



## wwPDB EM Validation Summary Report ⓘ

Mar 10, 2026 – 11:37 AM UTC

PDB ID : 8BMO / pdb\_00008bmo  
EMDB ID : EMD-16119  
Title : Structure of GroEL:GroES complex exhibiting ADP-conformation in trans ring obtained under the continuous turnover conditions  
Authors : Dhurandhar, M.; Torino, S.; Efremov, R.  
Deposited on : 2022-11-10  
Resolution : 3.40 Å(reported)

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

EMDB validation analysis : 0.0.1.dev132  
Mogul : 2022.3.0, CSD as543be (2022)  
MolProbity : 4-5-2 with Phenix2.0  
Buster-report : wwPDB partial adaption of 1.1.7 (2018)  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49



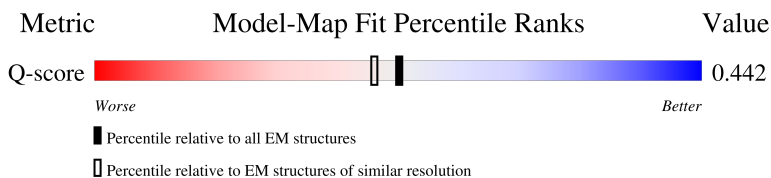
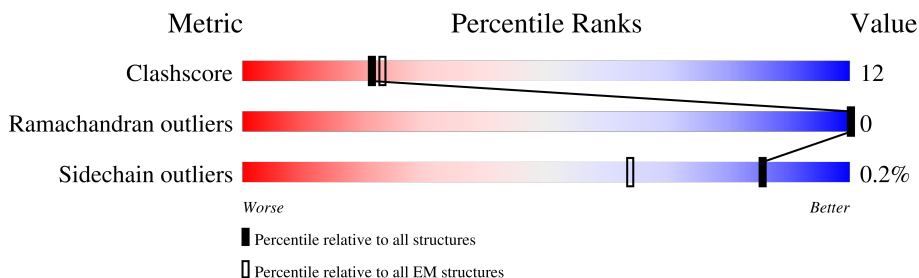
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*


The reported resolution of this entry is 3.40 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	14717 ( 2.90 - 3.90 )











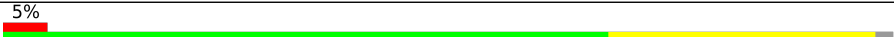


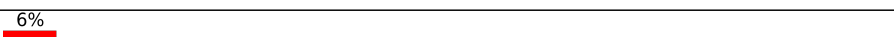
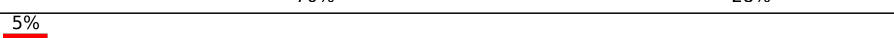
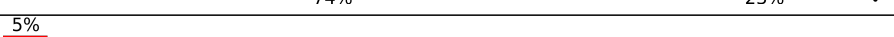

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion  $< 40\%$ ). The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	548	
1	B	548	
1	C	548	
1	E	548	

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Mol	Chain	Length	Quality of chain
1	F	548	
1	H	548	
1	I	548	
1	J	548	
1	L	548	
1	M	548	
1	O	548	
1	P	548	
1	R	548	
1	S	548	
2	D	98	
2	G	98	
2	K	98	
2	N	98	
2	Q	98	
2	T	98	
2	W	98	



## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 59346 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Chaperonin GroEL.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	C	524	Total	C	N	O	S	0	0
			3849	2394	662	773	20		
1	I	524	Total	C	N	O	S	0	0
			3851	2395	665	771	20		
1	A	524	Total	C	N	O	S	0	0
			3849	2394	662	773	20		
1	B	524	Total	C	N	O	S	0	0
			3851	2395	665	771	20		
1	E	524	Total	C	N	O	S	0	0
			3849	2394	662	773	20		
1	F	524	Total	C	N	O	S	0	0
			3851	2395	665	771	20		
1	H	524	Total	C	N	O	S	0	0
			3849	2394	662	773	20		
1	J	524	Total	C	N	O	S	0	0
			3851	2395	665	771	20		
1	L	524	Total	C	N	O	S	0	0
			3849	2394	662	773	20		
1	M	524	Total	C	N	O	S	0	0
			3851	2395	665	771	20		
1	O	524	Total	C	N	O	S	0	0
			3849	2394	662	773	20		
1	P	524	Total	C	N	O	S	0	0
			3851	2395	665	771	20		
1	R	524	Total	C	N	O	S	0	0
			3849	2394	662	773	20		
1	S	524	Total	C	N	O	S	0	0
			3851	2395	665	771	20		

- Molecule 2 is a protein called Co-chaperonin GroES.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	W	96	Total	C	N	O	S	0	0
			714	444	125	144	1		

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Mol	Chain	Residues	Atoms					AltConf	Trace
2	D	96	Total	C	N	O	S	0	0
			714	444	125	144	1		
2	G	96	Total	C	N	O	S	0	0
			714	444	125	144	1		
2	K	96	Total	C	N	O	S	0	0
			714	444	125	144	1		
2	N	96	Total	C	N	O	S	0	0
			714	444	125	144	1		
2	Q	96	Total	C	N	O	S	0	0
			714	444	125	144	1		
2	T	96	Total	C	N	O	S	0	0
			714	444	125	144	1		

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
W	0	MET	-	initiating methionine	UNP P0A6F9
W	1	ALA	-	expression tag	UNP P0A6F9
D	0	MET	-	initiating methionine	UNP P0A6F9
D	1	ALA	-	expression tag	UNP P0A6F9
G	0	MET	-	initiating methionine	UNP P0A6F9
G	1	ALA	-	expression tag	UNP P0A6F9
K	0	MET	-	initiating methionine	UNP P0A6F9
K	1	ALA	-	expression tag	UNP P0A6F9
N	0	MET	-	initiating methionine	UNP P0A6F9
N	1	ALA	-	expression tag	UNP P0A6F9
Q	0	MET	-	initiating methionine	UNP P0A6F9
Q	1	ALA	-	expression tag	UNP P0A6F9
T	0	MET	-	initiating methionine	UNP P0A6F9
T	1	ALA	-	expression tag	UNP P0A6F9

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
3	C	1	Total	Mg	0
			1	1	
3	I	1	Total	Mg	0
			1	1	
3	A	1	Total	Mg	0
			1	1	
3	B	1	Total	Mg	0
			1	1	

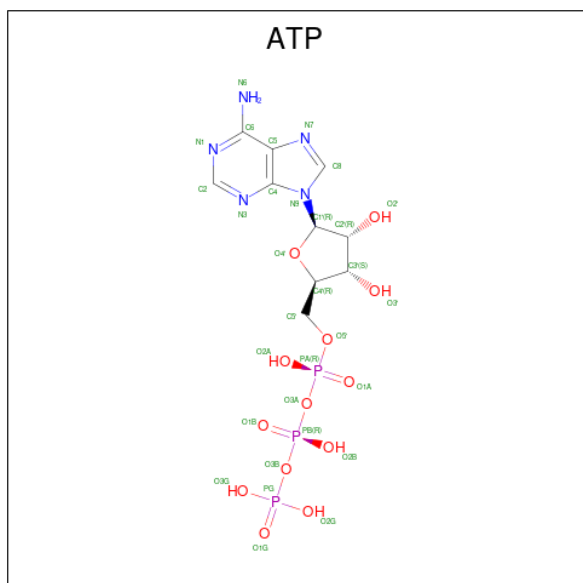
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Mol	Chain	Residues	Atoms		AltConf
3	E	1	Total	Mg	0
			1	1	
3	F	1	Total	Mg	0
			1	1	
3	H	1	Total	Mg	0
			1	1	
3	J	1	Total	Mg	0
			1	1	
3	L	1	Total	Mg	0
			1	1	
3	M	1	Total	Mg	0
			1	1	
3	O	1	Total	Mg	0
			1	1	
3	P	1	Total	Mg	0
			1	1	
3	R	1	Total	Mg	0
			1	1	
3	S	1	Total	Mg	0
			1	1	

- Molecule 4 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula:  $C_{10}H_{16}N_5O_{13}P_3$ ).



Mol	Chain	Residues	Atoms					AltConf
4	C	1	Total	C	N	O	P	0
			31	10	5	13	3	

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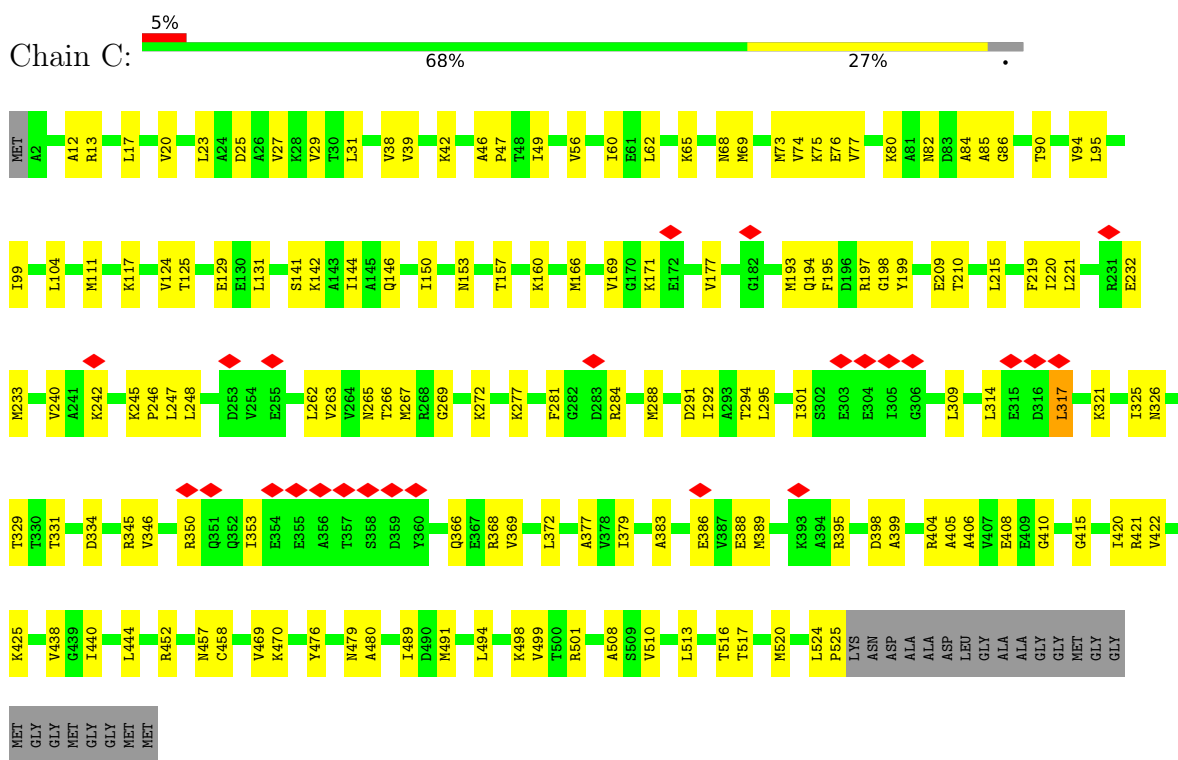
Mol	Chain	Residues	Atoms					AltConf
4	I	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	A	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	B	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	E	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	F	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	H	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	J	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	L	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	M	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	O	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	P	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	R	1	Total	C	N	O	P	0
			31	10	5	13	3	
4	S	1	Total	C	N	O	P	0
			31	10	5	13	3	



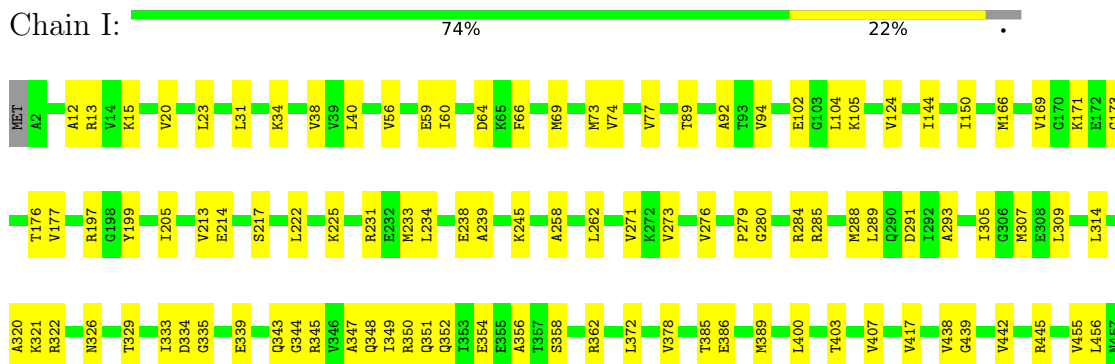
### 3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

