



## wwPDB EM Validation Summary Report ⓘ

Oct 6, 2024 – 03:32 PM JST

PDB ID : 8WSS  
EMDB ID : EMD-37823  
Title : Cryo-EM structure of Melanin-Concentrating Hormone Receptor 1 with MCH  
Authors : Zhao, L.; He, Q.; Yuan, Q.; Gu, Y.; Shan, H.; Hu, W.; Wu, K.; Xu, H.E.;  
Zhang, Y.; Wu, C.  
Deposited on : 2023-10-17  
Resolution : 3.01 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:

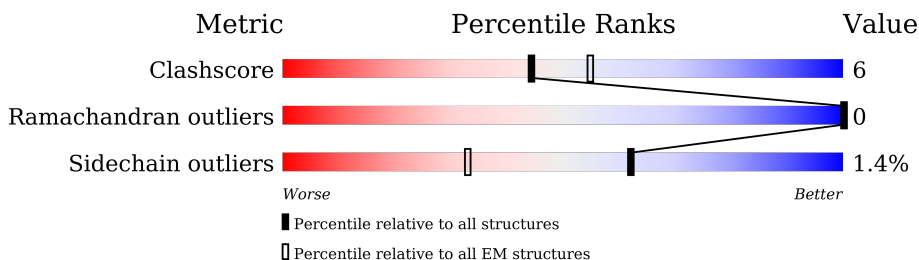
EMDB validation analysis : 0.0.1.dev113  
MolProbity : 4.02b-467  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

# 1 Overall quality at a glance i

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

The reported resolution of this entry is 3.01 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	A	354	
2	B	377	
3	G	71	
4	H	285	
5	L	19	
6	R	402	

## 2 Entry composition i

There are 6 unique types of molecules in this entry. The entry contains 8797 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 Guanine nucleotide-binding protein G(i) subunit alpha-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	217	1749	1116	293	328	12	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	47	ASN	SER	engineered mutation	UNP P63096
A	203	ALA	GLY	engineered mutation	UNP P63096
A	245	ALA	GLU	engineered mutation	UNP P63096
A	326	SER	ALA	engineered mutation	UNP P63096

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	339	2560	1585	461	493	21	0	0

There are 38 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-10	MET	-	initiating methionine	UNP P62873
B	-9	HIS	-	expression tag	UNP P62873
B	-8	HIS	-	expression tag	UNP P62873
B	-7	HIS	-	expression tag	UNP P62873
B	-6	HIS	-	expression tag	UNP P62873
B	-5	HIS	-	expression tag	UNP P62873
B	-4	HIS	-	expression tag	UNP P62873
B	-3	GLY	-	expression tag	UNP P62873
B	-2	SER	-	expression tag	UNP P62873
B	-1	LEU	-	expression tag	UNP P62873
B	0	LEU	-	expression tag	UNP P62873
B	1	GLN	-	expression tag	UNP P62873

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Chain	Residue	Modelled	Actual	Comment	Reference
B	341	GLY	-	expression tag	UNP P62873
B	342	SER	-	expression tag	UNP P62873
B	343	SER	-	expression tag	UNP P62873
B	344	GLY	-	expression tag	UNP P62873
B	345	GLY	-	expression tag	UNP P62873
B	346	GLY	-	expression tag	UNP P62873
B	347	GLY	-	expression tag	UNP P62873
B	348	SER	-	expression tag	UNP P62873
B	349	GLY	-	expression tag	UNP P62873
B	350	GLY	-	expression tag	UNP P62873
B	351	GLY	-	expression tag	UNP P62873
B	352	GLY	-	expression tag	UNP P62873
B	353	SER	-	expression tag	UNP P62873
B	354	SER	-	expression tag	UNP P62873
B	355	GLY	-	expression tag	UNP P62873
B	356	VAL	-	expression tag	UNP P62873
B	357	SER	-	expression tag	UNP P62873
B	358	GLY	-	expression tag	UNP P62873
B	359	TRP	-	expression tag	UNP P62873
B	360	ARG	-	expression tag	UNP P62873
B	361	LEU	-	expression tag	UNP P62873
B	362	PHE	-	expression tag	UNP P62873
B	363	LYS	-	expression tag	UNP P62873
B	364	LYS	-	expression tag	UNP P62873
B	365	ILE	-	expression tag	UNP P62873
B	366	SER	-	expression tag	UNP P62873

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	G	56	401	253	71	74	3	0	0

- Molecule 4 is a protein called Scfv16.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	H	231	1720	1098	283	329	10	0	0

- Molecule 5 is a protein called Pro-MCH.

Mol	Chain	Residues	Atoms				AltConf	Trace	
			Total	C	N	O			S
5	L	17	149	96	28	21	4	0	0

- Molecule 6 is a protein called Melanin-concentrating hormone receptor 1.

Mol	Chain	Residues	Atoms				AltConf	Trace	
			Total	C	N	O			S
6	R	283	2218	1476	353	372	17	0	0

There are 66 discrepancies between the modelled and reference sequences:

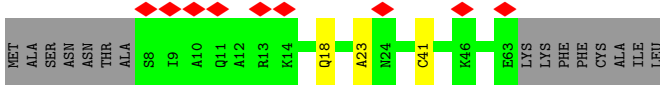
Chain	Residue	Modelled	Actual	Comment	Reference
R	66	GLN	-	expression tag	UNP Q99705
R	67	GLY	-	expression tag	UNP Q99705
R	68	GLY	-	expression tag	UNP Q99705
R	69	THR	-	expression tag	UNP Q99705
R	406	GLY	-	expression tag	UNP Q99705
R	407	SER	-	expression tag	UNP Q99705
R	408	SER	-	expression tag	UNP Q99705
R	409	GLY	-	expression tag	UNP Q99705
R	410	GLY	-	expression tag	UNP Q99705
R	411	GLY	-	expression tag	UNP Q99705
R	412	GLY	-	expression tag	UNP Q99705
R	413	SER	-	expression tag	UNP Q99705
R	414	GLY	-	expression tag	UNP Q99705
R	415	GLY	-	expression tag	UNP Q99705
R	416	GLY	-	expression tag	UNP Q99705
R	417	GLY	-	expression tag	UNP Q99705
R	418	SER	-	expression tag	UNP Q99705
R	419	SER	-	expression tag	UNP Q99705
R	420	GLY	-	expression tag	UNP Q99705
R	421	VAL	-	expression tag	UNP Q99705
R	422	PHE	-	expression tag	UNP Q99705
R	423	THR	-	expression tag	UNP Q99705
R	424	LEU	-	expression tag	UNP Q99705
R	425	GLU	-	expression tag	UNP Q99705
R	426	ASP	-	expression tag	UNP Q99705
R	427	PHE	-	expression tag	UNP Q99705
R	428	VAL	-	expression tag	UNP Q99705
R	429	GLY	-	expression tag	UNP Q99705
R	430	ASP	-	expression tag	UNP Q99705
R	431	TRP	-	expression tag	UNP Q99705
R	432	GLU	-	expression tag	UNP Q99705

