Full wwPDB EM Validation Report (i)

Oct 18, 2026 – 03:08 PM JST

PDB ID	:	9V1M / pdb_00009v1m
EMDB ID	:	EMD-64698
Title	:	CTP synthase RXN-condition state 1
Authors	:	Guo, C.J.
Deposited on	:	2025-05-19
Resolution	:	3.20 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 (i) 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 (i)) were used in the production of this report:

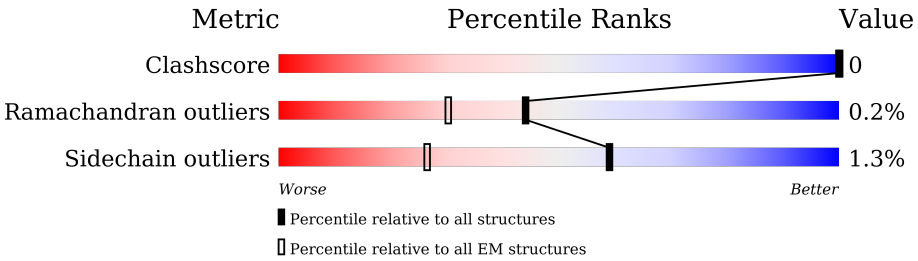
EMDB validation analysis	:	0.0.1.dev133
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4-5-2 with Phenix2.2
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics	:	202505.v01 (Using 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

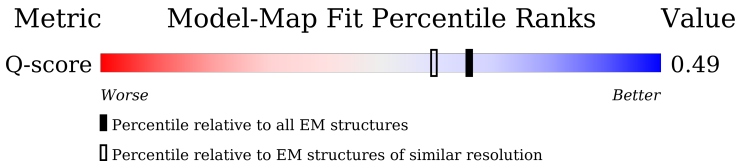
1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 3.20 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	15020 (2.70 - 3.70)

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	556	88% 9%
1	B	556	9% 91%
1	C	556	12% 88%

2 Entry composition (i)

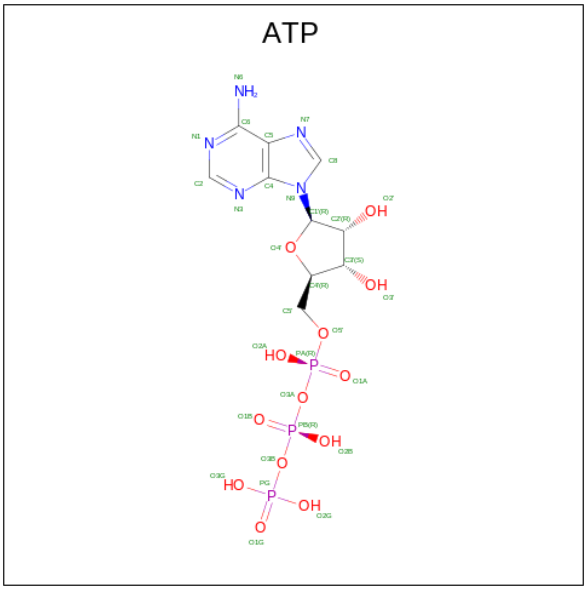
There are 4 unique types of molecules in this entry. The entry contains 4962 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 CTP synthase.

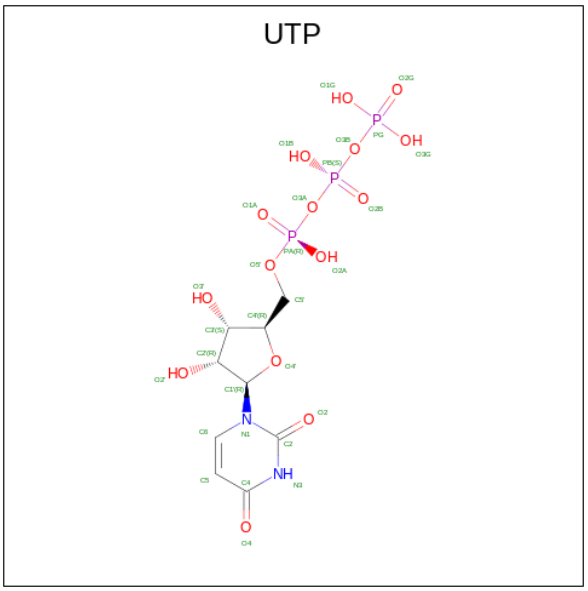
Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	504	3951	2511	690	729	21	0	0
			Total	C	N	O	S		
1	B	52	436	284	75	76	1	0	0
			Total	C	N	O	S		
1	C	67	513	322	92	96	3	0	0

- Molecule 2 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
2	A	1	31	10	5	13	3	0

- Molecule 3 is URIDINE 5'-TRIPHOSPHATE (CCD ID: UTP) (formula: $C_9H_{15}N_2O_{15}P_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
3	A	1	29	9	2	15	3	0

- Molecule 4 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

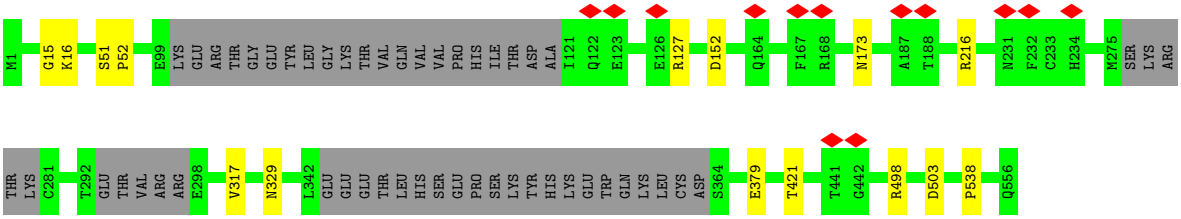
Mol	Chain	Residues	Atoms		AltConf
			Total	Mg	
4	A	1	1	1	0
4	C	1	1	1	0

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.

