



wwPDB EM Validation Summary Report ⓘ

Dec 9, 2025 – 12:42 pm GMT

PDB ID : 9QEC / pdb_00009qec
EMDB ID : EMD-53054
Title : Cryo-EM structure of the XPF-ERCC1-XPA complex
Authors : Feng, J.; Cronin, N.B.; Greber, B.J.
Deposited on : 2025-03-08
Resolution : 2.90 Å(reported)
Based on initial model : 6SXA

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:

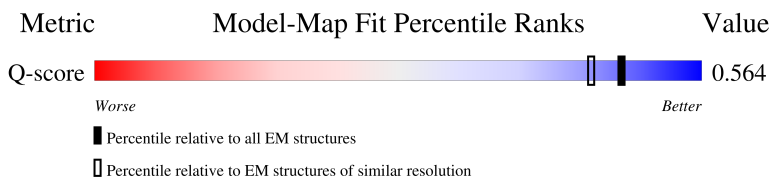
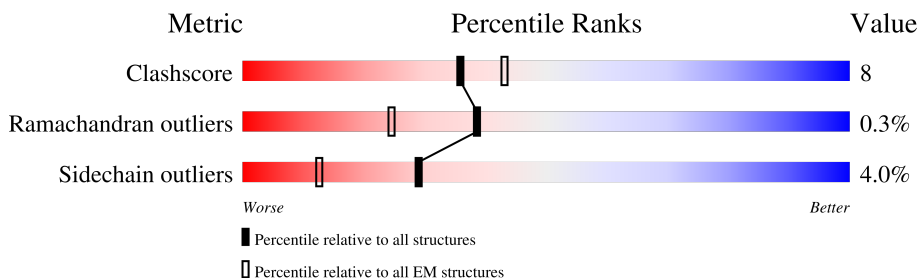
EMDB validation analysis : 0.0.1.dev129
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
EM percentile statistics : 202505.v01 (Using data in the EMDb archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.47

1 Overall quality at a glance

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

The reported resolution of this entry is 2.90 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	210492	15764	-
Ramachandran outliers	207382	16835	-
Sidechain outliers	206894	16415	-
Q-score	-	25397	13054 (2.40 - 3.40)

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	935	<div> <div>8%</div> <div>64%</div> <div>16%</div> <div>19%</div> </div>
2	B	297	<div> <div>51%</div> <div>16%</div> <div>33%</div> </div>
3	C	273	<div> <div>97%</div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7688 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 DNA repair endonuclease XPF.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	753	6060	3884	1038	1111	27	0	0

There are 19 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-18	MET	-	initiating methionine	UNP Q92889
A	-17	GLY	-	expression tag	UNP Q92889
A	-16	SER	-	expression tag	UNP Q92889
A	-15	SER	-	expression tag	UNP Q92889
A	-14	HIS	-	expression tag	UNP Q92889
A	-13	HIS	-	expression tag	UNP Q92889
A	-12	HIS	-	expression tag	UNP Q92889
A	-11	HIS	-	expression tag	UNP Q92889
A	-10	HIS	-	expression tag	UNP Q92889
A	-9	HIS	-	expression tag	UNP Q92889
A	-8	GLU	-	expression tag	UNP Q92889
A	-7	ASN	-	expression tag	UNP Q92889
A	-6	LEU	-	expression tag	UNP Q92889
A	-5	TYR	-	expression tag	UNP Q92889
A	-4	PHE	-	expression tag	UNP Q92889
A	-3	GLN	-	expression tag	UNP Q92889
A	-2	SER	-	expression tag	UNP Q92889
A	-1	ASN	-	expression tag	UNP Q92889
A	0	ALA	-	expression tag	UNP Q92889

- Molecule 2 is a protein called DNA excision repair protein ERCC-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	199	1582	1014	271	290	7	0	0

- Molecule 3 is a protein called DNA repair protein complementing XP-A cells.

Mol	Chain	Residues	Atoms				AltConf	Trace
3	C	7	Total	C	N	O	0	0
			46	31	7	8		

Chain B: 

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

ALA GLU TYR ALA ILE SER GLN PRO LEU GLY GLY ALA GLY ALA THR CYS PRO THR GLY SER GLU PRO LEU VAL ALA GLY GLU THR ASN GLN ALA LEU LYS PRO GLY ALA LYS S98 Q107 N110 P111 V112 L113 R117 W121 E122 F123 G124 D125 D129 Y130 V131 L132 A138

L139 F140 L143 R144 N147 L148 H154 G155 R156 L157 Q158 K162 N163 L166 L170 V171 K176 K183 E203 R207 T211 A220 L227 D230 F231 V232 S233 R234 K243 T248 D249 S250 Q251 T252 L253 L254 L263 S267 R268 E269 D270 L271

C274 L277 R283 F286 D287 H290 E291 P292 K295 V296 PRO

• Molecule 3: DNA repair protein complementing XP-A cells

Chain C: 

MET ALA ALA ALA ASP GLY ALA LEU PRO PRO GLU ALA ALA ALA LEU GLU GLN PRO ALA ALA GLU LEU LEU PRO ALA ARG LYS LYS ARG GLN ARG MET LEU ARG GLN ALA ALA MET LEU LEU ARG MET GLU PHE LEU ARG ALA ALA THR TYR SER ALA THR ALA ALA MET THR GLY MET MET ALA

ASN VAL LYS ALA ALA PRO GLY LYS ILE ASP T71 G72 G73 F75 I76 L77 GLU GLU GLU GLU GLU GLU GLN GLN LYS ILE GLY LYS VAL HIS PRO PRO LYS ARG MET PHE LEU LYS VAL LYS PHE ILE CYS GLU GLU CYS GLU CYS PRO THR LYS LYS HIS VAL ARG HIS SER SER PHE VAL TRP LYS ASP MET THR LEU MET ASN HIS

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

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

VAL HIS GLN HIS GLU TYR GLY PRO GLU ASN LEU GLU ASP ASP MET MET TYR ARG LYS THR CYS THR MET CYS GLY HIS GLU THR THR TYR LYS MET

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	73737	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 ($e^-/\text{\AA}^2$)	60	Depositor
Minimum defocus (nm)	400	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	165000	Depositor
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	0.114	Depositor
Minimum map value	-0.064	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.005	Depositor
Recommended contour level	0.0175	Depositor
Map size (Å)	183.59999, 183.59999, 183.59999	wwPDB
Map dimensions	180, 180, 180	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.02, 1.02, 1.02	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	0.10	0/6183	0.25	0/8369
2	B	0.09	0/1614	0.26	0/2190
3	C	0.04	0/46	0.07	0/60
All	All	0.10	0/7843	0.25	0/10619

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	6060	0	6148	94	0
2	B	1582	0	1616	28	0
3	C	46	0	46	0	0
All	All	7688	0	7810	117	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 8.

