



## wwPDB EM Validation Summary Report ⓘ

May 19, 2024 – 12:32 PM EDT

PDB ID : 7MP6  
EMDB ID : EMD-23930  
Title : Neurofibromin homodimer  
Authors : Lupton, C.J.; Bayly-Jones, C.; Ellisdon, A.M.  
Deposited on : 2021-05-04  
Resolution : 6.25 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](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.dev92  
MolProbity : 4.02b-467  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36.2

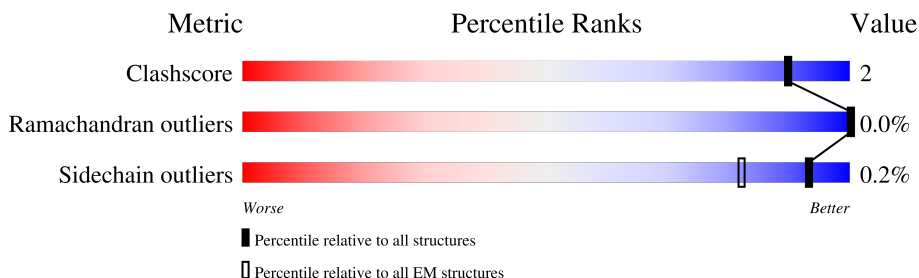
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 6.25 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	2826	
1	B	2826	

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 25464 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 Isoform I of Neurofibromin.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1600	Total	C	N	O	S	0	0
			12704	8190	2127	2296	91		
1	B	1609	Total	C	N	O	S	0	0
			12760	8223	2136	2310	91		

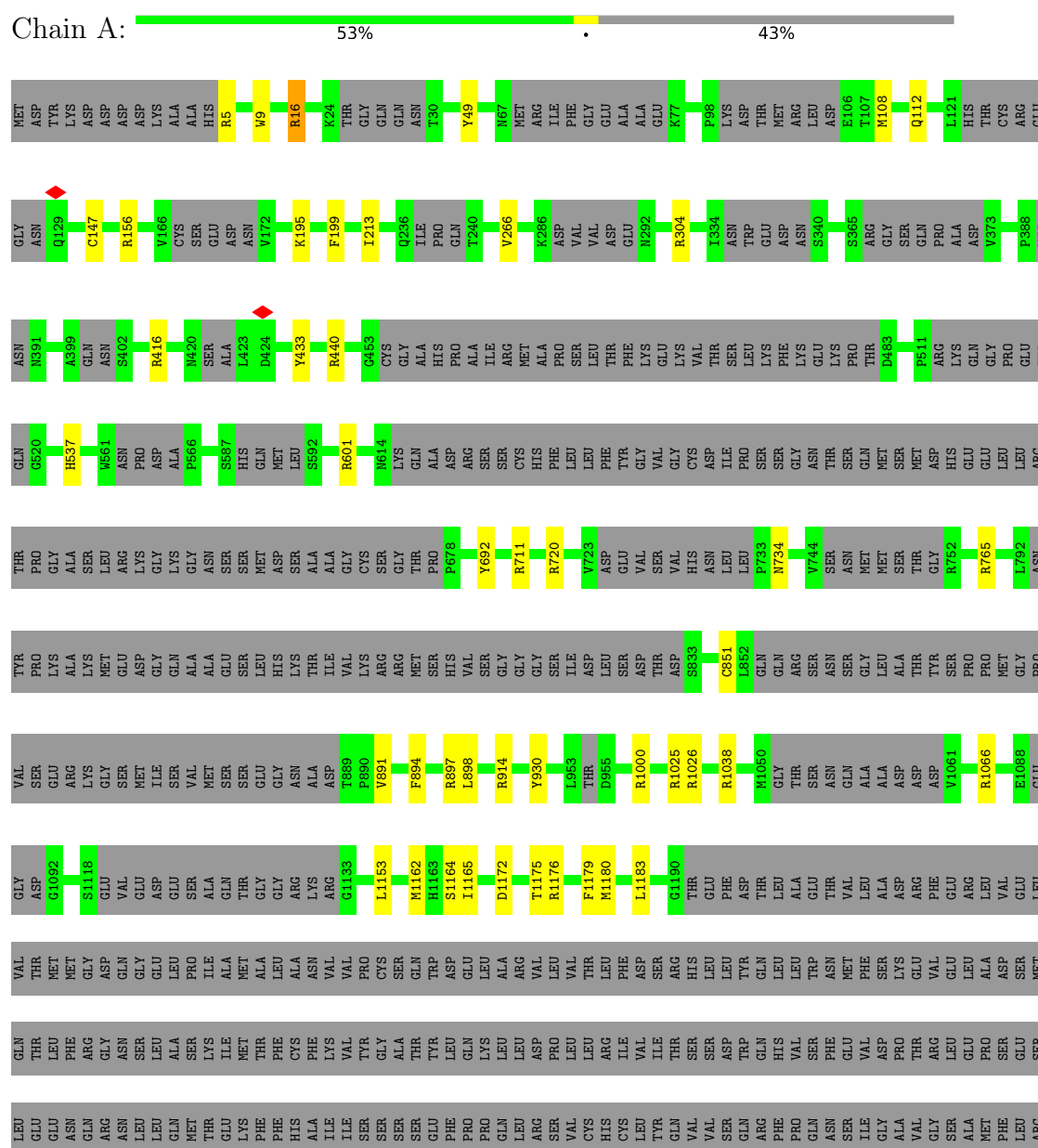
There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	MET	-	initiating methionine	UNP P21359
A	-6	ASP	-	expression tag	UNP P21359
A	-5	TYR	-	expression tag	UNP P21359
A	-4	LYS	-	expression tag	UNP P21359
A	-3	ASP	-	expression tag	UNP P21359
A	-2	ASP	-	expression tag	UNP P21359
A	-1	ASP	-	expression tag	UNP P21359
A	0	ASP	-	expression tag	UNP P21359
A	1	LYS	-	expression tag	UNP P21359
B	-7	MET	-	initiating methionine	UNP P21359
B	-6	ASP	-	expression tag	UNP P21359
B	-5	TYR	-	expression tag	UNP P21359
B	-4	LYS	-	expression tag	UNP P21359
B	-3	ASP	-	expression tag	UNP P21359
B	-2	ASP	-	expression tag	UNP P21359
B	-1	ASP	-	expression tag	UNP P21359
B	0	ASP	-	expression tag	UNP P21359
B	1	LYS	-	expression tag	UNP P21359

