



## wwPDB EM Validation Summary Report ⓘ

Nov 6, 2022 – 05:11 AM EST

PDB ID : 6B3J  
EMDB ID : EMD-7039  
Title : 3.3 angstrom phase-plate cryo-EM structure of a biased agonist-bound human GLP-1 receptor-Gs complex  
Authors : Liang, Y.L.; Khoshouei, M.; Glukhova, A.; Furness, S.G.B.; Koole, C.; Zhao, P.; Clydesdale, L.; Thal, D.M.; Radjainia, M.; Danev, R.; Baumeister, W.; Wang, M.W.; Miller, L.J.; Christopoulos, A.; Sexton, P.M.; Wootten, D.  
Deposited on : 2017-09-22  
Resolution : 3.30 Å (reported)  
Based on initial models : 3C5T, 5VAI, 3SN6

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.dev43  
MolProbity : 4.02b-467  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : 1.9.9  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.31.2

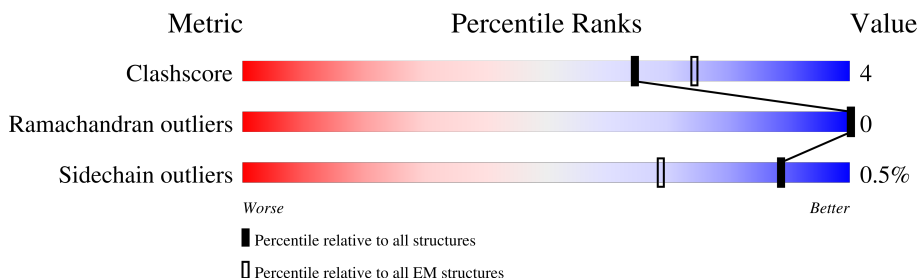
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 3.30 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	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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	R	491	
2	P	40	
3	A	394	
4	B	350	
5	G	71	
6	N	138	

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 9034 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 Glucagon-like peptide 1 receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	R	380	3134	2077	506	533	18	0	0

There are 52 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	-8	MET	-	initiating methionine	UNP P43220
R	-7	LYS	-	expression tag	UNP P43220
R	-6	THR	-	expression tag	UNP P43220
R	-5	ILE	-	expression tag	UNP P43220
R	-4	ILE	-	expression tag	UNP P43220
R	-3	ALA	-	expression tag	UNP P43220
R	-2	LEU	-	expression tag	UNP P43220
R	-1	SER	-	expression tag	UNP P43220
R	0	TYR	-	expression tag	UNP P43220
R	1	ILE	-	expression tag	UNP P43220
R	2	PHE	-	expression tag	UNP P43220
R	3	CYS	-	expression tag	UNP P43220
R	4	LEU	-	expression tag	UNP P43220
R	5	VAL	-	expression tag	UNP P43220
R	6	PHE	-	expression tag	UNP P43220
R	7	ALA	-	expression tag	UNP P43220
R	8	ASP	-	expression tag	UNP P43220
R	9	TYR	-	expression tag	UNP P43220
R	10	LYS	-	expression tag	UNP P43220
R	11	ASP	-	expression tag	UNP P43220
R	12	ASP	-	expression tag	UNP P43220
R	13	ASP	-	expression tag	UNP P43220
R	14	ASP	-	expression tag	UNP P43220
R	15	LEU	-	expression tag	UNP P43220
R	16	GLU	-	expression tag	UNP P43220
R	17	VAL	-	expression tag	UNP P43220
R	18	LEU	-	expression tag	UNP P43220
R	19	PHE	-	expression tag	UNP P43220

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Chain	Residue	Modelled	Actual	Comment	Reference
R	20	GLN	-	expression tag	UNP P43220
R	21	GLY	-	expression tag	UNP P43220
R	22	PRO	-	expression tag	UNP P43220
R	23	ALA	-	expression tag	UNP P43220
R	260	PHE	LEU	variant	UNP P43220
R	464	PRO	-	expression tag	UNP P43220
R	465	ALA	-	expression tag	UNP P43220
R	466	GLY	-	expression tag	UNP P43220
R	467	LEU	-	expression tag	UNP P43220
R	468	GLU	-	expression tag	UNP P43220
R	469	VAL	-	expression tag	UNP P43220
R	470	LEU	-	expression tag	UNP P43220
R	471	PHE	-	expression tag	UNP P43220
R	472	GLN	-	expression tag	UNP P43220
R	473	GLY	-	expression tag	UNP P43220
R	474	PRO	-	expression tag	UNP P43220
R	475	HIS	-	expression tag	UNP P43220
R	476	HIS	-	expression tag	UNP P43220
R	477	HIS	-	expression tag	UNP P43220
R	478	HIS	-	expression tag	UNP P43220
R	479	HIS	-	expression tag	UNP P43220
R	480	HIS	-	expression tag	UNP P43220
R	481	HIS	-	expression tag	UNP P43220
R	482	HIS	-	expression tag	UNP P43220

- Molecule 2 is a protein called Exendin-P5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	P	33	254	159	42	52	1	0	0

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(s) subunit alpha isoforms short.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	A	195	1654	1049	303	297	5	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	54	ASN	SER	engineered mutation	UNP P63092

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Chain	Residue	Modelled	Actual	Comment	Reference
A	226	ALA	GLY	engineered mutation	UNP P63092
A	268	ALA	GLU	engineered mutation	UNP P63092
A	271	LYS	ASN	engineered mutation	UNP P63092
A	274	ASP	LYS	engineered mutation	UNP P63092
A	280	LYS	ARG	engineered mutation	UNP P63092
A	284	ASP	THR	engineered mutation	UNP P63092
A	285	THR	ILE	engineered mutation	UNP P63092

- 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
			Total	C	N	O	S		
4	B	338	2595	1601	464	509	21	0	0

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-9	MET	-	initiating methionine	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	HIS	-	expression tag	UNP P62873
B	-2	GLY	-	expression tag	UNP P62873
B	-1	SER	-	expression tag	UNP P62873
B	0	SER	-	expression tag	UNP P62873
B	1	GLY	-	expression tag	UNP P62873

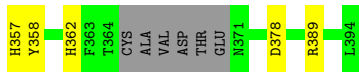
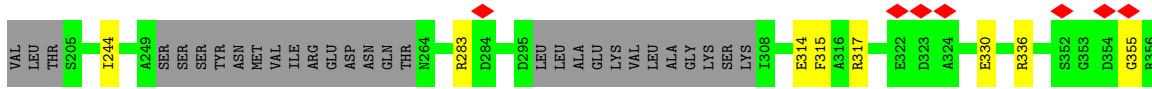
- Molecule 5 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

