



wwPDB EM Validation Summary Report ⓘ

Apr 5, 2026 – 07:04 PM UTC

PDB ID : 9BT8 / pdb_00009bt8
EMDB ID : EMD-44881
Title : Structure of Src in complex with beta-arrestin 1 revealing SH3 binding sites
Authors : Pakharukova, N.; Bansia, H.; Bassford, D.K.; des Georges, A.; Lefkowitz, R.J.
Deposited on : 2024-05-14
Resolution : 3.34 Å(reported)
Based on initial models : 2ptk, 6ni2

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

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

EMDB validation analysis : 0.0.1.dev132
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

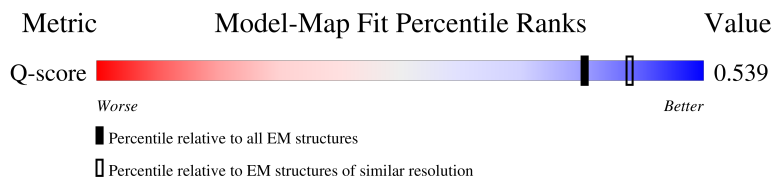
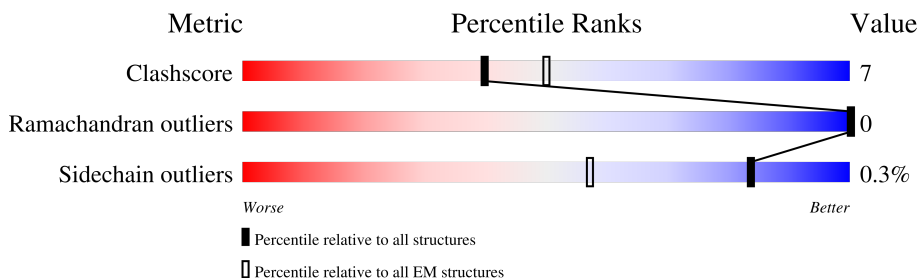
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.34 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	14446 (2.84 - 3.84)

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	C	477	 8% . 88%
2	H		

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Mol	Chain	Length	Quality of chain
5	B	392	
6	L	215	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 5712 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 Proto-oncogene tyrosine-protein kinase Src.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	C	55	Total	C	N	O	S	0	0
			439	280	69	89	1		

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	57	MET	-	initiating methionine	UNP P00523
C	58	GLY	-	expression tag	UNP P00523
C	59	SER	-	expression tag	UNP P00523
C	60	SER	-	expression tag	UNP P00523
C	61	HIS	-	expression tag	UNP P00523
C	62	HIS	-	expression tag	UNP P00523
C	63	HIS	-	expression tag	UNP P00523
C	64	HIS	-	expression tag	UNP P00523
C	65	HIS	-	expression tag	UNP P00523
C	66	HIS	-	expression tag	UNP P00523
C	67	ASP	-	expression tag	UNP P00523
C	68	TYR	-	expression tag	UNP P00523
C	69	ASP	-	expression tag	UNP P00523
C	70	ILE	-	expression tag	UNP P00523
C	71	PRO	-	expression tag	UNP P00523
C	72	THR	-	expression tag	UNP P00523
C	73	THR	-	expression tag	UNP P00523
C	74	GLU	-	expression tag	UNP P00523
C	75	ASN	-	expression tag	UNP P00523
C	76	LEU	-	expression tag	UNP P00523
C	77	TYR	-	expression tag	UNP P00523</

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Chain	Residue	Modelled	Actual	Comment	Reference
C	238	SER	CYS	engineered mutation	UNP P00523
C	245	SER	CYS	engineered mutation	UNP P00523
C	277	SER	CYS	engineered mutation	UNP P00523
C	400	SER	CYS	engineered mutation	UNP P00523

- Molecule 2 is a protein called Antibody fragment Fab30, heavy chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	H	117	Total	C	N	O	S	0	0
			908	578	153	174	3		

- Molecule 3 is a protein called Vasopressin V2 receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	V	14	Total	C	N	O	P S	0	0
			120	54	15	44	6 1		

- Molecule 4 is a protein called Nanobody 32.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	A	111	Total	C	N	O	S	0	0
			849	530	150	165	4		

- Molecule 5 is a protein called Beta-arrestin-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	B	326	Total	C	N	O	S	0	0
			2596	1663	448	481	4		

There are 8 discrepancies between the modelled and reference sequences:

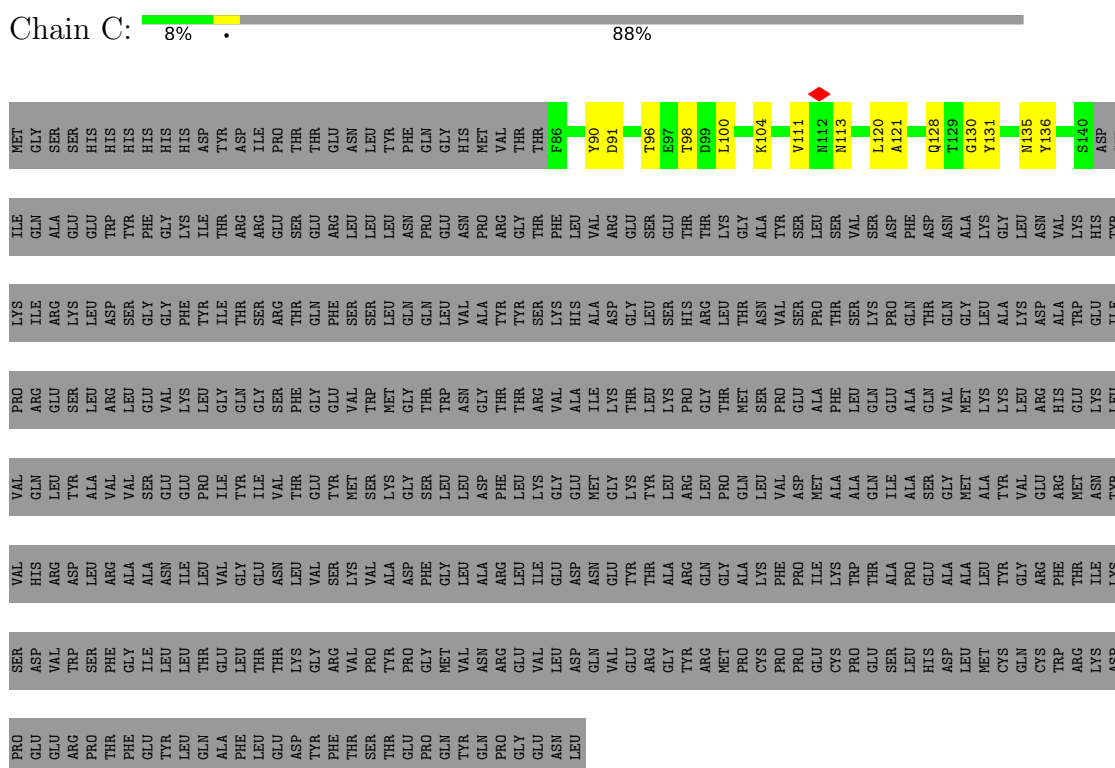
- Molecule 6 is a protein called Antibody fragment Fab30, light chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	L	105	800	506	132	159	3	0	0

