



wwPDB EM Validation Summary Report ⓘ

Mar 7, 2026 – 03:28 AM UTC

PDB ID : 8XQ5 / pdb_00008xq5
EMDB ID : EMD-38566
Title : Structure of the sea urchin spSLC9C1 in state-3 w/o cAMP dimer
Authors : Qu, H.; Zheng, X.
Deposited on : 2024-01-04
Resolution : 3.15 Å(reported)

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

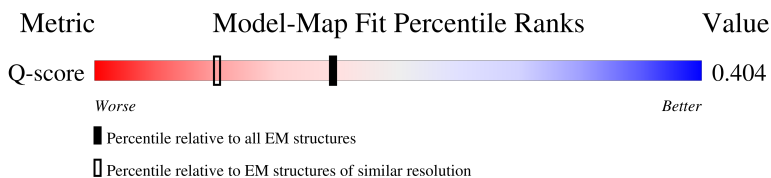
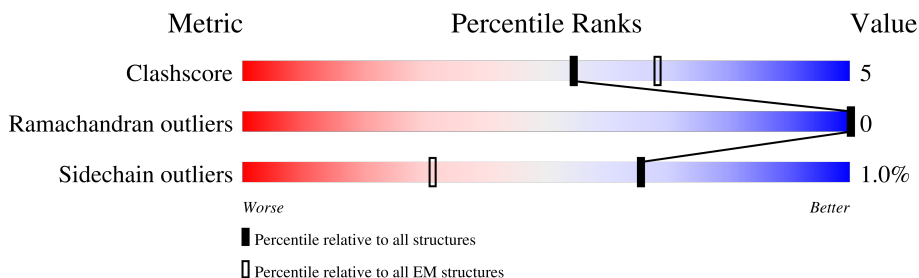
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.15 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	14486 (2.65 - 3.65)

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	1308	8% 64% 11% 25%
1	B	1308	7% 65% 10% 25%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 15128 atoms, of which 0 are hydrogens and 0 are deuteriums.

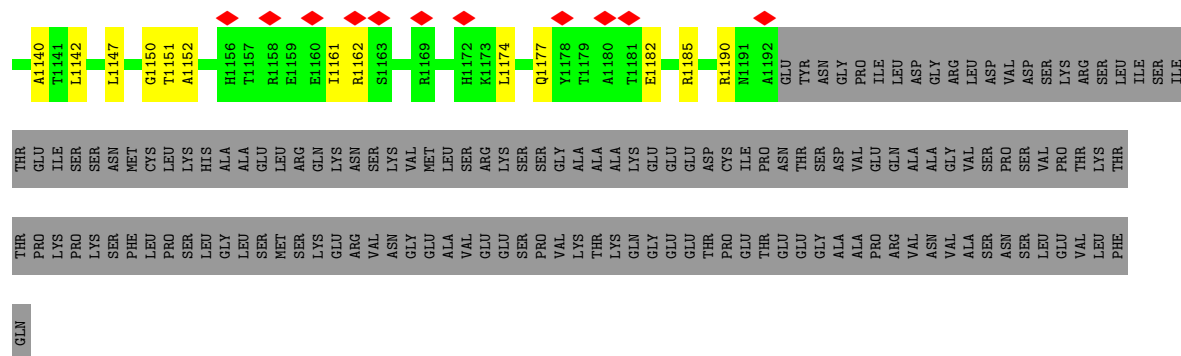
In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Sperm-specific sodium proton exchanger.

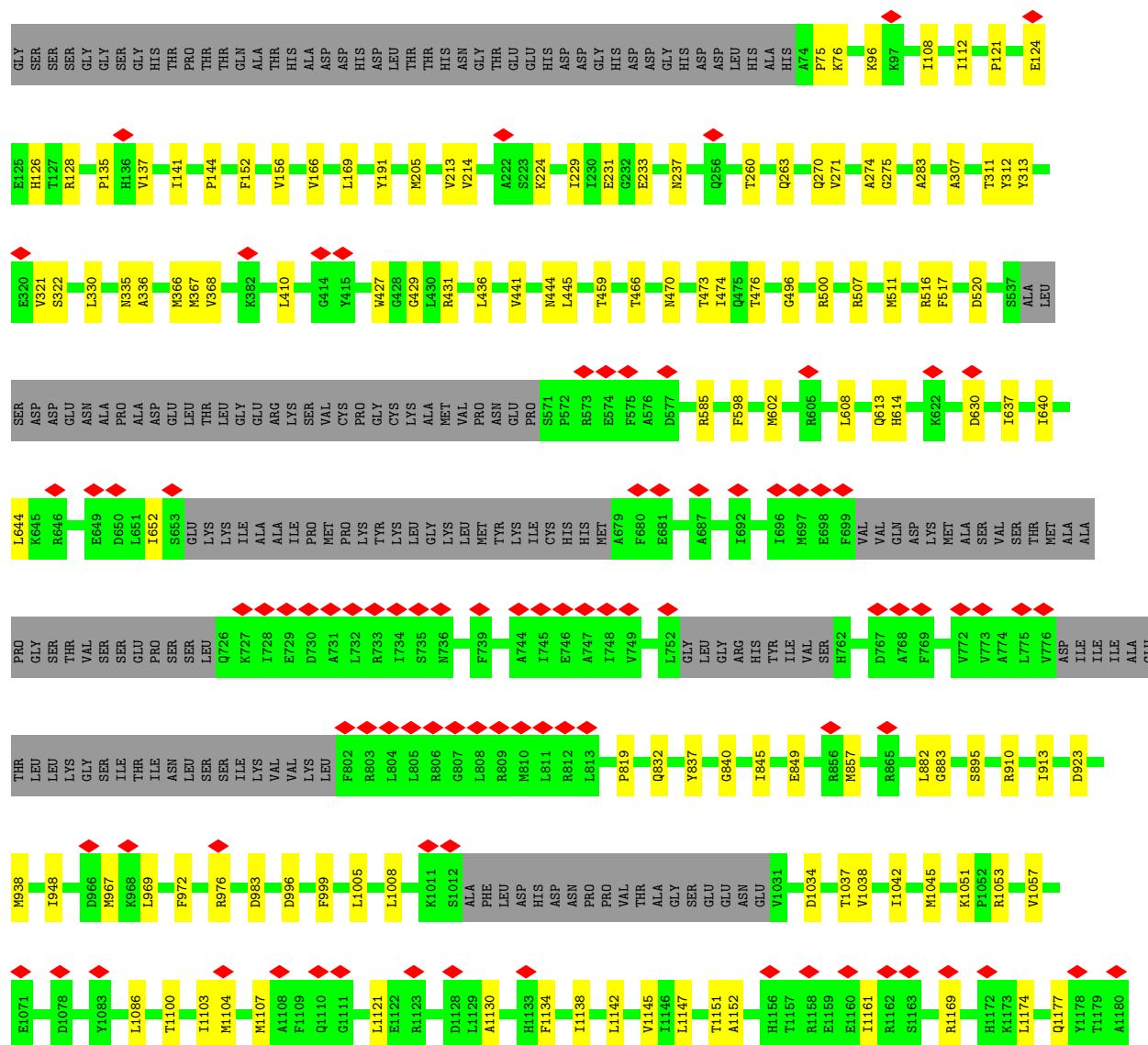
Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	983	Total	C	N	O	S	0	0
			7564	4910	1270	1346	38		
1	B	983	Total	C	N	O	S	0	0
			7564	4910	1270	1346	38		

