Full wwPDB EM Validation Report

Nov 9, 2026 – 06:25 PM JST

PDB ID	:	9XMZ / pdb_00009xmz
EMDB ID	:	EMD-67034
Title	:	Cryo-EM structure of human CMG-ATP-DNA in a pausing state
Authors	:	Bokori-Brown, M.; Danazumi, A.U.; Shahid, T.; Tehseen, M.; Savva, C.G.; Hamdan, S.M.; De Biasio, A.
Deposited on	:	2025-11-11
Resolution	:	3.18 Å(reported)

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:

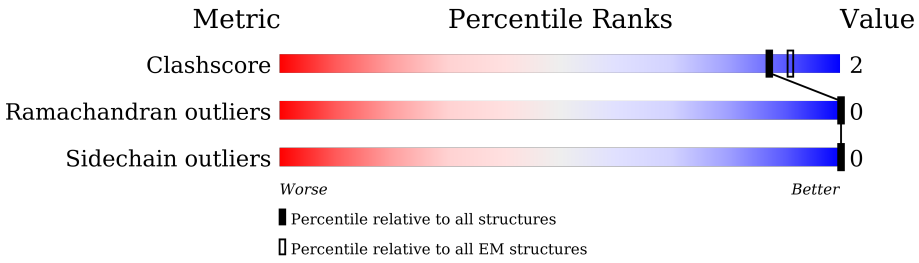
EMDB validation analysis	:	0.0.1.dev133
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4-5-2 with Phenix2.2
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics	:	202505.v01 (Using 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)	:	2.51

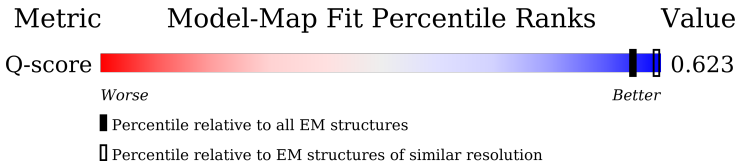
1 Overall quality at a glance (i)

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

The reported resolution of this entry is 3.18 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.





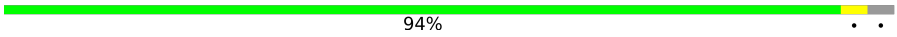
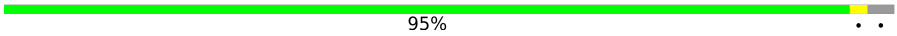
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	14470 (2.68 - 3.68)

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

Mol	Chain	Length	Quality of chain
1	2	904	66% · 31%
2	3	808	76% · 21%
3	4	863	67% 5% 28%
4	5	734	78% 6% 16%

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Mol	Chain	Length	Quality of chain
5	6	821	
6	7	719	
7	B	196	
8	C	185	
9	D	216	
10	E	223	
11	F	566	
12	M	78	
13	N	78	

2 Entry composition (i)

There are 16 unique types of molecules in this entry. The entry contains 80603 atoms, of which 40085 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 DNA replication licensing factor MCM2.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
1	2	626	9862	3095	4935	879	924	29	0	0

- Molecule 2 is a protein called DNA replication licensing factor MCM3.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
2	3	638	10061	3136	5050	882	967	26	0	0

- Molecule 3 is a protein called DNA replication licensing factor MCM4.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
3	4	618	9923	3105	4996	868	929	25	0	0

- Molecule 4 is a protein called DNA replication licensing factor MCM5.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
4	5	617	9718	3020	4893	859	911	35	0	0

- Molecule 5 is a protein called DNA replication licensing factor MCM6.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
5	6	614	9859	3088	4950	872	923	26	0	0

- Molecule 6 is a protein called DNA replication licensing factor MCM7.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
6	7	576	9203	2877	4634	809	855	28	0	0

- Molecule 7 is a protein called DNA replication complex GINS protein PSF1.

Mol	Chain	Residues	Atoms						AltConf	Trace
7	B	190	Total	C	H	N	O	S	0	0
			3132	989	1561	283	288	11		

- Molecule 8 is a protein called DNA replication complex GINS protein PSF2.

Mol	Chain	Residues	Atoms						AltConf	Trace
8	C	180	Total	C	H	N	O	S	0	0
			2946	934	1485	246	272	9		

- Molecule 9 is a protein called DNA replication complex GINS protein PSF3.

Mol	Chain	Residues	Atoms						AltConf	Trace
9	D	194	Total	C	H	N	O	S	0	0
			3080	986	1524	273	291	6		

- Molecule 10 is a protein called DNA replication complex GINS protein SLD5.

Mol	Chain	Residues	Atoms						AltConf	Trace
10	E	202	Total	C	H	N	O	S	0	0
			3360	1059	1689	289	313	10		

- Molecule 11 is a protein called Cell division control protein 45 homolog.

Mol	Chain	Residues	Atoms						AltConf	Trace
11	F	535	Total	C	H	N	O	S	0	0
			8657	2769	4300	747	811	30		

- Molecule 12 is a DNA chain called Leading strand DNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	M	17	Total	C	N	O	P	0	0
			340	168	42	113	17		

- Molecule 13 is a DNA chain called Lagging strand DNA.

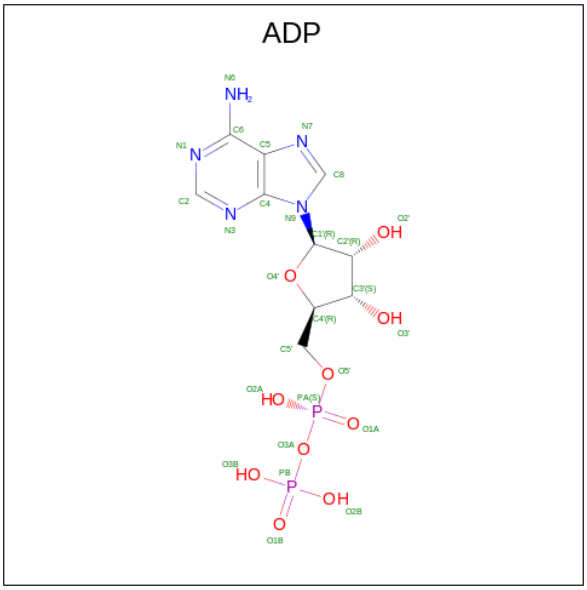
Mol	Chain	Residues	Atoms					AltConf	Trace
13	N	10	Total	C	N	O	P	0	0
			207	100	35	62	10		

- Molecule 14 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of

Interest" by depositor).

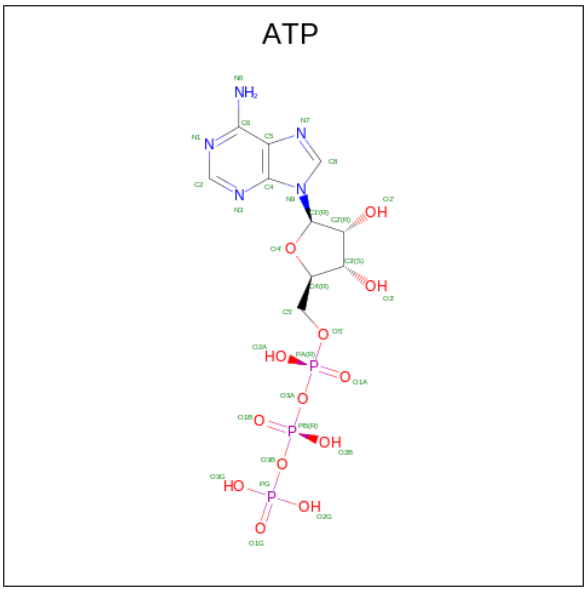
Mol	Chain	Residues	Atoms	AltConf
14	2	1	Total Mg 1 1	0
14	3	1	Total Mg 1 1	0
14	4	1	Total Mg 1 1	0
14	5	1	Total Mg 1 1	0
14	6	1	Total Mg 1 1	0

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



Mol	Chain	Residues	Atoms	AltConf
15	2	1	Total C H N O P 39 10 12 5 10 2	0

- Molecule 16 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
16	4	1	Total	C	H	N	O	P	0
			42	10	11	5	13	3	
16	5	1	Total	C	H	N	O	P	0
			42	10	11	5	13	3	
16	5	1	Total	C	H	N	O	P	0
			42	10	11	5	13	3	
16	6	1	Total	C	H	N	O	P	0
			42	10	11	5	13	3	
16	7	1	Total	C	H	N	O	P	0
			43	10	12	5	13	3	

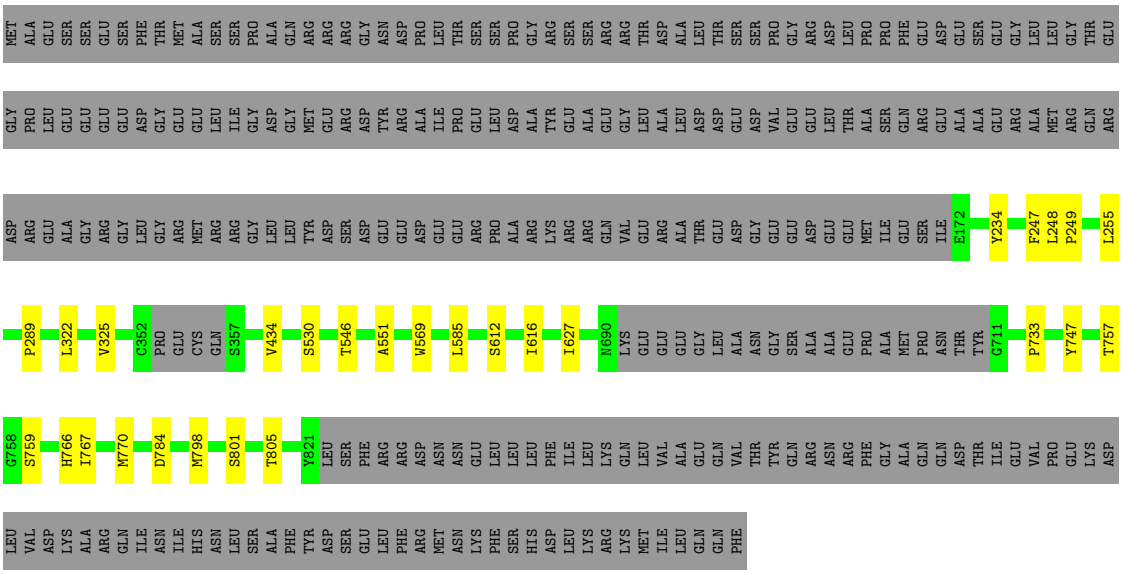
3 Residue-property plots (i)

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 replication licensing factor MCM2

Chain 2:

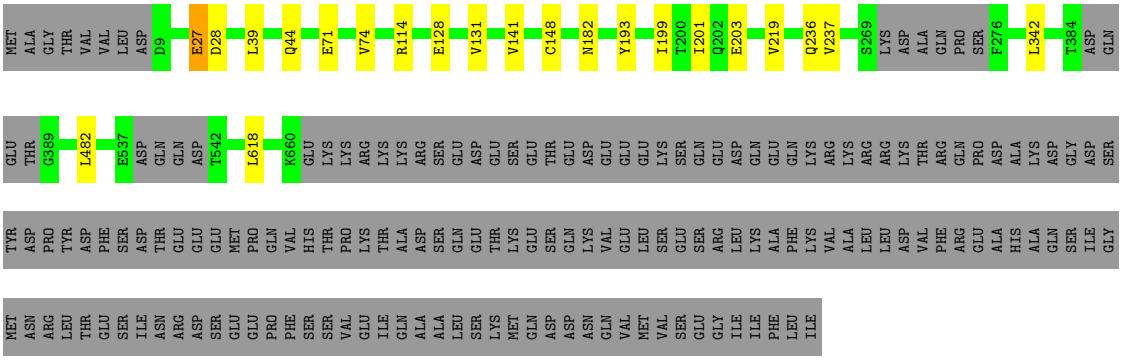




• Molecule 2: DNA replication licensing factor MCM3

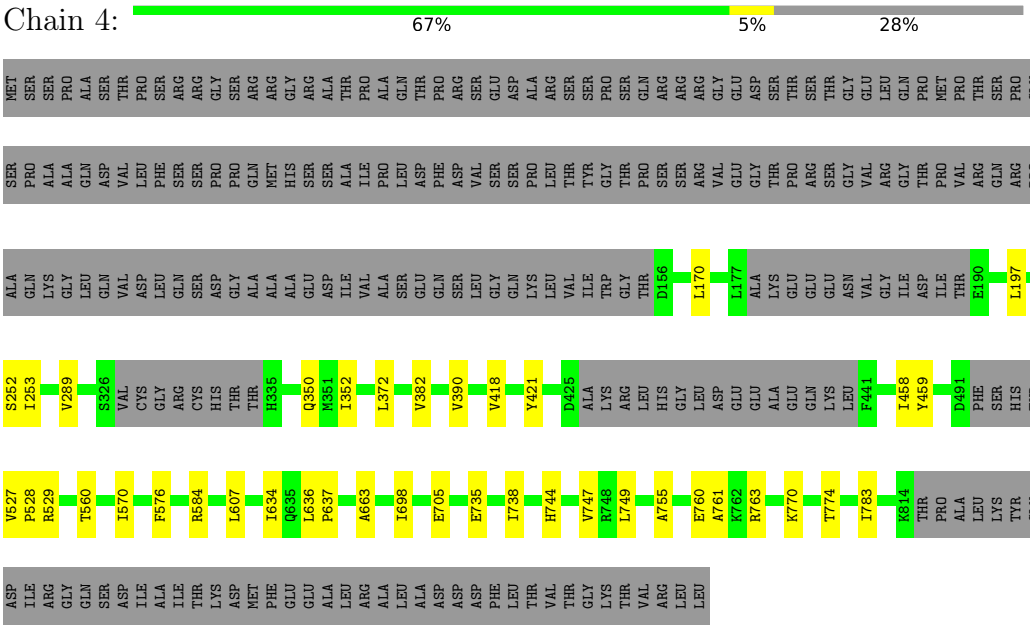
Chain 3:





