



## Full wwPDB EM Validation Report ⓘ

Nov 19, 2022 – 03:25 pm GMT

PDB ID : 5NO4  
EMDB ID : EMD-3663  
Title : RsgA-GDPNP bound to the 30S ribosomal subunit (RsgA assembly intermediate with uS3)  
Authors : Lopez-Alonso, J.P.; Kaminishi, T.; Kikuchi, T.; Hirata, Y.; Iturrioz, I.; Dhimole, N.; Schedlbauer, A.; Hase, Y.; Goto, S.; Kurita, D.; Muto, A.; Zhou, S.; Naoe, C.; Mills, D.J.; Gil-Carton, D.; Takemoto, C.; Himeno, H.; Fucini, P.; Connell, S.R.  
Deposited on : 2017-04-10  
Resolution : 5.16 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

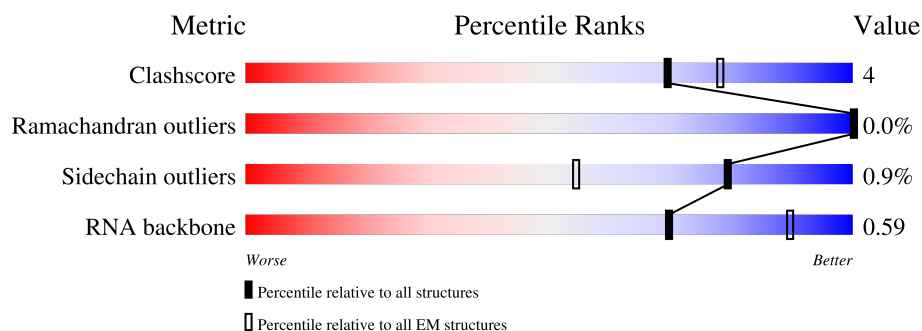
EMDB validation analysis : 0.0.1.dev43  
Mogul : 1.8.4, CSD as541be (2020)  
MolProbity : 4.02b-467  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : 1.9.9  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.31.2

# 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 5.16 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



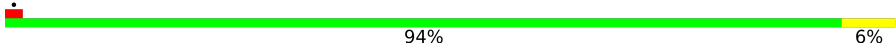

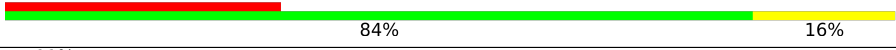


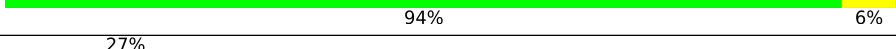
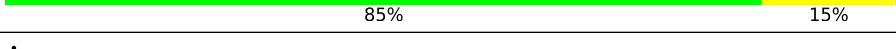
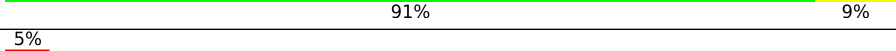
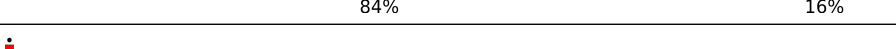
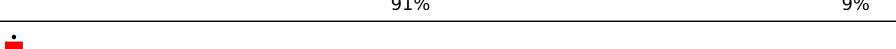
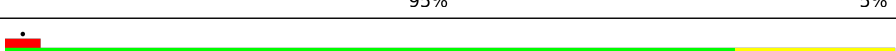
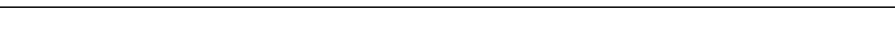
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826
RNA backbone	4643	859

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion  $< 40\%$ ). The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	1534	
2	C	206	
3	D	205	
4	E	155	
5	F	106	
6	G	130	

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Mol	Chain	Length	Quality of chain
7	H	129	
8	I	127	
9	J	99	
10	K	117	
11	L	14	
12	M	114	
13	N	100	
14	O	88	
15	P	82	
16	Q	80	
17	R	55	
18	S	79	
19	T	86	
20	Z	313	

## 2 Entry composition

There are 23 unique types of molecules in this entry. The entry contains 50850 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 16S ribosomal RNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1534	Total	C	N	O	P	0	0
			32930	14694	6041	10661	1534		

- Molecule 2 is a protein called 30S ribosomal protein S3.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	C	206	Total	C	N	O	S	0	0
			1625	1028	305	289	3		

- Molecule 3 is a protein called 30S ribosomal protein S4.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	D	205	Total	C	N	O	S	0	0
			1643	1026	315	298	4		

- Molecule 4 is a protein called 30S ribosomal protein S5.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	E	155	Total	C	N	O	S	0	0
			1144	711	216	211	6		

- Molecule 5 is a protein called 30S ribosomal protein S6.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	F	106	Total	C	N	O	S	0	0
			862	545	156	154	7		

- Molecule 6 is a protein called 30S ribosomal protein S7.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	G	107	Total	C	N	O	S	0	0
			841	525	160	153	3		

- Molecule 7 is a protein called 30S ribosomal protein S8.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	H	129	Total	C	N	O	S	0	0
			979	616	173	184	6		

- Molecule 8 is a protein called 30S ribosomal protein S9.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	I	127	Total	C	N	O	S	0	0
			1022	634	206	179	3		

- Molecule 9 is a protein called 30S ribosomal protein S10.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	J	99	Total	C	N	O	S	0	0
			796	498	152	145	1		

- Molecule 10 is a protein called 30S ribosomal protein S11.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	K	117	Total	C	N	O	S	0	0
			877	540	174	160	3		

- Molecule 11 is a protein called 30S ribosomal protein S12.

Mol	Chain	Residues	Atoms				AltConf	Trace
11	L	14	Total	C	N	O	0	0
			114	70	27	17		

- Molecule 12 is a protein called 30S ribosomal protein S13.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	M	114	Total	C	N	O	S	0	0
			884	546	178	157	3		

- Molecule 13 is a protein called 30S ribosomal protein S14.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	N	100	Total	C	N	O	S	0	0
			805	499	164	139	3		

- Molecule 14 is a protein called 30S ribosomal protein S15.

Mol	Chain	Residues	Atoms					AltConf	Trace
14	O	88	Total	C	N	O	S	0	0
			714	439	144	130	1		

- Molecule 15 is a protein called 30S ribosomal protein S16.

Mol	Chain	Residues	Atoms					AltConf	Trace
15	P	82	Total	C	N	O	S	0	0
			649	406	128	114	1		

- Molecule 16 is a protein called 30S ribosomal protein S17.

Mol	Chain	Residues	Atoms					AltConf	Trace
16	Q	80	Total	C	N	O	S	0	0
			649	411	121	114	3		

- Molecule 17 is a protein called 30S ribosomal protein S18.

Mol	Chain	Residues	Atoms				AltConf	Trace
17	R	55	Total	C	N	O	0	0
			456	288	86	82		

- Molecule 18 is a protein called 30S ribosomal protein S19.

Mol	Chain	Residues	Atoms					AltConf	Trace
18	S	79	Total	C	N	O	S	0	0
			638	408	120	108	2		

- Molecule 19 is a protein called 30S ribosomal protein S20.

Mol	Chain	Residues	Atoms					AltConf	Trace
19	T	86	Total	C	N	O	S	0	0
			670	414	138	115	3		

- Molecule 20 is a protein called Small ribosomal subunit biogenesis GTPase RsgA.

Mol	Chain	Residues	Atoms					AltConf	Trace
20	Z	313	Total	C	N	O	S	0	0
			2448	1538	432	468	10		

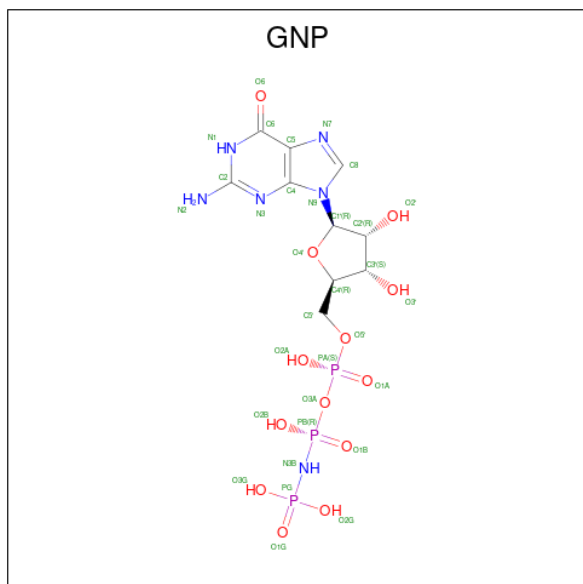
- Molecule 21 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
21	A	67	Total	Mg	0
			67	67	
21	E	1	Total	Mg	0
			1	1	
21	P	1	Total	Mg	0
			1	1	
21	T	1	Total	Mg	0
			1	1	
21	Z	1	Total	Mg	0
			1	1	

- Molecule 22 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		AltConf
22	Z	1	Total	Zn	0
			1	1	

- Molecule 23 is PHOSPHOAMINOPHOSPHONIC ACID-GUANYLATE ESTER (three-letter code: GNP) (formula: C<sub>10</sub>H<sub>17</sub>N<sub>6</sub>O<sub>13</sub>P<sub>3</sub>).

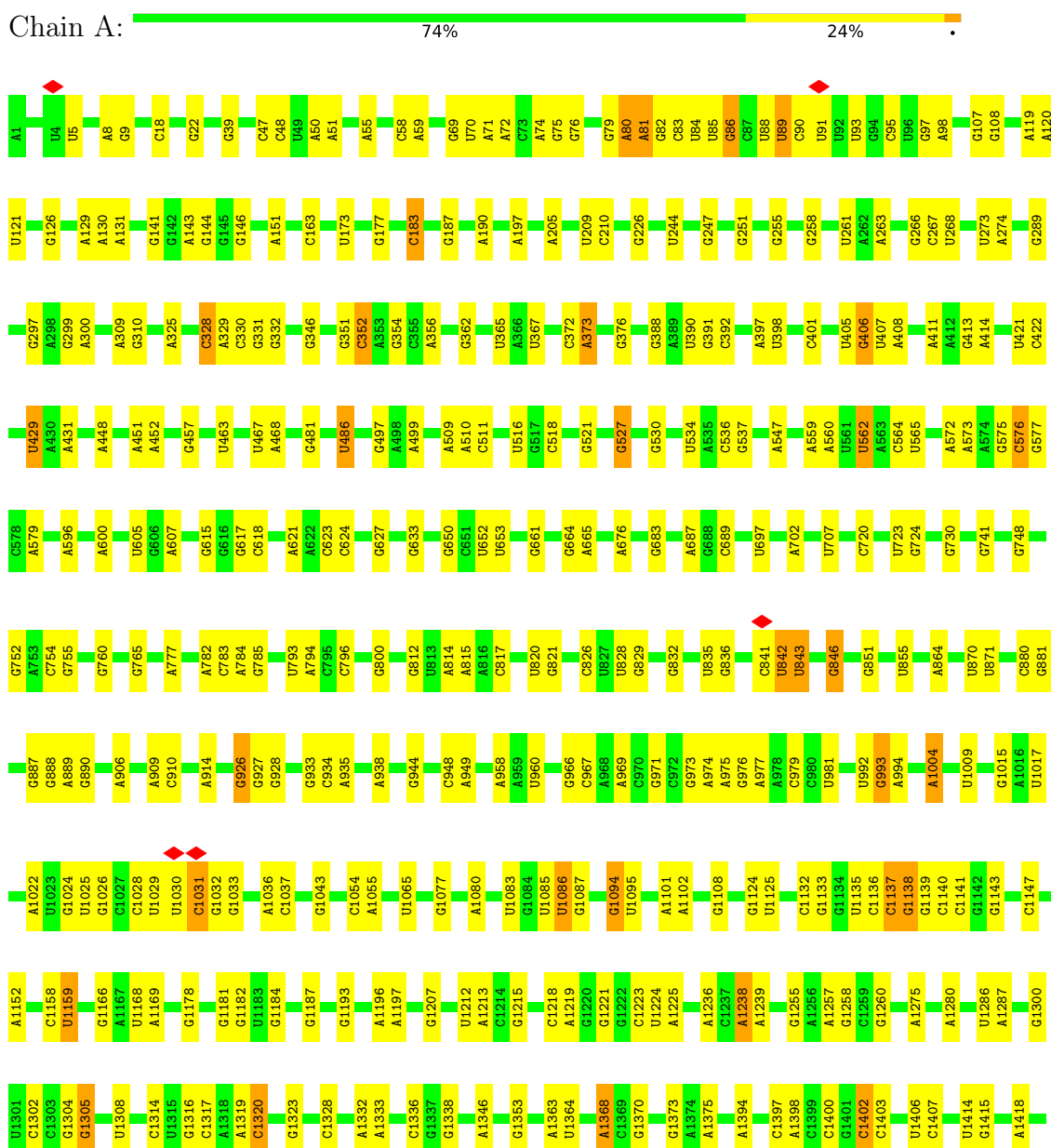


Mol	Chain	Residues	Atoms					AltConf
23	Z	1	Total	C	N	O	P	0
			32	10	6	13	3	

### 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.

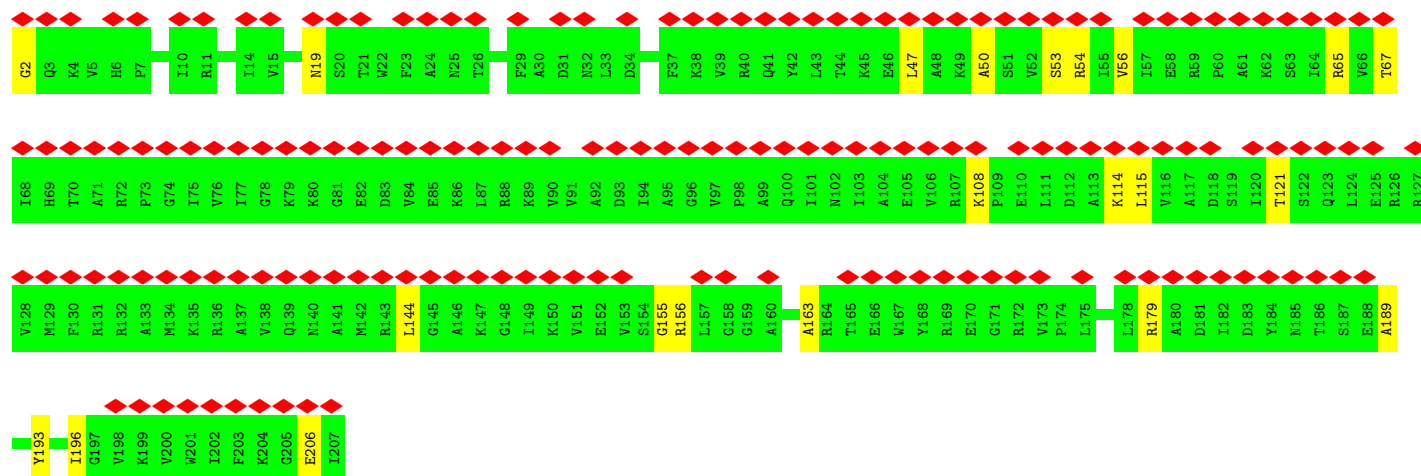
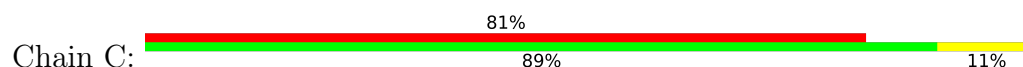
#### • Molecule 1: 16S ribosomal RNA



