wwPDB EM Validation Summary Report (i)

Mar 19, 2024 – 03:24 PM JST

PDB ID	:	6AHR
EMDB ID	:	EMD-9626
Title	:	Cryo-EM structure of human Ribonuclease P
Authors	:	Wu, J.; Niu, S.; Tan, M.; Lan, P.; Lei, M.
Deposited on	:	2018-08-20
Resolution	:	3.92 Å(reported)

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 3.92 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		10
Ramachandran outliers		0.3%
Sidechain outliers		0.9%
RNA backbone		0.52

Worse   *Better*

▮ Percentile relative to all structures
▯ Percentile relative to all EM structures
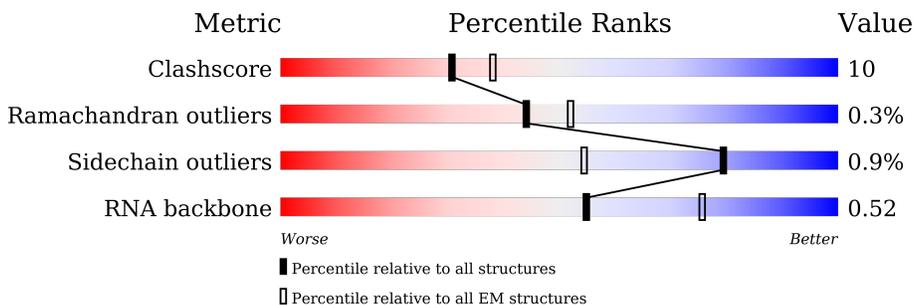
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826
RNA backbone	4643	859

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	341	50% 32% 18%
2	B	1024	62% 13% • 24%
3	C	283	6% 49% 15% 36%
4	D	220	53% 13% 34%
5	E	163	6% 74% 15% • 10%
6	F	199	6% 50% 15% 35%
7	G	140	6% 69% 25% 6%

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Mol	Chain	Length	Quality of chain
8	H	124	77% 20%
9	I	268	5% 70% 18% 12%
9	J	268	74% 18% 8%
10	K	154	60% 18% 21%
11	L	363	7% 88% 12%

2 Entry composition ⓘ

There are 12 unique types of molecules in this entry. The entry contains 27851 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 RNA chain called H1 RNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
1	A	341	7295	3249	1324	2381	341	0	0

- Molecule 2 is a protein called Ribonucleases P/MRP protein subunit POP1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	774	6142	3892	1121	1087	42	0	0

- Molecule 3 is a protein called Ribonuclease P protein subunit p38.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	C	182	1448	918	255	270	5	0	0

- Molecule 4 is a protein called Ribonuclease P protein subunit p29.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	D	145	1180	763	206	207	4	0	0

- Molecule 5 is a protein called Ribonuclease P/MRP protein subunit POP5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	E	147	1197	763	220	206	8	0	0

- Molecule 6 is a protein called Ribonuclease P protein subunit p25.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	F	129	979	614	189	170	6	0	0

- Molecule 7 is a protein called Ribonuclease P protein subunit p20.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	G	131	Total	C	N	O	S	0	0
			1021	634	192	192	3		

- Molecule 8 is a protein called Ribonuclease P protein subunit p14.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	H	121	Total	C	N	O	S	0	0
			941	611	152	173	5		

- Molecule 9 is a protein called Ribonuclease P protein subunit p30.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	I	236	Total	C	N	O	S	0	0
			1824	1166	319	332	7		
9	J	247	Total	C	N	O	S	0	0
			1905	1221	332	345	7		

- Molecule 10 is a protein called Ribonuclease P protein subunit p21.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	K	121	Total	C	N	O	S	0	0
			979	602	196	173	8		

- Molecule 11 is a protein called Ribonuclease P protein subunit p40.

Mol	Chain	Residues	Atoms					AltConf	Trace
11	L	362	Total	C	N	O	S	0	0
			2939	1893	489	540	17		

- Molecule 12 is ZINC ION (three-letter code: ZN) (formula: Zn).

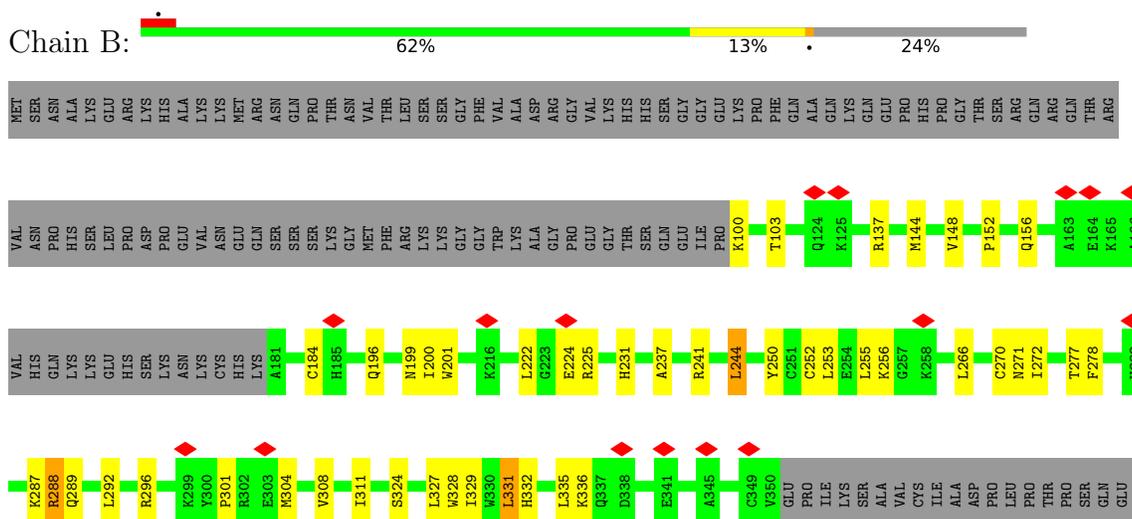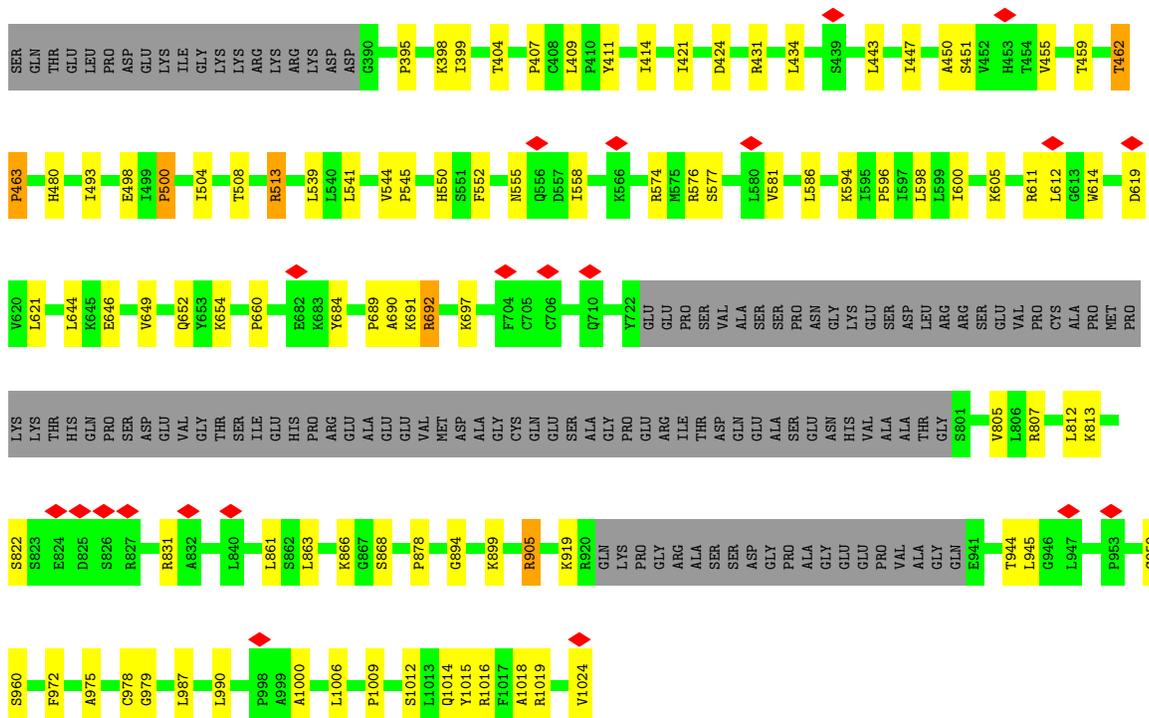| Mol	Chain	Residues	Atoms		AltConf
12	K	1	Total	Zn	0
			1	1	

