



wwPDB EM Validation Summary Report ⓘ

Jul 27, 2026 – 06:31 PM JST

PDB ID : 9LQQ / pdb_00009lqq
EMDB ID : EMD-63301
Title : Structure of transposase-activated RAG target capture complex with X-form
U-shaped target DNA (TCC-UDX)
Authors : Pang, J.; Zhang, Y.
Deposited on : 2025-01-28
Resolution : 3.60 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.dev133
MolProbity : 4-5-2 with Phenix2.0
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) : 2.50

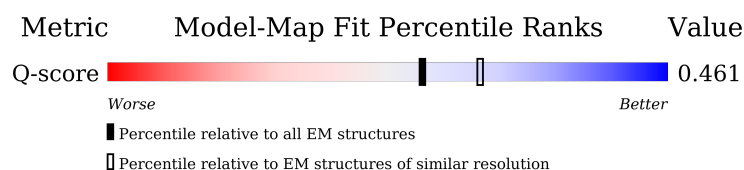
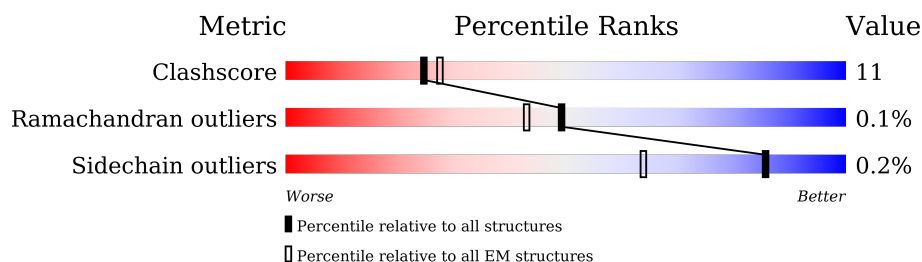
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.60 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	12797 (3.10 - 4.10)

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	I	59	
2	J	59	
3	A	750	
3	C	750	

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Mol	Chain	Length	Quality of chain
4	B	457	
4	D	457	
5	L	34	
6	y	34	
7	M	45	
8	x	45	

2 Entry composition

There are 10 unique types of molecules in this entry. The entry contains 16144 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 DNA chain called Target DNA bottom strand.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	I	25	Total	C	N	O	P	0	0
			506	243	87	151	25		

- Molecule 2 is a DNA chain called Target DNA top strand.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	J	25	Total	C	N	O	P	0	0
			519	247	98	149	25		

- Molecule 3 is a protein called V(D)J recombination-activating protein 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	A	543	Total	C	N	O	S	0	0
			4365	2757	761	814	33		
3	C	544	Total	C	N	O	S	0	0
			4373	2761	763	816	33		

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	259	GLY	-	expression tag	UNP P15919
A	260	PRO	-	expression tag	UNP P15919
A	848	MET	ARG	conflict	UNP P15919
A	962	ASN	GLU	engineered mutation	UNP P15919
C	259	GLY	-	expression tag	UNP P15919
C	260	PRO	-	expression tag	UNP P15919
C	848	MET	ARG	conflict	UNP P15919
C	962	ASN	GLU	engineered mutation	UNP P15919

- Molecule 4 is a protein called Early growth response protein 1,V(D)J recombination-activating protein 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	B	337	Total	C	N	O	S	0	0
			2642	1690	448	485	19		
4	D	335	Total	C	N	O	S	0	0
			2629	1680	446	484	19		

There are 34 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-101	GLY	-	expression tag	UNP P08046
B	-100	PRO	-	expression tag	UNP P08046
B	-99	MET	-	expression tag	UNP P08046
B	-82	ASP	ARG	conflict	UNP P08046
B	-80	SER	ASP	conflict	UNP P08046
B	-79	ASN	GLU	conflict	UNP P08046
B	-10	ASP	-	linker	UNP P08046
B	-9	GLY	-	linker	UNP P08046
B	-8	GLY	-	linker	UNP P08046
B	-7	GLY	-	linker	UNP P08046
B	-6	ASN	-	linker	UNP P08046
B	-5	GLY	-	linker	UNP P08046
B	-4	SER	-	linker	UNP P08046
B	-3	GLY	-	linker	UNP P08046
B	-2	GLY	-	linker	UNP P08046
B	-1	SER	-	linker	UNP P08046
B	0	GLY	-	linker	UNP P08046
D	-101	GLY	-	expression tag	UNP P08046
D	-100	PRO	-	expression tag	UNP P08046
D	-99	MET	-	expression tag	UNP P08046
D	-82	ASP	ARG	conflict	UNP P08046
D	-80	SER	ASP	conflict	UNP P08046
D	-79	ASN	GLU	conflict	UNP P08046
D	-10	ASP	-	linker	UNP P08046
D	-9	GLY	-	linker	UNP P08046
D	-8	GLY	-	linker	UNP P08046
D	-7	GLY	-	linker	UNP P08046
D	-6	ASN	-	linker	UNP P08046
D	-5	GLY	-	linker	UNP P08046
D	-4	SER	-	linker	UNP P08046
D	-3	GLY	-	linker	UNP P08046
D	-2	GLY	-	linker	UNP P08046
D	-1	SER	-	linker	UNP P08046
D	0	GLY	-	linker	UNP P08046

- Molecule 5 is a DNA chain called 12RSS top strand.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	L	12	Total	C	N	O	P	0	0
			249	118	47	72	12		

- Molecule 6 is a DNA chain called 12RSS bottom strand.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	y	12	Total	C	N	O	P	0	0
			243	116	43	72	12		

- Molecule 7 is a DNA chain called 23RSS top strand.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	M	15	Total	C	N	O	P	0	0
			314	148	62	89	15		

- Molecule 8 is a DNA chain called 23RSS bottom strand.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	x	15	Total	C	N	O	P	0	0
			301	144	51	91	15		

- Molecule 9 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
9	A	1	Total	Zn	0
			1	1	
9	C	1	Total	Zn	0
			1	1	

- Molecule 10 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

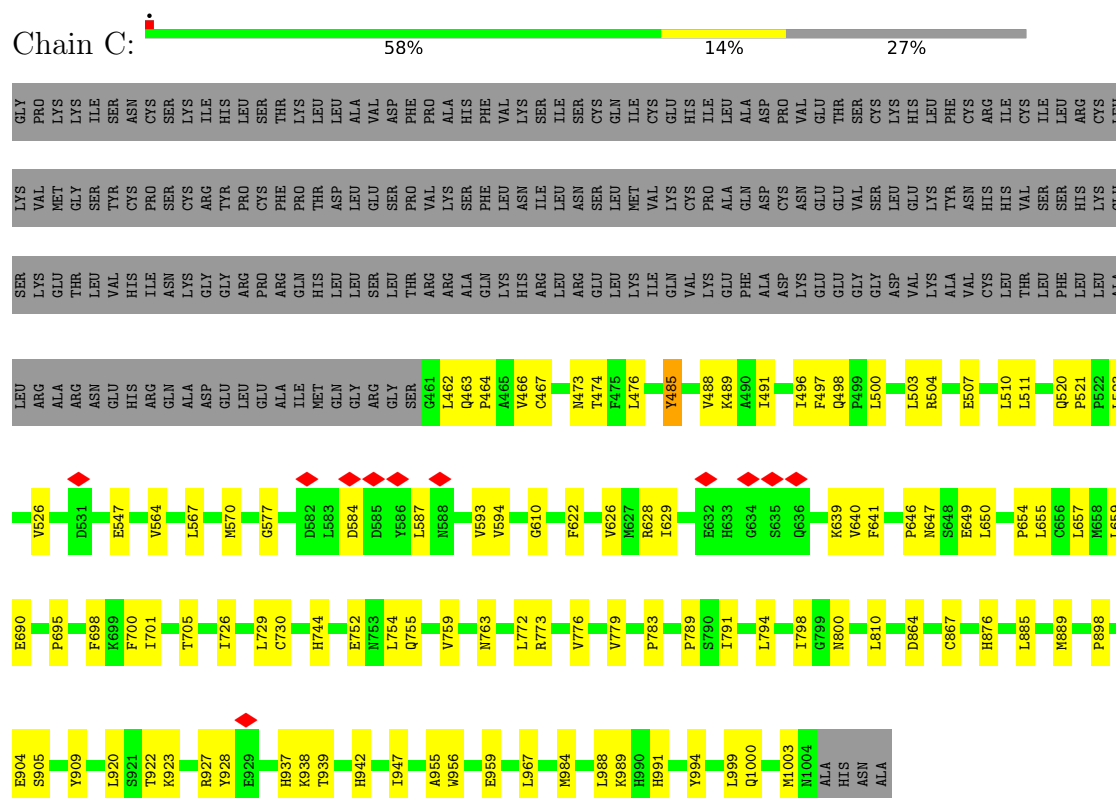
Mol	Chain	Residues	Atoms		AltConf
10	C	1	Total	Mg	0
			1	1	

