



Full wwPDB EM Validation Report ⓘ

Mar 8, 2026 – 12:51 am GMT

PDB ID : 9T2J / pdb_00009t2j
EMDB ID : EMD-55467
Title : E. coli 70S ribosome from delta-9 strain, PTC class 0
Authors : Larsson, D.S.D.; Selmer, M.
Deposited on : 2025-10-23
Resolution : 2.02 Å(reported)
Based on initial model : 9T0Y

This is a Full wwPDB EM Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

EMDB validation analysis : 0.0.1.dev132
Mogul : 1.8.4, CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
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) : 2.48.1

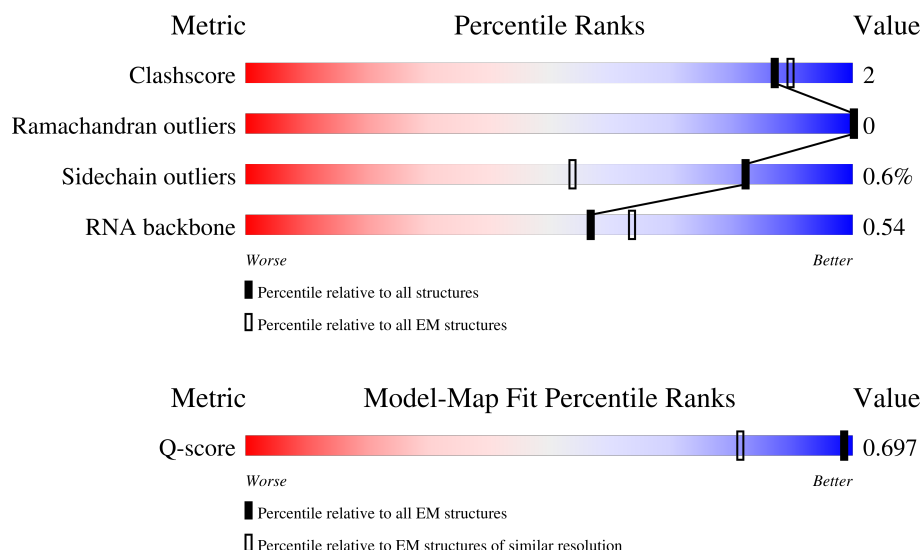
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

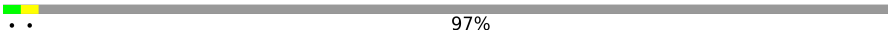
The reported resolution of this entry is 2.02 Å.

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	210492	15764	-
Ramachandran outliers	207382	16835	-
Sidechain outliers	206894	16415	-
RNA backbone	6643	2191	-
Q-score	-	25397	1728 (1.52 - 2.52)

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	 15% 5% 79%
2	b	120	 97%
3	c	273	 8% 90%

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Mol	Chain	Length	Quality of chain
4	d	209	 17% 79%
5	e	201	 10% 89%
6	i	142	 5% 94%
7	k	144	 18% 82%
8	l	136	 33% 64%
9	q	103	 7% 93%
10	r	110	 6% 94%
11	v	85	 8% 91%
12	z	57	 9% 5% 86%

2 Entry composition

There are 16 unique types of molecules in this entry. The entry contains 14602 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	596	Total	C	N	O	P	0	0
			12765	5705	2329	4135	596		

- Molecule 2 is a RNA chain called 5S rRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	b	4	Total	C	N	O	P	0	0
			80	36	10	30	4		

- Molecule 3 is a protein called Large ribosomal subunit protein uL2.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	c	26	Total	C	N	O	S	0	0
			191	116	41	33	1		

- Molecule 4 is a protein called Large ribosomal subunit protein uL3.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	d	43	Total	C	N	O	S	0	0
			333	206	68	58	1		

- Molecule 5 is a protein called Large ribosomal subunit protein uL4.

Mol	Chain	Residues	Atoms				AltConf	Trace
5	e	23	Total	C	N	O	0	0
			182	115	39	28		

- Molecule 6 is a protein called Large ribosomal subunit protein uL13.

Mol	Chain	Residues	Atoms				AltConf	Trace
6	i	8	Total	C	N	O	0	0
			55	34	12	9		

- Molecule 7 is a protein called Large ribosomal subunit protein uL15.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	k	26	Total	C	N	O	S	0	0
			182	106	42	33	1		

- Molecule 8 is a protein called Large ribosomal subunit protein uL16.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	l	49	Total	C	N	O	S	0	0
			395	248	83	61	3		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
l	82	MS6	MET	conflict	UNP A7ZSK2

- Molecule 9 is a protein called Large ribosomal subunit protein bL21.

Mol	Chain	Residues	Atoms				AltConf	Trace
9	q	7	Total	C	N	O	0	0
			75	48	19	8		

- Molecule 10 is a protein called Large ribosomal subunit protein uL22.

Mol	Chain	Residues	Atoms				AltConf	Trace
10	r	7	Total	C	N	O	0	0
			53	30	14	9		

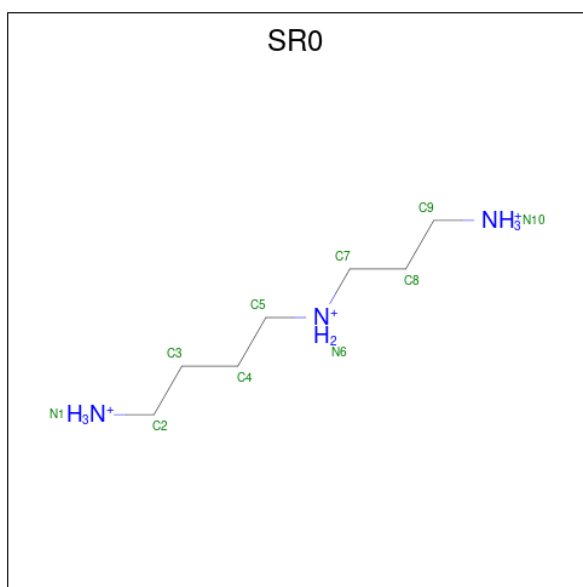
- Molecule 11 is a protein called Large ribosomal subunit protein bL27.

Mol	Chain	Residues	Atoms				AltConf	Trace
11	v	8	Total	C	N	O	0	0
			64	34	15	15		

- Molecule 12 is a protein called Large ribosomal subunit protein bL32.

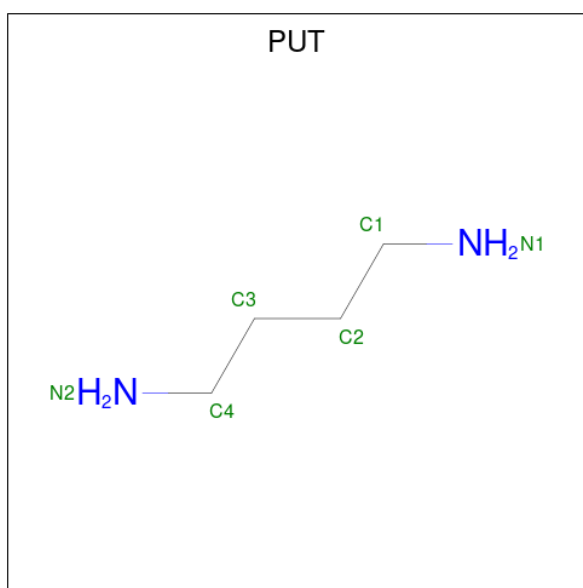
Mol	Chain	Residues	Atoms				AltConf	Trace
12	z	8	Total	C	N	O	0	0
			61	37	12	12		

- Molecule 13 is N 1 -(3-azaniumylpropyl)butane-1,4-diaminium (CCD ID: SR0) (formula: C₇H₂₂N₃).



Mol	Chain	Residues	Atoms			AltConf
13	a	1	Total	C	N	0
			10	7	3	
13	a	1	Total	C	N	0
			10	7	3	

- Molecule 14 is 1,4-DIAMINOBTANE (CCD ID: PUT) (formula: $C_4H_{12}N_2$).



