wwPDB EM Validation Summary Report (i)

Feb 25, 2024 – 10:13 AM EST

PDB ID	:	5IS0
EMDB ID	:	EMD-8119
Title	:	Structure of TRPV1 in complex with capsazepine, determined in lipid nanodisc
Authors	:	Gao, Y.; Cao, E.; Julius, D.; Cheng, Y.
Deposited on	:	2016-03-15
Resolution	:	3.43 Å(reported)
Based on initial model	:	3J5P

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 (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 (1)) were used in the production of this report:

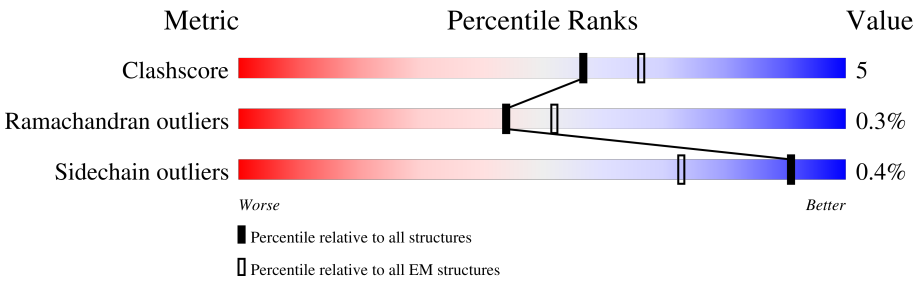
EMDB validation analysis	:	0.0.1.dev70
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 3.43 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)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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	B	636	7% 54% 8% 38%
1	C	636	7% 54% 7% 38%
1	D	636	7% 54% 7% 38%
1	E	636	7% 54% 8% 38%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 11892 atoms, of which 84 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.

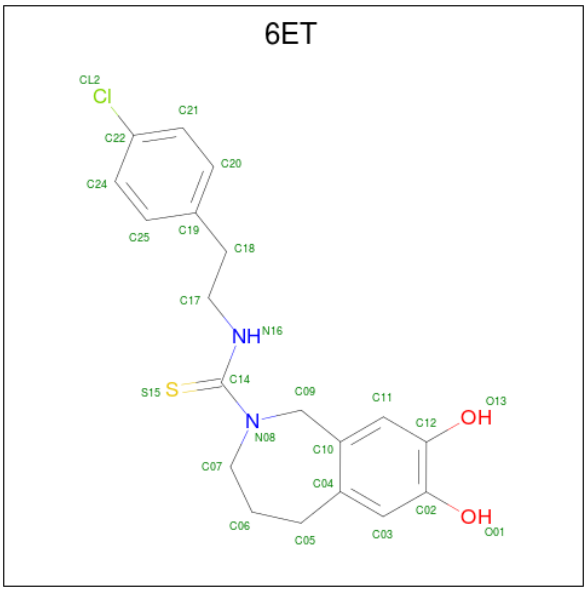
- Molecule 1 is a protein called Transient receptor potential cation channel subfamily V member 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	C	394	2927	1932	481	496	18	0	0
1	B	394	2927	1932	481	496	18	0	0
1	D	394	2927	1932	481	496	18	0	0
1	E	394	2927	1932	481	496	18	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	106	ALA	-	expression tag	UNP O35433
C	107	MET	-	expression tag	UNP O35433
C	108	GLY	-	expression tag	UNP O35433
C	109	SER	-	expression tag	UNP O35433
B	106	ALA	-	expression tag	UNP O35433
B	107	MET	-	expression tag	UNP O35433
B	108	GLY	-	expression tag	UNP O35433
B	109	SER	-	expression tag	UNP O35433
D	106	ALA	-	expression tag	UNP O35433
D	107	MET	-	expression tag	UNP O35433
D	108	GLY	-	expression tag	UNP O35433
D	109	SER	-	expression tag	UNP O35433
E	106	ALA	-	expression tag	UNP O35433
E	107	MET	-	expression tag	UNP O35433
E	108	GLY	-	expression tag	UNP O35433
E	109	SER	-	expression tag	UNP O35433

- Molecule 2 is capsazepine (three-letter code: 6ET) (formula: $C_{19}H_{21}ClN_2O_2S$).



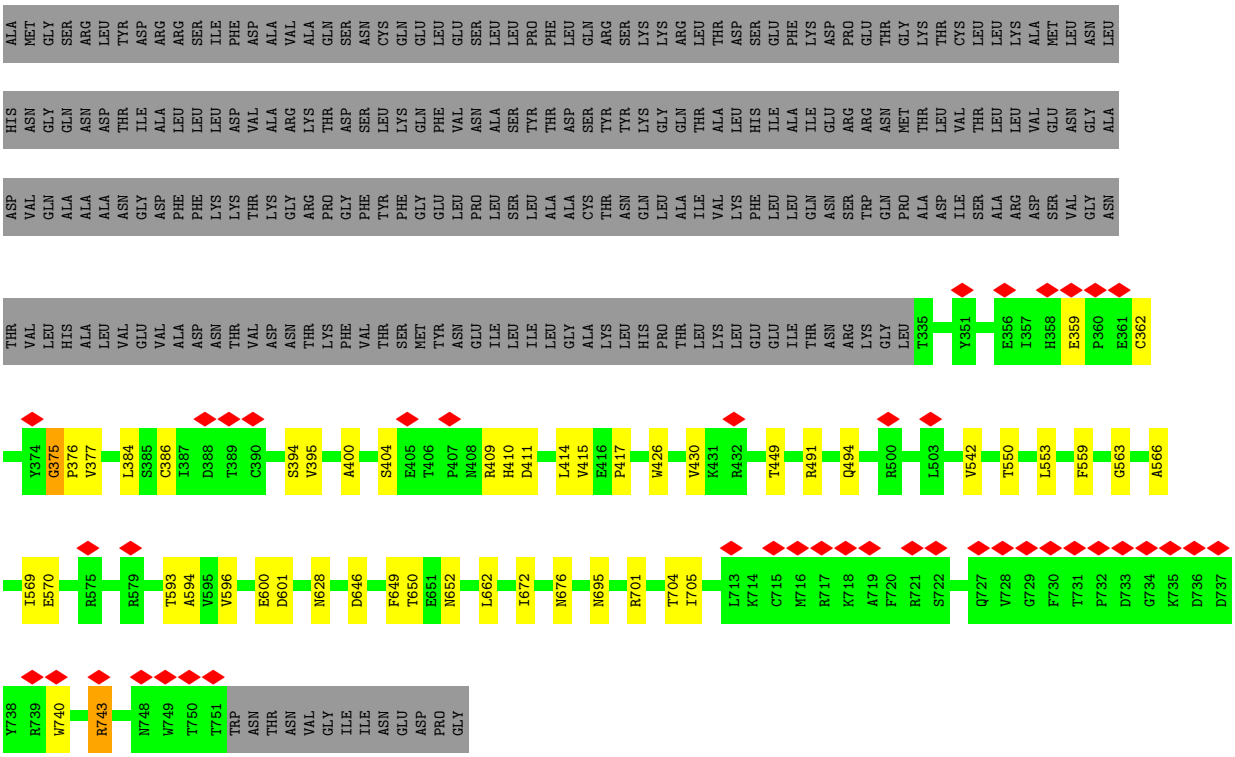
Mol	Chain	Residues	Atoms							AltConf
			Total	C	Cl	H	N	O	S	
2	C	1	46	19	1	21	2	2	1	0
			Total	C	Cl	H	N	O	S	
2	B	1	46	19	1	21	2	2	1	0
			Total	C	Cl	H	N	O	S	
2	D	1	46	19	1	21	2	2	1	0
			Total	C	Cl	H	N	O	S	
2	E	1	46	19	1	21	2	2	1	0

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.

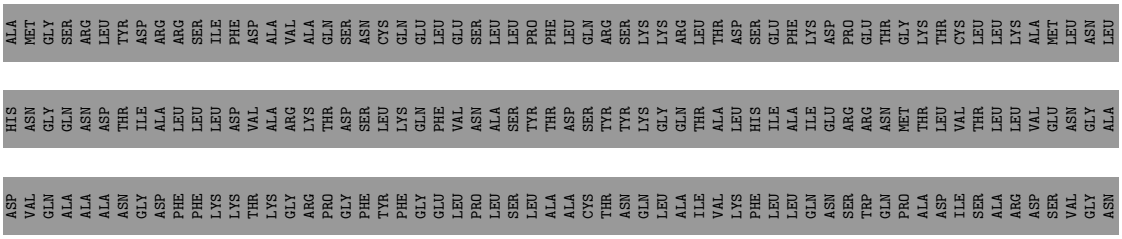
• Molecule 1: Transient receptor potential cation channel subfamily V member 1

