



## wwPDB EM Validation Summary Report ⓘ

Jan 23, 2024 – 04:31 PM JST

PDB ID : 7YLM  
EMDB ID : EMD-33914  
Title : Cryo-EM structure of 8-subunit Smc5/6 hinge region  
Authors : Qian, L.; Jun, Z.; Xiang, Z.; Wang, Z.; Tong, C.; Duo, J.; Zhenguo, C.; Wang, L.  
Deposited on : 2022-07-26  
Resolution : 6.17 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:

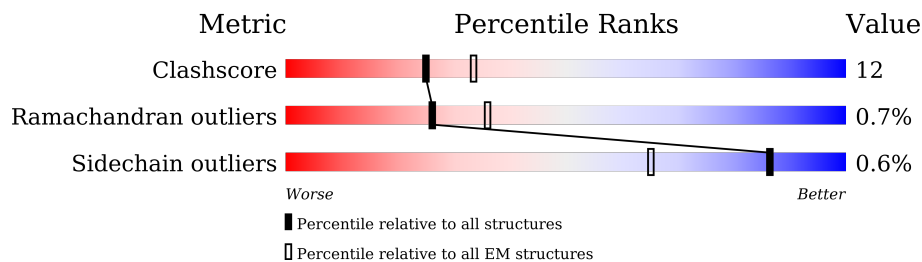
EMDB validation analysis : 0.0.1.dev70  
MolProbity : 4.02b-467  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : 1.9.9  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

# 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 6.17 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	1093	
2	B	1114	
3	C	267	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 8289 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 Structural maintenance of chromosomes protein 5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	428	3472	2169	623	669	11	0	0

- Molecule 2 is a protein called SMC6 isoform 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	436	3551	2181	659	699	12	0	0

- Molecule 3 is a protein called MMS21 isoform 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	C	160	1266	787	211	258	10	0	0





ILE ASP  
ILE PRO  
ALA ALA  
LEU GLU  
ASP ARG  
GLN ASN  
GLU ASN  
PHE ASN  
ASP SER  
VAL ASN  
PHE MET  
ASP TYR  
GLN ASN  
VAL VAL  
ASN ASN  
ARG ARG  
LYS LYS  
ILE ILE  
GLY THR  
THR THR  
LEU LEU  
ILE ILE  
VAL VAL  
LYS LYS  
LYS LYS  
LEU LEU  
LYS LYS  
ASP ASP  
ILE ILE  
ALA ALA  
ARG ARG  
ILE ILE

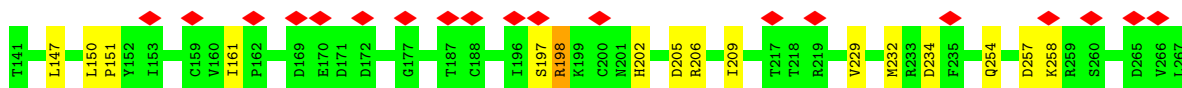
ASP  
PRO  
GLU  
ARG  
GLN  
ASN  
ASN  
SER  
ASN  
ASN  
TYR  
ASN

● Molecule 3: MMS21 isoform 1



MET ASP  
ALA SER  
LEU LEU  
ASN ASP  
ASP GLU  
ASN HIS  
ASN HIS  
PRO ILE  
ILE LYS  
ASP ASP  
LEU LEU  
LYS LYS  
VAL VAL  
PRO ASN  
LEU PHE  
LEU LYS  
HIS GLN  
PRO ARG  
PRO LYS  
SER LYS  
SER SER  
GLY ASP  
LYS ALA  
TYR CYS  
TRP PRO  
PHE GLN  
HIS ILE  
ASN ASP  
LEU LEU  
HIS SER  
ALA ARG  
THR THR  
ARG ARG  
ASP TRP  
ASP ASP  
LYS LYS  
TYR TYR  
ILE ARG  
THR THR  
GLY GLY  
GLU LEU  
LEU LEU  
THR THR  
ALA ALA  
PRO PRO  
LYS LYS  
LEU LEU  
SER SER  
GLU GLU  
LEU LEU  
TYR TYR  
LEU LEU  
ASN ASN  
MET MET  
PRO PRO  
THR THR  
PRO PRO  
GLU GLU  
THR THR  
ALA THR  
THR THR  
MET MET  
GLU GLU  
SER SER  
ASN ASN  
SER SER

ASN ASP  
SER SER  
PHE PHE  
ASP ASP  
GLU GLU  
HIS HIS  
ILE ILE  
LYS LYS  
ASP ASP  
LEU LEU  
LYS LYS  
ASN ASN  
PHE PHE  
LYS LYS  
GLN GLN  
SER SER  
SER SER  
ASP ASP  
ALA ALA  
CYS CYS  
PRO PRO  
GLN GLN  
ILE ILE  
ASP ASP  
LEU LEU  
SER SER  
THR THR  
ARG ARG  
TRP TRP  
ASP ASP  
LYS LYS  
TYR TYR  
ILE ARG  
THR THR  
GLY GLY  
GLU GLU  
LEU LEU  
THR THR  
ALA ALA  
PRO PRO  
LYS LYS  
LEU LEU  
SER SER  
GLU GLU  
LEU LEU  
TYR TYR  
LEU LEU  
ASN ASN  
MET MET  
PRO PRO  
THR THR  
PRO PRO  
GLU GLU  
THR THR  
ALA THR  
THR THR  
MET MET  
VAL VAL  
ASN ASN  
ASN ASN



