# Molecular Cell

# **The Hsp104 N-Terminal Domain Enables Disaggregase Plasticity and Potentiation**

# **Graphical Abstract**



# **Highlights**

- Hsp104 N-terminal domain confers plasticity that is critical for prion dissolution
- Detailed mechanism of how Hsp104 engages, fragments, and dissolves Sup35 prions
- SAXS reconstructions of Hsp104 hexamers reveal peristaltic pumping mechanism
- Hsp104 N-terminal domain is critical for activity of potentiated Hsp104 variants

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# In Brief

Sweeny et al. employ small-angle X-ray scattering to reveal that a peristaltic pumping mechanism underpins Hsp104 disaggregase activity. They also define the mechanism by which Hsp104 dissolves Sup35 prions and elucidate that the Hsp104 N-terminal domain enables disaggregase plasticity and potentiation.





# The Hsp104 N-Terminal Domain Enables Disaggregase Plasticity and Potentiation

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http://dx.doi.org/10.1016/j.molcel.2014.12.021

#### SUMMARY

The structural basis by which Hsp104 dissolves disordered aggregates and prions is unknown. A single subunit within the Hsp104 hexamer can solubilize disordered aggregates, whereas prion dissolution requires collaboration by multiple Hsp104 subunits. Here, we establish that the poorly understood Hsp104 N-terminal domain (NTD) enables this operational plasticity. Hsp104 lacking the NTD (Hsp104<sup> $\Delta N$ </sup>) dissolves disordered aggregates but cannot dissolve prions or be potentiated by activating mutations. We define how Hsp104<sup>ΔN</sup> invariably stimulates Sup35 prionogenesis by fragmenting prions without solubilizing Sup35, whereas Hsp104 couples Sup35 prion fragmentation and dissolution. Volumetric reconstruction of Hsp104 hexamers in ATP $\gamma$ S, ADP-AIF<sub>x</sub> (hydrolysis transition state mimic), and ADP via small-angle X-ray scattering revealed a peristaltic pumping motion upon ATP hydrolysis, which drives directional substrate translocation through the central Hsp104 channel and is profoundly altered in Hsp104<sup> $\Delta N$ </sup>. We establish that the Hsp104 NTD enables cooperative substrate translocation, which is critical for prion dissolution and potentiated disaggregase activity.

#### INTRODUCTION

Protein disaggregases hold potential to reverse protein aggregation and amyloidogenesis that underlie several fatal neurodegenerative disorders. Yet their structural and mechanistic basis of action is not understood. In yeast, a hexameric AAA+ protein, Hsp104, couples ATP hydrolysis to dissolution of disordered aggregates, preamyloid oligomers, and amyloid (Shorter, 2008). Curiously, metazoa lack an Hsp104 homolog. Thus, it could be valuable to translate these Hsp104 activities to counter neurodegenerative disease (Jackrel et al., 2014). In yeast, Hsp104 confers two major selective advantages (Shorter, 2008). First, Hsp104 confers tolerance to thermal and chemical stress by reactivating proteins trapped in disordered aggregates. Second, amyloid remodeling by Hsp104 enables yeast to deploy prions for adaptive purposes.

Hsp104 forms dynamic ring-shaped hexamers, which exchange subunits on the minute timescale (DeSantis et al., 2012; Wendler et al., 2007). Hsp104 harbors an N-terminal domain (NTD), two AAA+ nucleotide-binding domains (NBDs) that hydrolyze ATP, and a coiled-coil middle domain (MD) inserted in NBD1. Hsp104 drives protein disaggregation by coupling ATP hydrolysis to partial or complete substrate translocation across its central pore via interaction with conserved tyrosine-bearing pore loops (Shorter, 2008). Yet, the conformational changes of the hexamer and its central channel that drive substrate translocation are poorly resolved. Indeed, the hexameric structure of Hsp104 is unknown, and conflicting models have arisen from cryo-electron microscopy (EM) reconstructions of dysfunctional Hsp104 mutants in a limited number of nucleotide states (Carroni et al., 2014; Lee et al., 2010; Wendler et al., 2007, 2009).

Hsp104 hexamers exhibit mechanistic plasticity and adapt distinct modes of intersubunit collaboration to disaggregate disordered aggregates versus amyloid. To disaggregate disordered aggregates, Hsp104 subunits within the hexamer collaborate noncooperatively via probabilistic substrate binding and ATP hydrolysis (DeSantis et al., 2012). By contrast, to resolve stable amyloid, several Hsp104 subunits within the hexamer cooperatively engage substrate and hydrolyze ATP (DeSantis et al., 2012). How this switch from noncooperative to cooperative mechanism occurs is not understood.

Hsp104 activity is potentiated by specific mutations in the MD (Jackrel et al., 2014). Potentiating mutations enable Hsp104 to dissolve fibrils formed by neurodegenerative disease proteins, including TDP-43, FUS, and  $\alpha$ -synuclein ( $\alpha$ -syn), and mitigate neurodegeneration under conditions where wild-type (WT) Hsp104 is inactive (Jackrel et al., 2014). These mutations reconfigure how Hsp104 subunits collaborate and increase plasticity such that robust disaggregase activity is maintained despite diverse subunit-inactivating events (Jackrel et al., 2014). The precise domain requirements that underpin potentiation as well as operational plasticity are unknown.





#### Figure 1. Hsp104<sup>△N</sup> Has Reduced Disaggregase Activity

(A) Size-exclusion chromatography coupled to multiangle light scattering demonstrates that Hsp104 and Hsp104<sup>ΔN</sup> form hexamers. A representative data set from three experiments is shown. (B) Hsp104<sup>ΔN</sup> exhibits elevated ATPase activity compared to Hsp104. Values represent means ± SEM (n = 3-4; \*p < 0.05; \*\*p < 0.01, two-tailed ttest). (C) Luciferase aggregates were treated with Hsp104 or Hsp104<sup>ΔN</sup> plus various ATP:ATP<sub>γ</sub>S ratios. Values represent means ± SEM (n = 3; \*p < 0.05, two-tailed t test).

(D) Luciferase aggregates were treated with Hsp104 or Hsp104 $^{\Delta N}$  with ATP plus Hdj2 and Hsp72 or Hdj2 and Hsc70. Values represent means  $\pm$  SEM (n = 3–7; \*p < 0.05; \*\*p < 0.01, two-tailed t test).

(E)  $\Delta hsp104$  yeast expressing luciferase and Hsp104 or Hsp104<sup> $\Delta N$ </sup> were shifted to 44°C, treated with cycloheximide, and allowed to recover at 30°C. Luciferase activity (% WT control) was determined. Values represent means  $\pm$  SEM (n = 3; \*\*\*p < 0.001, two-tailed t test).

(F)  $\Delta hsp104$  yeast harboring empty vector or expressing Hsp104 or Hsp104^{AN} were treated at 37°C for 30 min and then 50°C for 0–30 min. Cells were plated and survival (%) calculated. Values represent means  $\pm$  SEM (n = 3; \*\*p < 0.01; \*\*\*p < 0.001, two-tailed t test).

and Hsp104<sup> $\Delta N$ </sup> hexamers coordinate substrate translocation. Indeed, the Hsp104 NTD enables cooperative substrate translocation by Hsp104, which

Hsp104 harbors an NTD of poorly defined function, which is considered dispensable (Hung and Masison, 2006; Lum et al., 2008). The NTD of ClpB, the E. coli Hsp104 homolog, contributes to substrate binding and disordered aggregate dissolution (Barnett et al., 2005). However, several facets of Hsp104 activity are not conserved from ClpB (DeSantis et al., 2012, 2014). Unlike Hsp104, ClpB has limited ability to dissolve amyloid (DeSantis et al., 2012). Thus, whether NTD function is conserved from ClpB to Hsp104 is unclear. Indeed, replacing the Hsp104 NTD with the ClpB NTD disrupts prion propagation (Tipton et al., 2008). Hsp104 lacking the NTD (Hsp104<sup> $\Delta N$ </sup>) supports [PSI<sup>+</sup>] (Sup35 prion) inheritance, which requires Sup35 prion fragmentation (Hung and Masison, 2006). Curiously, unlike Hsp104, overexpression of Hsp104<sup>ΔN</sup> does not cure or inefficiently cures [PSI<sup>+</sup>] depending upon genetic background (Hung and Masison, 2006; Park et al., 2014). The direct effects of Hsp104<sup>ΔN</sup> on Sup35 prionogenesis are unknown.

Here, we define critical NTD functions in enabling Hsp104 plasticity and potentiation. Using pure components, we establish that Hsp104<sup> $\Delta$ N</sup> dissolves disordered aggregates but not prions. In contrast to Hsp104, which breaks N- and C-terminal intermolecular prion contacts to release soluble Sup35 and eliminate cross- $\beta$  structure, Hsp104<sup> $\Delta$ N</sup> only breaks C-terminal intermolecular prion contacts and fragments Sup35 prions without solubilizing Sup35 or resolving cross- $\beta$  structure. These differences reflect profound alterations in how Hsp104

is critical for potentiated activity and prion dissolution, but not for prion fragmentation.

#### RESULTS

#### Hsp104<sup>ΔN</sup> Has Reduced Disaggregase Activity

Deletion of the Hsp104 NTD is reported to have minimal effect on disaggregase functionality (Hung and Masison, 2006; Lum et al., 2008). This is not what we found. Hsp104<sup>ΔN</sup> was hexameric and had elevated ATPase activity (Figures 1A and 1B). Hsp104 and Hsp104<sup>ΔN</sup> solubilized disordered aggregates without Hsp70 and Hsp40 when provided with mixtures of ATP and ATP<sub>γ</sub>S, a slowly hydrolyzable ATP analog (Figure 1C). However, at every ATP:ATP<sub>γ</sub>S ratio tested, Hsp104<sup>ΔN</sup> was slightly less active than Hsp104 (Figure 1C). At 2 ATP:1 ATP<sub>γ</sub>S, Hsp104 was optimally activated, but Hsp104<sup>ΔN</sup> was only ~50% active (Figure 1C). This distinct sensitivity to activation by ATP<sub>γ</sub>S suggests that Hsp104<sup>ΔN</sup> hexamers are tuned differently than Hsp104 hexamers. Specifically, under these conditions, Hsp104<sup>ΔN</sup> hexamers require more ATP<sub>γ</sub>S relative to ATP for maximal disaggregase activity (Figure 1C).

Compared to Hsp104, Hsp104<sup> $\Delta N$ </sup> displayed reduced disaggregase activity with different Hsp70s (Figure 1D). This deficit was most pronounced for Hsc70 and significant for Hsp72 (Figure 1D). Hsp104<sup> $\Delta N$ </sup> had reduced ability to disaggregate luciferase and confer thermotolerance in vivo (Figures 1E and 1F), despite



#### Figure 2. Hsp104<sup>ΔN</sup> Cannot Dissolve Amyloid and Invariably Promotes Sup35 Prionogenesis

(A and B) Sup35 or Ure2 prions, or Q62 or  $\alpha$ -syn amyloid, were treated with Hsp104 or Hsp104<sup>ΔN</sup> plus Ssa1, Sse1, and Sis1. Fiber integrity was assessed by ThT fluorescence (A) or sedimentation analysis (B). Values represent means  $\pm$  SEM (n = 3). (C and D) Kinetics of unseeded Sup35 prionogenesis without or with Hsp104 (C) or Hsp104<sup>ΔN</sup> (D) assessed by ThT fluorescence. Values represent means  $\pm$  SEM (n = 3).

(E and F) Unseeded Sup35 prionogenesis plus or minus Hsp104 (E) or Hsp104<sup> $\Delta$ N</sup> (F). In some reactions, ATP was replaced with AMP-PNP. At various times, the amount of A11-reactive species was determined. Values represent means ± SEM (n = 3).

(G and H) Kinetics of Sup35 prionogenesis seeded by Sup35 prions plus or minus Hsp104 (G) or Hsp104<sup> $\Delta N$ </sup> (H) assessed by ThT fluorescence. In some reactions, ATP was replaced with AMP-PNP. Values represent means  $\pm$  SEM (n = 3).

(I) Reactions were performed as in (C) and (D). Reaction products were sonicated and transformed into  $[psi^-]$  cells. The proportion of  $[psi^-]$ , weak  $[PSI^+]$ , and strong  $[PSI^+]$  colonies was determined. Values represent means (n = 3). See also Table S1.

(Figures 2A and 2B). Strikingly, Hsp104<sup> $\Delta$ N</sup> did not release soluble protein (Figure 2B), which helps explain why Hsp104<sup> $\Delta$ N</sup> overexpression fails to cure Sup35 prions in some genetic backgrounds (Hung and Masison, 2006). The inability of Hsp104<sup> $\Delta$ N</sup> to disaggregate amyloid was not due to reduced binding affinity (see Table S1 available online). Thus, after initial engagement, some aspect of amyloid antagonizes Hsp104<sup> $\Delta$ N</sup>, but not Hsp104. We suggest that Hsp104<sup> $\Delta$ N</sup> subunits are unable to function in a globally cooperative manner to resolve amyloid.

## Hsp104<sup>∆N</sup> Only Stimulates Sup35 Prionogenesis

We investigated the interaction between Hsp104<sup> $\Delta$ N</sup> and Sup35 further. Thus, we

similar expression levels to Hsp104. Thus, deletion of the Hsp104 NTD reduces disaggregase activity in vitro and in vivo.

Hsp104 dissolves disordered aggregates via a noncooperative mechanism that does not require collaboration between Hsp104 subunits within the hexamer. Indeed, a single active Hsp104 subunit within the hexamer can drive disaggregation (DeSantis et al., 2012). By contrast, amyloid dissolution requires cooperative ATP hydrolysis and substrate binding by several Hsp104 subunits (DeSantis et al., 2012). In contrast to Hsp104, which disaggregated Sup35, Ure2, polyglutamine, and  $\alpha$ -syn amyloid, Hsp104<sup> $\Delta N$ </sup> was ineffective even at high concentrations titrated Hsp104<sup> $\Delta N$ </sup> into de novo Sup35 prionogenesis in vitro, which is very sensitive to Hsp104 concentration. At low concentrations, Hsp104 stimulates spontaneous Sup35 prionogenesis by reducing lag phase and accelerating assembly phase (Figure 2C). At high concentrations, Hsp104 inhibits Sup35 prionogenesis (Figure 2C) (Shorter and Lindquist, 2006). By contrast, even at very high concentrations, Hsp104<sup> $\Delta N$ </sup> stimulated spontaneous Sup35 prionogenesis by reducing lag phase and accelerating assembly phase (Figure 2D). Thus, deletion of the Hsp104 NTD drastically alters the concentration-dependent effect of Hsp104 on Sup35 prionogenesis, such that inhibition of prion formation is diminished. Indeed, the absence of the NTD switches Hsp104 to an operating mode that stimulates Sup35 prionogenesis.

Stimulation of spontaneous Sup35 prionogenesis by low concentrations of Hsp104 is due to two activities (Shorter and Lindquist, 2006). First, Hsp104 reduces lag phase by accelerating formation of prionogenic Sup35 oligomers, which are recognized by an anti-oligomer antibody, A11. This activity requires ATP binding but not hydrolysis by Hsp104. Second, Hsp104 accelerates assembly phase by occasionally fragmenting Sup35 prions to generate additional fibril ends for conformational replication. This activity requires ATP hydrolysis by Hsp104.

We assessed the effect of Hsp104<sup>ΔN</sup> on prionogenic Sup35 oligomer formation. Sup35 slowly formed A11-reactive oligomers that peaked at the end of lag phase (~4 hr) and rapidly disappeared during assembly phase (Figure 2E). High concentrations of Hsp104 prevented formation of A11-reactive species, whereas low concentrations of Hsp104 stimulated their appearance at 30 min, after which A11-reactive oligomers disappeared upon rapid prionogenesis (Figures 2C and 2E) (Shorter and Lindquist, 2006). By contrast, low and high concentrations of Hsp104<sup>ΔN</sup> accelerated A11-reactive oligomer formation (Figures 2D and 2F). This acceleration did not require ATP hydrolysis and was supported by a nonhydrolyzable ATP analog, AMP-PNP (Figures 2E and 2F). Thus, the Hsp104 NTD is not required to accelerate prionogenic oligomer formation, but is essential for high concentrations of Hsp104 to inhibit Sup35 oligomer formation.

To assess how Hsp104<sup> $\Delta$ N</sup> affected assembly phase, we titrated it into Sup35 prionogenesis seeded by Sup35 prions. At low concentrations, Hsp104 accelerated seeded Sup35 assembly and was inhibited by AMP-PNP (Figure 2G). At high concentrations, Hsp104 inhibited seeded Sup35 assembly (Figure 2G). By contrast, even at high concentrations, Hsp104<sup> $\Delta$ N</sup> accelerated seeded Sup35 prionogenesis (Figure 2H). Acceleration by Hsp104<sup> $\Delta$ N</sup> required ATP hydrolysis, and was inhibited by AMP-PNP (Figure 2H). Acceleration by Hsp104<sup> $\Delta$ N</sup> required ATP hydrolysis, and was inhibited by AMP-PNP (Figure 2H). Thus, Hsp104<sup> $\Delta$ N</sup> fragments Sup35 prions but is unable to dissolve them (Figures 2A and 2B). Indeed, prion fragmentation and dissolution are uncoupled by deletion of the Hsp104 NTD.

# Hsp104<sup> $\Delta N$ </sup> Promotes Formation of Sup35 Prions that Encode Strong [*PSI*<sup>+</sup>]

Sup35 forms distinct cross- $\beta$  structures or "strains," which encode distinct [PSI+] phenotypes designated "weak" or "strong" to describe the magnitude of Sup35 loss of function. We assessed how Hsp104 and Hsp104<sup>ΔN</sup> altered Sup35 prion strain distribution. Thus, we infected [psi-] yeast with Sup35 prions formed in the presence of Hsp104 or Hsp104<sup>△N</sup>. Sup35 prions formed without Hsp104 gave rise to  $\sim$ 40% strong [PSI<sup>+</sup>] and  $\sim$ 60% weak [PSI+] (Figure 2I). Low concentrations of Hsp104 shifted the population toward strong [PSI<sup>+</sup>],  $\sim$ 63% strong [PSI<sup>+</sup>] and  $\sim$ 37% weak [PSI<sup>+</sup>], whereas a higher Hsp104 concentration (1 µM) prevented Sup35 prionogenesis (Figure 2I). By contrast, low concentrations of Hsp104<sup> $\Delta N$ </sup> (0.03  $\mu$ M) significantly shifted the population toward strong [PSI+]:  ${\sim}76\%$  strong [PSI+] and  $\sim$ 24% weak [*PSI*<sup>+</sup>] (Figure 2I; p < 0.05, two-tailed t test). Higher Hsp104<sup> $\Delta N$ </sup> concentration exacerbated this effect:  $\sim$ 92% strong  $[PSI^+]$  and ~8% weak  $[PSI^+]$  (Figure 2I). Thus, the altered activity of Hsp104<sup>ΔN</sup> accentuates prion strain selection events that favor strong [*PSI*<sup>+</sup>]. Indeed, Hsp104<sup>ΔN</sup> "strengthens" [*PSI*<sup>+</sup>] phenotypes in vivo (Hung and Masison, 2006).

#### Hsp104<sup>△N</sup> Fragments Sup35 Prions by Selectively Breaking Tail Contacts

To assess prion-fragmenting activity of Hsp104<sup> $\Delta N$ </sup>, we treated Sup35 prions with low or high concentrations of Hsp104<sup>ΔN</sup> or Hsp104. Low concentrations of Hsp104 fragmented Sup35 prions as revealed by EM (Figure 3A), without reducing ThT fluorescence (Figure 2A). Fragmentation was confirmed by the ability of remodeled products to seed Sup35 prionogenesis (Figure 3B) or infect [psi<sup>-</sup>] yeast (Figure 3C). High concentrations of Hsp104 eliminated Sup35 prions (Figures 2A and 3A-3C). By contrast, low or high concentrations of Hsp104  $^{\Delta N}$  fragmented Sup35 prions and enhanced their seeding activity without eliminating them (Figures 3A-3C). EM revealed long tracks of closely aligned short fibrils, as though Hsp104<sup>ΔN</sup> had fragmented a long fibril at several positions along its course (Figure 3A, asterisks). Treatment of Sup35 prions with low concentrations of Hsp104 or any concentration of Hsp104<sup> $\Delta N$ </sup> amplified strong [PSI<sup>+</sup>] prions (Figure 3C). This effect was most pronounced at high Hsp104<sup> $\Delta N$ </sup> concentrations (Figure 3C). Thus, the Hsp104 NTD is essential to dissolve Sup35 prions.

To determine how Hsp104<sup> $\Delta N$ </sup> fragments Sup35 prions, we monitored intermolecular prion contacts. We employed the N-terminal prion domain (N. residues 1-121) and MD (M, residues 122-253) of Sup35, termed NM (Figure 3D). We assembled NM prions at 4°C to yield the prion ensemble NM4, which encodes predominantly strong [PSI<sup>+</sup>] (DeSantis and Shorter, 2012). Specifically, we assembled NM4 prions with 17 individual single cysteine NM variants labeled with pyrene at different positions. These pyrene-labeled NM variants retain WT assembly kinetics and infectivity, indicating that pyrene does not significantly alter prion structure (Krishnan and Lindquist, 2005). Upon intermolecular contact formation, pyrene molecules at select positions, in the "Head" or "Tail" (Figures 3D and 3E), form excimers (excited-state dimers) that produce a strong red shift in fluorescence. Excimer fluorescence reports on intermolecular contact integrity, and NM prions are held together by intermolecular Head-to-Head and Tail-to-Tail contacts (Figure 3D) (Krishnan and Lindquist, 2005).

High concentrations of Hsp104 disrupted Head (residues 21–38) and Tail (residues 79–96) contacts of NM4 prions, whereas the low Hsp104 concentration also disrupted both contacts, but to a lesser extent (Figure 3E). By contrast, Hsp104<sup> $\Delta$ N</sup> only disrupted Tail contacts even at high concentrations (Figure 3E). Thus, the NTD is not required for Hsp104 to break the Tail contact, but is critical to break the Head contact and dissolve Sup35 prions.

#### Hsp104 Breaks the Tail Contact and then the Head Contact of Sup35 Prions

To understand the selective breakage of Tail contacts by Hsp104<sup> $\Delta$ N</sup>, we tracked NM4 prion remodeling kinetics. The "double Walker B" (DWB, E285Q:E687Q) Hsp104 mutant, which can bind but not hydrolyze ATP, failed to break Head or Tail contacts (Figure 3F). At early times (0–10 min), Hsp104 and



#### Figure 3. Hsp104<sup>ΔN</sup> Fragments Sup35 Prions by Selectively Breaking Tail Contacts

(A) Sup35 prions were treated with buffer, Hsp104, or Hsp104<sup> $\Delta$ N</sup> plus Sse1, Ssa1, and Sis1 for 1 hr and processed for EM. Note the long fibrils in buffer control (large arrow), shorter fibrils (small arrows) in the presence of Hsp104<sup> $\Delta$ N</sup> or Hsp104 (0.03  $\mu$ M), and absence of fibrils with Hsp104 (1  $\mu$ M). Asterisks denote long tracks of closely aligned short fibrils. Scale bar, 0.5  $\mu$ m.

(B) Sup35 prions were left untreated, sonicated, or treated with His<sub>6</sub>-Hsp104 or His<sub>6</sub>-Hsp104<sup> $\Delta N$ </sup> plus Sse1, Ssa1, and Sis1 for 1 hr. Reactions were depleted of His<sub>6</sub>-Hsp104 or His<sub>6</sub>-Hsp104 or His<sub>6</sub>-Hsp104<sup> $\Delta N$ </sup> and used to seed (2% wt/wt) Sup35 prionogenesis assessed by ThT fluorescence. Values represent means ± SEM (n = 3). (C) Sup35 prions were treated as in (A), and reaction products were sonicated and transformed into [*psi*<sup>-</sup>] cells. The proportion of [*psi*<sup>-</sup>], weak [*PSI*<sup>+</sup>], and strong

 $[PSI^+]$  colonies was determined. Values represent means (n = 3). (D) Sup35 harbors a C-terminal GTPase domain (residues 254–685, black), a charged middle domain (M, residues 124–253, dark gray), and a prionogenic N-terminal domain (N, residues 1–123, light gray). Within N, prion recognition elements make homotypic intermolecular contacts, and Sup35 prions are maintained by Head-to-Head (red) and Tail-to-Tail (green) contacts. A central core (blue) is sequestered by intramolecular contacts. Head, central core, and Tail position are shown for NM4 prions. Hsp104 engages Sup35 prions C-terminal to the Tail contact. Hsp104<sup>ΔN</sup> broke the Tail contact (G86C), whereas the Head contact (G31C) remained intact (Figure 3F). At later times (20–60 min), Hsp104 severed Head contacts, but Hsp104<sup>ΔN</sup> did not (Figure 3F). Thus, Hsp104 breaks the Tail and then the Head contact to remodel NM4 prions. This temporal separation suggested that Hsp104 and Hsp104<sup>ΔN</sup> engage NM4 prions C-terminal to the Tail contact and then exert a directional pulling force that first breaks the Tail contact (Figure 3D). However, Hsp104<sup>ΔN</sup> is unable to melt cross- $\beta$  structure N-terminal to the Tail and releases after the Tail contact is broken but before the Head contact is broken. By contrast, Hsp104 breaks the Tail contact and continues to translocate NM sequence along a C- to N-terminal vector, thereby melting cross- $\beta$  structure of the central core and then breaking the Head contact. To test this model, we performed three experiments.

First, we assessed where Hsp104 and Hsp104<sup> $\Delta N$ </sup> initially engage NM4 prions. Thus, single cysteine NM variants labeled with a cleavable thiol-specific UV-activatable 13Å crosslinker, benzophenone-4-carboxamidocysteine methanethiosulphonate (BPMTS), were assembled into NM4 prions. BPMTS-labeled NM variants retain WT assembly kinetics and infectivity (Figures S1A and S1B), indicating that BPMTS does not affect prionogenesis. BPMTS-labeled NM4 prions were incubated with Hsp104 or Hsp104<sup> $\Delta N$ </sup> plus ATP $\gamma$ S (to favor binding) or ADP (to disfavor binding) and crosslinked. Neither Hsp104 nor Hsp104<sup>ΔN</sup> was recovered without crosslinking or with ADP (Figure 3G). By contrast, with ATP $\gamma$ S, Hsp104 and Hsp104<sup> $\Delta$ N</sup> were recovered only when BPMTS was attached at positions 96, 106, 112, 121, 137, and 151 (Figure 3G). Thus, Hsp104 and Hsp104  $^{\Delta N}$ initially engage NM4 prions C-terminal to the Tail contact, in a region spanning residues 96-151 (Figure 3D). Subsequently, Hsp104<sup> $\Delta N$ </sup> breaks the Tail contact and fragments the prion, but is unable to release soluble NM, which requires unfolding the central core and severing the Head contact, a task accomplished by Hsp104.

Second, we tracked the central core between the Head and Tail. Thus, we employed single cysteine NM variants bearing acrylodan labels at G43C, G51C, or Y73C, which lie in the central core (Figure 3D). Sequestration of labeled sites from solvent in the assembled prion increases acrylodan fluorescence at these positions (Krishnan and Lindquist, 2005). Hsp104<sup> $\Delta$ N</sup> failed to alter acrylodan fluorescence of NM4 prions (Figure 3H). Thus, Hsp104<sup> $\Delta$ N</sup> does not remodel the central core. By contrast,

Hsp104 reduced acrylodan fluorescence at these positions, indicating that the central core was remodeled and exposed to solvent (Figure 3H). Hsp104-driven unfolding of the central core was not concerted but occurred in a stepwise manner. Thus, the Y73 position displayed changes prior to G51 and G43, indicating that Hsp104 remodels C-terminal portions of the central core prior to N-terminal portions (Figure 3H). Thus, Hsp104 breaks the Tail contact and then unfolds the central core by pulling on its C-terminal end.

Third, we assembled NM prions from single cysteine NM variants that were stapled together at the Head (N21C) or Tail (G96C) contact by an 11Å crosslinker 1,4-bis-maleimidobutane (BMB) (Krishnan and Lindquist, 2005). NM4 prions stapled at the Head contact could be fragmented by Hsp104 and Hsp104<sup> $\Delta$ N</sup> and were more potent seeds than untreated NM4 prions (Figure 3I). By contrast, NM prions stapled at the Tail contact could not be fragmented by Hsp104 or Hsp104<sup> $\Delta$ N</sup> and seeded NM assembly just as well as untreated prions (Figure 3I). Thus, Hsp104 cannot break the Head contact until after the Tail contact has been broken.

NM lacks the C-terminal GTPase domain of Sup35 (Figure 3D). Does Hsp104 need to unfold the C-terminal GTPase domain to dissolve Sup35 prions? Full-length Sup35 retains similar GTPase activity in the prion and soluble state (Krzewska et al., 2007). Thus, to assess whether the Sup35 C-terminal domain was unfolded during Hsp104-catalzed prion dissolution, we included GroEL<sub>TRAP</sub>, which captures unfolded protein and prevents refolding. Hsp104 disassembled Sup35 prions, but GTPase activity was unchanged (Figure 3J), indicating that Hsp104 dissolves Sup35 prions without unfolding the C-terminal GTPase domain. Likewise, Hsp104 did not unfold GFP during dissolution of NM-GFP prions (Figures S1C and S1D). Thus, Hsp104 selectively resolves N-terminal prion structure without unfolding the appended C-terminal domain.

# Hsp104 $^{\Delta N}$ Has Impaired Translocation and Unfoldase Activity

The inability to resolve cross- $\beta$  structure or break Head contacts of NM4 prions suggested that Hsp104<sup> $\Delta$ N</sup> might be defective in substrate translocation and unfolding. Indeed, FITC-casein degradation and RepA<sub>1-70</sub>-GFP unfolding assays confirmed that Hsp104<sup> $\Delta$ N</sup> has impaired translocation and unfoldase activity (Figures S1E and S1F).

See also Figure S1.

<sup>(</sup>E) NM4 prions carrying pyrene labels at the indicated single site were treated with Hsp104 or Hsp104 $^{\Delta N}$  plus Sse1, Ssa1, and Sis1 for 1 hr. The ratio of excimer to nonexcimer fluorescence (I<sub>465nm</sub>/I<sub>375nm</sub>) was then determined. Values represent means (n = 3).

<sup>(</sup>F) NM4 prions carrying pyrene labels in the Head (G31C) or Tail (G86C) were incubated with Hsp104, Hsp104<sup> $\Delta N$ </sup>, or Hsp104<sup>D WB</sup> (1  $\mu$ M) plus Sse1, Ssa1, and Sis1 for 0–1 hr. At various times, the ratio of excimer to nonexcimer fluorescence ( $I_{465nm}/I_{375nm}$ ) was determined and compared to the zero time point to determine contact integrity (%). Values represent means ± SEM (n = 3).

<sup>(</sup>G) Mapping contact sites between NM4 prions and Hsp104+ATP $\gamma$ S, Hsp104+ADP, Hsp104 $^{\Delta N}$ +ATP $\gamma$ S, and Hsp104 $^{\Delta N}$ +ADP by site-resolved BPMTS crosslinking. Heatmap displays positions where Hsp104 was crosslinked to NM4 prions. No cl (no crosslinking control). Values represent means (n = 3).

<sup>(</sup>H) NM4 prions carrying acrylodan labels in the central core (G43C, G51C, or Y73C) were treated with Hsp104 or Hsp104 $^{\Delta N}$  (1  $\mu$ M) plus Sse1, Ssa1, and Sis1 for 0–1 hr. At the indicated times, acrylodan fluorescence was measured. Values represent means ± SEM (n = 3).

<sup>(</sup>I) NM prions (2.5  $\mu$ M monomer) crosslinked by BMB in the Head (N21C) or Tail (G96C) were left untreated or treated with His<sub>6</sub>-Hsp104 (1  $\mu$ M) or His<sub>6</sub>-Hsp104<sup> $\Delta$ N</sup> (1  $\mu$ M) plus Sse1, Ssa1, and Sis1 for 1 hr. Reactions were depleted of His<sub>6</sub>-Hsp104 or His<sub>6</sub>-Hsp104<sup> $\Delta$ N</sup> and used to seed (2% wt/wt) NM prionogenesis assessed by ThT fluorescence. Values represent means  $\pm$  SEM (n = 3).

<sup>(</sup>J) Sup35 prions were treated with Hsp104 (1  $\mu$ M) plus GroEL<sub>TRAP</sub>, Sse1, Ssa1, and Sis1 for 0–1 hr. At various times, GTPase activity and ThT fluorescence were measured. Values represent means  $\pm$  SEM (n = 3).



Figure 4. NTD Deletion Alters ATPase-Driven Conformational Changes of Hsp104 Hexamers (A) Representative scattering profiles for Hsp104 and Hsp104<sup> $\Delta N$ </sup> (intensity versus momentum transfer, q [Å<sup>-1</sup>]). Profiles are arbitrarily scaled on the y axis for better visualization. Inset shows enlargement of regions where Hsp104 consistently differs from Hsp104<sup> $\Delta N$ </sup> in all nucleotide states. Experimental data are overlaid by GNOM fit.

#### NTD Deletion Alters ATPase-Driven Conformational Changes of Hsp104 Hexamers

To understand the differences between Hsp104 and Hsp104  $^{\Delta N}$ at a structural level, we examined changes in shape of Hsp104 and Hsp104<sup>ΔN</sup> hexamers through the ATPase cycle in solution using small- and wide-angle X-ray scattering (SAXS/WAXS). Xray scattering at very low angles provides information about particle size and shape. Hsp104 and Hsp104<sup>ΔN</sup> were hexameric and monodisperse in solution and ideally suited for SAXS (Figure 1A; and see calculated mass of particle [MM by Qr] in Table S2). We measured scattering at multiple concentrations and different beamlines and obtained very similar results (Table S2). Guinier analysis confirmed the absence of aggregation or other concentration-dependent effects (Figure S2A) (Volkov and Svergun, 2003). Thus, we determined structural parameters of Hsp104 and Hsp104<sup> $\Delta N$ </sup>, including maximum dimension (D<sub>max</sub>) and radius of gyration ( $R_{\alpha}$ ) in six nucleotide states-AMP-PNP, ATP $\gamma$ S, ATP, ADP-AIF<sub>x</sub> (ATP hydrolysis transition state mimic), ADP, and no nucleotide-to simulate the steps of the ATP hydrolysis cycle. Data were measured to a  $q_{max}$  of ~0.7–0.8 Å<sup>-1</sup> to yield a nominal resolution limit  $(2\pi/q_{max})$  of 7.6–8.4 Å.

Raw scattering profiles (I[q] versus q, where  $q = 4\pi [\sin\theta]/\lambda$ ) and GNOM (Svergun, 1992) fits to experimental data revealed large differences between Hsp104 and Hsp104<sup> $\Delta N$ </sup> (Figure 4A). Distinctive features in the low g region present in Hsp104, but not Hsp104<sup> $\Delta N$ </sup> (corresponding to the NTD), are highlighted (Figure 4A, inset). In the absence of nucleotide, Hsp104 and Hsp104<sup>ΔN</sup> hexamers have their largest Rg and Dmax (Figure 4B; Tables S2 and S3). Addition of nucleotide decreased R<sub>g</sub> and D<sub>max</sub> (Figure 4B; Tables S2 and S3). For Hsp104 and Hsp104<sup>ΔN</sup>, AMP-PNP and ATPγS elicited larger spatial properties (Figure 4B; Tables S2 and S3). ADP-AIF<sub>x</sub>, which mimics the ATP hydrolysis transition state, where ADP and Pi are bound, yielded the smallest R<sub>a</sub> and D<sub>max</sub> values for Hsp104 and Hsp104<sup>ΔN</sup> (Figure 4B; Tables S2 and S3). The spatial properties of Hsp104 and Hsp104<sup> $\Delta N$ </sup> then expand slightly upon Pi release in the ADP state (Figure 4B: Table S3). Thus, Hsp104 and Hsp104 $^{\Delta N}$  hexamers contract upon ATP hydrolysis and expand upon ATP binding (Figure 4B; Tables S2 and S3), indicating a pumping mechanism to drive substrate translocation.

Structural changes of Hsp104 and Hsp104<sup> $\Delta N$ </sup> hexamers were evident in the real-space pairwise distance distribution function, or P(r), which represents the distances between pairs of atoms within a given volume. As with R<sub>g</sub>, the apparent redistribution of interatomic vectors in the P(r) curves demonstrates that nucleotide addition and identity induce specific changes in shape for Hsp104 and Hsp104<sup> $\Delta N$ </sup> hexamers (Figures 4C and 4D). How the

Hsp104 hexamer responds to a given nucleotide, both in terms of the magnitude and the specific effect, differs in the absence of the NTD (Figures 4C and 4D).

To visualize these changes, we employed the ab initio modeling program GASBOR (Svergun et al., 2001) to derive volumetric reconstructions of the averaged solution shape of Hsp104 and Hsp104<sup>ΔN</sup> hexamers with each nucleotide. GASBOR employs simulated annealing to match experimental scattering data with an ensemble of beads corresponding to the composition of the particle. For each nucleotide, GASBOR calculations were performed ten times using scattering data to qmax of 0.7-0.8 Å<sup>-1</sup> (nominal resolution limit of 7.6-8.4 Å). GASBOR calculations using  $q_{max}$  truncated to 0.5 Å<sup>-1</sup> or calculations with the program DAMMIN/F yielded similar results. We imposed 6-fold symmetry based upon cryo-EM analyses of Hsp104 (Wendler et al., 2007). Superposition of each GASBOR solution for Hsp104 and Hsp104<sup> $\Delta N$ </sup> (Figures S2B and S2C) revealed consensus that was confirmed by the normalized spatial discrepancy (NSD) between independent calculations. NSD indicates the degree of discrepancy between the same relative position between any two structures (Volkov and Svergun, 2003). NSD values indicated little deviation between independent calculations, and reconstructions from different synchrotron trips yielded similar results (Figures 4E-4G; Table S2).

The outputs of each GASBOR calculation were averaged to provide filtered and unfiltered densities using DAMAVER (Figures 4E–4G) (Volkov and Svergun, 2003). Hsp104 shape reconstructions were oriented using Hsp104<sup>ΔN</sup> hexamers, which when overlaid indicated where density for the missing NTD would fit (Figure 4F). The general dimensions of Hsp104 and Hsp104<sup>ΔN</sup> particles determined by SAXS agree with Hsp104<sup>N728A</sup> and Hsp104<sup>ΔN</sup> cryo-EM reconstructions (Wendler et al., 2007), and the central channel through which substrate is translocated is resolved (Figures 4E–4G). Thus, we can identify conformational changes that enable Hsp104 and Hsp104<sup>ΔN</sup> to couple ATPase activity to protein disaggregation.

Hsp104 and Hsp104<sup> $\Delta$ N</sup> hexamers undergo large conformational changes between nucleotide states (Figures 4E–4G). Hsp104 and Hsp104<sup> $\Delta$ N</sup> hexamers have similar width, but Hsp104<sup> $\Delta$ N</sup> is shorter in height (Figures 4E and 4G). Two distinctive features change in each nucleotide state: (1) the placement of a projection of density on the hexamer exterior, along the plane of the largest dimension; and (2) the diameter and contours of the central channel (Figures 4E–4G, 5A, and 5B). The exterior projection is evident in the P(r) as a small population of large vectors that start around 175 Å (Figures 4C and 4D). Hsp104 and Hsp104<sup> $\Delta$ N</sup> have dynamic projections that shift from a more

See also Tables S2 and S3, Figure S2, Movie S1, and Movie S2.

<sup>(</sup>B)  $R_g$  of Hsp104 and Hsp104<sup> $\Delta N$ </sup> with the indicated nucleotide calculated by GNOM. These values closely match the Guinier approximations for  $R_g$  (Table S2). Values represent means  $\pm$  SEM (n = 3–7).