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

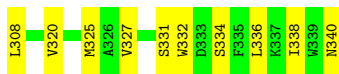
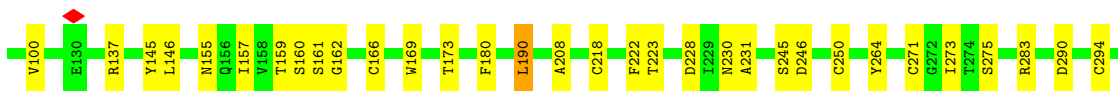
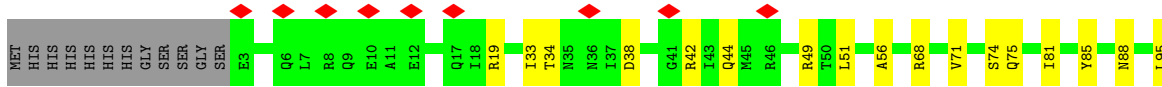
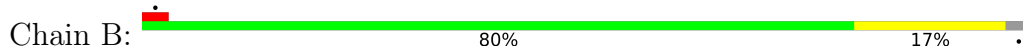
- Molecule 6 is a protein called Nanobody 35.

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

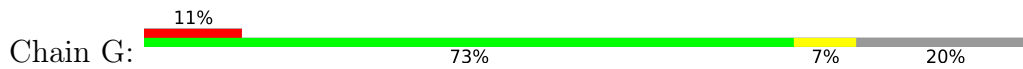




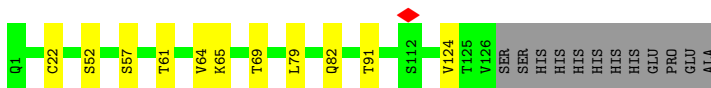
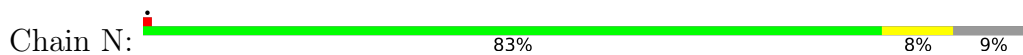
- Molecule 4: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1



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



- Molecule 6: Nanobody 35



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	614883	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE; Phase plate CTF correction	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	50	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	47170	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	0.191	Depositor
Minimum map value	-0.095	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.008	Depositor
Recommended contour level	0.04	Depositor
Map size ( $\text{\AA}$ )	211.99998, 211.99998, 211.99998	wwPDB
Map dimensions	200, 200, 200	wwPDB
Map angles ( $^\circ$ )	90.0, 90.0, 90.0	wwPDB
Pixel spacing ( $\text{\AA}$ )	1.06, 1.06, 1.06	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	R	0.36	0/3231	0.56	0/4403
2	P	0.35	0/257	0.60	0/345
3	A	0.35	0/1687	0.52	1/2266 (0.0%)
4	B	0.40	0/2642	0.63	1/3582 (0.0%)
5	G	0.30	0/442	0.52	0/597
6	N	0.41	0/981	0.59	0/1329
All	All	0.37	0/9240	0.58	2/12522 (0.0%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
1	R	0	1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
3	A	330	GLU	C-N-CA	5.55	135.57	121.70
4	B	190	LEU	CA-CB-CG	5.14	127.12	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	R	57	ALA	Peptide

## 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	R	3134	0	3085	24	0
2	P	254	0	248	6	0
3	A	1654	0	1622	11	0
4	B	2595	0	2494	35	0
5	G	436	0	448	3	0
6	N	961	0	928	6	0
All	All	9034	0	8825	75	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 4.

The worst 5 of 75 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:56:PRO:HD3	1:R:64:ARG:HH21	1.58	0.69
1:R:91:TRP:NE1	1:R:127:GLU:O	2.30	0.65
1:R:172:LEU:O	1:R:177:ASN:ND2	2.31	0.64
4:B:208:ALA:HB3	4:B:222:PHE:HB2	1.80	0.64
4:B:294:CYS:HB2	4:B:308:LEU:HB2	1.81	0.62

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	374/491 (76%)	359 (96%)	15 (4%)	0	<b>100</b> <b>100</b>

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	P	31/40 (78%)	29 (94%)	2 (6%)	0	100	100
3	A	185/394 (47%)	181 (98%)	4 (2%)	0	100	100
4	B	336/350 (96%)	320 (95%)	16 (5%)	0	100	100
5	G	55/71 (78%)	54 (98%)	1 (2%)	0	100	100
6	N	124/138 (90%)	116 (94%)	8 (6%)	0	100	100
All	All	1105/1484 (74%)	1059 (96%)	46 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	R	337/436 (77%)	335 (99%)	2 (1%)	86	91
2	P	27/32 (84%)	26 (96%)	1 (4%)	34	63
3	A	177/349 (51%)	176 (99%)	1 (1%)	86	91
4	B	280/291 (96%)	279 (100%)	1 (0%)	91	95
5	G	46/58 (79%)	46 (100%)	0	100	100
6	N	104/115 (90%)	104 (100%)	0	100	100
All	All	971/1281 (76%)	966 (100%)	5 (0%)	89	93

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

Mol	Chain	Res	Type
1	R	115	ASN
1	R	240	ASN
2	P	5	ASN
3	A	42	ARG
4	B	155	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:

Mol	Chain	Res	Type
4	B	16	ASN
4	B	155	ASN
5	G	18	GLN
2	P	14	GLN
3	A	19	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 monosaccharides 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.

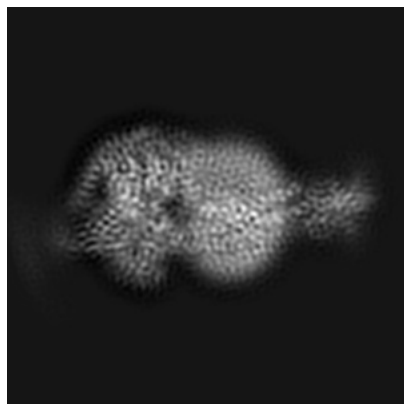
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-7039. These allow visual inspection of the internal detail of the map and identification of artifacts.

