



Full wwPDB EM Validation Report ⓘ

Mar 5, 2026 – 10:44 AM UTC

PDB ID : 8S0A / pdb_00008s0a
EMDB ID : EMD-19619
Title : H. sapiens MCM2-7 hexamer bound to double stranded DNA
Authors : Greiwe, J.F.; Weissmann, F.; Diffley, J.F.X.; Costa, A.
Deposited on : 2024-02-13
Resolution : 3.20 Å(reported)
Based on initial model : .

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

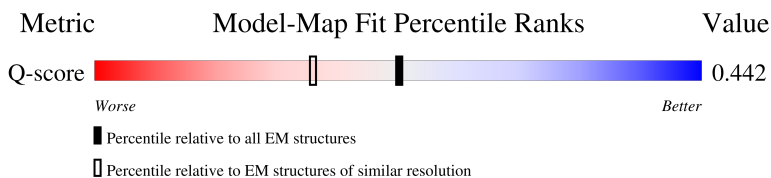
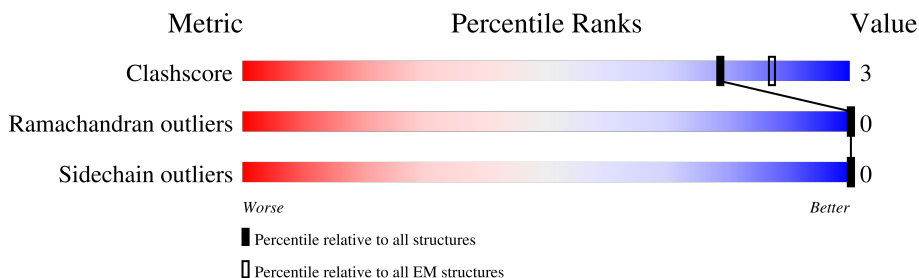
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.20 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	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	15020 (2.70 - 3.70)

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	X	22	
2	Y	22	
3	2	904	
4	3	810	

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Mol	Chain	Length	Quality of chain
5	4	863	
6	5	734	
7	6	821	
8	7	719	

2 Entry composition [i](#)

There are 12 unique types of molecules in this entry. The entry contains 31433 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 DNA chain called DNA (22-mer).

Mol	Chain	Residues	Atoms					AltConf	Trace
1	X	22	Total	C	N	O	P	0	0
			451	214	83	132	22		

- Molecule 2 is a DNA chain called DNA (22-mer).

Mol	Chain	Residues	Atoms					AltConf	Trace
2	Y	22	Total	C	N	O	P	0	0
			451	214	83	132	22		

- Molecule 3 is a protein called DNA replication licensing factor MCM2.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	2	694	Total	C	N	O	S	0	0
			5516	3472	985	1027	32		

- Molecule 4 is a protein called DNA replication licensing factor MCM3.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	3	609	Total	C	N	O	S	0	0
			4794	2999	851	918	26		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
3	-1	GLY	-	expression tag	UNP P25205
3	0	GLU	-	expression tag	UNP P25205

- Molecule 5 is a protein called DNA replication licensing factor MCM4.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	4	623	Total	C	N	O	S	0	0
			4969	3130	880	932	27		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
4	650	MET	LEU	variant	UNP P33991

- Molecule 6 is a protein called DNA replication licensing factor MCM5.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	5	669	Total	C	N	O	S	0	0
			5307	3329	958	982	38		

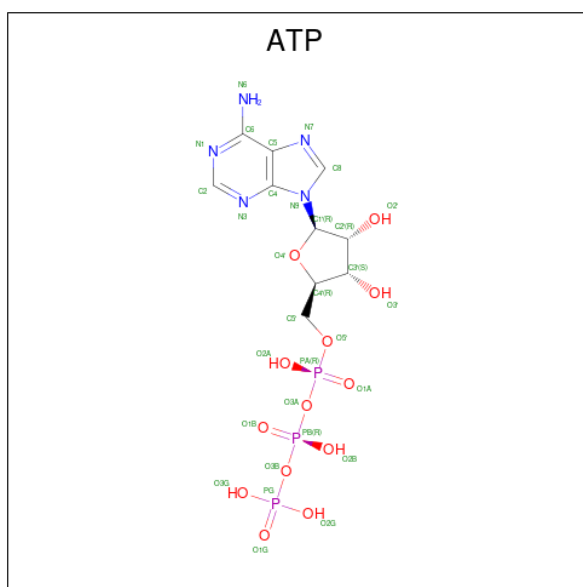
- Molecule 7 is a protein called DNA replication licensing factor MCM6.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	6	668	Total	C	N	O	S	0	0
			5386	3393	950	1016	27		

- Molecule 8 is a protein called DNA replication licensing factor MCM7.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	7	558	Total	C	N	O	S	0	0
			4410	2776	776	828	30		

- Molecule 9 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
9	2	1	Total	C	N	O	P	0
			31	10	5	13	3	

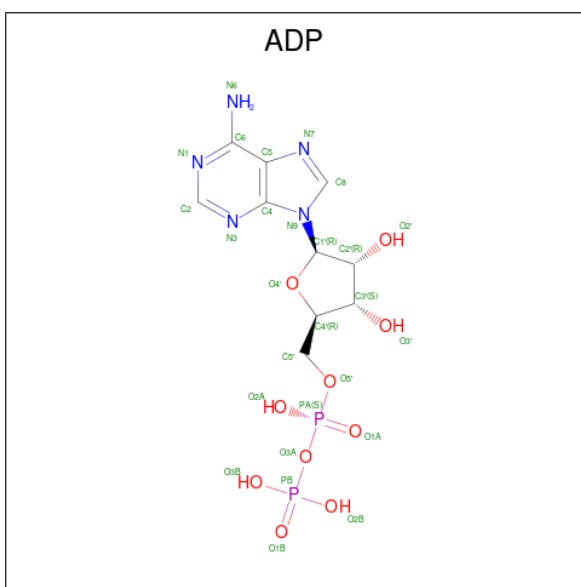
- Molecule 10 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
10	2	1	Total	Mg	0
			1	1	
10	3	1	Total	Mg	0
			1	1	
10	5	1	Total	Mg	0
			1	1	
10	6	1	Total	Mg	0
			1	1	
10	7	1	Total	Mg	0
			1	1	

- Molecule 11 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
11	2	1	Total	Zn	0
			1	1	
11	4	1	Total	Zn	0
			1	1	
11	5	1	Total	Zn	0
			1	1	
11	6	1	Total	Zn	0
			1	1	
11	7	1	Total	Zn	0
			1	1	

- Molecule 12 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: C₁₀H₁₅N₅O₁₀P₂) (labeled as "Ligand of Interest" by depositor).

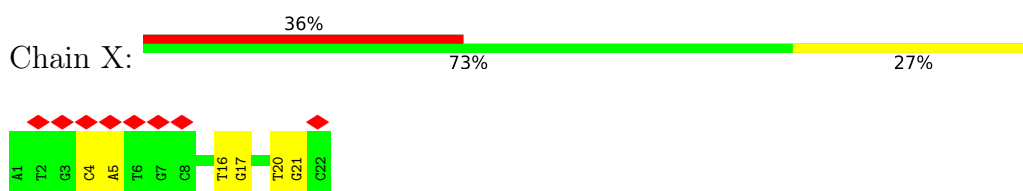


Mol	Chain	Residues	Atoms					AltConf
12	3	1	Total 27	C 10	N 5	O 10	P 2	0
12	5	1	Total 27	C 10	N 5	O 10	P 2	0
12	6	1	Total 27	C 10	N 5	O 10	P 2	0
12	7	1	Total 27	C 10	N 5	O 10	P 2	0

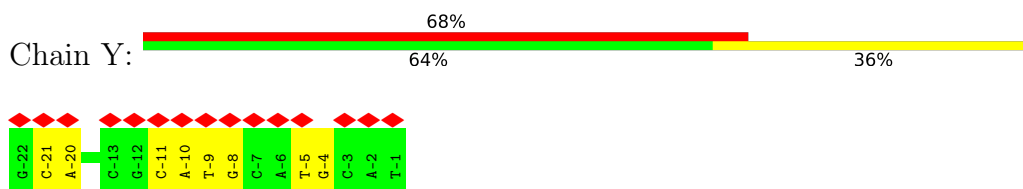
3 Residue-property plots

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.

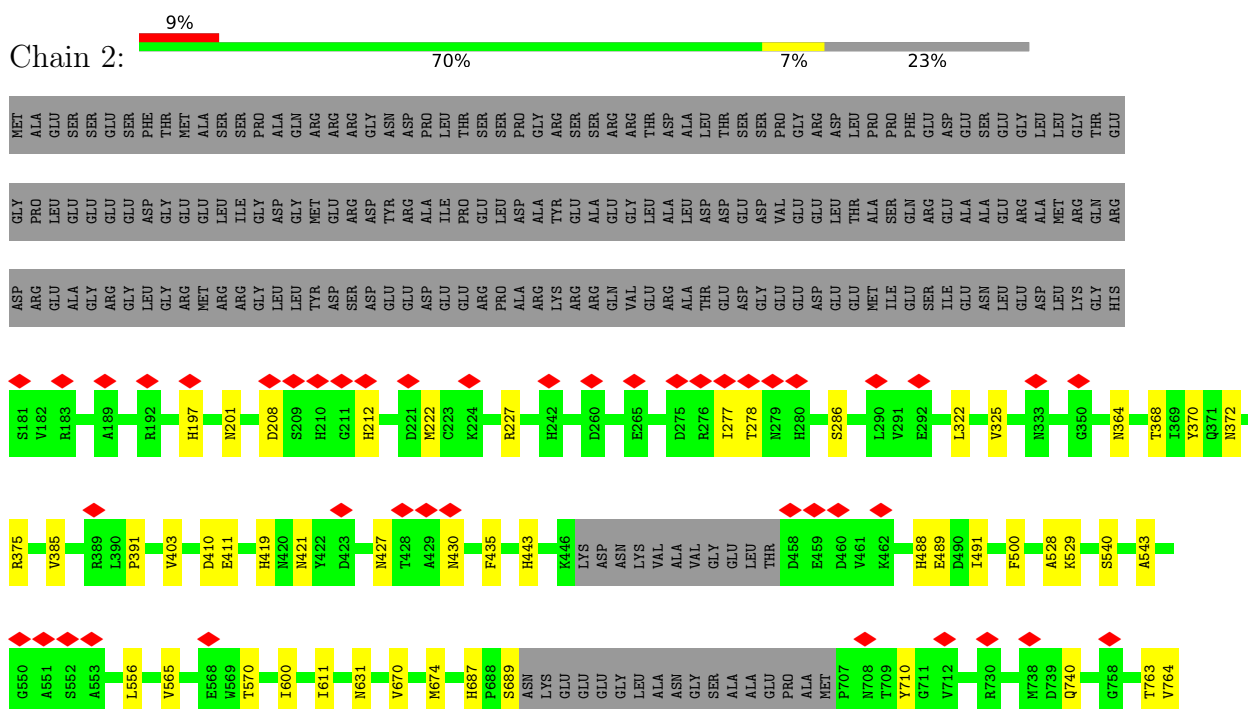
- Molecule 1: DNA (22-mer)

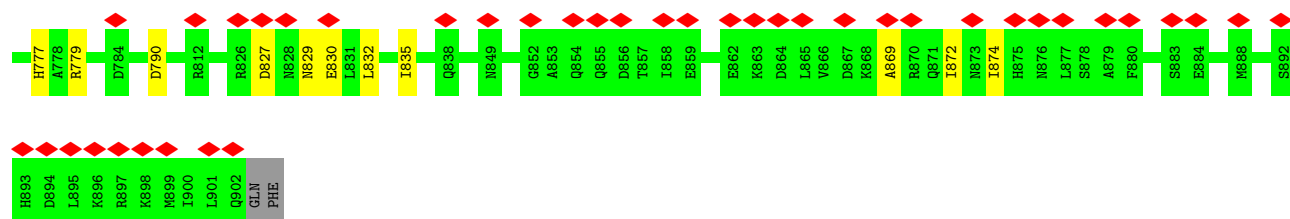


- Molecule 2: DNA (22-mer)