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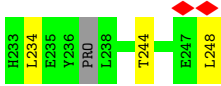
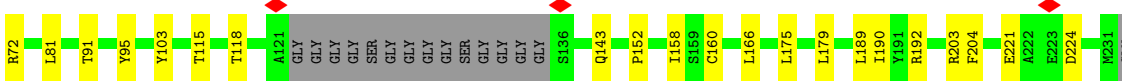
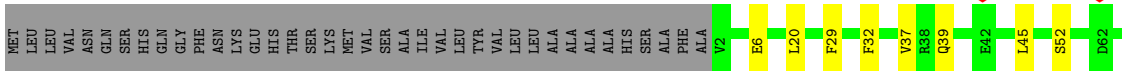
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Chain	Residue	Modelled	Actual	Comment	Reference
R	433	GLN	-	expression tag	UNP Q99705
R	434	THR	-	expression tag	UNP Q99705
R	435	ALA	-	expression tag	UNP Q99705
R	436	ALA	-	expression tag	UNP Q99705
R	437	TYR	-	expression tag	UNP Q99705
R	438	ASN	-	expression tag	UNP Q99705
R	439	LEU	-	expression tag	UNP Q99705
R	440	ASP	-	expression tag	UNP Q99705
R	441	GLN	-	expression tag	UNP Q99705
R	442	VAL	-	expression tag	UNP Q99705
R	443	LEU	-	expression tag	UNP Q99705
R	444	GLU	-	expression tag	UNP Q99705
R	445	GLN	-	expression tag	UNP Q99705
R	446	GLY	-	expression tag	UNP Q99705
R	447	GLY	-	expression tag	UNP Q99705
R	448	VAL	-	expression tag	UNP Q99705
R	449	SER	-	expression tag	UNP Q99705
R	450	SER	-	expression tag	UNP Q99705
R	451	LEU	-	expression tag	UNP Q99705
R	452	LEU	-	expression tag	UNP Q99705
R	453	GLN	-	expression tag	UNP Q99705
R	454	ASN	-	expression tag	UNP Q99705
R	455	LEU	-	expression tag	UNP Q99705
R	456	ALA	-	expression tag	UNP Q99705
R	457	VAL	-	expression tag	UNP Q99705
R	458	SER	-	expression tag	UNP Q99705
R	459	VAL	-	expression tag	UNP Q99705
R	460	THR	-	expression tag	UNP Q99705
R	461	PRO	-	expression tag	UNP Q99705
R	462	ILE	-	expression tag	UNP Q99705
R	463	GLN	-	expression tag	UNP Q99705
R	464	ARG	-	expression tag	UNP Q99705
R	465	ILE	-	expression tag	UNP Q99705
R	466	VAL	-	expression tag	UNP Q99705
R	467	ARG	-	expression tag	UNP Q99705

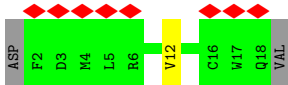
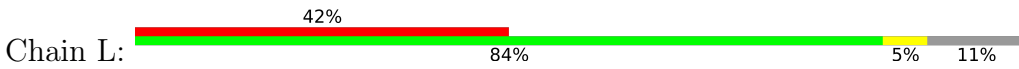




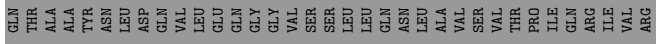
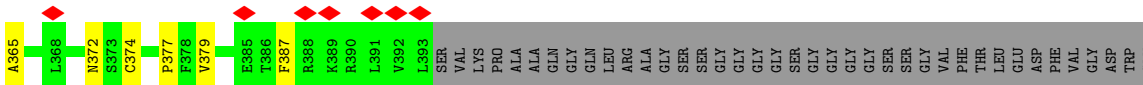
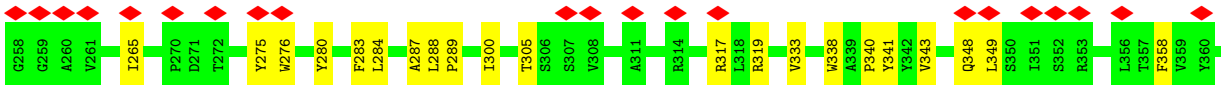
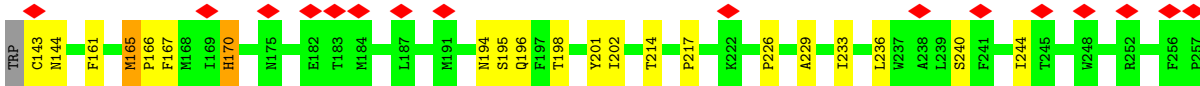
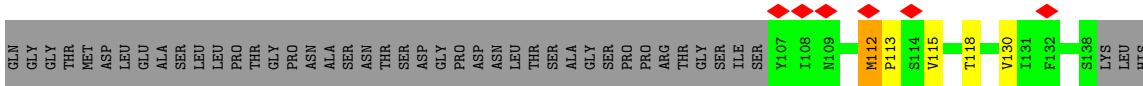
• Molecule 4: Scfv16



• Molecule 5: Pro-MCH



• Molecule 6: Melanin-concentrating hormone receptor 1





## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	311033	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 ( $e^-/\text{\AA}^2$ )	50	Depositor
Minimum defocus (nm)	8000	Depositor
Maximum defocus (nm)	18000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	0.076	Depositor
Minimum map value	-0.040	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.002	Depositor
Recommended contour level	0.01	Depositor
Map size (Å)	210.944, 210.944, 210.944	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.824, 0.824, 0.824	Depositor

## 5 Model quality

### 5.1 Standard geometry

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	0.24	0/1778	0.42	0/2383
2	B	0.24	0/2607	0.50	0/3540
3	G	0.24	0/407	0.42	0/554
4	H	0.25	0/1761	0.47	0/2393
5	L	0.29	0/153	0.52	0/204
6	R	0.25	0/2277	0.45	0/3113
All	All	0.24	0/8983	0.46	0/12187

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

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	1749	0	1750	20	0
2	B	2560	0	2446	45	0
3	G	401	0	385	3	0
4	H	1720	0	1618	19	0
5	L	149	0	145	1	0
6	R	2218	0	2282	27	0
All	All	8797	0	8626	108	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 6.

The worst 5 of 108 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:229:ASP:OD1	1:A:232:LEU:CD1	2.08	1.00
1:A:229:ASP:OD1	1:A:232:LEU:HD12	1.69	0.92
1:A:229:ASP:OD1	1:A:232:LEU:HD11	1.85	0.73
1:A:329:THR:O	1:A:329:THR:HG22	1.89	0.73
4:H:203:ARG:NH1	4:H:224:ASP:OD2	2.25	0.69

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	211/354 (60%)	210 (100%)	1 (0%)	0	100	100
2	B	337/377 (89%)	333 (99%)	4 (1%)	0	100	100
3	G	54/71 (76%)	53 (98%)	1 (2%)	0	100	100
4	H	223/285 (78%)	217 (97%)	6 (3%)	0	100	100
5	L	15/19 (79%)	13 (87%)	2 (13%)	0	100	100
6	R	279/402 (69%)	267 (96%)	12 (4%)	0	100	100
All	All	1119/1508 (74%)	1093 (98%)	26 (2%)	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	192/305 (63%)	191 (100%)	1 (0%)	86	94
2	B	270/308 (88%)	267 (99%)	3 (1%)	70	87
3	G	37/58 (64%)	37 (100%)	0	100	100
4	H	179/228 (78%)	179 (100%)	0	100	100
5	L	16/18 (89%)	16 (100%)	0	100	100
6	R	244/339 (72%)	235 (96%)	9 (4%)	29	62
All	All	938/1256 (75%)	925 (99%)	13 (1%)	62	83

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

Mol	Chain	Res	Type
6	R	196	GLN
6	R	217	PRO
6	R	387	PHE
6	R	317	ARG
6	R	374	CYS

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

Mol	Chain	Res	Type
4	H	143	GLN
4	H	180	GLN
6	R	345	GLN
6	R	171	GLN
6	R	281	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.