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	28	GLY	-	expression tag	UNP A3RL54
A	29	SER	-	expression tag	UNP A3RL54
A	1326	ALA	-	expression tag	UNP A3RL54
A	1327	SER	-	expression tag	UNP A3RL54
A	1328	ASN	-	expression tag	UNP A3RL54
A	1329	SER	-	expression tag	UNP A3RL54
A	1330	LEU	-	expression tag	UNP A3RL54
A	1331	GLU	-	expression tag	UNP A3RL54
A	1332	VAL	-	expression tag	UNP A3RL54
A	1333	LEU	-	expression tag	UNP A3RL54
A	1334	PHE	-	expression tag	UNP A3RL54
A	1335	GLN	-	expression tag	UNP A3RL54
B	28	GLY	-	expression tag	UNP A3RL54
B	29	SER	-	expression tag	UNP A3RL54
B	1326	ALA	-	expression tag	UNP A3RL54
B	1327	SER	-	expression tag	UNP A3RL54
B	1328	ASN	-	expression tag	UNP A3RL54
B	1329	SER	-	expression tag	UNP A3RL54
B	1330	LEU	-	expression tag	UNP A3RL54
B	1331	GLU	-	expression tag	UNP A3RL54
B	1332	VAL	-	expression tag	UNP A3RL54
B	1333	LEU	-	expression tag	UNP A3RL54
B	1334	PHE	-	expression tag	UNP A3RL54
B	1335	GLN	-	expression tag	UNP A3RL54



● Molecule 1: Sperm-specific sodium proton exchanger



Position	Residue	Conservation	Annotations
1	VAL	GLY	
2	LYS	ALA	
3	THR	ALA	
4	LYN	LYS	
5	GLN	ALA	
6	GLY	GLU	
7	GLU	GLU	
8	GLU	GLU	
9	THR	GLU	
10	THR	ASP	
11	PRO	CYS	
12	GLU	ILE	
13	GLU	PRO	
14	THR	ASN	
15	GLU	GLY	
16	GLU	THR	
17	GLY	SER	
18	ALA	ASP	
19	ALA	VAL	
20	PRO	GLU	
21	ARG	GLN	
22	VAL	ALA	
23	ASN	ALA	
24	VAL	GLY	
25	VAL	VAL	
26	ALA	VAL	
27	SER	SER	
28	ASN	PRO	
29	SER	SER	
30	LEU	VAL	
31	GLU	PRO	
32	VAL	THR	
33	PHE	LYS	
34	GLN	THR	
35		THR	
36		PRO	
37		LYS	
38		ILE	
39		SER	
40		ILE	
41		THR	
42		THR	
43		GLU	
44		GLU	
45		ILE	
46		SER	
47		SER	
48		SER	
49		ASN	
50		MET	
51		CYS	
52		PRO	
53		SER	
54		LEU	
55		LEU	
56		GLY	
57		LEU	
58		ALA	
59		SER	
60		MET	
61		SER	
62		LYS	
63		GLU	
64		ARG	
65		VAL	
66		ASN	
67		GLY	
68		GLU	
69		ALA	
70		VAL	
71		GLU	
72		GLU	
73		ARG	
74		LYS	
75		SER	
76		SER	
77		GLN	
78		THR	
79		THR	
80		ASP	
81		ASP	
82		VAL	
83		ASP	
84		GLY	
85		ARG	
86		LEU	
87		ASP	
88		ILE	
89		PRO	
90		GLY	
91		ASN	
92		THR	
93		GLU	
94		CYS	
95		NI191	
96		NI192	
97		VI188	
98		VI189	
99		RI190	
100		RI185	
101		TI181	

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	204139	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.745	Depositor
Minimum map value	-0.002	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.031	Depositor
Recommended contour level	0.146	Depositor
Map size ($\text{\AA}$)	276.48, 276.48, 276.48	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.08, 1.08, 1.08	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	0.24	0/7702	0.58	2/10456 (0.0%)
1	B	0.24	0/7702	0.58	1/10456 (0.0%)
All	All	0.24	0/15404	0.58	3/20912 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1107	MET	CA-CB-CG	6.88	127.86	114.10
1	A	499	ARG	CB-CG-CD	5.49	123.93	111.30
1	B	1107	MET	CA-CB-CG	5.17	124.45	114.10

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	7564	0	7672	88	0
1	B	7564	0	7672	80	0
All	All	15128	0	15344	154	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 5.