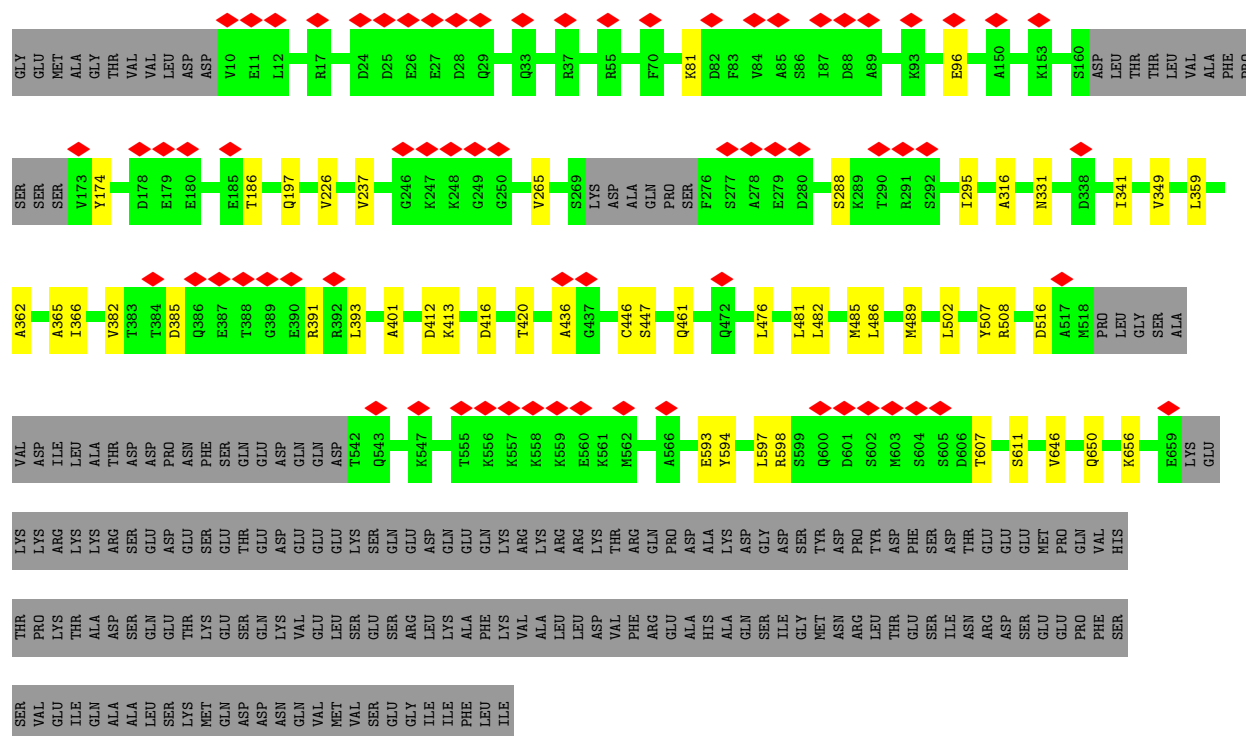


- Molecule 3: DNA replication licensing factor MCM2

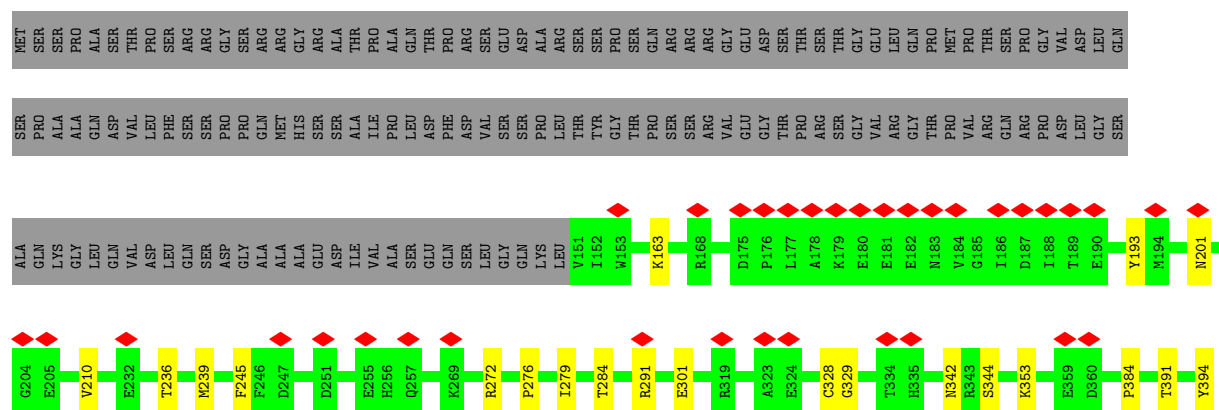


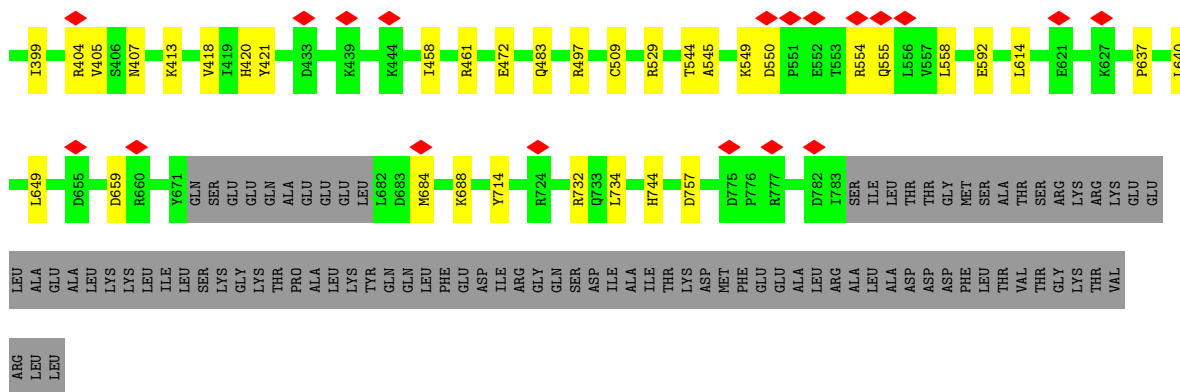


• Molecule 4: DNA replication licensing factor MCM3

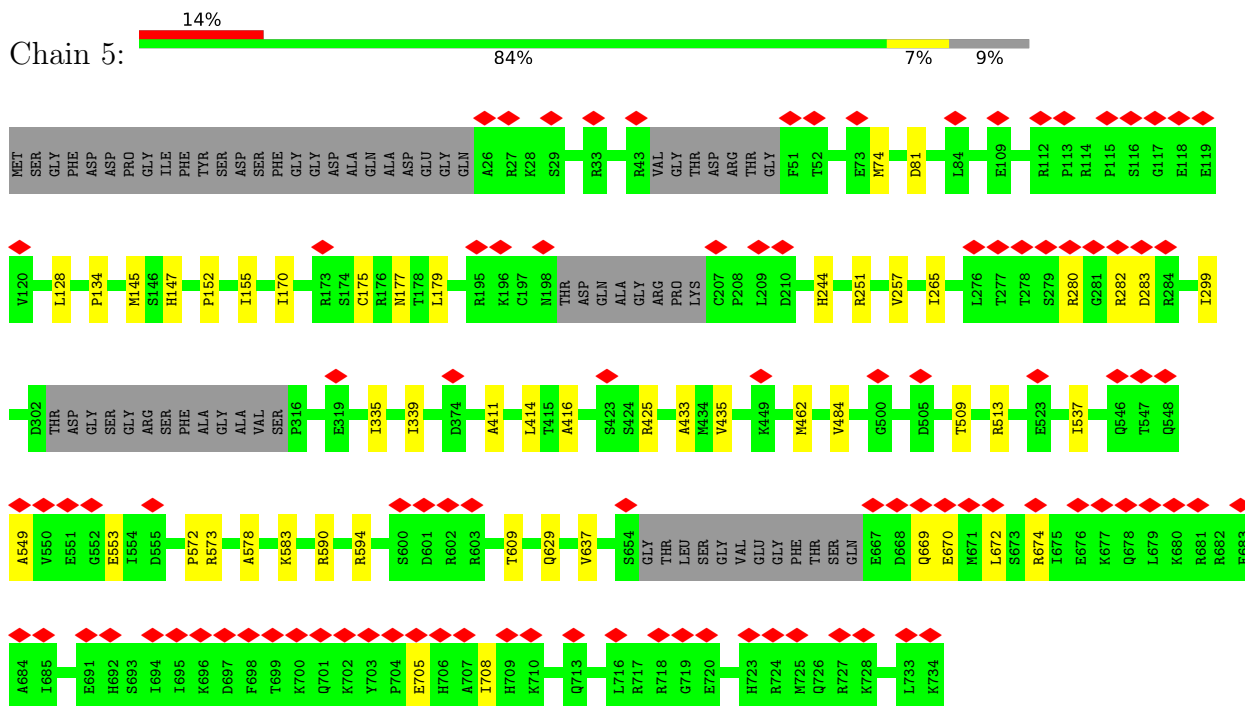


• Molecule 5: DNA replication licensing factor MCM4

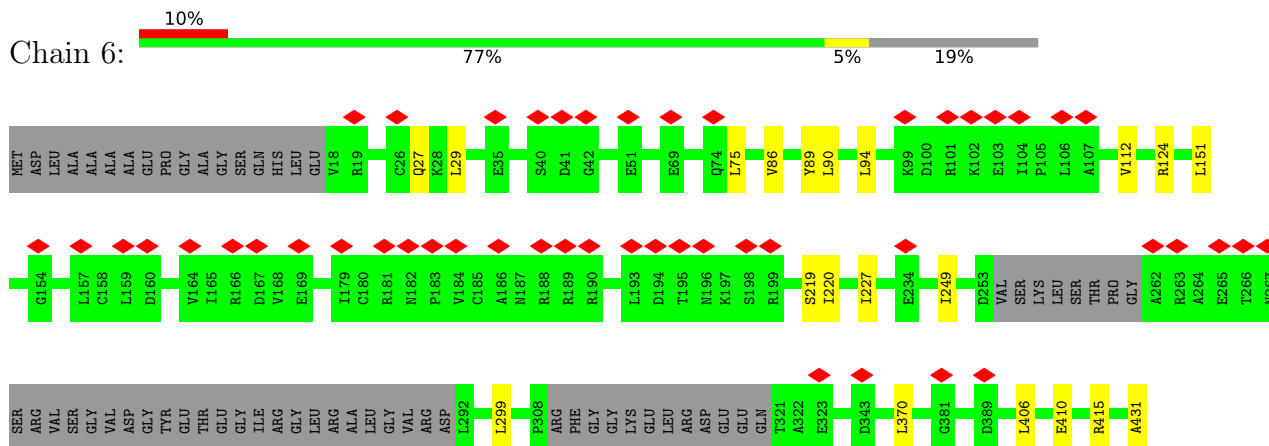




- Molecule 6: DNA replication licensing factor MCM5



- Molecule 7: DNA replication licensing factor MCM6



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	25069	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 ($e^-/\text{\AA}^2$)	49.19	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	130000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	1.772	Depositor
Minimum map value	-0.726	Depositor
Average map value	0.003	Depositor
Map value standard deviation	0.049	Depositor
Recommended contour level	0.33	Depositor
Map size (Å)	432.00003, 432.00003, 432.00003	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.08, 1.08, 1.08	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: ZN, MG, ATP, ADP

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	X	0.16	0/505	0.35	0/777
2	Y	0.16	0/505	0.35	0/777
3	2	0.10	0/5620	0.27	0/7591
4	3	0.10	0/4865	0.29	0/6557
5	4	0.11	0/5059	0.30	1/6841 (0.0%)
6	5	0.10	0/5387	0.27	1/7231 (0.0%)
7	6	0.10	0/5472	0.27	0/7378
8	7	0.10	0/4476	0.29	0/6043
All	All	0.10	0/31889	0.29	2/43195 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	4	472	GLU	CB-CA-C	-5.61	110.09	116.54
6	5	251	ARG	CB-CA-C	-5.46	109.81	117.23

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	X	451	0	248	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	Y	451	0	248	7	0
3	2	5516	0	5521	36	0
4	3	4794	0	4835	31	0
5	4	4969	0	5002	33	0
6	5	5307	0	5420	31	0
7	6	5386	0	5416	26	0
8	7	4410	0	4471	29	0
9	2	31	0	12	1	0
10	2	1	0	0	0	0
10	3	1	0	0	0	0
10	5	1	0	0	0	0
10	6	1	0	0	0	0
10	7	1	0	0	0	0
11	2	1	0	0	0	0
11	4	1	0	0	0	0
11	5	1	0	0	0	0
11	6	1	0	0	0	0
11	7	1	0	0	0	0
12	3	27	0	12	0	0
12	5	27	0	12	0	0
12	6	27	0	12	1	0
12	7	27	0	12	0	0
All	All	31433	0	31221	173	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 3.