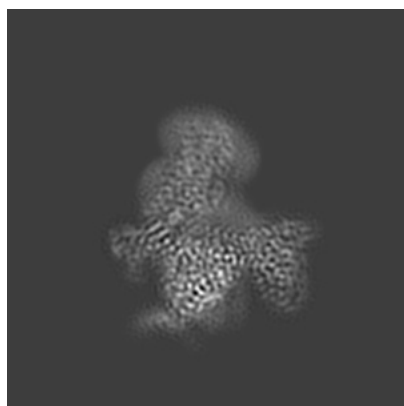
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-37823. These allow visual inspection of the internal detail of the map and identification of artifacts.

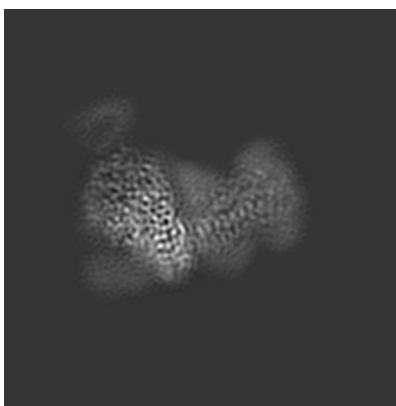
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

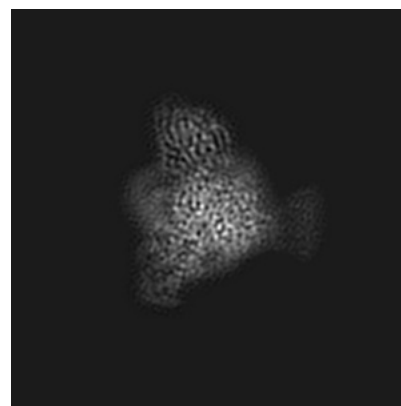
#### 6.1.1 Primary map



X

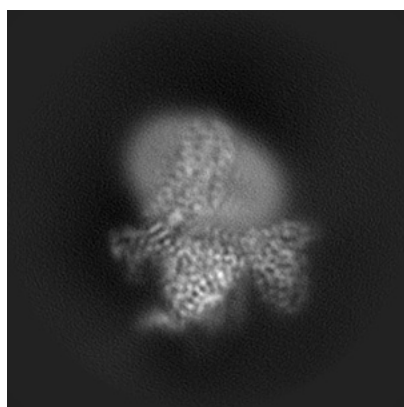


Y

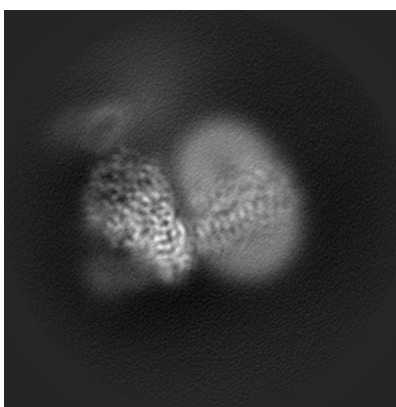


Z

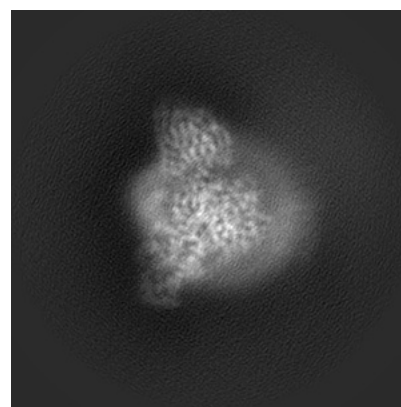
#### 6.1.2 Raw map



X



Y

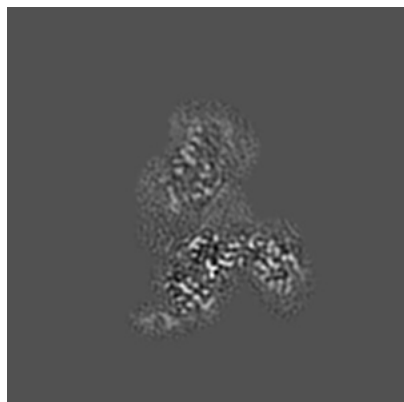


Z

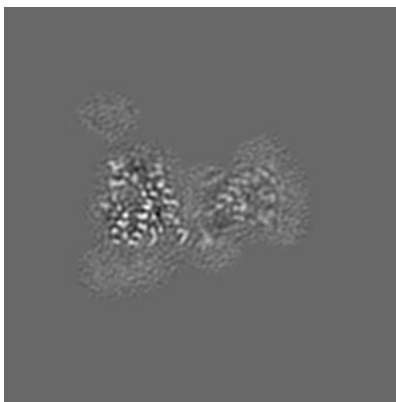
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

