



wwPDB EM Validation Summary Report ⓘ

Mar 5, 2026 – 06:19 AM UTC

PDB ID : 7E4I / pdb_00007e4i
EMDB ID : EMD-30986
Title : Cryo-EM structure of the yeast mitochondrial SAM-Tom40/Tom5/Tom6 complex at 3.0 angstrom
Authors : Wang, Q.; Guan, Z.Y.; Qi, L.B.; Yan, C.Y.; Yin, P.
Deposited on : 2021-02-13
Resolution : 3.05 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:

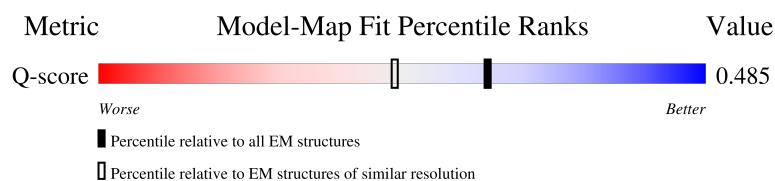
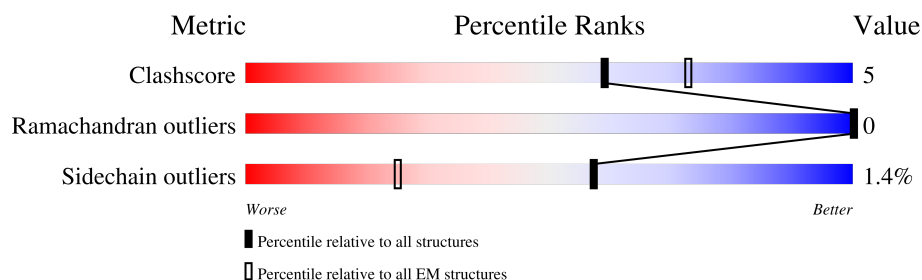
EMDB validation analysis : 0.0.1.dev132
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDb archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & 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 3.05 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	13971 (2.55 - 3.55)

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	485	
2	B	329	
3	C	351	
4	D	406	

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Mol	Chain	Length	Quality of chain
5	E	52	65% 63% 8% 29%
6	F	62	56% 44% 13% 44%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 11336 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 Sorting assembly machinery 50 kDa subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	439	Total	C	N	O	S	0	0
			3494	2240	604	636	14		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	initiating methionine	UNP P53969
A	1	ALA	-	expression tag	UNP P53969

- Molecule 2 is a protein called Sorting assembly machinery 35 kDa subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	317	Total	C	N	O	S	0	0
			2536	1614	428	480	14		

- Molecule 3 is a protein called Sorting assembly machinery 37 kDa subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	291	Total	C	N	O	S	0	0
			2344	1498	400	437	9		

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	328	LEU	-	expression tag	UNP P50110
C	329	GLU	-	expression tag	UNP P50110
C	330	ASP	-	expression tag	UNP P50110
C	331	TYR	-	expression tag	UNP P50110
C	332	LYS	-	expression tag	UNP P50110
C	333	ASP	-	expression tag	UNP P50110
C	334	HIS	-	expression tag	UNP P50110
C	335	ASP	-	expression tag	UNP P50110
C	336	GLY	-	expression tag	UNP P50110

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Chain	Residue	Modelled	Actual	Comment	Reference
C	337	ASP	-	expression tag	UNP P50110
C	338	TYR	-	expression tag	UNP P50110
C	339	LYS	-	expression tag	UNP P50110
C	340	ASP	-	expression tag	UNP P50110
C	341	HIS	-	expression tag	UNP P50110
C	342	ASP	-	expression tag	UNP P50110
C	343	ILE	-	expression tag	UNP P50110
C	344	ASP	-	expression tag	UNP P50110
C	345	TYR	-	expression tag	UNP P50110
C	346	LYS	-	expression tag	UNP P50110
C	347	ASP	-	expression tag	UNP P50110
C	348	ASP	-	expression tag	UNP P50110
C	349	ASP	-	expression tag	UNP P50110
C	350	ASP	-	expression tag	UNP P50110
C	351	LYS	-	expression tag	UNP P50110

- Molecule 4 is a protein called Mitochondrial import receptor subunit TOM40.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	307	Total	C	N	O	S	0	0
			2378	1499	405	467	7		

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	0	MET	-	initiating methionine	UNP P23644
D	1	ALA	-	expression tag	UNP P23644
D	388	LEU	-	expression tag	UNP P23644
D	389	GLU	-	expression tag	UNP P23644
D	390	SER	-	expression tag	UNP P23644
D	391	ALA	-	expression tag	UNP P23644
D	392	GLY	-	expression tag	UNP P23644
D	393	LYS	-	expression tag	UNP P23644
D	394	PRO	-	expression tag	UNP P23644
D	395	ILE	-	expression tag	UNP P23644
D	396	PRO	-	expression tag	UNP P23644
D	397	ASN	-	expression tag	UNP P23644
D	398	PRO	-	expression tag	UNP P23644
D	399	LEU	-	expression tag	UNP P23644
D	400	LEU	-	expression tag	UNP P23644
D	401	GLY	-	expression tag	UNP P23644
D	402	LEU	-	expression tag	UNP P23644

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Chain	Residue	Modelled	Actual	Comment	Reference
D	403	ASP	-	expression tag	UNP P23644
D	404	SER	-	expression tag	UNP P23644
D	405	THR	-	expression tag	UNP P23644

- Molecule 5 is a protein called Mitochondrial import receptor subunit TOM5.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	E	37	Total	C	N	O	S	0	0
			317	209	56	51	1		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	-1	MET	-	initiating methionine	UNP P80967
E	0	ALA	-	expression tag	UNP P80967