### 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: Isoform I of Neurofibromin



- Molecule 1: Isoform I of Neurofibromin

Chain B:  53% . 43%

[illegible]



LYS	TRP	PRO	ASN	V2606	GLY	Y2259
ILE	SER	LYS	LEU		PRO	
VAL	ASN	ARG	ASN	S2626	ASP	
	SER	GLN	GLU	F2633	THR	
	MET	MET	GLU		LYS	Y2264
	THR	THR	SER	Y2669	SER	
	SER	SER	GLU	H2670	GLU	Q2281
	LEU	LEU	GLY	E2671	TYR	P2282
	ALA	ALA	ILE		ALA	
	THR	THR	SER		LEU	Y2377
	SER	SER	PRO		ALA	R2378
	GLN	GLN	P2675		ALA	
	HIS	HIS			THR	R2390
	SER	SER			TYR	
	PRO	PRO	G2689		PRO	R2403
	GLY	GLY			THR	
	ILE	ILE	R2692		VAL	
	ASP	ASP	F2693		ARG	S2430
	LYS	LYS	F2697		GLY	ARG
	GLU	GLU	SER		CYS	
	VAL	VAL	ASN		THR	SER
	GLU	GLU	LYS		LEU	LYS
	ASN	ASN	GLN		PRO	SER
	THR	THR	THR		ARG	LEU
	ARG	ARG	GLU	I2703	HIS	THR
	THR	THR	GLU		LEU	ASP
	ALA	ALA	ASP		ILE	THR
	THR	THR	THR		ASP	ASP
	SER	SER	GLU		MET	ILE
	GLN	GLN	GLY	P2723	GLY	ILE
	VAL	VAL	ILE		ILE	GLY
	GLN	GLN	ASP		ARG	MET
	LYS	LYS	THR		GLN	GLU
	THR	THR	ARG		PRO	ASN
	ALA	ALA	THR		VAL	VAL
	SER	SER	HIS		ALA	PRO
	GLN	GLN	LEU		ASN	MET
	VAL	VAL	THR		THR	ASP
	GLN	GLN	THR		LYS	THR
	LYS	LYS	PRO		LEU	TYR
	THR	THR	THR		LEU	PRO
	ALA	ALA	VAL		ILE	ILE
	SER	SER	GLN		HIS	HIS
	GLY	GLY	LYS		THR	GLY
	THR	THR	GLN		ARG	ARG
	ASN	ASN	PHE		LYS	THR
	SER	SER	LYS		SER	ILE
	ILE	ILE	ILE		VAL	LYS
	LYS	LYS	THR		LEU	GLU
	ASN	ASN	ALA		THR	THR
	SER	SER	ASN		ALA	LYS
	ILE	ILE	ASN		THR	GLN
	LYS	LYS	LEU		ALA	PRO
					D2691	

## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C2	Depositor
Number of particles used	95564	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TALOS ARCTICA	Depositor
Voltage (kV)	200	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	40.0	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	2.365	Depositor
Minimum map value	-0.873	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.065	Depositor
Recommended contour level	0.3	Depositor
Map size (Å)	515.808, 515.808, 515.808	wwPDB
Map dimensions	216, 216, 216	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	2.388, 2.388, 2.388	Depositor



## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

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	0.61	0/12925	0.98	39/17476 (0.2%)
1	B	0.61	1/12983 (0.0%)	0.98	42/17558 (0.2%)
All	All	0.61	1/25908 (0.0%)	0.98	81/35034 (0.2%)

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	4
1	B	0	4
All	All	0	8

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	1897	ASN	C-N	8.97	1.54	1.34

The worst 5 of 81 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	304	ARG	NE-CZ-NH1	7.60	124.10	120.30
1	A	2669	TYR	CB-CG-CD2	-7.55	116.47	121.00
1	B	304	ARG	NE-CZ-NH1	7.53	124.06	120.30
1	B	2669	TYR	CB-CG-CD2	-7.53	116.48	121.00
1	B	156	ARG	NE-CZ-NH1	7.18	123.89	120.30

There are no chirality outliers.

5 of 8 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	147	CYS	Mainchain
1	A	1853	TYR	Sidechain
1	A	2693	PHE	Sidechain
1	A	49	TYR	Sidechain
1	B	49	TYR	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	12704	0	13032	48	0
1	B	12760	0	13087	50	0
All	All	25464	0	26119	89	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 2.

The worst 5 of 89 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:1916:SER:CB	1:B:1920:LEU:HD23	1.67	1.24
1:B:1865:LEU:HA	1:B:1898:GLU:OE1	1.46	1.15
1:B:1916:SER:HB3	1:B:1920:LEU:HD23	1.14	1.09
1:A:1987:ASP:OD1	1:A:2032:ARG:NH2	1.94	0.99
1:A:1987:ASP:OD1	1:A:2032:ARG:CZ	2.18	0.92

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	1532/2826 (54%)	1504 (98%)	27 (2%)	1 (0%)	51	85
1	B	1545/2826 (55%)	1518 (98%)	27 (2%)	0	100	100
All	All	3077/5652 (54%)	3022 (98%)	54 (2%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	2020	GLY

### 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	1438/2520 (57%)	1436 (100%)	2 (0%)	93	97
1	B	1444/2520 (57%)	1441 (100%)	3 (0%)	93	96
All	All	2882/5040 (57%)	2877 (100%)	5 (0%)	93	96

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	TRP
1	A	16	ARG
1	B	9	TRP
1	B	16	ARG
1	B	1984	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	112	GLN
1	B	112	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 monosaccharides 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.