### 6.2.1 Primary map



X Index: 128

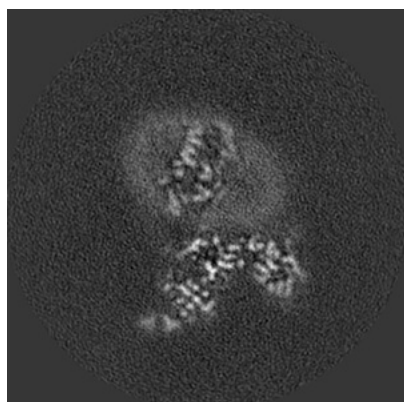


Y Index: 128

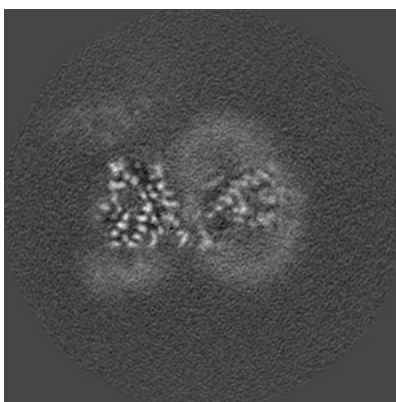


Z Index: 128

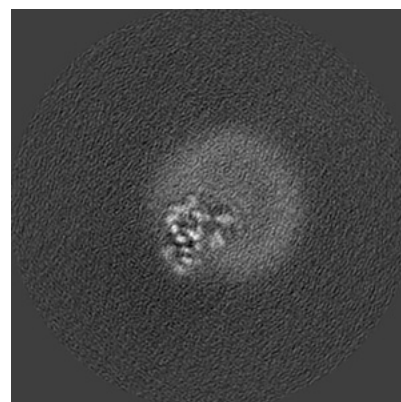
### 6.2.2 Raw map



X Index: 128



Y Index: 128

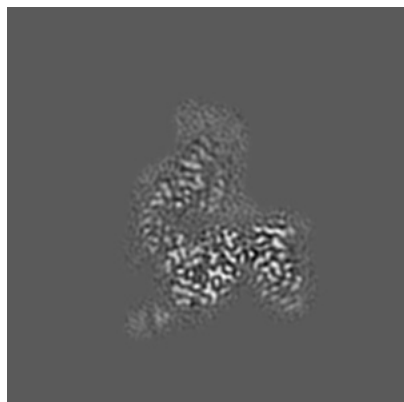


Z Index: 128

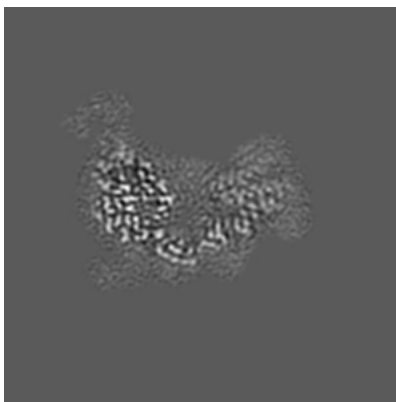
The images above show central slices of the map in three orthogonal directions.

