



wwPDB EM Validation Summary Report ⓘ

Jul 4, 2026 – 11:32 AM JST

PDB ID : 9VY1 / pdb_00009vy1
EMDB ID : EMD-65448
Title : Cryo-EM structure of Peste Des Petits Ruminants Virus L Protein bound by Phosphoprotein Tetramer
Authors : Xue, L.; Gui, J.; Chang, T.; Pan, H.; Xiong, X.
Deposited on : 2025-07-20
Resolution : 2.40 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:

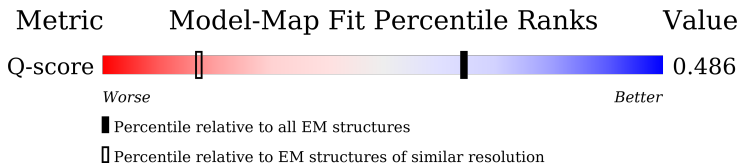
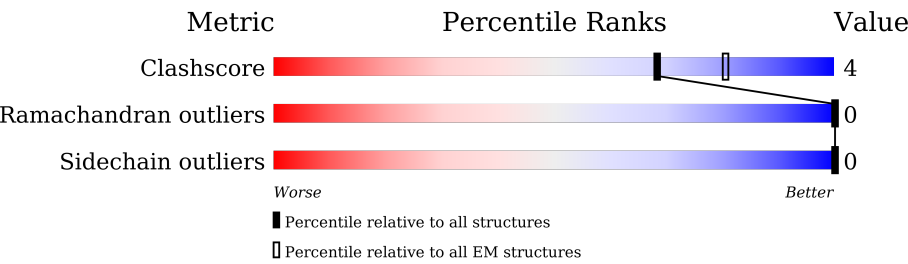
EMDB validation analysis : 0.0.1.dev133
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDb archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.50

1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 2.40 Å.

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



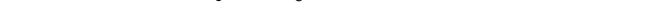
Metric	Whole archive (#Entries)	EM structures (#Entries)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	5628 (1.90 - 2.90)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion $< 40\%$). The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	2183	48%5%48%
2	B	509	27%69%
2	C	509	13%85%
2	D	509	10%88%

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Mol	Chain	Length	Quality of chain
2	E	509	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 11940 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	1146	Total	C	N	O	S	0	0
			9180	5891	1549	1688	52		

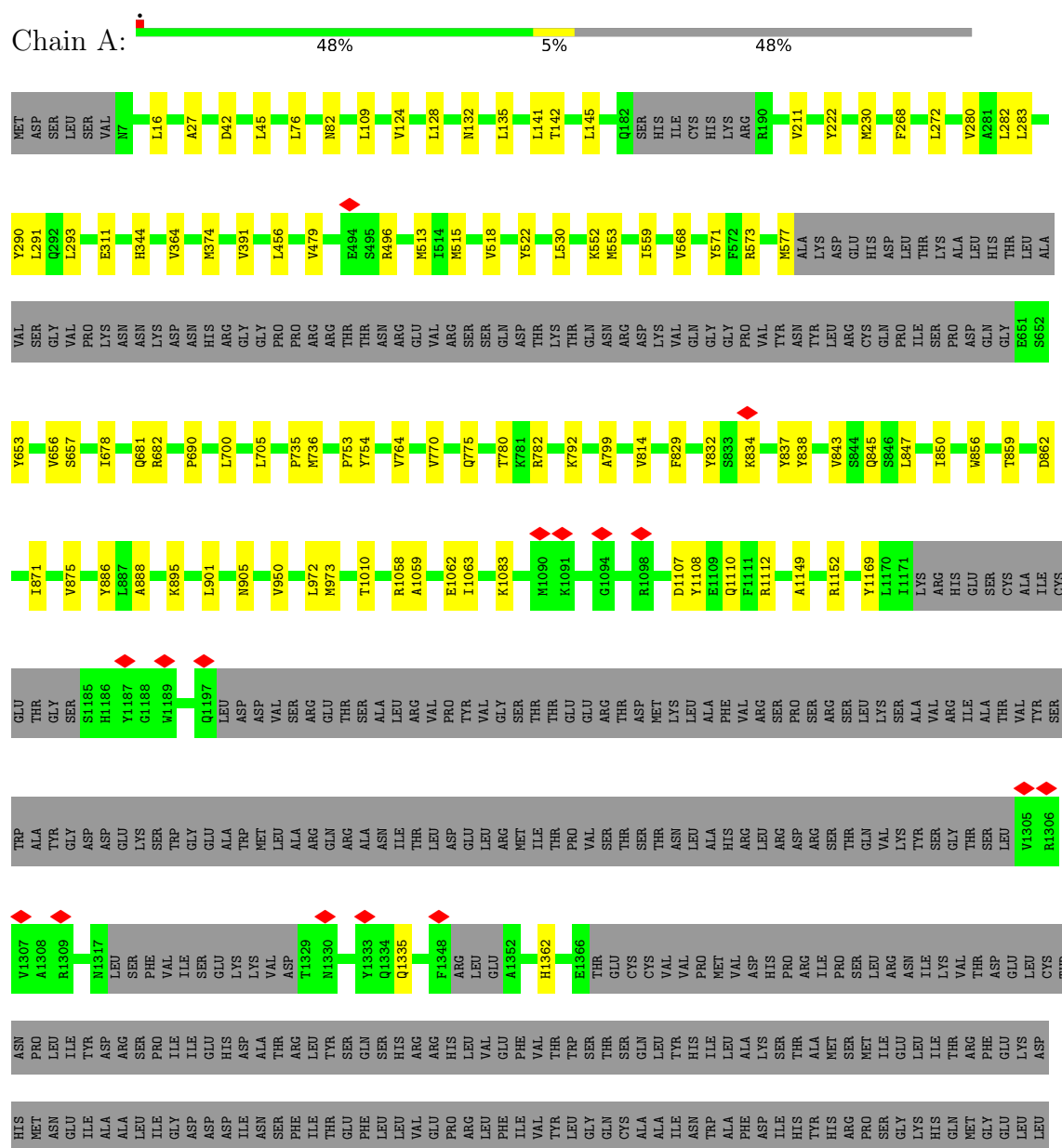
- Molecule 2 is a protein called Phosphoprotein.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	157	Total	C	N	O	S	1	0
			1221	771	216	232	2		
2	C	77	Total	C	N	O	S	0	0
			591	373	100	117	1		
2	D	59	Total	C	N	O	S	0	0
			452	286	77	88	1		
2	E	65	Total	C	N	O	S	0	0
			496	315	84	96	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