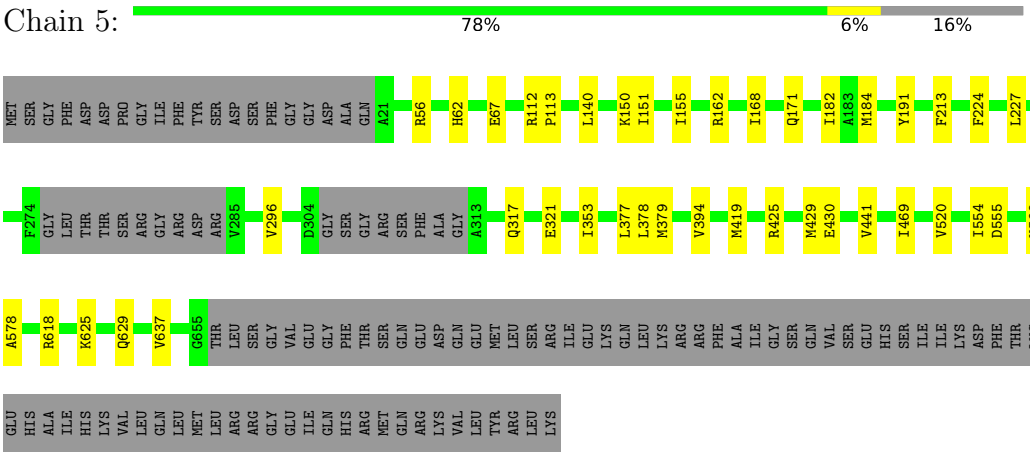
• Molecule 3: DNA replication licensing factor MCM4

Chain 4:



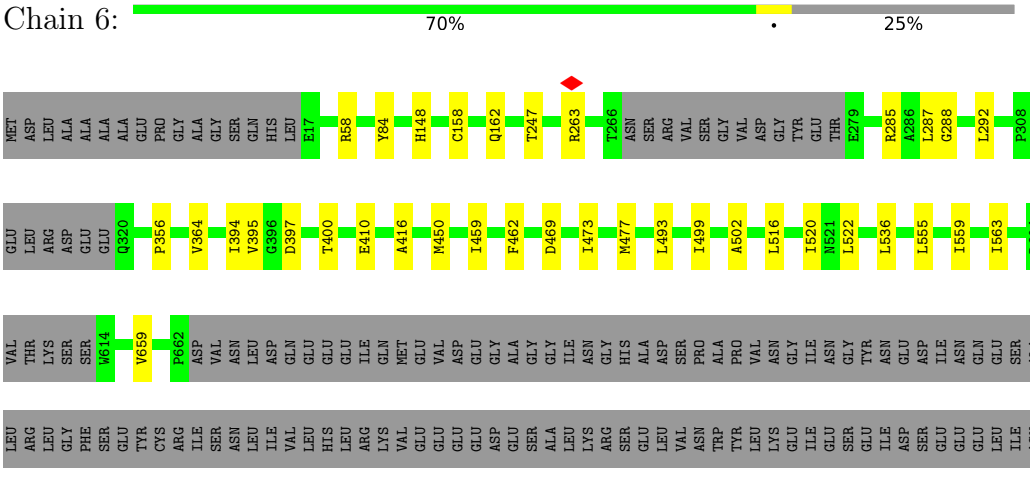
• Molecule 4: DNA replication licensing factor MCM5

Chain 5:



• Molecule 5: DNA replication licensing factor MCM6

Chain 6:





• Molecule 6: DNA replication licensing factor MCM7

Chain 7:





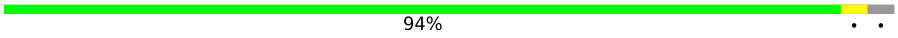






• Molecule 7: DNA replication complex GINS protein PSF1

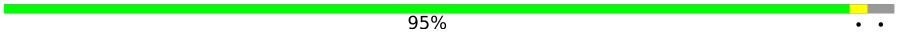
Chain B:





• Molecule 8: DNA replication complex GINS protein PSF2

Chain C:

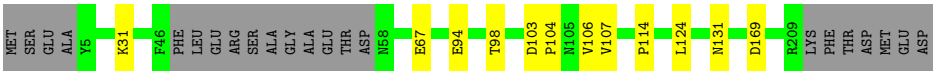




• Molecule 9: DNA replication complex GINS protein PSF3

Chain D:

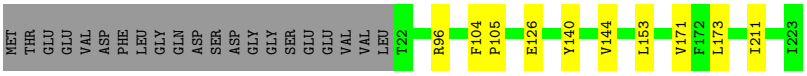




• Molecule 10: DNA replication complex GINS protein SLD5

Chain E:

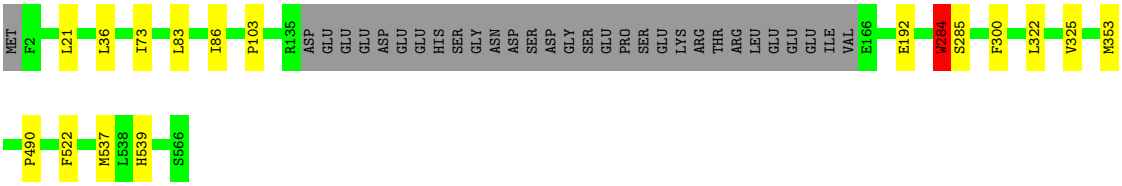




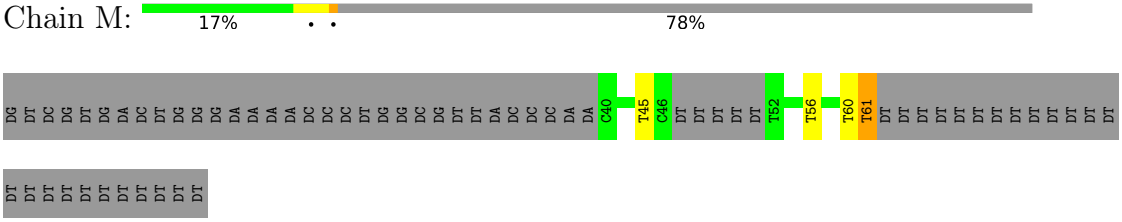
• Molecule 11: Cell division control protein 45 homolog

Chain F:

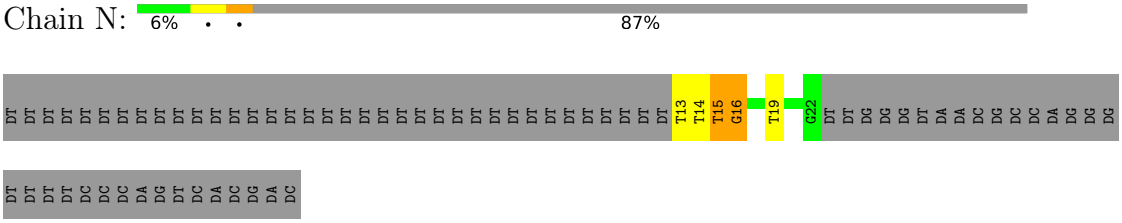




• Molecule 12: Leading strand DNA



• Molecule 13: Lagging strand DNA


Chain N:
6%
87%
DT DT DT DT DT DT DT DT DT DT DT DT DT DT DT DT DT DT DT

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	39780	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 ($e^-/Å^2$)	42.6	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	TFS FALCON 4i (4k x 4k)	Depositor
Maximum map value	33.117	Depositor
Minimum map value	-0.120	Depositor
Average map value	-0.007	Depositor
Map value standard deviation	0.599	Depositor
Recommended contour level	0.435	Depositor
Map size (Å)	372.0, 372.0, 372.0	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.93, 0.93, 0.93	Depositor

5 Model quality

5.1 Standard geometry

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

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$\|Z\|>5$	RMSZ	#$\|Z\|>5$
1	2	0.32	0/5018	0.43	0/6781
2	3	0.32	0/5087	0.54	2/6862 (0.0%)
3	4	0.30	0/5008	0.51	0/6761
4	5	0.35	0/4899	0.52	0/6594
5	6	0.32	0/4989	0.47	0/6732
6	7	0.30	0/4642	0.46	0/6265
7	B	0.33	0/1601	0.45	0/2152
8	C	0.34	0/1492	0.45	0/2022
9	D	0.32	0/1590	0.49	0/2144
10	E	0.33	0/1703	0.44	0/2294
11	F	0.33	0/4449	0.47	1/6006 (0.0%)
12	M	0.80	0/374	1.34	2/572 (0.3%)
13	N	0.81	0/231	1.35	4/355 (1.1%)
All	All	0.33	0/41083	0.51	9/55540 (0.0%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
3	4	0	2
4	5	0	4
5	6	0	2
11	F	0	1
All	All	0	9

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
12	M	56	DT	O4'-C4'-C3'	-6.15	102.31	106.00
12	M	61	DT	O5'-C5'-C4'	5.75	114.00	109.40
13	N	16	DG	O4'-C4'-C3'	-5.64	102.61	106.00
11	F	284	TRP	CA-CB-CG	5.48	124.01	113.60
13	N	14	DT	O4'-C4'-C3'	-5.45	102.73	106.00
2	3	27	GLU	CA-C-N	5.42	131.89	121.54
2	3	27	GLU	C-N-CA	5.42	131.89	121.54
13	N	13	DT	O4'-C1'-N1	5.31	111.71	108.00
13	N	15	DT	OP1-P-O3'	5.06	123.18	108.00

There are no chirality outliers.

All (9) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	4	252	SER	Peptide
3	4	763	ARG	Sidechain
4	5	425	ARG	Peptide
4	5	56	ARG	Sidechain
4	5	569	LYS	Peptide
4	5	618	ARG	Sidechain
5	6	285	ARG	Sidechain
5	6	58	ARG	Sidechain
11	F	284	TRP	Peptide

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	2	4927	4935	4933	17	0
2	3	5011	5050	5047	12	0
3	4	4927	4996	4992	27	0
4	5	4825	4893	4891	24	0
5	6	4909	4950	4947	28	0
6	7	4569	4634	4630	20	0
7	B	1571	1561	1560	5	0
8	C	1461	1485	1485	3	0
9	D	1556	1524	1523	7	0
10	E	1671	1689	1689	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
11	F	4357	4300	4298	12	0
12	M	340	0	202	6	0
13	N	207	0	116	3	0
14	2	1	0	0	0	0
14	3	1	0	0	0	0
14	4	1	0	0	0	0
14	5	1	0	0	0	0
14	6	1	0	0	0	0
15	2	27	12	12	1	0
16	4	31	11	12	0	0
16	5	62	22	24	0	0
16	6	31	11	12	0	0
16	7	31	12	12	0	0
All	All	40518	40085	40385	158	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 2.

