W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB EM Validation Summary Report (i)

Dec 21, 2024 – 04:03 pm GMT

PDB ID	:	8RIF
EMDB ID	:	EMD-19186
Title	:	Cryo-EM structure of the MCM double hexamer loaded onto dsDNA.
Authors	:	Miller, T.C.R.; Lim, C.T.; Diffley, J.F.X.; Costa, A.
Deposited on	:	2023-12-18
Resolution	:	2.79 Å(reported)
Based on initial model	:	7P30

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 (i) 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 (i)) were used in the production of this report:

EMDB validation analysis	:	0.0.1.dev113
Mogul	:	1.8.4, CSD as541be (2020)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.40

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 2.79 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	Percentile Ranks	Value
Clashscore		2
Ramachandran outliers		0.2%
Sidechain outliers		1.0%

Worse   *Better*

▮ Percentile relative to all structures

▯ Percentile relative to all EM structures

Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

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 <=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	6% / 67% · 5% · 28%
1	A	868	6% / 67% · 5% · 28%
2	3	1006	57% · 39%
2	B	1006	57% · 39%
3	4	933	66% · 31%
3	C	933	66% · 31%
4	5	775	6% / 78% · 7% · 15%
4	D	775	6% / 77% · 7% · 15%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
5	6	1017	59% · 40%
5	E	1017	58% · 40%
6	7	845	11% 85% 5% 11%
6	F	845	11% 85% 5% 11%
7	X	53	6% 98% ·
8	Y	53	6% 96% ·
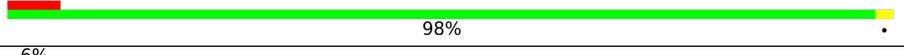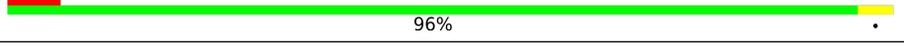
2 Entry composition ⓘ

There are 12 unique types of molecules in this entry. The entry contains 64125 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	624	Total	C	N	O	S	0	0
			4938	3114	878	927	19		
1	A	624	Total	C	N	O	S	0	0
			4938	3114	878	927	19		

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

Mol	Chain	Residues	Atoms					AltConf	Trace
2	3	614	Total	C	N	O	S	0	0
			4811	3037	858	903	13		
2	B	614	Total	C	N	O	S	0	0
			4811	3037	858	903	13		

There are 70 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
3	-34	MET	-	initiating methionine	UNP P24279
3	-33	LYS	-	expression tag	UNP P24279
3	-32	ARG	-	expression tag	UNP P24279
3	-31	ARG	-	expression tag	UNP P24279
3	-30	TRP	-	expression tag	UNP P24279
3	-29	LYS	-	expression tag	UNP P24279
3	-28	LYS	-	expression tag	UNP P24279
3	-27	ASN	-	expression tag	UNP P24279
3	-26	PHE	-	expression tag	UNP P24279
3	-25	ILE	-	expression tag	UNP P24279
3	-24	ALA	-	expression tag	UNP P24279
3	-23	VAL	-	expression tag	UNP P24279
3	-22	SER	-	expression tag	UNP P24279
3	-21	ALA	-	expression tag	UNP P24279
3	-20	ALA	-	expression tag	UNP P24279
3	-19	ASN	-	expression tag	UNP P24279
3	-18	ARG	-	expression tag	UNP P24279

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
3	-17	PHE	-	expression tag	UNP P24279
3	-16	LYS	-	expression tag	UNP P24279
3	-15	LYS	-	expression tag	UNP P24279
3	-14	ILE	-	expression tag	UNP P24279
3	-13	SER	-	expression tag	UNP P24279
3	-12	SER	-	expression tag	UNP P24279
3	-11	SER	-	expression tag	UNP P24279
3	-10	GLY	-	expression tag	UNP P24279
3	-9	ALA	-	expression tag	UNP P24279
3	-8	LEU	-	expression tag	UNP P24279
3	-7	GLU	-	expression tag	UNP P24279
3	-6	ASN	-	expression tag	UNP P24279
3	-5	LEU	-	expression tag	UNP P24279
3	-4	TYR	-	expression tag	UNP P24279
3	-3	PHE	-	expression tag	UNP P24279
3	-2	GLN	-	expression tag	UNP P24279
3	-1	GLY	-	expression tag	UNP P24279
3	0	GLU	-	expression tag	UNP P24279
B	-34	MET	-	initiating methionine	UNP P24279
B	-33	LYS	-	expression tag	UNP P24279
B	-32	ARG	-	expression tag	UNP P24279
B	-31	ARG	-	expression tag	UNP P24279
B	-30	TRP	-	expression tag	UNP P24279
B	-29	LYS	-	expression tag	UNP P24279
B	-28	LYS	-	expression tag	UNP P24279
B	-27	ASN	-	expression tag	UNP P24279
B	-26	PHE	-	expression tag	UNP P24279
B	-25	ILE	-	expression tag	UNP P24279
B	-24	ALA	-	expression tag	UNP P24279
B	-23	VAL	-	expression tag	UNP P24279
B	-22	SER	-	expression tag	UNP P24279
B	-21	ALA	-	expression tag	UNP P24279
B	-20	ALA	-	expression tag	UNP P24279
B	-19	ASN	-	expression tag	UNP P24279
B	-18	ARG	-	expression tag	UNP P24279
B	-17	PHE	-	expression tag	UNP P24279
B	-16	LYS	-	expression tag	UNP P24279
B	-15	LYS	-	expression tag	UNP P24279
B	-14	ILE	-	expression tag	UNP P24279
B	-13	SER	-	expression tag	UNP P24279
B	-12	SER	-	expression tag	UNP P24279
B	-11	SER	-	expression tag	UNP P24279

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	-10	GLY	-	expression tag	UNP P24279
B	-9	ALA	-	expression tag	UNP P24279
B	-8	LEU	-	expression tag	UNP P24279
B	-7	GLU	-	expression tag	UNP P24279
B	-6	ASN	-	expression tag	UNP P24279
B	-5	LEU	-	expression tag	UNP P24279
B	-4	TYR	-	expression tag	UNP P24279
B	-3	PHE	-	expression tag	UNP P24279
B	-2	GLN	-	expression tag	UNP P24279
B	-1	GLY	-	expression tag	UNP P24279
B	0	GLU	-	expression tag	UNP P24279

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

Mol	Chain	Residues	Atoms					AltConf	Trace
3	4	645	Total 5120	C 3211	N 886	O 993	S 30	0	0
3	C	645	Total 5120	C 3211	N 886	O 993	S 30	0	0

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

Mol	Chain	Residues	Atoms					AltConf	Trace
4	5	656	Total 5136	C 3219	N 878	O 1014	S 25	0	0
4	D	656	Total 5136	C 3219	N 878	O 1014	S 25	0	0

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

Mol	Chain	Residues	Atoms					AltConf	Trace
5	6	615	Total 4874	C 3077	N 851	O 921	S 25	0	0
5	E	615	Total 4874	C 3077	N 851	O 921	S 25	0	0

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

Mol	Chain	Residues	Atoms					AltConf	Trace
6	7	755	Total 5976	C 3771	N 1031	O 1142	S 32	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms					AltConf	Trace
6	F	755	Total	C	N	O	S	0	0
			5976	3771	1031	1142	32		

- Molecule 7 is a DNA chain called DNA (53-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
7	X	53	Total	C	N	O	P	0	0
			1086	515	199	319	53		

- Molecule 8 is a DNA chain called DNA (53-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
8	Y	53	Total	C	N	O	P	0	0
			1087	515	202	317	53		

- Molecule 9 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).
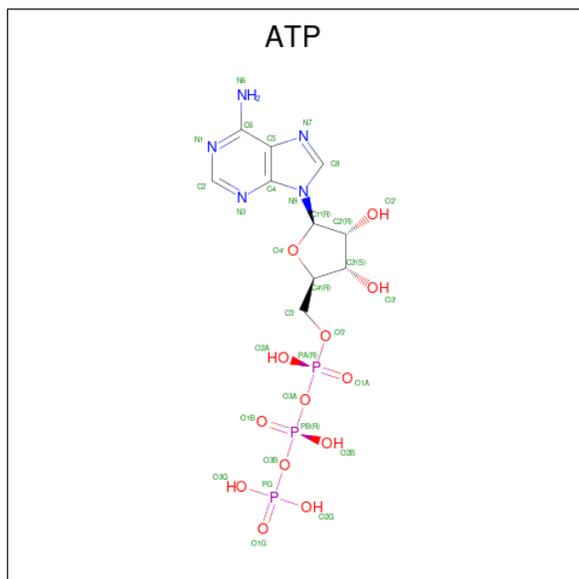
Mol	Chain	Residues	Atoms					AltConf
9	2	1	Total	C	N	O	P	0
			31	10	5	13	3	
9	A	1	Total	C	N	O	P	0
			31	10	5	13	3	

- Molecule 10 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
10	2	1	Total 1	Mg 1	0
10	3	1	Total 1	Mg 1	0
10	5	1	Total 1	Mg 1	0
10	7	1	Total 1	Mg 1	0
10	A	1	Total 1	Mg 1	0
10	B	1	Total 1	Mg 1	0
10	D	1	Total 1	Mg 1	0
10	F	1	Total 1	Mg 1	0

- Molecule 11 is ZINC ION (three-letter code: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
11	2	1	Total 1	Zn 1	0
11	4	1	Total 1	Zn 1	0
11	5	1	Total 1	Zn 1	0
11	6	1	Total 1	Zn 1	0
11	7	1	Total 1	Zn 1	0
11	A	1	Total 1	Zn 1	0
11	C	1	Total 1	Zn 1	0
11	D	1	Total 1	Zn 1	0
11	E	1	Total 1	Zn 1	0
11	F	1	Total 1	Zn 1	0

- Molecule 12 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).

