



wwPDB EM Validation Summary Report ⓘ

Jan 27, 2022 – 06:31 pm GMT

PDB ID : 7QFQ
EMDB ID : EMD-13947
Title : Cryo-EM structure of Botulinum neurotoxin serotype B
Authors : Kosenina, S.; Martinez-Carranza, M.; Davies, J.R.; Masuyer, G.; Stenmark, P.
Deposited on : 2021-12-06
Resolution : 3.60 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

EMDB validation analysis : 0.0.0.dev97
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.26

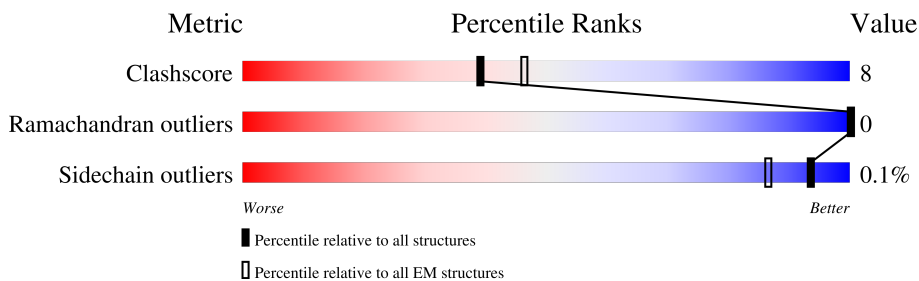
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.60 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	1307	

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 10659 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 Botulinum neurotoxin type B.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	1291	10659	6878	1714	2032	35	0	0

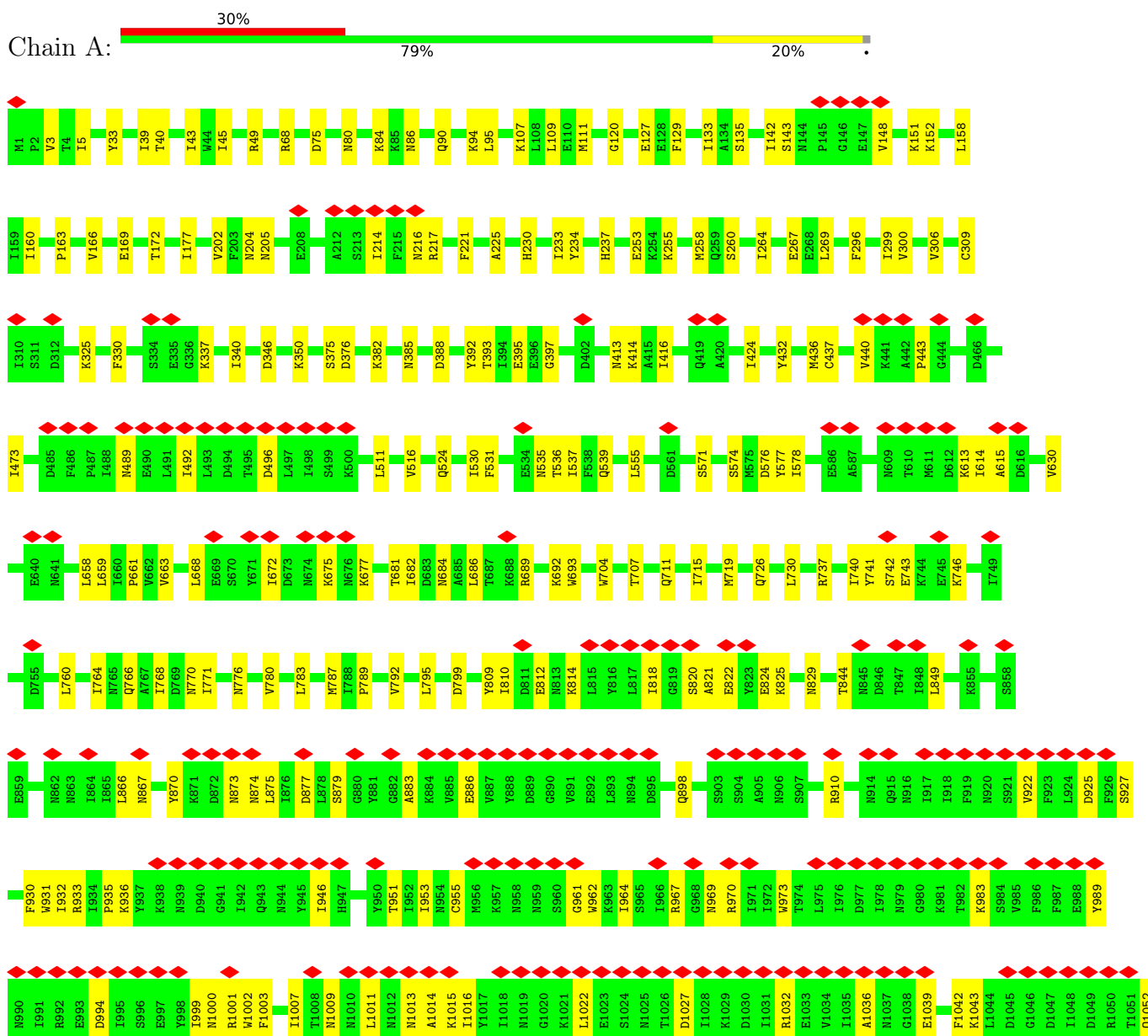
There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	231	GLN	GLU	engineered mutation	UNP P10844
A	234	TYR	HIS	engineered mutation	UNP P10844
A	1191	MET	GLU	conflict	UNP P10844
A	1199	TYR	SER	conflict	UNP P10844
A	1292	LEU	-	expression tag	UNP P10844
A	1293	GLU	-	expression tag	UNP P10844
A	1294	VAL	-	expression tag	UNP P10844
A	1295	LEU	-	expression tag	UNP P10844
A	1296	PHE	-	expression tag	UNP P10844
A	1297	GLN	-	expression tag	UNP P10844
A	1298	GLY	-	expression tag	UNP P10844
A	1299	PRO	-	expression tag	UNP P10844
A	1300	LEU	-	expression tag	UNP P10844
A	1301	GLU	-	expression tag	UNP P10844
A	1302	HIS	-	expression tag	UNP P10844
A	1303	HIS	-	expression tag	UNP P10844
A	1304	HIS	-	expression tag	UNP P10844
A	1305	HIS	-	expression tag	UNP P10844
A	1306	HIS	-	expression tag	UNP P10844
A	1307	HIS	-	expression tag	UNP P10844