Mol	Chain	Residues	Atoms			AltConf
14	a	1	Total	C	N	0
			6	4	2	

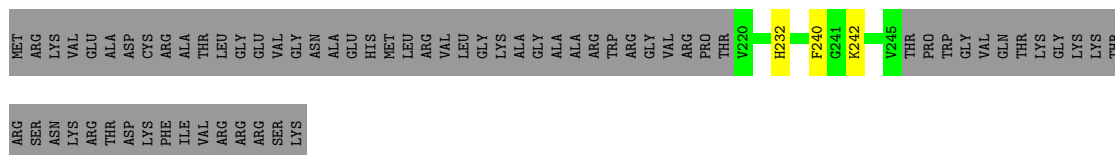
- Molecule 15 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
15	a	100	Total 100	Mg 100	0
15	d	1	Total 1	Mg 1	0

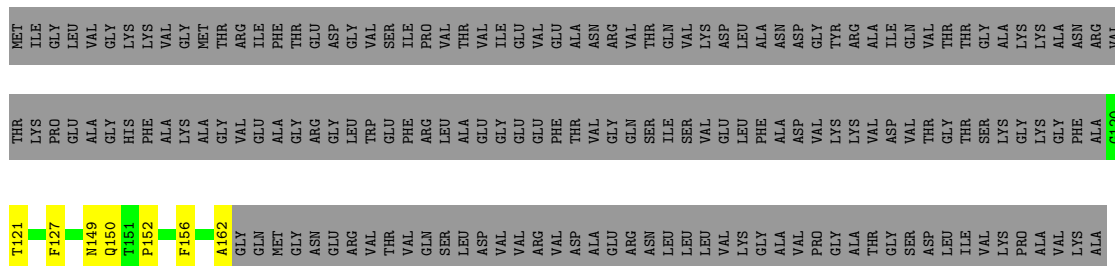
- Molecule 16 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms		AltConf
16	a	38	Total 38	K 38	0
16	e	1	Total 1	K 1	0

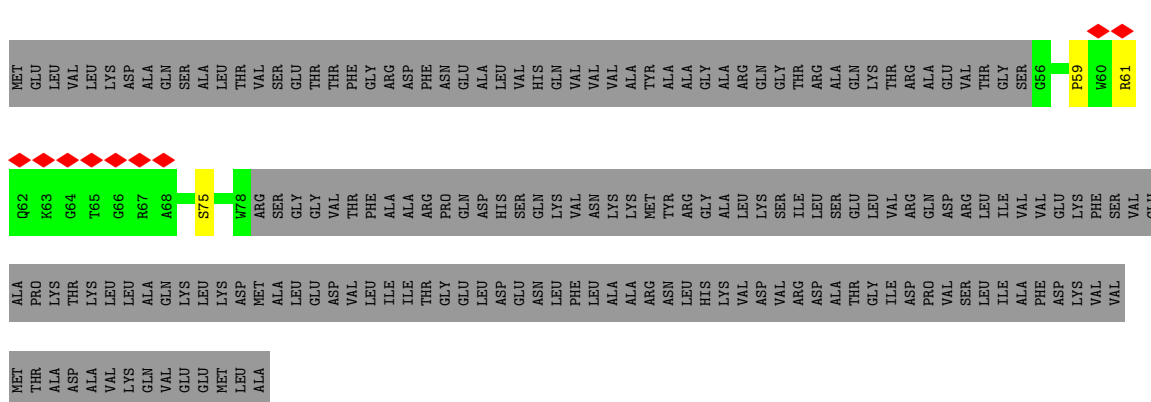




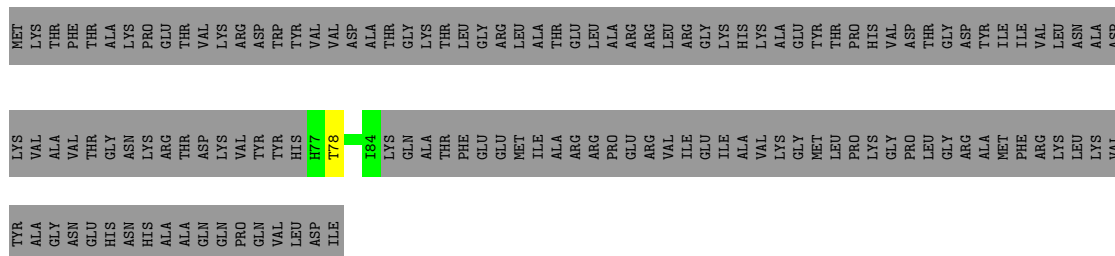
- Molecule 4: Large ribosomal subunit protein uL3



- Molecule 5: Large ribosomal subunit protein uL4

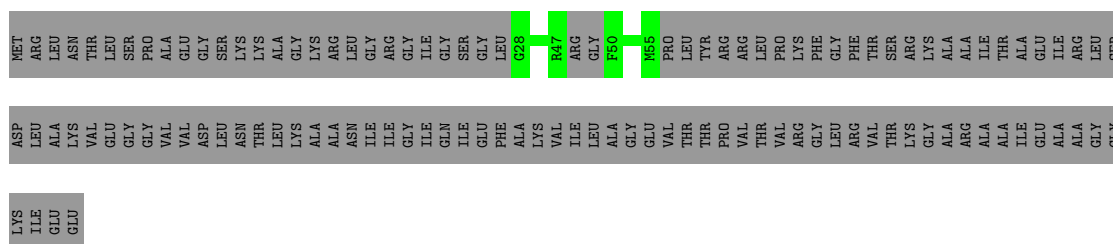


- Molecule 6: Large ribosomal subunit protein uL13



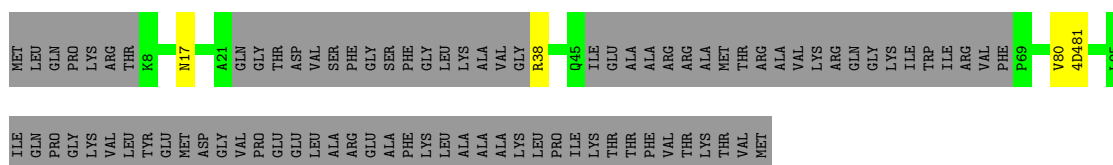
- Molecule 7: Large ribosomal subunit protein uL15





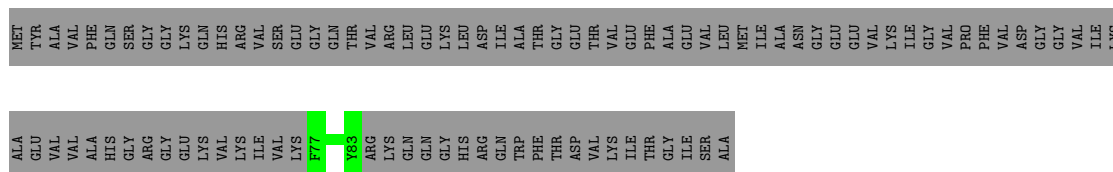
- Molecule 8: Large ribosomal subunit protein uL16

Chain l: 33% 64%



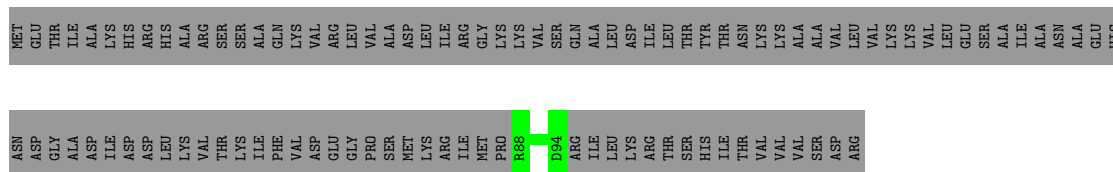
- Molecule 9: Large ribosomal subunit protein bL21

Chain q: 7% 93%



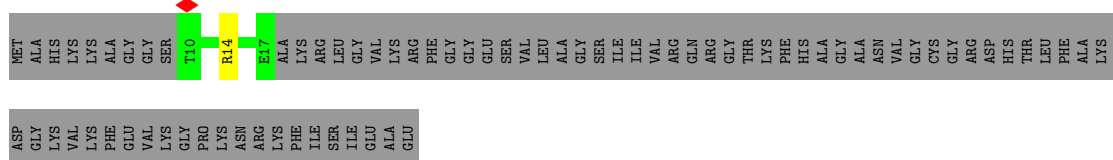
- Molecule 10: Large ribosomal subunit protein uL22

Chain r: 6% 94%



- Molecule 11: Large ribosomal subunit protein bL27

Chain v: 8% 91%



- Molecule 12: Large ribosomal subunit protein bL32

Chain z: 9% 86%

MET	A2	V3	Q4	P8	T9	ARG	SER	LYS	ARG	GLY	MET	ARG	ARG	SER	SER	HIS	ASP	ALA	LEU	THR	ALA	VAL	THR	SER	LEU	SER	VAL	ASP	LYS	THR	SER	GLY	GLU	LYS	HIS	LEU	ARG	HIS	HIS	ILE	THR	ALA	ASP	GLY	TYR	TYR	ARG	GLY	ARG	LYS	VAL	ILE	ALA	LYS
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4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	107941	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	30.0	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	1500	Depositor
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	3.883	Depositor
Minimum map value	-0.819	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.112	Depositor
Recommended contour level	0.4	Depositor
Map size (Å)	420.608, 420.608, 420.608	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.8215, 0.8215, 0.8215	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MG, PUT, SR0, 6MZ, 1MG, K, H2U, 4D4, MEQ, PSU, OMU, 5MC, 5MU, MS6

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	0.52	1/14044 (0.0%)	1.00	31/21811 (0.1%)
2	b	0.62	0/87	0.89	0/132
3	c	0.71	0/197	0.92	0/265
4	d	0.65	0/329	1.03	1/438 (0.2%)
5	e	0.73	0/187	1.09	1/248 (0.4%)
6	i	0.64	0/56	1.17	1/74 (1.4%)
7	k	0.67	0/182	1.11	0/232
8	l	0.59	0/379	1.01	0/498
9	q	0.69	0/77	1.05	0/99
10	r	0.70	0/52	0.94	0/66
11	v	0.70	0/63	1.17	0/82
12	z	0.69	0/61	1.10	0/82
All	All	0.54	1/15714 (0.0%)	1.00	34/24027 (0.1%)