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

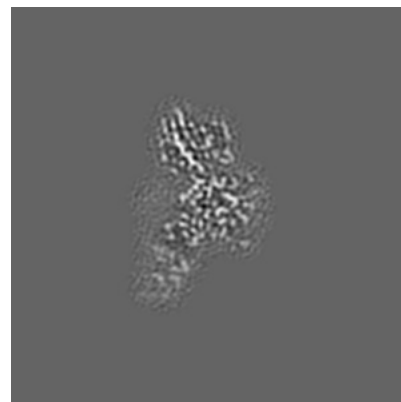
### 6.3.1 Primary map



X Index: 117

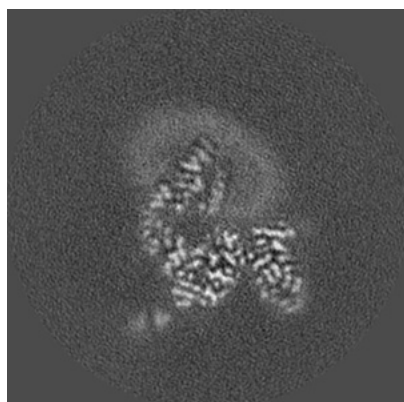


Y Index: 116

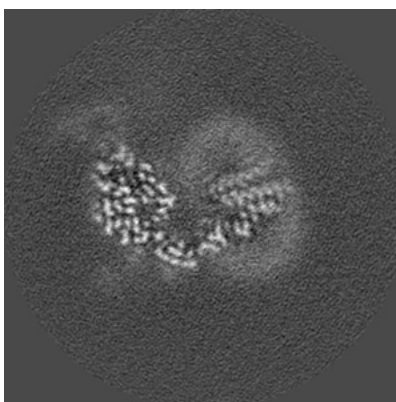


Z Index: 98

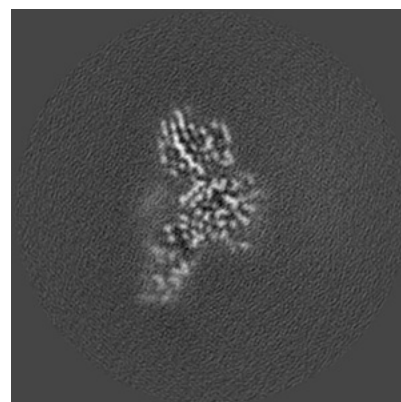
### 6.3.2 Raw map



X Index: 117



Y Index: 116



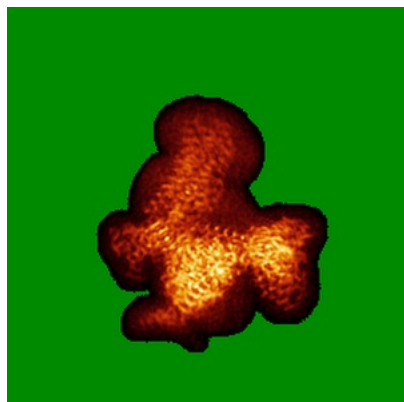
Z Index: 98

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

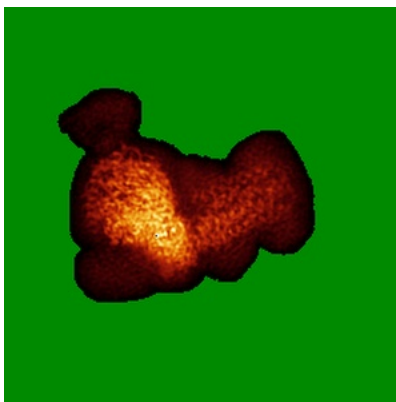


## 6.4 Orthogonal standard-deviation projections (False-color) [i](#)

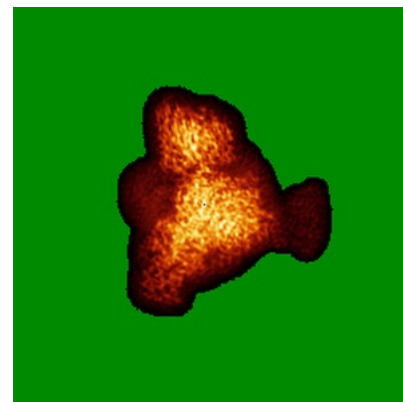
### 6.4.1 Primary map



X

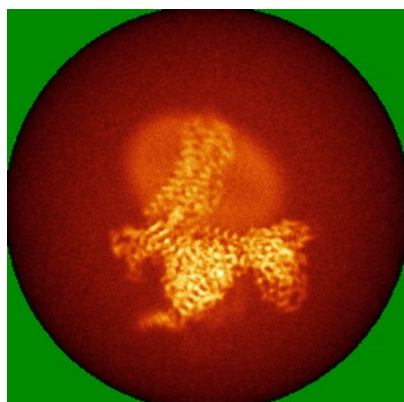


Y

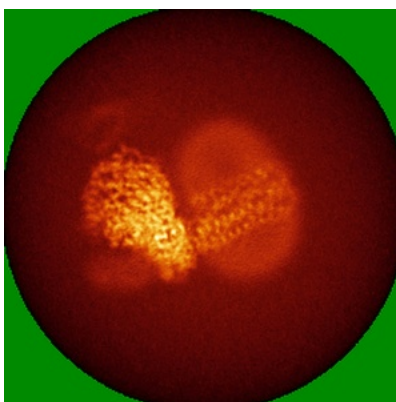


Z

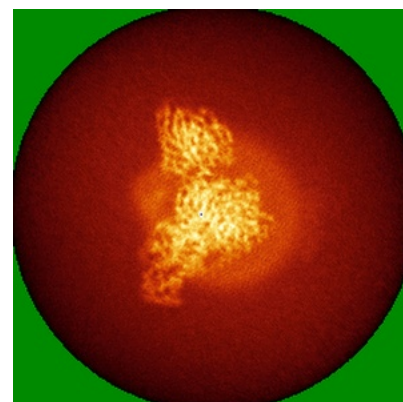
### 6.4.2 Raw map



X



Y

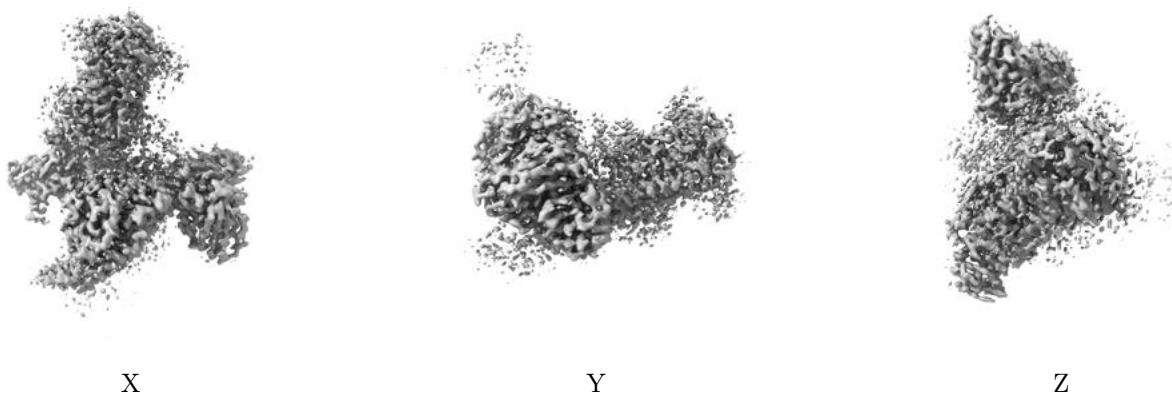


Z

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.

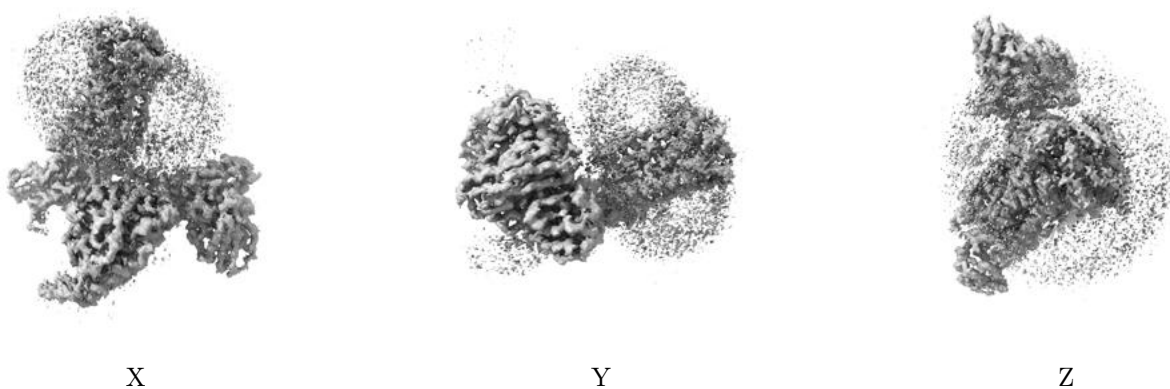
## 6.5 Orthogonal surface views [i](#)

### 6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.01. 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.

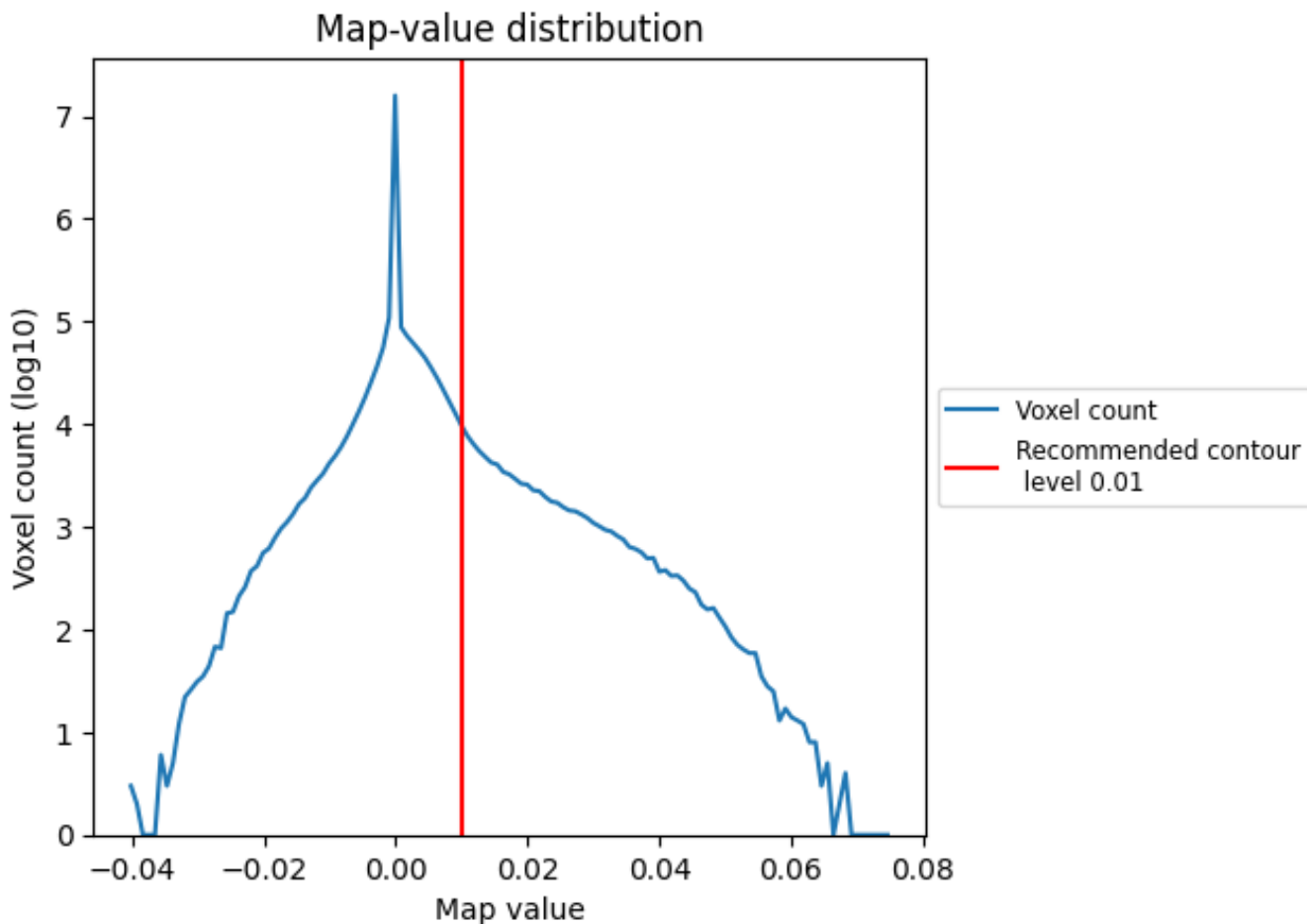
## 6.6 Mask visualisation [i](#)

