



wwPDB EM Validation Summary Report ⓘ

Mar 5, 2026 – 12:38 AM UTC

PDB ID : 7FHO / pdb_00007fho
EMDB ID : EMD-31588
Title : Structure of AtTPC1 D240A/D454A/E528A mutant with 50 mM Ca²⁺
Authors : Ye, F.; Xu, L.; Li, X.; Jiang, Y.; Guo, J.
Deposited on : 2021-07-29
Resolution : 2.80 Å(reported)

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

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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.dev132
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

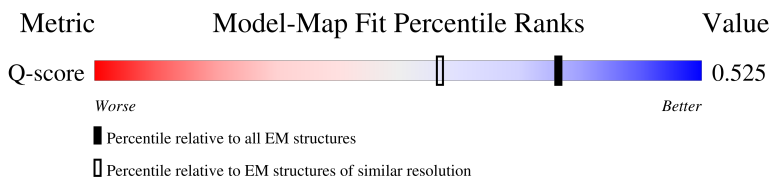
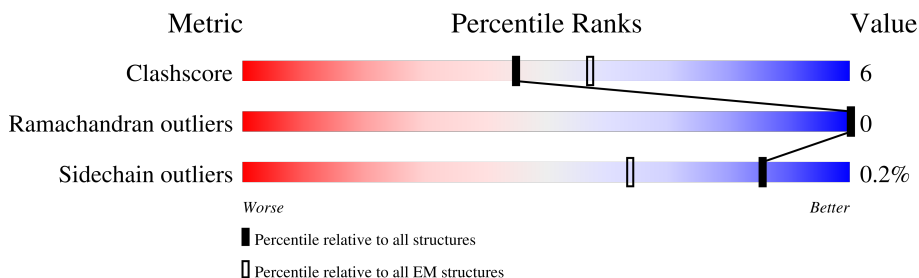
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.80 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)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	11806 (2.30 - 3.30)

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	998	 5% 56% 9% 35%
1	C	998	 5% 53% 12% 35%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 10648 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 Two pore calcium channel protein 1,GFP.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	647	Total	C	N	O	S	0	0
			5321	3551	815	933	22		
1	C	647	Total	C	N	O	S	0	0
			5321	3551	815	933	22		

There are 60 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	240	ALA	ASP	engineered mutation	UNP Q94KI8
A	454	ALA	ASP	engineered mutation	UNP Q94KI8
A	528	ALA	GLU	engineered mutation	UNP Q94KI8
A	734	SER	-	linker	UNP Q94KI8
A	735	THR	-	linker	UNP Q94KI8
A	736	ALA	-	linker	UNP Q94KI8
A	737	GLY	-	linker	UNP Q94KI8
A	738	LEU	-	linker	UNP Q94KI8
A	739	VAL	-	linker	UNP Q94KI8
A	740	PRO	-	linker	UNP Q94KI8
A	741	ARG	-	linker	UNP Q94KI8
A	742	GLY	-	linker	UNP Q94KI8
A	743	SER	-	linker	UNP Q94KI8
A	744	ALA	-	linker	UNP Q94KI8
A	745	ALA	-	linker	UNP Q94KI8
A	746	ALA	-	linker	UNP Q94KI8
A	747	ALA	-	linker	UNP Q94KI8
A	986	SER	-	expression tag	UNP A0A5P9VSM6
A	987	GLY	-	expression tag	UNP A0A5P9VSM6
A	988	LEU	-	expression tag	UNP A0A5P9VSM6
A	989	ARG	-	expression tag	UNP A0A5P9VSM6
A	990	SER	-	expression tag	UNP A0A5P9VSM6
A	991	HIS	-	expression tag	UNP A0A5P9VSM6
A	992	HIS	-	expression tag	UNP A0A5P9VSM6
A	993	HIS	-	expression tag	UNP A0A5P9VSM6
A	994	HIS	-	expression tag	UNP A0A5P9VSM6

