Full wwPDB EM Validation Report ⓘ

Nov 3, 2024 – 05:04 PM EST

PDB ID	:	8TM5
EMDB ID	:	EMD-41379
Title	:	Human mixed 13S proteasome assembly intermediate
Authors	:	Zhang, H.; Zhao, J.
Deposited on	:	2023-07-28
Resolution	:	3.00 Å(reported)

This is a Full wwPDB EM Validation 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:
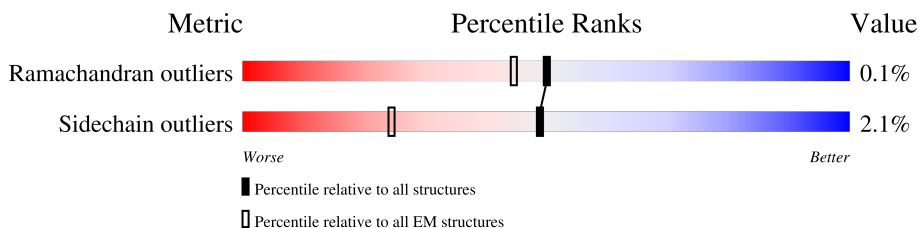
EMDB validation analysis	:	0.0.1.dev113
MolProbity	:	4.02b-467
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 3.00 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.
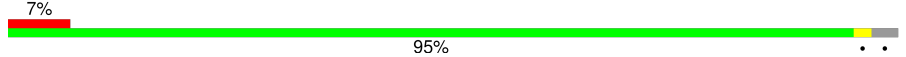
Metric	Percentile Ranks	Value
Ramachandran outliers		0.1%
Sidechain outliers		2.1%

Worse   *Better*

▪ Percentile relative to all structures

▯ Percentile relative to all EM structures

Metric	Whole archive (#Entries)	EM structures (#Entries)
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	A	234	99%
2	B	261	96%
3	C	248	95%
4	D	241	93%
5	E	263	88% 11%
6	F	255	93% 6%
7	G	246	97%
8	H	277	78% 21%
9	I	205	83% 15%

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Mol	Chain	Length	Quality of chain
10	J	201	82% · 16%
11	c	288	7% 95% · ·
12	d	264	91% · 6%
13	e	141	67% · 30%

2 Entry composition (i)

There are 13 unique types of molecules in this entry. The entry contains 21689 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 Proteasome subunit alpha type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	233	Total 1800	C 1153	N 308	O 333	S 6	0	0

- Molecule 2 is a protein called Proteasome subunit alpha type-4.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	251	Total 1933	C 1226	N 337	O 360	S 10	0	0

- Molecule 3 is a protein called Proteasome subunit alpha type-7.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	238	Total 1792	C 1133	N 325	O 329	S 5	0	0

- Molecule 4 is a protein called Proteasome subunit alpha type-5.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	232	Total 1708	C 1081	N 288	O 328	S 11	0	0

- Molecule 5 is a protein called Proteasome subunit alpha type-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	E	235	Total 1816	C 1147	N 329	O 328	S 12	0	0

- Molecule 6 is a protein called Proteasome subunit alpha type-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	F	239	Total 1832	C 1164	N 316	O 341	S 11	0	0

• Molecule 7 is a protein called Proteasome subunit alpha type-6.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	G	245	Total	C	N	O	S	0	0
			1873	1194	318	349	12		

• Molecule 8 is a protein called Proteasome subunit beta type-7.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	H	219	Total	C	N	O	S	0	0
			1596	1010	271	305	10		

• Molecule 9 is a protein called Proteasome subunit beta type-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	I	175	Total	C	N	O	S	0	0
			1331	856	222	239	14		

• Molecule 10 is a protein called Proteasome subunit beta type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	J	168	Total	C	N	O	S	0	0
			1222	786	205	224	7		

• Molecule 11 is a protein called Proteasome assembly chaperone 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
11	c	279	Total	C	N	O	S	0	0
			2092	1347	350	378	17		

• Molecule 12 is a protein called Proteasome assembly chaperone 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	d	247	Total	C	N	O	S	0	0
			1907	1232	311	350	14		

• Molecule 13 is a protein called Proteasome maturation protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	e	99	Total	C	N	O	S	0	0
			787	500	132	151	4		

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: Proteasome subunit alpha type-2

Chain A: 99%

MET A2 E3 N42 Q52 C137 A234
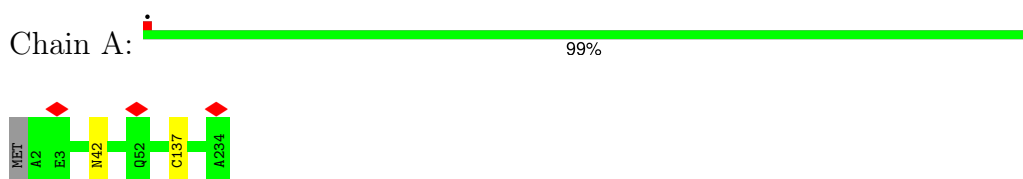
• Molecule 2: Proteasome subunit alpha type-4

Chain B: 96%

MET S2 D151 K251 K252 GLU LYS GLU GLN LYS GLU LYS ASP LYS
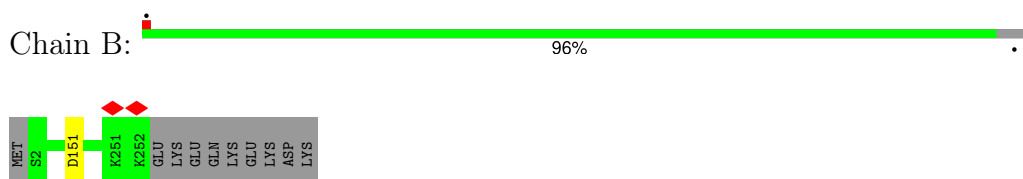
• Molecule 3: Proteasome subunit alpha type-7

Chain C: 95%

MET S2 K48 F138 D178 N239 GLU LYS LYS LYS GLN LYS LYS ALA SER
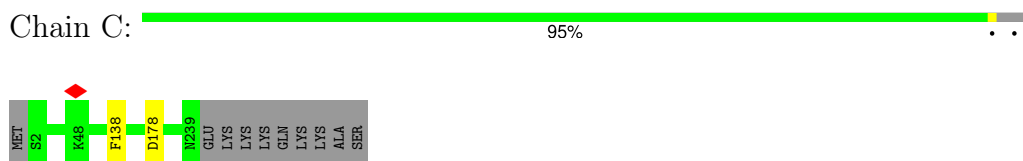
• Molecule 4: Proteasome subunit alpha type-5

Chain D: 93%

M1 R5 C47 E69 L88 N98 M107 G124 GLU GLU ASP ALA ASP PRO GLY A132 A194 M206 M228 I238 K239 ASP ILE
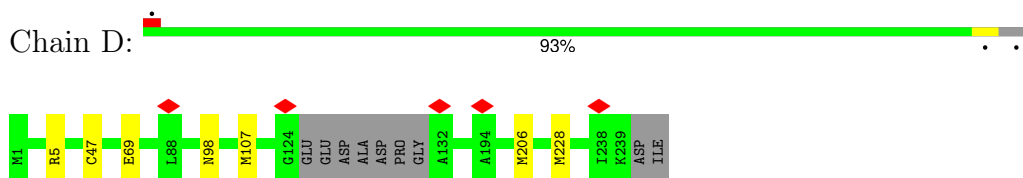
• Molecule 5: Proteasome subunit alpha type-1

