



wwPDB EM Validation Summary Report ⓘ

May 23, 2026 – 03:28 PM EDT

PDB ID : 11DR / pdb_000011dr
EMDB ID : EMD-75638
Title : Human Brain RNA Vault Shoulder bound to ADPR, focused refinement (EMPIAR-10766)
Authors : Osinski, A.; Tagliabracci, V.S.
Deposited on : 2026-02-18
Resolution : 2.62 Å(reported)

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
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
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) : 2.49

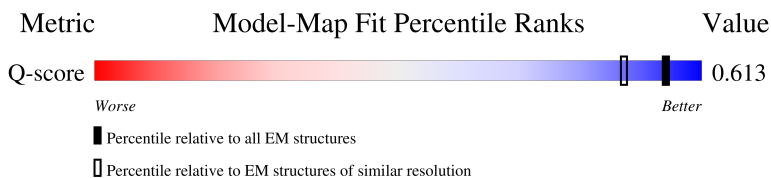
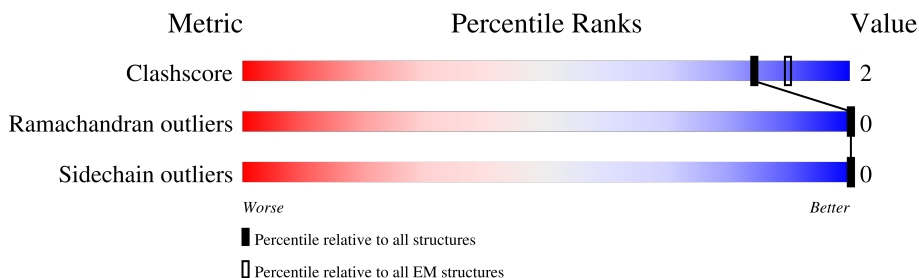
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.62 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	8810 (2.12 - 3.12)

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.

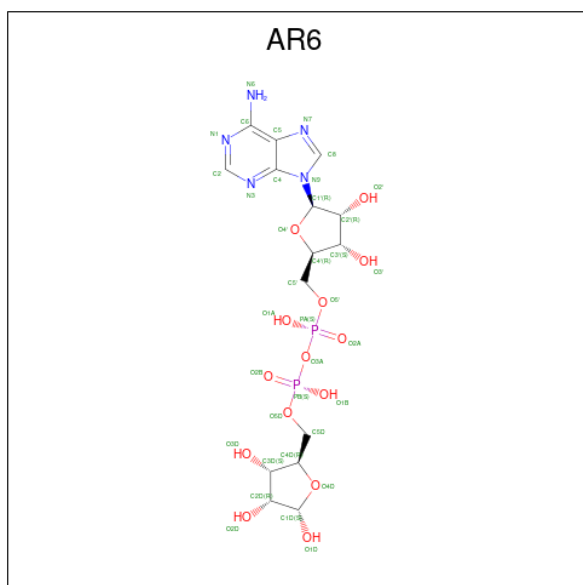
Mol	Chain	Length	Quality of chain
1	A	893	
1	B	893	
1	C	893	

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 Major vault protein.

Mol	Chain	Residues	Atoms						AltConf	Trace
1	A	254	Total 4003	C 1260	H 1998	N 366	O 376	S 3	0	0
1	B	254	Total 4001	C 1260	H 1996	N 366	O 376	S 3	0	0
1	C	254	Total 4001	C 1260	H 1996	N 366	O 376	S 3	0	0

- Molecule 2 is [(2R,3S,4R,5R)-5-(6-AMINOPURIN-9-YL)-3,4-DIHYDROXY-OXOLAN-2-YL]METHYL[HYDROXY-[(2R,3S,4R,5S)-3,4,5-TRIHYDROXYOXOLAN-2-YL]METHOXY]PHOSPHORYL] HYDROGEN PHOSPHATE (CCD ID: AR6) (formula: C₁₅H₂₃N₅O₁₄P₂) (labeled as "Ligand of Interest" by depositor).

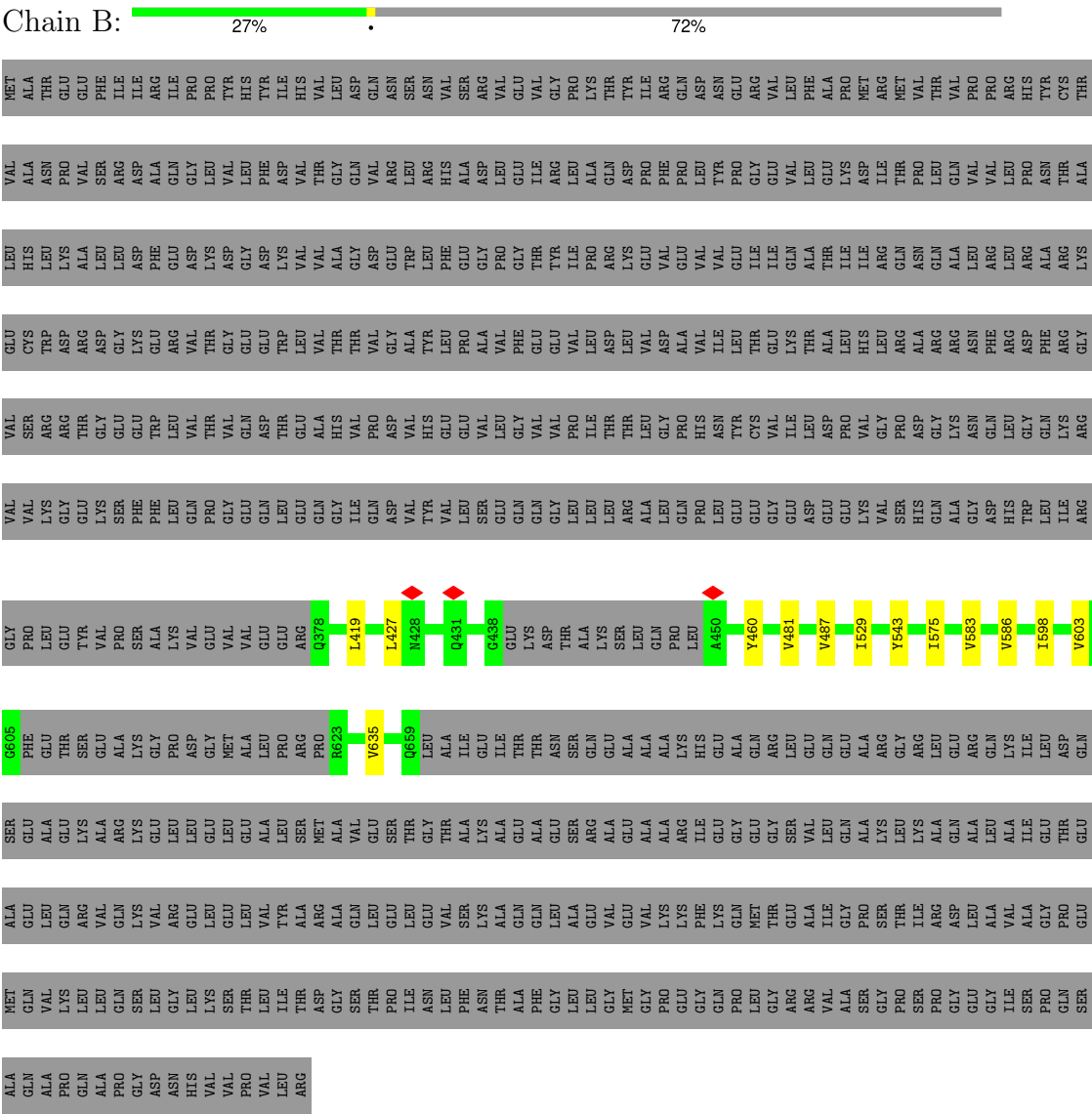


Mol	Chain	Residues	Atoms						AltConf
2	A	1	Total 57	C 15	H 21	N 5	O 14	P 2	0
2	B	1	Total 57	C 15	H 21	N 5	O 14	P 2	0

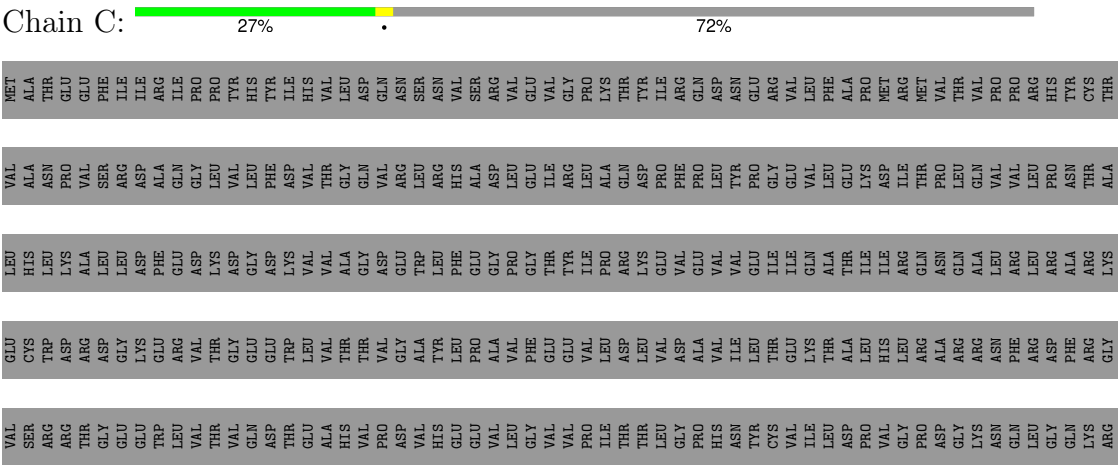
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Mol	Chain	Residues	Atoms						AltConf
2	C	1	Total	C	H	N	O	P	0
			57	15	21	5	14	2	