ADP
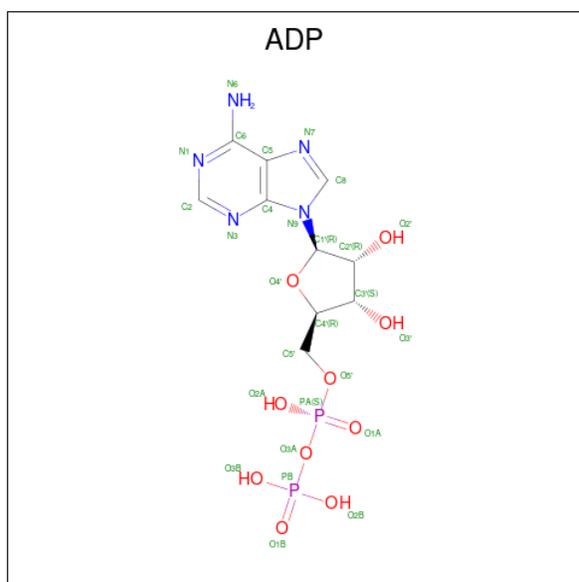
Mol	Chain	Residues	Atoms					AltConf
12	3	1	Total	C	N	O	P	0
			27	10	5	10	2	
12	5	1	Total	C	N	O	P	0
			27	10	5	10	2	
12	7	1	Total	C	N	O	P	0
			27	10	5	10	2	
12	B	1	Total	C	N	O	P	0
			27	10	5	10	2	
12	D	1	Total	C	N	O	P	0
			27	10	5	10	2	
12	F	1	Total	C	N	O	P	0
			27	10	5	10	2	

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: DNA replication licensing factor MCM2

Chain 2:

6%

67%   5%   28%

• Molecule 1: DNA replication licensing factor MCM2

Chain A:

6%

67%   5%   28%

• Molecule 2: DNA replication licensing factor MCM3

Chain 3:

• Molecule 2: DNA replication licensing factor MCM3

Chain B:

• Molecule 3: DNA replication licensing factor MCM4

Chain 4: 66% 31%

• Molecule 3: DNA replication licensing factor MCM4

Chain C:

66%   31%

• Molecule 4: Minichromosome maintenance protein 5

Chain 5:

6%

78%   7%   15%

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

• Molecule 4: Minichromosome maintenance protein 5

Chain D:

6%

77%　　7%　　15%

MET S2 D21 F31 K32 L40 D41 I75 F90 E91 T92 A93 Q96 V97 R106 ALA GLN SER ALA ASN ASN ASP LYS ASP PRO GLU ASN THR SER MET ASP THR ASP SER LEU LEU LEU ASN S131 F135 N144 Q145 T169 I200 THR GLY ASN T204

S217 A222 N223 E224 S225 N226 I227 G228 D229 E230 S231 T232 K233 D239 P240 L256 S303 LYS ASN GLY ALA GLY SER GLY ARG SER GLY GLY ASN GLY S319 D336 V337 E338 T339 S340 W343 N344 S345 V346 T347 M348 F349 T350 E353 E354 E355 L358

R362 K365 I410 L415 T420 A421 L426 V437 G441 K442 M458 V477 C478 M497 T517 S518 V519 I540 T544 L547 M552 D558 D559 H560 N561 E562 E563 N579 A580 N581 Q584 N585 Q586 Q587 E588 E589 E593 R613 A619

L622 N625 R630 N636 E637 L638 E639 S640 T641 E642 R643 S644 S645 I646 Q652 A672 A680 I681 Q694 D695 P696 I697 G698 G699 LEU ASN GLN ALA SER GLY THR SER LEU SER GLU ILE ARG ARG PHE GLU GLN LEU LYS ARG ARG LEU PRO ILE GLY TRP SER

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

• Molecule 5: DNA replication licensing factor MCM6

Chain 6:

59%　　　40%

MET SER SER PRO PHE PRO ALA ASP THR PRO SER SER ARG PRO ASN ARG PRO SER SER PRO PRO SER ILE GLY ALA GLY PHE GLY SER SER GLY LEU ASP SER GLN ILE GLY SER ARG LEU HIS PHE PRO SER SER GLN PRO HIS VAL SER ASN SER GLN THR GLY PRO

PHE VAL ASN SER THR GLN PHE SER SER GLN ARG LEU GLN THR ASP GLY SER ALA THR ASN ASP MET GLU GLY ASN GLU PRO ALA ARG SER PHE LYS SER ARG ALA LEU GLU ASN GLN H99 V100 K101 K102 V103 D104 D121 V124 Q125 SER THR ASP THR GLY V132 E141 I145

N163 G164 A165 L166 E195 L196 S200 ASP SER LEU LYS ARG SER GLU GLY ASP GLU GLN ALA ASP GLU GLU GLN ASP ASP MET ASN GLY SER LEU PRO ARG ASP SER GLY SER SER ALA ALA PRO GLY ASN GLY THR SER ALA MET ALA THR ARG SER ILE

THR THR SER THR SER PRO GLU Q258 T259 E260 S337 C338 E339 T370 T429 THR GLU GLY ASN ASN SER GLY VAL THR GLY LEU ARG SER L443 G463 SER ASN ILE GLY ALA SER SER PRO ASP ALA ASN SER ASN ARG GLU GLU THR LEU MET ALA ALA ASN LEU GLN

ALA ASN ASN VAL TYR GLN ASP ASN GLU ARG ASP GLN GLU GLU VAL PHE LEU ASN SER LEU SER SER ASP E512 K521 D522 E523 H524 G562 E616 E617 G618 G619 D620 D642 S647 V650 R688 V714 I715 L716 D717 D718 K737 E740 A741 I742 I764 L765 T766

K767 R770 D784 A785 GLN GLY PHE SER ARG S791 D839 V840 D841 D842 VAL GLU MET ASP GLU GLU PHE VAL ASP MET ASN ILE GLU SER GLN ASN HIS ALA ALA SER GLY ASN ASN ASP ASN ASP ASP GLY THR GLY ALA VAL ASP ILE VAL THR ASP GLU PRO ALA ASP ILE GLU GLU

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

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

GLU VAL LEU ASP LEU GLN GLU GLU PRO GLN SER SER

• Molecule 5: DNA replication licensing factor MCM6

Chain E:

58%   •   40%

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

PHE VAL ASN ASP SER THR GLN PHE SER GLN ARG GLN THR ASP GLY SER ALA THR ASN ASP MET GLU GLY ASN GLU PRO ALA ARG SER PHE LYS SER ARG ALA LEU ASN LEU PRO **H99 V100 K101 K102 V103 D104** D121 V124 Q125 SER ASP THR GLY GLU V132 E141 I145

N163 G164 A165 L166 E195 L196 S200 ASP SER LEU LYS ARG SER ARG SER GLU ASP GLU ASP GLU GLN GLU ASP ASP MET ASN SER GLU LEU PRO ARG SER GLY SER SER ALA PRO GLY ASN GLY THR SER ALA MET ALA THR ARG SER ILE

THR THR SER THR SER PRO GLU Q258 T259 E260 S337 C338 E339 T370 T429 THR GLU GLY LEU ASN SER GLY VAL THR GLY LEU ARG SER L443 G463 SER ASN ILE GLY ALA SER PRO ASP ALA ASN SER ASN ASN ARG GLU THR GLU LEU GLN MET ALA ALA ASN LEU GLN

ALA ASN ASN VAL TYR GLN ASP ASN GLU ARG ASP GLN VAL VAL PHE LEU ASN SER LEU SER ASP E512 K521 D522 E523 H524 G562 E616 E617 G618 G619 D620 D642 S647 V650 V714 I715 L716 D717 D718 A728 K737 E740 A741 I742 I764 L765 T766

