



wwPDB EM Validation Summary Report ⓘ

Mar 5, 2026 – 04:51 AM UTC

PDB ID : 9V28 / pdb_00009v28
EMDB ID : EMD-64720
Title : Cryo- EM structure of small subunit (head) of 75S ribosome with A/P- & P/E- tRNAs from *Entamoeba histolytica*
Authors : Sharma, S.; Mishra, S.; Gourinath, S.; Kaushal, P.S.
Deposited on : 2025-05-19
Resolution : 3.40 Å(reported)
Based on initial model : .

This is a wwPDB EM Validation Summary 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

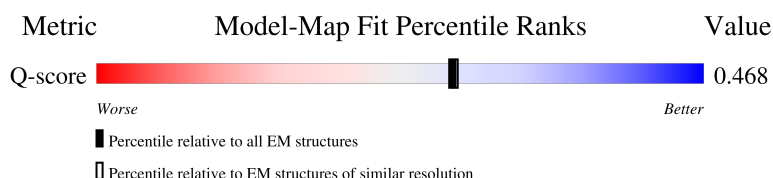
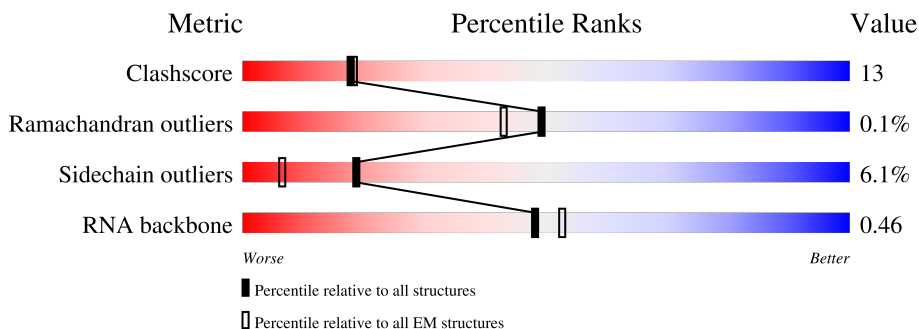
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.40 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.



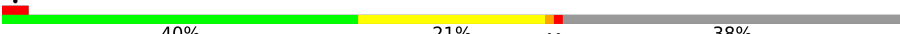
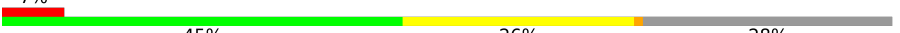
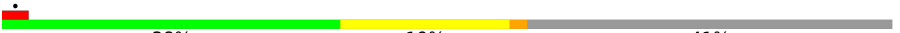
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
RNA backbone	8273	3508	-
Q-score	-	25397	14717 (2.90 - 3.90)

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	sA	137	
2	sD	69	
3	sE	56	

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Mol	Chain	Length	Quality of chain
4	sa	1947	
5	sd	244	
6	sg	206	
7	sl	127	
8	sq	144	
9	ss	158	
10	st	117	
11	su	155	
12	sv	155	
13	sw	118	

2 Entry composition [i](#)

There are 13 unique types of molecules in this entry. The entry contains 19649 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called 40S ribosomal protein S25.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	sA	41	Total	C	N	O	S	0	0
			325	214	54	55	2		

- Molecule 2 is a protein called 40S ribosomal protein S28, putative.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	sD	60	Total	C	N	O	S	0	0
			468	289	93	84	2		

- Molecule 3 is a protein called Ribosomal protein S29, putative.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	sE	55	Total	C	N	O	S	0	0
			442	273	90	75	4		

- Molecule 4 is a RNA chain called 17S rRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	sa	475	Total	C	N	O	P	0	0
			10153	4544	1840	3294	475		

- Molecule 5 is a protein called 40S ribosomal protein S3.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	sd	183	Total	C	N	O	S	0	0
			1385	874	248	252	11		

- Molecule 6 is a protein called Small ribosomal subunit protein uS7.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	sg	175	Total	C	N	O	S	0	0
			1391	876	254	250	11		

- Molecule 7 is a protein called 40S ribosomal protein S10, putative.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	sl	63	Total	C	N	O	S	0	0
			513	337	87	80	9		

- Molecule 8 is a protein called 40S ribosomal protein S15, putative.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	sq	89	Total	C	N	O	S	0	0
			723	468	130	121	4		

- Molecule 9 is a protein called 40S ribosomal protein S16, putative.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	ss	114	Total	C	N	O	S	0	0
			891	574	164	149	4		

- Molecule 10 is a protein called 40S ribosomal protein S17, putative.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	st	69	Total	C	N	O	S	0	0
			565	361	111	92	1		

- Molecule 11 is a protein called Small ribosomal subunit protein uS13.

Mol	Chain	Residues	Atoms					AltConf	Trace
11	su	136	Total	C	N	O	S	0	0
			1107	690	225	186	6		

- Molecule 12 is a protein called Small ribosomal subunit protein eS19.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	sv	139	Total	C	N	O	S	0	0
			1123	717	202	198	6		

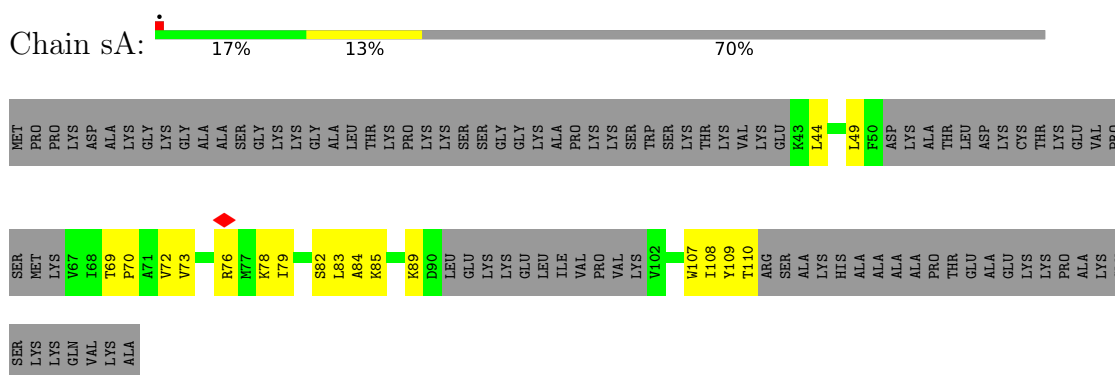
- Molecule 13 is a protein called 40S ribosomal protein S20, putative.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	sw	72	Total	C	N	O	S	0	0
			563	357	99	103	4		

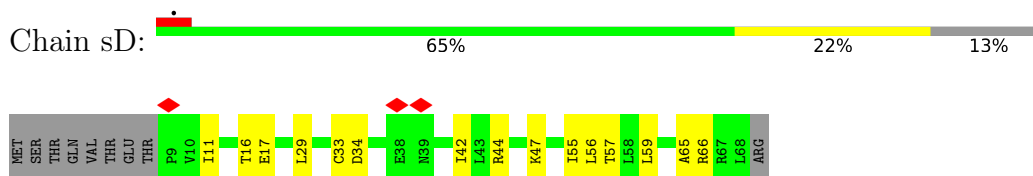
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

