



wwPDB EM Validation Summary Report ⓘ

May 7, 2026 – 10:10 AM JST

PDB ID : 9LDR / pdb_00009ldr
EMDB ID : EMD-63006
Title : Overall structure of the γ +LAT2-4F2hc bound with Leu
Authors : Yan, R.H.; Dai, I.; Zhang, T.
Deposited on : 2025-01-06
Resolution : 3.58 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
Mogul : 1.8.5 (274361), CSD as541be (2020)
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

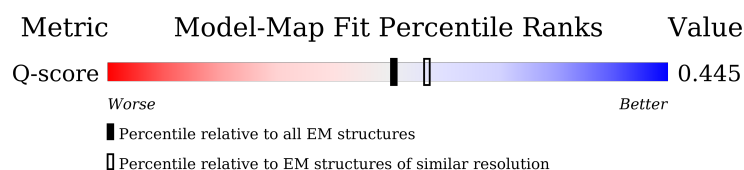
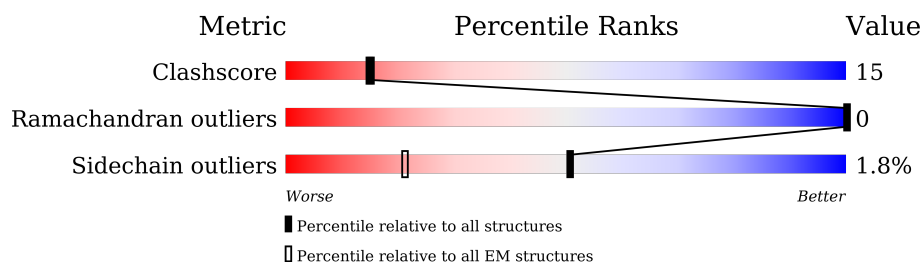
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.58 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	12629 (3.08 - 4.08)

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	534	
2	B	645	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7274 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 Y+L amino acid transporter 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	463	Total	C	N	O	S	0	0
			3595	2389	560	623	23		

There are 19 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-18	ASP	-	expression tag	UNP Q92536
A	-17	TYR	-	expression tag	UNP Q92536
A	-16	LYS	-	expression tag	UNP Q92536
A	-15	ASP	-	expression tag	UNP Q92536
A	-14	ASP	-	expression tag	UNP Q92536
A	-13	ASP	-	expression tag	UNP Q92536
A	-12	ASP	-	expression tag	UNP Q92536
A	-11	LYS	-	expression tag	UNP Q92536
A	-10	SER	-	expression tag	UNP Q92536
A	-9	GLY	-	expression tag	UNP Q92536
A	-8	PRO	-	expression tag	UNP Q92536
A	-7	ASP	-	expression tag	UNP Q92536
A	-6	GLU	-	expression tag	UNP Q92536
A	-5	VAL	-	expression tag	UNP Q92536
A	-4	ASP	-	expression tag	UNP Q92536
A	-3	ALA	-	expression tag	UNP Q92536
A	-2	SER	-	expression tag	UNP Q92536
A	-1	GLY	-	expression tag	UNP Q92536
A	0	ARG	-	expression tag	UNP Q92536

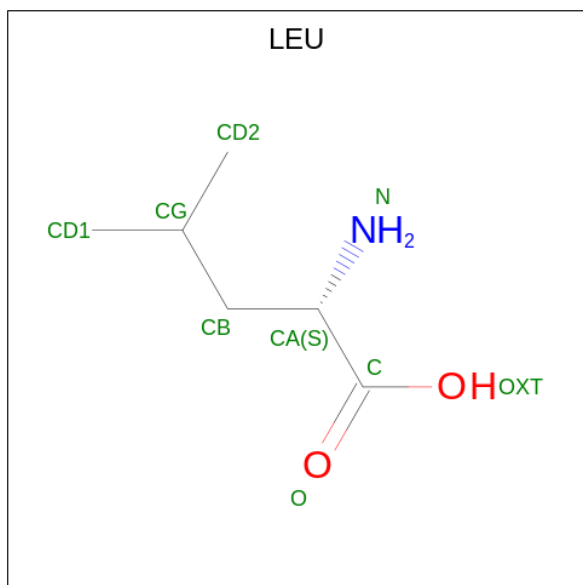
- Molecule 2 is a protein called Amino acid transporter heavy chain SLC3A2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	471	Total	C	N	O	S	0	0
			3670	2348	629	686	7		

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-10	HIS	-	expression tag	UNP P08195
B	-9	HIS	-	expression tag	UNP P08195
B	-8	HIS	-	expression tag	UNP P08195
B	-7	HIS	-	expression tag	UNP P08195
B	-6	HIS	-	expression tag	UNP P08195
B	-5	HIS	-	expression tag	UNP P08195
B	-4	HIS	-	expression tag	UNP P08195
B	-3	HIS	-	expression tag	UNP P08195
B	-2	HIS	-	expression tag	UNP P08195
B	-1	HIS	-	expression tag	UNP P08195
B	0	SER	-	expression tag	UNP P08195
B	1	GLY	-	expression tag	UNP P08195
B	2	ARG	-	expression tag	UNP P08195
B	632	THR	-	expression tag	UNP P08195
B	633	GLY	-	expression tag	UNP P08195
B	634	ALA	-	expression tag	UNP P08195

- Molecule 3 is LEUCINE (CCD ID: LEU) (formula: C₆H₁₃NO₂).