The worst 5 of 117 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:549:GLU:HG2	1:A:550:PRO:HD3	1.62	0.79

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:733:ILE:HG12	1:A:784:ILE:HG13	1.68	0.76
1:A:258:ILE:HG22	1:A:618:ARG:HG3	1.71	0.71
1:A:322:GLN:HE21	2:B:251:GLN:HE21	1.42	0.65
1:A:310:LEU:HD21	1:A:335:MET:HG2	1.79	0.65

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	743/935 (80%)	713 (96%)	28 (4%)	2 (0%)	37	66
2	B	197/297 (66%)	192 (98%)	4 (2%)	1 (0%)	25	56
3	C	5/273 (2%)	5 (100%)	0	0	100	100
All	All	945/1505 (63%)	910 (96%)	32 (3%)	3 (0%)	38	66

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	249	VAL
1	A	13	ALA
2	B	295	LYS

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	671/832 (81%)	647 (96%)	24 (4%)	30	65
2	B	177/254 (70%)	168 (95%)	9 (5%)	20	51
3	C	4/233 (2%)	3 (75%)	1 (25%)	0	1
All	All	852/1319 (65%)	818 (96%)	34 (4%)	29	61

5 of 34 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	211	THR
2	B	233	SER
2	B	290	HIS
1	A	266	ILE
1	A	221	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 24 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	590	GLN
1	A	859	ASN
1	A	849	GLN
1	A	862	ASN
1	A	256	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

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.

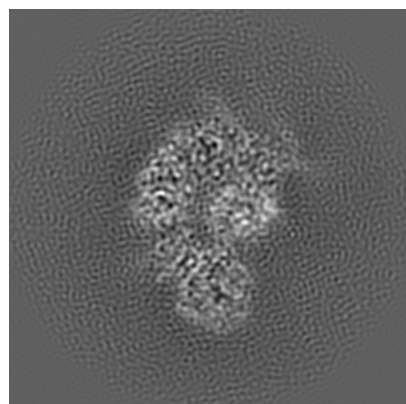
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-53054. These allow visual inspection of the internal detail of the map and identification of artifacts.

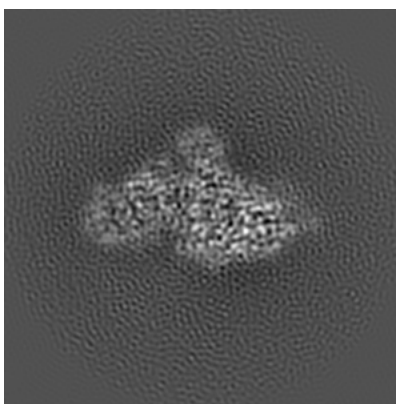
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

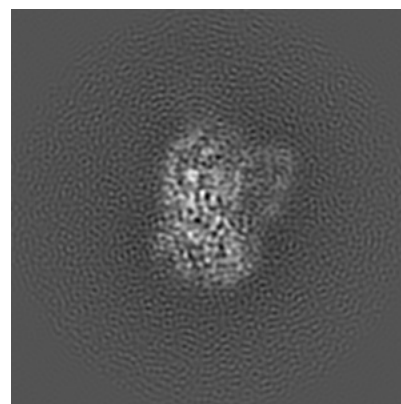
6.1.1 Primary map



X

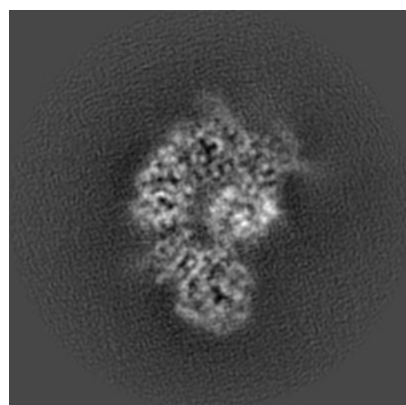


Y

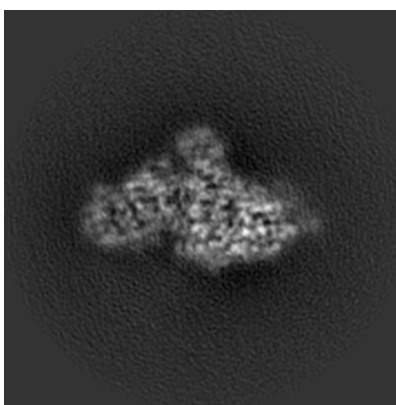


Z

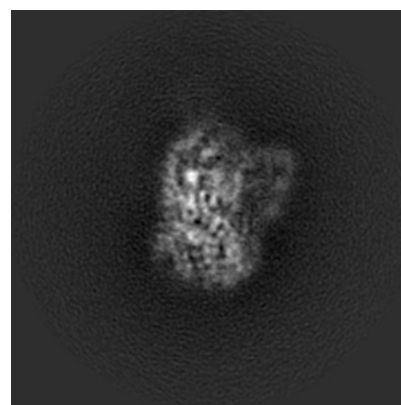
6.1.2 Raw map



X



Y

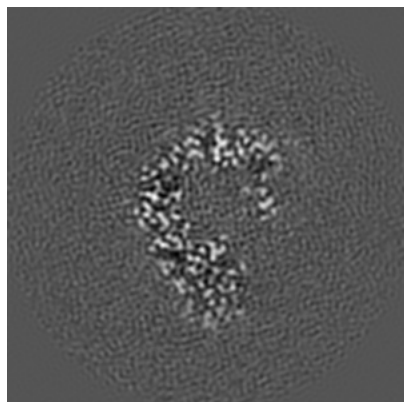


Z

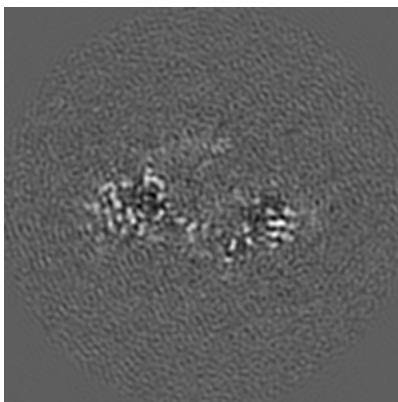
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

