



# wwPDB EM Validation Summary Report ⓘ

Apr 10, 2025 – 01:24 pm BST

PDB ID : 9F6Z / pdb\_00009f6z  
EMDB ID : EMD-17349  
Title : Human N-deacetylase/N-sulfotransferase 1 homodimer  
Authors : Wild, R.; Lortat-Jacob, H.; Vallet, S.D.  
Deposited on : 2024-05-02  
Resolution : 4.50 Å (reported)  
Based on initial model : .

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto: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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

EMDB validation analysis : 0.0.1.dev117  
MolProbity : 4.02b-467  
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

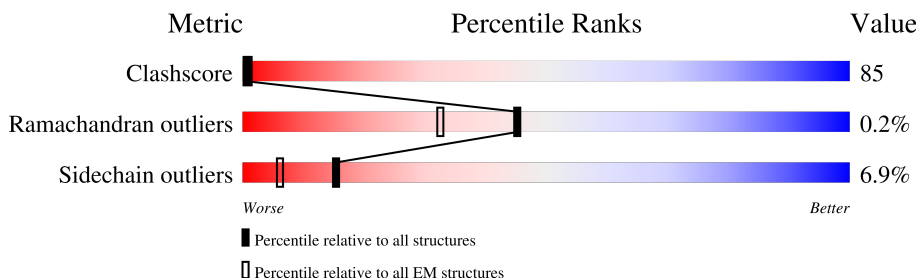
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*



The reported resolution of this entry is 4.50 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  $\geq 3$ , 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	858	
1	B	858	

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 13072 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 Bifunctional heparan sulfate N-deacetylase/N-sulfotransferase 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	803	Total	C	N	O	S	0	0
			6526	4225	1111	1168	22		
1	B	806	Total	C	N	O	S	0	0
			6546	4237	1114	1173	22		

There are 36 discrepancies between the modelled and reference sequences:

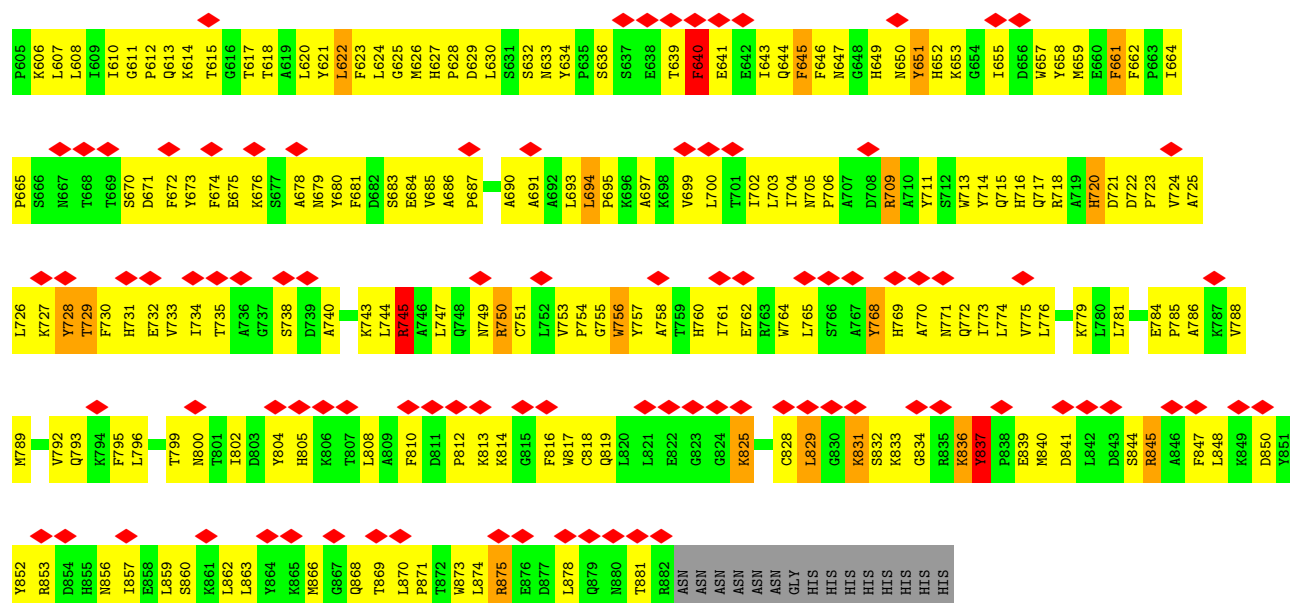
Chain	Residue	Modelled	Actual	Comment	Reference
A	40	GLY	-	expression tag	UNP P52848
A	41	ALA	-	expression tag	UNP P52848
A	42	SER	-	expression tag	UNP P52848
A	883	ASN	-	expression tag	UNP P52848
A	884	ASN	-	expression tag	UNP P52848
A	885	ASN	-	expression tag	UNP P52848
A	886	ASN	-	expression tag	UNP P52848
A	887	ASN	-	expression tag	UNP P52848
A	888	ASN	-	expression tag	UNP P52848
A	889	GLY	-	expression tag	UNP P52848
A	890	HIS	-	expression tag	UNP P52848
A	891	HIS	-	expression tag	UNP P52848
A	892	HIS	-	expression tag	UNP P52848
A	893	HIS	-	expression tag	UNP P52848
A	894	HIS	-	expression tag	UNP P52848
A	895	HIS	-	expression tag	UNP P52848
A	896	HIS	-	expression tag	UNP P52848
A	897	HIS	-	expression tag	UNP P52848
B	40	GLY	-	expression tag	UNP P52848
B	41	ALA	-	expression tag	UNP P52848
B	42	SER	-	expression tag	UNP P52848
B	883	ASN	-	expression tag	UNP P52848
B	884	ASN	-	expression tag	UNP P52848
B	885	ASN	-	expression tag	UNP P52848
B	886	ASN	-	expression tag	UNP P52848