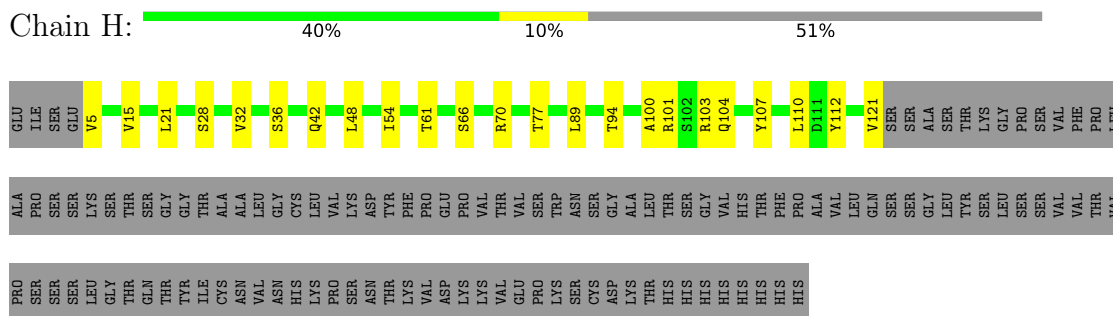
3 Residue-property plots

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: Proto-oncogene tyrosine-protein kinase Src



- Molecule 2: Antibody fragment Fab30, heavy chain



- Molecule 3: Vasopressin V2 receptor

Chain V:  17% 31% 52%

ALA	ARG	GLY	ARG	TPQ	PRO	PRO	SEP	LEU	GLY	PRO	GLN	D355	E356	S357	C358	T359	T360	A361	S362	S363	S364	L365	A366	K367	D368	THR	SER	SER
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• Molecule 4: Nanobody 32

Chain A:  73% 15% 10%

GLN	VAL	Q3	L4	Q5	E6	S7	G8	S21	S25	W36	R39	R45	Y69	I69	S70	R71	D72	Y79	L80	Q81	M82	L85	N96	L102	S113	SER	HIS	HIS	HIS	HIS	HIS	HIS	GLU	PRO	GLU	ALA
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• Molecule 5: Beta-arrestin-1

Chain B:  69% 14% 17%

GLY	ASP	LYS	GLY	T6	L18	T19	V20	Y21	D26	D29	V34	V40	V41	L42	V43	D44	Y47	L48	K49	E50	R51	L57	Y63	G64	R65	P66	P66	D67	LEU	ASP	VAL	L71	G72	L73	R76	K77	R83	VAL	GLN	SER	PHE	PRO	PRO	ALA	PRO	PRO	GLU	ASP	LYS	LYS	P96
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L97	T119	L123	P124	T128	V142	V146	E152	M153	L154	E155	V164	R169	Q172	P178	P182	L199	L203	I207	I241	V242	L243	F244	M255	A263	S266	G291	N299	L300	E308	R312	E313</
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4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	140156	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	55	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2400	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	3.966	Depositor
Minimum map value	-3.227	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.055	Depositor
Recommended contour level	0.38	Depositor
Map size (Å)	432.00003, 432.00003, 432.00003	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.44, 1.44, 1.44	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: SEP, TPO

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	C	0.19	0/451	0.44	0/616
2	H	0.17	0/932	0.29	0/1267
3	V	0.10	0/54	0.18	0/66
4	A	0.17	0/865	0.28	0/1172
5	B	0.16	0/2647	0.30	0/3586
6	L	0.17	0/818	0.32	0/1111
All	All	0.17	0/5767	0.31	0/7818

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	C	439	0	405	10	0
2	H	908	0	860	15	0
3	V	120	0	78	2	0
4	A	849	0	826	12	0
5						

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 80 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:90:TYR:HB3	5:B:314:ILE:HG13	1.58	0.85
2:H:94:THR:HG22	2:H:121:VAL:H	1.51	0.76
2:H:103:ARG:HB2	2:H:107:TYR:HB3	1.73	0.70
5:B:128:THR:HG23	5:B:291:GLY:HA2	1.81	0.62
1:C:135:ASN:ND2	5:B:76:ARG:O	2.33	0.62

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	C	53/477 (11%)	49 (92%)	4 (8%)	0	100	100
2	H	115/237 (48%)	112 (97%)	3 (3%)	0	100	100
3	V	6/29 (21%)	4 (67%)	2 (33%)	0	100	100
4	A	109/124 (88%)	105 (96%)	4 (4%)	0	100	100
5	B	318/392 (81%)	314 (99%)	4 (1%)	0	100	100
6	L	103/215 (48%)	97 (94%)	6 (6%)	0	100	100
All	All	704/1474 (48%)	681 (97%)	23 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	C	48/416 (12%)	48 (100%)	0	100	100
2	H	94/200 (47%)	94 (100%)	0	100	100
3	V	6/16 (38%)	6 (100%)	0	100	100
4	A	91/103 (88%)	89 (98%)	2 (2%)	45	65
5	B	291/349 (83%)	291 (100%)	0	100	100
6	L	91/190 (48%)	91 (100%)	0	100	100
All	All	621/1274 (49%)	619 (100%)	2 (0%)	84	85

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	A	72	ASP
4	A	80	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
2	H	31	ASN
2	H	42	GLN
5	B	130	GLN
5	B	353	HIS
6	L	39	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

6 non-standard protein/DNA/RNA residues 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	$\# Z > 2$
3	SEP	V	362	3	8,9,10	1.57	1 (12%)	7,12,14	0.97	0
3	SEP	V	364	3	8,9,10	1.55	1 (12%)	7,12,14	1.19	1 (14%)
3	TPO	V	359	3	8,10,11	1.08	0	10,14,16	2.08	1 (10%)
3	TPO	V	360	3	8,10,11	1.09	0	10,14,16	2.09	2 (20%)
3	SEP	V	363	3	8,9,10	1.55	1 (12%)	7,12,14	0.99	0
3	SEP	V	357	3	8,9,10	1.60	1 (12%)	7,12,14	1.45	1 (14%)

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	SEP	V	362	3	-	0/6/8/10	-
3	SEP	V	364	3	-	0/6/8/10	-
3	TPO	V	359	3	-	2/9/11/13	-
3	TPO	V	360	3	-	0/9/11/13	-
3	SEP	V	363	3	-	1/6/8/10	-
3	SEP	V	357	3	-		

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	V	359	TPO	O-C-CA-CB
3	V	363	SEP	N-CA-CB-OG
3	V	359	TPO	C-CA-CB-CG2

There are no ring outliers.

No monomer is involved in short contacts.

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.