3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: Botulinum neurotoxin type B



LEU	I1240	M1179	G1119	F1053
GLU	H1241	V1180	E1120	I1054
HIS	R1242	Y1181	I1121	M1055
HIS	F1243	T1182	L1122	K1057
HIS	Y1244	Y1183	T1123	Y1058
HIS	E1245	K1184	R1124	F1059
HIS	S1246	Y1185	S1125	S1060
	G1247	F1186	K1126	
	I1248	K1187	Y1127	M1063
	V1249	K1188	N1128	T1064
	F1250	E1189	Q1129	E1065
	E1251	E1190	N1130	L1066
	E1252	M1191	S1131	S1067
	Y1253	K1192	K1132	Q1068
	K1254	L1193	Y1133	S1069
	D1255	F1194	Y1136	M1070
	Y1256	L1195	I1134	I1071
	F1257	A1196	N1135	E1072
	C1258	P1197	Y1136	E1073
	I1259	I1198	R1137	S1079
	S1260	I1199	D1138	Y1080
	K1261	Y1199	L1139	Y1081
	W1262	D1200	Y1140	S1081
	Y1263	S1201	I1141	E1082
	L1264	D1202	G1142	Y1083
	K1265	E1203	I1143	
	E1266	F1204	K1144	D1086
	V1267	Y1205	F1145	F1087
	K1268	M1206	I1146	M1088
	R1269	T1207	I1147	G1089
	R1269	I1208	R1148	M1090
	K1270	Q1209	L1092	P1091
	P1271	I1210	K1149	L1092
	Y1272	K1211	R1150	M1093
	M1273	E1212	S1151	Y1094
	L1274	Y1213	N1152	M1095
	K1275	D1214	S1153	K1096
	L1276	E1215	Q1154	E1097
	G1277	Q1216	S1155	Y1098
	C1278	P1217	I1156	Y1099
	M1279	T1218	M1157	M1100
	W1280	Y1219	D1158	F1101
	Q1281	S1220	D1159	A1103
	F1282	L1223	I1160	G1104
	I1283	L1224	V1161	M1105
	P1284	F1225	R1162	K1106
	K1285	K1226	K1163	M1107
	D1286	K1227	E1164	S1108
	E1287	D1228	D1165	Y1109
	G1288	E1229	Y1166	I1110
	W1289	E1230	I1167	K1111
	T1290	S1231	Y1168	L1112
	E1291	T1232	L1169	K1113
	LEU	D1233	D1170	K1114
	GLU	E1234	F1171	D1115
	VAL	I1235	F1172	S1116
	LEU	I1236	N1173	P1117
	PHE	G1236	L1174	V1118
	LEU	L1237	N1175	
	PHE	I1238	Q1176	
	GLN		E1177	
	GLY		W1178	
	PRO			

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	286802	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50.0	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	2.181	Depositor
Minimum map value	-1.697	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.034	Depositor
Recommended contour level	0.252	Depositor
Map size (Å)	327.0, 327.0, 327.0	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.09, 1.09, 1.09	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.25	0/10893	0.46	0/14716

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	10659	0	10529	165	0
All	All	10659	0	10529	165	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 165 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:844:THR:HG21	1:A:849:LEU:HD12	1.66	0.77
1:A:668:LEU:HD11	1:A:681:THR:HB	1.69	0.75
1:A:536:THR:HG22	1:A:537:ILE:H	1.50	0.75
1:A:1237:LEU:HD12	1:A:1267:VAL:HG23	1.69	0.75
1:A:95:LEU:HD22	1:A:225:ALA:HB2	1.69	0.73

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	1289/1307 (99%)	1219 (95%)	70 (5%)	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	1190/1205 (99%)	1189 (100%)	1 (0%)	93 98

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1088	TRP

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](#)

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.

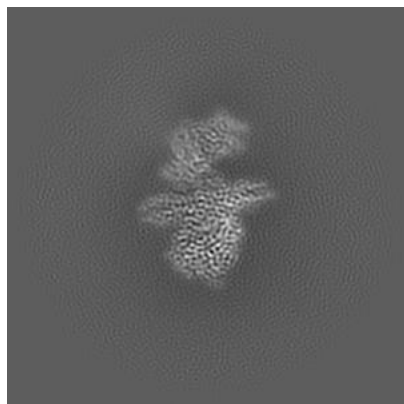
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-13947. These allow visual inspection of the internal detail of the map and identification of artifacts.

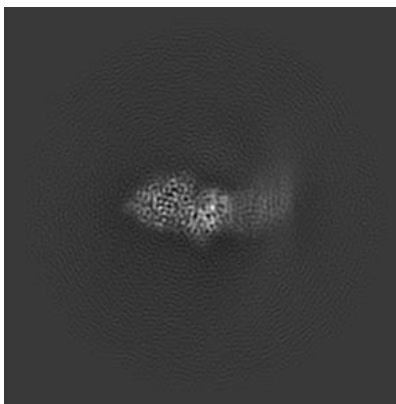
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