<sup>(</sup>C and D) Real-space shape information for Hsp104 and Hsp104<sup> $\Delta$ N</sup>. Normalized P(r) curves (density distribution plots) generated by GNOM for Hsp104 (C) and Hsp104<sup> $\Delta$ N</sup> (D) in the presence of AMP-PNP, ATP<sub>Y</sub>S, ATP, ADP-AIF<sub>x</sub>, ADP, and no nucleotide. P(r) plots are normalized to the area under the curve and overlaid to show differences between nucleotide states. Insets display the P(r) peak, which reveals differences between nucleotide states. Compared to Hsp104<sup> $\Delta$ N</sup> has large spatial extent in the absence of nucleotide relative to its nucleotide-bound states.

<sup>(</sup>E-G) Averaged ab initio GASBOR volume reconstructions of Hsp104 (E) and Hsp104<sup> $\Delta N$ </sup> (G). Filtered density is solid blue (Hsp104) or orange (Hsp104<sup> $\Delta N$ </sup>) overlaid with the unfiltered average shown in gray mesh. NSD of averaged models and q range used for reconstructions are shown plus average particle dimensions. (F) Overlay of Hsp104 and Hsp104<sup> $\Delta N$ </sup> average reconstructions for each state, which was used to orient particles. Reconstructions are oriented with the N terminus pointing toward the top of the page.



# Figure 5. Channel Motions of Hsp104 and Hsp104 $^{\Delta N}$ Hexamers

(A and B) Cut-away side views of Hsp104 (A) and Hsp104<sup> $\Delta$ N</sup> (B) hexamers in ATP<sub>Y</sub>S, ADP-AIF<sub>x</sub>, or ADP. The channel was reconstructed using the filtered average volumes for each nucleotide state. Bar graphs display the average channel diameter (Å) of each z slice starting from the N terminus. Each bar represents 1 Å, and the number of bars represents the length of the channel that is closed for 360°. Substrate binds in the ATPvS state and is translocated from the N-terminal entrance to the C-terminal exit. The Hsp104 channel exhibits a peristaltic wave motion: dilation at the N-terminal entrance (in ATP<sub>Y</sub>S) followed by a contraction of the N-terminal end of the channel (in ADP-AIF<sub>x</sub>) and finally a shift in the location of a constriction from the N- to the C-terminal region (in ADP, arrow). The Hsp104<sup>ΔN</sup> hexamer displays defects in the peristalsis motion, especially at the N-terminal channel entrance, which fails to contract in the ADP-AIF, and ADP states.

See also Movie S1 and Movie S2.

N-terminal position (in no nucleotide, AMP-PNP, ATP $\gamma$ S, and ATP) to a more C-terminal position (in ADP-AIF<sub>x</sub> and ADP) upon ATP hydrolysis (Figures 4E–4G, 5A, and 5B; Movie S1 and Movie S2). Rudimentary rigid body domain fitting reveals that the volumetric envelopes readily accommodate six Hsp104 monomers (Figure S2D). The external projection is likely the MD in accord with cryo-EM models of HAP plus ATP $\gamma$ S and ClpP (Figure S2D) (Carroni et al., 2014). Thus, our SAXS reconstructions resolve controversy surrounding MD location generated by cryo-EM studies (Lee et al., 2010; Wendler et al., 2007, 2009). The change in position of the external projection (Figures 4E–4G) is consistent with the MD located on the surface of the hexamer, which can move from an N-terminal, horizontal position to a C-terminally tilted position (Carroni et al., 2014; DeSantis et al., 2014).

To disaggregate substrates, Hsp104 translocates proteins through its central channel. Thus, we focused on the central channel (Figures 5A and 5B). The changes in shape of the Hsp104 channel are reminiscent of a peristaltic wave: there is dilation at the site of substrate entrance followed by a wave of constriction that travels in the direction that substrate is being pumped. Substrate enters through the N-terminal entrance and can be expelled from the C-terminal exit (Shorter, 2008). Accordingly, in the ATP<sub>Y</sub>S state where Hsp104 initially engages substrate, the N-terminal channel entrance of Hsp104 is open and dilated with a diameter of  $\sim$ 45–50 Å (Figure 5A). In the ATP<sub>Y</sub>S state, there is a region of constriction (channel diameter  $\sim$ 18 Å) after the N-terminal opening (Figure 5A, arrow), and C-terminal to this constriction the channel is ~25-30 Å in diameter. The channel constricts to a diameter of  $\sim$ 25–30 Å across its entire length with the transition state mimic ADP-AIF<sub>x</sub> (Figure 5A), the state with the smallest R<sub>a</sub> (Figure 4B). Thus, upon ATP hydrolysis the Hsp104 channel constricts (Figure 5A). In the ADP state, a C-terminal point of constriction becomes apparent (Figure 5A, arrow), which likely helps expel substrate from the C-terminal exit. Thus, cycles of ATP binding and hydrolysis drive a peristaltic pumping motion of the Hsp104 hexamer, which likely drives directional substrate translocation (Movie S1). The peristaltic pumping motion likely underpins how Hsp104 transduces energy from ATP hydrolysis to conformational change and substrate remodeling using physical force.

NTD deletion grossly perturbs this peristaltic pump motion (Figure 5B; Movie S2). In ATP $\gamma$ S, the Hsp104<sup> $\Delta$ N</sup> channel is narrow in diameter ( $\sim$ 16–30 Å) compared to Hsp104, and there is no dilation at the N-terminal entrance (Figures 5A and 5B). Thus, it is more difficult for substrate to access the Hsp104  $^{\Delta N}$ channel in the binding-competent ATP<sub>Y</sub>S state. In ADP-AIF<sub>x</sub>, the Hsp104  $^{\Delta N}$  channel is dilated at N- and C-terminal ends, and only a central portion of the channel is  $\sim$ 25–30 Å in diameter, unlike Hsp104, where the channel aperture is  $\sim$ 25-30 Å across its whole length (Figures 5A and 5B). Thus, the "power stroke" motion elicited by ATP hydrolysis in Hsp104 is profoundly altered in Hsp104<sup> $\Delta N$ </sup>. In ADP, the Hsp104<sup> $\Delta N$ </sup> and Hsp104 channels change in diameter in a similar manner along their length, although the N-terminal channel entrance is more dilated in Hsp104<sup> $\Delta N$ </sup> (Figures 5A and 5B). The more dilated Hsp104<sup> $\Delta N$ </sup> channel in  $\mathsf{ADP}\text{-}\mathsf{AIF}_x$  might allow substrate to escape the channel. These channel defects help explain why Hsp104  $^{\Delta N}$  is defective in translocation, unfolding, and disaggregation.

# $\text{Hsp104}^{\Delta N}$ hexamers Operate Differently Than Hsp104 Hexamers

The profound alterations in the Hsp104<sup> $\Delta N$ </sup> channel (Figures 4E–4G, 5A, and 5B) indicated that Hsp104<sup> $\Delta N$ </sup> and Hsp104 might coordinate substrate translocation differently. Indeed, Hsp104<sup> $\Delta N$ </sup> hexamers appear unable to process substrate in a subglobally



# Figure 6. Altered Substrate Handling by Hsp104 $^{\Delta N}$ Hexamers Precludes Prion Dissolution

(A) Theoretical Hsp104 hexamer ensembles containing zero (black), one (blue), two (green), three (orange), four (red), five (purple), and six (yellow) mutant subunits as a function of fraction mutant subunit.

(B) Theoretical activity curves where one or more (blue), two or more (red), three or more (green), four or more (purple), five or more (light blue), or six mutant subunits (orange) ablate Hsp104 hexamer activity.

(C) Luciferase aggregates were treated with Hsp104 (blue markers) or Hsp104<sup>ΔN</sup> (orange markers), Hsp72, and Hdj2 plus increasing fractions of Hsp104<sup>DPL</sup> (blue markers) or Hsp104<sup>ΔNDPL</sup> (orange markers) subunits. Luciferase reactivation was determined (fraction WT Hsp104 activity). Values represent means  $\pm$  SEM (n = 3–4). Theoretical disaggregase activity if six DPL subunits ablate hexamer activity (orange line). Theoretical curves are shown wherein adjacent pairs of WT:WT (or ΔN:ΔN) or WT:DPL (or ΔN:ΔNDPL)

subunits confer hexamer activity, while adjacent DPL (or  $\Delta$ NDPL) subunits have no activity. Each adjacent WT:WT (or  $\Delta$ N: $\Delta$ N) pair has an activity of 1/6. Adjacent WT:DPL (or  $\Delta$ N: $\Delta$ NDPL) pairs have a stimulated activity (s), and the effect of s = 2 (black curve) or s = 3 (gray curve) is shown. (D) NM25 prions were treated with Hsp104, Sse1, Ssa1, and Sis1 plus increasing fractions of Hsp104<sup> $\Delta$ N</sup></sup>. Remodeling was monitored by Head contact integrity (for G31C-pyrene-labeled NM25 prions, red markers), ThT fluorescence (for unlabeled NM25 prions, yellow markers), or Tail contact integrity (for G96C-pyrene-labeled NM25 prions, green markers). Values represent means ± SEM (n = 3). Theoretical disaggregase activity if 1 Hsp104<sup> $\Delta$ N</sup> subunit ablates hexamer activity (blue line). See also Figure S1.

or globally cooperative manner required for prion dissolution (De-Santis et al., 2012). We utilized a mutant subunit doping strategy to generate heterohexamer ensembles and determine whether subunit collaboration was altered with respect to substrate handling in Hsp104<sup> $\Delta$ N</sup> (Figures 6A and 6B) (DeSantis et al., 2012).

To define how Hsp104<sup>ΔN</sup> subunits coordinate substrate binding during disordered aggregate dissolution, we employed the "double pore loop" (DPL, Y257A;Y662A) mutant, DPL has normal ATPase activity but harbors Y257A and Y662A mutations in substrate-binding pore loops, which impair substrate translocation (DeSantis et al., 2012). We assembled heterohexamer ensembles of Hsp104 and Hsp104<sup>DPL</sup>, or Hsp104<sup> $\Delta N$ </sup> and Hsp104 $^{\Delta NDPL}$ , and assessed disaggregase activity against disordered luciferase aggregates. Hsp104 and Hsp104 $^{\Delta N}$  hexamers responded very differently to DPL subunits (Figure 6C). Hsp104<sup>DPL</sup> subunits caused a roughly linear decline in Hsp104 luciferase reactivation activity, indicating probabilistic substrate handling (Figure 6C) (DeSantis et al., 2012). By contrast, Hsp104<sup> $\Delta$ NDPL</sup> subunits stimulated Hsp104<sup> $\Delta$ N</sup> activity and only inhibited when the average number of Hsp104<sup> $\Delta$ NDPL</sup> subunits per hexamer exceeded 4 (Figure 6C). We could model this behavior if we imposed rules whereby an Hsp104  $^{\Delta NDPL}$  subunit stimulates the activity of an adjacent Hsp104<sup> $\Delta N$ </sup> subunit by  $\sim$ 2-fold but exerts an inhibitory effect if it is adjacent to a mutant subunit (Figure 6C) (DeSantis et al., 2012). Thus, Hsp104<sup>△N</sup> subunits cooperate negatively with respect to substrate binding. Addition of up to 4 substrate-binding defective subunits within the Hsp104<sup>ΔN</sup> hexamer stimulates activity against disordered aggregates. Thus, the NTD is essential for cooperative substrate handling by the Hsp104 hexamer.

# Hsp104 $^{\Delta N}$ Subunits Inhibit Prion Dissolution by Hsp104 Hexamers

The negative cooperativity of Hsp104<sup> $\Delta$ N</sup> subunits with respect to substrate binding likely precludes prion dissolution by Hsp104<sup> $\Delta$ N</sup>, which requires multiple subunits within the hexamer to work together (DeSantis et al., 2012). To assess how Hsp104<sup> $\Delta$ N</sup> subunits affected prion remodeling by Hsp104, we doped Hsp104<sup> $\Delta$ N</sup> subunits into Hsp104 hexamers and assessed ability to (1) break Head and Tail prion contacts, and (2) dissolve NM25 prions (NM prions formed at 25°C). Tail contact severing was unaffected by Hsp104<sup> $\Delta$ N</sup> subunits, whereas a single Hsp104<sup> $\Delta$ N</sup> subunit per Hsp104 hexamer inhibited Head contact severing and elimination of amyloid structure (Figure 6D). Thus, all six Hsp104 subunits must possess the NTD for globally cooperative prion dissolution.

#### Hsp104 $^{\Delta N}$ Is Not Potentiated by Mutations in the MD

Hsp104 disaggregase activity is potentiated by specific mutations in the MD, which enable Hsp104 to dissolve TDP-43, FUS, and  $\alpha$ -syn fibrils and mitigate neurodegeneration under conditions where Hsp104 is inactive (Jackrel et al., 2014). We tested whether potentiating MD mutations, A503S and A503V, could overcome defects in cooperativity caused by NTD deletion. Unlike their full-length counterparts, Hsp104<sup>ΔN-A503V</sup> and Hsp104<sup>ΔN-A503S</sup> could not rescue TDP-43, FUS, or  $\alpha$ -syn toxicity in yeast, despite robust expression (Figures 7A and 7B). Moreover, Hsp104<sup>ΔN-A503V</sup> and Hsp104<sup>ΔN-A503S</sup> failed to rescue  $\alpha$ -syn or FUS aggregation in yeast, unlike Hsp104<sup>A503V</sup> (Figures 7C–7F). Thus, the NTD is essential for potentiation of the Hsp104 hexamer by specific MD mutations.



#### Figure 7. Deletion of the Hsp104 NTD Inhibits Hsp104 Potentiation

(A) Δhsp104 yeast integrated with galactose-inducible TDP-43, FUS, or α-syn was transformed with the indicated Hsp104 variant or vector. Strains were serially diluted 5-fold and spotted on glucose (off) or galactose (on) media.

- (B) Selected yeast from (A) were induced for 5 hr, lysed, and immunoblotted. 3-phosphoglycerate kinase (PGK) serves as a loading control.
- (C) Fluorescence microscopy of cells expressing *α*-syn-YFP plus indicated Hsp104 variant or vector.
- (D) Quantification of  $\alpha$ -syn aggregation. Values represent means  $\pm$  SEM (n = 2).
- (E) Fluorescence microscopy of cells expressing FUS-GFP plus indicated Hsp104 variant or vector.
- (F) Quantification of FUS aggregation. Values represent means  $\pm$  SEM (n = 2).

(G) Model of Sup35 prion fragmentation versus dissolution by Hsp104. Hsp104 initially engages Sup35 prions in a region (residues 96–151; purple) C-terminal to the Tail contact (dark green). Directional pulling on N-terminal cross- $\beta$  structure leads to partial translocation and breakage of the Tail contact and Sup35 prion fragmentation. Further translocation breaks Central Core contacts (blue) and the Head contacts (red), resulting in monomer release. Thus, Sup35 prions are fragmented with or without monomer release. The Sup35 C-terminal domain remains folded throughout. Hsp104<sup> $\Delta N$ </sup> can break the Tail but not the Central Core or Head contacts, thus fragmenting Sup35 prions without solubilizing Sup35.

#### DISCUSSION

We have established that the Hsp104 NTD is essential for nucleotide-dependent conformational changes that enable productive hexamer cooperativity, plasticity, and potentiation. Reconstruction of Hsp104 hexamers in solution via SAXS revealed conformational changes that drive a peristaltic pumping motion triggered by ATP hydrolysis and completed by release of Pi. This peristaltic pumping motion likely drives directional substrate translocation through the N-terminal channel entrance, across the central channel, and out the C-terminal exit, but is grossly perturbed in Hsp104<sup> $\Delta N$ </sup>.

Mutant doping revealed negative cooperativity between substrate-binding pore loops in Hsp104<sup> $\Delta N$ </sup> hexamers. Remarkably, Hsp104<sup> $\Delta N$ </sup> hexamers containing  $\sim$ 1–4 subunits that cannot engage substrate outperform Hsp104<sup>ΔN</sup> hexamers in disaggregation of disordered aggregates. Thus, the NTD regulates substrate binding and prevents nonproductive competition for substrate binding by pore loops. This finding helps explain why Hsp104<sup>ΔN</sup> is less active than Hsp104 in disaggregating disordered aggregates. Although subunit cooperativity is not essential for disordered aggregate dissolution (DeSantis et al., 2012), it is necessary for optimal activity and adaptable hexamer function. This deficiency in Hsp104<sup> $\Delta N$ </sup> hexamer cooperativity due to defects in conformational changes results in deregulated ATPase activity, reduced disaggregase, unfoldase, and translocase activity, and an inability to dissolve stable amyloid, even in the presence of potentiating mutations. Hsp104<sup>ΔN</sup> is slightly less able to collaborate with Hsp70 and Hsp40 (Figure 1D), which might also contribute to reduced amyloid dissolution. However, amyloid dissolution by Hsp104 does not typically require Hsp70 and Hsp40 (DeSantis et al., 2012); thus we suggest that altered subunit cooperativity is the major defect limiting amyloid dissolution by Hsp104<sup> $\Delta N$ </sup>.

Cryo-EM reconstructions of Hsp104 have fueled controversy, and a clear picture of how Hsp104 drives protein disaggregation has not emerged from these studies. Controversy has been compounded by the use of only dysfunctional Hsp104 mutants in a limited number of nucleotide states: only ATP<sub>Y</sub>S, ATP, and ADP have been explored (Carroni et al., 2014; Lee et al., 2010; Wendler et al., 2007, 2009). It is difficult to relate these findings to WT Hsp104. To provide an independent view, we employed SAXS, a powerful method to study structural changes of AAA+ proteins in solution (Chen et al., 2010). SAXS is performed in solution, under conditions where Hsp104 is active, eliminating issues caused by freezing or fixation in cryo-EM. We reconstructed Hsp104 and Hsp104<sup> $\Delta N$ </sup> in AMP-PNP, ATP<sub>Y</sub>S, ATP, ADP-AIF<sub>x</sub> (hydrolysis transition state), ADP, and apo states to a nominal resolution of 7.6-8.4 Å. Thus, we provide the highestresolution and most comprehensive set of volume envelopes for Hsp104 (which has not been studied by cryo-EM) and Hsp104<sup>ΔN</sup> hexamers to date. By studying Hsp104 in various nucleotides, we uncover hexameric states that are likely populated during its natural ATPase cycle. We revealed a peristaltic pumping motion of the central channel that drives directional substrate translocation, which is profoundly altered in Hsp104<sup> $\Delta N$ </sup>. This finding helps explain several functional deficits of Hsp104<sup>ΔN</sup>. However, pore shape is unlikely to be the only determinant of substrate translocation, and it is critical to define the location of the substrate-binding pore loops in each nucleotide state. Future studies will fit atomic models of Hsp104 monomers into these SAXS envelopes and will be constrained by X-ray footprinting data (DeSantis et al., 2014).

We have elucidated the mechanism of Sup35 prion severing and dissolution by Hsp104. Hsp104 engages Sup35 prions by binding to a region spanning amino acids 96–151 (Figure 7G, purple regions). Hsp104 then exerts a directional pulling force that selectively unfolds cross- $\beta$  structure N-terminal to this binding site, but does not unfold domains C-terminal to this binding site (Figure 7G). This partial translocation mechanism enables Hsp104 to dissolve Sup35 prions without unfolding the C-terminal GTPase domain (Figure 7G). Thus, Hsp104 rapidly releases functional, folded protein from the prion to rapidly cure the loss-of-function [*PSI*<sup>+</sup>] phenotype (Paushkin et al., 1996).

After engaging the prion, Hsp104 resolves cross- $\beta$  structure N-terminal to its binding site in three steps: (1) the Tail-to-Tail contact is broken (Figure 7G, dark green regions), (2) the central cross- $\beta$  core is unfolded (Figure 7G, blue regions), and (3) the Head-to-Head contact is broken to release soluble Sup35 (Figure 7G, red regions). This sequence was confirmed by covalently stapling the Tail-to-Tail or Head-to-Head contact with BMB. Thus, Hsp104 severed prions with a covalent Head-to-Head contact by breaking the Tail-to-Tail contact, but could not fragment prions with a covalent Tail-to-Tail contact.

Hsp104<sup> $\Delta N$ </sup> is specifically defective in the second and third steps of this process. Hsp104<sup> $\Delta N$ </sup> engages the same binding site on Sup35 prions and breaks the Tail-to-Tail contact. However, Hsp104<sup> $\Delta N$ </sup> is unable to unfold the central core or break the Head-to-Head contact. Thus, Hsp104<sup> $\Delta N$ </sup> is capable of fragmenting but not dissolving Sup35 prions (Figure 7G). The ability of Hsp104<sup> $\Delta N$ </sup> to fragment but not dissolve Sup35 prions explains why it can propagate [*PSI*<sup>+</sup>], but not readily eliminate it at high concentrations in vivo (Hung and Masison, 2006). Indeed, in vitro, Hsp104<sup> $\Delta N$ </sup> operates in a way that only stimulates Sup35 prionogenesis and selectively amplifies strong [*PSI*<sup>+</sup>] prions.

Curiously, Hsp104<sup>ΔN</sup> overexpression very slowly cures [*PSI*<sup>+</sup>] in some genetic backgrounds but not others (Park et al., 2014). It was proposed that Hsp104<sup>ΔN</sup> promotes Sup35 prion dissolution via a "trimming" activity that solubilizes Sup35 only from the ends of prion fibrils (Park et al., 2014). Our findings provide a rationale for this proposed activity. Selective cleavage of the Tail-to-Tail contact by Hsp104<sup>ΔN</sup> could liberate soluble Sup35 at the subset of fibril ends where the Tail-to-Tail contact holds the final monomer to the fibril. However, we did not observe dissolution of Sup35 from assembled prions by Hsp104<sup>ΔN</sup> in vitro. Released monomers could be rapidly converted to the prion form by fibril ends or Hsp104<sup>ΔN</sup> may not access fibril ends in vitro. In vivo, other factors not reconstituted here might prevent this reassociation or selectively target Hsp104<sup>ΔN</sup> to Sup35 prion fibril ends.

Mechanisms distinct from prion dissolution have been proposed to explain  $[PSI^+]$  curing by Hsp104 overexpression including inhibition of Sup35 prion fragmentation (Winkler et al., 2012). Based on colocalization studies, it was proposed

that the Hsp104 NTD mediated binding to large NM-YFP aggregates and displaced Ssa1, thereby perturbing prion fragmentation (Winkler et al., 2012). However, overexpression of the Hsp104 NTD alone does not cure [*PSI*<sup>+</sup>] (Hung and Masison, 2006). It is unclear whether the colocalization reflects direct binding, as Hsp104 and Hsp104<sup> $\Delta$ N</sup> bind pure Sup35 prions with similar affinity. Moreover, these results are uncorroborated with native untagged proteins, and large NM-YFP aggregates are not disseminated prions. Importantly, [*PSI*<sup>+</sup>] curing kinetics by Hsp104 overexpression are inconsistent with inhibition of prion fragmentation (Park et al., 2014). This mechanism also fails to explain why Hsp104<sup> $\Delta$ N</sup> cures [*PSI*<sup>+</sup>] in some genetic backgrounds (Park et al., 2014).

We have established that the NTD is essential for potentiation of Hsp104 activity by specific MD mutations. Unlike their full-length counterparts, neither Hsp104<sup>ΔN-A503V</sup> nor Hsp104<sup>ΔN-A503S</sup> rescued TDP-43, FUS, or α-syn toxicity in yeast. Potentiating mutations at the A503 position of the MD likely promote an allosteric activation step that enhances Hsp104 ATPase, unfoldase, and disaggregase activity (Jackrel et al., 2014). These effects are ablated by NTD deletion. We conclude that optimal Hsp104 functionality depends on the NTD, which enables hexamer plasticity and potentiation.

#### **EXPERIMENTAL PROCEDURES**

#### **Proteins**

Proteins were purified using standard protocols. For more details, see Supplemental Experimental Procedures.

#### Size-Exclusion Chromatography

Absolute molecular weights of apo hexamers of Hsp104 and Hsp104<sup> $\Delta N$ </sup> (15  $\mu$ M monomer) were determined using multiangle light scattering coupled with refractive interferometric detection and a TSK4000 size-exclusion column.

#### **NTPase Activity**

Hsp104 ATPase and Sup35 GTPase activity was assessed as described (DeSantis et al., 2012; Krzewska et al., 2007).

#### **Protein Disaggregation**

Luciferase disaggregation and reactivation in vitro and in vivo were as described (DeSantis et al., 2012). Amyloid and prion disaggregation was as described (DeSantis et al., 2012). For more details, see Supplemental Experimental Procedures.

#### Thermotolerance

Yeast thermotolerance was assessed as described (DeSantis et al., 2012).

#### Sup35 Prionogenesis and Transformation

Sup35 prionogenesis in vitro and transformation were performed as described (DeSantis and Shorter, 2012; Shorter and Lindquist, 2006). For more details, see Supplemental Experimental Procedures.

#### Site-Resolved Pyrene and Acrylodan Fluorescence

Pyrene and acrylodan fluorescence were monitored as described (Krishnan and Lindquist, 2005).

#### Site-Resolved BPMTS Crosslinking

Single cysteine NM variants (10  $\mu$ M) bearing BPMTS at the indicated position were assembled into prions with agitation at 1,400 rpm (Eppendorf thermomixer) in the dark. Crosslinking was elicited by UV irradiation at 365 nm for 20 min. Samples were processed for reducing SDS-PAGE and immunoblot. For more details, see Supplemental Experimental Procedures. X-ray scattering data were collected at beamline 4-2 at Stanford Synchrotron Radiation Laboratory (SSRL, Menlo Park, CA) and beamline X9 at the National Synchrotron Light Source (NSLS, Upton, NY). Data were collected and analyzed as described (DeSantis et al., 2014). Shape reconstructions of the hexamer were generated using GASBOR (Svergun et al., 2001). Six-fold symmetry was imposed. Reconstructions were averaged and filtered using DAMAVER and converted to volume envelopes using SITUS (Volkov and Svergun, 2003; Wriggers et al., 1999). For more details, see Supplemental Experimental Procedures.

#### Mutant Doping Studies

Mathematical modeling and mutant doping studies were as described (DeSantis et al., 2012).

#### **Yeast Proteinopathy Models**

Yeast strains integrated with galactose-inducible TDP-43, FUS, or  $\alpha$ -syn were transformed with the indicated galactose-inducible Hsp104 variant or vector. Toxicity, aggregation, and expression were assessed as described (Jackrel et al., 2014).

#### **ACCESSION NUMBERS**

The SAXS data have been deposited in BIOISIS, an open-access database dedicated to the study of biological macromolecules by SAXS (http://www.bioisis.net/). The accession codes are available upon request from the authors.

#### SUPPLEMENTAL INFORMATION

Supplemental Information includes two figures, three tables, two movies, and Supplemental Experimental Procedures and can be found with this article at http://dx.doi.org/10.1016/j.molcel.2014.12.021.

#### ACKNOWLEDGMENTS

We thank Sue Lindquist, Walid Houry, Aaron Gitler, Martin Duennwald, and Laura Castellano for kindly providing reagents; Marta Carroni and Helen Saibil for sharing HAP model coordinates; Greg Van Duyne for help with SAXS; and Hiro Tsuruta, Lin Yang, and Marc Allaire for beamline assistance. This work was funded by American Heart Association predoctoral (E.A.S.) and post-doctoral (M.E.J.) fellowships; NIH grants T32GM008275 (E.A.S. and M.A.S.), T32GM071339 (M.E.D.), F31NS079009 (M.E.D.), DP2OD002177 (J.S.), and R01GM099836 (J.S.); an Ellison Medical Foundation New Scholar in Aging Award, Target ALS, Muscular Dystrophy Association (MDA277268), and The Robert Packard Center for ALS Research at Johns Hopkins University (J.S.).

Received: August 26, 2014 Revised: November 6, 2014 Accepted: December 12, 2014 Published: January 22, 2015

#### REFERENCES

Barnett, M.E., Nagy, M., Kedzierska, S., and Zolkiewski, M. (2005). The aminoterminal domain of ClpB supports binding to strongly aggregated proteins. J. Biol. Chem. *280*, 34940–34945.

Carroni, M., Kummer, E., Oguchi, Y., Wendler, P., Clare, D.K., Sinning, I., Kopp, J., Mogk, A., Bukau, B., and Saibil, H.R. (2014). Head-to-tail interactions of the coiled-coil domains regulate ClpB activity and cooperation with Hsp70 in protein disaggregation. eLife 3, e02481.

Chen, B., Sysoeva, T.A., Chowdhury, S., Guo, L., De Carlo, S., Hanson, J.A., Yang, H., and Nixon, B.T. (2010). Engagement of arginine finger to ATP triggers large conformational changes in NtrC1 AAA+ ATPase for remodeling bacterial RNA polymerase. Structure *18*, 1420–1430. DeSantis, M.E., and Shorter, J. (2012). Hsp104 drives "protein-only" positive selection of Sup35 prion strains encoding strong [PSI(+)]. Chem. Biol. *19*, 1400–1410.

DeSantis, M.E., Leung, E.H., Sweeny, E.A., Jackrel, M.E., Cushman-Nick, M., Neuhaus-Follini, A., Vashist, S., Sochor, M.A., Knight, M.N., and Shorter, J. (2012). Operational plasticity enables hsp104 to disaggregate diverse amyloid and nonamyloid clients. Cell *151*, 778–793.

DeSantis, M.E., Sweeny, E.A., Snead, D., Leung, E.H., Go, M.S., Gupta, K., Wendler, P., and Shorter, J. (2014). Conserved distal loop residues in the Hsp104 and ClpB middle domain contact nucleotide-binding domain 2 and enable Hsp70-dependent protein disaggregation. J. Biol. Chem. *289*, 848–867.

Hung, G.C., and Masison, D.C. (2006). N-terminal domain of yeast Hsp104 chaperone is dispensable for thermotolerance and prion propagation but necessary for curing prions by Hsp104 overexpression. Genetics *173*, 611–620.

Jackrel, M.E., DeSantis, M.E., Martinez, B.A., Castellano, L.M., Stewart, R.M., Caldwell, K.A., Caldwell, G.A., and Shorter, J. (2014). Potentiated Hsp104 variants antagonize diverse proteotoxic misfolding events. Cell *156*, 170–182.

Krishnan, R., and Lindquist, S.L. (2005). Structural insights into a yeast prion illuminate nucleation and strain diversity. Nature *435*, 765–772.

Krzewska, J., Tanaka, M., Burston, S.G., and Melki, R. (2007). Biochemical and functional analysis of the assembly of full-length Sup35p and its prion-forming domain. J. Biol. Chem. *282*, 1679–1686.

Lee, S., Sielaff, B., Lee, J., and Tsai, F.T. (2010). CryoEM structure of Hsp104 and its mechanistic implication for protein disaggregation. Proc. Natl. Acad. Sci. USA *107*, 8135–8140.

Lum, R., Niggemann, M., and Glover, J.R. (2008). Peptide and protein binding in the axial channel of Hsp104. Insights into the mechanism of protein unfolding. J. Biol. Chem. 283, 30139–30150.

Park, Y.N., Zhao, X., Yim, Y.I., Todor, H., Ellerbrock, R., Reidy, M., Eisenberg, E., Masison, D.C., and Greene, L.E. (2014). Hsp104 overexpression cures *Saccharomyces cerevisiae* [*PSI*<sup>+</sup>] by causing dissolution of the prion seeds. Eukaryot. Cell *13*, 635–647.

Paushkin, S.V., Kushnirov, V.V., Smirnov, V.N., and Ter-Avanesyan, M.D. (1996). Propagation of the yeast prion-like [*psi*<sup>+</sup>] determinant is mediated by oligomerization of the SUP35-encoded polypeptide chain release factor. EMBO J. *15*, 3127–3134.

Shorter, J. (2008). Hsp104: a weapon to combat diverse neurodegenerative disorders. Neurosignals 16, 63–74.

Shorter, J., and Lindquist, S. (2006). Destruction or potentiation of different prions catalyzed by similar Hsp104 remodeling activities. Mol. Cell *23*, 425–438.

Svergun, D.I. (1992). Determination of the Regularization Parameter in Indirect-Transform Methods Using Perceptual Criteria. J. Appl. Cryst. 25, 495–503.

Svergun, D.I., Petoukhov, M.V., and Koch, M.H. (2001). Determination of domain structure of proteins from X-ray solution scattering. Biophys. J. *80*, 2946–2953.

Tipton, K.A., Verges, K.J., and Weissman, J.S. (2008). In vivo monitoring of the prion replication cycle reveals a critical role for Sis1 in delivering substrates to Hsp104. Mol. Cell *32*, 584–591.

Volkov, V.V., and Svergun, D.I. (2003). Uniqueness of ab initio shape determination in small-angle scattering. J. Appl. Cryst. 36, 860–864.

Wendler, P., Shorter, J., Plisson, C., Cashikar, A.G., Lindquist, S., and Saibil, H.R. (2007). Atypical AAA+ subunit packing creates an expanded cavity for disaggregation by the protein-remodeling factor Hsp104. Cell *131*, 1366–1377.

Wendler, P., Shorter, J., Snead, D., Plisson, C., Clare, D.K., Lindquist, S., and Saibil, H.R. (2009). Motor mechanism for protein threading through Hsp104. Mol. Cell *34*, 81–92.

Winkler, J., Tyedmers, J., Bukau, B., and Mogk, A. (2012). Hsp70 targets Hsp100 chaperones to substrates for protein disaggregation and prion fragmentation. J. Cell Biol. *198*, 387–404.

Wriggers, W., Milligan, R.A., and McCammon, J.A. (1999). Situs: A package for docking crystal structures into low-resolution maps from electron microscopy. J. Struct. Biol. *125*, 185–195.

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# **Supplemental Information**

# The Hsp104 N-Terminal Domain Enables Disaggregase Plasticity and Potentiation

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Figure S1. Hsp104<sup>ΔN</sup> has impaired translocation and unfoldase activity. Related to Figure 3 and 6. (A) NM or BPMTS-labeled single cysteine NM variants (10µM) were agitated for 1h at 4°C. At the indicated times, prion assembly was assessed by ThT fluorescence. A representative dataset from three separate experiments in shown. (B) NM or BPMTS-labeled single cysteine NM variants were assembled into prions as in (A). Reaction products were sonicated and transformed into [psi] cells. The proportion of [psi], weak  $[PSI^{\dagger}]$ , and strong  $[PSI^{\dagger}]$  colonies was determined. A representative dataset from three separate experiments in shown. (C, D) NM lacks the C-terminal GTPase domain of Sup35 (amino acids 254-625; Figure 3D). Thus, does Hsp104 need to unfold domains C-terminal to NM to dissolve Sup35 prions? To answer this question, we employed NM-GFP, which forms prions in vivo (Tyedmers et al., 2010). NM-GFP retains similar GFP fluorescence in the prion and soluble state. Thus, GFP remains folded upon prionogenesis. To assess whether GFP was unfolded during Hsp104-catalzed prion dissolution we included GroEL<sub>TRAP</sub>, which captures unfolded GFP and prevents refolding (Doyle et al., 2007). NM-GFP prions were treated with Hsp $104^{\Delta N}$  (C) or Hsp104 (1µM) (D) plus GroEL<sub>TRAP</sub>, Sse1, Ssa1, and Sis1 for 0-1h. At various times, GFP fluorescence and ThT fluorescence was measured. Values represent means $\pm$ SEM (n=3). As anticipated, treatment of NM-GFP prions with Hsp104<sup> $\Delta N$ </sup> reduced neither GFP nor ThT fluorescence (C). By contrast, Hsp104 disassembled NM-GFP prions as determined by ThT fluorescence (**D**). However, GFP fluorescence was unchanged (**D**), indicating that Hsp104 can disassemble NM-GFP prions without unfolding GFP. Thus, Hsp104 selectively resolves N-terminal prion structure without unfolding the appended Cterminal domain. (E) We determined  $K_m$  and  $V_{max}$  of FITC-casein degradation for HAP and HAP<sup> $\Delta N$ </sup>. HAP is an Hsp104 mutant (739-GSK-741 to 739-IGF-741) that translocates substrates into a chambered protease, ClpP (Tessarz et al., 2008). FITC is released and fluorescence increases upon FITC-casein translocation by HAP and subsequent degradation by ClpP. Increasing concentrations of FITC-casein were incubated with ClpP plus HAP or HAP<sup> $\Delta N$ </sup>. Degradation rates were plotted against FITC-casein concentration to determine  $K_{\rm m}$  and  $V_{max}$ . Values represent means±SEM (n=3). HAP or HAP<sup> $\Delta N$ </sup>  $K_{\rm m}$  and  $V_{max}$  values are significantly different as determined by a two-tailed t-test (p<0.05). Compared to HAP, HAP<sup> $\Delta N$ </sup> displayed an increased  $K_m$  as well as a reduced  $V_{max}$ , revealing defects in protein translocation. **(F)** To determine whether Hsp104<sup> $\Delta$ N</sup> is a defective unfoldase, we used a RepA<sub>1-70</sub>-GFP substrate. Here, the first seventy amino acids of RepA are appended to GFP and serve as a recognition signal for Hsp104 (Doyle et al., 2007). To track RepA<sub>1-70</sub>-GFP unfolding by Hsp104 or Hsp104<sup> $\Delta$ N</sup> in the absence of subsequent refolding, we added GroEL<sub>TRAP</sub> (Doyle et al., 2007). RepA<sub>1-70</sub>-GFP was incubated with Hsp104 or Hsp104<sup> $\Delta$ N</sup> and GroEL<sub>TRAP</sub> plus ATP:ATP $\gamma$ S (2:1 or 1:1). GFP unfolding was measured by fluorescence. A representative dataset from three separate experiments is shown. With 1:1 or 2:1 ATP:ATP $\gamma$ S, Hsp104 robustly unfolds RepA<sub>1-70</sub>-GFP. By contrast, Hsp104<sup> $\Delta$ N</sup> displayed reduced RepA<sub>1-70</sub>-GFP unfoldase activity at 1:1 ATP:ATP $\gamma$ S, and was unable to unfold RepA<sub>1-70</sub>-GFP at 2:1 ATP:ATP $\gamma$ S. Thus, Hsp104<sup> $\Delta$ N</sup> is defective in substrate translocation and unfolding.





Top view



Side view

Figure S2. Guinier analysis, GASBOR replicates, and rigid-body fitting individual Hsp104 domains into volume envelope generated from SAXS data. Related to **Figure 4 and 5. (A)** Guinier plots of the raw scattering for Hsp104 and Hsp104<sup> $\Delta N$ </sup>. Guinier plots of the raw scattering for Hsp104 and Hsp104<sup> $\Delta N$ </sup> in the presence of AMP-PNP, ATPyS, ATP, ADP-AlF<sub>x</sub>, ADP, and no nucleotide. Linearity of the Guinier plot indicates that there were no interparticle interactions such as aggregation. (B, C) GASBOR replicates. Each GASBOR (Svergun et al., 2001) model of Hsp104 (B) and Hsp $104^{\Delta N}$  (C) are overlaid to show agreement of the individual GASBOR solutions for each of the nucleotide states: AMP-PNP, ATPyS, ATP, ADP-AlF<sub>x</sub>, ADP, and no nucleotide. (D) Rigid-body fitting individual Hsp104 domains into the volume envelope generated from SAXS/WAXS data of the Hsp104 hexamer in the presence of ATP. Individual Hsp104 domains were homology modeled based on the ClpB crystal structure 1khy (NTD) and 1qvr (for NBD1, MD, and NBD2). The domains were then rigid-body fit into the volume envelope generated from SAX/WAXS data of the Hsp104 hexamer in the presence of ATP. Top and side views are shown. The individual domains are colorcoded: NTD (orange), NBD1 (light blue), MD (purple), and NBD2 (dark blue).

Movie S1. Hsp104 volume envelope reconstructions in the ATP $\gamma$ S, ADP-AlF<sub>x</sub>, and ADP states. Related to Figure 4 and 5. Movie shows conformational changes of the Hsp104 hexamer and central channel from the ATP $\gamma$ S, ADP-AlFx, to ADP bound states.