Mol	Chain	Residues	Atoms				AltConf
3	A	1	Total	C	N	O	0
			9	6	1	2	

S587	A588	S589	L590	P591	A592	K593	L596	L597	T600	G603	R604	E605	E606	G607	L612	E613	R614	L615	K616	L617	E618	P619	H620	G621	G622	L623	L624	Y629	A630	A631	THR	GLY	ALA	G342	F346	Q347	V348	R349	D350	I351	E352	N353	L354	K355	D356	A357	F360	L361	A362	E363	W364	K369	G370	F371	S372	E373	D374	R375	A379	N382	D385	L386	Q387	Q388	T389	L390	S391	L392	L393	E394	S395	N396	K397	D398	S403	S404	Y405	L406	S407	D408	S409	G410	S411	T412	G413	E414	H415	T416	K417	T421	A426	T427	R430	W431	W434	Q438	P447	A448	Q449	L450	L451	R452	Q455	T460	G463	T464	D471	E472	A478	A479	L480	P481	G482	Q483	P484	M485	E486	V489	D493	E494	S495	S496	F497	P498	D499	I500	P501	G502	A503	A506	T509	V510	K511	G512	Q513	S514	E515	D516	P517	G518	S519	L520	L527	S528	D529	Q530	R531	S532	K533	H539	G540	D541	F542	H543	A544	F545	S546	A547	G548	P549	G550	L551	Y554	I555	R556	H557	W558	D559	Q560	V567	L568	N569	D572	V573	G574	L575	S576	A577	G578	L579	Q580	A581	S582	D583	A586																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	370341	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)	1200	Depositor
Maximum defocus (nm)	5000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	3.192	Depositor
Minimum map value	-2.262	Depositor
Average map value	0.003	Depositor
Map value standard deviation	0.070	Depositor
Recommended contour level	0.3	Depositor
Map size ($\text{\AA}$)	218.88, 218.88, 218.88	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	0.855, 0.855, 0.855	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	0.34	0/3691	0.56	2/5036 (0.0%)
2	B	0.24	0/3755	0.49	2/5095 (0.0%)
All	All	0.29	0/7446	0.52	4/10131 (0.0%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	120	GLY	N-CA-C	7.04	120.85	112.33
2	B	240	GLY	N-CA-C	-6.61	103.62	111.36
1	A	122	PHE	N-CA-C	-6.28	104.13	110.97
2	B	414	GLU	N-CA-C	-5.63	106.45	113.38

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	3595	0	3669	87	0
2	B	3670	0	3663	139	0
3	A	9	0	10	1	0
All	All	7274	0	7342	217	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 15.

The worst 5 of 217 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:498:VAL:HG11	2:B:167:LYS:HA	1.60	0.81
2:B:577:ALA:HB3	2:B:615:LEU:HB2	1.65	0.78
1:A:358:MET:HB3	1:A:497:CYS:HB3	1.65	0.77
1:A:485:ALA:HB1	2:B:162:PHE:HB2	1.67	0.77
2:B:270:LYS:HG3	2:B:271:ASP:H	1.49	0.76

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	461/534 (86%)	420 (91%)	41 (9%)	0	100	100
2	B	469/645 (73%)	429 (92%)	40 (8%)	0	100	100
All	All	930/1179 (79%)	849 (91%)	81 (9%)	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	394/459 (86%)	390 (99%)	4 (1%)	68	75

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
2	B	394/526 (75%)	385 (98%)	9 (2%)	44 64
All	All	788/985 (80%)	775 (98%)	13 (2%)	51 69

5 of 13 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	246	LYS
2	B	249	LEU
2	B	258	LYS
2	B	255	LEU
2	B	256	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	217	GLN
2	B	221	HIS
2	B	513	GLN
2	B	317	ASN
2	B	365	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](#)

1 ligand is 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	LEU	A	601	-	7,8,8	1.10	1 (14%)	9,10,10	1.27	2 (22%)

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	LEU	A	601	-	-	4/8/8/8	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	601	LEU	OXT-C	-2.80	1.21	1.30

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	601	LEU	OXT-C-O	-2.81	117.71	124.09
3	A	601	LEU	OXT-C-CA	2.40	121.56	113.38

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	601	LEU	CA-CB-CG-CD1
3	A	601	LEU	CA-CB-CG-CD2
3	A	601	LEU	OXT-C-CA-CB
3	A	601	LEU	O-C-CA-CB

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	601	LEU	1	0

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.

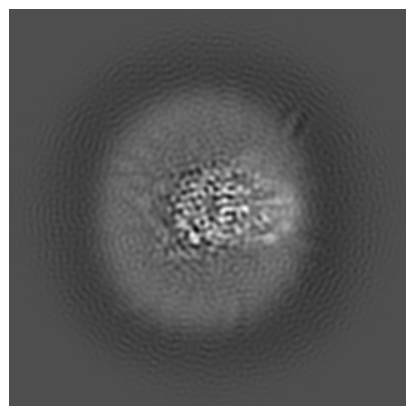
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-63006. These allow visual inspection of the internal detail of the map and identification of artifacts.

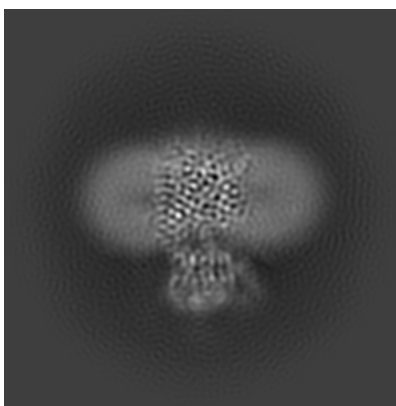
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