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
11	v	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	a	2552	OMU	O3'-P	5.14	1.61	1.56

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	a	980	A	O3'-P-O5'	-15.53	80.70	104.00
1	a	980	A	C4'-C3'-O3'	11.22	129.83	113.00
1	a	1971	U	O3'-P-O5'	-10.69	87.97	104.00
1	a	2278	A	O3'-P-O5'	-7.62	92.57	104.00
5	e	75	SER	O-C-N	-7.59	113.90	121.27
1	a	781	A	O3'-P-O5'	-7.55	92.67	104.00
1	a	1902	C	O3'-P-O5'	-7.36	92.96	104.00
1	a	2504	U	O3'-P-O5'	-7.28	93.07	104.00
1	a	811	U	C2'-C3'-O3'	7.22	120.33	109.50
1	a	1974	C	O3'-P-O5'	-6.92	93.63	104.00
1	a	676	A	O3'-P-O5'	-6.83	93.76	104.00
1	a	2429	G	O3'-P-O5'	-6.57	94.15	104.00
1	a	2050	C	O3'-P-O5'	-6.45	94.33	104.00
1	a	2051	A	O3'-P-O5'	-6.39	94.42	104.00
1	a	2048	G	O3'-P-O5'	-6.11	94.83	104.00
1	a	982	C	C2'-C3'-O3'	-6.08	104.58	113.70
1	a	674	G	O3'-P-O5'	-6.04	94.95	104.00
1	a	980	A	C2'-C3'-O3'	-5.76	105.06	113.70
1	a	1960	A	C4'-C3'-O3'	-5.71	104.43	113.00
1	a	2279	G	O3'-P-O5'	-5.67	95.49	104.00
1	a	1959	G	O3'-P-O5'	-5.65	95.52	104.00
1	a	1969	A	O3'-P-O5'	-5.59	95.61	104.00
1	a	1971	U	C2'-C3'-O3'	-5.56	105.36	113.70
1	a	1936	A	O4'-C1'-C2'	-5.50	100.30	105.80
1	a	980	A	P-O3'-C3'	5.46	128.39	120.20
1	a	972	A	O3'-P-O5'	-5.38	95.93	104.00
1	a	1785	A	O3'-P-O5'	-5.36	95.96	104.00
1	a	2428	G	C2'-C3'-O3'	-5.29	105.76	113.70
1	a	2019	A	O3'-P-O5'	-5.29	96.07	104.00
1	a	1929	G	O3'-P-O5'	-5.12	96.32	104.00
6	i	78	THR	CA-CB-OG1	-5.09	101.96	109.60
1	a	2022	U	O3'-P-O5'	-5.08	96.38	104.00
1	a	1254	A	C4'-C3'-O3'	-5.06	105.41	113.00
4	d	162	ALA	CA-C-O	-5.01	112.28	120.80

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
11	v	14	ARG	Sidechain

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	12765	0	6465	36	0
2	b	80	0	43	0	0
3	c	191	0	177	2	0
4	d	333	0	336	4	0
5	e	182	0	193	1	0
6	i	55	0	51	0	0
7	k	182	0	179	0	0
8	l	395	0	412	1	0
9	q	75	0	76	0	0
10	r	53	0	55	0	0
11	v	64	0	56	0	0
12	z	61	0	62	3	0
13	a	20	0	0	0	0
14	a	6	0	12	0	0
15	a	100	0	0	0	0
15	d	1	0	0	0	0
16	a	38	0	0	0	0
16	e	1	0	0	0	0
All	All	14602	0	8117	43	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 (43) 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:e:59:PRO:HG2	5:e:61:ARG:HE	1.58	0.67
3:c:232:HIS:HA	3:c:242:LYS:HD2	1.78	0.65
1:a:568:U:H1'	1:a:2030:6MZ:H9C1	1.80	0.62
1:a:2547:A:H2'	1:a:2548:U:C6	2.38	0.57
1:a:2020:A:H5'	12:z:9:THR:CG2	2.37	0.54
1:a:2273:A:H2'	1:a:2274:A:C8	2.43	0.53
1:a:2504:U:O4	1:a:2609:U:H3'	2.08	0.52
1:a:1028:A:N6	1:a:1125:G:H2'	2.24	0.52
1:a:1939:5MU:OP1	1:a:2604:U:O2'	2.28	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:a:2254:C:H6	1:a:2254:C:O5'	1.97	0.48
8:l:17:ASN:O	8:l:38:ARG:HD3	2.13	0.48
4:d:121:THR:HB	4:d:127:PHE:CD2	2.49	0.48
3:c:240:PHE:O	3:c:242:LYS:HE3	2.15	0.47
4:d:149:ASN:OD1	4:d:150:MEQ:N	2.47	0.47
1:a:2461:A:H2'	1:a:2462:C:C6	2.49	0.47
1:a:2032:G:C8	4:d:150:MEQ:HE3	2.48	0.47
1:a:1028:A:H2'	1:a:1029:A:C8	2.50	0.47
1:a:2461:A:H1'	1:a:2492:U:C2	2.51	0.46
1:a:2554:U:H2'	1:a:2555:U:C6	2.50	0.46
1:a:2243:U:H2'	1:a:2244:U:C6	2.51	0.46
1:a:2615:U:C2	12:z:4:GLN:HA	2.51	0.46
1:a:2567:G:H2'	1:a:2568:U:C6	2.51	0.46
1:a:2557:G:H2'	1:a:2558:C:C6	2.51	0.46
1:a:1840:G:C6	1:a:1841:U:C4	3.05	0.45
1:a:1942:C:H3'	1:a:1943:U:H2'	1.99	0.45
1:a:2063:C:H2'	1:a:2064:C:C6	2.51	0.45
1:a:2251:G:H5'	1:a:2449:H2U:H52	1.98	0.44
1:a:2537:U:H2'	1:a:2538:C:C6	2.53	0.44
1:a:984:A:H2'	1:a:984:A:N3	2.34	0.43
1:a:2446:G:H2'	1:a:2447:G:O4'	2.19	0.42
1:a:2430:A:H2'	1:a:2430:A:N3	2.34	0.42
1:a:1980:G:O2'	1:a:1982:U:OP2	2.32	0.42
1:a:2061:G:N3	1:a:2061:G:H2'	2.35	0.41
1:a:2038:G:H2'	1:a:2039:U:O4'	2.19	0.41
1:a:1263:U:O2'	12:z:8:PRO:HD2	2.20	0.41
1:a:2016:U:H2'	1:a:2017:U:C6	2.56	0.41
1:a:2064:C:H2'	1:a:2065:C:C6	2.56	0.41
1:a:948:C:H1'	1:a:984:A:C8	2.56	0.41
1:a:2070:A:H2'	1:a:2071:A:O4'	2.21	0.41
1:a:2447:G:H22	1:a:2450:A:H62	1.69	0.41
1:a:2238:G:N3	1:a:2238:G:H2'	2.36	0.40
1:a:576:U:H2'	1:a:577:G:C8	2.57	0.40
4:d:152:PRO:HG3	4:d:156:PHE:CZ	2.56	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	c	24/273 (9%)	23 (96%)	1 (4%)	0	100	100
4	d	40/209 (19%)	36 (90%)	4 (10%)	0	100	100
5	e	21/201 (10%)	20 (95%)	1 (5%)	0	100	100
6	i	6/142 (4%)	6 (100%)	0	0	100	100
7	k	22/144 (15%)	20 (91%)	2 (9%)	0	100	100
8	l	41/136 (30%)	40 (98%)	1 (2%)	0	100	100
9	q	5/103 (5%)	5 (100%)	0	0	100	100
10	r	5/110 (4%)	5 (100%)	0	0	100	100
11	v	6/85 (7%)	5 (83%)	1 (17%)	0	100	100
12	z	6/57 (10%)	6 (100%)	0	0	100	100
All	All	176/1460 (12%)	166 (94%)	10 (6%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	c	19/218 (9%)	19 (100%)	0	100	100
4	d	34/163 (21%)	34 (100%)	0	100	100
5	e	18/165 (11%)	18 (100%)	0	100	100
6	i	5/116 (4%)	5 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
7	k	16/103 (16%)	16 (100%)	0	100	100
8	l	37/107 (35%)	36 (97%)	1 (3%)	40	40
9	q	7/84 (8%)	7 (100%)	0	100	100
10	r	4/93 (4%)	4 (100%)	0	100	100
11	v	7/63 (11%)	7 (100%)	0	100	100
12	z	7/48 (15%)	7 (100%)	0	100	100
All	All	154/1160 (13%)	153 (99%)	1 (1%)	82	88

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

Mol	Chain	Res	Type
8	l	80	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
7	k	54	GLN
8	l	13	HIS
12	z	6	ASN

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	a	560/2904 (19%)	85 (15%)	0
2	b	3/120 (2%)	2 (66%)	0
All	All	563/3024 (18%)	87 (15%)	0

All (87) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	a	196	A
1	a	199	A
1	a	531	C
1	a	532	A
1	a	563	A
1	a	573	U
1	a	575	A