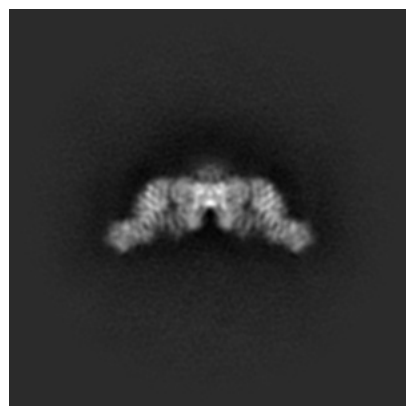
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-23930. These allow visual inspection of the internal detail of the map and identification of artifacts.

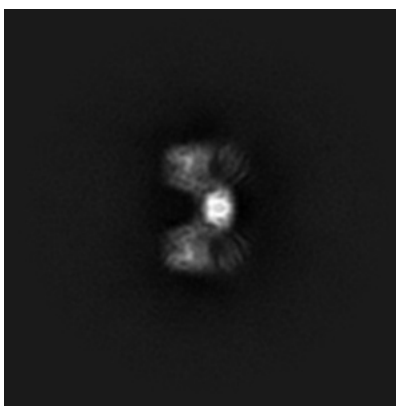
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

#### 6.1.1 Primary map



X

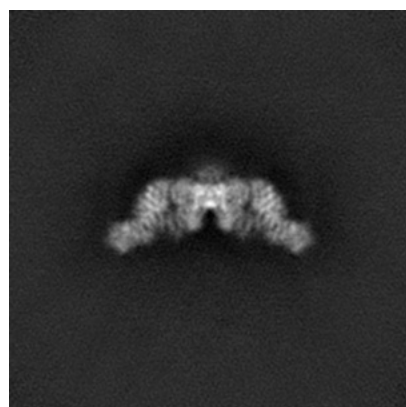


Y

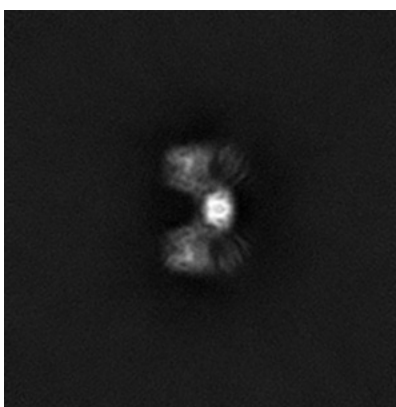


Z

#### 6.1.2 Raw map



X



Y



Z

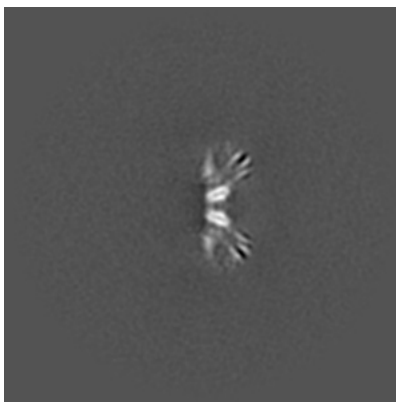
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

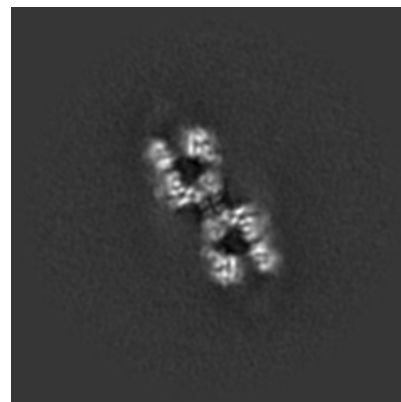
### 6.2.1 Primary map



X Index: 108



Y Index: 108

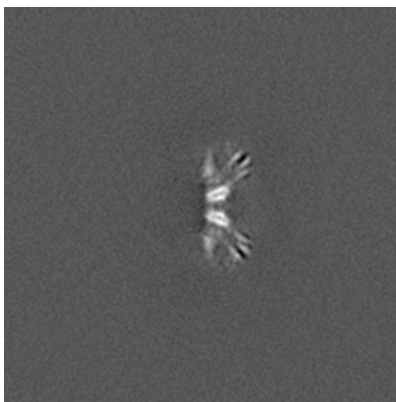


Z Index: 108

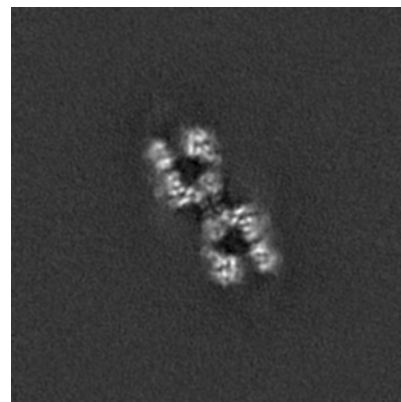
### 6.2.2 Raw map



X Index: 108



Y Index: 108



Z Index: 108

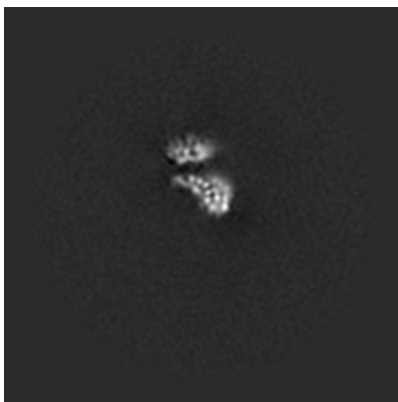
The images above show central slices of the map in three orthogonal directions.

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

### 6.3.1 Primary map



X Index: 105



Y Index: 76



Z Index: 112

### 6.3.2 Raw map



X Index: 105



Y Index: 76

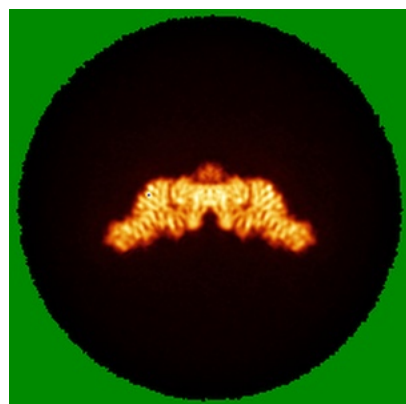


Z Index: 112

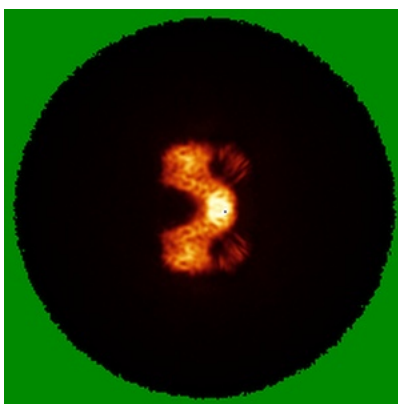
The images above show the largest variance slices of the map in three orthogonal directions.