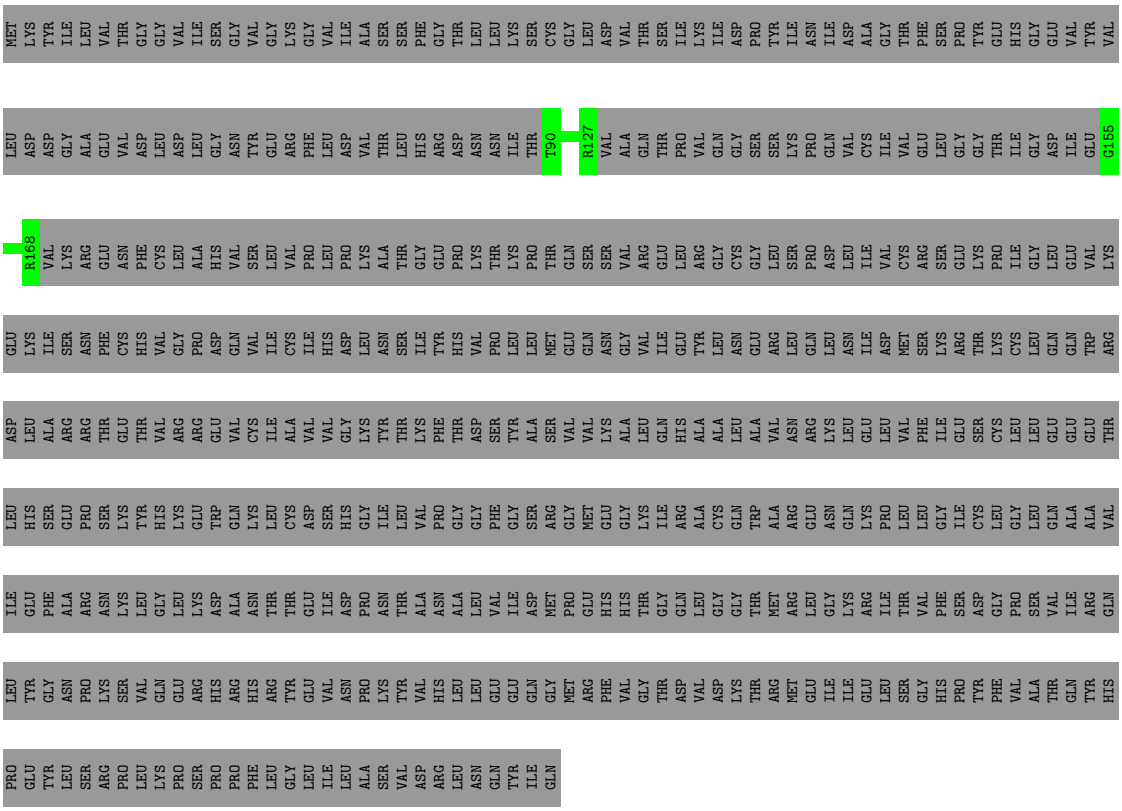
- Molecule 1: CTP synthase

Chain A:



- Molecule 1: CTP synthase

Chain B:



- Molecule 1: CTP synthase

Chain C: 12% 88%

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

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

ILE GLN GLU TRP VAL GLU ARG VAL ALA GLN THR PRO VAL GLN GLY SER SER LYS PRO GLN VAL CYS ILE VAL GLU LEU GLY THR ILE GLY ASP ILE GLU GLY MET PRO PHE VAL GLU ALA PHE ARG GLN PHE GLN PHE ARG VAL LYS ARG GLU ASN PHE CYS LEU ALA H178 G205

CYS GLY LEU S209 R216 N247 SER ILE TYR HIS VAL PRO LEU LEU MET GLU GLN ASN GLY VAL ILE GLU TYR LEU ASN GLU ARG LEU GLN LEU ASN ILE ASP MET SER LYS ARG THR LYS CYS LEU GLN GLN TRP ARG ASP LEU ALA ARG ARG THR GLU THR VAL ARG ARG GLU VAL

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

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

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

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

PHE LEU GLY LEU ILE LEU ALA SER VAL ASP ARG LEU ASN GLN TYR ILE GLN

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	79751	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 ($e^-/Å^2$)	60	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	0.794	Depositor
Minimum map value	-0.553	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.011	Depositor
Recommended contour level	0.05	Depositor
Map size (Å)	262.4, 262.4, 262.4	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.025, 1.025, 1.025	Depositor

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: ATP, MG, UTP

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	0.73	0/4027	1.34	8/5447 (0.1%)
1	B	0.71	0/445	1.34	0/597
1	C	0.75	0/522	1.38	1/706 (0.1%)
All	All	0.73	0/4994	1.35	9/6750 (0.1%)

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	538	PRO	N-CA-C	6.64	118.80	110.70
1	A	152	ASP	CA-CB-CG	5.83	118.43	112.60
1	A	216	ARG	NE-CZ-NH2	5.50	124.15	119.20
1	C	216	ARG	NE-CZ-NH2	5.32	123.98	119.20
1	A	498	ARG	NE-CZ-NH2	5.21	123.89	119.20
1	A	127	ARG	NE-CZ-NH2	5.07	123.77	119.20
1	A	15	GLY	CA-C-N	5.04	127.03	120.28
1	A	15	GLY	C-N-CA	5.04	127.03	120.28
1	A	173	ASN	CA-CB-CG	5.02	117.62	112.60

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	3951	0	3996	0	0
1	B	436	0	438	0	0
1	C	513	0	531	0	0
2	A	31	0	12	0	0
3	A	29	0	11	0	0
4	A	1	0	0	0	0
4	C	1	0	0	0	0
All	All	4962	0	4988	0	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 0.

There are no clashes within the asymmetric unit.

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	494/556 (89%)	481 (97%)	12 (2%)	1 (0%)	43 73
1	B	48/556 (9%)	48 (100%)	0	0	100 100
1	C	63/556 (11%)	61 (97%)	2 (3%)	0	100 100
All	All	605/1668 (36%)	590 (98%)	14 (2%)	1 (0%)	44 73

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	52	PRO

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	437/486 (90%)	430 (98%)	7 (2%)	55	75
1	B	46/486 (10%)	46 (100%)	0	100	100
1	C	62/486 (13%)	62 (100%)	0	100	100
All	All	545/1458 (37%)	538 (99%)	7 (1%)	59	78

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	16	LYS
1	A	51	SER
1	A	317	VAL
1	A	329	ASN
1	A	379	GLU
1	A	421	THR
1	A	503	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	87	ASN
1	A	122	GLN
1	A	140	GLN
1	A	258	GLN
1	A	266	ASN
1	A	270	GLN
1	A	392	GLN
1	A	430	ASN
1	A	475	GLN
1	B	112	GLN
1	B	164	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)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
3	UTP	A	602	4	26,30,30	1.03	1 (3%)	39,47,47	1.34	5 (12%)
2	ATP	A	601	4	29,33,33	0.96	0	44,52,52	1.29	6 (13%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	UTP	A	602	4	-	0/22/38/38	0/2/2/2
2	ATP	A	601	4	-	2/22/38/38	0/3/3/3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	602	UTP	C4-N3	-2.23	1.34	1.38

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	602	UTP	PB-O3A-PA	-3.94	119.32	132.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	602	UTP	PB-O3B-PG	-3.45	120.99	132.83
2	A	601	ATP	PB-O3B-PG	-3.29	121.54	132.83
2	A	601	ATP	PA-O3A-PB	-2.96	122.66	132.83
2	A	601	ATP	C5-C4-N3	-2.84	123.04	126.75
3	A	602	UTP	O3G-PG-O3B	2.68	113.62	104.64
2	A	601	ATP	C4-C5-N7	2.58	113.76	110.62
3	A	602	UTP	O4'-C1'-C2'	-2.32	101.59	106.64
3	A	602	UTP	C5-C6-N1	-2.24	118.05	121.81
2	A	601	ATP	C5-C6-N1	2.24	122.20	117.39
2	A	601	ATP	N3-C4-N9	2.09	130.52	127.08

There are no chirality outliers.

