



wwPDB EM Validation Summary Report ⓘ

Mar 30, 2026 – 05:04 PM UTC

PDB ID : 7Z15 / pdb_00007z15
EMDB ID : EMD-14441
Title : E. coli C-P lyase bound to a PhnK/PhnL dual ABC dimer and ADP + Pi
Authors : Amstrup, S.K.; Sofos, N.; Karlsen, J.L.; Skjerning, R.B.; Boesen, T.; Enghild, J.J.; Hove-Jensen, B.; Brodersen, D.E.
Deposited on : 2022-02-24
Resolution : 1.93 Å(reported)
Based on initial model : 4XB6

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

We welcome your comments at 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>.

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

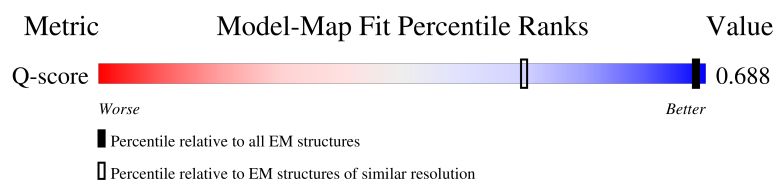
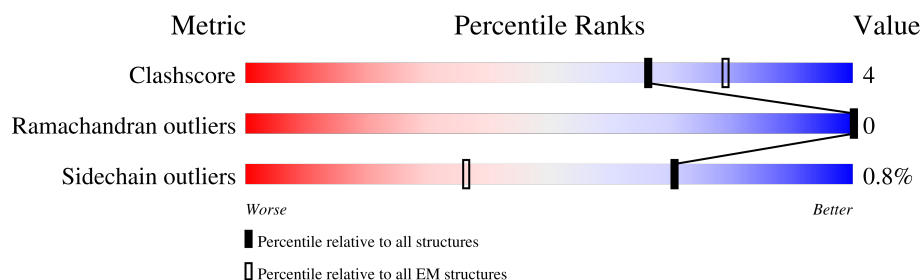
EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data 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 1.93 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.



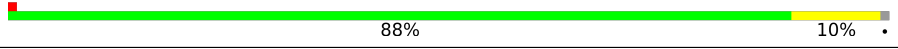
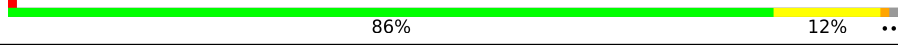
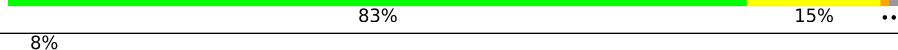
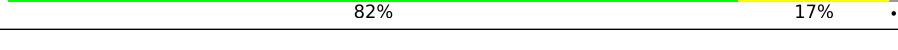
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	1227 (1.45 - 2.42)

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 ≥ 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	150	80% 15% • 5%
1	E	150	79% 15% • 5%
2	B	194	82% 16% ..
2	F	194	82% 15% ...

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Mol	Chain	Length	Quality of chain
3	C	354	 90% 10%
3	G	354	 88% 12%
4	D	281	 88% 10% .
4	H	281	 86% 12% ..
5	I	291	 77% 10% . 13%
5	J	291	 78% 9% 13%
6	K	226	 8% 83% 15% ..
6	L	226	 8% 82% 17% .

2 Entry composition [i](#)

There are 13 unique types of molecules in this entry. The entry contains 46176 atoms, of which 22421 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 Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnG.

Mol	Chain	Residues	Atoms						AltConf	Trace
1	A	143	Total	C	H	N	O	S	0	0
			2195	682	1091	209	207	6		
1	E	143	Total	C	H	N	O	S	0	0
			2195	682	1091	209	207	6		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	85	LEU	GLN	conflict	UNP P16685
E	85	LEU	GLN	conflict	UNP P16685

- Molecule 2 is a protein called Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnH.

Mol	Chain	Residues	Atoms						AltConf	Trace
2	B	193	Total	C	H	N	O	S	0	0
			2961	926	1494	256	278	7		
2	F	193	Total	C	H	N	O	S	0	0
			2961	926	1494	256	278	7		

- Molecule 3 is a protein called Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnI.

Mol	Chain	Residues	Atoms						AltConf	Trace
3	C	353	Total	C	H	N	O	S	0	0
			5412	1713	2679	478	531	11		
3	G	353	Total	C	H	N	O	S	0	0
			5413	1713	2680	478	531	11		

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	264	ASP	GLY	conflict	UNP P16687
C	351	LYS	GLN	conflict	UNP P16687
G	264	ASP	GLY	conflict	UNP P16687
G	351	LYS	GLN	conflict	UNP P16687

- Molecule 4 is a protein called Alpha-D-ribose 1-methylphosphonate 5-phosphate C-P lyase.

Mol	Chain	Residues	Atoms						AltConf	Trace
4	D	278	Total	C	H	N	O	S	0	0
			4365	1399	2153	378	421	14		
4	H	278	Total	C	H	N	O	S	0	0
			4365	1399	2153	378	421	14		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	103	LEU	VAL	conflict	UNP P16688
H	103	LEU	VAL	conflict	UNP P16688

- Molecule 5 is a protein called Putative phosphonates utilization ATP-binding protein PhnK.

Mol	Chain	Residues	Atoms						AltConf	Trace
5	I	253	Total	C	H	N	O	S	0	0
			3950	1232	1985	360	368	5		
5	J	253	Total	C	H	N	O	S	0	0
			3950	1232	1985	360	368	5		

There are 78 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
I	253	GLU	-	expression tag	UNP P16678
I	254	ASN	-	expression tag	UNP P16678
I	255	LEU	-	expression tag	UNP P16678
I	256	TYR	-	expression tag	UNP P16678
I	257	PHE	-	expression tag	UNP P16678
I	258	GLN	-	expression tag	UNP P16678
I	259	GLY	-	expression tag	UNP P16678
I	260	GLN	-	expression tag	UNP P16678
I	261	PHE	-	expression tag	UNP P16678
I	262	GLY	-	expression tag	UNP P16678
I	263	SER	-	expression tag	UNP P16678
I	264	TRP	-	expression tag	UNP P16678
I	265	SER	-	expression tag	UNP P16678

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Chain	Residue	Modelled	Actual	Comment	Reference
I	266	HIS	-	expression tag	UNP P16678
I	267	PRO	-	expression tag	UNP P16678
I	268	GLN	-	expression tag	UNP P16678
I	269	PHE	-	expression tag	UNP P16678
I	270	GLU	-	expression tag	UNP P16678
I	271	LYS	-	expression tag	UNP P16678
I	272	GLY	-	expression tag	UNP P16678
I	273	GLY	-	expression tag	UNP P16678
I	274	GLY	-	expression tag	UNP P16678
I	275	SER	-	expression tag	UNP P16678
I	276	GLY	-	expression tag	UNP P16678
I	277	GLY	-	expression tag	UNP P16678
I	278	GLY	-	expression tag	UNP P16678
I	279	SER	-	expression tag	UNP P16678
I	280	GLY	-	expression tag	UNP P16678
I	281	GLY	-	expression tag	UNP P16678
I	282	GLY	-	expression tag	UNP P16678
I	283	SER	-	expression tag	UNP P16678
I	284	TRP	-	expression tag	UNP P16678
I	285	SER	-	expression tag	UNP P16678
I	286	HIS	-	expression tag	UNP P16678
I	287	PRO	-	expression tag	UNP P16678
I	288	GLN	-	expression tag	UNP P16678
I	289	PHE	-	expression tag	UNP P16678
I	290	GLU	-	expression tag	UNP P16678
I	291	LYS	-	expression tag	UNP P16678
J	253	GLU	-	expression tag	UNP P16678
J	254	ASN	-	expression tag	UNP P16678
J	255	LEU	-	expression tag	UNP P16678
J	256	TYR	-	expression tag	UNP P16678
J	257	PHE	-	expression tag	UNP P16678
J	258	GLN	-	expression tag	UNP P16678
J	259	GLY	-	expression tag	UNP P16678
J	260	GLN	-	expression tag	UNP P16678
J	261	PHE	-	expression tag	UNP P16678
J	262	GLY	-	expression tag	UNP P16678
J	263	SER	-	expression tag	UNP P16678
J	264	TRP	-	expression tag	UNP P16678
J	265	SER	-	expression tag	UNP P16678
J	266	HIS	-	expression tag	UNP P16678
J	267	PRO	-	expression tag	UNP P16678
J	268	GLN	-	expression tag	UNP P16678

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Chain	Residue	Modelled	Actual	Comment	Reference
J	269	PHE	-	expression tag	UNP P16678
J	270	GLU	-	expression tag	UNP P16678
J	271	LYS	-	expression tag	UNP P16678
J	272	GLY	-	expression tag	UNP P16678
J	273	GLY	-	expression tag	UNP P16678
J	274	GLY	-	expression tag	UNP P16678
J	275	SER	-	expression tag	UNP P16678
J	276	GLY	-	expression tag	UNP P16678
J	277	GLY	-	expression tag	UNP P16678
J	278	GLY	-	expression tag	UNP P16678
J	279	SER	-	expression tag	UNP P16678
J	280	GLY	-	expression tag	UNP P16678
J	281	GLY	-	expression tag	UNP P16678
J	282	GLY	-	expression tag	UNP P16678
J	283	SER	-	expression tag	UNP P16678
J	284	TRP	-	expression tag	UNP P16678
J	285	SER	-	expression tag	UNP P16678
J	286	HIS	-	expression tag	UNP P16678
J	287	PRO	-	expression tag	UNP P16678
J	288	GLN	-	expression tag	UNP P16678
J	289	PHE	-	expression tag	UNP P16678
J	290	GLU	-	expression tag	UNP P16678
J	291	LYS	-	expression tag	UNP P16678

- Molecule 6 is a protein called Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnL.

Mol	Chain	Residues	Atoms						AltConf	Trace
6	K	224	Total	C	H	N	O	S	0	0
			3503	1090	1776	319	313	5		
6	L	224	Total	C	H	N	O	S	0	0
			3503	1090	1776	319	313	5		

- Molecule 7 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

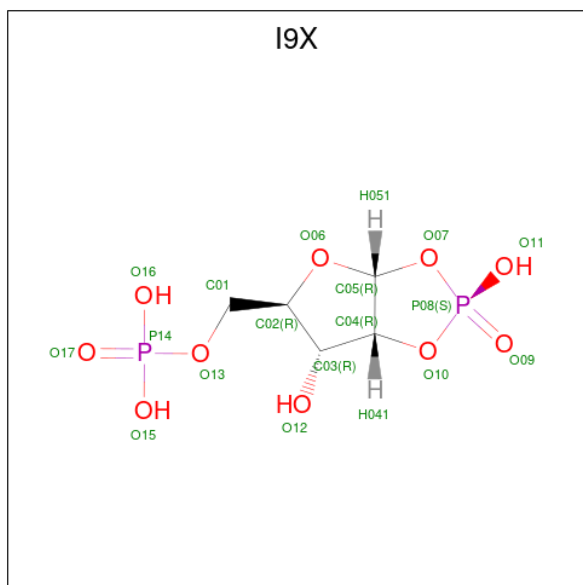
Mol	Chain	Residues	Atoms		AltConf
7	C	1	Total	Zn	0
			1	1	
7	D	1	Total	Zn	0
			1	1	
7	G	1	Total	Zn	0
			1	1	

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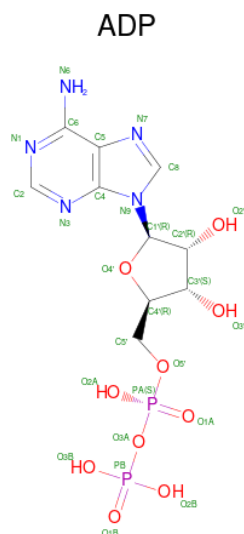
Mol	Chain	Residues	Atoms		AltConf
7	H	1	Total	Zn	0
			1	1	

- Molecule 8 is alpha-D-ribose-1,2-cyclic-phosphate-5-phosphate (CCD ID: I9X) (formula: $C_5H_{10}O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).