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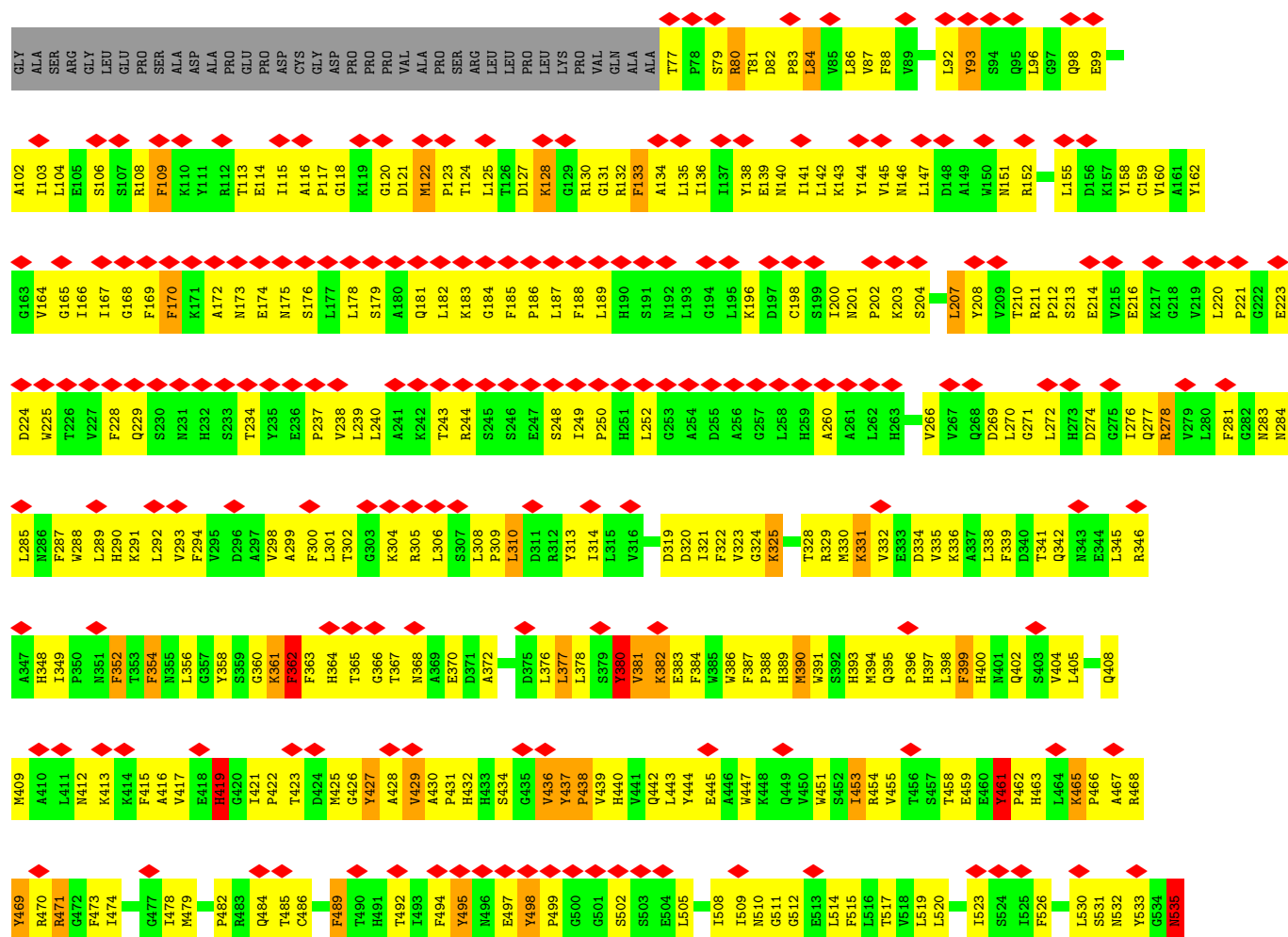
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Chain	Residue	Modelled	Actual	Comment	Reference
B	887	ASN	-	expression tag	UNP P52848
B	888	ASN	-	expression tag	UNP P52848
B	889	GLY	-	expression tag	UNP P52848
B	890	HIS	-	expression tag	UNP P52848
B	891	HIS	-	expression tag	UNP P52848
B	892	HIS	-	expression tag	UNP P52848
B	893	HIS	-	expression tag	UNP P52848
B	894	HIS	-	expression tag	UNP P52848
B	895	HIS	-	expression tag	UNP P52848
B	896	HIS	-	expression tag	UNP P52848
B	897	HIS	-	expression tag	UNP P52848





• Molecule 1: Bifunctional heparan sulfate N-deacetylase/N-sulfotransferase 1



R845	L848	D850	Y851	Y852	R853	D854	H855	N856	L859	S860	K861	L862	L863	K865	M866	G867	Q868	T869	P871	T872	K873	L874	R875	E876	D877	L878	Q879	N880	T881	R882	ASN	ASN	ASN	ASN	ASN	ASN	GLY	HIS	HIS	HIS	HIS	HIS	HIS	HIS	HIS													
T783	E784	F785	A786	K787	V788	M789	V792	Q793	K794	F795	L796	G797	V798	T799	N800	T801	L802	D803	Y804	H805	L808	A809	F810	D811	P812	K813	K814	G815	F816	N817	C818	Q819	L820	L821	E822	G823	G824	K825	T826	K827	C828	L829	G830	K831	S832	K833	G834	R835	K836	Y837	P838	E839	M840	D841	L842	D843	S844	
F723	V724	A725	L726	K727	Y728	T729	F730	H731	E732	V733	L734	T735	A736	G737	S738	D739	A740	S741	S742	K743	L744	R745	A746	L747	Q748	N749	R750	C751	L752	V753	P754	G755	Y756	Y757	A758	T759	H760	I761	E762	R763	W764	L765	S766	A767	Y768	H769	A770	N771	Q772	I773	L774	V775	L776	D777	Q778	K779	L780	R782
F662	P663	I664	P665	S666	M667	T668	T669	S670	D671	F672	Y673	F674	E675	K676	S677	A678	N679	Y680	F681	D682	S683	E684	V685	A686	P687	H688	R689	A690	A691	A692	L693	L694	F695	K696	A697	K698	V699	L700	T701	I702	L703	I704	N705	P706	A707	D708	R709	A710	W713	Y714	Q715	H716	Q717	Y718	A719	H720	D721	D722
C601	D602	R603	F604	P605	K606	L607	L608	I609	S610	G611	P612	Q613	K614	T615	G616	T617	T618	A619	L620	Y621	L622	F623	L624	G625	M626	H627	P628	D629	S632	N633	Y634	P635	S636	S637	E638	T639	F640	E641	E642	I643	Q644	F645	F646	N647	G648	H649	N650	Y651	H652	K653	G654	I655	D656	W657	Y658	M659	E660	F661
D536	R537	L538	G539	L540	Y541	T542	F543	V547	R548	F549	L550	H551	S552	V553	T554	N555	L556	R557	L558	Q559	T560	L561	P562	P563	V564	Q565	L566	A567	Y570	F571	Q572	L573	F574	S575	E576	E577	K578	D579	P580	L581	V582	Q583	D584	P585	C586	R590	H591	K592	D593	I594	W595	S596	K597	E598	K599	T600		

## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	221316	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 ( $e^-/\text{\AA}^2$ )	38.9	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	36000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	1.265	Depositor
Minimum map value	-0.837	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.029	Depositor
Recommended contour level	0.262	Depositor
Map size (Å)	360.0, 360.0, 360.0	wwPDB
Map dimensions	320, 320, 320	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.125, 1.125, 1.125	Depositor



## 5 Model quality

### 5.1 Standard geometry

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	0.88	0/6717	1.18	42/9118 (0.5%)
1	B	0.90	0/6738	1.21	46/9148 (0.5%)
All	All	0.89	0/13455	1.20	88/18266 (0.5%)

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	A	0	6
1	B	0	6
All	All	0	12

There are no bond length outliers.

The worst 5 of 88 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	645	PHE	CB-CG-CD1	-11.98	112.41	120.80
1	A	461	TYR	CB-CG-CD2	-11.24	114.25	121.00
1	B	661	PHE	CB-CG-CD2	-11.21	112.95	120.80
1	B	278	ARG	NE-CZ-NH1	10.35	125.47	120.30
1	A	278	ARG	NE-CZ-NH1	10.26	125.43	120.30

There are no chirality outliers.

5 of 12 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	223	GLU	Peptide
1	A	380	TYR	Peptide
1	A	694	LEU	Peptide
1	A	709	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	A	745	ARG	Sidechain

## 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	6526	0	6429	1056	0
1	B	6546	0	6448	1163	0
All	All	13072	0	12877	2212	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 85.