All (173) 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)
3:2:670:VAL:HG12	3:2:674:MET:HE2	1.73	0.69
8:7:43:ARG:HH11	8:7:133:ARG:HD2	1.59	0.68
6:5:578:ALA:HB1	6:5:637:VAL:HG21	1.76	0.68
8:7:139:GLN:HG2	8:7:302:ARG:HG3	1.75	0.67
3:2:565:VAL:HA	7:6:488:GLY:HA2	1.77	0.66
2:Y:-10:DA:H5''	5:4:554:ARG:HD2	1.78	0.66
6:5:705:GLU:HA	6:5:708:ILE:HD12	1.78	0.65
3:2:222:MET:HG2	3:2:227:ARG:HB2	1.79	0.65
6:5:265:ILE:HG12	6:5:299:ILE:HG12	1.79	0.65
6:5:590:ARG:HH21	6:5:609:THR:HA	1.62	0.65
3:2:827:ASP:HB3	3:2:830:GLU:HG3	1.79	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:3:366:ILE:HD12	4:3:401:ALA:HB2	1.80	0.63
8:7:42:HIS:HE1	8:7:90:GLU:H	1.45	0.63
7:6:249:ILE:HD12	7:6:299:LEU:HD12	1.80	0.62
4:3:288:SER:HA	4:3:295:ILE:HD11	1.82	0.62
4:3:476:LEU:HD22	4:3:482:LEU:HD11	1.82	0.61
8:7:169:ARG:NH2	8:7:420:ARG:O	2.34	0.60
5:4:544:THR:OG1	5:4:545:ALA:N	2.33	0.60
5:4:558:LEU:HB3	7:6:220:ILE:HD13	1.82	0.60
5:4:291:ARG:HD2	5:4:353:LYS:HD2	1.84	0.60
5:4:328:CYS:SG	5:4:329:GLY:N	2.74	0.60
8:7:182:TYR:HB3	8:7:220:LEU:HB3	1.84	0.60
7:6:29:LEU:HB3	7:6:75:LEU:HD22	1.85	0.59
3:2:427:ASN:ND2	3:2:430:ASN:O	2.36	0.59
5:4:405:VAL:HG12	5:4:407:ASN:H	1.69	0.57
4:3:507:TYR:O	6:5:573:ARG:NH1	2.38	0.56
4:3:237:VAL:HG22	4:3:265:VAL:HG12	1.88	0.56
4:3:362:ALA:HB3	4:3:365:ALA:HB2	1.87	0.56
5:4:272:ARG:O	8:7:263:ARG:NH1	2.38	0.55
7:6:631:MET:HB3	7:6:644:HIS:ND1	2.22	0.55
4:3:482:LEU:HD12	4:3:611:SER:HB2	1.86	0.55
7:6:29:LEU:HD23	7:6:75:LEU:HB2	1.88	0.55
5:4:399:ILE:HD11	5:4:413:LYS:HB2	1.89	0.55
6:5:74:MET:HE2	6:5:128:LEU:HB3	1.90	0.54
5:4:714:TYR:HB2	5:4:734:LEU:HD13	1.89	0.54
4:3:607:THR:HG22	4:3:656:LYS:HG2	1.90	0.54
7:6:587:SER:HG	7:6:590:SER:HG	1.54	0.53
6:5:416:ALA:HB2	6:5:435:VAL:HG21	1.89	0.53
3:2:385:VAL:HG21	3:2:391:PRO:HG3	1.90	0.53
3:2:277:ILE:HG22	3:2:278:THR:HG23	1.91	0.53
3:2:540:SER:HB3	3:2:543:ALA:HB2	1.90	0.53
8:7:280:ILE:N	8:7:295:GLU:O	2.41	0.53
5:4:342:ASN:OD1	7:6:249:ILE:HG23	2.08	0.53
5:4:497:ARG:NH2	12:6:901:ADP:O3'	2.42	0.52
4:3:594:TYR:OH	4:3:598:ARG:NH2	2.42	0.52
5:4:592:GLU:OE2	5:4:732:ARG:NH1	2.41	0.52
5:4:744:HIS:ND1	5:4:757:ASP:OD1	2.42	0.52
6:5:175:CYS:SG	6:5:177:ASN:ND2	2.66	0.52
4:3:385:ASP:OD1	6:5:425:ARG:NH2	2.43	0.52
3:2:529:LYS:NZ	3:2:631:ASN:OD1	2.39	0.52
3:2:869:ALA:HB1	3:2:874:ILE:HB	1.92	0.51
3:2:208:ASP:OD1	3:2:212:HIS:N	2.44	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:5:155:ILE:HG13	6:5:257:VAL:HG11	1.92	0.50
6:5:282:ARG:NH2	7:6:441:GLU:O	2.33	0.50
4:3:316:ALA:HB1	4:3:341:ILE:HD13	1.94	0.50
5:4:236:THR:HA	5:4:239:MET:HE2	1.93	0.50
3:2:687:HIS:CD2	3:2:689:SER:H	2.30	0.50
7:6:546:TYR:O	7:6:550:ARG:HG2	2.12	0.50
8:7:273:VAL:HG22	8:7:303:ILE:HG12	1.94	0.50
5:4:163:LYS:HD2	5:4:239:MET:HE3	1.94	0.50
8:7:262:THR:HG22	8:7:263:ARG:HG3	1.93	0.49
4:3:174:TYR:OH	4:3:186:THR:OG1	2.25	0.49
3:2:740:GLN:HG2	6:5:537:ILE:HG21	1.94	0.49
4:3:331:ASN:O	8:7:396:ARG:NH1	2.46	0.49
6:5:414:LEU:HD12	6:5:433:ALA:HB3	1.94	0.49
4:3:461:GLN:HE22	4:3:486:LEU:HD13	1.77	0.49
2:Y:-5:DT:O4	6:5:280:ARG:NH1	2.46	0.49
7:6:227:ILE:HB	7:6:299:LEU:HD23	1.93	0.48
8:7:372:ARG:HD2	8:7:465:GLN:HG3	1.95	0.48
7:6:431:ALA:HB2	7:6:450:MET:SD	2.53	0.48
3:2:364:ASN:O	3:2:368:THR:OG1	2.21	0.48
4:3:359:LEU:HD23	4:3:365:ALA:HB1	1.94	0.48
4:3:446:CYS:SG	4:3:447:SER:N	2.87	0.48
5:4:384:PRO:O	5:4:529:ARG:NH2	2.45	0.48
8:7:359:VAL:HG21	8:7:619:LEU:HD21	1.95	0.48
4:3:489:MET:O	6:5:594:ARG:NH1	2.46	0.48
6:5:81:ASP:N	6:5:81:ASP:OD1	2.46	0.48
7:6:27:GLN:HG3	7:6:89:TYR:HB3	1.94	0.48
8:7:12:LYS:O	8:7:15:LYS:HG3	2.14	0.48
5:4:418:VAL:HG11	5:4:421:TYR:CZ	2.49	0.48
6:5:134:PRO:HB2	6:5:152:PRO:HD3	1.95	0.48
8:7:620:ARG:NH2	8:7:629:ASP:OD1	2.34	0.47
8:7:398:ALA:HB3	8:7:401:SER:HB3	1.95	0.47
3:2:410:ASP:OD1	3:2:411:GLU:N	2.47	0.47
3:2:570:THR:HG22	6:5:244:HIS:NE2	2.30	0.47
2:Y:-9:DT:OP1	7:6:435:ARG:NE	2.46	0.47
4:3:508:ARG:NH2	4:3:516:ASP:O	2.48	0.47
5:4:201:ASN:HB2	5:4:245:PHE:HE1	1.80	0.47
7:6:770:LYS:NZ	7:6:774:GLU:OE2	2.41	0.47
3:2:419:HIS:CE1	3:2:421:ASN:HB3	2.50	0.46
4:3:436:ALA:H	8:7:412:VAL:HG12	1.80	0.46
5:4:684:MET:HG2	5:4:688:LYS:HE3	1.97	0.46
6:5:145:MET:O	6:5:147:HIS:ND1	2.47	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:4:659:ASP:OD1	8:7:589:ARG:NH1	2.48	0.46
8:7:244:VAL:HG21	8:7:250:PRO:HG3	1.98	0.46
8:7:421:ASP:OD1	8:7:428:THR:OG1	2.32	0.46
5:4:483:GLN:OE1	5:4:614:LEU:HD21	2.15	0.46
7:6:760:ILE:HD13	7:6:766:LEU:HA	1.98	0.46
8:7:184:CYS:HB3	8:7:187:CYS:SG	2.56	0.46
4:3:412:ASP:OD2	4:3:413:LYS:NZ	2.42	0.45
7:6:124:ARG:NH2	7:6:219:SER:OG	2.45	0.45
4:3:597:LEU:HD21	4:3:650:GLN:OE1	2.15	0.45
4:3:382:VAL:HG22	4:3:393:LEU:HD23	1.98	0.45
4:3:349:VAL:HG12	4:3:485:MET:HE2	1.98	0.45
3:2:488:HIS:HB3	3:2:491:ILE:HD12	1.97	0.45
1:X:16:DT:H2"	1:X:17:DG:H8	1.82	0.45
6:5:170:ILE:HD11	6:5:179:LEU:HD12	1.99	0.45
8:7:184:CYS:SG	8:7:185:ASP:N	2.90	0.45
4:3:81:LYS:NZ	4:3:96:GLU:O	2.35	0.45
3:2:372:ASN:HB3	3:2:403:VAL:HG21	1.98	0.44
4:3:341:ILE:HG12	4:3:481:LEU:HB2	1.99	0.44
4:3:416:ASP:O	4:3:420:THR:HG23	2.17	0.44
1:X:5:DA:H5"	5:4:404:ARG:HG3	1.99	0.44
6:5:669:GLN:HA	6:5:672:LEU:HD12	2.00	0.44
2:Y:-11:DC:OP1	5:4:549:LYS:HE3	2.17	0.44
2:Y:-9:DT:H2"	2:Y:-8:DG:H8	1.82	0.44
3:2:777:HIS:HB3	3:2:790:ASP:HB3	1.99	0.44
5:4:550:ASP:HB2	5:4:555:GLN:HB2	1.99	0.44
8:7:516:ASP:OD2	8:7:611:ARG:NH2	2.51	0.44
5:4:284:THR:HG22	5:4:391:THR:HG23	1.99	0.44
3:2:322:LEU:HB3	3:2:325:VAL:HG22	2.00	0.43
4:3:593:GLU:OE1	4:3:646:VAL:HG21	2.18	0.43
1:X:4:DC:H2"	1:X:5:DA:C8	2.53	0.43
1:X:20:DT:H2"	1:X:21:DG:C8	2.53	0.43
3:2:500:PHE:HD2	3:2:779:ARG:HG2	1.83	0.43
7:6:370:LEU:HD21	7:6:631:MET:HG2	2.00	0.43
2:Y:-21:DC:H2"	2:Y:-20:DA:C8	2.53	0.43
7:6:406:LEU:O	7:6:410:GLU:HG3	2.18	0.43
2:Y:-5:DT:H2"	2:Y:-4:DG:C8	2.53	0.43
7:6:415:ARG:NH1	7:6:451:LEU:O	2.52	0.43
3:2:556:LEU:HD21	3:2:600:ILE:HD11	2.01	0.42
4:3:197:GLN:HB2	4:3:226:VAL:HG13	2.00	0.42
3:2:489:GLU:OE1	3:2:710:TYR:OH	2.30	0.42
3:2:375:ARG:NH1	6:5:283:ASP:OD2	2.42	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:3:391:ARG:NH1	4:3:436:ALA:O	2.53	0.42
3:2:872:ILE:O	3:2:872:ILE:HG22	2.20	0.42
3:2:763:THR:OG1	3:2:764:VAL:N	2.51	0.42
3:2:832:LEU:HA	3:2:835:ILE:HD12	2.01	0.42
6:5:509:THR:O	6:5:513:ARG:NH1	2.52	0.42
6:5:670:GLU:O	6:5:674:ARG:HG3	2.18	0.42
7:6:752:TYR:CE2	7:6:756:ILE:HD11	2.54	0.42
3:2:827:ASP:CG	3:2:829:ASN:HD22	2.28	0.42
8:7:378:CYS:HB3	8:7:518:LEU:HD23	2.01	0.42
3:2:325:VAL:HA	3:2:368:THR:HG23	2.02	0.41
4:3:349:VAL:HG12	4:3:349:VAL:O	2.20	0.41
5:4:193:TYR:HE2	5:4:210:VAL:HG22	1.85	0.41
3:2:197:HIS:O	3:2:201:ASN:ND2	2.45	0.41
3:2:370:TYR:CE1	6:5:145:MET:HG2	2.56	0.41
7:6:94:LEU:HD22	7:6:112:VAL:HG22	2.03	0.41
3:2:611:ILE:HA	6:5:411:ALA:HB3	2.02	0.41
4:3:502:LEU:HD12	6:5:583:LYS:HG3	2.01	0.41
5:4:509:CYS:HB3	5:4:649:LEU:HD23	2.03	0.41
3:2:286:SER:HA	3:2:443:HIS:CD2	2.55	0.41
6:5:462:MET:HE2	6:5:484:VAL:HG11	2.02	0.41
3:2:435:PHE:HE2	7:6:151:LEU:HG	1.86	0.41
6:5:335:ILE:O	6:5:339:ILE:HG12	2.21	0.41
6:5:572:PRO:HB3	6:5:629:GLN:O	2.21	0.41
8:7:83:GLU:O	8:7:86:PRO:HD2	2.21	0.41
3:2:528:ALA:HB2	9:2:1001:ATP:C8	2.56	0.40
5:4:279:ILE:HA	5:4:394:TYR:HD2	1.86	0.40
5:4:391:THR:HB	5:4:420:HIS:HB3	2.02	0.40
5:4:637:PRO:HG2	5:4:640:LEU:HB2	2.03	0.40
5:4:301:GLU:O	5:4:344:SER:HB3	2.21	0.40
6:5:549:ALA:HB1	6:5:553:GLU:HB2	2.02	0.40
7:6:27:GLN:CG	7:6:89:TYR:HB3	2.51	0.40
8:7:148:VAL:HG12	8:7:150:ARG:H	1.87	0.40
8:7:447:PHE:HE1	8:7:458:ILE:HD13	1.86	0.40
5:4:458:ILE:HA	5:4:461:ARG:HB2	2.03	0.40
5:4:276:PRO:HG3	8:7:175:PRO:HB3	2.03	0.40
7:6:86:VAL:HG12	7:6:90:LEU:HG	2.04	0.40
7:6:746:SER:O	7:6:750:ASN:ND2	2.52	0.40
8:7:12:LYS:HE2	8:7:62:LEU:HD11	2.03	0.40
8:7:177:MET:SD	8:7:227:SER:HB3	2.62	0.40