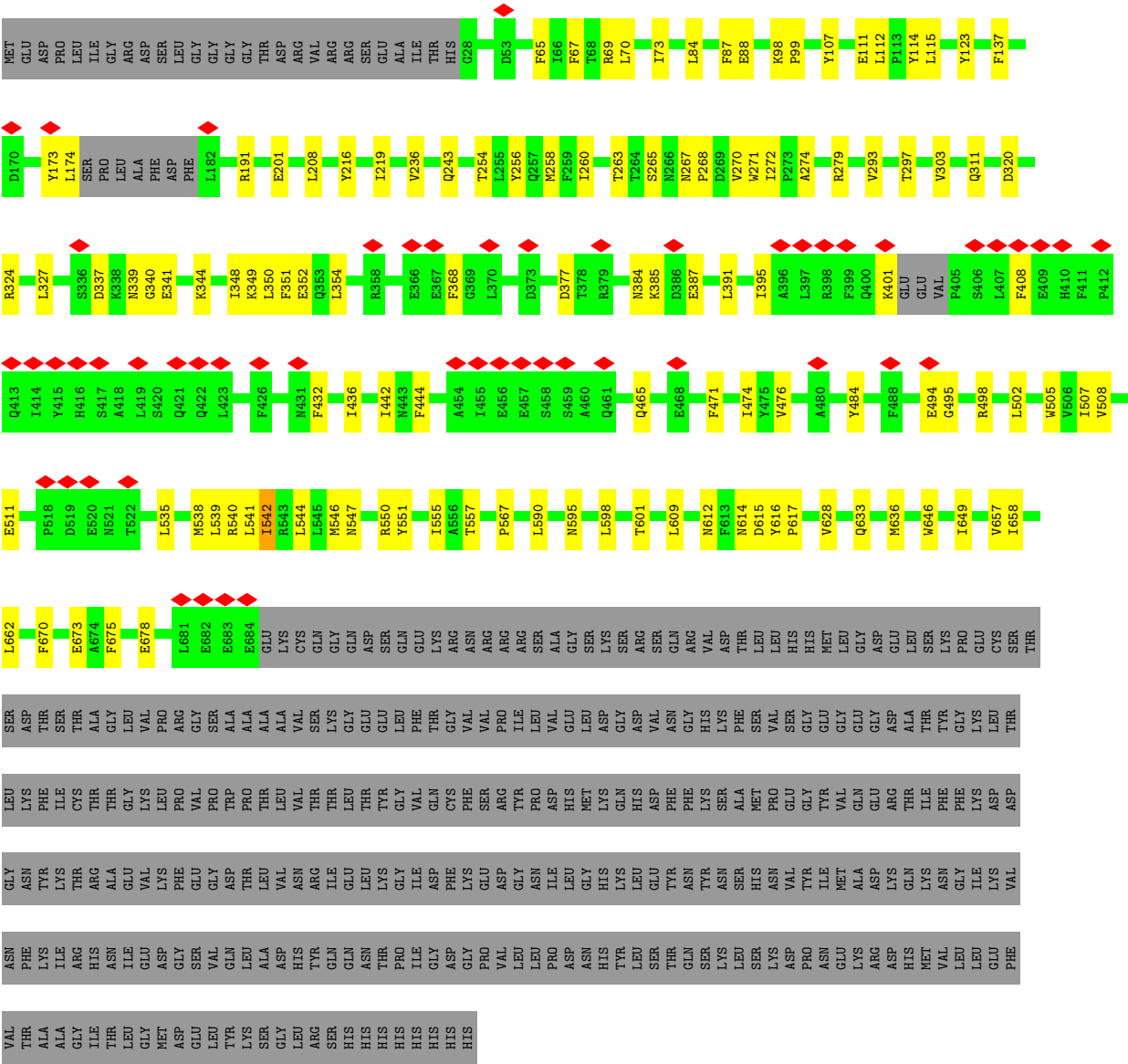
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Chain	Residue	Modelled	Actual	Comment	Reference
A	995	HIS	-	expression tag	UNP A0A5P9VSM6
A	996	HIS	-	expression tag	UNP A0A5P9VSM6
A	997	HIS	-	expression tag	UNP A0A5P9VSM6
A	998	HIS	-	expression tag	UNP A0A5P9VSM6
C	240	ALA	ASP	engineered mutation	UNP Q94KI8
C	454	ALA	ASP	engineered mutation	UNP Q94KI8
C	528	ALA	GLU	engineered mutation	UNP Q94KI8
C	734	SER	-	linker	UNP Q94KI8
C	735	THR	-	linker	UNP Q94KI8
C	736	ALA	-	linker	UNP Q94KI8
C	737	GLY	-	linker	UNP Q94KI8
C	738	LEU	-	linker	UNP Q94KI8
C	739	VAL	-	linker	UNP Q94KI8
C	740	PRO	-	linker	UNP Q94KI8
C	741	ARG	-	linker	UNP Q94KI8
C	742	GLY	-	linker	UNP Q94KI8
C	743	SER	-	linker	UNP Q94KI8
C	744	ALA	-	linker	UNP Q94KI8
C	745	ALA	-	linker	UNP Q94KI8
C	746	ALA	-	linker	UNP Q94KI8
C	747	ALA	-	linker	UNP Q94KI8
C	986	SER	-	expression tag	UNP A0A5P9VSM6
C	987	GLY	-	expression tag	UNP A0A5P9VSM6
C	988	LEU	-	expression tag	UNP A0A5P9VSM6
C	989	ARG	-	expression tag	UNP A0A5P9VSM6
C	990	SER	-	expression tag	UNP A0A5P9VSM6
C	991	HIS	-	expression tag	UNP A0A5P9VSM6
C	992	HIS	-	expression tag	UNP A0A5P9VSM6
C	993	HIS	-	expression tag	UNP A0A5P9VSM6
C	994	HIS	-	expression tag	UNP A0A5P9VSM6
C	995	HIS	-	expression tag	UNP A0A5P9VSM6
C	996	HIS	-	expression tag	UNP A0A5P9VSM6
C	997	HIS	-	expression tag	UNP A0A5P9VSM6
C	998	HIS	-	expression tag	UNP A0A5P9VSM6

