



wwPDB EM Validation Summary Report ⓘ

Apr 17, 2025 – 03:46 PM EDT

PDB ID : 9DH7 / pdb_00009dh7
EMDB ID : EMD-46858
Title : State-4 of the motor domain from full-length human dynein-1 in 5mM AMPPNP with 5mM Mg²⁺
Authors : Chai, P.; Zhang, K.
Deposited on : 2024-09-03
Resolution : 3.40 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.dev117
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4.02b-467
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.42

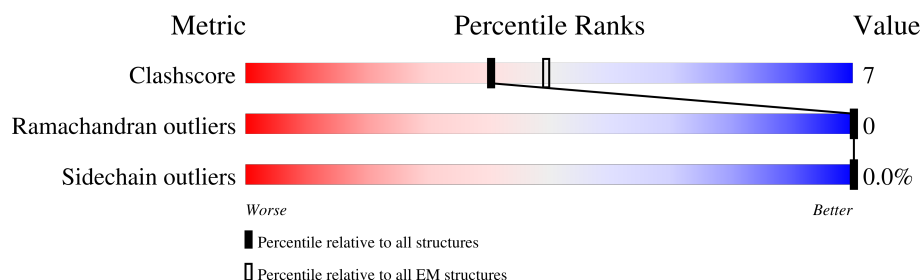
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.40 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	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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	4646	

2 Entry composition [i](#)

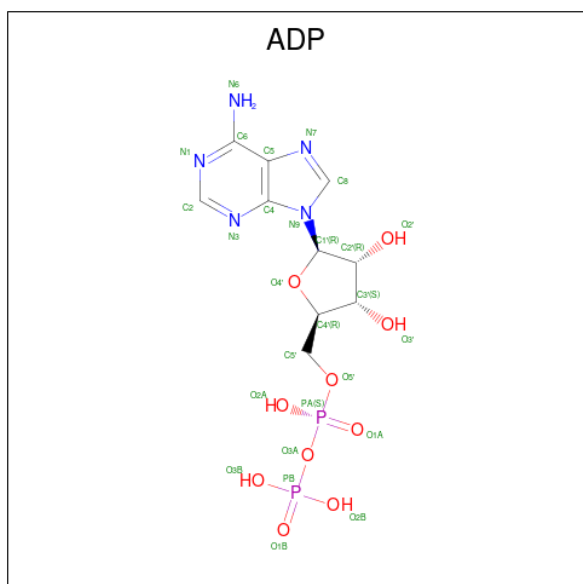
There are 4 unique types of molecules in this entry. The entry contains 23020 atoms, of which 0 are hydrogens and 0 are deuteriums.

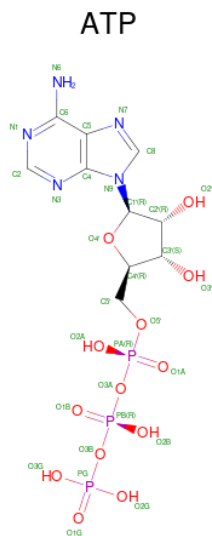
In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Cytoplasmic dynein 1 heavy chain 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	2857	22907	14584	3957	4253	113	0	0

- Molecule 2 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).





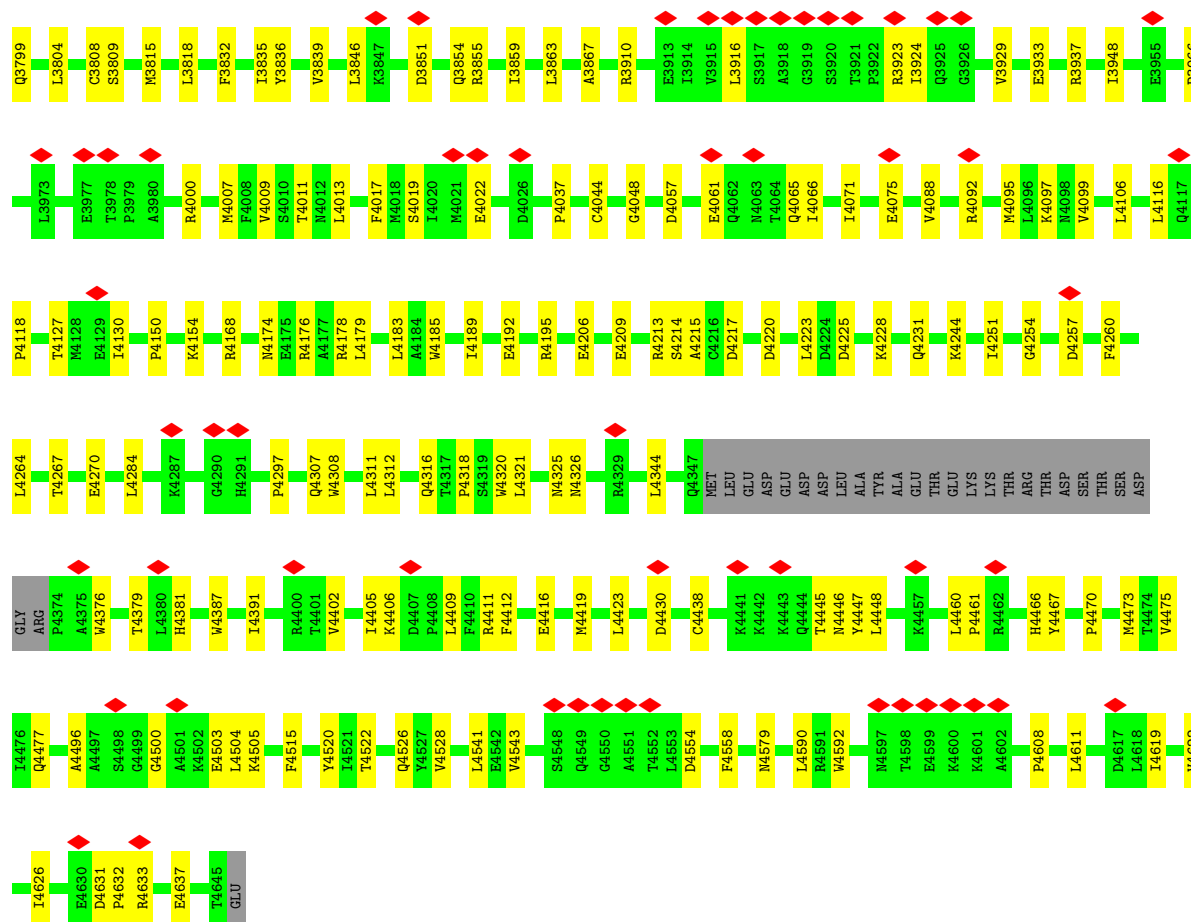
Mol	Chain	Residues	Atoms					AltConf
3	A	1	Total	C	N	O	P	0
			31	10	5	13	3	

