



wwPDB EM Validation Summary Report ⓘ

Mar 5, 2026 – 11:45 AM UTC

PDB ID : 8BBE / pdb_00008bbe
EMDB ID : EMD-15954
Title : Structure of the IFT-A complex; IFT-A2 module
Authors : Hesketh, S.J.; Mukhopadhyay, A.G.; Nakamura, D.; Toropova, K.; Roberts, A.J.
Deposited on : 2022-10-12
Resolution : 3.50 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:

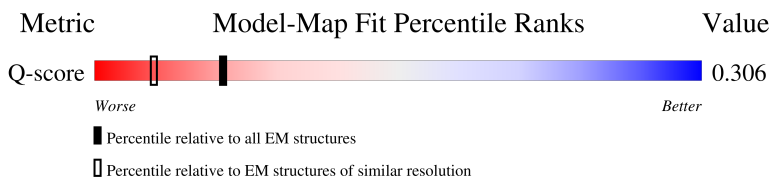
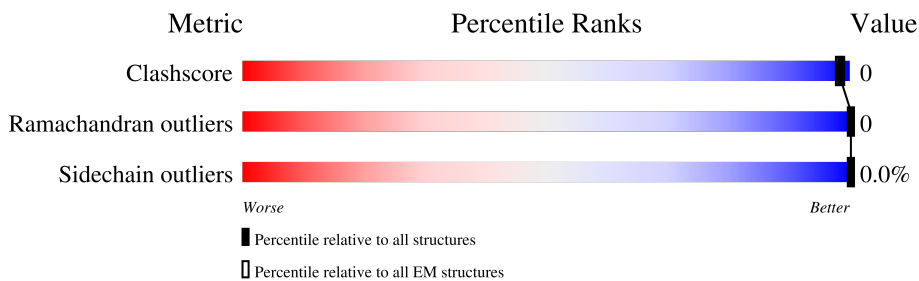
EMDB validation analysis : 0.0.1.dev132
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

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 3.50 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	13950 (3.00 - 4.00)

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	C	1241	6% (red), 55% (green), 43% (grey)
2	D	1500	24% (red), 42% (green), 57% (grey)
3	E	1184	21% (red), 92% (green), 6% (grey)
4	F	209	21% (red), 27% (green), 73% (grey)

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 20181 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 Intraflagellar transport protein 122 homolog.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	C	702	5595	3569	951	1040	35	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	208	UNK	ASN	conflict	UNP Q9HBG6
C	209	UNK	ARG	conflict	UNP Q9HBG6
C	210	UNK	TYR	conflict	UNP Q9HBG6
C	211	UNK	ILE	conflict	UNP Q9HBG6
C	212	UNK	GLN	conflict	UNP Q9HBG6
C	213	UNK	GLU	conflict	UNP Q9HBG6

- Molecule 2 is a protein called SNAP-tag,Tetratricopeptide repeat protein 21B.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	D	648	5253	3318	916	978	41	0	0

- Molecule 3 is a protein called WD repeat-containing protein 35.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	E	1112	8863	5657	1497	1650	59	0	0

There are 3 discrepancies between the modelled and reference sequences:

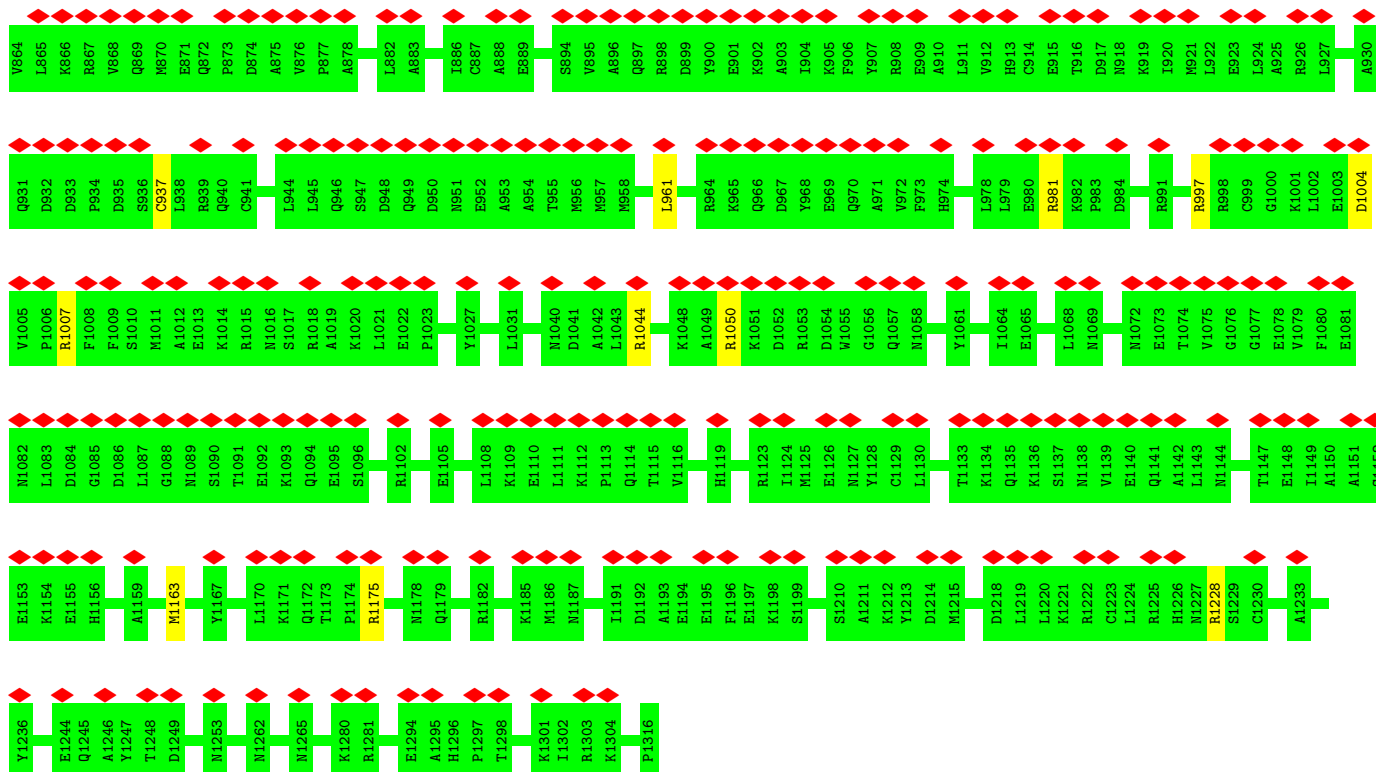
Chain	Residue	Modelled	Actual	Comment	Reference
E	-2	PHE	-	expression tag	UNP Q9P2L0
E	-1	GLN	-	expression tag	UNP Q9P2L0
E	0	GLY	-	expression tag	UNP Q9P2L0

- Molecule 4 is a protein called Intraflagellar transport protein 43 homolog.

