



Full wwPDB EM Validation Report ⓘ

Mar 9, 2026 – 10:04 AM UTC

PDB ID : 8C93 / pdb_00008c93
EMDB ID : EMD-16500
Title : Cryo-EM captures early ribosome assembly in action
Authors : Lauer, S.; Nikolay, R.; Qin, B.
Deposited on : 2023-01-21
Resolution : 4.17 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:

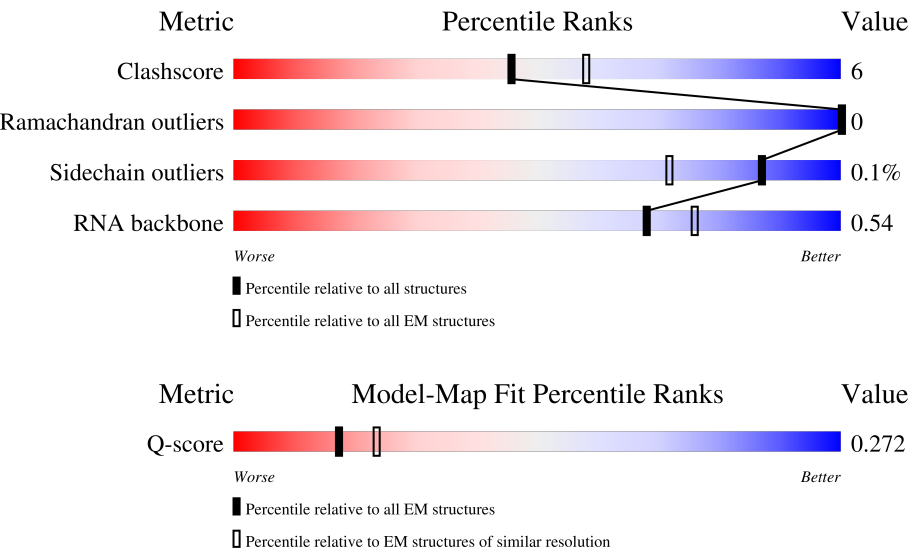
EMDB validation analysis : 0.0.1.dev132
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

1 Overall quality at a glance i

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

The reported resolution of this entry is 4.17 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.



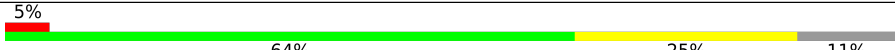
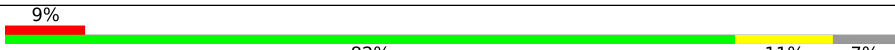
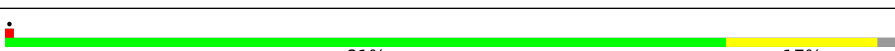
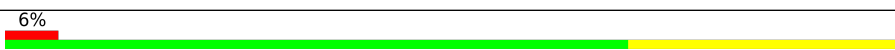
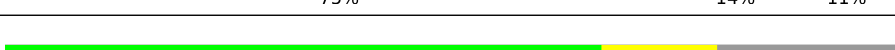
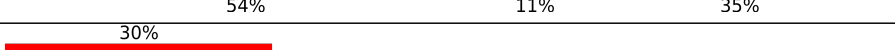
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
RNA backbone	8273	3508	-
Q-score	-	25397	5438 (3.67 - 4.67)

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

Mol	Chain	Length	Quality of chain
1	A	2904	
2	D	209	
3	E	201	

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Mol	Chain	Length	Quality of chain
4	J	142	
5	K	123	
6	N	127	
7	Q	118	
8	R	103	
9	S	110	
10	T	100	
11	U	104	
12	Y	63	
13	O	57	
14	2	46	
15	Z	59	
16	L	144	
17	P	115	

2 Entry composition

There are 17 unique types of molecules in this entry. The entry contains 50320 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 RNA chain called 23S rRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1740	Total	C	N	O	P	0	0
			37393	16681	6929	12043	1740		

- Molecule 2 is a protein called 50S ribosomal protein L3.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	D	162	Total	C	N	O	S	0	0
			1207	757	216	231	3		

- Molecule 3 is a protein called 50S ribosomal protein L4.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	E	186	Total	C	N	O	S	0	0
			1432	901	254	272	5		

- Molecule 4 is a protein called 50S ribosomal protein L13.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	J	138	Total	C	N	O	S	0	0
			1103	698	206	195	4		

- Molecule 5 is a protein called 50S ribosomal protein L14.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	K	122	Total	C	N	O	S	0	0
			938	587	180	165	6		

- Molecule 6 is a protein called 50S ribosomal protein L17.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	N	120	Total	C	N	O	S	0	0
			960	593	196	166	5		

- Molecule 7 is a protein called 50S ribosomal protein L20.

Mol	Chain	Residues	Atoms				AltConf	Trace
7	Q	117	Total	C	N	O	0	0
			947	604	192	151		

- Molecule 8 is a protein called 50S ribosomal protein L21.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	R	103	Total	C	N	O	S	0	0
			816	516	153	145	2		

- Molecule 9 is a protein called 50S ribosomal protein L22.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	S	98	Total	C	N	O	S	0	0
			762	474	144	142	2		

- Molecule 10 is a protein called 50S ribosomal protein L23.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	T	93	Total	C	N	O	S	0	0
			738	466	139	131	2		

- Molecule 11 is a protein called 50S ribosomal protein L24.

Mol	Chain	Residues	Atoms				AltConf	Trace
11	U	102	Total	C	N	O	0	0
			779	492	146	141		

- Molecule 12 is a protein called 50S ribosomal protein L29.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	Y	63	Total	C	N	O	S	0	0
			509	313	99	95	2		

- Molecule 13 is a protein called 50S ribosomal protein L32.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	0	51	Total	C	N	O	S	0	0
			404	245	86	72	1		

- Molecule 14 is a protein called 50S ribosomal protein L34.

Mol	Chain	Residues	Atoms					AltConf	Trace
14	2	37	Total	C	N	O	S	0	0
			299	179	75	44	1		

- Molecule 15 is a protein called 50S ribosomal protein L30.

Mol	Chain	Residues	Atoms					AltConf	Trace
15	Z	57	Total	C	N	O	S	0	0
			439	276	86	75	2		

- Molecule 16 is a protein called 50S ribosomal protein L15.

Mol	Chain	Residues	Atoms					AltConf	Trace
16	L	94	Total	C	N	O		0	0
			677	423	127	127			

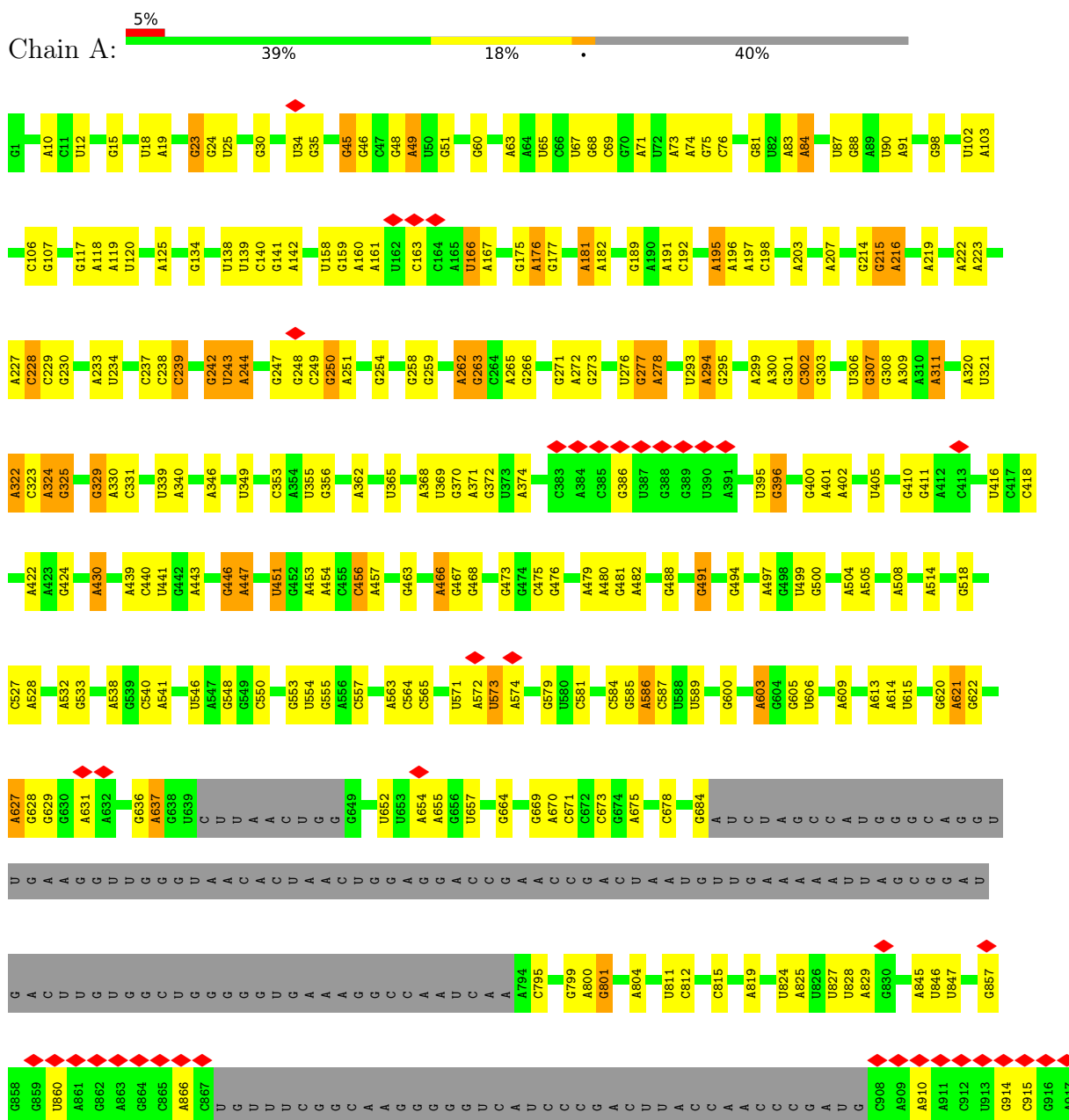
- Molecule 17 is a protein called 50S ribosomal protein L19.

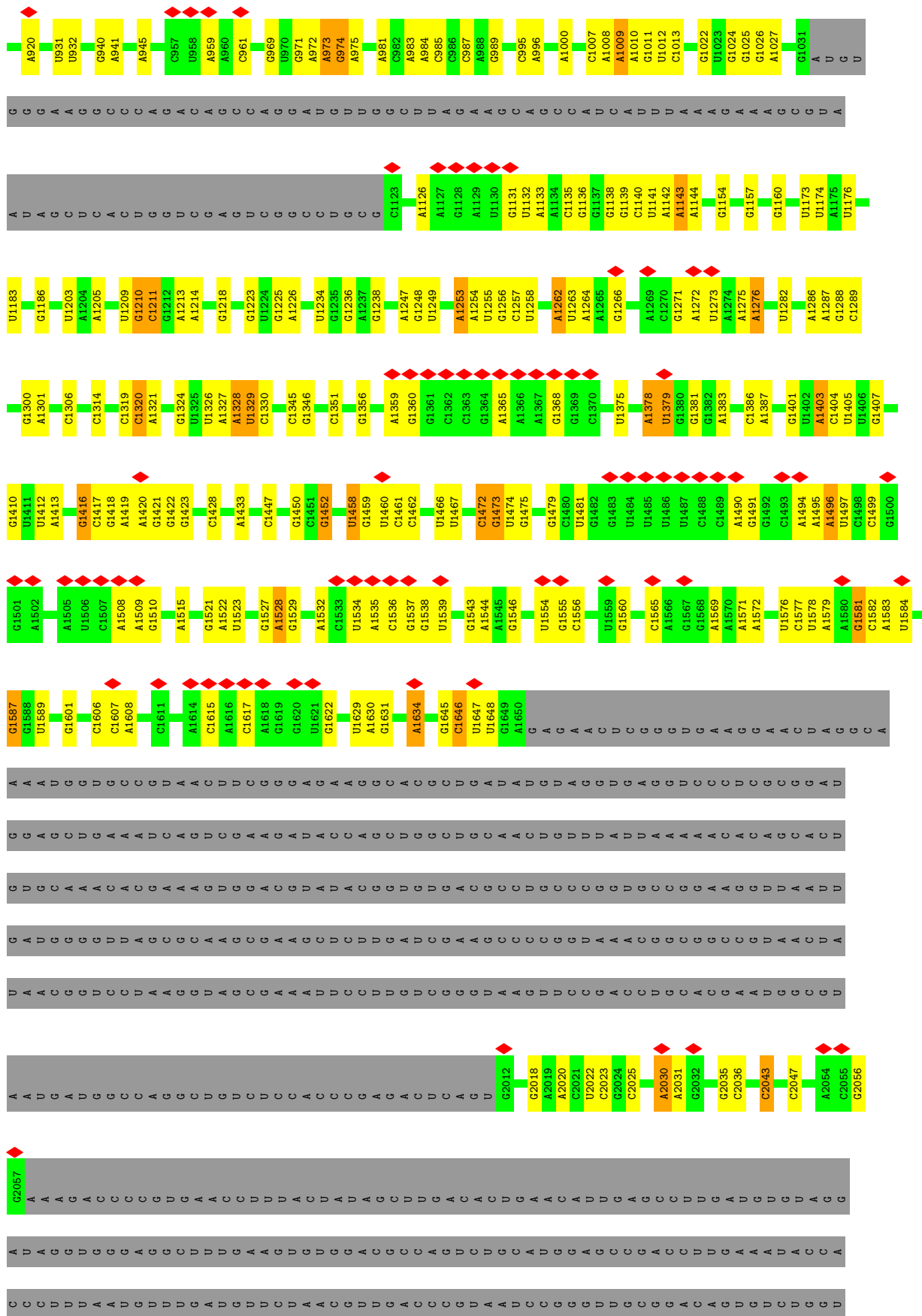
Mol	Chain	Residues	Atoms					AltConf	Trace
17	P	114	Total	C	N	O	S	0	0
			917	574	179	163	1		

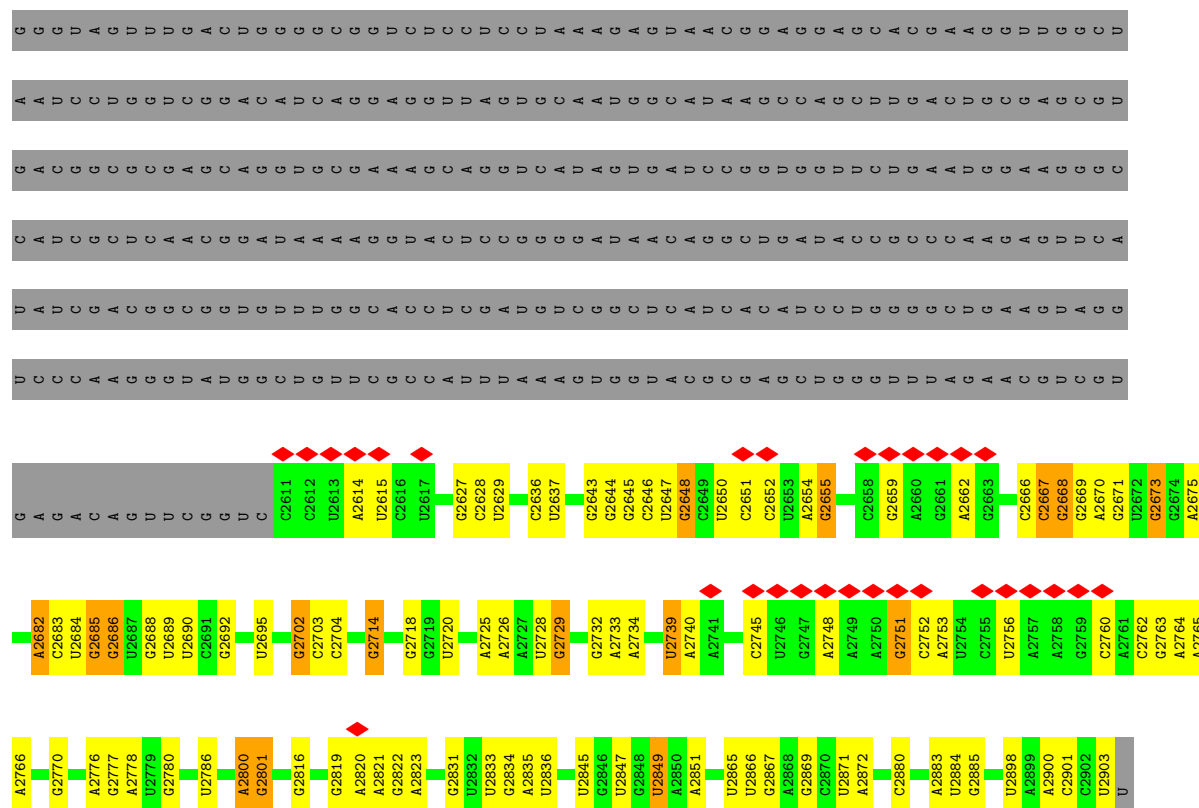
3 Residue-property plots

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.