- Molecule 1: Target DNA bottom strand

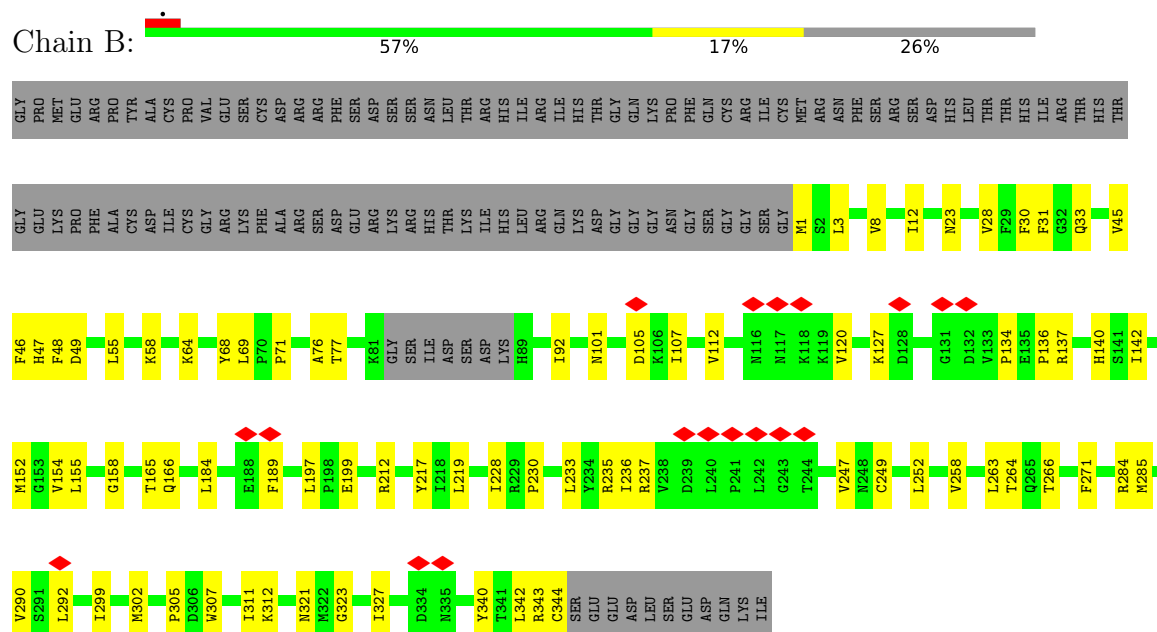




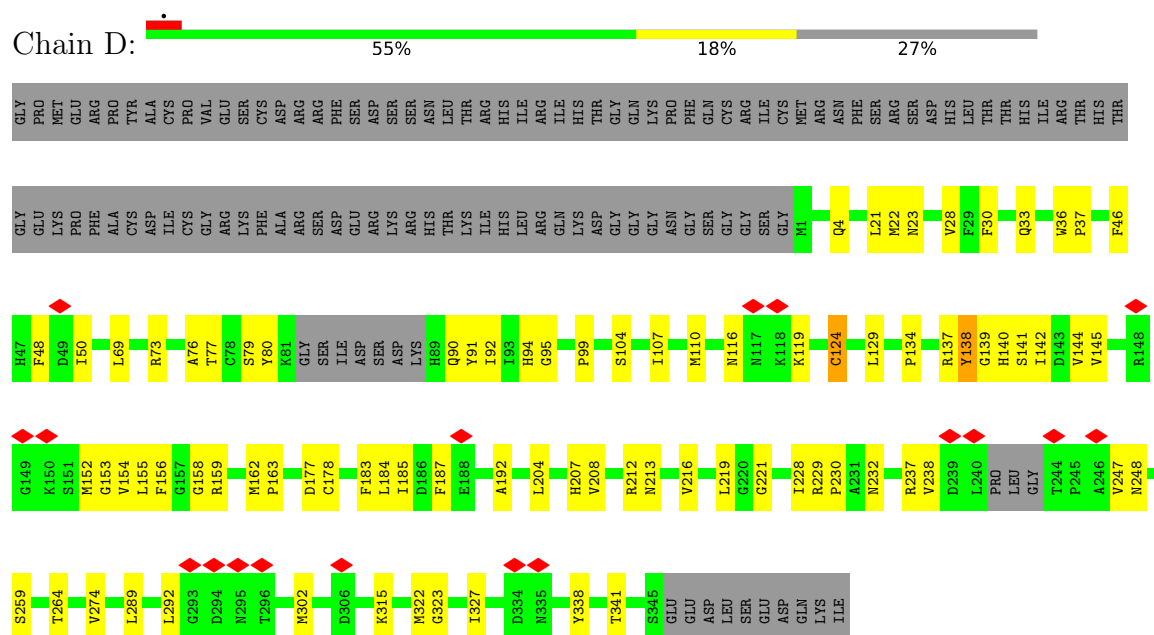
• Molecule 3: V(D)J recombination-activating protein 1



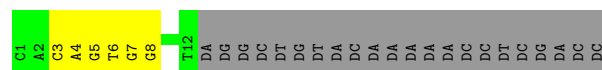
• Molecule 4: Early growth response protein 1, V(D)J recombination-activating protein 2



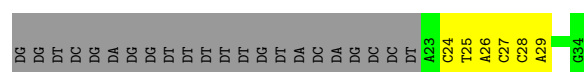
• Molecule 4: Early growth response protein 1, V(D)J recombination-activating protein 2



- Molecule 5: 12RSS top strand



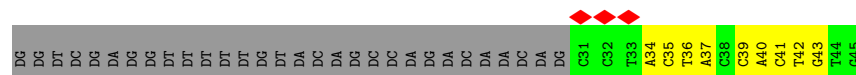
- Molecule 6: 12RSS bottom strand



- Molecule 7: 23RSS top strand



- Molecule 8: 23RSS bottom strand



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	123668	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	72.00	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	1600	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	3.337	Depositor
Minimum map value	-1.710	Depositor
Average map value	-0.001	Depositor
Map value standard deviation	0.081	Depositor
Recommended contour level	0.657	Depositor
Map size ($\text{\AA}$)	352.0, 352.0, 352.0	wwPDB
Map dimensions	320, 320, 320	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.1, 1.1, 1.1	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: ZN, 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	I	0.23	0/565	0.45	0/868
2	J	0.21	0/583	0.43	0/899
3	A	0.15	0/4461	0.34	0/6016
3	C	0.16	0/4469	0.39	0/6027
4	B	0.20	0/2710	0.38	0/3674
4	D	0.18	0/2695	0.37	0/3651
5	L	0.27	0/279	0.50	0/429
6	y	0.17	0/271	0.37	0/415
7	M	0.19	0/353	0.35	0/544
8	x	0.18	0/335	0.35	0/513
All	All	0.17	0/16721	0.38	0/23036

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	I	506	0	284	17	0
2	J	519	0	283	11	0
3	A	4365	0	4326	89	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	4373	0	4332	67	0
4	B	2642	0	2606	66	0
4	D	2629	0	2589	72	0
5	L	249	0	136	7	0
6	y	243	0	136	5	0
7	M	314	0	169	7	0
8	x	301	0	169	7	0
9	A	1	0	0	0	0
9	C	1	0	0	0	0
10	C	1	0	0	0	0
All	All	16144	0	15030	330	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 11.