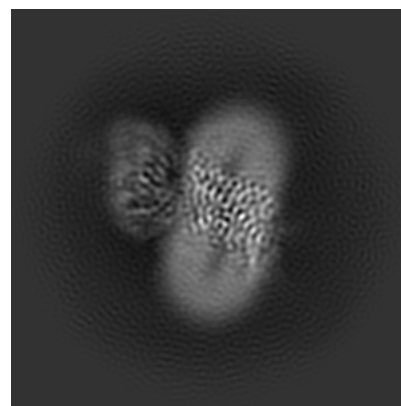
6.1.1 Primary map



X

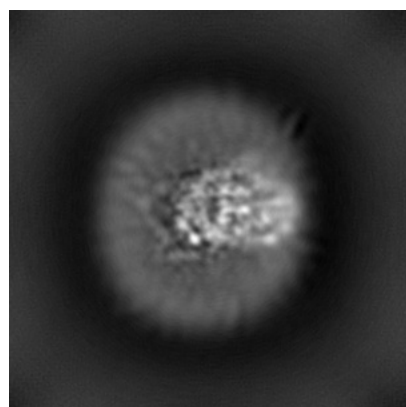


Y

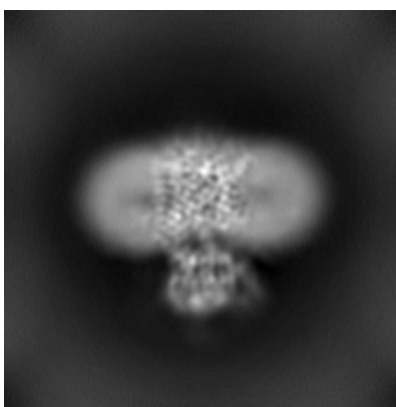


Z

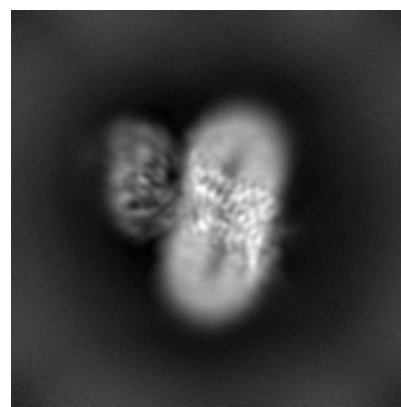
6.1.2 Raw map



X



Y

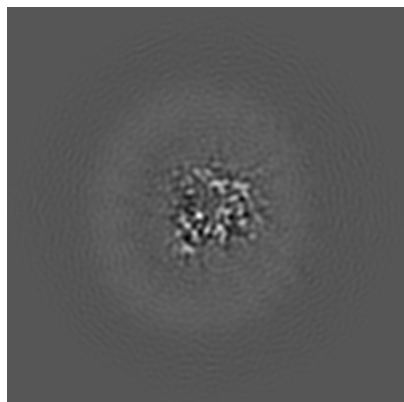


Z

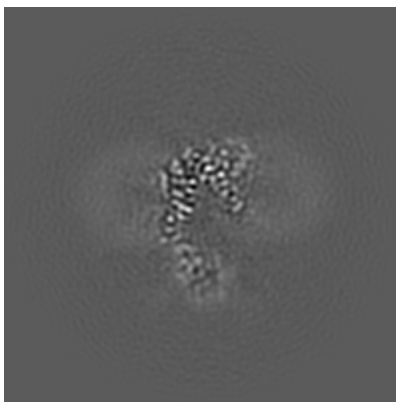
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

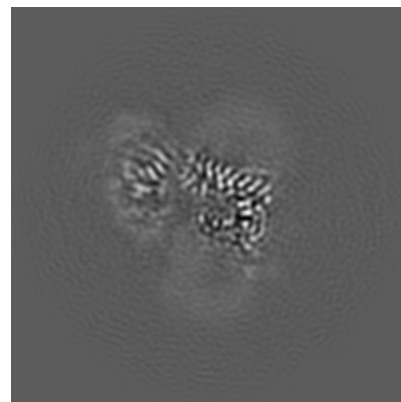
6.2.1 Primary map



X Index: 128

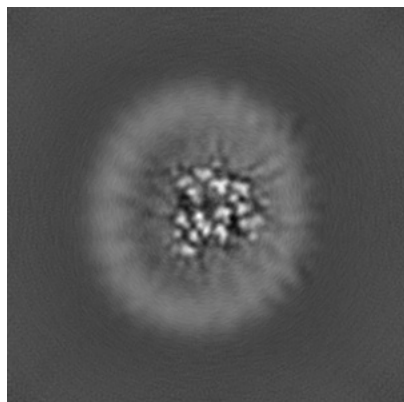


Y Index: 128

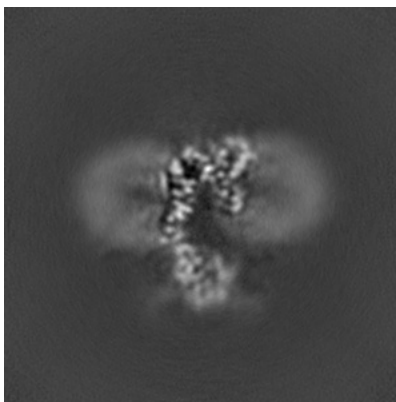


Z Index: 128

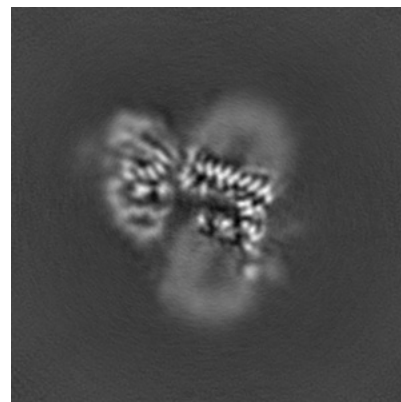
6.2.2 Raw map



X Index: 128



Y Index: 128

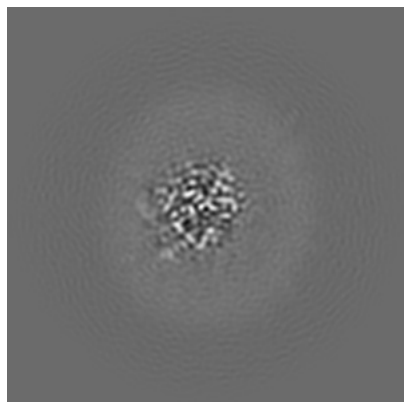


Z Index: 128

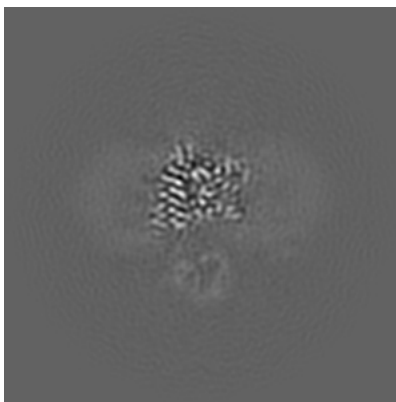
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

