



Full wwPDB EM Validation Report ⓘ

Aug 11, 2022 – 08:06 pm BST

PDB ID : 7QE5
EMDB ID : EMD-13930
Title : Structure of the membrane domains of the sialic acid TRAP transporter HiSi-aQM from Haemophilus influenzae
Authors : Peter, M.F.; Hagelueken, G.
Deposited on : 2021-12-01
Resolution : 4.70 Å(reported)

This is a Full wwPDB EM Validation 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.dev8
MolProbity : 4.02b-467
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.29

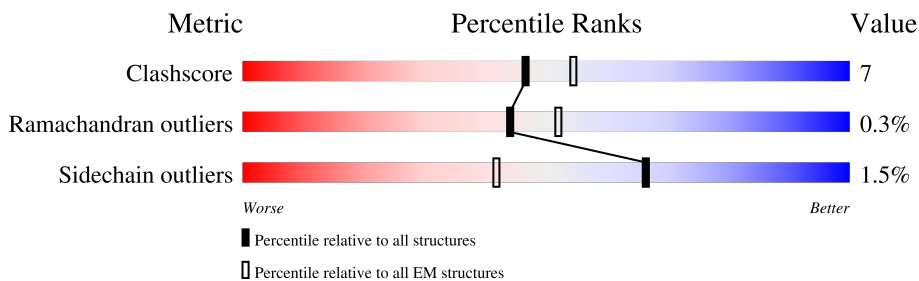
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.70 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	616	
2	B	576	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 11652 atoms, of which 5932 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 Sialic acid TRAP transporter permease protein SiaT.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
1	A	616	9794	3201	5030	737	792	34	0	0

- Molecule 2 is a protein called Megabody3.

Mol	Chain	Residues	Atoms						AltConf	Trace
			Total	C	H	N	O	S		
2	B	124	1858	592	902	168	193	3	0	0

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	215956	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 ($e^-/\text{\AA}^2$)	50.213	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	1.397	Depositor
Minimum map value	-0.707	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.024	Depositor
Recommended contour level	0.2	Depositor
Map size (Å)	330.24, 330.24, 330.24	wwPDB
Map dimensions	192, 192, 192	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.7199999, 1.7199999, 1.7199999	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	0.66	0/4880	1.00	9/6632 (0.1%)
2	B	0.79	0/976	1.36	9/1321 (0.7%)
All	All	0.68	0/5856	1.07	18/7953 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3
2	B	0	4
All	All	0	7

There are no bond length outliers.

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	550	TYR	CB-CA-C	-11.50	87.41	110.40
1	A	239	TYR	CB-CG-CD2	-10.29	114.82	121.00
1	A	239	TYR	CB-CG-CD1	8.30	125.98	121.00
2	B	546	ASN	CB-CA-C	6.76	123.93	110.40
1	A	118	GLY	N-CA-C	6.36	129.00	113.10
1	A	386	ARG	NE-CZ-NH2	6.33	123.46	120.30
2	B	549	ARG	N-CA-CB	-6.16	99.51	110.60
2	B	546	ASN	N-CA-C	-6.06	94.64	111.00
1	A	239	TYR	CA-CB-CG	5.91	124.63	113.40
1	A	76	PRO	CB-CA-C	-5.77	97.57	112.00
2	B	485	GLY	N-CA-C	5.44	126.69	113.10
1	A	267	ARG	NE-CZ-NH2	5.40	123.00	120.30
2	B	476	ARG	NE-CZ-NH2	5.27	122.94	120.30
2	B	539	ALA	N-CA-CB	-5.26	102.73	110.10

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	484	ARG	NE-CZ-NH2	5.26	122.93	120.30
2	B	540	TYR	CB-CA-C	-5.24	99.92	110.40
1	A	121	GLU	CB-CA-C	-5.18	100.04	110.40
2	B	563	SER	C-N-CA	5.01	132.82	122.30

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	116	LEU	Mainchain
1	A	252	TYR	Sidechain
1	A	76	PRO	Mainchain
2	B	498	TYR	Sidechain
2	B	501	SER	Mainchain
2	B	536	ARG	Sidechain
2	B	538	SER	Mainchain

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	4764	5030	5030	30	0
2	B	956	902	900	47	0
All	All	5720	5932	5930	76	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 7.

All (76) 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:200:TRP:CH2	1:A:532:MET:HE3	2.07	0.89
1:A:200:TRP:HH2	1:A:532:MET:HE3	1.39	0.87
1:A:200:TRP:CH2	1:A:532:MET:CE	2.65	0.78
2:B:540:TYR:CD1	2:B:548:SER:HB2	2.20	0.77

