Full wwPDB EM Validation Report ⓘ

Oct 25, 2026 – 11:19 AM EDT

PDB ID	:	9ZUP / pdb_00009zup
EMDB ID	:	EMD-74825
Title	:	EBV gB trimer with "deliDoP" mutations and I5350A2h (prefusion conformation) - I5350A2h local refinement
Authors	:	McCallum, M.; Veesler, D.; Seattle Structural Genomics Center for Infectious Disease (SSGCID)
Deposited on	:	2025-12-24
Resolution	:	3.70 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:

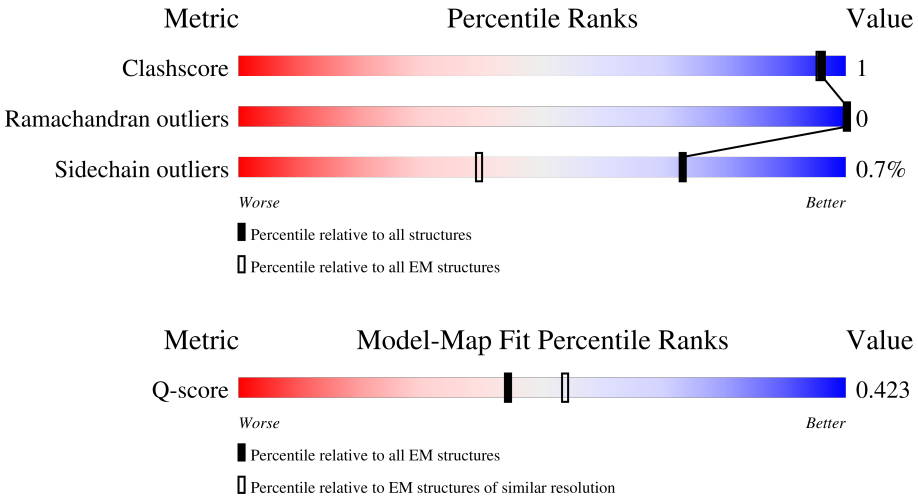
EMDB validation analysis	:	0.0.1.dev133
MolProbity	:	4-5-2 with Phenix2.2
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics	:	202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.51

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 3.70 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)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	11569 (3.20 - 4.20)

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 <=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	910	27% 72%
1	B	910	27% 72%
1	C	910	27% 72%

2 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 5279 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 EBV gB trimer with "deliDoP" mutations and I5350A2h - I5350A2h local refinement.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	C	258	Total	C	N	O	S	0	0
			1760	1146	319	288	7		
1	A	258	Total	C	N	O	S	0	0
			1759	1146	319	287	7		
1	B	258	Total	C	N	O	S	0	0
			1760	1146	319	288	7		

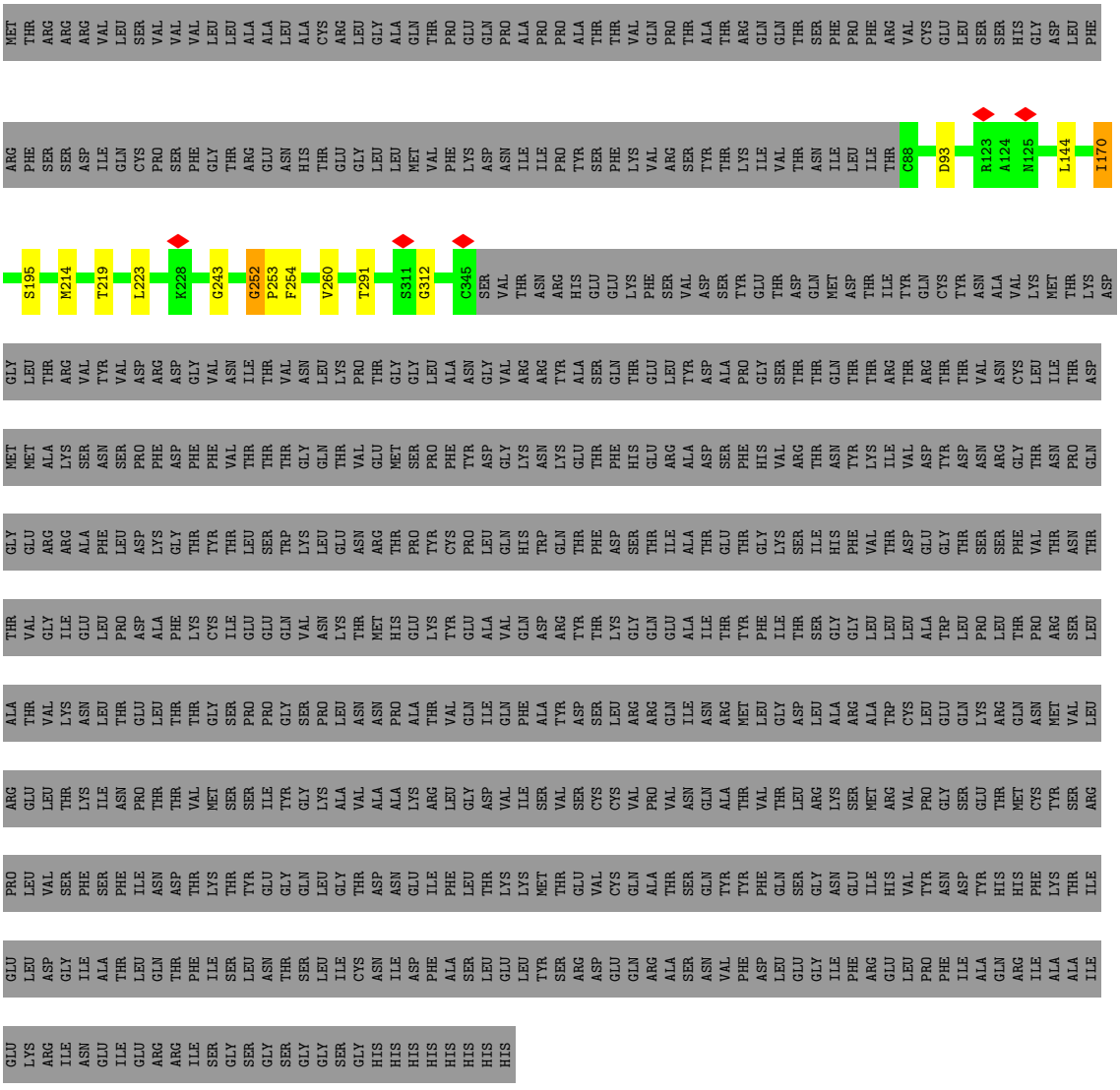
3 Residue-property plots (i)

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: EBV gB trimer with "deliDoP" mutations and I5350A2h - I5350A2h local refinement

