



wwPDB EM Validation Summary Report ⓘ

May 29, 2025 – 04:37 PM EDT

PDB ID : 9NFL / pdb_00009nfl
EMDB ID : EMD-49369
Title : Tuna P-glycoprotein Apo Conformation 4
Authors : Young, M.A.; Rees, S.D.; Nicklisch, S.C.T.; Stowell, M.; Hamdoun, A.; Chang, G.
Deposited on : 2025-02-21
Resolution : 4.02 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.dev118
MolProbity : 4-5-2 with Phenix2.0rc1
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.43.1

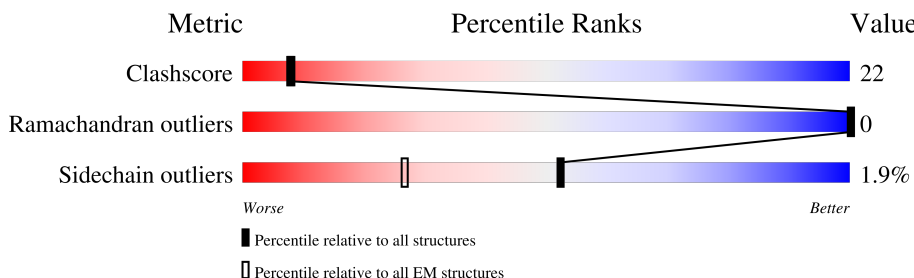
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.02 Å.

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



Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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	1306	

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 6936 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.

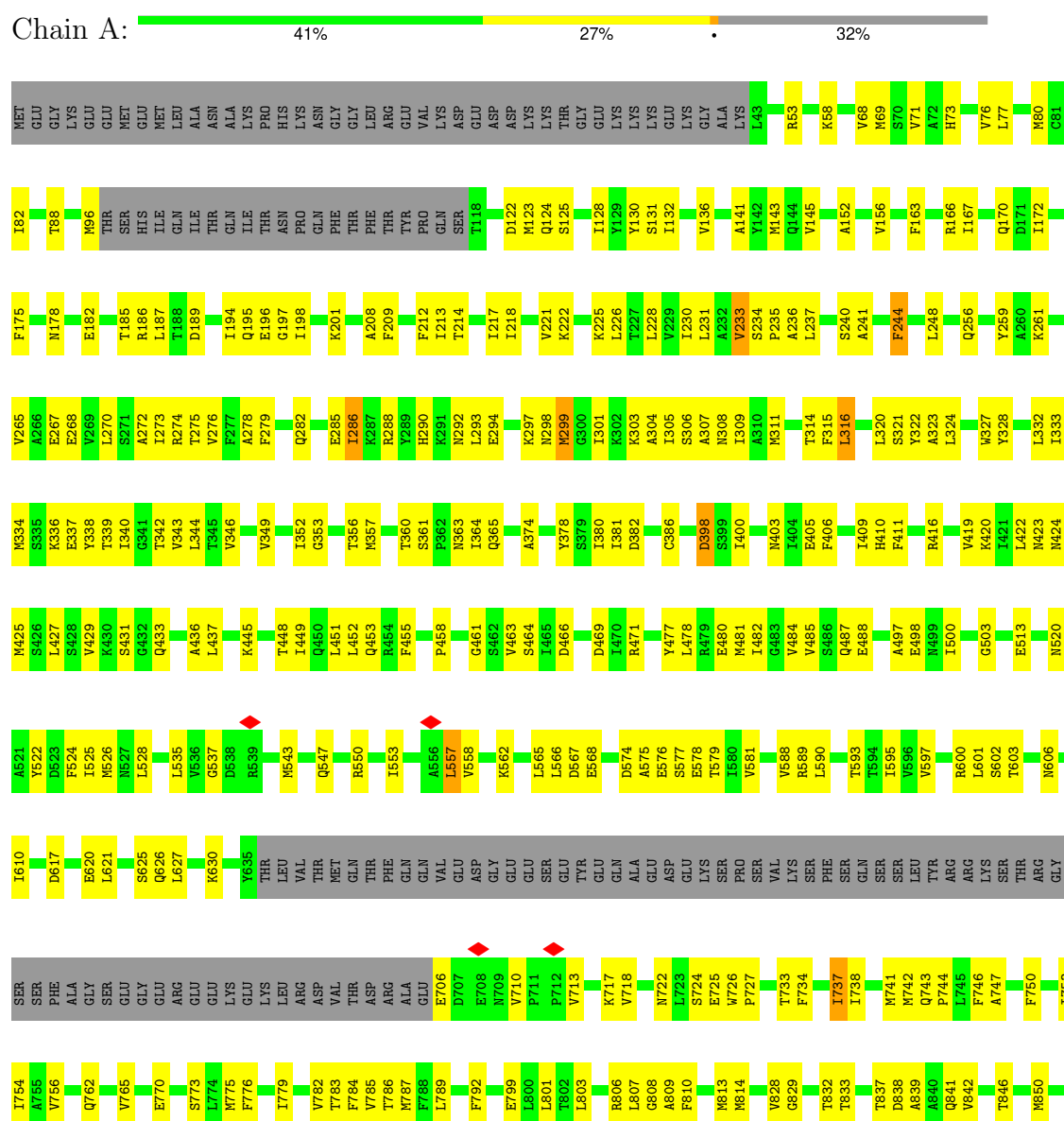
- Molecule 1 is a protein called Permeability Glycoprotein (P-gp).

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	893	6936	4474	1158	1259	45	0	0

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: Permeability Glycoprotein (P-gp)