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

Mol	Chain	Residues	Atoms	AltConf
2	A	3	Total Ca 3 3	0
2	C	3	Total Ca 3 3	0



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	205220	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 ($e^-/\text{\AA}^2$)	64	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	0.128	Depositor
Minimum map value	-0.070	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.003	Depositor
Recommended contour level	0.015	Depositor
Map size (Å)	243.36002, 243.36002, 243.36002	wwPDB
Map dimensions	240, 240, 240	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.014, 1.014, 1.014	Depositor

5 Model quality

5.1 Standard geometry

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	0.11	0/5467	0.33	0/7438
1	C	0.13	0/5467	0.36	0/7438
All	All	0.12	0/10934	0.34	0/14876

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

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	5321	0	5314	64	0
1	C	5321	0	5313	83	0
2	A	3	0	0	0	0
2	C	3	0	0	0	0
All	All	10648	0	10627	133	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 6.

The worst 5 of 133 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:444:PHE:HD1	1:C:541:LEU:HD13	1.50	0.76
1:A:267:ASN:HD22	1:C:628:VAL:HG21	1.50	0.76
1:C:507:ILE:HD12	1:C:540:ARG:HH11	1.54	0.72
1:C:615:ASP:HB3	1:C:617:PRO:HD2	1.72	0.71
1:A:628:VAL:HG21	1:C:267:ASN:HD22	1.55	0.70

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	641/998 (64%)	622 (97%)	19 (3%)	0	100	100
1	C	641/998 (64%)	620 (97%)	21 (3%)	0	100	100
All	All	1282/1996 (64%)	1242 (97%)	40 (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	577/881 (66%)	576 (100%)	1 (0%)	87	96
1	C	577/881 (66%)	576 (100%)	1 (0%)	87	96
All	All	1154/1762 (66%)	1152 (100%)	2 (0%)	85	96

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	543	ARG
1	C	542	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	421	GLN
1	C	54	GLN
1	C	267	ASN
1	C	421	GLN
1	C	547	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 6 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.

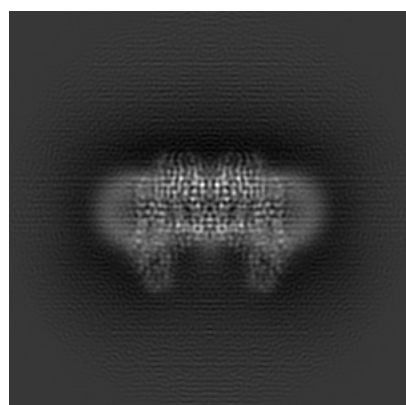
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-31588. These allow visual inspection of the internal detail of the map and identification of artifacts.

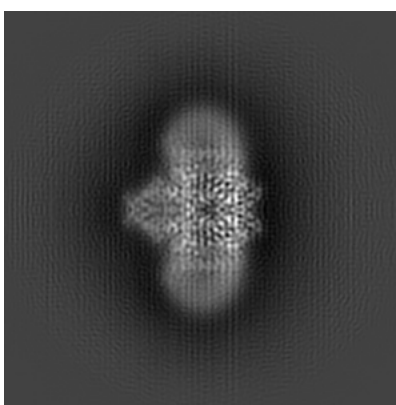
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

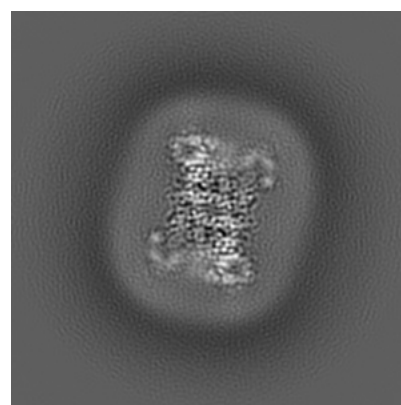
6.1.1 Primary map



X



Y

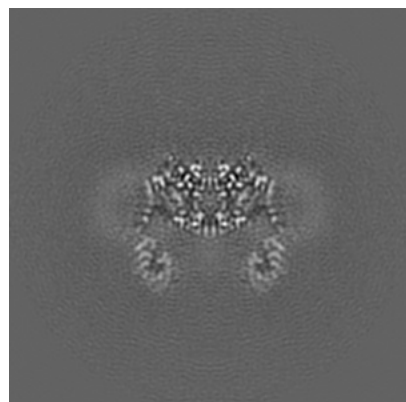


Z

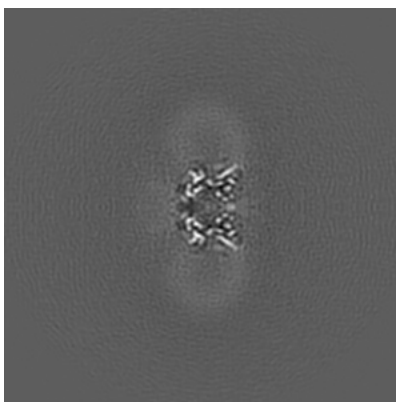
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

