



Full wwPDB EM Validation Report ⓘ

Aug 6, 2024 – 12:39 AM JST

PDB ID : 8YF7
EMDB ID : EMD-39213
Title : Cryo-EM structure of Dragon Grouper nervous necrosis virus-like particle at pH6.5 (2.82Å)
Authors : Wang, C.H.; Chang, W.H.
Deposited on : 2024-02-24
Resolution : 2.82 Å(reported)

This is a Full wwPDB EM Validation 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.dev92
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.37.1

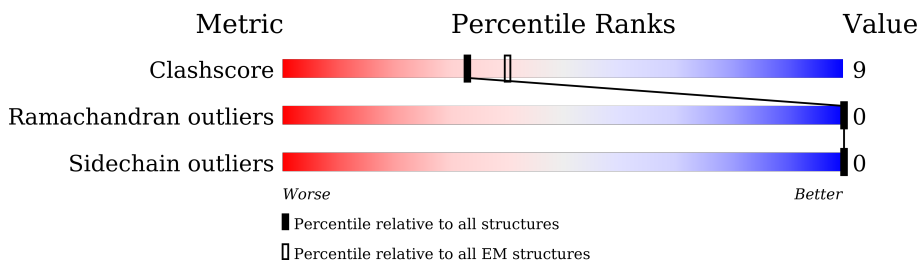
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.82 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 ≥ 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	338	
1	B	338	
1	C	338	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3895 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 Capsid protein alpha.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	164	1259	793	224	237	5	0	0
1	B	164	1259	793	224	237	5	0	0
1	C	181	1374	863	245	261	5	0	0

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
2	A	1	Total 1	Ca 1	0
2	B	1	Total 1	Ca 1	0
2	C	1	Total 1	Ca 1	0

ASN	E108	ASN	GLY
ASP	F109	ASP	THR
LEU	E110	SER	PRO
SER	F127	LEU	ALA
THR	L128	SER	GLY
ASN	P131	THR	TRP
ASP	L141	ASN	PHE
PHE	T144	ASP	ARG
LYS	R145	TRP	TRP
SER	G146	GLY	TRP
ILE	P160	ILE	ILE
TRP	L166	TRP	TRP
ASP	L167	ASP	ASP
LEU	W168	LEU	ASN
PRO	T169	PRO	LYS
THR	T178	THR	THR
ASP	S179	PHE	PHE
GLY	P180	THR	THR
ALA	G181	ASP	THR
VAL	R182	ILE	GLY
PHE	L183	ALA	ASP
GLN	I184	PRO	VAL
LEU	L185	VAL	ALA
ASP	L186	TYR	TYR
ARG	V199	TYR	TYR
PRO	L200	SER	SER
GLN	C201	ASP	ASP
LEU	R202	LEU	GLU
ILE	W203	LEU	GLN
LEU	V209	PRO	PRO
ASP	P210	VAL	VAL
THR	S211	THR	THR
GLY	L212	CYS	CYS
ASP	E213	THR	THR
VAL	T214	ARG	ARG
ASP	P215	VAL	VAL
ASP	GLU	ASP	ASP
ARG	GLU	SER	SER
ALA	THR	GLU	GLU
VAL	THR	ASN	ASN
TYR	ALA	ALA	ALA
TRP	PRO	THR	THR
HIS	ILE	ALA	ALA
LYS	MET	VAL	VAL
LYS	THR	THR	THR
PHE	GLN	THR	THR
ALA	GLY	GLN	GLN
GLY	SER	ASP	ASP
ASN	LEU	LEU	LEU
ALA	TYR	ALA	ALA

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	39884	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TECNAI 20	Depositor
Voltage (kV)	200	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	400	Depositor
Maximum defocus (nm)	2910	Depositor
Magnification	Not provided	
Image detector	GATAN K2 BASE (4k x 4k)	Depositor
Maximum map value	3.985	Depositor
Minimum map value	-1.492	Depositor
Average map value	0.036	Depositor
Map value standard deviation	0.203	Depositor
Recommended contour level	0.545	Depositor
Map size (\AA)	570.4, 570.4, 570.4	wwPDB
Map dimensions	460, 460, 460	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (\AA)	1.24, 1.24, 1.24	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

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	0.29	0/1288	0.54	0/1764
1	B	0.30	0/1288	0.54	0/1764
1	C	0.30	0/1405	0.54	0/1923
All	All	0.30	0/3981	0.54	0/5451

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1259	0	1249	21	0
1	B	1259	0	1249	23	0
1	C	1374	0	1363	27	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
All	All	3895	0	3861	71	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 9.