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Mol	Chain	Res	Type
1	a	747	5MU
1	a	776	G
1	a	777	G
1	a	782	A
1	a	784	G
1	a	785	G
1	a	792	A
1	a	805	G
1	a	827	U
1	a	828	U
1	a	946	C
1	a	961	C
1	a	962	G
1	a	974	G
1	a	981	A
1	a	983	A
1	a	984	A
1	a	985	C
1	a	1026	G
1	a	1132	U
1	a	1133	A
1	a	1135	C
1	a	1253	A
1	a	1256	G
1	a	1674	G
1	a	1773	A
1	a	1782	U
1	a	1929	G
1	a	1930	G
1	a	1937	A
1	a	1938	A
1	a	1955	U
1	a	1967	C
1	a	1970	A
1	a	1971	U
1	a	1972	G
1	a	1993	U
1	a	2023	C
1	a	2031	A
1	a	2033	A
1	a	2055	C
1	a	2056	G

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Mol	Chain	Res	Type
1	a	2059	A
1	a	2062	A
1	a	2069	G
1	a	2077	A
1	a	2239	G
1	a	2251	G
1	a	2425	A
1	a	2429	G
1	a	2430	A
1	a	2431	U
1	a	2435	A
1	a	2441	U
1	a	2447	G
1	a	2448	A
1	a	2449	H2U
1	a	2450	A
1	a	2459	A
1	a	2491	U
1	a	2494	G
1	a	2498	C
1	a	2499	C
1	a	2500	U
1	a	2502	G
1	a	2504	U
1	a	2505	G
1	a	2506	U
1	a	2507	C
1	a	2518	A
1	a	2547	A
1	a	2566	A
1	a	2567	G
1	a	2573	C
1	a	2585	U
1	a	2602	A
1	a	2609	U
1	a	2613	U
2	b	88	C
2	b	89	U

There are no RNA pucker outliers to report.

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

12 non-standard protein/DNA/RNA residues are modelled in this entry.

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
1	5MU	a	747	1	19,22,23	0.33	0	28,32,35	0.62	0
1	6MZ	a	2030	1	18,25,26	0.80	0	16,36,39	0.84	0
4	MEQ	d	150	4	8,9,10	0.59	0	5,10,12	1.11	0
1	5MC	a	1962	1,16	18,22,23	0.32	0	26,32,35	0.46	0
1	PSU	a	955	1	18,21,22	0.56	0	22,30,33	0.45	0
1	OMU	a	2552	15,1	19,22,23	0.40	0	26,31,34	0.36	0
1	PSU	a	746	15,1	18,21,22	0.36	0	22,30,33	0.47	0
1	5MU	a	1939	1,16	19,22,23	0.32	0	28,32,35	0.36	0
1	H2U	a	2449	1	18,21,22	0.39	0	21,30,33	0.58	0
8	MS6	l	82	8	5,7,8	0.29	0	2,7,9	0.09	0
1	1MG	a	745	1	18,26,27	1.20	2 (11%)	19,39,42	0.52	0
8	4D4	l	81	8	9,11,12	0.79	0	8,13,15	1.10	1 (12%)

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
1	5MU	a	747	1	-	0/7/25/26	0/2/2/2
1	6MZ	a	2030	1	-	1/5/27/28	0/3/3/3
4	MEQ	d	150	4	-	4/8/9/11	-
1	5MC	a	1962	1,16	-	2/7/25/26	0/2/2/2
1	PSU	a	955	1	-	0/7/25/26	0/2/2/2
1	OMU	a	2552	15,1	-	1/9/27/28	0/2/2/2
1	PSU	a	746	15,1	-	3/7/25/26	0/2/2/2
1	5MU	a	1939	1,16	-	0/7/25/26	0/2/2/2
1	H2U	a	2449	1	-	3/7/38/39	0/2/2/2
8	MS6	l	82	8	-	1/4/6/8	-
1	1MG	a	745	1	-	0/3/25/26	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
8	4D4	l	81	8	-	1/11/12/14	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	a	745	1MG	C5-C4	-3.30	1.34	1.43
1	a	745	1MG	C8-N7	-3.21	1.29	1.35

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	l	81	4D4	O-C-CA	-2.30	118.74	124.78

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	d	150	MEQ	C-CA-CB-CG
1	a	746	PSU	C2'-C1'-C5-C4
1	a	746	PSU	C2'-C1'-C5-C6
1	a	746	PSU	O4'-C1'-C5-C6
1	a	2449	H2U	C4'-C5'-O5'-P
1	a	2449	H2U	O4'-C4'-C5'-O5'
1	a	2449	H2U	C3'-C4'-C5'-O5'
4	d	150	MEQ	OE1-CD-CG-CB
4	d	150	MEQ	NE2-CD-CG-CB
8	l	82	MS6	CB-CG-SD-CE
1	a	1962	5MC	C2'-C1'-N1-C6
1	a	2552	OMU	C3'-C2'-O2'-CM2
1	a	1962	5MC	O4'-C1'-N1-C6
1	a	2030	6MZ	O4'-C4'-C5'-O5'
8	l	81	4D4	O-C-CA-CB
4	d	150	MEQ	N-CA-CB-CG

There are no ring outliers.

4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	a	2030	6MZ	1	0
4	d	150	MEQ	2	0
1	a	1939	5MU	1	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	a	2449	H2U	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 143 ligands modelled in this entry, 140 are monoatomic - leaving 3 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
13	SR0	a	3001	-	9,9,9	0.51	0	8,8,8	0.19	0
13	SR0	a	3002	-	9,9,9	0.54	0	8,8,8	0.58	0
14	PUT	a	3003	-	5,5,5	0.26	0	4,4,4	0.20	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
13	SR0	a	3001	-	-	3/7/7/7	-
13	SR0	a	3002	-	-	3/7/7/7	-
14	PUT	a	3003	-	-	0/3/3/3	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
13	a	3002	SR0	N6-C7-C8-C9
13	a	3002	SR0	C8-C7-N6-C5
13	a	3001	SR0	C7-C8-C9-N10
13	a	3002	SR0	C2-C3-C4-C5
13	a	3001	SR0	N1-C2-C3-C4
13	a	3001	SR0	C2-C3-C4-C5

There are no ring outliers.

No monomer is involved in short contacts.

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.

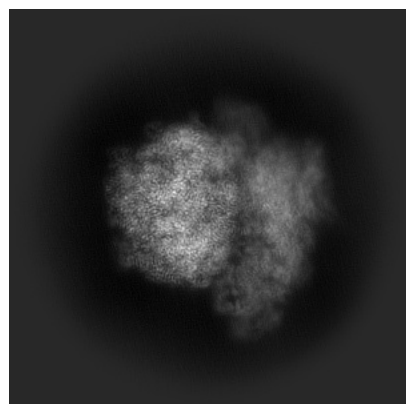
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-55467. These allow visual inspection of the internal detail of the map and identification of artifacts.

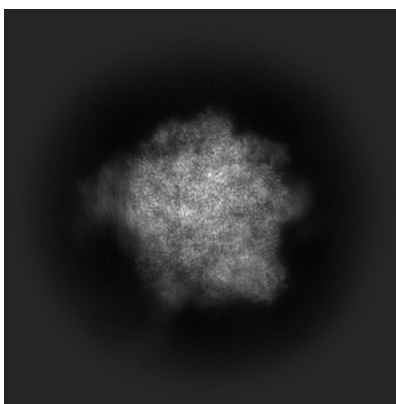
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