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

### 6.4.1 Primary map



X



Y

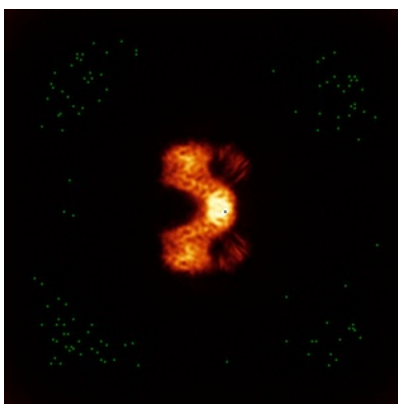


Z

### 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.



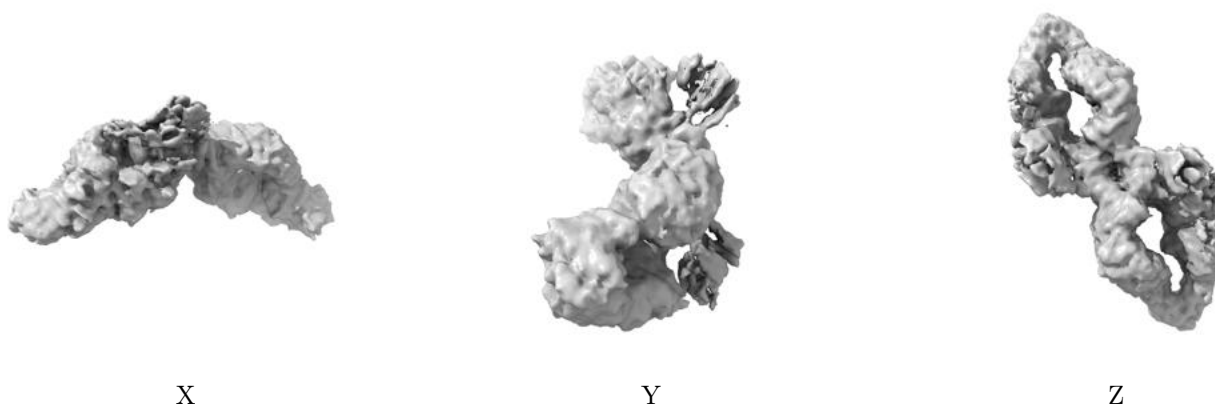
## 6.5 Orthogonal surface views [i](#)

### 6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.3. 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.

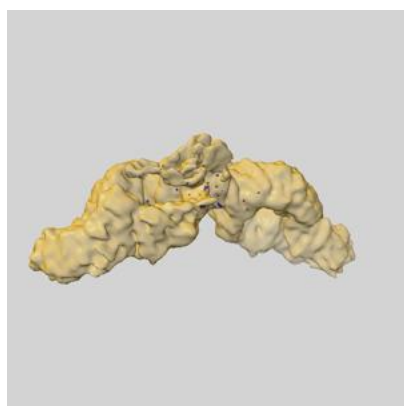
## 6.6 Mask visualisation [i](#)

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

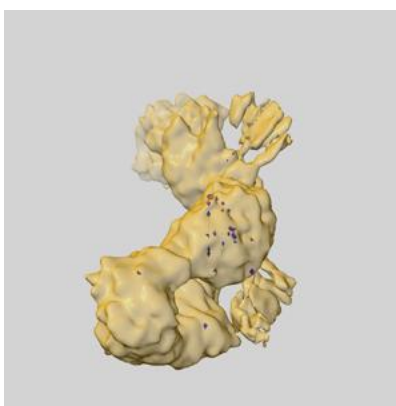
A mask typically either:

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

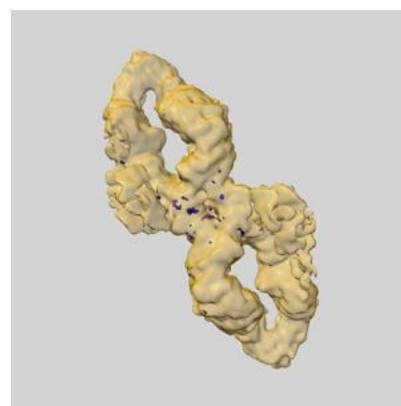
### 6.6.1 emd\_23930\_msk\_1.map [i](#)



