



wwPDB EM Validation Summary Report ⓘ

Sep 14, 2026 – 05:05 PM JST

PDB ID : 9U40 / pdb_00009u40
EMDB ID : EMD-63831
Title : Cryo-EM structure of peptide GPCR-Gq complex
Authors : Liu, S.H.; Zhang, Y.J.; Hua, T.; Liu, Z.J.
Deposited on : 2025-03-19
Resolution : 3.04 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.dev133
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) : 2.50

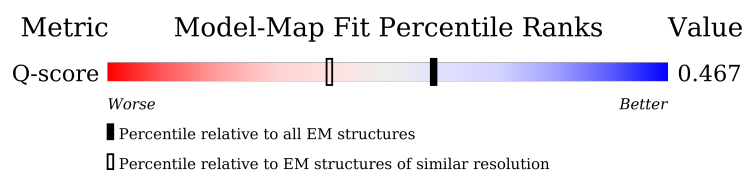
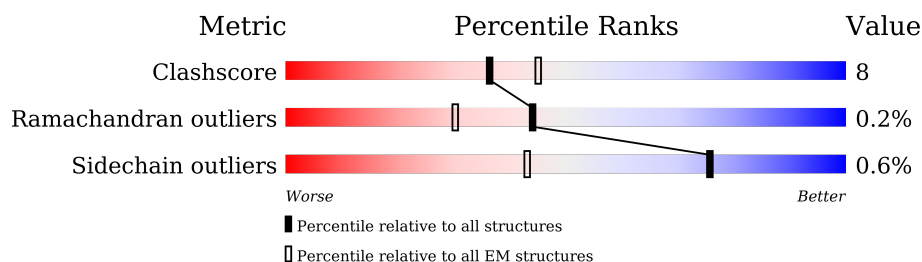
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.04 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	13952 (2.54 - 3.54)

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	R	855	
2	P	10	
3	A	246	
4	B	377	

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Mol	Chain	Length	Quality of chain
5	G	71	6%77%20%
6	N	157	67%13%20%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 8211 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 exo-alpha-sialidase, Vasopressin V1a receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	R	290	Total	C	N	O	S	0	0
			2325	1527	393	382	23		

There are 46 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	-458	MET	-	initiating methionine	UNP Q59310
R	-457	LYS	-	expression tag	UNP Q59310
R	-456	THR	-	expression tag	UNP Q59310
R	-455	ILE	-	expression tag	UNP Q59310
R	-454	ILE	-	expression tag	UNP Q59310
R	-453	ALA	-	expression tag	UNP Q59310
R	-452	LEU	-	expression tag	UNP Q59310
R	-451	SER	-	expression tag	UNP Q59310
R	-450	TYR	-	expression tag	UNP Q59310
R	-449	ILE	-	expression tag	UNP Q59310
R	-448	PHE	-	expression tag	UNP Q59310
R	-447	CYS	-	expression tag	UNP Q59310
R	-446	LEU	-	expression tag	UNP Q59310
R	-445	VAL	-	expression tag	UNP Q59310
R	-444	PHE	-	expression tag	UNP Q59310
R	-443	ALA	-	expression tag	UNP Q59310
R	-442	ASP	-	expression tag	UNP Q59310
R	-441	TYR	-	expression tag	UNP Q59310
R	-440	LYS	-	expression tag	UNP Q59310
R	-439	ASP	-	expression tag	UNP Q59310
R	-438	ASP	-	expression tag	UNP Q59310
R	-437	ASP	-	expression tag	UNP Q59310
R	-436	ASP	-	expression tag	UNP Q59310
R	-435	ALA	-	expression tag	UNP Q59310
R	-434	GLY	-	expression tag	UNP Q59310
R	-433	ARG	-	expression tag	UNP Q59310
R	-432	ALA	-	expression tag	UNP Q59310
R	-281	SER	GLY	conflict	UNP Q59310

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Chain	Residue	Modelled	Actual	Comment	Reference
R	379	LEU	-	expression tag	UNP P37288
R	380	GLU	-	expression tag	UNP P37288
R	381	VAL	-	expression tag	UNP P37288
R	382	LEU	-	expression tag	UNP P37288
R	383	PHE	-	expression tag	UNP P37288
R	384	GLN	-	expression tag	UNP P37288
R	385	GLY	-	expression tag	UNP P37288
R	386	PRO	-	expression tag	UNP P37288
R	387	HIS	-	expression tag	UNP P37288
R	388	HIS	-	expression tag	UNP P37288
R	389	HIS	-	expression tag	UNP P37288
R	390	HIS	-	expression tag	UNP P37288
R	391	HIS	-	expression tag	UNP P37288
R	392	HIS	-	expression tag	UNP P37288
R	393	HIS	-	expression tag	UNP P37288
R	394	HIS	-	expression tag	UNP P37288
R	395	HIS	-	expression tag	UNP P37288
R	396	HIS	-	expression tag	UNP P37288

- Molecule 2 is a protein called Arg-vasopressin.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	P	10	Total	C	N	O	S	0	1
			75	46	15	12	2		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
P	10	NH2	-	amidation	UNP P01185

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(q) subunit alpha-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	A	221	Total	C	N	O	S	0	0
			1813	1144	322	340	7		

- Molecule 4 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	B	338	Total	C	N	O	S	0	0
			2600	1604	467	508	21		

There are 38 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-5	MET	-	initiating methionine	UNP P62873
B	-4	HIS	-	expression tag	UNP P62873
B	-3	HIS	-	expression tag	UNP P62873
B	-2	HIS	-	expression tag	UNP P62873
B	-1	HIS	-	expression tag	UNP P62873
B	0	HIS	-	expression tag	UNP P62873
B	1	HIS	-	expression tag	UNP P62873
B	2	GLY	-	expression tag	UNP P62873
B	3	SER	-	expression tag	UNP P62873
B	4	LEU	-	expression tag	UNP P62873
B	5	LEU	-	expression tag	UNP P62873
B	6	GLN	-	expression tag	UNP P62873
B	346	GLY	-	expression tag	UNP P62873
B	347	SER	-	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	GLY	-	expression tag	UNP P62873
B	355	GLY	-	expression tag	UNP P62873
B	356	GLY	-	expression tag	UNP P62873
B	357	GLY	-	expression tag	UNP P62873
B	358	SER	-	expression tag	UNP P62873
B	359	SER	-	expression tag	UNP P62873
B	360	GLY	-	expression tag	UNP P62873
B	361	VAL	-	expression tag	UNP P62873
B	362	SER	-	expression tag	UNP P62873
B	363	GLY	-	expression tag	UNP P62873
B	364	TRP	-	expression tag	UNP P62873
B	365	ARG	-	expression tag	UNP P62873
B	366	LEU	-	expression tag	UNP P62873
B	367	PHE	-	expression tag	UNP P62873
B	368	LYS	-	expression tag	UNP P62873
B	369	LYS	-	expression tag	UNP P62873
B	370	ILE	-	expression tag	UNP P62873
B	371	SER	-	expression tag	UNP P62873