SER	ASN	ASP	HIS	GLU	SER	GLN	SER	SER	ARG	ASN	VAL	ILE	ARG	SER	ILE	ILE	LYS	SER	SER	LYS	LEU	ASN	THR	ASP	HIS	LYS	ASP	LYS	ASP	TYR	LEU	LEU	ASP	LYS	GLY	SER	LYS	ASP	LYS	GLU	PHE	HIS	LYS	MET	LEU	THR	ALA	ILE	LEU	ALA	LYS	HIS	PRO
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● Molecule 2: Phosphoprotein



MET	ALA	GLU	SER	GLN	ALA	TYR	HIS	VAL	ASN	LYS	GLY	GLU	CYS	ILE	LYS	PRO	GLY	ASN	LEU	LYS	ASN	ALA	GLY	THR	ILE	ASP	ARG	GLY	THR	LEU	ASP	GLY	GLN	VAL	THR	ASP	ASN	ARG	GLY	THR	VAL	TYR	GLY	GLU	GLN	GLY	ASP	ILE
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ASN	GLN	CYS	PRO	ALA	ILE	ASP	VAL	ASN	LYS	VAL	TYR	ASP	PRO	VAL	ALA	ASN	GLY	ARG	GLU	ILE	THR	ASN	ASP	ASP	GLY	THR	CYS	GLU	ASP	THR	GLU	ALA	GLY	LYS	ARG	PRO	SER	ASN	SER	VAL	GLN	ARG	TYR	TYR	VAL	SER	GLY	GLY	GLU	GLN	THR	ILE
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GLU	GLY	LEU	ASP	ALA	SER	ASP	LEU	VAL	GLN	ALA	ASP	PRO	VAL	ASN	LEU	VAL	ASN	PHE	GLY	GLY	ASP	GLY	ASP	ASP	SER	GLY	THR	VAL	ASP	PRO	ASP	PRO	GLY	ARG	SER	THR	LEU	TYR	ASN	THR	GLN	ASP	GLY	ASN	VAL	VAL	ASP	ALA	ARG	THR
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ASP	VAL	GLU	LYS	LEU	GLY	ALA	ASP	GLN	GLU	VAL	LEU	ASN	GLN	LYS	GLY	GLY	THR	GLY	ASN	ARG	GLY	PHE	GLY	GLN	GLY	GLY	LYS	THR	VAL	PRO	GLU	ILE	ARG	PRO	SER	ALA	GLY	THR	GLN	SER	ILE	GLN	GLU	THR	GLY	ASP	GLY	ASN	VAL	SER	GLY
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THR	VAL	THR	GLU	CYS	LEU	SER	ILE	SER	GLY	ALA	THR	GLN	ALA	GLU	ASN	PRO	VAL	GLN	SER	ARG	THR	SER	GLU	GLN	ASN	ALA	GLY	LYS	VAL	LEU	LYS	ALA	THR	ILE	GLN	GLY	THR	ILE	ALA	ASP	GLY	ASN	THR	GLN	PRO	GLY	THR	GLN	PRO	LYS	GLU	SER
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ASN	ASP	ASN	SER	GLU	TYR	TYR	GLU	ASP	LEU	PHE	LYS	GLU	GLN	ILE	D317	I318	R319	A320	D327	T331	I332	K335	L336	I339	L342	V346	Q352	Q356	P375	I381	LYS	ASP	PRO	THR	SER	GLU	VAL	GLU	LEU	ASN	VAL	PRO	ASP	LEU	ARG	PRO	ILE	ILE	SER
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ARG	ASP	SER	GLY	ARG	ALA	LEU	ALA	GLU	VAL	LYS	LYS	PRO	ALA	GLN	ASP	ARG	SER	GLN	ILE	THR	LYS	ALA	ASN	SER	LYS	GLY	SER	GLN	LEU	VAL	ASP	LYS	GLN	LEU	ALA	ALA	SER	SER	ALA	ILE	GLY	PHE	VAL	PRO	PRO	ASP	ASP	HIS	ILE	SER
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SER	ARG	ASN	VAL	ILE	SER	ILE	SER	LYS	LEU	ASN	THR	THR	HIS	LYS	ASP	TYR	LEU	LEU	LEU	ASN	ASP	VAL	LYS	GLY	SER	LYS	ASP	PHE	HIS	LYS	MET	LEU	THR	ALA	ILE	LEU	ALA	LYS	HIS	PRO
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4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	5435091	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)	600	Depositor
Maximum defocus (nm)	2400	Depositor
Magnification	Not provided	
Image detector	TFS FALCON 4i (4k x 4k)	Depositor
Maximum map value	1.996	Depositor
Minimum map value	-0.021	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.037	Depositor
Recommended contour level	0.084	Depositor
Map size (Å)	262.8, 262.8, 262.8	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.876, 0.876, 0.876	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	0.16	0/9387	0.33	0/12715
2	B	0.16	0/1235	0.36	0/1655
2	C	0.18	0/595	0.39	0/799
2	D	0.22	0/454	0.55	0/609
2	E	0.19	0/499	0.40	0/668
All	All	0.17	0/12170	0.35	0/16446

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	9180	0	9151	60	0
2	B	1221	0	1308	12	0
2	C	591	0	627	11	0
2	D	452	0	493	9	0
2	E	496	0	536	9	0
All	All	11940	0	12115	89	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 4.

The worst 5 of 89 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)
2:C:377:PHE:HA	2:D:370:ILE:HG13	1.64	0.79
2:B:399:SER:HB3	2:B:403:GLY:HA2	1.73	0.71
1:A:950:VAL:HG21	1:A:1335:GLN:HE21	1.58	0.67
1:A:530:LEU:HD13	1:A:700:LEU:HD21	1.78	0.64
1:A:770:VAL:HG22	1:A:775:GLN:HG3	1.79	0.64

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	1132/2183 (52%)	1104 (98%)	28 (2%)	0	100	100
2	B	152/509 (30%)	146 (96%)	6 (4%)	0	100	100
2	C	73/509 (14%)	70 (96%)	3 (4%)	0	100	100
2	D	57/509 (11%)	55 (96%)	2 (4%)	0	100	100
2	E	63/509 (12%)	62 (98%)	1 (2%)	0	100	100
All	All	1477/4219 (35%)	1437 (97%)	40 (3%)	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	1012/1937 (52%)	1012 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	143/436 (33%)	143 (100%)	0	100	100
2	C	70/436 (16%)	70 (100%)	0	100	100
2	D	54/436 (12%)	54 (100%)	0	100	100
2	E	58/436 (13%)	58 (100%)	0	100	100
All	All	1337/3681 (36%)	1337 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
2	C	326	HIS
2	E	329	ASN
1	A	1167	ASN
1	A	1335	GLN
1	A	1362	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

There are no chain breaks in this entry.