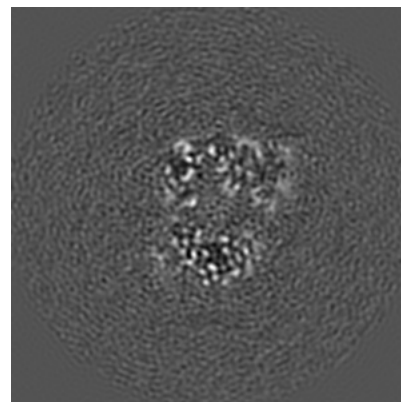
6.2.1 Primary map



X Index: 90

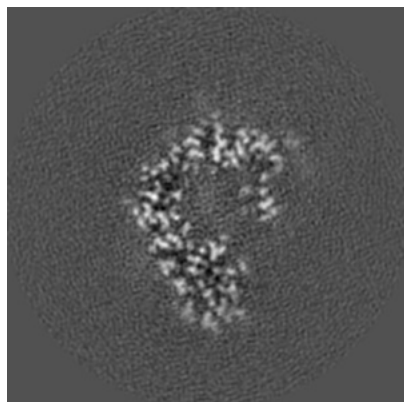


Y Index: 90

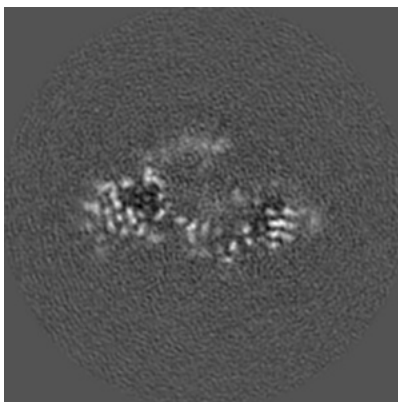


Z Index: 90

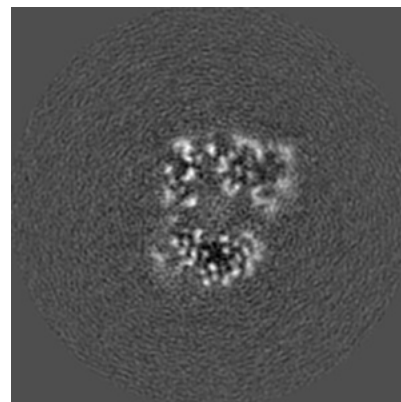
6.2.2 Raw map



X Index: 90



Y Index: 90

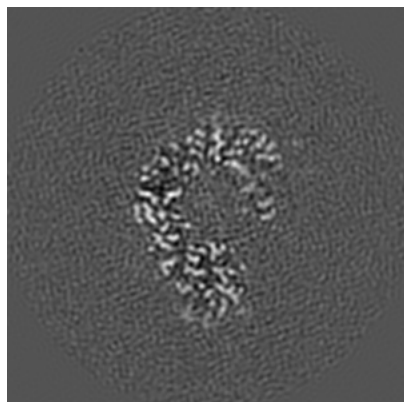


Z Index: 90

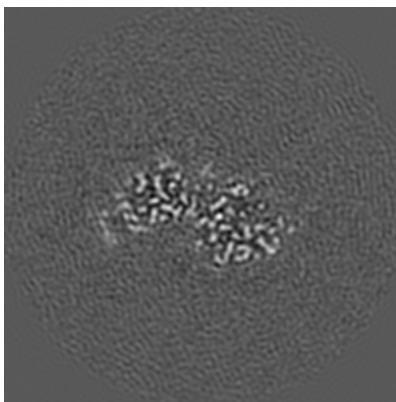
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

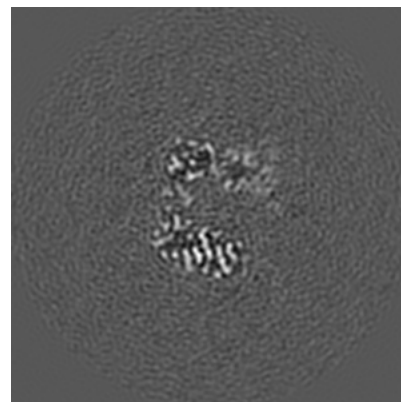
6.3.1 Primary map



X Index: 91

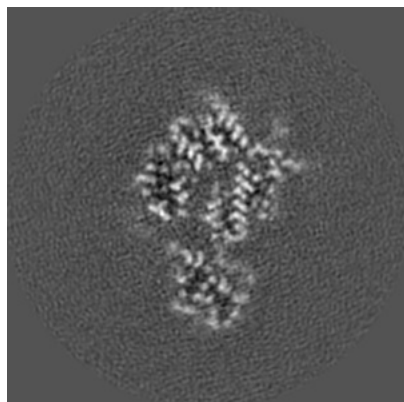


Y Index: 77

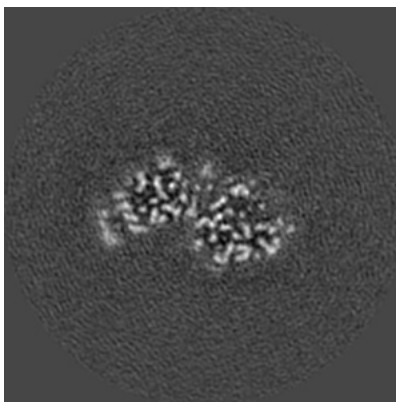


Z Index: 97

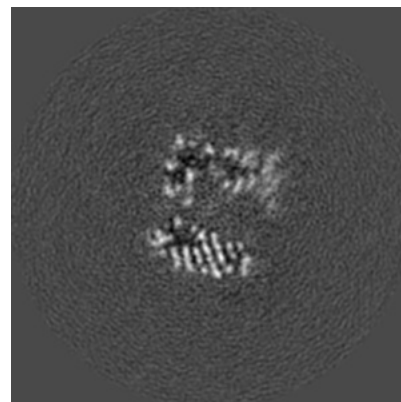
6.3.2 Raw map



X Index: 81



Y Index: 77

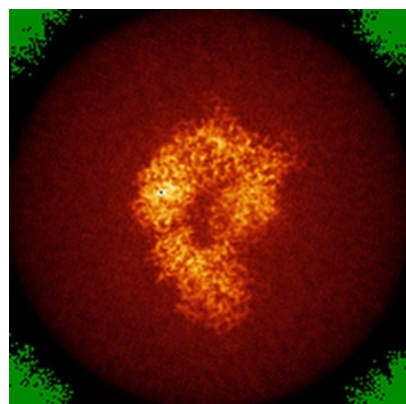


Z Index: 96

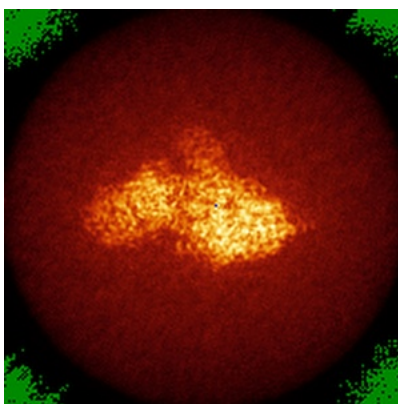
The images above show the largest variance slices of the map in three orthogonal directions.

