



wwPDB EM Validation Summary Report ⓘ

Mar 29, 2026 – 11:37 PM UTC

PDB ID : 5XF8 / pdb_00005xf8
EMDB ID : EMD-6671
Title : Cryo-EM structure of the Cdt1-MCM2-7 complex in AMPPNP state
Authors : Zhai, Y.; Cheng, E.; Wu, H.; Li, N.; Yung, P.Y.; Gao, N.; Tye, B.K.
Deposited on : 2017-04-09
Resolution : 7.10 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

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
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

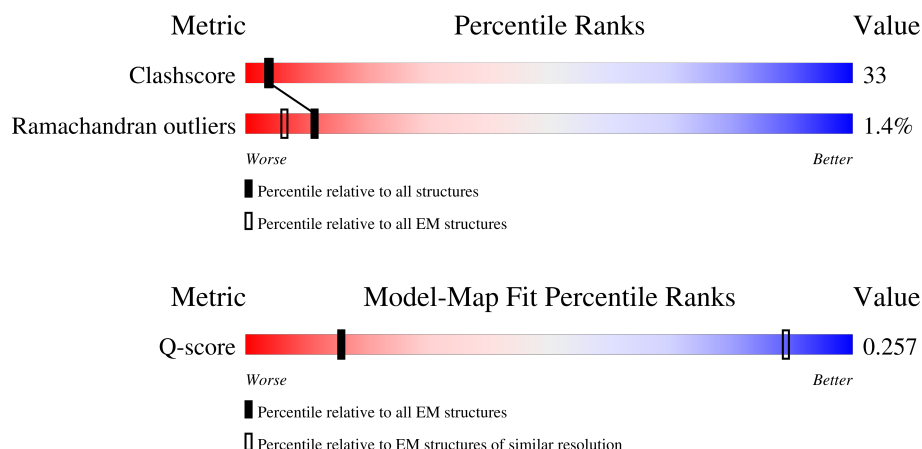
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 7.10 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	-
Q-score	-	25397	464 (6.60 - 7.60)

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	2	868	19% 45% 22% • 32%
2	3	997	26% 41% 19% • 40%
3	4	933	23% 50% 25% • 23%
4	5	775	48% 61% 19% • 18%
5	6	1017	16% 35% 26% • 36%

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Mol	Chain	Length	Quality of chain
6	7	845	35% 50% 23% 26%
7	C	604	36% 63% 14% 22%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 21215 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 DNA replication licensing factor MCM2.

Mol	Chain	Residues	Atoms				AltConf	Trace
1	2	591	Total	C	N	O	0	0
			2924	1742	591	591		

- Molecule 2 is a protein called DNA replication licensing factor MCM3.

Mol	Chain	Residues	Atoms				AltConf	Trace
2	3	601	Total	C	N	O	0	0
			2974	1772	601	601		

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
3	-25	MET	-	initiating methionine	UNP P24279
3	-24	ASP	-	expression tag	UNP P24279
3	-23	TYR	-	expression tag	UNP P24279
3	-22	LYS	-	expression tag	UNP P24279
3	-21	ASP	-	expression tag	UNP P24279
3	-20	HIS	-	expression tag	UNP P24279
3	-19	ASP	-	expression tag	UNP P24279
3	-18	GLY	-	expression tag	UNP P24279
3	-17	ASP	-	expression tag	UNP P24279
3	-16	TYR	-	expression tag	UNP P24279
3	-15	LYS	-	expression tag	UNP P24279
3	-14	ASP	-	expression tag	UNP P24279
3	-13	HIS	-	expression tag	UNP P24279
3	-12	ASP	-	expression tag	UNP P24279
3	-11	ILE	-	expression tag	UNP P24279
3	-10	ASP	-	expression tag	UNP P24279
3	-9	TYR	-	expression tag	UNP P24279
3	-8	LYS	-	expression tag	UNP P24279
3	-7	ASP	-	expression tag	UNP P24279
3	-6	ASP	-	expression tag	UNP P24279
3	-5	ASP	-	expression tag	UNP P24279

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Chain	Residue	Modelled	Actual	Comment	Reference
3	-4	ASP	-	expression tag	UNP P24279
3	-3	LYS	-	expression tag	UNP P24279
3	-2	GLY	-	expression tag	UNP P24279
3	-1	GLY	-	expression tag	UNP P24279
3	0	ARG	-	expression tag	UNP P24279

- Molecule 3 is a protein called DNA replication licensing factor MCM4.

Mol	Chain	Residues	Atoms				AltConf	Trace
3	4	716	Total	C	N	O	0	0
			3551	2119	716	716		

- Molecule 4 is a protein called Minichromosome maintenance protein 5.

Mol	Chain	Residues	Atoms				AltConf	Trace
4	5	632	Total	C	N	O	0	0
			3130	1866	632	632		

- Molecule 5 is a protein called DNA replication licensing factor MCM6.

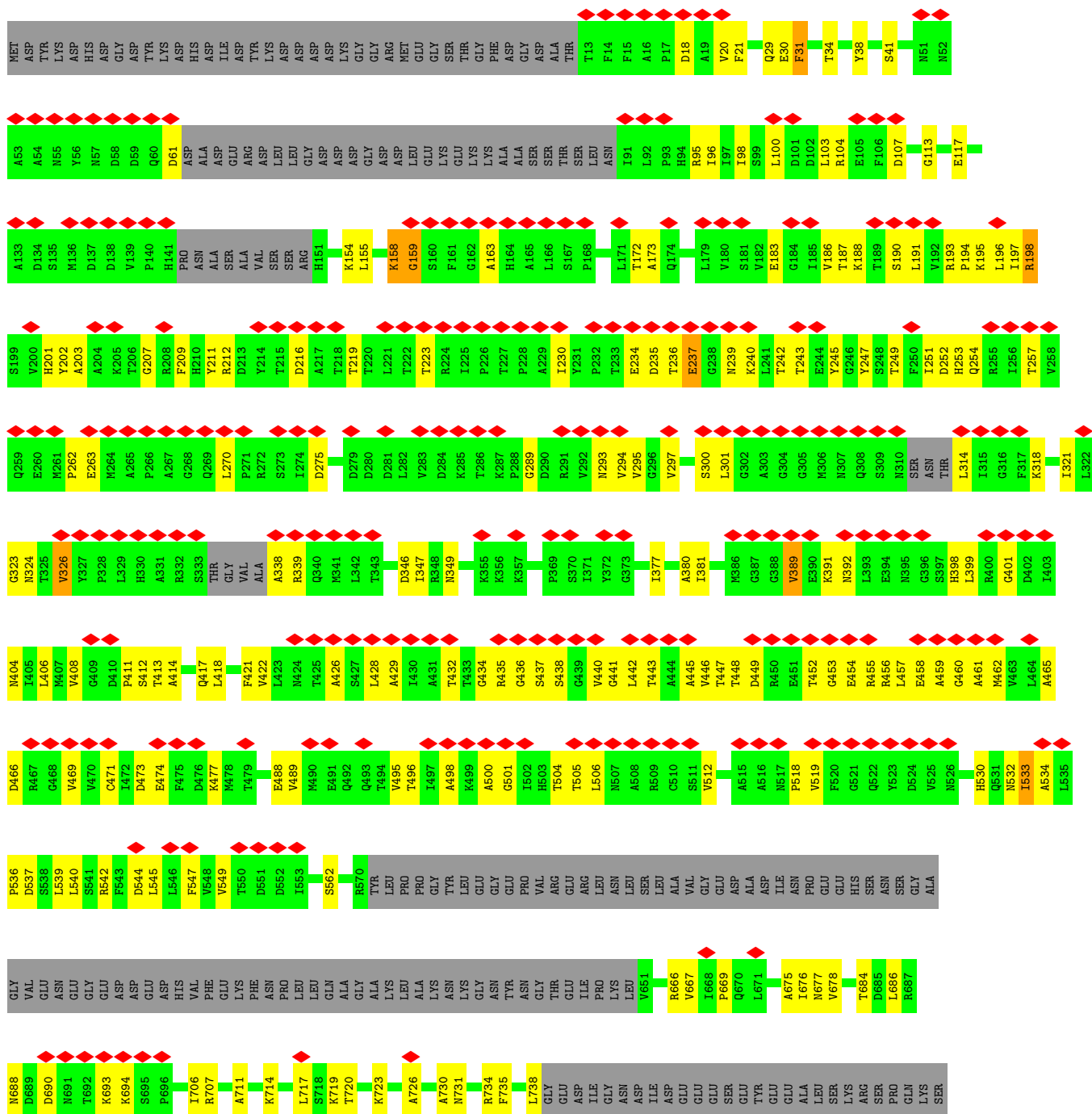
Mol	Chain	Residues	Atoms				AltConf	Trace
5	6	652	Total	C	N	O	0	0
			3230	1926	652	652		