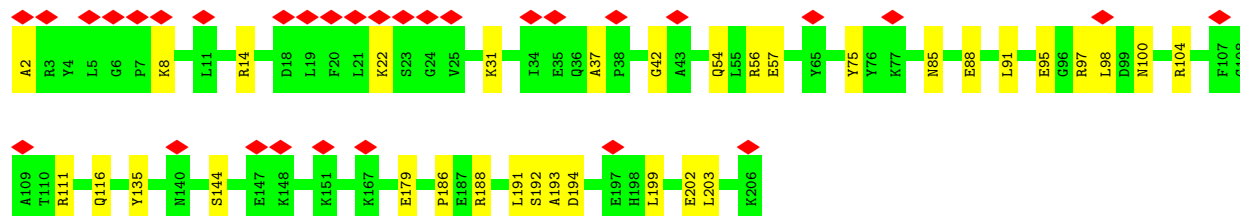
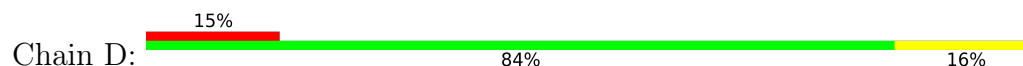




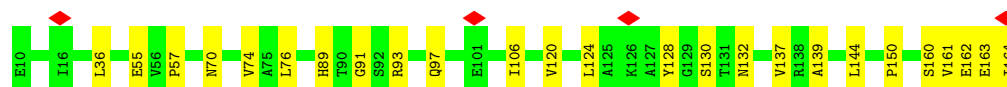
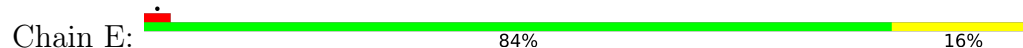
• Molecule 2: 30S ribosomal protein S3



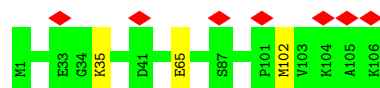
• Molecule 3: 30S ribosomal protein S4



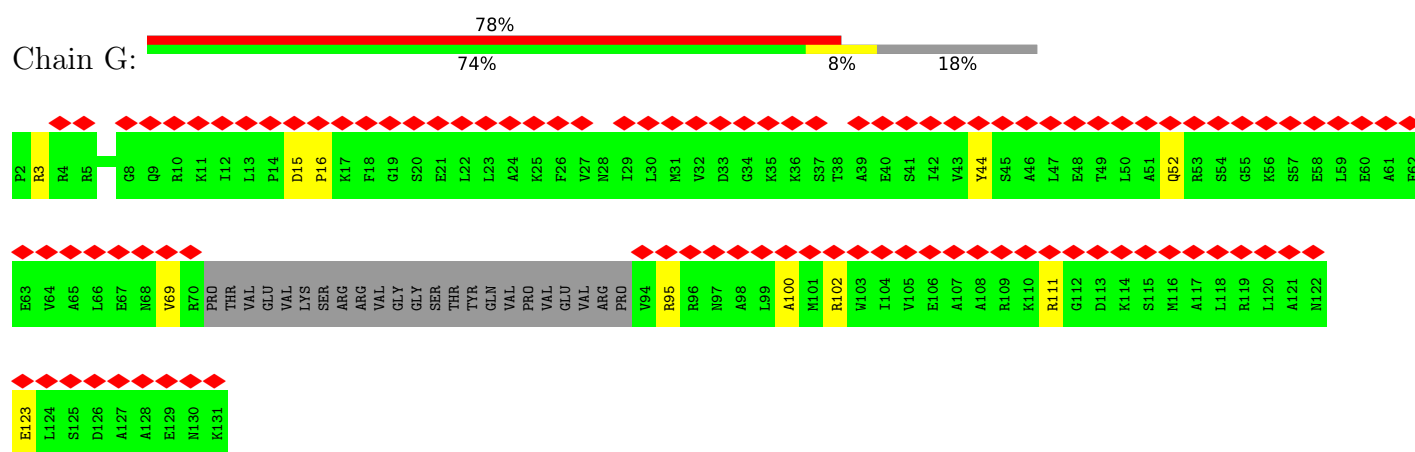
• Molecule 4: 30S ribosomal protein S5



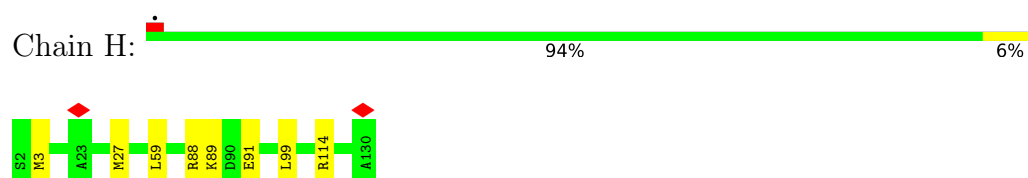
• Molecule 5: 30S ribosomal protein S6



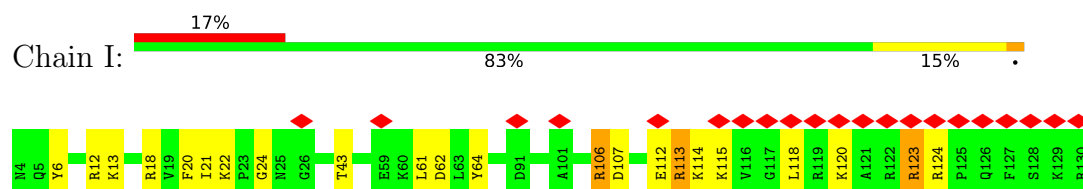
• Molecule 6: 30S ribosomal protein S7



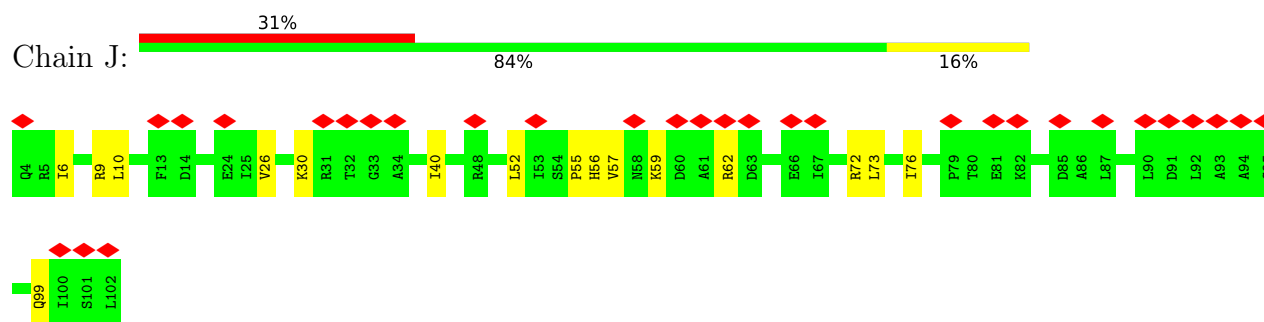
- Molecule 7: 30S ribosomal protein S8



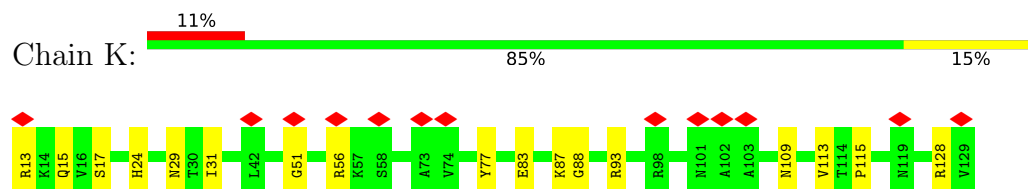
- Molecule 8: 30S ribosomal protein S9



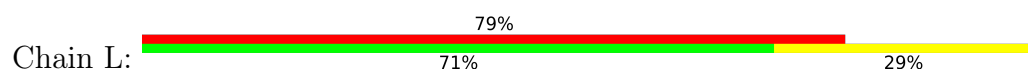
- Molecule 9: 30S ribosomal protein S10



- Molecule 10: 30S ribosomal protein S11

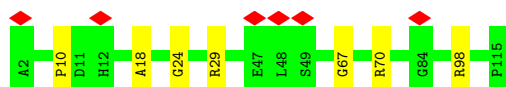


- Molecule 11: 30S ribosomal protein S12

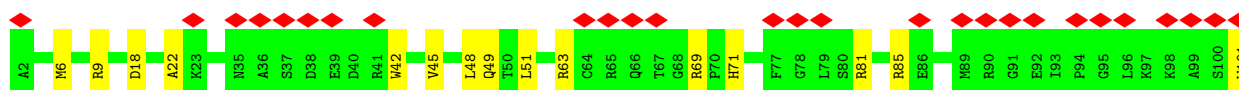
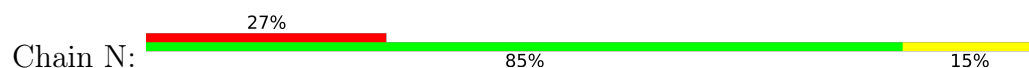




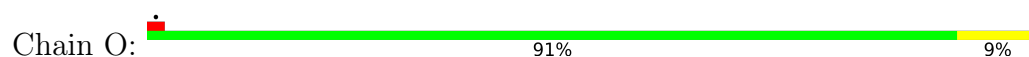
- Molecule 12: 30S ribosomal protein S13



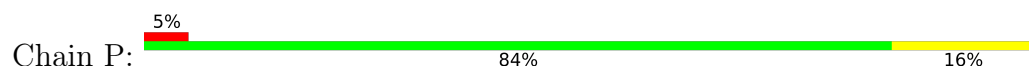
- Molecule 13: 30S ribosomal protein S14



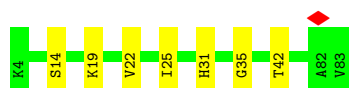
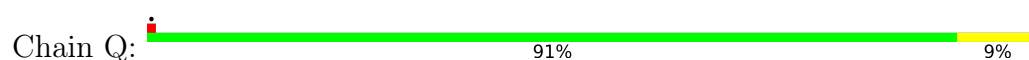
- Molecule 14: 30S ribosomal protein S15



- Molecule 15: 30S ribosomal protein S16




- Molecule 16: 30S ribosomal protein S17

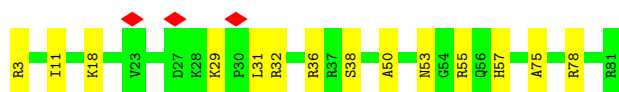


- Molecule 17: 30S ribosomal protein S18



- Molecule 18: 30S ribosomal protein S19

Chain S:  82% 18%




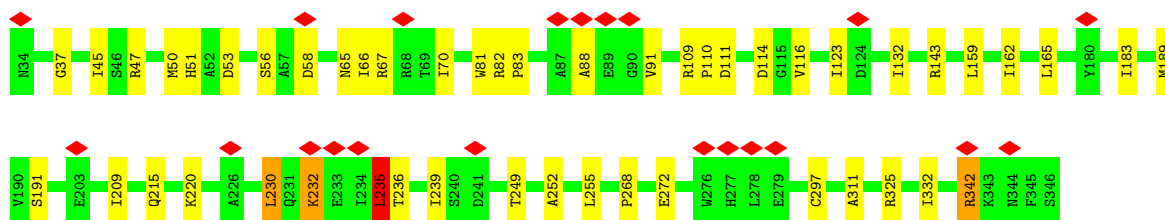
- Molecule 19: 30S ribosomal protein S20

Chain T:  5% 94% 6%



- Molecule 20: Small ribosomal subunit biogenesis GTPase RsgA

Chain Z:  7% 84% 14%



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	61908	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	2.3	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	3000	Depositor
Magnification	101000	Depositor
Image detector	FEI FALCON II (4k x 4k)	Depositor
Maximum map value	0.304	Depositor
Minimum map value	-0.102	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.016	Depositor
Recommended contour level	0.06	Depositor
Map size (Å)	355.84, 355.84, 355.84	wwPDB
Map dimensions	256, 256, 256	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.39, 1.39, 1.39	Depositor

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: PSU, MG, 5MC, 4OC, ZN, MA6, 2MG, GNP, G7M, UR3