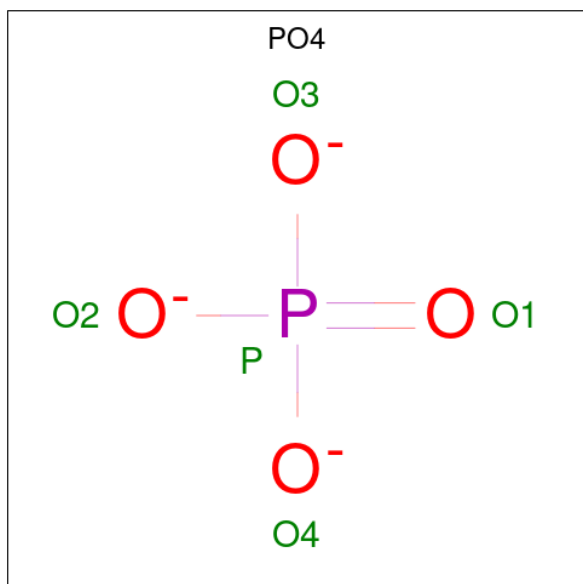
Mol	Chain	Residues	Atoms					AltConf
8	D	1	Total	C	H	O	P	0
			25	5	8	10	2	
8	H	1	Total	C	H	O	P	0
			25	5	8	10	2	

- Molecule 9 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms						AltConf
9	I	1	Total 39	C 10	H 12	N 5	O 10	P 2	0
9	J	1	Total 39	C 10	H 12	N 5	O 10	P 2	0

- Molecule 10 is PHOSPHATE ION (CCD ID: PO4) (formula: O_4P) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			AltConf
10	I	1	Total	O	P	0
			5	4	1	

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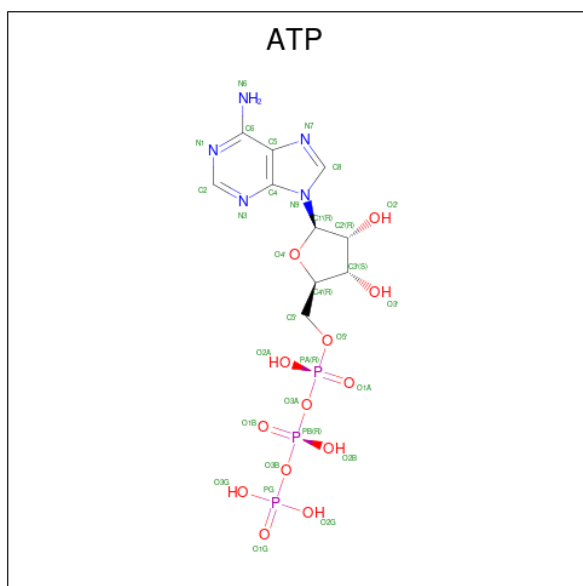
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Mol	Chain	Residues	Atoms			AltConf
10	J	1	Total	O	P	0
			5	4	1	

- Molecule 11 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
11	I	1	Total	Mg	0
			1	1	
11	J	1	Total	Mg	0
			1	1	
11	K	1	Total	Mg	0
			1	1	
11	L	1	Total	Mg	0
			1	1	

- Molecule 12 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).



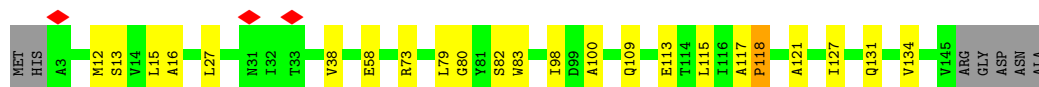
Mol	Chain	Residues	Atoms		AltConf
13	A	58	Total 58	O 58	0
13	B	73	Total 73	O 73	0
13	C	210	Total 210	O 210	0
13	D	170	Total 170	O 170	0
13	E	56	Total 56	O 56	0
13	F	73	Total 73	O 73	0
13	G	220	Total 220	O 220	0
13	H	162	Total 162	O 162	0
13	I	69	Total 69	O 69	0
13	J	69	Total 69	O 69	0
13	K	5	Total 5	O 5	0
13	L	6	Total 6	O 6	0

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.

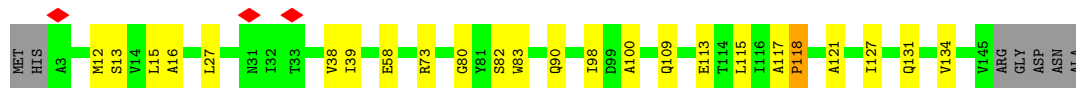
- Molecule 1: Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnG

Chain A: 



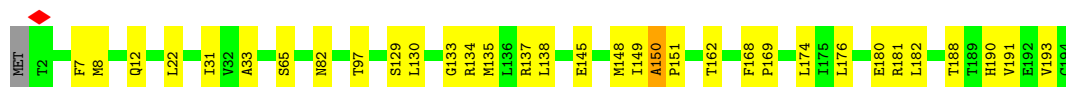
- Molecule 1: Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnG

Chain E: 



- Molecule 2: Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnH

Chain B: 



- Molecule 2: Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnH

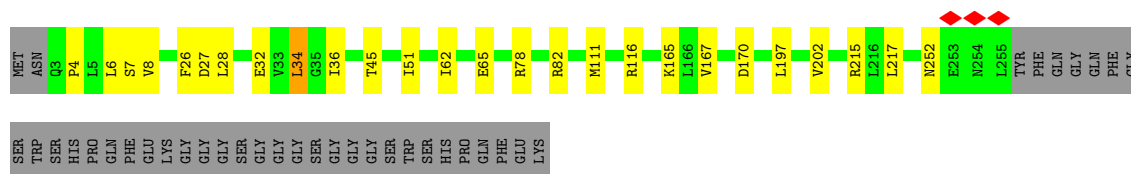
Chain F: 



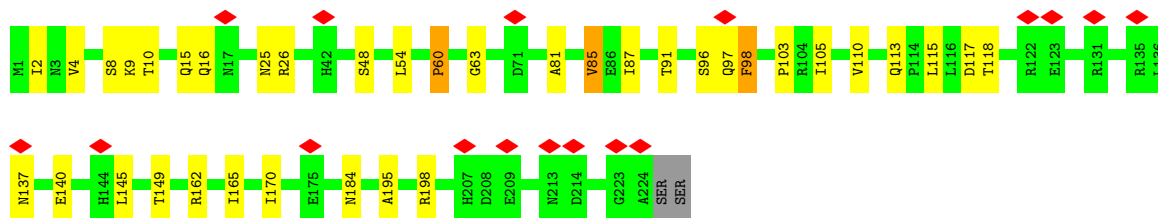
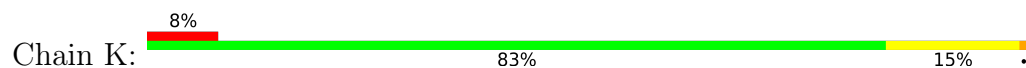
- Molecule 3: Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnI

Chain C: 

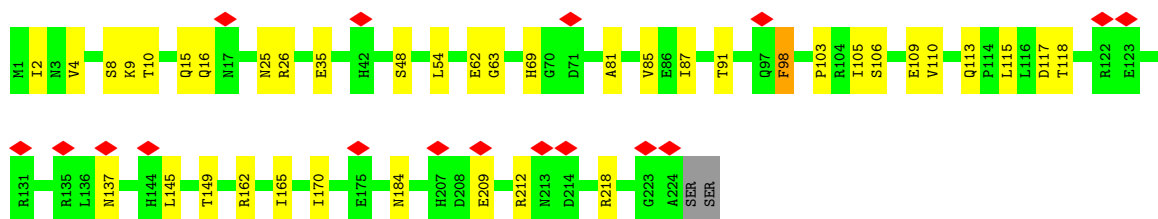
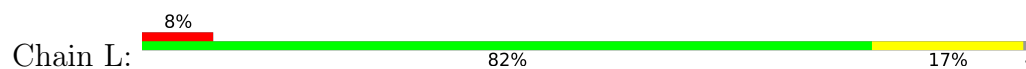




- Molecule 6: Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnL



- Molecule 6: Alpha-D-ribose 1-methylphosphonate 5-triphosphate synthase subunit PhnL



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C2	Depositor
Number of particles used	222056	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	62	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	1400	Depositor
Magnification	135000	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	4.971	Depositor
Minimum map value	-1.543	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.069	Depositor
Recommended contour level	0.6	Depositor
Map size (Å)	401.136, 401.136, 401.136	wwPDB
Map dimensions	480, 480, 480	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.8357, 0.8357, 0.8357	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: I9X, PO4, ATP, ZN, ADP, 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	0.84	7/1120 (0.6%)	0.69	7/1516 (0.5%)
1	E	0.84	7/1120 (0.6%)	0.69	7/1516 (0.5%)
2	B	1.15	14/1495 (0.9%)	0.69	3/2044 (0.1%)
2	F	1.11	15/1495 (1.0%)	0.72	5/2044 (0.2%)
3	C	0.78	11/2787 (0.4%)	0.55	5/3779 (0.1%)
3	G	0.99	20/2787 (0.7%)	0.67	12/3779 (0.3%)
4	D	0.64	7/2265 (0.3%)	0.49	3/3078 (0.1%)
4	H	0.93	15/2265 (0.7%)	0.60	4/3078 (0.1%)
5	I	0.93	16/1999 (0.8%)	0.71	9/2714 (0.3%)
5	J	0.63	9/1999 (0.5%)	0.56	4/2714 (0.1%)
6	K	0.47	3/1758 (0.2%)	0.57	3/2391 (0.1%)
6	L	0.40	2/1758 (0.1%)	0.52	2/2391 (0.1%)
All	All	0.83	126/22848 (0.6%)	0.62	64/31044 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
4	D	0	1
4	H	0	1
All	All	0	2

The worst 5 of 126 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	G	219	HIS	C-O	-20.86	1.14	1.23
3	C	219	HIS	C-O	-20.11	1.14	1.23
3	G	245	VAL	C-O	-19.66	1.02	1.24
3	C	245	VAL	C-O	-19.64	1.02	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	151	GLY	C-O	-18.76	1.01	1.23

The worst 5 of 64 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	H	171	TYR	CB-CA-C	7.48	127.35	110.67
4	D	171	TYR	CB-CA-C	7.42	127.22	110.67
3	G	220	PRO	N-CA-CB	7.31	110.14	103.19
3	C	340	GLU	CA-C-O	-7.28	113.11	120.90
3	G	339	ALA	N-CA-C	-7.11	103.46	111.14

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
4	D	18	ARG	Sidechain
4	H	18	ARG	Sidechain

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	1104	1091	1091	12	0
1	E	1104	1091	1091	13	0
2	B	1467	1494	1494	21	0
2	F	1467	1494	1494	17	0
3	C	2733	2679	2679	17	0
3	G	2733	2680	2679	17	0
4	D	2212	2153	2153	16	0
4	H	2212	2153	2153	16	0
5	I	1965	1985	1983	9	0
5	J	1965	1985	1983	11	0
6	K	1727	1776	1776	24	0
6	L	1727	1776	1776	26	0
7	C	1	0	0	0	0
7	D	1	0	0	0	0
7	G	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	H	1	0	0	0	0
8	D	17	8	0	0	0
8	H	17	8	0	0	0
9	I	27	12	12	1	0
9	J	27	12	12	1	0
10	I	5	0	0	0	0
10	J	5	0	0	0	0
11	I	1	0	0	0	0
11	J	1	0	0	0	0
11	K	1	0	0	0	0
11	L	1	0	0	0	0
12	K	31	12	12	1	0
12	L	31	12	12	1	0
13	A	58	0	0	1	0
13	B	73	0	0	2	0
13	C	210	0	0	3	0
13	D	170	0	0	4	0
13	E	56	0	0	1	0
13	F	73	0	0	2	0
13	G	220	0	0	2	0
13	H	162	0	0	4	0
13	I	69	0	0	1	0
13	J	69	0	0	1	0
13	K	5	0	0	2	0
13	L	6	0	0	2	0
All	All	23755	22421	22400	175	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 4.