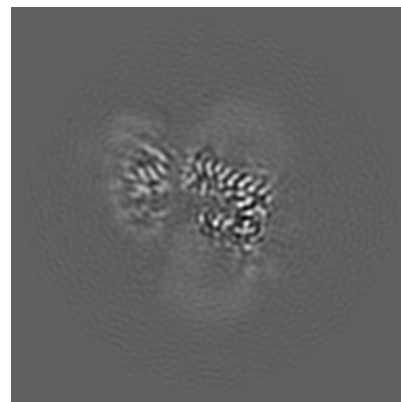
6.3.1 Primary map



X Index: 151

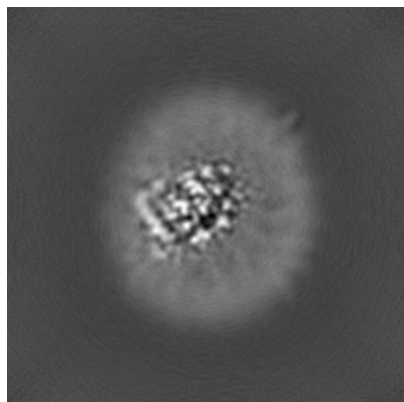


Y Index: 117

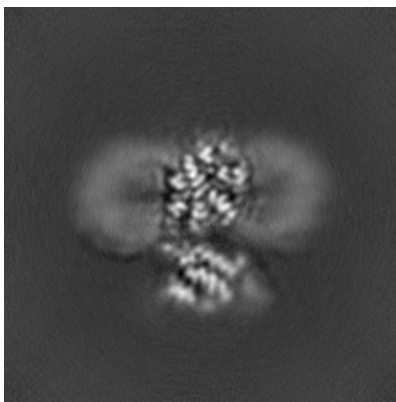


Z Index: 127

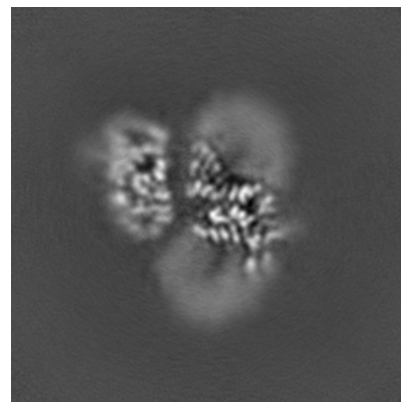
6.3.2 Raw map



X Index: 154



Y Index: 137

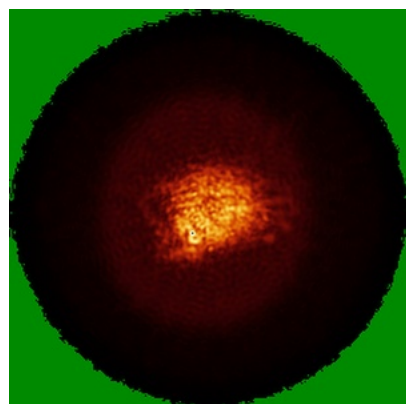


Z Index: 121

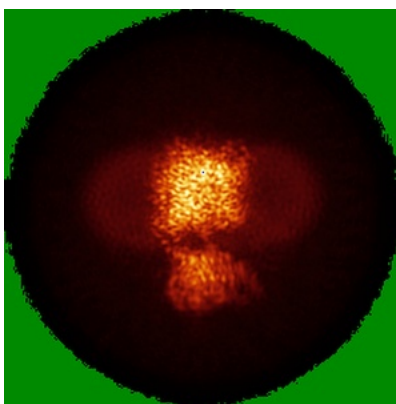
The images above show the largest variance slices of the map in three orthogonal directions.

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

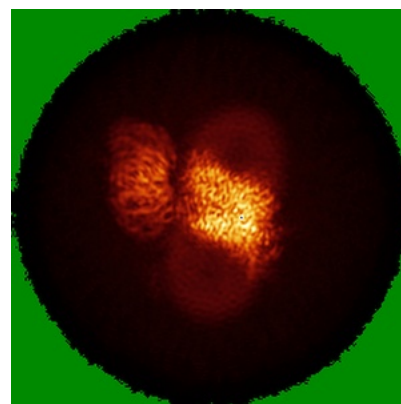
6.4.1 Primary map



X

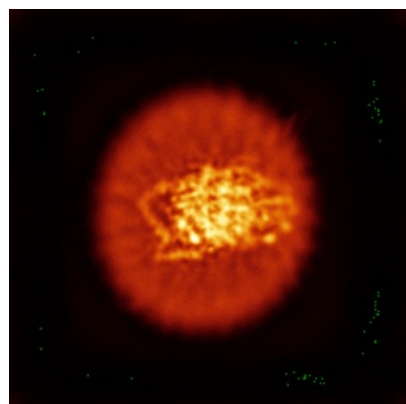


Y

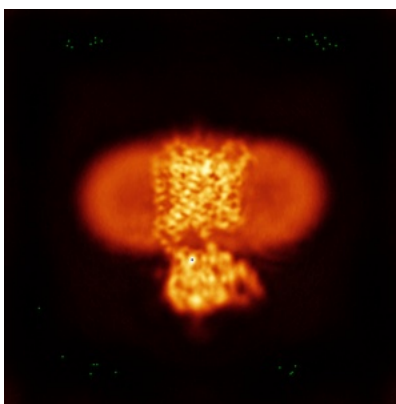


Z

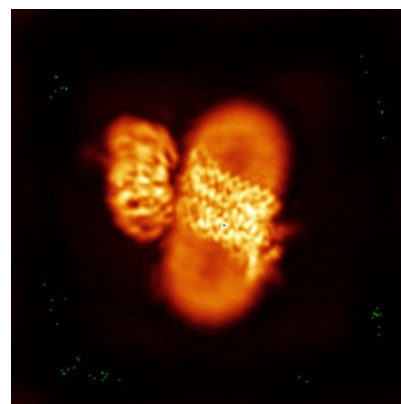
6.4.2 Raw map



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.

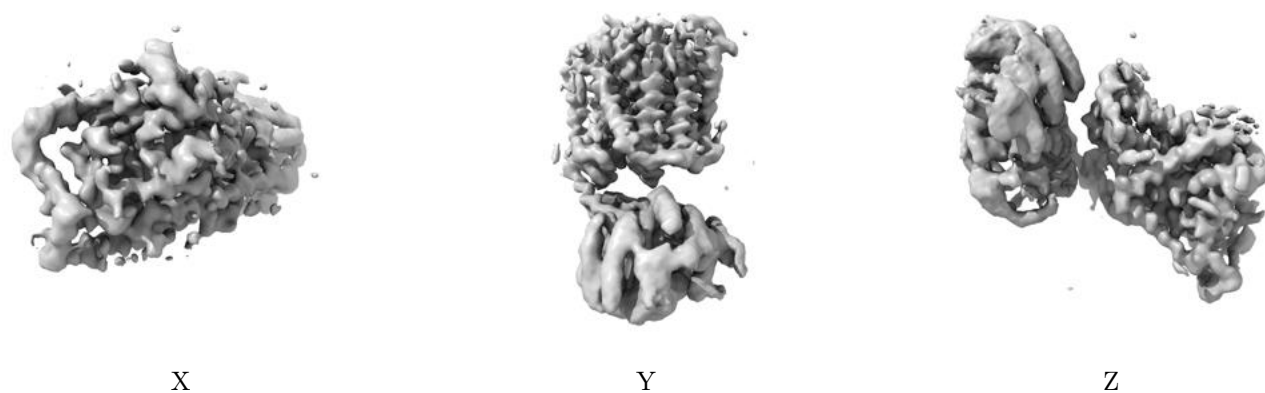
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.3. 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.