All (71) 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:C:100:GLN:NE2	1:C:211:SER:OG	2.10	0.80
1:B:65:GLN:NE2	1:B:196:ASN:OD1	2.18	0.77
1:C:100:GLN:HE21	1:C:211:SER:HG	1.39	0.70
1:C:141:LEU:HD21	1:C:184:ILE:HB	1.73	0.70
1:A:141:LEU:HD21	1:A:184:ILE:HB	1.74	0.69
1:C:89:LEU:HD12	1:C:92:LEU:HD23	1.76	0.67
1:A:110:GLU:OE2	1:A:202:ARG:NH1	2.29	0.66
1:A:89:LEU:HD12	1:A:92:LEU:HD23	1.77	0.65
1:C:80:VAL:HB	1:C:185:LEU:HB3	1.78	0.64
1:C:110:GLU:OE2	1:C:202:ARG:NH1	2.32	0.63
1:A:65:GLN:NE2	1:A:196:ASN:OD1	2.32	0.63
1:A:80:VAL:HB	1:A:185:LEU:HB3	1.80	0.62
1:B:89:LEU:HD12	1:B:92:LEU:HD23	1.81	0.62
1:B:101:ARG:NH2	1:B:166:LEU:O	2.32	0.62
1:B:86:PRO:HB3	1:B:92:LEU:HG	1.82	0.61
1:A:96:ALA:HB1	1:A:169:THR:HB	1.81	0.61
1:C:79:VAL:HG12	1:C:80:VAL:HG23	1.81	0.61
1:B:80:VAL:HB	1:B:185:LEU:HB3	1.81	0.61
1:B:62:ARG:NH1	1:B:65:GLN:OE1	2.35	0.60
1:A:89:LEU:O	1:A:93:GLY:N	2.35	0.58
1:A:100:GLN:HB2	1:A:209:VAL:HB	1.84	0.58
1:B:79:VAL:HG12	1:B:80:VAL:HG23	1.84	0.57
1:B:131:PRO:O	1:B:182:ARG:NH2	2.33	0.57
1:C:97:ARG:NH1	1:C:215:PRO:HD3	2.19	0.57
1:A:163:THR:HG22	1:A:165:THR:HG23	1.87	0.57
1:B:92:LEU:HD12	1:B:95:ALA:HB3	1.87	0.56
1:C:100:GLN:HB2	1:C:209:VAL:HB	1.86	0.56
1:A:89:LEU:HB2	1:A:92:LEU:HB3	1.87	0.56
1:B:89:LEU:HB2	1:B:92:LEU:HB3	1.87	0.56
1:C:131:PRO:O	1:C:182:ARG:NH2	2.37	0.54
1:B:100:GLN:HB2	1:B:209:VAL:HB	1.89	0.54
1:B:61:SER:HB2	1:B:90:PRO:HD2	1.90	0.53
1:A:128:LEU:HD12	1:A:144:THR:HG21	1.91	0.52
1:C:108:GLU:OE1	1:C:202:ARG:NH2	2.30	0.52
1:C:145:ARG:HG2	1:C:146:GLY:N	2.24	0.52
1:C:89:LEU:HB2	1:C:92:LEU:HB3	1.91	0.52
1:B:111:ILE:HG22	1:B:113:PRO:HD3	1.91	0.51
1:B:106:THR:HB	1:B:204:SER:HB3	1.93	0.51
1:A:131:PRO:HB2	1:A:175:GLN:HG2	1.92	0.50
1:B:113:PRO:HA	1:B:197:VAL:HA	1.93	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:78:VAL:HA	1:B:186:LEU:HD23	1.94	0.50
1:A:69:PRO:HD2	1:A:72:THR:HG21	1.94	0.49
1:B:54:ASP:OD1	1:B:208:SER:OG	2.26	0.49
1:C:62:ARG:HA	1:C:200:LEU:HD23	1.95	0.49
1:A:95:ALA:HB1	1:A:207:LEU:HD11	1.95	0.49
1:B:97:ARG:NH2	1:B:215:PRO:HD3	2.28	0.49
1:C:76:GLY:HA2	1:C:186:LEU:HD23	1.95	0.49
1:C:96:ALA:HB1	1:C:169:THR:HB	1.96	0.48
1:A:128:LEU:HD13	1:A:184:ILE:HD13	1.94	0.48
1:C:109:PHE:CD1	1:C:183:LEU:HD22	2.48	0.48
1:B:182:ARG:HG3	1:B:184:ILE:HD11	1.97	0.47
1:C:127:PHE:HB3	1:C:160:PRO:HB3	1.96	0.47
1:C:63:ILE:HD11	1:C:183:LEU:HD23	1.97	0.47
1:A:81:ASP:OD2	1:A:182:ARG:NH2	2.49	0.46
1:C:69:PRO:HD2	1:C:72:THR:OG1	2.15	0.46
1:B:128:LEU:HG	1:B:184:ILE:HD13	1.97	0.45
1:B:97:ARG:HH21	1:B:215:PRO:HD3	1.81	0.45
1:B:141:LEU:HD21	1:B:184:ILE:HB	1.99	0.45
1:A:150:ALA:HB2	1:A:156:ARG:HG3	1.98	0.45
1:C:103:ALA:HB2	1:C:166:LEU:HD23	1.99	0.44
1:A:54:ASP:HA	1:A:207:LEU:O	2.18	0.43
1:A:62:ARG:NH1	1:A:65:GLN:OE1	2.51	0.43
1:B:139:ASP:O	1:B:142:GLN:HG2	2.18	0.43
1:A:130:ASP:OD1	1:A:132:THR:OG1	2.23	0.43
1:C:80:VAL:HG21	1:C:199:VAL:HG21	2.00	0.43
1:C:169:THR:OG1	1:C:213:GLU:OE2	2.37	0.42
1:C:89:LEU:HD13	1:C:203:TRP:CD1	2.55	0.42
1:C:84:ILE:O	1:C:180:PRO:HD2	2.20	0.42
1:C:168:TRP:HB2	1:C:178:THR:HG22	2.02	0.41
1:A:115:CYS:HB3	1:A:195:VAL:HG13	2.03	0.41
1:C:128:LEU:HD23	1:C:144:THR:HG21	2.02	0.41

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	162/338 (48%)	157 (97%)	5 (3%)	0	100	100
1	B	162/338 (48%)	159 (98%)	3 (2%)	0	100	100
1	C	179/338 (53%)	174 (97%)	5 (3%)	0	100	100
All	All	503/1014 (50%)	490 (97%)	13 (3%)	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	139/284 (49%)	139 (100%)	0	100	100
1	B	139/284 (49%)	139 (100%)	0	100	100
1	C	151/284 (53%)	151 (100%)	0	100	100
All	All	429/852 (50%)	429 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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](#)

Of 3 ligands modelled in this entry, 3 are 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.

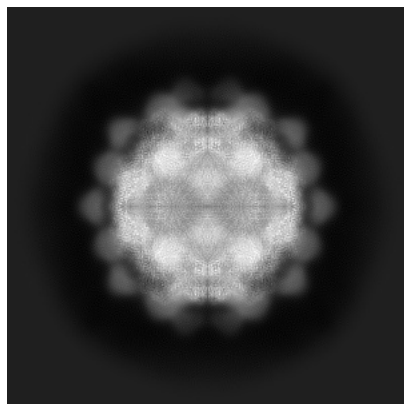
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-39213. These allow visual inspection of the internal detail of the map and identification of artifacts.

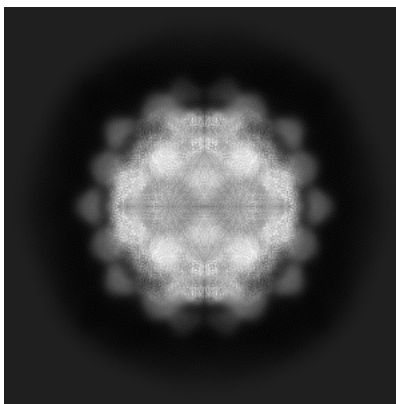
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

