



Full wwPDB EM Validation Report ⓘ

Jul 6, 2026 – 12:26 PM JST

PDB ID : 9VPD / pdb_00009vpd
EMDB ID : EMD-65239
Title : Cryo-EM structure of the IF1 bound bovine ATP synthase monomer: rotary state 1, F1 focused map
Authors : Nakano, A.; Jiko, C.; Yamashita, E.; Yokoyama, K.; Gerle, C.
Deposited on : 2025-07-03
Resolution : 2.30 Å(reported)
Based on initial model : 6YY0

This is a Full wwPDB EM Validation 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:

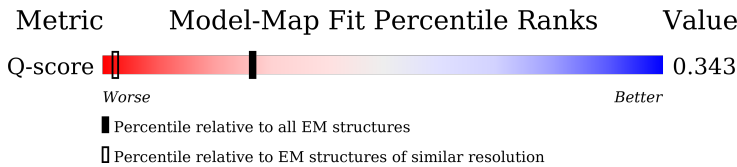
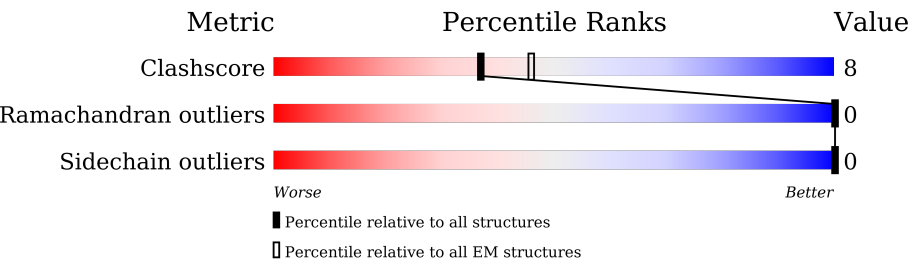
EMDB validation analysis : 0.0.1.dev133
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using 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) : 2.50

1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 2.30 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.



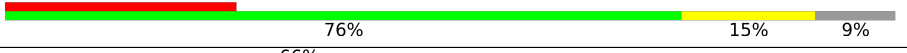
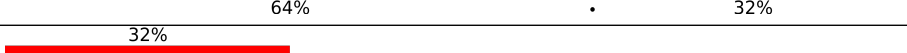
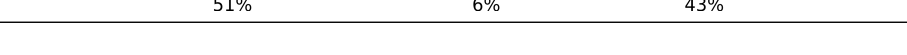
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	4254 (1.80 - 2.80)

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	553	6% 79% 13% 8%
1	B	553	75% 11% 14%
1	C	553	7% 72% 18% 10%
2	D	528	71% 18% 11%

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Mol	Chain	Length	Quality of chain
2	E	528	
2	F	528	
3	G	298	
4	H	168	
5	I	51	
6	J	109	
7	S	213	
8	b	256	
9	d	161	
10	h	108	

2 Entry composition

There are 14 unique types of molecules in this entry. The entry contains 27808 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 ATP synthase F(1) complex subunit alpha, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	508	Total	C	N	O	S	0	0
			3868	2434	681	741	12		
1	B	477	Total	C	N	O	S	0	0
			3641	2294	645	690	12		
1	C	498	Total	C	N	O	S	0	0
			3794	2390	669	723	12		

- Molecule 2 is a protein called ATP synthase F(1) complex catalytic subunit beta, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	D	469	Total	C	N	O	S	0	0
			3558	2254	605	688	11		
2	E	467	Total	C	N	O	S	0	0
			3539	2243	601	684	11		
2	F	467	Total	C	N	O	S	0	0
			3539	2243	601	684	11		

- Molecule 3 is a protein called ATP synthase F(1) complex subunit gamma, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	G	272	Total	C	N	O	S	0	0
			2115	1330	368	409	8		

- Molecule 4 is a protein called ATP synthase F(1) complex subunit delta, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	H	132	Total	C	N	O	S	0	0
			979	614	165	198	2		

- Molecule 5 is a protein called ATP synthase F(1) complex subunit epsilon, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	I	47	Total	C	N	O	S	0	0
			369	237	66	64	2		

- Molecule 6 is a protein called ATPase inhibitor, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	J	47	Total	C	N	O		0	0
			370	224	76	70			

- Molecule 7 is a protein called ATP synthase peripheral stalk subunit OSCP, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	S	188	Total	C	N	O		0	0
			752	376	188	188			

- Molecule 8 is a protein called ATP synthase peripheral stalk subunit b, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	b	101	Total	C	N	O		0	0
			404	202	101	101			

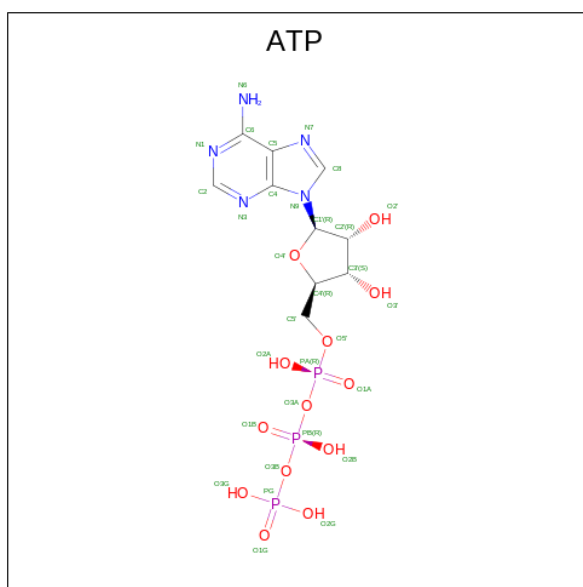
- Molecule 9 is a protein called ATP synthase peripheral stalk subunit d, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	d	109	Total	C	N	O		0	0
			436	218	109	109			

- Molecule 10 is a protein called ATP synthase peripheral stalk subunit F6, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	h	62	Total	C	N	O		0	0
			248	124	62	62			

- Molecule 11 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: C₁₀H₁₆N₅O₁₃P₃) (labeled as "Ligand of Interest" by depositor).



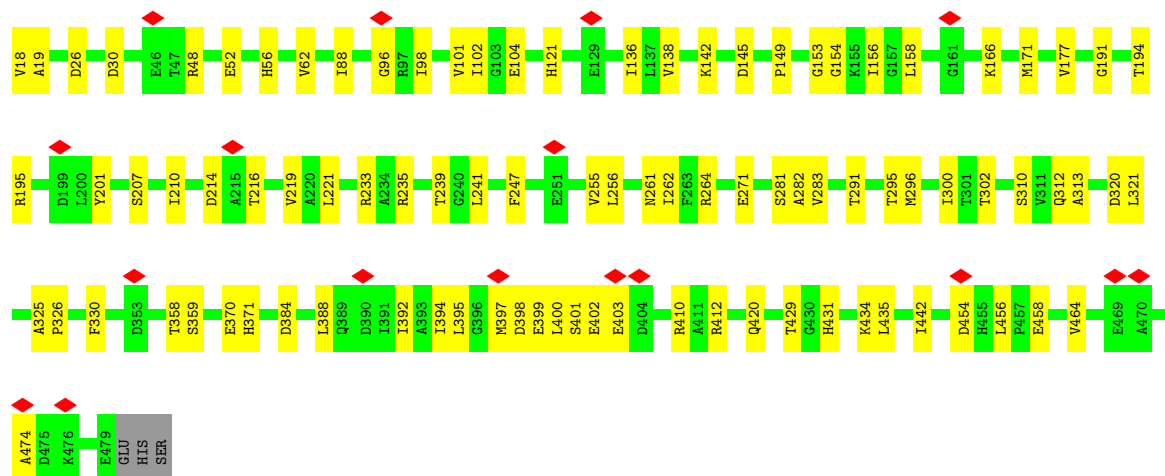
Mol	Chain	Residues	Atoms					AltConf
11	A	1	Total	C	N	O	P	0
			31	10	5	13	3	
11	B	1	Total	C	N	O	P	0
			31	10	5	13	3	
11	C	1	Total	C	N	O	P	0
			31	10	5	13	3	

- Molecule 12 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
12	A	1	Total	Mg	0
			1	1	
12	B	1	Total	Mg	0
			1	1	
12	C	1	Total	Mg	0
			1	1	
12	D	1	Total	Mg	0
			1	1	
12	F	1	Total	Mg	0
			1	1	

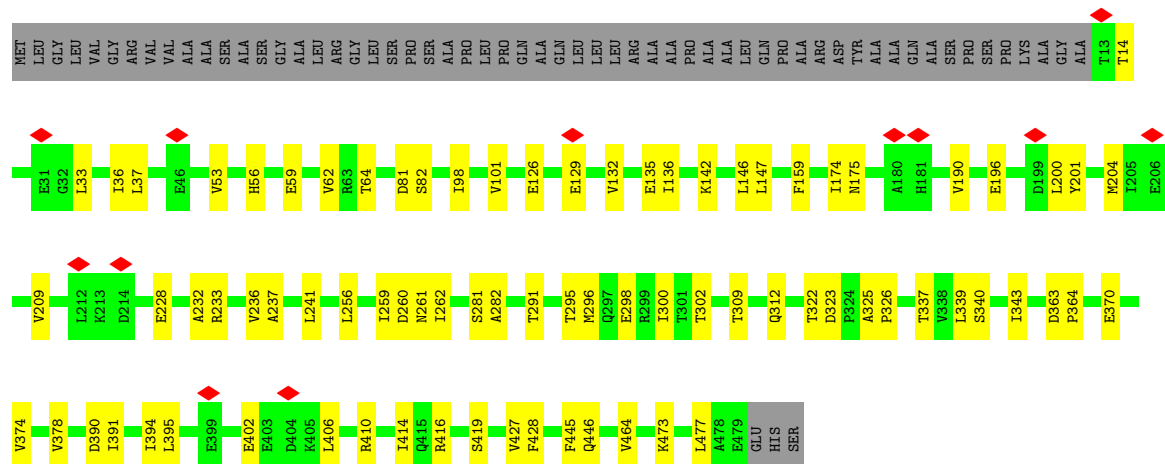
- Molecule 13 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: C₁₀H₁₅N₅O₁₀P₂) (labeled as "Ligand of Interest" by depositor).





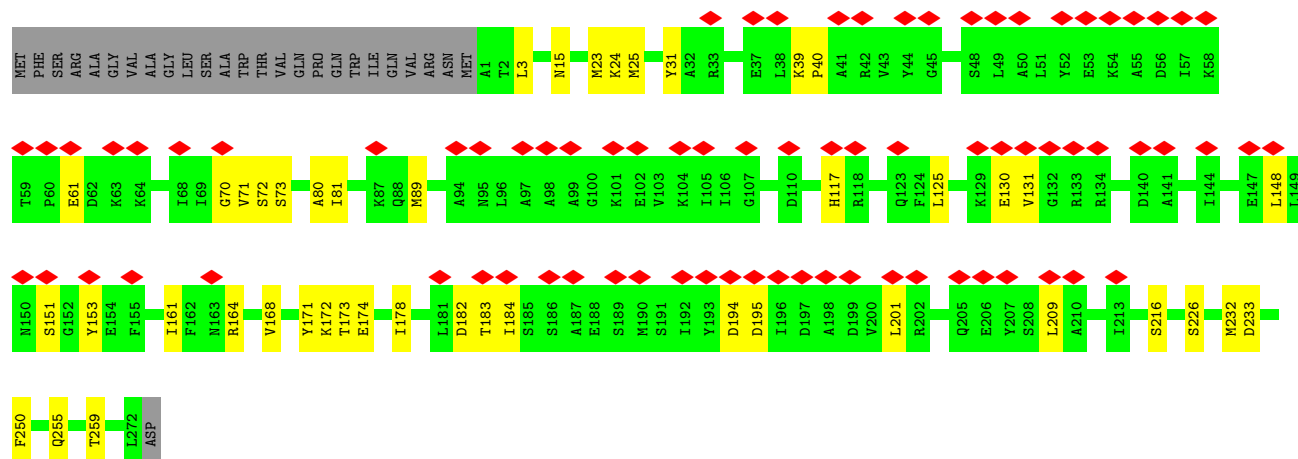
- Molecule 2: ATP synthase F(1) complex catalytic subunit beta, mitochondrial

Chain F: 73% 15% 12%

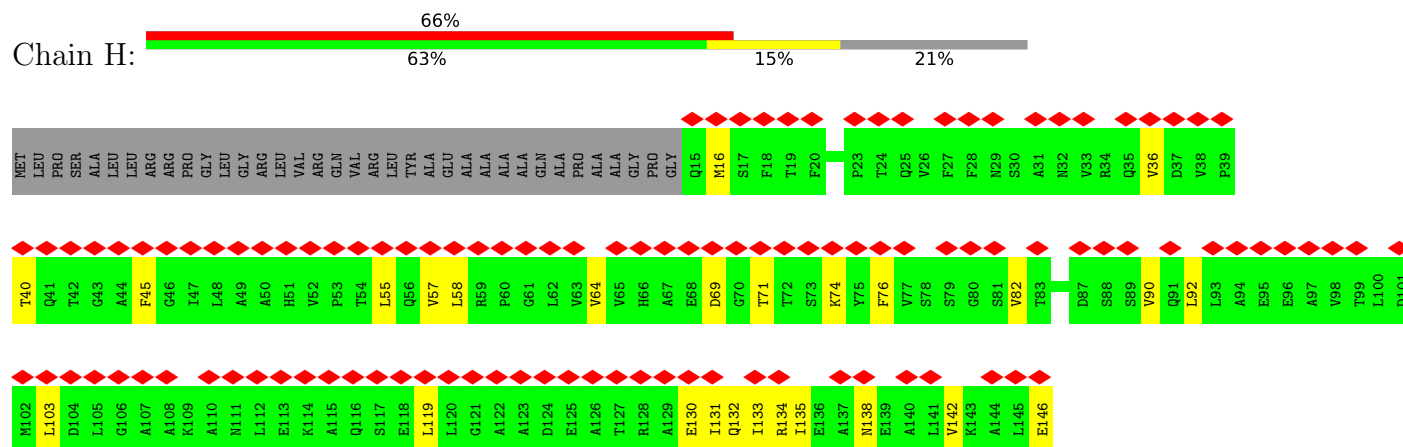


- Molecule 3: ATP synthase F(1) complex subunit gamma, mitochondrial

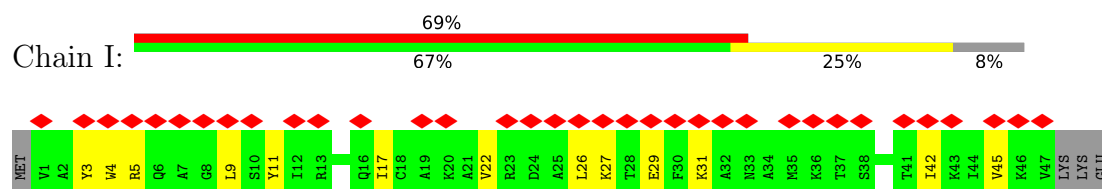
Chain G: 26% 76% 15% 9%



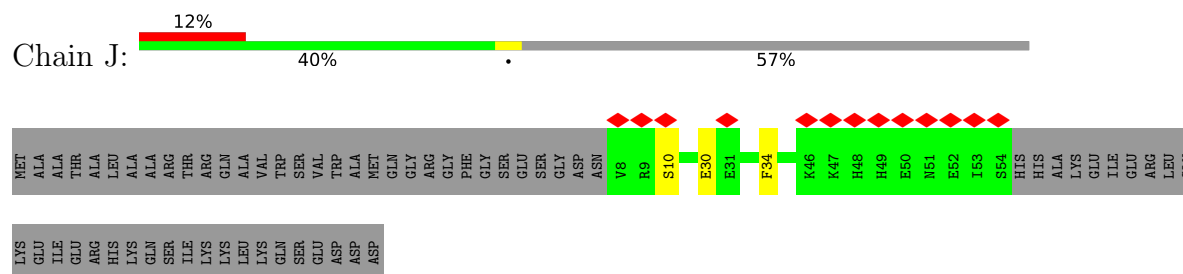
- Molecule 4: ATP synthase F(1) complex subunit delta, mitochondrial