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	252457	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 ( $e^-/\text{\AA}^2$ )	50	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	16.723	Depositor
Minimum map value	-11.029	Depositor
Average map value	-0.001	Depositor
Map value standard deviation	0.108	Depositor
Recommended contour level	0.7	Depositor
Map size ( $\text{\AA}$ )	680.96, 680.96, 680.96	wwPDB
Map dimensions	320, 320, 320	wwPDB
Map angles ( $^\circ$ )	90.0, 90.0, 90.0	wwPDB
Pixel spacing ( $\text{\AA}$ )	2.128, 2.128, 2.128	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	0.28	0/3514	0.54	0/4717
2	B	0.24	0/3586	0.54	0/4800
3	C	0.23	0/1285	0.49	0/1742
All	All	0.26	0/8385	0.54	0/11259

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	A	3472	0	3588	89	0
2	B	3551	0	3582	99	0
3	C	1266	0	1252	19	0
All	All	8289	0	8422	194	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 12.

The worst 5 of 194 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:A:548:VAL:CG1	1:A:552:THR:HG21	1.59	1.30

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:548:VAL:HG13	1:A:552:THR:CG2	1.80	1.11
1:A:548:VAL:HG13	1:A:552:THR:HG21	0.91	0.90
3:C:48:LEU:HD21	3:C:147:LEU:HD13	1.53	0.89
3:C:69:THR:HG22	3:C:70:TYR:H	1.48	0.77

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	426/1093 (39%)	376 (88%)	47 (11%)	3 (1%)	22	63
2	B	434/1114 (39%)	384 (88%)	48 (11%)	2 (0%)	29	69
3	C	156/267 (58%)	126 (81%)	28 (18%)	2 (1%)	12	48
All	All	1016/2474 (41%)	886 (87%)	123 (12%)	7 (1%)	26	63

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	341	ILE
1	A	656	LYS
3	C	44	THR
1	A	349	ARG
3	C	39	LYS

### 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	A	394/1003 (39%)	391 (99%)	3 (1%)	81	89
2	B	397/1003 (40%)	395 (100%)	2 (0%)	88	93
3	C	148/248 (60%)	147 (99%)	1 (1%)	84	91
All	All	939/2254 (42%)	933 (99%)	6 (1%)	86	92

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

Mol	Chain	Res	Type
2	B	468	LYS
2	B	585	ARG
3	C	198	ARG
1	A	448	THR
1	A	404	LYS

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	357	ASN
1	A	535	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.

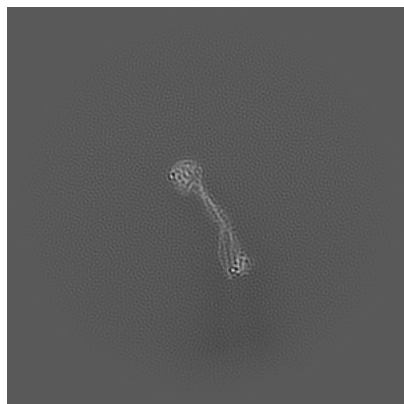
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-33914. These allow visual inspection of the internal detail of the map and identification of artifacts.

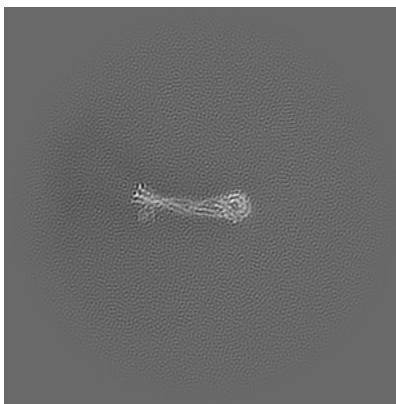
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