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

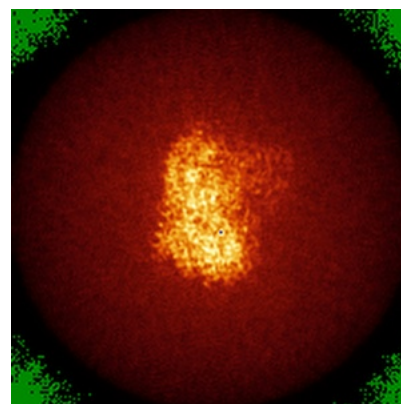
6.4.1 Primary map



X

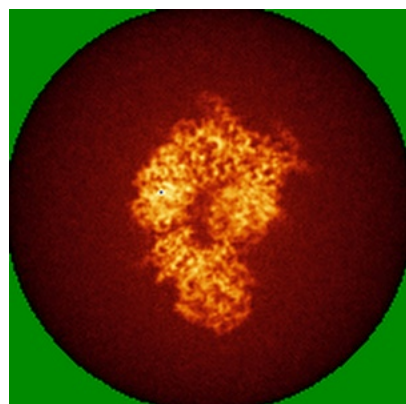


Y

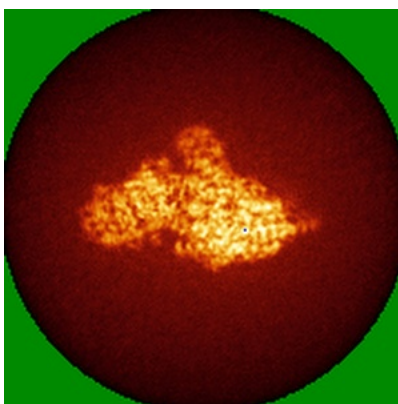


Z

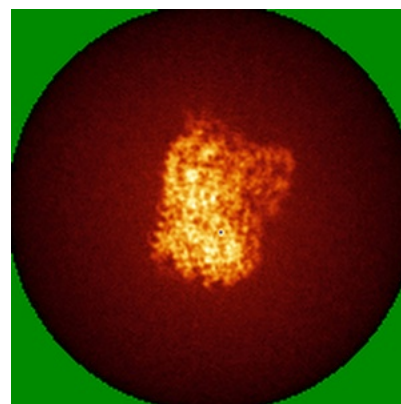
6.4.2 Raw map



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.

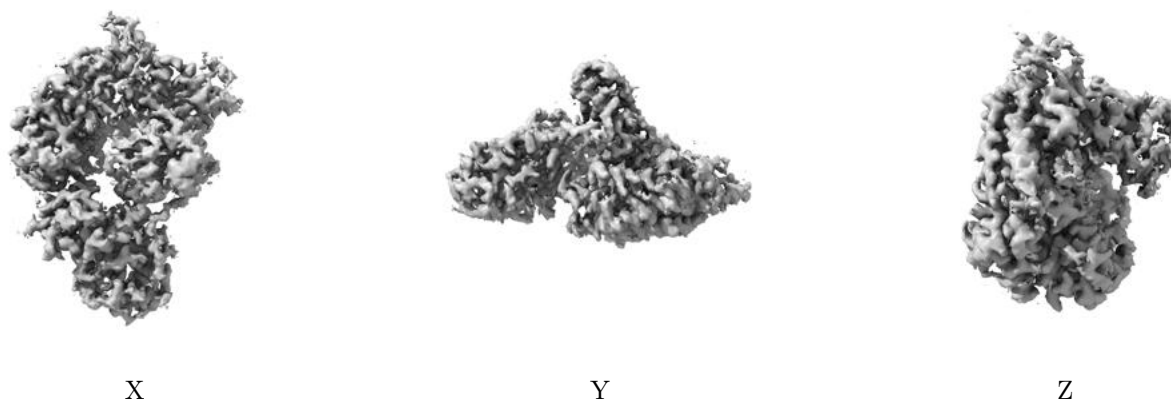
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.0175. 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.

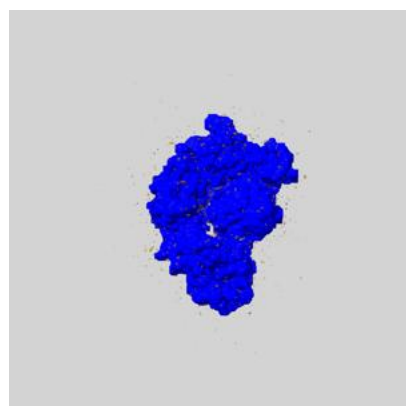
6.6 Mask visualisation [i](#)

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

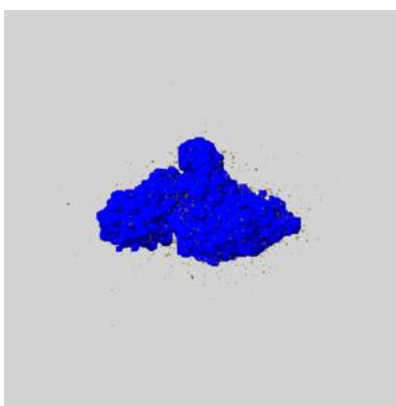
A mask typically either:

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

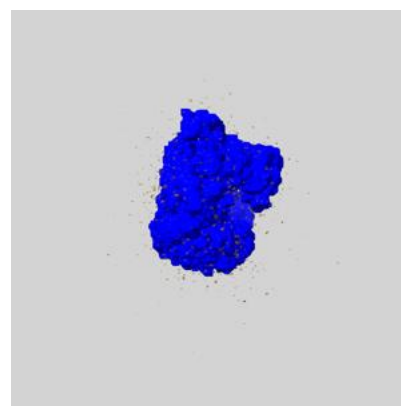
6.6.1 emd_53054_msk_1.map [i](#)