The worst 5 of 175 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)
4:D:258:ASP:OD1	3:G:161:ARG:NH2	2.23	0.71
3:C:161:ARG:NH2	4:H:258:ASP:OD1	2.24	0.71
2:B:135:MET:HE2	2:B:150:ALA:HB2	1.74	0.69
2:F:7:PHE:O	13:F:201:HOH:O	2.12	0.68
4:D:191:PHE:O	13:D:1101:HOH:O	2.12	0.68

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	A	141/150 (94%)	139 (99%)	2 (1%)	0	100	100
1	E	141/150 (94%)	139 (99%)	2 (1%)	0	100	100
2	B	191/194 (98%)	188 (98%)	3 (2%)	0	100	100
2	F	191/194 (98%)	188 (98%)	3 (2%)	0	100	100
3	C	351/354 (99%)	347 (99%)	4 (1%)	0	100	100
3	G	351/354 (99%)	348 (99%)	3 (1%)	0	100	100
4	D	276/281 (98%)	268 (97%)	8 (3%)	0	100	100
4	H	276/281 (98%)	267 (97%)	9 (3%)	0	100	100
5	I	251/291 (86%)	250 (100%)	1 (0%)	0	100	100
5	J	251/291 (86%)	250 (100%)	1 (0%)	0	100	100
6	K	222/226 (98%)	217 (98%)	5 (2%)	0	100	100
6	L	222/226 (98%)	218 (98%)	4 (2%)	0	100	100
All	All	2864/2992 (96%)	2819 (98%)	45 (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	110/115 (96%)	110 (100%)	0	100	100
1	E	110/115 (96%)	110 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	163/164 (99%)	163 (100%)	0	100	100
2	F	163/164 (99%)	159 (98%)	4 (2%)	42	29
3	C	286/286 (100%)	283 (99%)	3 (1%)	68	64
3	G	286/286 (100%)	284 (99%)	2 (1%)	76	74
4	D	241/244 (99%)	239 (99%)	2 (1%)	73	71
4	H	241/244 (99%)	239 (99%)	2 (1%)	73	71
5	I	214/242 (88%)	214 (100%)	0	100	100
5	J	214/242 (88%)	214 (100%)	0	100	100
6	K	186/188 (99%)	182 (98%)	4 (2%)	45	35
6	L	186/188 (99%)	183 (98%)	3 (2%)	55	46
All	All	2400/2478 (97%)	2380 (99%)	20 (1%)	70	71

5 of 20 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
6	K	60	PRO
6	L	8	SER
6	L	98	PHE
6	L	62	GLU
2	F	103	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 18 such sidechains are listed below:

Mol	Chain	Res	Type
5	J	223	GLN
6	L	57	ASN
6	K	57	ASN
3	G	218	ASN
5	J	10	ASN

5.3.3 RNA ⓘ

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 16 ligands modelled in this entry, 8 are monoatomic - leaving 8 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
12	ATP	K	1000	11	32,33,33	0.28	0	48,52,52	0.67	0
12	ATP	L	1000	11	32,33,33	0.27	0	48,52,52	0.67	0
10	PO4	J	1001	11	4,4,4	1.01	0	6,6,6	0.49	0
9	ADP	I	1000	11	28,29,29	1.38	5 (17%)	43,45,45	1.83	10 (23%)
10	PO4	I	1001	11	4,4,4	1.02	0	6,6,6	0.49	0
8	I9X	D	1001	7	16,18,18	5.85	7 (43%)	23,29,29	1.17	2 (8%)
9	ADP	J	1000	11	28,29,29	1.37	5 (17%)	43,45,45	1.83	10 (23%)
8	I9X	H	1001	7	16,18,18	5.85	7 (43%)	23,29,29	1.17	2 (8%)

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
12	ATP	K	1000	11	-	6/22/38/38	0/3/3/3
12	ATP	L	1000	11	-	6/22/38/38	0/3/3/3
9	ADP	I	1000	11	-	1/16/32/32	0/3/3/3
8	I9X	D	1001	7	-	0/6/32/32	0/2/2/2
9	ADP	J	1000	11	-	1/16/32/32	0/3/3/3
8	I9X	H	1001	7	-	0/6/32/32	0/2/2/2

The worst 5 of 24 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
8	D	1001	I9X	C03-C04	-14.12	1.22	1.53
8	H	1001	I9X	C03-C04	-14.12	1.22	1.53
8	H	1001	I9X	O07-C05	-11.34	1.21	1.46
8	D	1001	I9X	O07-C05	-11.31	1.22	1.46
8	D	1001	I9X	C05-C04	9.98	1.72	1.53

The worst 5 of 24 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	J	1000	ADP	C5-C4-N3	-5.50	119.14	126.72
9	I	1000	ADP	C5-C4-N3	-5.47	119.18	126.72
9	J	1000	ADP	N3-C4-N9	4.42	134.68	127.17
9	I	1000	ADP	N3-C4-N9	4.40	134.64	127.17
9	J	1000	ADP	C2-N3-C4	3.81	121.14	111.83

There are no chirality outliers.

5 of 14 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
12	K	1000	ATP	C5'-O5'-PA-O2A
12	L	1000	ATP	C5'-O5'-PA-O2A
12	K	1000	ATP	C3'-C4'-C5'-O5'
12	L	1000	ATP	C3'-C4'-C5'-O5'
12	K	1000	ATP	O4'-C4'-C5'-O5'

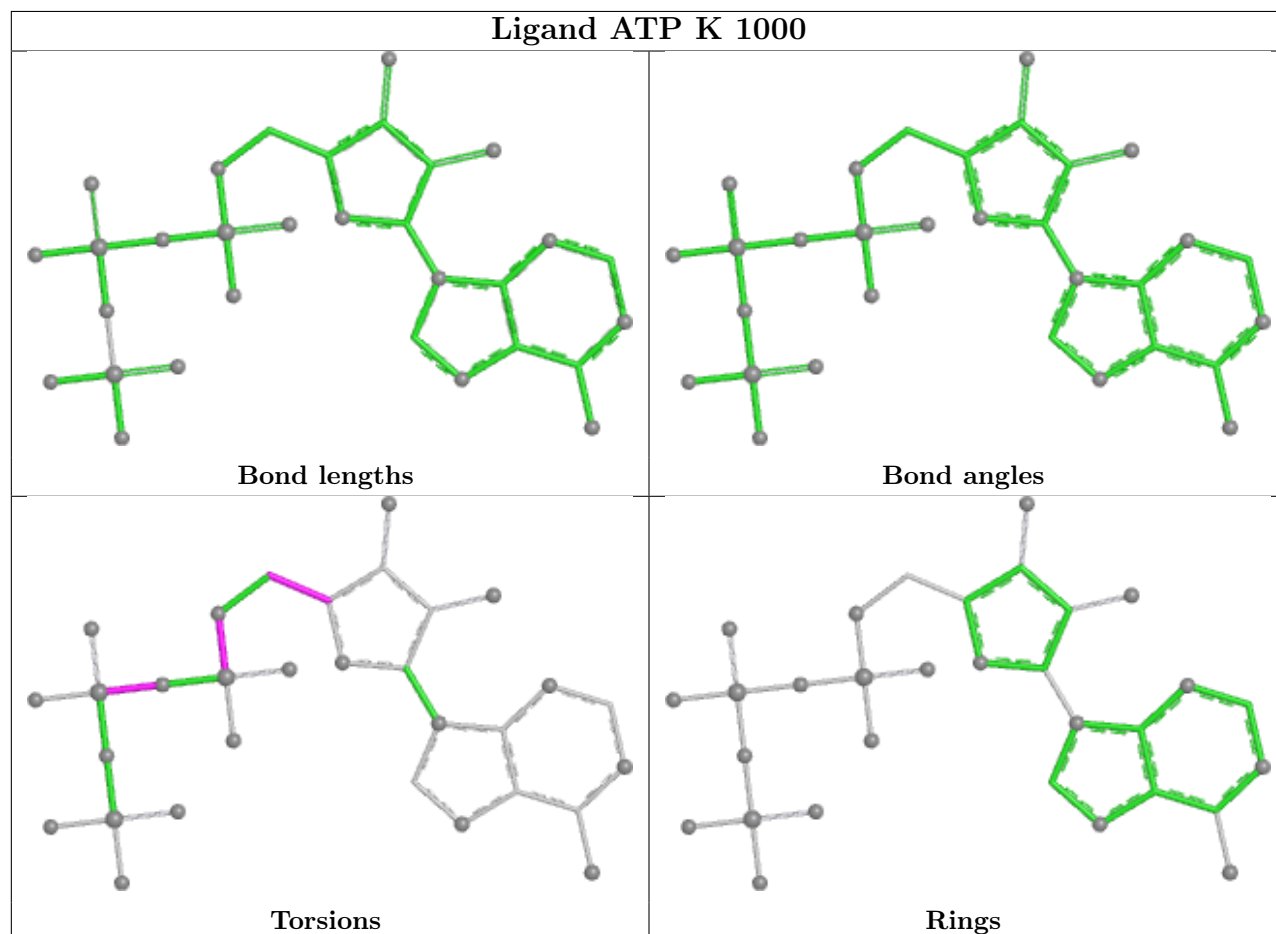
There are no ring outliers.

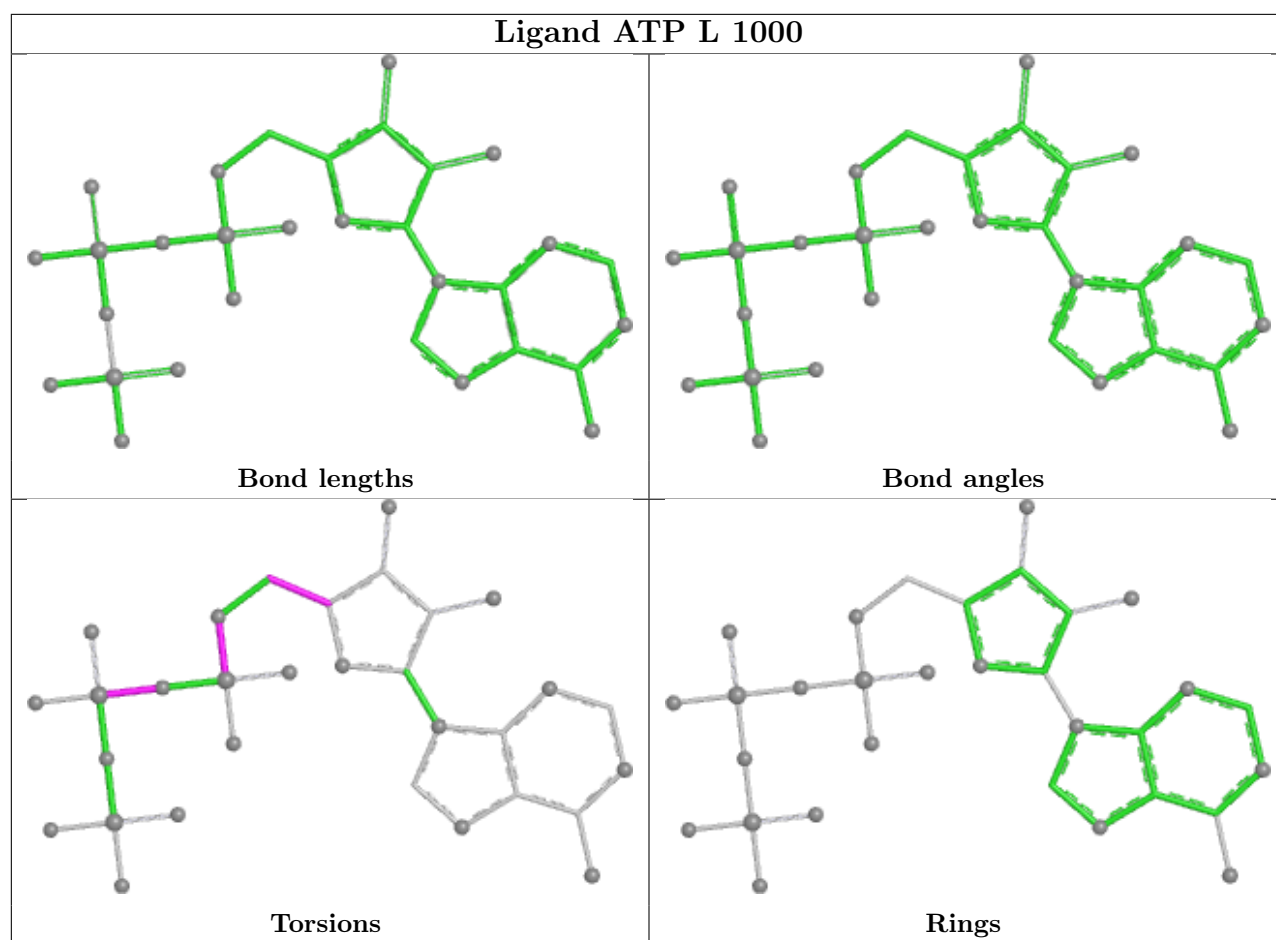
4 monomers are involved in 4 short contacts:

