



wwPDB EM Validation Summary Report ⓘ

Aug 10, 2026 – 10:21 PM JST

PDB ID : 22TE / pdb_000022te
EMDB ID : EMD-68655
Title : Cryo-EM structure of Crimean-Congo hemorrhagic fever virus RNA polymerase in apo state
Authors : Ma, J.; Yang, K.; Wu, H.; Liang, Z.
Deposited on : 2026-01-22
Resolution : 2.59 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.dev133
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) : 2.50

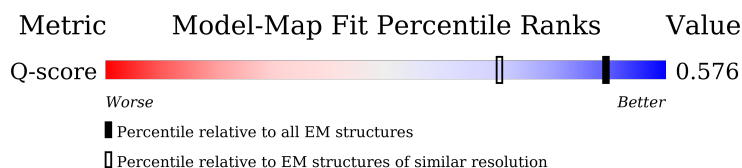
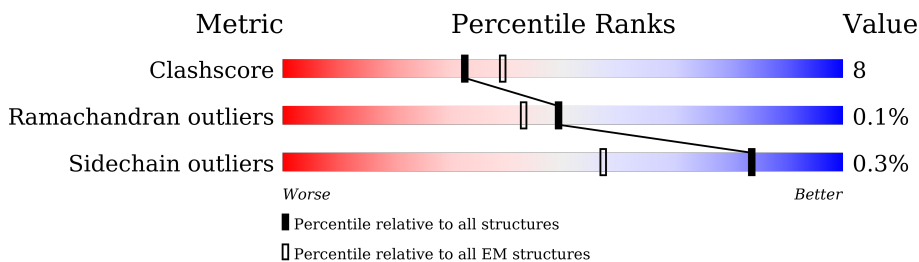
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.59 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	7741 (2.09 - 3.09)

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	3974	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 10546 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 RNA-directed RNA polymerase L.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1351	Total	C	N	O	S	0	0
			10542	6684	1817	1963	78		

There are 29 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	3946	TRP	-	expression tag	UNP Q6TQR6
A	3947	SER	-	expression tag	UNP Q6TQR6
A	3948	HIS	-	expression tag	UNP Q6TQR6
A	3949	PRO	-	expression tag	UNP Q6TQR6
A	3950	GLN	-	expression tag	UNP Q6TQR6
A	3951	PHE	-	expression tag	UNP Q6TQR6
A	3952	GLU	-	expression tag	UNP Q6TQR6
A	3953	LYS	-	expression tag	UNP Q6TQR6
A	3954	GLY	-	expression tag	UNP Q6TQR6
A	3955	SER	-	expression tag	UNP Q6TQR6
A	3956	SER	-	expression tag	UNP Q6TQR6
A	3957	GLY	-	expression tag	UNP Q6TQR6
A	3958	GLY	-	expression tag	UNP Q6TQR6
A	3959	SER	-	expression tag	UNP Q6TQR6
A	3960	SER	-	expression tag	UNP Q6TQR6
A	3961	GLY	-	expression tag	UNP Q6TQR6
A	3962	SER	-	expression tag	UNP Q6TQR6
A	3963	SER	-	expression tag	UNP Q6TQR6
A	3964	GLY	-	expression tag	UNP Q6TQR6
A	3965	GLY	-	expression tag	UNP Q6TQR6
A	3966	ALA	-	expression tag	UNP Q6TQR6
A	3967	TRP	-	expression tag	UNP Q6TQR6
A	3968	SER	-	expression tag	UNP Q6TQR6
A	3969	HIS	-	expression tag	UNP Q6TQR6
A	3970	PRO	-	expression tag	UNP Q6TQR6
A	3971	GLN	-	expression tag	UNP Q6TQR6
A	3972	PHE	-	expression tag	UNP Q6TQR6
A	3973	GLU	-	expression tag	UNP Q6TQR6

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Chain	Residue	Modelled	Actual	Comment	Reference
A	3974	LYS	-	expression tag	UNP Q6TQR6

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
2	A	2	Total	Zn	0
			2	2	

- Molecule 3 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
3	A	1	Total	Mn	0
			1	1	

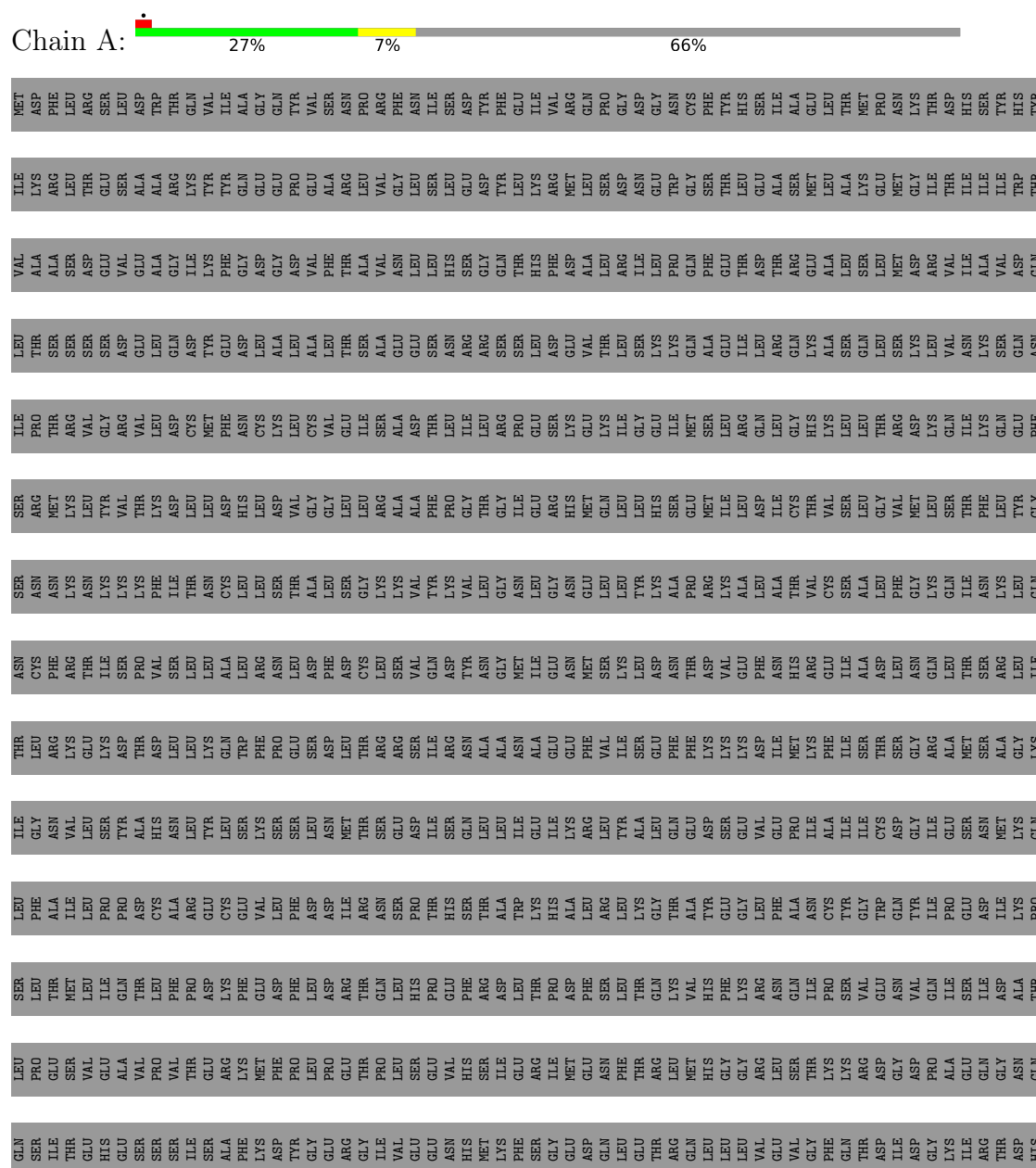
- Molecule 4 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
4	A	1	Total	Mg	0
			1	1	