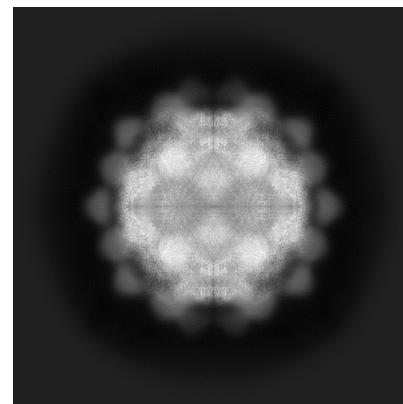
6.1.1 Primary map



X

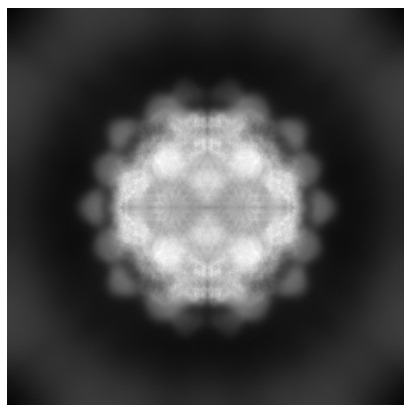


Y

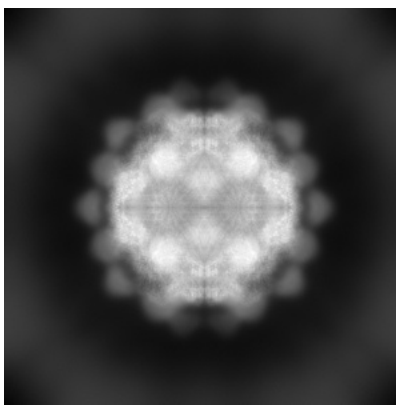


Z

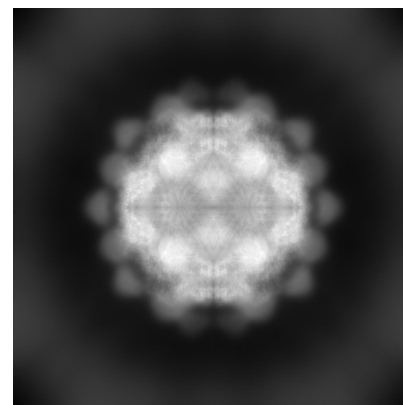
6.1.2 Raw map



X



Y

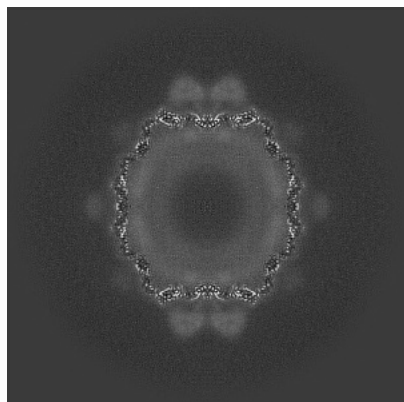


Z

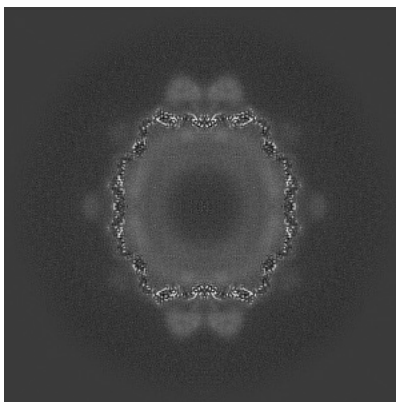
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

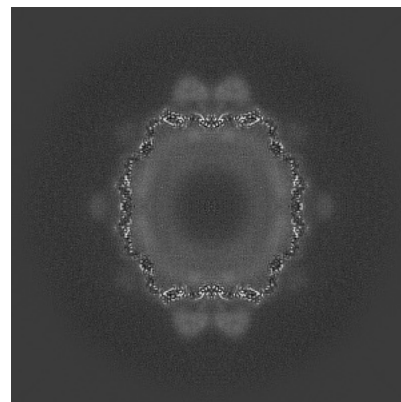
6.2.1 Primary map



X Index: 230

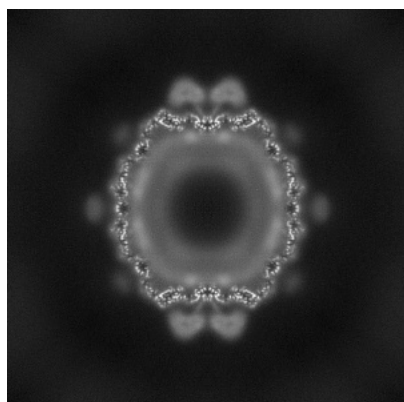


Y Index: 230

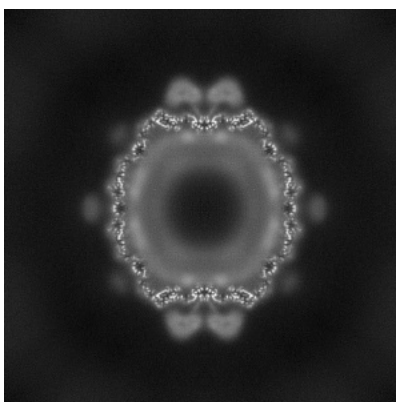


Z Index: 230

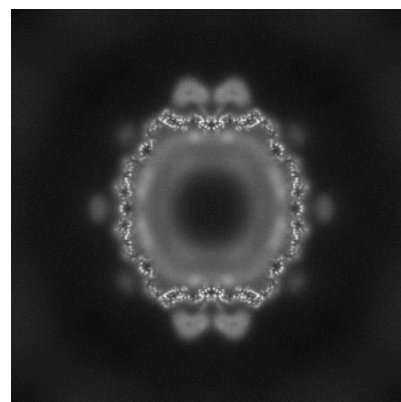
6.2.2 Raw map



X Index: 230



Y Index: 230

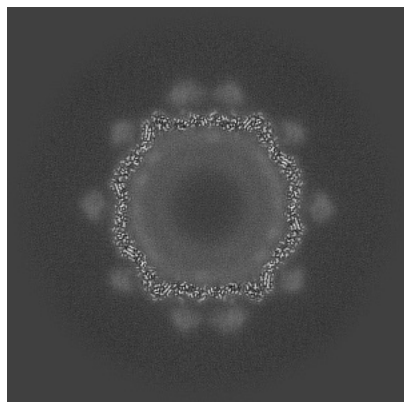


Z Index: 230

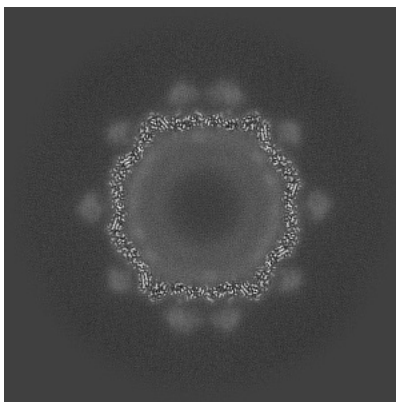
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