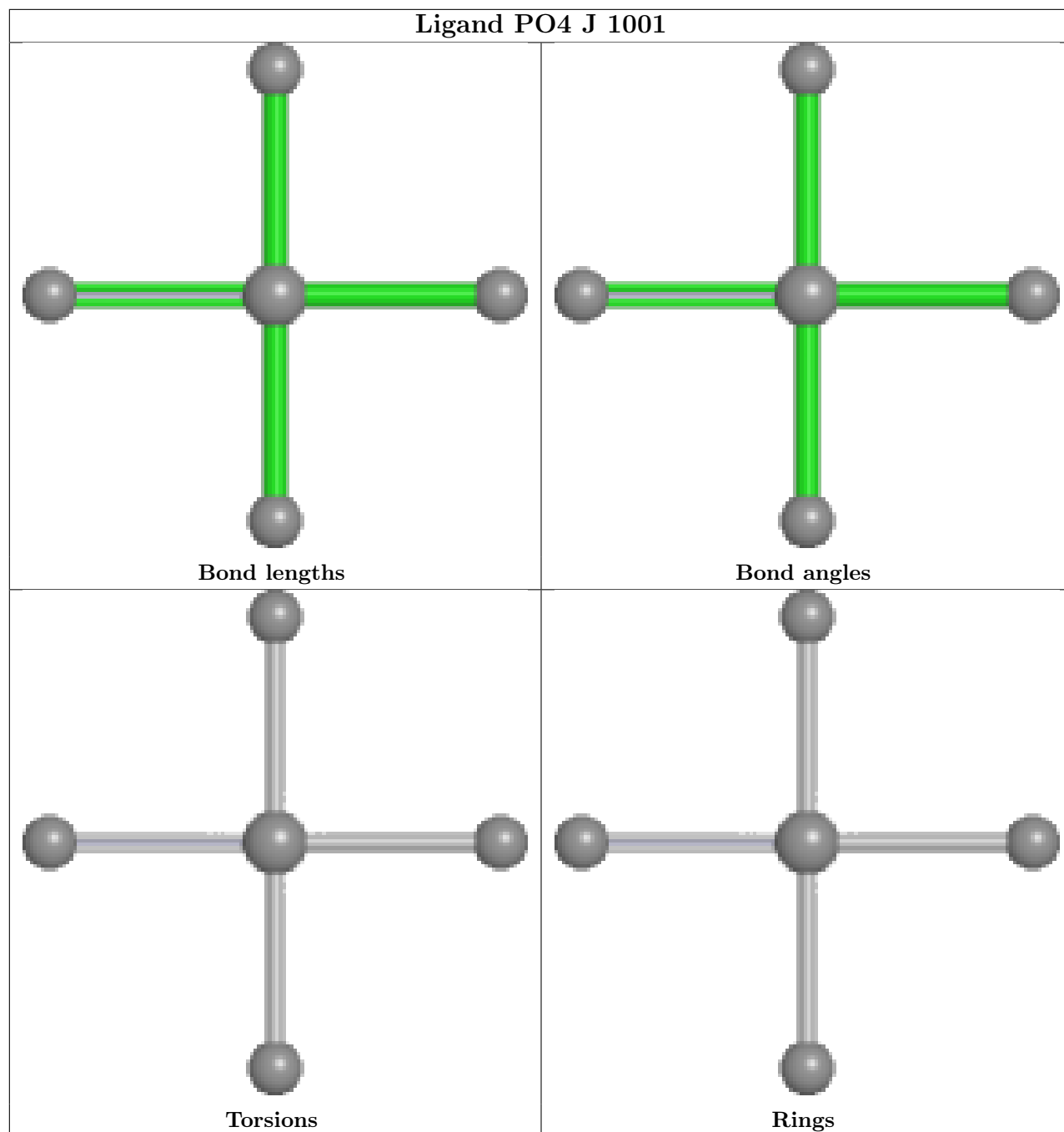
Mol	Chain	Res	Type	Clashes	Symm-Clashes
12	K	1000	ATP	1	0
12	L	1000	ATP	1	0
9	I	1000	ADP	1	0
9	J	1000	ADP	1	0

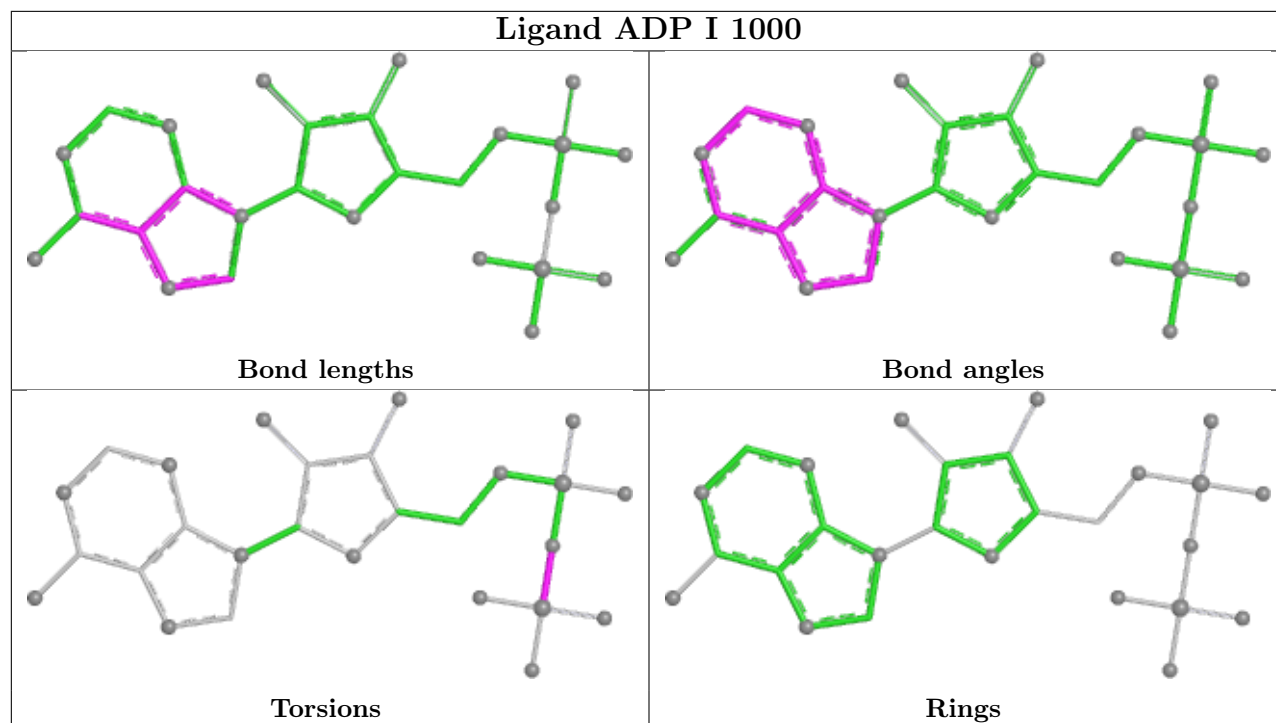
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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

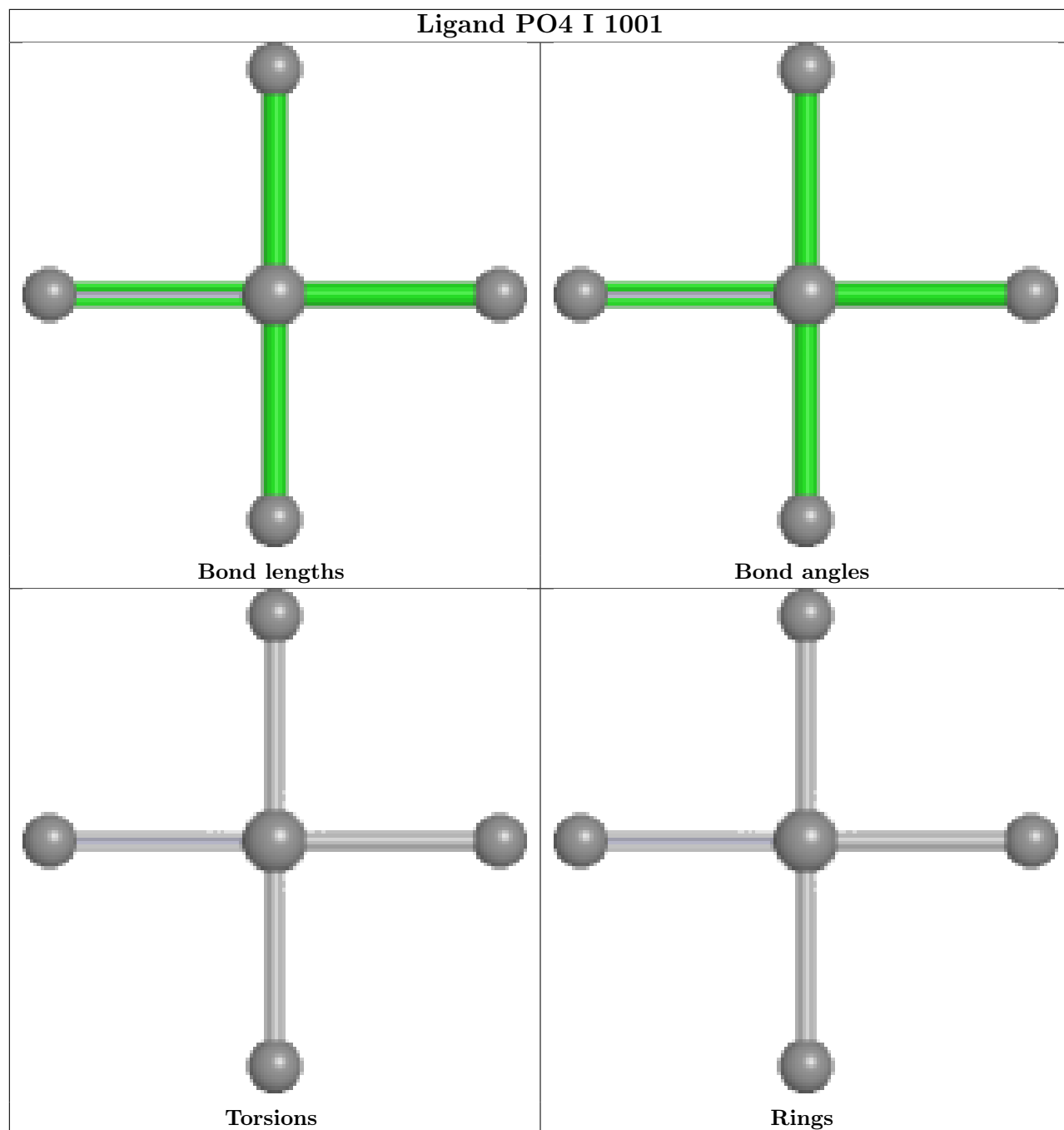
in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