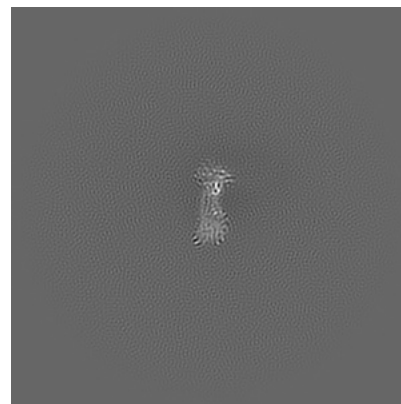
#### 6.1.1 Primary map



X



Y



Z

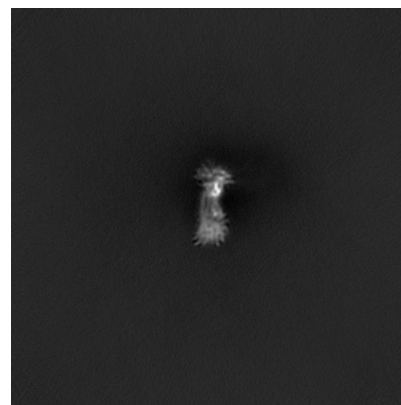
#### 6.1.2 Raw map



X



Y

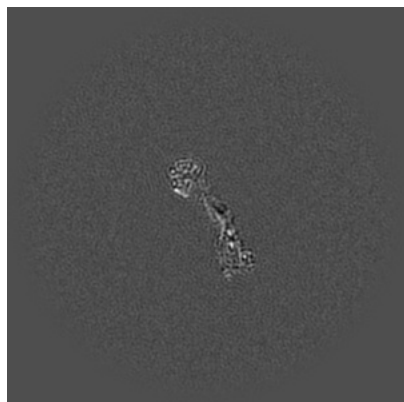


Z

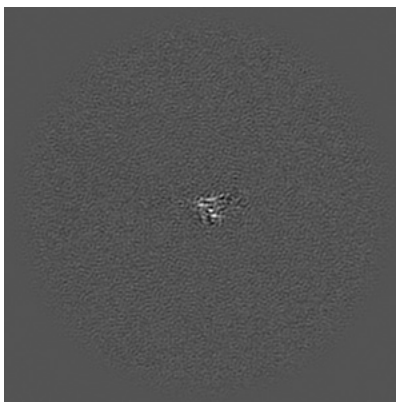
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