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	0.19	0/36593	0.79	10/57081 (0.0%)
2	C	0.25	0/1652	0.45	0/2225
3	D	0.24	0/1665	0.42	0/2227
4	E	0.26	0/1157	0.50	0/1557
5	F	0.24	0/881	0.47	0/1189
6	G	0.25	0/848	0.47	0/1132
7	H	0.26	0/989	0.48	0/1326
8	I	0.26	0/1034	0.55	0/1375
9	J	0.25	0/806	0.51	0/1089
10	K	0.25	0/893	0.46	0/1205
11	L	0.22	0/114	0.40	0/151
12	M	0.26	0/893	0.49	0/1193
13	N	0.24	0/817	0.43	0/1088
14	O	0.23	0/722	0.46	0/964
15	P	0.25	0/659	0.47	0/884
16	Q	0.25	0/658	0.50	0/881
17	R	0.22	0/463	0.41	0/621
18	S	0.26	0/653	0.48	0/877
19	T	0.24	0/676	0.42	0/895
20	Z	0.26	0/2493	0.55	2/3376 (0.1%)
All	All	0.21	0/54666	0.71	12/81336 (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
9	J	0	1
20	Z	0	2
All	All	0	3

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1158	C	C2-N1-C1'	9.22	128.94	118.80
1	A	1158	C	N1-C2-O2	9.19	124.42	118.90
1	A	1158	C	N3-C2-O2	-7.47	116.67	121.90
20	Z	230	LEU	CA-CB-CG	6.90	131.16	115.30
20	Z	235	LEU	CA-CB-CG	6.58	130.44	115.30
1	A	1158	C	C6-N1-C1'	-6.37	113.16	120.80
1	A	754	C	C2-N1-C1'	6.31	125.74	118.80
1	A	1031	C	P-O3'-C3'	6.02	126.92	119.70
1	A	1158	C	C6-N1-C2	-6.01	117.89	120.30
1	A	754	C	N1-C2-O2	5.61	122.27	118.90
1	A	183	C	N1-C2-O2	5.39	122.14	118.90
1	A	328	C	N1-C2-O2	5.21	122.02	118.90

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
9	J	57	VAL	Peptide
20	Z	235	LEU	Peptide
20	Z	342	ARG	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	32930	0	16591	112	0
2	C	1625	0	1696	13	0
3	D	1643	0	1707	20	0
4	E	1144	0	1185	14	0
5	F	862	0	864	2	0
6	G	841	0	886	7	0
7	H	979	0	1031	5	0
8	I	1022	0	1070	16	0
9	J	796	0	836	10	0
10	K	877	0	887	10	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
11	L	114	0	131	2	0
12	M	884	0	941	5	0
13	N	805	0	844	11	0
14	O	714	0	734	4	0
15	P	649	0	666	11	0
16	Q	649	0	691	4	0
17	R	456	0	478	3	0
18	S	638	0	665	10	0
19	T	670	0	719	5	0
20	Z	2448	0	2419	25	0
21	A	67	0	0	0	0
21	E	1	0	0	0	0
21	P	1	0	0	0	0
21	T	1	0	0	0	0
21	Z	1	0	0	0	0
22	Z	1	0	0	0	0
23	Z	32	0	13	0	0
All	All	50850	0	35054	240	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 4.

All (240) 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)
4:E:89:HIS:HB2	4:E:139:ALA:HB2	1.76	0.68
20:Z:252:ALA:HA	20:Z:268:PRO:HG3	1.78	0.66
1:A:1438:G:H1	1:A:1463:U:H3	1.44	0.65
1:A:683:G:H1	1:A:707:U:H3	1.46	0.64
2:C:189:ALA:HB3	2:C:196:ILE:HB	1.83	0.61
3:D:14:ARG:HG3	3:D:56:ARG:HH22	1.66	0.60
4:E:76:LEU:HD11	4:E:120:VAL:HG22	1.84	0.60
4:E:55:GLU:HG3	4:E:57:PRO:HD2	1.84	0.59
3:D:22:LYS:HE3	3:D:31:LYS:HE2	1.83	0.59
2:C:56:VAL:HB	2:C:67:THR:HB	1.83	0.59
1:A:933:G:N7	6:G:3:ARG:NH1	2.50	0.58
1:A:406:G:H21	3:D:116:GLN:HE22	1.51	0.58
1:A:1437:A:H5''	19:T:29:ARG:HH12	1.69	0.58
1:A:1406:U:O2	1:A:1517:G:N2	2.37	0.57
1:A:376:G:H5''	15:P:5:ARG:HB2	1.87	0.57
1:A:782:A:H62	1:A:800:G:H21	1.52	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
8:I:123:ARG:NH1	8:I:124:ARG:O	2.38	0.56
1:A:407:U:OP1	3:D:8:LYS:NZ	2.38	0.56
1:A:664:G:H22	1:A:741:G:H1	1.52	0.56
1:A:76:G:H1	1:A:93:U:H3	1.54	0.56
1:A:1320:C:N3	18:S:36:ARG:NH1	2.53	0.56
1:A:890:G:O2'	1:A:906:A:N6	2.38	0.56
18:S:53:ASN:HB3	18:S:75:ALA:HB1	1.88	0.56
1:A:187:G:N2	1:A:190:A:OP2	2.39	0.56
9:J:26:VAL:HG12	9:J:30:LYS:HE3	1.88	0.56
1:A:579:A:H4'	14:O:54:ARG:HH22	1.70	0.56
6:G:111:ARG:NH1	6:G:123:GLU:OE2	2.39	0.55
1:A:562:U:OP2	11:L:14:ARG:NH1	2.40	0.55
3:D:188:ARG:HH12	3:D:193:ALA:HA	1.72	0.55
1:A:1137:C:O2	1:A:1138:G:N2	2.40	0.55
1:A:618:C:N4	1:A:621:A:OP2	2.40	0.55
13:N:69:ARG:HG3	13:N:71:HIS:H	1.72	0.55
1:A:1221:G:OP1	18:S:36:ARG:NH1	2.40	0.54
20:Z:132:ILE:HG12	20:Z:165:LEU:HD11	1.89	0.54
1:A:1238:A:H5'	1:A:1336:C:H41	1.72	0.54
8:I:24:GLY:H	8:I:61:LEU:HA	1.72	0.53
1:A:981:U:OP1	13:N:9:ARG:NH1	2.42	0.53
1:A:1418:A:N6	1:A:1482:G:O2'	2.42	0.53
18:S:18:LYS:HE3	18:S:31:LEU:HD23	1.91	0.53
13:N:48:LEU:HD12	13:N:51:LEU:HD12	1.91	0.53
1:A:8:A:N6	3:D:202:GLU:O	2.41	0.53
8:I:120:LYS:HB2	8:I:123:ARG:HB3	1.91	0.53
9:J:40:ILE:HD11	9:J:73:LEU:HD23	1.91	0.53
1:A:958:A:OP1	18:S:55:ARG:NH1	2.39	0.52
12:M:67:GLY:HA2	12:M:70:ARG:HD3	1.90	0.52
16:Q:25:ILE:HB	16:Q:42:THR:HB	1.91	0.52
18:S:50:ALA:HB1	18:S:57:HIS:HB3	1.90	0.52
1:A:618:C:O2'	15:P:14:ARG:NH2	2.41	0.52
1:A:979:C:OP1	1:A:1223:C:N4	2.43	0.52
9:J:9:ARG:HB2	9:J:99:GLN:HB2	1.90	0.52
15:P:34:GLU:OE2	15:P:60:TRP:NE1	2.43	0.52
6:G:16:PRO:HG3	8:I:43:THR:HG23	1.90	0.52
1:A:107:G:OP1	1:A:325:A:N6	2.42	0.52
7:H:88:ARG:NH2	7:H:91:GLU:OE2	2.42	0.52
8:I:114:LYS:NZ	8:I:118:LEU:O	2.43	0.52
1:A:1055:A:O2'	2:C:156:ARG:NH1	2.42	0.52
1:A:1375:A:O2'	6:G:102:ARG:NH2	2.43	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
20:Z:88:ALA:HB3	20:Z:91:VAL:HB	1.90	0.52
1:A:1147:C:H1'	8:I:18:ARG:HH12	1.74	0.51
3:D:192:SER:OG	3:D:194:ASP:OD1	2.28	0.51
12:M:10:PRO:HB2	12:M:18:ALA:HB1	1.92	0.51
1:A:730:G:O2'	1:A:814:A:N6	2.44	0.51
20:Z:47:ARG:HH12	20:Z:66:ILE:HG21	1.74	0.51
15:P:20:VAL:HG12	15:P:35:ARG:HA	1.93	0.51
9:J:59:LYS:HE2	9:J:62:ARG:HH21	1.75	0.51
1:A:974:A:OP1	13:N:69:ARG:NH2	2.44	0.51
20:Z:37:GLY:H	20:Z:82:ARG:HB3	1.75	0.51
20:Z:123:ILE:HG13	20:Z:209:ILE:HB	1.92	0.51
1:A:676:A:H5''	10:K:115:PRO:HB3	1.93	0.51
14:O:44:ALA:O	14:O:47:LYS:NZ	2.41	0.51
4:E:160:SER:HA	4:E:164:ILE:HD12	1.93	0.51
3:D:54:GLN:HB3	3:D:203:LEU:HB2	1.93	0.50
9:J:10:LEU:HB2	9:J:72:ARG:HB2	1.91	0.50
15:P:18:GLN:HE22	15:P:35:ARG:HE	1.58	0.50
1:A:401:C:O2'	1:A:621:A:N3	2.44	0.50
1:A:1316:G:N1	1:A:1319:A:OP2	2.44	0.50
3:D:95:GLU:HG2	3:D:186:PRO:HG3	1.93	0.50
9:J:52:LEU:HB2	13:N:81:ARG:HD2	1.94	0.50
10:K:88:GLY:O	10:K:93:ARG:NH1	2.45	0.50
20:Z:143:ARG:HD2	20:Z:332:ILE:HG12	1.93	0.50
1:A:299:G:N2	1:A:565:U:O2	2.45	0.50
18:S:11:ILE:HG13	18:S:38:SER:HB2	1.92	0.50
1:A:973:G:H1'	9:J:56:HIS:HD2	1.77	0.50
8:I:6:TYR:HB2	8:I:21:ILE:HB	1.93	0.50
16:Q:31:HIS:HB3	16:Q:35:GLY:H	1.76	0.50
1:A:1255:G:O2'	1:A:1258:G:N3	2.40	0.49
3:D:95:GLU:HA	3:D:100:ASN:HD22	1.76	0.49
1:A:373:A:O2'	1:A:451:A:N7	2.45	0.49
14:O:10:LYS:NZ	14:O:14:GLU:OE2	2.43	0.49
20:Z:111:ASP:HB3	20:Z:114:ASP:HB2	1.92	0.49
20:Z:183:ILE:HD13	20:Z:325:ARG:HH12	1.77	0.49
1:A:1077:G:N2	1:A:1080:A:OP2	2.40	0.49
20:Z:110:PRO:HB3	20:Z:116:VAL:HG22	1.94	0.49
1:A:1304:G:H21	1:A:1333:A:H62	1.58	0.49
10:K:24:HIS:HB3	10:K:31:ILE:HB	1.94	0.49
1:A:1314:C:N4	18:S:3:ARG:O	2.43	0.49
1:A:846:G:OP1	17:R:48:ARG:NH2	2.46	0.48
12:M:24:GLY:O	12:M:29:ARG:NH1	2.46	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
20:Z:215:GLN:O	20:Z:220:LYS:NZ	2.45	0.48
1:A:617:G:H1	1:A:623:C:H42	1.59	0.48
5:F:35:LYS:HB2	5:F:65:GLU:HB3	1.94	0.48
1:A:1328:C:O2'	12:M:29:ARG:NH2	2.47	0.48
10:K:87:LYS:HG3	10:K:115:PRO:HD3	1.95	0.48
1:A:297:G:N2	1:A:300:A:OP2	2.39	0.48
3:D:144:SER:HA	3:D:179:GLU:HA	1.96	0.48
1:A:69:G:O6	1:A:98:A:N6	2.47	0.47
1:A:1402:4OC:HM22	1:A:1403:C:H5'	1.95	0.47
1:A:1187:G:H4'	8:I:113:ARG:HH11	1.79	0.47
2:C:156:ARG:HH21	2:C:193:TYR:HB3	1.79	0.47
1:A:1236:A:H4'	1:A:1304:G:H4'	1.96	0.47
10:K:51:GLY:O	10:K:56:ARG:NH1	2.47	0.47
1:A:273:U:O4	1:A:274:A:N6	2.47	0.47
2:C:53:SER:HB2	2:C:114:LYS:HB3	1.95	0.47
2:C:108:LYS:HD3	2:C:144:LEU:HB3	1.96	0.47
5:F:35:LYS:N	5:F:65:GLU:O	2.48	0.47
8:I:106:ARG:NH1	8:I:107:ASP:O	2.47	0.47
1:A:405:U:O4	3:D:2:ALA:N	2.48	0.47
1:A:407:U:H2'	1:A:408:A:H8	1.79	0.47
1:A:887:G:H1	1:A:910:C:H42	1.61	0.47
1:A:1094:G:O2'	1:A:1108:G:N2	2.47	0.47
4:E:36:LEU:HD21	4:E:137:VAL:HG21	1.96	0.47
7:H:27:MET:O	7:H:59:LEU:N	2.45	0.47
1:A:835:U:OP1	17:R:53:ARG:NH2	2.43	0.47
1:A:689:C:OP1	10:K:29:ASN:ND2	2.46	0.47
1:A:1305:G:H21	1:A:1332:A:H2	1.63	0.47
1:A:81:A:N1	1:A:86:G:N1	2.57	0.46
3:D:37:ALA:HB3	3:D:42:GLY:HA2	1.97	0.46
1:A:58:C:O2'	1:A:388:G:N7	2.39	0.46
1:A:362:G:N2	1:A:365:U:OP2	2.41	0.46
3:D:75:TYR:OH	3:D:97:ARG:NH1	2.48	0.46
1:A:55:A:OP2	1:A:352:C:N4	2.46	0.46
9:J:52:LEU:HD23	9:J:62:ARG:HG2	1.97	0.46
20:Z:45:ILE:HG23	20:Z:255:LEU:HB3	1.98	0.46
1:A:600:A:H5''	7:H:89:LYS:HD2	1.97	0.46
1:A:310:G:H5''	15:P:31:ARG:HB2	1.97	0.46
1:A:842:U:H3'	1:A:843:U:H4'	1.98	0.46
4:E:163:GLU:HB3	7:H:114:ARG:HH12	1.81	0.46
20:Z:162:ILE:HG12	20:Z:191:SER:HB2	1.98	0.46
14:O:33:THR:HA	14:O:63:ARG:HH11	1.80	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:309:A:O2'	1:A:607:A:N1	2.48	0.45
3:D:14:ARG:O	3:D:56:ARG:NH2	2.49	0.45
1:A:429:U:H3	1:A:431:A:H62	1.64	0.45
2:C:121:THR:HG23	2:C:189:ALA:HA	1.99	0.45
6:G:15:ASP:OD1	6:G:44:TYR:OH	2.31	0.45
1:A:59:A:H3'	1:A:331:G:H22	1.80	0.45
1:A:624:C:H4'	15:P:10:GLY:HA2	1.99	0.45
1:A:1178:G:N2	1:A:1181:G:OP2	2.48	0.45
6:G:69:VAL:HG23	6:G:100:ALA:HB1	1.99	0.45
1:A:843:U:OP1	1:A:846:G:N1	2.42	0.45
1:A:1193:G:N7	2:C:2:GLY:N	2.64	0.45
8:I:22:LYS:HB3	8:I:62:ASP:HB2	1.99	0.45
2:C:179:ARG:NH1	2:C:206:GLU:OE1	2.47	0.45
8:I:20:PHE:HB2	8:I:64:TYR:HB3	1.98	0.45
8:I:112:GLU:OE2	8:I:115:LYS:NZ	2.47	0.45
1:A:1083:U:O2'	1:A:1102:A:OP2	2.29	0.44
3:D:98:LEU:HB2	3:D:135:TYR:HB3	1.99	0.44
1:A:944:G:N1	1:A:1338:G:OP2	2.44	0.44
1:A:993:G:O2'	1:A:994:A:N7	2.51	0.44
1:A:80:A:N6	1:A:89:U:O4	2.48	0.44
1:A:255:G:H4'	16:Q:19:LYS:HD2	1.99	0.44
19:T:10:ARG:NH1	19:T:13:GLN:OE1	2.50	0.44
9:J:6:ILE:HG13	9:J:76:ILE:HB	1.98	0.44
10:K:87:LYS:HB2	10:K:113:VAL:HG23	2.00	0.44
20:Z:56:SER:OG	20:Z:58:ASP:OD1	2.33	0.44
20:Z:159:LEU:HB3	20:Z:189:MET:HG3	2.00	0.44
1:A:928:G:O2'	1:A:1533:C:OP1	2.33	0.44
2:C:53:SER:HB3	2:C:115:LEU:HG	2.00	0.44
1:A:261:U:OP2	19:T:74:ARG:NH2	2.46	0.44
1:A:1510:C:H42	1:A:1525:G:H1	1.66	0.44
2:C:19:ASN:OD1	2:C:54:ARG:NE	2.51	0.44
1:A:1368:A:H5''	8:I:114:LYS:HB3	1.99	0.43
8:I:12:ARG:HG3	8:I:13:LYS:H	1.83	0.43
10:K:15:GLN:HE21	10:K:17:SER:HB2	1.83	0.43
20:Z:51:HIS:HA	20:Z:65:ASN:HA	2.00	0.43
1:A:697:U:O2'	1:A:785:G:O2'	2.34	0.43
19:T:9:LYS:HE3	19:T:13:GLN:HE21	1.83	0.43
13:N:6:MET:HB3	13:N:63:ARG:HH12	1.84	0.43
20:Z:45:ILE:N	20:Z:53:ASP:O	2.44	0.43
1:A:1086:U:H3'	1:A:1087:G:H8	1.83	0.43
13:N:42:TRP:HE1	13:N:45:VAL:HG23	1.83	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
20:Z:109:ARG:NH2	20:Z:272:GLU:O	2.51	0.43
1:A:1373:G:O6	8:I:13:LYS:NZ	2.50	0.43
2:C:155:GLY:HA2	2:C:163:ALA:HB1	2.00	0.43
1:A:258:G:H1	1:A:268:U:H3	1.66	0.43
1:A:926:G:H1	20:Z:342:ARG:HH21	1.67	0.43
1:A:1218:C:H2'	1:A:1219:A:C8	2.54	0.43
3:D:104:ARG:HH21	3:D:111:ARG:HH22	1.66	0.43
13:N:49:GLN:NE2	18:S:11:ILE:O	2.51	0.43
1:A:373:A:H61	1:A:391:G:H1'	1.83	0.42
16:Q:14:SER:HB3	16:Q:22:VAL:HB	2.01	0.42
3:D:57:GLU:HG2	3:D:199:LEU:HB2	2.01	0.42
13:N:18:ASP:HA	13:N:22:ALA:HB2	2.01	0.42
10:K:13:ARG:NH2	10:K:77:TYR:OH	2.52	0.42
4:E:150:PRO:HG3	7:H:99:LEU:HD21	2.01	0.42
1:A:390:U:O3'	15:P:28:ARG:NH1	2.51	0.42
1:A:575:G:H4'	1:A:576:C:H5''	2.02	0.42
1:A:126:G:OP1	1:A:605:U:O2'	2.30	0.42
20:Z:239:ILE:O	20:Z:249:THR:OG1	2.33	0.42
4:E:106:ILE:HD11	4:E:124:LEU:HD23	2.01	0.42
20:Z:45:ILE:HB	20:Z:53:ASP:HB3	2.02	0.42
1:A:948:C:H2'	1:A:949:A:H8	1.85	0.42
1:A:1166:G:N1	1:A:1169:A:OP2	2.52	0.42
3:D:85:ASN:HB3	3:D:88:GLU:HB2	2.02	0.42
9:J:55:PRO:HA	13:N:81:ARG:HH22	1.85	0.42
20:Z:232:LYS:HA	20:Z:235:LEU:HB2	2.02	0.42
1:A:18:C:OP1	4:E:132:ASN:ND2	2.51	0.41
4:E:93:ARG:HB2	4:E:128:TYR:HB2	2.02	0.41
1:A:652:U:O4	1:A:752:G:O2'	2.33	0.41
4:E:91:GLY:O	4:E:130:SER:N	2.46	0.41
18:S:32:ARG:HA	18:S:50:ALA:HB3	2.02	0.41
8:I:113:ARG:NH1	13:N:101:TRP:OXT	2.53	0.41
15:P:46:LYS:HG3	15:P:47:GLU:HG3	2.01	0.41
1:A:627:G:OP1	15:P:35:ARG:NH1	2.53	0.41
1:A:888:G:H21	1:A:909:A:H62	1.69	0.41
1:A:1512:U:H2'	1:A:1513:A:C8	2.56	0.41
11:L:7:LEU:HD21	11:L:12:ARG:HE	1.84	0.41
15:P:7:ALA:HB3	15:P:18:GLN:HB2	2.02	0.41
1:A:263:A:OP1	19:T:74:ARG:NH1	2.53	0.41
1:A:765:G:N1	1:A:812:G:O2'	2.46	0.41
1:A:783:C:H2'	1:A:784:A:H8	1.85	0.41
1:A:880:C:H2'	1:A:881:G:H8	1.85	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1159:U:O4'	1:A:1182:G:N2	2.54	0.41
1:A:720:C:H5''	17:R:41:PRO:HB3	2.03	0.41
1:A:448:A:H62	1:A:486:U:H3	1.68	0.41
1:A:1308:U:OP2	12:M:98:ARG:NH1	2.54	0.41
1:A:1414:U:H2'	1:A:1415:G:H8	1.85	0.41
3:D:91:LEU:HD13	3:D:191:LEU:HD12	2.02	0.41
4:E:74:VAL:HG21	4:E:144:LEU:HB3	2.03	0.41
10:K:83:GLU:HG2	10:K:109:ASN:HB2	2.03	0.41
1:A:855:U:OP2	1:A:871:U:N3	2.41	0.41
1:A:938:A:O2'	6:G:95:ARG:NH1	2.50	0.41
20:Z:67:ARG:HB3	20:Z:70:ILE:HG12	2.02	0.40
20:Z:81:TRP:HZ3	20:Z:83:PRO:HB3	1.86	0.40
20:Z:297:CYS:SG	20:Z:311:ALA:N	2.93	0.40
1:A:1004:A:H5'	1:A:1024:G:H1	1.86	0.40
1:A:1516:2MG:N2	1:A:1519:MA6:OP2	2.49	0.40
2:C:47:LEU:HB3	2:C:50:ALA:HB3	2.03	0.40
4:E:97:GLN:HB3	4:E:124:LEU:HB2	2.02	0.40
1:A:536:C:N4	1:A:537:G:O6	2.54	0.40
4:E:161:VAL:HG12	4:E:162:GLU:H	1.87	0.40

