



wwPDB EM Validation Summary Report ⓘ

Jul 7, 2024 – 04:30 pm BST

PDB ID : 7PD8
EMDB ID : EMD-13331
Title : Structure of Adenylyl cyclase 9 in complex with DARPin C4 and MANT-GTP
Authors : Qi, C.; Korkhov, V.M.
Deposited on : 2021-08-04
Resolution : 4.20 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.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

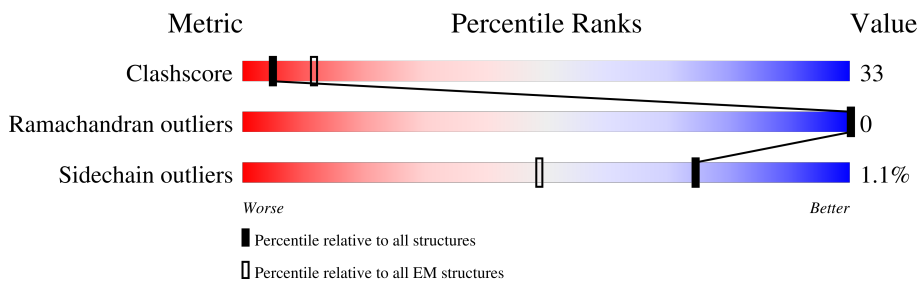
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.20 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	1354	
2	B	147	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7642 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 Adenylate cyclase 9.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	842	6676	4329	1098	1194	55	0	0

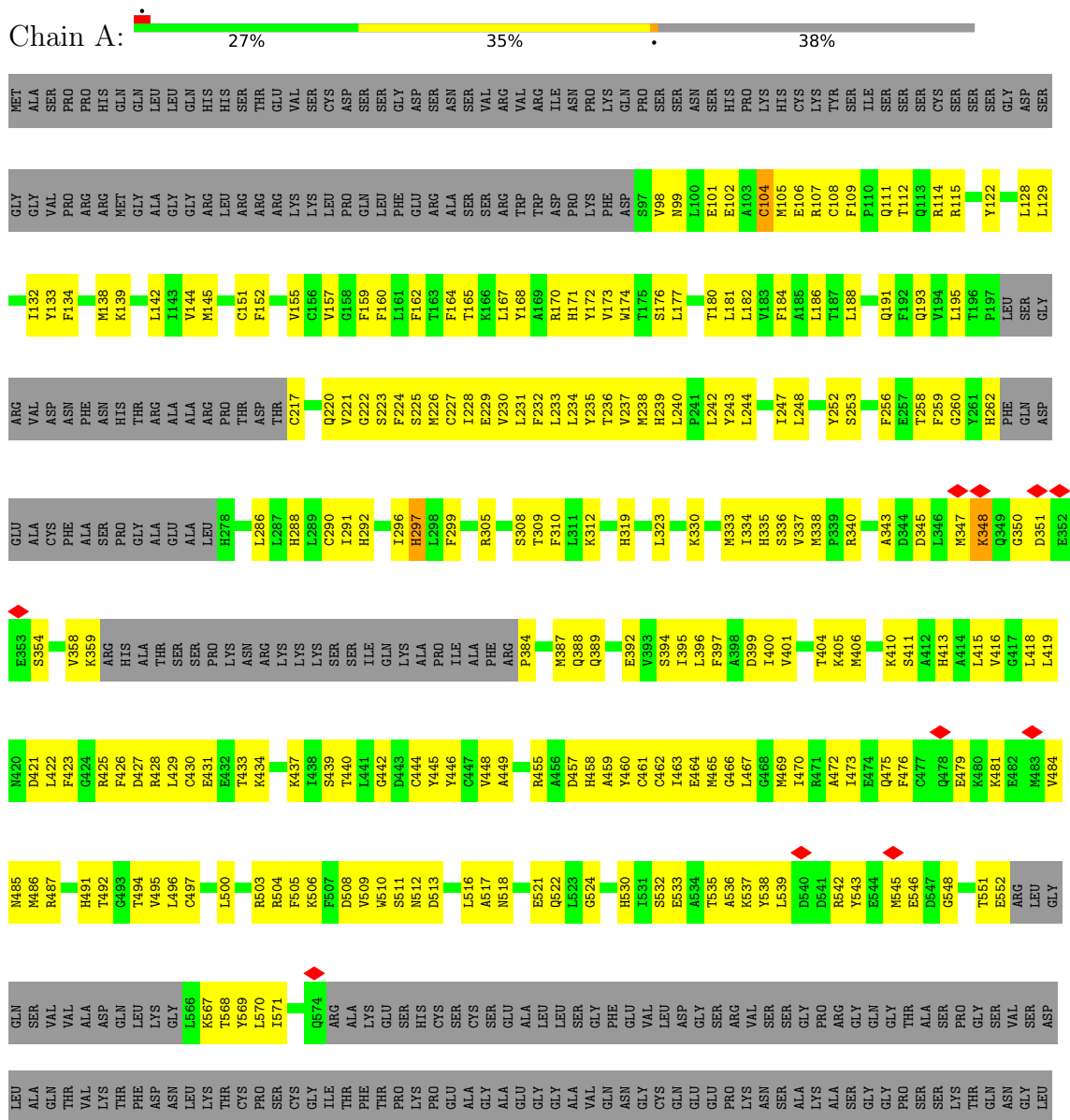
- Molecule 2 is a protein called DARPin C4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	128	966	607	171	187	1	0	0

