



Full wwPDB EM Validation Report ⓘ

Mar 8, 2026 – 05:38 AM UTC

PDB ID : 6CT0 / pdb_00006ct0
EMDB ID : EMD-7610
Title : Atomic Structure of the E2 Inner Core of Human Pyruvate Dehydrogenase Complex
Authors : Jiang, J.; Baiesc, F.L.; Hiromasa, Y.; Yu, X.; Hui, W.H.; Dai, X.; Roche, T.E.; Zhou, Z.H.
Deposited on : 2018-03-21
Resolution : 3.10 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.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

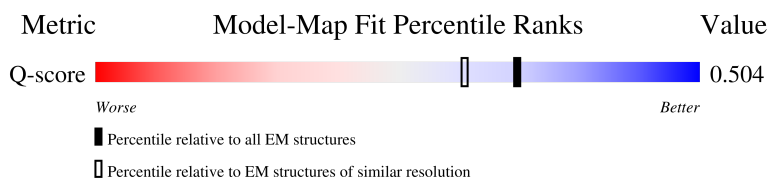
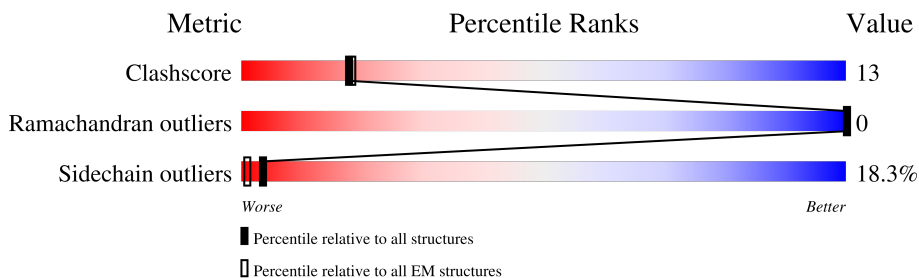
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.10 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	14724 (2.60 - 3.60)

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	0	647	

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1760 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 Dihydrolipoyllysine-residue acetyltransferase component of pyruvate dehydrogenase complex, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	0	229	1760	1122	302	326	10	0	0

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	49374	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 ($e^-/\text{\AA}^2$)	38	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	12.255	Depositor
Minimum map value	-6.469	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	1.000	Depositor
Recommended contour level	2.5	Depositor
Map size (Å)	261.12, 261.12, 261.12	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.02, 1.02, 1.02	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	0	0.61	1/1789 (0.1%)	1.05	9/2423 (0.4%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	0	562	THR	CA-CB	5.21	1.61	1.53

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	0	621	ARG	N-CA-C	-7.85	103.92	113.97
1	0	628	GLY	N-CA-C	-7.32	103.94	112.73
1	0	470	GLY	N-CA-C	-7.07	105.32	115.64
1	0	582	PRO	CA-C-N	-6.89	111.40	119.05
1	0	582	PRO	C-N-CA	-6.89	111.40	119.05
1	0	582	PRO	N-CA-C	5.87	117.86	110.70
1	0	618	CYS	CA-C-N	5.84	128.10	120.28
1	0	618	CYS	C-N-CA	5.84	128.10	120.28
1	0	509	VAL	N-CA-C	5.20	115.25	107.51

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	0	1760	0	1815	48	0
All	All	1760	0	1815	48	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 13.

