



wwPDB EM Validation Summary Report ⓘ

Mar 4, 2024 – 02:52 PM EST

PDB ID : 8EZQ
EMDB ID : EMD-28748
Title : Cryo-EM structure of the *S. cerevisiae* guanine nucleotide exchange factor Gea2
Authors : Duan, H.D.; Li, H.
Deposited on : 2022-11-01
Resolution : 3.70 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.dev70
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) : 2.36

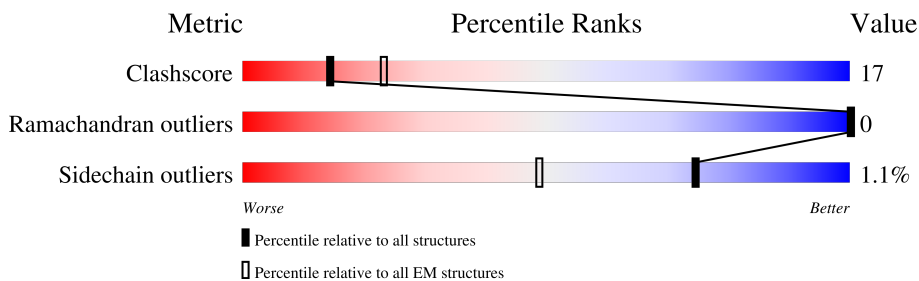
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.70 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	1483	
1	B	1483	

2 Entry composition i

There is only 1 type of molecule in this entry. The entry contains 20456 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 ARF guanine-nucleotide exchange factor 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	1273	10223	6555	1667	1964	37	0	0
1	B	1272	10233	6569	1666	1961	37	0	0

There are 48 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-23	MET	-	initiating methionine	UNP P39993
A	-22	HIS	-	expression tag	UNP P39993
A	-21	HIS	-	expression tag	UNP P39993
A	-20	HIS	-	expression tag	UNP P39993
A	-19	HIS	-	expression tag	UNP P39993
A	-18	HIS	-	expression tag	UNP P39993
A	-17	HIS	-	expression tag	UNP P39993
A	-16	SER	-	expression tag	UNP P39993
A	-15	SER	-	expression tag	UNP P39993
A	-14	GLY	-	expression tag	UNP P39993
A	-13	VAL	-	expression tag	UNP P39993
A	-12	ASP	-	expression tag	UNP P39993
A	-11	LEU	-	expression tag	UNP P39993
A	-10	GLY	-	expression tag	UNP P39993
A	-9	THR	-	expression tag	UNP P39993
A	-8	GLU	-	expression tag	UNP P39993
A	-7	ASN	-	expression tag	UNP P39993
A	-6	LEU	-	expression tag	UNP P39993
A	-5	TYR	-	expression tag	UNP P39993
A	-4	PHE	-	expression tag	UNP P39993
A	-3	GLN	-	expression tag	UNP P39993
A	-2	SER	-	expression tag	UNP P39993
A	-1	ASN	-	expression tag	UNP P39993
A	0	ALA	-	expression tag	UNP P39993
B	-23	MET	-	initiating methionine	UNP P39993
B	-22	HIS	-	expression tag	UNP P39993