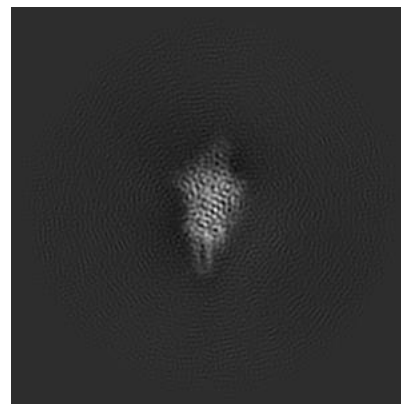
6.1.1 Primary map



X

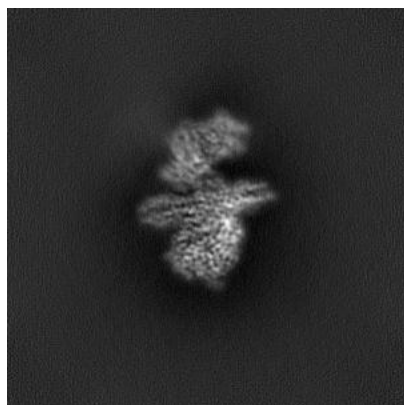


Y

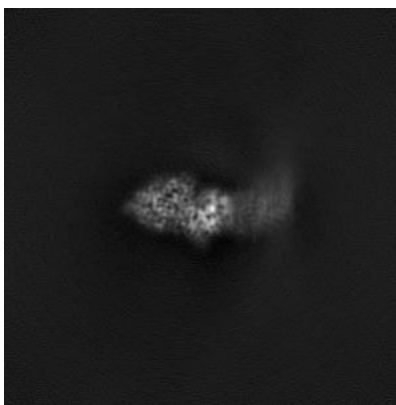


Z

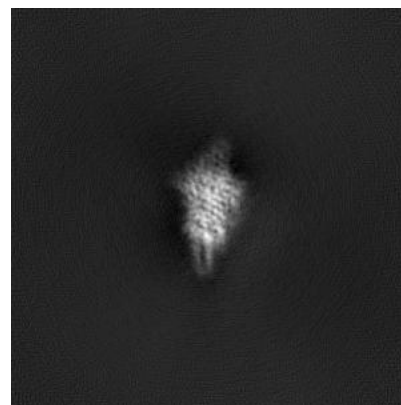
6.1.2 Raw map



X



Y

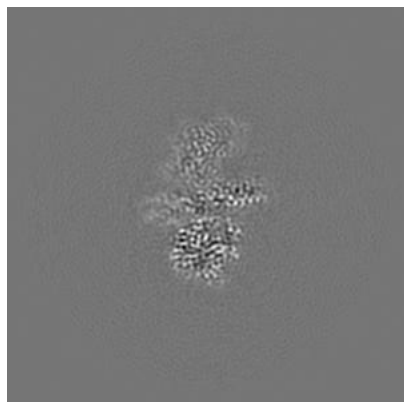


Z

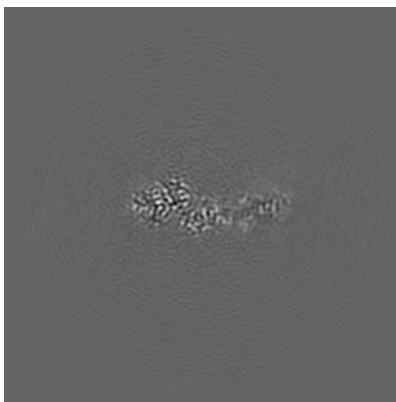
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

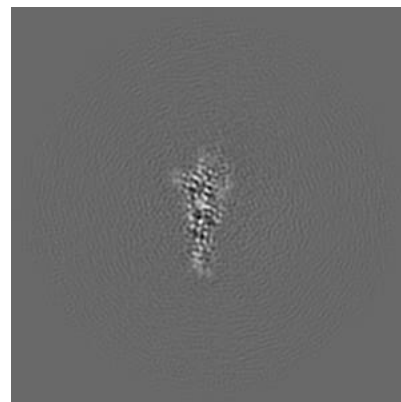
6.2.1 Primary map



X Index: 150

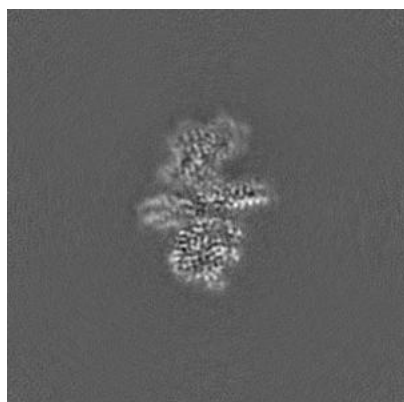


Y Index: 150

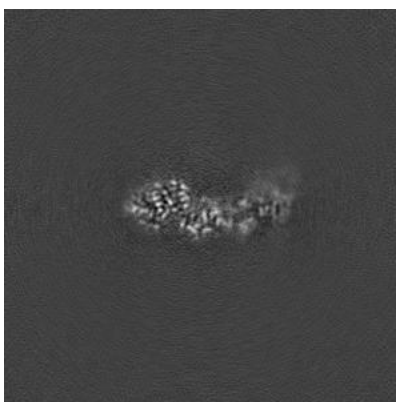


Z Index: 150

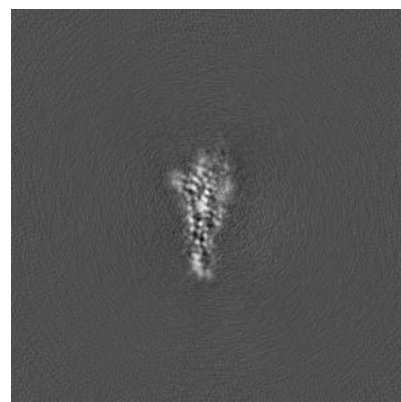
6.2.2 Raw map



X Index: 150



Y Index: 150

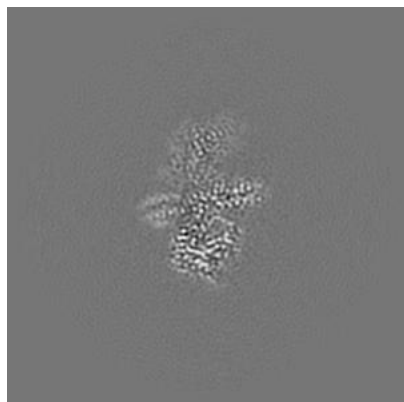


Z Index: 150

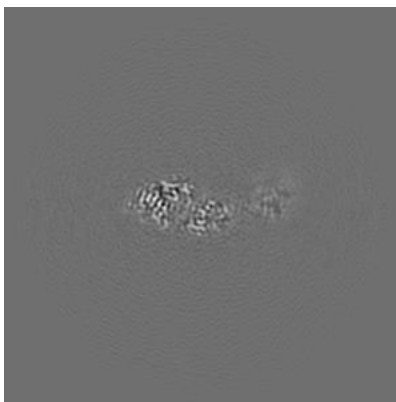
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