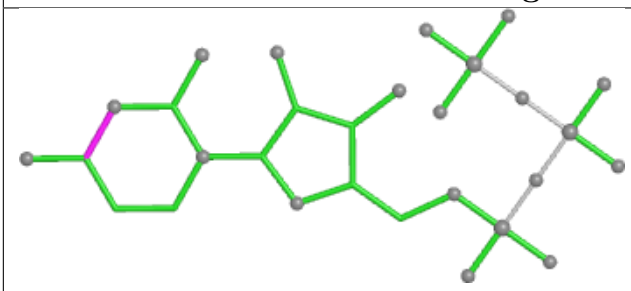
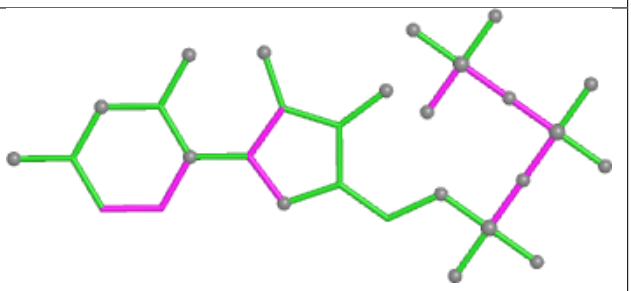
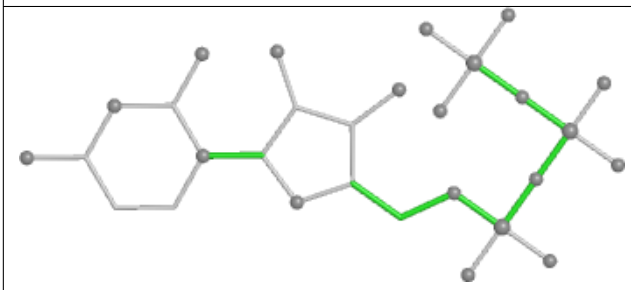
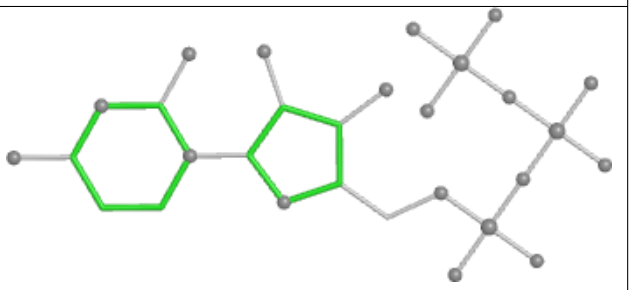
All (2) torsion outliers are listed below:

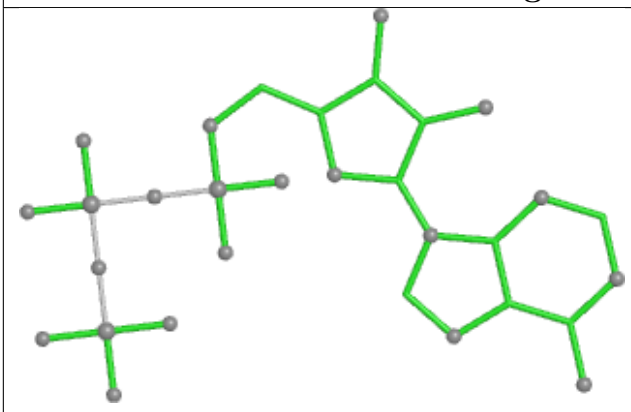
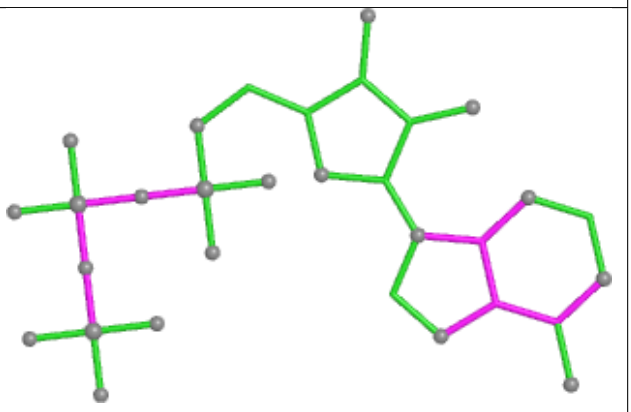
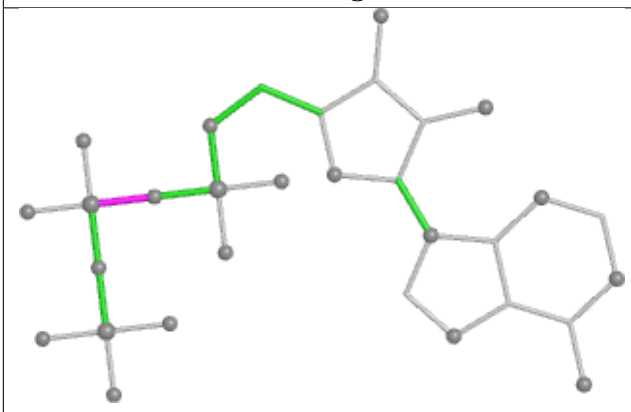
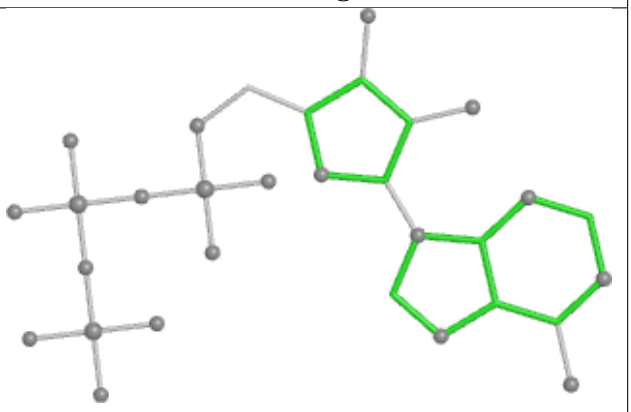
Mol	Chain	Res	Type	Atoms
2	A	601	ATP	PA-O3A-PB-O2B
2	A	601	ATP	PA-O3A-PB-O1B

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand UTP A 602	
 Bond lengths	 Bond angles
 Torsions	 Rings

Ligand ATP A 601	
 Bond lengths	 Bond angles
 Torsions	 Rings

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.

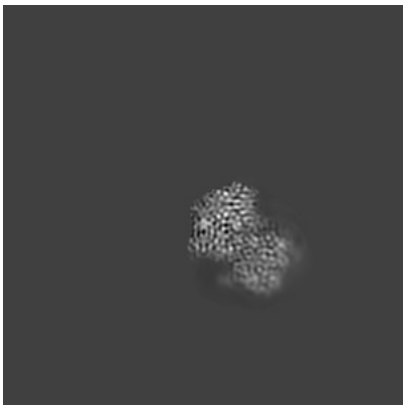
6 Map visualisation (i)

This section contains visualisations of the EMDB entry EMD-64698. These allow visual inspection of the internal detail of the map and identification of artifacts.

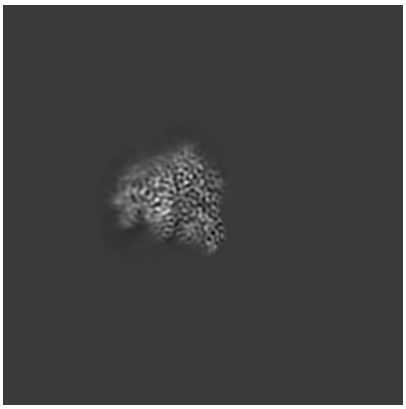
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections (i)

