



## wwPDB EM Validation Summary Report ⓘ

May 5, 2022 – 04:12 pm BST

PDB ID : 7QPG  
EMDB ID : EMD-14120  
Title : Human RZZ kinetochore corona complex.  
Authors : Raisch, T.; Ciossani, G.; d'Amico, E.; Cmetowski, V.; Carmignani, S.; Maffini, S.; Merino, F.; Wohlgemuth, S.; Vetter, I.R.; Raunser, S.; Musacchio, A.  
Deposited on : 2022-01-04  
Resolution : 3.90 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.

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

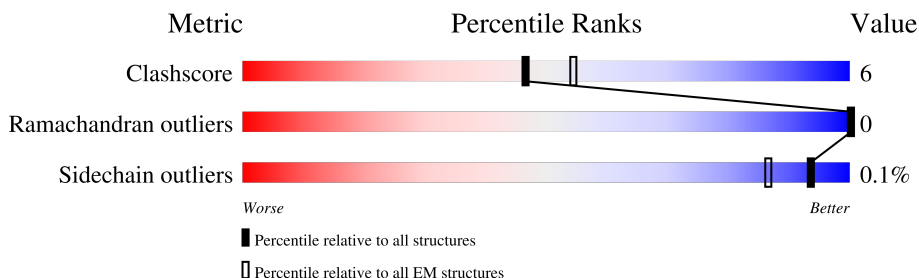
EMDB validation analysis : 0.0.1.dev8  
MolProbity : 4.02b-467  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.28.1

# 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 3.90 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	B	591	
1	C	591	
2	R	2464	
2	S	2464	
3	W	779	
3	X	779	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 57164 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 Protein zwilch homolog.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	B	591	4737	3031	791	898	17	0	0
1	C	591	4737	3031	791	898	17	0	0

- Molecule 2 is a protein called Kinetochore-associated protein 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	R	2208	17614	11298	2909	3312	95	0	0
2	S	2208	17614	11298	2909	3312	95	0	0

There are 42 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	-254	MET	-	initiating methionine	UNP A0A366VY15
R	-253	ALA	-	expression tag	UNP A0A366VY15
R	-252	HIS	-	expression tag	UNP A0A366VY15
R	-251	HIS	-	expression tag	UNP A0A366VY15
R	-250	HIS	-	expression tag	UNP A0A366VY15
R	-249	HIS	-	expression tag	UNP A0A366VY15
R	-248	HIS	-	expression tag	UNP A0A366VY15
R	-247	HIS	-	expression tag	UNP A0A366VY15
R	-246	SER	-	expression tag	UNP A0A366VY15
R	-245	SER	-	expression tag	UNP A0A366VY15
R	-244	GLY	-	expression tag	UNP A0A366VY15
R	-8	LEU	-	linker	UNP A0A366VY15
R	-7	GLU	-	linker	UNP A0A366VY15
R	-6	VAL	-	linker	UNP A0A366VY15
R	-5	LEU	-	linker	UNP A0A366VY15
R	-4	PHE	-	linker	UNP A0A366VY15
R	-3	GLN	-	linker	UNP A0A366VY15

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Chain	Residue	Modelled	Actual	Comment	Reference
R	-2	GLY	-	linker	UNP A0A366VY15
R	-1	PRO	-	linker	UNP A0A366VY15
R	0	GLY	-	linker	UNP A0A366VY15
R	1	SER	-	linker	UNP A0A366VY15
S	-254	MET	-	initiating methionine	UNP A0A366VY15
S	-253	ALA	-	expression tag	UNP A0A366VY15
S	-252	HIS	-	expression tag	UNP A0A366VY15
S	-251	HIS	-	expression tag	UNP A0A366VY15
S	-250	HIS	-	expression tag	UNP A0A366VY15
S	-249	HIS	-	expression tag	UNP A0A366VY15
S	-248	HIS	-	expression tag	UNP A0A366VY15
S	-247	HIS	-	expression tag	UNP A0A366VY15
S	-246	SER	-	expression tag	UNP A0A366VY15
S	-245	SER	-	expression tag	UNP A0A366VY15
S	-244	GLY	-	expression tag	UNP A0A366VY15
S	-8	LEU	-	linker	UNP A0A366VY15
S	-7	GLU	-	linker	UNP A0A366VY15
S	-6	VAL	-	linker	UNP A0A366VY15
S	-5	LEU	-	linker	UNP A0A366VY15
S	-4	PHE	-	linker	UNP A0A366VY15
S	-3	GLN	-	linker	UNP A0A366VY15
S	-2	GLY	-	linker	UNP A0A366VY15
S	-1	PRO	-	linker	UNP A0A366VY15
S	0	GLY	-	linker	UNP A0A366VY15
S	1	SER	-	linker	UNP A0A366VY15

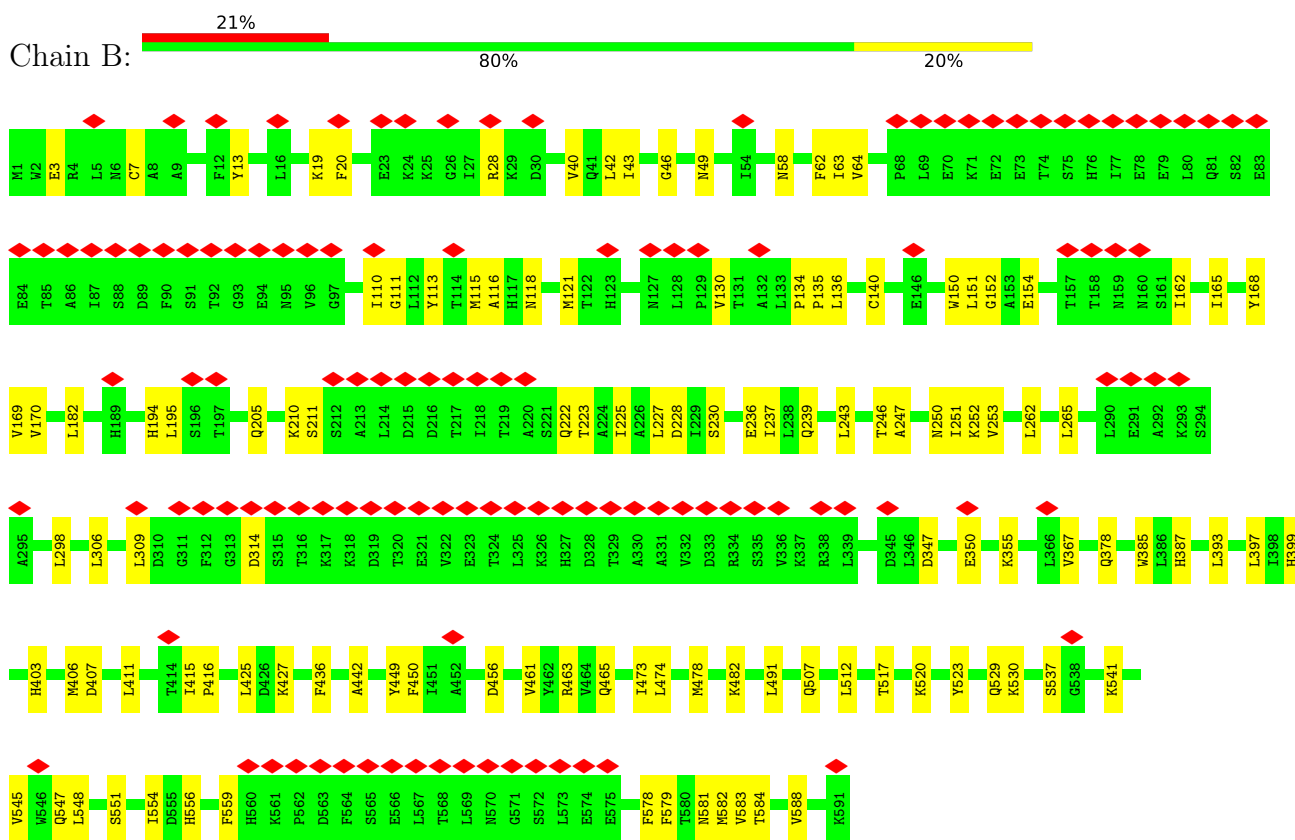
- Molecule 3 is a protein called Centromere/kinetochore protein zw10 homolog.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	W	779	Total	C	N	O	S	0	0
			6231	3952	1053	1189	37		
3	X	779	Total	C	N	O	S	0	0
			6231	3952	1053	1189	37		