Movie S2. Hsp104<sup> $\Delta N$ </sup> volume envelope reconstructions in the ATP $\gamma$ S, ADP-AlF<sub>x</sub>, and ADP states. Related to Figure 4 and 5. Movie shows conformational changes of the Hsp104<sup> $\Delta N$ </sup> hexamer and central channel from the ATP $\gamma$ S, ADP-AlFx, to ADP bound states.

Table S1. Sweeny et al.

Substrate	Hsp104 + ATPγS	$Hsp104^{\Delta N} + ATP\gamma S$
Ure2 prions	65±6nM	55±8nM
Sup35 prions	51±4nM	45±11nM
NM4 prions	59±9nM	66±9nM
$lpha$ -syn $^{ ext{WT}}$ amyloid	47±6nM	49±7nM
Q62 amyloid	56±8nM	63±7nM
Urea-denatured	49±3nM	55±6nM
luciferase aggregates		
FITC-casein (soluble)	55±7nM	194±60nM

# Table S1. Apparent dissociation constants of Hsp104 and Hsp104<sup> $\Delta N$ </sup> binding to various amyloid, disordered aggregate, and soluble substrates. Related to Figure 2. The apparent $K_d$ of Hsp104 or Hsp104<sup> $\Delta N$ </sup> binding the indicated amyloid, disordered aggregate, or soluble substrates in the presence of ATP $\gamma$ S. Values represent means±SD (n=3).