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	C	204/206 (99%)	201 (98%)	3 (2%)	0	100	100
3	D	203/205 (99%)	196 (97%)	7 (3%)	0	100	100
4	E	153/155 (99%)	147 (96%)	6 (4%)	0	100	100
5	F	104/106 (98%)	102 (98%)	2 (2%)	0	100	100
6	G	103/130 (79%)	100 (97%)	3 (3%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
7	H	127/129 (98%)	124 (98%)	3 (2%)	0	100	100
8	I	125/127 (98%)	118 (94%)	7 (6%)	0	100	100
9	J	97/99 (98%)	91 (94%)	6 (6%)	0	100	100
10	K	115/117 (98%)	112 (97%)	3 (3%)	0	100	100
11	L	12/14 (86%)	12 (100%)	0	0	100	100
12	M	112/114 (98%)	104 (93%)	8 (7%)	0	100	100
13	N	98/100 (98%)	96 (98%)	2 (2%)	0	100	100
14	O	86/88 (98%)	84 (98%)	2 (2%)	0	100	100
15	P	80/82 (98%)	77 (96%)	3 (4%)	0	100	100
16	Q	78/80 (98%)	76 (97%)	2 (3%)	0	100	100
17	R	53/55 (96%)	53 (100%)	0	0	100	100
18	S	77/79 (98%)	74 (96%)	3 (4%)	0	100	100
19	T	84/86 (98%)	83 (99%)	1 (1%)	0	100	100
20	Z	311/313 (99%)	295 (95%)	15 (5%)	1 (0%)	41	76
All	All	2222/2285 (97%)	2145 (96%)	76 (3%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
20	Z	236	THR

### 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	C	170/170 (100%)	169 (99%)	1 (1%)	86	91
3	D	172/172 (100%)	172 (100%)	0	100	100
4	E	118/118 (100%)	117 (99%)	1 (1%)	81	89
5	F	92/92 (100%)	91 (99%)	1 (1%)	73	84

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
6	G	88/109 (81%)	87 (99%)	1 (1%)	73	84
7	H	104/104 (100%)	103 (99%)	1 (1%)	76	86
8	I	105/105 (100%)	102 (97%)	3 (3%)	42	64
9	J	87/87 (100%)	87 (100%)	0	100	100
10	K	90/90 (100%)	89 (99%)	1 (1%)	73	84
11	L	12/12 (100%)	11 (92%)	1 (8%)	11	36
12	M	92/92 (100%)	92 (100%)	0	100	100
13	N	83/83 (100%)	82 (99%)	1 (1%)	71	84
14	O	76/76 (100%)	75 (99%)	1 (1%)	69	82
15	P	65/65 (100%)	65 (100%)	0	100	100
16	Q	74/74 (100%)	74 (100%)	0	100	100
17	R	48/48 (100%)	48 (100%)	0	100	100
18	S	70/70 (100%)	68 (97%)	2 (3%)	42	64
19	T	65/65 (100%)	65 (100%)	0	100	100
20	Z	267/267 (100%)	264 (99%)	3 (1%)	73	84
All	All	1878/1899 (99%)	1861 (99%)	17 (1%)	79	87

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	C	65	ARG
4	E	70	ASN
5	F	102	MET
6	G	52	GLN
7	H	3	MET
8	I	106	ARG
8	I	113	ARG
8	I	123	ARG
10	K	128	ARG
11	L	5	ASN
13	N	85	ARG
14	O	89	ARG
18	S	29	LYS
18	S	78	ARG
20	Z	50	MET
20	Z	230	LEU
20	Z	232	LYS



Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
3	D	71	GLN
3	D	116	GLN
3	D	120	HIS
4	E	70	ASN
5	F	55	HIS
6	G	52	GLN
8	I	5	GLN
8	I	75	GLN
8	I	126	GLN
10	K	15	GLN
12	M	14	HIS
12	M	91	HIS
12	M	105	ASN
15	P	18	GLN
18	S	52	HIS
18	S	57	HIS
19	T	84	ASN

### 5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	1530/1534 (99%)	238 (15%)	2 (0%)

All (238) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	A	5	U
1	A	9	G
1	A	22	G
1	A	39	G
1	A	47	C
1	A	48	C
1	A	50	A
1	A	51	A
1	A	70	U
1	A	71	A
1	A	72	A
1	A	74	A
1	A	75	G
1	A	79	G