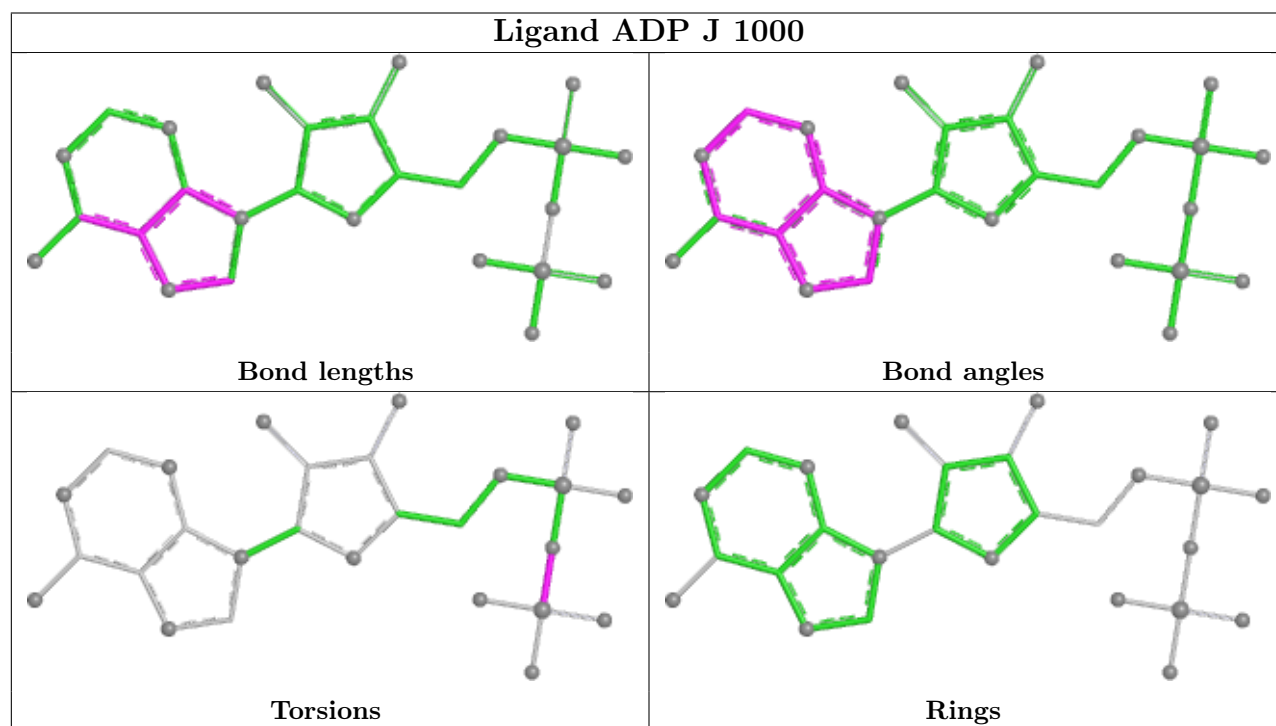
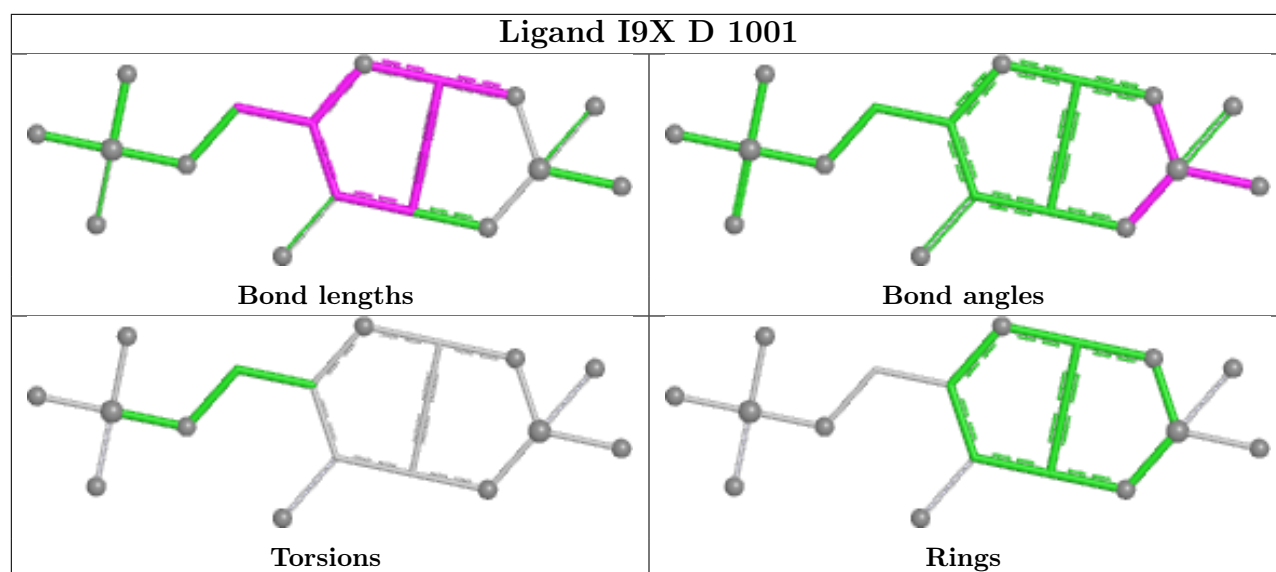


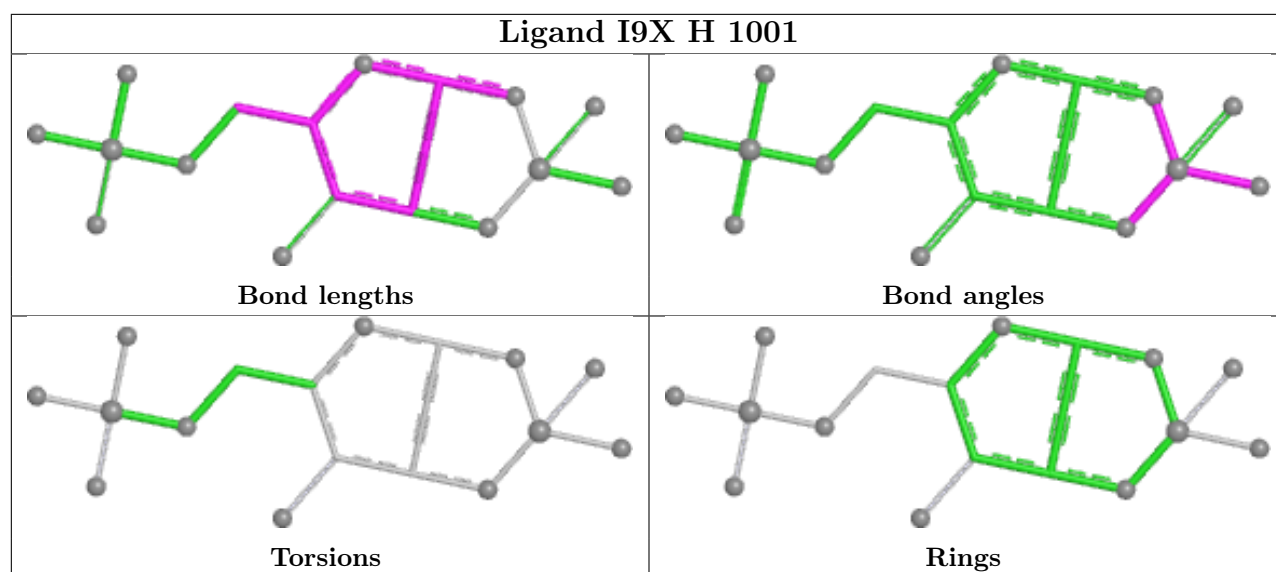












5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

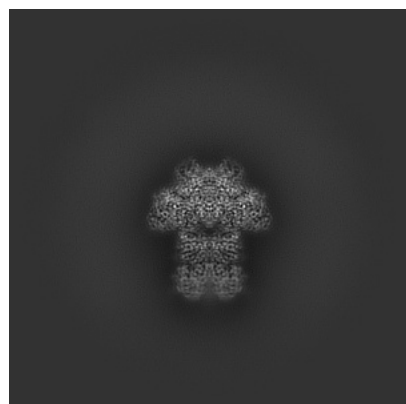
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-14441. These allow visual inspection of the internal detail of the map and identification of artifacts.

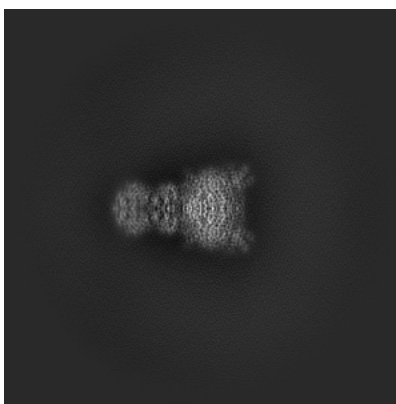
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

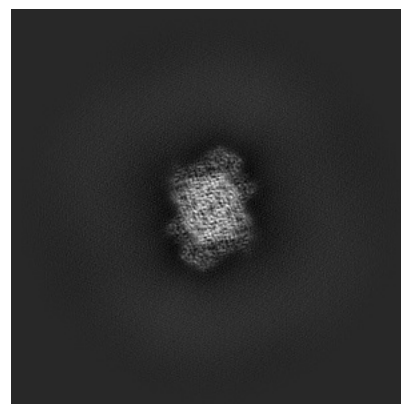
6.1.1 Primary map



X

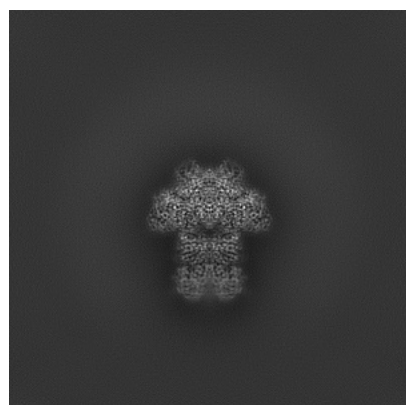


Y

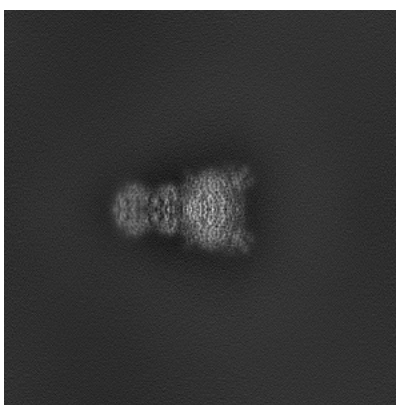


Z

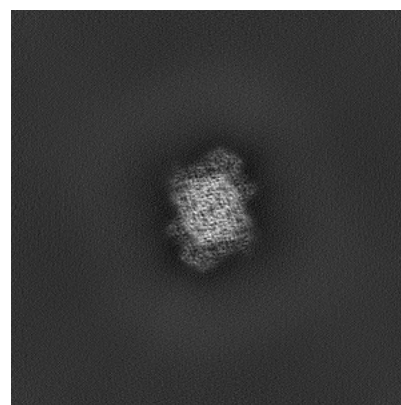
6.1.2 Raw map



X



Y

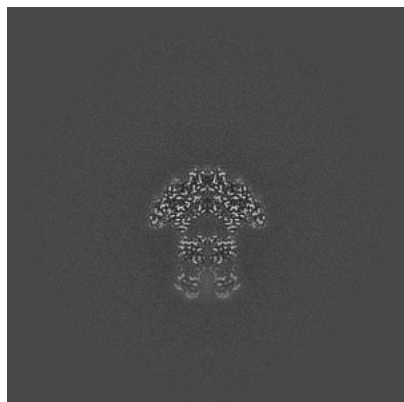


Z

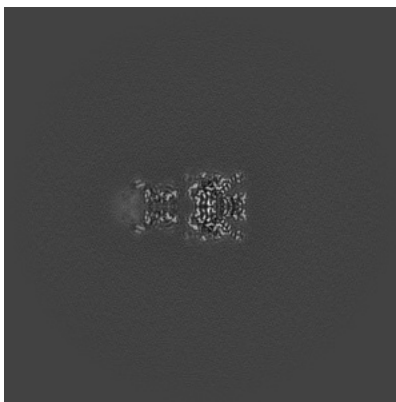
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