| HSp104 WI  |   |   |   
  |  | Calaba  
   |   |   
  | C11014   | Bernd   
   | 1011 h. O.  | C45000  
  | Cit  |  |  |   | Channel.  |  |                          |
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   | (0)   | Angela angela   
  | GNOM   | Porod   
   | MM by Qr  | GASBOR  
  | Situs Di   | mensions   | Maluma A   | D'and   | Channel   | Ada and allow diam   | <b>C</b> II              |
|  | Location  | Conc.   | qmin  
  | qkg range  | кд  
   | 1(0)  | Angle range   
  | Dmax kg I(U) Total Es  | . volume P  
   | Exp IVIVI Theor IVIVI   | No. Included INSD   
  | Damaver  | Damfilt  | volume A   | vg Diam   | iviax avg slice diam  | IVIIN avg slice diam   | Slices                   |
| WT AMP-PNP   | NSLS  | 2.5 mg/mL   | 0.01100   
  | 0.748-1.50   | 68.0 +- 0.0811  
   | 522.49 +- 0.644   | 0.0092-0.8290   
  | 255 69.2 526 0.77  | 1/2//02 3.9   
   | 645000 612000   | 10 2.588 +-   
  | 0.495 252x224x188.090  | 154x126x89.095   |  |   | ·   |  |                          |
|  | NSLS  | 5.0 mg/mL   | 0.01098   
  | 30.755-1.51  | 68.7 +- 0.0547  
   | 1011.5 +- 0.811   | 0.0073-0.8300   
  | 230 68.6 1010 0.67   | 1706347 3.9   
   | 650000 612000   | 9 2.373 +-  
  | 0.549 234x234x156.270  | 143x169x91.924   | 1.71E+05   | 29  | 56  | . 0  | 90                       |
|  | NSLS  | 2.9 mg/mL   | 0.01201   
  | 0.817-1.50   | 68.1 +- 0.0980  
   | 570.01 +- 0.835   | 0.0120-0.7950   
  | 235 68.2 567 0.65  | 1700962 3.9   
   | 624000 612000   | 9 2.366 +-  
  | 0.341 228x240x127.280  | 156x180x84.853   |  |   |   |  |                          |
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   |   |   
  |  |   
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  |  |  |  |   |   |  |                          |
| WT ATP <b>Y</b> S  | NSLS  | 2.5 mg/mL   | 0.01101   
  | 0.754-1.51   | 68.5 +- 0.0739  
   | 530.51 +- 0.592   | 0.0097-0.7290   
  | 235 69.2 530 0.60  | 1711825 3.9   
   | 609000 612000   | 10 2.053 +-   
  | 0.266 221x234x156.271  | 130x143x91.924   |  |   | 1   |  |                          |
|  | NSLS  | 5.0 mg/mL   | 0.01100   
  | 0.756-1.51   | 68.7 +- 0.0518  
   | 1085.4 +- 0.824   | 0.0103-0.7290   
  | 235 69 1080 0.60   | 1708074 3.9   
   | 620000 612000   | 9 2.096 +-  
  | 0.169 237.5x225x150.261  | 150x137.5x88.388   |  |   |   |  |                          |
|  | SSRI  | 2.9 mg/ml   | 0.01497   
  | 1.04-1.53  | 69.4 +- 0.264   
   | 18.144 +- 0.0786  | 0.0140-0.4435   
  | 235 70.2 18 0.67   | 1660568 3.8   
   | 612000  | 9 2 267 +-  
  | 0.394 238x224x158.391  | 140x154x89.095   |  |   |   |  |                          |
|  | SSRI  | 5.9 mg/ml   | 0.01506   
  | 1 04-1 53  | 69 5 += 0 209   
   | 35 650 += 0 124   | 0.0140-0.4435   
  | 235 69.4 35 0.66   | 1647299 3.8   
   | 612000  | 9 2 173 +-  
  | 0 551 246 5x232x133 289  | 145x159 5x92 277   |  |   |   | +  |                          |
|  | NCLC  | 1.5 mg/mL   | 0.01300   
  | 0 802 1 51   | 69.7 + 0.109  
   | 219.99 + 0.521  | 0.0110 0.7050   
  | 235 60 317 0.66  | 1654510 3.0   
   | 617000 612000   | 0 1 012 1   
  | 0.303 316+338+144.35   | 156-156-94 952   |  |   |   |  |                          |
|  | NOLO  | 1.5 mg/mL   | 0.01300   
  | 0.093-1.51   | 00.7 +- 0.108   
   | 518.88 +- 0.321   | 0.0110-0.7950   
  | 223 09 317 0.00  | 1034319 3.9   
   | 617000 612000   | 9 1.912 +-  
  | 0.292 210x228x144.25   | 130x130x64.833   | 4.055.05   | 27.0  | 46.0  |  | 04                       |
|  | INSES   | 2.9 mg/mL   | 0.01300   
  | 0.909-1.54   | 69.9 +- 0.0832  
   | 616.75 +- 0.800   | 0.0110-0.7950   
  | 240 /1.5 620 0.62  | 1692549 3.9   
   | 630000 612000   | 9 1.641 +-  
  | 0.114 228x228x135.765  | 168X156X93.338   | 1.05E+05   | 27.9  | 40.8  | 18   | 8                        |
|  |   | 1   |   
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  |  |  |  |   |   |  |                          |
| WT ATP   | NSLS  | 2.5 mg/mL   | 0.01000   
  | 0.677-1.49   | 67.7 +- 0.0701  
   | 450.12 +- 0.458   | 0.0103-0.8290   
  | 220 67.1 445 0.68  | 1654371 3.9   
   | 631000 612000   | 10 2.034 +-   
  | 0.189 216x228x135.764  | 132x144x93.338   |  |   |   |  |                          |
|  | NSLS  | 5.0 mg/mL   | 0.01100   
  | 0.749-1.50   | 68.1 +- 0.0507  
   | 936.03 +- 0.685   | 0.0078-0.8100   
  | 230 68.2 935 0.59  | 1674270 3.9   
   | 640000 612000   | 9 2.013 +-  
  | 0.512 225x237.5x150.260  | 187.5x187.5x88.388   | 1.82E+05   | 38.2  | 50  | / 28.4   | 95                       |
|  | SSRL  | 2.9 mg/mL   | 0.01499   
  | 1.01-1.55  | 67.1 +- 0.241   
   | 17.190 +- 0.0683  | 0.0140-0.3171   
  | 230 67.1 17.1 0.65   | 1684247 3.9   
   | 612000  | 9 1.801 +-  
  | 0.203 237.5x237.5x141.422  | 187.5x175x97.227   | 1 1  |   | 1   |  |                          |
|  | SSRL  | 5.9 mg/mL   | 0.01493   
  | 3 1.01-1.56  | 67.5 +- 0.185   
   | 32,498 +- 0,100   | 0.0140-0.4435   
  | 230 67.1 32 0.66   | 1679654 3.9   
   | 612000  | 9 2.829 +-  
  | 0.653 234x221x165.463  | 143x143x101.117  |  |   |   |  |                          |
|  | NSLS  | 1.5 mg/ml   | 0.01000   
  | 0.670-1.54   | 67.0 +- 0.0871  
   | 242.38 +- 0.331   |   
  |  |   
   | 612000  |   
  |  |  |  |   |   |  |                          |
|  | NSIS  | 2.9 mg/ml   | 0.01099   
  | 0 736-1 54   | 66.9 += 0.0862  
   | 444 53 += 0 592   | 0.0110-0.7900   
  | 230 672 443 0.5  | 1654772 3.8   
   | 603000 612000   | 10 1 706 +-   
  | 0.080 216x228x135 764  | 156v168v93 338   |  |   |   |  |                          |
|  | NJCJ  | 2.9 mg/mc   | 0.01033   
  | 10.730-1.34  | 00.3 +- 0.0802  
   | 444.55 1- 0.552   | 0.0110-0.7500   
  | 230 07.2 443 0.3   | 1054772 5.8   
   | 003000 012000   | 10 1.700 1-   
  | 0.000 210/220/133.704  | 150x108x55.558   |  | _   |   |  |                          |
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  |  |  |  |   |   |  | -                        |
| WT ADP-AIFX  | SSRL  | 2.9 mg/mL   | 0.01498   
  | 80.981-1.51  | 65.4 +- 0.234   
   | 17.404 +- 0.0672  | 0.0140-0.4435   
  | 220 65 17.2 0.71   | 1642119 3.9   
   | 612000  | 9 2.412 +-  
  | 0.634 225x212.5x159.099  | 1/5x150x97.227   |  |   |   |  |                          |
|  | SSRL  | 5.9 mg/mL   | 0.01500   
  | 0.990-1.52   | 66.1 +- 0.188   
   | 33.300 +- 0.100   | 0.0140-0.4435   
  | 220 65.1 32.7 0.6  | 1641887 3.9   
   | 612000  | 9 2.343 +-  
  | 0.286 225x225x141.421  | 150x175x79.550   |  |   | I   |  |                          |
|  | NSLS  | 1.5 mg/mL   | 0.02108   
  | 3 1.39-1.73  | 66.3 +- 0.228   
   | 306.67 +- 1.77  | 0.0210-0.7950   
  | 225 66.5 305 0.64  | 1593390 3.9   
   | 612000  | 9 1.806 +-  
  | 0.288 228x216x135.764  | 180x156x84.853   |  |   |   |  |                          |
|  | NSLS  | 2.9 mg/mL   | 0.02096   
  | 5 1.39-1.72  | 66.2 +- 0.145   
   | 586.1 +- 2.15   | 0.0210-0.7950   
  | 210 64.2 560 0.69  | 1625506 3.9   
   | 612000  | 10 2.108 +-   
  | 0.220 216x216x144.250  | 168x156x84.853   |  |   |   |  |                          |
|  | NSLS  | 5.0 mg/mL   | 0.01300   
  | 0.850-1.50   | 65.4 +- 0.298   
   | 1964.9 +- 9.52  | 0.0130-0.8000   
  | 220 63.9 1920 0.71   | 1580239 3.8   
   | 564000 612000   | 8 1.904 +-  
  | 0.132 216x228x135.764  | 180x180x93.338   | 6.51E+05   | 26.4  | 32.2  | 24.8   | 80                       |
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  |  |  |  |   |   |  | -                        |
| WTADP  | NSIS  | 2.5 mg/ml   | 0.01000   
  | 0 663-1 49   | 66 3 += 0 0274  
   | 1365 4 += 0 709   | 0.0078-0.8050   
  | 240 67 1370 0.62   | 1595855 2.9   
   | 617000 612000   | 9 2 004 +-  
  | 0 286 250x225x141 421  | 175v150v88 389   | 8 50E+04   | 27.1  | 10.3  | 14.5   | 71                       |
|  | NCLC  | E 0 mg/ril  | 0.0100  
  | 0.704 1 47   | 67.0 + 0.0374   
   | 2907.5 + 1.40   | 0.0078-0.0050   
  | 245 67 0 2820 0.03   | 1555655 3.0   
   | 632000 612000   | 0 2 024 -   
  | 0.247 224-247-427 005  | 142-156-02 721   | 0.301104   | 27.1  | 40.5  | 14.5   | /:                       |
|  | INSES   | 15.0 mg/mL  | 0.01051   
  | 0.704-1.47   | 07.0 +- 0.0384  
   | 2007.5 +- 1.40  | 0.0078-0.7300   
  | 245 67.9 2820 0.60   | 12300/0 3.9   
   | 022000 012000   | 9 2.034 +-  
  | 0.247 23482478137.885  | 143x150X82./31   |  |   |   | l  |                          |
|  | SSRL  | 2.9 mg/mL   | 0.01499   
  | 0.985-1.52   | 65.7 +- 0.225   
   | 16.606 +- 0.0616  | 0.0140-0.4435   
  | 210 64.8 16.3 0.72   | 1644595 3.9   
   | 612000  | 9 1.847 +-  
  | 0.193 207x218.5x138.24   | 172.5x195.5x105.712  |  |   |   |  |                          |
|  | SSRL  | 5.9 mg/mL   | 0.01499   
  | 0.994-1.53   | 66.3 +- 0.182   
   | 33.548 +- 0.100   | 0.0140-0.4435   
  | 215 64.6 32.6 0.73   | 1629344 3.8   
   | 612000  | 10 2.807 +-   
  | 0.487 216x216x200.465  | 135x148.5x95.460   |  |   |   |  |                          |
|  | NSLS  | 1.5 mg/ml   | 0.01201   
  | 0.799-1.53   | 66.6 +- 0.0935  
   | 287.34 +- 0.410   | 0.0120-0.7950   
  | 225 66.1 284 0.64  | 1610198 3.9   
   | 596000 612000   | 10 2.034 +-   
  | 0.245 216x228x144.250  | 168x168x84.852   |  |   |   |  |                          |
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| WT no nucleotic  | e NSLS  | 2.5 mg/mL   | 0.00750   
  | 0.538-1.51   | 71.7 +- 0.106   
   | 490.30 +- 0.773   | 0.0090-0.2240   
  | 245 71.6 487 0.64  | 1977362 3.8   
   | 612000  | 10 2.359 +-   
  | 0.158 243x243x152.736  | 148.5x148.5x85.914   |  |   |   |  |                          |
|  | NSLS  | 5.0 mg/ml   | 0.00899   
  | 0.616-1.49   | 72.5 +- 0.0647  
   | 971.03 +- 0.856   | 0.0090-0.1590   
  | 260 73.6 975 0.63  | 1979811 3.9   
   | 612000  | 9 2 663 +-  
  | 0.613 256.5x256.5x133.644  | 148.5x.148.5x95.460  |  |   |   |  |                          |
|  | SSRI  | 2.9 mg/ml   | 0.01497   
  | 1 09-1 53  | 72.8 += 0.340   
   | 18 995 += 0 105   | 0.0140-0.4435   
  | 255 73 3 18 9 0 74   | 2064711 3.9   
   | 612000  | 9 2 692 +-  
  | 0.958 256 5x256 5x152 736  | 162x175 5x85 914   |  |   | · · · · · · · · · · · · · · · · · · ·   |  |                          |
|  | CCDI  | E 0 mg/mL   | 0.01501   
  | 1 11 1 56  | 74.2 + 0.340  
   | 28.035 + 0.214  | 0.0140 0.4394   
  | 255 75.5 10.5 0.74   | 2066202 2.0   
   | 612000  | 0,2,525,1   
  | 0.676 242+256 5+142 100  | 175 54220 54105 006  |  |   |   |  |                          |
|  | DORL  | 5.9 mg/mL   | 0.01301   
  | 1.11-1.50  | 74.2 +- 0.554   
   | 36.933 +- 0.214   | 0.0140-0.4564   
  | 233 74.7 38.7 0.76   | 2000202 3.9   
   | 612000  | 9 2.323 +-  
  | 0.676 2432230.33143.190  | 173.38229.38103.008  | 4.005.05   | 26.5  |   |  | 4.04                     |
|  | INSES   | 1.5 mg/mL   | 0.01400   
  | 0.990-1.49   | /0./ +- 0.1//   
   | 344.72 +- 0.945   | 0.0110-0.7950   
  | 225 70 341 0.70  | 2069872 3.8   
   | 668000 612000   | 9 2.530 +-  
  | 0.527 234x234x156.27   | 156X195X101.116  | 1.80E+05   | 20.5  | 50.5  | 10.5   | 100                      |
|  | NSLS  | 2.9 mg/mL   | 0.01397   
  | 1.01-1.52  | 72.3 +- 0.116   
   | 688.30 +- 1.25  | 0.0110-0.7950   
  | 225 71.3 678 0.  | 1969839 3.9   
   | 612000  | 9 2.714 +-  
  | 0.420 234x234x156.271  | 143x143x91.924   |  |   | ·   |  |                          |
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| Hsp104 dN  |   |   |   
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| Hsp104 dN  |   |   |   
  |  | Guinier   
   |   |   
  | GNOM   | Porod   
   | MM by Qr  | GASBOR  
  | Situs Di   | mensions   |  |   | Channel   |  |                          |
| Hsp104 dN<br>ΔN AMP-PNP  | Location  | Conc.   | qmin  
  | qRg range  | Guinier<br>Rg   
   | I(O)  | Angle range   
  | GNOM<br>Dmax Rg I(0) Total Es  | Porod<br>Volume P   
   | MM by Qr<br>Exp MM Theor MM   | GASBOR<br>No. Included NSD  
  | Situs Di<br>Damaver  | mensions<br>Damfilt  | Volume A   | vg Diam   | Channel<br>Max avg slice diam   | Min avg slice diam   | Slices                   |
| Hsp104 dN<br>ΔN AMP-PNP  | Location<br>NSLS  | Conc.<br>5.0 mg/mL  | qmin<br>0.01150   
  | qRg range  | Guinier<br>Rg<br>66.8 +- 0.0553   
   | I(O)<br>869.53 +- 0.732   | Angle range<br>0.0118-0.7490  
  | GNOM<br>Dmax Rg I(0) Total Es<br>235 67.2 864 0.65   | Porod<br>Volume P<br>1521470 3.9  
   | MM by Qr<br>Exp MM Theor MM<br>563000 506000  | GASBOR<br>No. Included NSD<br>10 1.717 +-   
  | Situs Di<br>Damaver<br>0.069 228x240x118.794   | Damfilt<br>144x156x67.882  | Volume A   | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam   | Slices<br>60             |
| Hsp104 dN<br>ΔN AMP-PNP  | Location<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL  | qmin<br>0.01150<br>0.01000  
  | <b>qRg range</b><br>0.768-1.50<br>0.651-1.50   | Guinier<br>Rg<br>66.8 +- 0.0553<br>65.1 +- 0.0976   
   | I(O)<br>869.53 +- 0.732<br>254.35 +- 0.394  | Angle range<br>0.0118-0.7490<br>0.0100-0.7950   
  | GNOM<br>Dmax Rg I(0) Total Es<br>235 67.2 864 0.65<br>235 65.8 255 0.56  | Porod<br>Volume P<br>1521470 3.9<br>1441966 3.9   
   | MM by Qr<br>Exp MM Theor MM<br>563000 506000<br>530000 506000   | GASBOR<br>No. Included NSD<br>10 1.717 +-<br>10 2.182 +-  
  | Situs Di<br>Damaver<br>0.069 228x240x118.794<br>0.167 237.5x237.5x123.743  | mensions<br>Damfilt<br>144x156x67.882<br>175x187.5x70.711  | Volume A<br>7.80E+04   | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam 26.7  | Slices<br>60             |
| Hsp104 dN<br>ΔN AMP-PNP  | Location<br>NSLS<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/ml  | qmin<br>0.01150<br>0.01000  
  | qRg range<br>0.768-1.50<br>0.651-1.50<br>0.523-1.50  | Guinier<br>Rg<br>66.8 +- 0.0553<br>65.1 +- 0.0976<br>65.3 +- 0.0822   
   | I(O)<br>869.53 +- 0.732<br>254.35 +- 0.394<br>339.88 +- 0.435   | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950  
  | GNOM<br>Dmax Rg I(0) Total Es<br>235 67.2 864 0.65<br>235 65.8 255 0.56<br>235 66 5 342 0.57   | Porod<br>Volume P<br>1521470 3.9<br>1441966 3.9<br>1455462 3.9  
   | MM by Qr           Exp MM         Theor MM           563000         506000           530000         506000           537000         506000  | GASBOR<br>No. Included NSD<br>10 1.717 +-<br>10 2.182 +-<br>9 2.066 +-  
  | Situs Di<br>Damaver<br>0.069 228x240x118.794<br>0.167 237.5x237.5x123.743<br>0.182 240x240x118.794   | mensions<br>Damfilt<br>144x156x67.882<br>175x187.5x70.711<br>204x204x67.883  | Volume A<br>7.80E+04   | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam<br>26.7   | Slices<br>60             |
| Hsp104 dN<br>ΔN AMP-PNP  | Location<br>NSLS<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL  | qmin<br>0.01150<br>0.01000<br>0.00801   
  | <b>qRg range</b><br>0.768-1.50<br>0.651-1.50<br>0.523-1.50   | Guinier           Rg           66.8 +- 0.0553           65.1 +- 0.0976           65.3 +- 0.0822   
   | I(O)<br>869.53 +- 0.732<br>254.35 +- 0.394<br>339.88 +- 0.435   | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950  
  | GNOM         I(0)         Total Est           Dmax         Rg         I(0)         Total Est           235         67.2         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57   | Porod           Volume         P           1521470         3.9           1441966         3.9           1455462         3.9  
   | MM by Qr           Exp MM         Theor MM           563000         506000           530000         506000           537000         506000  | GASBOR<br>No. Included NSD<br>10 1.717 +-<br>10 2.182 +-<br>9 2.066 +-  
  | Situs Di           Damaver           0.069         228x240x118.794           0.167         237.5x237.5x123.743           0.182         240x240x118.794   | Damfilt           144x156x67.882           175x187.5x70.711           204x204x67.883   | Volume Av  | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam<br>26.7   | Slices<br>60             |
| Hsp104 dN<br>ΔN AMP-PNP  | Location<br>NSLS<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL  | qmin<br>0.01150<br>0.01000<br>0.00801   
  | qRg range<br>0.768-1.50<br>0.651-1.50<br>0.523-1.50  | Guinier<br>Rg<br>66.8 +- 0.0553<br>65.1 +- 0.0976<br>65.3 +- 0.0822   
   | I(0)<br>869.53 +- 0.732<br>254.35 +- 0.394<br>339.88 +- 0.435<br>I 434.30 +- 0.403  | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950  
  | GNOM           Dmax         Rg         I(0)         Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57  | Porod<br>Volume P<br>1521470 3.9<br>1441966 3.9<br>1455462 3.9<br>1251130 3.0   
   | MM by Qr           Exp MM         Theor MM           563000         506000           530000         506000           537000         506000           537000         506000  | GASBOR<br>No. Included NSD<br>10 1.717 +-<br>10 2.182 +-<br>9 2.066 +-  
  | Situs Di<br>Damaver<br>0.069 228x240x118.794<br>0.167 237.5x237.5x123.743<br>0.182 240x240x118.794   | mensions           Damfilt           144x156x67.882           175x187.5x70.711           204x204x67.883  | Volume A   | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam   | Slices<br>6              |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATP <b>y</b> S                           | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL   | qmin<br>0.01150<br>0.01000<br>0.00801   
  | <b>qRg range</b><br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48   | Guinier           Rg           66.8 +- 0.0553           65.1 +- 0.0976           65.3 +- 0.0822           65.7 +- 0.0747           65.7 +- 0.0747   
   | I(O)<br>869.53 + 0.732<br>254.35 + 0.394<br>339.88 + 0.435<br>434.39 + 0.492<br>032.43 + 0.492  | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950<br>0.0113-0.7890   
  | GNOM           Dmax         Rg         I(0)         Total Est           235         67.2         864         0.65:           235         65.8         255         0.56:           235         66.5         342         0.57           235         67.1         9.44         0.66           235         67.1         9.44         0.67  | Porod<br>Volume P<br>1521470 3.9<br>1441966 3.9<br>1455462 3.9<br>1351120 3.9<br>144550 2.0   
   | MM by Qr           Exp MM         Theor MM           563000         \$506000           530000         \$506000           537000         \$506000           \$230000         \$506000           \$230000         \$506000  | GASBOR<br>No. Included NSD<br>10 1.717 +-<br>10 2.182 +-<br>9 2.066 +-<br>9 1.661 +-  
  | Situs Di<br>Damaver<br>0.069 228x240x118.794<br>0.167 237.5x237.5x123.743<br>0.182 240x240x118.794<br>0.182 240x240x118.844  | mensions           Damfilt           144x155x67.882           175x187.5x70.711           204x204x67.883           184x195.5x73.186   | Volume A   | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam   | Slices<br>60             |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡ <b>γ</b> S                           | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL   | qmin<br>0.01150<br>0.01000<br>0.00801<br>0.01099<br>0.01100   
  | qRg range<br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50  | Guinier           Rg           66.8 + 0.0553           65.1 + 0.0976           65.3 + 0.0822           65.6 + 0.0747           66.6 + 0.0610  
   | I(O)<br>869.53 + 0.732<br>254.35 + 0.394<br>339.88 + 0.435<br>434.39 + 0.492<br>933.47 + 0.851  | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950<br>0.0113-0.7890<br>0.0113-0.7860  
  | GNOM           Dmax         Rg         I(0)         Total Es           235         67.2         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         67.1         434         0.6           235         67.1         434         0.60           235         68         933         0.600   | Porod<br>Volume P<br>1521470 3.9<br>1441966 3.9<br>1455462 3.9<br>1351120 3.9<br>1441596 3.9  
   | MM by Qr           Exp MM         Theor MM           563000         506000           537000         506000           537000         506000           523000         506000           538000         506000  | GASBOR<br>No. Included NSD<br>10 1.717 +-<br>10 2.182 +-<br>9 2.066 +-<br>9 1.661 +-<br>9 1.726 +-  
  | Situs Di<br>Damaver<br>0.069 228x240x118.794<br>0.167 237.5x237.5x123.743<br>0.182 240x240x118.794<br>0.182 230x230x113.844<br>0.235 241.5x230x113.844   | Damfil           144x156x67.882           175x187.5x70.711           204x204x67.883           184x195.5x73.186           172.5x149.5x73.186  | Volume A/<br>7.80E+04  | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam   | Slices<br>60             |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATP <b>y</b> S                           | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL   | qmin<br>0.01150<br>0.01000<br>0.00801<br>0.01099<br>0.01100<br>0.01398  
  | <b>qRg range</b><br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50<br>0.996-1.50   | Guinier           Rg           66.8 + 0.0553           65.1 + 0.0976           65.3 + 0.0822           65.7 + 0.0747           66.6 + 0.0610           71.2 + 0.290   
   | I(O)<br>869.53 + 0.732<br>254.35 + 0.394<br>339.88 + 0.435<br>434.39 + 0.492<br>933.47 + 0.851<br>16.918 + 0.780  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7860           0.0140-0.2414   
  | GNOM           Dmax         Rg         I(0)         Total Et           235         67.2         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         67.1         434         0.6           235         68         933         0.60           220         69.6         8.25         0.68   | Porod           Volume         P           1521470         3.9           1441966         3.9           1455462         3.9           1351120         3.9           15441596         3.9           1543621         3.9   
   | MM by Qr           Exp MM         Theor MM           53000         506000           530000         506000           537000         506000           538000         506000           538000         506000           538000         506000   | GASBOR<br>No. Included NSD<br>10] 1.717 +-<br>10] 2.182 +-<br>9] 2.066 +-<br>9] 1.661 +-<br>9] 1.726 +-   
  | Situs Di           Damaver         Onego         228x240x118.794           0.167         237.5x237.5x123.7x3         0.182         240x240x118.794           0.182         240x240x118.794         0.182         230x230x113.844           0.235         241.5x230x113.844         0.235         241.5x230x113.844   | mensions           Damfilt           144x155x67.882           175x187.5x70.711           204x204x67.883           184x195.5x73.186           172.5x149.5x73.186  | Volume A<br>7.80E+04   | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam   | Slices<br>60             |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγS                                    | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>5.0 mg/mL<br>2.3 mg/mL<br>4.6 mg/mL   | qmin<br>0.01150<br>0.01000<br>0.00801<br>0.01099<br>0.01100<br>0.01398<br>0.01399   
  | qRg range           0.768-1.50           0.651-1.50           0.523-1.50           0.723-1.48           0.733-1.50           0.996-1.50           0.970-1.53   | Guinier           Rg           66.8 + 0.0553           65.1 + 0.0976           65.3 + 0.0822           65.7 + 0.0747           66.6 + 0.0610           71.2 + 0.290           69.4 + 0.336  
   | $\begin{array}{c} \textbf{I(O)}\\ 869.53+0.732\\ 254.35+0.394\\ 339.88+0.435\\ \hline\\ 434.39+0.492\\ 933.47+0.851\\ 16.918+0.780\\ 8.3718+0.470\\ \end{array}$  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7860           0.0140-0.2414           0.0150-0.2515   
  | GNOM           Dmax Rg         I(0)         Total Es           235         67.2         864         0.55           235         65.8         255         0.56           235         66.5         342         0.57           235         67.1         434         0.6           235         68         933         0.60           220         69.6         8.25         0.68           220         69.6         16.1         0.62  | Porod           Volume         P           1521470         3.9           1441966         3.9           1455462         3.9           1455462         3.9           1455462         3.9           1455462         3.9           1455462         3.9           156362         3.9           157120         3.9           1543621         3.9           1571916         3.9  
   | Exp MM         Theor MM           563000         S06000           537000         S06000           537000         S06000           538000         S06000           538000         S06000           538000         S06000           538000         S06000           538000         S06000           536000         S06000   | GASBOR<br>No. Included NSD<br>10 1.717 +<br>10 2.182 +<br>9 2.066 +<br>9 1.661 +<br>9 1.726 +   
  | Situs Di           Damaver           0.069         228x240x118.794           0.167         237.5x237.5x123.743           0.182         240x240x118.794           0.182         240x240x113.844           0.235         241.5x230x113.844   | mensions           Damfit           144x156x67.882           175x187.5x70.711           204x204x67.883           184x195.5x73.186           172.5x149.5x73.186   | Volume Ar  | vg Diam<br>31.9   | Channel<br>Max avg slice diam<br>46.4   | Min avg slice diam   | Slices<br>60             |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATP <b>y</b> S                           | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL  | qmin<br>0.01150<br>0.01000<br>0.00801<br>0.01099<br>0.01100<br>0.01398<br>0.01399   
  | <b>qRg range</b><br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50<br>0.996-1.50<br>0.970-1.53<br>0.777-1.51   | Guinier           Rg         66.8 + 0.0553         65.1 + 0.0976         65.3 + 0.0822           65.3 + 0.0822         65.7 + 0.0747         66.6 + 0.0610         71.2 + 0.290         69.4 + 0.336         65.6 + 0.0364  
   | I(O)           869.53 + 0.732           254.35 + 0.394           339.88 + 0.435           434.39 + 0.492           933.47 + 0.851           16.918 + 0.780           8.3718 + 0.470           298.48 + 0.392  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7860           0.0140-0.2414           0.0150-0.2515           0.0120-0.7950   
  | GNOM           Dmax Rg         I(0)         Total Et           2235         67.2         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         66.5         342         0.60           235         66.8         933         0.60           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         69.6         259         0.58  | Porod           1521470         3.9           1441966         3.9           1455462         3.9           1455462         3.9           1551120         3.9           1543621         3.9           1571916         3.9           135332         3.9  
   | Exp MM         Theor MM           563000         506000           537000         506000           537000         506000           538000         506000           538000         506000           538000         506000           538000         506000           538000         506000           538000         506000           536000         506000   | GASBOR<br>No. Included NSD<br>10 1.717 +-<br>10 2.182 +-<br>9 2.066 +-<br>9 1.726 +-<br>9 1.726 +-<br>9 1.338 +-  
  | Situs Di           Damaver           0.069         228x240x118.794           0.167         237.5x237.5x123.743           0.182         240x240x118.794           0.182         230x230x113.844           0.235         241.5x230x113.844           0.235         241.5x230x113.647           0.072         198x209x116.672   | mensions Damfit 144x156x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 174.5x149.5x73.186 154x154x77.782   | Volume A<br>7.80E+04   | vg Diam<br>31.9<br>21.6                                 | Channel<br>Max avg slice diam<br>46.4<br>24.7   | Min avg slice diam<br>1 26.7<br>   | Slices<br>60             |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγS                                    | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>4.6 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL   | qmin<br>0.01150<br>0.01000<br>0.00801<br>0.01099<br>0.01100<br>0.01398<br>0.01399<br>0.01200  
  | qRg range<br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50<br>0.996-1.50<br>0.990-1.53<br>0.790-1.53  | $\begin{tabular}{ c c c c c } \hline Rg \\ \hline 66.8 + 0.0553 \\ \hline 65.1 + 0.0976 \\ \hline 65.3 + 0.0822 \\ \hline \\ \hline \\ \hline \\ 65.7 + 0.0747 \\ \hline 66.6 + 0.0610 \\ \hline \\ 71.2 + 0.290 \\ \hline 69.4 + 0.336 \\ \hline 65.6 + 0.0864 \\ \hline 65.9 + 0.0904 \\ \hline \end{tabular}$  
   | $\begin{array}{c} 1(0)\\ 869.53+0.732\\ 254.35+0.394\\ 339.88+0.435\\ \hline\\ 434.39+0.492\\ 933.47+0.851\\ 16.918+0.780\\ 8.3718+0.470\\ 298.48+0.392\\ 404.09+0.565\\ \hline\end{array}$   | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950<br>0.0113-0.7890<br>0.0113-0.7860<br>0.0113-0.7860<br>0.0140-0.2414<br>0.0150-0.2515<br>0.0120-0.7950<br>0.0120-0.7950   
  | GNOM           Dmax Rg 1(0) Total Et           2235         67.2         8.64         0.65           2235         65.8         255         0.56           2235         66.5         342         0.57           2235         66.5         342         0.57           2235         68         933         0.60           220         69.6         8.25         0.68           220         66         295         0.58           220         66         295         0.58           220         66         400         0.51  | Porod           Volume         P           1521470         3.9           1441966         3.9           1351120         3.9           144596         3.9           1571916         3.9           135332         3.9           1325326         3.9  
   | Science         Science           Stando         Sofocol           Sigado         Sofocol           Sofocol         Sofocol           Sofocol         Sofocol           Sofocol         Sofocol           Sofocol         Sofocol  | GASBOR<br>No. Included NSD<br>101.7.17 +<br>102.182 +<br>92.066 +<br>91.661 +<br>91.726 +<br>91.726 +<br>91.338 +<br>91.458 +  
   | Situs Di           Damaver           0.069         228x240x118.794           0.167         237.5x237.5x123.743           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x113.844           0.052         198x209x116.672           0.027         199x209x108.894   | mensions<br>Damfil<br>144x156x67.882<br>175x187.5x70.711<br>204x204x67.883<br>184x195.5x73.186<br>172.5x149.5x73.186<br>154x154x77.782   | Volume A:<br>7.80E+04<br>5.70E+04  | vg Diam<br>31.9<br>21.6                                 | Channel<br>Max avg slice diam<br>46.4<br>24.7   | Min avg slice diam 26.7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | Slices<br>60             |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡ <del>γ</del> S                       | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>NSLS  | Conc.           5.0 mg/mL           1.5 mg/mL           2.0 mg/mL           2.5 mg/mL           5.0 mg/mL           2.3 mg/mL           4.6 mg/mL           1.5 mg/mL           2.0 mg/mL   | qmin<br>0.01150<br>0.01000<br>0.00801<br>0.01099<br>0.01100<br>0.01398<br>0.01399<br>0.01200  
  | qRg range           0.768-1.50           0.651-1.50           0.551-1.50           0.723-1.48           0.733-1.50           0.996-1.50           0.970-1.53           0.778-1.51           0.790-1.52   | Guinier           Rg           66.8 + 0.0553           65.1 + 0.0976           65.3 + 0.0822           65.7 + 0.0747           66.6 + 0.0610           71.2 + 0.290           69.4 + 0.336           65.5 + 0.0864           65.9 + 0.0904  
   | I(0)           869.53 + 0.732           254.35 + 0.394           339.88 + 0.435           434.39 + 0.492           93.47 + 0.851           16.918 + 0.780           8.3718 + 0.470           298.48 + 0.392           404.09 + 0.565  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7880           0.0113-0.7860           0.0120-0.2515           0.0120-0.7950   
  | GNOM         Grad         Reg         (0)         Total         E           235         67.21         866         0.65         235         0.65         235         0.65         232         235         66.5         342         0.57         235         66.5         342         0.57         235         66.5         342         0.57         235         66.8         933         0.60         220         69.6         3.25         0.68         220         69.6         3.25         0.48         220         69.6         1.61         0.62         220         69.6         3.25         0.48         220         66.4         400         0.61   | Porod           1521470         3.9           1441966         3.9           1455462         3.9           1455462         3.9           1441596         3.9           1543621         3.9           1571916         3.9           1335332         3.9           1328161         3.9   
   | MM by Qr           Exp MM         Theor MM           563000         So6000           537000         So6000           537000         So6000           532000         So6000           538000         So6000           538000         So6000           538000         So6000           538000         So6000           538000         So6000           538000         So6000           515000         So6000           520000         So6000  | GASBOR<br>No. Included NSD<br>1011.717 +-<br>102.182 +-<br>92.066 +-<br>91.726 +-<br>91.726 +-<br>91.726 +-<br>91.338 +-<br>91.458 +-   
  | Situs Di           Damaver           0.060         228x240x118.794           0.167         237.5x237.5x123.743           0.182         240x240x118.794           0.182         220x230x113.844           0.235         241.5x230x113.844           0.235         98x209x116.672           0.227         209x209x108.894  | Interview         Interview <t< th=""><th>Volume A<br/>7.80E+04</th><th>vg Diam<br/>31.9<br/>21.6</th><th>Channel<br/>Max avg slice diam<br/>46.4<br/>24.7</th><th>Min avg slice diam<br/>26.7<br/>1<br/>1<br/>1<br/>1<br/>1<br/>1<br/>1<br/>1<br/>1<br/>1<br/>1<br/>1<br/>1</th><th>Slices<br/>60</th></t<>   | Volume A<br>7.80E+04   | vg Diam<br>31.9<br>21.6                                 | Channel<br>Max avg slice diam<br>46.4<br>24.7   | Min avg slice diam<br>26.7<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1  | Slices<br>60             |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATPγS                                    | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL  | qmin           0.01150           0.01000           0.00001           0.01092           0.01092           0.01093           0.01398           0.01398           0.01200           0.01200           0.00650  
  | qRg range<br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50<br>0.996-1.50<br>0.970-1.53<br>0.771-51<br>0.790-1.52  | Guinier         Rg           66.8 + 0.0553         65.1 + 0.0976           65.3 + 0.0822         65.7 + 0.0747           66.6 + 0.0610         71.2 + 0.290           65.4 + 0.0364         65.6 + 0.0864           65.5 + 0.0864         65.9 + 0.0904           64.8 + 0.0769         64.8 + 0.0769   
   | $\begin{array}{c} \textbf{I(0)}\\ 869.53\pm0.732\\ 254.35\pm0.394\\ 339.88\pm0.435\\ 434.39\pm0.492\\ 933.47\pm0.4851\\ 16.918\pm0.780\\ 8.3718\pm0.470\\ 298.48\pm0.392\\ 404.09\pm0.565\\ 379.69\pm0.454\\ \end{array}$   | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950<br>0.0113-0.7890<br>0.0113-0.7860<br>0.0140-0.2414<br>0.0150-0.2515<br>0.0120-0.7950<br>0.0120-0.7950  
  | GNOM           Dmax Rg 1(0) Total E:           2235         67.2         864         0.65           2255         65.8         255         0.56           2255         65.7         342         0.57           2255         67.1         434         0.6           2250         69.6         933         0.60           2200         69.6         8.25         0.68           2200         66.6         295         0.58           2200         66.6         490         0.61           2200         66.7         400         0.61           2200         67.2         387         0.50   | Porod           1521470         3.9           1441966         3.9           1455462         3.9           1351120         3.9           1441596         3.9           153162         3.9           153120         3.9           1351120         3.9           135122         3.9           13232461         3.9           13535601         3.9  
   | MM by Qr           Exp MM         Theor MM           563000         So6000           330000         So6000           \$32000         So6000           \$32000         So6000           \$23000         So6000           \$506000         So6000           \$500000         So6000   | GASBOR<br>No. Included NSD<br>101.717+<br>102.182+<br>92.066+<br>91.661+<br>91.726+<br>91.338+<br>91.458+   
  | Situs Di<br>Damer<br>0.069 [228x240x118.794<br>0.167 [237.5x237.5x123.748<br>10.162 [237.5x237.5x123.748<br>10.182 [240x240x118.794<br>0.182 [240x240x118.484<br>0.105 [240x240x116.672<br>0.272 [209x209x106.672<br>0.116 [230x241 5x105 713  | mensions<br>Damfilt<br>144x15665.882<br>175x187.5x70.711<br>204x204x67.883<br>184x195.5x73.186<br>154x154.5x73.186<br>154x154x77.782<br>134x154x77.782   | Volume A<br>7.80E+04   | vg Diam<br>31.9<br>21.6                                 | Channel<br>Max avg slice diam<br>46.4<br>24.7   | Min avg slice diam 26.7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | Slices 60                |
| Hsp104 dN<br>AN AMP-PNP<br>AN ATP <b>y</b> S<br>AN ATP                 | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>4.6 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL  | qmin           0.01150           0.01000           0.00801           0.01099           0.01100           0.01398           0.01399           0.01200           0.01200           0.01200           0.00650           0.01100  
  | <b>qRg range</b><br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50<br>0.996-1.50<br>0.970-1.53<br>0.787-1.51<br>0.787-1.51<br>0.790-1.52   | Guinier         Rg           66.8 + 0.0553         65.1 + 0.0976           65.3 + 0.0822         65.7 + 0.0747           66.6 + 0.0610         71.2 + 0.290           65.6 + 0.0864         65.6 + 0.0864           65.9 + 0.09864         65.9 + 0.09864           65.8 + 0.00864         65.9 + 0.0906           64.8 + 0.0769         65.2 + 0.0904  
   | $\begin{array}{c} \textbf{I(0)} \\ 869.53 + 0.732 \\ 254.35 + 0.394 \\ 339.88 + 0.435 \\ 434.39 + 0.492 \\ 933.47 + 0.851 \\ 16.918 + 0.780 \\ 8.3718 + 0.470 \\ 298.48 + 0.392 \\ 404.09 + 0.565 \\ 379.69 + 0.454 \\ 379.69 + 0.454 \\ 379.69 + 0.629 \end{array}$  | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950<br>0.0113-0.7890<br>0.0113-0.7800<br>0.0140-0.2414<br>0.0150-0.2515<br>0.0120-0.7950<br>0.0120-0.7950<br>0.0068-0.7900<br>0.0113.0.7900  
  | GNOM           Dmax Rg         (0)         Total E           235         67.21         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         66.7         342         0.57           235         67.1         434         0.6           235         68         933         0.60           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           220         66.4         400         0.61           240         67.2         387         0.50           236         67.2         387         0.50   | Porod           Volume         P           1521470         3.9           1441466         3.9           1455462         3.9           1451406         3.9           1441596         3.9           154120         3.9           154120         3.9           15421         3.9           1571916         3.9           1335332         3.9           1325360         3.9           1335360         3.9  
   | MM by Qr<br>Exp Mm Theor MM<br>563000 506000<br>330000 506000<br>532000 506000<br>533000 506000<br>533000 506000<br>535000 506000<br>515000 506000<br>515000 506000<br>515000 506000  | GASBOR<br>No. Included NSD<br>1011717+<br>102182+<br>92.066+<br>91.661+<br>91.726+<br>91.338+<br>91.4584<br>91.4584<br>91.899+<br>91.899+   
  | Situs Di           Damaver           0.069         228x240x118.794           0.167         237         5x23           0.167         237         5x23           0.167         237         5x23           0.167         237         5x23           0.162         230x20x113.844         0.33           0.272         298x209x116.672         0.227           0.072         198x209x116.672         0.227           0.072         193x209x116.844         0.116           0.116         230x201x108.845         713           0.116         230x201x108.844         0.116           0.116         230x201x108.844         0.116   | mensions<br>Damfilt<br>1441156x67.882<br>175x187.5x70.711<br>204x204x67.883<br>184x195.5x73.186<br>172.5x149.5x73.186<br>154x154x77.782<br>143x154x77.782<br>195.5x195.5x73.185  | Volume A<br>7.80E+04   | vg Diam<br>31.9<br>21.6                                 | Channel<br>Max avg slice diam<br>46.4<br>24.7<br>24.7                                 | Min avg slice diam<br>1 26.7<br>1 15.7<br>15.7   | Slices 60                |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγS<br>ΔΝ ΑΤΡ                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>5.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL  | qmin           0.01150           0.01000           0.00801           0.01099           0.01100           0.01399           0.01200           0.01200           0.00650           0.01100           0.01200  
  | <b>qRg range</b><br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50<br>0.733-1.50<br>0.7970-1.53<br>0.787-1.51<br>0.787-1.51<br>0.790-1.52<br>0.712-1.49<br>0.717-1.50  | Guinier         Rg           66.8 + 0.0553         65.1 + 0.0976           65.3 + 0.0822         65.7 + 0.0747           66.6 + 0.0610         71.2 + 0.290           65.4 + 0.0366         65.6 + 0.0864           65.9 + 0.0904         64.8 + 0.0769           63.8 + 0.0769         65.2 + 0.0491   
   | 1(0)<br>869.53 + 0.732<br>254.35 + 0.394<br>339.88 + 0.435<br>434.39 + 0.492<br>434.39 + 0.492<br>16.918 + 0.780<br>8.3718 + 0.470<br>298.48 + 0.381<br>404.09 + 0.565<br>379.69 + 0.454<br>862.45 + 0.638  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7860           0.0114-0.7860           0.0140-0.2414           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0133-0.7900           0.0113-0.7900   
  | GNOM           Dmax Rg         [0]         Total E           2235         67.2         864         0.65           2235         65.8         255         0.56           2235         66.5         342         0.57           2235         66.5         342         0.57           2235         68         933         0.60           220         69.6         8.25         0.68           220         66.4         400         0.61           220         66.4         400         0.50           220         67.2         387         0.50           220         67.2         387         0.50           235         65.9         859         0.57           236         67.4         7.04         7.04  | Porod           Volume P           1521470         3.9           1441966         3.9           1455662         3.9           1351120         3.9           1543621         3.9           1543623         3.9           1353120         3.9           1328161         3.9           1328161         3.9           1353560         3.9           1438188         3.9  
   | MM by Qr           Exp MM         Theor MM           563000         S06000           330000         S06000           337000         S06000           538000         S06000           530000         S06000           506000         S06000           506000         S06000           506000         S06000           515000         S06000           512000         S06000           512000         S06000           512000         S06000  | GASBOR<br>No. Included NSD<br>101.717+<br>92.066 +-<br>91.661 +-<br>91.726 +-<br>91.338 +-<br>91.458 +-<br>91.458 +-<br>91.899 +-<br>91.899 +-<br>91.6757 +-  
  | Situs Di<br>Damba<br>0.066 228x240x118.794<br>0.167 237 5x237.5x123.743<br>1.82 240x240x118.794<br>0.182 230x240x113.844<br>0.235 241.5x230x113.844<br>0.072 198x209x116.672<br>0.272 209x209x108.894<br>0.171 230x207x113.844<br>0.171 230x207x1130x207x113.844<br>0.171 230x207x113.844<br>0.171 230x207x | mensions Damfilt 144x156x67.882 175x187.5x70.711 204x204x67.883 172x187.5x70.883 172x5x149.5x73.186 172x5x149.5x73.186 154x154x77.782 195x5x195.5x73.185 184x149.5x50.54 184x149.5x50.54 184x149.5x50.54 184x149.5x60.54 184x149 184x14 184x14 184x14 184x14 184x14 184x14 184x14 184x14 184x1 184x14 184x1 184x14 184x1 | Volume A<br>7.80E+04<br>5.70E+04<br>5.70E+04<br>1.25E+05   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg slice diam<br>46.4<br>24.7<br>24.7<br>60.9                         | Min avg slice diam<br>26.7<br>1<br>1<br>15.7<br>24.2   | Slices 60                |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγS<br>ΔΝ ΑΤΡ                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>3.0 | qmin           0.01150           0.01000           0.00801           0.01095           0.01395           0.01395           0.01200           0.01200           0.00650           0.01495           0.01495   
   | qRg range<br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50<br>0.996-1.50<br>0.996-1.50<br>0.996-1.51<br>0.790-1.52<br>0.790-1.52<br>0.712-1.49<br>0.717-1.50<br>0.957-1.54  | Guinier         Rg           66.8 + 0.0553         65.1 + 0.0976           65.3 + 0.0822         65.7 + 0.0747           66.6 + 0.0610         71.2 + 0.290           69.4 + 0.336         65.6 + 0.0844           65.9 + 0.0904         65.9 + 0.0904           65.8 + 0.0804         65.8 + 0.0804           65.8 + 0.0491         63.8 + 0.0769           65.2 + 0.0491         63.8 + 0.2769   
  | 1(0)<br>869.53 + 0.732<br>254.35 + 0.394<br>339.88 + 0.435<br>434.39 + 0.432<br>433.37 + 0.451<br>16.918 + 0.780<br>298.48 + 0.392<br>404.09 + 0.565<br>379.69 + 0.454<br>379.69 + 0.658<br>170.691 + 0.038<br>70.691 + 0.038   | Angle range<br>(0.0118-0.7490)<br>(0.010-0.7950)<br>(0.0080-0.7950)<br>(0.0113-0.7890)<br>(0.0113-0.7890)<br>(0.0140-0.2414)<br>(0.0150-0.2515)<br>(0.0120-0.7950)<br>(0.0120-0.7950)<br>(0.0120-0.7950)<br>(0.0113-0.7900)<br>(0.0114-0.2910)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.0140-0.2915)<br>(0.   
   | GNOM           Dmax Rg         (0)         Total E           235         67.21         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         66.7         342         0.57           220         69.6         933         0.60           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           235         65.9         859         0.57           235         66.4         400         0.61           240         67.2         387         0.50           235         66.9         859         0.57           235         66.4         7.08         0.77           235         66.4         7.08         0.77  | Porod           Volume P           1521470         3.9           1441966         3.9           14551120         3.9           13551426         3.9           1345120         3.9           15434916         3.9           135332         3.9           1328461         3.9           1335332         3.9           1335360         3.9           1335360         3.9           1338360         3.9           1338202         3.9           138202         3.9           138202         3.9           138202         3.9  
  | MM by Qr           Exp MM         Theor MM           56300         S06000           33000         S06000           532000         S06000           533000         S06000           538000         S06000           538000         S06000           53000         S06000           53000         S06000           515000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000  | GASBOR           No. Included NSD           101.717 +.           102.182 +.           912.066 +.           91.661 +.           91.726 +.           91.458 +.           91.458 +.           91.757 +.           91.661  | Situs D<br>Damaver<br>0.069 228x240x118.794<br>0.167 237 5x237.5x123.743<br>22 240x240x118.794<br>0.182 23 0x240x118.794<br>0.182 23 0x240x113.844<br>0.235 24 15.2230x113.844<br>0.272 198x209x116.672<br>0.272 209x209x108.894<br>0.116 230x241.5x105.713<br>0.176 230x209x118.844<br>0.135 230x241.5x105.713<br>0.136 230x241.3x105.713  
  | mensions<br>Damfilt<br>144x156x67.882<br>175x187.5x70.711<br>204x20467.883<br>184x195.5x73.186<br>172.5x149.5x73.186<br>154x154x77.782<br>143x154x77.782<br>143x154x77.782<br>185x195.5x73.185<br>184x1425.056.054<br>195.5x172.5x81.317   | Volume A<br>7.80E+04   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg slice diam<br>46.4<br>24.7<br>24.7<br>60.9                         | Min avg slice diam<br>1 26.7<br>1 15.7<br>24.2   | Slices<br>60             |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγS<br>ΔΝ ΑΤΡ                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>5.0 mg/mL<br>4.6 mg/mL   | qmin           0.01150           0.01000           0.00801           0.0109           0.01100           0.01398           0.01200           0.01200           0.00650           0.01499           0.01499           0.01499           0.01499   
  | qRg range<br>0.768-1.50<br>0.651-1.50<br>0.523-1.50<br>0.723-1.48<br>0.733-1.50<br>0.996-1.50<br>0.970-1.53<br>0.787-1.51<br>0.790-1.52<br>0.712-1.49<br>0.712-1.49<br>0.927-1.54<br>0.927-1.54  | Guinier           Rg           66.8 + 0.0553           65.1 + 0.0976           65.3 + 0.0822           65.7 + 0.0747           65.7 + 0.0747           66.6 + 0.0610           71.2 + 0.290           65.4 + 0.336           65.5 + 0.0864           65.9 + 0.0904           64.8 + 0.0769           63.8 + 0.276           64.8 + 0.238           63.8 + 0.276           64.8 + 0.278  
   | (O)<br>860.53 + 0.732<br>254.35 + 0.394<br>333.88 + 0.435<br>434.39 + 0.435<br>434.39 + 0.432<br>434.39 + 0.432<br>434.39 + 0.432<br>33718 + 0.470<br>298.48 + 0.392<br>379.69 + 0.454<br>862.45 + 0.633<br>13.913 + 0.534  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.013-0.7860           0.0140-0.2414           0.0150-0.2515           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0068-0.7900           0.0113-0.7800           0.0113-0.7950           0.0068-0.7900           0.0140-0.2919           0.0140-0.2919  
  | GNOM           Dmax Rg 1(0) Total E           2235         67.2         864         0.65           2235         65.8         255         0.56           2235         66.5         342         0.57           2235         66.7         1.434         0.6           2235         68         933         0.60           220         66.6         8.25         0.68           220         66.6         295         0.58           220         66.4         400         0.61           220         66.4         400         0.50           220         67.2         387         0.50           220         67.2         387         0.50           225         65.9         3.59         0.57           225         65.9         1.38         0.67           225         55.3         1.38         0.77           225         55.4         1.38         0.67   | Porod           Volume p           1521470           1441966           3.9           1445562           3.9           144196           3.9           144196           3.9           144196           3.9           144196           3.9           144196           3.9           135120           1571316           1353260           1353360           1353560           138382           9           1382222           9           138460           39           1382222           39           138462   
   | MM by Qr           Exp MM         Theor MM           563000         S06000           537000         S06000           537000         S06000           538000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           515000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000  | GASBOR<br>No. Included MSD<br>1011.717 +<br>102.182 +<br>92.066 +<br>911.661 +<br>91.726 +<br>91.458 +<br>91.458 +<br>91.458 +<br>91.459 +<br>91.459 +<br>101.419 +   
  | Situs Di           Dame           0.066         228×240×118.794           0.167         237.5x23.742           0.182         240×240×118.794           0.182         240×240×118.794           0.255         241.5x230×113.844           0.052         294.5x230×113.844           0.072         298×299×116.672           0.272         209×209×108.894           0.116         230×217.113.844           0.135         230×230×12.976           0.363         230×219.718  | mensions<br>Damfilt<br>144x15667.882<br>175x187.5x70.711<br>204x204x67.883<br>184x195.5x73.186<br>154x154x77.782<br>195x195.5x73.185<br>184x149.5x67.3185<br>184x149.5x63.054<br>195.5x172.5x81.317<br>207x207x73.186  | Volume A<br>7.80E+04<br>5.70E+04<br>5.70E+04<br>1.25E+05   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9                          | Min avg slice diam<br>1 26.7<br>1 15.7<br>24.2   | Slices<br>60<br>80<br>70 |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγS<br>ΔΝ ΑΤΡ                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>NSLS<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL  | qmin           0.01150           0.01000           0.00801           0.01099           0.01398           0.01398           0.01200           0.01200           0.01200           0.01200           0.01499           0.01499           0.01499           0.01499           0.01499           0.01499  
  | <b>qRg range</b><br><b>qRg range</b><br><b>0.768-1.50</b><br><b>0.561-1.50</b><br><b>0.523-1.50</b><br><b>0.723-1.48</b><br><b>0.733-1.50</b><br><b>0.970-1.53</b><br><b>0.787-1.51</b><br><b>0.770-1.52</b><br><b>0.712-1.49</b><br><b>0.712-1.49</b><br><b>0.712-1.50</b><br><b>0.972-1.50</b><br><b>0.972-1.54</b><br><b>0.972-1.51</b>   | $\begin{array}{c} \textbf{Guinter} \\ \textbf{Rg} \\ \textbf{66.8} + 0.0553 \\ \textbf{65.1} + 0.0976 \\ \textbf{65.3} + 0.0823 \\ \textbf{65.7} + 0.0747 \\ \textbf{66.6} + 0.0610 \\ \textbf{71.2} + 0.290 \\ \textbf{66.6} + 0.0610 \\ \textbf{67.6} + 0.0366 \\ \textbf{65.6} + 0.0864 \\ \textbf{65.9} + 0.0904 \\ \textbf{64.8} + 0.0769 \\ \textbf{64.8} + 0.2768 \\ \textbf{64.8} + 0.238 \\ \textbf{64.8} + 0.278 \\ \textbf{64.8} + 0.278 \\ \textbf{64.8} + 0.278 \\ \textbf{64.8} + 0.278 \\ \textbf{64.8} + 0.0789 \\ \textbf{64.8} + 0.0788 \\ \textbf{65.9} + 0.0799 \\ \textbf{64.8} + 0.0238 \\ \textbf{64.8} + 0.0789 \\ \textbf{65.9} \\ \textbf{65.9}$  
                         | $\begin{array}{c} \textbf{I(O)} \\ \textbf{860:53} = 0.732 \\ \textbf{254.35} = 0.394 \\ \textbf{330.88} + 0.435 \\ \textbf{330.88} + 0.435 \\ \textbf{330.88} + 0.435 \\ \textbf{3310} \\ \textbf{347} + 0.851 \\ \textbf{16.918} + 0.781 \\ \textbf{16.918} + 0.781 \\ \textbf{370.69} + 0.455 \\ \textbf{370.69} + 0.458 \\ \textbf{367.45} - 0.558 \\ \textbf{370.681} + 0.033 \\ \textbf{13.913} + 0.534 \\ \textbf{320.51} + 0.277 \\ \textbf{3311} + 0.534 \\ \textbf{3311} + 0.5$  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.013-0.7860           0.0113-0.7860           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0068-0.7900           0.0140-0.2919           0.0140-0.2919           0.0140-0.7950   | GNOM           Dmax Rg (0) Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         65.6         342         0.57           235         66.7         342         0.57           235         66.7         434         0.6           235         66.8         933         0.60           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           235         65.9         859         0.57           235         65.4         7.08         0.77           235         65.1         1.38         0.67           236         65.4         7.08         0.77           235         65.1         1.38         0.67           230         63.4         221         0.84         0.26  
  | Porod           Volume P           1521470         3.9           1441966         3.9           14551120         3.9           13551476         3.9           13551476         3.9           1345142         3.9           1335332         3.9           1328461         3.9           1335360         3.9           1335360         3.9           1342638         3.9           13426463         3.9           1342669         3.9           1342669         3.9           1342669         3.9           1342669         3.9  | MM by Qr           Exp MM         Theor MM           56300         S06000           33000         S06000           532000         S06000           533000         S06000           538000         S06000           538000         S06000           538000         S06000           539000         S06000           515000         S06000           512000         S06000           506000         S06000           478000         S06000   
  | GASBON           No. Included NSD           101.717 +.           102.182 +.           91.066 +.           91.661 +.           91.726 +.           91.458 +.           91.458 +.           91.458 +.           91.657 +.           91.657 +.           91.657 +.  | Situs Di           Damore:           0.069         228x240x118.794           0.167         237 5x27.5x123.743           0.167         237 5x27.5x123.743           0.167         237 5x27.5x123.743           0.167         237 5x27.5x123.743           0.182         240x240x118.794           0.182         240x240x118.794           0.072         198x209x116.672           0.0272         209x209x108.894           0.116         230x2415x105.713           0.135         230x240x12.1976           0.036         230x218.5x105.712   | mensions Damfilt 144x156x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 174.54x77.782 143x154x77.782 143x154x77.782 184x149.5x65.054 195.5x172.5x81.317 207x207x73.186   
