



wwPDB EM Validation Summary Report ⓘ

Feb 27, 2024 – 12:08 PM EST

PDB ID : 6V9Y
EMDB ID : EMD-21130
Title : Structure of TRPA1 bound with A-967079, PMAL-C8
Authors : Zhao, J.; Lin King, J.V.; Paulsen, C.E.; Cheng, Y.; Julius, D.
Deposited on : 2019-12-16
Resolution : 3.60 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.dev70
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

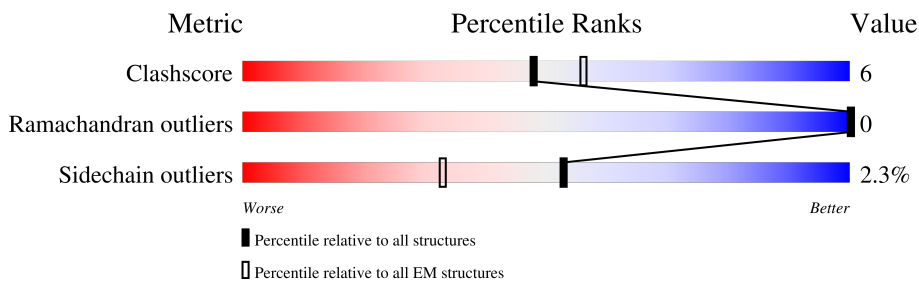
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.60 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)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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	1119	41% (green), 9% (yellow), 50% (grey)
1	B	1119	42% (green), 8% (yellow), 50% (grey)
1	C	1119	41% (green), 8% (yellow), 50% (grey)
1	D	1119	41% (green), 9% (yellow), 50% (grey)

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 17716 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 Transient receptor potential cation channel subfamily A member 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	562	4429	2907	738	753	31	0	0
1	B	562	4429	2907	738	753	31	0	0
1	D	562	4429	2907	738	753	31	0	0
1	C	562	4429	2907	738	753	31	0	0


There are 4 discrepancies between the modelled and reference sequences:

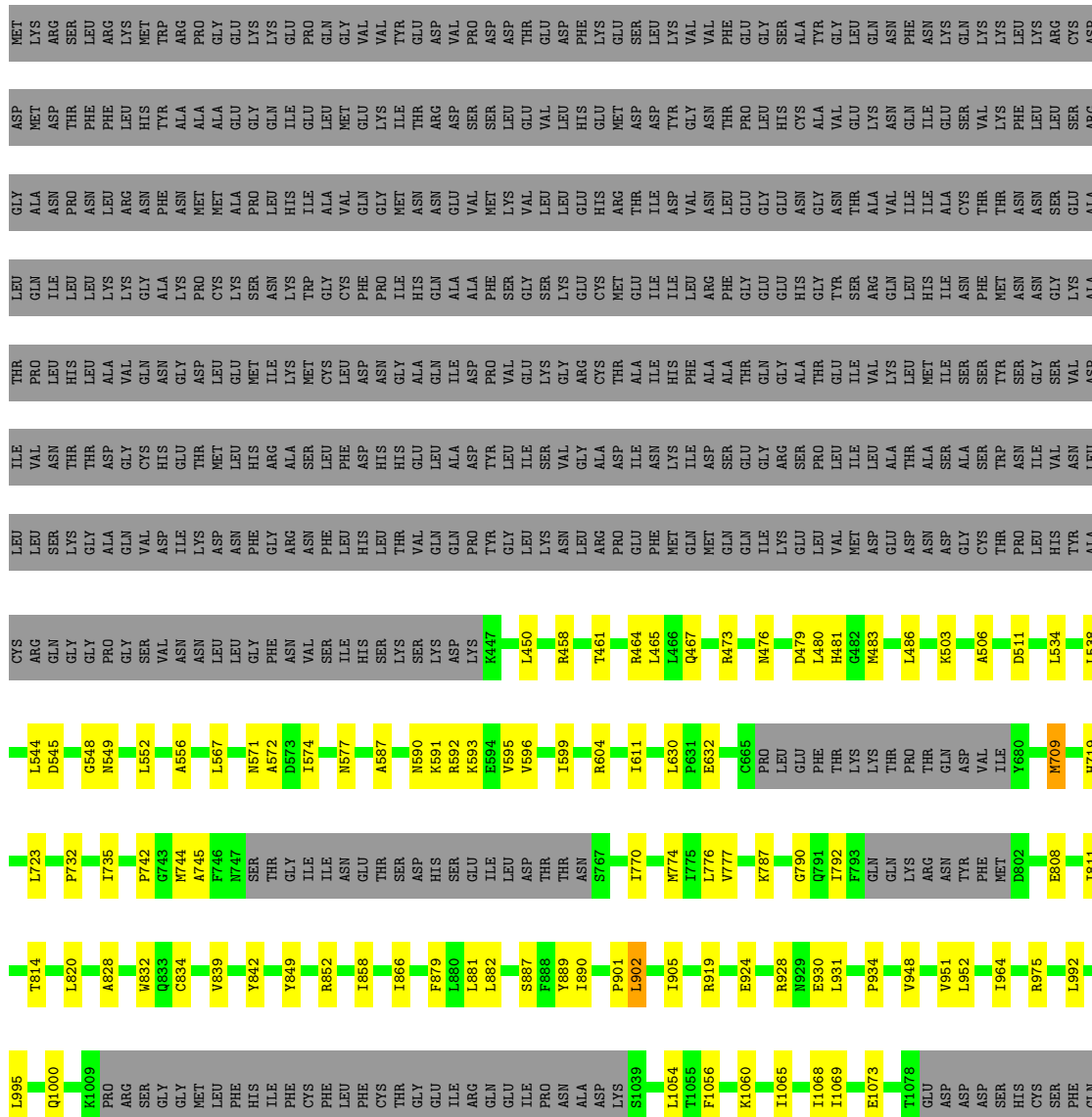
Chain	Residue	Modelled	Actual	Comment	Reference
A	966	ASP	GLU	engineered mutation	UNP O75762
B	966	ASP	GLU	engineered mutation	UNP O75762
D	966	ASP	GLU	engineered mutation	UNP O75762
C	966	ASP	GLU	engineered mutation	UNP O75762

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: Transient receptor potential cation channel subfamily A member 1

Chain A: 