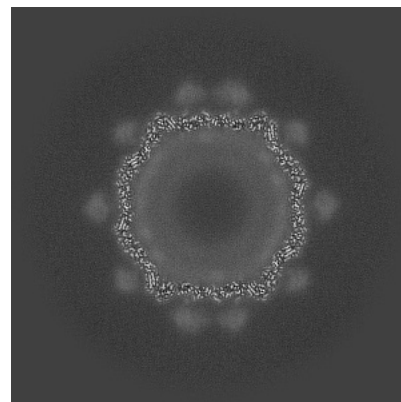
6.3.1 Primary map



X Index: 243

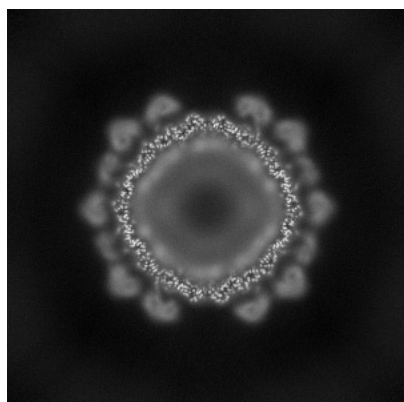


Y Index: 217

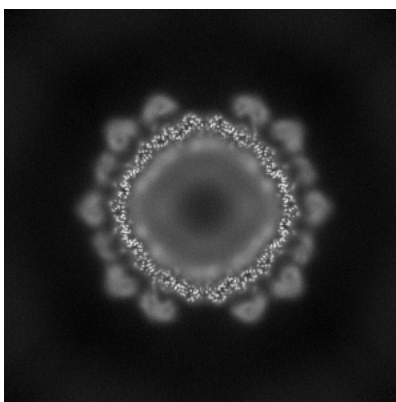


Z Index: 217

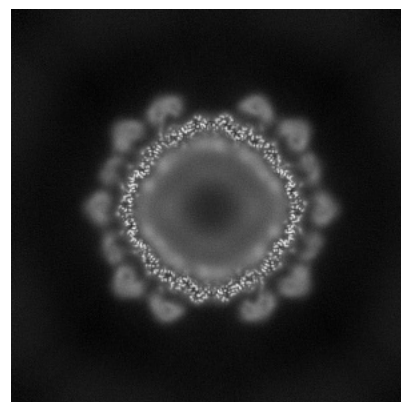
6.3.2 Raw map



X Index: 193



Y Index: 193

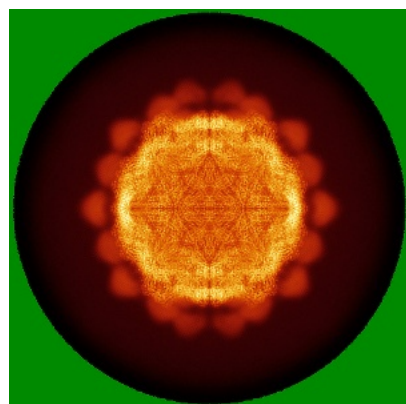


Z Index: 267

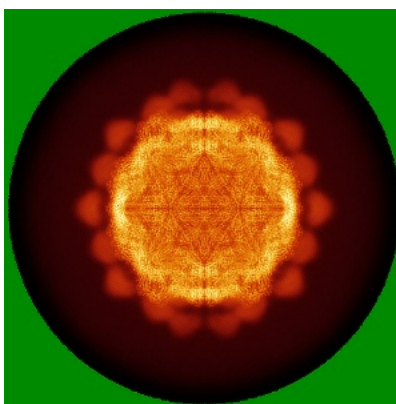
The images above show the largest variance slices of the map in three orthogonal directions.

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

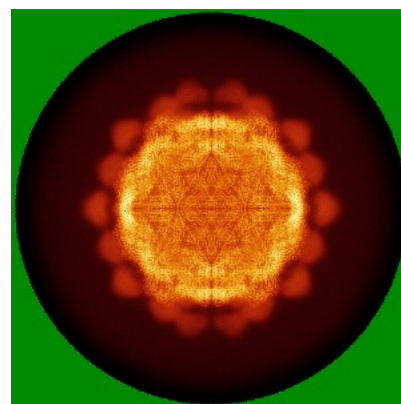
6.4.1 Primary map



X

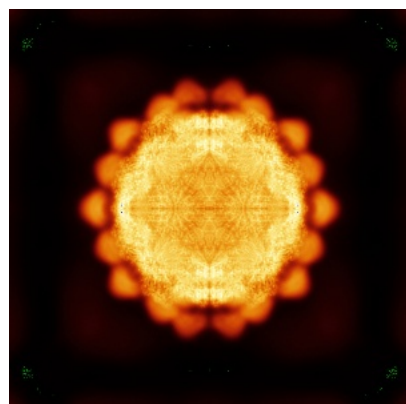


Y

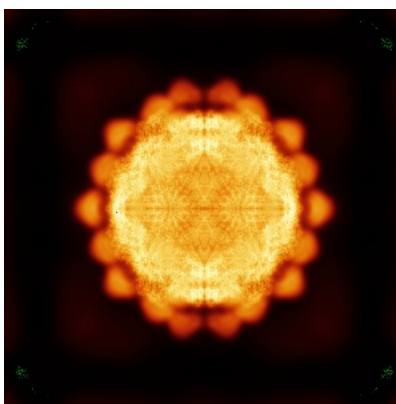


Z

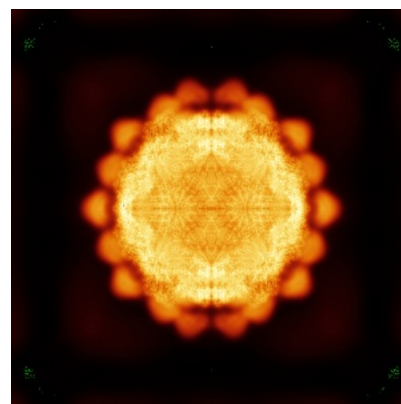
6.4.2 Raw map



X



Y

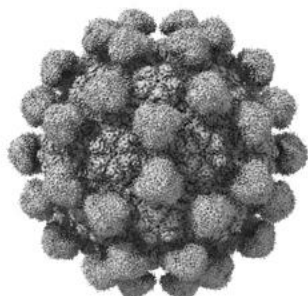


Z

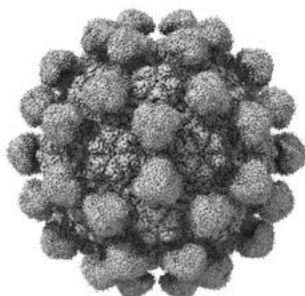
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views [i](#)

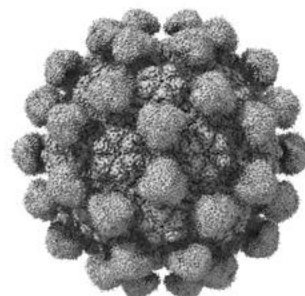
6.5.1 Primary map



X



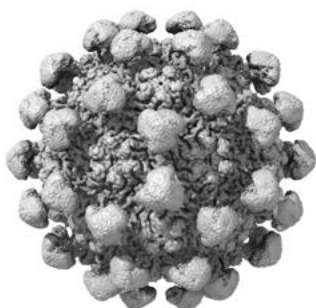
Y



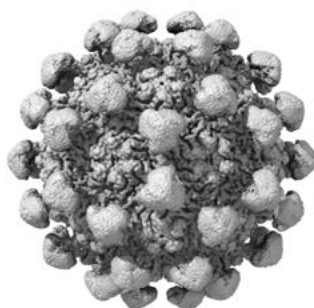
Z

The images above show the 3D surface view of the map at the recommended contour level 0.545. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

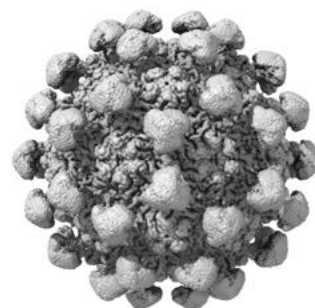
6.5.2 Raw map



X



Y



Z

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.