- Molecule 6 is a protein called Mitochondrial import receptor subunit TOM6.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	F	35	Total	C	N	O	S	0	0
			267	180	39	46	2		

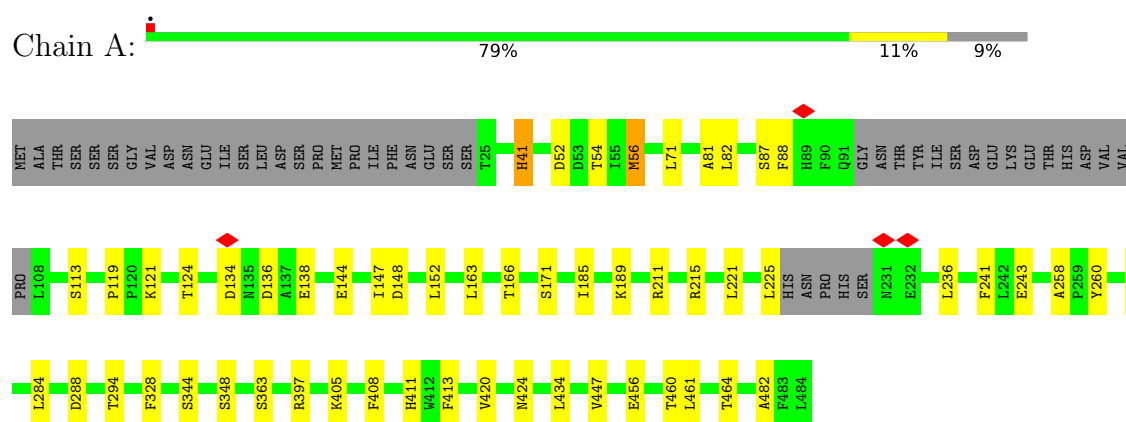
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
F	0	MET	-	initiating methionine	UNP P33448
F	1	ALA	-	expression tag	UNP P33448

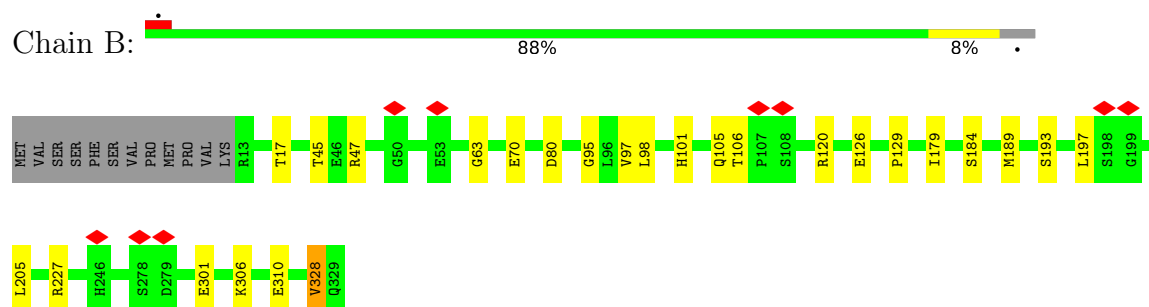
3 Residue-property plots

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.

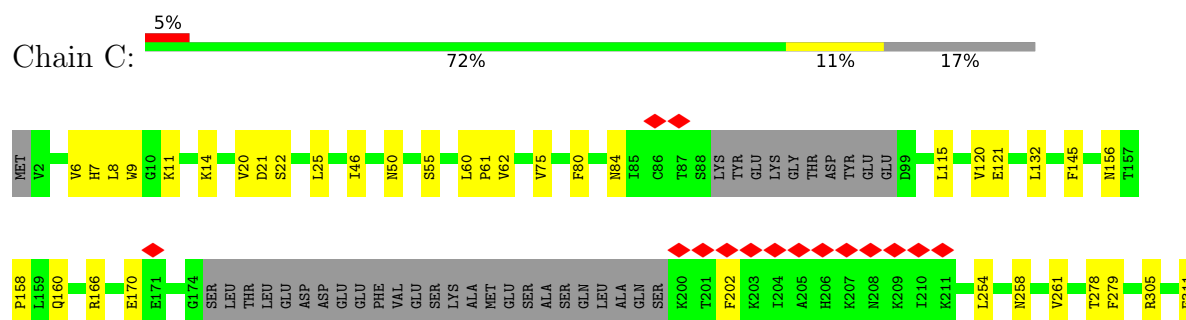
- Molecule 1: Sorting assembly machinery 50 kDa subunit