LEU	CYS	L544	I735	W832	K1009	LYS
LEU	ARG	D545	M744	Q833	PRO	LYS
SER	GLY	G548	A745	C834	ARG	GLN
LYS	GLY	N549	F746	V839	SER	GLN
ALA	PRO	G549	M747	Y840	GLY	GLU
GLN	GLY	L552	SER	F841	GLY	GLN
VAL	SER	H553	THR	Y842	MET	ARG
ASP	VAL	L567	GLY	Y849	LEU	ASN
ASP	ASN	L567	ILE	R852	PHE	SER
ILE	ASN	I574	ILE	I858	ILE	ARG
LYS	LEU	N577	ASN	I866	CYS	TRP
ASP	LEU	L586	GLU	L871	PHE	ASN
ASN	ASN	N590	THR	F879	CYS	THR
ASN	VAL	K591	SER	L880	THR	VAL
PHE	VAL	R592	HIS	L881	ALA	VAL
LEU	ILE	K593	GLU	L882	LYS	LYS
HIS	ILE	E594	ILE	L889	ALA	ALA
LEU	HIS	V595	GLU	Y889	THR	LYS
THR	THR	V596	THR	P901	GLY	LYS
GLN	ASP	I599	ASN	L902	ILE	GLN
PRO	LYS	I611	S767	I905	PRO	LEU
TYR	R447	L450	L776	I906	ASN	GLU
GLY	L450	R458	V777	Q907	ALA	PRO
LEU	R458	T461	F778	R919	ASP	ALA
LYS	R458	R464	K787	E924	LYS	ALA
ASN	R464	L465	G790	R928	LYS	LYS
LEU	L465	L466	I792	R929	LYS	LYS
LEU	L466	Q467	F793	E930	GLN	LYS
PRO	L466	R473	GLN	L931	LYS	LYS
PRO	Q467	M476	ARG	P934	ARG	LYS
GLU	R473	D479	LYS	V948	ASN	LYS
GLN	M476	L480	THR	V951	TYR	GLU
GLN	D479	H481	THR	L952	PHE	GLU
GLN	L480	G482	THR	L955	MET	LEU
MET	H481	M483	GLN	E808	GLU	LEU
GLN	G482	L486	VAL	I611	ILE	LEU
GLN	M483	K503	ILE	T611	Y680	LEU
MET	L486	A506	Y709	T814	THR	LEU
ASP	K503	D511	H719	I816	THR	LEU
GLU	A506	L723	L723	L820	PRO	LEU
ASN	D511	Y726	Y726	A828	PRO	LEU
ASN	L538	P732	P732		HIS	LEU
ASP	L538				TYR	LEU
GLY					HIS	LEU
CYS					ARG	LEU
THR					ARG	LEU
PRO					PHE	LEU
THR					PHE	LEU
PRO					ARG	LEU
LEU					ARG	LEU
LEU					PHE	LEU
HIS					PHE	LEU
TYR					PHE	LEU
TYR					PHE	LEU
ALA					PHE	LEU

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C4	Depositor
Number of particles used	30321	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 ($e^-/\text{\AA}^2$)	40	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	42.620	Depositor
Minimum map value	-18.891	Depositor
Average map value	0.000	Depositor
Map value standard deviation	1.000	Depositor
Recommended contour level	0.01	Depositor
Map size (Å)	311.1936, 311.1936, 311.1936	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.2156, 1.2156, 1.2156	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	0.44	0/4524	0.64	3/6130 (0.0%)
1	B	0.44	0/4524	0.64	3/6130 (0.0%)
1	C	0.44	0/4524	0.64	3/6130 (0.0%)
1	D	0.44	0/4524	0.64	3/6130 (0.0%)
All	All	0.44	0/18096	0.64	12/24520 (0.0%)

There are no bond length outliers.

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	902	LEU	CA-CB-CG	7.88	133.43	115.30
1	A	902	LEU	CA-CB-CG	7.87	133.41	115.30
1	C	902	LEU	CA-CB-CG	7.87	133.40	115.30
1	D	902	LEU	CA-CB-CG	7.86	133.37	115.30
1	B	503	LYS	CD-CE-NZ	7.27	128.42	111.70

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	4429	0	4494	60	0
1	B	4429	0	4494	59	0
1	C	4429	0	4494	61	0
1	D	4429	0	4494	61	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	17716	0	17976	224	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.

The worst 5 of 224 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:D:1056:PHE:CZ	1:D:1060:LYS:HE2	1.99	0.97
1:C:1056:PHE:CZ	1:C:1060:LYS:HE2	1.99	0.97
1:B:1056:PHE:CZ	1:B:1060:LYS:HE2	1.99	0.97
1:A:1056:PHE:CZ	1:A:1060:LYS:HE2	1.99	0.96
1:B:732:PRO:HG2	1:B:776:LEU:HD22	1.77	0.67

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	552/1119 (49%)	521 (94%)	31 (6%)	0	100	100
1	B	552/1119 (49%)	521 (94%)	31 (6%)	0	100	100
1	C	552/1119 (49%)	521 (94%)	31 (6%)	0	100	100
1	D	552/1119 (49%)	521 (94%)	31 (6%)	0	100	100
All	All	2208/4476 (49%)	2084 (94%)	124 (6%)	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	469/995 (47%)	458 (98%)	11 (2%)	50	76
1	B	469/995 (47%)	458 (98%)	11 (2%)	50	76
1	C	469/995 (47%)	458 (98%)	11 (2%)	50	76
1	D	469/995 (47%)	458 (98%)	11 (2%)	50	76
All	All	1876/3980 (47%)	1832 (98%)	44 (2%)	53	76

5 of 44 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	839	VAL
1	C	534	LEU
1	D	881	LEU
1	D	1073	GLU
1	C	709	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 29 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	954	ASN
1	C	933	HIS
1	D	700	HIS
1	C	719	HIS
1	D	644	HIS

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 monosaccharides 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.

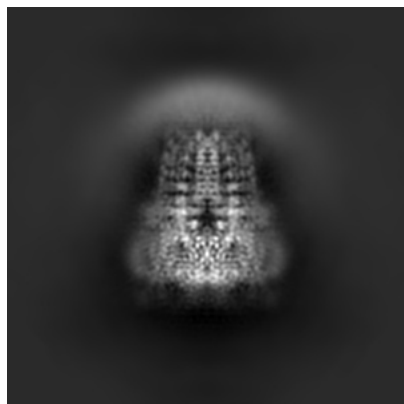
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-21130. These allow visual inspection of the internal detail of the map and identification of artifacts.

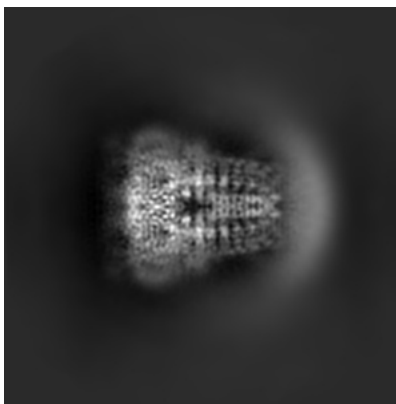
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