#### • Molecule 1: Chaperonin GroEL



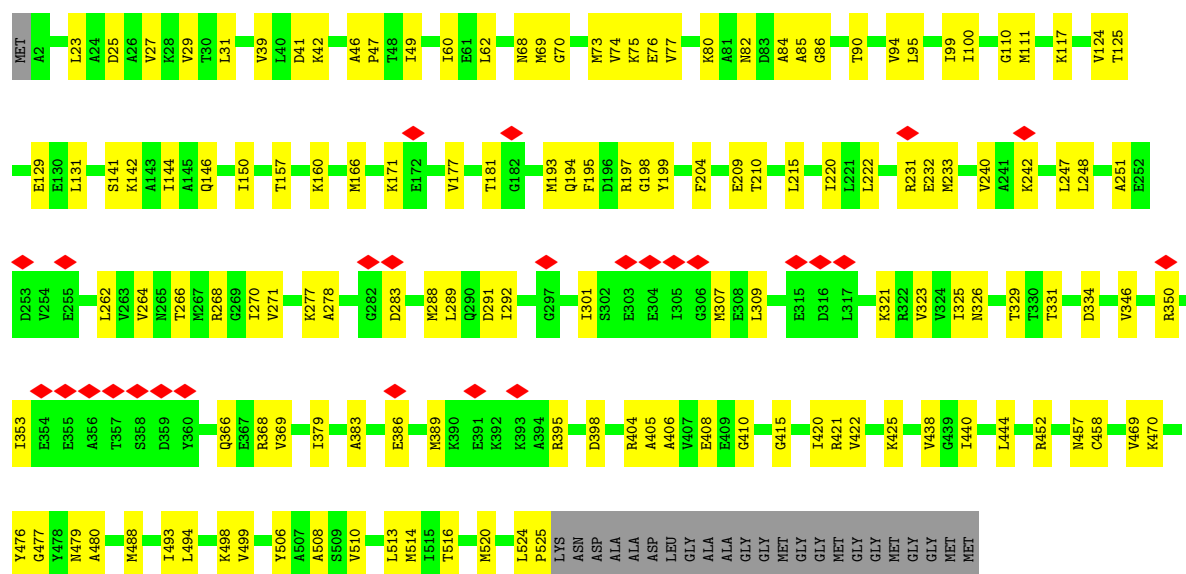
#### • Molecule 1: Chaperonin GroEL



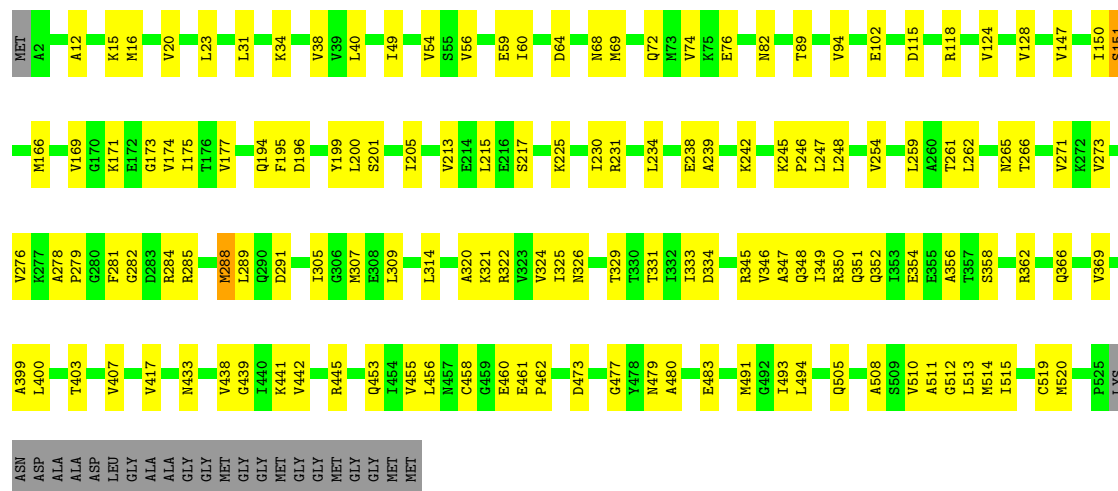




• Molecule 1: Chaperonin GroEL



• Molecule 1: Chaperonin GroEL



• Molecule 1: Chaperonin GroEL



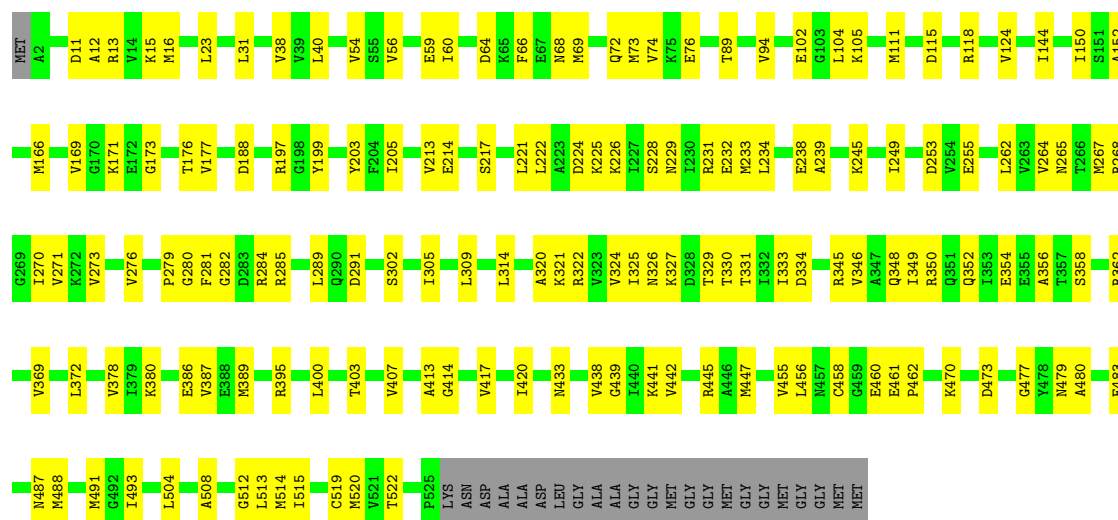






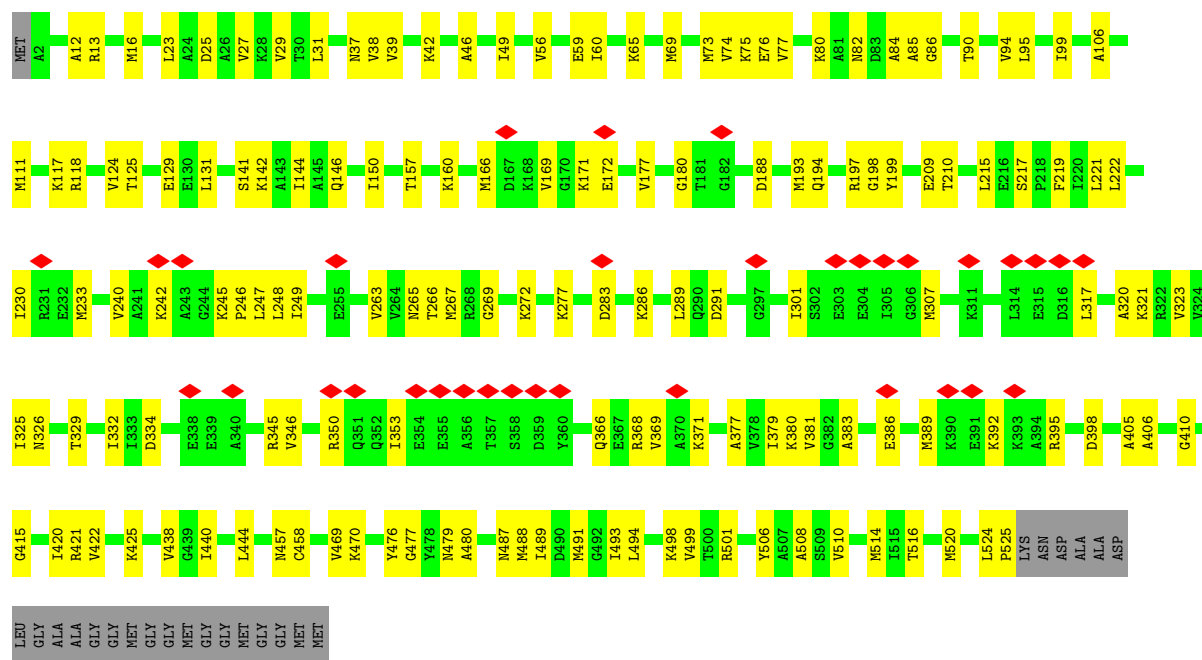
- Molecule 1: Chaperonin GroEL

Chain J:  68% 28% .



- Molecule 1: Chaperonin GroEL

Chain L:  6% 68% 28% .



- Molecule 1: Chaperonin GroEL



MET	MET	M447	V324	G173	MET
		E448	I325	A2	
MET	MET	Q453	N326	T176	MET
		I454	T329	V177	
MET	MET	V455	T330	R197	MET
		L456	T331	K15	
MET	MET	N457	N332	T205	MET
		G458	T333	L23	
MET	MET	G459	D334	V213	MET
		E460	G335	L31	
MET	MET	E461		S217	MET
		P462	R345	K34	
MET	MET	D473	V346	D224	MET
			A347	V38	
MET	MET	G477	Q348	N229	MET
			T349	V39	
MET	MET	A480	R350	T230	MET
			Q351	L40	
MET	MET	E483	Q352	R231	MET
			I353	V56	
MET	MET	I493	I354	A239	MET
			F355	E59	
MET	MET	L504	A356	K245	MET
		Q505	I357	E60	
MET	MET	A508	S358	L248	MET
			R362	N68	
MET	MET	A511	L372	L262	MET
		G512		M69	
MET	MET	L513		N265	MET
		M514	V378	T270	
MET	MET	I515		V271	MET
			E366	K75	
MET	MET	C519	V367	V273	MET
		M520	E368	E76	
MET	MET	P525	M389	A274	MET
		LVS	K390	T89	
MET	MET	ASN	L400	P279	MET
		ASP	T403	G280	
MET	MET	ALA	V407	R285	MET
		ASP	V417	E102	
MET	MET	LEU	I420	G103	MET
		GLY		L104	
MET	MET	ALA	A423	K105	MET
		GLY	V438	V124	
MET	MET	GLY	G439	T301	MET
		GLY	I440	S302	
MET	MET	GLY	K441	I305	MET
		GLY	V442	K144	
MET	MET	GLY	A443	G306	MET
		GLY	I444	M307	
MET	MET	GLY	G439	E308	MET
		GLY	I440	L309	
MET	MET	GLY	K441	L314	MET
		GLY	V442	M166	
MET	MET	GLY	A443	A320	MET
		GLY	I444	K321	
MET	MET	GLY	R445	G322	MET
		GLY	I446	E323	

Chain 0:  68% 28%

MET	R452	R350	R231	M110	A2	MET
MET	N457	Q351	E232	M111	A12	
	C458	Q352	N233	M114	A16	
	V469	I353	V240	K117	V20	
	K470	E354	K242	A123	L23	
	Y476	E355	A241	V124	A24	
	Q477	A356	P246	L247	L25	
	A480	T357	L248	T125	D25	
		S358		E129	A26	
	A483	D359	D253	E130	V27	
		Y360	V254	L131	K28	
	N487	D361	E255	S141	T29	
	M488	Q366	E256	K142	L31	
	T489	E367	G257	A143	V30	
	Q490	R368		I144	N37	
	N491	V369	V263	A145	V38	
				Q146	V39	
	L494	L372	T266	I150	K42	
	K498	V376	N267	T157	A46	
	V499	I379	K272	V158		
	Y506	K380	D283	G159	L49	
	A507	A383	R284	K160		
	S509		K286	M166	V56	
	V510	E386	A287	K171	L60	
	M514	R389	N288	V174	K65	
	T515	K390	L289			
	T516	E391	Q290	V177	M69	
	M520	K392	T292	D185	M73	
	P625	K393	E303	K186	V74	
LYS	V396		E304	V190	K75	
ASN			I306	M193	E76	
ASP	R404		G306	Q194	V77	
ALA	A405			F195	X80	
ALA	A406		E315	D196	A81	
ASP	V407		D316	R197	N82	
LEU	E408		L317	G198	A85	
GLY	E409			Y199	G86	
ALA	G410		K321	E209	T89	
ALA	G415		R322	T210	T90	
GLY			V323	L215		
MET	T420		V324	F219	Y84	
GLY	R421		N325	L220	L95	
GLY	V422		N326	L221		
MET				L222		
GLY	K425		T329	I99		
GLY	V438		T333	L100		
MET			D334			
GLY	G439		R345			
GLY	T440		V346			
	L444		A247			

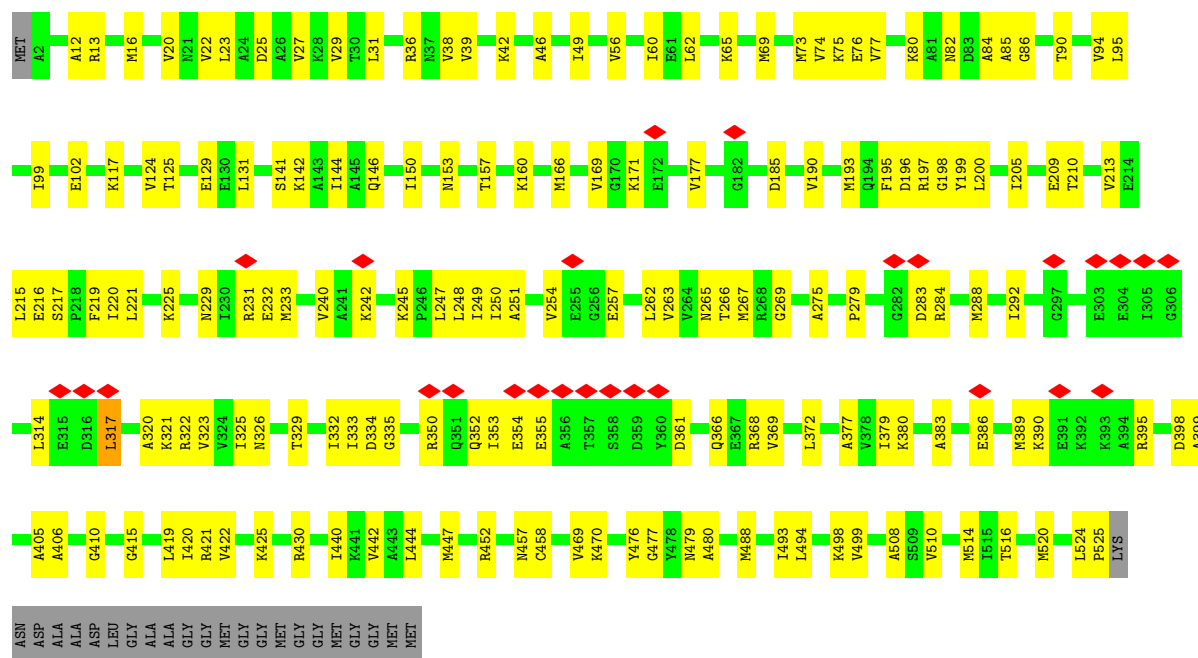
Chain P:  71% 24% .

M166	M167	M168	M169	G170	K171	E172	G173	G174	M175	M176	M177	L217	L218	L219	L220	L221	L222	K223	K224	K225	K226	M227	M228	M229	L230	L231	M232	M233	E234	E235	D236	E237	E238	K239	K240	L241	L242	L243	L244	L245	L246	L247	L248	L249	L250	A251	A252	E253	E254	D255	A256	A257	L258	L259	A260	T261	L262	L263	L264	L265	L266	L267	L268	L269	L270																																																																																																																																																																																																																																																																																																																																																																																																									
M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36	M37	M38	M39	M40	M41	M42	M43	M44	M45	M46	M47	M48	M49	M50	M51	M52	M53	M54	M55	M56	M57	M58	M59	M60	M61	M62	M63	M64	M65	M66	M67	M68	M69	M70	M71	M72	M73	M74	M75	M76	M77	M78	M79	M80	M81	M82	M83	M84	M85	M86	M87	M88	M89	M90	M91	M92	M93	M94	M95	M96	M97	M98	M99	M100	M101	M102	M103	M104	M105	M106	M107	M108	M109	M110	M111	M112	M113	M114	M115	M116	M117	M118	M119	M120	M121	M122	M123	M124	M125	M126	M127	M128	M129	M130	M131	M132	M133	M134	M135	M136	M137	M138	M139	M140	M141	M142	M143	M144	M145	M146	M147	M148	M149	M150	M151	M152	M153	M154	M155	M156	M157	M158	M159	M160	M161	M162	M163	M164	M165	M166	M167	M168	M169	M170	M171	M172	M173	M174	M175	M176	M177	M178	M179	M180	M181	M182	M183	M184	M185	M186	M187	M188	M189	M190	M191	M192	M193	M194	M195	M196	M197	M198	M199	M200	M201	M202	M203	M204	M205	M206	M207	M208	M209	M210	M211	M212	M213	M214	M215	M216	M217	M218	M219	M220	M221	M222	M223	M224	M225	M226	M227	M228	M229	M230	M231	M232	M233	M234	M235	M236	M237	M238	M239	M240	M241	M242	M243	M244	M245	M246	M247	M248	M249	M250	M251	M252	M253	M254	M255	M256	M257	M258	M259	M260	M261	M262	M263	M264	M265	M266	M267	M268	M269	M270	M271	M272	M273	M274	M275	M276	M277	M278	M279	M280	M281	M282	M283	M284	M285	M286	M287	M288	M289	M290	M291	M292	M293	M294	M295	M296	M297	M298	M299	M300	M301	M302	M303	M304	M305	M306	M307	M308	M309	M310	M311	M312	M313	M314	M315	M316	M317	M318	M319	M320	M321	M322	M323	M324	M325	M326	M327	M328	M329	M330	M331	M332	M333	M334	M335	M336	M337	M338	M339	M340	M341	M342	M343	M344	M345	M346	M347	M348	M349	M350	M351	M352	M353	M354	M355	M356	M357	M358	M359	M360	M361	M362	M363	M364	M365	M366	M367	M368	M369	M370	M371	M372	M373	M374	M375	M376	M377	M378	M379	M380	M381	M382	M383	M384	M385	M386	M387	M388	M389	M390	M391	M392	M393	M394	M395	M396	M397	M398	M399	M400	M401	M402	M403	M404	M405	M406	M407	M408	M409	M410	M411	M412	M413	M414	M415	M416	M417	M418	M419	M420	M421	M422	M423	M424	M425	M426	M427	M428	M429	M430	M431	M432	M433	M434	M435	M436	M437	M438	M439	M440	M441	M442	M443	M444	M445	M446	M447	M448	M449	M450	M451	M452	M453	M454	M455	M456	M457	M458	M45

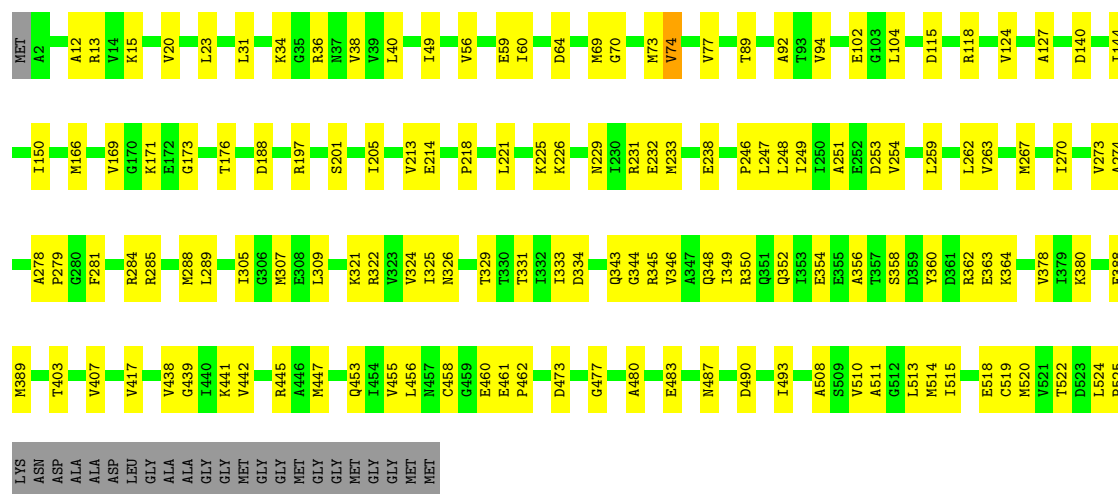




• Molecule 1: Chaperonin GroEL



• Molecule 1: Chaperonin GroEL





- Molecule 2: Co-chaperonin GroES

Chain W:  67% 31%



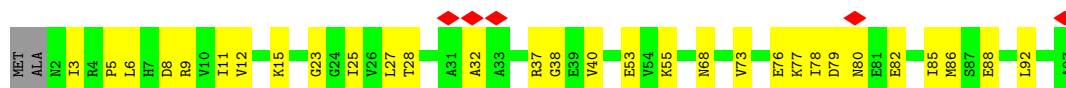
- Molecule 2: Co-chaperonin GroES

Chain D:  5% 68% 30%



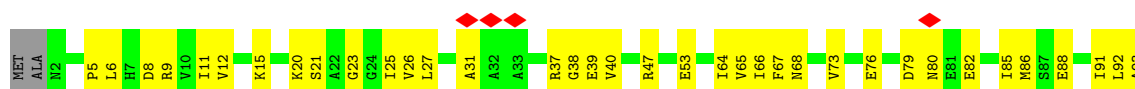
- Molecule 2: Co-chaperonin GroES

Chain G:  5% 67% 31%



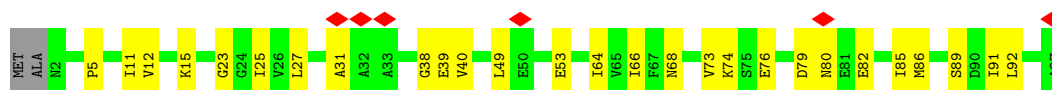
- Molecule 2: Co-chaperonin GroES

Chain K:  5% 60% 38%




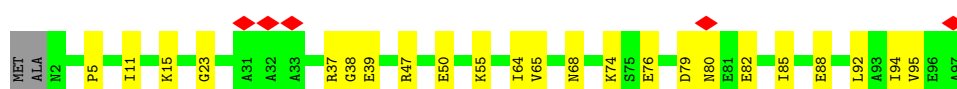
- Molecule 2: Co-chaperonin GroES

Chain N:  6% 70% 28%



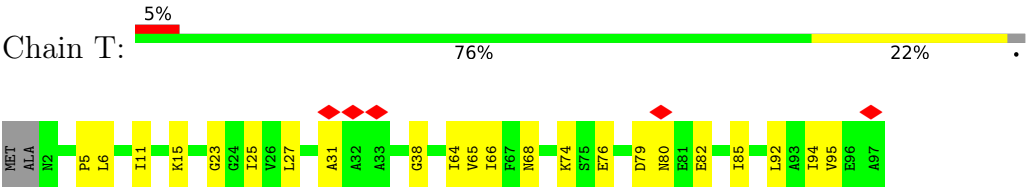
- Molecule 2: Co-chaperonin GroES

Chain Q:  5% 74% 23%



- Molecule 2: Co-chaperonin GroES







## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C7	Depositor
Number of particles used	4612	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	JEOL CRYO ARM 300	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	63.6	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	3500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	0.203	Depositor
Minimum map value	-0.086	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.006	Depositor
Recommended contour level	0.025	Depositor
Map size (Å)	376.31998, 376.31998, 376.31998	wwPDB
Map dimensions	392, 392, 392	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.9599999, 0.9599999, 0.9599999	Depositor



## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ATP, MG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z  > 5$	RMSZ	$\# Z  > 5$
1	A	0.14	0/3877	0.30	0/5236
1	B	0.19	0/3879	0.30	0/5238
1	C	0.15	0/3877	0.33	0/5236
1	E	0.15	0/3877	0.33	0/5236
1	F	0.18	0/3879	0.30	0/5238
1	H	0.15	0/3877	0.32	0/5236
1	I	0.18	0/3879	0.30	0/5238
1	J	0.19	0/3879	0.31	0/5238
1	L	0.15	0/3877	0.32	0/5236
1	M	0.19	0/3879	0.32	0/5238
1	O	0.15	0/3877	0.30	0/5236
1	P	0.19	0/3879	0.31	0/5238
1	R	0.15	0/3877	0.32	0/5236
1	S	0.18	0/3879	0.31	0/5238
2	D	0.12	0/718	0.32	0/966
2	G	0.12	0/718	0.29	0/966
2	K	0.12	0/718	0.31	0/966
2	N	0.11	0/718	0.30	0/966
2	Q	0.11	0/718	0.29	0/966
2	T	0.11	0/718	0.31	0/966
2	W	0.12	0/718	0.31	0/966
All	All	0.16	0/59318	0.31	0/80080

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.