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: Adenylate cyclase 9



LEU	SER	LEU	LEU	L799	P876	SER	I1019	I1090	L1158	ALA	PRO	ALA	E61	I121
SER	MET	LEU	MET	I800	A877	SER	I1020	G1091	W1159	PRO	GLY	MET	I62	D122
PRO	LYS	ASP	LYS	L801	V680	THR	K1021	D1092	F1160	GLY	SER	ARG	V63	N123
PRO	TYR	PHE	TYR	T804	Y881	ILE	D1027	F1093	M1161	HIS	SER	HIS	E64	G124
GLU	PHE	CYS	PHE	C805	S882	ASN	Q1028	E1094	F1162	ASN	ASN	HIS	V65	N125
GLU	PHE	HIS	PHE	F806	H883	HIS	W1031	E1095	K1163	ALA	ALA	HIS	L66	E126
LYS	LYS	LEU	LYS	L807	W884	LEU	W1032	L1096	L1164	GLN	GLN	HIS	L67	D127
THR	PRO	ASP	PRO	R808	F888	ASP	L1033	P1100	R1165	THR	THR	H9	K68	I128
ASN	ALA	ILE	PRO	Y809	I892	VAL	R1034	Y1101	G1167	ARG	ASP	H10	A69	A129
GLN	GLN	ASN	ASN	S813	I893	GLN	M1035	Y1102	M1168	ALA	ASP	G11	P1244	E130
THR	PHE	GLN	PHE	P815	S894	ASN	I1036	S1104	M1169	HIS	HIS	S12	K1245	V131
LEU	SER	THR	LEU	A820	T895	PHE	I1037	I1106	P1172	PRO	PRO	D13	T1247	Q133
CYS	LEU	ASN	LEU	A820	W896	SER	Y1039	K1107	P1172	SER	ALA	ALA	D1248	Q133
GLY	PHE	CYS	PHE	F824	F897	THR	H1040	H1111	S1249	LYS	ARG	ARG	S1249	K134
LYS	LEU	ILE	LEU	A827	W898	ARG	H1041	I1112	G1250	PRO	PRO	PRO	G1250	A136
LEU	LEU	LEU	LEU	L828	G899	LYS	A1042	G1113	T1180	TRP	TRP	LYS	L18	LYS
GLN	PRO	GLU	PRO	E831	S900	ASN	Q1044	A1113	T1181	LYS	LYS	ALA	L19	LEU
LYS	LEU	LEU	LEU	L832	V902	ASN	L1045	T1114	K1182	GLU	GLU	ALA	E20	GLU
GLY	GLU	GLU	GLU	I832	L903	ALA	K1046	Y1115	L1184	PRO	PRO	HIS	A21	GLU
ARG	ARG	ARG	ARG	W836	A905	LEU	V1047	M1116	Y1185	VAL	VAL	GLN	A22	VAL
TRP	ALA	ALA	ALA	V837	V906	PRO	S1048	S1119	D1186	ALA	ALA	LEU	R23	ALA
ALA	TYR	TYR	TYR	Y837	Y907	ASP	I1049	G1120	W1187	GLU	GLU	ALA	A24	ALA
GLY	GLY	GLY	GLY	W839	Y908	ASP	T1050	L1121	D1188	GLU	GLU	ILE	G25	GLU
VAL	THR	THR	THR	R840	Y909	GLY	Y1051	T1122	G1189	ARG	ARG	GLU	Q26	GLU
SER	SER	SER	SER	R841	Y909	ARG	S1052	A1123	T1191	PRO	PRO	CYS	D27	CYS
LEU	LEU	LEU	LEU	Y841	Y912	PRO	K1053	T1194	Y1192	ASP	ASP	ILE	D28	ILE
ASP	ASP	ASP	ASP	Y841	Y913	PRO	M1054	C1126	M1193	ILE	ILE	ARG	A28	ARG
GLN	GLN	GLN	GLN	L845	Q913	PRO	H1055	R1127	S1196	VAL	VAL	VAL	E29	VAL
ALA	GLU	GLU	GLU	E847	L915	GLU	D1056	D1128	R1197	ALA	ALA	ALA	V30	ALA
ALA	VAL	VAL	VAL	D847	L916	VAL	I1061	G1129	T1200	ALA	ALA	ALA	R30	ALA
LEU	VAL	VAL	VAL	W848	S916	LEU	F1062	S1130	T1200	GLY	GLY	ILE	I32	ILE
LEU	LYS	LYS	LYS	R849	S916	LEU	I1065	H1131	V1203	GLY	LYS	LYS	L33	GLY
PRO	SER	SER	SER	T850	R920	PRO	V1066	P1132	E1204	ILE	ILE	ILE	R31	LYS
ARG	SER	SER	SER	C851	S921	PRO	M1067	Q1133	C1205	GLY	ASP	ASP	I32	LEU
PHE	VAL	VAL	VAL	R852	S922	VAL	F1068	Q1133	R1206	ARG	ARG	ARG	L33	GLY
LYS	ARG	ARG	ARG	R853	L923	VAL	F1068	Q1137	I1207	GLU	GLU	GLU	M34	CYS
ASN	ARG	ARG	ARG	R854	T925	VAL	S1069	I1137	I1207	PRO	PRO	GLU	A35	GLU
ILE	THR	THR	THR	L855	W926	THR	E1070	I1138	Q1208	PRO	PRO	GLU	G37	GLU
ARG	THR	THR	THR	L856	Y927	THR	F1071	L1139	V1209	THR	THR	VAL	A38	VAL
GLU	GLU	GLU	GLU	T859	G928	GLU	Y1072	F1140	S1210	THR	THR	MET	D39	MET
LYS	LYS	LYS	LYS	A860	A929	LYS	E1073	E1141	E1211	GLU	GLU	GLU	W40	GLU
ASP	ASP	ASP	ASP	G861	G930	ASP	E1077	F1142	E1212	ILE	ILE	ILE	M41	GLU
ALA	ALA	ALA	ALA	W862	G931	ASP	Y1076	F1142	S1213	ALA	ALA	ALA	A42	ALA
HIS	PHE	PHE	PHE	P864	L932	HIS	K1080	E1145	R1215	LEU	LEU	LEU	T43	ASN
VAL	VAL	VAL	VAL	R866	L933	VAL	E1081	M1146	V1216	VAL	VAL	VAL	D44	GLU
ASP	ASP	ASP	ASP	R867	L934	VAL	C1082	R1147	L1217	SER	SER	SER	D45	LEU
VAL	VAL	VAL	VAL	L791	L935	VAL	Y1083	V1149	L1217	VAL	VAL	VAL	Y46	THR
ILE	ILE	ILE	ILE	L792	L936	VAL	Y1084	V1150	M1220	VAL	VAL	VAL	C47	LEU
LYS	LYS	LYS	LYS	L793	S939	VAL	R1084	D1151	G1221	GLN	GLN	GLN	H48	LEU
GLU	GLU	GLU	GLU	G869	LEU	LEU	R1085	F1152	E1222	ASN	ASN	ASN	T49	ASN
ASP	ASP	ASP	ASP	W873	CYS	PRO	V1086	F1153	E1223	PRO	PRO	PRO	P50	VAL
SER	SER	SER	SER	S874	PRO	PRO	L1087	N1154	F1224	ASP	ASP	ASP	L51	VAL
				L875	ASP	ASP	E1088	N1155	D1225	GLN	GLN	GLN	H52	GLU
							L1089	N1156	Y1226	VAL	VAL	VAL	L53	ARG
													A54	
													A55	
													W56	
													F57	
													G58	
													H59	
													L60	

