



Full wwPDB EM Validation Report ⓘ

Mar 5, 2026 – 05:20 PM UTC

PDB ID : 7LCC / pdb_00007lcc
EMDB ID : EMD-23271
Title : Helitron transposase bound to LTS
Authors : Kosek, D.; Dyda, F.
Deposited on : 2021-01-10
Resolution : 3.66 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:

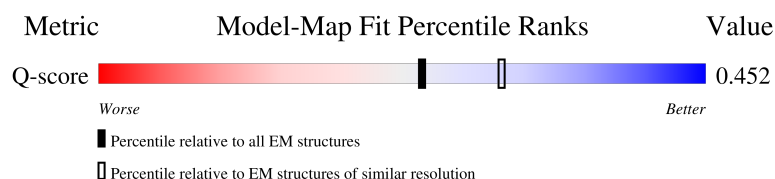
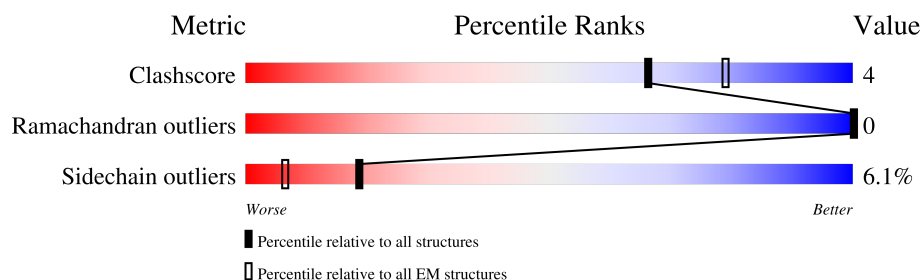
EMDB validation analysis : 0.0.1.dev132
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & 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 3.66 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	11491 (3.16 - 4.16)

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	1496	 5% 80% 10% 5% 0%
2	B	20	 5% 75% 10% 10% 0%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 11281 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 Helraiser K1068Q.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1369	Total	C	N	O	S	0	0
			10931	6932	1911	2014	74		

- Molecule 2 is a DNA chain called LTS.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	17	Total	C	N	O	P	0	0
			349	168	66	98	17		

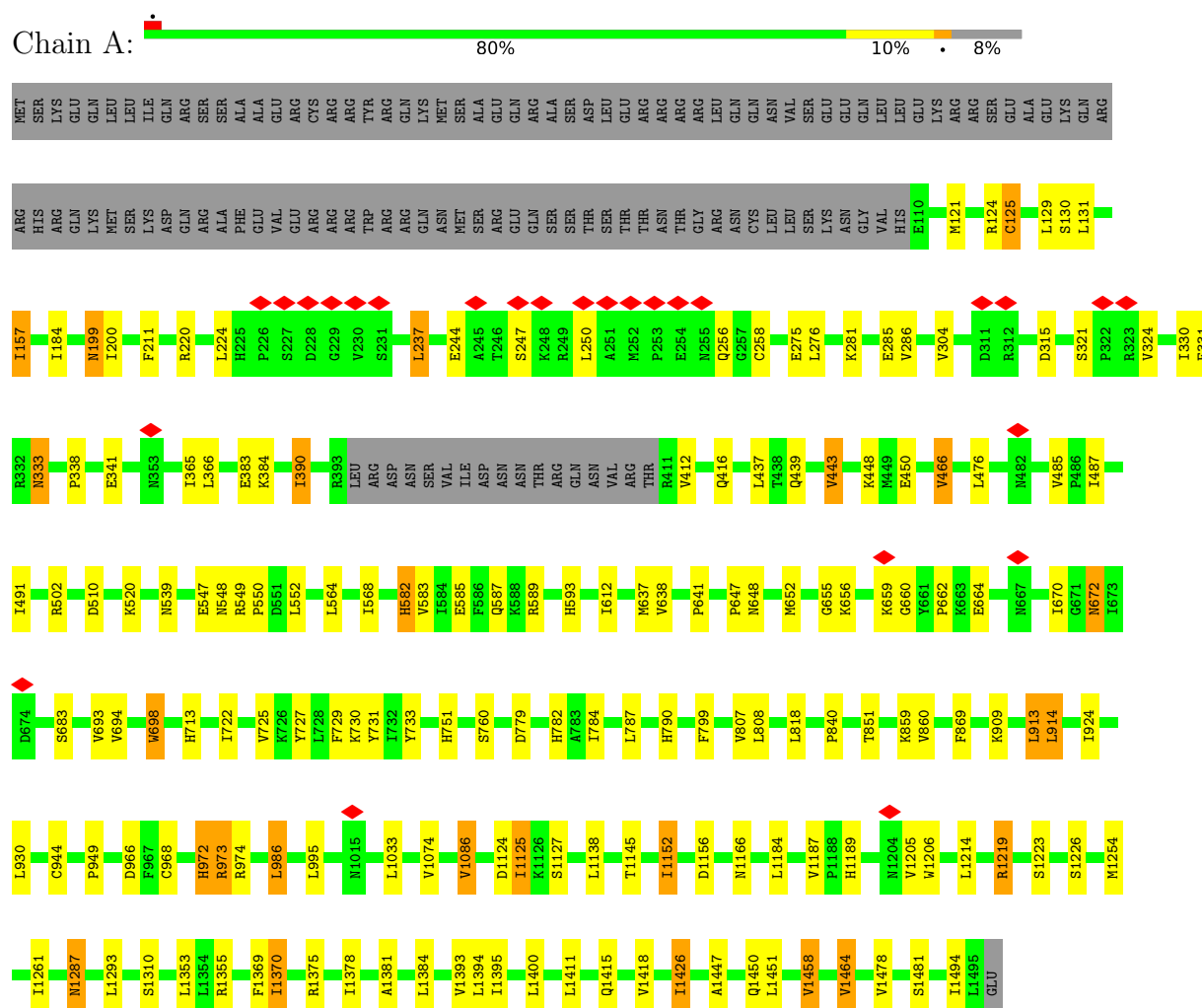
- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		AltConf
3	A	1	Total	Zn	0
			1	1	