• Molecule 1: Major vault protein



GLY	ILE	VAL	ALA	LEU	GLN	V586	GLY	VAL
SER	PRO	ALA	ILE	ALA	LYS	D590	PRO	VAL
GLY	GLY	PRO	THR	ILE	LEU	V603	GLY	LYS
SER	GLN	GLY	THR	THR	ASP	P604	TYR	GLY
ALA	SER	GLY	GLY	GLY	SER	G605	VAL	LYS
GLN	GLN	MET	ALA	ALA	SER	PHE	PRO	SER
GLN	GLY	VAL	GLY	GLY	GLU	ALA	SER	PHE
PRO	ALA	VAL	LEU	LEU	ALA	THR	LYS	PHE
GLY	PRO	VAL	GLN	ARG	LYS	GLY	VAL	LEU
ASP	SER	GLY	GLN	VAL	ALA	GLU	GLY	GLN
ASN	GLY	VAL	LYS	GLN	ARG	ALA	VAL	PRO
HIS	VAL	VAL	VAL	VAL	LYS	ALA	GLY	GLY
VAL	VAL	SER	SER	GLY	LEU	MET	GLY	GLN
PRO	PRO	THR	THR	LEU	GLY	ALA	GLY	ILE
VAL	VAL	LEU	LEU	VAL	ALA	ALA	ILE	GLN
LEU	LEU	ILE	ILE	TYR	LEU	VAL	ASP	GLN
ARG	ARG	THR	THR	ALA	SER	ALA	ARG	VAL
		ASP	ASP	ARG	MET	PRO	ARG	TYR
		GLY	GLY	ALA	ALA	B623	GLY	LEU
		SER	SER	GLN	VAL	V635	+	LEU
		THR	PRO	LEU	GLY	+	+	SER
		ILE	ILE	LEU	THR	Q659	+	GLN
		ASN	ASN	VAL	GLY	LEU	GLY	GLN
		LEU	LEU	GLY	THR	ALA	ALA	GLY
		PHE	ASN	SER	ALA	ILE	LYS	LEU
		ASN	THR	LYS	LYS	ILE	ASP	LEU
		ALA	ALA	ALA	ALA	THR	THR	LEU
		PHE	ALA	GLN	GLU	THR	ALA	ARG
		GLY	GLY	GLN	ALA	THR	LYS	ALA
		LEU	LEU	LEU	GLY	ASN	SER	LEU
		LEU	LEU	ALA	SER	SER	LEU	GLN
		GLY	GLY	GLY	ARG	GLN	PRO	PRO
		MET	MET	VAL	ALA	GLY	LEU	GLY
		GLY	VAL	GLY	GLY	ALA	LEU	GLY
		PRO	PRO	LYS	ALA	ALA	LEU	GLY
		GLY	GLY	VAL	ALA	ALA	A450	GLY
		PRO	PRO	PHE	ARG	LYS	R456	GLY
		GLY	GLY	LYS	ILE	HIS	Y460	ASP
		PRO	GLN	GLN	GLY	ALA	GLY	GLY
		LEU	MET	THR	GLY	ALA	V481	LYS
		GLY	THR	GLY	GLY	ARG	V487	VAL
		ARG	GLY	SER	VAL	GLU	+	SER
		ARG	ILE	LEU	GLN	GLY	+	HIS
		VAL	ALA	ILE	LEU	GLN	I529	GLN
		ALA	GLY	GLY	GLN	GLY	+	ALA
		SER	PRO	PRO	ALA	ALA	Y543	GLY
		GLY	SER	SER	LYS	ARG	+	ASP
		PRO	THR	THR	LEU	ARG	I575	HIS
		SER	ILE	ILE	LYS	GLY	+	TRP
		PRO	SER	ARG	LYS	ARG	R580	LEU
		GLY	ASP	ALA	ALA	LEU	+	ILE
		GLY	ARG	GLN	GLY	GLU	V583	ARG
		GLY	LEU	ALA	ALA	ARG	+	

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, D39	Depositor
Number of particles used	464690	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 ($e^-/\text{\AA}^2$)	40	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	5000	Depositor
Magnification	Not provided	
Image detector	GATAN K2 QUANTUM (4k x 4k)	Depositor
Maximum map value	0.827	Depositor
Minimum map value	-0.563	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.027	Depositor
Recommended contour level	0.1	Depositor
Map size (Å)	289.28, 289.28, 289.28	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.13, 1.13, 1.13	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: AR6

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	0.18	0/2043	0.28	0/2772
1	B	0.19	0/2043	0.28	0/2772
1	C	0.18	0/2043	0.28	0/2772
All	All	0.18	0/6129	0.28	0/8316

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 [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	2005	1998	1996	10	0
1	B	2005	1996	1996	9	0
1	C	2005	1996	1996	9	0
2	A	36	21	21	0	0
2	B	36	21	21	0	0
2	C	36	21	21	0	0
All	All	6123	6053	6051	28	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 2.

The worst 5 of 28 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:529:ILE:HG22	1:C:580:ARG:HB3	1.74	0.68
1:A:575:ILE:HD11	1:A:635:VAL:HG21	1.77	0.66
1:C:388:ILE:HG22	1:C:456:ARG:HD3	1.79	0.64
1:C:575:ILE:HG23	1:C:603:VAL:HG22	1.77	0.64
1:A:434:LEU:HD22	1:A:464:HIS:O	1.98	0.63

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	248/893 (28%)	241 (97%)	7 (3%)	0	100	100
1	B	248/893 (28%)	242 (98%)	6 (2%)	0	100	100
1	C	248/893 (28%)	241 (97%)	7 (3%)	0	100	100
All	All	744/2679 (28%)	724 (97%)	20 (3%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	217/755 (29%)	217 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	217/755 (29%)	217 (100%)	0	100	100
1	C	217/755 (29%)	217 (100%)	0	100	100
All	All	651/2265 (29%)	651 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

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

Mol	Chain	Res	Type
1	A	469	GLN
1	B	534	HIS
1	C	428	ASN
1	C	641	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](#)

3 ligands are modelled in this entry.

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
2	AR6	A	2001	-	39,39,39	1.25	2 (5%)	56,60,60	0.69	0
2	AR6	B	2001	-	39,39,39	1.25	2 (5%)	56,60,60	0.75	0
2	AR6	C	2001	-	39,39,39	1.24	2 (5%)	56,60,60	0.71	0

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
2	AR6	A	2001	-	-	1/22/54/54	0/4/4/4
2	AR6	B	2001	-	-	4/22/54/54	0/4/4/4
2	AR6	C	2001	-	-	2/22/54/54	0/4/4/4

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2001	AR6	PB-O3A	4.48	1.64	1.59
2	A	2001	AR6	PB-O3A	4.45	1.64	1.59
2	C	2001	AR6	PB-O3A	4.39	1.64	1.59
2	C	2001	AR6	PA-O3A	4.30	1.64	1.59
2	A	2001	AR6	PA-O3A	4.30	1.64	1.59

There are no bond angle outliers.

There are no chirality outliers.

5 of 7 torsion outliers are listed below:

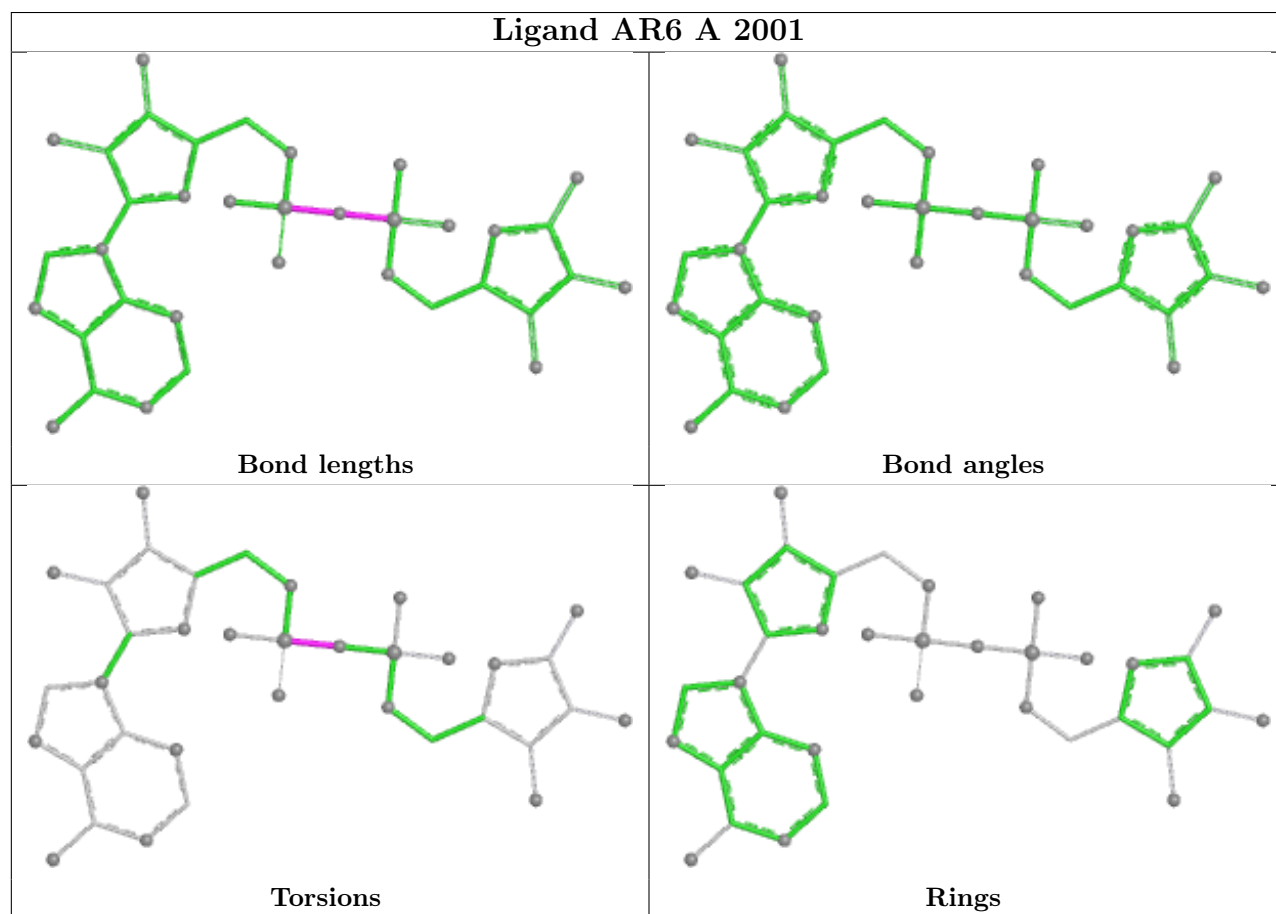
Mol	Chain	Res	Type	Atoms
2	B	2001	AR6	C2'-C1'-N9-C8
2	B	2001	AR6	O4D-C4D-C5D-O5D
2	C	2001	AR6	O4D-C4D-C5D-O5D
2	B	2001	AR6	O4'-C1'-N9-C8
2	A	2001	AR6	PB-O3A-PA-O1A

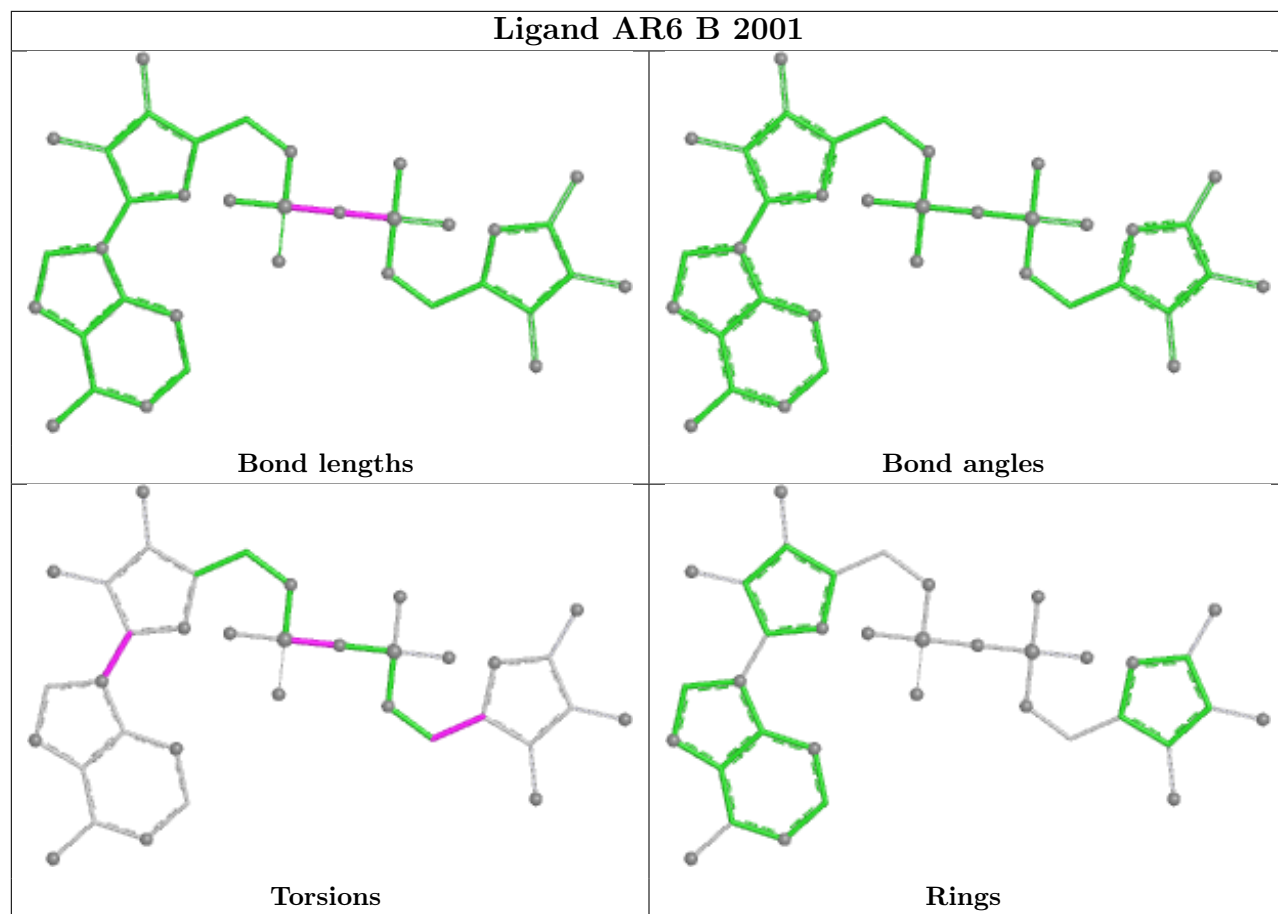
There are no ring outliers.

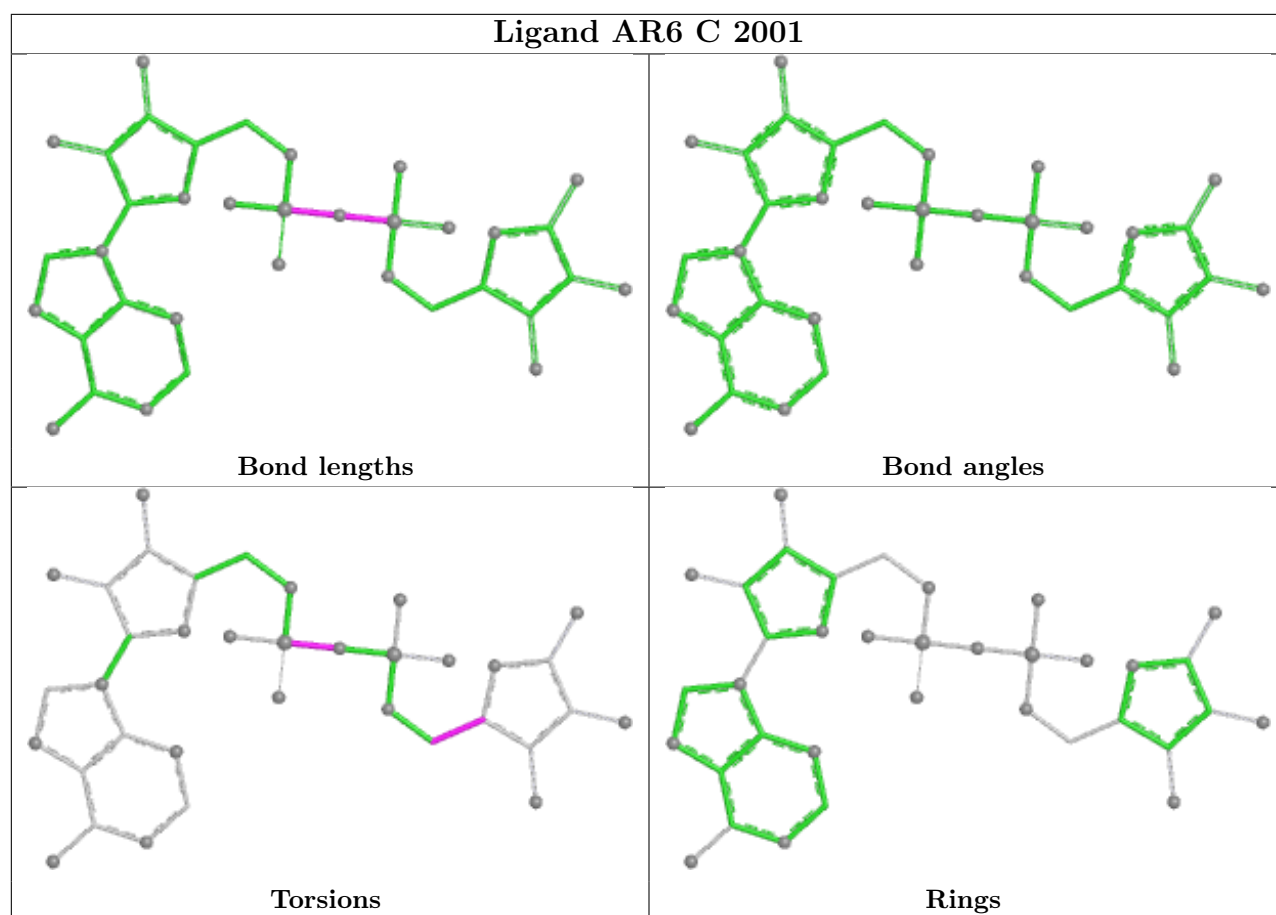
No monomer is involved in short contacts.