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.
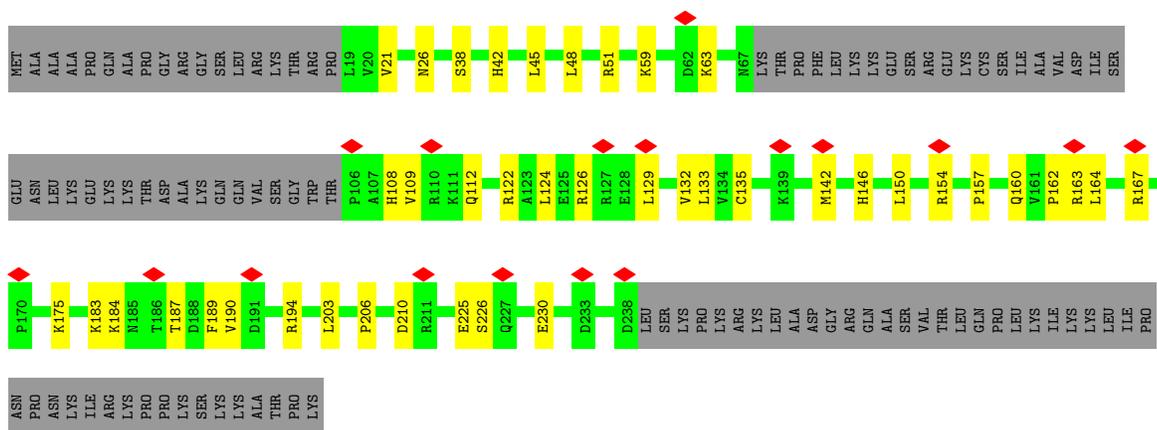
- Molecule 1: H1 RNA

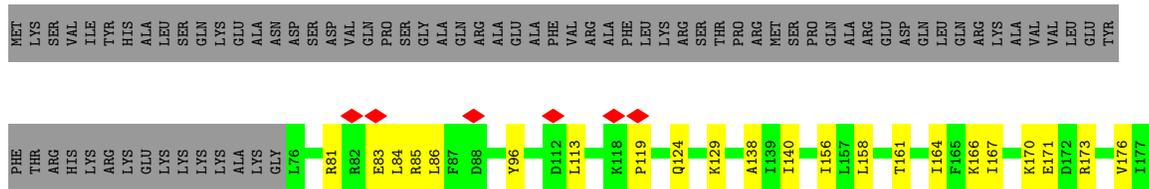

- Molecule 2: Ribonucleases P/MRP protein subunit POP1

SER GLN THR GLU LEU PRO ASP GLU LYS ILE GLY LYS LYS ARG LYS LYS ASP G390 P395 K398 I399 T404 P407 C408 L409 P410 Y411 I414 I421 I447 D424 R431 L434 S439 L443 I447 A450 S451 V452 H453 T454 V455 T459 T462

P463 H480 I493 E498 I499 P500 I504 T508 R513 L539 L540 L541 V544 P545 H550 S551 F552 N555 Q556 D557 I558 K566 R574 M575 R576 S577 L580 V581 L586 K594 I595 P596 I597 L598 L599 I600 K605 R611 L612 G613 W614 D619

V620 L621 L644 K645 E646 V649 Q652 Y653 K654 P660 E682 K683 Y684 P689 A690 K691 R692 K697 F704 C705 C706 Q710 Y722 GLU GLU PRO SER VAL ALA SER SER PRO ASN GLY LYS GLU SER ASP LEU ARG ARG SER GLU VAL PRO CYS ALA PRO MET PRO

LYS LYS THR HIS GLN PRO ASP SER GLU VAL GLY THR SER ILE GLU HIS PRO ARG GLU ALA GLU GLU VAL MET ASP ALA GLY CYS GLN GLU SER ALA GLY PRO GLU ARG ILE THR ASP GLU ALA SER GLU ASN HIS VAL ALA THR GLY S801 V805 L806 R807 L812 K813