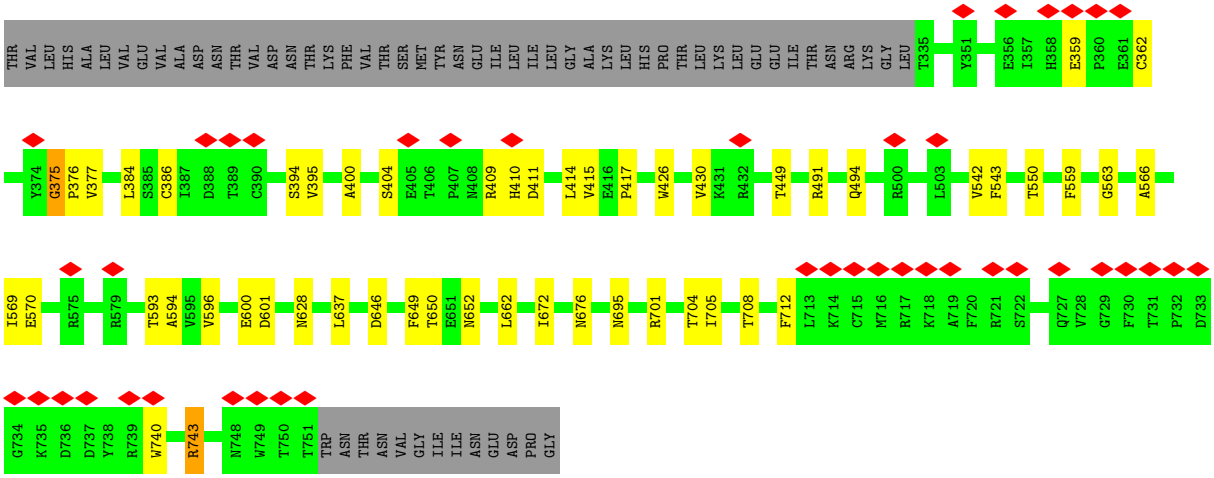
Chain C:



• Molecule 1: Transient receptor potential cation channel subfamily V member 1

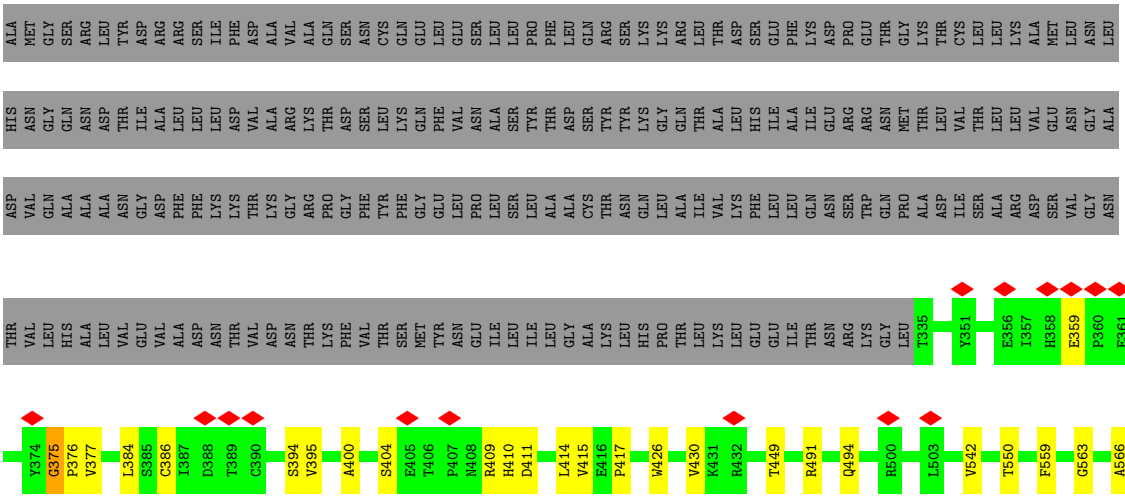
Chain B:





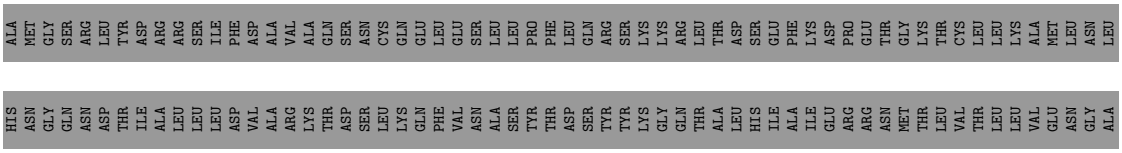
• Molecule 1: Transient receptor potential cation channel subfamily V member 1

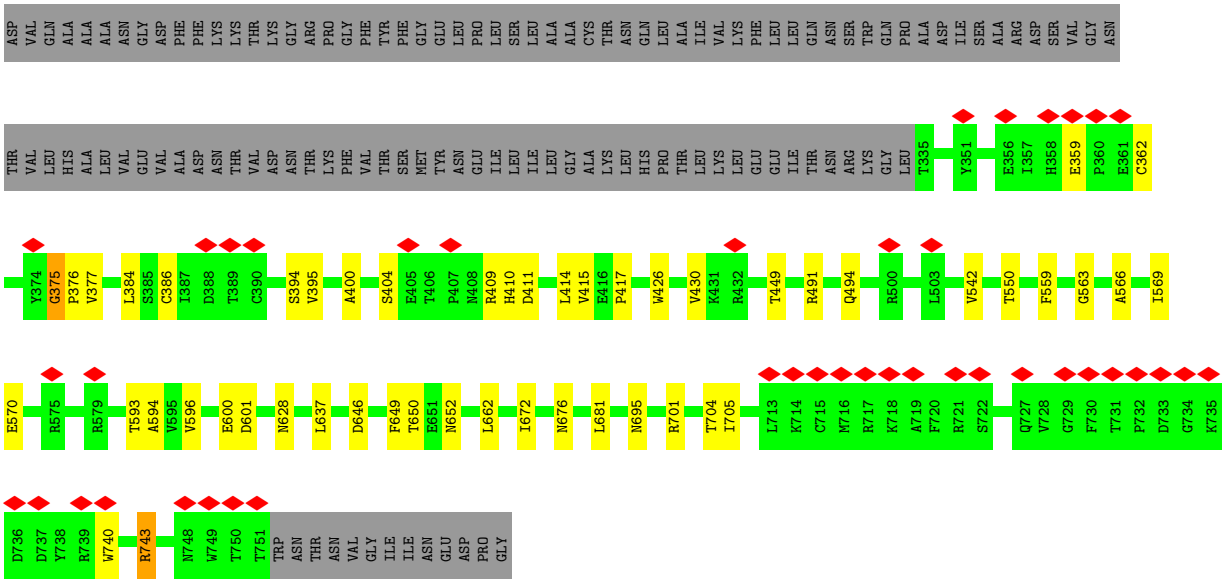
Chain D:



• Molecule 1: Transient receptor potential cation channel subfamily V member 1

Chain E:




ASP VAL GLN ALA ALA ALA ASN GLY ASP PHE PHE LYS LYS THR LYS GLY ARG PRO GLY PHE TYR PHE GLY GLU LEU PRO LEU SER LEU ALA ALA CYS THR ASN GLN LEU ALA ILE VAL LYS PHE LEU LEU GLN ASN SER TRP GLN PRO ALA ASP ILE SER ALA ARG ASP SER VAL GLY ASN
THR VAL LEU HIS ALA LEU VAL GLU VAL ALA ASP ASN THR VAL ASP ASN THR LYS PHE VAL THR SER MET TYR ASN GLU ILE LEU LEU GLY ALA LYS LEU HIS PRO THR LEU LYS LEU GLU GLU ILE THR ASN ARG LYS GLY LEU T335 Y351 E356 I357 H358 E359 P360 E361 C362
Y374 G375 P376 V377 L384 S385 C386 I387 D388 T389 C390 S394 V395 A400 S404 E405 T406 P407 N408 R409 H410 D411 L414 V415 E416 P417 W426 V430 K431 R432 T449 R491 Q494 R500 L503 V542 T550 F559 G563 A566 I569
E570 R575 R579 T593 A594 V595 V596 E600 D601 N628 L637 D646 F649 T650 E651 N652 L662 I672 N676 L681 N695 R701 T704 I705 L713 K714 C715 M716 R717 K718 A719 F720 R721 S722 Q727 V728 G729 F730 T731 P732 D733 G734 K735
D736 D737 Y738 R739 W740 R743 N748 W749 T750 T751 TRP ASN THR ASN VAL GLY ILE ILE ASN GLU ASP PRO GLY

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C4	Depositor
Number of particles used	80725	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION; CTF correction was performed before classification and refinement.	Depositor
Microscope	FEI POLARA 300	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	41	Depositor
Minimum defocus (nm)	700	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	41132	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	22.570	Depositor
Minimum map value	-11.678	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	1.000	Depositor
Recommended contour level	4.5	Depositor
Map size (Å)	233.3952, 233.3952, 233.3952	wwPDB
Map dimensions	192, 192, 192	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.2156, 1.2156, 1.2156	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: 6ET

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	B	0.69	1/2992 (0.0%)	0.63	1/4064 (0.0%)
1	C	0.69	1/2992 (0.0%)	0.63	1/4064 (0.0%)
1	D	0.69	1/2992 (0.0%)	0.63	1/4064 (0.0%)
1	E	0.69	1/2992 (0.0%)	0.63	1/4064 (0.0%)
All	All	0.69	4/11968 (0.0%)	0.63	4/16256 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	2
1	C	0	2
1	D	0	2
1	E	0	2
All	All	0	8

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	596	VAL	CB-CG2	-5.84	1.40	1.52
1	C	596	VAL	CB-CG2	-5.83	1.40	1.52
1	D	596	VAL	CB-CG2	-5.83	1.40	1.52
1	B	596	VAL	CB-CG2	-5.81	1.40	1.52

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	E	662	LEU	CB-CG-CD1	-5.34	101.92	111.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	662	LEU	CB-CG-CD1	-5.32	101.95	111.00
1	D	662	LEU	CB-CG-CD1	-5.31	101.98	111.00
1	C	662	LEU	CB-CG-CD1	-5.30	101.98	111.00

There are no chirality outliers.