LYS	GLY	SER	GLU	GLU	GLY	GLY	L853
GLY	ILE	ALA	ILE	ALA	ARG	GLN	A854
TYR	SER	ASP	ALA	ALA	TYR	PHE	G956
SER	THR	THR	ALA	ALA	ASP	PRO	F959
MET	GLU	GLU	ALA	ALA	ASP	ASP	Q963
LEU	SER	SER	LYS	LYS	MET	LYS	LYS
VAL	GLU	GLU	ALA	ALA	PHE	PHE	L865
ASN	VAL	VAL	ALA	ALA	GLY	GLY	L866
THR	LYS	LYS	ASN	ASN	LYS	ASN	S867
GLN	VAL	VAL	ILE	ILE	VAL	VAL	F868
MET	GLN	GLN	HIS	HIS	GLU	VAL	V869
GLY	THR	THR	SER	SER	GLU	ARG	
HIS	GLY	ALA	SER	PHE	ASP	PHE	E873
HIS	THR	ALA	ILE	ILE	GLY	GLU	L874
ASN	LEU	LEU	GLU	GLU	ILE	GLY	T875
ARG	ASP	ASP	ASN	ASN	SER	VAL	L876
CYS	ALA	ALA	LEU	LEU	ALA	LYS	L877
			PRO	PRO	LYS	PHE	L878
ASP	ASP	ARG	GLN	GLN	GLN	ASN	D987
GLY	GLY	GLY	GLY	GLY	LEU	TYR	L879
HIS	GLY	ARG	ASN	TYR	ASN	PRO	G990
HIS	THR	THR	ASP	ASP	ILE	SER	V991
HIS	CYS	THR	THR	THR	HIS	ARG	V881
HIS	ILE	ILE	GLN	GLN	TRP	PRO	V882
HIS	VAL	VAL	ALA	ALA	LEU	GLU	P883
HIS	VAL	VAL	GLY	GLY	ARG	VAL	L884
	ALA	ALA	ASP	ASP	SER	PRO	
	HIS	HIS	LYS	LYS	GLN	ILE	V887
	ARG	ARG	GLY	GLY	ILE	LEU	
			THR	THR	GLY	ARG	Q992
	SER	SER	GLN	GLN	ILE	GLY	
	THR	THR	LEU	LEU	VAL	LEU	L896
	ILE	ILE	SER	SER	ASN	ASN	A897
	GLN	GLN	GLY	GLY	GLN	LEU	G898
	ASN	ASN	GLY	GLY	LEU	LEU	H899
	ALA	ALA	GLN	GLN	PRO	VAL	
	ASP	ASP	LYS	LYS	SER	SER	E902
	ASP	ASP	GLN	GLN	THR	THR	
	ILE	ILE	ARG	ARG	PHE	GLY	E906
	ALA	ALA	ILE	ILE	ASP	GLY	
	VAL	VAL	ALA	ALA	CYS	THR	K909
	PHE	PHE	ILE	ILE	THR	LEU	A914
	GLN	GLN	LEU	LEU	ALA	ALA	
	ALA	ALA	ARG	ARG	LEU	LEU	A917
	GLY	GLY	ALA	ALA	GLU	VAL	
	VAL	VAL	ILE	ILE	ASN	GLY	I921
	VAL	VAL	LEU	LEU	ILE	SER	
	VAL	VAL	ARG	ARG	ILE	GLY	V924
	GLU	GLU	ASN	ASN	TYR	CYS	
	GLN	GLN	PRO	PRO	GLY	GLY	L927
	THR	THR	LYS	LYS	ASP	GLY	T928
	GLY	GLY	LEU	LEU	ASN	LYS	R929
	HIS	HIS	LEU	LEU	SER	SER	
	GLN	GLN	LEU	LEU	ARG	THR	F933
	LEU	LEU	LEU	LEU	THR	ASP	
	LEU	LEU	ASP	ASP	ILE	ASN	Y937
	LEU	LEU	GLU	GLU	THR	GLN	
	ALA	ALA	ALA	ALA	LEU	SER	V943
	LYS	LYS	THR	THR	GLU	LEU	

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	82929	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 ($e^-/\text{\AA}^2$)	55	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	1.852	Depositor
Minimum map value	-1.334	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.047	Depositor
Recommended contour level	0.13	Depositor
Map size (Å)	299.2, 299.2, 299.2	wwPDB
Map dimensions	160, 160, 160	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.8700001, 1.8700001, 1.8700001	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	0.18	0/7070	0.39	0/9546

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	6936	0	7045	309	0
All	All	6936	0	7045	309	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 22.

The worst 5 of 309 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:452:LEU:HD23	1:A:565:LEU:HD11	1.57	0.86
1:A:196:GLU:OE2	1:A:201:LYS:NZ	2.09	0.85
1:A:308:ASN:ND2	1:A:787:MET:O	2.10	0.85
1:A:339:THR:O	1:A:342:THR:OG1	1.98	0.81
1:A:236:ALA:O	1:A:240:SER:OG	1.99	0.80

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	885/1306 (68%)	830 (94%)	55 (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	736/1088 (68%)	722 (98%)	14 (2%)	52	70

5 of 14 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	478	LEU
1	A	557	LEU
1	A	970	TYR
1	A	867	SER
1	A	882	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	124	GLN

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Mol	Chain	Res	Type
1	A	375	HIS
1	A	542	GLN
1	A	549	GLN
1	A	899	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 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 [i](#)

There are no chain breaks in this entry.

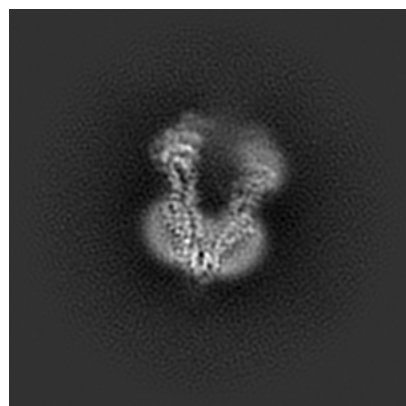
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-49369. These allow visual inspection of the internal detail of the map and identification of artifacts.

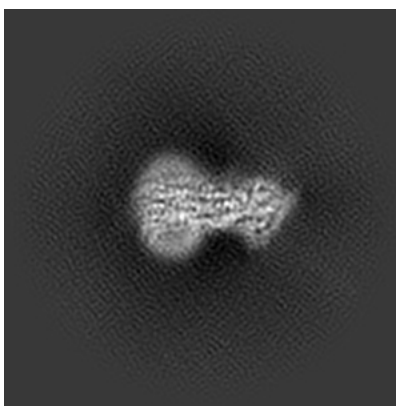
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