S822 S823 E824 D825 S826 R827 R831 A832 L840 L861 S862 L863 K866 G867 S868 P878 G894 K899 R905 K919 R920 GLN LYS PRO GLY ARG ALA SER SER ASP GLY PRO ALA GLY GLU GLU PRO VAL ALA GLY GLN E941 T944 L945 G946 L947 P953 C959

S960 F972 A975 C978 G979 L987 L990 P998 A999 A1000 L1006 P1009 S1012 L1013 Q1014 Y1015 R1016 F1017 A1018 R1019 V1024

• Molecule 3: Ribonuclease P protein subunit p38

Chain C:

6%

49%   15%   36%

MET ALA ALA ALA PRO GLN ALA PRO GLY ARG GLY SER LEU ARG LYS THR ARG PRO L19 V20 V21 N26 S38 H42 L45 L48 R51 K59 D62 K63 N67 LYS THR PRO PHE LEU LYS LYS GLU ARG GLU LYS CYS SER ILE ALA VAL ASP ILE SER

GLU ASN LEU LYS GLU LYS LYS THR ASP ALA LYS GLN GLN VAL SER GLY TRP THR P106 A107 H108 V109 R110 K111 Q112 R122 A123 L124 E125 R126 R127 E128 L129 V132 L133 V134 C135 K139 M142 H146 L150 R154 P157 Q160 V161 P162 R163 L164 R167

P170 K175 K183 K184 N185 T186 T187 D188 F189 V190 D191 R194 L203 P206 D210 R211 E225 S226 Q227 E230 D233 D238 LEU SER LYS PRO LYS ARG LYS LEU ALA ASP GLY ARG GLN ALA SER VAL THR LEU GLN PRO LEU LYS ILE LYS LEU ILE LYS LEU ILE PRO

ASN PRO ASN LYS ILE ARG LYS PRO PRO LYS SER LYS LYS ALA THR PRO LYS

• Molecule 4: Ribonuclease P protein subunit p29

Chain D:

53%   13%   34%

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

PHE THR ARG HIS LYS ARG GLU LYS LYS LYS LYS LYS ALA LYS GLY L76 R81 R82 E83 L84 R85 L86 F87 D88 Y96 D112 L113 K118 P119 Q124 K129 A138 I139 I140 I156 L157 L158 T161 I164 F165 K166 I167 K170 E171 D172 R173 V176 I177
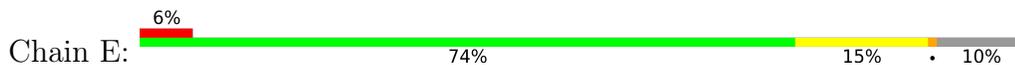
• Molecule 5: Ribonuclease P/MRP protein subunit POP5

• Molecule 6: Ribonuclease P protein subunit p25

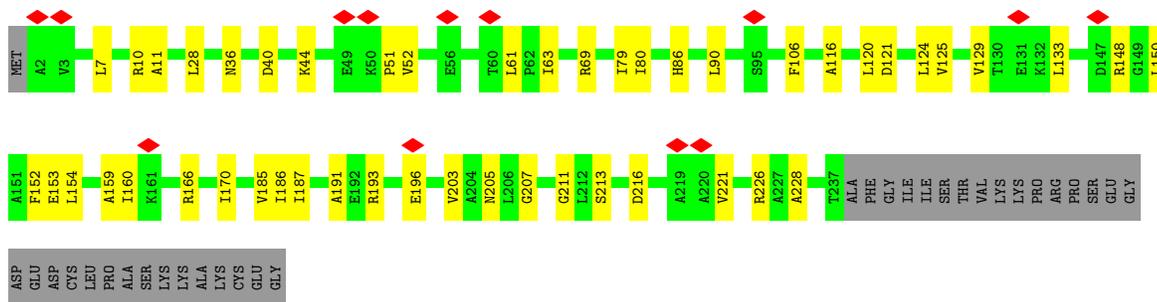• Molecule 7: Ribonuclease P protein subunit p20
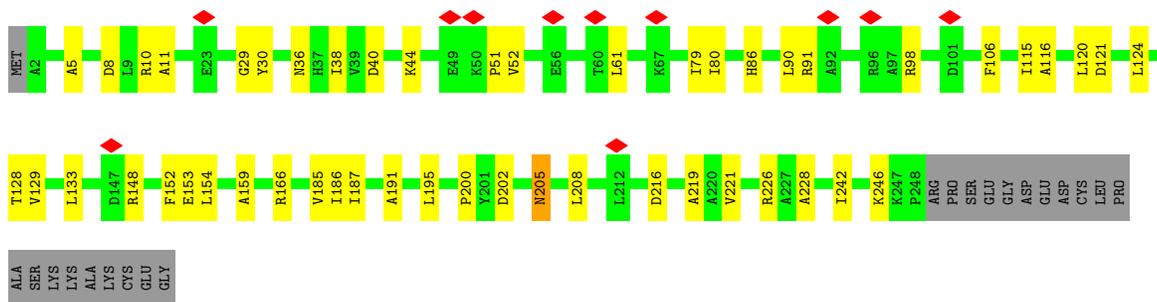

• Molecule 8: Ribonuclease P protein subunit p14

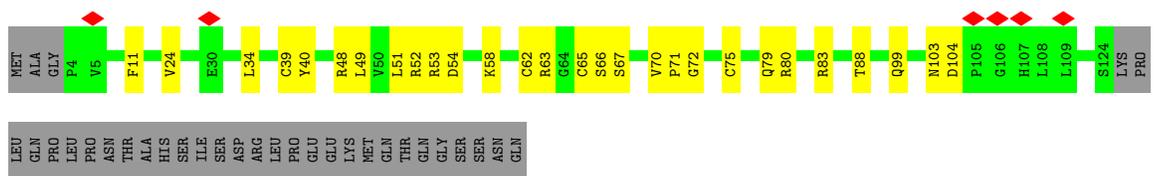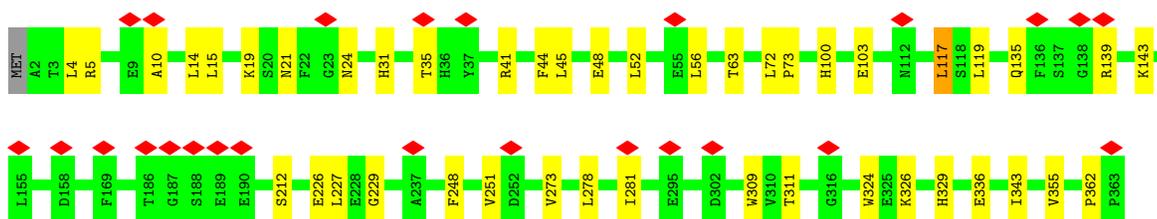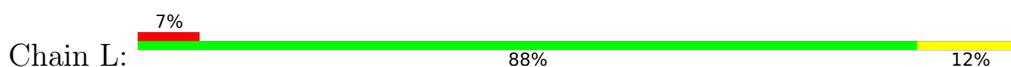• Molecule 9: Ribonuclease P protein subunit p30