5 of 8 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	375	GLY	Peptide
1	B	740	TRP	Peptide
1	C	375	GLY	Peptide
1	C	740	TRP	Peptide
1	D	375	GLY	Peptide

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	B	2927	0	2746	33	0
1	C	2927	0	2746	30	0
1	D	2927	0	2746	30	0
1	E	2927	0	2746	31	0
2	B	25	21	0	5	0
2	C	25	21	0	5	0
2	D	25	21	0	4	0
2	E	25	21	0	4	0
All	All	11808	84	10984	116	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 5.

The worst 5 of 116 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:550:THR:OG1	2:C:801:6ET:S15	2.16	1.01

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:550:THR:OG1	2:D:801:6ET:S15	2.19	0.99
1:E:550:THR:OG1	2:E:801:6ET:S15	2.21	0.98
1:B:550:THR:OG1	2:B:801:6ET:S15	2.21	0.97
1:C:550:THR:CB	2:C:801:6ET:S15	2.70	0.80

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	B	392/636 (62%)	352 (90%)	39 (10%)	1 (0%)	41	75
1	C	392/636 (62%)	351 (90%)	40 (10%)	1 (0%)	41	75
1	D	392/636 (62%)	351 (90%)	40 (10%)	1 (0%)	41	75
1	E	392/636 (62%)	352 (90%)	39 (10%)	1 (0%)	41	75
All	All	1568/2544 (62%)	1406 (90%)	158 (10%)	4 (0%)	44	75

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	376	PRO
1	B	376	PRO
1	D	376	PRO
1	E	376	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	B	267/562 (48%)	266 (100%)	1 (0%)	91	96
1	C	267/562 (48%)	266 (100%)	1 (0%)	91	96
1	D	267/562 (48%)	266 (100%)	1 (0%)	91	96
1	E	267/562 (48%)	266 (100%)	1 (0%)	91	96
All	All	1068/2248 (48%)	1064 (100%)	4 (0%)	91	96

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	743	ARG
1	B	743	ARG
1	D	743	ARG
1	E	743	ARG

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

4 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	6ET	B	801	-	27,27,27	2.44	6 (22%)	33,37,37	3.08	8 (24%)
2	6ET	C	801	-	27,27,27	2.43	6 (22%)	33,37,37	3.08	8 (24%)
2	6ET	E	801	-	27,27,27	2.44	6 (22%)	33,37,37	3.08	8 (24%)
2	6ET	D	801	-	27,27,27	2.43	6 (22%)	33,37,37	3.08	8 (24%)

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	6ET	B	801	-	-	0/10/20/20	0/3/3/3
2	6ET	C	801	-	-	0/10/20/20	0/3/3/3
2	6ET	E	801	-	-	0/10/20/20	0/3/3/3
2	6ET	D	801	-	-	0/10/20/20	0/3/3/3

The worst 5 of 24 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	801	6ET	C14-N08	6.67	1.43	1.33
2	C	801	6ET	C14-N08	6.61	1.43	1.33
2	D	801	6ET	C14-N08	6.61	1.43	1.33
2	E	801	6ET	C14-N08	6.61	1.43	1.33
2	E	801	6ET	C14-N16	6.00	1.42	1.34

The worst 5 of 32 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	801	6ET	C09-N08-C07	14.38	130.54	113.91
2	D	801	6ET	C09-N08-C07	14.37	130.52	113.91
2	C	801	6ET	C09-N08-C07	14.35	130.50	113.91
2	E	801	6ET	C09-N08-C07	14.35	130.50	113.91
2	D	801	6ET	C06-C05-C04	-5.80	102.80	113.91

There are no chirality outliers.

There are no torsion outliers.

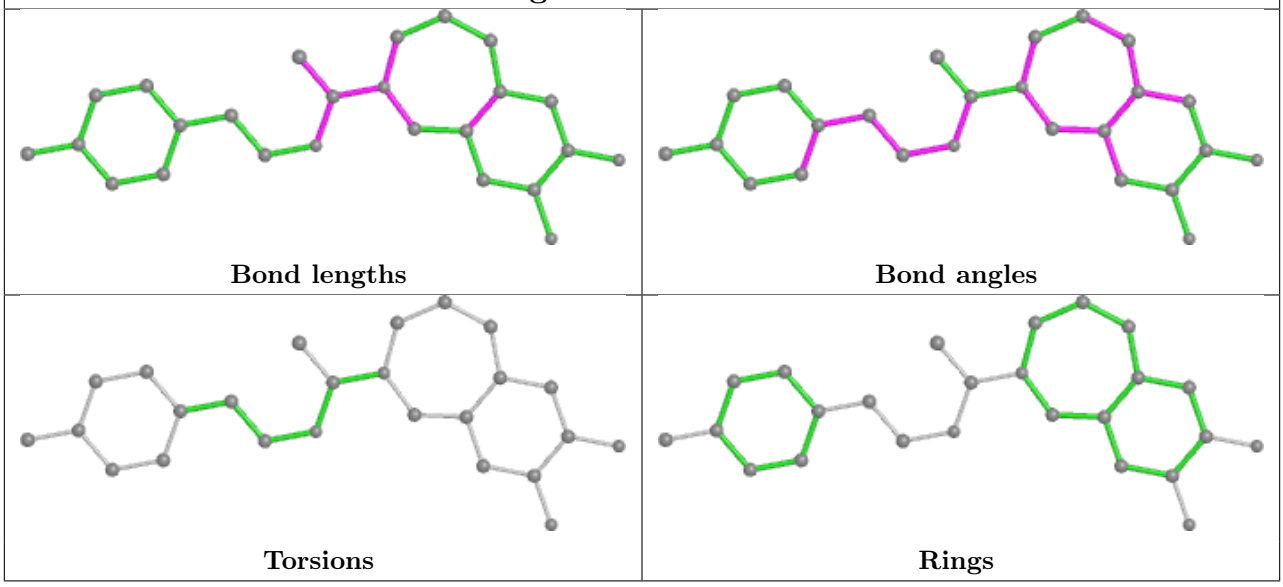
There are no ring outliers.

4 monomers are involved in 18 short contacts:

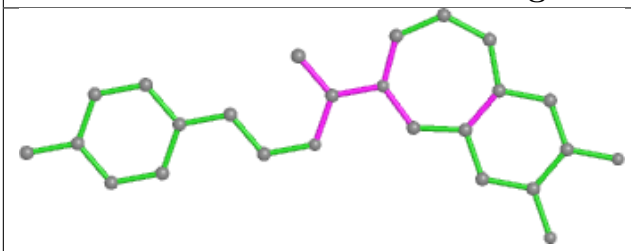
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	801	6ET	5	0
2	C	801	6ET	5	0
2	E	801	6ET	4	0
2	D	801	6ET	4	0

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.