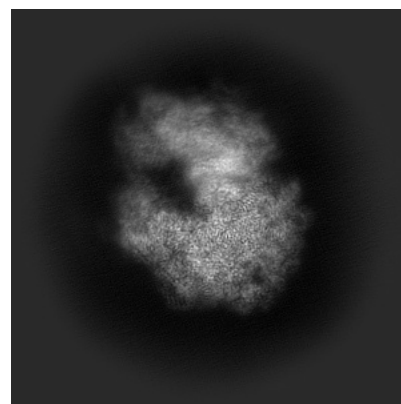
6.1.1 Primary map



X

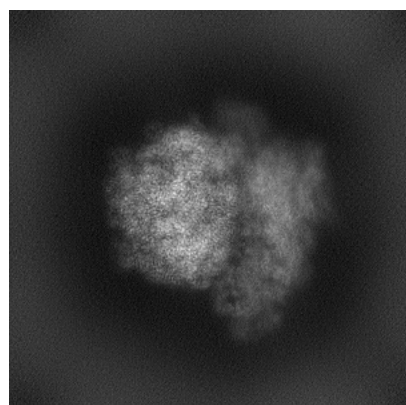


Y

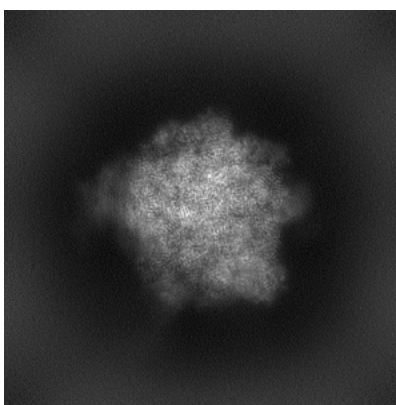


Z

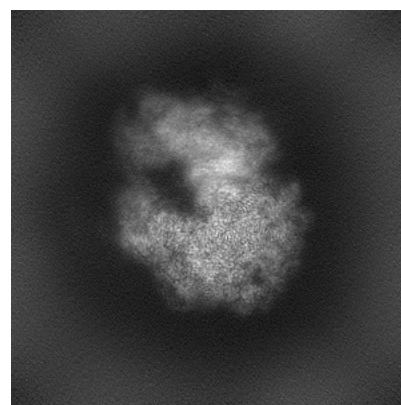
6.1.2 Raw map



X



Y

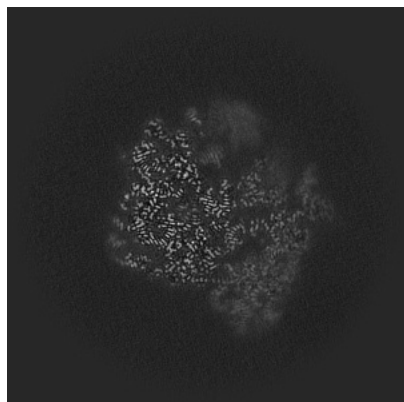


Z

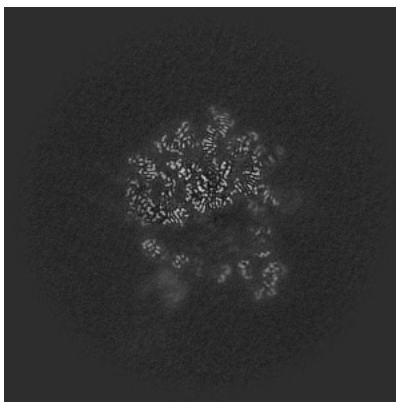
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

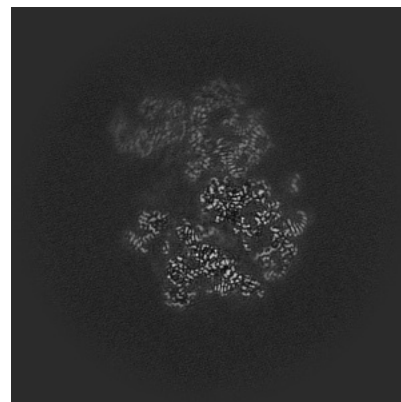
6.2.1 Primary map



X Index: 256

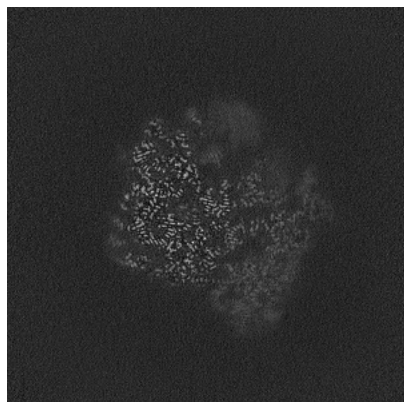


Y Index: 256

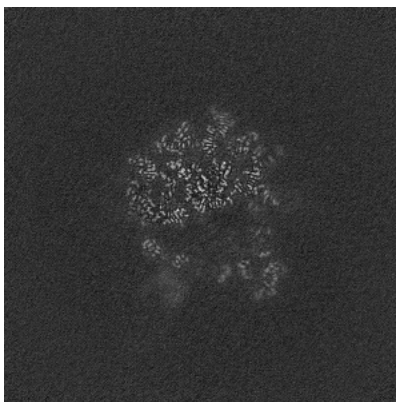


Z Index: 256

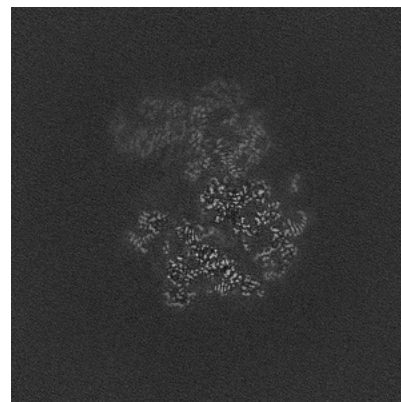
6.2.2 Raw map



X Index: 256



Y Index: 256

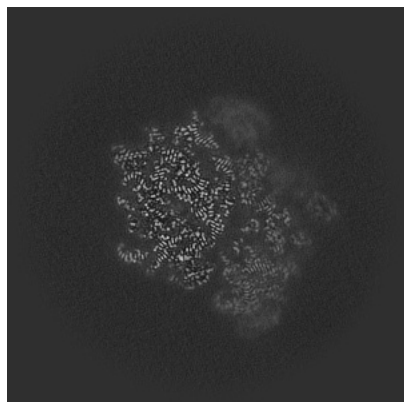


Z Index: 256

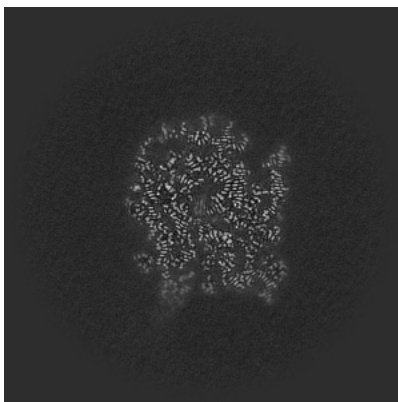
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

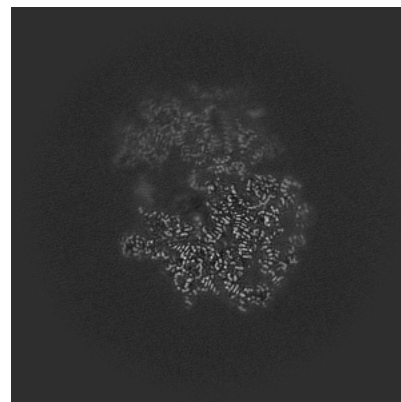
6.3.1 Primary map



X Index: 267

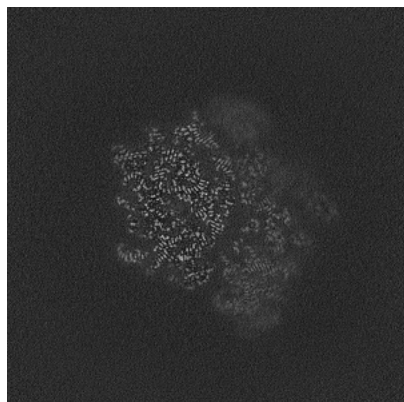


Y Index: 221

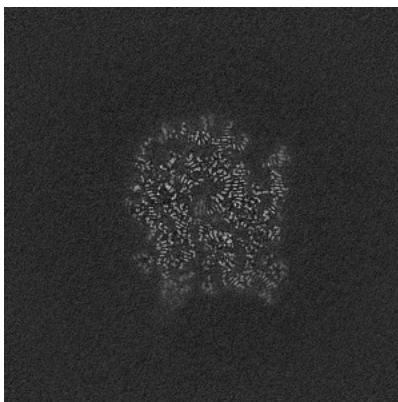


Z Index: 270

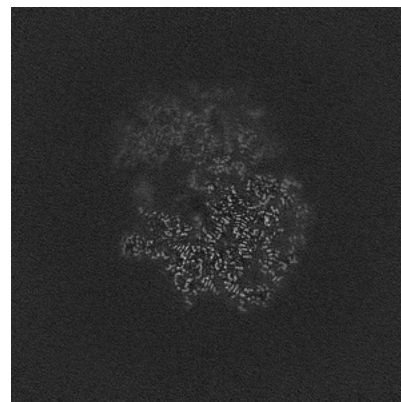
6.3.2 Raw map



X Index: 267



Y Index: 221

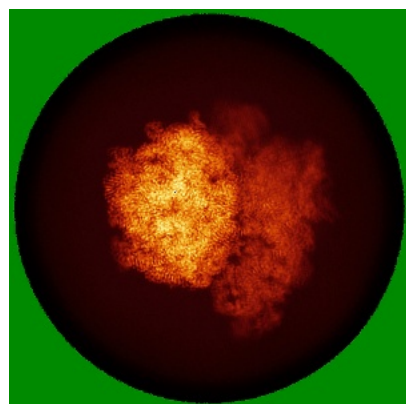


Z Index: 270

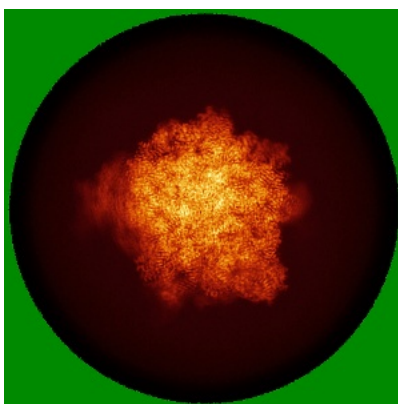
The images above show the largest variance slices of the map in three orthogonal directions.