3 Residue-property plots

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

• Molecule 1: RNA-directed RNA polymerase L





[illegible]

PHE	VAL	LEU	IIE	TYR	ASP	GLY	LEU
ASN	GLU	ASP	HIS	GLU	IIE	VAL	LEU
TRP	ASP	GLU	GLU	GLU	GLY	ARG	LEU
ASP	LEU	MET	ASP	VAL	PHE	GLN	GLN
SER	IIE	SER	TRP	LEU	ASN	ARG	VAL
ASP	LEU	LEU	GLN	MET	ASN	ASN	VAL
TRP	MET	PRO	ARG	ASN	VAL	THR	PHE
SER	LEU	GLU	ARG	ASN	LEU	GLU	SER
HIS	THR	LEU	IIE	IIE	VAL	VAL	ASP
PRO	GLY	LEU	GLY	IIE	VAL	VAL	SER
GLN	ARG	SER	LYS	ASN	ASN	LEU	SER
PHE	ALA	LEU	IIE	GLN	IIE	PHE	LYS
GLU	VAL	SER	LEU	LYS	ASP	ARG	VAL
LYS	LYS	VAL	VAL	ALA	ASN	GLU	VAL
GLY	PRO	ASN	ARG	VAL	THR	LEU	LEU
SER	SER	CYS	ALA	GLY	VAL	ASN	SER
SER	ALA	LYS	ASN	GLU	LYS	ARG	LYS
GLY	VAL	MET	ASN	LEU	SER	VAL	IIE
GLY	THR	GLY	GLU	IIE	GLU	VAL	PHE
SER	GLN	ASN	LEU	ASN	LEU	IIE	LYS
SER	PHE	PHE	GLY	THR	LEU	LYS	THR
GLY	VAL	GLU	ASP	THR	TRP	ASP	GLU
HIS	HIS	GLY	VAL	GLY	LYS	ASN	LEU
SER	GLY	GLU	SER	LEU	PHE	LEU	LEU
GLY	ASP	GLU	LEU	SER	THR	GLU	LEU
GLY	GLU	CYS	VAL	ASP	GLN	ASN	ASN
ALA	GLN	PHE	LYS	LEU	VAL	GLY	SER
TRP	CYS	GLU	ASN	LEU	THR	VAL	SER
SER	GLN	PHE	IIE	GLU	ASN	GLU	THR
HIS	GLU	THR	VAL	GLU	VAL	GLU	LEU
PRO	GLN	IIE	LEU	SER	SER	GLU	LEU
GLN	IIE	LEU	VAL	LEU	THR	IIE	HIS
PHE	LEU	LYS	PRO	LEU	THR	GLU	CYS
GLU	LEU	ASP	LEU	THR	SER	PHE	PHE
LYS	ASP	ASN	LYS	LEU	THR	CYS	LEU
	ASP	SER	ASP	CYS	IIE	ASN	LYS
	LEU	ALA	MET	ALA	LYS	ASN	HIS
	MET	ARG	SER	PHE	ASP	LEU	ALA
	ALA	LEU	LYS	TYR	VAL	THR	PRO
	ASN	ASP	PRO	PHN	ARG	LYS	SER
	ASP	TYR	LYS	GLN	THR	THR	ASP
	THR	ASN	SER	SER	LEU	VAL	ALA
	VAL	LYS	GLU	GLU	VAL	SER	IIE
	THR	LEU	ARG	CYS	VAL	GLU	LEU
	THR	LEU	GLY	GLU	THR	LEU	LYS
	PHE	IIE	VAL	SER	TYR	ASN	GLU
	ASP	ASP	VAL	LYS	VAL	PRO	VAL
	PRO	HIS	MET	ARG	SER	LEU	SER
	ASP	CYS	ALA	ASP	THR	PRO	GLU
	ARG	VAL	ARG	GLY	GLU	LEU	LYS
	GLU	ASP	ARG	PRO	THR	SER	SER
	GLU	MET	SER	ARG	IIE	CYS	SER
	ALA	GLU	LEU	CYS	PRO	TRP	LEU
	ALA	LYS	ASN	SER	LYS	SER	LEU
	LEU	LYS	HIS	PHE	PHE	GLU	HIS
	LYS	ARG	ALA	ALA	LEU	VAL	LYS
	THR	GLU	LEU	ALA	LEU	GLN	TYR
	GLY	ALA	SER	LEU	ALA	ASN	LYS
	ASN	VAL	LEU	LEU	PHE	TYR	LYS
	LEU	ARG	MET	THR	LEU	IIE	SER
	GLY	ALA	PHE	LEU	LEU	GLY	GLY

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	39727	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 ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	1.402	Depositor
Minimum map value	-1.036	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.038	Depositor
Recommended contour level	0.15	Depositor
Map size ($\text{\AA}$)	280.32, 280.32, 280.32	wwPDB
Map dimensions	384, 384, 384	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	0.73, 0.73, 0.73	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: MN, MG, ZN

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	0.10	0/10723	0.26	0/14499

There are no bond length outliers.

There are no bond angle outliers.

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	10542	0	10409	178	0
2	A	2	0	0	0	0
3	A	1	0	0	0	0
4	A	1	0	0	0	0
All	All	10546	0	10409	178	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 8.

The worst 5 of 178 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1534:SER:HA	1:A:2570:SER:HB3	1.70	0.72
1:A:1424:GLN:HB3	1:A:3219:GLU:HB3	1.72	0.72
1:A:2600:ASN:OD1	1:A:2601:SER:N	2.22	0.71
1:A:1323:LEU:HD23	1:A:1420:ILE:HG12	1.76	0.68
1:A:3203:MET:N	1:A:3203:MET:SD	2.66	0.68

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	1325/3974 (33%)	1296 (98%)	28 (2%)	1 (0%)	48	70

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1376	SER

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	1171/3623 (32%)	1168 (100%)	3 (0%)	86	94

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1374	LEU
1	A	1401	ASN
1	A	3012	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	3009	ASN
1	A	2817	ASN
1	A	2505	GLN
1	A	1785	GLN
1	A	2702	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](#)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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.