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Mol	Chain	Res	Type
1	A	80	A
1	A	81	A
1	A	82	G
1	A	83	C
1	A	84	U
1	A	85	U
1	A	86	G
1	A	88	U
1	A	89	U
1	A	90	C
1	A	91	U
1	A	95	C
1	A	97	G
1	A	108	G
1	A	119	A
1	A	120	A
1	A	121	U
1	A	129	A
1	A	130	A
1	A	131	A
1	A	141	G
1	A	143	A
1	A	144	G
1	A	146	G
1	A	151	A
1	A	163	C
1	A	173	U
1	A	177	G
1	A	183	C
1	A	197	A
1	A	205	A
1	A	210	C
1	A	226	G
1	A	244	U
1	A	247	G
1	A	251	G
1	A	266	G
1	A	267	C
1	A	289	G
1	A	328	C
1	A	329	A
1	A	330	C

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Mol	Chain	Res	Type
1	A	332	G
1	A	346	G
1	A	351	G
1	A	352	C
1	A	354	G
1	A	356	A
1	A	367	U
1	A	372	C
1	A	373	A
1	A	392	C
1	A	397	A
1	A	398	U
1	A	406	G
1	A	411	A
1	A	413	G
1	A	414	A
1	A	421	U
1	A	422	C
1	A	429	U
1	A	452	A
1	A	457	G
1	A	463	U
1	A	467	U
1	A	468	A
1	A	481	G
1	A	486	U
1	A	497	G
1	A	499	A
1	A	509	A
1	A	510	A
1	A	511	C
1	A	518	C
1	A	521	G
1	A	527	G7M
1	A	530	G
1	A	534	U
1	A	547	A
1	A	559	A
1	A	560	A
1	A	562	U
1	A	564	C
1	A	572	A

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Mol	Chain	Res	Type
1	A	573	A
1	A	576	C
1	A	577	G
1	A	596	A
1	A	615	G
1	A	633	G
1	A	650	G
1	A	653	U
1	A	661	G
1	A	665	A
1	A	687	A
1	A	702	A
1	A	723	U
1	A	724	G
1	A	748	G
1	A	755	G
1	A	760	G
1	A	777	A
1	A	793	U
1	A	794	A
1	A	796	C
1	A	815	A
1	A	817	C
1	A	820	U
1	A	821	G
1	A	826	C
1	A	828	U
1	A	829	G
1	A	832	G
1	A	836	G
1	A	841	C
1	A	842	U
1	A	843	U
1	A	846	G
1	A	851	G
1	A	864	A
1	A	870	U
1	A	889	A
1	A	914	A
1	A	926	G
1	A	927	G
1	A	934	C

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Mol	Chain	Res	Type
1	A	935	A
1	A	960	U
1	A	969	A
1	A	971	G
1	A	975	A
1	A	976	G
1	A	977	A
1	A	992	U
1	A	993	G
1	A	1004	A
1	A	1009	U
1	A	1015	G
1	A	1017	U
1	A	1022	A
1	A	1025	U
1	A	1026	G
1	A	1028	C
1	A	1029	U
1	A	1030	U
1	A	1032	G
1	A	1033	G
1	A	1036	A
1	A	1037	C
1	A	1043	G
1	A	1054	C
1	A	1065	U
1	A	1085	U
1	A	1086	U
1	A	1094	G
1	A	1095	U
1	A	1101	A
1	A	1124	G
1	A	1125	U
1	A	1132	C
1	A	1133	G
1	A	1135	U
1	A	1136	C
1	A	1137	C
1	A	1138	G
1	A	1139	G
1	A	1140	C
1	A	1141	C

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Mol	Chain	Res	Type
1	A	1143	G
1	A	1152	A
1	A	1159	U
1	A	1168	U
1	A	1184	G
1	A	1196	A
1	A	1197	A
1	A	1212	U
1	A	1213	A
1	A	1215	G
1	A	1224	U
1	A	1225	A
1	A	1238	A
1	A	1239	A
1	A	1257	A
1	A	1260	G
1	A	1275	A
1	A	1280	A
1	A	1286	U
1	A	1287	A
1	A	1300	G
1	A	1302	C
1	A	1305	G
1	A	1317	C
1	A	1320	C
1	A	1323	G
1	A	1346	A
1	A	1353	G
1	A	1363	A
1	A	1364	U
1	A	1368	A
1	A	1370	G
1	A	1394	A
1	A	1397	C
1	A	1398	A
1	A	1400	C
1	A	1432	G
1	A	1441	A
1	A	1446	A
1	A	1451	U
1	A	1452	C
1	A	1453	G

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Mol	Chain	Res	Type
1	A	1454	G
1	A	1455	G
1	A	1491	G
1	A	1492	A
1	A	1493	A
1	A	1494	G
1	A	1497	G
1	A	1499	A
1	A	1503	A
1	A	1505	G
1	A	1517	G
1	A	1529	G
1	A	1530	G
1	A	1534	A

All (2) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	A	209	U
1	A	1031	C

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

11 non-standard protein/DNA/RNA residues are modelled in this entry.

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
1	PSU	A	516	1,21	18,21,22	1.37	2 (11%)	22,30,33	1.86	3 (13%)
1	2MG	A	1516	1	18,26,27	0.89	1 (5%)	16,38,41	1.11	2 (12%)
1	2MG	A	966	1	18,26,27	1.01	1 (5%)	16,38,41	1.10	2 (12%)
1	G7M	A	527	1	20,26,27	1.11	2 (10%)	17,39,42	0.83	0
1	UR3	A	1498	1,21	19,22,23	0.98	1 (5%)	26,32,35	1.44	1 (3%)
1	5MC	A	1407	1	18,22,23	0.94	2 (11%)	26,32,35	1.10	3 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
1	4OC	A	1402	1	20,23,24	0.77	0	26,32,35	0.99	1 (3%)
1	MA6	A	1518	1	19,26,27	1.00	1 (5%)	18,38,41	1.95	6 (33%)
1	MA6	A	1519	1	19,26,27	0.98	1 (5%)	18,38,41	1.90	6 (33%)
1	5MC	A	967	1	18,22,23	0.95	2 (11%)	26,32,35	1.11	3 (11%)
1	2MG	A	1207	1	18,26,27	0.89	1 (5%)	16,38,41	1.12	2 (12%)

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
1	PSU	A	516	1,21	-	0/7/25/26	0/2/2/2
1	2MG	A	1516	1	-	0/5/27/28	0/3/3/3
1	2MG	A	966	1	-	2/5/27/28	0/3/3/3
1	G7M	A	527	1	-	3/3/25/26	0/3/3/3
1	UR3	A	1498	1,21	-	0/7/25/26	0/2/2/2
1	5MC	A	1407	1	-	0/7/25/26	0/2/2/2
1	4OC	A	1402	1	-	0/9/29/30	0/2/2/2
1	MA6	A	1518	1	-	4/7/29/30	0/3/3/3
1	MA6	A	1519	1	-	4/7/29/30	0/3/3/3
1	5MC	A	967	1	-	0/7/25/26	0/2/2/2
1	2MG	A	1207	1	-	0/5/27/28	0/3/3/3

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	516	PSU	C6-C5	3.27	1.39	1.35
1	A	966	2MG	C6-N1	-3.00	1.33	1.37
1	A	527	G7M	C5-C4	2.92	1.44	1.39
1	A	967	5MC	C6-C5	2.73	1.39	1.34
1	A	1407	5MC	C6-C5	2.73	1.39	1.34
1	A	516	PSU	C4-N3	-2.61	1.34	1.38
1	A	1518	MA6	C5-C4	2.52	1.47	1.40
1	A	1519	MA6	C5-C4	2.47	1.47	1.40
1	A	527	G7M	C6-N1	-2.40	1.34	1.37
1	A	1207	2MG	C6-N1	-2.35	1.34	1.37
1	A	1516	2MG	C6-N1	-2.34	1.34	1.37
1	A	967	5MC	C6-N1	-2.13	1.34	1.38
1	A	1407	5MC	C6-N1	-2.07	1.34	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1498	UR3	C2-N1	2.03	1.41	1.38

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1498	UR3	C4-N3-C2	-5.97	118.94	124.56
1	A	516	PSU	N1-C2-N3	5.96	121.89	115.13
1	A	1518	MA6	N1-C6-N6	4.94	122.25	117.06
1	A	516	PSU	C4-N3-C2	-3.77	120.91	126.34
1	A	1519	MA6	C10-N6-C6	-3.53	108.83	119.51
1	A	1519	MA6	C9-N6-C6	-3.48	108.97	119.51
1	A	1518	MA6	C9-N6-C6	-3.42	109.16	119.51
1	A	516	PSU	O2-C2-N1	-3.35	119.10	122.79
1	A	1519	MA6	N3-C2-N1	-3.26	123.58	128.68
1	A	967	5MC	C5-C6-N1	-3.26	119.98	123.34
1	A	1518	MA6	N3-C2-N1	-3.07	123.88	128.68
1	A	1518	MA6	C10-N6-C6	-3.07	110.22	119.51
1	A	1519	MA6	C4-C5-N7	-3.01	106.26	109.40
1	A	1407	5MC	C5-C6-N1	-2.99	120.26	123.34
1	A	1519	MA6	N1-C6-N6	2.97	120.18	117.06
1	A	966	2MG	CM2-N2-C2	-2.62	118.07	123.86
1	A	1407	5MC	C5-C4-N3	-2.56	118.91	121.67
1	A	967	5MC	C5-C4-N3	-2.56	118.91	121.67
1	A	1519	MA6	C10-N6-C9	-2.55	107.91	116.12
1	A	1207	2MG	C8-N7-C5	2.39	107.55	102.99
1	A	1518	MA6	C10-N6-C9	-2.38	108.45	116.12
1	A	1402	4OC	O2-C2-N3	-2.35	118.51	122.33
1	A	1516	2MG	C8-N7-C5	2.33	107.43	102.99
1	A	1207	2MG	C5-C6-N1	2.30	118.01	113.95
1	A	1516	2MG	C5-C6-N1	2.29	117.99	113.95
1	A	1518	MA6	C4-C5-N7	-2.27	107.03	109.40
1	A	1407	5MC	O2-C2-N3	-2.27	118.65	122.33
1	A	966	2MG	C8-N7-C5	2.13	107.04	102.99
1	A	967	5MC	O2-C2-N3	-2.04	119.01	122.33

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	527	G7M	O4'-C4'-C5'-O5'
1	A	527	G7M	C3'-C4'-C5'-O5'
1	A	966	2MG	N1-C2-N2-CM2

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Mol	Chain	Res	Type	Atoms
1	A	966	2MG	N3-C2-N2-CM2
1	A	1518	MA6	C5-C6-N6-C9
1	A	1518	MA6	C5-C6-N6-C10
1	A	1518	MA6	N1-C6-N6-C9
1	A	1519	MA6	C5-C6-N6-C9
1	A	1519	MA6	C5-C6-N6-C10
1	A	1519	MA6	N1-C6-N6-C9
1	A	1519	MA6	N1-C6-N6-C10
1	A	1518	MA6	N1-C6-N6-C10
1	A	527	G7M	C4'-C5'-O5'-P

There are no ring outliers.

3 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	1516	2MG	1	0
1	A	1402	4OC	1	0
1	A	1519	MA6	1	0

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 73 ligands modelled in this entry, 72 are monoatomic - leaving 1 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	$\# Z  > 2$
23	GNP	Z	402	21	29,34,34	1.71	6 (20%)	33,54,54	2.36	9 (27%)

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
23	GNP	Z	402	21	-	6/14/38/38	0/3/3/3

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
23	Z	402	GNP	PB-O3A	-4.79	1.53	1.59
23	Z	402	GNP	C6-N1	3.79	1.39	1.33
23	Z	402	GNP	PB-O2B	-3.16	1.48	1.56
23	Z	402	GNP	PG-O1G	3.11	1.51	1.46
23	Z	402	GNP	C8-N7	-2.23	1.30	1.34
23	Z	402	GNP	PG-O3G	-2.02	1.51	1.56

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
23	Z	402	GNP	C5-C6-N1	-8.62	111.64	123.43
23	Z	402	GNP	C2-N1-C6	5.59	124.82	115.93
23	Z	402	GNP	O3G-PG-O1G	-3.70	104.16	113.45
23	Z	402	GNP	O2B-PB-O1B	3.66	117.60	109.92
23	Z	402	GNP	C2-N3-C4	-3.18	111.72	115.36
23	Z	402	GNP	O2G-PG-O3G	2.99	115.61	107.64
23	Z	402	GNP	O1B-PB-N3B	-2.44	108.18	111.77
23	Z	402	GNP	PB-O3A-PA	-2.39	124.19	132.62
23	Z	402	GNP	N3-C2-N1	-2.32	124.13	127.22

There are no chirality outliers.