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

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



D3668	L3547	A3452	THR	ALA	V3212	L3075	L2905	V2648	Y2517	Q2346	E2188
L3671	L3553	V3453	THR	ASP	D3213	S3082	F2912	D2664	T2521	D2347	D2195
T3681	D3557	L3454	TRP	GLN	Q3214	S3082	N2913	D2670	T2528	L2348	E2198
D3682	L3557	L3455	LYS	MET	V3215	D3096	E2914	D2671	D2536	L2382	T2213
D3683	R3561	E3457	ALA	VAL	E3216	U3097	L2920	T2676	D2537	D2388	T2216
D3691	R3568	A3458	ARG	LYS	E3217	S3098	L2925	Q2677	E2538	GLU	GLY
L3692	A3569	Q3459	SER	GLU	R3218	S3099	L2925	Q2677	E2538	GLY	L2220
C3693	D3570	A3460	ILE	ASP	L3218	S3099	L2925	Q2677	E2538	ASP	W2221
S3694	A3461	A3461	ILE	ASP	R3219	S3099	L2925	Q2677	E2538	ASP	L2220
R3695	A3462	A3462	MET	ASP	R3220	S3099	L2925	Q2677	E2538	ASP	W2221
L3708	C3573	K3462	ARG	LYS	D3221	S3099	L2925	Q2677	E2538	ASP	W2221
V3716	T3574	A3463	GLU	VAL	L3222	S3099	L2925	Q2677	E2538	ASP	W2221
D3725	E3575	A3463	ASN	GLU	R3223	S3099	L2925	Q2677	E2538	ASP	W2221
D3725	E3575	A3463	PHE	PRO	I3224	S3099	L2925	Q2677	E2538	ASP	W2221
R3728	M3579	A3465	VAL	VAL	K3225	S3099	L2925	Q2677	E2538	ASP	W2221
F3738	R3585	A3466	THR	THR	S3226	S3099	L2925	Q2677	E2538	ASP	W2221
Q3739	R3606	A3467	ILE	ILE	Q3227	S3099	L2925	Q2677	E2538	ASP	W2221
L3740	R3607	A3468	ILE	GLU	E3228	S3099	L2925	Q2677	E2538	ASP	W2221
R3743	R3608	E3469	ASN	ASN	L3229	S3099	L2925	Q2677	E2538	ASP	W2221
Q3744	R3612	A3470	ALA	ALA	E3230	S3099	L2925	Q2677	E2538	ASP	W2221
L3745	S3613	K3471	ALA	VAL	V3231	S3099	L2925	Q2677	E2538	ASP	W2221
E3746	F3614	A3477	ALA	VAL	K3232	S3099	L2925	Q2677	E2538	ASP	W2221
E3755	L3615	A3477	LYS	LYS	Q3233	S3099	L2925	Q2677	E2538	ASP	W2221
V3756	D3617	A3477	ILE	ILE	N3233	S3099	L2925	Q2677	E2538	ASP	W2221
K3757	R3628	A3481	SER	LYS	A3234	S3099	L2925	Q2677	E2538	ASP	W2221
G3758	R3631	L3482	ALA	GLN	A3236	S3099	L2925	Q2677	E2538	ASP	W2221
R3759	L3634	L3482	ARG	GLU	N3237	S3099	L2925	Q2677	E2538	ASP	W2221
L3760	V3635	L3482	GLU	VAL	K3238	S3099	L2925	Q2677	E2538	ASP	W2221
D3762	V3638	L3482	ASN	VAL	L3240	S3099	L2925	Q2677	E2538	ASP	W2221
D3763	V3644	L3482	LYS	VAL	K3241	S3099	L2925	Q2677	E2538	ASP	W2221
D3764	V3644	L3482	LYS	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
T3765	N3650	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
L3766	R3651	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
L3767	E3652	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
K3774	R3653	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
R3775	R3655	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
R3782	T3656	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
K3783	G3657	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
V3784	G3658	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
E3785	R3659	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
D3788	V3660	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
M3791	L3664	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
V3794	G3665	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
E3795	D3666	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221
	Q3667	L3482	ASN	VAL	L3241	S3099	L2925	Q2677	E2538	ASP	W2221



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	20077	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS GLACIOS	Depositor
Voltage (kV)	200	Depositor
Electron dose ($e^-/\text{\AA}^2$)	40	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	3000	Depositor
Magnification	45000	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.167	Depositor
Minimum map value	-0.523	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.037	Depositor
Recommended contour level	0.25	Depositor
Map size (Å)	444.4032, 444.4032, 444.4032	wwPDB
Map dimensions	384, 384, 384	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.1573, 1.1573, 1.1573	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: ADP, ATP, MG

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	0.27	0/23391	0.48	0/31705

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	22907	0	22979	311	0
2	A	81	0	36	3	0
3	A	31	0	12	2	0
4	A	1	0	0	0	0
All	All	23020	0	23027	311	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 7.

The worst 5 of 311 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:A:3557:ASP:OD1	1:A:3743:ARG:NH1	2.22	0.73
1:A:3655:ARG:HG2	1:A:3660:VAL:HG22	1.71	0.73
1:A:4225:ASP:O	1:A:4228:LYS:NZ	2.22	0.73
1:A:4267:THR:HG23	1:A:4633:ARG:HD2	1.71	0.71
1:A:2840:ASP:OD1	1:A:2843:ARG:NH2	2.24	0.71

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	2849/4646 (61%)	2808 (99%)	41 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	2530/4125 (61%)	2529 (100%)	1 (0%)	100	100

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3607	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1856	GLN
1	A	1985	HIS
1	A	2621	ASN

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 5 ligands modelled in this entry, 1 is monoatomic - leaving 4 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	ATP	A	4702	4	28,33,33	0.74	0	34,52,52	0.79	1 (2%)
2	ADP	A	4703	-	24,29,29	0.72	0	29,45,45	0.73	1 (3%)
2	ADP	A	4701	-	24,29,29	0.74	0	29,45,45	0.75	1 (3%)
2	ADP	A	4704	-	24,29,29	0.75	0	29,45,45	0.74	1 (3%)

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	ATP	A	4702	4	-	1/18/38/38	0/3/3/3
2	ADP	A	4703	-	-	0/12/32/32	0/3/3/3
2	ADP	A	4701	-	-	1/12/32/32	0/3/3/3
2	ADP	A	4704	-	-	3/12/32/32	0/3/3/3

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	4703	ADP	C5-C6-N6	2.30	123.82	120.31
2	A	4704	ADP	C5-C6-N6	2.29	123.81	120.31
2	A	4701	ADP	C5-C6-N6	2.28	123.78	120.31
3	A	4702	ATP	C5-C6-N6	2.25	123.73	120.31

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	4704	ADP	PA-O3A-PB-O2B
2	A	4704	ADP	PA-O3A-PB-O3B
3	A	4702	ATP	O4'-C4'-C5'-O5'
2	A	4704	ADP	C5'-O5'-PA-O1A
2	A	4701	ADP	O4'-C4'-C5'-O5'

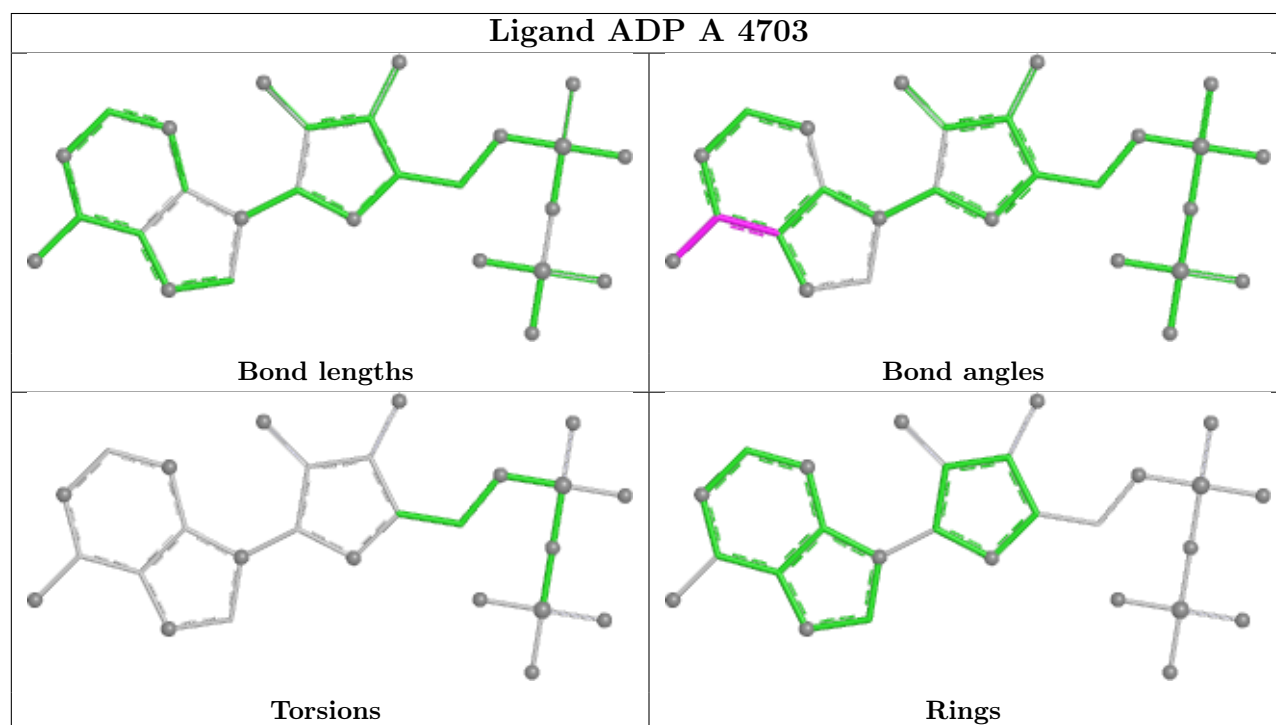
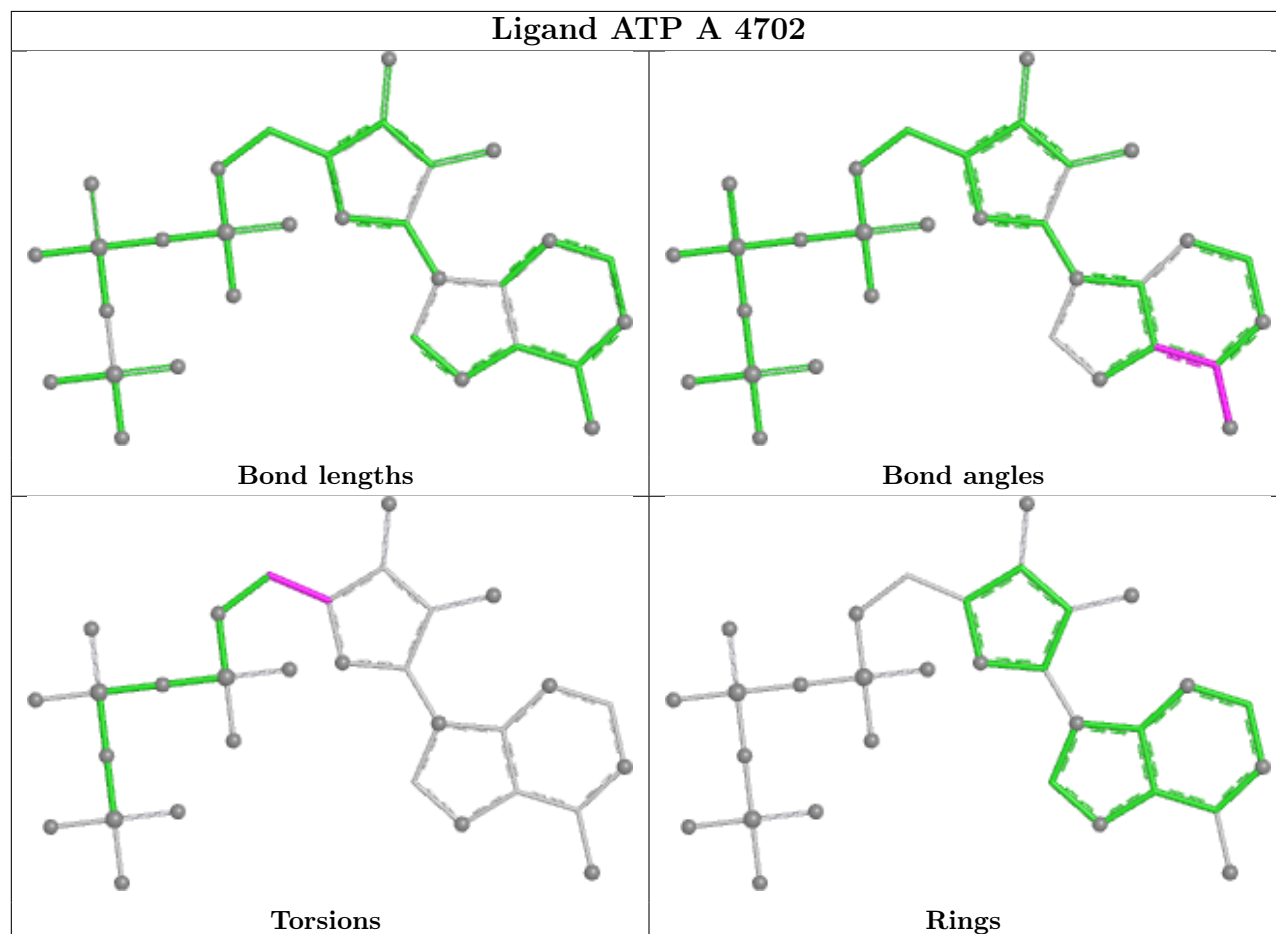
There are no ring outliers.