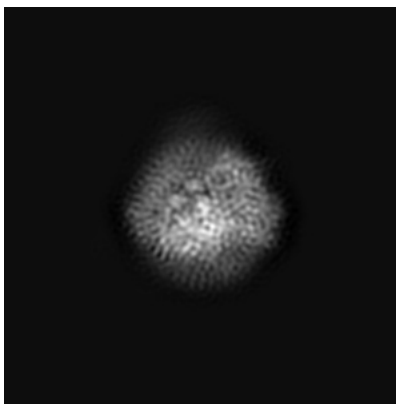
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

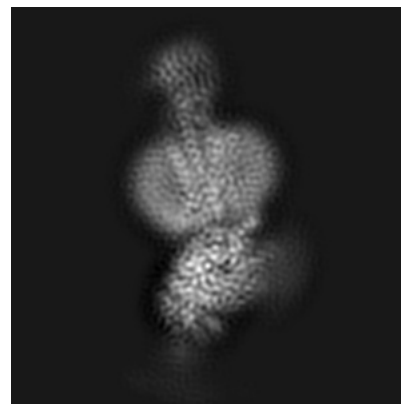
#### 6.1.1 Primary map



X

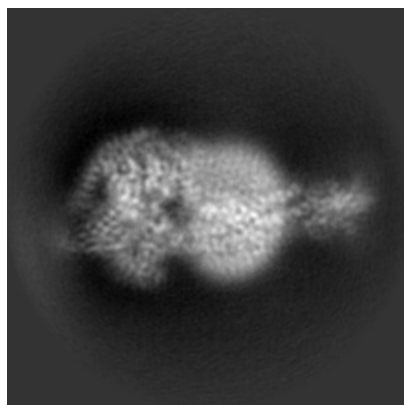


Y

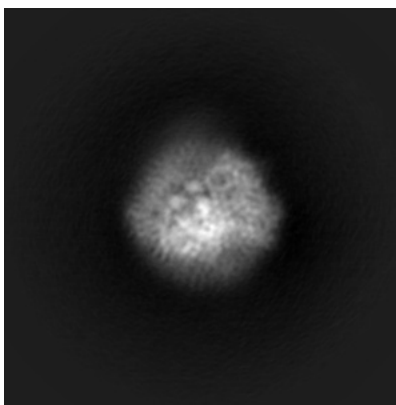


Z

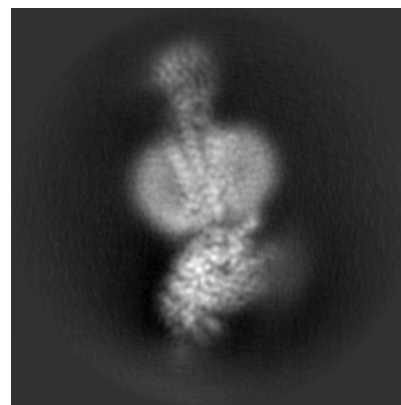
#### 6.1.2 Raw map



X



Y

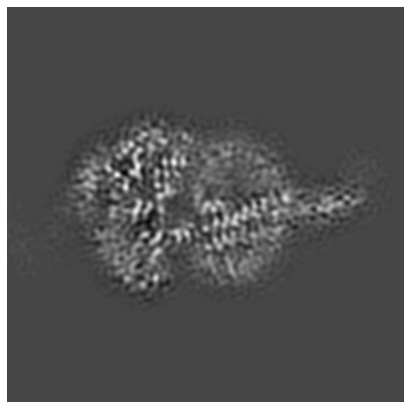


Z

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

## 6.2 Central slices [i](#)

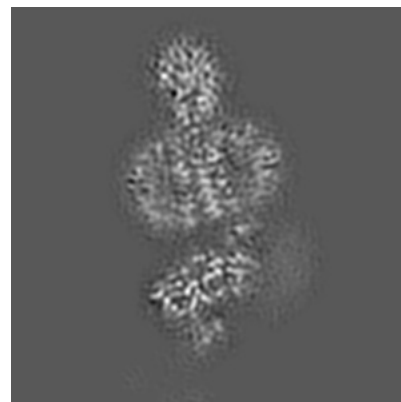
### 6.2.1 Primary map



X Index: 100

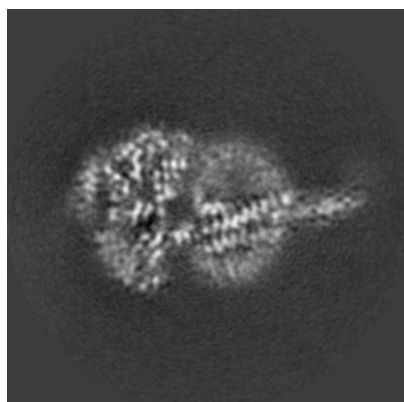


Y Index: 100

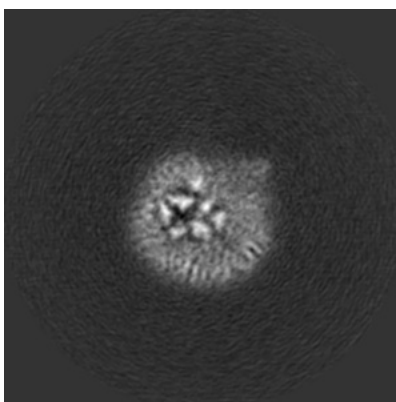


Z Index: 100

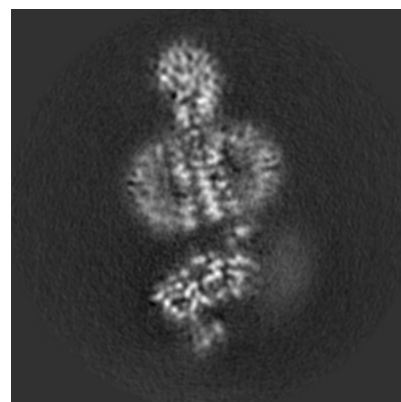
### 6.2.2 Raw map



X Index: 100



Y Index: 100

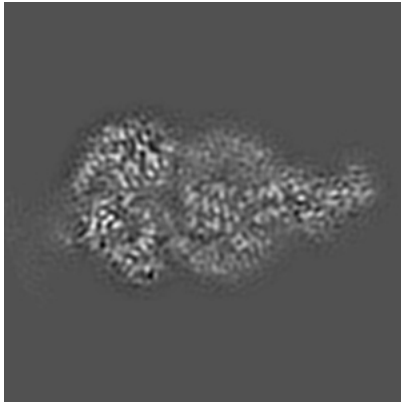


Z Index: 100

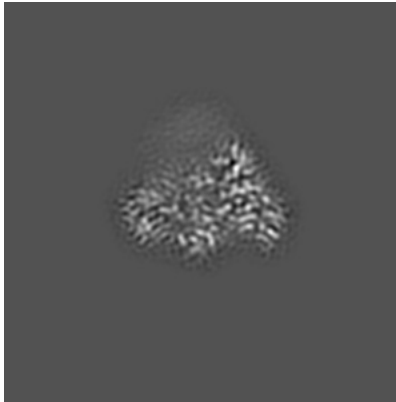
The images above show central slices of the map in three orthogonal directions.