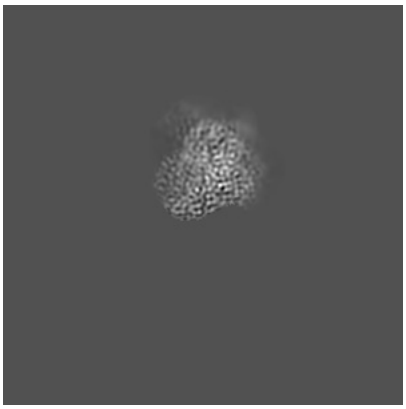
6.1.1 Primary map



X

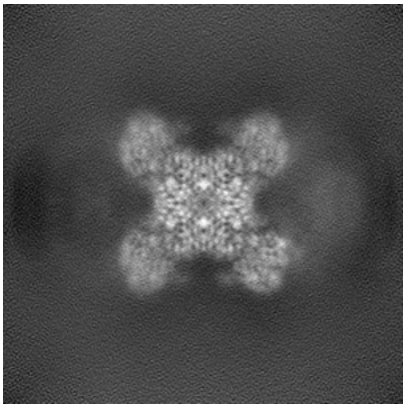


Y

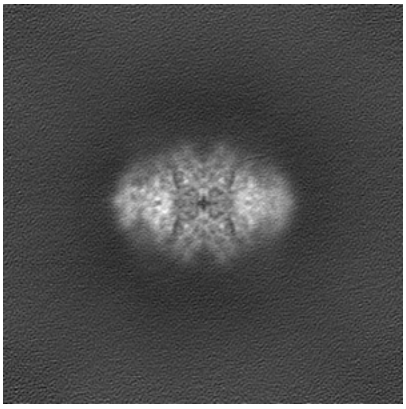


Z

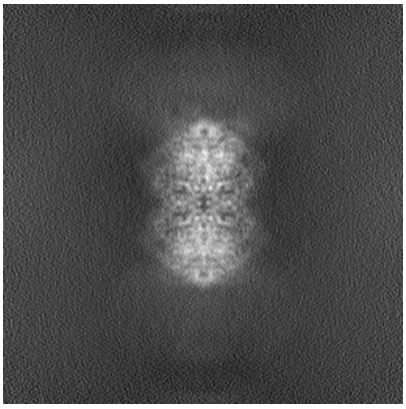
6.1.2 Raw map



X



Y



Z

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

6.2 Central slices (i)

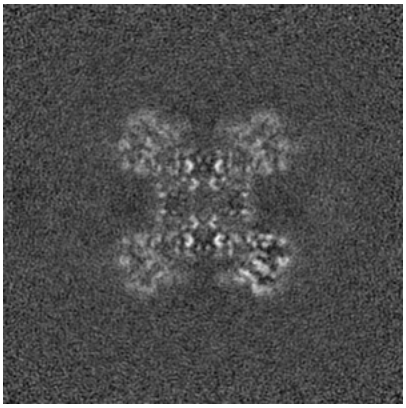
6.2.1 Primary map

X Index: 128

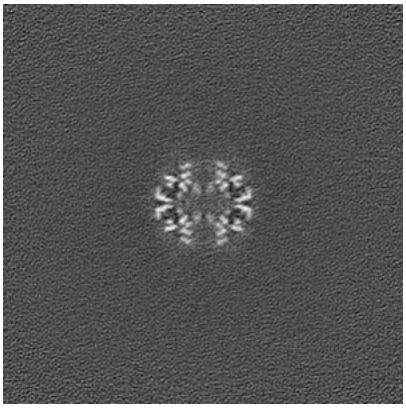
Y Index: 128

Z Index: 128

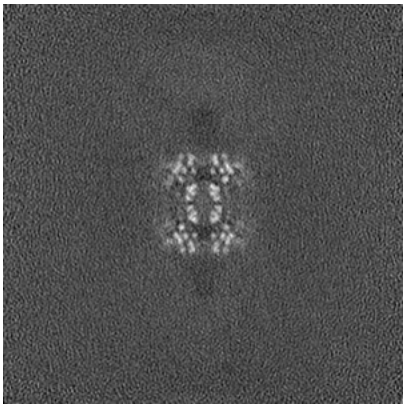
6.2.2 Raw map



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)

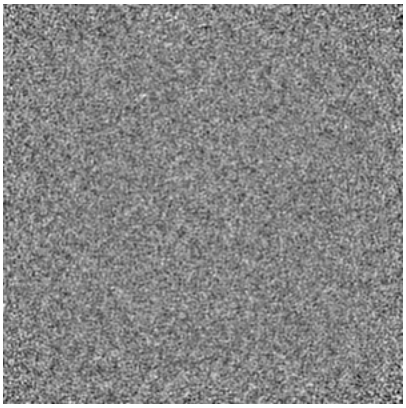
6.3.1 Primary map

X Index: 140

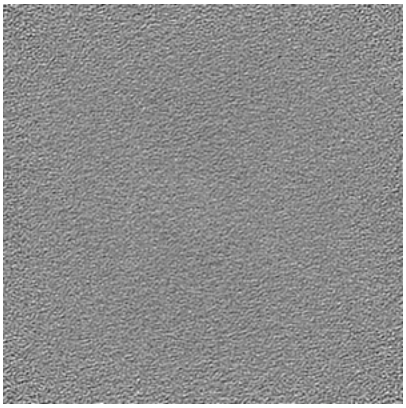
Y Index: 143

Z Index: 105

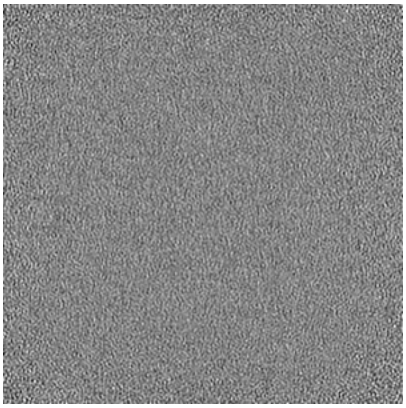
6.3.2 Raw map



X Index: 0



Y Index: 0

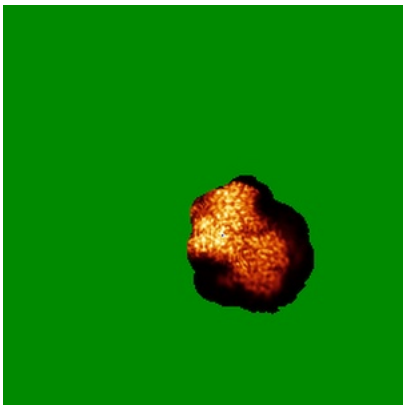


Z Index: 0

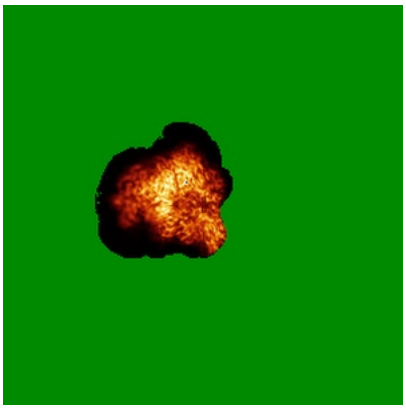
The images above show the largest variance slices of the map in three orthogonal directions.

