



wwPDB EM Validation Summary Report ⓘ

Mar 10, 2026 – 12:52 PM UTC

PDB ID : 9QC8 / pdb_00009qc8
EMDB ID : EMD-53006
Title : BoNT-NTNH-HA70 complex from Clostridium botulinum Serotype B1
Authors : Krc, A.; Persson Kosenina, S.; Masuyer, G.; Stenmark, P.
Deposited on : 2025-03-04
Resolution : 2.90 Å(reported)
Based on initial model : .

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

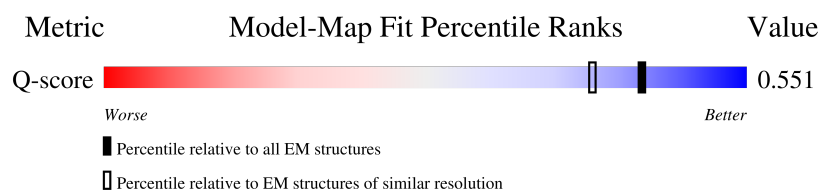
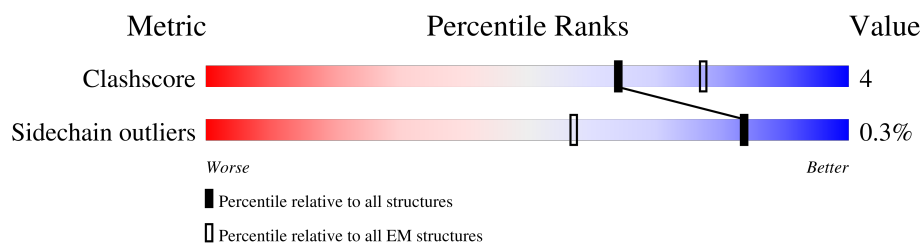
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.90 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	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	13054 (2.40 - 3.40)

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	1302	
2	B	1197	
3	C	626	
3	D	626	
3	E	626	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 29799 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 Botulinum neurotoxin type B.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	1253	9416	6151	1533	1702	30	0	0

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP B1INP5
A	2	GLY	-	expression tag	UNP B1INP5
A	232	GLN	GLU	engineered mutation	UNP B1INP5
A	235	TYR	HIS	engineered mutation	UNP B1INP5
A	1293	HIS	-	expression tag	UNP B1INP5
A	1294	HIS	-	expression tag	UNP B1INP5
A	1295	HIS	-	expression tag	UNP B1INP5
A	1296	HIS	-	expression tag	UNP B1INP5
A	1297	HIS	-	expression tag	UNP B1INP5
A	1298	HIS	-	expression tag	UNP B1INP5
A	1299	HIS	-	expression tag	UNP B1INP5
A	1300	HIS	-	expression tag	UNP B1INP5
A	1301	HIS	-	expression tag	UNP B1INP5
A	1302	HIS	-	expression tag	UNP B1INP5

- Molecule 2 is a protein called Non-toxic non-hemagglutinin component.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	1187	8883	5800	1466	1592	25	0	0

- Molecule 3 is a protein called Hemagglutinin component HA70.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	C	543	3710	2398	624	683	5	0	0

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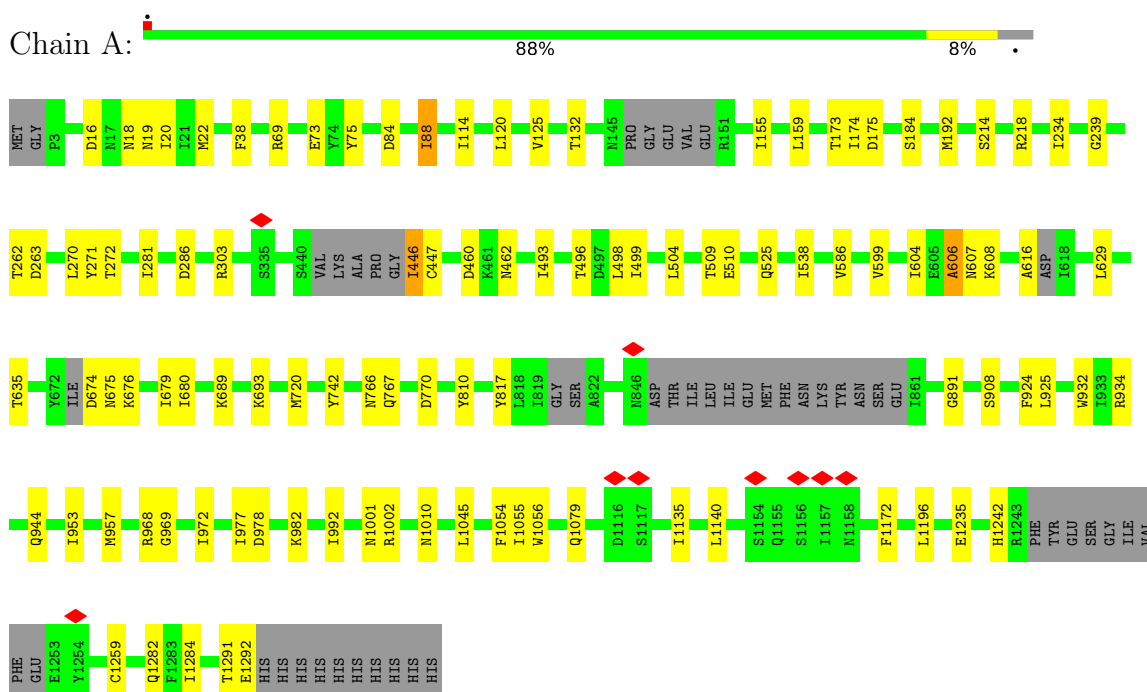
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Mol	Chain	Residues	Atoms					AltConf	Trace
3	D	570	Total	C	N	O	S	0	0
			4008	2586	682	735	5		
3	E	554	Total	C	N	O	S	0	0
			3782	2432	640	705	5		