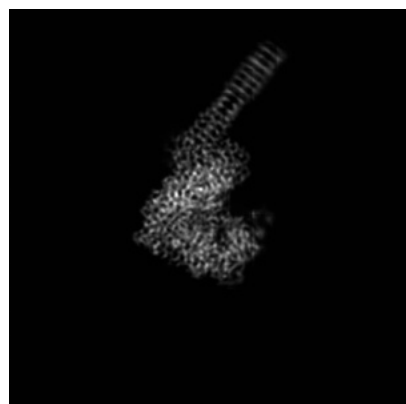
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-65448. These allow visual inspection of the internal detail of the map and identification of artifacts.

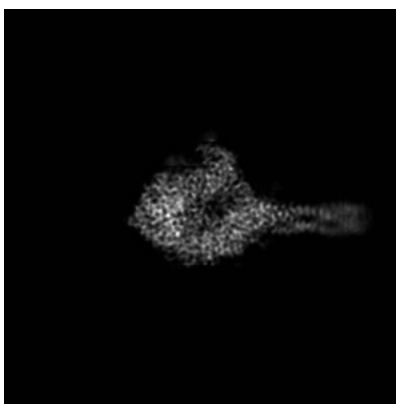
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

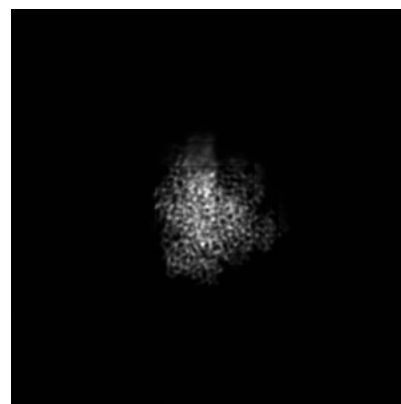
6.1.1 Primary map



X

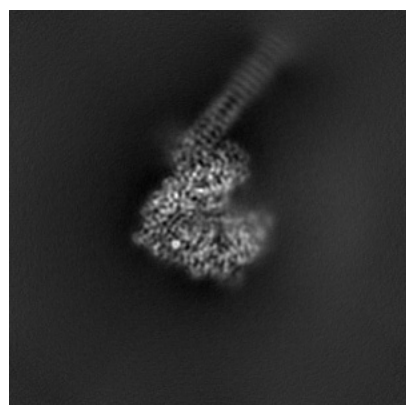


Y

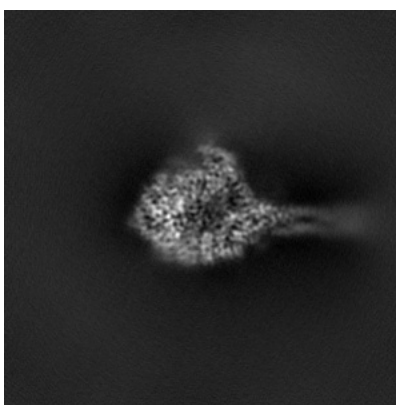


Z

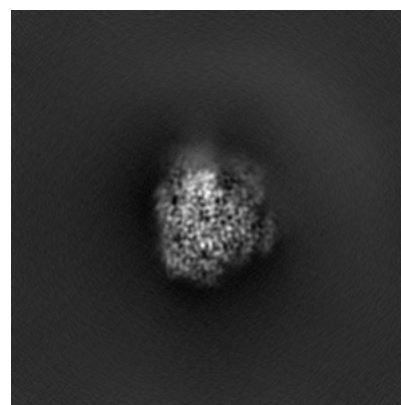
6.1.2 Raw map



X



Y

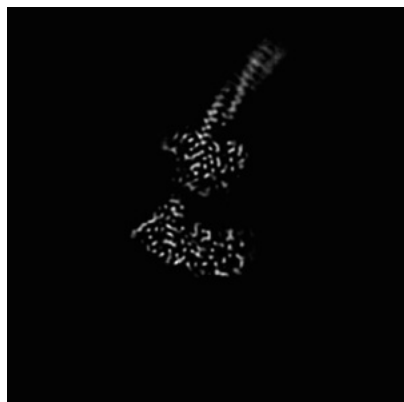


Z

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

6.2 Central slices [i](#)

6.2.1 Primary map



X Index: 150

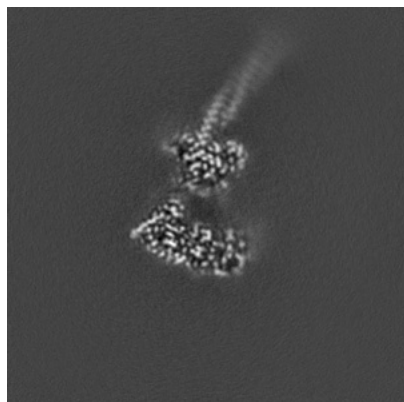


Y Index: 150

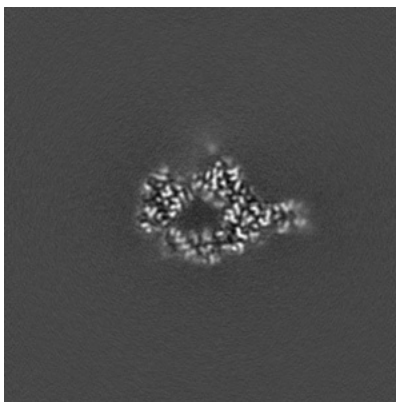


Z Index: 150

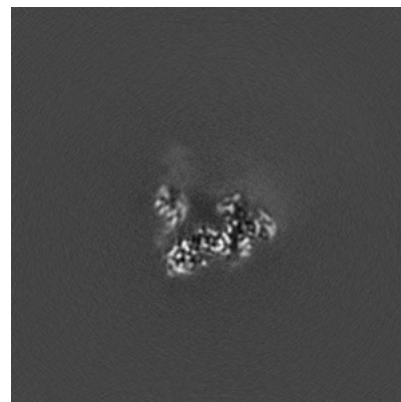
6.2.2 Raw map



X Index: 150



Y Index: 150

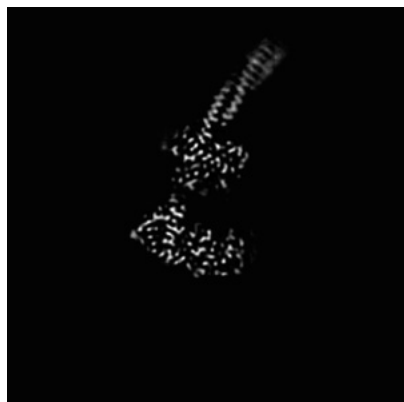


Z Index: 150

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: 149

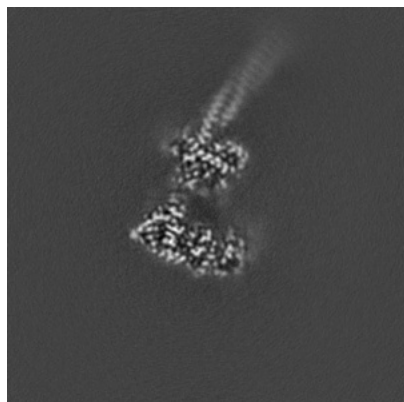