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

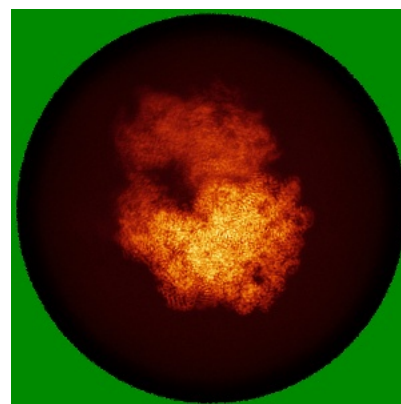
6.4.1 Primary map



X

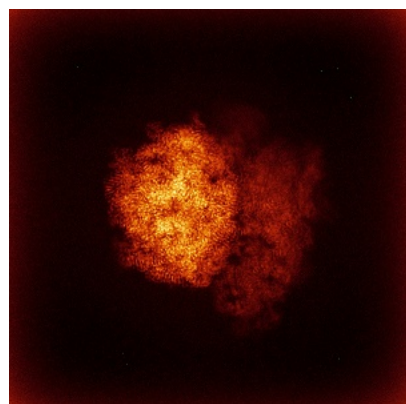


Y

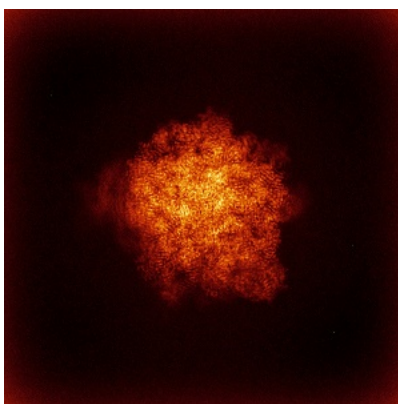


Z

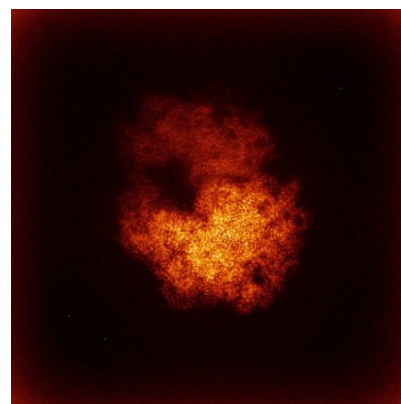
6.4.2 Raw map



X



Y

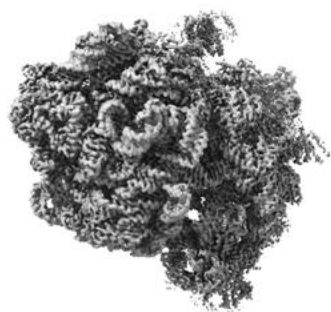


Z

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



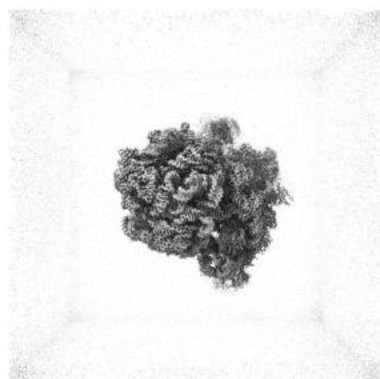
Y



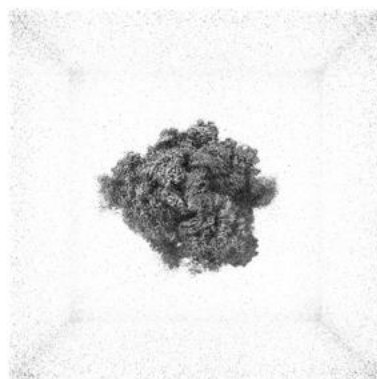
Z

The images above show the 3D surface view of the map at the recommended contour level 0.4. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

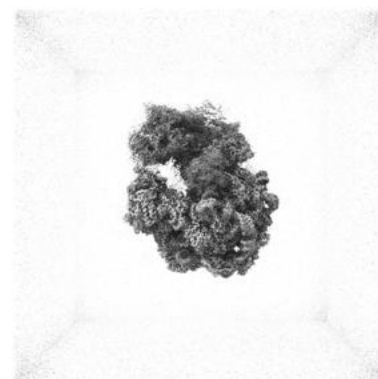
6.5.2 Raw map



X



Y



Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

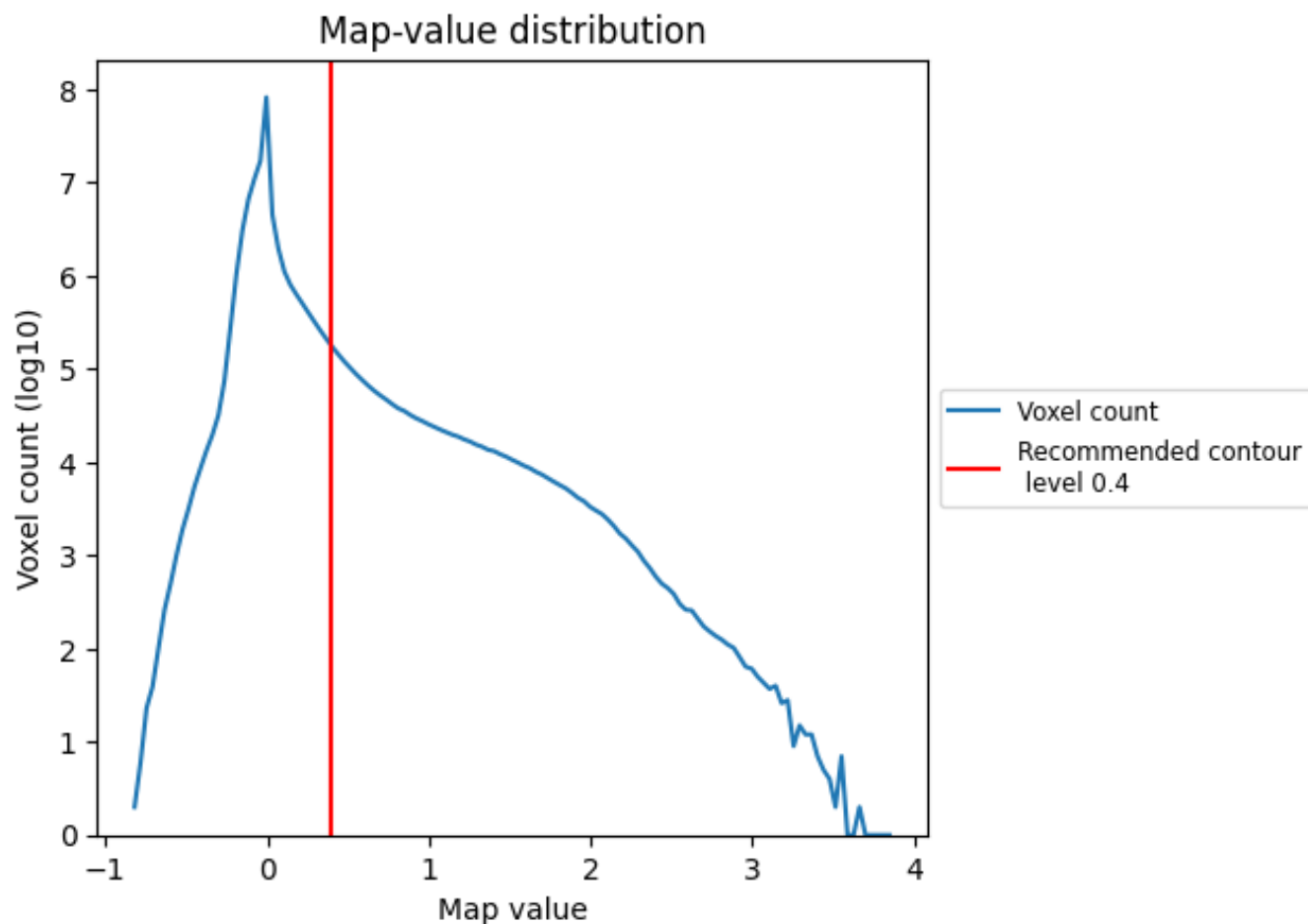
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

