



wwPDB EM Validation Summary Report ⓘ

Jul 3, 2024 – 11:12 am BST

PDB ID : 7O4H
EMDB ID : EMD-12718
Title : The structure of the native CNGA1/CNGB1 CNG channel from retinal rods
Authors : Barret, D.C.A.; Marino, J.
Deposited on : 2021-04-06
Resolution : 3.40 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:

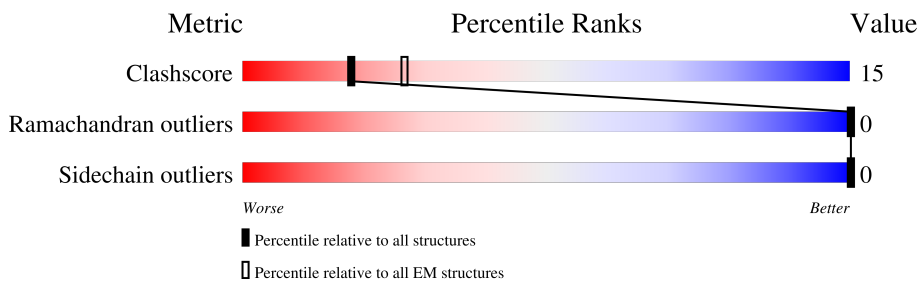
EMDB validation analysis : 0.0.1.dev92
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.37.1

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 3.40 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	690	
1	B	690	
1	C	690	
2	D	1394	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 14195 atoms, of which 0 are hydrogens and 0 are deuteriums.

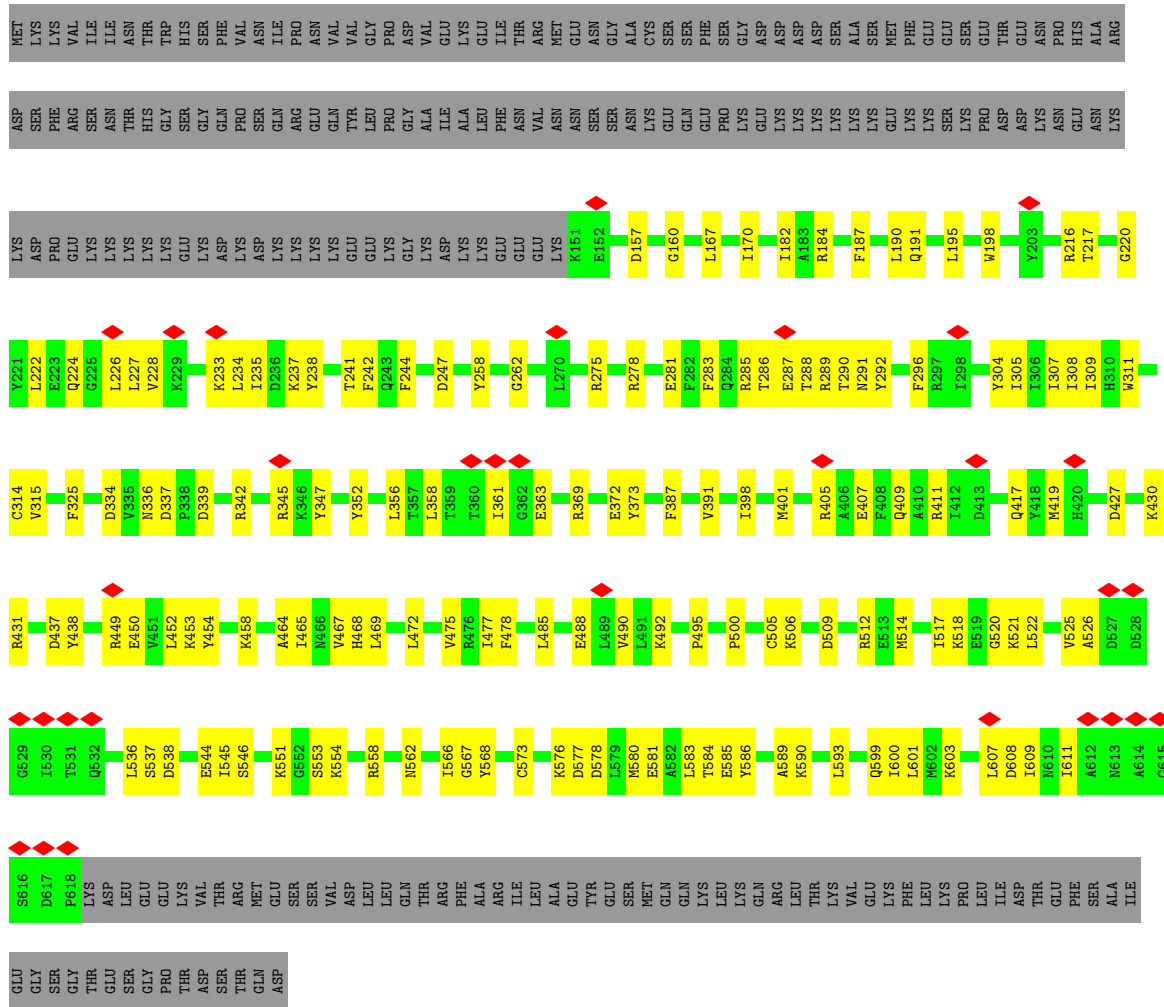
In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called cGMP-gated cation channel alpha-1.