• Molecule 9: Ribonuclease P protein subunit p30

Chain J:

74%   18%   8%

• Molecule 10: Ribonuclease P protein subunit p21

Chain K:

60%   18%   21%

• Molecule 11: Ribonuclease P protein subunit p40

Chain L:

7%

88%   12%

4 Experimental information ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	400198	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 $(e^-/\text{Å}^2)$	1.5625	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	0.199	Depositor
Minimum map value	-0.090	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.006	Depositor
Recommended contour level	0.02	Depositor
Map size (Å)	337.92, 337.92, 337.92	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.32, 1.32, 1.32	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: ZN

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	0.22	0/8156	0.87	13/12720 (0.1%)
2	B	0.28	0/6286	0.53	1/8492 (0.0%)
3	C	0.28	0/1468	0.58	0/1985
4	D	0.29	0/1202	0.62	1/1613 (0.1%)
5	E	0.26	0/1220	0.49	0/1647
6	F	0.27	0/996	0.51	0/1342
7	G	0.29	0/1035	0.61	0/1402
8	H	0.27	0/958	0.66	2/1295 (0.2%)
9	I	0.26	0/1855	0.54	1/2515 (0.0%)
9	J	0.26	0/1938	0.55	1/2627 (0.0%)
10	K	0.28	0/997	0.55	0/1345
11	L	0.25	0/3021	0.47	1/4099 (0.0%)
All	All	0.26	0/29132	0.66	20/41082 (0.0%)

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
2	B	0	2
4	D	0	3
6	F	0	1
11	L	0	1
All	All	0	7

There are no bond length outliers.

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
8	H	92	LEU	CA-CB-CG	7.58	132.73	115.30
1	A	61	C	N1-C2-O2	7.52	123.41	118.90
8	H	62	ASP	CB-CG-OD1	7.47	125.03	118.30
1	A	61	C	N3-C2-O2	-6.13	117.61	121.90
1	A	142	C	N1-C2-O2	6.12	122.57	118.90

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	1000	ALA	Peptide
2	B	463	PRO	Peptide
4	D	170	LYS	Peptide
4	D	171	GLU	Peptide
4	D	83	GLU	Peptide

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	7295	0	3693	254	0
2	B	6142	0	6249	99	0
3	C	1448	0	1520	25	0
4	D	1180	0	1249	15	0
5	E	1197	0	1220	30	0
6	F	979	0	1022	26	0
7	G	1021	0	1041	27	0
8	H	941	0	973	18	0
9	I	1824	0	1909	26	0
9	J	1905	0	2002	29	0
10	K	979	0	980	21	0
11	L	2939	0	2884	27	0
12	K	1	0	0	0	0
All	All	27851	0	24742	510	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 10.

The worst 5 of 510 close contacts within the same asymmetric unit are listed below, sorted by

their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:269:A:N6	1:A:315:A:C2	2.01	1.27
1:A:320:A:H2'	1:A:321:G:C8	1.74	1.23
1:A:73:G:O4'	1:A:315:A:N6	1.74	1.19
1:A:269:A:N6	1:A:315:A:N3	1.94	1.15
1:A:321:G:H2'	1:A:322:A:H8	1.04	1.14

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	
2	B	764/1024 (75%)	688 (90%)	73 (10%)	3 (0%)	34	71
3	C	178/283 (63%)	154 (86%)	23 (13%)	1 (1%)	25	63
4	D	143/220 (65%)	116 (81%)	25 (18%)	2 (1%)	11	46
5	E	145/163 (89%)	135 (93%)	10 (7%)	0	100	100
6	F	123/199 (62%)	113 (92%)	9 (7%)	1 (1%)	19	57
7	G	129/140 (92%)	110 (85%)	19 (15%)	0	100	100
8	H	119/124 (96%)	105 (88%)	14 (12%)	0	100	100
9	I	234/268 (87%)	209 (89%)	25 (11%)	0	100	100
9	J	245/268 (91%)	214 (87%)	31 (13%)	0	100	100
10	K	119/154 (77%)	105 (88%)	14 (12%)	0	100	100
11	L	360/363 (99%)	343 (95%)	17 (5%)	0	100	100
All	All	2559/3206 (80%)	2292 (90%)	260 (10%)	7 (0%)	44	75

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	D	119	PRO
3	C	126	ARG
4	D	96	TYR
2	B	407	PRO
6	F	149	PRO

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	
2	B	671/883 (76%)	664 (99%)	7 (1%)	76	86
3	C	167/255 (66%)	166 (99%)	1 (1%)	86	91
4	D	132/196 (67%)	129 (98%)	3 (2%)	50	70
5	E	131/143 (92%)	130 (99%)	1 (1%)	81	89
6	F	103/150 (69%)	103 (100%)	0	100	100
7	G	110/118 (93%)	109 (99%)	1 (1%)	78	88
8	H	104/106 (98%)	103 (99%)	1 (1%)	76	86
9	I	202/228 (89%)	200 (99%)	2 (1%)	76	86
9	J	211/228 (92%)	209 (99%)	2 (1%)	78	88
10	K	106/135 (78%)	104 (98%)	2 (2%)	57	75
11	L	331/332 (100%)	330 (100%)	1 (0%)	92	95
All	All	2268/2774 (82%)	2247 (99%)	21 (1%)	79	88

5 of 21 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
9	I	205	ASN
9	J	226	ARG
11	L	41	ARG
10	K	53	ARG
9	J	205	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
9	J	36	ASN
10	K	99	GLN
11	L	329	HIS
10	K	103	ASN
3	C	185	ASN

5.3.3   RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	340/341 (99%)	110 (32%)	10 (2%)

5 of 110 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	A	3	A
1	A	12	G
1	A	13	G
1	A	14	A
1	A	15	A

5 of 10 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	A	261	G
1	A	297	C
1	A	326	C
1	A	79	G
1	A	80	U

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 monosaccharides in this entry.