X



Y

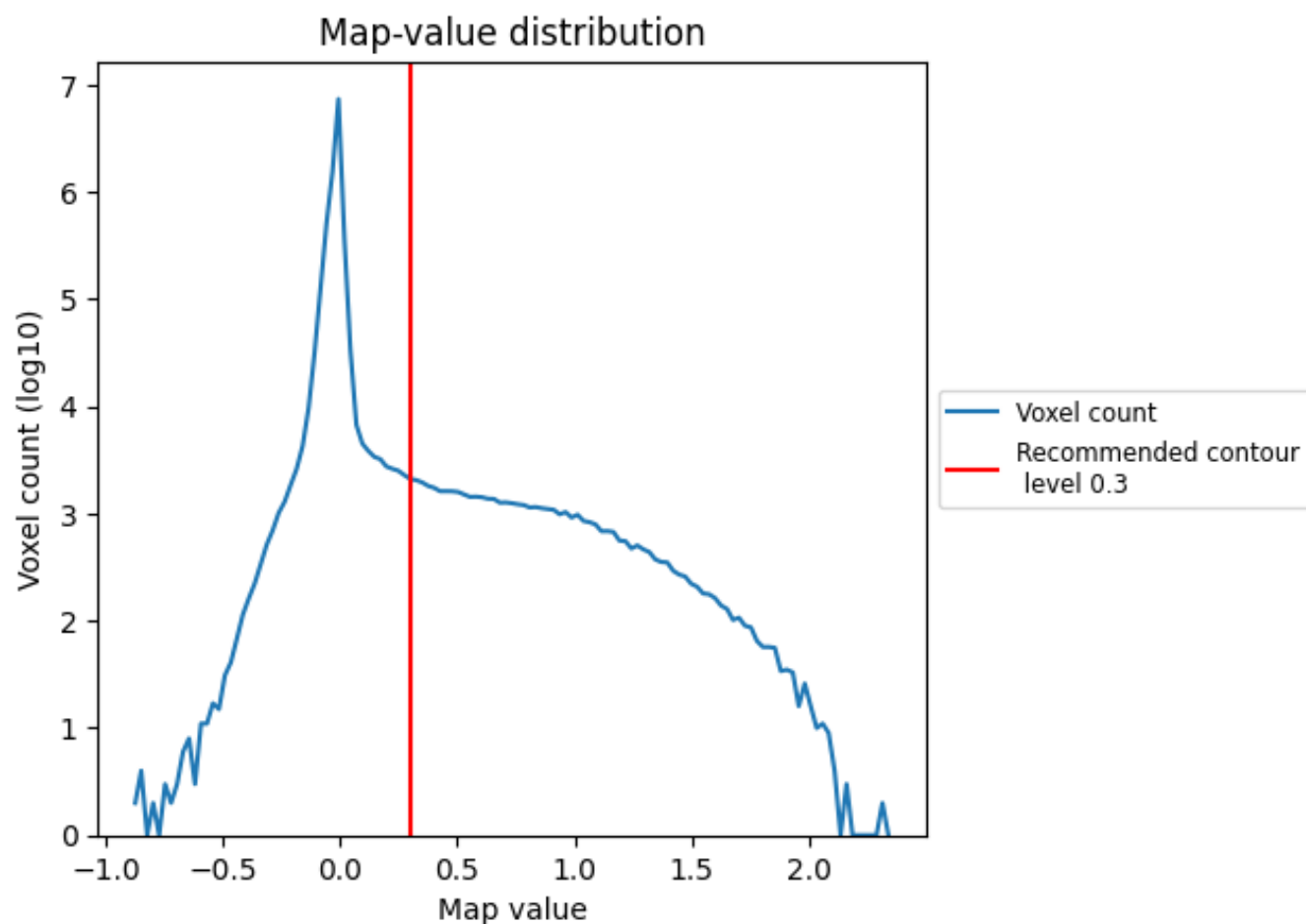


Z

## 7 Map analysis [i](#)

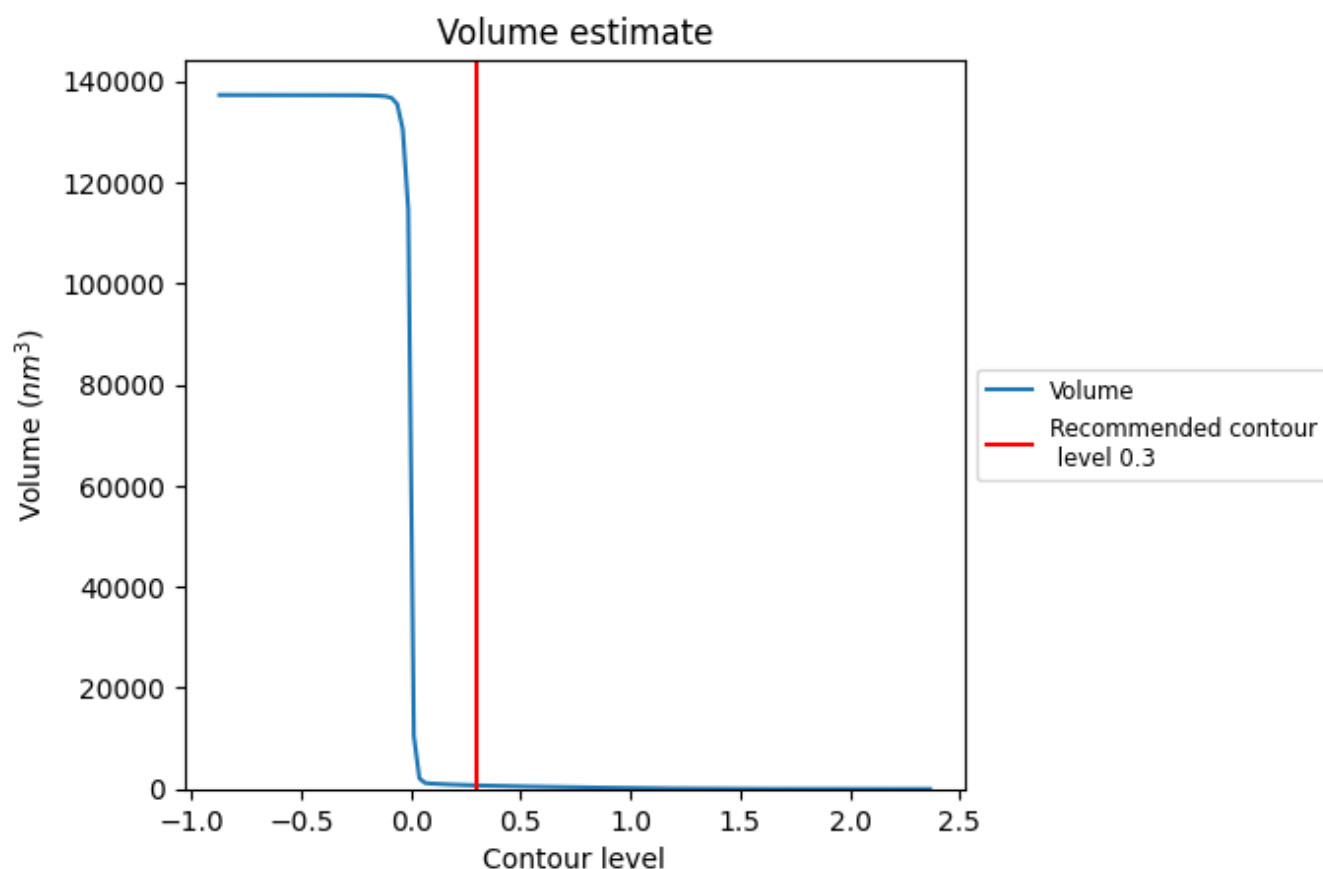
This section contains the results of statistical analysis of the map.