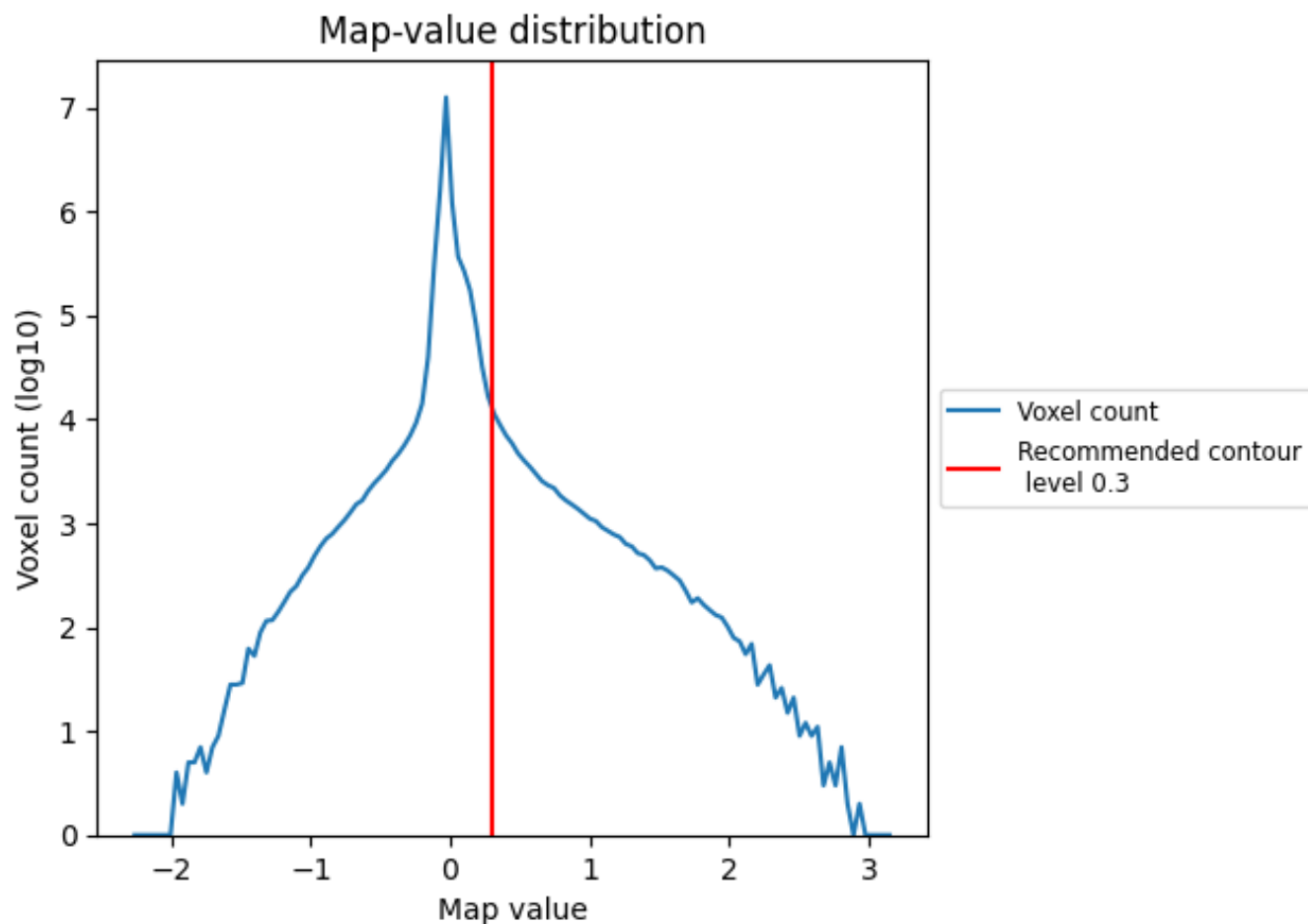
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

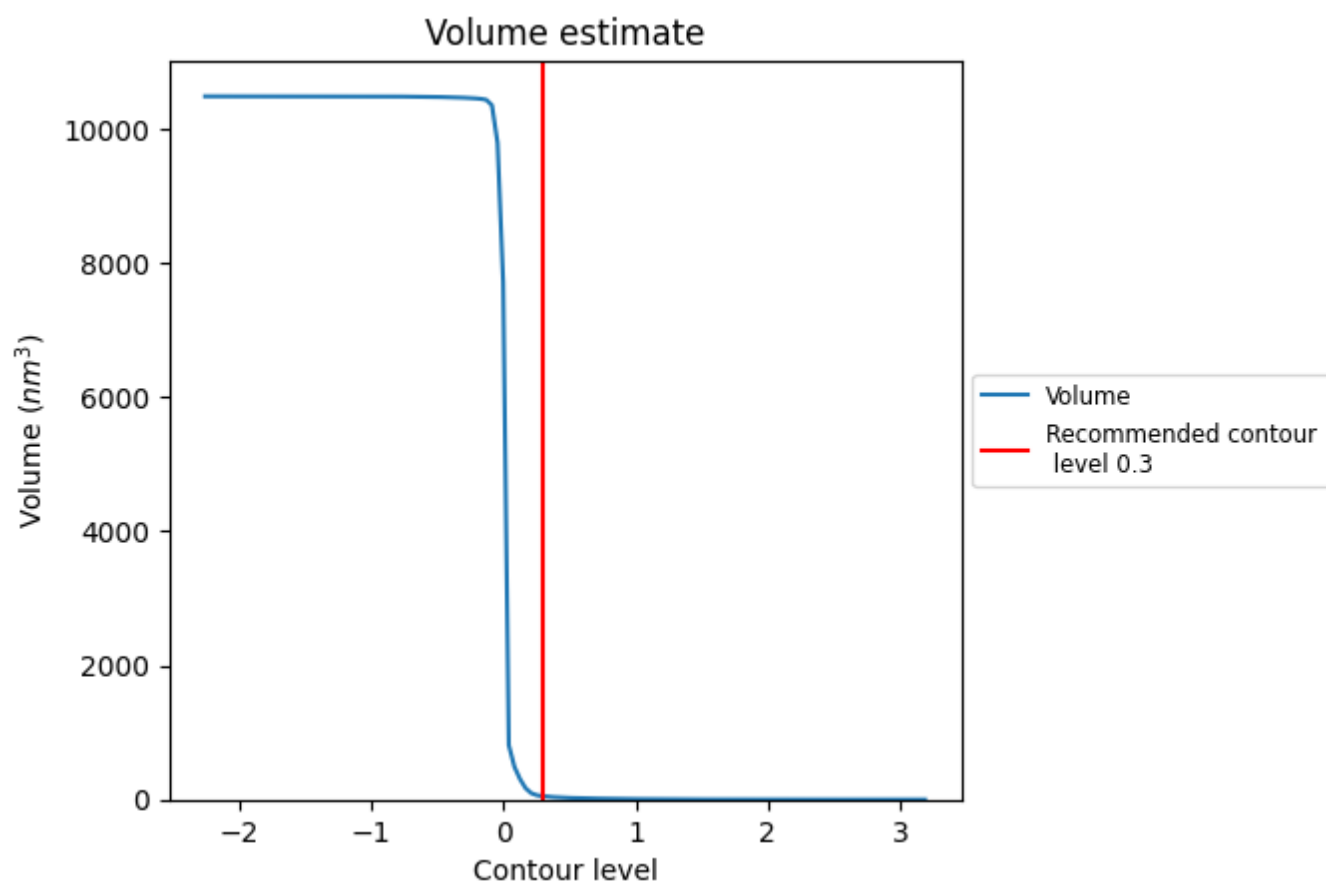
This section contains the results of statistical analysis of the map.