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	
3	2	688/904 (76%)	673 (98%)	15 (2%)	0	100	100
4	3	601/810 (74%)	591 (98%)	10 (2%)	0	100	100
5	4	619/863 (72%)	611 (99%)	8 (1%)	0	100	100
6	5	659/734 (90%)	644 (98%)	15 (2%)	0	100	100
7	6	656/821 (80%)	640 (98%)	16 (2%)	0	100	100
8	7	544/719 (76%)	528 (97%)	16 (3%)	0	100	100
All	All	3767/4851 (78%)	3687 (98%)	80 (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	
3	2	610/781 (78%)	610 (100%)	0	100	100
4	3	524/708 (74%)	524 (100%)	0	100	100
5	4	551/753 (73%)	551 (100%)	0	100	100
6	5	579/625 (93%)	579 (100%)	0	100	100
7	6	604/724 (83%)	604 (100%)	0	100	100
8	7	483/619 (78%)	483 (100%)	0	100	100
All	All	3351/4210 (80%)	3351 (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 (33) such sidechains are listed below:

Mol	Chain	Res	Type
3	2	196	HIS
3	2	299	GLN
3	2	419	HIS
3	2	421	ASN
3	2	472	GLN
3	2	621	GLN
3	2	646	ASN
3	2	686	HIS
3	2	708	ASN
3	2	717	GLN
3	2	854	GLN
4	3	44	GLN
4	3	298	GLN
4	3	461	GLN
5	4	275	ASN
5	4	332	HIS
5	4	368	HIS
5	4	407	ASN
5	4	594	GLN
5	4	765	HIS
6	5	261	ASN
6	5	524	HIS
7	6	187	ASN
7	6	359	HIS
7	6	494	ASN
7	6	730	HIS
8	7	105	HIS
8	7	223	GLN
8	7	376	ASN
8	7	439	GLN
8	7	479	ASN
8	7	535	GLN
8	7	631	ASN

5.3.3 RNA [i](#)

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 15 ligands modelled in this entry, 10 are monoatomic - leaving 5 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	ADP	5	801	10	28,29,29	1.42	4 (14%)	43,45,45	1.85	9 (20%)
12	ADP	3	901	10	28,29,29	1.41	4 (14%)	43,45,45	1.85	9 (20%)
12	ADP	6	901	10	28,29,29	1.41	4 (14%)	43,45,45	1.85	9 (20%)
12	ADP	7	801	10	28,29,29	1.41	4 (14%)	43,45,45	1.85	9 (20%)
9	ATP	2	1001	10	32,33,33	0.28	0	48,52,52	0.36	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
12	ADP	5	801	10	-	1/16/32/32	0/3/3/3
12	ADP	3	901	10	-	0/16/32/32	0/3/3/3
12	ADP	6	901	10	-	0/16/32/32	0/3/3/3
12	ADP	7	801	10	-	0/16/32/32	0/3/3/3
9	ATP	2	1001	10	-	4/22/38/38	0/3/3/3

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
12	5	801	ADP	C5-C4	4.76	1.47	1.39
12	6	901	ADP	C5-C4	4.76	1.47	1.39
12	3	901	ADP	C5-C4	4.75	1.47	1.39
12	7	801	ADP	C5-C4	4.74	1.47	1.39
12	5	801	ADP	C5-C6	2.74	1.48	1.41
12	6	901	ADP	C5-C6	2.73	1.48	1.41
12	3	901	ADP	C5-C6	2.73	1.48	1.41
12	7	801	ADP	C5-C6	2.73	1.48	1.41
12	3	901	ADP	C8-N7	2.32	1.36	1.31
12	5	801	ADP	C8-N7	2.32	1.36	1.31
12	7	801	ADP	C8-N7	2.31	1.36	1.31
12	6	901	ADP	C8-N7	2.31	1.36	1.31
12	5	801	ADP	C5-N7	-2.26	1.35	1.39
12	6	901	ADP	C5-N7	-2.26	1.35	1.39
12	3	901	ADP	C5-N7	-2.25	1.35	1.39
12	7	801	ADP	C5-N7	-2.25	1.35	1.39

All (36) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
12	5	801	ADP	C5-C4-N3	-5.86	118.65	126.72
12	6	901	ADP	C5-C4-N3	-5.85	118.66	126.72
12	7	801	ADP	C5-C4-N3	-5.83	118.69	126.72
12	3	901	ADP	C5-C4-N3	-5.82	118.70	126.72
12	5	801	ADP	N3-C4-N9	4.67	135.11	127.17
12	6	901	ADP	N3-C4-N9	4.67	135.10	127.17
12	7	801	ADP	N3-C4-N9	4.66	135.10	127.17
12	3	901	ADP	N3-C4-N9	4.64	135.06	127.17
12	5	801	ADP	C2-N3-C4	3.68	120.83	111.83
12	6	901	ADP	C2-N3-C4	3.68	120.82	111.83
12	3	901	ADP	C2-N3-C4	3.68	120.81	111.83
12	7	801	ADP	C2-N3-C4	3.68	120.81	111.83
12	6	901	ADP	C4-C5-N7	-3.42	106.67	110.58
12	3	901	ADP	C4-C5-N7	-3.41	106.68	110.58
12	5	801	ADP	C4-C5-N7	-3.41	106.68	110.58
12	7	801	ADP	C4-C5-N7	-3.41	106.69	110.58
12	3	901	ADP	N3-C2-N1	-3.19	123.75	128.58
12	7	801	ADP	N3-C2-N1	-3.19	123.76	128.58
12	5	801	ADP	N3-C2-N1	-3.17	123.78	128.58
12	6	901	ADP	N3-C2-N1	-3.17	123.78	128.58
12	7	801	ADP	C4-N9-C8	2.64	108.51	105.74
12	3	901	ADP	C4-N9-C8	2.63	108.50	105.74
12	6	901	ADP	C4-N9-C8	2.61	108.48	105.74

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
12	5	801	ADP	C3'-C2'-C1'	2.59	106.37	101.46
12	6	901	ADP	C3'-C2'-C1'	2.59	106.36	101.46
12	3	901	ADP	C3'-C2'-C1'	2.59	106.36	101.46
12	5	801	ADP	C4-N9-C8	2.59	108.45	105.74
12	7	801	ADP	C3'-C2'-C1'	2.56	106.30	101.46
12	3	901	ADP	C5-N7-C8	2.50	107.38	103.45
12	6	901	ADP	C5-N7-C8	2.50	107.38	103.45
12	7	801	ADP	C5-N7-C8	2.50	107.38	103.45
12	5	801	ADP	C5-N7-C8	2.50	107.37	103.45
12	3	901	ADP	C6-C5-N7	2.04	136.02	132.09
12	7	801	ADP	C6-C5-N7	2.02	135.99	132.09
12	6	901	ADP	C6-C5-N7	2.02	135.99	132.09
12	5	801	ADP	C6-C5-N7	2.01	135.97	132.09

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	2	1001	ATP	O4'-C4'-C5'-O5'
9	2	1001	ATP	C3'-C4'-C5'-O5'
9	2	1001	ATP	C4'-C5'-O5'-PA
12	5	801	ADP	O4'-C4'-C5'-O5'
9	2	1001	ATP	PG-O3B-PB-O2B

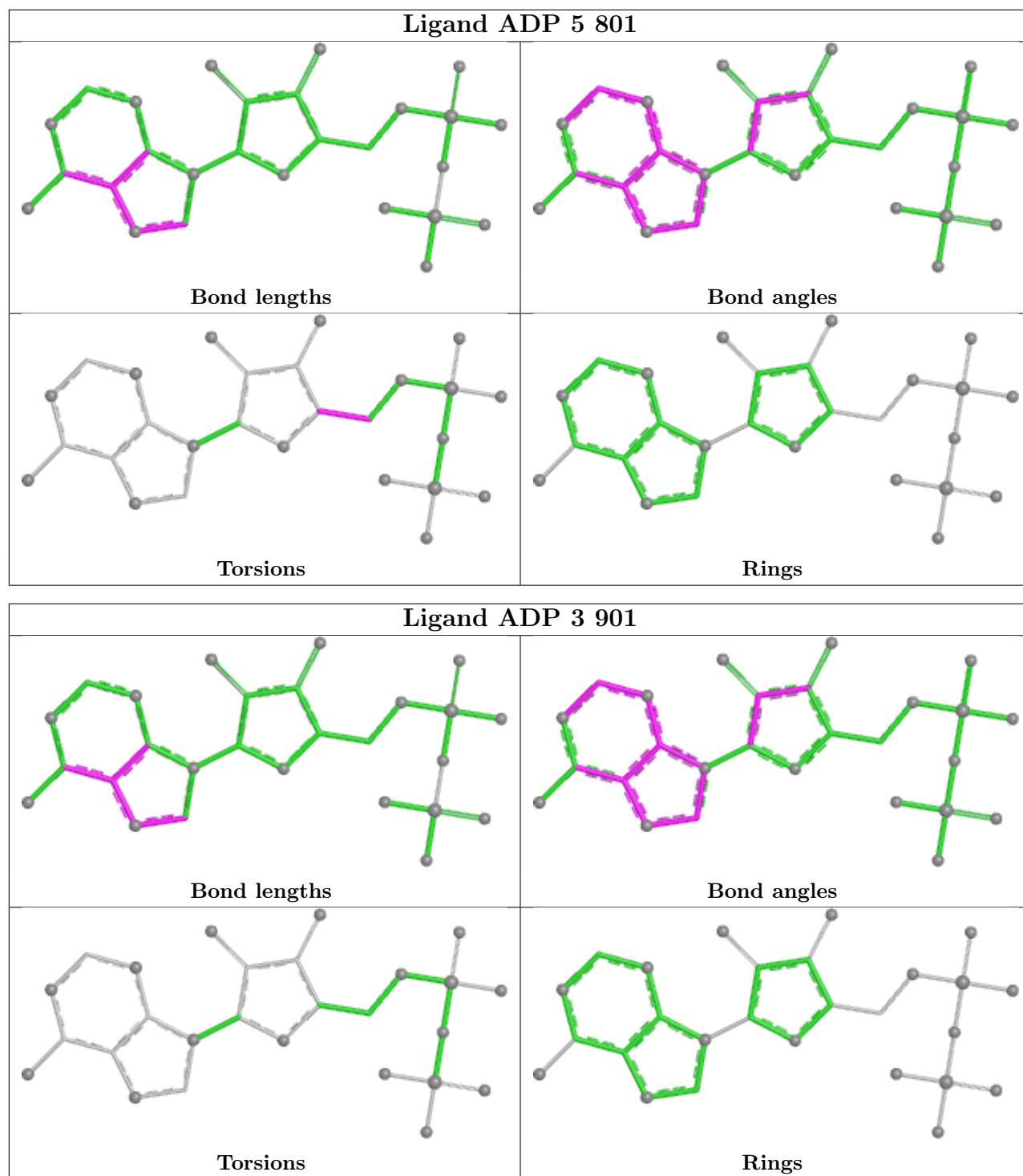
There are no ring outliers.