   | Volume A<br>7.80E+04<br>5.70E+04<br>5.70E+04   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg slice diam<br>46.4<br>24.7<br>24.7<br>60.9                         | Min avg slice diam<br>1 26.7<br>1 15.7<br>24.2   | Slices<br>6(<br>8(       |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγS<br>ΔΝ ΑΤΡ                          | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL   | qmin           0.01150           0.01000           0.00801           0.01099           0.01100           0.01399           0.01200           0.01200           0.00650           0.01499           0.00650           0.01499           0.01499           0.01499           0.01499           0.01000   | qRg range           Q.768.150           0.651-150           0.551-150           0.723-148           0.733-150           0.996.150           0.970.153           0.771-151           0.771-150           0.771-515           0.771-515           0.727-154           0.727-150           0.629-151  | $\begin{array}{c} \textbf{Guinier} \\ \textbf{Rg} \\ \hline \textbf{66.8} + 0.0553 \\ \hline \textbf{65.1} + 0.0976 \\ \hline \textbf{65.3} + 0.0822 \\ \hline \textbf{65.7} + 0.0741 \\ \hline \textbf{65.7} + 0.0741 \\ \hline \textbf{66.6} + 0.0610 \\ \hline \textbf{71.2} + 0.290 \\ \hline \textbf{63.4} + 0.336 \\ \hline \textbf{65.6} + 0.0864 \\ \hline \textbf{65.9} + 0.0904 \\ \hline \textbf{65.4} + 0.0364 \\ \hline \textbf{65.8} + 0.0286 \\ \hline \textbf{63.8} + 0.276 \\ \hline \textbf{64.8} + 0.278 \\ \hline \textbf{64.8} + 0.278 \\ \hline \textbf{62.9} + 0.0792 \\ \hline \textbf{62.9} + 0.0792 \\ \hline \textbf{62.9} - 0.0792 \\ \hline \textbf{63.9} \\ \hline \textbf{63.9} - 0.0792 \\ \hline \textbf{64.9} \\ \hline \textbf{65.9} - 0.0792 \\ \hline \textbf{65.9} \\ \hline \textbf{65.9} - 0.0792 \\ \hline \textbf{65.9} \\ \hline \textbf{65.9} - 0.0792 \\ \hline \textbf{65.9} $   | $\begin{array}{c} \textbf{I(0)}\\ \textbf{860.53} \leftarrow 0.732\\ \textbf{254.35} \leftarrow 0.394\\ \textbf{330.88} \leftarrow 0.435\\ \textbf{330.88} \leftarrow 0.435\\ \textbf{330.88} \leftarrow 0.435\\ \textbf{333.88} \leftarrow 0.435\\ \textbf{333.88} \leftarrow 0.435\\ \textbf{333.88} \leftarrow 0.378\\ \textbf{33718} \leftarrow 0.470\\ \textbf{33718} \leftarrow 0.470\\ \textbf{340.09} \leftarrow 0.565\\ \textbf{379.69} \leftarrow 0.56\\ $ | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950<br>0.0113-0.7890<br>0.0113-0.7860<br>0.0140-0.2414<br>0.0150-0.2515<br>0.0120-0.7950<br>0.0120-0.7950<br>0.013-0.7900<br>0.0113-0.7900<br>0.0140-0.2919<br>0.0110-0.7950  | GNOM           Dmax Rg 100 Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           225         67.1         434         0.6           235         68         933         0.60           220         69.6         16.1         0.62           220         66         295         0.58           220         66         400         0.61           220         66         400         0.51           220         66         7.83         0.50           220         66         7.98         0.77           225         65.1         7.08         0.67           225         65.1         7.08         0.67           225         65.1         7.08         0.67           225         65.1         7.88         0.67           225         65.1         1.38         0.67           236         63.4         221         0.48           240         63.3         222         0.48  | Porod           Volume p           1521470           1521470           1441966           3.9           1441967           1351120           141596           9           15345021           9           1535120           135120           135120           135350           9           135350           9           135322           135350           9           136360           1364062           9           1340023   | MM by Qr           Exp MM         Theor MM           563000         S06000           530000         S06000           537000         S06000           532000         S06000           532000         S06000           532000         S06000           506000         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           478000         S06000           468000         S06000  | GASBOR<br>No. Included NSD<br>10] 1.717 +<br>9] 2.066 +<br>9] 1.661 +<br>9] 1.726 +<br>9] 1.338 +<br>9] 1.458 +<br>9] 1.458 +<br>9] 1.459 +<br>9] 1.645 +<br>10] 1.419 +   | Situs Di<br>2014 2014 2014 2014 2014 2014 2014 2014  | mensions<br>Damfilt<br>144x156x67.882<br>175x187.5x70.711<br>204x204x67.883<br>184x195.5x73.186<br>172.5x149.5x73.186<br>154x154x77.782<br>195.5x195.5x73.185<br>184x149.5x65.054<br>195.5x195.5x73.186<br>207x207x73.186  | Volume A<br>7.80E+04<br>5.70E+04<br>5.70E+04<br>1.25E+05   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9                          | Min avg slice diam<br>1 26.7<br>1 15.7<br>24.2   | Slices<br>6(<br>8(<br>7( |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγS<br>ΔΝ ΑΤΡ                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL  | qmin           0.01150           0.01000           0.00001           0.01398           0.01398           0.01398           0.01200           0.01200           0.01200           0.01499           0.01499           0.01499           0.01000  
  | <b>qRg range</b><br><b>0.758</b> ±1.50<br><b>0.651</b> ±1.50<br><b>0.733</b> ±1.50<br><b>0.733</b> ±1.50<br><b>0.793</b> ±1.50<br><b>0.790</b> ±1.53<br><b>0.790</b> ±1.53<br><b>0.771</b> ±1.49<br><b>0.712</b> ±1.49<br><b>0.712</b> ±1.49<br><b>0.712</b> ±1.50<br><b>0.629</b> ±1.51<br><b>0.629</b> ±1.51   | $\begin{array}{c} \textbf{Guinter} \\ \textbf{Rg} \\ \textbf{66.8+0.0553} \\ \textbf{65.1+0.0976} \\ \textbf{65.3+0.0822} \\ \textbf{65.3+0.0822} \\ \textbf{65.7+0.0747} \\ \textbf{66.6+0.0610} \\ \textbf{71.2+0.290} \\ \textbf{66.6+0.0844} \\ \textbf{65.9+0.0904} \\ \textbf{66.8+0.0769} \\ \textbf{65.2+0.0491} \\ \textbf{64.8+0.0769} \\ \textbf{64.8+0.238} \\ \textbf{64.8+0.238} \\ \textbf{64.8+0.0792} \\ \textbf{65.9+0.0792} $  
   | $\begin{array}{c} \textbf{I(O)} \\ \textbf{860:53} = 0.732 \\ \textbf{254.35} + 0.394 \\ \textbf{330.88} + 0.435 \\ \textbf{330.88} + 0.435 \\ \textbf{330.88} + 0.435 \\ \textbf{331.84} + 0.816 \\ \textbf{331.84} + 0.816 \\ \textbf{331.84} + 0.878 \\ \textbf{331.84} + 0.470 \\ \textbf{331.84} + 0.551 \\ \textbf{331.84}$  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.013-0.7860           0.0113-0.7860           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.013-0.7900           0.0140-0.211           0.0160-0.2950           0.0110-0.7950           0.0110-0.7950           0.0110-0.7950           0.0110-0.7950   | GNOM           Dmax Rg (0) Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         65.6         342         0.57           235         66.5         342         0.57           2235         66.7         14.34         0.6           235         66.8         933         0.60           220         69.6         16.1         0.62           220         69.6         16.1         0.62           220         66.4         400         0.61           235         65.9         859         0.57           225         64.6         7.08         0.77           225         65.1         13.8         0.67           230         63.4         221         0.48           240         63.8         222         0.64  
  | Volume         p           1521470         3.9           1451426         3.9           1445462         3.9           1445462         3.9           1445462         3.9           1541821         3.9           1543621         3.9           1543621         3.9           1353122         3.9           1328161         3.9           132822         3.9           1328263         3.9           1346618         3.9           1348698         3.9           1348698         3.9           1348069         3.9           1349023         3.9   | MM by Qr           Exp MM         Theor MM           563000         S06000           530000         S06000           532000         S06000           533000         S06000           538000         S06000           538000         S06000           538000         S06000           538000         S06000           515000         S06000           512000         S06000           506000         S06000           478000         S06000           478000         S06000           468000         S06000   
  | GAS00<br>No. Included NSD<br>101.717 +.<br>102.182 +.<br>92.066 +.<br>91.661 +.<br>91.726 +.<br>91.726 +.<br>91.458 +.<br>91.458 +.<br>91.458 +.<br>91.457 +.<br>91.645 +.<br>91.645 +.  | Situs D<br>Damoser<br>0.069 228x240x118.794<br>0.167 237 5x237.5x123.743<br>240x240x118.794<br>0.167 237 5x237.5x123.743<br>1240x240x118.794<br>0.152 240x240x118.794<br>0.152 240x240x113.844<br>0.072 198x209x116.672<br>0.227 209x209x108.894<br>0.116 230x241.5x105.713<br>10.152 230x240.212.976<br>0.036 230x218.5x105.712<br>0.036 230x218.5x105.712  | mensions Damfilt 144:156x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 174.54x154x77.782 143x154x77.782 143x154x77.782 195.5x172.5x195.5x73.185 184x149.5x65.054 195.5x172.5x81.317 207x207x73.186   
   | Volume A<br>7.80E+04<br>5.70E+04<br>5.70E+04<br>1.25E+05   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9                         | Min avg slice diam           1         26.7  | Slices<br>60<br>80<br>70 |
| HSp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>3.3 | qmin           0.01150           0.01000           0.00801           0.01095           0.01395           0.01200           0.01200           0.00650           0.01495           0.01200           0.00650           0.01495           0.01495           0.01000           0.01495           0.01000           0.01395  
  | qRg range<br>0.758 1.50<br>0.651 1.50<br>0.723 1.48<br>0.733 1.50<br>0.996 1.50<br>0.997 1.51<br>0.790 1.52<br>0.712 1.19<br>0.712 1.19<br>0.712 1.19<br>0.712 1.51<br>0.629 1.51<br>0.629 1.51<br>0.629 1.51  | $\begin{array}{c} \textbf{Guinter} \\ \textbf{Rg} \\ \textbf{G6.8} + 0.0553 \\ \textbf{G5.1} + 0.0976 \\ \textbf{G5.3} + 0.0822 \\ \textbf{G5.7} + 0.0747 \\ \textbf{G6.6} + 0.0610 \\ \textbf{71.2} + 0.290 \\ \textbf{G5.9} + 0.336 \\ \textbf{G5.9} + 0.336 \\ \textbf{G5.9} + 0.0904 \\ \textbf{G5.9} + 0.0769 \\ \textbf{G3.8} + 0.276 \\ \textbf{G3.8} + 0.276 \\ \textbf{G4.8} + 0.278 \\ \textbf{G2.9} + 0.0792 \\ \textbf{G2.9} + 0.0792 \\ \textbf{G3.9} + 0.276 \\ \textbf{G4.9} + 0.0792 \\ \textbf{G5.9} + 0.0792 \\ \textbf{G5.9} + 0.0792 \\ \textbf{G5.9} + 0.0792 \\ \textbf{G5.9} + 0.249 \\ \textbf{G5.9} + 0.24$  | 1(0)<br>869.53 + 0.722<br>254.35 - 0.394<br>339.88 + 0.435<br>143.439 - 0.492<br>334.74 - 0.4851<br>16.918 + 0.780<br>8.3718 + 0.470<br>1298.48 + 0.392<br>404.09 + 0.454<br>379.69 + 0.454<br>862.45 + 0.638<br>7.0681 + 0.033<br>120.954 - 0.534<br>120.954 - 0.276<br>6.9066 + 0.0289  
   | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7890           0.0113-0.7890           0.0120-0.7950           0.0120-0.7950           0.0088-0.7900           0.013-0.7950           0.0068-0.7900           0.0113-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.7950           0.0140-0.7950   | GNOM           Dmax Rg         (0)         Total E           235         67.2         864         0.65           235         66.5         255         0.66           235         66.5         342         0.57           225         66.5         342         0.57           225         66.7         434         0.6           235         66.8         933         0.60           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           220         66.4         400         0.61           220         66.4         400         0.61           240         67.2         387         0.50           221         66.4         7.08         0.77           225         64.6         7.08         0.77           225         64.3         1.38         0.67           224     
   63.4         221         0.48           200         60.9         6.9         0.88   | Porod           Volume p           1521470         3.9           1441966         3.9           1441966         3.9           1441967         3.9           1441968         3.9           1521470         3.9           154321         3.9           1571916         3.9           135322         3.9           1328161         3.9           1335322         3.9           13460818         3.9           1346062         3.9           1346062         3.9           1349023         3.9           12237425         3.8  | MM by Qr           Exp MM         Theor MM           563000         S06000           530000         S06000           537000         S06000           532000         S06000           532000         S06000           532000         S06000           506000         S06000           512000         S06000           512000         S06000           512000         S06000           478000         S06000           48000         S06000           506000         S06000   
   | GASBOR<br>No. Included NSD<br>101.717 +<br>102.182 +<br>92.066 +-<br>91.661 +-<br>91.726 +-<br>91.738 +<br>91.458 +-<br>91.458 +-<br>91.459 +-<br>91.645 +-<br>101.419 +-<br>91.466 +-   | Situs Di           Damer           0.066         228×240×118.794           0.167         237.5×237.7423.743           0.168         237.5×237.443           0.182         240×240×118.794           0.182         240×240×118.744           0.255         241.5×230×113.844           0.072         198×209×116.672           0.272         298×209×116.854           0.116         230×241.5×105.713           0.135         230×2201.21.976           0.036         230×218.5×105.712           0.205         210×195.5×65.52  | mensions Damfil: 144x156x67.882 175x187.5x70.711 204x204x67.883 148x195.5x73.186 172.5x149.5x73.186 154x154x77.782 195.5x195.5x73.185 184x149.5x5.054 195.5x172.5x81.317 207x207x73.186 189x168x81.671  
  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9                          | Min avg slice diam<br>1 26.7<br>1 15.7<br>24.2   | Slices<br>60             |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATPyS<br>ΔN ATP                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>5.0 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>4.6 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>3.0 | qmin           0.01150           0.01000           0.00001           0.01099           0.01395           0.01395           0.01200           0.01200           0.01499           0.01499           0.01499           0.01000           0.01000           0.01000           0.01395           0.01000           0.01395   
   | qRg range           0.768 1.50           0.651 1.50           0.651 1.50           0.723 1.50           0.733 1.50           0.734 1.50           0.773 1.51           0.779 1.51           0.779 1.51           0.771 1.51           0.772 1.48           0.771 1.50           0.972 1.51           0.972 1.51           0.629 1.51           0.629 1.51           0.852 1.53           0.852 1.53  | Guinter         Rg           66.8 + 0.0553         65.1 + 0.0976           65.3 + 0.0822         65.7 + 0.0747           66.6 + 0.0610         71.2 + 0.290           65.4 + 0.0326         65.9 + 0.0904           65.5 + 0.0824         65.9 + 0.0904           65.4 + 0.0769         65.4 + 0.0276           63.8 + 0.0769         65.4 + 0.0375           62.9 + 0.0792         62.9 + 0.0792           60.9 + 0.249         62.9 + 0.0792   
  | $\begin{array}{c} \textbf{I(0)}\\ \textbf{860:53} = 0.732\\ \textbf{254.35} + 0.732\\ \textbf{254.35} + 0.394\\ \textbf{330.88} + 0.435\\ \textbf{330.88} + 0.435\\ \textbf{330.88} + 0.435\\ \textbf{331.88} + 0.470\\ \textbf{331.88} + 0.555\\ \textbf{337.98} + 0.454\\ \textbf{332.98} + 0.633\\ \textbf{331.91} + 0.534\\ \textbf{331.91} + 0.54$   | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7890           0.0113-0.7800           0.0140-0.2414           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0110-0.7950           0.0110-0.7950           0.0140-0.2919           0.0140-0.2959           0.0140-0.2950           0.0140-0.2443  | GNOM           Dmax Rg         (10)         Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         65.8         255         0.56           235         66.5         342         0.57           235         67.1         434         0.6           235         68         933         0.60           220         69.6         8.25         0.88           220         69.6         16.1         0.62           220         66.4         400         0.61           225         64.6         7.08         0.77           225         65.1         13.8         0.67           230         63.4         221         0.48           240         67.2         387         0.50           225         64.6         7.08         0.77           230         63.4         221         0.48           240         63.8         222         0.48           240         63.8         221         0.48           240         63.8         222         0.48 <td< th=""><th>Volume         p 
         152:1470         3.9           14414966         3.9           1445462         3.9           1445462         3.9           1445462         3.9           1445462         3.9           1445462         3.9           1521470         3.9           1541502         3.9           135122         3.9           1328161         3.9           132822         3.9           1346618         3.9           134662         3.9           1346969         3.9           1349023         3.9           1323795         3.9</th><th>MM by Qr           Exp MM         Theor MMI           563000         S06000           530000         S06000           532000         S06000           532000         S06000           532000         S06000           532000         S06000           532000         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           478000         S06000           468000         S06000           506000         S06000</th><th>GASBOR<br/>No. Included NSD<br/>101777+<br/>92.066 +<br/>91.661 +<br/>91.726 +<br/>91.726 +<br/>91.458 +<br/>91.458 +<br/>91.455 +<br/>91.455 +<br/>91.455 +<br/>91.455 +<br/>91.455 +<br/>91.445 +</th><th>Situs D           Damaver           0.066         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.168         240x240x118.794           0.128         240x240x118.744           0.235         2415.x230x113.844           0.272         299x209x116.672           0.272         209x209x108.894           0.116         230x241.5x105.713           0.135         240x242.012.976           0.036         230x218.5x105.712           0.245         210x199.5x96.52           0.245         210x199.5x96.52</th><th>Immensions           Damfill           144:156x67.882           175x187.5x70.711           204:20467.883           184x195.5x73.186           172.5x149.5x73.186           154x154x77.782           143x154x77.782           195.5x79.5x73.185           184x149.5x5.054           195.5x125.5x81.317           207x207x73.186           189x168x81.671           209x187x70.004</th><th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.25E+05</th><th>vg Diam<br/>31.9<br/>21.6<br/>33.75</th><th>Channel<br/>Max avg sike diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9</th><th>Min avg slice diam           1         26.7          </th><th>Slices 60</th></td<>   | Volume         p           152:1470         3.9           14414966         3.9           1445462         3.9           1445462         3.9           1445462         3.9           1445462         3.9           1445462         3.9           1521470         3.9           1541502         3.9           135122         3.9           1328161         3.9           132822         3.9           1346618         3.9           134662         3.9           1346969         3.9           1349023         3.9           1323795         3.9   | MM by Qr           Exp MM         Theor MMI           563000         S06000           530000         S06000           532000         S06000           532000         S06000           532000         S06000           532000         S06000           532000         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           478000         S06000           468000         S06000           506000         S06000  
  | GASBOR<br>No. Included NSD<br>101777+<br>92.066 +<br>91.661 +<br>91.726 +<br>91.726 +<br>91.458 +<br>91.458 +<br>91.455 +<br>91.455 +<br>91.455 +<br>91.455 +<br>91.455 +<br>91.445 +  | Situs D           Damaver           0.066         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.168         240x240x118.794           0.128         240x240x118.744           0.235         2415.x230x113.844           0.272         299x209x116.672           0.272         209x209x108.894           0.116         230x241.5x105.713           0.135         240x242.012.976           0.036         230x218.5x105.712           0.245         210x199.5x96.52           0.245         210x199.5x96.52  | Immensions           Damfill           144:156x67.882           175x187.5x70.711           204:20467.883           184x195.5x73.186           172.5x149.5x73.186           154x154x77.782           143x154x77.782           195.5x79.5x73.185           184x149.5x5.054           195.5x125.5x81.317           207x207x73.186           189x168x81.671           209x187x70.004   
   | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.25E+05   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9                          | Min avg slice diam           1         26.7  | Slices 60                |
| Hsp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.5 | qmin           0.01150           0.01000           0.00801           0.01095           0.01398           0.01200           0.01200           0.01200           0.01495           0.01000           0.01495           0.01000           0.01495           0.01000           0.01495           0.01000           0.01397           0.01397           0.01397   
   | qRg range           0.768 1.50           0.651.1.50           0.523.1.50           0.723.1.50           0.733.1.50           0.734.1.50           0.737.1.51           0.737.1.50           0.771.1.51           0.771.1.50           0.771.1.50           0.771.1.50           0.757.1.54           0.629.1.51           0.629.1.51           0.629.1.51           0.852.1.53           0.852.1.53           0.852.1.53   | $\begin{array}{c} \mbox{Guine} \\ \mbox{Guine} \\$  | 1(0)<br>860530.722<br>254350.394<br>339.88 +-0.435<br>434390.492<br>933.47 +-0.851<br>16.518 +-0.780<br>8.3718 +-0.470<br>15.984.88 +-0.392<br>404.09 +-0.565<br>379.69 +-0.543<br>139.59 +-0.543<br>120.5240.277<br>13.9130.534<br>120.524 +-0.276<br>13.9130.534<br>120.5340.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5550.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0289<br>13.5530.0           
  | Angle range<br>0.0118-0.7490<br>0.0100-0.7950<br>0.0080-0.7950<br>0.0113-0.7800<br>0.0113-0.7800<br>0.0140-0.2414<br>0.0150-0.2515<br>0.0120-0.7950<br>0.0120-0.7950<br>0.0113-0.7900<br>0.0140-0.2919<br>0.01140-0.7950<br>0.0140-0.2919<br>0.01140-0.7950<br>0.0140-0.2666<br>0.0140-0.2666  | GNOM           Datas Rg (10)         Total B4           Datas Rg (10)         Total B4           Datas Rg (10)         Total B4           Datas Rg (11)         235           65.5         342           Datas Rg (11)         434           Cass (11)         434           Cass (11)         434           Cass (11)         634           Cass (11)         638           Cass (11)         638           Cass (11)         634           Cass (11)         634           Cass (11)         634           Cass (11)         634           Cass (11)  
  | Porod           Volume         P           1521470         3.9           144166         3.9           1445462         3.9           1455462         3.9           1455462         3.9           1543621         3.9           1543621         3.9           1543623         3.9           1353532         3.9           1353563         3.9           1353560         3.9           1346688         3.9           1346062         3.9           1346062         3.9           1346062         3.9           1346062         3.9           1346093         3.9           1342725         3.8           1322725         3.9           1322725         3.9           1227425         3.8           1227425         3.8           1416628         2   | MM by Qr.           Exp MM         Theor MM           563001         S06000           330000         S06000           337000         S06000           538000         S06000           538000         S06000           538000         S06000           538000         S06000           538000         S06000           518000         S06000           518000         S06000           519000         S06000           519000         S06000           506000         S06000  
  | G6ASBOR           No. Included NSD           10]1.717 +           10]2.182 +           9]2.066 +           9]1.661 +           9]1.726 +           9]1.726 +           9]1.737 +           9]1.458 +           9]1.645 +           9]1.645 +           9]1.645 +           9]1.645 +           9]1.456 +           9]1.466 +           9]1.466 +           9]1.466 +           9]1.466 +           9]1.465 +           9]1.455 +           9]1.455 +   | Situs D           Damaver           0.669         228x240.0118.794           0.167         237.5227.5423.743           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.784           0.182         240x240x113.844           0.072         198x209x116.672           0.227         209x209x108.894           0.116         230x211.3.844           0.135         230x210.712.847           0.136         230x211.3.844           0.135         230x210.712.847           0.136         230x210.712.844           0.137         230x210.712.847           0.138         230x210.712.847           0.136         230x210.712.844           0.137         230x210.12.1976           0.245         210x199.5x96.52           0.074         202x099.116.673           0.074         202x09.116.673  | mensions Damfilt 144x156x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.185 154x154x77.782 143x154x77.782 195.5x195.5x73.185 195.5x172.5x81.317 207x207x73.186 189x165x84.671 209x187x70.004 155x152.275  
   | Volume A<br>7.80E+04<br>5.70E+04<br>1<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.25E+05  | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg silce diam<br>46.4<br>46.4<br>24.7<br>24.7                         | Min avg slice diam   | Slices 60                |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATPγS<br>ΔN ATP                          | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.6 mg/mL<br>2.6 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>2.3 mg/mL<br>1.5 | qmin           0.0115C           0.0102C           0.0102C           0.01095           0.01398           0.0120C           0.0120C           0.0120C           0.01495           0.0120C           0.01495           0.01495           0.01495           0.0100C           0.01397           0.01397           0.01397           0.01397   | qRg range<br>[0,768-1.50]<br>[0,523-1.50]<br>[0,733-1.50]<br>[0,733-1.50]<br>[0,733-1.50]<br>[0,773-1.51]<br>[0,790-1.52]<br>[0,712-1.49]<br>[0,712-1.49]<br>[0,712-1.49]<br>[0,712-1.49]<br>[0,712-1.51]<br>[0,629-1.51]<br>[0,629-1.51]<br>[0,629-1.51]<br>[0,629-1.51]<br>[0,629-1.51]<br>[0,869-1.50]<br>[0,869-1.50]<br>[0,869-1.50]<br>[0,869-1.50]<br>[0,869-1.51]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,869-1.52]<br>[0,86   | $\begin{array}{c} \mbox{Guine} \\ \mbox{Guine} \\ \mbox{Fig. 66, 8+ 0.0553} \\ \mbox{Guine} \\ \$   | $\begin{array}{c} \textbf{I(0)}\\ \textbf{860:53} = 0.732\\ \textbf{254.35} + 0.732\\ \textbf{254.35} + 0.394\\ \textbf{330.88} + 0.435\\ \textbf{330.88} + 0.435\\ \textbf{330.88} + 0.435\\ \textbf{331.80} + 0.80\\ \textbf{8.3718} + 0.870\\ \textbf{8.3718} + 0.670\\ \textbf{8.3718} + 0.670\\ \textbf{370.99} + 0.456\\ \textbf{862.45} + 0.638\\ \textbf{370.99} + 0.456\\ \textbf{862.45} + 0.638\\ \textbf{370.99} + 0.456\\ \textbf{370.99} + 0.276\\ \textbf{370.99} + 0.276\\ \textbf{3553} + 0.0428\\ \textbf{251.55} + 1.41\\ \textbf{3553} + 0.0428\\ \textbf{251.55} + 1.40\\ \textbf{370.95} + 1.60\\ \textbf{370.99} + 0.276\\ 3$  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7890           0.0113-0.7800           0.0140-0.2414           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2950           0.0110-0.7950           0.0140-0.2950           0.0140-0.2414           0.0140-0.2550           0.0140-0.4435           0.0140-0.7350  | GNOM           Dmax Rg         (10)         Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         65.8         255         0.56           235         66.5         342         0.57           235         67.1         434         0.6           235         68         933         0.60           220         69.6         8.25         0.68           220         69.6         1.61         0.62           220         66.4         400         0.61           225         64.6         7.08         0.77           225         65.1         7.8         0.67           230         63.4         221         0.48         0.67           230         63.4         221         0.48         0.77           225         65.1         7.8         0.67         230         63.4         221         0.48           240         63.8         222         0.48         221         0.48         221         0.48         221         0.48         221         0.48         221         0.48   | Porod           Volume p           152:1470         3.9           144:1466         3.9           144:1466         3.9           144:1456         3.9           144:1456         3.9           144:1456         3.9           145:1462         3.9           157:1916         3.9           135:122         3.9           1328:161         3.9           1346:18         3.9           1346:18         3.9           1346:22         3.9           1342:22         3.9           1342:55         3.9           1342:57         3.9           13490:23         3.9           13490:23         3.9           1342:57         3.9           145:628         3.9           146:58         3.9           146:58         3.9           146:58         3.9           146:58         3.9           146:58         3.9           146:58         3.9           146:58         3.9  | MM by Qr           Exp MM         Theor MMI           563000         S060000           330000         S060000           532000         S060000           532000         S060000           532000         S060000           532000         S060000           532000         S060000           512000         S060000           512000         S060000           512000         S060000           458000         S060000           458000         S060000           5060000         S060000           506000         S060000           506000         S060000           506000         S060000           506000         S060000           506000         S06000   | GASBOR<br>No. Included NSD<br>101777+<br>92.066+<br>91.661+<br>91.726+<br>91.726+<br>91.458+<br>91.458+<br>91.458+<br>91.458+<br>91.455+<br>91.455+<br>91.455+<br>91.465+<br>91.464+<br>91.464+<br>91.466+<br>91.462+<br>91.466+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462+<br>91.462 | Situs Di           Damaver           0.066         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.168         230x230x113.844           0.235         2415.x230x113.844           0.235         2415.x230x113.844           0.237         299x209x116.672           0.227         209x209x108.894           0.116         230x241.5x105.713           0.135         240x20x121.976           0.036         230x214.5x105.712           0.245         210x199.5x96.52           0.246         210x199.5x96.52           0.742         200x200x108.894           0.742         200x200x108.894           0.742         200x200x108.894  | mensions Damfilt JA4x155x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 172.5x149.5x73.185 184x149.5x55.054 195.5x72.5x81.317 207x207x73.186 189x165x81.671 209x187x0.004 154x154x62.225 155.4125.0004  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05   | vg Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9                          | Min avg slice diam           1         26.7           1         26.7           1         15.7           1         24.2   | Slices 60                |
| Hsp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.6 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.6 mg/mL<br>2.6 mg/mL<br>2.6 mg/mL<br>2.6 mg/mL<br>2.7 mg/mL<br>2.6 mg/mL<br>2.7 mg/mL<br>2.6 mg/mL<br>2.6 mg/mL<br>2.6 mg/mL<br>2.6 mg/mL<br>2.7 mg/mL<br>3.7 | qmin           0.01150           0.01095           0.01000           0.00801           0.01398           0.01200           0.01200           0.01200           0.01200           0.00650           0.01000           0.01495           0.01495           0.01000           0.01397           0.01397           0.01897           0.01897           0.01897  
  | qRg range           0.768 1.50           0.651 1.50           0.523 1.50           0.723 1.50           0.733 1.50           0.734 1.50           0.775 1.51           0.775 1.51           0.717 1.50           0.717 1.50           0.717 1.51           0.629 1.51           0.629 1.51           0.629 1.51           0.629 1.51           0.852 1.53           0.852 1.53           1.20 1.52           1.21 1.53   | $\begin{array}{l} \hline Guiner \\ \hline R_1 \\ \hline G_1 \\ \hline G_2 \\ \hline G_3 \\ \hline G_4 \\ \hline G_5 \\ \hline G_6 \\ \hline G_6 \\ \hline G_7 \\ \hline G_6 \\ \hline G_7 \\ \hline G_$   | 1(0)<br>860530.722<br>254350.394<br>339.880.435<br>434390.492<br>933.470.851<br>16.9180.780<br>8.37180.780<br>8.37180.780<br>8.37180.780<br>1379.690.585<br>379.690.584<br>139.690.584<br>139.690.584<br>139.690.584<br>120.5240.277<br>13.5130.0289<br>13.5530.0289<br>13.5551.41<br>1375.691.61<br>1375.691.61<br>1375.690.61<br>1355.691.41<br>1375.691.60<br>155.691.41<br>1375.691.60<br>155.691.61<br>135.690.61<br>155.691.41<br>135.690.61<br>155.691.61<br>155.691.61<br>155.691.41<br>135.690.61<br>155.691.41<br>135.690.61<br>155.691.41<br>135.690.61<br>155.691.41<br>135.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.61<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.72<br>155.690.75<br>155.690.75<br>155.690.75<br>155.690.75<br>155.690.75<br>155.690.75<br>155.690.75<br>155.690.75<br>155.69  
   | Angle range<br>0.118-0.7490<br>0.010-0.7950<br>0.0080-0.7950<br>0.0113-0.7890<br>0.0113-0.7800<br>0.0140-0.2414<br>0.0150-0.2515<br>0.0120-0.7950<br>0.0120-0.7950<br>0.0113-0.7900<br>0.0140-0.2919<br>0.0110-0.7950<br>0.0140-0.2919<br>0.0110-0.7950<br>0.0140-0.2666<br>0.0140-0.2666<br>0.0140-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7950<br>0.0190-0.7   | GNOM           Datas Rg (10) Total E           Datas Gr 22         864 0.65           235         65.5         255         0.56           235         66.5         342         0.57           235         66.5         342         0.57           235         66.6         342         0.57           235         66.7         434         0.6           235         66.8         933         0.60           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           240         67.2         387         0.50           235         65.9         859         0.57           235         65.4         7.08         0.77           235         65.4         7.08         0.77           236         63.4         221         0.48           240         63.8         222         0.48           220         62.2         220         6.2           2205         60.9         6.9         0.68           2205  
   | Pord           Volume         P           1521470         3.9           1451420         3.9           1441466         3.9           1445642         3.9           144542         3.9           1543621         3.9           1543621         3.9           1543621         3.9           1351302         3.9           1353560         3.9           135462         3.9           1353560         3.9           1348699         3.9           1346023         3.9           1346023         3.9           1342023         3.9           1342023         3.9           1342023         3.9           1342023         3.9           1342023         3.9           1342023         3.9           1342023         3.9           1342023         3.9           1416028         3.9           1416028         3.9           1406028         3.9           1406028         3.9           1406028         3.9           1406028         3.9           1406028         3.9   | MM by Gr.           Exp MM         Theor MM           563000         S06000           330000         S06000           337000         S06000           538000         S06000           33800         S06000           33800         S06000           538000         S06000           518000         S06000           512000         S06000           512000         S06000           512000         S06000           519000         S06000           506000         S06000           527000         S06000           524000         S06000           524000         S06000   
   | GASBOR           No. Included NSD           10] 1.717 +           10] 2.182 +           9] 2.066 +           9] 1.661 +           9] 1.726 +           9] 1.737 +           9] 1.458 +           9] 1.899 +           9] 1.645 +           9] 1.645 +           9] 1.456 +           9] 1.456 +           10] 1.456 +           9] 1.456 +           9] 1.456 +           9] 1.456 +           9] 1.456 +           9] 1.458 +           9] 1.456 +           9] 1.456 +           9] 1.458 +           9] 1.458 +           9] 1.456 +           9] 1.452 +           9] 1.452 +           10] 1.456 +           10] 1.456 +           10] 1.456 +           10] 1.456 +           10] 1.457 +           1.421 +           1.421 +           1.421 +           1.421 +           1.421 +           1.421 +           1.421 +  | Situs D           Damaver           0.660         228x240.0118.794           0.167         237.5227.5423.743           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.784           0.182         230x230x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         230x2113.844           0.135         230x2113.844           0.135         230x211.844           0.135         230x211.844           0.136         230x211.844           0.135         230x211.844           0.136         230x211.844           0.136         230x211.844           0.135         230x210.976           0.361         230x211.844           0.375         220x209.108           0.245         210x199.5x96.52           0.074         209x209.101.6673           0.056         209x209.108.894           0.362         209x209.008 ever   | mensions Damfilt 144x156x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 154x154x77.782 143x154x77.782 195.5x195.5x73.185 195.5x172.5x81.317 207x207x73.186 189x165x70.004 155x155x70.004 155x155x70.003 156x155x70.004  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05   | vg
Diam<br>31.9<br>21.6<br>33.75                        | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7                                 | Min avg slice diam<br>26.7<br>15.7<br>24.2   | Slices 60                |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATPγS<br>ΔN ATP                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>1.5 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>5.0 mg/mL   | qmin           0.01150           0.01095           0.01095           0.01395           0.01395           0.01200           0.01200           0.01495           0.01495           0.01495           0.01495           0.01495           0.01000           0.01397           0.01397           0.01400   | qRg range           0.758-150           0.651-150           0.651-150           0.723-148           0.733-150           0.970-153           0.797-148           0.791-151           0.712-160           0.712-160           0.721-149           0.712-100           0.712-100           0.829-151           0.629-151           0.629-151           0.865-153           0.865-153           1.20-152           1.21-153           0.889-152  | $\begin{array}{c} \mbox{Guine} \\ \mbox{Guine} \\$  | $\begin{array}{c} \textbf{I(0)}\\ \textbf{860:53} = 0.732\\ \textbf{254.35} + 0.732\\ \textbf{254.35} + 0.394\\ \textbf{330.88} + 0.435\\ \textbf{330.88} + 0.435\\ \textbf{330.88} + 0.470\\ \textbf{83.718} + 0.870\\ \textbf{83.718} + 0.870\\ \textbf{83.718} + 0.470\\ \textbf{331.81} + 0.470\\ \textbf{331.81} + 0.555\\ \textbf{370.69} + 0.454\\ \textbf{862.45} + 0.633\\ \textbf{331.313} + 0.534\\ \textbf{331.313} + 0.534\\ \textbf{331.313} + 0.534\\ \textbf{331.313} + 0.534\\ \textbf{331.353} + 0.0428\\ \textbf{251.55} + 1.41\\ \textbf{337.34} + 1.60\\ \textbf{1355.8} + 7.92\\ \textbf{351.55} + 7.92\\ 351.55$  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7890           0.0113-0.7800           0.0113-0.7800           0.0140-0.2414           0.0120-0.7950           0.0120-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2950           0.0110-0.7950           0.0140-0.4435           0.0140-0.4435           0.0190-0.7950           0.0140-0.4435           0.0140-0.7950           0.0140-0.7950  | GNOM           Dmax Rg         (0)         Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         65.8         255         0.56           235         66.5         342         0.57           235         66.7         342         0.57           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           225         64.6         7.08         0.57           225         65.1         0.88         0.67           225         64.7         0.80         0.50           225         65.1         1.38         0.67           230         63.4         221         0.48           240         67.2         387         0.50           230         63.4         221         0.48           240         67.2         387         0.50           230         63.4         221         0.48           240         62.7         1.38         0.67  | Porod           Volume p           152:1470           152:1470           135:1120           144:1466           145:462           145:462           145:462           145:462           145:462           157:1916           39           135:1120           135:1232           135:3232           1328:161           39           1328:360           39           1346:88           39           1340:023           39           13490:23           39           13490:23           13490:23           13490:27           1309:244           39   | MM by Qr           Exp MM         Theor MMI           563000         S060000           530000         S060000           532000         S060000           532000         S060000           532000         S060000           532000         S060000           532000         S060000           512000         S060000           512000         S060000           512000         S060000           478000         S060000           458000         S060000           540000         S060000           540000         S060000           540000         S060000           540000         S060000   | GASBOR<br>No. Included NSD<br>101777+<br>92.066 +<br>91.661 +<br>91.726 +<br>91.726 +<br>91.458 +<br>91.458 +<br>91.458 +<br>91.455 +<br>91.455 +<br>91.455 +<br>91.455 +<br>91.465 +<br>91.464 +<br>91.465 +<br>91.466  | Situs Di           Damaver           0.066         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.168         230x230x113.844           0.235         2415x230x113.844           0.237         298x209x116.672           0.227         209x209x108.894           0.116         230x241.5x105.713           0.152         230x207.113.844           0.161         230x241.5x105.713           0.135         230x202.12.976           0.036         230x214.5x105.712           0.245         210x199.5x96.52           0.245         210x199.5x96.52           0.245         210x199.5x96.52           0.245         210x199.5x96.52           0.256         20x209.116.873           0.265         20x209.108.895   | Immensions           Damfill           144:156x67.882           175x187.5x70.711           204x204x67.883           184x195.5x73.186           172.5x149.5x73.186           172.5x149.5x73.186           184x154x77.782           195.5x195.5x73.185           184x149.5x50.054           195.5x125.5x81.317           207x207x73.186           189x165x81.671           209x187x70.004           154x154x62.225           165x165x70.003           156x156x70.004   | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05   | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4                | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1                  | Min avg slice diam           1         26.7           1         26.7           1         26.7           1         26.7           1         24.2           1         24.2           2         24.2           2         23.4                           | Slices 6(                |
| Hsp104 dN<br>ΔΝ ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγ5<br>ΔΝ ΑΤΡ                          | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.0 | qmin           0.0115C           0.01095           0.01095           0.01095           0.01395           0.01395           0.0120C           0.01495           0.0100C           0.0100C           0.0120C           0.0120C           0.01495           0.0100C           0.01397           0.01397           0.01897           0.01400   
   | qRg range           0.768+150           0.651+150           0.651+150           0.523+150           0.723+148           0.731+151           0.790+152           0.771+140           0.772+148           0.772+151           0.790+152           0.771+100           0.797+151           0.629+151           0.629+151           0.629+151           0.629+151           0.852+153           0.852+153           0.869+150           1.20+152           1.21+153           0.889+152  | $\begin{array}{l} \hline Guiner \\ R_g \\ \hline 6.6.8 + 0.053 \\ GS + 0.0572 \\ GS - 1.00972 \\ GS - 1.009$  | I(O)           869530.732           254.350.394           339.880.435           343.980.435           434.390.492           933.470.851           16.9180.780           8.37180.780           8.37180.780           8.37180.780           8.37180.700           8.37180.700           8.37280.780           8.37280.780           379.690.541           3.9130.534           220.940.276           8.90660.0289           33.734 -1.60           135540.0428           251.55 +-1.41           337.34 +1.60           1556.8 +-7.92  
  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0081-0.7950           0.0113-0.7860           0.0113-0.7860           0.0113-0.7850           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0110-0.7950           0.0110-0.7950           0.0110-0.7950           0.0110-0.7950           0.0140-0.2919           0.0110-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2666           0.0140-0.4435           0.0140-0.4435           0.0140-0.4435           0.0140-0.4435           0.0140-0.4435           0.0140-0.4435           0.0140-0.4435           0.0140-0.4435           0.0140-0.4435           0.0140-0.4435  | GNOM         UD         Total E           Dmax Rg. (10)         Total E         0.65           235         67.21         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         66.71         434         0.6           235         66.8         933         0.60           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           220         66.4         7.08         0.77           225         65.1         1.38         0.67          
225         65.1         1.38         0.67           225         65.2         9.50         9.57           225         65.2         1.38         0.67           230         63.4         221         0.48           240         6.38         2220         0.48           251         62.7         1.36         0.68           2201         63.7         3.40         0.68           2200         62.7 <td< th=""><th>Volum         P           Volum         P           1521470         3.9           144166         3.9           1441466         3.9           144566         3.9           1455662         3.9           1445456         3.9           1543621         3.9           1543621         3.9           1531323         3.9           1328161         3.9           1328162         3.9           1346569         3.9           1346569         3.9           1342659         3.9           1227425         3.8           1227425         3.8           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           130924         3.9</th><th>MH by Gr.           Exp MM         Theor MM           563001         S06000           330000         S06000           532000         S06000           532000         S06000           533000         S06000           533000         S06000           532000         S06000           532000         S06000           515000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           \$27000         \$06000           \$44000         \$06000           \$48000         \$06000</th><th>GASBOR           No. Included NSD           10] 1.717 +           10] 2.182 +           9] 2.066 +           9] 1.661 +           9] 1.726 +           9] 1.338 +           9] 1.458 +           9] 1.458 +           9] 1.645 +           9] 1.645 +           9] 1.466 +           9] 1.466 +           9] 1.466 +           9] 1.466 +           9] 1.466 +           9] 1.462 +           10] 1.466 +           9] 1.432 +</th><th>Situs Di           Damaver           0.660         228x240.118.794           0.167         237.5x23.743           0.167         237.5x23.743           0.162         230x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.744           0.232         240x240x118.744           0.232         209x209x116.672           0.227         209x209x108.894           0.116         230x213.5x105.712           0.256         200x209x108.894           0.332         230x218.5x105.712           0.342         210x199.5x66.52           0.074         220x20x108.894           0.074         200x208.108.695           0.056         209x209x108.894           0.074         200x20x108.895           0.056         200x209x108.895</th><th>Immensions           Damfilt           144x156x67.882           175x187.5x70.711           204x2046x7.883           184x195.5x73.186           172.5x149.5x73.186           154x154x77.782           143x154x77.782           195.5x195.5x73.185           195.5x195.5x73.185           195.5x195.5x73.185           195.5x195.5x73.185           195.5x192.5x81.317           207x207x73.186           1139x156x81.671           209x187x70.004           155x155.5x70.03           176x176x70.03           176x176x70.04</th><th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.51E+05</th><th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4</th><th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1</th><th>Min avg slice diam<br/>26.7<br/>1 26.7<br/>1 5.7<br/>1 24.2<br/>23.4</th><th>Slices 6(</th></td<>   | Volum         P           Volum         P           1521470         3.9           144166         3.9           1441466         3.9           144566         3.9           1455662         3.9           1445456         3.9           1543621         3.9           1543621         3.9           1531323         3.9           1328161         3.9           1328162         3.9           1346569         3.9           1346569         3.9           1342659         3.9           1227425         3.8           1227425         3.8           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           1405872         3.9           130924         3.9  | MH by Gr.           Exp MM         Theor MM           563001         S06000           330000         S06000           532000         S06000           532000         S06000           533000         S06000           533000         S06000           532000         S06000           532000         S06000           515000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           \$27000         \$06000           \$44000         \$06000           \$48000         \$06000   
   | GASBOR           No. Included NSD           10] 1.717 +           10] 2.182 +           9] 2.066 +           9] 1.661 +           9] 1.726 +           9] 1.338 +           9] 1.458 +           9] 1.458 +           9] 1.645 +           9] 1.645 +           9] 1.466 +           9] 1.466 +           9] 1.466 +           9] 1.466 +           9] 1.466 +           9] 1.462 +           10] 1.466 +           9] 1.432 +   | Situs Di           Damaver           0.660         228x240.118.794           0.167         237.5x23.743           0.167         237.5x23.743           0.162         230x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.744           0.232         240x240x118.744           0.232         209x209x116.672           0.227         209x209x108.894           0.116         230x213.5x105.712           0.256         200x209x108.894           0.332         230x218.5x105.712           0.342         210x199.5x66.52           0.074         220x20x108.894           0.074         200x208.108.695           0.056         209x209x108.894           0.074         200x20x108.895           0.056         200x209x108.895   | Immensions           Damfilt           144x156x67.882           175x187.5x70.711           204x2046x7.883           184x195.5x73.186           172.5x149.5x73.186           154x154x77.782           143x154x77.782           195.5x195.5x73.185           195.5x195.5x73.185           195.5x195.5x73.185           195.5x195.5x73.185           195.5x192.5x81.317           207x207x73.186           1139x156x81.671           209x187x70.004           155x155.5x70.03           176x176x70.03           176x176x70.04  
  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05   | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4                | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1                 | Min avg slice diam<br>26.7<br>1 26.7<br>1 5.7<br>1 24.2<br>23.4  | Slices 6(                | | | | | | | | | | | | | | |
| HSp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>NSLS<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>1.5 mg/mL<br>2.3 mg/mL<br>5.0 mg/mL<br>3.5 | qmin           0.01150           0.01000           0.00801           0.0109           0.0139           0.0139           0.01200           0.01200           0.01200           0.01499           0.01499           0.01000           0.01397           0.01397           0.01397           0.01397           0.01400  | 9R; cnage<br>0.768-1.50<br>0.651-1.50<br>0.623-1.50<br>0.723-1.48<br>0.733-1.48<br>0.731-1.50<br>0.996-1.50<br>0.970-1.53<br>0.770-1.53<br>0.771-1.49<br>0.771-1.50<br>0.971-1.50<br>0.975-1.54<br>0.629-1.51<br>0.629-1.51<br>0.6869-1.50<br>1.20-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.889-1.52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0.521-52<br>0 | $\begin{array}{c} \mbox{Guine} \\ \mbox{Guine} \\ \mbox{Fig. 66, 8+ 0.0553} \\ \mbox{Guine} \\ \$   | $\begin{array}{c} \textbf{I(0)}\\ \textbf{860:53} = 0.732\\ \textbf{254.35} + 0.732\\ \textbf{254.35} + 0.394\\ \textbf{330.88} + 0.435\\ \textbf{330.88} + 0.435\\ \textbf{3310.88} + 0.470\\ \textbf{83.718} + 0.870\\ \textbf{83.718} + 0.870\\ \textbf{83.718} + 0.470\\ \textbf{33.75} + 0.638\\ \textbf{34.98} + 0.638\\ \textbf{35.98} + 0.038\\ \textbf{35.98} + 0.038\\ \textbf{35.98} + 0.0428\\ \textbf{35.95} + 0.0428\\ \textbf{35.95} + 1.41\\ \textbf{337.34} + 1.60\\ \textbf{155.88} + 7.92\\ \textbf{228.15} + 0.370\\ \textbf{28.15} + 0.370\\ \textbf{28.15} + 0.370\\ \textbf{35.98} + 0.370\\ $   | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7890           0.0113-0.7800           0.0113-0.7800           0.0140-0.2414           0.0150-0.2515           0.0120-0.7950           0.0120-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2950           0.0140-0.2950           0.0140-0.2950           0.0140-0.2950           0.0140-0.4435           0.0140-0.4435           0.0140-0.4350           0.0140-0.4355           0.0140-0.4435           0.0140-0.800           0.0140-0.800           0.0140-0.800   | GNOM           Dmax Rg (10) Total 8           235         67.2         864         0.65           235         65.8         255         0.56           235         65.8         255         0.56           235         66.5         342         0.57           235         66.7         342         0.57           220         69.6         8.53         0.68           220         69.6         16.1         0.62           220         69.6         16.1         0.62           220         66.4         400         0.61           225         64.6         7.08         0.77           225         65.1         7.88         0.67           230         63.4         221         0.48           240         67.2         387         0.50           225         64.1         7.08         0.77           225         65.1         7.88         0.67           230         63.4         221         0.48           240         63.8         222         0.48           225         62.7         13.6         0.68           225  | Porod           Volume p           1521470         3.9           1441966         3.9           14415962         3.9           14415963         3.9           14415963         3.9           1571916         3.9           1571916         3.9           1351120         3.9           1353123         3.9           1328161         3.9           1348618         3.9           1346062         3.9           1346062         3.9           1349023         3.9           1327425         3.8           1327425         3.9           1302244         3.9           1416528         2.9           1426628         3.9           1426628         3.9           1426628         3.9           1426628         3.9           1436572         3.9           13226602         3.8  | Seg Or           Exp Mm         Theor MMI           563000         S060000           530000         S060000           532000         S060000           532000         S060000           532000         S060000           532000         S060000           532000         S060000           512000         S060000           512000         S060000           519000         S060000           458000         S060000           458000         S060000           546000         S060000           5440000         S060000           488000         S060000           4480000         S060000           4480000         S060000   | GASBOR<br>No. Included NSD<br>101777+<br>102.182+<br>92.066+-<br>91.661+-<br>91.726+-<br>91.458+-<br>91.458+-<br>91.458+-<br>91.455+-<br>91.455+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.465+-<br>91.88+- 91.88+-   | Situs Di           Damew           0.069         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.162         240x240x118.784           0.283         2415x230x113.844           0.272         299x209x116.672           0.272         209x209x108.894           0.116         230x241.5x105.713           0.176         230x207.113.844           0.176         230x207.113.844           0.176         230x207.113.844           0.176         230x207.113.844           0.176         230x207.113.844           0.176         230x207.113.844           0.176         200x207.018.844           0.076         90x209.108.956           0.076         200x209.008.844           0.074         200x209.008.844           0.074         200x209.016.893           0.056         209x209.108.895           0.056         209x209.108.895           0.056         209x209.108.895           0.057         200x209.108.895           0.056         209x209.108.895           0.056   | Immensions           Damfill           14x1156x67.882           175x187.5x70.711           204x204x67.883           184x195.5x73.186           172.5x149.5x73.186           154x154x77.782           143x154x77.782           195.5x195.5x73.185           184x149.5x50.054           195.5x175.883.117           207x207x73.186           189x165x81.671           209x187x70.004           156x156x70.004           165x165x70.004           165x176x70.004  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05   | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4                | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1                  | Min avg slice diam           1         26.7           1         26.7           1         15.7           1         24.2           1         24.2           2         23.4   | Slices 6(                |
