wwPDB EM Validation Summary Report (i)

Oct 13, 2024 – 12:43 AM JST

PDB ID	:	8XKU
EMDB ID	:	EMD-38425
Title	:	Cryo-EM structure of the Ycf2-FtsHi motor complex from Arabidopsis in ATP-bound state
Authors	:	Liang, K.; Zhan, X.; Xu, Q.; Wu, J.; Yan, Z.
Deposited on	:	2023-12-24
Resolution	:	3.20 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/EMValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

EMDB validation analysis	:	0.0.1.dev113
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 3.20 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.
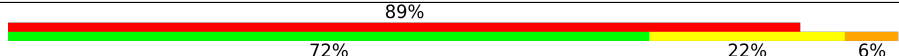
Metric	Percentile Ranks	Value
Clashscore		8
Ramachandran outliers		0.1%
Sidechain outliers		2.6%

Worse   *Better*

▮ Percentile relative to all structures
▯ Percentile relative to all EM structures
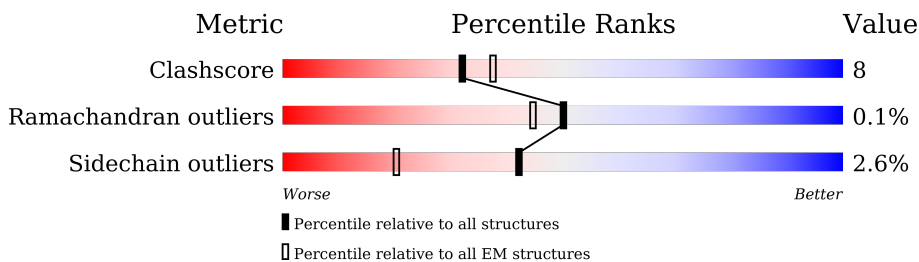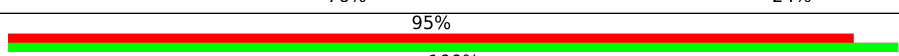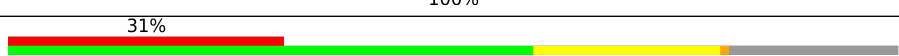
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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 <=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	855	23% — 65% / 19% / 15%
2	B	1008	13% — 66% / 17% / • / 16%
3	C	1320	42% — 54% / 15% / 30%
4	D	2294	10% — 27% / 8% / 65%
5	E	946	29% — 46% / 6% / • / 47%
6	F	876	31% — 43% / 11% / 45%
7	G	396	8% — 55% / 16% / • / 28%
8	H	348	• — 11% / 5% / 84%

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Mol	Chain	Length	Quality of chain
9	I	403	66% 13% 21%
9	J	403	64% 14% 21%
10	K	80	45% / 65% 18% 16%
11	L	18	89% / 72% 22% 6%
12	M	11	55% / 82% 18%
13	N	37	70% / 89% 11%
14	O	17	59% / 76% 24%
15	P	19	95% / 100%
16	R	328	31% / 59% 21% 19%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
18	ATP	A	902	-	-	X	-
18	ATP	B	1103	-	-	X	-
20	PX2	B	1104	-	-	X	-

2 Entry composition (i)

There are 20 unique types of molecules in this entry. The entry contains 45544 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 Probable inactive ATP-dependent zinc metalloprotease FTSHI 4, chloroplastic.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	730	Total	C	N	O	S	0	0
			5841	3718	1000	1103	20		

- Molecule 2 is a protein called ATP-dependent zinc metalloprotease FTSH 12, chloroplastic.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	845	Total	C	N	O	S	0	0
			6879	4404	1195	1251	29		

- Molecule 3 is a protein called Probable inactive ATP-dependent zinc metalloprotease FTSHI 5, chloroplastic.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	921	Total	C	N	O	S	0	0
			7494	4775	1299	1386	34		

- Molecule 4 is a protein called Protein Ycf2.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	805	Total	C	N	O	S	0	0
			6659	4314	1145	1173	27		

- Molecule 5 is a protein called Probable inactive ATP-dependent zinc metalloprotease FTSHI 1, chloroplastic.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	E	498	Total	C	N	O	S	0	0
			3881	2451	690	729	11		

- Molecule 6 is a protein called Probable inactive ATP-dependent zinc metalloprotease FTSHI 2, chloroplastic.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	F	478	Total 3744	C 2356	N 667	O 701	S 20	0	0

- Molecule 7 is a protein called AtTam46.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	G	285	Total 2375	C 1615	N 370	O 379	S 11	0	0

- Molecule 8 is a protein called At4g28210.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	H	54	Total 459	C 310	N 76	O 72	S 1	0	0

- Molecule 9 is a protein called Malate dehydrogenase, chloroplastic.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	I	317	Total 2363	C 1503	N 396	O 457	S 7	0	0
9	J	317	Total 2363	C 1503	N 396	O 457	S 7	0	0

- Molecule 10 is a protein called Aspartyl/glutamyl-tRNA (Asn/Gln) amidotransferase subunit B.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	K	67	Total 555	C 359	N 98	O 97	S 1	0	0

- Molecule 11 is a protein called UNK.

Mol	Chain	Residues	Atoms					AltConf	Trace
11	L	18	Total 131	C 89	N 21	O 20	S 1	0	0

- Molecule 12 is a protein called UNK.

Mol	Chain	Residues	Atoms				AltConf	Trace
12	M	11	Total 84	C 59	N 13	O 12	0	0

- Molecule 13 is a protein called UNK.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	N	37	Total 246	C 159	N 45	O 41	S 1	0	0

- Molecule 14 is a protein called UNK.

Mol	Chain	Residues	Atoms				AltConf	Trace
14	O	17	Total 132	C 89	N 25	O 18	0	0

- Molecule 15 is a protein called UNK.

Mol	Chain	Residues	Atoms				AltConf	Trace
15	P	19	Total 95	C 57	N 19	O 19	0	0

- Molecule 16 is a protein called Embryo defective 2737.

Mol	Chain	Residues	Atoms					AltConf	Trace
16	R	267	Total 2151	C 1371	N 367	O 397	S 16	0	0

- Molecule 17 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
17	A	1	Total 1	Mg 1	0
17	B	1	Total 1	Mg 1	0

- Molecule 18 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).
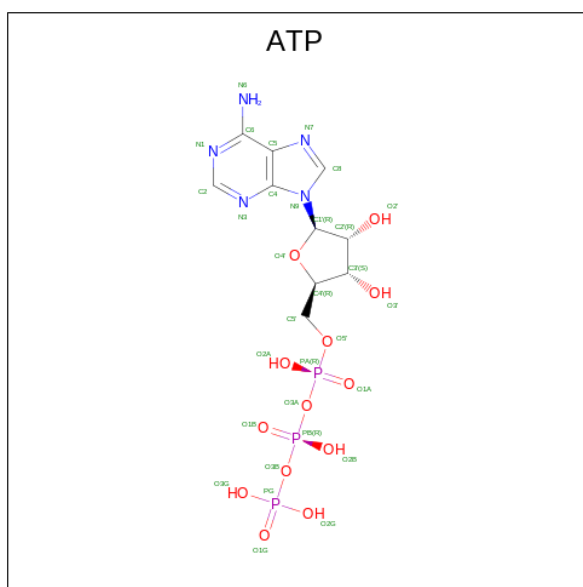
ATP

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

- Molecule 19 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		AltConf
19	B	1	Total	Zn	0
			1	1	
19	R	2	Total	Zn	0
			2	2	

- Molecule 20 is 1,2-DILAUROYL-SN-GLYCERO-3-PHOSPHATE (three-letter code: PX2) (formula: $C_{27}H_{52}O_8P$).