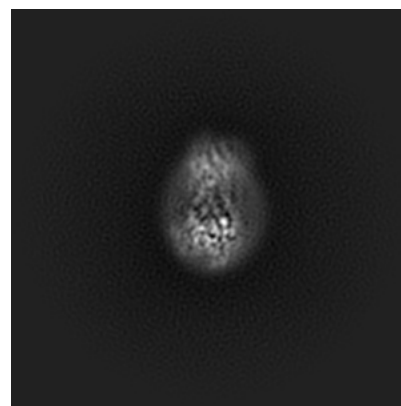
6.1.1 Primary map



X

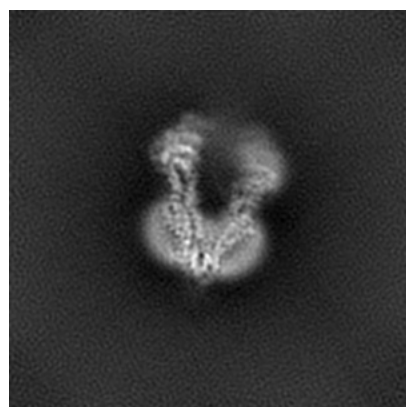


Y

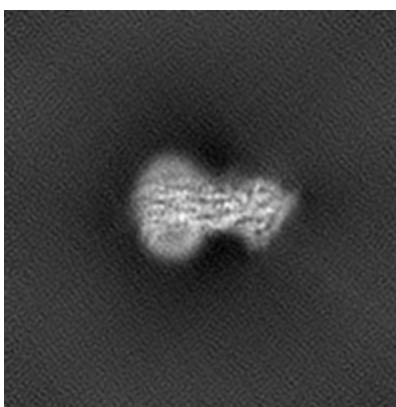


Z

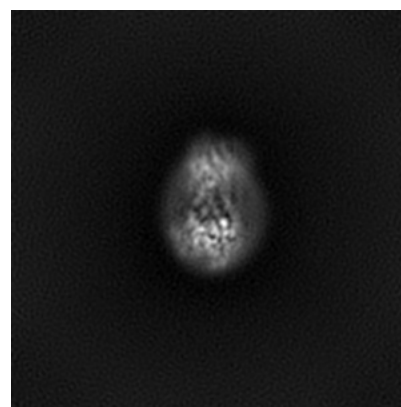
6.1.2 Raw map



X



Y

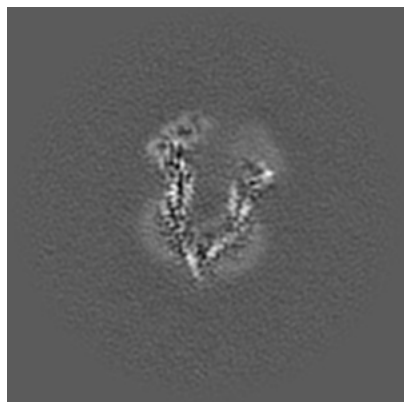


Z

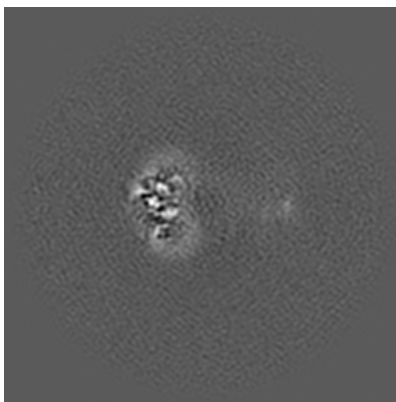
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

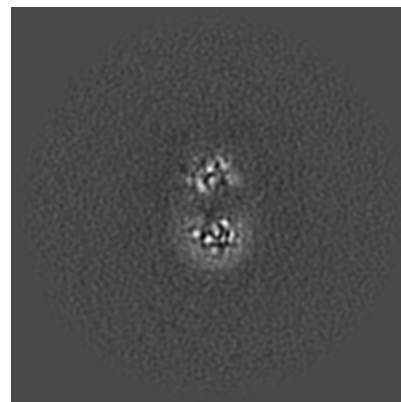
6.2.1 Primary map



X Index: 80

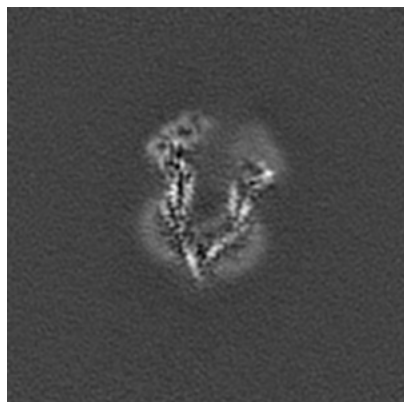


Y Index: 80

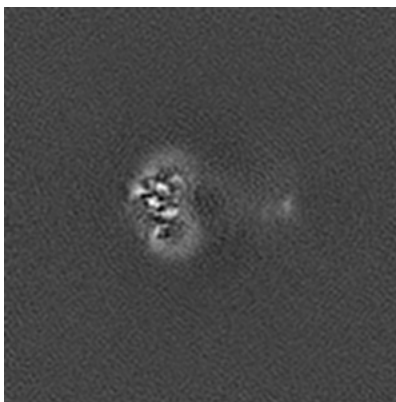


Z Index: 80

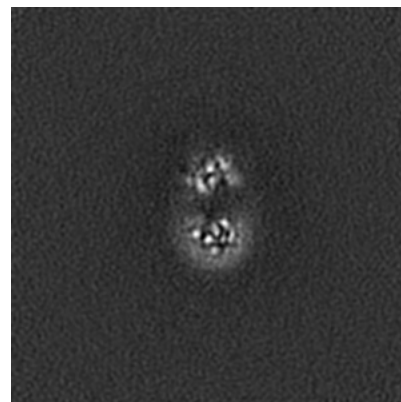
6.2.2 Raw map



X Index: 80



Y Index: 80

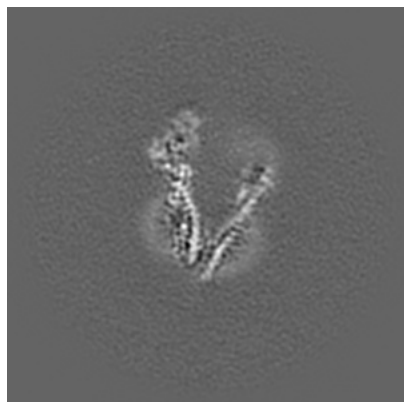


Z Index: 80

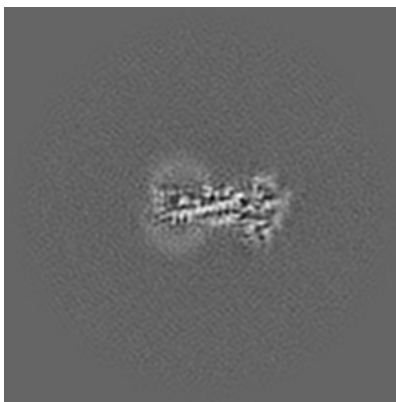
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