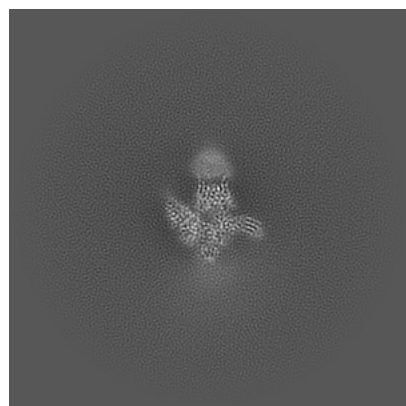
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-44881. These allow visual inspection of the internal detail of the map and identification of artifacts.

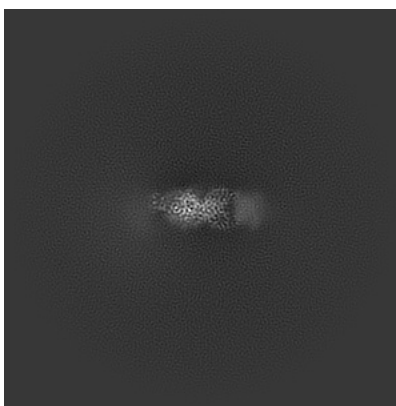
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

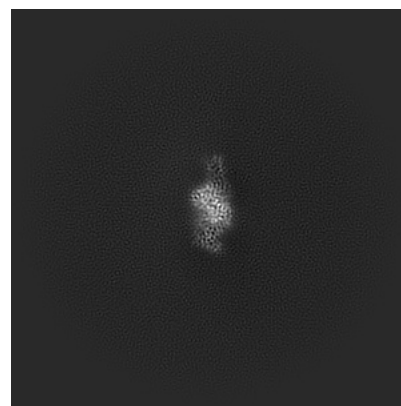
6.1.1 Primary map



X

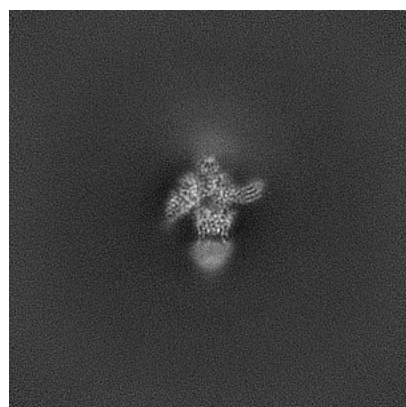


Y

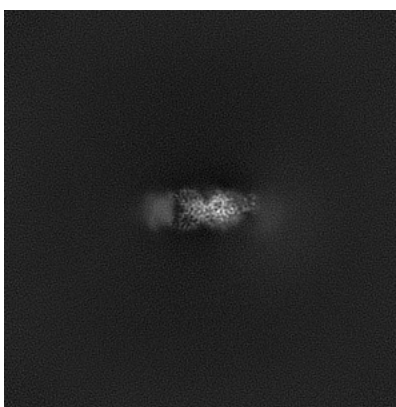


Z

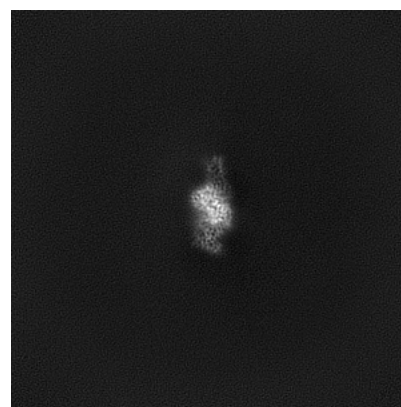
6.1.2 Raw map



X



Y

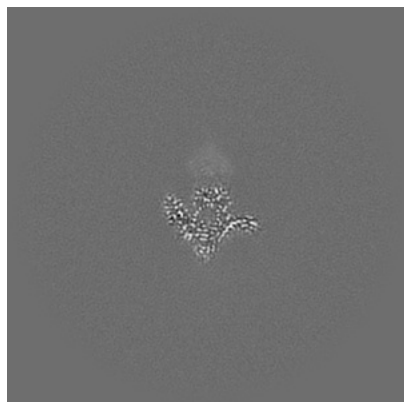


Z

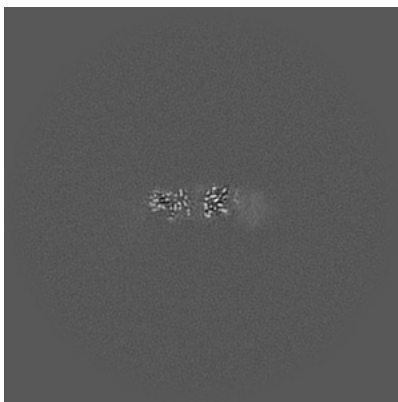
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