Chain E: 88% 11%

M1 Y6 R51 ALA GLN SER E55 L83 F154 D225 D228 E238 ARG PRO GLN ARG LYS ALA GLN PRO ALA GLN PRO ALA ASP GLU PRO ALA GLU LYS ALA ASP GLU PRO MET GLU HIS
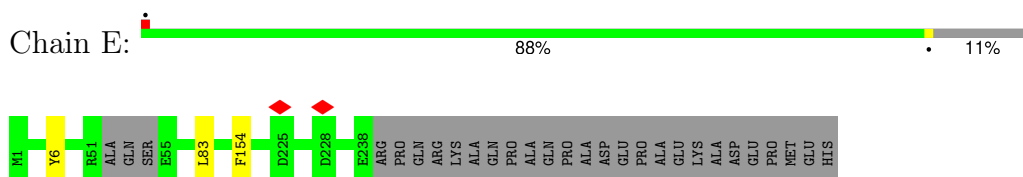
• Molecule 6: Proteasome subunit alpha type-3

Chain F:

93%   6%

MET SER SER ILE **G5** **M185** **W216** **S243** LEU LYS GLU GLU GLU SER ASP ASP ASN MET

• Molecule 7: Proteasome subunit alpha type-6

Chain G:

97%

M1 **S2** **R3** **C78** **D86** **F187** **N224** **E232** **N245** ASP

• Molecule 8: Proteasome subunit beta type-7

Chain H:

78%   21%

MET ALA **A-41** **V-40** **S-39** **N-26** **T18** ARG ALA THR GLU GLY MET VAL VAL ALA ASP LYS ASN CYS **S32** **D53** **F164** ASN ASP LEU GLY SER GLY **S171** **K182** LEU ASP PHE LEU ARG PRO TYR THR VAL PRO ASN LYS LYS GLY THR ARG LEU GLY ARG TYR ARG CYS **E205**

L219 GLU ILE GLU VAL LEU GLU GLU THR VAL GLN THR MET ASP THR SER
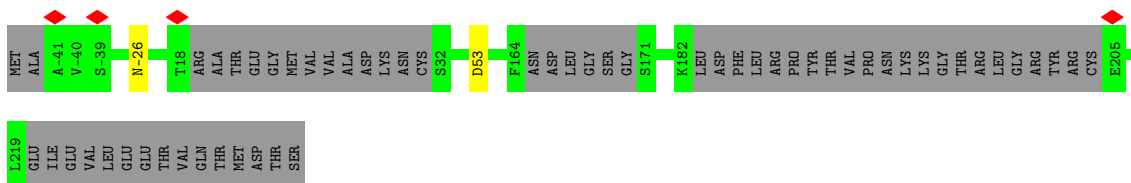
• Molecule 9: Proteasome subunit beta type-3

Chain I:

83%   15%

MET SER ILE MET SER TYR **N7** **R27** PHE GLY ILE GLN ALA GLN MET VAL THR THR **D38** **D47** **D59** **D134** **T141** **C142** **F164** **N173** ALA VAL ASP ARG ASP ALA VAL SER GLY MET **G184** **K201** ALA ARG MET ASP
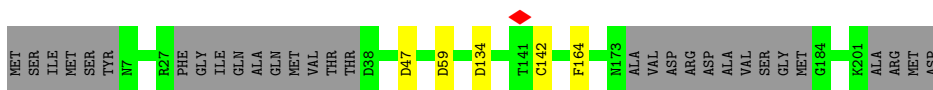
• Molecule 10: Proteasome subunit beta type-2

Chain J:

82%   16%

MET GLU **Y3** **D18** ARG VAL ALA ALA SER ASN ILE VAL GLN MET LYS ASP ASP HIS **D33** **F36** **S94** **N101** **H132** GLY TYR GLY ALA **F137** **C163** **L167** **R170** PHE ILE LEU ASN LEU PRO **T177** **F178** **D192** **N193** **I194** SER PHE PRO LYS GLN GLY SER
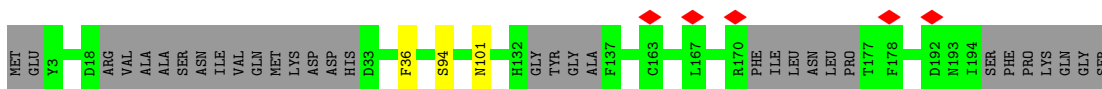
• Molecule 11: Proteasome assembly chaperone 1

Chain c:

7%

95%

MET **A2** **E21** **E24** **E25** **E26** **G27** **R28** **R29** **E30** **E33** **D34** **L50** **Q53** **T54** **K55** **M88** **R107** **T108** **T109** ASP THR THR HIS LEU SER SER THR **E118** **S156** **C169** **D199** **L234** **K260** **M277** **N280** **S284** **T288**
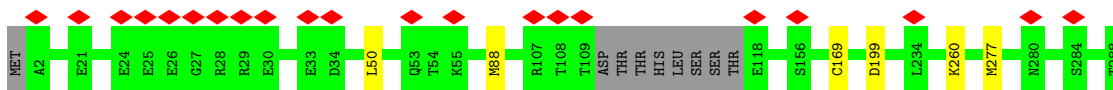
• Molecule 12: Proteasome assembly chaperone 2

Chain d:

91%   6%

M1 V24 M55 Y61 S79 L106 S123 S166 ARG CYS ILE PRO GLU ILE ASP ASP SER E176 D192 L234 SER ASP ASP PRO THR VAL SER ALA S243 F264
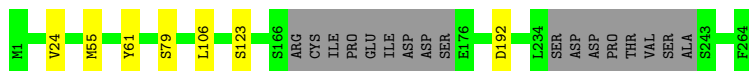
• Molecule 13: Proteasome maturation protein

Chain e:

67%　　　　　　　　　30%

MET ASN ALA ARG GLY LEU GLY SER GLU LEU LYS ASP SER ILE PRO VAL THR GLU LEU SER ALA SER GLY PRO PHE GLU SER HIS ASP LEU LEU ARG LYS GLY PHE SER CYS VAL LYS ASN GLU LEU L43 P44 L57 Q80 Q88 S98 D109 D116 L141
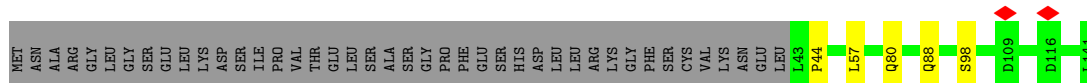
4   Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	44644	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 $(e^-/\text{Å}^2)$	30	Depositor
Minimum defocus (nm)	1700	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	34.712	Depositor
Minimum map value	-15.962	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	1.000	Depositor
Recommended contour level	7	Depositor
Map size (Å)	423.99997, 423.99997, 423.99997	wwPDB
Map dimensions	400, 400, 400	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.06, 1.06, 1.06	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	A	0.26	0/1839	0.47	0/2493
2	B	0.25	0/1963	0.49	0/2651
3	C	0.25	0/1818	0.50	0/2467
4	D	0.26	0/1735	0.48	0/2354
5	E	0.25	0/1850	0.51	0/2501
6	F	0.26	0/1867	0.48	0/2519
7	G	0.26	0/1907	0.46	0/2581
8	H	0.25	0/1621	0.49	0/2200
9	I	0.26	0/1355	0.48	0/1831
10	J	0.26	0/1242	0.49	0/1691
11	c	0.25	0/2137	0.48	0/2916
12	d	0.25	0/1949	0.46	0/2644
13	e	0.32	0/801	0.61	1/1081 (0.1%)
All	All	0.26	0/22084	0.49	1/29929 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
13	e	44	PRO	CA-N-CD	-11.15	95.89	111.50

There are no chirality outliers.

There are no planarity outliers.

5.2   Too-close contacts ⓘ

Due to software issues we are unable to calculate clashes - this section is therefore empty.