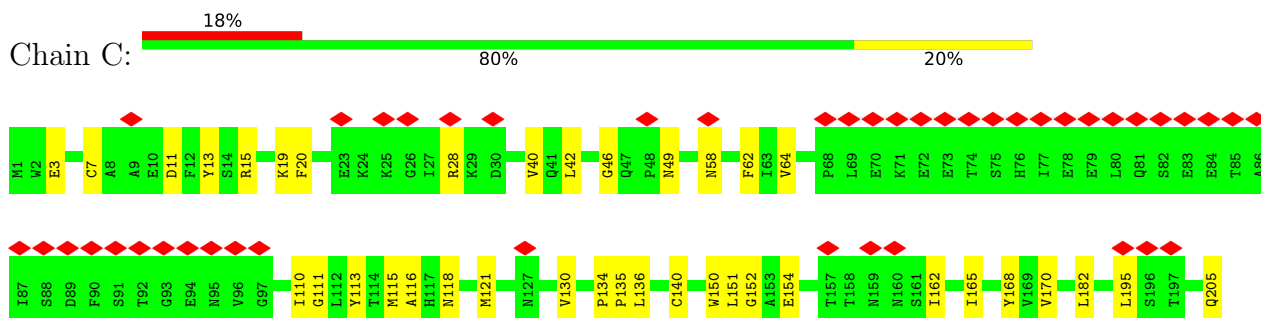
### 3 Residue-property plots [i](#)

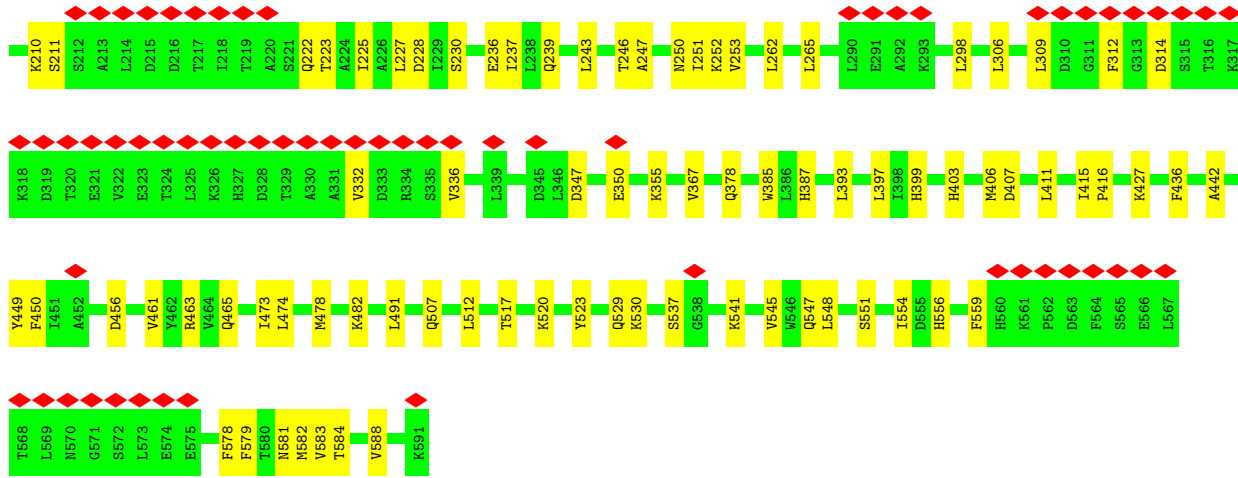
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion 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: Protein zwilch homolog

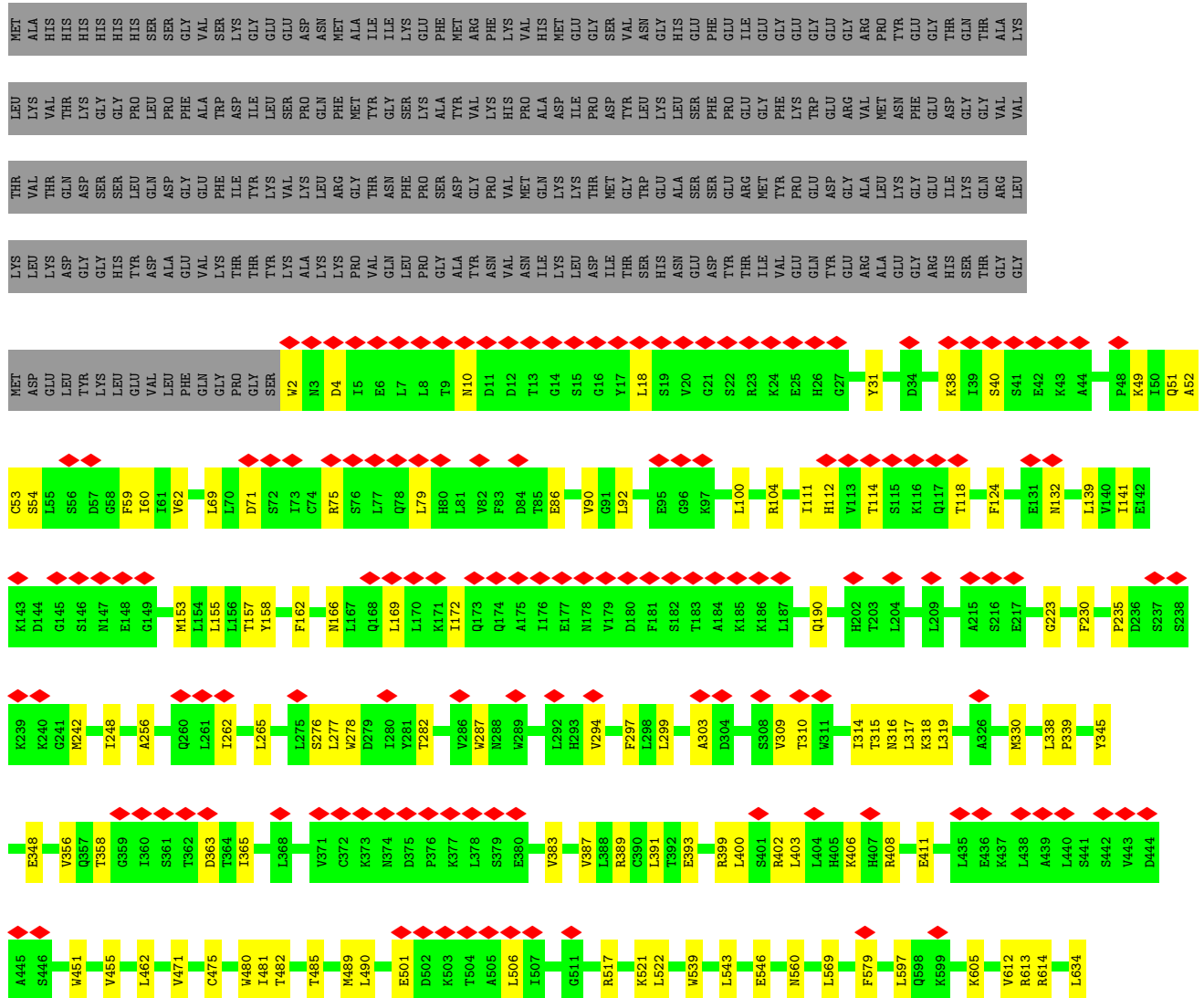
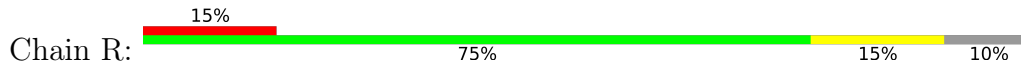