| Hsp104 dN<br>ΔN ΑΜΡ-ΡΝΡ<br>ΔΝ ΑΤΡγ5<br>ΔΝ ΑΤΡ<br>ΔΝ ΑΔΡ-ΑΙΓΧ<br>ΔΝ ΑΔΡ | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>2.3 mg/mL<br>4.6 mg/mL<br>1.5 mg/mL<br>2.0 | qmin           0.0115C           0.01095           0.01095           0.01392           0.01392           0.0120C           0.0120C           0.0120C           0.01095           0.0120C           0.0120C           0.01395           0.01495           0.01495           0.01495           0.0100C           0.0100C           0.01395           0.01395           0.01897           0.01897           0.01496           0.00745   | qRg range           0.768+150           0.651+150           0.651+150           0.723+148           0.733+150           0.996+150           0.797-151           0.790+152           0.712-149           0.727-150           0.727-150           0.629+151           0.629+151           0.629+151           0.629+151           0.629+151           0.852-153           0.852-153           0.852-153           0.869-150           120-152           0.465-152           0.645-152  | $\begin{array}{l} \hline Guiner\\ \hline R_8\\ \hline G6.8+0.0553\\ G5.7+0.0976\\ G5.3+0.0027\\ G6.5-0.0027\\ G6.5-0.0027\\ G6.5-0.0027\\ G7.2+0.202\\ G9.4+0.0792\\ G9.4+0.0326\\ G5.5+0.0828\\ G2.5+0.0924\\ G5.2+0.0924\\ G2.2+0.0792\\ G2.2+0.194\\ G3.2+0.0792\\ G3.3+0.228\\ G3.2+0.093\\ G3.$  | $\begin{array}{c} \textbf{I(0)}\\ \textbf{86653}=0.732\\ \textbf{254.35}=0.394\\ \textbf{339.88}=0.435\\ \textbf{339.88}=0.435\\ \textbf{339.88}=0.435\\ \textbf{339.88}=0.435\\ \textbf{339.88}=0.470\\ \textbf{339.88}=0.470\\ \textbf{339.88}=0.470\\ \textbf{339.88}=0.470\\ \textbf{339.88}=0.470\\ \textbf{339.88}=0.392\\ \textbf{400.69}=0.555\\ \textbf{379.69}=0.454\\ \textbf{369.68}=0.392\\ \textbf{400.69}=0.555\\ \textbf{379.69}=0.454\\ \textbf{369.68}=0.392\\ \textbf{379.69}=0.454\\ \textbf{395.69}=0.557\\ 395.69$  | Angle range           0.0118-0.7490           0.0110-0.7550           0.0080-0.7950           0.0113-0.7860           0.0113-0.7860           0.0113-0.7850           0.0113-0.7850           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0113-0.7800           0.0113-0.7900           0.0140-0.211           0.010-0.7950           0.0110-0.7950           0.0110-0.7950           0.0140-0.2191           0.0110-0.7950           0.0140-0.2566           0.0140-0.7950           0.0140-0.7950           0.0140-0.800           0.0140-0.800           0.0140-0.7950           0.0140-0.800   | GNOM           UPDAT Rg (0) Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         65.8         255         0.56           235         66.7         342         0.57           235         66.7         1.434         0.6           235         66.8         933         0.60           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           220         66.4         7.08         0.77           225         65.1         1.38         0.67           225         65.1         1.38         0.62           220         66.9         6.89         0.48           240         63.8         221         0.48           240         63.8         222         0.48           240         63.2         1.34         0.68           220         63.2         1.34         0.68           2  | Volume         P           Volume         P           1521470         3.9           1441466         3.9           1441466         3.9           144564         3.9           144546         3.9           1541470         3.9           144546         3.9           1543621         3.9           1531916         3.9           135120         3.9           1353560         3.9           1328161         3.9           134669         3.9           134669         3.9           134669         3.9           14236318         3.8           12237425         3.8           12237425         3.8           12408572         3.9           1406872         3.9           1408572         3.9           1408572         3.9           126062         3.8           1267646         3.9   | MM by Qr           Exp Mm         Theor MM           563000         S06000           330000         S06000           532000         S06000           532000         S06000           533000         S06000           533000         S06000           532000         S06000           532000         S06000           515000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           500000         S06000           500000         S06000           500000         S06000           488000         S06000           488000         S06000           470000         S06000  | GASBOR           No. Included NSD           1011.717 +           102.182 +           912.066 +           911.661 +           91.726 +           91.338 +           91.458 +           91.458 +           91.458 +           91.458 +           91.458 +           91.459 +           91.459 +           91.459 +           91.459 +           91.459 +           91.452 +           91.452 +           91.832 +           91.632 +   | Status Di           Damaver           0.060         228x240.118.794           0.167         237.5x23.7x123.7x13           0.167         237.5x23.7x12.318.44           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.192         230x240x118.794           0.104         230x241.5x105.713           0.116         230x218.5x105.712           0.116         230x218.5x105.712           0.116         230x218.5x105.712           0.026         200x20x108.884           0.036         200x20x108.884           0.042         210x199.5x96.52           0.042         210x20x108.885           0.256         200x20x108.885           0.256         200x20x108.885  | Immensions           Damfilt           Damfilt           134x156x67.882           134x155x70.711           204x2046x7883           184x195.5x73.186           172.5x149.5x73.186           134x154x77.782           143x154x77.782           195.5x125.5x73.185           195.5x125.5x73.185           195.5x125.5x73.185           195.5x125.5x73.185           195.5x125.5x73.185           195.5x125.5x73.185           195.5x125.5x73.185           195.5x125.5x70.004           155x155.5x70.004           155x155.5x70.03           176x176x70.004           165x176x70.004           165x176x70.003   | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05<br>9.30E+04   | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4.       | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>53.1         | Min avg slice diam<br>26.7<br>1 26.7<br>1 25.7<br>1 24.2<br>1 24.2<br>23.4   | Slices 60                |
| HSp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.1 mg/mL<br>2.0 mg/mL<br>2.2 mg/mL<br>2.3 mg/mL<br>3.3 | qmin           0.01150           0.01000           0.00801           0.01000           0.01390           0.01200           0.01200           0.01200           0.01200           0.01200           0.01399           0.01490           0.01495           0.01397           0.01397           0.01397           0.01397           0.01400           0.01397           0.01400   | 98; cange<br>0.768-150<br>0.651-150<br>0.652-150<br>0.723-148<br>0.733-148<br>0.731-150<br>0.996-150<br>0.970-153<br>0.770-153<br>0.771-149<br>0.771-150<br>0.772-149<br>0.771-150<br>0.957-154<br>0.629-151<br>0.629-151<br>0.629-151<br>0.6869-150<br>0.889-152<br>0.688-152<br>0.688-152<br>0.688-152<br>0.685-152<br>0.692-151   | $\begin{array}{c} \mbox{Guine} \\ \mbox{Guine} \\ \mbox{Fig. 1} \\ \mbox{Guine} $   | $\begin{array}{r} \textbf{I(0)}\\ \textbf{860:53} = 0.732\\ 254.35 + 0.732\\ 254.35 + 0.392\\ 330.88 + 0.435\\ \textbf{10}, 1$   | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7890           0.0113-0.7800           0.0140-0.2414           0.0150-0.2515           0.0120-0.7950           0.0120-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2915           0.0140-0.2956           0.0140-0.2956           0.0140-0.2956           0.0140-0.4435           0.0140-0.800           0.0078-0.7850           0.0113-0.7860           0.0140-0.2414   | GNOM           Dmax Rg         (10)         Total E           235         67.2         864         0.65           235         65.8         255         0.56           235         65.8         255         0.56           235         66.5         342         0.57           235         67.1         434         0.6           235         68         933         0.60           220         69.6         8.25         0.68           220         69.6         1.61         0.62           220         66.4         400         0.61           225         64.6         7.08         0.77           225         65.1         7.88         0.67           230         63.4         221         0.48           240         67.2         387         0.50           230         63.4         221         0.48           240         67.2         387         0.50           220         62.1         7.13.8         0.68           215         62.7         1.38         0.68           2215         62.5         1.334         0.68  | Porod           Volum p           1521470           1521470           1521470           1521470           14415966           1351120           14415963           14415963           1571916           39           1535120           135120           1353123           135323           1353560           39           1353560           39           1348083           39           1344062           39           1344062           39           1349023           1327555           1302244           1302244           1302244           1302575           1226602           38           1225756           31  | MM by Qr           Exp MM         Theor MM           563000         S06000           330000         S06000           532000         S06000           532000         S06000           532000         S06000           532000         S06000           532000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           488000         S06000           520000         S06000           488000         S06000           480000         S06000           480000         S06000           490000         S06000  | GASBOR No. Included NSD 101777+ 102.182+ 92.066+ 91.661+ 91.726+ 91.726+ 91.458+ 91.458+ 91.458+ 91.458+ 91.459+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.465+ 91.421+ 91.465+ 91.422+ 91.482+ 91.523+ 91.525+ 91.525+ 91.525+ 91.525+ 91.525+ 91.525+ 91.525+ 91.525+ 91.52   | Situs Di           Damew           0.069         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.162         240x240x118.794           0.128         240x240x118.794           0.128         240x240x118.794           0.129         240x240x118.794           0.120         240x240x118.794           0.121         298x209x116.672           0.227         209x209x108.894           0.116         230x241.5x105.713           0.135         230x220x12.1976           0.036         230x218.5x105.712           0.245         210x199.5x96.52           0.245         210x199.5x96.55           0.255         210x209x116.673           0.656         209x209x116.673           0.656         209x209x16.845           0.747         209x209x16.845           0.747         209x209x16.845           0.747         209x209x16.845           0.747         209x209x16.845           0.746         201x209x108.894           0.747         209x209x16.845           0.746         201x209x108.894           0.747         200x209x  | mensions Damfilt 144x156x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 154x154x77.782 195.5x73.185 184x149.5xx5.054 195.5x72.058.1317 207x207x73.186 189x158x81.671 207x207x73.186 189x158x81.671 205x175.5x70.004 185x176x70.004 185x176x70.004 187x176x70.004  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05<br>1.51E+05<br>9.30E+04                                     | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4        | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>53.1          | Min avg slice diam<br>1 26.7<br>1 26.7<br>1 26.7<br>1 26.7<br>1 26.7<br>1 24.2<br>2 3.4<br>2 3.4<br>1 4.7  | Slices 66                |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATPγS<br>ΔN ATP<br>ΔN ADP-AIFX<br>ΔN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>2.0 | qmin           0.01150           0.01000           0.00801           0.01000           0.01398           0.01398           0.01200           0.01200           0.01200           0.01200           0.01398           0.01499           0.01000           0.01397           0.01397           0.01887           0.01489           0.01499           0.01499           0.01499           0.01499           0.01100  
  | offer         offer           0.788.150         0.651.150           0.651.150         0.651.150           0.723.148         0.733.150           0.790.153         0.787.151           0.770.153         0.770.153           0.771.150         0.972.151           0.972.153         0.629.151           0.629.151         0.869.152           0.869.152         0.869.153           0.869.152         0.869.152           0.655.149         0.655.149           0.655.152         0.6651.152           0.655.152         0.691.154           0.921.154         0.921.154   | $\begin{array}{l} \hline Guiner\\ \hline R_g\\ \hline 6.6 & 8+0.0553\\ G5.1+0.0976\\ G5.3+0.0022\\ \hline 6.5 & 3+0.0022\\ \hline 6.5 & 3+0.0022\\ \hline 6.5 & 3+0.0022\\ \hline 6.5 & 3+0.0022\\ \hline 6.5 & 5+0.0864\\ \hline 6.5 & 9+0.0904\\ \hline 6.5 & 5+0.0864\\ \hline 6.5 & 9+0.0904\\ \hline 6.2 & 8+0.0792\\ \hline 6.2 & 9+0.0792\\ \hline 7.2 & 9+0.0792$   | $\begin{array}{c} 1(0)\\ 860538-0.722\\ 254.35-0.394\\ 339.88+0.435\\ 139.88+0.435\\ 1434.39+0.435\\ 16.918+0.470\\ 8.3718+0.470\\ 16.918+0.780\\ 8.3718+0.470\\ 1298.48+0.392\\ 404.09+0.565\\ 179.69+0.454\\ 120.55+0.458\\ 13913-0.534\\ 120.52+0.277\\ 120.94+0.276\\ 6.9066+0.0289\\ 13.558+0.0428\\ 13.584+0.0428\\ 13.584+0.0428\\ 13.584+0.0456\\ 13.284+0.0045\\
13.284+0.0045\\ 13.284+0.0045\\ 13.284+0.0045\\ 13.284+0.0045\\ 13.284+0.0045\\ 13.284+0.0045\\ 13.284+0$   | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7860           0.0113-0.7890           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0120-0.7950           0.0088-0.7900           0.0113-0.7950           0.0112-0.7950           0.0110-0.7950           0.0110-0.7950           0.0110-0.7950           0.0140-0.2191           0.0110-0.7950           0.0140-0.2666           0.0140-0.7950           0.0140-0.800           0.0140-0.800           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7860           0.0140-0.37860   | GNOM           Dmax Rg         (0)         Total 864         0.65.           235         67.21         866         0.65.           235         65.65         342         0.57.           235         66.55         342         0.57.           235         66.51         342         0.57.           235         66.51         82.9         0.60           235         66.9         9.33         0.60           220         69.6         16.1         0.52           220         69.6         16.1         0.52           220         66.4         400         0.61           240         67.2         387         0.50           220         66.4         7.08         0.77           235         65.9         859         0.57           225         65.1         13.8         0.67           230         63.4         221         0.48           240         63.8         220         64.8           220         62.7         13.4         0.68           220         63.2        
24.6         0.68           220         63.2         13.6  | Volum         P           Volum         P           1521470         3.9           1441466         3.9           1441456         3.9           144562         3.9           144542         3.9           1531120         3.9           144542         3.9           153132         3.9           1351120         3.9           135332         3.9           1328161         3.9           133560         3.9           134602         3.9           134602         3.9           134602         3.9           134602         3.9           134602         3.9           134602         3.9           134602         3.9           134602         3.9           134602         3.9           134755         3.9           1406572         3.9           1406572         3.9           1406572         3.9           1309244         3.9           1225756         3.9           1261348         3.9   | MM by Qr           Exp Mm         Theor MM           56300         S06000           33000         S06000           532000         S06000           533000         S06000           533000         S06000           532000         S06000           532000         S06000           532000         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           52000         S06000           48800         S06000           490000         S06000           9506000         S06000           506000         S06000   
   | GASBOR           No. Included NSD           1011.717 +           102.182 +           912.066 +           91.661 +           91.726 +           91.338 +           91.458 +           91.458 +           91.458 +           91.458 +           91.458 +           91.457 +           91.645 +           91.457 +           91.458 +           91.458 +           91.458 +           91.458 +           91.452 +           91.452 +           91.452 +           91.832 +           91.685 +           91.685 +           91.523 +   | Situs Di           Damour           0.069         228x240x118.794           0.167         237         5x23         5x12           0.167         237         5x23         5x12           0.167         237         5x23         5x12           0.162         240x240x118.794         0         0           0.182         240x240x118.794         0         0           0.172         298x209x116.672         0         0           0.272         299x209x108.894         0         0           0.176         230x217.814.705         0         0           0.306         203x214.5x105         7.13         0           0.306         203x214.5x105         7.13         0           0.306         203x214.5x105         7.12         0           0.306         203x214.5x105         12         0           0.306         203x214.5x105         12         0           0.307         204x214.16.673         0         0           0.305         204x20x108.895         0         2055         204x20x108.895           0.255         204x20x108.895         0         31x009x108.895         0 </th <th>International           Damfilt           Damfilt           Jaka156x67.882           175x187.5x70.711           Dava0tka7.883           184x195.5x73.186           172.5x149.5x73.186           172.5x149.5x73.186           184x154x77.782           195.5x173.185           195.5x172.5x61.317           207x207x73.186           189x168x81.671           209x187x70.004           155x155x70.03           176x176x70.004           187x176x70.004           187x176x70.004</th> <th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.51E+05<br/>9.30E+04</th> <th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4</th> <th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>49.5</th> <th>Min avg slice diam<br/>1 26.7<br/>1 15.7<br/>1 24.2<br/>1 24.2<br/>23.4<br/>14.7</th> <th>Slices 66</th>  | International           Damfilt           Damfilt           Jaka156x67.882           175x187.5x70.711           Dava0tka7.883           184x195.5x73.186           172.5x149.5x73.186           172.5x149.5x73.186           184x154x77.782           195.5x173.185           195.5x172.5x61.317           207x207x73.186           189x168x81.671           209x187x70.004           155x155x70.03           176x176x70.004           187x176x70.004           187x176x70.004  
  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05<br>9.30E+04   | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4        | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>49.5         | Min avg slice diam<br>1 26.7<br>1 15.7<br>1 24.2<br>1 24.2<br>23.4<br>14.7   | Slices 66                | | | | | | | | | | | | | | |
| HSp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>1.5 | qmin           qmin           0.01155           0.011000           0.00100           0.0000           0.01000           0.01000           0.01000           0.01100           0.01200           0.01200           0.01200           0.01200           0.01200           0.01399           0.01000           0.01399           0.01490           0.01490           0.01490           0.01000           0.01200           0.01200           0.01200           0.01200           0.01399           0.01490           0.01000           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.01100           0.011  | 9R; cange<br>0.768-150<br>0.651-150<br>0.652-150<br>0.723-148<br>0.733-148<br>0.733-150<br>0.996-150<br>0.770-153<br>0.770-153<br>0.770-153<br>0.771-149<br>0.771-150<br>0.957-154<br>0.957-154<br>0.629-151<br>0.629-151<br>0.629-151<br>0.629-151<br>0.6869-150<br>0.869-150<br>0.869-150<br>0.869-152<br>0.688-152<br>0.688-152<br>0.685-149<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154<br>0.921-154                        | $\begin{array}{c} \mbox{Guine} \\ \mbox{Guine} \\ \mbox{Fig. 1} \\ \mbox{Guine} $   | 1(0)<br>869.53.4 - 0.722<br>254.35 - 0.394<br>339.88 + 0.435<br>143.39 - 0.492<br>139.88 + 0.435<br>16.918 + -0.780<br>8.3718 + -0.780<br>8.3718 + -0.780<br>139.54 + 0.470<br>139.54 + 0.470<br>139.54 + 0.470<br>139.54 + 0.470<br>139.54 + 0.470<br>139.54 + 0.470<br>139.54 + 0.470<br>13.913 + 0.534<br>120.52 + 0.277<br>13.553 + 0.0428<br>13.553 + 0.0428<br>13.554 + 0.0289<br>13.555 + 0.0278<br>13.556 + 7.92<br>128.15 + 0.370<br>499.94 + 0.337<br>13.568 + 7.92<br>13.288 + 0.0428<br>13.556 + 7.92<br>13.554 + 0.0428<br>13.556 + 7.92<br>13.556 +   | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7890           0.0113-0.7890           0.0140-0.2414           0.0150-0.2515           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2916           0.0140-0.2916           0.0140-0.2956           0.0140-0.435           0.0140-0.800           0.0140-0.3800           0.0140-0.2414           0.0140-0.2414           0.0140-0.2414           0.0140-0.3744  | GNOM           Dmax Rg         (10)         Total E           Dmax Rg         (10)         Total E           235         67.2         864         0.65.           235         65.8         255         0.56           235         66.5         342         0.57           235         66.7         342         0.57           220         69.6         8.25         0.68           220         69.6         8.25         0.68           220         66.4         400         0.61           225         64.6         7.08         0.77           225         65.1         7.08         0.77           225         65.4         7.08         0.77           225         65.1         7.08         0.77           225         65.1         7.08         0.77           225         65.1         7.18         0.68           220         62.2         0.48         0.67           220         62.2         2.04         0.68           220         62.2         2.44         0.66           220         62.2         2.45         0.53           22   | Porod           Volum p           1521470           1521470           1521470           1521470           141566           39           1441566           141566           39           1441596           19           1351120           1441596           19           135321           133322           133322           133322           133322           13346818           39           1344002           1344023           39           1344023           1344023           39           1344023           1349023           132755           130244           130244           1302424           130244           1226602           38           1227575           1241628           1226602           3184287   | MM by Qr           Exp Mm         Theor MMI           563000         S060000           330000         S060000           337000         S060000           533000         S060000           533000         S060000           533000         S06000           53000         S06000           512000         S06000           512000         S06000           512000         S06000           458000         S06000           506000         S06000           468000         S06000           520000         S06000           488000         S06000           480000         S06000           480000         S06000           506000         S060   | GASBOR           No. Included NSD           1011.717 +           102.182 +           912.066 +           911.661 +           91.726 +           911.651 +           911.651 +           911.651 +           911.651 +           911.651 +           911.651 +           911.651 +           911.652 +           911.645 +           911.645 +           911.645 +           911.645 +           911.645 +           911.645 +           911.645 +           911.645 +           911.820 +           911.821 +           911.822 +           911.688 +           911.523 +           911.523 +  | Situs Di           Danew           0.069         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.168         237 5x237.5x123.743           0.128         240x240x118.794           0.128         240x240x118.794           0.129         240x240x118.744           0.237         298x209x116.672           0.247         210x207x113.844           0.176         230x204x16.854           0.176         230x204x108.894           0.176         230x204x108.7712           0.245         210x199.5x66.52           0.274         210x99.116.673           0.255         210x204x108.894           0.074         208x209x108.894           0.074         208x209x108.894           0.074         208x209x108.895           0.255         210x204x108.895           0.265         209x204x108.895           0.276         210x99x108.895           0.276         210x99x108.895           0.276         210x94x108.895           0.276         210x94x108.895           0.276         210x94x108.895           0.276         210x94x1  | mensions Damfilt 144:15667.882 175:187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 154x154x77.782 195.5x73.185 184x149.5x65.054 195.5x72.058.1317 207x207x73.186 189x158x81.671 209x187x70.004 185x176x70.004 185x176x70.004  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05<br>9.30E+04<br>9.30E+04                                     | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4        | Channel<br>Max avg sike diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>53.1          | Min avg slice diam<br>1 26.7<br>1 26.7<br>1 15.7<br>1 24.2<br>2 3.4<br>1 4.7   | Slices 64                |
| HSp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.           5.0 mg/mL           1.5 mg/mL           2.5 mg/mL           2.0 mg/mL           2.3 mg/mL           2.3 mg/mL           2.0 mg/mL           2.3 mg/mL           2.5 mg/mL           2.5 mg/mL           2.5 mg/mL           2.5 mg/mL           2.3 mg/mL           2.3 mg/mL           2.3 mg/mL           2.3 mg/mL           2.3 mg/mL           2.3 mg/mL           2.0 mg/mL   | qmin           qmin           0.01155           0.01000           0.0002           0.0109           0.0109           0.0109           0.0139           0.0139           0.01200           0.01200           0.01200           0.01000           0.01000           0.01000           0.01000           0.01097           0.01897           0.01097           0.01090           0.01000           0.01000           0.01100 <th>offer         offer           0.788.150         0.651.150           0.651.150         0.651.150           0.723.148         0.733.150           0.773.150         0.996.153           0.787.151         0.790.153           0.771.150         0.772.149           0.772.149         0.772.150           0.772.150         0.629.151           0.869.151         0.6629.151           0.869.152         0.869.152           0.869.152         0.6651.152           0.655.149         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.926.154</th> <th><math display="block">\begin{array}{l} \hline Guiner\\ \hline R_g\\ \hline 6.6 &amp; 8+0.0553\\ G5.1+0.0976\\ G5.3+0.0822\\ \hline 6.5 &amp; 3+0.0822\\ \hline 6.5 &amp; 3+0.0822\\ \hline 6.5 &amp; 3+0.082\\ G5.3+0.082\\ G5.3+</math></th> <th><math display="block">\begin{array}{r} \textbf{I(0)}\\ \textbf{86053} = 0.732\\ \textbf{524.35} = 0.732\\ \textbf{339.88} + 0.432\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.470\\ \textbf{33.34} + 0.851\\ \textbf{339.88} + 0.470\\ \textbf{339.88} + 0.470\\ \textbf{339.88} + 0.470\\ \textbf{339.88} + 0.580\\ \textbf{337.36} + 0.585\\ \textbf{379.69} + 0.458\\ \textbf{379.69} + 0.258\\ \textbf{379.69} + 0.276\\ \textbf{337.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{285.18} + 0.032\\ \textbf{337.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{285.18} + 0.0351\\ \textbf{327.64} + 0.658\\ \textbf{377.69} + 0.537\\ \textbf{377.64} + 0.658\\ </math></th> <th>Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0120-0.7950           0.0088-0.7900           0.0113-0.7950           0.0114-0.2919           0.0110-0.7950           0.0110-0.7950           0.0140-0.2919           0.0110-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2950           0.0140-0.2950           0.0140-0.2950           0.0140-0.2666           0.0140-0.7950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3144           0.0140-0.3144           0.0140-0.3144           0.0150-0.79500</th> <th>GNOM           Dmax Rg         (0)         Total E           225         67.21         864         0.65           225         65.8         255         0.56           225         65.8         255         0.56           225         66.5         342         0.57           2235         66.5         823         0.60           220         69.6         8.25         0.68           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           220         66.4         7.08         0.77           225         65.1         1.38         0.67           220         66.4         7.08         0.77           225         65.1         1.38         0.67           220         66.3         0.68         220         6.4           201         63.8         221         0.48         220           225         65.1         1.38         0.67           220         62.2         246         0.68         220         63.7         340         0.88</th> <th>Volum         P           Volum         P           1521470         3.9           1441466         3.9           1441456         3.9           144562         3.9           144563         3.9           1441563         3.9           1521470         3.9           144562         3.9           152132         3.9           1323161         3.9           1328161         3.9           138202         3.9           1348693         3.9           1348693         3.9           1348693         3.9           134725         3.8           132775         3.9           1406827         3.9           1309244         3.9           1227563         3.9           1226975         3.9           123975         3.9           1246823         3.9           123975         3.9           126382         3.9           126382         3.9           1364323         3.9</th> <th>MM by Gr           Exp MM         Theor MM           56300         506000           33000         506000           532000         506000           533000         506000           533000         506000           532000         506000           532000         506000           515000         506000           512000         506000           512000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           478000         506000           490000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000</th> <th>GASBOR           No. Included NSD           1011.717 +.           102.182 +.           912.066 +.           91.661 +.           91.726 +.           91.738 +.           91.458 +.           91.458 +.           91.455 +.           101.717 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.452 +.           91.523 +.           91.523 +.           91.523 +.</th> <th>Situs Di           Damener           0.069         228x240x118.794           0.167         237 5x237.5x123.7432           0.167         237 5x237.5x123.7432           0.167         237 5x237.5x123.7432           0.162         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.172         198x209x116.672           0.272         209x209x108.894           0.176         230x217.976           0.302         200x218.5x105.712           0.302         200x218.5x105.712           0.302         200x20x108.894           0.304         200x20x108.895           0.305         209x209x106.895           0.305         209x209x108.895           0.306         209x209x108.895</th> <th>mensions Damfilt JA4x156x67.882 175x187.5x70.711 204x2046x7.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 184x159.5x73.185 184x159.5x73.185 195.5x172.5x81.317 207x207x73.186 189x168x81.671 209x187x70.004 154x154x62.225 165x15x70.003 176x176x70.004 187x176x70.004</th> <th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.51E+05<br/>9.30E+04</th> <th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4</th> <th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>49.5</th> <th>Min avg slice diam<br/>1 26.7<br/>1 15.7<br/>1 24.2<br/>1 24.2<br/>23.4<br/>14.7</th> <th>Slices 66</th> | offer         offer           0.788.150         0.651.150           0.651.150         0.651.150           0.723.148         0.733.150           0.773.150         0.996.153           0.787.151         0.790.153           0.771.150         0.772.149           0.772.149         0.772.150           0.772.150         0.629.151           0.869.151         0.6629.151           0.869.152         0.869.152           0.869.152         0.6651.152           0.655.149         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.921.154           0.921.154         0.926.154  | $\begin{array}{l} \hline Guiner\\ \hline R_g\\ \hline 6.6 & 8+0.0553\\ G5.1+0.0976\\ G5.3+0.0822\\ \hline 6.5 & 3+0.0822\\ \hline 6.5 & 3+0.0822\\ \hline 6.5 & 3+0.082\\ G5.3+0.082\\ G5.3+$  | $\begin{array}{r} \textbf{I(0)}\\ \textbf{86053} = 0.732\\ \textbf{524.35} = 0.732\\ \textbf{339.88} + 0.432\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.470\\ \textbf{33.34} + 0.851\\ \textbf{339.88} + 0.470\\ \textbf{339.88} + 0.470\\ \textbf{339.88} + 0.470\\ \textbf{339.88} + 0.580\\ \textbf{337.36} + 0.585\\ \textbf{379.69} + 0.458\\ \textbf{379.69} + 0.258\\ \textbf{379.69} + 0.276\\ \textbf{337.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{285.18} + 0.032\\ \textbf{337.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{285.18} + 0.0351\\ \textbf{327.64} + 0.658\\ \textbf{377.69} + 0.537\\ \textbf{377.64} + 0.658\\ $  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0113-0.7890           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0120-0.7950           0.0088-0.7900           0.0113-0.7950           0.0114-0.2919           0.0110-0.7950           0.0110-0.7950           0.0140-0.2919           0.0110-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2950           0.0140-0.2950           0.0140-0.2950           0.0140-0.2666           0.0140-0.7950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3950           0.0140-0.3144           0.0140-0.3144           0.0140-0.3144           0.0150-0.79500   | GNOM           Dmax Rg         (0)         Total E           225         67.21         864         0.65           225         65.8         255         0.56           225         65.8         255         0.56           225         66.5         342         0.57           2235         66.5         823         0.60           220         69.6         8.25         0.68           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           220         66.4         7.08         0.77           225         65.1         1.38         0.67           220         66.4         7.08         0.77           225         65.1         1.38         0.67           220         66.3         0.68         220         6.4           201         63.8         221         0.48         220           225         65.1         1.38         0.67           220         62.2         246         0.68         220         63.7         340         0.88   | Volum         P           Volum         P           1521470         3.9           1441466         3.9           1441456         3.9           144562         3.9           144563         3.9           1441563         3.9           1521470         3.9           144562         3.9           152132         3.9           1323161         3.9           1328161         3.9           138202         3.9           1348693         3.9           1348693         3.9           1348693         3.9           134725         3.8           132775         3.9           1406827         3.9           1309244         3.9           1227563         3.9           1226975         3.9           123975         3.9           1246823         3.9           123975         3.9           126382         3.9           126382         3.9           1364323         3.9  | MM by Gr           Exp MM         Theor MM           56300         506000           33000         506000           532000         506000           533000         506000           533000         506000           532000         506000           532000         506000           515000         506000           512000         506000           512000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           478000         506000           490000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000  | GASBOR           No. Included NSD           1011.717 +.           102.182 +.           912.066 +.           91.661 +.           91.726 +.           91.738 +.           91.458 +.           91.458 +.           91.455 +.           101.717 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.465 +.           91.452 +.           91.523 +.           91.523 +.           91.523 +.   | Situs Di           Damener           0.069         228x240x118.794           0.167         237 5x237.5x123.7432           0.167         237 5x237.5x123.7432           0.167         237 5x237.5x123.7432           0.162         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.182         240x240x118.794           0.172         198x209x116.672           0.272         209x209x108.894           0.176         230x217.976           0.302         200x218.5x105.712           0.302         200x218.5x105.712           0.302         200x20x108.894           0.304         200x20x108.895           0.305         209x209x106.895           0.305         209x209x108.895           0.306         209x209x108.895  | mensions Damfilt JA4x156x67.882 175x187.5x70.711 204x2046x7.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 184x159.5x73.185 184x159.5x73.185 195.5x172.5x81.317 207x207x73.186 189x168x81.671 209x187x70.004 154x154x62.225 165x15x70.003 176x176x70.004 187x176x70.004  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05<br>9.30E+04   | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4        | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>49.5         | Min avg slice diam<br>1 26.7<br>1 15.7<br>1 24.2<br>1 24.2<br>23.4<br>14.7   | Slices 66                |
| HSp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>NSLS  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>3.0 | qmin<br>0.01150<br>0.01100<br>0.01000<br>0.01000<br>0.01000<br>0.01000<br>0.01399<br>0.01200<br>0.01399<br>0.01200<br>0.01000<br>0.01499<br>0.01000<br>0.01399<br>0.01000<br>0.01399<br>0.01000<br>0.01399<br>0.01000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.01399<br>0.011000<br>0.011000<br>0.01399<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.0110000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.011000<br>0.01100000000  | offst range           0.788.150           0.651.150           0.651.150           0.523.150           0.723.150           0.733.150           0.996.151           0.773.150           0.773.150           0.773.150           0.771.151           0.771.161           0.771.161           0.852.153           0.629.151           0.629.151           0.629.151           0.629.151           0.629.152           0.629.151           0.629.152           0.629.152           0.629.151           0.629.152           0.629.152           0.629.151           0.629.152           0.629.151           0.629.152           0.629.152           0.639.152           0.639.152           0.639.152           0.639.152           0.639.152           0.639.152           0.639.152           0.639.152           0.639.152           0.639.154           0.931.154  | $\begin{array}{l} \hline \textbf{Guinter} \\ \textbf{g}_{1} \\ \hline \textbf{g}_{2} \\ \hline \textbf{g}_{3} \\ \hline \textbf{g}_{5} \hline \textbf{g}_{5} \\ \hline \textbf{g}_{5} \\ \hline \textbf{g}_{5} \hline \hline \textbf{g}_{5} \\ \hline \textbf{g}_{5} \hline $                              | I(O)           8605.31 + 0.722           254.35 + 0.024           254.35 - 0.394           339.88 + 0.435           143.39 + 0.492           339.87 + 0.4851           16.918 + 0.700           329.84 + 0.432           404.09 + 0.455           379.69 + 0.454           862.45 + 0.638           7.0681 + 0.033           13.913 + 0.534           220.94 - 0.276           6.9066 + 0.0289           13.558 + 7.92           228.15 + 0.370           498.94 + 0.537           1356.8 + 7.92           228.15 + 0.0282           1356.4 + 0.032           1356.4 + 0.032           1324.4 + 0.0452           245.70 + 0.525           320.01 + 0.575  | Angle range           0.118-0.7590           0.0008-0.7950           0.0008-0.7950           0.0113-0.7860           0.0113-0.7860           0.0113-0.7860           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0140-0.211           0.0140-0.211           0.0140-0.211           0.0140-0.211           0.0140-0.211           0.0140-0.2566           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.267850           0.0140-0.27850           0.0140-0.27850           0.0140-0.27850 <th>GNOM           Demax Rg         (0)         Total B4           235         67.2         864         0.65           235         66.5         255         0.56           235         66.5         3242         0.57           235         66.5         342         0.57           2235         66.5         342         0.57           220         69.6         8.25         0.68           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           240         67.2         385         0.53           220         66.4         400         0.61           240         63.8         9.57         225           255         64.6         7.08         0.77           220         62.5         13.8         0.67           220         62.5         13.8         0.67           220         62.5         13.8         0.66           220         62.5         13.8         0.66           220         62.5         13.8         0.66</th> <th>Porod           Volum p           1521470           1521470           1521470           1521470           14415466           39           14415463           14415463           14415463           1571916           39           135120           135321           9           1328161           133522           133522           1335322           1335322           1334602           39           1344023           39           1344023           39           1349023           1349023           1349023           130244           1305244           1305244           1305244           1305244           1305244           1305244           1305244           1305244           13135575           1226602           38           1225757           135432           1356323           1356323           1356323</th> <th>MM by Qr           Exp Mm         Theor MM           563000         S06000           330000         S06000           337000         S06000           538000         S06000           532000         S06000           532000         S06000           532000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           512000         S06000           488000         S06000           520000         S06000           488000         S06000           548000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           512000         S06000           512000         S06000           512000         S06000</th> <th>GASBOR           No. Included NSD           1011.717 +           102.182 +           912.066 +           911.661 +           91.726 +           911.833 +           911.833 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.452 +           911.452 +           911.658 +           911.658 +           911.523 +           911.523 +</th> <th>Situs D           Damage           0.669         228x240x118.794           0.167         237.5x27.5x123.743           0.162         240x240x118.794           0.182         240x240x118.784           0.182         240x240x118.784           0.182         240x240x113.844           0.235         240x240x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         210x21.5x105.713           0.076         200x209x108.894           0.076         200x209x108.792           0.074         209x209x108.895           0.074         209x209x108.895           0.075         200x209x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         201x209x108.895</th> <th>mensions Damfilt 144:1566:7.882 175:187.5x70.711 204:2046:7.883 184:195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 1134:154x77.782 1154:154x77.782 1155.5x73.185 1184:1544.5x65.054 1195.5x72.058.1317 207x207x73.186 1189x158x81.671 209x187x70.004 1187x176x70.004 1187x176x70.004</th> <th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.51E+05<br/>9.30E+04<br/>1.51E+05</th> <th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4</th> <th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>53.1</th> <th>Min avg slice diam<br/>1 26.7<br/>1 26.7<br/>1 15.7<br/>1 24.2<br/>2 3.4<br/>2 3.4</th> <th>Slices 66</th>  | GNOM           Demax Rg         (0)         Total B4           235         67.2         864         0.65           235         66.5         255         0.56           235         66.5         3242         0.57           235         66.5         342         0.57           2235         66.5         342         0.57           220         69.6         8.25         0.68           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           240         67.2         385         0.53           220         66.4         400         0.61           240         63.8         9.57         225           255         64.6         7.08         0.77           220         62.5         13.8         0.67           220         62.5         13.8         0.67           220         62.5         13.8         0.66           220         62.5         13.8         0.66           220         62.5         13.8         0.66  | Porod           Volum p           1521470           1521470           1521470           1521470           14415466           39           14415463           14415463           14415463           1571916           39           135120           135321           9           1328161           133522           133522           1335322           1335322           1334602           39           1344023           39           1344023           39           1349023           1349023           1349023           130244           1305244           1305244           1305244           1305244           1305244           1305244           1305244           1305244           13135575           1226602           38           1225757           135432           1356323           1356323           1356323  | MM by Qr           Exp Mm         Theor MM           563000         S06000           330000         S06000           337000         S06000           538000         S06000           532000         S06000           532000         S06000           532000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           512000         S06000           488000         S06000           520000         S06000           488000         S06000           548000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           512000         S06000           512000         S06000           512000         S06000  | GASBOR           No. Included NSD           1011.717 +           102.182 +           912.066 +           911.661 +           91.726 +           911.833 +           911.833 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.458 +           911.452 +           911.452 +           911.658 +           911.658 +           911.523 +           911.523 +  | Situs D           Damage           0.669         228x240x118.794           0.167         237.5x27.5x123.743           0.162         240x240x118.794           0.182         240x240x118.784           0.182         240x240x118.784           0.182         240x240x113.844           0.235         240x240x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         210x21.5x105.713           0.076         200x209x108.894           0.076         200x209x108.792           0.074         209x209x108.895           0.074         209x209x108.895           0.075         200x209x108.895           0.076         201x209x108.895   | mensions Damfilt 144:1566:7.882 175:187.5x70.711 204:2046:7.883 184:195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 1134:154x77.782 1154:154x77.782 1155.5x73.185 1184:1544.5x65.054 1195.5x72.058.1317 207x207x73.186 1189x158x81.671 209x187x70.004 1187x176x70.004 1187x176x70.004   | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05<br>9.30E+04<br>1.51E+05                                     | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4        | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>53.1         | Min avg slice diam<br>1 26.7<br>1 26.7<br>1 15.7<br>1 24.2<br>2 3.4<br>2 3.4   | Slices 66                |
| HSp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>SSRL  | Conc.           5.0 mg/mL           1.5 mg/mL           2.5 mg/mL           2.0 mg/mL           2.3 mg/mL           2.3 mg/mL           2.0 mg/mL           2.3 mg/mL           2.5 mg/mL           2.5 mg/mL           2.3 mg/mL           2.0 mg/mL   | qmin           qmin           0.0115C           0.010000           0.010000           0.010000           0.010000           0.010000           0.0120000           0.0120000           0.0120000000000000000000000000000000000  
  | offer           0.788:150           0.651:150           0.651:150           0.651:150           0.723:148           0.733:150           0.996:151           0.787:151           0.770.153           0.771.100           0.772.149           0.772.149           0.772.150           0.772.151           0.972.150           0.629.151           0.6859.151           0.8659.153           0.869.152           0.6351.49           0.6351.49           0.972.154           0.869.151           0.869.152           0.869.152           0.651.49           0.921.51           0.921.51           0.921.51           0.921.51           0.921.51           0.921.54           0.921.54           0.921.54           0.921.54           0.921.54           0.921.54           0.926.51.49           0.926.51.49  | $\begin{array}{l} \hline Guiner\\ \hline Rg\\ \hline 66.8+0.0553\\ G5.1+0.0976\\ G5.3+0.0822\\ \hline 65.3+0.0822\\ \hline 65.3+0.0822\\ \hline 65.3+0.0822\\ \hline 65.3+0.0824\\ \hline 65.2+0.0924\\ \hline 75.2+0.0924\\ \hline $   | $\begin{array}{c} \textbf{I(0)}\\ \textbf{86053} = 0.732\\ \textbf{254.35} = 0.732\\ \textbf{254.35} = 0.394\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.470\\ \textbf{33.34} + 0.851\\ \textbf{16.318} + 0.780\\ \textbf{8.3718} + 0.470\\ \textbf{329.848} + 0.392\\ \textbf{404.09} + 0.555\\ \textbf{379.69} + 0.458\\ \textbf{379.69} + 0.256\\ \textbf{379.69} + 0.256\\ \textbf{379.69} + 0.276\\ \textbf{337.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{285.15} + 0.372\\ \textbf{327.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{285.15} + 0.458\\ \textbf{327.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{285.15} + 0.376\\
\textbf{327.34} + 1.60\\ \textbf{1556.8} + 0.537\\ \textbf{67263} + 0.0282\\ \textbf{245.70} + 0.537\\ \textbf{320.01} + 0.575\\ 320$  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0013-0.7890           0.0113-0.7860           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0113-0.7800           0.0120-0.7950           0.0088-0.7900           0.0140-0.2919           0.0113-0.7950           0.0110-0.7950           0.0110-0.7950           0.0140-0.2191           0.0110-0.7950           0.0140-0.2566           0.0140-0.2666           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0150-0.7950           0.0150-0.7950           0.0150-0.7950  | GNOM         UD           Dmax Rg (10)         Total E           235         67.21         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         66.5         342         0.57           235         66.5         8.25         0.68           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           240         67.2         387         0.50           220         66.4         7.08         0.77           235         65.9         859         0.57           225         64.6         7.08         0.77           230         63.4         221         0.48           240         63.8         220         64.8         0.68           220         62.2         1.36         0.68         220         6.37         1.36         0.68           220         62.5         1530         0.88         220<   
   | Volum         P           Volum         P           1521470         3.9           1441466         3.9           1441566         3.9           1441566         3.9           1441563         3.9           1521470         3.9           1445662         3.9           15213120         3.9           1521471         3.9           1521323         3.9           1328161         3.9           1328261         3.9           1348292         3.9           1346202         3.9           1348297         3.9           1348297         3.9           1348297         3.9           1348297         3.9           1349023         3.9           1349023         3.9           1325765         3.9           1309244         3.9           1326375         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9  | MM by Gr           Exp MM         Theor MM           56300         506000           33000         506000           332000         506000           533000         506000           533000         506000           53000         506000           53000         506000           515000         506000           512000         506000           512000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           52000         506000           52000         506000           52000         506000           52000         506000           52000         506000           430000         506000           520000         506000           520000         506000           506000         506000           506000         506000           506000         506000           506000         506000 </th <th>GASBOR           No. Included NSD           1011.717 +.         102.182 +.           912.066 +.         91.661 +.           91.726 +.         91.726 +.           91.338 +.         91.458 +.           91.458 +.         91.458 +.           91.456 +.         91.645 +.           91.465 +.         101.117 +.           91.465 +.         101.419 +.           91.466 +.         91.466 +.           91.468 +.         91.421 +.           91.832 +.         91.523 +.           91.523 +.         91.523 +.</th> <th>Situs Di           Damener           0.069         228x240x118.794           0.167         237         5x237           0.167         237         5x237           0.167         237         5x237           0.167         230x230x113.844         0.35           0.162         230x230x113.844         0.35           0.272         198x209x116.672         0.272          
0.272         230x230x121.976         0.36           0.362         230x230x121.976         0.362           0.362         230x230x121.976         0.362           0.376         230x230x121.976         0.362           0.362         230x230x121.976         0.362           0.362         203x230x18.844         0.375           0.375         230x218.5x105.712         0.375           <td< th=""><th>mensions Damfilt Jak1156x67.882 175x187.5x70.711 204x2046x7.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 184x159.6x73.185 184x159.6x6.054 195.5x172.5x81.317 207x207x73.186 189x166x81.671 209x187x70.004 154x154x62.225 165x15x70.003 176x176x70.004 187x176x70.004 187x176x70.004 187x176x70.004 187x176x70.004</th><th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>9.30E+04<br/>1.31E+05</th><th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4</th><th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>49.5</th><th>Min avg slice diam<br/>1 26.7<br/>1 15.7<br/>1 24.2<br/>24.2<br/>23.4<br/>14.7<br/>14.7</th><th>Slices 60</th></td<></th>   | GASBOR           No. Included NSD           1011.717 +.         102.182 +.           912.066 +.         91.661 +.           91.726 +.         91.726 +.           91.338 +.         91.458 +.           91.458 +.         91.458 +.           91.456 +.         91.645 +.           91.465 +.         101.117 +.           91.465 +.         101.419 +.           91.466 +.         91.466 +.           91.468 +.         91.421 +.           91.832 +.         91.523 +.           91.523 +.         91.523 +.  | Situs Di           Damener           0.069         228x240x118.794           0.167         237         5x237           0.167         237         5x237           0.167         237         5x237           0.167         230x230x113.844         0.35           0.162         230x230x113.844         0.35           0.272         198x209x116.672         0.272           0.272         230x230x121.976         0.36           0.362         230x230x121.976         0.362           0.362         230x230x121.976         0.362           0.376         230x230x121.976         0.362           0.362         230x230x121.976         0.362           0.362         203x230x18.844         0.375           0.375         230x218.5x105.712         0.375 <td< th=""><th>mensions Damfilt Jak1156x67.882 175x187.5x70.711 204x2046x7.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 184x159.6x73.185 184x159.6x6.054 195.5x172.5x81.317 207x207x73.186 189x166x81.671 209x187x70.004 154x154x62.225 165x15x70.003 176x176x70.004 187x176x70.004 187x176x70.004 187x176x70.004 187x176x70.004</th><th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>9.30E+04<br/>1.31E+05</th><th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4</th><th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>49.5</th><th>Min avg slice diam<br/>1 26.7<br/>1 15.7<br/>1 24.2<br/>24.2<br/>23.4<br/>14.7<br/>14.7</th><th>Slices 60</th></td<>   | mensions Damfilt Jak1156x67.882 175x187.5x70.711 204x2046x7.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 184x159.6x73.185 184x159.6x6.054 195.5x172.5x81.317 207x207x73.186 189x166x81.671 209x187x70.004 154x154x62.225 165x15x70.003 176x176x70.004 187x176x70.004 187x176x70.004 187x176x70.004 187x176x70.004  | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>9.30E+04<br>1.31E+05   | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4        | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>49.5         | Min avg slice diam<br>1 26.7<br>1 15.7<br>1 24.2<br>24.2<br>23.4<br>14.7<br>14.7  