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	A	231/234 (99%)	222 (96%)	9 (4%)	0	100	100
2	B	249/261 (95%)	247 (99%)	2 (1%)	0	100	100
3	C	236/248 (95%)	229 (97%)	6 (2%)	1 (0%)	30	66
4	D	228/241 (95%)	224 (98%)	4 (2%)	0	100	100
5	E	231/263 (88%)	221 (96%)	10 (4%)	0	100	100
6	F	237/255 (93%)	233 (98%)	4 (2%)	0	100	100
7	G	243/246 (99%)	237 (98%)	6 (2%)	0	100	100
8	H	211/277 (76%)	204 (97%)	7 (3%)	0	100	100
9	I	169/205 (82%)	162 (96%)	7 (4%)	0	100	100
10	J	160/201 (80%)	157 (98%)	3 (2%)	0	100	100
11	c	275/288 (96%)	265 (96%)	10 (4%)	0	100	100
12	d	241/264 (91%)	227 (94%)	13 (5%)	1 (0%)	30	66
13	e	97/141 (69%)	92 (95%)	5 (5%)	0	100	100
All	All	2808/3124 (90%)	2720 (97%)	86 (3%)	2 (0%)	50	81

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
12	d	24	VAL
3	C	138	PHE

5.3.2   Protein sidechains ⓘ

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

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	185/191 (97%)	183 (99%)	2 (1%)	70	87
2	B	196/221 (89%)	195 (100%)	1 (0%)	86	94
3	C	175/211 (83%)	174 (99%)	1 (1%)	84	93
4	D	173/203 (85%)	166 (96%)	7 (4%)	27	61
5	E	190/224 (85%)	187 (98%)	3 (2%)	58	82
6	F	185/212 (87%)	183 (99%)	2 (1%)	70	87
7	G	197/210 (94%)	191 (97%)	6 (3%)	36	69
8	H	166/228 (73%)	164 (99%)	2 (1%)	67	86
9	I	139/174 (80%)	134 (96%)	5 (4%)	30	64
10	J	114/171 (67%)	111 (97%)	3 (3%)	41	72
11	c	218/262 (83%)	212 (97%)	6 (3%)	38	70
12	d	212/237 (90%)	206 (97%)	6 (3%)	38	70
13	e	90/128 (70%)	86 (96%)	4 (4%)	24	58
All	All	2240/2672 (84%)	2192 (98%)	48 (2%)	49	77

All (48) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	42	ASN
1	A	137	CYS
2	B	151	ASP
3	C	178	ASP
4	D	5	ARG
4	D	47	CYS
4	D	69	GLU
4	D	98	ASN
4	D	107	MET
4	D	206	MET
4	D	228	MET
5	E	6	TYR
5	E	83	LEU
5	E	154	PHE
6	F	185	MET
6	F	216	TRP
7	G	3	ARG
7	G	78	CYS
7	G	86	ASP
7	G	187	PHE

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Mol	Chain	Res	Type
7	G	224	ASN
7	G	232	GLU
8	H	-26	ASN
8	H	53	ASP
9	I	47	ASP
9	I	59	ASP
9	I	134	ASP
9	I	142	CYS
9	I	164	PHE
10	J	36	PHE
10	J	94	SER
10	J	101	ASN
11	c	50	LEU
11	c	88	MET
11	c	169	CYS
11	c	199	ASP
11	c	260	LYS
11	c	277	MET
12	d	55	MET
12	d	61	TYR
12	d	79	SER
12	d	106	LEU
12	d	123	SER
12	d	192	ASP
13	e	57	LEU
13	e	80	GLN
13	e	88	GLN
13	e	98	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
4	D	182	GLN
6	F	98	ASN
6	F	102	ASN

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 ⓘ

There are no ligands in this entry.

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   ⓘ

This section contains visualisations of the EMDB entry EMD-41379. 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   ⓘ
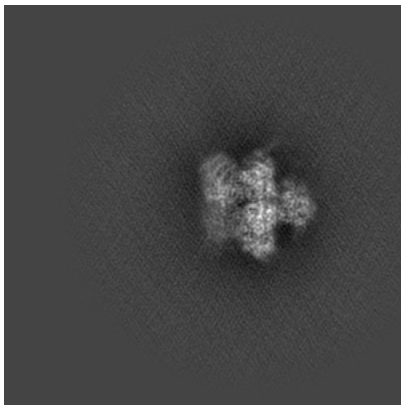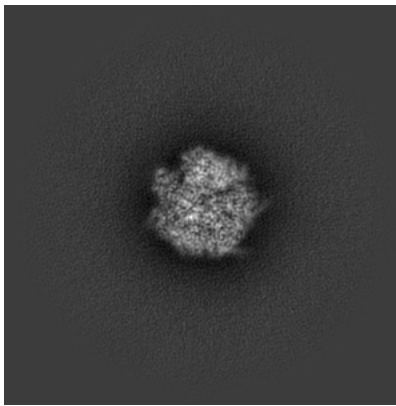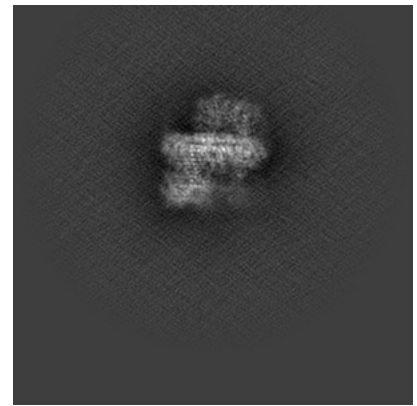
6.1.1   Primary map

X   Y   Z

6.1.2   Raw map

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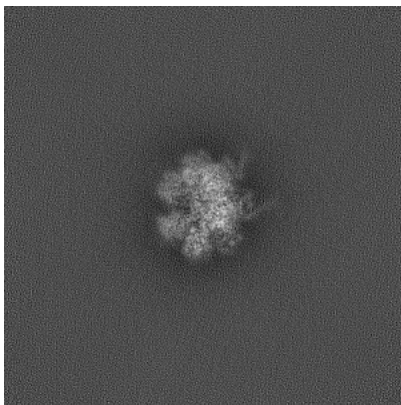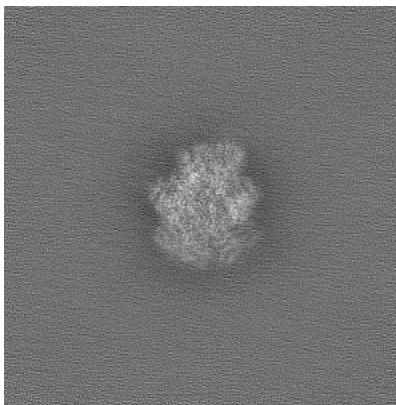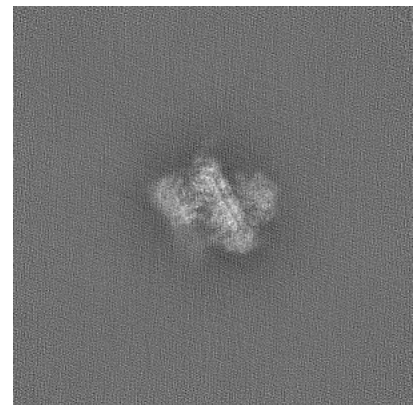
The images above show the map projected in three orthogonal directions.