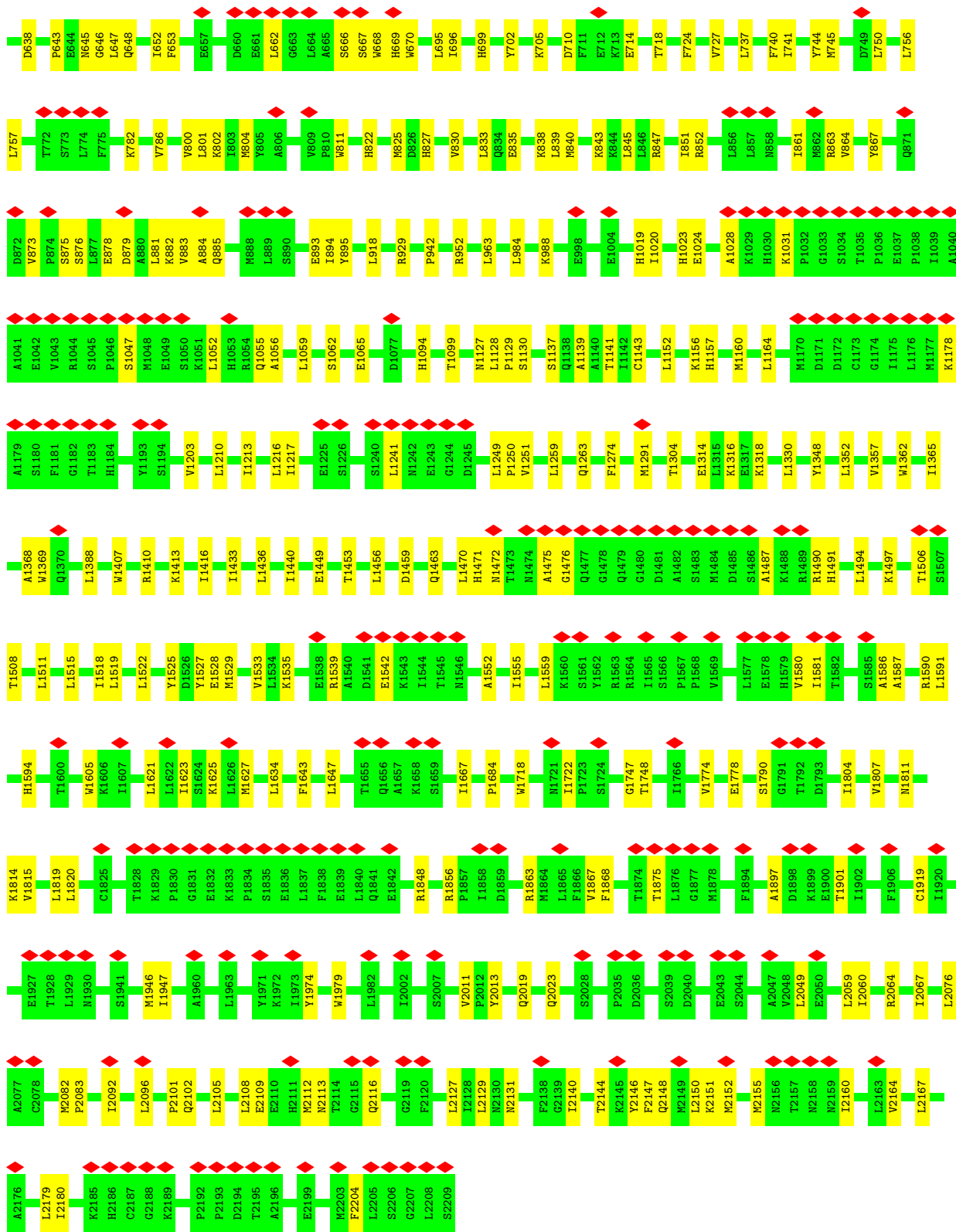
- Molecule 1: Protein zwilch homolog



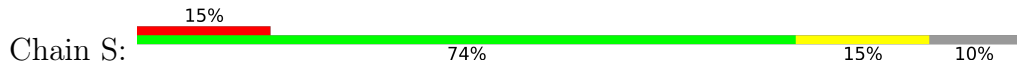


● Molecule 2: Kinetochores-associated protein 1



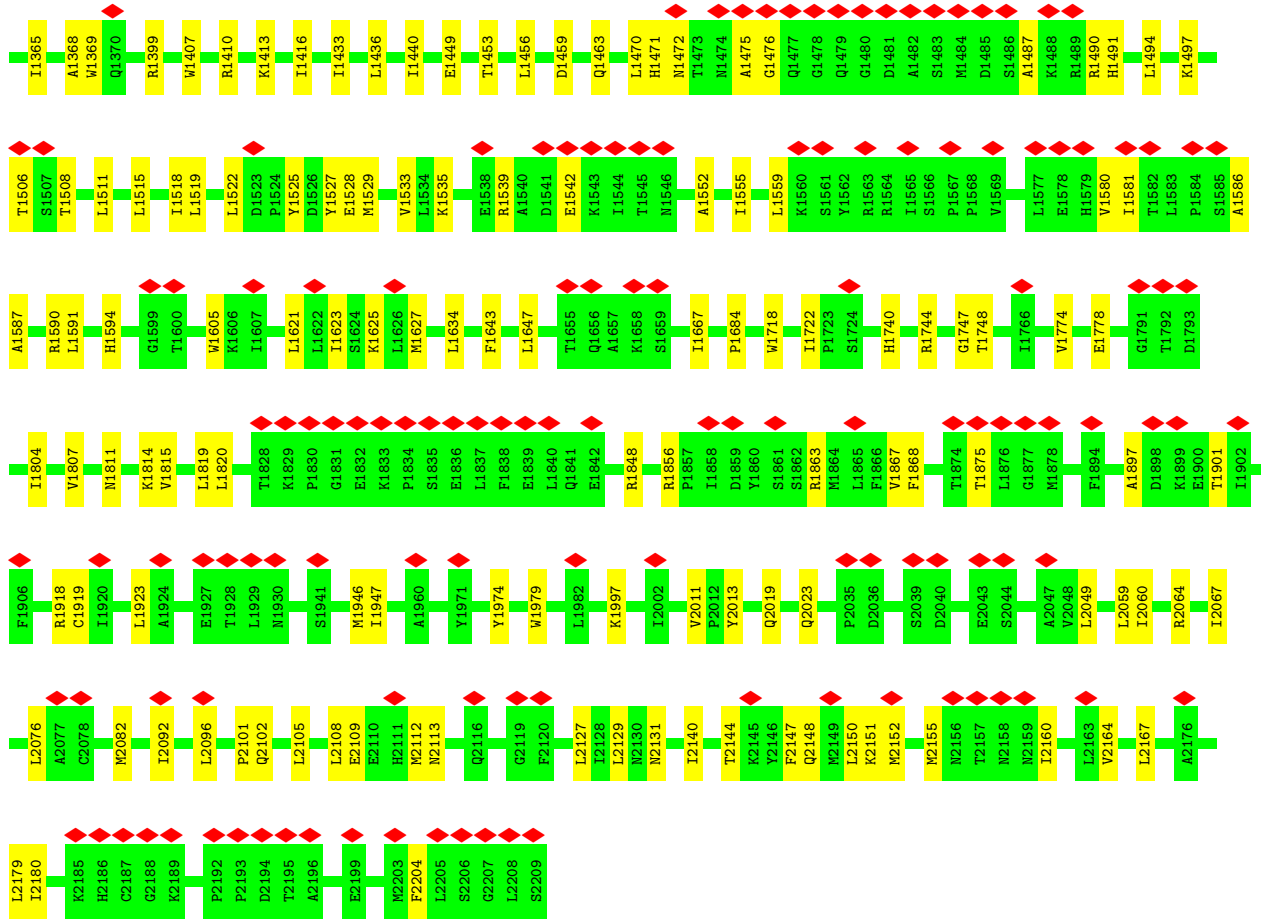


• Molecule 2: Kinetochores-associated protein 1

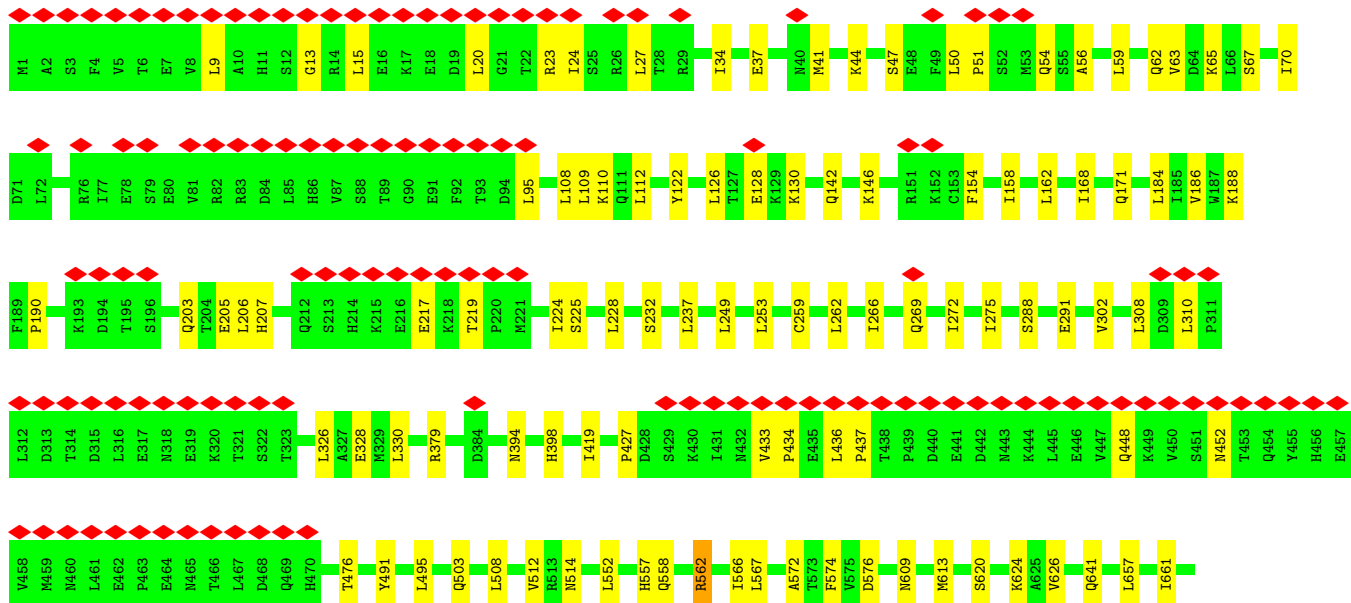
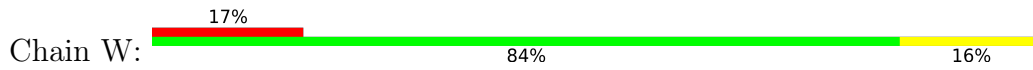






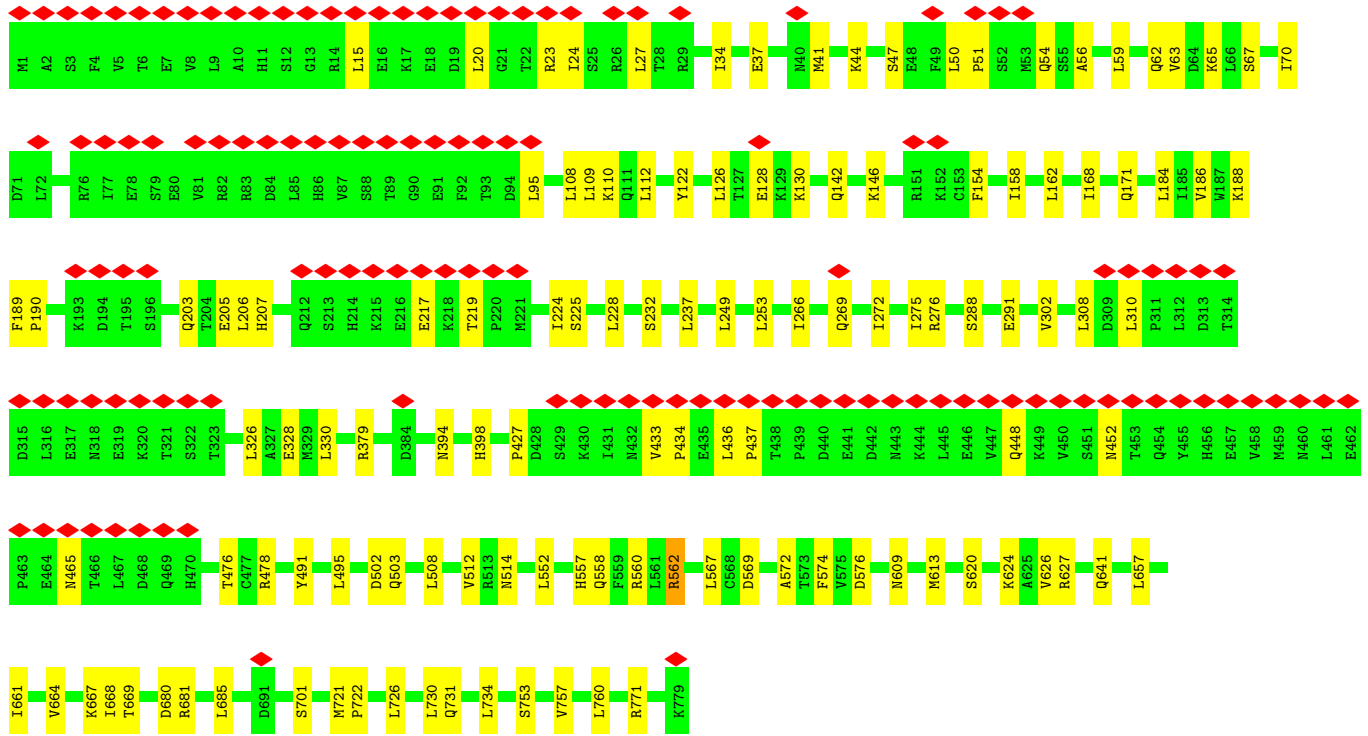
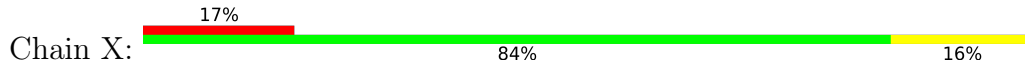


• Molecule 3: Centromere/kinetochore protein zw10 homolog





• Molecule 3: Centromere/kinetochore protein zw10 homolog



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	191979	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 ( $e^-/\text{\AA}^2$ )	60	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2700	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	3.677	Depositor
Minimum map value	0.000	Depositor
Average map value	0.004	Depositor
Map value standard deviation	0.051	Depositor
Recommended contour level	0.4	Depositor
Map size (Å)	540.0, 540.0, 540.0	wwPDB
Map dimensions	300, 300, 300	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.8, 1.8, 1.8	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	B	0.24	0/4840	0.39	0/6563
1	C	0.24	0/4840	0.39	0/6563
2	R	0.23	0/17950	0.40	0/24302
2	S	0.23	0/17950	0.40	0/24302
3	W	0.24	0/6340	0.39	0/8565
3	X	0.24	0/6340	0.39	0/8565
All	All	0.24	0/58260	0.40	0/78860

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	B	4737	0	4766	76	0
1	C	4737	0	4766	74	0
2	R	17614	0	17942	235	0
2	S	17614	0	17942	235	0
3	W	6231	0	6339	78	0
3	X	6231	0	6339	82	0
All	All	57164	0	58094	749	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 6.