All (48) 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)
1:0:567:ASN:HB2	1:0:590:ILE:HB	1.65	0.79
1:0:589:ALA:HB3	1:0:615:THR:HG22	1.70	0.70
1:0:570:MET:N	1:0:570:MET:SD	2.66	0.68
1:0:581:ASN:OD1	1:0:581:ASN:N	2.27	0.66
1:0:522:ILE:HG21	1:0:548:ALA:HB1	1.78	0.65
1:0:482:LYS:HG3	1:0:534:VAL:HG23	1.82	0.62
1:0:555:PRO:O	1:0:559:GLN:NE2	2.34	0.60
1:0:548:ALA:HB2	1:0:553:LEU:HD21	1.86	0.58
1:0:562:THR:HG22	1:0:562:THR:O	2.04	0.58
1:0:419:VAL:HG23	1:0:420:PHE:HD1	1.73	0.54
1:0:477:ASN:O	1:0:481:ILE:HG12	2.07	0.54
1:0:493:GLU:H	1:0:493:GLU:CD	2.15	0.53
1:0:567:ASN:CB	1:0:590:ILE:HB	2.40	0.51
1:0:562:THR:O	1:0:562:THR:CG2	2.60	0.50
1:0:580:ILE:HG22	1:0:587:ILE:HG13	1.94	0.49
1:0:423:ILE:HG13	1:0:424:PRO:HD2	1.95	0.49
1:0:512:SER:OG	1:0:523:THR:HG22	2.13	0.48
1:0:482:LYS:O	1:0:486:LEU:HG	2.14	0.48
1:0:585:ALA:HB1	1:0:619:ASP:HB2	1.96	0.47
1:0:524:PRO:HB3	1:0:544:LEU:HD12	1.97	0.47
1:0:443:ILE:HD13	1:0:580:ILE:HD11	1.96	0.46
1:0:574:LYS:HE3	1:0:574:LYS:HB2	1.82	0.46
1:0:548:ALA:HA	1:0:553:LEU:HD11	1.96	0.46
1:0:623:VAL:HG13	1:0:627:VAL:HG23	1.97	0.46
1:0:553:LEU:HD13	1:0:558:PHE:CZ	2.51	0.45
1:0:462:LYS:HE2	1:0:462:LYS:HB3	1.74	0.45
1:0:446:TYR:CE2	1:0:448:LEU:HD21	2.51	0.45
1:0:530:HIS:CD2	1:0:531:ILE:HG13	2.52	0.45
1:0:486:LEU:HB2	1:0:638:TYR:CE2	2.53	0.44
1:0:528:ASN:HD22	1:0:530:HIS:HE1	1.65	0.44
1:0:479:PHE:HD2	1:0:645:MET:HE1	1.82	0.43
1:0:553:LEU:HD13	1:0:558:PHE:HZ	1.83	0.43
1:0:576:PHE:CE1	1:0:589:ALA:HB1	2.52	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:0:439:SER:HB2	1:0:582:PRO:HD3	2.00	0.43
1:0:588:LEU:HD23	1:0:588:LEU:HA	1.84	0.43
1:0:526:VAL:HG12	1:0:529:ALA:HB2	2.01	0.43
1:0:458:LEU:HD23	1:0:458:LEU:HA	1.70	0.42
1:0:514:ALA:HA	1:0:523:THR:HG23	2.01	0.42
1:0:525:ILE:HD13	1:0:561:GLY:H	1.85	0.42
1:0:624:ASP:O	1:0:627:VAL:HG22	2.20	0.42
1:0:435:ARG:HD2	1:0:581:ASN:HB3	2.02	0.42
1:0:525:ILE:HD11	1:0:560:GLY:H	1.85	0.42
1:0:530:HIS:NE2	1:0:531:ILE:HG13	2.36	0.41
1:0:538:ALA:O	1:0:541:VAL:HG12	2.21	0.41
1:0:619:ASP:HB3	1:0:622:VAL:HG12	2.03	0.41
1:0:476:VAL:O	1:0:480:ILE:HG12	2.21	0.40
1:0:466:LYS:HD2	1:0:466:LYS:HA	1.76	0.40
1:0:446:TYR:OH	1:0:625:GLY:HA2	2.22	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	0	225/647 (35%)	219 (97%)	6 (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	0	197/532 (37%)	161 (82%)	36 (18%)	2 8

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	0	448	LEU
1	0	467	ILE
1	0	468	LEU
1	0	471	ARG
1	0	476	VAL
1	0	482	LYS
1	0	490	LYS
1	0	493	GLU
1	0	503	ILE
1	0	506	ASN
1	0	508	VAL
1	0	521	LEU
1	0	523	THR
1	0	534	VAL
1	0	536	THR
1	0	541	VAL
1	0	542	VAL
1	0	544	LEU
1	0	552	LYS
1	0	570	MET
1	0	573	ILE
1	0	574	LYS
1	0	579	ILE
1	0	580	ILE
1	0	581	ASN
1	0	587	ILE
1	0	588	LEU
1	0	598	VAL
1	0	610	SER
1	0	611	MET
1	0	615	THR
1	0	616	LEU
1	0	621	ARG
1	0	624	ASP
1	0	640	GLU
1	0	646	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	0	506	ASN
1	0	528	ASN
1	0	530	HIS
1	0	556	HIS

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](#)

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.