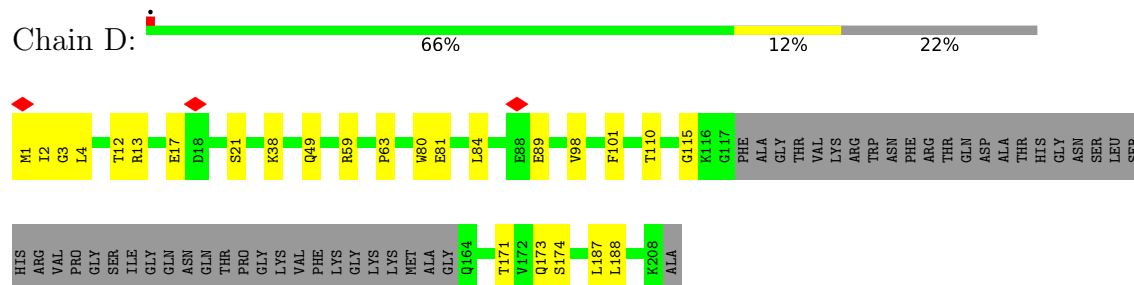
• Molecule 1: 23S rRNA



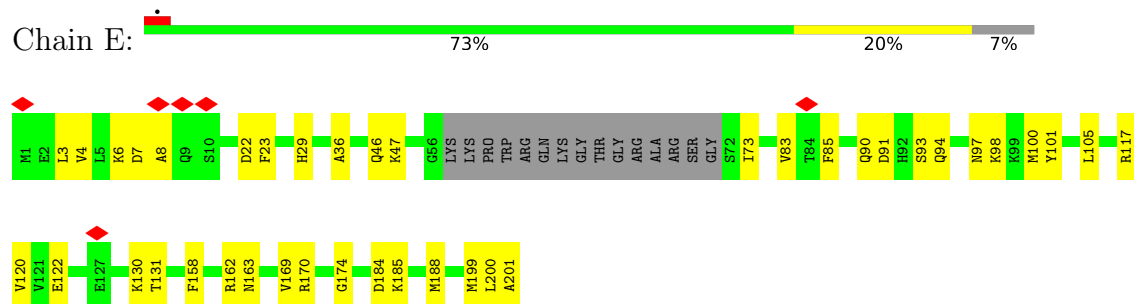




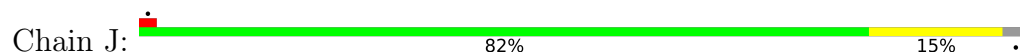
• Molecule 2: 50S ribosomal protein L3

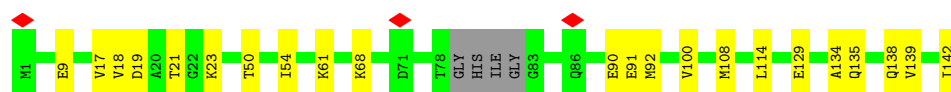


• Molecule 3: 50S ribosomal protein L4

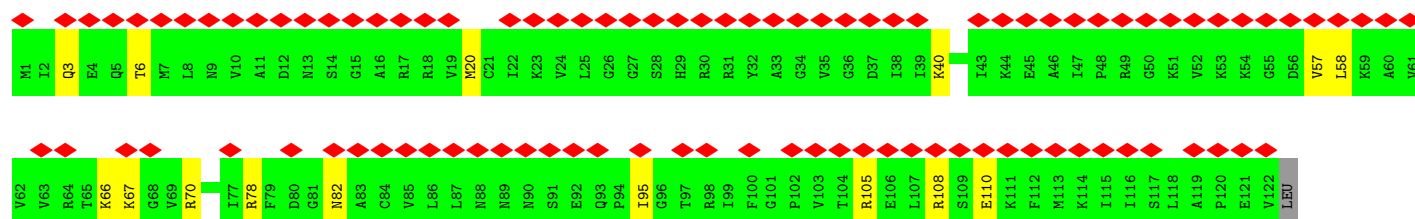
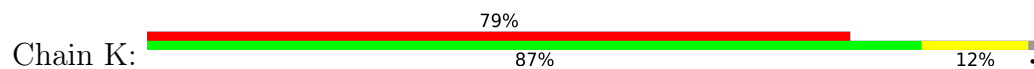


• Molecule 4: 50S ribosomal protein L13

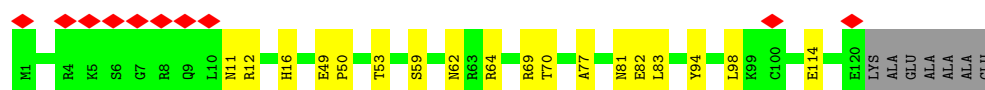
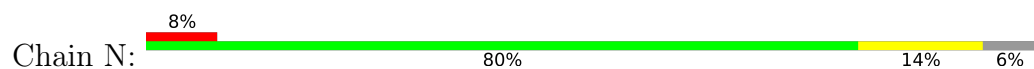




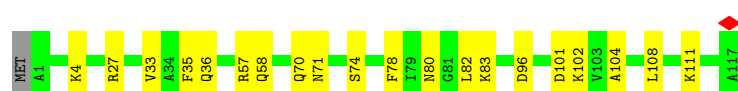
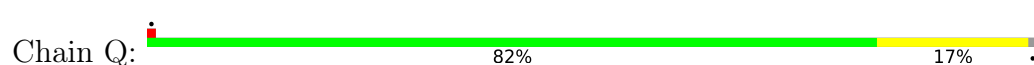
- Molecule 5: 50S ribosomal protein L14



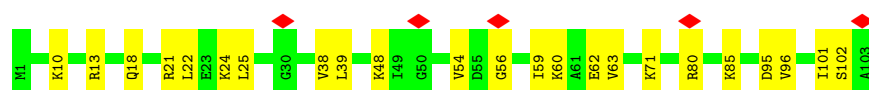
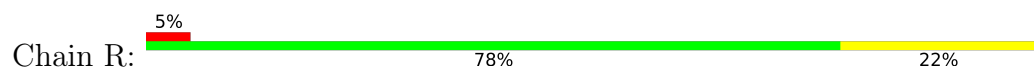
- Molecule 6: 50S ribosomal protein L17



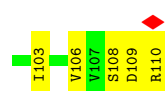
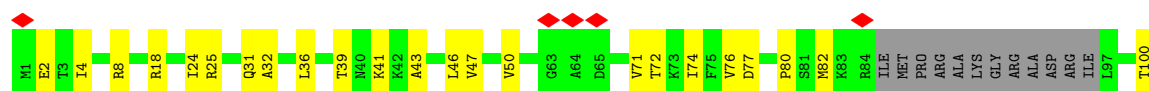
- Molecule 7: 50S ribosomal protein L20



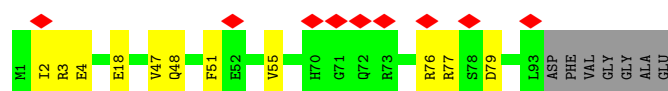
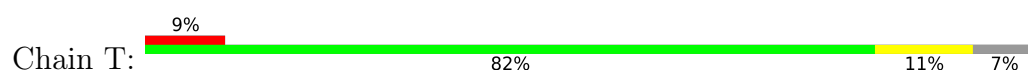
- Molecule 8: 50S ribosomal protein L21



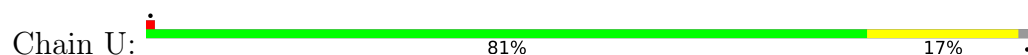
- Molecule 9: 50S ribosomal protein L22



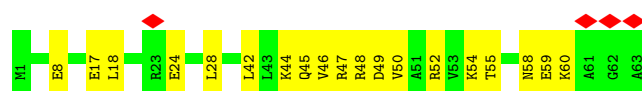
- Molecule 10: 50S ribosomal protein L23



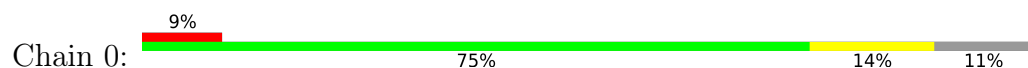
- Molecule 11: 50S ribosomal protein L24



- Molecule 12: 50S ribosomal protein L29



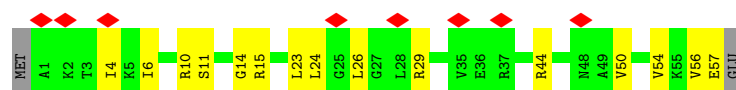
- Molecule 13: 50S ribosomal protein L32



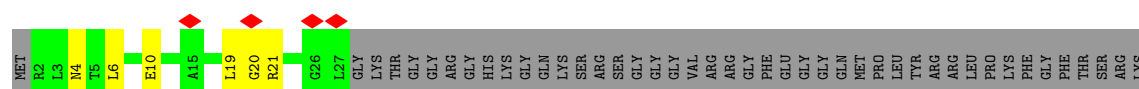
- Molecule 14: 50S ribosomal protein L34



- Molecule 15: 50S ribosomal protein L30

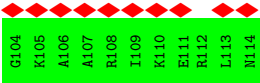
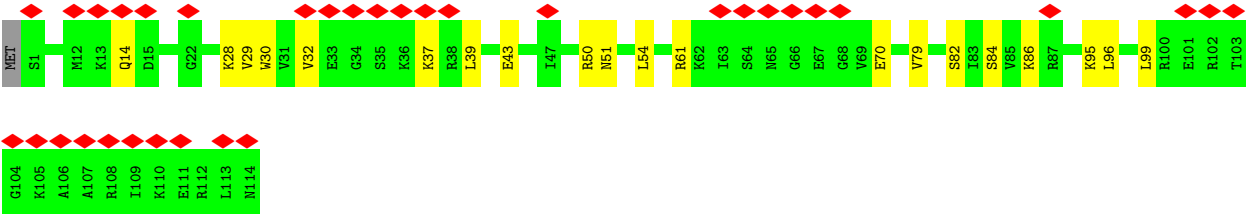
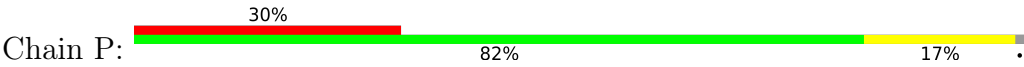


- Molecule 16: 50S ribosomal protein L15





• Molecule 17: 50S ribosomal protein L19



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	11975	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI POLARA 300	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	62	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	31000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	1.456	Depositor
Minimum map value	-0.510	Depositor
Average map value	0.003	Depositor
Map value standard deviation	0.074	Depositor
Recommended contour level	0.3	Depositor
Map size (Å)	375.0, 375.0, 375.0	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.25, 1.25, 1.25	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	0.08	2/41887 (0.0%)	0.18	0/65339
2	D	0.09	0/1218	0.21	0/1640
3	E	0.08	0/1447	0.19	0/1948
4	J	0.09	0/1124	0.19	0/1512
5	K	0.09	0/947	0.20	0/1268
6	N	0.10	0/973	0.25	0/1301
7	Q	0.09	0/960	0.19	0/1278
8	R	0.09	0/829	0.21	0/1107
9	S	0.10	0/767	0.22	0/1026
10	T	0.11	0/744	0.26	0/994
11	U	0.10	0/787	0.24	0/1051
12	Y	0.10	0/510	0.24	0/677
13	0	0.06	0/410	0.19	0/547
14	2	0.06	0/300	0.15	0/394
15	Z	0.11	0/443	0.21	0/593
16	L	0.09	0/678	0.24	0/906
17	P	0.09	0/929	0.21	0/1242
All	All	0.08	2/54953 (0.0%)	0.19	0/82823

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	411	G	C1'-N9	-6.75	1.37	1.48
1	A	827	U	C1'-N1	6.23	1.57	1.48

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	37393	0	18811	302	0
2	D	1207	0	1258	23	0
3	E	1432	0	1489	33	0
4	J	1103	0	1137	22	0
5	K	938	0	1012	12	0
6	N	960	0	1000	13	0
7	Q	947	0	1022	14	0
8	R	816	0	839	18	0
9	S	762	0	814	21	0
10	T	738	0	807	7	0
11	U	779	0	834	14	0
12	Y	509	0	543	14	0
13	0	404	0	415	7	0
14	2	299	0	331	5	0
15	Z	439	0	485	11	0
16	L	677	0	737	17	0
17	P	917	0	965	18	0
All	All	50320	0	32499	487	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 6.