All (158) 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)
5:6:263:ARG:HH22	12:M:45:DT:H5”	1.26	1.00
5:6:263:ARG:HH22	12:M:45:DT:C5’	1.93	0.81
10:E:173:LEU:HD21	10:E:211:ILE:HD13	1.69	0.73
2:3:27:GLU:O	2:3:28:ASP:OD1	2.07	0.73
7:B:125:MET:HE1	7:B:137:THR:HG23	1.70	0.72
4:5:155:ILE:HD12	4:5:227:LEU:HD23	1.77	0.66
7:B:125:MET:HE1	7:B:137:THR:CG2	2.25	0.65
5:6:395:VAL:HG21	5:6:520:ILE:HD11	1.78	0.65
1:2:569:TRP:HD1	4:5:419:MET:HE1	1.61	0.64
5:6:520:ILE:HG22	5:6:522:LEU:H	1.61	0.64
5:6:263:ARG:NH2	12:M:45:DT:C5’	2.63	0.62
5:6:263:ARG:NH2	12:M:45:DT:H5”	2.08	0.62
4:5:227:LEU:HD21	4:5:257:VAL:CG2	2.30	0.61
10:E:173:LEU:HD21	10:E:211:ILE:CD1	2.29	0.61
2:3:39:LEU:HD12	2:3:44:GLN:HB2	1.81	0.61
5:6:395:VAL:HG21	5:6:520:ILE:CD1	2.31	0.60
5:6:356:PRO:HB2	5:6:563:ILE:HG22	1.84	0.60
3:4:170:LEU:HD11	3:4:241:VAL:HG22	1.85	0.59
6:7:362:VAL:HG22	6:7:614:THR:HG21	1.84	0.58
3:4:372:LEU:HD21	3:4:390:VAL:HG21	1.85	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
9:D:103:ASP:O	9:D:106:VAL:HG22	2.05	0.57
11:F:21:LEU:HD21	11:F:36:LEU:HD23	1.88	0.56
2:3:128:GLU:HA	2:3:236:GLN:HA	1.88	0.55
3:4:253:ILE:HG22	3:4:253:ILE:O	2.06	0.55
1:2:747:TYR:CE2	1:2:767:ILE:HD11	2.41	0.55
1:2:234:TYR:CD1	1:2:289:PRO:HD3	2.41	0.55
3:4:527:VAL:HG21	3:4:570:ILE:HD12	1.90	0.54
4:5:578:ALA:HB1	4:5:637:VAL:HG21	1.88	0.54
2:3:201:ILE:HD12	2:3:219:VAL:HG21	1.88	0.54
1:2:585:LEU:HD23	1:2:627:ILE:HB	1.89	0.54
9:D:114:PRO:O	9:D:169:ASP:OD1	2.26	0.54
1:2:247:PHE:HB3	1:2:255:LEU:HD11	1.90	0.53
5:6:516:LEU:HG	5:6:520:ILE:HD12	1.91	0.53
10:E:173:LEU:HD11	10:E:211:ILE:HG21	1.91	0.53
5:6:450:MET:SD	5:6:493:LEU:HD13	2.50	0.52
6:7:288:VAL:HG21	13:N:15:DT:O4'	2.09	0.52
4:5:353:ILE:HD11	4:5:379:MET:HE1	1.91	0.51
3:4:663:ALA:HB3	6:7:582:THR:HG23	1.92	0.51
9:D:31:LYS:HB3	9:D:67:GLU:HG2	1.92	0.51
11:F:300:PHE:CZ	11:F:353:MET:HE1	2.46	0.51
5:6:469:ASP:O	5:6:473:ILE:HG23	2.11	0.51
4:5:265:ILE:HG23	4:5:296:VAL:HG13	1.92	0.50
5:6:459:ILE:HG21	5:6:462:PHE:HD1	1.75	0.50
7:B:125:MET:CE	7:B:137:THR:HG23	2.42	0.50
6:7:442:CYS:SG	6:7:484:ILE:HD13	2.52	0.50
1:2:546:THR:CG2	1:2:551:ALA:HB2	2.42	0.50
5:6:288:GLY:HA3	13:N:19:DT:OP1	2.12	0.50
4:5:150:LYS:HE2	4:5:264:THR:HG21	1.95	0.49
5:6:477:MET:HG2	5:6:499:ILE:HD12	1.95	0.49
5:6:397:ASP:OD1	5:6:400:THR:HG21	2.13	0.49
6:7:361:GLY:H	6:7:615:ALA:HB2	1.77	0.49
2:3:131:VAL:HG13	2:3:199:ILE:HG23	1.95	0.49
6:7:380:MET:HE1	6:7:507:LEU:HD12	1.95	0.48
8:C:100:LEU:O	8:C:104:SER:HB2	2.13	0.48
1:2:766:HIS:ND1	1:2:798:MET:HE1	2.29	0.48
4:5:140:LEU:HD21	4:5:151:ILE:HD11	1.96	0.48
5:6:364:VAL:HG21	5:6:536:LEU:HD21	1.96	0.48
1:2:801:SER:O	1:2:805:THR:HG23	2.13	0.48
5:6:263:ARG:NH2	12:M:45:DT:H4'	2.28	0.47
8:C:94:GLU:OE2	8:C:151:MET:HB2	2.13	0.47
1:2:530:SER:HB2	15:2:1002:ADP:O2A	2.14	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:6:356:PRO:HB2	5:6:563:ILE:CG2	2.44	0.47
6:7:622:VAL:HG22	6:7:624:VAL:H	1.79	0.47
3:4:735:GLU:HA	3:4:738:ILE:HD12	1.95	0.47
3:4:760:GLU:O	3:4:761:ALA:HB3	2.14	0.47
11:F:83:LEU:HA	11:F:86:ILE:HG22	1.96	0.47
2:3:201:ILE:HD11	2:3:237:VAL:HG21	1.96	0.47
1:2:612:SER:HA	1:2:616:ILE:O	2.16	0.46
9:D:104:PRO:O	9:D:107:VAL:HG22	2.14	0.46
6:7:462:MET:HE1	6:7:515:PHE:CZ	2.51	0.46
3:4:744:HIS:O	3:4:747:VAL:HG12	2.14	0.46
5:6:516:LEU:HD23	5:6:659:VAL:HG22	1.97	0.46
7:B:152:CYS:SG	7:B:169:LEU:HB3	2.55	0.46
6:7:167:VAL:HG13	6:7:235:MET:HG3	1.96	0.46
11:F:21:LEU:HD23	11:F:73:ILE:HB	1.98	0.46
8:C:94:GLU:OE2	8:C:151:MET:HE2	2.16	0.46
9:D:31:LYS:HB3	9:D:67:GLU:CG	2.45	0.46
3:4:418:VAL:HG11	3:4:421:TYR:CZ	2.51	0.45
6:7:401:SER:HA	6:7:441:VAL:O	2.15	0.45
9:D:124:LEU:HD22	9:D:131:ASN:OD1	2.16	0.45
3:4:350:GLN:HE21	3:4:352:ILE:HD11	1.81	0.45
4:5:377:LEU:HD23	4:5:378:LEU:N	2.31	0.45
4:5:182:ILE:HG21	4:5:191:TYR:CZ	2.51	0.45
11:F:103:PRO:HD3	11:F:192:GLU:HA	1.98	0.45
13:N:15:DT:H2'	13:N:16:DG:C6	2.51	0.45
4:5:419:MET:HG3	4:5:430:GLU:HB2	1.99	0.45
5:6:555:LEU:O	5:6:559:ILE:HG23	2.17	0.45
5:6:287:LEU:HD11	5:6:292:LEU:HB2	1.99	0.45
10:E:96:ARG:HH12	10:E:126:GLU:CD	2.24	0.45
3:4:197:LEU:HD23	3:4:200:ILE:HD12	1.99	0.44
3:4:528:PRO:O	3:4:529:ARG:HB2	2.17	0.44
4:5:112:ARG:HB3	4:5:113:PRO:HD3	1.99	0.44
4:5:162:ARG:HB2	4:5:224:PHE:CE1	2.52	0.44
1:2:248:LEU:HB3	1:2:249:PRO:HD3	1.98	0.44
1:2:322:LEU:HD22	1:2:325:VAL:HG12	2.00	0.44
3:4:663:ALA:CB	6:7:582:THR:HG23	2.48	0.44
12:M:60:DT:H2"	12:M:61:DT:C6	2.52	0.44
2:3:114:ARG:NH1	2:3:203:GLU:OE1	2.51	0.44
2:3:618:LEU:HD23	6:7:537:ILE:HD12	1.99	0.44
3:4:576:PHE:CD2	3:4:636:LEU:HD21	2.53	0.44
5:6:84:TYR:HB2	5:6:247:THR:HG21	1.99	0.43
6:7:409:SER:HB3	6:7:414:LEU:HD22	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:6:563:ILE:HG22	5:6:563:ILE:O	2.18	0.43
3:4:289:VAL:HG21	3:4:382:VAL:HG11	2.01	0.43
4:5:62:HIS:HB3	4:5:67:GLU:O	2.18	0.43
1:2:770:MET:HB3	1:2:798:MET:HG3	2.00	0.43
6:7:459:HIS:CE1	6:7:514:ARG:NH1	2.87	0.43
9:D:94:GLU:O	9:D:98:THR:HG23	2.18	0.43
2:3:141:VAL:HG22	2:3:193:TYR:CE2	2.53	0.43
6:7:463:GLU:HG3	6:7:514:ARG:NH1	2.34	0.43
11:F:300:PHE:CE1	11:F:353:MET:HE1	2.54	0.43
10:E:171:VAL:HG21	10:E:211:ILE:HD11	2.01	0.43
3:4:698:ILE:HG13	3:4:749:LEU:HD22	2.01	0.43
11:F:490:PRO:HB2	11:F:522:PHE:CE2	2.54	0.43
4:5:570:CYS:HB3	4:5:625:LYS:HG3	2.00	0.43
6:7:21:TYR:CG	6:7:29:LYS:HE3	2.54	0.43
6:7:462:MET:HE1	6:7:515:PHE:CE2	2.54	0.43
4:5:394:VAL:HG12	4:5:441:VAL:HG21	2.00	0.43
11:F:322:LEU:HA	11:F:325:VAL:HG22	2.01	0.43
2:3:342:LEU:HD23	2:3:482:LEU:HD13	2.00	0.43
4:5:171:GLN:HB3	4:5:213:PHE:CE1	2.54	0.43
1:2:757:THR:HG23	1:2:759:SER:H	1.84	0.42
6:7:52:LEU:HD12	6:7:141:PRO:HD3	2.01	0.42
3:4:783:ILE:HG22	3:4:783:ILE:O	2.19	0.42
3:4:560:THR:HG22	3:4:607:LEU:HD13	2.02	0.42
5:6:394:ILE:O	5:6:502:ALA:HA	2.19	0.42
4:5:227:LEU:HD21	4:5:257:VAL:HG21	2.01	0.42
1:2:733:PRO:HA	1:2:784:ASP:O	2.19	0.42
5:6:410:GLU:HA	5:6:416:ALA:HB3	2.00	0.42
2:3:71:GLU:O	2:3:74:VAL:HG22	2.20	0.42
1:2:434:VAL:HG13	5:6:148:HIS:HB3	2.02	0.42
3:4:253:ILE:O	3:4:253:ILE:CG2	2.68	0.42
6:7:82:GLN:O	6:7:86:PRO:HD3	2.20	0.42
11:F:537:MET:HE3	11:F:539:HIS:NE2	2.35	0.42
1:2:434:VAL:HG13	5:6:148:HIS:CB	2.50	0.41
10:E:140:TYR:CE1	10:E:144:VAL:HG21	2.55	0.41
5:6:158:CYS:O	5:6:162:GLN:N	2.53	0.41
3:4:705:GLU:HG3	3:4:755:ALA:HB2	2.03	0.41
4:5:168:ILE:HG21	4:5:184:MET:HE3	2.02	0.41
4:5:317:GLN:O	4:5:321:GLU:HG2	2.21	0.41
3:4:584:ARG:HH11	3:4:637:PRO:HD3	1.84	0.41
4:5:429:MET:CE	4:5:469:ILE:HD13	2.50	0.41
4:5:572:PRO:HB3	4:5:629:GLN:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:4:458:ILE:HG23	3:4:459:TYR:N	2.35	0.41
4:5:520:VAL:HG13	4:5:520:VAL:O	2.21	0.41
3:4:634:ILE:HG13	3:4:636:LEU:H	1.86	0.41
3:4:770:LYS:O	3:4:774:THR:HG23	2.21	0.41
11:F:537:MET:HE3	11:F:539:HIS:CE1	2.55	0.41
3:4:527:VAL:HG12	3:4:528:PRO:O	2.21	0.41
4:5:554:ILE:HG22	4:5:555:ASP:O	2.21	0.41
11:F:490:PRO:HB2	11:F:522:PHE:CZ	2.55	0.41
11:F:284:TRP:HB3	11:F:285:SER:O	2.21	0.40
2:3:148:CYS:SG	2:3:182:ASN:HB3	2.61	0.40
6:7:580:TYR:CD2	6:7:627:LYS:HE3	2.56	0.40
3:4:760:GLU:HG3	3:4:761:ALA:H	1.87	0.40
7:B:69:LEU:HB3	10:E:153:LEU:HD11	2.04	0.40
10:E:104:PHE:CG	10:E:105:PRO:HD3	2.56	0.40
3:4:744:HIS:CD2	3:4:760:GLU:HG2	2.56	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	2	620/904 (69%)	601 (97%)	19 (3%)	0	100	100
2	3	630/808 (78%)	602 (96%)	28 (4%)	0	100	100
3	4	608/863 (70%)	591 (97%)	17 (3%)	0	100	100
4	5	611/734 (83%)	586 (96%)	25 (4%)	0	100	100
5	6	606/821 (74%)	582 (96%)	24 (4%)	0	100	100
6	7	566/719 (79%)	555 (98%)	11 (2%)	0	100	100
7	B	186/196 (95%)	180 (97%)	6 (3%)	0	100	100
8	C	178/185 (96%)	175 (98%)	3 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
9	D	190/216 (88%)	182 (96%)	8 (4%)	0	100	100
10	E	200/223 (90%)	197 (98%)	3 (2%)	0	100	100
11	F	531/566 (94%)	516 (97%)	15 (3%)	0	100	100
All	All	4926/6235 (79%)	4767 (97%)	159 (3%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

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	2	544/781 (70%)	544 (100%)	0	100	100
2	3	551/707 (78%)	551 (100%)	0	100	100
3	4	548/753 (73%)	548 (100%)	0	100	100
4	5	525/625 (84%)	525 (100%)	0	100	100
5	6	547/724 (76%)	547 (100%)	0	100	100
6	7	494/619 (80%)	494 (100%)	0	100	100
7	B	170/174 (98%)	170 (100%)	0	100	100
8	C	164/169 (97%)	164 (100%)	0	100	100
9	D	168/186 (90%)	168 (100%)	0	100	100
10	E	187/205 (91%)	187 (100%)	0	100	100
11	F	488/517 (94%)	488 (100%)	0	100	100
All	All	4386/5460 (80%)	4386 (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 (24) such sidechains are listed below:

Mol	Chain	Res	Type
1	2	201	ASN

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Mol	Chain	Res	Type
1	2	344	ASN
1	2	421	ASN
1	2	427	ASN
1	2	601	HIS
1	2	732	HIS
1	2	736	ASN
2	3	43	ASN
2	3	67	ASN
2	3	453	ASN
2	3	573	HIS
3	4	242	ASN
3	4	257	GLN
3	4	744	HIS
4	5	95	HIS
5	6	196	ASN
6	7	22	GLN
6	7	243	GLN
7	B	172	ASN
9	D	122	GLN
11	F	65	HIS
11	F	292	ASN
11	F	427	GLN
11	F	472	HIS