### 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.

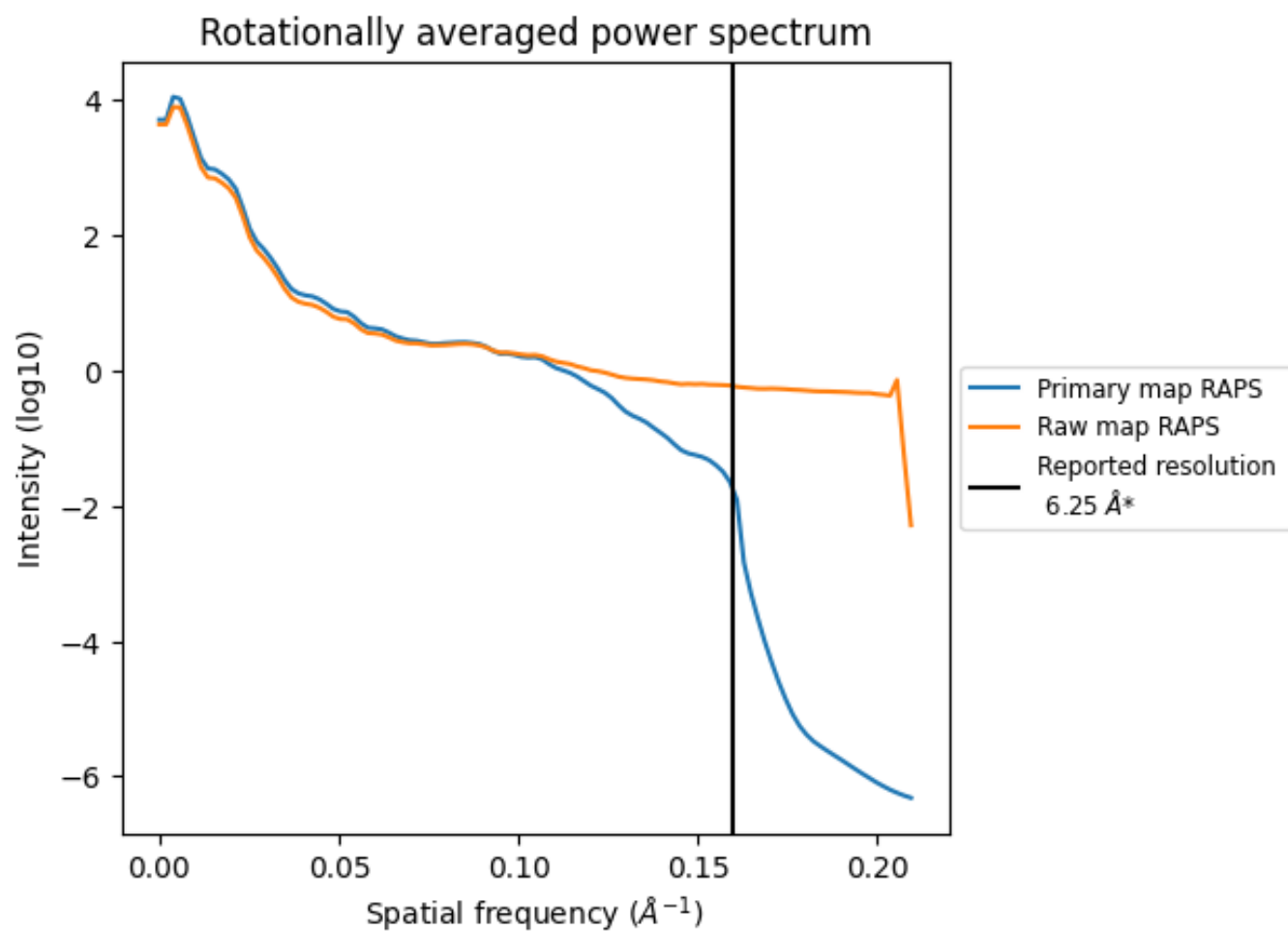
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 706  $\text{nm}^3$ ; this corresponds to an approximate mass of 638 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 ⓘ