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

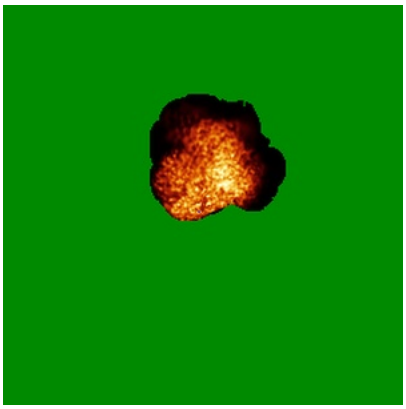
6.4.1 Primary map



X

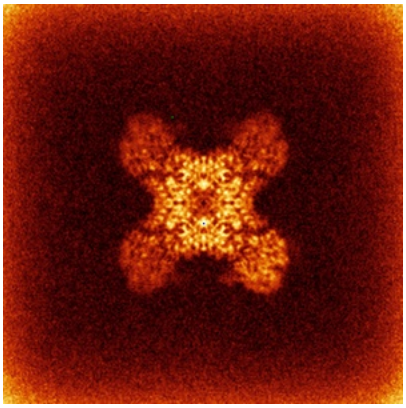


Y

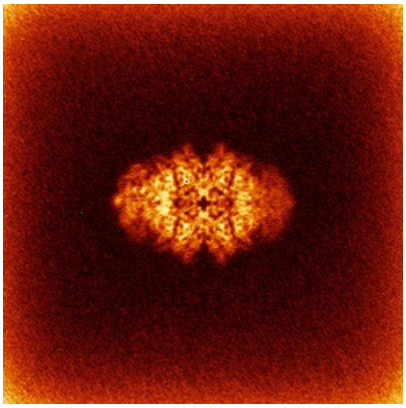


Z

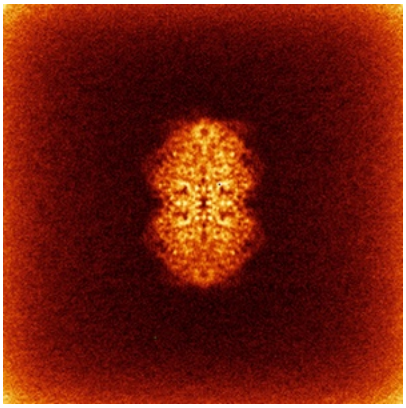
6.4.2 Raw map



X



Y

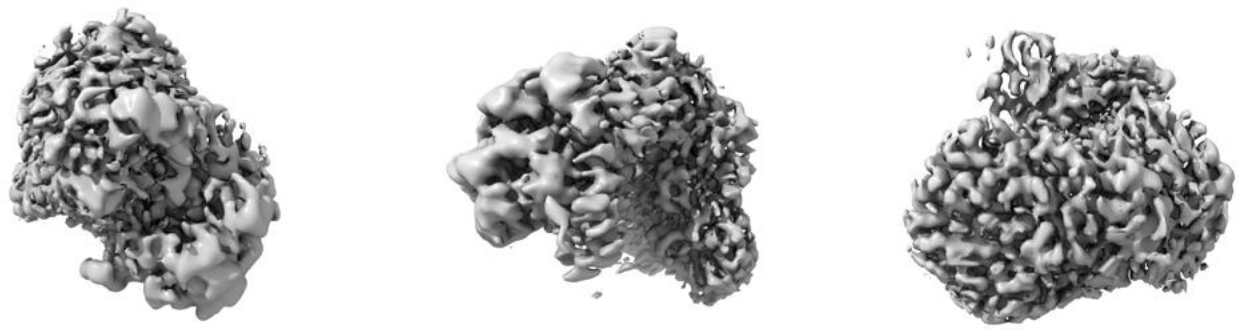


Z

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 0.05. 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.

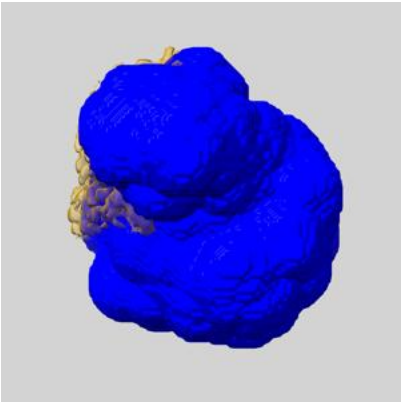
6.6 Mask visualisation (i)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

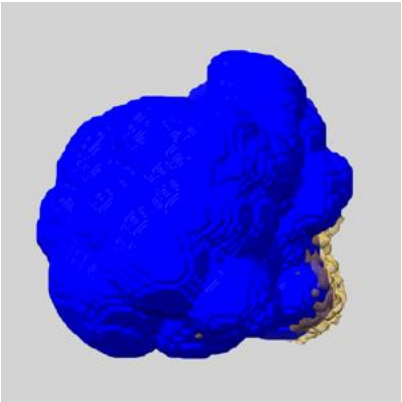
A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

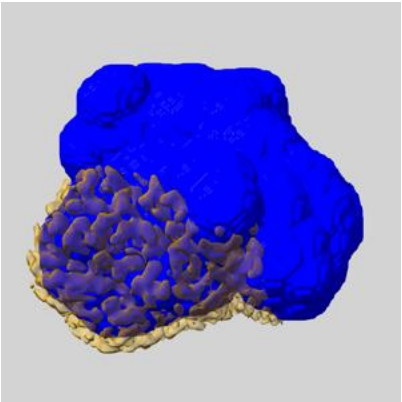
6.6.1 emd_64698_msk_1.map (i)