6.2 Central slices ⓘ
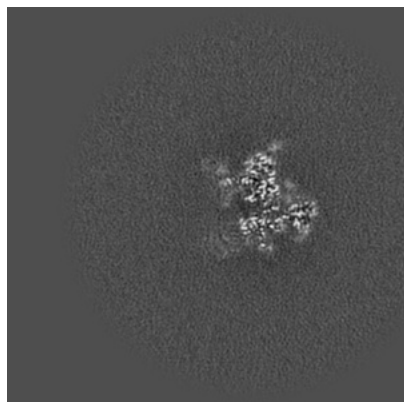
6.2.1 Primary map
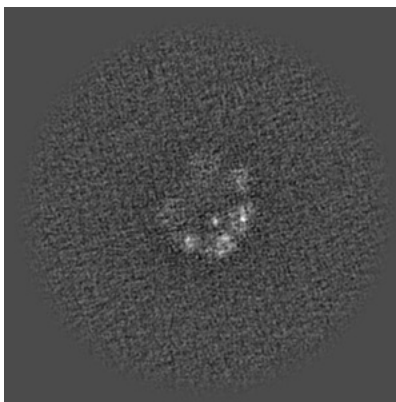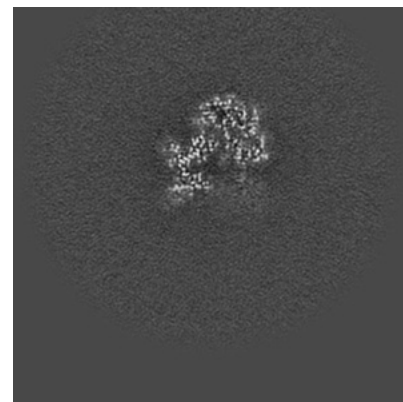
| X Index: 200 | Y Index: 200 | Z Index: 200 |

6.2.2 Raw map
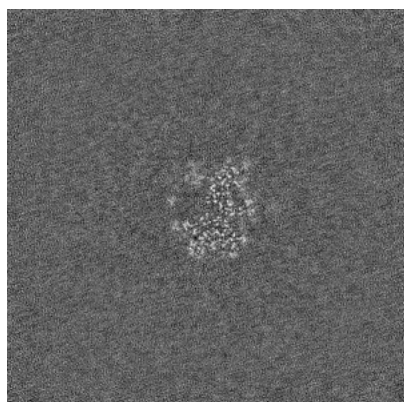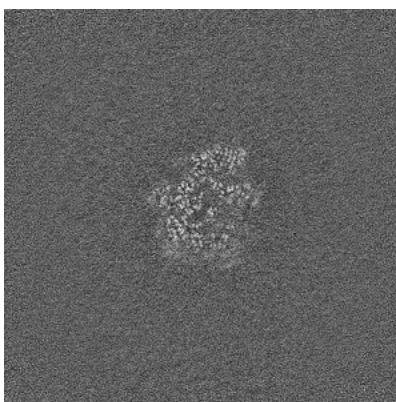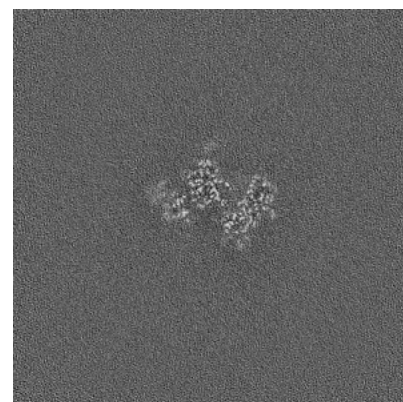
| X Index: 200 | Y Index: 200 | Z Index: 200 |

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

6.3   Largest variance slices ⓘ
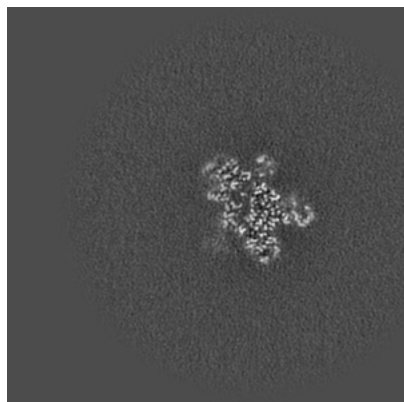
6.3.1   Primary map
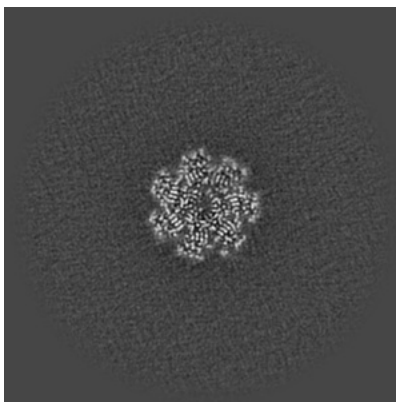
| X Index: 187 | Y Index: 254 | Z Index: 193 |
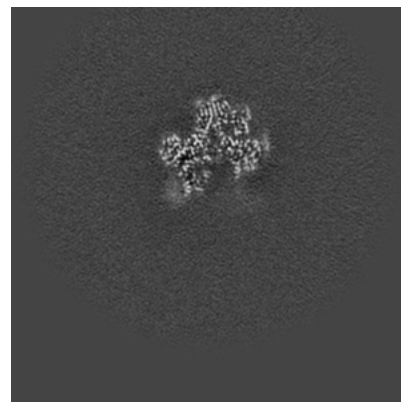
6.3.2   Raw map
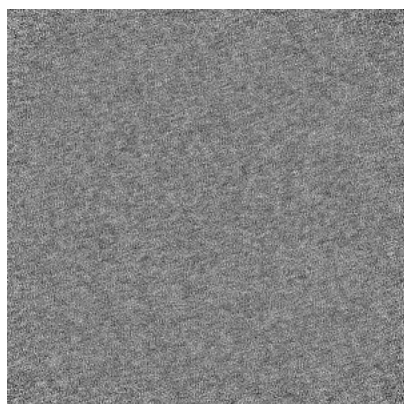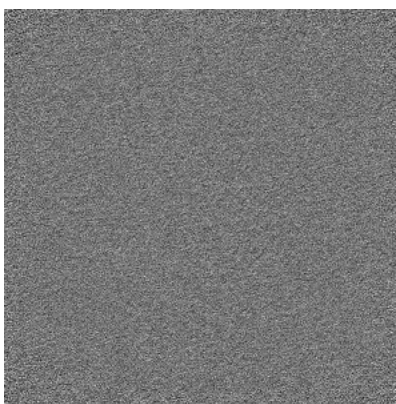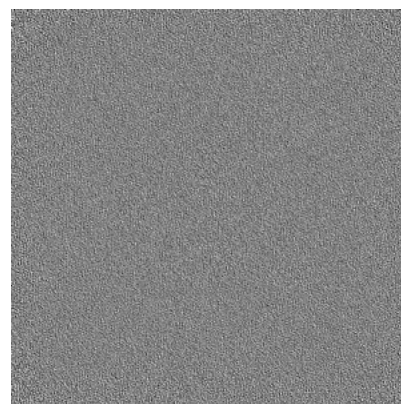
| X Index: 0 | Y Index: 0 | Z Index: 0 |