5.3.3 RNA

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 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	$\#\|Z\| > 2$
16	ATP	5	802	14	29,33,33	0.44	0	44,52,52	0.52	0
16	ATP	7	1000	-	29,33,33	0.41	0	44,52,52	0.60	0
16	ATP	5	801	14	29,33,33	0.44	0	44,52,52	0.57	0
16	ATP	4	1000	14	29,33,33	0.43	0	44,52,52	0.85	2 (4%)
15	ADP	2	1002	14	27,29,29	1.33	5 (18%)	42,45,45	2.01	11 (26%)
16	ATP	6	1000	14	29,33,33	0.45	0	44,52,52	0.78	2 (4%)

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
16	ATP	5	802	14	-	1/22/38/38	0/3/3/3
16	ATP	7	1000	-	-	2/22/38/38	0/3/3/3
16	ATP	5	801	14	-	3/22/38/38	0/3/3/3
16	ATP	4	1000	14	-	2/22/38/38	0/3/3/3
15	ADP	2	1002	14	-	5/16/32/32	0/3/3/3
16	ATP	6	1000	14	-	0/22/38/38	0/3/3/3

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
15	2	1002	ADP	C5-C4	4.07	1.46	1.39
15	2	1002	ADP	C5-N7	-2.72	1.33	1.39
15	2	1002	ADP	C4-N9	-2.17	1.32	1.37
15	2	1002	ADP	C8-N7	2.14	1.35	1.31
15	2	1002	ADP	C5-C6	2.07	1.46	1.41

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
15	2	1002	ADP	C5-C4-N3	-5.64	119.40	126.75

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
15	2	1002	ADP	N3-C4-N9	4.74	134.90	127.08
15	2	1002	ADP	PA-O3A-PB	-4.35	117.88	132.83
15	2	1002	ADP	C2-N3-C4	3.73	120.57	111.75
15	2	1002	ADP	N3-C2-N1	-3.66	122.88	128.60
15	2	1002	ADP	C4-N9-C8	3.02	109.00	105.73
16	6	1000	ATP	O2'-C2'-C1'	2.77	119.27	110.02
15	2	1002	ADP	C4-C5-N7	-2.67	107.37	110.62
15	2	1002	ADP	C5-N7-C8	2.52	107.09	103.51
16	4	1000	ATP	O4'-C1'-N9	2.46	112.91	108.06
16	4	1000	ATP	C2'-C1'-N9	2.33	119.20	113.30
15	2	1002	ADP	N9-C8-N7	-2.25	110.84	113.91
15	2	1002	ADP	C2-N1-C6	2.25	122.62	118.77
15	2	1002	ADP	O3B-PB-O2B	2.20	116.05	107.64
16	6	1000	ATP	PB-O3B-PG	2.07	139.95	132.83

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
15	2	1002	ADP	C5'-O5'-PA-O1A
15	2	1002	ADP	C5'-O5'-PA-O2A
16	4	1000	ATP	C2'-C1'-N9-C4
16	4	1000	ATP	C2'-C1'-N9-C8
15	2	1002	ADP	O4'-C4'-C5'-O5'
16	5	801	ATP	PB-O3A-PA-O2A
16	5	802	ATP	PA-O3A-PB-O2B
16	7	1000	ATP	PA-O3A-PB-O1B
16	7	1000	ATP	PA-O3A-PB-O2B
15	2	1002	ADP	C5'-O5'-PA-O3A
16	5	801	ATP	C5'-O5'-PA-O3A
15	2	1002	ADP	C3'-C4'-C5'-O5'
16	5	801	ATP	PB-O3A-PA-O1A

There are no ring outliers.

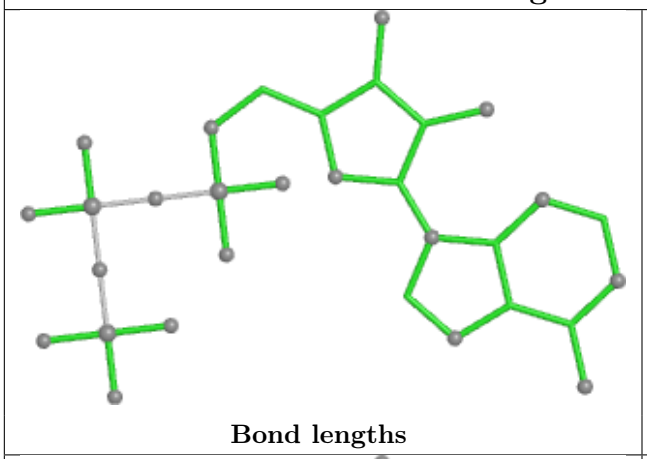
1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
15	2	1002	ADP	1	0

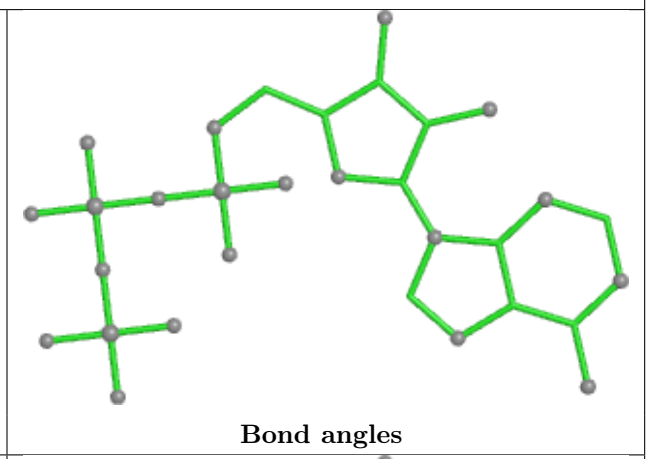
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In