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

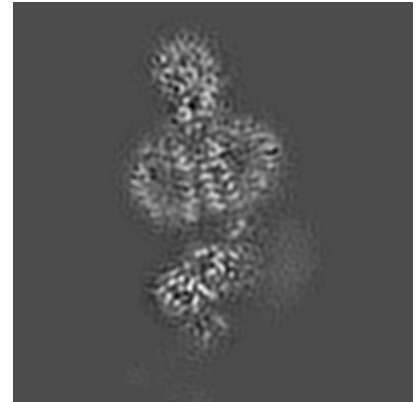
### 6.3.1 Primary map



X Index: 90

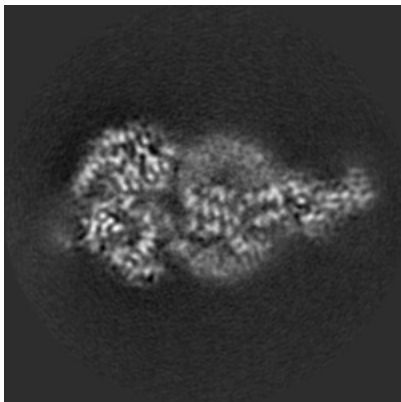


Y Index: 62

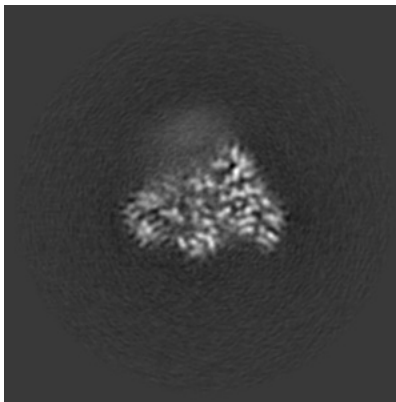


Z Index: 99

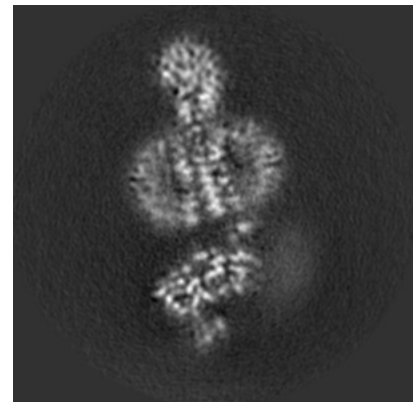
### 6.3.2 Raw map



X Index: 90



Y Index: 62

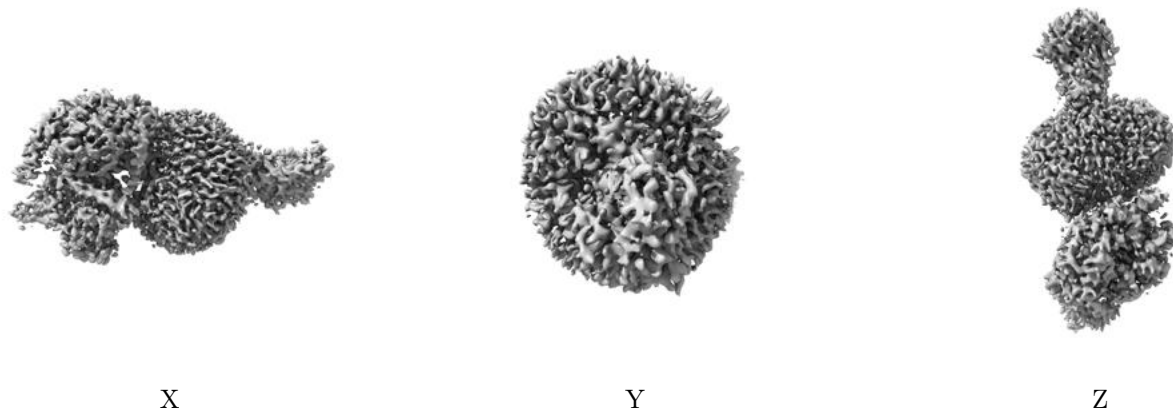


Z Index: 100

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

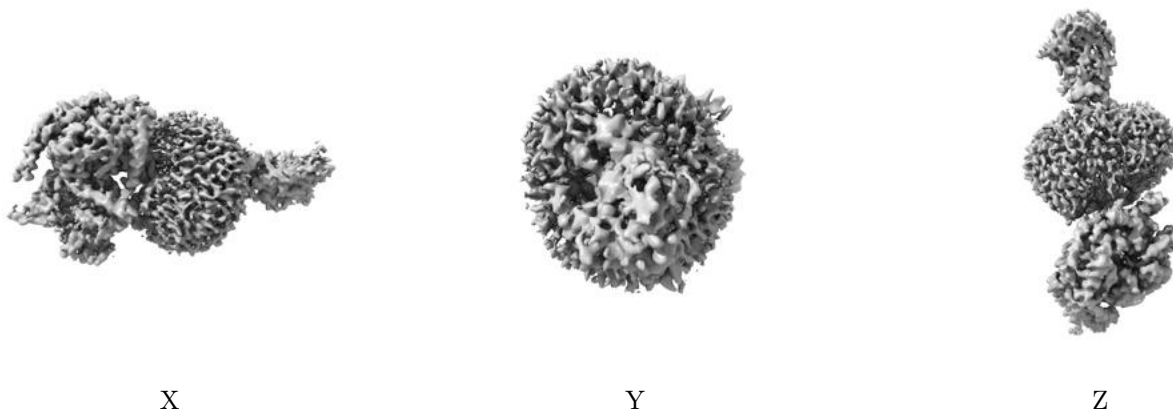
## 6.4 Orthogonal surface views [i](#)