X



Y

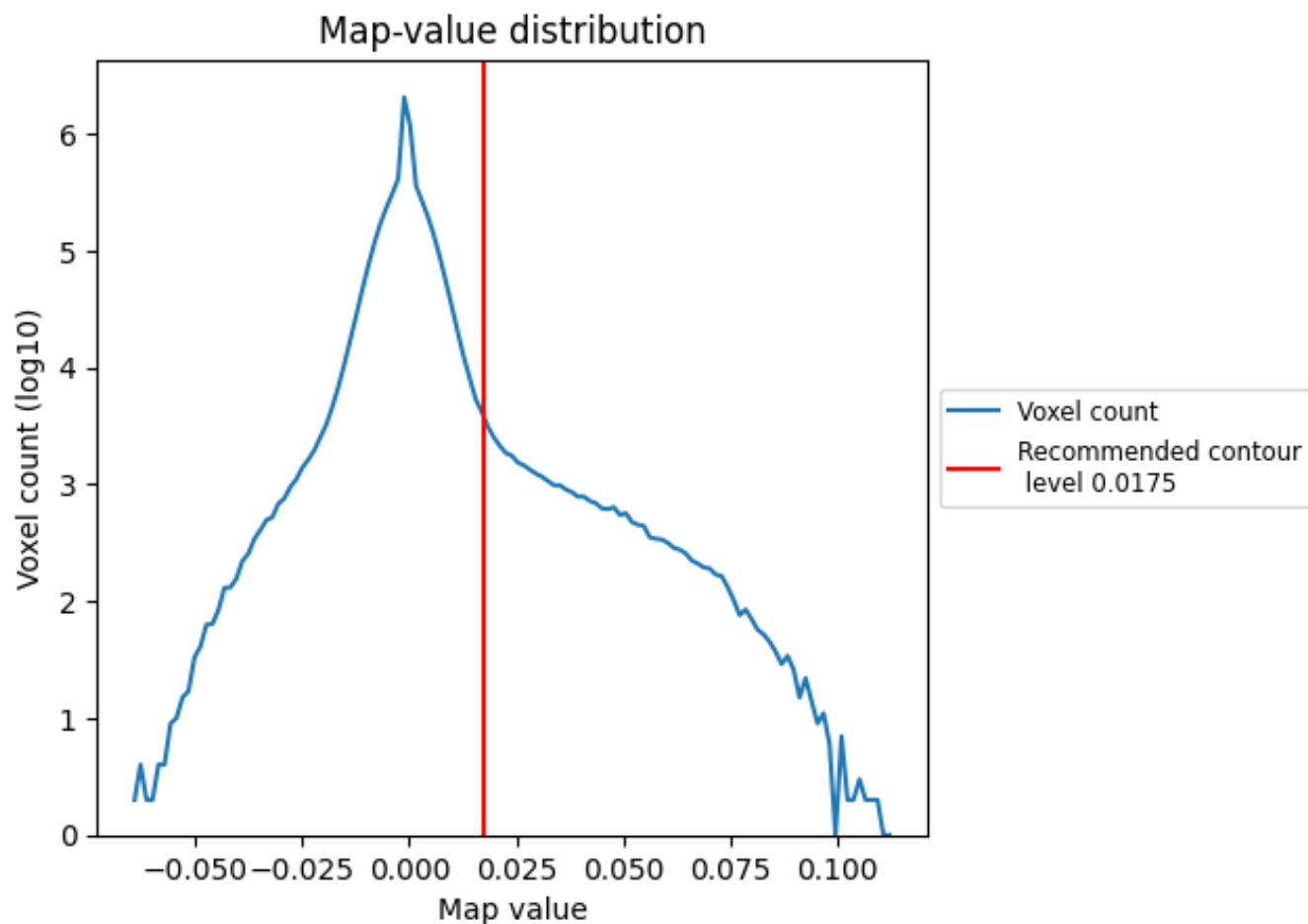


Z

7 Map analysis [i](#)

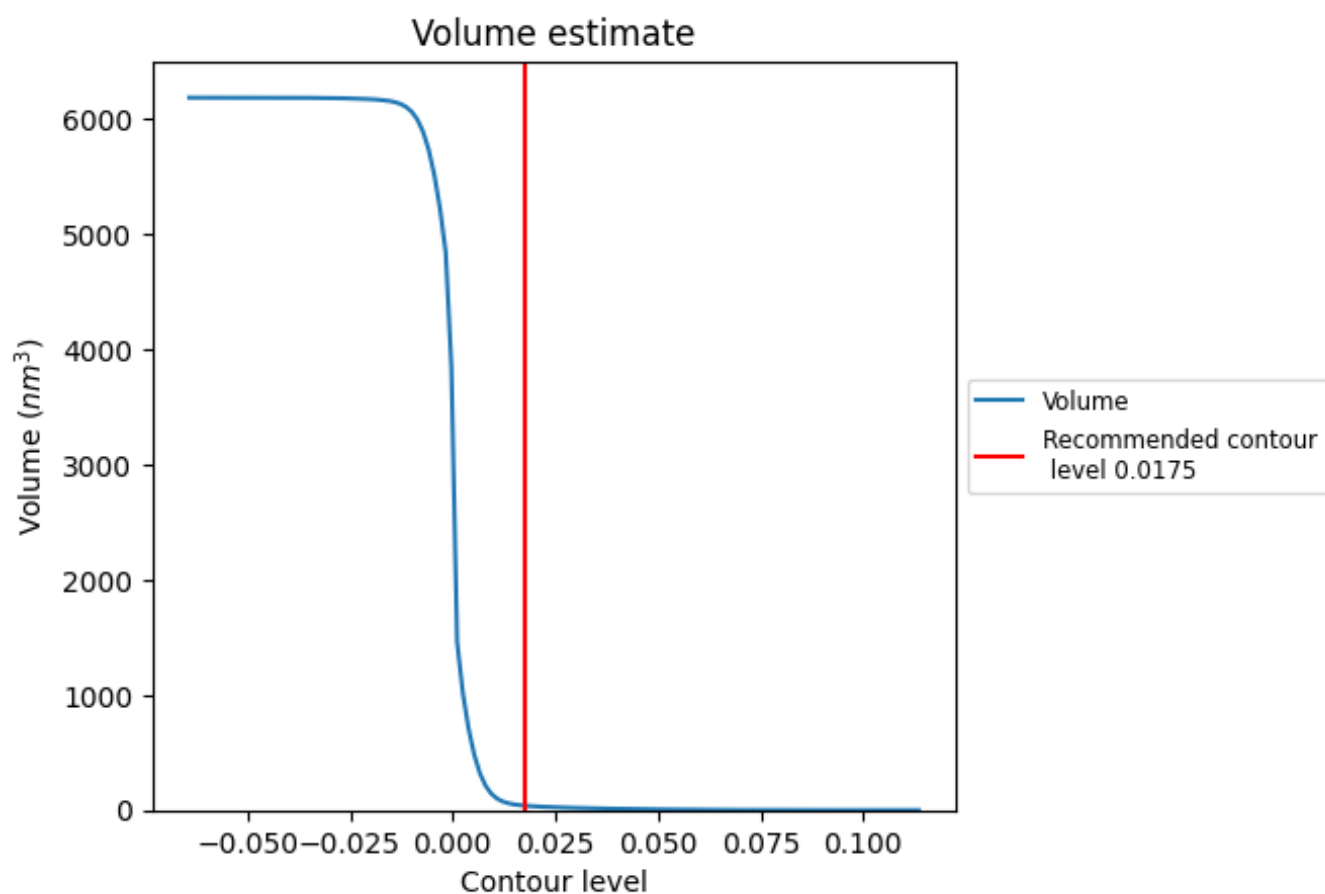
This section contains the results of statistical analysis of the map.