Mol	Chain	Residues	Atoms				AltConf
20	B	1	Total 25	C 16	O 8	P 1	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: Probable inactive ATP-dependent zinc metalloprotease FTSHI 4, chloroplastic
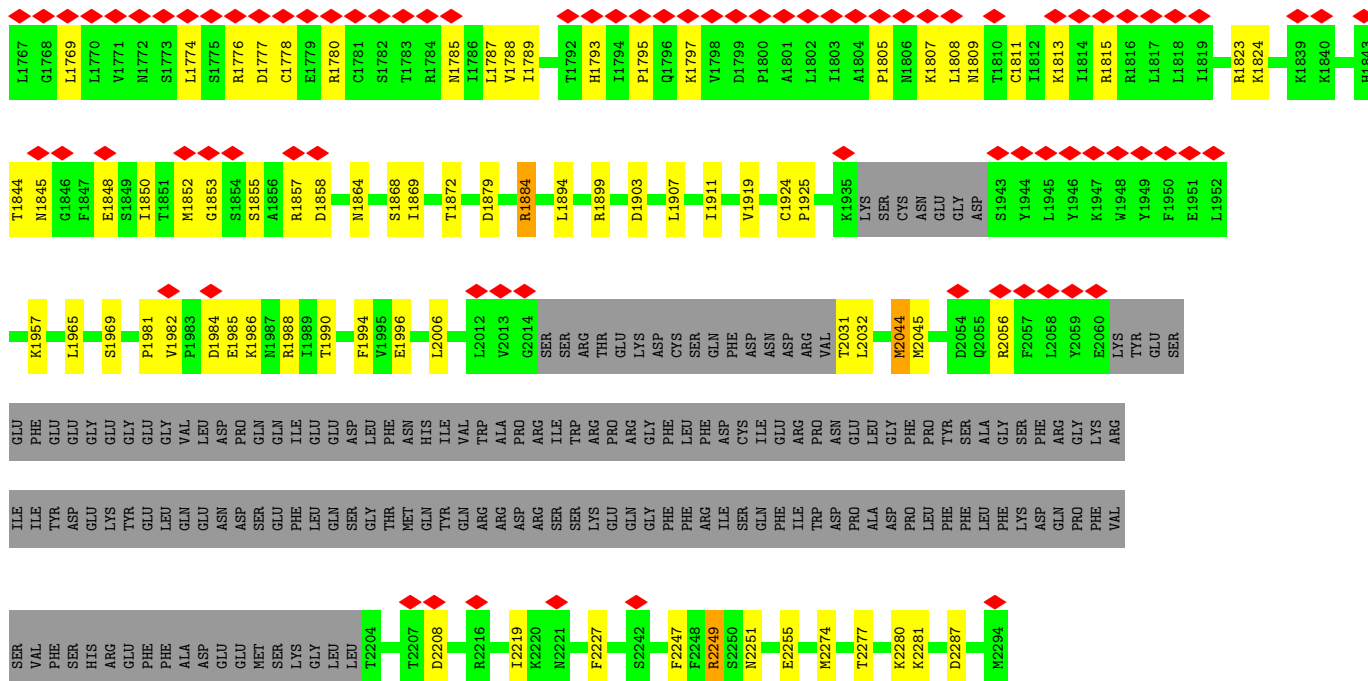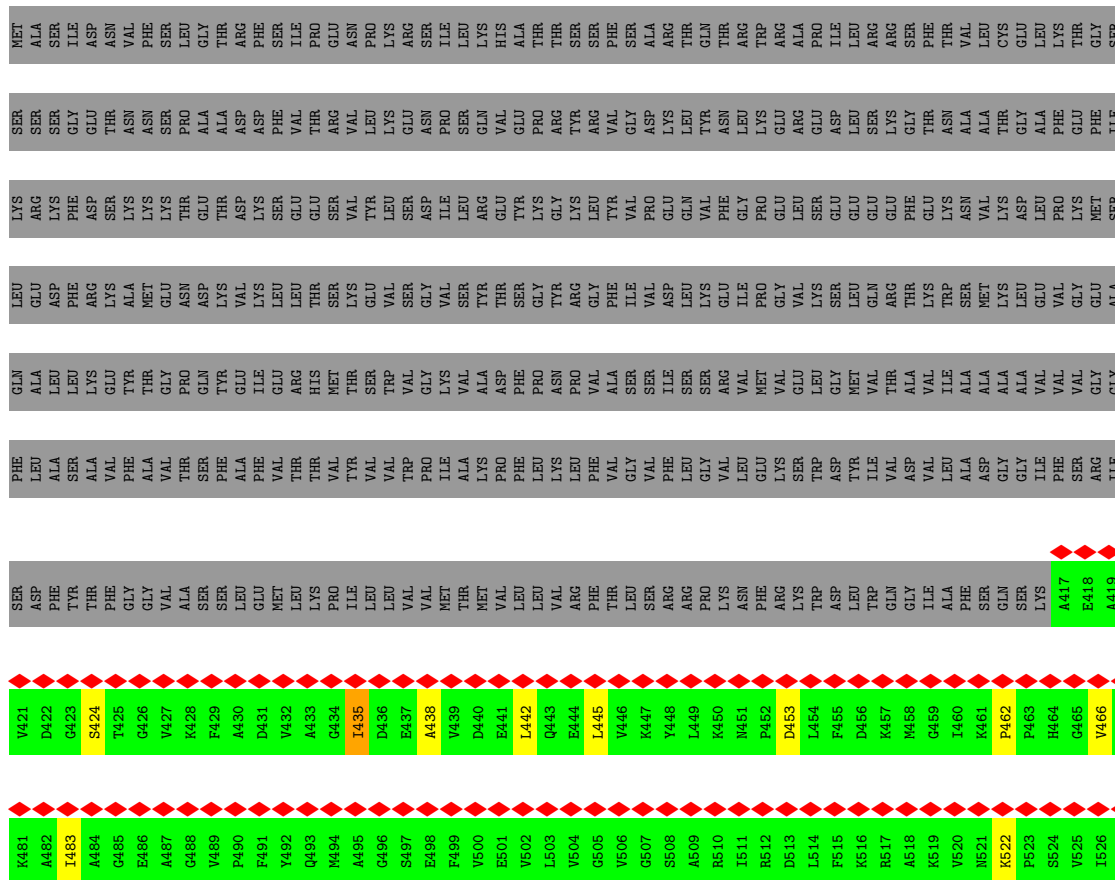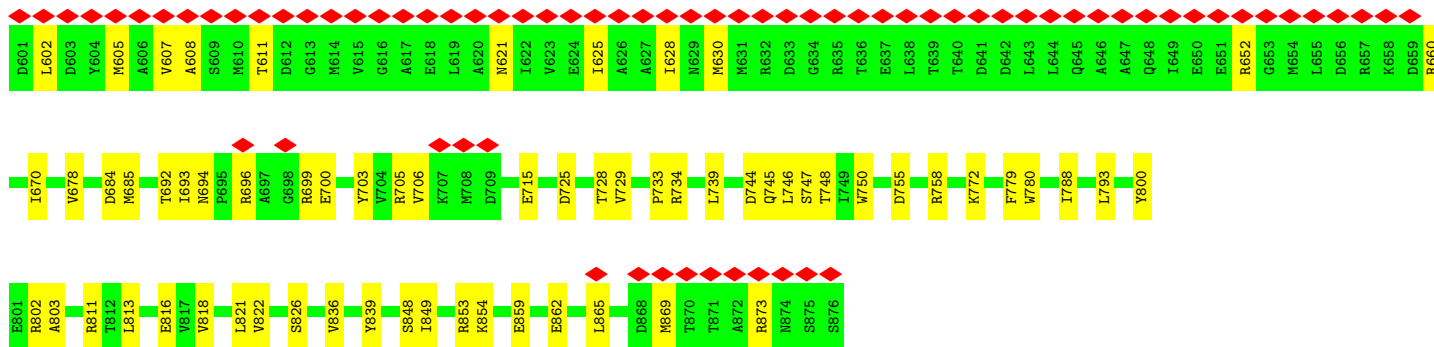
• Molecule 2: ATP-dependent zinc metalloprotease FTSH 12, chloroplastic

Chain B:

• Molecule 3: Probable inactive ATP-dependent zinc metalloprotease FTSHI 5, chloroplastic

Chain C:

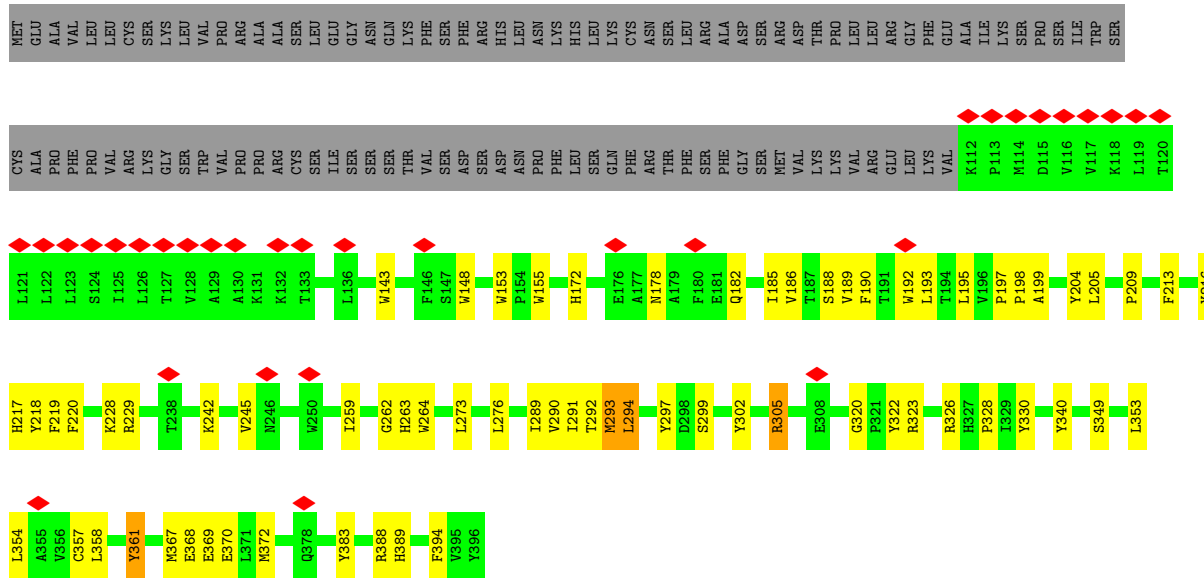• Molecule 4: Protein Ycf2

Chain D:

10%

27%   8%   65%

• Molecule 5: Probable inactive ATP-dependent zinc metalloprotease FTSHI 1, chloroplastic

Chain E:

29%

46% 6% 47%

• Molecule 6: Probable inactive ATP-dependent zinc metalloprotease FTSHI 2, chloroplastic

Chain F:

• Molecule 7: AtTam46

Chain G:

• Molecule 8: At4g28210

Chain H:

MET PRO LEU LEU ALA ALA ALA LEU ALA ILE GLY VAL ARG LEU ALA ALA LYS TRP ALA GLY TYR ARG HIS LEU THR TRP MET ILE VAL

- Molecule 9: Malate dehydrogenase, chloroplastic

Chain I:

66%   13%   21%

MET ALA THR ALA THR SER ALA SER LEU PHE SER THR VAL SER SER SER TYR SER LYS ALA SER SER ILE PRO HIS SER ARG LEU GLN SER VAL LYS PHE ASN VAL PRO SER PHE THR GLY LEU LYS SER THR SER LEU ILE SER GLY SER ASP SER SER LEU ALA LYS THR LEU

ARG GLY SER VAL LYS THR LYS ALA GLN THR ASP LYS LYS PRO TYR GLY PHE LYS ILE ASN ALA **S82 Y83 K84** I94 **L101 I102 K103 M104 S105** V108 **S109 T110 L111** H112 T131 R136 P141 **L144 A145** D146 K149 **D150 V151** N152 **V153 V154 I155** I156 P157 R162

K163 P164 G165 M166 **T167 R168 D169 D170** N173 **A176 N177 I178** V179 A185 N189 **F194 I195 H196 I197** I198 L247 **P253 V254** I255 **L264 P265** L266 V286 N290 V295 K299 **A302 G303** S304 A305 **T306 L307** S308 M309 F335 L340 A347 L357

L365 K374 **P397 A398** ALA ALA ALA ALA ASN

- Molecule 9: Malate dehydrogenase, chloroplastic

Chain J:

64%   14%   21%

MET ALA THR ALA THR SER ALA SER LEU PHE SER THR VAL SER SER SER TYR SER LYS ALA SER SER ILE PRO HIS SER ARG LEU GLN SER VAL LYS PHE ASN VAL PRO SER PHE THR GLY LEU LYS SER THR SER LEU ILE SER GLY SER ASP SER SER LEU ALA LYS THR LEU

ARG GLY SER VAL LYS THR LYS ALA GLN THR ASP LYS LYS PRO TYR GLY PHE LYS ILE ASN ALA **S82 Y83** K84 **L100 L101 I102 K103** V108 **L111 H112** K120 T131 V135 F138 D146 **C147 L148 K149 D150** V153 **V154 V155** I156 P157 **R162 K163 P164 G165 M166**

T167 **R168** D169 N173 N177 **I178** V179 A185 V186 N189 C190 F194 T205 I208 K222 T229 L230 I248 G257 T262 K271 V286 N290 T293 V296 K299 **A300 G301** A302 **G303** S304 M309 A310 Y311 A312 D327 F335 A347

L357 Y371 **K374** E377 **A378** L379 A394 **A398** ALA ALA ALA ALA ASN

- Molecule 10: Aspartyl/glutamyl-tRNA (Asn/Gln) amidotransferase subunit B

Chain K:

45%   65%   18%   16%

MET GLY ASN LYS ALA THR THR VAL LYS GLU GLU ARG GLU **E14 I15 H16 L17** V20 D24 F27 W30 L31 D34 R37 **V38 H39 G40 F41 K42 P43 K44 N45 N46** T47 R48 **P52 P53** D54 **S55 Y56** F59 L62 **S65 L66 D67 V68 D69 L70 D71 D72**

P73 D74 L75 A76 H77 L78 F79 K80

- Molecule 11: UNK

89%

Chain L:

72%   22%   6%

X8 F9 L10 N11 N12 L13 L14 K15 V16 M17 V18 X19 F20 L21 X22 X23 X24 X25

• Molecule 12: UNK

55%

Chain M:

82%   18%

X3 X4 V5 V9 I10 K11 V12 K13

• Molecule 13: UNK

70%

Chain N:

89%   11%

X4 X5 V6 X7 X8 X9 L10 X13 V14 F15 X16 X17 X18 X19 L20 X21 H22 G23 R24 X25 X26 Q27 X28 X29 X30 X31 L32 Y33 N34 L35 M36 X37 X38 F39 X40

• Molecule 14: UNK

59%

Chain O:

76%   24%

L141 L144 I145 K146 R147 L150 I151 L152 I153 H154 K155 K156 A157

• Molecule 15: UNK

95%

Chain P:

100%

X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 X13 X14 X15 X16 X17 X18 X19

• Molecule 16: Embryo defective 2737

31%

Chain R:

59%   21%   •   19%

MET SER ARG GLY PRO GLY ARG LEU ILE ILE GLN ASN VAL THR GLN PHE ALA ASP ALA GLN PHE LYS GLN PHE SER THR ARG TYR GLY GLN GLN VAL ILE ASP ILE LEU ASP PHE PRO ILE LYS LEU VAL LEU SER PRO PHE THR LEU ALA PHE ASP ILE ALA GLY SER ALA PRO ARG GLY PHE

GLY I62 P63 E64 F65 I66 S67 Y71 A78 G81 T82 V93 I94 C95 Q96 R97 D98 C99 K100 N103 G104 W105 Q106 A107 L108 R109 S118 V119 H120 Y121 Q122 I123 K124 D125 Y126 N127 L128 R129 S130 G131 E132 K133 P134 T135 A136 D137 C138 V139 A140 D141 A142 I143 V144 E145

N146 R147 A148 E149 L150 V151 H152 L153 P154 S155 S156 F157 N158 H159 S160 A161 P162 L163 P164 S165 K166 D167 C168 C171 D172 G173 T174 G175 A176 M177 T180 K183 N184 K185 L186 Q187 V188 R189 A192 D193 D194 I196 M196 E197 P198 P199 W200 Y203 M209 D210 Y211 P212 Y213 E214

H215 M220 K221 D222 P223 A226 N227 L230 L233 V237 Y242 D243 K249 Q253 Y254 R259 Y260 D261 R264 D265 L266 V267 A268 P272 Y276 L277 A280 L281 D285 E291 D292 P293 V294 I295 V296 K297 N298 Y301 Y302 K303 A304 K305 K306 S307

L308 E309 A310 E311 S312 Q313 K314 K315 A316 Q317 K318 G319 S320 R321 Q322 R323 K324 W325 W326 F327 F328

4 Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	738896	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 $(e^-/\text{Å}^2)$	50	Depositor
Minimum defocus (nm)	1400	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	0.115	Depositor
Minimum map value	-0.021	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.002	Depositor
Recommended contour level	0.009	Depositor
Map size (Å)	391.32, 391.32, 391.32	wwPDB
Map dimensions	360, 360, 360	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.087, 1.087, 1.087	Depositor

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MG, PX2, ZN, ATP

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	0.26	0/5952	0.55	4/8038 (0.0%)
2	B	0.30	1/7022 (0.0%)	0.62	5/9460 (0.1%)
3	C	0.25	0/7627	0.55	3/10262 (0.0%)
4	D	0.26	0/6804	0.55	1/9177 (0.0%)
5	E	0.24	0/3953	0.49	1/5357 (0.0%)
6	F	0.25	0/3798	0.57	0/5115
7	G	0.29	0/2470	0.59	2/3375 (0.1%)
8	H	0.27	0/477	0.50	0/651
9	I	0.25	0/2399	0.46	0/3261
9	J	0.25	0/2399	0.47	0/3261
10	K	0.28	0/570	0.69	2/772 (0.3%)
11	L	0.37	0/101	1.02	2/133 (1.5%)
12	M	0.26	0/74	0.55	0/99
13	N	0.26	0/142	0.72	0/179
14	O	0.23	0/132	0.61	0/175
16	R	0.27	0/2206	0.52	0/2986
All	All	0.26	1/46126 (0.0%)	0.56	20/62301 (0.0%)

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
1	A	0	1
2	B	0	3
4	D	0	2
5	E	0	1
All	All	0	7

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	406	PRO	CG-CD	-10.20	1.17	1.50

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	406	PRO	CA-N-CD	-12.63	93.82	111.50
2	B	406	PRO	N-CD-CG	-11.01	86.69	103.20
2	B	522	ASP	CB-CG-OD2	9.70	127.03	118.30
7	G	294	LEU	CA-CB-CG	8.76	135.44	115.30
10	K	54	ASP	CB-CG-OD1	8.54	125.99	118.30

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	811	ILE	Peptide
2	B	476	GLU	Peptide
2	B	477	ASN	Peptide
2	B	990	LYS	Peptide
4	D	495	SER	Peptide

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	5841	0	5858	150	0
2	B	6879	0	6912	165	0
3	C	7494	0	7625	128	0
4	D	6659	0	6763	139	0
5	E	3881	0	3926	42	0
6	F	3744	0	3823	68	0
7	G	2375	0	2353	51	0
8	H	459	0	455	10	0
9	I	2363	0	2437	29	0
9	J	2363	0	2437	34	0
10	K	555	0	561	12	0
11	L	131	0	123	3	0
12	M	84	0	97	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
13	N	246	0	175	5	0
14	O	132	0	161	5	0
15	P	95	0	21	0	0
16	R	2151	0	2123	54	0
17	A	1	0	0	0	0
17	B	1	0	0	0	0
18	A	31	0	12	33	0
18	B	31	0	12	19	0
19	B	1	0	0	0	0
19	R	2	0	0	0	0
20	B	25	0	23	32	0
All	All	45544	0	45897	766	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 8.