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.

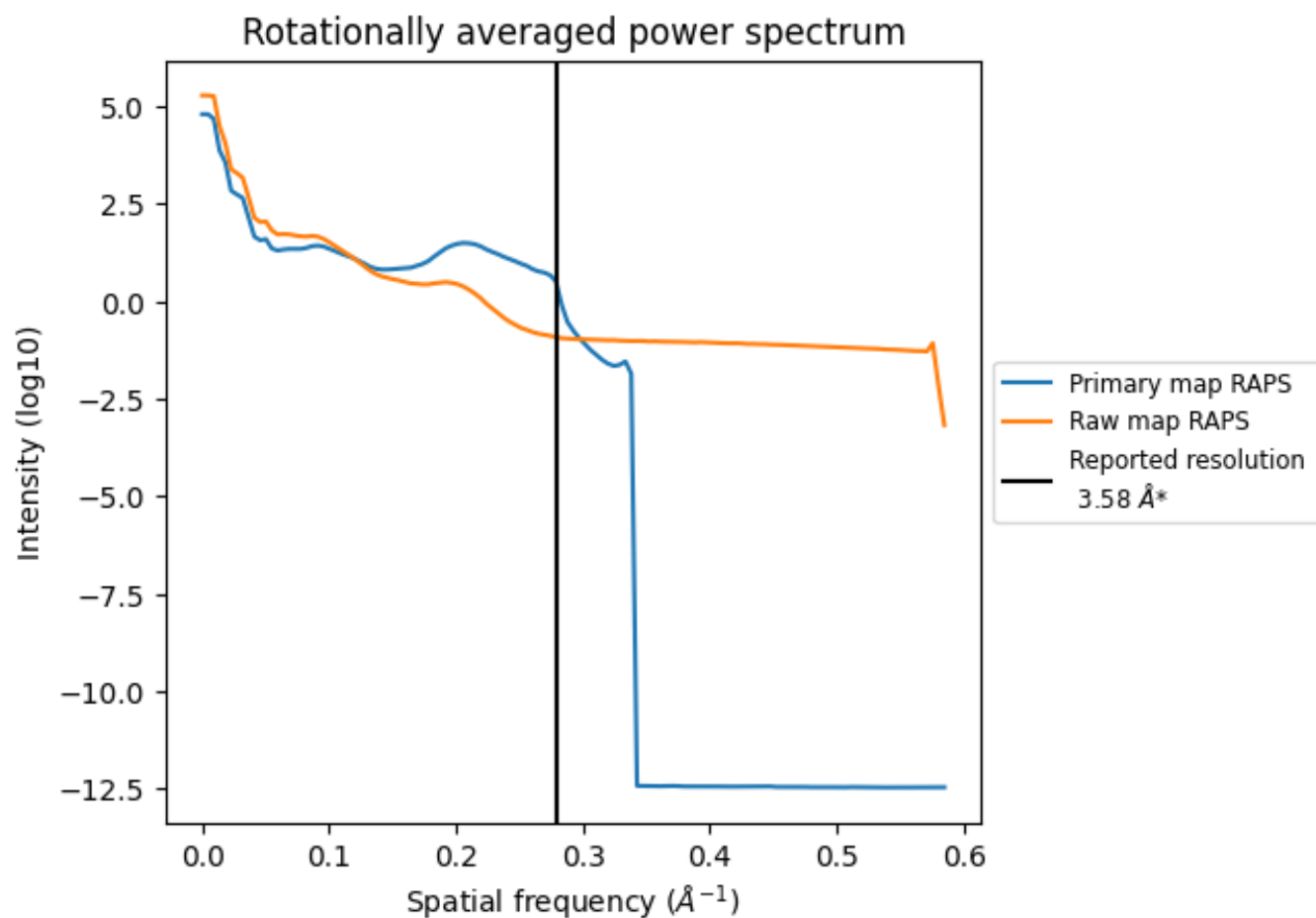
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 50 nm³; this corresponds to an approximate mass of 45 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 ⓘ