- Molecule 5 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	G	57	Total	C	N	O	S	0	0
			436	273	77	83	3		

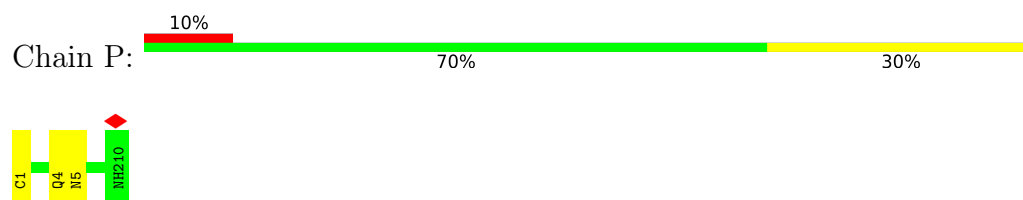
- Molecule 6 is a protein called Nanobody 35.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	N	126	Total	C	N	O	S	0	0
			961	599	168	188	6		

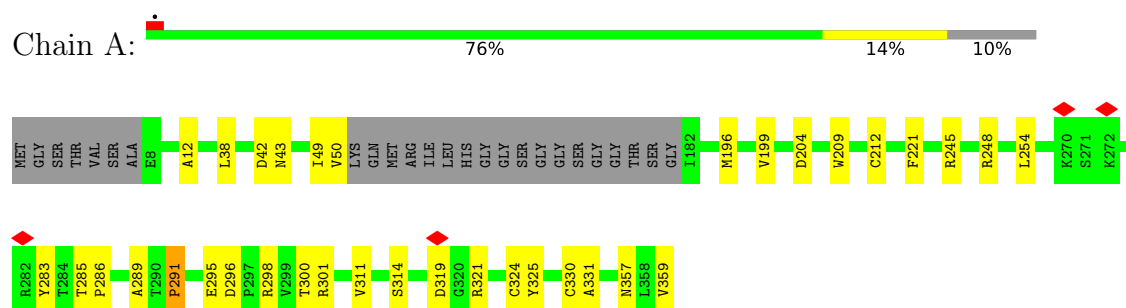
- Molecule 7 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
7	R	1	Total	Mg	0
			1	1	

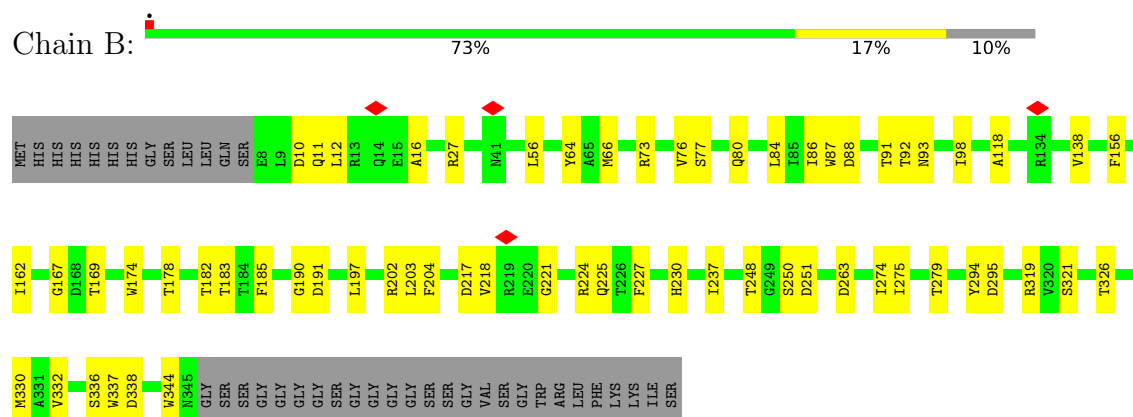
- Molecule 2: Arg-vasopressin



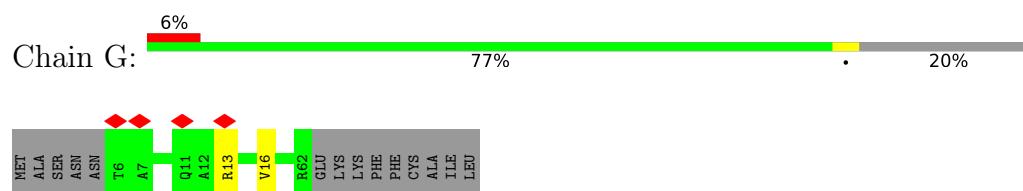
- Molecule 3: Guanine nucleotide-binding protein G(q) subunit alpha-1



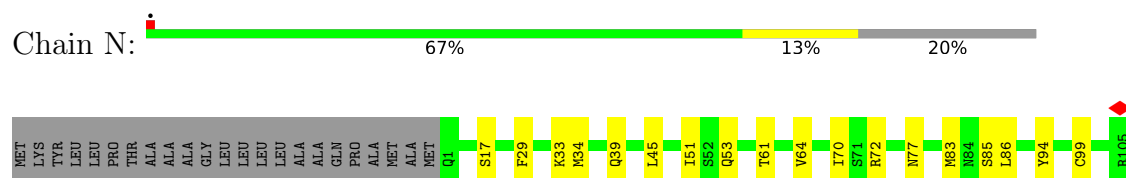
- Molecule 4: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1



- Molecule 5: Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2



- Molecule 6: Nanobody 35



F108	G121	V126	SER	SER	HIS	HIS	HIS	HIS	HIS	HIS
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4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	313990	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING ONLY	Depositor
Microscope	FEI TALOS ARCTICA	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	60	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	1600	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	2.209	Depositor
Minimum map value	-0.027	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.021	Depositor
Recommended contour level	0.1	Depositor
Map size ($\text{\AA}$)	307.19998, 307.19998, 307.19998	wwPDB
Map dimensions	320, 320, 320	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	0.9599999, 0.9599999, 0.9599999	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NH2, MG

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	R	0.18	0/2394	0.31	0/3267
2	P	0.26	0/76	0.42	0/101
3	A	0.19	0/1846	0.35	1/2486 (0.0%)
4	B	0.17	0/2647	0.33	0/3589
5	G	0.13	0/442	0.23	0/597
6	N	0.17	0/981	0.32	0/1329
All	All	0.18	0/8386	0.32	1/11369 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	291	PRO	CA-N-CD	-7.62	101.33	112.00