K767 R770 D784 A785 GLY PHE SER ARG S791 D839 V840 D841 D842 VAL GLU MET ASP GLU GLU PHE ASP ILE GLU SER GLN SER HIS ALA ALA SER GLY ASN ASN ASP ASP ASN ASP GLY GLY THR GLY LEU SER GLY VAL ILE THR SER GLU PRO ALA ASP ILE GLU GLU

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

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

GLU VAL LEU ASP LEU GLN GLU GLU PRO GLN ASP SER SER

• Molecule 6: DNA replication licensing factor MCM7

Chain 7:

11%

85%   5%   11%

MET SER A3 V12 D13 L25 D31 THR LEU SER SER ASP ALA THR ARG ASN GLU ASN GLU ASP GLU GLN LEU ASP ALA GLU ASN ILE GLU GLN HIS LEU LEU GLU LYS G60 I85 Q89 L94 Q95 G96 T97 Q98 A99 D100 I121 E131 E160 S163 E164

M165 L166 MET ASP THR THR MET ASP PRO PRO SER SER MET N178 D179 A180 L181 R182 E183 V184 V185 E188 T189 E190 L191 R213 R216 R228 V241 R242 T277 T285 I327 D350 S395 E403 R413 D427 D446 M459 V464 A465 Q544

• Molecule 6: DNA replication licensing factor MCM7

Chain F:

• Molecule 7: DNA (53-MER)

Chain X:

• Molecule 8: DNA (53-MER)

Chain Y:

4   Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C2	Depositor
Number of particles used	135143	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 $(e^-/\text{Å}^2)$	51.2	Depositor
Minimum defocus (nm)	1500	Depositor
Maximum defocus (nm)	4500	Depositor
Magnification	130000	Depositor
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor
Maximum map value	0.080	Depositor
Minimum map value	-0.039	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.003	Depositor
Recommended contour level	0.02	Depositor
Map size (Å)	453.6, 453.6, 453.6	wwPDB
Map dimensions	420, 420, 420	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.08, 1.08, 1.08	Depositor

5   Model quality (i)

5.1   Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: ATP, MG, ZN, ADP

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	0.38	0/5025	0.64	0/6790
1	A	0.38	0/5025	0.64	0/6790
2	3	0.31	0/4894	0.57	0/6635
2	B	0.31	0/4894	0.57	0/6635
3	4	0.36	0/5192	0.60	0/7016
3	C	0.36	0/5192	0.60	0/7016
4	5	0.38	0/5210	0.60	0/7046
4	D	0.38	0/5210	0.60	0/7046
5	6	0.33	0/4952	0.57	0/6679
5	E	0.33	0/4952	0.57	0/6679
6	7	0.36	0/6068	0.61	0/8199
6	F	0.36	0/6068	0.61	0/8199
7	X	0.49	0/1217	0.86	0/1876
8	Y	0.51	0/1219	0.85	0/1879
All	All	0.36	0/65118	0.61	0/88485

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.

WORLDWIDE
wwPDB
PROTEIN DATA BANK

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	2	4938	0	4997	25	0
1	A	4938	0	4997	24	0
2	3	4811	0	4893	25	0
2	B	4811	0	4893	25	0
3	4	5120	0	5187	13	0
3	C	5120	0	5187	14	0
4	5	5136	0	5177	25	0
4	D	5136	0	5177	27	0
5	6	4874	0	4918	13	0
5	E	4874	0	4918	14	0
6	7	5976	0	6057	19	0
6	F	5976	0	6057	20	0
7	X	1086	0	596	1	0
8	Y	1087	0	595	1	0
9	2	31	0	12	0	0
9	A	31	0	12	0	0
10	2	1	0	0	0	0
10	3	1	0	0	0	0
10	5	1	0	0	0	0
10	7	1	0	0	0	0
10	A	1	0	0	0	0
10	B	1	0	0	0	0
10	D	1	0	0	0	0
10	F	1	0	0	0	0
11	2	1	0	0	0	0
11	4	1	0	0	0	0
11	5	1	0	0	0	0
11	6	1	0	0	0	0
11	7	1	0	0	0	0
11	A	1	0	0	0	0
11	C	1	0	0	0	0
11	D	1	0	0	0	0
11	E	1	0	0	0	0
11	F	1	0	0	0	0
12	3	27	0	12	0	0
12	5	27	0	12	0	0
12	7	27	0	12	0	0
12	B	27	0	12	0	0
12	D	27	0	12	0	0
12	F	27	0	12	0	0
All	All	64125	0	63745	231	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 231 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)
1:2:501:MET:O	1:2:502:ALA:C	2.41	0.58
1:A:501:MET:O	1:A:502:ALA:C	2.41	0.58
4:5:410:ILE:HG23	4:5:552:MET:HE1	1.91	0.52
4:D:410:ILE:HG23	4:D:552:MET:HE1	1.93	0.51
3:C:729:LEU:O	3:C:730:GLU:C	2.50	0.50

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	618/868 (71%)	583 (94%)	32 (5%)	3 (0%)	25	56
1	A	618/868 (71%)	583 (94%)	32 (5%)	3 (0%)	25	56
2	3	604/1006 (60%)	582 (96%)	22 (4%)	0	100	100
2	B	604/1006 (60%)	582 (96%)	22 (4%)	0	100	100
3	4	637/933 (68%)	604 (95%)	33 (5%)	0	100	100
3	C	637/933 (68%)	604 (95%)	33 (5%)	0	100	100
4	5	648/775 (84%)	603 (93%)	43 (7%)	2 (0%)	37	67
4	D	648/775 (84%)	603 (93%)	43 (7%)	2 (0%)	37	67
5	6	603/1017 (59%)	570 (94%)	33 (6%)	0	100	100
5	E	603/1017 (59%)	570 (94%)	33 (6%)	0	100	100
6	7	747/845 (88%)	718 (96%)	28 (4%)	1 (0%)	48	77
6	F	747/845 (88%)	718 (96%)	28 (4%)	1 (0%)	48	77
All	All	7714/10888 (71%)	7320 (95%)	382 (5%)	12 (0%)	45	73

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	2	435	ASP
6	7	755	THR
1	A	435	ASP
6	F	755	THR
1	2	412	ALA

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	2	548/770 (71%)	540 (98%)	8 (2%)	60	86
1	A	548/770 (71%)	540 (98%)	8 (2%)	60	86
2	3	530/864 (61%)	526 (99%)	4 (1%)	79	93
2	B	530/864 (61%)	526 (99%)	4 (1%)	79	93
3	4	584/848 (69%)	578 (99%)	6 (1%)	73	91
3	C	584/848 (69%)	577 (99%)	7 (1%)	67	89
4	5	589/688 (86%)	579 (98%)	10 (2%)	56	84
4	D	589/688 (86%)	579 (98%)	10 (2%)	56	84
5	6	538/886 (61%)	538 (100%)	0	100	100
5	E	538/886 (61%)	538 (100%)	0	100	100
6	7	671/753 (89%)	664 (99%)	7 (1%)	73	91
6	F	671/753 (89%)	664 (99%)	7 (1%)	73	91
All	All	6920/9618 (72%)	6849 (99%)	71 (1%)	71	91

5 of 71 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	365	LYS
4	D	586	GLN
6	F	191	LEU
4	5	613	ARG
4	5	586	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 18 such sidechains are listed below:

Mol	Chain	Res	Type
5	E	274	HIS
6	F	538	HIS
5	E	730	HIS
6	7	538	HIS
4	D	652	GLN

5.3.3   RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5   Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6   Ligand geometry ⓘ

Of 26 ligands modelled in this entry, 18 are monoatomic - leaving 8 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
12	ADP	F	1000	10	24,29,29	0.78	0	29,45,45	0.87	1 (3%)
12	ADP	5	1000	10	24,29,29	1.04	2 (8%)	29,45,45	0.84	1 (3%)
12	ADP	3	1000	10	24,29,29	0.77	0	29,45,45	0.91	1 (3%)
12	ADP	7	1000	10	24,29,29	0.78	0	29,45,45	0.87	1 (3%)
12	ADP	B	1000	10	24,29,29	0.77	0	29,45,45	0.91	1 (3%)
12	ADP	D	1000	10	24,29,29	1.04	2 (8%)	29,45,45	0.84	1 (3%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
9	ATP	A	1000	10	26,33,33	0.80	0	31,52,52	0.89	1 (3%)
9	ATP	2	1000	10	26,33,33	0.80	0	31,52,52	0.89	1 (3%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
12	ADP	F	1000	10	-	3/12/32/32	0/3/3/3
12	ADP	5	1000	10	-	3/12/32/32	0/3/3/3
12	ADP	3	1000	10	-	2/12/32/32	0/3/3/3
12	ADP	7	1000	10	-	3/12/32/32	0/3/3/3
12	ADP	B	1000	10	-	2/12/32/32	0/3/3/3
12	ADP	D	1000	10	-	3/12/32/32	0/3/3/3
9	ATP	A	1000	10	-	5/18/38/38	0/3/3/3
9	ATP	2	1000	10	-	5/18/38/38	0/3/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
12	D	1000	ADP	PB-O2B	-3.15	1.42	1.54
12	5	1000	ADP	PB-O2B	-3.15	1.42	1.54
12	5	1000	ADP	C8-N7	-2.08	1.31	1.34
12	D	1000	ADP	C8-N7	-2.08	1.31	1.34

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
9	2	1000	ATP	C5-C6-N6	2.85	124.68	120.35
9	A	1000	ATP	C5-C6-N6	2.85	124.68	120.35
12	3	1000	ADP	C5-C6-N6	2.69	124.44	120.35
12	B	1000	ADP	C5-C6-N6	2.69	124.44	120.35
12	7	1000	ADP	C5-C6-N6	2.63	124.35	120.35

There are no chirality outliers.