The worst 5 of 154 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:B:466:THR:O	1:B:470:ASN:HB2	1.84	0.78
1:A:466:THR:O	1:A:470:ASN:HB2	1.84	0.77
1:A:205:MET:HE1	1:A:462:ILE:HG21	1.68	0.74
1:A:224:LYS:HE3	1:A:609:ARG:HH22	1.64	0.62
1:B:271:VAL:HG13	1:B:322:SER:HB3	1.82	0.61

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	969/1308 (74%)	926 (96%)	43 (4%)	0	100	100
1	B	969/1308 (74%)	928 (96%)	41 (4%)	0	100	100
All	All	1938/2616 (74%)	1854 (96%)	84 (4%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	789/1120 (70%)	779 (99%)	10 (1%)	61	73
1	B	789/1120 (70%)	784 (99%)	5 (1%)	78	81
All	All	1578/2240 (70%)	1563 (99%)	15 (1%)	65	76

5 of 15 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	837	TYR
1	B	613	GLN
1	A	900	GLN
1	B	837	TYR
1	B	224	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	361	ASN
1	B	444	ASN
1	B	1177	GLN
1	B	900	GLN
1	B	917	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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-38566. These allow visual inspection of the internal detail of the map and identification of artifacts.

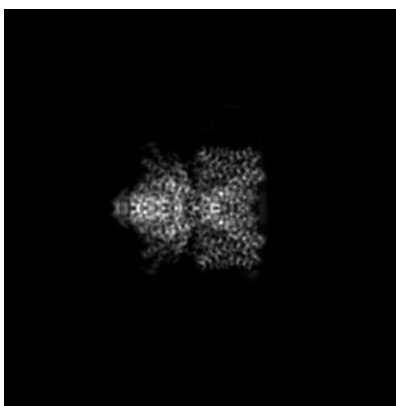
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