## 5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3849	0	3965	92	0
1	B	3851	0	3972	92	0
1	C	3849	0	3965	109	0
1	E	3849	0	3965	98	0
1	F	3851	0	3972	86	0
1	H	3849	0	3965	101	0
1	I	3851	0	3972	75	0
1	J	3851	0	3972	103	0
1	L	3849	0	3965	106	0
1	M	3851	0	3972	88	0
1	O	3849	0	3965	104	0
1	P	3851	0	3972	91	0
1	R	3849	0	3965	124	0
1	S	3851	0	3972	91	0
2	D	714	0	732	22	0
2	G	714	0	732	24	0
2	K	714	0	732	30	0
2	N	714	0	732	18	0
2	Q	714	0	732	17	0
2	T	714	0	732	19	0
2	W	714	0	732	23	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	E	1	0	0	0	0
3	F	1	0	0	0	0
3	H	1	0	0	0	0
3	I	1	0	0	0	0
3	J	1	0	0	0	0
3	L	1	0	0	0	0
3	M	1	0	0	0	0
3	O	1	0	0	0	0
3	P	1	0	0	0	0
3	R	1	0	0	0	0
3	S	1	0	0	0	0
4	A	31	0	12	2	0
4	B	31	0	12	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	C	31	0	12	1	0
4	E	31	0	12	2	0
4	F	31	0	12	1	0
4	H	31	0	12	2	0
4	I	31	0	12	1	0
4	J	31	0	12	2	0
4	L	31	0	12	1	0
4	M	31	0	12	2	0
4	O	31	0	12	1	0
4	P	31	0	12	2	0
4	R	31	0	12	1	0
4	S	31	0	12	1	0
All	All	59346	0	60851	1421	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 12.

The worst 5 of 1421 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:77:VAL:HG21	1:A:510:VAL:HB	1.63	0.80
1:O:77:VAL:HG21	1:O:510:VAL:HB	1.63	0.80
1:M:291:ASP:HB3	1:M:372:LEU:HD21	1.66	0.78
1:O:220:ILE:HG13	1:O:248:LEU:HD21	1.67	0.77
1:M:262:LEU:HD22	1:M:273:VAL:HG11	1.66	0.77

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.



Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	300/548 (55%)	294 (98%)	6 (2%)	0	100	100
1	E	522/548 (95%)	515 (99%)	7 (1%)	0	100	100
1	F	522/548 (95%)	513 (98%)	9 (2%)	0	100	100
1	H	522/548 (95%)	512 (98%)	10 (2%)	0	100	100
1	J	522/548 (95%)	511 (98%)	11 (2%)	0	100	100
1	L	522/548 (95%)	512 (98%)	10 (2%)	0	100	100
1	M	522/548 (95%)	514 (98%)	8 (2%)	0	100	100
1	O	522/548 (95%)	507 (97%)	15 (3%)	0	100	100
1	P	522/548 (95%)	514 (98%)	8 (2%)	0	100	100
1	R	522/548 (95%)	512 (98%)	10 (2%)	0	100	100
1	S	522/548 (95%)	515 (99%)	7 (1%)	0	100	100
2	D	94/98 (96%)	90 (96%)	4 (4%)	0	100	100
2	G	94/98 (96%)	92 (98%)	2 (2%)	0	100	100
2	K	94/98 (96%)	90 (96%)	4 (4%)	0	100	100
2	N	94/98 (96%)	91 (97%)	3 (3%)	0	100	100
2	Q	94/98 (96%)	90 (96%)	4 (4%)	0	100	100
2	T	94/98 (96%)	92 (98%)	2 (2%)	0	100	100
All	All	6084/6616 (92%)	5964 (98%)	120 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	403/415 (97%)	403 (100%)	0	100	100
1	B	403/415 (97%)	401 (100%)	2 (0%)	81	81
1	C	403/415 (97%)	402 (100%)	1 (0%)	87	85
1	E	76/415 (18%)	76 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	H	69/415 (17%)	69 (100%)	0	100	100
1	I	403/415 (97%)	402 (100%)	1 (0%)	87	85
1	J	403/415 (97%)	403 (100%)	0	100	100
1	L	403/415 (97%)	403 (100%)	0	100	100
1	M	403/415 (97%)	402 (100%)	1 (0%)	87	85
1	O	403/415 (97%)	403 (100%)	0	100	100
1	P	403/415 (97%)	403 (100%)	0	100	100
1	R	403/415 (97%)	402 (100%)	1 (0%)	87	85
1	S	403/415 (97%)	402 (100%)	1 (0%)	87	85
2	D	49/80 (61%)	49 (100%)	0	100	100
2	K	77/80 (96%)	76 (99%)	1 (1%)	61	71
2	N	77/80 (96%)	77 (100%)	0	100	100
2	Q	77/80 (96%)	77 (100%)	0	100	100
2	T	77/80 (96%)	77 (100%)	0	100	100
2	W	77/80 (96%)	77 (100%)	0	100	100
All	All	5012/5875 (85%)	5004 (100%)	8 (0%)	85	85

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	S	74	VAL
1	R	317	LEU
2	K	6	LEU
1	B	288	MET
1	M	270	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 24 such sidechains are listed below:

Mol	Chain	Res	Type
1	O	290	GLN
1	O	475	ASN
1	O	348	GLN
1	P	290	GLN
1	B	82	ASN



### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 28 ligands modelled in this entry, 14 are monoatomic - leaving 14 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
4	ATP	H	602	3	32,33,33	0.37	0	48,52,52	0.27	0
4	ATP	S	602	3	32,33,33	0.45	0	48,52,52	0.45	0
4	ATP	E	602	3	32,33,33	0.39	0	48,52,52	0.28	0
4	ATP	R	602	3	32,33,33	0.34	0	48,52,52	0.27	0
4	ATP	M	602	3	32,33,33	0.52	0	48,52,52	0.47	0
4	ATP	I	602	3	32,33,33	0.50	0	48,52,52	0.45	0
4	ATP	O	602	3	32,33,33	0.38	0	48,52,52	0.27	0
4	ATP	F	602	3	32,33,33	0.50	0	48,52,52	0.45	0
4	ATP	L	602	3	32,33,33	0.36	0	48,52,52	0.27	0
4	ATP	B	602	3	32,33,33	0.48	0	48,52,52	0.45	0
4	ATP	A	602	3	32,33,33	0.37	0	48,52,52	0.27	0
4	ATP	P	602	3	32,33,33	0.51	0	48,52,52	0.46	0
4	ATP	J	602	3	32,33,33	0.51	0	48,52,52	0.46	0
4	ATP	C	602	3	32,33,33	0.36	0	48,52,52	0.27	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the



Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns.  
'-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	ATP	H	602	3	-	5/22/38/38	0/3/3/3
4	ATP	S	602	3	-	7/22/38/38	0/3/3/3
4	ATP	E	602	3	-	5/22/38/38	0/3/3/3
4	ATP	R	602	3	-	6/22/38/38	0/3/3/3
4	ATP	M	602	3	-	7/22/38/38	0/3/3/3
4	ATP	I	602	3	-	6/22/38/38	0/3/3/3
4	ATP	O	602	3	-	5/22/38/38	0/3/3/3
4	ATP	F	602	3	-	7/22/38/38	0/3/3/3
4	ATP	L	602	3	-	4/22/38/38	0/3/3/3
4	ATP	B	602	3	-	7/22/38/38	0/3/3/3
4	ATP	A	602	3	-	5/22/38/38	0/3/3/3
4	ATP	P	602	3	-	8/22/38/38	0/3/3/3
4	ATP	J	602	3	-	6/22/38/38	0/3/3/3
4	ATP	C	602	3	-	5/22/38/38	0/3/3/3

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 83 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	I	602	ATP	C5'-O5'-PA-O1A
4	I	602	ATP	C5'-O5'-PA-O2A
4	I	602	ATP	C5'-O5'-PA-O3A
4	I	602	ATP	O4'-C4'-C5'-O5'
4	B	602	ATP	C5'-O5'-PA-O1A

There are no ring outliers.

14 monomers are involved in 20 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	H	602	ATP	2	0
4	S	602	ATP	1	0
4	E	602	ATP	2	0
4	R	602	ATP	1	0
4	M	602	ATP	2	0

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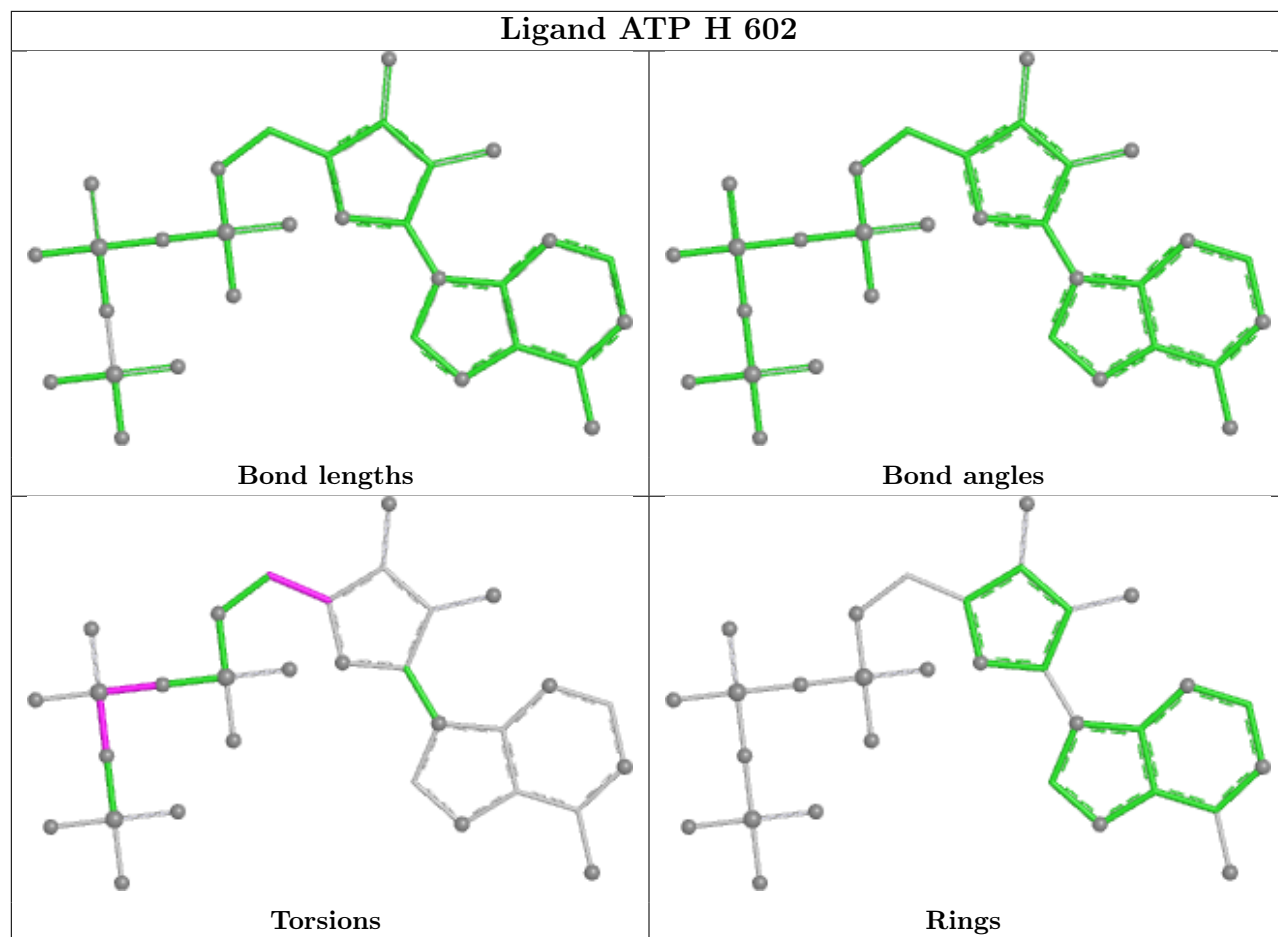


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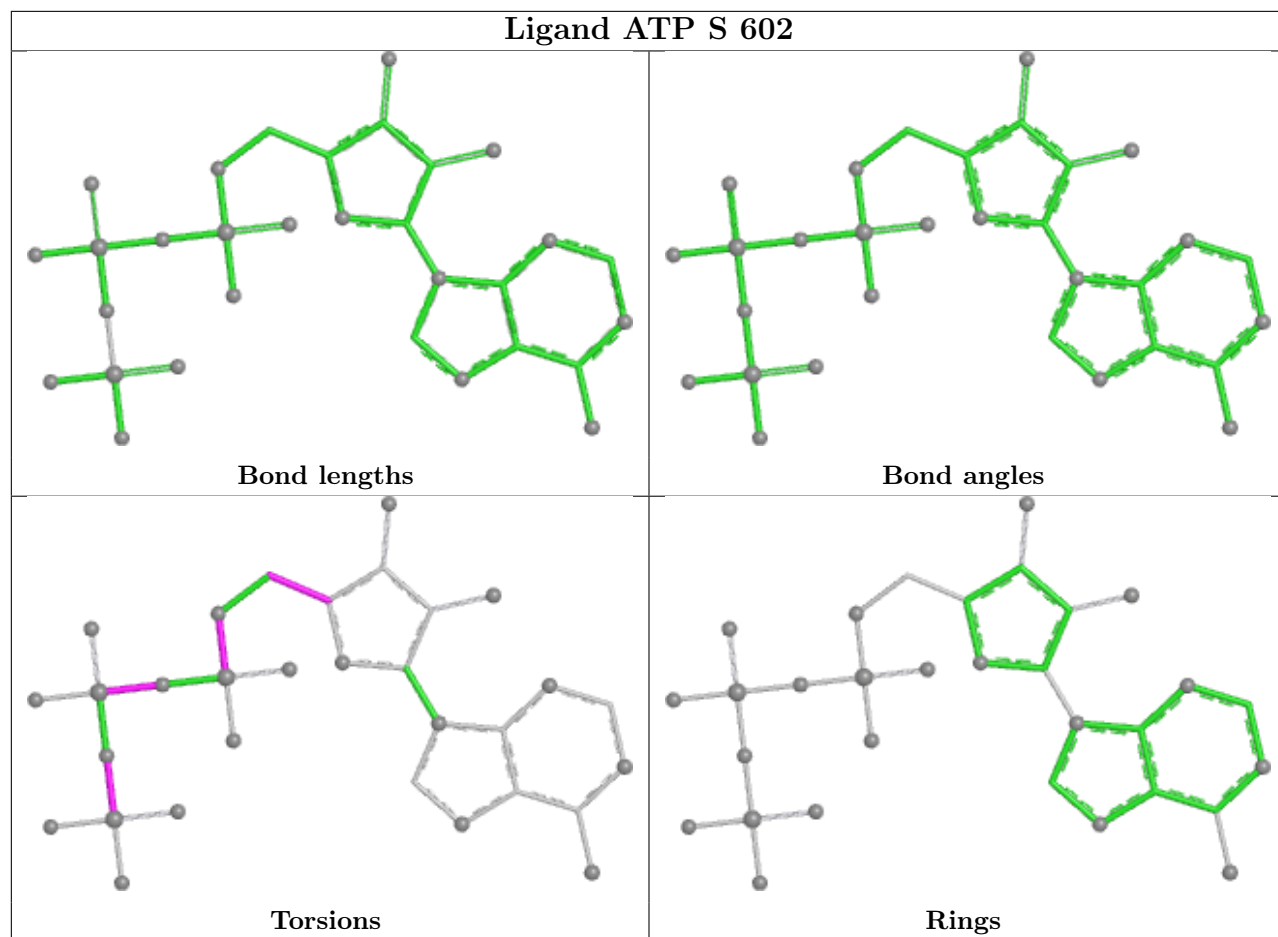
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	I	602	ATP	1	0
4	O	602	ATP	1	0
4	F	602	ATP	1	0
4	L	602	ATP	1	0
4	B	602	ATP	1	0
4	A	602	ATP	2	0
4	P	602	ATP	2	0
4	J	602	ATP	2	0
4	C	602	ATP	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