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:487:SER:OG	2:B:544:TRP:CB	2.33	0.77
2:B:551:ASP:O	2:B:552:TYR:CD1	2.42	0.72
1:A:283:MET:SD	1:A:283:MET:N	2.62	0.71
1:A:112:PRO:HB2	1:A:118:GLY:CA	2.20	0.70
1:A:77:GLU:HA	1:A:80:ARG:CZ	2.22	0.70
2:B:540:TYR:CZ	2:B:550:TYR:CE1	2.79	0.70
1:A:538:MET:SD	2:B:465:VAL:HG12	2.33	0.68
1:A:112:PRO:HB2	1:A:118:GLY:HA2	1.75	0.68
2:B:546:ASN:HD22	2:B:547:PRO:HD2	1.62	0.64
2:B:549:ARG:HD3	2:B:553:TRP:CH2	2.33	0.64
2:B:485:GLY:N	2:B:545:LEU:HD23	2.13	0.63
2:B:544:TRP:CE3	2:B:545:LEU:HG	2.33	0.63
2:B:546:ASN:HD22	2:B:547:PRO:CD	2.12	0.62
2:B:551:ASP:O	2:B:552:TYR:CG	2.53	0.62
2:B:540:TYR:CE1	2:B:550:TYR:CD2	2.88	0.62
2:B:487:SER:OG	2:B:544:TRP:HB3	1.99	0.61
2:B:540:TYR:OH	2:B:550:TYR:CD1	2.46	0.60
2:B:498:TYR:HB3	2:B:502:VAL:HG12	1.84	0.60
2:B:505:ARG:HB3	2:B:522:ASN:HB2	1.85	0.58
1:A:76:PRO:O	1:A:80:ARG:HG3	2.03	0.58
2:B:538:SER:O	2:B:550:TYR:CD2	2.57	0.58
2:B:545:LEU:HD12	2:B:545:LEU:O	2.03	0.58
2:B:540:TYR:CE1	2:B:550:TYR:CG	2.92	0.57
2:B:538:SER:O	2:B:550:TYR:CE2	2.58	0.57
2:B:546:ASN:ND2	2:B:547:PRO:HD2	2.19	0.56
2:B:540:TYR:CZ	2:B:550:TYR:CD1	2.95	0.55
2:B:487:SER:OG	2:B:544:TRP:HB2	2.04	0.54
2:B:540:TYR:CG	2:B:548:SER:HB2	2.43	0.54
2:B:498:TYR:HB3	2:B:502:VAL:CG1	2.38	0.53
1:A:547:PHE:CE2	1:A:551:THR:HG21	2.45	0.52
1:A:200:TRP:CZ3	1:A:532:MET:HE1	2.45	0.52
1:A:200:TRP:CH2	1:A:532:MET:HE1	2.43	0.52
2:B:544:TRP:CZ3	2:B:545:LEU:HG	2.45	0.52
2:B:540:TYR:CE1	2:B:550:TYR:CE2	2.99	0.51
1:A:76:PRO:C	1:A:80:ARG:NH2	2.64	0.51
2:B:477:GLN:OE1	2:B:484:GLU:OE2	2.28	0.51
2:B:483:ARG:C	2:B:484:GLU:HG3	2.30	0.51
1:A:200:TRP:CZ3	1:A:532:MET:CE	2.94	0.50
2:B:552:TYR:C	2:B:553:TRP:CD1	2.85	0.49
2:B:540:TYR:CE1	2:B:548:SER:HA	2.48	0.48
2:B:549:ARG:CD	2:B:553:TRP:CZ2	2.96	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:459:SER:HB3	2:B:518:TYR:CD2	2.48	0.48
1:A:61:ARG:NH1	1:A:138:ARG:CZ	2.76	0.48
1:A:112:PRO:HB2	1:A:118:GLY:HA3	1.92	0.48
2:B:485:GLY:N	2:B:545:LEU:CD2	2.77	0.48
1:A:77:GLU:HA	1:A:80:ARG:NH1	2.29	0.47
2:B:549:ARG:HD3	2:B:553:TRP:CZ2	2.49	0.47
2:B:463:SER:C	2:B:464:ARG:HG3	2.35	0.46
1:A:281:GLY:C	1:A:283:MET:SD	2.94	0.46
1:A:545:ILE:H	1:A:545:ILE:HD12	1.80	0.46
1:A:61:ARG:NH1	1:A:138:ARG:NH1	2.63	0.46
1:A:111:PHE:O	1:A:121:GLU:HG2	2.16	0.46
2:B:463:SER:C	2:B:464:ARG:CG	2.85	0.45
2:B:540:TYR:OH	2:B:550:TYR:CE1	2.68	0.44
2:B:540:TYR:CZ	2:B:550:TYR:CZ	3.06	0.44
1:A:412:THR:HB	1:A:413:PRO:HD3	2.00	0.44
1:A:75:MET:HG2	1:A:80:ARG:HG2	1.99	0.44
2:B:551:ASP:O	2:B:551:ASP:OD1	2.35	0.43
1:A:503:LEU:HD12	1:A:503:LEU:H	1.83	0.43
2:B:502:VAL:O	2:B:503:LYS:C	2.55	0.43
2:B:546:ASN:HD22	2:B:547:PRO:N	2.17	0.42
2:B:546:ASN:O	2:B:549:ARG:NE	2.51	0.42
1:A:106:PHE:CE1	1:A:122:LYS:HE2	2.55	0.41
1:A:607:ILE:O	1:A:611:PRO:HD2	2.20	0.41
2:B:547:PRO:HA	2:B:549:ARG:NE	2.35	0.41
1:A:283:MET:CE	1:A:284:GLY:H	2.34	0.41
1:A:78:LYS:O	1:A:81:LYS:N	2.54	0.41
1:A:471:MET:HG3	1:A:527:PHE:CD1	2.56	0.41
2:B:540:TYR:CE1	2:B:548:SER:CA	3.04	0.40
2:B:476:ARG:O	2:B:484:GLU:HB2	2.22	0.40
1:A:553:LEU:HA	1:A:556:MET:SD	2.61	0.40
2:B:544:TRP:CZ3	2:B:545:LEU:CD1	3.05	0.40

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	614/616 (100%)	593 (97%)	20 (3%)	1 (0%)	47	81
2	B	120/576 (21%)	104 (87%)	15 (12%)	1 (1%)	19	60
All	All	734/1192 (62%)	697 (95%)	35 (5%)	2 (0%)	44	76

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	565	GLY
2	B	487	SER

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	513/513 (100%)	508 (99%)	5 (1%)	76	86
2	B	103/469 (22%)	99 (96%)	4 (4%)	32	57
All	All	616/982 (63%)	607 (98%)	9 (2%)	66	80

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	98	PHE
1	A	239	TYR
1	A	283	MET
1	A	477	PHE
1	A	478	PHE
2	B	471	ASP
2	B	545	LEU
2	B	546	ASN
2	B	552	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such

sidechains are listed below:

Mol	Chain	Res	Type
2	B	546	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.