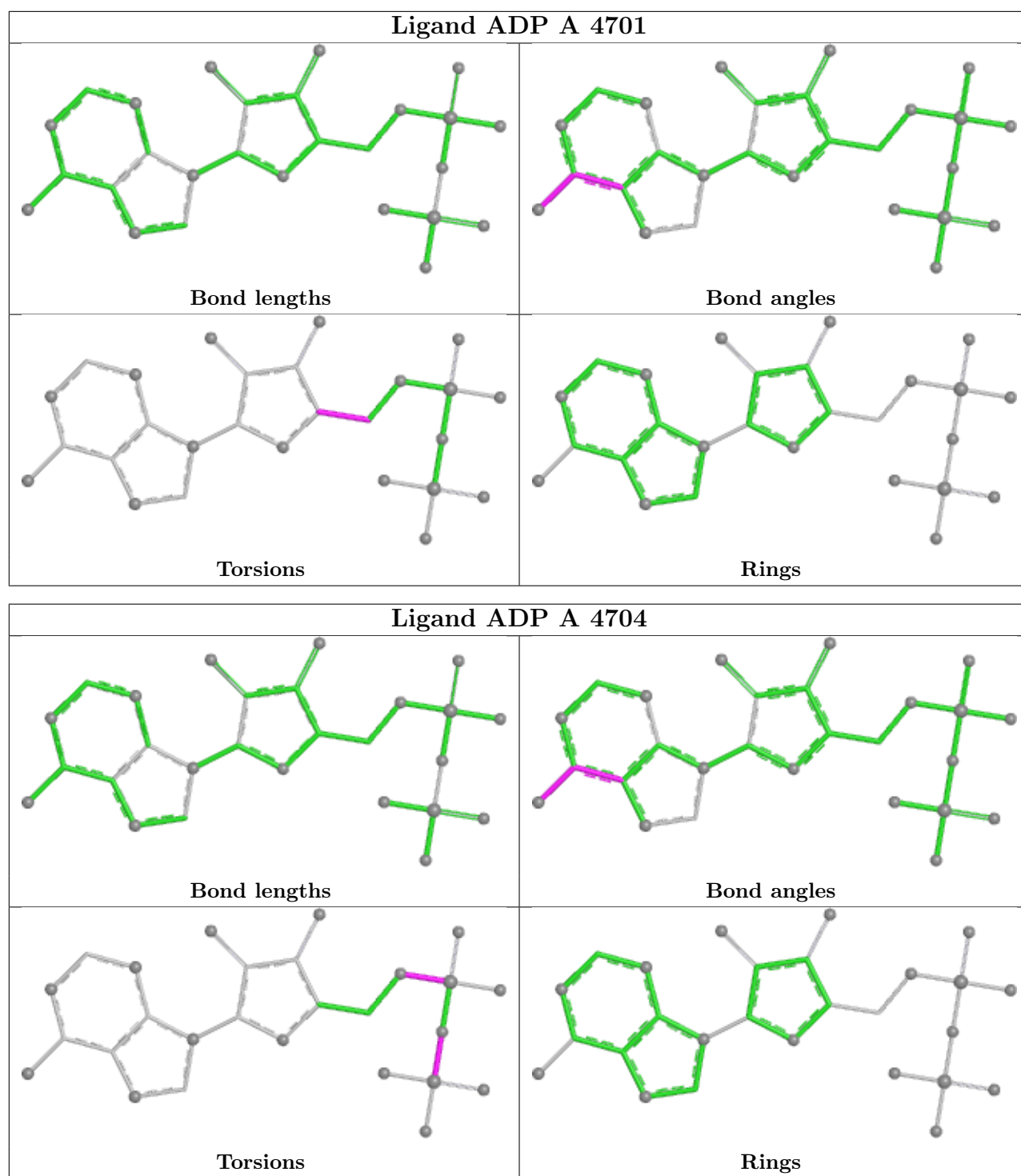
2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	4702	ATP	2	0
2	A	4701	ADP	3	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 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 ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

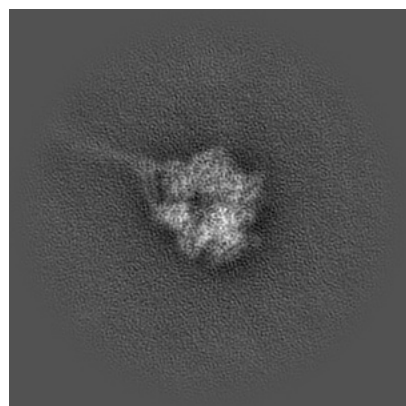
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-46858. These allow visual inspection of the internal detail of the map and identification of artifacts.