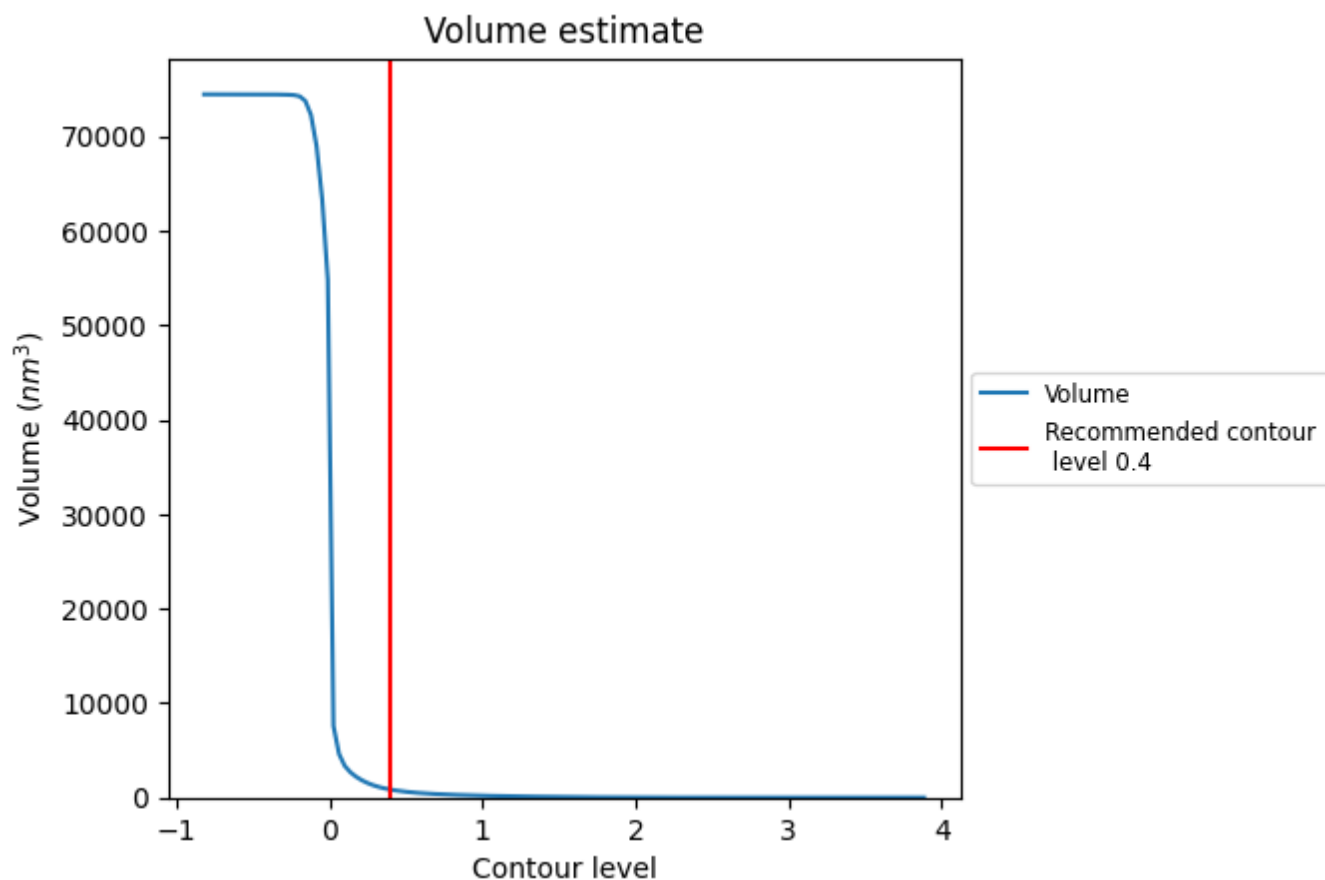
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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

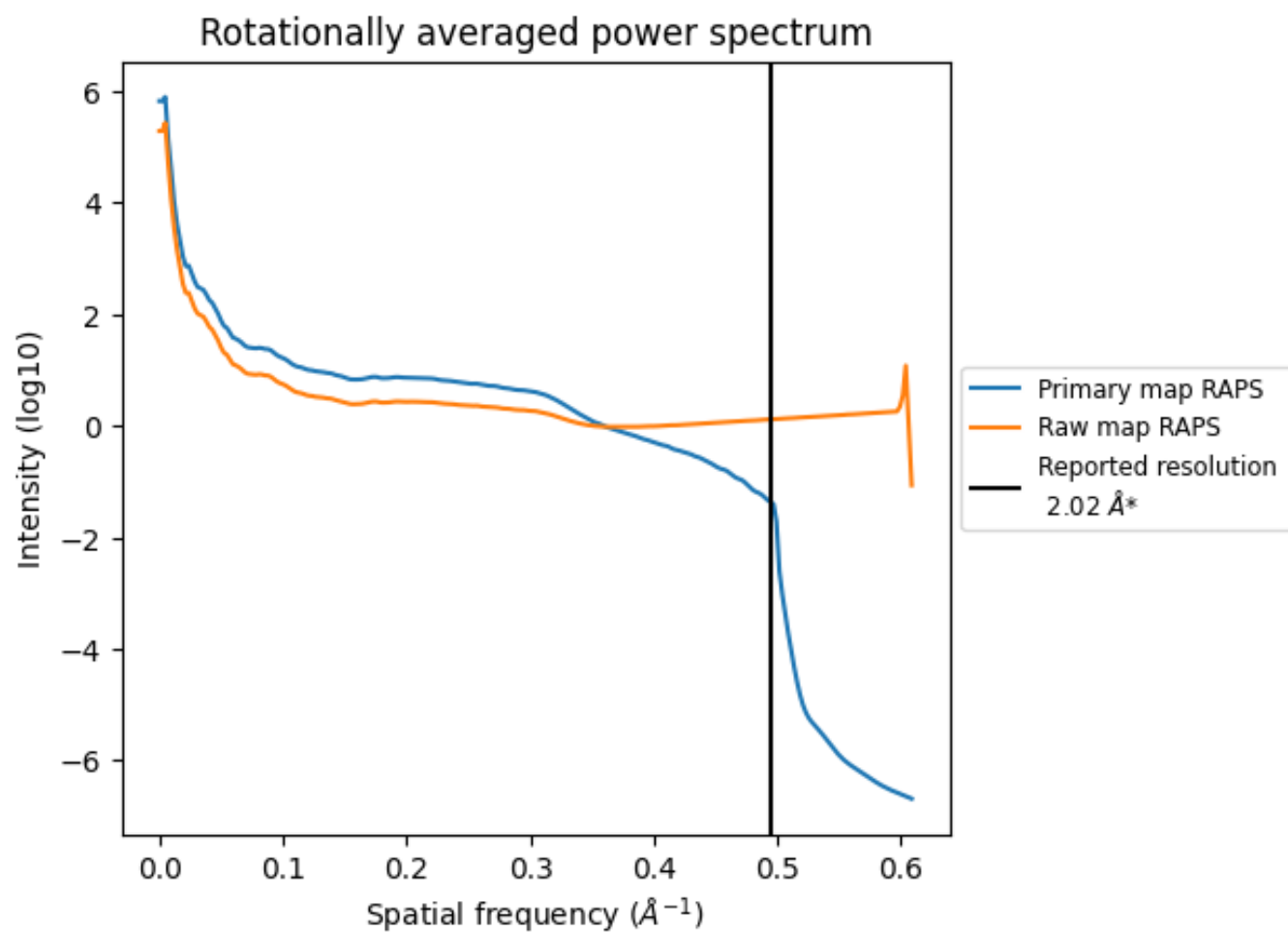
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 840 nm³; this corresponds to an approximate mass of 759 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 ⓘ

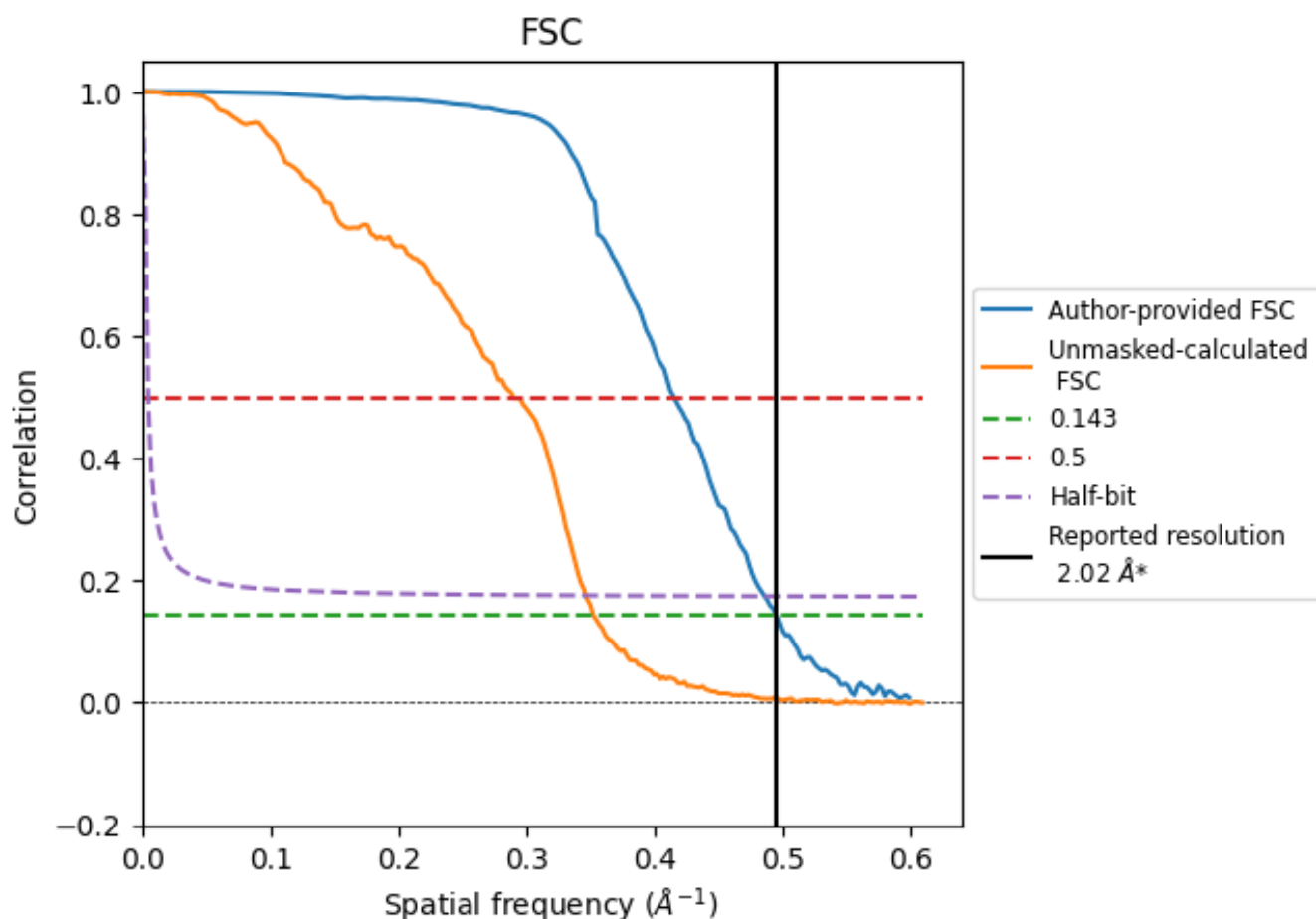


*Reported resolution corresponds to spatial frequency of 0.495 Å⁻¹

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 0.495 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