The worst 5 of 766 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)
2:B:354:TRP:CZ2	20:B:1104:PX2:H33	1.28	1.65
2:B:354:TRP:CE2	20:B:1104:PX2:H33	1.11	1.59
2:B:354:TRP:CH2	20:B:1104:PX2:C16	1.89	1.53
2:B:354:TRP:CZ2	20:B:1104:PX2:C18	1.94	1.48
2:B:354:TRP:CE2	20:B:1104:PX2:C18	1.98	1.46

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	724/855 (85%)	691 (95%)	31 (4%)	2 (0%)	37	69

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	B	833/1008 (83%)	798 (96%)	33 (4%)	2 (0%)	44	75
3	C	911/1320 (69%)	890 (98%)	21 (2%)	0	100	100
4	D	775/2294 (34%)	719 (93%)	56 (7%)	0	100	100
5	E	494/946 (52%)	478 (97%)	15 (3%)	1 (0%)	44	75
6	F	476/876 (54%)	460 (97%)	16 (3%)	0	100	100
7	G	283/396 (72%)	272 (96%)	11 (4%)	0	100	100
8	H	52/348 (15%)	51 (98%)	1 (2%)	0	100	100
9	I	315/403 (78%)	310 (98%)	5 (2%)	0	100	100
9	J	315/403 (78%)	309 (98%)	6 (2%)	0	100	100
10	K	65/80 (81%)	59 (91%)	6 (9%)	0	100	100
11	L	12/18 (67%)	11 (92%)	1 (8%)	0	100	100
12	M	8/11 (73%)	5 (62%)	3 (38%)	0	100	100
13	N	17/37 (46%)	13 (76%)	4 (24%)	0	100	100
14	O	15/17 (88%)	11 (73%)	4 (27%)	0	100	100
16	R	265/328 (81%)	252 (95%)	13 (5%)	0	100	100
All	All	5560/9340 (60%)	5329 (96%)	226 (4%)	5 (0%)	50	80

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	478	PHE
5	E	821	VAL
1	A	208	PRO
2	B	477	ASN
1	A	812	ILE

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	628/744 (84%)	621 (99%)	7 (1%)	70	86
2	B	734/872 (84%)	711 (97%)	23 (3%)	35	66
3	C	817/1177 (69%)	793 (97%)	24 (3%)	37	67
4	D	753/2151 (35%)	731 (97%)	22 (3%)	37	67
5	E	422/817 (52%)	414 (98%)	8 (2%)	52	76
6	F	399/757 (53%)	395 (99%)	4 (1%)	73	87
7	G	246/347 (71%)	235 (96%)	11 (4%)	23	56
8	H	46/287 (16%)	43 (94%)	3 (6%)	14	45
9	I	261/332 (79%)	258 (99%)	3 (1%)	70	86
9	J	261/332 (79%)	257 (98%)	4 (2%)	60	81
10	K	62/73 (85%)	60 (97%)	2 (3%)	34	65
11	L	12/12 (100%)	9 (75%)	3 (25%)	0	2
12	M	9/9 (100%)	8 (89%)	1 (11%)	5	22
13	N	16/16 (100%)	15 (94%)	1 (6%)	15	46
14	O	14/15 (93%)	14 (100%)	0	100	100
16	R	236/286 (82%)	226 (96%)	10 (4%)	25	58
All	All	4916/8227 (60%)	4790 (97%)	126 (3%)	42	70

5 of 126 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	1319	LEU
10	K	79	PHE
4	D	1994	PHE
10	K	54	ASP
16	R	196	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
4	D	1975	GLN
7	G	282	ASN
2	B	989	HIS
3	C	1178	ASN
4	D	1555	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 8 ligands modelled in this entry, 5 are monoatomic - leaving 3 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	$\#|Z| > 2$
18	ATP	A	902	17	26,33,33	0.88	0	31,52,52	1.85	5 (16%)
20	PX2	B	1104	-	24,24,35	1.98	7 (29%)	28,29,40	2.65	14 (50%)
18	ATP	B	1103	17	26,33,33	0.89	0	31,52,52	1.85	6 (19%)

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
18	ATP	A	902	17	-	3/18/38/38	0/3/3/3
20	PX2	B	1104	-	-	9/26/26/37	-
18	ATP	B	1103	17	-	3/18/38/38	0/3/3/3

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
20	B	1104	PX2	O5-C4	4.57	1.46	1.33
20	B	1104	PX2	O7-C2	-4.23	1.36	1.46
20	B	1104	PX2	O8-C16	-4.11	1.10	1.22
20	B	1104	PX2	P1-O3	-3.09	1.43	1.54
20	B	1104	PX2	O6-C4	-2.76	1.14	1.22

The worst 5 of 25 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
20	B	1104	PX2	O7-C16-C17	4.69	121.61	111.50
20	B	1104	PX2	C19-C18-C17	-4.62	96.59	113.19
20	B	1104	PX2	O5-C4-C5	4.57	126.24	111.91
18	A	902	ATP	PB-O3B-PG	-4.41	117.69	132.83
18	B	1103	ATP	PB-O3B-PG	-4.40	117.73	132.83

There are no chirality outliers.

5 of 15 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
18	A	902	ATP	C5'-O5'-PA-O1A
18	B	1103	ATP	C5'-O5'-PA-O1A
20	B	1104	PX2	C1-O4-P1-O1
20	B	1104	PX2	C1-O4-P1-O2
20	B	1104	PX2	C1-O4-P1-O3

There are no ring outliers.

3 monomers are involved in 84 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
18	A	902	ATP	33	0
20	B	1104	PX2	32	0
18	B	1103	ATP	19	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 then 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 A 902