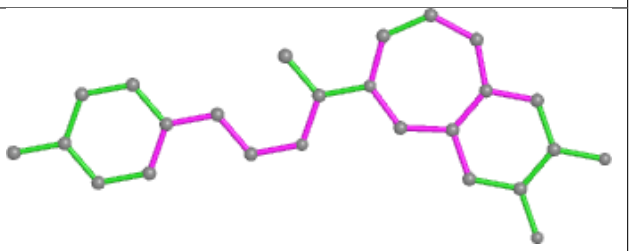
Ligand 6ET B 801



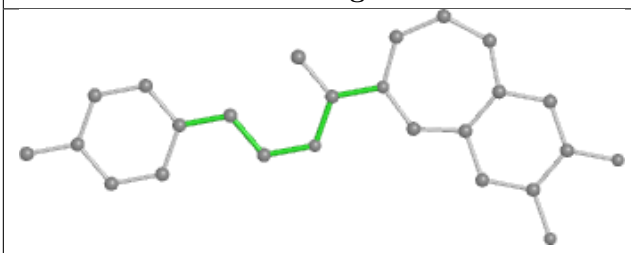
Ligand 6ET C 801



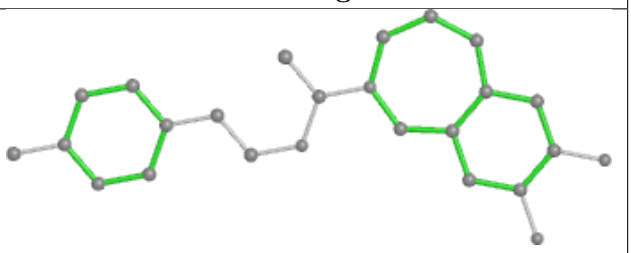
Bond lengths



Bond angles

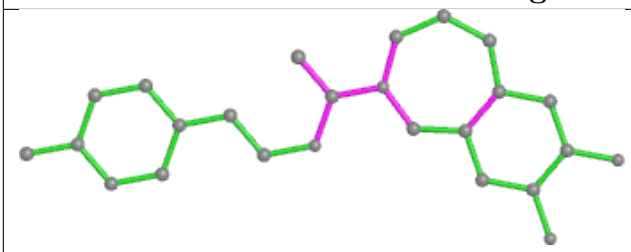


Torsions

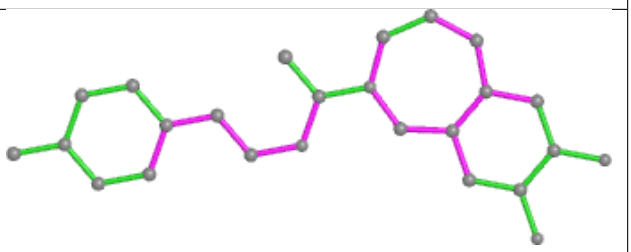


Rings

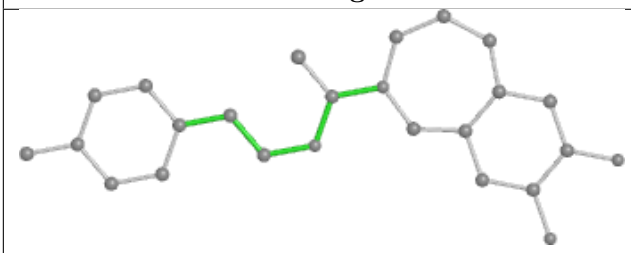
Ligand 6ET E 801



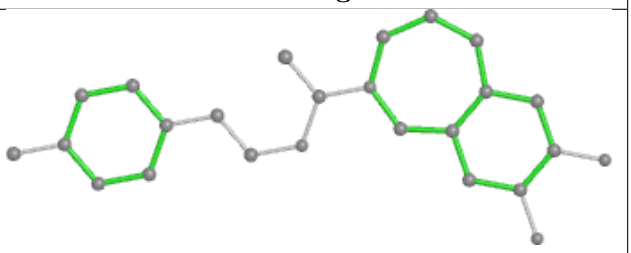
Bond lengths



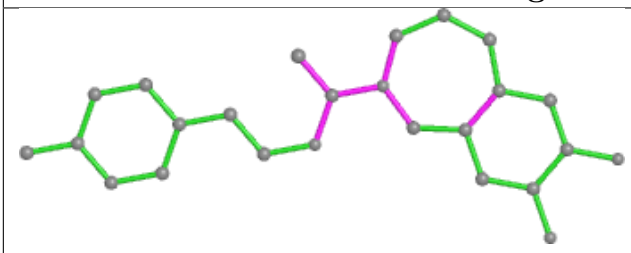
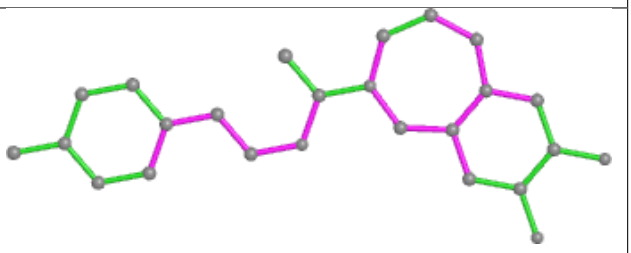
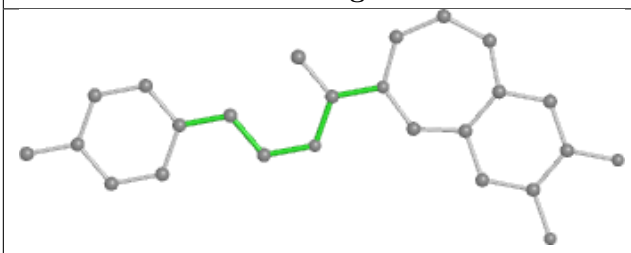
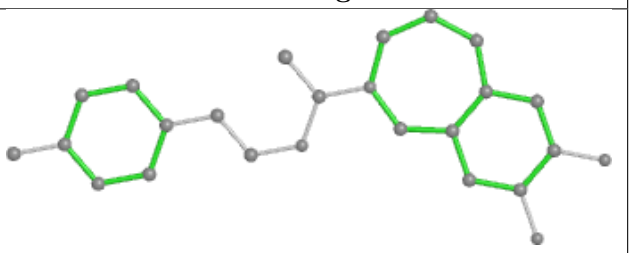
Bond angles



Torsions



Rings

Ligand 6ET D 801	
 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.

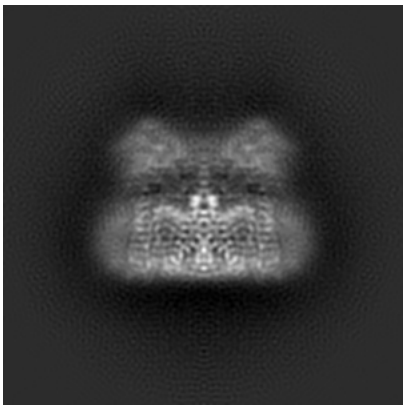
6 Map visualisation (i)

This section contains visualisations of the EMDB entry EMD-8119. These allow visual inspection of the internal detail of the map and identification of artifacts.

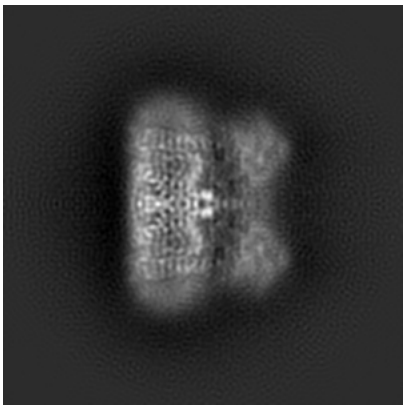
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections (i)

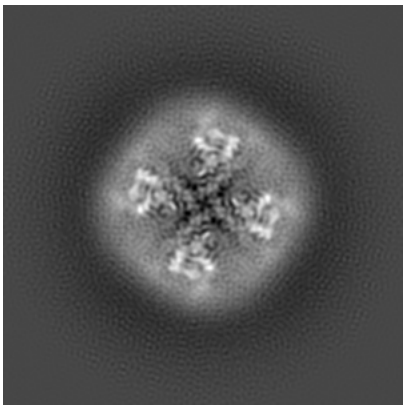
6.1.1 Primary map



X

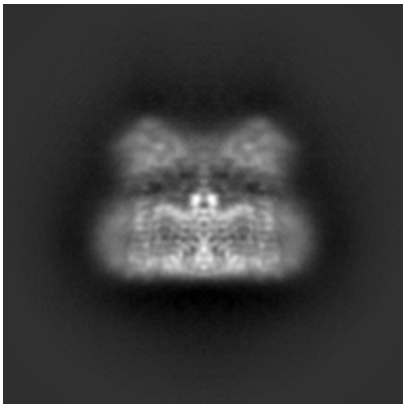


Y

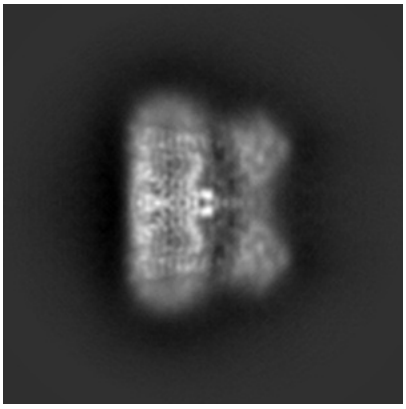


Z

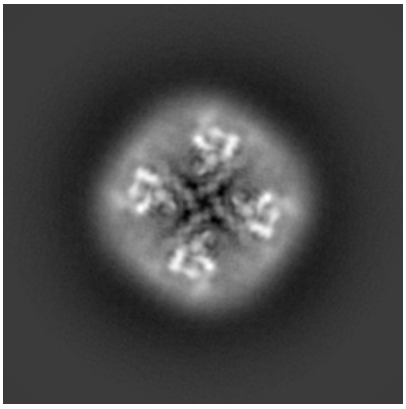
6.1.2 Raw map



X



Y

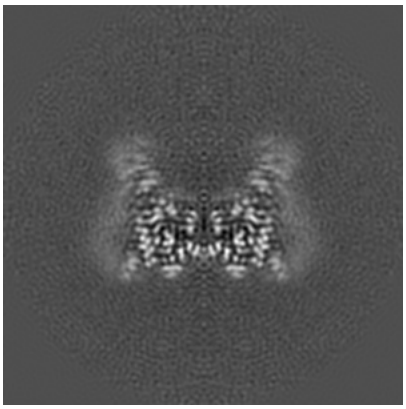


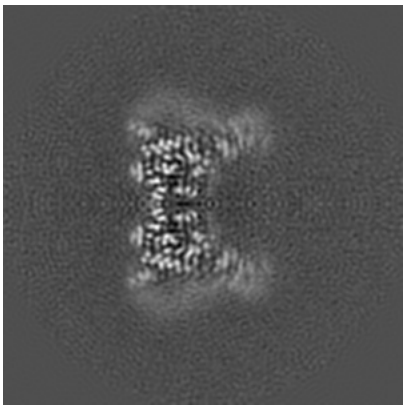
Z

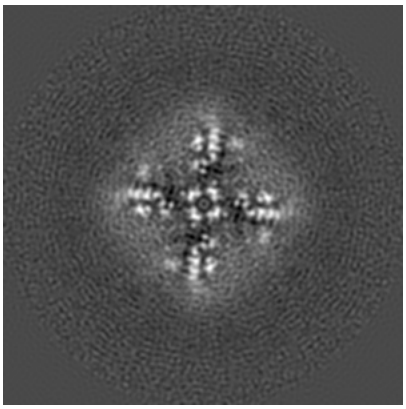
The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