The worst 5 of 2212 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:B:329:ARG:HD3	1:B:530:LEU:HD21	1.22	1.19
1:B:615:THR:HB	1:B:617:THR:HG23	1.29	1.14
1:A:455:VAL:HG21	1:A:564:VAL:HA	1.18	1.13
1:A:389:HIS:HB3	1:A:431:PRO:HG3	1.24	1.13
1:A:248:SER:HB2	1:A:252:LEU:HD11	1.28	1.11

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	801/858 (93%)	794 (99%)	5 (1%)	2 (0%)	44	78
1	B	804/858 (94%)	791 (98%)	11 (1%)	2 (0%)	44	78
All	All	1605/1716 (94%)	1585 (99%)	16 (1%)	4 (0%)	45	78

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	535	ASN
1	B	535	ASN
1	A	640	PHE
1	B	756	TRP

### 5.3.2 Protein sidechains ⓘ

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	705/750 (94%)	666 (94%)	39 (6%)	18	40
1	B	708/750 (94%)	650 (92%)	58 (8%)	9	28
All	All	1413/1500 (94%)	1316 (93%)	97 (7%)	15	33

5 of 97 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	382	LYS
1	B	535	ASN
1	B	399	PHE
1	B	461	TYR
1	B	598	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 45 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	284	ASN
1	B	476	ASN

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Mol	Chain	Res	Type
1	B	290	HIS
1	B	397	HIS
1	B	613	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](#)

There are no ligands in this entry.

### 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.

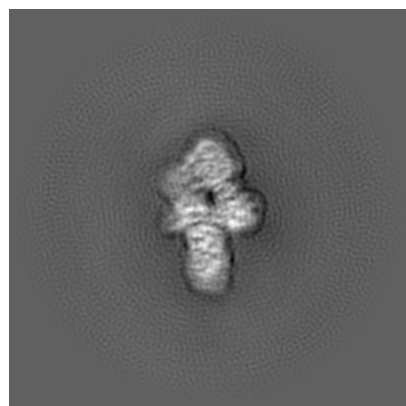
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-17349. These allow visual inspection of the internal detail of the map and identification of artifacts.

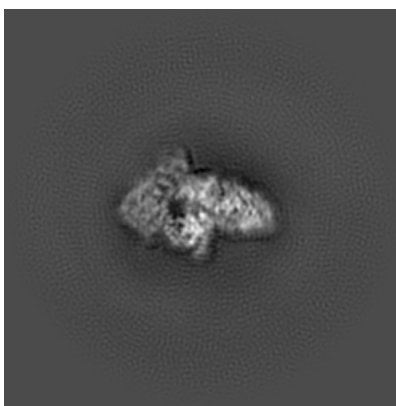
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

### 6.1 Orthogonal projections [i](#)

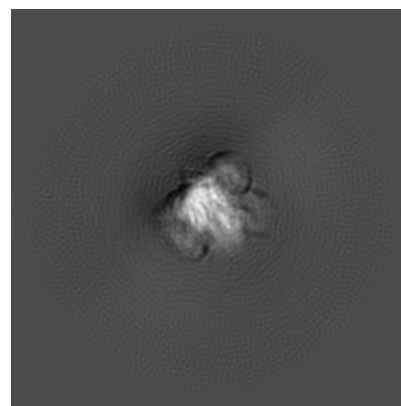
#### 6.1.1 Primary map



X

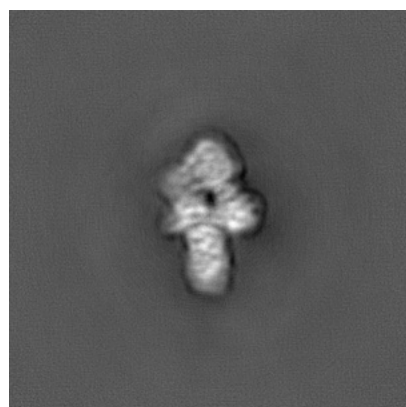


Y

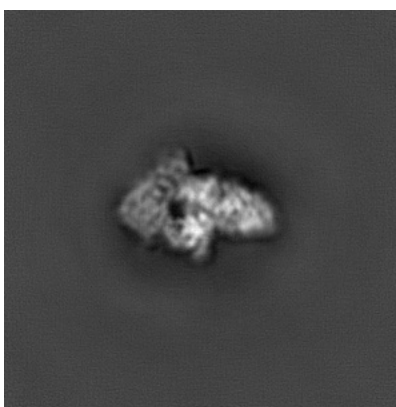


Z

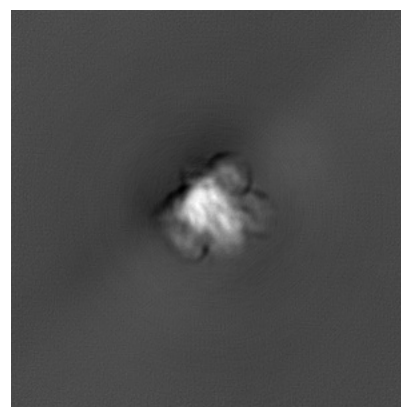
#### 6.1.2 Raw map



X



Y

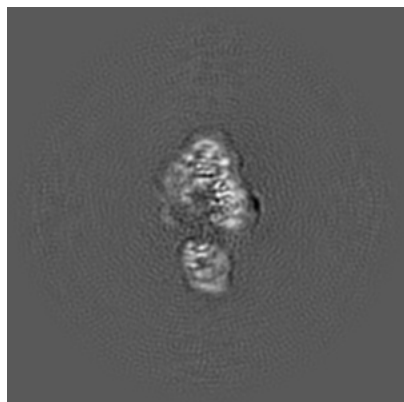


Z

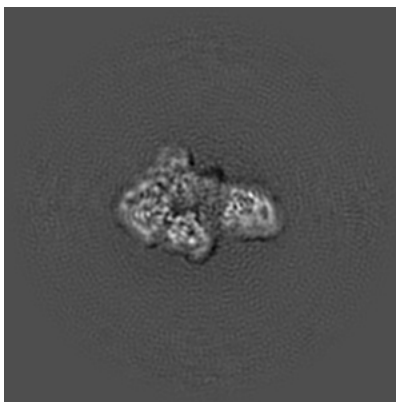
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

