



## wwPDB EM Validation Summary Report ⓘ

May 26, 2025 – 08:50 PM EDT

PDB ID : 8VJ9 / pdb\_00008vj9  
EMDB ID : EMD-43277  
Title : CryoEM structure of human ACKR3 phosphorylated by GRK5 in complex with Arrestin3 variant with the C edge loop from Arrestin2 inserted  
Authors : Chen, Q.; Tesmer, J.J.G.  
Deposited on : 2024-01-06  
Resolution : 3.30 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](mailto: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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

EMDB validation analysis : 0.0.1.dev118  
Mogul : 2022.3.0, CSD as543be (2022)  
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

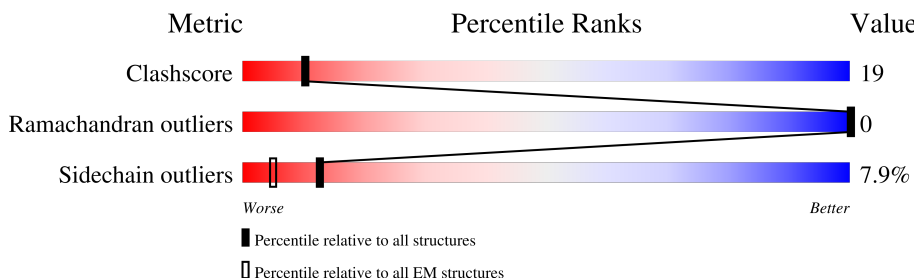
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 3.30 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  $\geq 3$ , 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	H	240	
2	L	215	
3	R	393	
4	A	400	

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 10983 atoms, of which 5472 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 Fab7 heavy chain.

Mol	Chain	Residues	Atoms						AltConf	Trace
1	H	212	Total	C	H	N	O	S	0	0
			3182	1036	1562	268	309	7		

- Molecule 2 is a protein called Fab7 light chain.

Mol	Chain	Residues	Atoms						AltConf	Trace
2	L	204	Total	C	H	N	O	S	0	0
			3115	992	1539	262	317	5		

- Molecule 3 is a protein called Atypical chemokine receptor 3.

Mol	Chain	Residues	Atoms						AltConf	Trace
3	R	7	Total	C	H	N	O	P	0	0
			121	34	61	9	15	2		

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	13	GLY	-	expression tag	UNP P25106
R	14	ALA	-	expression tag	UNP P25106
R	15	PRO	-	expression tag	UNP P25106
R	377	GLY	-	expression tag	UNP P25106
R	378	ARG	-	expression tag	UNP P25106
R	379	PRO	-	expression tag	UNP P25106
R	380	LEU	-	expression tag	UNP P25106
R	381	GLU	-	expression tag	UNP P25106
R	382	VAL	-	expression tag	UNP P25106
R	383	LEU	-	expression tag	UNP P25106
R	384	PHE	-	expression tag	UNP P25106
R	385	GLN	-	expression tag	UNP P25106
R	386	GLY	-	expression tag	UNP P25106
R	387	PRO	-	expression tag	UNP P25106
R	388	HIS	-	expression tag	UNP P25106

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Chain	Residue	Modelled	Actual	Comment	Reference
R	389	HIS	-	expression tag	UNP P25106
R	390	HIS	-	expression tag	UNP P25106
R	391	HIS	-	expression tag	UNP P25106
R	392	HIS	-	expression tag	UNP P25106
R	393	HIS	-	expression tag	UNP P25106
R	394	HIS	-	expression tag	UNP P25106
R	395	HIS	-	expression tag	UNP P25106
R	396	HIS	-	expression tag	UNP P25106
R	397	HIS	-	expression tag	UNP P25106
R	398	ASP	-	expression tag	UNP P25106
R	399	TYR	-	expression tag	UNP P25106
R	400	LYS	-	expression tag	UNP P25106
R	401	ASP	-	expression tag	UNP P25106
R	402	ASP	-	expression tag	UNP P25106
R	403	ASP	-	expression tag	UNP P25106
R	404	ASP	-	expression tag	UNP P25106
R	405	LYS	-	expression tag	UNP P25106

- Molecule 4 is a protein called Beta-arrestin-2.

Mol	Chain	Residues	Atoms						AltConf	Trace
4	A	282	Total	C	H	N	O	S	0	0
			4565	1450	2310	392	404	9		

There are 30 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	330E	LEU	-	insertion	UNP P32120
A	330F	LEU	-	insertion	UNP P32120
A	330G	GLY	-	insertion	UNP P32120
A	330H	ASP	-	insertion	UNP P32120
A	330I	LEU	-	insertion	UNP P32120
A	330J	ALA	-	insertion	UNP P32120
A	330K	SER	-	insertion	UNP P32120
A	330L	SER	-	insertion	UNP P32120
A	?	-	SER	deletion	UNP P32120
A	?	-	ALA	deletion	UNP P32120
A	?	-	ALA	deletion	UNP P32120
A	?	-	THR	deletion	UNP P32120
A	?	-	HIS	deletion	UNP P32120
A	?	-	PRO	deletion	UNP P32120
A	?	-	PRO	deletion	UNP P32120

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Chain	Residue	Modelled	Actual	Comment	Reference
A	?	-	THR	deletion	UNP P32120
A	?	-	LEU	deletion	UNP P32120
A	?	-	LEU	deletion	UNP P32120
A	?	-	PRO	deletion	UNP P32120
A	382	THR	-	expression tag	UNP P32120
A	383	ASP	-	expression tag	UNP P32120
A	384	ASP	-	expression tag	UNP P32120
A	385	ASP	-	expression tag	UNP P32120
A	386	ILE	-	expression tag	UNP P32120
A	387	VAL	-	expression tag	UNP P32120
A	388	PHE	-	expression tag	UNP P32120
A	389	GLU	-	expression tag	UNP P32120
A	390	ASP	-	expression tag	UNP P32120
A	391	PHE	-	expression tag	UNP P32120
A	392	ALA	-	expression tag	UNP P32120





## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	214953	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	56	Depositor
Minimum defocus (nm)	600	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.815	Depositor
Minimum map value	-1.217	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.020	Depositor
Recommended contour level	0.126	Depositor
Map size ( $\text{\AA}$ )	337.28, 337.28, 337.28	wwPDB
Map dimensions	320, 320, 320	wwPDB
Map angles ( $^\circ$ )	90.0, 90.0, 90.0	wwPDB
Pixel spacing ( $\text{\AA}$ )	1.054, 1.054, 1.054	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: TPO

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	H	0.27	0/1664	0.44	0/2267
2	L	0.24	0/1611	0.40	0/2187
3	R	0.13	0/35	0.32	0/40
4	A	0.22	0/2296	0.39	0/3102
All	All	0.24	0/5606	0.41	0/7596

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	H	1620	1562	1562	82	0
2	L	1576	1539	1539	71	0
3	R	60	61	62	3	0
4	A	2255	2310	2317	67	0
All	All	5511	5472	5480	205	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 19.