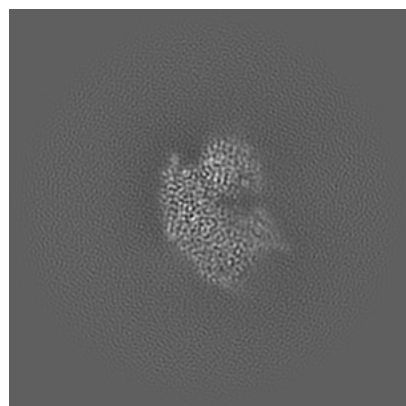
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-68655. These allow visual inspection of the internal detail of the map and identification of artifacts.

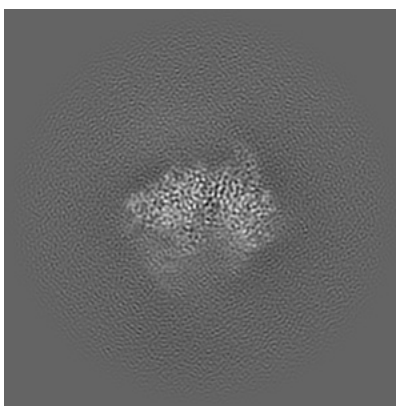
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

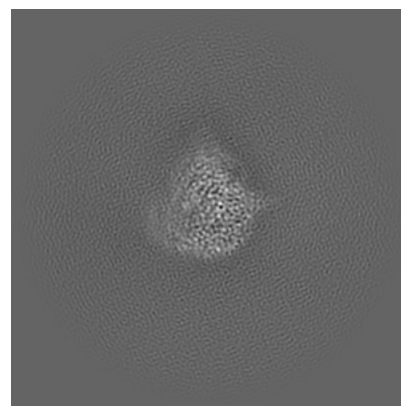
6.1.1 Primary map



X

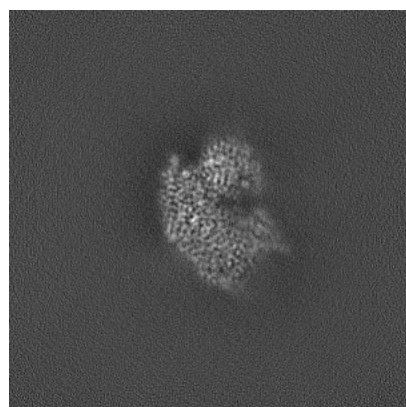


Y

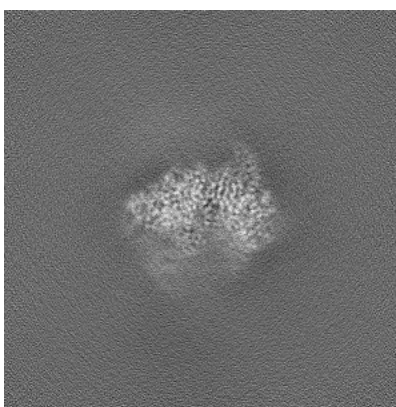


Z

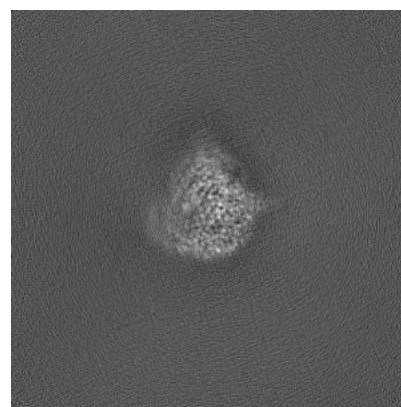
6.1.2 Raw map



X



Y

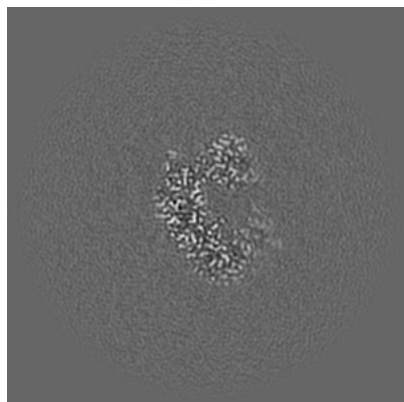


Z

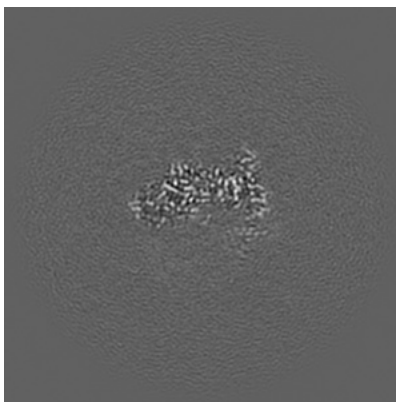
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

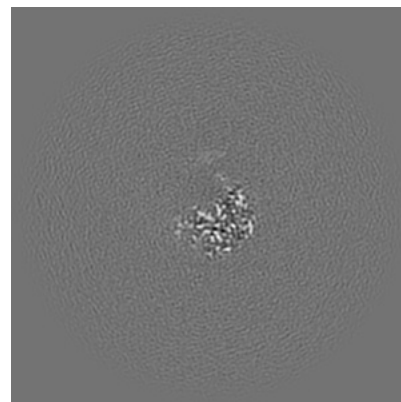
6.2.1 Primary map



X Index: 192

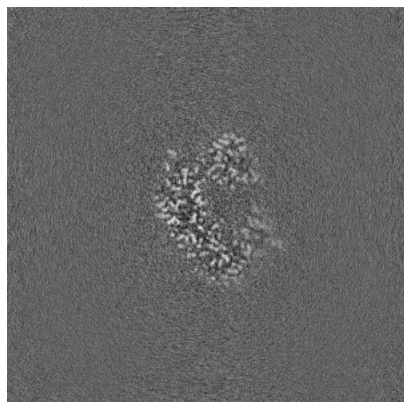


Y Index: 192

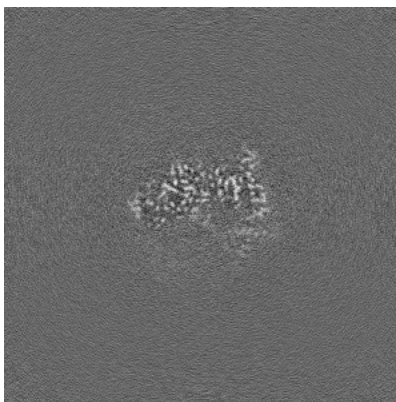


Z Index: 192

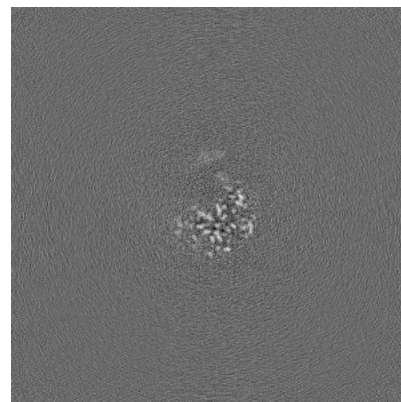
6.2.2 Raw map



X Index: 192



Y Index: 192

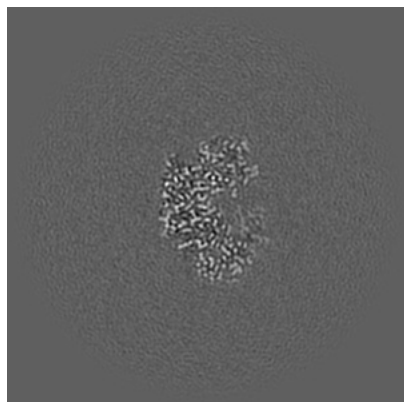


Z Index: 192

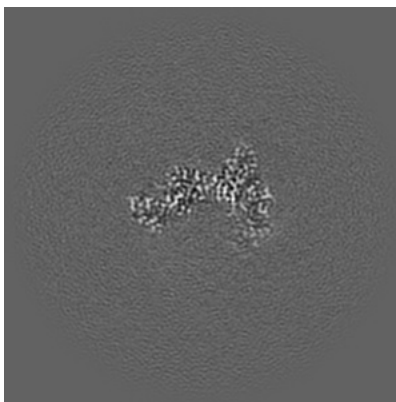
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