All (487) 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)
1:A:2692:G:O2'	1:A:2847:U:O2'	1.84	0.95
1:A:262:A:O2'	1:A:263:G:O5'	1.85	0.94
1:A:23:G:N2	9:S:77:ASP:OD2	2.06	0.88
1:A:1351:C:O2'	1:A:1571:A:O2'	1.92	0.87
1:A:2847:U:O2	1:A:2869:G:O6	1.93	0.85
4:J:18:VAL:HG23	4:J:54:ILE:HD11	1.56	0.85
1:A:463:G:N2	1:A:466:A:OP2	2.09	0.85
1:A:1351:C:HO2'	1:A:1571:A:HO2'	1.21	0.85
1:A:1007:C:OP2	1:A:1008:A:O2'	1.95	0.84
1:A:2821:A:O2'	1:A:2822:G:O4'	1.93	0.84

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:117:G:OP2	1:A:119:A:O2'	1.95	0.84
1:A:214:G:O2'	1:A:215:G:O4'	1.96	0.83
1:A:1433:A:N1	1:A:1560:G:O6	2.12	0.82
1:A:446:G:N2	1:A:454:A:N6	2.27	0.82
17:P:61:ARG:NH1	17:P:70:GLU:OE2	2.12	0.82
1:A:191:A:O2'	1:A:678:C:O2	1.97	0.82
1:A:2670:A:O2'	1:A:2671:G:O4'	1.98	0.82
1:A:1009:A:O2'	1:A:1010:A:O4'	1.97	0.81
1:A:247:G:N2	1:A:251:A:OP2	2.13	0.81
1:A:2718:G:O2'	1:A:2847:U:OP1	1.98	0.81
1:A:320:A:N3	3:E:163:ASN:ND2	2.28	0.80
1:A:2745:C:N4	1:A:2756:U:O4	2.14	0.80
1:A:106:C:O2	1:A:294:A:O2'	1.99	0.80
1:A:2816:G:N3	1:A:2883:A:O2'	2.14	0.80
1:A:161:A:N6	1:A:166:U:O2	2.15	0.79
1:A:234:U:O4	1:A:263:G:N2	2.16	0.79
1:A:2047:C:O2'	1:A:2823:A:N1	2.15	0.79
1:A:636:G:N7	16:L:128:THR:OG1	2.16	0.79
1:A:159:G:O2'	1:A:167:A:N6	2.15	0.79
1:A:589:U:O2'	3:E:90:GLN:OE1	1.99	0.79
1:A:446:G:H21	1:A:454:A:N6	1.81	0.79
1:A:2683:C:O2	5:K:70:ARG:NH2	2.16	0.78
1:A:1412:U:O4	1:A:1413:A:N6	2.17	0.78
1:A:1417:C:N4	1:A:1579:A:OP2	2.17	0.78
1:A:1479:G:HO2'	1:A:1560:G:HO2'	0.83	0.78
1:A:107:G:O3'	1:A:293:U:O2'	2.01	0.78
1:A:603:A:N6	1:A:655:A:O4'	2.17	0.77
1:A:446:G:N2	1:A:454:A:C6	2.52	0.77
1:A:2684:U:O3'	5:K:78:ARG:NH2	2.18	0.77
1:A:1521:G:OP2	1:A:1522:A:O2'	2.03	0.76
1:A:571:U:O2'	1:A:573:U:OP2	2.04	0.76
3:E:91:ASP:OD2	3:E:93:SER:OG	2.02	0.76
1:A:989:G:OP2	15:Z:11:SER:OG	2.01	0.76
1:A:2685:G:O2'	1:A:2686:G:OP1	2.03	0.76
7:Q:96:ASP:OD2	8:R:13:ARG:NH2	2.19	0.76
1:A:301:G:OP2	11:U:81:ARG:NH2	2.19	0.76
1:A:242:G:O2'	1:A:243:U:OP2	2.05	0.75
1:A:606:U:O2	1:A:622:G:O6	2.05	0.74
1:A:983:A:N6	1:A:2030:A:OP1	2.19	0.74
1:A:2647:U:O2	1:A:2673:G:O6	2.05	0.74
1:A:2682:A:N3	2:D:13:ARG:NH2	2.36	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:30:G:O2'	1:A:1214:A:N3	2.19	0.74
1:A:2898:U:O2'	4:J:134:ALA:O	2.05	0.73
1:A:494:G:OP1	9:S:8:ARG:NH1	2.20	0.73
4:J:91:GLU:N	4:J:91:GLU:OE1	2.22	0.73
1:A:514:A:N3	1:A:581:C:O2'	2.21	0.72
14:2:34:ARG:NH1	14:2:42:LEU:O	2.21	0.72
12:Y:17:GLU:OE2	12:Y:54:LYS:NZ	2.22	0.72
1:A:584:C:N4	1:A:585:G:O6	2.22	0.72
1:A:2645:G:OP2	1:A:2645:G:N2	2.21	0.71
1:A:2020:A:H5'	13:0:8:THR:HG21	1.72	0.71
1:A:2851:A:O2'	6:N:64:ARG:NH1	2.24	0.71
1:A:262:A:HO2'	1:A:263:G:C5'	2.03	0.71
1:A:311:A:N6	1:A:329:G:OP1	2.24	0.70
9:S:31:GLN:N	9:S:31:GLN:OE1	2.24	0.70
1:A:2659:G:N2	1:A:2662:A:OP2	2.24	0.70
4:J:92:MET:HE1	4:J:100:VAL:CG2	2.21	0.70
1:A:195:A:O2'	1:A:250:G:N2	2.25	0.70
1:A:1024:G:O2'	1:A:1144:A:O2'	2.06	0.70
1:A:1273:U:OP2	1:A:1646:C:N4	2.25	0.70
12:Y:52:ARG:O	12:Y:55:THR:OG1	2.08	0.69
3:E:122:GLU:N	3:E:122:GLU:OE1	2.24	0.69
1:A:1009:A:O4'	7:Q:58:GLN:NE2	2.26	0.69
7:Q:36:GLN:OE1	7:Q:36:GLN:N	2.25	0.69
1:A:475:C:O2	1:A:479:A:N6	2.26	0.69
1:A:239:C:O2'	1:A:622:G:O2'	2.10	0.68
1:A:1140:C:OP2	4:J:68:LYS:NZ	2.27	0.68
1:A:2831:G:OP2	2:D:59:ARG:NH1	2.27	0.68
1:A:197:A:OP2	1:A:198:C:N4	2.24	0.68
1:A:84:A:N1	1:A:98:G:O2'	2.23	0.68
3:E:170:ARG:NH1	3:E:174:GLY:O	2.27	0.68
1:A:447:A:N7	1:A:473:G:O6	2.27	0.67
6:N:49:GLU:O	6:N:53:THR:HG23	1.94	0.67
1:A:60:G:N2	1:A:88:G:N7	2.42	0.67
1:A:69:C:O2	1:A:73:A:O2'	2.12	0.67
1:A:2667:C:O2'	1:A:2668:G:OP1	2.12	0.67
7:Q:80:ASN:OD1	7:Q:83:LYS:NZ	2.27	0.67
10:T:76:ARG:NH2	10:T:79:ASP:OD2	2.28	0.66
1:A:63:A:O3'	10:T:77:ARG:NH2	2.28	0.66
1:A:1447:C:O2'	1:A:1544:A:N3	2.28	0.66
6:N:77:ALA:O	6:N:81:ASN:ND2	2.28	0.66
1:A:1225:G:O2'	1:A:1226:A:O4'	2.12	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:2739:U:O2	1:A:2764:A:N7	2.29	0.66
1:A:2684:U:OP2	17:P:50:ARG:NH2	2.29	0.65
5:K:66:LYS:N	5:K:82:ASN:OD1	2.29	0.65
1:A:2751:G:O2'	1:A:2752:C:O4'	2.13	0.65
1:A:1223:G:N2	1:A:1226:A:OP2	2.28	0.65
1:A:65:U:O2'	1:A:456:C:N3	2.27	0.65
16:L:136:GLU:OE1	16:L:136:GLU:N	2.30	0.65
1:A:636:G:N2	16:L:110:VAL:O	2.30	0.65
2:D:49:GLN:OE1	2:D:80:TRP:N	2.31	0.64
3:E:94:GLN:N	3:E:94:GLN:OE1	2.30	0.64
1:A:273:G:O6	1:A:365:U:O4	2.15	0.64
1:A:401:A:O2'	1:A:402:A:O4'	2.14	0.64
1:A:974:G:O2'	1:A:989:G:N2	2.31	0.64
2:D:38:LYS:NZ	2:D:81:GLU:OE2	2.31	0.64
6:N:59:SER:OG	6:N:62:ASN:OD1	2.14	0.64
1:A:815:C:OP2	8:R:85:LYS:NZ	2.30	0.64
5:K:20:MET:SD	5:K:20:MET:N	2.70	0.64
1:A:987:C:OP1	15:Z:10:ARG:NH2	2.31	0.64
1:A:1629:U:O4	1:A:1630:A:N6	2.31	0.64
1:A:1287:A:O2'	1:A:1288:G:O4'	2.16	0.63
1:A:1472:C:N4	1:A:1473:G:O6	2.31	0.63
1:A:324:A:O2'	1:A:325:G:OP1	2.15	0.63
12:Y:28:LEU:HD21	12:Y:42:LEU:HB3	1.81	0.63
4:J:135:GLN:N	4:J:135:GLN:OE1	2.32	0.62
1:A:468:G:N7	14:2:39:ARG:NH2	2.47	0.62
1:A:541:A:N6	1:A:553:G:O6	2.32	0.62
1:A:2685:G:HO2'	1:A:2686:G:P	2.20	0.62
1:A:1288:G:OP2	1:A:1288:G:N2	2.33	0.62
1:A:2748:A:N7	1:A:2753:A:N6	2.47	0.62
1:A:189:G:O2'	1:A:207:A:N6	2.33	0.62
1:A:675:A:N7	1:A:804:A:N6	2.47	0.62
1:A:1631:G:N2	1:A:1634:A:OP2	2.31	0.62
1:A:453:A:N3	1:A:457:A:O2'	2.32	0.62
13:O:43:THR:OG1	13:O:45:ASP:OD1	2.18	0.62
1:A:824:U:O4	1:A:825:A:N6	2.33	0.61
1:A:2667:C:HO2'	1:A:2668:G:P	2.23	0.61
1:A:1027:A:N6	1:A:1126:A:O4'	2.34	0.61
1:A:467:G:OP2	14:2:34:ARG:NE	2.31	0.61
1:A:273:G:N1	1:A:365:U:N3	2.49	0.61
1:A:1535:A:N6	1:A:1539:U:O2	2.34	0.61
1:A:2651:C:N4	1:A:2670:A:N1	2.49	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:E:117:ARG:NE	3:E:184:ASP:O	2.33	0.61
1:A:664:G:O2'	1:A:940:G:OP1	2.11	0.60
6:N:53:THR:HG22	6:N:94:TYR:HE2	1.67	0.60
1:A:177:G:OP2	1:A:177:G:N2	2.34	0.60
1:A:482:A:O2'	1:A:497:A:N1	2.34	0.60
4:J:90:GLU:OE1	4:J:90:GLU:N	2.33	0.60
12:Y:58:ASN:OD1	12:Y:59:GLU:N	2.35	0.60
1:A:518:G:O5'	9:S:18:ARG:NH1	2.35	0.60
8:R:18:GLN:N	8:R:18:GLN:OE1	2.35	0.60
1:A:1581:G:O2'	1:A:1582:C:O4'	2.14	0.60
1:A:324:A:N6	1:A:339:U:O4'	2.36	0.59
16:L:10:GLU:N	16:L:10:GLU:OE1	2.34	0.59
1:A:300:A:O5'	11:U:81:ARG:NH2	2.36	0.58
1:A:322:A:OP1	3:E:162:ARG:NH2	2.37	0.58
1:A:2043:C:OP1	1:A:2777:G:O2'	2.19	0.58
3:E:184:ASP:OD1	3:E:185:LYS:N	2.36	0.58
12:Y:24:GLU:N	12:Y:24:GLU:OE1	2.36	0.58
12:Y:59:GLU:N	12:Y:59:GLU:OE1	2.37	0.58
1:A:987:C:O2'	1:A:1000:A:N3	2.32	0.57
1:A:1497:U:O2'	1:A:1577:C:O5'	2.22	0.57
3:E:4:VAL:HG12	3:E:6:LYS:H	1.67	0.57
4:J:23:LYS:NZ	4:J:142:ILE:OXT	2.35	0.57
17:P:14:GLN:OE1	17:P:14:GLN:N	2.38	0.57
17:P:32:VAL:HG22	17:P:37:LYS:HD2	1.86	0.57
6:N:82:GLU:HG2	6:N:83:LEU:HD12	1.85	0.57
11:U:87:GLU:OE1	11:U:87:GLU:N	2.38	0.57
1:A:320:A:OP2	3:E:130:LYS:NZ	2.36	0.57
17:P:84:SER:OG	17:P:86:LYS:NZ	2.36	0.57
15:Z:57:GLU:N	15:Z:57:GLU:OE1	2.38	0.57
1:A:81:G:O2'	1:A:295:G:O2'	2.22	0.57
1:A:1138:G:O2'	4:J:108:MET:HE3	2.04	0.57
1:A:2695:U:O2	1:A:2714:G:O6	2.22	0.56
17:P:28:LYS:HG2	17:P:39:LEU:HD12	1.87	0.56
9:S:82:MET:HE2	9:S:82:MET:HA	1.86	0.56
1:A:306:U:O2'	1:A:1211:C:OP1	2.15	0.56
1:A:2654:A:O2'	1:A:2655:G:OP2	2.21	0.56
1:A:2020:A:C5'	13:O:8:THR:HG21	2.36	0.56
8:R:63:VAL:HG12	8:R:96:VAL:HG12	1.87	0.56
1:A:299:A:N1	1:A:322:A:O2'	2.33	0.56
1:A:533:G:O5'	7:Q:27:ARG:NH2	2.38	0.56
1:A:1418:G:N2	1:A:1581:G:O6	2.39	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:307:G:N1	1:A:309:A:O5'	2.39	0.56
3:E:3:LEU:HD23	3:E:3:LEU:H	1.71	0.56
1:A:1462:C:O2'	1:A:2702:G:O2'	1.93	0.55
1:A:627:A:N6	16:L:118:THR:OG1	2.39	0.55
4:J:17:VAL:N	4:J:138:GLN:O	2.38	0.55
4:J:92:MET:HE1	4:J:100:VAL:HG22	1.87	0.55
1:A:673:C:OP1	1:A:801:G:N2	2.35	0.55
3:E:158:PHE:HA	3:E:169:VAL:HG21	1.89	0.55
1:A:2845:U:OP1	17:P:51:ASN:ND2	2.39	0.55
1:A:1328:A:O2'	1:A:1329:U:O5'	2.24	0.55
15:Z:23:LEU:HD12	15:Z:24:LEU:N	2.22	0.55
1:A:83:A:O2'	1:A:103:A:N6	2.40	0.54
1:A:1011:G:OP1	7:Q:74:SER:OG	2.25	0.54
16:L:110:VAL:O	16:L:110:VAL:HG22	2.08	0.54
1:A:2865:U:OP2	1:A:2866:U:O2'	2.12	0.54
1:A:1328:A:HO2'	1:A:1329:U:P	2.31	0.54
5:K:110:GLU:N	5:K:110:GLU:OE1	2.37	0.54
1:A:557:C:O2'	4:J:114:LEU:HD11	2.08	0.54
1:A:565:C:OP2	8:R:80:ARG:NH2	2.41	0.54
8:R:60:LYS:NZ	8:R:102:SER:OG	2.41	0.54
2:D:173:GLN:N	2:D:173:GLN:OE1	2.40	0.54
4:J:9:GLU:N	4:J:9:GLU:OE1	2.42	0.54
5:K:105:ARG:O	5:K:108:ARG:NH1	2.41	0.53
1:A:1306:C:OP2	1:A:1606:C:N4	2.41	0.53
1:A:1346:G:N1	1:A:1601:G:O6	2.41	0.53
1:A:1422:G:H21	1:A:1499:C:H1'	1.73	0.53
1:A:2637:U:O4	1:A:2776:A:N7	2.41	0.53
1:A:2726:A:N3	5:K:67:LYS:NZ	2.57	0.53
2:D:13:ARG:NH1	2:D:21:SER:OG	2.37	0.53
12:Y:46:VAL:O	12:Y:49:ASP:N	2.41	0.53
17:P:95:LYS:C	17:P:96:LEU:HD22	2.34	0.53
1:A:321:U:OP2	3:E:131:THR:HG23	2.09	0.53
6:N:53:THR:HG22	6:N:94:TYR:CE2	2.42	0.53
16:L:19:LEU:HD23	16:L:20:GLY:N	2.24	0.53
1:A:799:G:OP2	1:A:800:A:O2'	2.24	0.53
1:A:981:A:HO2'	1:A:2036:C:HO2'	1.48	0.53
2:D:89:GLU:OE1	2:D:89:GLU:N	2.42	0.53
6:N:49:GLU:N	6:N:50:PRO:HD2	2.24	0.53
8:R:21:ARG:NE	8:R:95:ASP:OD1	2.38	0.53
1:A:606:U:OP1	3:E:97:ASN:ND2	2.43	0.52
6:N:69:ARG:O	6:N:70:THR:OG1	2.23	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:972:A:OP2	1:A:973:A:O2'	2.25	0.52
1:A:324:A:HO2'	1:A:325:G:P	2.31	0.52
7:Q:111:LYS:HD3	8:R:48:LYS:HZ1	1.74	0.52
1:A:308:G:O2'	1:A:329:G:N2	2.43	0.52
17:P:32:VAL:HG22	17:P:37:LYS:CD	2.40	0.52
1:A:374:A:OP2	1:A:400:G:N2	2.42	0.51
17:P:43:GLU:OE1	17:P:43:GLU:N	2.43	0.51
4:J:129:GLU:OE1	4:J:129:GLU:N	2.38	0.51
11:U:98:ASN:C	11:U:98:ASN:OD1	2.53	0.51
3:E:200:LEU:HD12	3:E:201:ALA:N	2.26	0.51
15:Z:50:VAL:O	15:Z:50:VAL:HG13	2.11	0.51
1:A:176:A:O2'	1:A:177:G:O4'	2.22	0.51
1:A:446:G:C2	1:A:454:A:N6	2.78	0.51
1:A:2643:G:C6	1:A:2644:G:O6	2.64	0.51
4:J:108:MET:HA	4:J:108:MET:HE2	1.92	0.51
1:A:447:A:C5	1:A:473:G:O6	2.64	0.51
17:P:29:VAL:HG13	17:P:79:VAL:HG12	1.92	0.50
1:A:981:A:O2'	1:A:2036:C:O2'	2.20	0.50
2:D:17:GLU:OE1	2:D:17:GLU:N	2.40	0.50
4:J:19:ASP:OD1	4:J:21:THR:HG23	2.11	0.50
9:S:43:ALA:O	9:S:47:VAL:HG23	2.12	0.50
1:A:1210:G:OP1	1:A:1211:C:O2'	2.23	0.50
1:A:1329:U:OP2	1:A:1330:C:N4	2.44	0.50
11:U:88:ASP:OD1	11:U:89:GLY:N	2.44	0.50
15:Z:6:ILE:HD11	15:Z:54:VAL:HB	1.94	0.50
8:R:38:VAL:C	8:R:39:LEU:HD12	2.37	0.50
1:A:2686:G:O4'	1:A:2726:A:N6	2.43	0.50
9:S:72:THR:OG1	9:S:106:VAL:O	2.23	0.50
17:P:30:TRP:O	17:P:79:VAL:HG13	2.12	0.50
1:A:90:U:OP2	1:A:91:A:O2'	2.24	0.49
1:A:1276:A:O2'	6:N:16:HIS:NE2	2.44	0.49
3:E:83:VAL:HG12	3:E:85:PHE:H	1.77	0.49
1:A:242:G:HO2'	1:A:243:U:P	2.31	0.49
1:A:586:A:O2'	1:A:671:C:O2'	2.30	0.49
4:J:138:GLN:NE2	4:J:139:VAL:O	2.46	0.49
12:Y:24:GLU:O	12:Y:28:LEU:HD13	2.11	0.49
14:2:13:ASN:O	14:2:17:GLY:N	2.45	0.49
15:Z:4:ILE:HD11	15:Z:44:ARG:HH22	1.77	0.49
17:P:29:VAL:CG1	17:P:79:VAL:HG12	2.42	0.49
1:A:48:G:H22	1:A:177:G:P	2.35	0.49
1:A:2871:U:O2'	1:A:2872:A:N7	2.43	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:J:21:THR:HG22	4:J:61:LYS:HE2	1.93	0.49
10:T:2:ILE:HA	10:T:3:ARG:C	2.37	0.49
1:A:2668:G:H2'	1:A:2669:G:C8	2.48	0.49
1:A:228:C:H42	1:A:418:C:H1'	1.78	0.49
1:A:636:G:H22	16:L:110:VAL:HG13	1.77	0.49