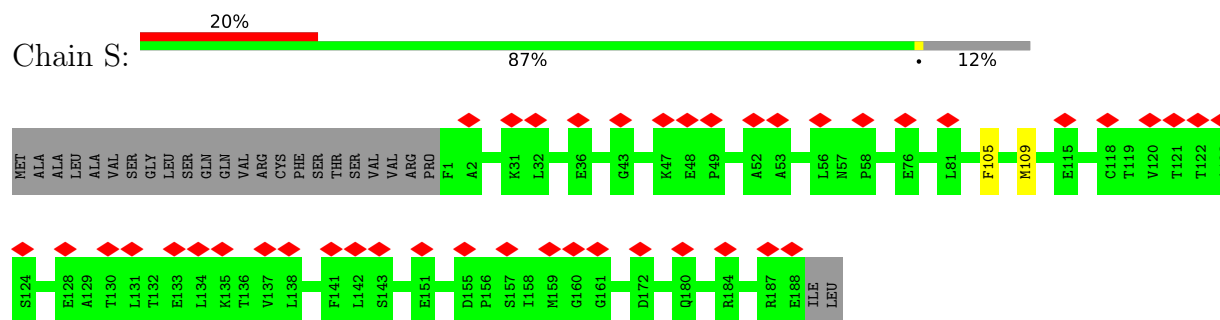
- Molecule 5: ATP synthase F(1) complex subunit epsilon, mitochondrial



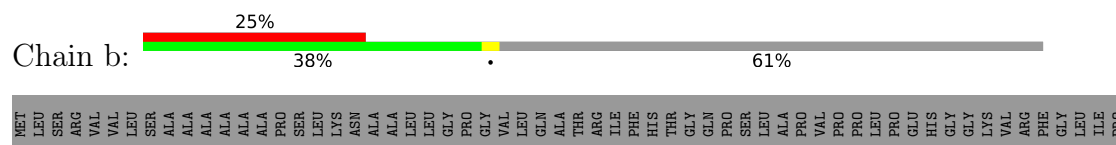
- Molecule 6: ATPase inhibitor, mitochondrial

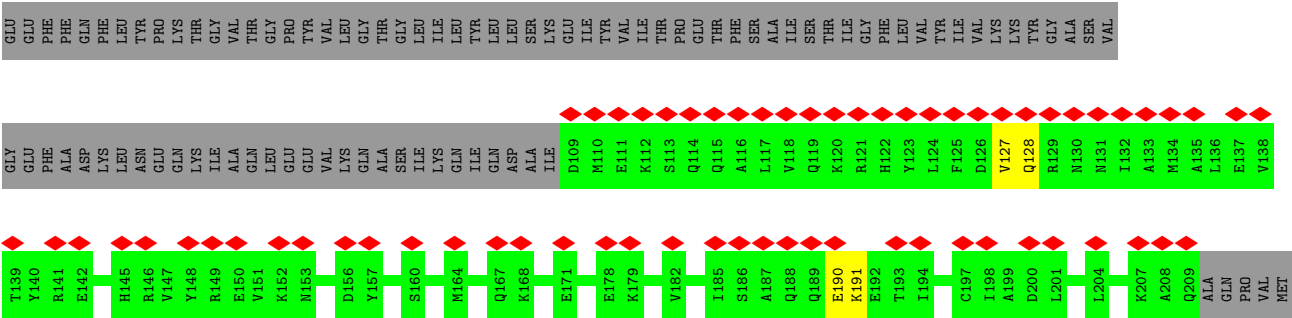


- Molecule 7: ATP synthase peripheral stalk subunit OSCP, mitochondrial

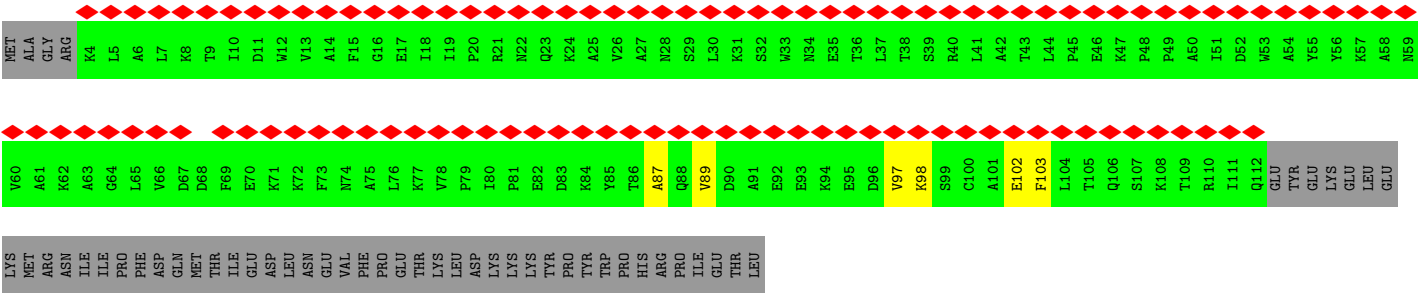


- Molecule 8: ATP synthase peripheral stalk subunit b, mitochondrial

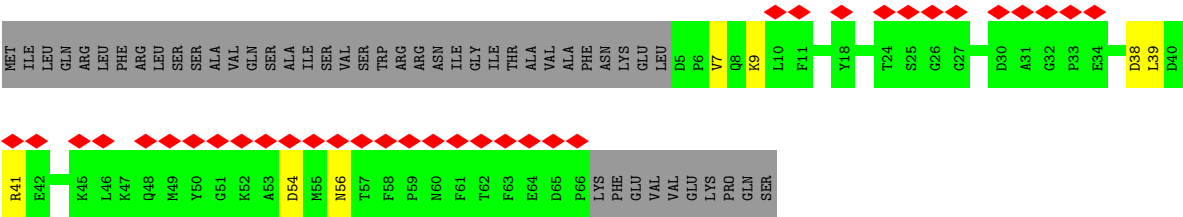




● Molecule 9: ATP synthase peripheral stalk subunit d, mitochondrial



● Molecule 10: ATP synthase peripheral stalk subunit F6, mitochondrial



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	398620	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.214	Depositor
Minimum map value	-0.387	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.031	Depositor
Recommended contour level	0.15	Depositor
Map size (Å)	319.1988, 319.1988, 319.1988	wwPDB
Map dimensions	340, 340, 340	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.93882, 0.93882, 0.93882	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ADP, 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	0.26	0/3919	0.33	0/5287
1	B	0.26	0/3689	0.34	0/4975
1	C	0.27	0/3843	0.35	0/5184
2	D	0.27	0/3616	0.34	0/4906
2	E	0.25	0/3596	0.34	0/4879
2	F	0.27	0/3596	0.34	0/4879
3	G	0.23	0/2141	0.34	0/2876
4	H	0.20	0/991	0.35	0/1349
5	I	0.18	0/374	0.31	0/501
6	J	0.21	0/374	0.31	0/495
7	S	0.18	0/751	0.29	0/937
8	b	0.17	0/403	0.37	0/502
9	d	0.12	0/435	0.27	0/542
10	h	0.16	0/247	0.46	0/307
All	All	0.25	0/27975	0.34	0/37619

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 [i](#)

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	3868	0	3969	49	0
1	B	3641	0	3750	47	0
1	C	3794	0	3903	69	0
2	D	3558	0	3605	70	0
2	E	3539	0	3593	65	0
2	F	3539	0	3592	57	0
3	G	2115	0	2185	36	0
4	H	979	0	978	23	0
5	I	369	0	395	11	0
6	J	370	0	361	3	0
7	S	752	0	200	1	0
8	b	404	0	100	2	0
9	d	436	0	106	3	0
10	h	248	0	64	4	0
11	A	31	0	12	0	0
11	B	31	0	12	0	0
11	C	31	0	12	0	0
12	A	1	0	0	0	0
12	B	1	0	0	0	0
12	C	1	0	0	0	0
12	D	1	0	0	0	0
12	F	1	0	0	0	0
13	D	27	0	12	1	0
13	E	27	0	12	0	0
13	F	27	0	12	0	0
14	A	3	0	0	0	0
14	B	3	0	0	0	0
14	C	3	0	0	0	0
14	D	4	0	0	2	0
14	F	4	0	0	2	0
All	All	27808	0	26873	415	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.

All (415) 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:E:310:SER:OG	2:E:312:GLN:OE1	1.85	0.94
2:D:385:TYR:OH	6:J:30:GLU:OE2	1.89	0.91
1:B:127:ARG:NH2	1:B:255:GLU:OE1	2.06	0.87
2:D:196:GLU:OE1	14:D:701:HOH:O	1.91	0.87