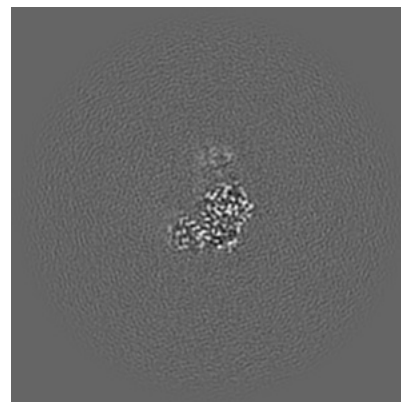
6.3.1 Primary map



X Index: 199

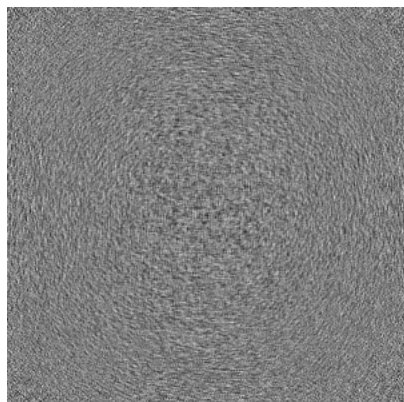


Y Index: 197

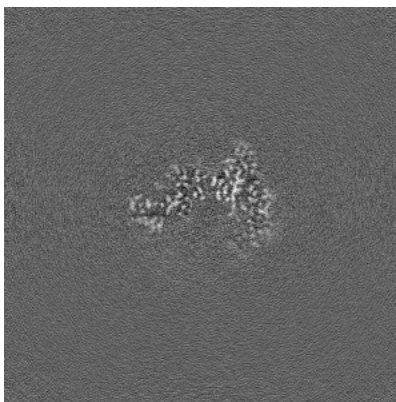


Z Index: 174

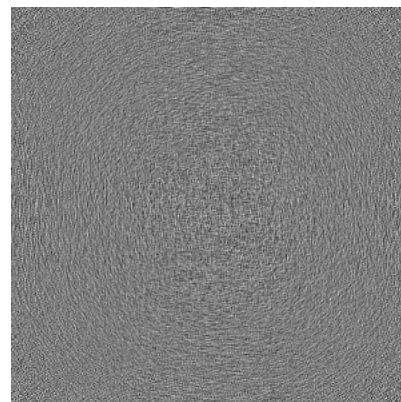
6.3.2 Raw map



X Index: 0



Y Index: 198

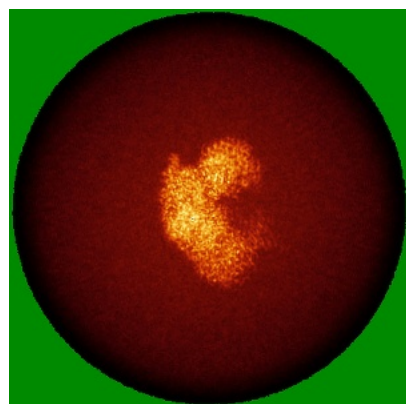


Z Index: 0

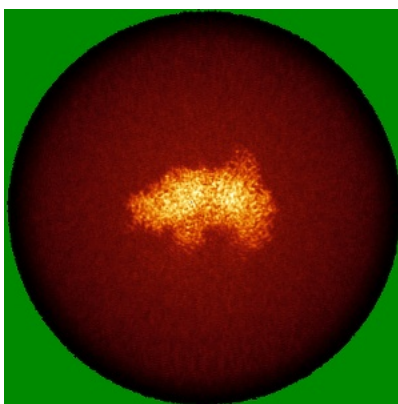
The images above show the largest variance slices of the map in three orthogonal directions.