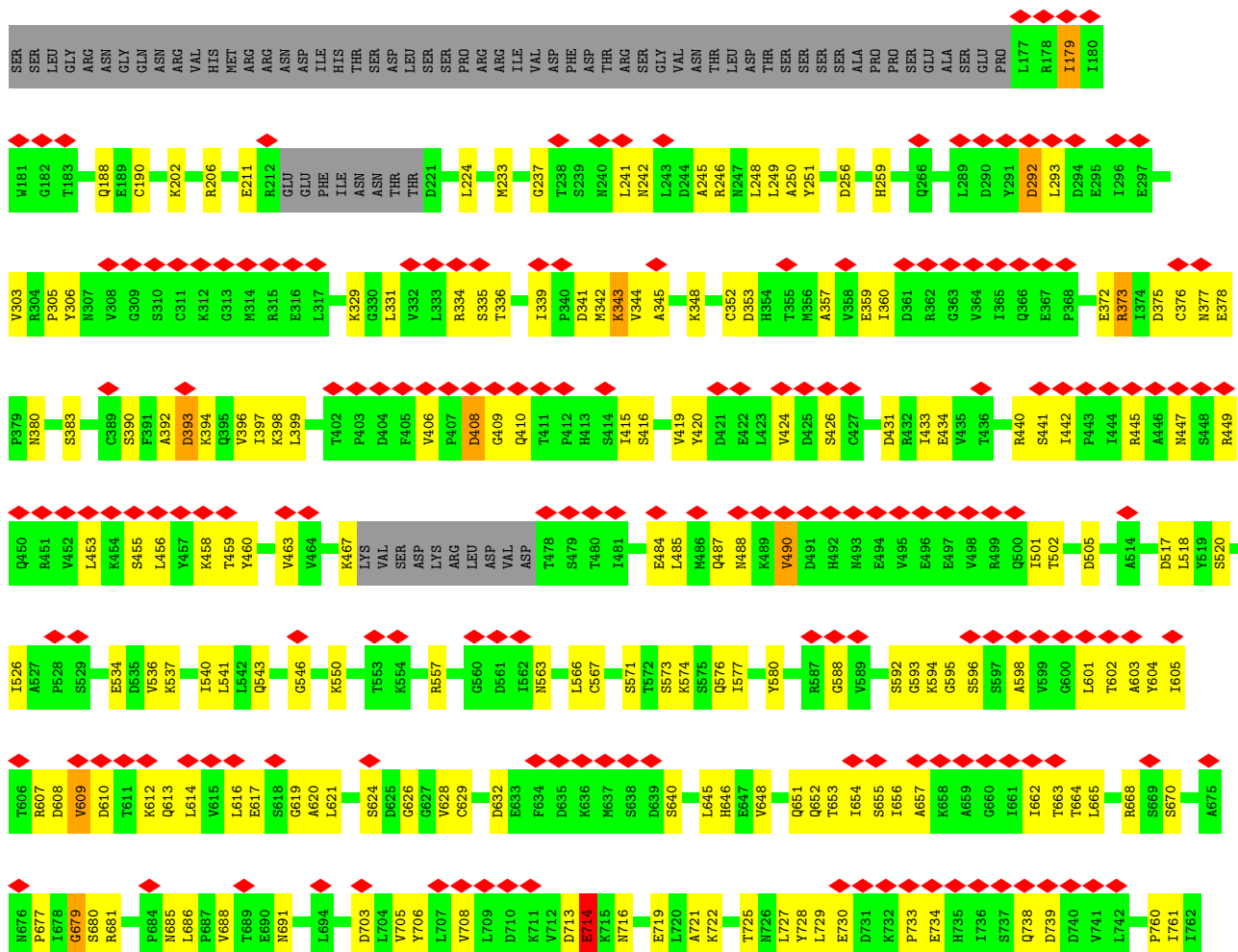
- Molecule 6 is a protein called DNA replication licensing factor MCM7.

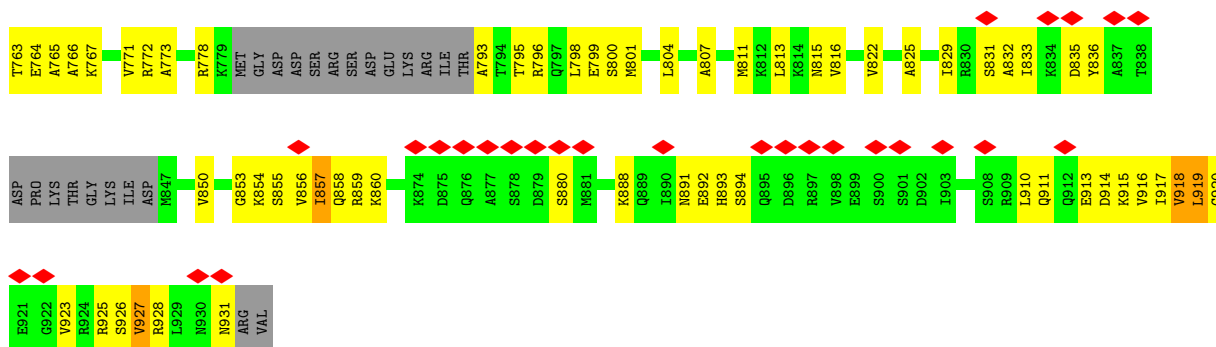
Mol	Chain	Residues	Atoms				AltConf	Trace
6	7	622	Total	C	N	O	0	0
			3076	1832	622	622		

- Molecule 7 is a protein called Cell division cycle protein CDT1.

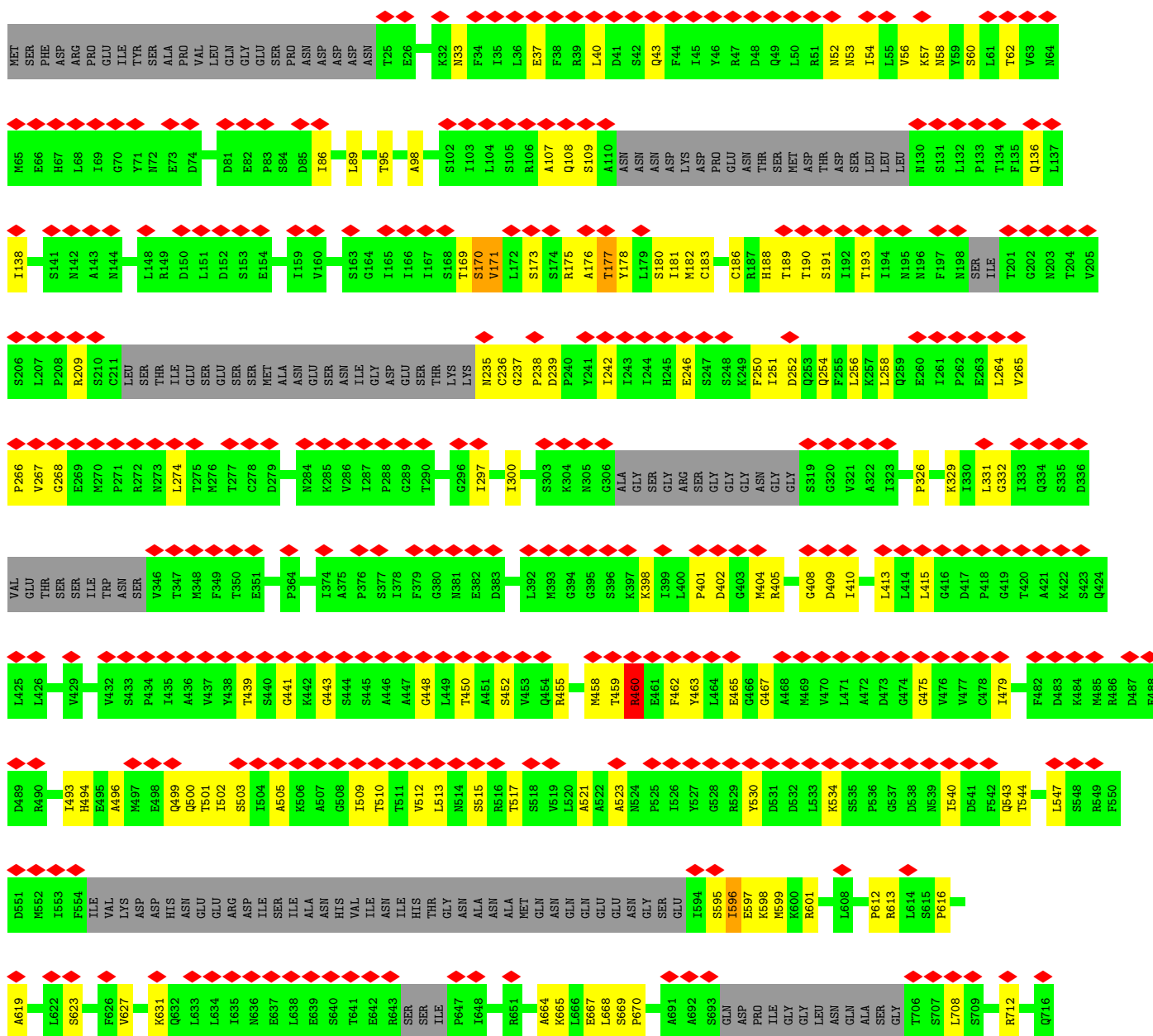
Mol	Chain	Residues	Atoms				AltConf	Trace
7	C	469	Total	C	N	O	0	0
			2330	1392	469	469		