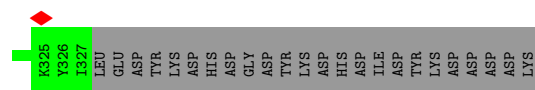


- Molecule 2: Sorting assembly machinery 35 kDa subunit

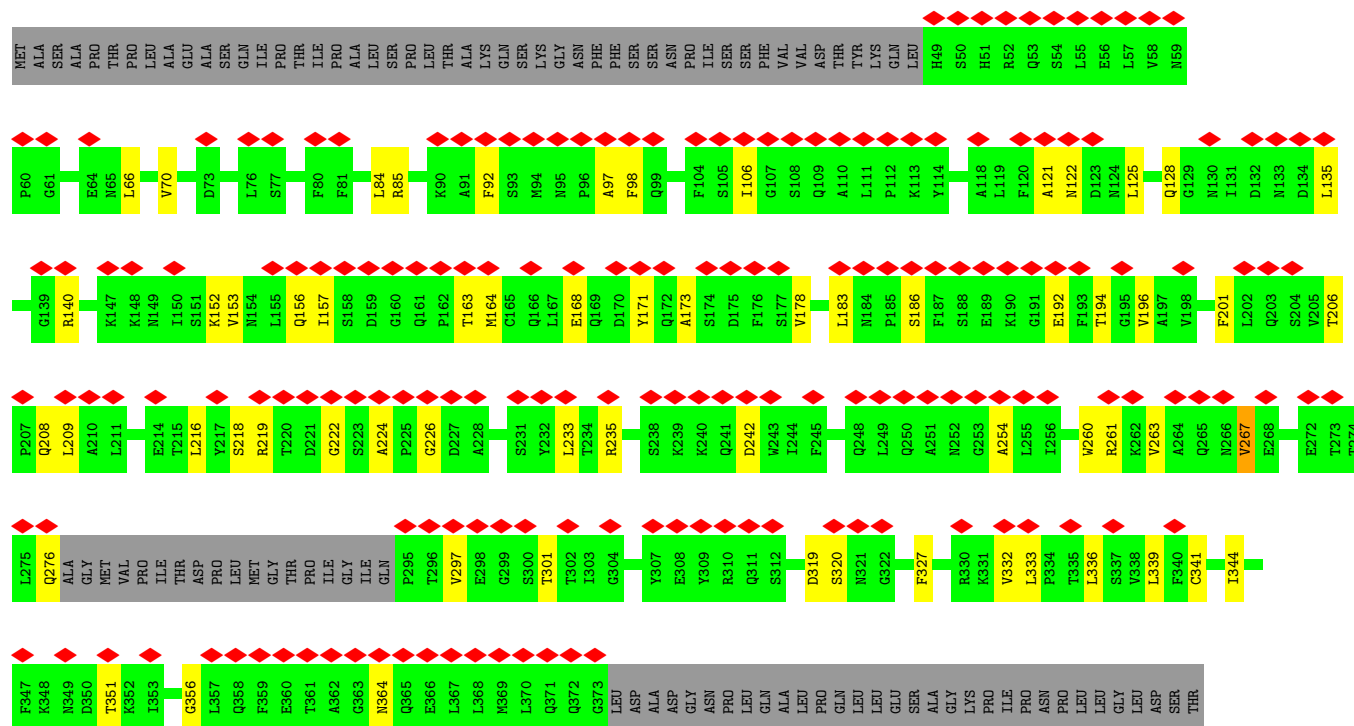


- Molecule 3: Sorting assembly machinery 37 kDa subunit





• Molecule 4: Mitochondrial import receptor subunit TOM40



• Molecule 5: Mitochondrial import receptor subunit TOM5



• Molecule 6: Mitochondrial import receptor subunit TOM6



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	406531	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 ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	6.534	Depositor
Minimum map value	-4.856	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.116	Depositor
Recommended contour level	0.6	Depositor
Map size ($\text{\AA}$)	304.36002, 304.36002, 304.36002	wwPDB
Map dimensions	280, 280, 280	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.087, 1.087, 1.087	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	0.11	0/3577	0.33	0/4834
2	B	0.11	0/2581	0.27	0/3493
3	C	0.10	0/2383	0.26	0/3212
4	D	0.09	0/2423	0.26	0/3278
5	E	0.08	0/327	0.22	0/442
6	F	0.09	0/274	0.22	0/372
All	All	0.10	0/11565	0.29	0/15631

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	3494	0	3495	31	0
2	B	2536	0	2563	10	0
3	C	2344	0	2382	21	0
4	D	2378	0	2320	38	0
5	E	317	0	320	3	0
6	F	267	0	271	7	0
All	All	11336	0	11351	105	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 5.

The worst 5 of 105 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)
3:C:7:HIS:O	3:C:61:PRO:HA	1.87	0.73
4:D:156:GLN:HG3	4:D:164:MET:HB3	1.77	0.66
1:A:87:SER:HB3	1:A:113:SER:HB3	1.80	0.62
3:C:20:VAL:HG12	3:C:261:VAL:HG21	1.82	0.61
1:A:413:PHE:HZ	1:A:460:THR:HG22	1.66	0.60

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	433/485 (89%)	414 (96%)	19 (4%)	0	100	100
2	B	315/329 (96%)	304 (96%)	11 (4%)	0	100	100
3	C	285/351 (81%)	278 (98%)	7 (2%)	0	100	100
4	D	303/406 (75%)	292 (96%)	11 (4%)	0	100	100
5	E	35/52 (67%)	34 (97%)	1 (3%)	0	100	100
6	F	33/62 (53%)	33 (100%)	0	0	100	100
All	All	1404/1685 (83%)	1355 (96%)	49 (4%)	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	390/433 (90%)	383 (98%)	7 (2%)	51	70
2	B	288/300 (96%)	281 (98%)	7 (2%)	43	66
3	C	266/322 (83%)	265 (100%)	1 (0%)	84	84
4	D	260/342 (76%)	257 (99%)	3 (1%)	63	75
5	E	32/45 (71%)	32 (100%)	0	100	100
6	F	28/44 (64%)	28 (100%)	0	100	100
All	All	1264/1486 (85%)	1246 (99%)	18 (1%)	57	73

5 of 18 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	C	21	ASP
4	D	339	LEU
4	D	267	VAL
2	B	70	GLU
2	B	328	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:

Mol	Chain	Res	Type
3	C	168	ASN
4	D	89	ASN
4	D	358	GLN
1	A	415	ASN
2	B	103	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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](#)

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.