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

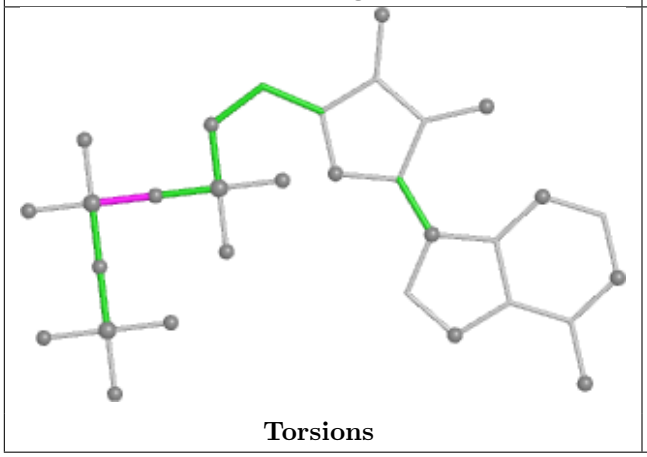
Ligand ATP 5 802



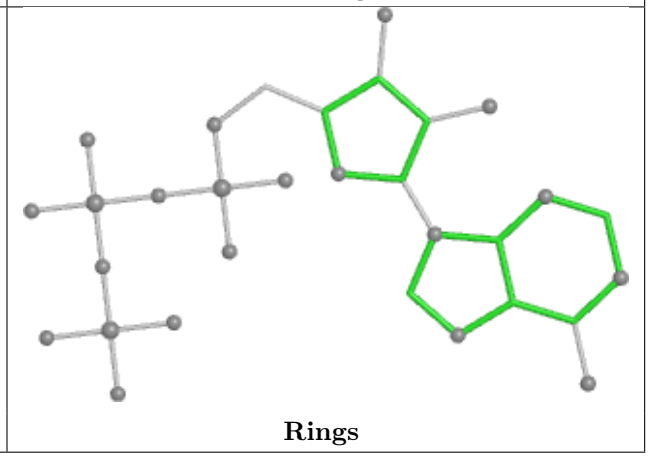
Bond lengths



Bond angles

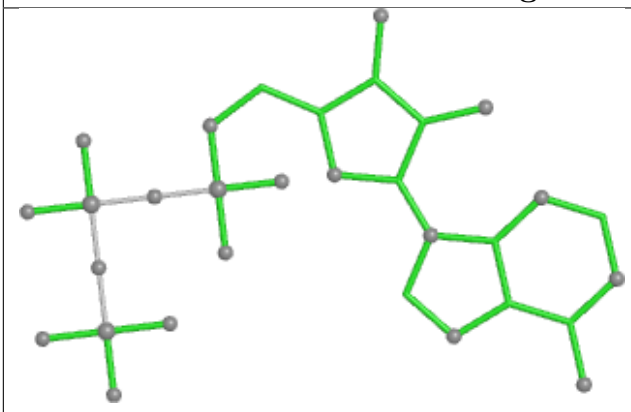


Torsions

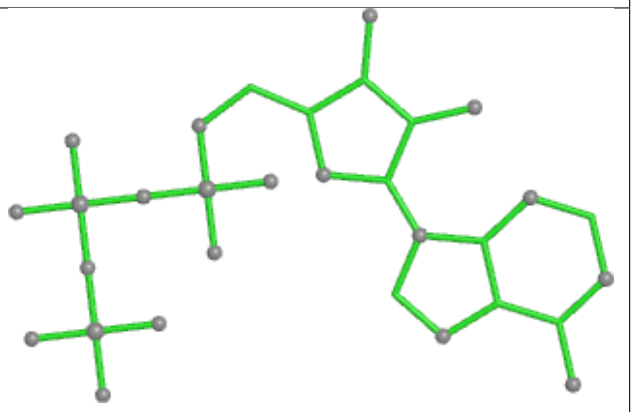


Rings

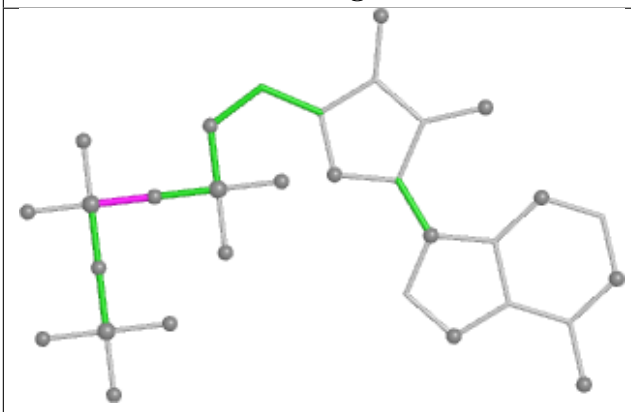
Ligand ATP 7 1000



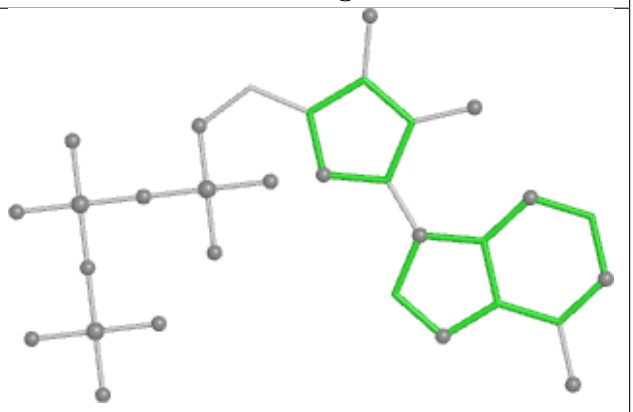
Bond lengths



Bond angles

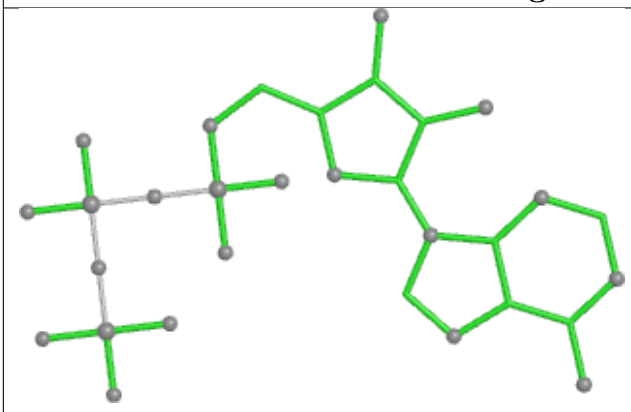


Torsions

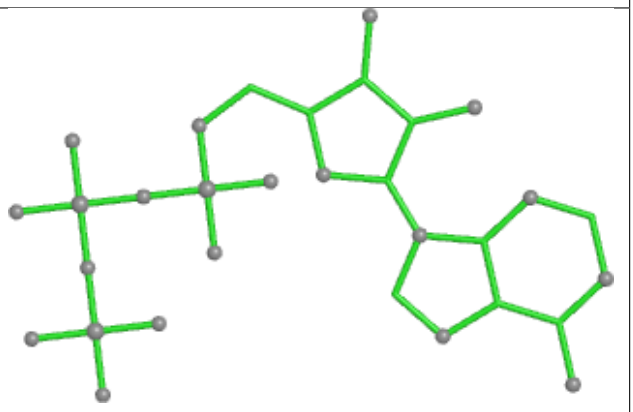


Rings

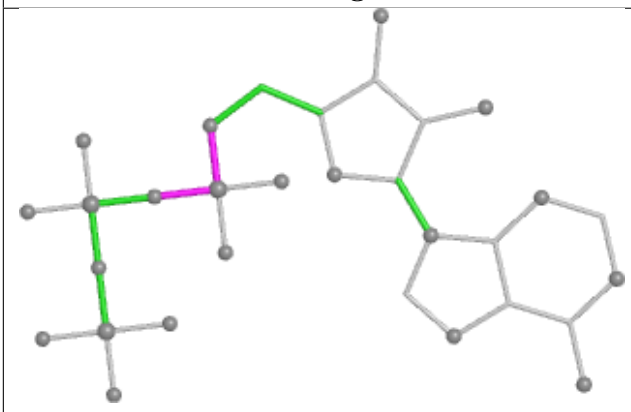
Ligand ATP 5 801



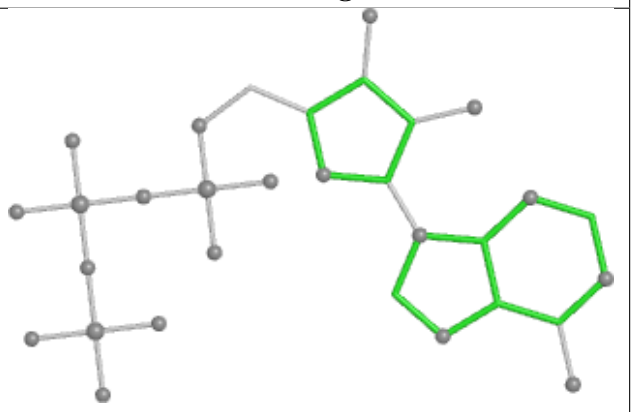
Bond lengths



Bond angles

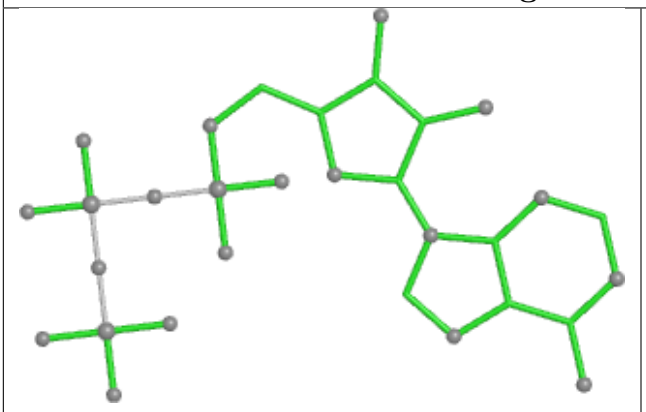


Torsions

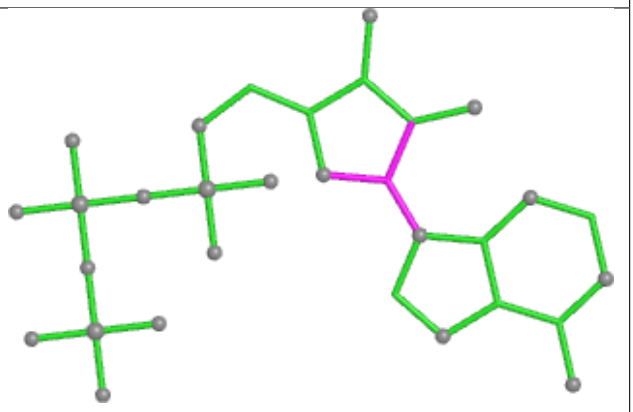


Rings

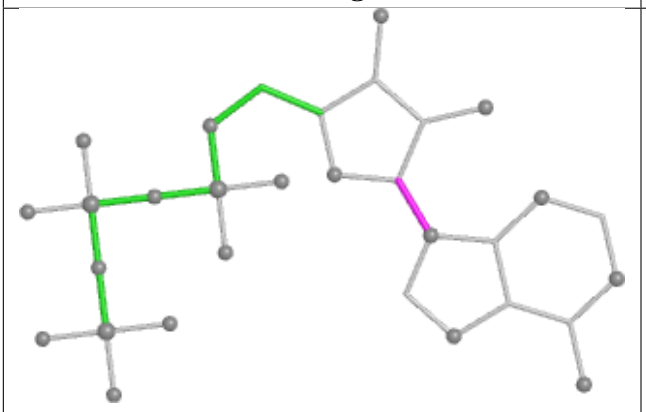
Ligand ATP 4 1000



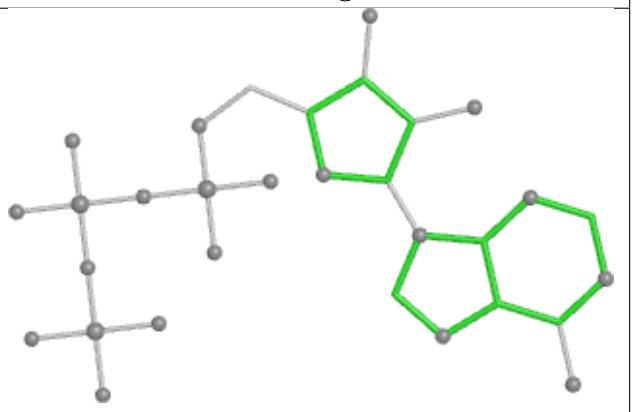
Bond lengths



Bond angles

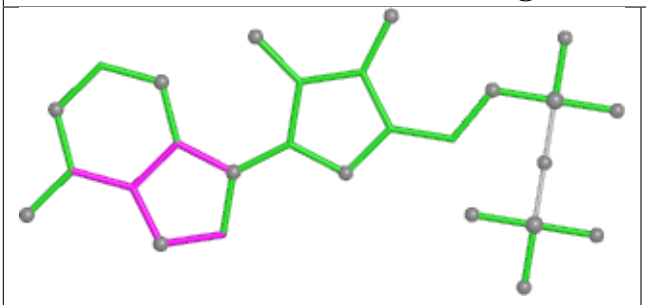


Torsions

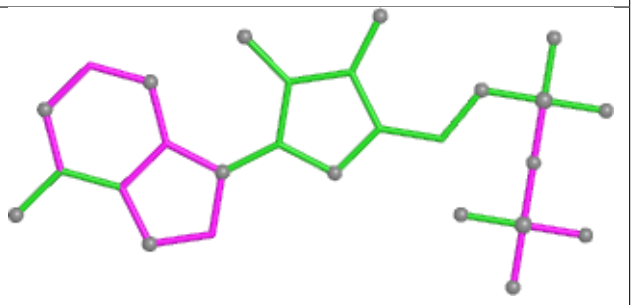


Rings

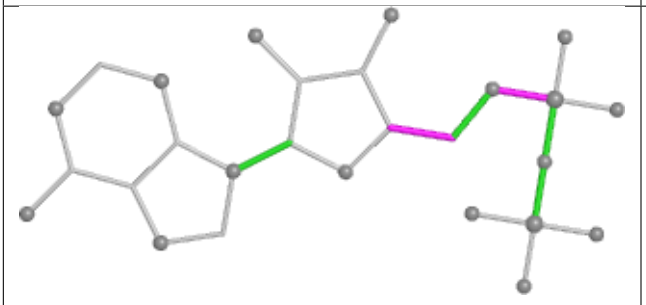
Ligand ADP 2 1002



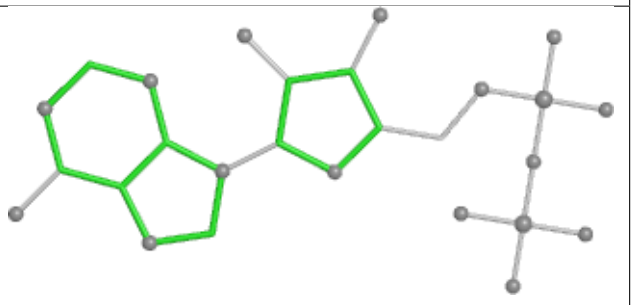
Bond lengths



Bond angles

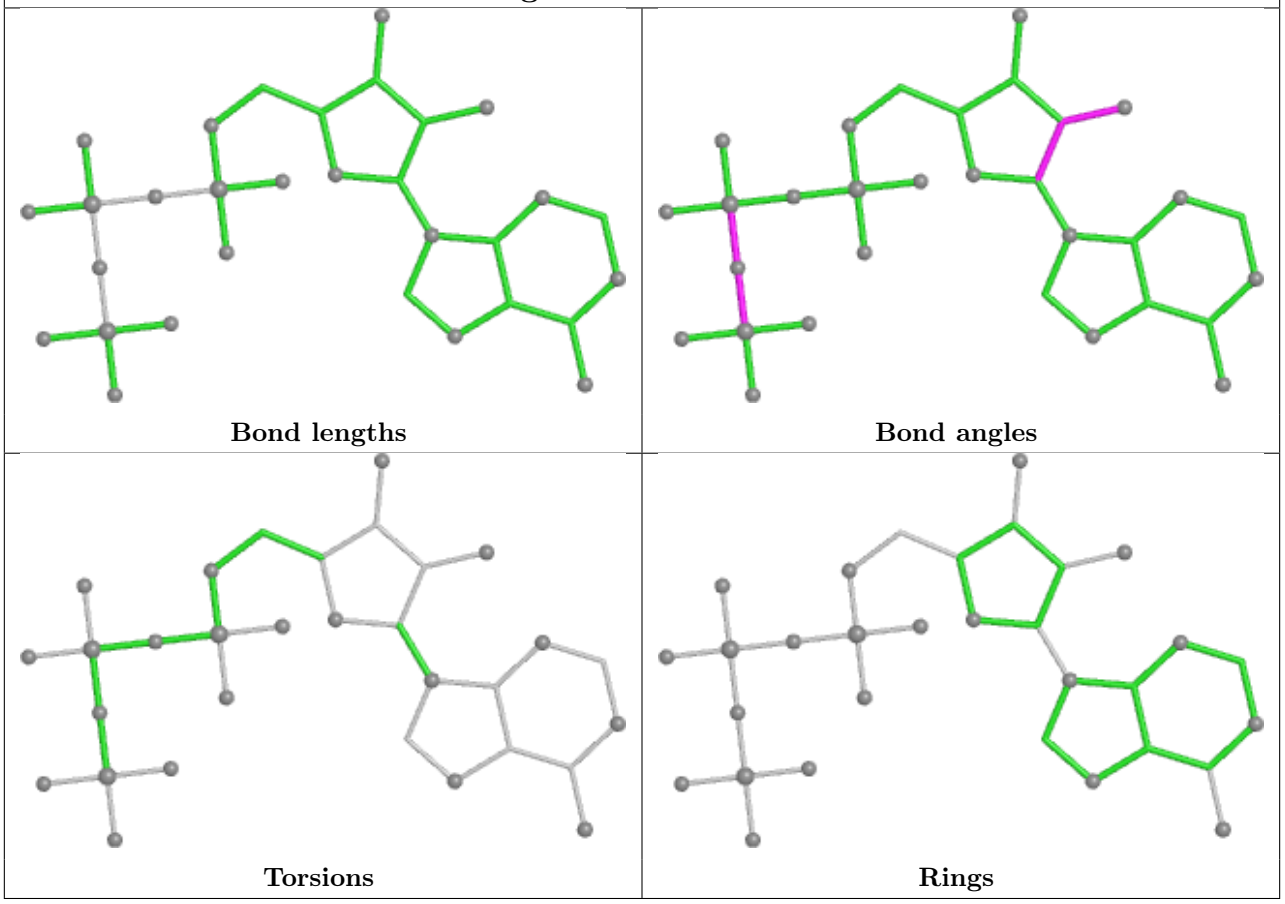


Torsions



Rings

Ligand ATP 6 1000



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.

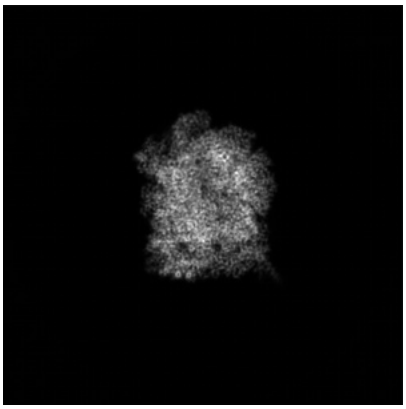
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-67034. These allow visual inspection of the internal detail of the map and identification of artifacts.