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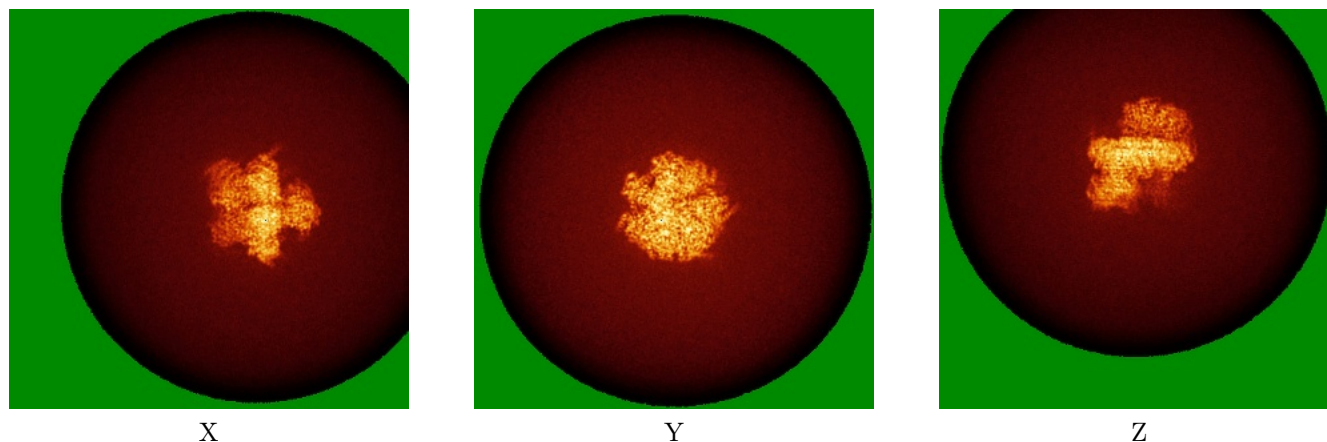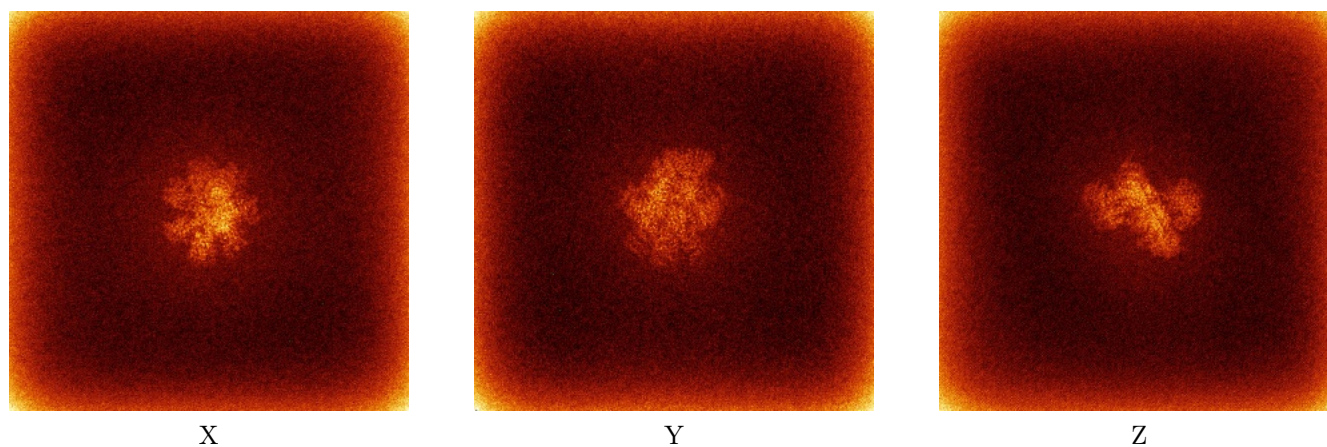
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views (i)

6.5.1 Primary map

X   Y   Z
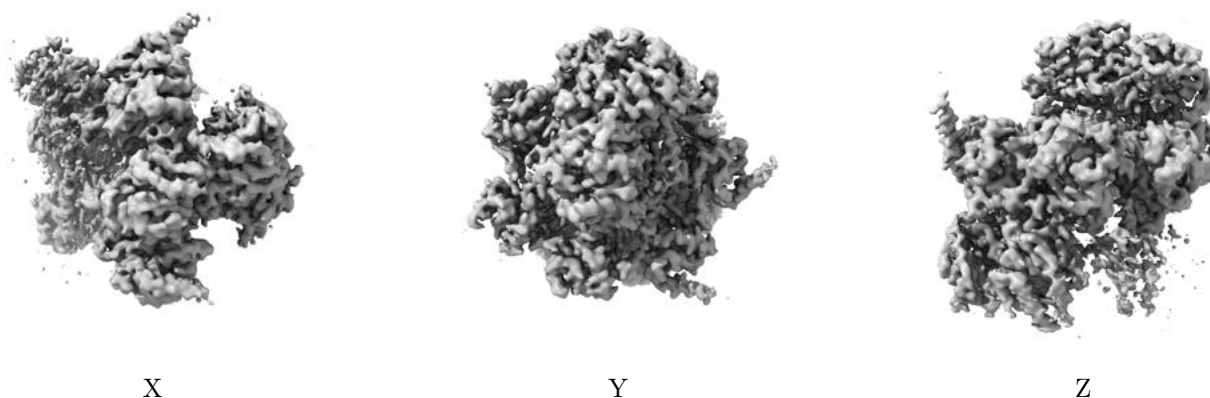
The images above show the 3D surface view of the map at the recommended contour level 7.0. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 Raw map

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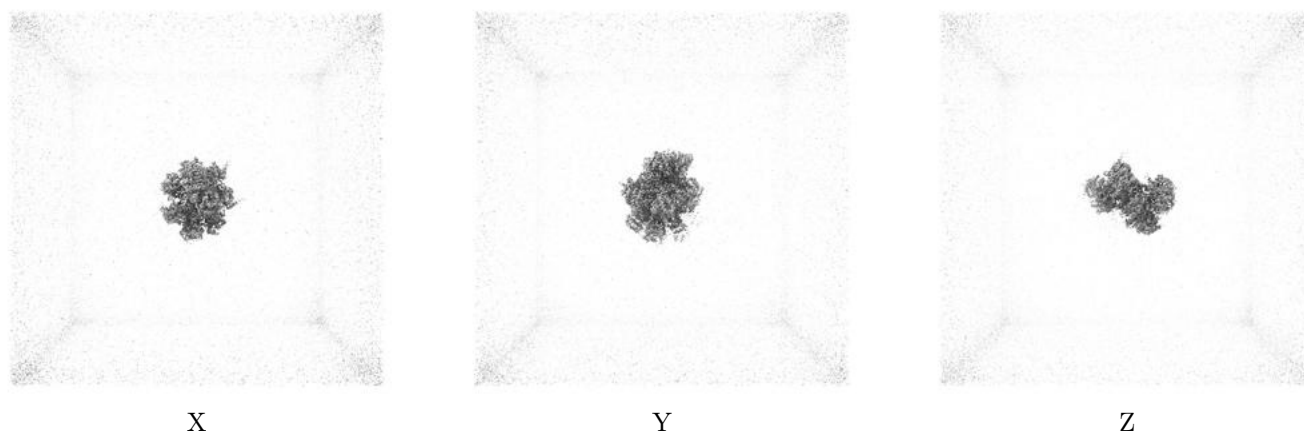
These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

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_41379_msk_1.map ⓘ

X　　　　　　　　　　Y　　　　　　　　　　Z
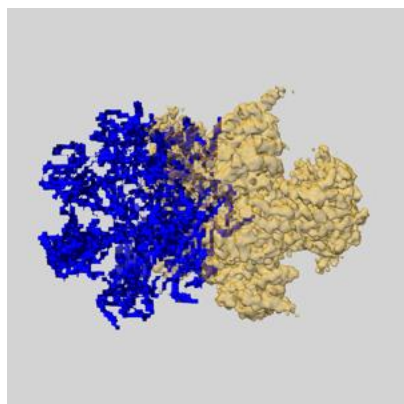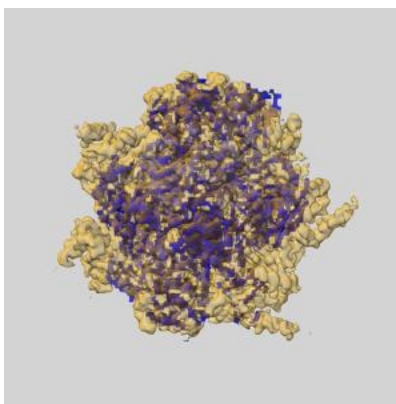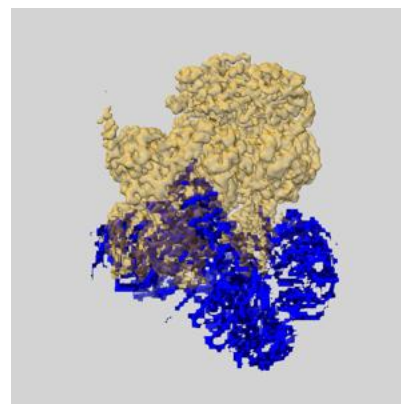
7 Map analysis ⓘ