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

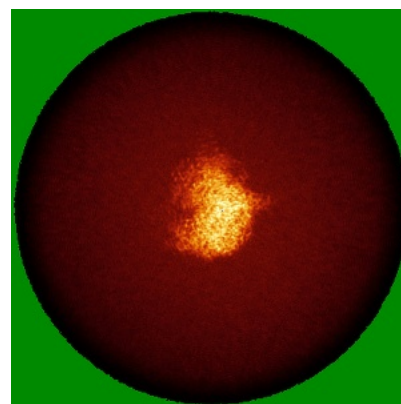
6.4.1 Primary map



X

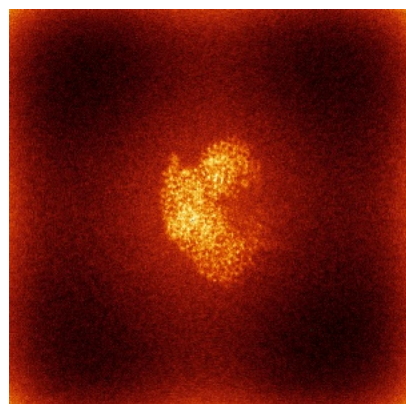


Y

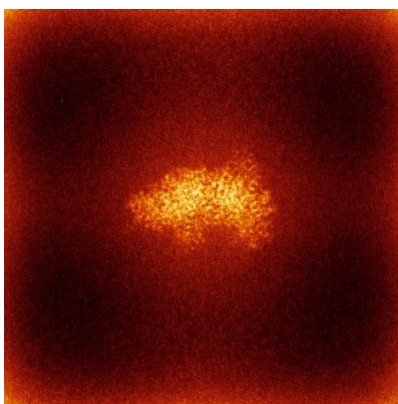


Z

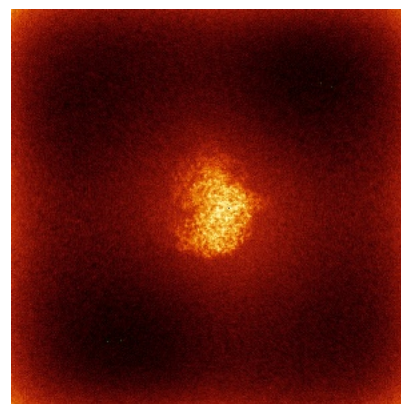
6.4.2 Raw map



X



Y

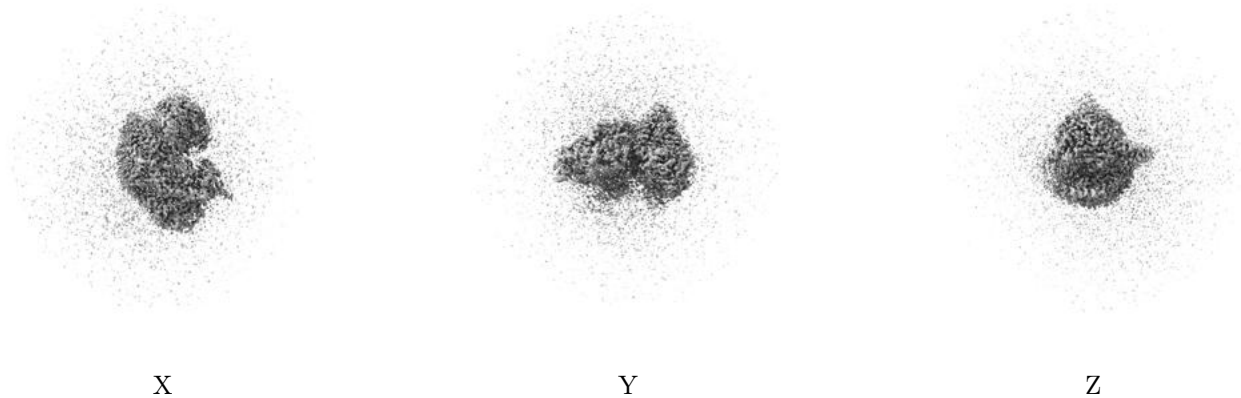


Z

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.

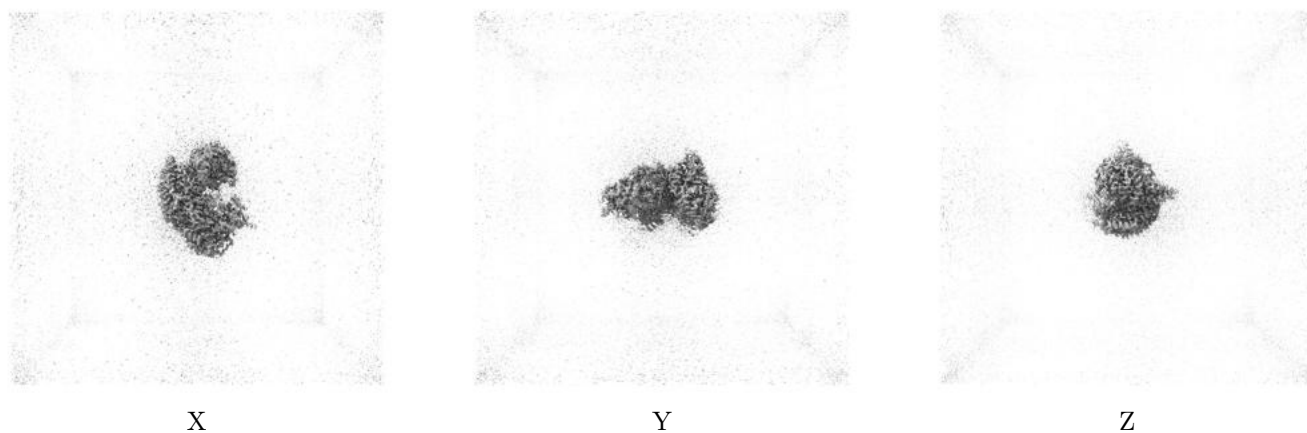
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.15. 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.

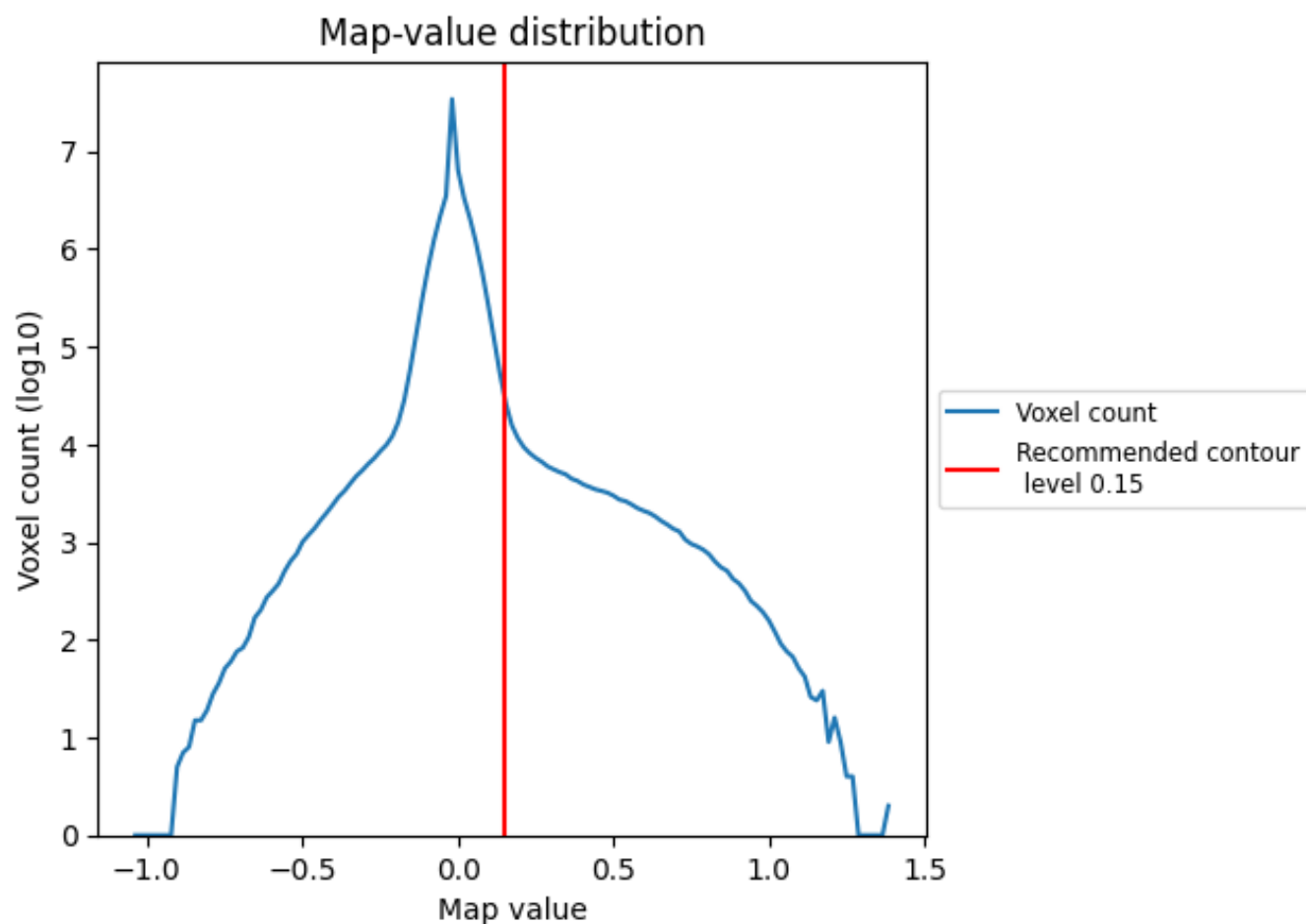
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