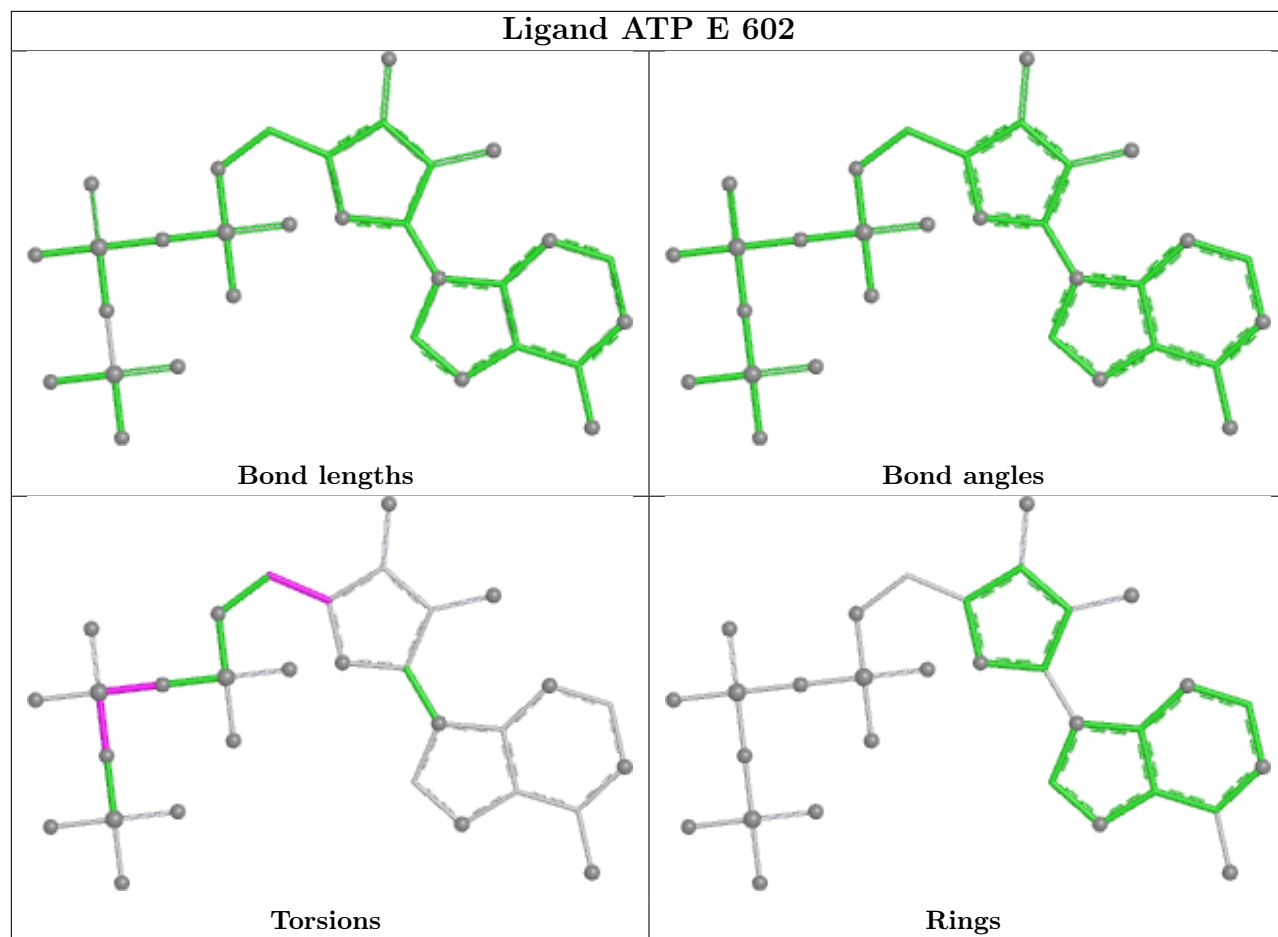




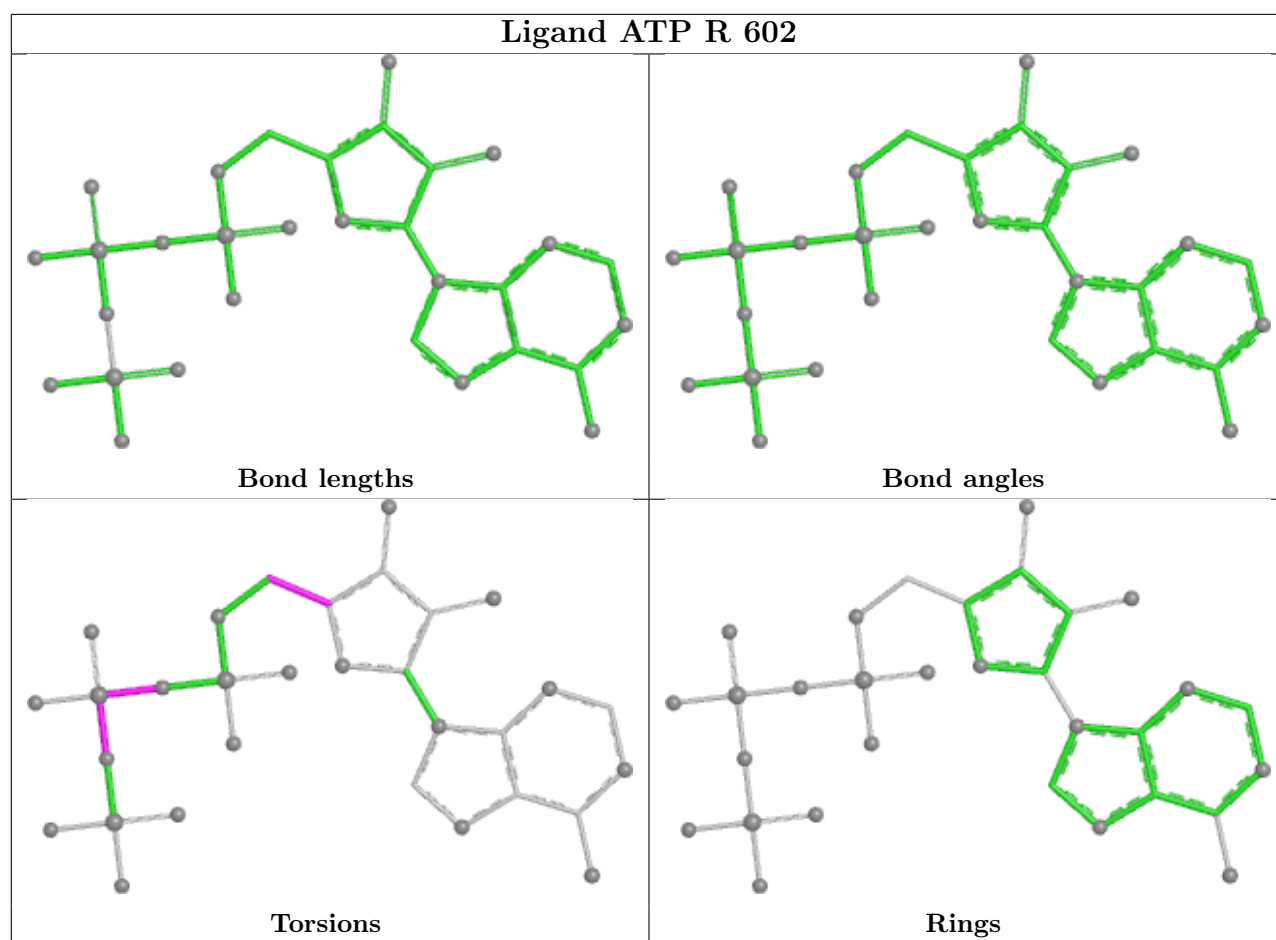




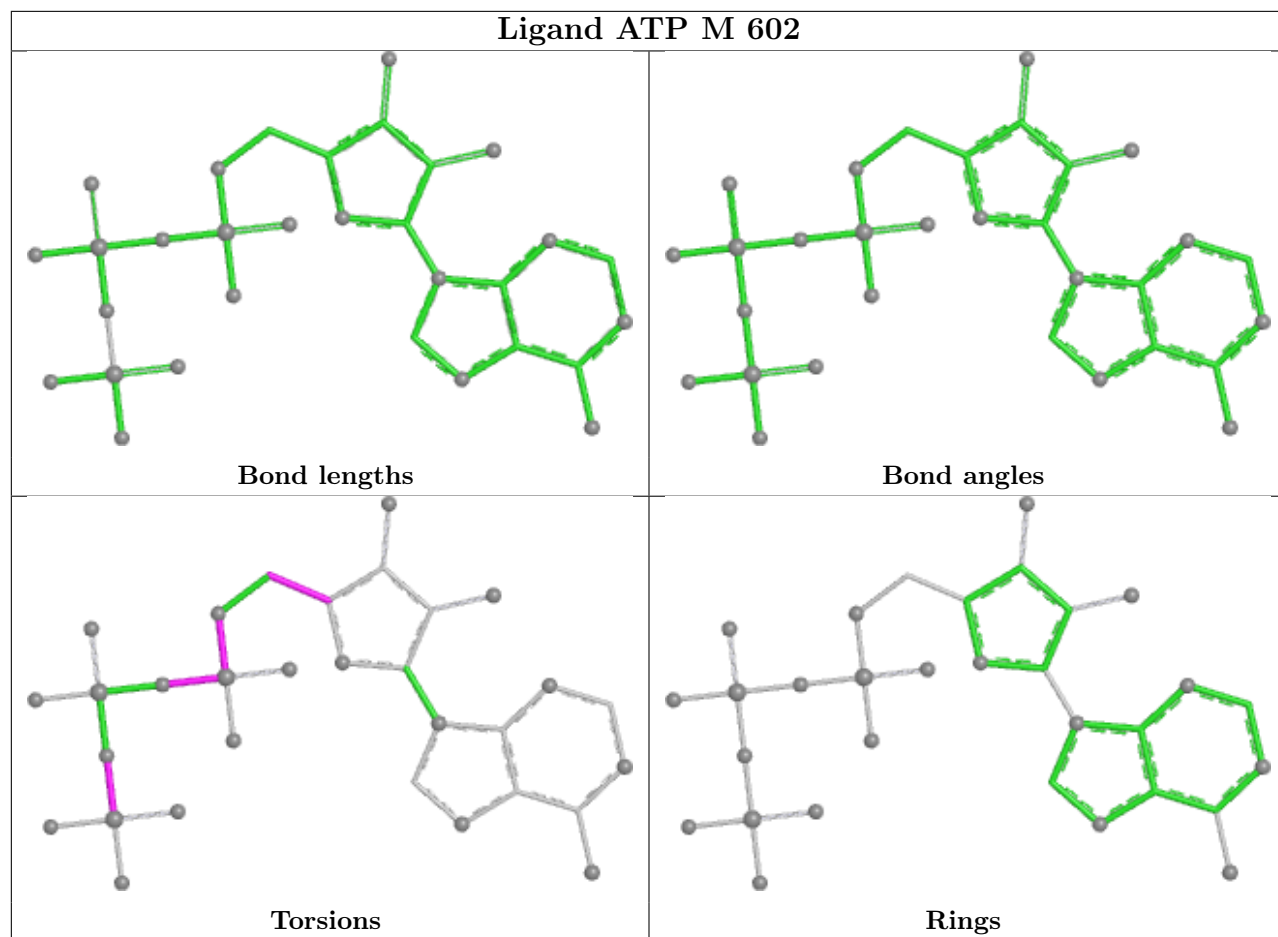






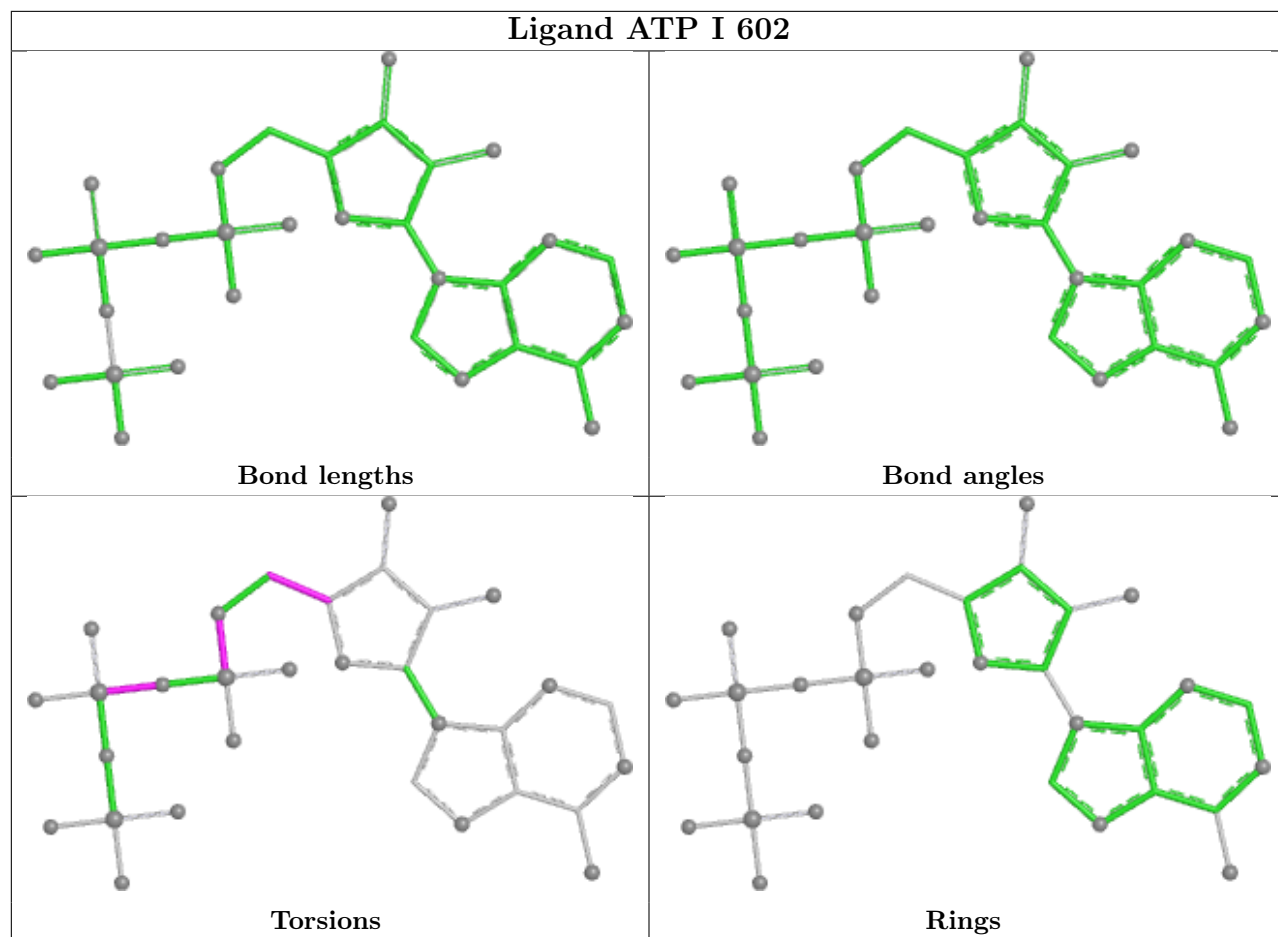




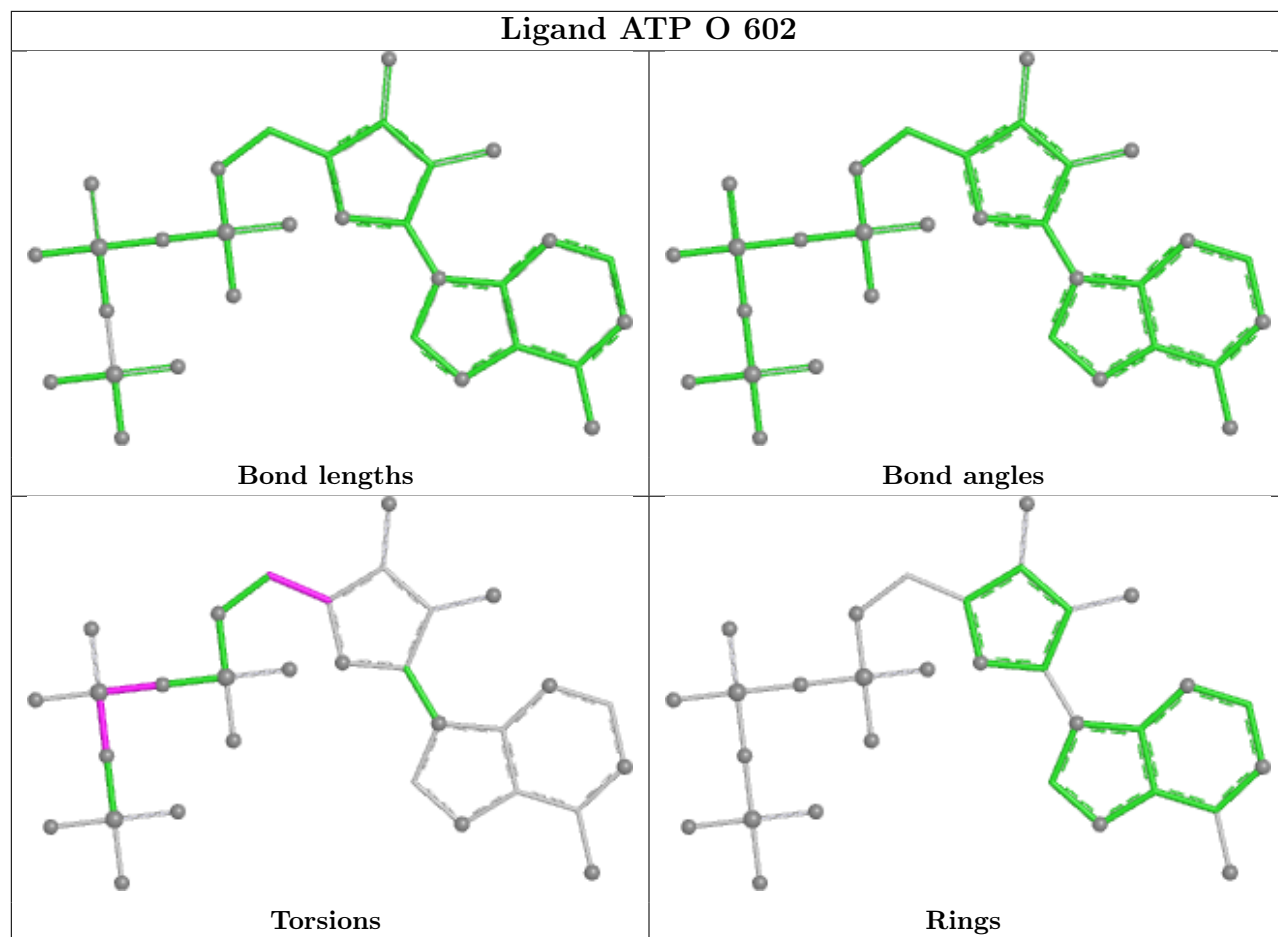




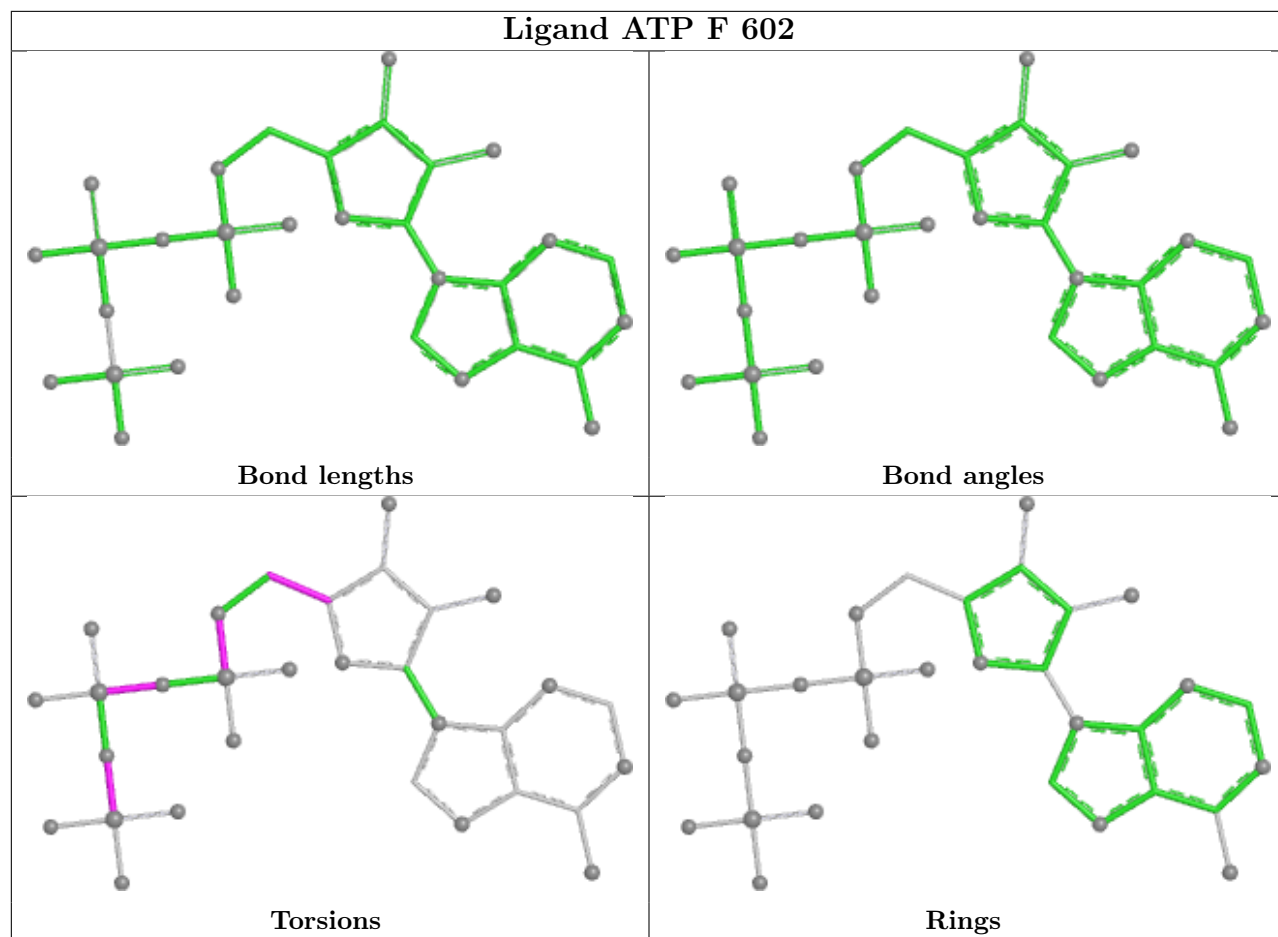
## Ligand ATP I 602





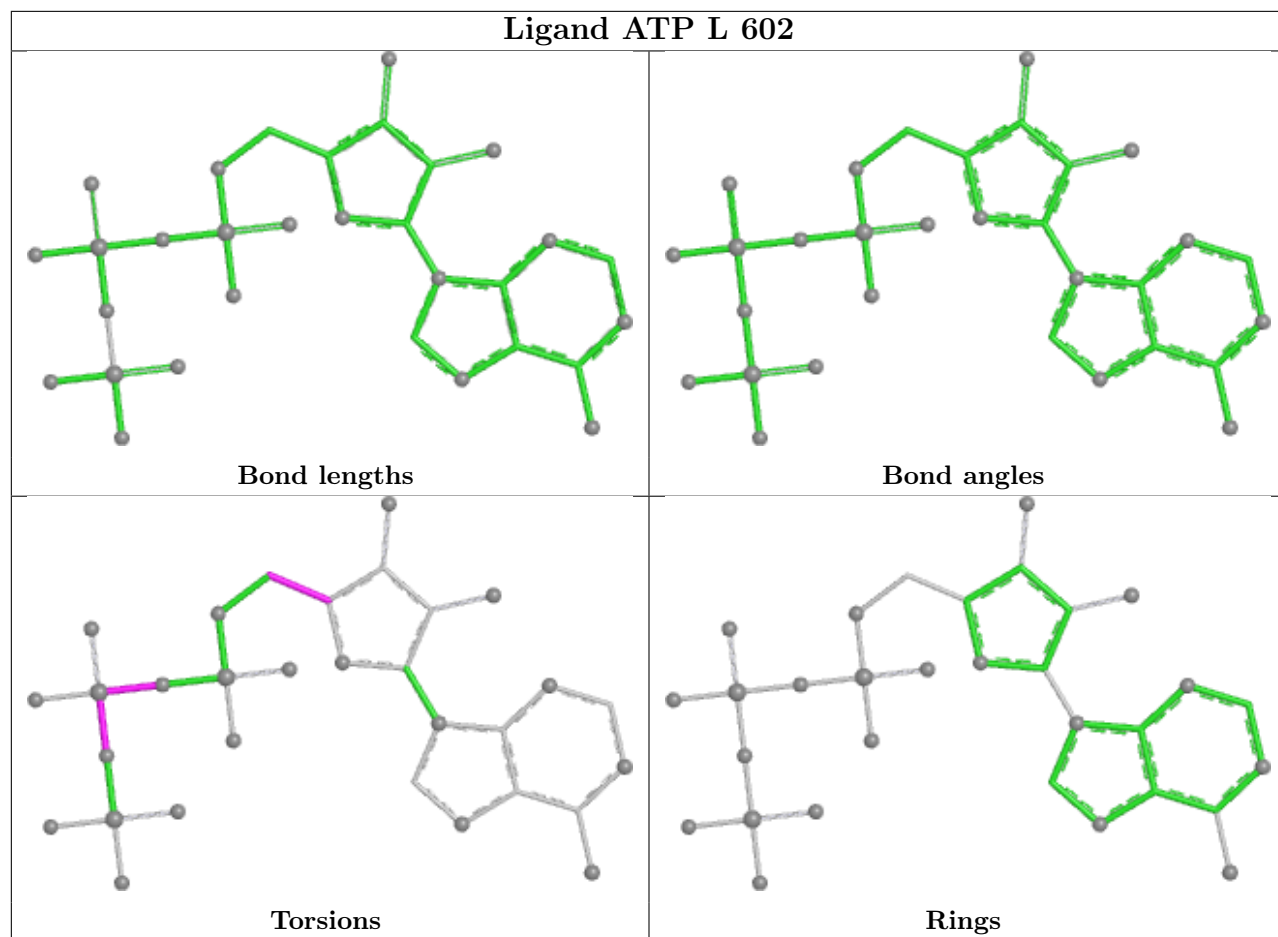




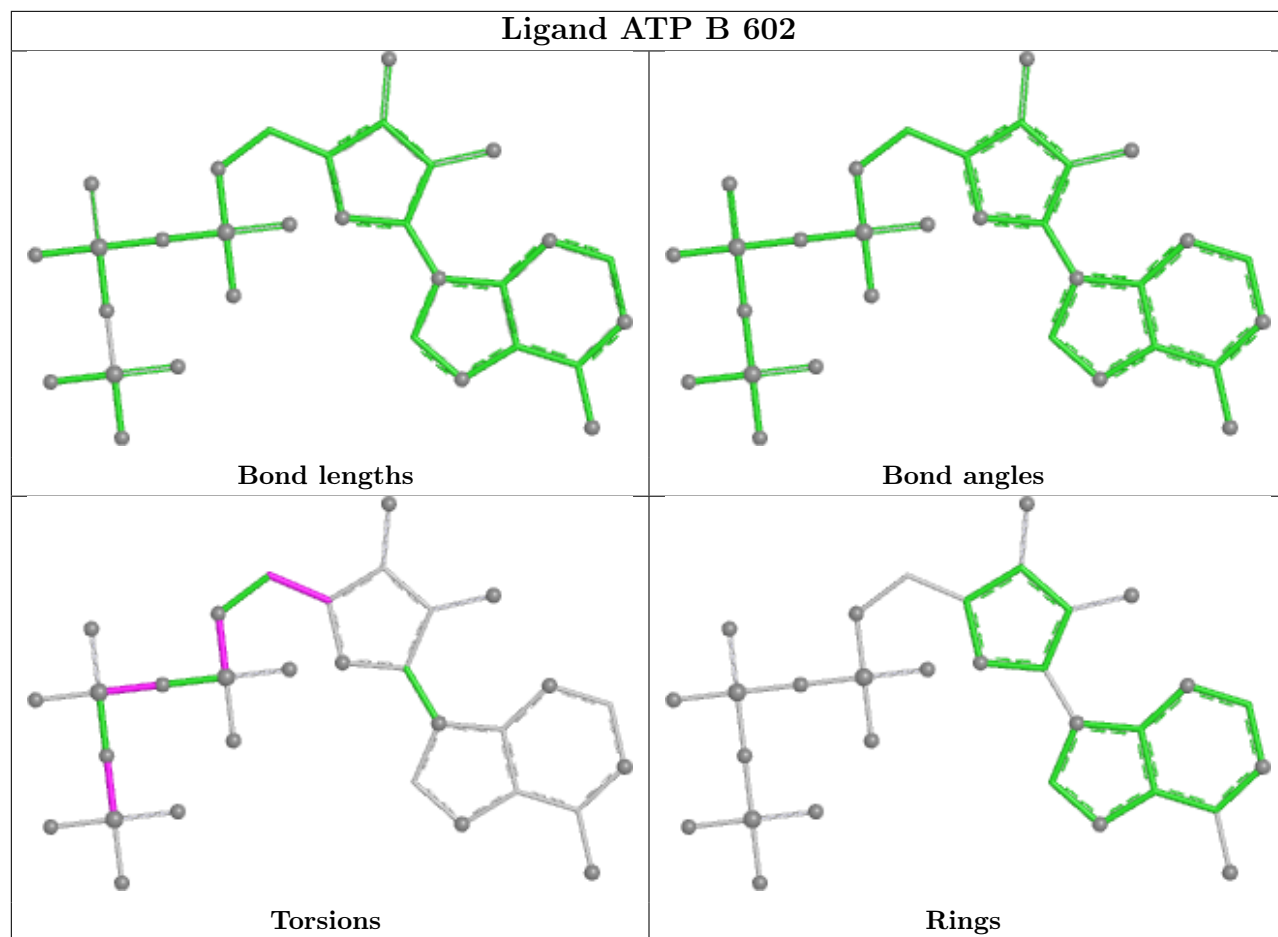




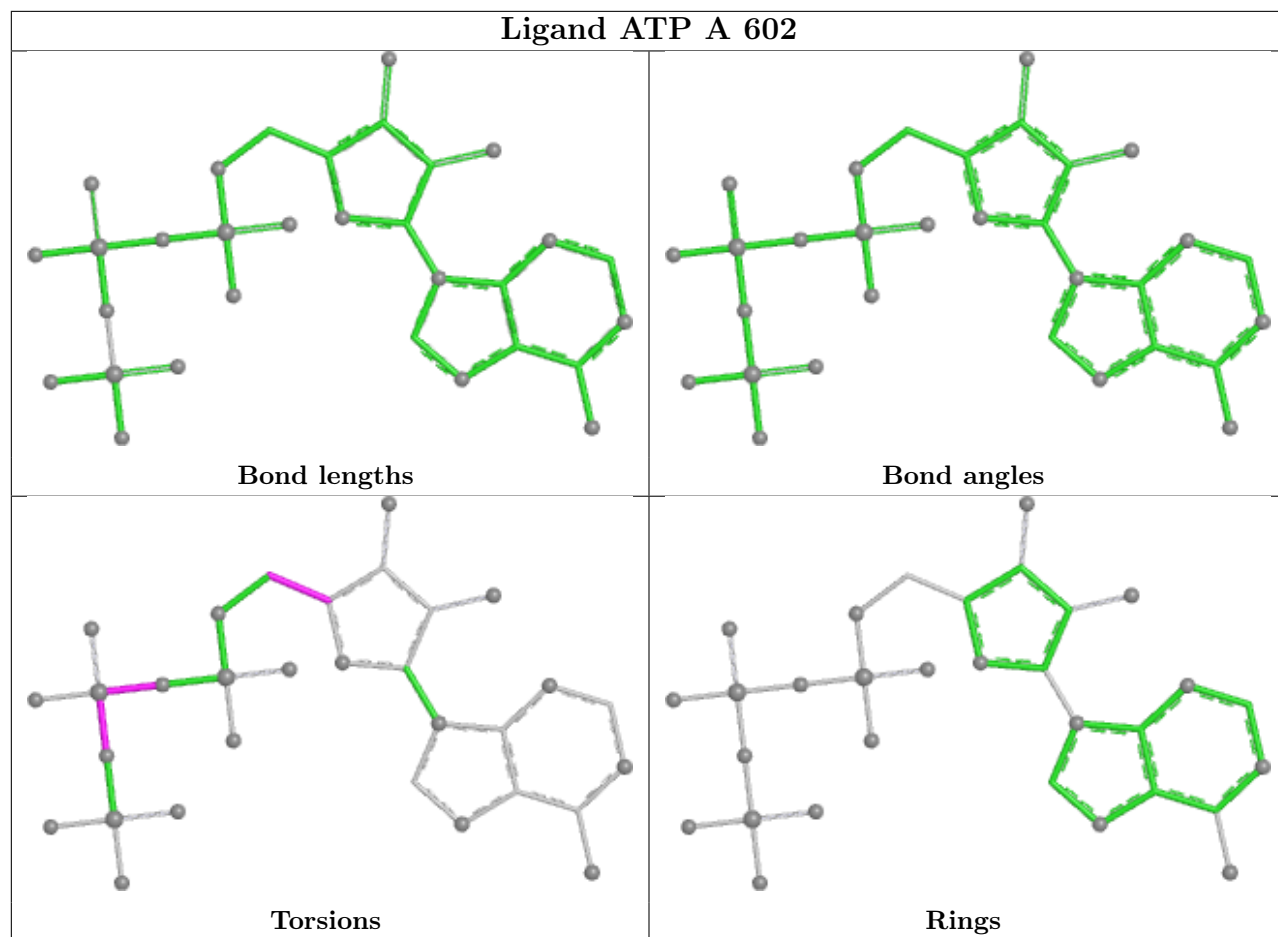
## Ligand ATP L 602



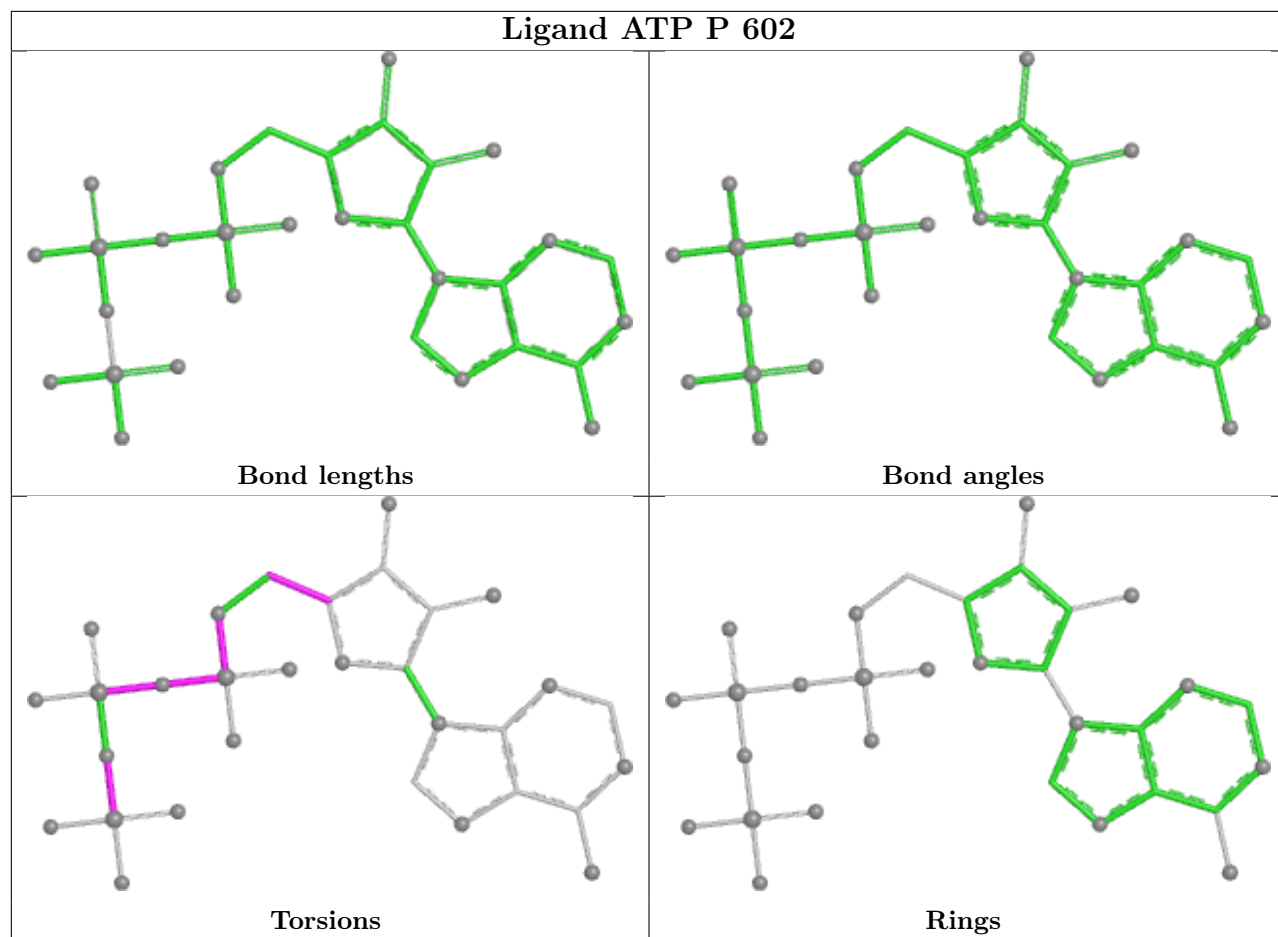




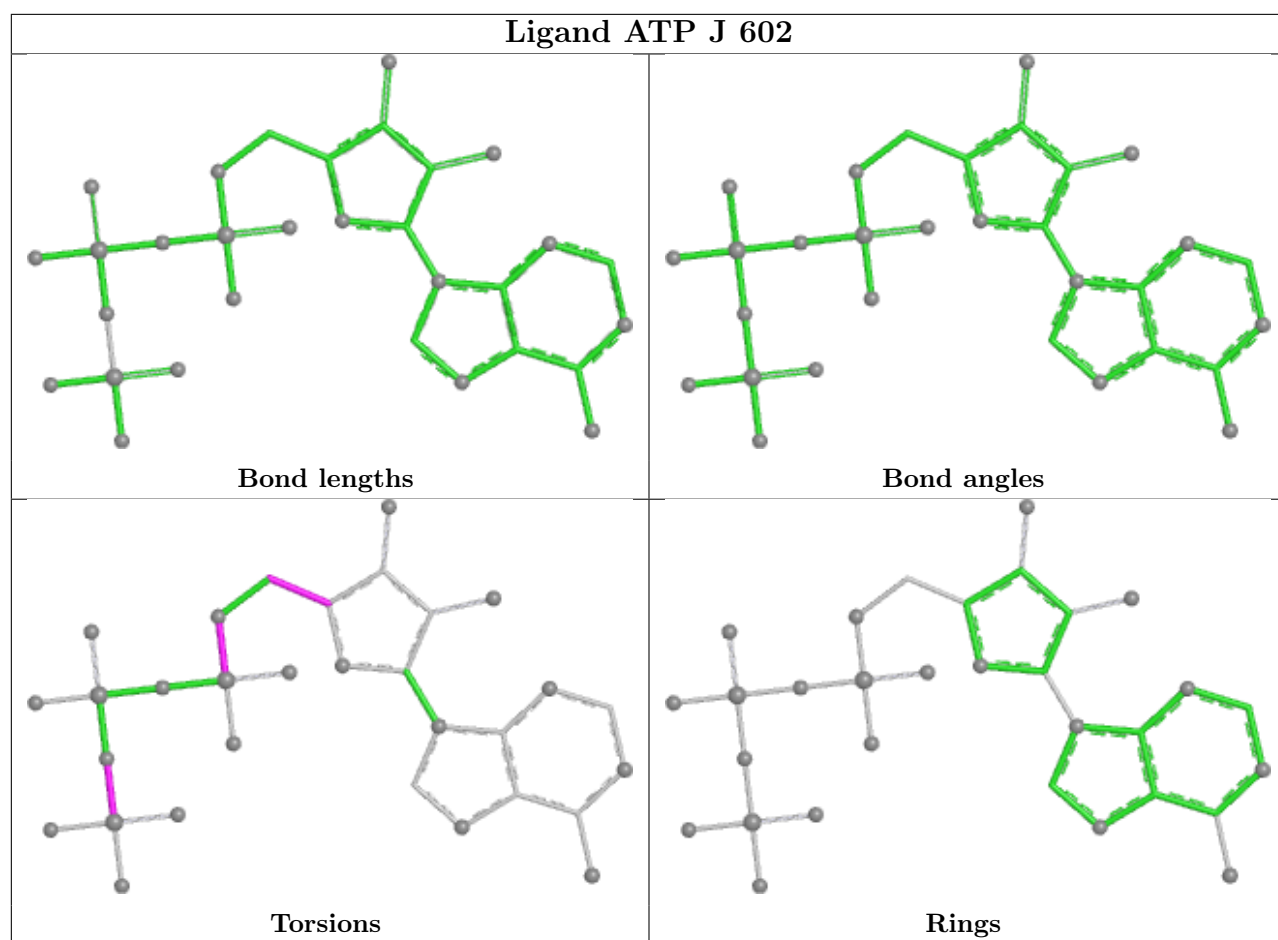




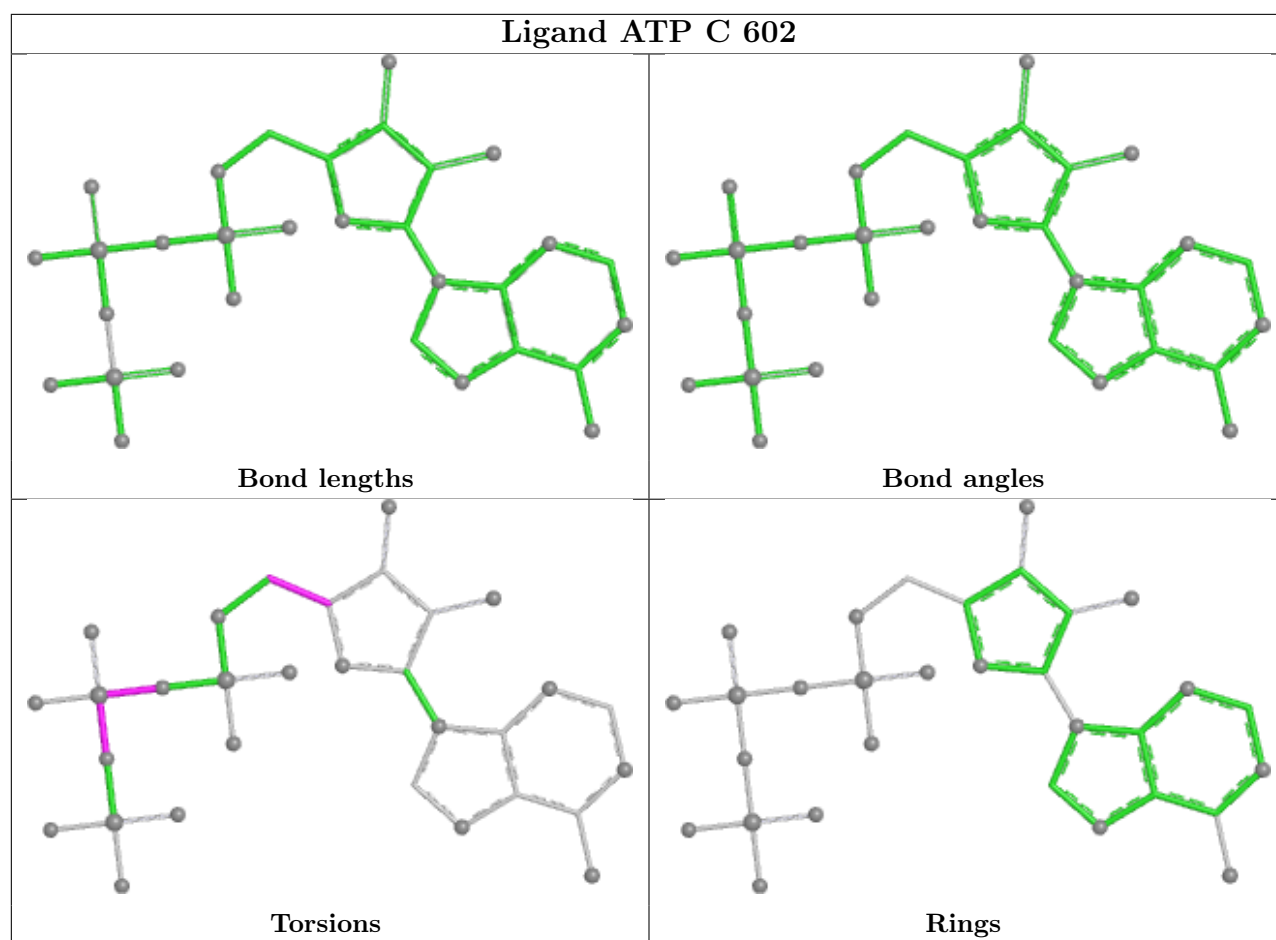












## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.



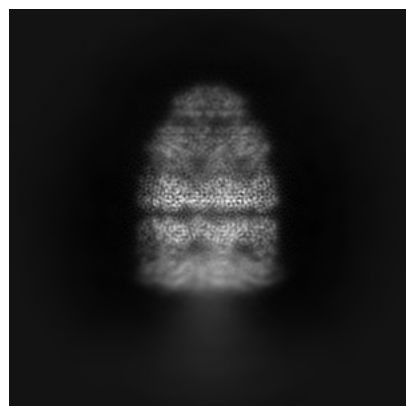
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-16119. These allow visual inspection of the internal detail of the map and identification of artifacts.

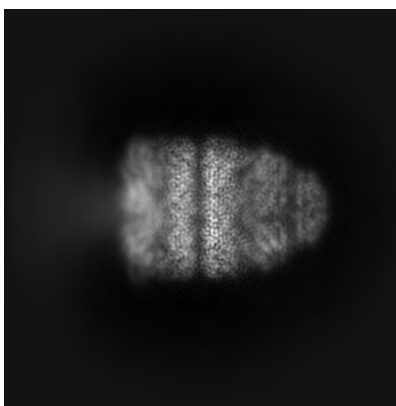
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

### 6.1 Orthogonal projections [i](#)

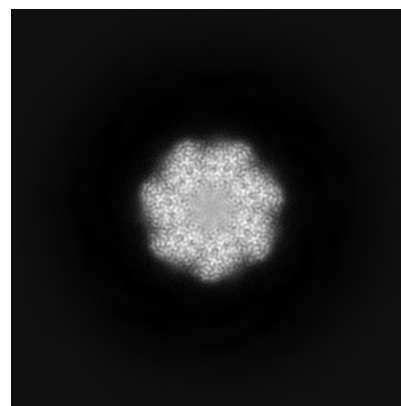
#### 6.1.1 Primary map



X

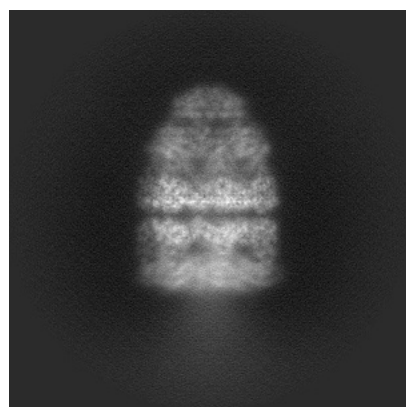


Y

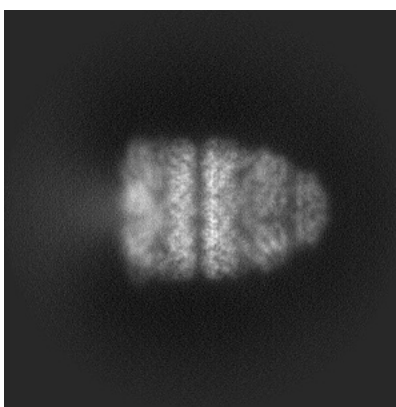


Z

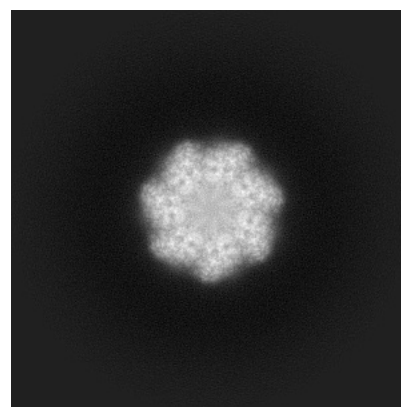
#### 6.1.2 Raw map



X



Y