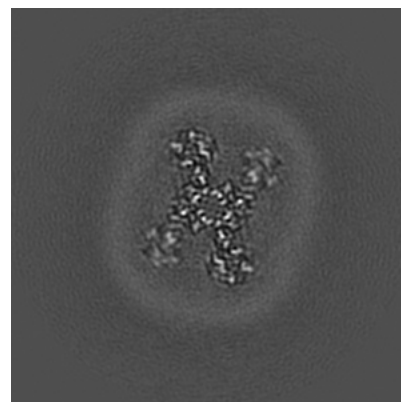
6.2.1 Primary map



X Index: 120



Y Index: 120

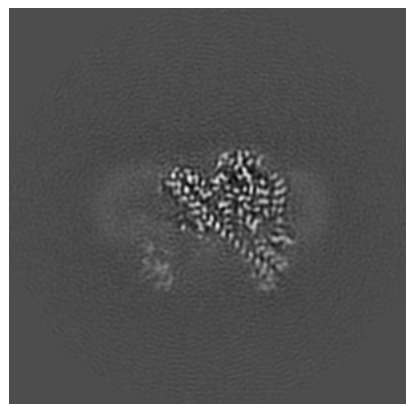


Z Index: 120

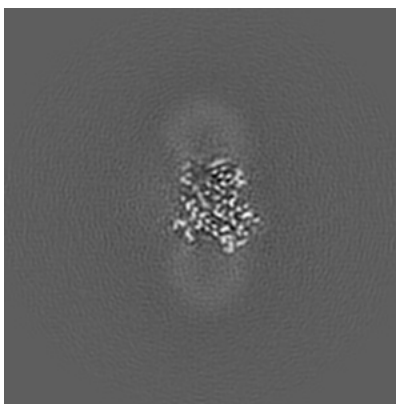
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

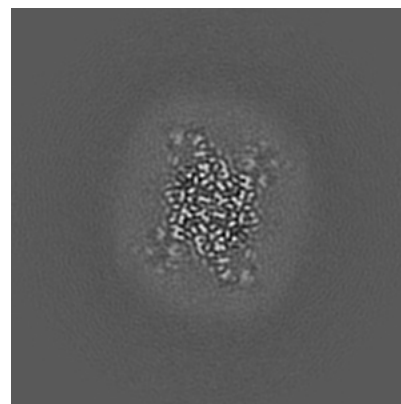
6.3.1 Primary map



X Index: 112



Y Index: 129

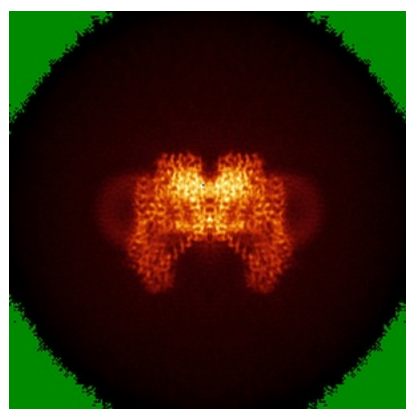


Z Index: 134

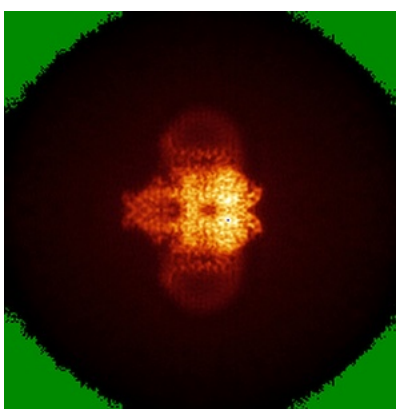
The images above show the largest variance slices of the map in three orthogonal directions.