Bond lengths

Bond angles

Torsions

Rings

Ligand PX2 B 1104

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP B 1103

Bond lengths

Bond angles

Torsions

Rings
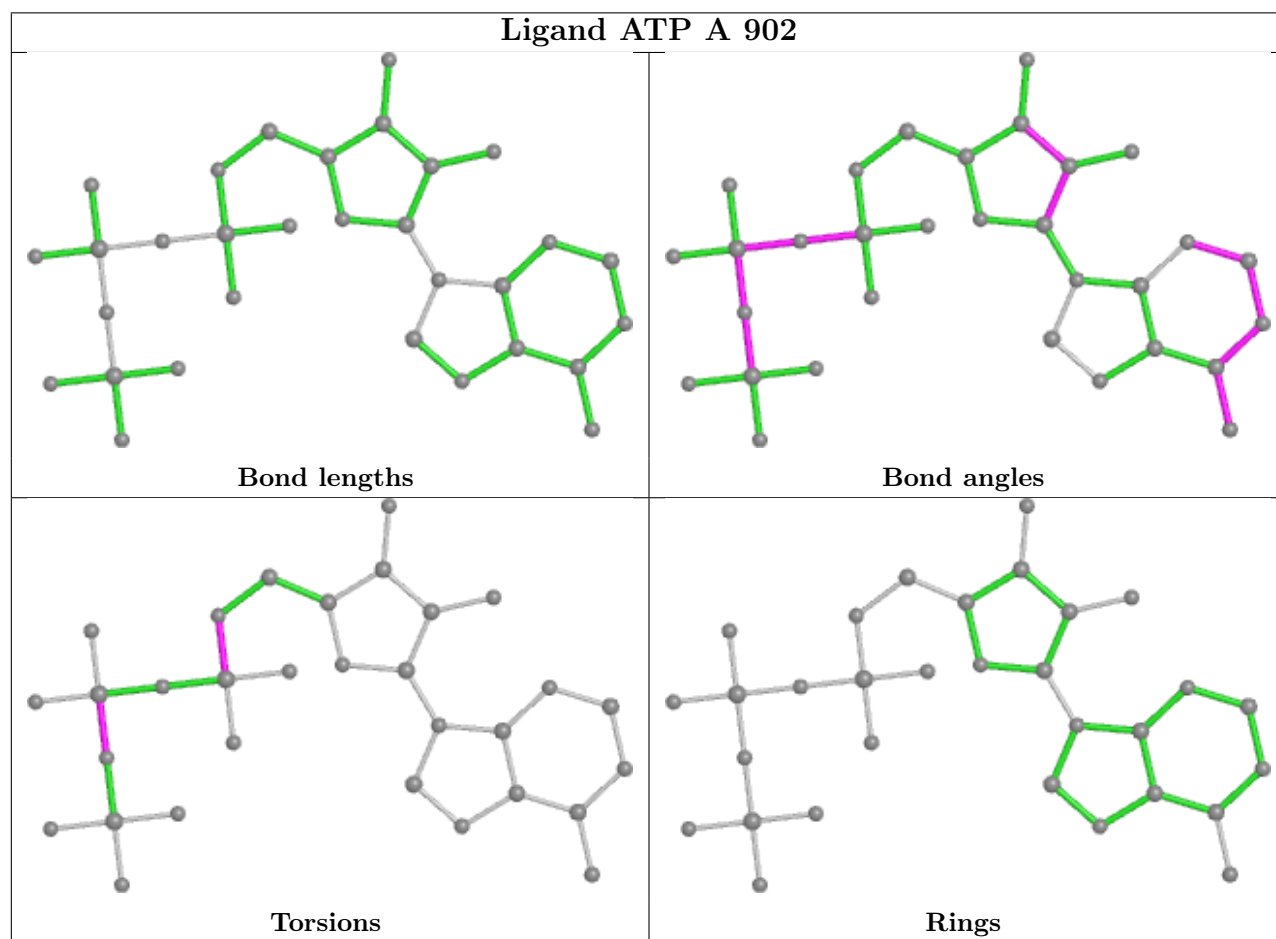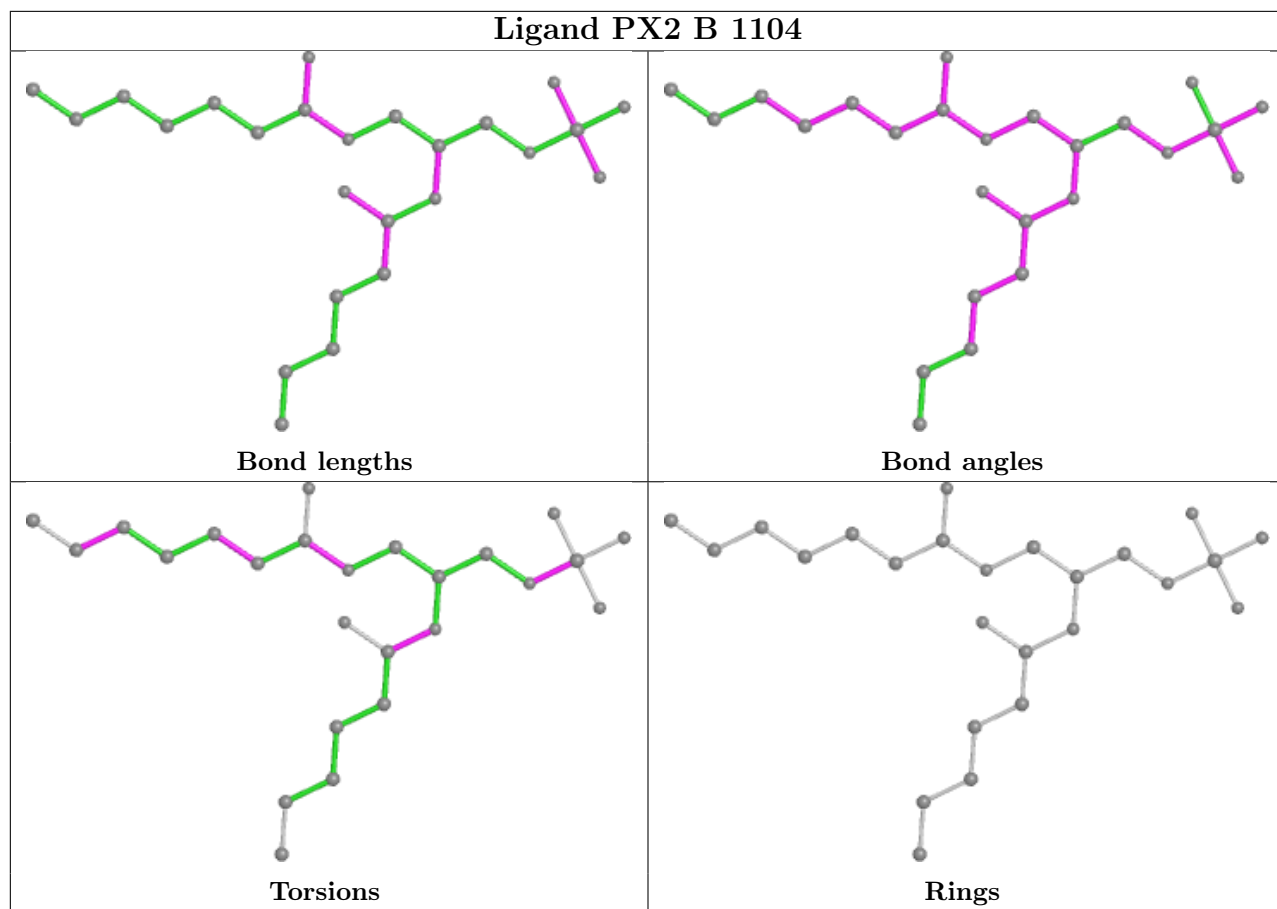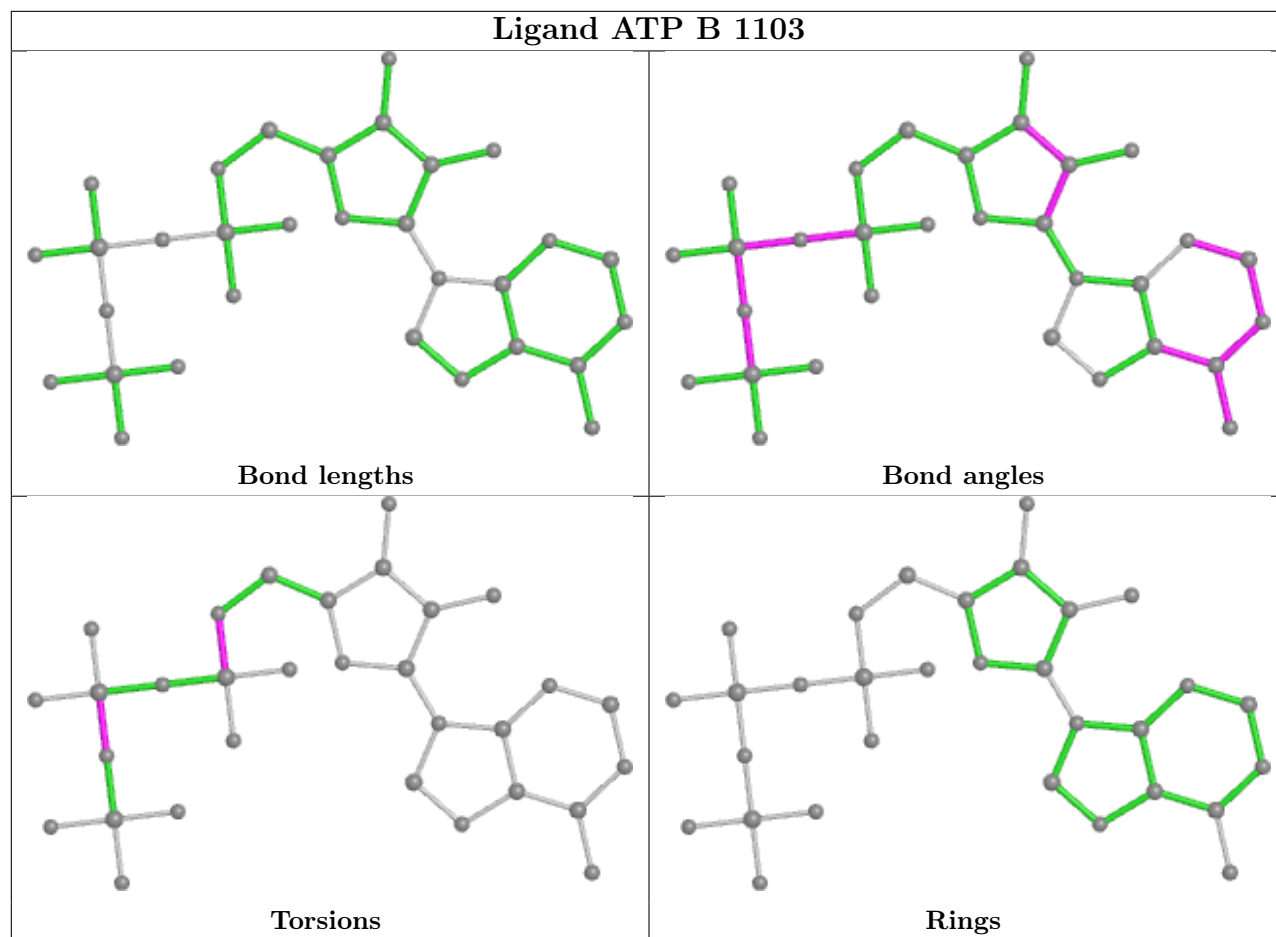
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6   Map visualisation ⓘ

This section contains visualisations of the EMDB entry EMD-38425. These allow visual inspection of the internal detail of the map and identification of artifacts.

No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1   Orthogonal projections ⓘ

6.1.1   Primary map

| X | Y | Z |
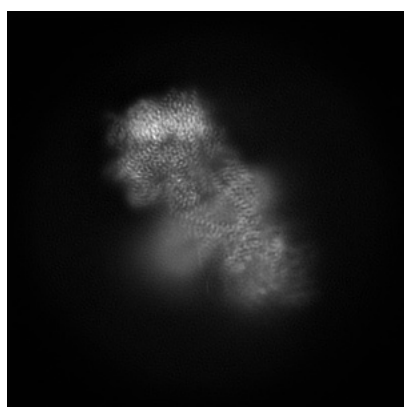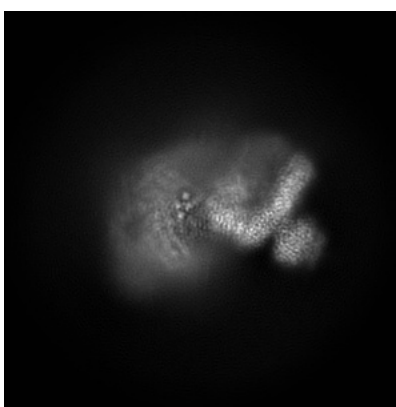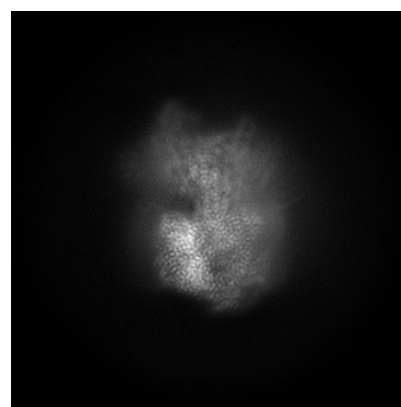
The images above show the map projected in three orthogonal directions.