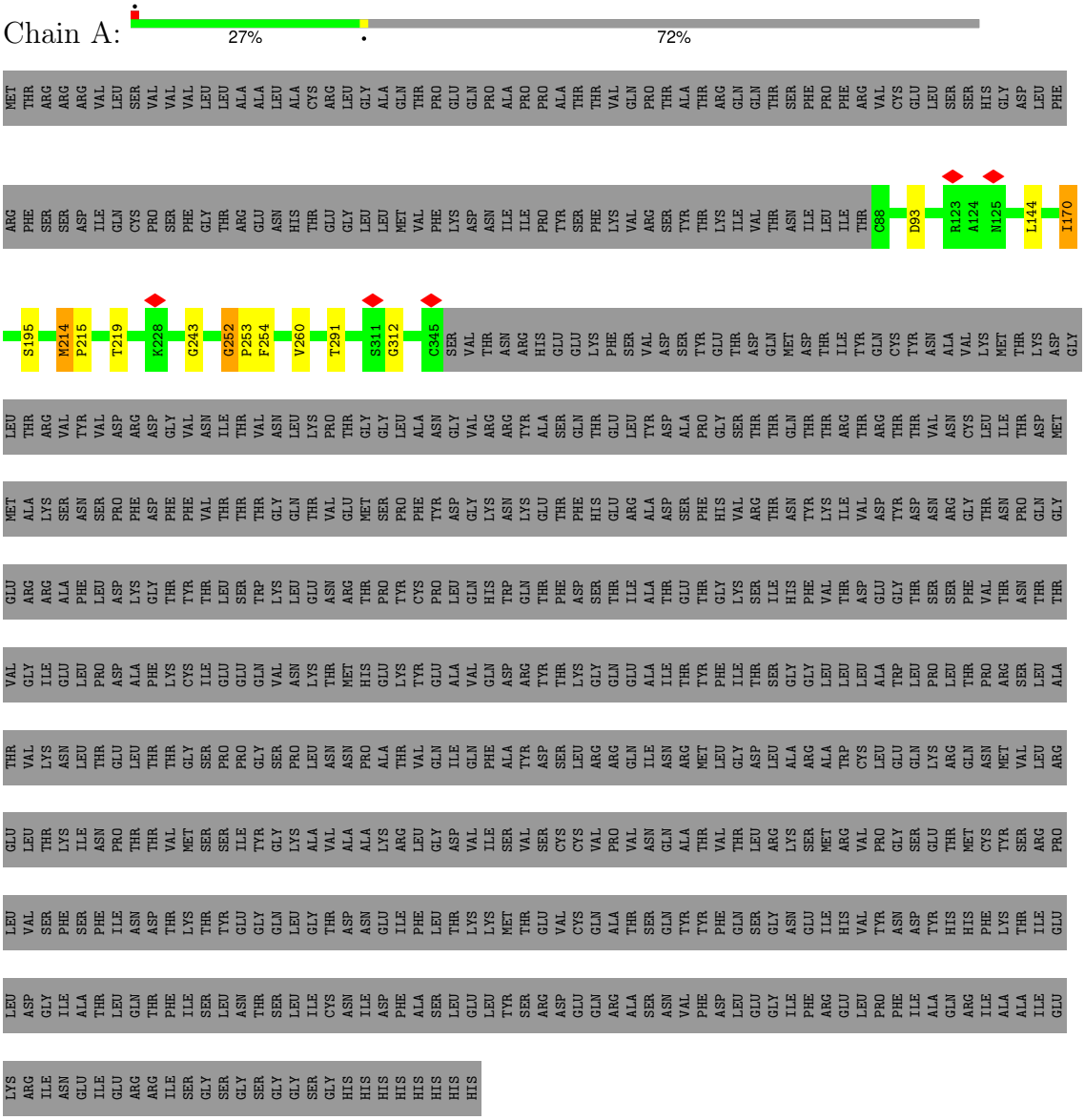
Chain C:





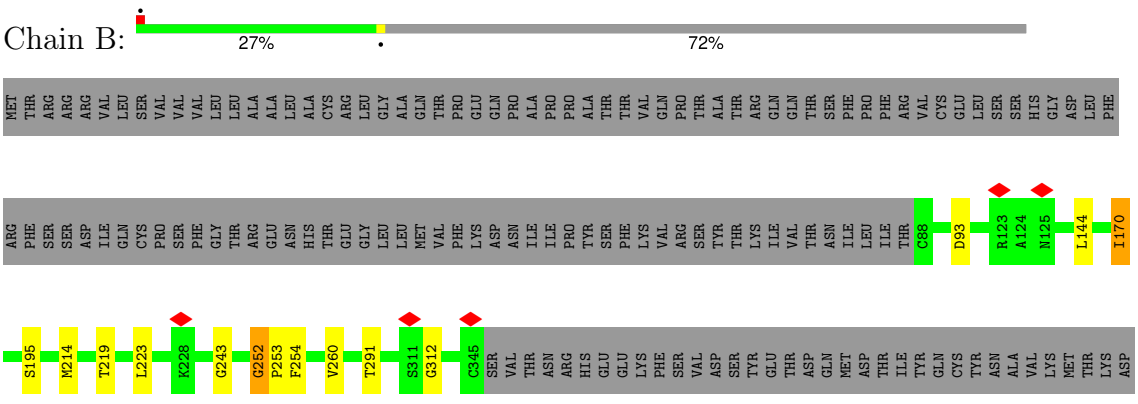
• Molecule 1: EBV gB trimer with "deliDoP" mutations and I5350A2h - I5350A2h local refinement

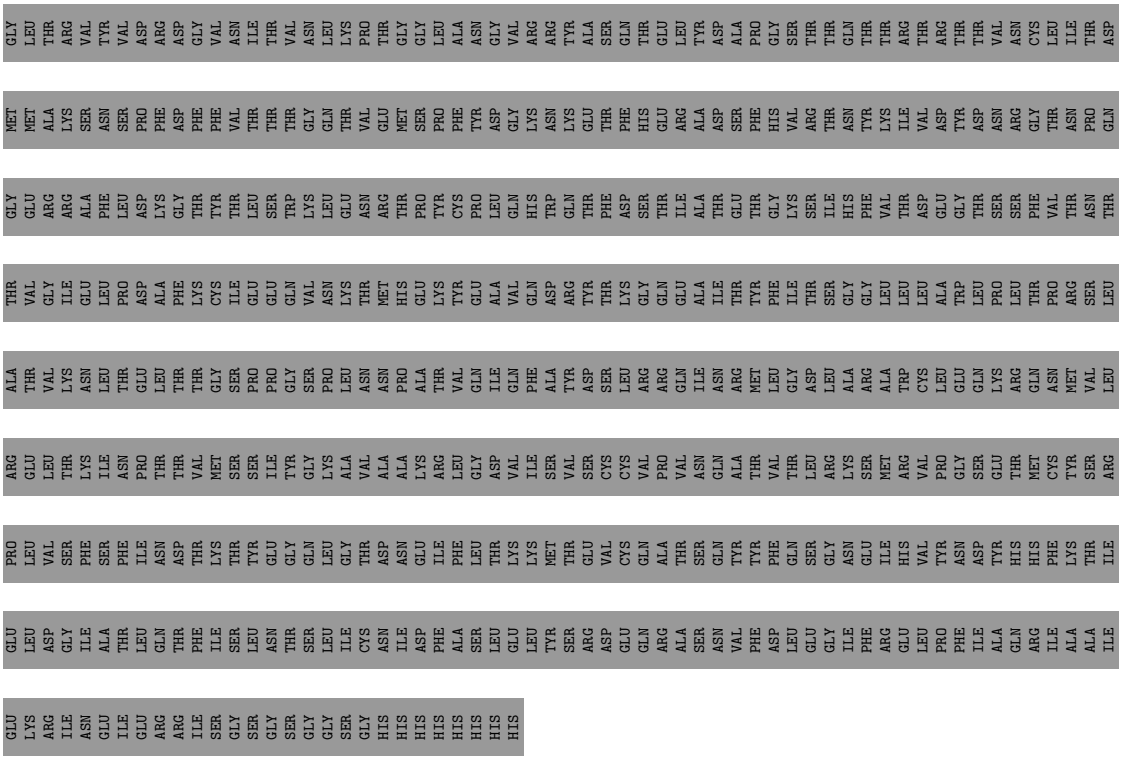
Chain A:



• Molecule 1: EBV gB trimer with "deliDoP" mutations and I5350A2h - I5350A2h local refinement

Chain B:




GLY LEU THR ARG VAL TYR VAL ASP ARG ASP GLY VAL ASN ILE THR VAL ASN LEU LYS PRO THR GLY GLY LEU ALA ASN GLY VAL ARG ARG TYR ALA SER GLN THR GLU LEU TYR ASP ALA PRO GLY SER THR THR GLN THR THR ARG THR ARG THR THR VAL ASN CYS LEU ILE THR ASP
MET MET ALA LYS SER ASN SER PRO PHE ASP PHE PHE VAL THR THR THR GLY GLN THR VAL GLU MET SER PRO PHE TYR ASP GLY LYS ASN LYS GLU THR PHE HIS GLU ARG ALA ASP SER PHE HIS VAL ARG THR ASN TYR LYS ILE VAL ASP TYR ASP ASN ARG GLY THR ASN PRO GLN
GLY GLU ARG ARG ALA PHE LEU ASP LYS GLY THR TYR THR LEU SER TRP LYS LEU GLU ASN ARG THR PRO TYR CYS PRO LEU GLN HIS TRP GLN THR PHE ASP SER SER THR ILE ALA THR GLU THR GLY LYS SER ILE HIS PHE VAL THR ASP GLU GLY THR SER SER PHE VAL THR ASN THR
THR VAL GLY ILE GLU LEU PRO ASP ALA PHE LYS CYS ILE GLU GLU GLN VAL ASN LYS THR MET HIS GLU LYS TYR GLU ALA VAL GLN ASP ARG TYR THR LYS GLY GLN GLU ALA ILE THR TYR PHE ILE THR SER GLY GLY LEU LEU LEU ALA TRP LEU PRO LEU THR PRO ARG SER LEU
ALA THR VAL LYS ASN LEU THR GLU LEU THR THR GLY SER PRO PRO GLY SER PRO LEU ASN ASN PRO ALA ALA THR VAL GLN ILE GLN PHE ALA TYR ASP SER LEU ARG GLN ILE ASN ARG MET LEU GLY ASP LEU ALA ARG ALA TRP CYS LEU GLU LYS ARG GLN ASN MET VAL LEU
ARG GLU LEU THR LYS ILE ASN PRO THR THR VAL MET SER SER ILE TYR GLY LYS ALA VAL ALA ALA LYS ARG LEU GLY ASP VAL ILE SER VAL SER CYS CYS VAL PRO VAL ASN GLN ALA THR VAL THR LEU ARG LYS SER MET ARG VAL PRO GLY SER GLU THR MET CYS TYR SER ARG
PRO LEU VAL SER PHE SER PHE ILE ASN ASP THR LYS THR TYR GLU GLY GLN LEU GLY THR ASP ASN GLU ILE PHE LEU THR LYS LYS MET THR GLU VAL CYS GLN ALA THR SER GLN TYR TYR PHE GLN SER GLY ASN GLU ILE HIS VAL TYR ASN ASP TYR HIS HIS PHE LYS THR ILE
GLU LEU ASP GLY ILE ALA THR LEU GLN THR PHE ILE SER LEU ASN THR SER LEU ILE CYS ASN ILE ASP PHE ALA SER LEU GLU LEU TYR SER ARG ASP GLU GLN ARG ALA SER ASN VAL PHE ASP LEU GLU GLY ILE PHE ARG GLU LEU PRO PHE ILE ALA GLN ARG ILE ALA ALA ILE
GLU LYS ARG ILE ASN GLU ILE GLU ARG ARG ILE SER GLY SER GLY SER GLY GLY SER GLY HIS HIS HIS HIS HIS HIS HIS

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	64249	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	50	Depositor
Minimum defocus (nm)	400	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	0.898	Depositor
Minimum map value	-0.309	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.013	Depositor
Recommended contour level	0.35	Depositor
Map size (Å)	424.448, 424.448, 424.448	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.829, 0.829, 0.829	Depositor

5 Model quality

5.1 Standard geometry

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	0.56	0/1790	0.93	20/2428 (0.8%)
1	B	0.56	0/1791	0.93	20/2429 (0.8%)
1	C	0.56	0/1791	0.93	20/2429 (0.8%)
All	All	0.56	0/5372	0.93	60/7286 (0.8%)

There are no bond length outliers.

All (60) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	243	GLY	CA-C-N	7.73	127.36	119.56
1	C	243	GLY	C-N-CA	7.73	127.36	119.56
1	A	243	GLY	CA-C-N	7.72	127.35	119.56
1	A	243	GLY	C-N-CA	7.72	127.35	119.56
1	B	243	GLY	CA-C-N	7.71	127.34	119.56
1	B	243	GLY	C-N-CA	7.71	127.34	119.56
1	C	312	GLY	CA-C-N	6.78	126.73	119.28
1	C	312	GLY	C-N-CA	6.78	126.73	119.28
1	A	312	GLY	CA-C-N	6.75	126.71	119.28
1	A	312	GLY	C-N-CA	6.75	126.71	119.28
1	B	312	GLY	CA-C-N	6.74	126.69	119.28
1	B	312	GLY	C-N-CA	6.74	126.69	119.28
1	A	214	MET	CA-C-N	6.42	126.33	119.85
1	A	214	MET	C-N-CA	6.42	126.33	119.85
1	B	214	MET	CA-C-N	6.42	126.33	119.85
1	B	214	MET	C-N-CA	6.42	126.33	119.85
1	C	214	MET	CA-C-N	6.38	126.29	119.85
1	C	214	MET	C-N-CA	6.38	126.29	119.85
1	B	195	SER	CA-C-N	6.31	126.43	119.87
1	B	195	SER	C-N-CA	6.31	126.43	119.87
1	C	195	SER	CA-C-N	6.29	126.41	119.87
1	C	195	SER	C-N-CA	6.29	126.41	119.87
1	B	254	PHE	CA-C-N	6.24	126.36	119.87
1	B	254	PHE	C-N-CA	6.24	126.36	119.87

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	195	SER	CA-C-N	6.24	126.36	119.87
1	A	195	SER	C-N-CA	6.24	126.36	119.87
1	C	254	PHE	CA-C-N	6.18	126.30	119.87
1	C	254	PHE	C-N-CA	6.18	126.30	119.87
1	A	254	PHE	CA-C-N	6.18	126.30	119.87
1	A	254	PHE	C-N-CA	6.18	126.30	119.87
1	C	93	ASP	CA-C-N	6.05	126.49	119.47
1	C	93	ASP	C-N-CA	6.05	126.49	119.47
1	A	252	GLY	CA-C-N	6.05	125.94	119.28
1	A	252	GLY	C-N-CA	6.05	125.94	119.28
1	A	93	ASP	CA-C-N	6.05	126.48	119.47
1	A	93	ASP	C-N-CA	6.05	126.48	119.47
1	B	93	ASP	CA-C-N	6.05	126.48	119.47
1	B	93	ASP	C-N-CA	6.05	126.48	119.47
1	B	252	GLY	CA-C-N	6.04	125.93	119.28
1	B	252	GLY	C-N-CA	6.04	125.93	119.28
1	C	252	GLY	CA-C-N	6.04	125.92	119.28
1	C	252	GLY	C-N-CA	6.04	125.92	119.28
1	A	219	THR	CA-C-N	5.93	125.80	119.28
1	A	219	THR	C-N-CA	5.93	125.80	119.28
1	B	219	THR	CA-C-N	5.91	125.78	119.28
1	B	219	THR	C-N-CA	5.91	125.78	119.28
1	C	219	THR	CA-C-N	5.89	125.76	119.28
1	C	219	THR	C-N-CA	5.89	125.76	119.28
1	B	260	VAL	CA-C-N	5.80	125.71	119.85
1	B	260	VAL	C-N-CA	5.80	125.71	119.85
1	C	260	VAL	CA-C-N	5.80	125.71	119.85
1	C	260	VAL	C-N-CA	5.80	125.71	119.85
1	A	260	VAL	CA-C-N	5.79	125.69	119.85
1	A	260	VAL	C-N-CA	5.79	125.69	119.85
1	A	291	THR	CA-C-N	5.35	125.42	119.32
1	A	291	THR	C-N-CA	5.35	125.42	119.32
1	C	291	THR	CA-C-N	5.29	125.36	119.32
1	C	291	THR	C-N-CA	5.29	125.36	119.32
1	B	291	THR	CA-C-N	5.27	125.33	119.32
1	B	291	THR	C-N-CA	5.27	125.33	119.32

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	1759	0	1697	3	0
1	B	1760	0	1700	3	0
1	C	1760	0	1700	3	0
All	All	5279	0	5097	9	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 1.