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 ⓘ
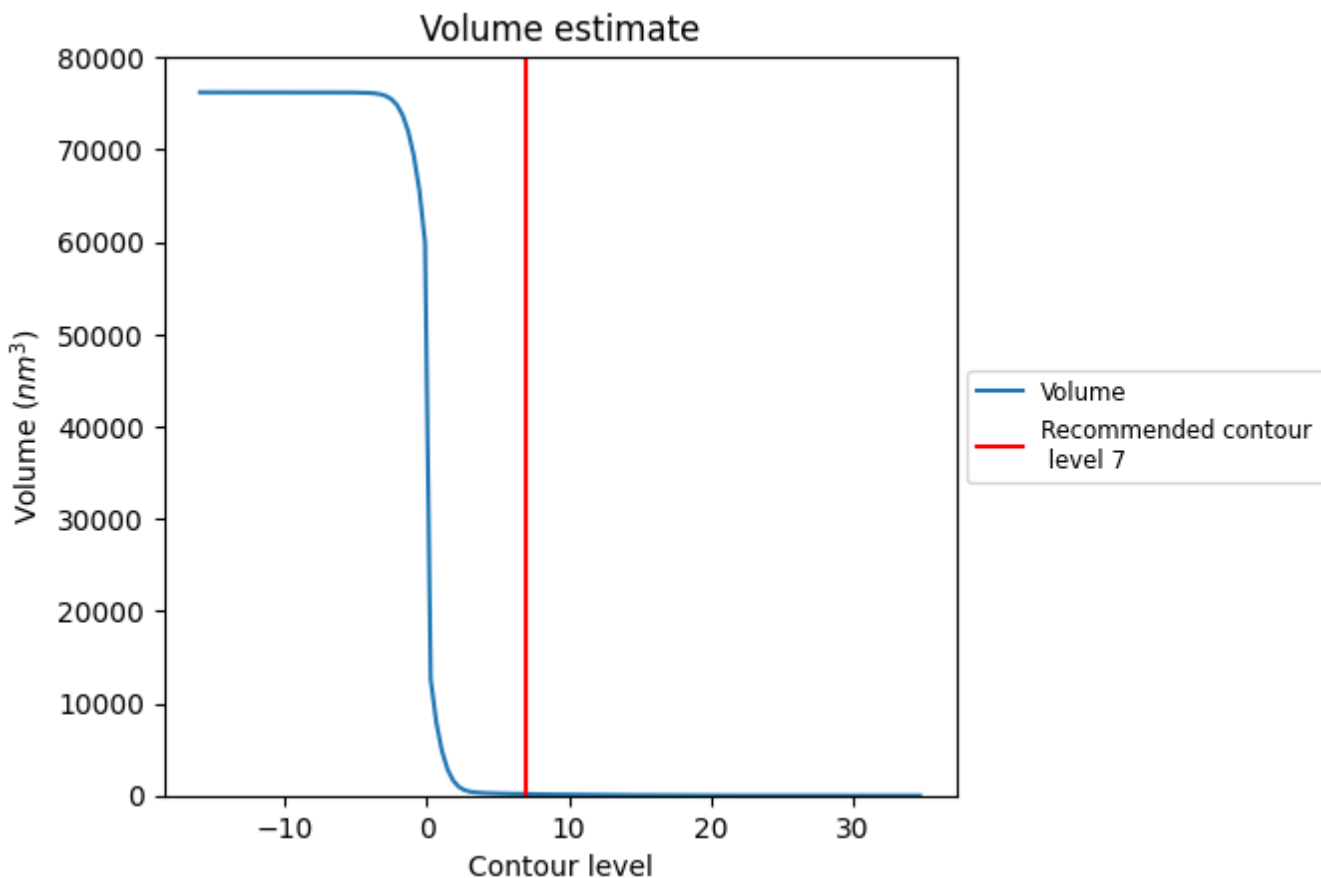
The volume at the recommended contour level is 163 nm^3; this corresponds to an approximate mass of 147 kDa.

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 ⓘ
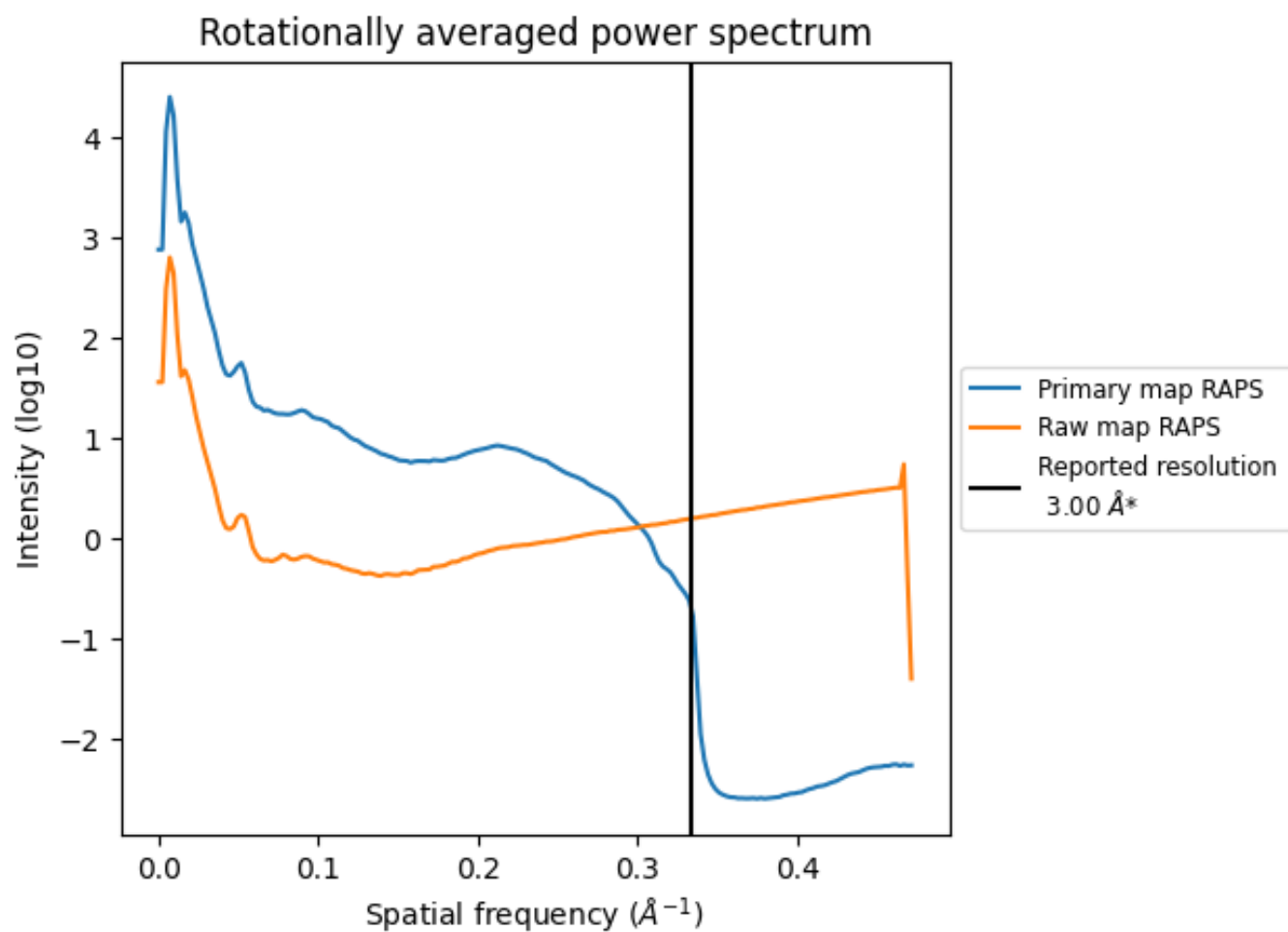
*Reported resolution corresponds to spatial frequency of 0.333 Å^{-1}