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 than 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.







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.

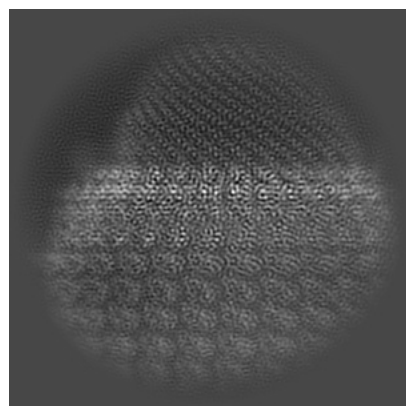
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-75638. These allow visual inspection of the internal detail of the map and identification of artifacts.

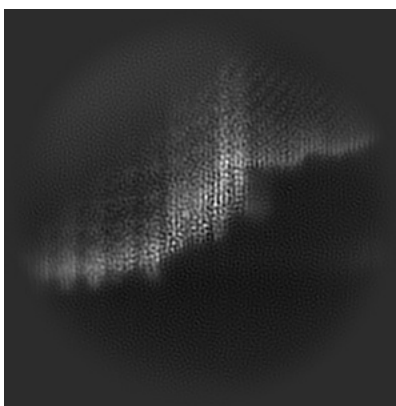
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

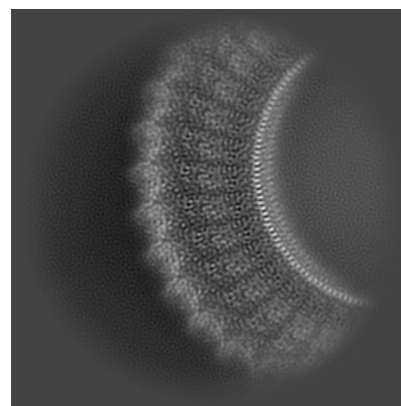
6.1.1 Primary map



X

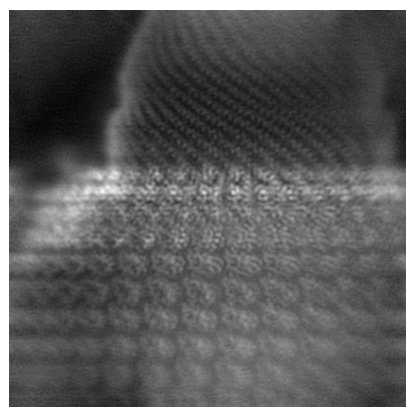


Y

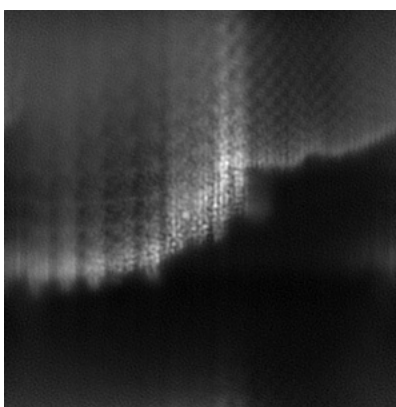


Z

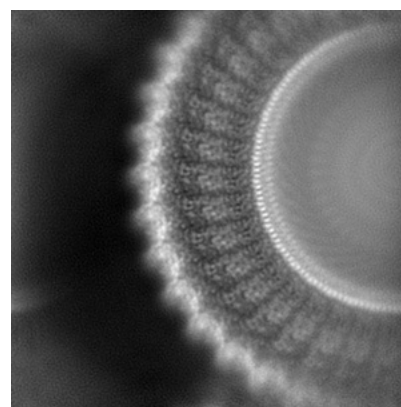
6.1.2 Raw map



X



Y

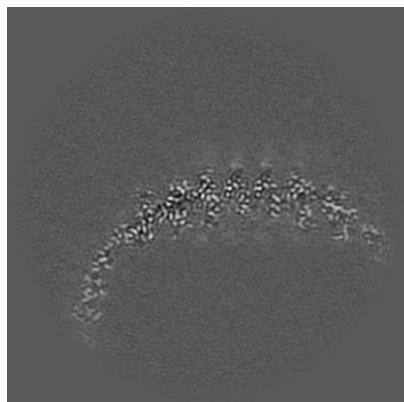


Z

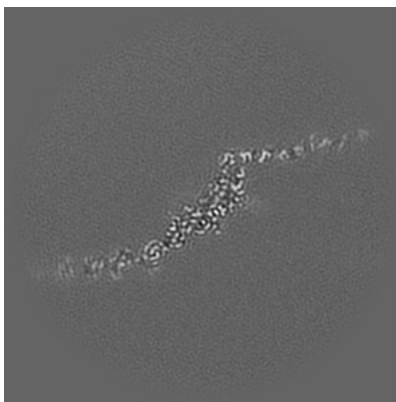
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

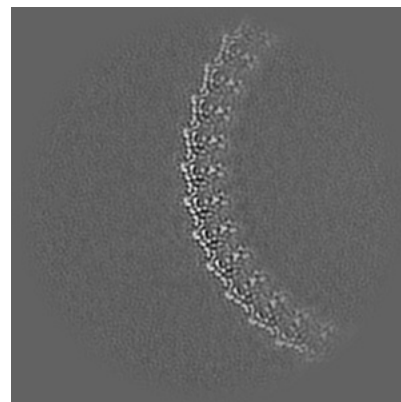
6.2.1 Primary map



X Index: 128

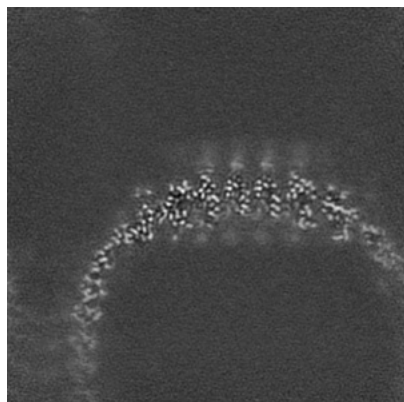


Y Index: 128

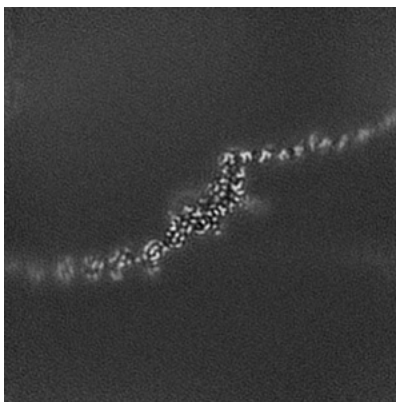


Z Index: 128

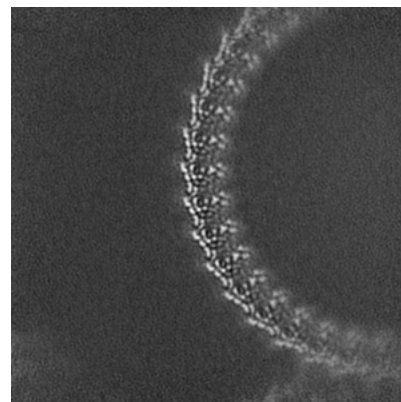
6.2.2 Raw map



X Index: 128



Y Index: 128

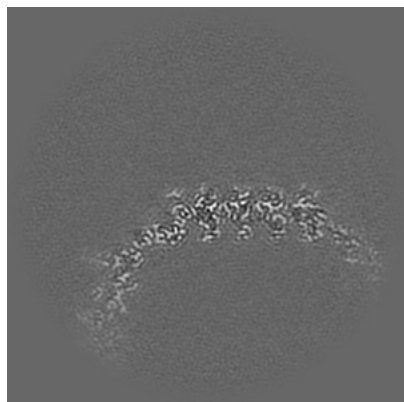


Z Index: 128

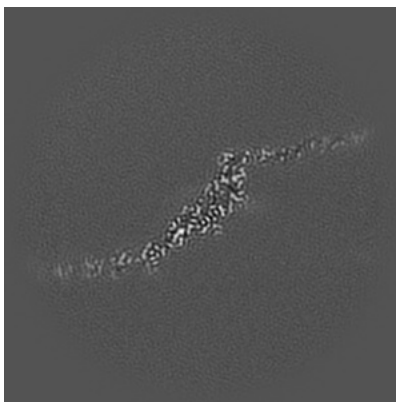
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