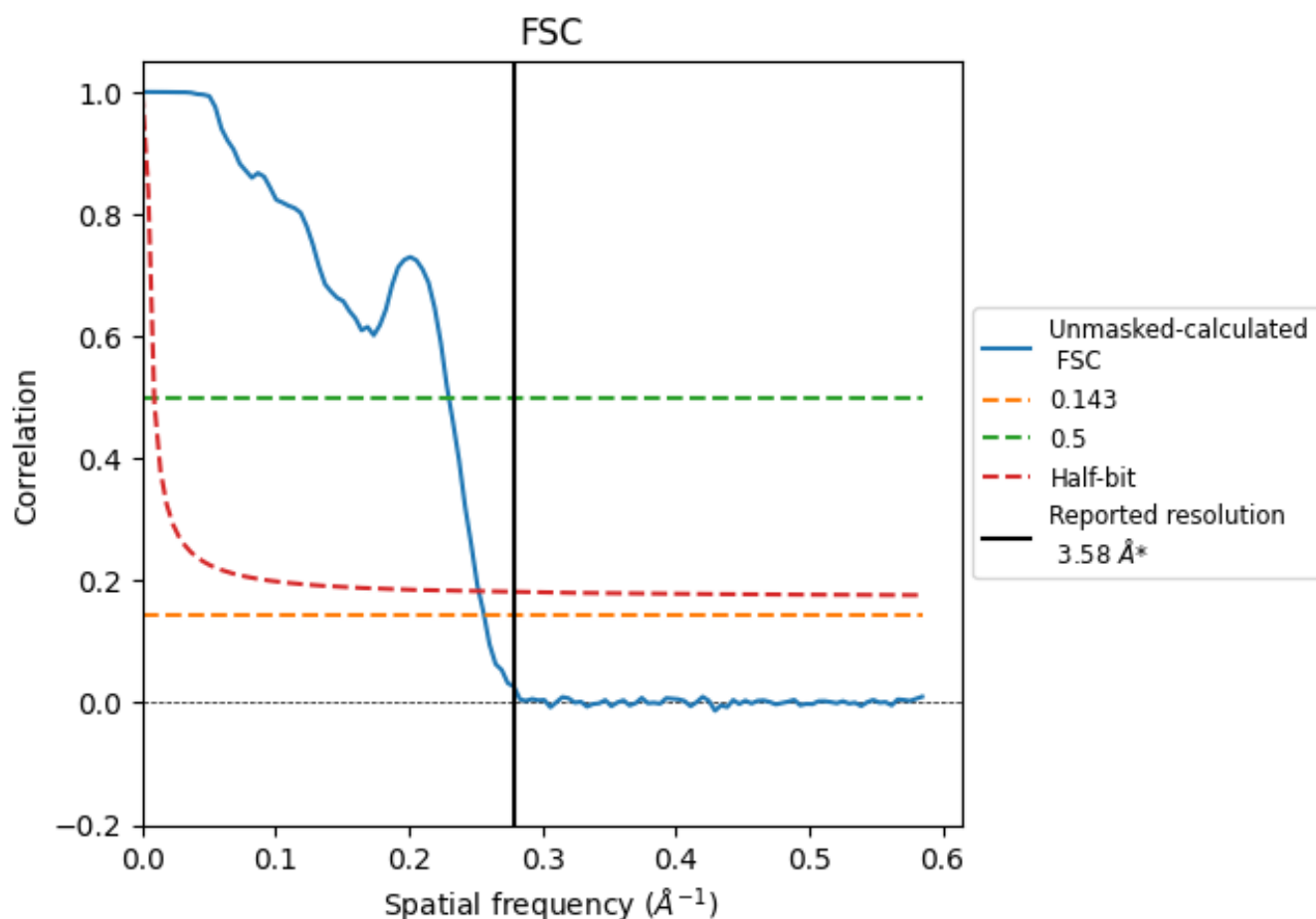


*Reported resolution corresponds to spatial frequency of 0.279 Å⁻¹

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 0.279 Å⁻¹

8.2 Resolution estimates [i](#)

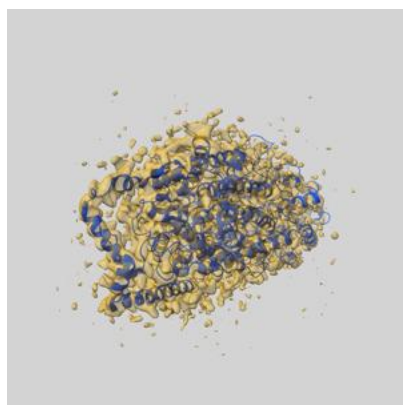
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.58	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.90	4.35	3.96

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.

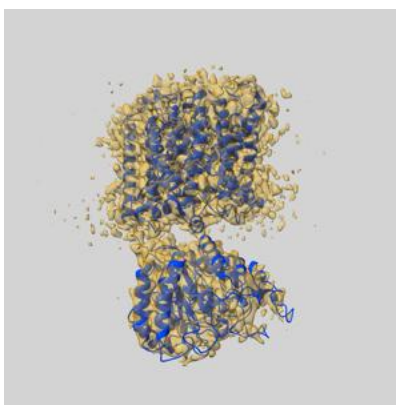
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-63006 and PDB model 9LDR. Per-residue inclusion information can be found in [section 3](#) on [page 5](#).

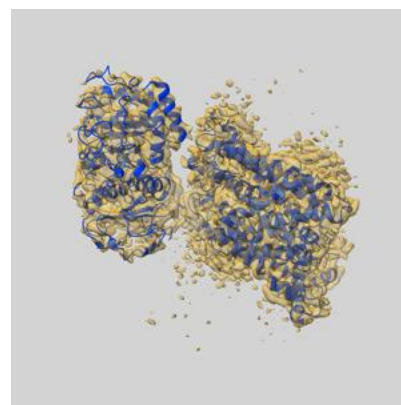
9.1 Map-model overlay [i](#)