The worst 5 of 205 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)
4:A:38:VAL:HG11	4:A:147:ILE:HD11	1.49	0.94
1:H:119:MET:N	1:H:119:MET:SD	2.40	0.94
1:H:38:HIS:ND1	1:H:53:SER:OG	2.06	0.87
4:A:211:HIS:NE2	4:A:344:LEU:O	2.08	0.86
2:L:89:CYS:O	2:L:100:GLY:N	2.10	0.84

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	H	204/240 (85%)	176 (86%)	28 (14%)	0	100	100
2	L	200/215 (93%)	177 (88%)	23 (12%)	0	100	100
3	R	3/393 (1%)	1 (33%)	2 (67%)	0	100	100
4	A	262/400 (66%)	242 (92%)	20 (8%)	0	100	100
All	All	669/1248 (54%)	596 (89%)	73 (11%)	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	H	177/200 (88%)	160 (90%)	17 (10%)	7	25
2	L	182/190 (96%)	169 (93%)	13 (7%)	12	37
3	R	4/361 (1%)	3 (75%)	1 (25%)	0	2
4	A	260/359 (72%)	242 (93%)	18 (7%)	13	38
All	All	623/1110 (56%)	574 (92%)	49 (8%)	13	32

5 of 49 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	L	173	THR
4	A	44	VAL
2	L	198	THR
4	A	19	LEU
4	A	129	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
4	A	300	ASN
4	A	249	GLN
4	A	114	HIS
2	L	190	HIS
4	A	173	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

2 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	TPO	R	352	3	8,10,11	1.56	1 (12%)	10,14,16	2.26	1 (10%)
3	TPO	R	355	3	8,10,11	1.14	0	10,14,16	2.10	1 (10%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	TPO	R	352	3	-	1/9/11/13	-
3	TPO	R	355	3	-	3/9/11/13	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	R	352	TPO	P-O1P	3.26	1.60	1.50

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	R	352	TPO	P-OG1-CB	-6.44	105.82	123.33
3	R	355	TPO	P-OG1-CB	-6.00	107.03	123.33

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	R	355	TPO	N-CA-CB-OG1
3	R	355	TPO	O-C-CA-CB
3	R	355	TPO	CB-OG1-P-O3P
3	R	352	TPO	CB-OG1-P-O2P

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	R	352	TPO	2	0

## 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.

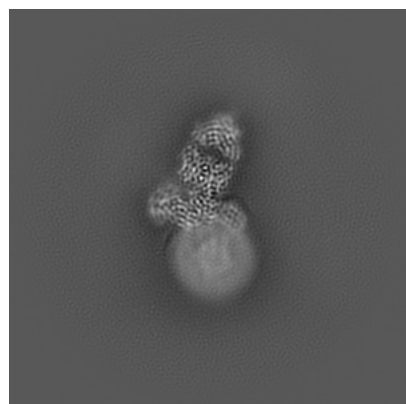
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-43277. These allow visual inspection of the internal detail of the map and identification of artifacts.

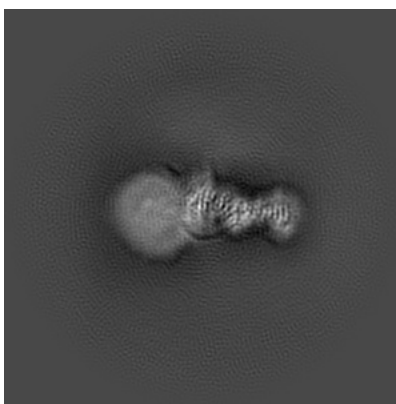
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

### 6.1 Orthogonal projections [i](#)

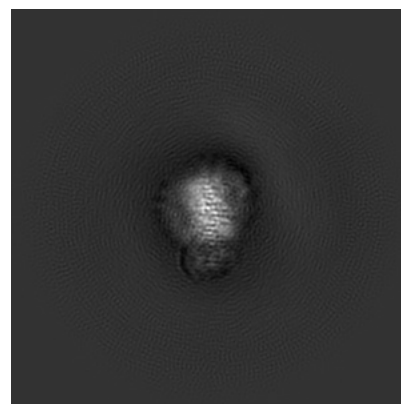
#### 6.1.1 Primary map



X

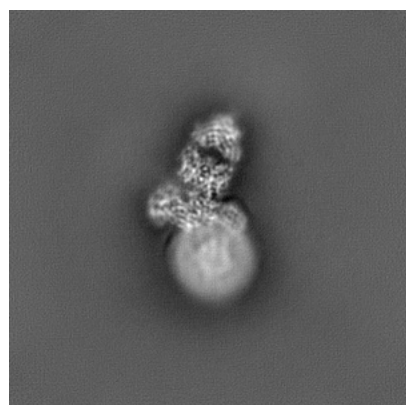


Y

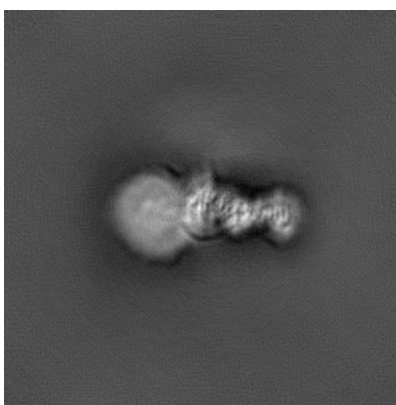


Z

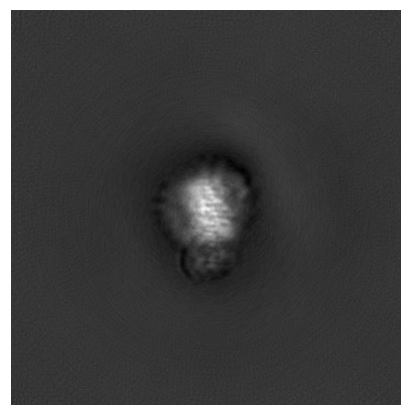
#### 6.1.2 Raw map



X



Y

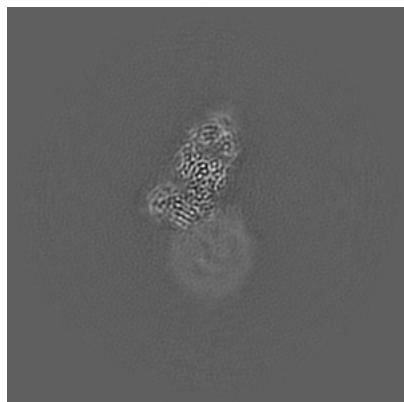


Z

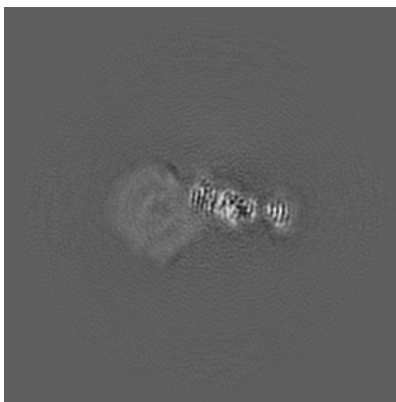
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