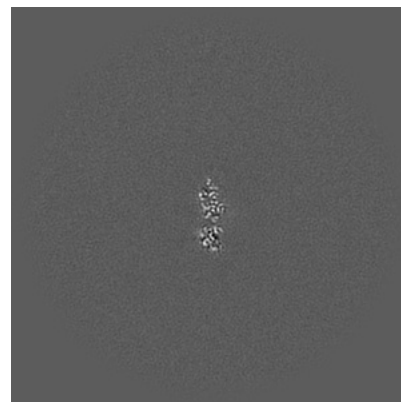
6.2.1 Primary map



X Index: 150

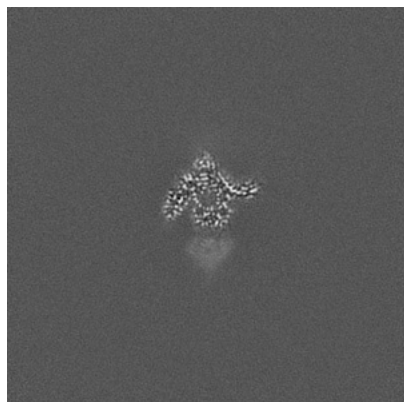


Y Index: 150

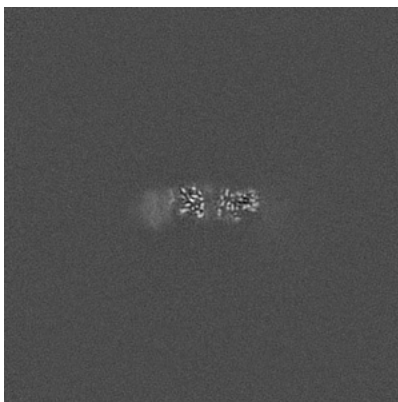


Z Index: 150

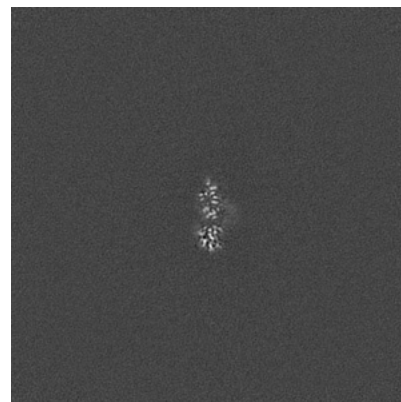
6.2.2 Raw map



X Index: 150



Y Index: 150

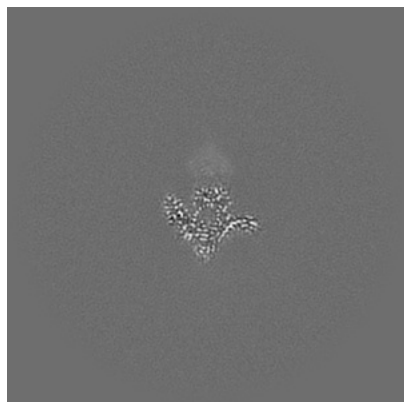


Z Index: 150

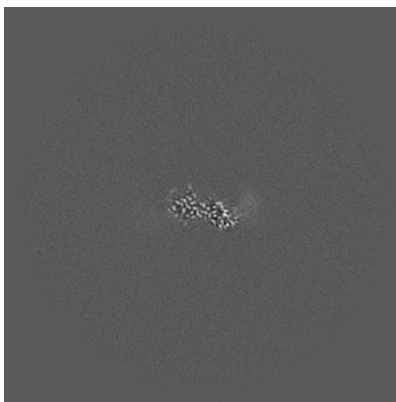
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

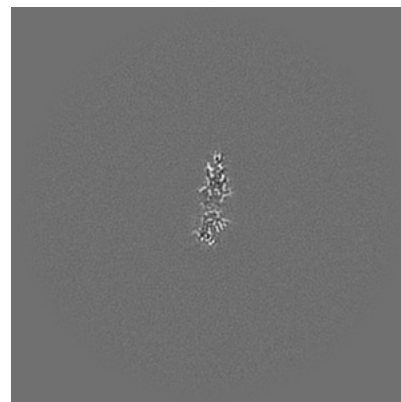
6.3.1 Primary map



X Index: 150

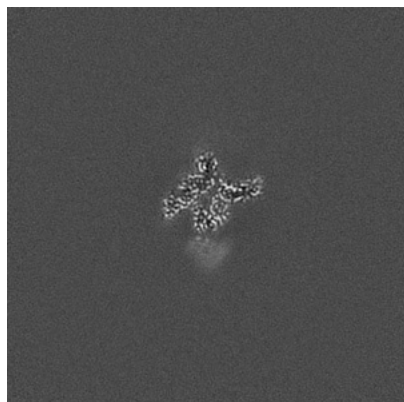


Y Index: 160

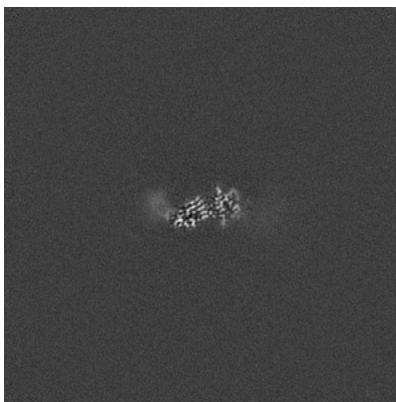


Z Index: 139

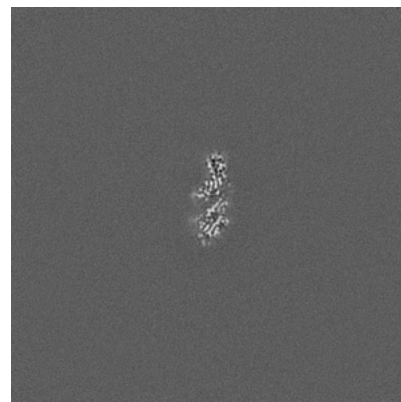
6.3.2 Raw map



X Index: 153



Y Index: 159

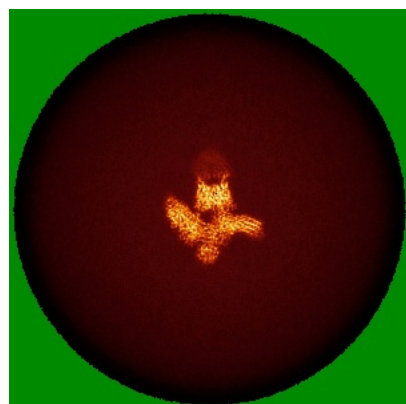


Z Index: 164

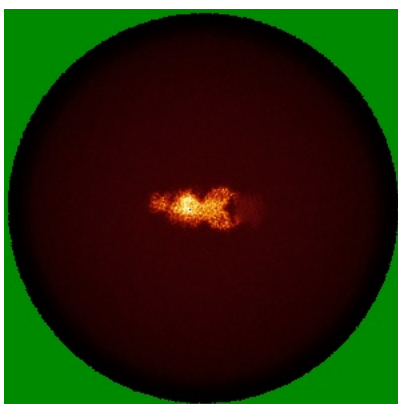
The images above show the largest variance slices of the map in three orthogonal directions.

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

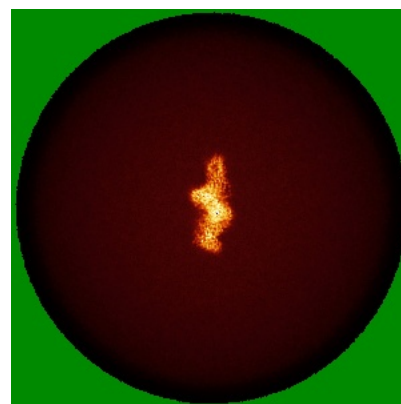
6.4.1 Primary map



X



Y

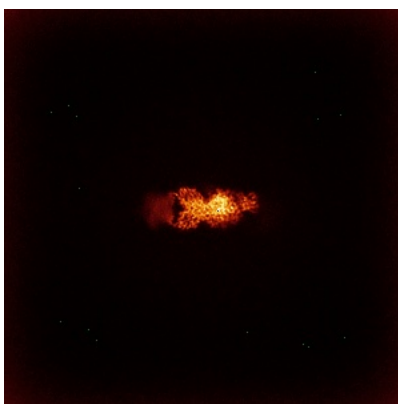


Z

6.4.2 Raw map



X



Y

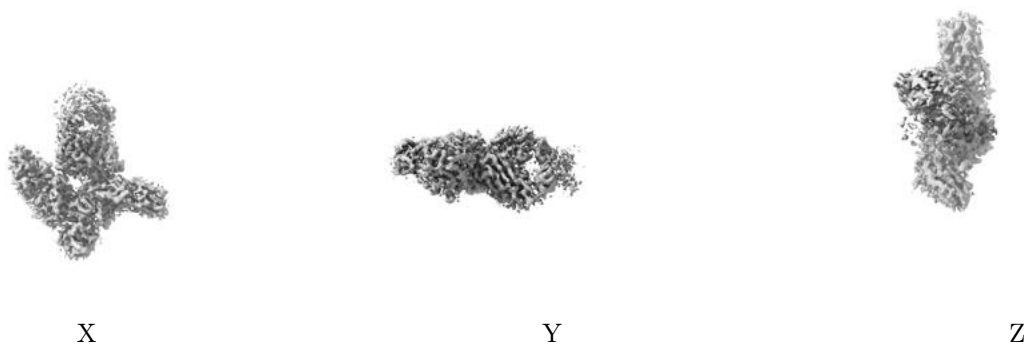


Z

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.