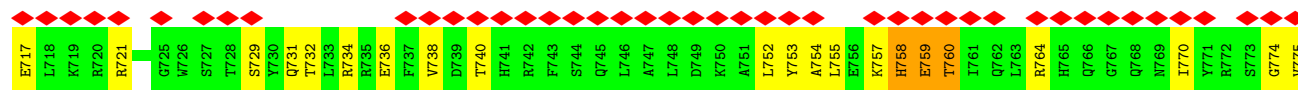




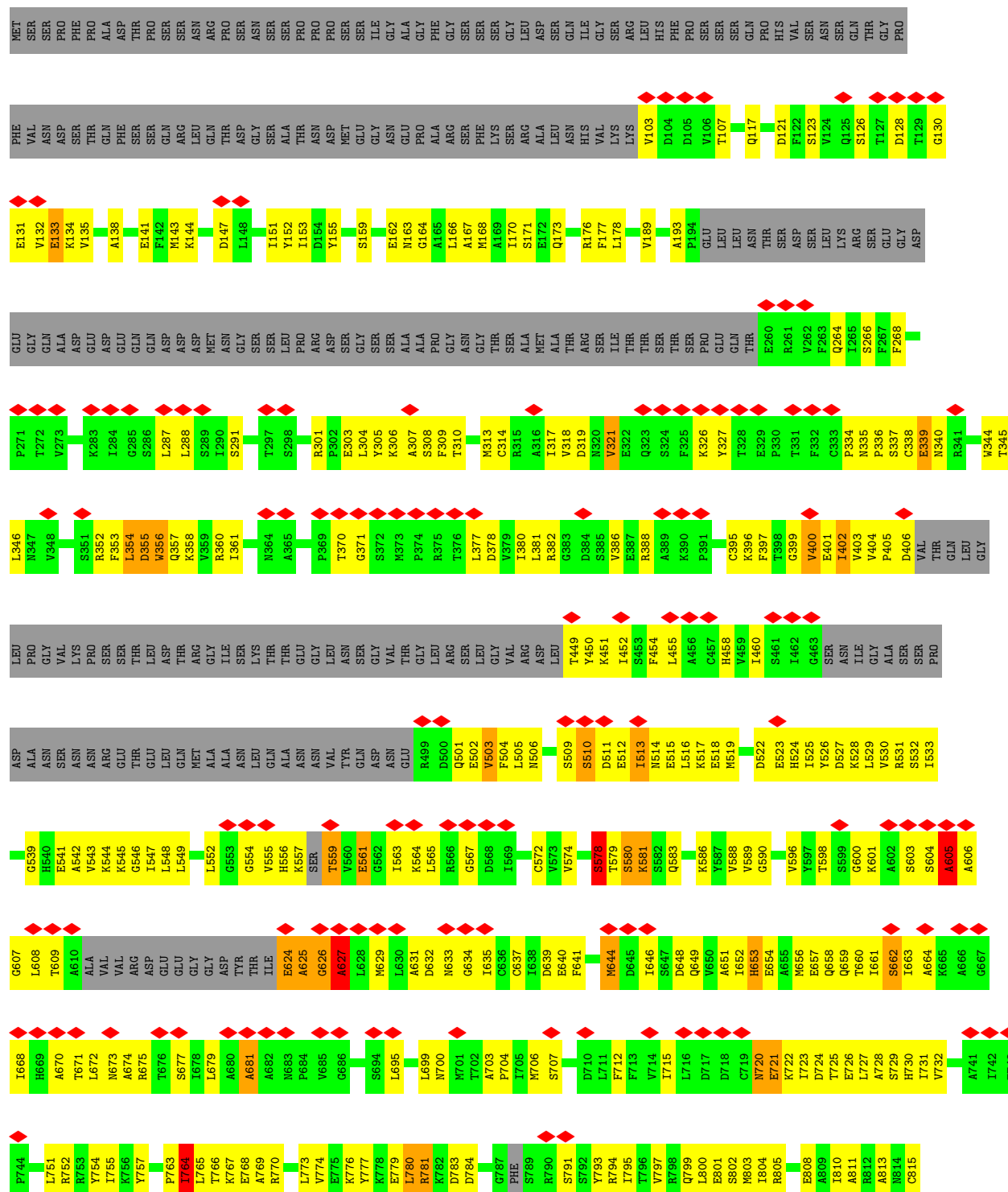


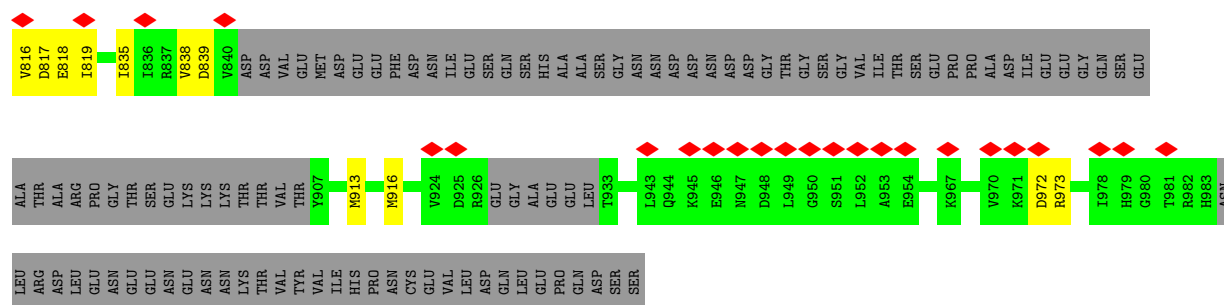
• Molecule 4: Minichromosome maintenance protein 5