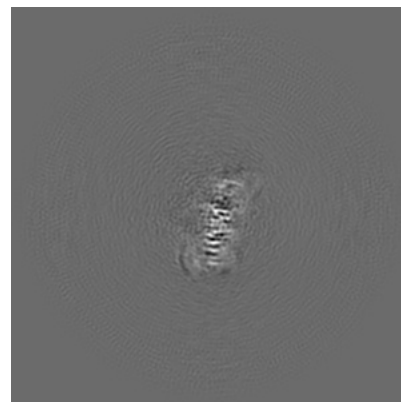
### 6.2.1 Primary map



X Index: 160

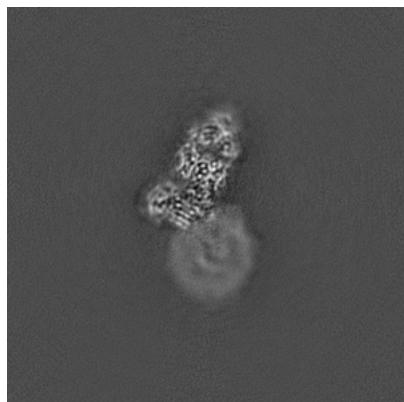


Y Index: 160

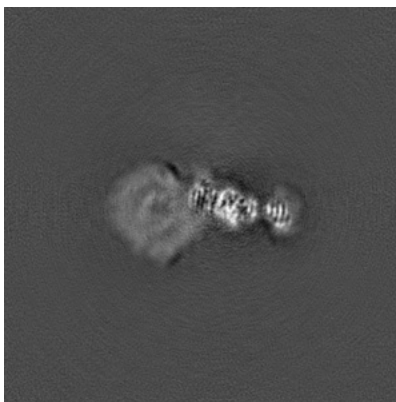


Z Index: 160

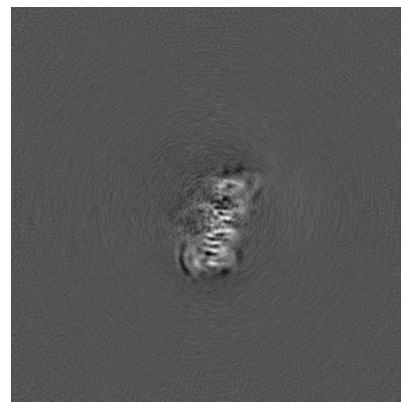
### 6.2.2 Raw map



X Index: 160



Y Index: 160

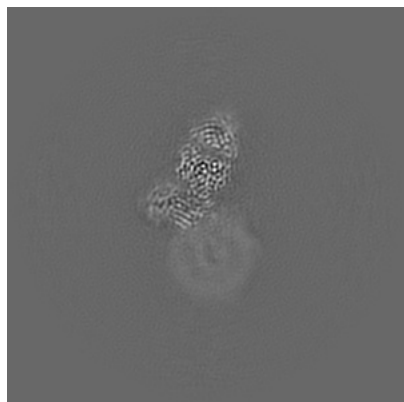


Z Index: 160

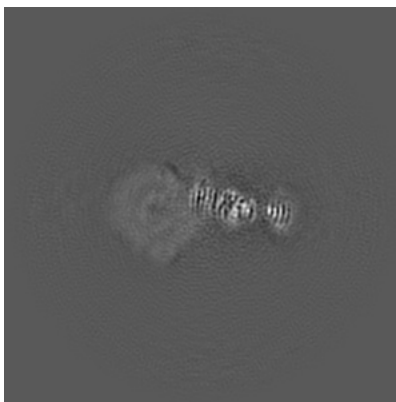
The images above show central slices of the map in three orthogonal directions.

