



## Full wwPDB EM Validation Report ⓘ

Mar 12, 2025 – 07:46 AM EDT

PDB ID : 8FZG  
EMDB ID : EMD-29627  
Title : Cryo-EM structure of an E. coli non-rotated ribosome termination complex bound with RF3-GDPCP, RF1, P- and E-site tRNAPhe (Composite state II-A)  
Authors : Rybak, M.Y.; Li, L.; Lin, J.; Gagnon, M.G.  
Deposited on : 2023-01-28  
Resolution : 3.10 Å (reported)  
Based on initial model : 7K00

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.dev117  
Mogul : 2022.3.0, CSD as543be (2022)  
MolProbity : 4.02b-467  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.41.4

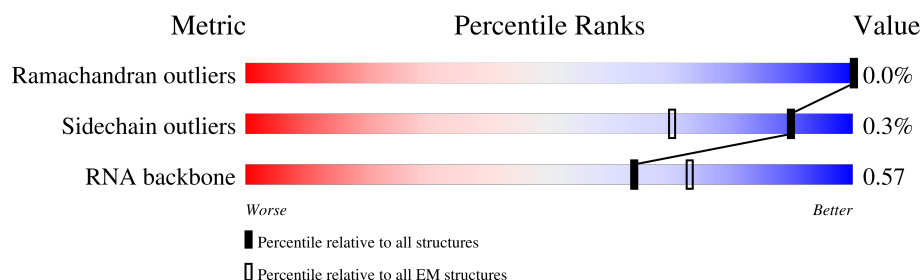


# 1 Overall quality at a glance

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

The reported resolution of this entry is 3.10 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)
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	1542	
2	b	241	
3	c	233	
4	d	206	
5	e	167	
6	f	131	
7	g	156	
8	h	130	

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Mol	Chain	Length	Quality of chain
9	i	130	
10	j	103	
11	k	129	
12	l	124	
13	m	118	
14	n	101	
15	o	89	
16	p	82	
17	q	84	
18	r	75	
19	s	92	
20	t	87	
21	u	71	
22	x	76	
22	y	76	
23	z	21	
24	w	360	
25	v	529	
26	A	2904	
27	B	120	
28	C	273	
29	D	209	
30	E	201	
31	F	179	
32	G	177	

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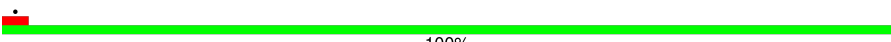
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Mol	Chain	Length	Quality of chain
33	H	149	
34	I	165	
35	J	142	
36	L	142	
37	M	123	
38	N	144	
39	O	136	
40	P	127	
41	Q	117	
42	R	115	
43	S	118	
44	T	103	
45	U	110	
46	V	100	
47	W	104	
48	X	94	
49	Y	85	
50	Z	78	
51	1	63	
52	2	59	
53	3	70	
54	4	57	
55	5	55	
56	6	46	
57	7	65	

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Mol	Chain	Length	Quality of chain
58	8	38	 100%



## 2 Entry composition

There are 62 unique types of molecules in this entry. The entry contains 153589 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	1528	Total	C	N	O	P	0	0
			32803	14637	6019	10619	1528		

- Molecule 2 is a protein called 30S ribosomal protein S2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	b	224	Total	C	N	O	S	0	0
			1754	1110	315	321	8		

- Molecule 3 is a protein called 30S ribosomal protein S3.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	c	206	Total	C	N	O	S	0	0
			1624	1028	305	288	3		

- Molecule 4 is a protein called 30S ribosomal protein S4.

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

- Molecule 5 is a protein called 30S ribosomal protein S5.

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

- Molecule 6 is a protein called 30S ribosomal protein S6.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	f	103	Total	C	N	O	S	0	0
			839	530	151	151	7		



- Molecule 7 is a protein called 30S ribosomal protein S7.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	g	152	Total	C	N	O	S	0	0
			1191	741	230	216	4		

- Molecule 8 is a protein called 30S ribosomal protein S8.

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

- Molecule 9 is a protein called 30S ribosomal protein S9.

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

- Molecule 10 is a protein called 30S ribosomal protein S10.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	j	98	Total	C	N	O	S	0	0
			786	493	150	142	1		

- Molecule 11 is a protein called 30S ribosomal protein S11.

Mol	Chain	Residues	Atoms					AltConf	Trace
11	k	117	Total	C	N	O	S	0	0
			877	540	173	161	3		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
k	119	IAS	ASN	conflict	UNP A0A0H3PWX2

- Molecule 12 is a protein called 30S ribosomal protein S12.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	l	121	Total	C	N	O	S	0	0
			942	582	193	162	5		

- Molecule 13 is a protein called 30S ribosomal protein S13.