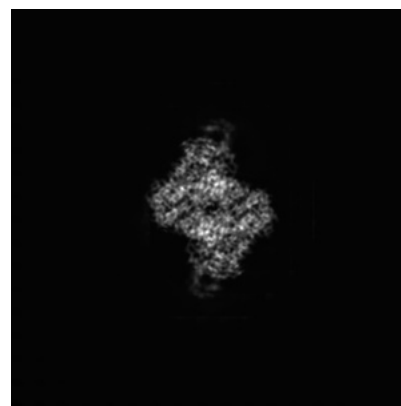
6.1.1 Primary map



X

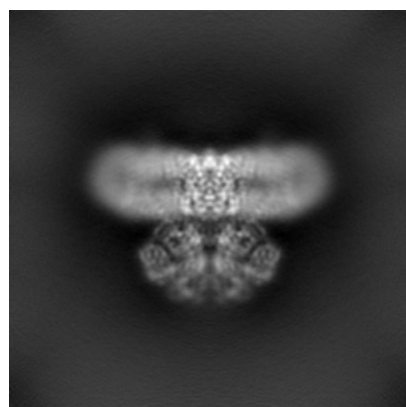


Y

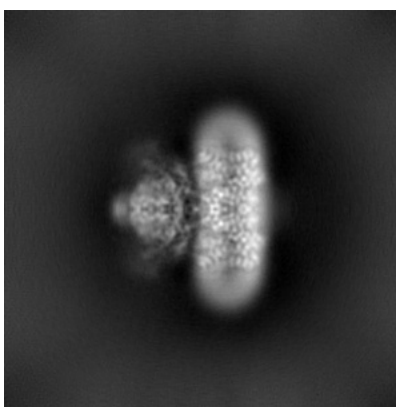


Z

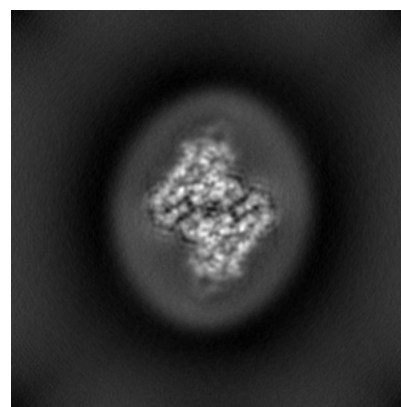
6.1.2 Raw map



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: 128

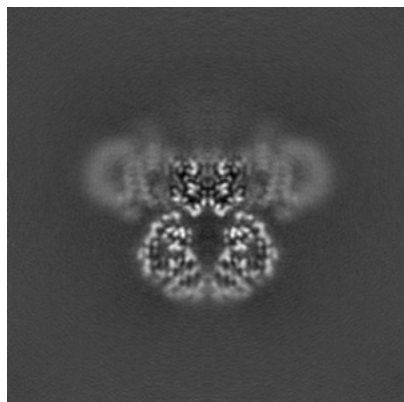


Y Index: 128

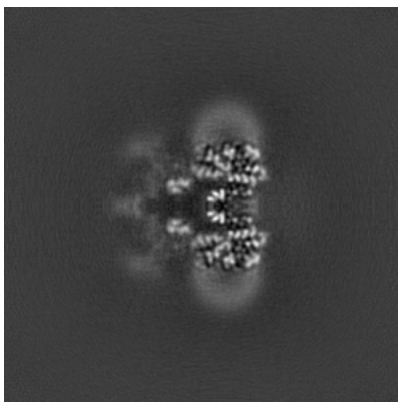


Z Index: 128

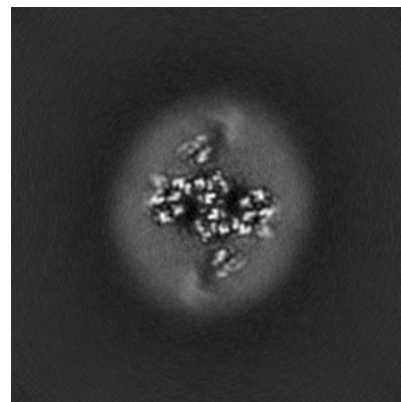
6.2.2 Raw map



X Index: 128



Y Index: 128



Z Index: 128

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

6.3 Largest variance slices [i](#)

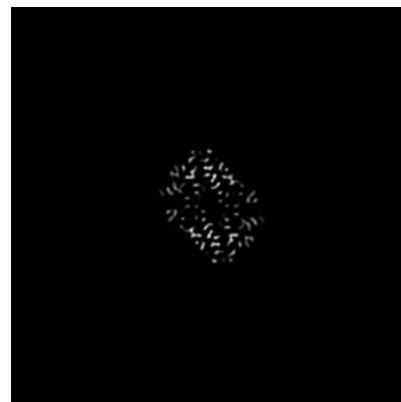
6.3.1 Primary map



X Index: 126

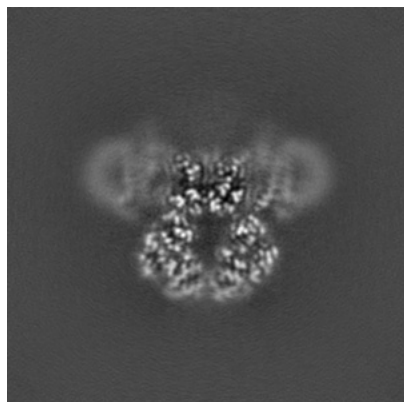


Y Index: 120

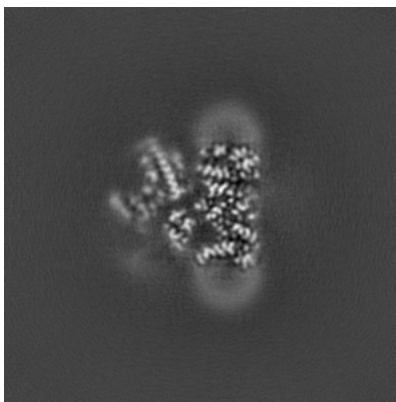


Z Index: 112

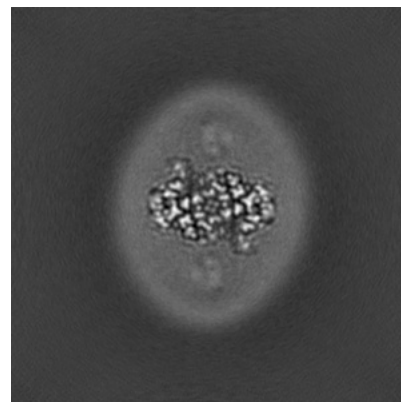
6.3.2 Raw map



X Index: 126



Y Index: 120

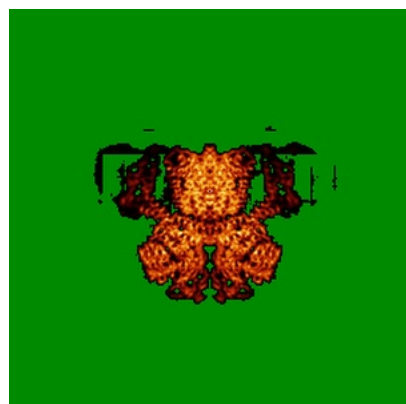


Z Index: 155

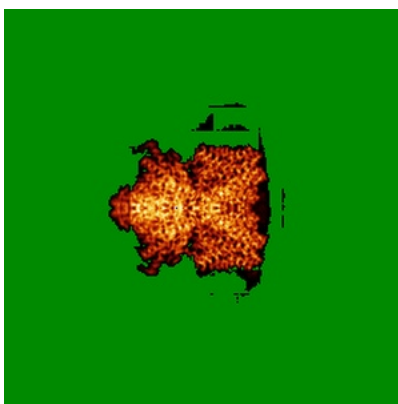
The images above show the largest variance slices of the map in three orthogonal directions.

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

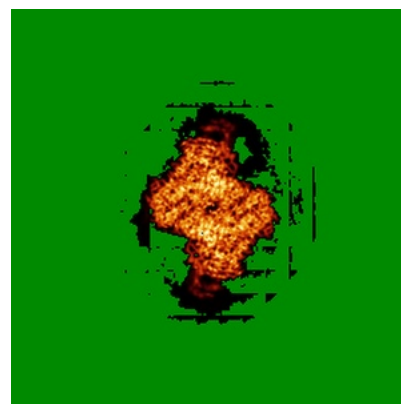
6.4.1 Primary map



X

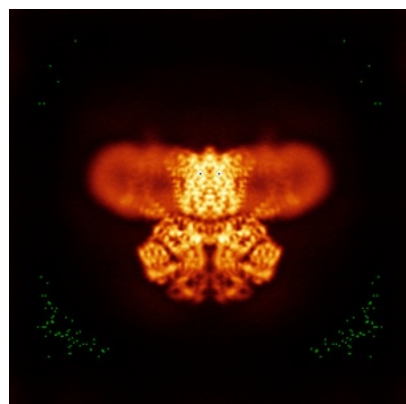


Y

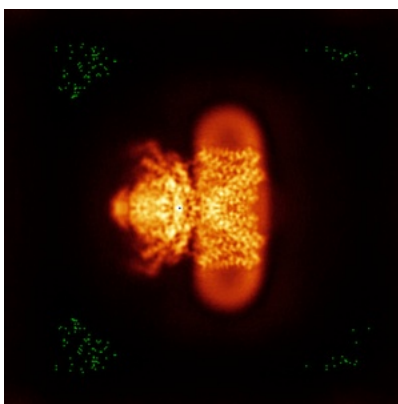


Z

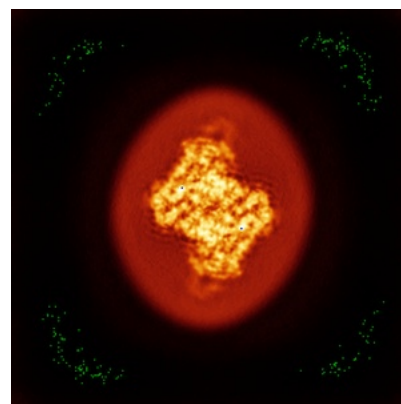
6.4.2 Raw map



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.