8   Fourier-Shell correlation ⓘ

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 ⓘ
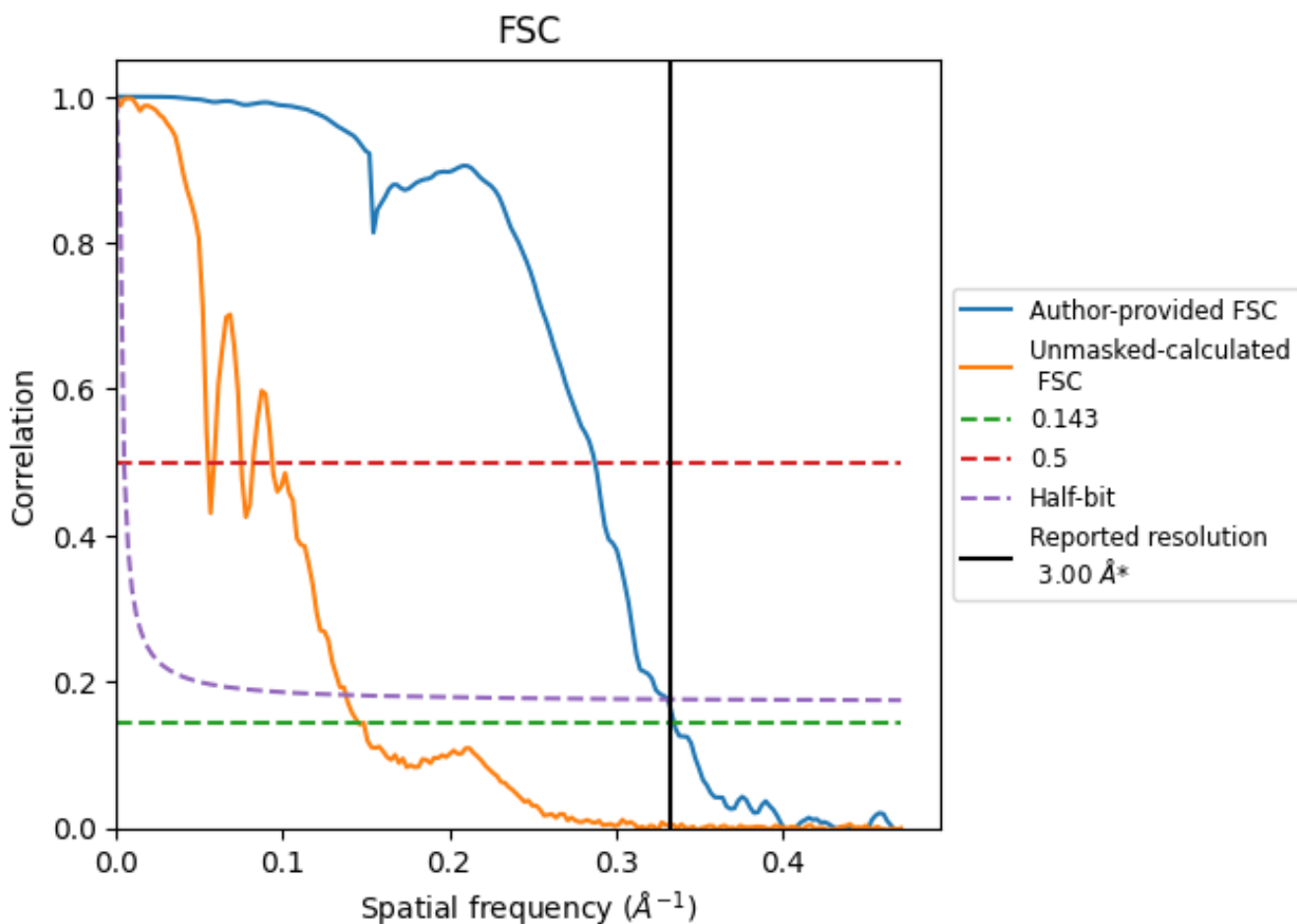
*Reported resolution corresponds to spatial frequency of 0.333 Å^{-1}

8.2   Resolution estimates (i)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.00	-	-
Author-provided FSC curve	2.98	3.48	3.02
Unmasked-calculated*	6.86	18.15	7.25

*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 6.86 differs from the reported value 3.0 by more than 10 %

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9　Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-41379 and PDB model 8TM5. Per-residue inclusion information can be found in section 3 on page 6.