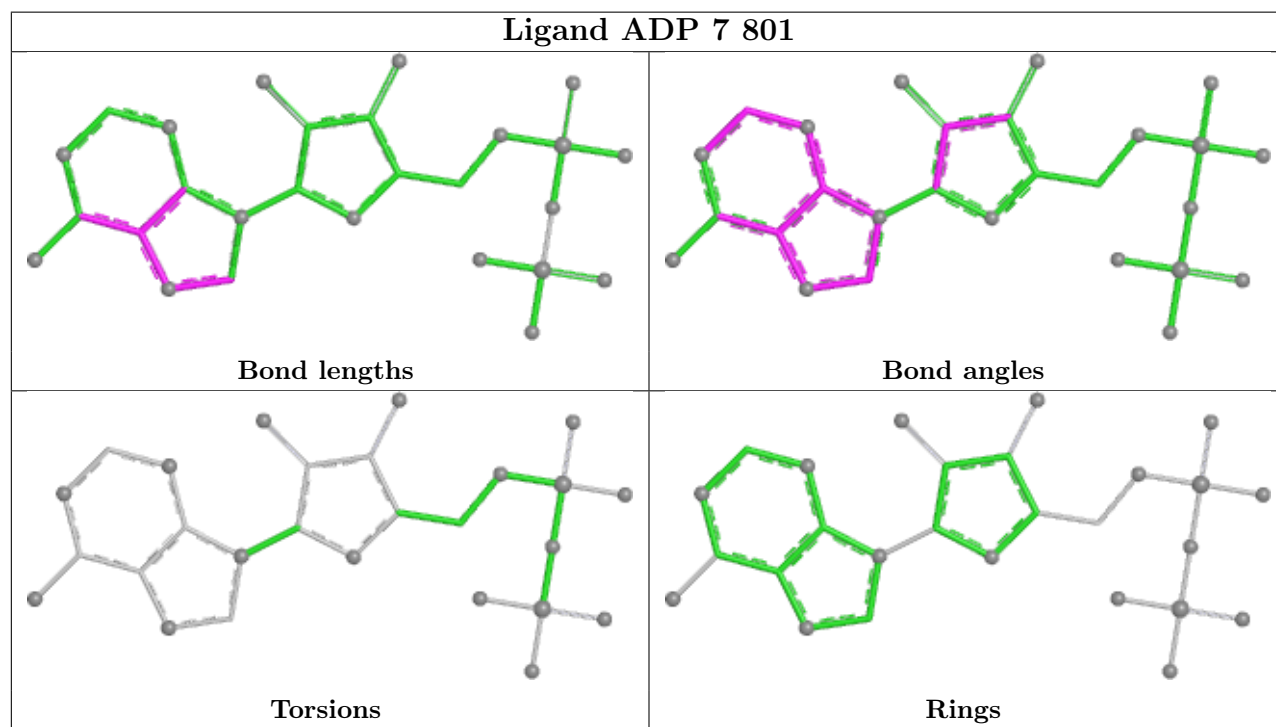
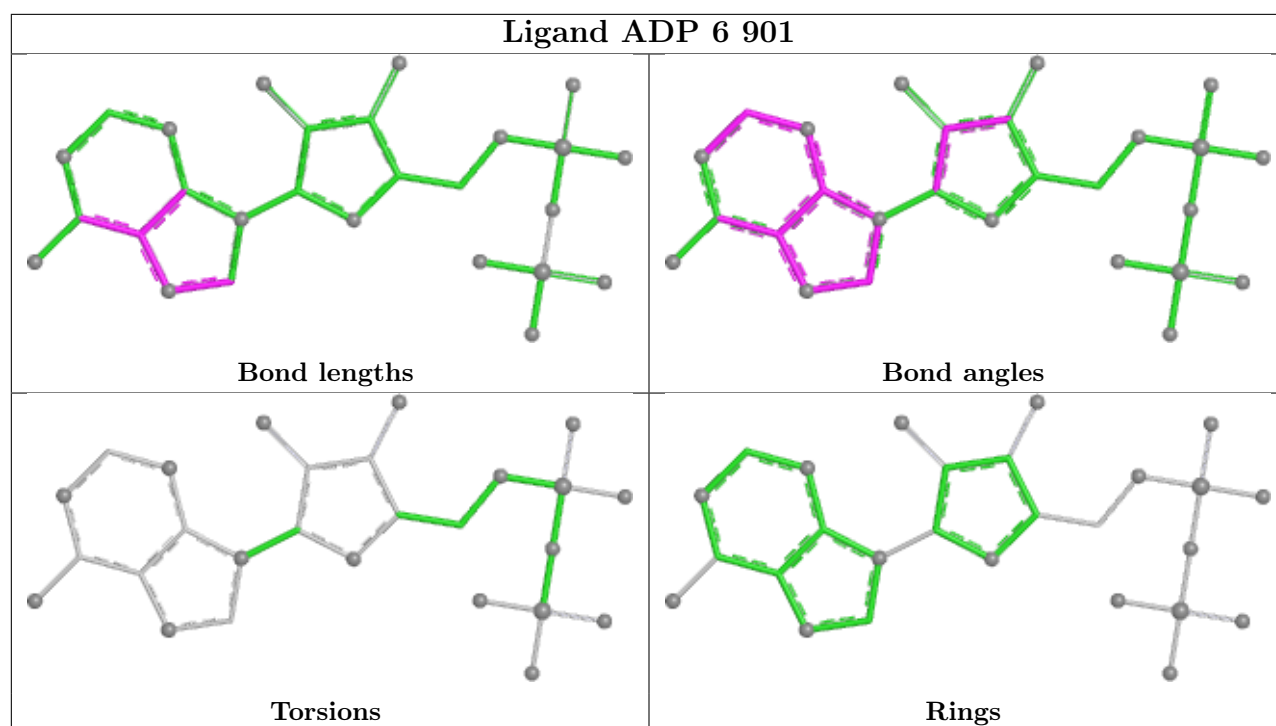
2 monomers are involved in 2 short contacts:

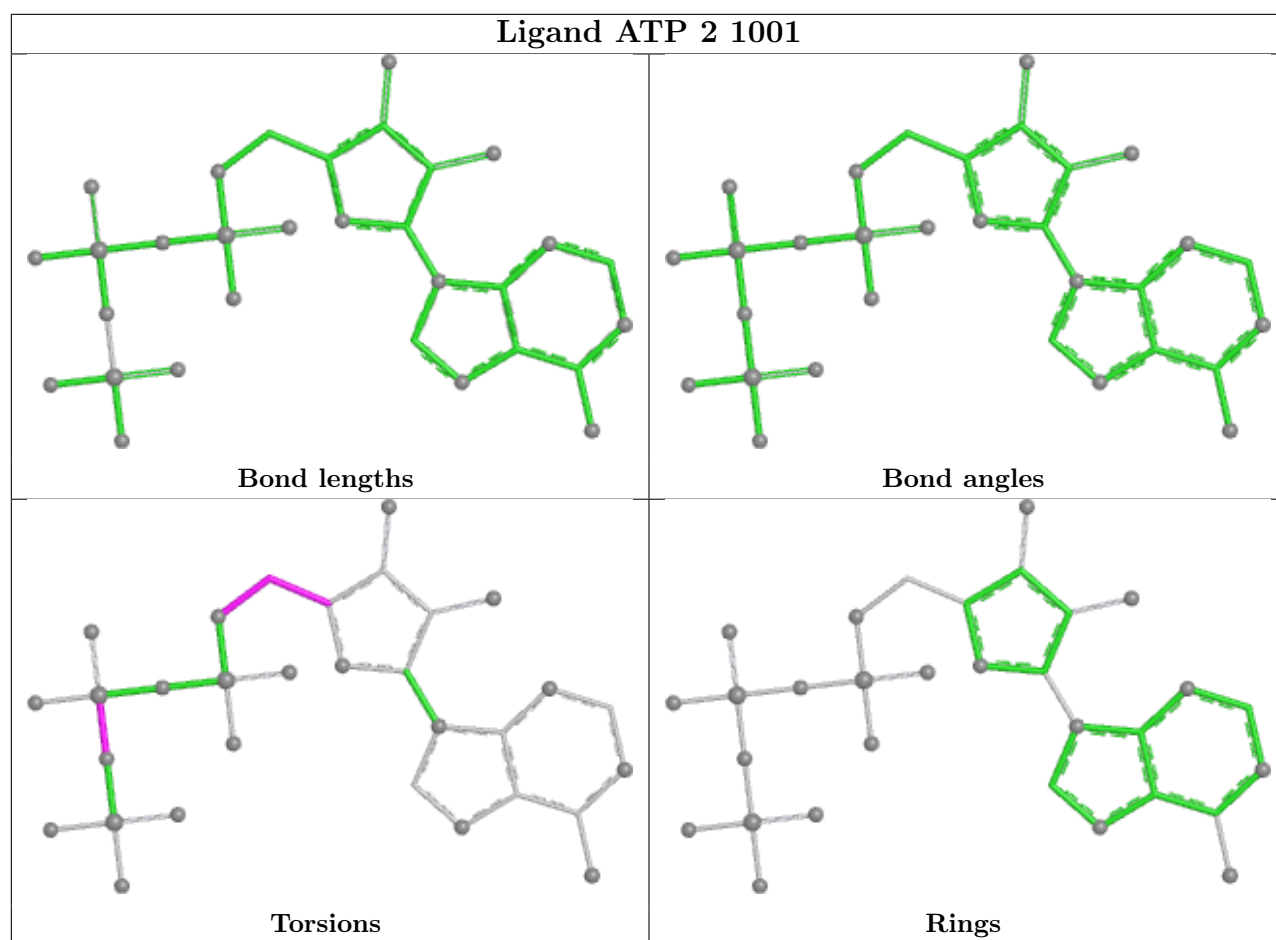
Mol	Chain	Res	Type	Clashes	Symm-Clashes
12	6	901	ADP	1	0
9	2	1001	ATP	1	0

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

equivalents in the CSD to analyse the geometry.







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.

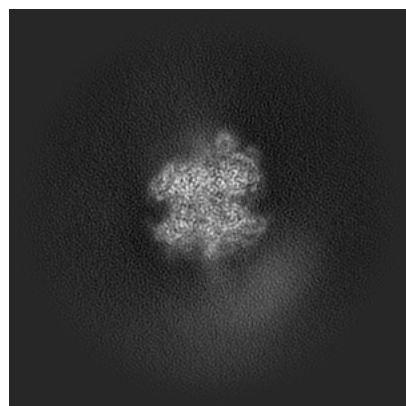
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-19619. These allow visual inspection of the internal detail of the map and identification of artifacts.