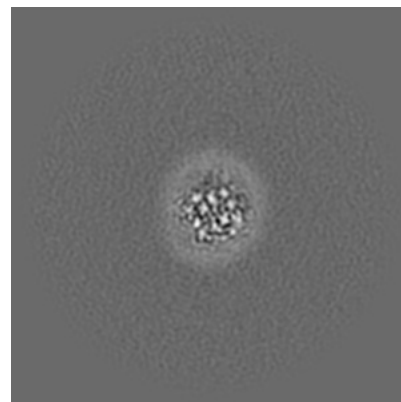
6.3.1 Primary map



X Index: 85

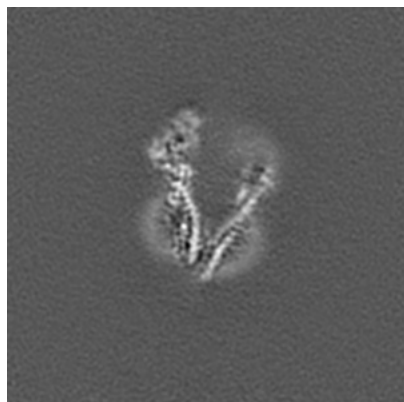


Y Index: 67

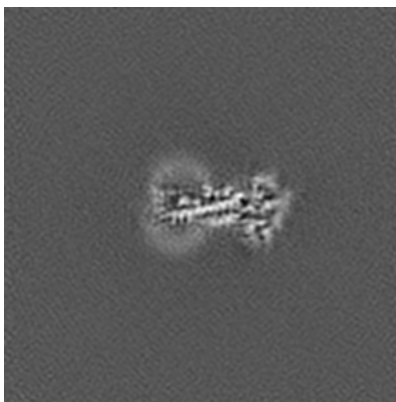


Z Index: 63

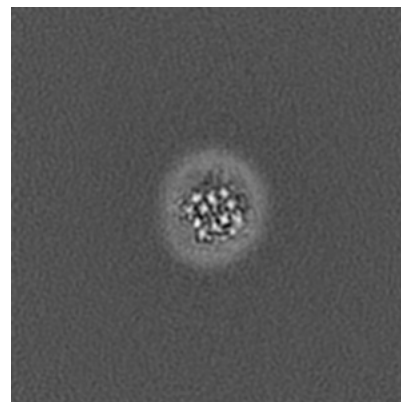
6.3.2 Raw map



X Index: 85



Y Index: 67

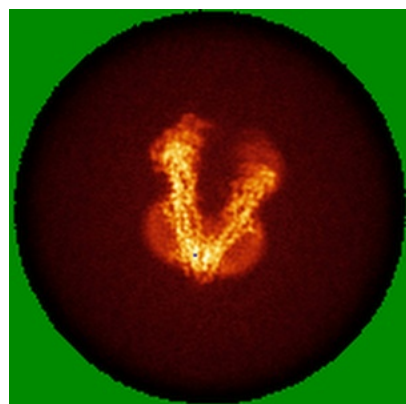


Z Index: 63

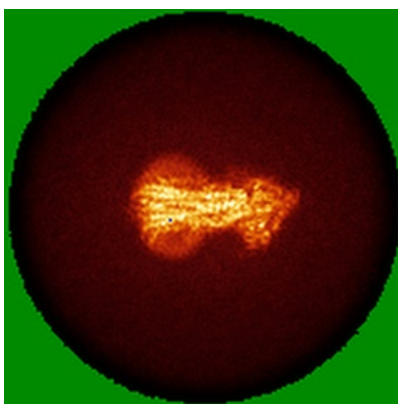
The images above show the largest variance slices of the map in three orthogonal directions.

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

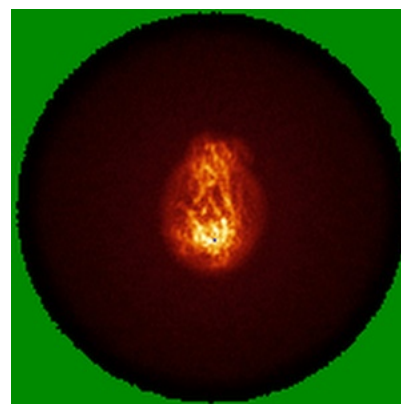
6.4.1 Primary map



X



Y

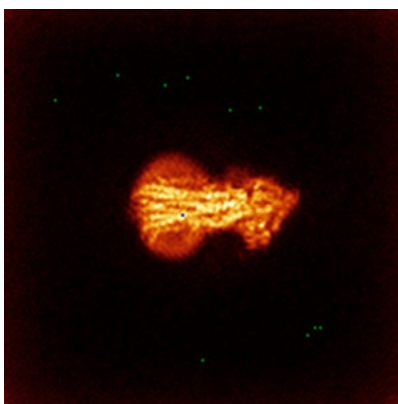


Z

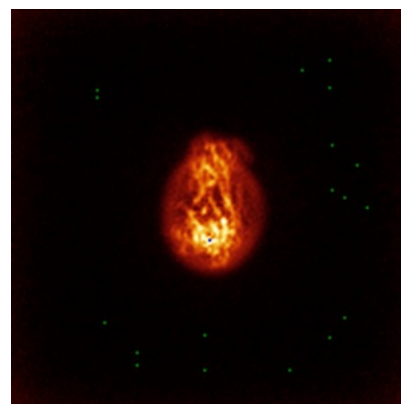
6.4.2 Raw map



X



Y

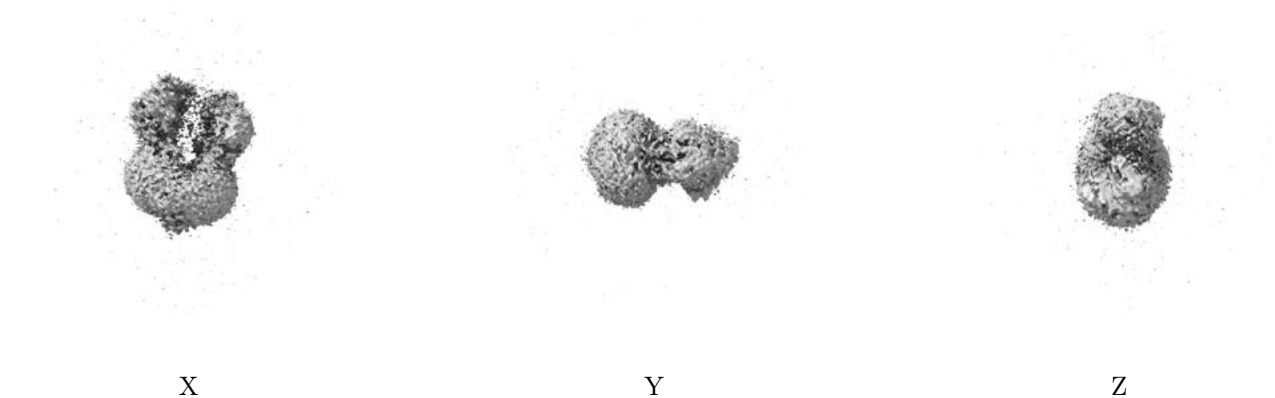


Z

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.