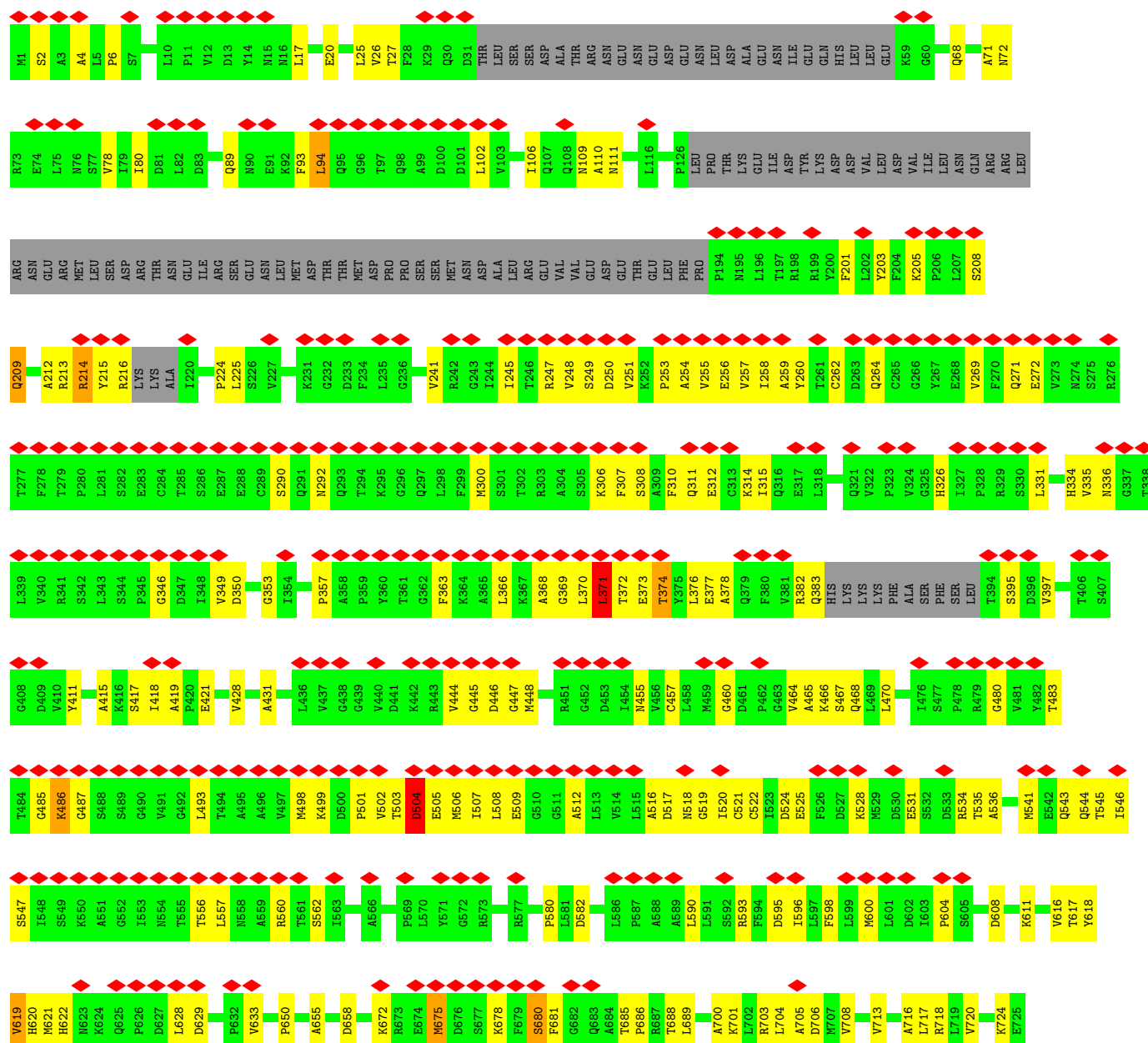


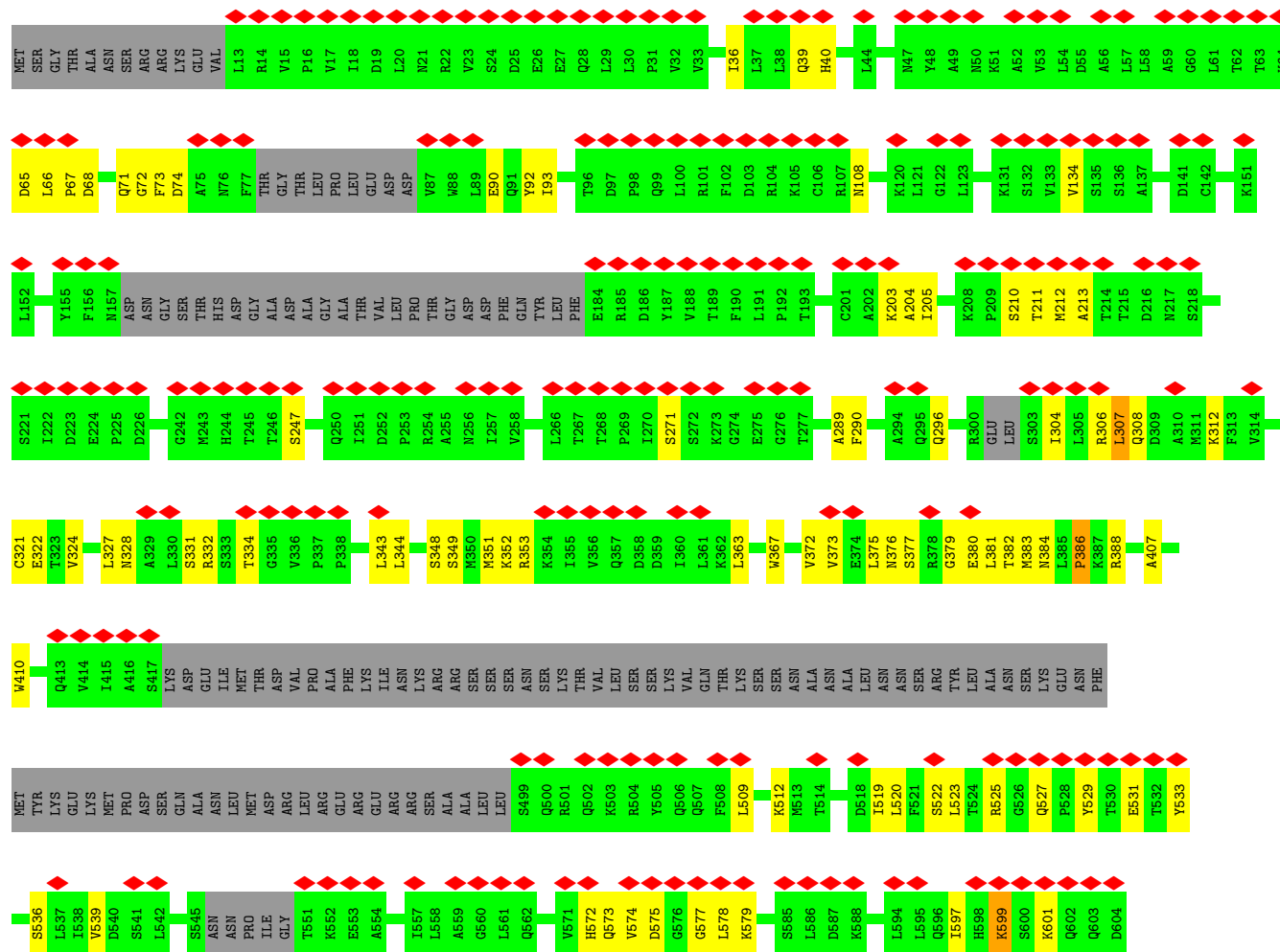
• Molecule 5: DNA replication licensing factor MCM6





• Molecule 6: DNA replication licensing factor MCM7





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	63000	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	22.0	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	0.068	Depositor
Minimum map value	-0.025	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.005	Depositor
Recommended contour level	0.0253	Depositor
Map size ($\text{\AA}$)	264.0, 264.0, 264.0	wwPDB
Map dimensions	200, 200, 200	wwPDB
Map angles ($^\circ$)	90.0, 90.0, 90.0	wwPDB
Pixel spacing ($\text{\AA}$)	1.32, 1.32, 1.32	Depositor

5 Model quality

5.1 Standard geometry

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	2	0.73	1/2920 (0.0%)	0.93	7/4063 (0.2%)
2	3	0.59	0/2968	0.78	6/4127 (0.1%)
3	4	0.74	4/3546 (0.1%)	0.95	14/4939 (0.3%)
4	5	0.48	0/3121	0.72	6/4337 (0.1%)
5	6	0.77	0/3221	1.11	24/4477 (0.5%)
6	7	0.63	1/3071 (0.0%)	0.83	8/4271 (0.2%)
7	C	0.58	0/2324	1.05	10/3235 (0.3%)
All	All	0.66	6/21171 (0.0%)	0.92	75/29449 (0.3%)

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	2	0	6
2	3	0	5
3	4	0	6
4	5	0	2
5	6	0	19
6	7	0	6
7	C	0	4
All	All	0	48

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	4	919	LEU	CA-C	8.23	1.62	1.52
3	4	918	VAL	CA-C	7.17	1.61	1.52
3	4	918	VAL	N-CA	7.09	1.54	1.46
3	4	919	LEU	N-CA	6.89	1.54	1.46
1	2	219	THR	CA-CB	-6.27	1.46	1.54

The worst 5 of 75 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	6	626	GLY	N-CA-C	-13.51	96.52	112.73
1	2	570	GLY	N-CA-C	11.83	128.77	114.69
3	4	919	LEU	N-CA-C	11.30	125.10	108.60
3	4	343	LYS	N-CA-C	-9.61	100.89	111.36
7	C	66	LEU	CA-C-N	9.49	131.70	119.84

There are no chirality outliers.