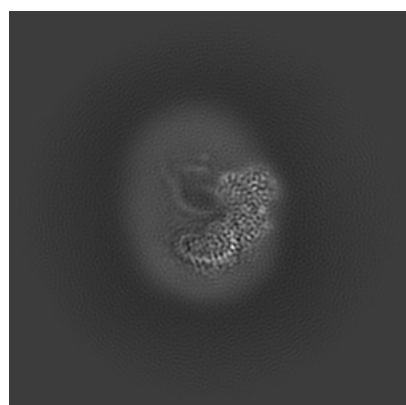
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-30986. These allow visual inspection of the internal detail of the map and identification of artifacts.

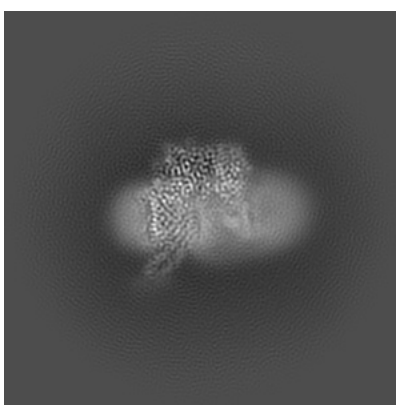
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

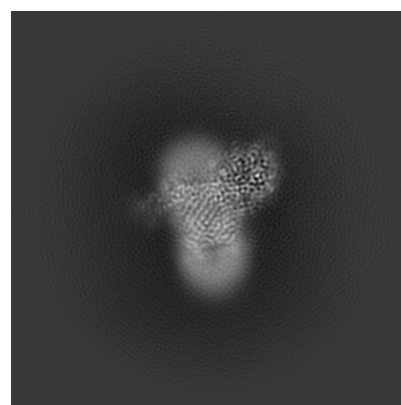
6.1.1 Primary map



X



Y

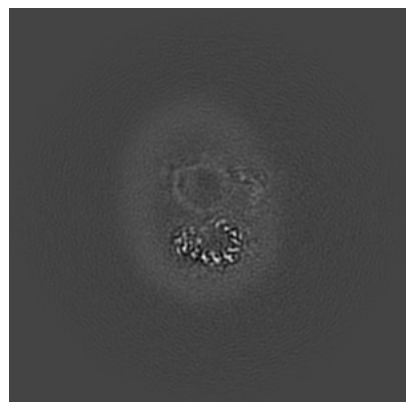


Z

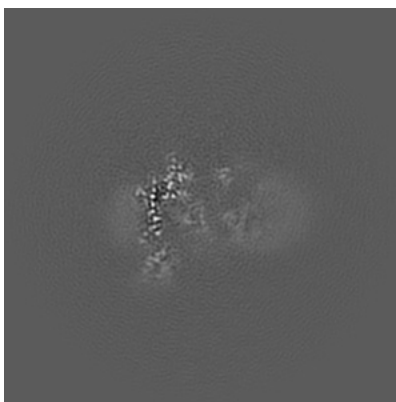
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

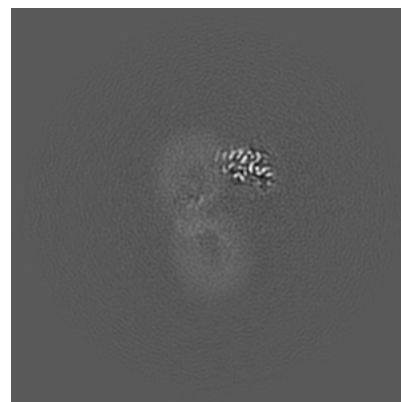
6.2.1 Primary map



X Index: 140



Y Index: 140

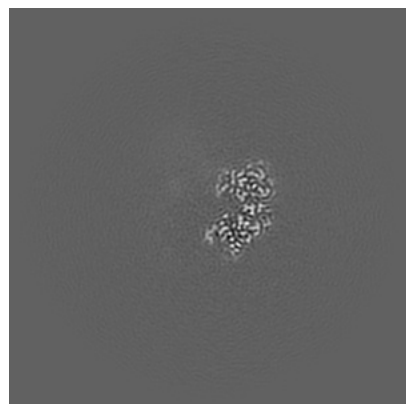


Z Index: 140

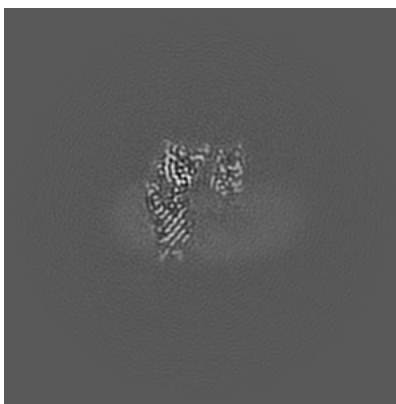
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

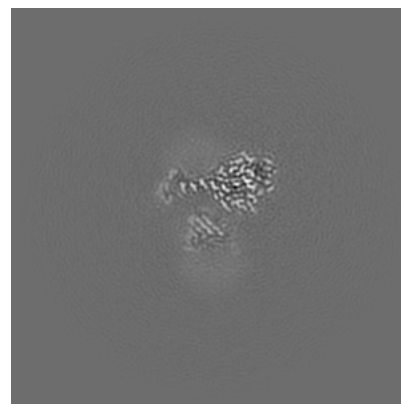
6.3.1 Primary map



X Index: 168



Y Index: 156

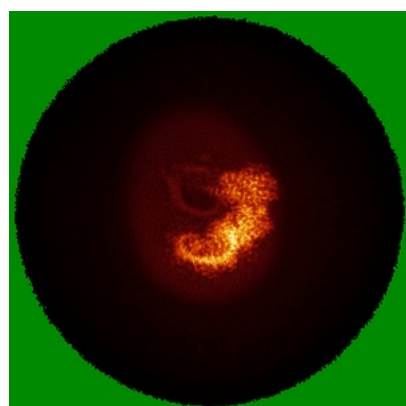


Z Index: 122

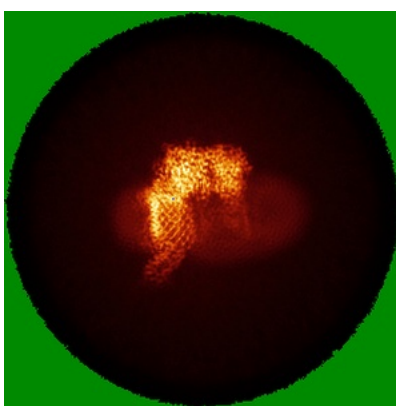
The images above show the largest variance slices of the map in three orthogonal directions.

