



## Full wwPDB EM Validation Report ⓘ

Jul 31, 2025 – 10:26 am BST

PDB ID : 9H9J / pdb\_00009h9j  
EMDB ID : EMD-51966  
Title : Complex 2 (BODY) 30S-IF1-IF3-tRNA-GE81112  
Authors : Schedlbauer, A.; Han, X.; van Bakel, W.; Kaminishi, T.; Ochoa-Lizarralde, B.; Iturrioz, I.; Capuni, R.; Parry, R.; Zegarra, R.; Gil-Carton, D.; Lopez-Alonso, J.P.; Barragan Sanz, K.; Brandi, L.; Gualerzi, C.O.; Fucini, P.; Connell, S.R.  
Deposited on : 2024-10-31  
Resolution : 3.20 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.dev126  
Mogul : 1.8.4, CSD as541be (2020)  
MolProbity : 4-5-2 with Phenix2.0rc1  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.45.1

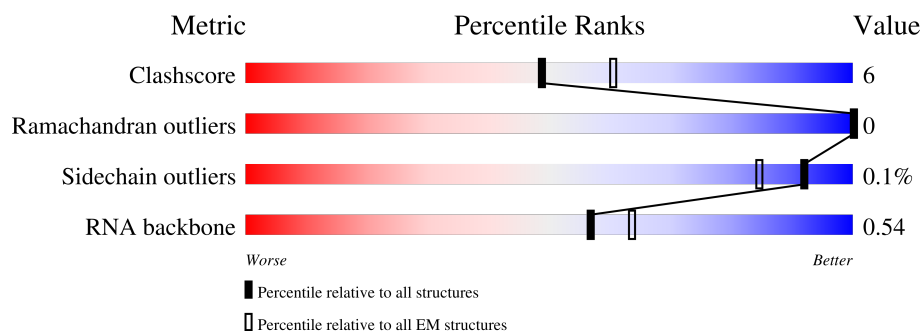
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 3.20 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.






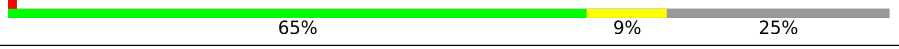



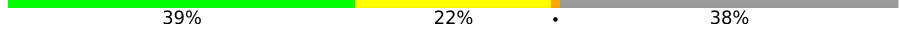
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415
RNA backbone	6643	2191

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	1541	
2	D	206	
3	E	167	
4	F	135	
5	H	130	
6	K	129	
7	L	124	

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Mol	Chain	Length	Quality of chain
8	O	89	
9	P	82	
10	Q	84	
11	R	75	
12	T	87	
13	U	71	
14	X	72	
15	Z	180	

## 2 Entry composition

There are 18 unique types of molecules in this entry. The entry contains 34840 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 RNA (1078-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	1078	Total	C	N	O	P	0	0
			23172	10337	4269	7488	1078		

- Molecule 2 is a protein called Small ribosomal subunit protein uS4.

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

- Molecule 3 is a protein called Small ribosomal subunit protein uS5.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	E	156	Total	C	N	O	S	0	0
			1152	717	217	212	6		

- Molecule 4 is a protein called Small ribosomal subunit protein bS6, fully modified isoform.

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

- Molecule 5 is a protein called Small ribosomal subunit protein uS8.

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

- Molecule 6 is a protein called Small ribosomal subunit protein uS11.

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

- Molecule 7 is a protein called Small ribosomal subunit protein uS12.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	L	123	Total	C	N	O	S	0	0
			955	590	196	165	4		

- Molecule 8 is a protein called Small ribosomal subunit protein uS15.

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

- Molecule 9 is a protein called Small ribosomal subunit protein bS16.

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

- Molecule 10 is a protein called Small ribosomal subunit protein uS17.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	Q	80	Total	C	N	O	S	0	0
			648	411	121	113	3		

- Molecule 11 is a protein called Small ribosomal subunit protein bS18.

Mol	Chain	Residues	Atoms				AltConf	Trace
11	R	56	Total	C	N	O	0	0
			464	293	88	83		

- Molecule 12 is a protein called Small ribosomal subunit protein bS20.

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

- Molecule 13 is a protein called Small ribosomal subunit protein bS21.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	U	52	Total	C	N	O	S	0	0
			430	269	89	71	1		

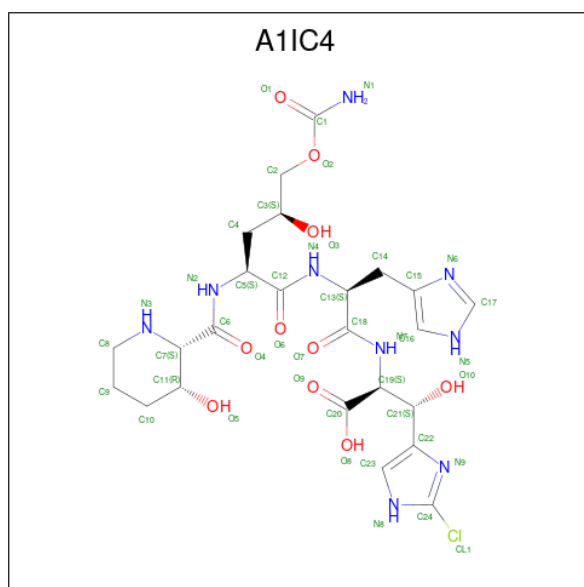
- Molecule 14 is a protein called Translation initiation factor IF-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
14	X	70	Total	C	N	O	S	0	0
			563	353	102	105	3		

- Molecule 15 is a protein called Translation initiation factor IF-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
15	Z	112	Total	C	N	O	S	0	0
			923	586	166	167	4		

- Molecule 16 is (2S,3S)-2-[[[(2S)-2-[[[(2S,4S)-5-aminocarbonyloxy-4-oxidanyl-2-[[[(2S,3R)-3-oxidanylpiperidin-2-yl]carbonylamino]pentanoyl]amino]-3-(1H-imidazol-4-yl)propanoyl]amino]-3-(2-chloranyl-1H-imidazol-4-yl)-3-oxidanyl-propanoic acid (CCD ID: A1IC4) (formula: C<sub>24</sub>H<sub>34</sub>ClN<sub>9</sub>O<sub>10</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
16	A	1	Total	C	Cl	N	O	0
			44	24	1	9	10	

- Molecule 17 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
17	A	91	Total	Mg	0
			91	91	

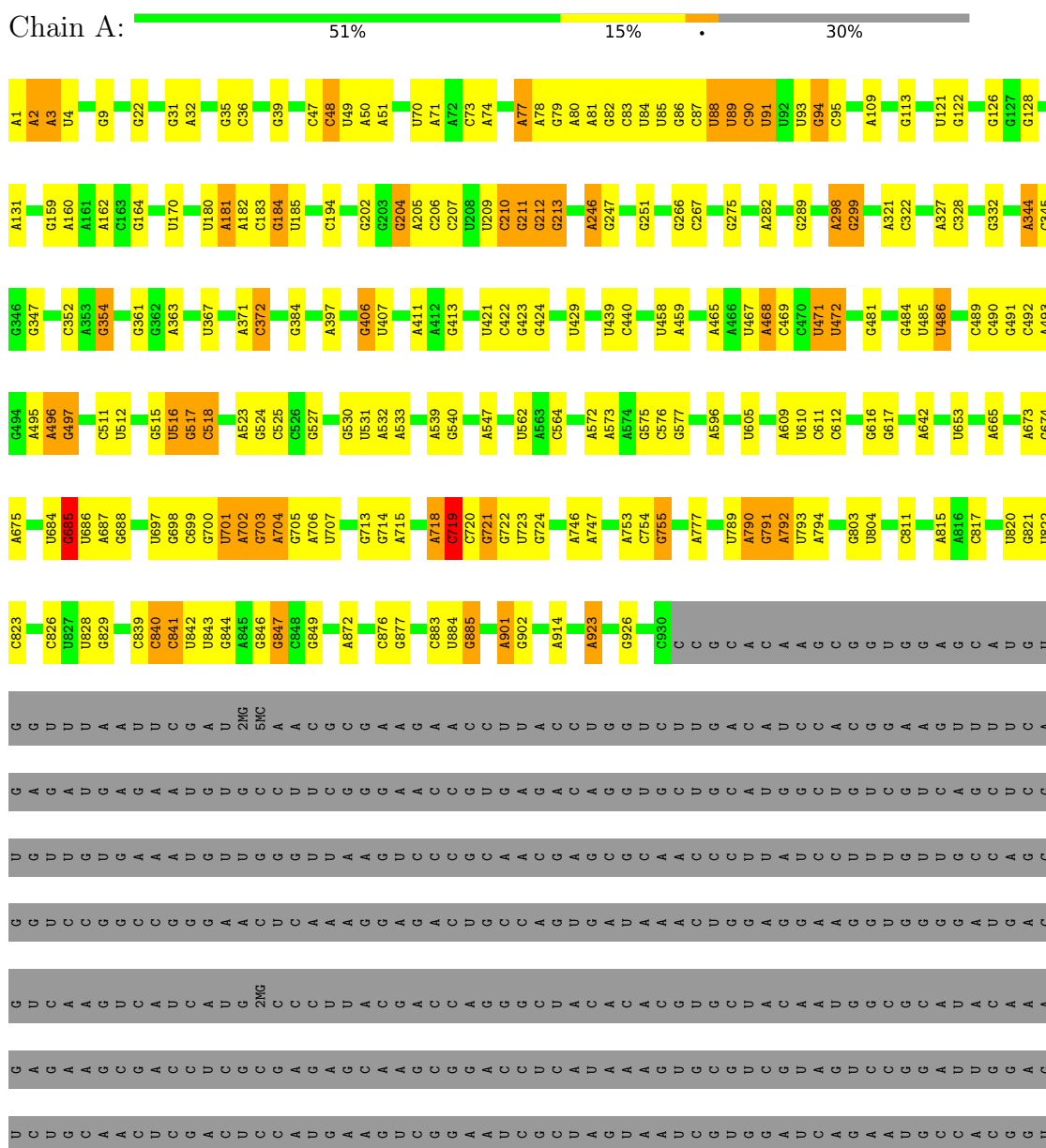
- Molecule 18 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms		AltConf
18	A	4	Total 4	K 4	0

### 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 RNA (1078-MER)







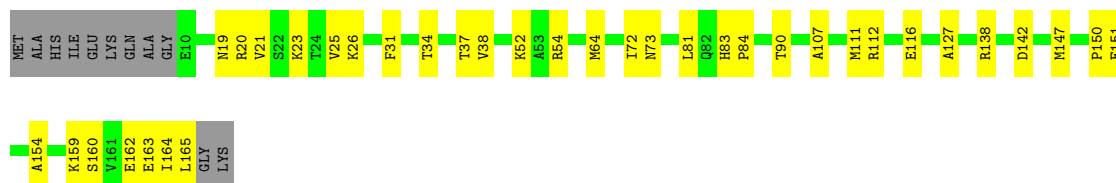
- Molecule 2: Small ribosomal subunit protein uS4

Chain D: 91% 8%



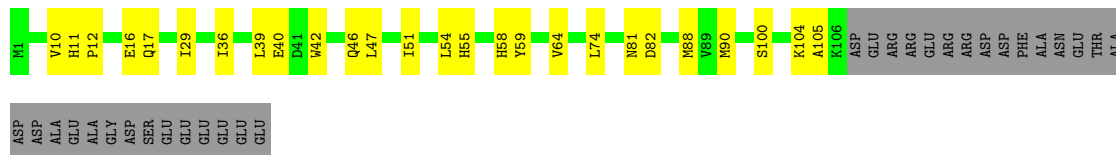
- Molecule 3: Small ribosomal subunit protein uS5

Chain E: 72% 22% 7%



- Molecule 4: Small ribosomal subunit protein bS6, fully modified isoform

Chain F: 59% 19% 21%



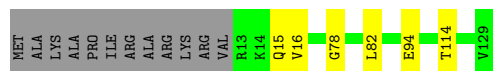
- Molecule 5: Small ribosomal subunit protein uS8

Chain H: 87% 11% ..