5 of 48 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	2	218	TYR	Peptide
1	2	298	SER	Peptide
1	2	367	CYS	Peptide
1	2	434	TYR	Peptide
1	2	588	GLU	Peptide

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	2	2924	0	1308	165	0
2	3	2974	0	1349	153	0
3	4	3551	0	1537	178	0
4	5	3130	0	1369	108	0
5	6	3230	0	1449	231	0
6	7	3076	0	1381	174	0
7	C	2330	0	1004	53	0
All	All	21215	0	9397	1025	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 33.

The worst 5 of 1025 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)
1:2:386:GLN:N	1:2:410:LEU:O	1.57	1.36
1:2:224:ARG:CB	7:C:212:MET:HA	1.55	1.34
3:4:856:VAL:HA	3:4:860:LYS:CB	1.73	1.19
5:6:625:ALA:HB3	5:6:629:MET:H	1.04	1.13
2:3:190:SER:HA	2:3:456:ARG:HA	1.34	1.09

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	2	583/868 (67%)	503 (86%)	69 (12%)	11 (2%)	6	32
2	3	589/997 (59%)	516 (88%)	65 (11%)	8 (1%)	9	40
3	4	706/933 (76%)	603 (85%)	95 (14%)	8 (1%)	11	46
4	5	614/775 (79%)	564 (92%)	45 (7%)	5 (1%)	16	54
5	6	634/1017 (62%)	539 (85%)	80 (13%)	15 (2%)	4	27
6	7	612/845 (72%)	542 (89%)	62 (10%)	8 (1%)	9	42
7	C	457/604 (76%)	407 (89%)	46 (10%)	4 (1%)	14	51
All	All	4195/6039 (70%)	3674 (88%)	462 (11%)	59 (1%)	11	40

5 of 59 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	2	305	SER
1	2	334	LEU
2	3	198	ARG
3	4	179	ILE
3	4	490	VAL

5.3.2 Protein sidechains [i](#)

There are no protein residues with a non-rotameric sidechain to report in this entry.

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

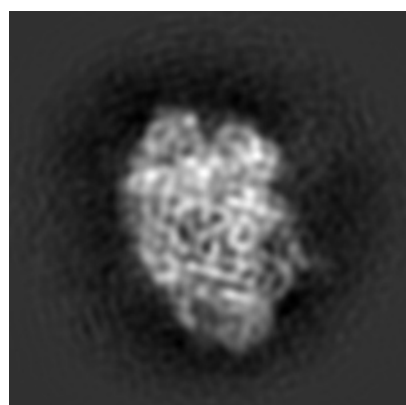
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-6671. These allow visual inspection of the internal detail of the map and identification of artifacts.

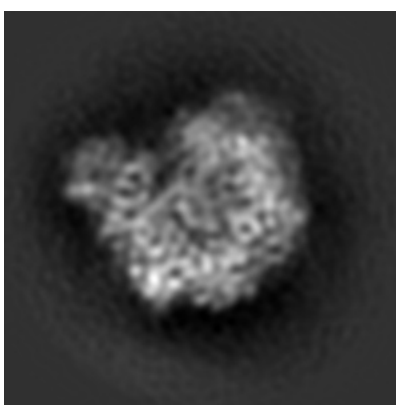
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

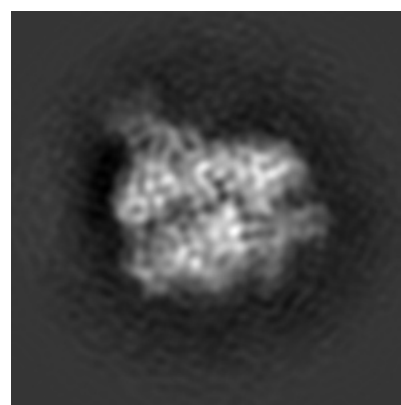
6.1.1 Primary map



X



Y

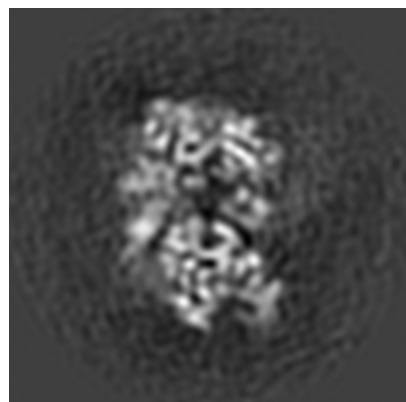


Z

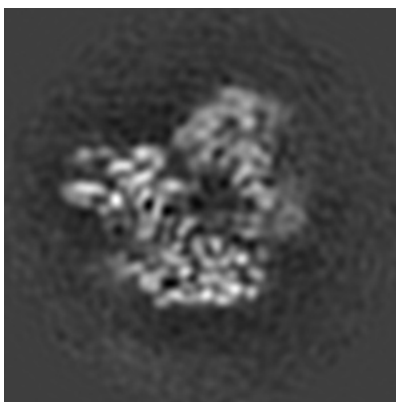
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

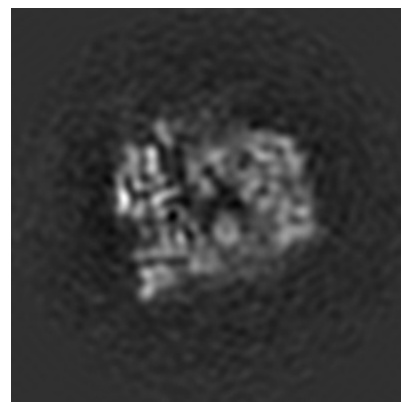
6.2.1 Primary map



X Index: 100



Y Index: 100

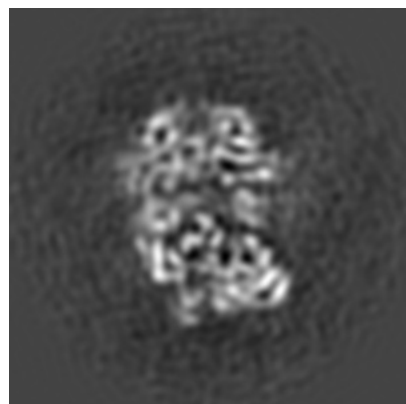


Z Index: 100

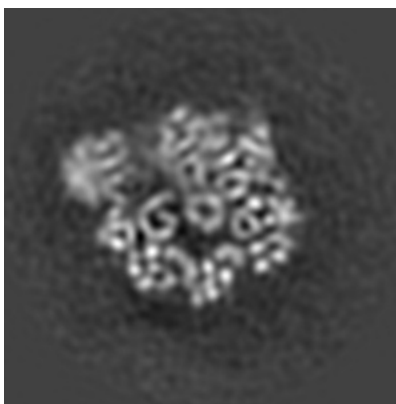
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

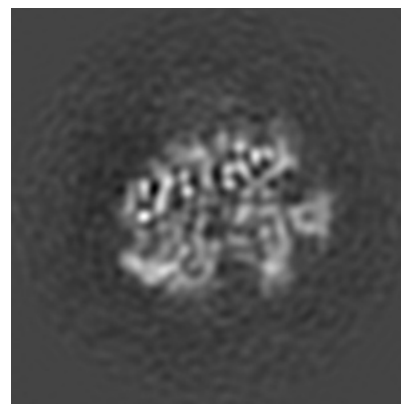
6.3.1 Primary map



X Index: 93



Y Index: 118

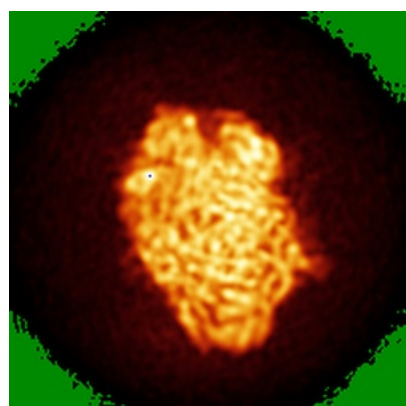


Z Index: 118

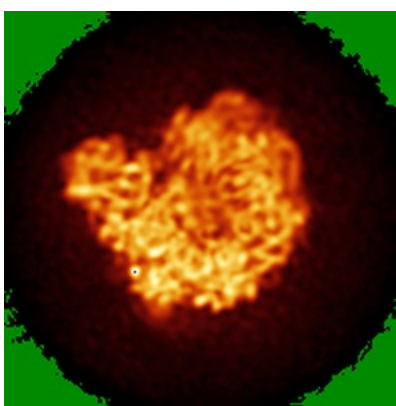
The images above show the largest variance slices of the map in three orthogonal directions.