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

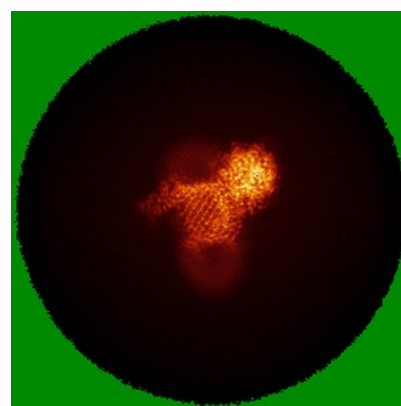
6.4.1 Primary map



X



Y

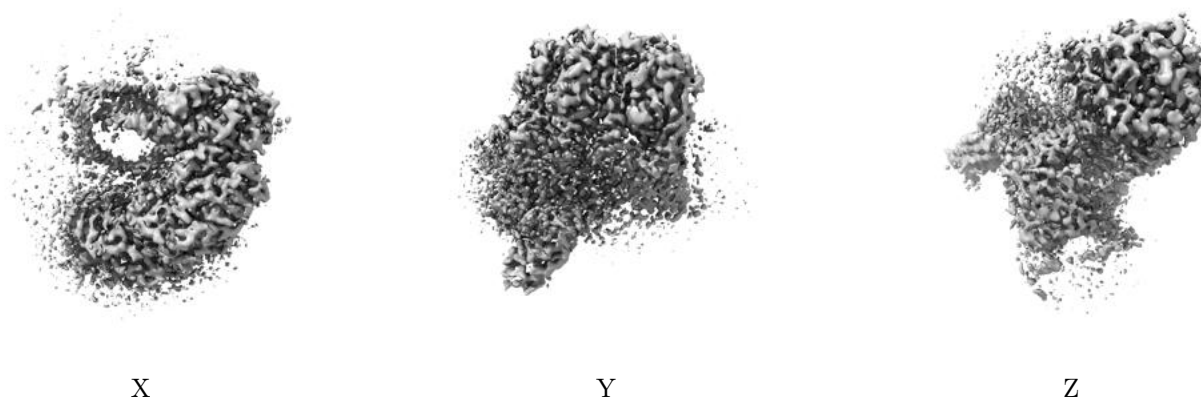


Z

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

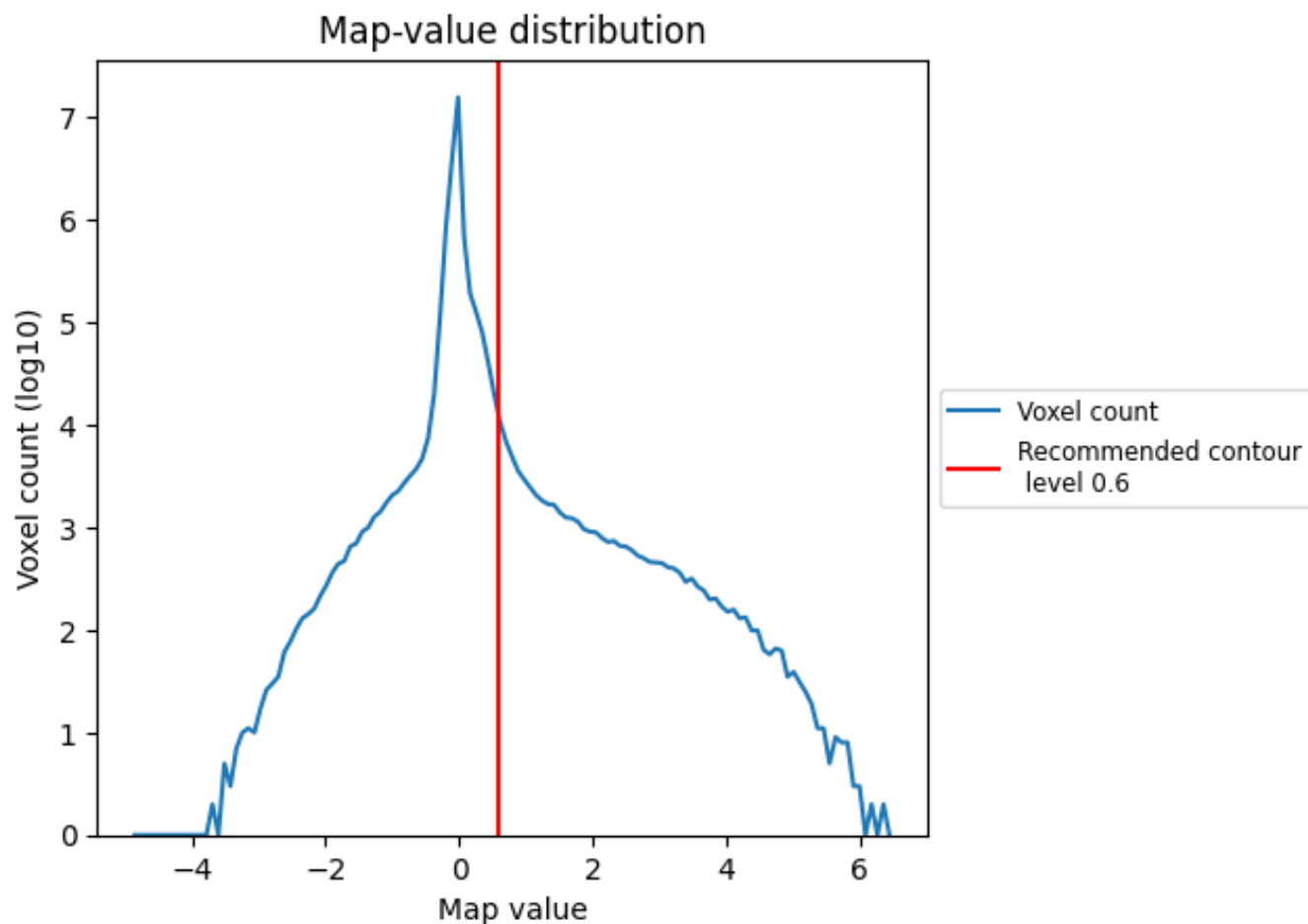
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