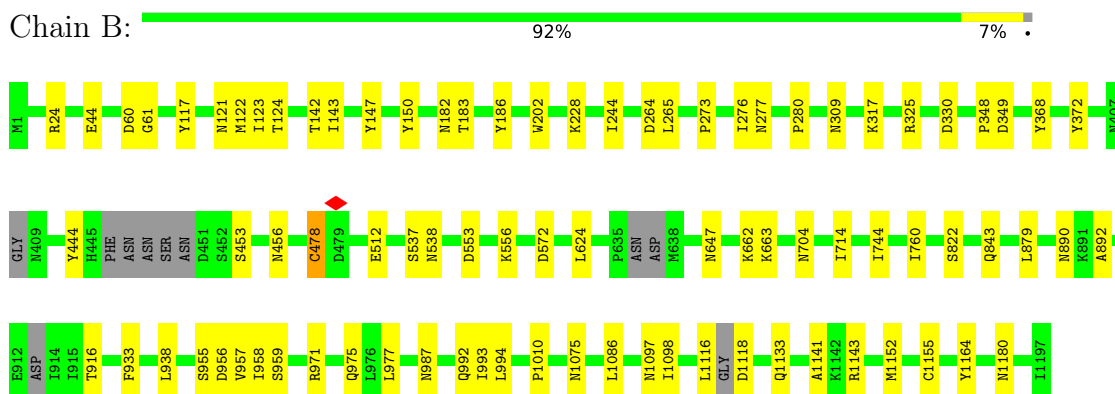
3 Residue-property plots

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: Botulinum neurotoxin type B

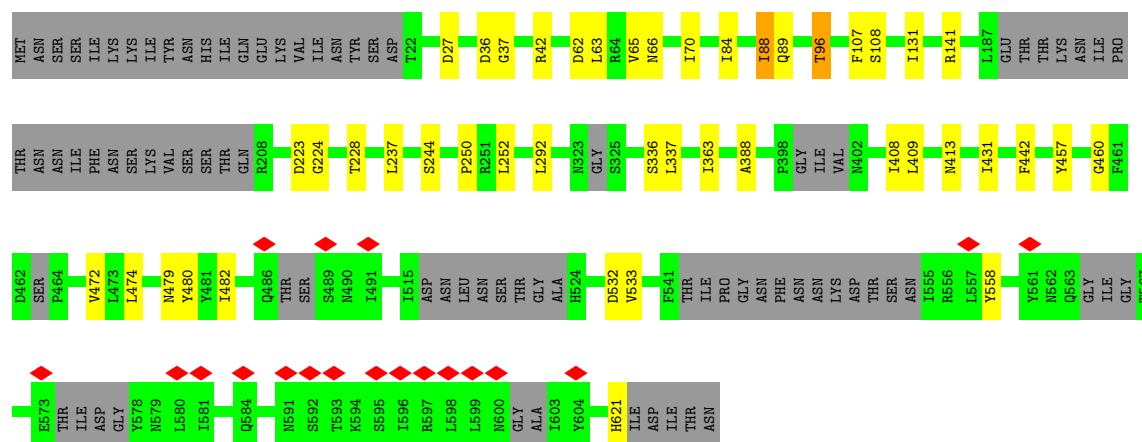


• Molecule 2: Non-toxic non-hemagglutinin component



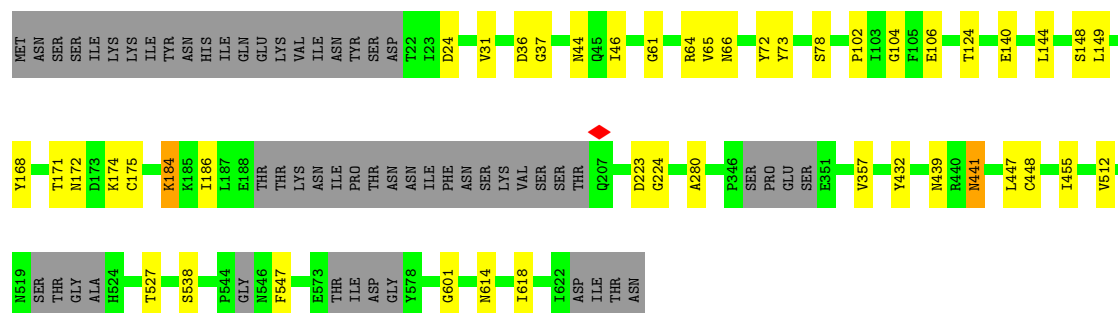
• Molecule 3: Hemagglutinin component HA70