The worst 5 of 749 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:223:THR:HA	1:B:252:LYS:O	1.73	0.89
1:C:223:THR:HA	1:C:252:LYS:O	1.73	0.89
2:R:277:LEU:HB3	2:R:287:TRP:HB3	1.70	0.73
2:S:277:LEU:HB3	2:S:287:TRP:HB3	1.70	0.73
3:W:613:MET:O	3:W:681:ARG:NH1	2.22	0.72

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	B	589/591 (100%)	573 (97%)	16 (3%)	0	100	100
1	C	589/591 (100%)	573 (97%)	16 (3%)	0	100	100
2	R	2206/2464 (90%)	2136 (97%)	70 (3%)	0	100	100
2	S	2206/2464 (90%)	2137 (97%)	69 (3%)	0	100	100
3	W	777/779 (100%)	766 (99%)	11 (1%)	0	100	100
3	X	777/779 (100%)	766 (99%)	11 (1%)	0	100	100
All	All	7144/7668 (93%)	6951 (97%)	193 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains [i](#)

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

The Analysed column shows the number of residues for which the sidechain conformation was

analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	542/542 (100%)	542 (100%)	0	100	100
1	C	542/542 (100%)	542 (100%)	0	100	100
2	R	1988/2204 (90%)	1986 (100%)	2 (0%)	93	97
2	S	1988/2204 (90%)	1986 (100%)	2 (0%)	93	97
3	W	710/710 (100%)	709 (100%)	1 (0%)	93	97
3	X	710/710 (100%)	709 (100%)	1 (0%)	93	97
All	All	6480/6912 (94%)	6474 (100%)	6 (0%)	93	97

5 of 6 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	S	863	ARG
3	W	562	ARG
3	X	562	ARG
2	R	863	ARG
2	R	560	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14 such sidechains are listed below:

Mol	Chain	Res	Type
2	S	1491	HIS
2	S	2023	GLN
3	X	557	HIS
3	X	62	GLN
3	X	452	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

There are no 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.

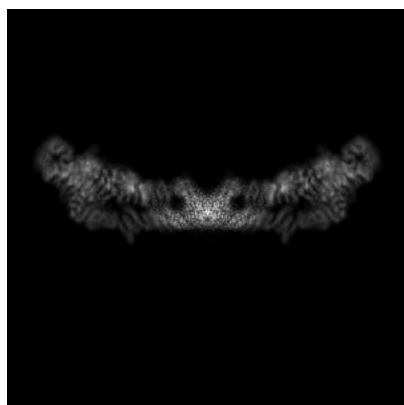
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-14120. These allow visual inspection of the internal detail of the map and identification of artifacts.

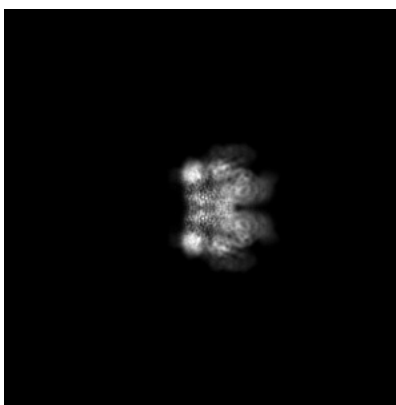
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

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

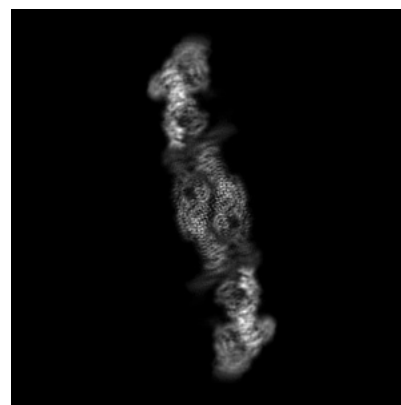
#### 6.1.1 Primary map



X



Y

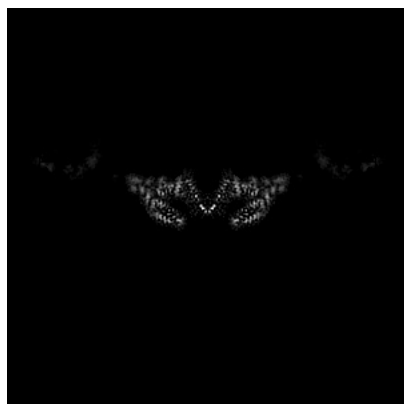


Z

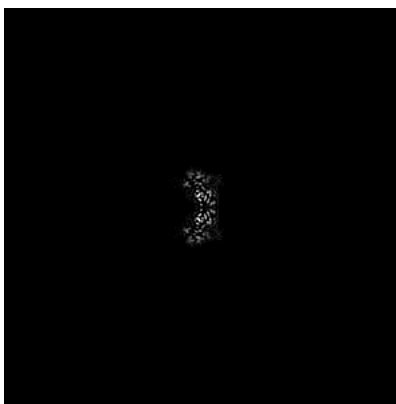
The images above show the map projected in three orthogonal directions.

### 6.2 Central slices [i](#)

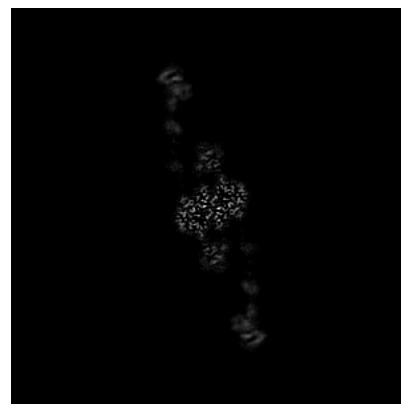
#### 6.2.1 Primary map



X Index: 150



Y Index: 150



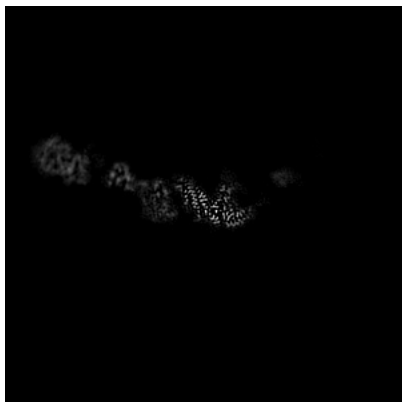
Z Index: 150



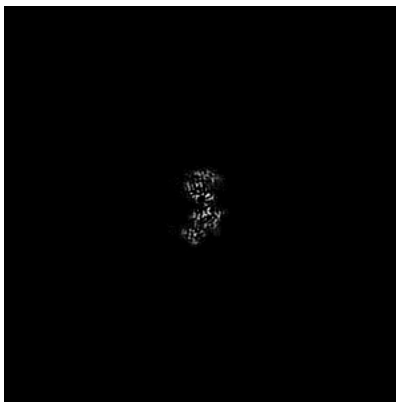
The images above show central slices of the map in three orthogonal directions.

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

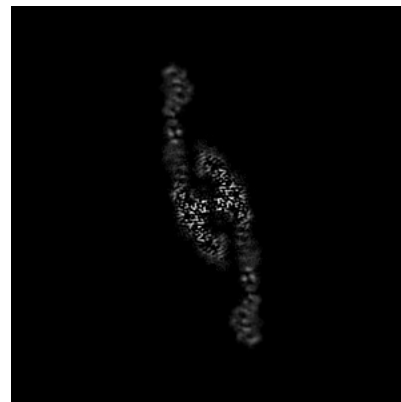
### 6.3.1 Primary map



X Index: 159



Y Index: 155



Z Index: 144

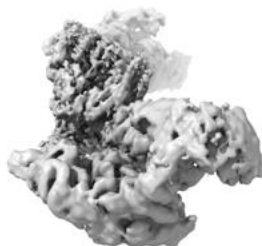
The images above show the largest variance slices of the map in three orthogonal directions.