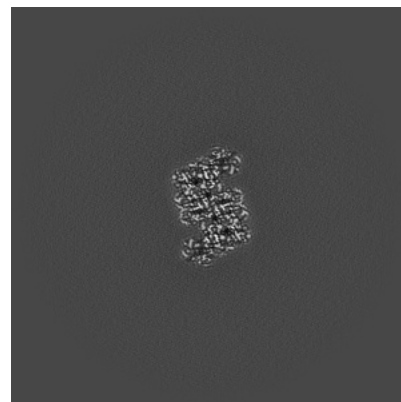
6.2.1 Primary map



X Index: 240

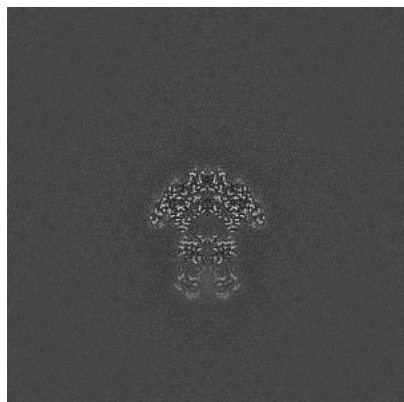


Y Index: 240

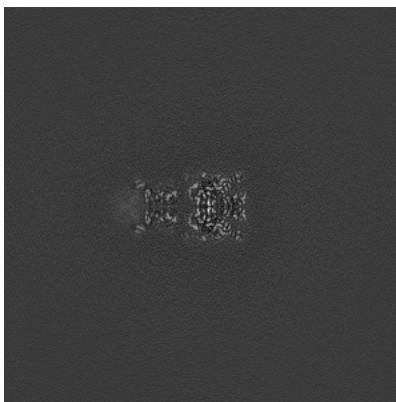


Z Index: 240

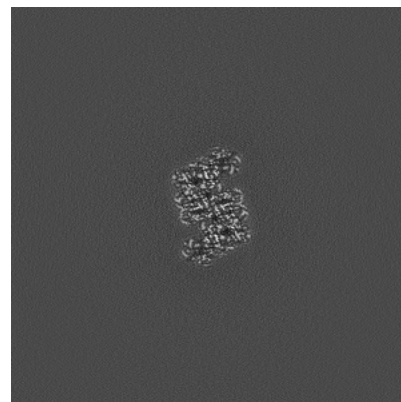
6.2.2 Raw map



X Index: 240



Y Index: 240

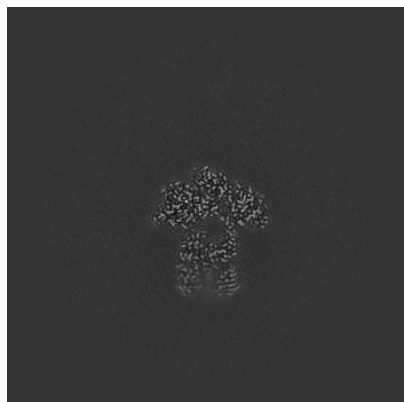


Z Index: 240

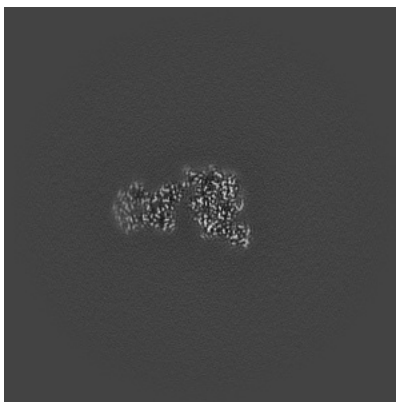
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

6.3.1 Primary map



X Index: 246

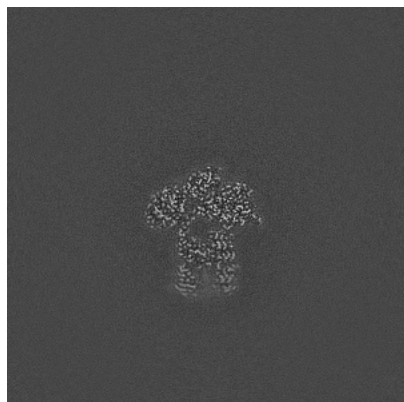


Y Index: 226

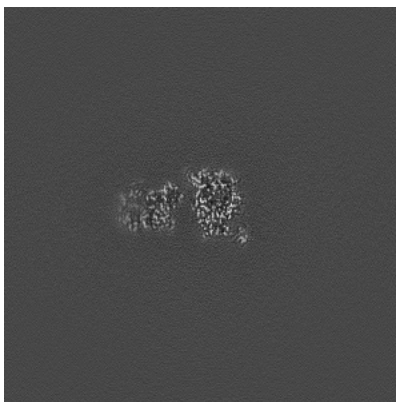


Z Index: 246

6.3.2 Raw map



X Index: 233



Y Index: 231

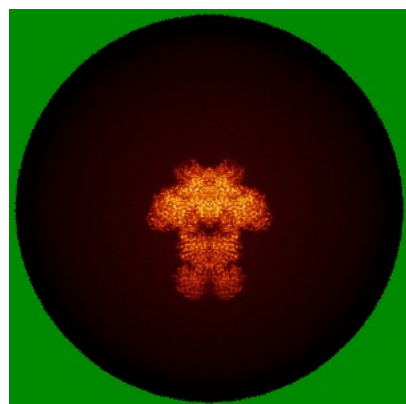


Z Index: 246

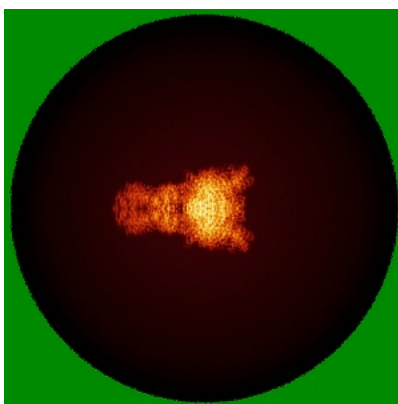
The images above show the largest variance slices of the map in three orthogonal directions.

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

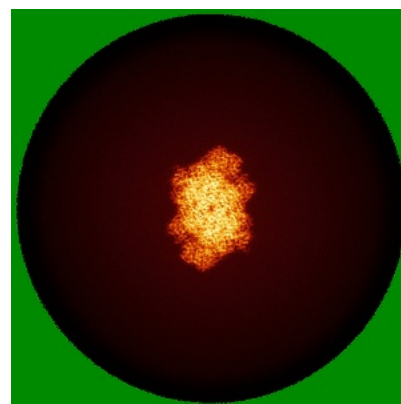
6.4.1 Primary map



X

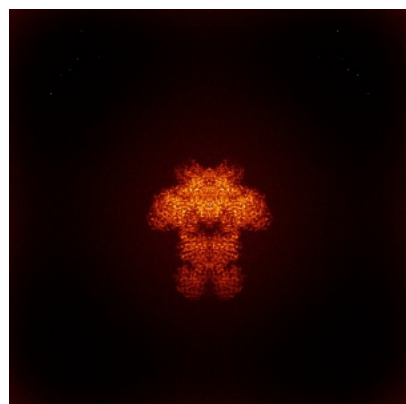


Y

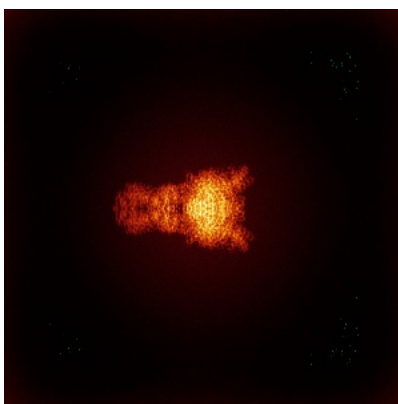


Z

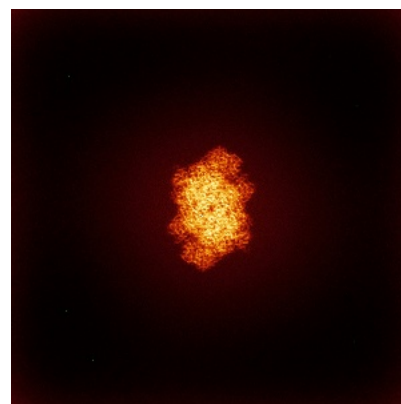
6.4.2 Raw map



X



Y

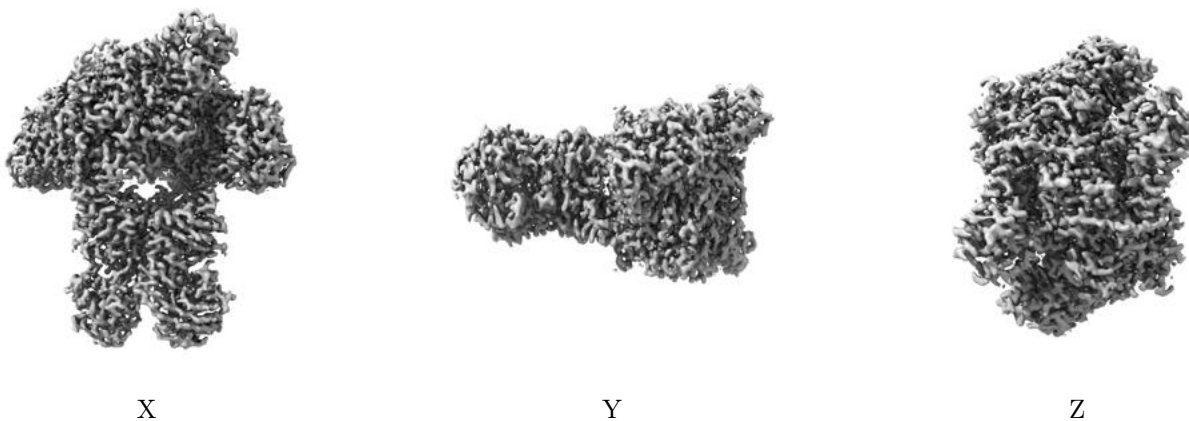


Z

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.

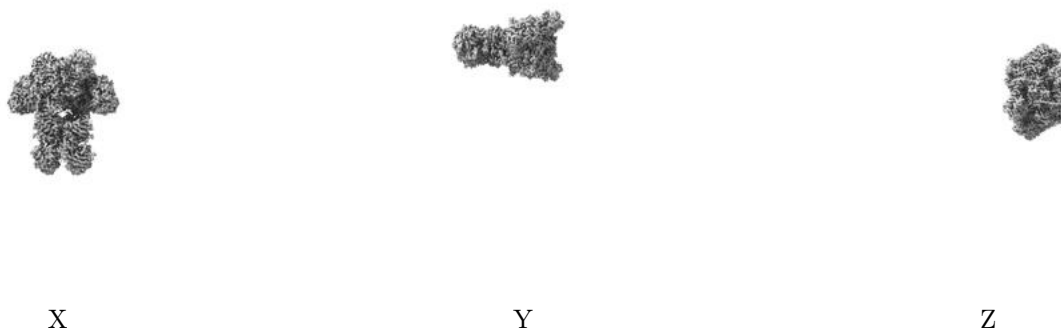
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.6. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 Raw map