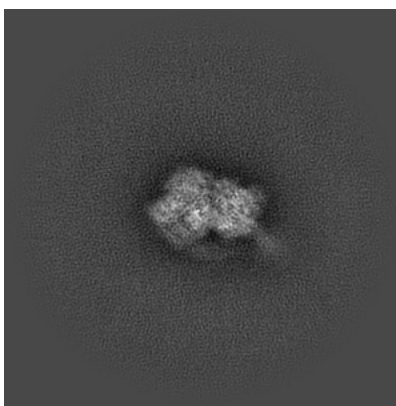
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

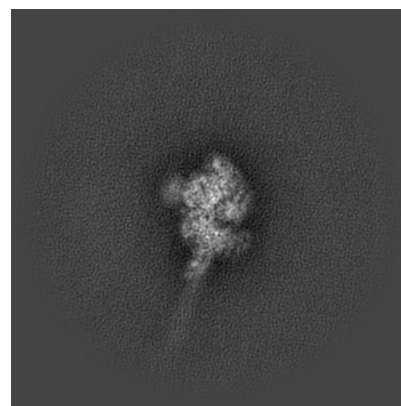
6.1.1 Primary map



X

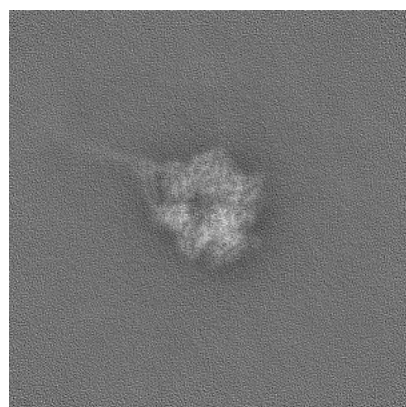


Y

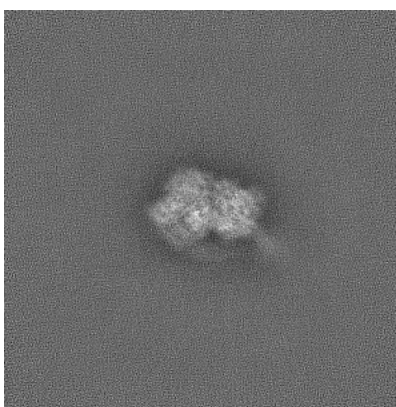


Z

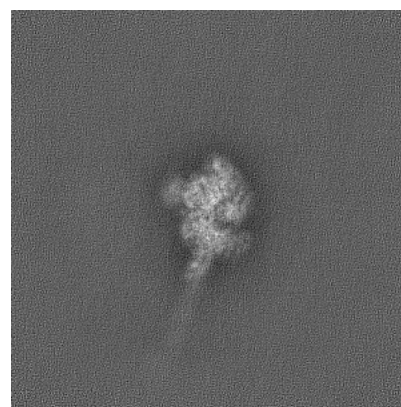
6.1.2 Raw map



X



Y

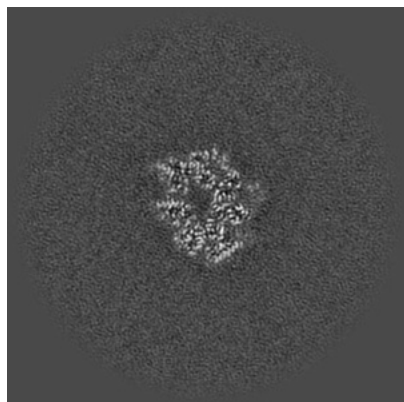


Z

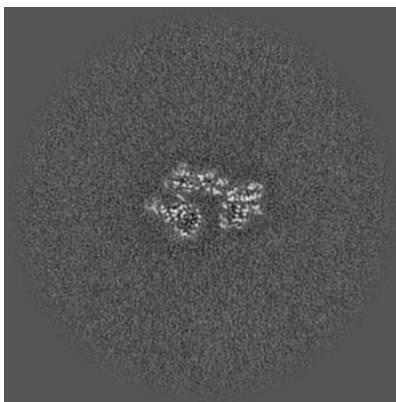
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

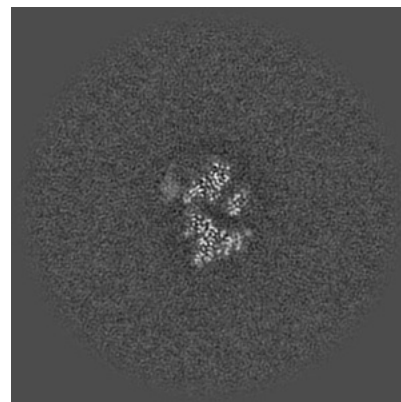
6.2.1 Primary map



X Index: 192

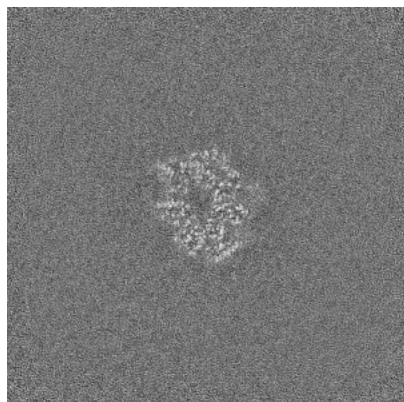


Y Index: 192

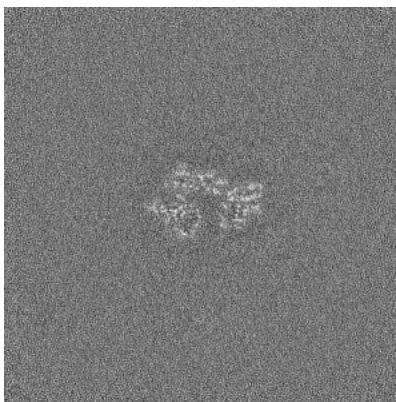


Z Index: 192

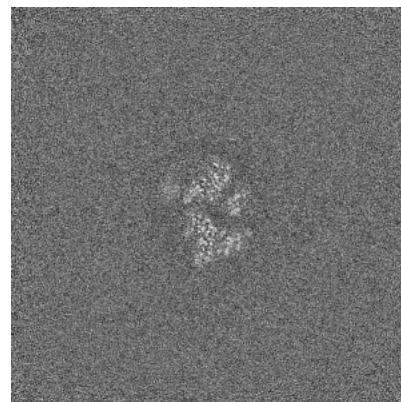
6.2.2 Raw map



X Index: 192



Y Index: 192

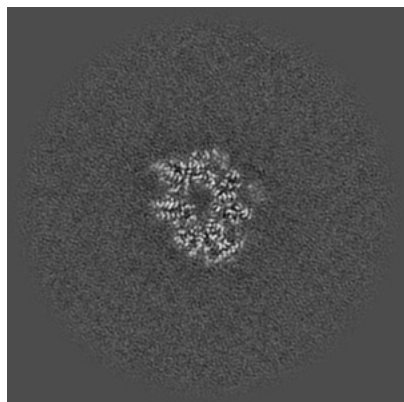


Z Index: 192

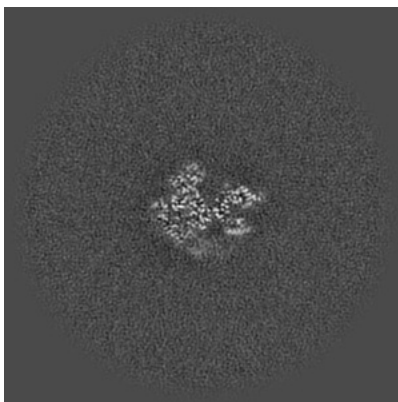
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