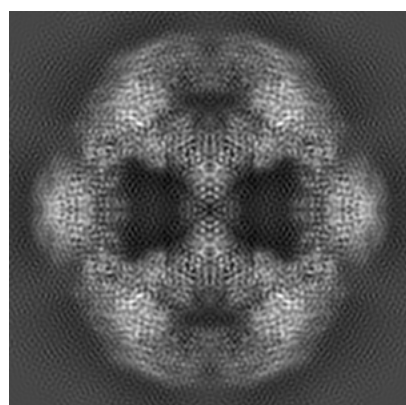
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-7610. These allow visual inspection of the internal detail of the map and identification of artifacts.

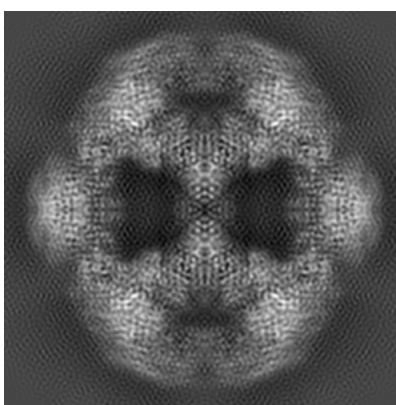
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

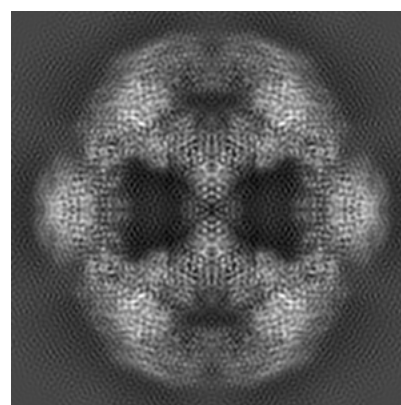
6.1.1 Primary map



X



Y

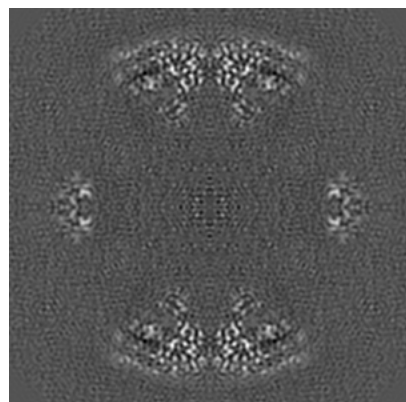


Z

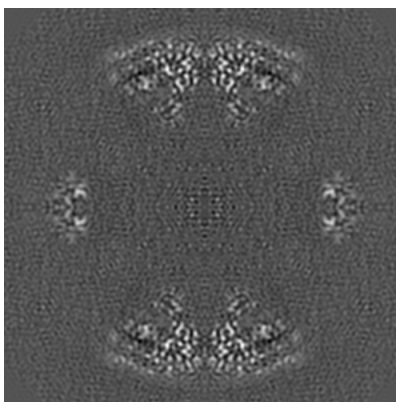
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

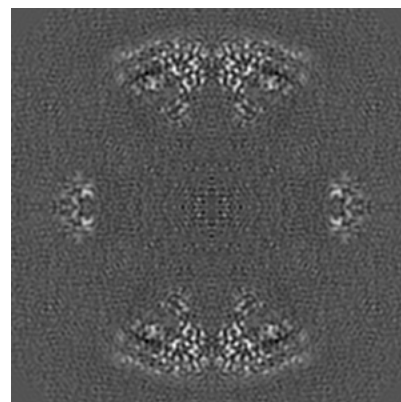
6.2.1 Primary map



X Index: 128



Y Index: 128

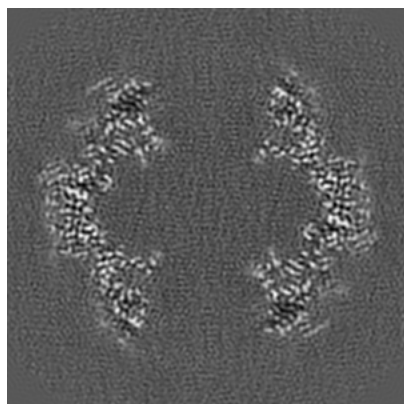


Z Index: 128

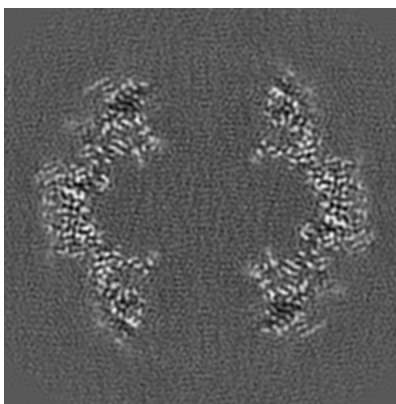
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