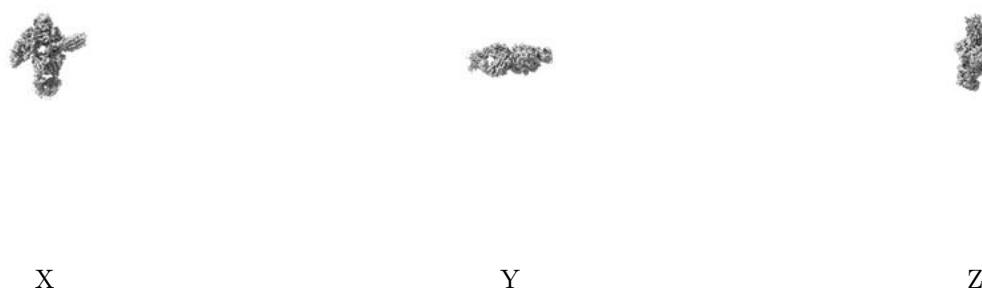
6.5 Orthogonal surface views [i](#)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.38. 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.

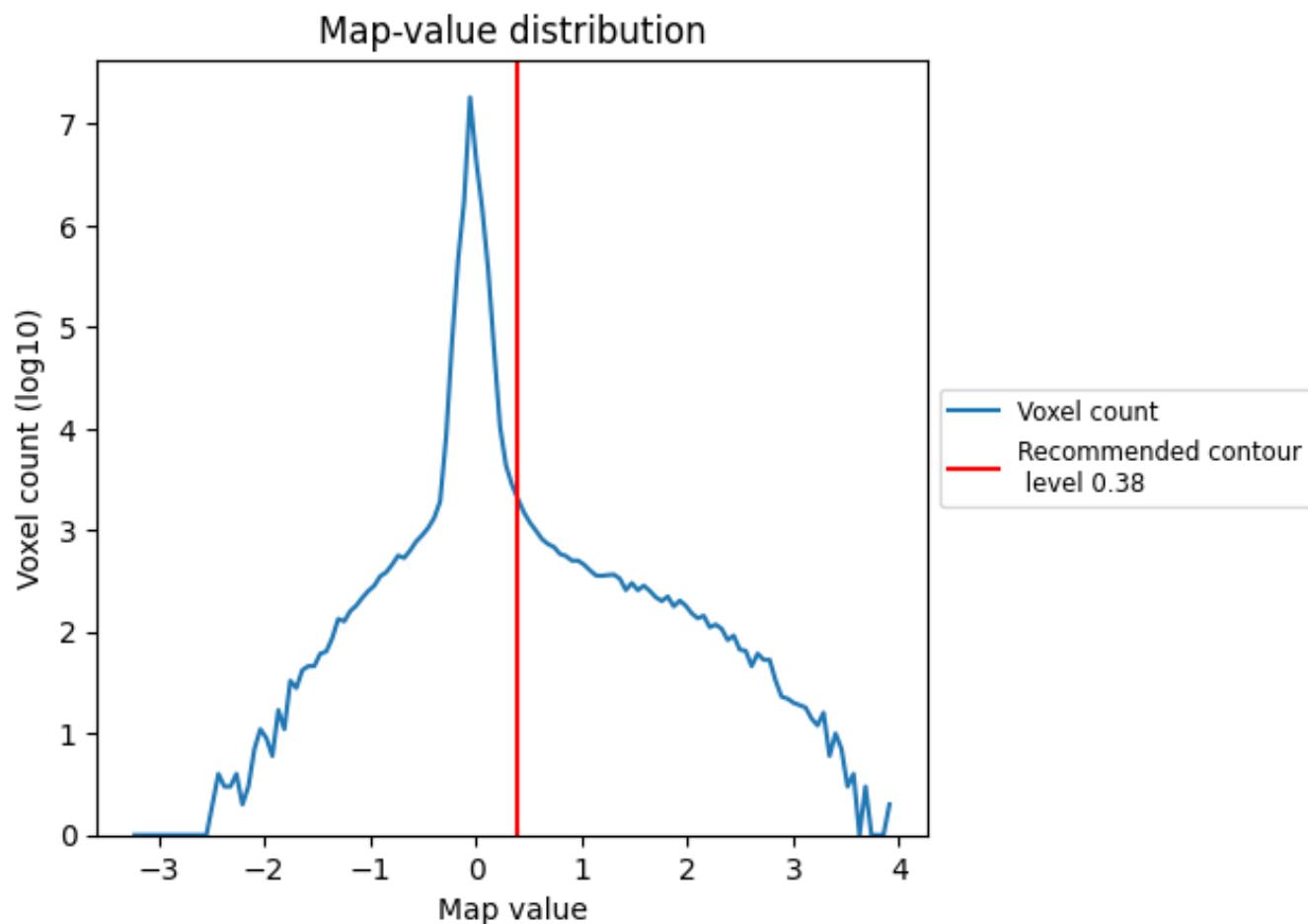
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