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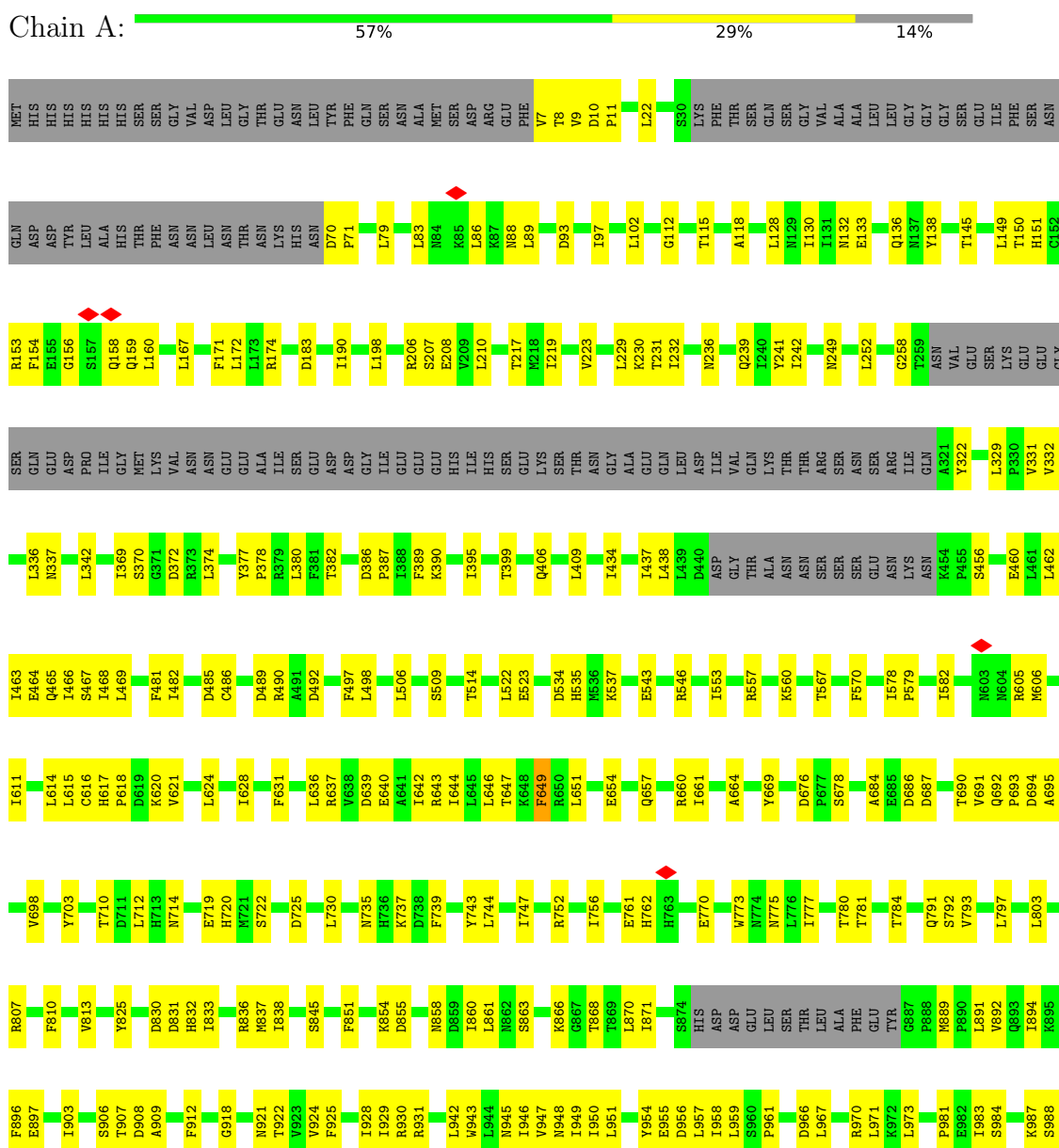
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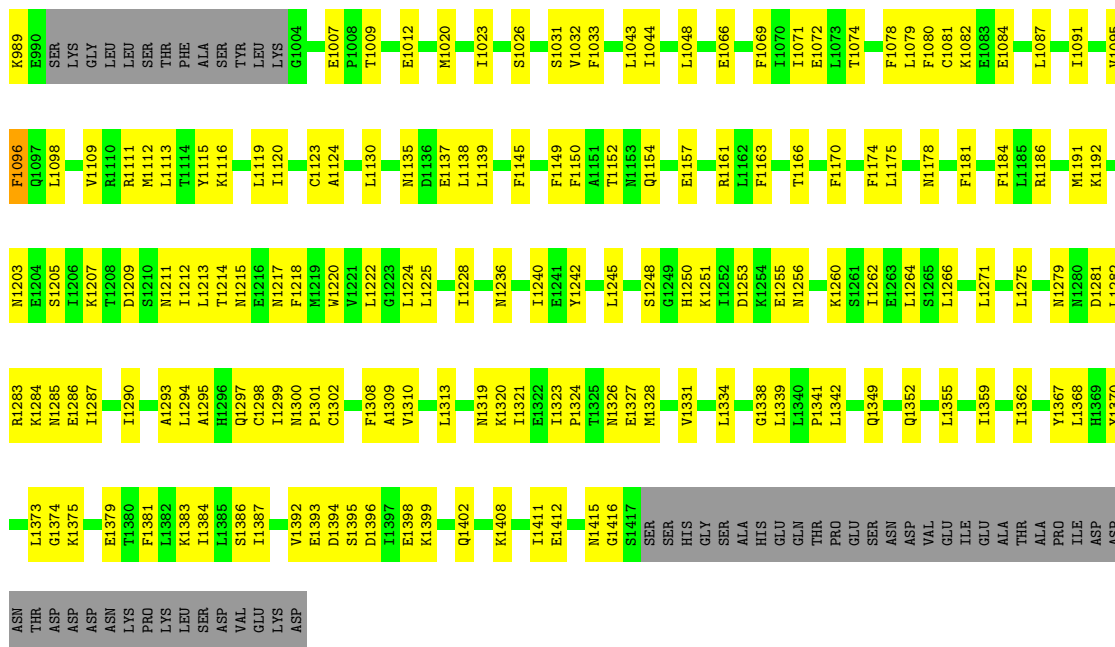
Chain	Residue	Modelled	Actual	Comment	Reference
B	-21	HIS	-	expression tag	UNP P39993
B	-20	HIS	-	expression tag	UNP P39993
B	-19	HIS	-	expression tag	UNP P39993
B	-18	HIS	-	expression tag	UNP P39993
B	-17	HIS	-	expression tag	UNP P39993
B	-16	SER	-	expression tag	UNP P39993
B	-15	SER	-	expression tag	UNP P39993
B	-14	GLY	-	expression tag	UNP P39993
B	-13	VAL	-	expression tag	UNP P39993
B	-12	ASP	-	expression tag	UNP P39993
B	-11	LEU	-	expression tag	UNP P39993
B	-10	GLY	-	expression tag	UNP P39993
B	-9	THR	-	expression tag	UNP P39993
B	-8	GLU	-	expression tag	UNP P39993
B	-7	ASN	-	expression tag	UNP P39993
B	-6	LEU	-	expression tag	UNP P39993
B	-5	TYR	-	expression tag	UNP P39993
B	-4	PHE	-	expression tag	UNP P39993
B	-3	GLN	-	expression tag	UNP P39993
B	-2	SER	-	expression tag	UNP P39993
B	-1	ASN	-	expression tag	UNP P39993
B	0	ALA	-	expression tag	UNP P39993