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:G:23:MET:HE2	3:G:232:MET:SD	2.15	0.86
1:B:291:ARG:NH2	2:F:323:ASP:OD1	2.12	0.83
5:I:26:LEU:O	5:I:31:LYS:NZ	2.12	0.83
1:B:420:ARG:NH1	1:B:449:VAL:O	2.13	0.82
2:F:196:GLU:OE2	14:F:701:HOH:O	1.97	0.81
2:E:210:ILE:HD11	2:E:221:LEU:HD11	1.61	0.81
1:A:101:GLU:OE1	1:A:262:LYS:NZ	2.14	0.81
4:H:58:LEU:HD11	4:H:92:LEU:HD11	1.62	0.81
1:C:237:SER:OG	2:F:298:GLU:OE1	1.98	0.80
1:A:102:GLU:OE1	1:A:102:GLU:N	2.15	0.80
1:C:151:LYS:NZ	1:C:465:GLU:OE1	2.14	0.80
1:B:258:ARG:NH1	1:B:308:ARG:O	2.15	0.79
2:E:142:LYS:NZ	2:E:464:VAL:O	2.14	0.79
1:B:499:GLU:OE2	1:B:503:ASN:ND2	2.17	0.78
1:C:452:TYR:OH	1:C:498:LYS:NZ	2.17	0.78
1:C:163:GLN:NE2	1:C:165:GLU:OE2	2.18	0.76
1:C:34:ILE:HD11	1:C:79:ASP:OD1	1.86	0.75
2:F:196:GLU:OE1	14:F:702:HOH:O	2.03	0.75
1:A:163:GLN:NE2	1:A:165:GLU:OE1	2.21	0.74
1:C:255:GLU:OE1	1:C:308:ARG:NE	2.21	0.73
2:D:314:ILE:HD13	2:D:329:THR:HG21	1.69	0.72
2:F:291:THR:O	2:F:295:THR:HG23	1.88	0.72
1:C:52:MET:O	1:C:91:THR:OG1	2.07	0.72
2:F:416:ARG:O	2:F:419:SER:OG	2.08	0.72
1:A:185:ASN:OD1	1:A:188:ARG:NH1	2.23	0.71
2:E:403:GLU:OE2	2:E:403:GLU:N	2.24	0.71
2:F:200:LEU:HG	2:F:204:MET:HE3	1.73	0.71
4:H:16:MET:HE1	4:H:36:VAL:HG23	1.73	0.70
2:D:171:MET:SD	2:D:200:LEU:HD13	2.31	0.70
2:D:402:GLU:OE1	2:D:405:LYS:NZ	2.22	0.70
1:B:164:ARG:NH2	1:B:347:ASP:OD1	2.25	0.69
2:D:196:GLU:OE2	14:D:702:HOH:O	2.09	0.69
2:E:52:GLU:OE1	2:E:235:ARG:NE	2.25	0.69
2:D:16:ARG:NH2	2:D:28:GLN:OE1	2.25	0.69
2:D:155:LYS:NZ	2:D:297:GLN:O	2.24	0.69
1:B:157:VAL:O	1:B:157:VAL:HG23	1.91	0.69
3:G:61:GLU:OE1	3:G:61:GLU:N	2.26	0.69
2:D:291:THR:O	2:D:295:THR:HG23	1.92	0.69
1:B:442:VAL:CG1	1:B:489:ILE:HD11	2.22	0.69
1:A:210:ARG:NH1	2:D:125:PRO:O	2.25	0.68
2:D:302:THR:HG23	2:D:307:SER:HA	1.74	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:G:15:ASN:OD1	6:J:10:SER:OG	2.13	0.67
1:B:393:GLU:OE1	1:B:420:ARG:NH1	2.28	0.67
2:D:142:LYS:NZ	2:D:417:PHE:O	2.18	0.67
2:D:480:GLU:OE1	2:D:480:GLU:N	2.28	0.67
1:C:400:VAL:O	1:C:418:LEU:HD11	1.94	0.67
4:H:64:VAL:HG22	4:H:74:LYS:HG3	1.77	0.67
2:D:233:ARG:NH2	2:D:271:GLU:OE1	2.29	0.66
1:A:38:ILE:CD1	1:A:74:VAL:HG12	2.25	0.66
2:F:126:GLU:N	2:F:129:GLU:OE2	2.29	0.66
2:E:291:THR:O	2:E:295:THR:HG23	1.95	0.65
2:D:52:GLU:OE2	2:D:235:ARG:NE	2.27	0.65
2:D:416:ARG:O	2:D:419:SER:OG	2.13	0.65
3:G:31:TYR:OH	3:G:168:VAL:HG22	1.95	0.65
1:B:255:GLU:OE2	1:B:308:ARG:NE	2.30	0.64
1:B:437:ALA:HB3	1:B:440:GLU:OE1	1.97	0.64
1:A:327:ILE:HD11	1:A:342:VAL:HG21	1.79	0.64
1:C:491:GLU:OE1	1:C:491:GLU:N	2.30	0.64
2:E:320:ASP:OD2	3:G:255:GLN:NE2	2.31	0.64
1:A:258:ARG:NH1	1:A:308:ARG:O	2.30	0.64
2:D:394:ILE:HG22	3:G:23:MET:HE1	1.80	0.64
1:C:499:GLU:OE1	1:C:503:ASN:ND2	2.32	0.63
1:B:62:MET:HE3	1:B:64:LEU:HD21	1.81	0.63
2:F:59:GLU:O	2:F:59:GLU:HG2	1.98	0.62
2:E:56:HIS:HD2	2:E:62:VAL:HG12	1.63	0.62
1:A:36:ASP:OD2	2:D:278:ARG:NE	2.32	0.62
2:E:395:LEU:HD23	2:E:399:GLU:HG2	1.82	0.62
3:G:72:SER:OG	3:G:73:SER:N	2.22	0.62
2:E:370:GLU:OE2	2:E:370:GLU:N	2.30	0.62
1:A:38:ILE:HD13	1:A:74:VAL:HG12	1.82	0.62
2:E:233:ARG:NH2	2:E:271:GLU:OE1	2.33	0.62
4:H:103:LEU:O	5:I:27:LYS:NZ	2.33	0.62
2:E:88:ILE:HD13	2:E:239:THR:HG23	1.81	0.61
1:A:421:GLY:O	1:A:425:THR:HG23	2.00	0.61
3:G:117:HIS:ND1	3:G:117:HIS:O	2.34	0.61
1:C:496:LYS:O	1:C:500:ILE:HD12	2.00	0.61
4:H:16:MET:HE1	4:H:36:VAL:CG2	2.31	0.61
1:B:62:MET:HE3	1:B:64:LEU:CD2	2.31	0.61
2:E:283:VAL:HG12	2:E:283:VAL:O	2.01	0.60
2:D:370:GLU:O	2:D:374:VAL:HG23	2.01	0.60
1:B:474:SER:OG	1:B:475:GLN:N	2.34	0.60
4:H:134:ARG:O	4:H:138:ASN:ND2	2.35	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:H:131:ILE:O	4:H:135:ILE:HD12	2.01	0.60
2:F:237:ALA:O	2:F:241:LEU:HD13	2.02	0.60
1:A:170:ASP:O	1:A:175:LYS:NZ	2.34	0.60
2:D:456:LEU:HD22	2:D:474:ALA:CB	2.31	0.59
1:C:472:VAL:HG12	1:C:480:LEU:HD11	1.84	0.59
3:G:71:VAL:HG21	3:G:216:SER:OG	2.03	0.59
1:B:169:GLY:O	1:B:329:THR:OG1	2.21	0.59
1:B:444:VAL:CG2	1:B:469:LEU:HD21	2.32	0.59
2:D:45:ARG:NH1	2:D:71:GLU:O	2.33	0.59
2:D:262:ILE:HD11	2:D:296:MET:HE1	1.85	0.59
2:E:241:LEU:HD21	2:E:300:ILE:HG13	1.84	0.58
1:C:206:ILE:HD11	1:C:247:PRO:HG3	1.85	0.58
2:E:456:LEU:HD22	2:E:474:ALA:CB	2.33	0.58
1:C:474:SER:OG	1:C:475:GLN:OE1	2.20	0.58
2:F:300:ILE:HG22	2:F:300:ILE:O	2.04	0.58
3:G:168:VAL:O	3:G:226:SER:OG	2.21	0.58
2:E:48:ARG:NH1	2:E:104:GLU:OE2	2.36	0.58
1:C:225:ALA:O	1:C:229:THR:OG1	2.15	0.57
2:E:214:ASP:OD1	2:E:216:THR:HG22	2.03	0.57
3:G:89:MET:HG2	3:G:161:ILE:HD13	1.87	0.57
1:B:170:ASP:O	1:B:175:LYS:NZ	2.37	0.57
1:C:134:PRO:CB	1:C:312:MET:HE1	2.35	0.57
2:E:397:MET:HE3	2:E:400:LEU:HD12	1.87	0.57
1:B:166:LEU:HD13	1:B:342:VAL:CG1	2.35	0.57
1:B:47:VAL:HG23	1:B:51:GLU:OE1	2.05	0.57
2:F:340:SER:HB3	2:F:343:ILE:HD13	1.86	0.56
3:G:194:ASP:OD1	3:G:195:ASP:N	2.39	0.56
3:G:80:ALA:O	3:G:171:TYR:OH	2.23	0.56
1:A:255:GLU:OE2	1:A:258:ARG:NH2	2.38	0.56
1:B:55:PHE:CD1	1:B:88:VAL:HG22	2.41	0.56
2:D:259:ILE:HG21	2:D:262:ILE:HD13	1.87	0.56
2:F:406:LEU:HD21	2:F:410:ARG:NH2	2.21	0.56
1:B:156:LEU:HD22	1:B:367:VAL:HG11	1.88	0.55
2:E:177:VAL:HG21	2:E:256:LEU:HD11	1.88	0.55
4:H:55:LEU:HD12	4:H:55:LEU:O	2.06	0.55
1:C:203:TYR:OH	1:C:269:ASP:OD2	2.12	0.55
2:E:384:ASP:O	2:E:388:LEU:HD13	2.06	0.55
2:F:200:LEU:CG	2:F:204:MET:HE3	2.36	0.55
2:E:321:LEU:HD22	2:E:330:PHE:HE2	1.72	0.55
1:A:51:GLU:OE2	1:A:90:ARG:NH2	2.39	0.55
1:A:449:VAL:HG22	1:A:449:VAL:O	2.07	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:E:191:GLY:O	2:E:264:ARG:NE	2.40	0.55
2:D:161:GLY:O	2:D:166:LYS:NZ	2.40	0.54
1:A:389:THR:OG1	1:A:449:VAL:HG21	2.07	0.54
2:E:420:GLN:NE2	2:E:434:LYS:O	2.39	0.54
2:D:101:VAL:HG13	2:D:102:ILE:HG23	1.88	0.54
2:F:146:LEU:HD22	2:F:445:PHE:CD2	2.42	0.54
2:D:166:LYS:N	13:D:600:ADP:O1B	2.41	0.54
2:D:397:MET:HE2	6:J:34:PHE:CE2	2.43	0.54
2:E:401:SER:OG	2:E:402:GLU:N	2.41	0.54
2:E:321:LEU:HD22	2:E:330:PHE:CE2	2.43	0.54
1:A:101:GLU:OE2	1:A:101:GLU:N	2.40	0.53
2:F:259:ILE:HD12	2:F:312:GLN:HG2	1.90	0.53
1:A:46:ASN:O	1:A:90:ARG:NH1	2.41	0.53
1:B:452:TYR:CE2	1:B:501:VAL:HG13	2.43	0.53
2:D:406:LEU:HD21	2:D:410:ARG:NH2	2.22	0.53
2:F:302:THR:O	2:F:302:THR:HG23	2.09	0.53
1:C:129:VAL:HG21	1:C:245:LEU:HD11	1.90	0.53
4:H:69:ASP:OD1	4:H:71:THR:N	2.41	0.53
4:H:133:ILE:HD11	5:I:4:TRP:HB3	1.91	0.52
1:B:380:THR:O	1:B:384:LYS:N	2.40	0.52
2:F:81:ASP:OD1	2:F:82:SER:N	2.43	0.52
2:F:281:SER:OG	2:F:282:ALA:N	2.38	0.52
1:A:270:ASP:OD1	1:A:271:LEU:N	2.43	0.52
1:B:206:ILE:HD11	1:B:247:PRO:HG3	1.90	0.52
1:A:171:ARG:NH2	2:D:356:ASP:OD1	2.39	0.52
1:B:32:LEU:N	1:B:40:ARG:O	2.42	0.52
2:D:33:LEU:HD21	2:D:60:SER:O	2.09	0.52
2:E:247:PHE:HB2	2:E:255:VAL:HG21	1.92	0.52
2:E:456:LEU:HD22	2:E:474:ALA:HB1	1.92	0.52
2:F:101:VAL:HG21	2:F:232:ALA:HB1	1.92	0.52
2:F:132:VAL:HG12	2:F:132:VAL:O	2.11	0.51
2:D:172:GLU:OE2	2:D:176:ASN:ND2	2.43	0.51
1:C:422:VAL:O	1:C:426:GLU:OE1	2.28	0.51
2:E:281:SER:OG	2:E:282:ALA:N	2.44	0.51
1:B:188:ARG:HE	1:B:437:ALA:HB2	1.75	0.51
2:E:154:GLY:O	2:E:156:ILE:HD12	2.11	0.51
2:E:398:ASP:OD1	2:E:399:GLU:N	2.44	0.51
1:B:180:ILE:HG22	1:B:184:ILE:HD12	1.93	0.51
1:C:218:LYS:HD3	2:F:132:VAL:HG11	1.93	0.51
2:D:101:VAL:HG21	2:D:235:ARG:HB2	1.91	0.51
1:A:440:GLU:CG	1:A:473:ILE:HD11	2.40	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:F:390:ASP:OD1	2:F:391:ILE:N	2.43	0.51
1:C:444:VAL:HG23	1:C:469:LEU:HD21	1.92	0.51
2:D:378:VAL:O	2:D:381:ILE:HG22	2.11	0.51
1:B:166:LEU:HD13	1:B:342:VAL:HG12	1.94	0.50
2:D:289:LEU:C	2:D:289:LEU:HD23	2.37	0.50
10:h:38:ASP:O	10:h:39:LEU:C	2.54	0.50
1:C:497:LEU:O	1:C:501:VAL:HG23	2.11	0.50
2:D:228:GLU:O	2:D:233:ARG:NH1	2.45	0.50
2:D:283:VAL:HG23	2:D:283:VAL:O	2.12	0.50
2:F:322:THR:HG22	2:F:322:THR:O	2.11	0.50
2:D:378:VAL:HG13	2:D:414:ILE:HG21	1.94	0.50
2:E:138:VAL:HG13	2:E:145:ASP:OD2	2.12	0.50
3:G:164:ARG:N	3:G:172:LYS:O	2.44	0.50
2:D:241:LEU:HD13	2:D:300:ILE:HG12	1.94	0.49
1:B:170:ASP:OD1	1:B:329:THR:OG1	2.30	0.49
2:E:371:HIS:HD2	2:E:442:ILE:HD11	1.77	0.49
2:F:142:LYS:NZ	2:F:464:VAL:O	2.44	0.49
1:C:116:ASP:OD1	1:C:116:ASP:N	2.44	0.49
2:D:157:GLY:HA3	2:D:333:LEU:HD13	1.94	0.49
1:B:442:VAL:HG13	1:B:489:ILE:HD11	1.95	0.49
2:F:259:ILE:HG21	2:F:262:ILE:HD13	1.94	0.49
1:C:143:ARG:HG2	1:C:143:ARG:HH11	1.77	0.49
2:F:427:VAL:HG23	2:F:428:PHE:CD1	2.48	0.49
1:C:464:PHE:O	1:C:465:GLU:C	2.56	0.49
2:E:96:GLY:N	2:E:219:VAL:O	2.36	0.49
2:F:337:THR:HG22	2:F:337:THR:O	2.12	0.49
1:C:371:VAL:HG22	1:C:372:SER:N	2.28	0.48
1:C:458:PRO:HD2	1:C:459:SER:H	1.78	0.48
2:D:33:LEU:HD22	2:D:62:VAL:CG1	2.43	0.48
2:D:281:SER:O	2:D:282:ALA:C	2.56	0.48
3:G:148:LEU:HD23	3:G:148:LEU:C	2.37	0.48
1:C:335:SER:O	1:C:335:SER:OG	2.30	0.48
1:C:462:THR:HG23	1:C:463:LYS:N	2.29	0.48
2:D:159:PHE:CZ	2:D:314:ILE:HD12	2.49	0.48
2:D:394:ILE:CG2	3:G:23:MET:HE1	2.43	0.48
2:D:456:LEU:HD22	2:D:474:ALA:HB1	1.96	0.48
1:A:423:ARG:HG2	1:A:423:ARG:HH11	1.79	0.47
1:A:440:GLU:HG2	1:A:473:ILE:HD11	1.96	0.47
1:C:376:SER:O	1:C:384:LYS:NZ	2.46	0.47
2:E:98:ILE:HD11	2:E:201:TYR:CD1	2.49	0.47
3:G:70:GLY:HA3	3:G:89:MET:SD	2.53	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:165:GLU:OE1	1:B:349:GLN:N	2.47	0.47
2:D:153:GLY:O	2:D:302:THR:OG1	2.26	0.47
2:D:361:ILE:O	2:D:363:ASP:N	2.46	0.47
2:E:101:VAL:HG13	2:E:102:ILE:HG23	1.95	0.47
1:C:14:GLU:OE1	1:C:17:LEU:HD12	2.14	0.47
1:C:496:LYS:O	1:C:497:LEU:C	2.57	0.47
2:E:325:ALA:HB3	2:E:326:PRO:CD	2.45	0.47
1:B:180:ILE:HD11	1:B:216:LEU:HD11	1.97	0.47
3:G:164:ARG:NH1	3:G:174:GLU:OE1	2.46	0.47
2:E:177:VAL:HG21	2:E:256:LEU:CD1	2.44	0.47
2:D:200:LEU:HD11	2:D:204:MET:HE3	1.95	0.47
4:H:16:MET:HE3	4:H:90:VAL:HG21	1.96	0.47
10:h:38:ASP:O	10:h:41:ARG:N	2.47	0.47
1:A:471:HIS:NE2	1:A:475:GLN:OE1	2.45	0.47
2:D:253:GLN:HA	2:D:253:GLN:OE1	2.13	0.47
2:E:171:MET:HE3	2:E:207:SER:CB	2.44	0.47
2:F:402:GLU:OE2	2:F:402:GLU:HA	2.15	0.47
3:G:24:LYS:NZ	3:G:233:ASP:OD2	2.45	0.47
1:C:41:VAL:HG11	1:C:44:LEU:HD12	1.97	0.47
2:D:49:LEU:HD13	2:D:68:ASP:HB3	1.96	0.47
2:D:174:ILE:HD11	2:D:187:PHE:HE2	1.80	0.47
1:C:8:VAL:HG23	1:C:9:SER:N	2.30	0.46
2:E:18:VAL:HG22	2:E:26:ASP:O	2.15	0.46
3:G:131:VAL:HG22	5:I:42:ILE:CD1	2.46	0.46
1:B:489:ILE:O	1:B:489:ILE:HG22	2.15	0.46
2:E:429:THR:HG23	2:E:431:HIS:H	1.80	0.46
3:G:151:SER:O	3:G:153:TYR:N	2.39	0.46
1:A:452:TYR:CD2	1:A:501:VAL:HG11	2.51	0.46
1:C:249:SER:O	1:C:253:MET:HG3	2.15	0.46
1:B:166:LEU:HD11	1:B:327:ILE:CG1	2.46	0.46
1:C:30:ARG:HD2	1:C:87:ILE:HD13	1.98	0.46
1:C:499:GLU:O	1:C:503:ASN:ND2	2.48	0.46
2:D:33:LEU:HD22	2:D:62:VAL:HG13	1.97	0.46
2:F:363:ASP:OD1	2:F:364:PRO:HD2	2.16	0.46
2:D:43:GLN:CG	2:D:80:LEU:HD23	2.47	0.45
2:E:412:ARG:NE	2:E:458:GLU:OE1	2.46	0.45
4:H:132:GLN:NE2	5:I:3:TYR:CE1	2.85	0.45
1:C:10:SER:O	1:C:14:GLU:HG2	2.16	0.45
1:C:63:SER:O	1:C:63:SER:OG	2.31	0.45
10:h:54:ASP:O	10:h:56:ASN:N	2.44	0.45
2:F:174:ILE:O	2:F:175:ASN:C	2.58	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:174:ILE:HD11	2:D:187:PHE:CE2	2.52	0.45
5:I:45:VAL:HG23	5:I:45:VAL:O	2.16	0.45
1:B:127:ARG:NH2	1:B:131:LEU:HD23	2.32	0.45
2:E:241:LEU:HD11	2:E:296:MET:HG2	1.99	0.45
1:B:390:MET:HE3	1:B:424:LEU:HD22	1.99	0.45
4:H:131:ILE:O	4:H:134:ARG:HB2	2.16	0.45
1:A:173:THR:HG22	1:A:354:THR:HG22	1.99	0.45
2:E:216:THR:O	2:E:216:THR:HG23	2.17	0.45
3:G:125:LEU:HD21	3:G:151:SER:HB3	1.99	0.45
1:C:166:LEU:HD11	1:C:327:ILE:HG12	1.97	0.45
1:B:164:ARG:NH1	1:B:345:ILE:O	2.50	0.45
1:C:224:ASP:OD1	1:C:224:ASP:O	2.35	0.45
1:A:164:ARG:NH2	1:A:347:ASP:OD2	2.50	0.44
1:A:313:ASN:OD1	1:A:315:ALA:N	2.48	0.44
2:E:56:HIS:CD2	2:E:62:VAL:HG12	2.47	0.44
4:H:130:GLU:OE1	5:I:17:ILE:HG13	2.16	0.44
1:A:159:ILE:HD11	1:A:350:ILE:HD11	1.98	0.44
2:E:325:ALA:HB3	2:E:326:PRO:HD3	1.98	0.44
2:F:14:THR:HG23	2:F:14:THR:O	2.18	0.44
1:B:473:ILE:O	1:B:473:ILE:HG22	2.17	0.44
1:C:41:VAL:HG11	1:C:44:LEU:CD1	2.48	0.44
1:C:463:LYS:O	1:C:464:PHE:C	2.58	0.44
2:E:300:ILE:HG22	2:E:300:ILE:O	2.17	0.44
1:B:141:SER:OG	1:B:143:ARG:NH1	2.51	0.44
1:C:496:LYS:O	1:C:499:GLU:HG3	2.17	0.44
2:E:394:ILE:HD13	3:G:25:MET:HE1	2.00	0.44
1:C:50:GLU:OE2	2:D:71:GLU:HG2	2.17	0.44
1:C:180:ILE:HD11	1:C:216:LEU:HG	1.99	0.44
1:C:248:TYR:OH	1:C:301:LEU:O	2.35	0.44
2:F:325:ALA:HB3	2:F:326:PRO:CD	2.48	0.44
1:B:166:LEU:HD13	1:B:342:VAL:HG11	1.98	0.43
2:E:282:ALA:O	3:G:259:THR:OG1	2.34	0.43
2:F:256:LEU:HD23	2:F:309:THR:HB	1.98	0.43
4:H:58:LEU:HD11	4:H:92:LEU:CD1	2.41	0.43
2:E:261:ASN:OD1	2:E:262:ILE:N	2.50	0.43
1:A:133:ALA:HB2	1:A:308:ARG:HG3	1.99	0.43
1:A:148:THR:CG2	1:A:150:ILE:HD12	2.48	0.43
1:B:157:VAL:O	1:B:157:VAL:CG2	2.62	0.43
1:C:103:LEU:HD13	1:C:253:MET:SD	2.58	0.43
3:G:184:ILE:HG22	3:G:201:LEU:HD11	2.00	0.43
1:C:423:ARG:NH2	1:C:456:LEU:O	2.38	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:F:190:VAL:HG23	2:F:236:VAL:CG1	2.49	0.43
2:F:370:GLU:O	2:F:374:VAL:HG23	2.17	0.43
4:H:57:VAL:CG1	5:I:11:TYR:CZ	3.02	0.43
1:B:166:LEU:HD11	1:B:327:ILE:HG13	2.00	0.43
1:C:327:ILE:HG22	1:C:328:GLU:N	2.32	0.43
2:E:210:ILE:HD11	2:E:221:LEU:CD1	2.41	0.43
2:F:159:PHE:O	2:F:339:LEU:N	2.49	0.43
2:F:374:VAL:HG21	2:F:446:GLN:HG3	2.00	0.43
4:H:132:GLN:HA	4:H:135:ILE:HD13	2.00	0.43
1:C:237:SER:CB	2:F:298:GLU:OE1	2.66	0.43
1:B:444:VAL:HG21	1:B:469:LEU:HD21	2.01	0.43
2:D:88:ILE:HG21	2:D:239:THR:HG23	2.00	0.43
3:G:81:ILE:HD13	3:G:171:TYR:CZ	2.54	0.43
4:H:82:VAL:HG13	4:H:82:VAL:O	2.18	0.43
7:S:105:PHE:O	7:S:109:MET:N	2.47	0.43
1:A:269:ASP:HA	1:A:270:ASP:HA	1.86	0.43
1:B:444:VAL:HG23	1:B:469:LEU:HD21	2.01	0.43
2:E:388:LEU:O	2:E:392:ILE:HG12	2.19	0.43
3:G:125:LEU:HD11	3:G:153:TYR:HB3	2.01	0.43
1:A:136:ILE:HD13	2:E:194:THR:HG23	2.01	0.43
2:E:435:LEU:O	2:E:435:LEU:HD23	2.19	0.43
3:G:178:ILE:HG21	3:G:209:LEU:HD12	2.00	0.43
1:A:133:ALA:HB1	1:A:134:PRO:CD	2.49	0.42
1:C:444:VAL:CG2	1:C:469:LEU:HD21	2.48	0.42
2:E:19:ALA:HB3	2:E:26:ASP:HB2	2.00	0.42
2:E:153:GLY:HA3	2:E:302:THR:OG1	2.19	0.42
2:F:260:ASP:HA	2:F:261:ASN:HA	1.87	0.42
1:A:347:ASP:OD1	2:E:195:ARG:NE	2.46	0.42
2:D:68:ASP:OD1	2:D:69:GLY:N	2.47	0.42
1:A:143:ARG:CZ	1:A:143:ARG:HB2	2.48	0.42
1:C:151:LYS:HZ2	1:C:465:GLU:CD	2.18	0.42
1:C:462:THR:O	1:C:463:LYS:C	2.63	0.42
2:E:435:LEU:HD23	2:E:435:LEU:C	2.44	0.42
2:F:56:HIS:CD2	2:F:62:VAL:HG12	2.54	0.42
1:C:388:GLY:O	1:C:392:LEU:HD23	2.18	0.42
2:F:200:LEU:CD1	2:F:204:MET:HE3	2.49	0.42
4:H:142:VAL:O	4:H:146:GLU:N	2.53	0.42
1:C:186:GLN:O	1:C:190:ASN:ND2	2.48	0.42
9:d:87:ALA:C	9:d:89:VAL:N	2.77	0.42
1:A:3:THR:HG22	1:A:4:GLY:N	2.34	0.42
1:A:168:ILE:HG23	1:A:351:PHE:HD1	1.84	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:400:VAL:O	1:C:400:VAL:HG23	2.20	0.42
2:F:98:ILE:HD11	2:F:201:TYR:CD1	2.55	0.42
9:d:98:LYS:O	9:d:103:PHE:N	2.53	0.42
1:C:211:SER:O	1:C:215:GLN:HG2	2.19	0.42
2:D:317:PRO:O	2:D:318:ALA:HB3	2.20	0.42
2:E:30:ASP:OD1	2:E:30:ASP:N	2.52	0.42
1:C:206:ILE:CD1	1:C:247:PRO:HG3	2.47	0.42
2:D:143:VAL:HG13	2:D:144:VAL:N	2.35	0.42
1:A:389:THR:O	1:A:393:GLU:HG2	2.20	0.42
1:B:156:LEU:CD2	1:B:367:VAL:HG11	2.50	0.42
2:F:53:VAL:HA	2:F:64:THR:HG22	2.01	0.42
3:G:39:LYS:HE2	3:G:39:LYS:HA	2.02	0.42
1:B:174:GLY:O	1:B:178:ILE:HG12	2.19	0.41
2:D:223:TYR:HD2	2:D:225:GLN:NE2	2.19	0.41
2:F:146:LEU:HD23	2:F:147:LEU:CD1	2.50	0.41
3:G:178:ILE:HG21	3:G:209:LEU:CD1	2.50	0.41
9:d:97:VAL:O	9:d:102:GLU:N	2.44	0.41
1:B:350:ILE:O	1:B:352:LEU:HD12	2.19	0.41
2:E:52:GLU:OE2	2:E:121:HIS:NE2	2.53	0.41
2:F:56:HIS:HD2	2:F:62:VAL:HG12	1.85	0.41
3:G:39:LYS:HB2	3:G:40:PRO:CD	2.50	0.41
1:A:134:PRO:CB	1:A:312:MET:HE1	2.51	0.41
1:A:469:LEU:O	1:A:472:VAL:HG22	2.20	0.41
2:E:410:ARG:NH1	2:E:454:ASP:OD2	2.53	0.41
2:F:33:LEU:HD22	2:F:62:VAL:CG1	2.49	0.41
4:H:40:THR:HG21	4:H:45:PHE:CE2	2.55	0.41
5:I:5:ARG:NH2	5:I:9:LEU:O	2.54	0.41
2:D:13:THR:HG23	2:D:31:GLU:HB2	2.01	0.41
2:E:158:LEU:HD21	2:E:166:LYS:HG3	2.02	0.41
2:F:209:VAL:O	2:F:209:VAL:HG12	2.19	0.41
2:F:228:GLU:O	2:F:233:ARG:NH1	2.54	0.41
1:A:427:LEU:CD1	1:A:448:GLY:HA3	2.50	0.41
1:C:374:VAL:HG23	1:C:375:GLY:N	2.36	0.41
2:D:43:GLN:HG3	2:D:80:LEU:HD23	2.01	0.41
2:F:473:LYS:O	2:F:477:LEU:HD13	2.20	0.41
1:C:62:MET:HE2	1:C:95:VAL:HG21	2.02	0.41
2:F:36:ILE:O	2:F:37:LEU:HB2	2.20	0.41
2:F:147:LEU:N	2:F:147:LEU:HD12	2.36	0.41
1:A:143:ARG:HB2	1:A:143:ARG:NH1	2.36	0.41
1:C:32:LEU:HD11	1:C:42:HIS:HB2	2.03	0.41
1:C:170:ASP:OD2	1:C:332:GLY:N	2.53	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:322:THR:HG22	1:C:323:ALA:N	2.35	0.41
1:C:465:GLU:O	1:C:466:ASN:C	2.64	0.41
2:E:171:MET:HE3	2:E:207:SER:HB3	2.03	0.41
2:F:36:ILE:HG22	2:F:37:LEU:HG	2.02	0.41
2:F:135:GLU:HG2	2:F:136:ILE:H	1.86	0.41
2:F:378:VAL:HG13	2:F:414:ILE:HG21	2.03	0.41
3:G:164:ARG:HB2	3:G:174:GLU:HG3	2.03	0.41
4:H:76:PHE:HE2	5:I:22:VAL:HG22	1.86	0.41
1:A:13:GLU:O	1:A:17:LEU:CD2	2.68	0.41
1:A:406:PHE:O	1:A:408:SER:N	2.54	0.41
1:C:115:ILE:O	1:C:115:ILE:CG2	2.67	0.41
2:D:225:GLN:OE1	2:D:225:GLN:HA	2.20	0.41
2:D:325:ALA:HB3	2:D:326:PRO:CD	2.51	0.41
3:G:130:GLU:O	3:G:130:GLU:HG3	2.20	0.41
5:I:29:GLU:OE2	5:I:29:GLU:N	2.40	0.41
8:b:127:VAL:O	8:b:128:GLN:C	2.63	0.41
1:A:292:GLU:O	1:A:293:ALA:HB3	2.21	0.40
2:F:262:ILE:HD11	2:F:296:MET:CE	2.51	0.40
3:G:182:ASP:OD1	3:G:183:THR:N	2.54	0.40
1:C:16:ILE:O	1:C:17:LEU:C	2.65	0.40
1:C:34:ILE:HD13	1:C:39:ALA:HB2	2.02	0.40
2:D:36:ILE:HG22	2:D:37:LEU:HG	2.02	0.40
2:D:381:ILE:HD11	2:D:407:THR:HG23	2.02	0.40
1:A:127:ARG:NH1	1:A:131:LEU:HD12	2.36	0.40
2:D:174:ILE:O	2:D:178:ALA:HB3	2.21	0.40
2:E:261:ASN:OD1	2:E:313:ALA:O	2.40	0.40
2:E:358:THR:HG22	2:E:359:SER:N	2.37	0.40
2:F:394:ILE:HG22	2:F:395:LEU:N	2.37	0.40
4:H:132:GLN:HA	4:H:135:ILE:CD1	2.51	0.40
1:A:403:PHE:O	1:A:407:GLY:N	2.54	0.40
1:C:156:LEU:HD13	1:C:367:VAL:HG11	2.02	0.40
2:D:18:VAL:HG11	2:D:28:GLN:HB2	2.03	0.40
2:D:56:HIS:CD2	2:D:62:VAL:HG12	2.55	0.40
2:D:70:THR:HB	2:D:73:LEU:HD12	2.04	0.40
2:E:136:ILE:HD11	2:E:149:PRO:HB3	2.03	0.40
3:G:3:LEU:HD11	3:G:250:PHE:CE1	2.57	0.40
1:A:270:ASP:OD1	1:A:270:ASP:C	2.62	0.40
2:D:167:THR:O	2:D:171:MET:HG2	2.22	0.40
3:G:173:THR:O	3:G:173:THR:HG23	2.21	0.40
4:H:119:LEU:HA	4:H:131:ILE:HG21	2.03	0.40
8:b:190:GLU:O	8:b:191:LYS:C	2.64	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
10:h:7:VAL:O	10:h:9:LYS:N	2.55	0.40