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	2	1000	ATP	PB-O3B-PG-O3G
9	A	1000	ATP	PB-O3B-PG-O3G
12	7	1000	ADP	C5'-O5'-PA-O1A
12	F	1000	ADP	C5'-O5'-PA-O1A
12	7	1000	ADP	C5'-O5'-PA-O3A

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand ADP F 1000

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP 5 1000

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP 3 1000

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP 7 1000

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP B 1000

Bond lengths

Bond angles

Torsions

Rings

Ligand ADP D 1000

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP A 1000

Bond lengths

Bond angles

Torsions

Rings

Ligand ATP 2 1000

Bond lengths

Bond angles

Torsions

Rings

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Map visualisation (i)

This section contains visualisations of the EMDB entry EMD-19186. 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
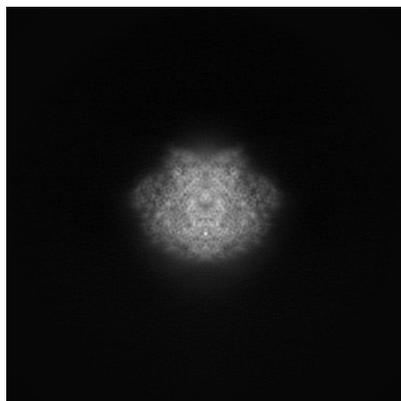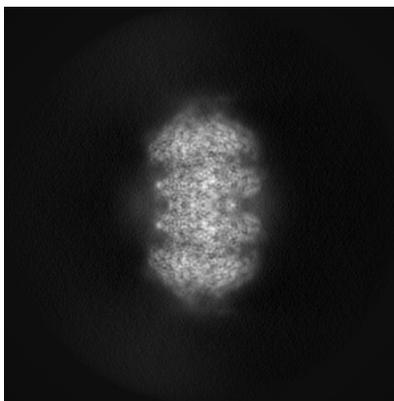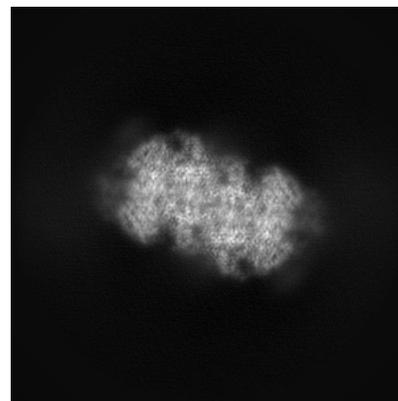
X	Y	Z

6.1.2 Raw map

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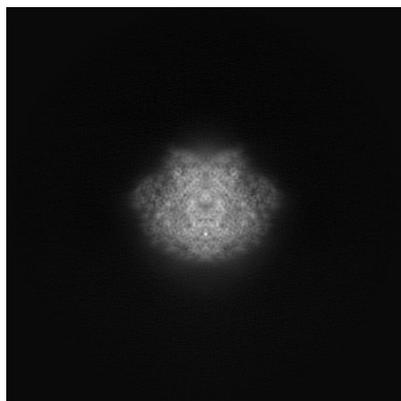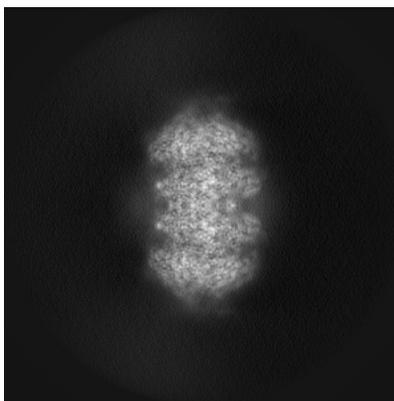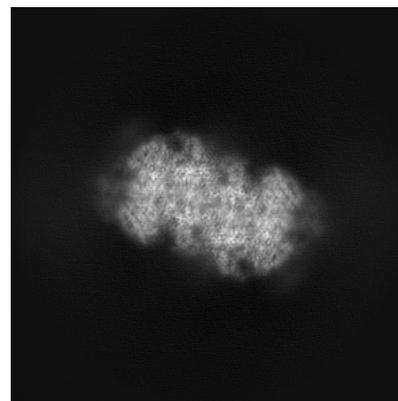
The images above show the map projected in three orthogonal directions.

6.2 Central slices ⓘ
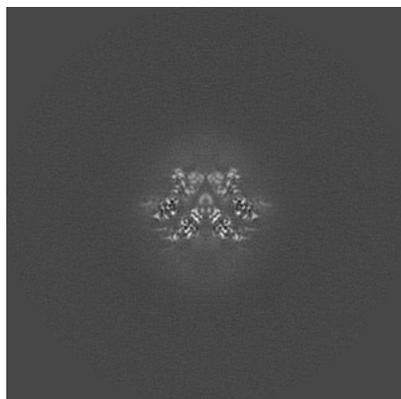
6.2.1 Primary map
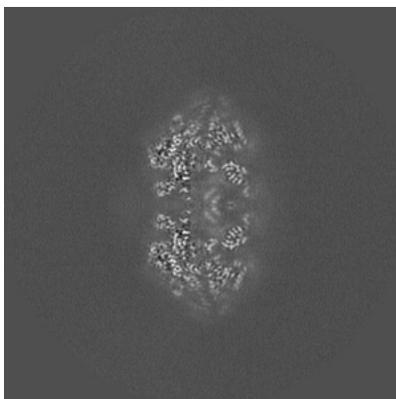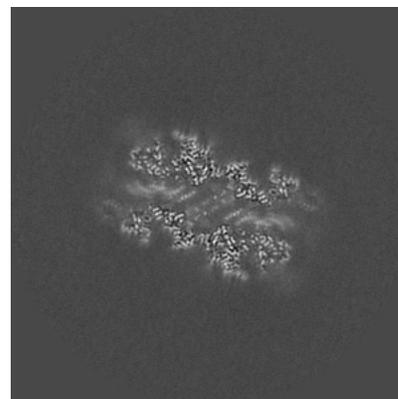
| X Index: 210 | Y Index: 210 | Z Index: 210 |

6.2.2 Raw map
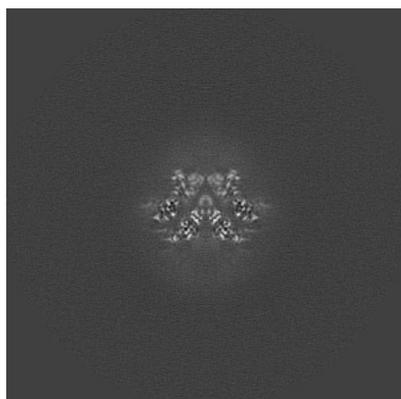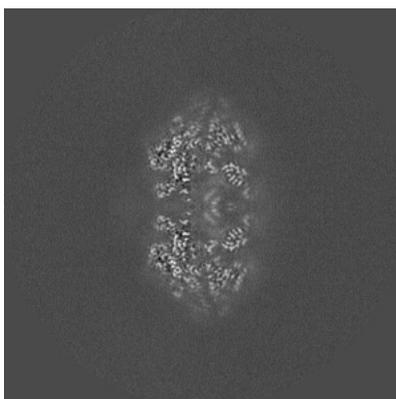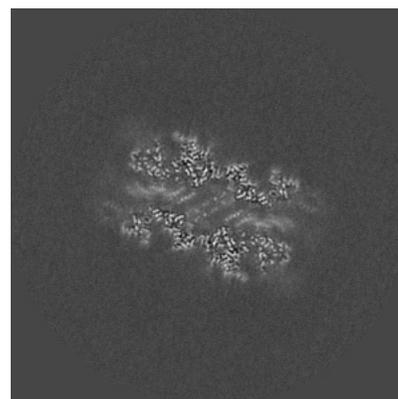
| X Index: 210 | Y Index: 210 | Z Index: 210 |