● Molecule 2: DARPin C4



MET	ARG	GLY	SER	HIS	ASN	ALA	GLN	THR	H9	H10	G11	S12	L14	Y14	G15	K16	K17	L18	L19	E20	A21	A22	R23	A24	G25	Q26	D27	A28	E29	V30	R30	I30	I32	L33	M34	A35	N36	G37	A38	D39	W40	M41	A42	T43	D44	D45	Y46	C47	H48	T49	P50	L51	H52	L53	A54	A55	W56	F57	G58	H59	L60
E61	I62	V63	E64	V65	L66	L67	K68	A69	G70	A71	D72	V73	N74	A75	A76	D77	W78	L79	G80	D81	P83	L84	H85	L86	A87	A88	R89	I90	G91	H92	L93	E94	I95	V96	E97	V98	W99	L99	L100	K101	H102	G103	A104	D105	V106	N107	Q109	D110	K111	F112	G113	K114	T115	P116	F117	D118	L119	A120			
I121	D122	N123	G124	N125	E126	D127	L128	A129	E130	V131	L132	Q133	K134	A135	A136	LYS	LEU	ASN	ASP	TYR	D81	T82	P83	L84	H85	L86	A87	A88	R89	I90	G91	H92	L93	E94	I95	V96	E97	V98	W99	L99	L100	K101	H102	G103	A104	D105	V106	N107	Q109	D110	K111	F112	G113	K114	T115	P116	F117	D118	L119	A120	

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	210729	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	40	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	0.073	Depositor
Minimum map value	-0.048	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.002	Depositor
Recommended contour level	0.01	Depositor
Map size (\AA)	243.0, 243.0, 243.0	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (\AA)	0.81, 0.81, 0.81	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	0.50	1/6822 (0.0%)	0.59	3/9226 (0.0%)
2	B	0.27	0/984	0.45	0/1337
All	All	0.48	1/7806 (0.0%)	0.58	3/10563 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	862	TRP	CB-CG	6.80	1.62	1.50

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	813	SER	C-N-CA	-5.64	107.60	121.70
1	A	231	LEU	CA-CB-CG	-5.49	102.68	115.30
1	A	997	LEU	CA-CB-CG	-5.06	103.67	115.30

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	6676	0	6696	419	0
2	B	966	0	938	88	0
All	All	7642	0	7634	501	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 33.

The worst 5 of 501 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:912:PHE:O	1:A:920:ARG:NH1	2.00	0.93
2:B:116:PRO:HA	2:B:119:LEU:HD13	1.62	0.81
1:A:104:CYS:SG	1:A:105:MET:N	2.53	0.81
1:A:1137:GLN:HG2	1:A:1220:MET:HG2	1.62	0.80
1:A:389:GLN:NE2	1:A:494:THR:OG1	2.15	0.79

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	828/1354 (61%)	734 (89%)	94 (11%)	0	100	100
2	B	126/147 (86%)	113 (90%)	13 (10%)	0	100	100
All	All	954/1501 (64%)	847 (89%)	107 (11%)	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	729/1176 (62%)	720 (99%)	9 (1%)	71	83
2	B	96/114 (84%)	96 (100%)	0	100	100
All	All	825/1290 (64%)	816 (99%)	9 (1%)	74	84

5 of 9 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	993	LEU
1	A	1214	TYR
1	A	348	LYS
1	A	798	PHE
1	A	907	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1154	ASN
2	B	48	HIS
2	B	107	ASN
2	B	102	HIS
1	A	883	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 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.

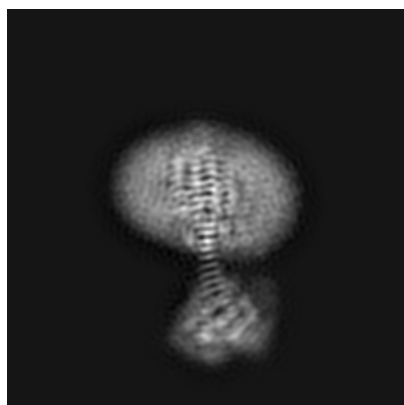
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-13331. These allow visual inspection of the internal detail of the map and identification of artifacts.

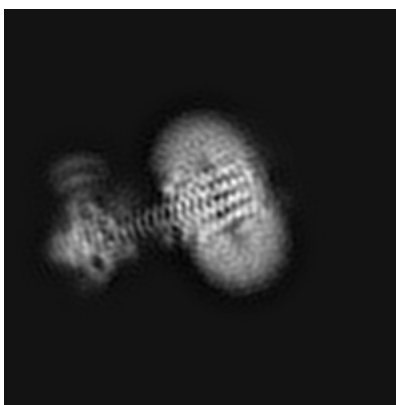
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

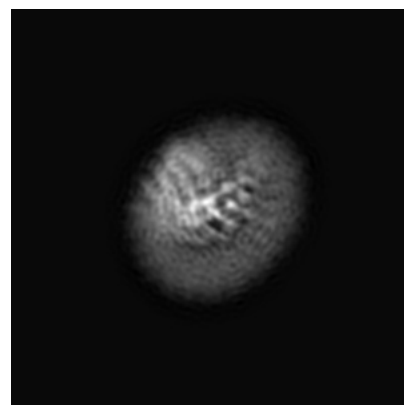
6.1.1 Primary map



X



Y

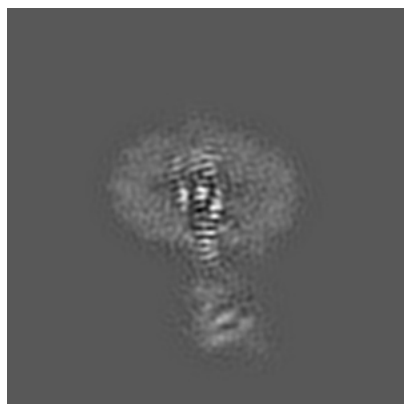


Z

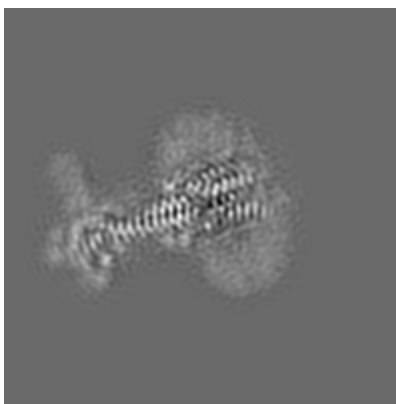
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