These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

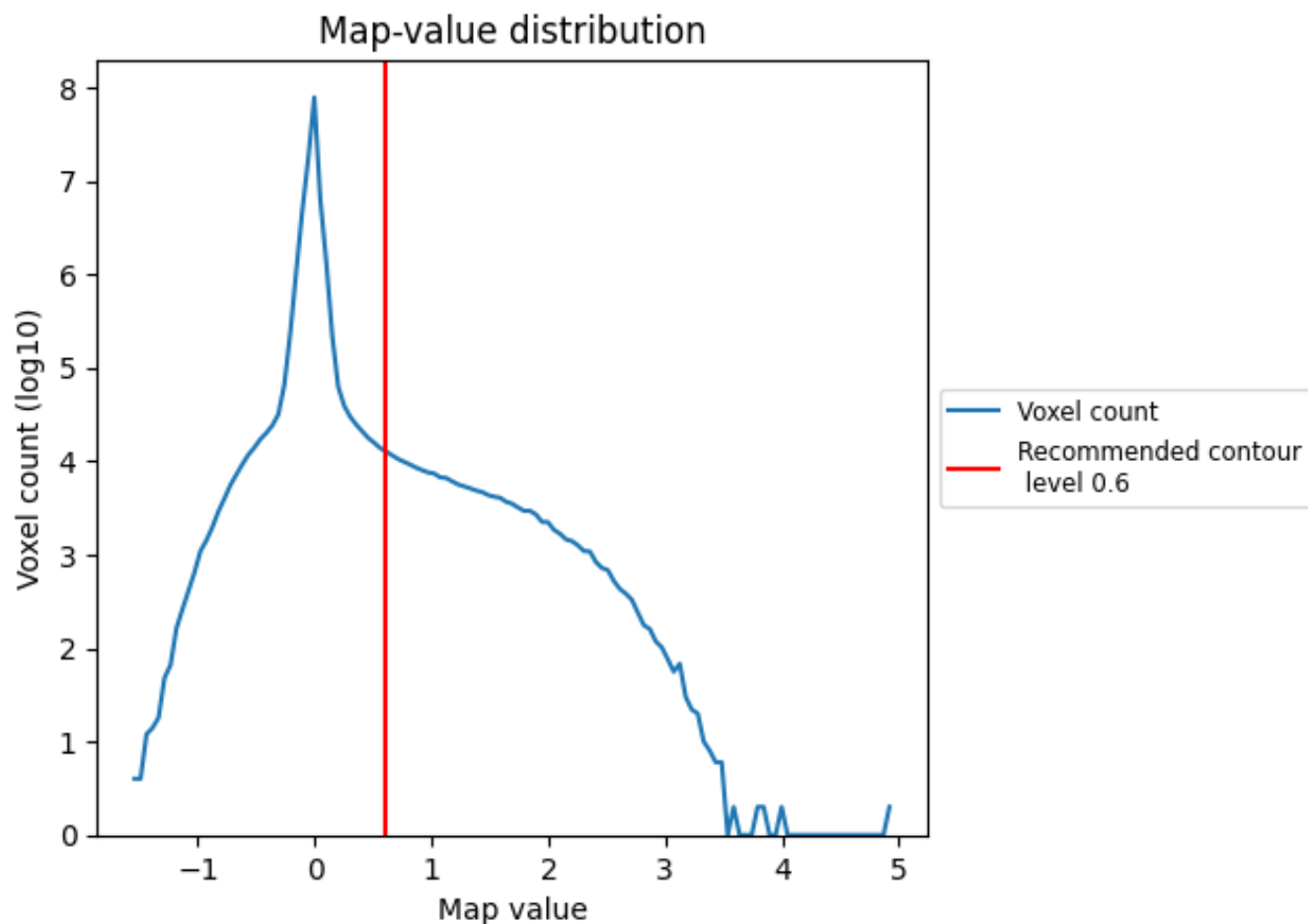
6.6 Mask visualisation [i](#)

This section was not generated. No masks/segmentation were deposited.

7 Map analysis [i](#)

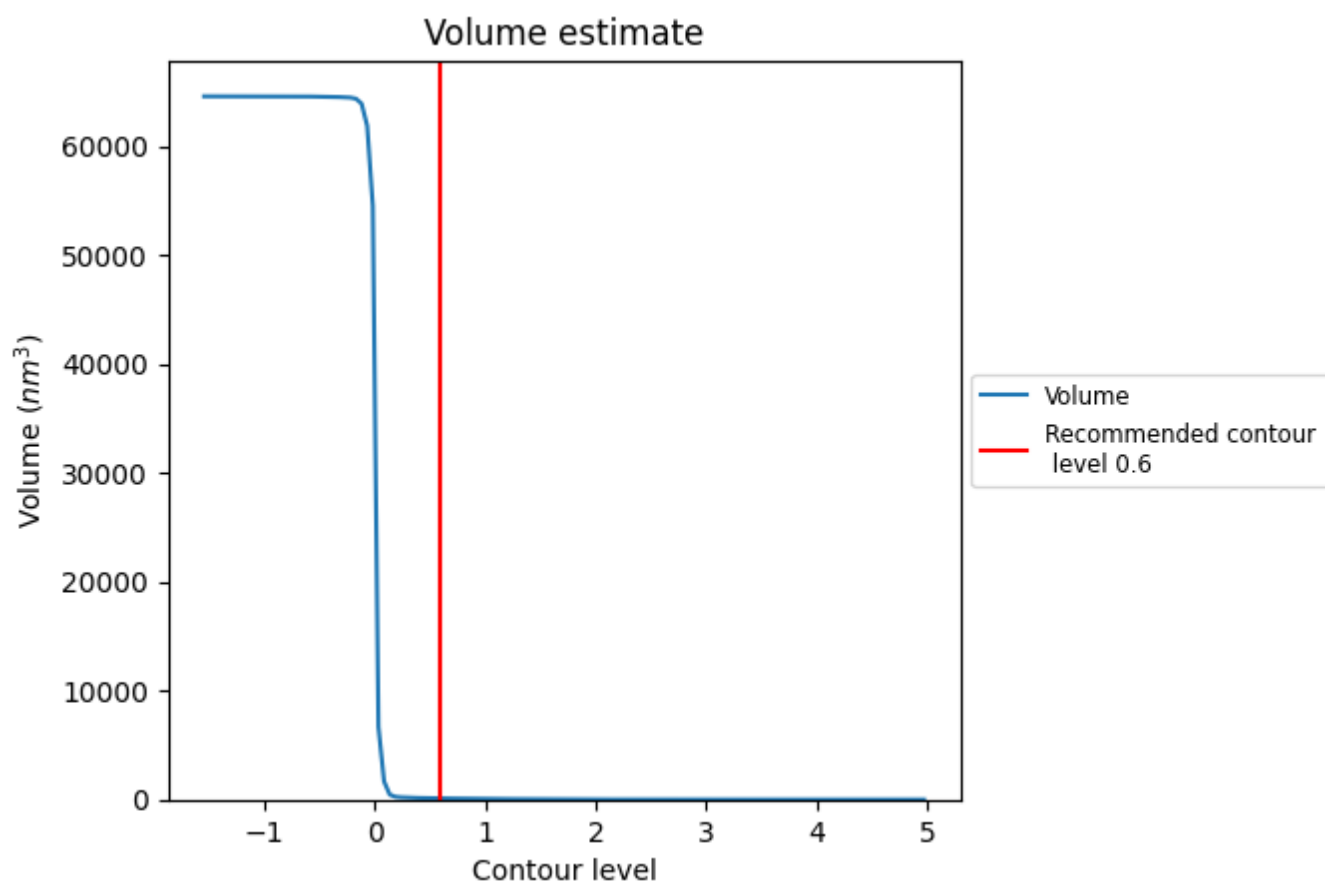
This section contains the results of statistical analysis of the map.

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.

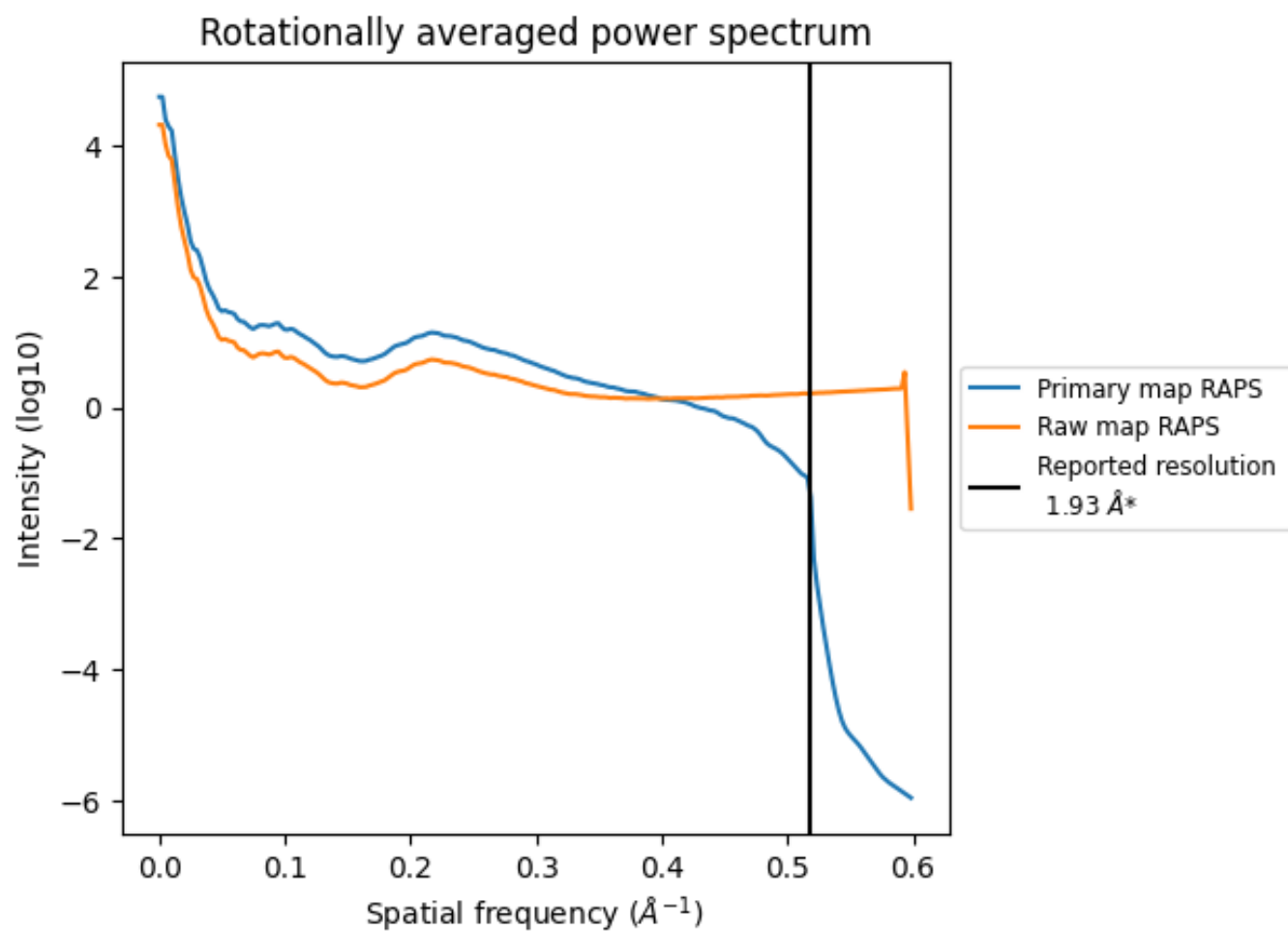
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 108 nm^3 ; this corresponds to an approximate mass of 97 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 ⓘ