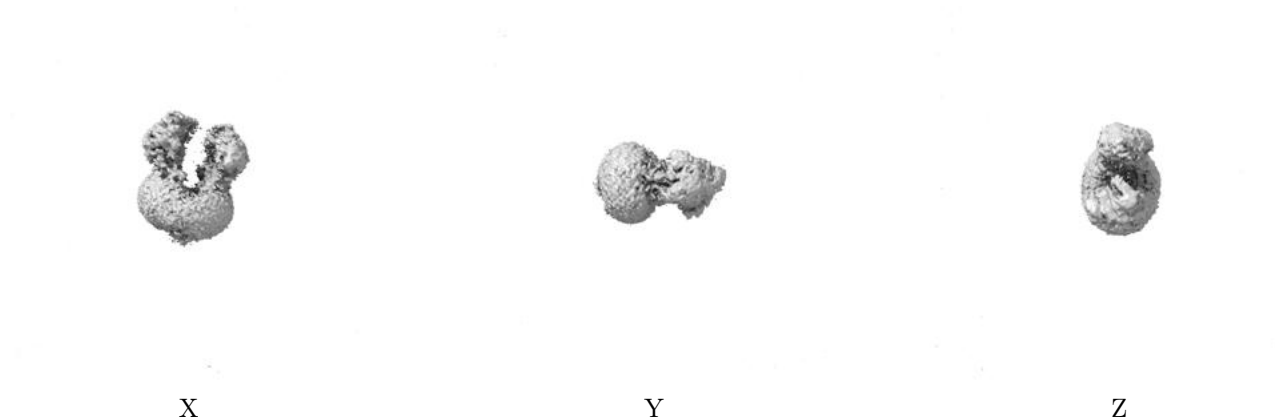
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.13. 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.

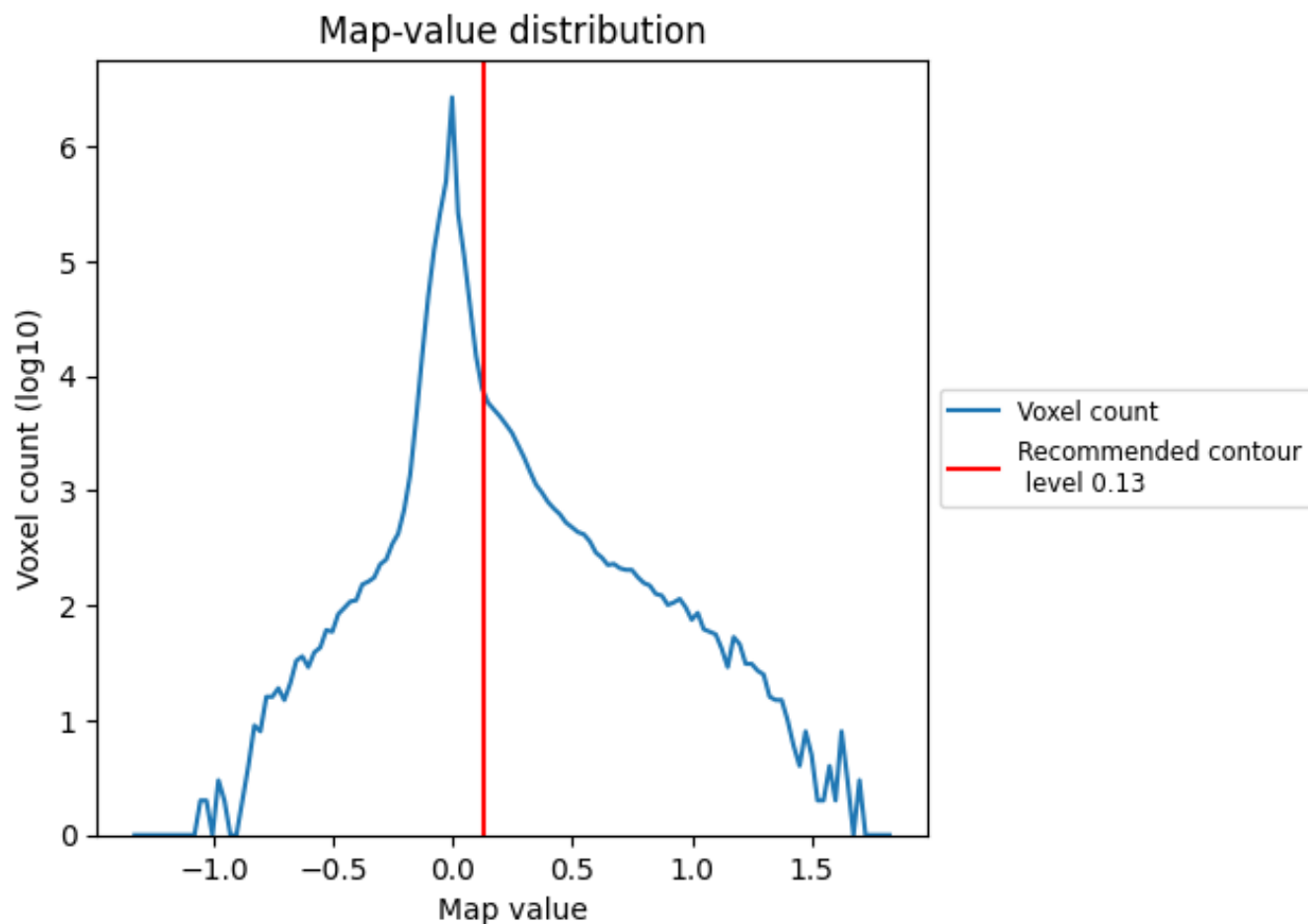
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