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

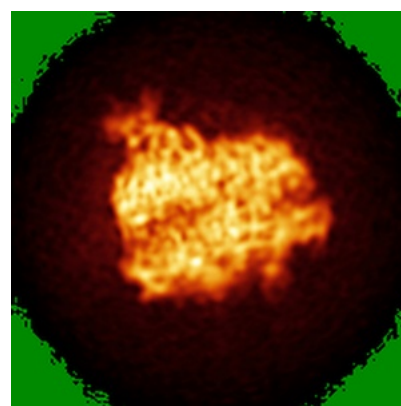
6.4.1 Primary map



X



Y

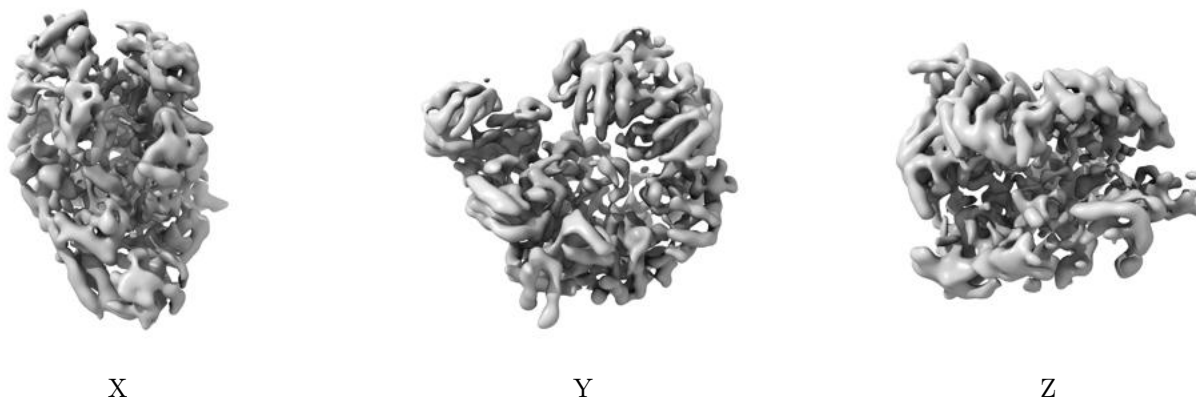


Z

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 0.0253. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

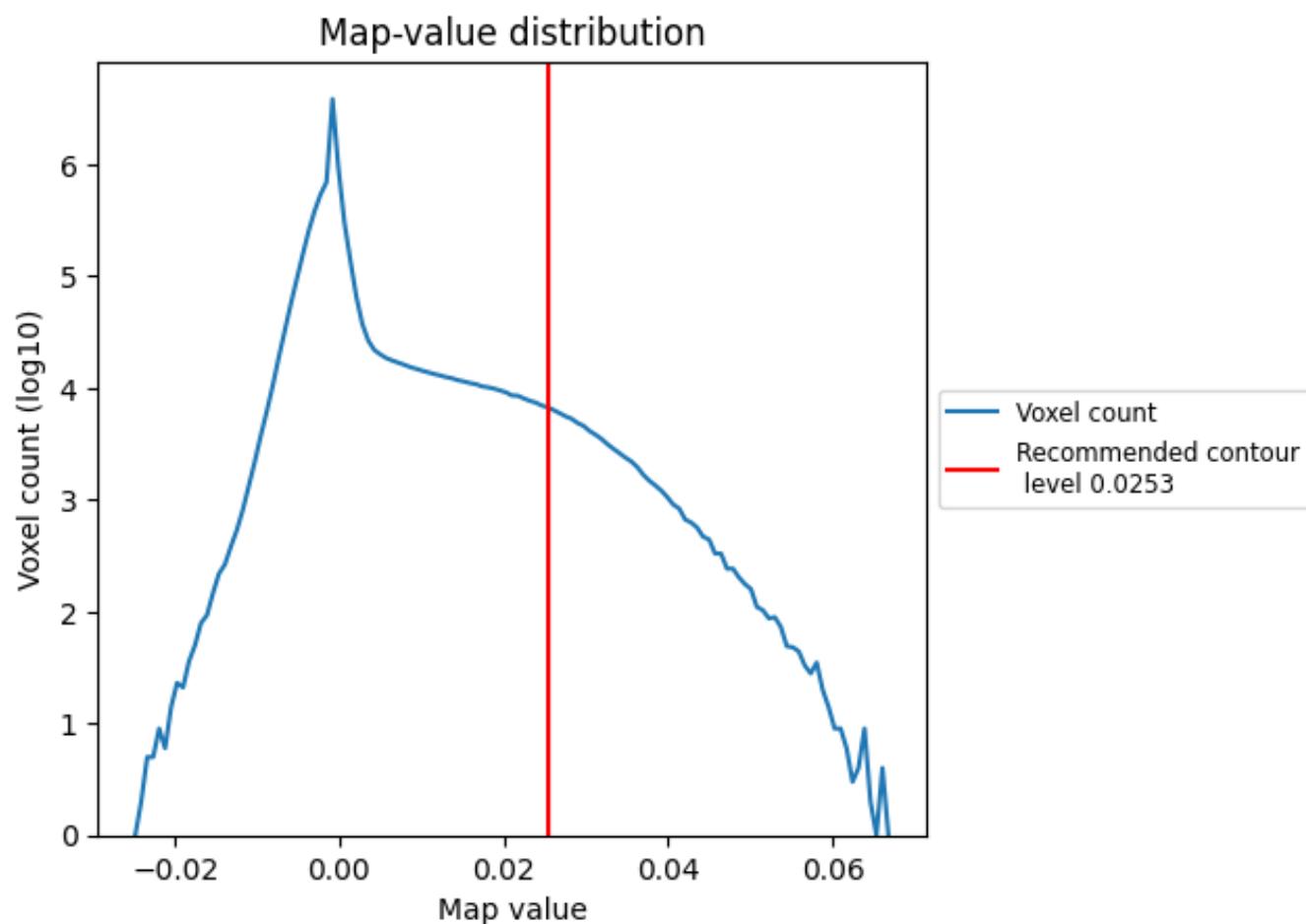
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