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	A	506/553 (92%)	464 (92%)	42 (8%)	0	100	100
1	B	473/553 (86%)	440 (93%)	33 (7%)	0	100	100
1	C	494/553 (89%)	449 (91%)	45 (9%)	0	100	100
2	D	467/528 (88%)	428 (92%)	39 (8%)	0	100	100
2	E	465/528 (88%)	427 (92%)	38 (8%)	0	100	100
2	F	465/528 (88%)	420 (90%)	45 (10%)	0	100	100
3	G	270/298 (91%)	253 (94%)	17 (6%)	0	100	100
4	H	130/168 (77%)	112 (86%)	18 (14%)	0	100	100
5	I	45/51 (88%)	42 (93%)	3 (7%)	0	100	100
6	J	45/109 (41%)	44 (98%)	1 (2%)	0	100	100
7	S	186/213 (87%)	172 (92%)	14 (8%)	0	100	100
8	b	99/256 (39%)	94 (95%)	5 (5%)	0	100	100
9	d	107/161 (66%)	97 (91%)	10 (9%)	0	100	100
10	h	60/108 (56%)	46 (77%)	14 (23%)	0	100	100
All	All	3812/4607 (83%)	3488 (92%)	324 (8%)	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	411/444 (93%)	411 (100%)	0	100	100
1	B	387/444 (87%)	387 (100%)	0	100	100
1	C	403/444 (91%)	403 (100%)	0	100	100
2	D	379/417 (91%)	379 (100%)	0	100	100
2	E	377/417 (90%)	377 (100%)	0	100	100
2	F	377/417 (90%)	377 (100%)	0	100	100
3	G	230/251 (92%)	230 (100%)	0	100	100
4	H	105/128 (82%)	105 (100%)	0	100	100
5	I	38/42 (90%)	38 (100%)	0	100	100
6	J	34/84 (40%)	34 (100%)	0	100	100
All	All	2741/3088 (89%)	2741 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	186	GLN
1	A	379	GLN
1	B	349	GLN
1	B	471	HIS
1	B	475	GLN
1	C	366	ASN
2	D	371	HIS
2	E	202	HIS
2	E	211	ASN
2	E	371	HIS
2	F	227	ASN
2	F	383	GLN
3	G	205	GLN

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 11 ligands modelled in this entry, 5 are monoatomic - leaving 6 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$
13	ADP	E	600	-	27,29,29	1.37	4 (14%)	42,45,45	2.00	12 (28%)
13	ADP	F	600	12	27,29,29	1.33	4 (14%)	42,45,45	2.05	12 (28%)
13	ADP	D	600	12	27,29,29	1.35	4 (14%)	42,45,45	1.99	12 (28%)
11	ATP	A	600	12	29,33,33	1.30	5 (17%)	44,52,52	2.10	11 (25%)
11	ATP	B	600	12	29,33,33	1.28	4 (13%)	44,52,52	2.10	12 (27%)
11	ATP	C	600	12	29,33,33	1.29	4 (13%)	44,52,52	2.08	12 (27%)

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
13	ADP	E	600	-	-	3/16/32/32	0/3/3/3
13	ADP	F	600	12	-	2/16/32/32	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
13	ADP	D	600	12	-	2/16/32/32	0/3/3/3
11	ATP	A	600	12	-	1/22/38/38	0/3/3/3
11	ATP	B	600	12	-	0/22/38/38	0/3/3/3
11	ATP	C	600	12	-	0/22/38/38	0/3/3/3

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
13	E	600	ADP	C5-C4	4.44	1.47	1.39
13	D	600	ADP	C5-C4	4.16	1.46	1.39
11	A	600	ATP	C5-C4	4.13	1.46	1.39
11	C	600	ATP	C5-C4	4.09	1.46	1.39
13	F	600	ADP	C5-C4	4.07	1.46	1.39
11	B	600	ATP	C5-C4	4.02	1.46	1.39
13	E	600	ADP	C5-C6	2.60	1.48	1.41
13	F	600	ADP	C5-N7	-2.58	1.34	1.39
13	D	600	ADP	C5-N7	-2.55	1.34	1.39
11	B	600	ATP	C5-N7	-2.55	1.34	1.39
11	A	600	ATP	C5-N7	-2.52	1.34	1.39
13	E	600	ADP	C8-N7	2.47	1.36	1.31
11	C	600	ATP	C5-N7	-2.46	1.34	1.39
13	D	600	ADP	C5-C6	2.43	1.47	1.41
13	F	600	ADP	C5-C6	2.42	1.47	1.41
11	C	600	ATP	C8-N7	2.38	1.36	1.31
11	B	600	ATP	C5-C6	2.38	1.47	1.41
11	A	600	ATP	C5-C6	2.38	1.47	1.41
11	C	600	ATP	C5-C6	2.36	1.47	1.41
13	E	600	ADP	C5-N7	-2.32	1.34	1.39
11	A	600	ATP	C8-N7	2.24	1.35	1.31
13	F	600	ADP	C8-N7	2.21	1.35	1.31
13	D	600	ADP	C8-N7	2.20	1.35	1.31
11	B	600	ATP	C8-N7	2.17	1.35	1.31
11	A	600	ATP	C4-N9	-2.00	1.33	1.37

All (71) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
11	C	600	ATP	C5-C4-N3	-6.29	118.55	126.75
13	F	600	ADP	C5-C4-N3	-6.24	118.61	126.75
11	B	600	ATP	C5-C4-N3	-6.21	118.65	126.75
11	A	600	ATP	C5-C4-N3	-6.17	118.70	126.75
13	D	600	ADP	C5-C4-N3	-6.06	118.84	126.75

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
13	E	600	ADP	C5-C4-N3	-6.04	118.86	126.75
11	B	600	ATP	N3-C4-N9	4.94	135.21	127.08
11	A	600	ATP	PB-O3B-PG	-4.93	115.90	132.83
13	F	600	ADP	N3-C4-N9	4.87	135.10	127.08
11	C	600	ATP	N3-C4-N9	4.86	135.09	127.08
13	D	600	ADP	N3-C4-N9	4.83	135.04	127.08
11	A	600	ATP	N3-C4-N9	4.76	134.92	127.08
13	E	600	ADP	N3-C4-N9	4.67	134.78	127.08
11	C	600	ATP	PB-O3B-PG	-4.32	117.99	132.83
11	B	600	ATP	PA-O3A-PB	-4.32	118.01	132.83
13	F	600	ADP	C2-N3-C4	4.01	121.22	111.75
11	C	600	ATP	C2-N3-C4	4.00	121.20	111.75
13	E	600	ADP	C2-N3-C4	4.00	121.20	111.75
11	B	600	ATP	C2-N3-C4	3.98	121.16	111.75
11	A	600	ATP	C2-N3-C4	3.95	121.09	111.75
13	D	600	ADP	C2-N3-C4	3.87	120.89	111.75
13	E	600	ADP	PA-O3A-PB	-3.83	119.69	132.83
13	F	600	ADP	N3-C2-N1	-3.65	122.89	128.60
13	E	600	ADP	N3-C2-N1	-3.64	122.91	128.60
11	B	600	ATP	N3-C2-N1	-3.61	122.95	128.60
11	A	600	ATP	N3-C2-N1	-3.56	123.04	128.60
11	C	600	ATP	N3-C2-N1	-3.52	123.09	128.60
13	D	600	ADP	N3-C2-N1	-3.50	123.13	128.60
13	F	600	ADP	PA-O3A-PB	-3.43	121.04	132.83
11	A	600	ATP	C4-C5-N7	-3.36	106.52	110.62
13	E	600	ADP	C4-C5-N7	-3.33	106.56	110.62
13	F	600	ADP	C4-C5-N7	-3.32	106.57	110.62
11	C	600	ATP	PA-O3A-PB	-3.32	121.43	132.83
11	C	600	ATP	C4-C5-N7	-3.30	106.60	110.62
11	B	600	ATP	PB-O3B-PG	-3.29	121.53	132.83
11	A	600	ATP	PA-O3A-PB	-3.25	121.66	132.83
13	D	600	ADP	C4-C5-N7	-3.23	106.69	110.62
11	B	600	ATP	C4-C5-N7	-3.16	106.77	110.62
13	F	600	ADP	C5-N7-C8	2.99	107.76	103.51
13	D	600	ADP	C5-N7-C8	2.93	107.67	103.51
11	A	600	ATP	C5-N7-C8	2.93	107.67	103.51
11	B	600	ATP	C5-N7-C8	2.87	107.59	103.51
11	C	600	ATP	C5-N7-C8	2.86	107.58	103.51
13	D	600	ADP	PA-O3A-PB	-2.81	123.18	132.83
11	B	600	ATP	C4-N9-C8	2.80	108.76	105.73
13	D	600	ADP	C4-N9-C8	2.79	108.75	105.73
13	E	600	ADP	C5-N7-C8	2.78	107.46	103.51