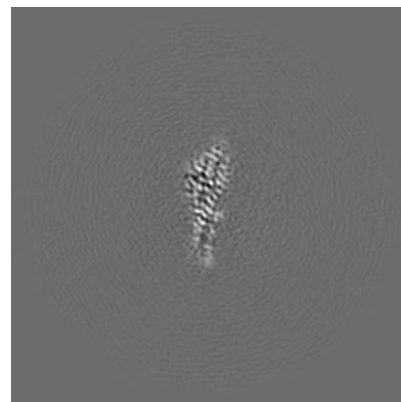
6.3.1 Primary map



X Index: 148



Y Index: 157

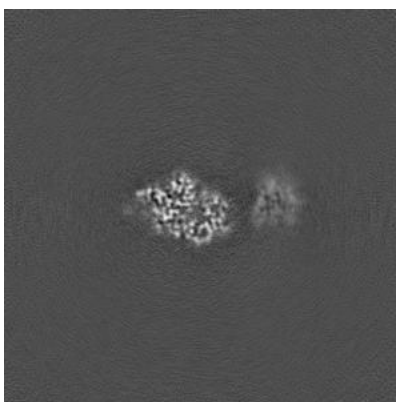


Z Index: 156

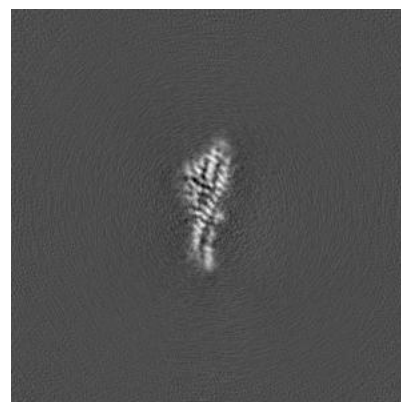
6.3.2 Raw map



X Index: 148



Y Index: 164

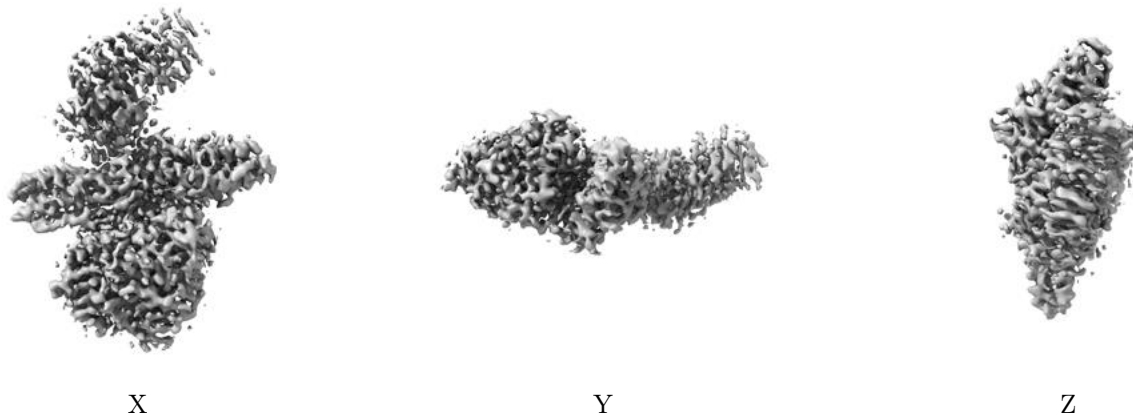


Z Index: 156

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

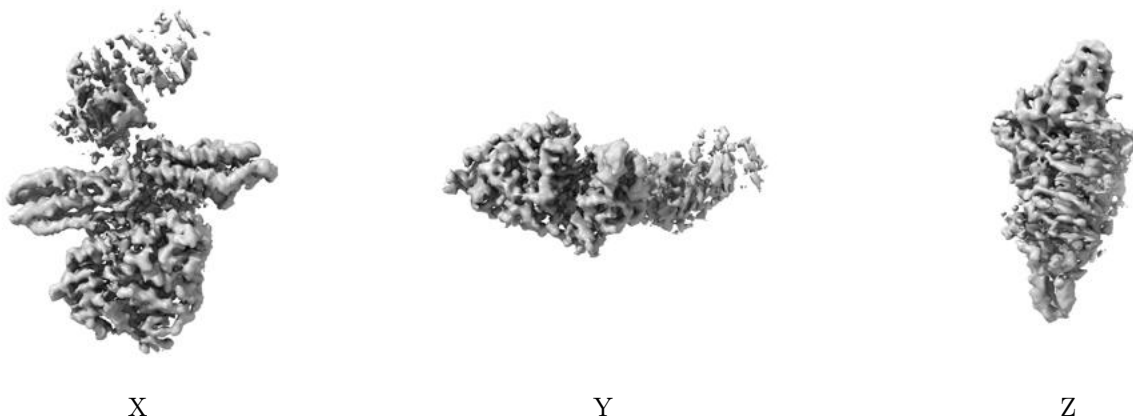
6.4 Orthogonal surface views [i](#)

6.4.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.252. 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.