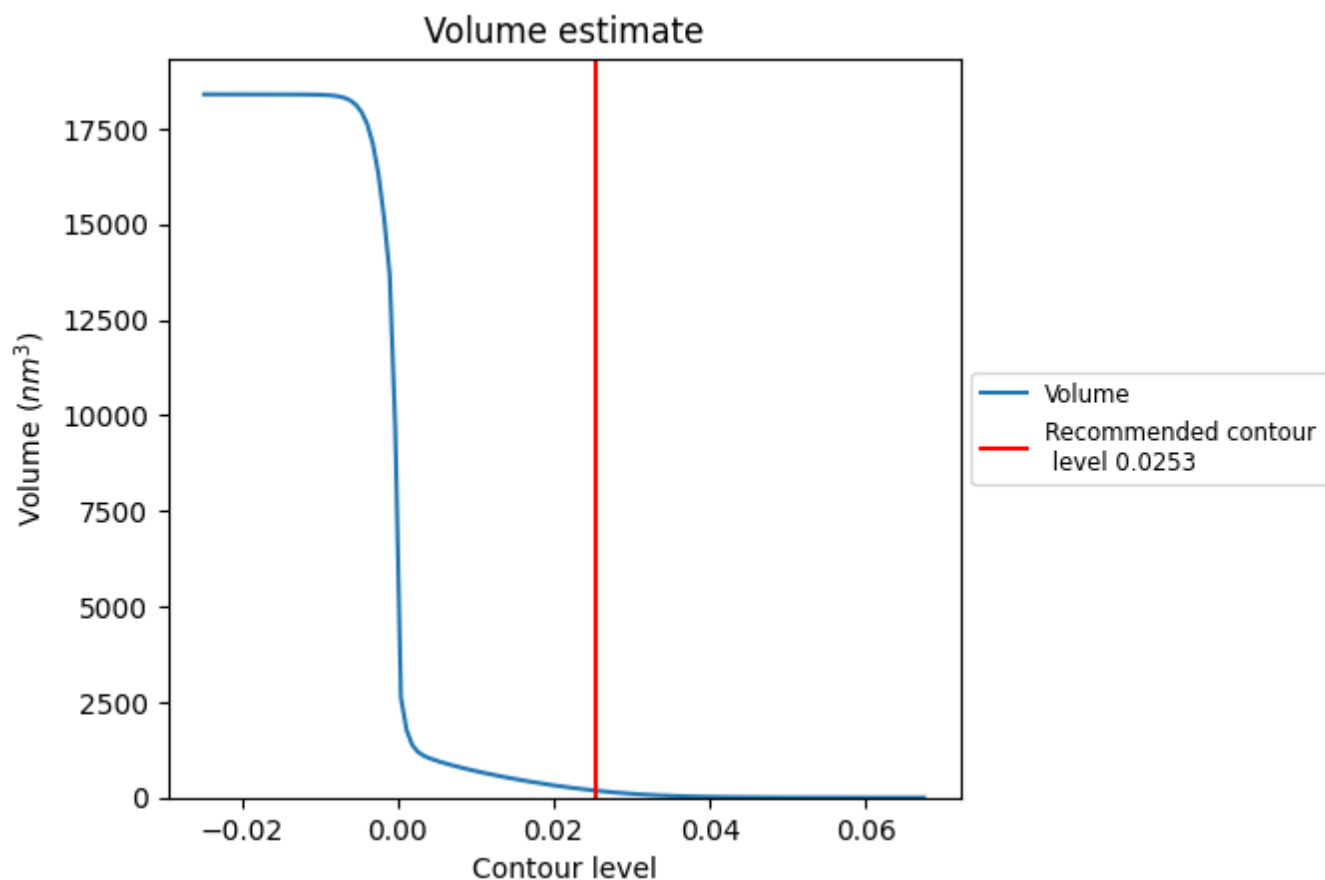
This section contains the results of statistical analysis of the map.

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.

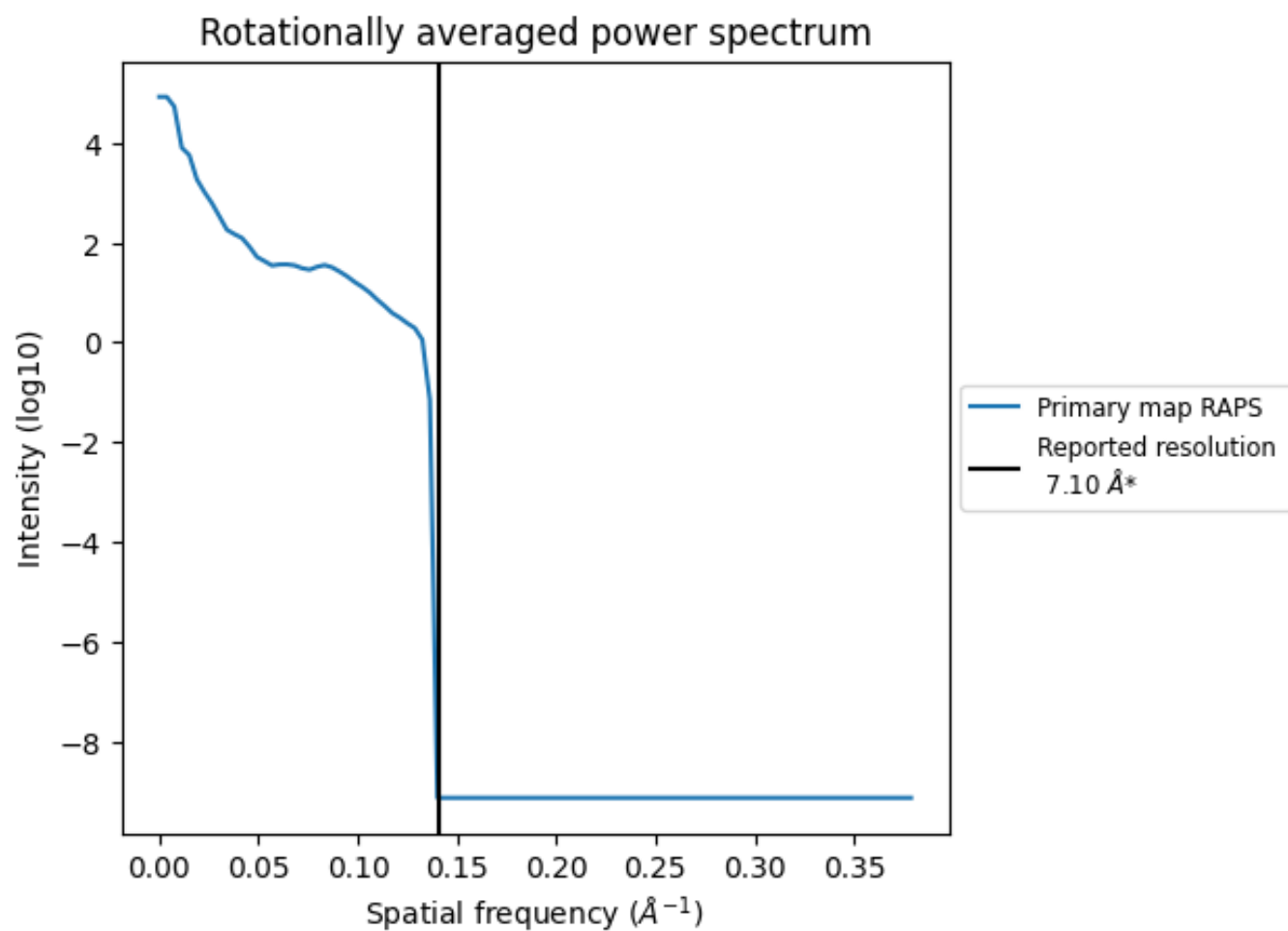
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 185 nm³; this corresponds to an approximate mass of 167 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 0.141 $\text{\AA}^{-1}$

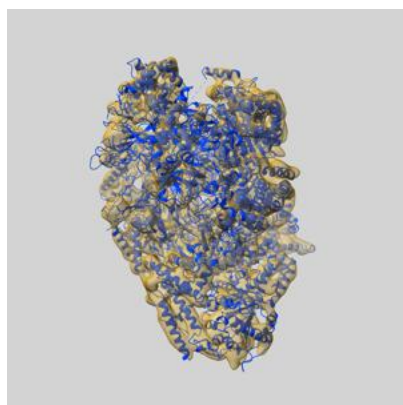
8 Fourier-Shell correlation

This section was not generated. No FSC curve or half-maps provided.

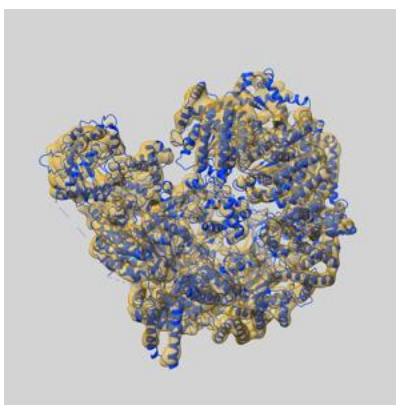
9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-6671 and PDB model 5XF8. Per-residue inclusion information can be found in section [3](#) on page [6](#).