X



Y

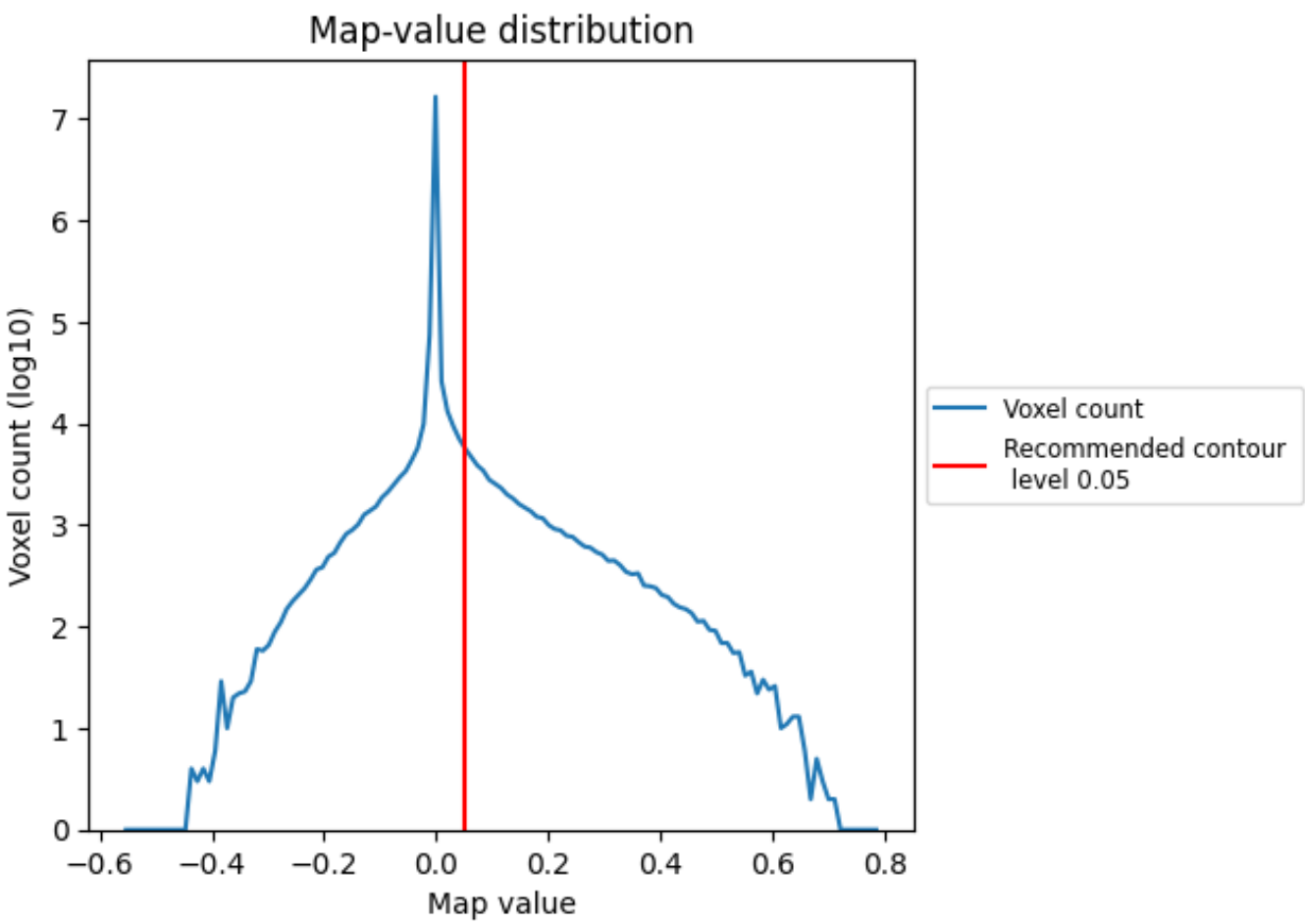


Z

7 Map analysis (i)

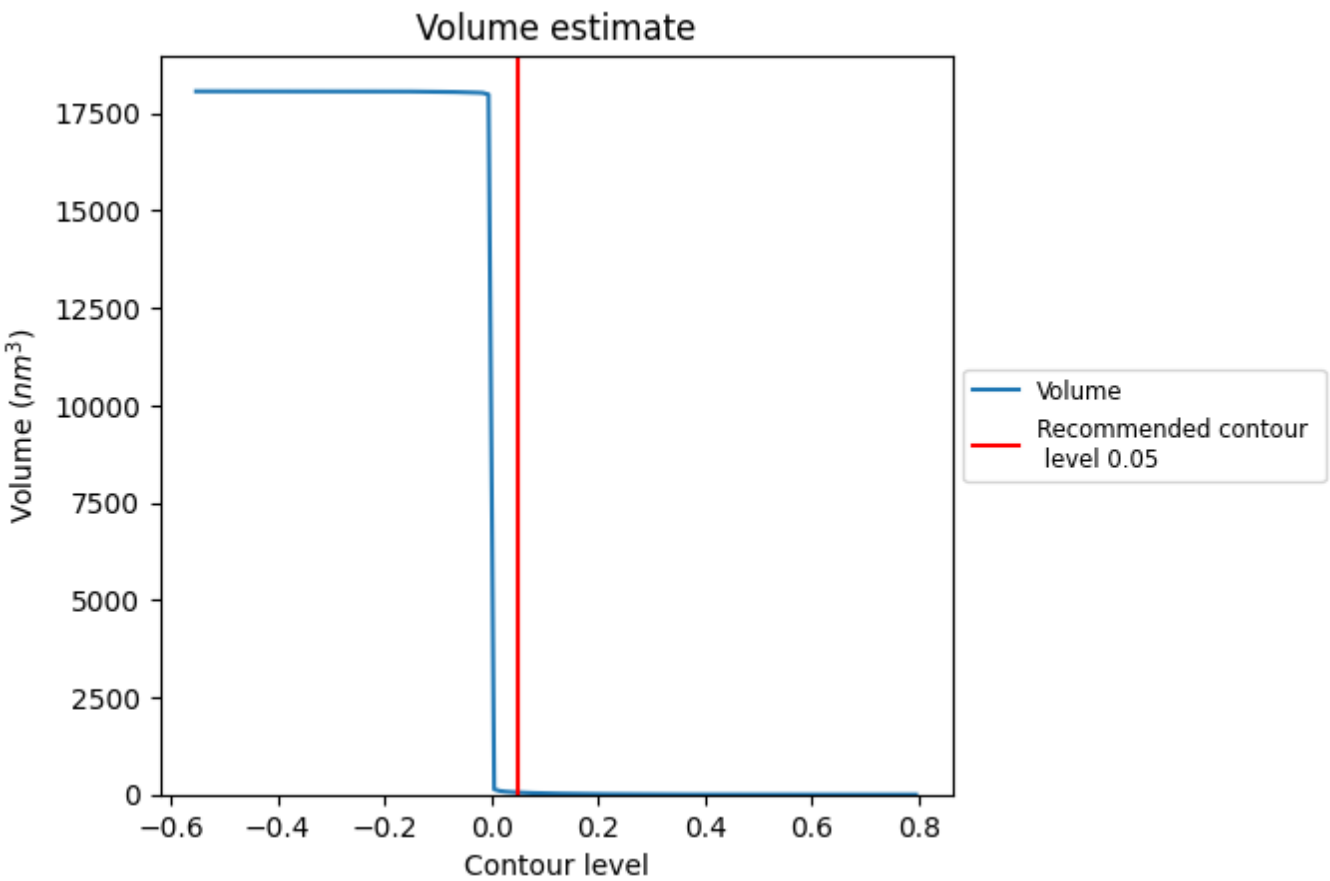
This section contains the results of statistical analysis of the map.

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.

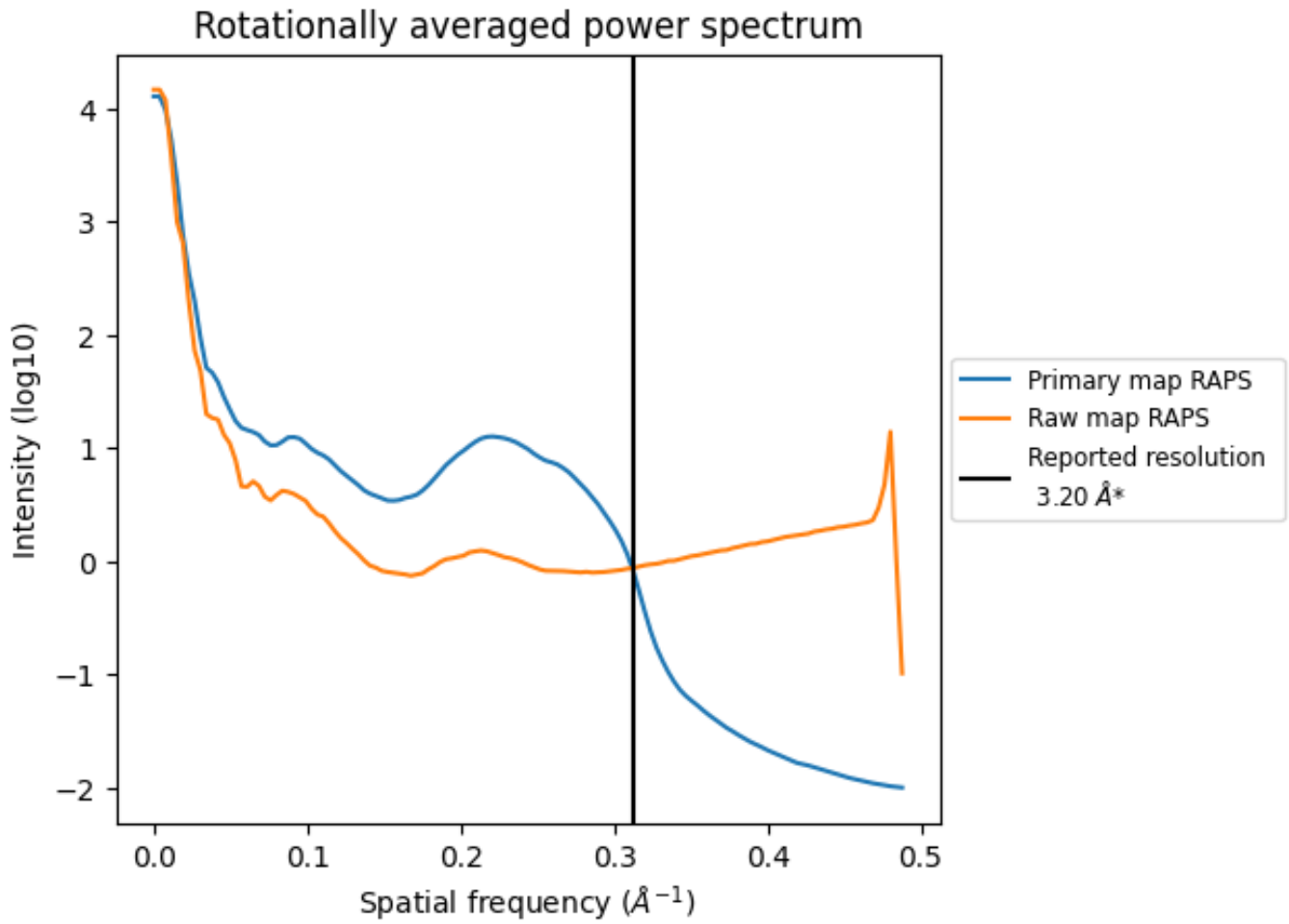
7.2 Volume estimate (i)