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
13	E	600	ADP	C4-N9-C8	2.75	108.71	105.73
11	A	600	ATP	C4-N9-C8	2.71	108.66	105.73
11	C	600	ATP	C4-N9-C8	2.70	108.65	105.73
13	F	600	ADP	C4-N9-C8	2.66	108.61	105.73
13	F	600	ADP	C3'-C2'-C1'	2.62	106.40	101.43
13	D	600	ADP	C3'-C2'-C1'	2.55	106.28	101.43
13	E	600	ADP	C3'-C2'-C1'	2.48	106.14	101.43
11	B	600	ATP	C3'-C2'-C1'	2.47	106.12	101.43
11	C	600	ATP	C3'-C2'-C1'	2.43	106.05	101.43
11	B	600	ATP	N9-C8-N7	-2.32	110.75	113.91
13	D	600	ADP	N9-C8-N7	-2.30	110.77	113.91
13	E	600	ADP	C6-C5-N7	2.30	136.30	132.02
11	A	600	ATP	N9-C8-N7	-2.30	110.77	113.91
13	F	600	ADP	N9-C8-N7	-2.29	110.78	113.91
11	C	600	ATP	N9-C8-N7	-2.27	110.81	113.91
11	A	600	ATP	C6-C5-N7	2.24	136.19	132.02
13	E	600	ADP	N9-C8-N7	-2.19	110.91	113.91
11	C	600	ATP	C6-C5-N7	2.16	136.05	132.02
13	F	600	ADP	C6-C5-N7	2.13	135.99	132.02
13	E	600	ADP	C2-N1-C6	2.11	122.38	118.77
13	D	600	ADP	C6-C5-N7	2.08	135.89	132.02
11	B	600	ATP	C6-C5-N7	2.07	135.87	132.02
13	F	600	ADP	C2-N1-C6	2.03	122.26	118.77
13	D	600	ADP	C2-N1-C6	2.03	122.25	118.77

There are no chirality outliers.

All (8) torsion outliers are listed below:

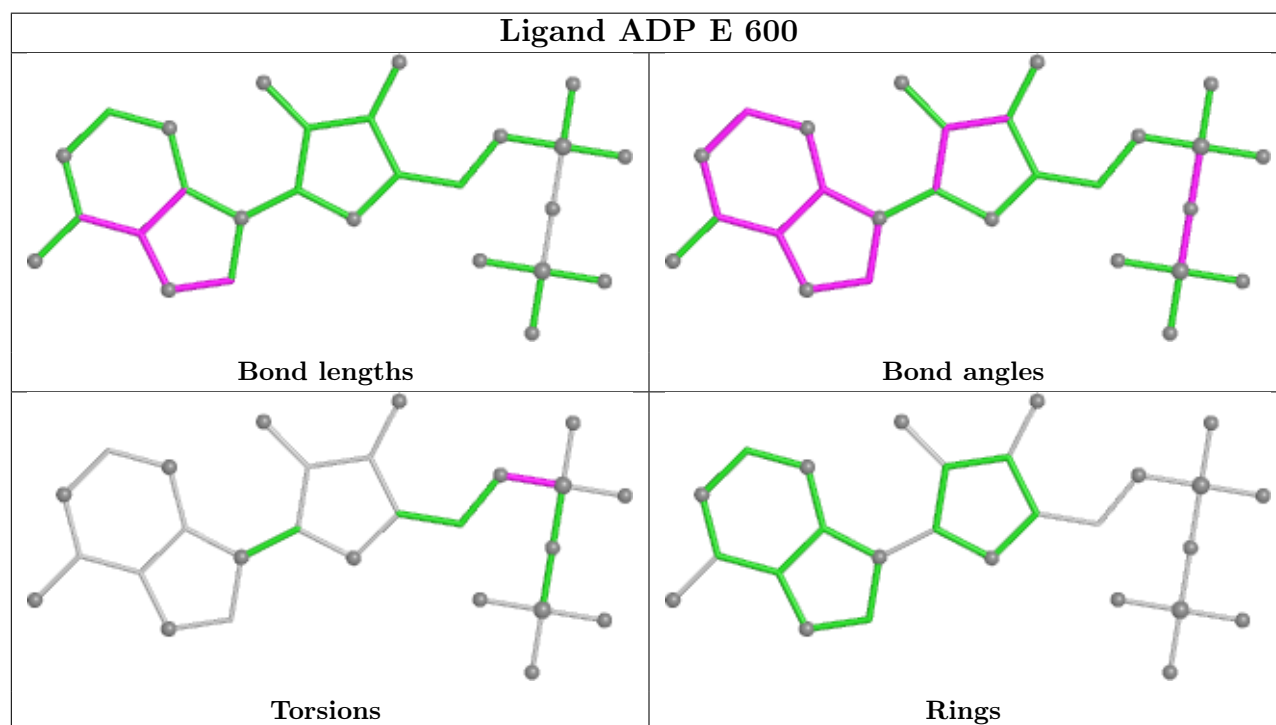
Mol	Chain	Res	Type	Atoms
13	D	600	ADP	C5'-O5'-PA-O3A
13	E	600	ADP	C5'-O5'-PA-O1A
13	E	600	ADP	C5'-O5'-PA-O3A
13	F	600	ADP	C5'-O5'-PA-O3A
11	A	600	ATP	PB-O3B-PG-O1G
13	D	600	ADP	C5'-O5'-PA-O1A
13	E	600	ADP	C5'-O5'-PA-O2A
13	F	600	ADP	C5'-O5'-PA-O1A

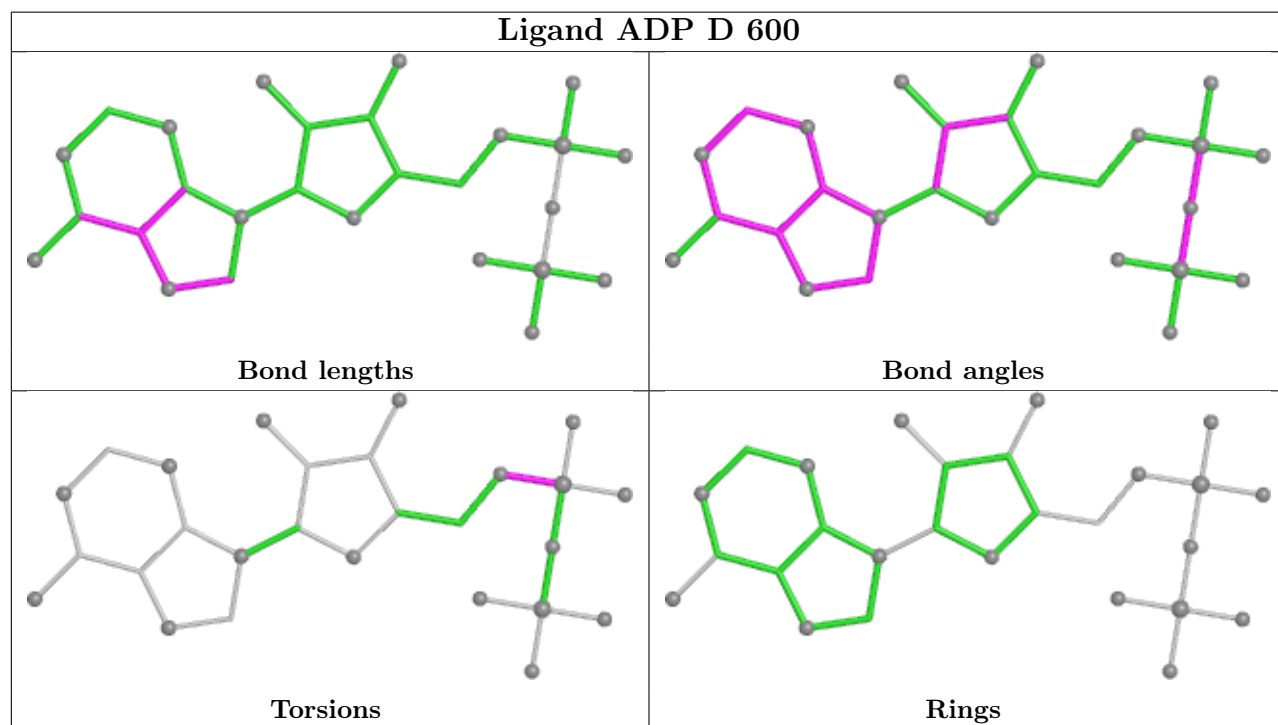
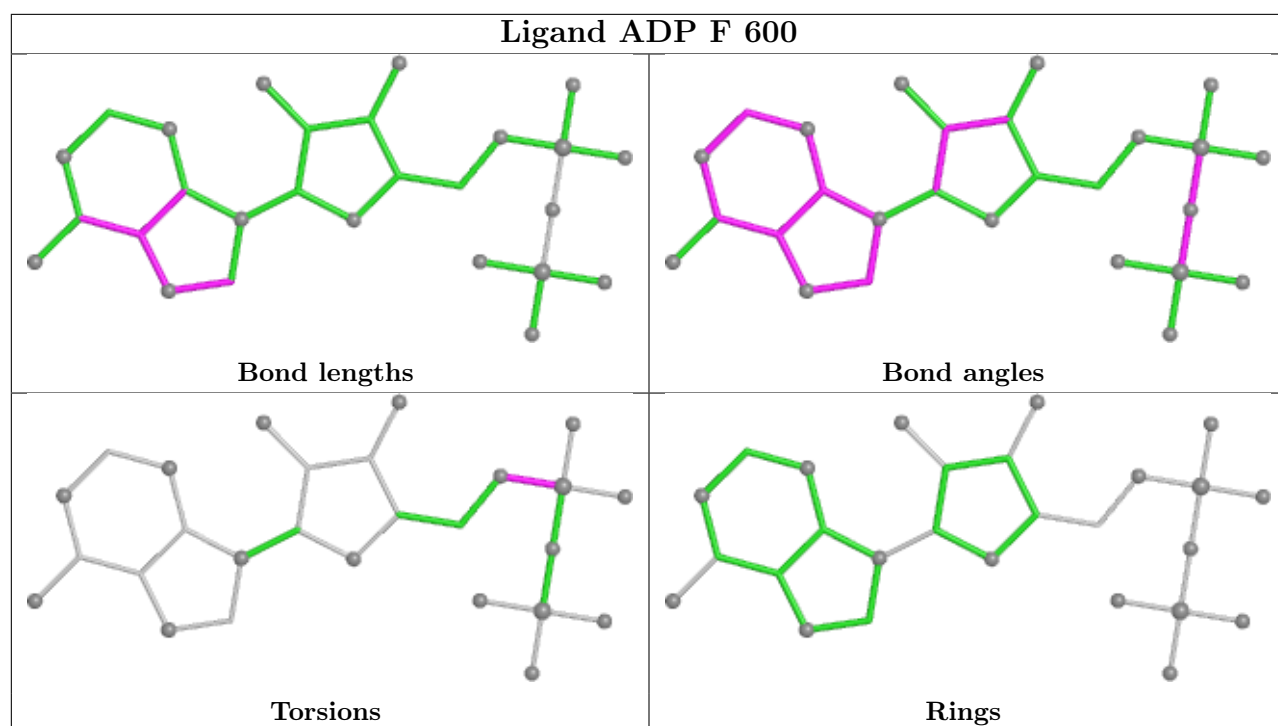
There are no ring outliers.

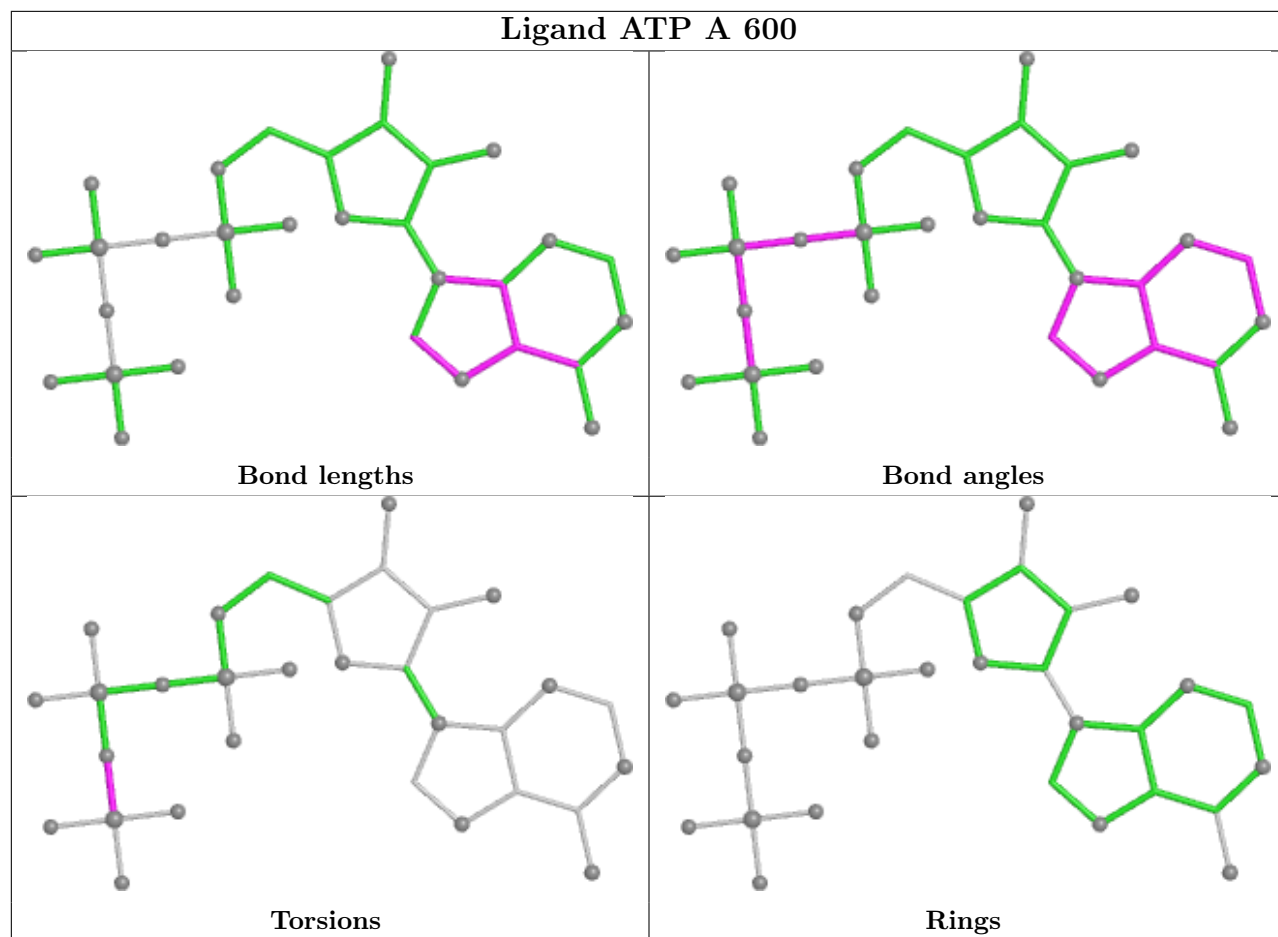
1 monomer is involved in 1 short contact:

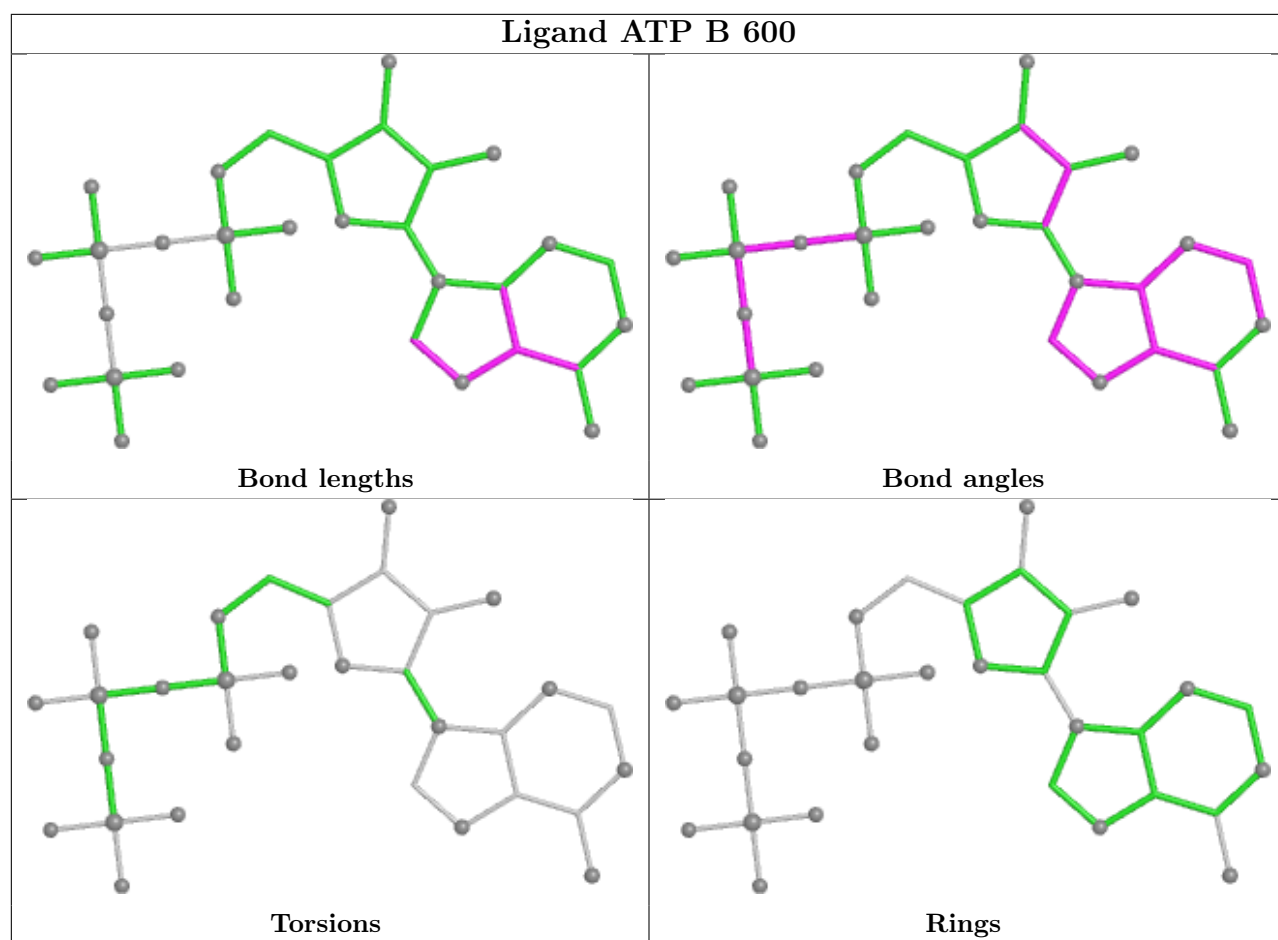
Mol	Chain	Res	Type	Clashes	Symm-Clashes
13	D	600	ADP	1	0

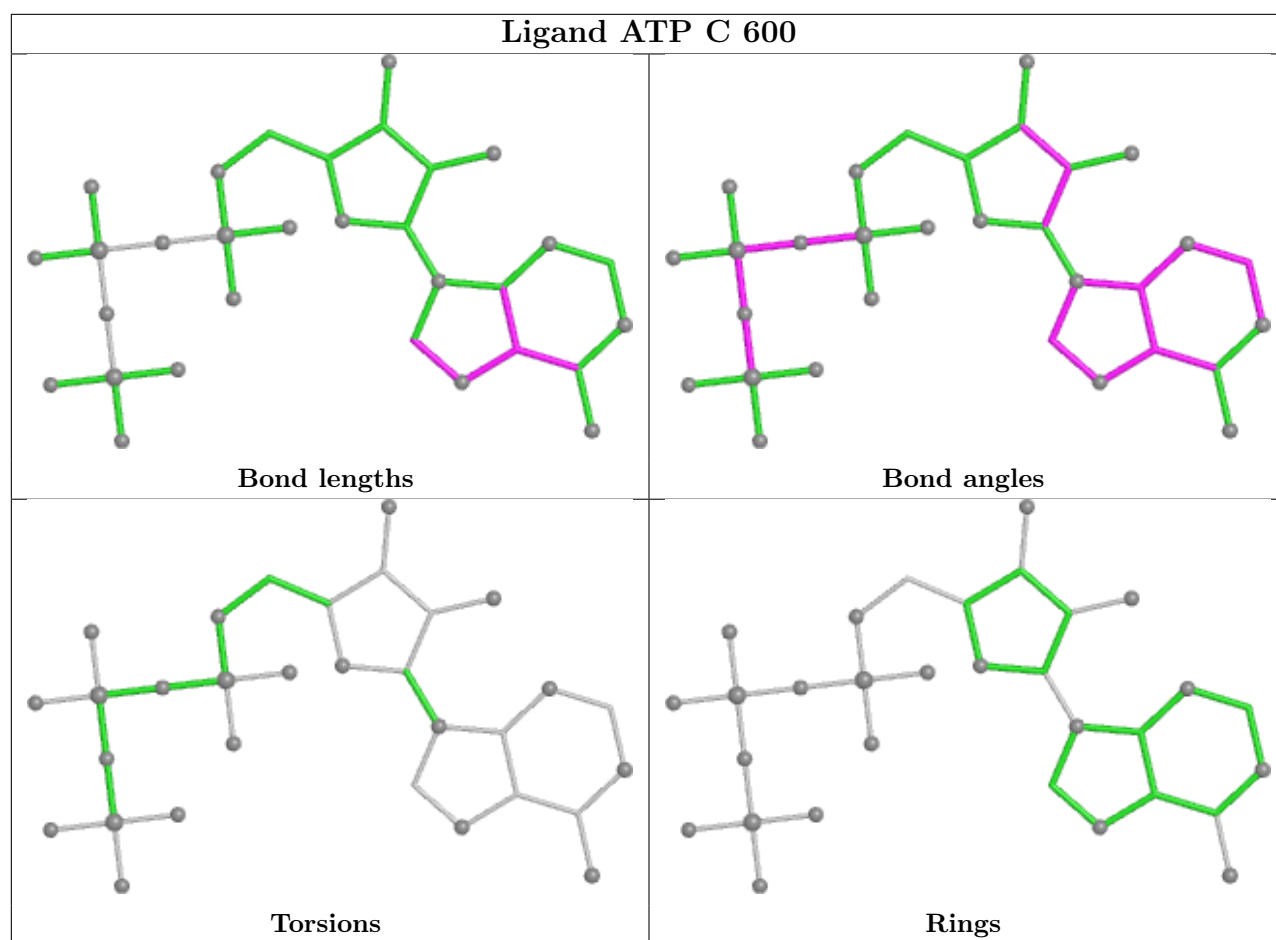
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

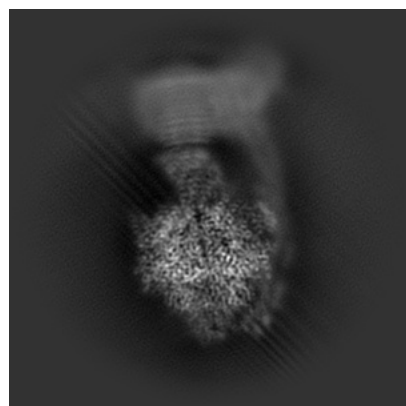
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-65239. These allow visual inspection of the internal detail of the map and identification of artifacts.

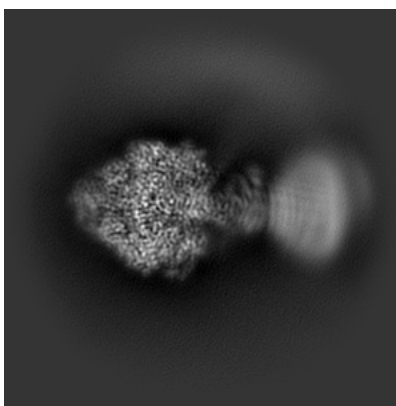
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

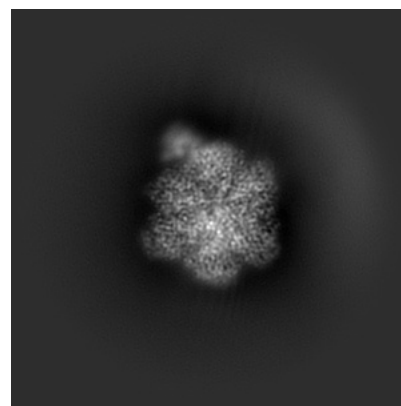
6.1.1 Primary map



X

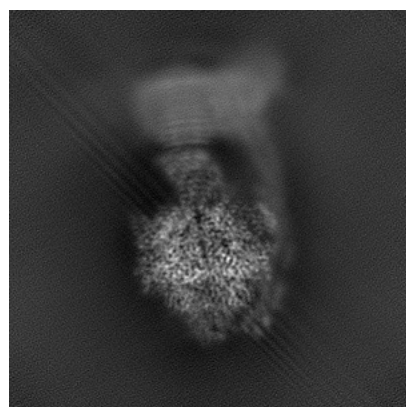


Y

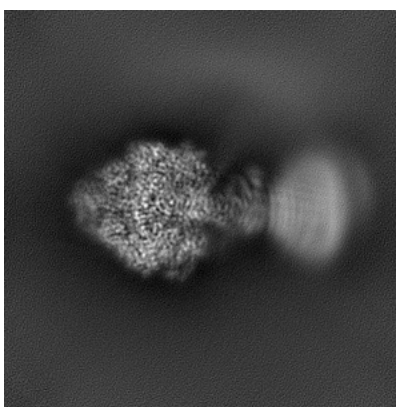


Z

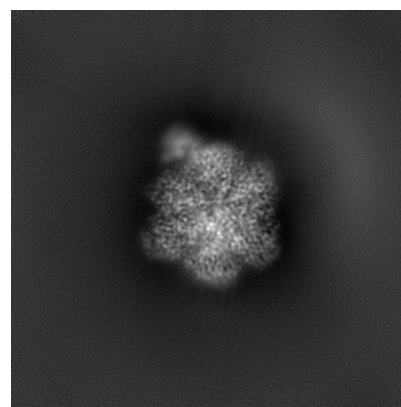
6.1.2 Raw map



X



Y

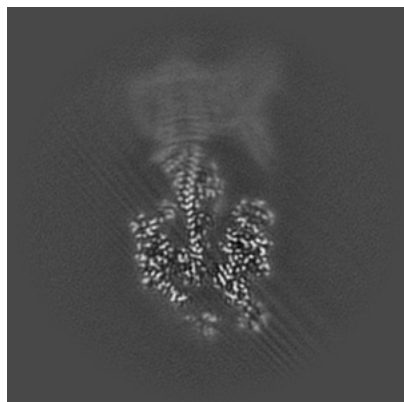


Z

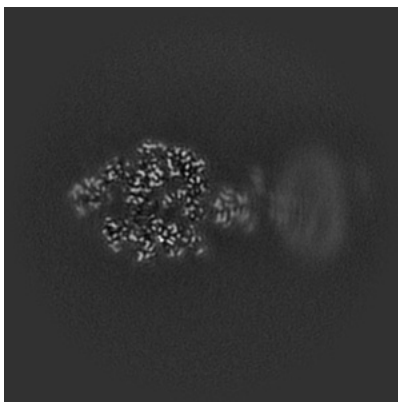
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

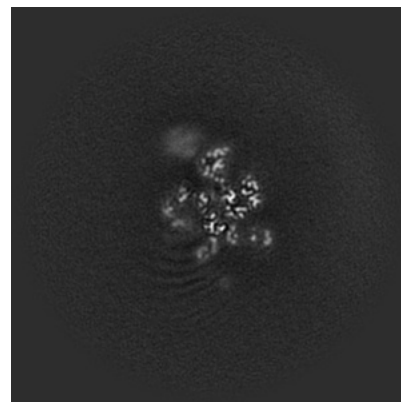
6.2.1 Primary map



X Index: 170

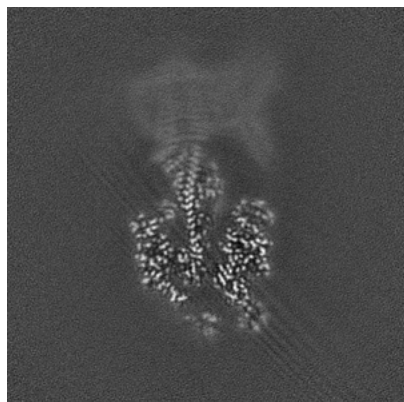


Y Index: 170

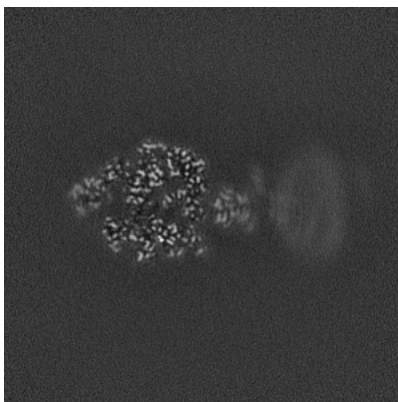


Z Index: 170

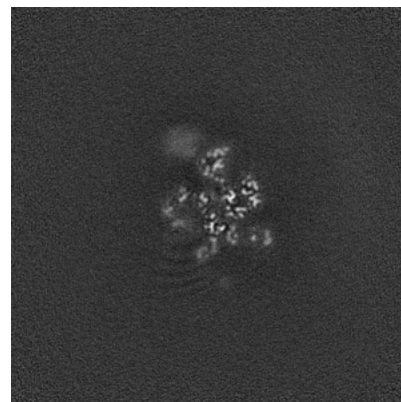
6.2.2 Raw map



X Index: 170



Y Index: 170

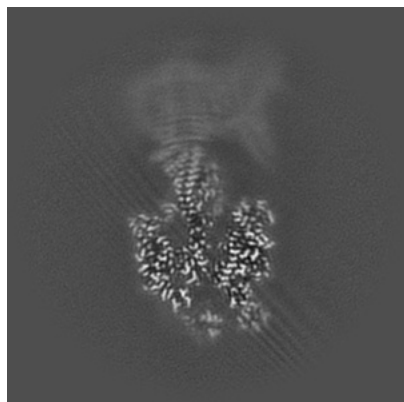


Z Index: 170

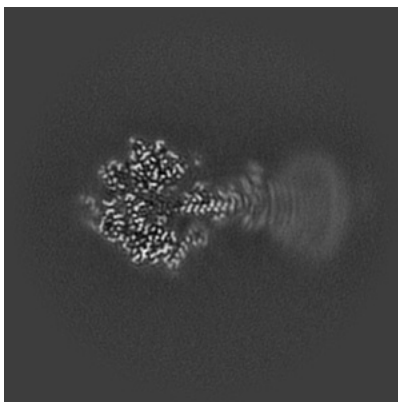
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

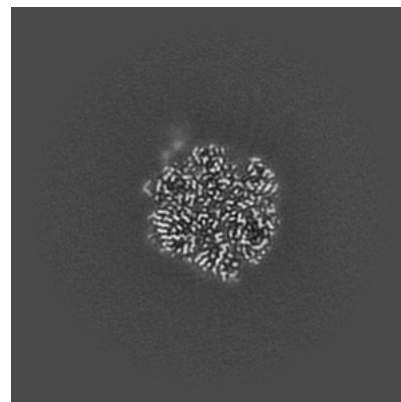
6.3.1 Primary map



X Index: 172

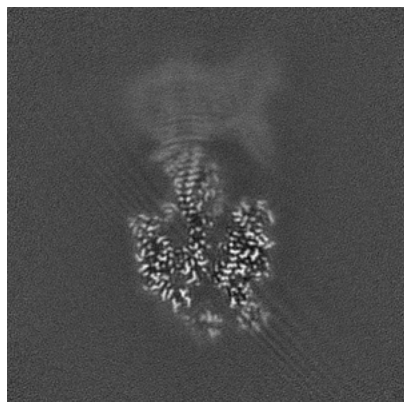


Y Index: 154

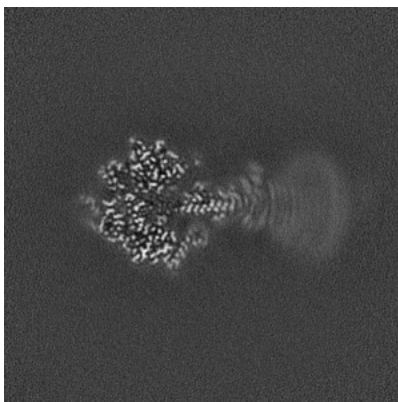


Z Index: 118

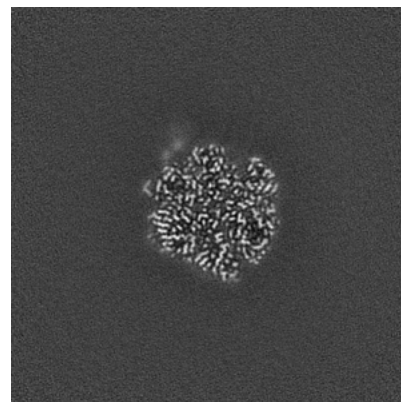
6.3.2 Raw map



X Index: 172



Y Index: 154

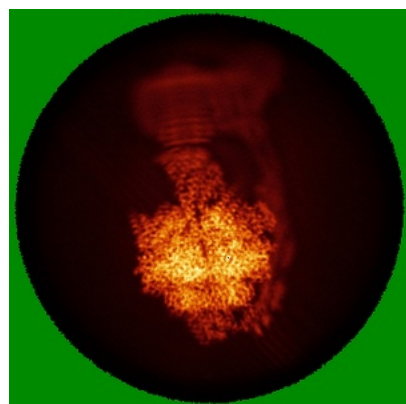


Z Index: 118

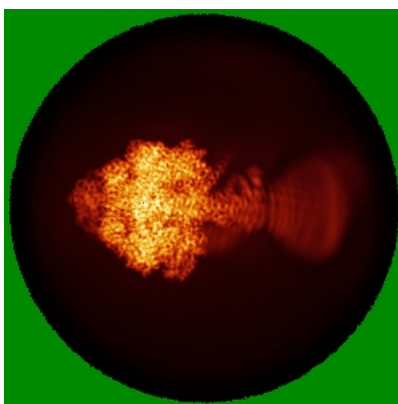
The images above show the largest variance slices of the map in three orthogonal directions.