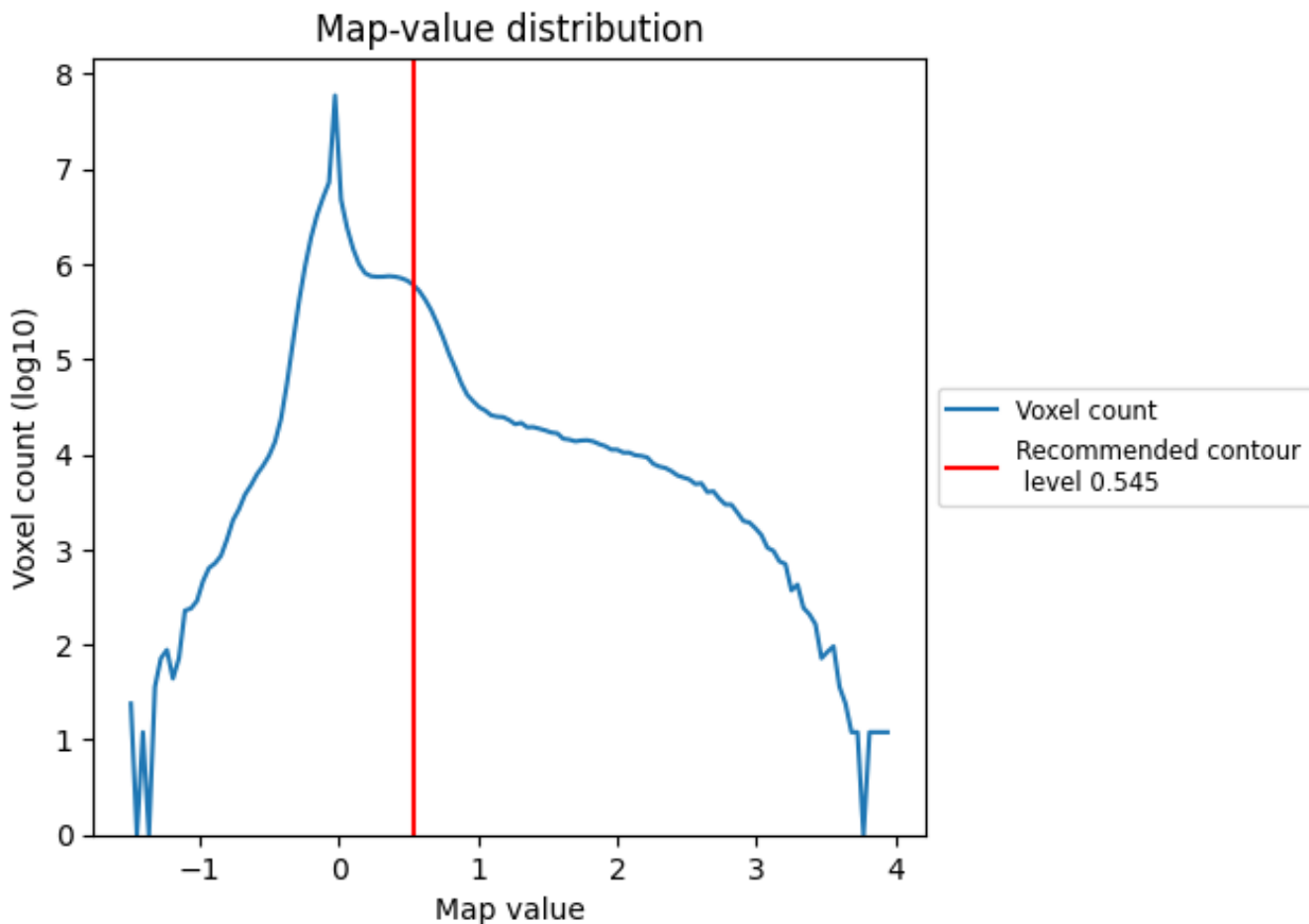
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

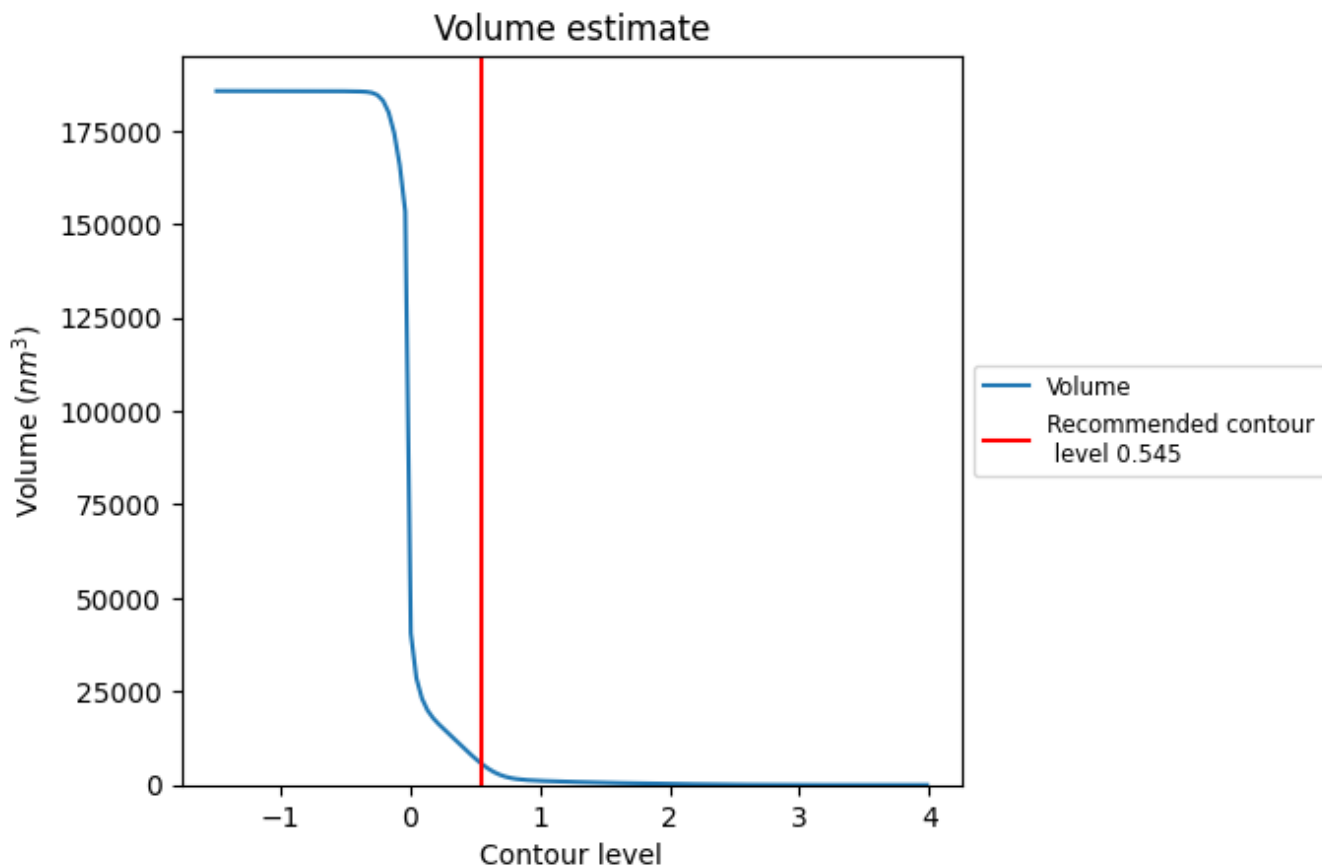
This section contains the results of statistical analysis of the map.