## 6.3 Largest variance slices [i](#)

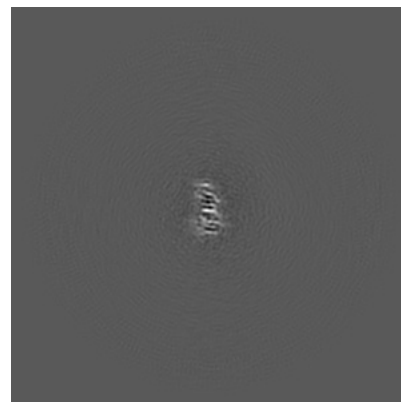
### 6.3.1 Primary map



X Index: 158

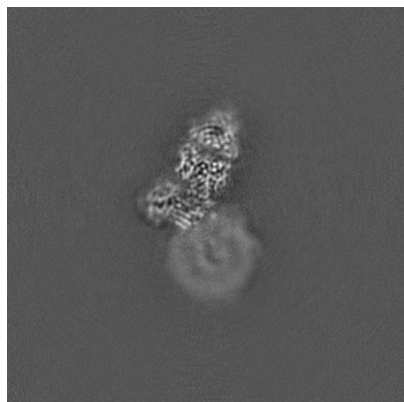


Y Index: 161

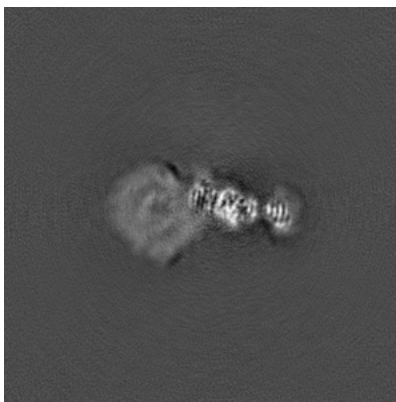


Z Index: 192

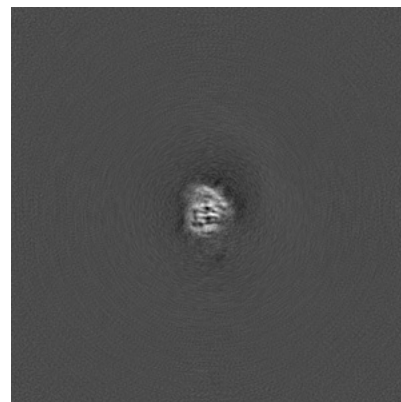
### 6.3.2 Raw map



X Index: 158



Y Index: 160

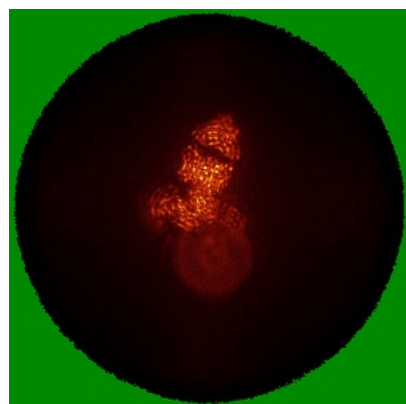


Z Index: 184

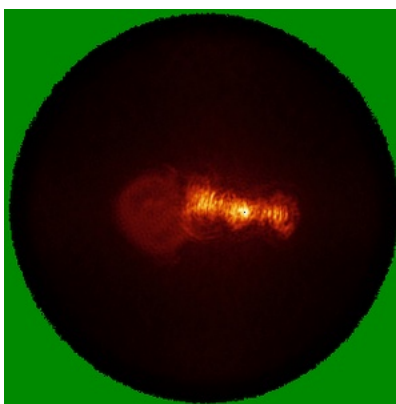
The images above show the largest variance slices of the map in three orthogonal directions.

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

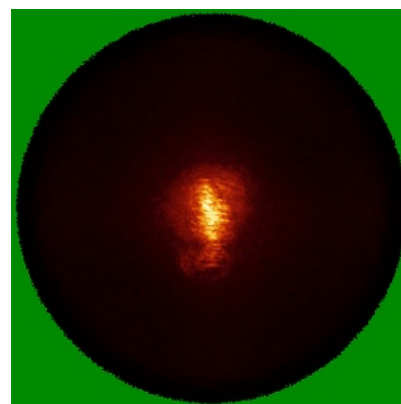
### 6.4.1 Primary map



X

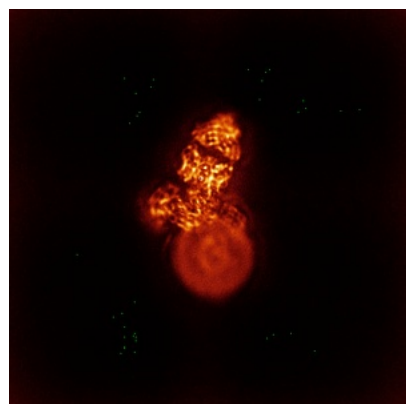


Y

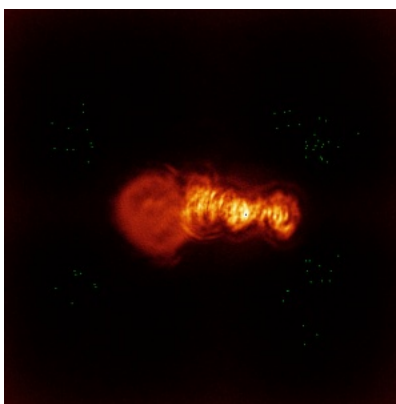


Z

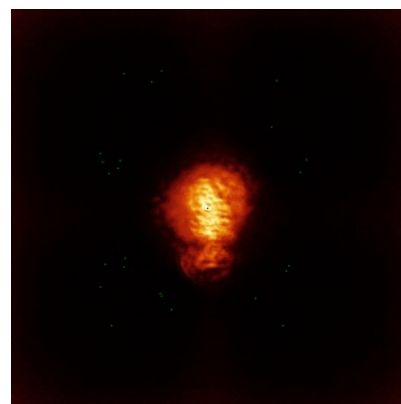
### 6.4.2 Raw map



X



Y

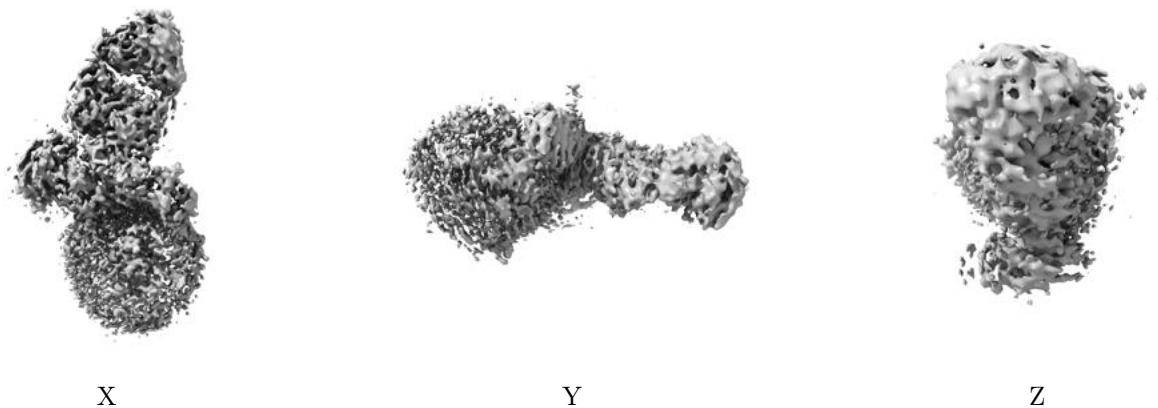


Z

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.

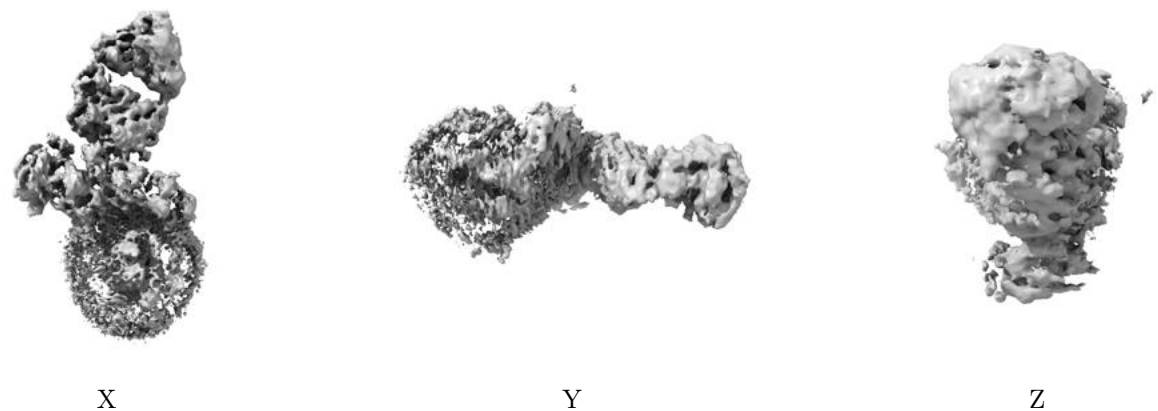
## 6.5 Orthogonal surface views [i](#)