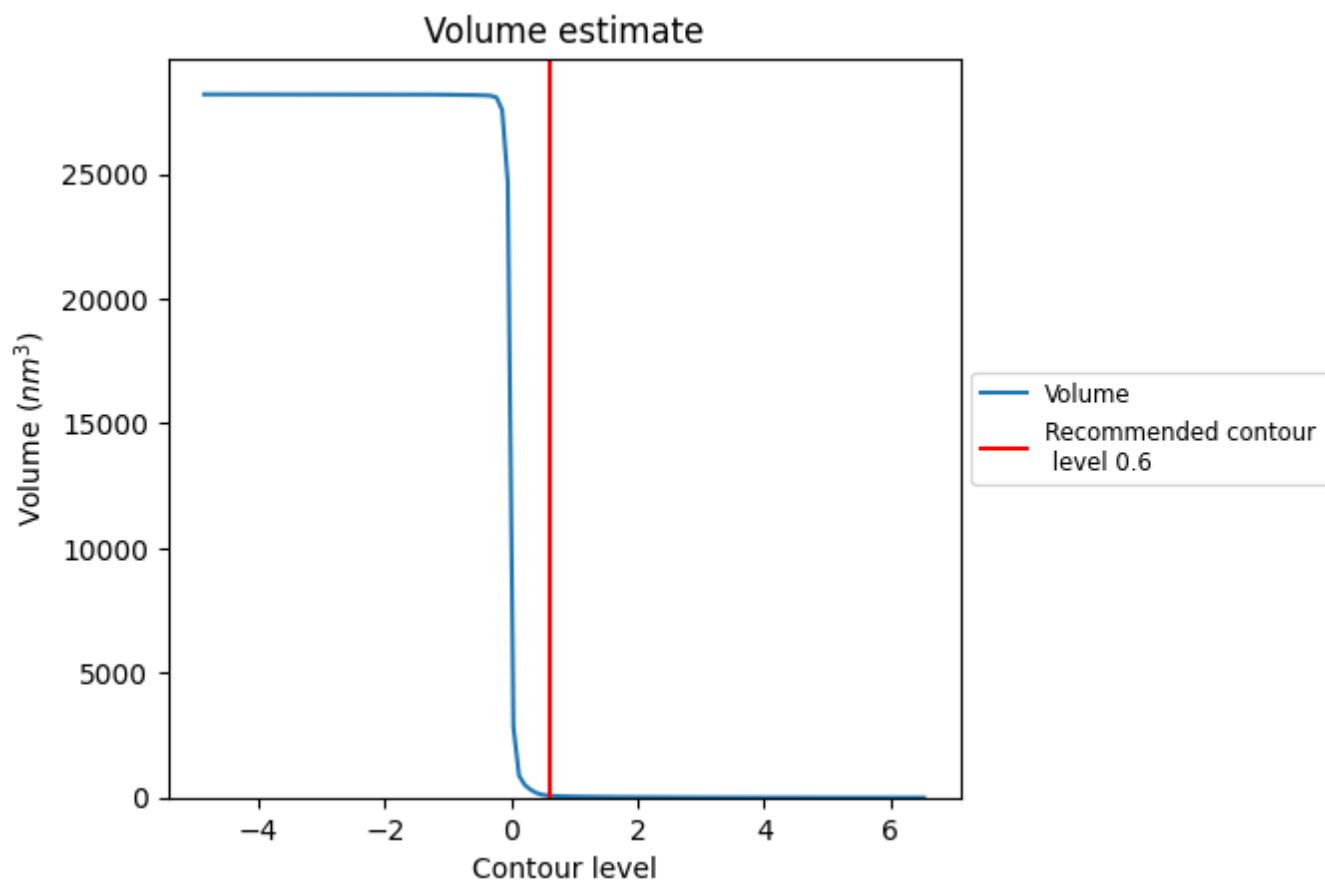
This section contains the results of statistical analysis of the map.

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.