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

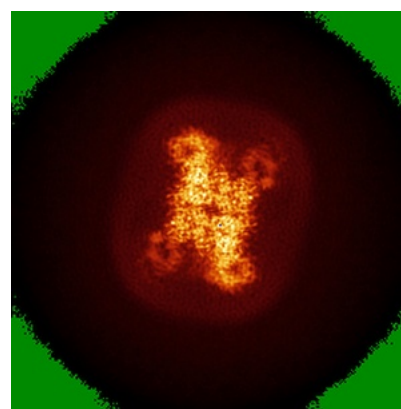
6.4.1 Primary map



X



Y

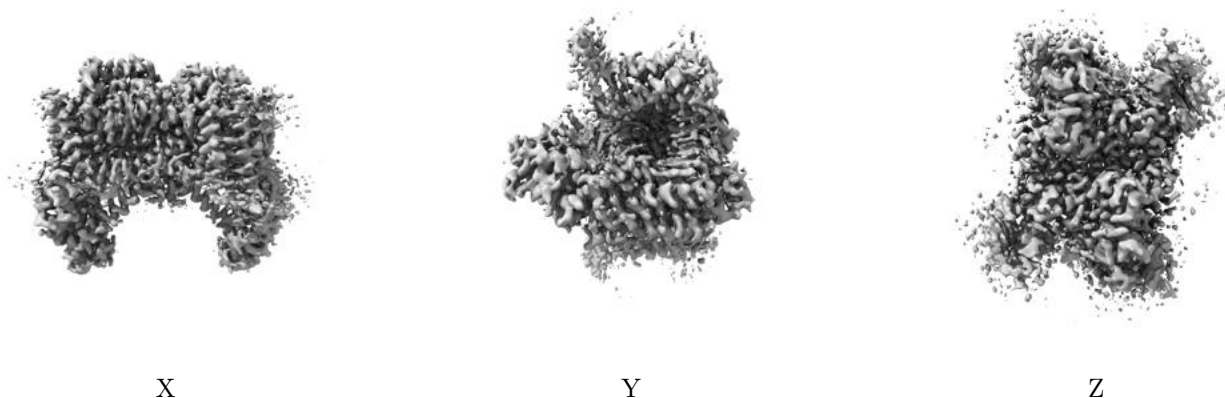


Z

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

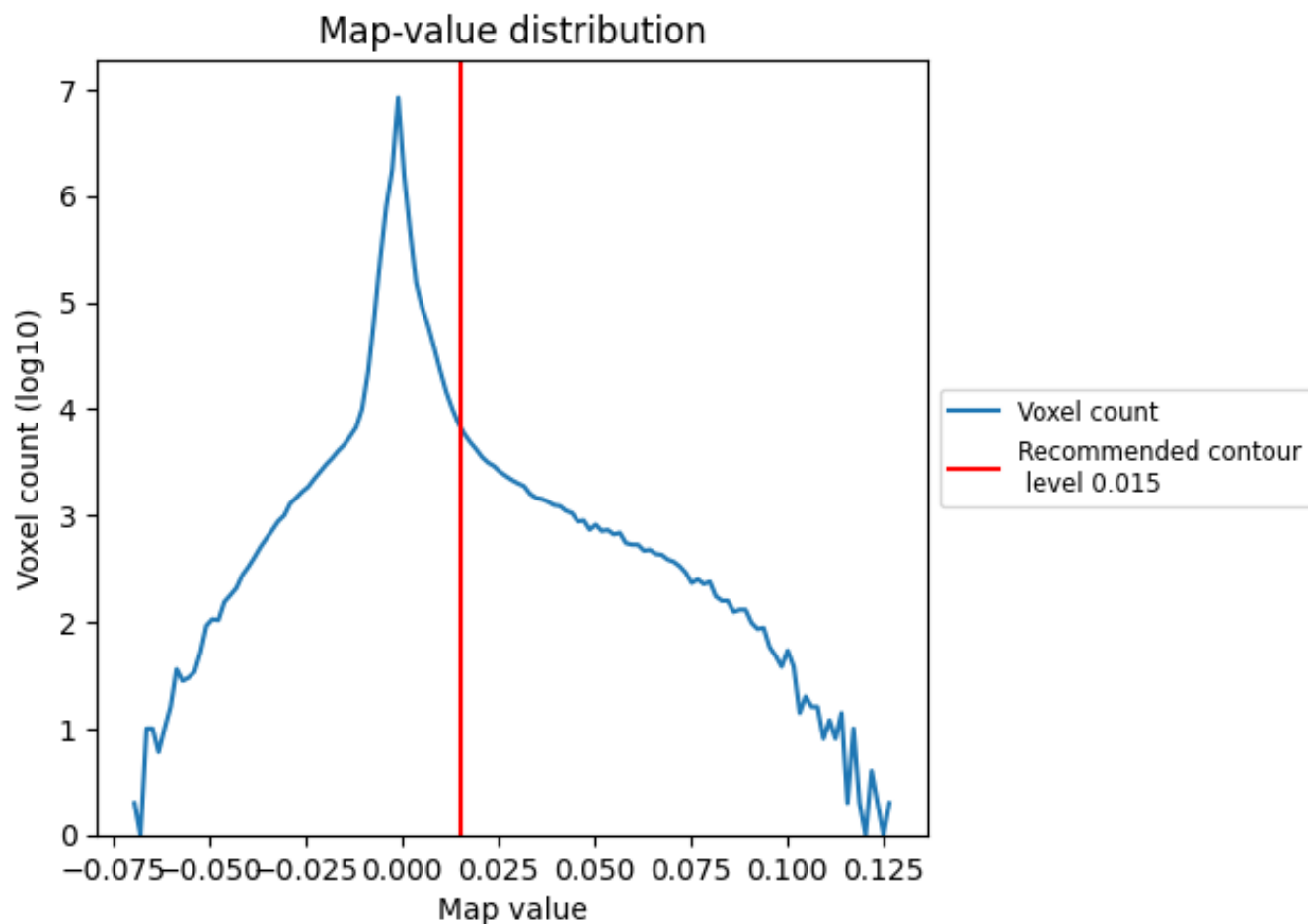
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