Y Index: 152

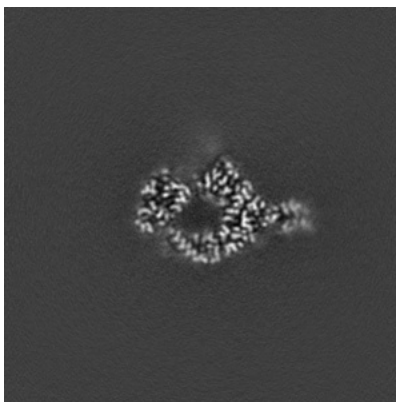


Z Index: 130

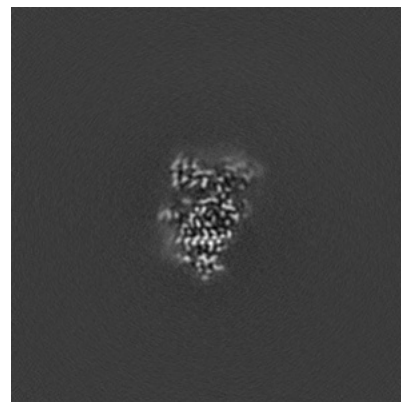
6.3.2 Raw map



X Index: 149



Y Index: 152

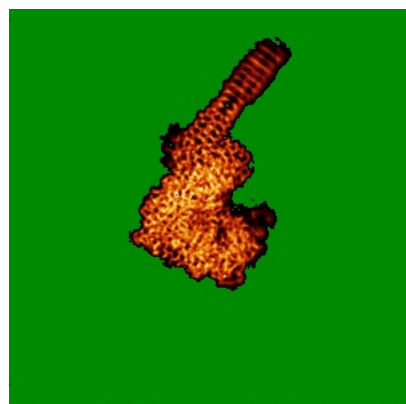


Z Index: 123

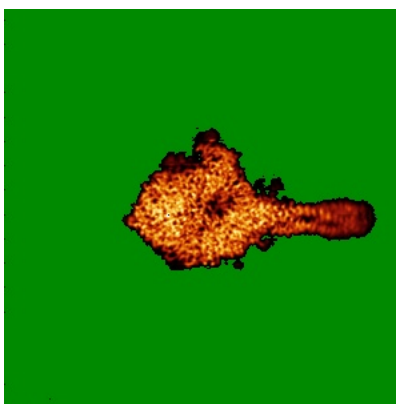
The images above show the largest variance slices of the map in three orthogonal directions.

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

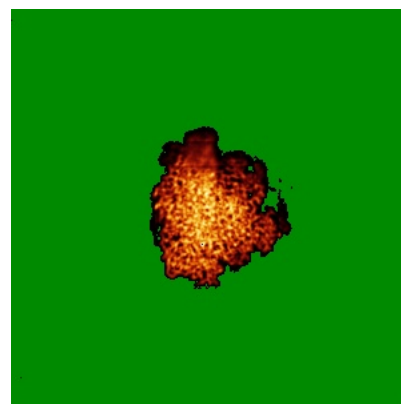
6.4.1 Primary map



X

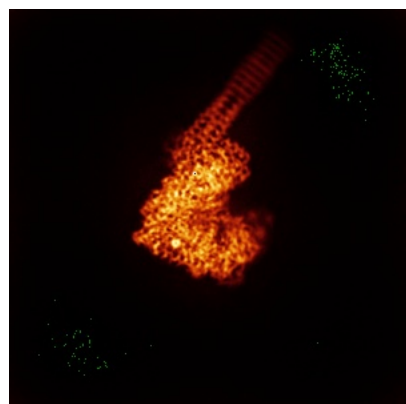


Y

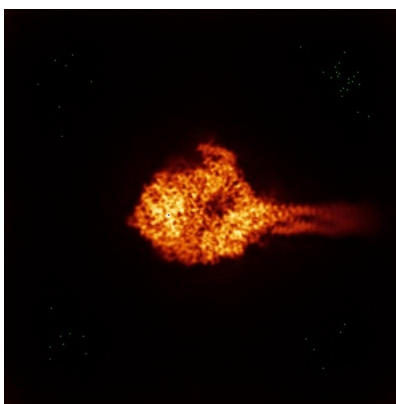


Z

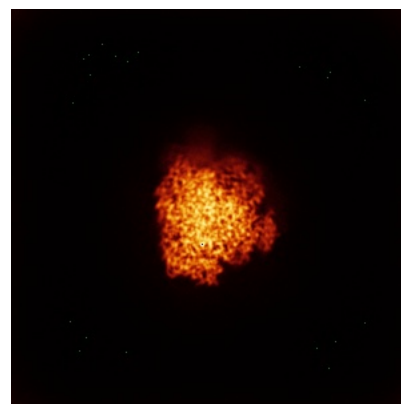
6.4.2 Raw map



X



Y



Z

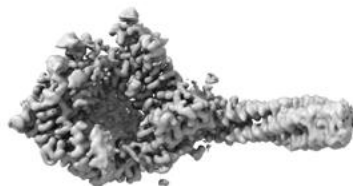
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



X



Y



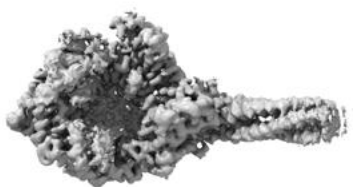
Z

The images above show the 3D surface view of the map at the recommended contour level 0.084. 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



X



Y



Z

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.