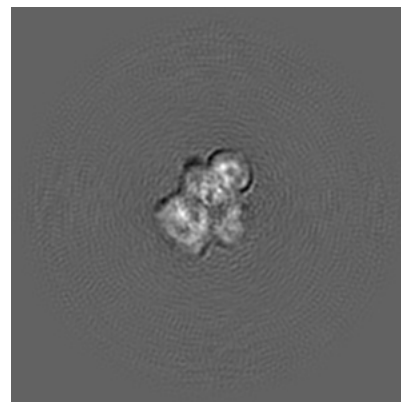
### 6.2.1 Primary map



X Index: 160

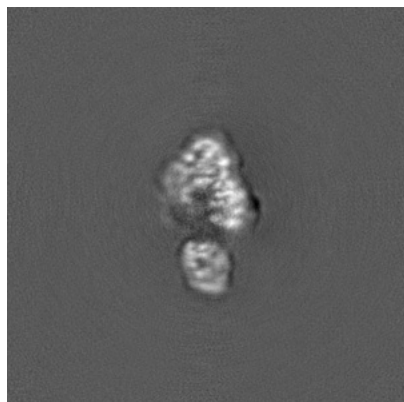


Y Index: 160

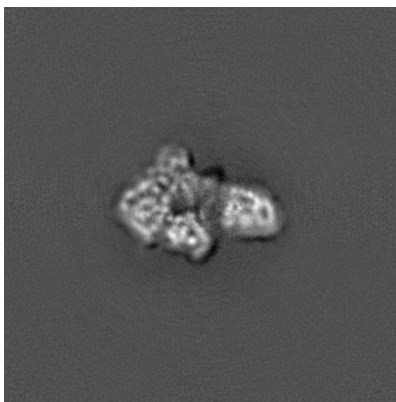


Z Index: 160

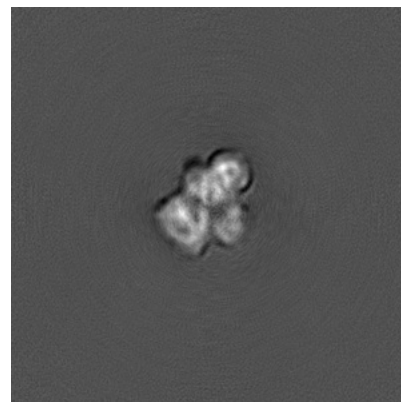
### 6.2.2 Raw map



X Index: 160



Y Index: 160



Z Index: 160

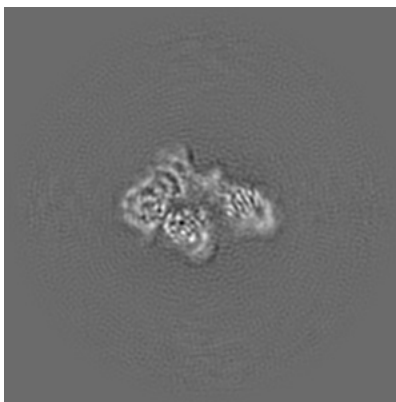
The images above show central slices of the map in three orthogonal directions.