### 6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.126. 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.

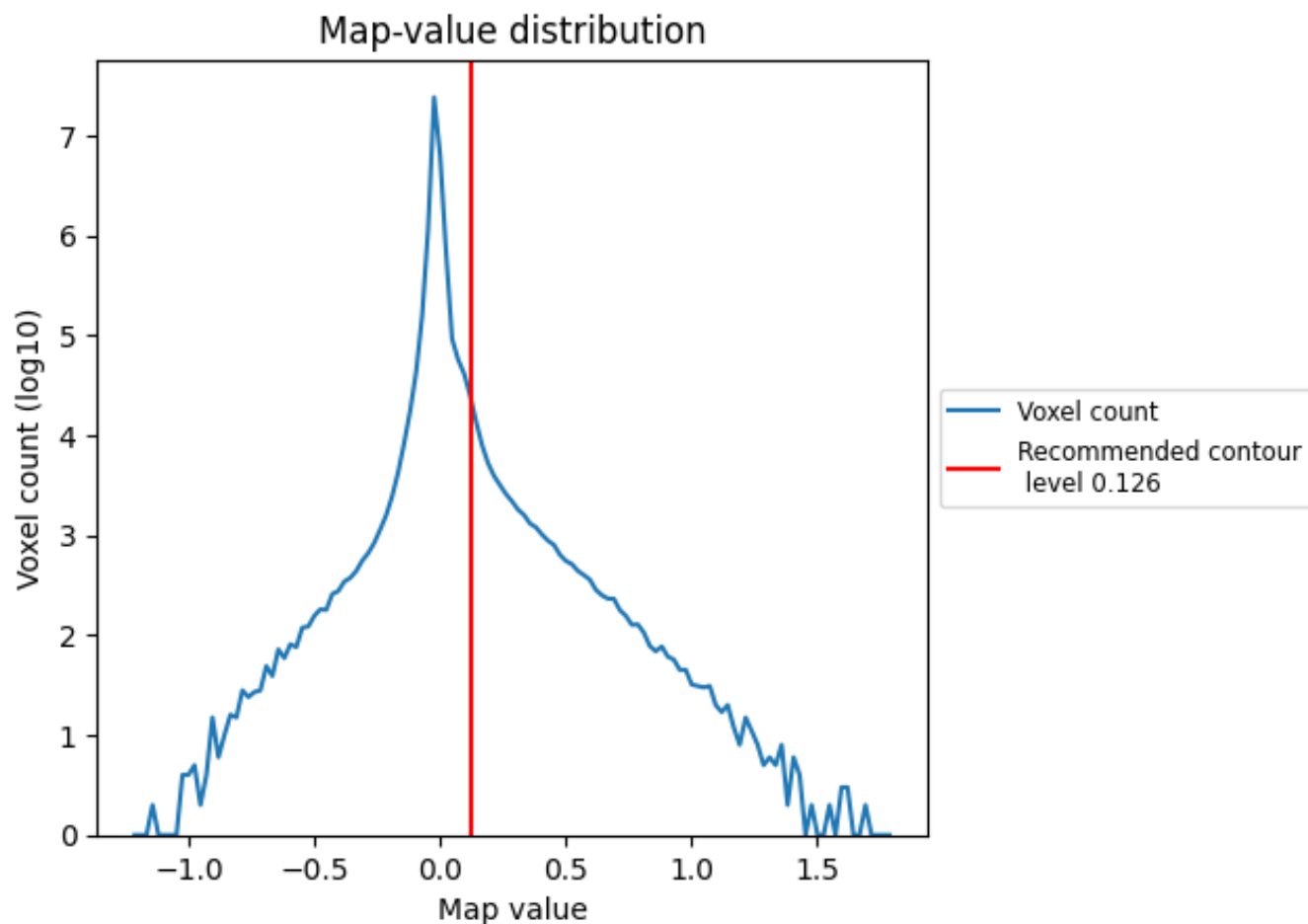
## 6.6 Mask visualisation [i](#)

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

## 7 Map analysis [i](#)

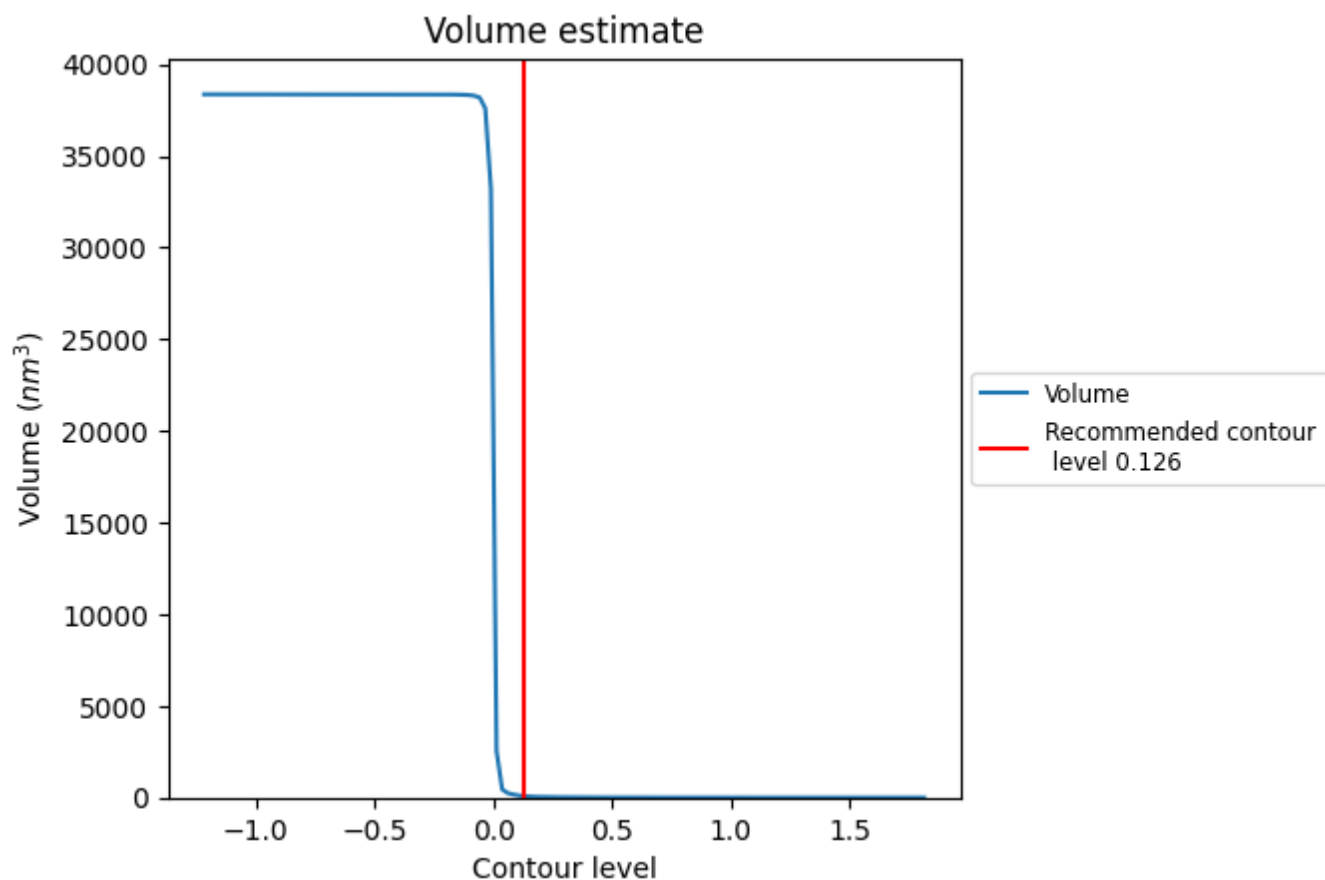
This section contains the results of statistical analysis of the map.