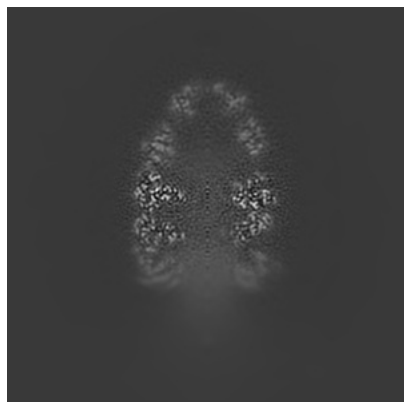
Z

The images above show the map projected in three orthogonal directions.

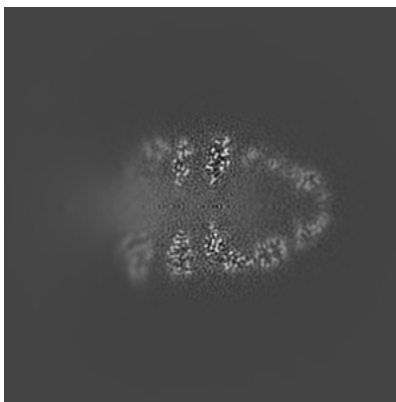


## 6.2 Central slices [i](#)

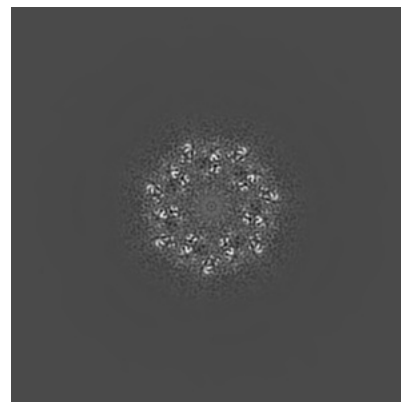
### 6.2.1 Primary map



X Index: 196

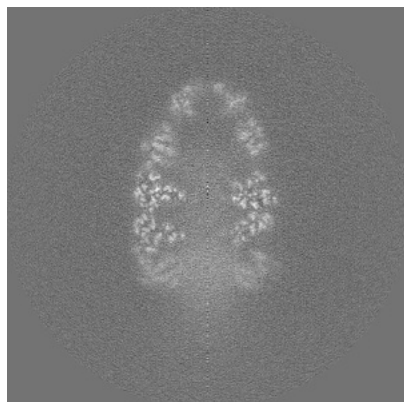


Y Index: 196

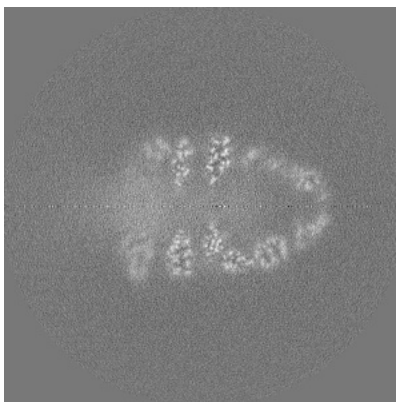


Z Index: 196

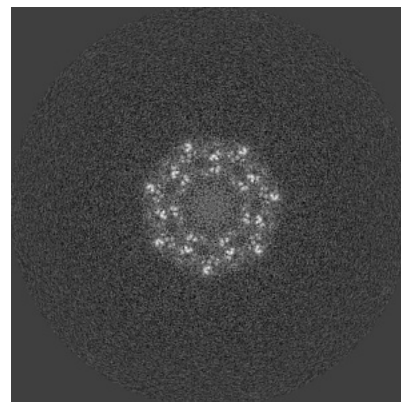
### 6.2.2 Raw map



X Index: 196



Y Index: 196



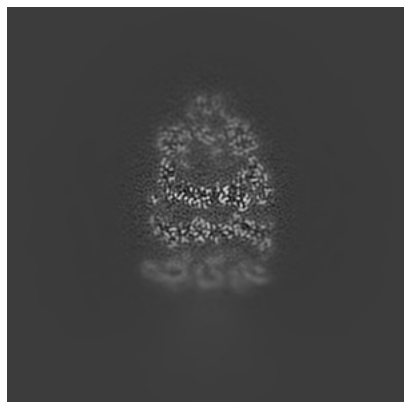
Z Index: 196

The images above show central slices of the map in three orthogonal directions.