## 6.3 Largest variance slices [i](#)

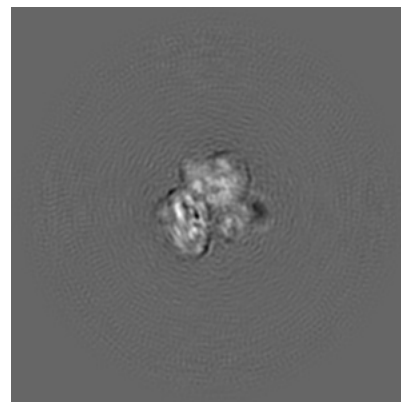
### 6.3.1 Primary map



X Index: 153

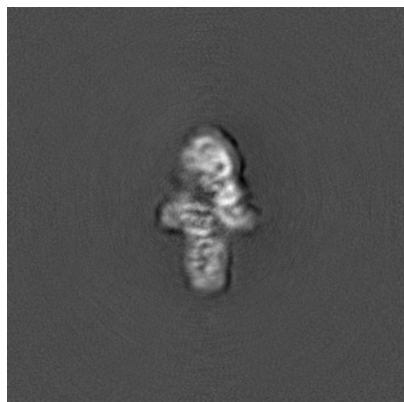


Y Index: 155

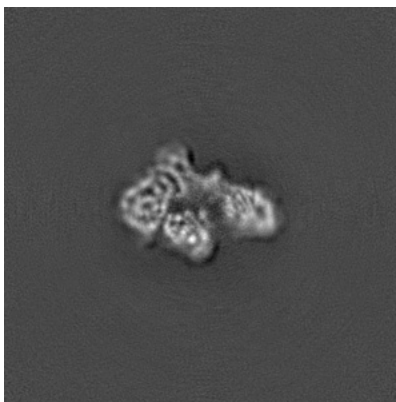


Z Index: 150

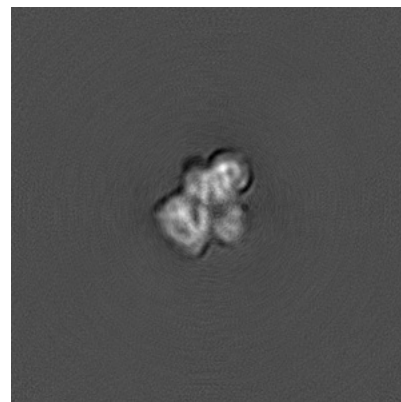
### 6.3.2 Raw map



X Index: 151



Y Index: 156



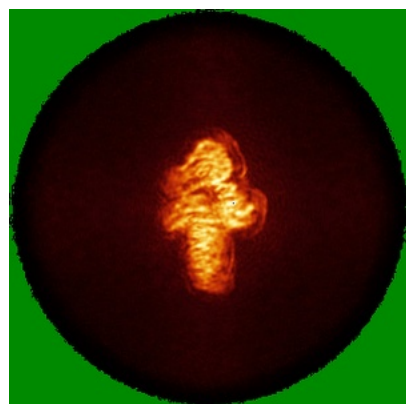
Z Index: 159

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

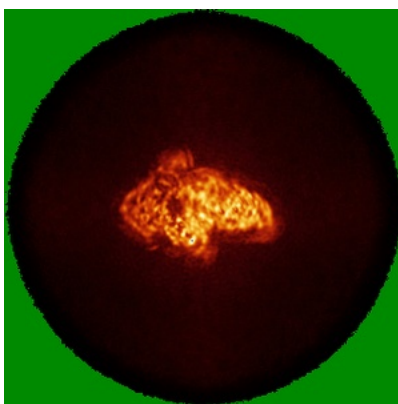


## 6.4 Orthogonal standard-deviation projections (False-color) ⓘ

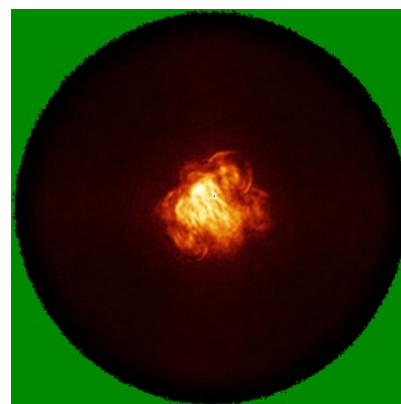
### 6.4.1 Primary map



X

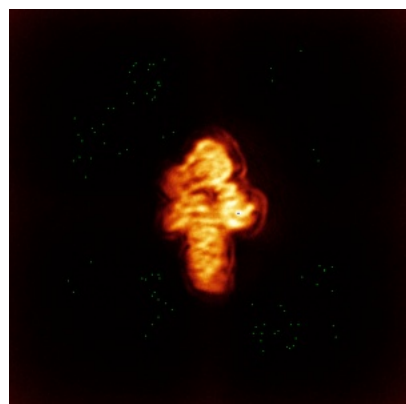


Y

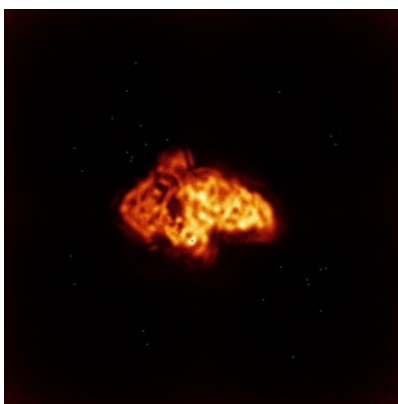


Z

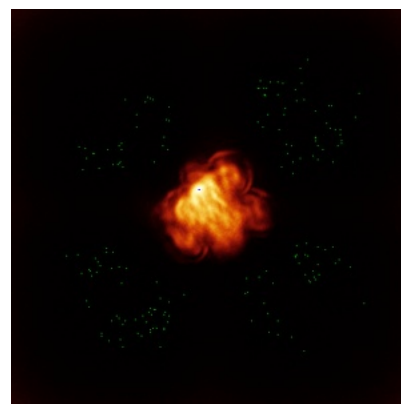
### 6.4.2 Raw map



X



Y



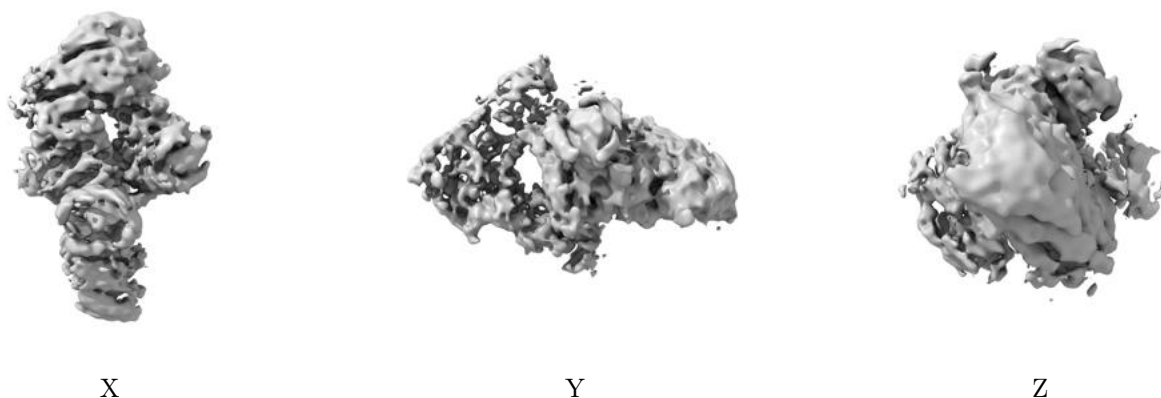
Z

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 0.262. 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.

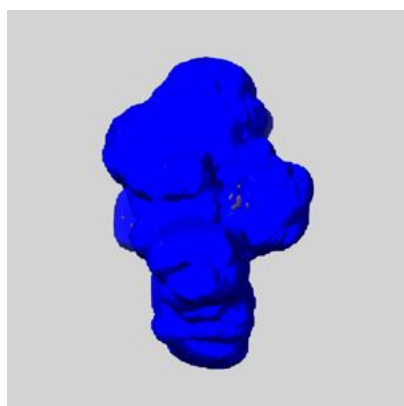
## 6.6 Mask visualisation [i](#)

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

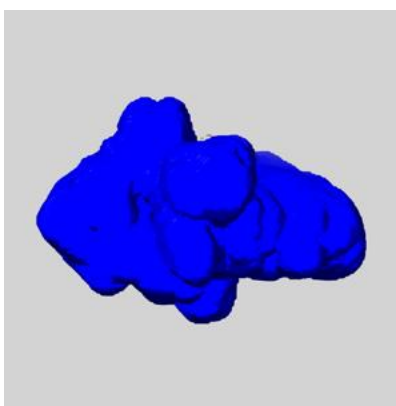
A mask typically either:

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

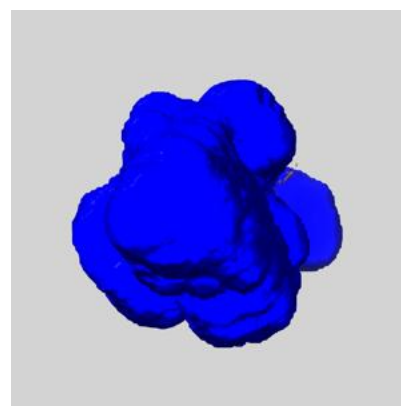
### 6.6.1 emd\_17349\_msk\_1.map [i](#)