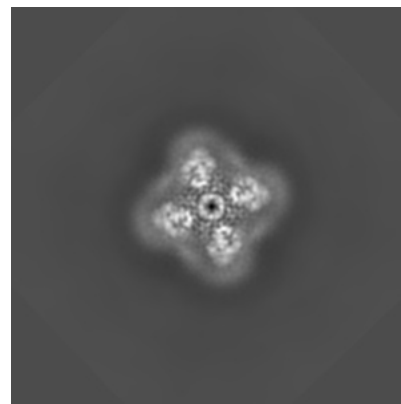
6.1.1 Primary map



X

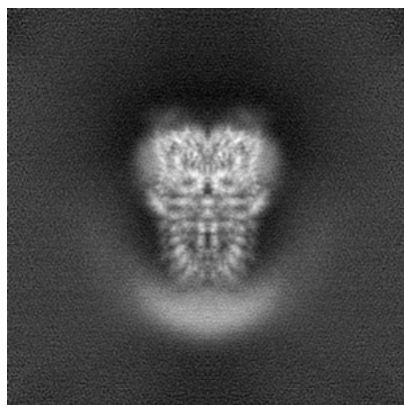


Y

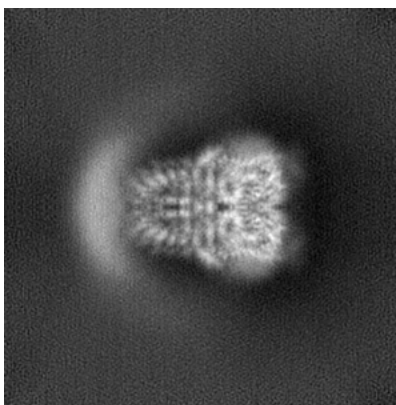


Z

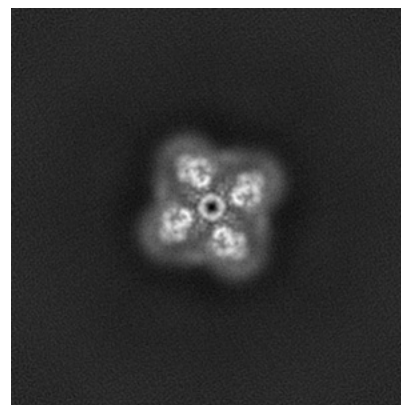
6.1.2 Raw map



X



Y

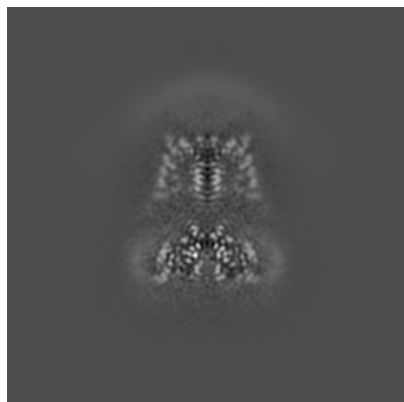


Z

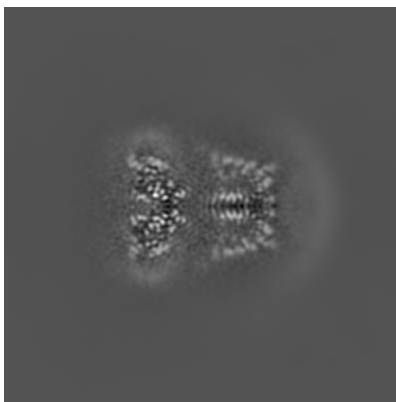
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

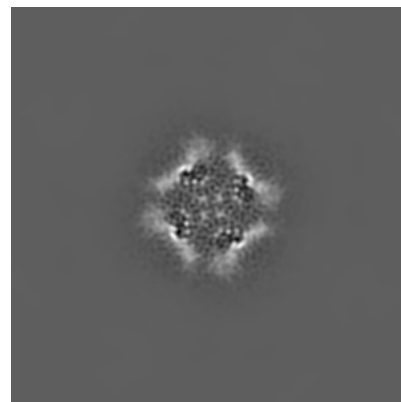
6.2.1 Primary map



X Index: 128

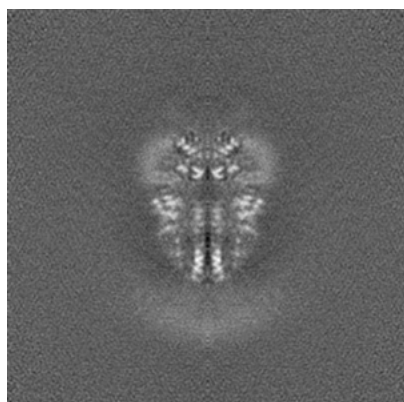


Y Index: 128

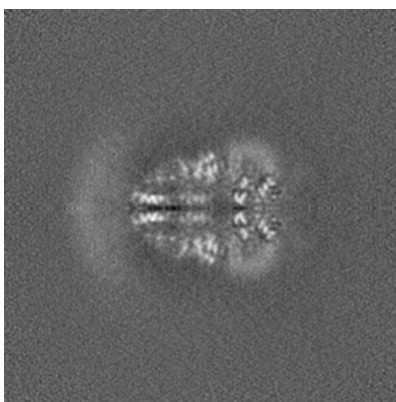


Z Index: 128

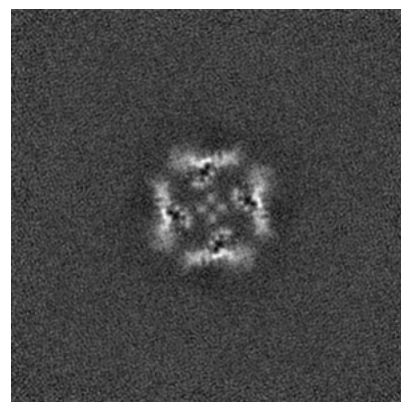
6.2.2 Raw map



X Index: 128



Y Index: 128

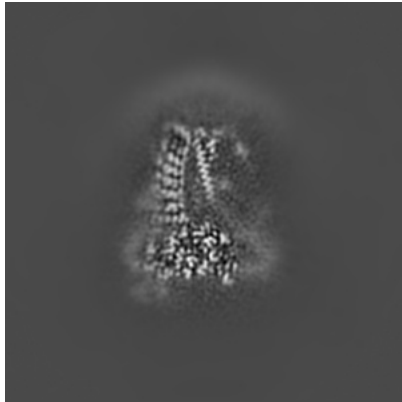


Z Index: 128

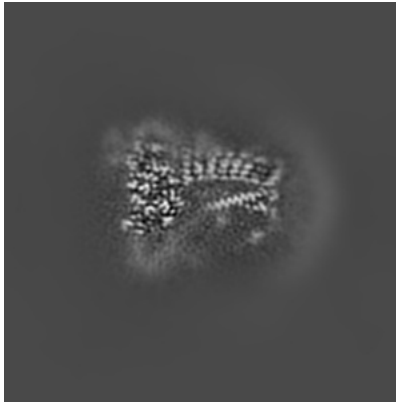
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