The worst 5 of 330 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)
4:D:76:ALA:HB2	4:D:140:HIS:HB2	1.17	1.16
4:B:1:MET:CE	4:B:305:PRO:HG3	1.86	1.06
4:D:76:ALA:HB2	4:D:140:HIS:CB	1.92	1.00
4:B:3:LEU:HD11	4:B:342:LEU:HD12	1.43	0.97
4:D:110:MET:SD	4:D:124:CYS:SG	2.63	0.95

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	
3	A	541/750 (72%)	501 (93%)	39 (7%)	1 (0%)	43	72
3	C	542/750 (72%)	510 (94%)	32 (6%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
4	B	333/457 (73%)	303 (91%)	30 (9%)	0	100	100
4	D	329/457 (72%)	290 (88%)	39 (12%)	0	100	100
All	All	1745/2414 (72%)	1604 (92%)	140 (8%)	1 (0%)	49	79

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	A	740	ASN

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	
3	A	482/668 (72%)	482 (100%)	0	100	100
3	C	483/668 (72%)	482 (100%)	1 (0%)	87	85
4	B	296/401 (74%)	296 (100%)	0	100	100
4	D	295/401 (74%)	293 (99%)	2 (1%)	76	78
All	All	1556/2138 (73%)	1553 (100%)	3 (0%)	85	85

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

Mol	Chain	Res	Type
3	C	485	TYR
4	D	124	CYS
4	D	138	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

Mol	Chain	Res	Type
4	D	10	HIS
4	D	33	GLN
4	B	100	ASN

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Mol	Chain	Res	Type
4	B	222	HIS
3	C	480	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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.

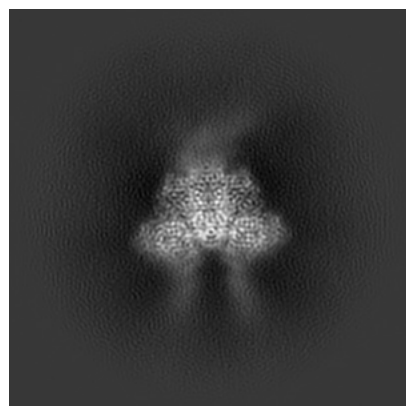
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-63301. These allow visual inspection of the internal detail of the map and identification of artifacts.

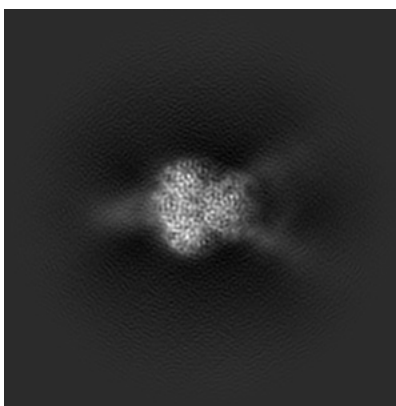
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

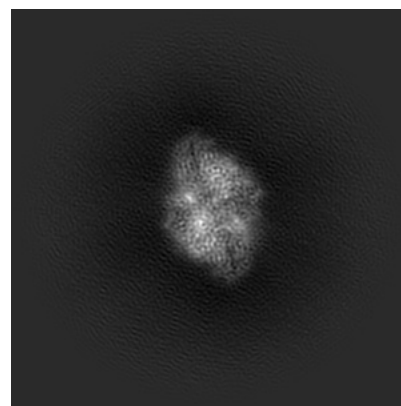
6.1.1 Primary map



X

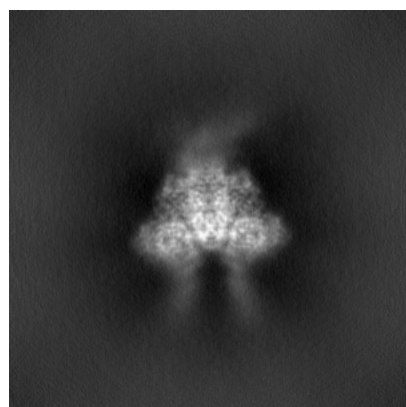


Y

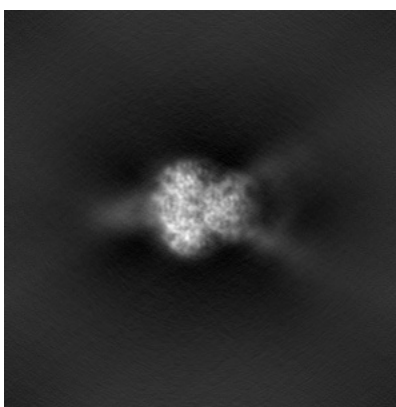


Z

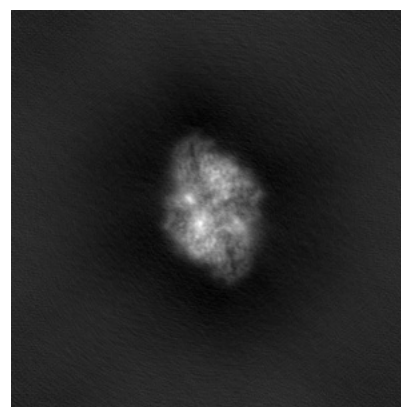
6.1.2 Raw map



X



Y

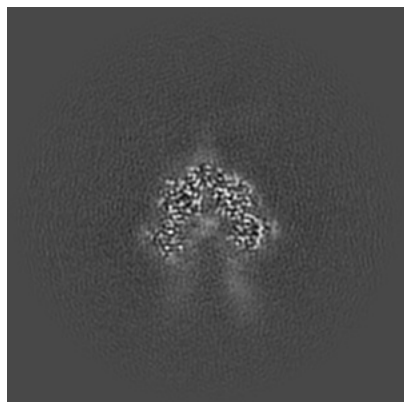


Z

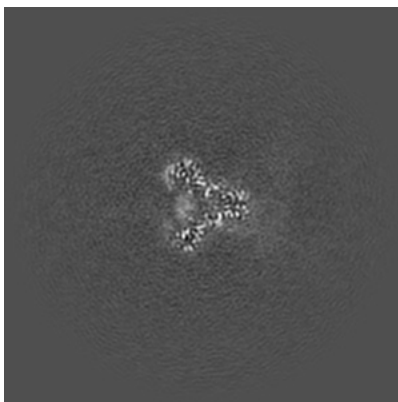
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