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	R	2325	0	2350	54	0
2	P	75	0	65	2	0
3	A	1813	0	1791	24	0
4	B	2600	0	2505	38	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	G	436	0	448	2	0
6	N	961	0	928	13	0
7	R	1	0	0	0	0
All	All	8211	0	8087	125	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 125 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:R:154:CYS:SG	1:R:242:ASN:ND2	2.48	0.87
1:R:129:HIS:CD2	1:R:130:LEU:HD12	2.16	0.81
3:A:286:PRO:HG2	3:A:289:ALA:HB2	1.69	0.74
3:A:330:CYS:SG	3:A:331:ALA:N	2.62	0.73
4:B:56:LEU:HD23	4:B:92:THR:HG23	1.71	0.71

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	R	286/855 (34%)	264 (92%)	20 (7%)	2 (1%)	18	49
2	P	8/10 (80%)	7 (88%)	1 (12%)	0	100	100
3	A	217/246 (88%)	203 (94%)	14 (6%)	0	100	100
4	B	336/377 (89%)	323 (96%)	13 (4%)	0	100	100
5	G	55/71 (78%)	53 (96%)	2 (4%)	0	100	100
6	N	124/157 (79%)	118 (95%)	6 (5%)	0	100	100
All	All	1026/1716 (60%)	968 (94%)	56 (6%)	2 (0%)	44	73

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	R	115	TYR
1	R	209	GLN

5.3.2 Protein sidechains ⓘ

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	R	253/734 (34%)	251 (99%)	2 (1%)	73	83
2	P	8/8 (100%)	7 (88%)	1 (12%)	4	18
3	A	197/213 (92%)	197 (100%)	0	100	100
4	B	281/308 (91%)	280 (100%)	1 (0%)	84	87
5	G	46/58 (79%)	46 (100%)	0	100	100
6	N	104/127 (82%)	103 (99%)	1 (1%)	68	81
All	All	889/1448 (61%)	884 (99%)	5 (1%)	76	85

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	R	102	PHE
1	R	131	GLN
2	P	1	CYS
4	B	64	TYR
6	N	108	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	R	131	GLN
1	R	242	ASN
3	A	244	ASN
4	B	67	HIS

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](#)

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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.

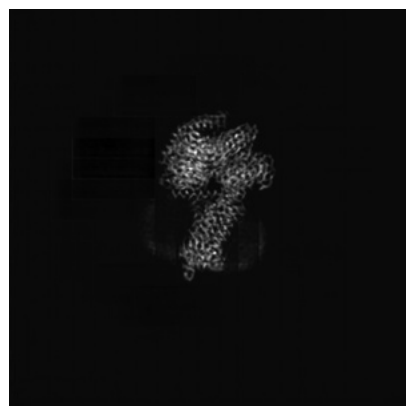
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-63831. These allow visual inspection of the internal detail of the map and identification of artifacts.

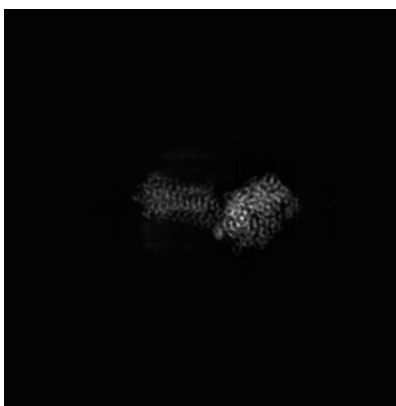
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