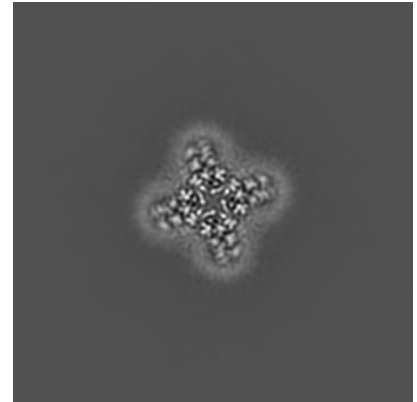
6.3.1 Primary map



X Index: 134

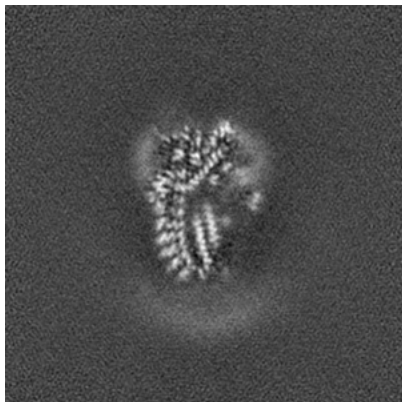


Y Index: 134

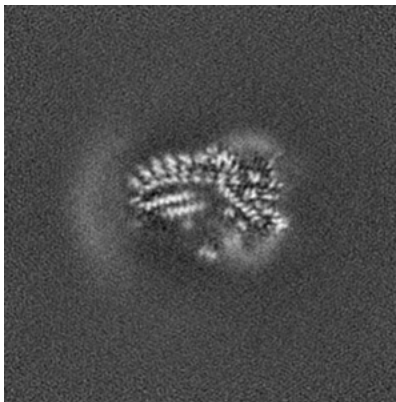


Z Index: 87

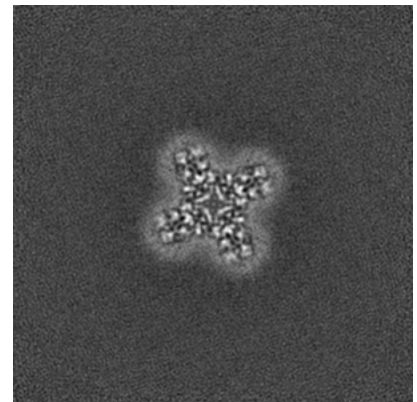
6.3.2 Raw map



X Index: 133



Y Index: 133

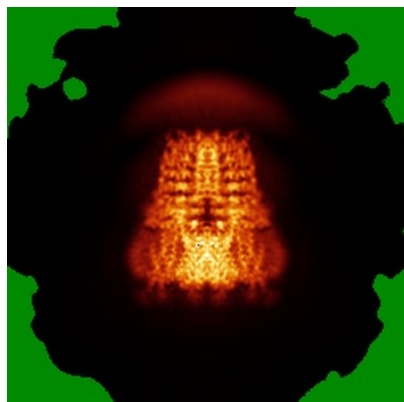


Z Index: 170

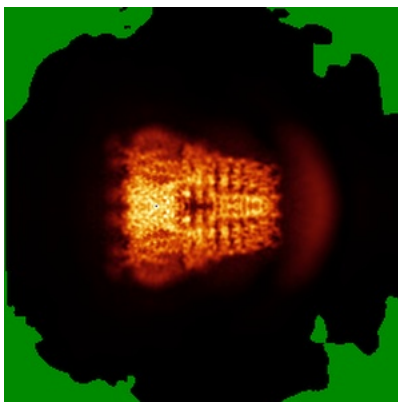
The images above show the largest variance slices of the map in three orthogonal directions.

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

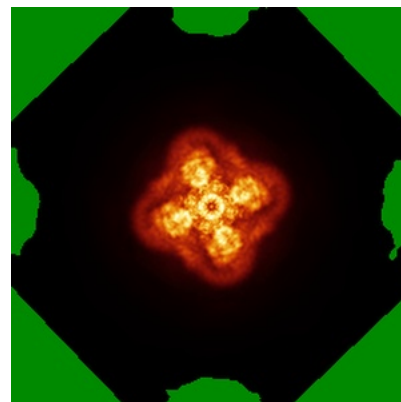
6.4.1 Primary map



X

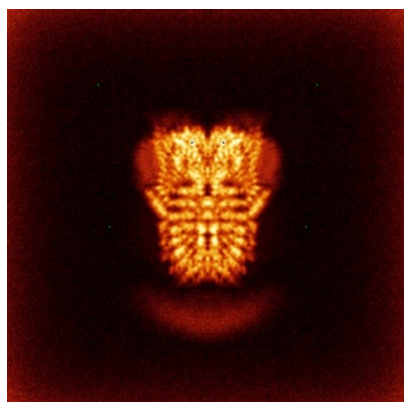


Y

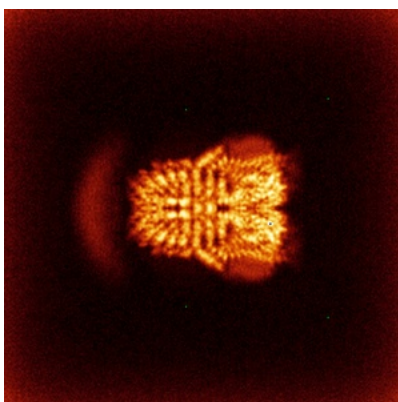


Z

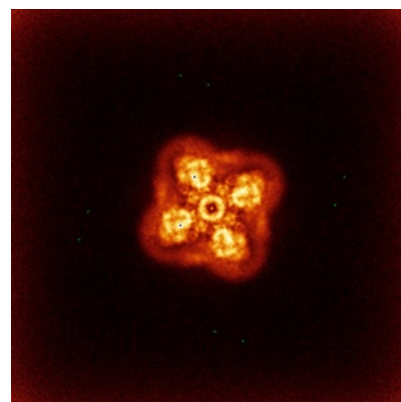
6.4.2 Raw map



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.

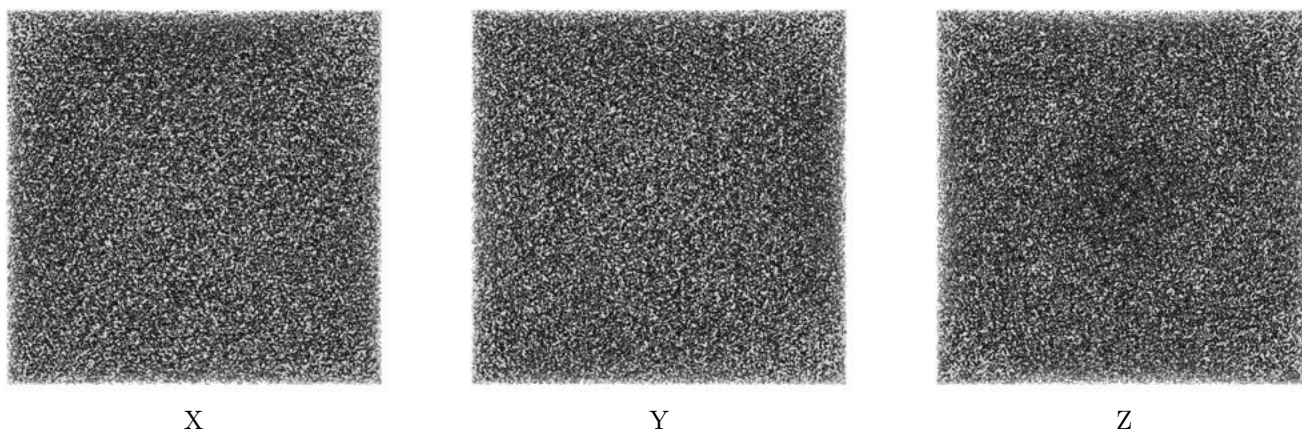
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.01. 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.