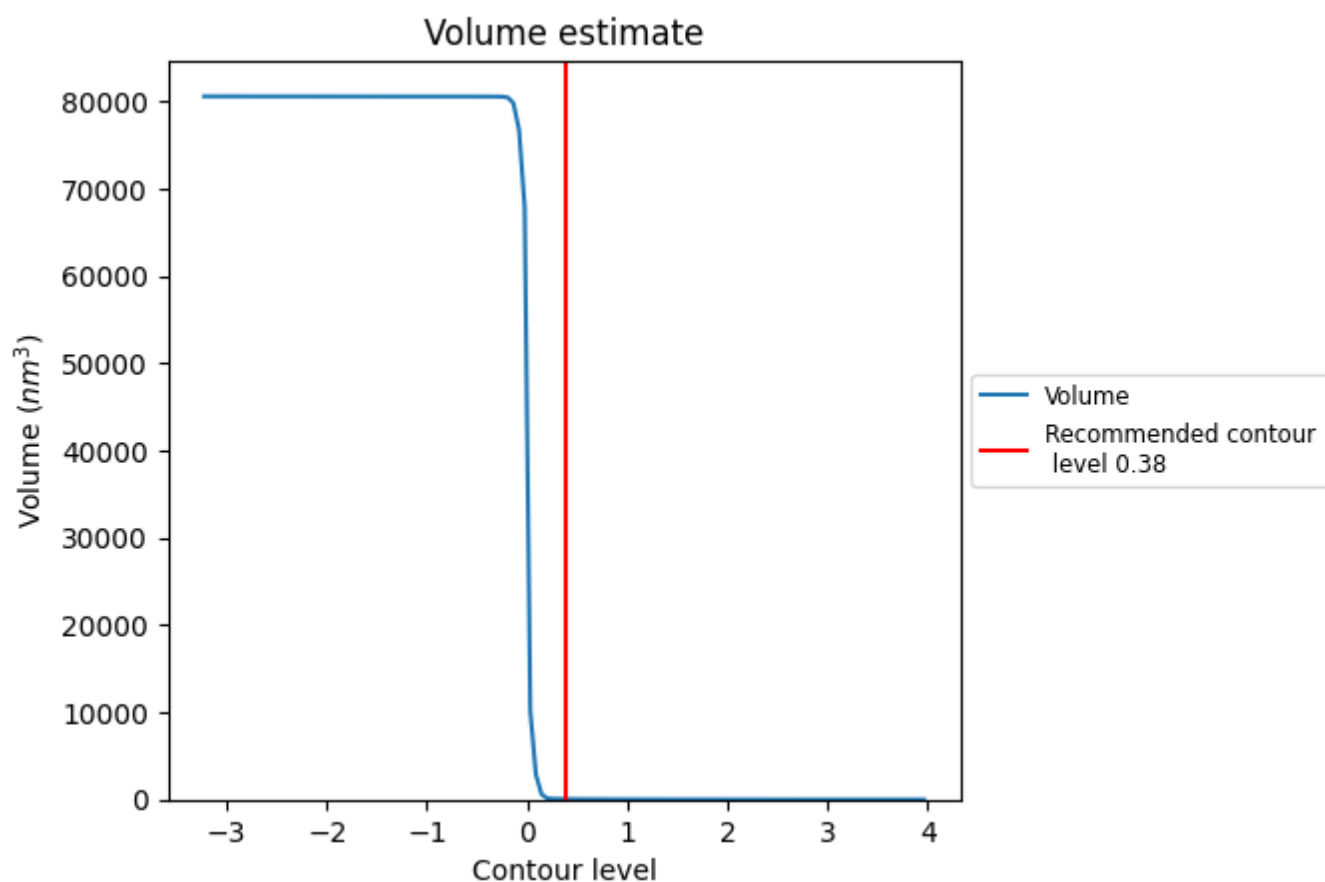
This section contains the results of statistical analysis of the map.

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.

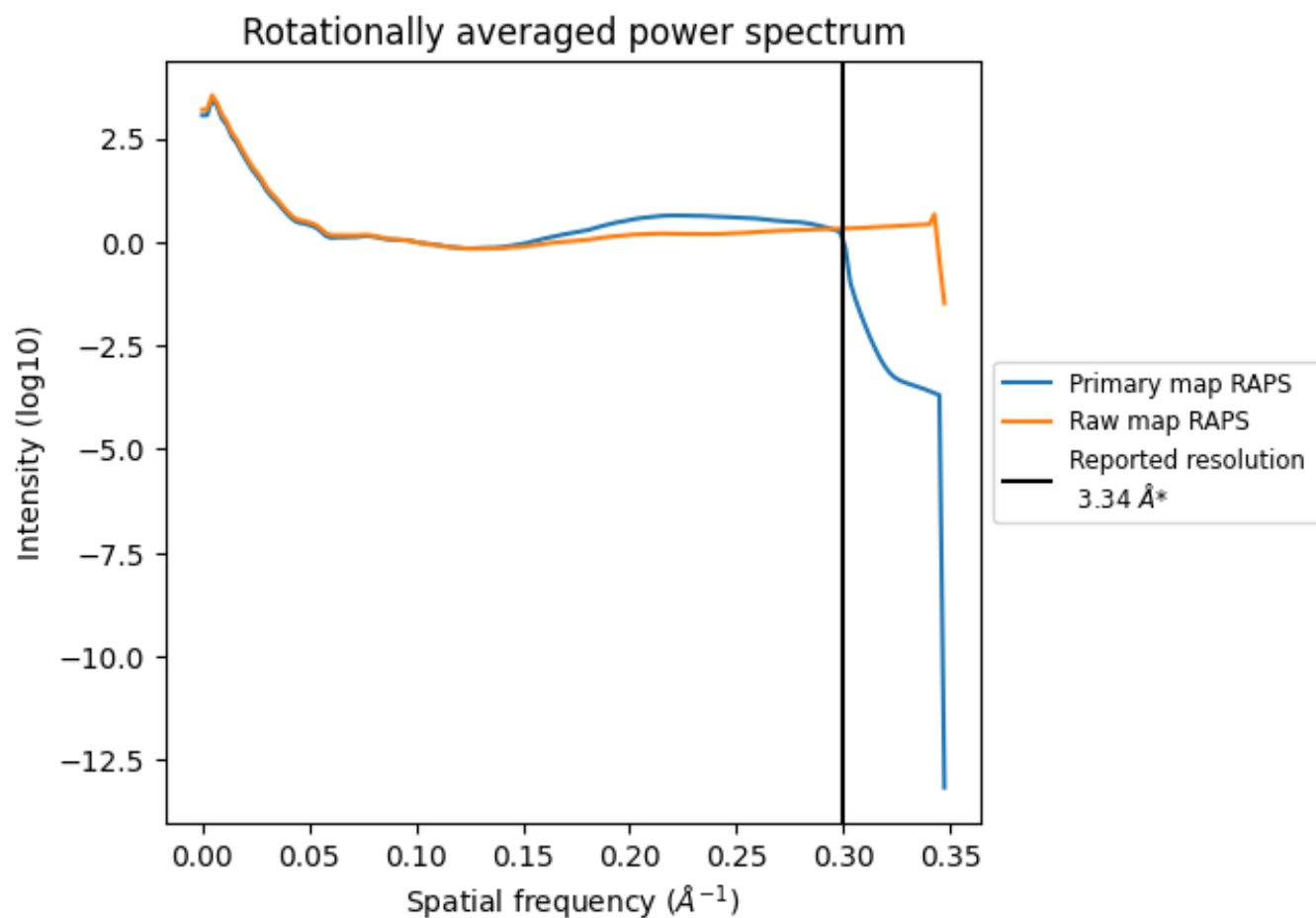
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 52 nm³; this corresponds to an approximate mass of 47 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 ⓘ