3 Residue-property plots

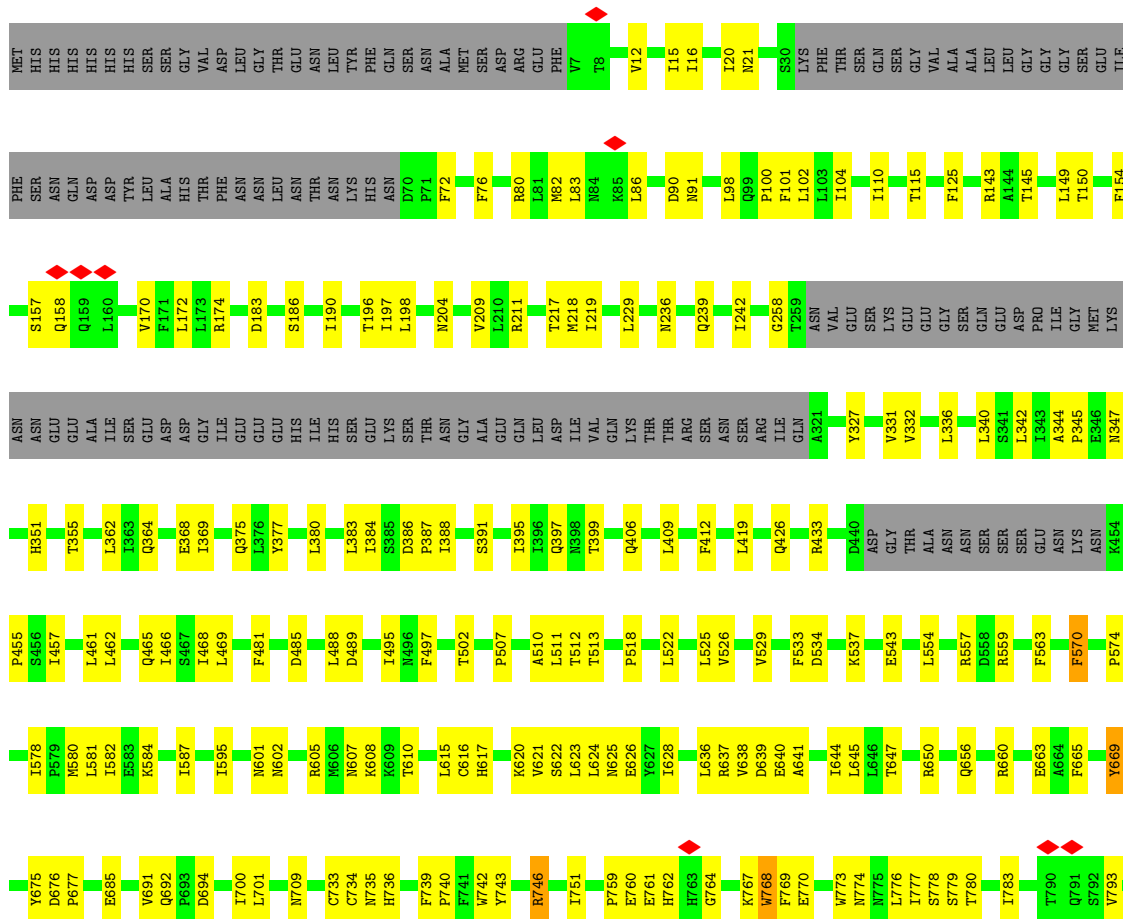
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion 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: ARF guanine-nucleotide exchange factor 2





- Molecule 1: ARF guanine-nucleotide exchange factor 2



ASP	L1368	L1290	Y1201	K1094	K989	L891	L897	K796
ASP	H1369	I1291	L1202	V1095	GLU	V892	T798	L797
ASN	L1370	L1294	M1203	F1096	SER	Q893	E801	E801
LYS	L1371	A1295	E1204	R1111	LYS	T899	L802	L802
PRO	K1372	H1296	S1205	T1114	GLY	N900	D806	D806
LYS	T1376	Q1297	T1208	T1116	LEU	T901	R807	R807
LEU	S1377	C1302	E1216	K1116	LEU	E902	A808	A808
SER	M1378	K1303	N1217	I1117	SER	P904	I809	I809
ASP	E1379	Q1304	F1218	Q1126	THR	V905	F810	F810
VAL	T1380	I1305	M1219	I1134	PHE	S906	V813	V813
GLU	F1381	S1306	W1220	M1135	ALA	T907	I817	I817
LYS	L1382	E1307	V1221	D1136	SER	D908	V818	V818
ASP	K1383	L1313	L1224	E1137	G1004	A909	L821	L821
	I1384	T1316	L1225	L1138	P1008	V910	F822	F822
	L1385	L1317	D1226	L1139	E1012	R914	M823	M823
	D1396	I1318	E1227	F1150	S1016	S915	I824	I824
	K1400	M1319	I1228	A1151	M1020	F916	T835	T835
	I1405	I1321	A1233	K1155	I1023	F925	R836	R836
	K1409	E1322	M1236	G1156	S1026	F926	M837	M837
	E1412	I1323	E1239	E1157	I1028	I928	I838	I838
	K1413	P1324	I1240	R1161	N1027	I929	D842	D842
GLY	GLY	M1325	E1241	F1162	I1028	L942	K843	K843
ASN	ASN	M1326	Y1242	F1163	V1032	W943	D852	D852
GLY	GLY	E1327	K1243	T1166	F1033	I946	F853	F853
SER	SER	E1329	K1244	E1167	L1048	I950	D854	D854
SER	SER	G1338	L1246	S1168	T1053	L951	L856	L856
SER	SER	L1339	T1252	Y1171	M1056	Y954	F857	F857
HIS	HIS	L1340	D1253	F1174	S1060	E955	M858	M858
GLY	GLY	P1341	D1254	L1175	R1061	D956	L861	L861
ALA	ALA	L1342	K1254	M1178	S1060	I957	S863	S863
HIS	HIS	L1343	E1255	M1180	R1061	L958	I864	I864
GLU	GLU	M1344	M1256	F1181	L1067	L959	A865	A865
GLN	GLN	S1345	P1257	M1184	I1071	S960	T868	T868
THR	THR	S1346	Y1258	L1185	E1072	P961	S874	S874
PRO	PRO	Q1349	S1261	L1186	I1072	D962	HIS	HIS
GLU	GLU	E1350	S1268	K1187	L1073	I963	ASP	ASP
SER	SER	D1351	S1268	V1188	T1074	F964	ASP	ASP
ASN	ASN	Q1352	S1268	T1189	I1075	L971	GLU	GLU
VAL	VAL	K1353	L1271	A1190	A1076	L972	GLU	GLU
GLU	GLU	L1354	T1272	M1191	L1077	L973	LEU	LEU
ILE	ILE	L1355	L1275	K1192	F1078	S974	SER	SER
GLU	GLU	I1356	L1276	E1193	C1081	N975	THR	THR
ALA	ALA	S1357	L1276	Q1194	E1084	L976	LEU	LEU
THR	THR	S1358	E1277	S1197	I1085	P981	ALA	ALA
ALA	ALA	I1359	D1278	I1198	K1085	E982	PHE	PHE
PRO	PRO	L1360	M1279	S1198	E1086		GLU	GLU
PRO	PRO	L1361	M1280	I1198	I1086		GLU	GLU
ILE	ILE	T1361	D1281					
ASP	ASP	I1362	L1282					
ASN	ASN	I1363	L1282					
THR	THR	V1366	I1287					
ASP	ASP	Y1367	I1287					

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	435876	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	69	Depositor
Minimum defocus (nm)	1300	Depositor
Maximum defocus (nm)	1700	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	2.193	Depositor
Minimum map value	-0.040	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.021	Depositor
Recommended contour level	0.01	Depositor
Map size (Å)	423.936, 423.936, 423.936	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.828, 0.828, 0.828	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	0.27	0/10392	0.45	0/14039
1	B	0.27	0/10404	0.47	0/14056
All	All	0.27	0/20796	0.46	0/28095

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	10223	0	10417	357	0
1	B	10233	0	10436	363	0
All	All	20456	0	20853	710	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 17.