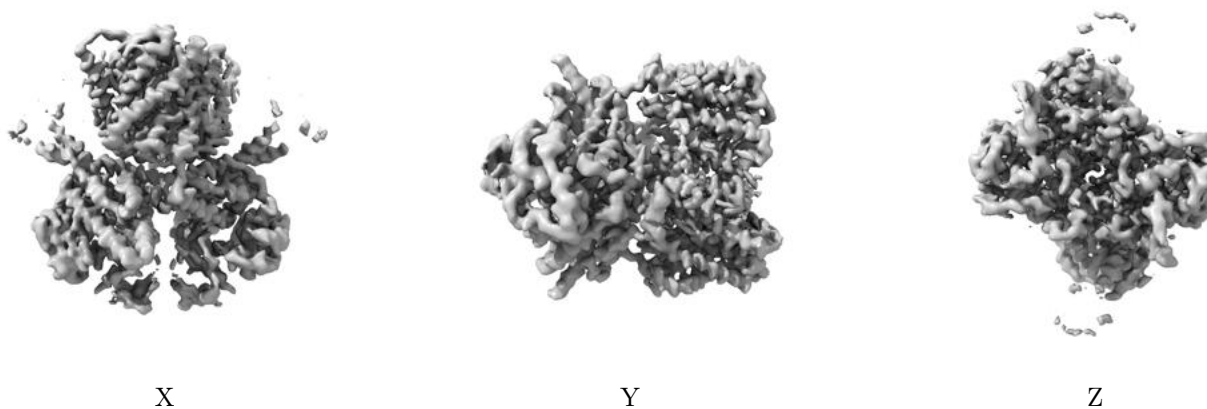
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.146. 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.

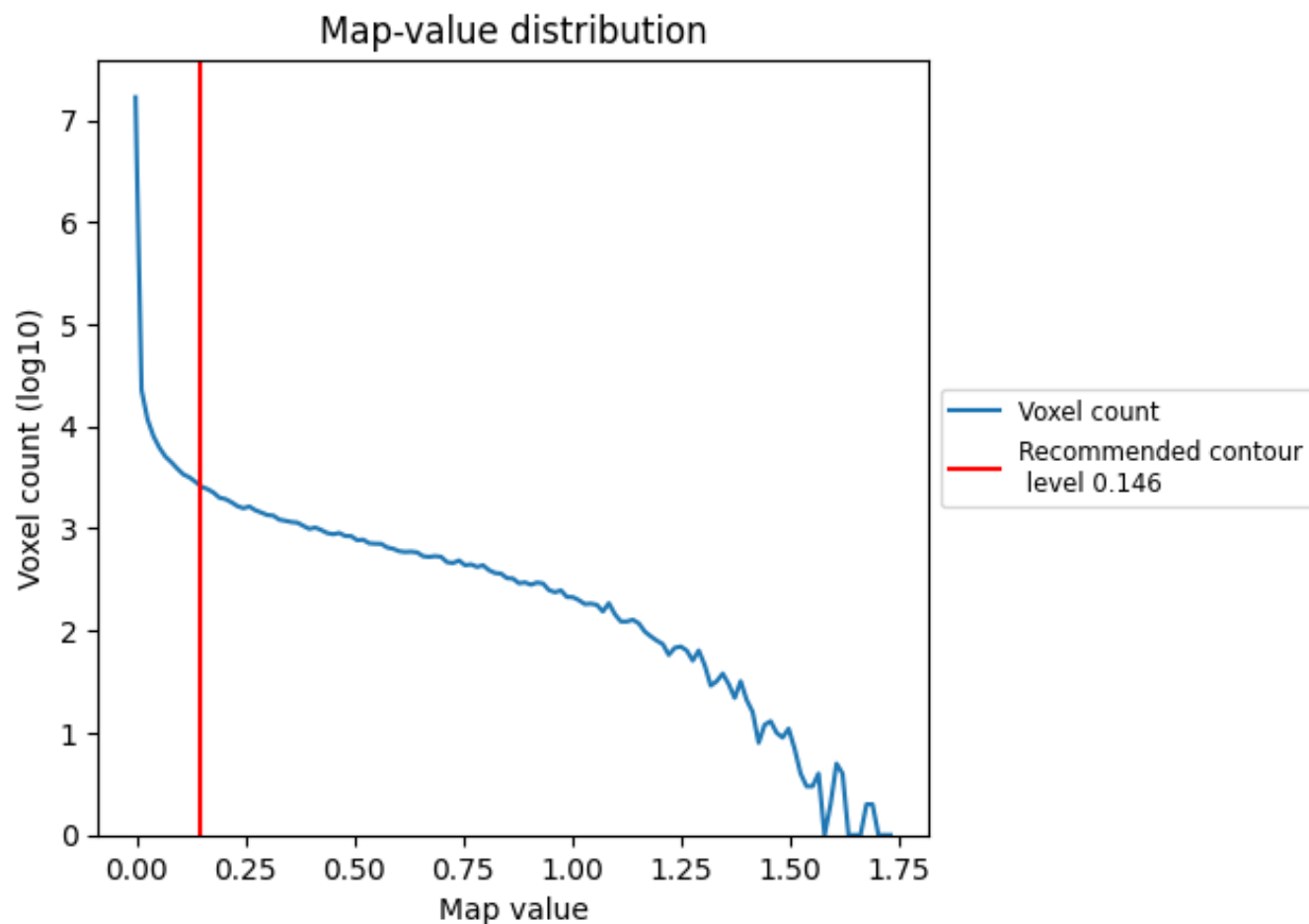
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