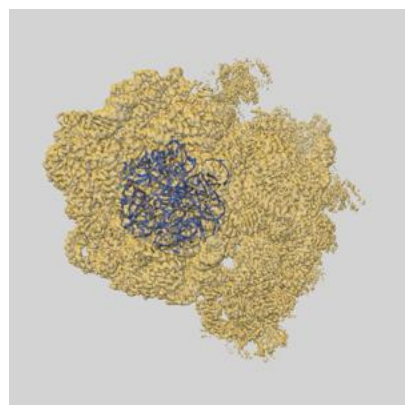
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.02	-	-
Author-provided FSC curve	2.02	2.41	2.06
Unmasked-calculated*	2.84	3.45	2.89

*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 2.84 differs from the reported value 2.02 by more than 10 %

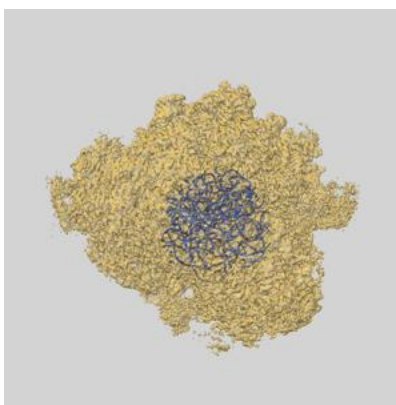
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-55467 and PDB model 9T2J. Per-residue inclusion information can be found in section [3](#) on page [8](#).

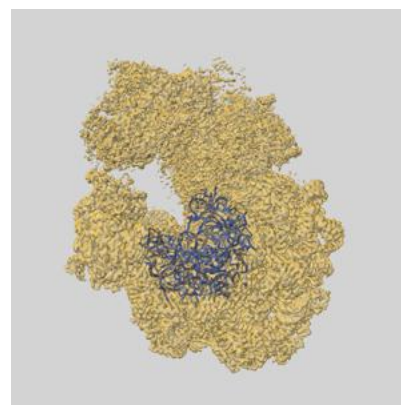
9.1 Map-model overlay [i](#)



X



Y



Z

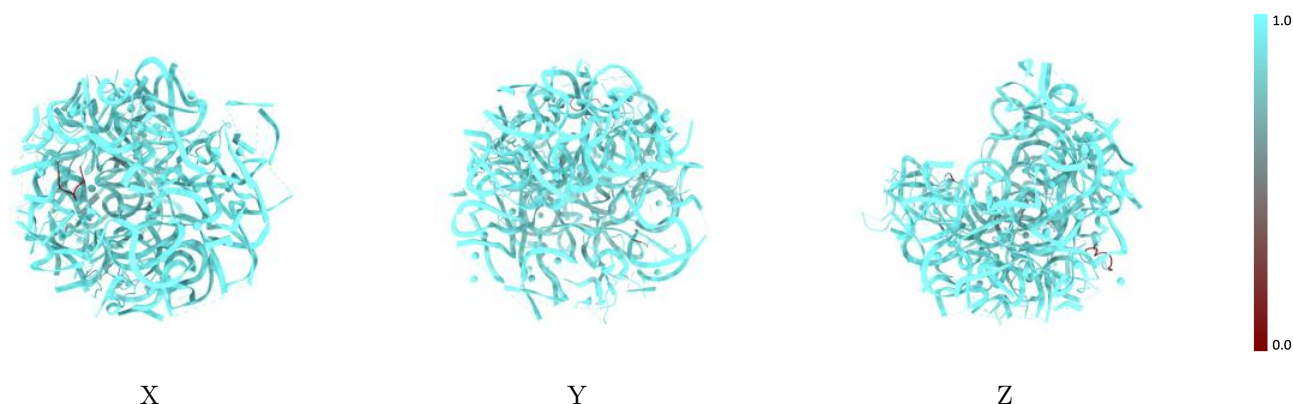
The images above show the 3D surface view of the map at the recommended contour level 0.4 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



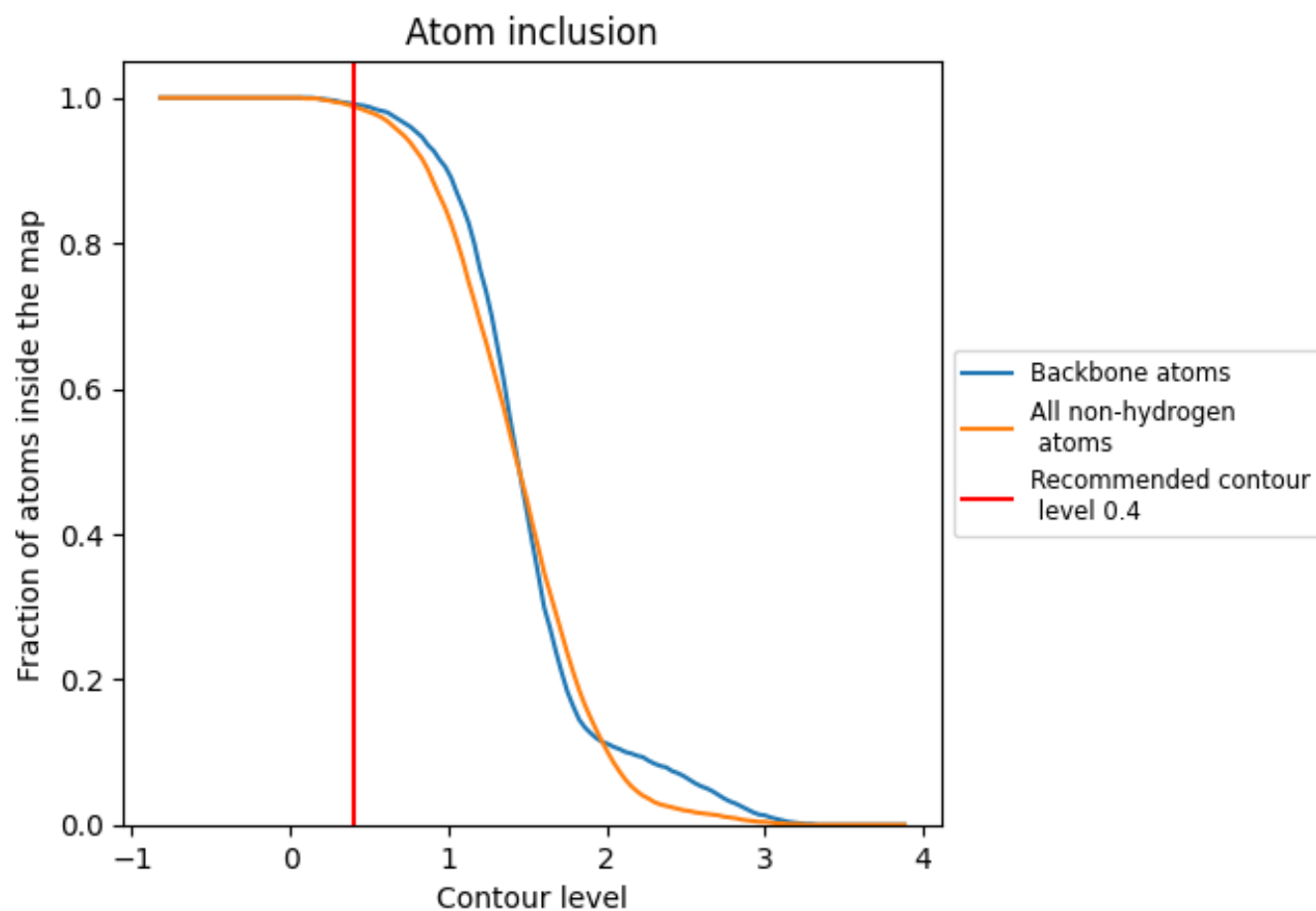
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.4).

9.4 Atom inclusion [i](#)



At the recommended contour level, 99% 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 (0.4) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9880	0.6970
a	0.9950	0.6980
b	0.9630	0.6310
c	0.9950	0.7270
d	0.9850	0.7180
e	0.6000	0.5760
i	1.0000	0.7150
k	0.9890	0.7250
l	0.9820	0.7010
q	1.0000	0.7220
r	0.8980	0.6800
v	0.8170	0.6350
z	1.0000	0.7270

1.0

0.0

<0.0