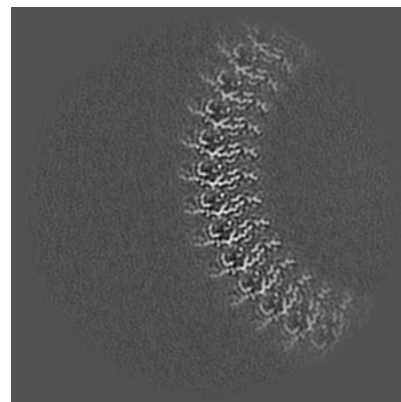
6.3.1 Primary map



X Index: 117

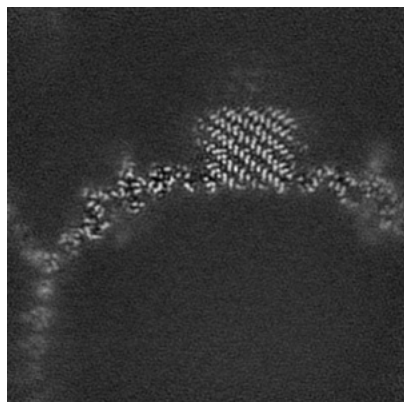


Y Index: 129

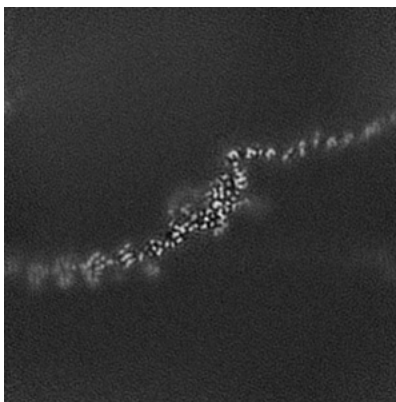


Z Index: 139

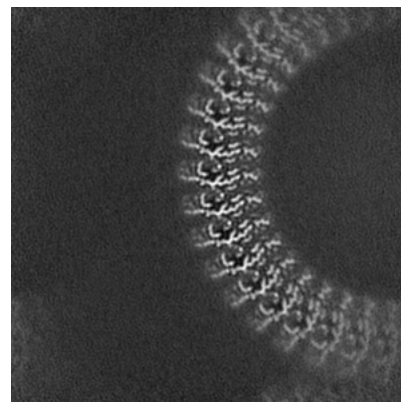
6.3.2 Raw map



X Index: 158



Y Index: 125

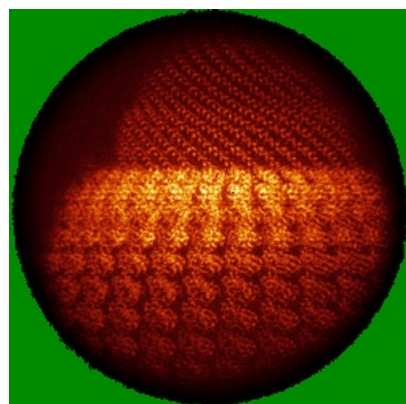


Z Index: 139

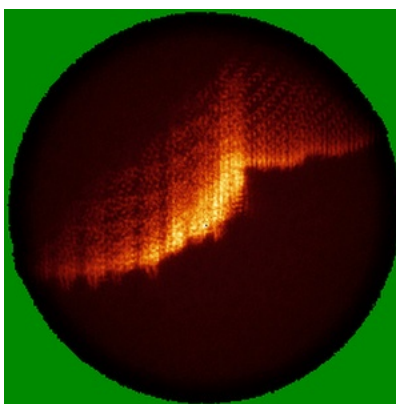
The images above show the largest variance slices of the map in three orthogonal directions.

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

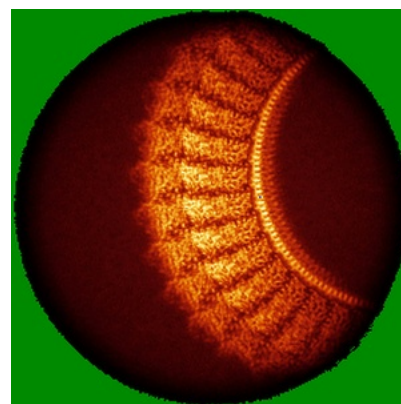
6.4.1 Primary map



X

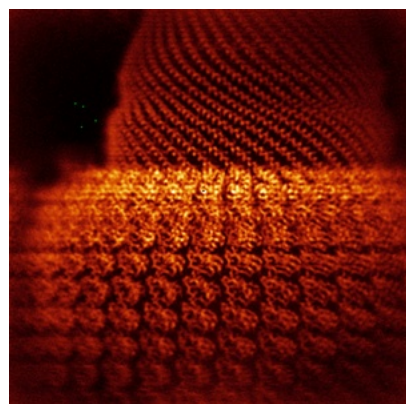


Y

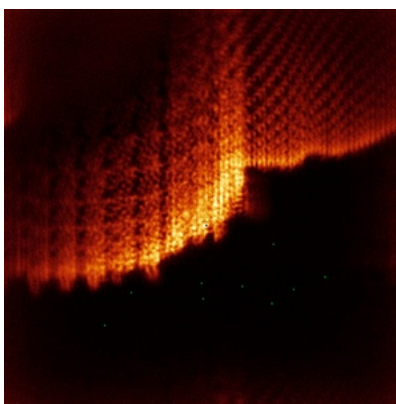


Z

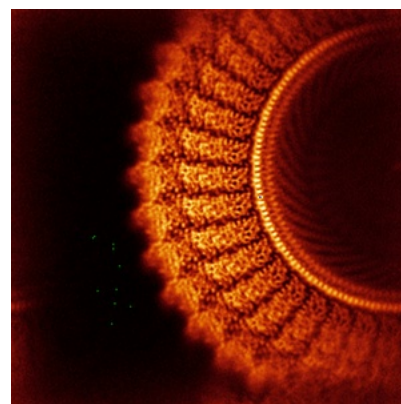
6.4.2 Raw map



X



Y

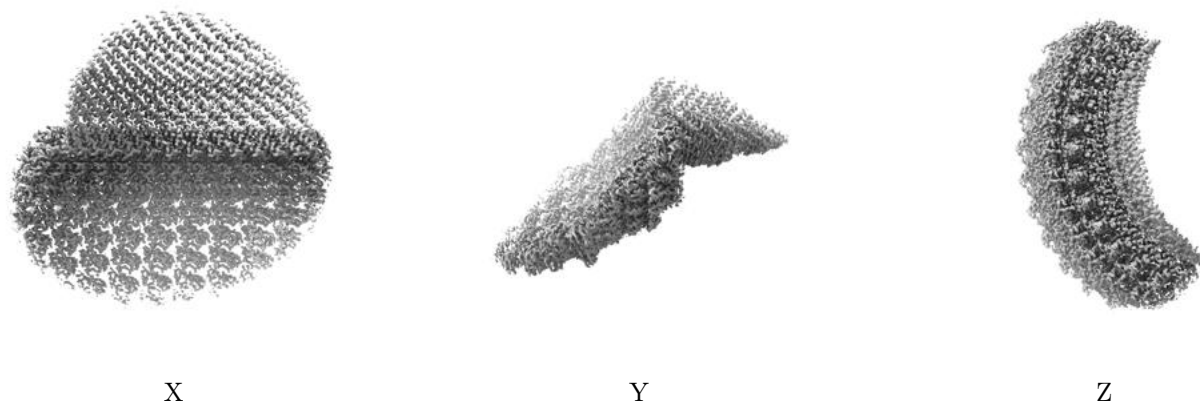


Z

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.

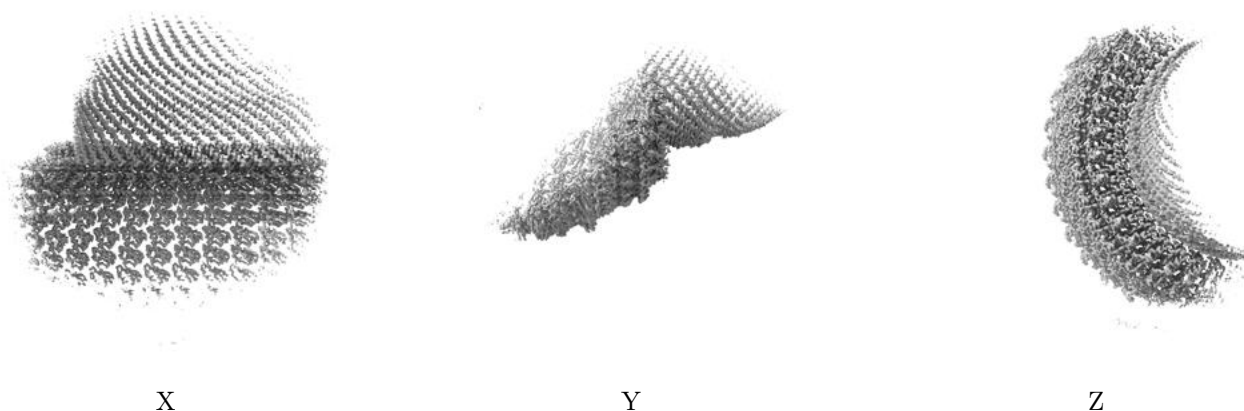
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.1. 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



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.