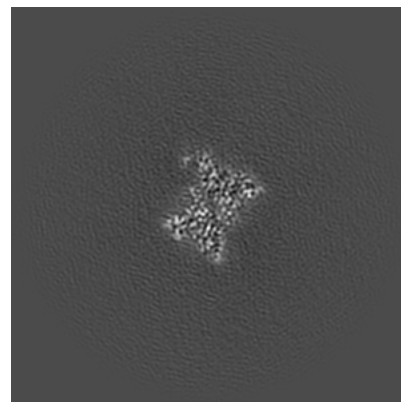
6.2.1 Primary map



X Index: 160

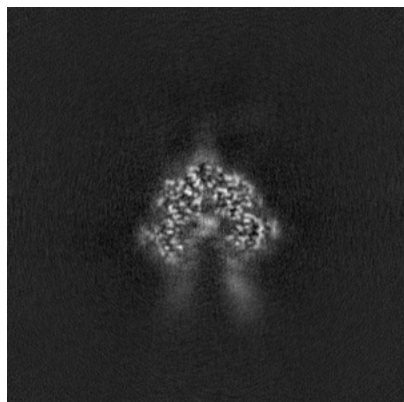


Y Index: 160

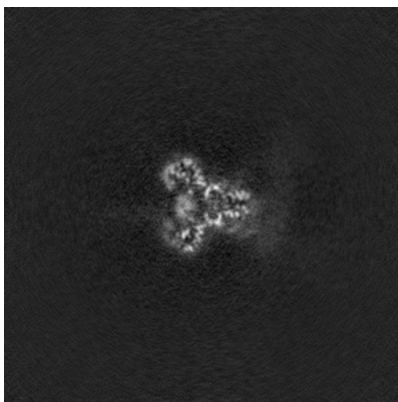


Z Index: 160

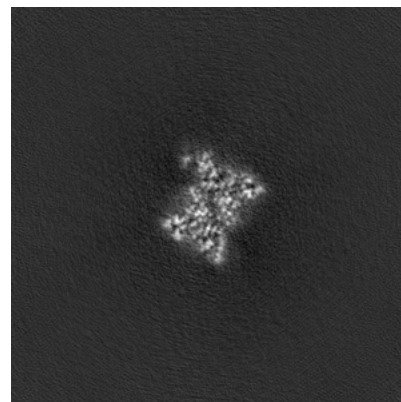
6.2.2 Raw map



X Index: 160



Y Index: 160

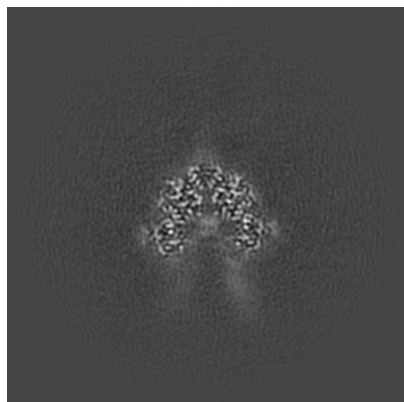


Z Index: 160

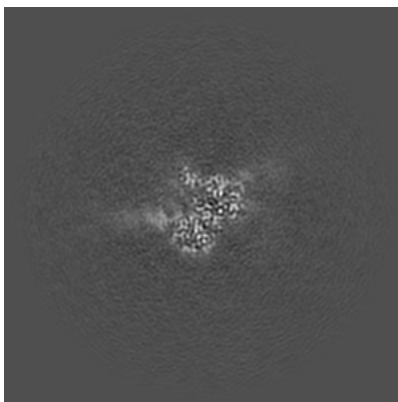
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

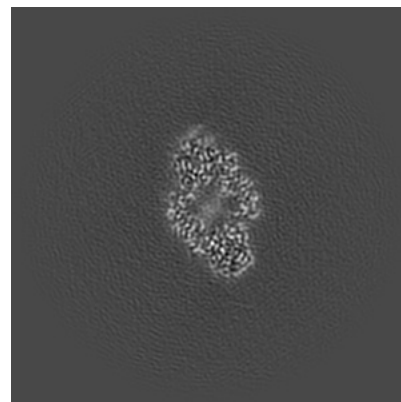
6.3.1 Primary map



X Index: 161

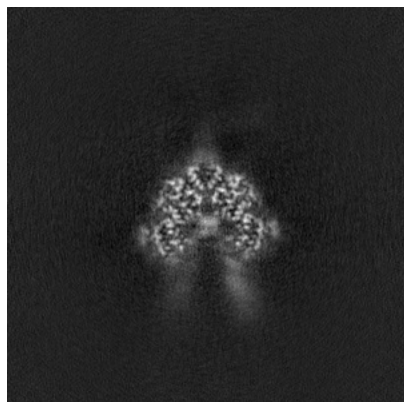


Y Index: 149

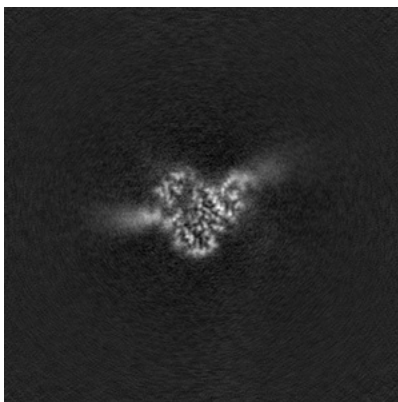


Z Index: 139

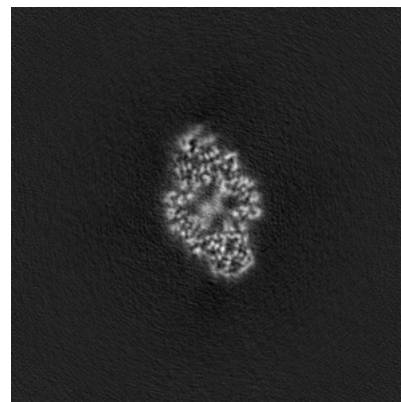
6.3.2 Raw map



X Index: 161



Y Index: 145

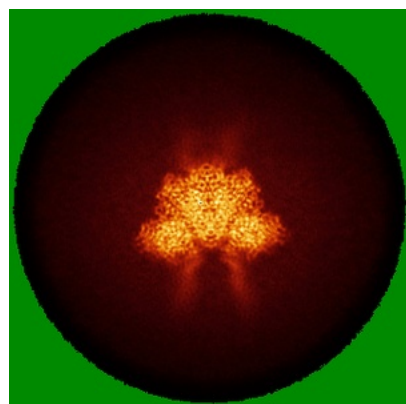


Z Index: 140

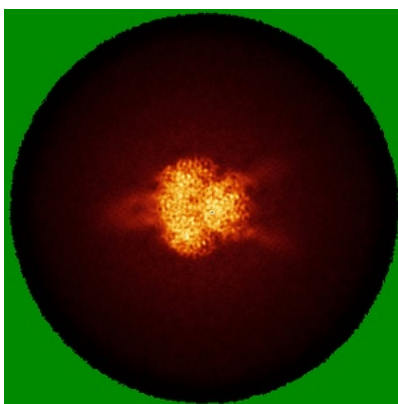
The images above show the largest variance slices of the map in three orthogonal directions.