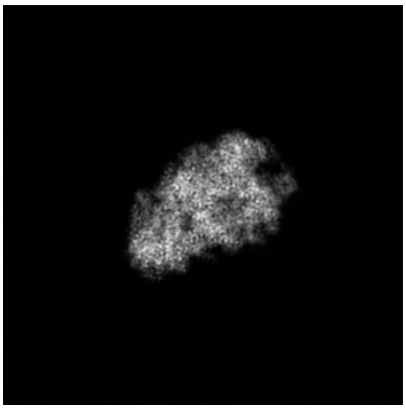
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections

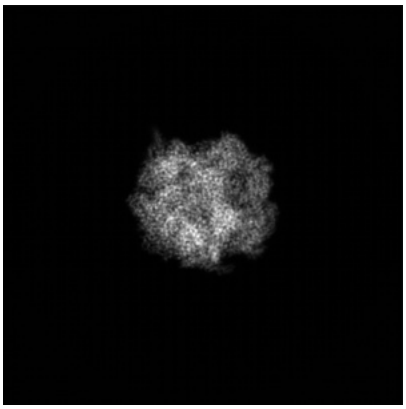
6.1.1 Primary map



X

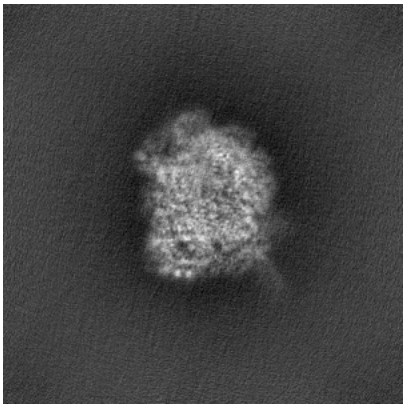


Y

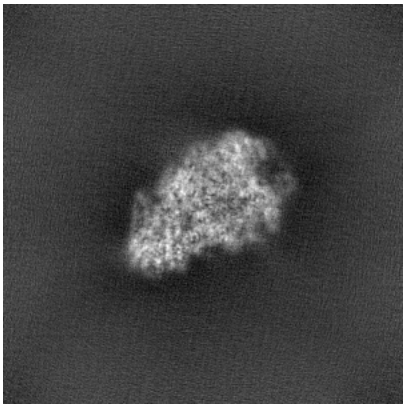


Z

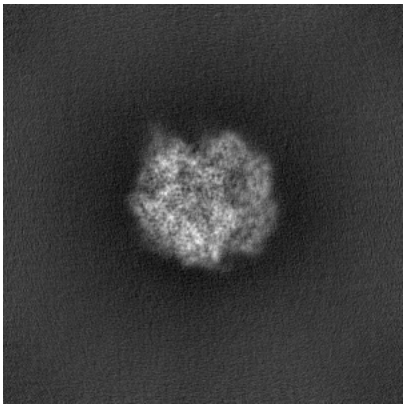
6.1.2 Raw map



X



Y

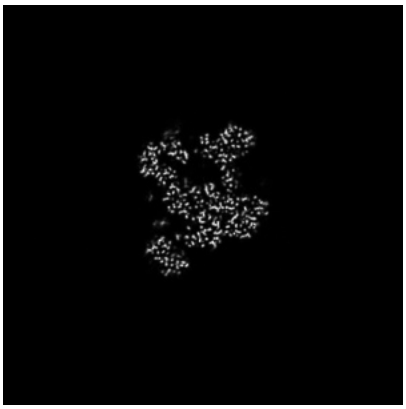


Z

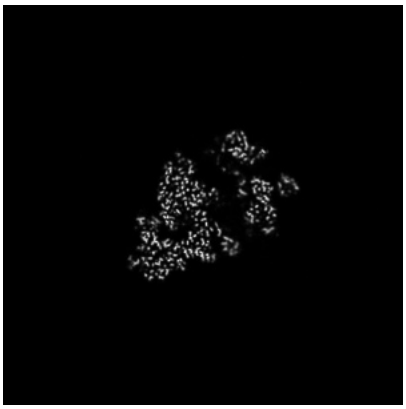
The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

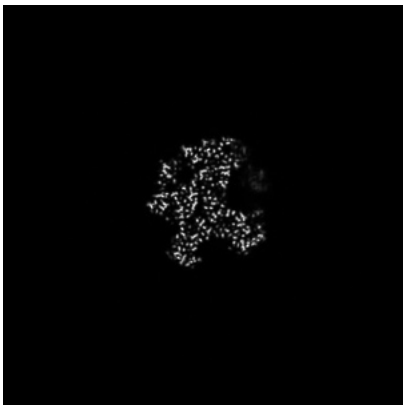
6.2.1 Primary map



X Index: 200

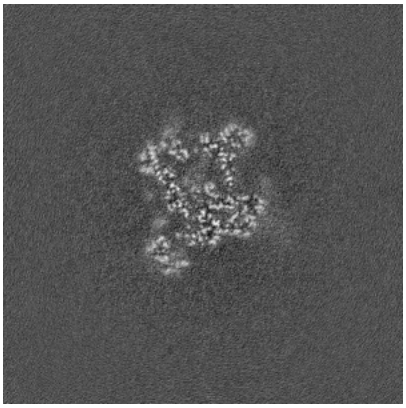


Y Index: 200

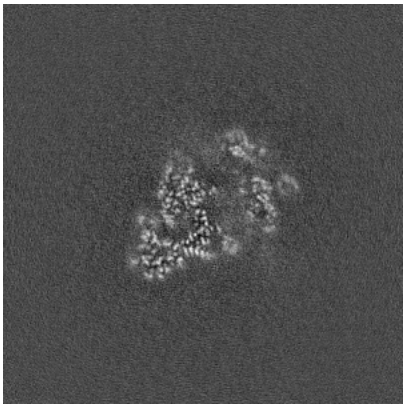


Z Index: 200

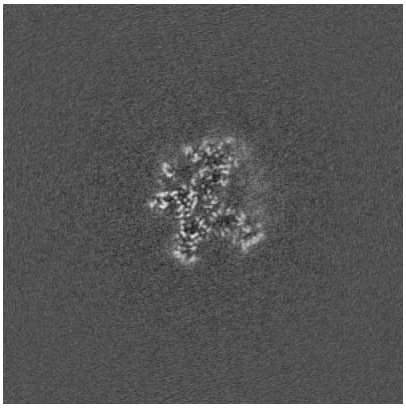
6.2.2 Raw map



X Index: 200



Y Index: 200



Z Index: 200

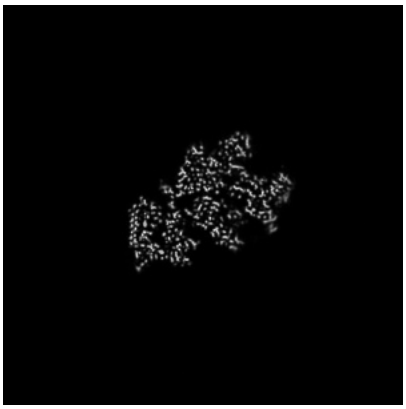
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

6.3.1 Primary map



X Index: 212

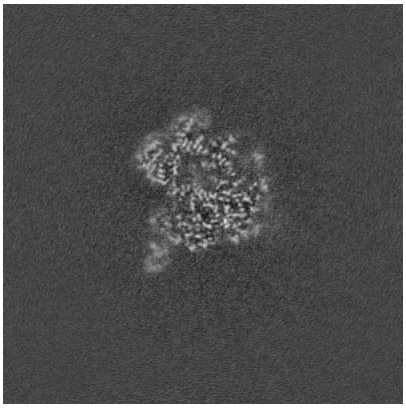


Y Index: 175

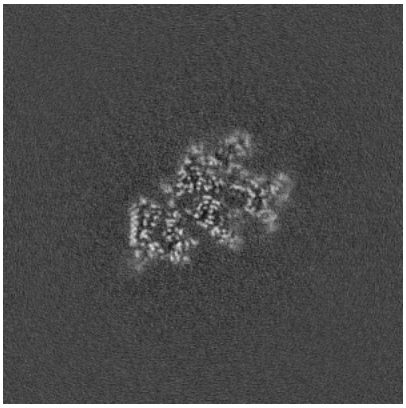


Z Index: 174

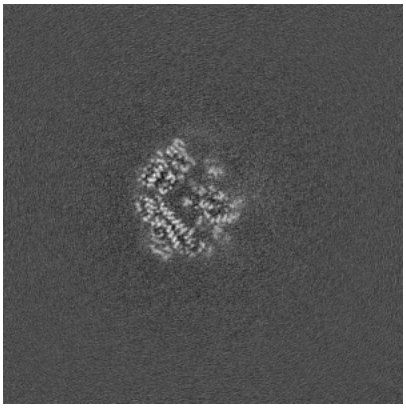
6.3.2 Raw map



X Index: 212



Y Index: 175

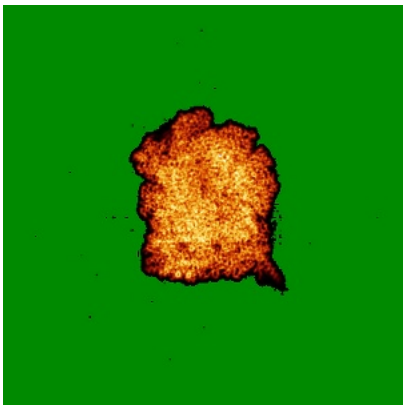


Z Index: 165

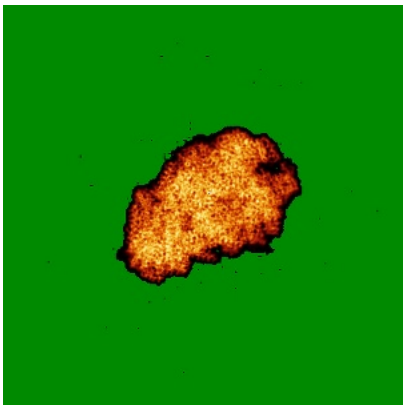
The images above show the largest variance slices of the map in three orthogonal directions.

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

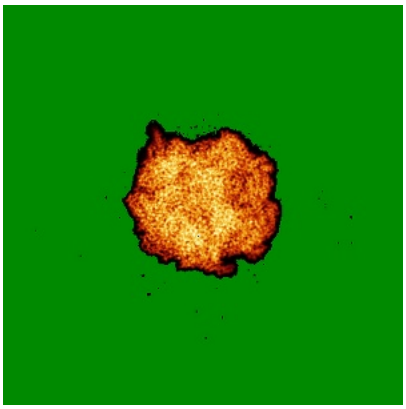
6.4.1 Primary map



X

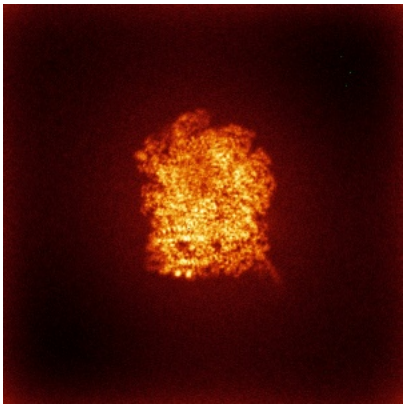


Y

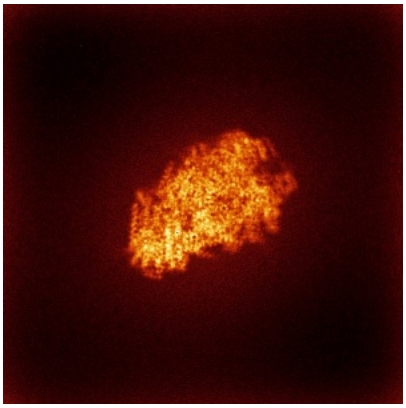


Z

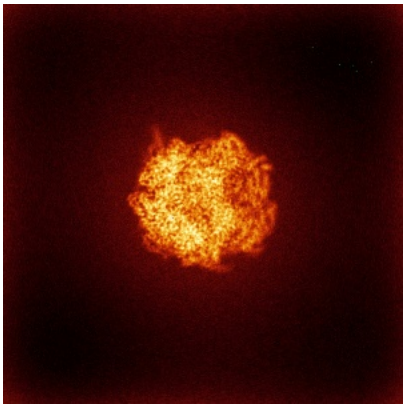
6.4.2 Raw map



X



Y

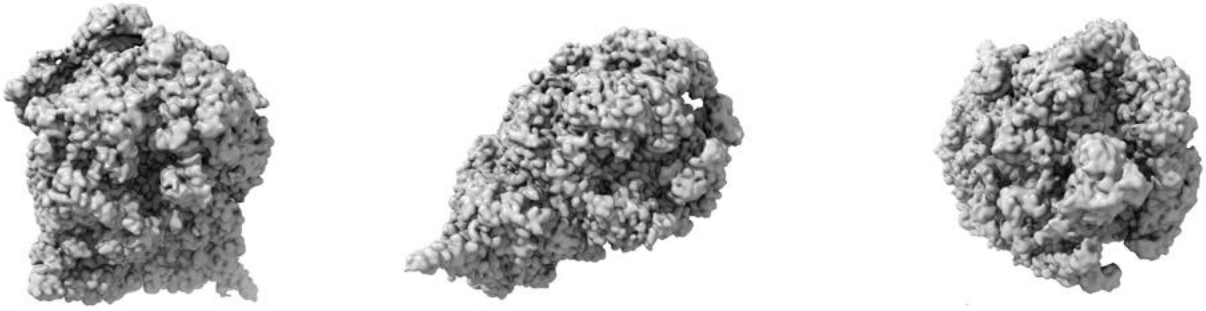


Z

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)

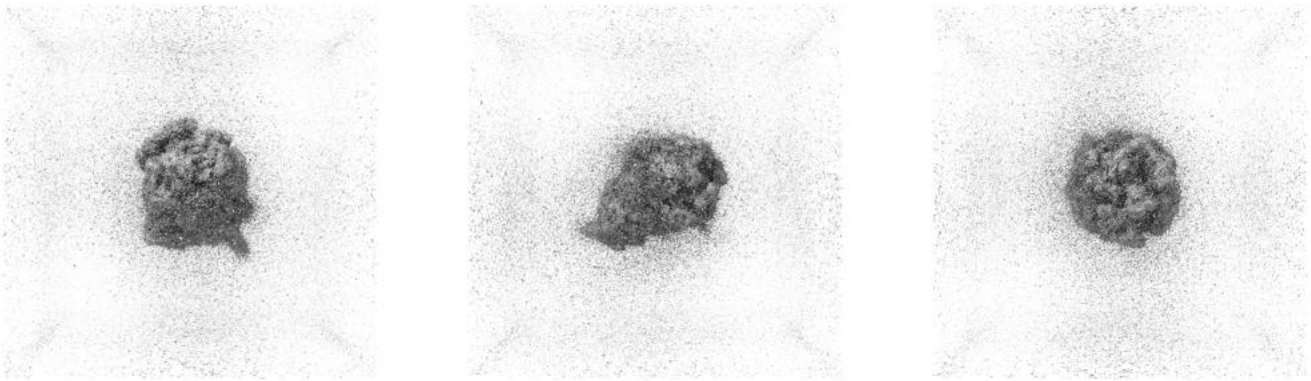
6.5.1 Primary map



X Y Z

The images above show the 3D surface view of the map at the recommended contour level 0.435. 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.