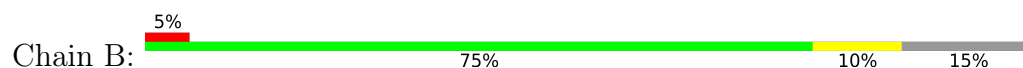
3 Residue-property plots

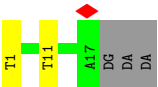
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion 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: Helraiser K1068Q



• Molecule 2: LTS





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	937125	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 ($e^-/\text{\AA}^2$)	73.5	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	43.092	Depositor
Minimum map value	-25.867	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	1.000	Depositor
Recommended contour level	3.5	Depositor
Map size (Å)	237.6, 237.6, 237.6	wwPDB
Map dimensions	220, 220, 220	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.08, 1.08, 1.08	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN

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	0.94	0/11173	1.19	0/15106
2	B	0.32	0/392	0.67	0/602
All	All	0.93	0/11565	1.17	0/15708

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	10931	0	10888	88	0
2	B	349	0	193	4	0
3	A	1	0	0	0	0
All	All	11281	0	11081	88	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 4.

All (88) 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:727:TYR:OH	2:B:1:DT:P	2.03	1.17
1:A:1370:ILE:HG13	1:A:1384:LEU:HD11	1.61	0.83
1:A:1219:ARG:HG3	1:A:1223:SER:HA	1.73	0.71
1:A:281:LYS:CE	1:A:286:VAL:HG22	2.22	0.69
1:A:281:LYS:HD2	1:A:286:VAL:HG22	1.76	0.67
1:A:237:LEU:HD12	1:A:331:PHE:HB3	1.80	0.63
1:A:281:LYS:CD	1:A:286:VAL:HG22	2.29	0.62
1:A:281:LYS:HE2	1:A:286:VAL:HG22	1.81	0.61
1:A:655:GLY:HA2	1:A:659:LYS:HB2	1.83	0.60
1:A:281:LYS:HD2	1:A:286:VAL:CG2	2.30	0.60
1:A:1219:ARG:HH11	1:A:1226:SER:HB3	1.68	0.59
1:A:660:GLY:HA3	1:A:698:TRP:HE1	1.68	0.58
1:A:641:PRO:HB2	1:A:647:PRO:HB2	1.85	0.58
1:A:439:GLN:O	1:A:443:VAL:HG23	2.02	0.58
1:A:859:LYS:H	1:A:859:LYS:HD2	1.69	0.57
1:A:1254:MET:HE3	1:A:1464:VAL:HB	1.88	0.55
1:A:909:LYS:HA	1:A:914:LEU:HD22	1.89	0.55
1:A:539:ASN:HB2	1:A:552:LEU:HD21	1.88	0.54
1:A:799:PHE:HB2	1:A:807:VAL:CG2	2.38	0.54
1:A:276:LEU:HD11	1:A:383:GLU:HG3	1.90	0.53
1:A:1310:SER:HB3	1:A:1415:GLN:HG2	1.90	0.53
1:A:722:ILE:O	1:A:725:VAL:HG12	2.09	0.53
1:A:1369:PHE:HB3	1:A:1381:ALA:HB1	1.92	0.52
1:A:338:PRO:HG3	1:A:450:GLU:HB3	1.92	0.52
1:A:466:VAL:HG12	1:A:491:ILE:HG23	1.92	0.51
1:A:1261:ILE:HD11	1:A:1293:LEU:HD22	1.93	0.51
1:A:787:LEU:HD21	1:A:840:PRO:HG3	1.90	0.51
1:A:664:GLU:HG2	1:A:683:SER:HB3	1.92	0.51
1:A:790:HIS:HE1	1:A:818:LEU:HB3	1.75	0.51
1:A:1478:VAL:HB	1:A:1481:SER:HB3	1.93	0.51
1:A:1447:ALA:HB3	1:A:1450:GLN:HG3	1.91	0.51
1:A:790:HIS:CE1	1:A:818:LEU:HB3	2.46	0.51
1:A:944:CYS:HA	1:A:949:PRO:HG3	1.92	0.50
1:A:782:HIS:CE1	1:A:859:LYS:HD3	2.47	0.50
1:A:244:GLU:HG3	1:A:247:SER:HB3	1.94	0.49
1:A:727:TYR:HH	2:B:1:DT:P	2.28	0.49
1:A:157:ILE:HB	1:A:390:ILE:HD11	1.94	0.49
1:A:250:LEU:HA	1:A:256:GLN:HG3	1.93	0.49
1:A:321:SER:HB3	1:A:324:VAL:HG22	1.94	0.48
1:A:582:HIS:CD2	1:A:779:ASP:HB3	2.49	0.48
1:A:1458:VAL:HG21	1:A:1464:VAL:HG22	1.96	0.47
1:A:315:ASP:HB2	1:A:589:ARG:HD2	1.95	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:502:ARG:NE	2:B:11:DT:H3	2.12	0.47
1:A:660:GLY:HA3	1:A:698:TRP:NE1	2.27	0.47
1:A:548:ASN:O	1:A:550:PRO:HD3	2.14	0.47
1:A:476:LEU:HD13	1:A:808:LEU:HD13	1.96	0.47
1:A:869:PHE:HE2	1:A:949:PRO:HD2	1.80	0.47
1:A:587:GLN:HB2	1:A:593:HIS:NE2	2.30	0.46
1:A:1152:ILE:HD13	1:A:1152:ILE:HA	1.76	0.46
1:A:121:MET:HB3	1:A:131:LEU:HB3	1.98	0.46
1:A:510:ASP:HA	1:A:784:ILE:HD12	1.98	0.46
1:A:1355:ARG:HD2	1:A:1355:ARG:HA	1.68	0.46
1:A:799:PHE:HB2	1:A:807:VAL:HG21	1.98	0.45
1:A:1125:ILE:H	1:A:1125:ILE:HG13	1.45	0.45
1:A:913:LEU:H	1:A:913:LEU:HG	1.56	0.45
1:A:275:GLU:HG2	1:A:384:LYS:HE3	1.98	0.45
1:A:730:LYS:HD2	1:A:1189:HIS:HB2	1.98	0.45
1:A:1124:ASP:HB3	1:A:1127:SER:HB3	1.99	0.45
1:A:211:PHE:CE2	1:A:220:ARG:HG2	2.52	0.44
1:A:199:ASN:HD22	1:A:199:ASN:HA	1.63	0.44
1:A:275:GLU:H	1:A:275:GLU:HG3	1.60	0.43
1:A:799:PHE:CB	1:A:807:VAL:HG21	2.48	0.43
1:A:986:LEU:HD22	1:A:986:LEU:HA	1.78	0.43
1:A:437:LEU:HD12	1:A:437:LEU:HA	1.92	0.43
1:A:1451:LEU:HD12	1:A:1451:LEU:HA	1.78	0.43
1:A:1033:LEU:HD11	1:A:1074:VAL:HG11	2.00	0.43
1:A:1426:ILE:H	1:A:1426:ILE:HG12	1.66	0.42
1:A:782:HIS:HE1	1:A:859:LYS:HD3	1.84	0.42
1:A:564:LEU:O	1:A:568:ILE:HG12	2.20	0.42
1:A:968:CYS:HA	1:A:972:HIS:CE1	2.53	0.42
1:A:637:MET:HB2	1:A:637:MET:HE3	1.86	0.42
1:A:1086:VAL:HG13	1:A:1138:LEU:HB3	2.01	0.42
1:A:502:ARG:HE	2:B:11:DT:H3	1.66	0.42
1:A:125:CYS:SG	1:A:130:SER:HB3	2.60	0.41
1:A:333:ASN:HD22	1:A:333:ASN:HA	1.50	0.41
1:A:390:ILE:HD12	1:A:390:ILE:HA	1.93	0.41
1:A:1184:LEU:HD11	1:A:1494:ILE:HG13	2.02	0.41
1:A:973:ARG:HD2	1:A:973:ARG:HA	1.62	0.41
1:A:412:VAL:HG13	1:A:416:GLN:HB2	2.03	0.41
1:A:660:GLY:C	1:A:662:PRO:HD2	2.46	0.41
1:A:930:LEU:HD11	1:A:1375:ARG:NH2	2.35	0.41
1:A:281:LYS:CD	1:A:286:VAL:CG2	2.94	0.41
1:A:672:ASN:HD22	1:A:672:ASN:HA	1.59	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:549:ARG:HE	1:A:549:ARG:HB3	1.76	0.40
1:A:1287:ASN:HD22	1:A:1287:ASN:HA	1.67	0.40
1:A:585:GLU:O	1:A:585:GLU:HG3	2.20	0.40
1:A:1378:ILE:HD11	1:A:1394:LEU:HD13	2.04	0.40
1:A:365:ILE:HD11	1:A:448:LYS:HA	2.03	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	1365/1496 (91%)	1334 (98%)	31 (2%)	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	1213/1332 (91%)	1139 (94%)	74 (6%)	17	42