All (9) 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:C:252:GLY:N	1:C:253:PRO:HD2	2.28	0.48
1:B:252:GLY:N	1:B:253:PRO:HD2	2.29	0.48
1:A:252:GLY:N	1:A:253:PRO:HD2	2.29	0.47
1:C:144:LEU:HD23	1:C:170:ILE:HG23	2.00	0.44
1:A:144:LEU:HD23	1:A:170:ILE:HG23	2.00	0.43
1:B:144:LEU:HD23	1:B:170:ILE:HG23	2.00	0.42
1:A:214:MET:HA	1:A:215:PRO:HD2	1.95	0.41
1:B:223:LEU:HD23	1:B:223:LEU:C	2.46	0.41
1:C:223:LEU:HD23	1:C:223:LEU:C	2.46	0.41

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	256/910 (28%)	254 (99%)	2 (1%)	0	100	100
1	B	256/910 (28%)	254 (99%)	2 (1%)	0	100	100
1	C	256/910 (28%)	254 (99%)	2 (1%)	0	100	100
All	All	768/2730 (28%)	762 (99%)	6 (1%)	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	142/789 (18%)	141 (99%)	1 (1%)	76	77
1	B	143/789 (18%)	142 (99%)	1 (1%)	76	77
1	C	143/789 (18%)	142 (99%)	1 (1%)	76	77
All	All	428/2367 (18%)	425 (99%)	3 (1%)	73	77

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	170	ILE
1	A	170	ILE
1	B	170	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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.

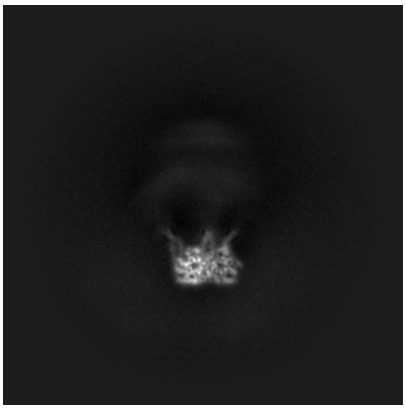
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-74825. These allow visual inspection of the internal detail of the map and identification of artifacts.

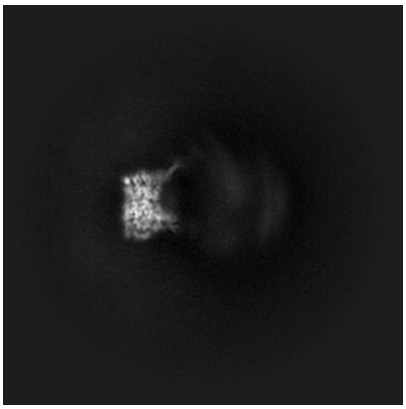
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections

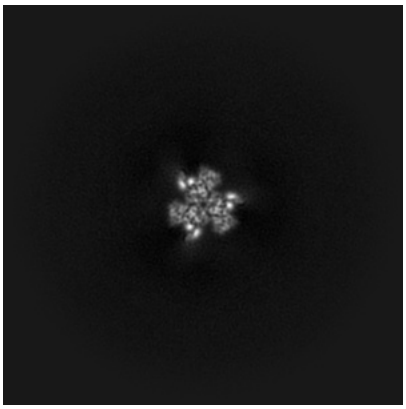
6.1.1 Primary map



X

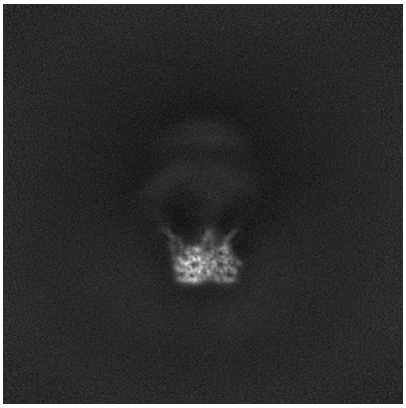


Y

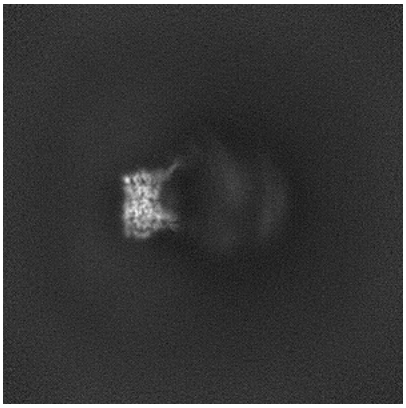


Z

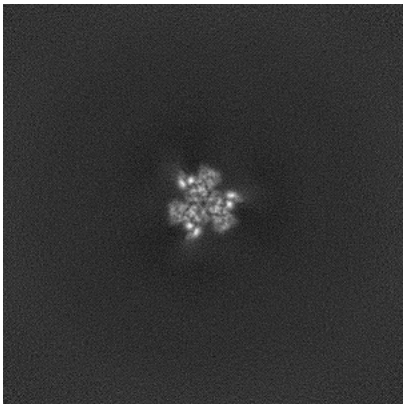
6.1.2 Raw map



X



Y

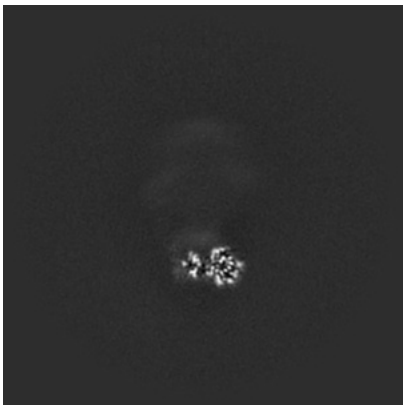


Z

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

6.2 Central slices (i)

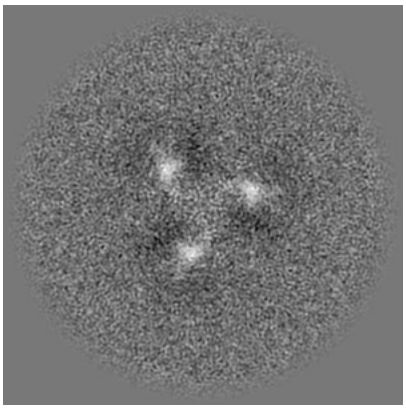
6.2.1 Primary map



X Index: 256

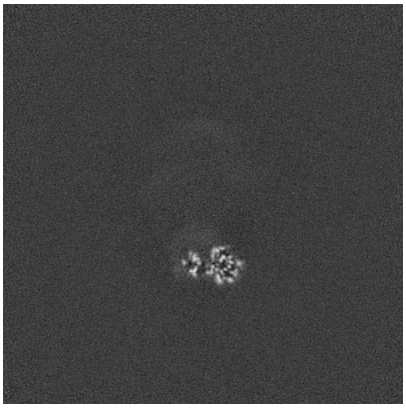


Y Index: 256



Z Index: 256

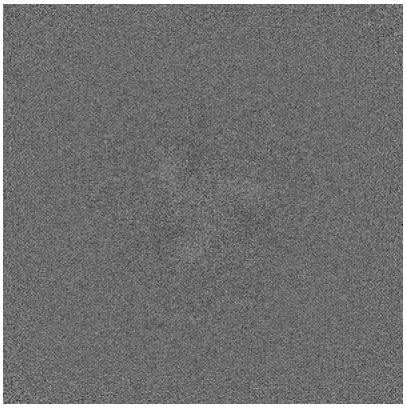
6.2.2 Raw map



X Index: 256



Y Index: 256



Z Index: 256

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

6.3 Largest variance slices (i)

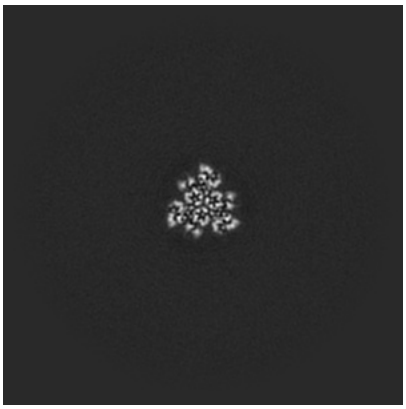
6.3.1 Primary map



X Index: 240

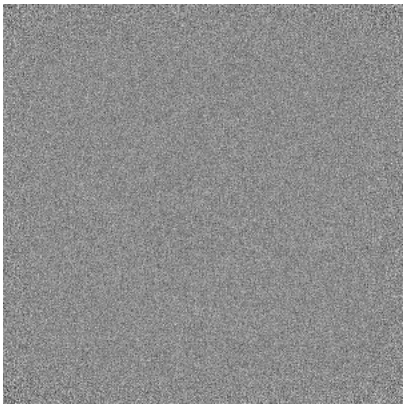


Y Index: 245

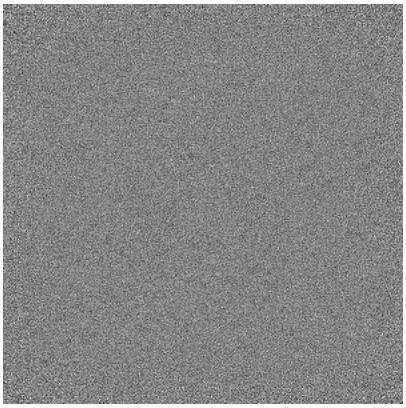


Z Index: 181

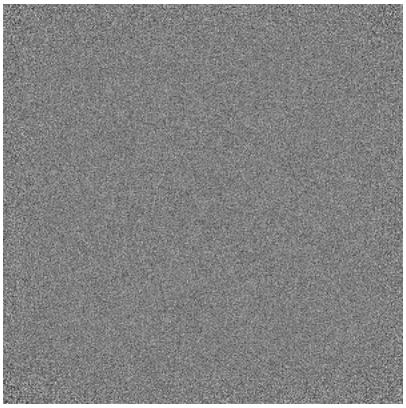
6.3.2 Raw map



X Index: 0



Y Index: 0



Z Index: 511

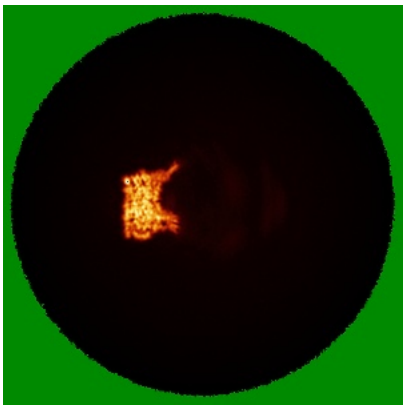
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) (i)

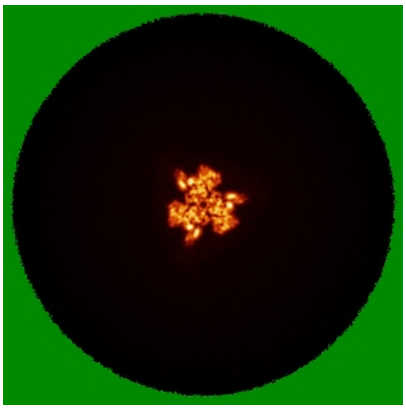
6.4.1 Primary map



X

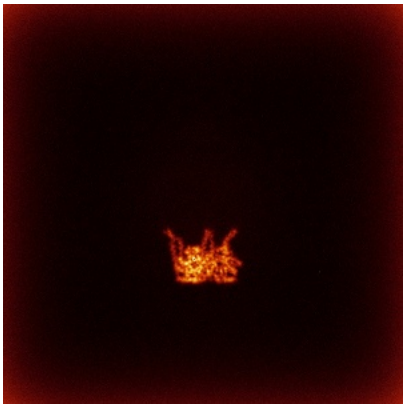


Y

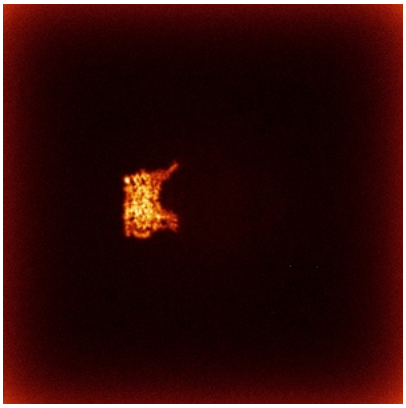


Z

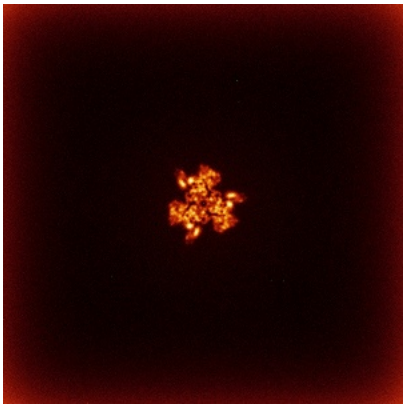
6.4.2 Raw map



X



Y

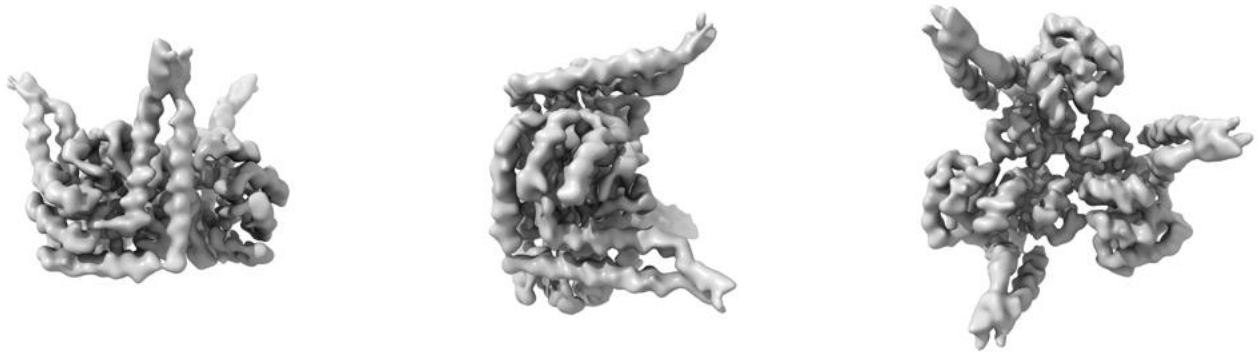


Z

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



X Y Z

The images above show the 3D surface view of the map at the recommended contour level 0.35. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 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.