The worst 5 of 710 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:615:LEU:HD12	1:A:649:PHE:CE1	1.86	1.11
1:B:1325:THR:HG22	1:B:1326:ASN:H	1.17	1.03

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:825:TYR:CE1	1:A:838:ILE:HD11	1.94	1.02
1:A:615:LEU:CD1	1:A:649:PHE:CE1	2.43	1.01
1:B:1302:CYS:SG	1:B:1304:GLN:NE2	2.34	1.00

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	1261/1483 (85%)	1150 (91%)	111 (9%)	0	100	100
1	B	1260/1483 (85%)	1129 (90%)	131 (10%)	0	100	100
All	All	2521/2966 (85%)	2279 (90%)	242 (10%)	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	1182/1367 (86%)	1171 (99%)	11 (1%)	78	88
1	B	1183/1367 (86%)	1169 (99%)	14 (1%)	71	84
All	All	2365/2734 (86%)	2340 (99%)	25 (1%)	74	85

5 of 25 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	563	PHE
1	B	739	PHE
1	B	1218	PHE
1	B	669	TYR
1	B	746	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 11 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	1178	ASN
1	B	1304	GLN
1	B	1352	GLN
1	B	1349	GLN
1	A	858	ASN

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.

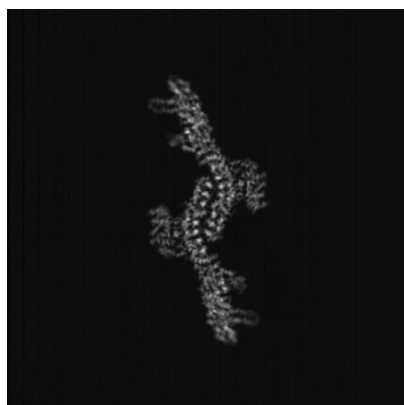
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-28748. These allow visual inspection of the internal detail of the map and identification of artifacts.

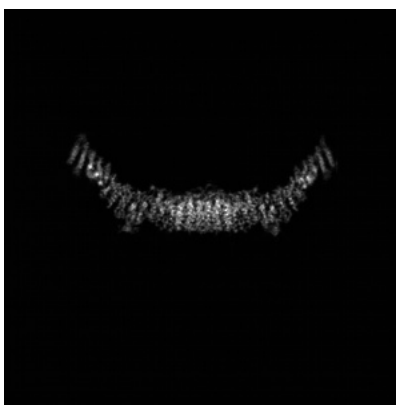
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

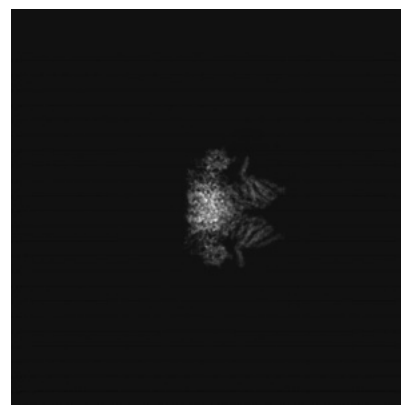
6.1.1 Primary map



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: 256



Y Index: 256

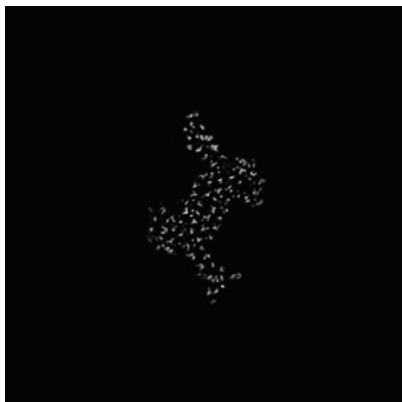


Z Index: 256

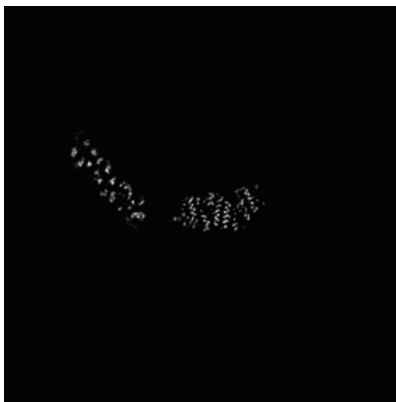
The images above show central slices of the map in three orthogonal directions.

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

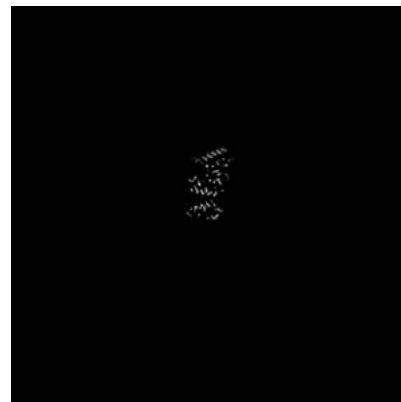
6.3.1 Primary map



X Index: 256



Y Index: 274

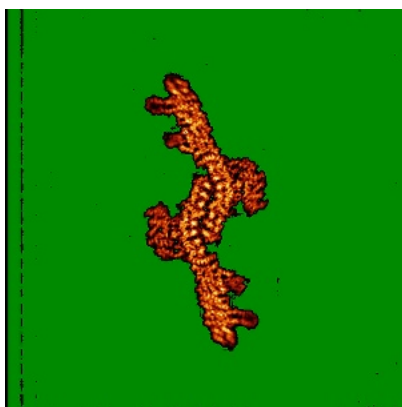


Z Index: 273

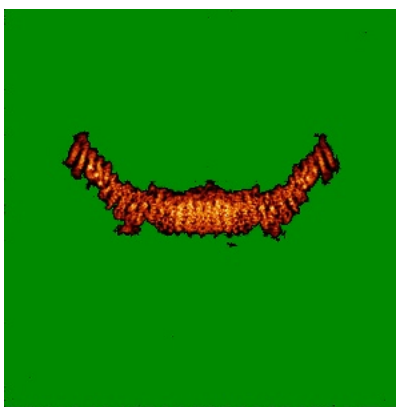
The images above show the largest variance slices of the map in three orthogonal directions.