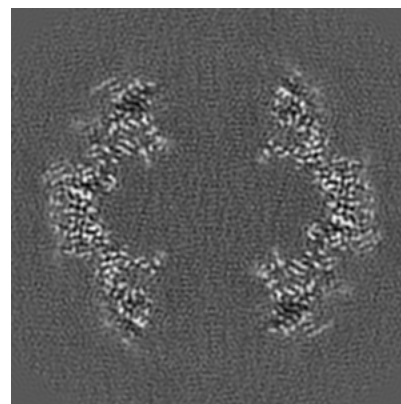
6.3.1 Primary map



X Index: 170



Y Index: 170

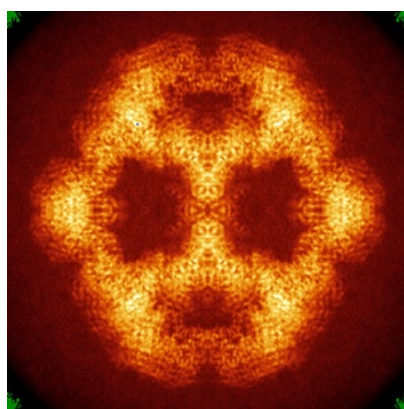


Z Index: 170

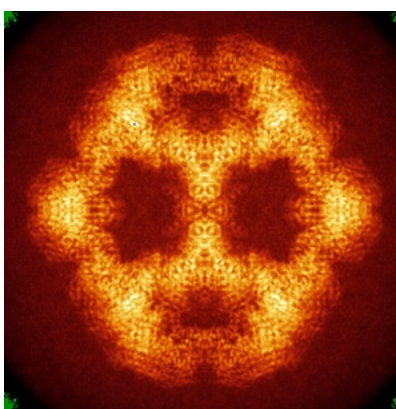
The images above show the largest variance slices of the map in three orthogonal directions.