Chain C:  80% 7% 13%



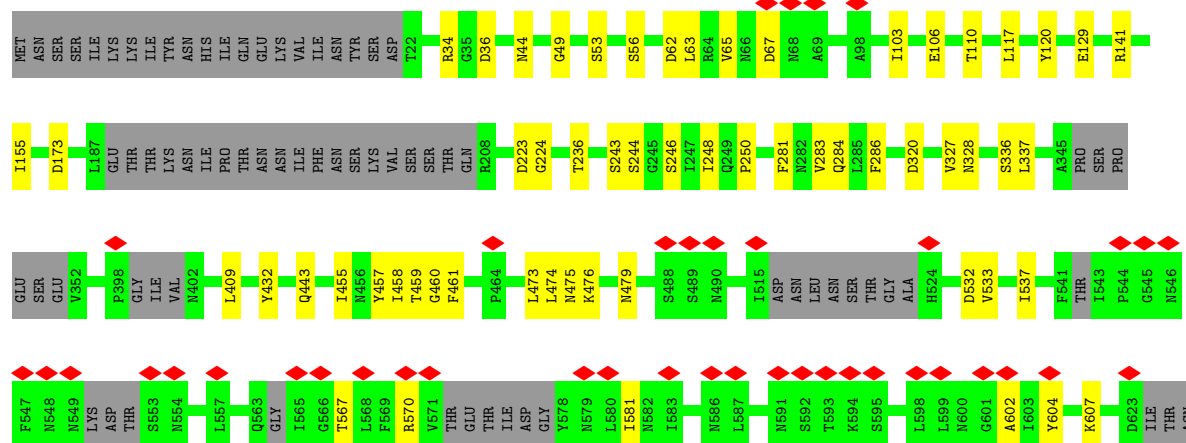
• Molecule 3: Hemagglutinin component HA70

Chain D:  84% 7% 9%



• Molecule 3: Hemagglutinin component HA70

Chain E:  7% 79% 9% 12%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	465128	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION; CTF amplitude correction was performed following 3D reconstruction	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	40	Depositor
Minimum defocus (nm)	400	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	105000	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	36.977	Depositor
Minimum map value	-15.250	Depositor
Average map value	-0.008	Depositor
Map value standard deviation	1.158	Depositor
Recommended contour level	7.4	Depositor
Map size (Å)	331.2, 331.2, 331.2	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.828, 0.828, 0.828	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	0.16	0/9634	0.34	4/13142 (0.0%)
2	B	0.18	0/9085	0.34	2/12399 (0.0%)
3	C	0.15	0/3778	0.31	0/5180
3	D	0.15	0/4091	0.35	1/5607 (0.0%)
3	E	0.15	0/3858	0.31	0/5291
All	All	0.16	0/30446	0.33	7/41619 (0.0%)

There are no bond length outliers.

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	679	ILE	N-CA-C	-9.03	105.13	113.71
1	A	606	ALA	N-CA-C	-7.35	100.63	110.55
2	B	478	CYS	N-CA-C	6.78	119.95	108.90
3	D	184	LYS	N-CA-C	6.65	119.25	108.34
2	B	348	PRO	CA-C-O	-5.71	114.83	121.34

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	9416	0	8570	73	0
2	B	8883	0	8124	62	0
3	C	3710	0	3066	31	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	4008	0	3410	36	0
3	E	3782	0	3049	42	0
All	All	29799	0	26219	228	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.

The worst 5 of 228 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:D:441:ASN:ND2	3:D:448:CYS:SG	2.01	1.30
1:A:1242:HIS:ND1	1:A:1259:CYS:SG	2.26	1.00
2:B:24:ARG:HG2	2:B:478:CYS:SG	2.03	0.98
1:A:1242:HIS:CE1	1:A:1259:CYS:HG	1.89	0.89
2:B:121:ASN:OD1	2:B:122:MET:N	2.08	0.87

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

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	886/1200 (74%)	882 (100%)	4 (0%)	81	93
2	B	837/1114 (75%)	835 (100%)	2 (0%)	87	96
3	C	286/570 (50%)	284 (99%)	2 (1%)	76	92
3	D	328/570 (58%)	327 (100%)	1 (0%)	86	96

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	E	285/570 (50%)	285 (100%)	0	100	100
All	All	2622/4024 (65%)	2613 (100%)	9 (0%)	84	96

5 of 9 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	C	96	THR
3	D	441	ASN
1	A	680	ILE
2	B	186	TYR
2	B	744	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 23 such sidechains are listed below:

Mol	Chain	Res	Type
3	C	43	GLN
3	C	364	GLN
3	C	136	HIS
3	D	172	ASN
1	A	1069	GLN

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.

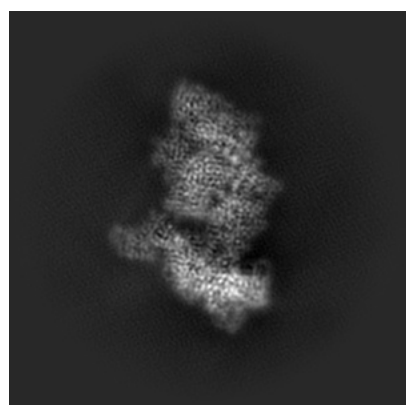
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-53006. These allow visual inspection of the internal detail of the map and identification of artifacts.