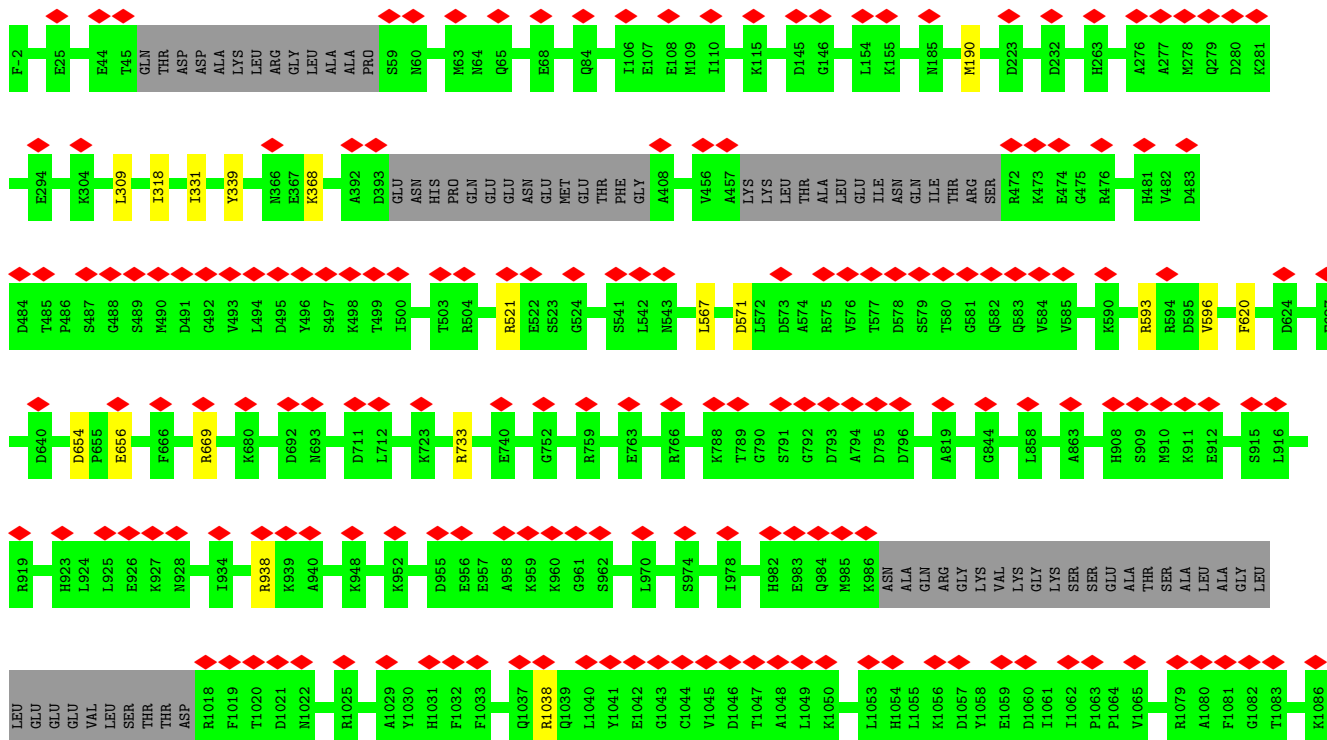
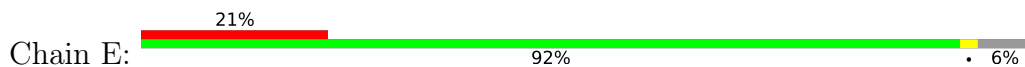
Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	F	57	470	296	74	98	2	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
F	0	GLY	-	expression tag	UNP Q96FT9



• Molecule 3: WD repeat-containing protein 35



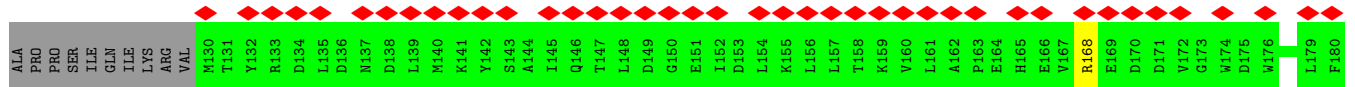


● Molecule 4: Intraflagellar transport protein 43 homolog



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

GLN GLY
GLY TRP
ALA SER
GLY LEU
ASP ASP
SER VAL
VAL LYS
ALA LYS
SER SER
LYS LYS
PHE PHE
ARG ARG
SER ARG
LYS LYS
ALA LYS
SER SER
GLU GLU
GLU ALA
ILE ILE
GLU ASP
PHE PHE
ARG ARG
LEU LEU
GLN PRO
GLN GLN
SER SER
LEU ILE
ASN ASN
GLY GLY
SER ASP
TYR TYR
GLY GLY
ASP ASP
ILE ILE
LEU ILE
ILE ILE
PRO PRO
LEU LEU
ASP ASP
GLU GLU
GLU GLU
VAL VAL
GLN GLN
SER SER
ASP ASP
PHE PHE
VAL VAL
LEU LEU
GLN GLN
VAL VAL
ALA ALA



V183
S184
S185
E186
VAL
LEU
THR
GLU
TRP
TRP
ASP
PRO
PRO
LEU
LEU
GLN
THR
THR
GLU
GLU
GLU
GLU
ASP
PRO
ALA
GLY
GLN
ALA
ALA
HIS
HIS
THR

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	242645	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	48	Depositor
Minimum defocus (nm)	1500	Depositor
Maximum defocus (nm)	3500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	0.701	Depositor
Minimum map value	-0.291	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.009	Depositor
Recommended contour level	0.16	Depositor
Map size (\AA)	546.304, 546.304, 546.304	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (\AA)	1.067, 1.067, 1.067	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	C	0.76	0/5679	1.32	18/7662 (0.2%)
2	D	0.78	0/5347	1.31	13/7203 (0.2%)
3	E	0.75	0/9049	1.29	11/12229 (0.1%)
4	F	0.83	0/479	1.39	1/650 (0.2%)
All	All	0.76	0/20554	1.30	43/27744 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	C	0	6
2	D	0	1
3	E	0	3
All	All	0	10

There are no bond length outliers.

The worst 5 of 43 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	620	PHE	CA-CB-CG	7.13	120.93	113.80
3	E	669	ARG	NE-CZ-NH2	6.41	124.97	119.20
2	D	1004	ASP	CA-C-N	6.33	124.23	120.24
2	D	1004	ASP	C-N-CA	6.33	124.23	120.24
1	C	61	TYR	CB-CA-C	6.09	120.30	109.65

There are no chirality outliers.

5 of 10 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	288	TYR	Sidechain

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Mol	Chain	Res	Type	Group
1	C	453	ARG	Sidechain
1	C	465	ARG	Sidechain
1	C	61	TYR	Sidechain
1	C	90	TYR	Sidechain

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	C	5595	0	5567	4	0
2	D	5253	0	5275	1	0
3	E	8863	0	8810	6	0
4	F	470	0	441	0	0
All	All	20181	0	20093	9	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 0.