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

6.3 Largest variance slices (i)

6.3.1 Primary map
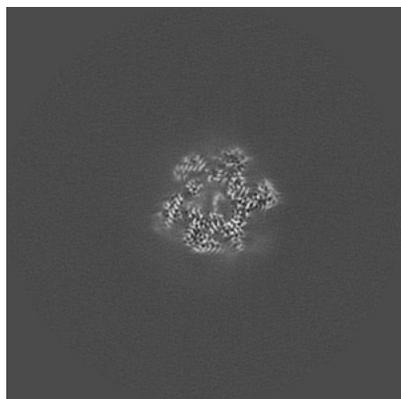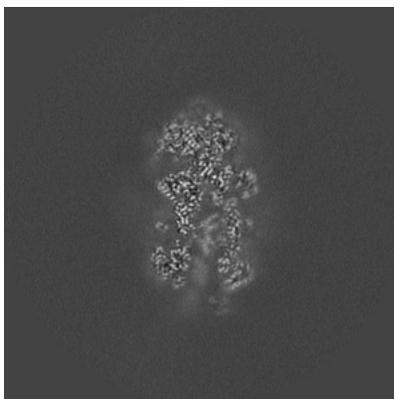
| X Index: 187 | Y Index: 222 | Z Index: 185 |
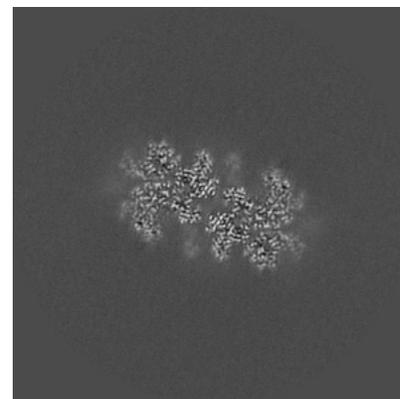
6.3.2 Raw map
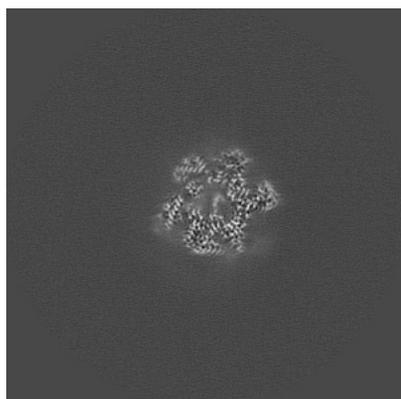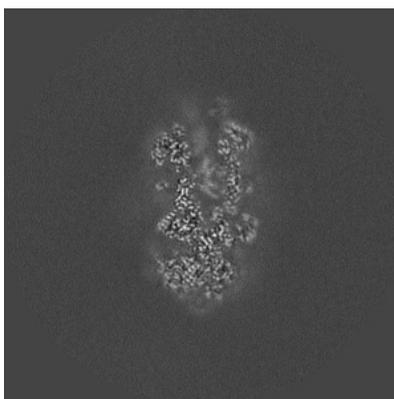
| X Index: 187 | Y Index: 198 | Z Index: 185 |
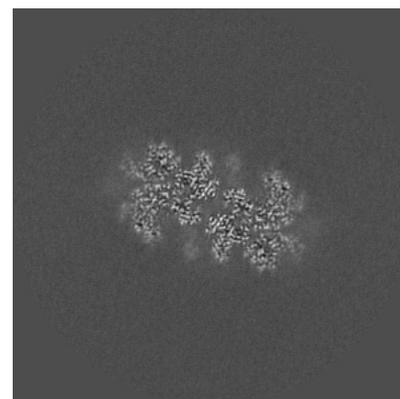
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) ⓘ

6.4.1 Primary map
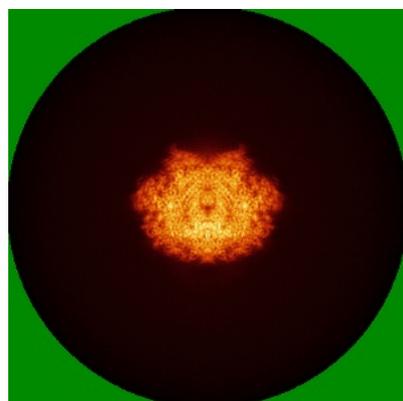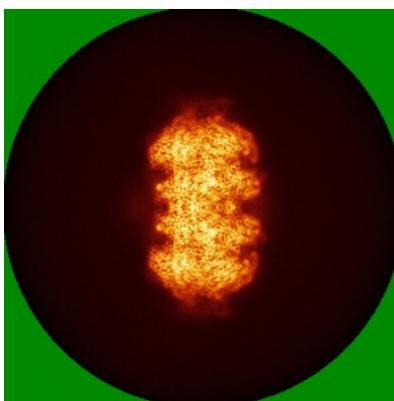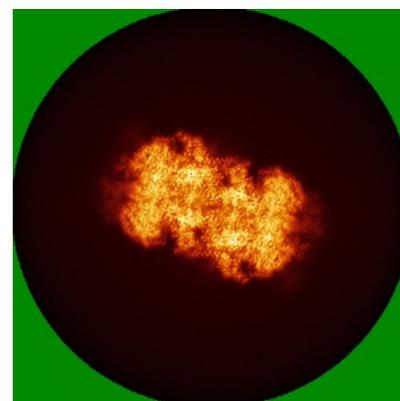
X   Y   Z

6.4.2 Raw map

X   Y   Z
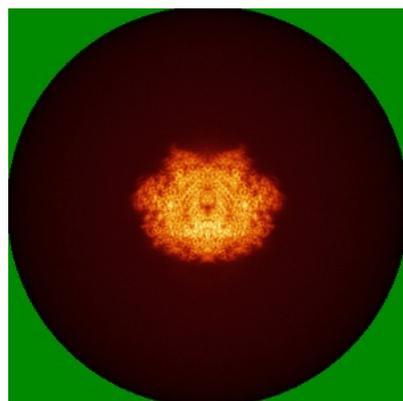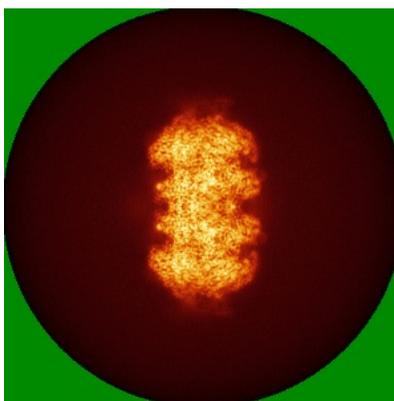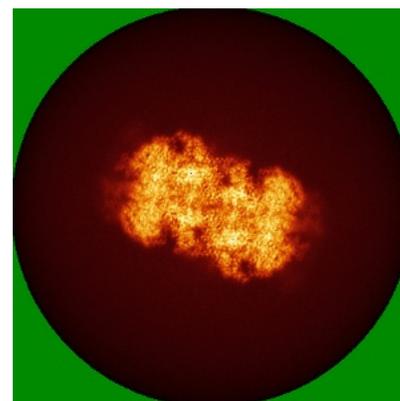
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views ⓘ

6.5.1 Primary map

| | | |
| X | Y | Z |
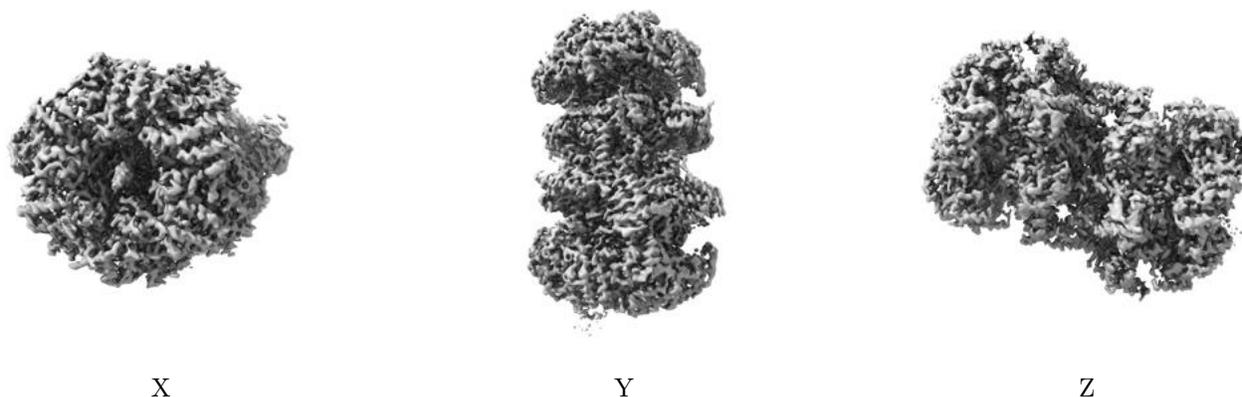
The images above show the 3D surface view of the map at the recommended contour level 0.02. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 Raw map