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

### 6.4.1 Primary map



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.4. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

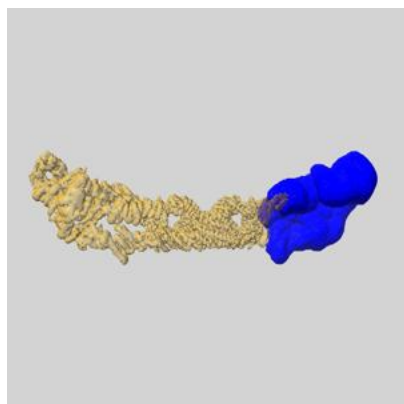
## 6.5 Mask visualisation [i](#)

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

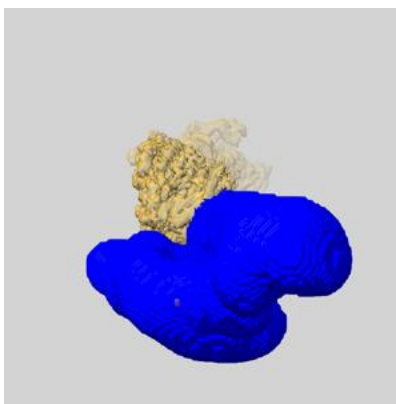
A mask typically either:

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

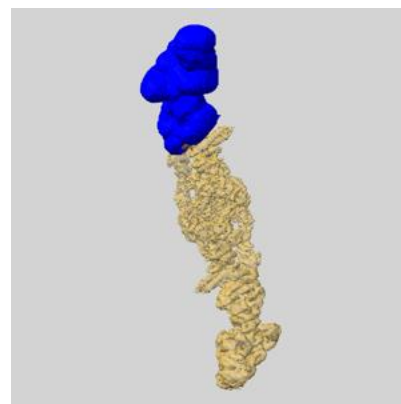
### 6.5.1 emd\_14120\_msk\_1.map [i](#)



X

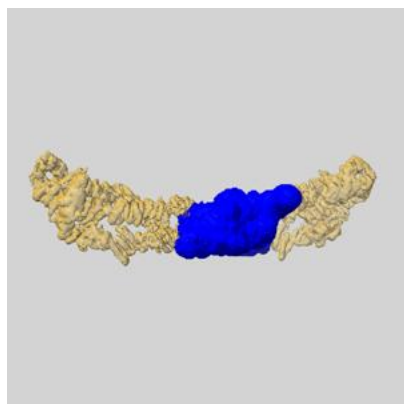


Y

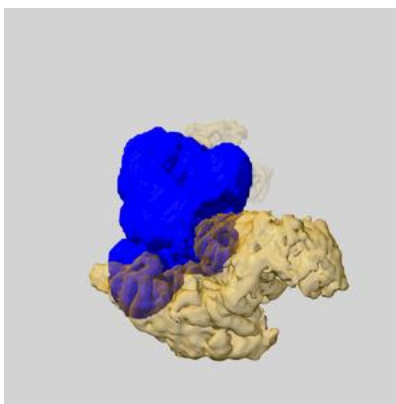


Z

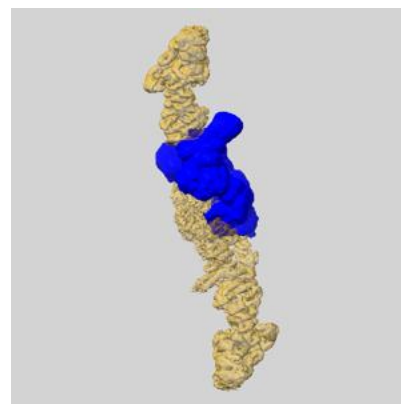
### 6.5.2 emd\_14120\_msk\_2.map [i](#)