X



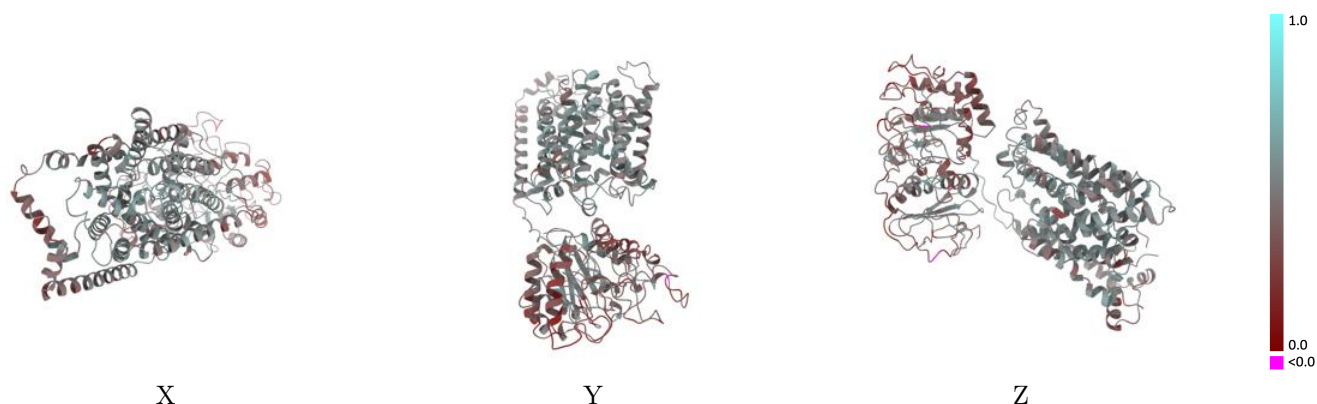
Y



Z

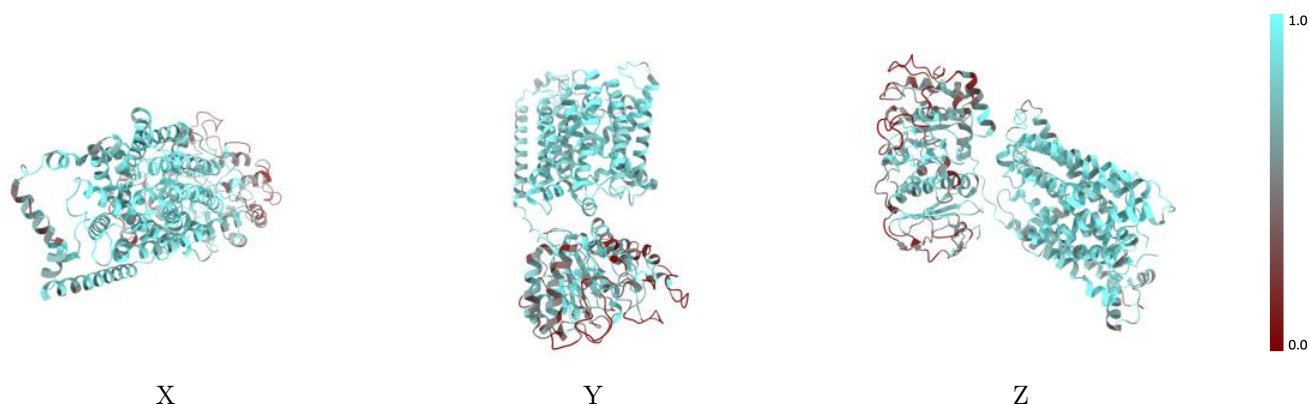
The images above show the 3D surface view of the map at the recommended contour level 0.3 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



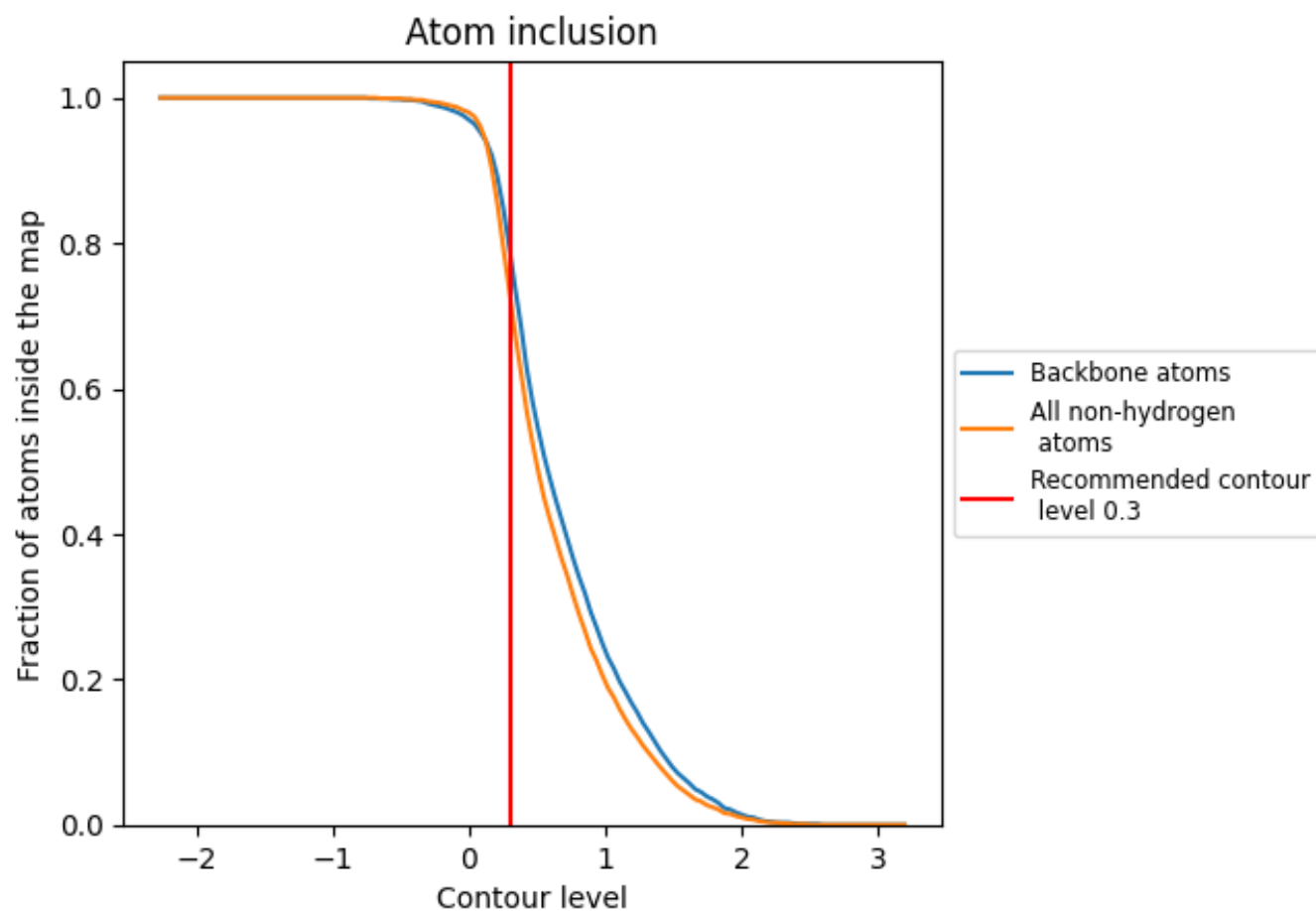
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.3).

9.4 Atom inclusion [i](#)



At the recommended contour level, 79% of all backbone atoms, 73% 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 (0.3) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7280	0.4450
A	0.8520	0.4950
B	0.6050	0.3970