9:S:80:PRO:O	9:S:100:THR:OG1	2.31	0.49
10:T:18:GLU:OE1	10:T:18:GLU:N	2.41	0.49
1:A:15:G:O2'	13:O:14:MET:HE2	2.12	0.49
1:A:242:G:O2'	1:A:243:U:P	2.69	0.49
1:A:451:U:OP2	3:E:47:LYS:NZ	2.46	0.49
1:A:2800:A:O2'	1:A:2801:G:OP1	2.27	0.49
2:D:2:ILE:HD12	2:D:2:ILE:N	2.28	0.49
4:J:50:THR:O	4:J:50:THR:HG22	2.13	0.49
7:Q:101:ASP:OD1	7:Q:102:LYS:N	2.46	0.49
1:A:1024:G:HO2'	1:A:1144:A:HO2'	1.54	0.49
1:A:2650:U:O2	1:A:2671:G:N2	2.42	0.49
1:A:2849:U:O2	1:A:2866:U:O2'	2.30	0.49
2:D:1:MET:SD	2:D:1:MET:N	2.82	0.49
1:A:1416:G:O2'	1:A:1417:C:OP2	2.23	0.48
1:A:30:G:OP2	7:Q:4:LYS:NZ	2.28	0.48
1:A:1223:G:O6	8:R:71:LYS:NZ	2.45	0.48
8:R:54:VAL:HG12	8:R:56:GLY:H	1.78	0.48
1:A:262:A:H2'	1:A:263:G:C8	2.48	0.48
1:A:811:U:O4	16:L:21:ARG:NH2	2.46	0.48
9:S:76:VAL:HG22	9:S:103:ILE:HG22	1.94	0.48
15:Z:14:GLY:O	15:Z:15:ARG:NH1	2.44	0.48
1:A:262:A:C2'	1:A:263:G:O5'	2.61	0.48
17:P:70:GLU:OE1	17:P:70:GLU:N	2.46	0.48
1:A:2684:U:O2'	5:K:78:ARG:NH2	2.43	0.48
2:D:110:THR:HG22	2:D:171:THR:HB	1.94	0.48
1:A:324:A:O2'	1:A:325:G:P	2.71	0.48
1:A:2703:C:C2	1:A:2704:C:C5	3.02	0.48
3:E:199:MET:SD	3:E:200:LEU:N	2.86	0.48
1:A:600:G:N3	3:E:100:MET:HE1	2.29	0.48
1:A:1466:U:O3'	1:A:1546:G:O2'	2.32	0.48
1:A:1423:G:N1	1:A:1576:U:O4	2.46	0.48
1:A:2685:G:O2'	1:A:2686:G:P	2.68	0.48
2:D:3:GLY:C	2:D:4:LEU:HD22	2.39	0.48
2:D:12:THR:HG22	2:D:13:ARG:H	1.79	0.48
1:A:258:G:H2'	1:A:259:G:C8	2.49	0.47
1:A:1421:G:N2	1:A:1578:U:O2	2.47	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:87:U:O2'	12:Y:44:LYS:NZ	2.42	0.47
1:A:76:C:OP1	12:Y:48:ARG:NH1	2.47	0.47
1:A:1257:C:C2	1:A:1258:U:C5	3.03	0.47
2:D:2:ILE:HD11	2:D:84:LEU:CD2	2.45	0.47
3:E:101:TYR:CE2	3:E:105:LEU:HD11	2.50	0.47
1:A:1319:C:H2'	1:A:1320:C:O4'	2.15	0.46
12:Y:46:VAL:O	12:Y:50:VAL:N	2.46	0.46
1:A:554:U:H2'	1:A:555:G:O4'	2.15	0.46
9:S:109:ASP:OD1	9:S:110:ARG:N	2.47	0.46
15:Z:6:ILE:HD13	15:Z:56:VAL:HG12	1.96	0.46
1:A:262:A:N3	1:A:430:A:O2'	2.33	0.46
1:A:447:A:C6	1:A:473:G:C6	3.04	0.46
3:E:22:ASP:OD1	3:E:23:PHE:N	2.48	0.46
9:S:46:LEU:O	9:S:50:VAL:HG23	2.14	0.46
1:A:451:U:C4	1:A:453:A:C8	3.04	0.46
7:Q:78:PHE:O	7:Q:82:LEU:HD23	2.16	0.46
1:A:443:A:N6	3:E:36:ALA:O	2.49	0.46
1:A:600:G:H1'	3:E:100:MET:HE1	1.98	0.46
1:A:2821:A:OP2	2:D:115:GLY:N	2.46	0.46
3:E:46:GLN:N	3:E:46:GLN:OE1	2.49	0.46
1:A:540:C:N4	1:A:541:A:H62	2.14	0.46
1:A:969:G:N2	1:A:984:A:O2'	2.49	0.46
1:A:1286:A:N6	1:A:1329:U:O2	2.48	0.46
8:R:10:LYS:HE2	8:R:10:LYS:HA	1.98	0.46
1:A:857:G:O6	1:A:920:A:N6	2.49	0.46
1:A:273:G:C6	1:A:365:U:N3	2.84	0.46
12:Y:8:GLU:O	12:Y:60:LYS:NZ	2.45	0.46
1:A:214:G:O2'	1:A:216:A:O2'	2.33	0.45
1:A:273:G:N1	1:A:365:U:C4	2.84	0.45
1:A:527:C:O2	1:A:528:A:N6	2.49	0.45
3:E:29:HIS:HB2	16:L:6:LEU:HD21	1.97	0.45
11:U:97:SER:O	11:U:98:ASN:CG	2.59	0.45
1:A:175:G:O2'	1:A:176:A:O5'	2.35	0.45
1:A:276:U:O2	1:A:278:A:N6	2.46	0.45
1:A:564:C:O2'	1:A:1253:A:N1	2.45	0.45
1:A:628:G:H2'	1:A:629:G:C1'	2.47	0.45
3:E:200:LEU:HD12	3:E:201:ALA:O	2.15	0.45
9:S:2:GLU:OE1	9:S:2:GLU:N	2.49	0.45
9:S:72:THR:HG21	9:S:108:SER:OG	2.16	0.45
1:A:1319:C:C2'	1:A:1320:C:O4'	2.64	0.45
1:A:324:A:OP2	1:A:1205:A:N6	2.47	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
7:Q:104:ALA:O	7:Q:108:LEU:HD23	2.16	0.45
11:U:41:VAL:HG11	11:U:62:ALA:HB2	1.99	0.45
3:E:97:ASN:OD1	3:E:98:LYS:N	2.50	0.45
11:U:71:ILE:HD11	11:U:82:VAL:HB	1.98	0.45
1:A:466:A:N1	1:A:795:C:O2'	2.42	0.45
1:A:1417:C:C4'	1:A:1587:G:H21	2.30	0.45
1:A:1461:C:C2	1:A:1462:C:C5	3.04	0.45
1:A:1024:G:OP2	1:A:1025:G:O2'	2.14	0.45
1:A:2786:U:O2'	2:D:63:PRO:O	2.29	0.45
1:A:395:U:O2'	1:A:396:G:N7	2.48	0.44
17:P:30:TRP:CE2	17:P:39:LEU:HD11	2.52	0.44
1:A:684:G:OP1	14:2:16:HIS:NE2	2.50	0.44
2:D:12:THR:HG22	2:D:13:ARG:N	2.31	0.44
8:R:59:ILE:HG12	8:R:101:ILE:HD12	1.97	0.44
1:A:1275:A:O3'	1:A:1645:G:O2'	2.35	0.44
1:A:1319:C:O2'	1:A:1320:C:O4'	2.33	0.44
3:E:73:ILE:H	3:E:73:ILE:HD12	1.82	0.44
1:A:219:A:N3	1:A:234:U:O2'	2.48	0.44
5:K:3:GLN:O	5:K:6:THR:OG1	2.26	0.44
1:A:1346:G:C6	1:A:1601:G:O6	2.70	0.44
2:D:173:GLN:O	2:D:174:SER:OG	2.35	0.44
1:A:2800:A:HO2'	1:A:2801:G:P	2.41	0.44
1:A:49:A:N1	1:A:177:G:N2	2.66	0.44
1:A:237:C:O2	1:A:609:A:O2'	2.35	0.44
1:A:476:G:N1	1:A:479:A:OP2	2.47	0.44
1:A:1154:G:OP2	7:Q:57:ARG:NH2	2.46	0.44
8:R:63:VAL:HG23	8:R:63:VAL:O	2.17	0.44
1:A:258:G:H2'	1:A:259:G:O4'	2.18	0.44
8:R:22:LEU:HD21	8:R:96:VAL:HG13	2.00	0.44
1:A:1319:C:H2'	1:A:1320:C:C6	2.53	0.44
3:E:200:LEU:HD12	3:E:200:LEU:C	2.43	0.44
17:P:99:LEU:C	17:P:99:LEU:HD12	2.42	0.44
1:A:18:U:O4	1:A:19:A:N6	2.51	0.43
1:A:301:G:O2'	1:A:302:C:O5'	2.33	0.43
4:J:92:MET:HE1	4:J:100:VAL:HG23	1.98	0.43
1:A:488:G:H22	1:A:491:G:H5''	1.82	0.43
9:S:24:ILE:O	9:S:74:ILE:HD13	2.18	0.43
1:A:2688:G:N1	1:A:2720:U:OP2	2.47	0.43
2:D:98:VAL:HG22	2:D:98:VAL:O	2.19	0.43
2:D:98:VAL:CG2	2:D:187:LEU:HD11	2.49	0.43
2:D:187:LEU:C	2:D:188:LEU:HD22	2.42	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:620:G:H4'	1:A:621:A:H5'	2.00	0.43
7:Q:70:GLN:NE2	7:Q:71:ASN:OD1	2.51	0.43
9:S:32:ALA:O	9:S:36:LEU:HD23	2.18	0.43
12:Y:45:GLN:O	12:Y:47:ARG:N	2.51	0.43
15:Z:6:ILE:HG21	15:Z:26:LEU:HD21	2.01	0.43
8:R:24:LYS:C	8:R:25:LEU:HD12	2.43	0.43
9:S:50:VAL:HG21	9:S:103:ILE:CD1	2.49	0.43
1:A:587:C:OP1	16:L:21:ARG:NH2	2.49	0.43
1:A:1381:G:H21	1:A:1572:A:H1'	1.83	0.43
1:A:2637:U:H3	1:A:2776:A:H62	1.66	0.43
6:N:114:GLU:N	6:N:114:GLU:OE1	2.52	0.43
10:T:48:GLN:OE1	10:T:55:VAL:N	2.50	0.43
1:A:1537:G:H2'	1:A:1538:G:O4'	2.17	0.43
1:A:2648:G:N1	1:A:2673:G:N7	2.66	0.43
11:U:13:LEU:N	11:U:68:ASN:O	2.44	0.43
10:T:4:GLU:OE1	12:Y:18:LEU:HD11	2.19	0.43
11:U:4:ILE:N	11:U:4:ILE:HD12	2.33	0.43
1:A:1282:U:H3	1:A:1286:A:H62	1.66	0.43
1:A:1378:A:C4'	1:A:1379:U:OP1	2.67	0.43
1:A:1450:G:N2	1:A:1452:G:O6	2.52	0.43
1:A:2651:C:H2'	1:A:2652:C:C1'	2.48	0.43
9:S:39:THR:HG22	9:S:41:LYS:H	1.84	0.43
4:J:108:MET:HE2	4:J:108:MET:CA	2.49	0.42
1:A:176:A:H2'	1:A:177:G:C4	2.54	0.42
1:A:1160:G:H21	8:R:10:LYS:HE3	1.84	0.42
1:A:585:G:H21	1:A:1254:A:N6	2.17	0.42
1:A:1419:A:N6	1:A:1579:A:N7	2.67	0.42
1:A:2740:A:OP2	1:A:2763:G:N1	2.42	0.42
8:R:62:GLU:OE1	8:R:62:GLU:N	2.52	0.42
3:E:3:LEU:CD1	3:E:120:VAL:HG21	2.49	0.42
16:L:121:THR:HG22	16:L:123:ARG:HD2	2.00	0.42
1:A:475:C:C2	1:A:479:A:N6	2.85	0.42
1:A:620:G:H4'	1:A:621:A:C5'	2.49	0.42
1:A:975:A:N7	1:A:989:G:N2	2.63	0.42
3:E:7:ASP:OD1	3:E:8:ALA:N	2.53	0.42
11:U:12:VAL:HG11	11:U:17:ASP:HB2	2.01	0.42
16:L:94:THR:HG22	16:L:94:THR:O	2.19	0.42
16:L:121:THR:HG23	16:L:141:LYS:O	2.19	0.42
1:A:1282:U:O4	1:A:1286:A:N7	2.53	0.42
1:A:1422:G:H21	1:A:1499:C:C1'	2.31	0.42
1:A:2834:G:O2'	1:A:2835:A:O5'	2.28	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
9:S:71:VAL:CG2	9:S:74:ILE:HD11	2.50	0.42
17:P:54:LEU:HD12	17:P:54:LEU:C	2.45	0.42
1:A:585:G:N2	1:A:1254:A:H62	2.18	0.42
1:A:2020:A:N6	1:A:2035:G:O6	2.53	0.42
7:Q:27:ARG:HA	7:Q:33:VAL:HG23	2.01	0.42
1:A:2734:A:N6	1:A:2770:G:O2'	2.49	0.42
1:A:579:G:C6	1:A:1262:A:N6	2.88	0.41
1:A:1183:U:O3'	15:Z:29:ARG:NH1	2.48	0.41
16:L:6:LEU:C	16:L:6:LEU:HD23	2.45	0.41
1:A:192:C:H42	1:A:203:A:H2'	1.85	0.41
9:S:4:ILE:HD12	9:S:4:ILE:N	2.35	0.41
1:A:67:U:C2	1:A:68:G:C8	3.08	0.41
1:A:637:A:N6	1:A:652:U:O4'	2.53	0.41
1:A:1403:A:H2'	1:A:1404:C:O4'	2.20	0.41
5:K:58:LEU:N	5:K:58:LEU:HD23	2.36	0.41
6:N:98:LEU:HD23	6:N:98:LEU:N	2.35	0.41
1:A:499:U:H2'	1:A:500:G:O4'	2.19	0.41
1:A:2670:A:H2'	1:A:2671:G:C8	2.55	0.41
1:A:2702:G:C2	1:A:2703:C:C6	3.08	0.41
1:A:2885:G:O6	13:O:39:ARG:NH2	2.53	0.41
4:J:18:VAL:CG2	4:J:54:ILE:HD11	2.40	0.41
11:U:12:VAL:HG22	11:U:69:VAL:HG12	2.02	0.41
1:A:447:A:N6	1:A:473:G:C6	2.88	0.41
1:A:1203:U:O2	16:L:4:ASN:ND2	2.48	0.41
1:A:1458:U:OP2	1:A:1459:G:N2	2.54	0.41
1:A:605:G:O2'	1:A:657:U:O2	2.37	0.41
1:A:1421:G:H2'	1:A:1422:G:H8	1.86	0.41
1:A:1581:G:H2'	1:A:1582:C:C6	2.55	0.41
1:A:2627:G:O2'	1:A:2628:C:O4'	2.36	0.41
1:A:24:G:H2'	1:A:25:U:C6	2.55	0.41
1:A:238:C:H2'	1:A:239:C:O4'	2.20	0.41
1:A:1494:A:OP1	1:A:1496:A:N6	2.52	0.41
1:A:1615:C:OP2	1:A:1617:C:N4	2.54	0.41
3:E:120:VAL:HG22	3:E:188:MET:HB2	2.02	0.41
1:A:45:G:H3'	1:A:215:G:C8	2.55	0.41
1:A:2819:G:C6	1:A:2821:A:C2	3.09	0.41
2:D:38:LYS:HZ1	2:D:81:GLU:CD	2.27	0.41
10:T:47:VAL:HG23	10:T:51:PHE:CD2	2.56	0.41
1:A:181:A:N1	1:A:182:A:N6	2.69	0.41
1:A:309:A:N3	1:A:329:G:O2'	2.44	0.41
1:A:439:A:H2'	1:A:440:C:O4'	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:971:G:H2'	1:A:972:A:O4'	2.21	0.41
1:A:1139:G:O2'	1:A:1143:A:N1	2.51	0.41
1:A:1528:A:N6	1:A:1543:G:O2'	2.54	0.41
2:D:4:LEU:HD23	2:D:101:PHE:CE2	2.55	0.41
9:S:24:ILE:O	9:S:24:ILE:HG22	2.21	0.41
13:O:21:LEU:HD23	13:O:21:LEU:H	1.85	0.41
1:A:243:U:O2'	1:A:244:A:O5'	2.37	0.41
1:A:228:C:H41	1:A:410:G:N2	2.19	0.40
9:S:25:ARG:NH1	9:S:74:ILE:O	2.54	0.40
1:A:192:C:H42	1:A:203:A:C2'	2.33	0.40
1:A:1356:G:H22	1:A:1375:U:H3	1.69	0.40
11:U:100:GLU:OE1	11:U:100:GLU:N	2.49	0.40
13:O:31:LYS:HG3	13:O:32:THR:HG23	2.03	0.40
16:L:90:VAL:HG11	16:L:122:VAL:HG13	2.03	0.40
17:P:28:LYS:N	17:P:82:SER:OG	2.50	0.40
1:A:2728:U:O2'	1:A:2729:G:H8	2.05	0.40
5:K:95:ILE:HD12	5:K:95:ILE:N	2.36	0.40
1:A:273:G:C6	1:A:365:U:C4	3.09	0.40
1:A:277:G:O2'	1:A:278:A:N1	2.52	0.40
6:N:11:ASN:O	6:N:12:ARG:HG3	2.22	0.40
11:U:82:VAL:HG22	11:U:83:GLY:N	2.36	0.40
1:A:538:A:H62	1:A:555:G:N2	2.20	0.40
1:A:1328:A:O2'	1:A:1329:U:P	2.78	0.40
1:A:1386:C:H2'	1:A:1387:A:H8	1.87	0.40
1:A:2654:A:N6	1:A:2666:C:OP2	2.45	0.40
5:K:40:LYS:HE2	5:K:57:VAL:HG12	2.04	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	
2	D	158/209 (76%)	151 (96%)	7 (4%)	0	100	100
3	E	182/201 (90%)	176 (97%)	6 (3%)	0	100	100
4	J	134/142 (94%)	132 (98%)	2 (2%)	0	100	100
5	K	120/123 (98%)	114 (95%)	6 (5%)	0	100	100
6	N	118/127 (93%)	108 (92%)	10 (8%)	0	100	100
7	Q	115/118 (98%)	111 (96%)	4 (4%)	0	100	100
8	R	101/103 (98%)	98 (97%)	3 (3%)	0	100	100
9	S	94/110 (86%)	91 (97%)	3 (3%)	0	100	100
10	T	91/100 (91%)	86 (94%)	5 (6%)	0	100	100
11	U	100/104 (96%)	92 (92%)	8 (8%)	0	100	100
12	Y	61/63 (97%)	55 (90%)	6 (10%)	0	100	100
13	O	49/57 (86%)	47 (96%)	2 (4%)	0	100	100
14	2	35/46 (76%)	35 (100%)	0	0	100	100
15	Z	55/59 (93%)	55 (100%)	0	0	100	100
16	L	90/144 (62%)	75 (83%)	15 (17%)	0	100	100
17	P	112/115 (97%)	110 (98%)	2 (2%)	0	100	100
All	All	1615/1821 (89%)	1536 (95%)	79 (5%)	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	
2	D	128/164 (78%)	128 (100%)	0	100	100
3	E	154/165 (93%)	154 (100%)	0	100	100
4	J	114/116 (98%)	114 (100%)	0	100	100
5	K	103/104 (99%)	103 (100%)	0	100	100
6	N	100/103 (97%)	100 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
7	Q	89/90 (99%)	88 (99%)	1 (1%)	65	73
8	R	84/84 (100%)	84 (100%)	0	100	100
9	S	84/93 (90%)	84 (100%)	0	100	100
10	T	80/84 (95%)	80 (100%)	0	100	100
11	U	83/85 (98%)	83 (100%)	0	100	100
12	Y	55/55 (100%)	55 (100%)	0	100	100
13	O	43/48 (90%)	43 (100%)	0	100	100
14	2	29/38 (76%)	29 (100%)	0	100	100
15	Z	47/49 (96%)	47 (100%)	0	100	100
16	L	68/103 (66%)	68 (100%)	0	100	100
17	P	99/100 (99%)	99 (100%)	0	100	100
All	All	1360/1481 (92%)	1359 (100%)	1 (0%)	87	88