5.6   Ligand geometry ⓘ

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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-9626. 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 ⓘ

6.1.1 Primary map

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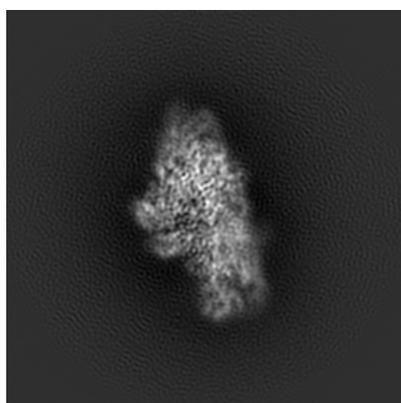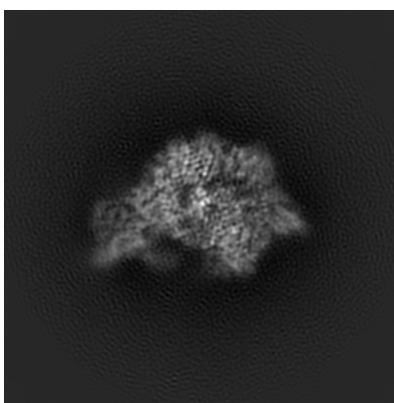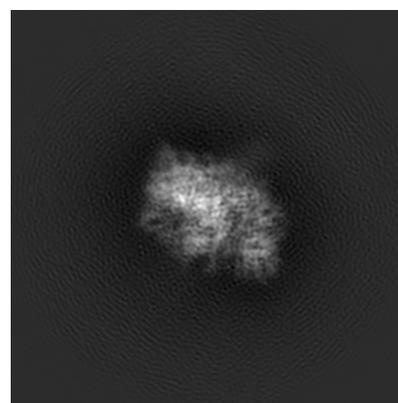
The images above show the map projected in three orthogonal directions.

6.2 Central slices ⓘ
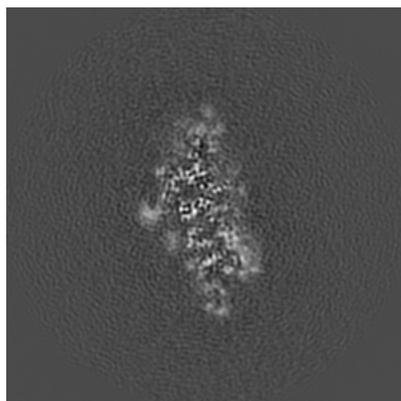
6.2.1 Primary map
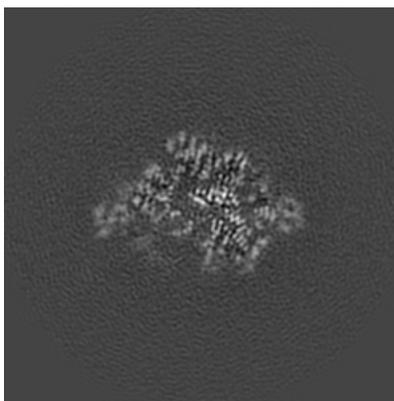
| X Index: 128 | Y Index: 128 | Z Index: 128 |
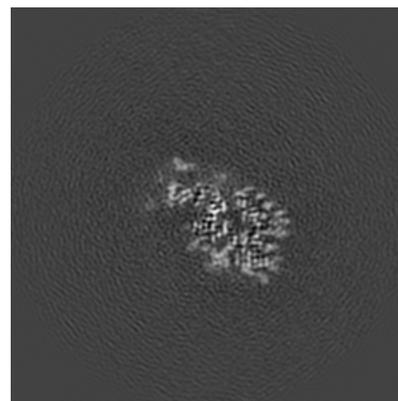
The images above show central slices of the map in three orthogonal directions.

6.3   Largest variance slices ⓘ
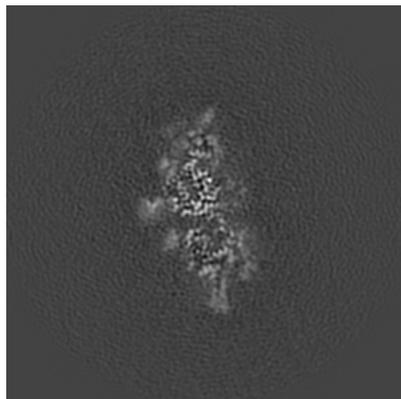
6.3.1   Primary map
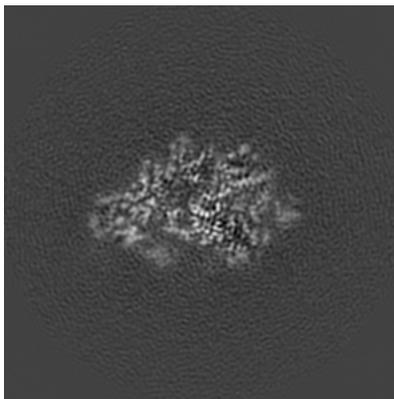
| X Index: 131 | Y Index: 133 | Z Index: 129 |
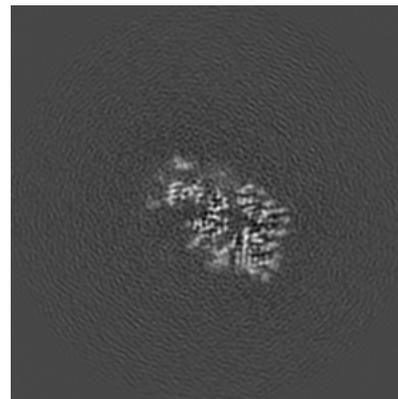
The images above show the largest variance slices of the map in three orthogonal directions.