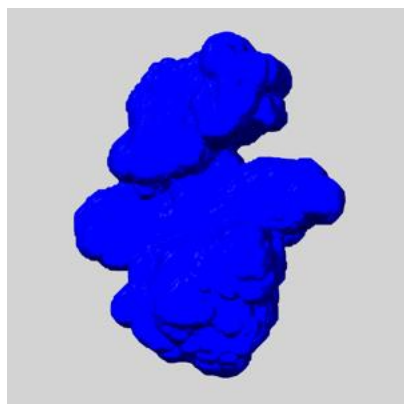
6.5 Mask visualisation [i](#)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

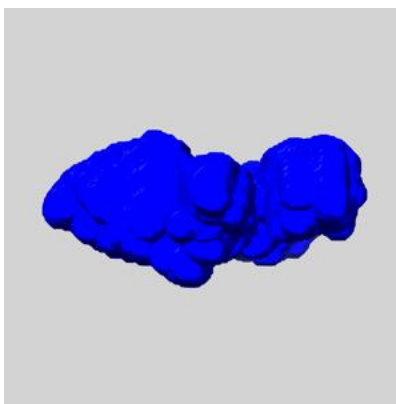
A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

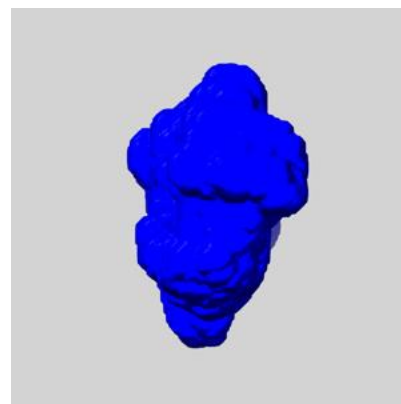
6.5.1 emd_13947_msk_1.map [i](#)