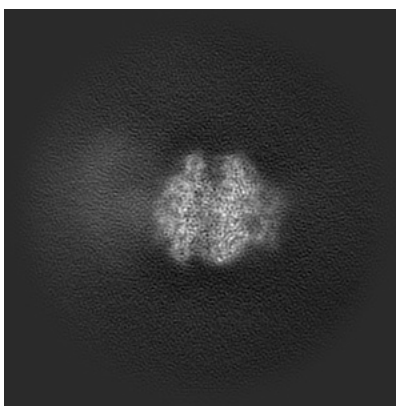
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

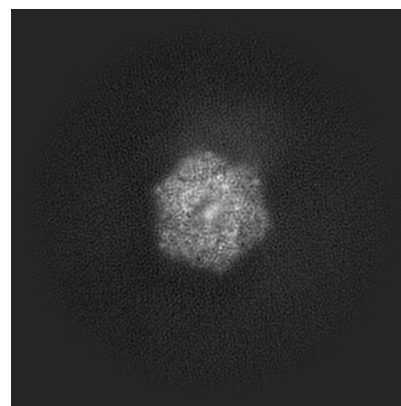
6.1.1 Primary map



X

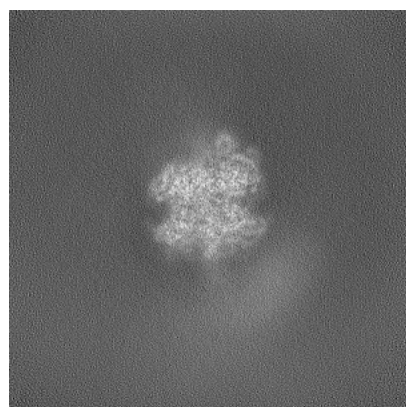


Y

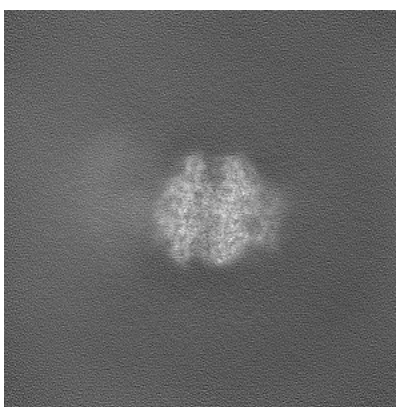


Z

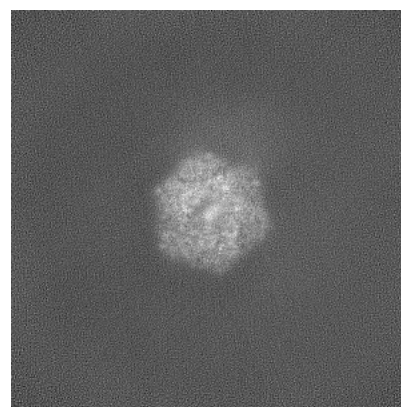
6.1.2 Raw map



X



Y

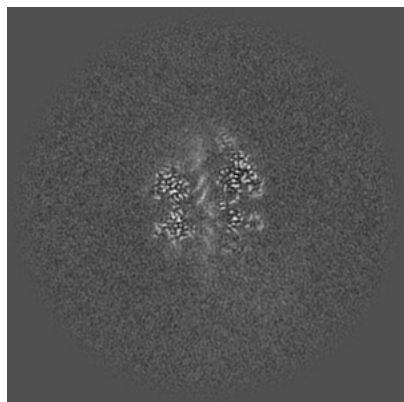


Z

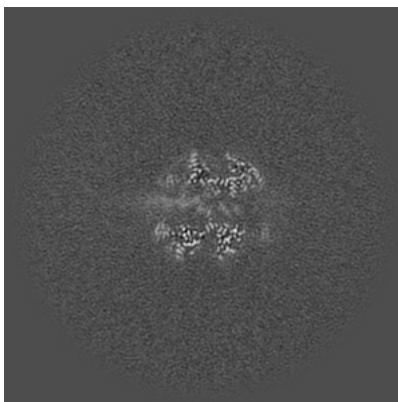
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

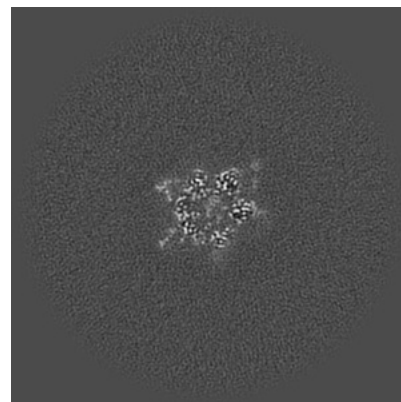
6.2.1 Primary map



X Index: 200

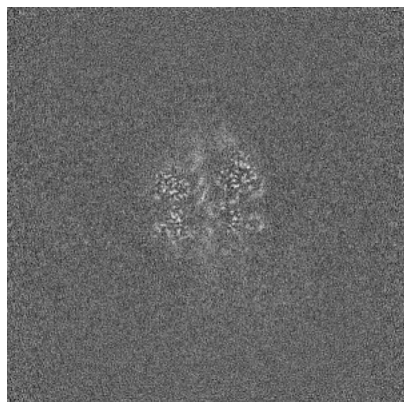


Y Index: 200

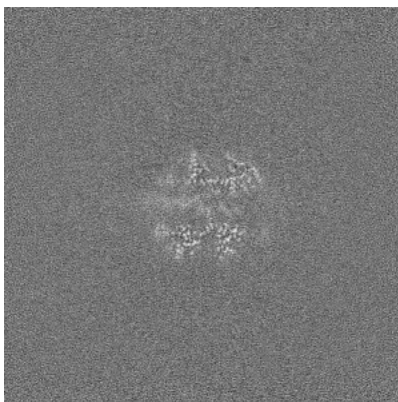


Z Index: 200

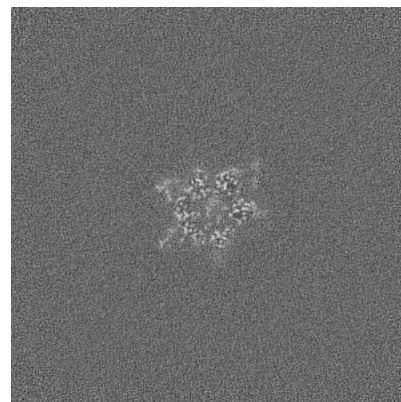
6.2.2 Raw map



X Index: 200



Y Index: 200

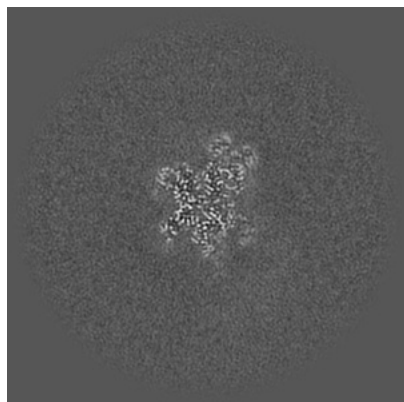


Z Index: 200

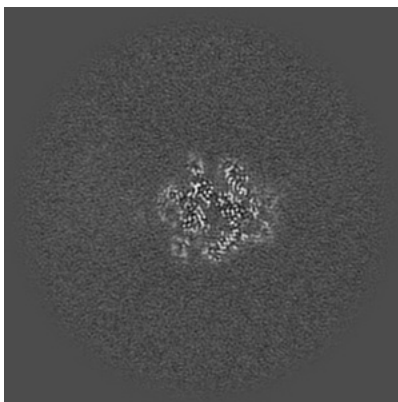
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

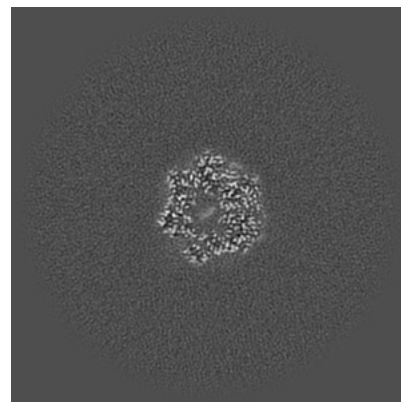
6.3.1 Primary map



X Index: 175

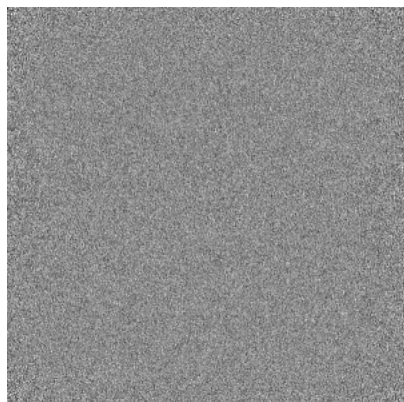


Y Index: 223

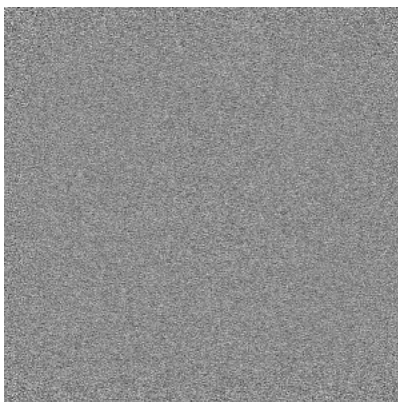


Z Index: 229

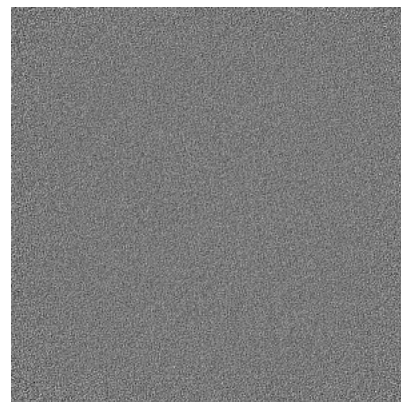
6.3.2 Raw map



X Index: 0



Y Index: 0

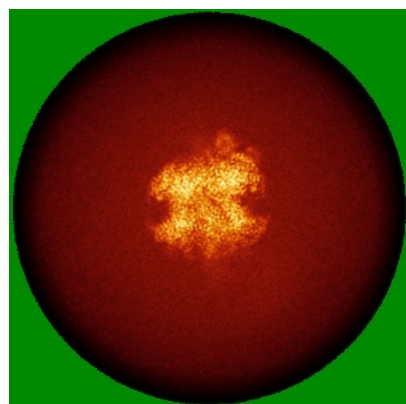


Z Index: 0

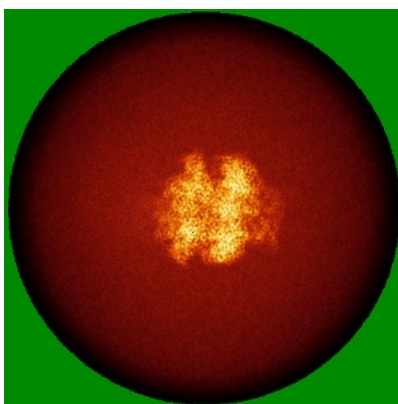
The images above show the largest variance slices of the map in three orthogonal directions.

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

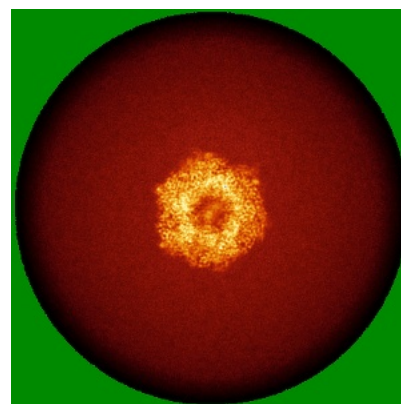
6.4.1 Primary map



X

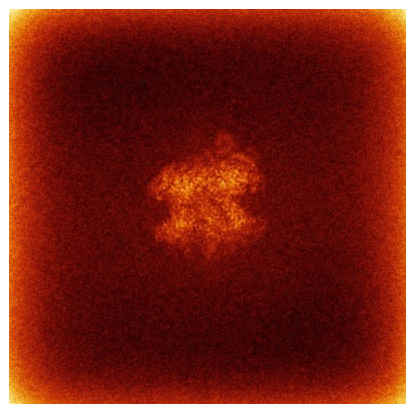


Y

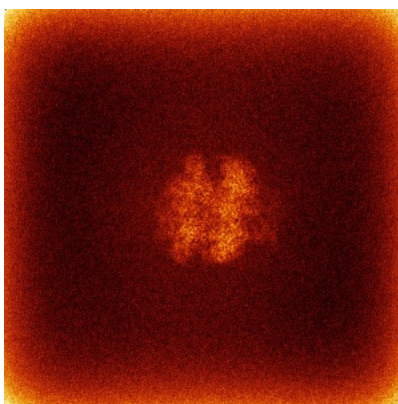


Z

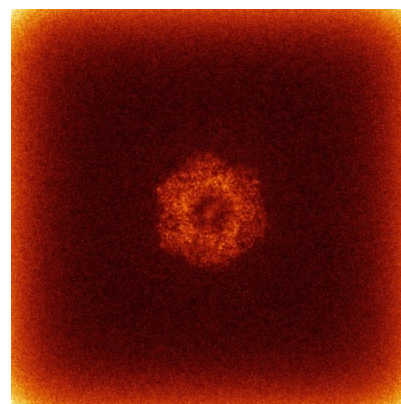
6.4.2 Raw map



X



Y



Z

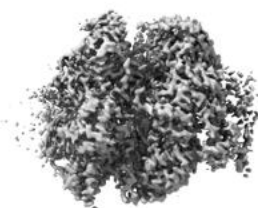
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views [i](#)

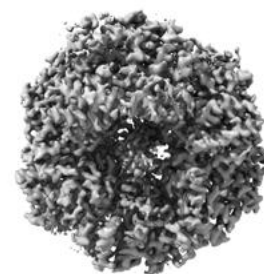
6.5.1 Primary map



X



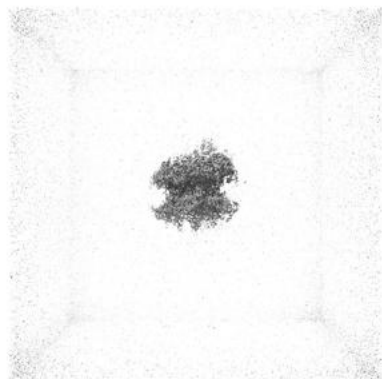
Y



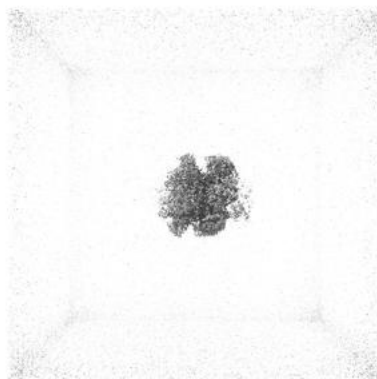
Z

The images above show the 3D surface view of the map at the recommended contour level 0.33. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

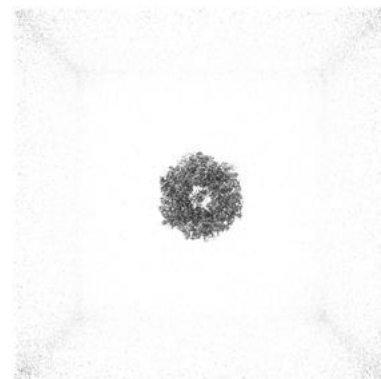
6.5.2 Raw map



X



Y



Z

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.