6.2   Central slices ⓘ
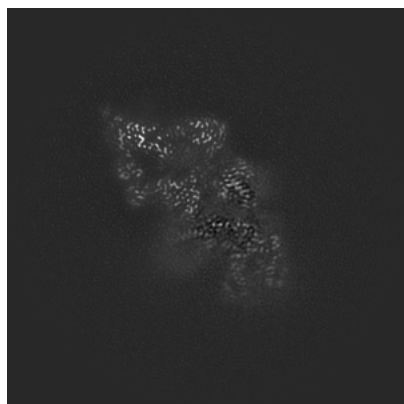
6.2.1   Primary map
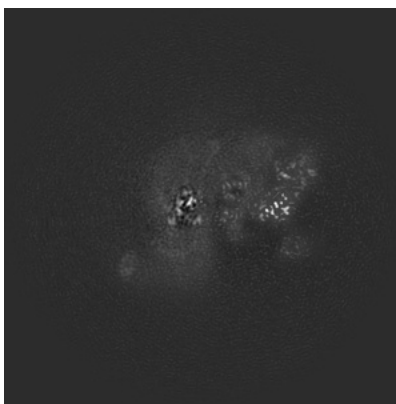
| X Index: 180 | Y Index: 180 | Z Index: 180 |
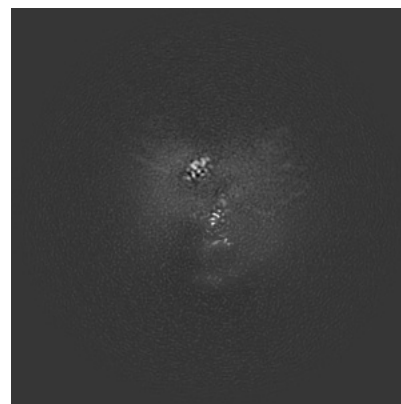
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices ⓘ
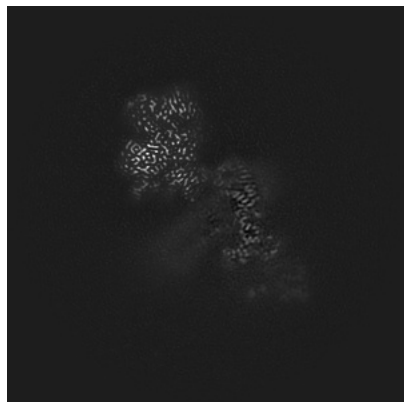
6.3.1 Primary map
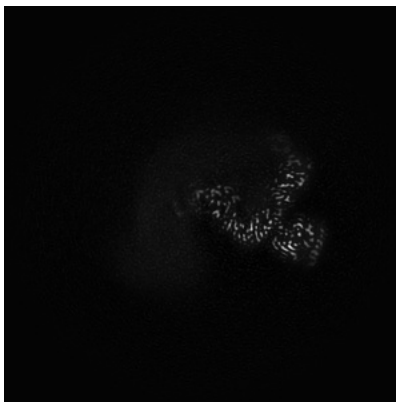
| X Index: 163 | Y Index: 156 | Z Index: 254 |
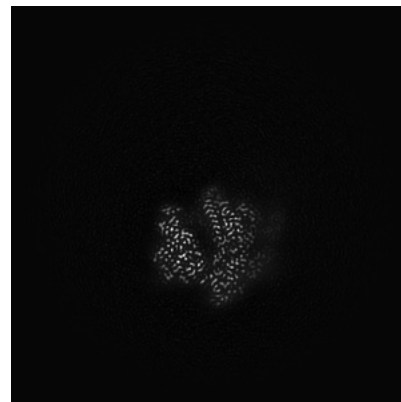
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) ⓘ

6.4.1 Primary map

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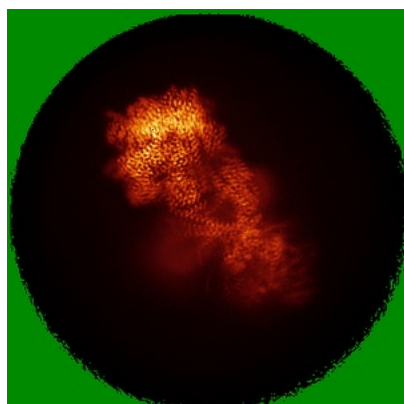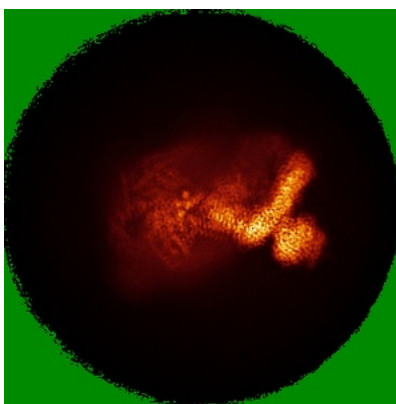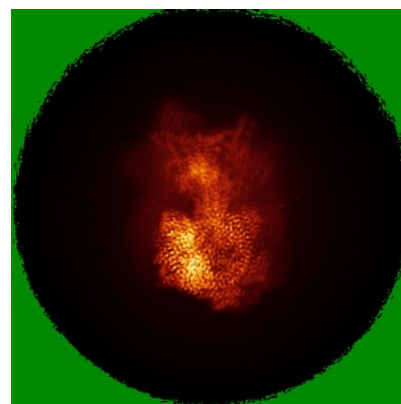
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5   Orthogonal surface views ⓘ

6.5.1   Primary map

X   Y   Z
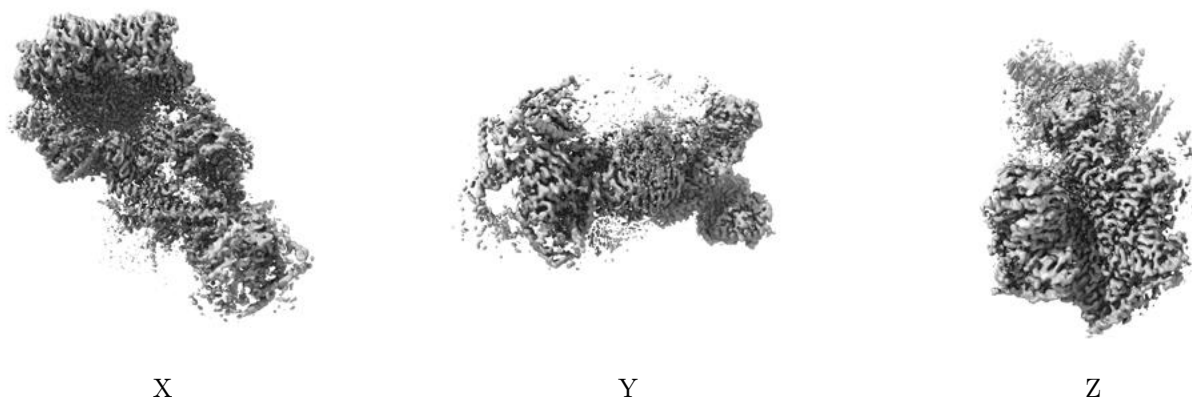
The images above show the 3D surface view of the map at the recommended contour level 0.009. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.6   Mask visualisation ⓘ

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

7   Map analysis ⓘ

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

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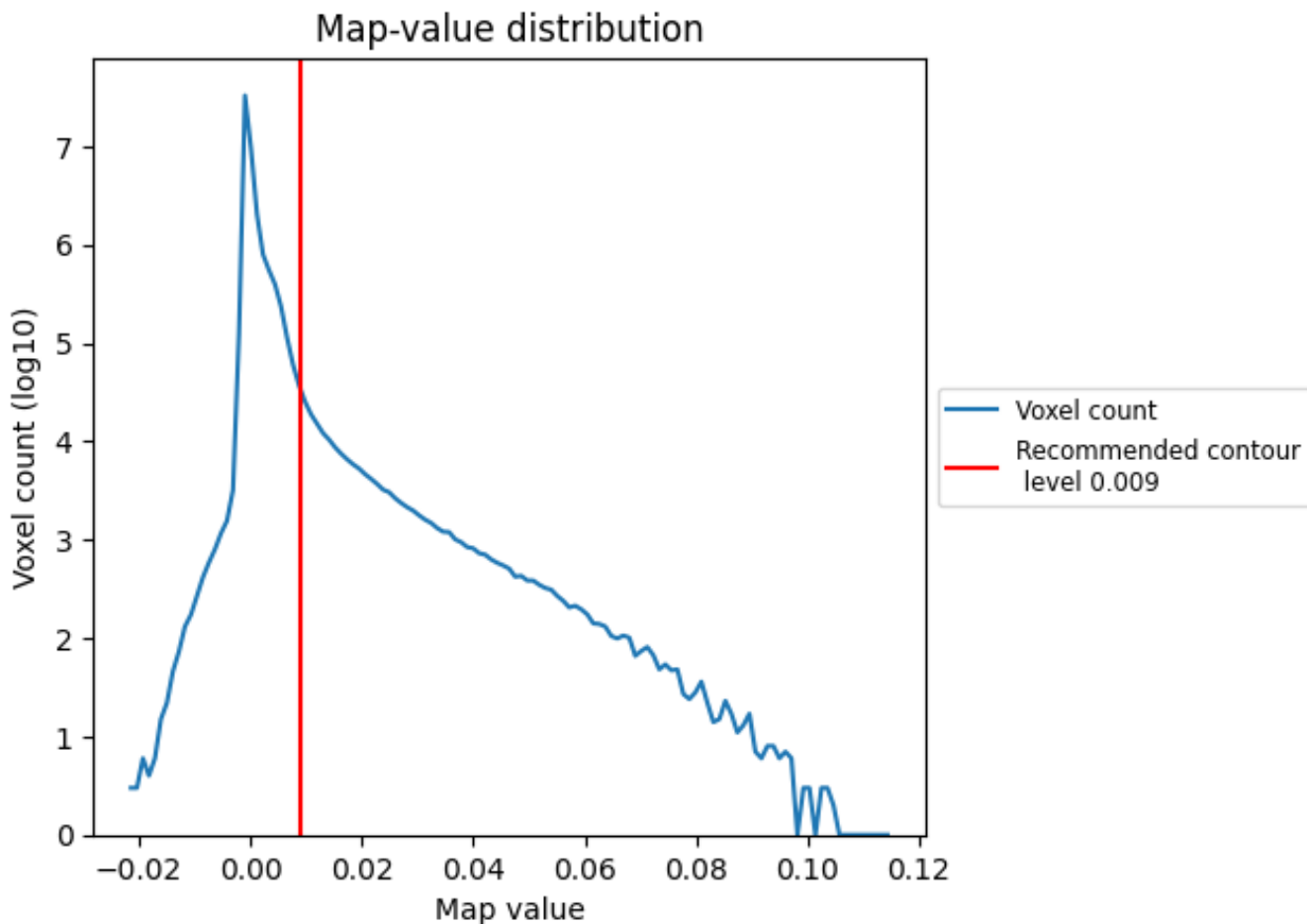
The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