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
7	Q	35	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
2	D	32	ASN
5	K	29	HIS
7	Q	70	GLN
9	S	61	ASN

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	1733/2904 (59%)	296 (17%)	9 (0%)

All (296) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	A	10	A
1	A	12	U

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Mol	Chain	Res	Type
1	A	23	G
1	A	34	U
1	A	35	G
1	A	45	G
1	A	46	G
1	A	49	A
1	A	51	G
1	A	71	A
1	A	74	A
1	A	75	G
1	A	84	A
1	A	102	U
1	A	118	A
1	A	120	U
1	A	125	A
1	A	134	G
1	A	138	U
1	A	139	U
1	A	140	C
1	A	141	G
1	A	142	A
1	A	158	U
1	A	160	A
1	A	163	C
1	A	166	U
1	A	176	A
1	A	181	A
1	A	195	A
1	A	196	A
1	A	215	G
1	A	216	A
1	A	222	A
1	A	223	A
1	A	227	A
1	A	228	C
1	A	229	C
1	A	230	G
1	A	233	A
1	A	239	C
1	A	242	G
1	A	243	U
1	A	244	A

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Mol	Chain	Res	Type
1	A	248	G
1	A	249	C
1	A	250	G
1	A	254	G
1	A	262	A
1	A	263	G
1	A	265	A
1	A	266	G
1	A	271	G
1	A	272	A
1	A	277	G
1	A	278	A
1	A	294	A
1	A	302	C
1	A	303	G
1	A	307	G
1	A	311	A
1	A	322	A
1	A	323	C
1	A	325	G
1	A	329	G
1	A	330	A
1	A	331	C
1	A	340	A
1	A	346	A
1	A	349	U
1	A	353	C
1	A	355	U
1	A	356	G
1	A	362	A
1	A	368	A
1	A	369	U
1	A	370	G
1	A	371	A
1	A	372	G
1	A	386	G
1	A	396	G
1	A	405	U
1	A	416	U
1	A	422	A
1	A	424	G
1	A	430	A

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Mol	Chain	Res	Type
1	A	441	U
1	A	446	G
1	A	447	A
1	A	451	U
1	A	456	C
1	A	466	A
1	A	480	A
1	A	481	G
1	A	491	G
1	A	504	A
1	A	505	A
1	A	508	A
1	A	532	A
1	A	546	U
1	A	548	G
1	A	550	C
1	A	563	A
1	A	572	A
1	A	573	U
1	A	574	A
1	A	586	A
1	A	603	A
1	A	613	A
1	A	614	A
1	A	615	U
1	A	621	A
1	A	627	A
1	A	631	A
1	A	637	A
1	A	654	A
1	A	669	G
1	A	670	A
1	A	801	G
1	A	812	C
1	A	819	A
1	A	828	U
1	A	829	A
1	A	845	A
1	A	846	U
1	A	847	U
1	A	860	U
1	A	866	A

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Mol	Chain	Res	Type
1	A	910	A
1	A	914	G
1	A	915	C
1	A	931	U
1	A	932	U
1	A	941	A
1	A	945	A
1	A	959	A
1	A	961	C
1	A	973	A
1	A	974	G
1	A	985	C
1	A	995	C
1	A	996	A
1	A	1009	A
1	A	1012	U
1	A	1013	C
1	A	1022	G
1	A	1026	G
1	A	1131	G
1	A	1132	U
1	A	1133	A
1	A	1135	C
1	A	1136	G
1	A	1141	U
1	A	1142	A
1	A	1143	A
1	A	1157	G
1	A	1173	U
1	A	1174	U
1	A	1176	U
1	A	1186	G
1	A	1209	U
1	A	1210	G
1	A	1211	C
1	A	1213	A
1	A	1218	G
1	A	1234	U
1	A	1236	G
1	A	1238	G
1	A	1247	A
1	A	1248	G

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Mol	Chain	Res	Type
1	A	1249	U
1	A	1253	A
1	A	1255	U
1	A	1256	G
1	A	1262	A
1	A	1264	A
1	A	1266	G
1	A	1271	G
1	A	1272	A
1	A	1276	A
1	A	1289	C
1	A	1300	G
1	A	1301	A
1	A	1314	C
1	A	1320	C
1	A	1321	A
1	A	1324	G
1	A	1326	U
1	A	1327	A
1	A	1329	U
1	A	1345	C
1	A	1359	A
1	A	1360	G
1	A	1365	A
1	A	1368	G
1	A	1378	A
1	A	1379	U
1	A	1383	A
1	A	1401	G
1	A	1403	A
1	A	1405	U
1	A	1407	G
1	A	1410	G
1	A	1416	G
1	A	1420	A
1	A	1428	C
1	A	1452	G
1	A	1458	U
1	A	1460	U
1	A	1467	U
1	A	1472	C
1	A	1473	G

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Mol	Chain	Res	Type
1	A	1474	U
1	A	1475	G
1	A	1481	U
1	A	1490	A
1	A	1491	G
1	A	1495	A
1	A	1496	A
1	A	1508	A
1	A	1509	A
1	A	1510	G
1	A	1515	A
1	A	1523	U
1	A	1527	G
1	A	1528	A
1	A	1529	G
1	A	1532	A
1	A	1534	U
1	A	1536	C
1	A	1554	U
1	A	1555	G
1	A	1556	C
1	A	1565	C
1	A	1569	A
1	A	1581	G
1	A	1583	A
1	A	1584	U
1	A	1587	G
1	A	1589	U
1	A	1607	C
1	A	1608	A
1	A	1622	G
1	A	1634	A
1	A	1646	C
1	A	1647	U
1	A	1648	U
1	A	2018	G
1	A	2022	U
1	A	2023	C
1	A	2025	C
1	A	2030	A
1	A	2031	A
1	A	2043	C

Continued on next page...