### 6.4.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.04. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

### 6.4.2 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.

## 6.5 Mask visualisation [i](#)

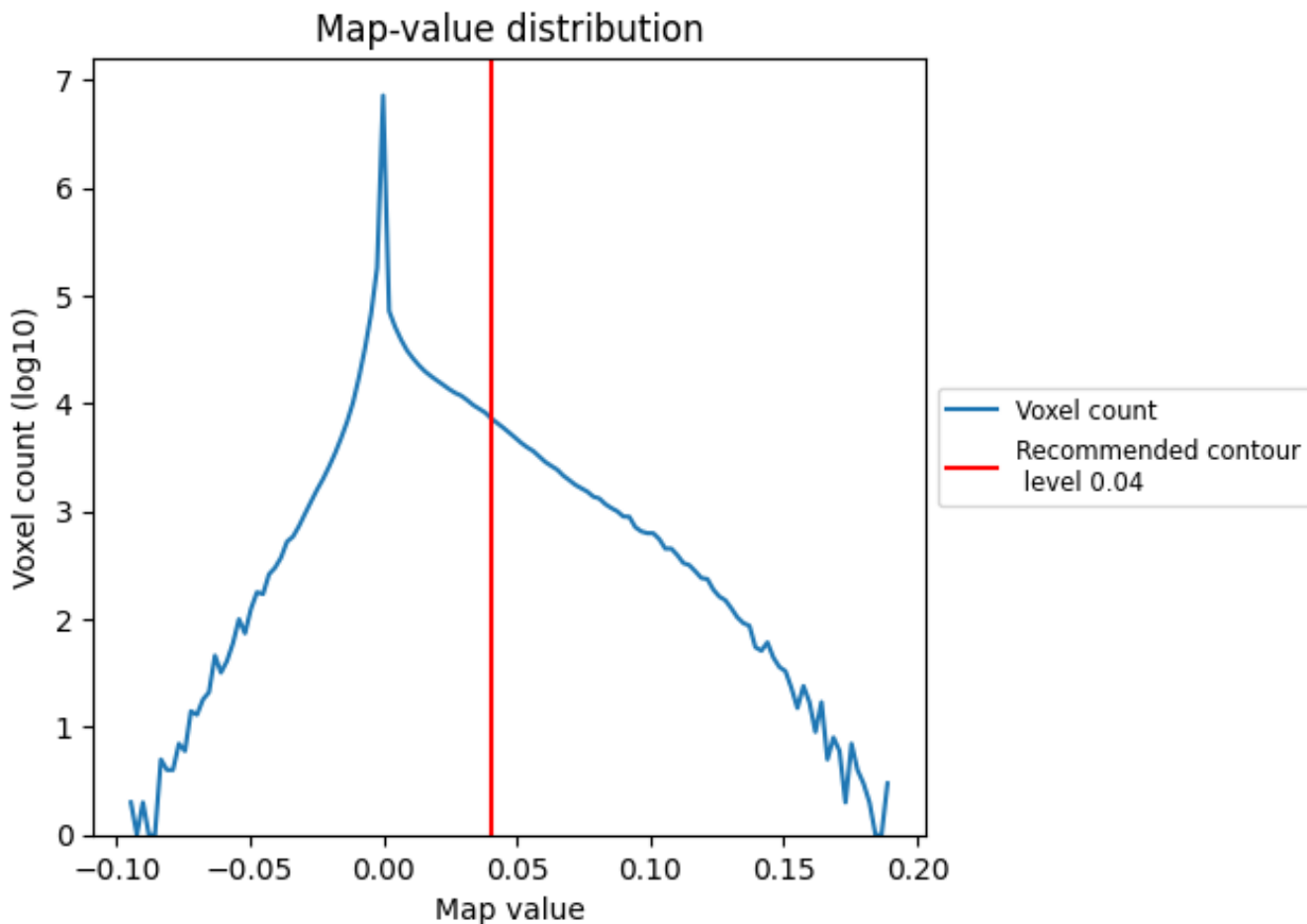
This section was not generated. No masks/segmentation were deposited.



## 7 Map analysis [i](#)

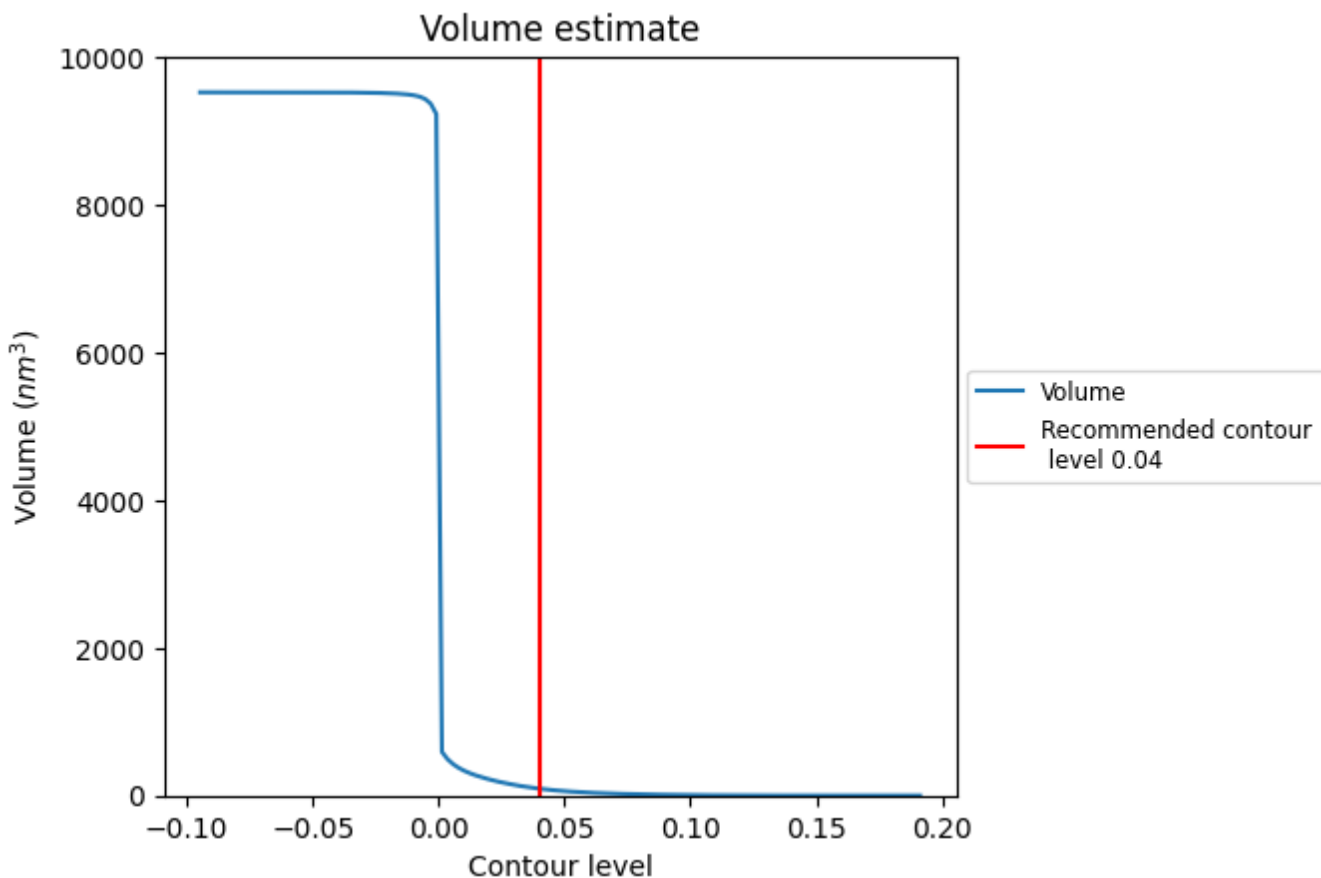
This section contains the results of statistical analysis of the map.