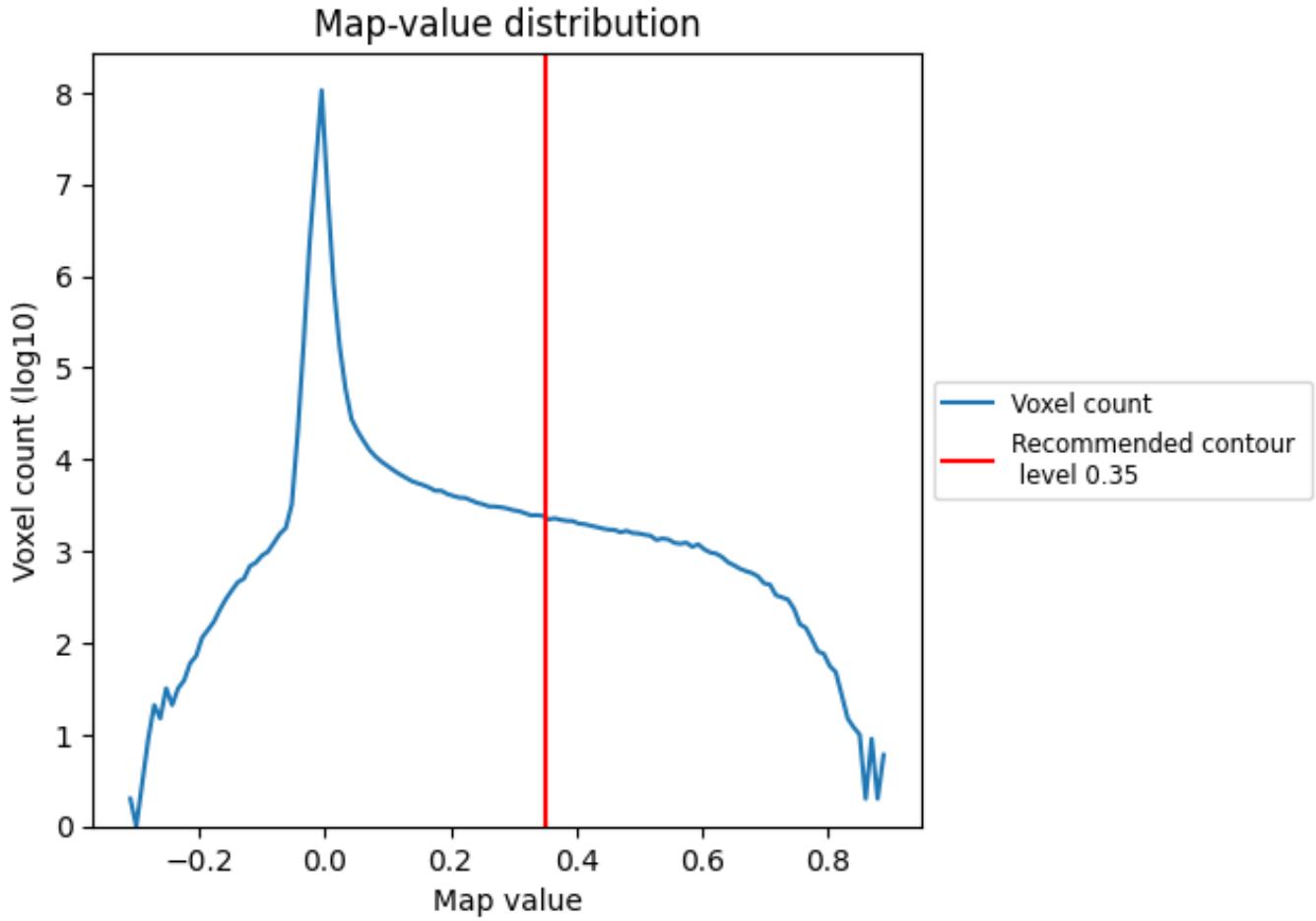
6.6 Mask visualisation (i)

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

7 Map analysis

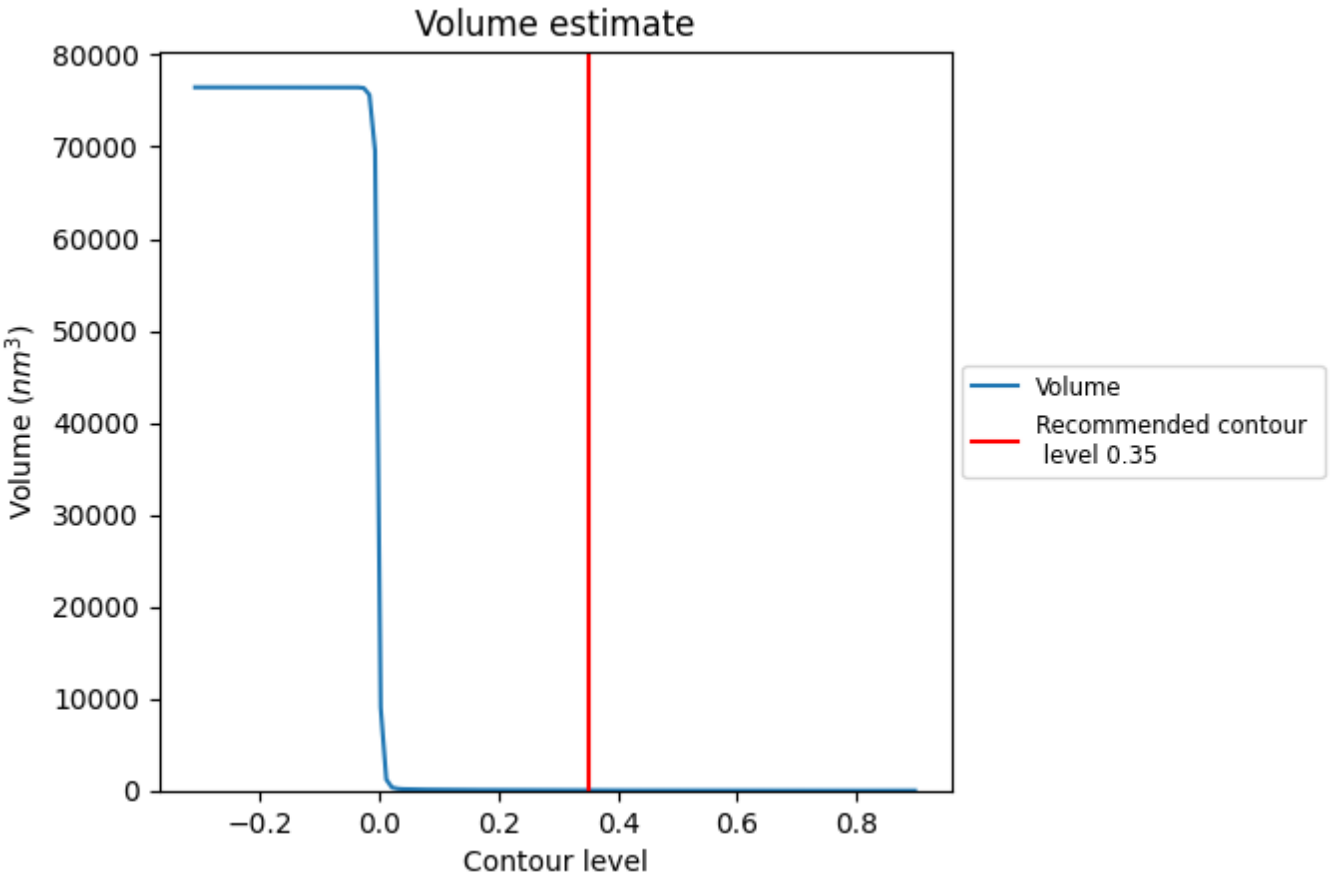
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution



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.