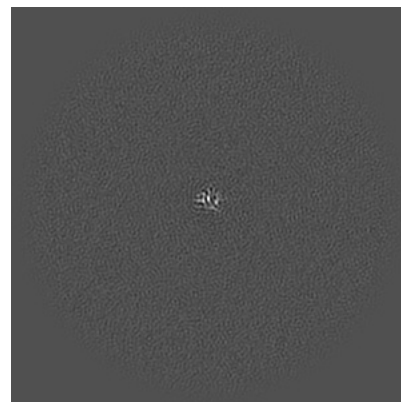
### 6.2.1 Primary map



X Index: 160



Y Index: 160

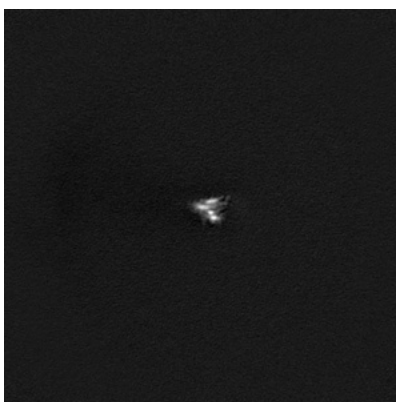


Z Index: 160

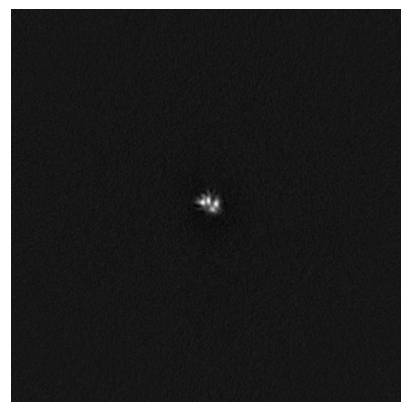
### 6.2.2 Raw map



X Index: 160



Y Index: 160

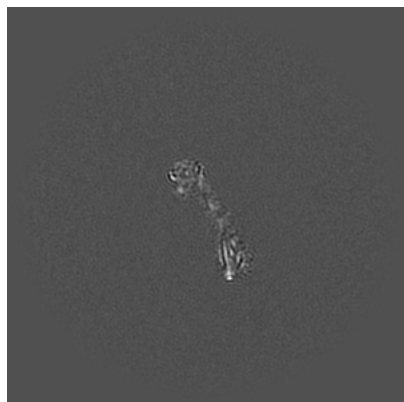


Z Index: 160

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

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

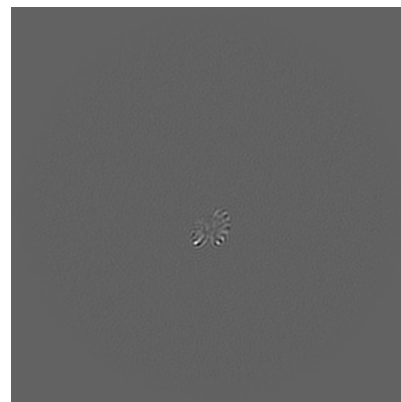
### 6.3.1 Primary map



X Index: 164

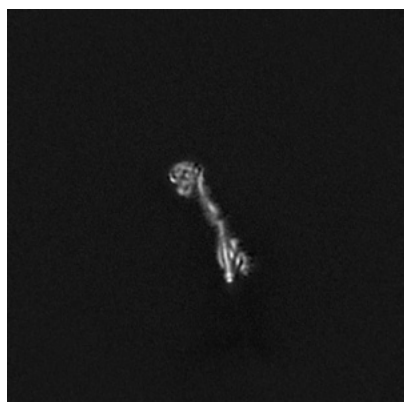


Y Index: 180



Z Index: 184

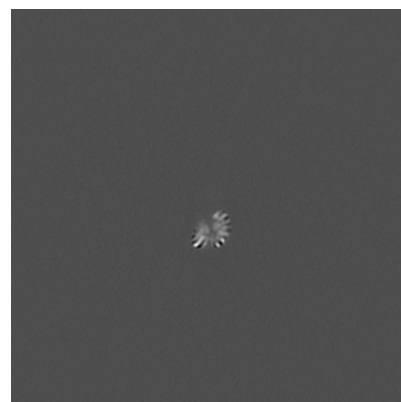
### 6.3.2 Raw map



X Index: 164



Y Index: 180

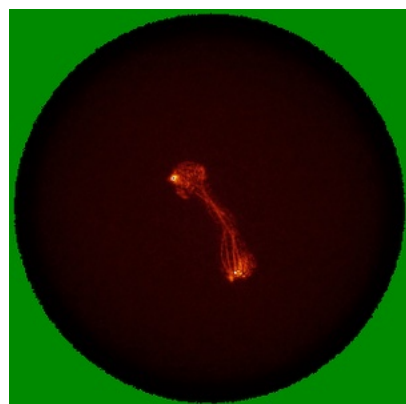


Z Index: 184

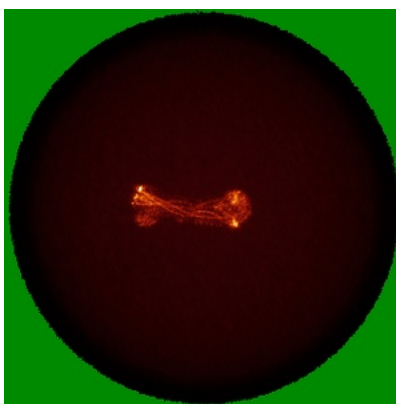
The images above show the largest variance slices of the map in three orthogonal directions.

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

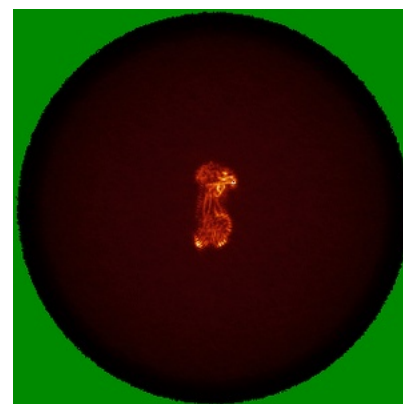
### 6.4.1 Primary map



X

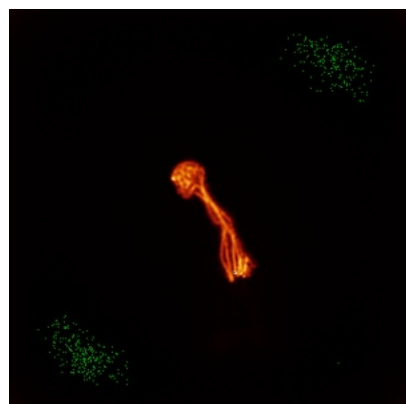


Y

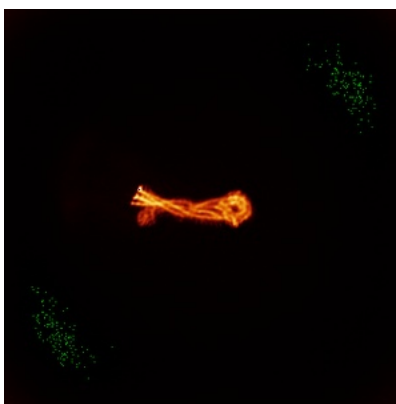


Z

### 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



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.7. 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



X



Y



Z

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](#)