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

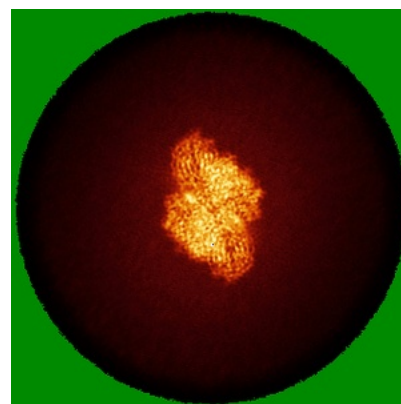
6.4.1 Primary map



X

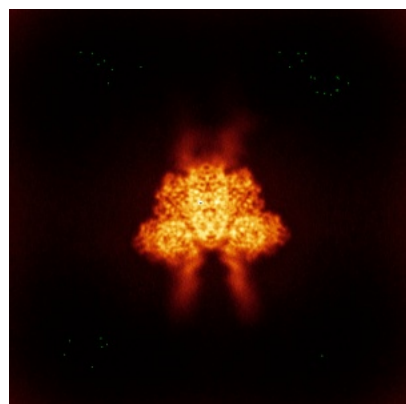


Y

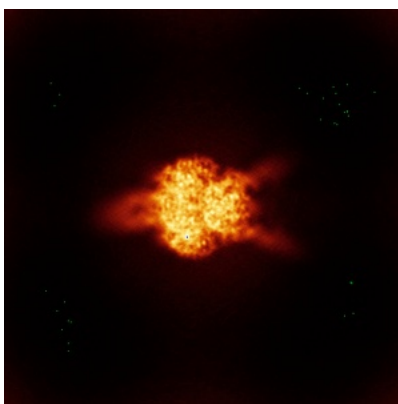


Z

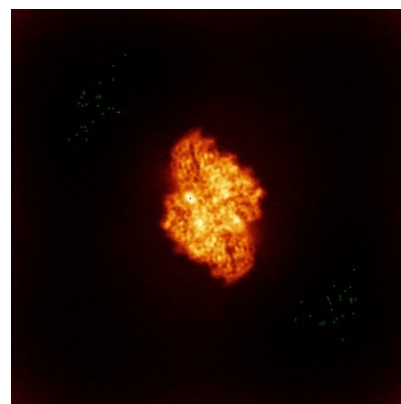
6.4.2 Raw map



X



Y

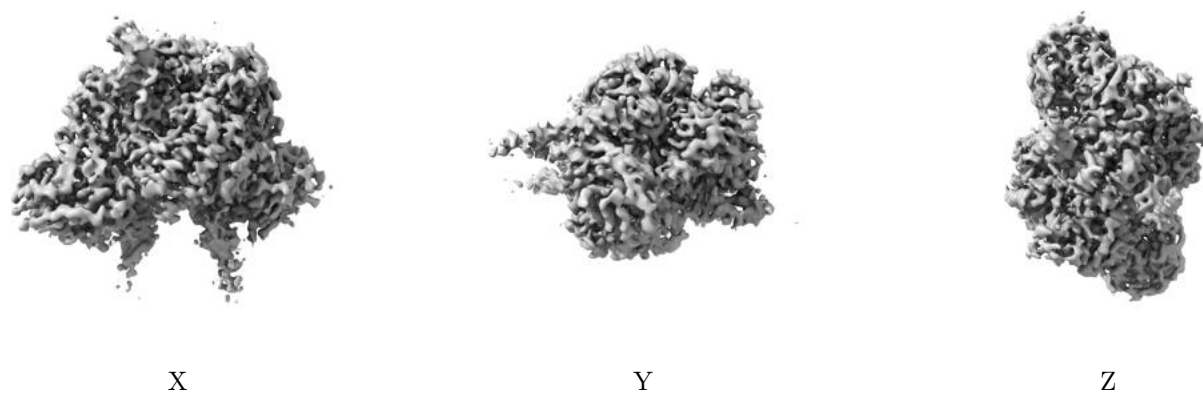


Z

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.

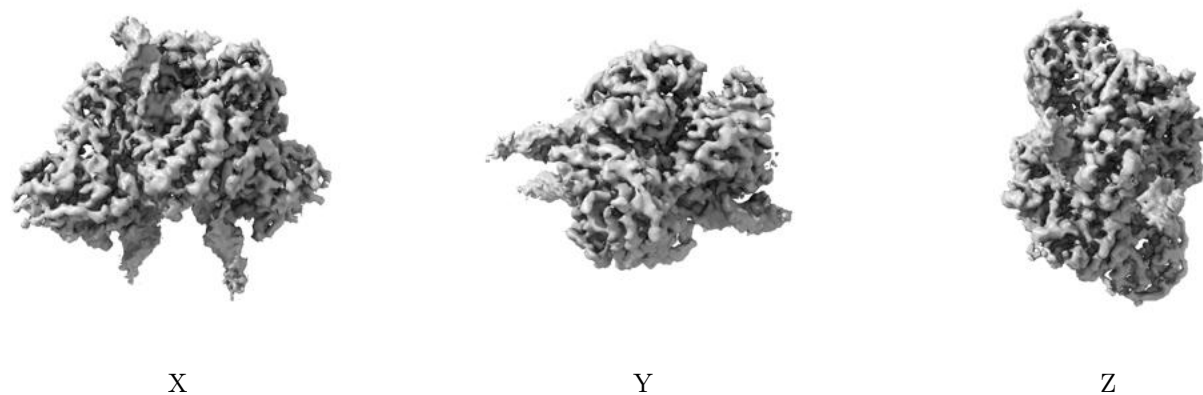
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.657. 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.

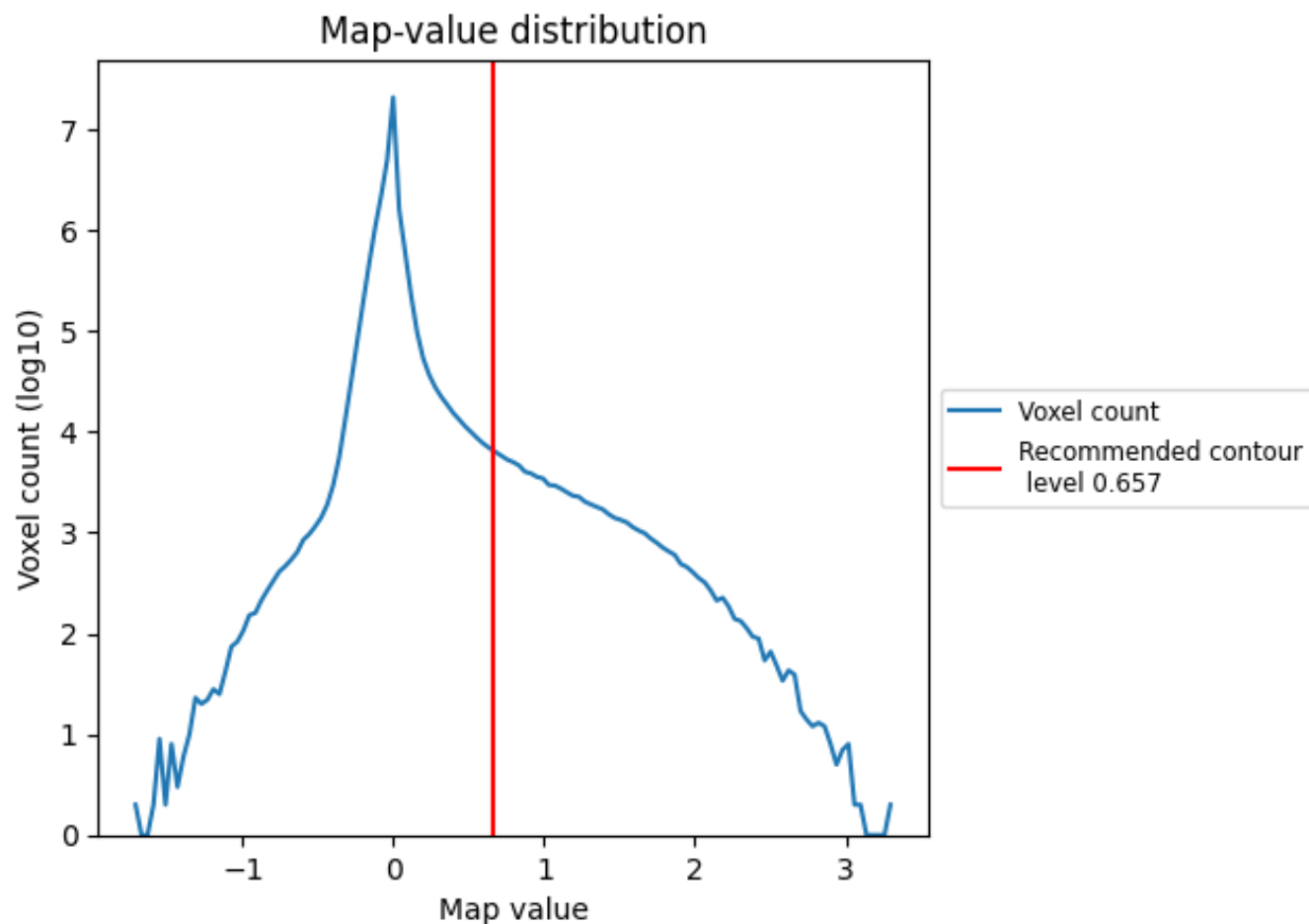
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