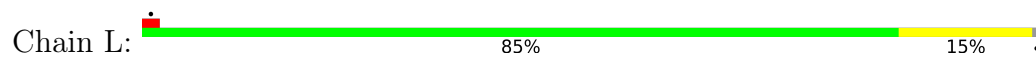


- Molecule 6: Small ribosomal subunit protein uS11

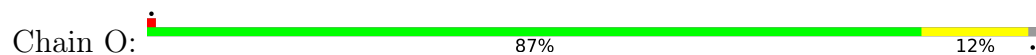
Chain K: 86% 5% 9%



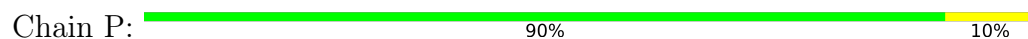
- Molecule 7: Small ribosomal subunit protein uS12



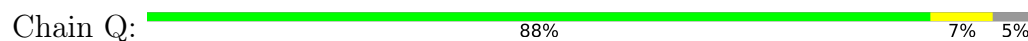
- Molecule 8: Small ribosomal subunit protein uS15



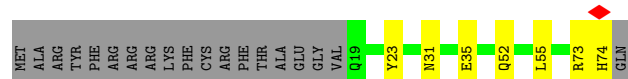
- Molecule 9: Small ribosomal subunit protein bS16



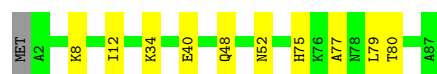
- Molecule 10: Small ribosomal subunit protein uS17



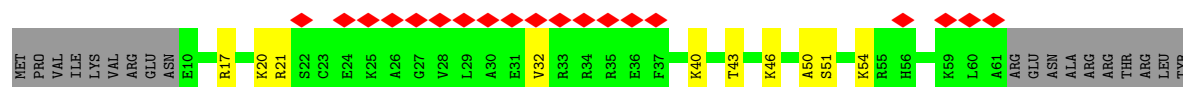
- Molecule 11: Small ribosomal subunit protein bS18



- Molecule 12: Small ribosomal subunit protein bS20



- Molecule 13: Small ribosomal subunit protein bS21



- |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| E154 | L155 | A156 | V157 | V158 | E159 | G167 | R168 | Q169 | V173 | L174 | A175 | P176 | K177 | Q180 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	34701	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	44.08	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	3250	Depositor
Magnification	Not provided	
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	0.122	Depositor
Minimum map value	-0.040	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.005	Depositor
Recommended contour level	0.017	Depositor
Map size (Å)	427.39203, 427.39203, 427.39203	wwPDB
Map dimensions	384, 384, 384	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.113, 1.113, 1.113	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: MG, MA6, K, A1IC4, UR3, 5MC, 4OC, PSU, G7M, 2MG

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	0.27	1/25749 (0.0%)	0.38	2/40169 (0.0%)
2	D	0.23	0/1665	0.38	0/2227
3	E	0.41	1/1165 (0.1%)	0.58	0/1568
4	F	0.42	0/881	0.65	0/1189
5	H	0.48	0/989	0.70	2/1326 (0.2%)
6	K	0.43	0/893	0.56	0/1205
7	L	0.44	0/969	0.64	0/1300
8	O	0.38	0/722	0.66	0/964
9	P	0.37	0/659	0.46	0/884
10	Q	0.26	0/657	0.40	0/881
11	R	0.16	0/471	0.39	0/633
12	T	0.31	0/676	0.44	0/895
13	U	0.14	0/436	0.31	0/577
14	X	0.54	0/570	0.71	1/766 (0.1%)
15	Z	0.55	0/934	0.78	1/1238 (0.1%)
All	All	0.31	2/37436 (0.0%)	0.44	6/55822 (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
15	Z	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	527	G7M	O3'-P	5.07	1.61	1.56
3	E	23	LYS	C-O	-5.03	1.18	1.24

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
15	Z	107	TYR	N-CA-CB	-6.69	100.29	110.12
5	H	107	SER	N-CA-C	-6.25	104.76	112.38
1	A	719	C	C2'-C3'-O3'	5.51	117.77	109.50
14	X	15	GLU	N-CA-C	5.37	117.42	108.99
1	A	685	G	C2'-C3'-O3'	5.37	117.55	109.50
5	H	106	THR	CA-CB-OG1	-5.03	102.05	109.60

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
15	Z	112	ARG	Sidechain

## 5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	23172	0	11666	155	0
2	D	1643	0	1707	14	0
3	E	1152	0	1196	26	0
4	F	862	0	864	23	0
5	H	979	0	1031	13	0
6	K	877	0	887	10	0
7	L	955	0	1016	11	0
8	O	714	0	734	7	0
9	P	649	0	666	6	0
10	Q	648	0	691	5	0
11	R	464	0	486	6	0
12	T	670	0	719	7	0
13	U	430	0	458	10	0
14	X	563	0	581	18	0
15	Z	923	0	976	39	0
16	A	44	0	0	0	0
17	A	91	0	0	0	0
18	A	4	0	0	0	0
All	All	34840	0	23678	325	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 6.