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Mol	Chain	Res	Type
1	A	2056	G
1	A	2614	A
1	A	2615	U
1	A	2629	U
1	A	2636	C
1	A	2646	C
1	A	2648	G
1	A	2655	G
1	A	2668	G
1	A	2673	G
1	A	2675	A
1	A	2682	A
1	A	2685	G
1	A	2686	G
1	A	2689	U
1	A	2690	U
1	A	2702	G
1	A	2714	G
1	A	2725	A
1	A	2729	G
1	A	2732	G
1	A	2733	A
1	A	2739	U
1	A	2751	G
1	A	2760	C
1	A	2762	C
1	A	2765	A
1	A	2766	A
1	A	2778	A
1	A	2780	G
1	A	2800	A
1	A	2801	G
1	A	2820	A
1	A	2833	U
1	A	2836	U
1	A	2849	U
1	A	2867	G
1	A	2880	C
1	A	2884	U
1	A	2900	A
1	A	2901	C
1	A	2903	U

All (9) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	A	242	G
1	A	262	A
1	A	324	A
1	A	1263	U
1	A	1328	A
1	A	1378	A
1	A	1473	G
1	A	2667	C
1	A	2685	G

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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.

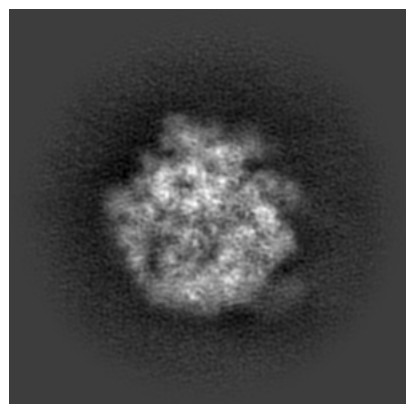
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-16500. These allow visual inspection of the internal detail of the map and identification of artifacts.

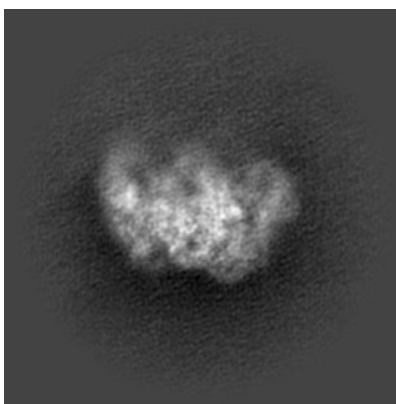
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

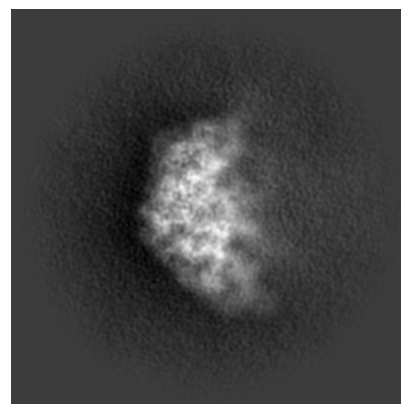
6.1.1 Primary map



X

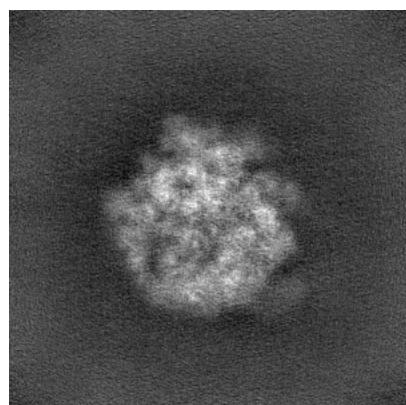


Y

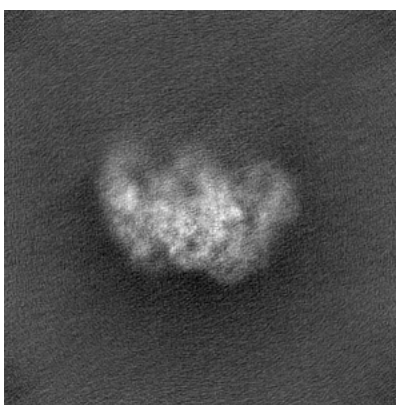


Z

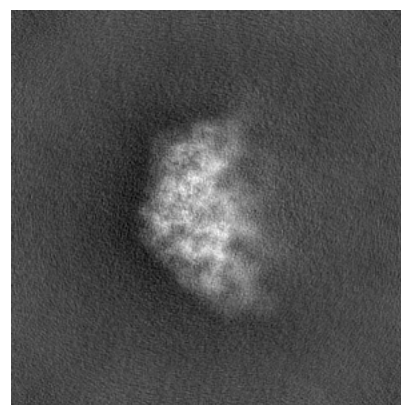
6.1.2 Raw map



X



Y

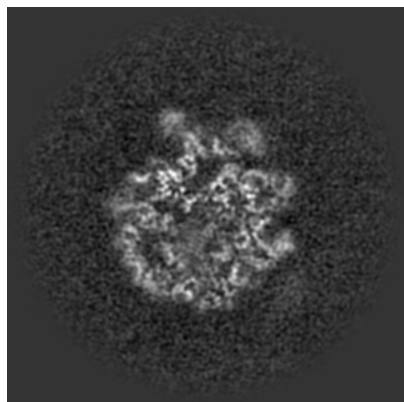


Z

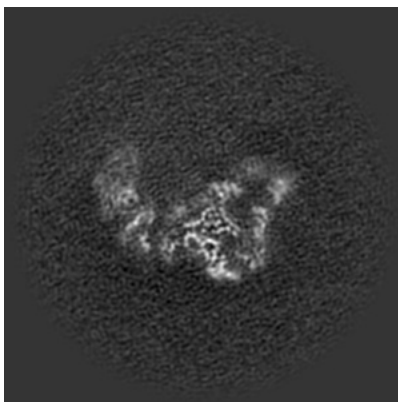
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

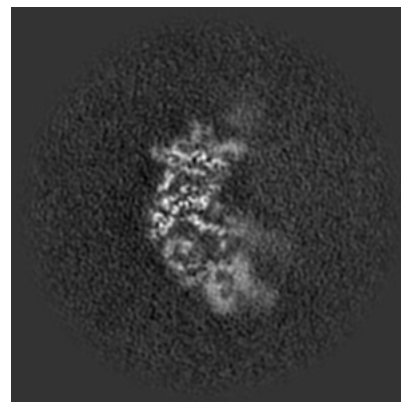
6.2.1 Primary map



X Index: 150

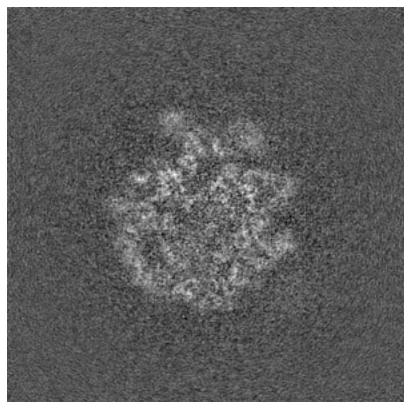


Y Index: 150

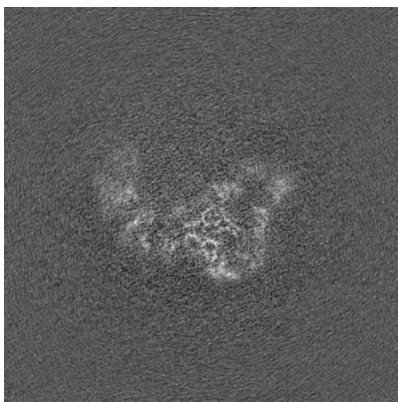


Z Index: 150

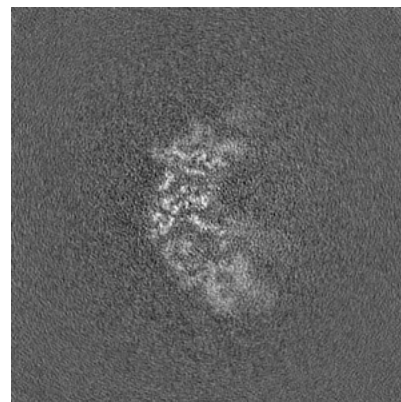
6.2.2 Raw map



X Index: 150



Y Index: 150

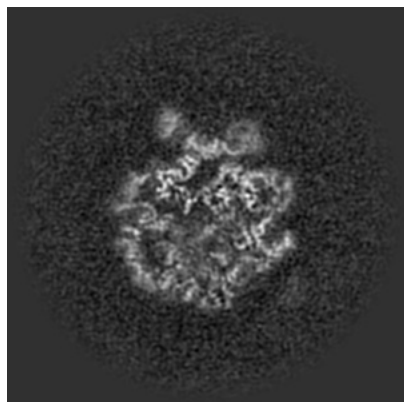


Z Index: 150

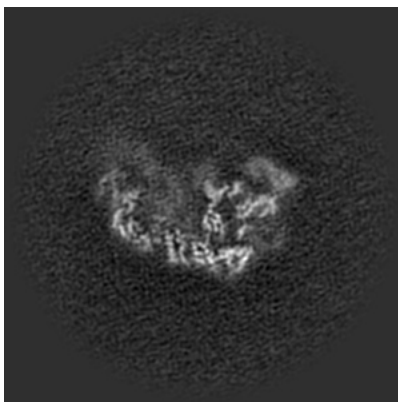
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