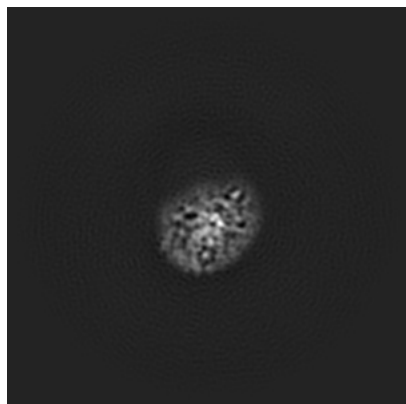
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-13930. These allow visual inspection of the internal detail of the map and identification of artifacts.

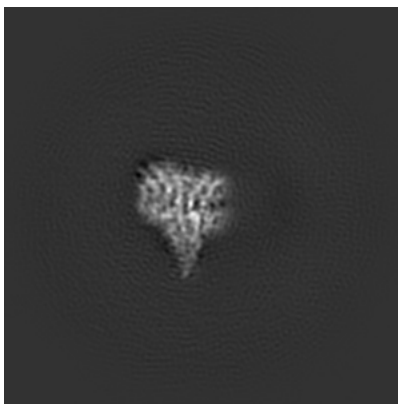
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

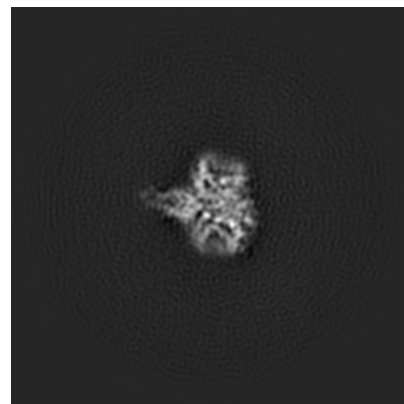
6.1.1 Primary map



X

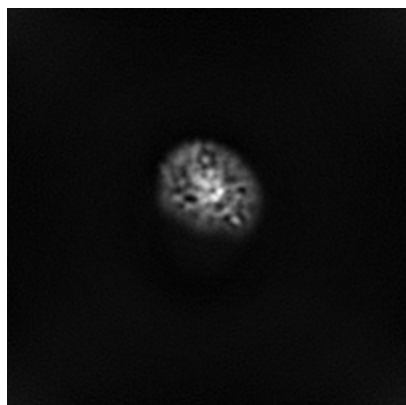


Y

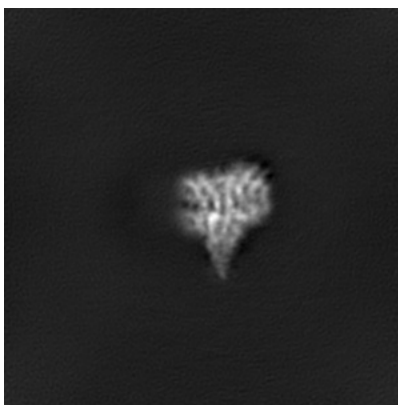


Z

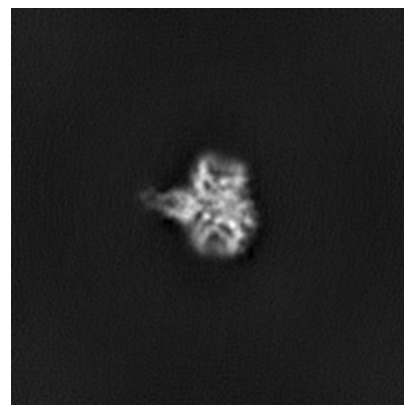
6.1.2 Raw map



X



Y

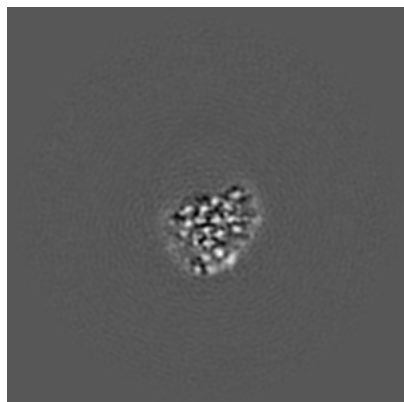


Z

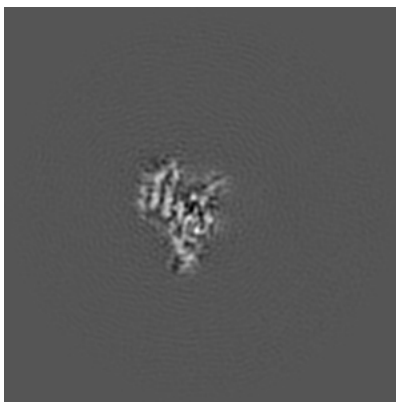
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