The volume at the recommended contour level is 53 nm^3; this corresponds to an approximate mass of 48 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)

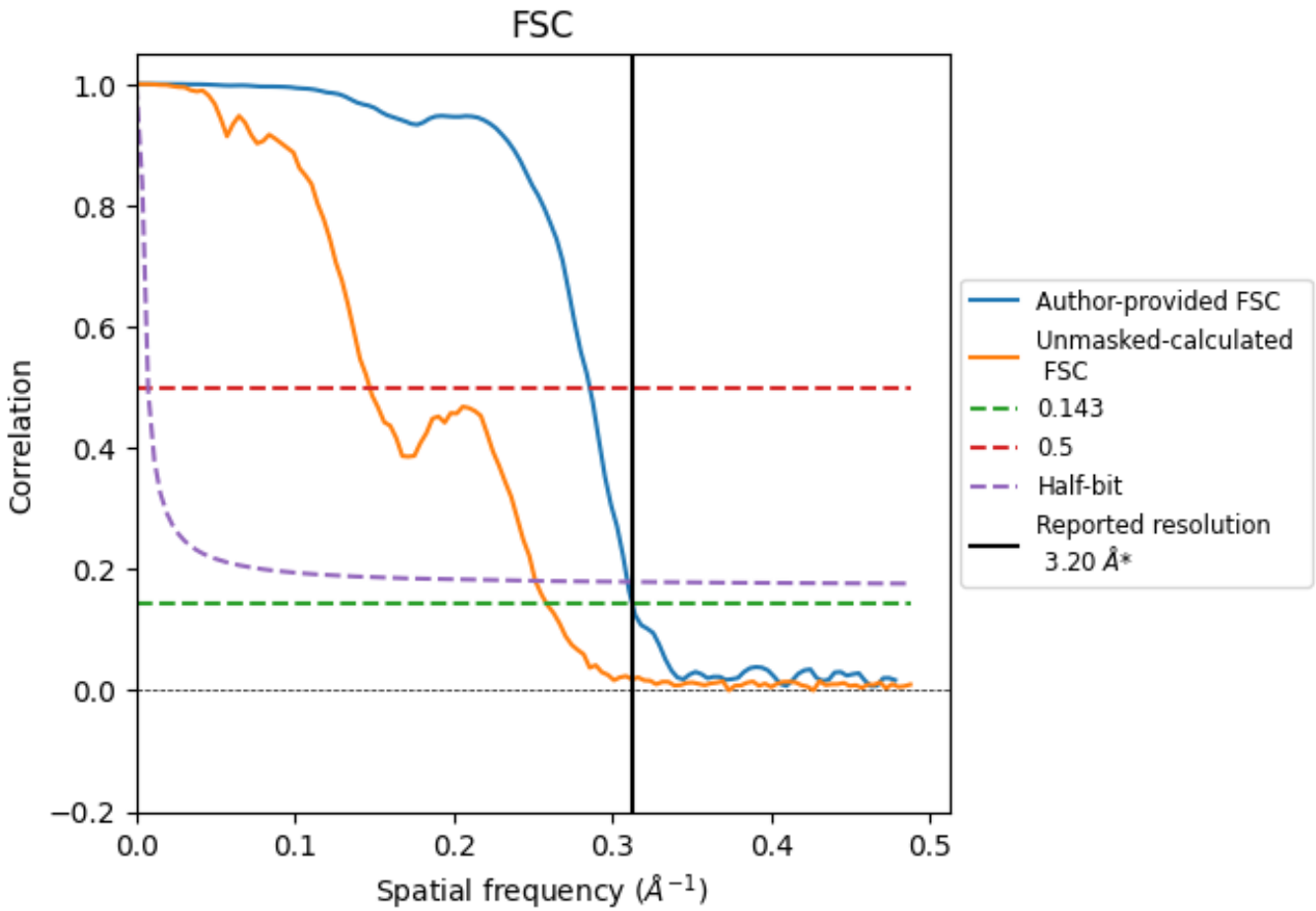


*Reported resolution corresponds to spatial frequency of 0.312 Å^{-1}

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 0.312 Å^{-1}

8.2 Resolution estimates (i)

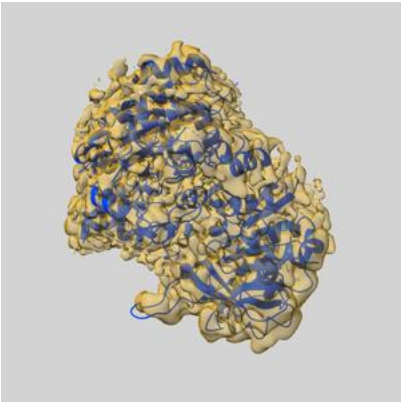
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.20	-	-
Author-provided FSC curve	3.20	3.50	3.23
Unmasked-calculated*	3.87	6.80	3.98

*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 3.87 differs from the reported value 3.2 by more than 10 %

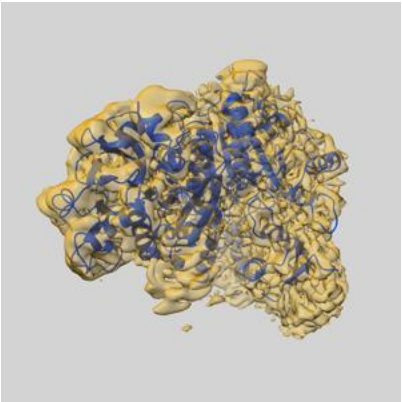
9 Map-model fit (i)

This section contains information regarding the fit between EMDB map EMD-64698 and PDB model 9V1M. Per-residue inclusion information can be found in section 3 on page 5.