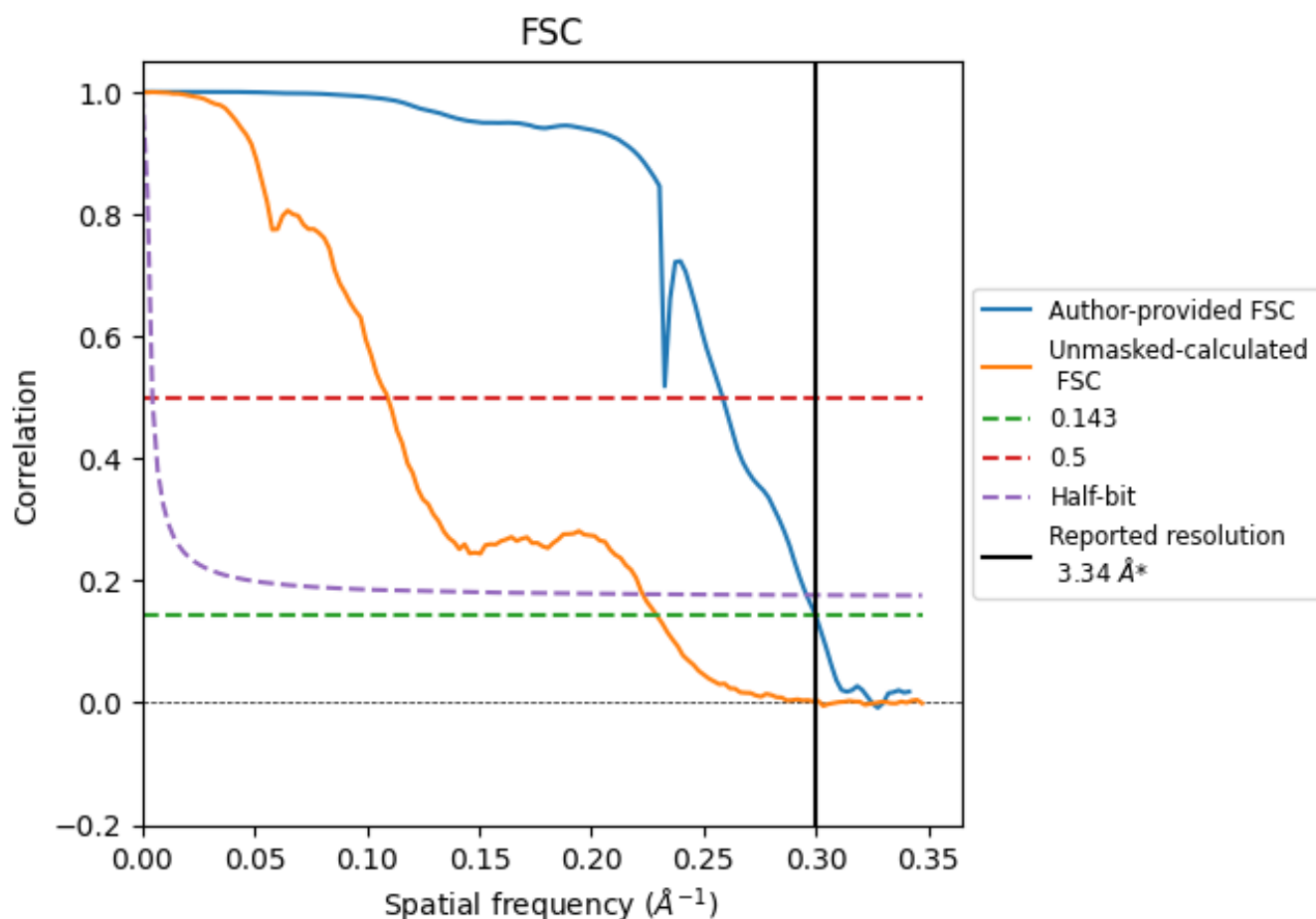


*Reported resolution corresponds to spatial frequency of $0.299 \text{ \AA}^{-1}$

8 Fourier-Shell correlation [i](#)

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

8.1 FSC [i](#)



*Reported resolution corresponds to spatial frequency of $0.299 \text{ \AA}^{-1}$

8.2 Resolution estimates [i](#)

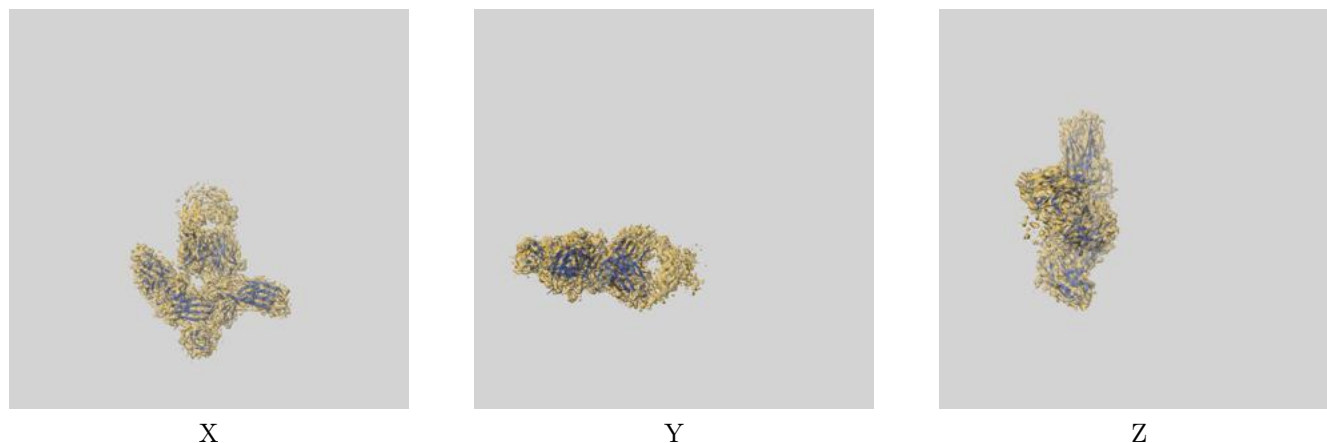
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.34	-	-
Author-provided FSC curve	3.34	3.87	3.38
Unmasked-calculated*	4.37	9.16	4.49

*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 4.37 differs from the reported value 3.34 by more than 10 %

9 Map-model fit [i](#)

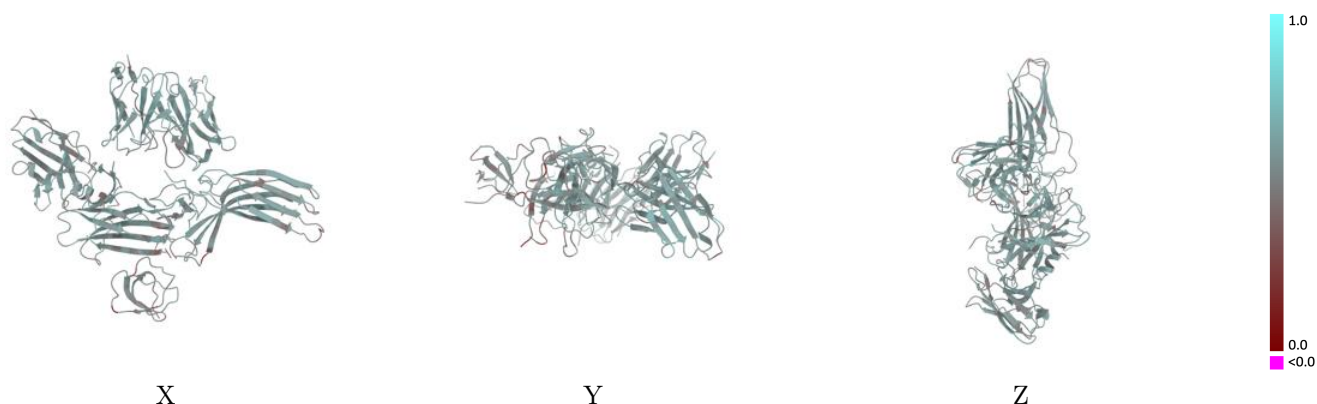
This section contains information regarding the fit between EMDB map EMD-44881 and PDB model 9BT8. Per-residue inclusion information can be found in [section 3](#) on [page 7](#).