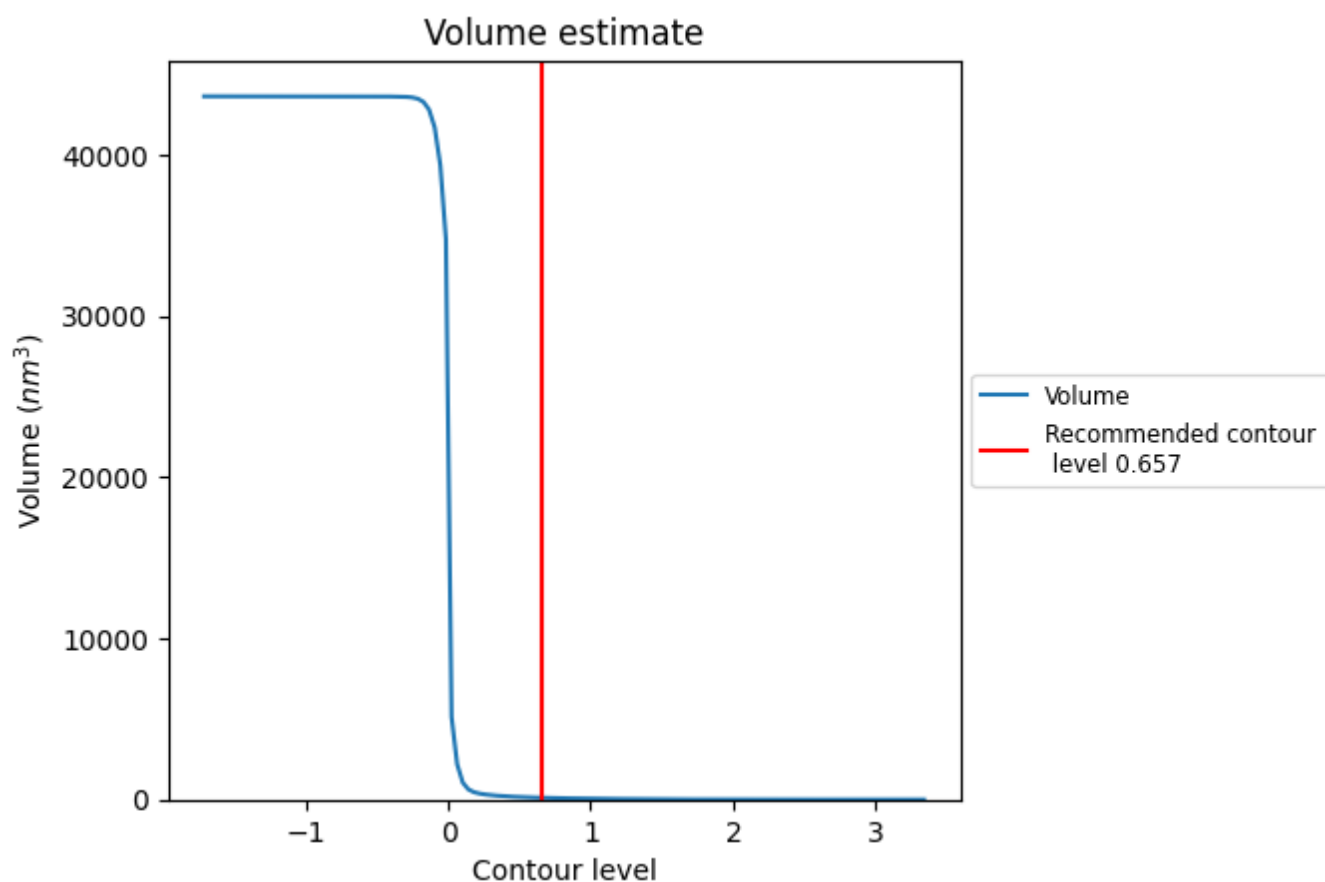
This section contains the results of statistical analysis of the map.

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.

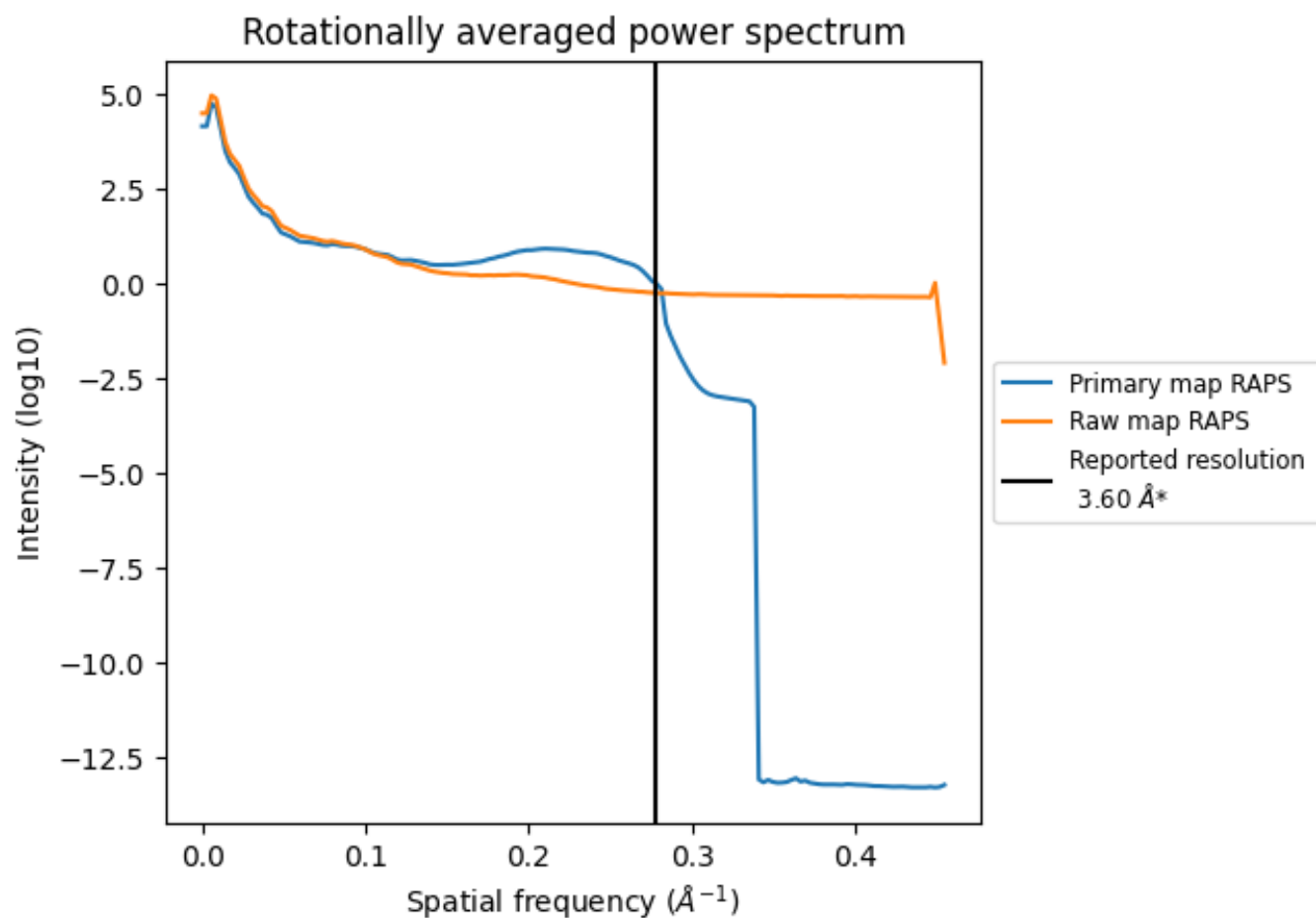
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 112 nm³; this corresponds to an approximate mass of 102 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 ⓘ