| | | |
| X | Y | Z |
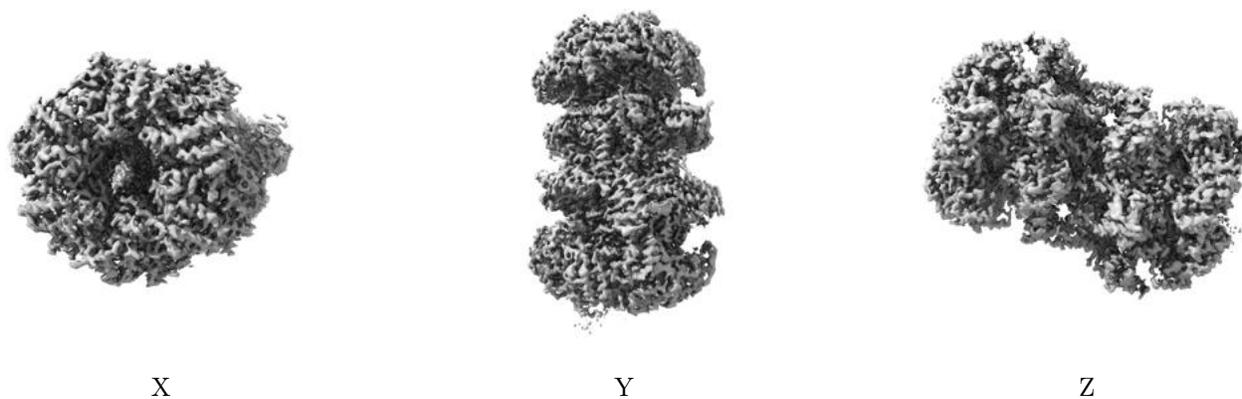
These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

6.6   Mask visualisation ⓘ

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_19186_msk_1.map ⓘ

X   Y   Z
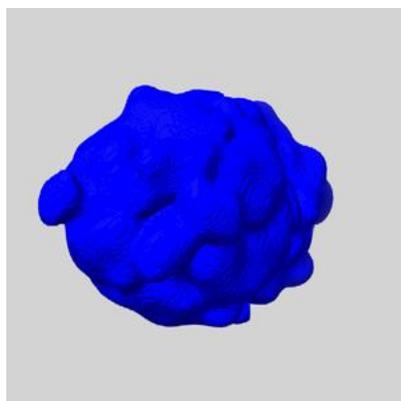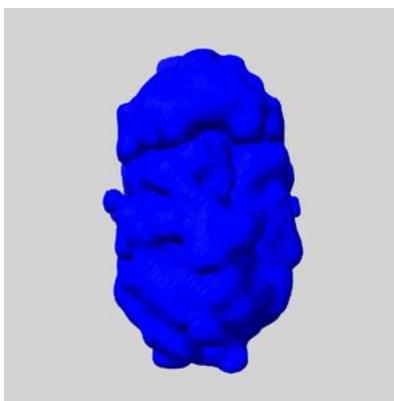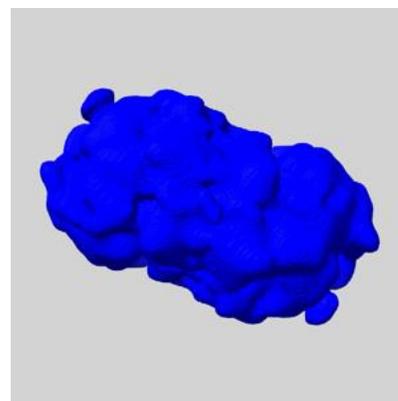
7 Map analysis ⓘ

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

7.1 Map-value distribution ⓘ

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 ⓘ
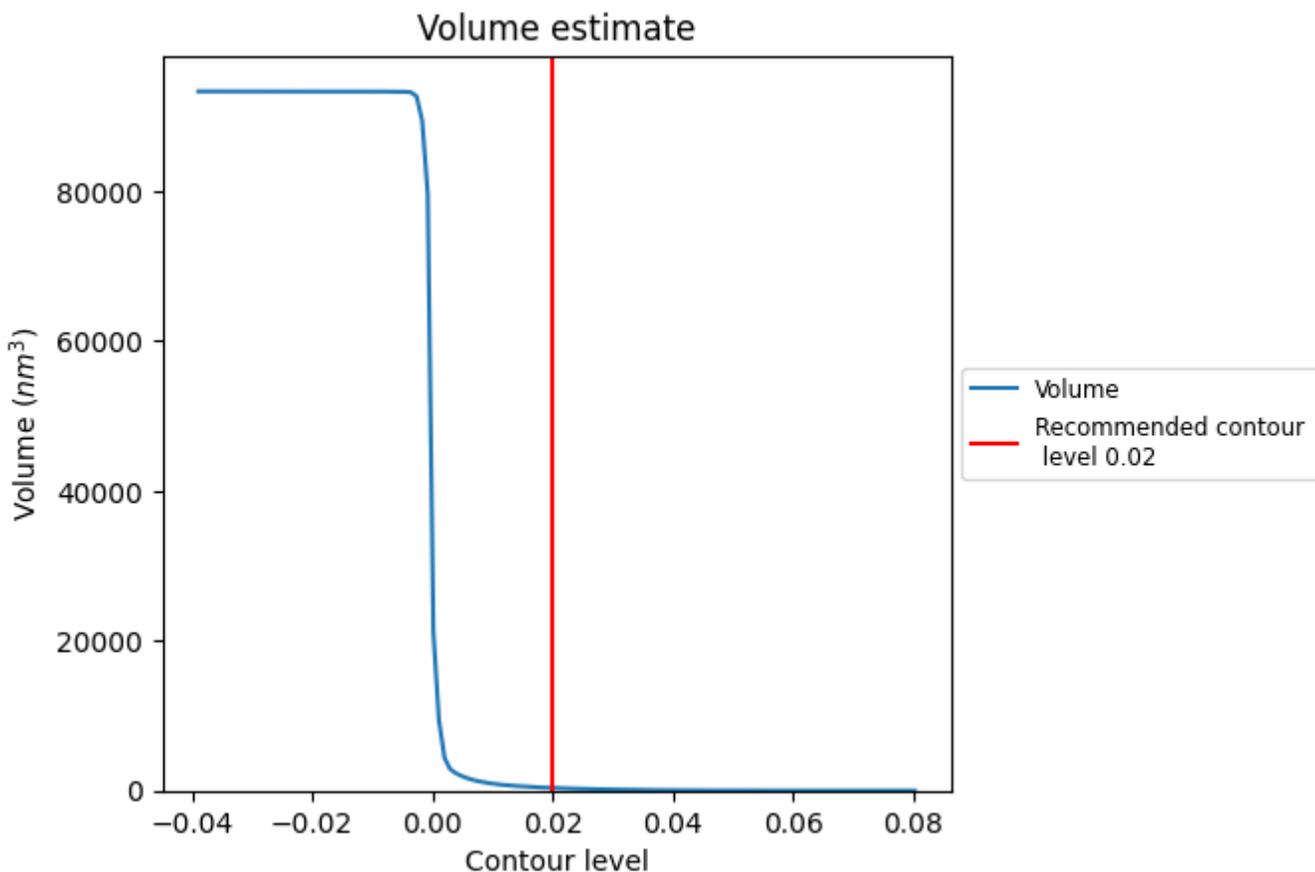
The volume at the recommended contour level is 363 nm^3; this corresponds to an approximate mass of 328 kDa.