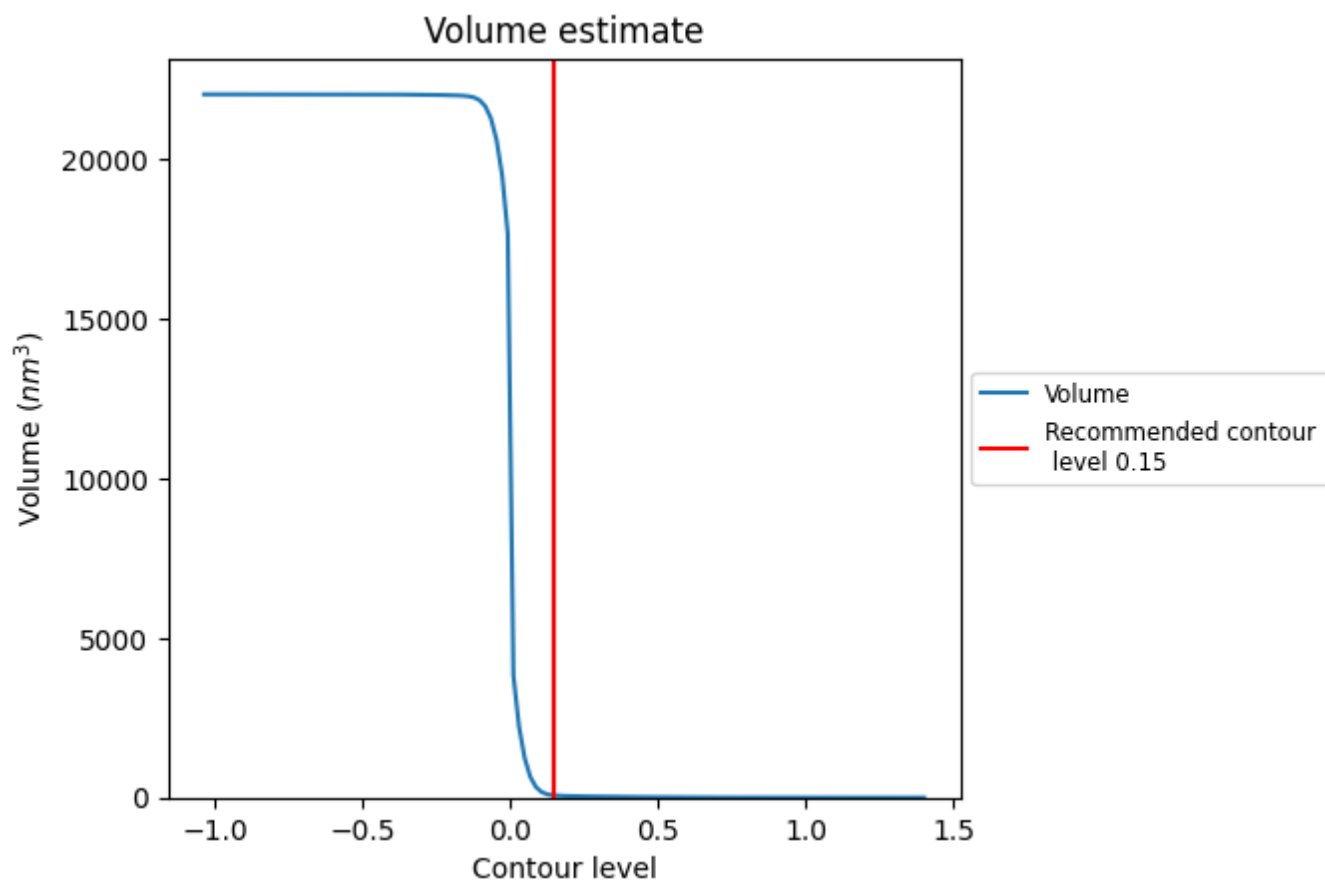
This section contains the results of statistical analysis of the map.

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.

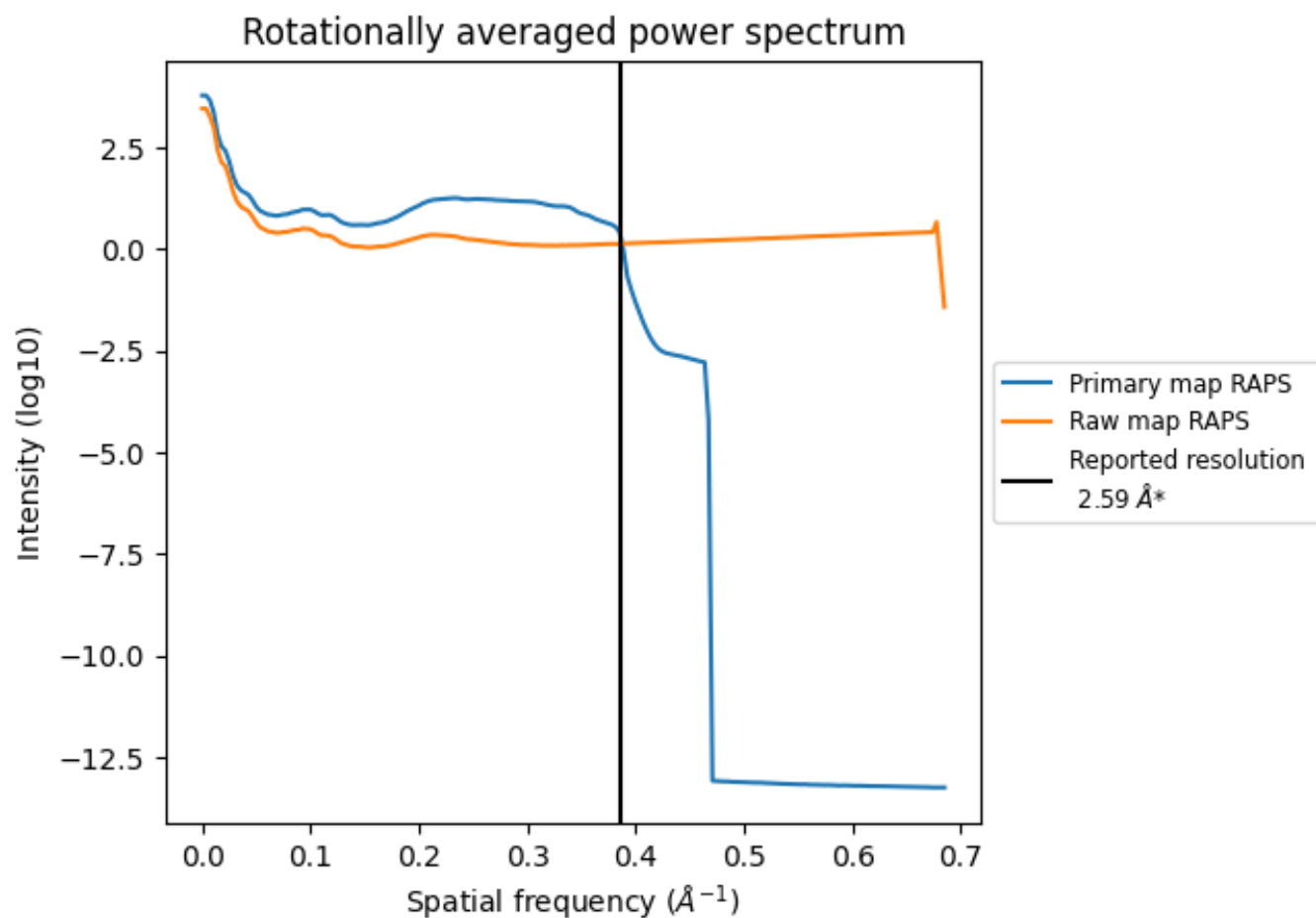
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 69 nm³; this corresponds to an approximate mass of 63 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 ⓘ