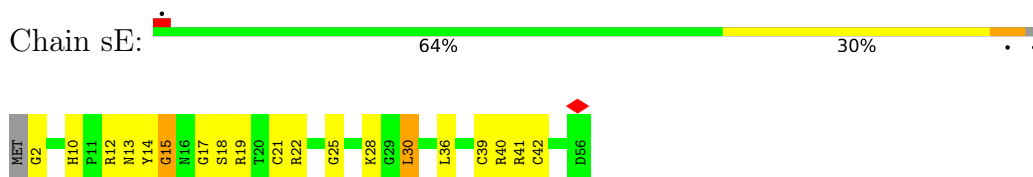
- Molecule 1: 40S ribosomal protein S25



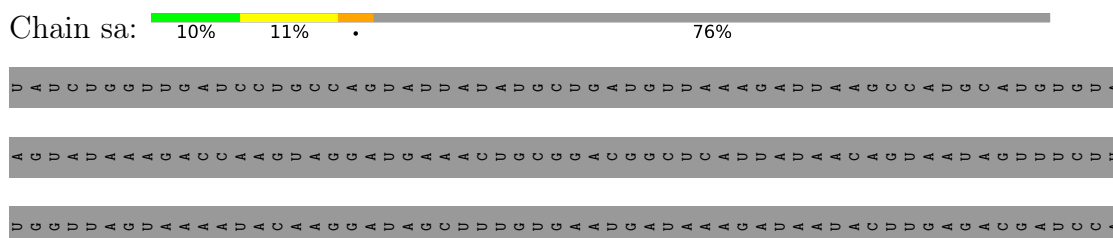
- Molecule 2: 40S ribosomal protein S28, putative



- Molecule 3: Ribosomal protein S29, putative



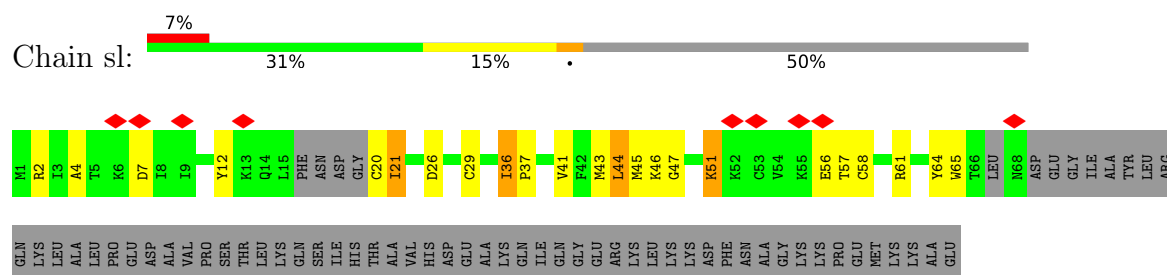
- Molecule 4: 17S rRNA



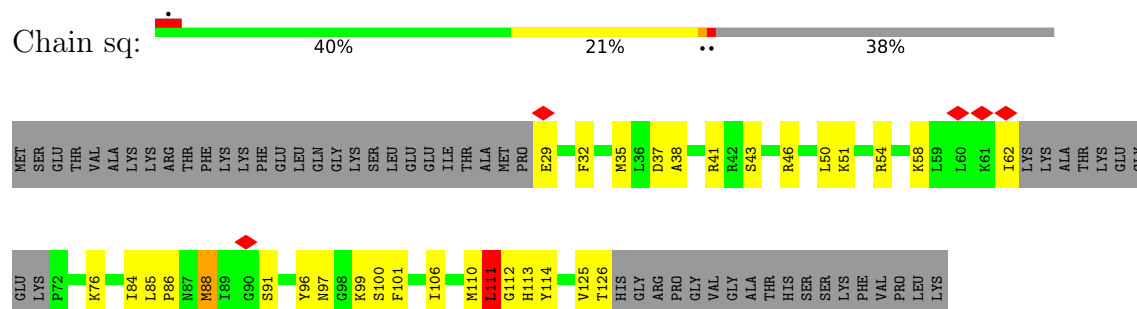




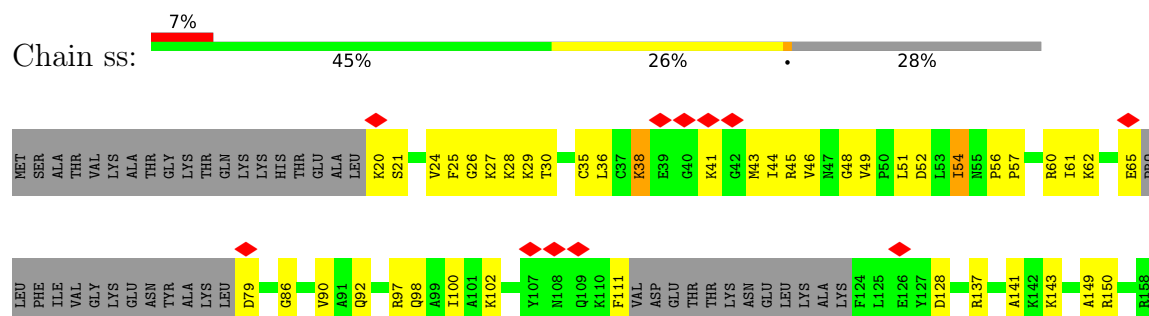
- Molecule 7: 40S ribosomal protein S10, putative



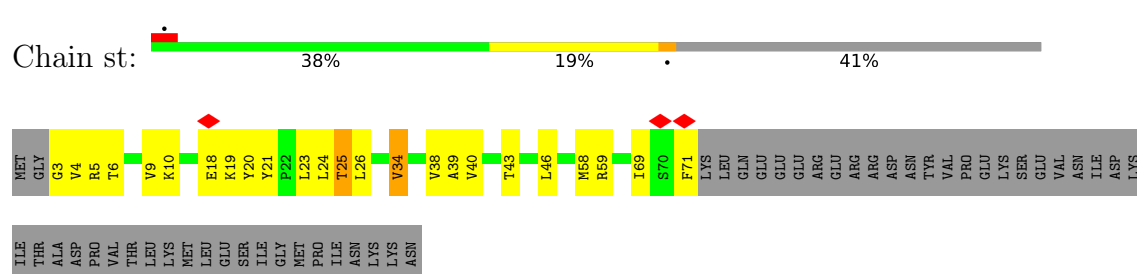
- Molecule 8: 40S ribosomal protein S15, putative



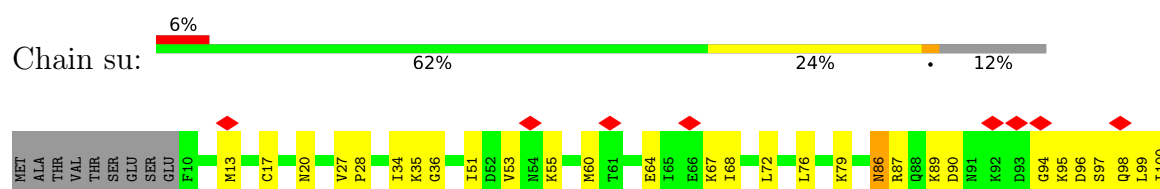
- Molecule 9: 40S ribosomal protein S16, putative



- Molecule 10: 40S ribosomal protein S17, putative

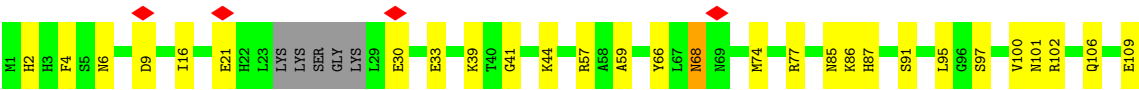


- Molecule 11: Small ribosomal subunit protein uS13

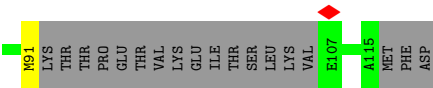
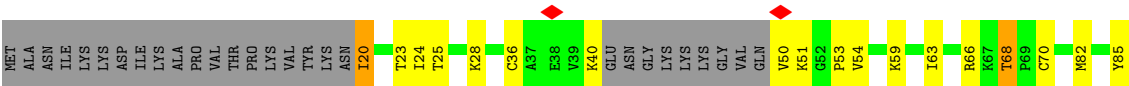