7.2　Volume estimate ⓘ
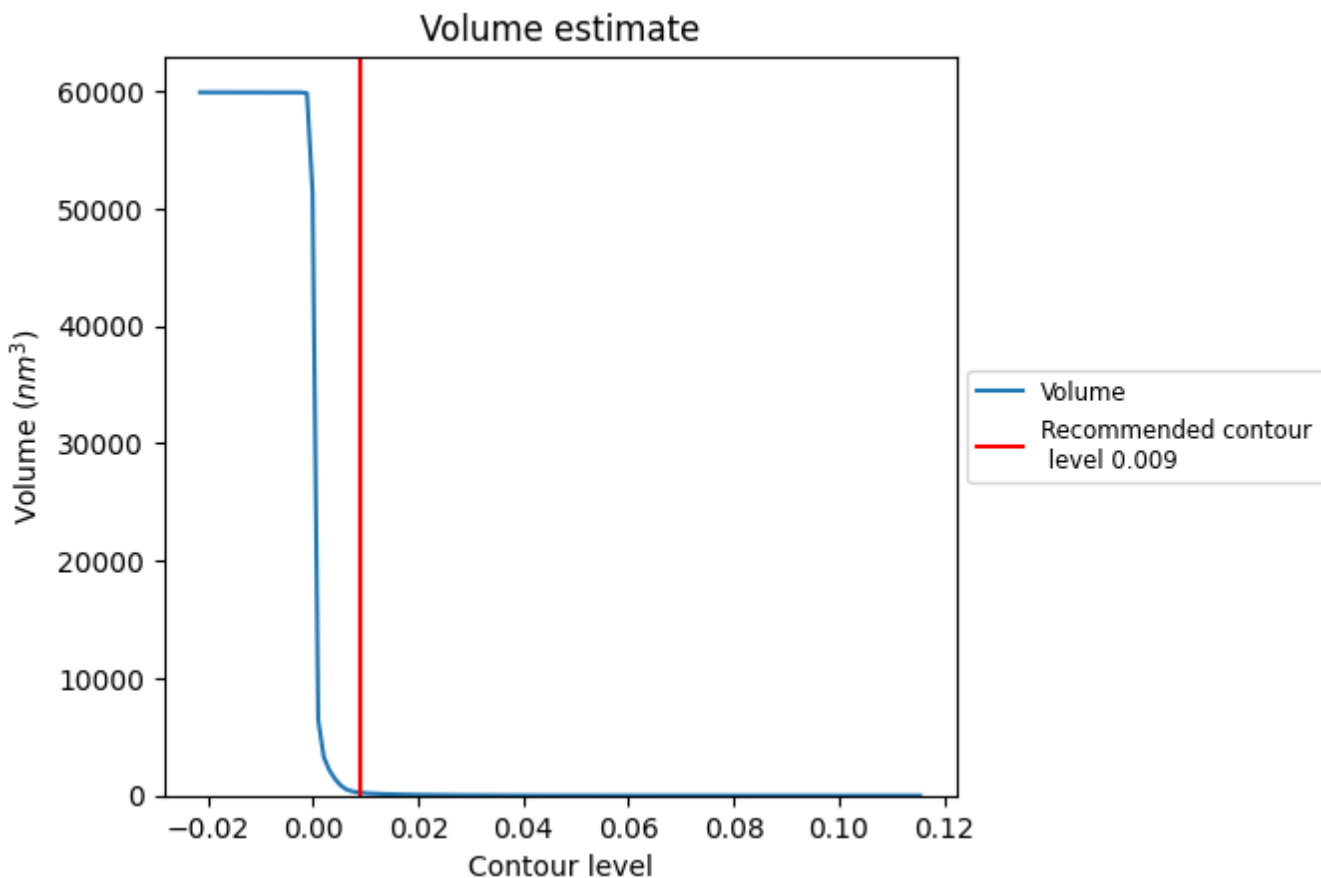
Volume estimate

The volume at the recommended contour level is 249 nm^3; this corresponds to an approximate mass of 225 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)
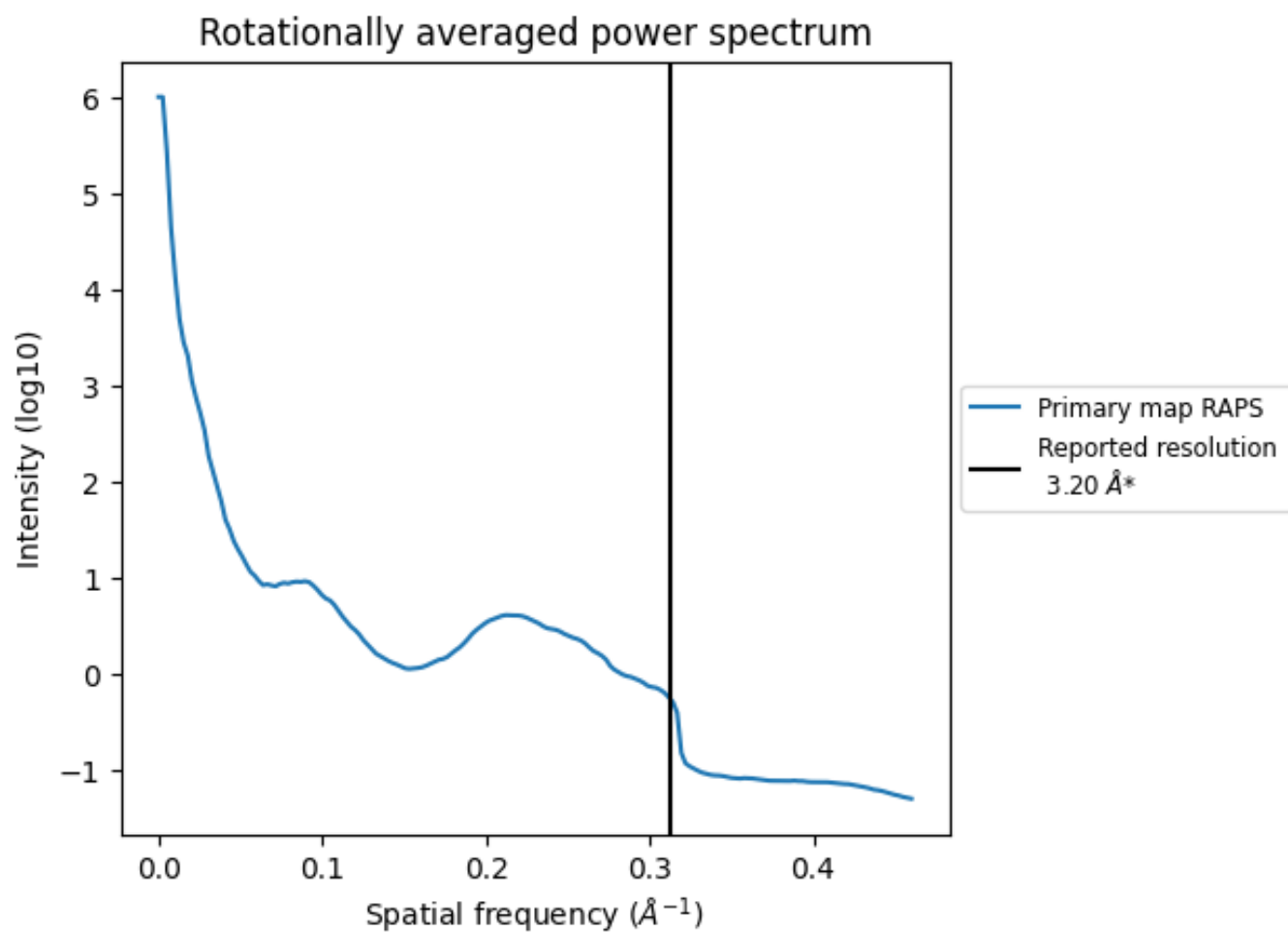
*Reported resolution corresponds to spatial frequency of 0.312 Å^{-1}

8   Fourier-Shell correlation ⓘ

This section was not generated. No FSC curve or half-maps provided.

9 Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-38425 and PDB model 8XKU. Per-residue inclusion information can be found in section 3 on page 9.