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

## 7 Map analysis [i](#)

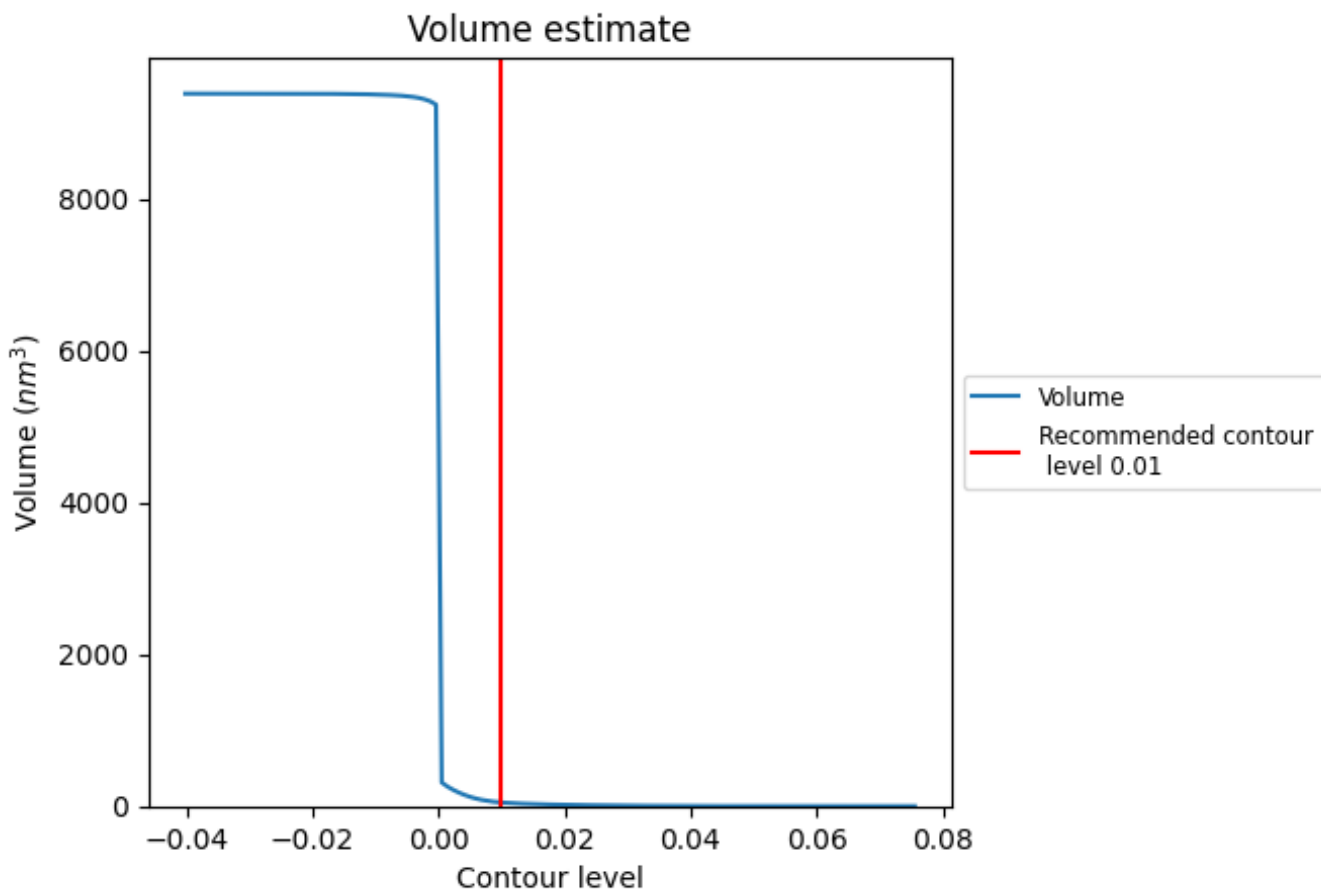
This section contains the results of statistical analysis of the map.

### 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.

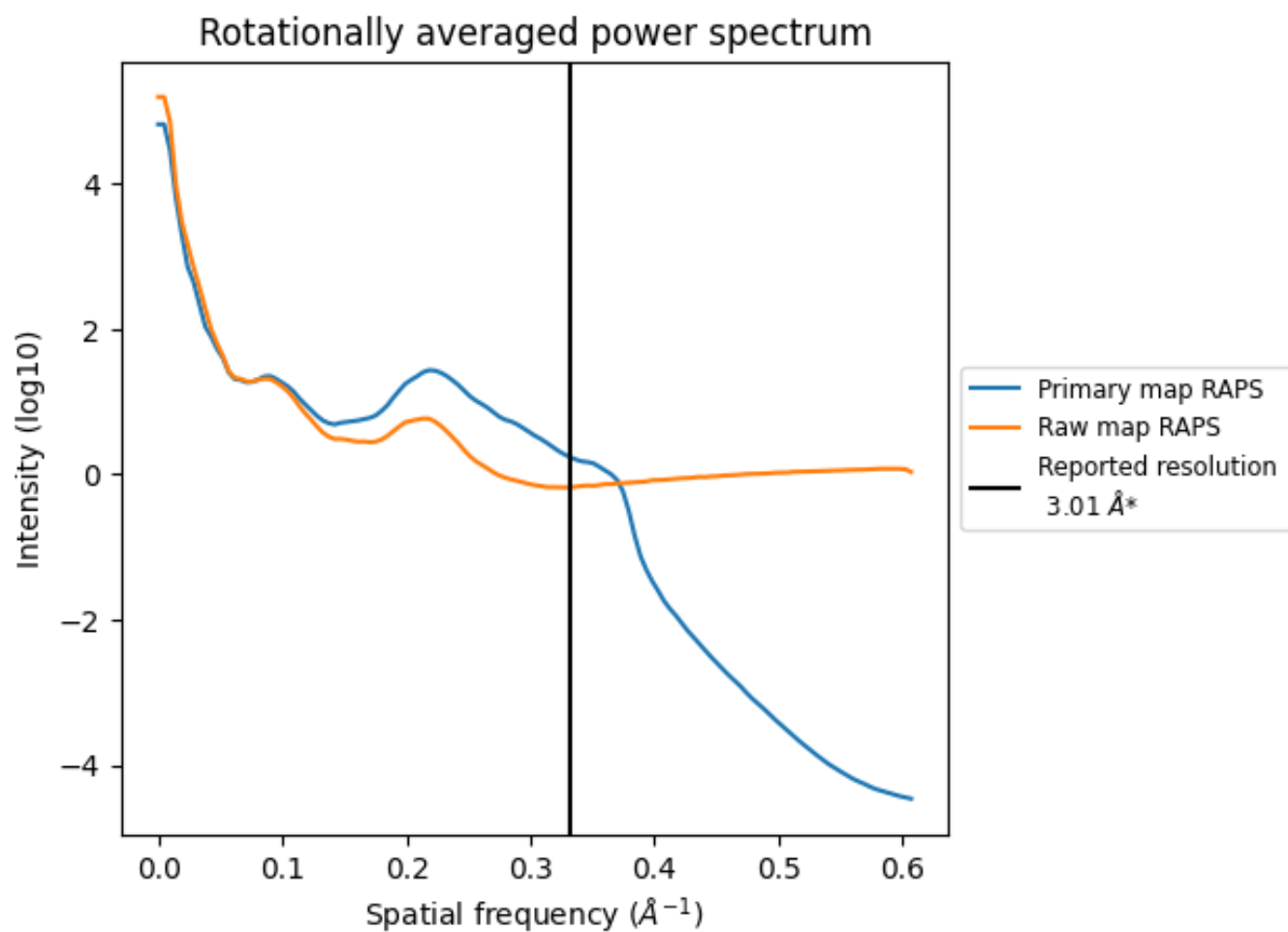
## 7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 48 nm<sup>3</sup>; this corresponds to an approximate mass of 44 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](#)