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

6.4.1   Primary map

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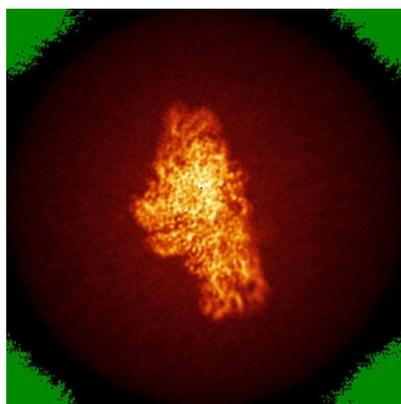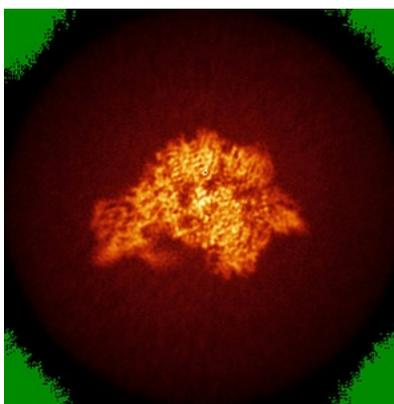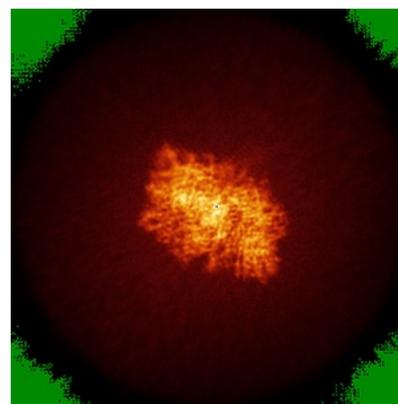
The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

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.

6.6   Mask visualisation ⓘ

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

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 ⓘ
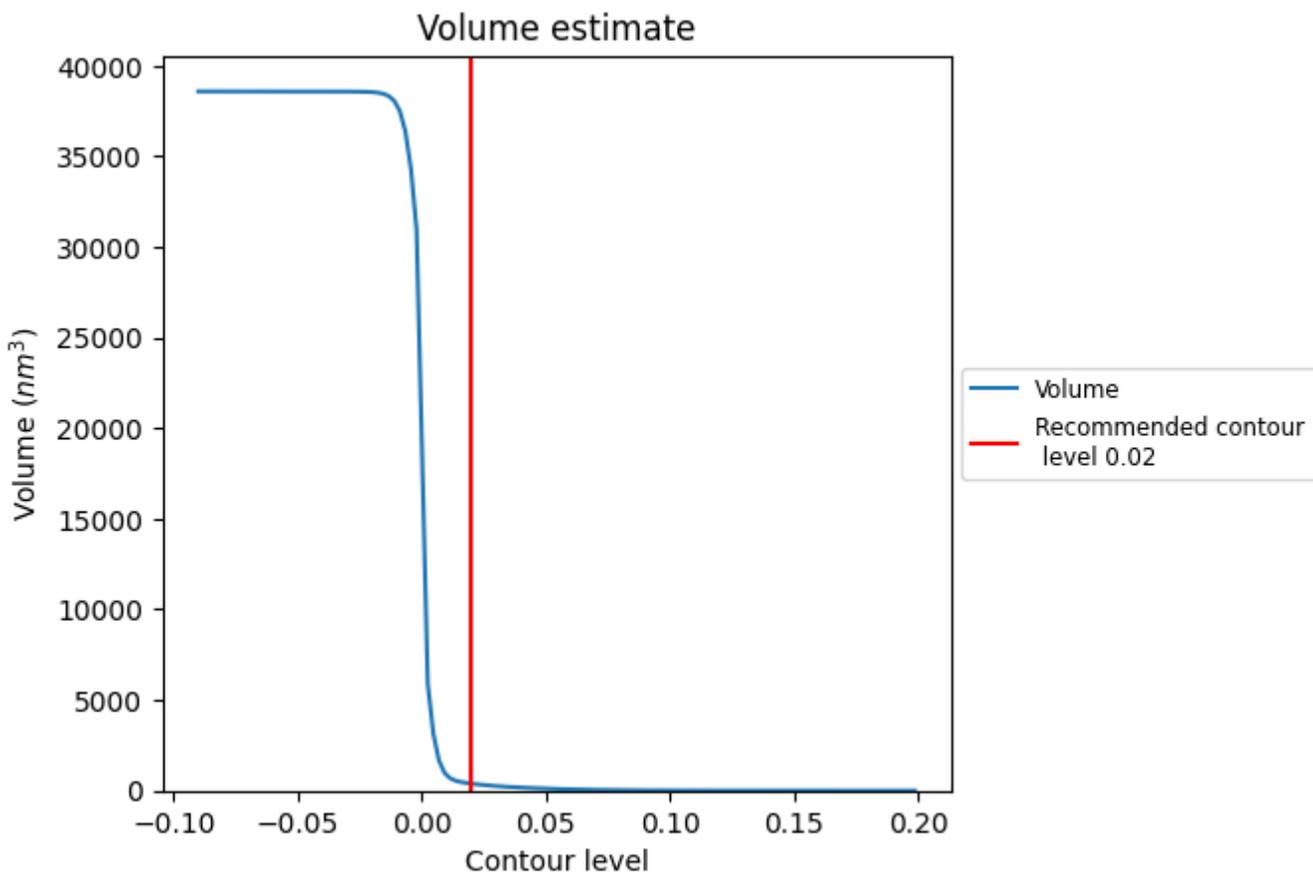
The volume at the recommended contour level is 383 nm^3; this corresponds to an approximate mass of 346 kDa.