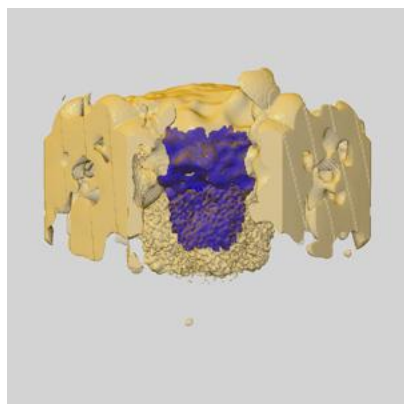
6.6 Mask visualisation [i](#)

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

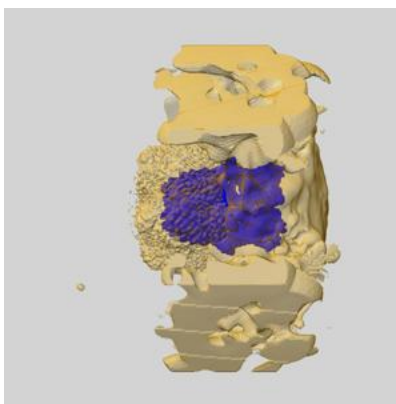
A mask typically either:

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

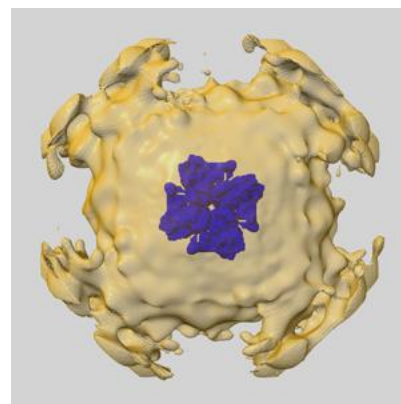
6.6.1 emd_21130_msk_1.map [i](#)