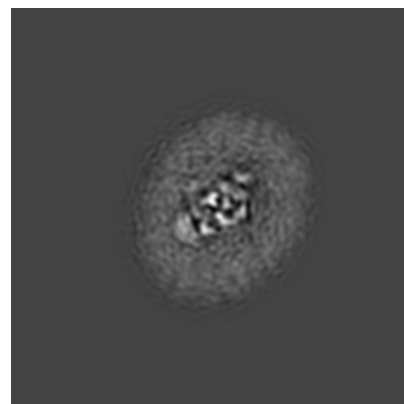
6.2.1 Primary map



X Index: 150



Y Index: 150

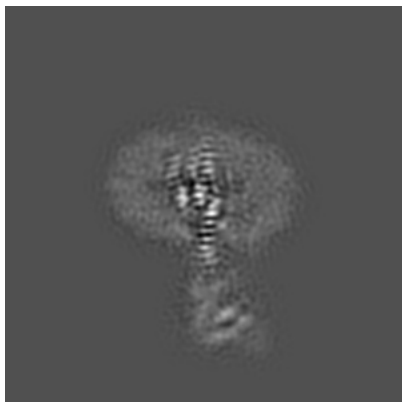


Z Index: 150

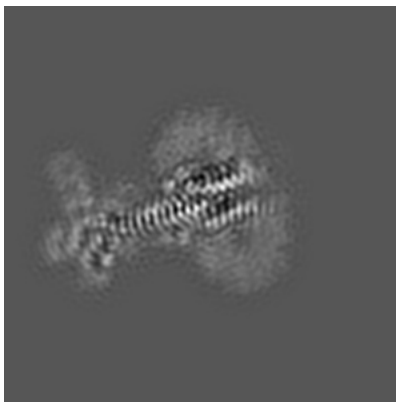
The images above show central slices of the map in three orthogonal directions.

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

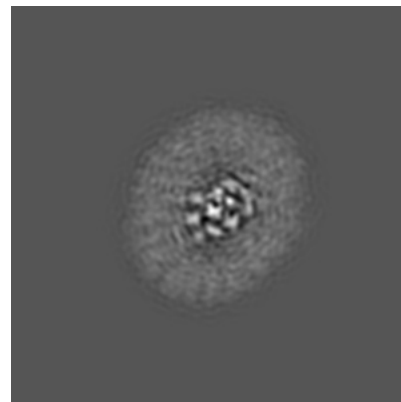
6.3.1 Primary map



X Index: 148



Y Index: 153



Z Index: 163

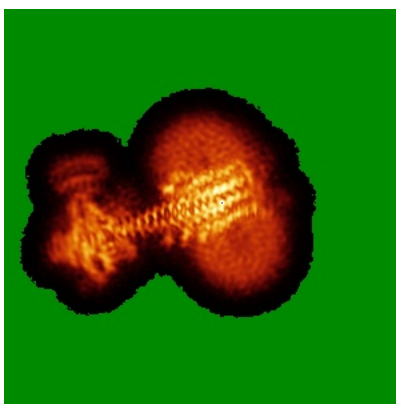
The images above show the largest variance slices of the map in three orthogonal directions.

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

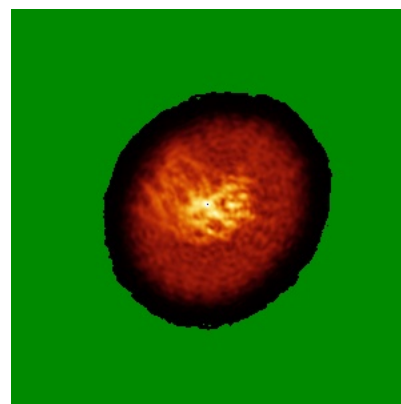
6.4.1 Primary map



X



Y

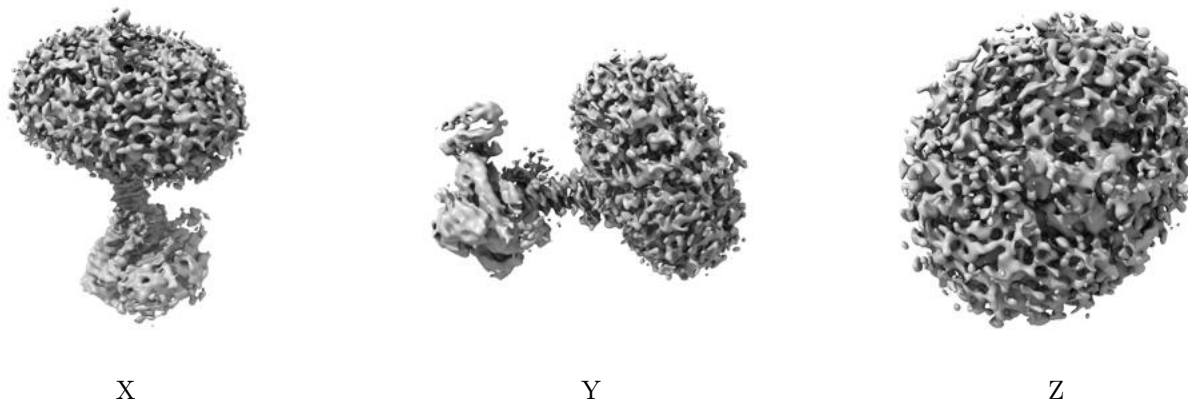


Z

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

6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.01. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