### 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.

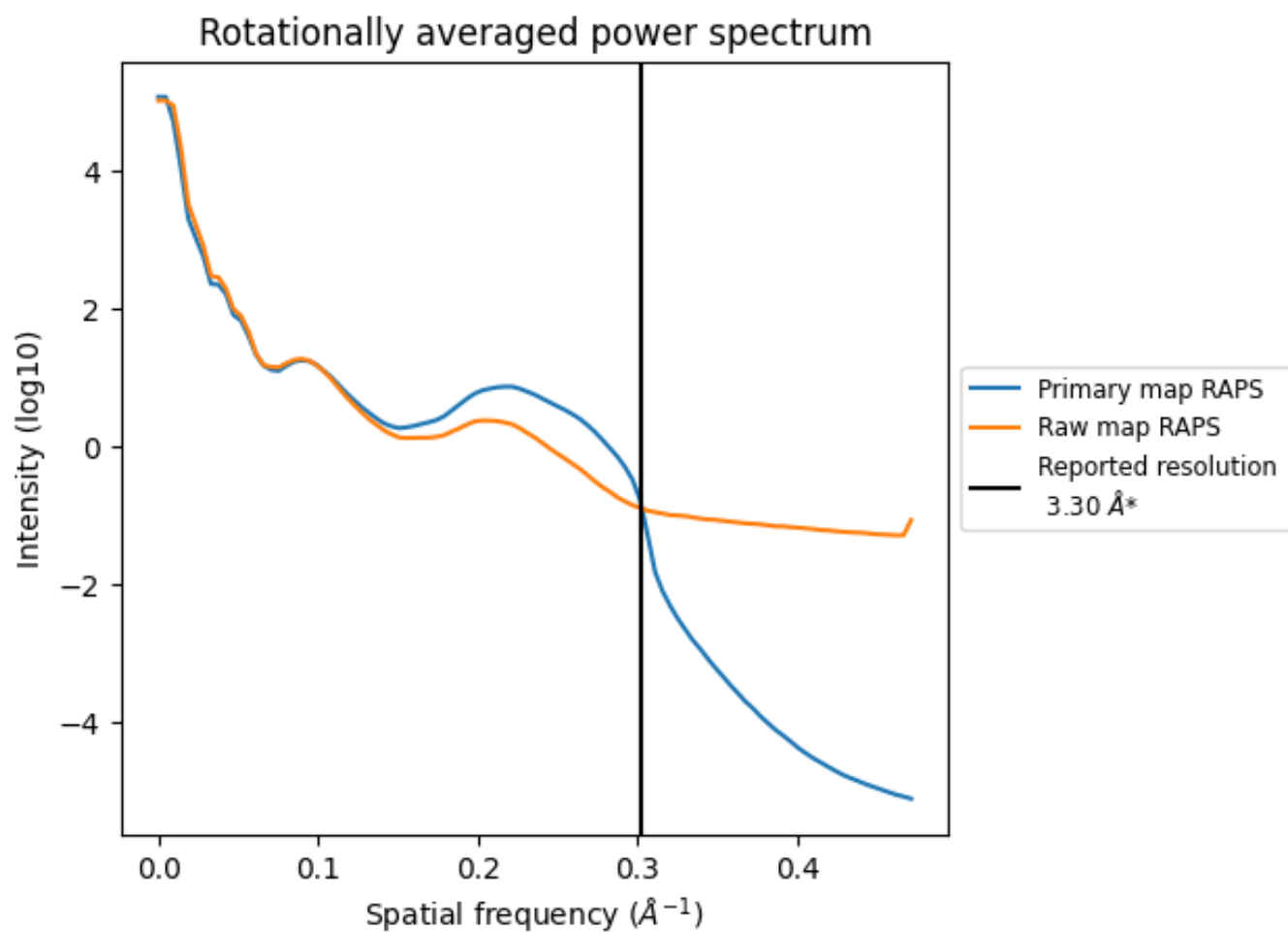
## 7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 93 nm<sup>3</sup>; this corresponds to an approximate mass of 84 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