X



Y

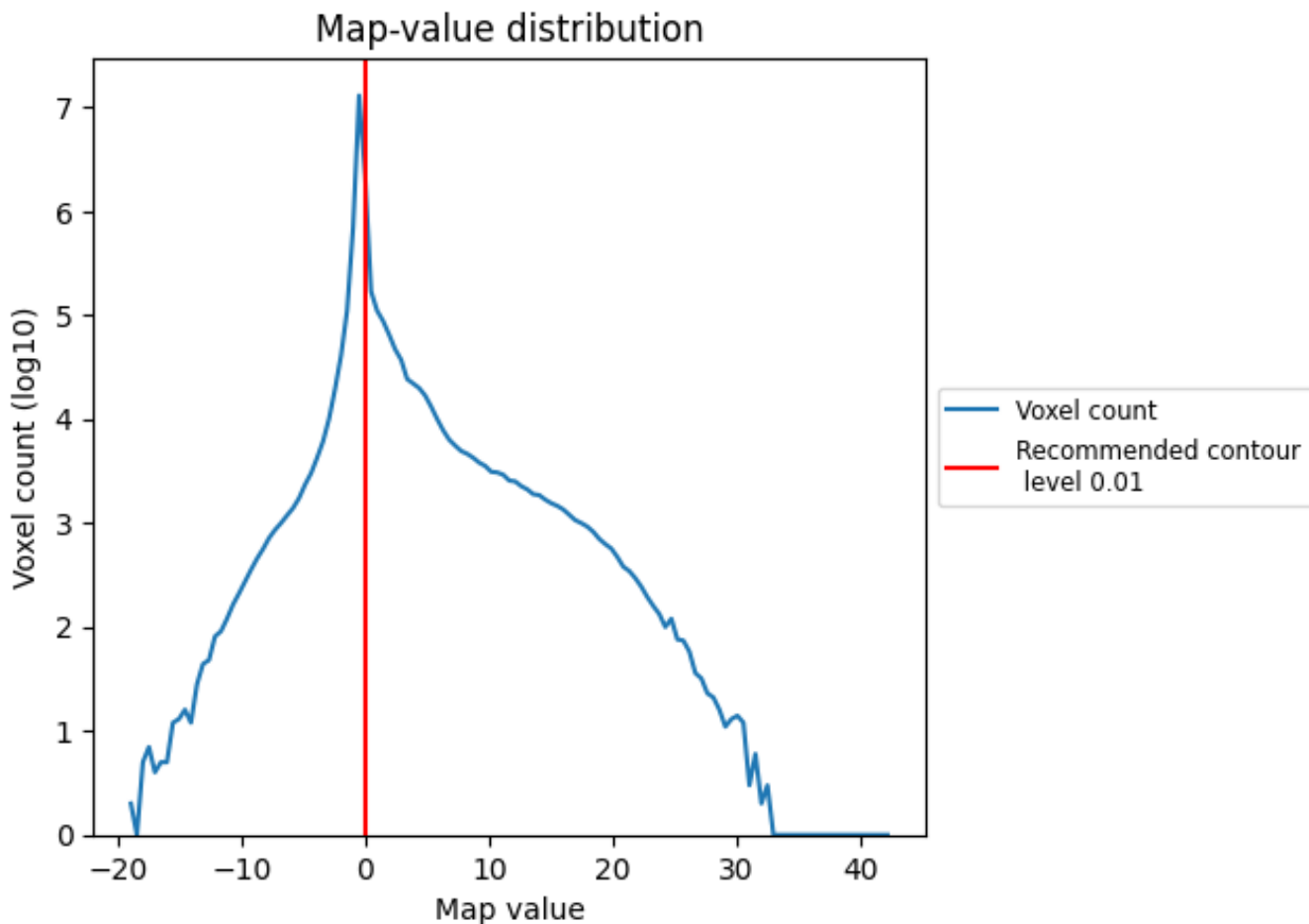


Z

7 Map analysis [i](#)

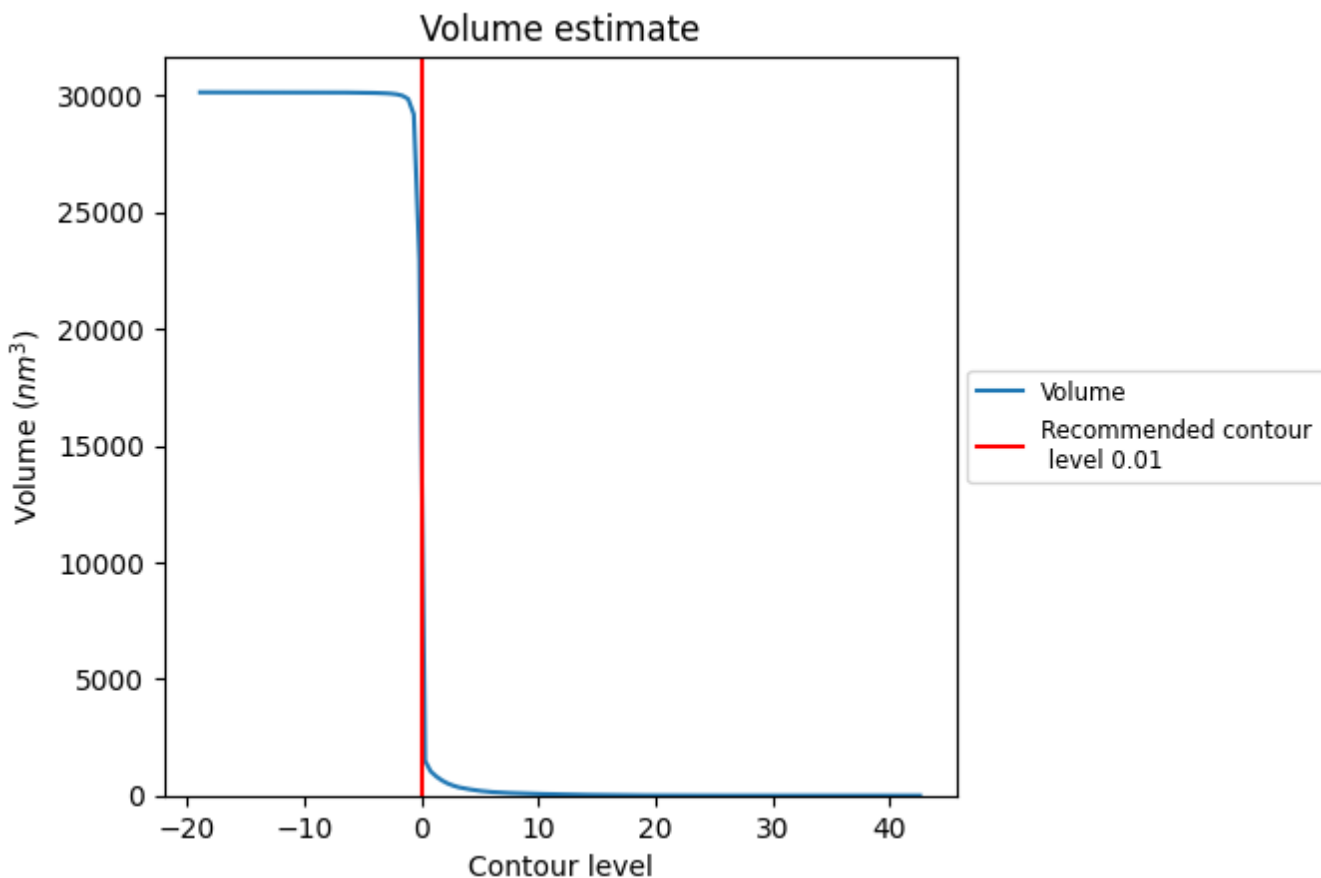
This section contains the results of statistical analysis of the map.

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.

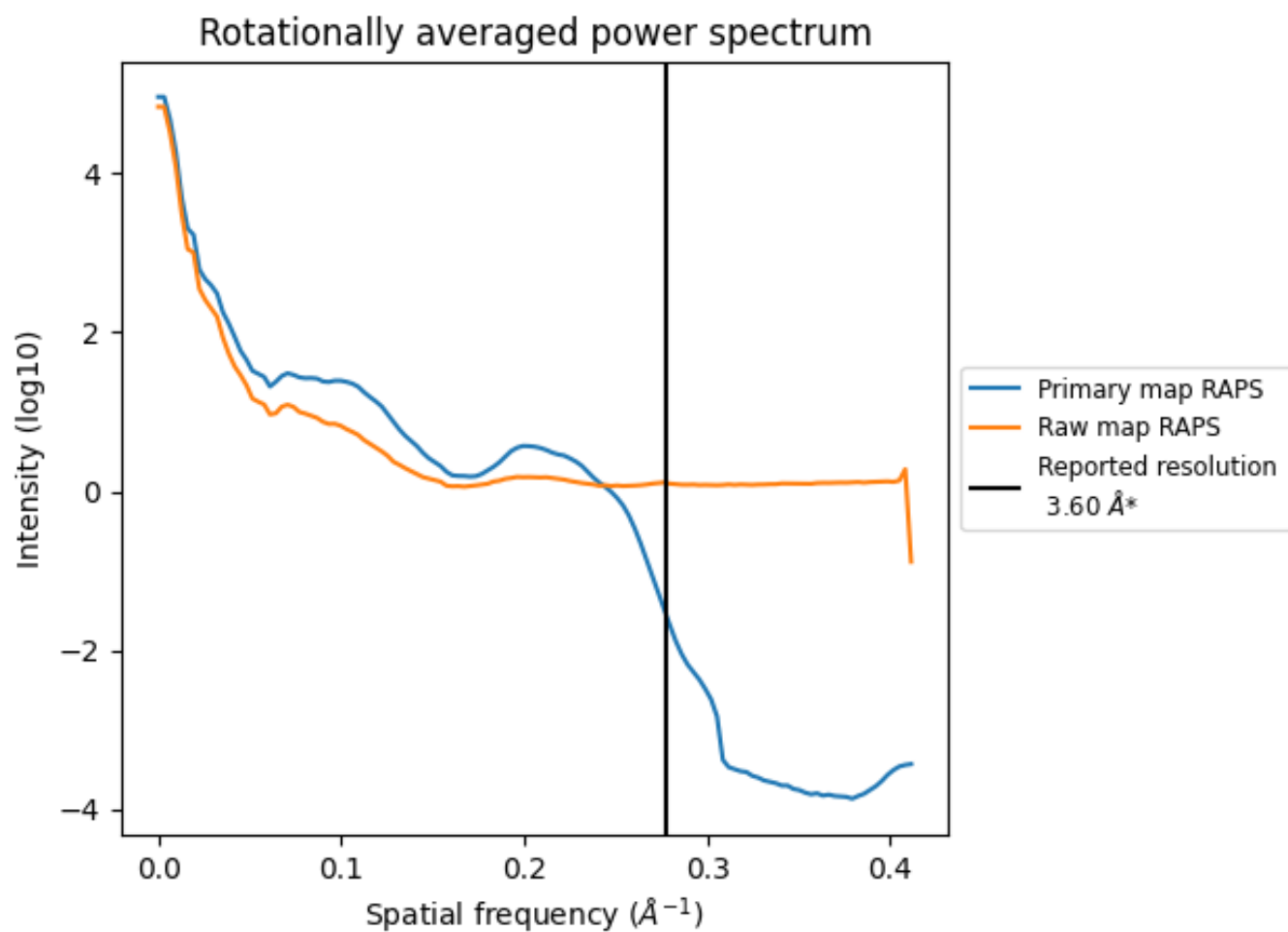
7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 15828 nm³; this corresponds to an approximate mass of 14298 kDa.