6.1.1 Primary map



X

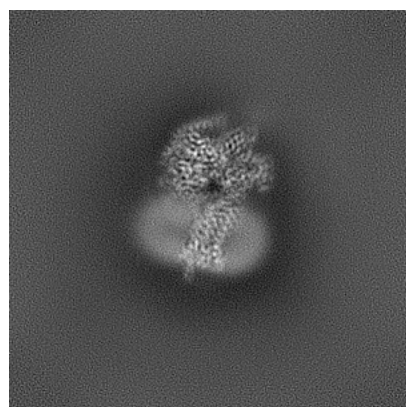


Y

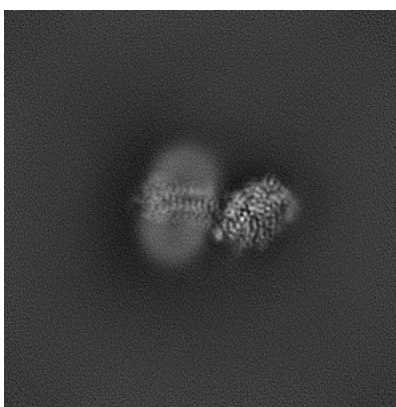


Z

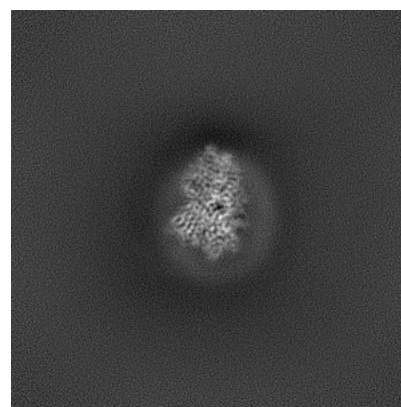
6.1.2 Raw map



X



Y



Z

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

6.2 Central slices [i](#)

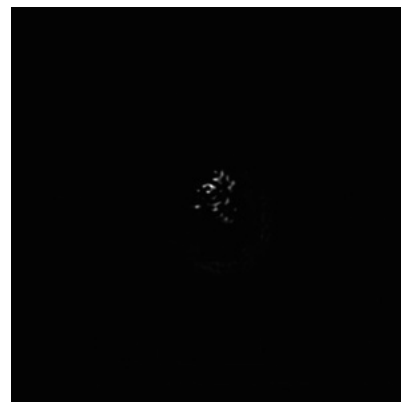
6.2.1 Primary map



X Index: 160

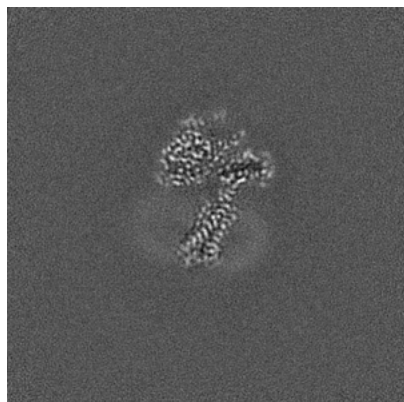


Y Index: 160

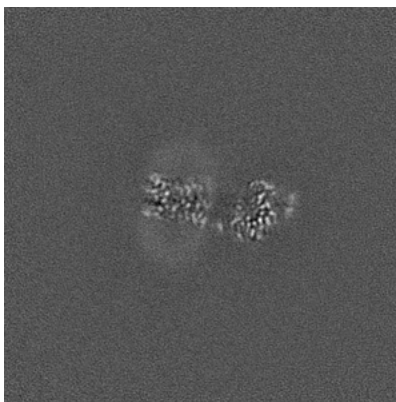


Z Index: 160

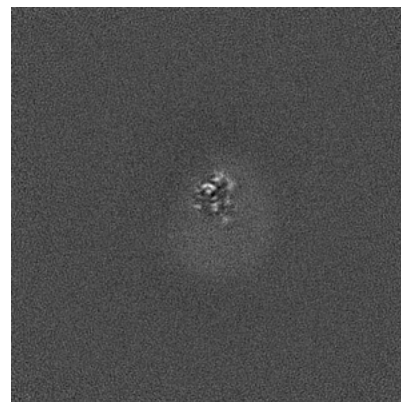
6.2.2 Raw map



X Index: 160



Y Index: 160



Z Index: 160

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

6.3 Largest variance slices [i](#)

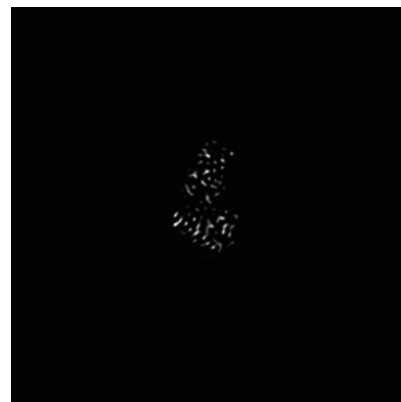
6.3.1 Primary map



X Index: 161

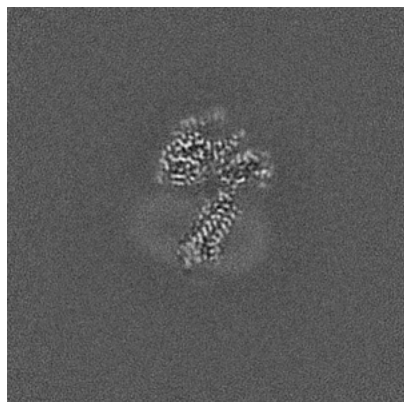


Y Index: 145

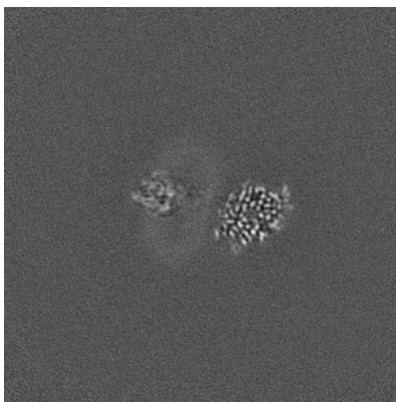


Z Index: 192

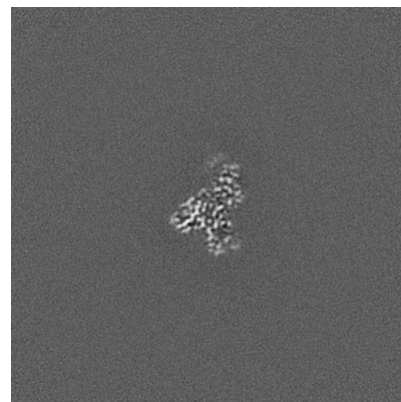
6.3.2 Raw map



X Index: 161



Y Index: 145



Z Index: 205

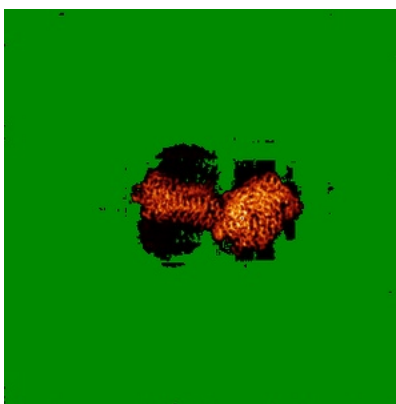
The images above show the largest variance slices of the map in three orthogonal directions.

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

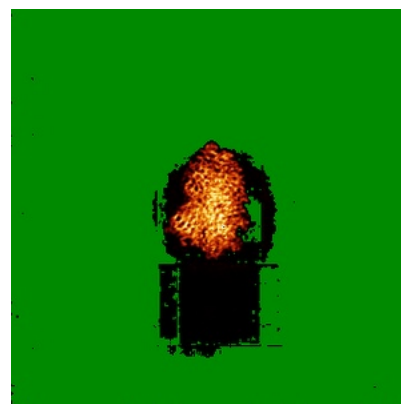
6.4.1 Primary map



X

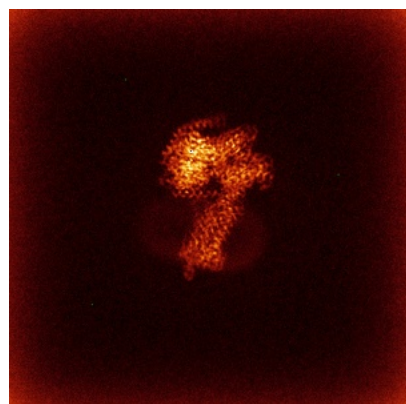


Y

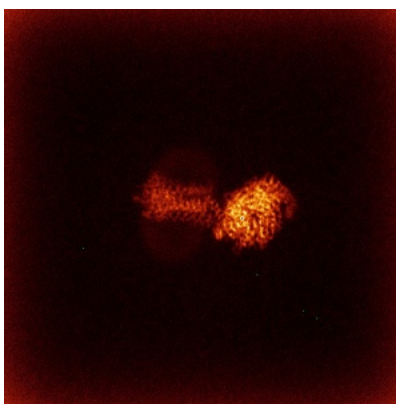


Z

6.4.2 Raw map



X



Y

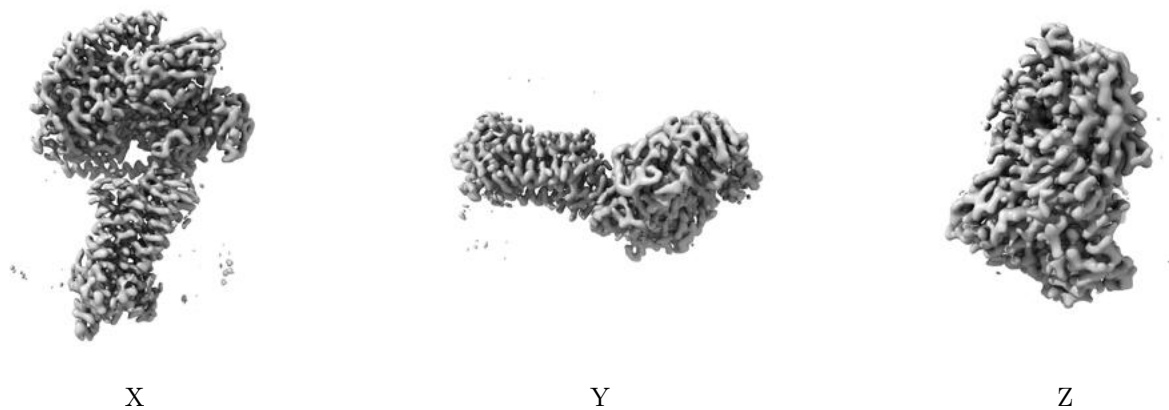


Z

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.