### 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.

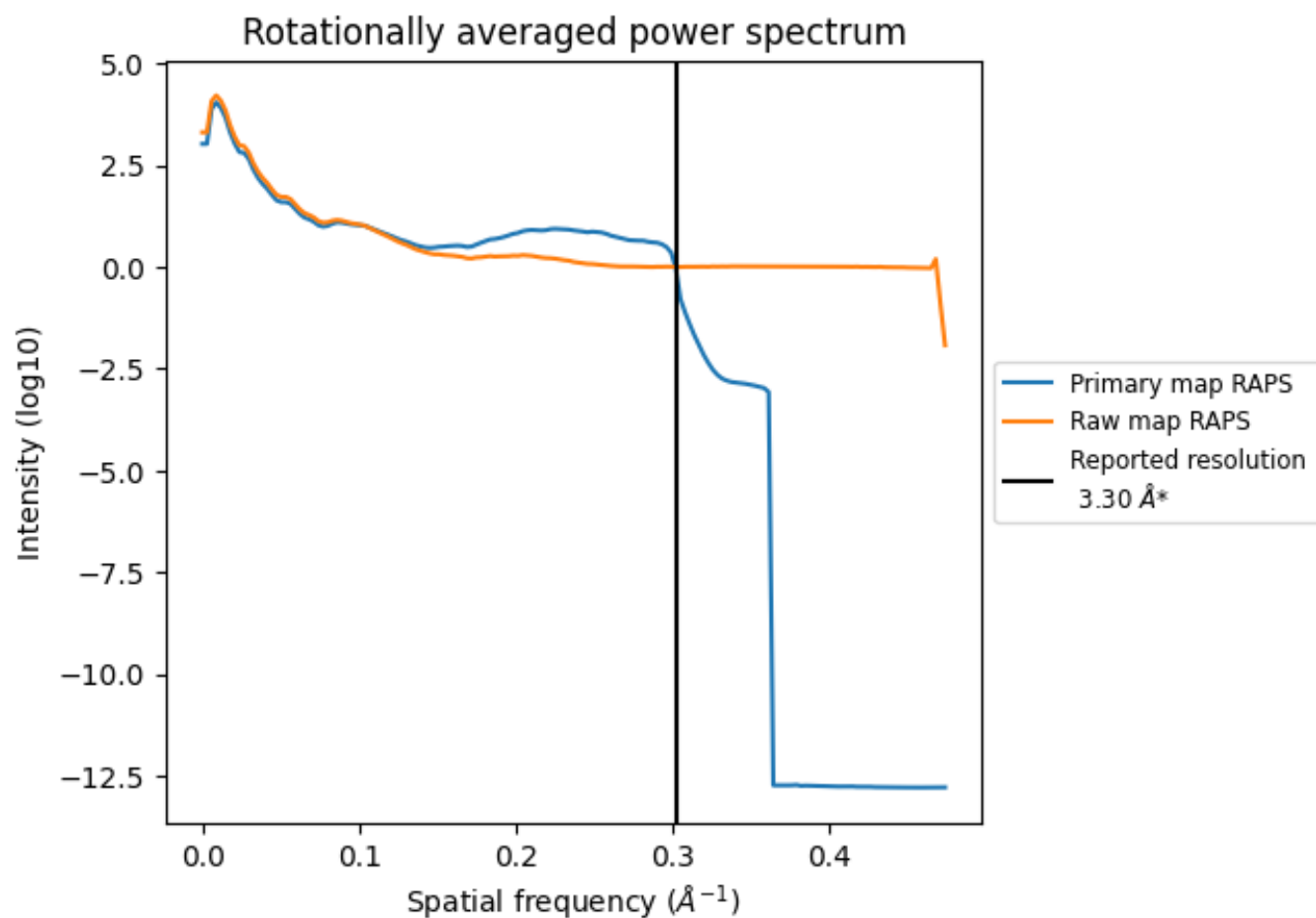
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 84 nm<sup>3</sup>; this corresponds to an approximate mass of 76 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 ⓘ