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

7.3 Rotationally averaged power spectrum i

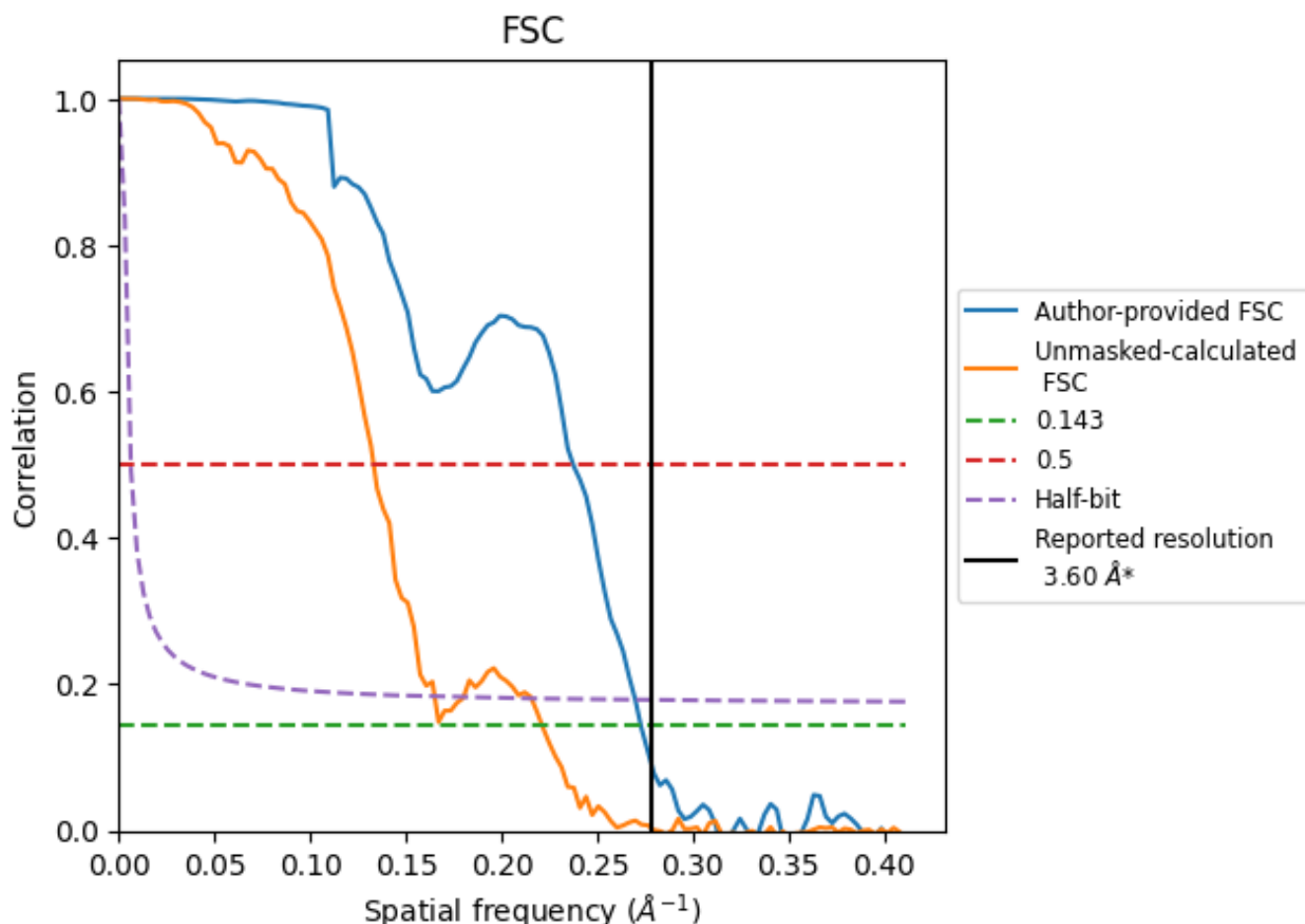


*Reported resolution corresponds to spatial frequency of 0.278 Å⁻¹

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 0.278 Å⁻¹

8.2 Resolution estimates [i](#)

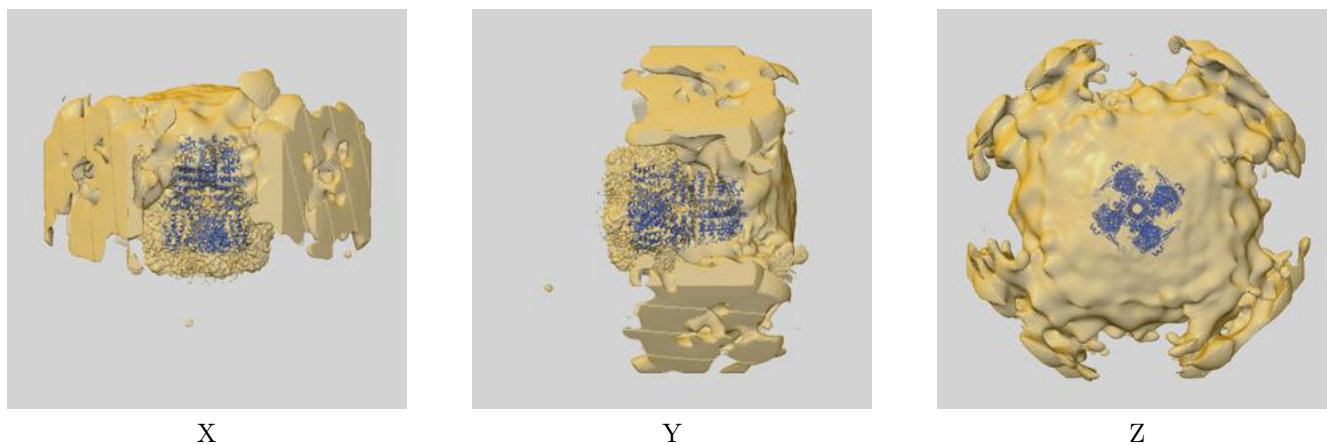
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.60	-	-
Author-provided FSC curve	3.66	4.21	3.71
Unmasked-calculated*	4.52	7.51	6.06

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 4.52 differs from the reported value 3.6 by more than 10 %

9 Map-model fit [i](#)

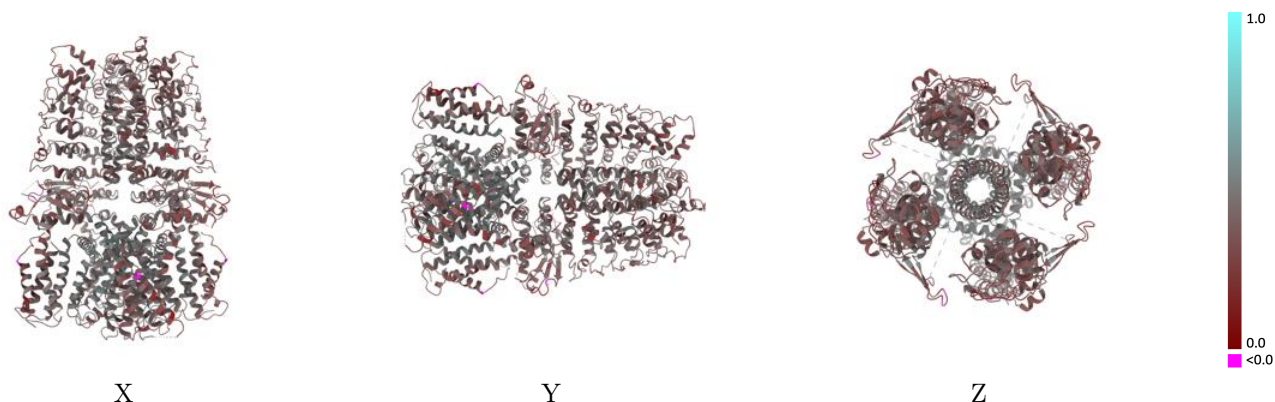
This section contains information regarding the fit between EMDB map EMD-21130 and PDB model 6V9Y. Per-residue inclusion information can be found in section 3 on page 4.