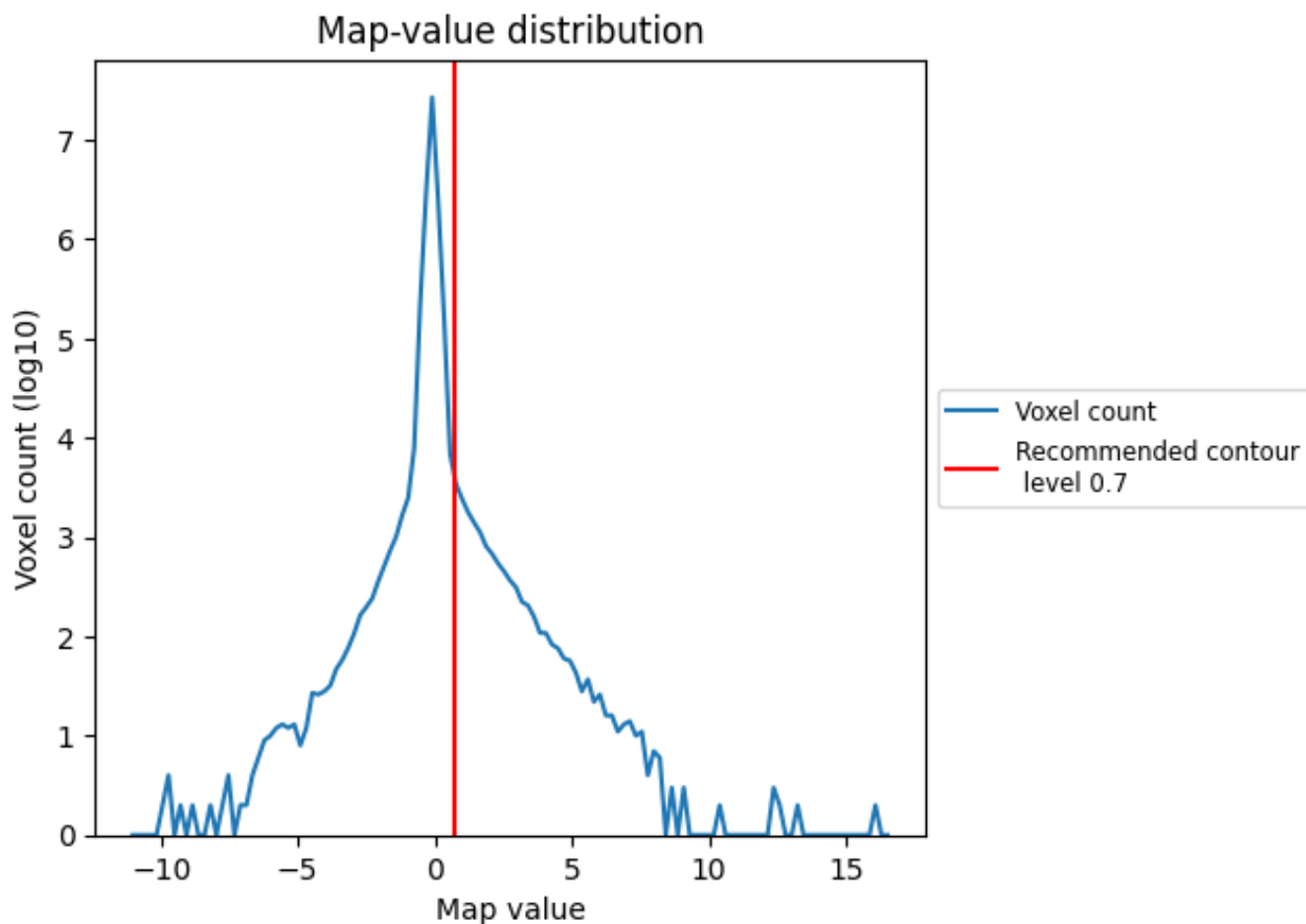
This section was not generated. No masks/segmentation were deposited.



## 7 Map analysis [i](#)

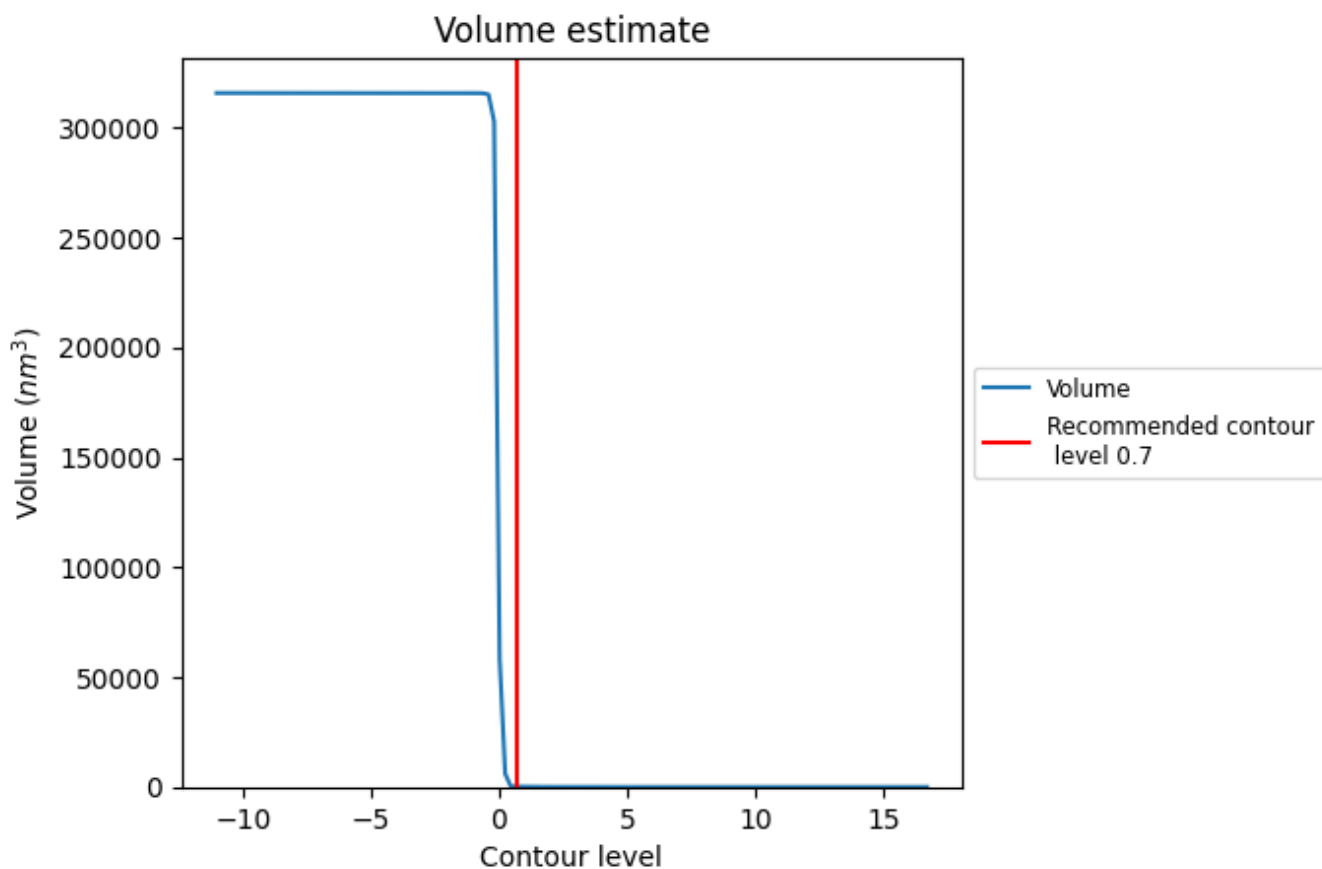
This section contains the results of statistical analysis of the map.