All (6) torsion outliers are listed below:

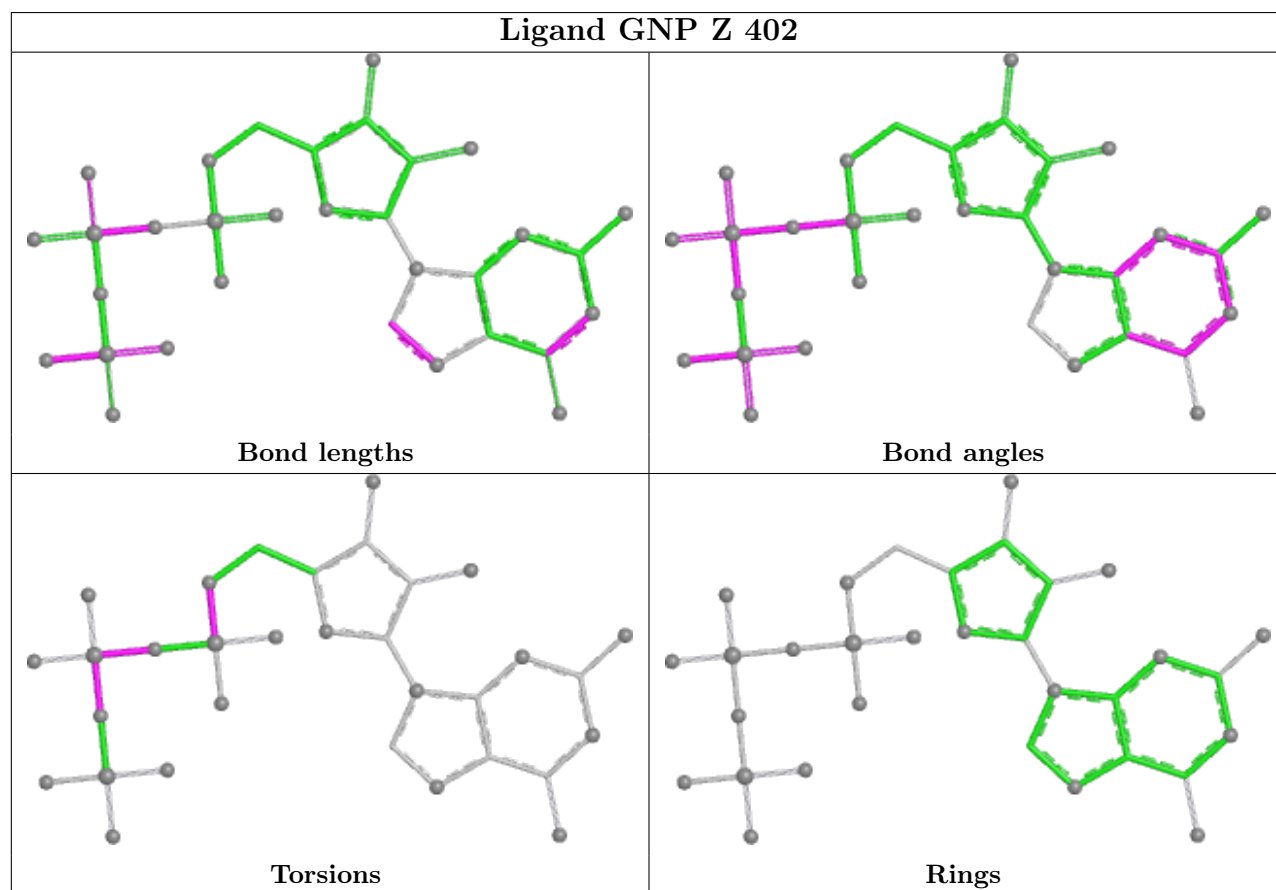
Mol	Chain	Res	Type	Atoms
23	Z	402	GNP	PG-N3B-PB-O1B
23	Z	402	GNP	PG-N3B-PB-O3A
23	Z	402	GNP	PA-O3A-PB-O1B
23	Z	402	GNP	PA-O3A-PB-O2B
23	Z	402	GNP	C5'-O5'-PA-O1A
23	Z	402	GNP	C5'-O5'-PA-O3A

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 than 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.



## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

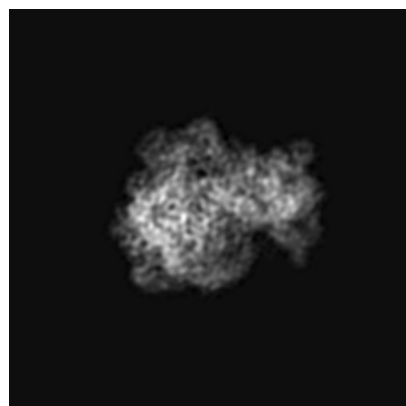
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-3663. These allow visual inspection of the internal detail of the map and identification of artifacts.

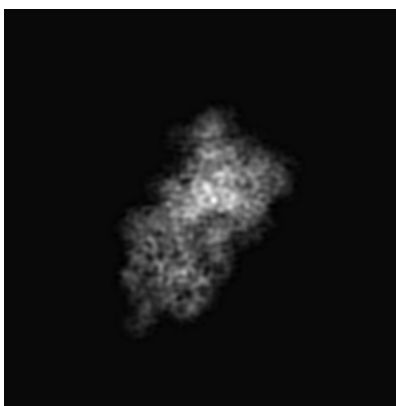
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

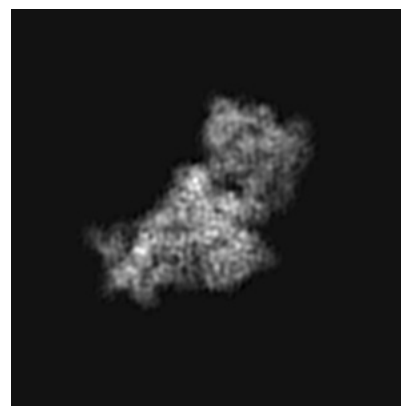
#### 6.1.1 Primary map



X

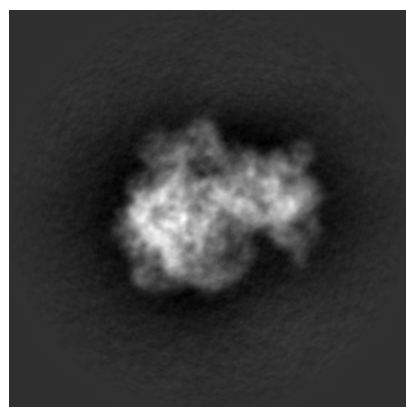


Y

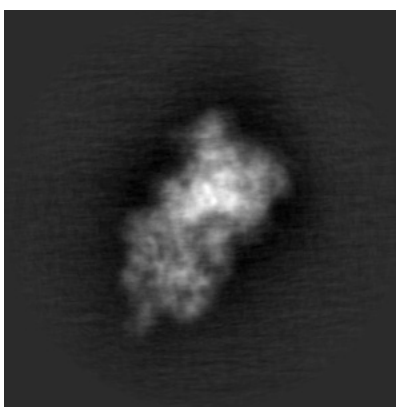


Z

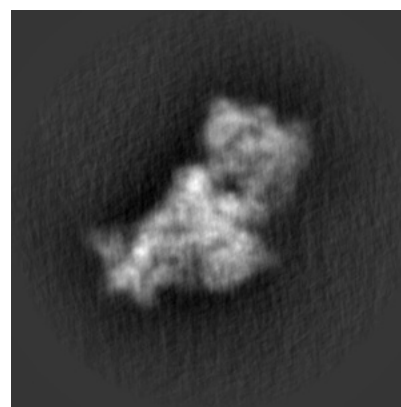
#### 6.1.2 Raw map



X



Y

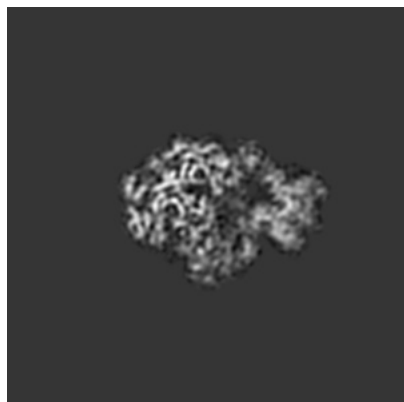


Z

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

## 6.2 Central slices [i](#)

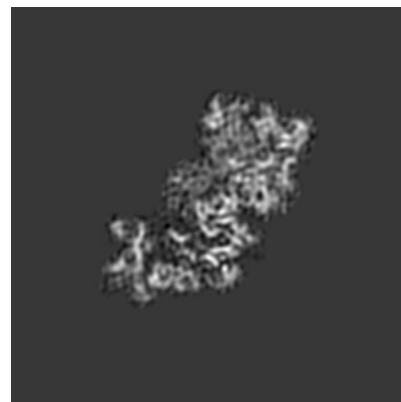
### 6.2.1 Primary map



X Index: 128

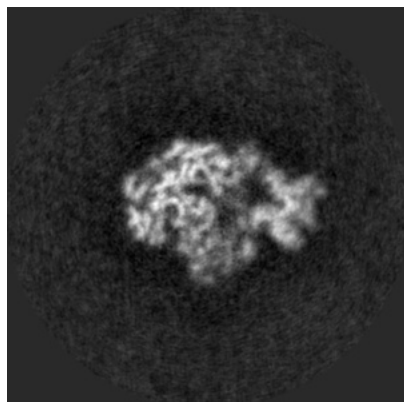


Y Index: 128

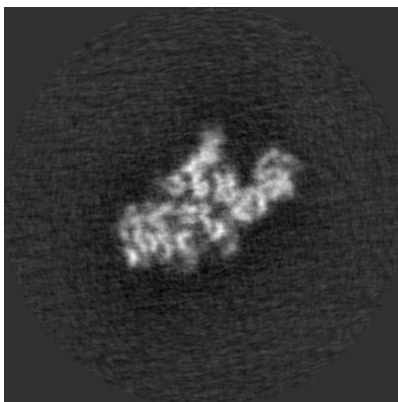


Z Index: 128

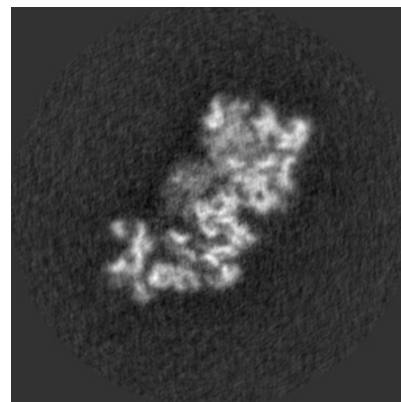
### 6.2.2 Raw map



X Index: 128



Y Index: 128

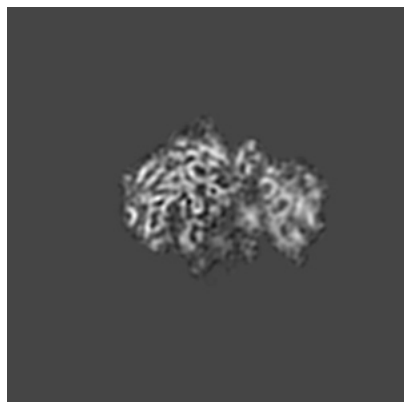


Z Index: 128

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

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

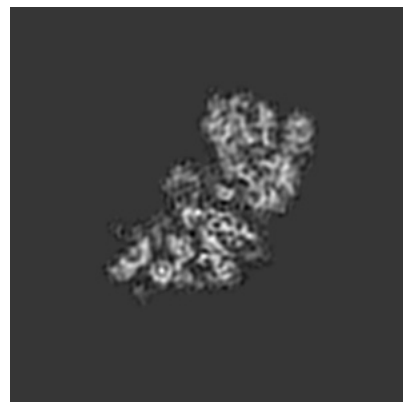
### 6.3.1 Primary map



X Index: 132

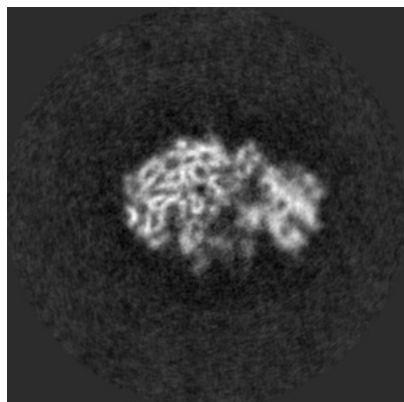


Y Index: 106

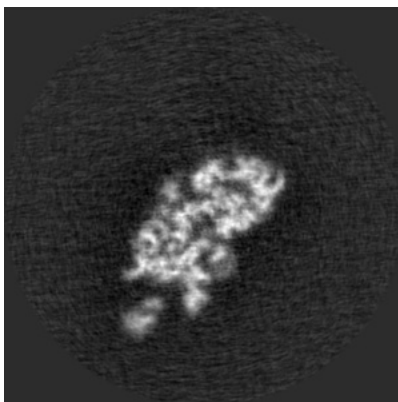


Z Index: 132

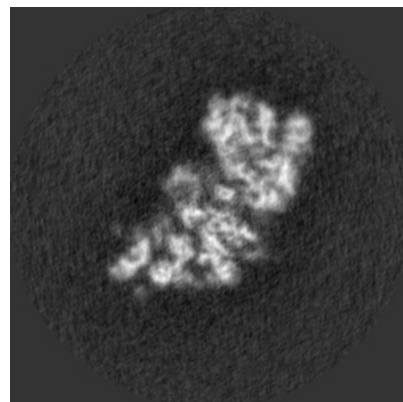
### 6.3.2 Raw map



X Index: 131



Y Index: 110

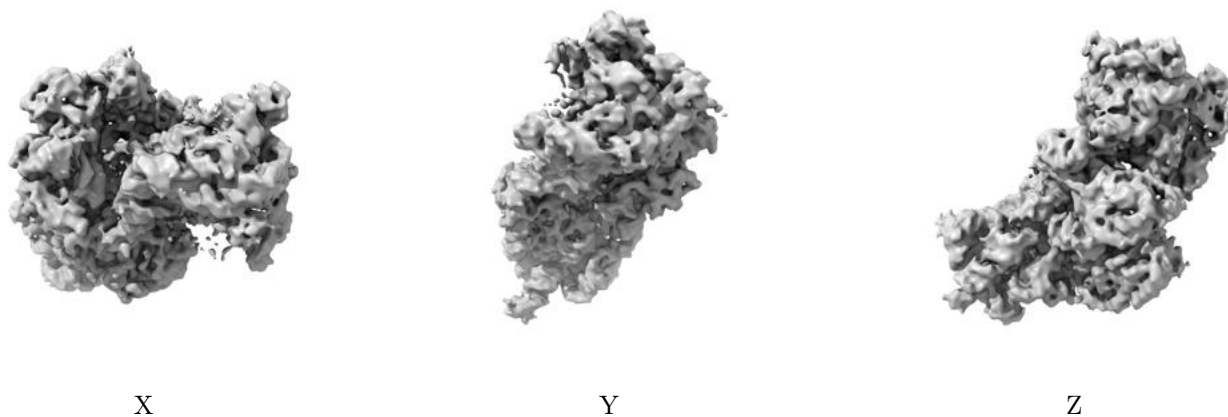


Z Index: 132

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

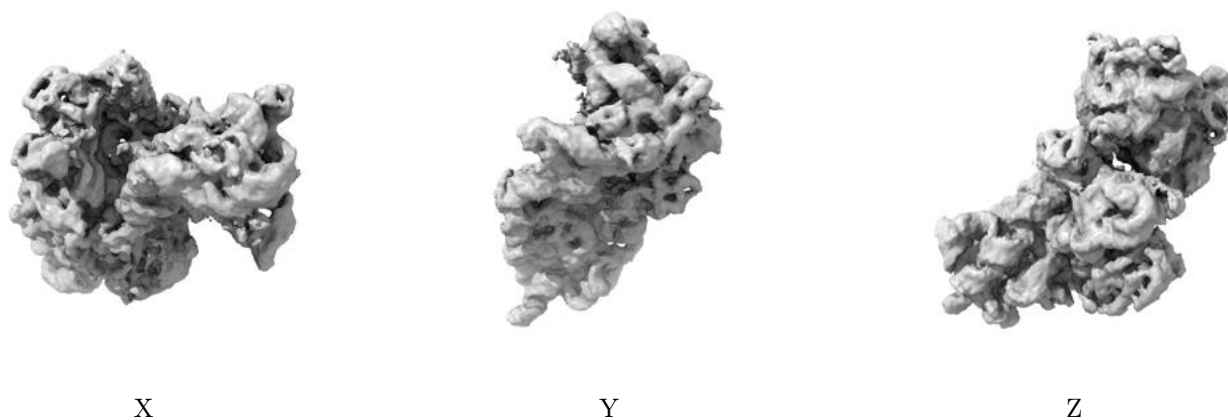
## 6.4 Orthogonal surface views [i](#)

### 6.4.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.06. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

### 6.4.2 Raw map



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.