All (325) 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:1518:MA6:H3'	1:A:1519:MA6:H8	1.69	0.74
3:E:20:ARG:HD3	3:E:31:PHE:HB3	1.72	0.71
4:F:40:GLU:OE1	4:F:100:SER:HB2	1.91	0.71
1:A:1517:G:H2'	1:A:1518:MA6:H8	1.74	0.68
2:D:19:LEU:HB2	2:D:21:LEU:HD13	1.75	0.68
4:F:81:ASN:OD1	4:F:82:ASP:N	2.27	0.68
1:A:700:G:H1	15:Z:74:LEU:CD1	2.06	0.68
15:Z:85:LYS:O	15:Z:89:LYS:N	2.27	0.67
1:A:575:G:O2'	1:A:821:G:OP2	2.08	0.67
3:E:90:THR:O	3:E:90:THR:HG22	1.94	0.67
14:X:19:ASN:HB3	14:X:21:MET:HE2	1.76	0.67
1:A:485:U:O2'	1:A:486:U:OP1	2.12	0.67
15:Z:90:VAL:HG12	15:Z:121:GLY:O	1.95	0.67
2:D:99:ASP:OD1	2:D:100:ASN:N	2.28	0.67
2:D:202:GLU:OE2	3:E:112:ARG:NH2	2.28	0.67
14:X:39:LYS:O	14:X:43:ASN:N	2.28	0.66
1:A:702:A:O2'	1:A:703:G:OP1	2.13	0.66
3:E:154:ALA:HA	3:E:164:ILE:HD12	1.78	0.65
3:E:111:MET:HE2	3:E:127:ALA:HB2	1.80	0.64
1:A:811:C:O2'	1:A:901:A:N1	2.32	0.63
1:A:1457:G:OP1	12:T:34:LYS:NZ	2.25	0.63
5:H:106:THR:HB	5:H:121:LEU:HD13	1.80	0.63
1:A:212:G:O2'	1:A:213:G:OP1	2.17	0.61
1:A:840:C:H2'	1:A:841:C:H5''	1.81	0.61
4:F:29:ILE:HD13	4:F:64:VAL:CG2	2.31	0.61
7:L:50:ARG:HD2	7:L:90:LEU:HD11	1.82	0.61
1:A:700:G:H1	15:Z:74:LEU:HD12	1.64	0.61
1:A:212:G:HO2'	1:A:213:G:P	2.25	0.60
1:A:88:U:O2'	1:A:89:U:OP2	2.20	0.60
3:E:150:PRO:HB3	3:E:165:LEU:HD21	1.83	0.60
1:A:298:A:O2'	1:A:299:G:OP1	2.20	0.59
14:X:17:LEU:HD11	14:X:23:ARG:HG2	1.84	0.59
5:H:5:ASP:OD1	5:H:77:ARG:NH1	2.35	0.59
15:Z:135:MET:O	15:Z:138:GLN:HG2	2.02	0.59
5:H:8:ALA:O	5:H:12:THR:HG23	2.01	0.59
4:F:36:ILE:O	4:F:36:ILE:HG13	2.01	0.58
14:X:36:ILE:HG12	14:X:67:ILE:HD11	1.85	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:700:G:O6	15:Z:74:LEU:HD12	2.03	0.58
14:X:70:ARG:O	14:X:72:ARG:NH2	2.37	0.58
1:A:1397:C:O2'	1:A:1398:A:OP1	2.21	0.58
4:F:100:SER:O	4:F:104:LYS:HG2	2.04	0.58
4:F:90:MET:HE1	11:R:23:TYR:OH	2.03	0.58
13:U:50:ALA:O	13:U:54:LYS:HG3	2.03	0.58
4:F:29:ILE:HD13	4:F:64:VAL:HG21	1.86	0.57
7:L:80:ILE:HD12	7:L:97:THR:HG23	1.85	0.57
5:H:106:THR:N	5:H:109:GLY:O	2.37	0.57
12:T:75:HIS:O	12:T:79:LEU:HD23	2.05	0.56
1:A:674:G:H2'	1:A:675:A:C8	2.40	0.56
1:A:673:A:H2'	1:A:674:G:C8	2.40	0.56
1:A:530:G:H2'	14:X:39:LYS:HE2	1.88	0.56
1:A:1441:A:H5'	1:A:1442:G:OP2	2.06	0.56
1:A:202:G:O2'	1:A:468:A:H2'	2.06	0.56
14:X:12:THR:HG22	14:X:52:LYS:CD	2.36	0.56
3:E:37:THR:HG21	3:E:64:MET:SD	2.46	0.55
7:L:39:THR:HG22	7:L:51:LYS:HD3	1.87	0.55
1:A:180:U:H2'	1:A:181:A:H5'	1.89	0.55
14:X:12:THR:HG22	14:X:52:LYS:HD2	1.89	0.54
1:A:700:G:N1	15:Z:74:LEU:HD12	2.23	0.54
1:A:1486:G:H2'	1:A:1487:G:C8	2.42	0.54
1:A:77:A:H2'	1:A:78:A:C8	2.43	0.54
3:E:151:GLU:OE1	3:E:151:GLU:N	2.35	0.53
3:E:160:SER:OG	3:E:162:GLU:OE2	2.24	0.53
1:A:79:G:HO2'	1:A:80:A:H8	1.55	0.53
2:D:9:LEU:HD22	2:D:28:ILE:HD11	1.90	0.53
4:F:54:LEU:HD23	4:F:55:HIS:N	2.22	0.53
14:X:38:GLY:O	14:X:42:LYS:N	2.39	0.53
1:A:700:G:C6	15:Z:74:LEU:HD12	2.44	0.53
1:A:1445:U:O2'	1:A:1446:A:OP2	2.22	0.53
12:T:8:LYS:O	12:T:12:ILE:HG12	2.09	0.53
3:E:25:VAL:HG12	3:E:26:LYS:H	1.75	0.52
6:K:94:GLU:CD	13:U:20:LYS:CE	2.82	0.52
8:O:23:GLY:O	8:O:28:GLN:NE2	2.32	0.52
2:D:99:ASP:OD1	2:D:99:ASP:C	2.52	0.52
6:K:15:GLN:HA	6:K:78:GLY:HA3	1.91	0.52
15:Z:159:GLU:OE2	15:Z:175:ALA:HB3	2.10	0.52
15:Z:167:GLY:O	15:Z:169:GLN:NE2	2.43	0.52
1:A:298:A:O2'	1:A:299:G:P	2.68	0.52
1:A:406:G:C2	1:A:407:U:C5	2.98	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:184:G:H2'	1:A:185:U:C6	2.46	0.51
12:T:40:GLU:C	12:T:40:GLU:OE1	2.53	0.51
14:X:26:LEU:N	14:X:30:HIS:O	2.44	0.51
15:Z:158:VAL:HA	15:Z:174:LEU:HD22	1.91	0.51
1:A:492:C:H2'	1:A:493:A:C8	2.46	0.51
6:K:82:LEU:C	6:K:82:LEU:HD12	2.36	0.51
9:P:4:ILE:HD13	9:P:67:ILE:HD13	1.92	0.51
9:P:70:ARG:O	9:P:74:LEU:HD23	2.12	0.50
1:A:49:U:C2	1:A:361:G:N2	2.80	0.50
9:P:4:ILE:HD13	9:P:67:ILE:CD1	2.41	0.50
4:F:29:ILE:CD1	4:F:64:VAL:HG21	2.42	0.50
4:F:46:GLN:OE1	4:F:46:GLN:HA	2.11	0.50
8:O:57:LEU:O	8:O:60:VAL:HG22	2.12	0.50
2:D:95:GLU:OE1	2:D:100:ASN:ND2	2.41	0.50
11:R:52:GLN:HA	11:R:55:LEU:HD12	1.94	0.50
1:A:518:C:H5'	1:A:530:G:O4'	2.12	0.50
15:Z:71:GLY:O	15:Z:74:LEU:HG	2.11	0.50
15:Z:149:LYS:NZ	15:Z:158:VAL:HG23	2.27	0.50
1:A:1408:A:N3	1:A:1408:A:H2'	2.26	0.50
1:A:468:A:H3'	1:A:469:C:H6	1.75	0.49
1:A:515:G:H3'	1:A:516:PSU:H6	1.77	0.49
6:K:15:GLN:N	6:K:15:GLN:CD	2.70	0.49
4:F:88:MET:HE2	4:F:90:MET:SD	2.51	0.49
13:U:40:LYS:O	13:U:43:THR:OG1	2.24	0.49
15:Z:123:LYS:HD3	15:Z:123:LYS:N	2.28	0.49
1:A:1431:A:H2'	1:A:1432:G:H5'	1.95	0.49
1:A:790:A:H2'	1:A:791:G:C8	2.48	0.49
1:A:714:G:H2'	1:A:715:A:C8	2.47	0.49
3:E:112:ARG:O	3:E:116:GLU:HG2	2.13	0.49
1:A:246:A:C2	1:A:282:A:C5	3.01	0.48
15:Z:114:LEU:HD21	15:Z:152:LEU:HD21	1.94	0.48
1:A:1518:MA6:C3'	1:A:1519:MA6:H8	2.41	0.48
15:Z:98:PHE:CE1	15:Z:107:TYR:HA	2.48	0.48
1:A:820:U:H4'	1:A:821:G:OP2	2.13	0.48
1:A:298:A:HO2'	1:A:299:G:P	2.36	0.48
8:O:3:LEU:HD11	8:O:34:ALA:HB3	1.95	0.48
1:A:371:A:H2'	1:A:372:C:O4'	2.14	0.48
1:A:517:G:O2'	1:A:530:G:H4'	2.13	0.48
12:T:48:GLN:OE1	12:T:52:ASN:ND2	2.42	0.48
15:Z:173:VAL:O	15:Z:174:LEU:HD23	2.12	0.48
14:X:8:GLU:OE2	14:X:54:THR:HG23	2.14	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
15:Z:98:PHE:HE1	15:Z:107:TYR:HA	1.79	0.48
1:A:78:A:N6	1:A:79:G:H21	2.12	0.48
1:A:923:A:O2'	1:A:1399:C:OP2	2.26	0.48
15:Z:153:GLN:N	15:Z:153:GLN:OE1	2.46	0.48
1:A:610:U:C4	1:A:611:C:C5	3.02	0.48
1:A:704:A:C4	1:A:705:G:C8	3.02	0.48
4:F:16:GLU:OE1	4:F:16:GLU:N	2.38	0.47
11:R:35:GLU:OE1	11:R:35:GLU:N	2.28	0.47
5:H:35:ALA:HB1	5:H:110:VAL:HG21	1.96	0.47
1:A:706:A:H2'	1:A:707:U:H6	1.79	0.47
1:A:1517:G:H2'	1:A:1518:MA6:C8	2.44	0.47
1:A:713:G:H2'	1:A:714:G:C8	2.49	0.47
2:D:164:GLN:OE1	2:D:164:GLN:HA	2.14	0.47
12:T:77:ALA:O	12:T:80:THR:HG22	2.15	0.47
5:H:108:LYS:HG2	5:H:121:LEU:HD11	1.96	0.47
1:A:31:G:O2'	1:A:48:C:N4	2.45	0.47
1:A:79:G:O2'	1:A:80:A:H8	1.98	0.47
15:Z:125:LYS:O	15:Z:125:LYS:HG3	2.15	0.47
1:A:1407:5MC:OP2	1:A:1407:5MC:HM51	2.15	0.47
2:D:159:LEU:O	2:D:163:GLU:OE2	2.32	0.47
7:L:42:PRO:HD3	7:L:48:ALA:O	2.14	0.47
15:Z:130:PHE:CZ	15:Z:138:GLN:HA	2.50	0.47
1:A:1493:A:N1	14:X:46:ARG:HA	2.30	0.47
15:Z:157:VAL:HG23	15:Z:177:LYS:HG2	1.97	0.47
1:A:840:C:C2'	1:A:841:C:H5''	2.45	0.47
1:A:846:G:C2	1:A:847:G:N7	2.84	0.46
6:K:94:GLU:CD	13:U:20:LYS:HE3	2.40	0.46
11:R:73:ARG:O	11:R:74:HIS:CG	2.69	0.46
4:F:42:TRP:CE3	4:F:59:TYR:HB3	2.50	0.46
6:K:16:VAL:N	6:K:78:GLY:O	2.45	0.46
15:Z:98:PHE:O	15:Z:128:LEU:HA	2.15	0.46
2:D:200:ILE:HD12	2:D:200:ILE:N	2.31	0.46
2:D:50:ASP:O	2:D:53:VAL:HG12	2.16	0.46
4:F:104:LYS:HG3	4:F:105:ALA:N	2.30	0.46
5:H:125:ILE:HD12	5:H:125:ILE:N	2.30	0.46
15:Z:138:GLN:C	15:Z:142:MET:HE3	2.40	0.46
1:A:159:G:N2	1:A:162:A:OP2	2.38	0.46
1:A:205:A:C4	1:A:206:C:C6	3.04	0.46
4:F:16:GLU:OE2	4:F:17:GLN:OE1	2.34	0.46
1:A:205:A:C5	1:A:206:C:C5	3.04	0.45
3:E:160:SER:OG	3:E:163:GLU:HG2	2.16	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:H:9:ASP:O	5:H:13:ARG:HG3	2.17	0.45
1:A:406:G:C2	1:A:407:U:C6	3.05	0.45
5:H:35:ALA:HB1	5:H:110:VAL:CG2	2.45	0.45
2:D:50:ASP:OD1	2:D:51:TYR:N	2.49	0.45
6:K:114:THR:HG21	13:U:32:VAL:HG21	1.97	0.45
15:Z:81:SER:O	15:Z:85:LYS:HG3	2.17	0.45
1:A:471:U:O2'	1:A:472:U:P	2.75	0.45
1:A:1406:U:H3'	1:A:1407:5MC:C6	2.51	0.45
2:D:145:ILE:HD13	2:D:178:MET:HB3	1.98	0.45
1:A:206:C:C2	1:A:207:C:C6	3.04	0.45
1:A:468:A:H5''	1:A:469:C:H5	1.81	0.45
1:A:496:A:H5'	1:A:497:G:OP2	2.17	0.45
3:E:154:ALA:HA	3:E:164:ILE:CD1	2.46	0.45
1:A:610:U:C2	1:A:611:C:C6	3.05	0.45
4:F:29:ILE:HD13	4:F:64:VAL:HG23	1.98	0.45
1:A:211:G:H5''	1:A:212:G:OP2	2.17	0.45
1:A:468:A:H5'	1:A:469:C:OP2	2.17	0.45
1:A:518:C:H2'	1:A:530:G:C8	2.52	0.45
1:A:754:C:H3'	1:A:755:G:H5'	1.99	0.45
4:F:10:VAL:HG12	4:F:58:HIS:HB3	1.99	0.45
5:H:106:THR:C	5:H:108:LYS:N	2.74	0.45
6:K:94:GLU:OE1	13:U:20:LYS:NZ	2.50	0.45
14:X:56:GLU:N	14:X:56:GLU:OE1	2.49	0.45
1:A:523:A:C2	7:L:88:LYS:HB3	2.52	0.45
1:A:3:A:H5''	1:A:4:U:H6	1.81	0.44
1:A:839:C:C4	1:A:840:C:C5	3.05	0.44
1:A:883:C:O2'	1:A:884:U:H5'	2.17	0.44
1:A:1497:G:N2	1:A:1519:MA6:N3	2.64	0.44
1:A:160:A:H1'	1:A:344:A:N7	2.32	0.44
1:A:840:C:H2'	1:A:840:C:O2	2.17	0.44
1:A:93:U:H5'	1:A:94:G:OP2	2.17	0.44
1:A:490:C:C2	1:A:491:G:C8	3.05	0.44
14:X:56:GLU:C	14:X:57:LEU:HD22	2.42	0.44
15:Z:138:GLN:O	15:Z:142:MET:HE3	2.18	0.44
8:O:3:LEU:HG	8:O:35:GLN:HG2	1.99	0.44
1:A:3:A:H4'	1:A:612:C:O2'	2.17	0.44
1:A:746:A:H2'	1:A:747:A:C8	2.52	0.44
1:A:885:G:OP2	7:L:15:LYS:NZ	2.50	0.44
1:A:1530:G:N7	13:U:46:LYS:HE2	2.32	0.44
1:A:471:U:HO2'	1:A:472:U:P	2.41	0.44
15:Z:128:LEU:HD21	15:Z:130:PHE:CZ	2.53	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1:A:H2'	1:A:2:A:C8	2.53	0.44
1:A:128:G:OP1	10:Q:6:ARG:NH2	2.51	0.44
1:A:180:U:C2'	1:A:181:A:H5'	2.47	0.44
5:H:7:ILE:HB	5:H:77:ARG:NH1	2.32	0.44
15:Z:126:ILE:N	15:Z:126:ILE:HD12	2.32	0.44
1:A:1417:G:H1'	1:A:1483:A:H61	1.83	0.44
13:U:51:SER:HA	13:U:54:LYS:CE	2.48	0.44
14:X:17:LEU:HD11	14:X:23:ARG:CG	2.48	0.44
1:A:90:C:H4'	1:A:91:U:OP1	2.18	0.43
10:Q:43:LYS:C	10:Q:44:LEU:HD12	2.43	0.43
14:X:56:GLU:OE1	14:X:68:VAL:HG22	2.18	0.43
15:Z:107:TYR:CE2	15:Z:111:LEU:HD11	2.53	0.43
1:A:87:C:O2'	1:A:88:U:O5'	2.36	0.43
1:A:458:U:H2'	1:A:459:A:H8	1.82	0.43
4:F:47:LEU:HD13	4:F:51:ILE:HD12	2.00	0.43
12:T:12:ILE:HD13	12:T:12:ILE:N	2.33	0.43
1:A:209:U:C3'	1:A:210:C:H4'	2.48	0.43
8:O:28:GLN:O	8:O:32:LEU:HD23	2.17	0.43
13:U:17:ARG:NH1	13:U:21:ARG:HB2	2.34	0.43
1:A:4:U:O2	1:A:4:U:H2'	2.18	0.43
1:A:204:G:C8	1:A:465:A:N1	2.86	0.43
1:A:489:C:N3	1:A:490:C:C5	2.86	0.43
1:A:524:G:H2'	1:A:525:C:C6	2.53	0.43
15:Z:129:ARG:HD2	15:Z:130:PHE:N	2.33	0.43
1:A:876:C:C2	1:A:877:G:C8	3.07	0.43
7:L:110:ARG:HB3	7:L:119:VAL:HG21	2.00	0.43
7:L:120:LYS:O	7:L:121:ARG:C	2.60	0.43
1:A:181:A:O2'	1:A:194:C:N4	2.52	0.43
1:A:212:G:C4	1:A:213:G:C8	3.06	0.43
1:A:1480:A:H2'	1:A:1481:U:O4'	2.19	0.43
1:A:789:U:H2'	1:A:790:A:H3'	2.00	0.43
1:A:1496:C:H2'	1:A:1497:G:O4'	2.19	0.43
1:A:275:G:H5'	10:Q:16:LYS:HG2	1.99	0.43
1:A:363:A:C6	7:L:28:PRO:HD2	2.54	0.43
1:A:275:G:C5'	10:Q:16:LYS:HG2	2.49	0.42
1:A:841:C:H5'	1:A:843:U:OP2	2.19	0.42
3:E:19:ASN:OD1	3:E:20:ARG:N	2.51	0.42
8:O:24:SER:O	8:O:27:VAL:HG12	2.19	0.42
1:A:204:G:H2'	1:A:205:A:O4'	2.19	0.42
1:A:876:C:O2	1:A:877:G:C8	2.73	0.42
1:A:1413:A:H2	1:A:1487:G:H22	1.59	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:19:LEU:CB	2:D:21:LEU:HD13	2.47	0.42
1:A:209:U:H3'	1:A:210:C:H4'	2.00	0.42
3:E:37:THR:HG22	3:E:38:VAL:N	2.33	0.42
1:A:210:C:O2	1:A:212:G:C6	2.72	0.42
10:Q:48:ASP:OD1	10:Q:51:ASN:N	2.52	0.42
3:E:25:VAL:HG12	3:E:26:LYS:N	2.35	0.42
1:A:113:G:H1'	1:A:354:G:H5'	2.02	0.42
1:A:609:A:C5	1:A:610:U:C6	3.07	0.42
3:E:31:PHE:O	3:E:54:ARG:NH2	2.53	0.42
3:E:81:LEU:HD23	3:E:147:MET:HE1	2.02	0.42
6:K:94:GLU:OE1	13:U:20:LYS:CE	2.67	0.42
1:A:321:A:H2'	1:A:322:C:C6	2.55	0.42
1:A:539:A:H2'	1:A:540:G:C8	2.55	0.42
1:A:1478:U:H2'	1:A:1479:C:C6	2.54	0.42
2:D:202:GLU:OE1	2:D:202:GLU:HA	2.19	0.42
6:K:15:GLN:HA	6:K:78:GLY:CA	2.49	0.42
9:P:61:VAL:HG22	9:P:67:ILE:HD11	2.00	0.42
1:A:700:G:H1	15:Z:74:LEU:HD11	1.81	0.42
1:A:1406:U:H3'	1:A:1407:5MC:H6	1.83	0.42
1:A:1530:G:H2'	1:A:1531:A:C8	2.55	0.42
4:F:11:HIS:ND1	4:F:12:PRO:HD2	2.35	0.42
4:F:42:TRP:CD1	4:F:42:TRP:N	2.88	0.42
14:X:34:ALA:HB1	14:X:67:ILE:HG23	2.02	0.42
15:Z:107:TYR:OH	15:Z:147:ARG:HB2	2.19	0.42
1:A:822:U:C4	1:A:823:C:C5	3.07	0.41
9:P:23:ASP:OD1	9:P:23:ASP:C	2.63	0.41
1:A:684:U:H2'	1:A:685:G:O4'	2.20	0.41
3:E:83:HIS:HB2	3:E:84:PRO:HD2	2.02	0.41
7:L:109:ASP:OD1	7:L:109:ASP:C	2.64	0.41
15:Z:88:GLN:O	15:Z:91:ILE:N	2.53	0.41
1:A:202:G:O2'	1:A:468:A:H8	2.04	0.41
1:A:642:A:N7	5:H:107:SER:HA	2.35	0.41
1:A:844:G:OP2	1:A:846:G:C5	2.74	0.41
3:E:72:ILE:CG2	3:E:73:ASN:N	2.83	0.41
1:A:610:U:N3	1:A:611:C:C5	2.89	0.41
1:A:697:U:H2'	1:A:698:G:H5'	2.03	0.41
1:A:1507:A:O2'	1:A:1508:A:O5'	2.30	0.41
3:E:34:THR:HG22	3:E:52:LYS:HG2	2.02	0.41
3:E:159:LYS:HB3	3:E:163:GLU:OE2	2.20	0.41
9:P:75:ILE:O	9:P:78:VAL:HG12	2.21	0.41
1:A:210:C:H1'	1:A:211:G:H22	1.85	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:F:42:TRP:CE3	4:F:59:TYR:CB	3.03	0.41
4:F:74:LEU:HD13	4:F:74:LEU:C	2.46	0.41
15:Z:85:LYS:O	15:Z:88:GLN:N	2.53	0.41
1:A:439:U:O2	1:A:439:U:H2'	2.21	0.41
1:A:611:C:N3	1:A:612:C:C5	2.89	0.41
1:A:718:A:H5'	1:A:719:C:H5	1.84	0.41
1:A:803:G:H2'	1:A:804:U:O4'	2.21	0.41
1:A:616:G:O2'	1:A:617:G:H5'	2.21	0.41
11:R:31:ASN:OD1	11:R:31:ASN:C	2.64	0.41
15:Z:115:ILE:HG22	15:Z:119:GLU:OE2	2.21	0.41
1:A:516:PSU:H3'	1:A:517:G:C8	2.56	0.41
15:Z:135:MET:C	15:Z:137:HIS:N	2.78	0.41
1:A:611:C:C2	1:A:612:C:C5	3.09	0.41
1:A:790:A:HO2'	1:A:791:G:P	2.43	0.41
1:A:126:G:OP1	1:A:605:U:O2'	2.35	0.41
3:E:72:ILE:HG22	3:E:73:ASN:N	2.36	0.41
15:Z:107:TYR:O	15:Z:111:LEU:HG	2.21	0.41
1:A:705:G:C5	1:A:706:A:C8	3.10	0.40
15:Z:108:GLN:O	15:Z:112:ARG:HG3	2.21	0.40
1:A:35:G:H2'	1:A:36:C:C6	2.55	0.40
1:A:826:C:O2	5:H:16:ASN:ND2	2.55	0.40
1:A:1403:C:O2	1:A:1403:C:H2'	2.22	0.40
1:A:1433:A:H2'	1:A:1434:A:C8	2.56	0.40
3:E:107:ALA:O	3:E:112:ARG:NE	2.53	0.40
4:F:39:LEU:HD23	4:F:39:LEU:C	2.46	0.40
7:L:56:ARG:CZ	7:L:62:GLU:OE1	2.70	0.40
14:X:36:ILE:CG2	14:X:40:MET:HG3	2.51	0.40
1:A:439:U:C2	1:A:440:C:C6	3.09	0.40
1:A:706:A:C4	1:A:707:U:C5	3.09	0.40
1:A:1425:U:H2'	1:A:1426:G:H8	1.86	0.40
1:A:1434:A:H2'	1:A:1435:G:O4'	2.21	0.40
15:Z:115:ILE:HD12	15:Z:155:LEU:CD2	2.51	0.40
1:A:699:C:H6	1:A:699:C:O5'	2.04	0.40
1:A:701:U:O2	1:A:703:G:C2	2.75	0.40
1:A:721:G:H4'	1:A:722:G:O4'	2.21	0.40
1:A:791:G:C2'	1:A:792:A:H5'	2.50	0.40
1:A:1513:A:C6	1:A:1523:G:O6	2.75	0.40
1:A:205:A:H2'	1:A:206:C:O4'	2.21	0.40
3:E:90:THR:O	3:E:90:THR:CG2	2.66	0.40
3:E:138:ARG:O	3:E:142:ASP:OD2	2.40	0.40
8:O:17:ARG:HG2	8:O:17:ARG:HH11	1.86	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
11:R:31:ASN:OD1	11:R:31:ASN:O	2.38	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	D	203/206 (98%)	202 (100%)	1 (0%)	0	100	100
3	E	154/167 (92%)	149 (97%)	5 (3%)	0	100	100
4	F	104/135 (77%)	104 (100%)	0	0	100	100
5	H	127/130 (98%)	125 (98%)	2 (2%)	0	100	100
6	K	115/129 (89%)	111 (96%)	4 (4%)	0	100	100
7	L	121/124 (98%)	118 (98%)	3 (2%)	0	100	100
8	O	86/89 (97%)	85 (99%)	1 (1%)	0	100	100
9	P	80/82 (98%)	80 (100%)	0	0	100	100
10	Q	78/84 (93%)	78 (100%)	0	0	100	100
11	R	54/75 (72%)	54 (100%)	0	0	100	100
12	T	84/87 (97%)	84 (100%)	0	0	100	100
13	U	50/71 (70%)	50 (100%)	0	0	100	100
14	X	68/72 (94%)	66 (97%)	2 (3%)	0	100	100
15	Z	110/180 (61%)	107 (97%)	3 (3%)	0	100	100
All	All	1434/1631 (88%)	1413 (98%)	21 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	D	172/173 (99%)	172 (100%)	0	100	100
3	E	119/126 (94%)	118 (99%)	1 (1%)	79	90
4	F	92/116 (79%)	92 (100%)	0	100	100
5	H	104/105 (99%)	104 (100%)	0	100	100
6	K	90/99 (91%)	90 (100%)	0	100	100
7	L	103/104 (99%)	103 (100%)	0	100	100
8	O	76/77 (99%)	76 (100%)	0	100	100
9	P	65/65 (100%)	65 (100%)	0	100	100
10	Q	74/78 (95%)	74 (100%)	0	100	100
11	R	49/65 (75%)	49 (100%)	0	100	100
12	T	65/66 (98%)	65 (100%)	0	100	100
13	U	43/61 (70%)	43 (100%)	0	100	100
14	X	64/65 (98%)	64 (100%)	0	100	100
15	Z	101/156 (65%)	101 (100%)	0	100	100
All	All	1217/1356 (90%)	1216 (100%)	1 (0%)	92	98