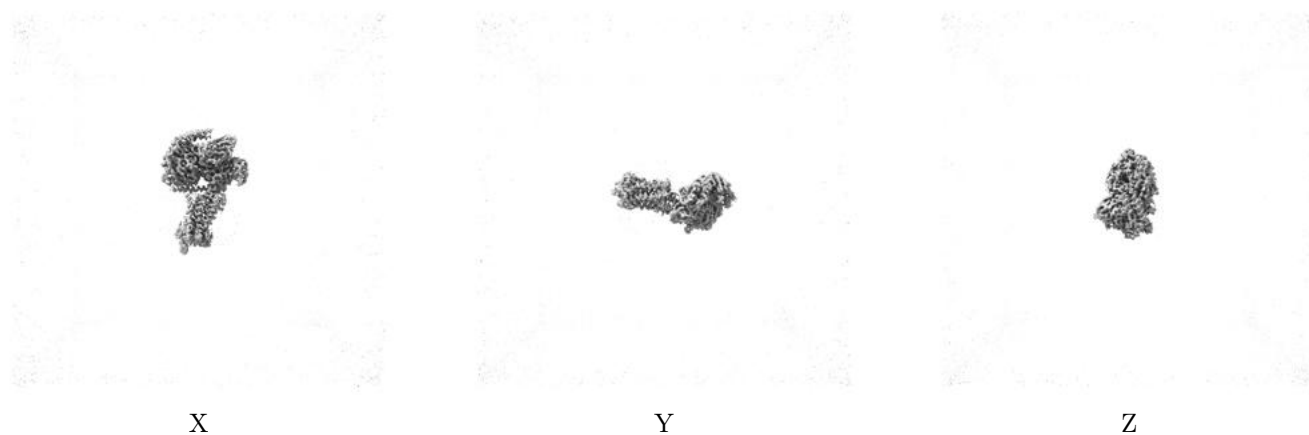
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.1. 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.

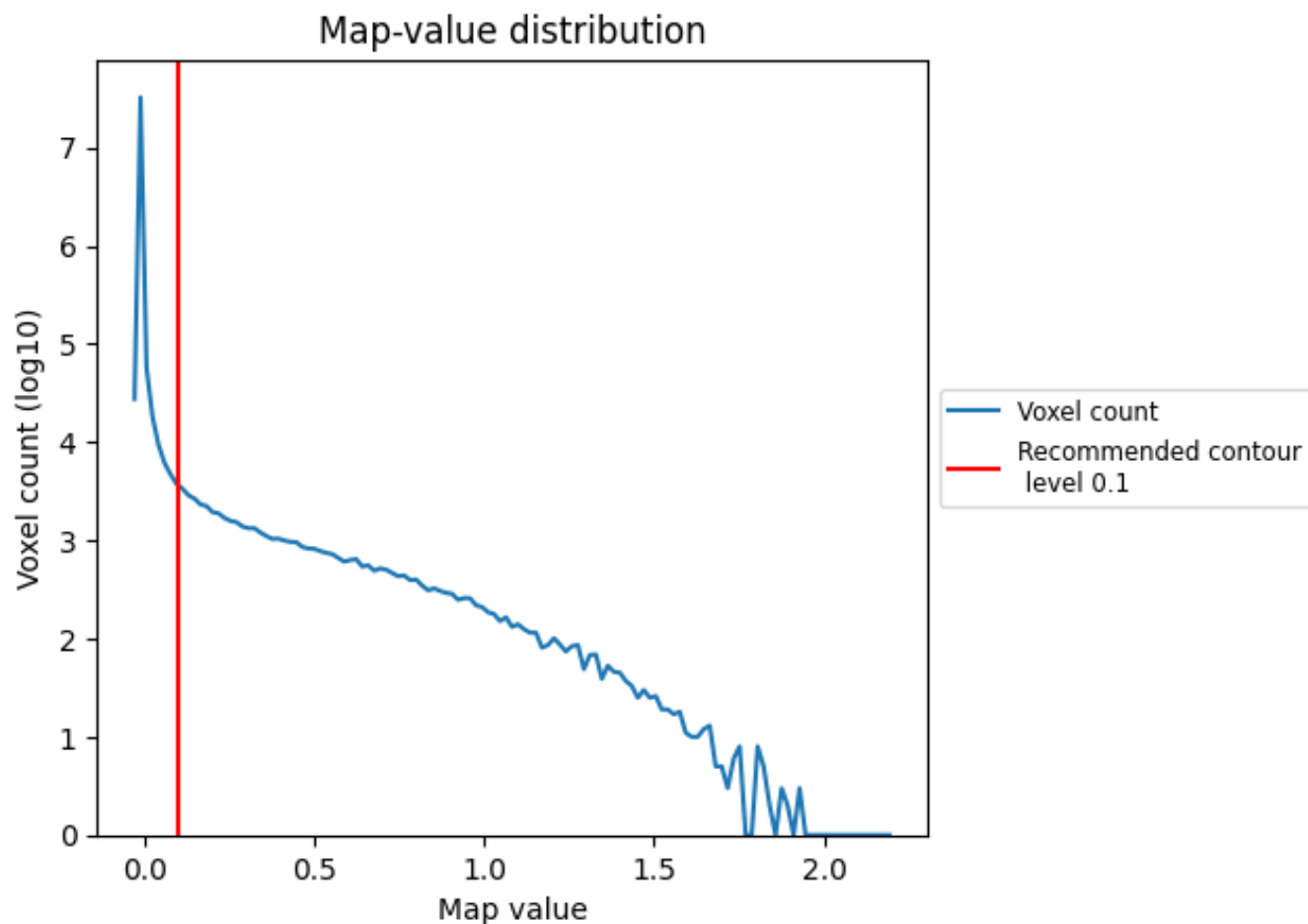
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