• Molecule 12: Small ribosomal subunit protein eS19



• Molecule 13: 40S ribosomal protein S20, putative



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	39958	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 ($e^-/\text{\AA}^2$)	1.106	Depositor
Minimum defocus (nm)	1800	Depositor
Maximum defocus (nm)	3000	Depositor
Magnification	75000	Depositor
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	15.011	Depositor
Minimum map value	-4.527	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	1.000	Depositor
Recommended contour level	3.6	Depositor
Map size (Å)	224.70001, 224.70001, 224.70001	wwPDB
Map dimensions	210, 210, 210	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.07, 1.07, 1.07	Depositor

5 Model quality

5.1 Standard geometry

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	sA	0.21	0/328	0.40	0/443
2	sD	0.17	0/470	0.36	0/630
3	sE	0.21	0/449	0.36	0/595
4	sa	0.33	6/11368 (0.1%)	0.48	16/17709 (0.1%)
5	sd	0.17	0/1397	0.32	0/1869
6	sg	0.18	0/1408	0.36	0/1888
7	sl	0.18	0/523	0.36	0/702
8	sq	0.18	0/736	0.43	0/983
9	ss	0.20	0/903	0.33	0/1206
10	st	0.19	0/573	0.36	0/768
11	su	0.18	0/1125	0.40	0/1507
12	sv	0.19	0/1146	0.34	0/1541
13	sw	0.22	0/569	0.40	0/765
All	All	0.27	6/20995 (0.0%)	0.44	16/30606 (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
3	sE	0	1
8	sq	0	1
All	All	0	2

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	sa	1791	C	O3'-P	-6.89	1.50	1.61
4	sa	1597	A	C1'-N9	-5.80	1.38	1.47
4	sa	1668	G	O3'-P	-5.47	1.52	1.61
4	sa	1788	G	O3'-P	-5.40	1.53	1.61
4	sa	1587	A	C1'-N9	-5.39	1.39	1.48

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	sa	1788	G	C1'-C2'-O2'	-21.01	76.88	108.40
4	sa	1791	C	C1'-C2'-O2'	-14.13	87.21	108.40
4	sa	1790	C	C1'-C2'-O2'	-14.11	87.24	108.40
4	sa	1427	U	C1'-C2'-O2'	-10.45	96.12	111.80
4	sa	1596	U	P-O3'-C3'	-8.05	108.13	120.20

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	sE	15	GLY	Peptide
8	sq	111	LEU	Peptide

5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	sA	325	0	349	12	0
2	sD	468	0	500	10	0
3	sE	442	0	444	17	0
4	sa	10153	0	5106	266	0
5	sd	1385	0	1454	33	0
6	sg	1391	0	1457	39	0
7	sl	513	0	541	16	0
8	sq	723	0	780	22	0
9	ss	891	0	954	30	0
10	st	565	0	613	18	0
11	su	1107	0	1152	28	0
12	sv	1123	0	1139	37	0
13	sw	563	0	604	11	0
All	All	19649	0	15093	459	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 13.

The worst 5 of 459 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)
8:sq:106:ILE:HA	8:sq:110:MET:HE2	1.63	0.81
11:su:87:ARG:HB3	11:su:97:SER:HA	1.64	0.80
4:sa:1750:G:N2	4:sa:1776:G:O2'	2.16	0.79
4:sa:1383:C:H5	4:sa:1389:G:H1	1.33	0.77
4:sa:1441:C:HO2'	4:sa:1442:A:H8	1.29	0.77

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	
1	sA	35/137 (26%)	29 (83%)	6 (17%)	0	100	100
2	sD	58/69 (84%)	52 (90%)	6 (10%)	0	100	100
3	sE	53/56 (95%)	49 (92%)	4 (8%)	0	100	100
5	sd	174/244 (71%)	160 (92%)	14 (8%)	0	100	100
6	sg	169/206 (82%)	158 (94%)	11 (6%)	0	100	100
7	sl	58/127 (46%)	54 (93%)	4 (7%)	0	100	100
8	sq	85/144 (59%)	75 (88%)	9 (11%)	1 (1%)	10	35
9	ss	108/158 (68%)	103 (95%)	5 (5%)	0	100	100
10	st	67/117 (57%)	65 (97%)	2 (3%)	0	100	100
11	su	134/155 (86%)	126 (94%)	8 (6%)	0	100	100
12	sv	135/155 (87%)	128 (95%)	7 (5%)	0	100	100
13	sw	66/118 (56%)	64 (97%)	2 (3%)	0	100	100
All	All	1142/1686 (68%)	1063 (93%)	78 (7%)	1 (0%)	49	78

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
8	sq	112	GLY

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	sA	37/112 (33%)	36 (97%)	1 (3%)	39	60
2	sD	50/59 (85%)	46 (92%)	4 (8%)	11	36
3	sE	45/46 (98%)	41 (91%)	4 (9%)	9	31
5	sd	149/206 (72%)	143 (96%)	6 (4%)	28	53
6	sg	156/178 (88%)	147 (94%)	9 (6%)	18	45
7	sl	58/111 (52%)	51 (88%)	7 (12%)	5	19
8	sq	81/127 (64%)	74 (91%)	7 (9%)	10	33
9	ss	91/128 (71%)	87 (96%)	4 (4%)	25	51
10	st	61/106 (58%)	56 (92%)	5 (8%)	10	35
11	su	115/130 (88%)	109 (95%)	6 (5%)	21	48
12	sv	117/132 (89%)	113 (97%)	4 (3%)	32	57
13	sw	65/107 (61%)	59 (91%)	6 (9%)	8	29
All	All	1025/1442 (71%)	962 (94%)	63 (6%)	19	43

5 of 63 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
7	sl	46	LYS
12	sv	134	ILE
8	sq	91	SER
12	sv	68	ASN
13	sw	54	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
9	ss	23	GLN
11	su	73	ASN
12	sv	89	ASN
11	su	126	HIS
8	sq	78	HIS

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
4	sa	472/1947 (24%)	116 (24%)	0

5 of 116 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
4	sa	1176	G
4	sa	1177	A
4	sa	1184	C
4	sa	1185	A
4	sa	1188	A

There are no RNA pucker outliers to report.

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 ⓘ

There are no chain breaks in this entry.

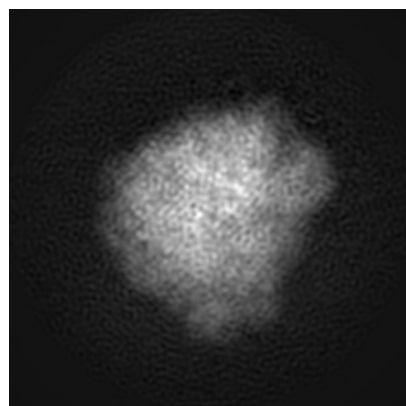
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-64720. These allow visual inspection of the internal detail of the map and identification of artifacts.