### 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.

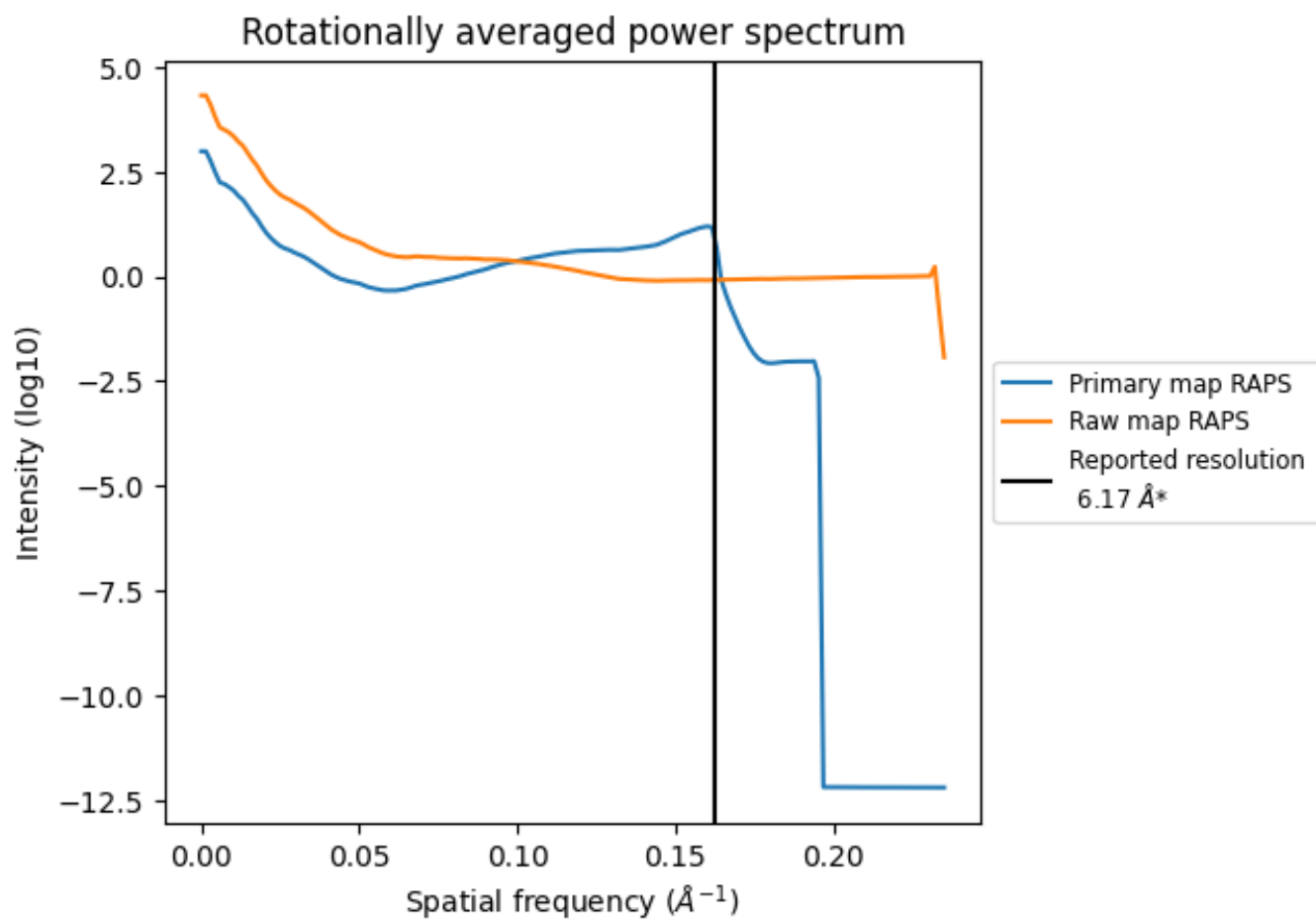
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 156  $\text{nm}^3$ ; this corresponds to an approximate mass of 141 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](#)