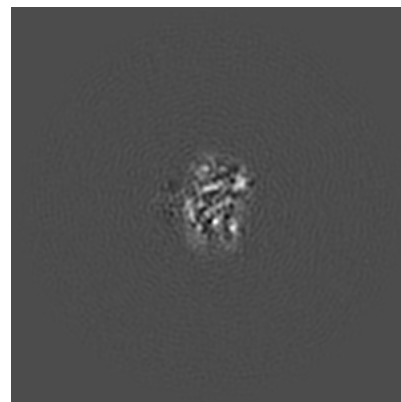
6.2.1 Primary map



X Index: 96

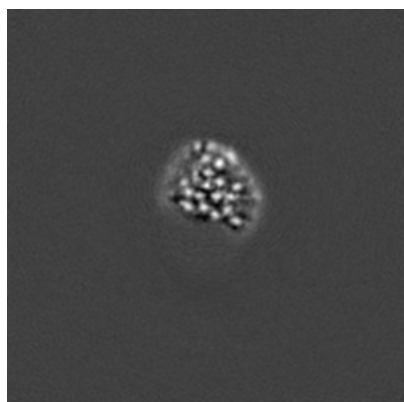


Y Index: 96

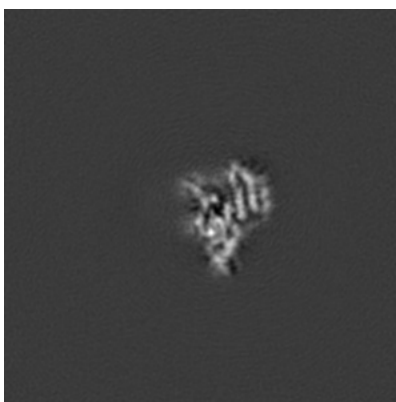


Z Index: 96

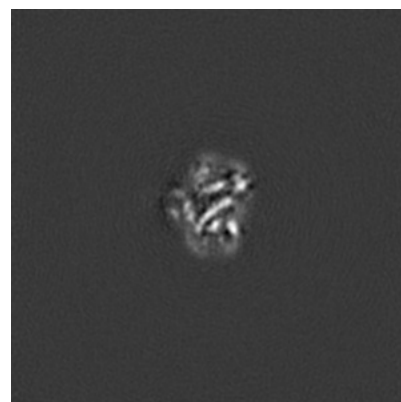
6.2.2 Raw map



X Index: 96



Y Index: 96

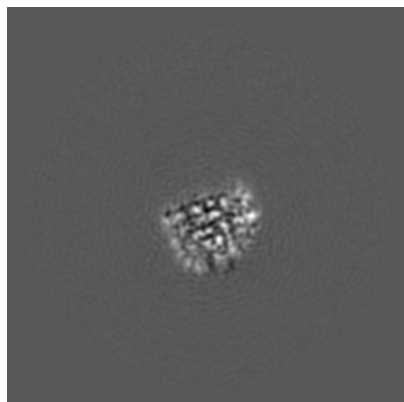


Z Index: 96

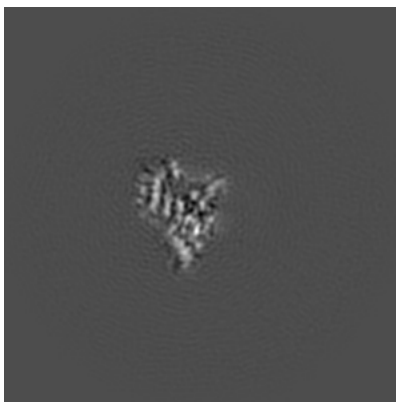
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

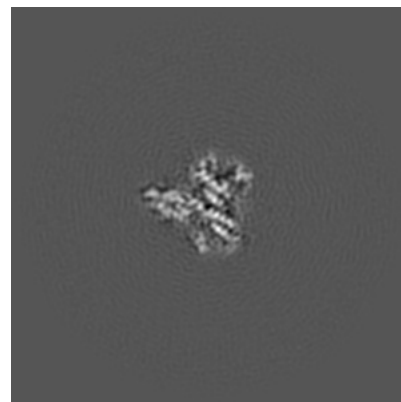
6.3.1 Primary map



X Index: 92

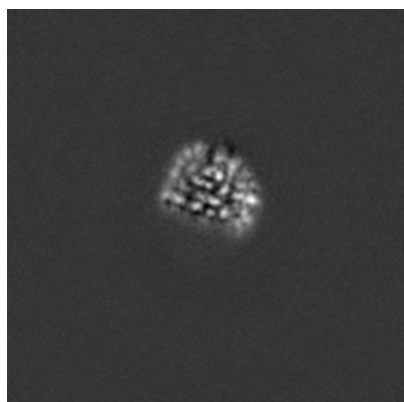


Y Index: 95

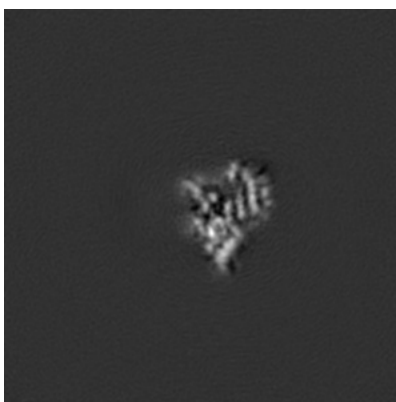


Z Index: 89

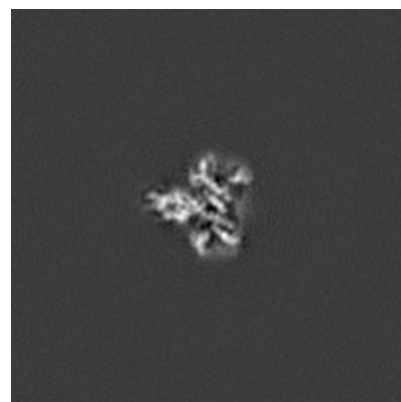
6.3.2 Raw map



X Index: 92



Y Index: 95

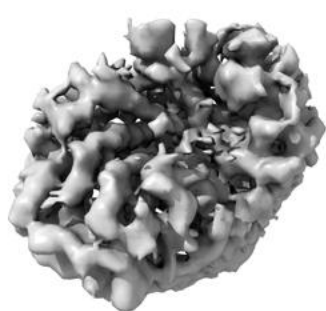


Z Index: 101

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

6.4 Orthogonal surface views [i](#)

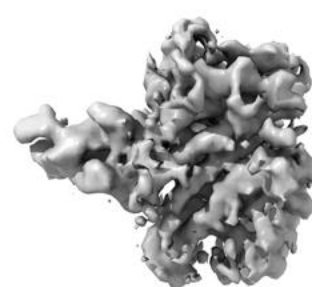
6.4.1 Primary map



X



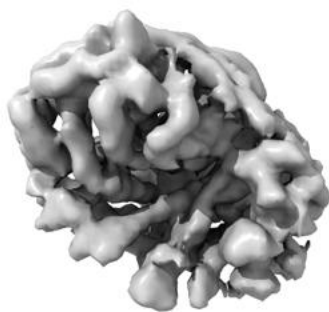
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.2. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