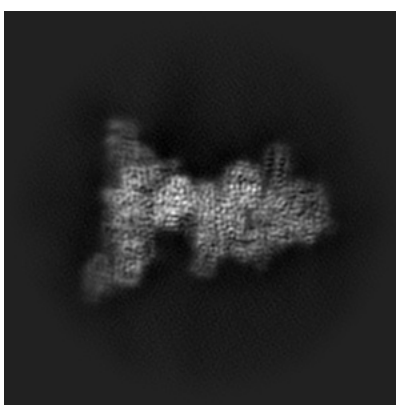
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

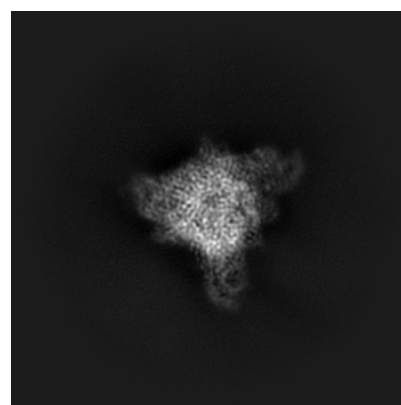
6.1.1 Primary map



X



Y

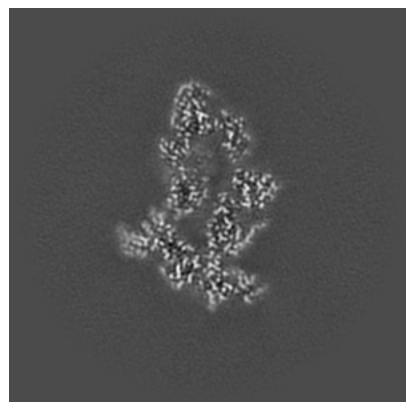


Z

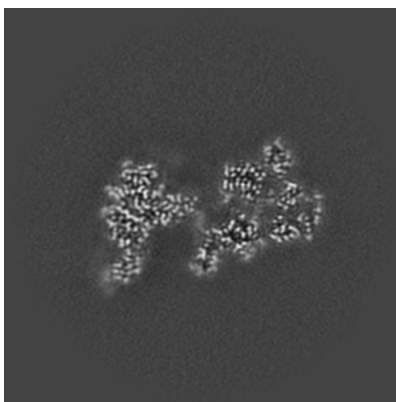
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

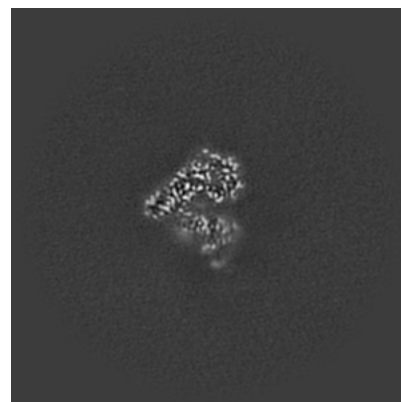
6.2.1 Primary map



X Index: 200



Y Index: 200

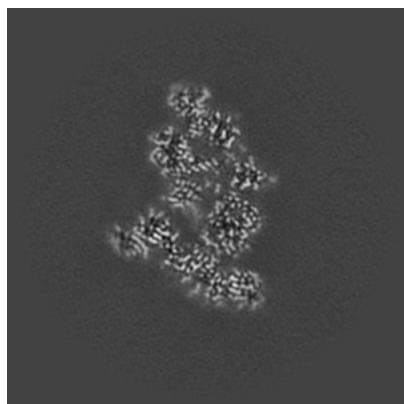


Z Index: 200

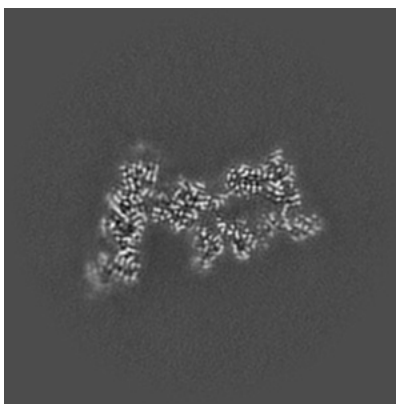
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

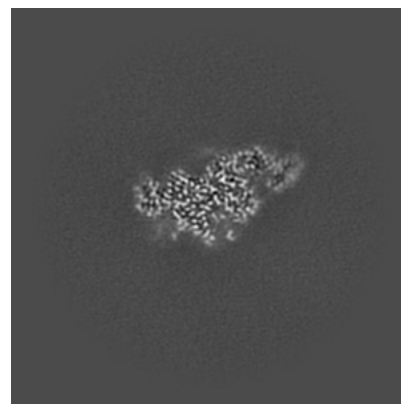
6.3.1 Primary map



X Index: 211



Y Index: 211

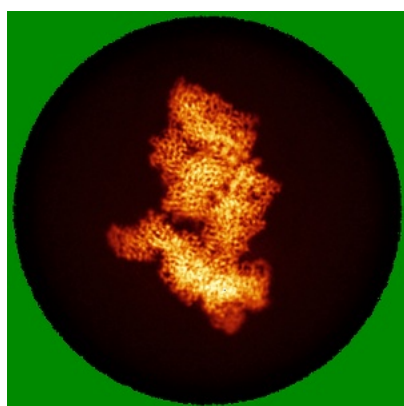


Z Index: 122

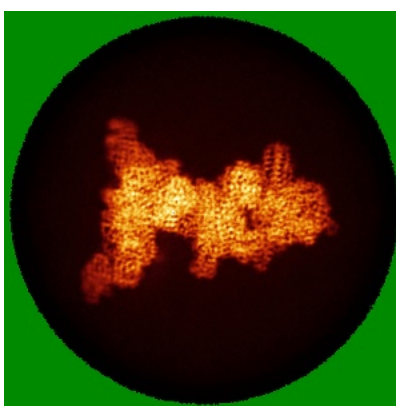
The images above show the largest variance slices of the map in three orthogonal directions.