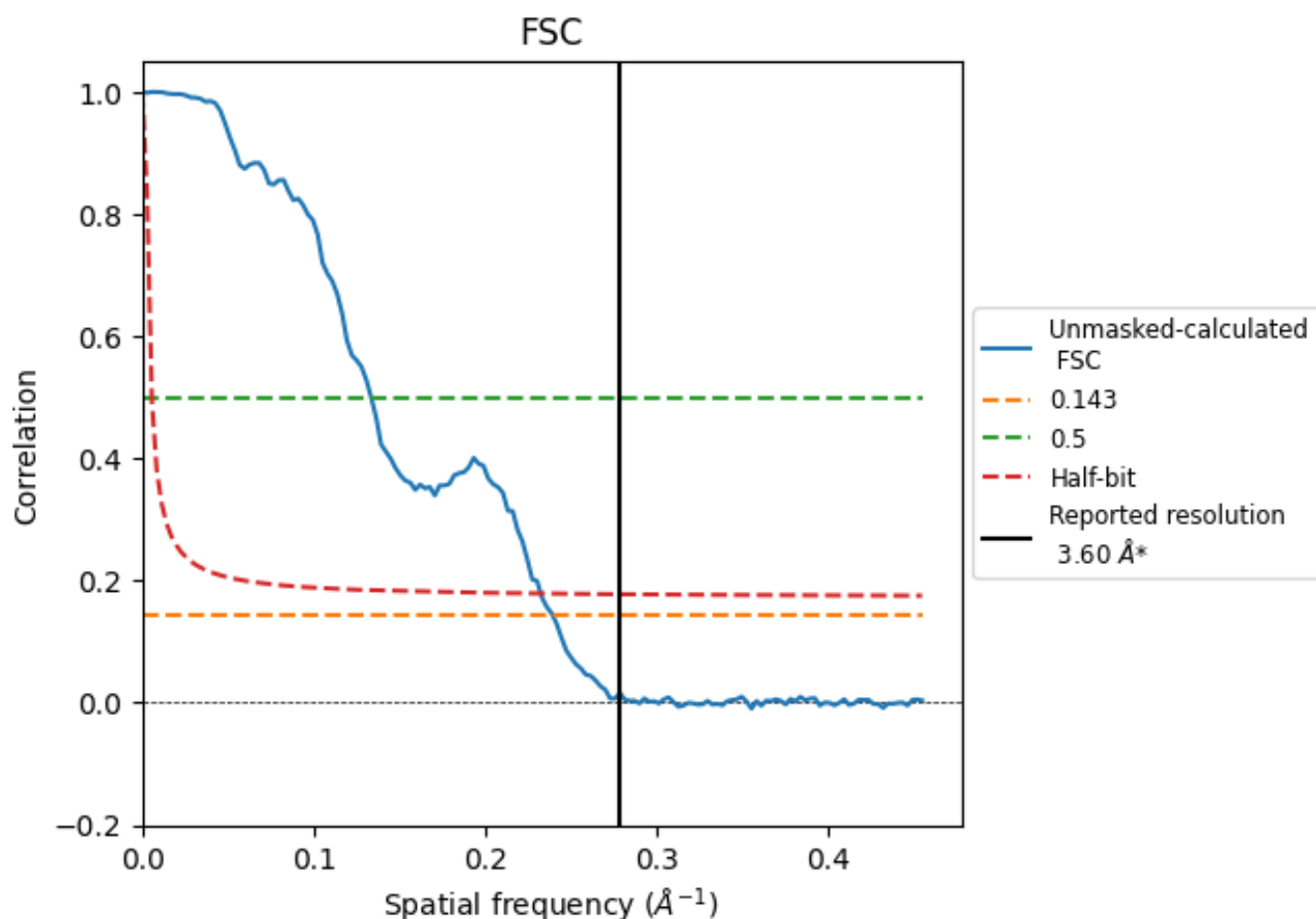


*Reported resolution corresponds to spatial frequency of 0.278 Å⁻¹

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 0.278 Å⁻¹

8.2 Resolution estimates [i](#)

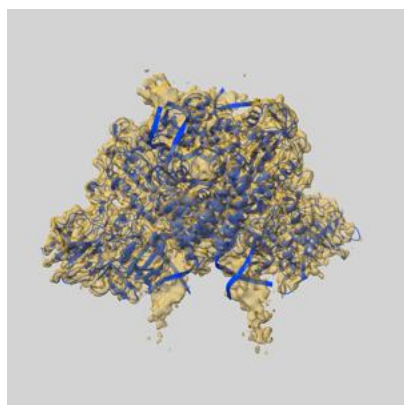
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.60	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	4.18	7.50	4.31

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 4.18 differs from the reported value 3.6 by more than 10 %

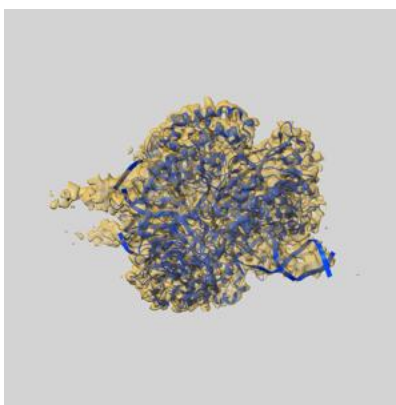
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-63301 and PDB model 9LQQ. Per-residue inclusion information can be found in section [3](#) on page [7](#).