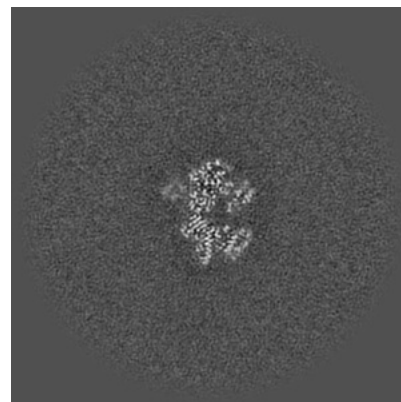
6.3.1 Primary map



X Index: 191

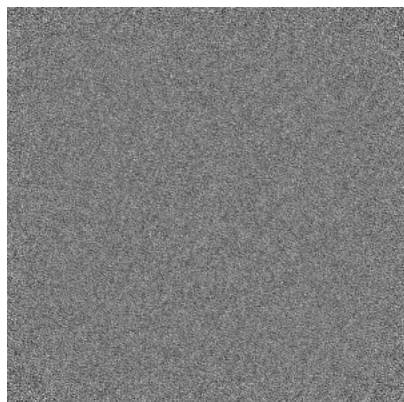


Y Index: 206

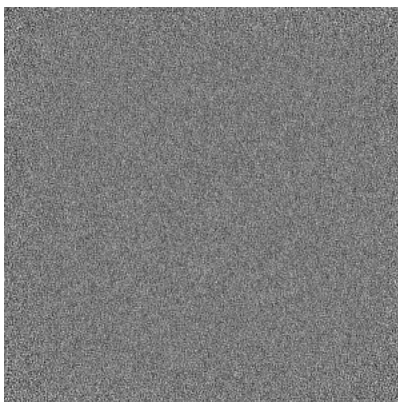


Z Index: 184

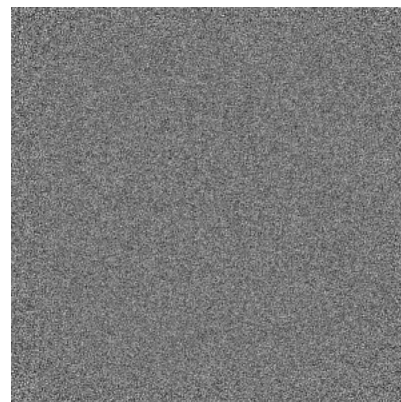
6.3.2 Raw map



X Index: 0



Y Index: 0

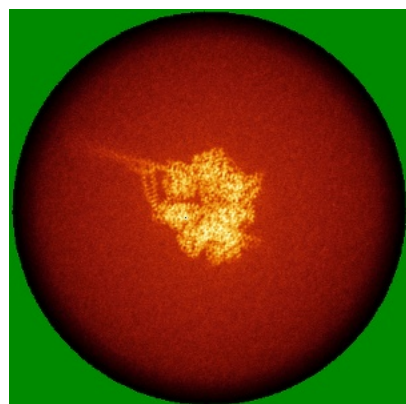


Z Index: 0

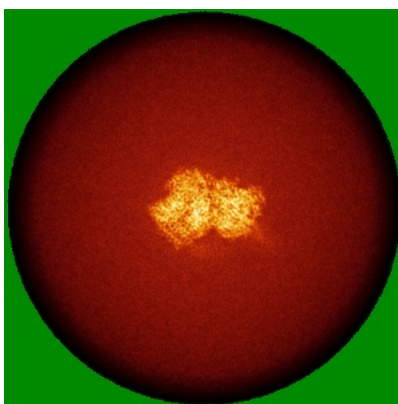
The images above show the largest variance slices of the map in three orthogonal directions.

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

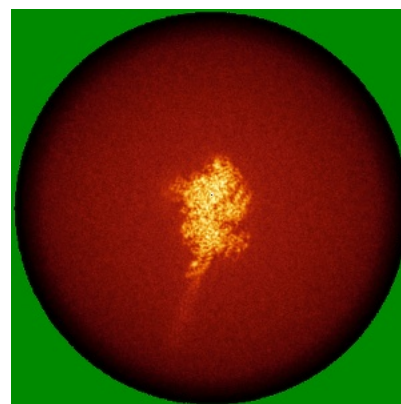
6.4.1 Primary map



X

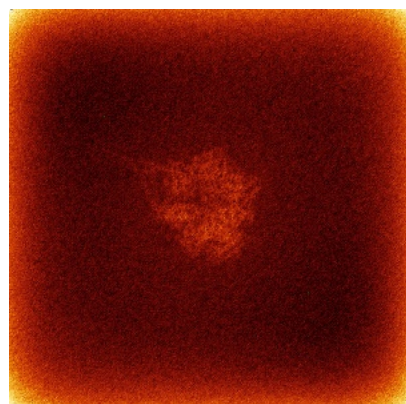


Y

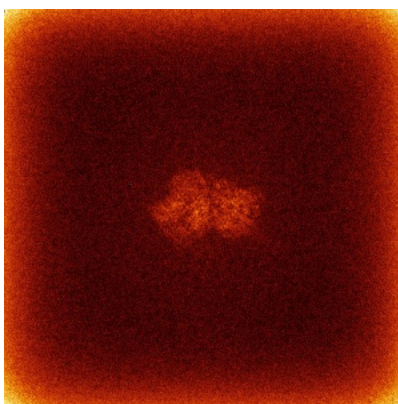


Z

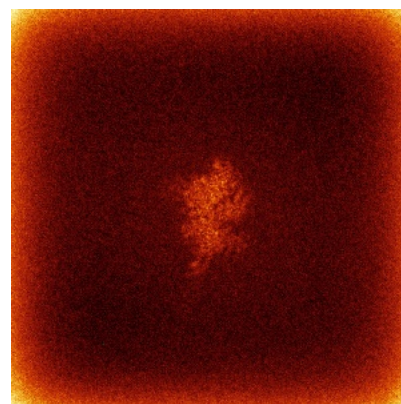
6.4.2 Raw map



X



Y

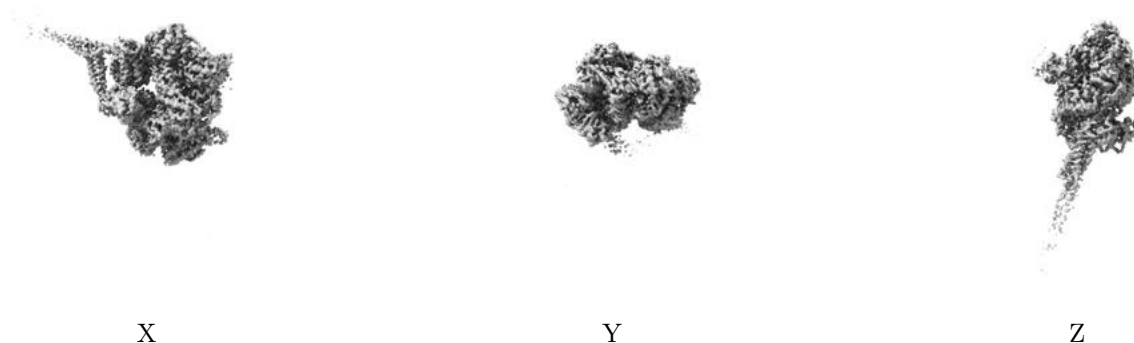


Z

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.

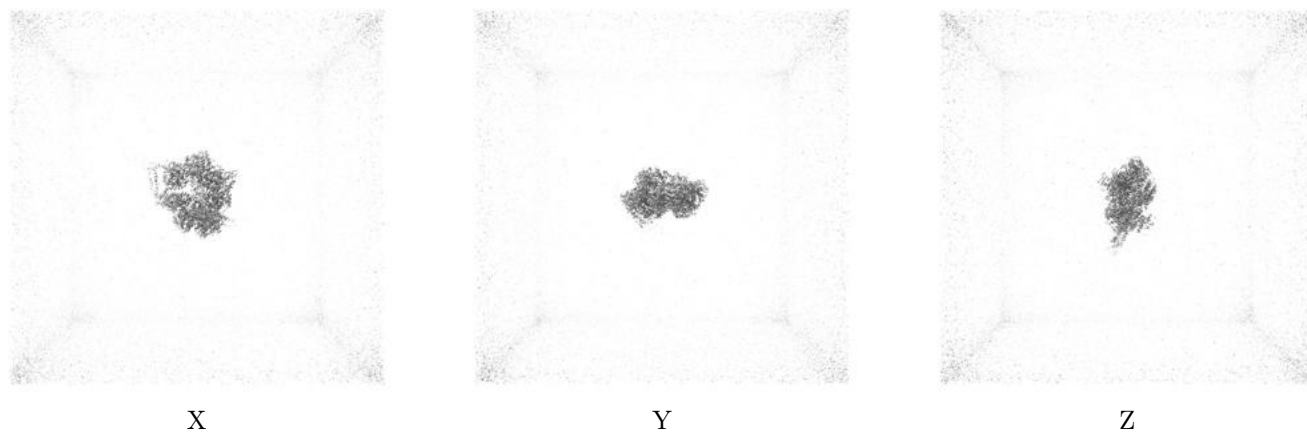
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.25. 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.

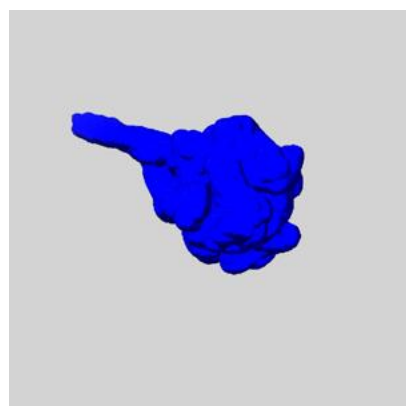
6.6 Mask visualisation [i](#)

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

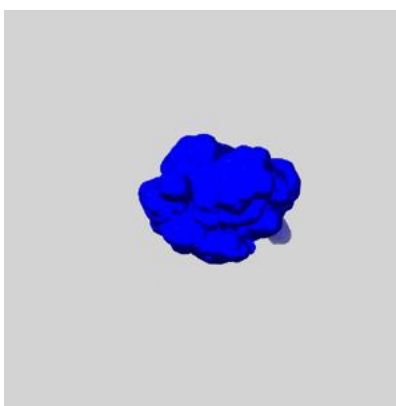
A mask typically either:

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

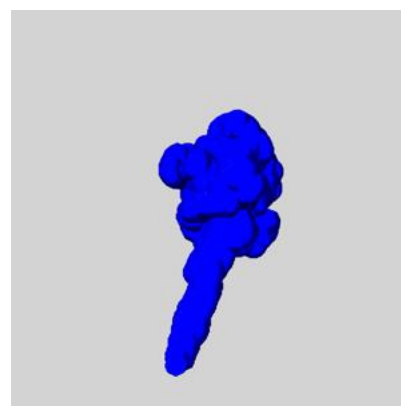
6.6.1 emd_46858_msk_1.map [i](#)



X



Y

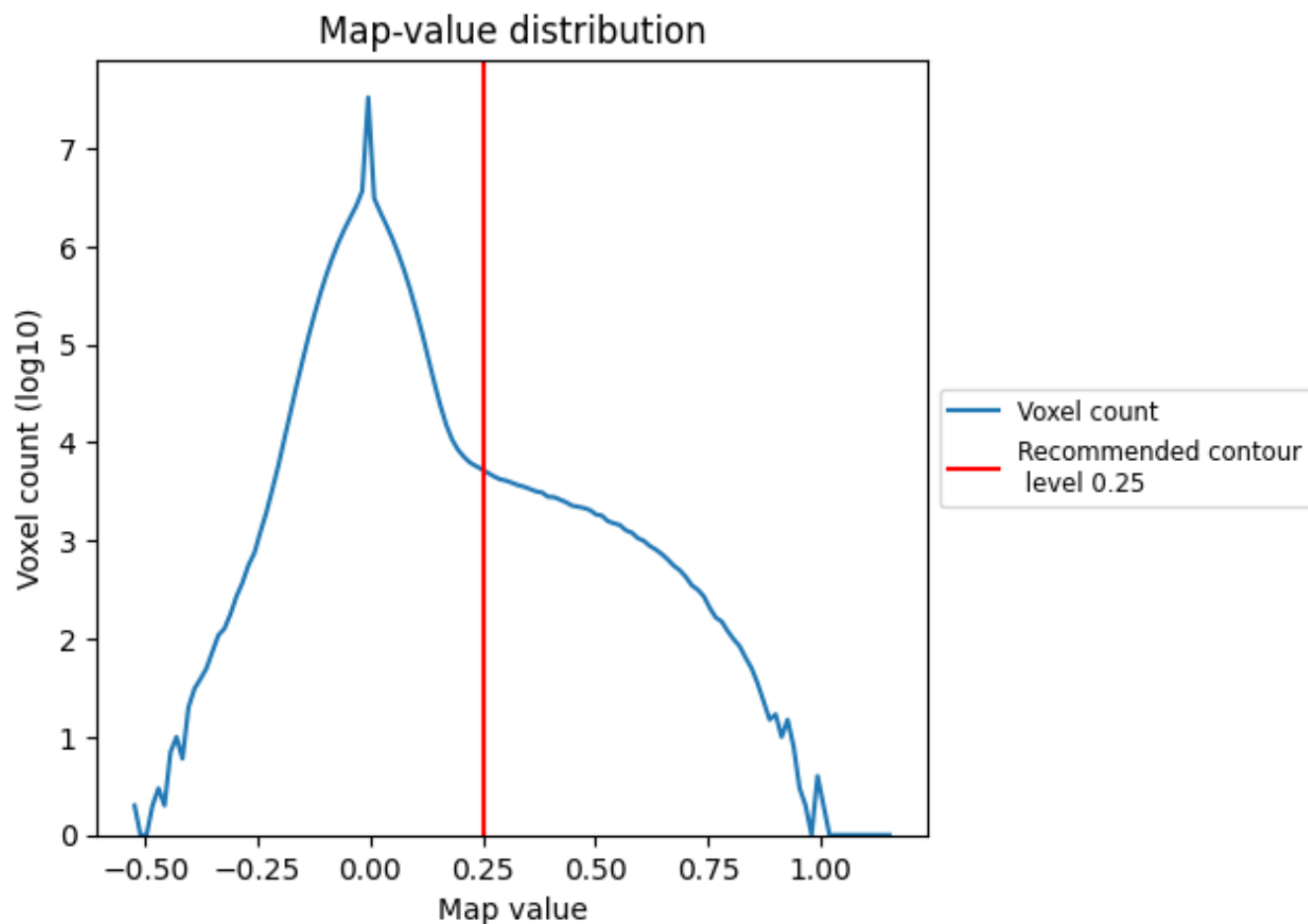


Z

7 Map analysis [i](#)

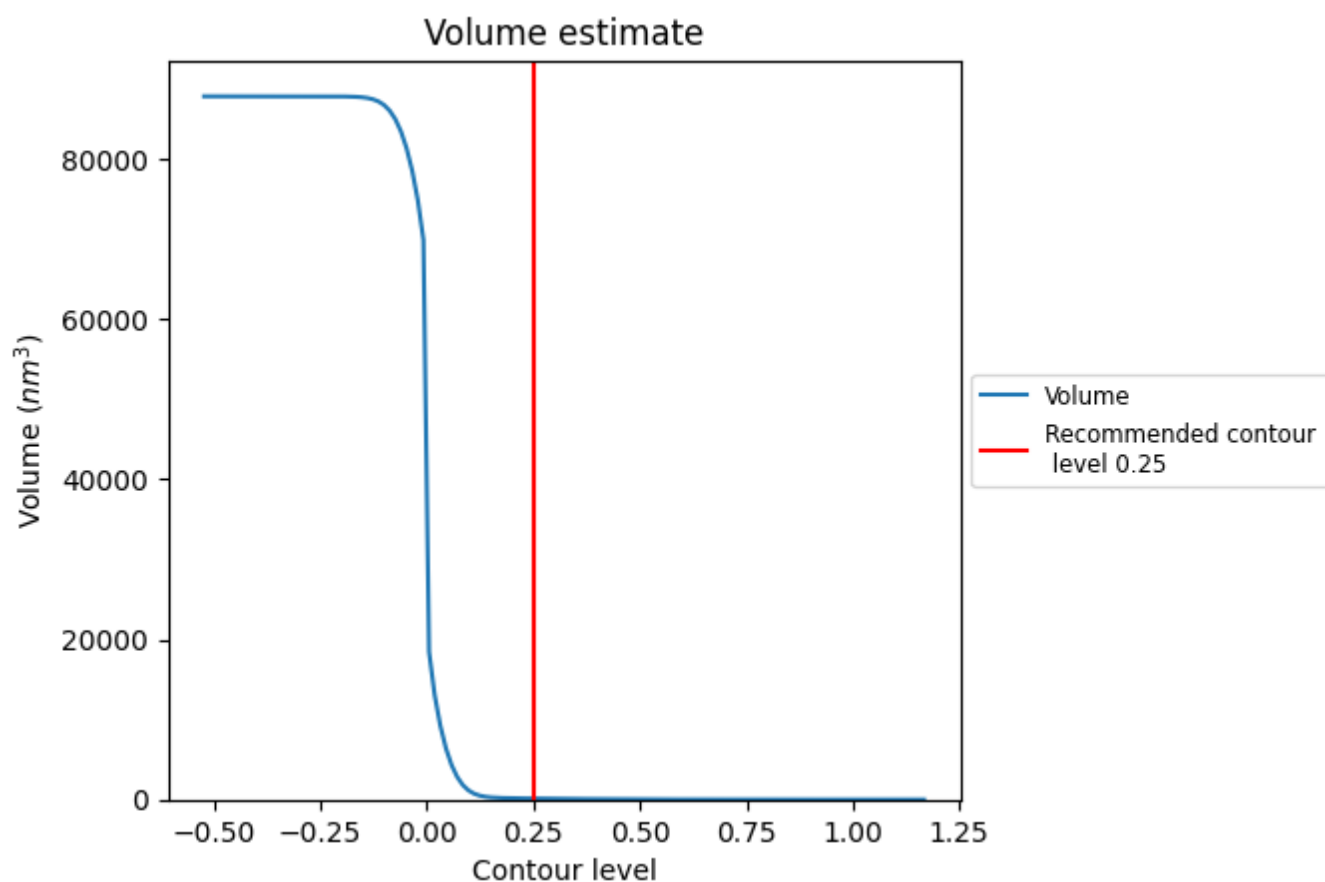
This section contains the results of statistical analysis of the map.

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.