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

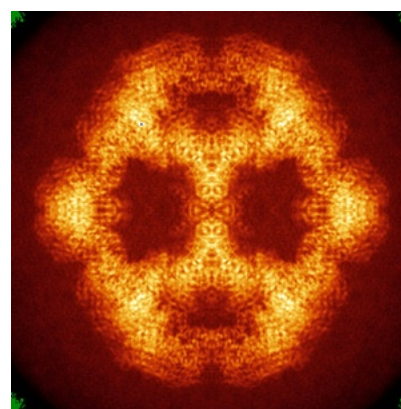
6.4.1 Primary map



X



Y

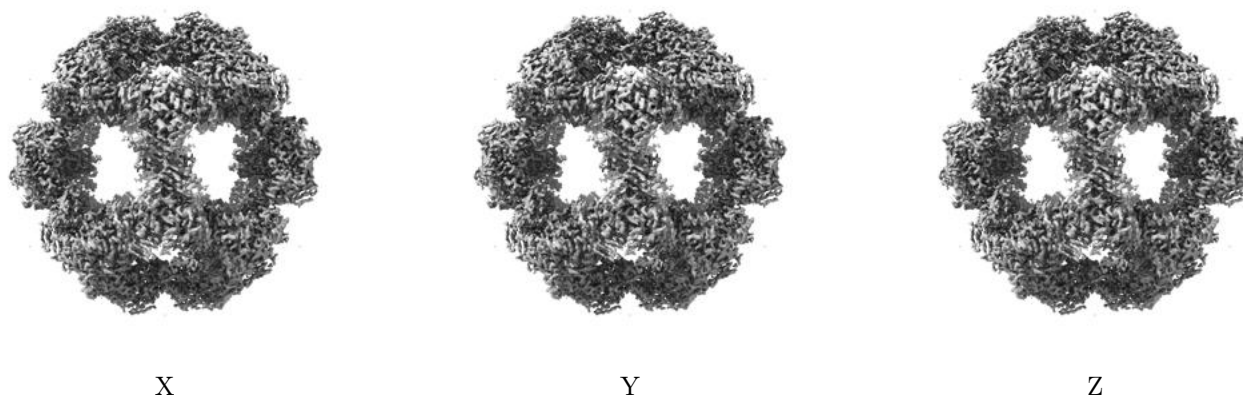


Z

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

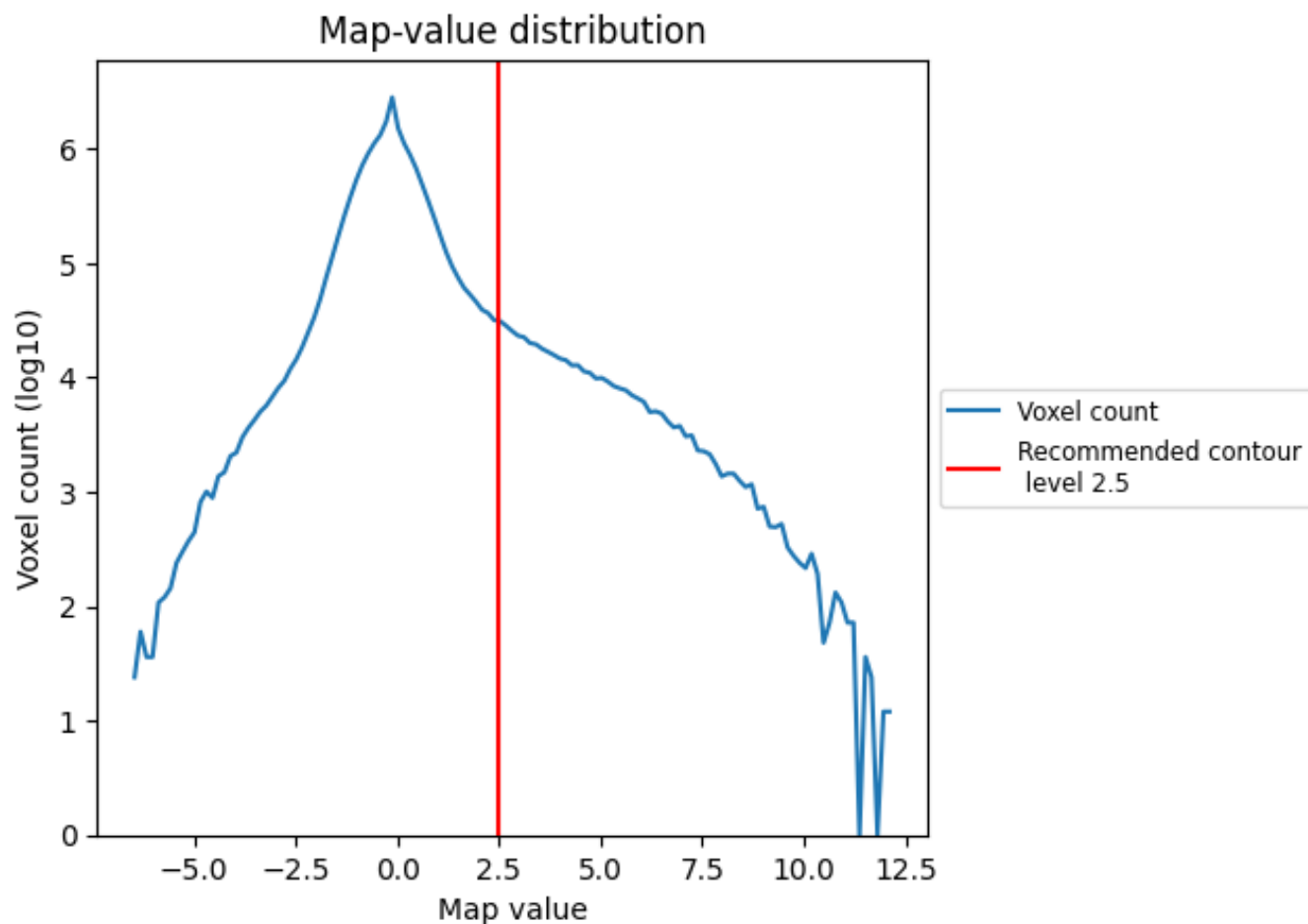
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