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

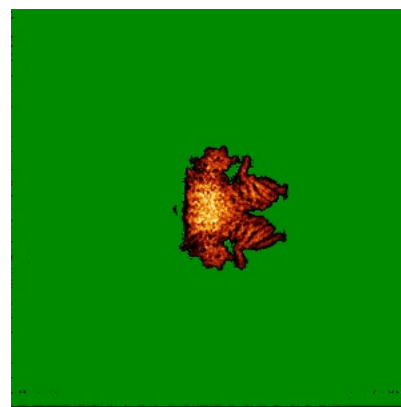
6.4.1 Primary map



X



Y

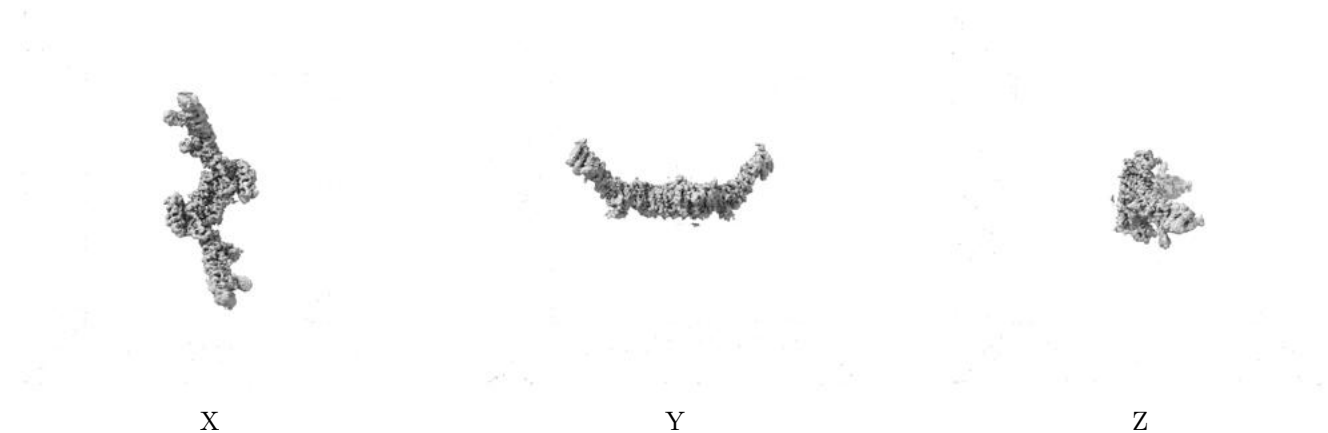


Z

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.

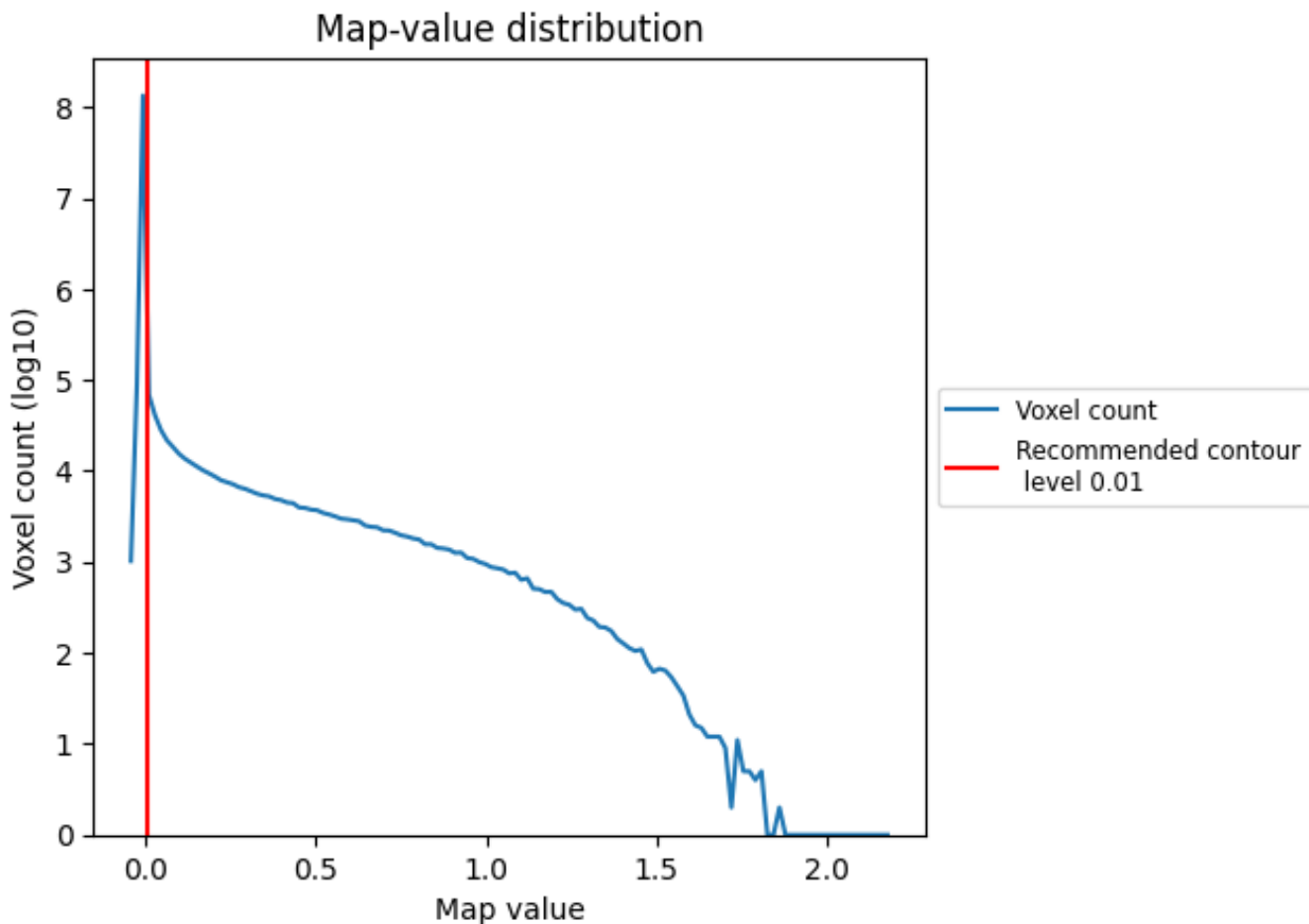
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