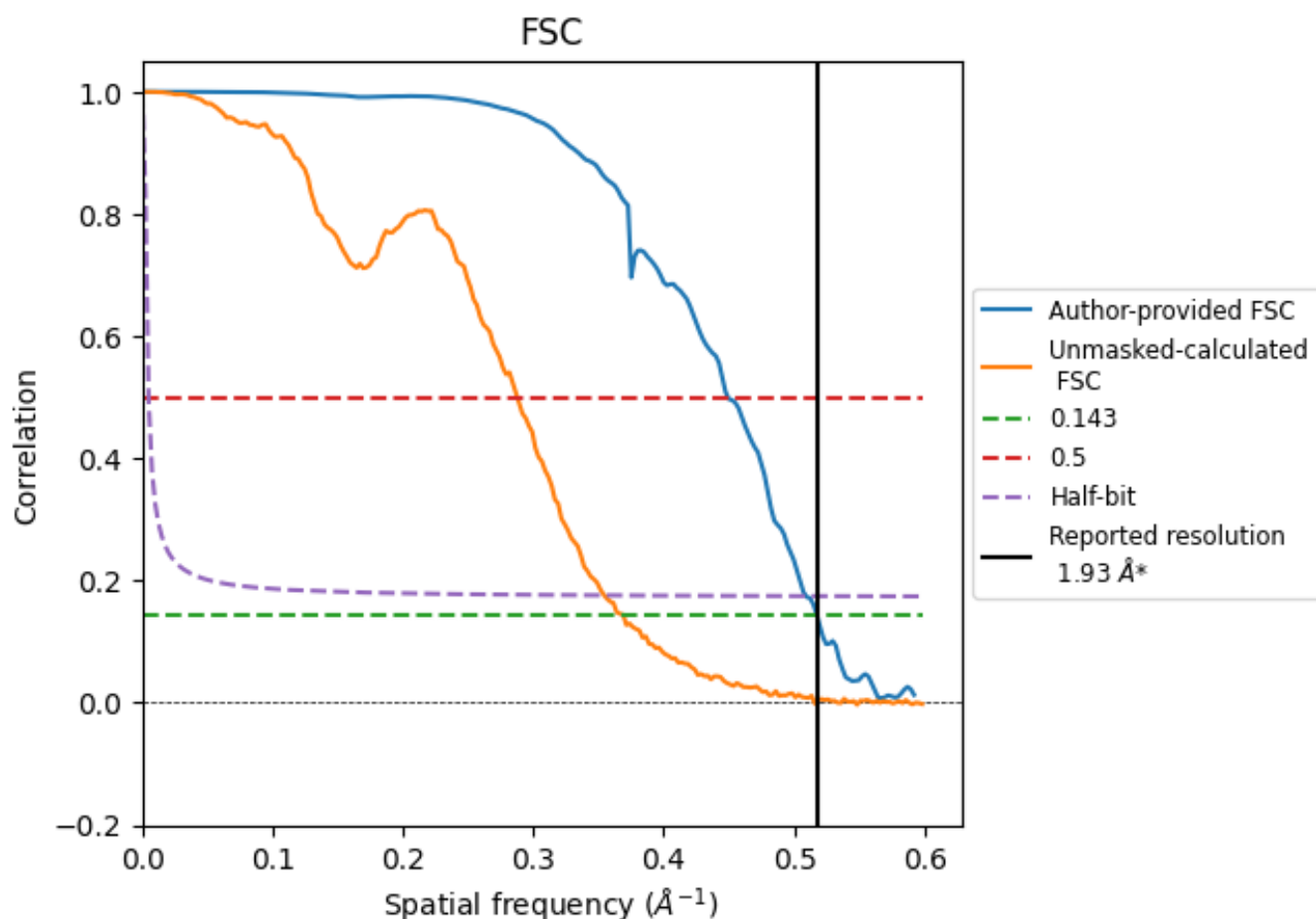


*Reported resolution corresponds to spatial frequency of 0.518 Å⁻¹

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 $0.518 \text{ \AA}^{-1}$

8.2 Resolution estimates [i](#)

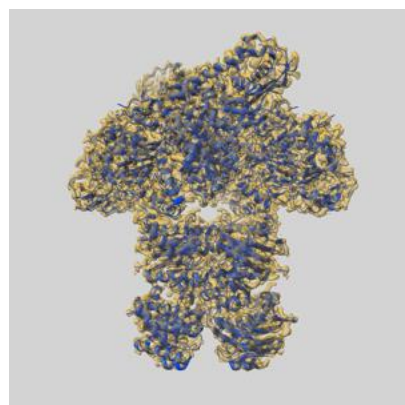
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	1.93	-	-
Author-provided FSC curve	1.93	2.23	1.96
Unmasked-calculated*	2.71	3.48	2.82

*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 2.71 differs from the reported value 1.93 by more than 10 %

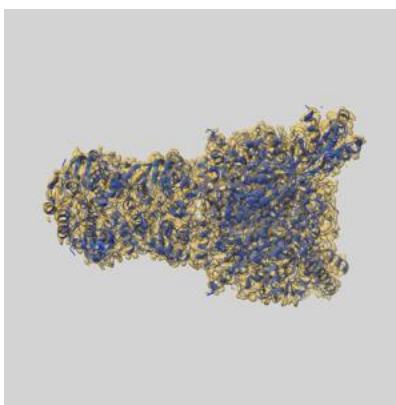
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-14441 and PDB model 7Z15. Per-residue inclusion information can be found in section 3 on page 12.

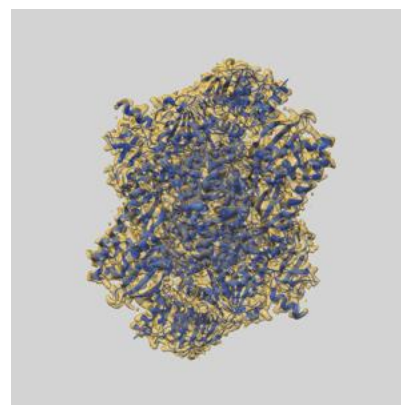
9.1 Map-model overlay [i](#)



X



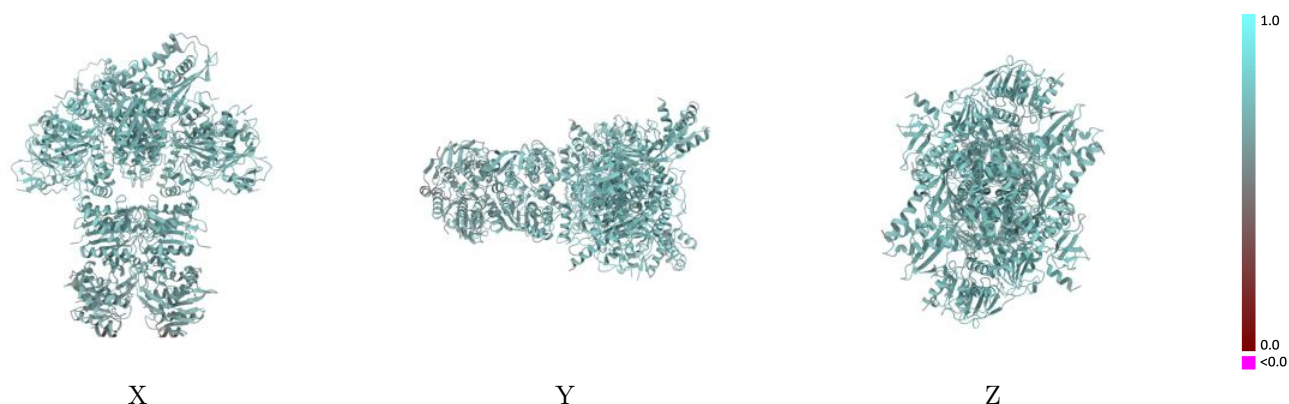
Y



Z

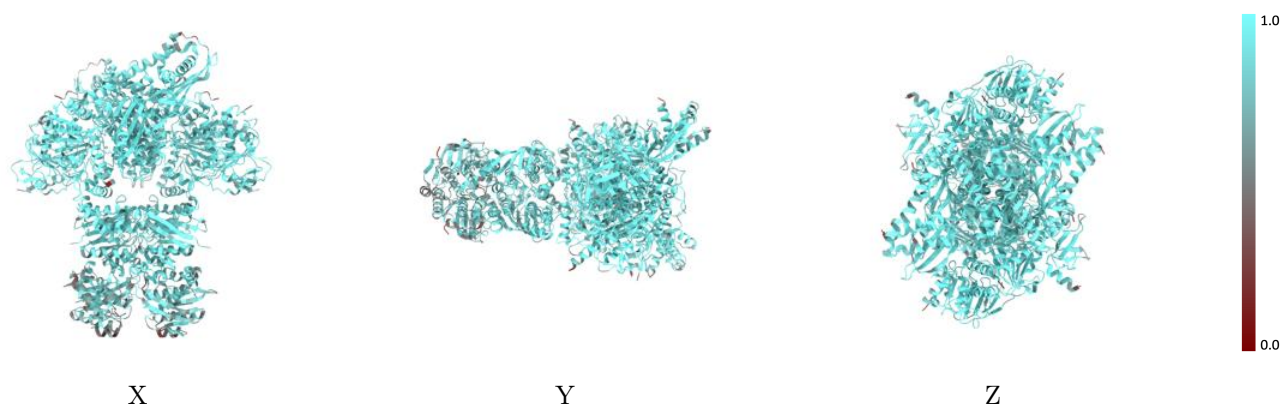
The images above show the 3D surface view of the map at the recommended contour level 0.6 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



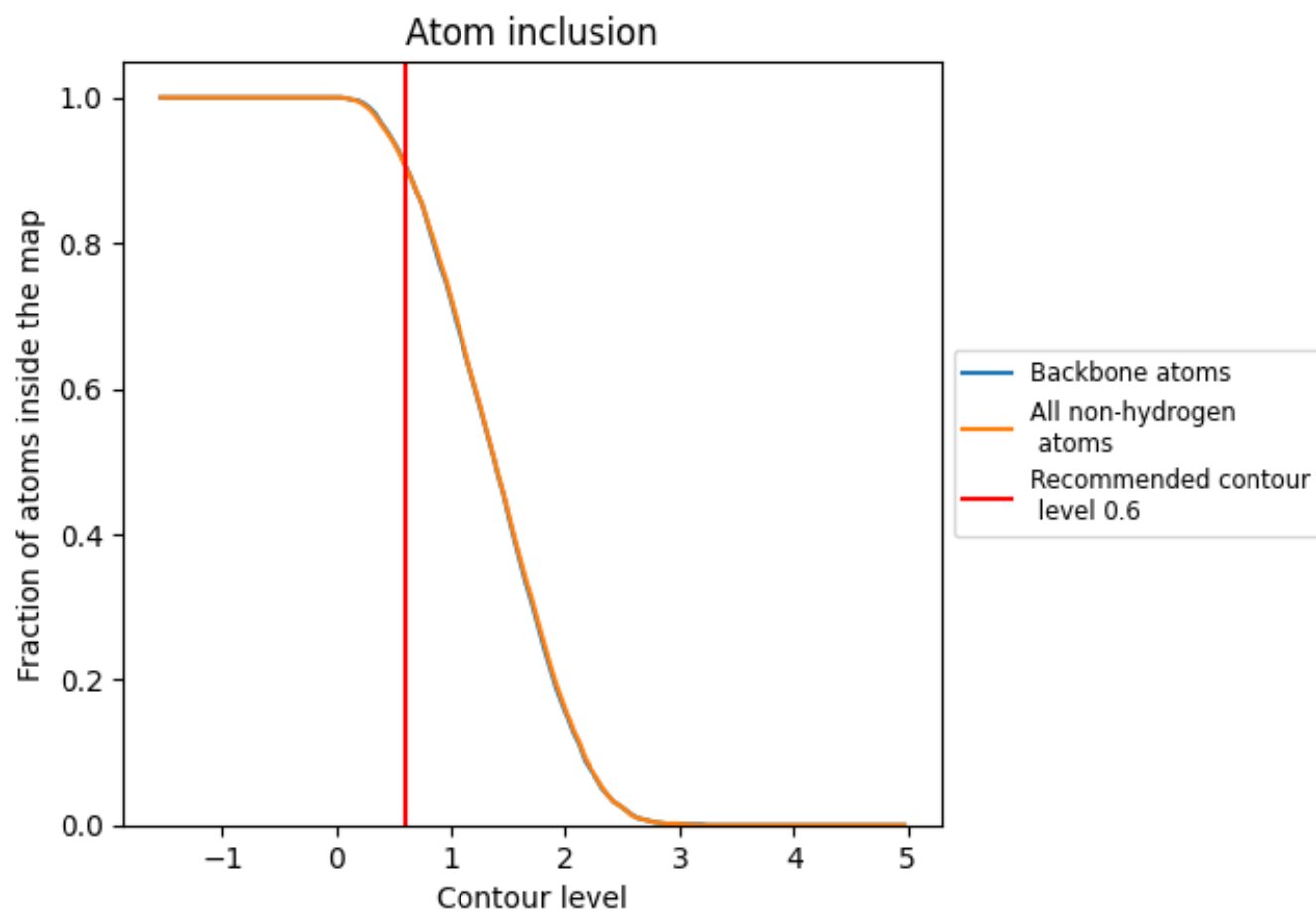
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.6).

9.4 Atom inclusion [i](#)



At the recommended contour level, 91% of all backbone atoms, 91% 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 (0.6) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9060	0.6880
A	0.9010	0.6800
B	0.9180	0.6890
C	0.9510	0.7130
D	0.9590	0.7210
E	0.9010	0.6790
F	0.9200	0.6880
G	0.9500	0.7150
H	0.9590	0.7200
I	0.9190	0.6900
J	0.9180	0.6890
K	0.7420	0.6100
L	0.7420	0.6100

1.0

0.0

<0.0