The worst 5 of 9 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)
3:E:567:LEU:HB2	3:E:596:VAL:HG21	1.93	0.49
3:E:368:LYS:HZ1	3:E:656:GLU:CD	2.23	0.47
1:C:576:LEU:C	1:C:577:ASN:HD22	2.23	0.46
3:E:309:LEU:HD11	3:E:318:ILE:HD11	1.97	0.46
1:C:190:TRP:CZ3	3:E:190:MET:HE1	2.51	0.45

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	C	692/1241 (56%)	659 (95%)	33 (5%)	0	100	100
2	D	646/1500 (43%)	623 (96%)	23 (4%)	0	100	100
3	E	1102/1184 (93%)	1053 (96%)	49 (4%)	0	100	100
4	F	55/209 (26%)	55 (100%)	0	0	100	100
All	All	2495/4134 (60%)	2390 (96%)	105 (4%)	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	C	610/1085 (56%)	610 (100%)	0	100	100
2	D	556/1279 (44%)	555 (100%)	1 (0%)	87	85
3	E	961/1020 (94%)	961 (100%)	0	100	100
4	F	53/181 (29%)	53 (100%)	0	100	100
All	All	2180/3565 (61%)	2179 (100%)	1 (0%)	100	100

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	D	1163	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 33 such sidechains are listed below:

Mol	Chain	Res	Type
3	E	726	GLN
3	E	801	GLN
3	E	1116	HIS
2	D	918	ASN

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Mol	Chain	Res	Type
2	D	751	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](#)

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.

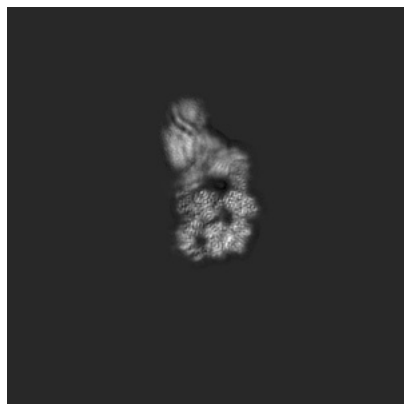
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-15954. These allow visual inspection of the internal detail of the map and identification of artifacts.

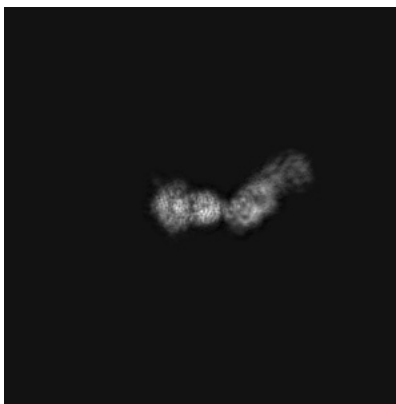
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

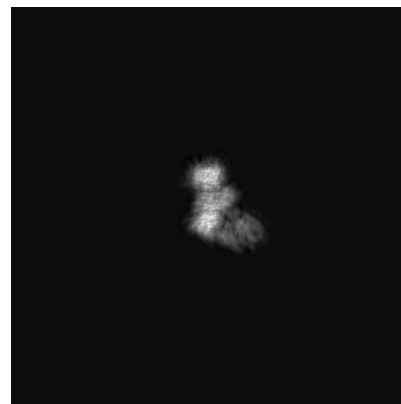
6.1.1 Primary map



X

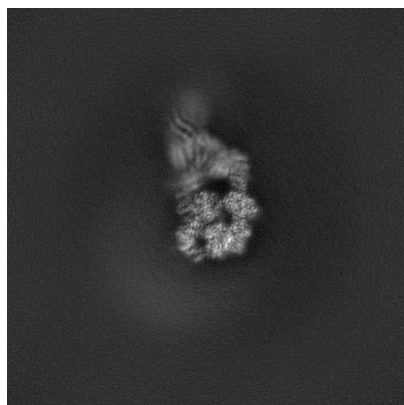


Y

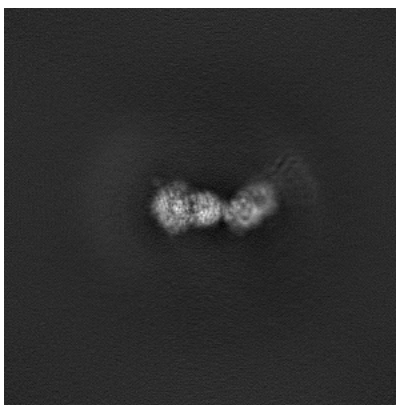


Z

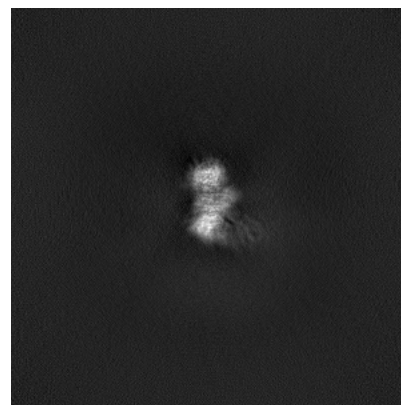
6.1.2 Raw map



X



Y



Z

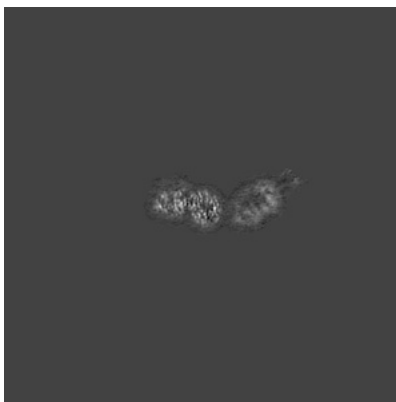
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