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

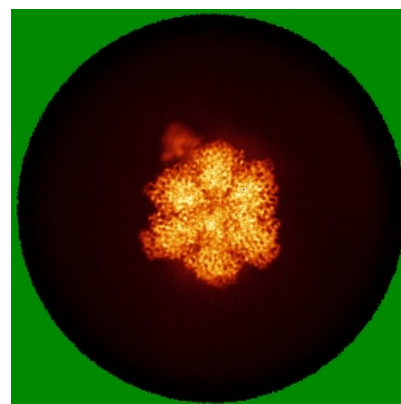
6.4.1 Primary map



X

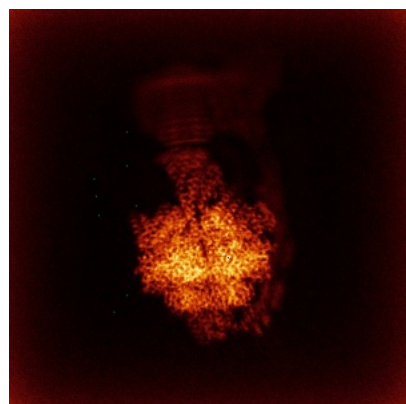


Y

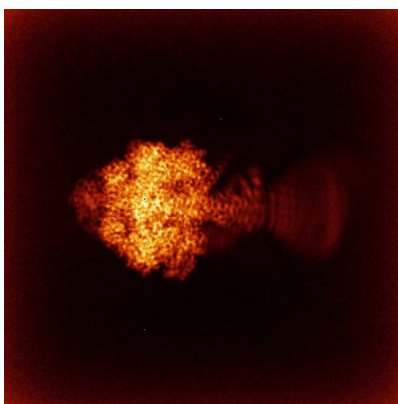


Z

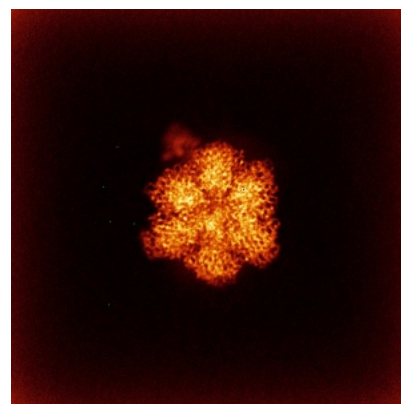
6.4.2 Raw map



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.

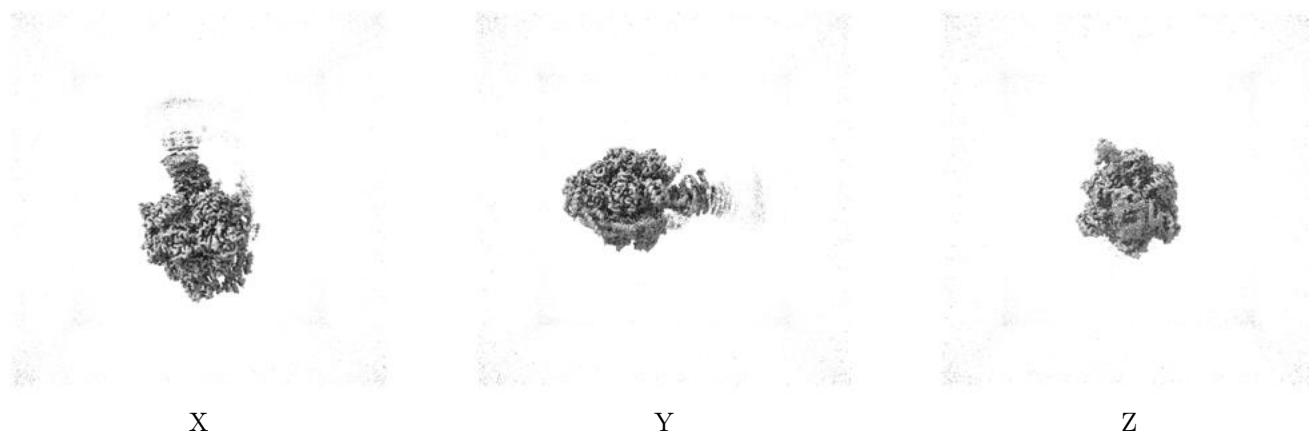
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.15. 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.

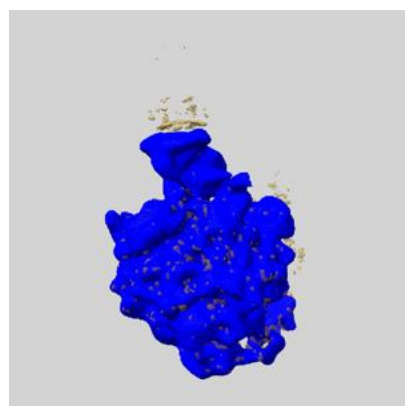
6.6 Mask visualisation [i](#)

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

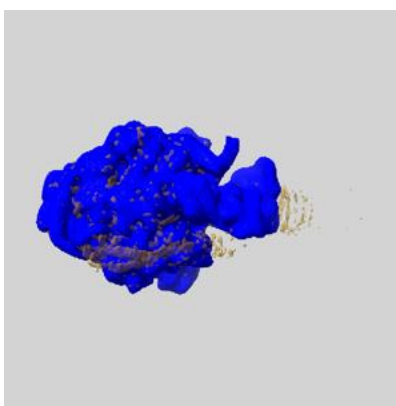
A mask typically either:

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

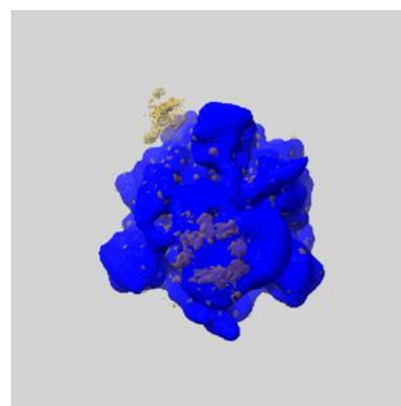
6.6.1 emd_65239_msk_1.map [i](#)



X



Y

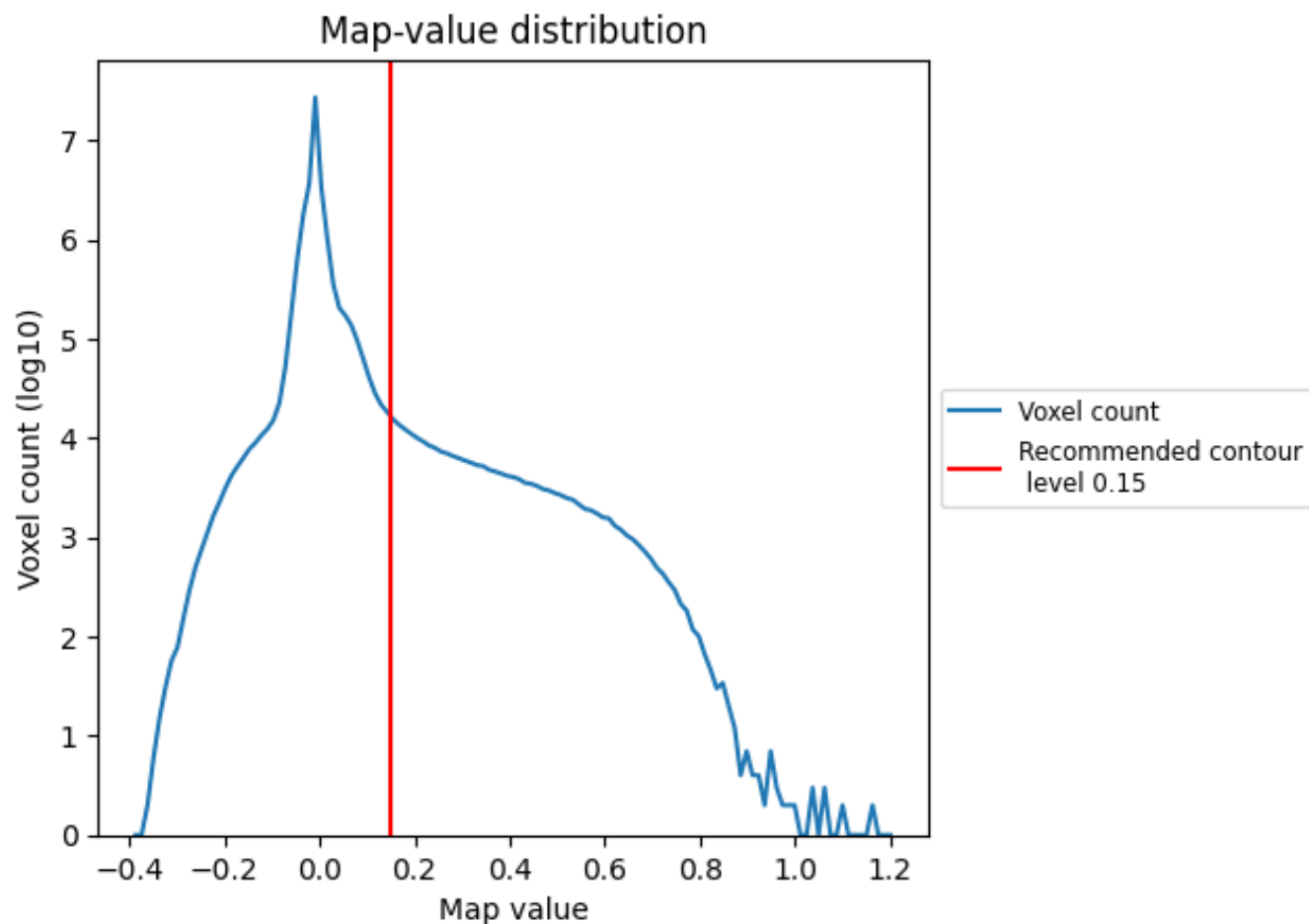


Z

7 Map analysis [i](#)

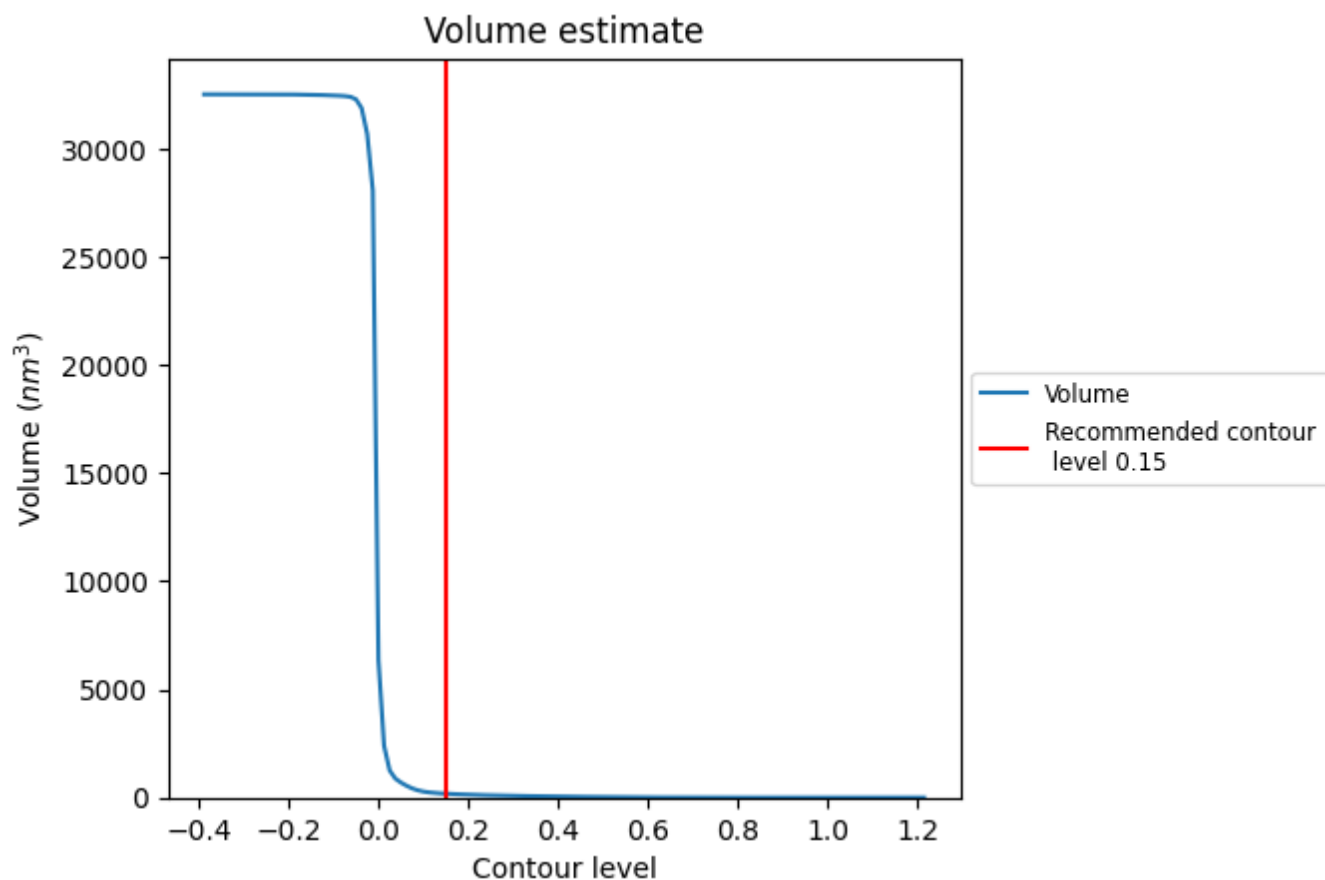
This section contains the results of statistical analysis of the map.

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.