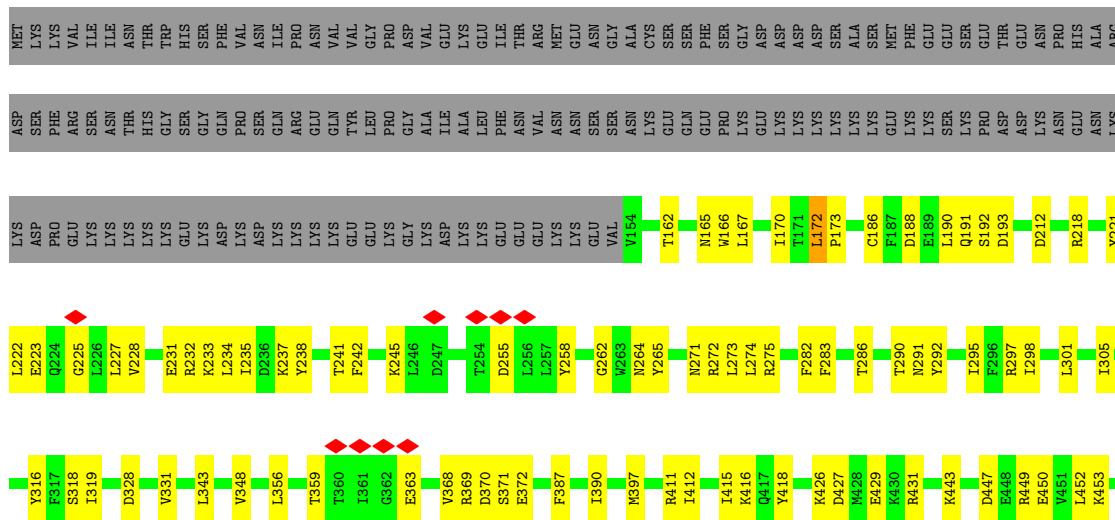
Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	465	3705	2416	592	679	18	0	0
1	B	468	3765	2453	607	689	16	0	0
1	C	464	3748	2445	608	678	17	0	0

- Molecule 2 is a protein called Cyclic nucleotide-gated cation channel beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	D	383	2977	1932	506	526	13	0	0



• Molecule 1: cGMP-gated cation channel alpha-1



GLU	Y901	G961	D1061	L1171	ALA	ASP	GLU	Y902	G962	I1064	D1171	D1172	ALA	PRO	GLU	Y903	L963	I1064	D1173	LYS	PRO	ASN	Y904	L963	A1075	K1174	K1173	GLY	GLU	ASN	R905	P964	A1075	D1175	K1174	ARG	ALA	TYR	I906	D965	Q1078	L1176	D1176	GLY	ALA	VAL	R907	P966	Q1079	E1177	N1177	GLY	PRO	LYS	T908	R967	C1080	E1178	E1178	ARG	GLU	GLN	A910	F970	D1081	L1179	L1179	ARG	GLU	GLN	Y911	E971	R1082	L1180	E1179	ALA	THR	LYS	L912	I972	Q1083	V1181	L1181	ALA	GLU	PHE	S915	Y973	M1084	E1185	V1181	ARG	VAL	LYS	L913	F974	H1085	E1186	S1186	ALA	PRO	MET	Y914	F974	D1087	S1186	S1186	ALA	PRO	ASP	L916	L977	M1088	L1189	L1189	ARG	LEU	LEU	S915	L977	L1089	L1190	L1190	LEU	LEU	LEU	L917	N978	K1090	R1191	L1190	LYS	GLU	CYS	H917	Y979	R1091	K1192	R1191	GLY	GLU	LEU	L918	A985	L1092	K1193	K1193	ALA	ALA	PRO	L919	F986	R1093	A1194	A1194	ALA	PRO	LEU	L920	S987	Y1097	R1195	R1195	ALA	PRO	LEU	L922	V988	P1099	R1196	R1196	ALA	PRO	LEU	Y923	M989	Y1102	M1197	M1197	ALA	PRO	LEU	Y924	I990	Y1108	L1198	L1198	ALA	PRO	LEU	W925	D995	E1108	R1199	R1199	ALA	PRO	VAL	A926	V996	E1108	N1200	N1200	LEU	PRO	ASN	S927	Q1004	R1111	N1201	N1201	LEU	PRO	ASN	A928	R1008	E1112	N1202	N1202	LEU	PRO	LEU	Y929	R1008	I1115	K1203	K1203	GLU	ALA	LEU	E930	D1012	I1115	P1204	P1204	ALA	ALA	ARG	G931	S1013	G1125	K1205	K1205	LYS	LYS	ARG	L932	T1014	G1126	E1206	E1206	LYS	ARG	PRO	G933	V1015	P1127	K1207	K1207	SER	SER	ARG	S934	K1016	Y1017	S1208	S1208	GLY	GLY	PRO	T935	Y1017	S1131	V1209	V1209	ASP	ASP	ARG	H936	F1020	I1145	L1210	L1210	LYS	VAL	CYS	W937	R1025	S1146	I1211	I1211	ALA	GLY	LYS	V938	R1025	I1145	L1212	L1212	ALA	GLY	GLY	Y939	Q1028	A1149	P1213	P1213	ALA	GLU	LEU	D940	N1029	V1150	P1214	P1214	ARG	GLU	LEU	G941	R1030	G1151	R1215	R1215	ALA	GLU	LEU	V942	W1034	T1157	A1216	A1216	SER	HIS	LEU	G943	E1049	T1157	A1217	G1217	PRO	PRO	LEU	N944	P1055	A1158	G1217	G1217	GLU	VAL	LEU	S945	D1056	V1161	T1218	T1218	GLU	VAL	LEU	Y946	K1057	G1164	L1220	L1220	GLU	ARG	LEU	I947	I1058	F1165	L1221	L1221	PRO	ILE	LEU	R948	M1058	T1166	F1222	F1222	PRO	ILE	LEU	C949	R1059	F1169	A1224	A1224	PRO	HIS	LEU	Y950	R1059	I1170	A1225	A1225	PRO	VAL	LEU	S951	L1060	I1170	L1226	L1226	PRO	THR	LEU	W952	A953	I1170	ALA	ALA	PRO	VAL	LEU	V954	V954	ALA	ALA	ALA	PRO	THR	LEU	K955	K955	ALA	ALA	ALA	PRO	THR	LEU	T956	T956	GLY	GLY	GLY	PRO	THR	LEU	L957	L957	LYS	LYS	LYS	PRO	THR	LEU	I958	I958	MET	MET	MET	PRO	THR	LEU	T959	T959	GLY	GLY	GLY	PRO	THR	LEU	I960	I960	GLY	GLY	GLY	PRO	THR
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4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	118084	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 ($e^-/\text{\AA}^2$)	1.5	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	0.242	Depositor
Minimum map value	-0.122	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.006	Depositor
Recommended contour level	0.051	Depositor
Map size (Å)	324.0, 324.0, 324.0	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.08, 1.08, 1.08	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	0.33	0/3790	0.53	0/5152
1	B	0.35	0/3850	0.51	0/5222
1	C	0.36	0/3834	0.52	1/5197 (0.0%)
2	D	0.31	0/3052	0.51	0/4158
All	All	0.34	0/14526	0.52	1/19729 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	172	LEU	CA-CB-CG	5.25	127.37	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	3705	0	3648	99	0
1	B	3765	0	3751	119	0
1	C	3748	0	3752	98	0
2	D	2977	0	2872	119	0
All	All	14195	0	14023	420	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 15.