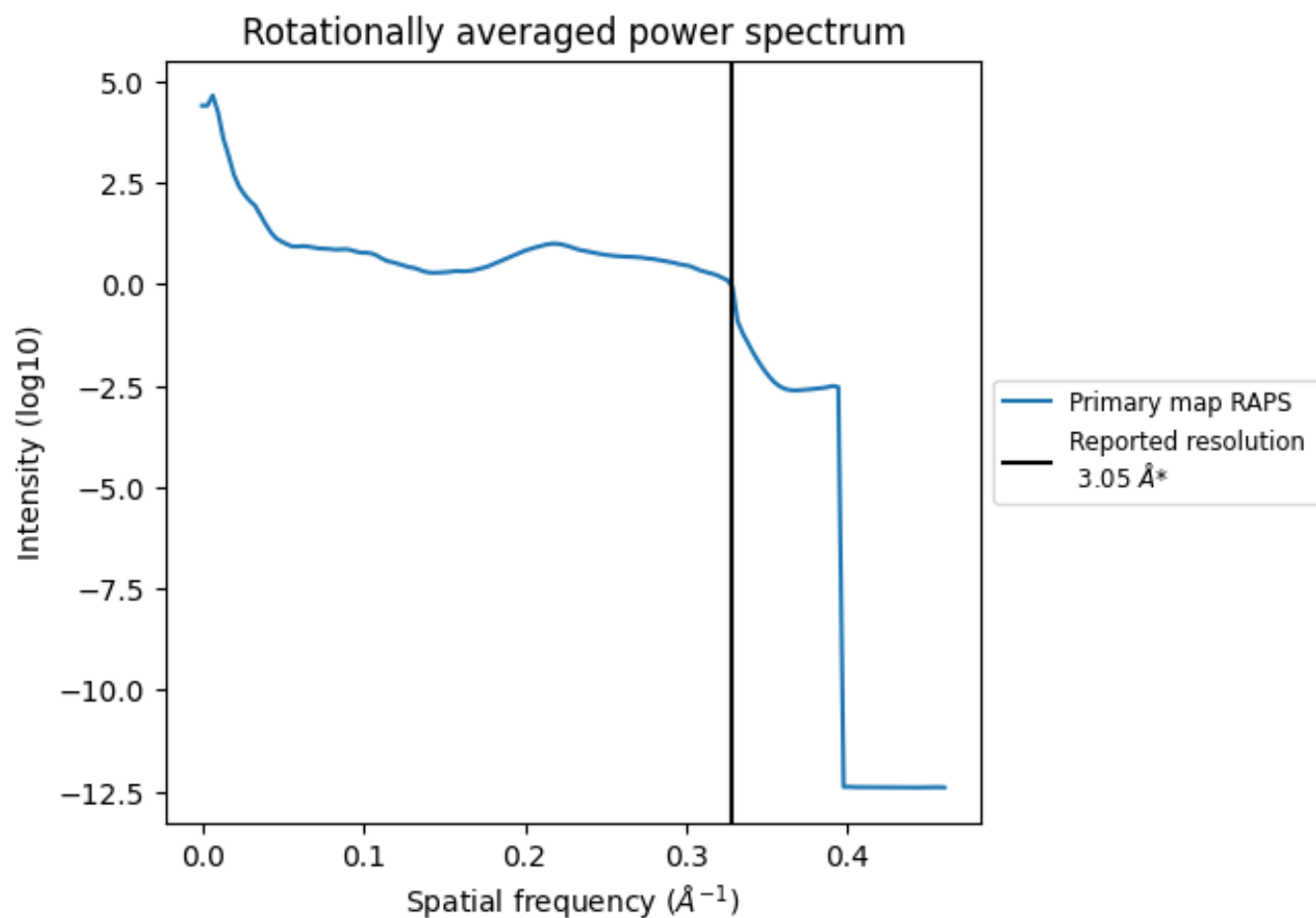
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 78 nm^3 ; this corresponds to an approximate mass of 71 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 0.328 $\text{\AA}^{-1}$

8 Fourier-Shell correlation

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

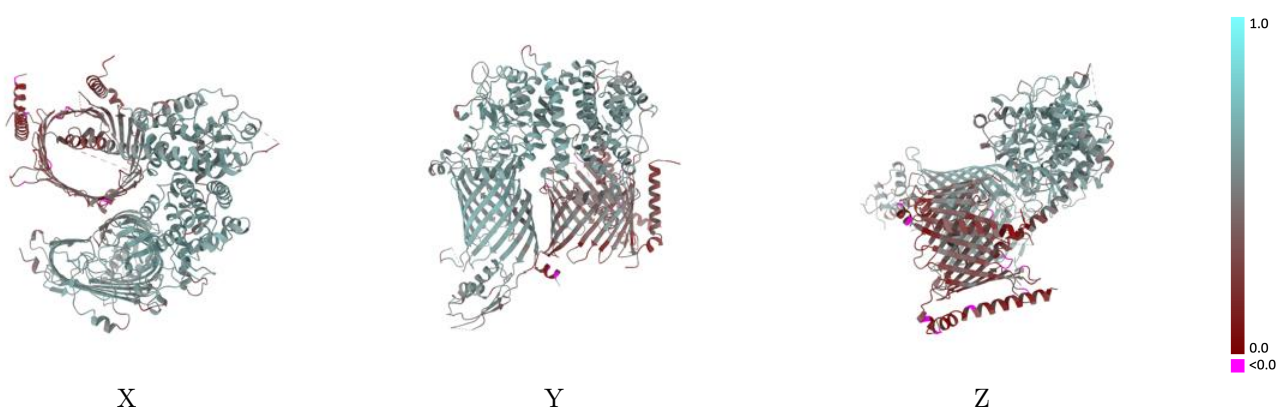
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-30986 and PDB model 7E4I. Per-residue inclusion information can be found in section 3 on page 7.