X



Y

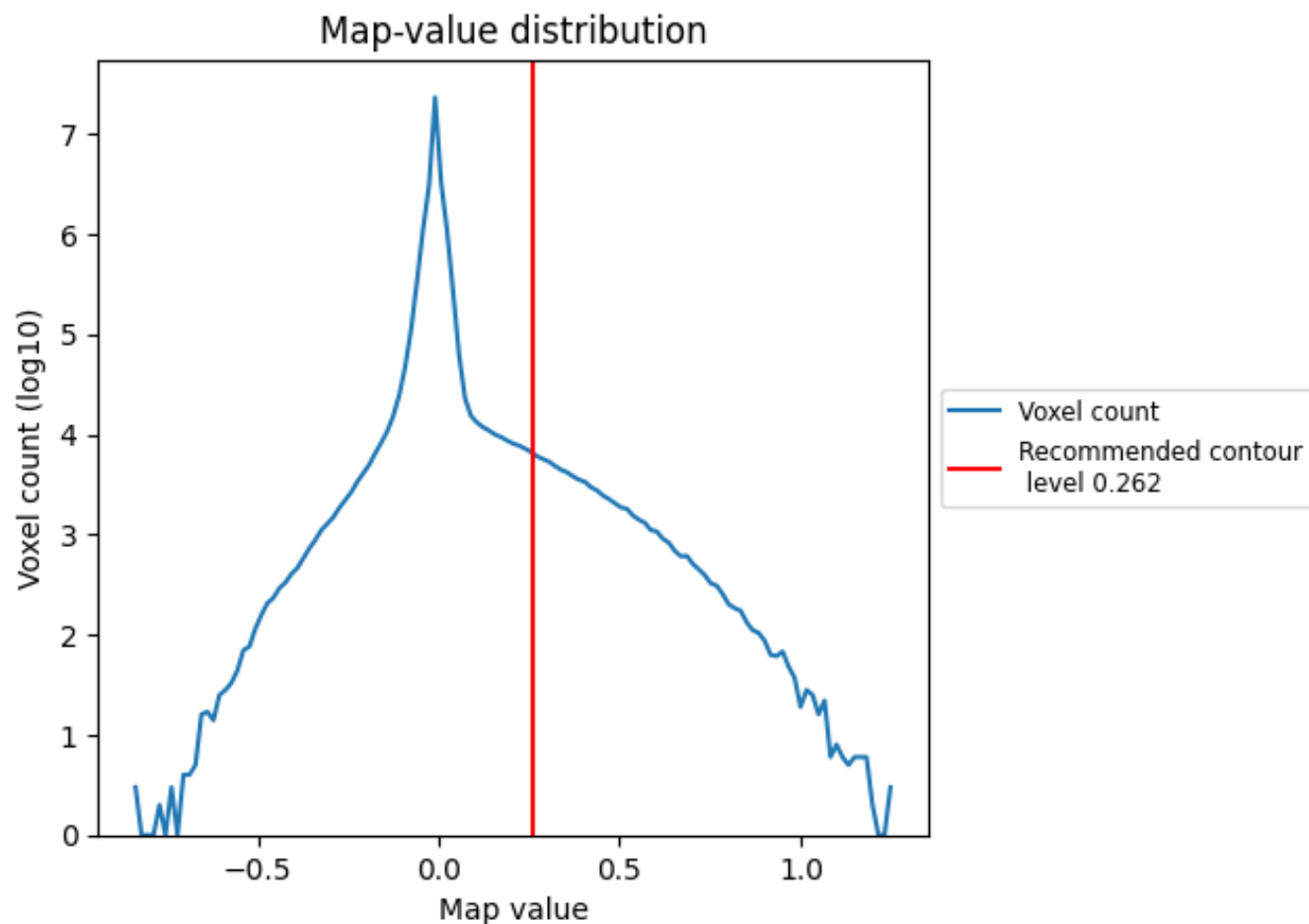


Z

## 7 Map analysis [i](#)

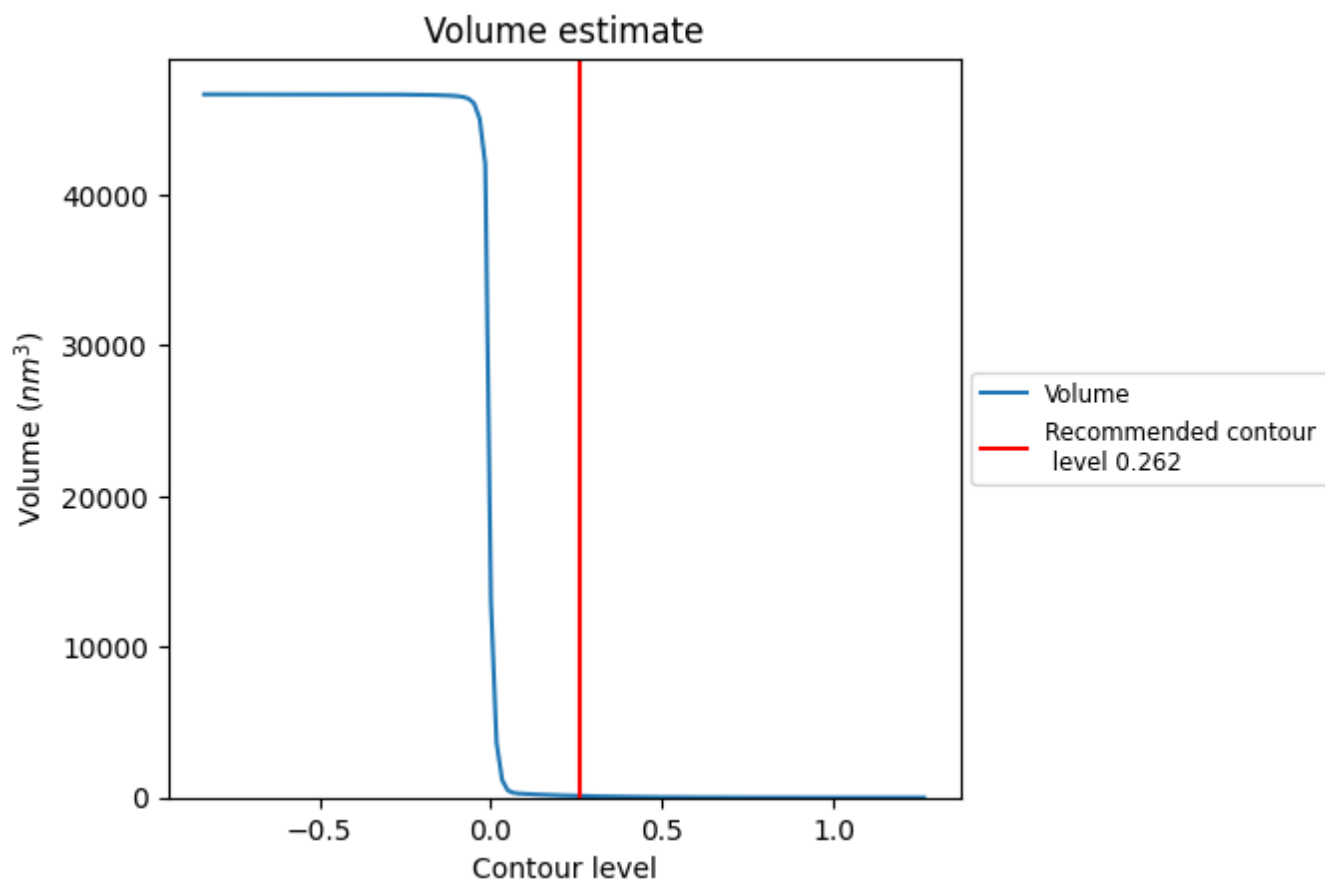
This section contains the results of statistical analysis of the map.

### 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.

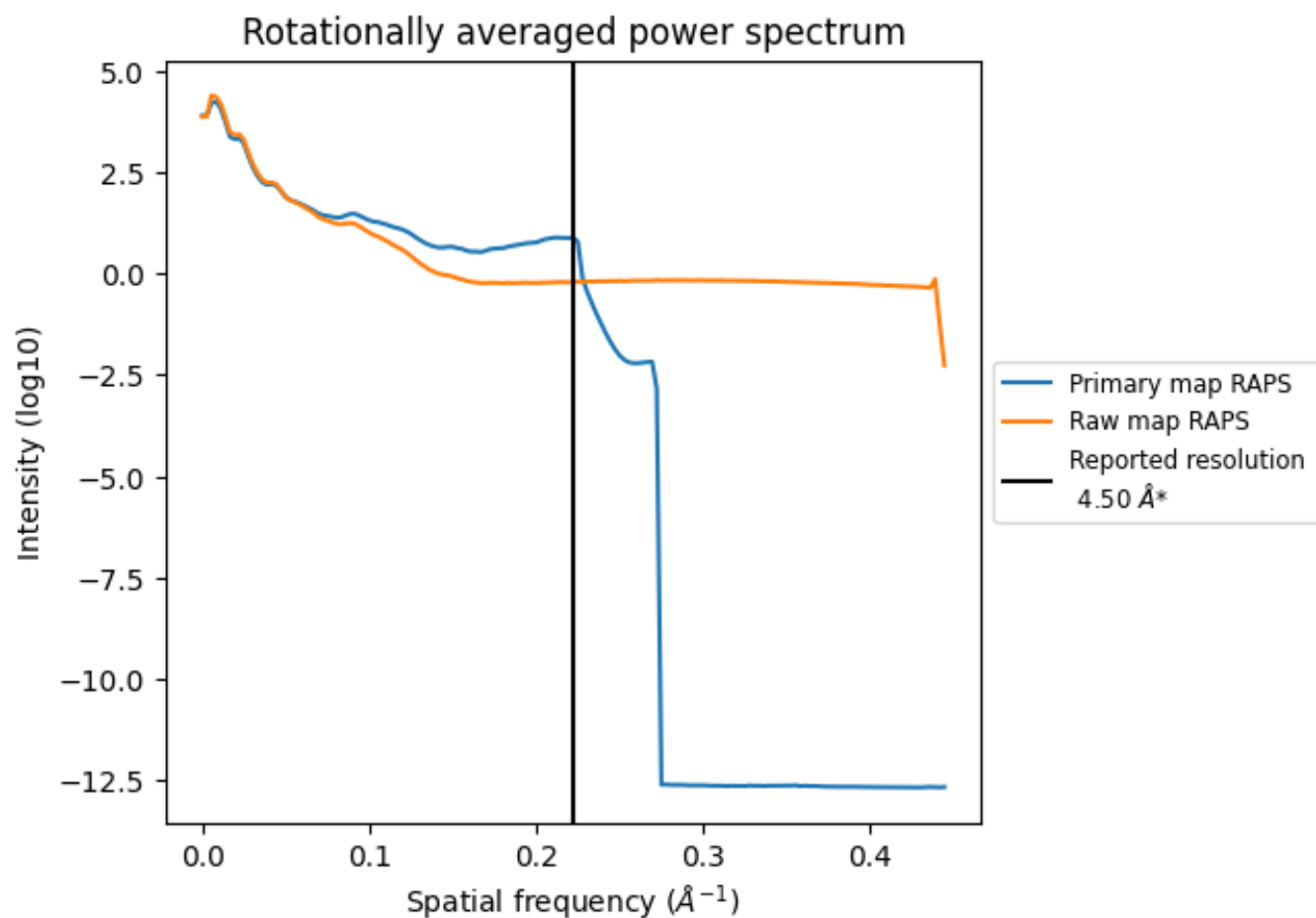
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 107  $\text{nm}^3$ ; this corresponds to an approximate mass of 96 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 ⓘ