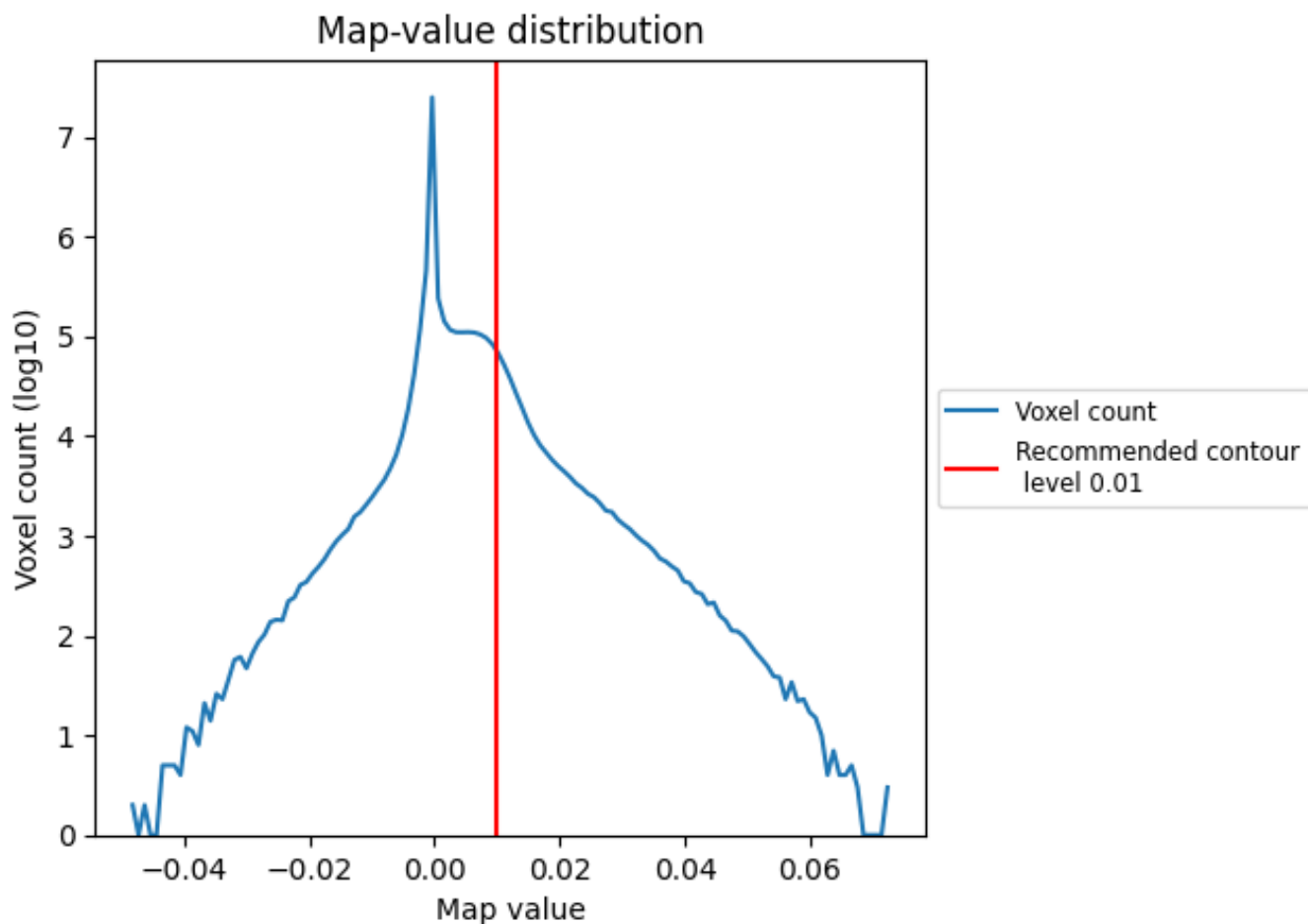
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

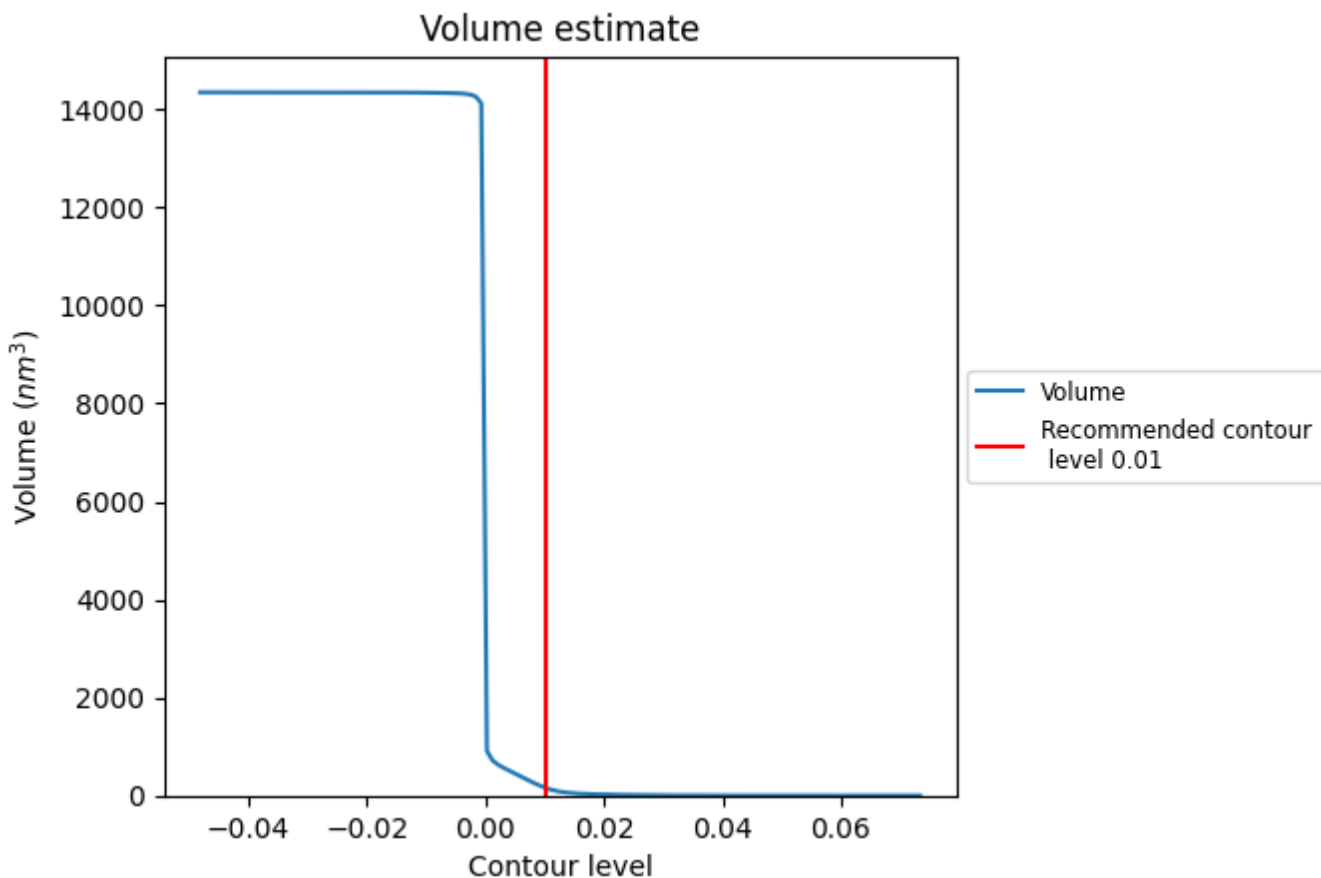
This section contains the results of statistical analysis of the map.