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	E	21	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
2	D	198	HIS
3	E	97	GLN
4	F	3	HIS
5	H	4	GLN
7	L	73	ASN

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Mol	Chain	Res	Type
7	L	96	HIS
8	O	20	ASN
8	O	46	HIS
10	Q	50	ASN
12	T	20	HIS
14	X	19	ASN

### 5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	1076/1541 (69%)	159 (14%)	16 (1%)

All (159) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	A	3	A
1	A	9	G
1	A	22	G
1	A	32	A
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	73	C
1	A	74	A
1	A	77	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	94	G
1	A	95	C

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Mol	Chain	Res	Type
1	A	109	A
1	A	121	U
1	A	122	G
1	A	131	A
1	A	164	G
1	A	170	U
1	A	181	A
1	A	182	A
1	A	183	C
1	A	184	G
1	A	204	G
1	A	210	C
1	A	211	G
1	A	212	G
1	A	213	G
1	A	246	A
1	A	247	G
1	A	251	G
1	A	266	G
1	A	267	C
1	A	289	G
1	A	299	G
1	A	328	C
1	A	332	G
1	A	344	A
1	A	345	C
1	A	347	G
1	A	352	C
1	A	354	G
1	A	367	U
1	A	372	C
1	A	384	G
1	A	397	A
1	A	406	G
1	A	411	A
1	A	413	G
1	A	421	U
1	A	422	C
1	A	423	G
1	A	424	G
1	A	429	U
1	A	467	U

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Mol	Chain	Res	Type
1	A	468	A
1	A	472	U
1	A	481	G
1	A	484	G
1	A	486	U
1	A	495	A
1	A	496	A
1	A	497	G
1	A	511	C
1	A	512	U
1	A	517	G
1	A	518	C
1	A	531	U
1	A	532	A
1	A	533	A
1	A	547	A
1	A	562	U
1	A	564	C
1	A	572	A
1	A	573	A
1	A	576	C
1	A	577	G
1	A	596	A
1	A	653	U
1	A	665	A
1	A	686	U
1	A	687	A
1	A	688	G
1	A	701	U
1	A	702	A
1	A	703	G
1	A	704	A
1	A	718	A
1	A	719	C
1	A	720	C
1	A	721	G
1	A	723	U
1	A	724	G
1	A	755	G
1	A	777	A
1	A	791	G
1	A	792	A

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Mol	Chain	Res	Type
1	A	793	U
1	A	794	A
1	A	815	A
1	A	817	C
1	A	828	U
1	A	829	G
1	A	840	C
1	A	841	C
1	A	842	U
1	A	847	G
1	A	849	G
1	A	872	A
1	A	885	G
1	A	901	A
1	A	902	G
1	A	914	A
1	A	923	A
1	A	926	G
1	A	1398	A
1	A	1400	C
1	A	1404	C
1	A	1408	A
1	A	1423	G
1	A	1441	A
1	A	1442	G
1	A	1446	A
1	A	1450	U
1	A	1458	G
1	A	1474	U
1	A	1475	G
1	A	1481	U
1	A	1485	U
1	A	1486	G
1	A	1492	A
1	A	1493	A
1	A	1494	G
1	A	1497	G
1	A	1498	UR3
1	A	1503	A
1	A	1506	U
1	A	1507	A
1	A	1508	A

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Mol	Chain	Res	Type
1	A	1517	G
1	A	1519	MA6
1	A	1520	C
1	A	1522	U
1	A	1529	G
1	A	1530	G
1	A	1532	U

All (16) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	A	2	A
1	A	182	A
1	A	212	G
1	A	298	A
1	A	327	A
1	A	467	U
1	A	471	U
1	A	685	G
1	A	687	A
1	A	719	C
1	A	753	A
1	A	790	A
1	A	793	U
1	A	1484	C
1	A	1485	U
1	A	1493	A

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

8 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	UR3	A	1498	1	19,22,23	2.92	8 (42%)	26,32,35	1.38	2 (7%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
1	G7M	A	527	1	20,26,27	1.13	2 (10%)	17,39,42	0.57	0
1	PSU	A	516	1	18,21,22	0.89	1 (5%)	22,30,33	0.86	1 (4%)
1	4OC	A	1402	1	20,23,24	3.10	8 (40%)	26,32,35	0.95	2 (7%)
1	MA6	A	1519	1	18,26,27	0.75	0	19,38,41	0.78	0
1	5MC	A	1407	1	18,22,23	3.58	7 (38%)	26,32,35	0.84	1 (3%)
1	2MG	A	1516	1	18,26,27	1.01	2 (11%)	16,38,41	0.76	0
1	MA6	A	1518	1	18,26,27	0.74	0	19,38,41	0.53	0