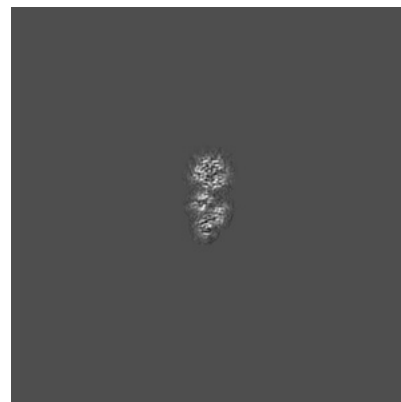
6.2.1 Primary map



X Index: 256



Y Index: 256

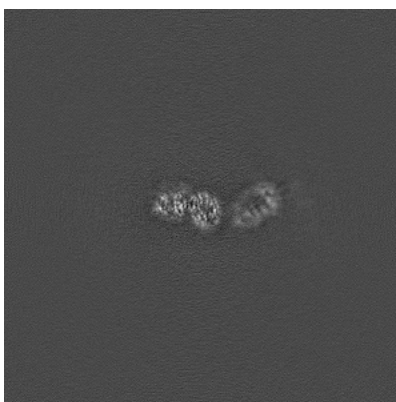


Z Index: 256

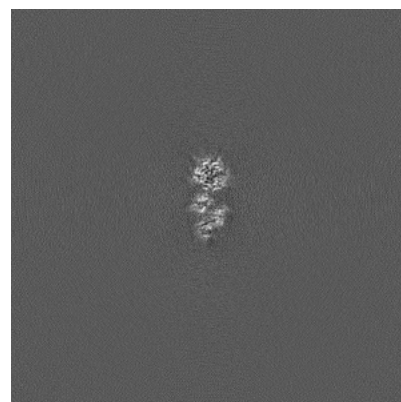
6.2.2 Raw map



X Index: 256



Y Index: 256



Z Index: 256

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: 254

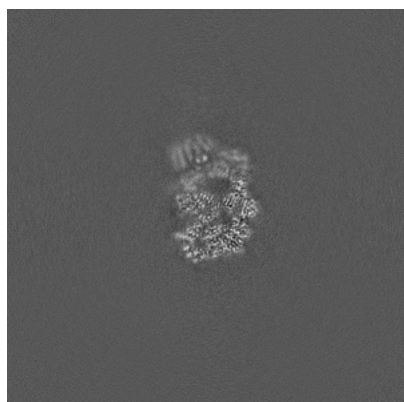


Y Index: 235

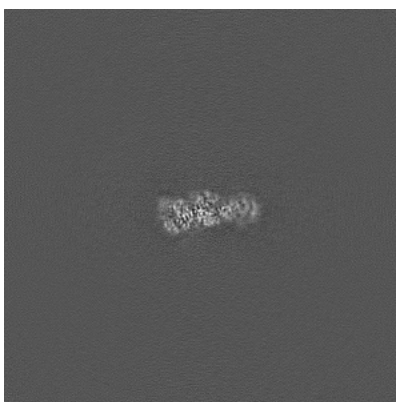


Z Index: 262

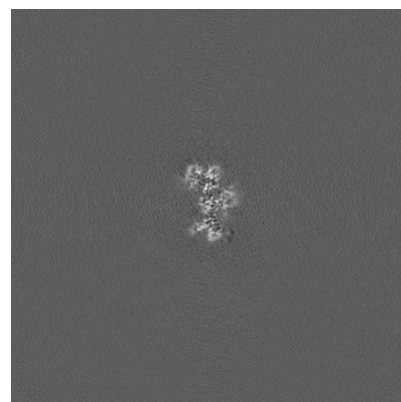
6.3.2 Raw map



X Index: 254



Y Index: 301

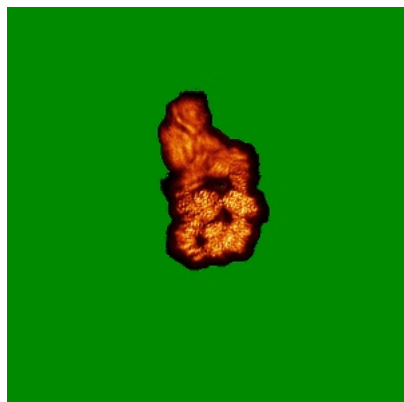


Z Index: 221

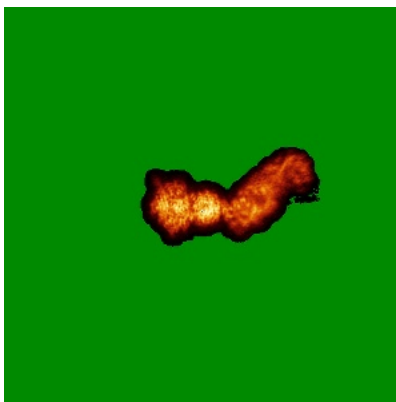
The images above show the largest variance slices of the map in three orthogonal directions.

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

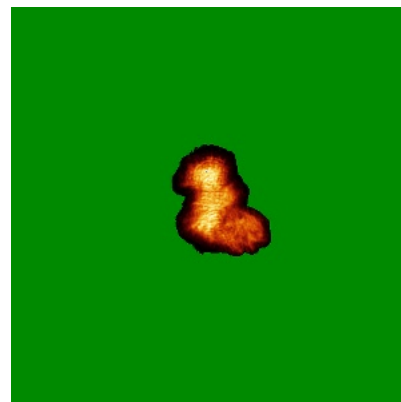
6.4.1 Primary map



X

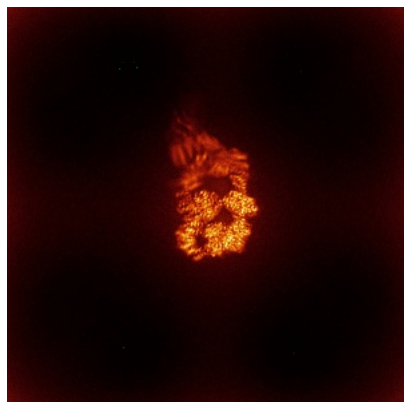


Y

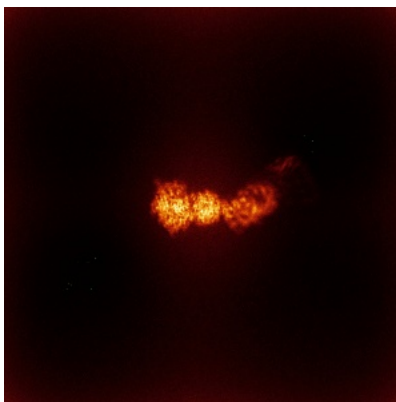


Z

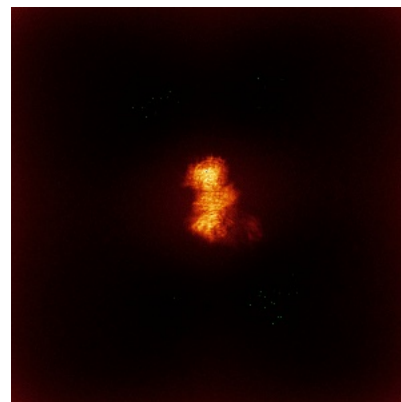
6.4.2 Raw map



X



Y

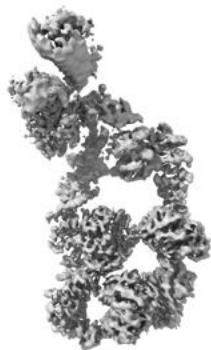


Z

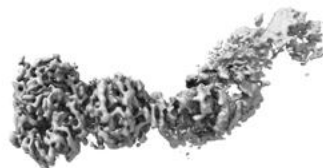
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views [i](#)

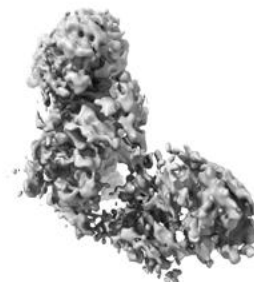
6.5.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.16. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