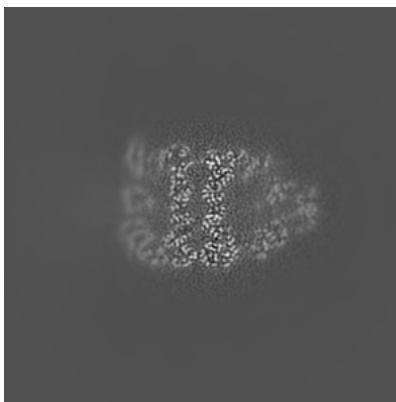


## 6.3 Largest variance slices [i](#)

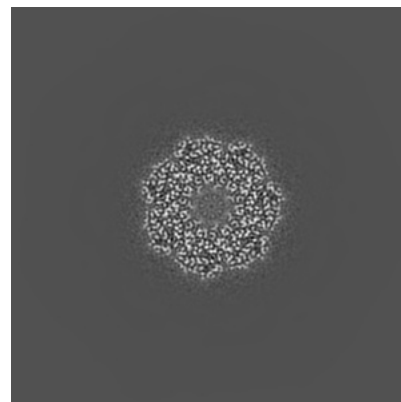
### 6.3.1 Primary map



X Index: 162

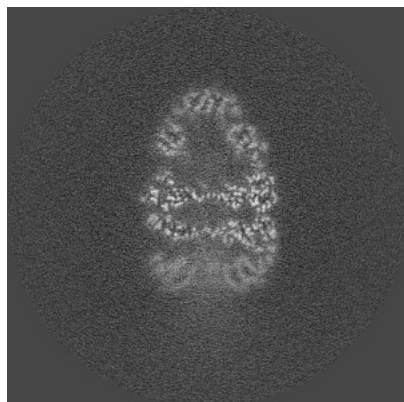


Y Index: 163

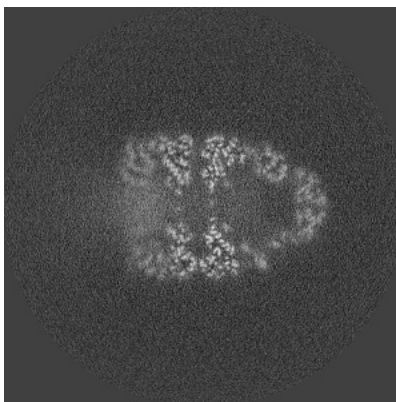


Z Index: 204

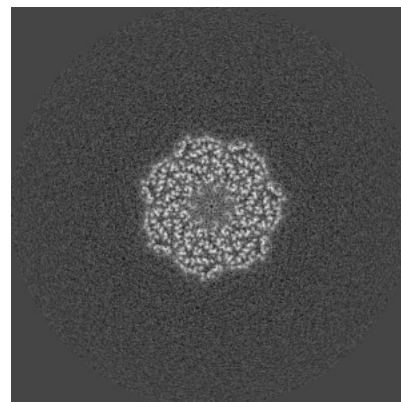
### 6.3.2 Raw map



X Index: 172



Y Index: 213



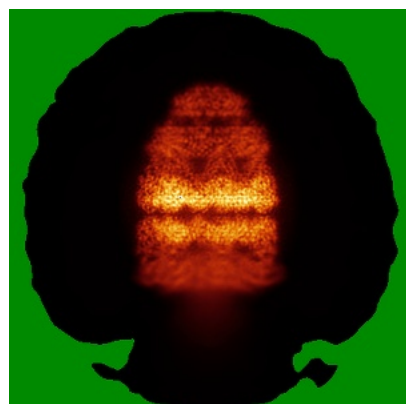
Z Index: 204

The images above show the largest variance slices of the map in three orthogonal directions.

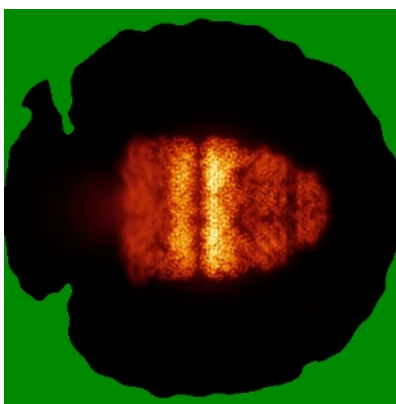


## 6.4 Orthogonal standard-deviation projections (False-color) [i](#)

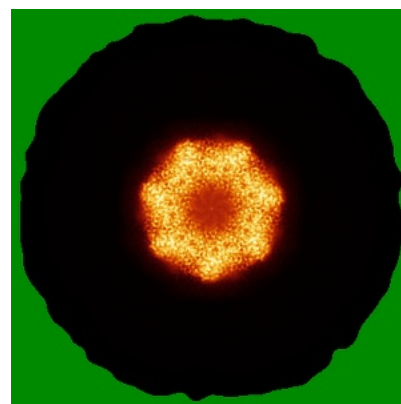
### 6.4.1 Primary map



X

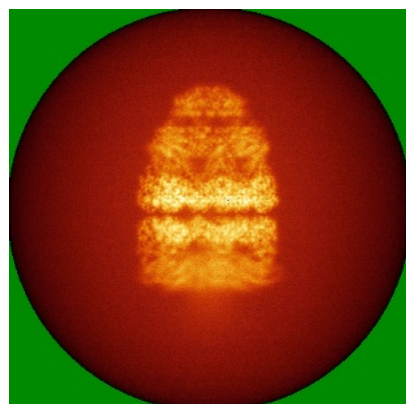


Y

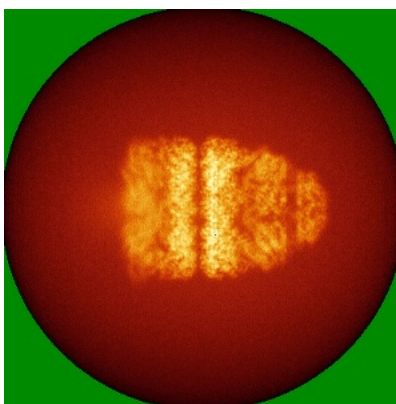


Z

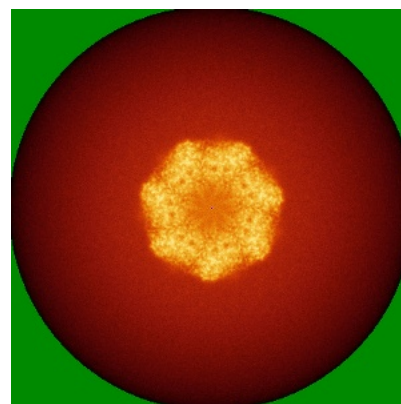
### 6.4.2 Raw map



X



Y



Z

The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

## 6.5 Orthogonal surface views [i](#)

This section was not generated.



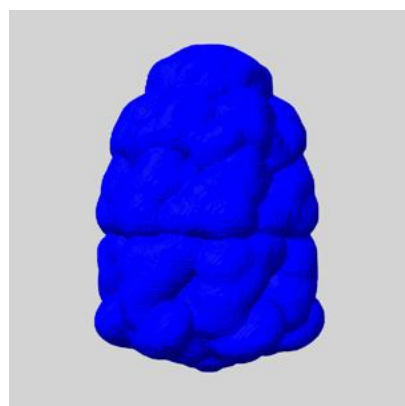
## 6.6 Mask visualisation [i](#)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

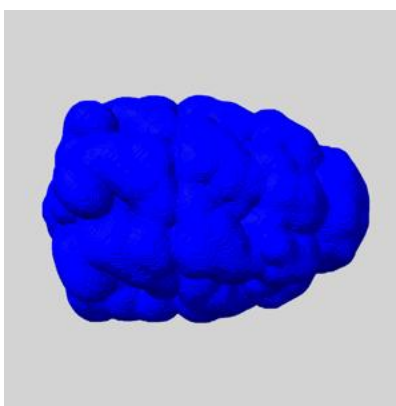
A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

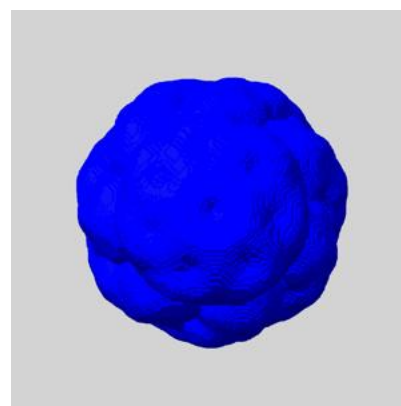
### 6.6.1 emd\_16119\_msk\_1.map [i](#)



X



Y



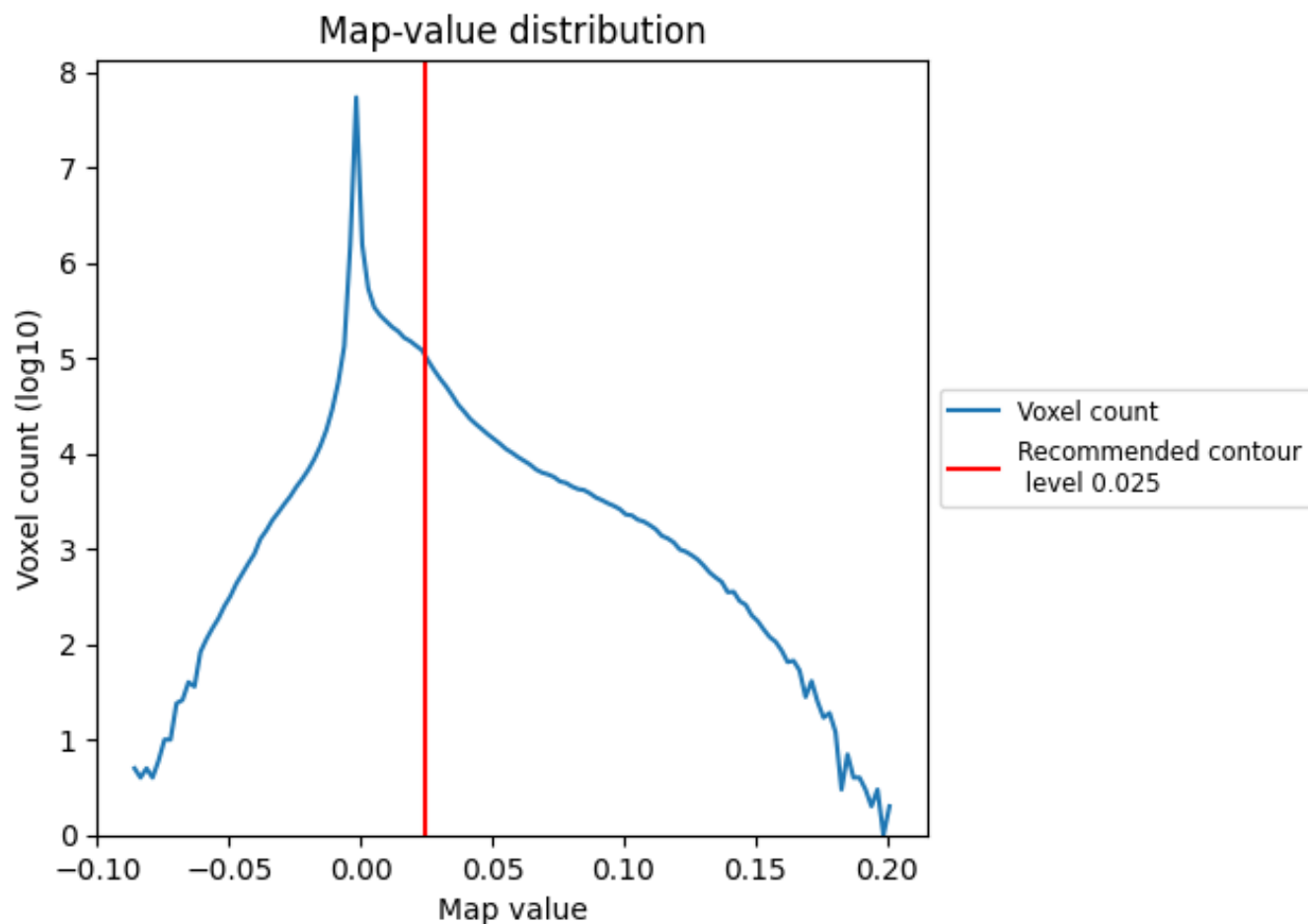
Z



## 7 Map analysis [i](#)

This section contains the results of statistical analysis of the map.

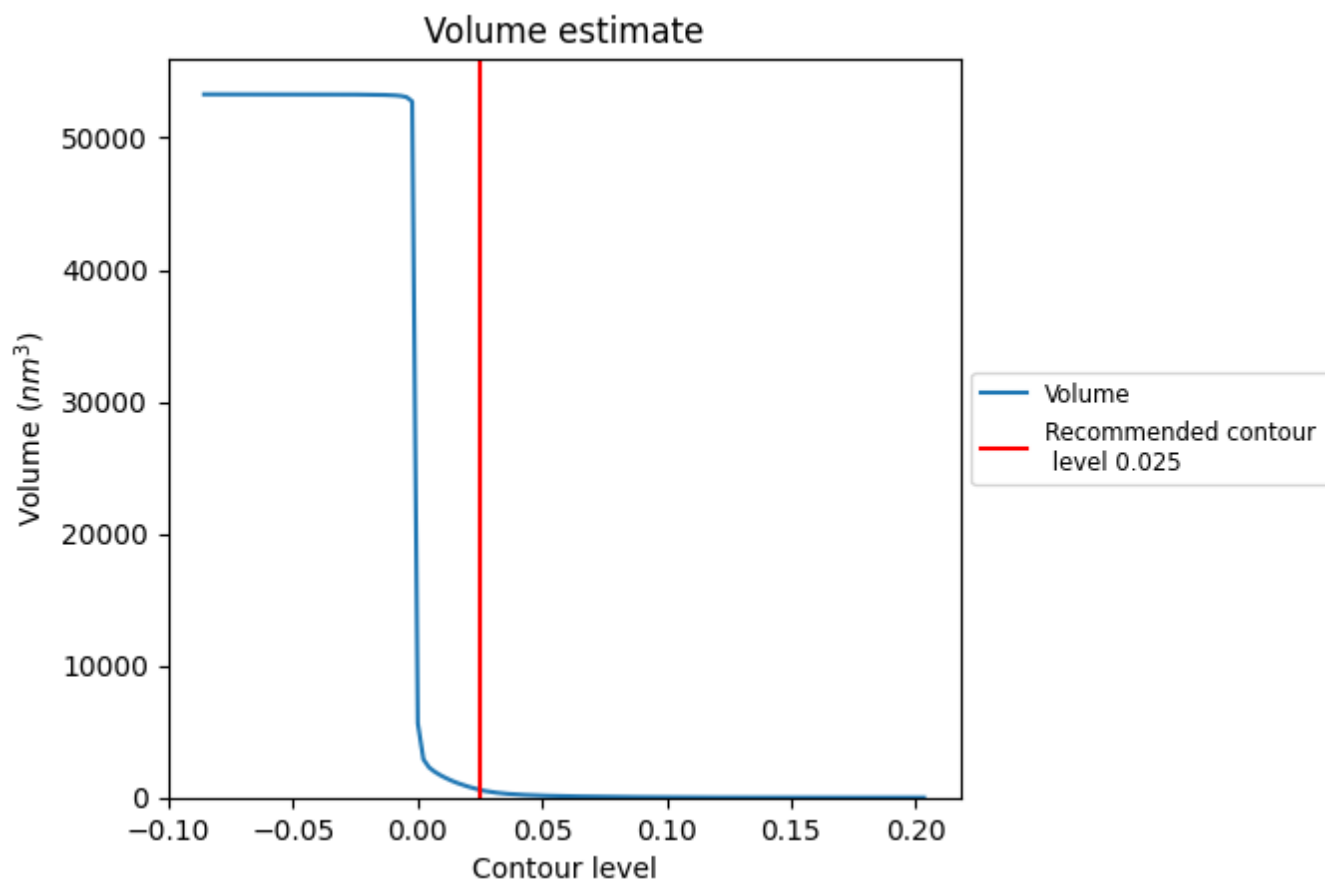
### 7.1 Map-value distribution [i](#)



The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.