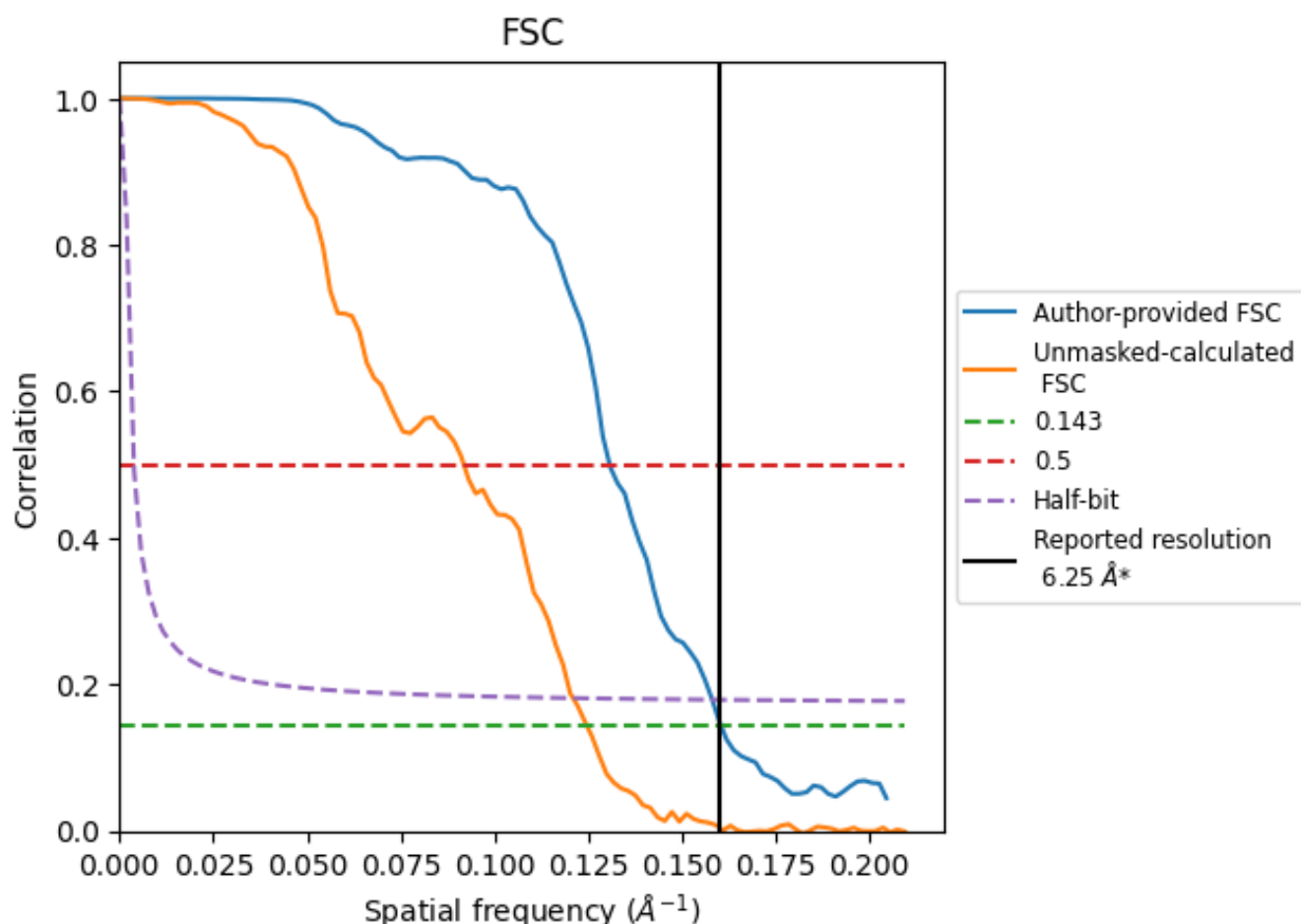


\*Reported resolution corresponds to spatial frequency of 0.160 Å<sup>-1</sup>

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

## 8.2 Resolution estimates [i](#)

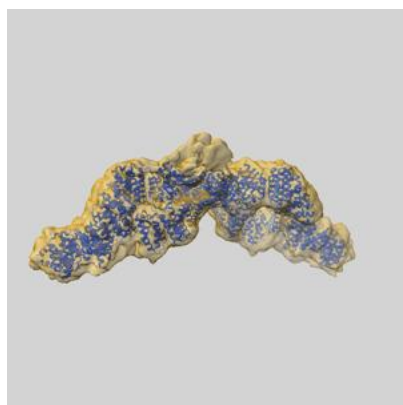
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	6.25	-	-
Author-provided FSC curve	6.23	7.65	6.33
Unmasked-calculated*	8.03	10.89	8.26

\*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 8.03 differs from the reported value 6.25 by more than 10 %

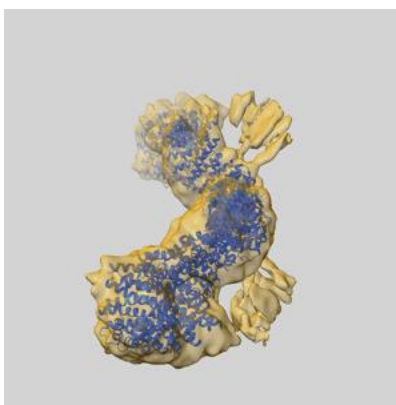
## 9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-23930 and PDB model 7MP6. Per-residue inclusion information can be found in [section 3](#) on [page 4](#).

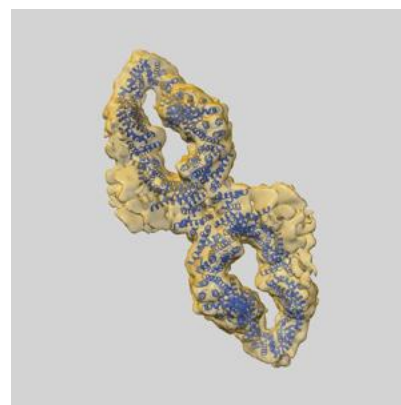
### 9.1 Map-model overlay [i](#)



X



Y

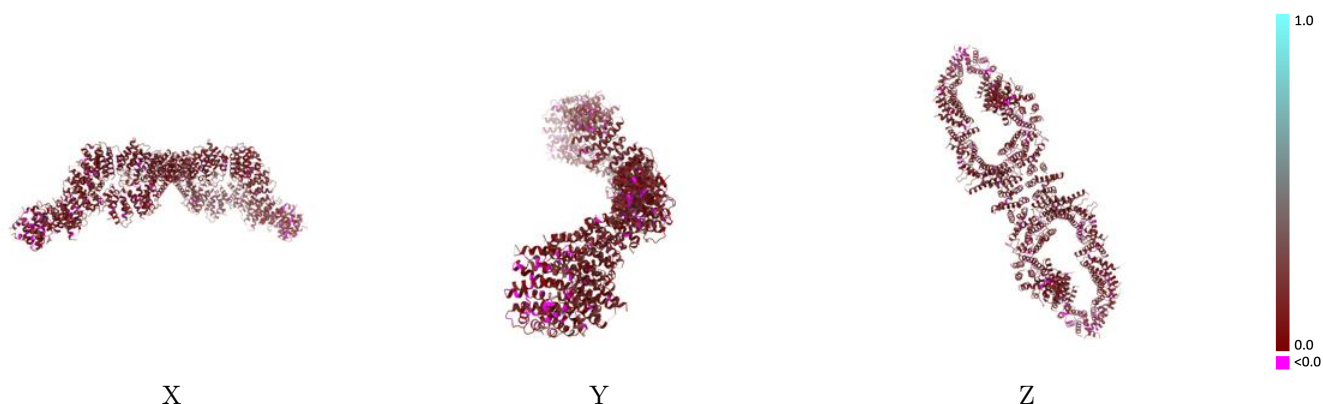


Z

The images above show the 3D surface view of the map at the recommended contour level 0.3 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.