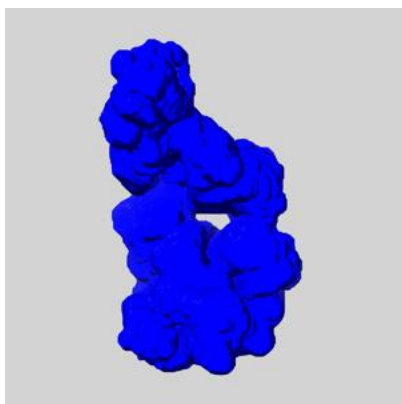
6.6 Mask visualisation [i](#)

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

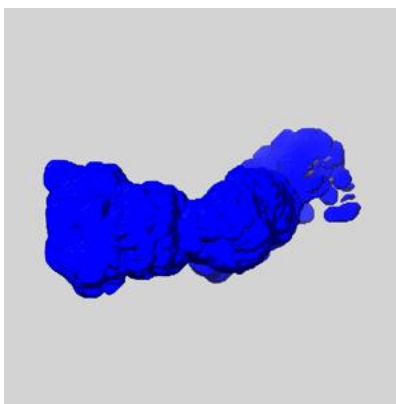
A mask typically either:

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

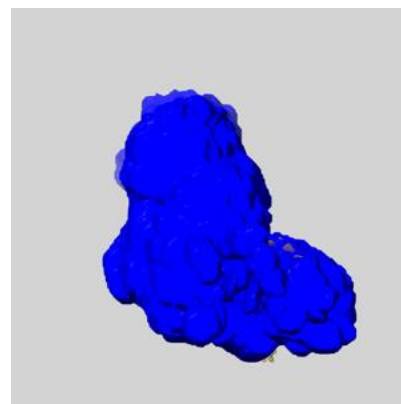
6.6.1 emd_15954_msk_1.map [i](#)