## 7.2 Volume estimate [i](#)

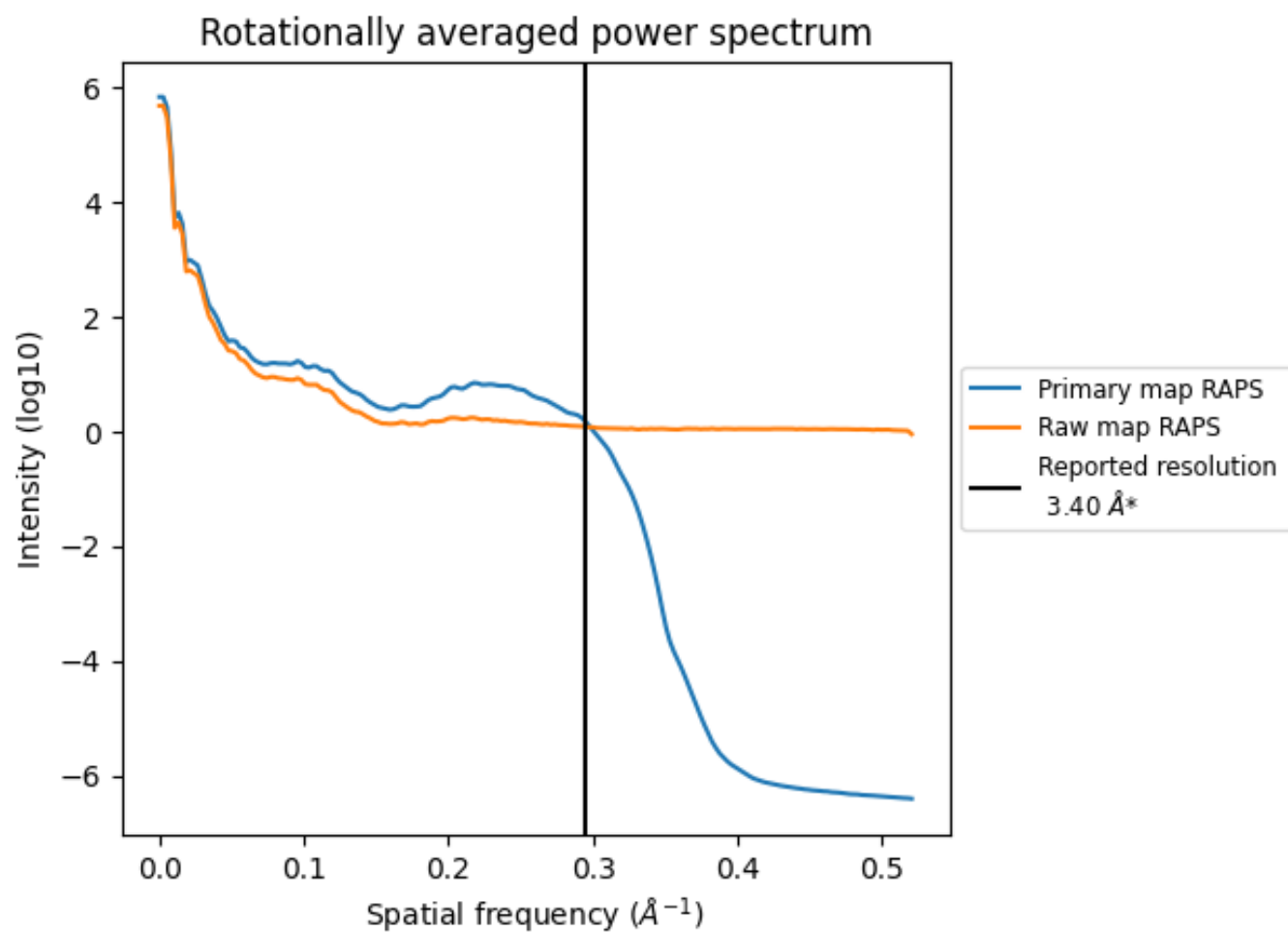


The volume at the recommended contour level is 583 nm<sup>3</sup>; this corresponds to an approximate mass of 527 kDa.

The volume estimate graph shows how the enclosed volume varies with the contour level. The recommended contour level is shown as a vertical line and the intersection between the line and the curve gives the volume of the enclosed surface at the given level.



### 7.3 Rotationally averaged power spectrum [i](#)



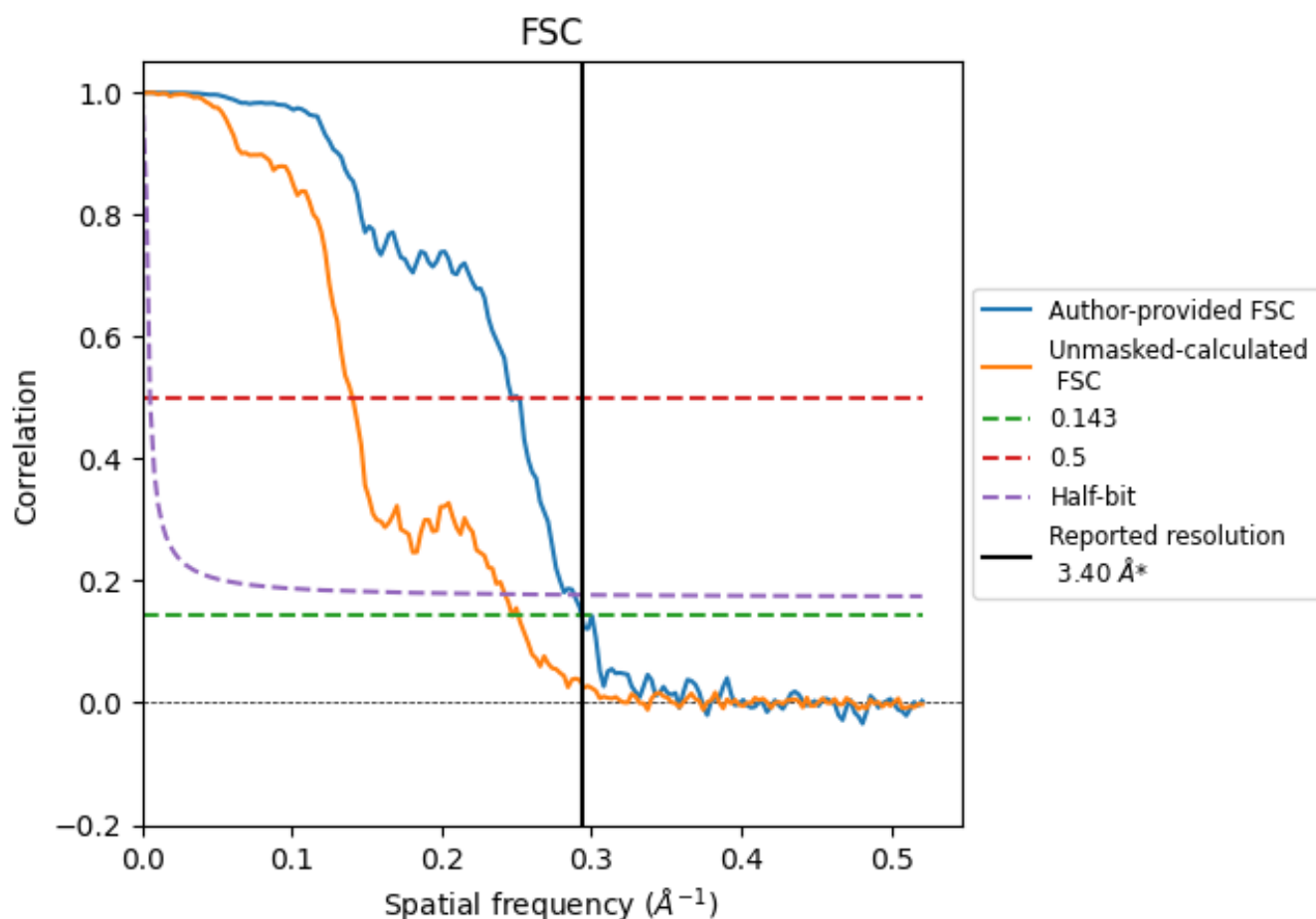
\*Reported resolution corresponds to spatial frequency of 0.294 Å<sup>-1</sup>



## 8 Fourier-Shell correlation [i](#)

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

### 8.1 FSC [i](#)



\*Reported resolution corresponds to spatial frequency of 0.294  $\text{\AA}^{-1}$



## 8.2 Resolution estimates [i](#)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.40	-	-
Author-provided FSC curve	3.41	4.05	3.47
Unmasked-calculated*	4.05	7.12	4.13

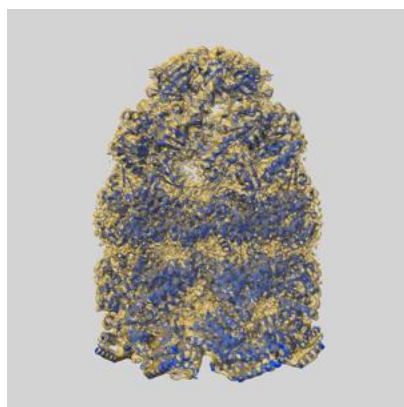
\*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 4.05 differs from the reported value 3.4 by more than 10 %



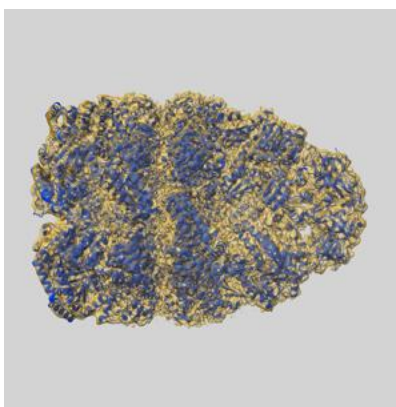
## 9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-16119 and PDB model 8BMO. Per-residue inclusion information can be found in section [3](#) on page [8](#).

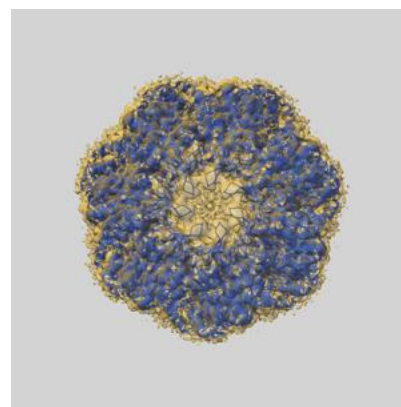
### 9.1 Map-model overlay [i](#)



X



Y

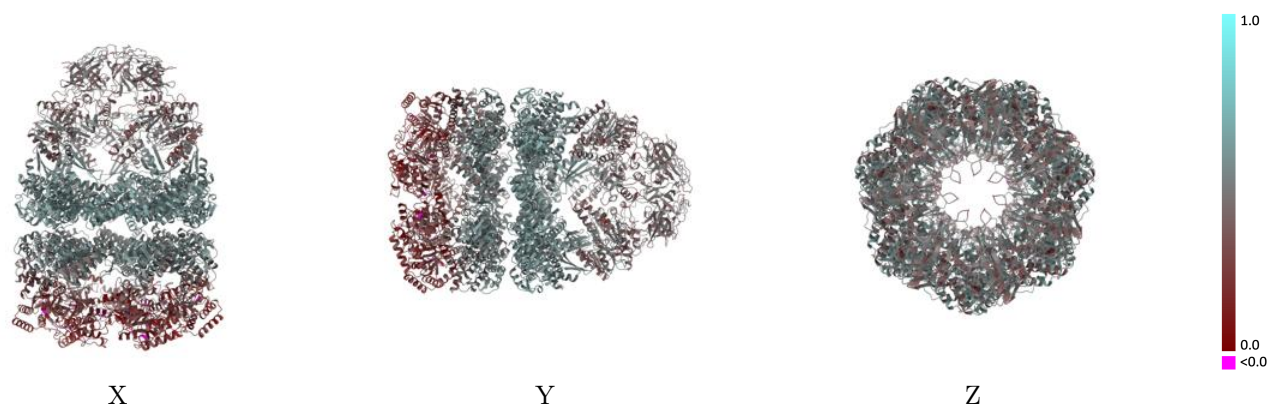


Z

The images above show the 3D surface view of the map at the recommended contour level 0.025 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

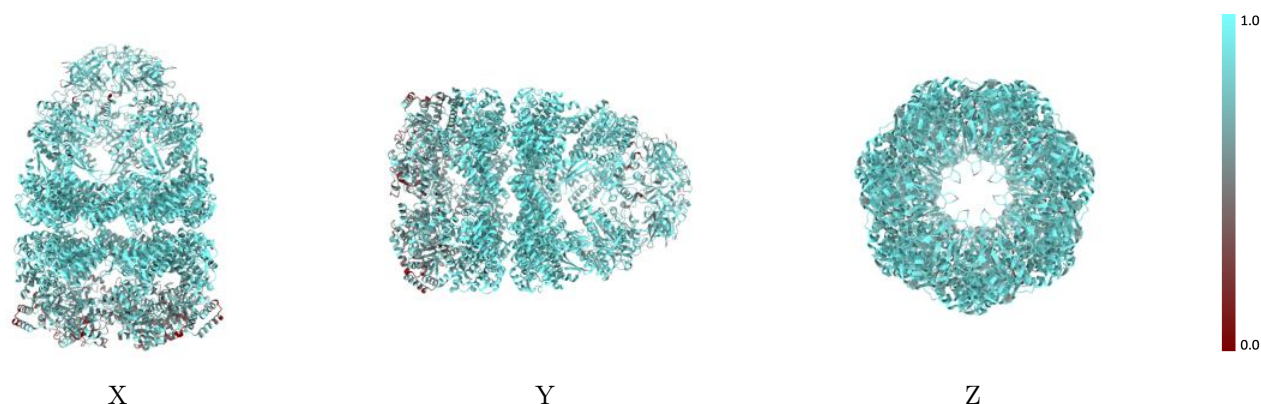


## 9.2 Q-score mapped to coordinate model [i](#)



The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

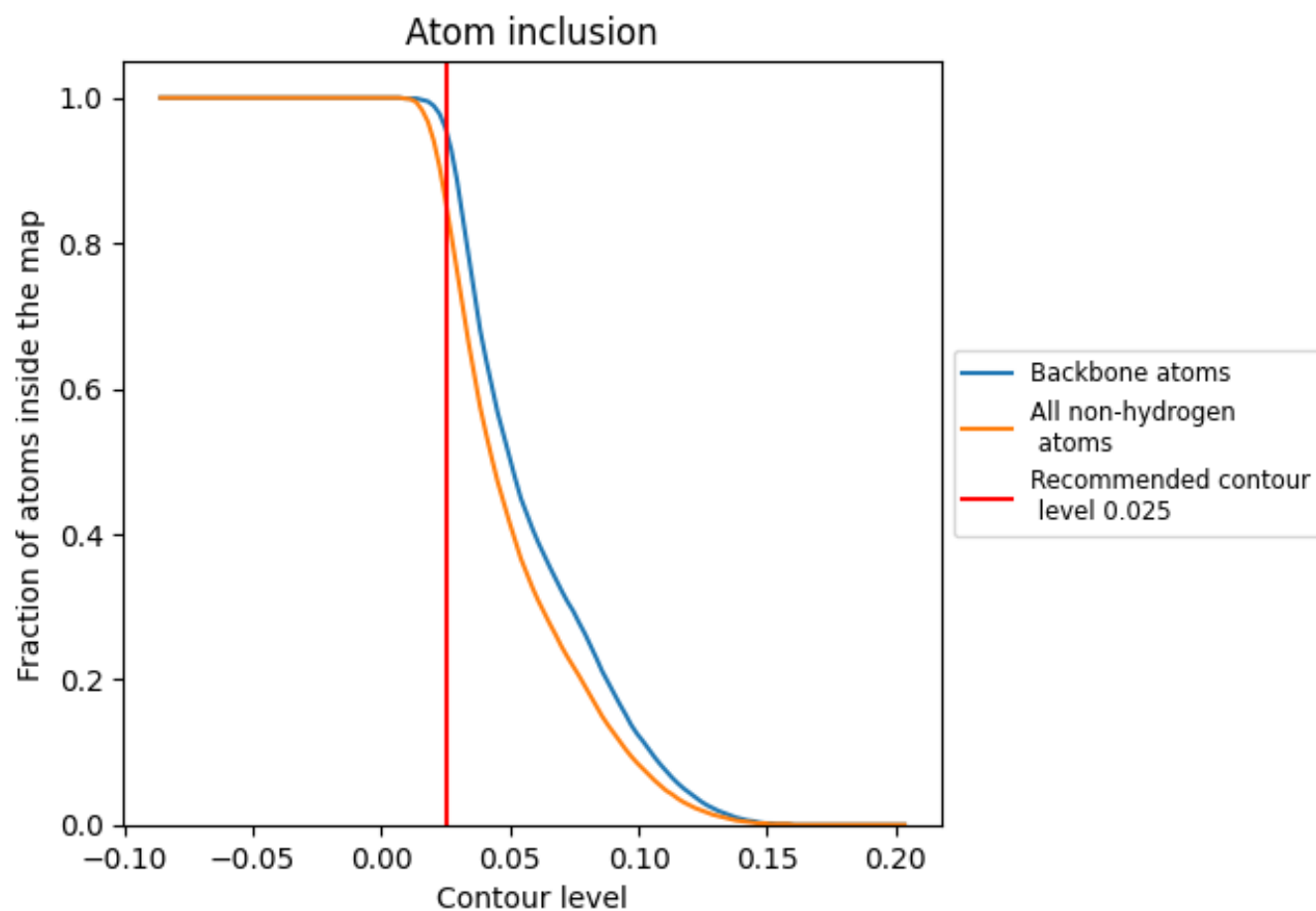
## 9.3 Atom inclusion mapped to coordinate model [i](#)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.025).



## 9.4 Atom inclusion [i](#)















































At the recommended contour level, 96% of all backbone atoms, 86% of all non-hydrogen atoms, are inside the map.



## 9.5 Map-model fit summary

The table lists the average atom inclusion at the recommended contour level (0.025) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8580	 0.4420
A	 0.8070	 0.3730
B	 0.9240	 0.5170
C	 0.8090	 0.3730
D	 0.7780	 0.4180
E	 0.8100	 0.3730
F	 0.9230	 0.5140
G	 0.7790	 0.4240
H	 0.8100	 0.3730
I	 0.9220	 0.5140
J	 0.9220	 0.5140
K	 0.7700	 0.4180
L	 0.8060	 0.3690
M	 0.9220	 0.5150
N	 0.7740	 0.4180
O	 0.8110	 0.3770
P	 0.9240	 0.5140
Q	 0.7680	 0.4180
R	 0.8120	 0.3760
S	 0.9210	 0.5130
T	 0.7740	 0.4250
W	 0.7750	 0.4230