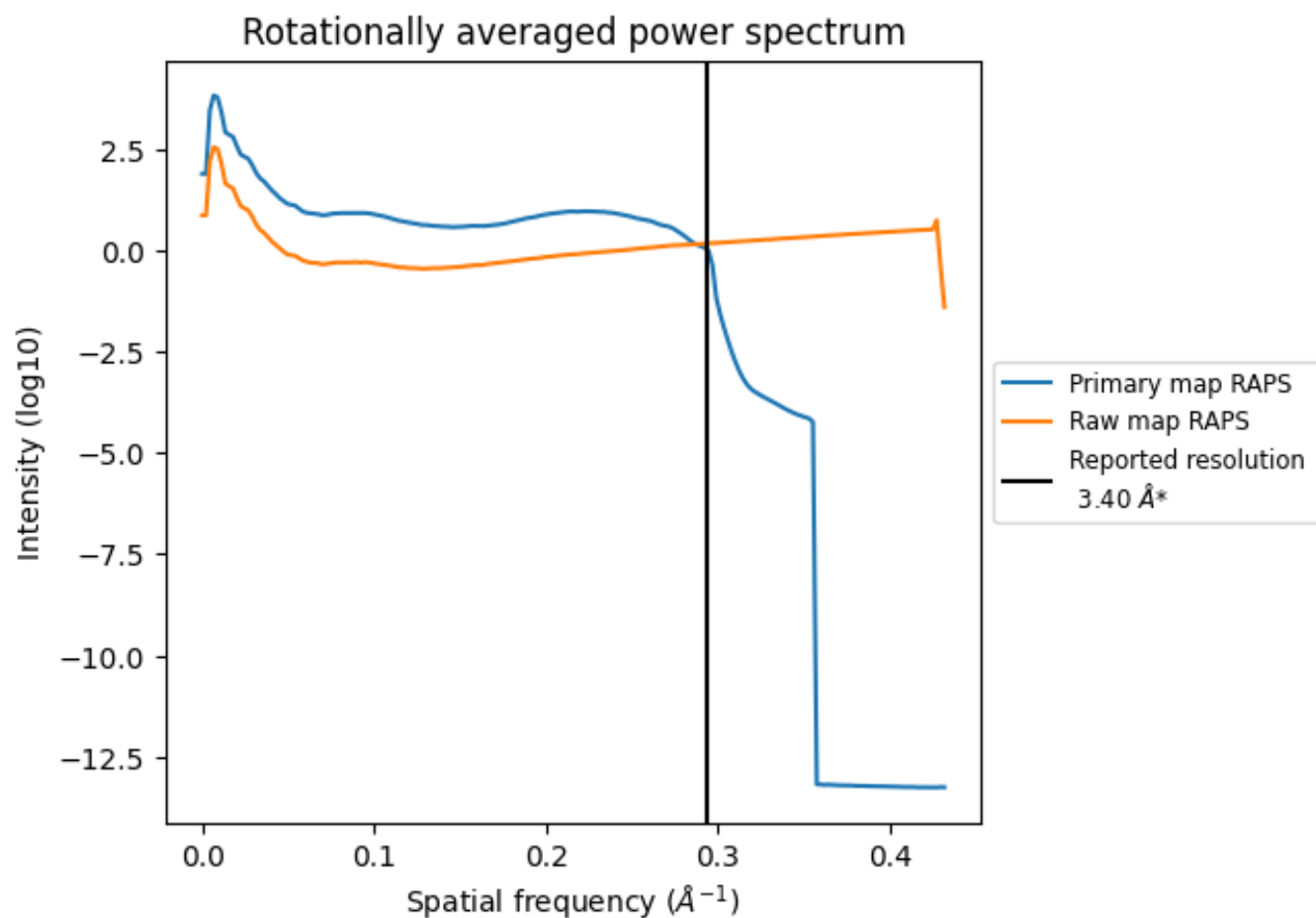
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 127 nm³; this corresponds to an approximate mass of 115 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 ⓘ

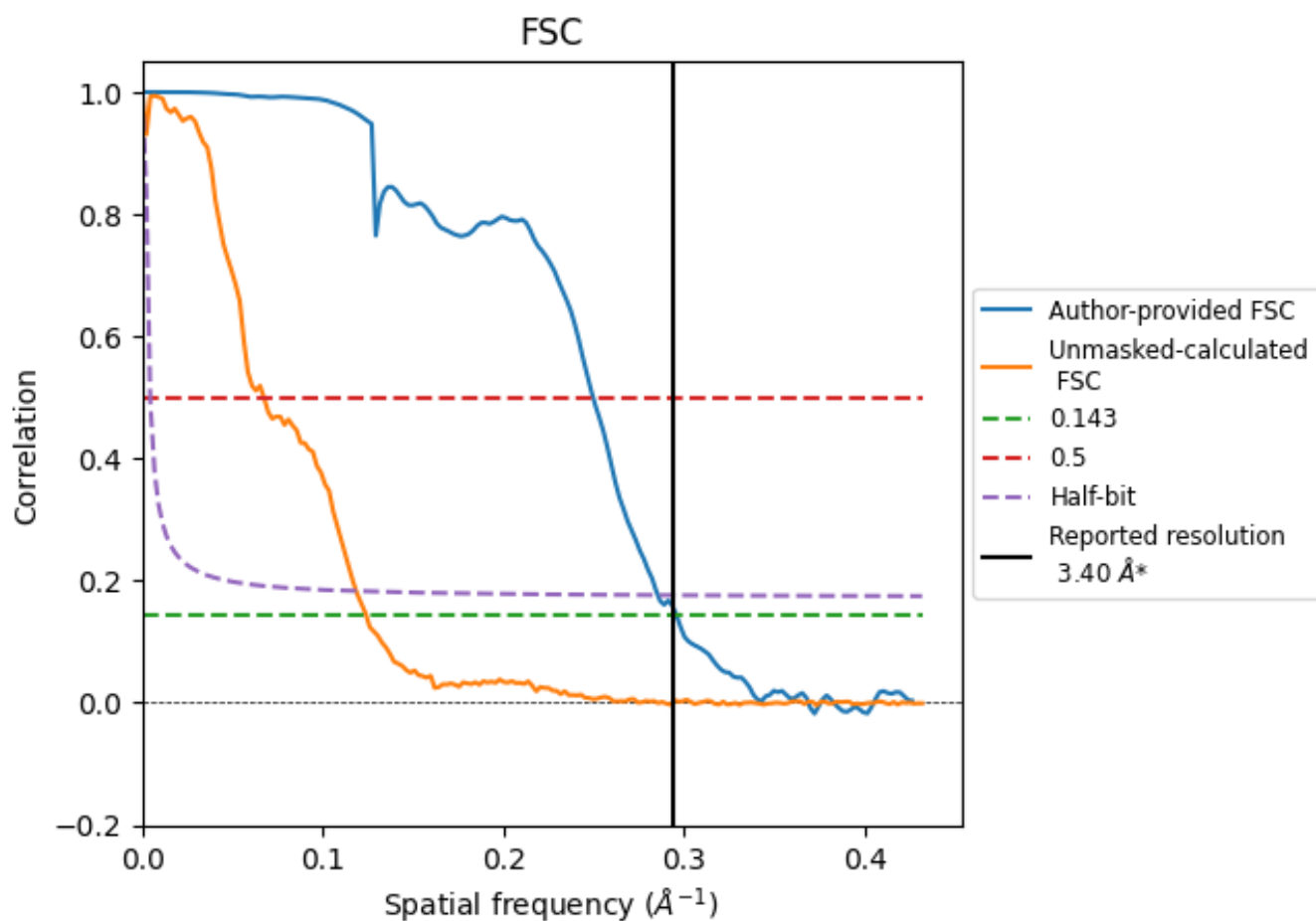


*Reported resolution corresponds to spatial frequency of 0.294 Å⁻¹

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 0.294 Å⁻¹

8.2 Resolution estimates [i](#)

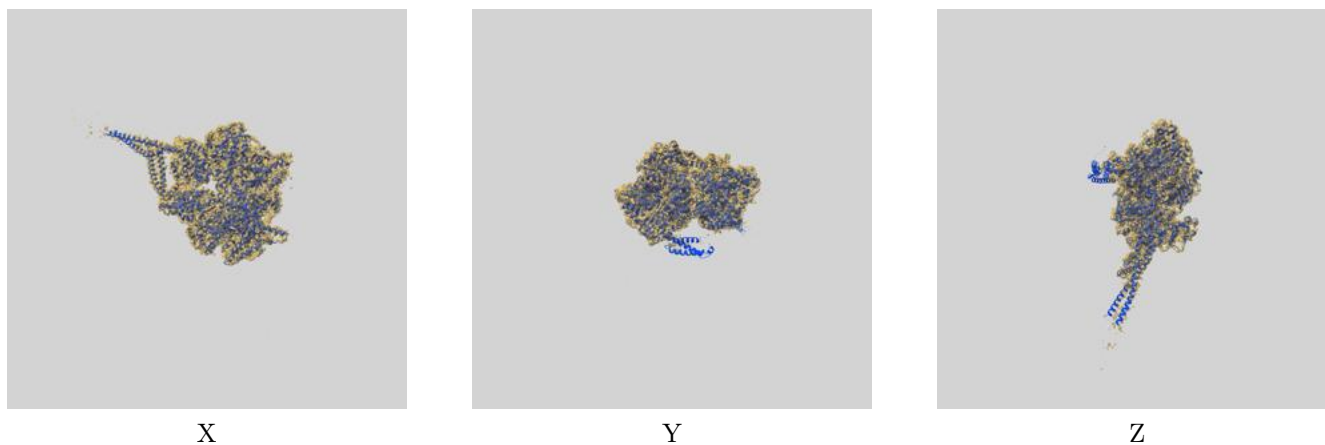
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.40	-	-
Author-provided FSC curve	3.38	4.00	3.50
Unmasked-calculated*	8.06	14.84	8.43