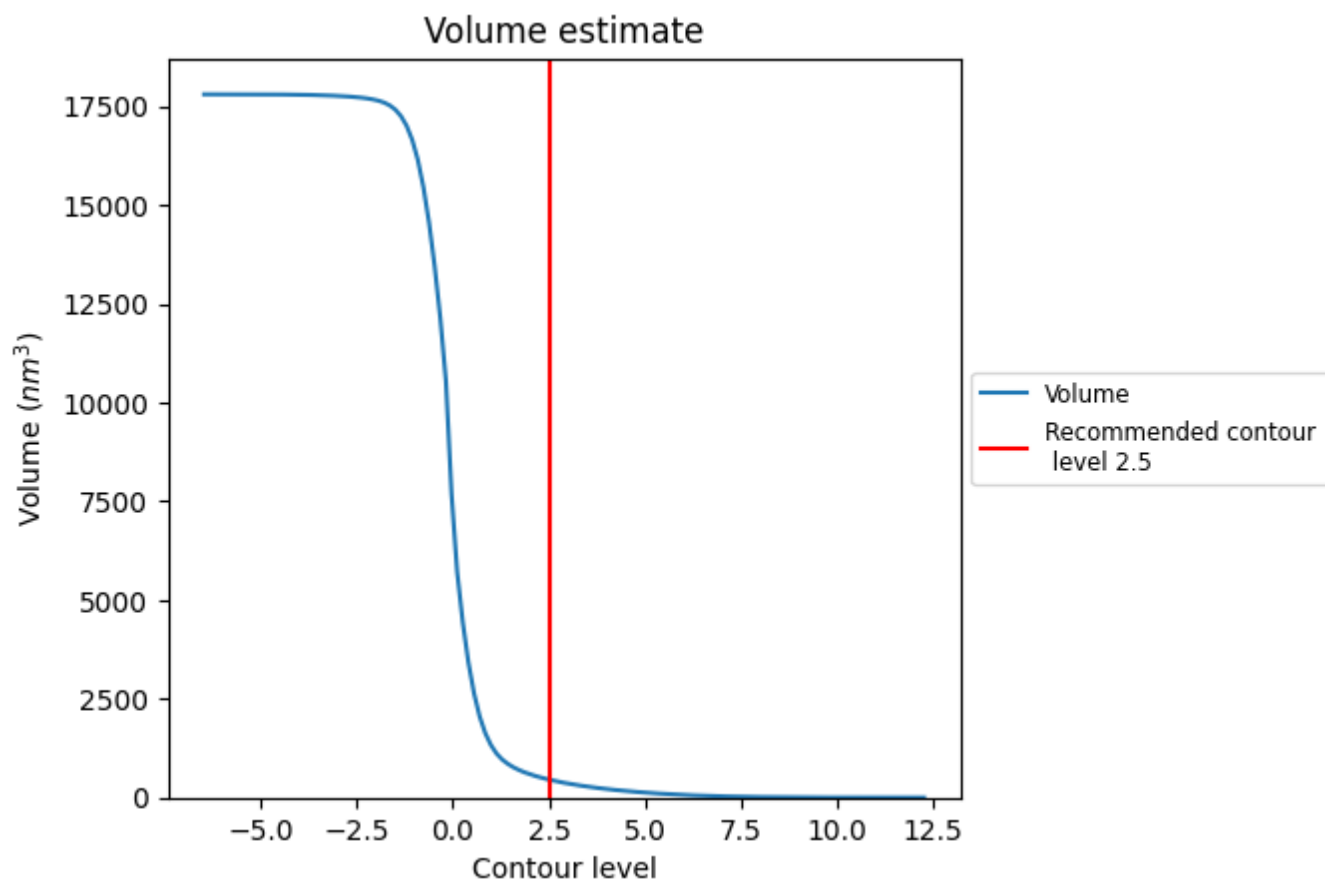
This section contains the results of statistical analysis of the map.

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.