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.

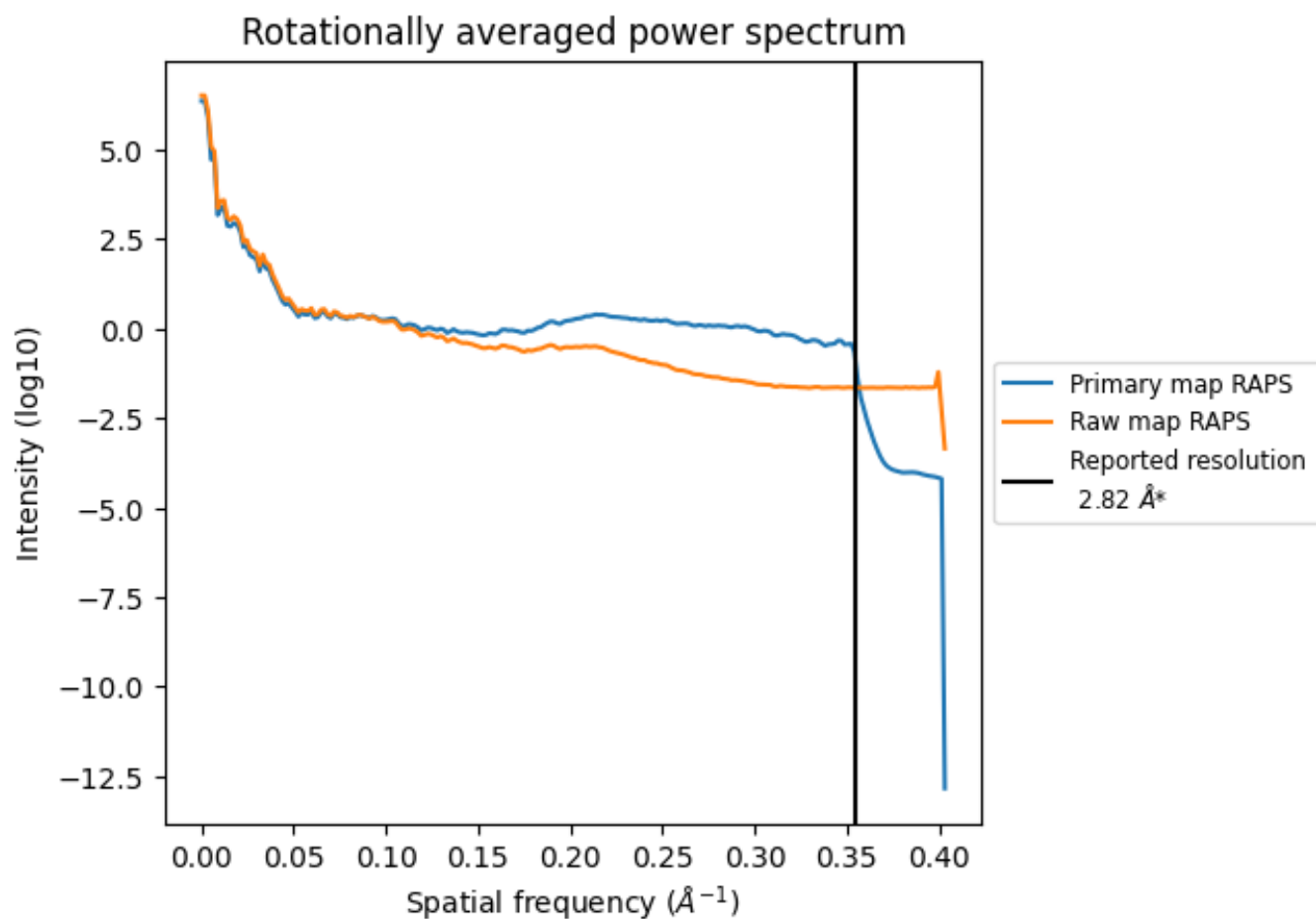
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 5843 nm³; this corresponds to an approximate mass of 5278 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