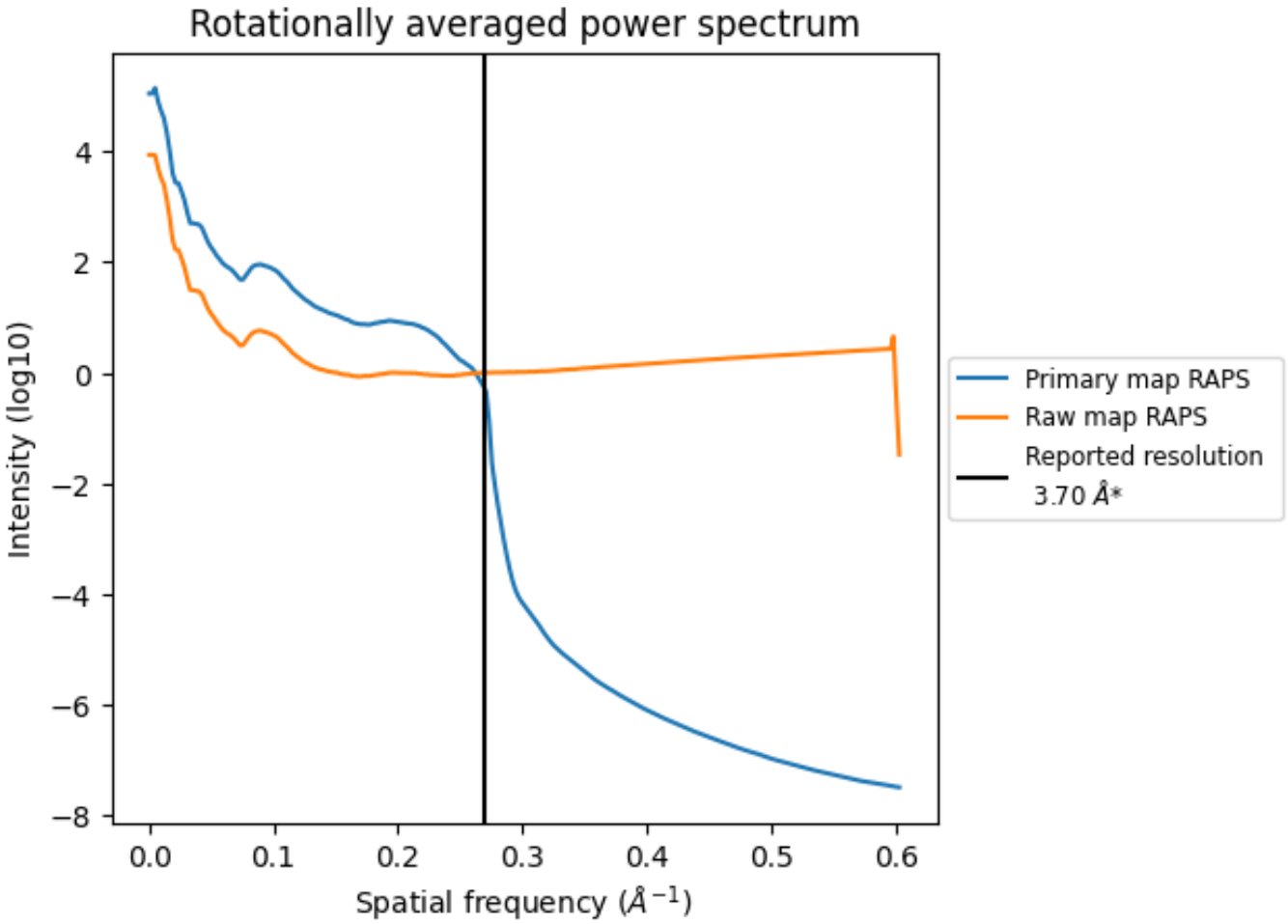
7.2 Volume estimate (i)



The volume at the recommended contour level is 32 nm^3; this corresponds to an approximate mass of 28 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)

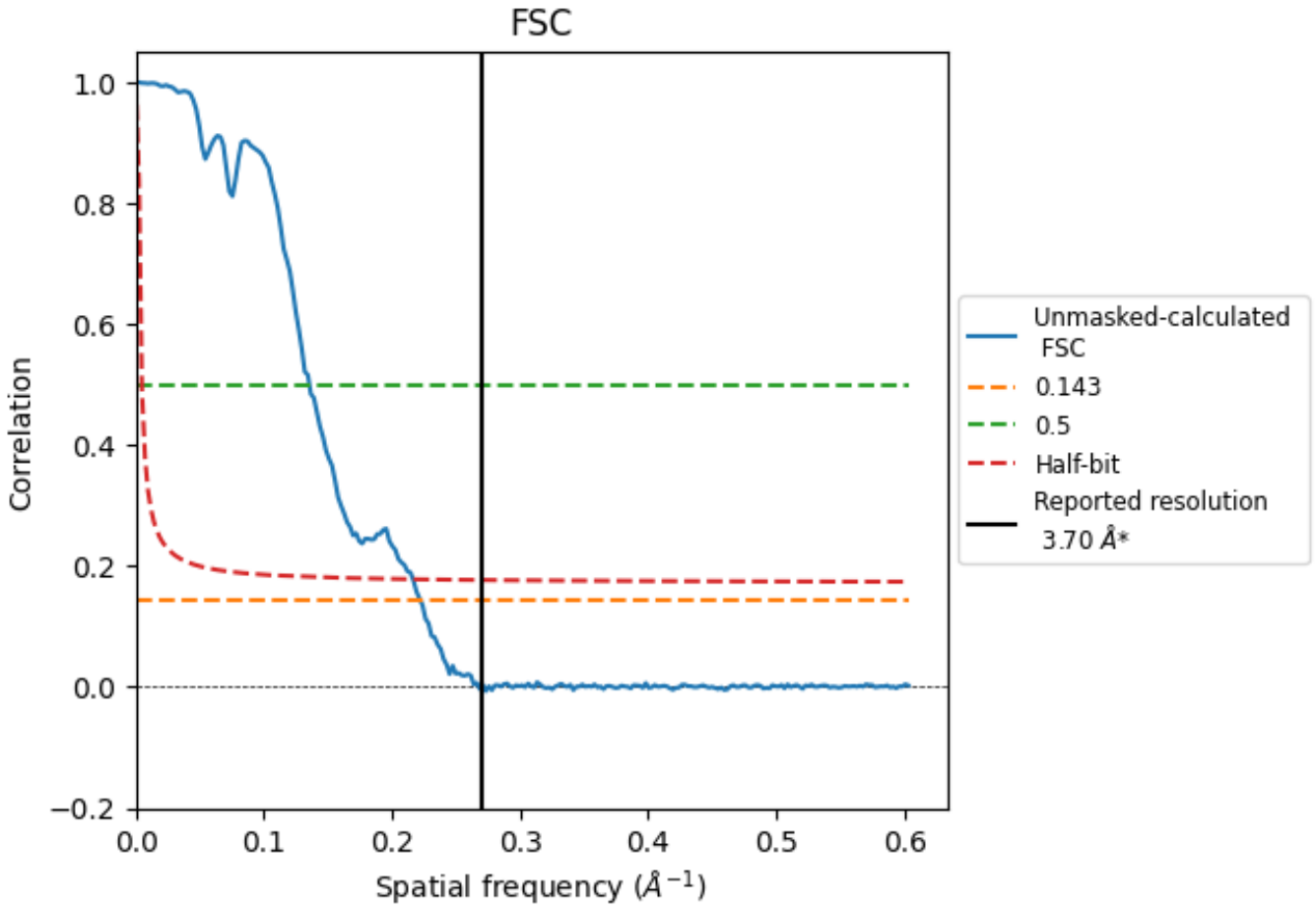


*Reported resolution corresponds to spatial frequency of 0.270 Å^{-1}

8 Fourier-Shell correlation

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



*Reported resolution corresponds to spatial frequency of 0.270 Å^{-1}

8.2 Resolution estimates (i)

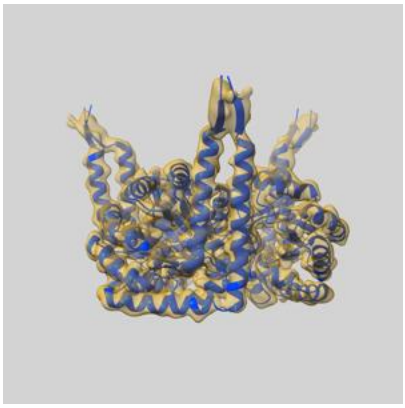
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.70	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	4.50	7.38	4.62

*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 4.50 differs from the reported value 3.7 by more than 10 %

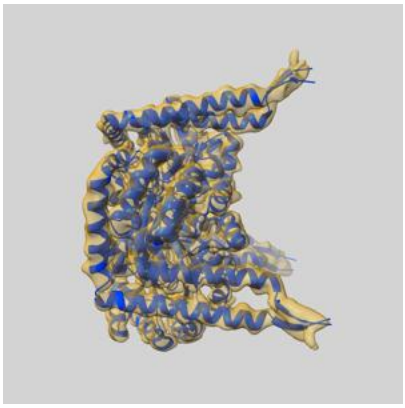
9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-74825 and PDB model 9ZUP. Per-residue inclusion information can be found in section 3 on page 4.