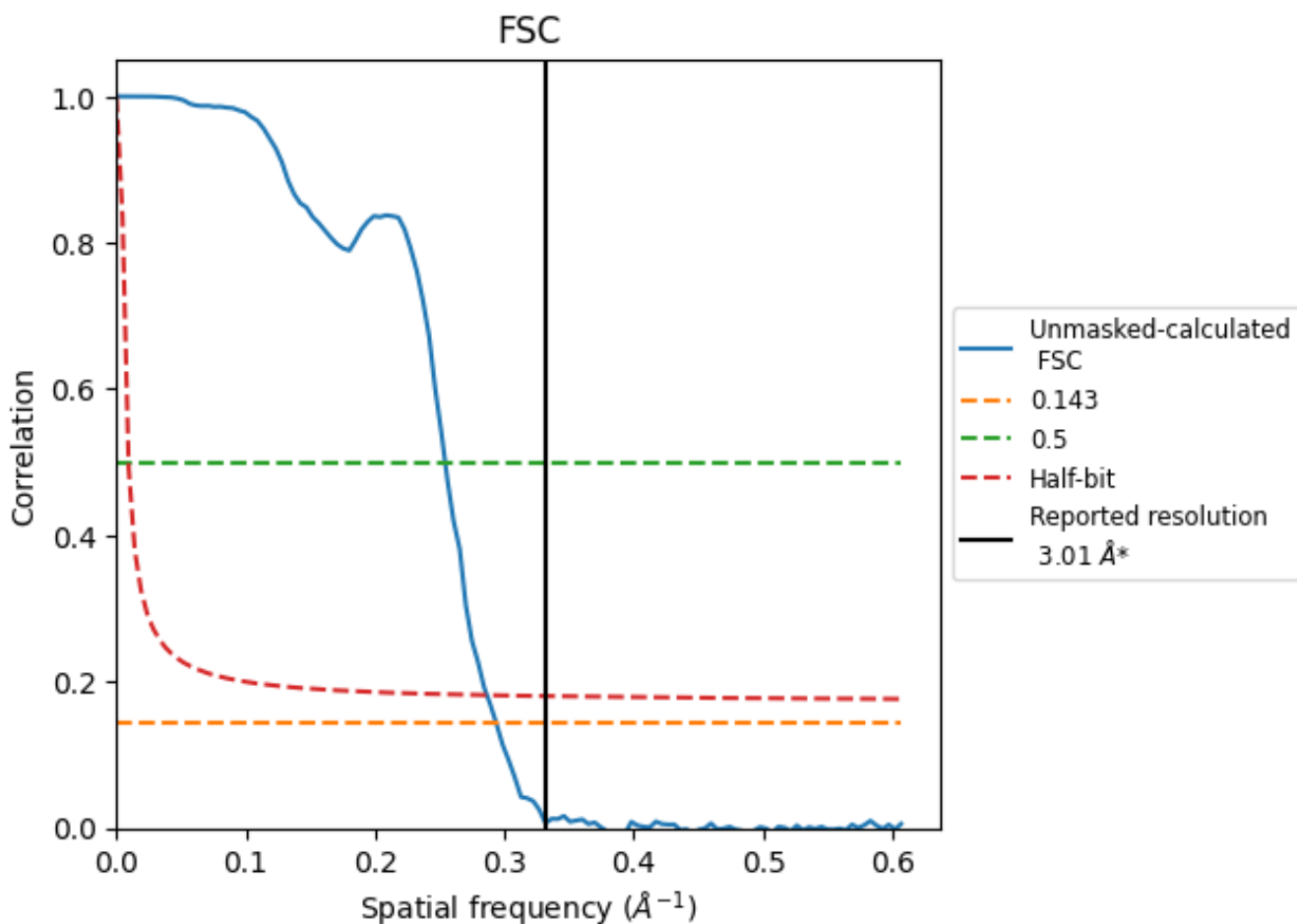


\*Reported resolution corresponds to spatial frequency of 0.332 Å<sup>-1</sup>

## 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 0.332 Å<sup>-1</sup>

## 8.2 Resolution estimates [i](#)

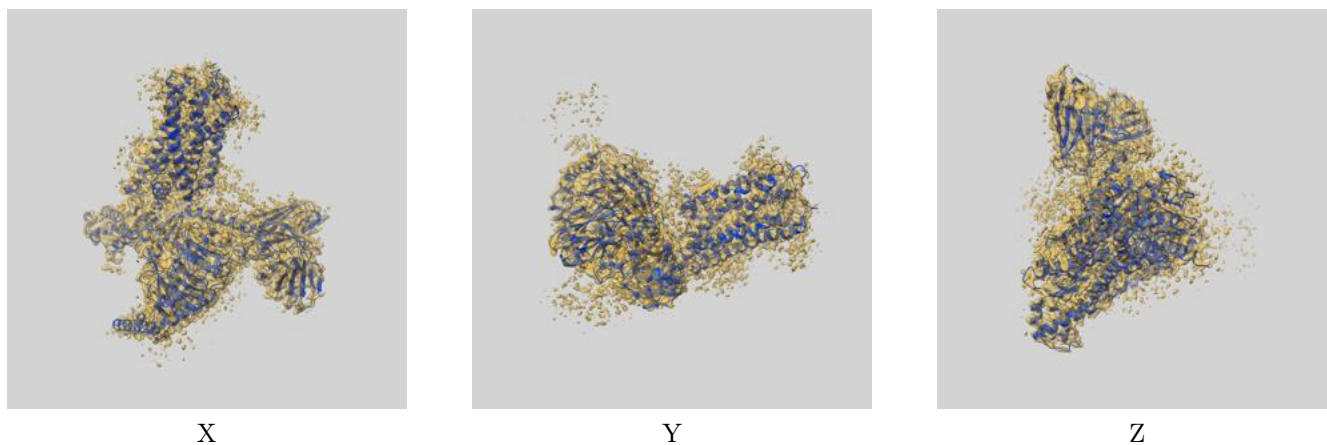
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.01	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.40	3.93	3.49

\*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 3.40 differs from the reported value 3.01 by more than 10 %

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

This section contains information regarding the fit between EMDB map EMD-37823 and PDB model 8WSS. Per-residue inclusion information can be found in section 3 on page 7.