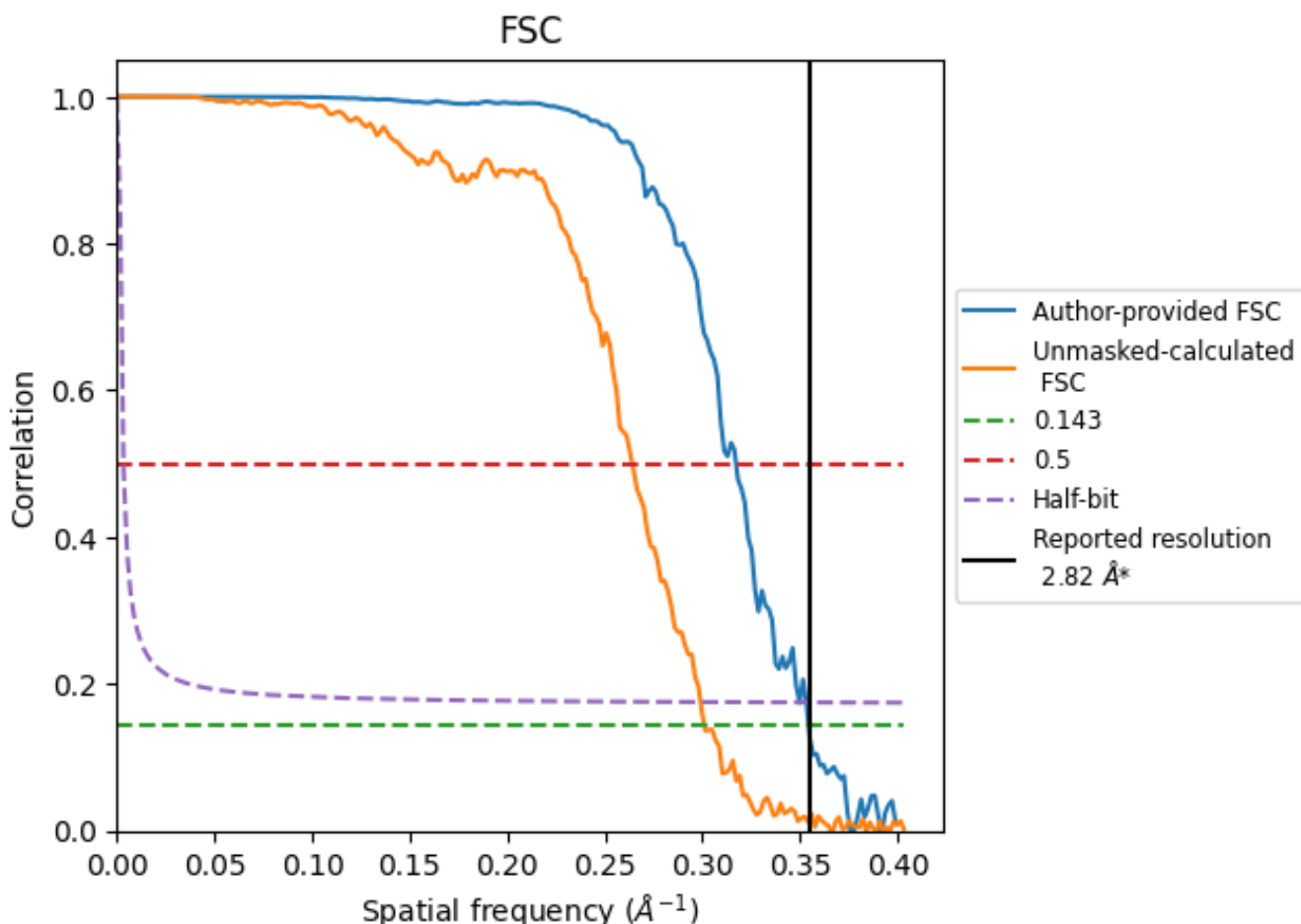


*Reported resolution corresponds to spatial frequency of 0.355 \AA^{-1}

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 0.355 Å⁻¹

8.2 Resolution estimates [i](#)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.82	-	-
Author-provided FSC curve	2.82	3.15	2.86
Unmasked-calculated*	3.32	3.79	3.34

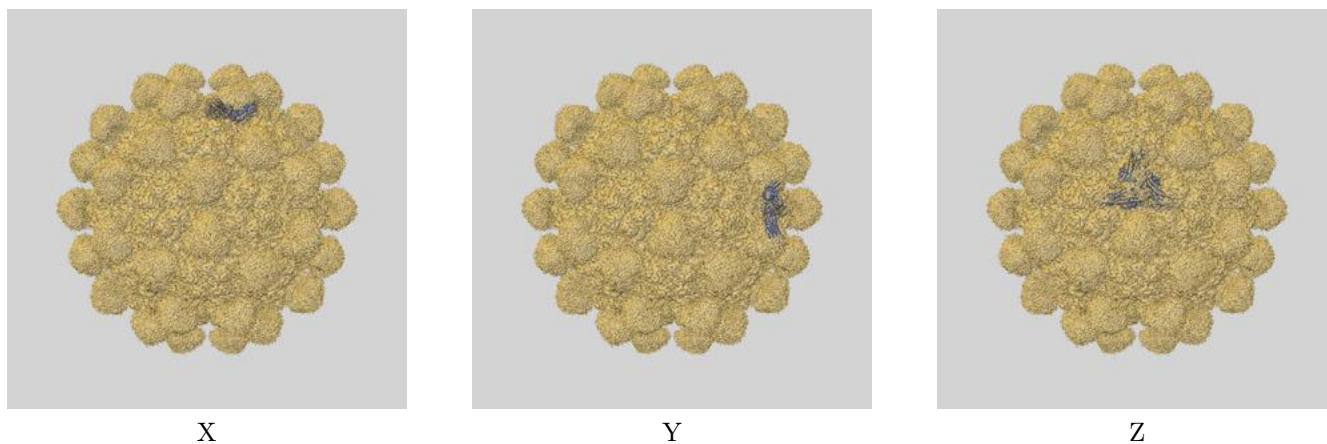
*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 3.32 differs from the reported value 2.82 by more than 10 %

9 Map-model fit [i](#)

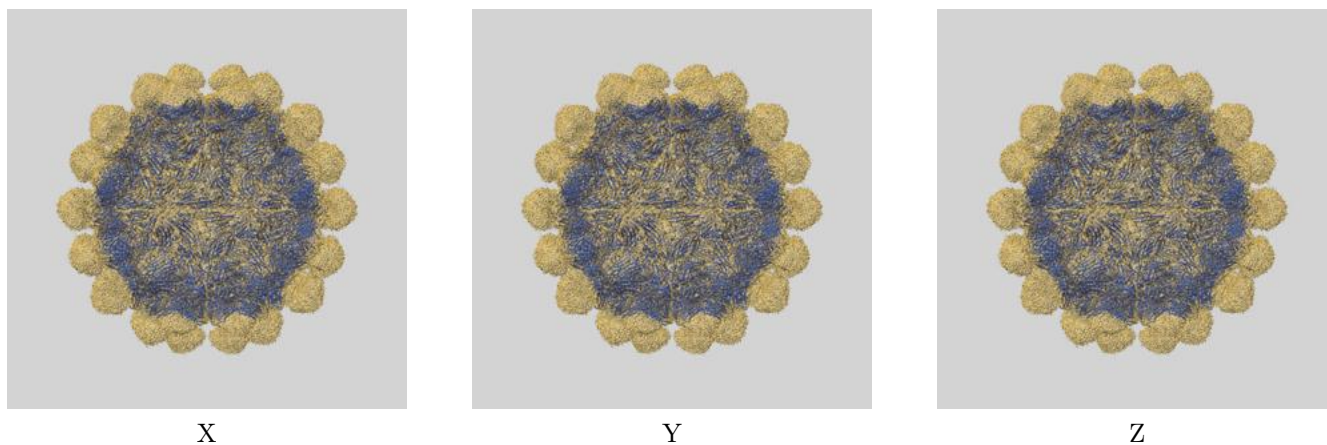
This section contains information regarding the fit between EMDB map EMD-39213 and PDB model 8YF7. Per-residue inclusion information can be found in section 3 on page 4.