X



Y

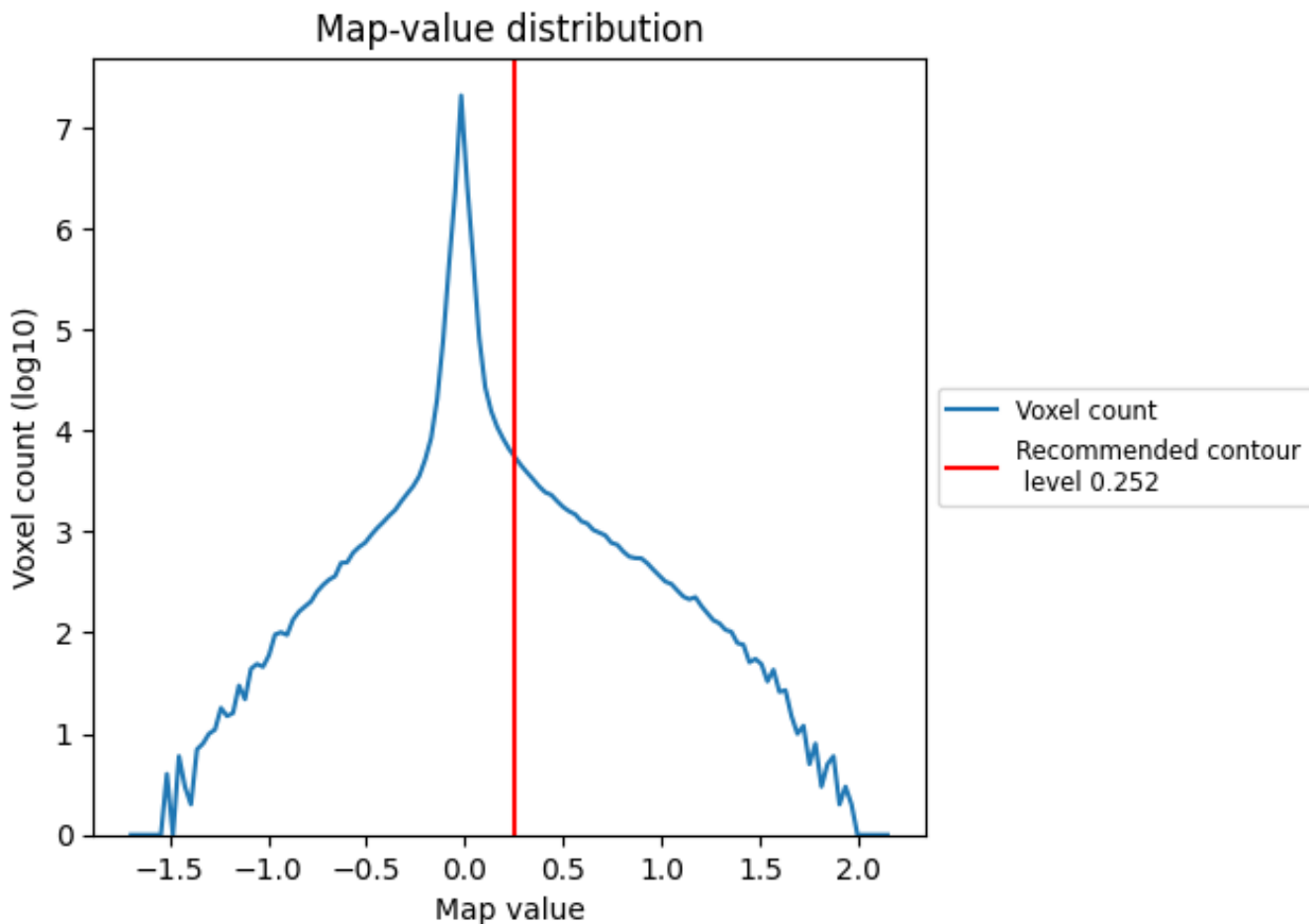


Z

7 Map analysis [i](#)

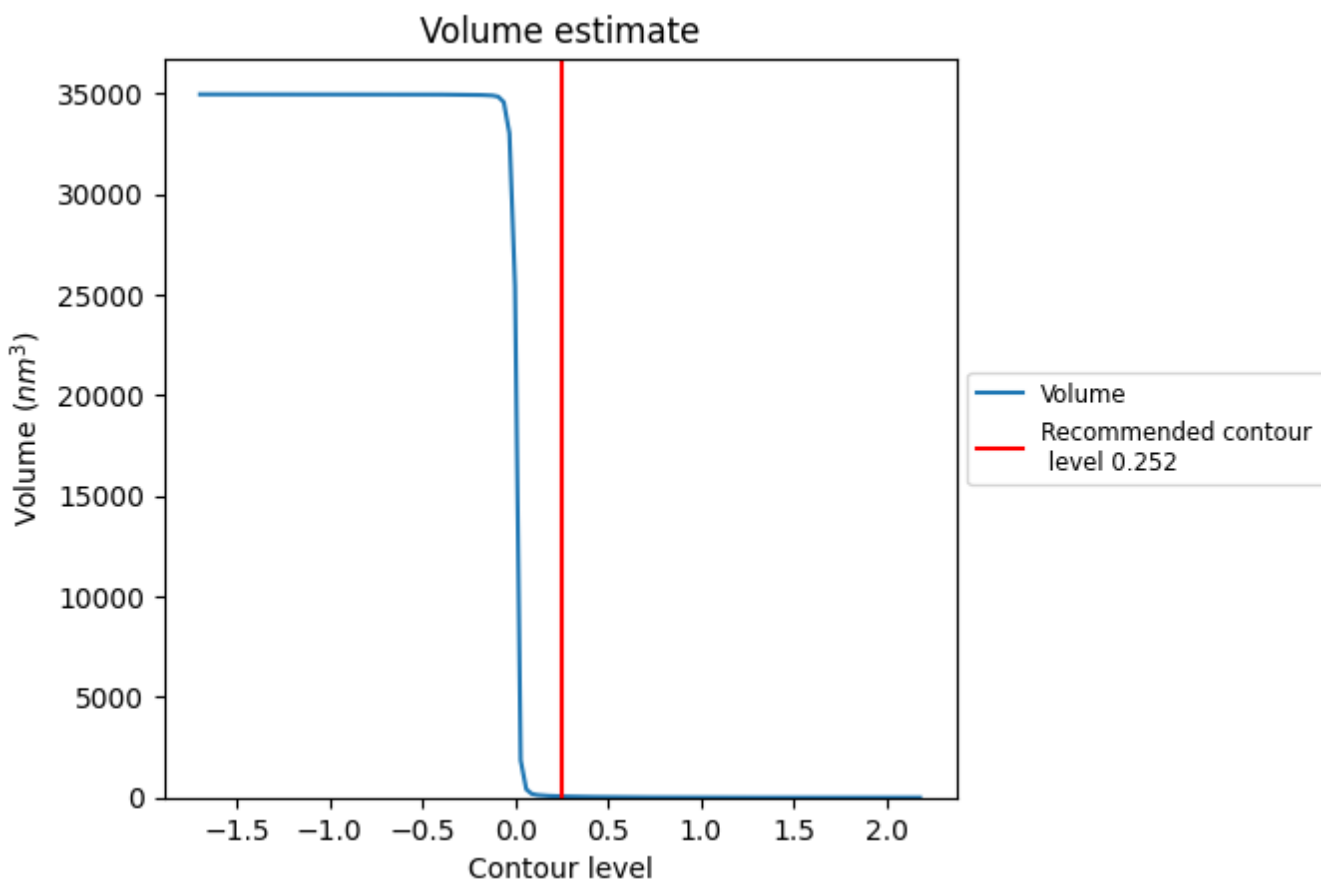
This section contains the results of statistical analysis of the map.

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.