X



Y

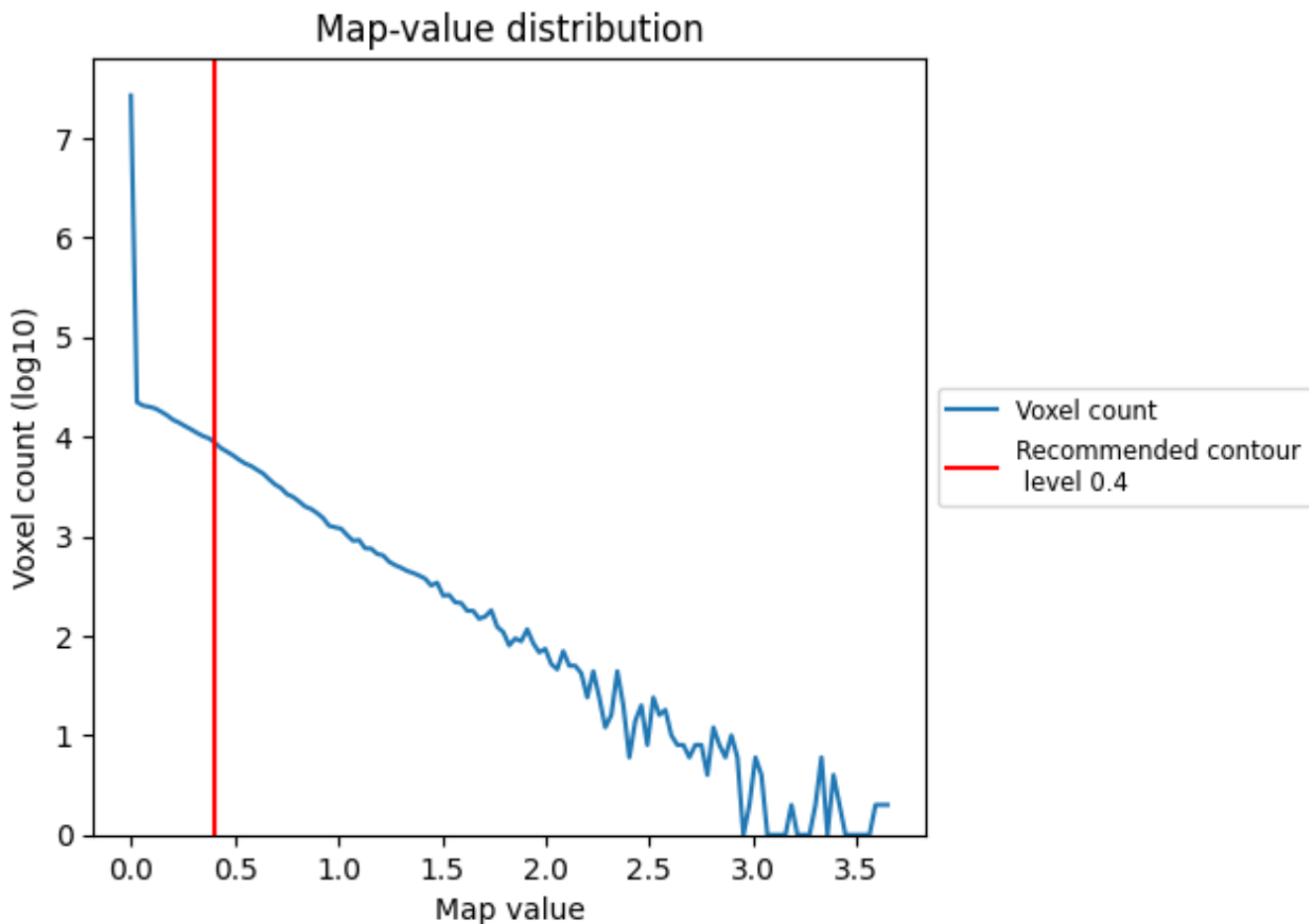


Z

## 7 Map analysis [i](#)

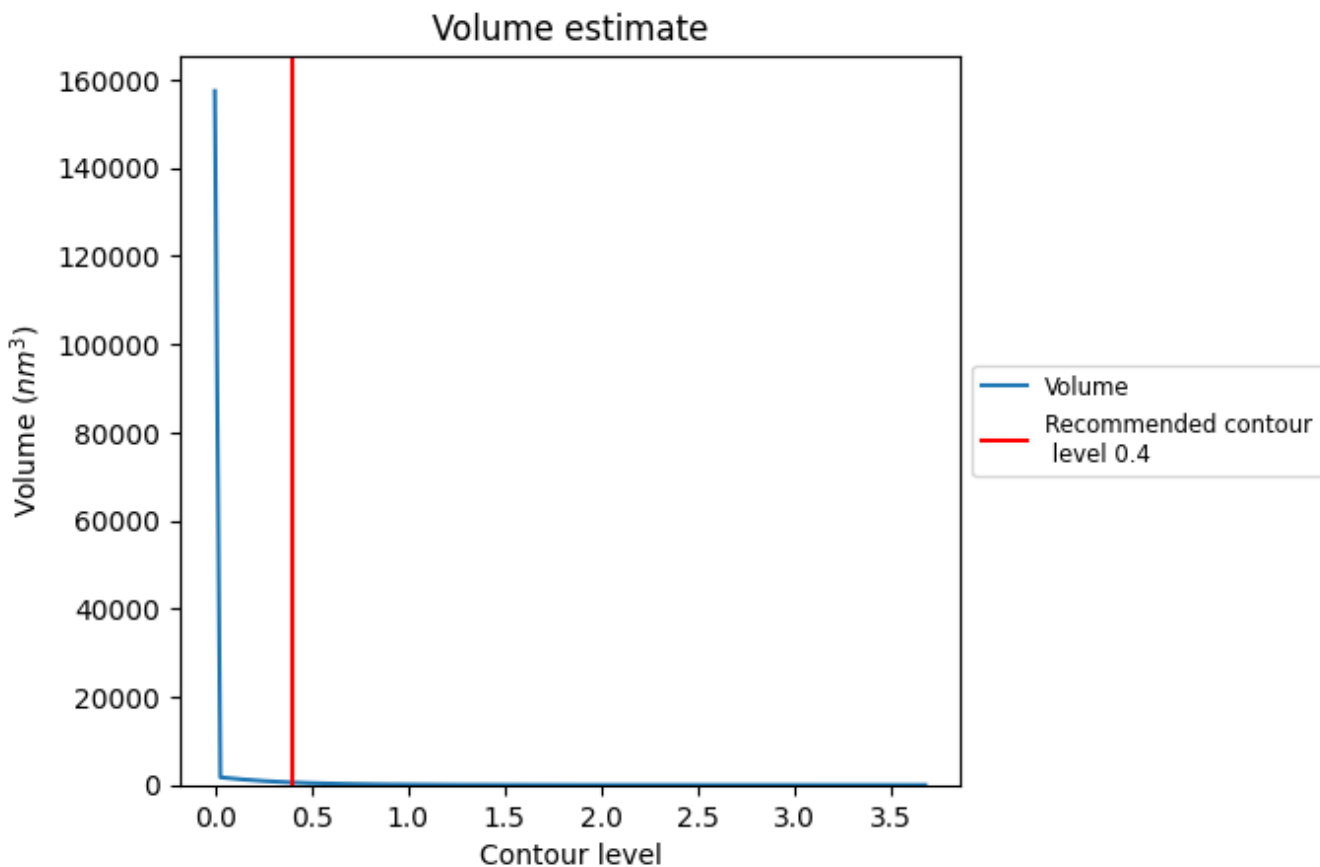
This section contains the results of statistical analysis of the map.

### 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.

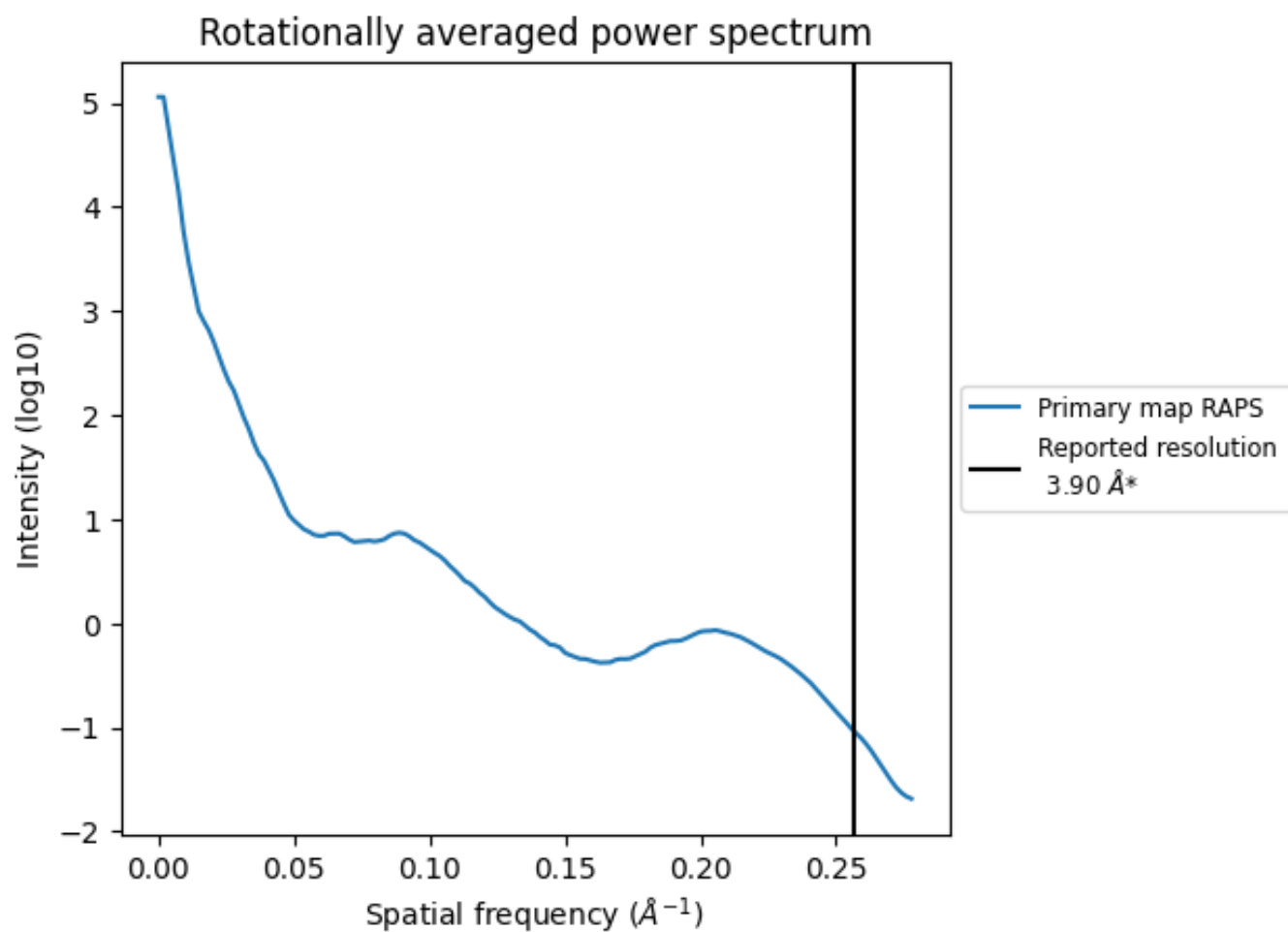
## 7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 571  $\text{nm}^3$ ; this corresponds to an approximate mass of 516 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 i