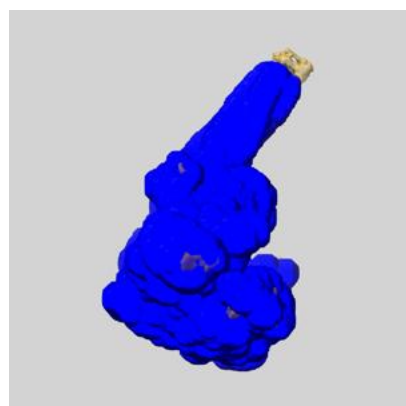
6.6 Mask visualisation [i](#)

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

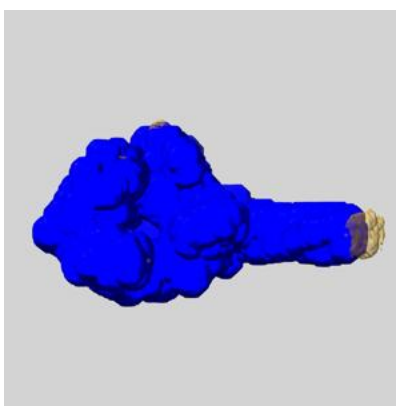
A mask typically either:

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

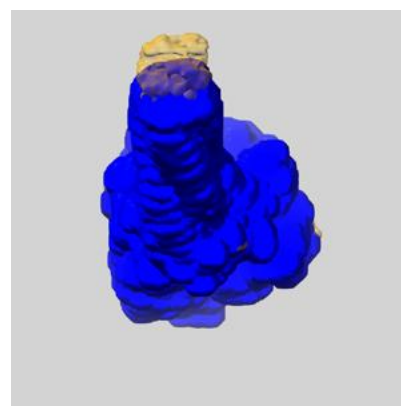
6.6.1 emd_65448_msk_1.map [i](#)