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   ⓘ
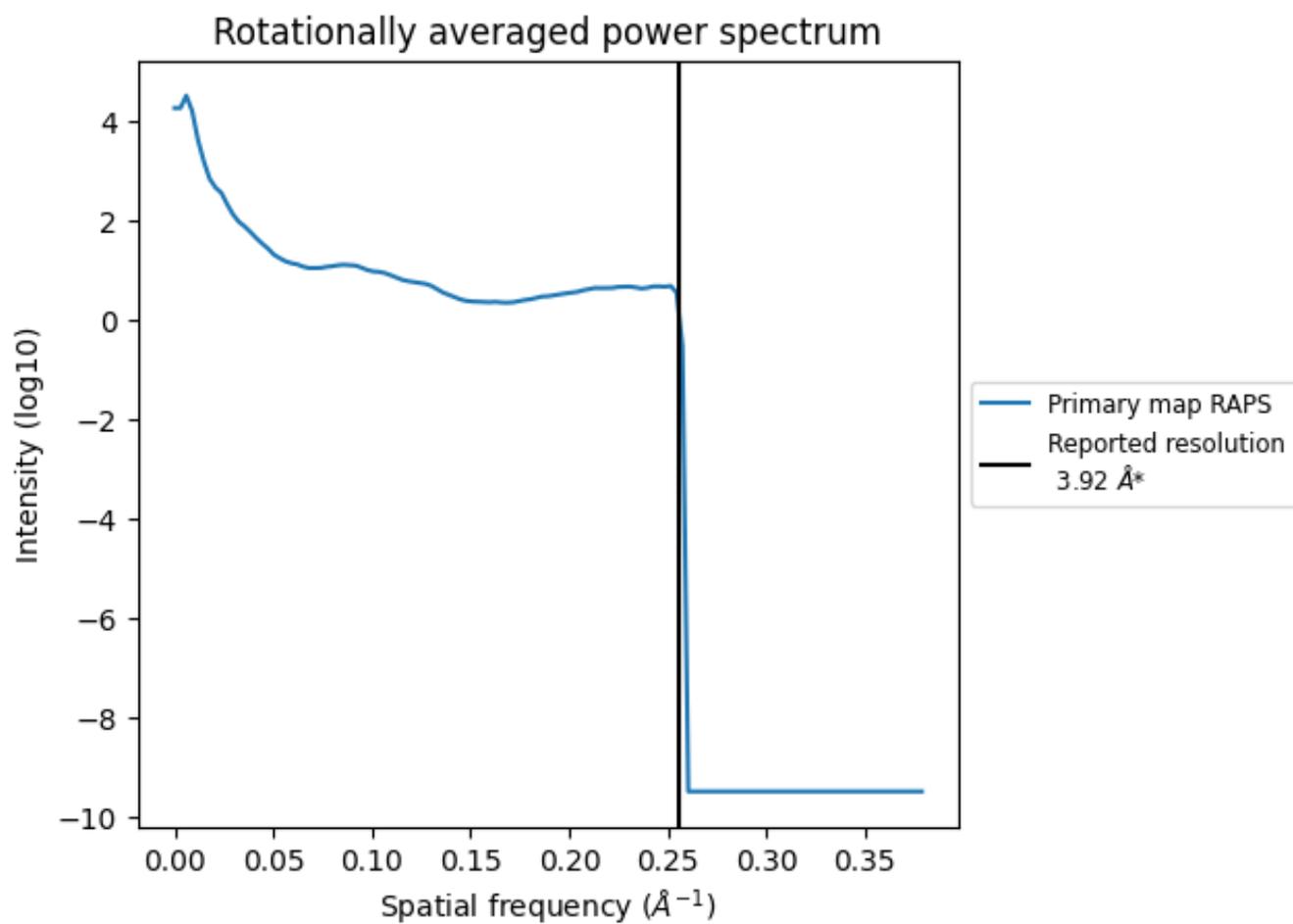
*Reported resolution corresponds to spatial frequency of 0.255 Å^{-1}

8 Fourier-Shell correlation (i)

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

9 Map-model fit ⓘ

This section contains information regarding the fit between EMDB map EMD-9626 and PDB model 6AHR. Per-residue inclusion information can be found in section 3 on page 6.

9.1 Map-model overlay ⓘ


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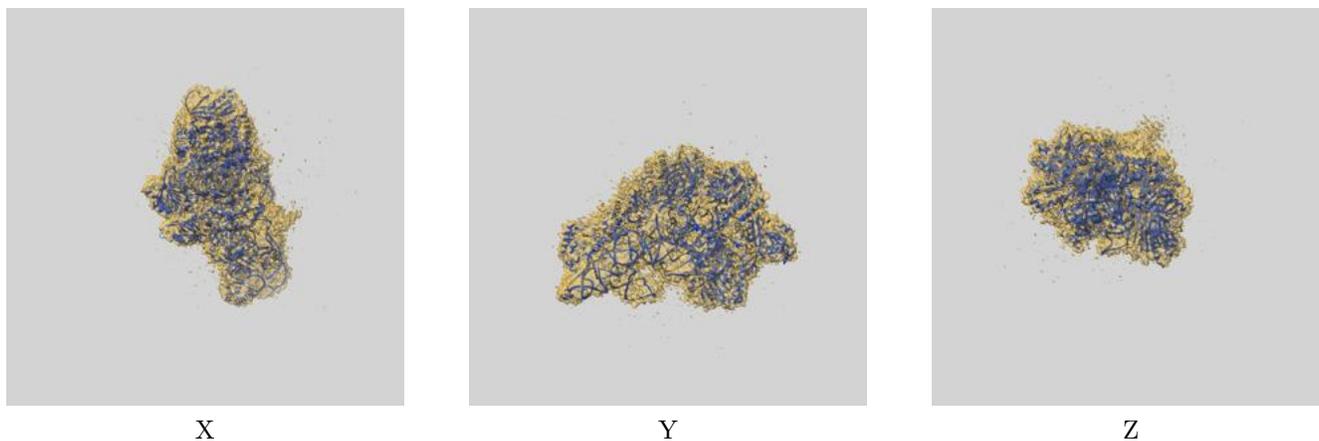
The images above show the 3D surface view of the map at the recommended contour level 0.02 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2 Q-score mapped to coordinate model ⓘ
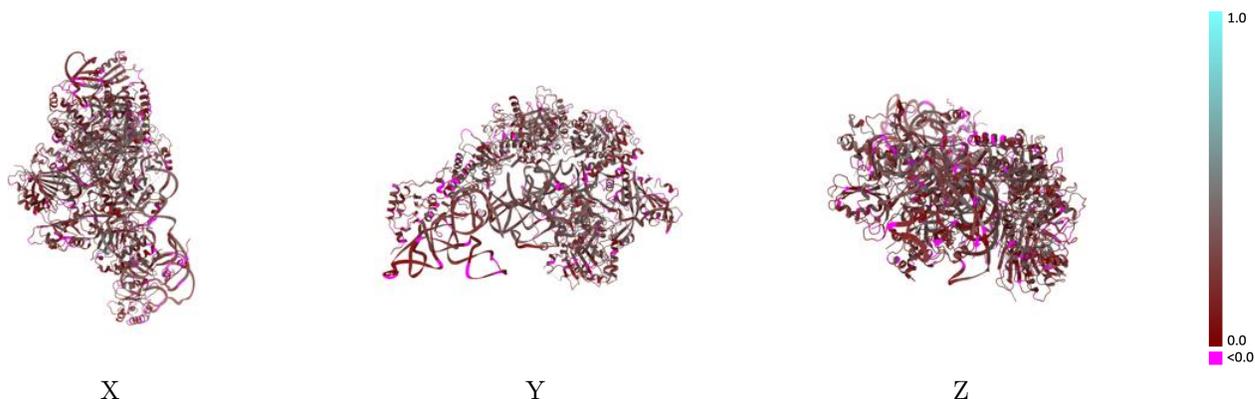
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 ⓘ
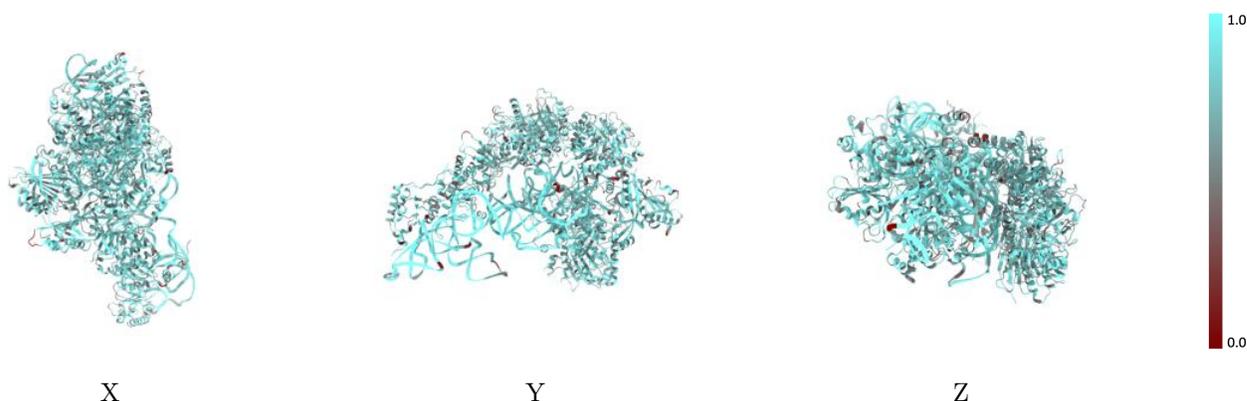
The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.02).