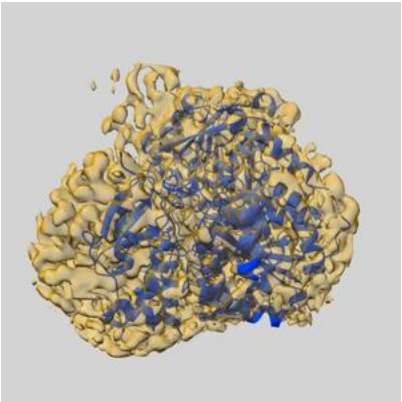
9.1 Map-model overlay (i)



X



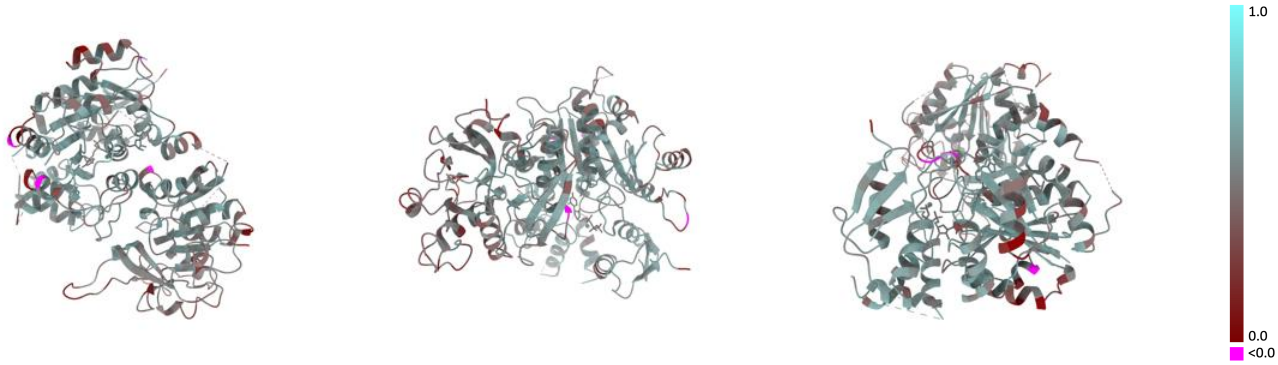
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.05 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.

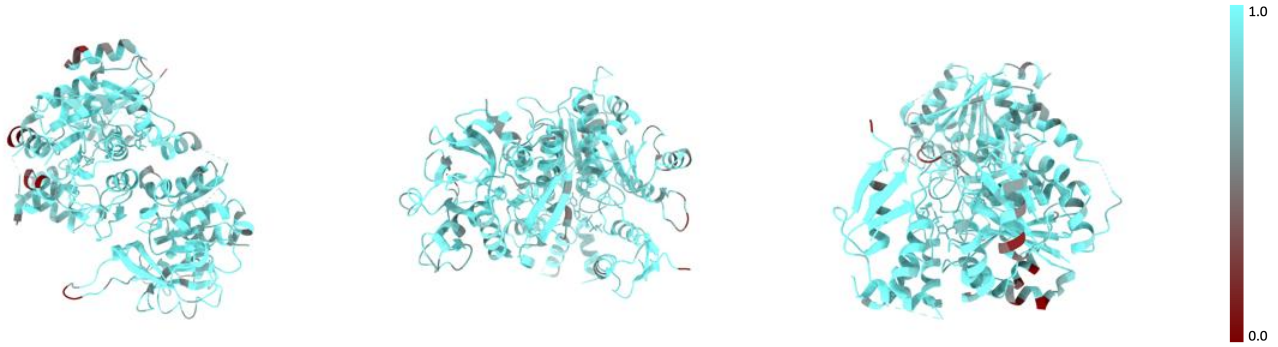
9.2 Q-score mapped to coordinate model (i)



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.

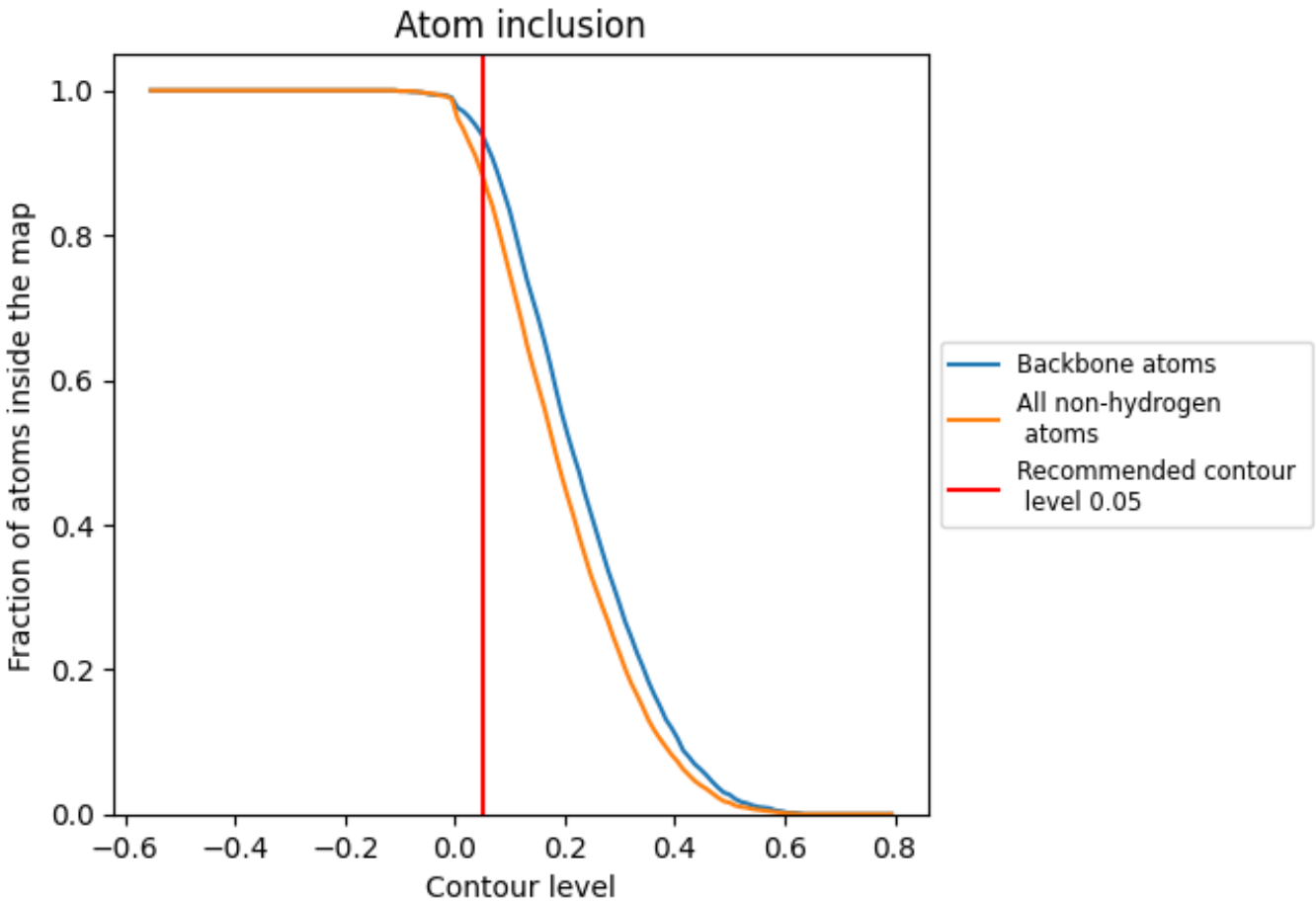
9.3 Atom inclusion mapped to coordinate model (i)



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 (0.05).

9.4 Atom inclusion (i)



At the recommended contour level, 94% of all backbone atoms, 88% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary (i)

The table lists the average atom inclusion at the recommended contour level (0.05) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8830	0.4900
A	0.8750	0.4790
B	0.9250	0.5550
C	0.9130	0.5270