## 6.5 Mask visualisation [i](#)

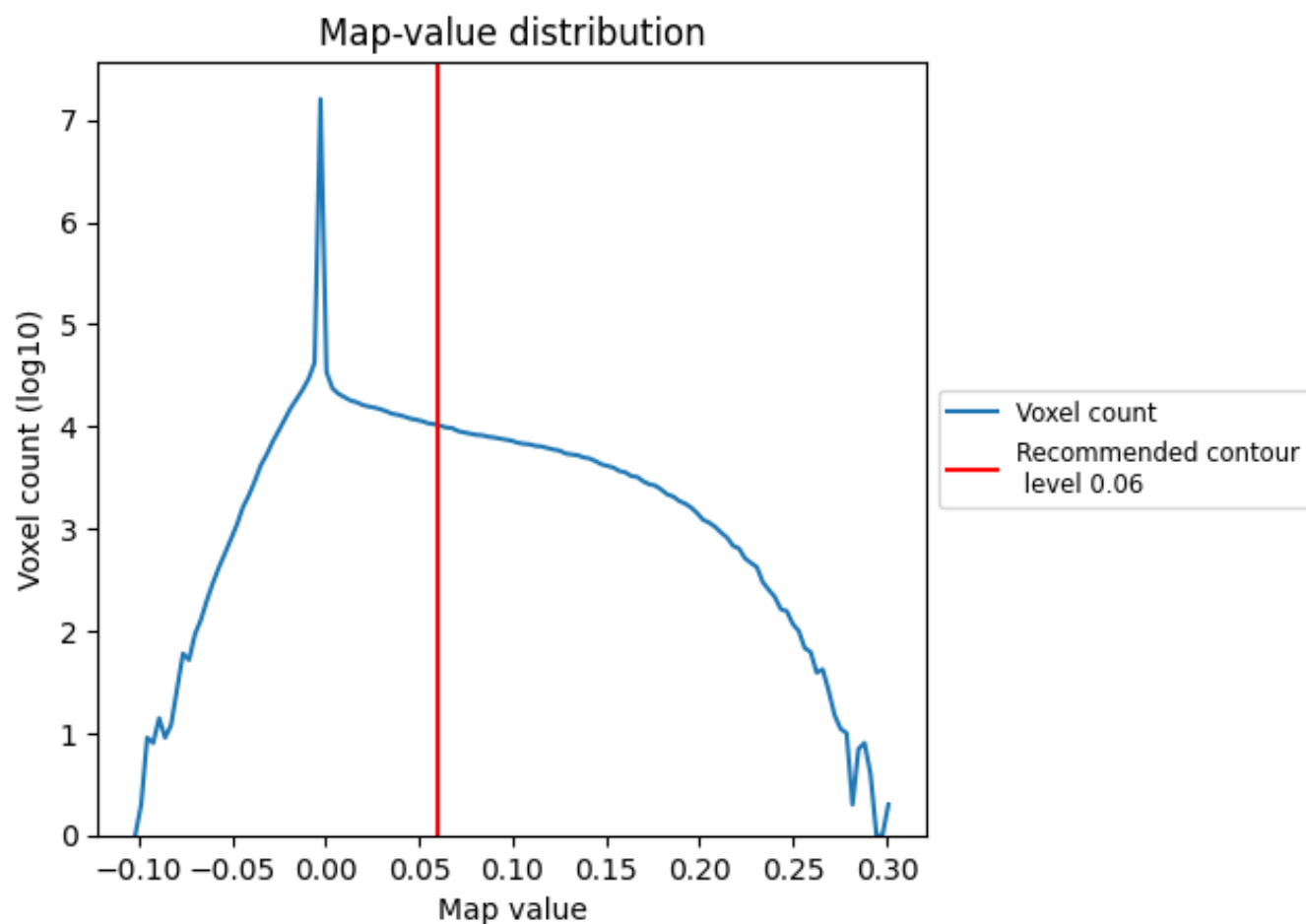
This section was not generated. No masks/segmentation were deposited.



## 7 Map analysis [i](#)

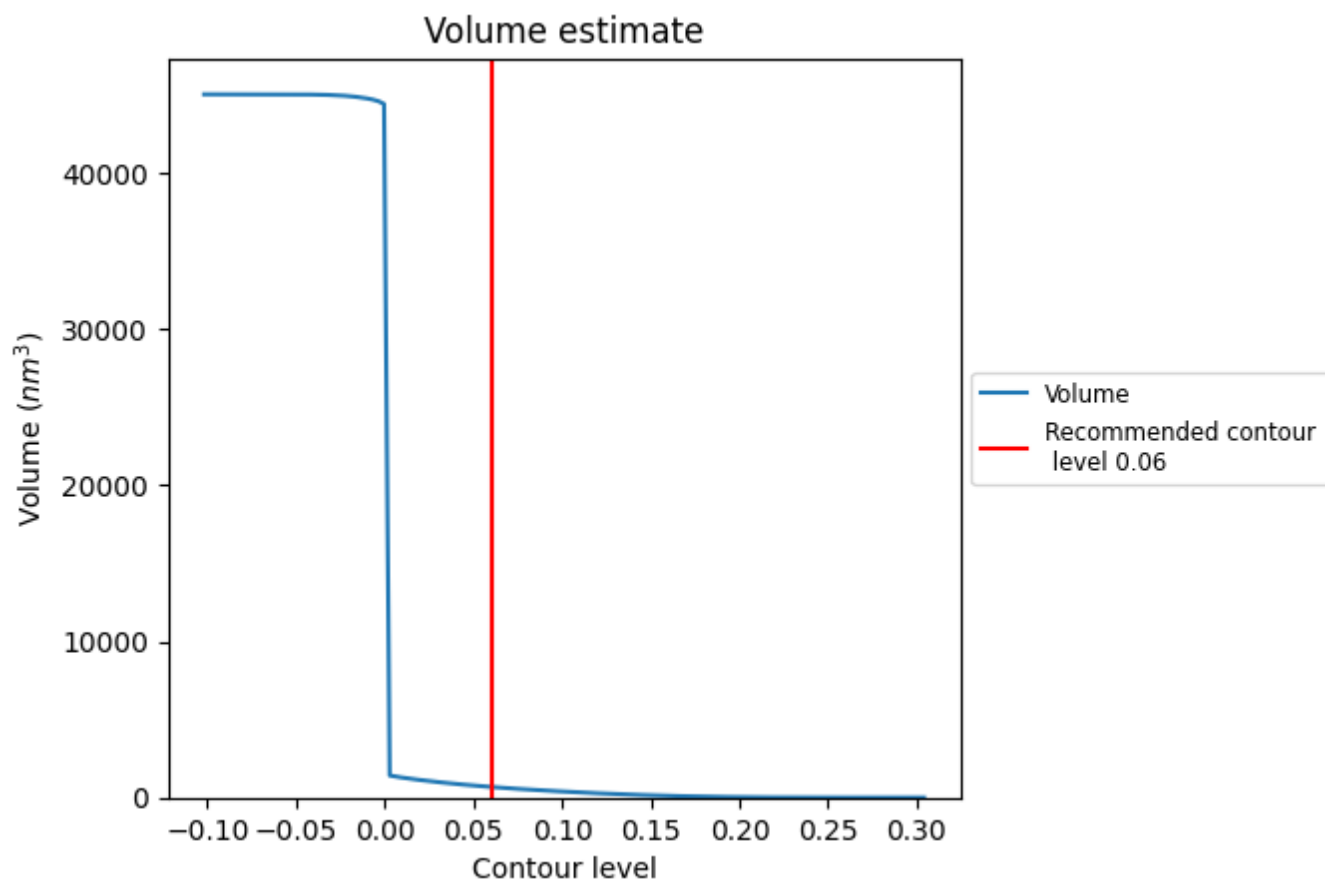
This section contains the results of statistical analysis of the map.

### 7.1 Map-value distribution [i](#)



The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.

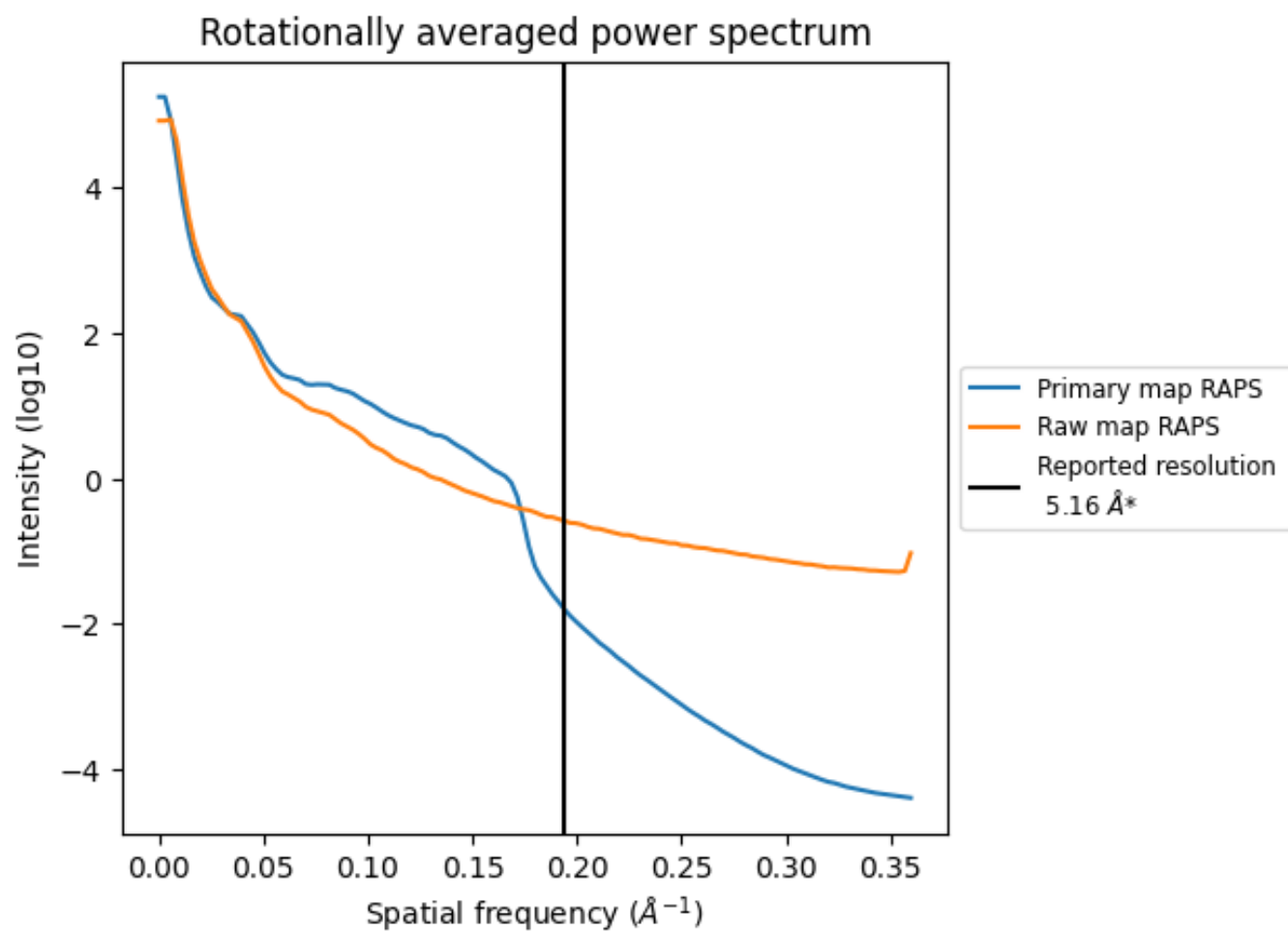
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 681  $\text{nm}^3$ ; this corresponds to an approximate mass of 615 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 ⓘ