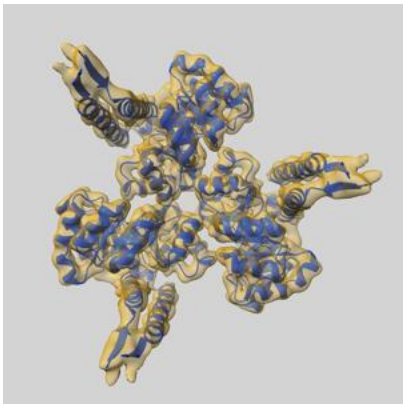
9.1 Map-model overlay



X



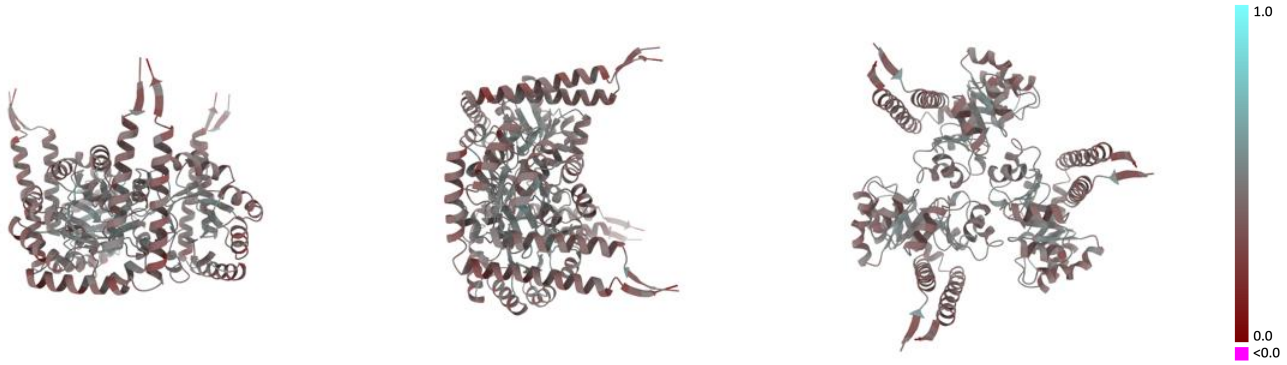
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.35 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.

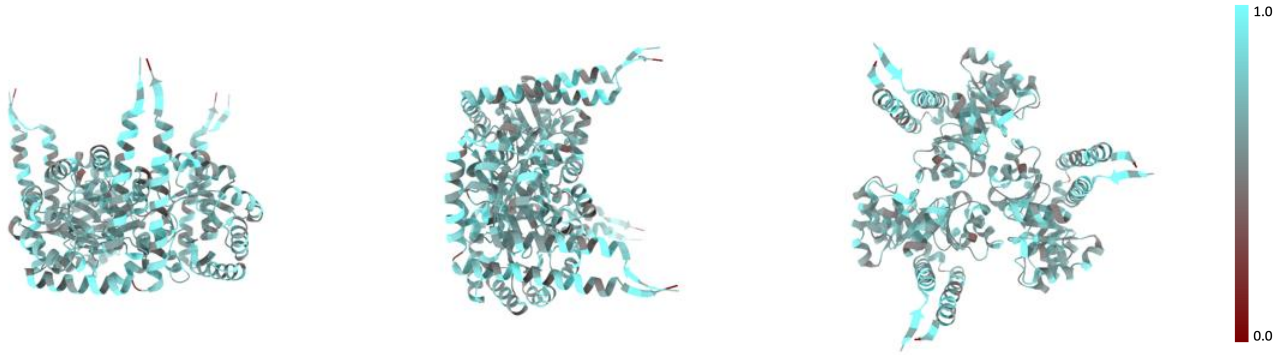
9.2 Q-score mapped to coordinate model (i)



X Y Z

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.

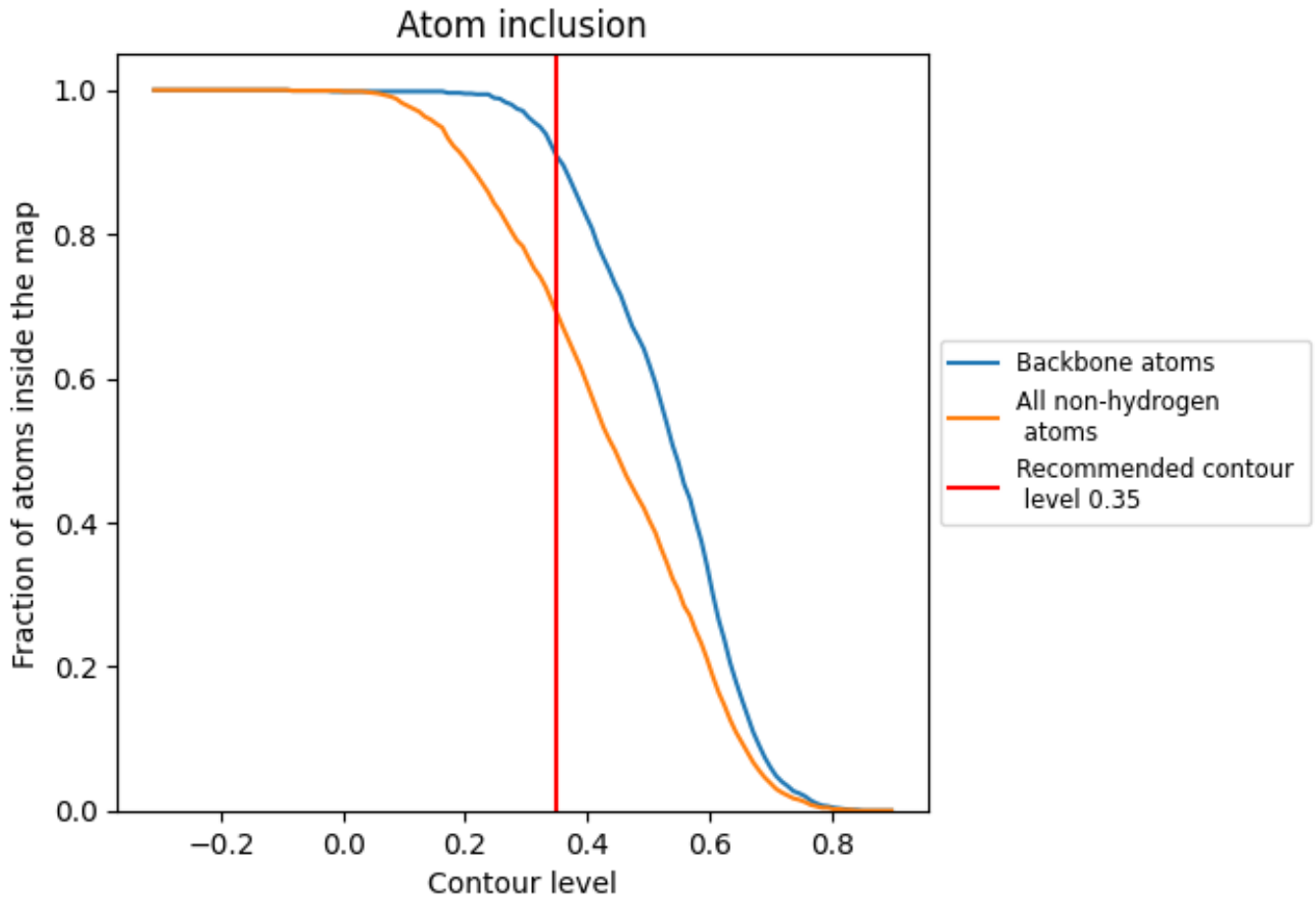
9.3 Atom inclusion mapped to coordinate model (i)



X Y Z

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 (0.35).

9.4 Atom inclusion (i)



At the recommended contour level, 91% of all backbone atoms, 69% 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 (0.35) and Q-score for the entire model and for each chain.



Chain	Atom inclusion	Q-score
All	0.6900	0.4230
A	0.6890	0.4220
B	0.6910	0.4230
C	0.6900	0.4240