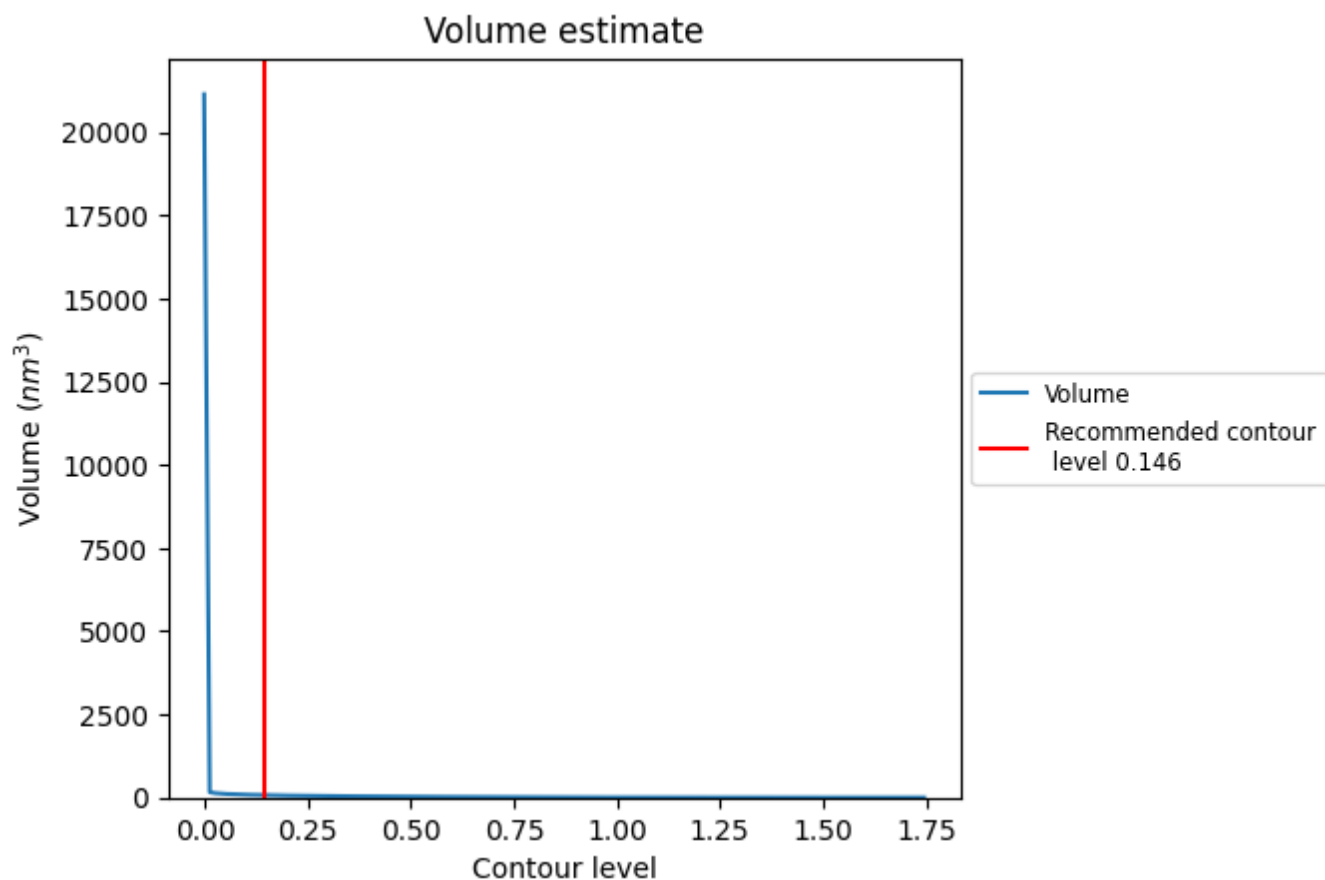
This section contains the results of statistical analysis of the map.

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.

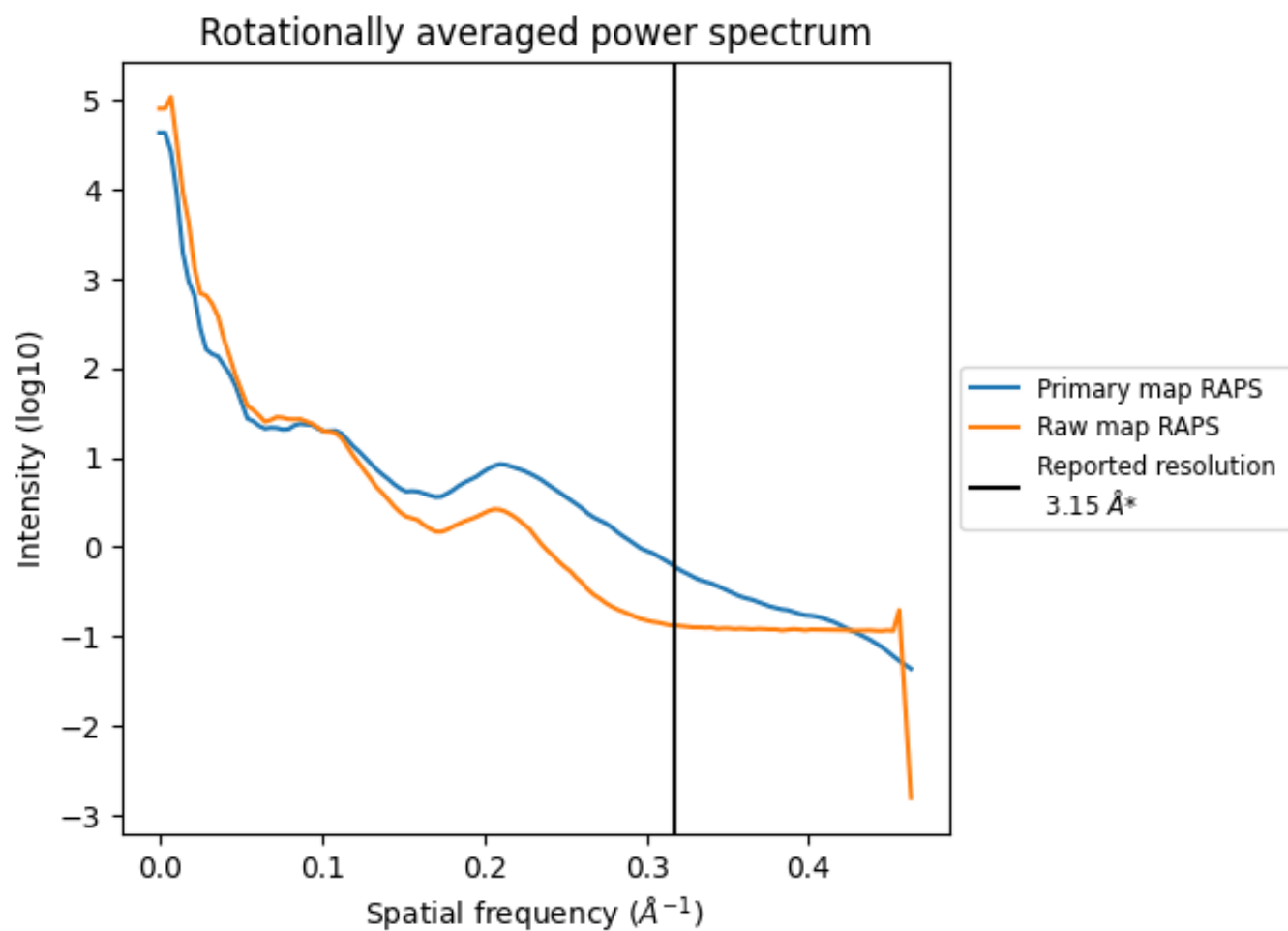
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 72 nm^3 ; this corresponds to an approximate mass of 65 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 ⓘ