The worst 5 of 420 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)
2:D:1004:GLN:HB3	2:D:1008:ARG:HH12	1.41	0.83
1:C:512:ARG:HH12	1:C:576:LYS:H	1.27	0.82
1:B:554:LYS:HG3	1:B:607:LEU:HG	1.63	0.79
1:C:368:VAL:N	1:C:372:GLU:OE2	2.16	0.78
1:A:512:ARG:NH2	1:A:546:SER:O	2.17	0.78

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	463/690 (67%)	393 (85%)	70 (15%)	0	100	100
1	B	466/690 (68%)	410 (88%)	56 (12%)	0	100	100
1	C	462/690 (67%)	403 (87%)	59 (13%)	0	100	100
2	D	379/1394 (27%)	311 (82%)	68 (18%)	0	100	100
All	All	1770/3464 (51%)	1517 (86%)	253 (14%)	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	393/621 (63%)	393 (100%)	0	100	100
1	B	404/621 (65%)	404 (100%)	0	100	100
1	C	403/621 (65%)	403 (100%)	0	100	100
2	D	299/1185 (25%)	299 (100%)	0	100	100
All	All	1499/3048 (49%)	1499 (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. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	417	GLN
1	B	599	GLN
2	D	1200	ASN
1	A	532	GLN
1	A	177	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

There are no chain breaks in this entry.

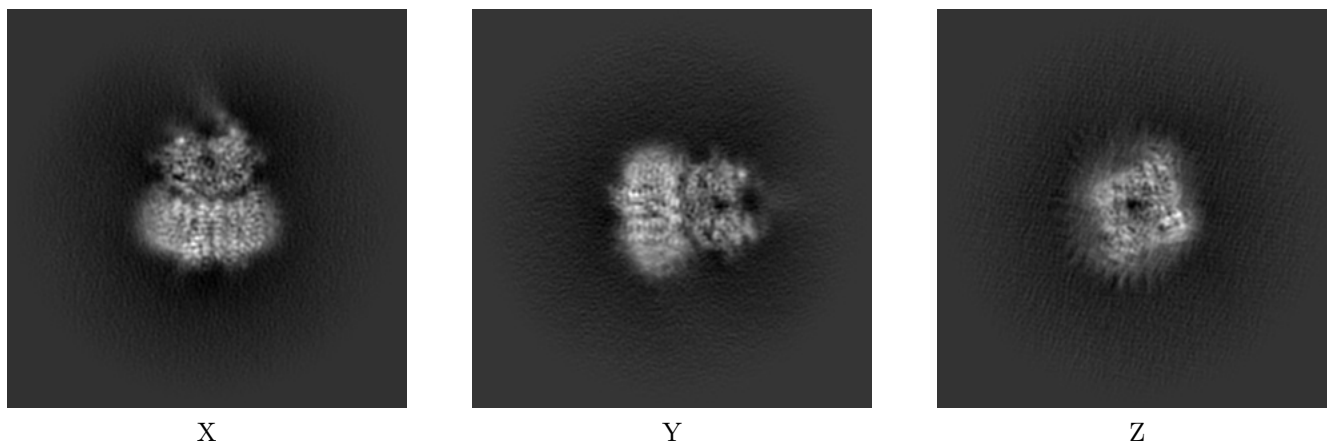
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-12718. 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](#)