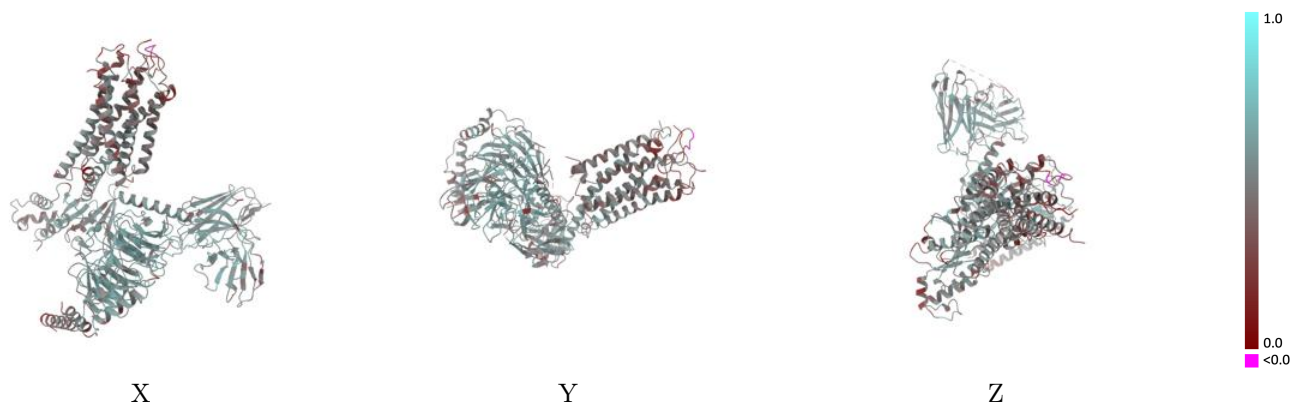
### 9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.01 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.

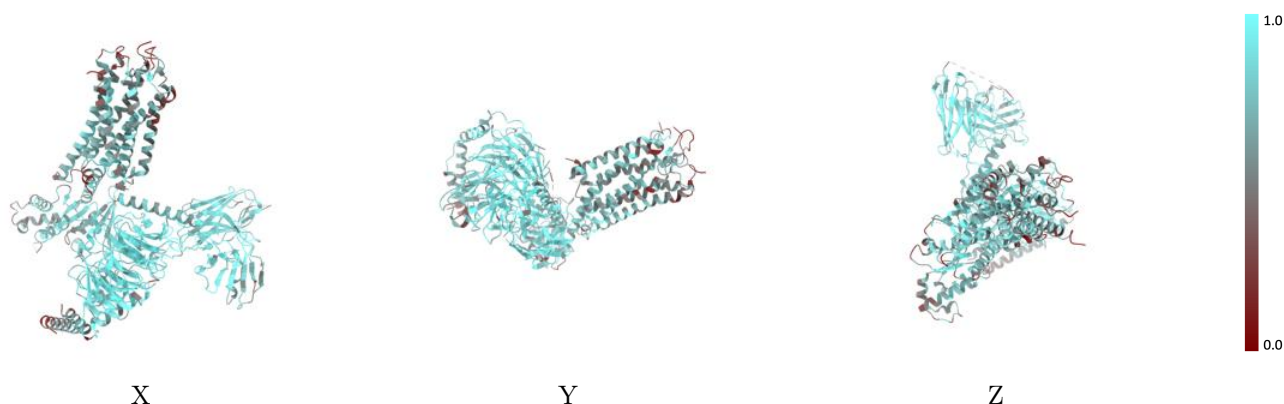


## 9.2 Q-score mapped to coordinate model [i](#)



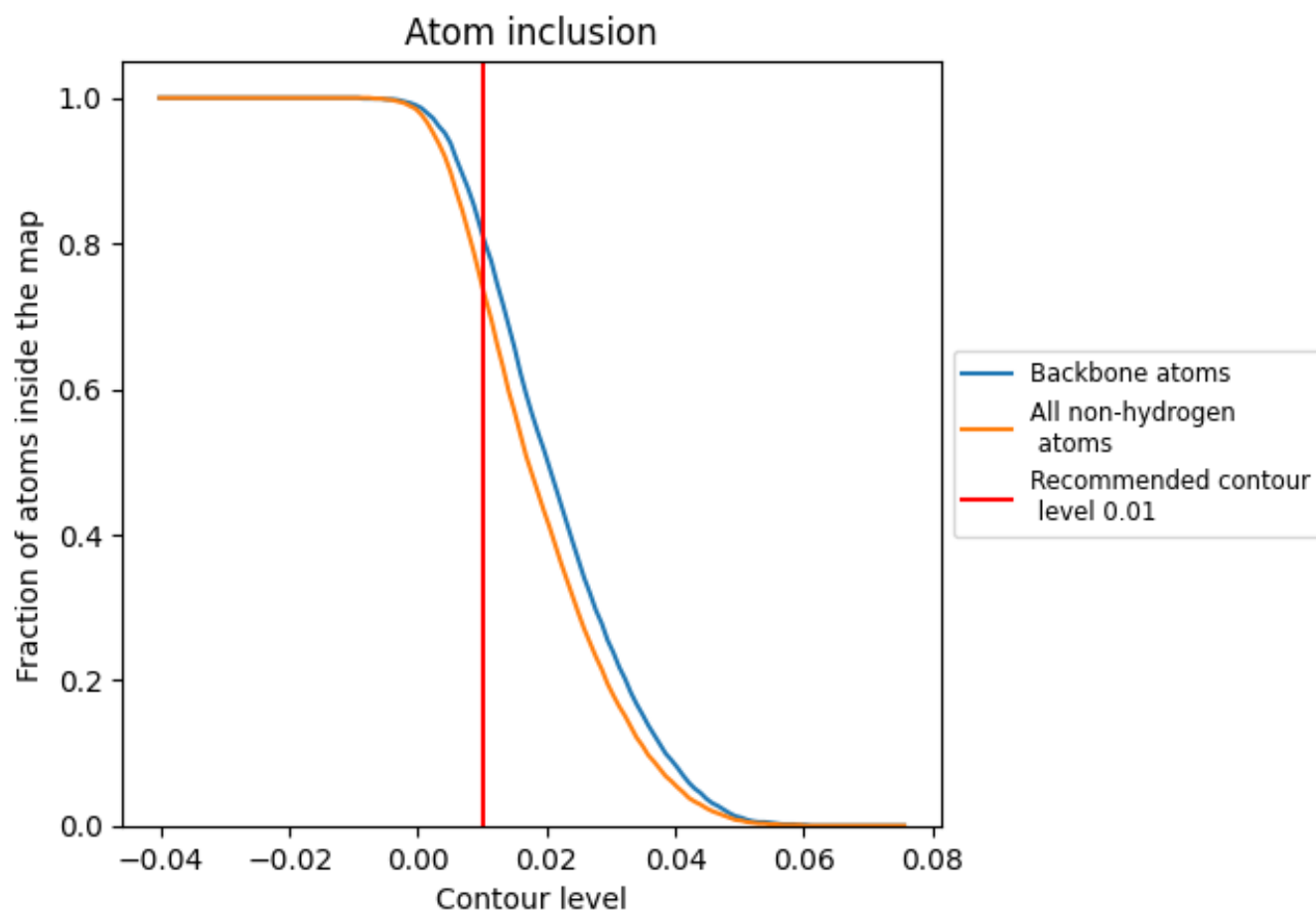
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.01).















## 9.4 Atom inclusion [i](#)



At the recommended contour level, 81% of all backbone atoms, 74% 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 (0.01) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.7400	 0.4950
A	 0.7010	 0.4870
B	 0.8510	 0.5580
G	 0.6820	 0.4520
H	 0.8240	 0.5390
L	 0.4330	 0.2940
R	 0.6100	 0.4170