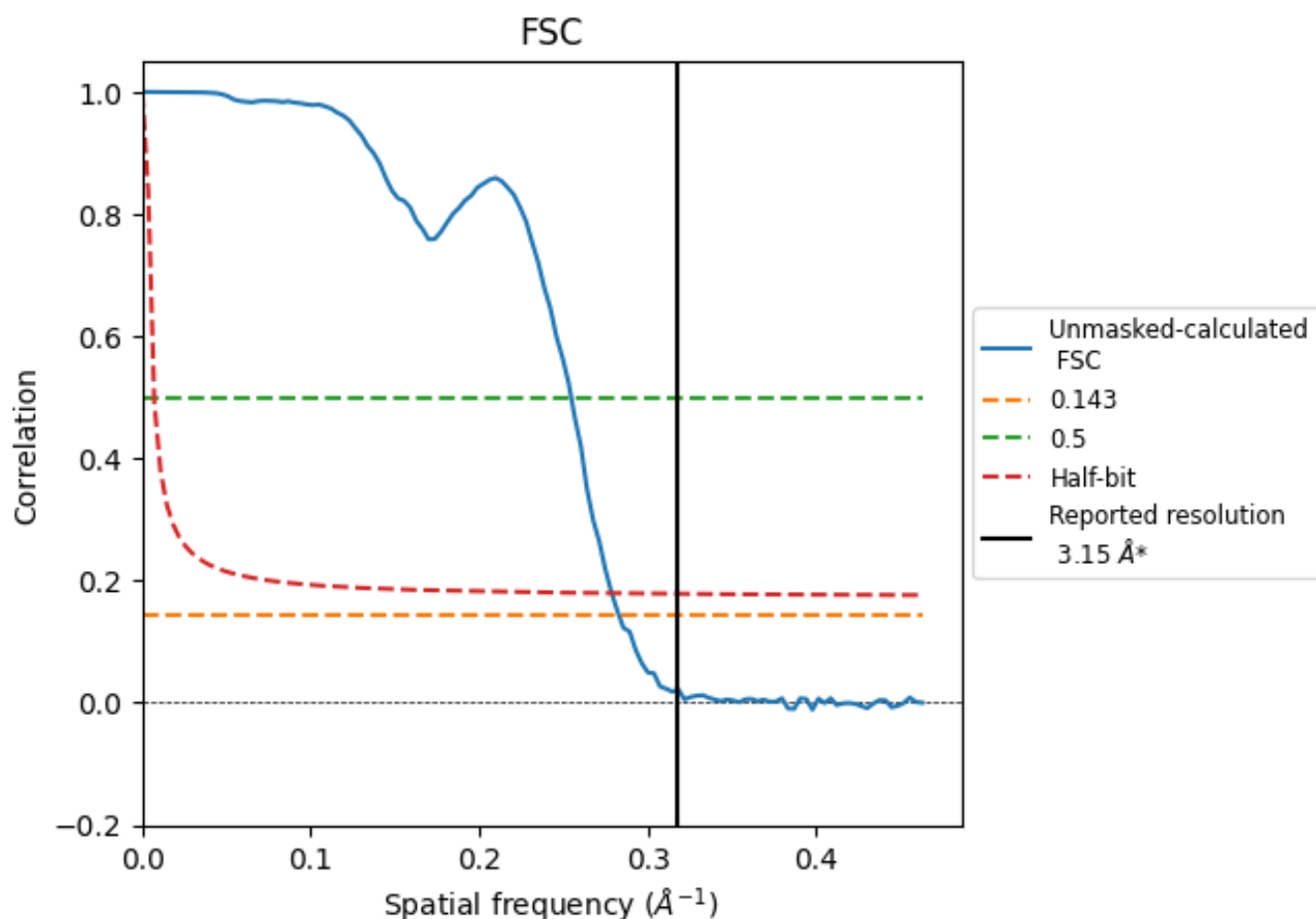


*Reported resolution corresponds to spatial frequency of $0.317 \text{ \AA}^{-1}$

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 $0.317 \text{ \AA}^{-1}$

8.2 Resolution estimates [i](#)

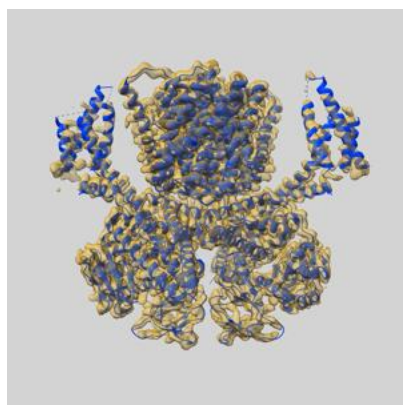
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.15	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.53	3.93	3.59

*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 3.53 differs from the reported value 3.15 by more than 10 %

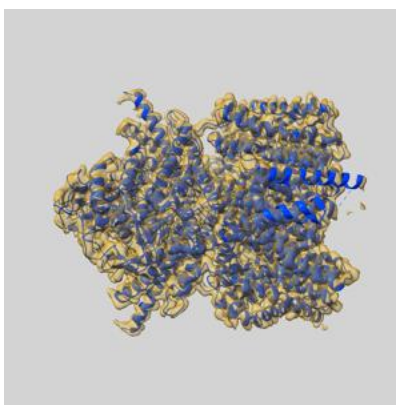
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-38566 and PDB model 8XQ5. Per-residue inclusion information can be found in [section 3](#) on [page 4](#).