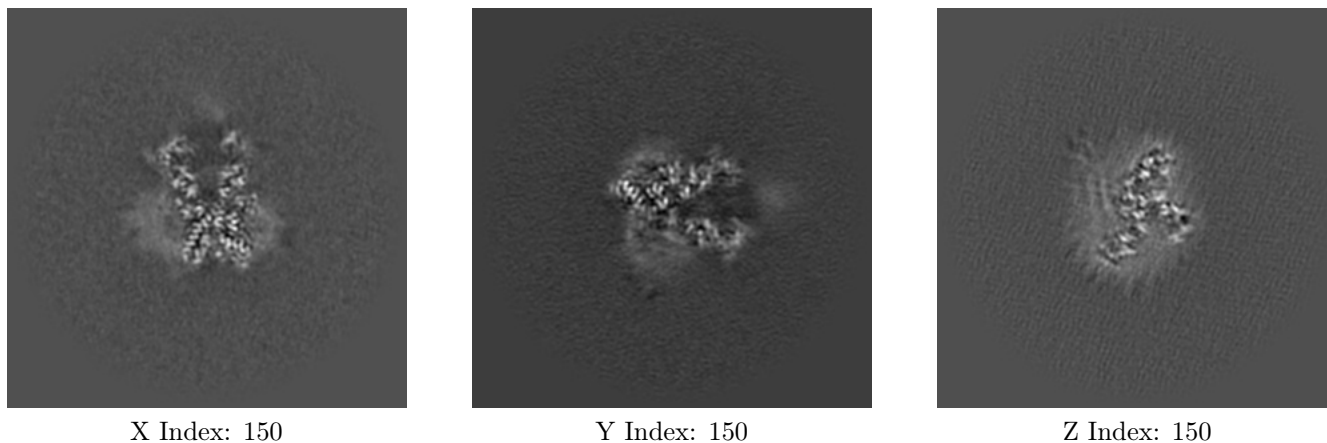
6.1.1 Primary map



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

6.2 Central slices [i](#)

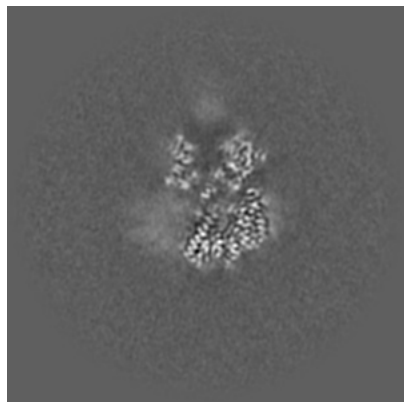
6.2.1 Primary map



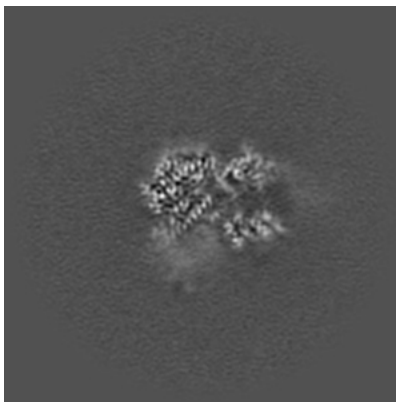
The images above show central slices of the map in three orthogonal directions.

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

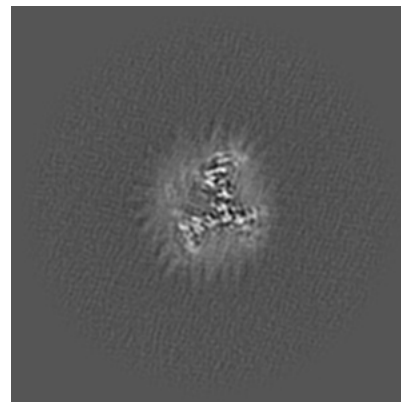
6.3.1 Primary map



X Index: 160



Y Index: 143

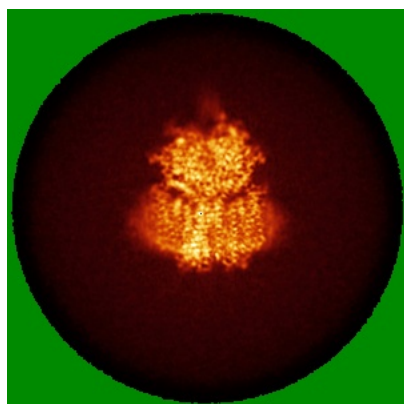


Z Index: 122

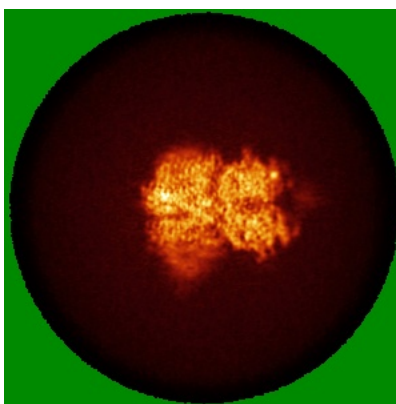
The images above show the largest variance slices of the map in three orthogonal directions.