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.

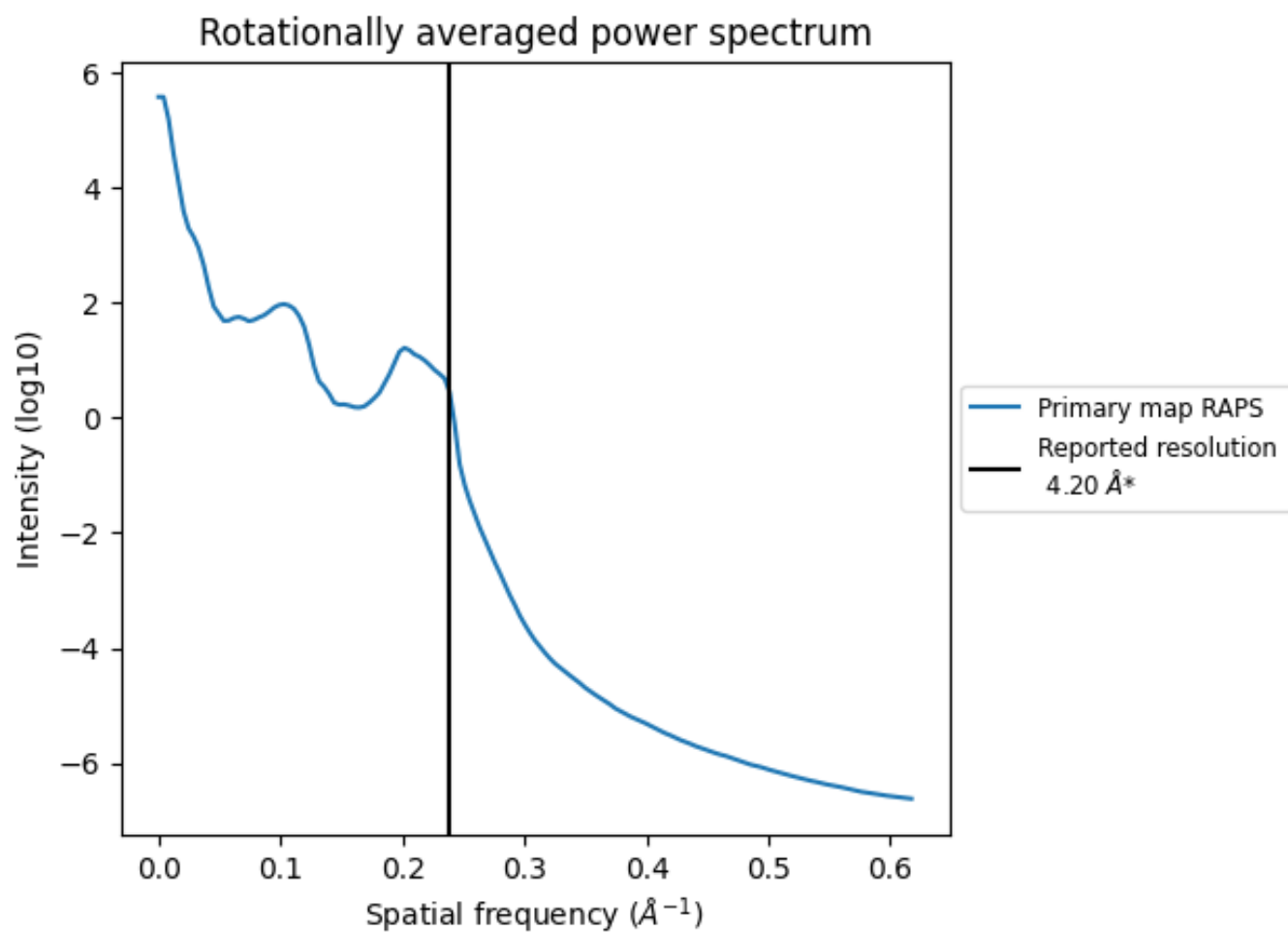
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 163 nm³; this corresponds to an approximate mass of 147 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](#)