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

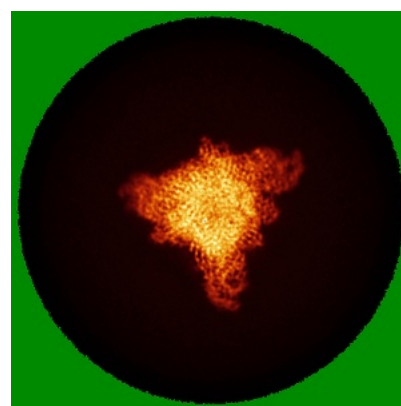
6.4.1 Primary map



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

This section was not generated.

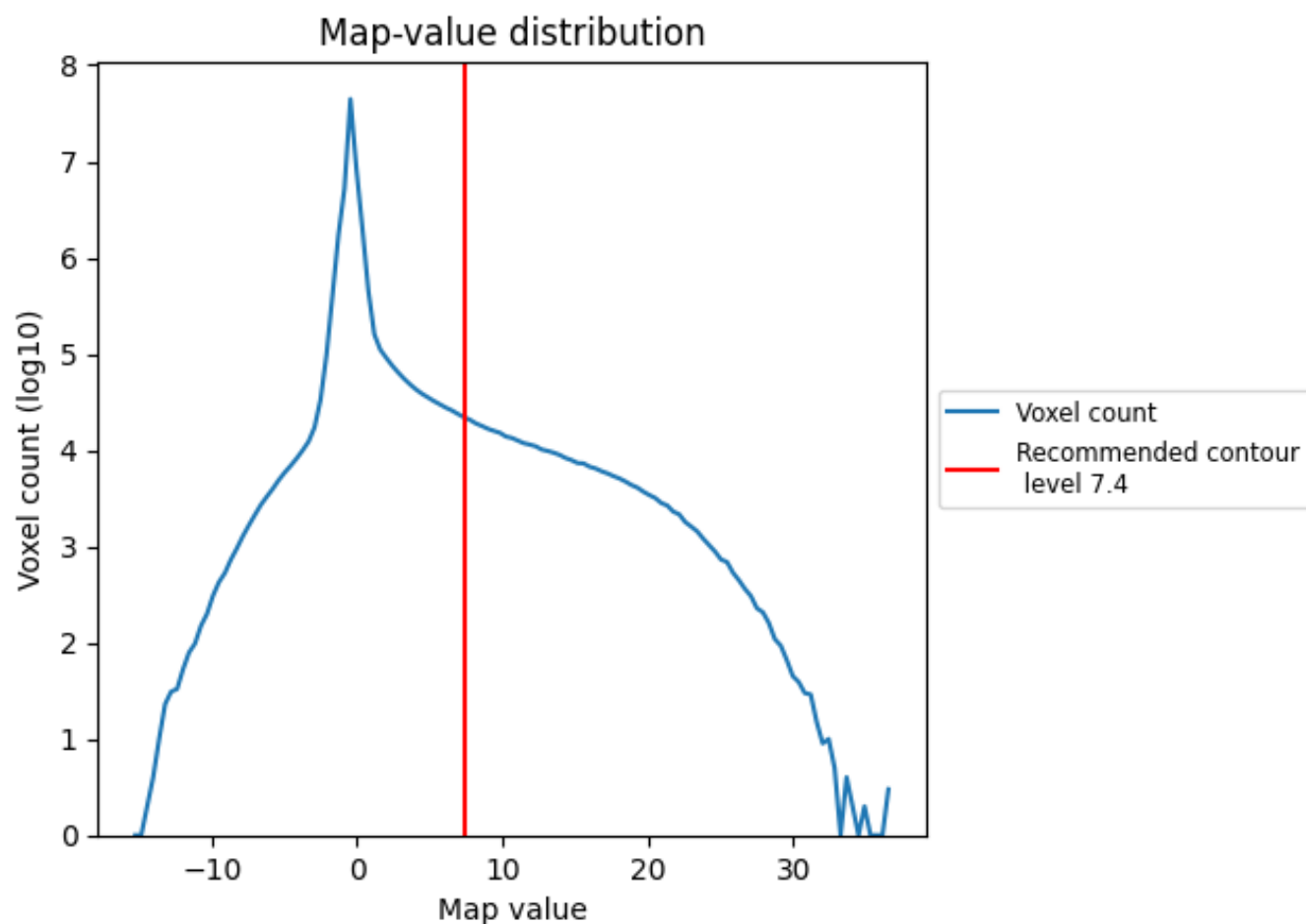