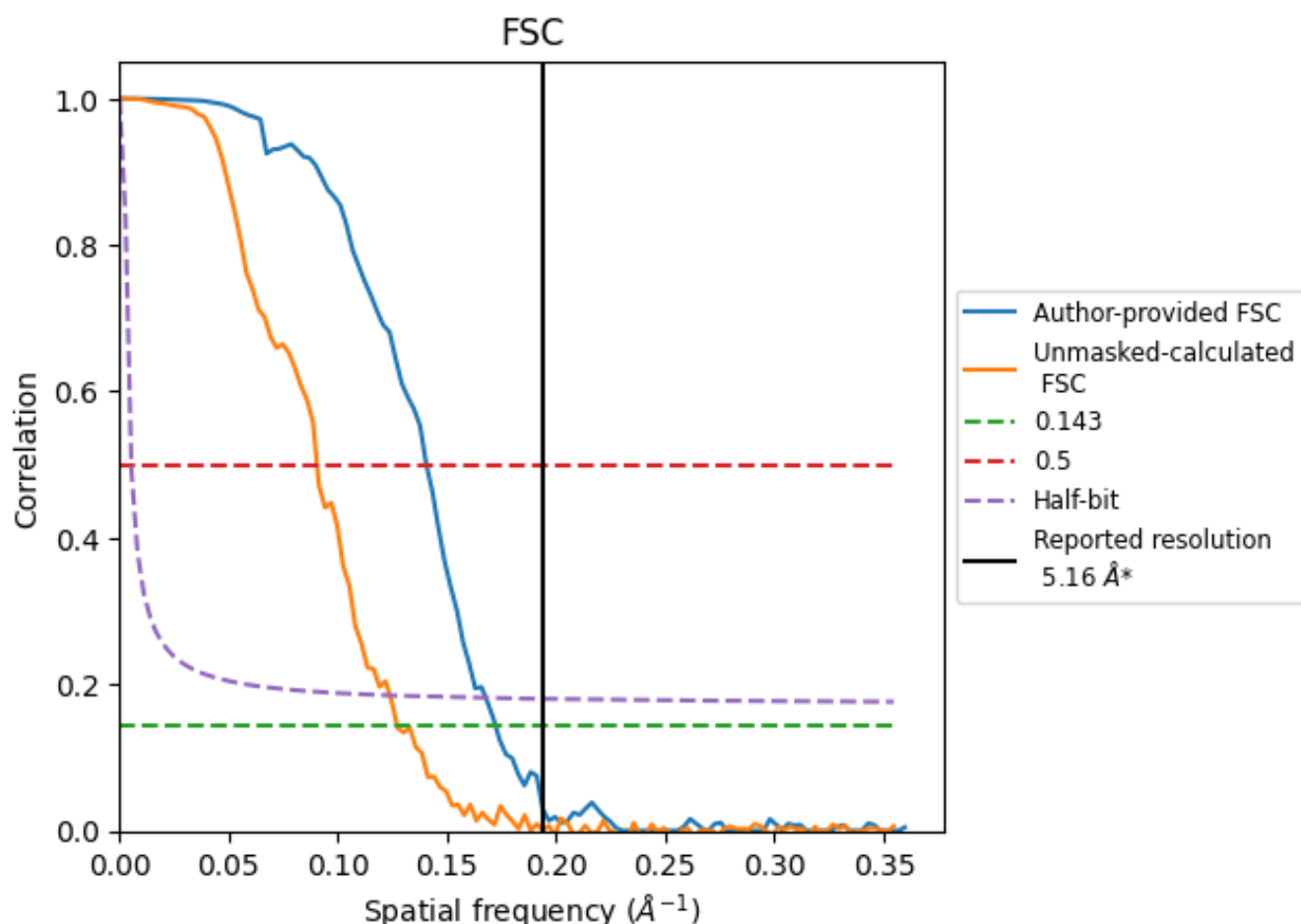


\*Reported resolution corresponds to spatial frequency of 0.194 Å<sup>-1</sup>

## 8 Fourier-Shell correlation [i](#)

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

### 8.1 FSC [i](#)



\*Reported resolution corresponds to spatial frequency of 0.194 Å<sup>-1</sup>

## 8.2 Resolution estimates

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	5.16	-	-
Author-provided FSC curve	5.80	7.11	5.96
Unmasked-calculated*	7.86	11.05	8.08

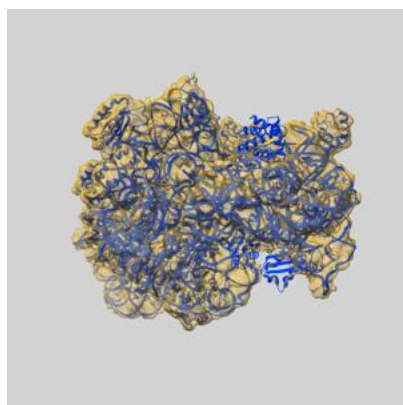
\*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from author-provided FSC intersecting FSC 0.143 CUT-OFF 5.80 differs from the reported value 5.16 by more than 10 %

The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 7.86 differs from the reported value 5.16 by more than 10 %

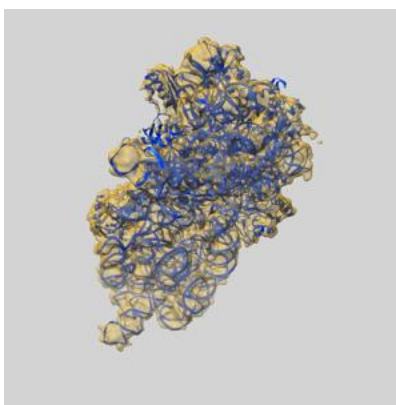
## 9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-3663 and PDB model 5NO4. Per-residue inclusion information can be found in [section 3](#) on [page 8](#).

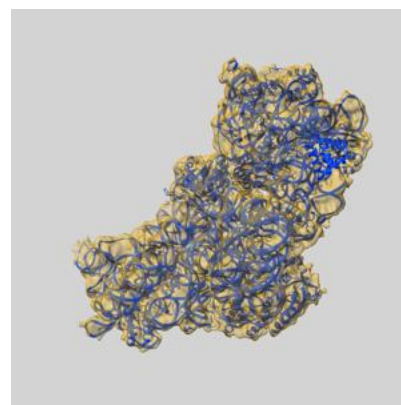
### 9.1 Map-model overlay [i](#)



X



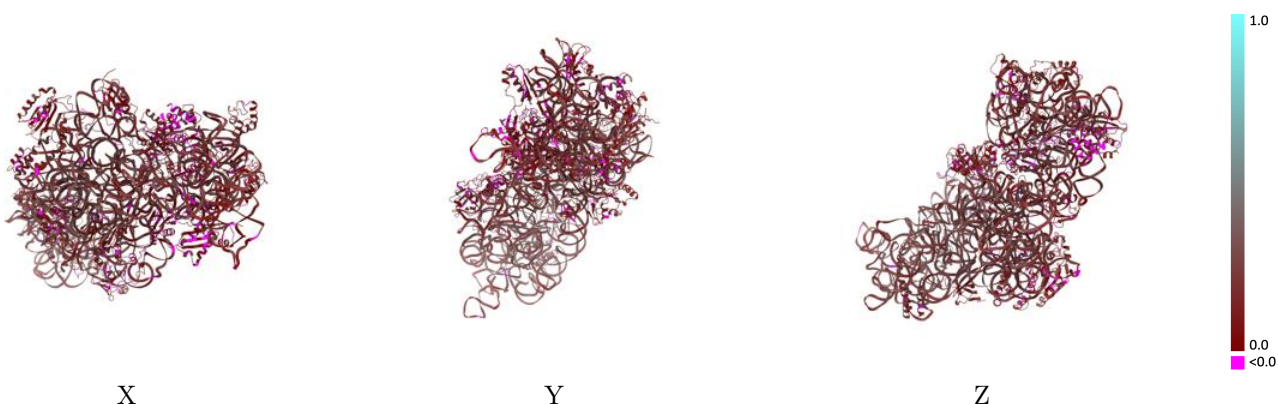
Y



Z

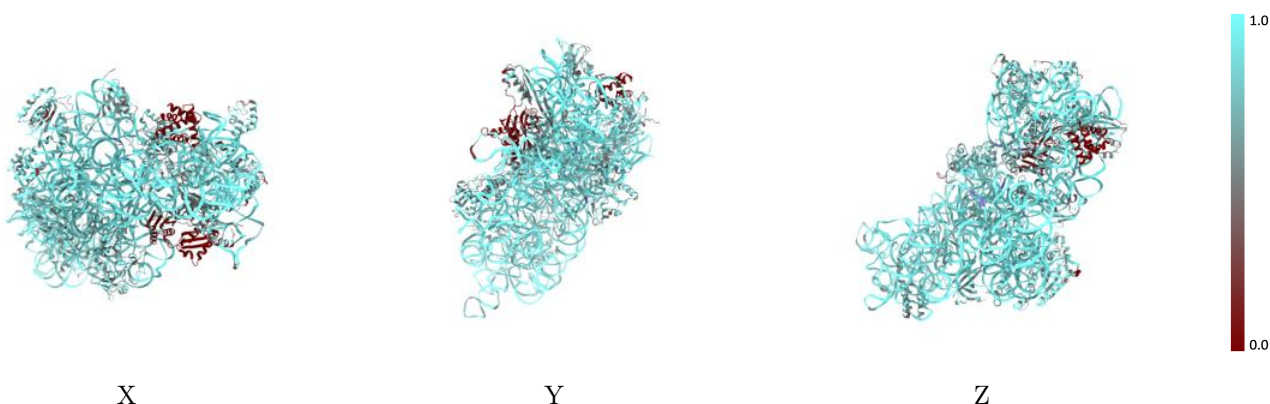
The images above show the 3D surface view of the map at the recommended contour level 0.06 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



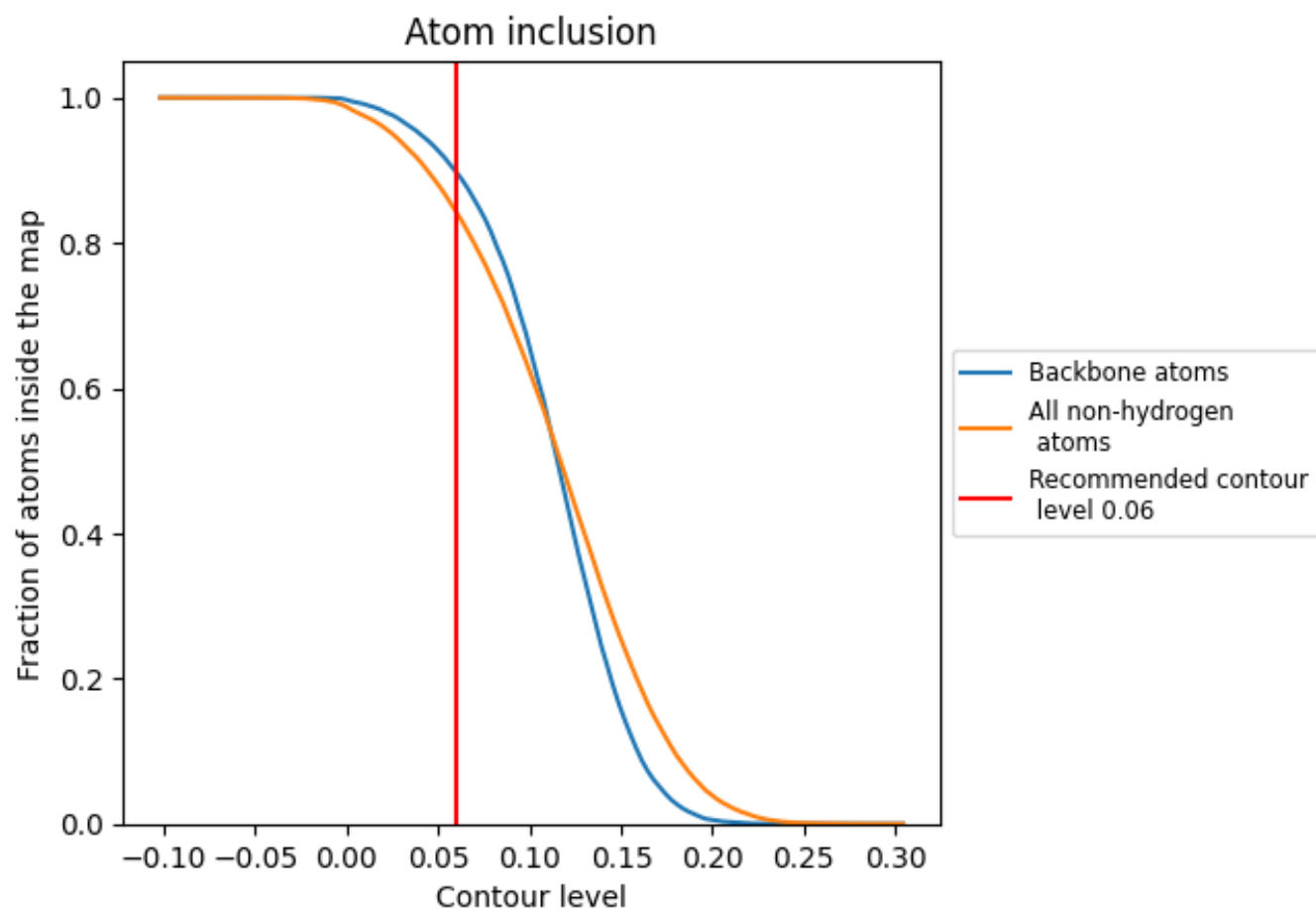
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

## 9.3 Atom inclusion mapped to coordinate model [i](#)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.06).

## 9.4 Atom inclusion [i](#)













































At the recommended contour level, 90% of all backbone atoms, 84% 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 (0.06) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8420	 0.1990
A	 0.9561	 0.2300
C	 0.1887	 0.0950
D	 0.6648	 0.1220
E	 0.7427	 0.1800
F	 0.7099	 0.1490
G	 0.0675	 0.0520
H	 0.7552	 0.1670
I	 0.6364	 0.1070
J	 0.5435	 0.1410
K	 0.6952	 0.1620
L	 0.2037	 0.0700
M	 0.7371	 0.1500
N	 0.5879	 0.1130
O	 0.7942	 0.1640
P	 0.7452	 0.1600
Q	 0.7488	 0.1750
R	 0.7277	 0.1540
S	 0.7781	 0.1680
T	 0.7622	 0.1610
Z	 0.7146	 0.1610