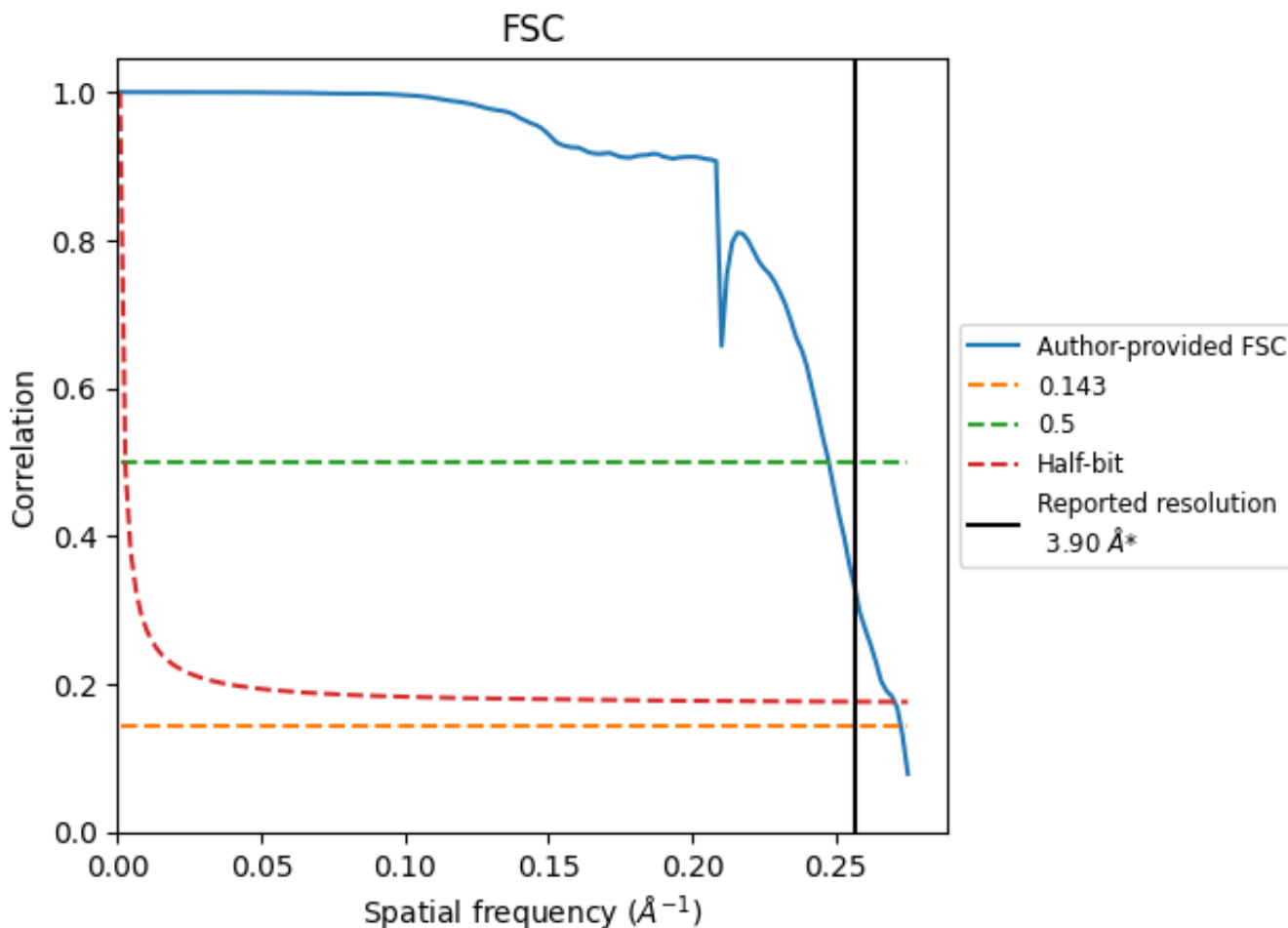


\*Reported resolution corresponds to spatial frequency of 0.256 Å<sup>-1</sup>

## 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 0.256 Å<sup>-1</sup>

## 8.2 Resolution estimates [i](#)

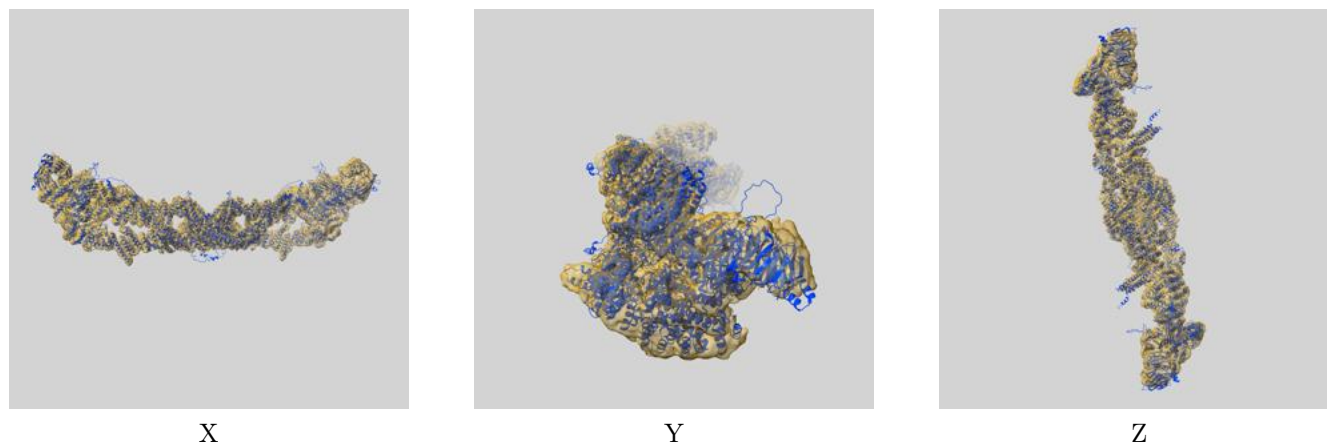
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.90	-	-
Author-provided FSC curve	3.67	4.04	3.70
Unmasked-calculated*	-	-	-

\*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.

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

This section contains information regarding the fit between EMDB map EMD-14120 and PDB model 7QPG. Per-residue inclusion information can be found in section [3](#) on page [5](#).

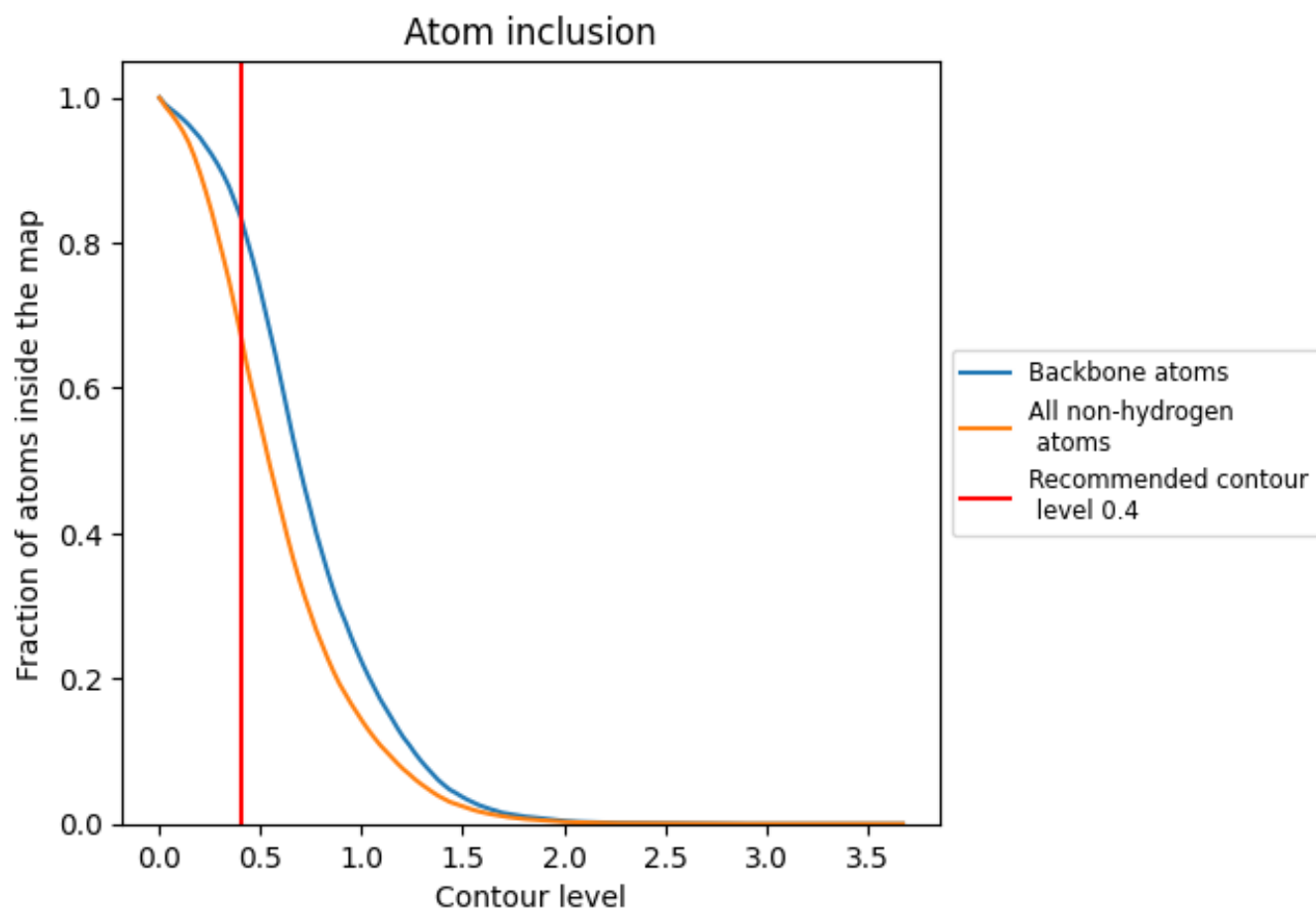
### 9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 0.4 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 Atom inclusion [i](#)



At the recommended contour level, 84% of all backbone atoms, 68% of all non-hydrogen atoms, are inside the map.