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.

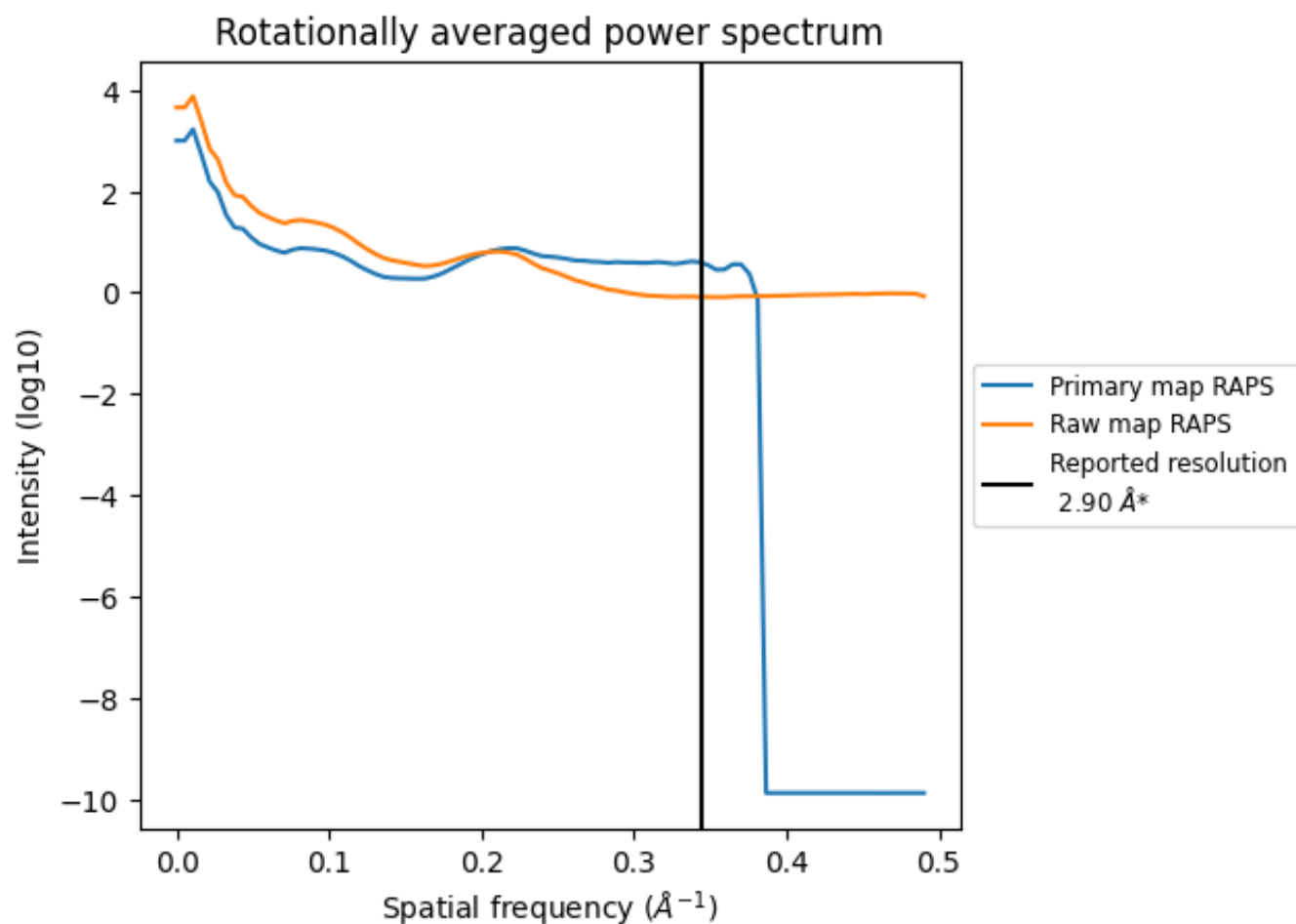
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 39 nm³; this corresponds to an approximate mass of 35 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 ⓘ