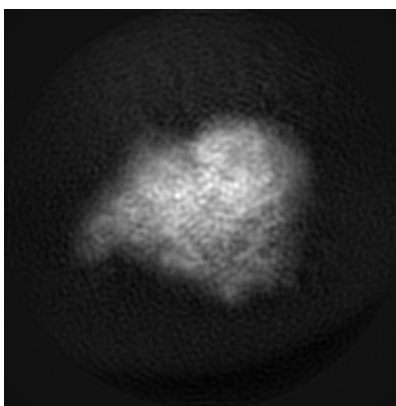
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

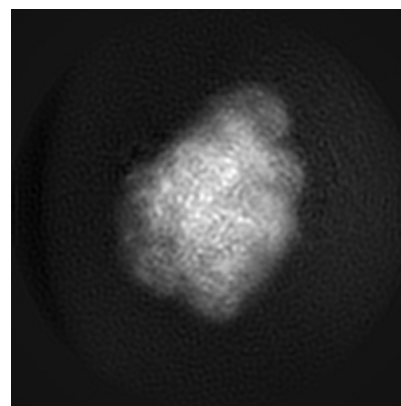
6.1.1 Primary map



X

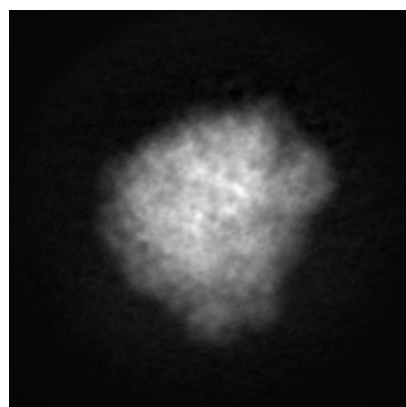


Y

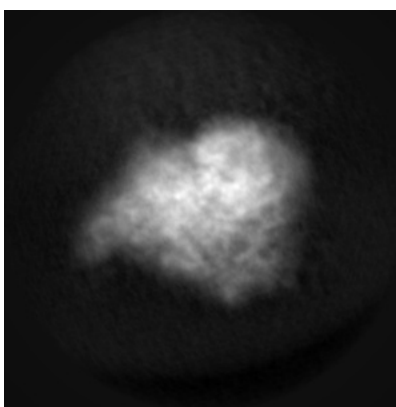


Z

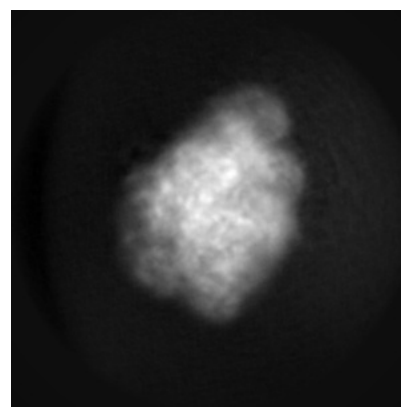
6.1.2 Raw map



X



Y

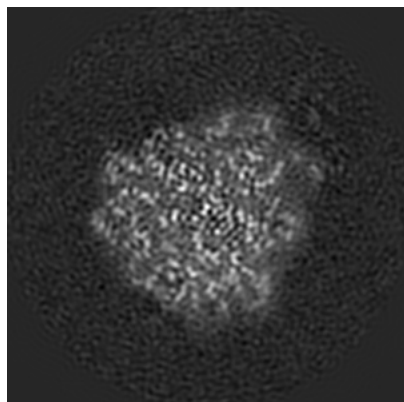


Z

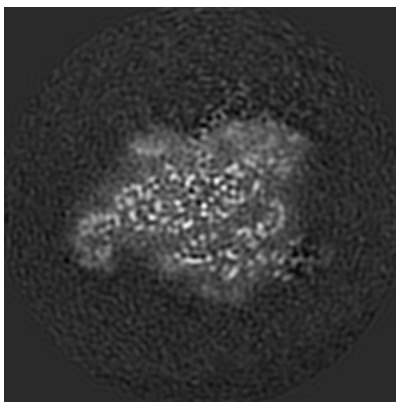
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

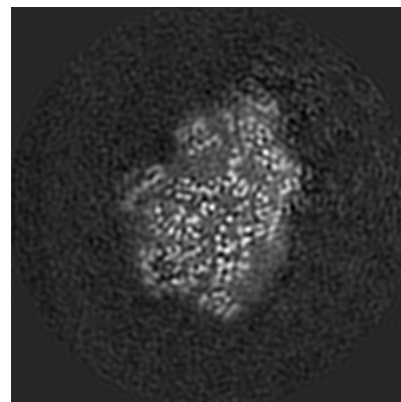
6.2.1 Primary map



X Index: 105

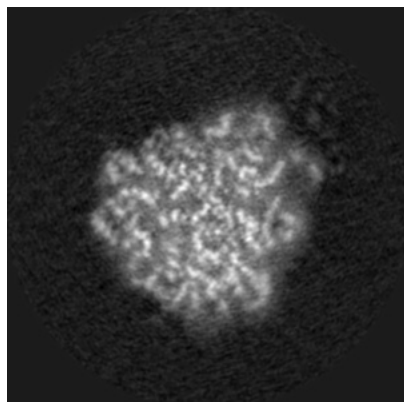


Y Index: 105

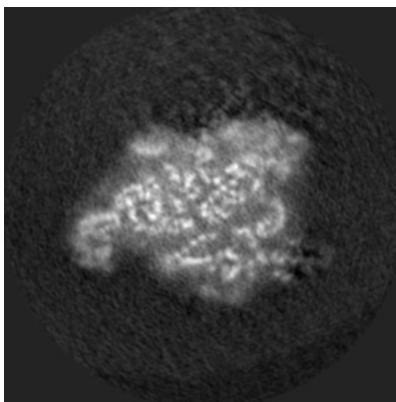


Z Index: 105

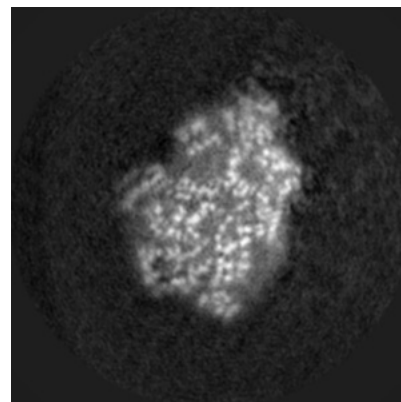
6.2.2 Raw map



X Index: 105



Y Index: 105

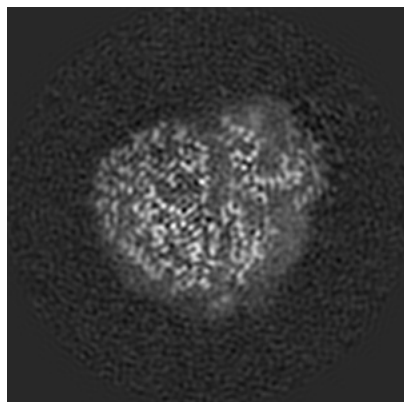


Z Index: 105

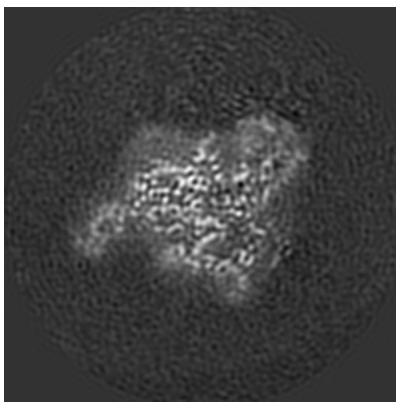
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