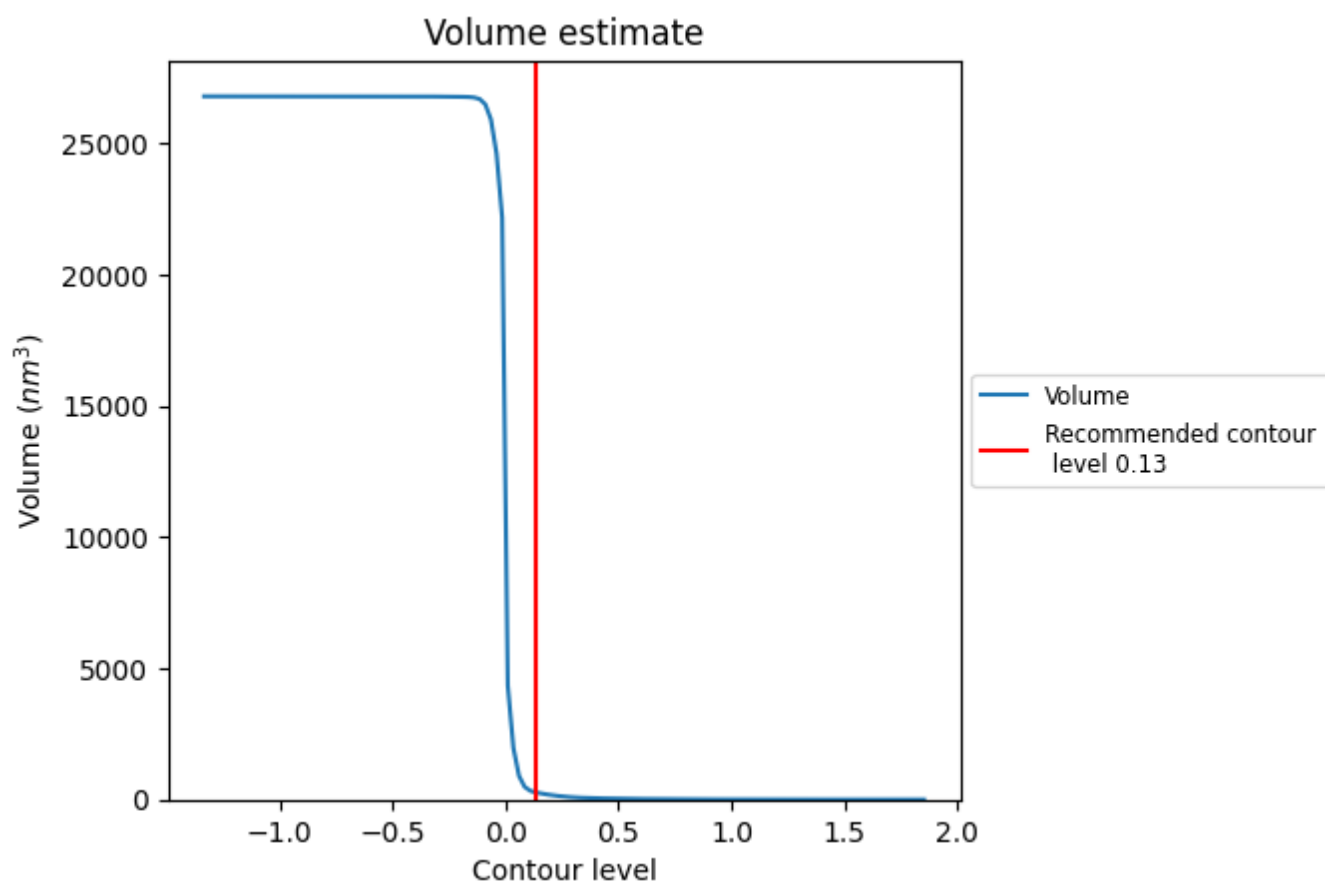
This section contains the results of statistical analysis of the map.

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.

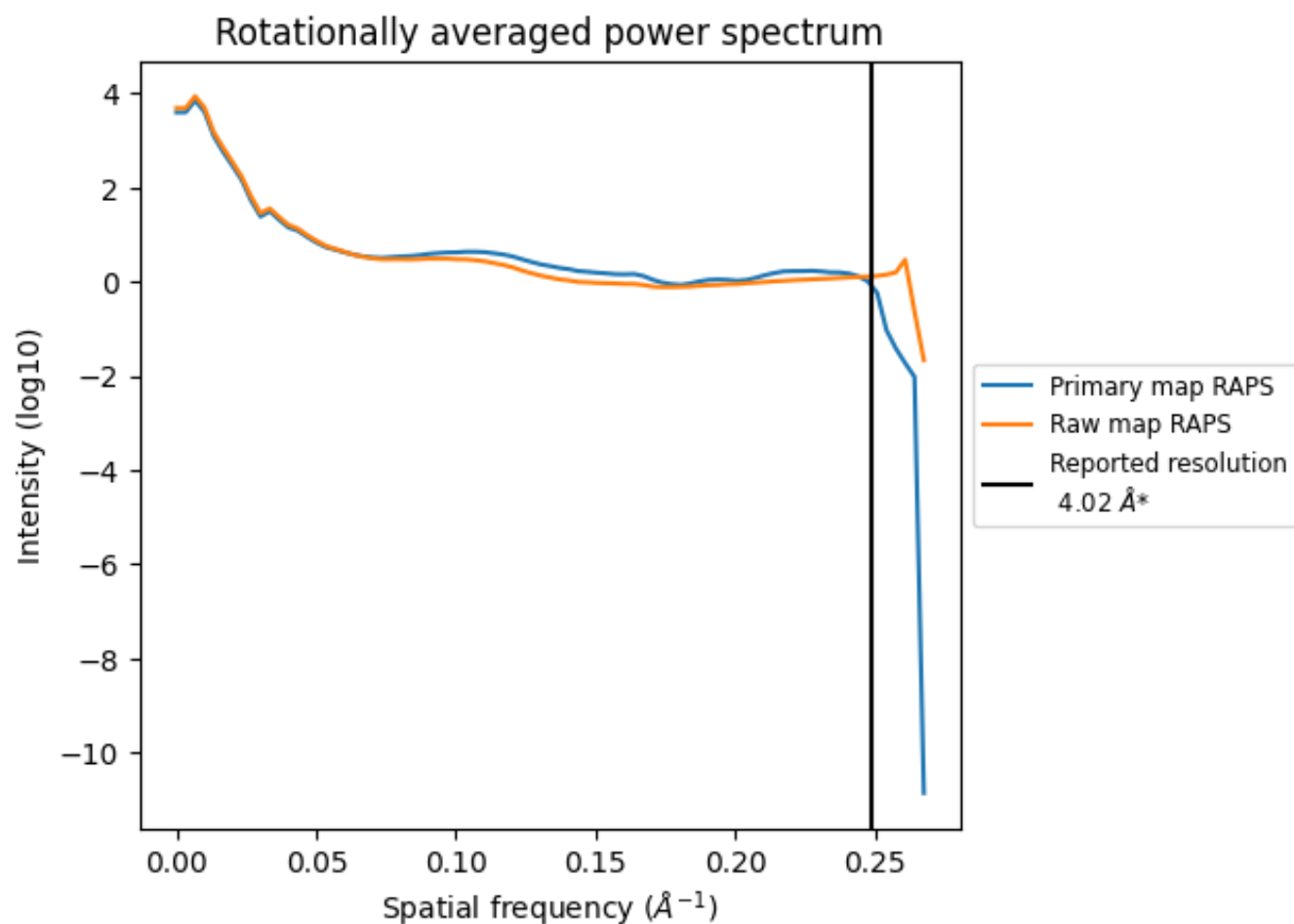
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 282 nm³; this corresponds to an approximate mass of 255 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 ⓘ