6.6 Mask visualisation

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

7 Map analysis [i](#)

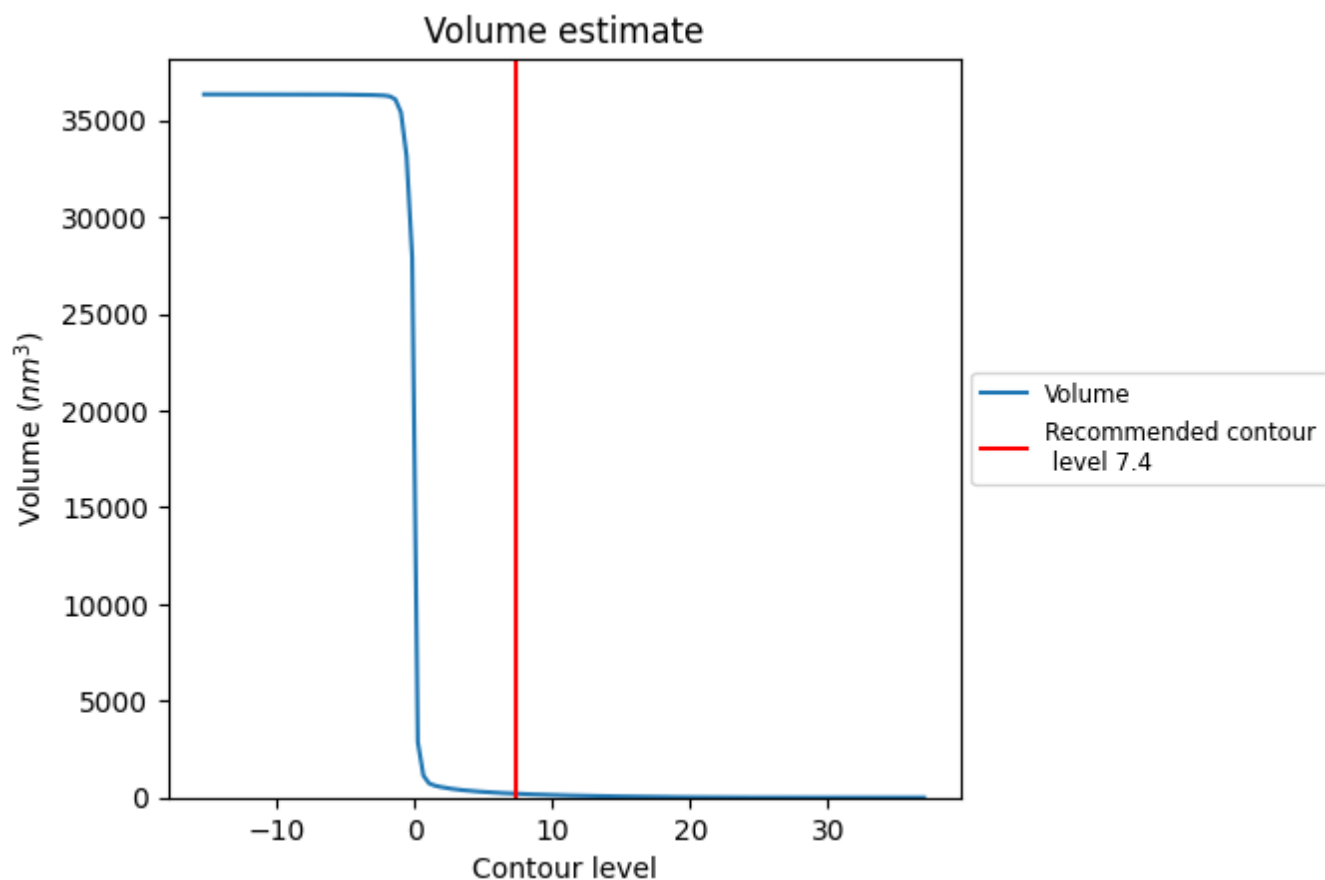
This section contains the results of statistical analysis of the map.

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.