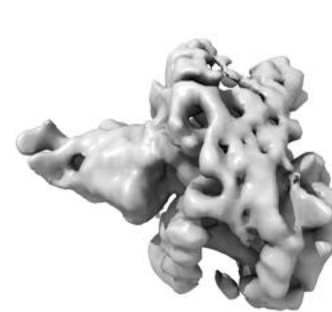
6.4.2 Raw map



X



Y



Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

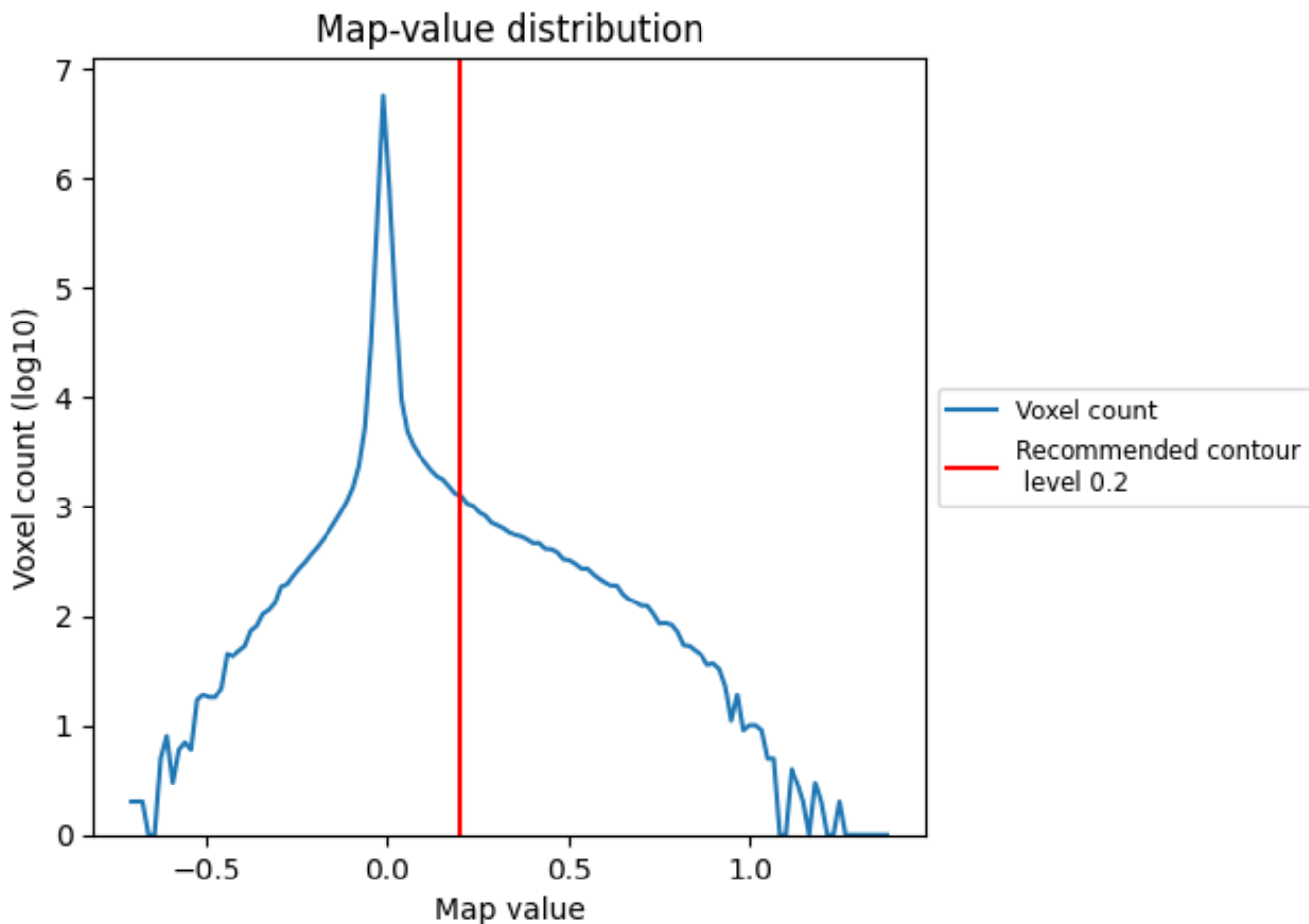
6.5 Mask visualisation [i](#)