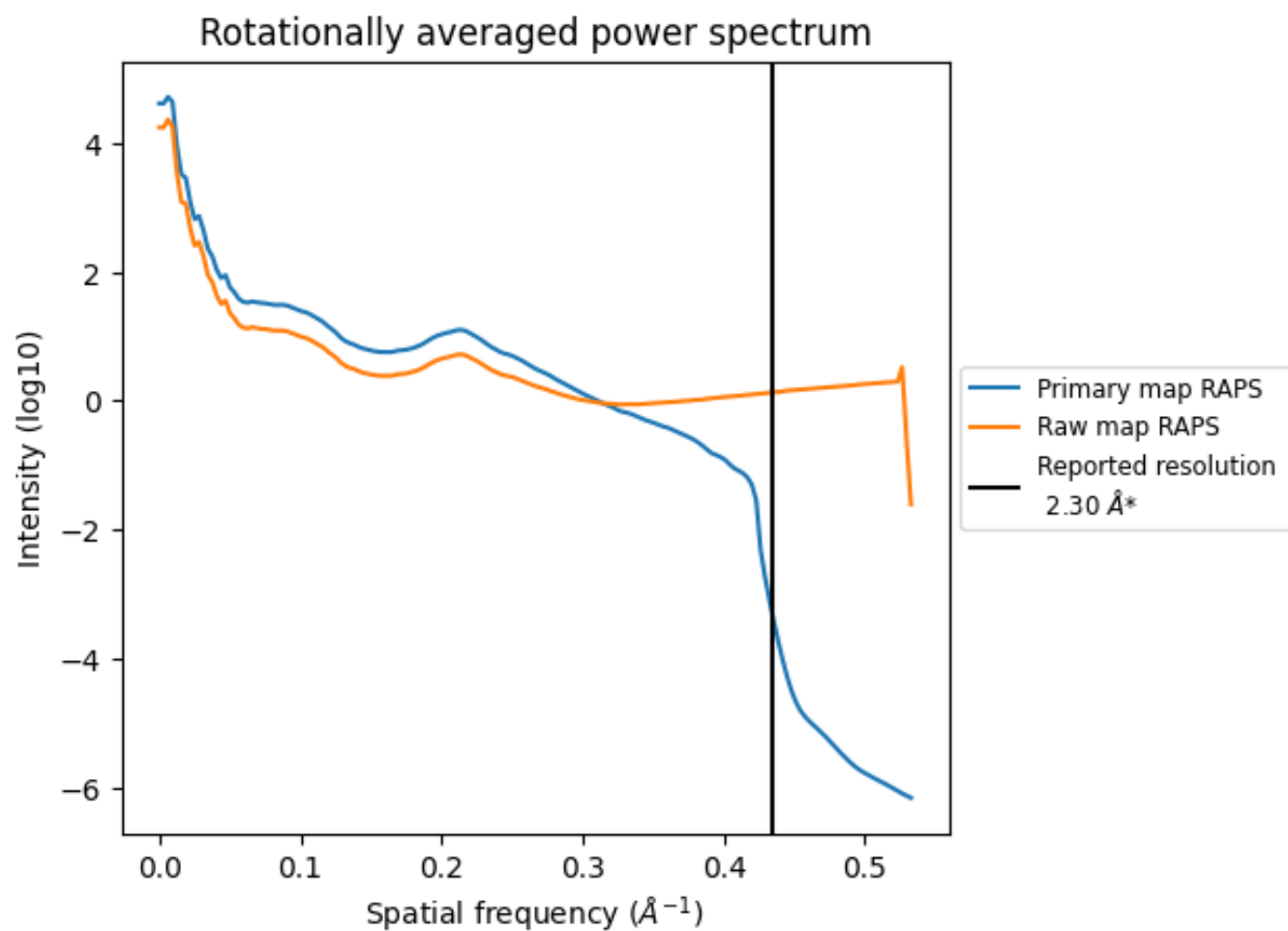
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 179 nm³; this corresponds to an approximate mass of 162 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 ⓘ

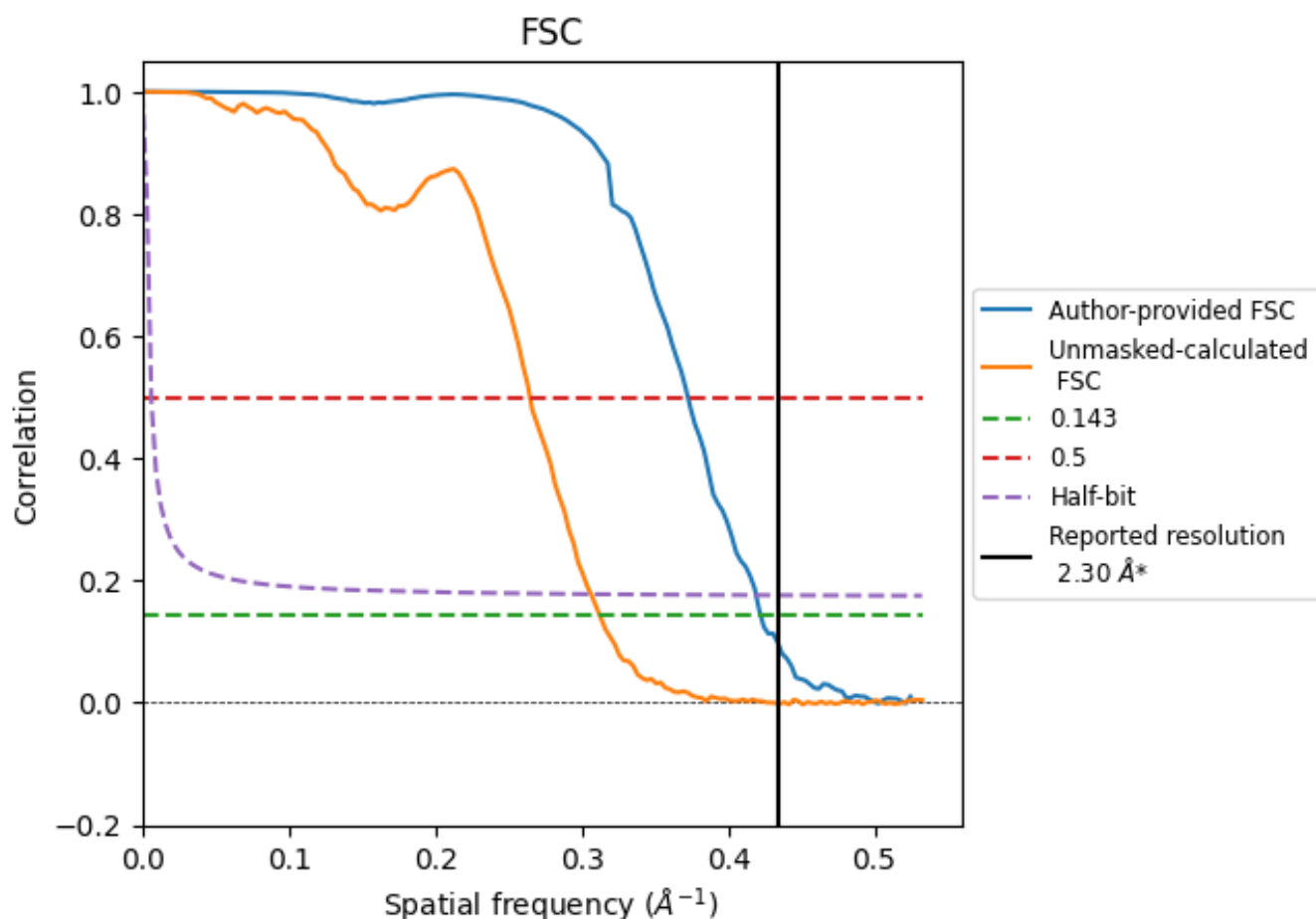


*Reported resolution corresponds to spatial frequency of 0.435 Å⁻¹

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 0.435 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

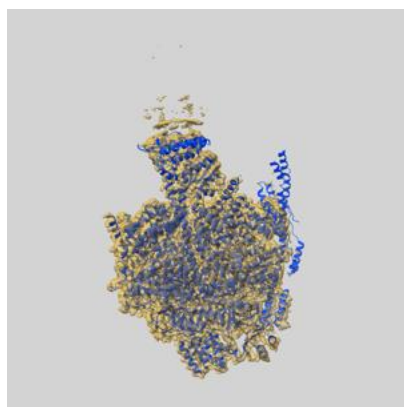
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.30	-	-
Author-provided FSC curve	2.37	2.68	2.39
Unmasked-calculated*	3.20	3.78	3.26

*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 3.20 differs from the reported value 2.3 by more than 10 %

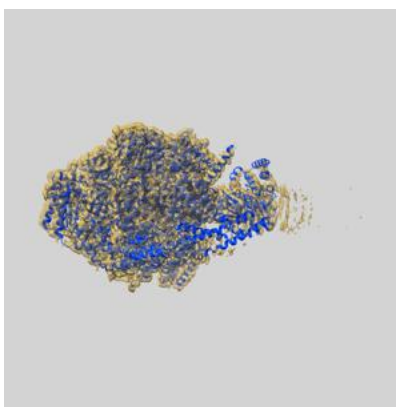
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-65239 and PDB model 9VPD. Per-residue inclusion information can be found in [section 3](#) on [page 8](#).

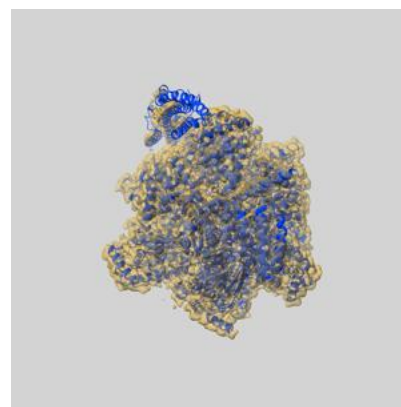
9.1 Map-model overlay [i](#)



X



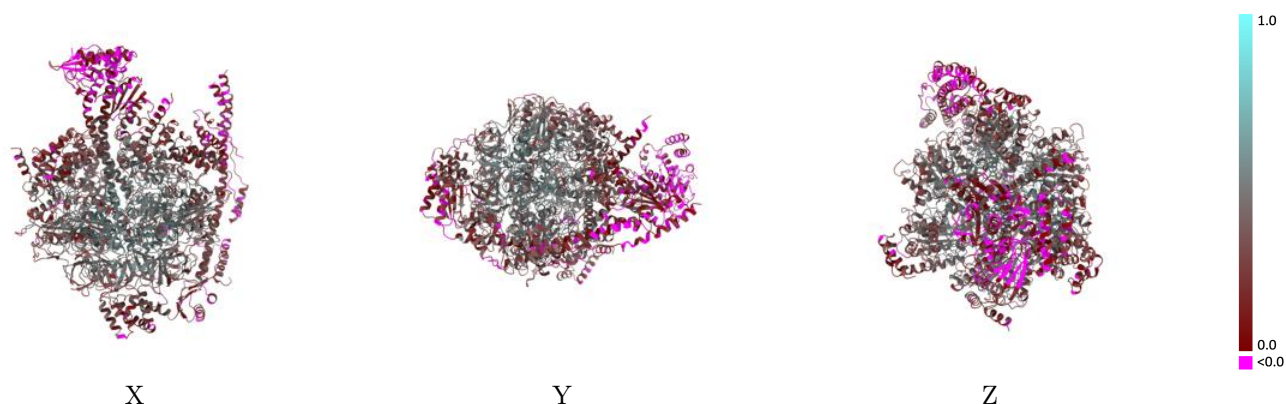
Y



Z

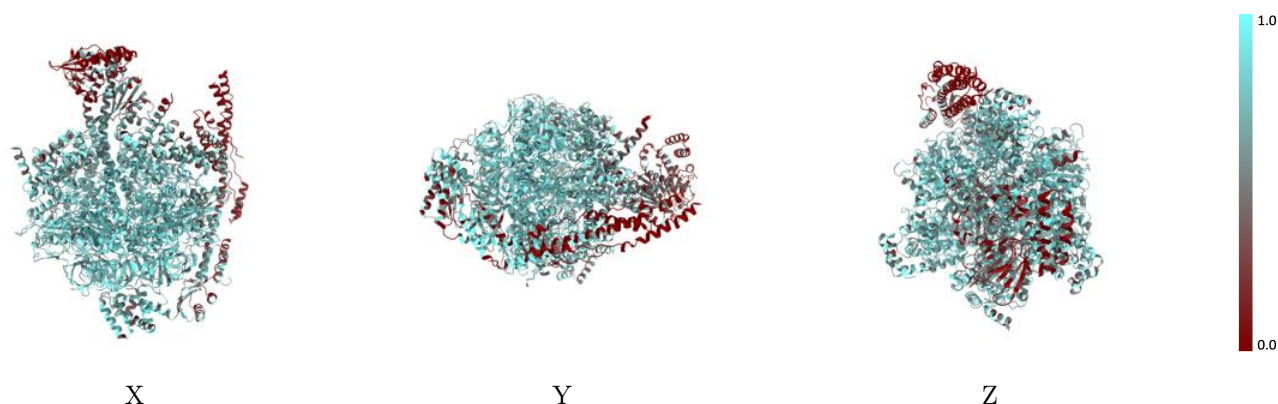
The images above show the 3D surface view of the map at the recommended contour level 0.15 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



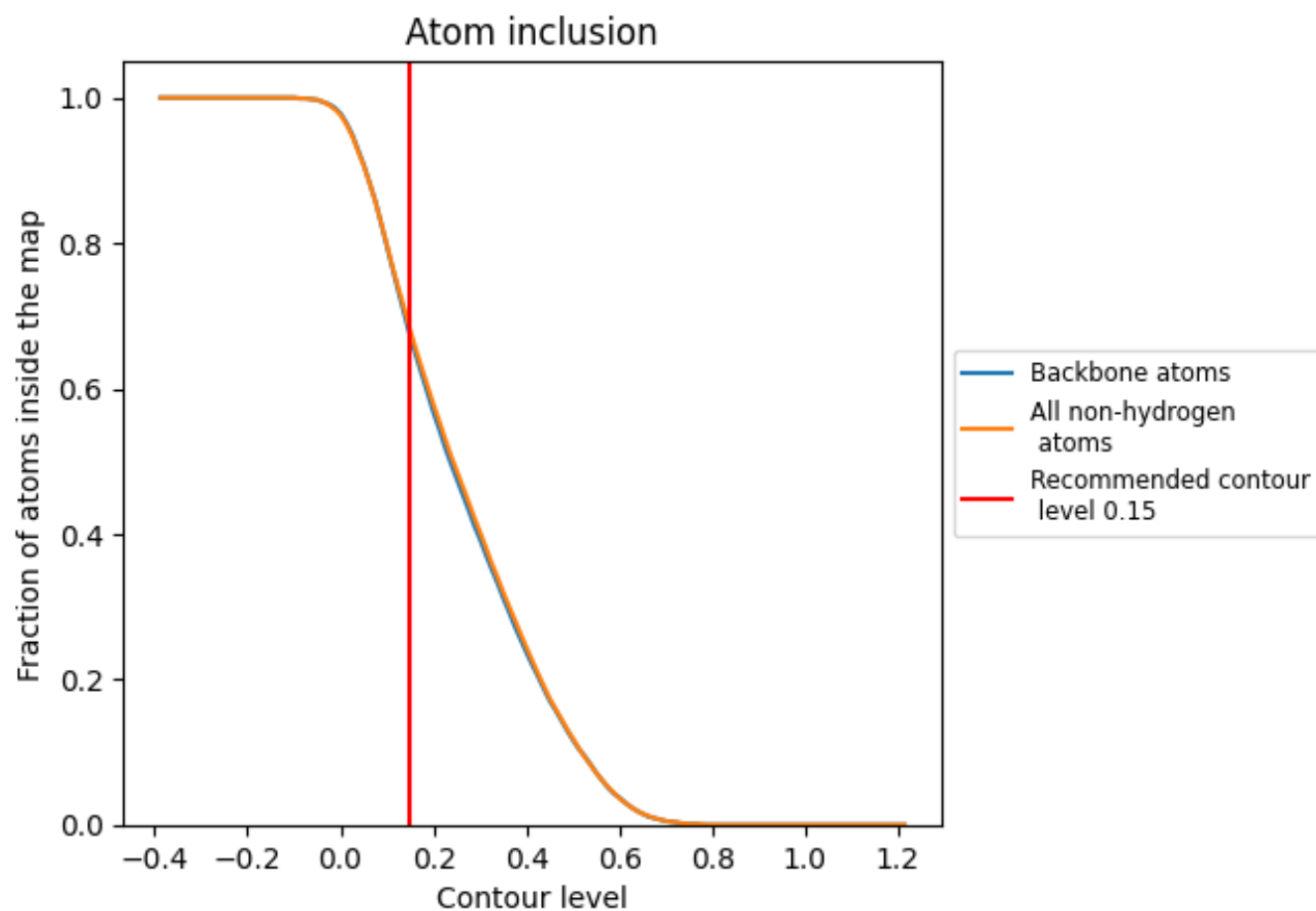
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.15).

9.4 Atom inclusion [i](#)



At the recommended contour level, 67% of all backbone atoms, 68% 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 (0.15) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.6800	 0.3430
A	 0.7360	 0.3780
B	 0.7600	 0.3770
C	 0.7360	 0.3920
D	 0.7740	 0.4170
E	 0.7510	 0.3910
F	 0.7720	 0.4080
G	 0.5550	 0.2100
H	 0.1830	 -0.0200
I	 0.2370	 0.0100
J	 0.5690	 0.2830
S	 0.6540	 0.2310
b	 0.3120	 0.1220
d	 0.0140	 0.0690
h	 0.4070	 0.2060