X



Y

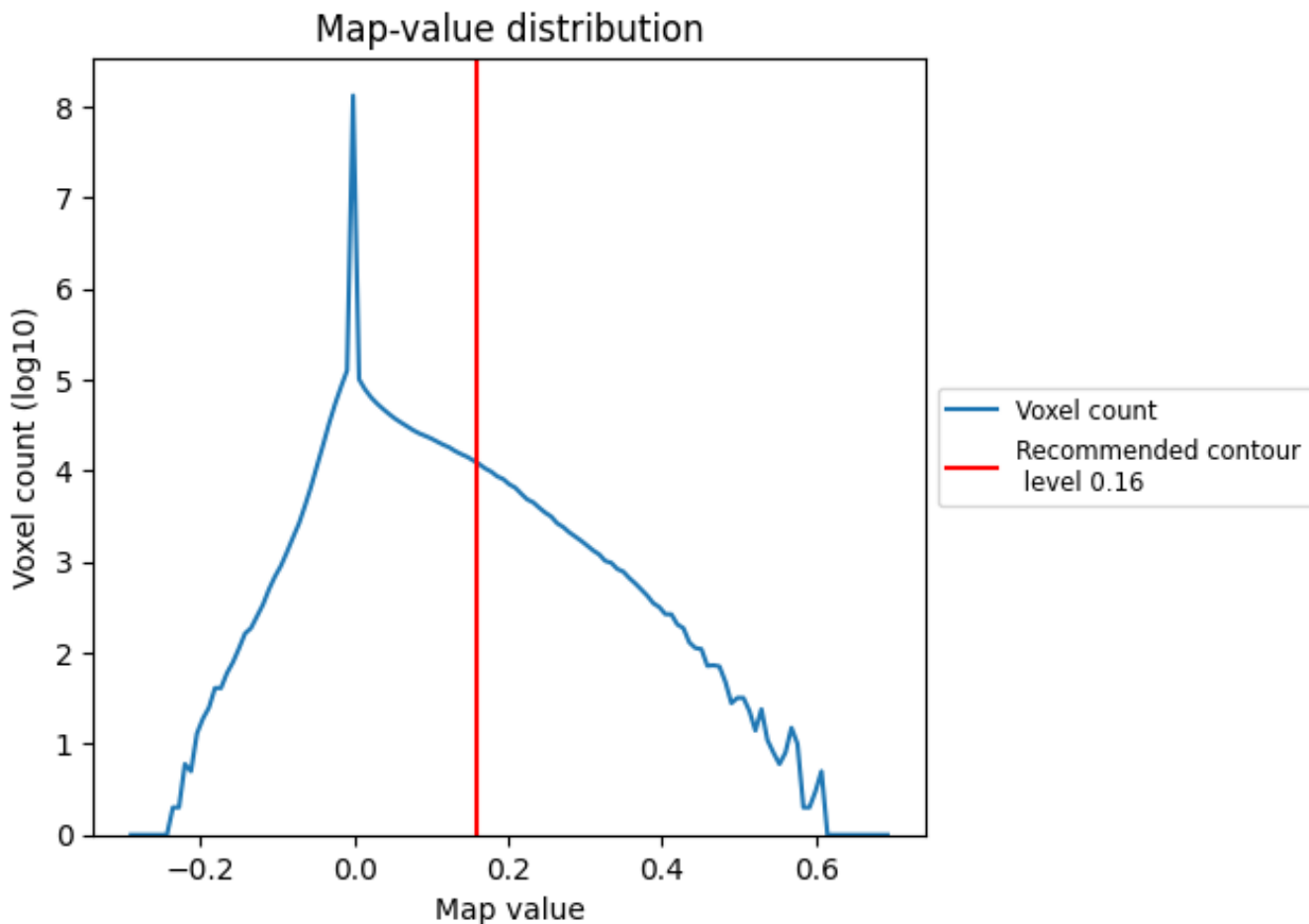


Z

7 Map analysis [i](#)

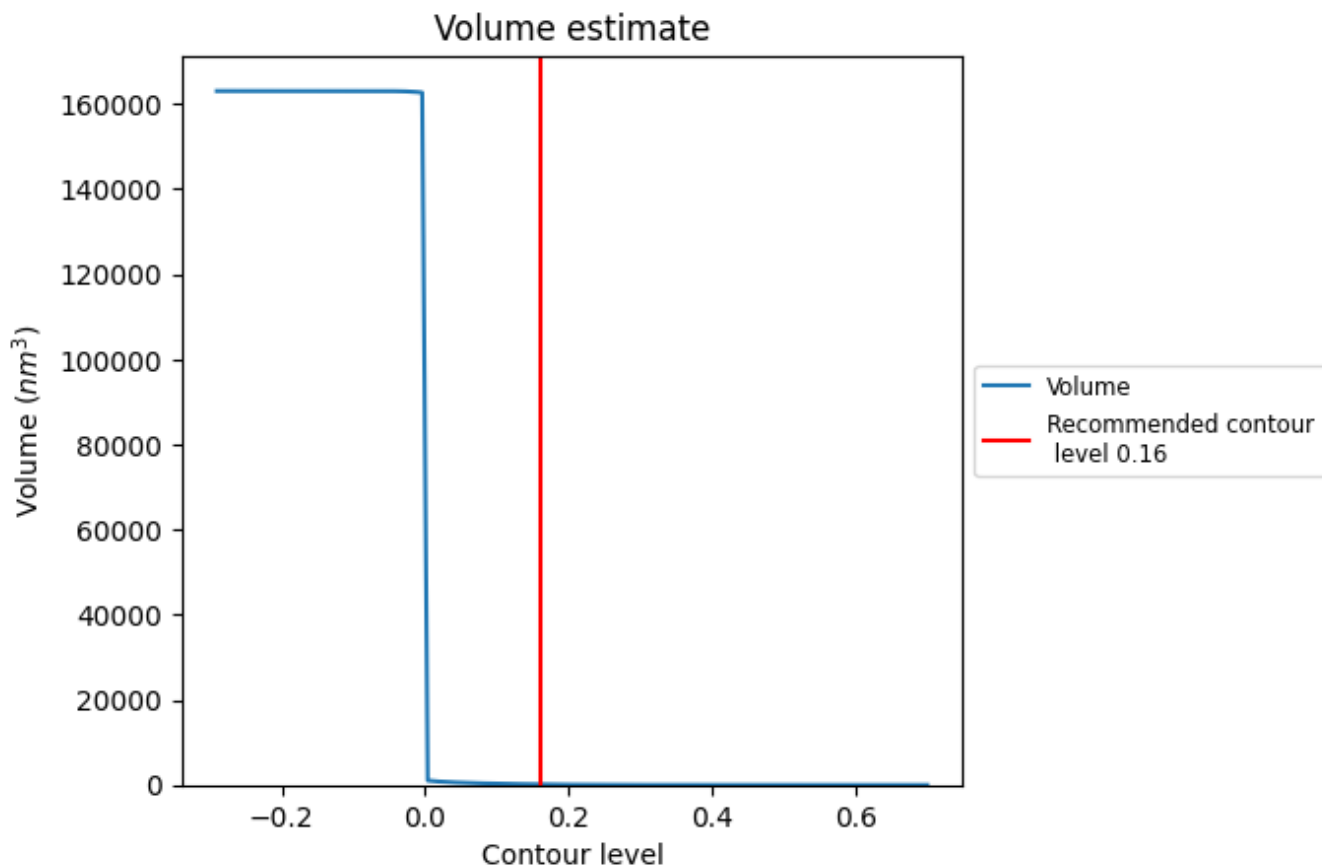
This section contains the results of statistical analysis of the map.

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.

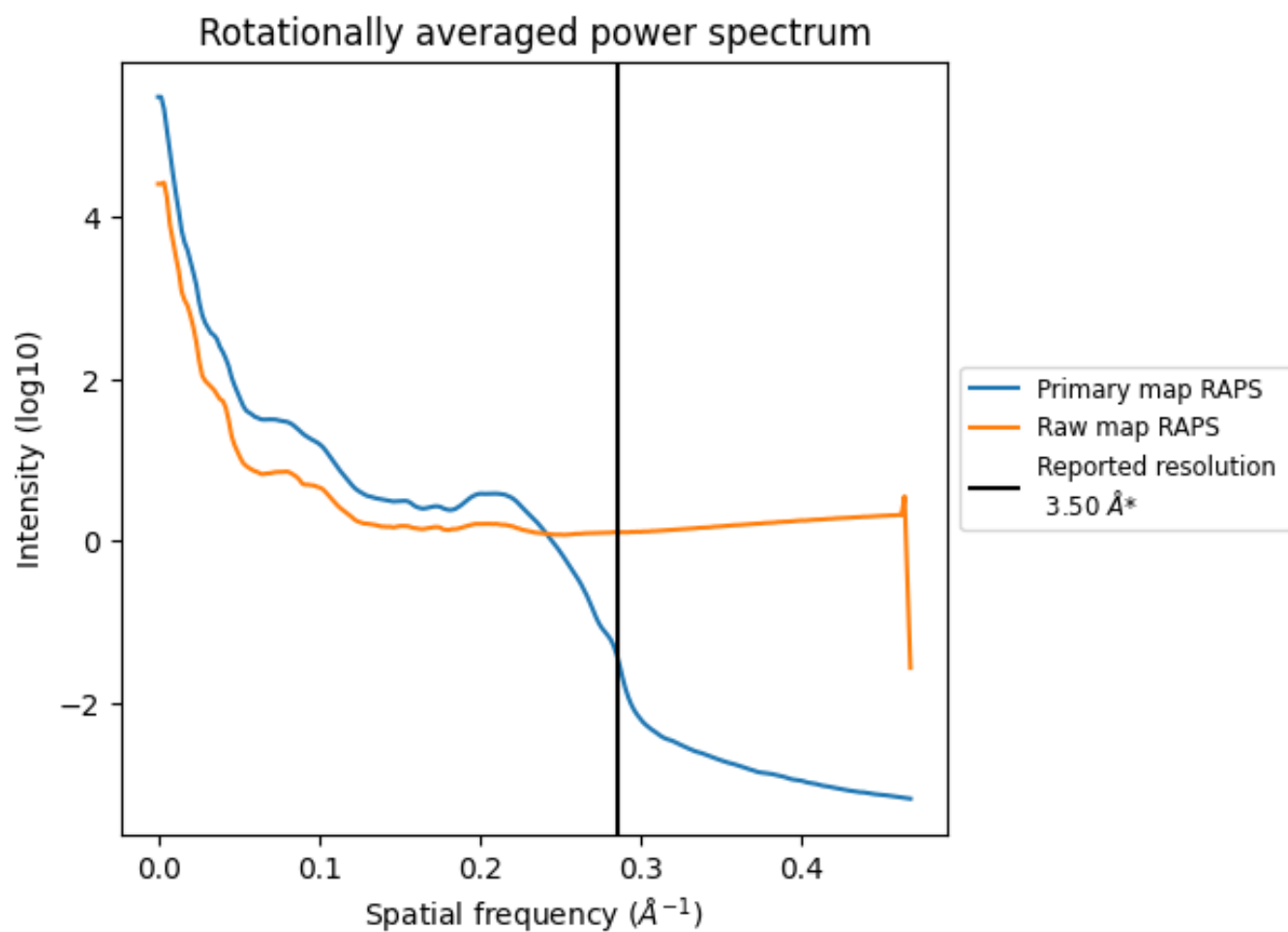
7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 140 nm³; this corresponds to an approximate mass of 126 kDa.