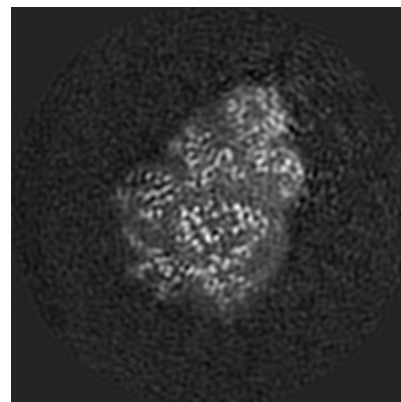
6.3.1 Primary map



X Index: 113

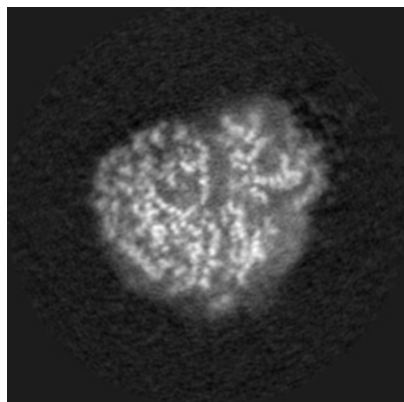


Y Index: 99

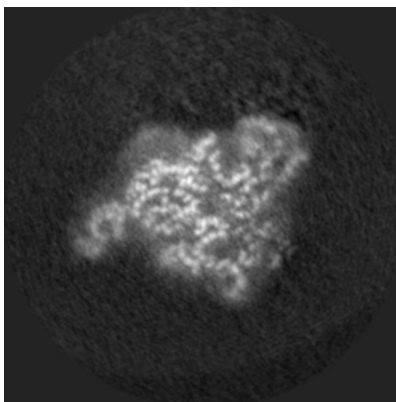


Z Index: 111

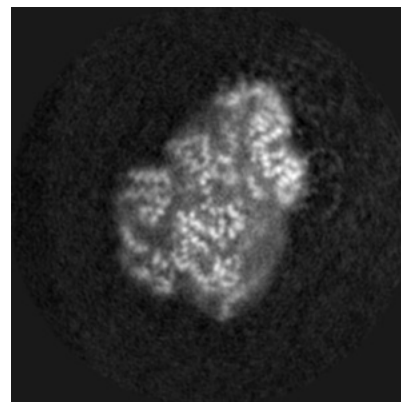
6.3.2 Raw map



X Index: 113



Y Index: 98

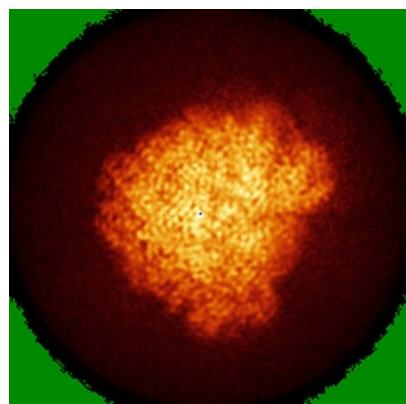


Z Index: 114

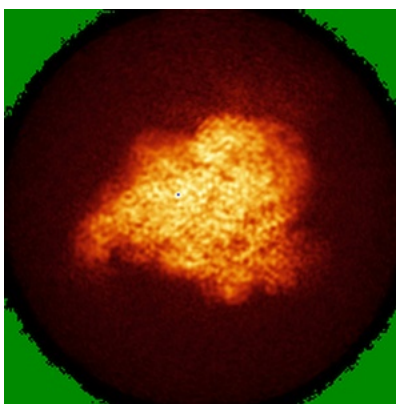
The images above show the largest variance slices of the map in three orthogonal directions.

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

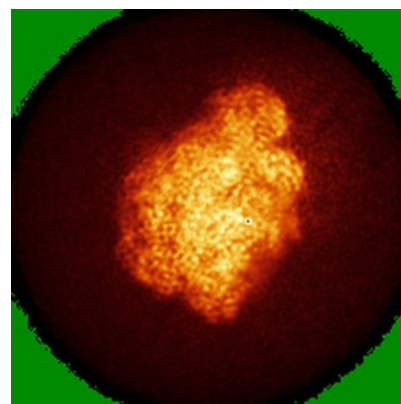
6.4.1 Primary map



X

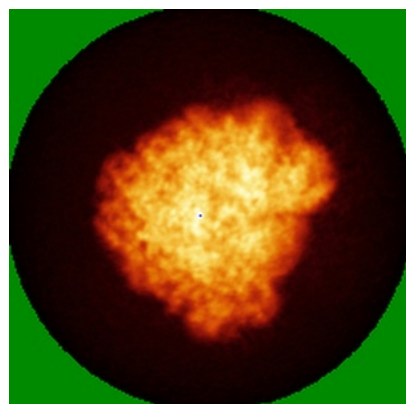


Y

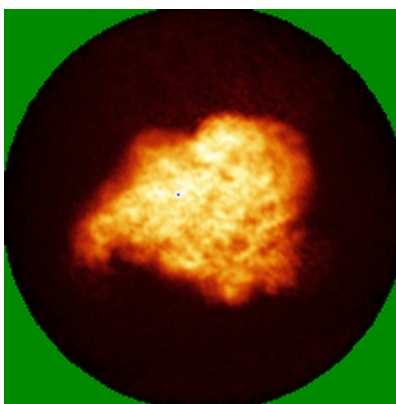


Z

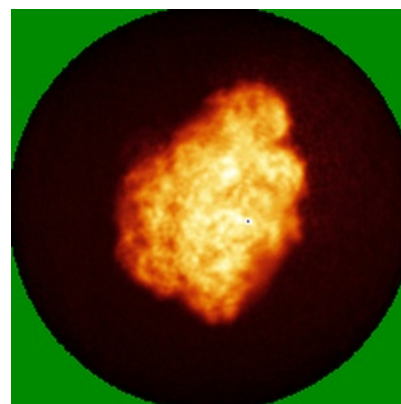
6.4.2 Raw map



X



Y



Z

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

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 3.6. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 Raw map