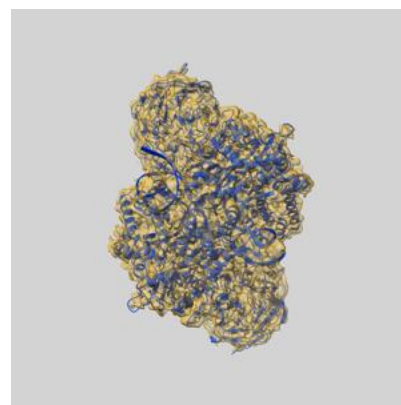
9.1 Map-model overlay [i](#)



X



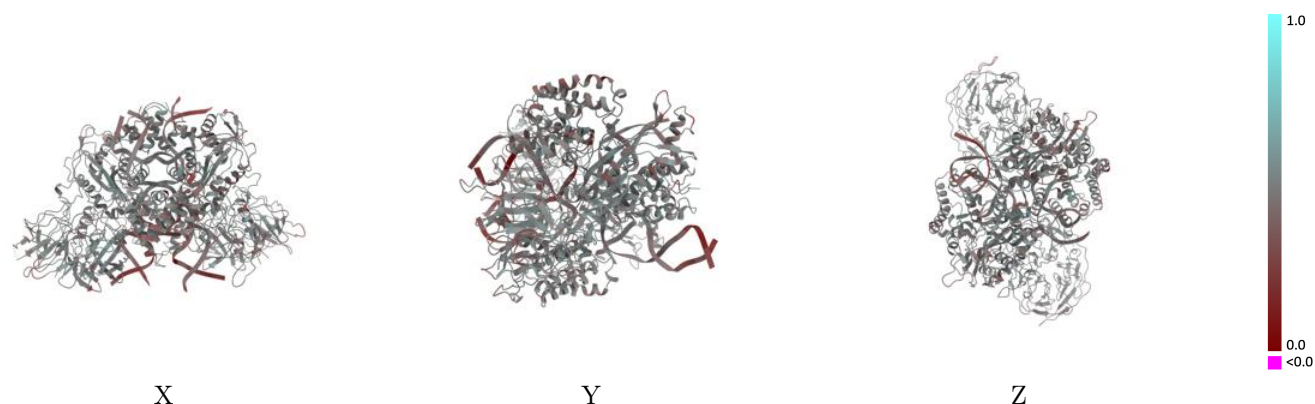
Y



Z

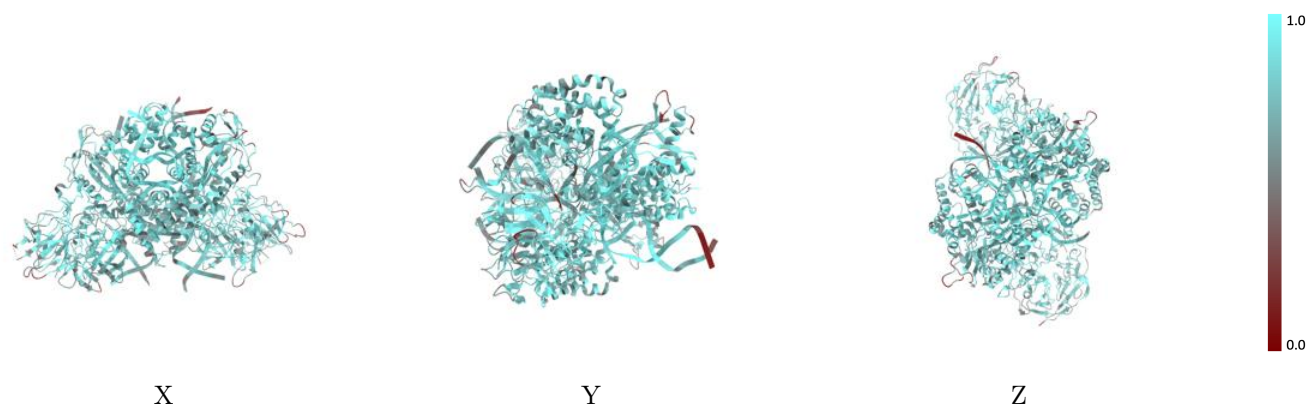
The images above show the 3D surface view of the map at the recommended contour level 0.657 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



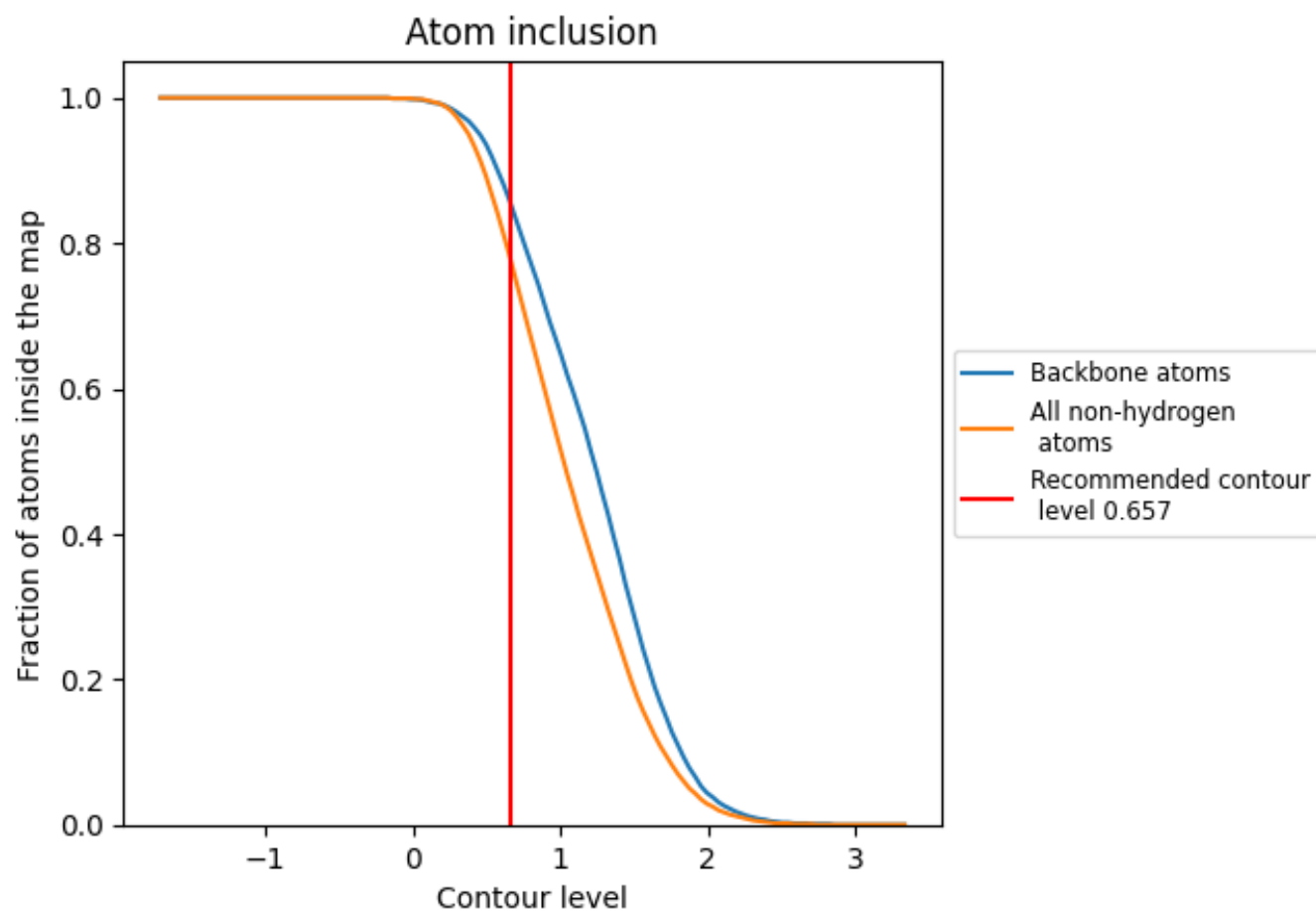
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.657).

9.4 Atom inclusion [i](#)



At the recommended contour level, 86% of all backbone atoms, 78% 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 (0.657) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7830	0.4610
A	0.8000	0.4710
B	0.7670	0.4750
C	0.7980	0.4770
D	0.7510	0.4720
I	0.7350	0.3440
J	0.7050	0.3200
L	0.8920	0.4560
M	0.8220	0.4160
x	0.7640	0.3790
y	0.8760	0.4410

1.0

0.0

<0.0