  | Slices 60                |
| Hsp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>1.5 mg/mL<br>1.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.5 mg/mL<br>3.5 | qmin           qmin           0.0115C           0.011000           0.01000           0.01000           0.01000           0.01000           0.01000           0.01000           0.01000           0.01200           0.01200           0.01200           0.01200           0.01000           0.01000           0.01000           0.01395           0.01495           0.01500           0.01500           0.01500           0.01500           0.01500   | offer         offer           0.788.150         0.651.150           0.651.150         0.651.150           0.523.150         0.723.150           0.733.150         0.996.151           0.707.153         0.773.150           0.772.148         0.773.150           0.772.151         0.772.151           0.771.160         0.972.150           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.152           0.629.152         0.629.152           0.629.152         0.629.152           0.629.152         0.629.152           0.629.151         0.629.152           0.629.152         0.629.152           0.629.151         0.629.152           0.629.152         0.6389.152           0.639.152         0.6455.152           0.6455.152         0.6455.152           0.960.154         0.961.154           0.961.154         0.963.154           0.963.154         0.963.154  | $\begin{array}{l} \hline \textbf{Guinter} \\ \textbf{g}_{1} \\ \hline \textbf{g}_{2} \\ \hline \textbf{g}_{1} \\ \hline \textbf{g}_{2} \hline \textbf{g}_{2} \\ \hline \textbf{g}_{2} \\ \hline \textbf{g}_{2} \hline \textbf{g}_{2} \hline \textbf{g}_{2} \\ \hline \textbf{g}_{2} \hline \textbf{g}_{2} \hline \textbf{g}_{2} \\ \hline \textbf{g}_{2} \hline $ | I(O)           860531 + 0.722           254.35 - 0.394           339.88 + 0.435           3439.88 + 0.435           3439.88 + 0.435           343.97 - 0.851           16.918 + 0.700           298.48 + 0.432           404.09 + 0.455           379.69 + 0.454           862.45 + 0.638           7.0681 + 0.032           13.913 + 0.534           220.94 - 0.276           6.9066 + 0.0289           13.558 + 7.92           225.55 + 1.41           1356.8 + 7.92           226.44 - 0.0428           255.55 + 1.41           375.48 + 0.032           498.94 + 0.537           1356.8 + 7.92           226.15 - 0.370           498.94 + 0.537           132.04 + 0.0555           320.01 + 0.575           395.38 + 0.881  | Angle range           0.118-0.7590           0.0008-0.7950           0.0008-0.7950           0.0113-0.7860           0.0113-0.7860           0.0113-0.7860           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0140-0.211           0.0140-0.211           0.0140-0.211           0.0140-0.211           0.0140-0.211           0.0140-0.2566           0.0140-0.2666           0.0140-0.2666           0.0140-0.4300           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.2666           0.0140-0.26780           0.0140-0.2780           0.0140-0.2780           0.0140-0.2780           0.0140-0.2780   | GNOM           Demax Rg         (0)         Total B4           235         67.2         864         0.65           235         66.5         255         0.52           235         66.5         325         0.63           235         66.5         342         0.57           235         66.5         342         0.57           220         69.6         8.25         0.68           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           240         67.2         385         0.53           220         66.4         400         0.61           240         63.8         222         66.4           0.64         7.08         9.77         13.8         0.67           225         64.6         7.08         0.77         230         63.4         221         0.48           2205         60.9         6.9         0.68         222         0.42         220         62.5         13.8         0.67           2205         63.5         229         0.62<   | Porod           Volum p           1521470           1521470           1521470           1521470           1351120           14415966           19           1441596           19           1441596           19           152120           19           1441596           19           1531320           1353120           1353220           1353560           13133560           131346818           131346818           13134602           13140023           1324755           1302244           1302242           1302424           1327595           1302575           1302244           1226602           38           1225757           1364382           1354383           1354383           1354232           1354232           1354232           1354242           1354233           1354242           1354342           1354342  | MM by Qr           Exp Mm         Theor MM           563000         S06000           330000         S06000           337000         S06000           532000         S06000           532000         S06000           532000         S06000           532000         S06000           512000         S06000           512000         S06000           519000         S06000           506000         S06000           519000         S06000           506000         S06000           488000         S06000           488000         S06000           480000         S06000           5120000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           512000         S06000 </th <th>GASBOR No. Included NSD 101.717 + 102.182 + 92.066 + 91.661 + 91.726 + 91.726 + 91.458 + 91.458 + 91.458 + 91.458 + 91.459 + 91.465 + 91.464 + 91.465 + 91.465 + 91.465 + 91.465 + 91.465 + 91.465 + 91.421 + 91.465 + 91.425 + 91.4</th> <th>Situs D           Danage           0.669         228x240x118.794           0.167         237.5x27.5x123.743           0.162         240x240x118.794           0.182         240x240x118.784           0.182         240x240x118.784           0.182         240x240x113.844           0.235         21.5x230x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         210x21.5x105.713           0.076         200x201x108.894           0.036         200x210.976.52           0.074         209x209x108.895           0.075         200x20x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         211x209x108.895           0.076         2109x209x108.895           0.076         2109x209x1</th> <th>mensions           Damfilt           14x1156x67.882           175x187.5x70.711           204x204x67.883           184x195.5x73.186           172.5x149.5x73.186           174.154x77.782           184x149.5x50.5x1           195.5x195.5x73.185           184x149.5x65.054           195.5x195.5x13.17           207x207x73.186           189x168x81.671           209x187x70.004           165x176x70.004           165x176x70.004           165x176x70.004           161x172.5x65.054</th> <th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.51E+05<br/>9.30E+04<br/>1.28E+05<br/>1.28E+05<br/>1.28E+05</th> <th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4<br/>47</th> <th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>49.5<br/>53.1</th> <th>Min avg slice diam<br/>1 26.7<br/>1 26.7<br/>1 15.7<br/>1 24.2<br/>2 3.4<br/>1 41.7</th> <th>Slices 60</th> | GASBOR No. Included NSD 101.717 + 102.182 + 92.066 + 91.661 + 91.726 + 91.726 + 91.458 + 91.458 + 91.458 + 91.458 + 91.459 + 91.465 + 91.464 + 91.465 + 91.465 + 91.465 + 91.465 + 91.465 + 91.465 + 91.421 + 91.465 + 91.425 + 91.4   | Situs D           Danage           0.669         228x240x118.794           0.167         237.5x27.5x123.743           0.162         240x240x118.794           0.182         240x240x118.784           0.182         240x240x118.784           0.182         240x240x113.844           0.235         21.5x230x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         210x21.5x105.713           0.076         200x201x108.894           0.036         200x210.976.52           0.074         209x209x108.895           0.075         200x20x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         201x209x108.895           0.076         211x209x108.895           0.076         2109x209x108.895           0.076         2109x209x1  | mensions           Damfilt           14x1156x67.882           175x187.5x70.711           204x204x67.883           184x195.5x73.186           172.5x149.5x73.186           174.154x77.782           184x149.5x50.5x1           195.5x195.5x73.185           184x149.5x65.054           195.5x195.5x13.17           207x207x73.186           189x168x81.671           209x187x70.004           165x176x70.004           165x176x70.004           165x176x70.004           161x172.5x65.054   | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.51E+05<br>9.30E+04<br>1.28E+05<br>1.28E+05<br>1.28E+05             | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4<br>47  | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>49.5<br>53.1 | Min avg slice diam<br>1 26.7<br>1 26.7<br>1 15.7<br>1 24.2<br>2 3.4<br>1 41.7  | Slices 60                |
| HSp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>SSRL<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>SSRL  | Conc.           5.0 mg/mL           1.5 mg/mL           2.5 mg/mL           2.0 mg/mL           2.3 mg/mL           2.5 mg/mL           2.0 mg/mL           2.3 mg/mL           2.5 mg/mL           2.5 mg/mL           2.3 mg/mL           2.3 mg/mL           2.3 mg/mL           2.3 mg/mL           2.3 mg/mL           2.0 mg/mL           2.0 mg/mL           2.0 mg/mL           2.0 mg/mL           2.0 mg/mL           2.5 mg/mL           2.5 mg/mL           2.5 mg/mL           2.5 mg/mL           2.5 mg/mL           2.5 mg/mL   | qmin           qmin           0.0115C           0.010000           0.010000           0.010000           0.010000           0.010000           0.01200           0.01398           0.01200           0.01300           0.01200           0.01200           0.01399           0.01499           0.01000           0.01399           0.01399           0.01399           0.01399           0.01499           0.01499           0.01499           0.01499           0.01499           0.01499           0.01591           0.01591           0.01591           0.01592           0.01593           0.01594           0.01595  
  | offer           0.788:150           0.651:150           0.651:150           0.651:150           0.723:148           0.733:150           0.996:151           0.787:151           0.770.153           0.771.100           0.772.149           0.772.149           0.772.150           0.629:151           0.629:151           0.869:150           0.869:151           0.869:153           0.869:152           0.635:149           0.971:154           0.869:151           0.869:151           0.869:152           0.869:152           0.651:12           0.651:12           0.697:154           0.911:151           0.927:154           0.931:151           0.941:151           0.960:154           0.931:151           0.941:151           0.958:152           0.958:154           0.958:154           0.958:154           0.958:154           0.958:154  | $\begin{array}{l} \hline \textbf{Guiner} \\ \textbf{g}_{0} \\ \hline \textbf{g}_{0} \\ \textbf{g}_{0} \\$   | $\begin{array}{r} \textbf{I(0)}\\ \textbf{86053} = 0.732\\ \textbf{254.35} = 0.732\\ \textbf{254.35} = 0.394\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.470\\ \textbf{33.34} + 0.851\\ \textbf{16.318} + 0.780\\ \textbf{8.3718} + 0.470\\ \textbf{40.09} + 0.555\\ \textbf{379.69} + 0.454\\ \textbf{40.09} + 0.555\\ \textbf{379.69} + 0.454\\ \textbf{6.906} + 0.0289\\ \textbf{13.591} + 0.032\\ \textbf{220.52} + 0.276\\ \textbf{220.52} + 0.276\\ \textbf{220.52} + 0.276\\ \textbf{237.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{228.55} + 1.41\\ \textbf{357.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{228.55} + 0.0428\\ \textbf{245.70} + 0.525\\ \textbf{327.64} + 0.035\\ \textbf{327.34} +
1.60\\ \textbf{1556.8} + 7.92\\ \textbf{28.55} + 0.0456\\ \textbf{245.70} + 0.525\\ \textbf{320.01} + 0.575\\ \textbf{320.01} + 0.575\\ \textbf{320.01} + 0.575\\ \textbf{320.01} + 0.575\\ \textbf{395.38} + 0.881\\ \textbf{395.66} + 1.56\\ \textbf{50.01} + 1.5$  | Angle range           0.0118-0.7490           0.0100-0.7950           0.0080-0.7950           0.0081-0.7950           0.0113-0.7860           0.0113-0.7850           0.0113-0.7950           0.0120-0.7950           0.0088-0.7900           0.0120-0.7950           0.0120-0.7950           0.0110-0.7950           0.0110-0.7950           0.0110-0.7950           0.0110-0.7950           0.0140-0.2414           0.010-0.7950           0.0110-0.7950           0.0110-0.7950           0.0110-0.7950           0.0140-0.4435           0.0140-0.4435           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0140-0.7950           0.0150-0.7950           0.0150-0.7950           0.0150-0.7950           0.0162-0.7850           0.0150-0.7850           0.0162-0.7850           0.0162-0.7850           0.0162-0.7850   | GNOM           Dmax Rg         (0)         Total B(4)           225         67.21         864         0.65           225         65.65         325.0         0.56           225         65.65         342         0.57           2235         66.51         342         0.57           2235         66.51         825         0.68           220         69.6         8.25         0.68           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           220         66.4         7.08         0.77           225         65.1         1.38         0.67           220         66.4         7.08         0.77           225         65.1         1.38         0.67           220         66.3         0.68         220         6.48           220         63.4         221         0.48         220           225         65.1         1.38         0.67           220         62.2         246         0.68           220         62.7         1  
  | Volum         P           Volum         P           1521470         3.9           1441466         3.9           1441566         3.9           1441566         3.9           1441563         3.9           1521470         3.9           1451662         3.9           1571916         3.9           1351120         3.9           1328161         3.9           1382322         3.9           1348699         3.9           1348699         3.9           1348697         3.9           1346572         3.9           1342574         3.9           1322575         3.9           1309244         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382   | MM by Gr           Exp MM         Theor MM           56300         506000           33000         506000           33000         506000           532000         506000           533000         506000           53000         506000           53000         506000           515000         506000           512000         506000           512000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           527000         506000           520000         506000           527000         506000           490000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           506000         506000           507000         506000      507000         506000  <  
  | GASBOR<br>No. Included NSD<br>1011.717 +<br>102.182 +<br>92.066 +<br>91.726 +<br>91.726 +<br>91.738 +<br>91.458 +<br>91.458 +<br>91.458 +<br>91.457 +<br>91.645 +<br>101.419 +<br>91.465 +<br>91.465 +<br>91.465 +<br>91.465 +<br>91.421 +<br>91.832 +   | Status Di           Damour           0.069         228x240x118.794           0.167         237 5x237.5x123.7432           0.167         237 5x237.5x123.7432           0.167         237 5x237.5x123.7432           0.167         230x230x113.844           0.282         240x240x118.794           0.172         198x209x116.672           0.272         209x209x108.894           0.176         230x217.813.844           0.136         230x210.121.976           0.036         203x209x121.976           0.036         209x209x108.894           0.076         209x209x108.895           0.255         200x20x08.895           0.265         209x209x108.895           0.276         210x199.5x96.52           0.076         209x209x108.895           0.276         210x20x08.895           0.276         210x20x08.895           0.276         210x209x108.895           0.276         210x209x108.895           0.276         210x209x108.895           0.276         210x209x108.895           0.276         210x209x108.895           0.276         210x209x108.895           0.276         210  | mensions           Damfilt           Damfilt           134x1156x67.882           1175x187.5x70.711           204x20467.883           184x195.5x73.186           172.5x149.5x73.186           172.5x149.5x73.186           184x154x77.782           143x154x77.782           143x154x77.782           195.5x172.5x81.317           207x207x73.186           189x165x81.671           209x187x70.004           155x15x70.003           165x15x70.003           165x15x70.003           161x172.5x65.054           161x172.5x65.054   
   | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>9.30E+04<br>1.28E+05<br>1.28E+05                                     | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4<br>477 | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>53.1<br>53.1<br>49.5         | Min avg slice diam           1         26.7           26.7         1           7         15.7           1         24.2           2         24.2           2         3.4           1         24.2           2         3.4           14.7         41.7 | Slices 60                | | | | | | | | | | | | | | |
| Hsp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFx<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.5 mg/mL<br>2.3 mg/mL<br>3.3 | gmin           0.0115C           0.01000           0.00000           0.00000           0.01099           0.0109           0.0109           0.01000           0.0120C           0.0120C           0.0120C           0.0120C           0.01499           0.01392           0.01392           0.01490           0.01499           0.01490           0.01490           0.01490           0.01490           0.01490           0.01490           0.0150C   | offer         offer           0.788.150         0.651.150           0.651.150         0.651.150           0.723.148         0.731.150           0.723.148         0.796.153           0.787.151         0.701.153           0.771.160         0.772.108           0.772.149         0.771.160           0.771.149         0.771.161           0.772.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.639.152           0.639.152         0.6465.152           0.6391.154         0.931.154           0.9631.154         0.931.154           0.9631.154         0.961.154           0.9631.154         0.961.154           0.9645.152         110.154  | $\begin{array}{l} \hline \textbf{Guinter} \\ \textbf{g}_{1} \\ \hline \textbf{g}_{2} \\ \hline \textbf{g}_{3} \\ \hline \textbf{g}_{5} \hline \textbf{g}_{5} \hline \textbf{g}_{5} \\ \hline \textbf{g}_{5} \hline \textbf{g}_{5} \\ \hline \textbf{g}_{5} \hline \textbf{g}_{5} \\ \hline \textbf{g}_{5} \hline \textbf{g}_{5$    | $\begin{array}{r} \textbf{I(0)}\\ \textbf{860:53} = 0.722\\ \textbf{524.35} = 0.394\\ \textbf{339.88} = 0.435\\ \textbf{339.88} = 0.385\\ \textbf{339.87} = 0.585\\ \textbf{339.47} = 0.685\\ \textbf{339.47} = 0.685\\ \textbf{379.69} = 0.555\\ \textbf{379.69} = 0.658\\ \textbf{379.69} = 0.658\\ \textbf{379.69} = 0.638\\ \textbf{375.68} = 0.0289\\ \textbf{355.68} = 0.0289\\ \textbf{355.68} = 0.0289\\ \textbf{355.68} = 0.0282\\ \textbf{355.68} = 0.0045\\ $  | Angle range           0.118-0.7590           0.0113-0.7590           0.0081-0.7950           0.0113-0.7600           0.0113-0.7600           0.0113-0.7600           0.0113-0.7600           0.0113-0.7800           0.0113-0.7800           0.0140-0.2414           0.0150-0.2515           0.0120-0.7950           0.0120-0.7950           0.0130-0.7950           0.0140-0.2191           0.0140-0.2191           0.0140-0.2566           0.0140-0.2666           0.0140-0.7950 <th>GNOM           Damax Rg. (10)         Total B4           235         67.2         864         0.65           235         65.5         255         0.52           235         66.5         342         0.57           235         66.5         342         0.57           235         66.6         933         0.60           235         66.7         8.25         0.68           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           240         67.2         387         0.50           225         65.1         1.38         0.67           235         65.9         859         0.57           225         65.1         1.38         0.67           226         62.6         7.08         0.77           220         62.6         7.08         0.77           225         65.1         1.38         0.67           220         62.2         246         0.66           220         62.2         246         0.66           220<th>Pored           Volume         P           1521470         3.9           144166         3.9           1441466         3.9           1445462         3.9           1445462         3.9           1543621         3.9           1543621         3.9           1543621         3.9           1543621         3.9           1353323         3.9           1353560         3.9           1354623         3.9           135260         3.9           1346023         3.9           1346023         3.9           1346023         3.9           1346023         3.9           134628         3.9           1408572         3.9           1226602         2.8           125766         3.9           126183         3.0           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9     &lt;</th><th>MM by Gr           Exp MM         Theor MM           563001         S06000           330000         S06000           337000         S06000           33800         S06000           33800         S06000           33800         S06000           53000         S06000           53000         S06000           513000         S06000           512000         S06000           512000         S06000           51900         S06000           506000         S06000           512000         S06000      512000         S06000      <t< th=""><th>GASBOR           No. Included MSD           10         1.717 +           10         2.182 +           9         2.066 +           9         1.661 +           9         1.727 +           9         1.738 +           9         1.338 +           9         1.458 +           9         1.645 +           9         1.645 +           10         1.419 +           9         1.538 +           9         1.422 +           9         1.635 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.523 +</th><th>UBUE DE           Discatorial: 204           0.669         228x240x118.294           0.167         237.5x27.5x123.743           0.182         240x240x118.794           0.182         240x240x118.784           0.182         240x240x118.784           0.182         240x240x113.844           0.182         240x240x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         210x241.5x105.713           0.156         240x209x108.894           0.156         240x209x108.894           0.036         240x212.1976           0.042         220x209x108.895           0.056         209x209x108.895           0.056         209x209x108.895           0.259         220x20x108.895           0.250         220x20x108.895           0.056         211x209x108.895           0.057         220x20x108.895           0.058         230x230x113.844           0.059         230x230x113.844</th><th>mensions           Damfilt           14x1156x67.882           175x187.5x70.711           204x204c7.883           184x195.5x73.186           172.5x149.5x73.186           172.5x149.5x73.186           184x194.5x77.782           143x154x77.782           195.5x195.5x73.185           184x149.5x5.054           195.5x172.5x81.317           207x207x73.186           125x156x70.004           155x175x70.004           155x176x70.004           155x176x70.004           155x176x70.004           161x172.5x65.054</th><th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.25E+05<br/>9.30E+04<br/>1.51E+05<br/>9.30E+04<br/>1.28E+05<br/>1.28E+05</th><th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4<br/>47</th><th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>60.9<br/>53.1<br/>49.5<br/>53.1</th><th>Min avg slice diam</th><th>Slices 60</th></t<></th></th>   | GNOM           Damax Rg. (10)         Total B4           235         67.2         864         0.65           235         65.5         255         0.52           235         66.5         342         0.57           235         66.5         342         0.57           235         66.6         933         0.60           235         66.7         8.25         0.68           220         69.6         8.25         0.68           220         69.6         16.1         0.62           220         66.4         400         0.61           240         67.2         387         0.50           225         65.1         1.38         0.67           235         65.9         859         0.57           225         65.1         1.38         0.67           226         62.6         7.08         0.77           220         62.6         7.08         0.77           225         65.1         1.38         0.67           220         62.2         246         0.66           220         62.2         246         0.66           220 <th>Pored           Volume         P           1521470         3.9           144166         3.9           1441466         3.9           1445462         3.9           1445462         3.9           1543621         3.9           1543621         3.9           1543621         3.9           1543621         3.9           1353323         3.9           1353560         3.9           1354623         3.9           135260         3.9           1346023         3.9           1346023         3.9           1346023         3.9           1346023         3.9           134628         3.9           1408572         3.9           1226602         2.8           125766         3.9           126183         3.0           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9     &lt;</th> <th>MM by Gr           Exp MM         Theor MM           563001         S06000           330000         S06000           337000         S06000           33800         S06000           33800         S06000           33800         S06000           53000         S06000           53000         S06000           513000         S06000           512000         S06000           512000         S06000           51900         S06000           506000         S06000           512000         S06000      512000         S06000      <t< th=""><th>GASBOR           No. Included MSD           10         1.717 +           10         2.182 +           9         2.066 +           9         1.661 +           9         1.727 +           9         1.738 +           9         1.338 +           9         1.458 +           9         1.645 +           9         1.645 +           10         1.419 +           9         1.538 +           9         1.422 +           9         1.635 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.523 +</th><th>UBUE DE           Discatorial: 204           0.669         228x240x118.294           0.167         237.5x27.5x123.743           0.182         240x240x118.794           0.182         240x240x118.784           0.182         240x240x118.784           0.182         240x240x113.844           0.182         240x240x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         210x241.5x105.713           0.156         240x209x108.894           0.156         240x209x108.894           0.036         240x212.1976           0.042         220x209x108.895           0.056         209x209x108.895           0.056         209x209x108.895           0.259         220x20x108.895           0.250         220x20x108.895           0.056         211x209x108.895           0.057         220x20x108.895           0.058         230x230x113.844           0.059         230x230x113.844</th><th>mensions           Damfilt           14x1156x67.882           175x187.5x70.711           204x204c7.883           184x195.5x73.186           172.5x149.5x73.186           172.5x149.5x73.186           184x194.5x77.782           143x154x77.782           195.5x195.5x73.185           184x149.5x5.054           195.5x172.5x81.317           207x207x73.186           125x156x70.004           155x175x70.004           155x176x70.004           155x176x70.004           155x176x70.004           161x172.5x65.054</th><th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.25E+05<br/>9.30E+04<br/>1.51E+05<br/>9.30E+04<br/>1.28E+05<br/>1.28E+05</th><th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4<br/>47</th><th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>60.9<br/>53.1<br/>49.5<br/>53.1</th><th>Min avg slice diam</th><th>Slices 60</th></t<></th> | Pored           Volume         P           1521470         3.9           144166         3.9           1441466         3.9           1445462         3.9           1445462         3.9           1543621         3.9           1543621         3.9           1543621         3.9           1543621         3.9           1353323         3.9           1353560         3.9           1354623         3.9           135260         3.9           1346023         3.9           1346023         3.9           1346023         3.9           1346023         3.9           134628         3.9           1408572         3.9           1226602         2.8           125766         3.9           126183         3.0           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9           1362623         3.9     <   | MM by Gr           Exp MM         Theor MM           563001         S06000           330000         S06000           337000         S06000           33800         S06000           33800         S06000           33800         S06000           53000         S06000           53000         S06000           513000         S06000           512000         S06000           512000         S06000           51900         S06000           506000         S06000           512000         S06000      512000         S06000 <t< th=""><th>GASBOR           No. Included MSD           10         1.717 +           10         2.182 +           9         2.066 +           9         1.661 +           9         1.727 +           9         1.738 +           9         1.338 +           9         1.458 +           9         1.645 +           9         1.645 +           10         1.419 +           9         1.538 +           9         1.422 +           9         1.635 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.523 +</th><th>UBUE DE           Discatorial: 204           0.669         228x240x118.294           0.167         237.5x27.5x123.743           0.182         240x240x118.794           0.182         240x240x118.784           0.182         240x240x118.784           0.182         240x240x113.844           0.182         240x240x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         210x241.5x105.713           0.156         240x209x108.894           0.156         240x209x108.894           0.036         240x212.1976           0.042         220x209x108.895           0.056         209x209x108.895           0.056         209x209x108.895           0.259         220x20x108.895           0.250         220x20x108.895           0.056         211x209x108.895           0.057         220x20x108.895           0.058         230x230x113.844           0.059         230x230x113.844</th><th>mensions           Damfilt           14x1156x67.882           175x187.5x70.711           204x204c7.883           184x195.5x73.186           172.5x149.5x73.186           172.5x149.5x73.186           184x194.5x77.782           143x154x77.782           195.5x195.5x73.185           184x149.5x5.054           195.5x172.5x81.317           207x207x73.186           125x156x70.004           155x175x70.004           155x176x70.004           155x176x70.004           155x176x70.004           161x172.5x65.054</th><th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>1.25E+05<br/>9.30E+04<br/>1.51E+05<br/>9.30E+04<br/>1.28E+05<br/>1.28E+05</th><th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4<br/>47</th><th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>60.9<br/>53.1<br/>49.5<br/>53.1</th><th>Min avg slice diam</th><th>Slices 60</th></t<>   | GASBOR           No. Included MSD           10         1.717 +           10         2.182 +           9         2.066 +           9         1.661 +           9         1.727 +           9         1.738 +           9         1.338 +           9         1.458 +           9         1.645 +           9         1.645 +           10         1.419 +           9         1.538 +           9         1.422 +           9         1.635 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.623 +           9         1.523 +   | UBUE DE           Discatorial: 204           0.669         228x240x118.294           0.167         237.5x27.5x123.743           0.182         240x240x118.794           0.182         240x240x118.784           0.182         240x240x118.784           0.182         240x240x113.844           0.182         240x240x113.844           0.072         198x209x116.672           0.272         209x209x108.894           0.116         210x241.5x105.713           0.156         240x209x108.894           0.156         240x209x108.894           0.036         240x212.1976           0.042         220x209x108.895           0.056         209x209x108.895           0.056         209x209x108.895           0.259         220x20x108.895           0.250         220x20x108.895           0.056         211x209x108.895           0.057         220x20x108.895           0.058         230x230x113.844           0.059         230x230x113.844  | mensions           Damfilt           14x1156x67.882           175x187.5x70.711           204x204c7.883           184x195.5x73.186           172.5x149.5x73.186           172.5x149.5x73.186           184x194.5x77.782           143x154x77.782           195.5x195.5x73.185           184x149.5x5.054           195.5x172.5x81.317           207x207x73.186           125x156x70.004           155x175x70.004           155x176x70.004           155x176x70.004           155x176x70.004           161x172.5x65.054   | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>1.25E+05<br>9.30E+04<br>1.51E+05<br>9.30E+04<br>1.28E+05<br>1.28E+05 | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4<br>47  | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>60.9<br>53.1<br>49.5<br>53.1         | Min avg slice diam   | Slices 60                |
| Hsp104 dN<br>ΔN AMP-PNP<br>ΔN ATPγS<br>ΔN ATP<br>ΔN ADP-AIFx<br>ΔN ADP | Location           NSLS           NSLS           NSLS           NSLS           SSRL           NSLS           SSRL           SSRL           SSRL           NSLS           SSRL           SSRL           SSRL           NSLS           SSRL           SSRL | Conc.           5.0 mg/mL           1.5 mg/mL           2.5 mg/mL           2.0 mg/mL           2.3 mg/mL           2.3 mg/mL           2.6 mg/mL           2.0 mg/mL           2.3 mg/mL           2.6 mg/mL           2.0 mg/mL           2.3 mg/mL           2.46 mg/mL           2.0 mg/mL           2.3 mg/mL           2.46 mg/mL           2.0 mg/mL           2.5 mg/mL           2   | qmin           0.01150           0.01000           0.00801           0.00801           0.01095           0.01095           0.01150           0.01398           0.01398           0.01398           0.01398           0.01300           0.01200           0.  | offer           0.768-1.50           0.651-1.50           0.651-1.50           0.652-1.50           0.723-1.48           0.733-1.50           0.996-1.50           0.787-1.51           0.787-1.51           0.770-1.53           0.772-1.48           0.771-1.50           0.772-1.49           0.772-1.64           0.772-1.51           0.629-1.51           0.629-1.51           0.889-1.52           0.6852-1.53           0.6851-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.6951-1.52           0.941-1.51           0.931-1.51           0.938-1.52           0.931-1.51           0.938-1.52           0.931-1.51           1.01-1.54           1.10-1.54  | $\begin{array}{  c  }\hline Guiner\\\hline Rg\\ 66.8+0.0553\\ 65.1+0.0976\\ 65.3+0.0822\\ \hline 65.3+0.0822\\ \hline 65.3+0.0822\\ \hline 65.3+0.0822\\ \hline 65.3+0.0824\\ \hline 65.2+0.0924\\ \hline 64.8+0.276\\ \hline 65.2+0.0924\\ \hline 75.2+0.0924\\ \hline 75.2+0.0924\\$   | $\begin{array}{r} \textbf{I(0)}\\ \textbf{86053} = 0.732\\ \textbf{254.35} = 0.394\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.470\\ \textbf{8.3718} + 0.870\\ \textbf{8.3718} + 0.470\\ \textbf{8.3718} + 0.392\\ \textbf{400.09} + 0.555\\ \textbf{379.69} + 0.454\\ \textbf{8.3708} + 0.392\\ \textbf{400.09} + 0.555\\ \textbf{379.69} + 0.454\\ \textbf{8.3708} + 0.392\\ \textbf{370.69} + 0.454\\ \textbf{375.68} + 0.392\\ \textbf{37.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{228.15} + 0.0428\\ \textbf{251.55} + 0.0428\\ \textbf{255.5} + 1.41\\ \textbf{337.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{228.15} + 0.370\\ \textbf{327.34} + 1.60\\ \textbf{1556.8} + 7.92\\ \textbf{228.15} + 0.0352\\ \textbf{327.34} + 1.60\\ \textbf{1556.8} + 0.537\\ \textbf{327.34} + 1.60\\ \textbf{1556.8} + 0.537\\ \textbf{327.34} + 1.60\\ \textbf{1556.8} + 0.537\\ \textbf{329.38} + 0.881\\ \textbf{395.06} + 1.56\\ \textbf{8.5800} + 0.0659\\ \textbf{37.38} + 0.041\\ \textbf{37.38} + 0.0141\\ \textbf{37.38}$  | Angle range           0.0118-0.7490           0.0100-0.7550           0.0080-0.7950           0.0113-0.7890           0.0113-0.7890           0.0113-0.7800           0.0113-0.7800           0.0113-0.7950           0.0120-0.7950           0.0120-0.7950           0.0120-0.7950           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2919           0.0140-0.2414           0.0130-0.7950           0.0140-0.4435           0.0140-0.4435           0.0150-0.7950           0.01618-0.7890           0.0163-0.7890           0.0163-0.7890           0.0163-0.7890           0.0174-0.7890           0.018-0.7890           0.018-0.7890           0.018-0.7890           0.0140-0.4435 <th>GNOM           Dmax Rg         (0)         Total 84           235         67.21         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         66.5         342         0.57           220         66.6         933         0.60           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           220         66.4         7.08         0.57           225         65.4         7.08         0.57           225         65.4         7.08         0.57           220         66.4         7.08         0.57           225         65.1         1.3.8         0.67           220         63.8         222         0.48           220         63.8         222         0.48           220         63.8         222         0.48           220         63.7         1.3.6         0.68           221         6.43         946         0.60</th> <th>Volum         P           Volum         P           1521470         3.9           1441406         3.9           1441406         3.9           1441563         3.9           1441563         3.9           1521470         3.9           1445663         3.9           1531120         3.9           1531323         3.9           1323161         3.9           1335360         3.9           1346669         3.9           1346662         3.9           1346663         3.9           1340623         3.9           1340623         3.9           1342575         3.9           1309244         3.9           132575         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382</th> <th>MM by Gr           Exp MM         Theor MM           563000         S06000           330000         S06000           330000         S06000           533000         S06000           533000         S06000           530000         S06000           530000         S06000           515000         S06000           515000         S06000           506000         S06000           51200         S06000           51200         S06000           512000         S06000           512000         S06000           512000         S06000           560000         S06000           560000         S06000           506000         S06000           506000         S06000</th> <th>GASBO           No. Included NSD           1011.717 +.           102.182 +.           92.066 +.           91.661 +.           91.726 +.           91.738 +.           91.458 +.           91.458 +.           91.458 +.           91.458 +.           91.454 +.           91.454 +.           91.465 +.           91.465 +.           91.452 +.           91.452 +.           91.452 +.           91.452 +.           91.523 +.           91.523 +.           91.568 +.           91.575 +.           91.675 +.</th> <th>Situs Di           Damore           0.069         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.167         230x230x113.844           0.128         240x240x118.794           0.128         240x240x118.794           0.132         230x230x113.844           0.135         230x210x18.844           0.135         230x210x18.844           0.135         230x230x121.976           0.036         2230x230x121.976           0.036         220x20x108.894           0.074         20x20x108.894           0.075         20x20x108.895           0.245         210x1295.596.522           0.076         231x209x108.895           0.216         231x209x108.895           0.216         231x209x108.895           0.216         231x209x108.895           0.076         231x209x108.895           0.076         230x230x113.844           0.076         230x230x113.844</th> <th>mensions Damfilt Jak1156x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 174.5x154x77.782 143x154x77.782 145x155x55.784 145x155x55.784 145x155x55.784 145x155x55.784 145x155x55.784 145x155x55.784 145x155x55.784 145x1572 145x157x77 145x157x77 145x157 145x157x7 145x157 145x157 145x155x5 145x15 145x1 145x15 145x1 145x15 145x1 145x1 145x1 145x1 145x1 145x 145 145 145 145 145 145 145 145 145 145</th> <th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>1.25E+05<br/>1.25E+05<br/>9.30E+04<br/>1.28E+05<br/>1.28E+05<br/>1.28E+05</th> <th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4<br/>477</th> <th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>49.5<br/>52.3</th> <th>Min aug clice diam           1         26.7           26.7         1           7         15.7           1         24.2           2         23.4           23.4         34.7           41.7         41.7</th> <th>Slices 6(</th> | GNOM           Dmax Rg         (0)         Total 84           235         67.21         864         0.65           235         65.8         255         0.56           235         66.5         342         0.57           235         66.5         342         0.57           220         66.6         933         0.60           220         69.6         1.61         0.62           220         69.6         1.61         0.62           220         66.4         400         0.61           220         66.4         7.08         0.57           225         65.4         7.08         0.57           225         65.4         7.08         0.57           220         66.4         7.08         0.57           225         65.1         1.3.8         0.67           220         63.8         222         0.48           220         63.8         222         0.48           220         63.8         222         0.48           220         63.7         1.3.6         0.68           221         6.43         946         0.60   | Volum         P           Volum         P           1521470         3.9           1441406         3.9           1441406         3.9           1441563         3.9           1441563         3.9           1521470         3.9           1445663         3.9           1531120         3.9           1531323         3.9           1323161         3.9           1335360         3.9           1346669         3.9           1346662         3.9           1346663         3.9           1340623         3.9           1340623         3.9           1342575         3.9           1309244         3.9           132575         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382         3.9           1364382  | MM by Gr           Exp MM         Theor MM           563000         S06000           330000         S06000           330000         S06000           533000         S06000           533000         S06000           530000         S06000           530000         S06000           515000         S06000           515000         S06000           506000         S06000           51200         S06000           51200         S06000           512000         S06000           512000         S06000           512000         S06000           560000         S06000           560000         S06000           506000         S06000           506000         S06000  | GASBO           No. Included NSD           1011.717 +.           102.182 +.           92.066 +.           91.661 +.           91.726 +.           91.738 +.           91.458 +.           91.458 +.           91.458 +.           91.458 +.           91.454 +.           91.454 +.           91.465 +.           91.465 +.           91.452 +.           91.452 +.           91.452 +.           91.452 +.           91.523 +.           91.523 +.           91.568 +.           91.575 +.           91.675 +.  | Situs Di           Damore           0.069         228x240x118.794           0.167         237 5x237.5x123.743           0.167         237 5x237.5x123.743           0.167         230x230x113.844           0.128         240x240x118.794           0.128         240x240x118.794           0.132         230x230x113.844           0.135         230x210x18.844           0.135         230x210x18.844           0.135         230x230x121.976           0.036         2230x230x121.976           0.036         220x20x108.894           0.074         20x20x108.894           0.075         20x20x108.895           0.245         210x1295.596.522           0.076         231x209x108.895           0.216         231x209x108.895           0.216         231x209x108.895           0.216         231x209x108.895           0.076         231x209x108.895           0.076         230x230x113.844           0.076         230x230x113.844   | mensions Damfilt Jak1156x67.882 175x187.5x70.711 204x204x67.883 184x195.5x73.186 172.5x149.5x73.186 172.5x149.5x73.186 174.5x154x77.782 143x154x77.782 145x155x55.784 145x155x55.784 145x155x55.784 145x155x55.784 145x155x55.784 145x155x55.784 145x155x55.784 145x1572 145x157x77 145x157x77 145x157 145x157x7 145x157 145x157 145x155x5 145x15 145x1 145x15 145x1 145x15 145x1 145x1 145x1 145x1 145x1 145x 145 145 145 145 145 145 145 145 145 145   | Volume A<br>7.80E+04<br>5.70E+04<br>1.25E+05<br>1.25E+05<br>9.30E+04<br>1.28E+05<br>1.28E+05<br>1.28E+05                         | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4<br>477 | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>49.5<br>52.3 | Min aug clice diam           1         26.7           26.7         1           7         15.7           1         24.2           2         23.4           23.4         34.7           41.7         41.7  | Slices 6(                |
| Hsp104 dN<br>AN AMP-PNP<br>AN ATPYS<br>AN ATP<br>AN ADP-AIFX<br>AN ADP | Location<br>NSLS<br>NSLS<br>NSLS<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>NSLS<br>SSRL<br>SSRL  | Conc.<br>5.0 mg/mL<br>1.5 mg/mL<br>2.5 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.0 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>2.3 mg/mL<br>3.0 | gmin           0.0115C           0.01000           0.00000           0.00000           0.01099           0.01099           0.01100           0.0120C           0.0120C           0.0120C           0.0120C           0.0120C           0.0120C           0.01499           0.01392           0.01392           0.01392           0.01499           0.01490           0.01490           0.0150C           0.0150C           0.0150C           0.01499           0.0150C           0.0150C           0.01497           0.01497           0.01497           0.01497           0.01497           0.01497           0.01497           0.01497           0.01497           0.01497           0.01497           0.01497           0.01497   | offer         offer           0.788.150         0.651.150           0.651.150         0.651.150           0.723.148         0.733.150           0.723.150         0.996.150           0.770.153         0.787.151           0.770.153         0.770.153           0.771.150         0.972.150           0.772.149         0.771.150           0.772.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.629.151           0.629.151         0.6455.152           0.6455.152         0.6695.149           0.921.154         0.963.154           0.963.154         0.963.154           0.963.154         1.61.55           1.10.154         1.10.154   | $\begin{array}{l} \hline \textbf{Guinter} \\ \textbf{g}_{1} \\ \textbf{g}_{2} \\ \textbf{g}_{3} \\ \textbf{g}_{5} \\ $  | $\begin{array}{r} \textbf{I(0)}\\ \textbf{860:53} = 0.732\\ \textbf{254.35} = 0.394\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{339.88} + 0.435\\ \textbf{333.47} + 0.851\\ \textbf{333.47} + 0.851\\ \textbf{333.47} + 0.851\\ \textbf{333.47} + 0.855\\ \textbf{379.69} + 0.454\\ \textbf{404.09} + 0.565\\ \textbf{379.69} + 0.454\\ \textbf{404.09} + 0.565\\ \textbf{379.69} + 0.454\\ \textbf{404.09} + 0.555\\ \textbf{379.69} + 0.454\\ \textbf{373.49} + 0.322\\ \textbf{404.09} + 0.525\\ \textbf{375.59} + 1.43\\ \textbf{337.34} + 1.60\\ \textbf{337.34} + 1.032\\ \textbf{245.55} + 0.372\\ \textbf{499.044} + 0.537\\ \textbf{327.69} + 0.525\\ \textbf{325.15} + 0.0282\\ \textbf{325.15} + 0.0282\\ \textbf{325.15} + 0.0428\\ \textbf{325.10} + 0.0555\\ \textbf{395.38} + 0.0881\\ \textbf{95.06} + 0.0659\\ \textbf{355.39} + 0.0659\\ \textbf{355.9} + 0.0792\\ \textbf{355.9} + 0.07$   | Angle range           0.118-0.7590           0.0118-0.7590           0.010-0.7950           0.0081-0.7950           0.0113-0.7860           0.0113-0.7860           0.0113-0.7860           0.0113-0.7860           0.0140-0.2414           0.0150-0.2515           0.0120-0.7950           0.0120-0.7950           0.0130-0.7950           0.0140-0.2191           0.0140-0.2191           0.0140-0.2566           0.0140-0.2666           0.0140-0.7950 <th>GNOM           UPDMAX Rg. (U) Total E           Distribution of the second secon</th> <th>Pord           Volume         P           1521470         3.9           1414166         3.9           1414166         3.9           1414166         3.9           1414566         3.9           1414566         3.9           1414566         3.9           1543621         3.9           1543621         3.9           1531532         3.9           1351360         3.9           135206         3.9           134869         3.9           134602         3.9           134602         3.9           1348692         3.9           1408572         3.9           122675         3.9           1226762         3.8           1226762         3.8           1226762         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9     <!--</th--><th>MH 9/G*           Exp MM         Theor MM           563001         S06000           330000         S06000           337000         S06000           33800         S06000           33800         S06000           33800         S06000           33800         S06000           51800         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           527000         S06000           512000         S06000      512000         S060000</th><th>GASBOR           No. Included NSD           10] 1.717 +           10] 2.182 +           9] 2.066 +           9] 1.661 +           9] 1.726 +           9] 1.737 +           9] 1.458 +           9] 1.757 +           9] 1.645 +           9] 1.454 +           9] 1.454 +           9] 1.454 +           9] 1.454 +           9] 1.452 +           9] 1.452 +           9] 1.452 +           9] 1.452 +           9] 1.453 +           9] 1.832 +           9] 1.832 +           9] 1.823 +           9] 1.523 +           9] 1.675 +           9] 1.675 +</th><th>Ibites Di           Data 2400:118.794           0.167         237.5227.5423.743           0.162         237.5227.5423.743           0.162         230.4204.0118.794           0.182         24042.400.118.794           0.182         24042.400.118.794           0.182         24042.400.118.794           0.182         23042.300.113.844           0.072         198x209.116.672           0.272         209x209.108.894           0.116         230x210.511.3.844           0.135         230x210.511.3.844           0.136         230x210.113.844           0.136         230x210.113.844           0.136         230x210.116.873           0.036         230x210.5116.673           0.036         230x210.116.673           0.036         230x210.116.673           0.036         230x20.200.108.895           0.256         200x20.001.8845           0.076         230x20.200.108.895           0.076         230x20.200.108.895           0.076         230x20.200.108.894           0.076         230x20.200.113.844           0.079         230x20.200.113.844</th><th>mensios           Damfilt           Damfilt           144x156x67.882           175x187.5x70.711           204x204c7.883           184x195.5x73.186           172.5x149.5x73.186           154x154x77.782           143x154x77.782           195.5x172.5x81.317           185x165x81.671           209x158x70.004           155x165x70.003           176x176x70.004           165x176x70.003           165x176x70.003           161x172.5x65.054</th><th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>5.70E+04<br/>1.25E+05<br/>9.30E+04<br/>1.51E+05<br/>9.30E+04<br/>1.28E+05<br/>1.28E+05</th><th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4<br/>47</th><th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>53.1<br/>49.5</th><th>Min avg slice diam<br/>26.7<br/>1 26.7<br/>1 5.7<br/>24.2<br/>24.2<br/>23.4<br/>14.7<br/>41.7</th><th>Slices 64</th></th>                                | GNOM           UPDMAX Rg. (U) Total E           Distribution of the second secon  | Pord           Volume         P           1521470         3.9           1414166         3.9           1414166         3.9           1414166         3.9           1414566         3.9           1414566         3.9           1414566         3.9           1543621         3.9           1543621         3.9           1531532         3.9           1351360         3.9           135206         3.9           134869         3.9           134602         3.9           134602         3.9           1348692         3.9           1408572         3.9           122675         3.9           1226762         3.8           1226762         3.8           1226762         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9           1364262         3.9 </th <th>MH 9/G*           Exp MM         Theor MM           563001         S06000           330000         S06000           337000         S06000           33800         S06000           33800         S06000           33800         S06000           33800         S06000           51800         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           527000         S06000           512000         S06000      512000         S060000</th> <th>GASBOR           No. Included NSD           10] 1.717 +           10] 2.182 +           9] 2.066 +           9] 1.661 +           9] 1.726 +           9] 1.737 +           9] 1.458 +           9] 1.757 +           9] 1.645 +           9] 1.454 +           9] 1.454 +           9] 1.454 +           9] 1.454 +           9] 1.452 +           9] 1.452 +           9] 1.452 +           9] 1.452 +           9] 1.453 +           9] 1.832 +           9] 1.832 +           9] 1.823 +           9] 1.523 +           9] 1.675 +           9] 1.675 +</th> <th>Ibites Di           Data 2400:118.794           0.167         237.5227.5423.743           0.162         237.5227.5423.743           0.162         230.4204.0118.794           0.182         24042.400.118.794           0.182         24042.400.118.794           0.182         24042.400.118.794           0.182         23042.300.113.844           0.072         198x209.116.672           0.272         209x209.108.894           0.116         230x210.511.3.844           0.135         230x210.511.3.844           0.136         230x210.113.844           0.136         230x210.113.844           0.136         230x210.116.873           0.036         230x210.5116.673           0.036         230x210.116.673           0.036         230x210.116.673           0.036         230x20.200.108.895           0.256         200x20.001.8845           0.076         230x20.200.108.895           0.076         230x20.200.108.895           0.076         230x20.200.108.894           0.076         230x20.200.113.844           0.079         230x20.200.113.844</th> <th>mensios           Damfilt           Damfilt           144x156x67.882           175x187.5x70.711           204x204c7.883           184x195.5x73.186           172.5x149.5x73.186           154x154x77.782           143x154x77.782           195.5x172.5x81.317           185x165x81.671           209x158x70.004           155x165x70.003           176x176x70.004           165x176x70.003           165x176x70.003           161x172.5x65.054</th> <th>Volume A<br/>7.80E+04<br/>5.70E+04<br/>5.70E+04<br/>1.25E+05<br/>9.30E+04<br/>1.51E+05<br/>9.30E+04<br/>1.28E+05<br/>1.28E+05</th> <th>vg Diam<br/>31.9<br/>21.6<br/>33.75<br/>30.4<br/>26.4<br/>47</th> <th>Channel<br/>Max avg silce diam<br/>46.4<br/>24.7<br/>24.7<br/>60.9<br/>53.1<br/>53.1<br/>49.5</th> <th>Min avg slice diam<br/>26.7<br/>1 26.7<br/>1 5.7<br/>24.2<br/>24.2<br/>23.4<br/>14.7<br/>41.7</th> <th>Slices 64</th> | MH 9/G*           Exp MM         Theor MM           563001         S06000           330000         S06000           337000         S06000           33800         S06000           33800         S06000           33800         S06000           33800         S06000           51800         S06000           512000         S06000           512000         S06000           512000         S06000           512000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           506000         S06000           527000         S06000           512000         S06000      512000         S060000  | GASBOR           No. Included NSD           10] 1.717 +           10] 2.182 +           9] 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A<br>7.80E+04<br>5.70E+04<br>5.70E+04<br>1.25E+05<br>9.30E+04<br>1.51E+05<br>9.30E+04<br>1.28E+05<br>1.28E+05             | vg Diam<br>31.9<br>21.6<br>33.75<br>30.4<br>26.4<br>47  | Channel<br>Max avg silce diam<br>46.4<br>24.7<br>24.7<br>60.9<br>53.1<br>53.1<br>49.5 | Min avg slice diam<br>26.7<br>1 26.7<br>1 5.7<br>24.2<br>24.2<br>23.4<br>14.7<br>41.7  | Slices 64                |