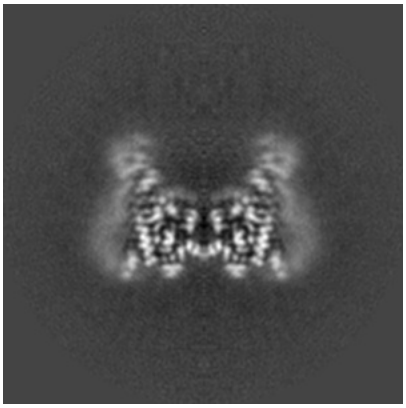
6.2.1 Primary map

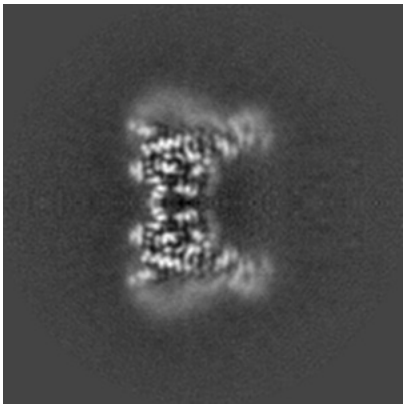

X Index: 96

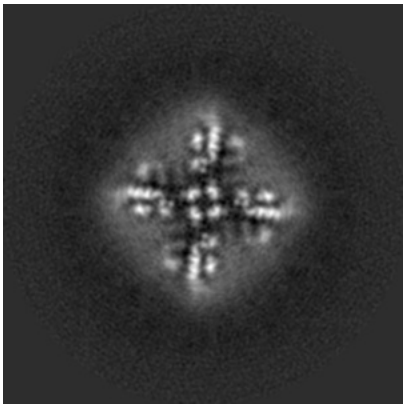

Y Index: 96


Z Index: 96

6.2.2 Raw map


X Index: 96

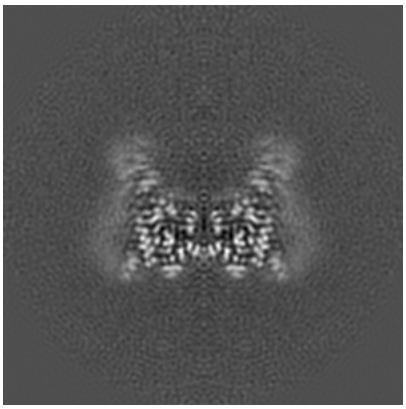

Y Index: 96

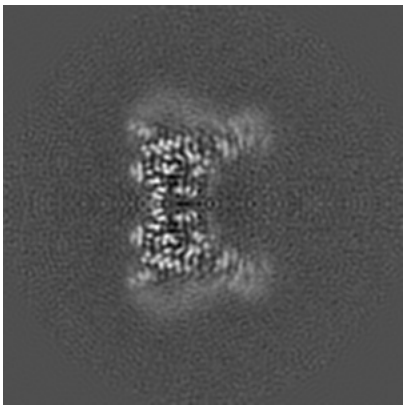

Z Index: 96

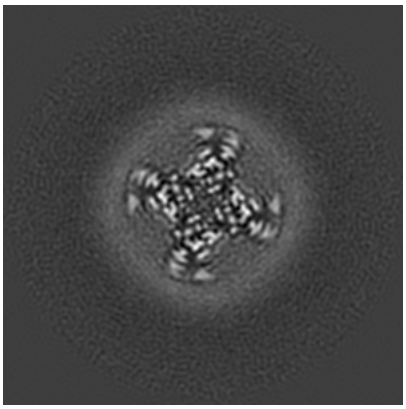
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

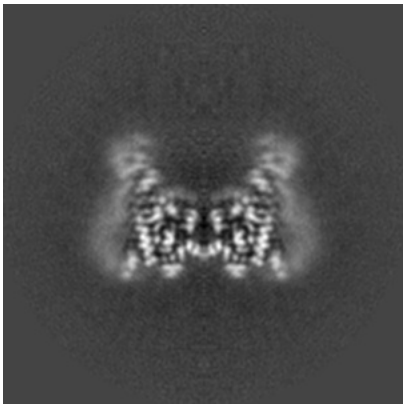
6.3.1 Primary map

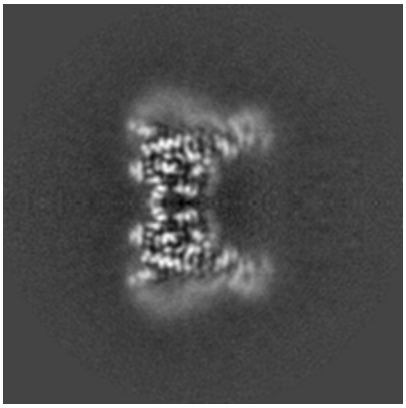

X Index: 96

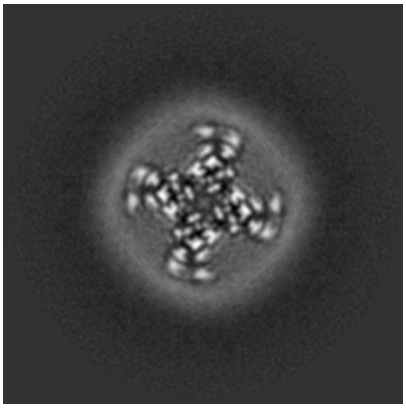

Y Index: 96


Z Index: 69

6.3.2 Raw map


X Index: 96

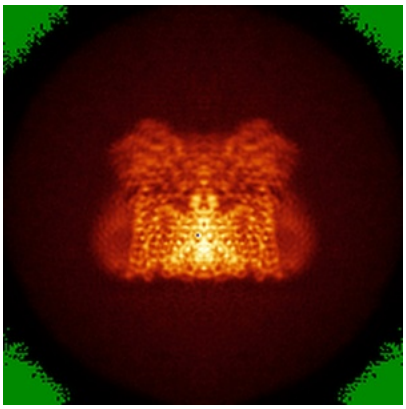

Y Index: 96

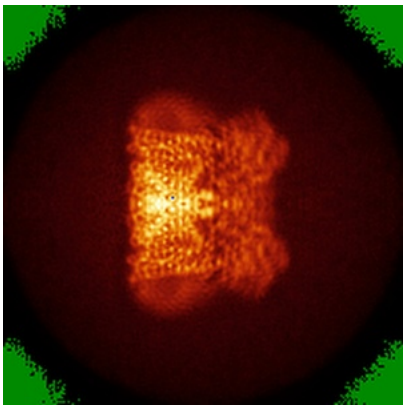

Z Index: 69

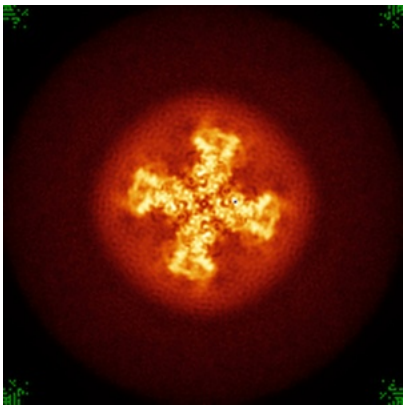
The images above show the largest variance slices of the map in three orthogonal directions.

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

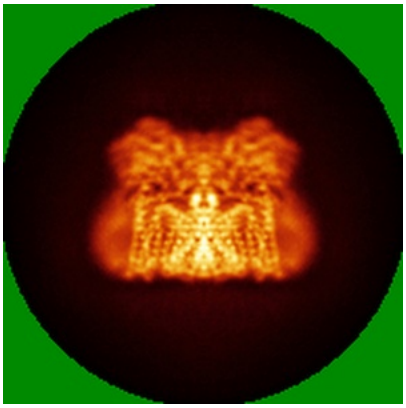
6.4.1 Primary map

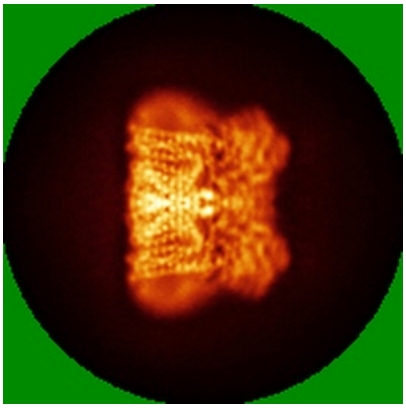

X

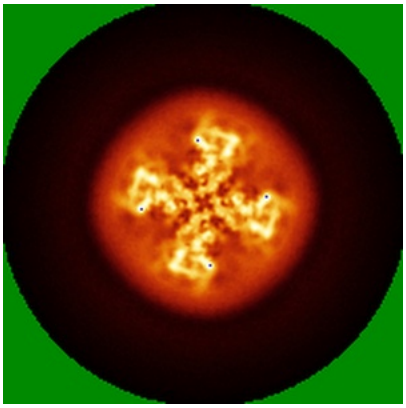

Y


Z

6.4.2 Raw map


X

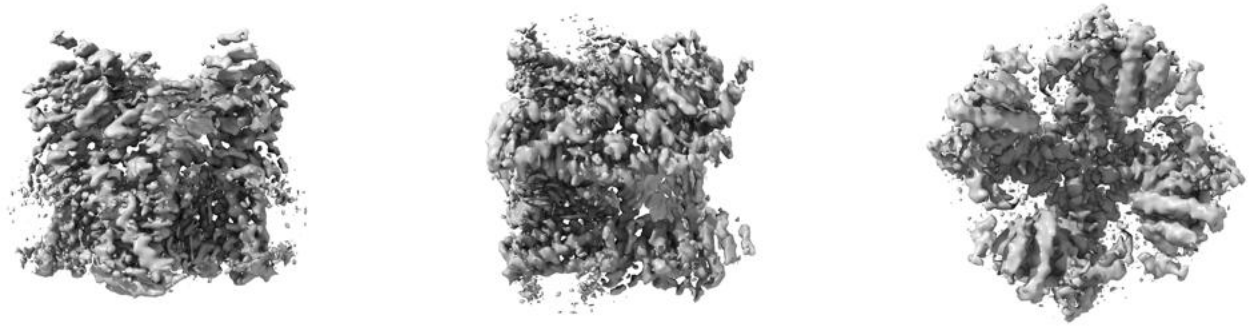

Y


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)