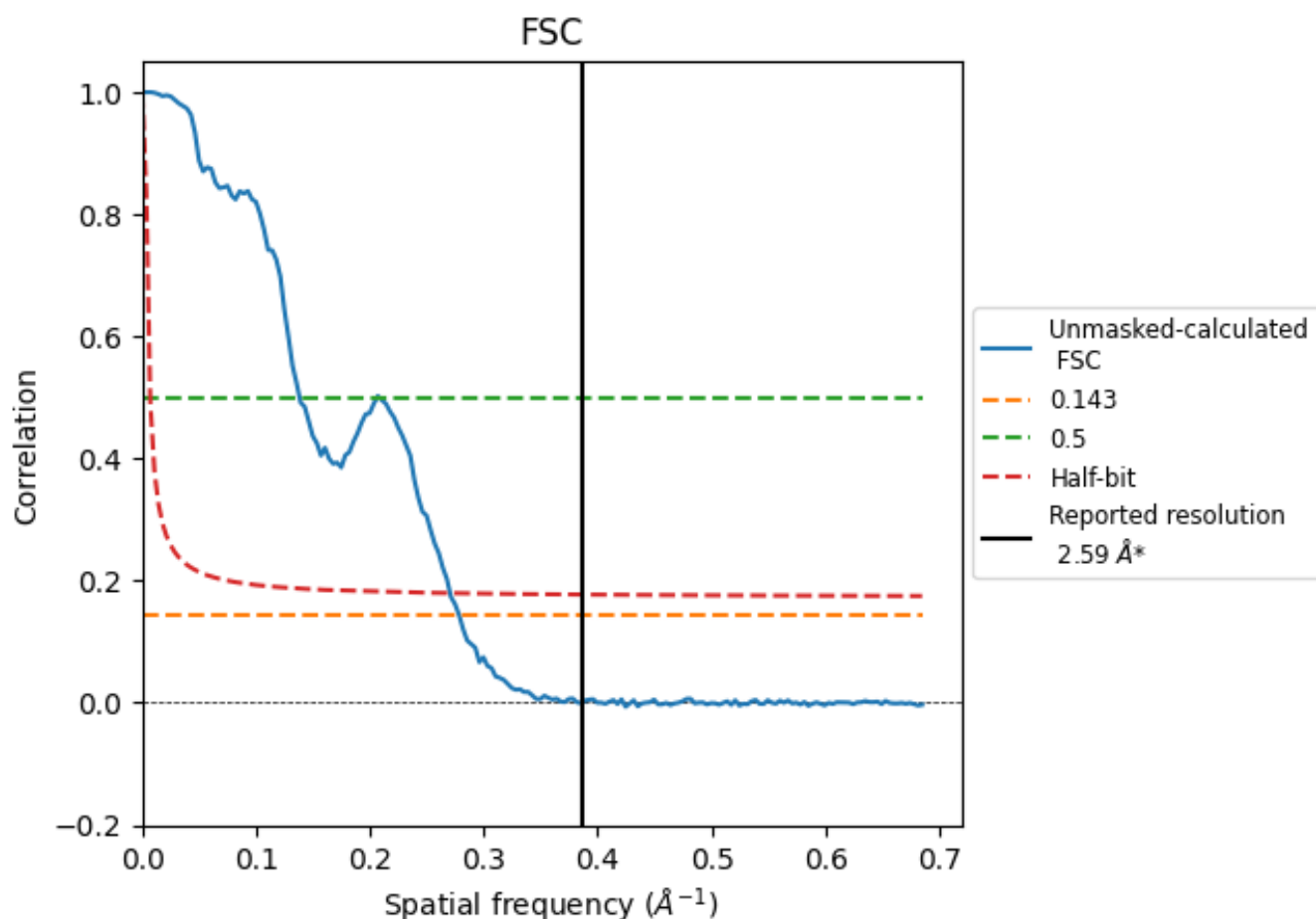


*Reported resolution corresponds to spatial frequency of 0.386 Å⁻¹

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 0.386 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

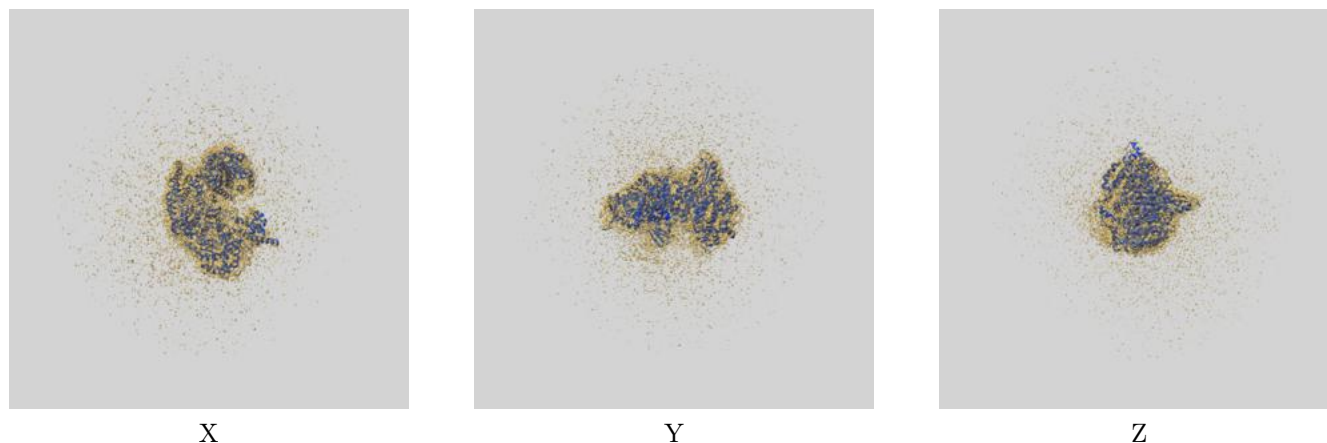
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.59	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.59	7.24	3.70

*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 3.59 differs from the reported value 2.59 by more than 10 %