9.4 Atom inclusion ⓘ
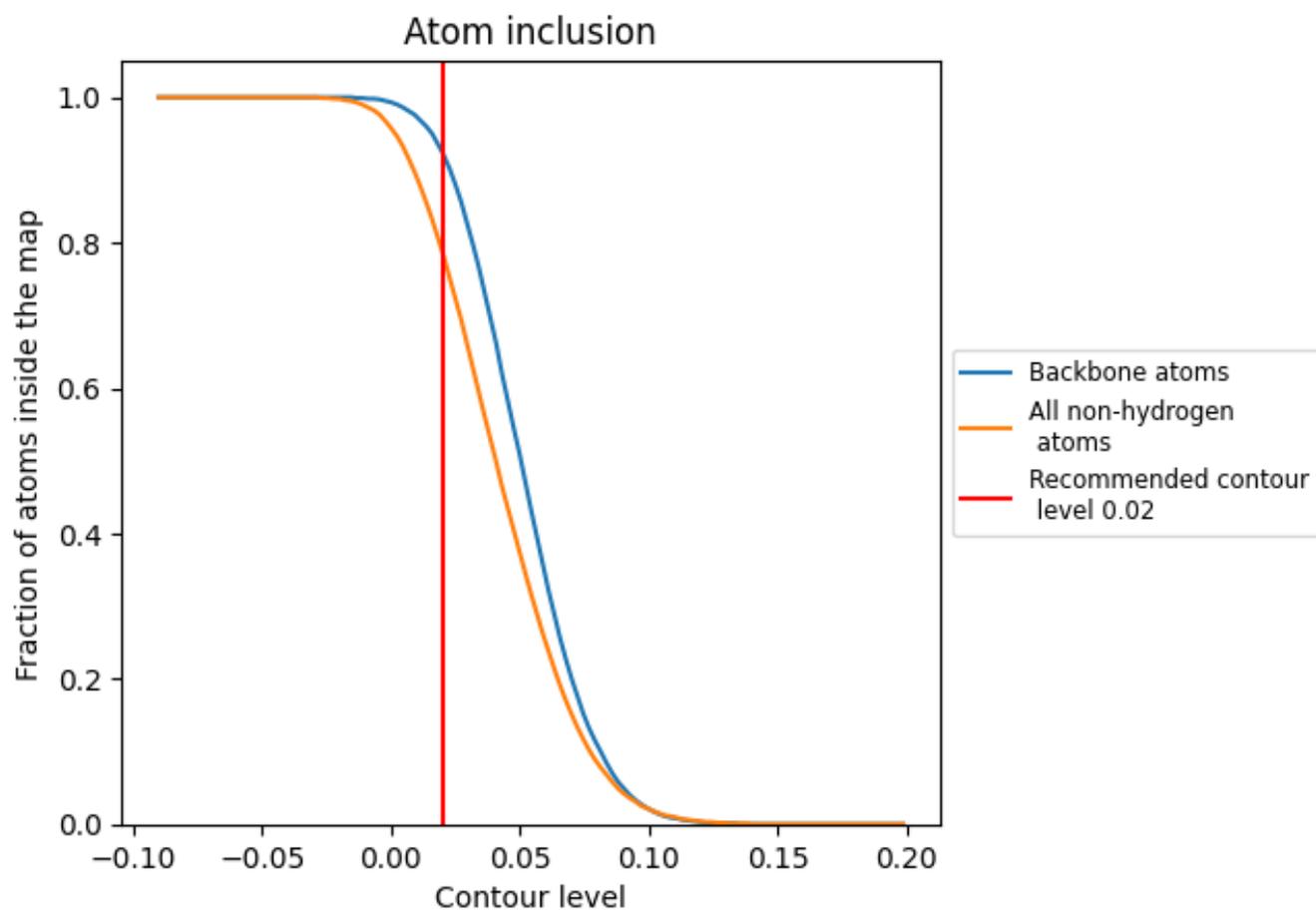
At the recommended contour level, 92% of all backbone atoms, 79% of all non-hydrogen atoms, are inside the map.

9.5   Map-model fit summary (i)

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

Chain	Atom inclusion	Q-score
All	0.7870	0.2240
A	0.8940	0.2350
B	0.7610	0.2410
C	0.7290	0.1450
D	0.7490	0.2520
E	0.7630	0.2380
F	0.7330	0.1530
G	0.7690	0.2250
H	0.7540	0.2540
I	0.7170	0.2070
J	0.7330	0.2280
K	0.7870	0.2280
L	0.7370	0.2080

1.0

0.0
<0.0