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 ⓘ
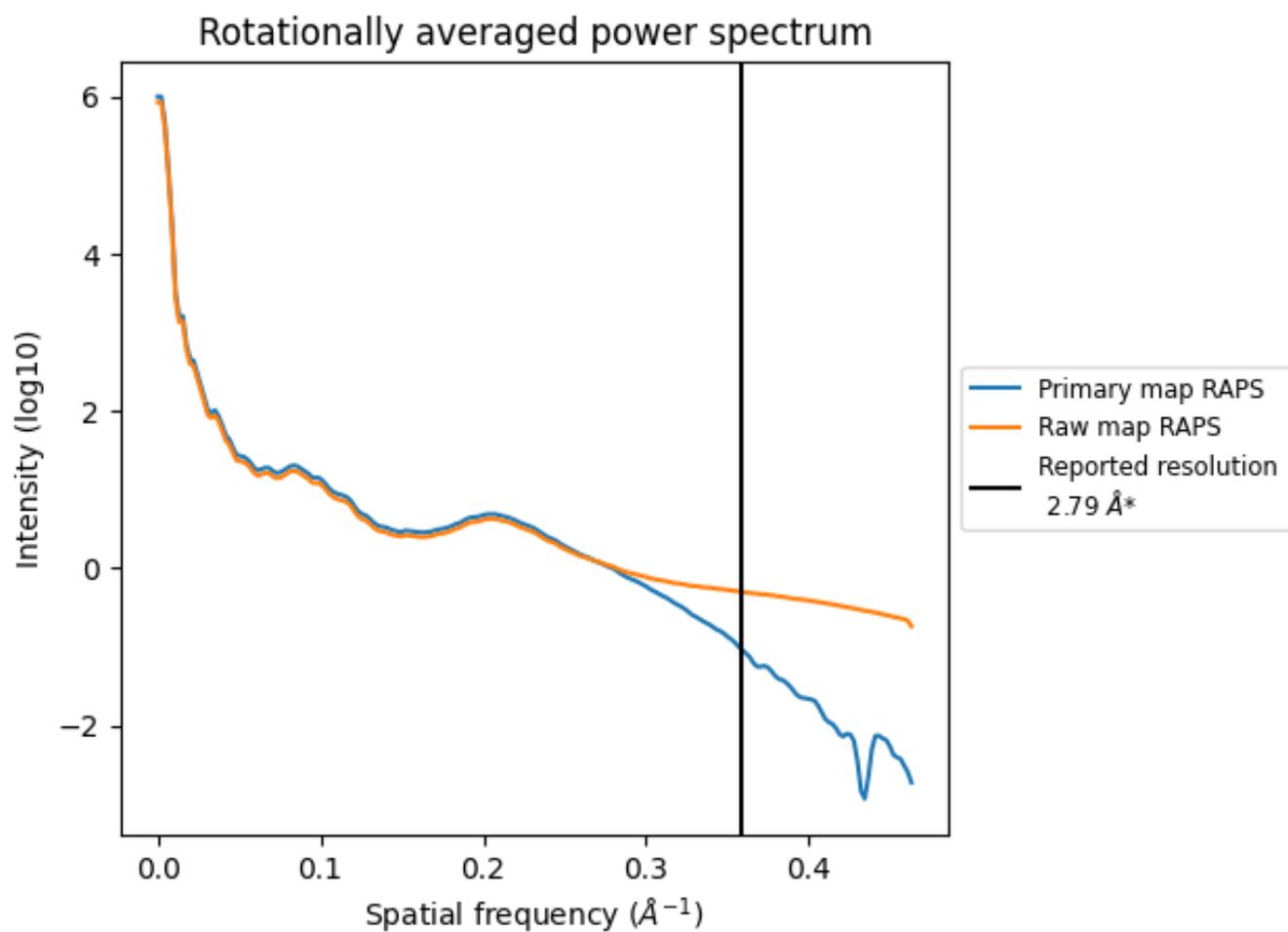
*Reported resolution corresponds to spatial frequency of 0.358 Å^{-1}

8   Fourier-Shell correlation (i)

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

8.1   FSC (i)
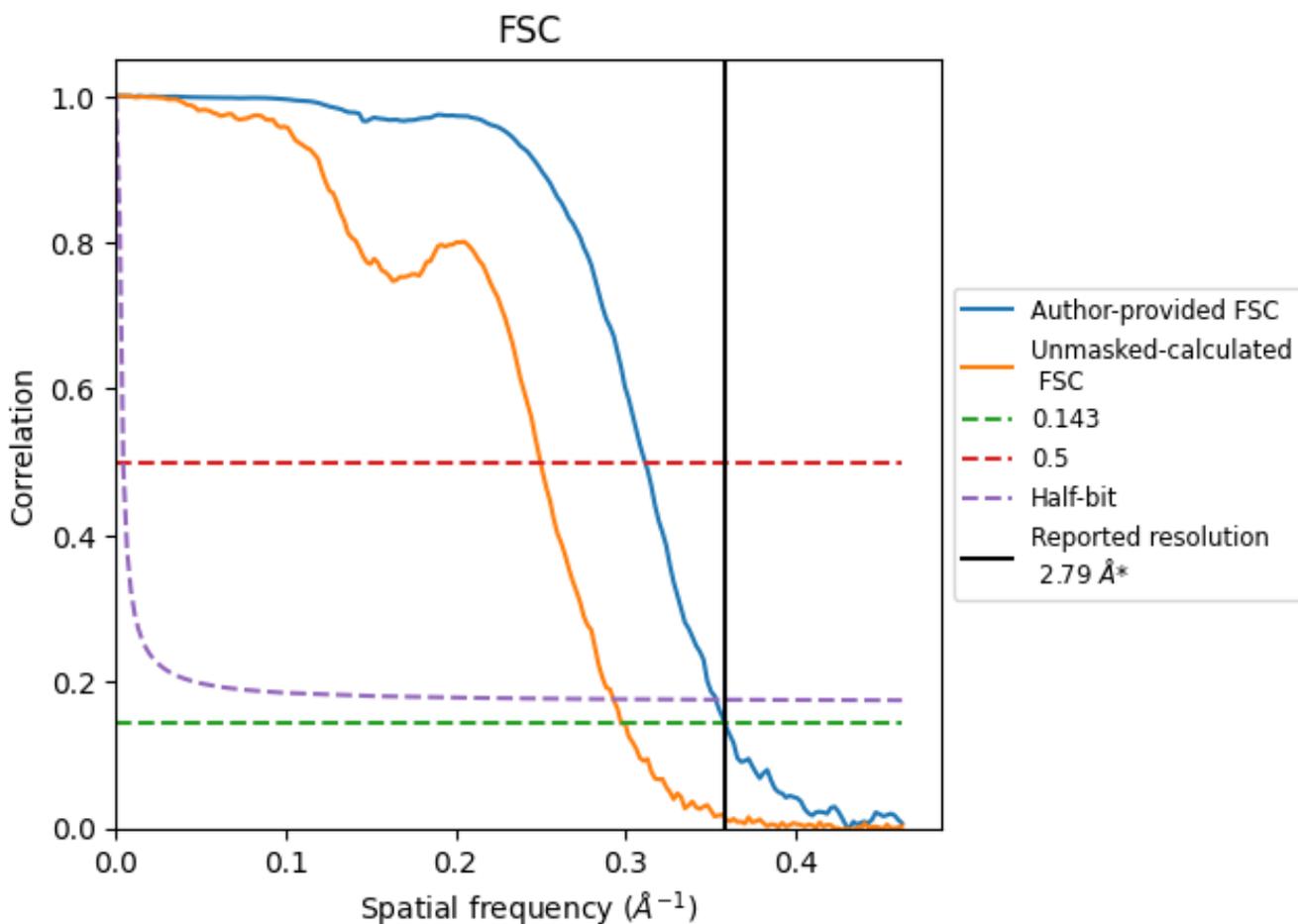
*Reported resolution corresponds to spatial frequency of 0.358 Å^{-1}

8.2 Resolution estimates (i)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.79	-	-
Author-provided FSC curve	2.79	3.21	2.83
Unmasked-calculated*	3.36	4.00	3.41

*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 3.36 differs from the reported value 2.79 by more than 10 %

9 Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-19186 and PDB model 8RIF. Per-residue inclusion information can be found in section 3 on page 10.

9.1 Map-model overlay ⓘ

| X | Y | Z |
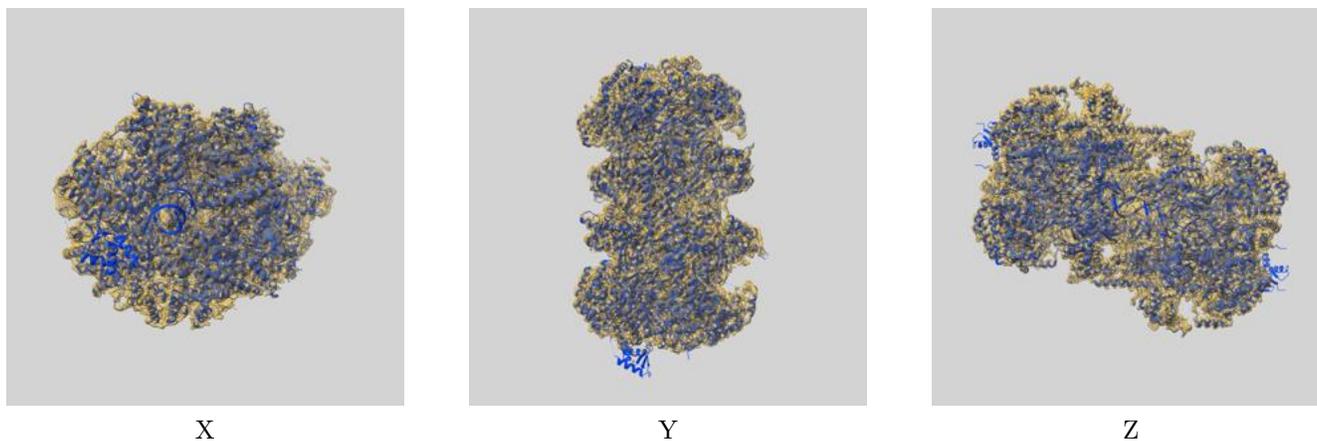
The images above show the 3D surface view of the map at the recommended contour level 0.02 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