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

All (28) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1407	5MC	C6-C5	9.17	1.49	1.34
1	A	1498	UR3	C2-N1	7.67	1.49	1.38
1	A	1402	4OC	C4-N3	6.99	1.45	1.32
1	A	1407	5MC	C4-N3	6.66	1.45	1.34
1	A	1498	UR3	C6-C5	6.28	1.49	1.35
1	A	1402	4OC	C6-C5	6.18	1.49	1.35
1	A	1407	5MC	C2-N3	6.11	1.48	1.36
1	A	1402	4OC	C2-N3	6.02	1.48	1.36
1	A	1498	UR3	C2-N3	5.33	1.49	1.39
1	A	1407	5MC	C6-N1	4.71	1.46	1.38
1	A	1402	4OC	C4-N4	4.46	1.45	1.35
1	A	1407	5MC	C4-N4	4.36	1.45	1.34
1	A	1402	4OC	C5-C4	3.88	1.49	1.40
1	A	1407	5MC	C2-N1	3.82	1.48	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1402	4OC	C2-N1	3.78	1.48	1.40
1	A	527	G7M	C8-N9	3.45	1.39	1.33
1	A	516	PSU	C6-C5	3.22	1.39	1.35
1	A	1402	4OC	C6-N1	3.16	1.45	1.38
1	A	1402	4OC	O2-C2	-2.76	1.18	1.23
1	A	1498	UR3	C6-N1	2.75	1.44	1.38
1	A	1498	UR3	O2-C2	-2.68	1.17	1.22
1	A	1498	UR3	O4-C4	-2.65	1.17	1.23
1	A	1407	5MC	O2-C2	-2.56	1.19	1.23
1	A	527	G7M	C8-N7	2.51	1.37	1.33
1	A	1516	2MG	C5-C6	-2.51	1.42	1.47
1	A	1498	UR3	C5-C4	2.42	1.50	1.43
1	A	1516	2MG	C8-N7	-2.10	1.31	1.35
1	A	1498	UR3	C4-N3	2.03	1.45	1.40

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1498	UR3	C4-N3-C2	-5.22	119.65	124.56
1	A	1407	5MC	C5-C6-N1	-2.53	120.74	123.34
1	A	516	PSU	C3'-C2'-C1'	2.19	104.19	101.64
1	A	1402	4OC	C2'-C1'-N1	-2.06	110.23	114.22
1	A	1498	UR3	C6-N1-C2	-2.05	119.95	121.79
1	A	1402	4OC	CM4-N4-C4	-2.02	118.51	122.45

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	1498	UR3	O4'-C4'-C5'-O5'
1	A	1498	UR3	C3'-C4'-C5'-O5'
1	A	1518	MA6	C3'-C4'-C5'-O5'
1	A	1518	MA6	C5-C6-N6-C9
1	A	1518	MA6	C5-C6-N6-C10
1	A	1519	MA6	C5-C6-N6-C9
1	A	1519	MA6	C5-C6-N6-C10
1	A	1402	4OC	C3'-C4'-C5'-O5'
1	A	1518	MA6	O4'-C4'-C5'-O5'
1	A	1402	4OC	O4'-C4'-C5'-O5'
1	A	1518	MA6	N1-C6-N6-C9
1	A	1519	MA6	N1-C6-N6-C9
1	A	1519	MA6	C4'-C5'-O5'-P

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Mol	Chain	Res	Type	Atoms
1	A	1402	4OC	C3'-C2'-O2'-CM2
1	A	1407	5MC	O4'-C4'-C5'-O5'

There are no ring outliers.

4 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	516	PSU	2	0
1	A	1519	MA6	3	0
1	A	1407	5MC	3	0
1	A	1518	MA6	4	0

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 96 ligands modelled in this entry, 95 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	$\# Z  > 2$
16	A1IC4	A	1601	-	38,46,46	2.26	12 (31%)	39,63,63	1.82	5 (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
16	A1IC4	A	1601	-	-	14/45/60/60	0/3/3/3

All (12) bond length outliers are listed below:



Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
16	A	1601	A1IC4	C1-N1	6.48	1.45	1.33
16	A	1601	A1IC4	C6-N2	5.11	1.45	1.34
16	A	1601	A1IC4	C12-N4	5.05	1.45	1.34
16	A	1601	A1IC4	C18-N7	4.85	1.44	1.34
16	A	1601	A1IC4	O2-C1	3.49	1.40	1.35
16	A	1601	A1IC4	C23-N8	-2.67	1.32	1.36
16	A	1601	A1IC4	O6-C12	-2.60	1.18	1.23
16	A	1601	A1IC4	O1-C1	-2.46	1.18	1.21
16	A	1601	A1IC4	O7-C18	-2.45	1.18	1.23
16	A	1601	A1IC4	O4-C6	-2.38	1.18	1.23
16	A	1601	A1IC4	O2-C2	-2.32	1.39	1.45
16	A	1601	A1IC4	C24-N9	-2.04	1.31	1.34

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
16	A	1601	A1IC4	O2-C1-N1	7.68	120.61	111.08
16	A	1601	A1IC4	O1-C1-N1	-3.59	119.59	125.51
16	A	1601	A1IC4	O2-C1-O1	-3.46	119.80	123.07
16	A	1601	A1IC4	C5-C12-N4	2.37	121.90	116.70
16	A	1601	A1IC4	O6-C12-N4	-2.10	119.04	122.93

There are no chirality outliers.

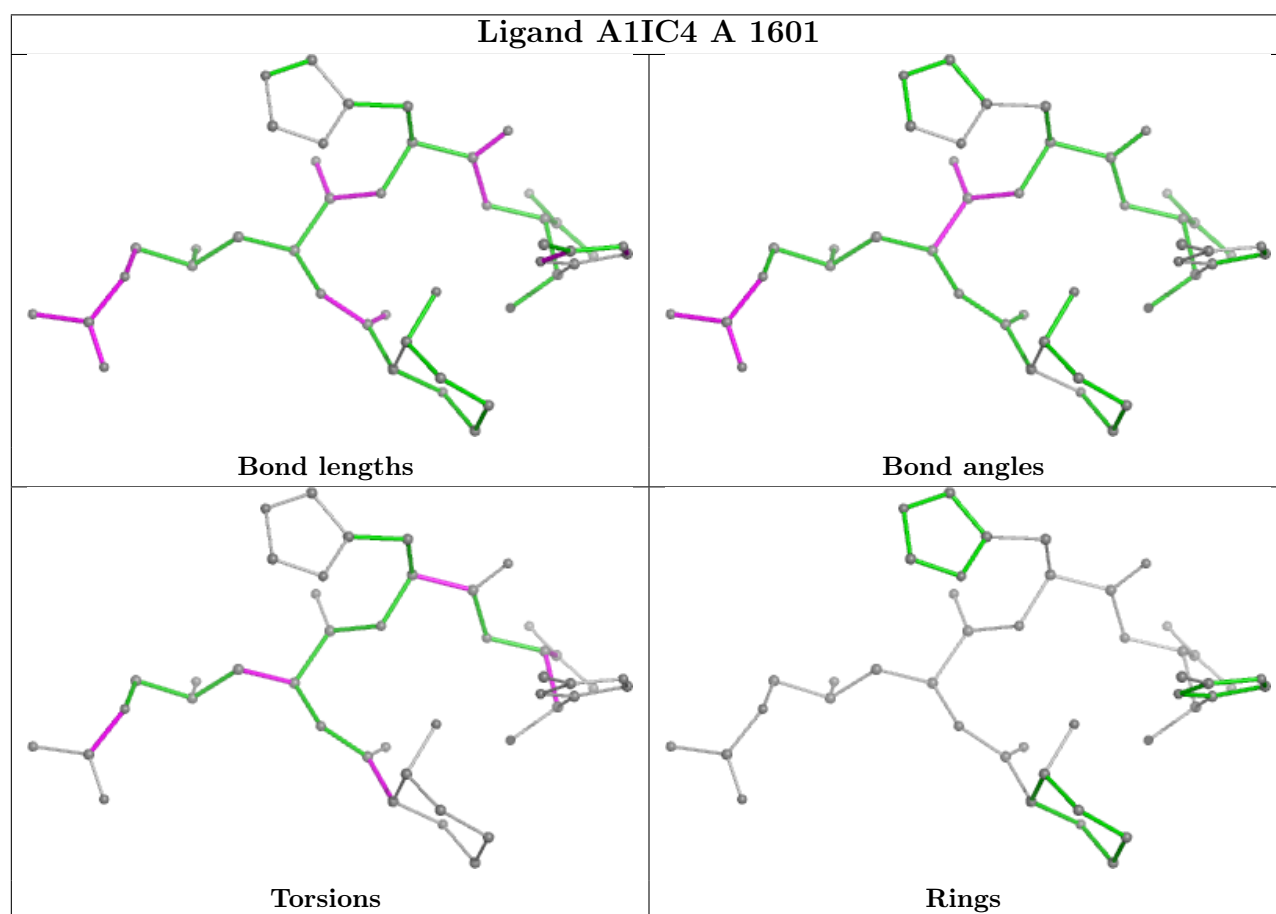
All (14) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
16	A	1601	A1IC4	N2-C6-C7-N3
16	A	1601	A1IC4	C3-C4-C5-N2
16	A	1601	A1IC4	N1-C1-O2-C2
16	A	1601	A1IC4	O1-C1-O2-C2
16	A	1601	A1IC4	N7-C19-C21-O10
16	A	1601	A1IC4	N7-C19-C21-C22
16	A	1601	A1IC4	C20-C19-C21-O10
16	A	1601	A1IC4	C3-C4-C5-C12
16	A	1601	A1IC4	O4-C6-C7-C11
16	A	1601	A1IC4	C21-C19-C20-O8
16	A	1601	A1IC4	C21-C19-C20-O9
16	A	1601	A1IC4	C20-C19-C21-C22
16	A	1601	A1IC4	C14-C13-C18-O7
16	A	1601	A1IC4	C14-C13-C18-N7

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 ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

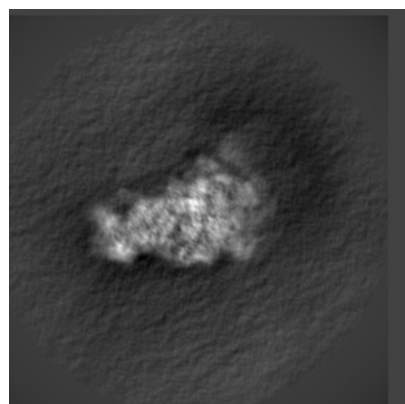
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-51966. These allow visual inspection of the internal detail of the map and identification of artifacts.

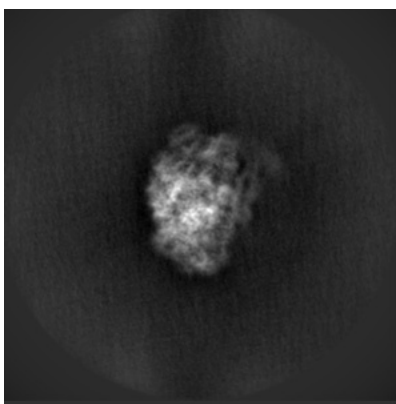
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

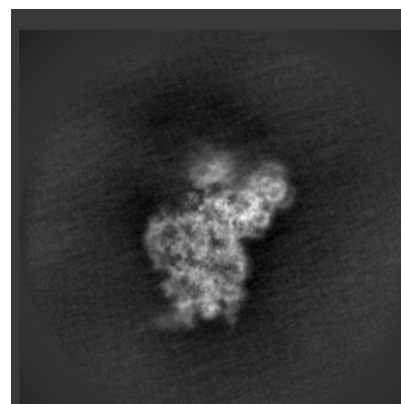
#### 6.1.1 Primary map



X

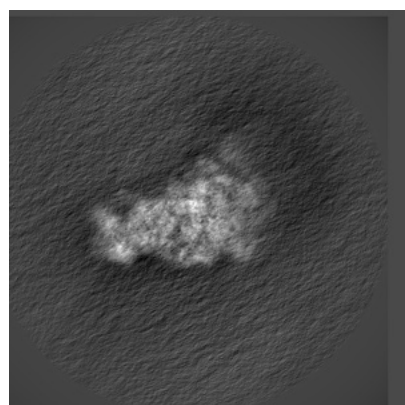


Y

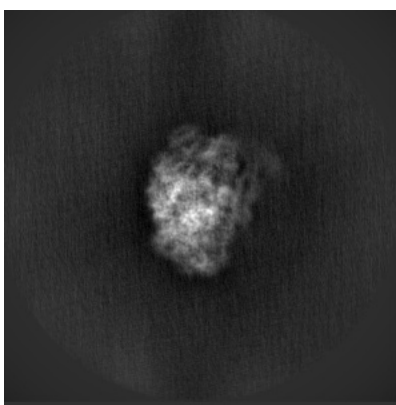


Z

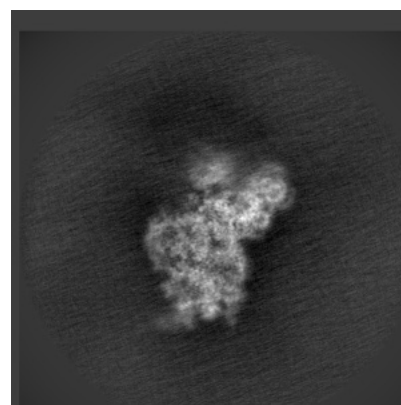
#### 6.1.2 Raw map



X



Y

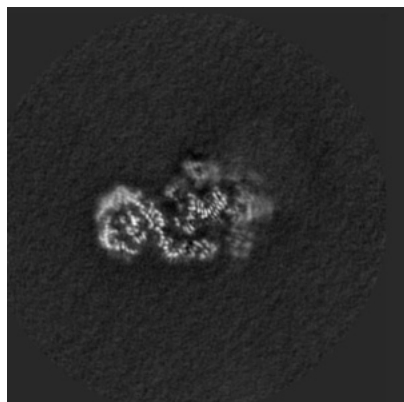


Z

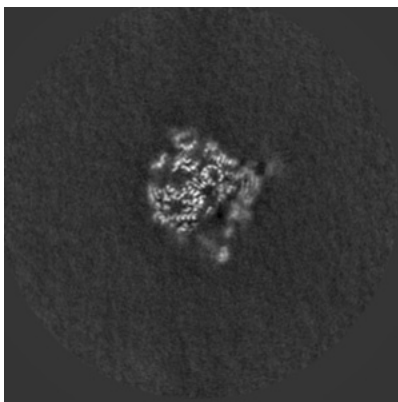
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