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

7 Map analysis [i](#)

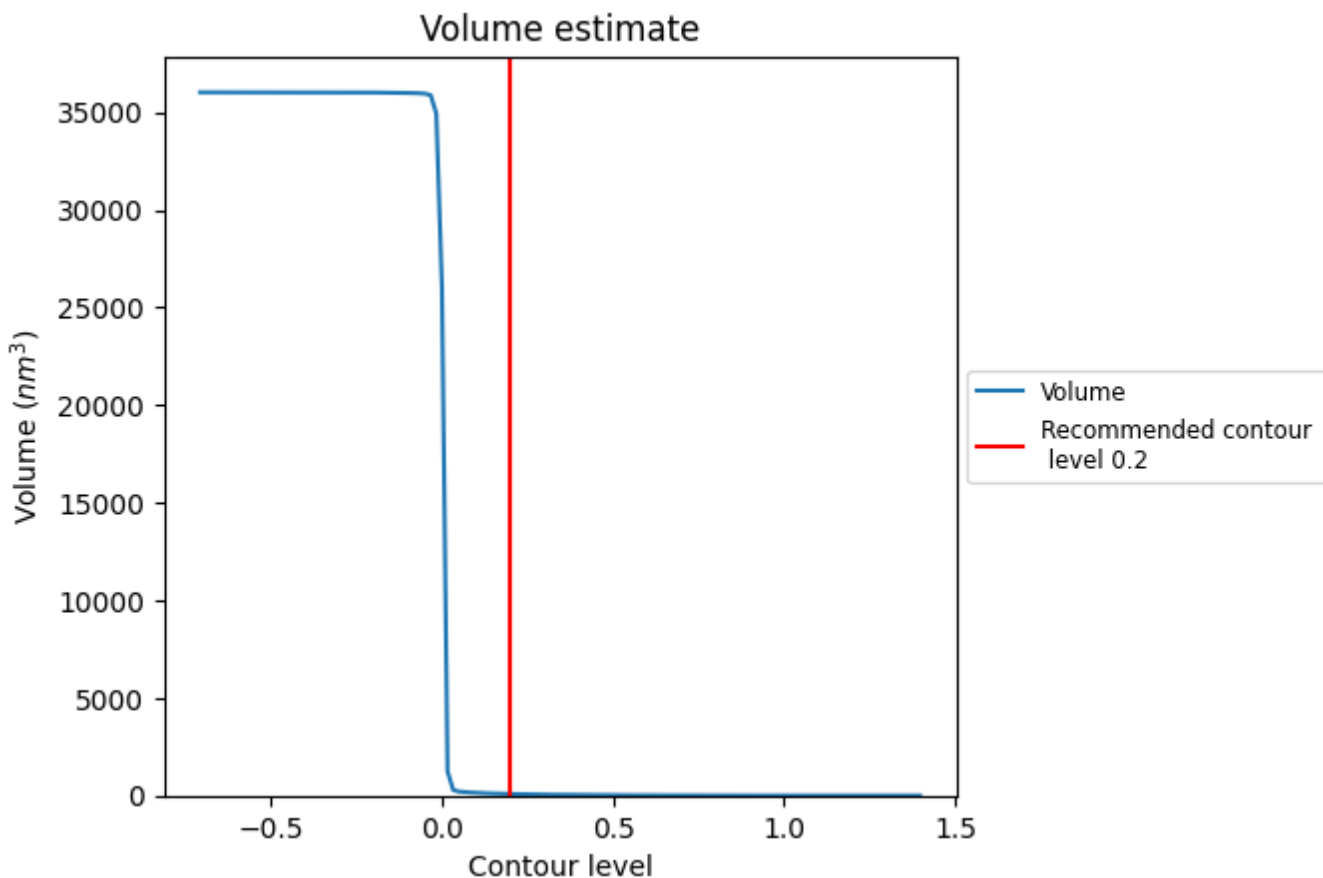
This section contains the results of statistical analysis of the map.

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.

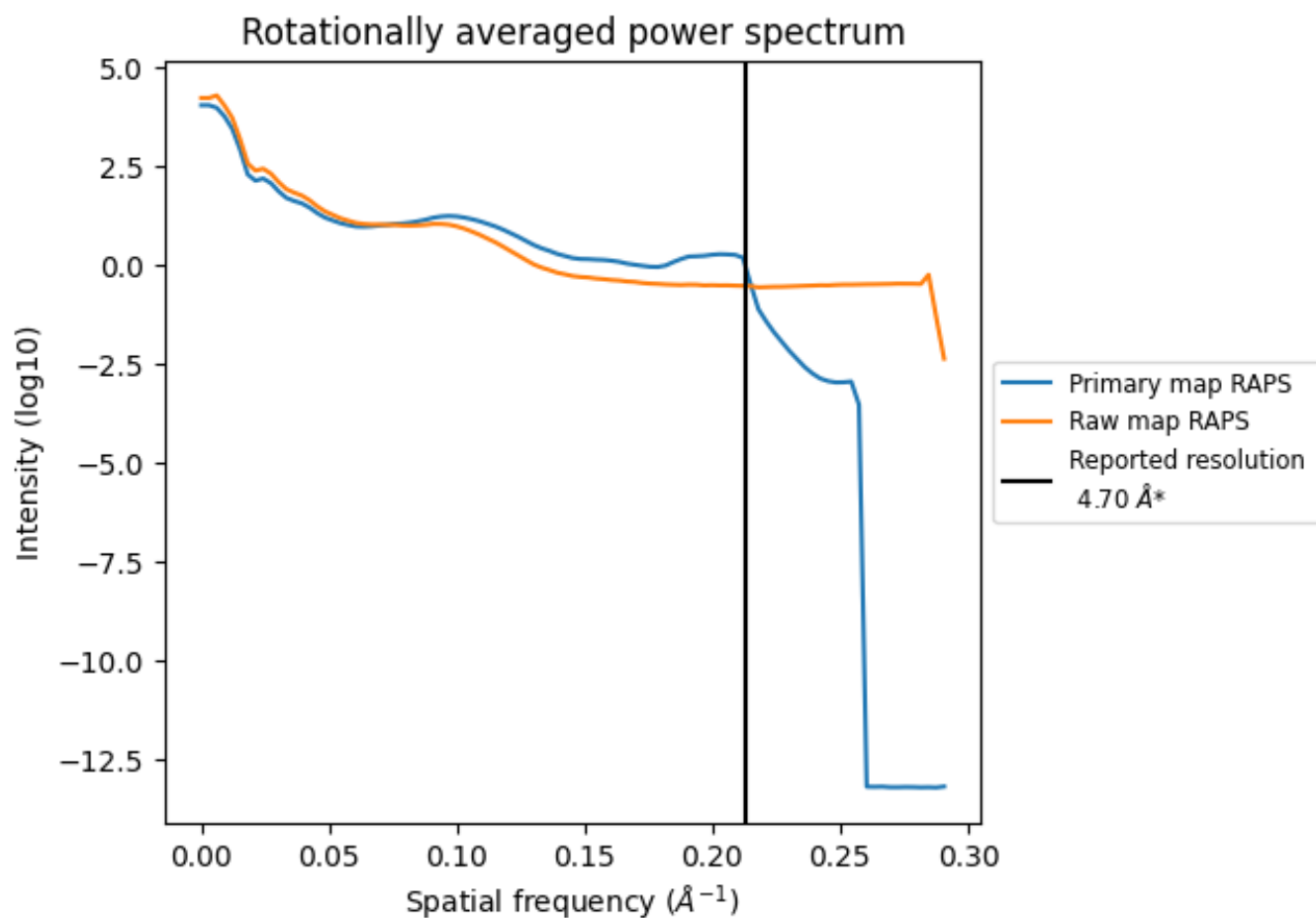
7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 80 nm³; this corresponds to an approximate mass of 72 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