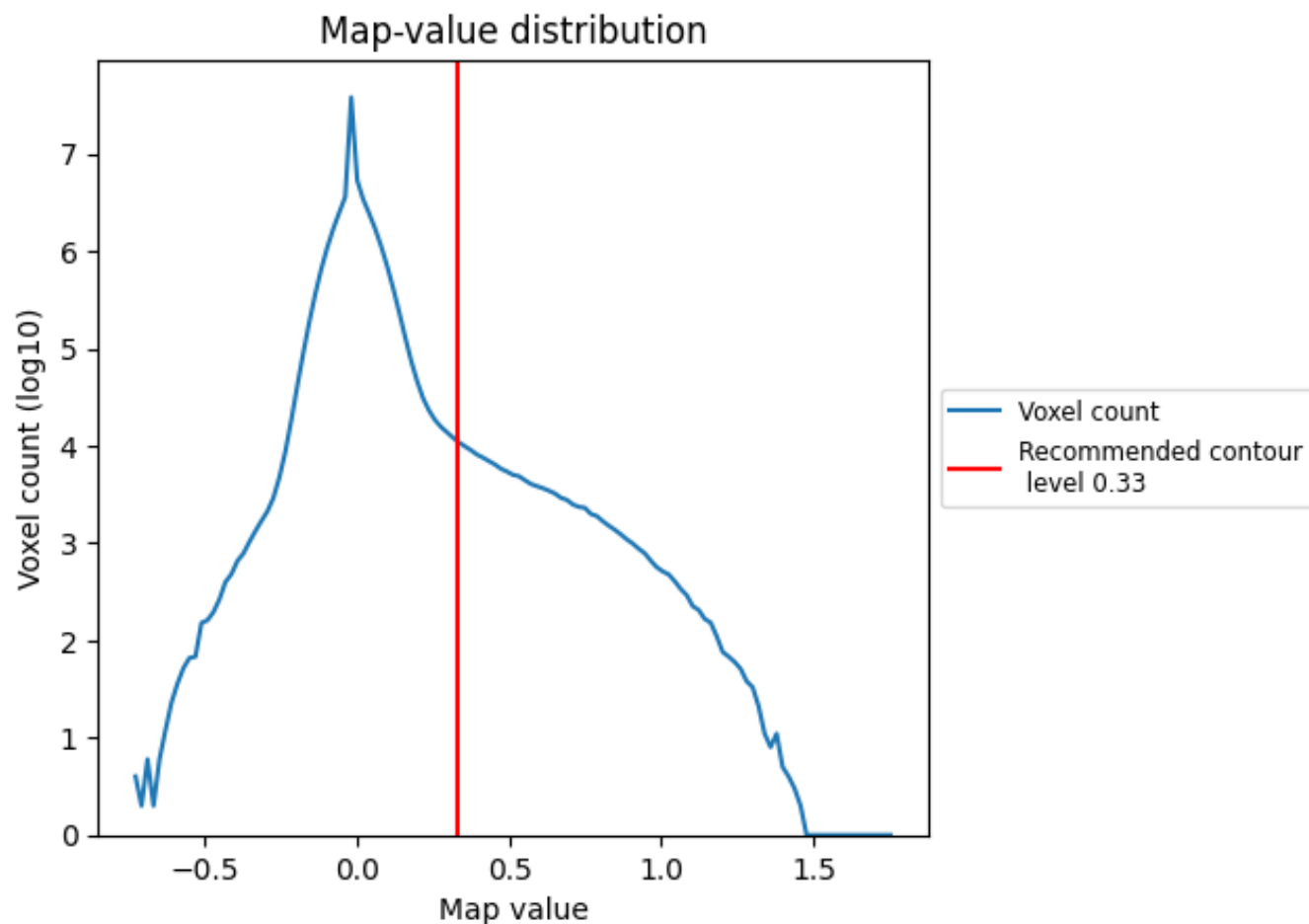
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

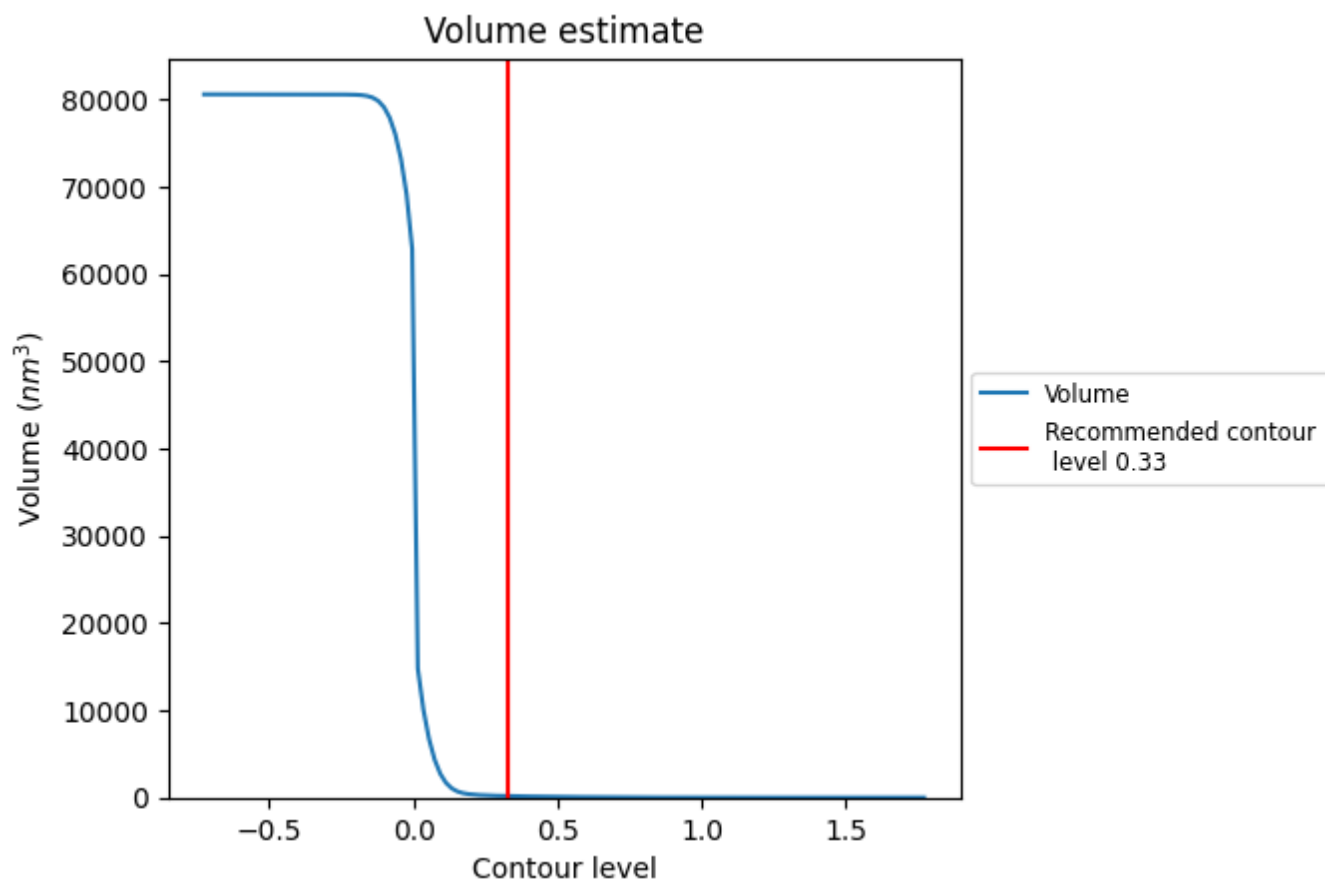
This section contains the results of statistical analysis of the map.

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.

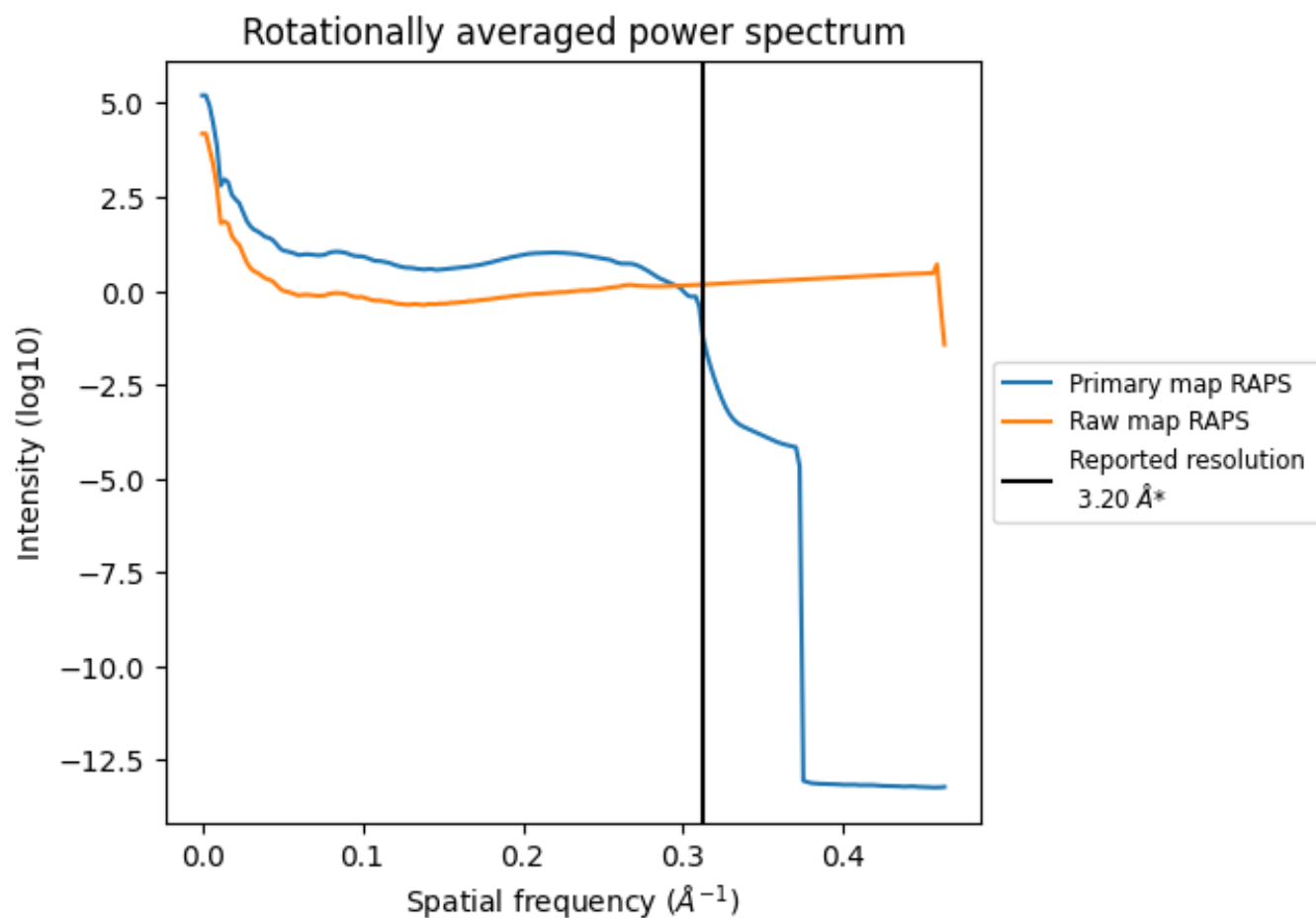
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 172 nm³; this corresponds to an approximate mass of 156 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 ⓘ