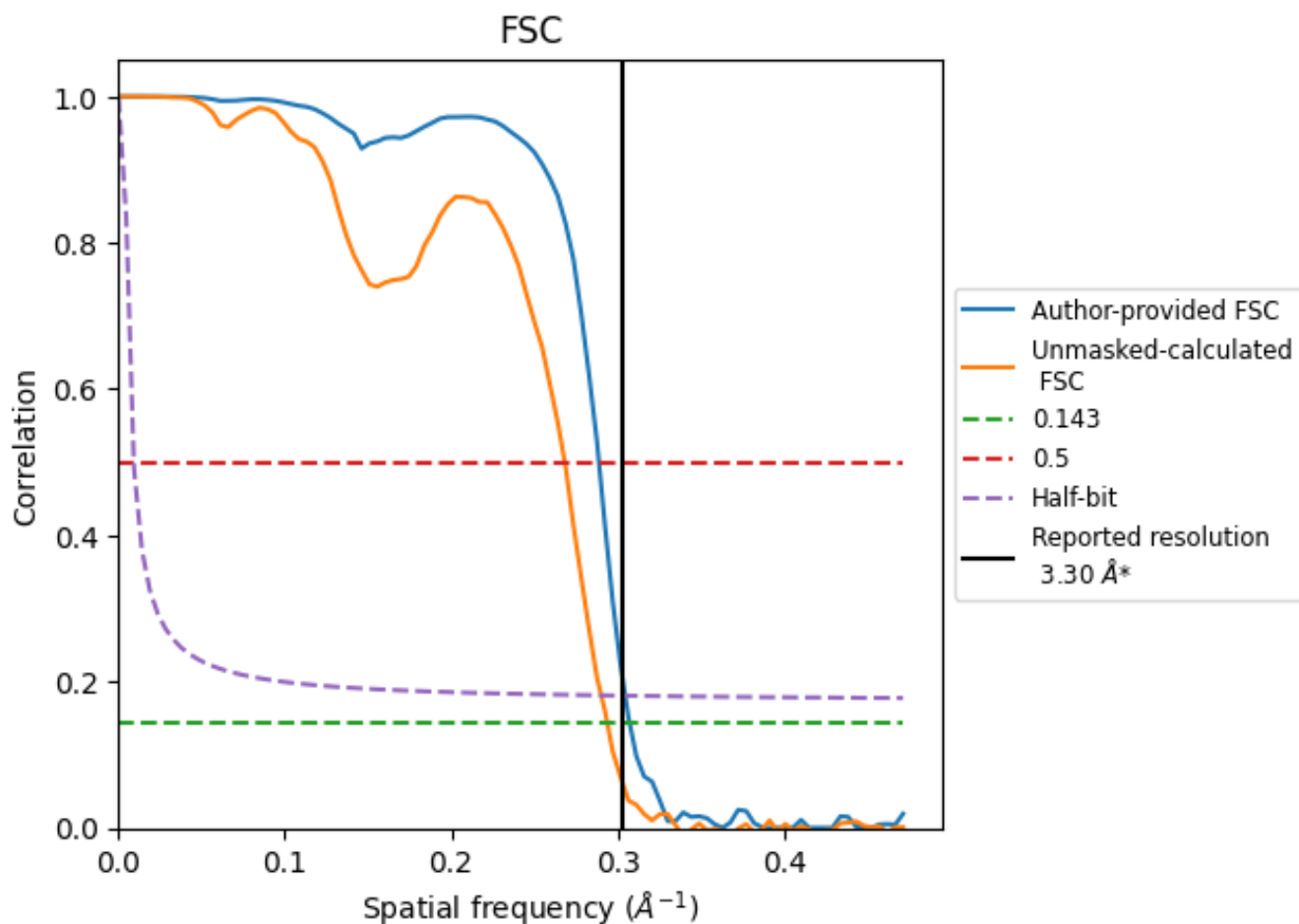


\*Reported resolution corresponds to spatial frequency of 0.303 Å<sup>-1</sup>

## 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 0.303  $\text{\AA}^{-1}$

## 8.2 Resolution estimates [i](#)

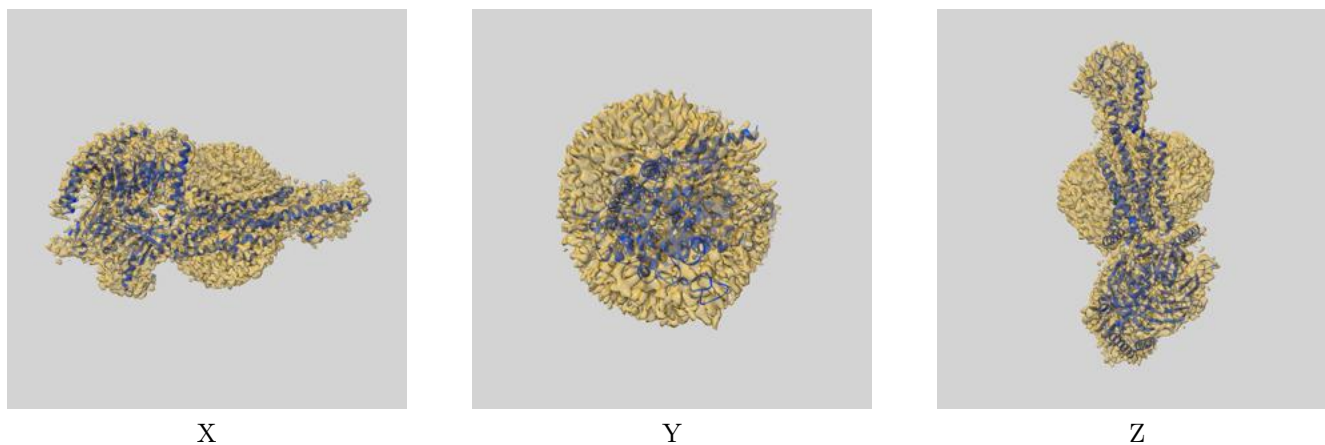
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.30	-	-
Author-provided FSC curve	3.25	3.46	3.28
Unmasked-calculated*	3.40	3.73	3.45

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

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

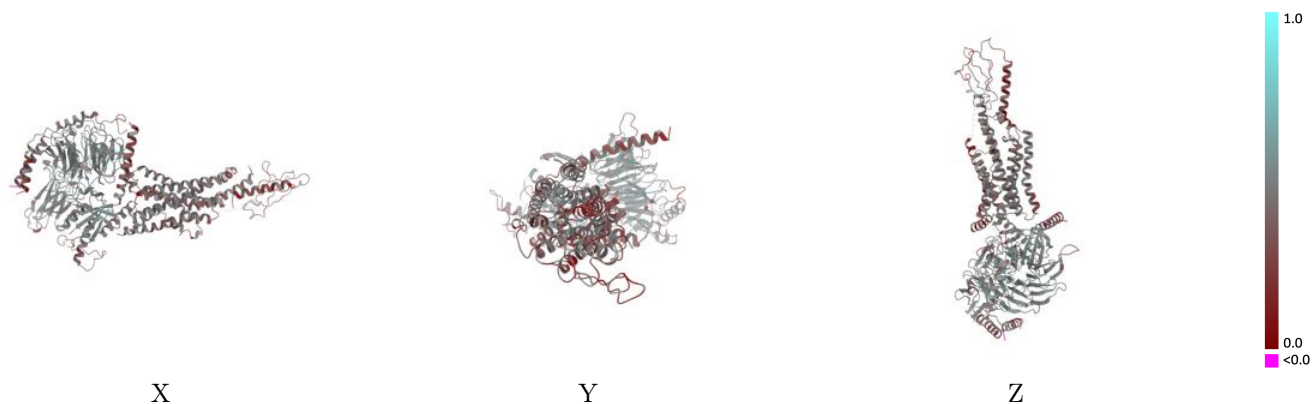
This section contains information regarding the fit between EMDB map EMD-7039 and PDB model 6B3J. Per-residue inclusion information can be found in section 3 on page 6.