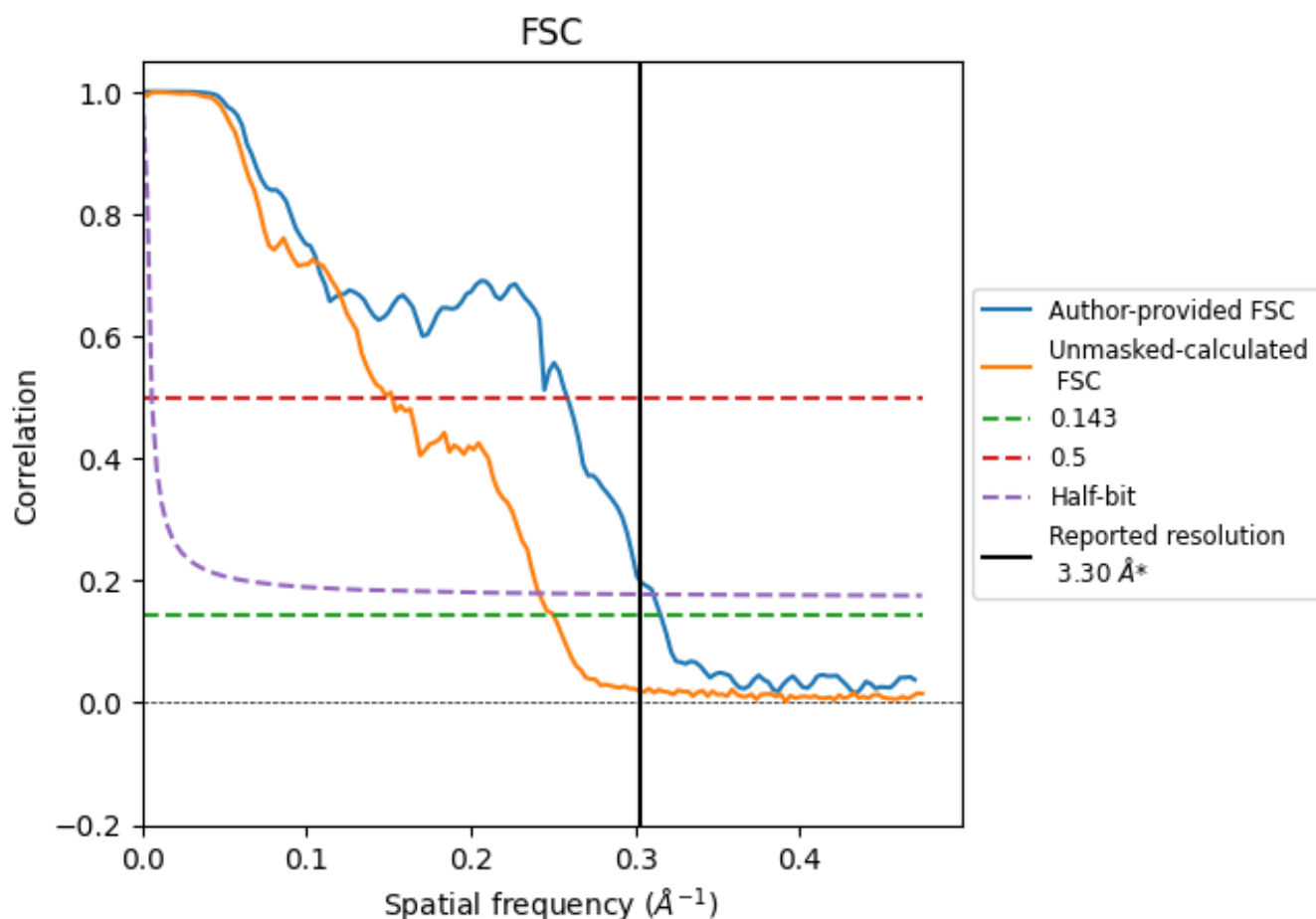


\*Reported resolution corresponds to spatial frequency of 0.303 Å<sup>-1</sup>

## 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  $0.303 \text{ \AA}^{-1}$

## 8.2 Resolution estimates [i](#)

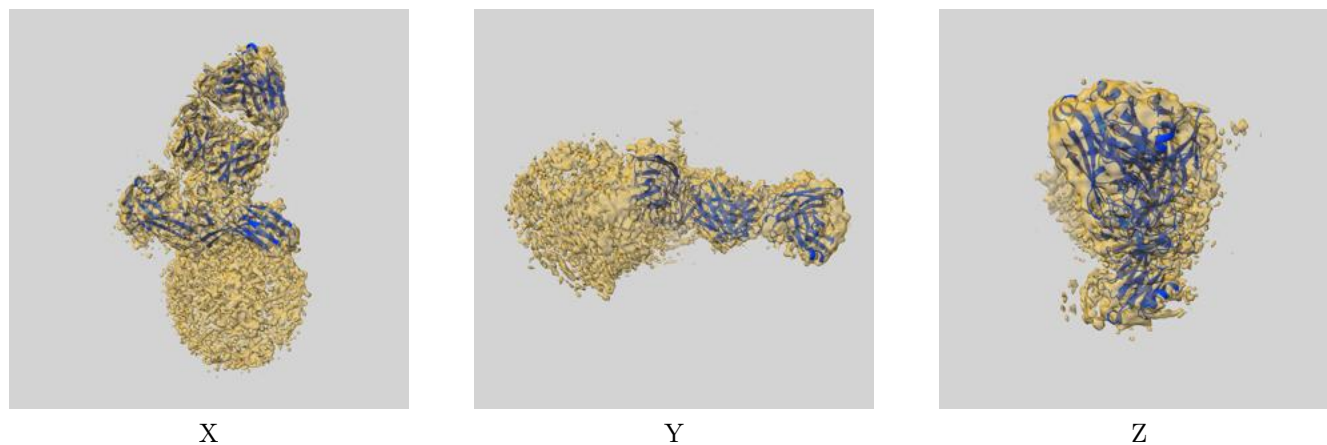
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.30	-	-
Author-provided FSC curve	3.17	3.87	3.22
Unmasked-calculated*	4.00	6.58	4.14

\*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 4.00 differs from the reported value 3.3 by more than 10 %

## 9 Map-model fit [i](#)

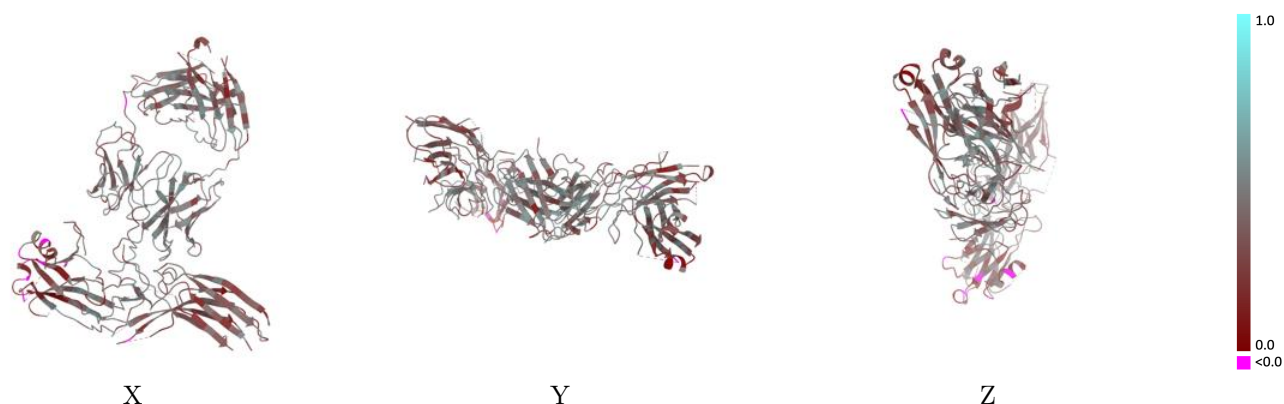
This section contains information regarding the fit between EMDB map EMD-43277 and PDB model 8VJ9. Per-residue inclusion information can be found in [section 3](#) on [page 6](#).