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

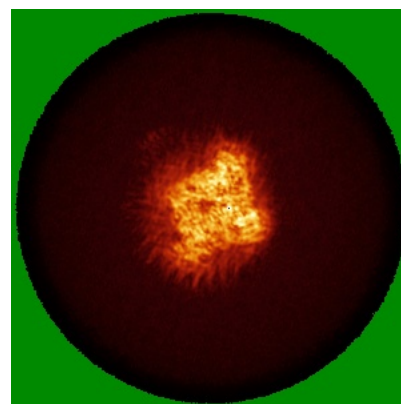
6.4.1 Primary map



X



Y

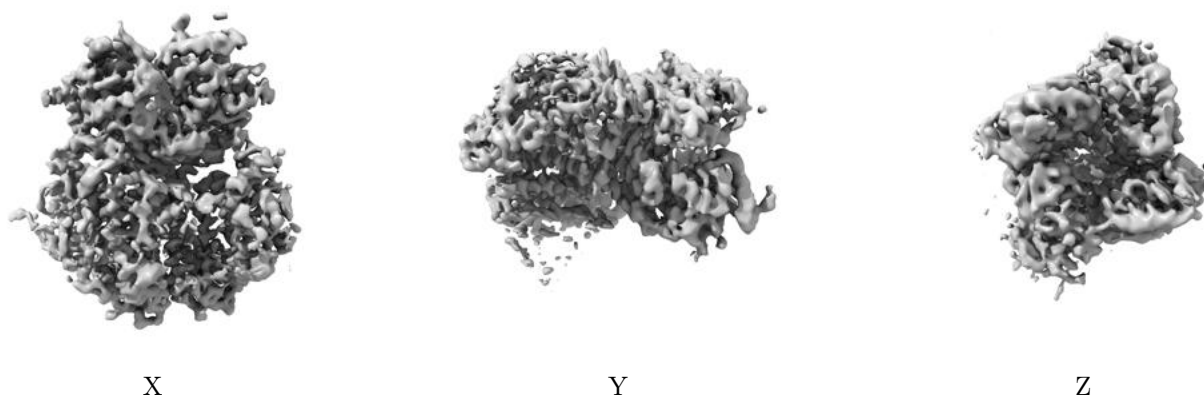


Z

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 0.051. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

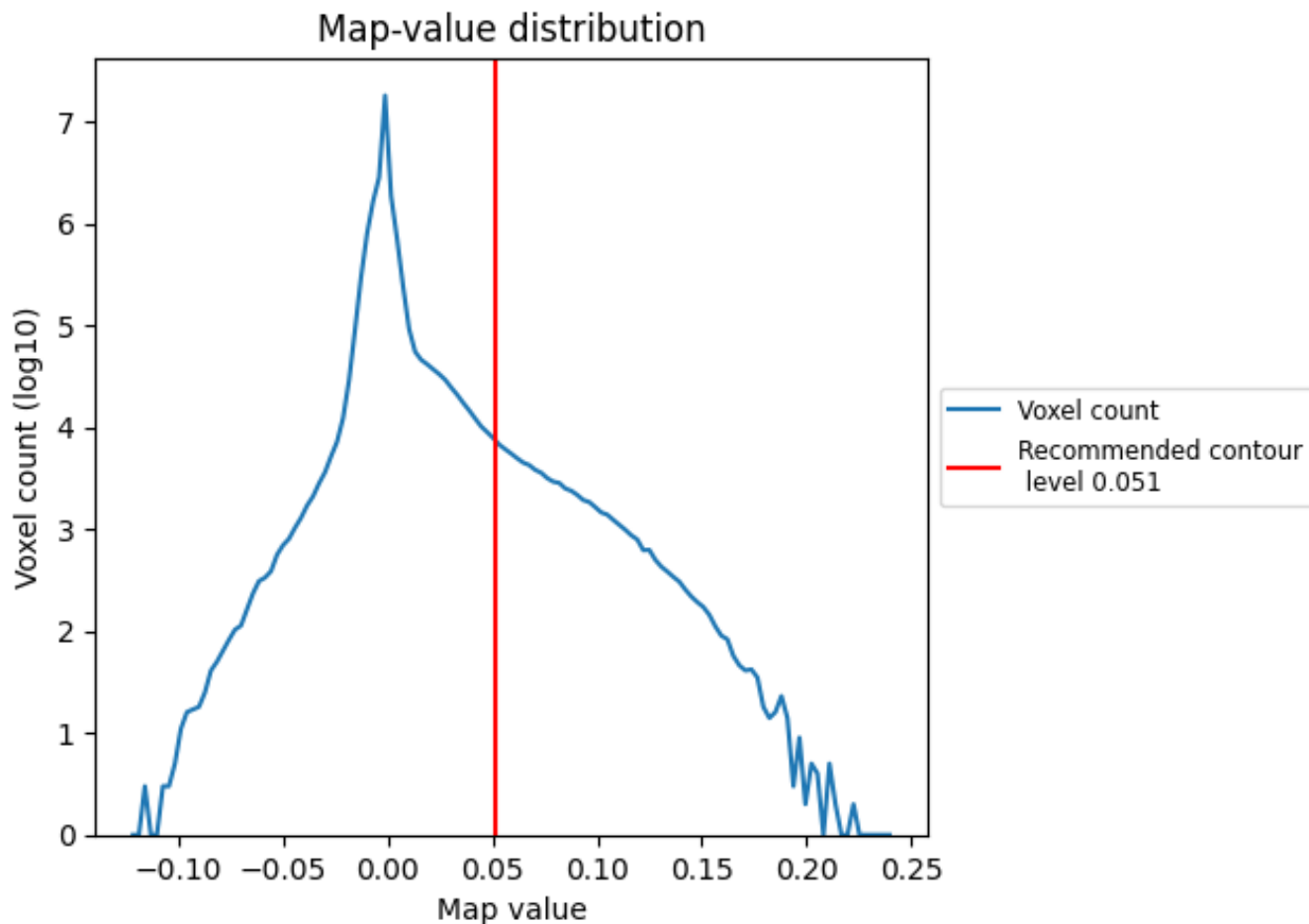
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