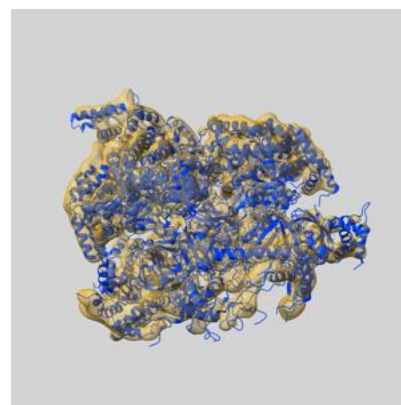
9.1 Map-model overlay [i](#)



X



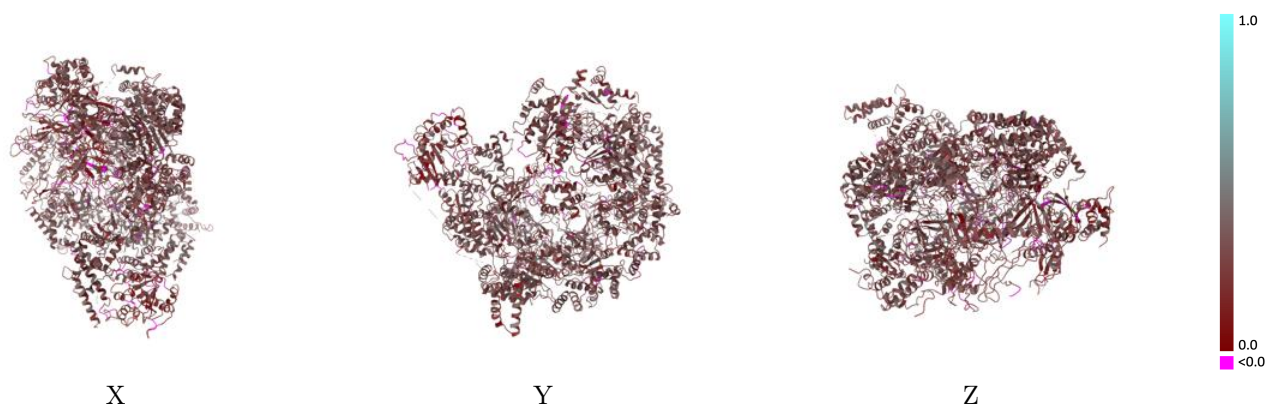
Y



Z

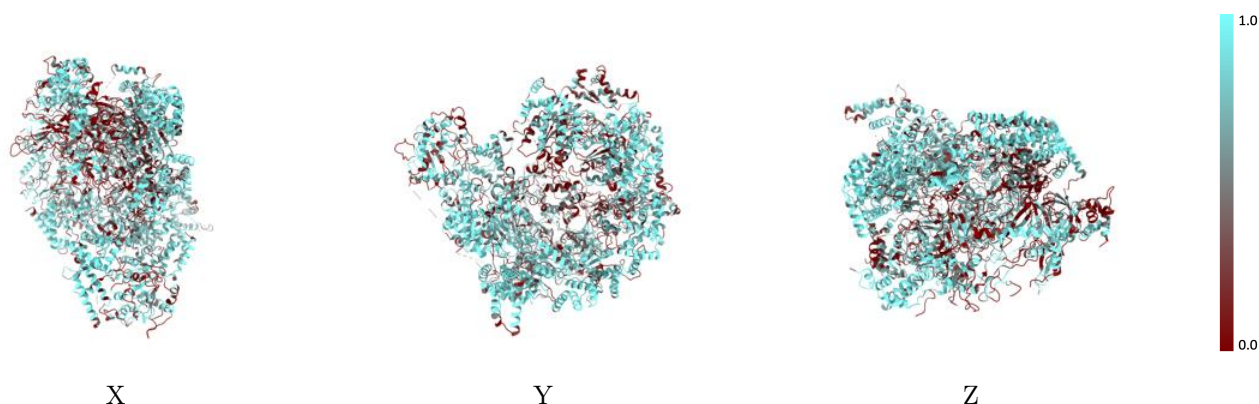
The images above show the 3D surface view of the map at the recommended contour level 0.0253 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



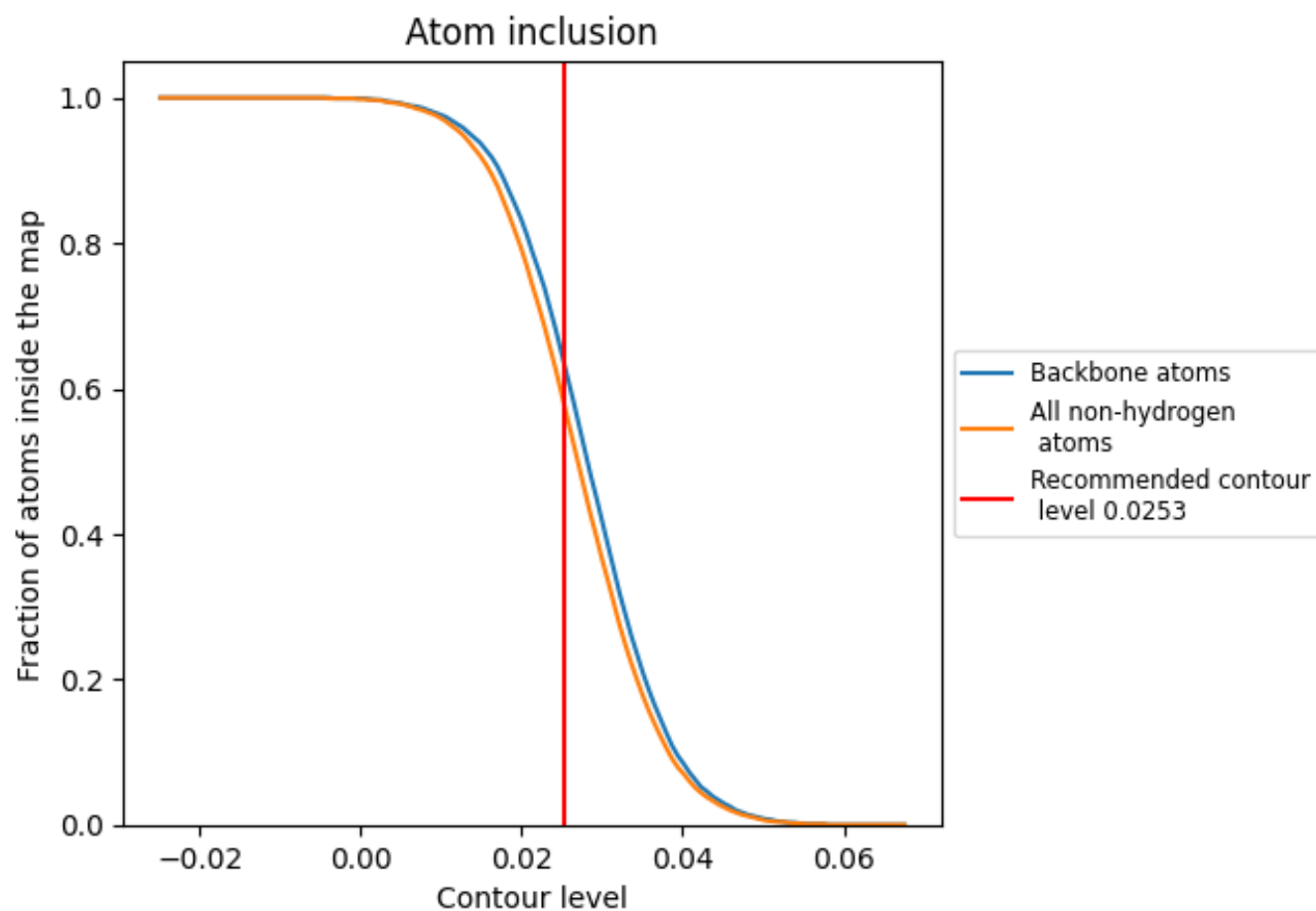
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.0253).

9.4 Atom inclusion [i](#)



At the recommended contour level, 63% of all backbone atoms, 58% 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 (0.0253) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.5770	0.2570
2	0.6710	0.2760
3	0.5460	0.2630
4	0.6590	0.2670
5	0.4120	0.2320
6	0.7080	0.2840
7	0.4990	0.2580
C	0.5150	0.2100

1.0

0.0

<0.0