9.1 Map-model overlays

9.1.1 Map-model overlay [i](#)

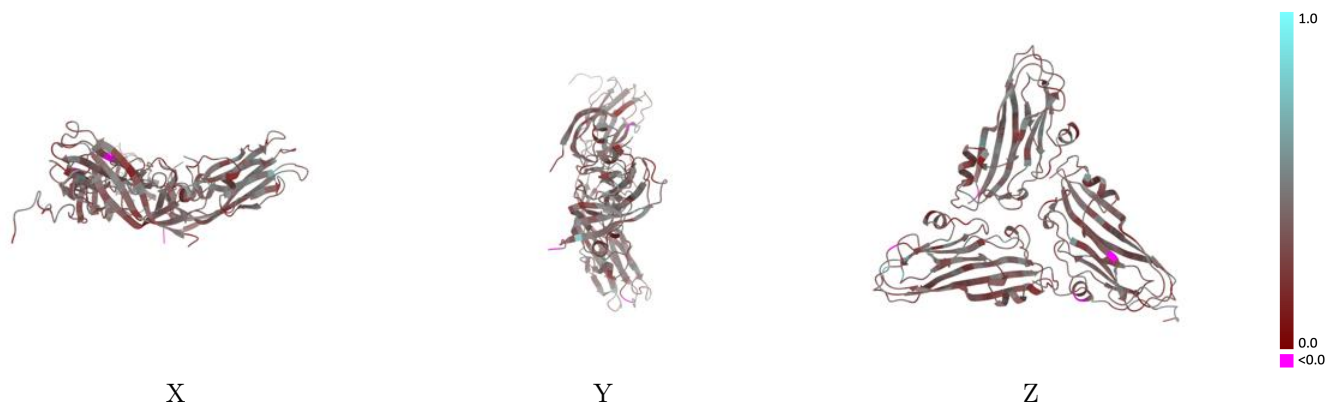


9.1.2 Map-model assembly overlay [i](#)



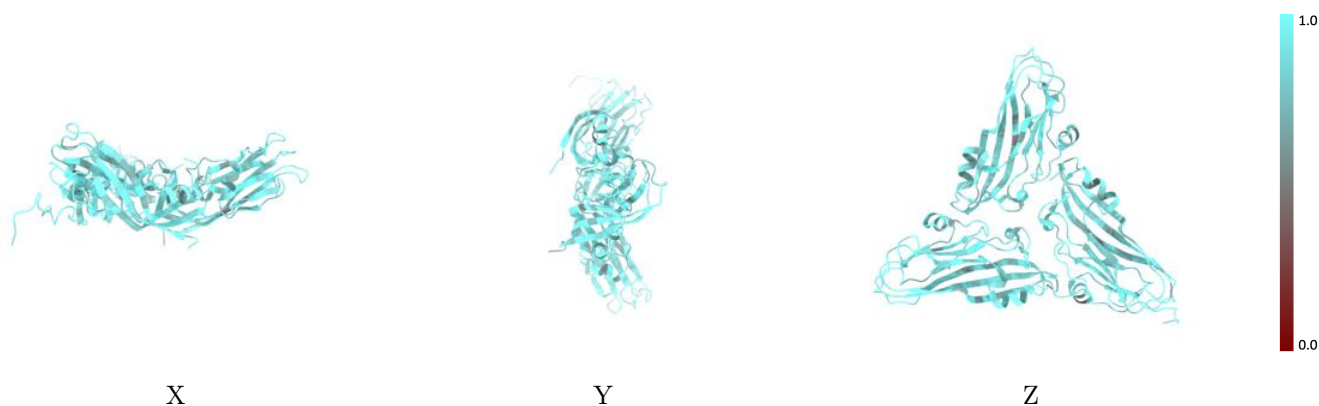
The images above show the 3D surface view of the map at the recommended contour level 0.545 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



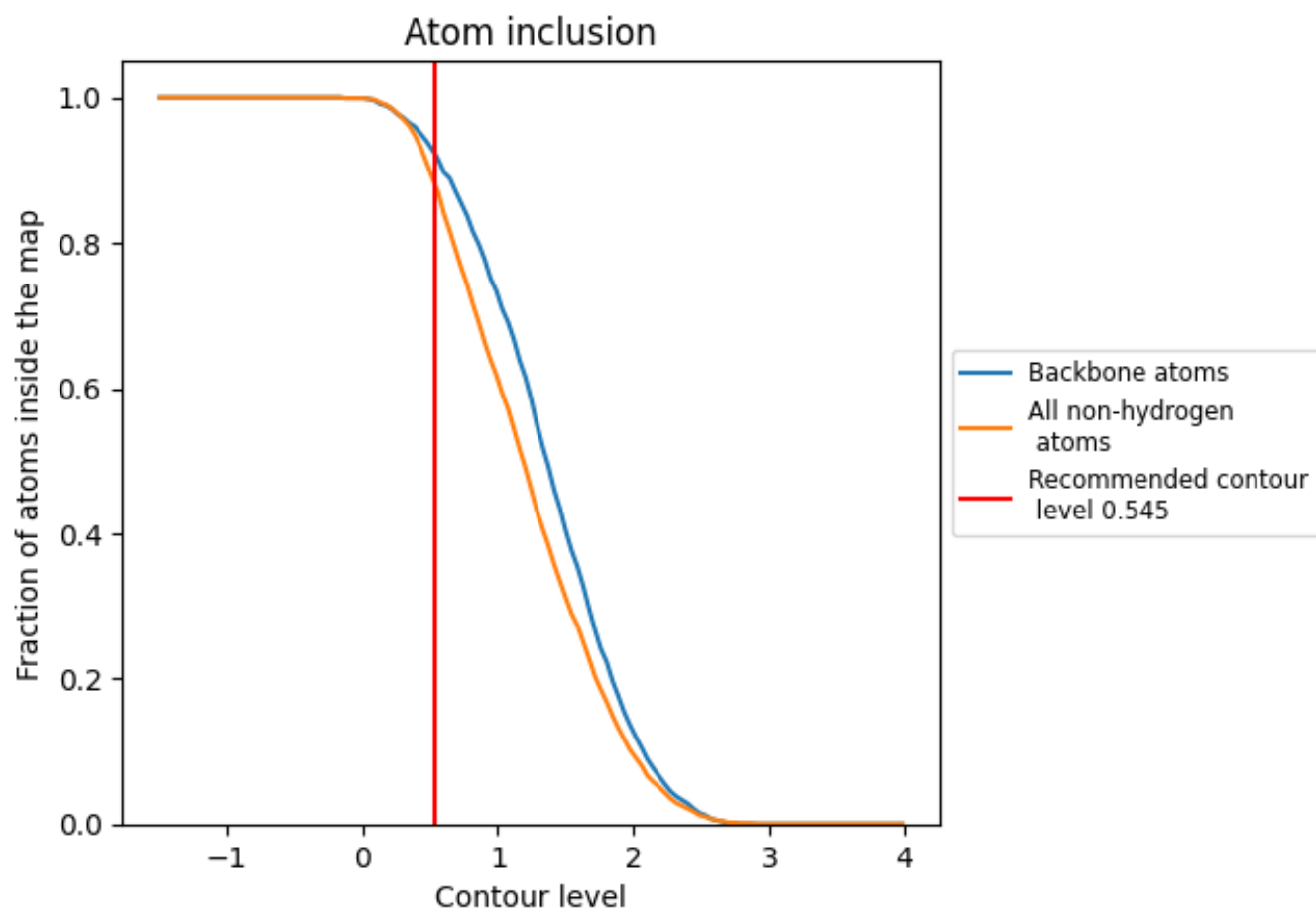
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.545).


9.4 Atom inclusion [i](#)



At the recommended contour level, 92% of all backbone atoms, 88% 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 (0.545) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8770	 0.3640
A	 0.8620	 0.3740
B	 0.8740	 0.3590
C	 0.8930	 0.3590