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

7.3 Rotationally averaged power spectrum i

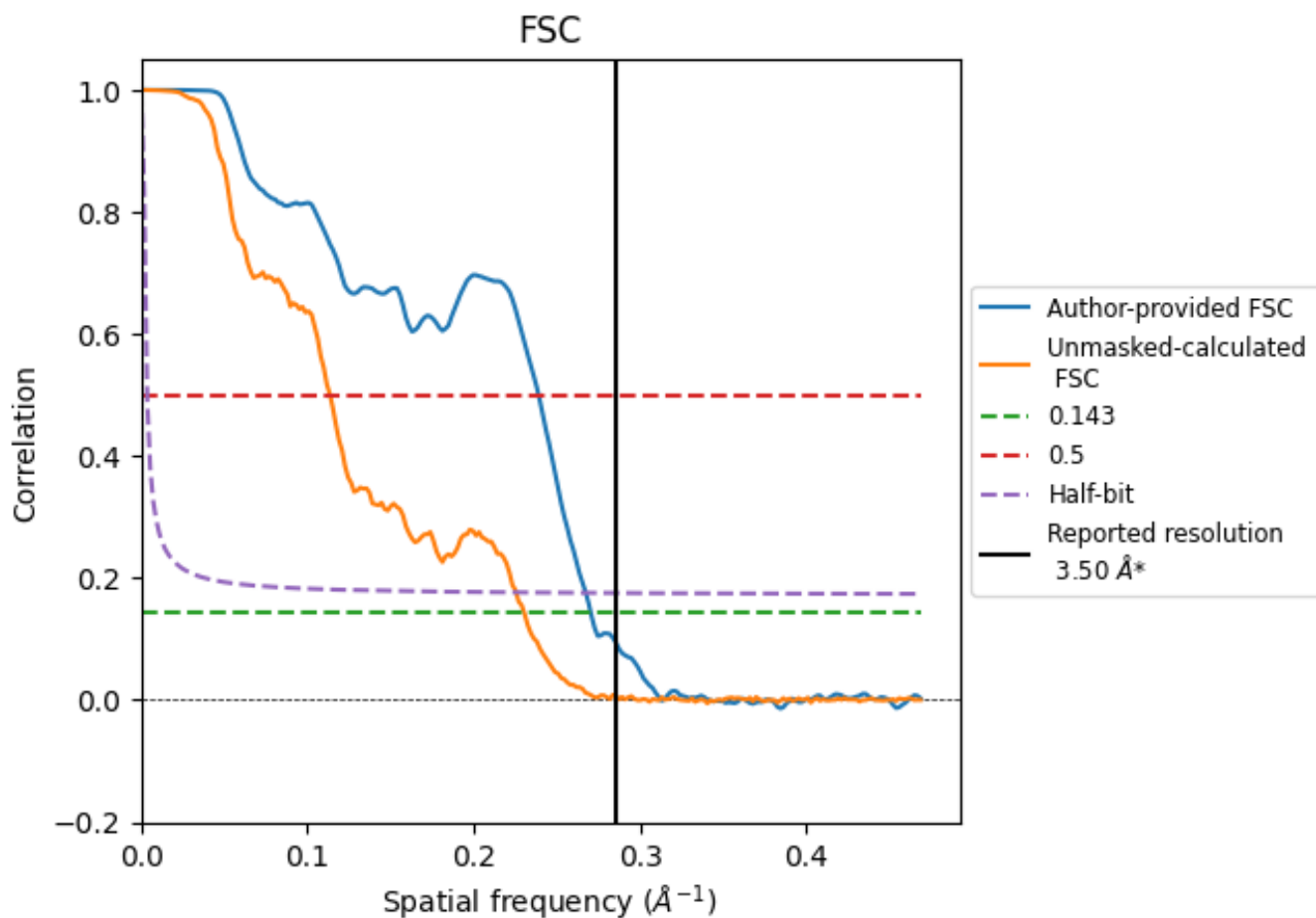


*Reported resolution corresponds to spatial frequency of 0.286 Å⁻¹

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 0.286 \AA^{-1}

8.2 Resolution estimates

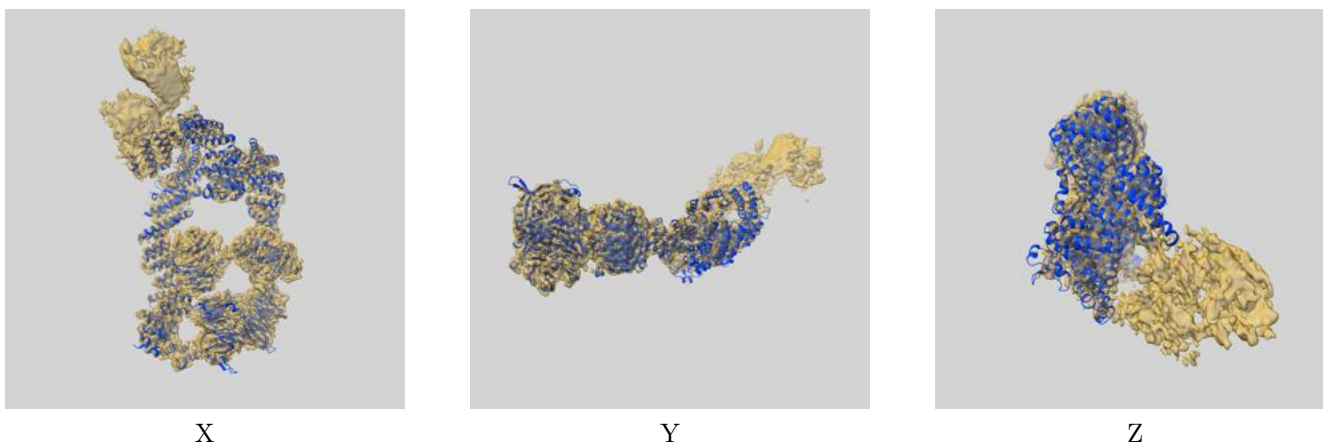
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.50	-	-
Author-provided FSC curve	3.70	4.18	3.74
Unmasked-calculated*	4.34	8.80	4.43

*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 4.34 differs from the reported value 3.5 by more than 10 %

9 Map-model fit [i](#)

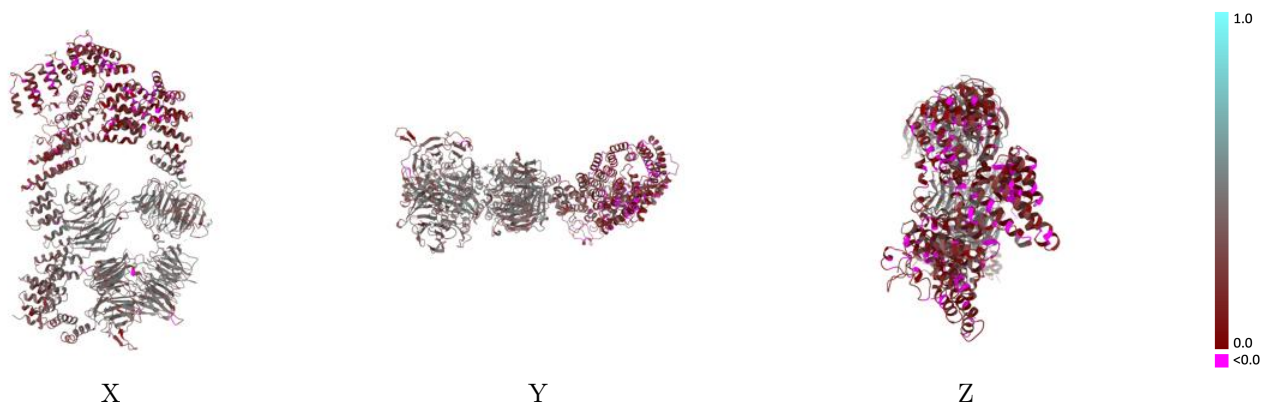
This section contains information regarding the fit between EMDB map EMD-15954 and PDB model 8BBE. Per-residue inclusion information can be found in section 3 on page 5.