## 9.2   Q-score mapped to coordinate model ⓘ

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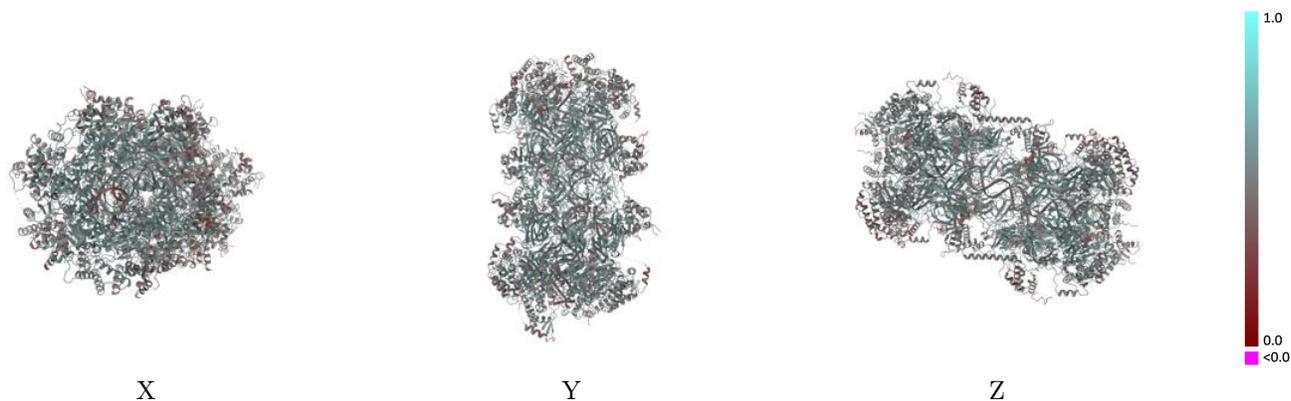
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

X   Y   Z
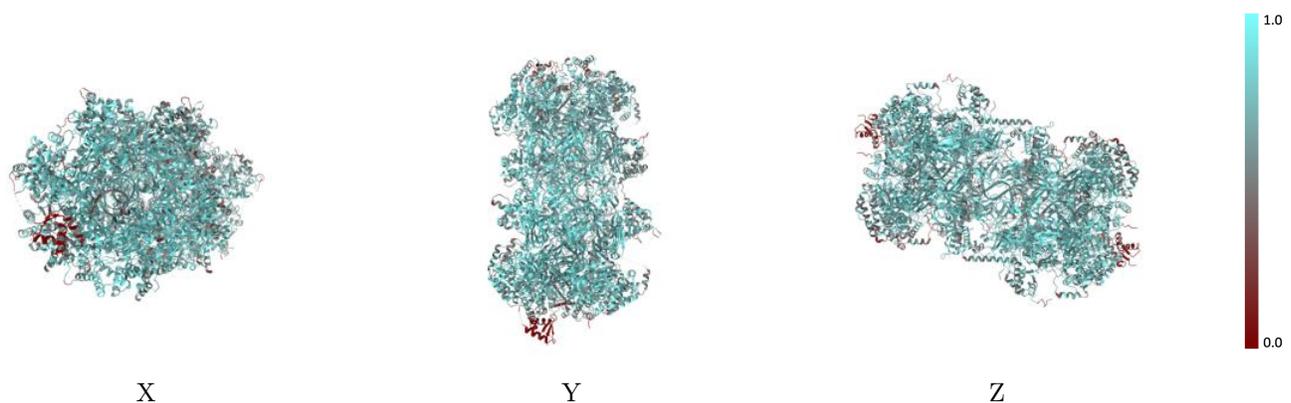
The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.02).

9.4 Atom inclusion (i)
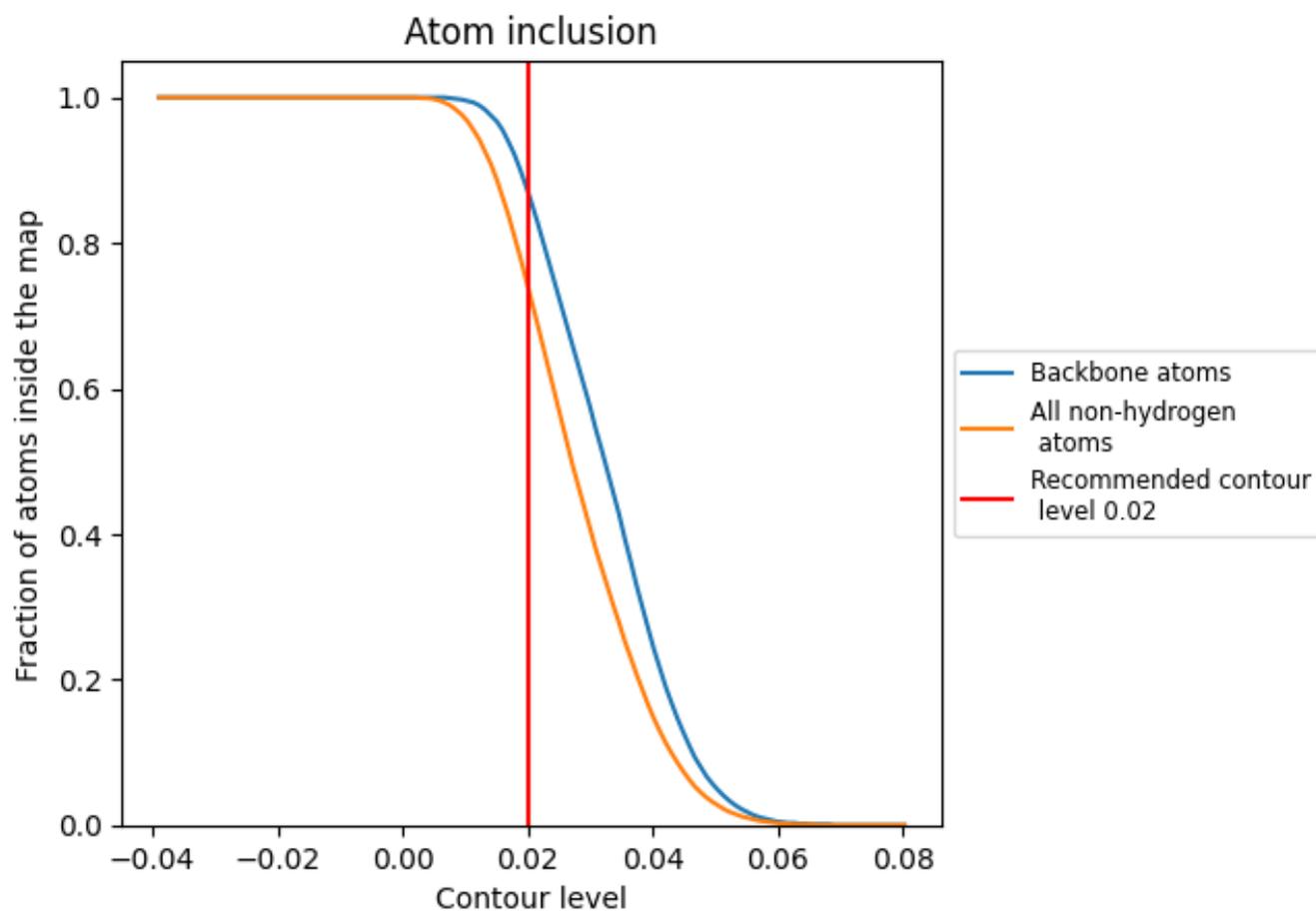
At the recommended contour level, 87% of all backbone atoms, 74% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary ⓘ

The table lists the average atom inclusion at the recommended contour level (0.02) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.7420	0.5160
2	0.7140	0.4990
3	0.8070	0.5360
4	0.7480	0.5180
5	0.7480	0.5060
6	0.7400	0.5220
7	0.7200	0.5210
A	0.7120	0.5000
B	0.8070	0.5380
C	0.7450	0.5170
D	0.7450	0.5080
E	0.7380	0.5230
F	0.7180	0.5210
X	0.6960	0.4630
Y	0.6960	0.4670

1.0

0.0
<0.0