All (74) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	124	ARG

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Mol	Chain	Res	Type
1	A	125	CYS
1	A	129	LEU
1	A	157	ILE
1	A	184	ILE
1	A	199	ASN
1	A	200	ILE
1	A	224	LEU
1	A	237	LEU
1	A	258	CYS
1	A	285	GLU
1	A	304	VAL
1	A	330	ILE
1	A	333	ASN
1	A	341	GLU
1	A	366	LEU
1	A	390	ILE
1	A	443	VAL
1	A	466	VAL
1	A	485	VAL
1	A	487	ILE
1	A	520	LYS
1	A	547	GLU
1	A	582	HIS
1	A	583	VAL
1	A	612	ILE
1	A	638	VAL
1	A	648	ASN
1	A	652	MET
1	A	656	LYS
1	A	670	ILE
1	A	672	ASN
1	A	693	VAL
1	A	694	VAL
1	A	698	TRP
1	A	713	HIS
1	A	729	PHE
1	A	731	TYR
1	A	733	TYR
1	A	751	HIS
1	A	760	SER
1	A	851	THR
1	A	860	VAL

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Mol	Chain	Res	Type
1	A	913	LEU
1	A	914	LEU
1	A	924	ILE
1	A	966	ASP
1	A	972	HIS
1	A	973	ARG
1	A	974	ARG
1	A	986	LEU
1	A	995	LEU
1	A	1086	VAL
1	A	1125	ILE
1	A	1145	THR
1	A	1152	ILE
1	A	1156	ASP
1	A	1166	ASN
1	A	1187	VAL
1	A	1205	VAL
1	A	1206	TRP
1	A	1214	LEU
1	A	1219	ARG
1	A	1287	ASN
1	A	1353	LEU
1	A	1370	ILE
1	A	1393	VAL
1	A	1395	ILE
1	A	1400	LEU
1	A	1411	LEU
1	A	1418	VAL
1	A	1426	ILE
1	A	1458	VAL
1	A	1464	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (24) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	132	ASN
1	A	188	ASN
1	A	199	ASN
1	A	333	ASN
1	A	347	HIS
1	A	433	ASN
1	A	440	GLN

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Mol	Chain	Res	Type
1	A	509	GLN
1	A	582	HIS
1	A	672	ASN
1	A	713	HIS
1	A	740	ASN
1	A	782	HIS
1	A	790	HIS
1	A	815	ASN
1	A	905	HIS
1	A	972	HIS
1	A	987	ASN
1	A	1166	ASN
1	A	1242	HIS
1	A	1287	ASN
1	A	1289	HIS
1	A	1331	ASN
1	A	1470	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 1 ligands modelled in this entry, 1 is 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.