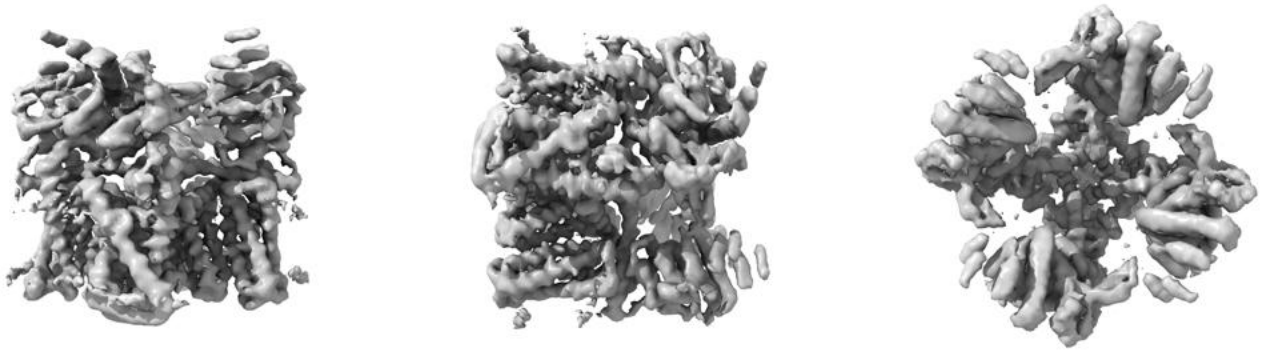
6.5.1 Primary map



X Y Z

The images above show the 3D surface view of the map at the recommended contour level 4.5. 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.

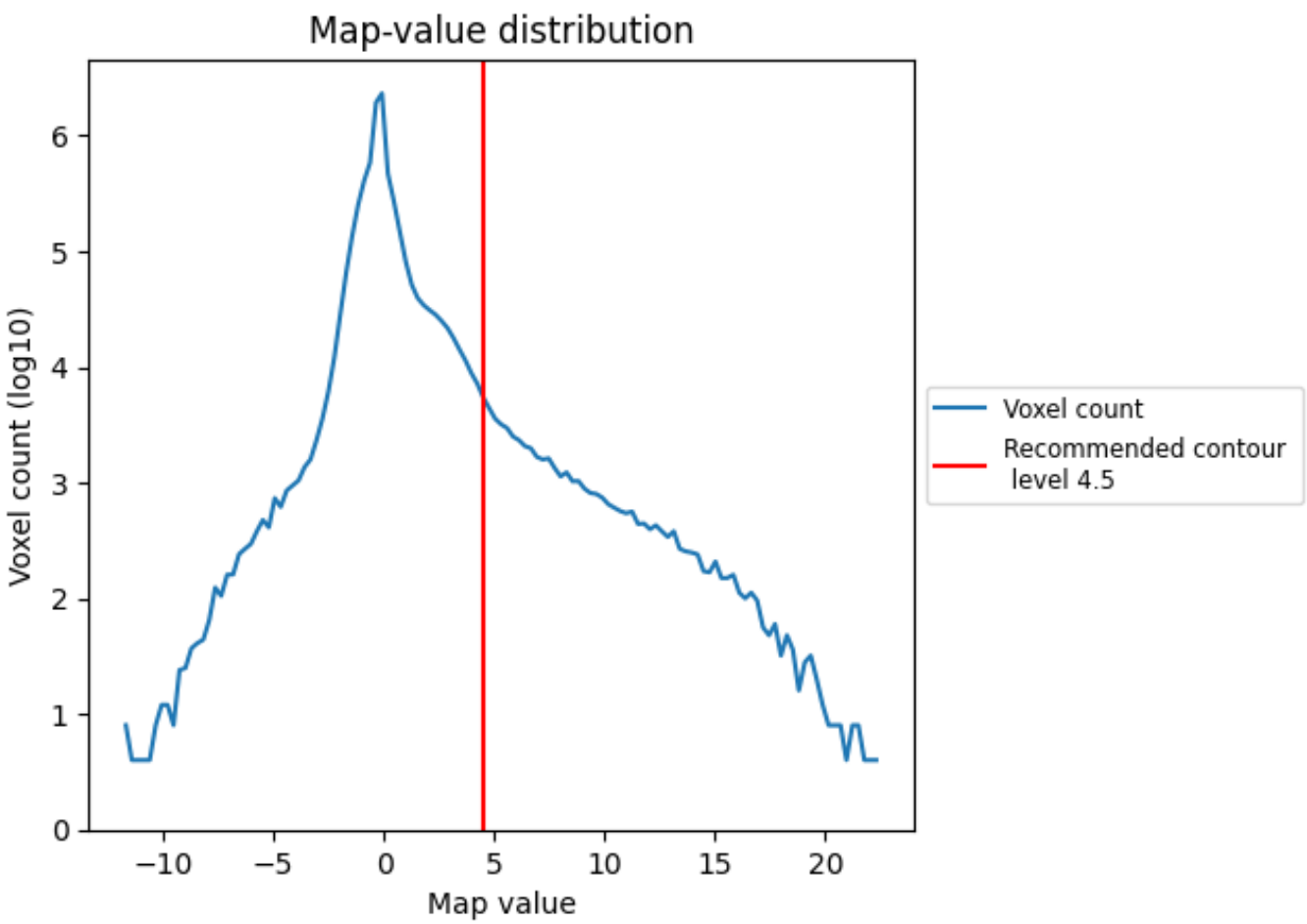
6.6 Mask visualisation (i)

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

7 Map analysis (i)

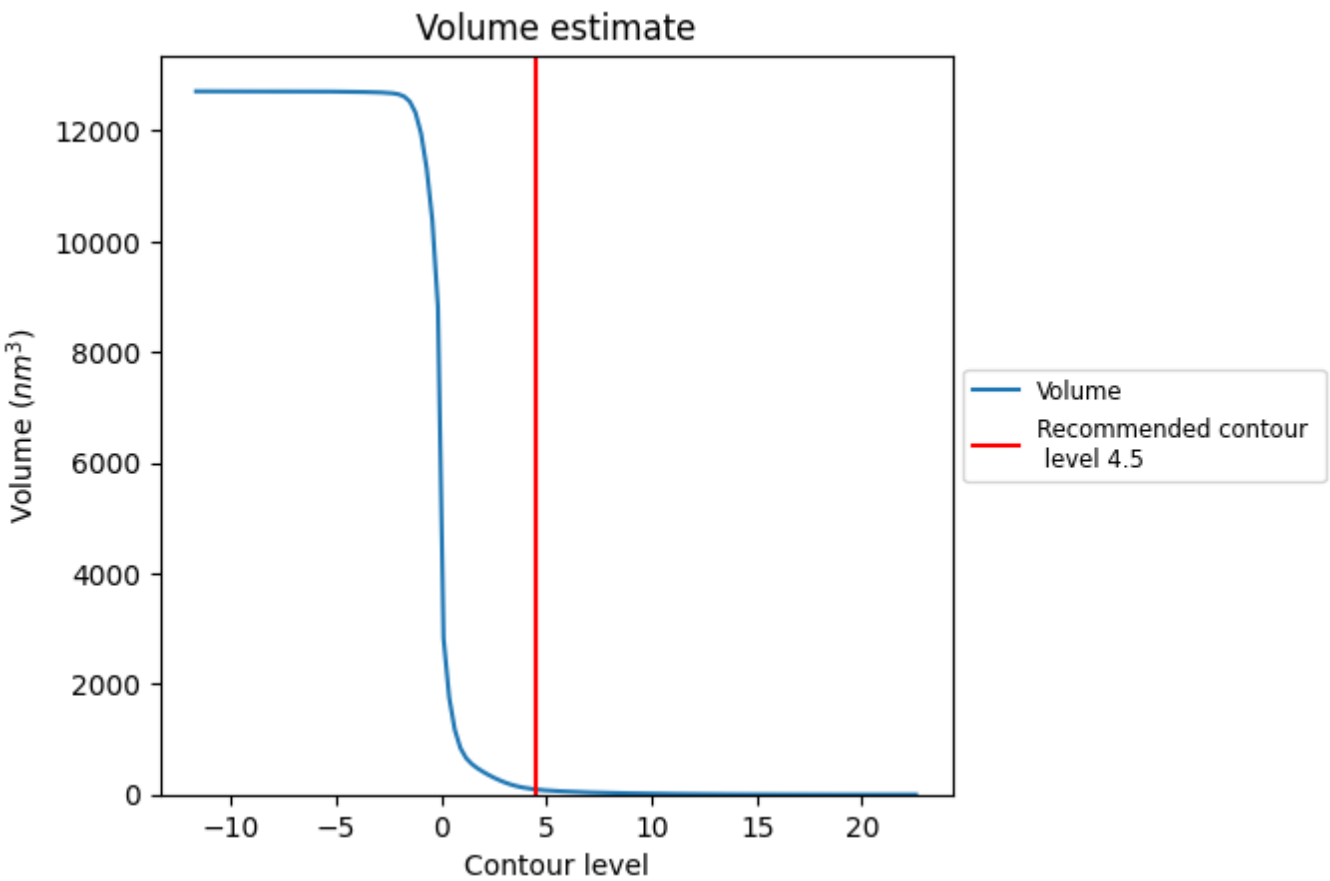
This section contains the results of statistical analysis of the map.