X



Y

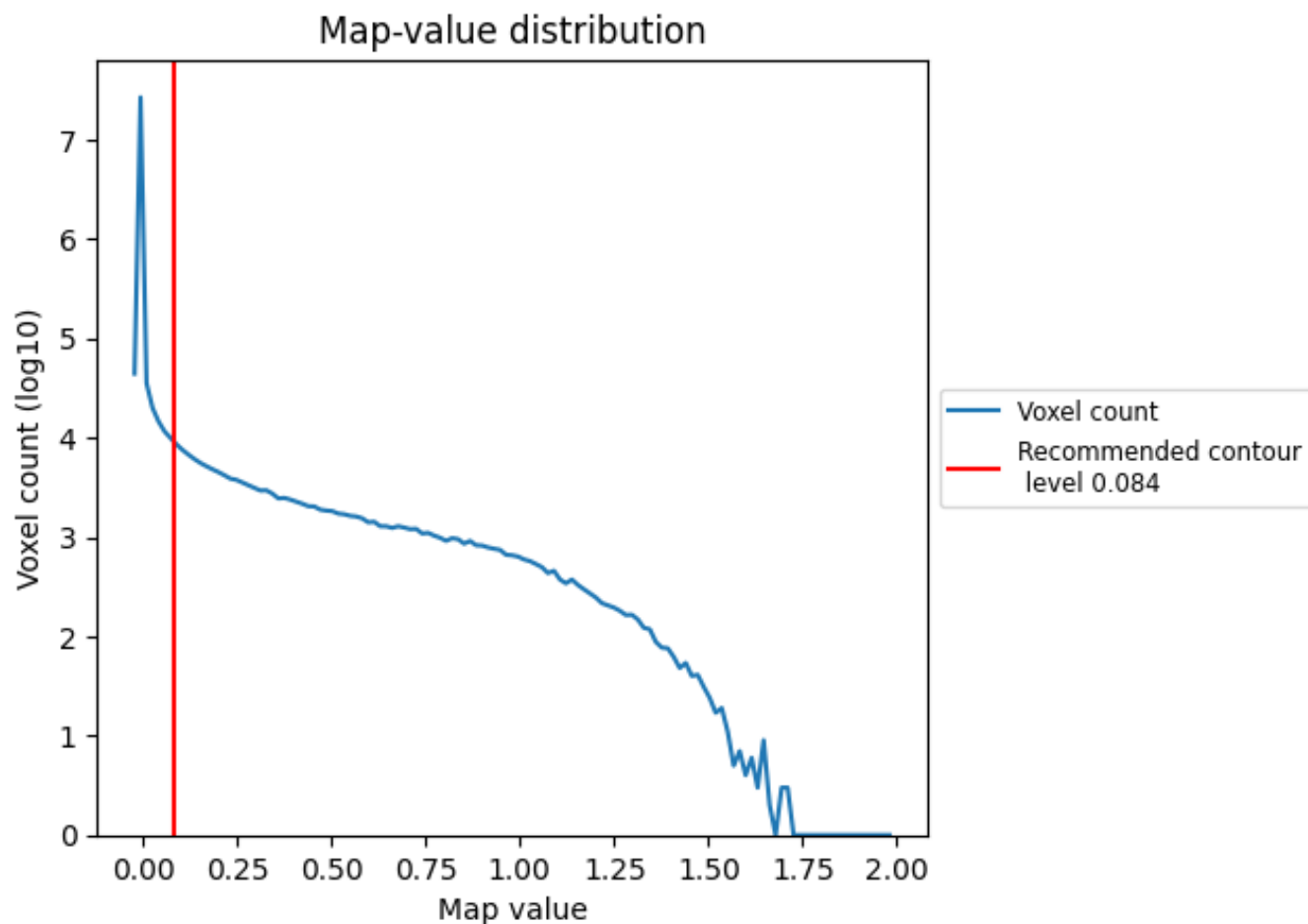


Z

7 Map analysis [i](#)

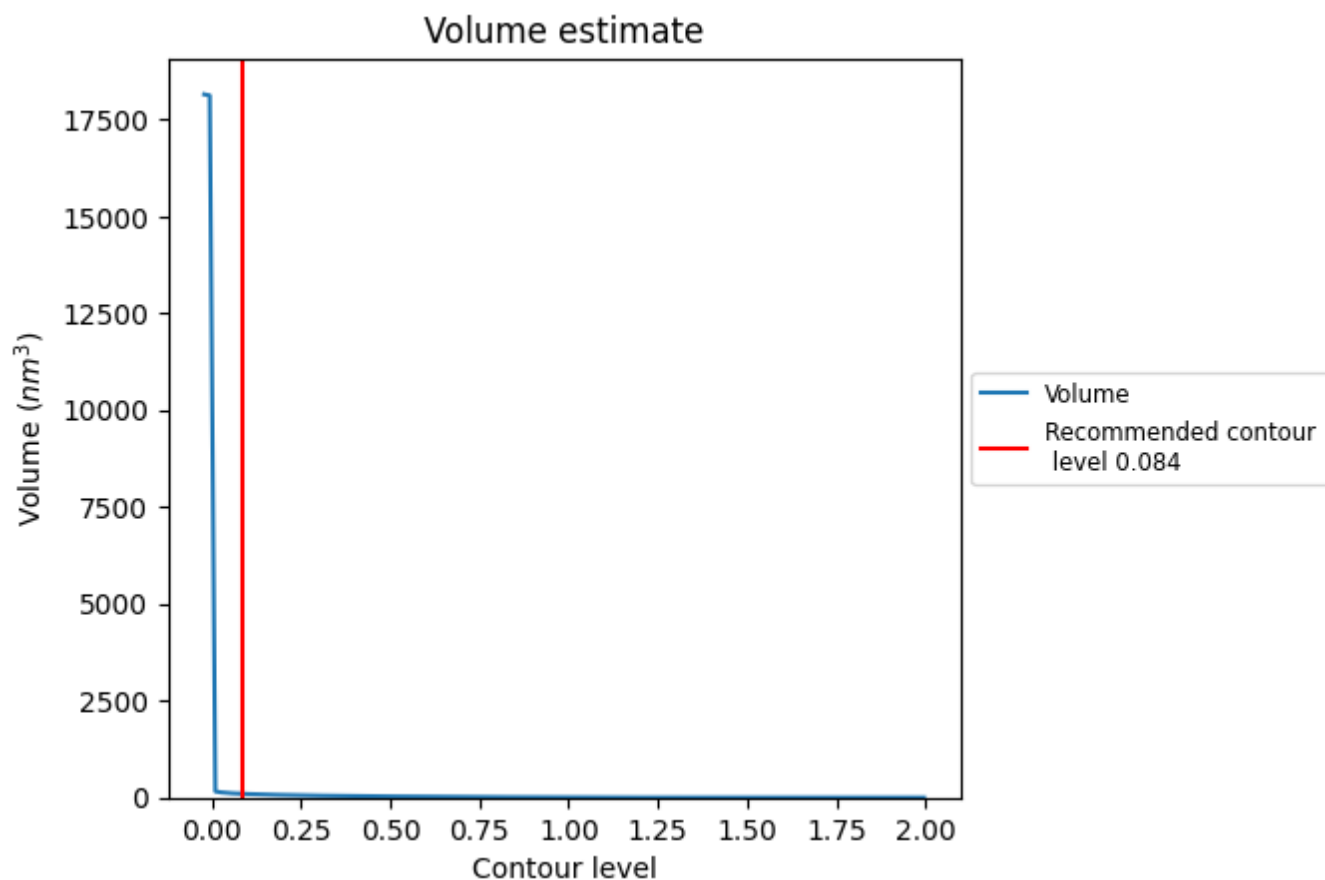
This section contains the results of statistical analysis of the map.

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.

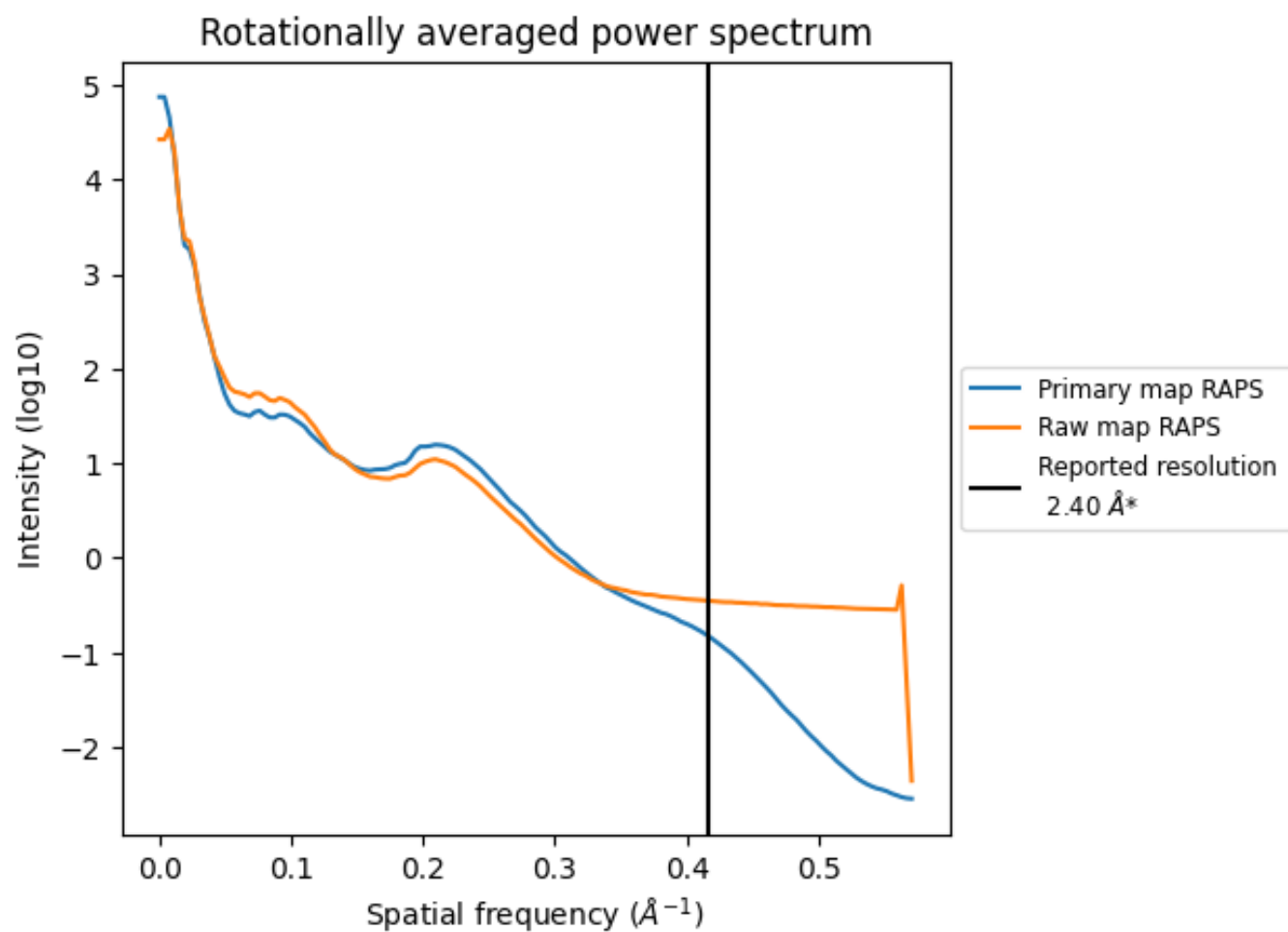
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 98 nm^3 ; this corresponds to an approximate mass of 89 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 ⓘ