### 9.1 Map-model overlay [i](#)



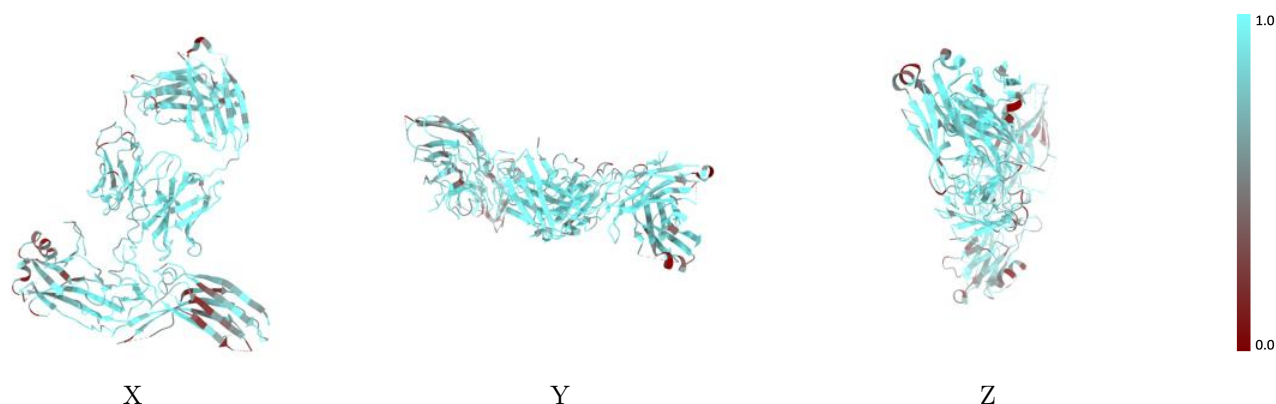
The images above show the 3D surface view of the map at the recommended contour level 0.126 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



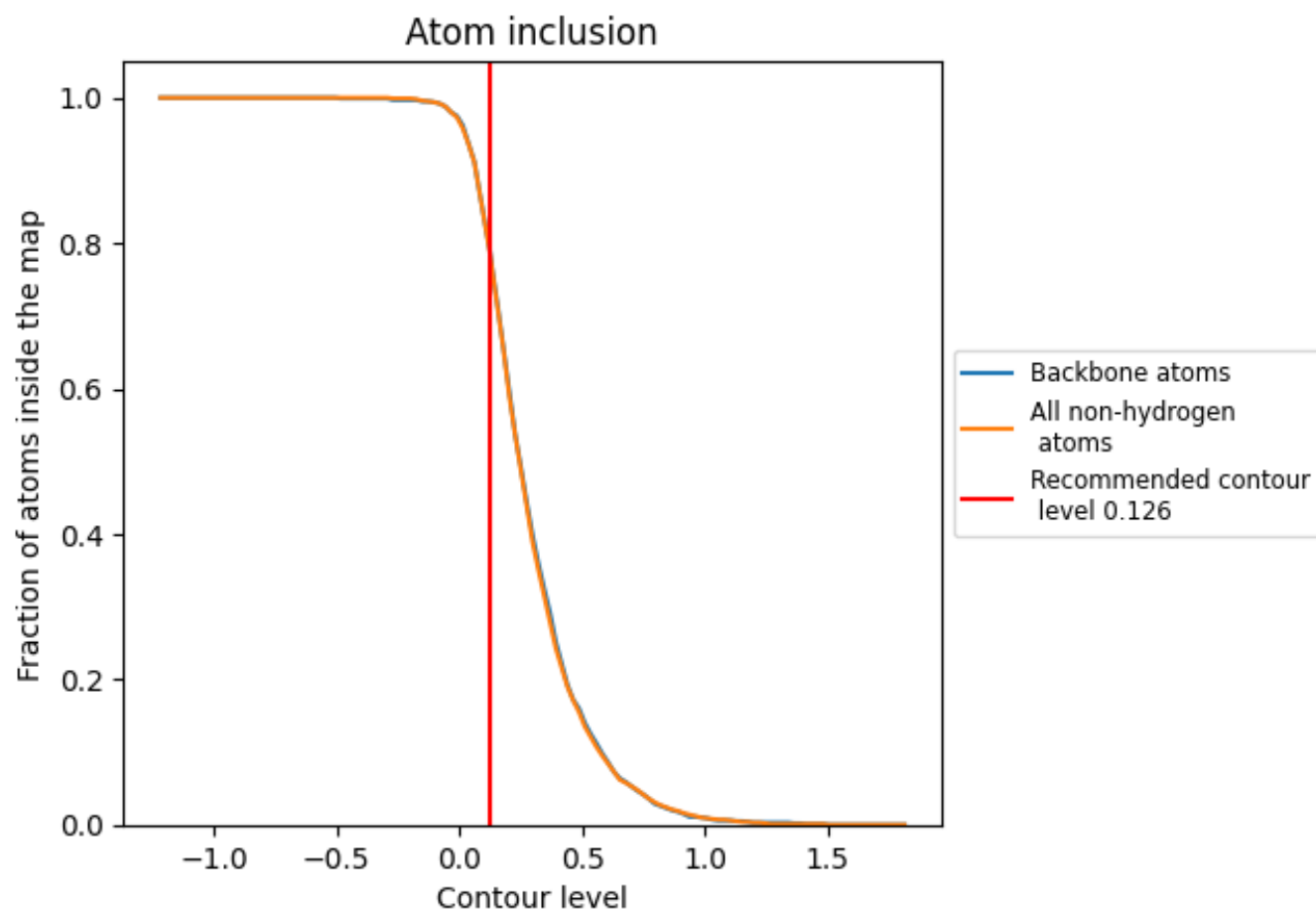
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.126).

## 9.4 Atom inclusion [i](#)



At the recommended contour level, 79% of all backbone atoms, 79% 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 (0.126) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div></div> 0.7860	<div></div> 0.3780
A	<div></div> 0.7240	<div></div> 0.3390
H	<div></div> 0.8680	<div></div> 0.4240
L	<div></div> 0.8020	<div></div> 0.3880
R	<div></div> 0.6170	<div></div> 0.2930