9.1 Map-model overlay [i](#)



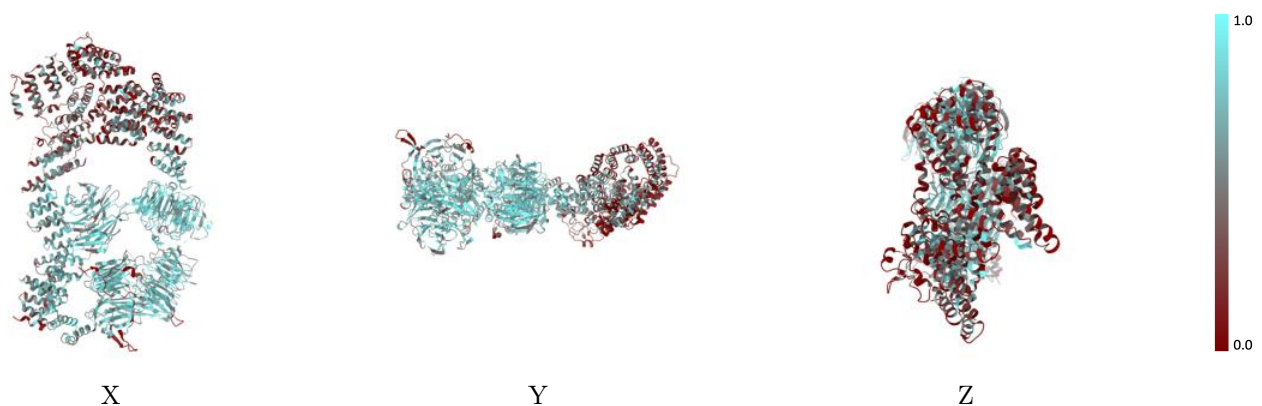
The images above show the 3D surface view of the map at the recommended contour level 0.16 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



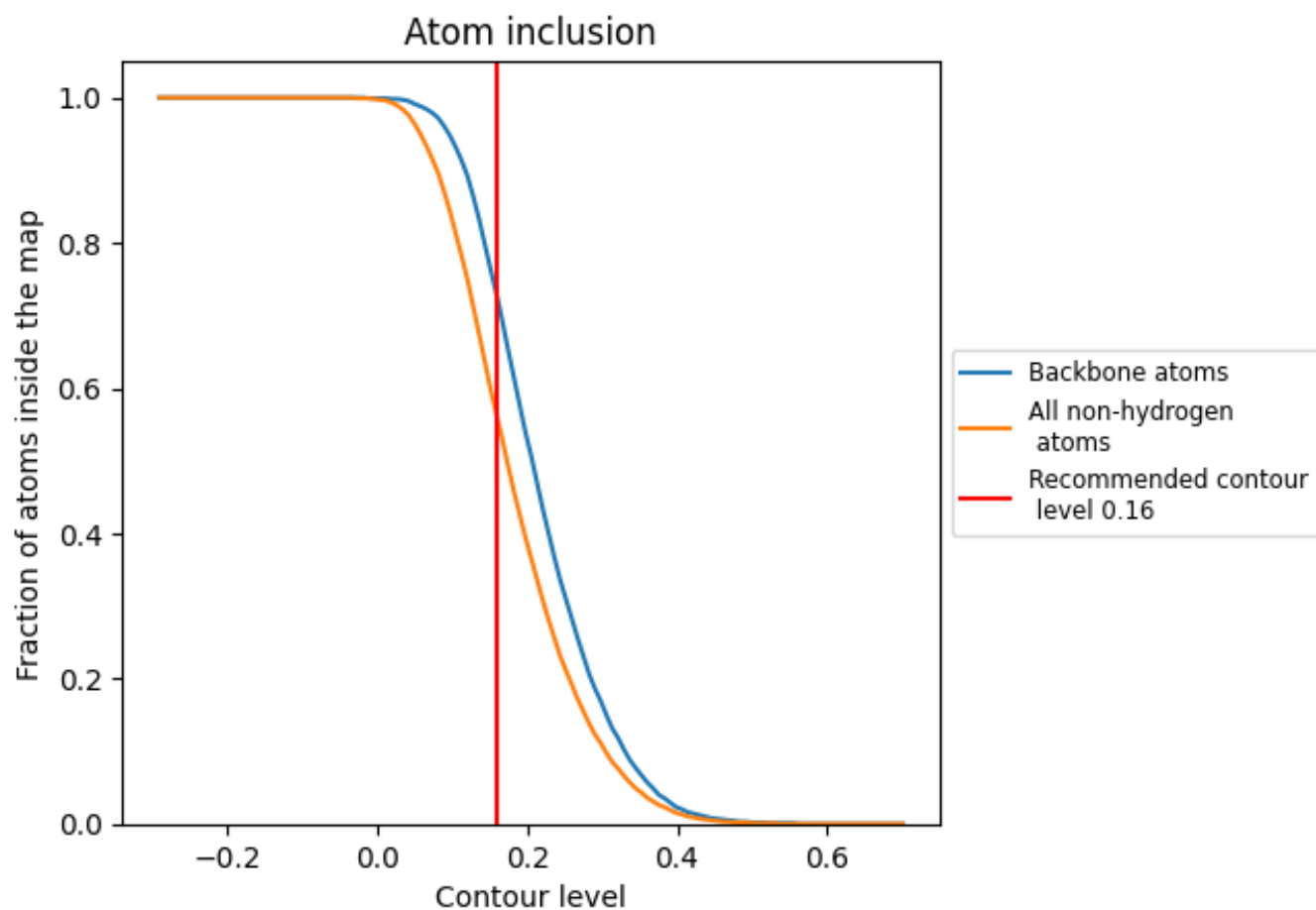
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.16).











9.4 Atom inclusion [i](#)



At the recommended contour level, 72% of all backbone atoms, 56% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary [i](#)

The table lists the average atom inclusion at the recommended contour level (0.16) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.5590	 0.3060
C	 0.7010	 0.4050
D	 0.3670	 0.1580
E	 0.6000	 0.3390
F	 0.2340	 0.1720