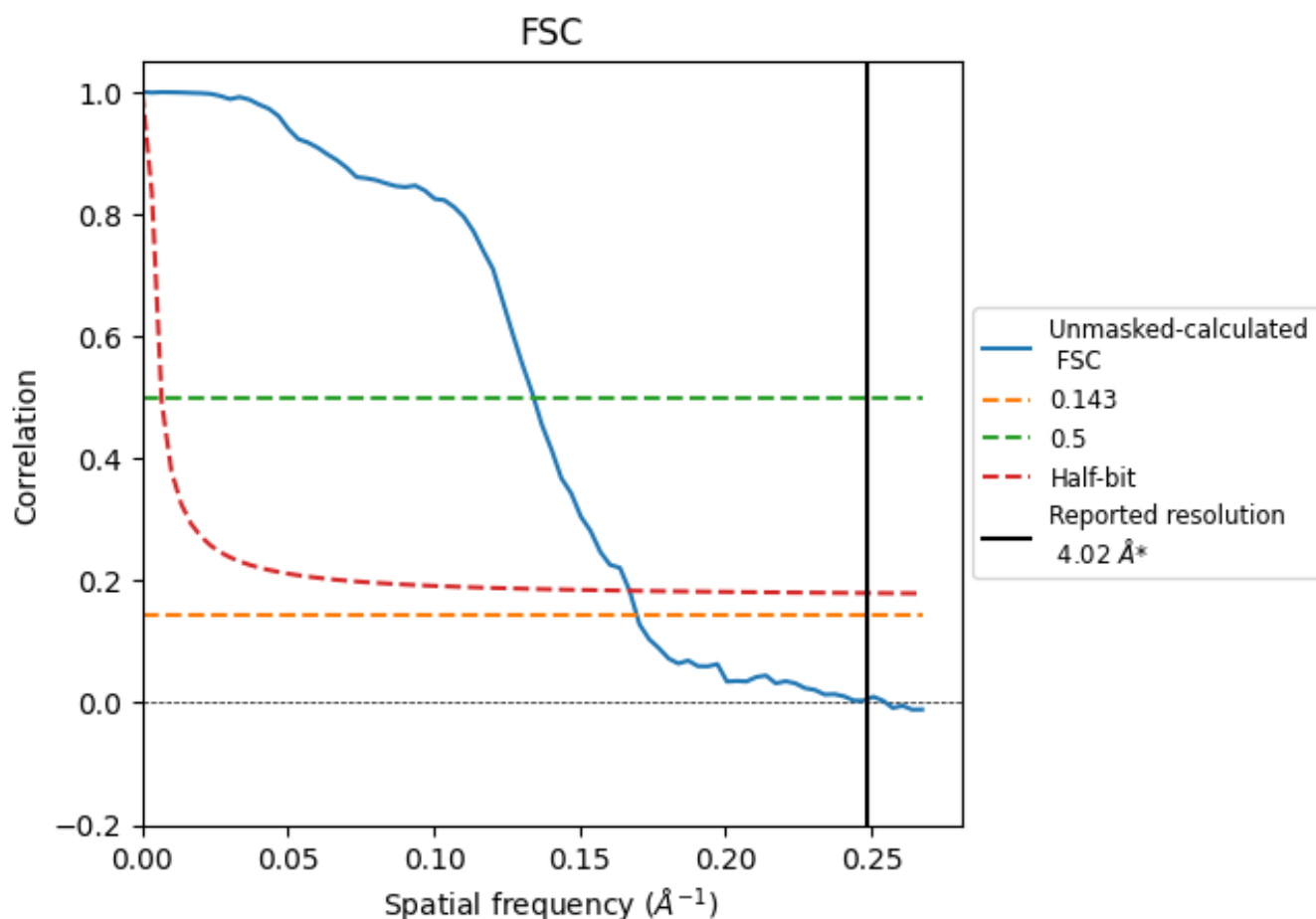


*Reported resolution corresponds to spatial frequency of 0.249 Å⁻¹

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 0.249 \AA^{-1}

8.2 Resolution estimates [i](#)

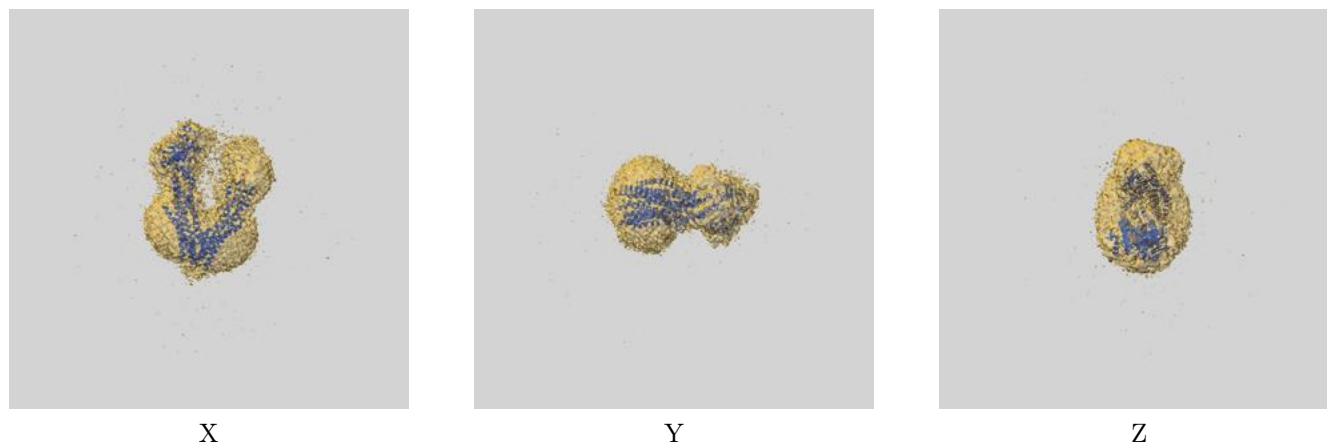
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	4.02	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	5.90	7.45	5.98