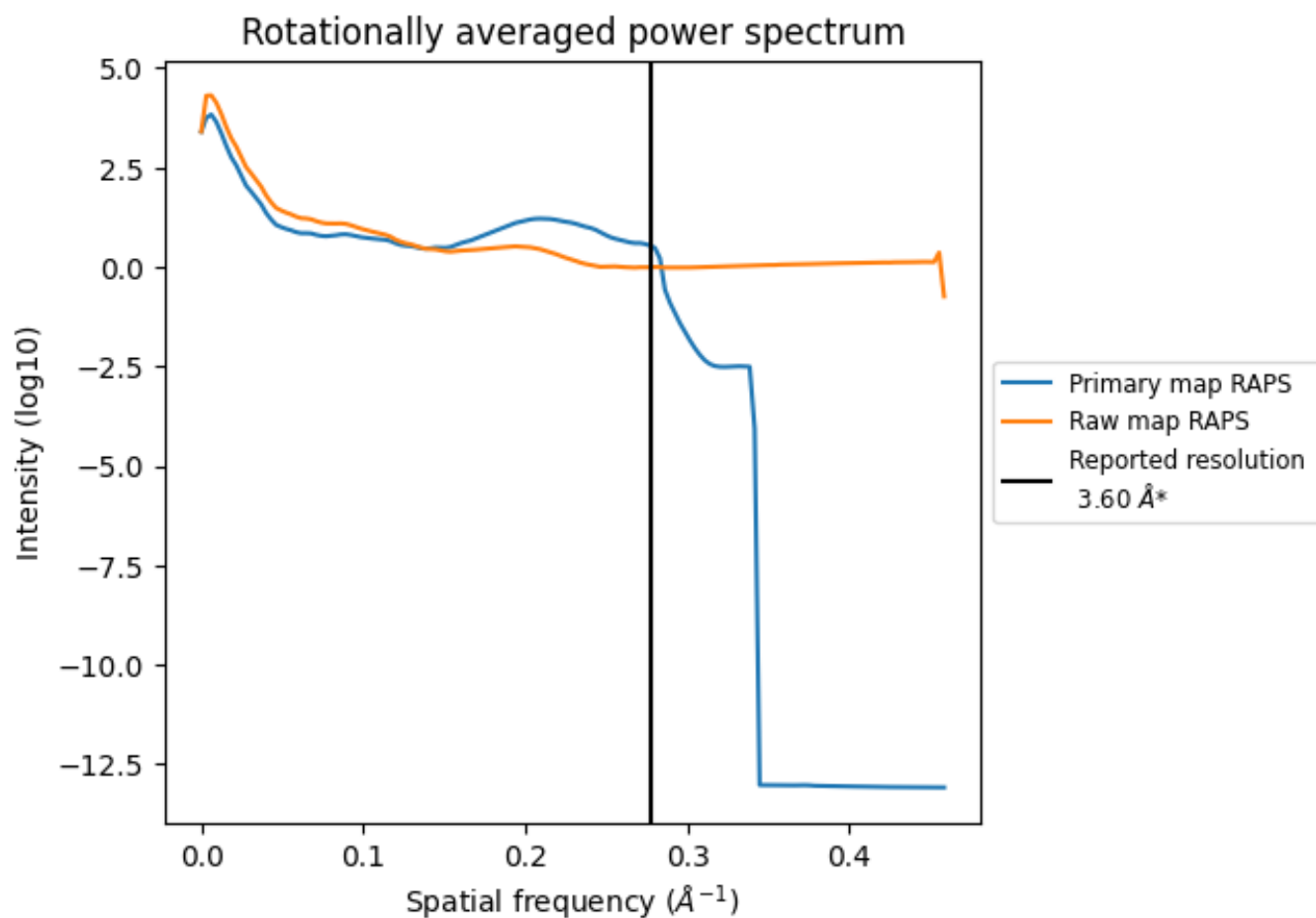
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 60 nm³; this corresponds to an approximate mass of 54 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](#)