9.1　Map-model overlay ⓘ

X　　　　　　　　　　　Y　　　　　　　　　　　Z
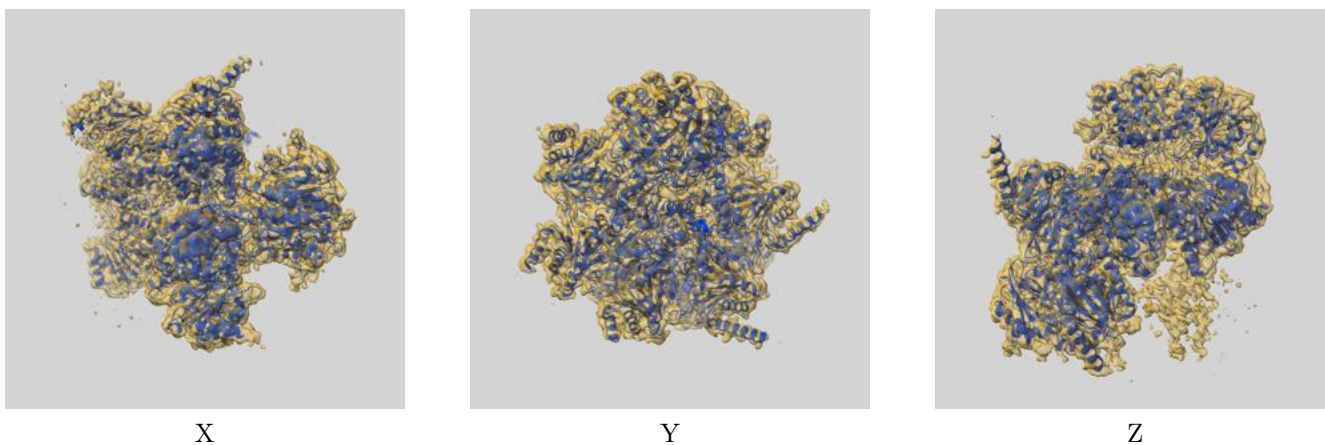
The images above show the 3D surface view of the map at the recommended contour level 7.0 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2 Q-score mapped to coordinate model ⓘ
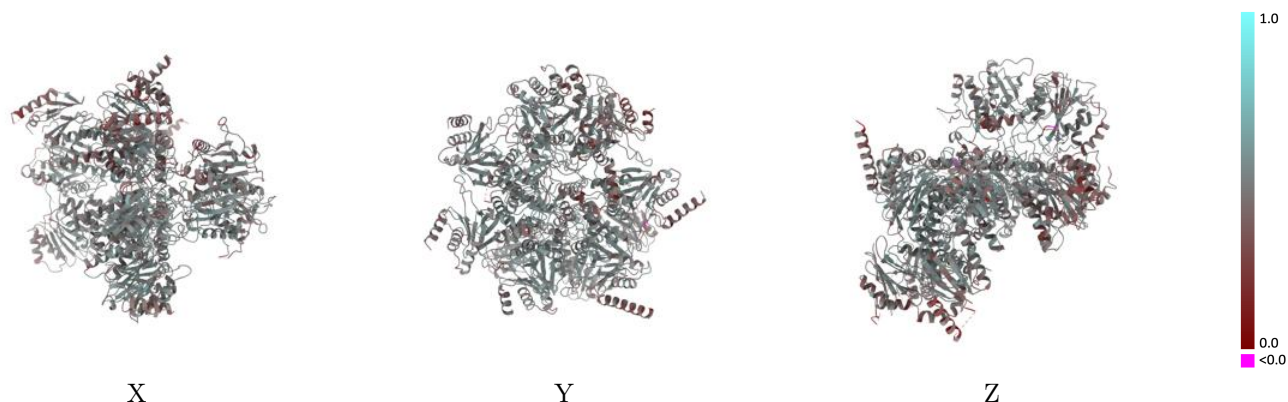
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 ⓘ
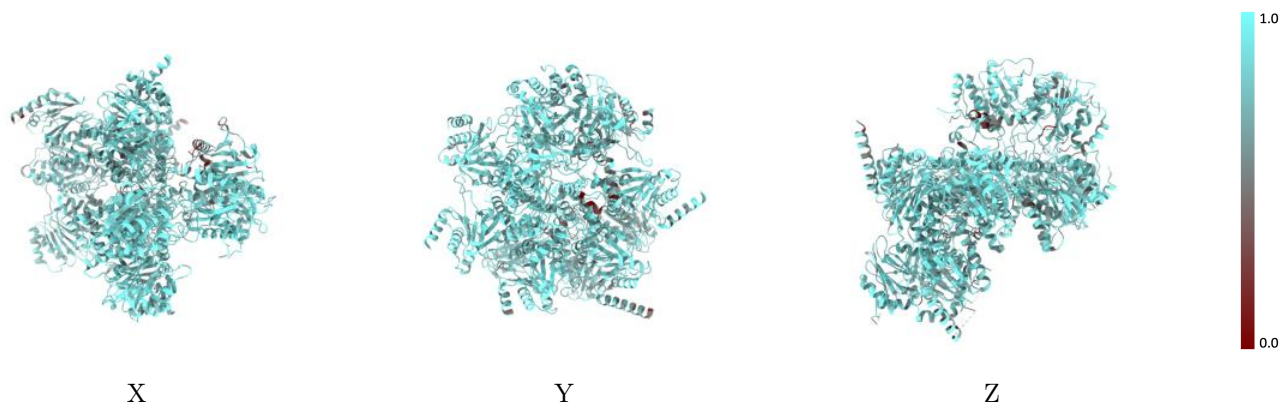
The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (7).

9.4 Atom inclusion ⓘ
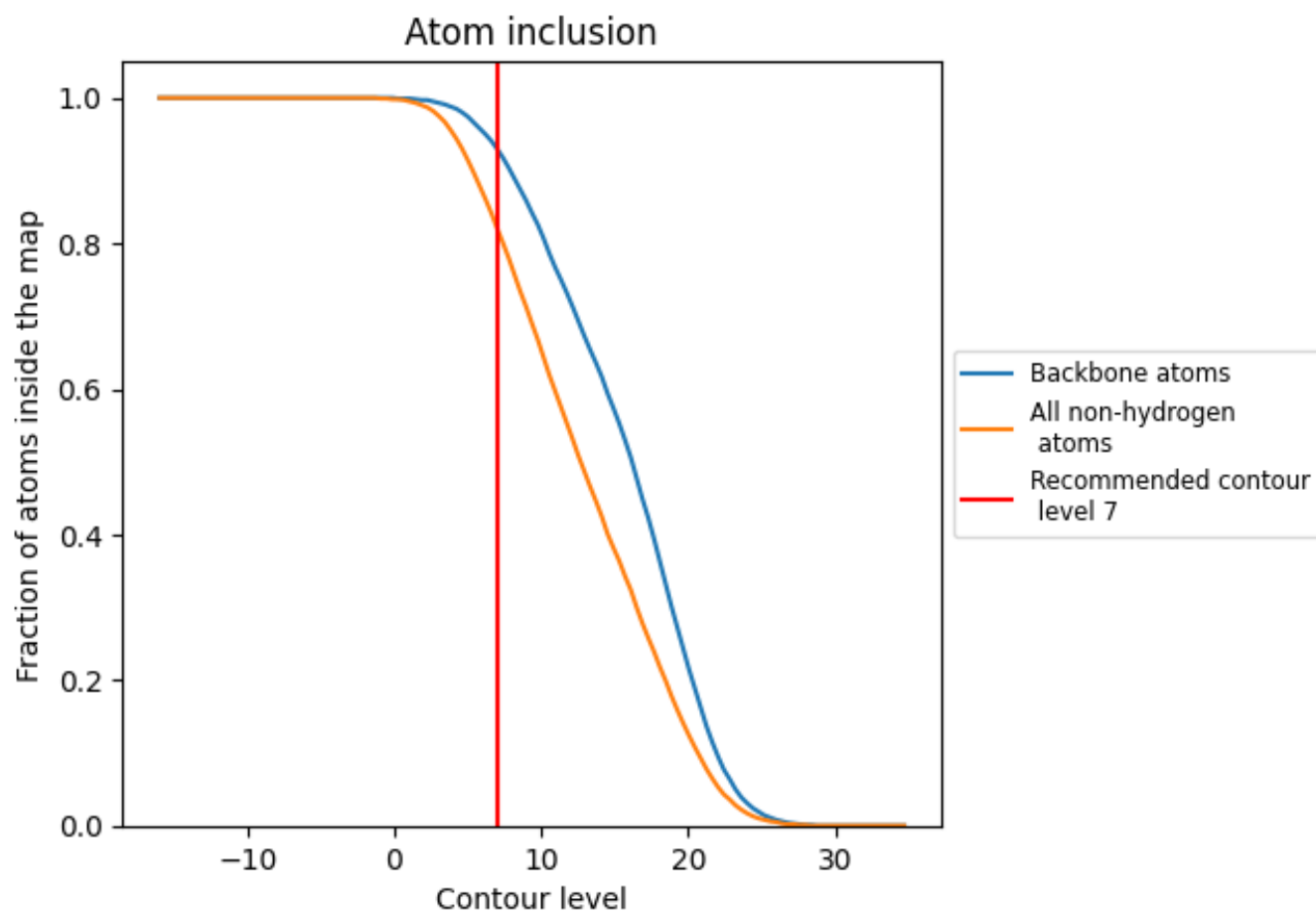
At the recommended contour level, 93% of all backbone atoms, 82% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary (i)

The table lists the average atom inclusion at the recommended contour level (7) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8210	0.4770
A	0.8500	0.5020
B	0.8200	0.4890
C	0.8490	0.4760
D	0.7790	0.4280
E	0.8420	0.4820
F	0.8570	0.4890
G	0.8540	0.4910
H	0.8140	0.4680
I	0.8330	0.4800
J	0.7730	0.4460
c	0.7540	0.4570
d	0.8490	0.4910
e	0.7450	0.5000

1.0

0.0
<0.0