9.1 Map-model overlay [i](#)



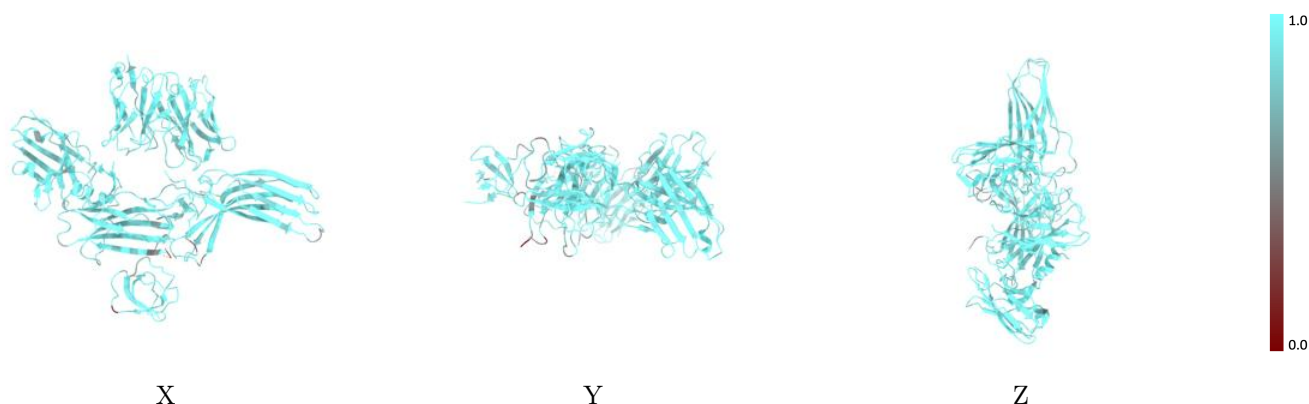
The images above show the 3D surface view of the map at the recommended contour level 0.38 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



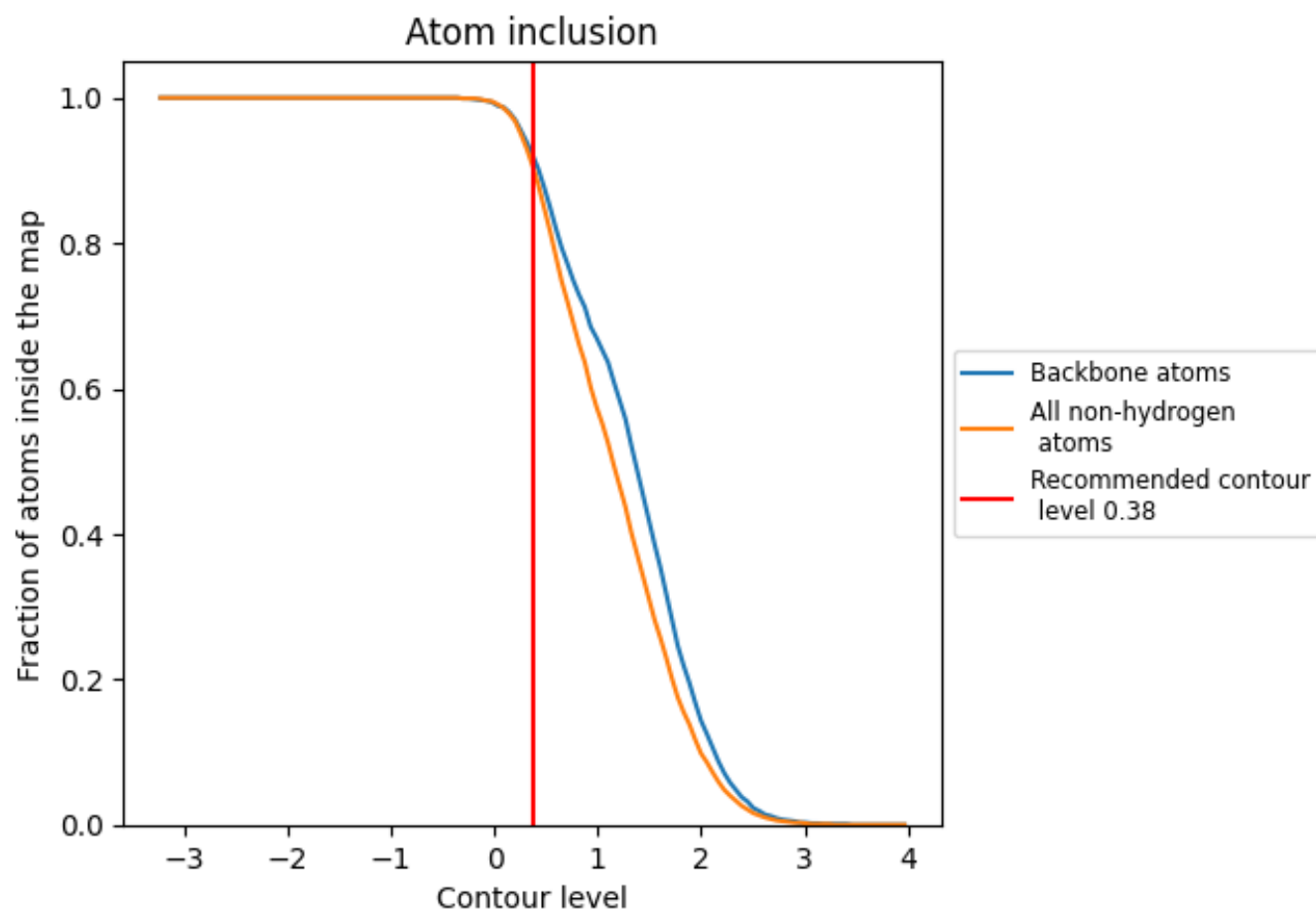
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.38).

9.4 Atom inclusion [i](#)



At the recommended contour level, 92% of all backbone atoms, 90% 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 (0.38) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.9020	0.5390
A	0.9240	0.5400
B	0.8800	0.5370
C	0.8700	0.4790
H	0.9340	0.5570
L	0.9390	0.5610
V	0.8670	0.5290

1.0

0.0

<0.0