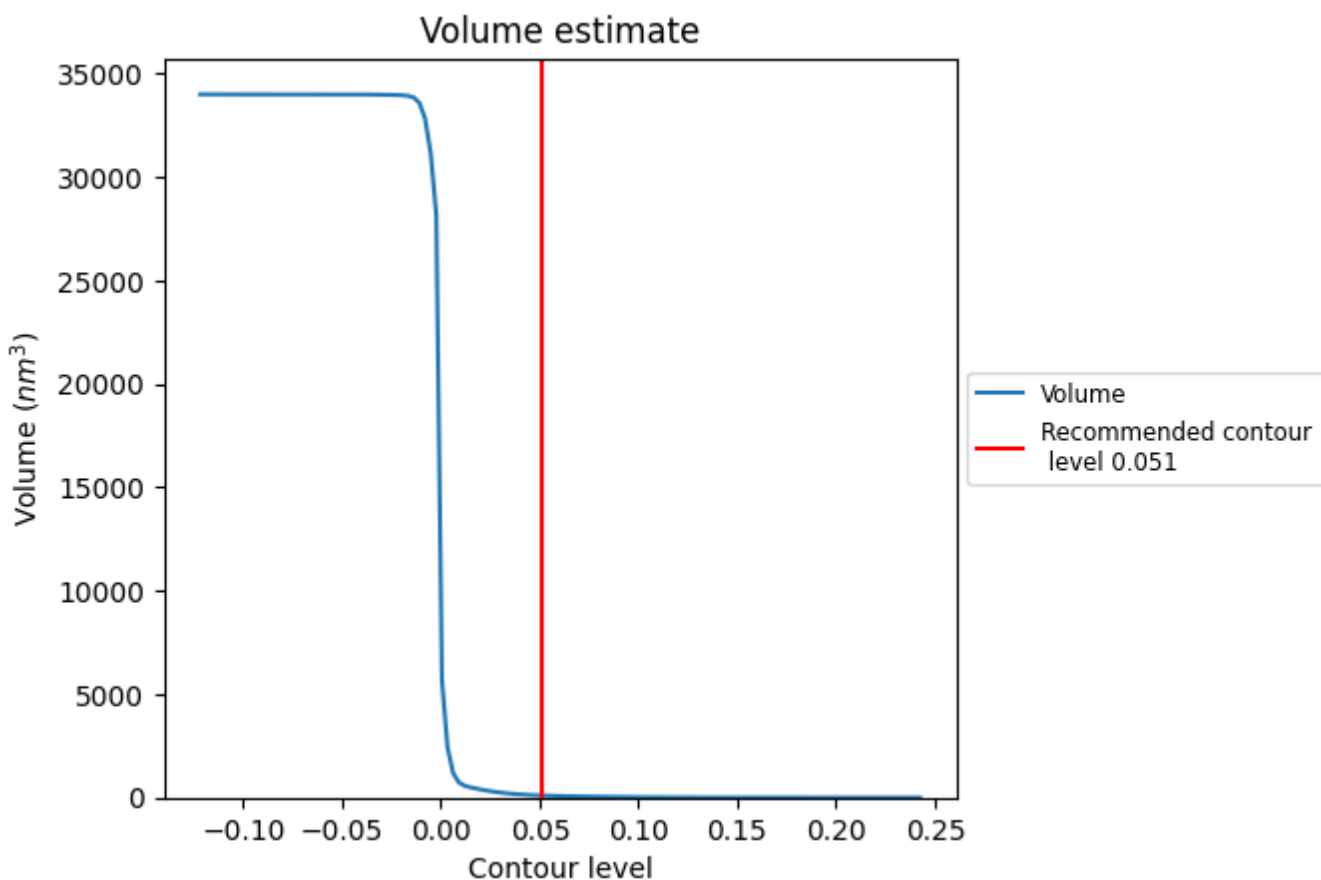
This section contains the results of statistical analysis of the map.

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.

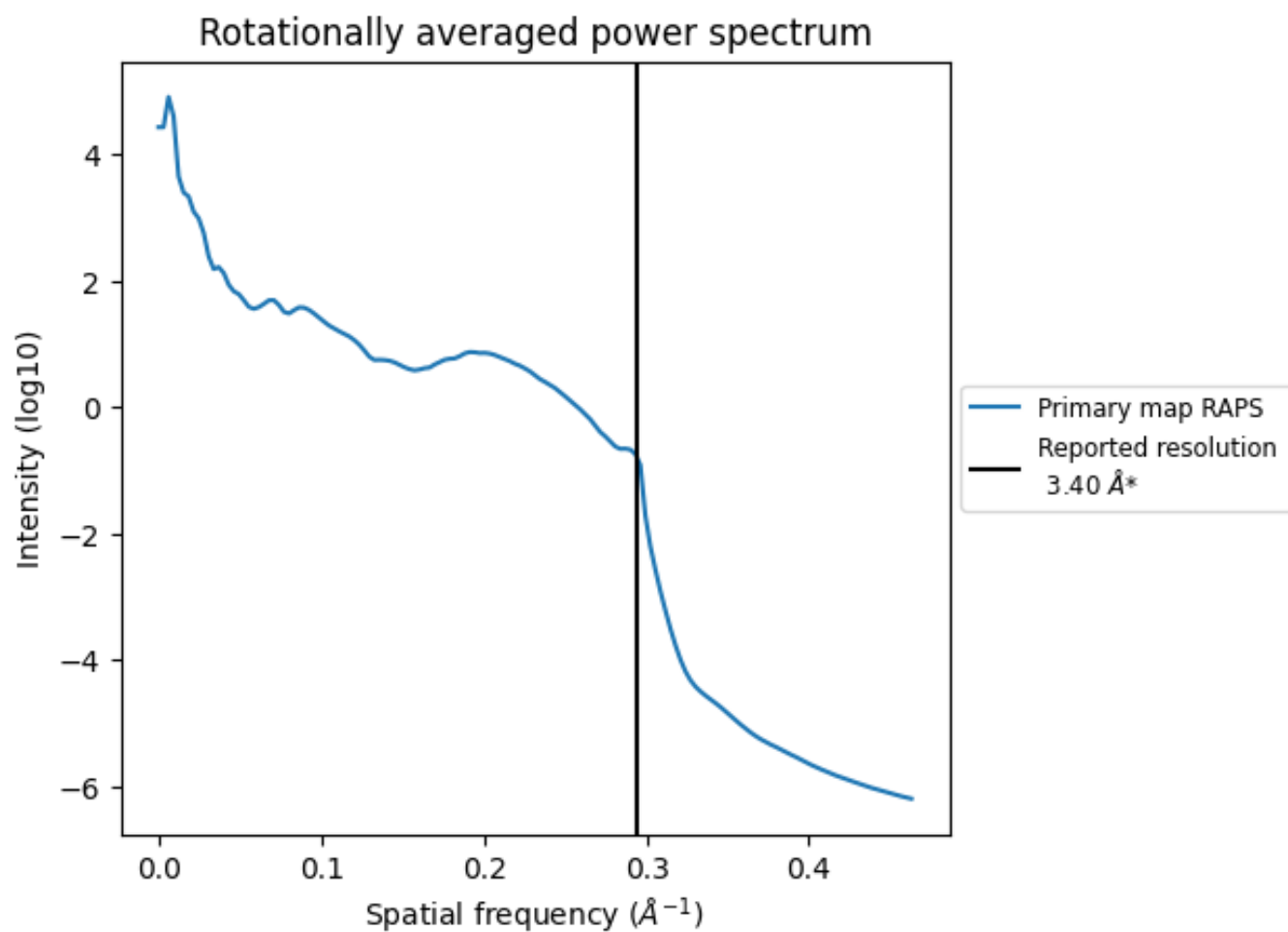
7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 100 nm³; this corresponds to an approximate mass of 90 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 0.294\AA^{-1}