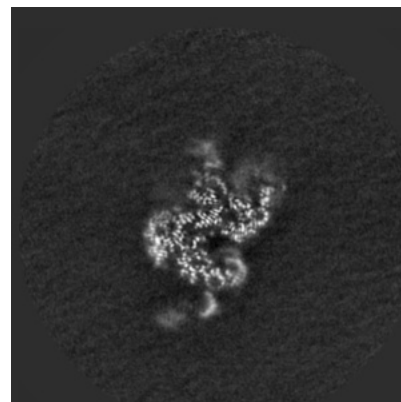
### 6.2.1 Primary map



X Index: 192

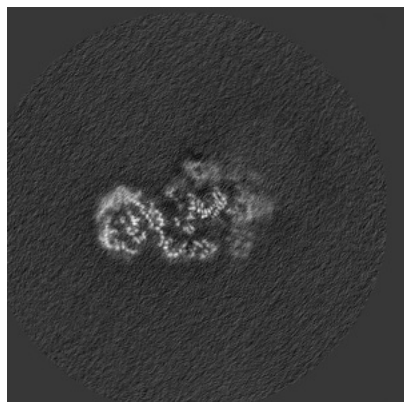


Y Index: 192

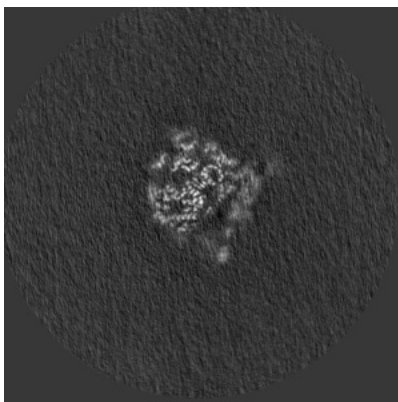


Z Index: 192

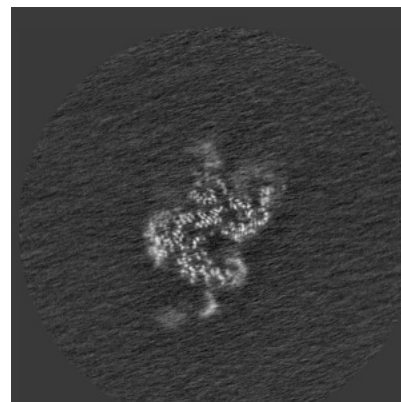
### 6.2.2 Raw map



X Index: 192



Y Index: 192

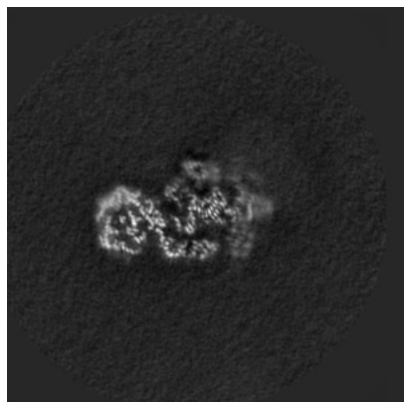


Z Index: 192

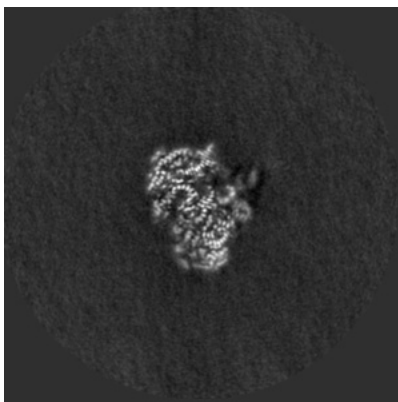
The images above show central slices of the map in three orthogonal directions.

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

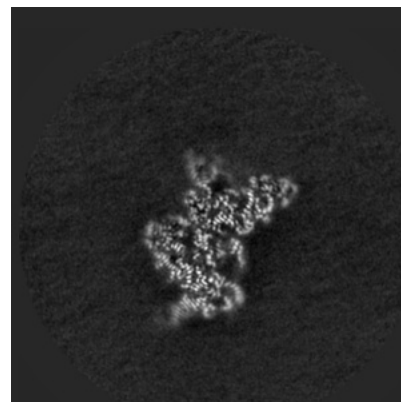
### 6.3.1 Primary map



X Index: 191

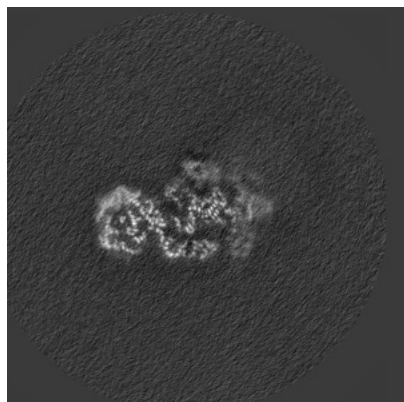


Y Index: 178

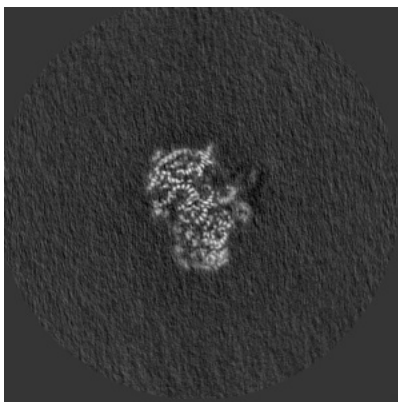


Z Index: 177

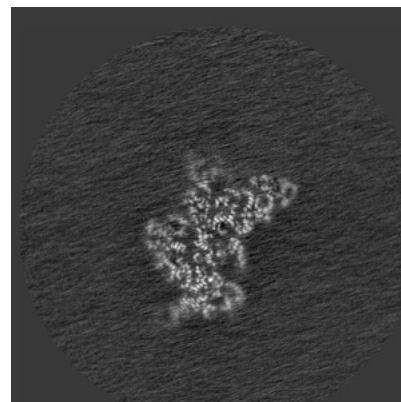
### 6.3.2 Raw map



X Index: 191



Y Index: 177



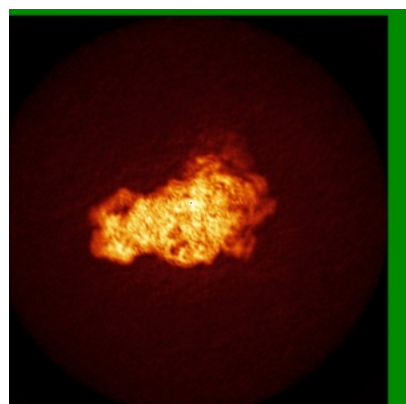
Z Index: 176

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

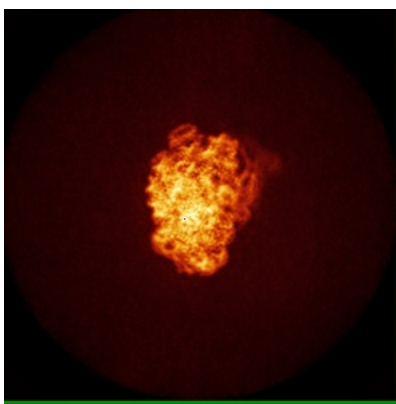


## 6.4 Orthogonal standard-deviation projections (False-color) [i](#)

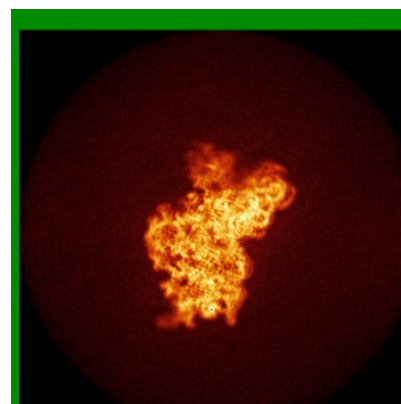
### 6.4.1 Primary map



X

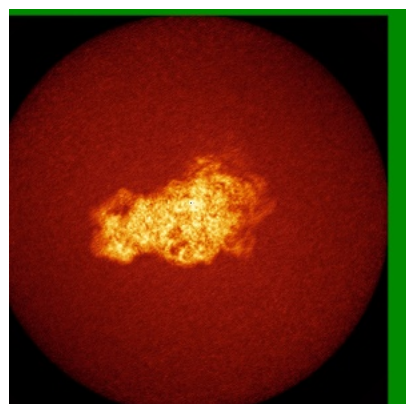


Y

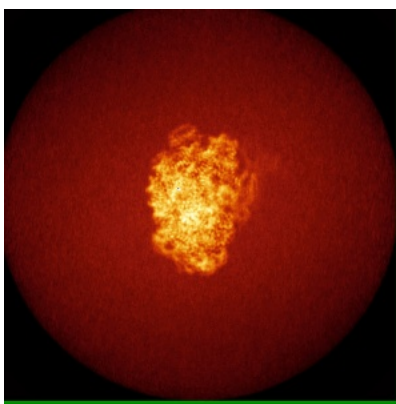


Z

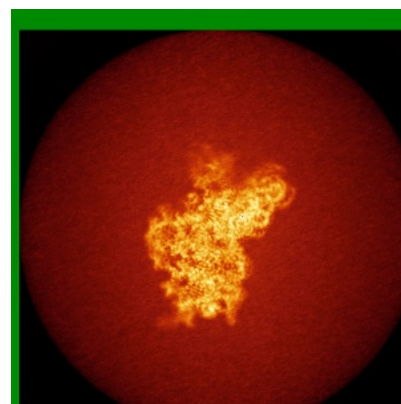
### 6.4.2 Raw map



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.

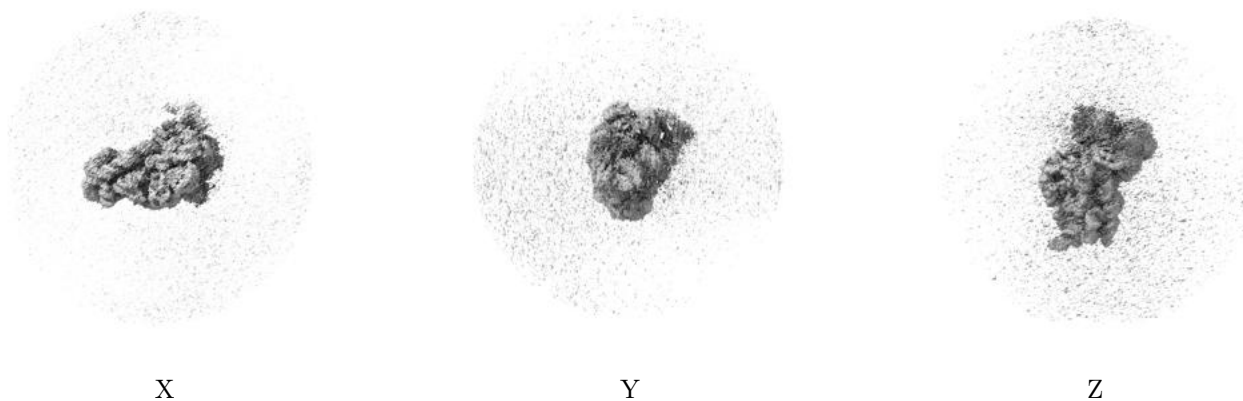
## 6.5 Orthogonal surface views [i](#)

### 6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.017. 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



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 [i](#)