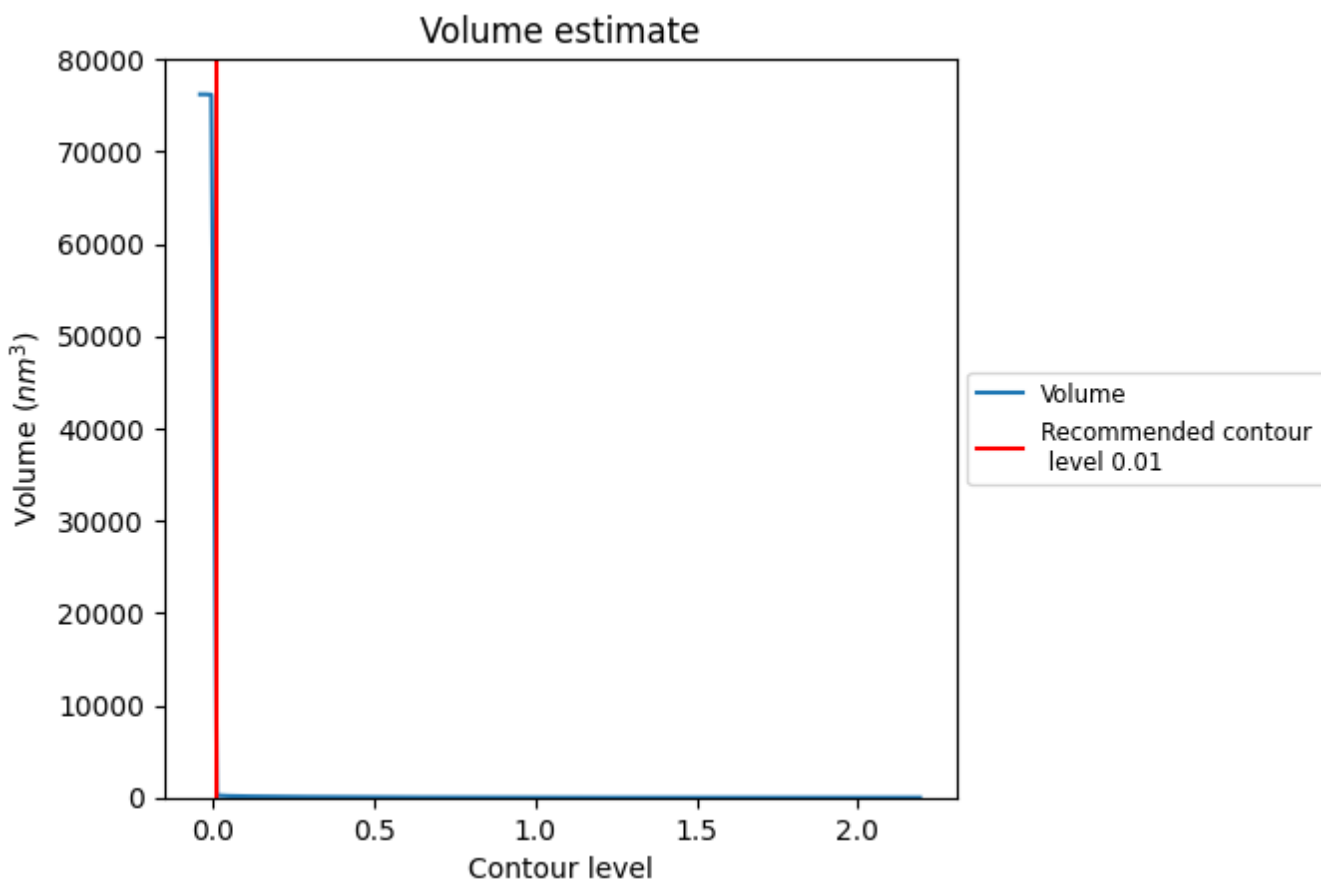
This section contains the results of statistical analysis of the map.

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.