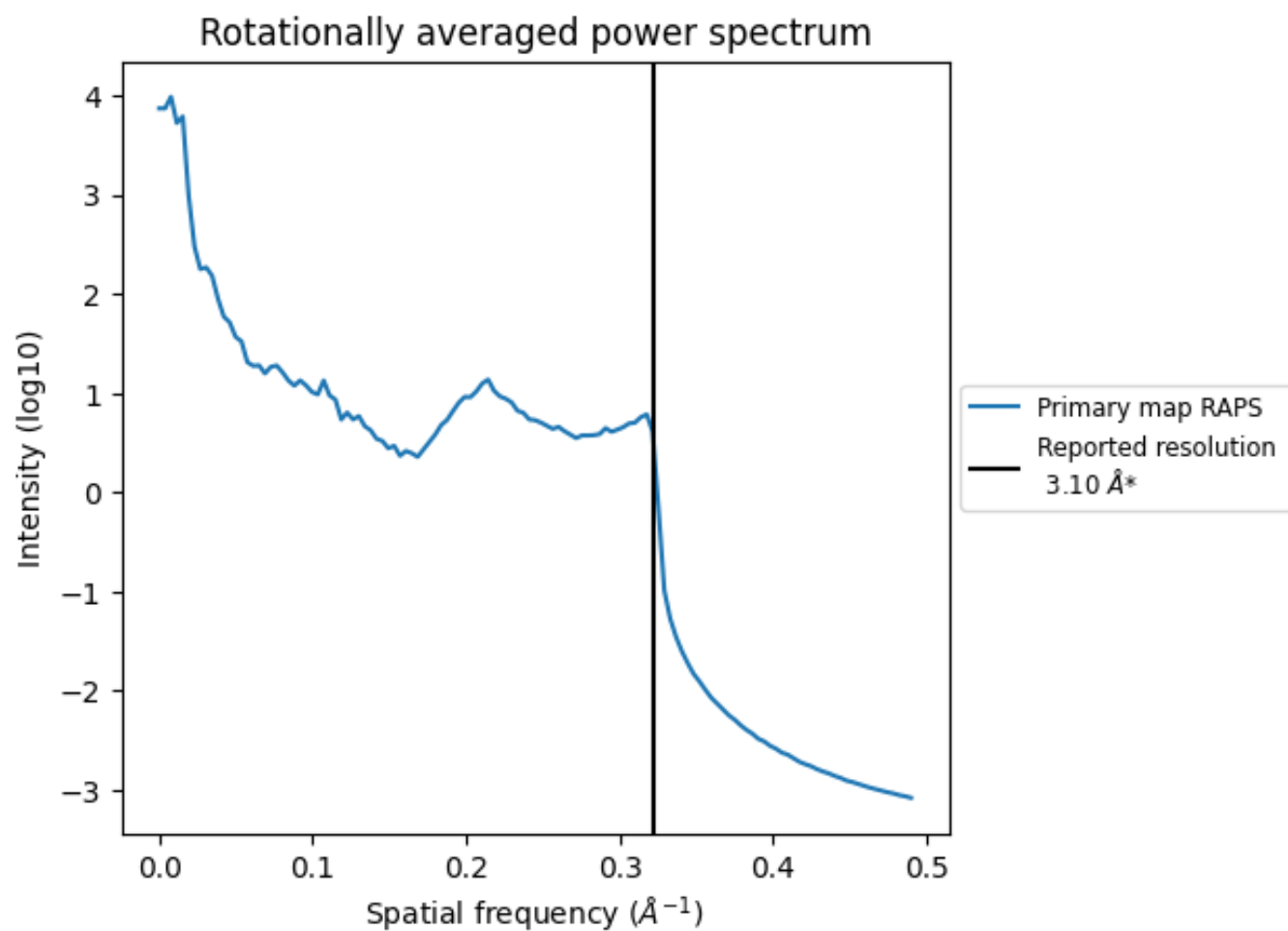
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 455 nm^3 ; this corresponds to an approximate mass of 411 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 0.323 Å⁻¹

8 Fourier-Shell correlation ⓘ

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

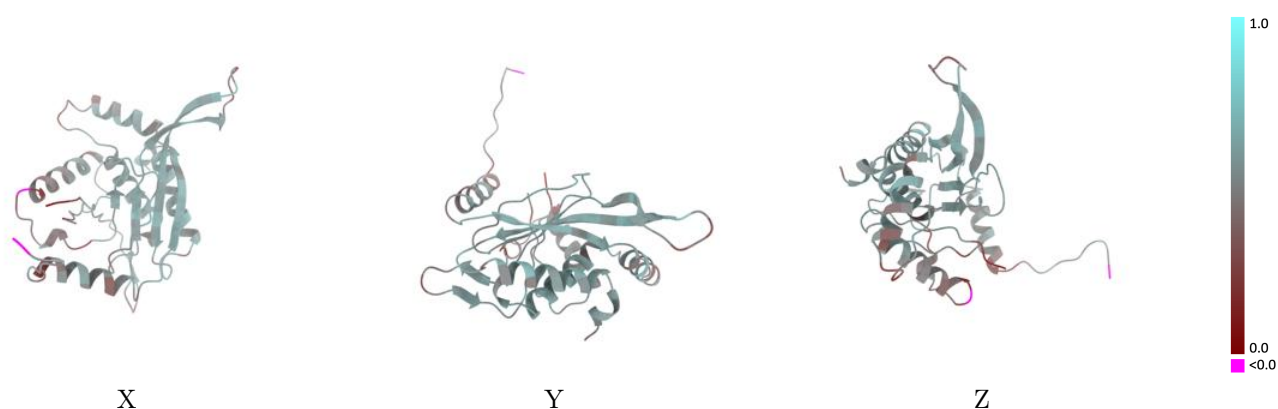
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-7610 and PDB model 6CT0. Per-residue inclusion information can be found in section 3 on page 4.