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

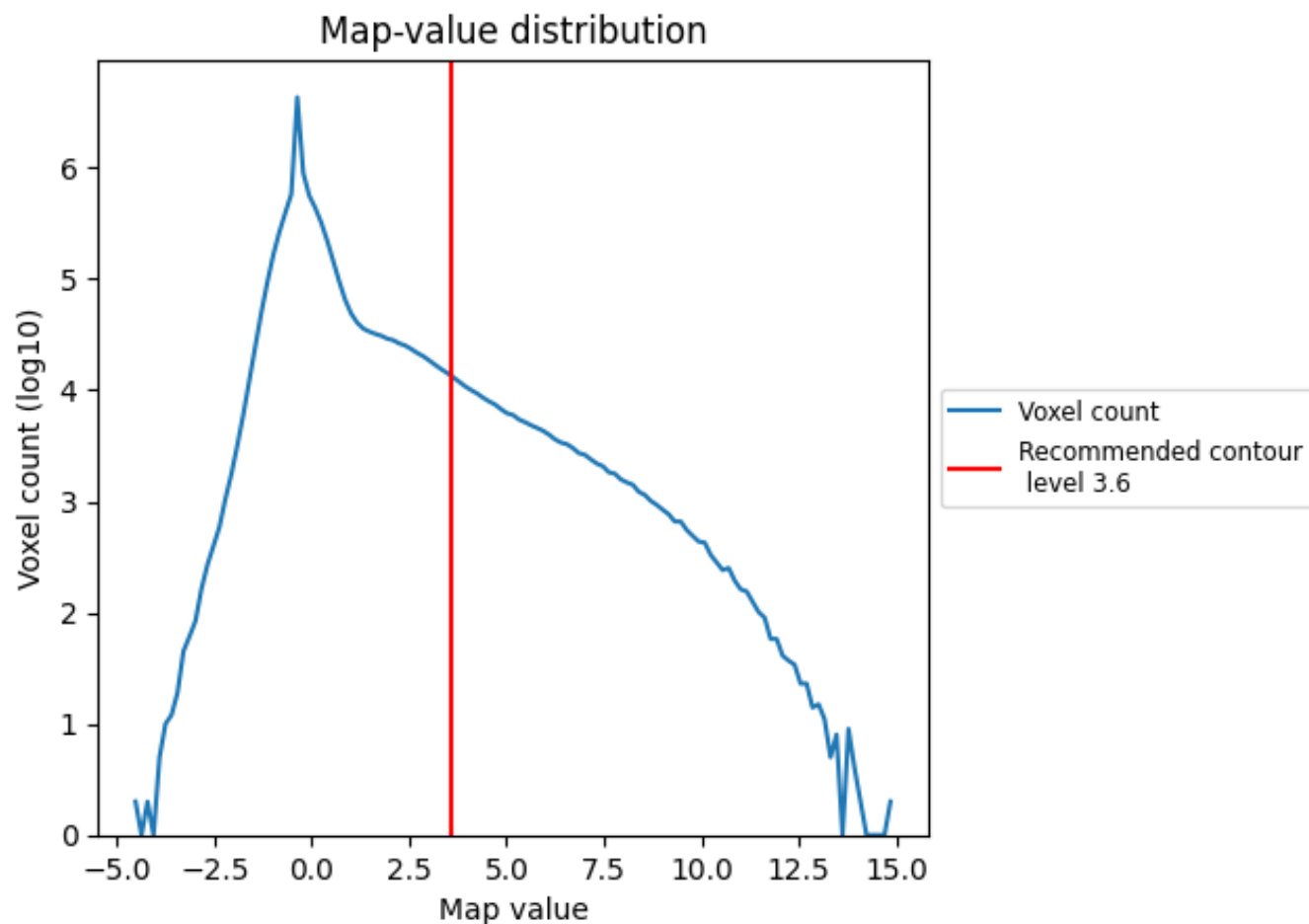
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

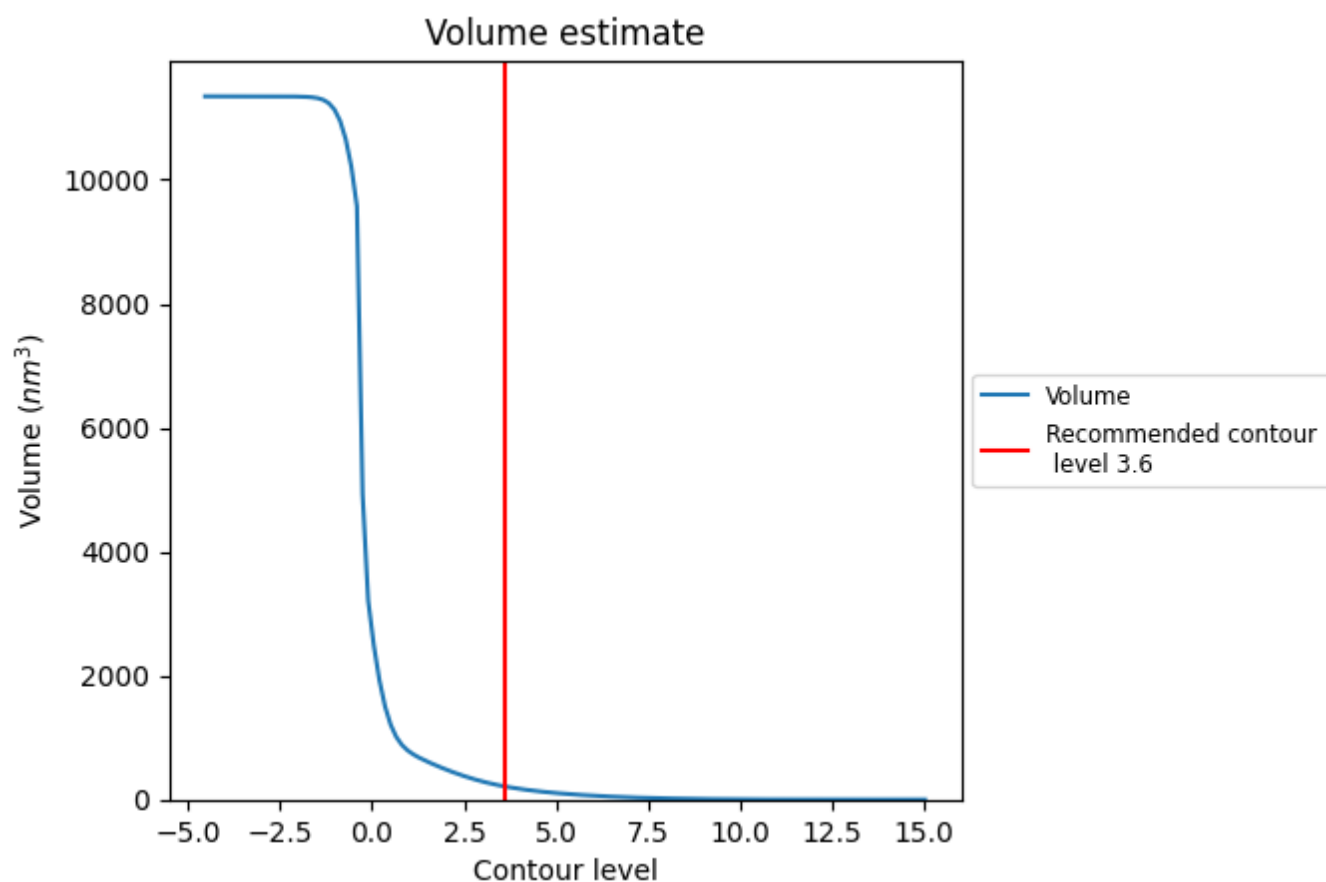
This section contains the results of statistical analysis of the map.

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.