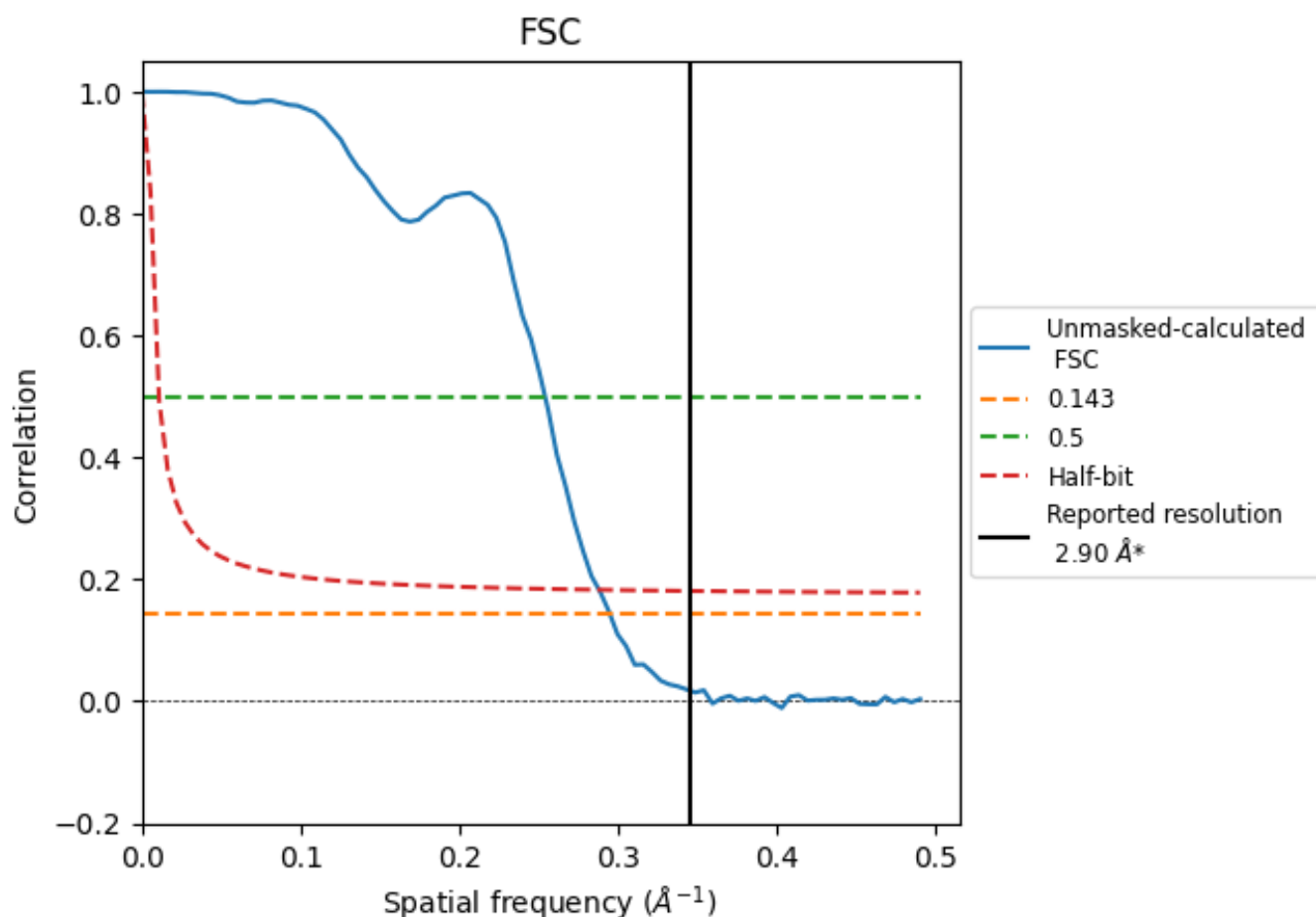


*Reported resolution corresponds to spatial frequency of 0.345 Å⁻¹

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 0.345 \AA^{-1}

8.2 Resolution estimates [i](#)

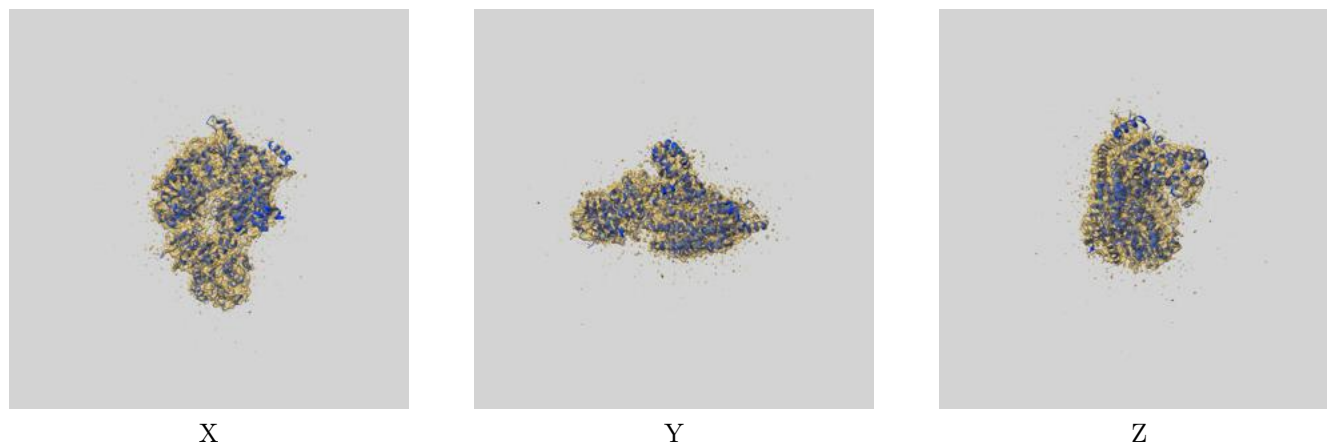
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.90	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.39	3.94	3.47

*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 3.39 differs from the reported value 2.9 by more than 10 %

9 Map-model fit [i](#)

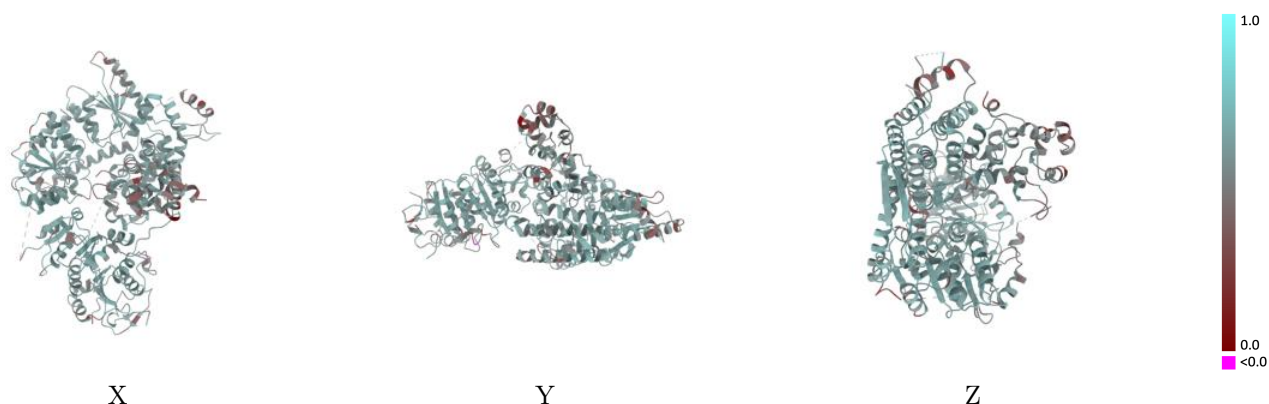
This section contains information regarding the fit between EMDB map EMD-53054 and PDB model 9QEC. Per-residue inclusion information can be found in section [3](#) on page [5](#).