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.

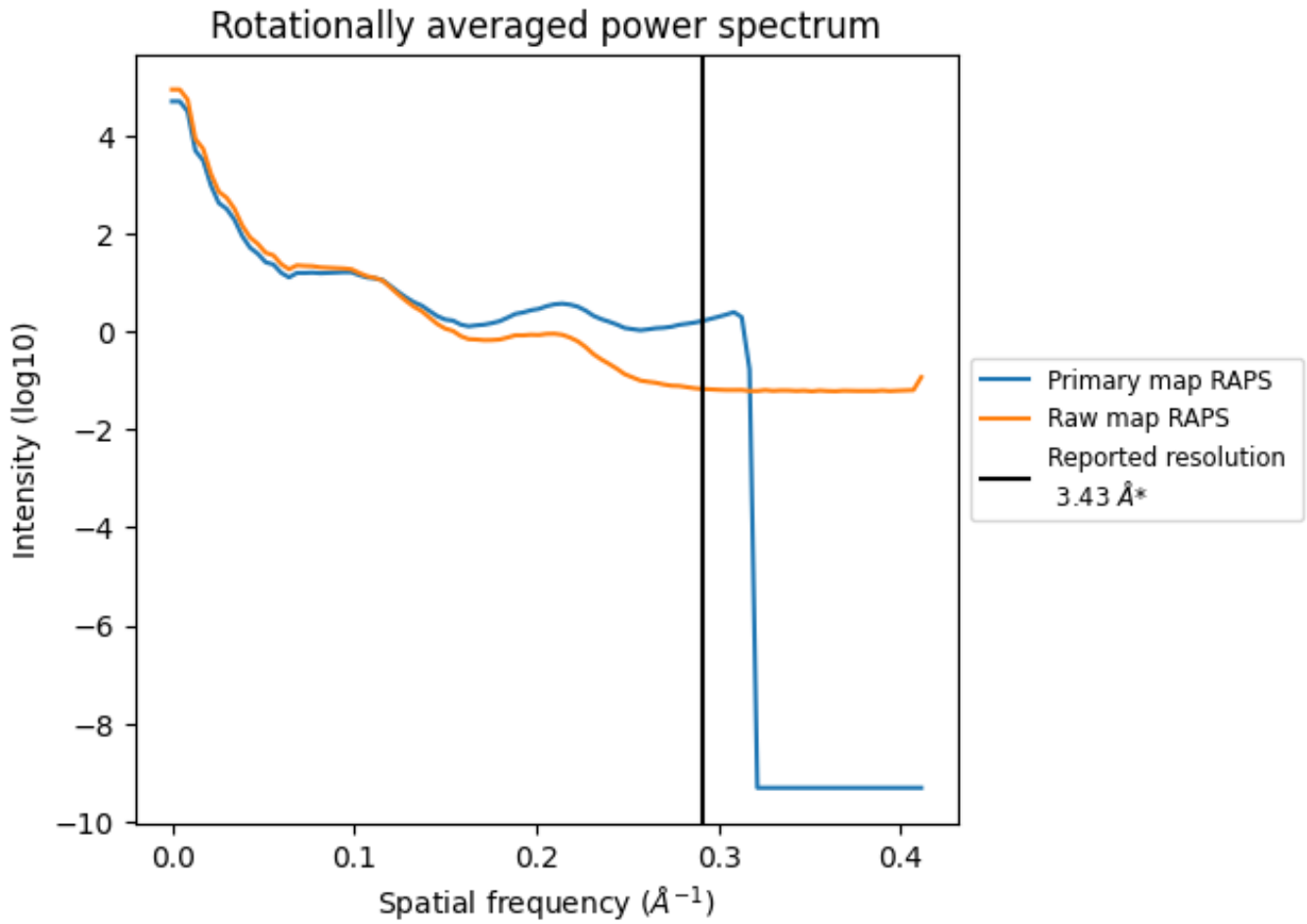
7.2 Volume estimate (i)



The volume at the recommended contour level is 92 nm^3; this corresponds to an approximate mass of 83 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)

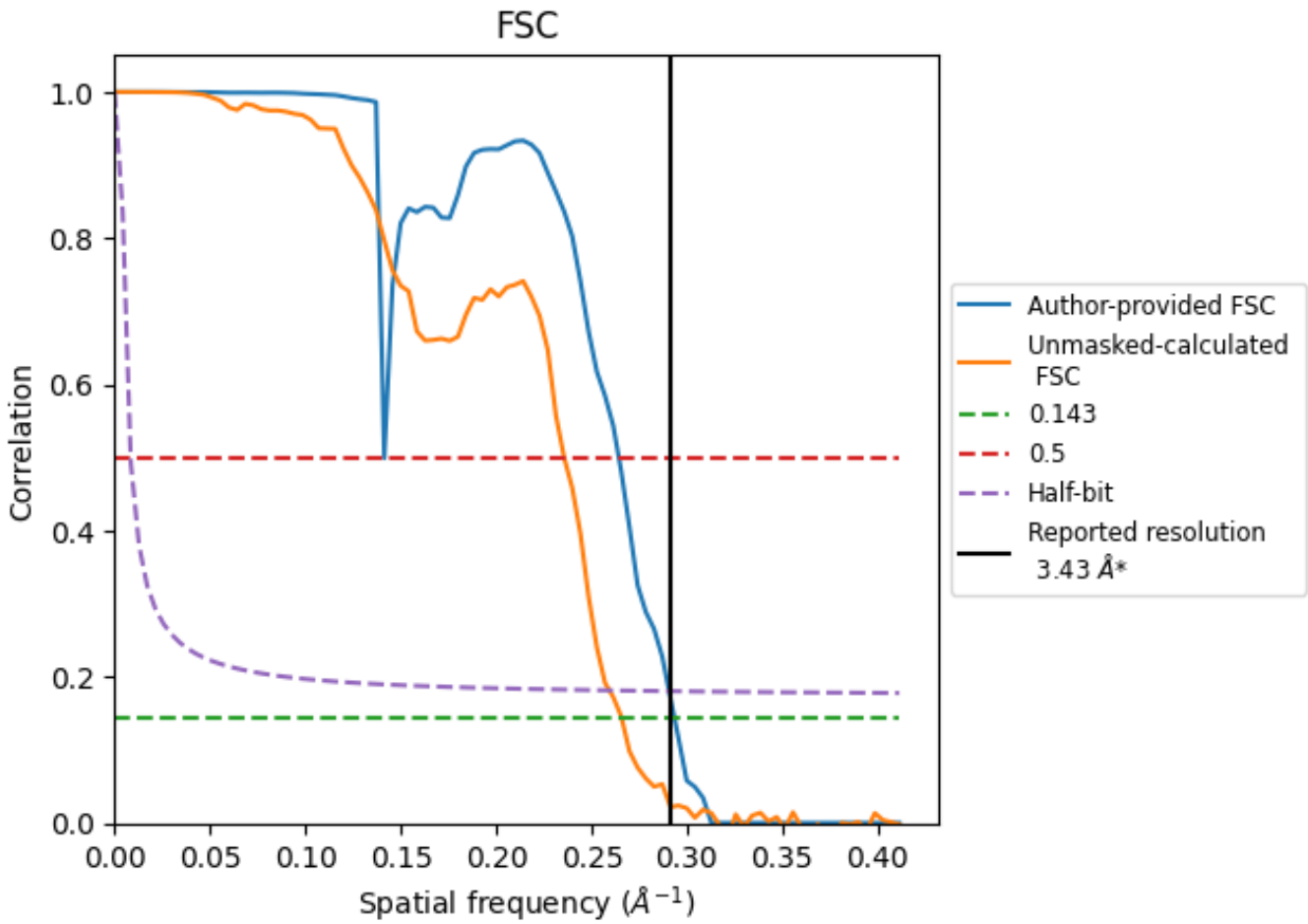


*Reported resolution corresponds to spatial frequency of 0.292 Å^{-1}

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 0.292 Å^{-1}

8.2 Resolution estimates (i)

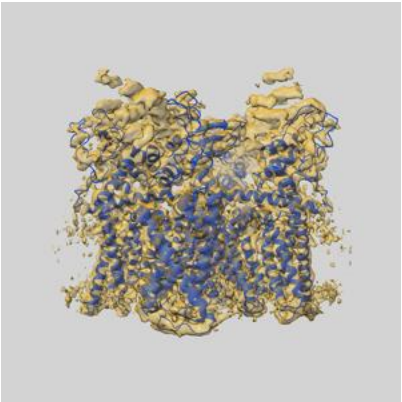
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.43	-	-
Author-provided FSC curve	3.41	7.07	3.44
Unmasked-calculated*	3.76	4.24	3.86

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.