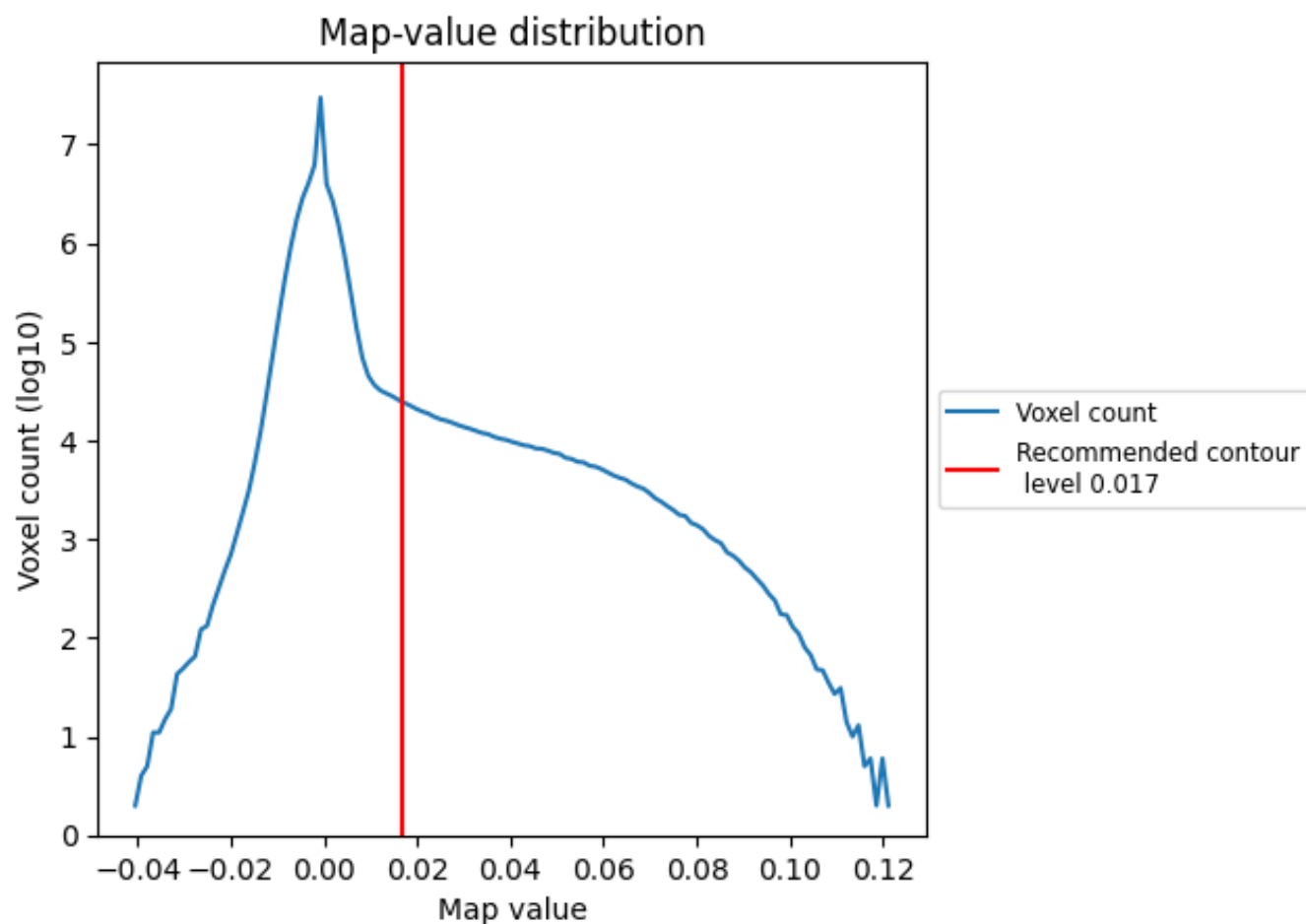
This section was not generated. No masks/segmentation were deposited.



## 7 Map analysis [i](#)

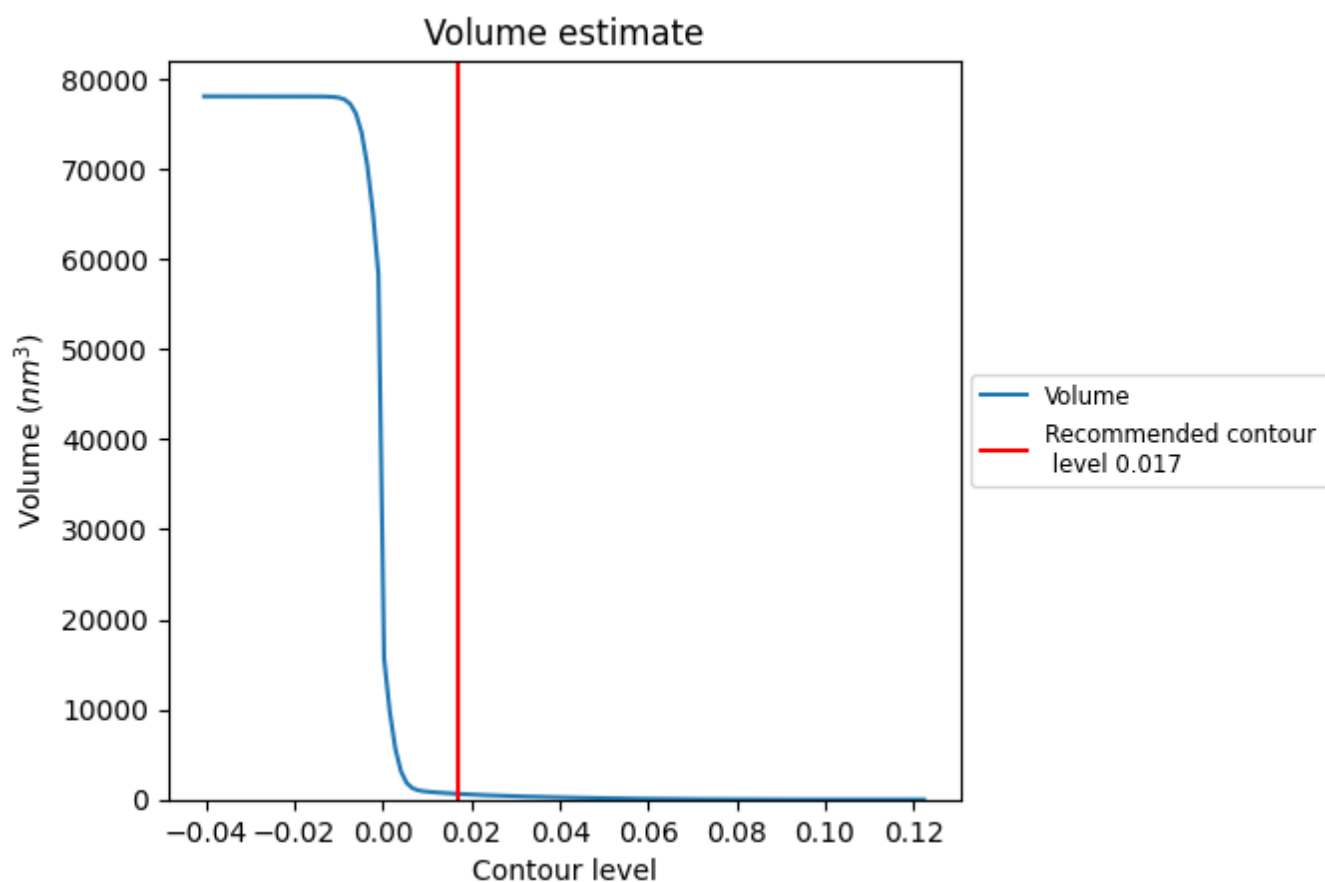
This section contains the results of statistical analysis of the map.

### 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.

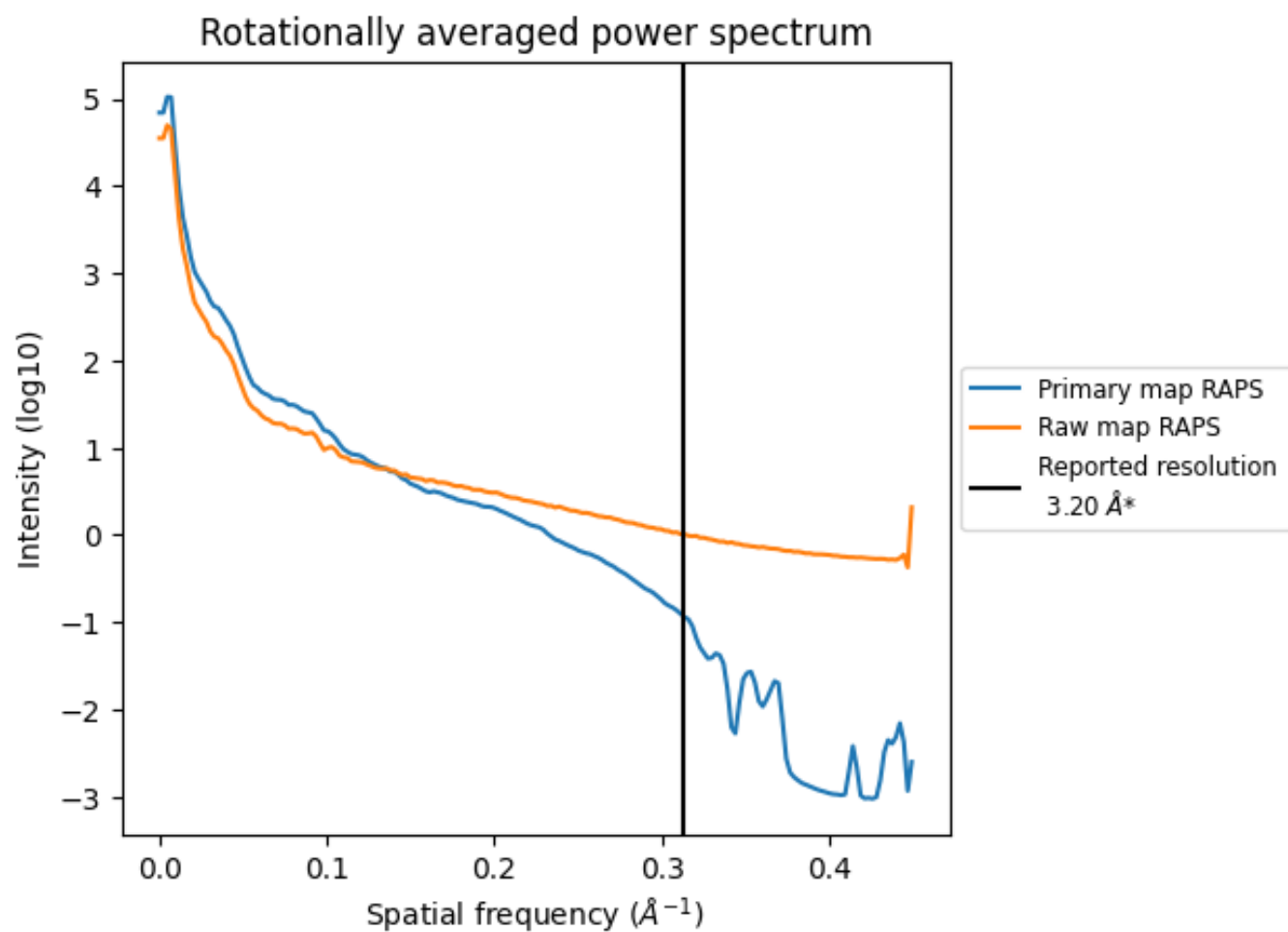
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 632 nm<sup>3</sup>; this corresponds to an approximate mass of 571 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 ⓘ