9.1 Map-model overlay [i](#)



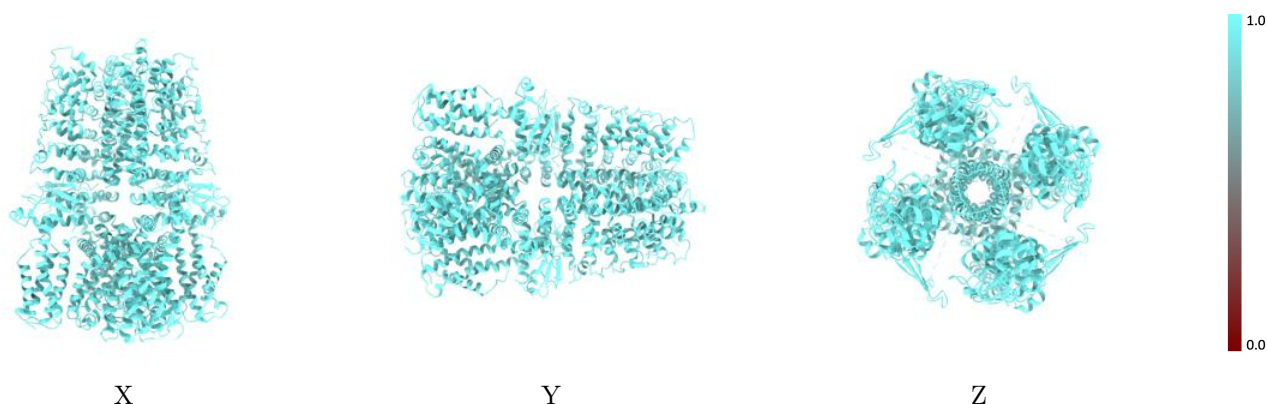
The images above show the 3D surface view of the map at the recommended contour level 0.01 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



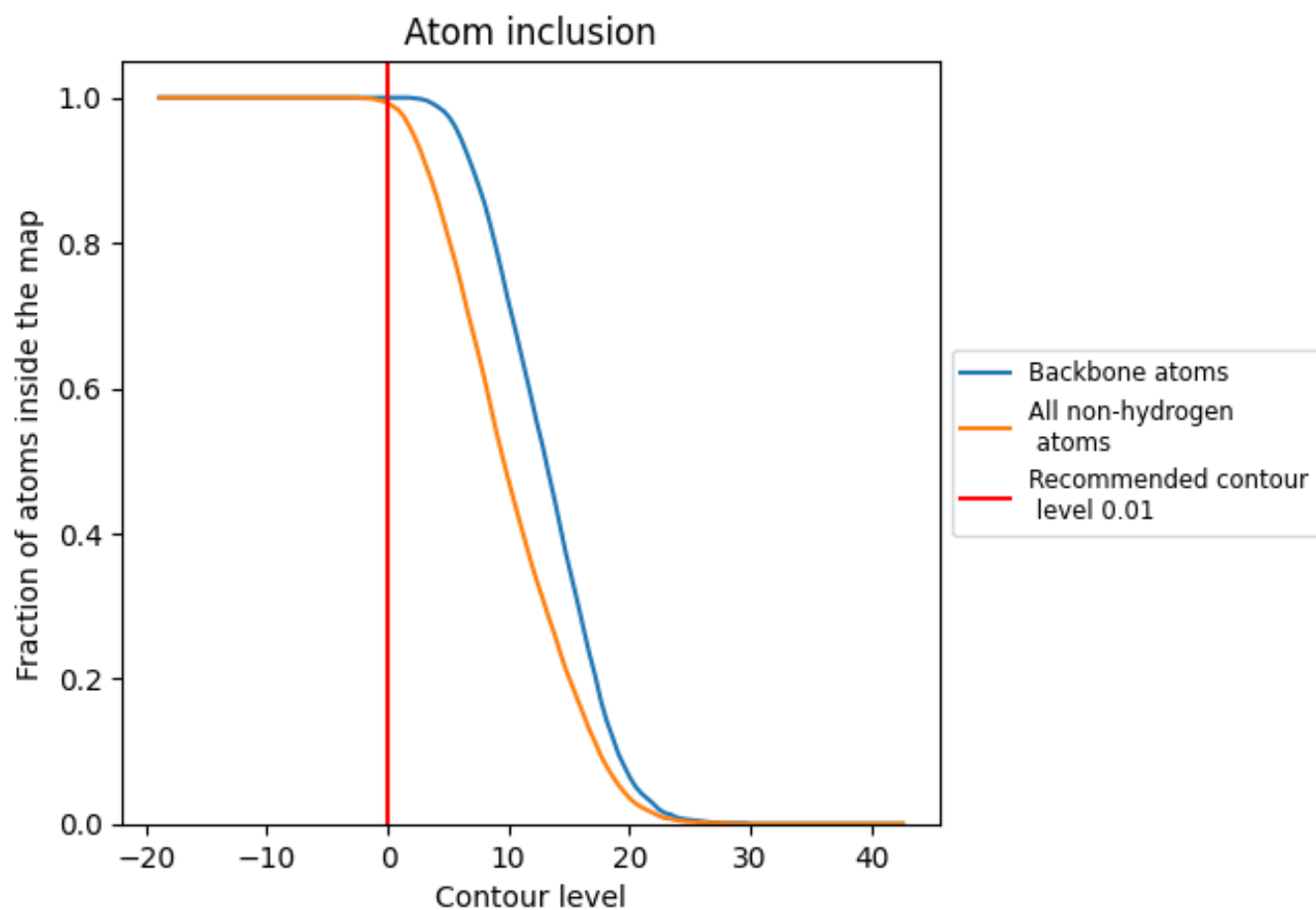
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.01).


9.4 Atom inclusion [i](#)



At the recommended contour level, 100% 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 (0.01) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.9930	 0.3900
A	 0.9940	 0.3950
B	 0.9930	 0.3930
C	 0.9930	 0.3880
D	 0.9930	 0.3860