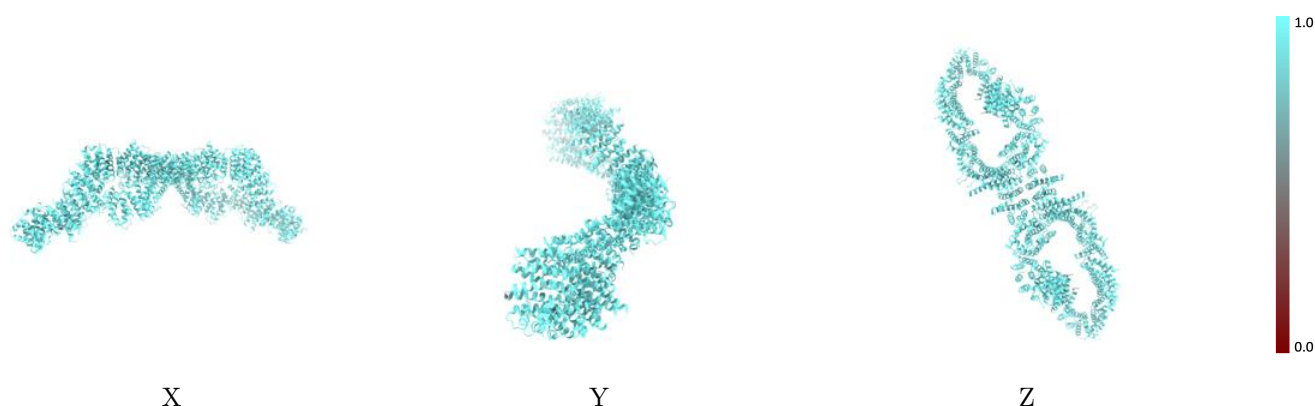


## 9.2 Q-score mapped to coordinate model [i](#)



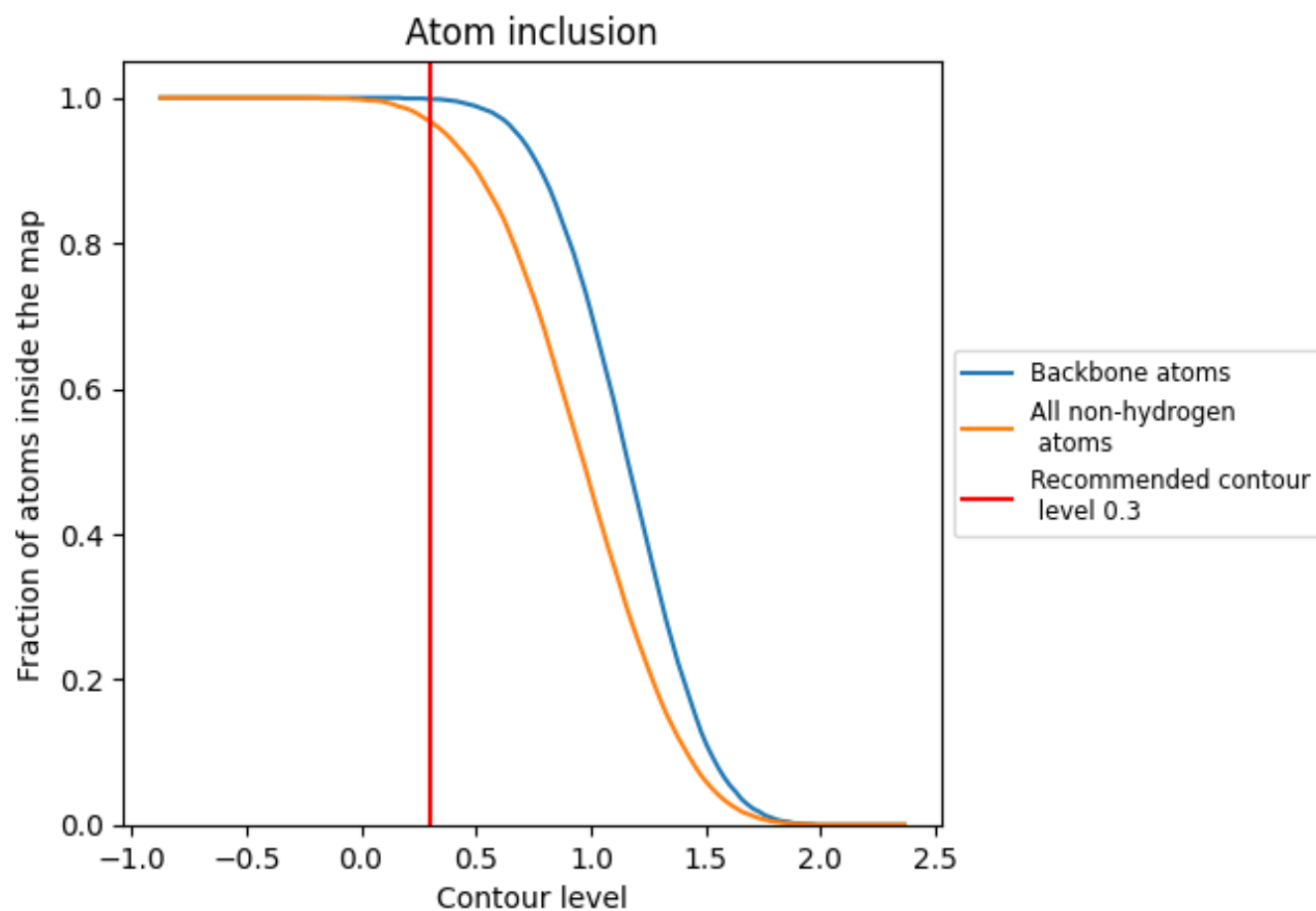
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.3).

## 9.4 Atom inclusion [i](#)



At the recommended contour level, 100% of all backbone atoms, 97% 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 (0.3) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	<div></div> 0.9670	<div></div> 0.1400
A	<div></div> 0.9690	<div></div> 0.1400
B	<div></div> 0.9660	<div></div> 0.1390