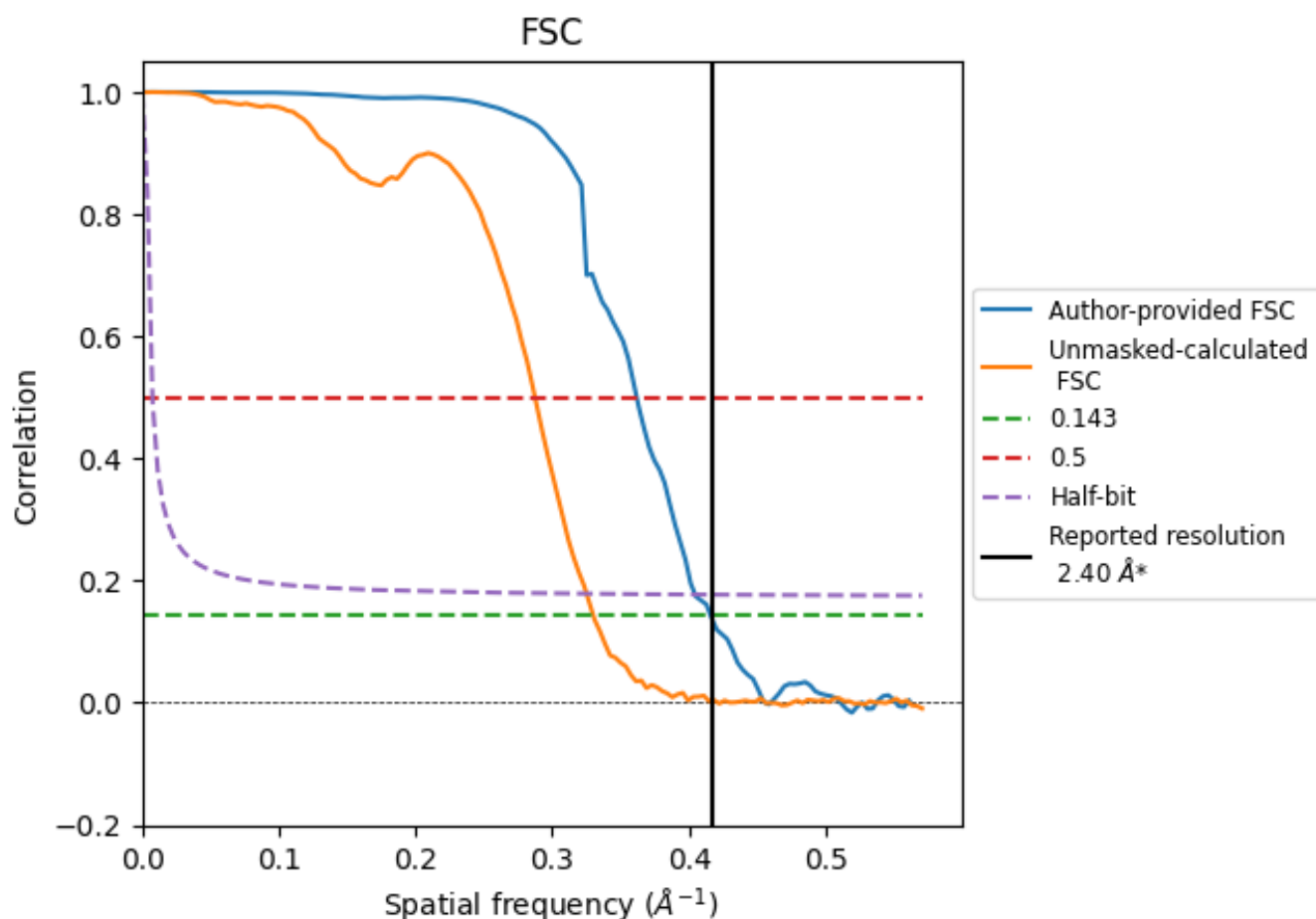


*Reported resolution corresponds to spatial frequency of 0.417 Å⁻¹

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 0.417 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

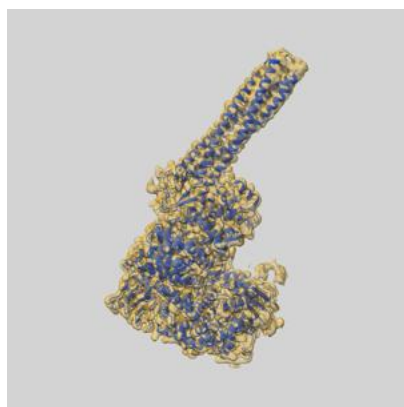
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.40	-	-
Author-provided FSC curve	2.40	2.76	2.47
Unmasked-calculated*	3.03	3.48	3.07

*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 3.03 differs from the reported value 2.4 by more than 10 %

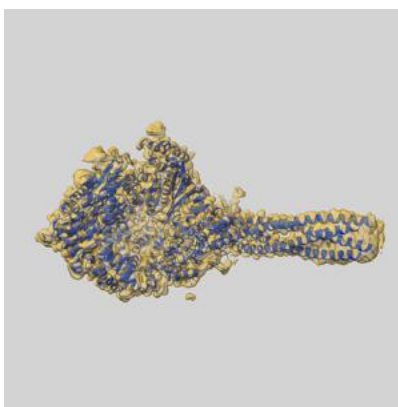
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-65448 and PDB model 9VY1. Per-residue inclusion information can be found in section [3](#) on page [5](#).

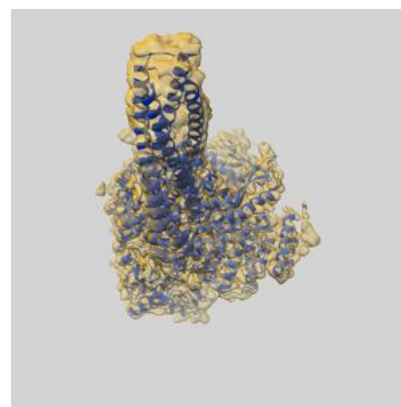
9.1 Map-model overlay [i](#)