9.1 Map-model overlay ⓘ

X   Y   Z
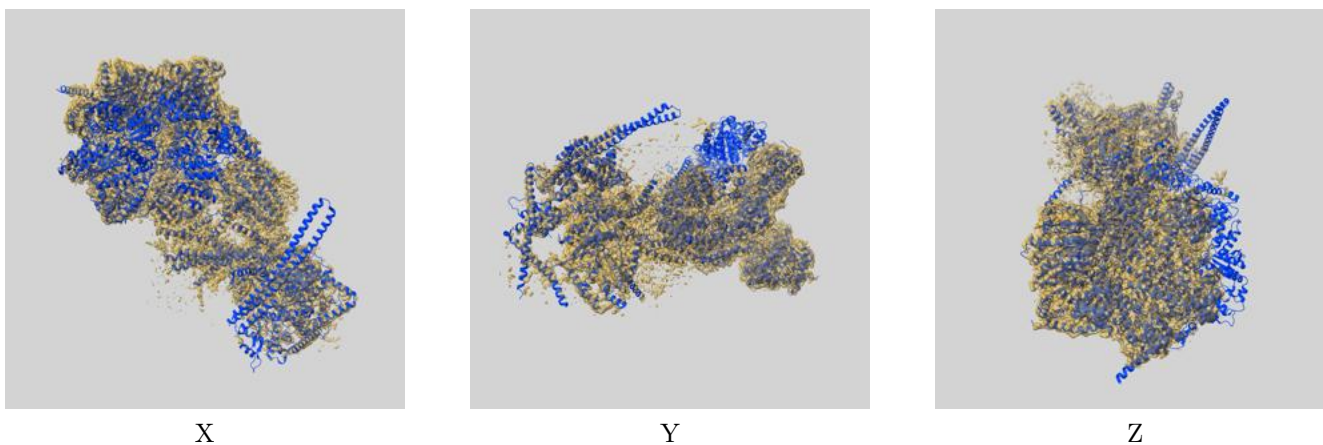
The images above show the 3D surface view of the map at the recommended contour level 0.009 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2   Q-score mapped to coordinate model   ⓘ

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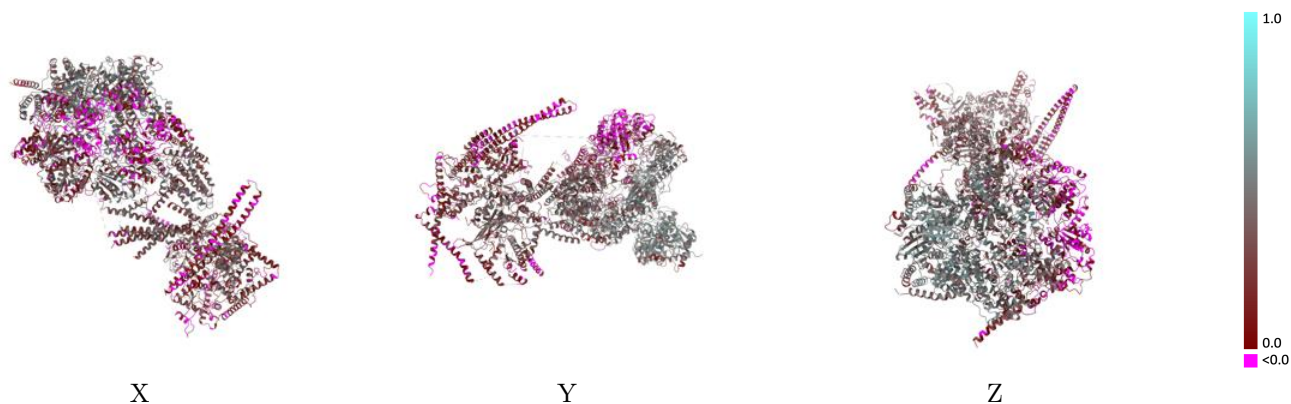
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

X   Y   Z
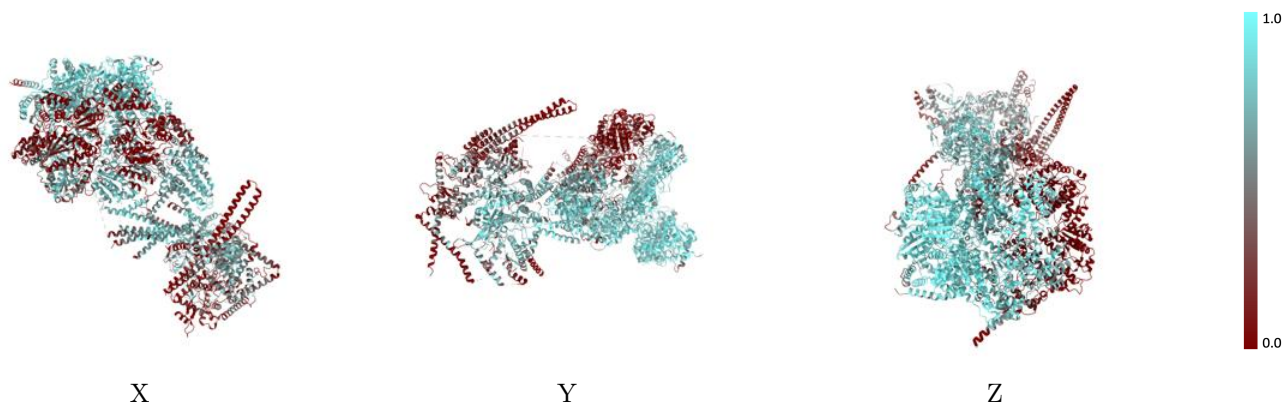
The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.009).

9.4   Atom inclusion ⓘ
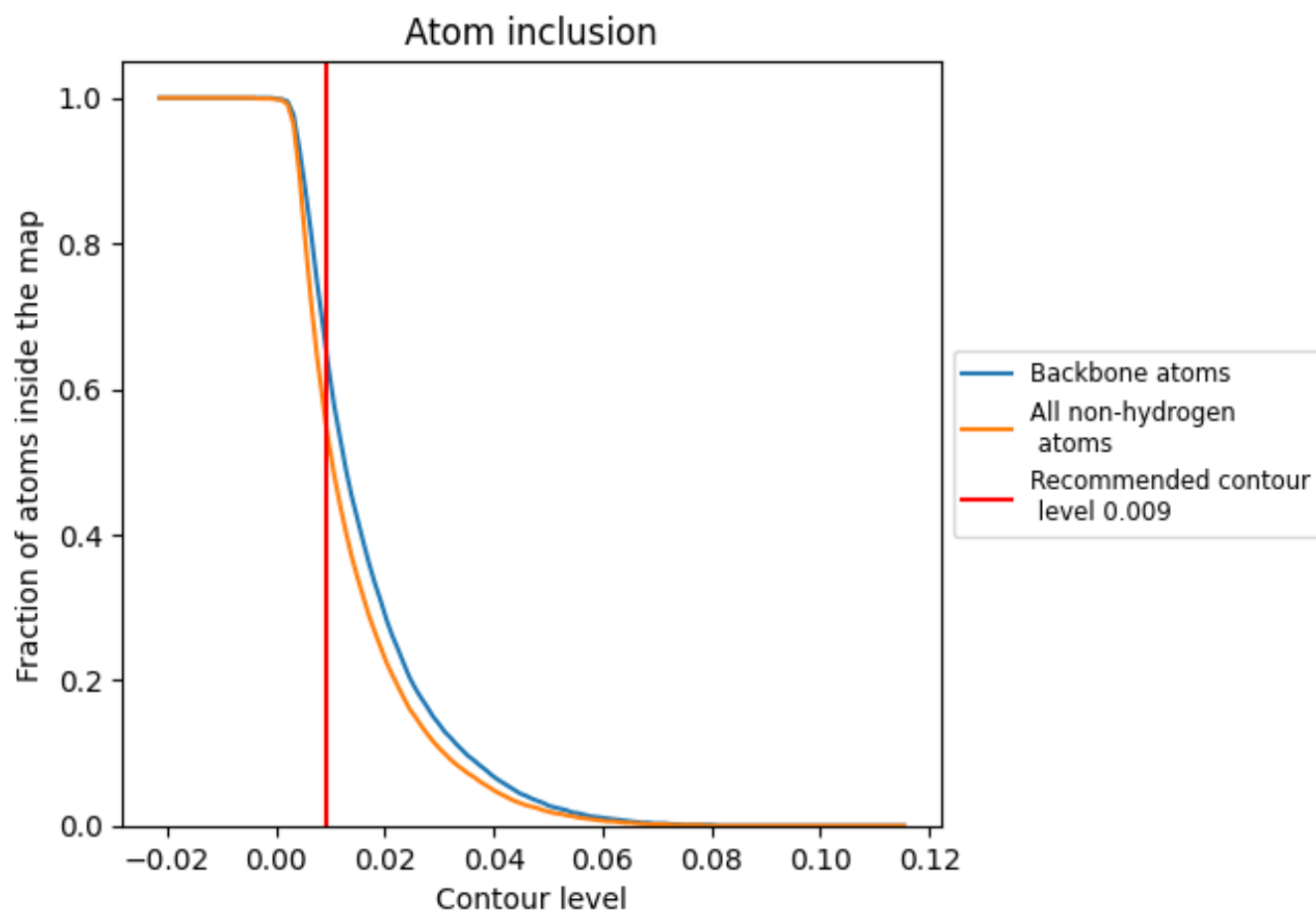
At the recommended contour level, 66% of all backbone atoms, 56% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary ⓘ

The table lists the average atom inclusion at the recommended contour level (0.009) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.5580	0.3040
A	0.6090	0.3260
B	0.7080	0.3600
C	0.3380	0.2030
D	0.5830	0.3230
E	0.4010	0.2060
F	0.3870	0.2610
G	0.7150	0.3440
H	0.6660	0.3500
I	0.8660	0.4610
J	0.8700	0.4660
K	0.3460	0.2390
L	0.1680	0.1950
M	0.3610	0.2750
N	0.2880	0.2530
O	0.3540	0.3120
P	0.1160	0.1110
R	0.4750	0.2460

1.0

0.0
<0.0