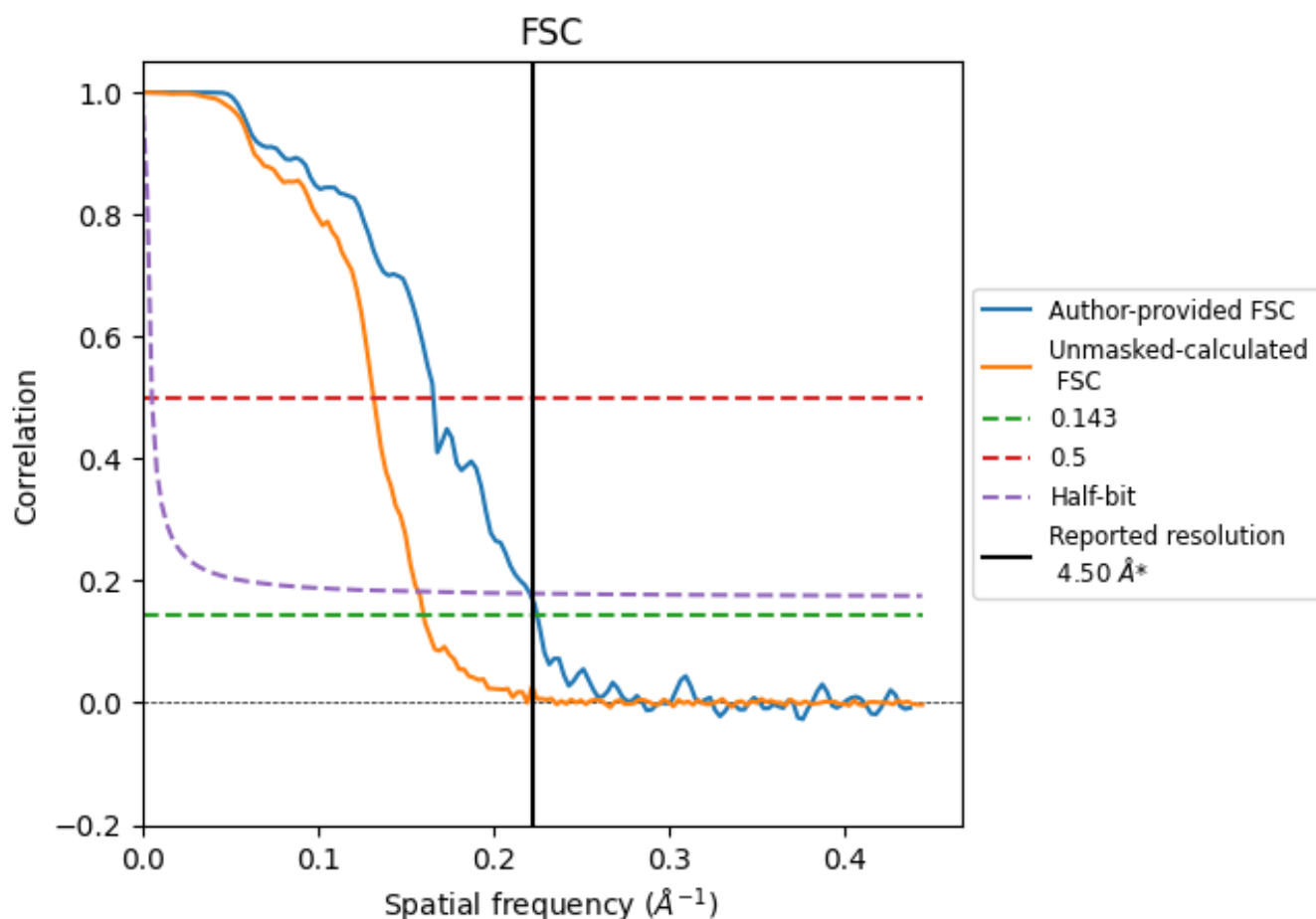


\*Reported resolution corresponds to spatial frequency of 0.222 Å<sup>-1</sup>

## 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 0.222  $\text{\AA}^{-1}$

## 8.2 Resolution estimates [i](#)

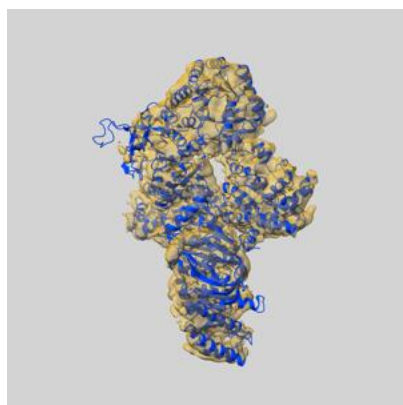
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	4.50	-	-
Author-provided FSC curve	4.44	6.03	4.53
Unmasked-calculated*	6.23	7.58	6.36

\*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 6.23 differs from the reported value 4.5 by more than 10 %

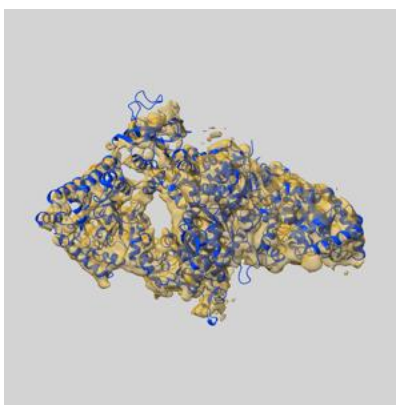
## 9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-17349 and PDB model 9F6Z. Per-residue inclusion information can be found in [section 3](#) on [page 5](#).