X



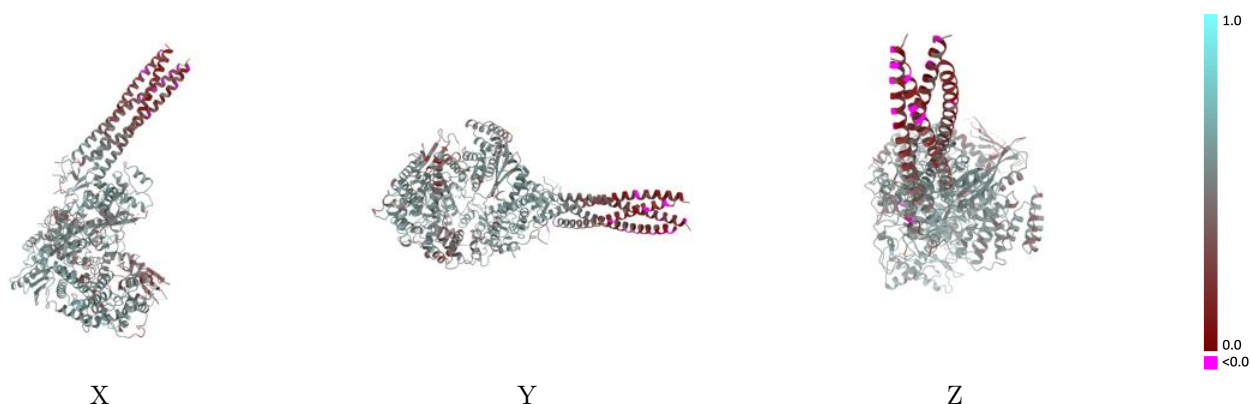
Y



Z

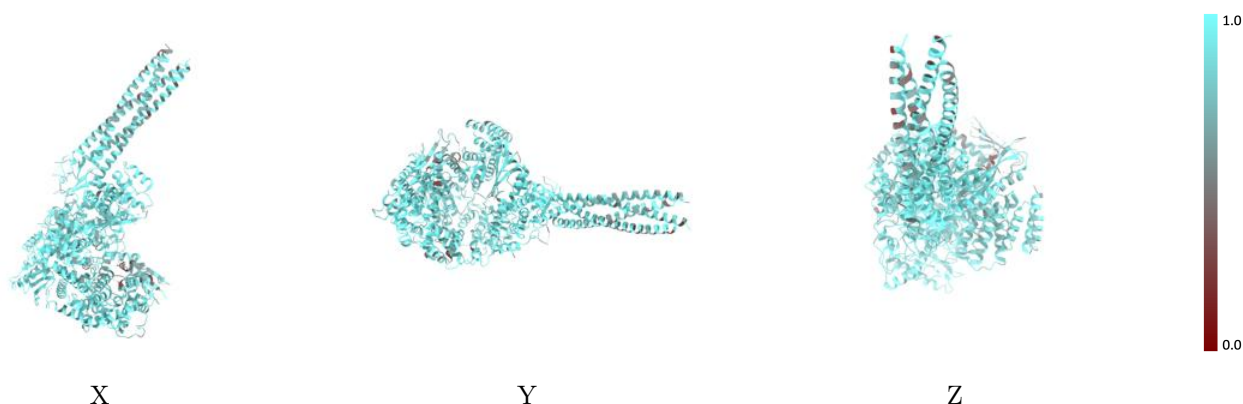
The images above show the 3D surface view of the map at the recommended contour level 0.084 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



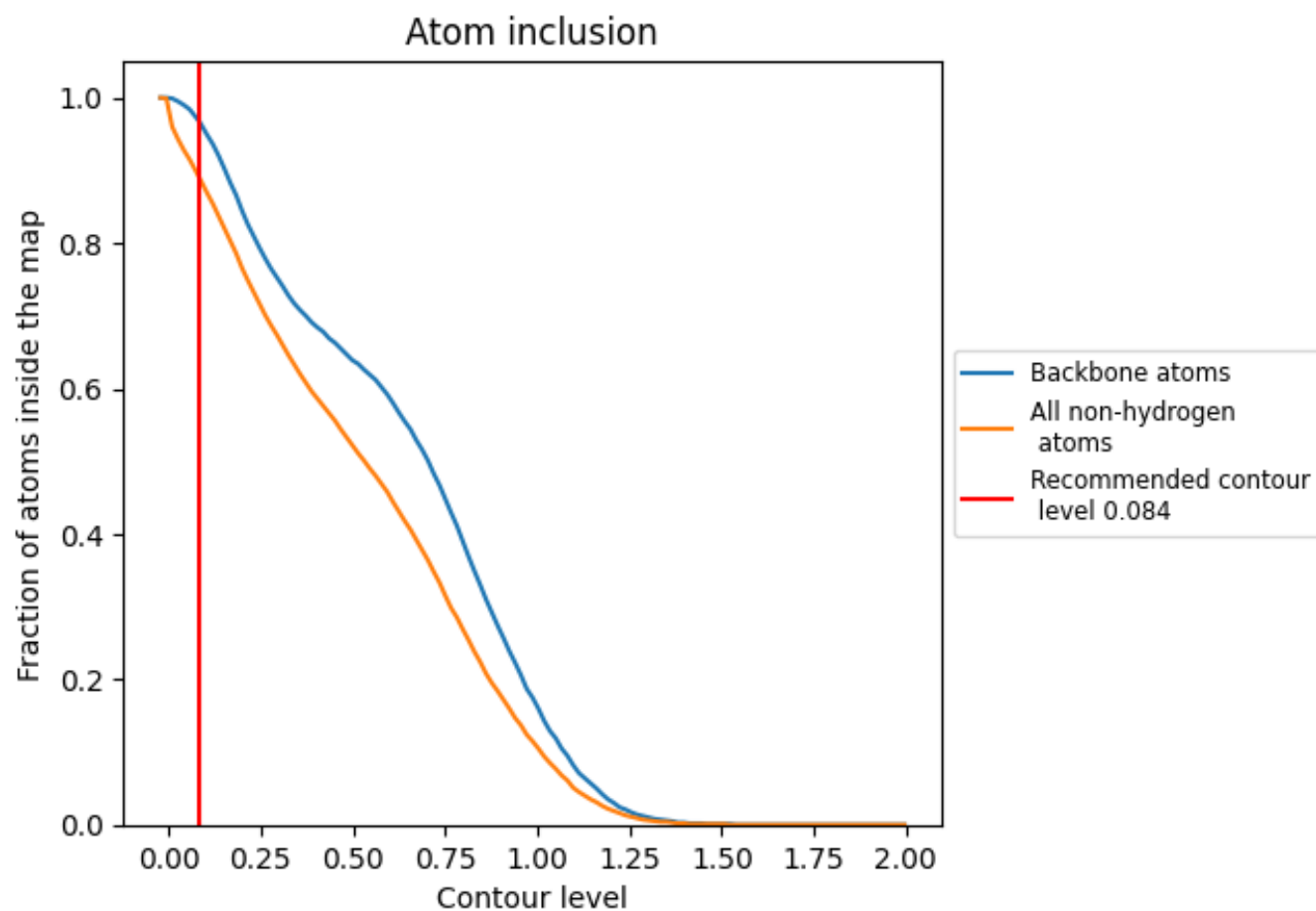
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.084).

9.4 Atom inclusion [i](#)



At the recommended contour level, 97% of all backbone atoms, 89% 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 (0.084) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8900	0.4860
A	0.9080	0.5220
B	0.8400	0.4160
C	0.8280	0.3460
D	0.7980	0.2740
E	0.8360	0.3360