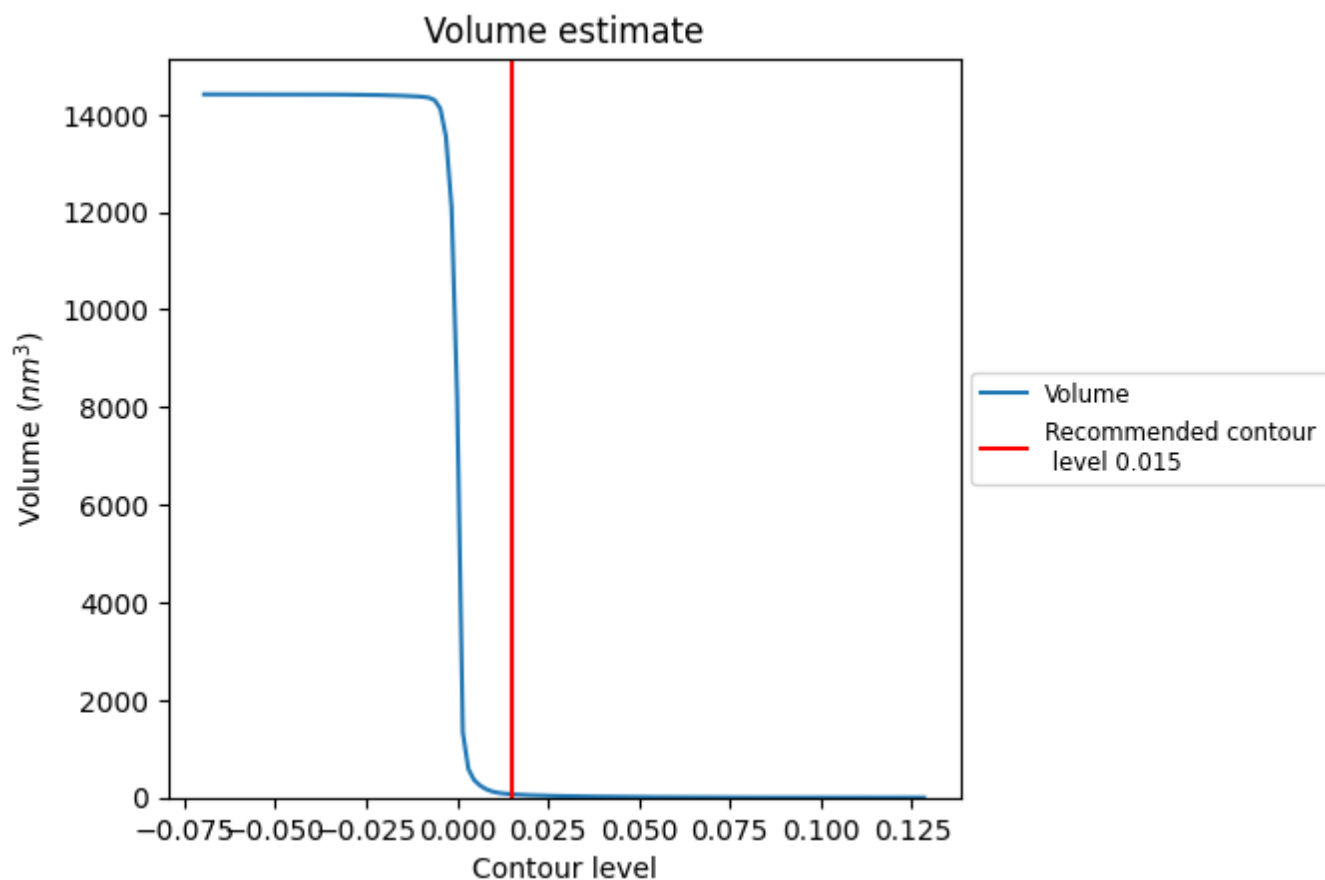
This section contains the results of statistical analysis of the map.

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.