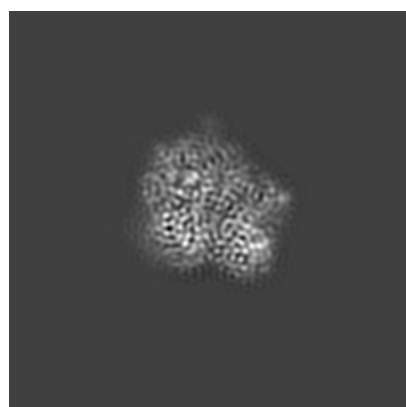
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-23271. These allow visual inspection of the internal detail of the map and identification of artifacts.

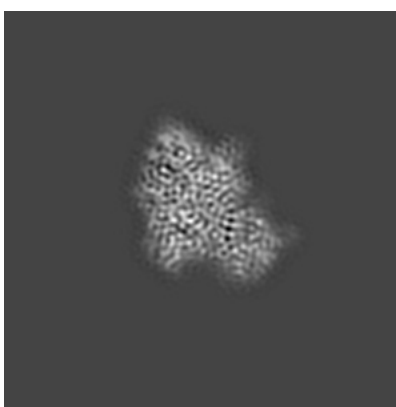
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

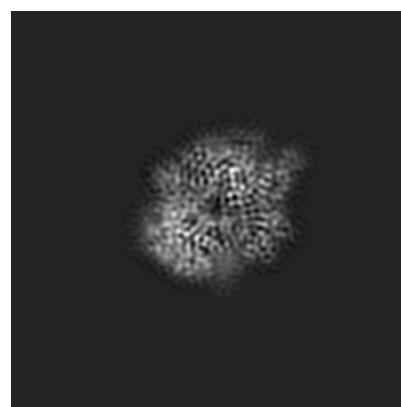
6.1.1 Primary map



X



Y

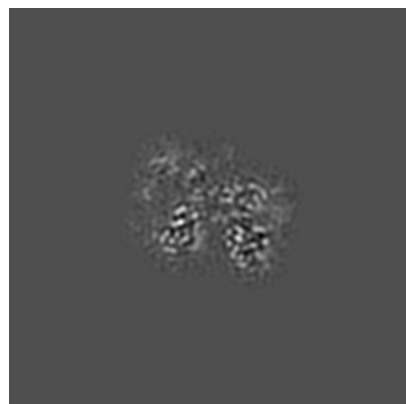


Z

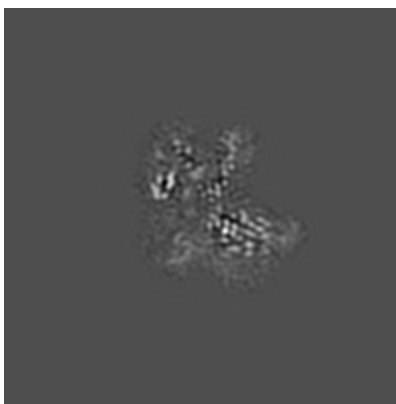
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

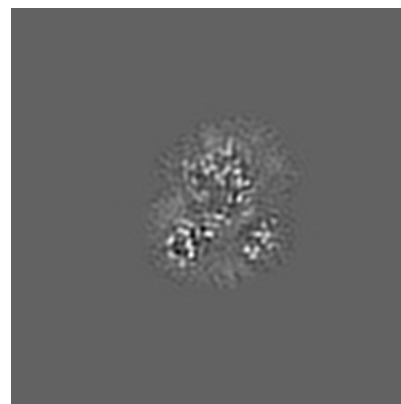
6.2.1 Primary map



X Index: 110



Y Index: 110



Z Index: 110

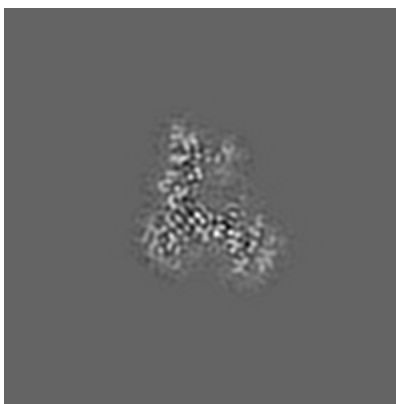
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

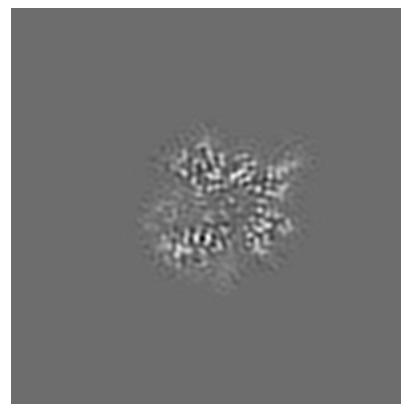
6.3.1 Primary map



X Index: 102



Y Index: 97

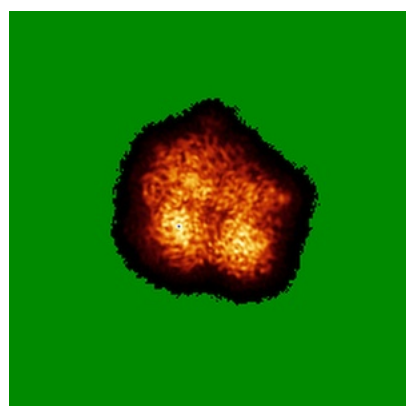


Z Index: 97

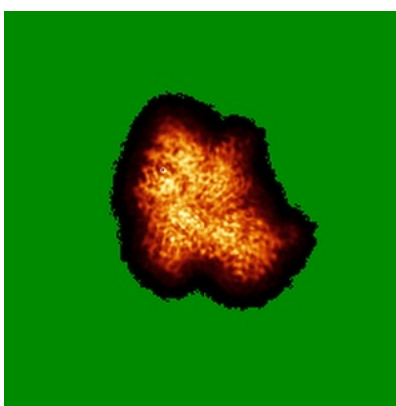
The images above show the largest variance slices of the map in three orthogonal directions.