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



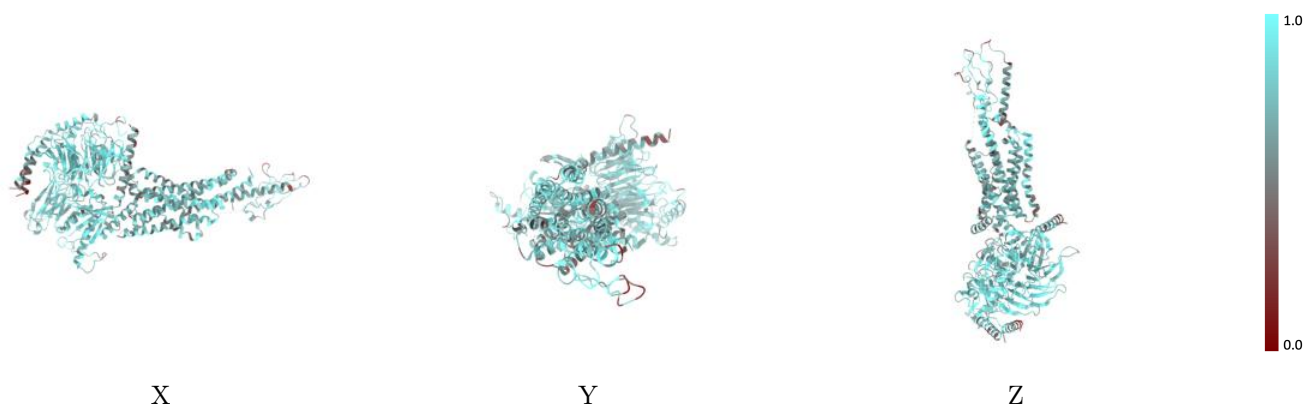
The images above show the 3D surface view of the map at the recommended contour level 0.04 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



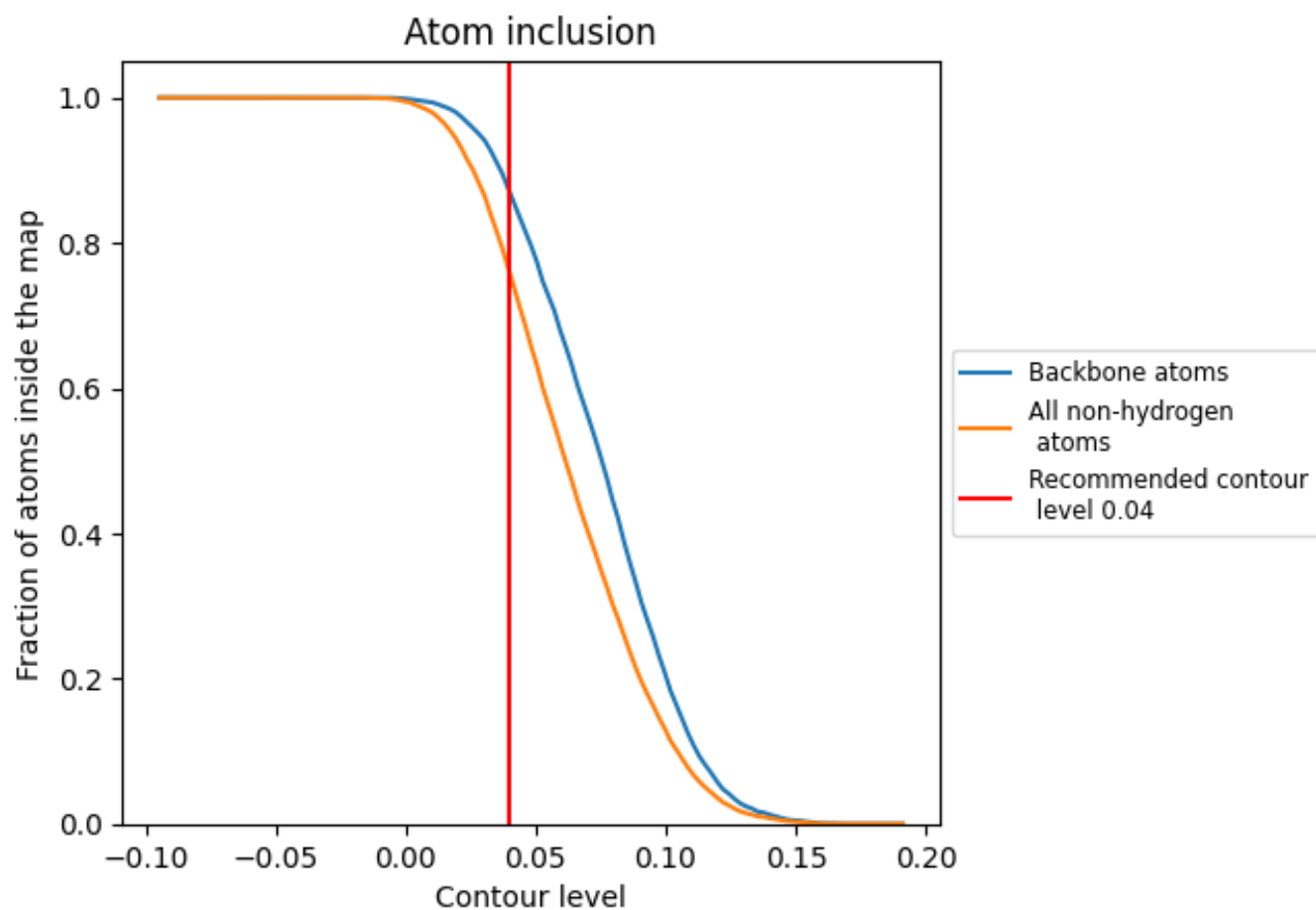
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.04).

## 9.4 Atom inclusion [i](#)

















At the recommended contour level, 87% of all backbone atoms, 76% 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 (0.04) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.7588	 0.4310
A	 0.7612	 0.4470
B	 0.8104	 0.4800
G	 0.6970	 0.3930
N	 0.8230	 0.4830
P	 0.7092	 0.3850
R	 0.7079	 0.3750