9.1 Map-model overlay [i](#)



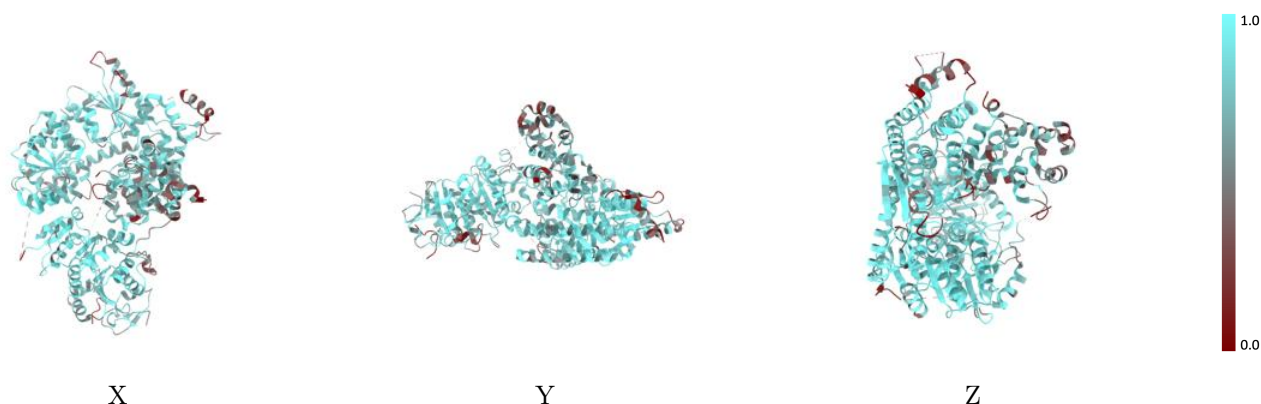
The images above show the 3D surface view of the map at the recommended contour level 0.0175 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



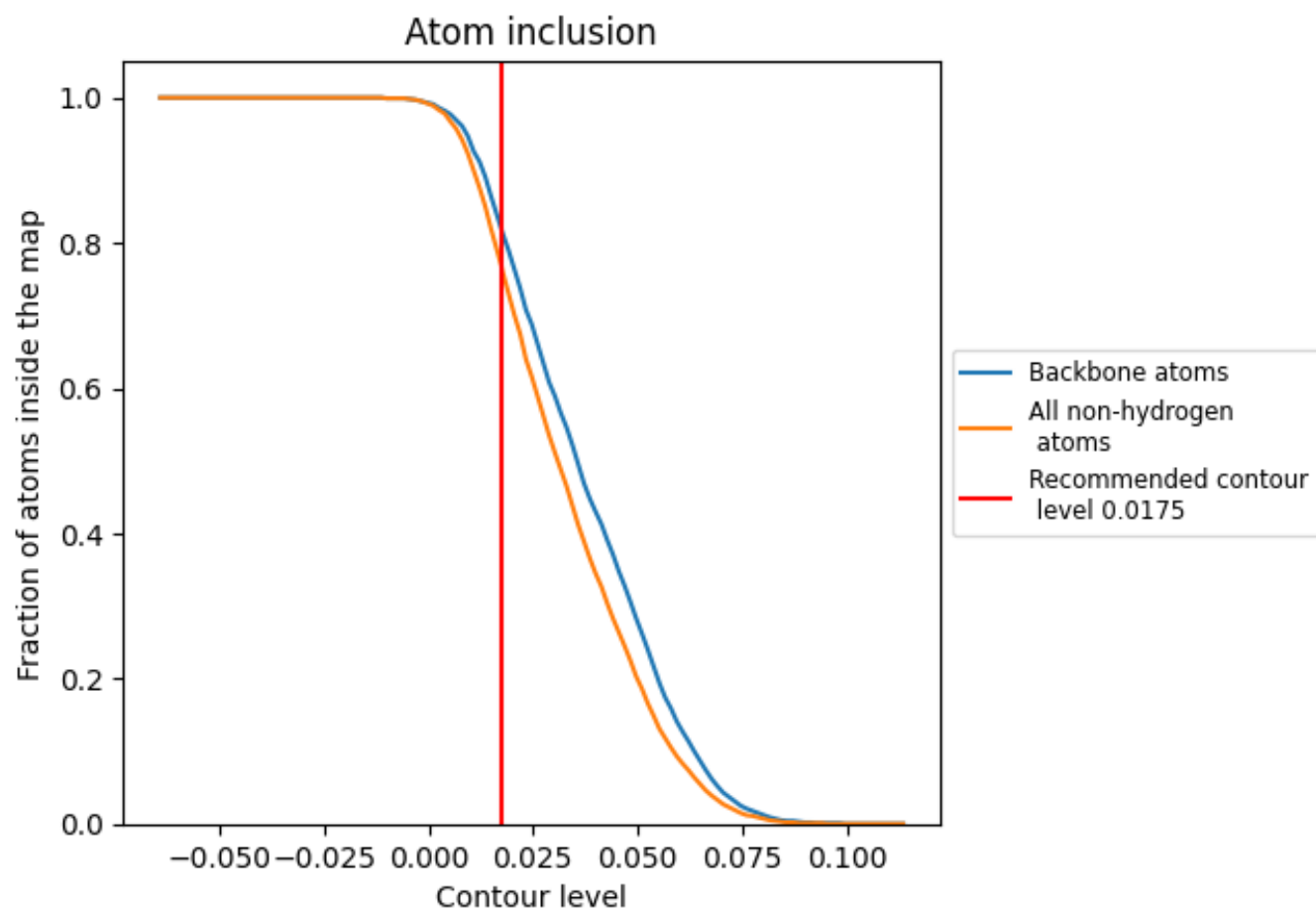
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.0175).

9.4 Atom inclusion [i](#)



At the recommended contour level, 82% of all backbone atoms, 77% 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 (0.0175) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div></div> 0.7670	<div></div> 0.5640
A	<div></div> 0.7780	<div></div> 0.5670
B	<div></div> 0.7440	<div></div> 0.5570
C	<div></div> 0.1300	<div></div> 0.4520