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

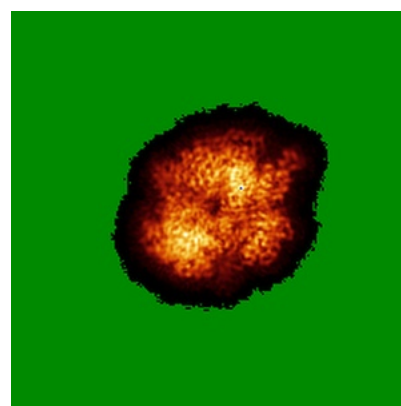
6.4.1 Primary map



X



Y

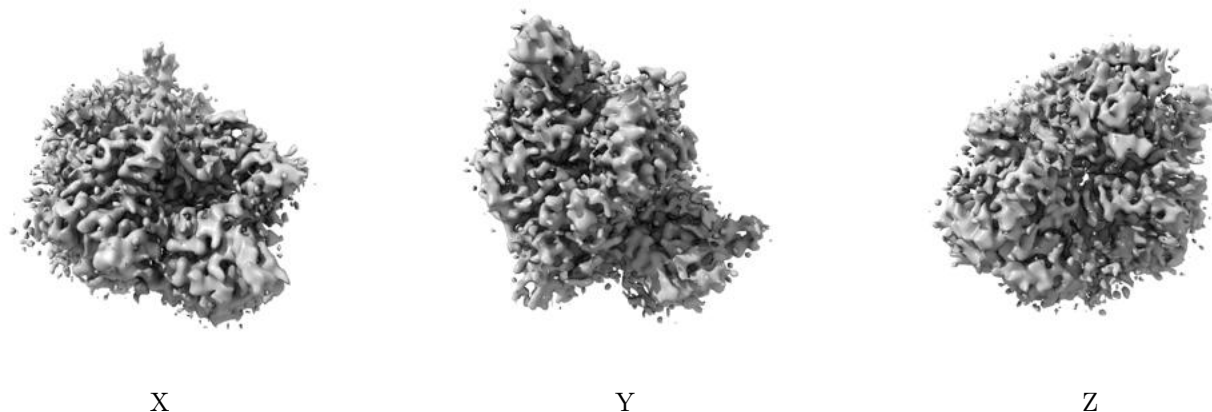


Z

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

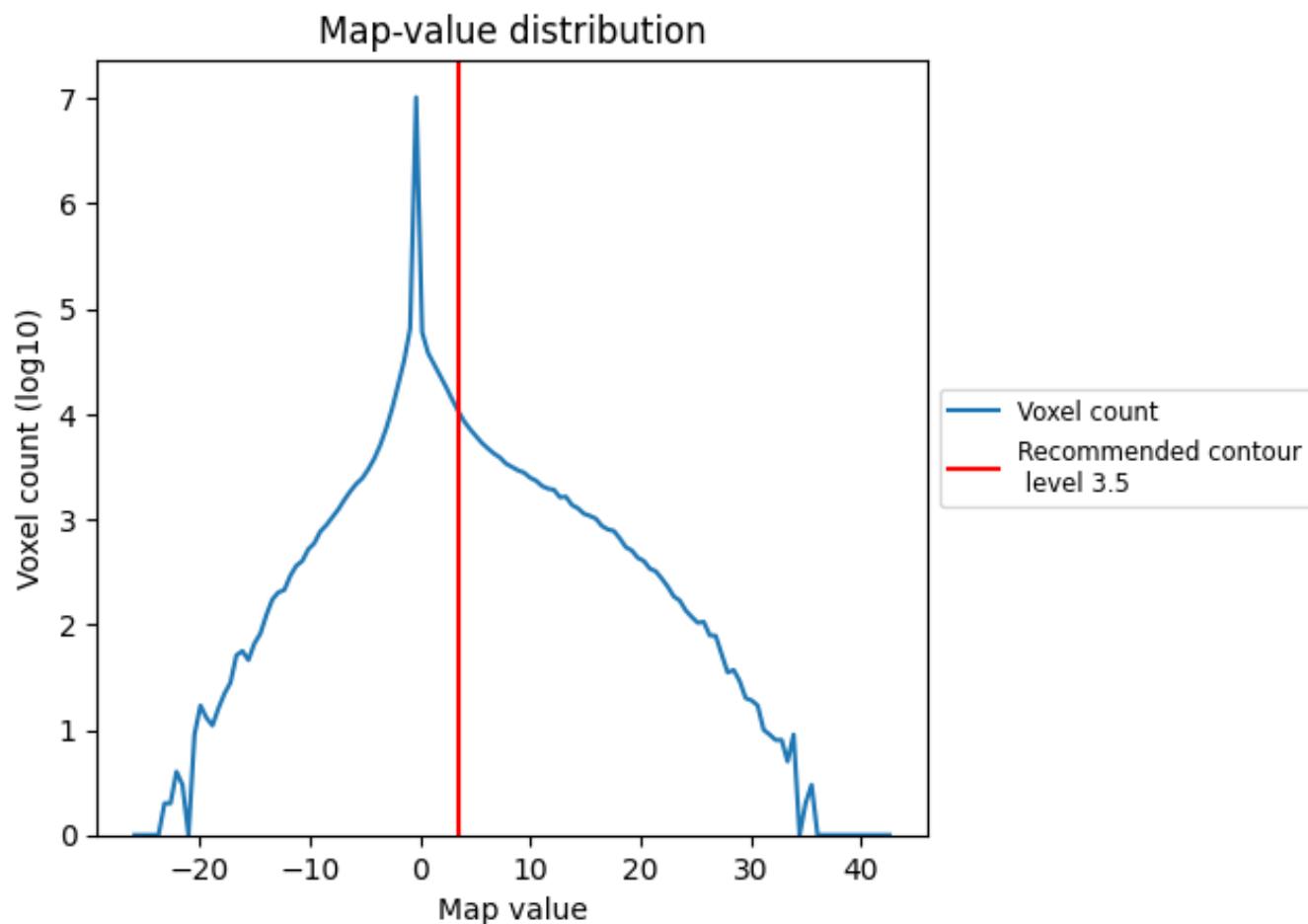
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