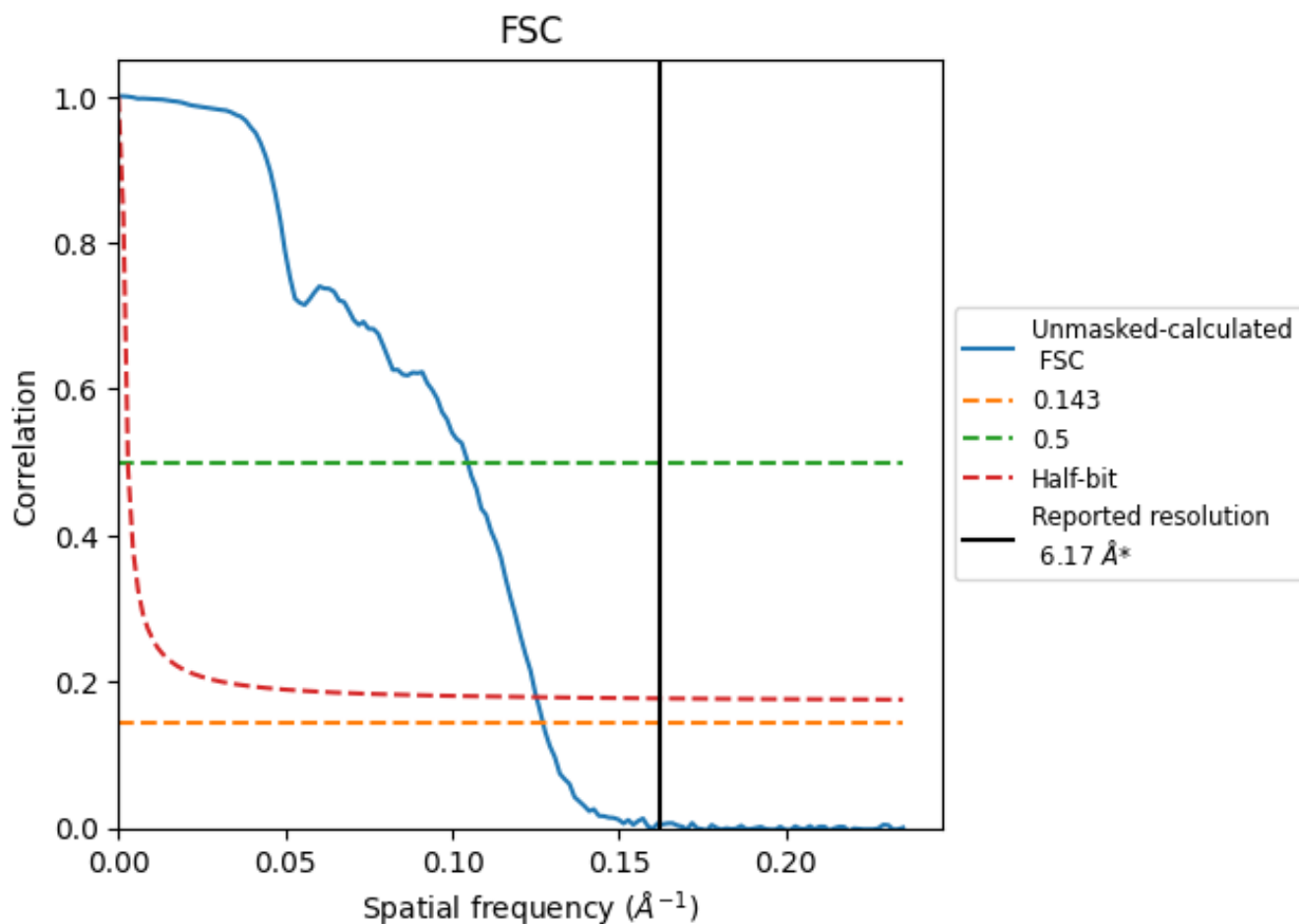


\*Reported resolution corresponds to spatial frequency of 0.162 Å<sup>-1</sup>

## 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 0.162 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	6.17	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	7.86	9.56	7.99

\*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 7.86 differs from the reported value 6.17 by more than 10 %

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

This section contains information regarding the fit between EMDB map EMD-33914 and PDB model 7YLM. Per-residue inclusion information can be found in section [3](#) on page [4](#).

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



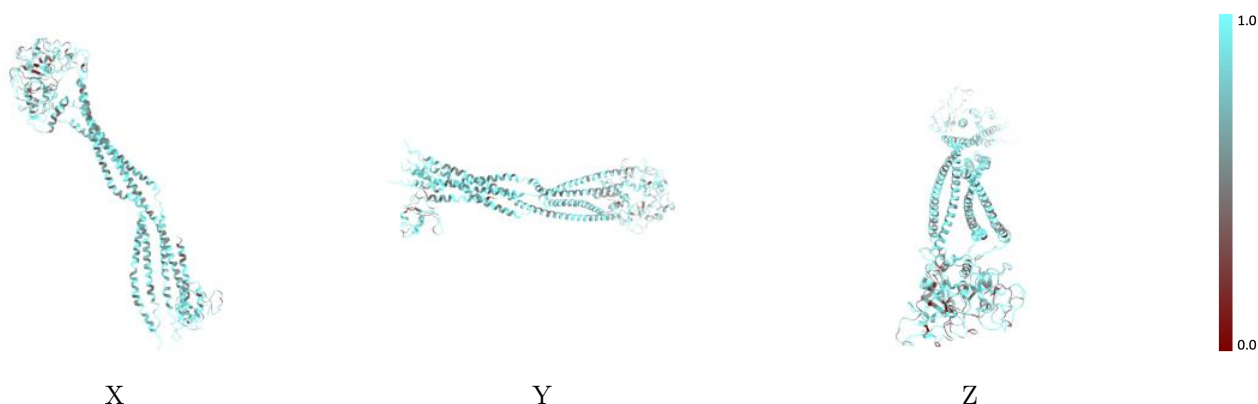
The images above show the 3D surface view of the map at the recommended contour level 0.7 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