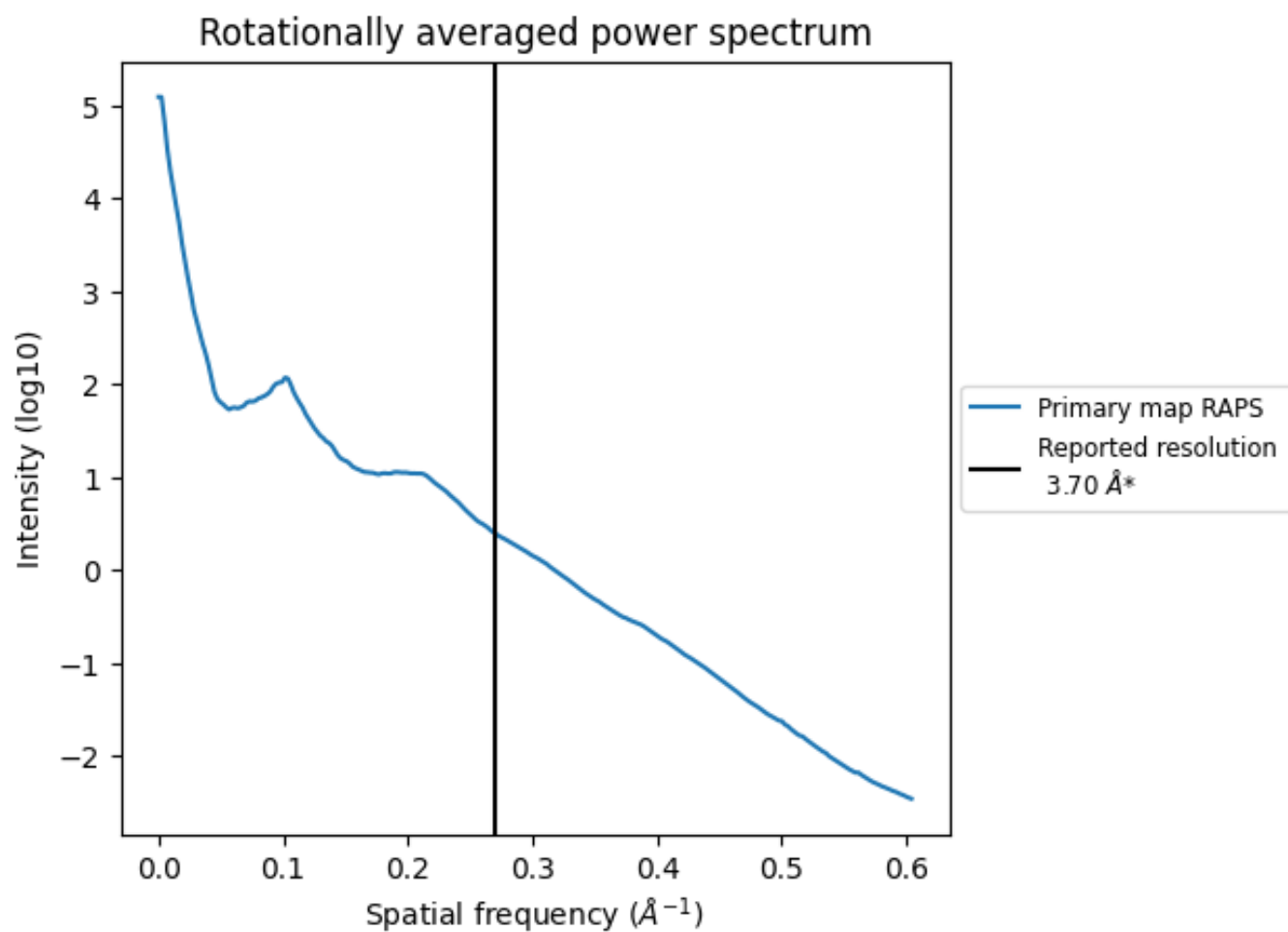
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 12112 nm³; this corresponds to an approximate mass of 10941 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 0.270 Å⁻¹

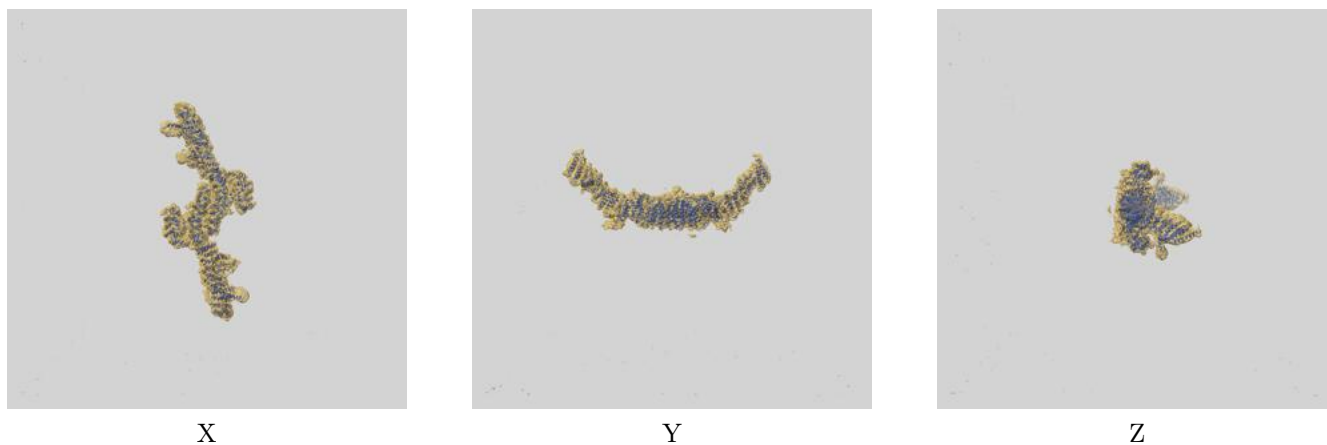
8 Fourier-Shell correlation

This section was not generated. No FSC curve or half-maps provided.

9 Map-model fit [i](#)

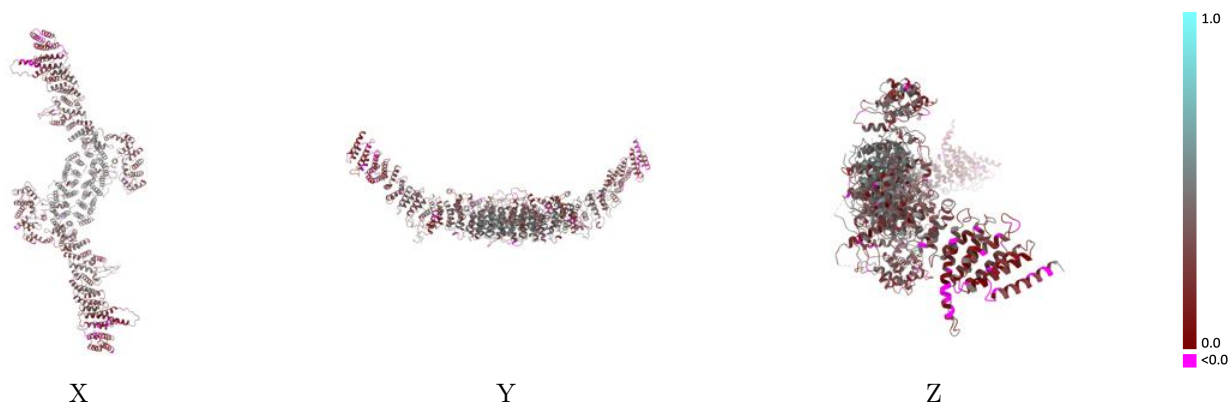
This section contains information regarding the fit between EMDB map EMD-28748 and PDB model 8EZQ. Per-residue inclusion information can be found in section 3 on page 5.