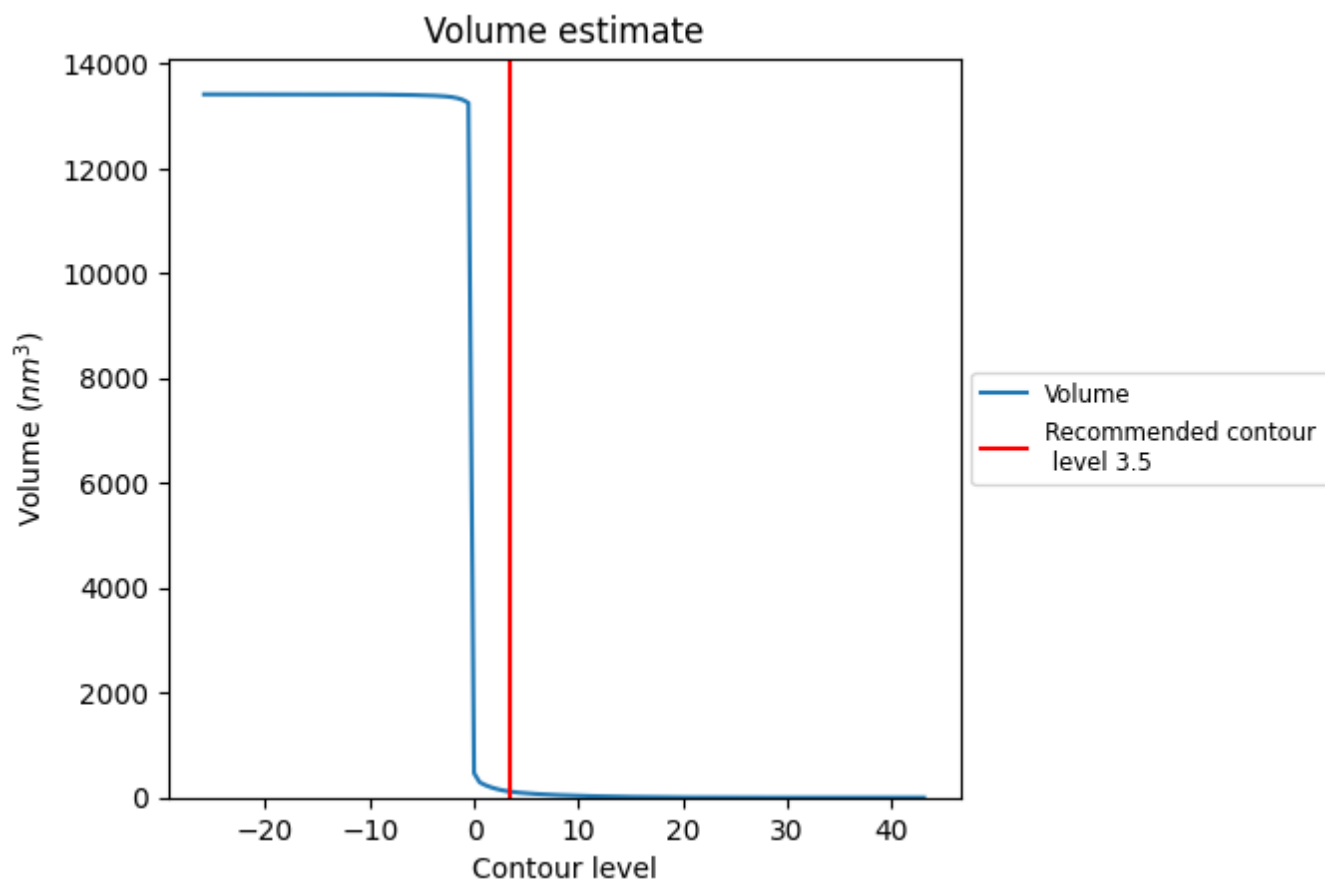
This section contains the results of statistical analysis of the map.

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.