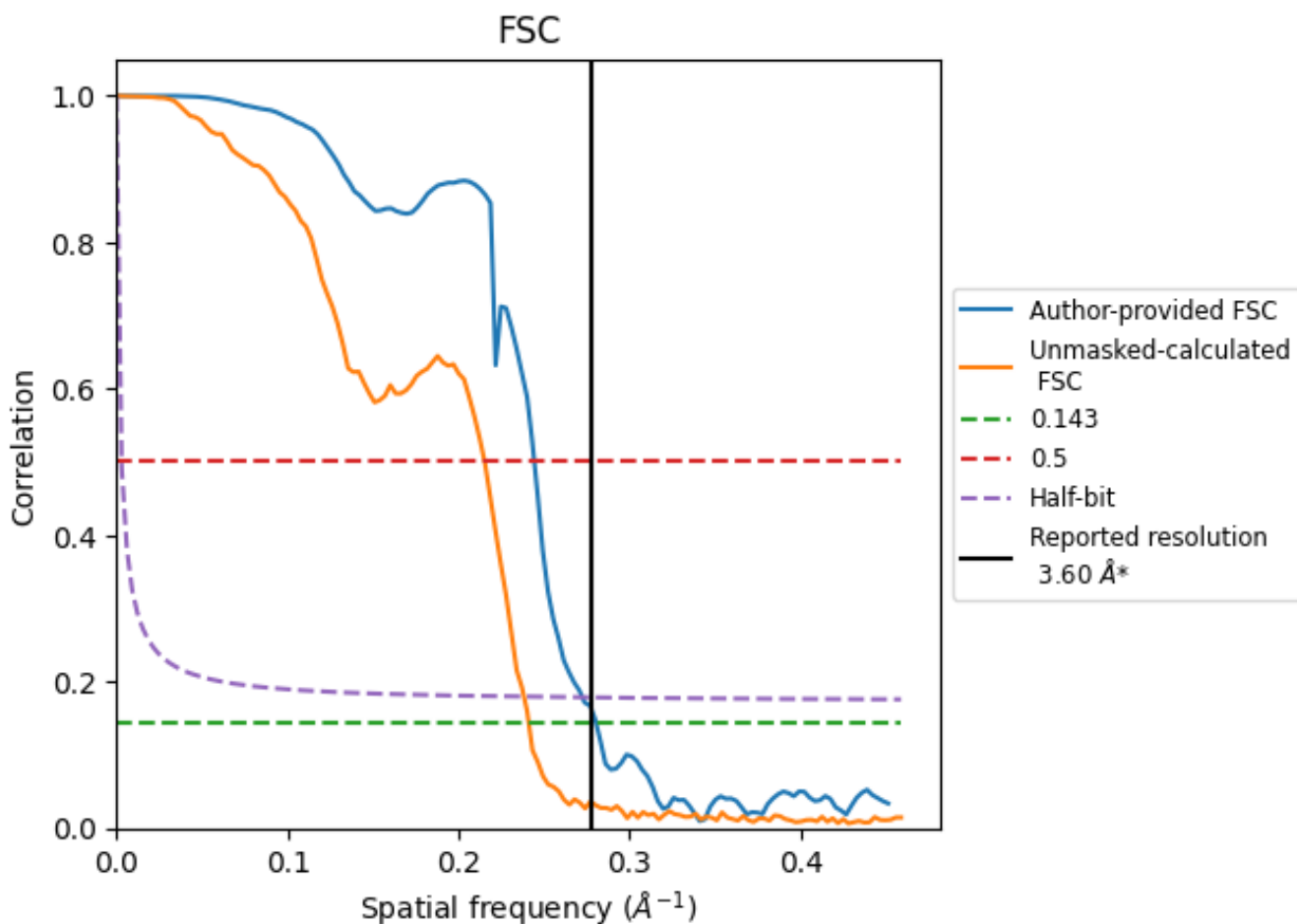


*Reported resolution corresponds to spatial frequency of 0.278 Å⁻¹

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 0.278 Å⁻¹

8.2 Resolution estimates [i](#)

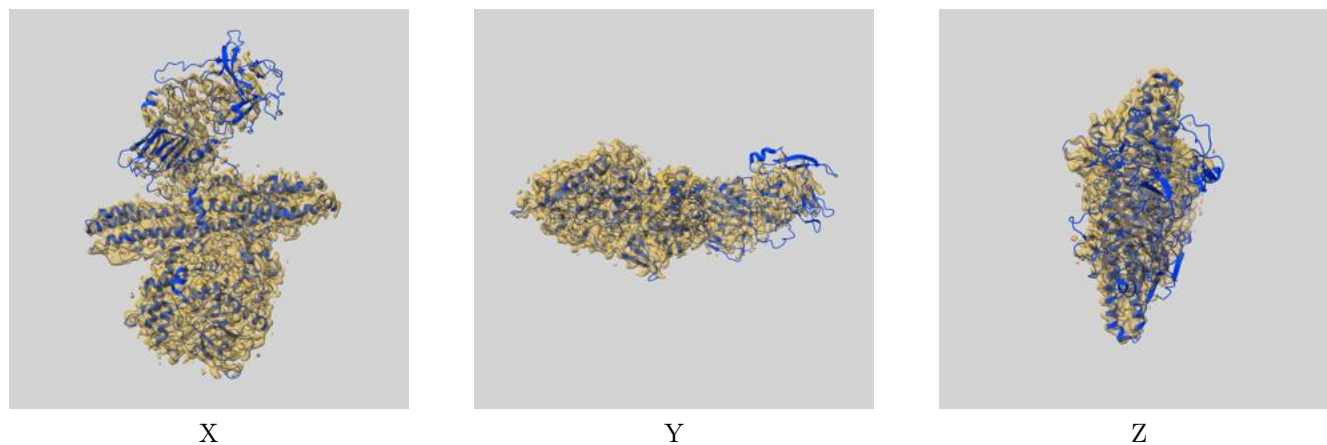
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.60	-	-
Author-provided FSC curve	3.57	4.09	3.67
Unmasked-calculated*	4.15	4.64	4.20

*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 4.15 differs from the reported value 3.6 by more than 10 %

9 Map-model fit [i](#)

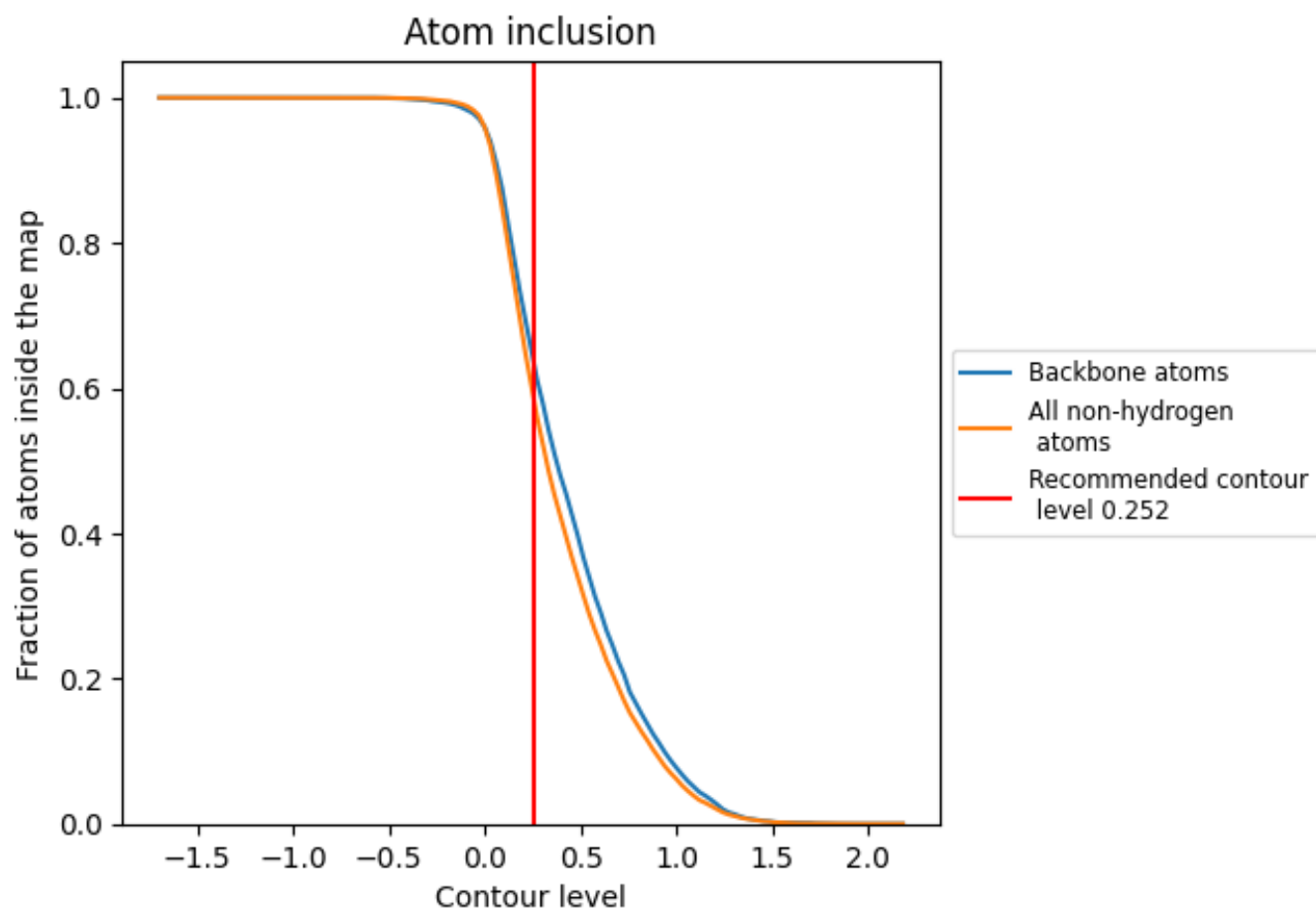
This section contains information regarding the fit between EMDB map EMD-13947 and PDB model 7QFQ. Per-residue inclusion information can be found in section 3 on page 4.

9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.252 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 Atom inclusion [i](#)



At the recommended contour level, 64% of all backbone atoms, 59% of all non-hydrogen atoms, are inside the map.