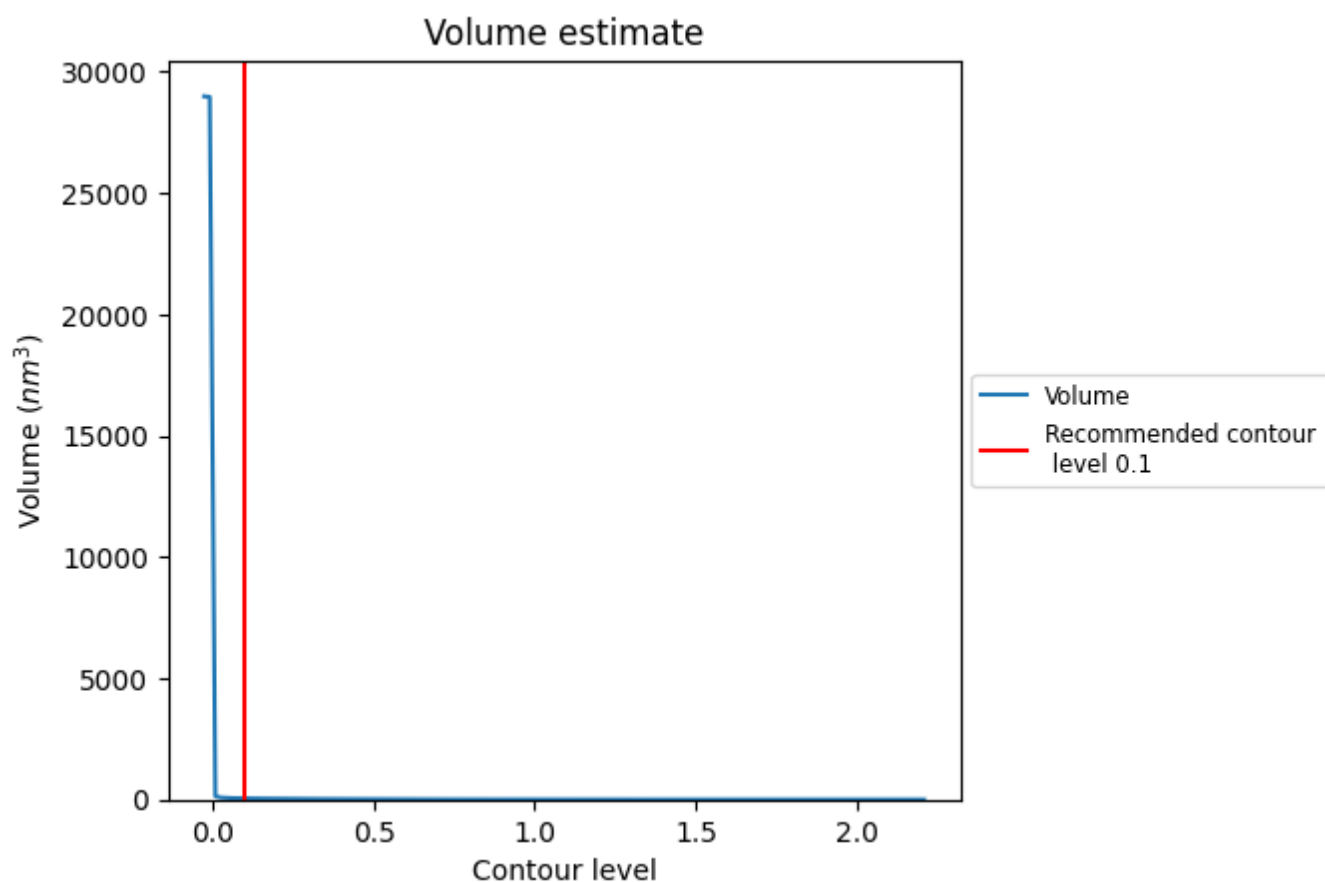
This section contains the results of statistical analysis of the map.

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.

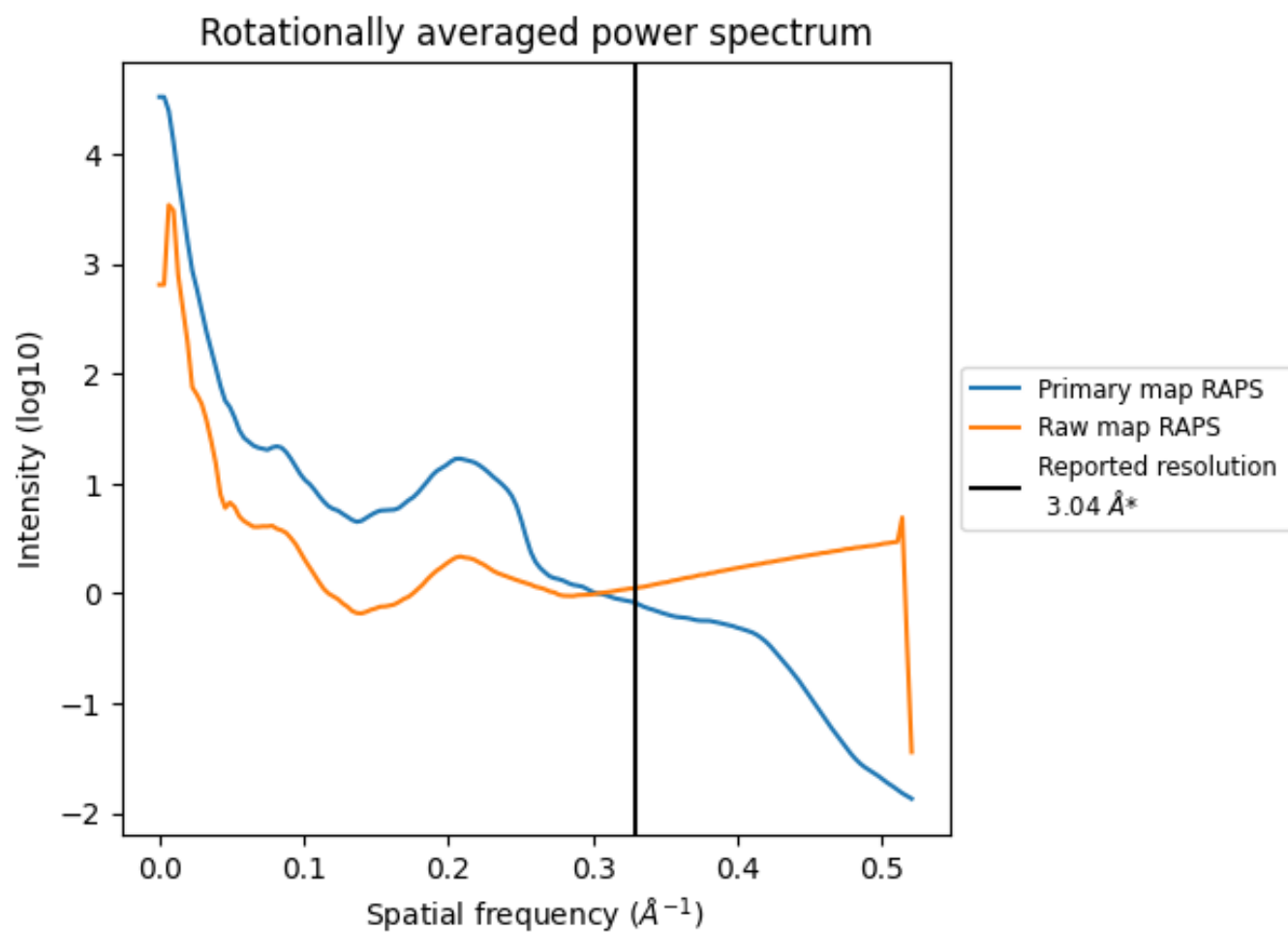
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 48 nm^3 ; this corresponds to an approximate mass of 43 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 ⓘ