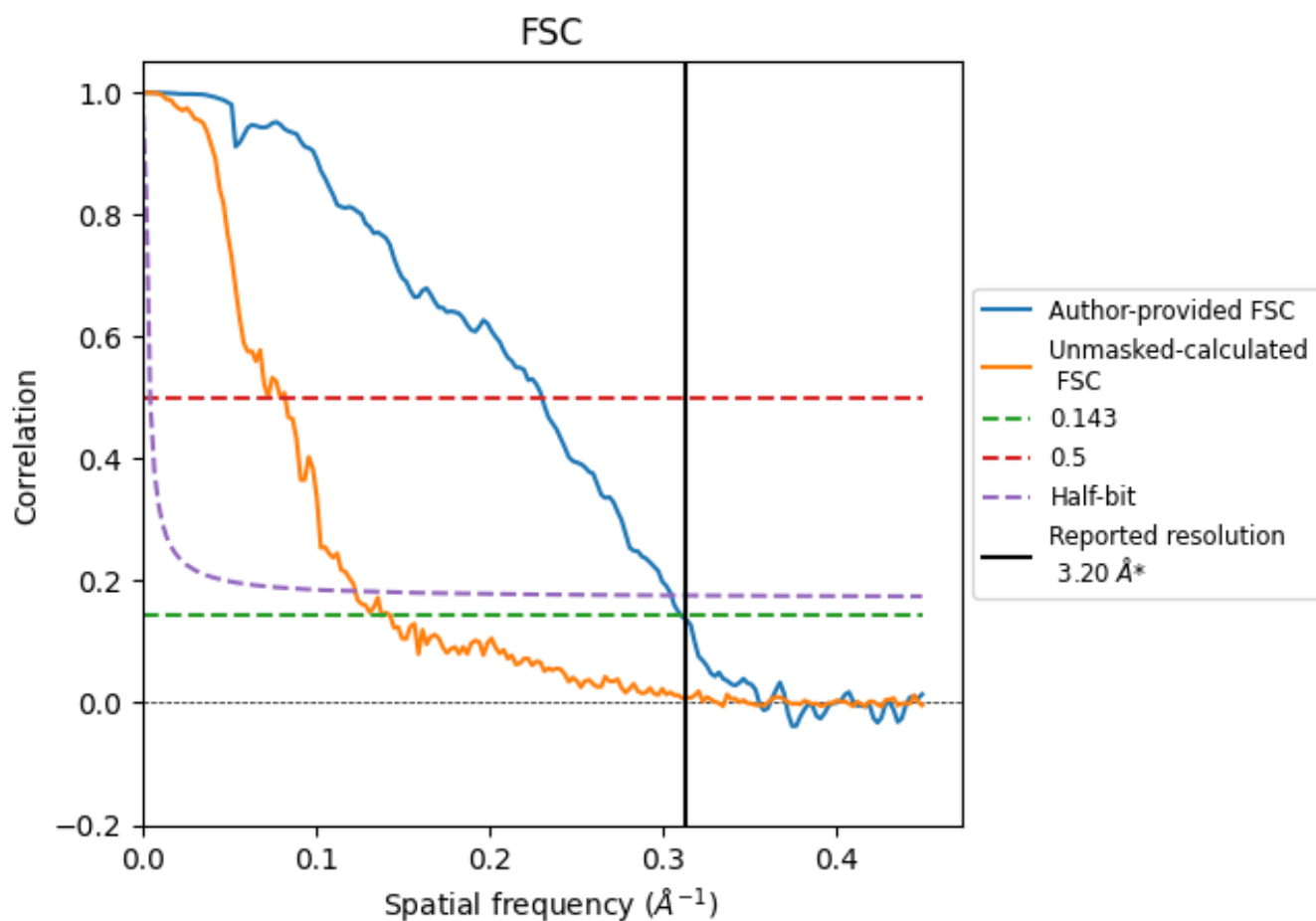


\*Reported resolution corresponds to spatial frequency of 0.312  $\text{\AA}^{-1}$

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

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

### 8.1 FSC [i](#)



\*Reported resolution corresponds to spatial frequency of 0.312  $\text{\AA}^{-1}$

## 8.2 Resolution estimates [i](#)

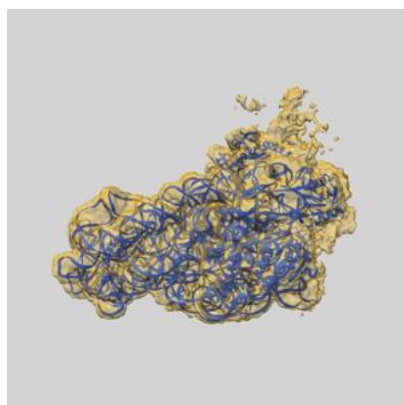
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.20	-	-
Author-provided FSC curve	3.22	4.34	3.28
Unmasked-calculated*	7.25	12.56	8.14

\*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 7.25 differs from the reported value 3.2 by more than 10 %

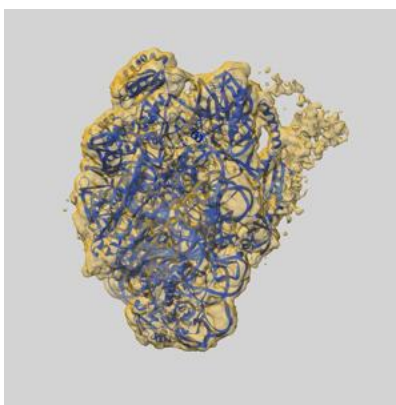
## 9 Map-model fit [i](#)

This section contains information regarding the fit between EMDB map EMD-51966 and PDB model 9H9J. Per-residue inclusion information can be found in section [3](#) on page [8](#).

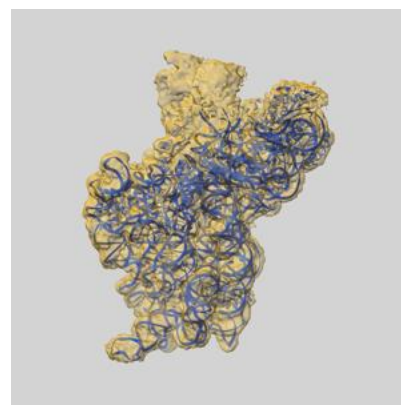
### 9.1 Map-model overlay [i](#)



X



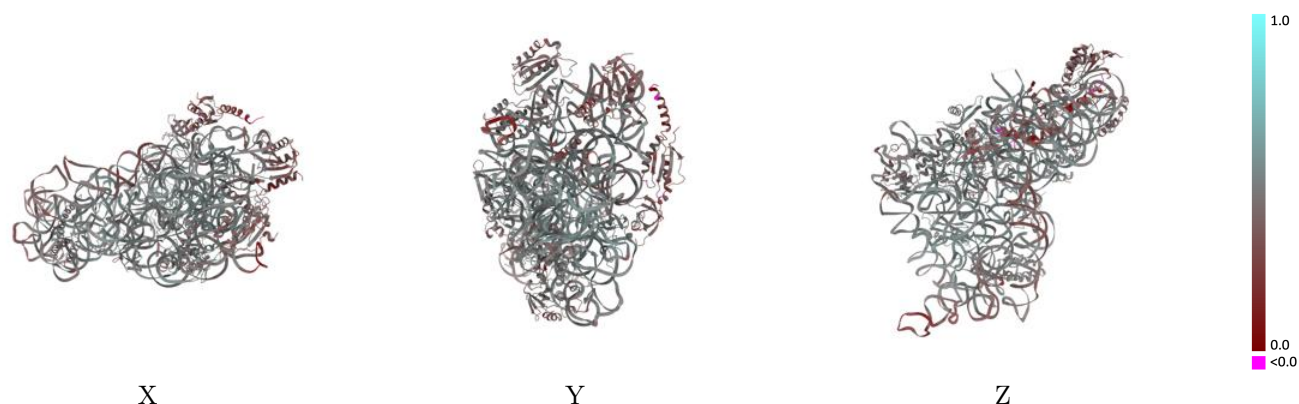
Y



Z

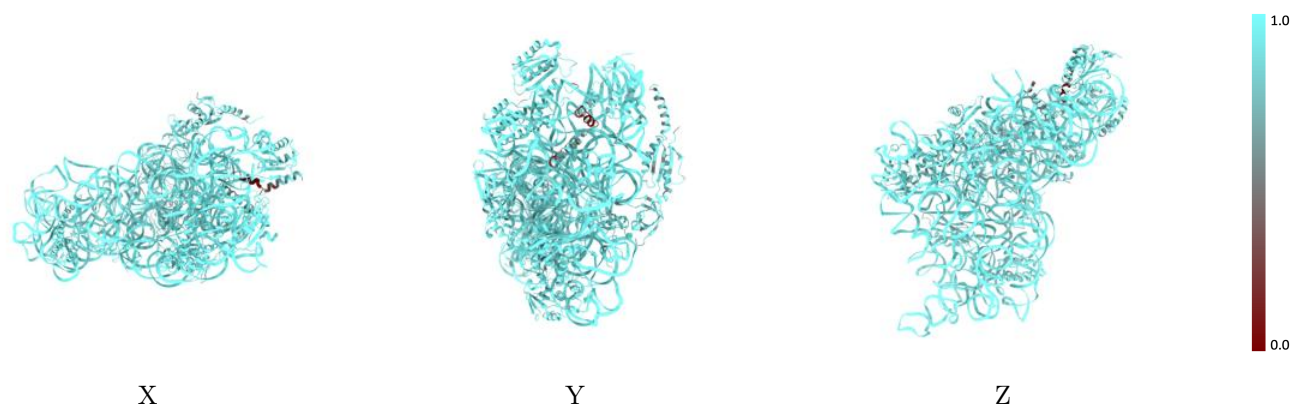
The images above show the 3D surface view of the map at the recommended contour level 0.017 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



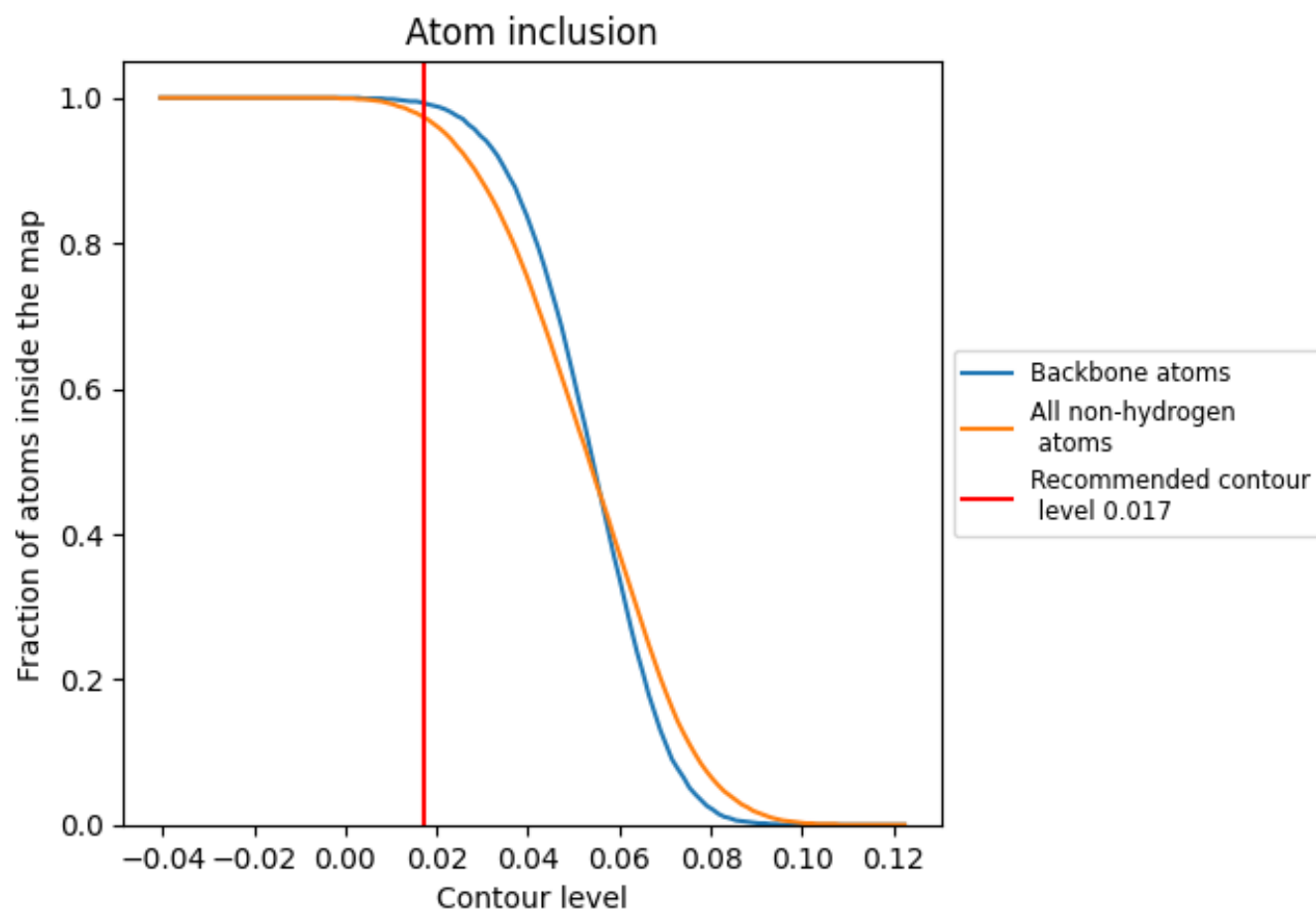
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.017).

## 9.4 Atom inclusion [i](#)



































At the recommended contour level, 99% of all backbone atoms, 97% 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 (0.017) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.9740	 0.4630
A	 0.9970	 0.4800
D	 0.9450	 0.4340
E	 0.9590	 0.4680
F	 0.9430	 0.3910
H	 0.9550	 0.4820
K	 0.9560	 0.3930
L	 0.9260	 0.4940
O	 0.9610	 0.4510
P	 0.9620	 0.4930
Q	 0.9720	 0.4770
R	 0.9240	 0.4160
T	 0.9760	 0.4500
U	 0.5160	 0.3190
X	 0.9020	 0.3840
Z	 0.8750	 0.2880