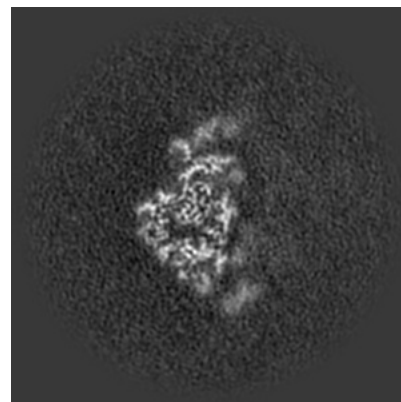
6.3.1 Primary map



X Index: 148

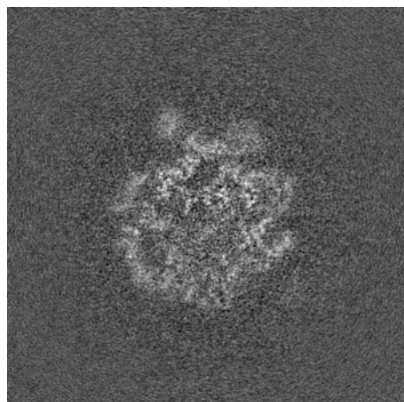


Y Index: 139

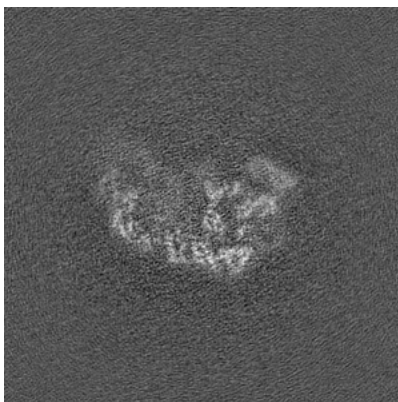


Z Index: 162

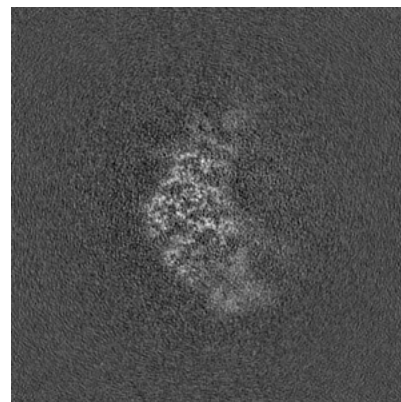
6.3.2 Raw map



X Index: 148



Y Index: 139

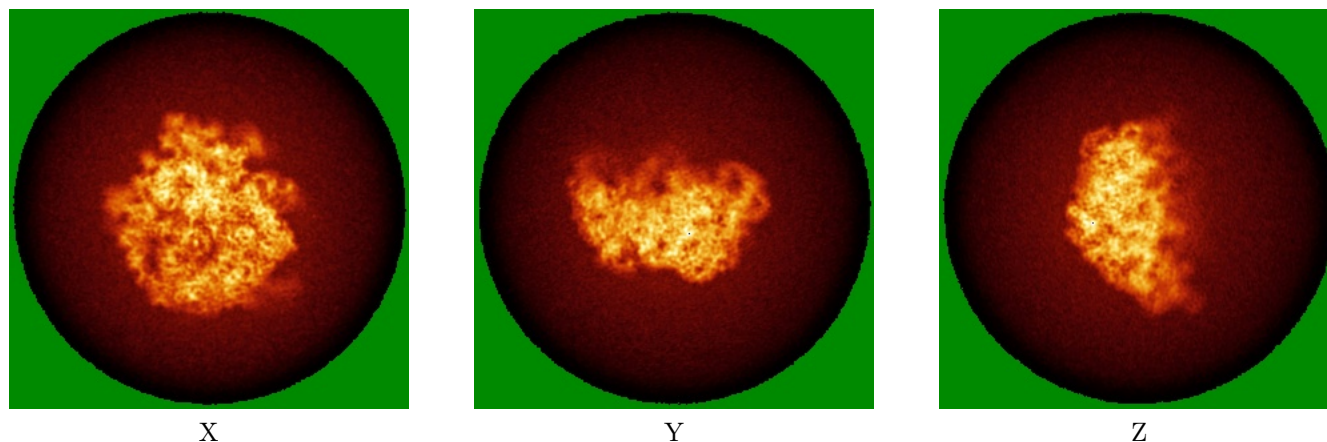


Z Index: 154

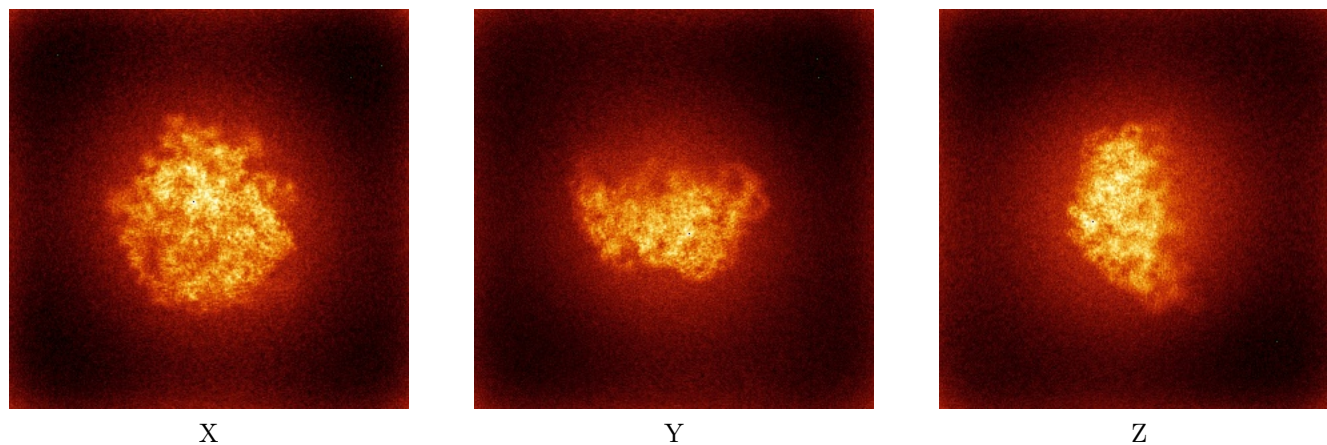
The images above show the largest variance slices of the map in three orthogonal directions.

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

6.4.1 Primary map



6.4.2 Raw map



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](#)

This section was not generated.

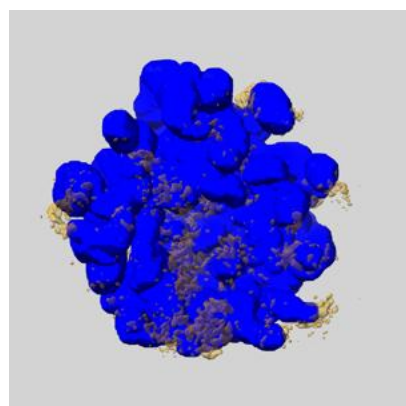
6.6 Mask visualisation [i](#)

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

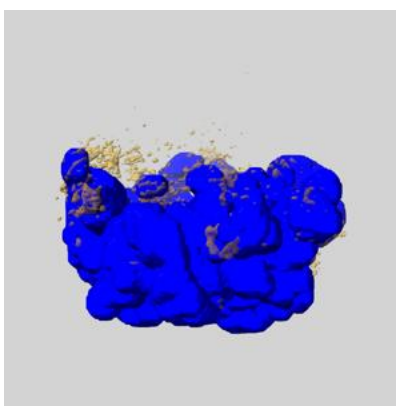
A mask typically either:

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

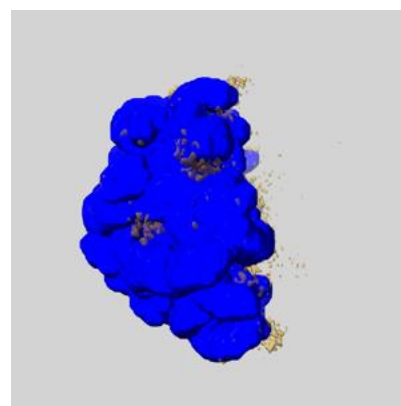
6.6.1 emd_16500_msk_1.map [i](#)



X



Y

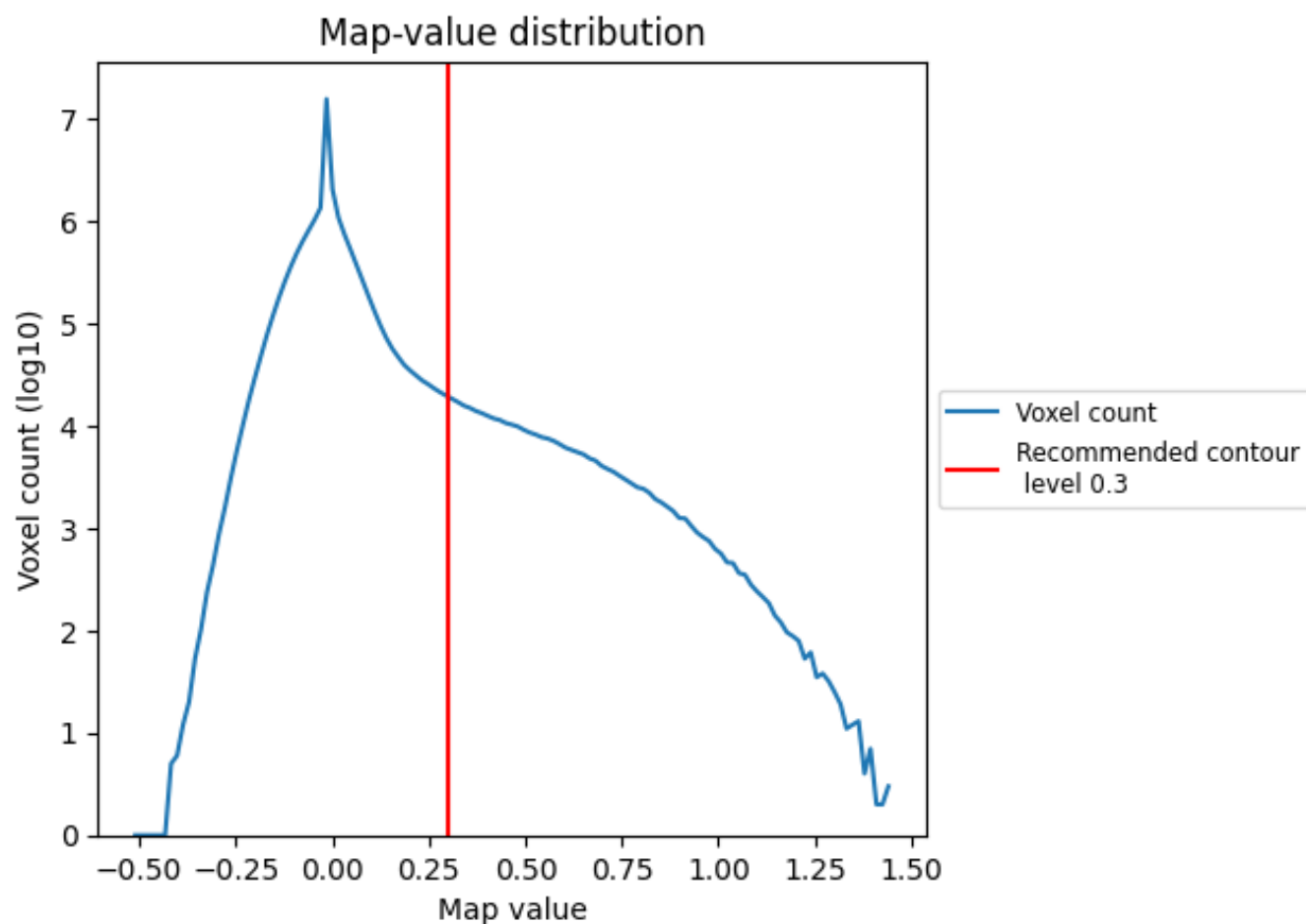


Z

7 Map analysis [i](#)

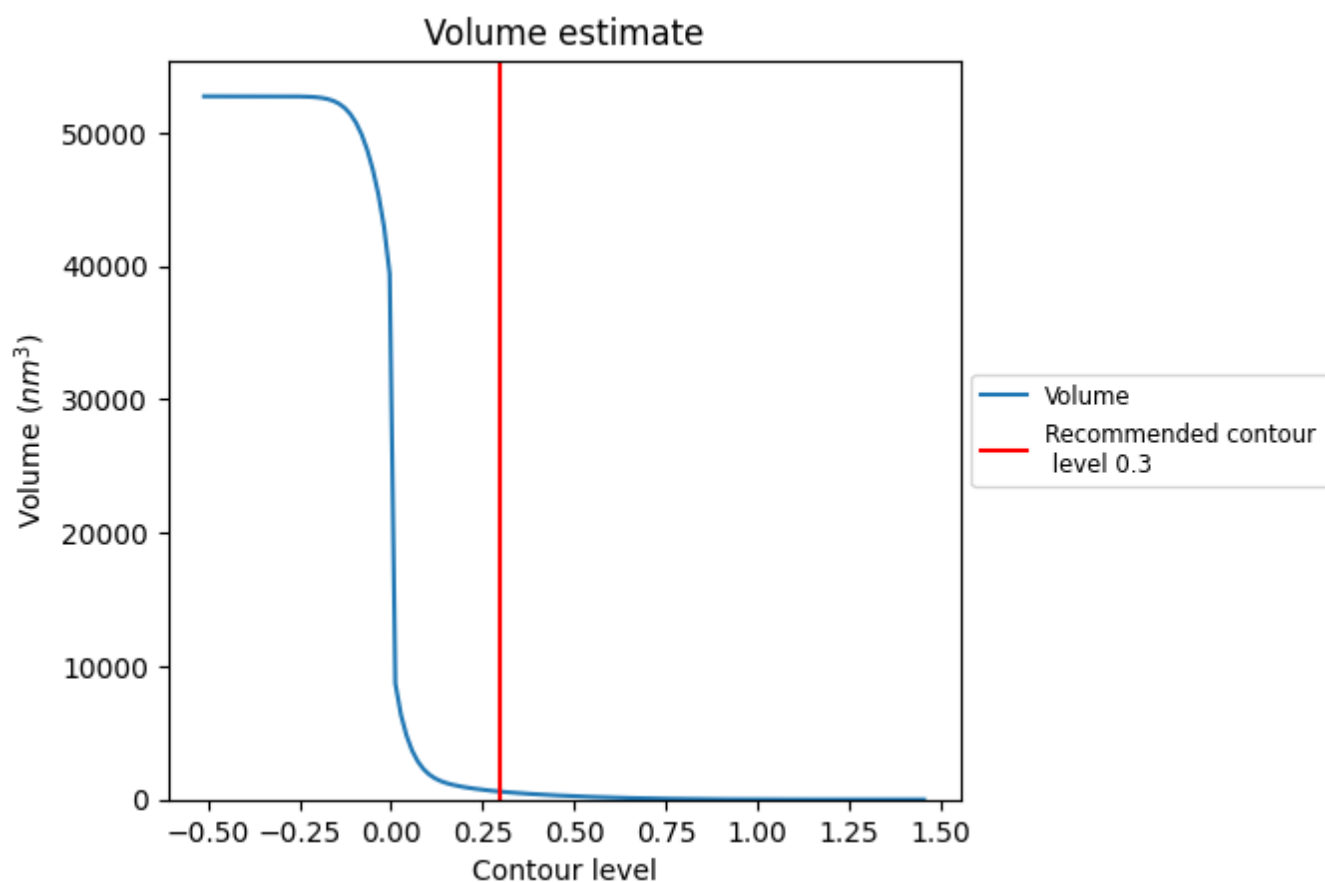
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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

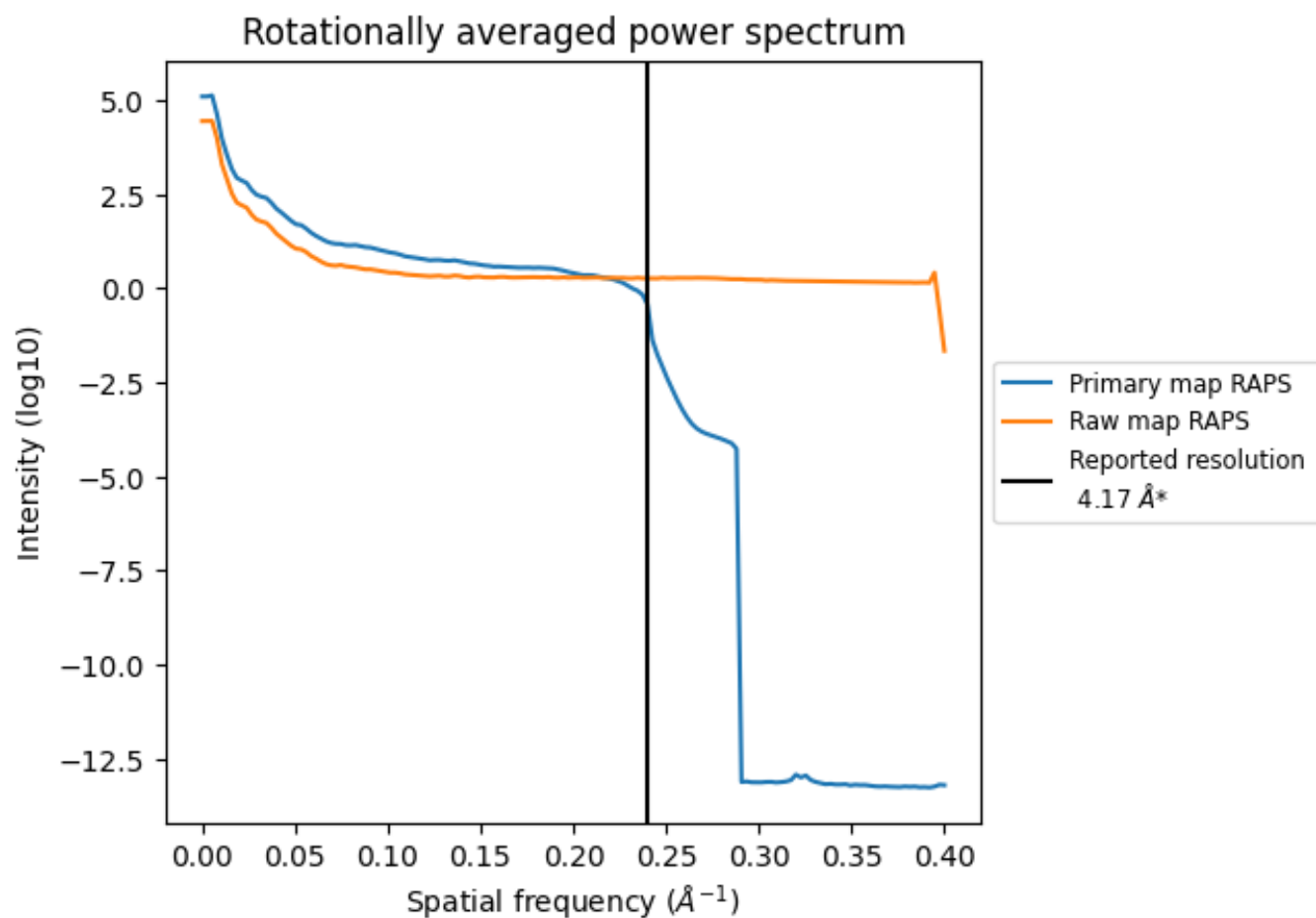
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 593 nm³; this corresponds to an approximate mass of 536 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 ⓘ