9 Map-model fit [i](#)

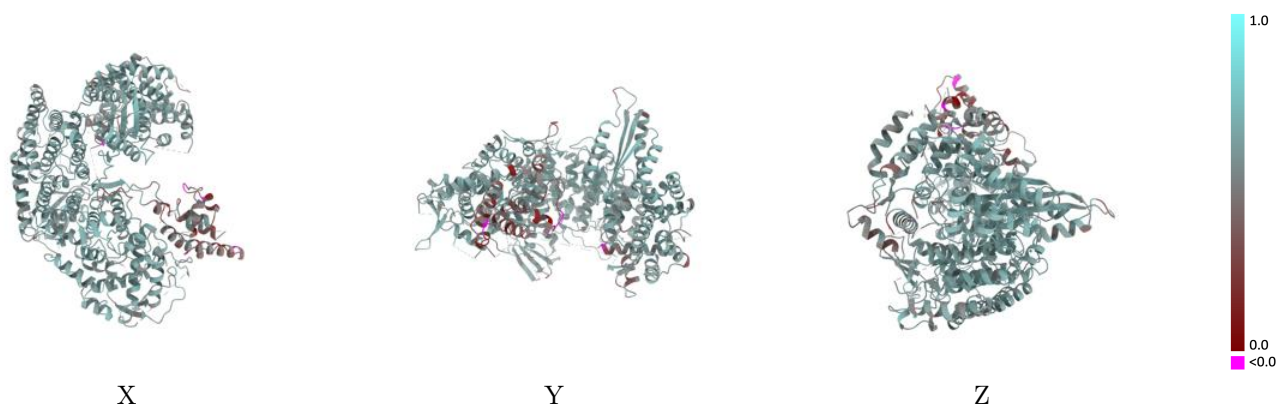
This section contains information regarding the fit between EMDB map EMD-68655 and PDB model 22TE. Per-residue inclusion information can be found in section [3](#) on page [5](#).

9.1 Map-model overlay [i](#)



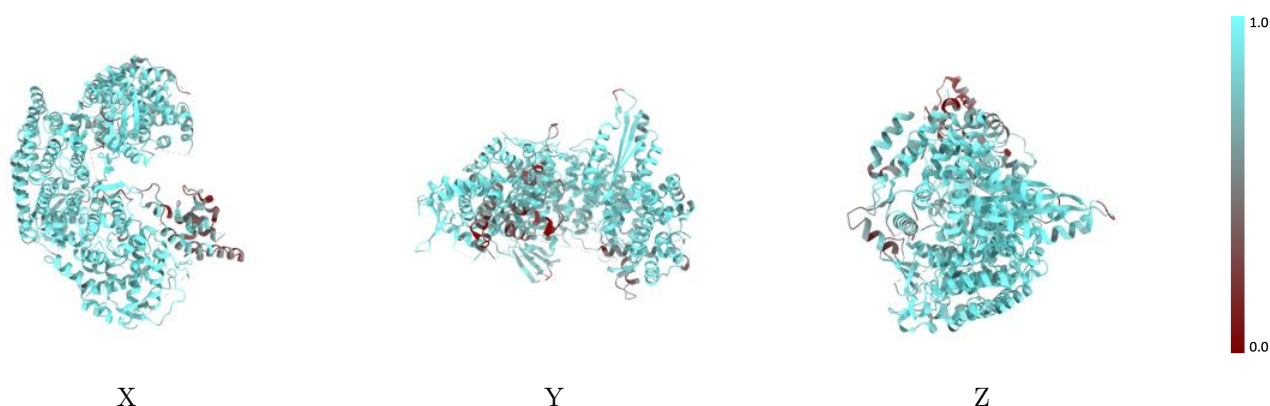
The images above show the 3D surface view of the map at the recommended contour level 0.15 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



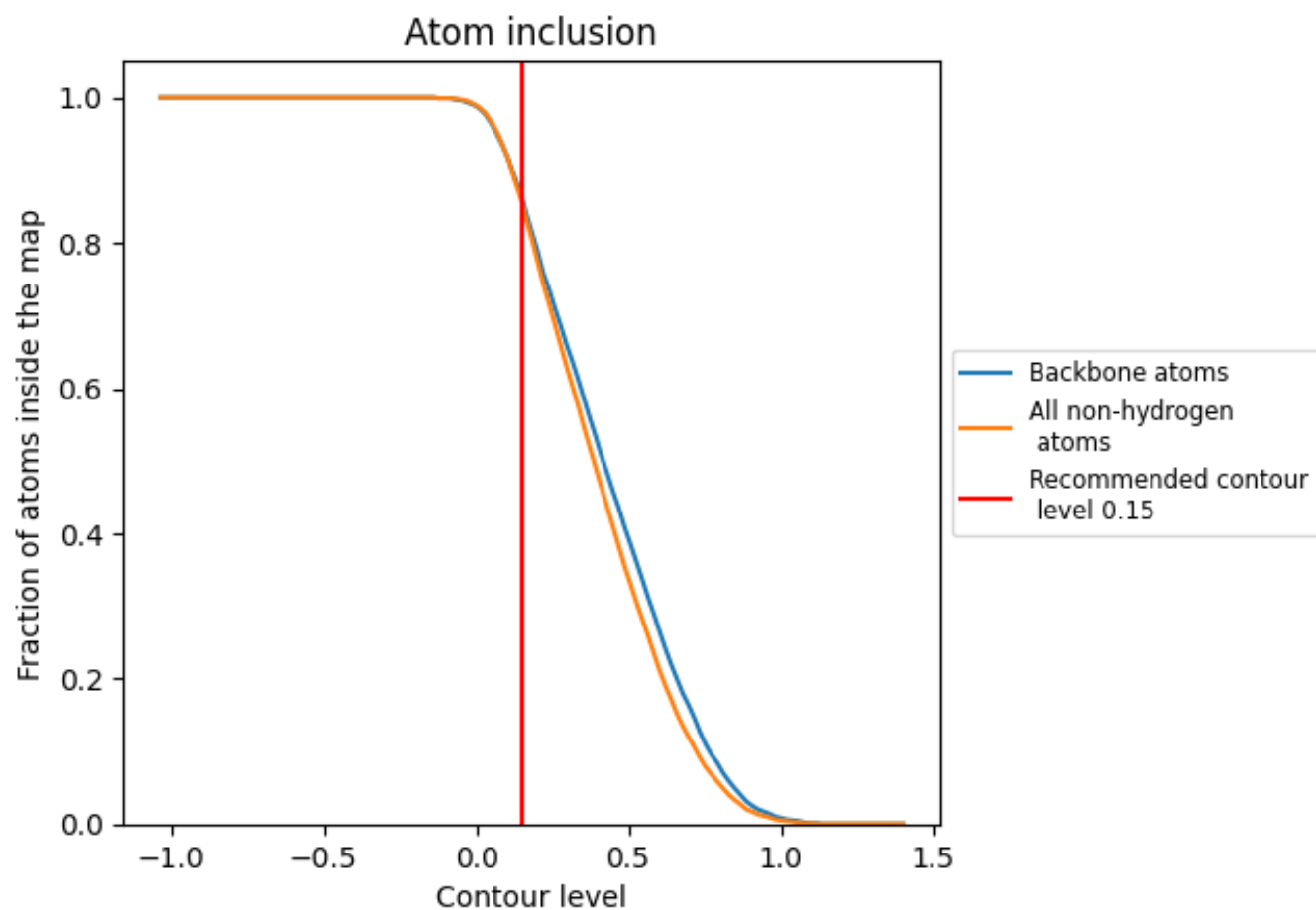
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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



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 (0.15).

9.4 Atom inclusion [i](#)



At the recommended contour level, 86% of all backbone atoms, 86% 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 (0.15) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8580	0.5760
A	0.8580	0.5760