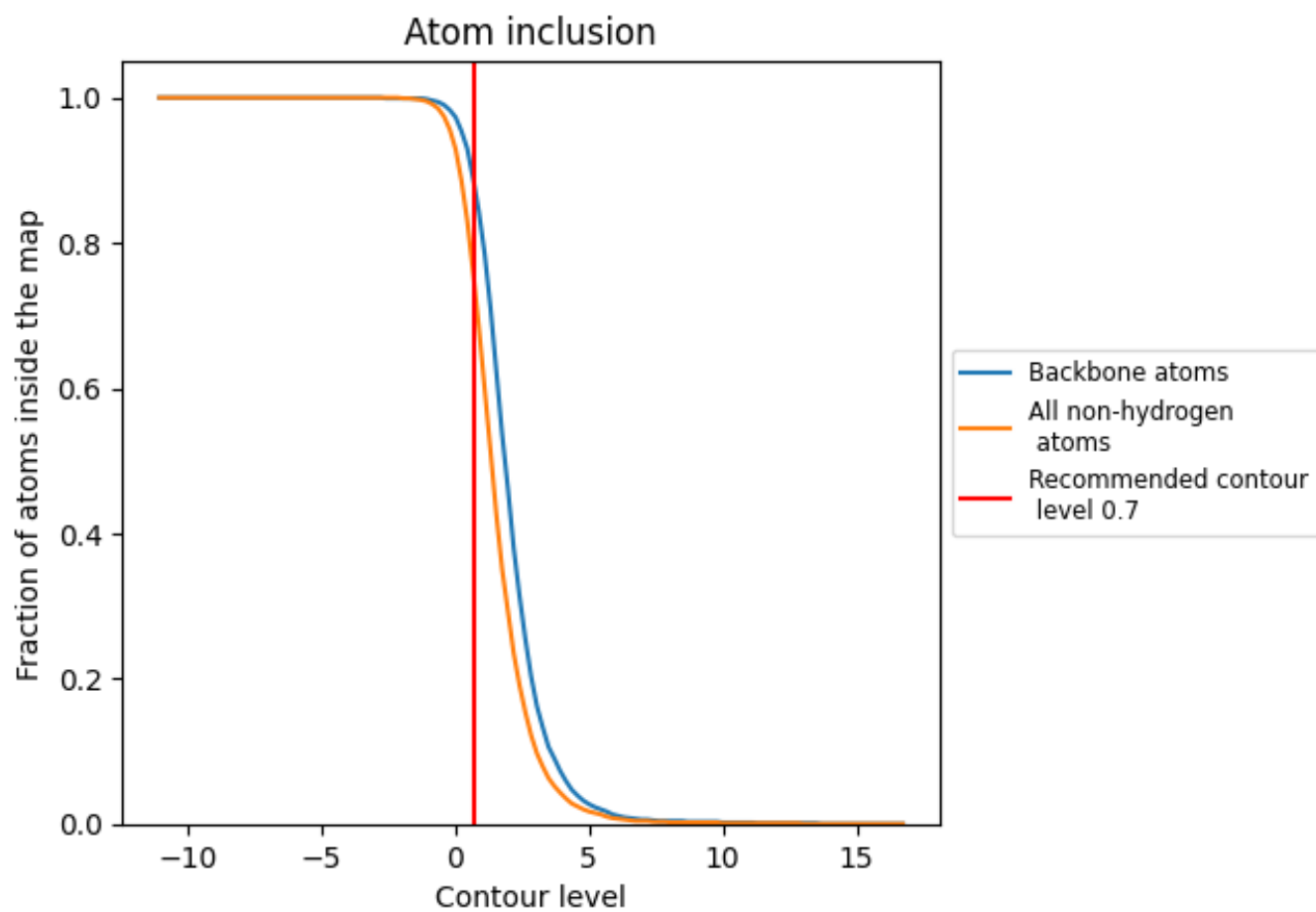
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.7).

## 9.4 Atom inclusion [i](#)











At the recommended contour level, 88% of all backbone atoms, 75% of all non-hydrogen atoms, are inside the map.



## 9.5 Map-model fit summary [i](#)

The table lists the average atom inclusion at the recommended contour level (0.7) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.7530	 0.2130
A	 0.7520	 0.2050
B	 0.7510	 0.2120
C	 0.7620	 0.2380