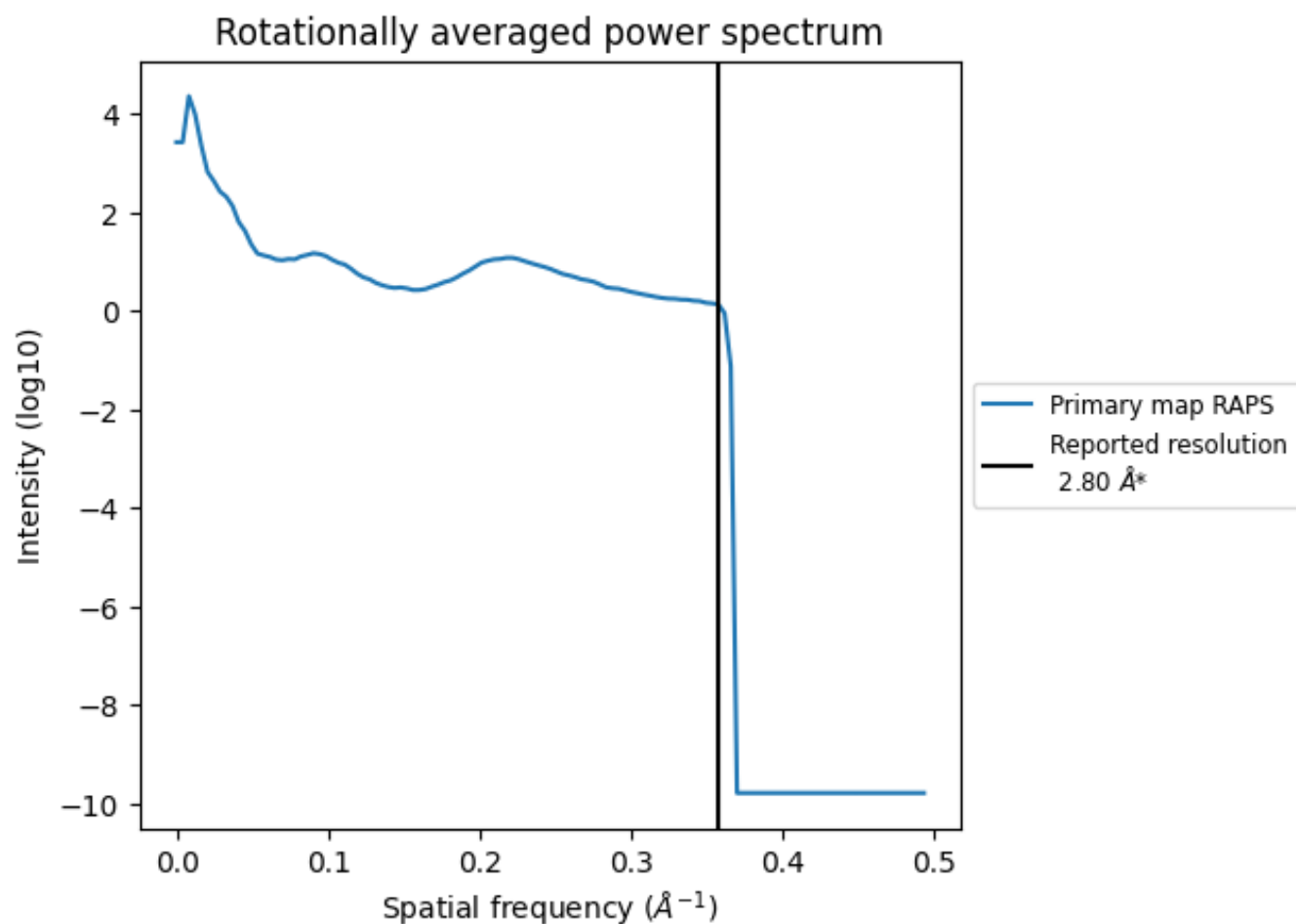
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 68 nm^3 ; this corresponds to an approximate mass of 61 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 ⓘ



*Reported resolution corresponds to spatial frequency of 0.357 $\text{\AA}^{-1}$

8 Fourier-Shell correlation

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

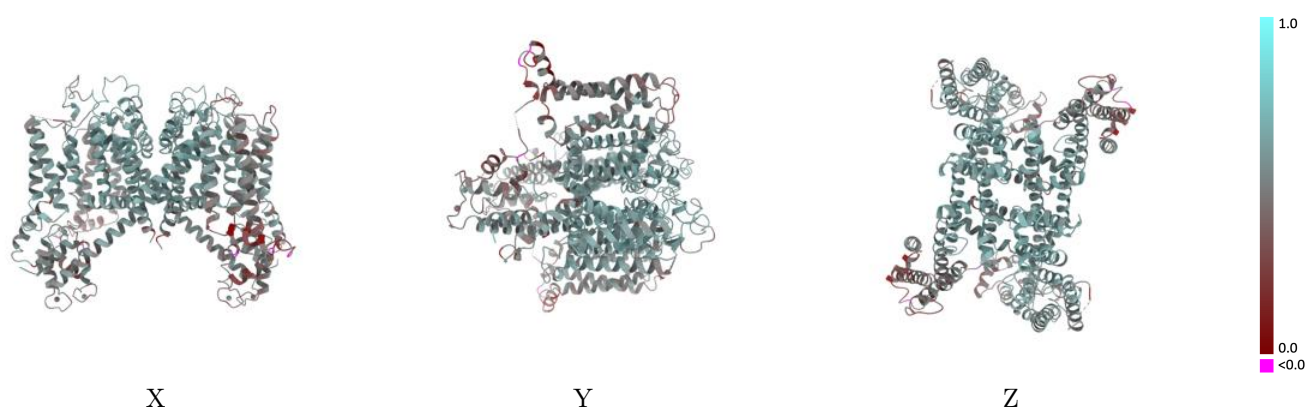
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-31588 and PDB model 7FHO. Per-residue inclusion information can be found in section 3 on page 5.