9.1 Map-model overlay [i](#)

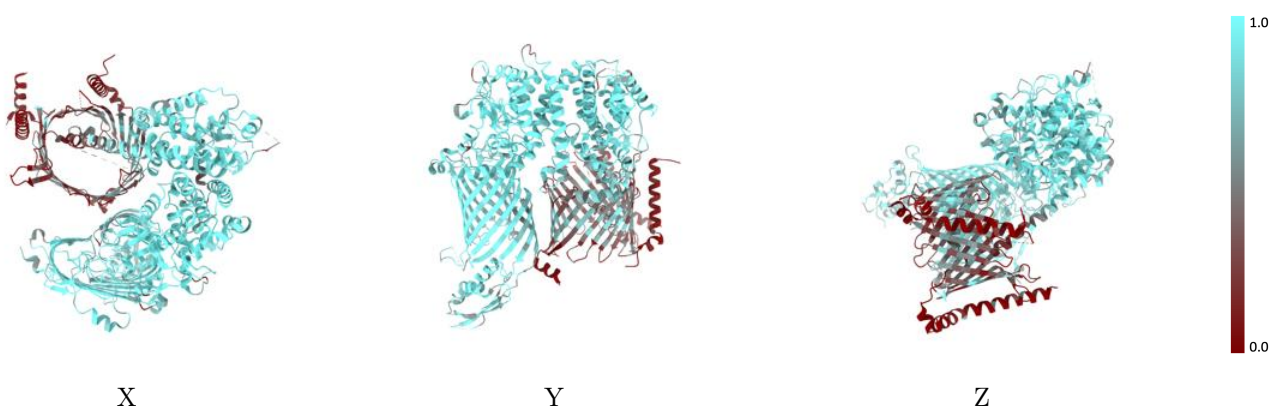
This section was not generated.

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



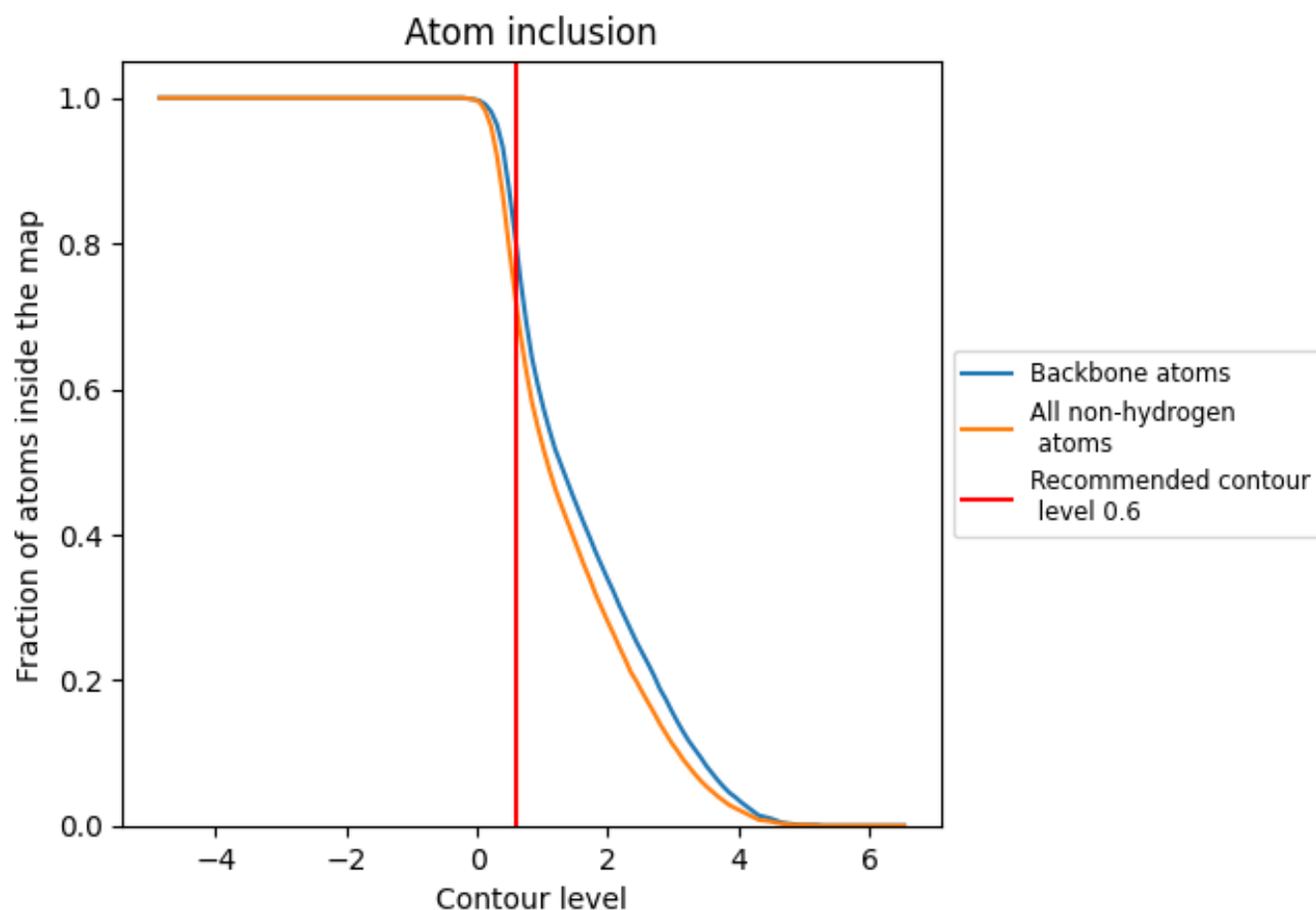
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.6).

9.4 Atom inclusion [i](#)



At the recommended contour level, 80% of all backbone atoms, 72% 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 (0.6) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7160	0.4850
A	0.8660	0.5480
B	0.9010	0.5730
C	0.8310	0.5310
D	0.3410	0.3210
E	0.1000	0.2070
F	0.0600	0.2320

1.0
0.0
-0.0