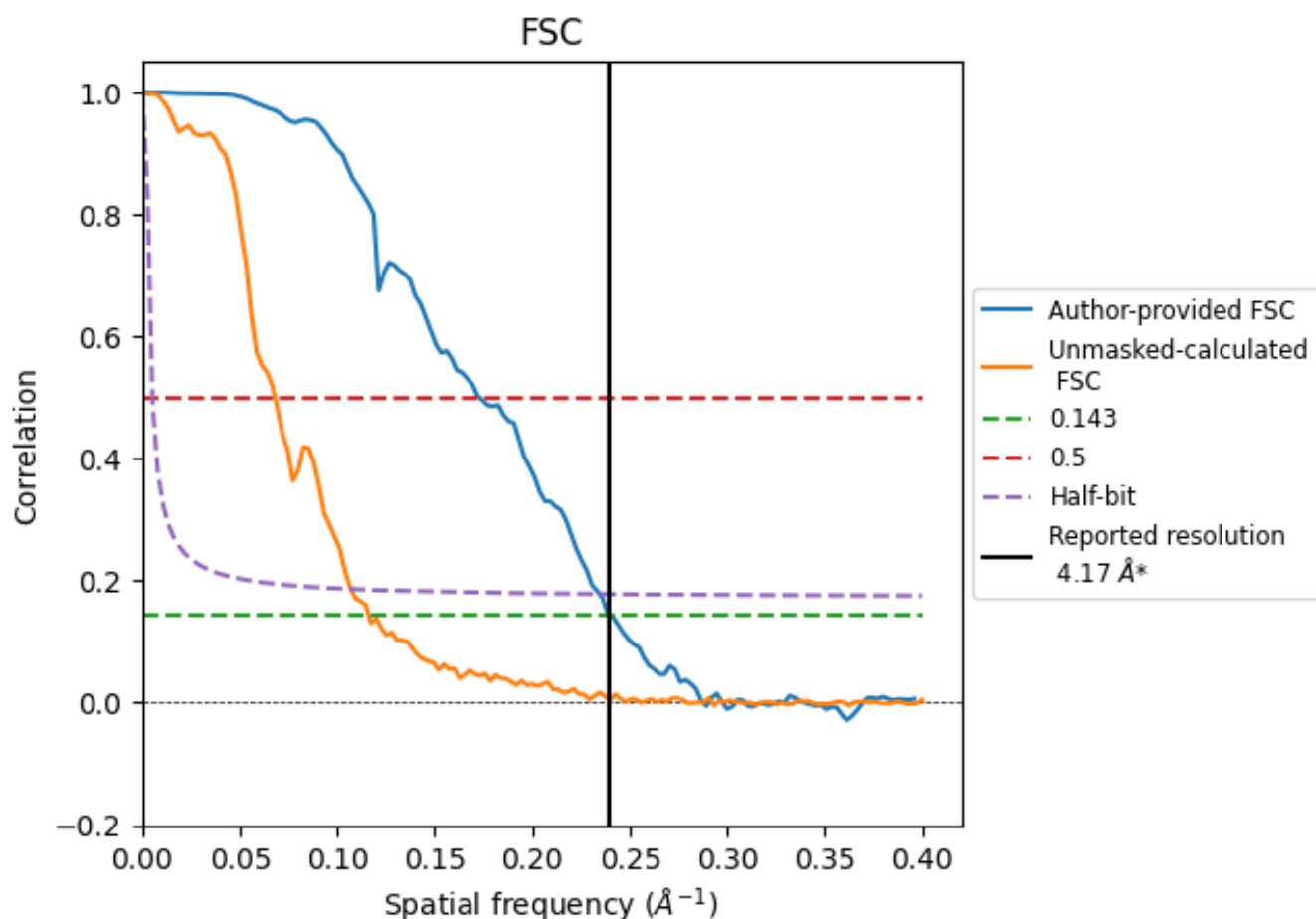


*Reported resolution corresponds to spatial frequency of 0.240 Å⁻¹

8 Fourier-Shell correlation [i](#)

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

8.1 FSC [i](#)



*Reported resolution corresponds to spatial frequency of 0.240 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

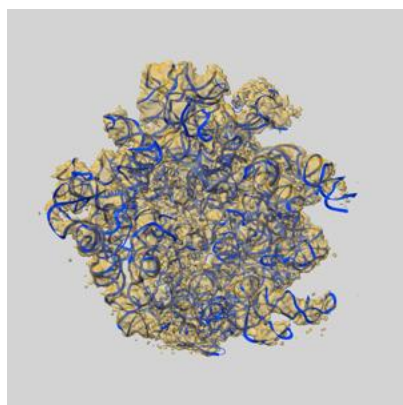
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	4.17	-	-
Author-provided FSC curve	4.16	5.78	4.26
Unmasked-calculated*	8.61	14.68	9.34

*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 8.61 differs from the reported value 4.17 by more than 10 %

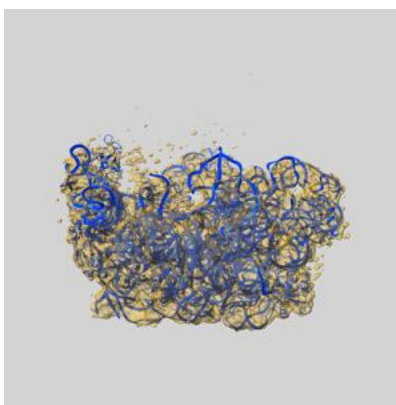
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-16500 and PDB model 8C93. Per-residue inclusion information can be found in section [3](#) on page [7](#).

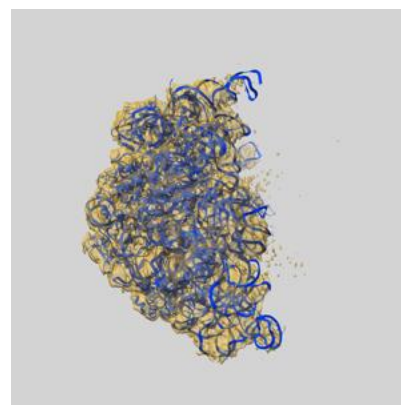
9.1 Map-model overlay [i](#)



X



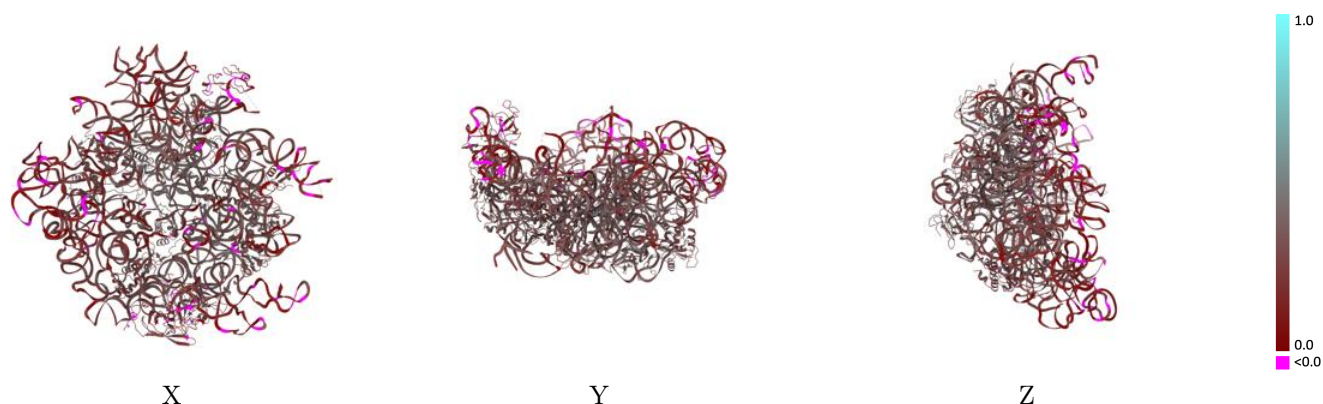
Y



Z

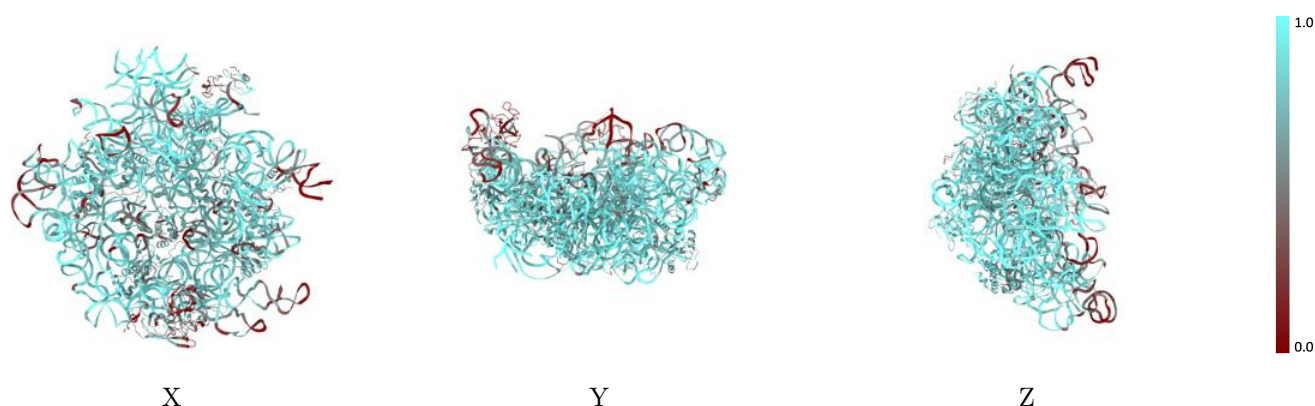
The images above show the 3D surface view of the map at the recommended contour level 0.3 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



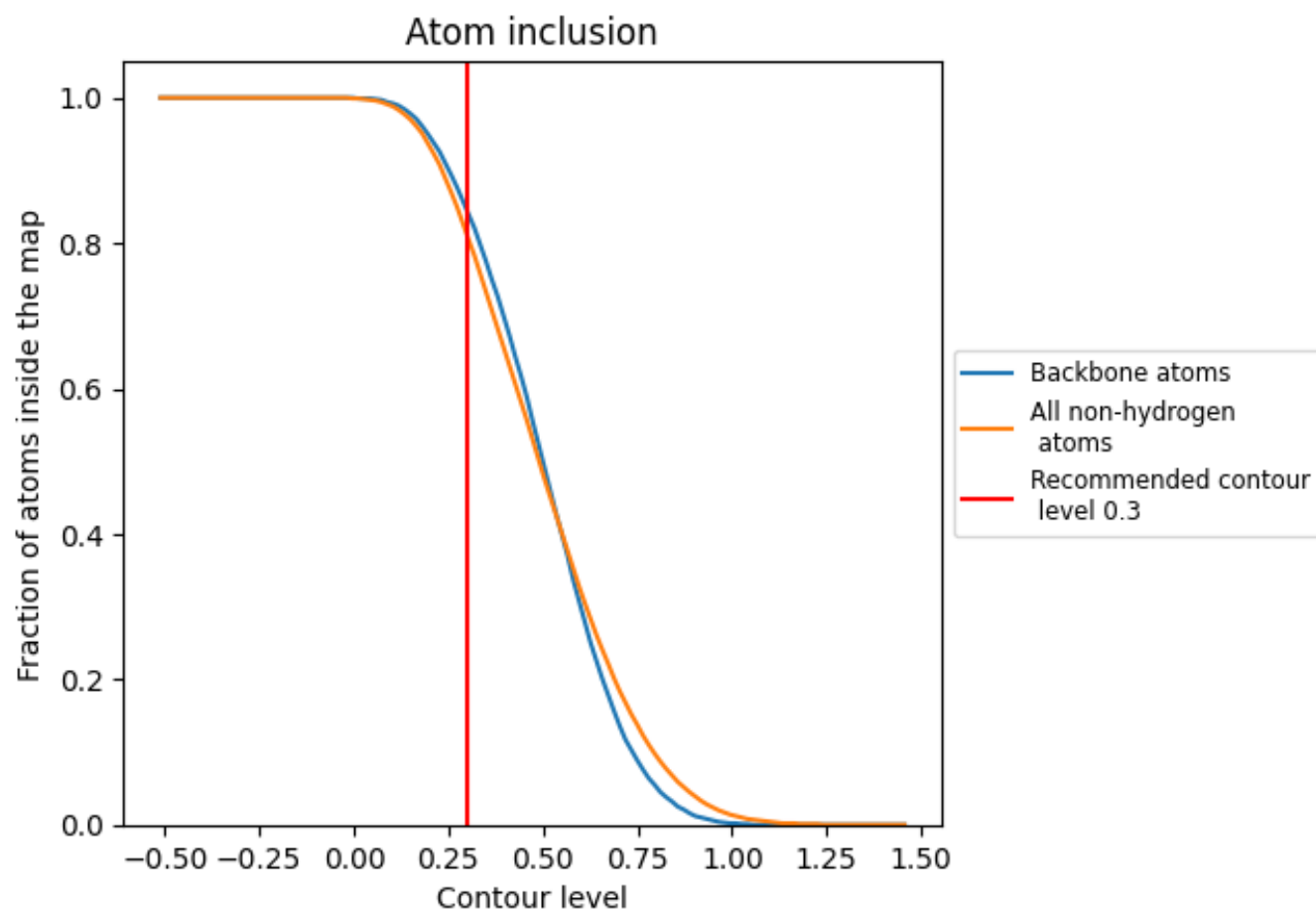
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

9.3 Atom inclusion mapped to coordinate model [i](#)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.3).

9.4 Atom inclusion [i](#)



At the recommended contour level, 84% of all backbone atoms, 81% 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 (0.3) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8100	 0.2720
0	 0.7370	 0.2930
2	 0.8100	 0.3420
A	 0.8430	 0.2630
D	 0.7870	 0.3390
E	 0.7950	 0.3310
J	 0.8270	 0.3310
K	 0.2060	 0.1630
L	 0.5410	 0.1620
N	 0.7600	 0.2640
P	 0.5460	 0.2500
Q	 0.8720	 0.3380
R	 0.8130	 0.3320
S	 0.7320	 0.3400
T	 0.6740	 0.3280
U	 0.8440	 0.3460
Y	 0.8090	 0.2700
Z	 0.6230	 0.2610