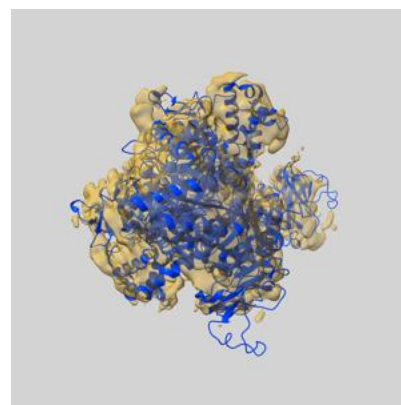
### 9.1 Map-model overlay [i](#)



X



Y

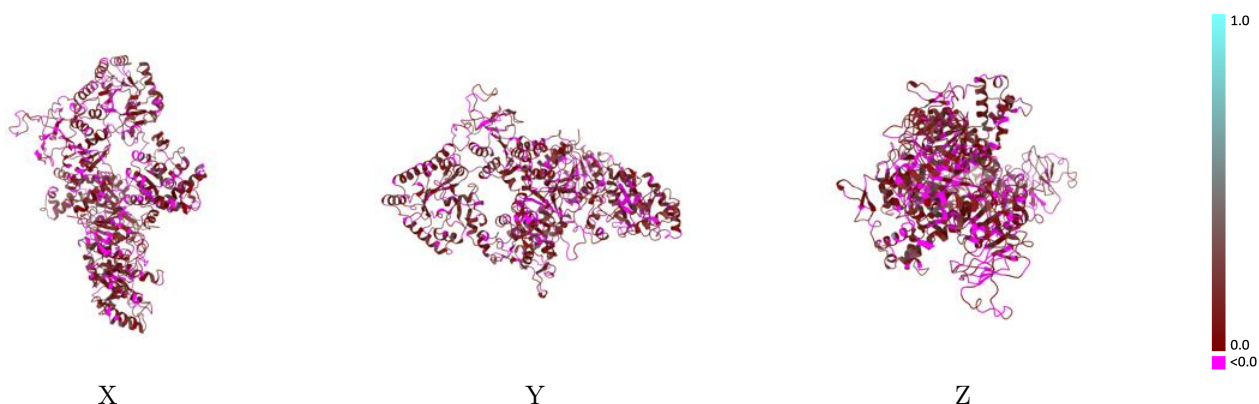


Z

The images above show the 3D surface view of the map at the recommended contour level 0.262 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.

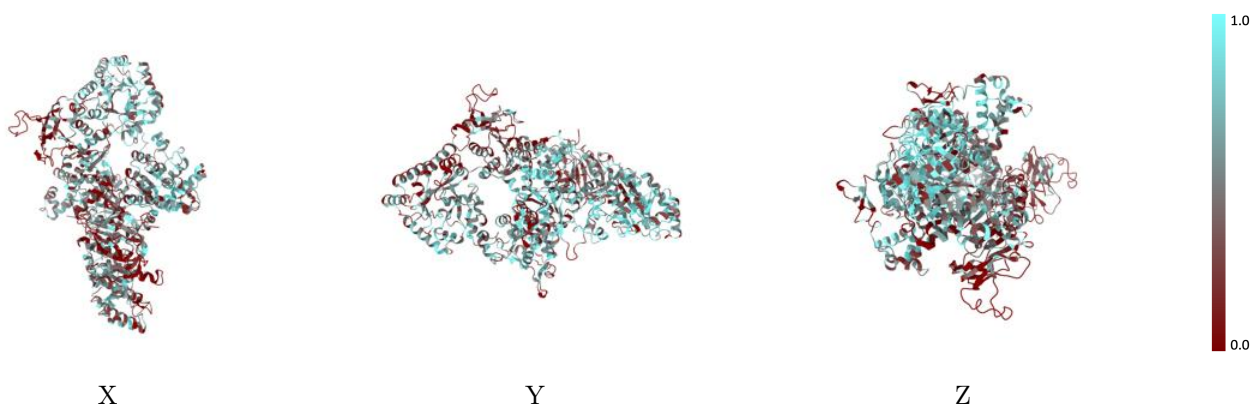


## 9.2 Q-score mapped to coordinate model [i](#)



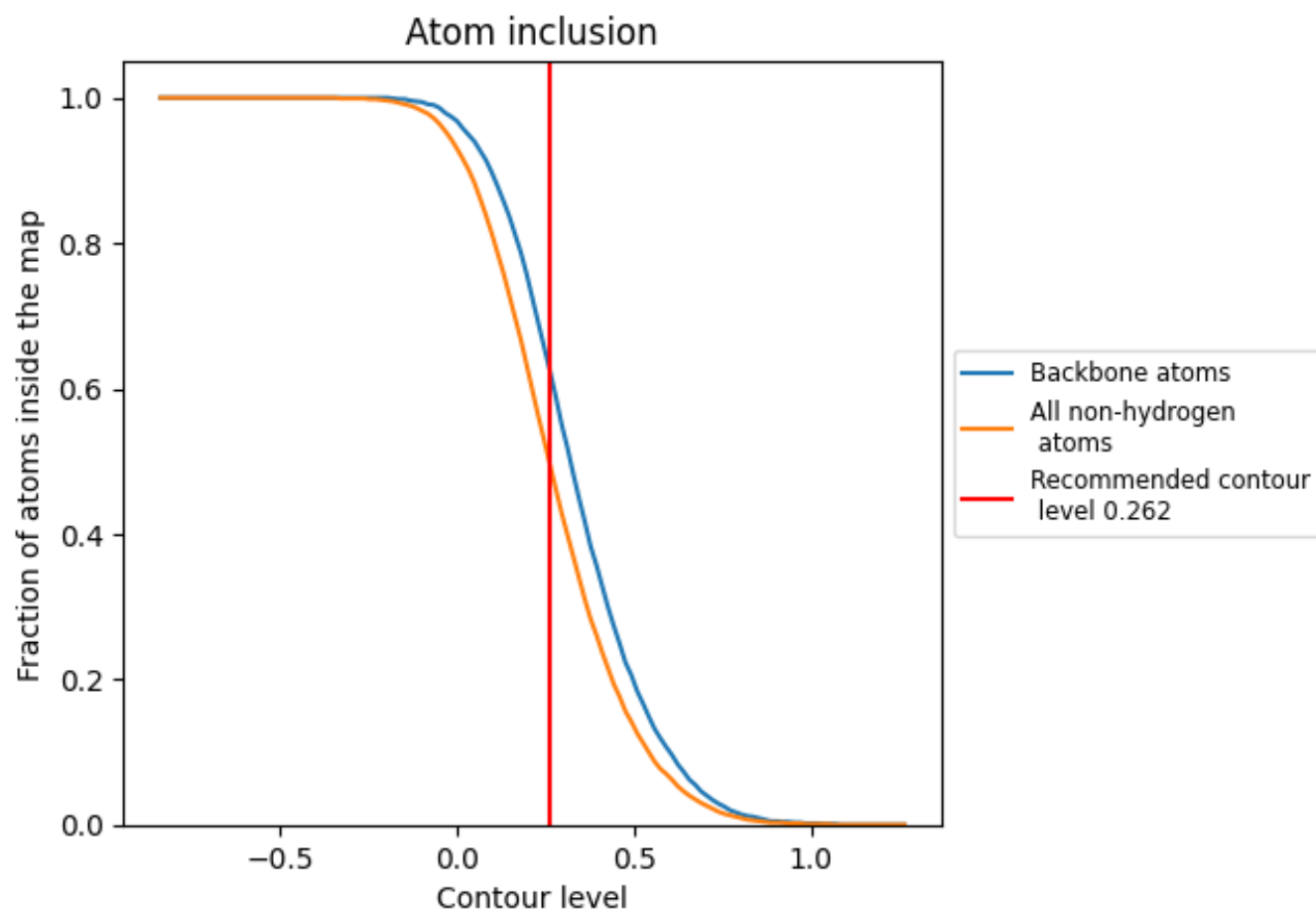
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.262).

## 9.4 Atom inclusion [i](#)



At the recommended contour level, 63% of all backbone atoms, 50% 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 (0.262) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div></div> 0.4980	<div></div> 0.0970
A	<div></div> 0.4500	<div></div> 0.1170
B	<div></div> 0.5470	<div></div> 0.0760