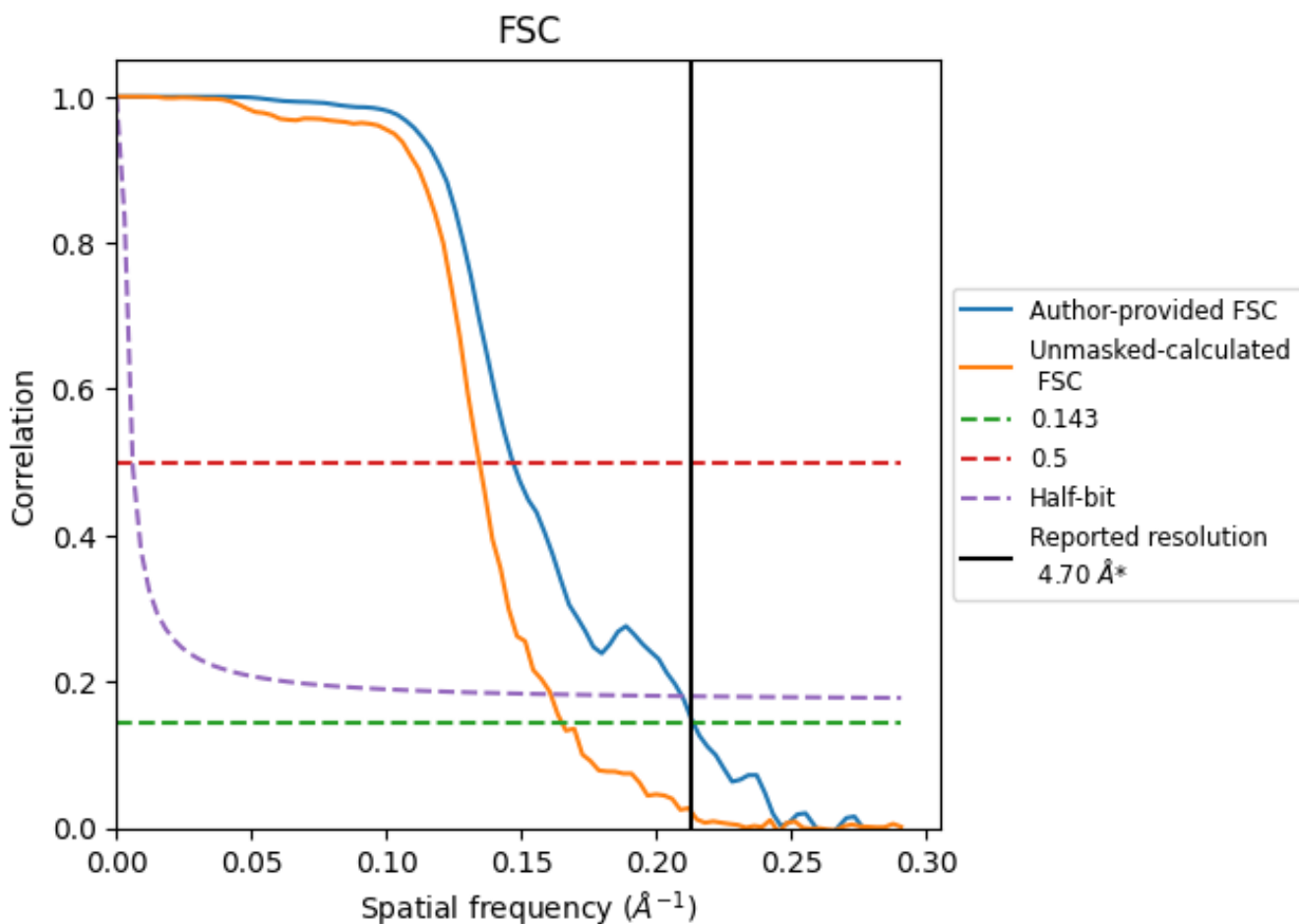


*Reported resolution corresponds to spatial frequency of 0.213 Å⁻¹

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 0.213 Å⁻¹

8.2 Resolution estimates [i](#)

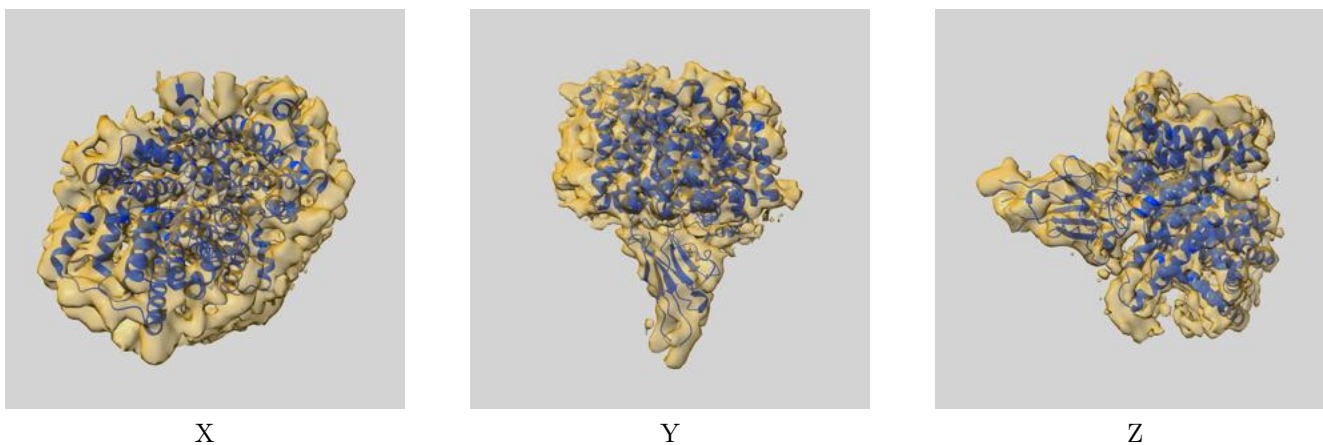
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	4.70	-	-
Author-provided FSC curve	4.68	6.81	4.77
Unmasked-calculated*	6.05	7.43	6.22

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 6.05 differs from the reported value 4.7 by more than 10 %