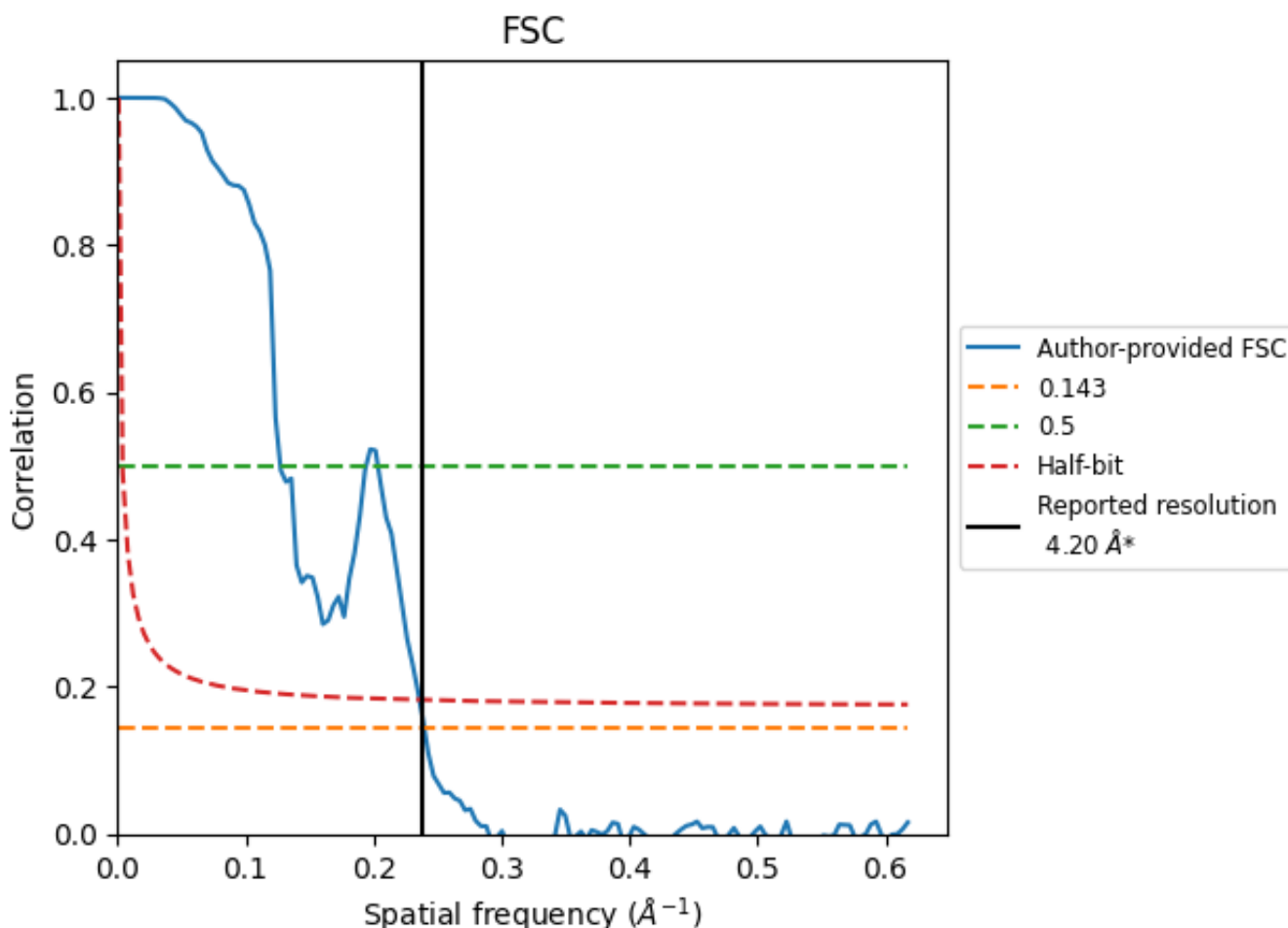


*Reported resolution corresponds to spatial frequency of 0.238\AA^{-1}

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 0.238 Å⁻¹

8.2 Resolution estimates [i](#)

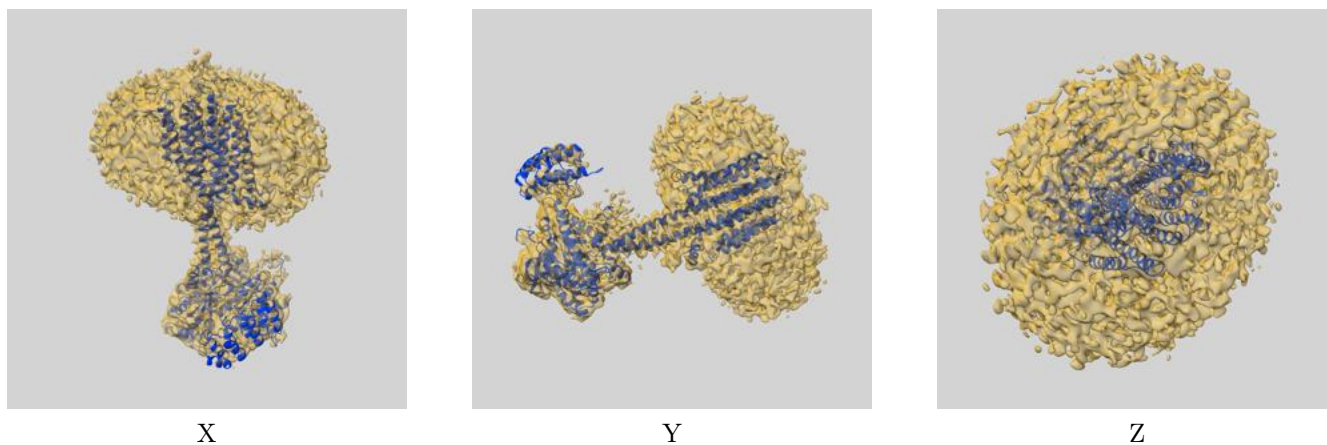
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	4.20	-	-
Author-provided FSC curve	4.17	7.86	4.24
Unmasked-calculated*	-	-	-

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

9 Map-model fit [i](#)

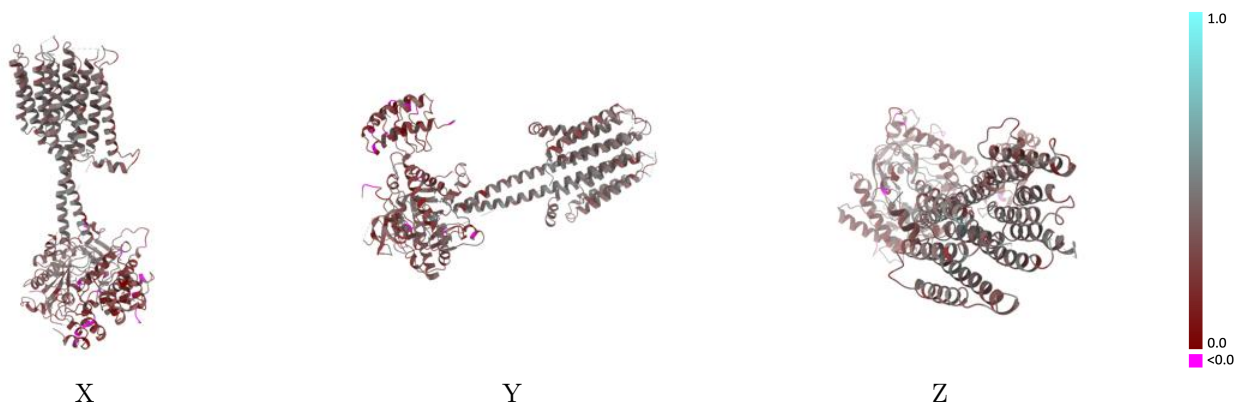
This section contains information regarding the fit between EMDB map EMD-13331 and PDB model 7PD8. Per-residue inclusion information can be found in section [3](#) on page [4](#).