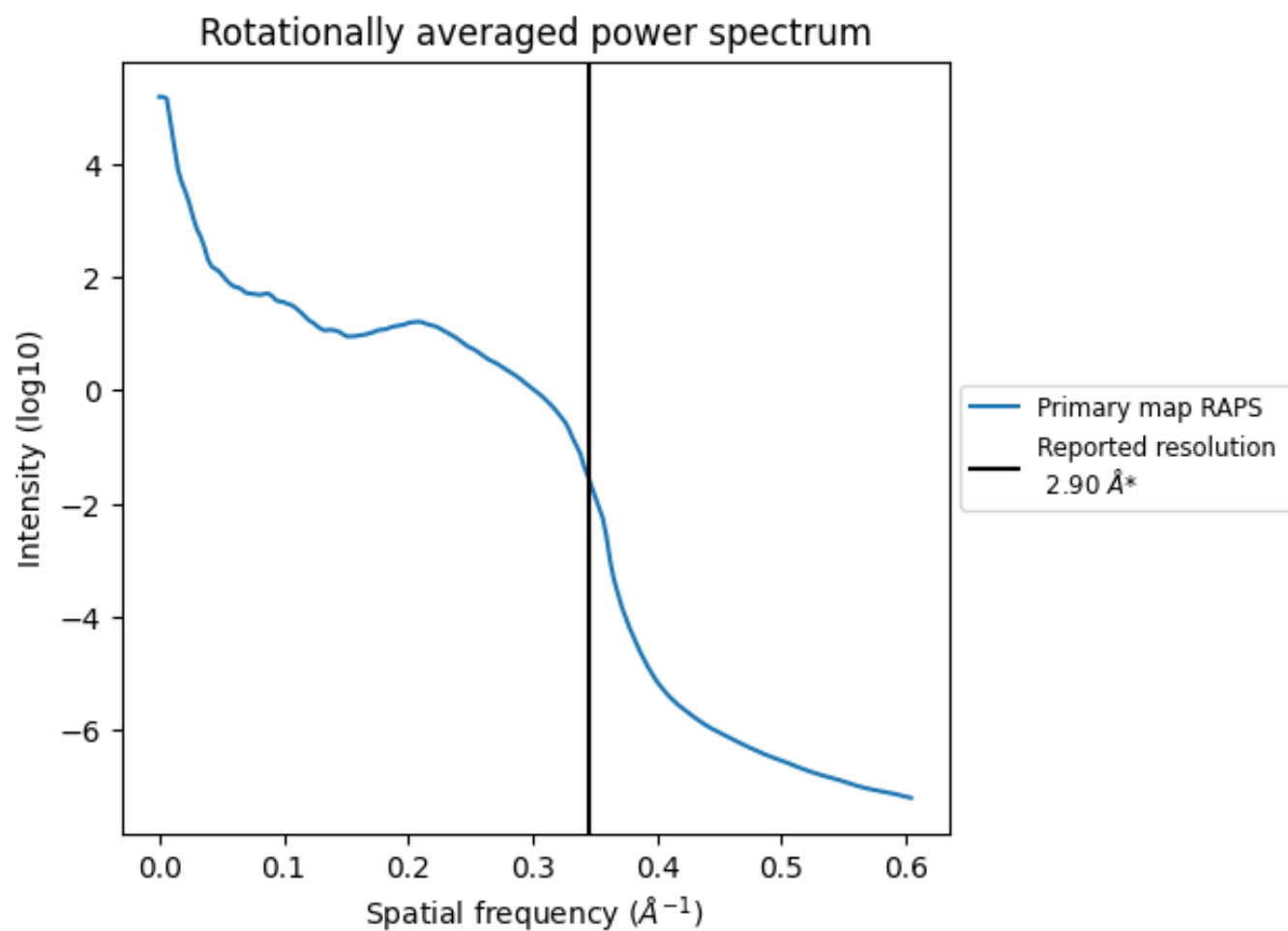
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 198 nm^3 ; this corresponds to an approximate mass of 179 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 0.345 Å⁻¹

8 Fourier-Shell correlation ⓘ

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

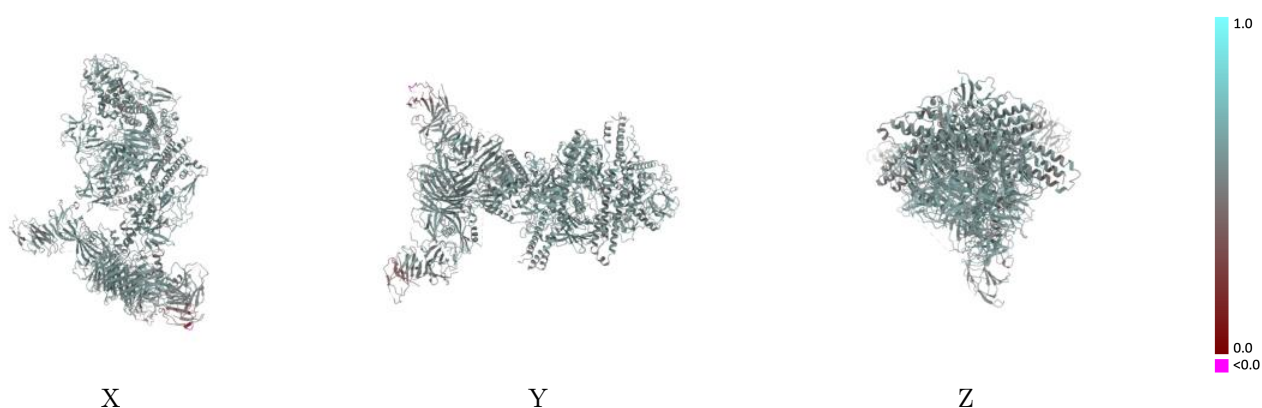
9 Map-model fit [i](#)

This section contains information regarding the fit between EMD map EMD-53006 and PDB model 9QC8. Per-residue inclusion information can be found in section 3 on page 5.