9 Map-model fit [i](#)

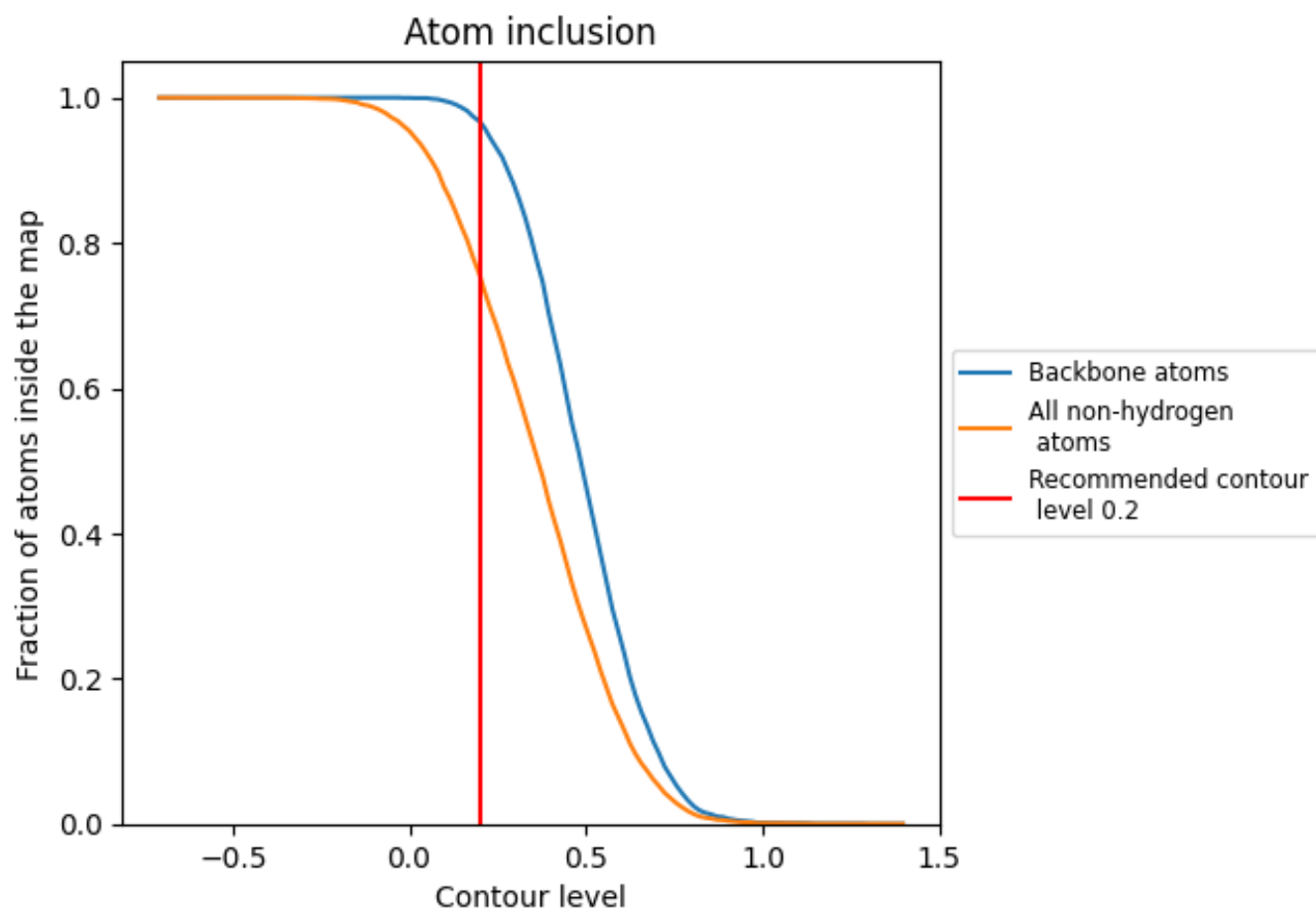
This section contains information regarding the fit between EMDB map EMD-13930 and PDB model 7QE5. Per-residue inclusion information can be found in section [3](#) on page [4](#).

9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.2 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 Atom inclusion [i](#)



At the recommended contour level, 97% of all backbone atoms, 75% of all non-hydrogen atoms, are inside the map.