9.1 Map-model overlay [i](#)



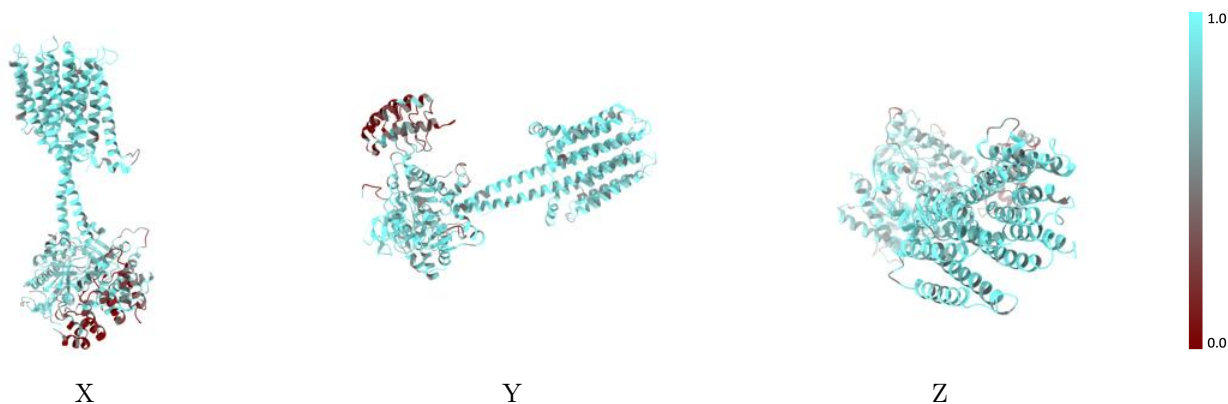
The images above show the 3D surface view of the map at the recommended contour level 0.01 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



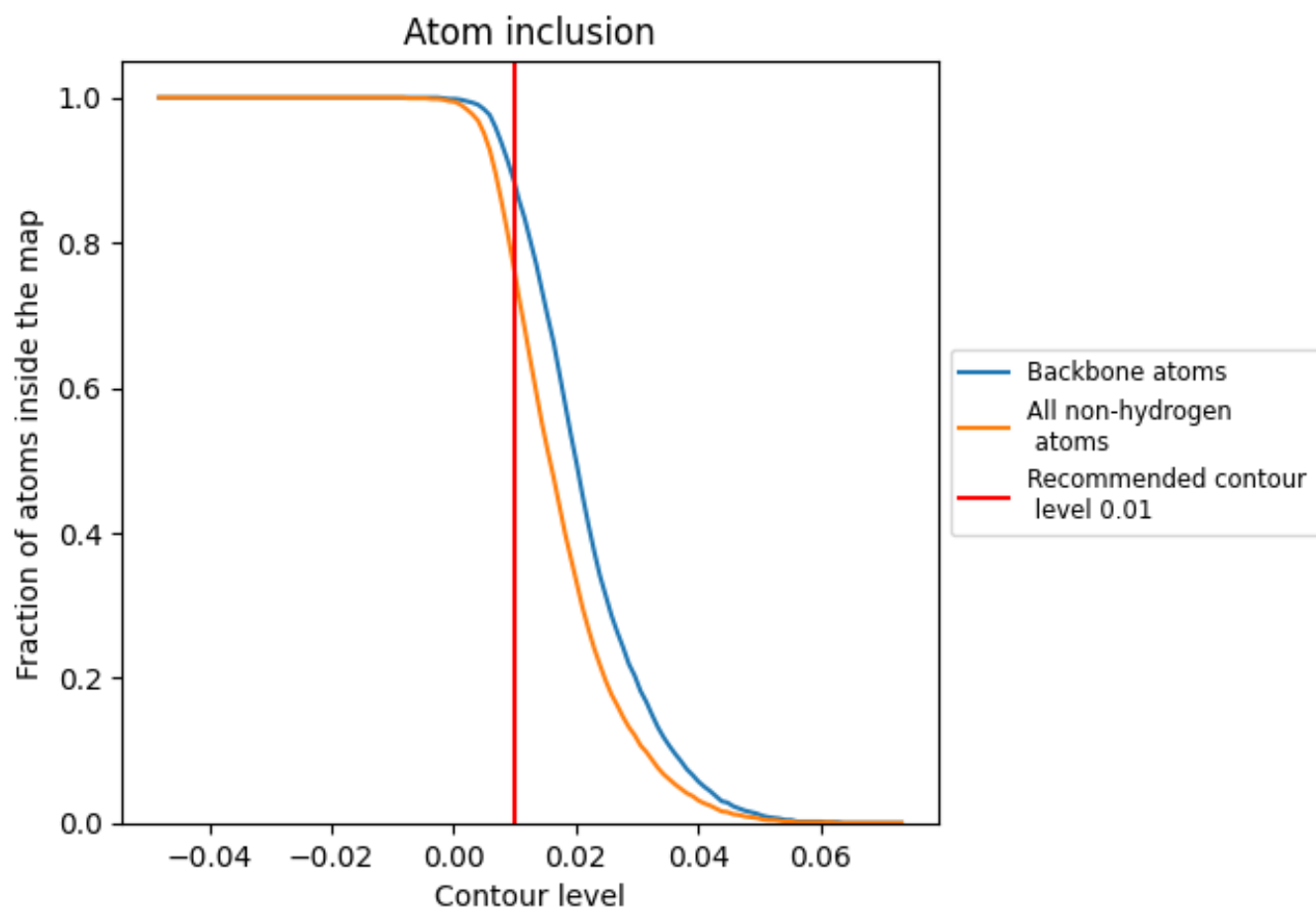
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

9.3 Atom inclusion mapped to coordinate model [\(i\)](#)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.01).







9.4 Atom inclusion [i](#)



At the recommended contour level, 88% of all backbone atoms, 76% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary [i](#)

The table lists the average atom inclusion at the recommended contour level (0.01) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.7590	 0.3390
A	 0.8240	 0.3560
B	 0.3110	 0.2270