9.1 Map-model overlay [i](#)

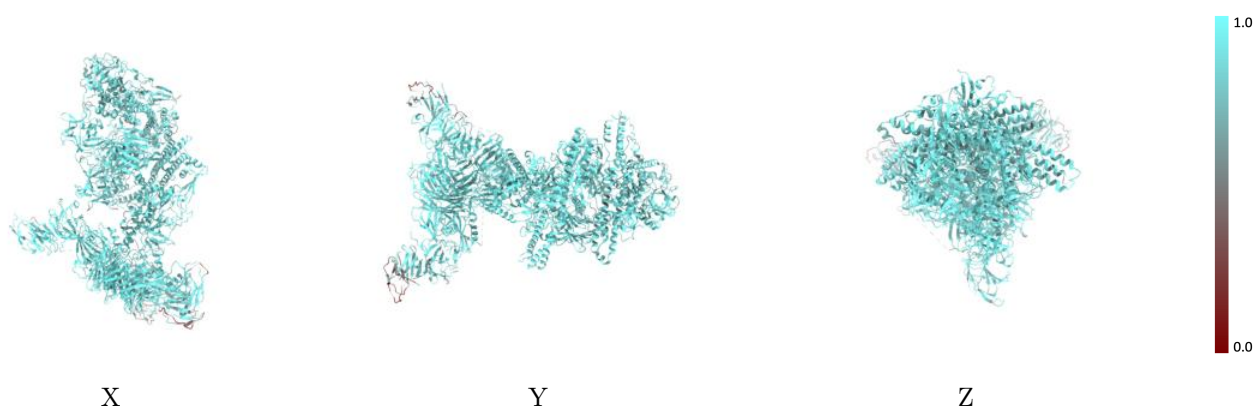
This section was not generated.

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



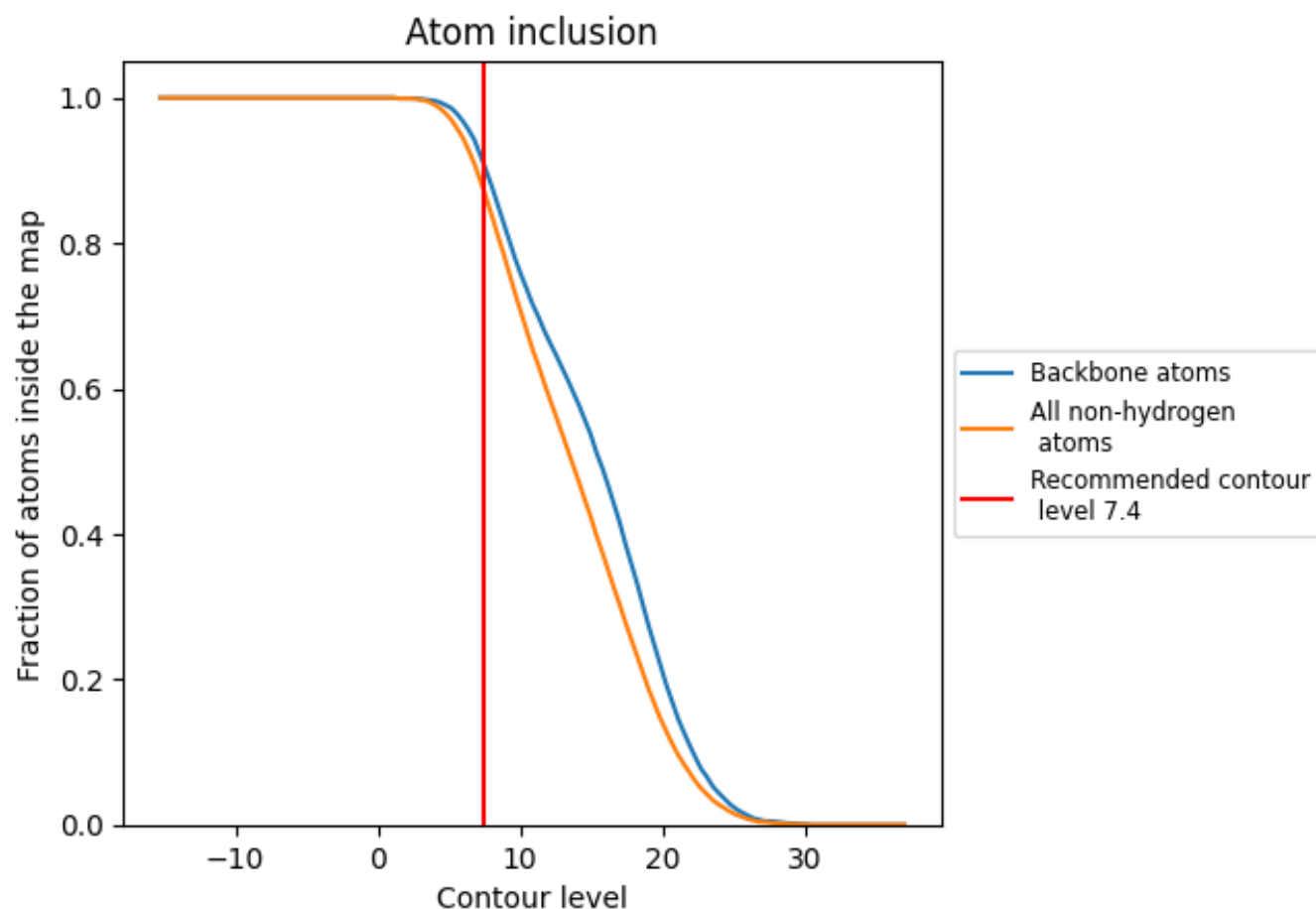
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (7.4).

9.4 Atom inclusion [i](#)



At the recommended contour level, 91% of all backbone atoms, 88% 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 (7.4) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8750	0.5510
A	0.8640	0.5600
B	0.8940	0.5660
C	0.8590	0.5250
D	0.9120	0.5480
E	0.8390	0.5250