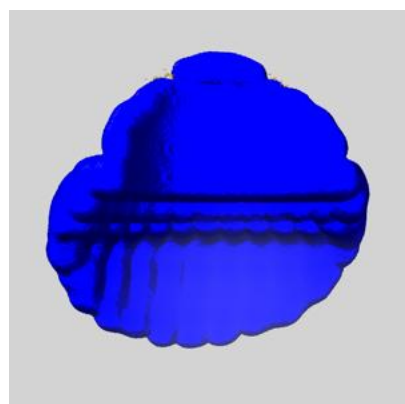
6.6 Mask visualisation [i](#)

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

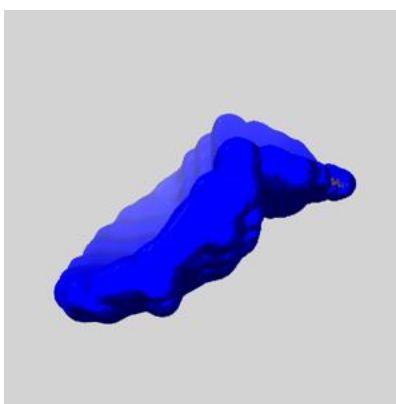
A mask typically either:

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

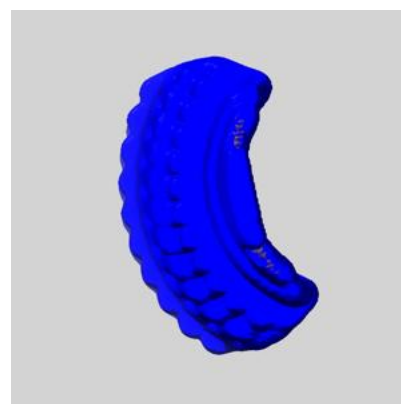
6.6.1 emd_75638_msk_1.map [i](#)



X



Y

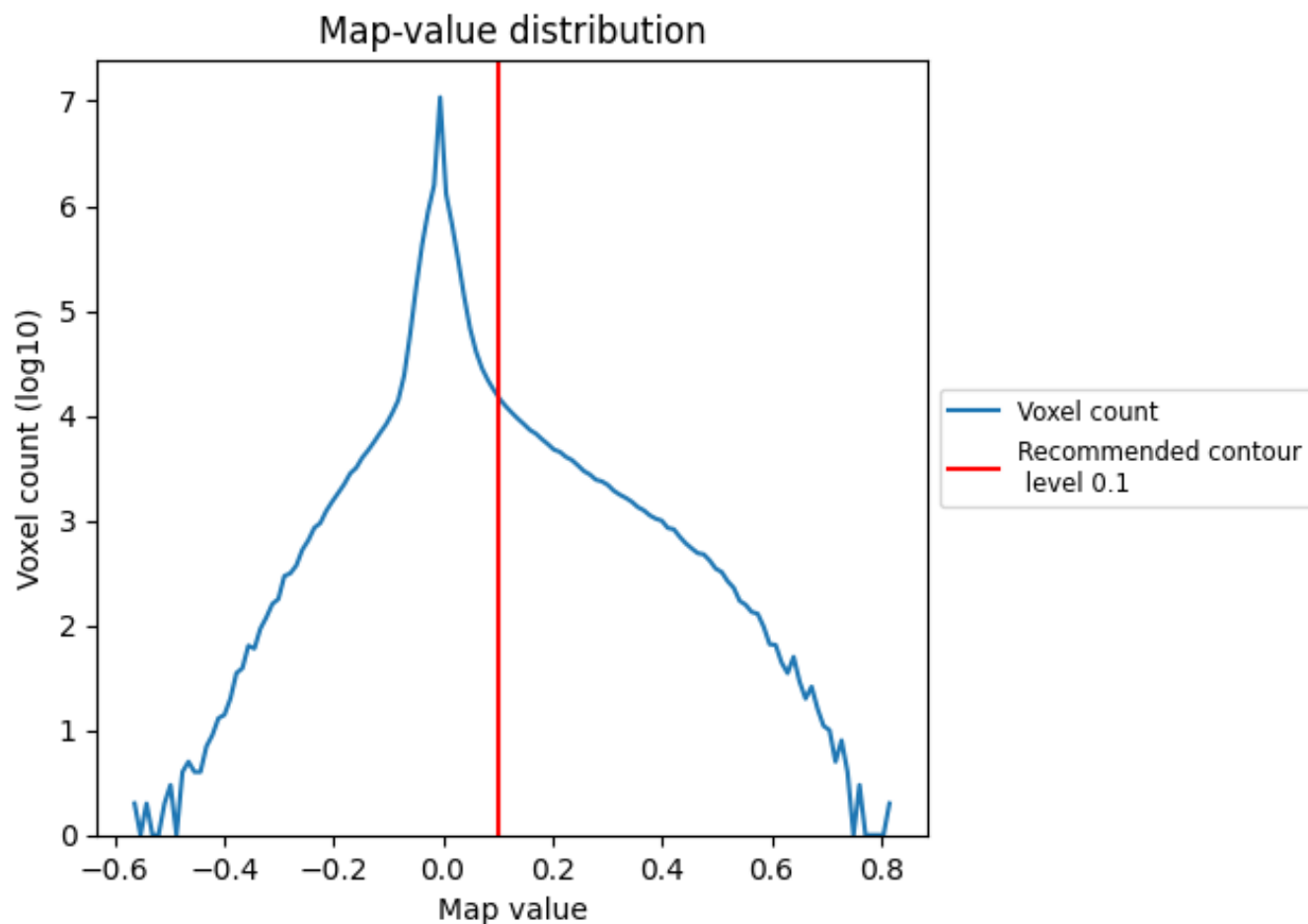


Z

7 Map analysis [i](#)

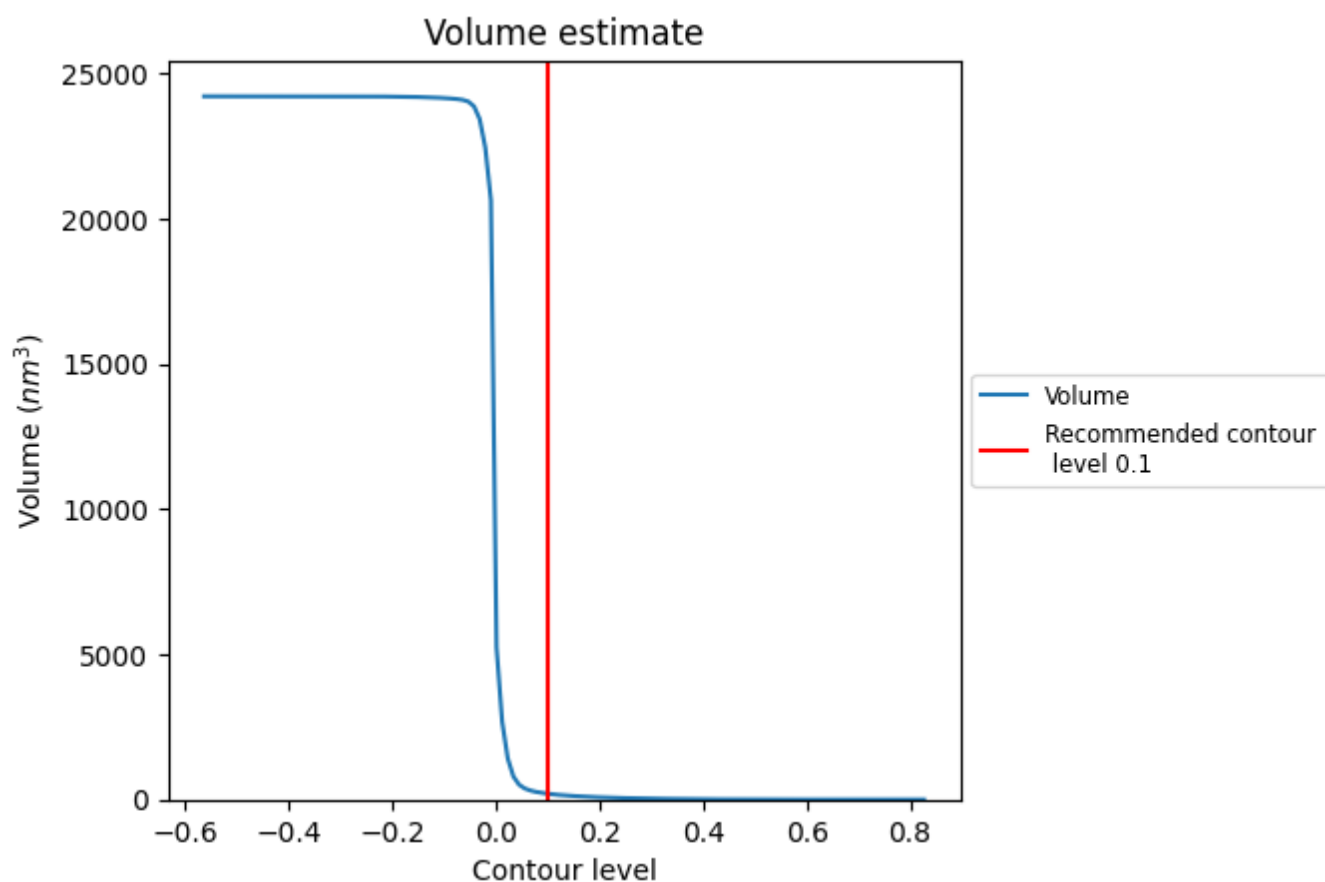
This section contains the results of statistical analysis of the map.