*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 8.06 differs from the reported value 3.4 by more than 10 %

9 Map-model fit [i](#)

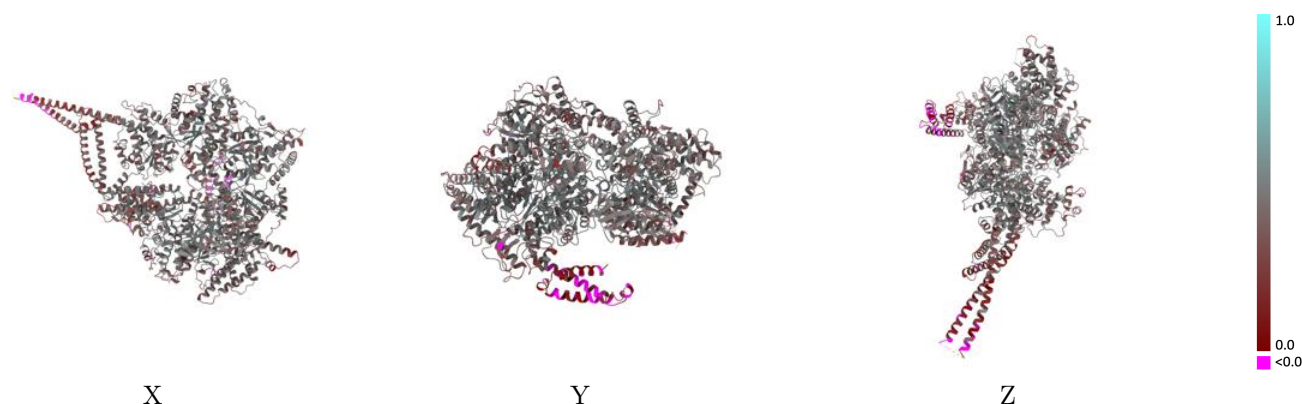
This section contains information regarding the fit between EMDB map EMD-46858 and PDB model 9DH7. Per-residue inclusion information can be found in section [3](#) on page [5](#).

9.1 Map-model overlay [i](#)



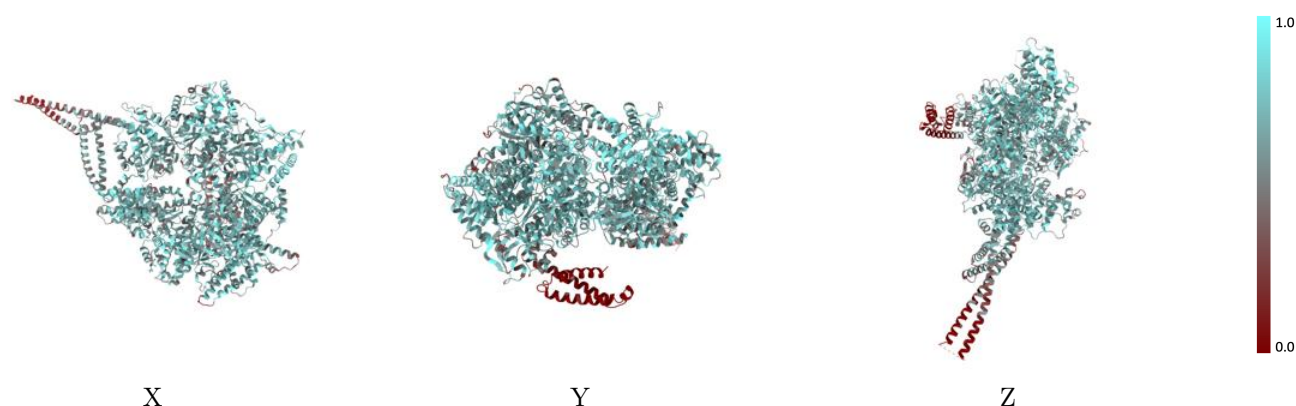
The images above show the 3D surface view of the map at the recommended contour level 0.25 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



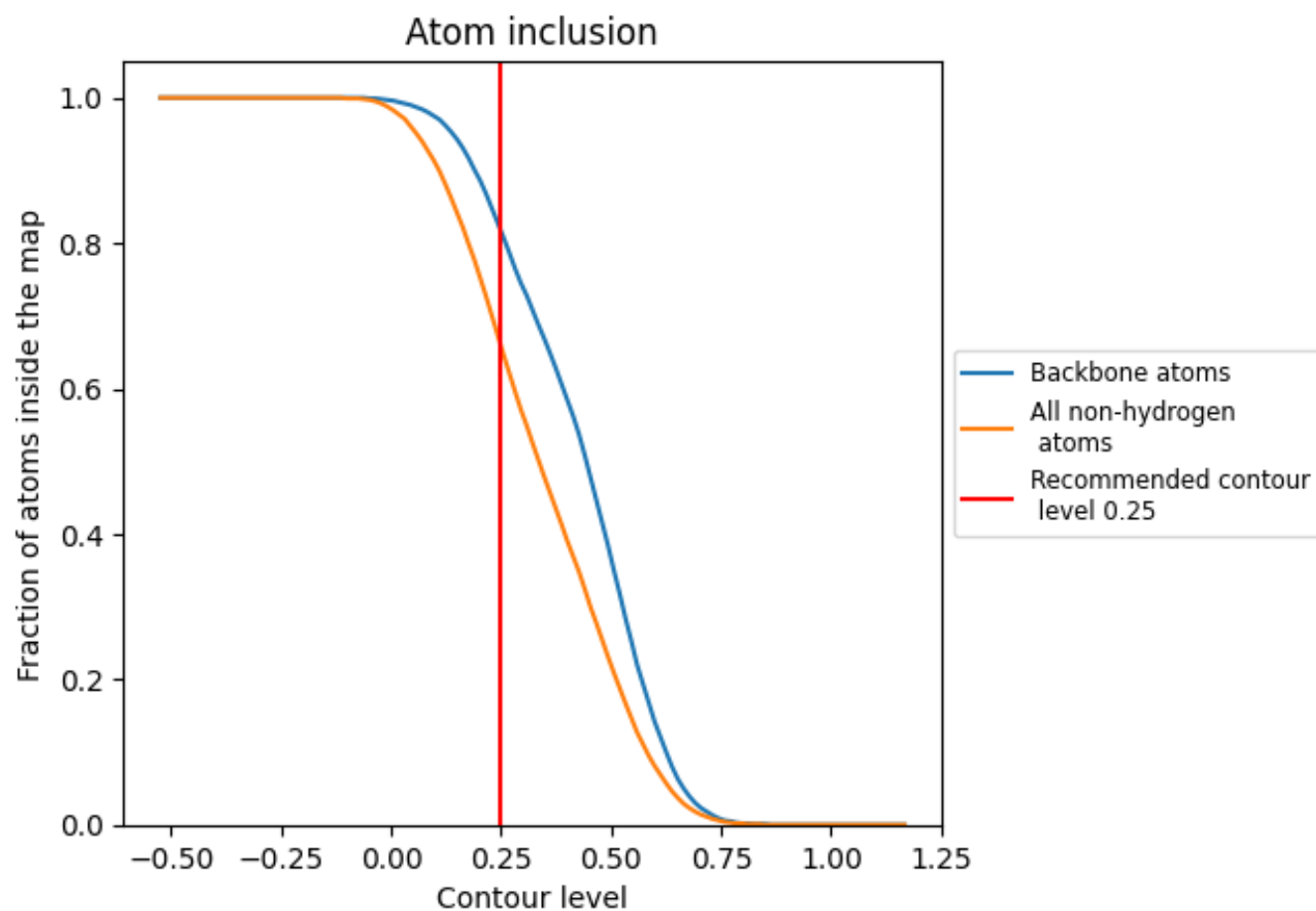
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.25).

9.4 Atom inclusion [i](#)



At the recommended contour level, 82% of all backbone atoms, 66% 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 (0.25) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div></div> 0.6580	<div></div> 0.4120
A	<div></div> 0.6580	<div></div> 0.4120