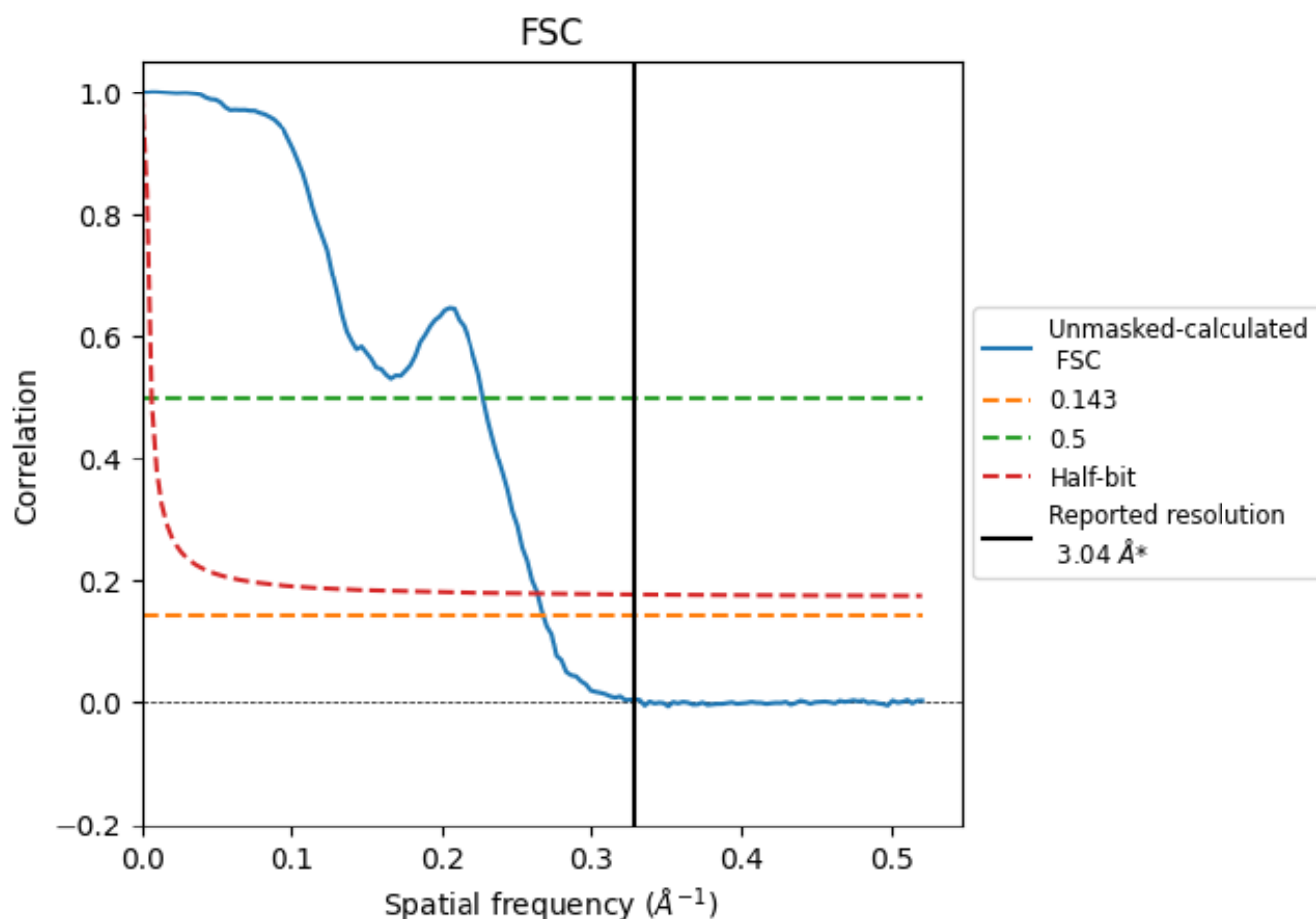


*Reported resolution corresponds to spatial frequency of 0.329 Å⁻¹

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 0.329 $\text{\AA}^{-1}$

8.2 Resolution estimates [i](#)

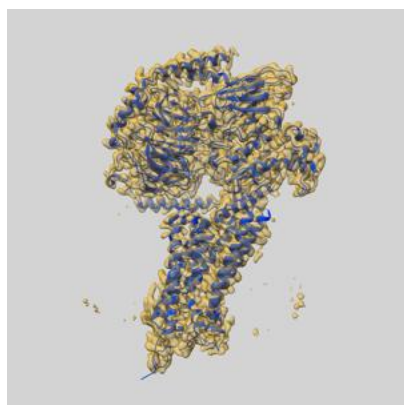
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.04	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.73	4.39	3.79

*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 3.73 differs from the reported value 3.04 by more than 10 %

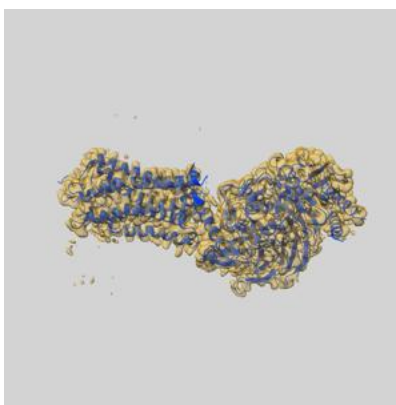
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-63831 and PDB model 9U40. Per-residue inclusion information can be found in [section 3](#) on [page 8](#).