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.

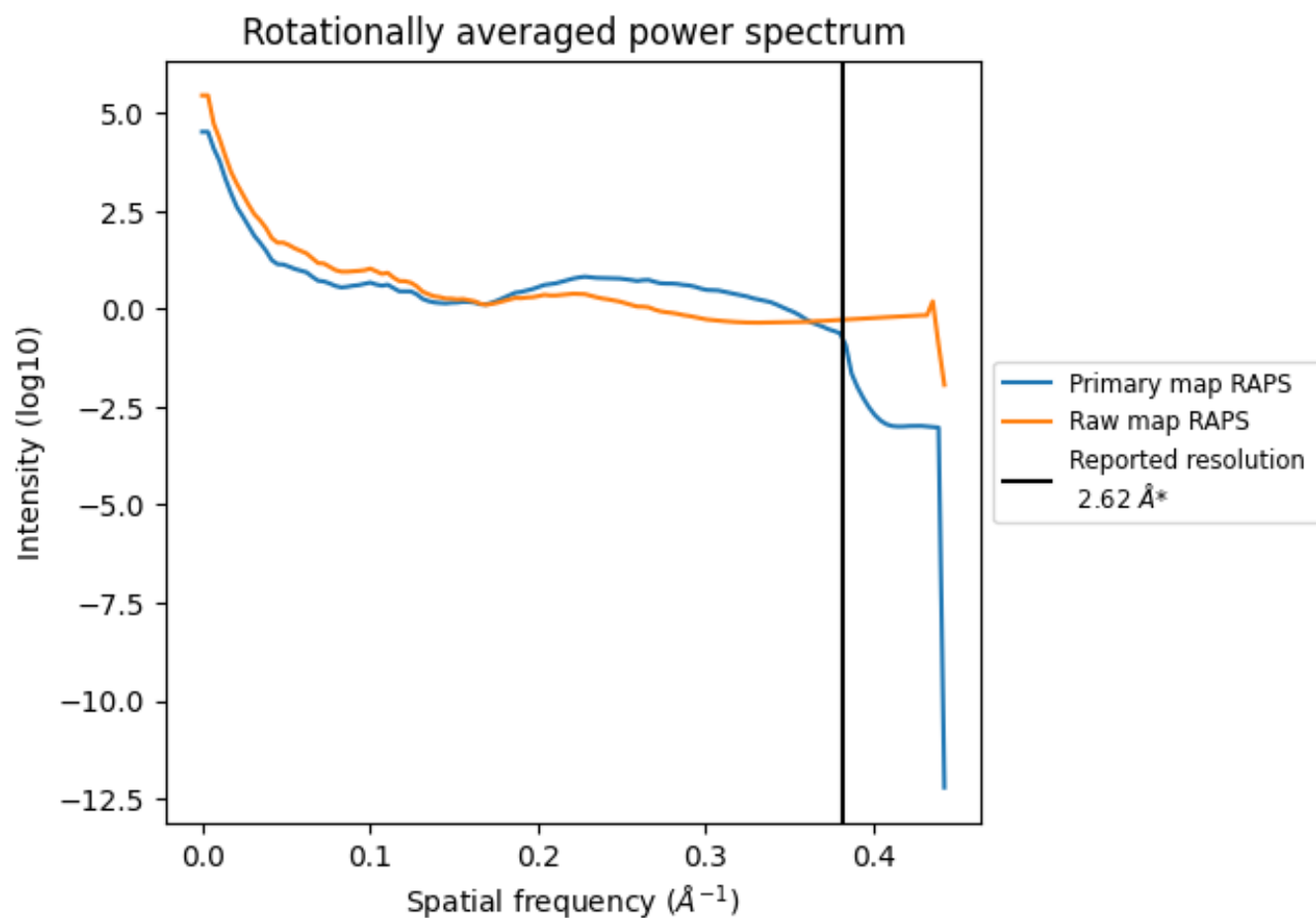
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 201 nm³; this corresponds to an approximate mass of 182 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 ⓘ

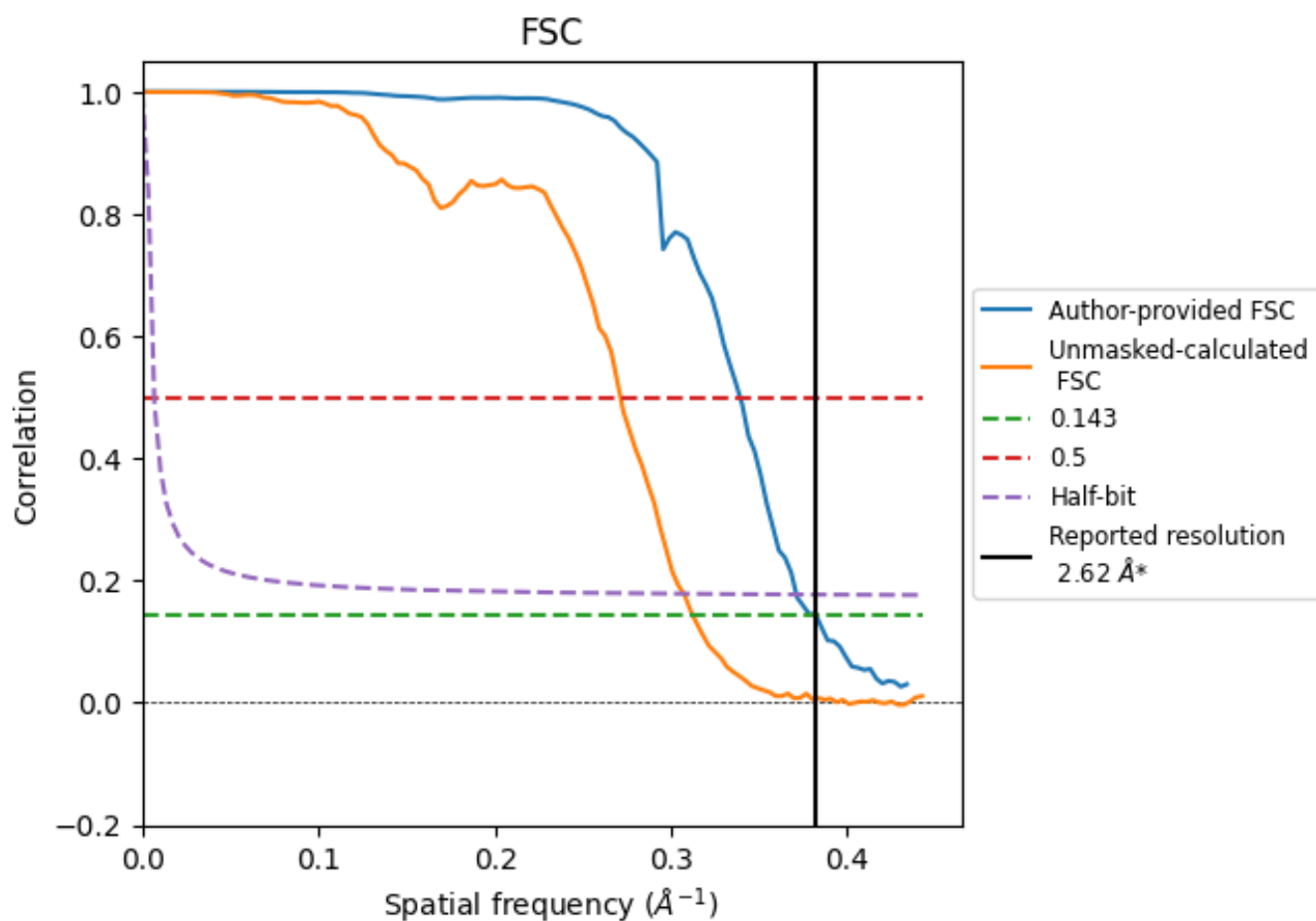


*Reported resolution corresponds to spatial frequency of 0.382 \AA^{-1}

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 0.382 \AA^{-1}

8.2 Resolution estimates [i](#)

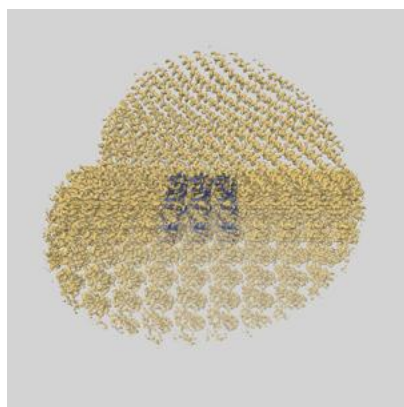
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.62	-	-
Author-provided FSC curve	2.62	2.95	2.69
Unmasked-calculated*	3.20	3.68	3.25

*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 3.20 differs from the reported value 2.62 by more than 10 %

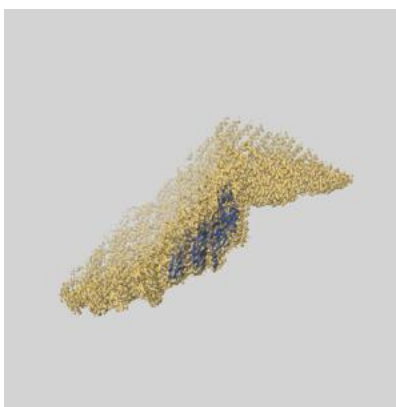
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-75638 and PDB model 11DR. Per-residue inclusion information can be found in section [3](#) on page [5](#).