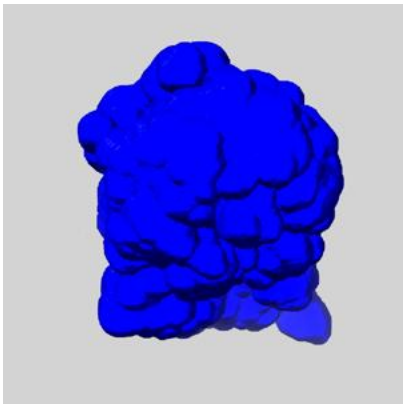
6.6 Mask visualisation (i)

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

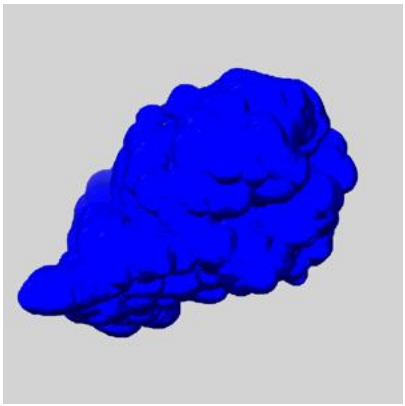
A mask typically either:

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

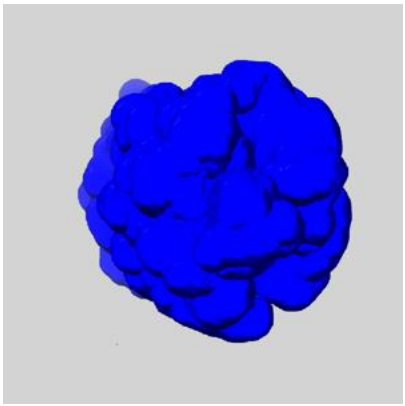
6.6.1 emd_67034_msk_1.map (i)



X



Y

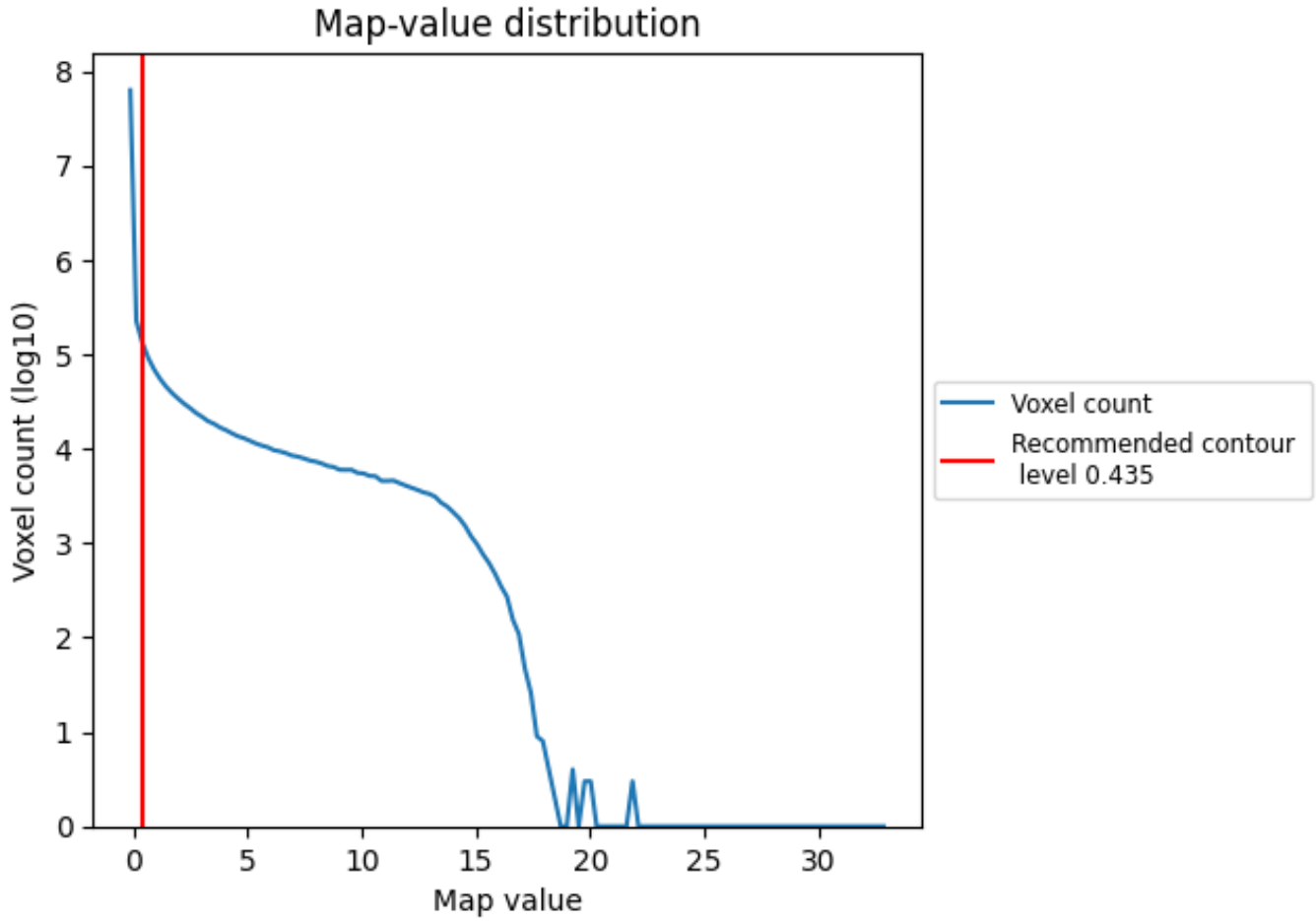


Z

7 Map analysis

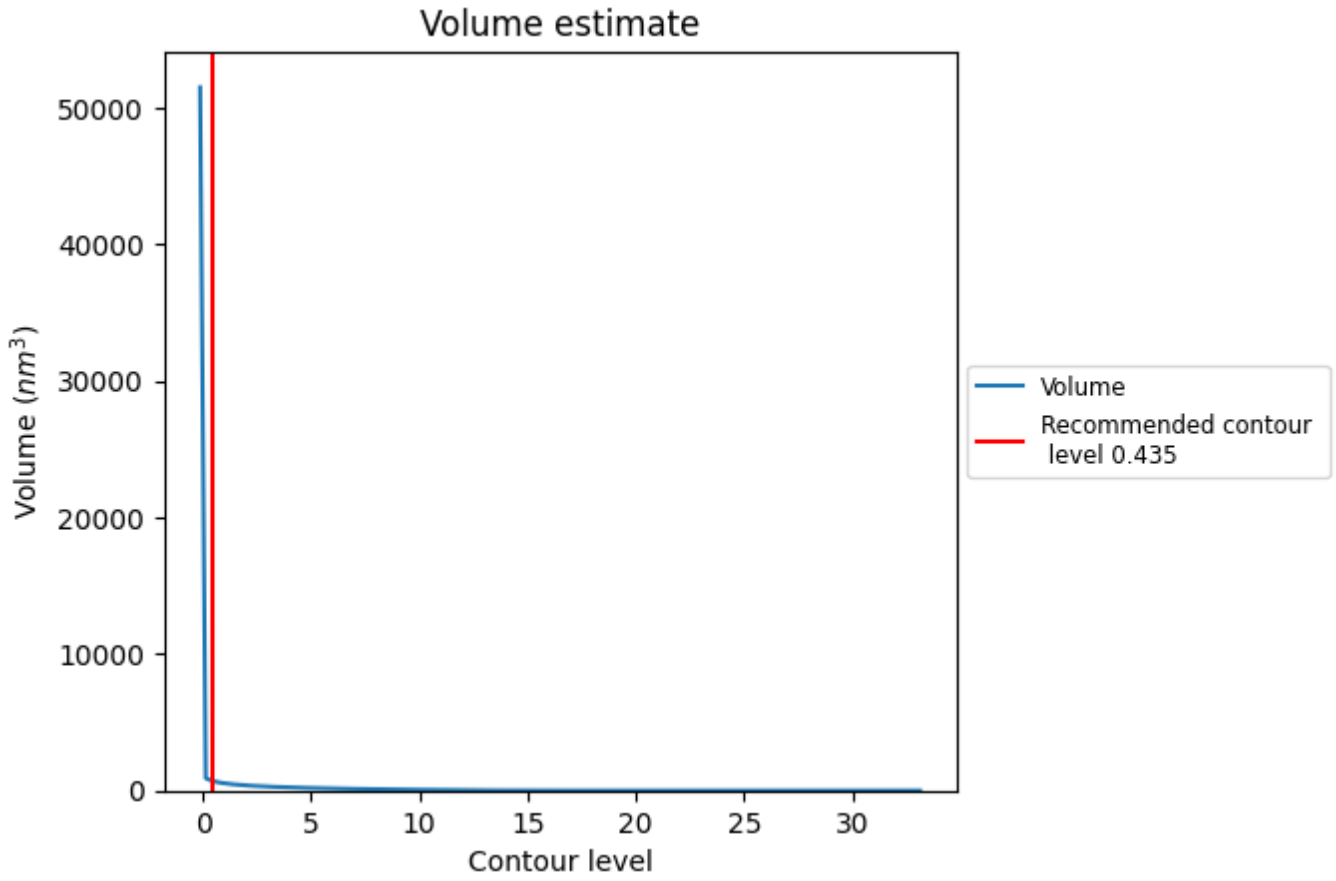
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution



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

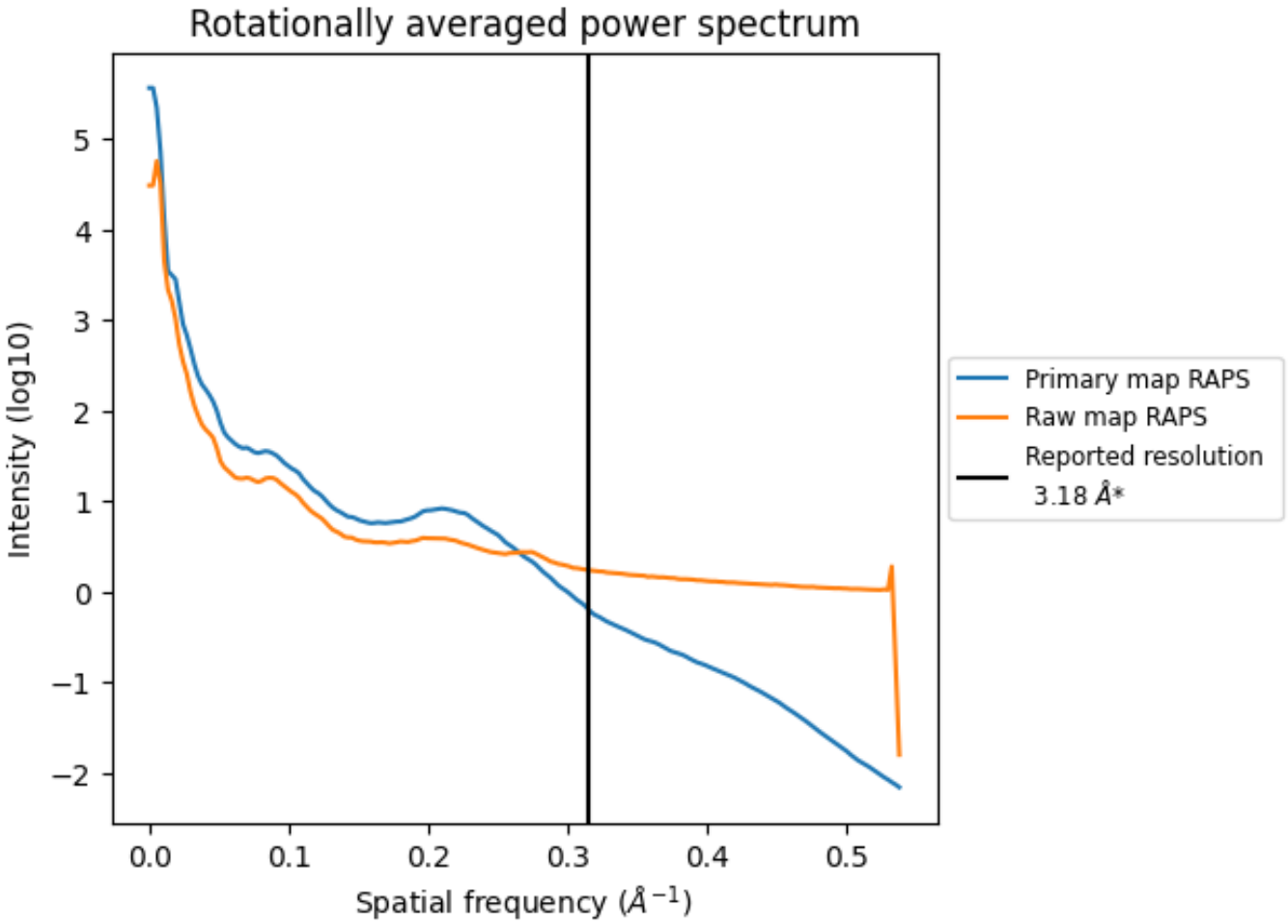
7.2 Volume estimate



The volume at the recommended contour level is 717 nm^3; this corresponds to an approximate mass of 647 kDa.