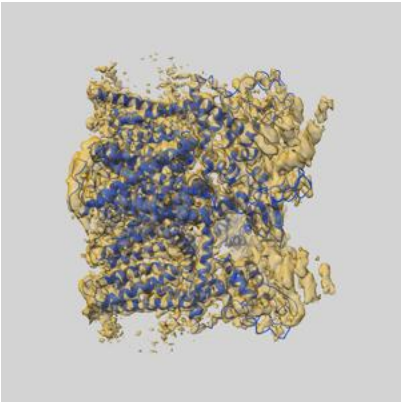
9 Map-model fit (i)

This section contains information regarding the fit between EMDB map EMD-8119 and PDB model 5IS0. Per-residue inclusion information can be found in section 3 on page 5.

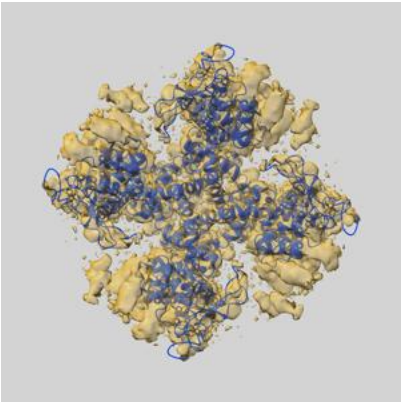
9.1 Map-model overlay (i)



X



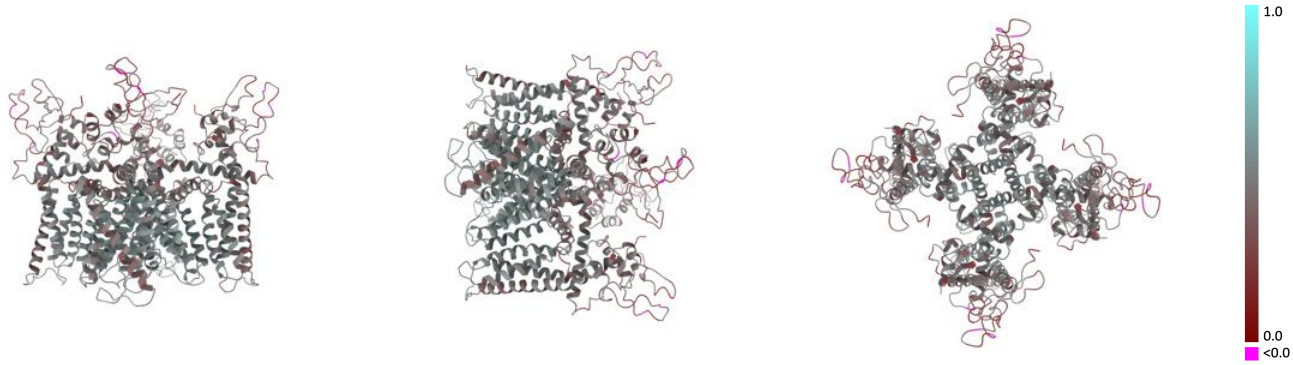
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 4.5 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

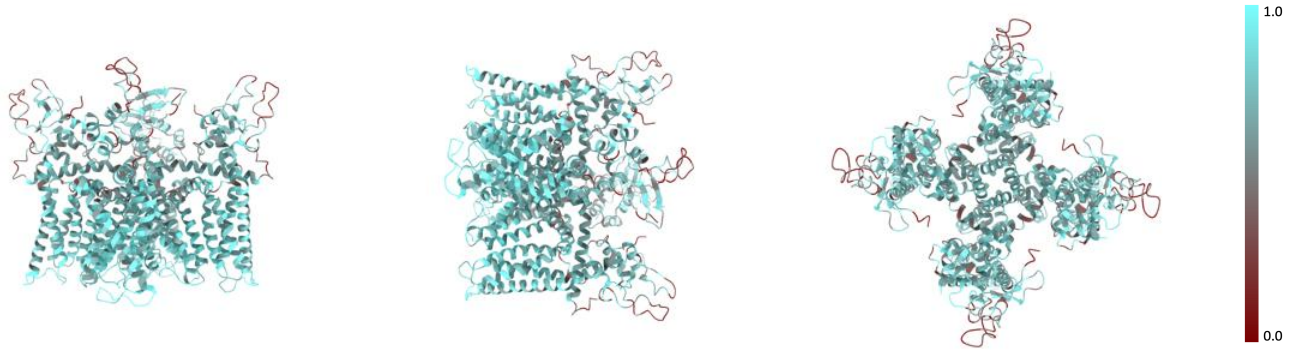
9.2 Q-score mapped to coordinate model (i)



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.

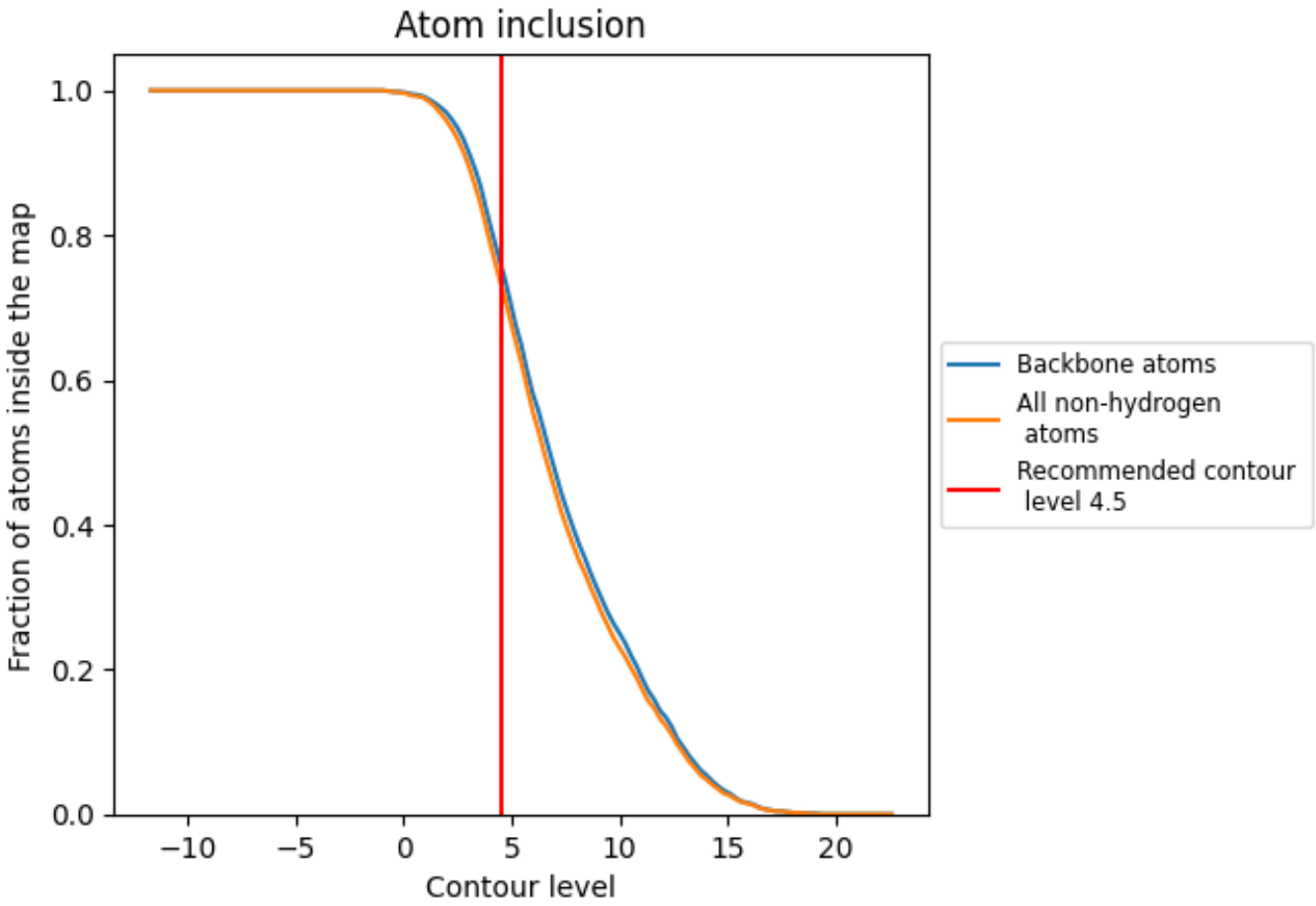
9.3 Atom inclusion mapped to coordinate model (i)



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 (4.5).

9.4 Atom inclusion (i)



At the recommended contour level, 76% of all backbone atoms, 73% 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 (4.5) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7330	0.4550
B	0.7410	0.4550
C	0.7420	0.4550
D	0.7430	0.4540
E	0.7440	0.4540