9.1 Map-model overlay [i](#)



X



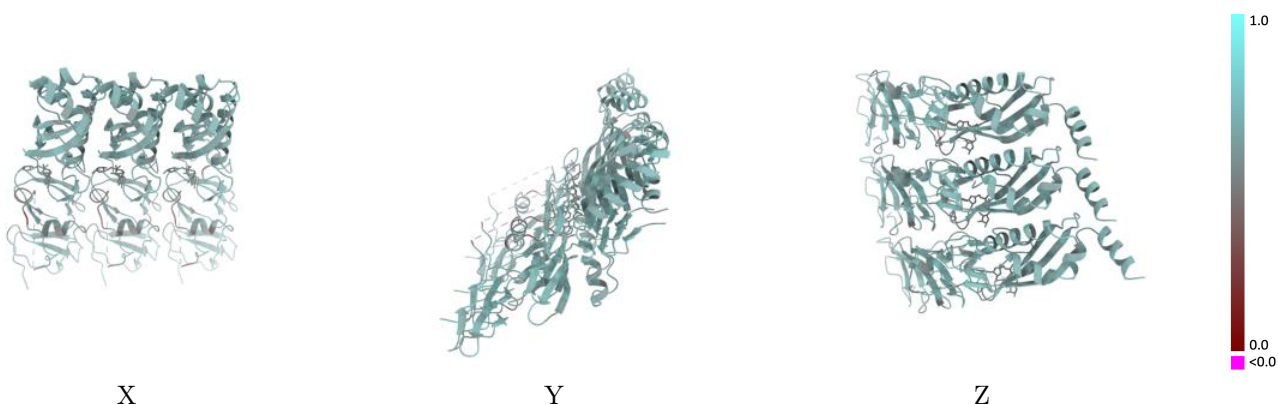
Y



Z

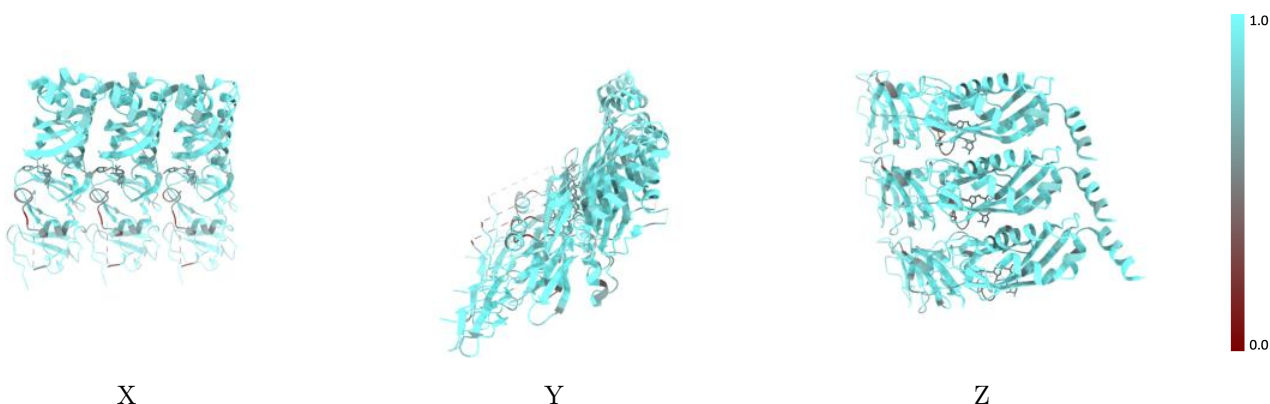
The images above show the 3D surface view of the map at the recommended contour level 0.1 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



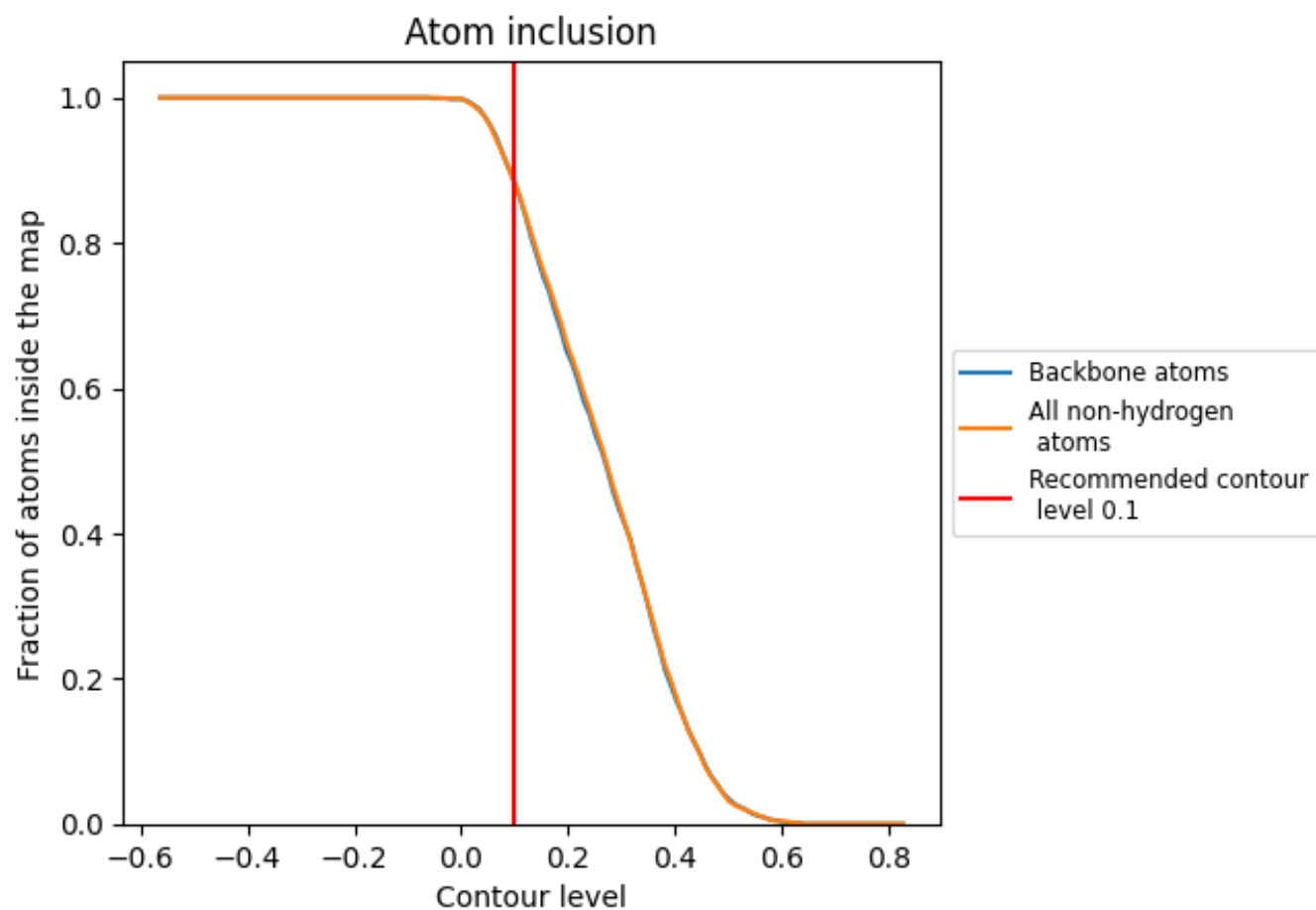
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.1).

9.4 Atom inclusion [i](#)



At the recommended contour level, 88% 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 (0.1) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div><div></div></div> 0.8820	<div><div></div></div> 0.6130
A	<div><div></div></div> 0.8830	<div><div></div></div> 0.6110
B	<div><div></div></div> 0.8900	<div><div></div></div> 0.6150
C	<div><div></div></div> 0.8870	<div><div></div></div> 0.6130