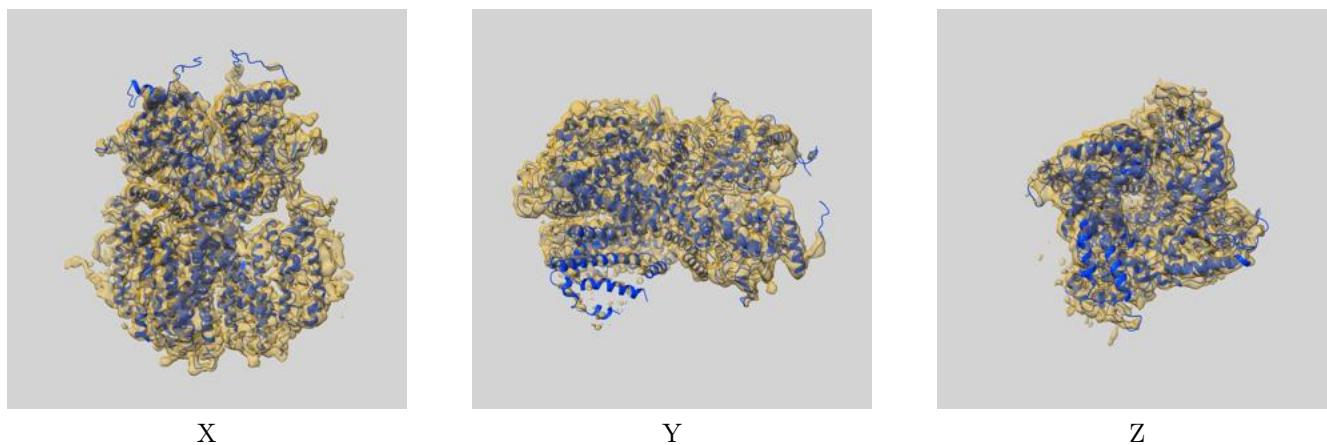
8 Fourier-Shell correlation

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

9 Map-model fit [i](#)

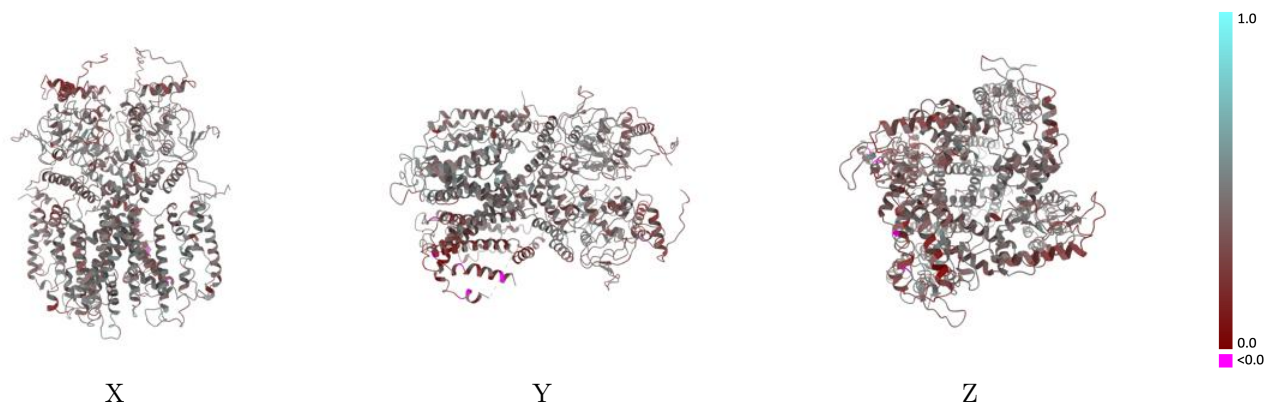
This section contains information regarding the fit between EMDB map EMD-12718 and PDB model 7O4H. Per-residue inclusion information can be found in section 3 on page 4.