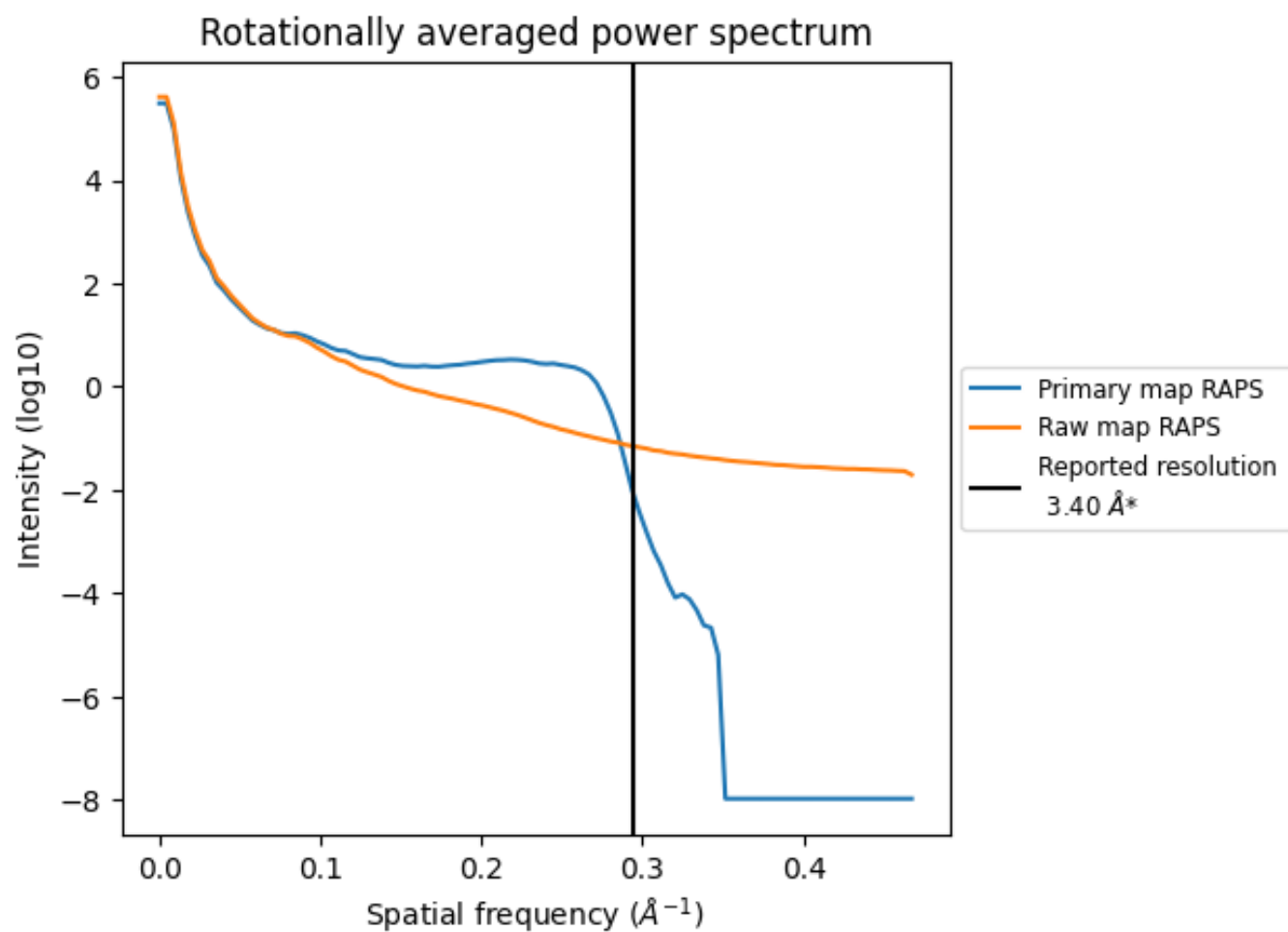
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 213 nm³; this corresponds to an approximate mass of 192 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 ⓘ

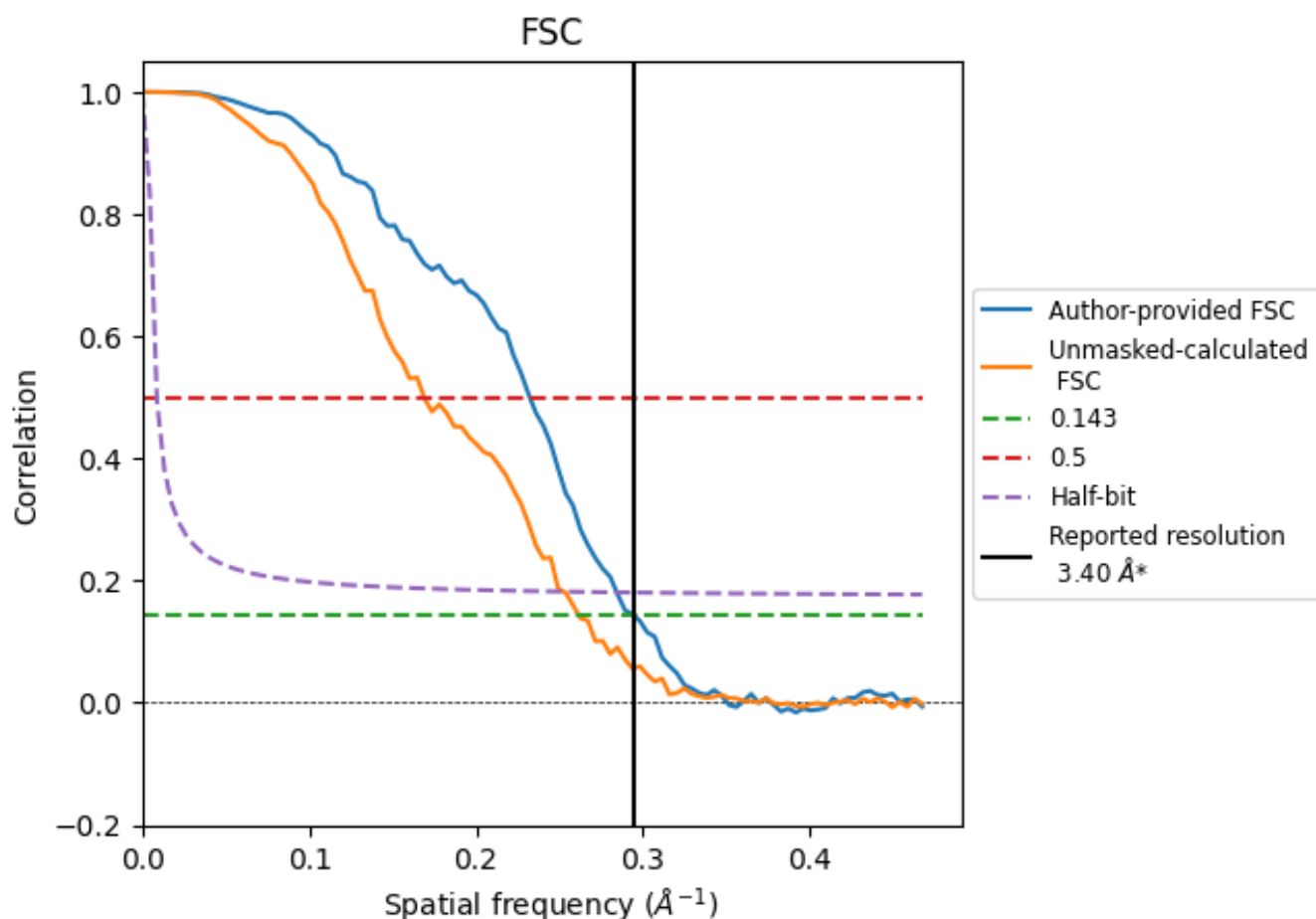


*Reported resolution corresponds to spatial frequency of $0.294 \text{ \AA}^{-1}$

8 Fourier-Shell correlation [i](#)

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

8.1 FSC [i](#)



*Reported resolution corresponds to spatial frequency of $0.294 \text{ \AA}^{-1}$

8.2 Resolution estimates [i](#)

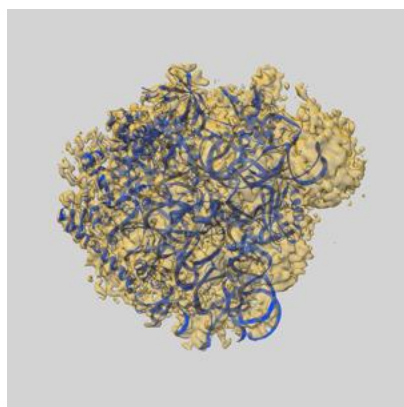
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.40	-	-
Author-provided FSC curve	3.40	4.30	3.52
Unmasked-calculated*	3.82	5.92	3.96

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 3.82 differs from the reported value 3.4 by more than 10 %

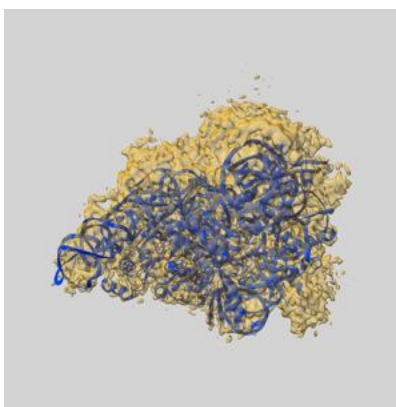
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-64720 and PDB model 9V28. Per-residue inclusion information can be found in [section 3](#) on [page 6](#).