9.1 Map-model overlay [i](#)

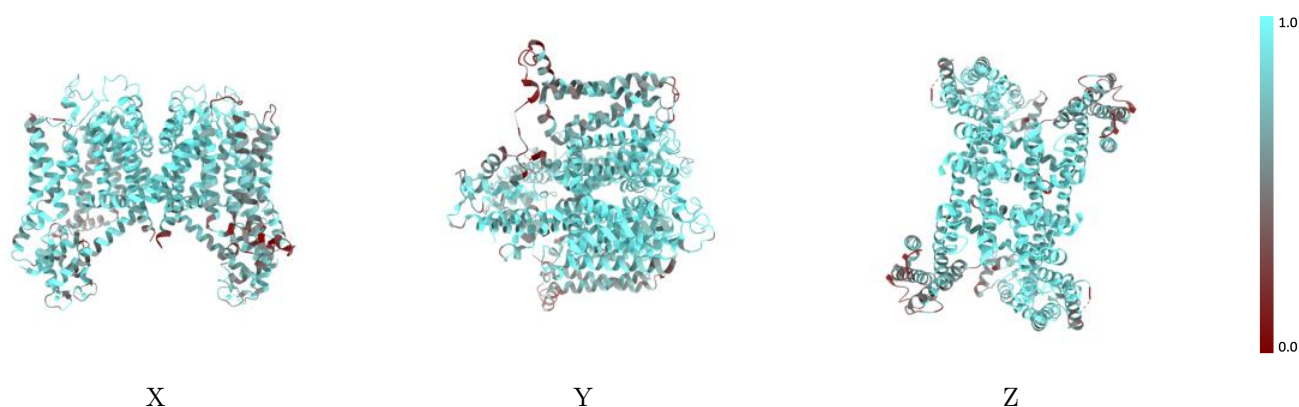
This section was not generated.

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



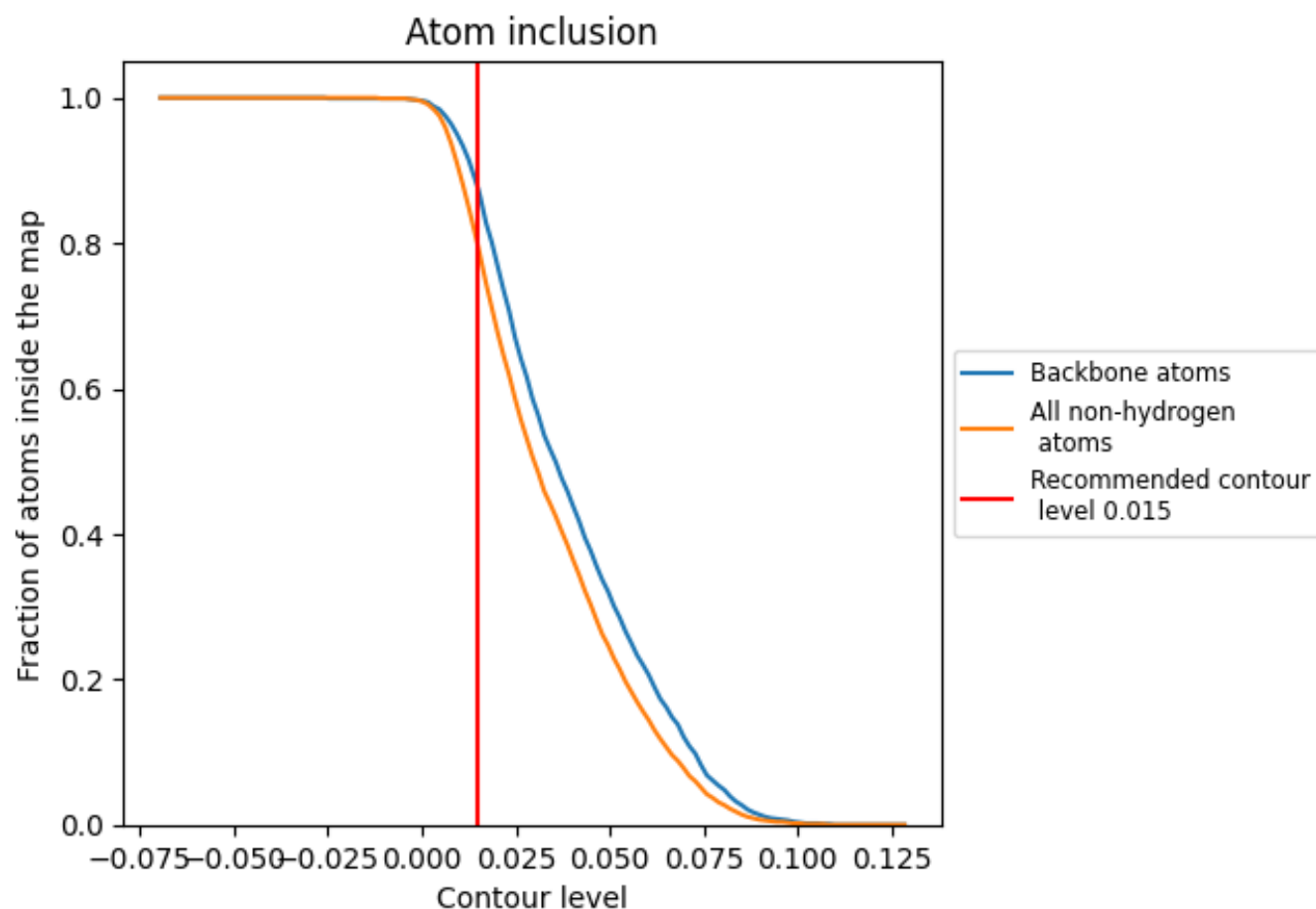
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.015).

9.4 Atom inclusion [i](#)



At the recommended contour level, 87% of all backbone atoms, 79% 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 (0.015) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7940	0.5250
A	0.8000	0.5280
C	0.7890	0.5210