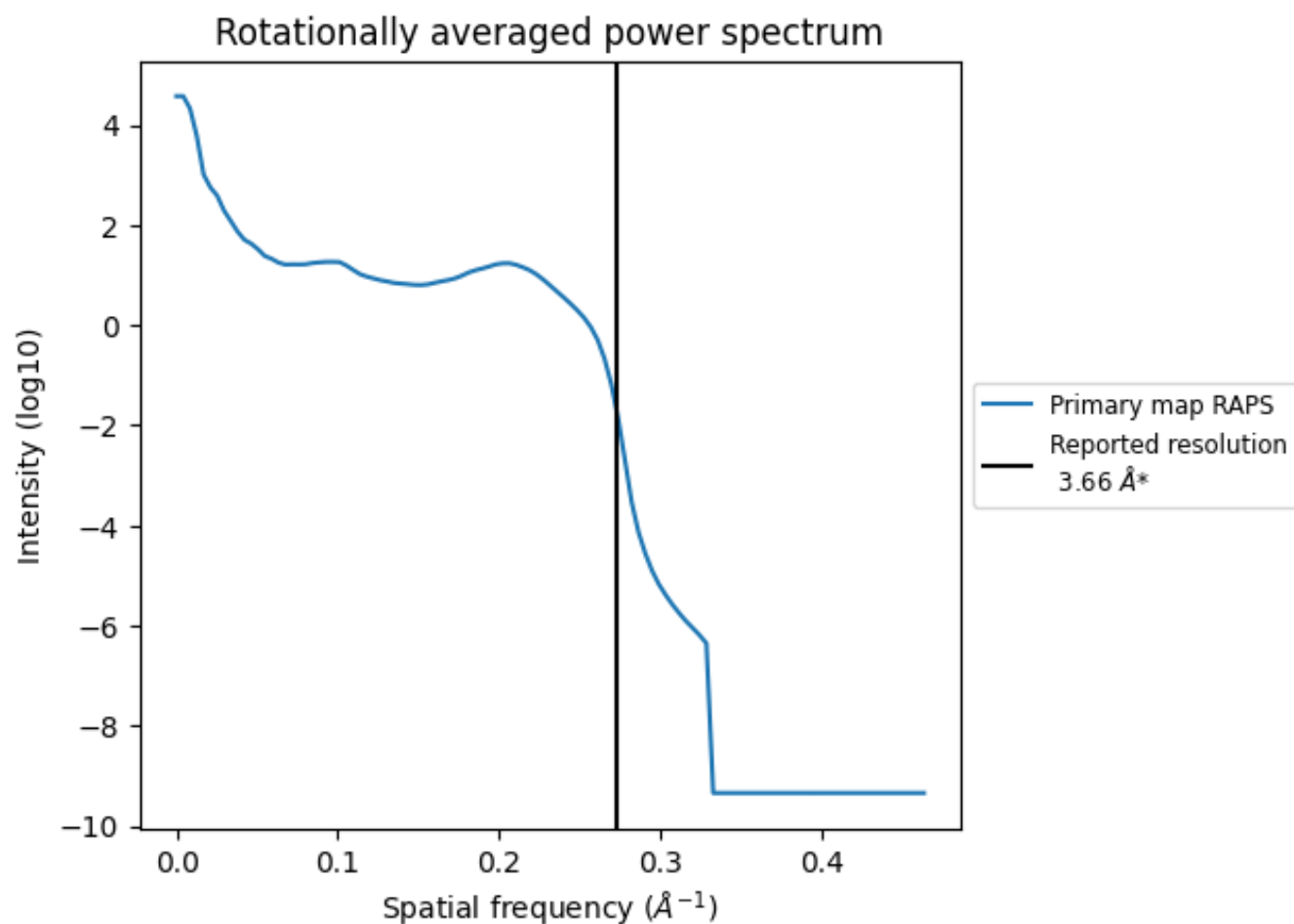
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 113 nm³; this corresponds to an approximate mass of 102 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 0.273 $\text{\AA}^{-1}$

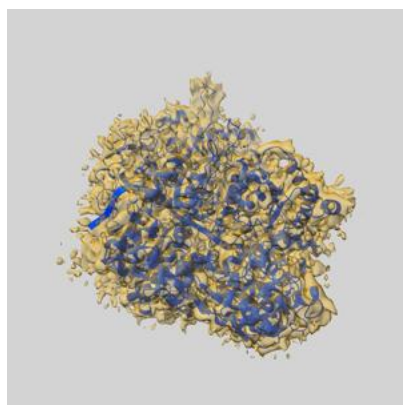
8 Fourier-Shell correlation ⓘ

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

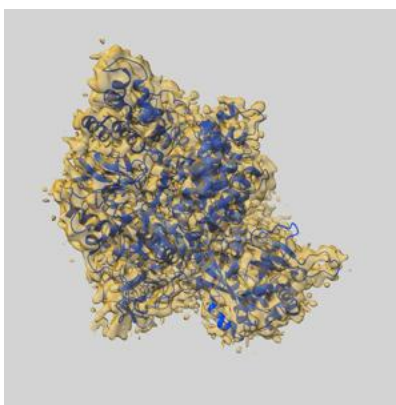
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-23271 and PDB model 7LCC. Per-residue inclusion information can be found in [section 3](#) on [page 4](#).

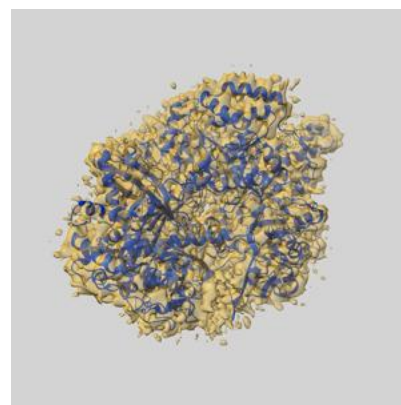
9.1 Map-model overlay [i](#)