Samples shaded in blue are the ones used in the final reconstructions

## Hsp104 WT

## Table S2. Parameters derived from SAXS/WAXS of WT Hsp104 and Hsp104.

**Related to Figure 4 and 5.** R<sub>g</sub> values from the Guinier region of the scattering curves were determined using the program PRIMUS (Konarev et al., 2003). Distance distribution functions P(r) were calculated by the program GNOM using an indirect Fourier transform (Svergun 1992). The maximum dimension of the particle (Dmax) was determined by examining the quality of fit to the experimental data for a Dmax range of 180 to 280 Å varied in 5Å increments. Values for R<sub>g</sub> were computed from the second moment of the P(r). The Porod volume and p value were calculated by the java-based program ScÅtter (www.bioisis.net/tutorial/9). The mass of the particle was calculated from Qr as described (Rambo and Tainer, 2013). GASBOR (Svergun et al. 2001) was run on the raw scattering data and DAMAVER (Volkov and Svergun, 2003) used to avergae the envelopes and calculate normalized spatial discrepancy (NSD). Damaver and damfilt pdb files were converted using the program pdb2vol from the SITUS suite of programs (Wriggers et al., 2011). Channel dimensions of the reconstructed volumes were determined using MATLAB. See also Extended Experimental Procedures.

Table S3. Sweeny et al.

	WT		ΔΝ	
Nucleotide	R <sub>g</sub>	D <sub>max</sub>	R <sub>g</sub>	D <sub>max</sub>
AMP-PNP	$68.7\pm0.3$	240 ± 8	$66.5 \pm 0.4$	$235 \pm 0$
ΑΤΡγS	$69.7 \pm 0.4$	234 ± 2	$67.8 \pm 0.6$	225 ± 3
ATP	$67.3 \pm 0.2$	228 ± 2	$65.7 \pm 0.6$	$231 \pm 4$
ADP-AIF <sub>x</sub>	$64.9 \pm 0.5$	219 ± 2	$62.2 \pm 0.4$	213 ± 3
ADP	66.1 ± 0.6	227 ± 7	$63.8 \pm 0.3$	227 ± 2
No Nucleotide	$72.4 \pm 0.7$	244 ± 6	$72.9 \pm 0.7$	238 ± 2

Table S3. Average  $R_g$  and  $D_{max}$  values from GNOM analysis of SAXS data. Related to Figure 4 and 5. Distance distribution functions, P(r), were calculated by the program GNOM using an indirect Fourier transform (Svergun, 1992). The maximum dimension of the particle ( $D_{max}$ ) was determined by examining the quality of fit to the experimental data for a  $D_{max}$  range of 180 to 280Å, varied in 5Å increments. Values for  $R_g$  were computed from the second moment of the P(r). Values reported are averaged from scattering data collected at various concentrations and beamlines (See Extended Experimental Procedures for beamline details). Full details of each sample are given in Table S2.

# **Extended Experimental Procedures**

# Proteins

Hsp104 variants were generated by Quikchange Site-Directed Mutagenesis (Agilent). Hsp104, Hsp104<sup>DPL</sup> (Y257A:Y662A), Hsp104<sup>ΔN</sup> (Hsp104 lacking amino acids 1-156), Hsp104<sup> $\Delta$ NDPL</sup> ( $\Delta$ 1-156:Y257A:Y662A), and HAP were purified as described (DeSantis et al., 2014; Sweeny et al., 2011). Sup35, Ure2, Q62, α-syn, ClpP, GroEL<sub>TRAP</sub>, Sse1, Ssa1, and Sis1 were purified as described (DeSantis et al., 2012; Doyle et al., 2007; Jackrel et al., 2014; Shorter and Lindquist, 2006). NM, NM-GFP, and single cysteine NM variants were purified as described (Krishnan and Lindquist, 2005). Single cysteine NM mutants were labeled with either pyrene maleimide (N-(1-pyrene)maleimide; Life Technologies), acrylodan (6-acryloyl-2-dimethylaminonaphthalene; Life Technologies), BPMTS (benzophenone-4-carboxamidocysteine methanethiosulfonate; Toronto Research Chemicals Inc.), or crosslinked with BMB (1,4-bis-maleimidobutane; Thermo Scientific Pierce) under denaturing conditions as described (Krishnan and Lindquist, 2005). Hsc70, Hsp72, and Hdj2 were from Enzo Life Sciences. Firefly luciferase and FITC-casein were from Sigma. Creatine kinase was from Roche. Purity of all proteins was determined by SDS-PAGE and Coomassie staining to be > 95%. Unless otherwise stated Hsp104 concentrations refer to the hexamer.

Size-exclusion chromatography coupled to multi-angle light scattering (SEC MALS)

The absolute molecular weights of the apo hexamers of Hsp104 and Hsp104<sup> $\Delta$ N</sup> (15µM monomer) were determined using multi-angle light scattering coupled with refractive interferometric detection (Wyatt Technology Corporation) and a TSK4000 size-exclusion column. The column was equilibrated with 20mM TrisHCl pH 7.4, 140mM KCl and 10mM MgCl<sub>2</sub> at room temperature and elution of Hsp104 was monitored by both absorbance at 280nm and refractive index.

# **ATPase and GTPase activity**

Hsp104 variants (0.25µM monomer) were incubated for 5min or 10min at 25°C with ATP (1mM) in luciferase refolding buffer (LRB: 25mM HEPES-KOH pH 7.4, 150mM KAOc, 10mM MgAOc, 10mM DTT). ATPase activity was assessed using a malachite

green phosphate detection kit (Innova). Sup35 GTPase activity was measured as described (Krzewska et al., 2007).

# Luciferase reactivation in vitro

Luciferase aggregation and reactivation were performed as described (DeSantis et al., 2012; Glover and Lindquist, 1998). Briefly, firefly luciferase (50 $\mu$ M) was incubated in LRB with 8M urea at 30°C for 30min to form aggregates. After a rapid 100-fold dilution in LRB, the aggregates were flash frozen and stored at -80°C until use. Reactivation assays were performed with Hsp104 (1 $\mu$ M), Hsp70 (Hsc70 or Hsp72 at 1 $\mu$ M), Hsp40 (Hdj2, 1 $\mu$ M), 5.1mM ATP, and an ATP regeneration system (1mM creatine phosphate, 0.25 $\mu$ M creatine kinase) for 90min at 25°C. Alternatively, Hsp70, Hsp40 and 5.1 mM ATP were replaced with 5.1mM nucleotide of different ratios of ATP:ATP $\gamma$ S. Luciferase activity was assessed using a luciferase assay system from Promega. Luminescence was measured on a Tecan Infinite M1000 or Safire<sup>2</sup> plate reader.

# Luciferase reactivation in vivo

Luciferase reactivation in vivo was performed as described (DeSantis et al., 2014). Briefly, W303  $\Delta hsp104$  (*MATa, can1-100, his3-11,15, leu2-3,112, trp1-1, ura3-1, ade2-1, hsp104:kanMX4*) yeast cells harboring pGPD-LuxAB (encoding a temperature-sensitive luciferase fusion protein) and empty centromeric pHSE vector, pHSE-Hsp104, or pHSE-Hsp104<sup> $\Delta$ N</sup> were grown to mid-log phase in SD-his-ura liquid. Matched cultures were preincubated at 37°C for 30min and then incubated at 44°C for 50min. Cycloheximide (10µg/ml) was then added and cultures were incubated for a further 10min at 44°C. Cells were then shifted to 30°C and luciferase activity was measured at 0, 90, and 120min. Luciferase activity was expressed as the percentage of the Hsp104 condition after 120min

## Thermotolerance

Yeast thermotolerance assays were performed as described (DeSantis et al., 2014). Briefly, W303a∆*hsp104* (*MATa, can1-100, his3-11,15, leu2-3,112, trp1-1, ura3-1, ade2-1, hsp104:kanMX4*) yeast were transformed with a centromeric pHSE plasmid encoding Hsp104, Hsp104<sup> $\Delta$ N</sup>, or the empty vector control. The strains were grown in SD-ura media to an  $A_{600}$  of 0.5, and incubated at 37°C for 30min to induce Hsp104 expression. Cells were then heat shocked for 0-20min at 50°C, immediately transferred to ice for 2min, and then plated on SD-ura plates, and after a 2-day incubation at 30°C colonies were counted using an acolyte automated colony counter (Synbiosis). Immunoblotting was used to confirm expression levels of Hsp104.

# Amyloid and prion disaggregation

Sup35, NM-GFP, and Ure2 prions were assembled in assembly buffer (AB: 40mM HEPES-KOH pH 7.4, 150mM KCl, 20mM MgCl<sub>2</sub> and 1mM DTT) plus 10% (v/v) glycerol as described (Shorter and Lindquist, 2006). For Sup35, GTP (1mM) was included to stabilize the C-terminal GTP binding domain. Q62 fibrils and  $\alpha$ -syn fibrils were assembled in AB as described (DeSantis et al., 2012). Preformed Sup35 or Ure2 prions, or Q62 or  $\alpha$ -syn amyloid (1µM monomer) were treated with Hsp104 (0.03µM, 1µM, or 10µM) or Hsp104<sup> $\Delta N$ </sup> (1µM or 10µM) plus Ssa1 (1µM), Sse1 (1µM), Sis1 (1µM), ATP (5mM), and ATP regeneration system (1mM creatine phosphate, 0.25µM creatine kinase) for 6h at 25°C. For experiments with NM-GFP prions, NM-GFP prions (2.5µM) were treated with Hsp104 (1µM) plus GroEL<sub>TRAP</sub> (1.5µM), Ssa1 (1µM), Sse1 (1µM), and Sis1 (1 $\mu$ M) for 0-60min at 25°C. At the indicated times, GFP fluorescence was measured (excitation: 395nm; emission: 510nm). Fibril integrity was determined by the fluorescence of the amyloid-diagnostic dye Thioflavin-T (ThT) (excitation: 450 nm; emission: 482 nm) as described (Krishnan and Lindquist, 2005). Alternatively, fibril integrity was determined by sedimentation analysis: reactions were centrifuged at 100,000g for 10min at 25°C. The amount of soluble protein (Sup35, Ure2, Q62, or  $\alpha$ -syn) in the supernatant fraction was then determined via immunoblot. For electron microscopy (EM), disassembly reactions were spotted onto 300-mesh-formvar carbon-coated EM grids. The samples were allowed to adhere to the grid for 2min before being negatively stained with 2% uranyl acetate for 2min and rinsed with milli-Q distilled water. Micrographs were captured using a transmission electron microscope (JEOL 1010, Jeol USA).

# Hsp104 and Hsp104<sup> $\Delta N$ </sup> substrate binding

The apparent  $K_d$  of Hsp104 or Hsp104<sup> $\Delta N$ </sup> binding the indicated amyloid, disordered aggregate, or soluble substrate in the presence of ATP $\gamma$ S (1mM) was determined as described (DeSantis et al., 2012; Jackrel et al., 2014).

# Sup35 prionogenesis

For spontaneous, unseeded prionogenesis, Sup35 (2.5µM) was incubated in AB plus 10% glycerol and 1mM GTP for 0-8h at 25°C with rotation (80rpm on a mini-rotator, Glas-Col) in the absence or presence of Hsp104 (0.03 $\mu$ M or 1 $\mu$ M) or Hsp104<sup> $\Delta$ N</sup> (0.03 $\mu$ M. 1µM, or 5µM) plus ATP (5mM) and ATP regeneration system (1mM creatine phosphate, 0.25µM creatine kinase). Prionogenesis was assessed by ThT fluorescence as above. The oligomer-specific A11 antibody was used to detect prionogenic Sup35 oligomers via ELISA as described (Kayed et al., 2003). Seeded assembly was unagitated and performed for the indicated time at 25°C. The amount of seed was 2% (wt/wt). In some seeded reactions, ATP (5mM) was replaced with AMP-PNP (5mM). In some reactions, Sup35 prions (2.5µM), or NM prions (2.5µM monomer) stapled by a BMB crosslink in the Head (N21C) or Tail (G96C) region were treated with His<sub>6</sub>-Hsp104 (0.03µM or 1µM) or His<sub>6</sub>-Hsp104<sup> $\Delta N$ </sup> (0.03µM, 1µM, or 5µM) plus Ssa1 (1µM), Sse1 (1µM), Sis1 (1µM), ATP (5mM), and ATP regeneration system (1mM creatine phosphate,  $0.25\mu$ M creatine kinase) for 1h at 25°C. Reactions were then depleted of His<sub>6</sub>-Hsp104 as described (Shorter and Lindquist, 2004) and used to seed (2% wt/wt) fresh, undisturbed Sup35 (2.5µM) prionogenesis.

# Sup35 prion transformation

Yeast cells from a W303-derived strain (*MAT* $\alpha$  *leu2-3, -112 his3-11 trp1-1 ura3-1 ade1-14 can1-100* [*rnq*<sup>-</sup>] [*psi*<sup>-</sup>] [*ure-o*]) that contained an ADE1 nonsense mutation suppressible by [*PSI*<sup>+</sup>] were transformed with the indicated Sup35 conformers and a URA3 plasmid. The proportion of Ura<sup>+</sup> transformants that acquired [*PSI*<sup>+</sup>] was determined as described (Krishnan and Lindquist, 2005).

# Site-resolved pyrene and acrylodan fluorescence

Single cysteine NM variants (5µM) bearing pyrene or acrylodan labels at the indicated position were assembled into prions in AB at 4°C or 25°C with agitation at 1,400rpm (Eppendorf thermomixer). Pyrene and acrylodan fluorescence were monitored as described (Krishnan and Lindquist, 2005; Roberts et al., 2009).

# Site-resolved BPMTS crosslinking

Single cysteine NM variants ( $10\mu$ M) bearing benzophenone-4-carboxamidocysteine methanethiosulphonate (BPMTS) at the indicated position were assembled into prions in AB without DTT at 4°C with agitation at 1,400rpm (Eppendorf thermomixer) in the dark. Prionogenesis was confirmed by ThT fluorescence and ability to infect [*psī*] yeast cells. BPMTS-labeled NM4 prions ( $2.5\mu$ M) were then incubated with Hsp104 or Hsp104<sup>ΔN</sup> ( $5\mu$ M) plus ATPγS (5mM) or ADP (5mM) for 10min at 4°C. Crosslinking was then elicited by UV irradiation at 365nm for 20min. Omission of UV irradiation at this step served as the no crosslinking control. NM4 prions were then separated from soluble Hsp104 or Hsp104<sup>ΔN</sup> by centrifugation (100,000g, 10min, 4°C), followed by washes with AB (without DTT) plus ADP (5mM) and AB (without DTT) plus 1M KCl to remove any uncrosslinked Hsp104. Samples were then processed for reducing SDS-PAGE (which cleaves the crosslink) and quantitative immunoblot to detect Hsp104 using an anti-Hsp104 polyclonal antibody (ADI-SPA-1040, Enzo Life Sciences). The Hsp104 binding site on NM4 prions defined by our studies is in accord with those suggested by peptide array studies (Helsen and Glover, 2012).

## FITC-casein degradation assay

FITC-casein degradation assays were performed as described (Jackrel et al., 2014; Tessarz et al., 2008). Briefly, FITC-casein (100nM-60 $\mu$ M) was incubated with HAP variants (1 $\mu$ M), ClpP (21 $\mu$ M monomer), 5.1mM ATP and an ATP regenerating system in LRB for 60min at 25°C. Degradation of FITC-casein was monitored by measuring fluorescence of free FITC (excitation: 490nm; emission: 520 nm) using a Tecan Infinite M1000 or Safire<sup>2</sup> plate reader. Degradation rates were plotted against FITC-casein concentration to determine  $K_m$  and  $V_{max}$ .

## **RepA**<sub>1-70</sub>-**GFP** unfolding assay

RepA<sub>1-70</sub>-GFP unfolding assays were performed as described (Doyle et al., 2007; Jackrel et al., 2014). Briefly, RepA<sub>1-70</sub>-GFP (0.7 $\mu$ M) was treated with Hsp104 or Hsp104<sup> $\Delta$ N</sup> (1 $\mu$ M) plus either 2.5mM ATP and 2.5mM ATP $\gamma$ S (1:1) or 3.33mM ATP and 1.67mM ATP $\gamma$ S (2:1), GroEL<sub>TRAP</sub> (1.5 $\mu$ M), 0.02mg/ml BSA, and 0.005% (v/v) Triton-X100 and an ATP regenerating system (1mM creatine phosphate, 0.25 $\mu$ M creatine kinase) in LRB. The decrease in fluorescence (excitation: 395 nm; emission: 510 nm) over a period of 60min was monitored using a Tecan Infinite M1000.

# Small- and wide-angle x-ray scattering (SAXS/WAXS)

X-ray scattering data were collected at beamline 4-2 at the Stanford Synchrotron Radiation Laboratory (SSRL, Menlo Park, CA), and beamline X9 at the National Synchrotron Light Source (NSLS, Upton, NY) (details specific to each beamline are provided below). Data were collected at multiple concentrations between 1.5mg/ml and 6mg/ml. Samples were oscillated in quartz capillaries during data collection to minimize radiation damage. The two-dimensional scattering images were collected on CCD detectors, and circularly averaged using software developed at the individual beamlines to yield one-dimensional scattering profiles as a function of momentum transfer q (in  $Å^{-1}$ , where  $q=4\pi \sin(\theta)/\lambda$ , where  $2\pi$  is the scattering angle and  $\lambda$  is the wavelength). The raw scattering data were scaled and buffer subtracted using the program PRIMUS (Konarev et al., 2003). Each individual scattering profile was visually inspected for radiation damage and aggregation prior to averaging, including Guinier and Kratky plot analysis. For data collected at NSLS, where both SAXS and WAXS data are collected on separate detectors simultaneously, averaged scattering profiles from the SAXS and WAXS detectors were scaled and merged in PRIMUS to yield a composite profile encompassing all of the recorded scattering angles. The parameters derived from classical Guinier analysis (Rice, 1956) ( $R_g$ , and I(0)) corresponded well with those derived from distance distribution functions. P(r) were calculated by the program GNOM (Svergun, 1992) using the indirect Fourier transform. The maximum dimension of the particle  $(D_{max})$  was determined by examining the quality of fit to the experimental data for a  $D_{max}$  range of 180Å to 280Å, varied in 5Å increments. Fits were optimized by three criteria: (1) maximizing the Total

Estimate metric; (2) minimization of the discrepancy between calculated and experimental profiles; and (3) optimizing the visual properties of the shape distribution function. The Porod volume and Porod exponent values were calculated by the Javabased program ScÅtter (http://www.bioisis.net/tutorial/9). The mass of the particle was confirmed by Qr calculations, as previously described (Rambo and Tainer, 2013).

SAXS data were collected at beamline 4-2 at the Stanford Synchrotron Radiation Laboratory (SSRL, Menlo Park, CA) at room temperature with a sample to detector distance of 1600mm. Using software developed at the beamline, two-dimensional scattering profiles collected using a Rayonix MX225-HE detector were converted into one-dimensional intensity profiles. The x-ray wavelength was 1.2Å, providing an accessible q where  $0.0140 < q < 0.4435 Å^{-1}$ . The protein samples and matching buffer solutions,  $30\mu$ l for each measurement, were exposed for ten 10s exposures in a 1.2mm path capillary with thin mica windows sealed across the evacuated flight path with oscillation. Each exposure was checked for radiation damage by the automated software prior to averaging. After each measurement the capillary was washed thoroughly and purged with compressed nitrogen.

SAXS and WAXS data were collected simultaneously at beamline X9 at the National Synchrotron Light Source (NSLS, Upton, NY) at 10°C, or 25°C for the ADP-AlF<sub>x</sub> state, by two overlapping detectors, a Mar 165 CCD SAXS detector 3.4m from the sample, and a custom built Photonic Science CCD WAXS detector. The two-dimensional images were converted into one-dimensional scattering profiles using software developed at the beamline. The x-ray wavelength was 0.855Å. Between the two detectors configurations, an accessible q of 0.0055 < q < 1.0Å<sup>-1</sup> was achieved. Data to  $q_{max}$  of 0.795Å<sup>-1</sup> was used for data analysis and reconstructions. The sample cell contained a glass capillary sealed across the evacuated chamber. The protein samples and matching buffer solutions were flowed through the capillary and oscillated during exposure to reduce radiation damage. For data collection 30µl of the protein sample or matching buffer solution was exposed for 180s, subdivided into three 60s exposures of 10µl. Our SAXS data will be deposited at BioIsis.net upon publication.

## Shape reconstructions from SAXS/WAXS data

Shape reconstructions of the hexamer were generated using the program GASBOR (Svergun et al., 2001). Information required for GASBOR modeling is the x-ray scattering profile, the number of residues to be modeled (GASBOR assigns a dummy reside to represent each residue), and the D<sub>max</sub>. Six-fold symmetry was imposed. Since each inverse scattering has no one unique solution, GASBOR calculations were performed ten times using all of the recorded scattering data to  $q_{max}$  of 0.7-0.8 Å<sup>-1</sup>; GASBOR calculations using  $q_{max}$  truncated to 0.5Å<sup>-1</sup> or calculations with the program DAMMIN/F yielded similar results. Regions that are flexible are assigned different positions in individual simulations. The ten independent dummy residue reconstructions were aligned and scored based on the normalized spatial discrepancy (NSD) (Kozin and Svergun, 2001). The individual reconstructions were only included if their NSD  $\leq$  mean NSD + 2 \* variation. The included reconstructions were averaged and filtered to yield a final most-probable model using the DAMAVER suite of programs (Svergun and Koch, 2003; Volkov and Svergun, 2003). The individual bead models were visualized in PvMOL (http://www.pymol.org). The filtered and unfiltered average models were converted to volume envelopes using SITUS (Wriggers et al., 1999) and visualized using Chimera (Pettersen et al., 2004).

## Channel reconstructions from SAXS/WAXS data

The SITUS maps were converted to MRC-format maps using map2map, part of the SITUS suite of programs (Wriggers et al., 1999). The three-dimensional electron density file in the MRC format was imported into Matlab (Mathworks) using a custom script, which parses the file into a three-dimensional matrix of electron density. The read function also extracts the voxel dimensions to scale the measurement. The built in Matlab function "edge" was used to find the edges of two-dimensional slices of the electron density using the Sobel method. The Sobel method finds the edges by approximating the first derivative over the image; maxima of the first derivative are edges.

The density matrix was oriented such that the Z-axis moved through the central channel of the Hsp104 hexamer. Two-dimensional X-Y slices are torroidal slices of the density where the central cavity is the channel. A custom script was used to find edges for each two-dimensional slice of the density matrix. The X, Y and Z coordinates of each edge point were stored in an array and were scaled by the voxel dimensions. This array can be interpreted as a list of three-dimensional vectors that all point from one corner of the density matrix (0,0,0) to voxels, which lie upon the edge of the channel. The built in Matlab function "convhulln" was used to convert the vector array into a convex hull and measured the volume of the hull. The convex hull is the shell of the channel and the volume is the volume of the Hsp104 hexamer channel.

A distance was measured for each slice of the channel to determine its width. First, edges were found for each slice using the Matlab function "edge". Two mid-lines of the channel were extracted, one horizontal and one vertical, and the scaled distance from edge to edge was measured. The two-dimensional slice was then rotated over 45 degrees in 5 degree increments for a total of 18 channel width measurements of each two-dimensional slice. The average of the 18 channel width measurements is reported. The algorithm was then iterated over every Z-slice of the density to measure the channel widths through the channel. We have made the custom scripts generated for measuring channel width and volume from SAXS MRC files available at:

http://www.mathworks.com/matlabcentral/fileexchange/47095-saxs-channel-width-andvolume-measurement

# **Mutant doping studies**

Here, mutant Hsp104 subunits with specific defects (e.g. substrate translocation) are mixed with WT subunits to generate heterohexamer ensembles. Incorporation of mutant subunits into hexamers occurs according to a binomial distribution dictated by the WT:mutant ratio (Figure 6A) (DeSantis et al., 2012; Werbeck et al., 2008). Theoretical activities for each ratio of WT:mutant can be determined based on the fraction of each type of heterohexamer present and how many active subunits per hexamer are required for activity (Figure 6A, B) (DeSantis et al., 2012; Werbeck et al., 2008). If cooperativity is dispensable, then only one WT subunit per hexamer is required, and a linear decrease in activity is expected (Figure 6B, orange line) (DeSantis et al., 2012). If global cooperativity (i.e. one mutant subunit per hexamer eliminates activity) were required, a steep decline in activity is expected (Figure 6B, blue line), and if sub-global cooperativity (i.e. 2-5 mutant subunits per hexamer ablate activity) were required, an intermediate curve is anticipated (Figure 6B) (DeSantis et al., 2012). Luciferase reactivation was performed as above except prior to addition to the reaction Hsp104 was mixed with Hsp104<sup>DPL</sup>, and, Hsp104<sup> $\Delta$ N</sup> was mixed with Hsp104<sup> $\Delta$ NDPL</sup> in the following ratios: 6:0, 5:1, 4:2, 3:3, 2:4, 1:5, 0:6 and incubated for 30min on ice. NM25 prion disaggregation was monitored as above except that prior to addition to the reaction Hsp104 was mixed with Hsp104<sup> $\Delta$ N</sup> in the following ratios: 6:0, 5:1, 4:2, 3:3, 2:4, 1:5, 0:6 and incubated for 30min on ice.

## Yeast proteinopathy models

W303a∆hsp104 (MATa, can1-100, his3-11,15, leu2-3,112, trp1-1, ura3-1, ade2-1, hsp104:kanMX4) yeast strains integrated with galactose-inducible TDP-43, FUS, or asyn were transformed with the indicated galactose-inducible Hsp104 variant or vector control as described (Jackrel et al., 2014). For the spotting assays, yeast were grown to saturation overnight in raffinose supplemented dropout media at 30°C. Cultures were diluted and normalized to  $A_{600nm}$ , grown to an  $A_{600nm}$ =2.0, serially diluted, and spotted in duplicate onto synthetic dropout media containing glucose or galactose. Plates were analyzed after growth for 2-3 days at 30°C. Select strains were induced for 5h, lysed, and immunoblotted for Hsp104 to assess expression level as described (Jackrel et al., 2014). 3-Phosphoglycerate kinase (PGK) serves as a loading control. Fluorescence microscopy of yeast co-expressing  $\alpha$ -syn-YFP or FUS-GFP and the indicated Hsp104 variant or vector was performed as described (Jackrel et al., 2014) except that images were captured using LAF software (Leica) with a charge-coupled device camera (ORCA AG; Hamamatsu Photonics) mounted on an inverted microscope (DMI6000B Leica) with a 100X objective.  $\alpha$ -syn localization was quantified by counting the number of cells containing plasma membrane fluorescence or cytoplasmic aggregates. FUS localization was quantified by counting the number of cells containing foci or diffuse fluorescence.

# **Supplemental References**

Doyle, S.M., Shorter, J., Zolkiewski, M., Hoskins, J.R., Lindquist, S., and Wickner, S. (2007). Asymmetric deceleration of ClpB or Hsp104 ATPase activity unleashes protein-remodeling activity. Nat. Struct. Mol. Biol *14*, 114-122.

Glover, J.R., and Lindquist, S. (1998). Hsp104, Hsp70, and Hsp40: a novel chaperone system that rescues previously aggregated proteins. Cell *94*, 73-82.

Helsen, C.W., and Glover, J.R. (2012). Insight into molecular basis of curing of [PSI+] prion by overexpression of 104-kDa heat shock protein (Hsp104). J Biol Chem 287, 542-556.

Kayed, R., Head, E., Thompson, J.L., McIntire, T.M., Milton, S.C., Cotman, C.W., and Glabe, C.G. (2003). Common structure of soluble amyloid oligomers implies common mechanism of pathogenesis. Science *300*, 486-489.

Konarev, P.V., Volkov, V.V., Sokolova, A.V., Koch, M.H.J., and Svergun, D.I. (2003). PRIMUS: a Windows PC-based system for small-angle scattering data analysis. J. Appl. Cryst. *36*, 1277-1282.

Kozin, M.B., and Svergun, D. (2001). Automated matching of high- and low-resolution structural models. J. Appl. Cryst. *34*, 33-41.

Pettersen, E.F., Goddard, T.D., Huang, C.C., Couch, G.S., Greenblatt, D.M., Meng, E.C., and Ferrin, T.E. (2004). UCSF Chimera--a visualization system for exploratory research and analysis. J. Comput. Chem. *25*, 1605-1612.

Rambo, R.P., and Tainer, J.A. (2013). Accurate assessment of mass, models and resolution by small-angle scattering. Nature *496*, 477-481.

Rice, S.A. (1956). Small angle scattering of X-rays. A. Guinier and G. Fournet. Translated by C. B. Wilson and with a bibliographical appendix by K. L. Yudowitch. Wiley, New York, 1955. J. Polym. Sci. *19*, 594-594.

Roberts, B.E., Duennwald, M.L., Wang, H., Chung, C., Lopreiato, N.P., Sweeny, E.A., Knight, M.N., and Shorter, J. (2009). A synergistic small-molecule combination directly eradicates diverse prion strain structures. Nat. Chem. Biol. *5*, 936-946.

Shorter, J., and Lindquist, S. (2004). Hsp104 catalyzes formation and elimination of self-replicating Sup35 prion conformers. Science *304*, 1793-1797.

Svergun, D.I., Petoukhov, M.V., and Koch, M.H. (2001). Determination of domain structure of proteins from X-ray solution scattering. Biophys. J. *80*, 2946-2953.

Sweeny, E.A., DeSantis, M.E., and Shorter, J. (2011). Purification of Hsp104, a protein disaggregase. J. Vis. Exp. 55, e3190.

Tessarz, P., Mogk, A., and Bukau, B. (2008). Substrate threading through the central pore of the Hsp104 chaperone as a common mechanism for protein disaggregation and prion propagation. Mol. Microbiol. *68*, 87-97.

Werbeck, N.D., Schlee, S., and Reinstein, J. (2008). Coupling and dynamics of subunits in the hexameric AAA+ chaperone ClpB. J Mol Biol *378*, 178-190.