9.1 Map-model overlay [i](#)



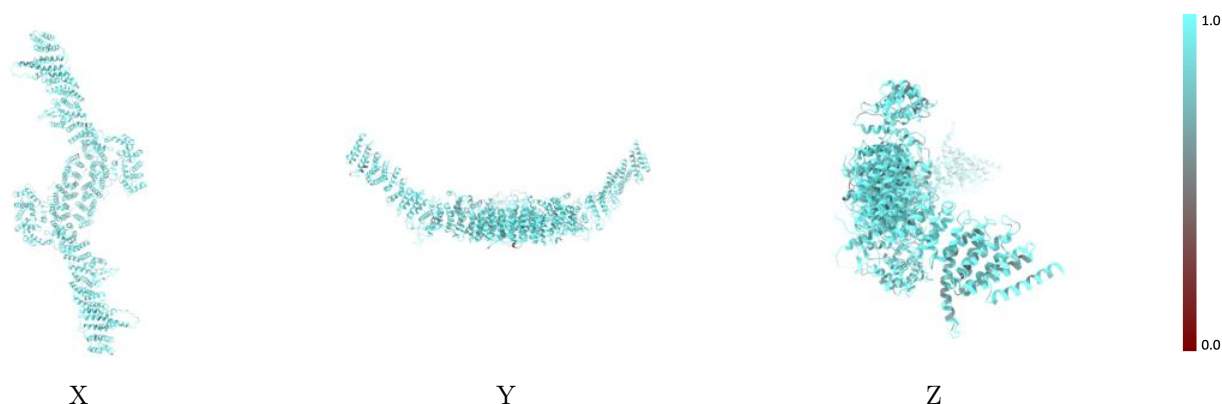
The images above show the 3D surface view of the map at the recommended contour level 0.01 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



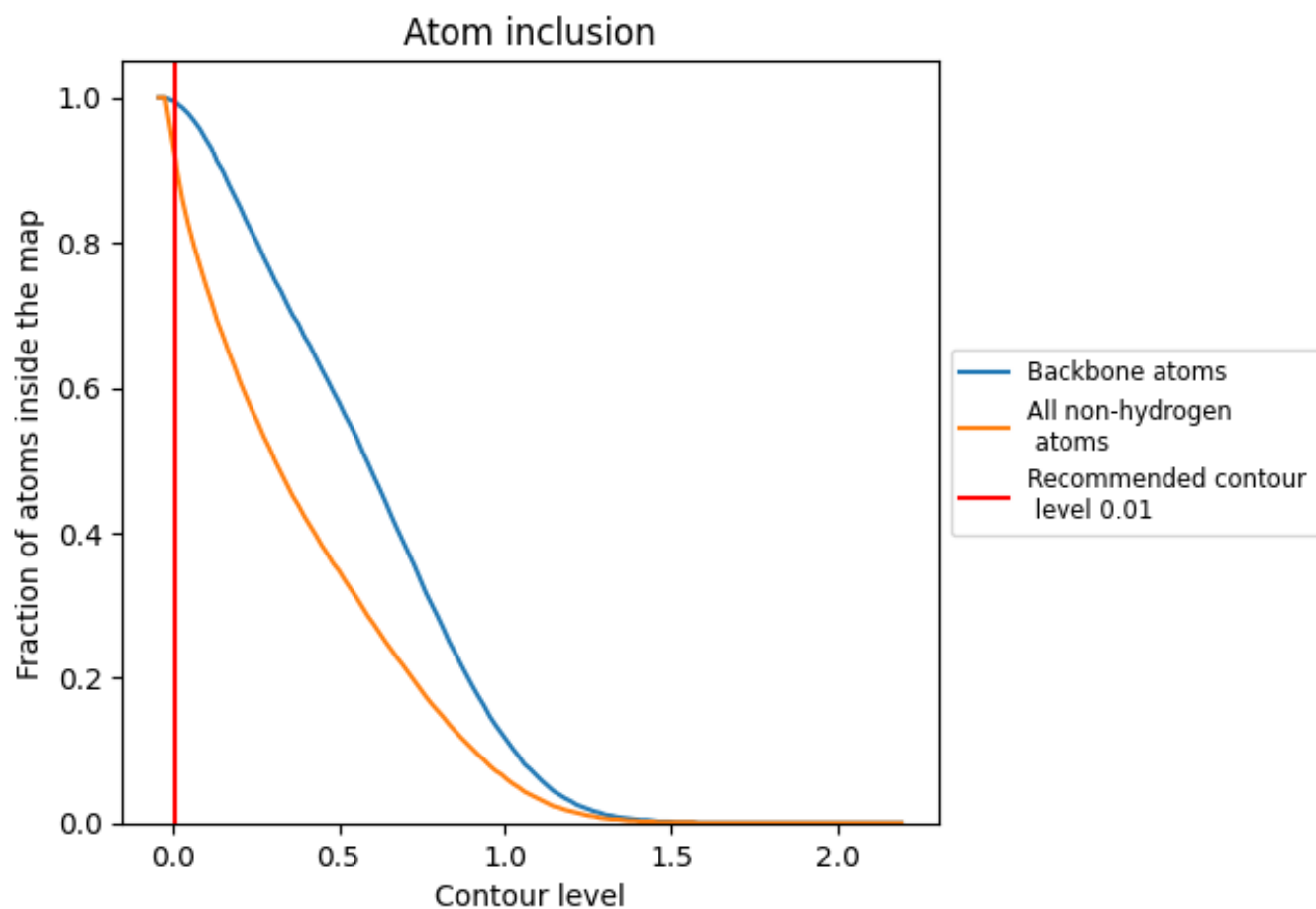
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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, 99% of all backbone atoms, 91% 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	 0.9120	 0.3290
A	 0.9170	 0.3370
B	 0.9070	 0.3200