*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 5.90 differs from the reported value 4.02 by more than 10 %

9 Map-model fit [i](#)

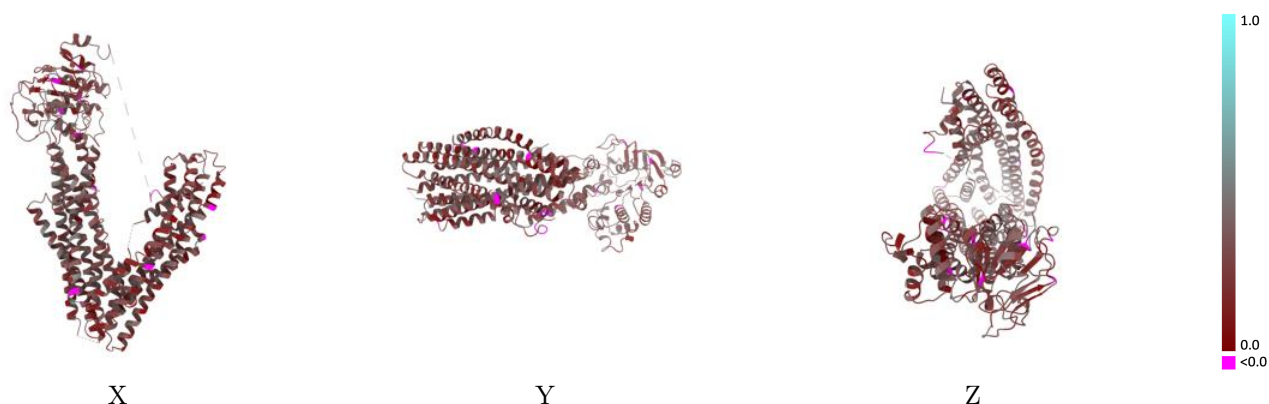
This section contains information regarding the fit between EMDB map EMD-49369 and PDB model 9NFL. Per-residue inclusion information can be found in [section 3](#) on [page 4](#).

9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.13 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](#)



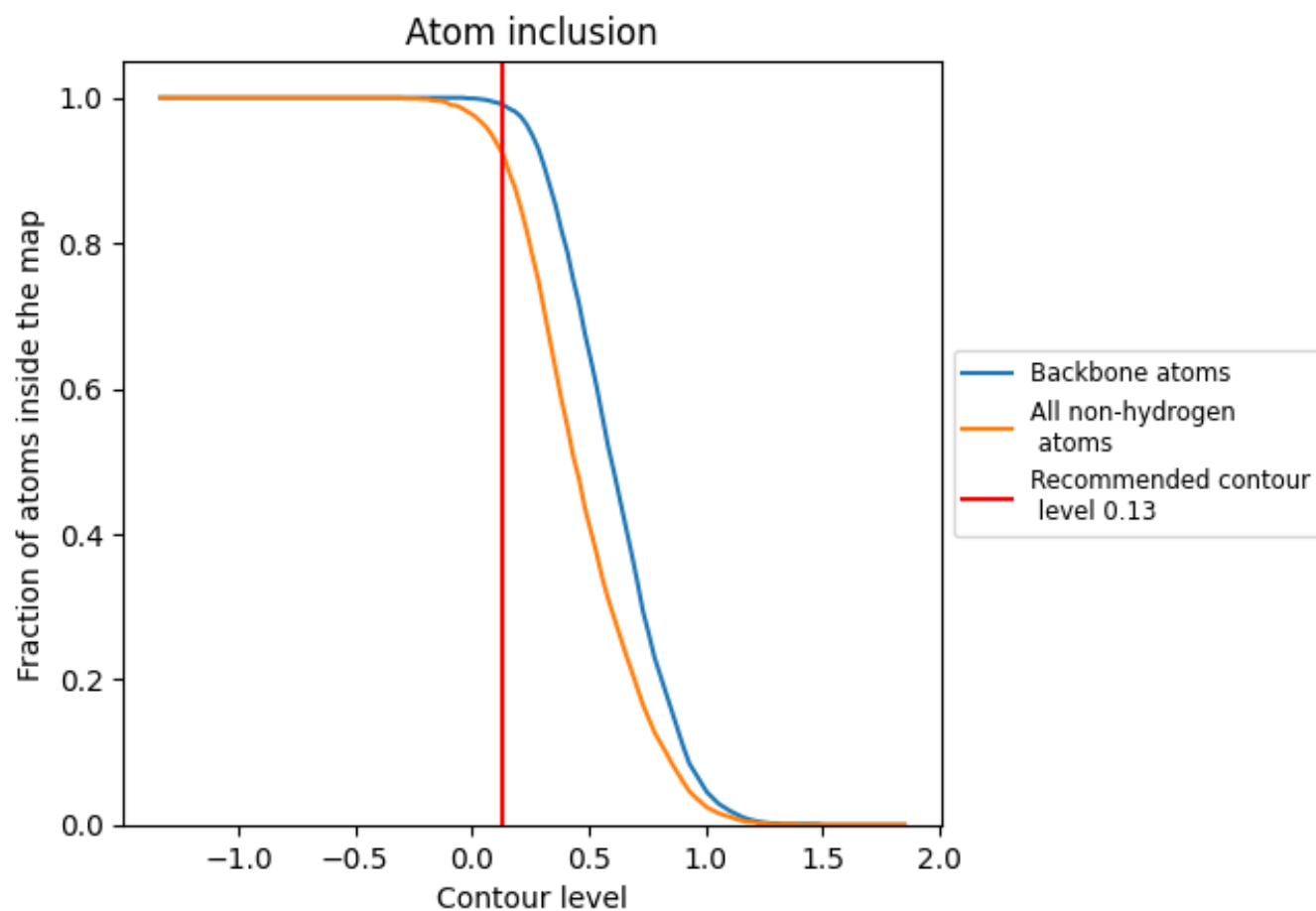
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.13).

9.4 Atom inclusion [i](#)



At the recommended contour level, 99% of all backbone atoms, 92% 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 (0.13) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div></div> 0.9240	<div></div> 0.2810
A	<div></div> 0.9240	<div></div> 0.2810