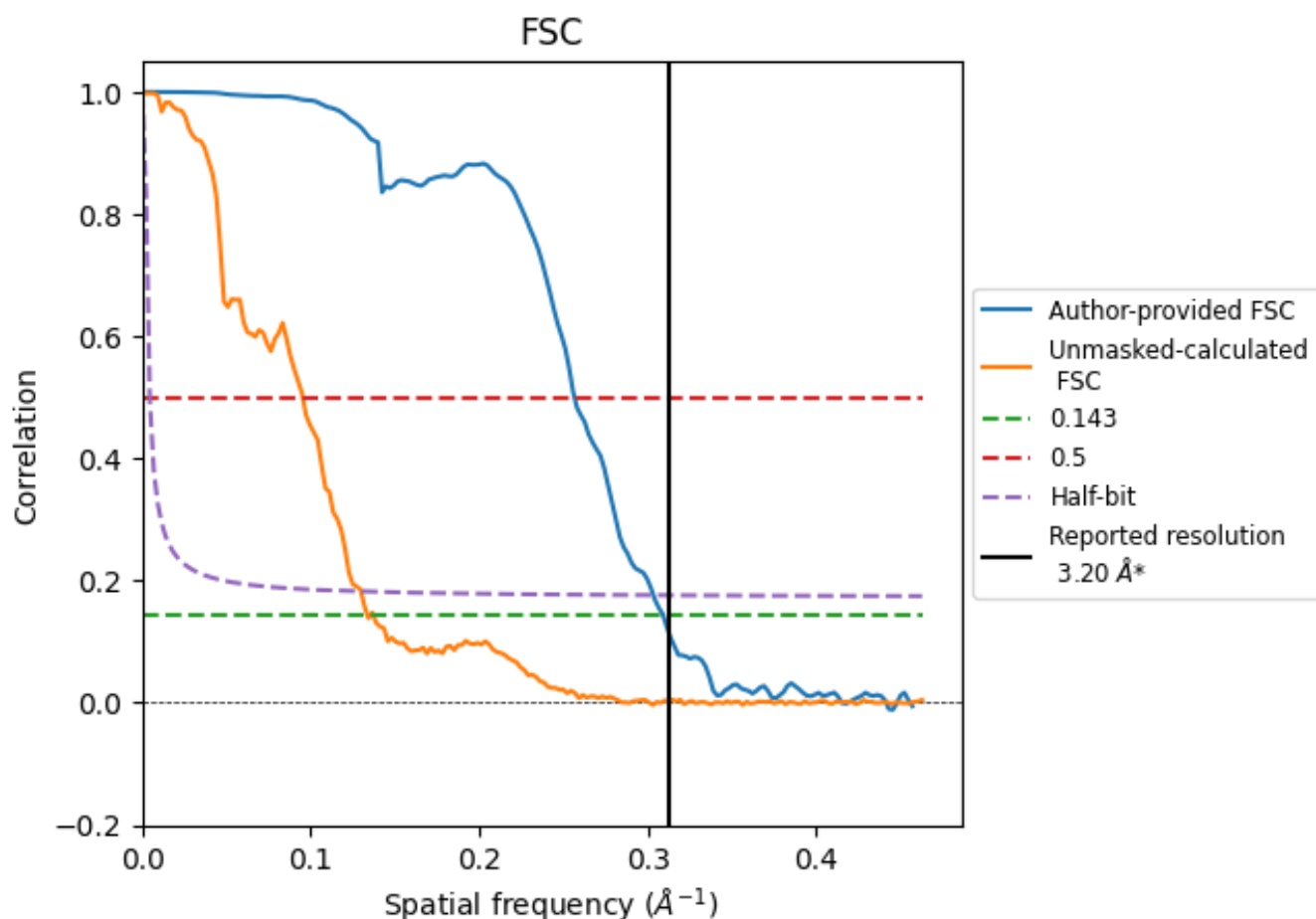


*Reported resolution corresponds to spatial frequency of $0.312 \text{ \AA}^{-1}$

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 0.312 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

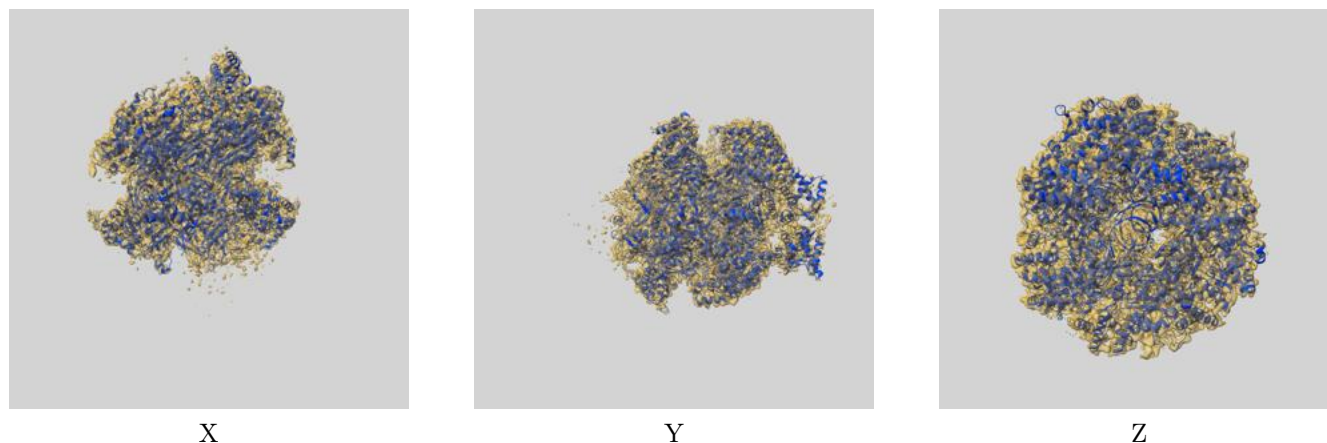
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.20	-	-
Author-provided FSC curve	3.23	3.90	3.29
Unmasked-calculated*	7.48	10.49	7.70

*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 7.48 differs from the reported value 3.2 by more than 10 %

9 Map-model fit [i](#)

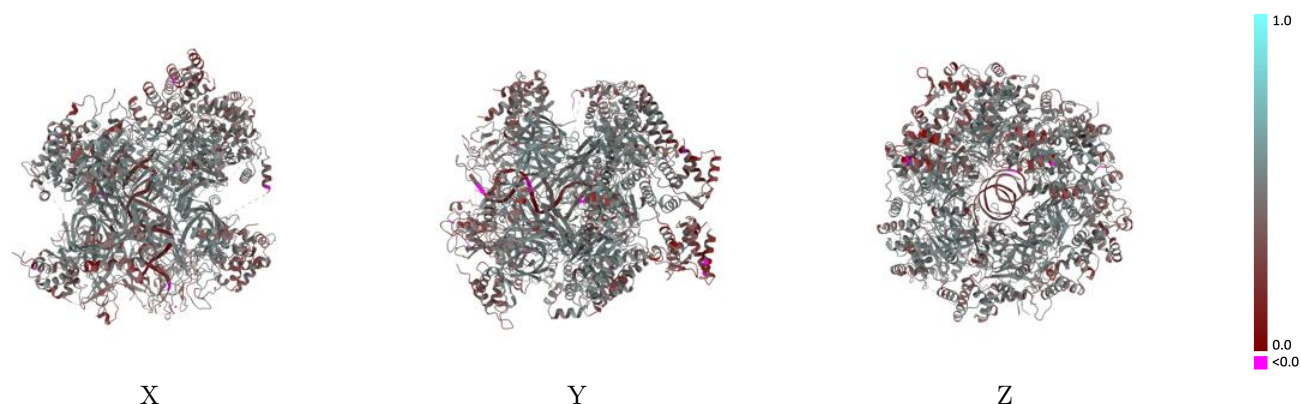
This section contains information regarding the fit between EMDB map EMD-19619 and PDB model 8S0A. Per-residue inclusion information can be found in [section 3](#) on [page 8](#).

9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.33 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](#)

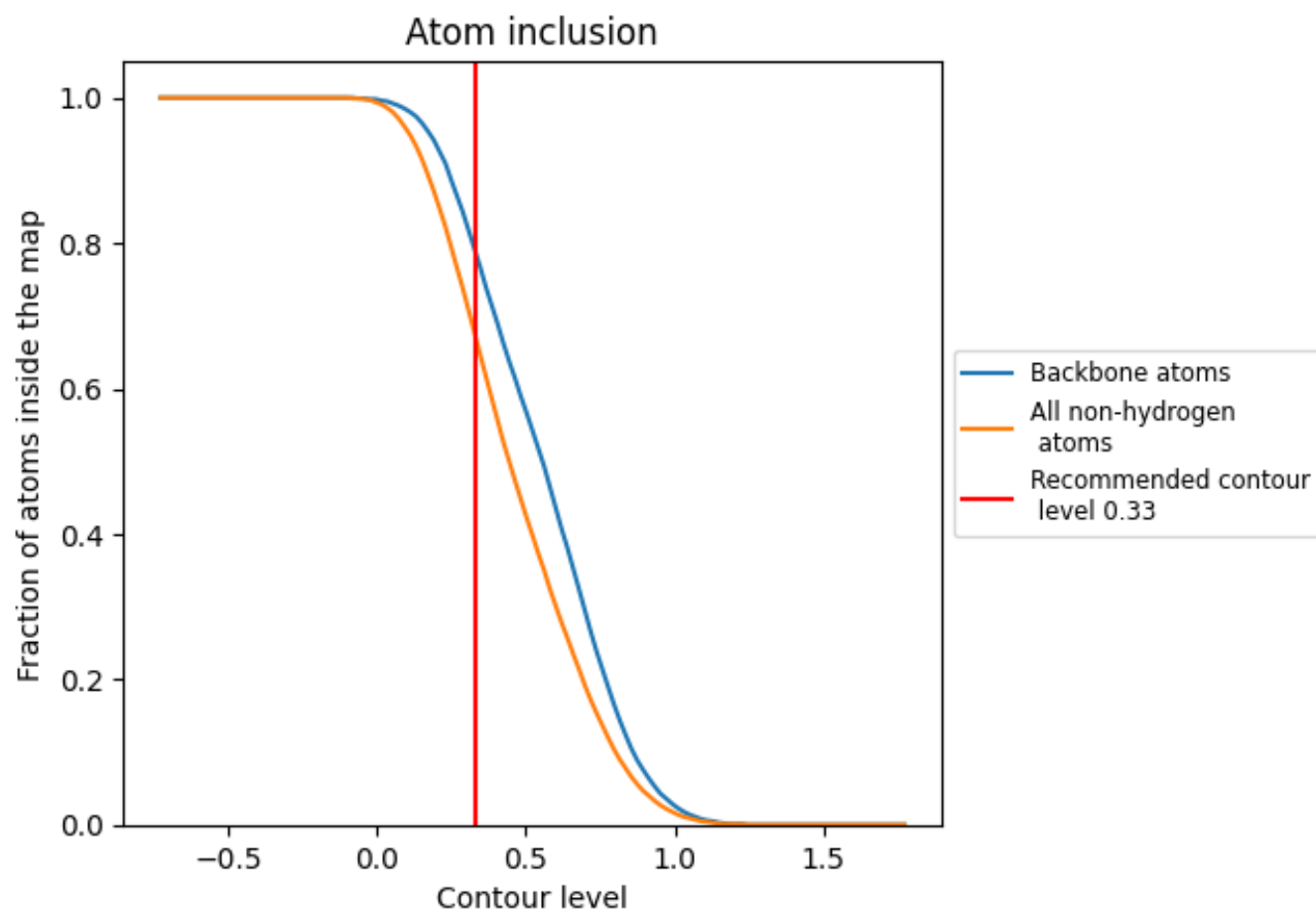


The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

This section was not generated.

9.4 Atom inclusion [i](#)



At the recommended contour level, 79% of all backbone atoms, 67% 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 (0.33) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.6740	0.4420
2	0.6850	0.4480
3	0.6770	0.4450
4	0.7080	0.4610
5	0.6500	0.4450
6	0.6740	0.4410
7	0.7020	0.4590
X	0.4810	0.2640
Y	0.3520	0.1430

1.0

0.0

<0.0