X



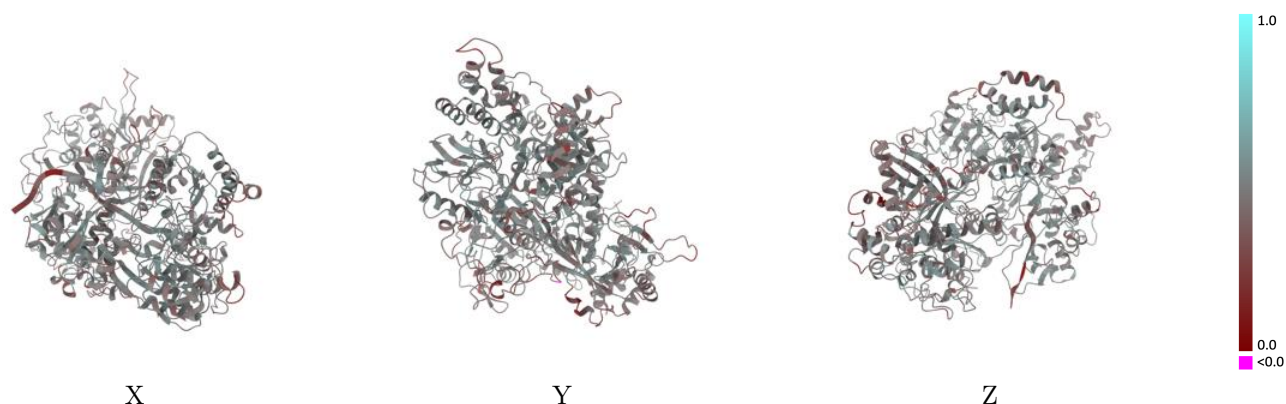
Y



Z

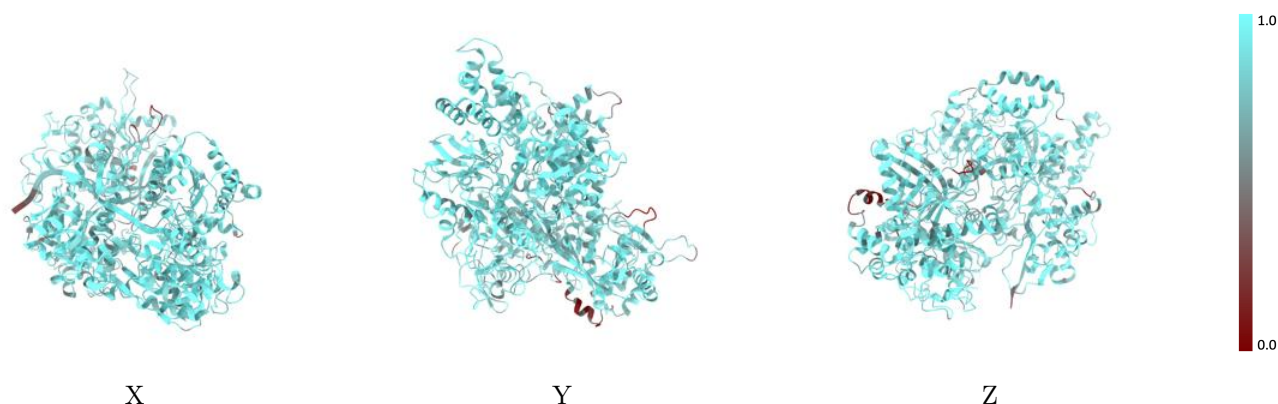
The images above show the 3D surface view of the map at the recommended contour level 3.5 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



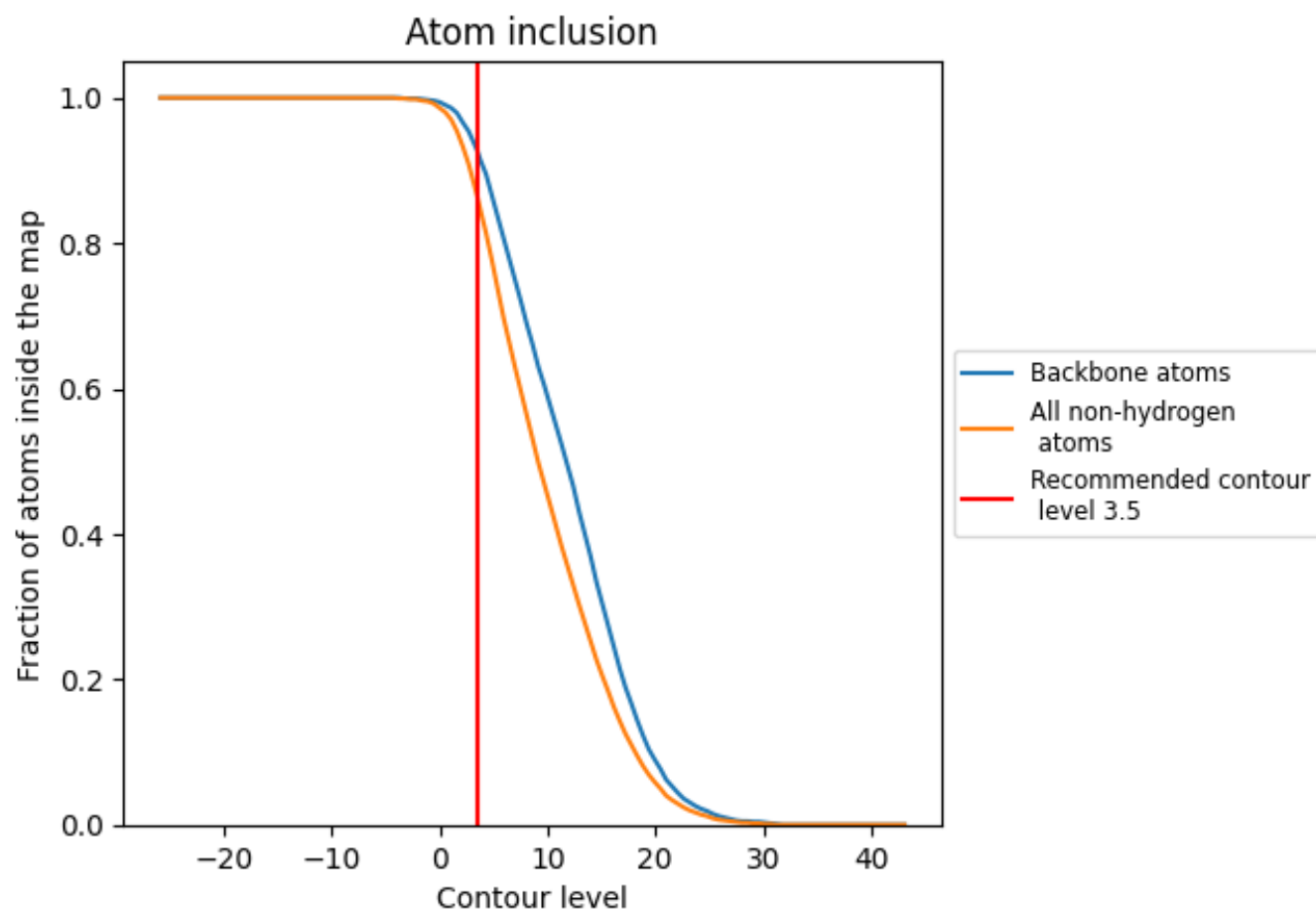
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (3.5).

9.4 Atom inclusion [i](#)



At the recommended contour level, 93% of all backbone atoms, 86% 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 (3.5) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8640	0.4520
A	0.8660	0.4530
B	0.8220	0.4210