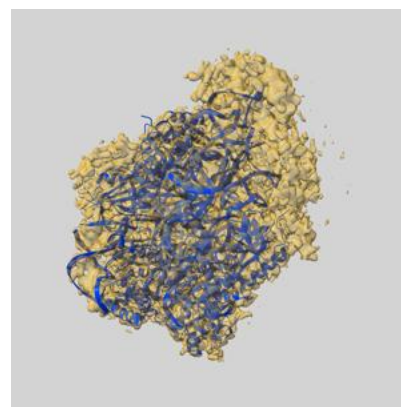
9.1 Map-model overlay [i](#)



X



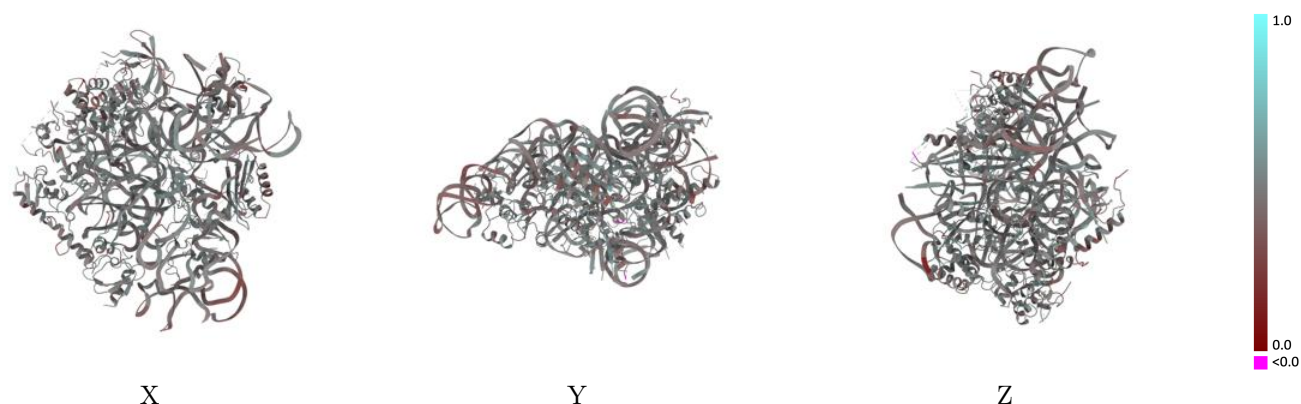
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 3.6 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](#)

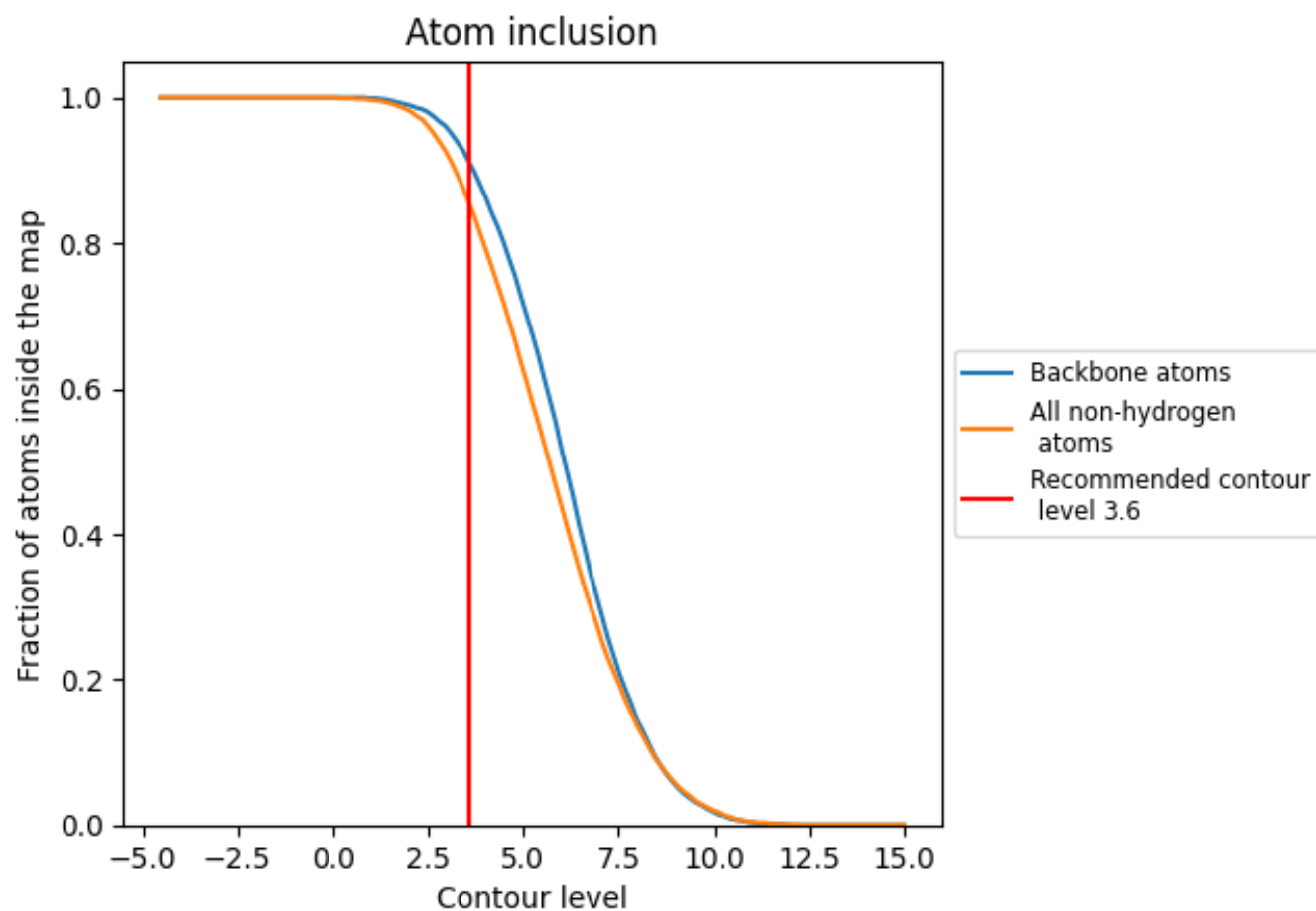


The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

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

This section was not generated.

9.4 Atom inclusion [i](#)



At the recommended contour level, 91% of all backbone atoms, 85% 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 (3.6) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8520	 0.4680
sA	 0.7040	 0.4660
sD	 0.7530	 0.4560
sE	 0.9190	 0.5130
sa	 0.9300	 0.4580
sd	 0.7420	 0.4720
sg	 0.7720	 0.4690
sl	 0.7050	 0.4850
sq	 0.7910	 0.4790
ss	 0.7590	 0.5020
st	 0.7610	 0.4690
su	 0.7910	 0.4690
sv	 0.7520	 0.4860
sw	 0.7730	 0.4890