9.1 Map-model overlay [i](#)



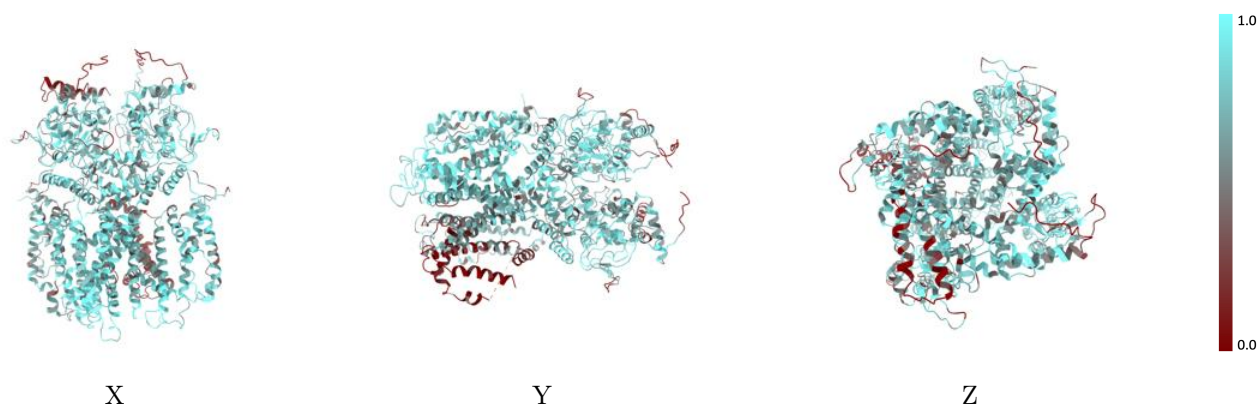
The images above show the 3D surface view of the map at the recommended contour level 0.051 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



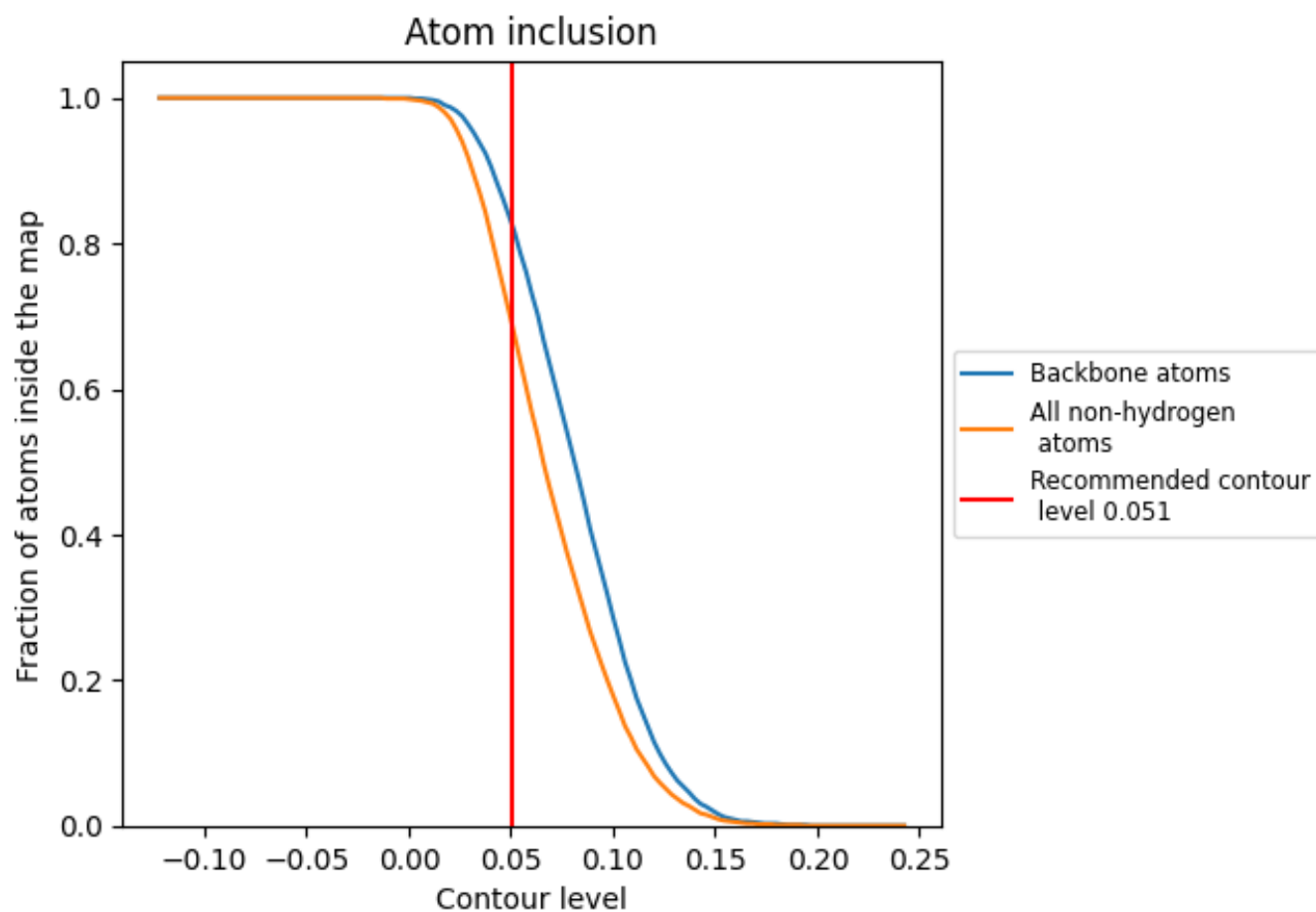
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

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



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.051).











9.4 Atom inclusion [i](#)



At the recommended contour level, 82% of all backbone atoms, 68% 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 (0.051) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.6820	 0.4040
A	 0.6710	 0.3970
B	 0.7490	 0.4240
C	 0.7680	 0.4310
D	 0.5030	 0.3520