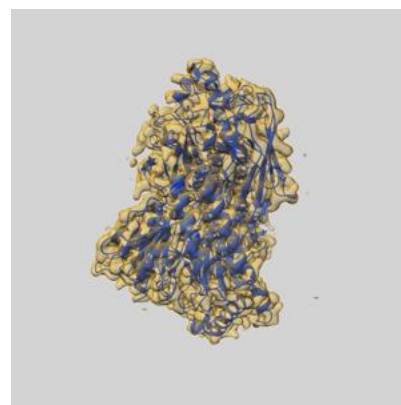
9.1 Map-model overlay [i](#)



X



Y



Z

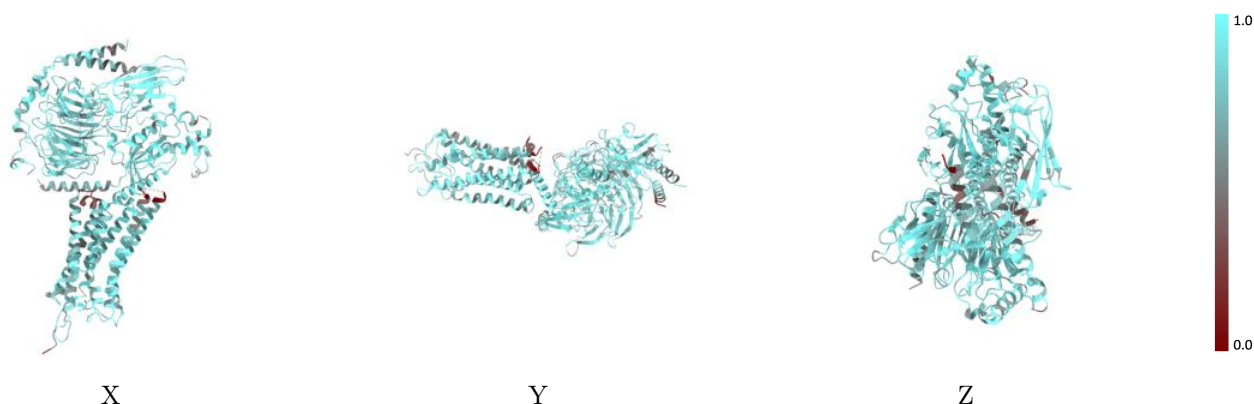
The images above show the 3D surface view of the map at the recommended contour level 0.1 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



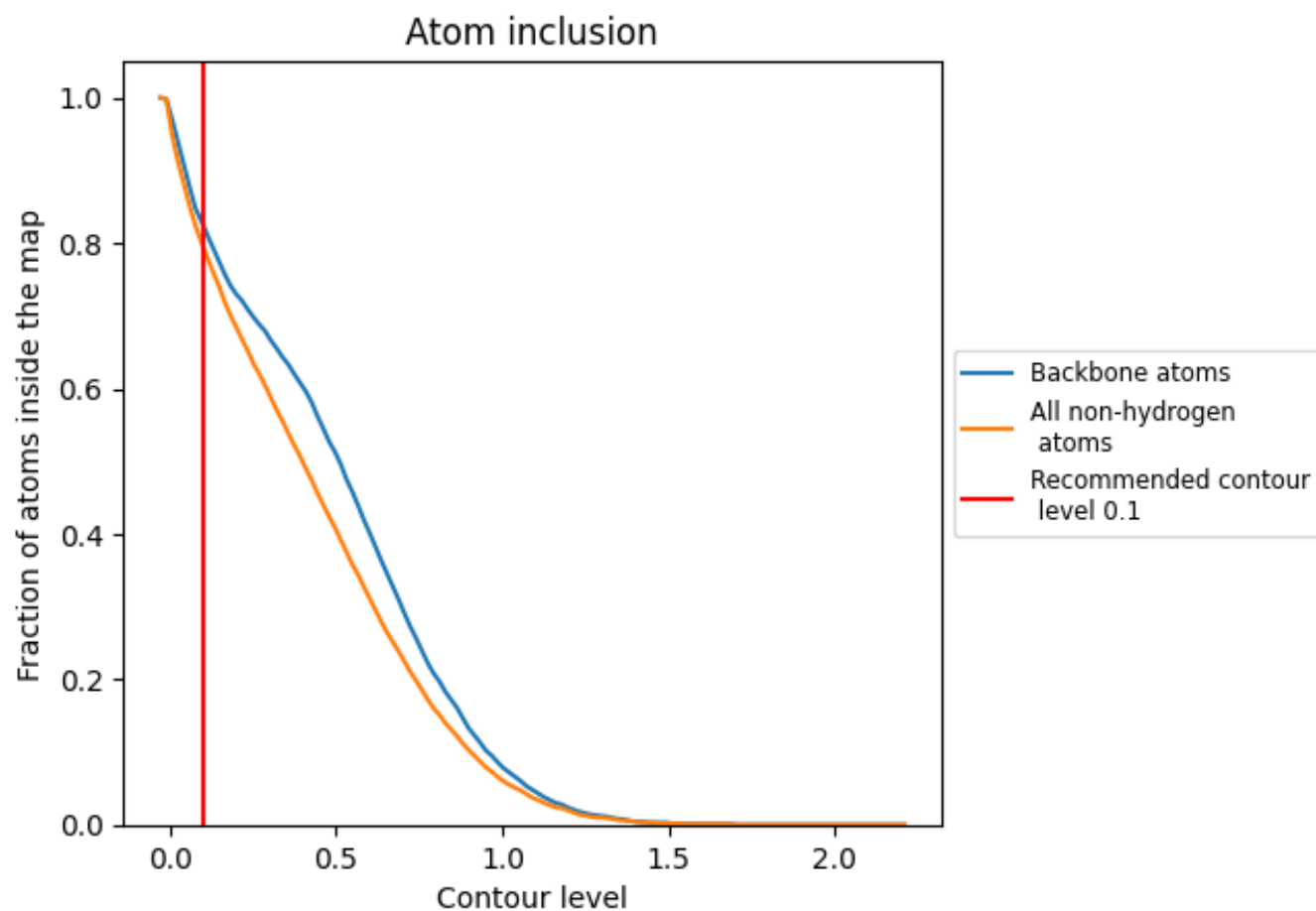
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.1).

9.4 Atom inclusion ⓘ



At the recommended contour level, 83% of all backbone atoms, 80% 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 (0.1) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7960	0.4670
A	0.8090	0.4790
B	0.8190	0.5020
G	0.7300	0.4260
N	0.8290	0.4960
P	0.9170	0.5410
R	0.7540	0.4120

1.0

0.0

<0.0