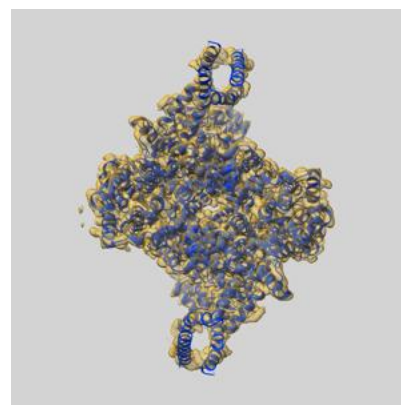
9.1 Map-model overlay [i](#)



X



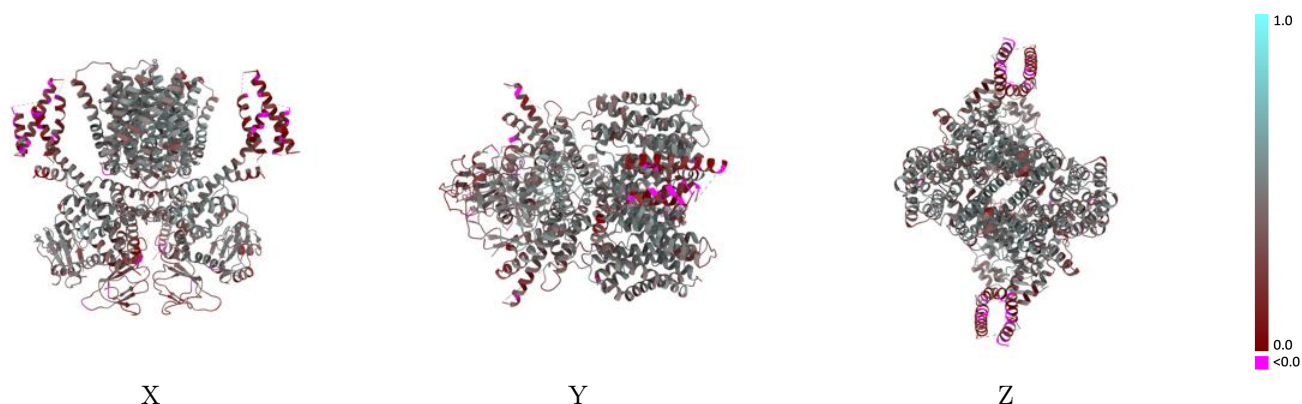
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.146 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](#)

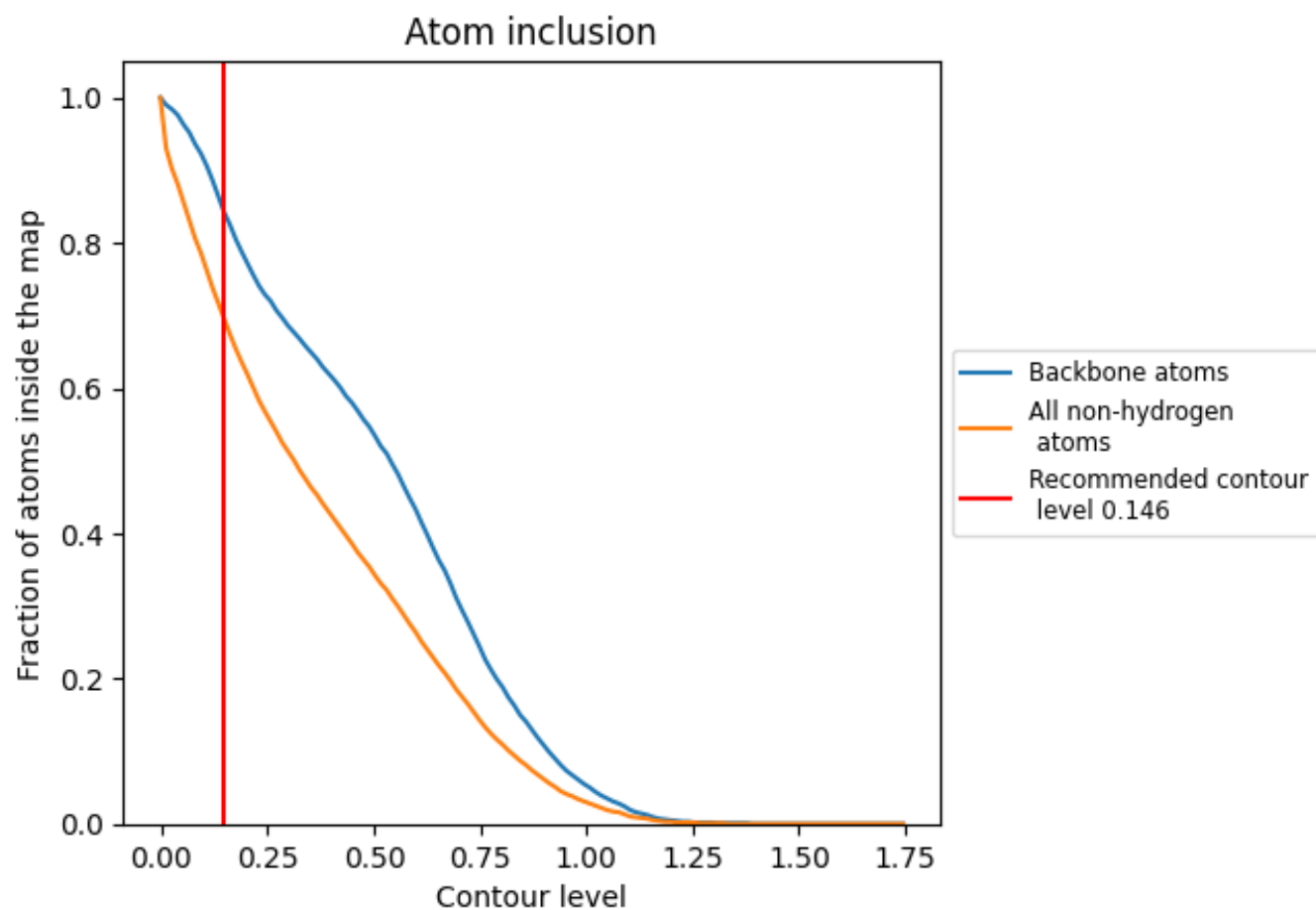


The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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, 85% of all backbone atoms, 70% 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 (0.146) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.6980	0.4040
A	0.6980	0.4040
B	0.6990	0.4040