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

7.3 Rotationally averaged power spectrum (i)

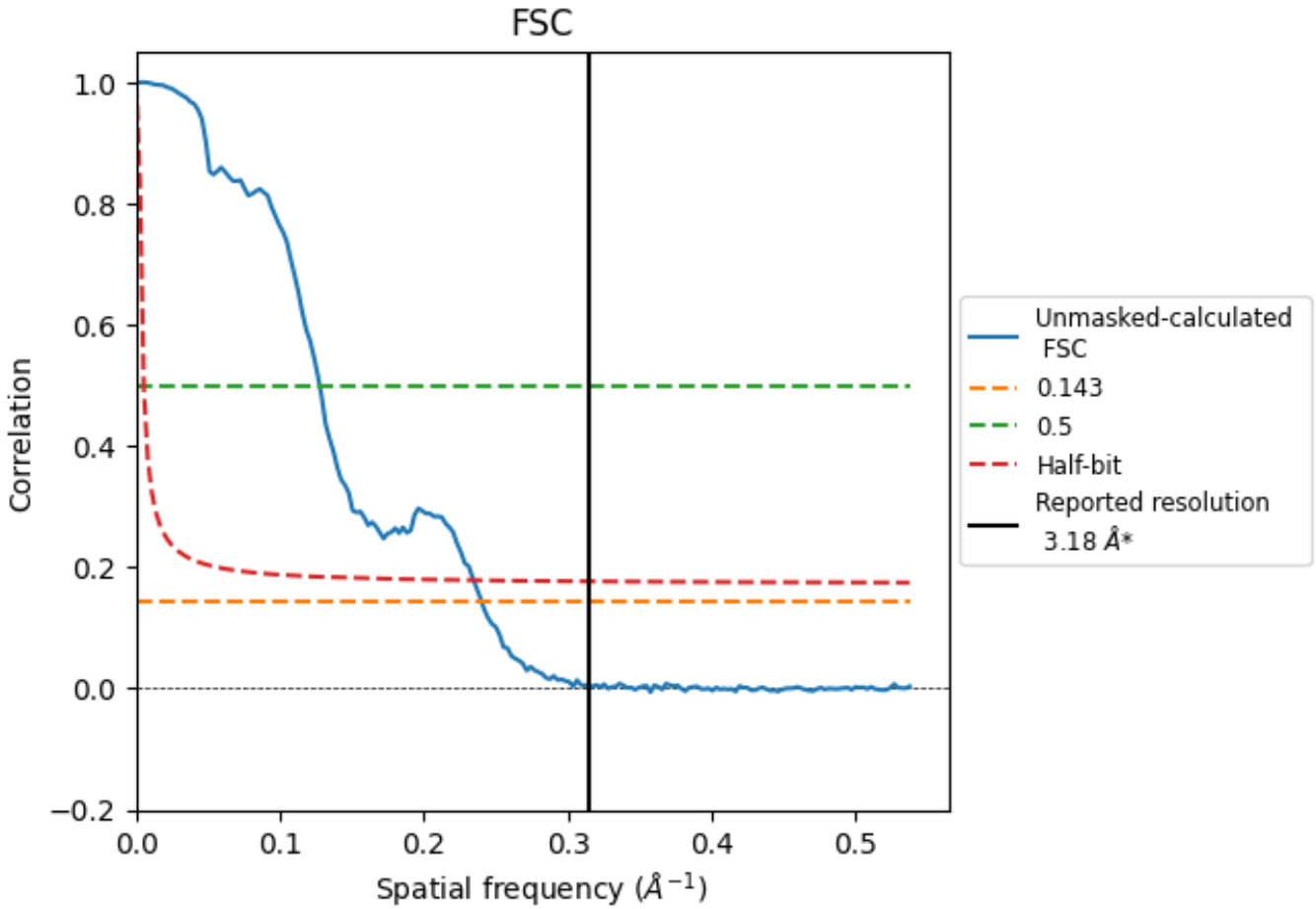


*Reported resolution corresponds to spatial frequency of 0.314 Å^{-1}

8 Fourier-Shell correlation

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



*Reported resolution corresponds to spatial frequency of 0.314 Å^{-1}

8.2 Resolution estimates (i)

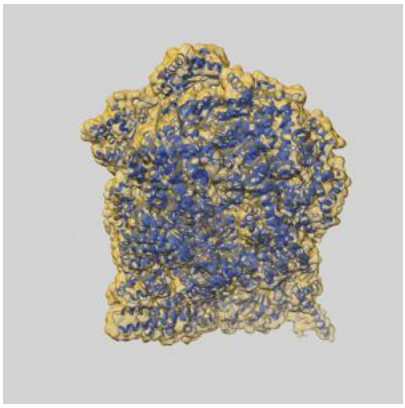
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.18	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	4.16	7.84	4.26

*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 4.16 differs from the reported value 3.18 by more than 10 %

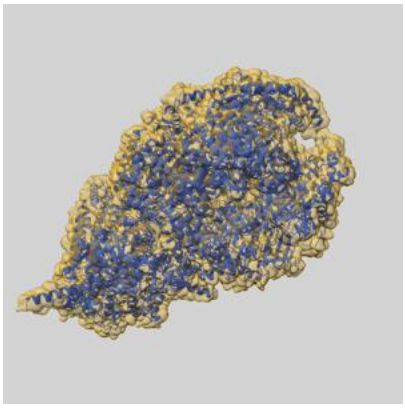
9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-67034 and PDB model 9XMZ. Per-residue inclusion information can be found in section 3 on page 8.

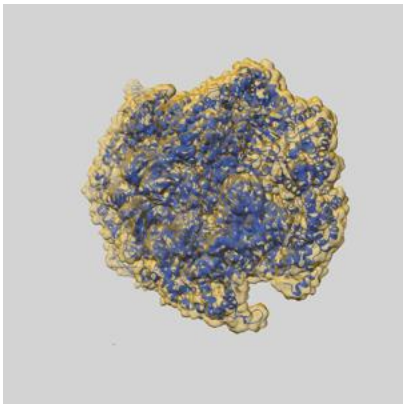
9.1 Map-model overlay



X



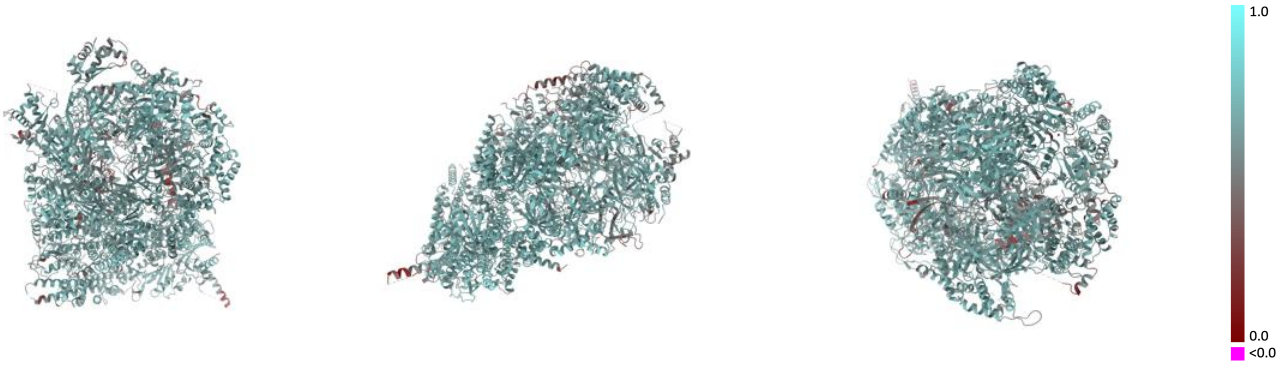
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.435 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.

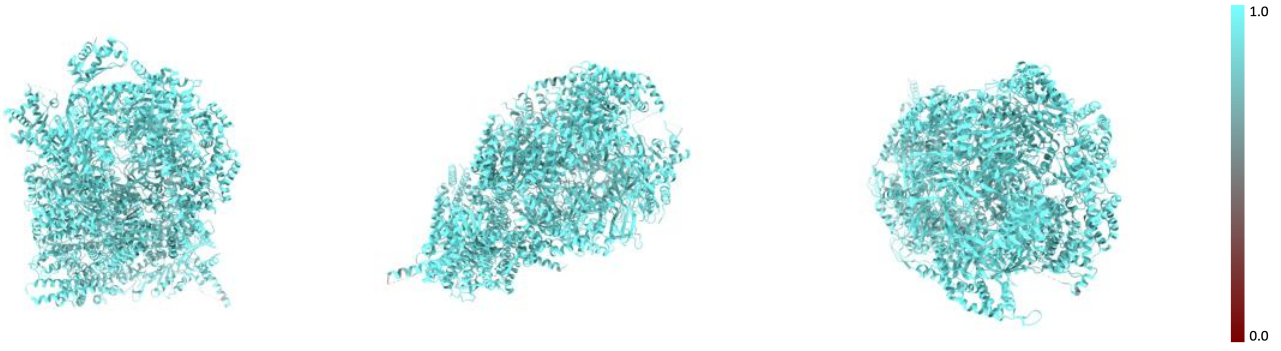
9.2 Q-score mapped to coordinate model (i)



X Y Z

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

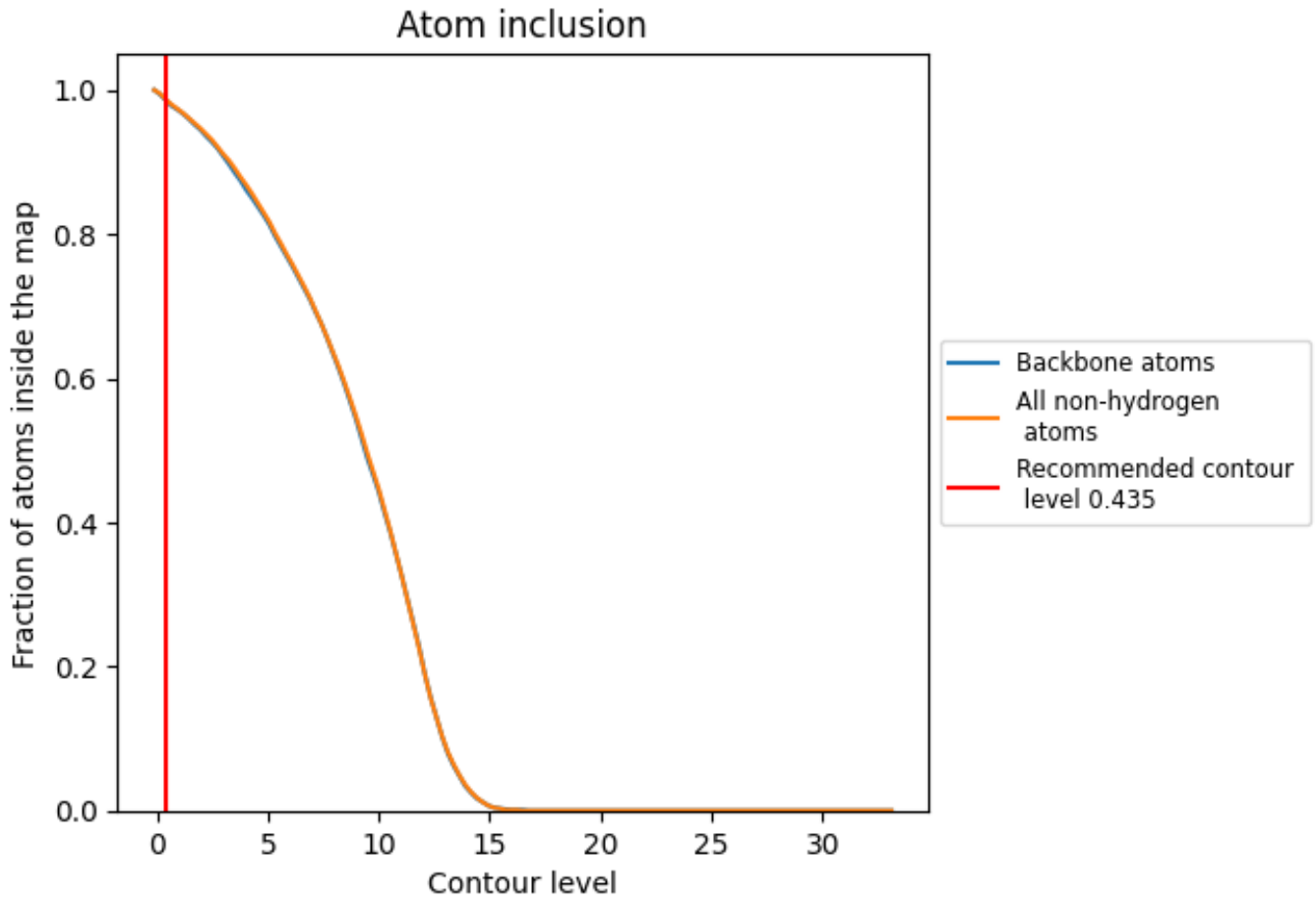
9.3 Atom inclusion mapped to coordinate model (i)



X Y Z

The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.435).

9.4 Atom inclusion (i)



At the recommended contour level, 98% of all backbone atoms, 99% 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 (0.435) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9860	0.6230
2	0.9940	0.6500
3	0.9860	0.6280
4	0.9860	0.5800
5	0.9950	0.6500
6	0.9900	0.6180
7	0.9850	0.5880
B	0.9880	0.6300
C	0.9910	0.6700
D	0.9960	0.6490
E	0.9880	0.6420
F	0.9870	0.6350
M	0.9820	0.4880
N	0.9900	0.4440