9.1 Map-model overlay [i](#)

This section was not generated.

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

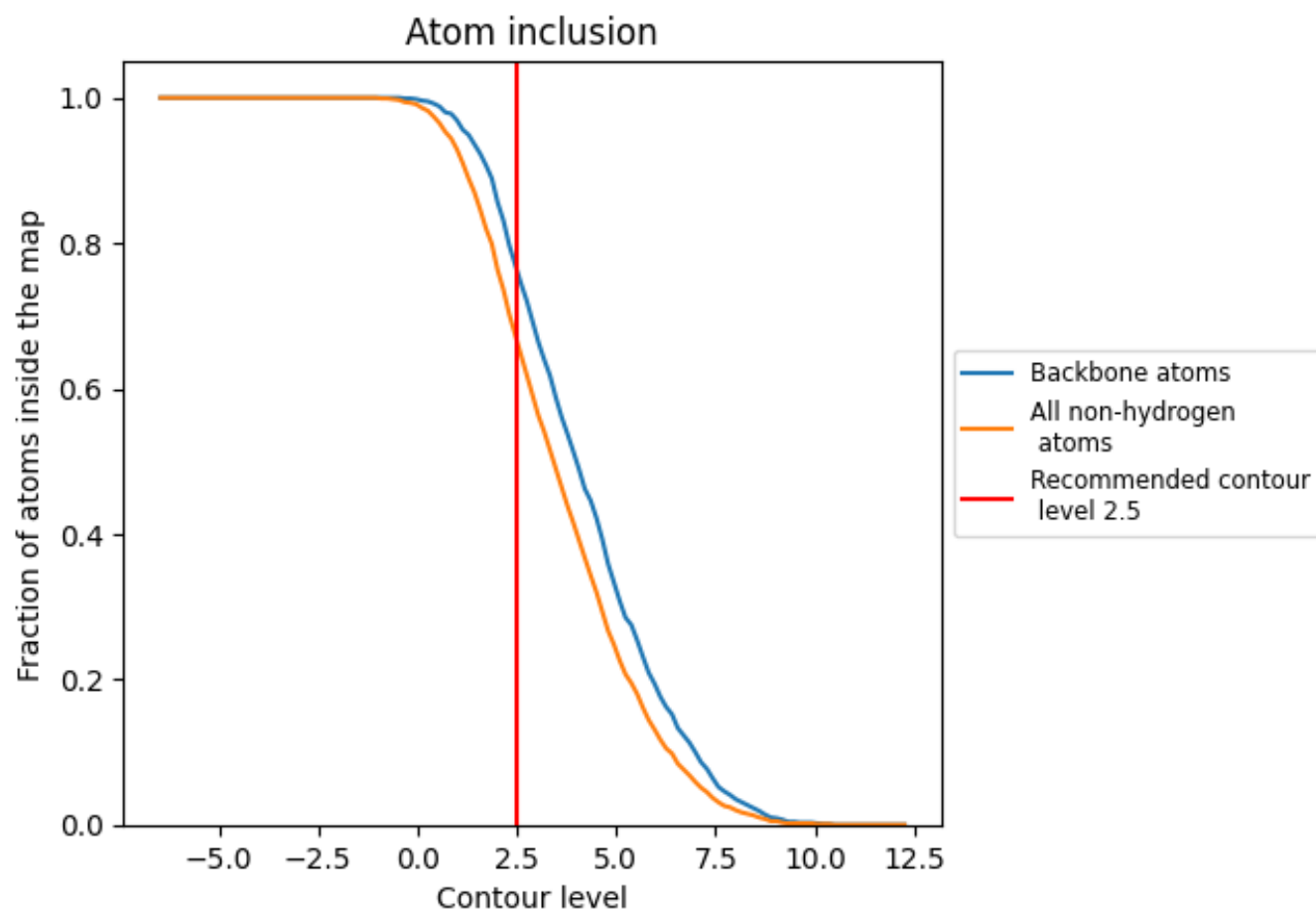


The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

This section was not generated.

9.4 Atom inclusion [i](#)



At the recommended contour level, 76% of all backbone atoms, 67% 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 (2.5) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.6660	0.5040
0	0.6650	0.5040