Mol	Chain	Residues	Atoms					AltConf	Trace
13	m	115	Total	C	N	O	S	0	0
			891	552	179	157	3		

- Molecule 14 is a protein called 30S ribosomal protein S14.

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

- Molecule 15 is a protein called 30S ribosomal protein S15.

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

- Molecule 16 is a protein called 30S ribosomal protein S16.

Mol	Chain	Residues	Atoms					AltConf	Trace
16	p	81	Total	C	N	O	S	0	0
			643	403	127	112	1		

- Molecule 17 is a protein called 30S ribosomal protein S17.

Mol	Chain	Residues	Atoms					AltConf	Trace
17	q	79	Total	C	N	O	S	0	0
			641	406	120	112	3		

- Molecule 18 is a protein called 30S ribosomal protein S18.

Mol	Chain	Residues	Atoms				AltConf	Trace
18	r	54	Total	C	N	O	0	0
			446	283	85	78		

- Molecule 19 is a protein called 30S ribosomal protein S19.

Mol	Chain	Residues	Atoms					AltConf	Trace
19	s	83	Total	C	N	O	S	0	0
			663	424	126	111	2		

- Molecule 20 is a protein called 30S ribosomal protein S20.



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

- Molecule 21 is a protein called 30S ribosomal protein S21.

Mol	Chain	Residues	Atoms					AltConf	Trace
21	u	55	Total	C	N	O	S	0	0
			460	287	95	77	1		

- Molecule 22 is a RNA chain called P-site phenylalanyl-tRNA.

Mol	Chain	Residues	Atoms						AltConf	Trace
22	x	76	Total 1632	C 731	N 290	O 533	P 76	S 2	0	0
22	y	74	Total 1584	C 707	N 285	O 517	P 74	S 1	0	0

- Molecule 23 is a RNA chain called F-UAA mRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
23	z	11	Total	C	N	O	P	0	0
			232	105	41	75	11		

- Molecule 24 is a protein called Peptide chain release factor 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
24	w	349	Total	C	N	O	S	0	0
			2750	1679	513	545	13		

- Molecule 25 is a protein called Peptide chain release factor RF3.

Mol	Chain	Residues	Atoms					AltConf	Trace
25	v	487	Total	C	N	O	S	0	0
			3671	2328	639	687	17		

- Molecule 26 is a RNA chain called 23S Ribosomal RNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
26	A	2899	Total	C	N	O	P	0	0
			62252	27778	11456	20119	2899		

- Molecule 27 is a RNA chain called 5S Ribosomal RNA.



Mol	Chain	Residues	Atoms					AltConf	Trace
27	B	120	Total	C	N	O	P	0	0
			2572	1145	470	837	120		

- Molecule 28 is a protein called 50S ribosomal protein L2.

Mol	Chain	Residues	Atoms					AltConf	Trace
28	C	271	Total	C	N	O	S	0	0
			2082	1288	423	364	7		

- Molecule 29 is a protein called 50S ribosomal protein L3.

Mol	Chain	Residues	Atoms					AltConf	Trace
29	D	209	Total	C	N	O	S	0	0
			1566	980	288	294	4		

- Molecule 30 is a protein called 50S ribosomal protein L4.

Mol	Chain	Residues	Atoms					AltConf	Trace
30	E	201	Total	C	N	O	S	0	0
			1552	974	283	290	5		

- Molecule 31 is a protein called 50S ribosomal protein L5.

Mol	Chain	Residues	Atoms					AltConf	Trace
31	F	177	Total	C	N	O	S	0	0
			1410	899	249	256	6		

- Molecule 32 is a protein called 50S ribosomal protein L6.

Mol	Chain	Residues	Atoms					AltConf	Trace
32	G	176	Total	C	N	O	S	0	0
			1323	832	243	246	2		

- Molecule 33 is a protein called 50S ribosomal protein L9.

Mol	Chain	Residues	Atoms					AltConf	Trace
33	H	39	Total	C	N	O	S	0	0
			287	184	51	51	1		

- Molecule 34 is a protein called 50S ribosomal protein L10.



Mol	Chain	Residues	Atoms					AltConf	Trace
34	I	131	Total	C	N	O	S	0	0
			988	625	175	183	5		

- Molecule 35 is a protein called 50S ribosomal protein L11.

Mol	Chain	Residues	Atoms					AltConf	Trace
35	J	141	Total	C	N	O	S	0	0
			1032	651	179	196	6		

- Molecule 36 is a protein called 50S ribosomal protein L13.

Mol	Chain	Residues	Atoms					AltConf	Trace
36	L	142	Total	C	N	O	S	0	0
			1129	714	212	199	4		

- Molecule 37 is a protein called 50S ribosomal protein L14.

Mol	Chain	Residues	Atoms					AltConf	Trace
37	M	123	Total	C	N	O	S	0	0
			946	593	181	166	6		

- Molecule 38 is a protein called 50S ribosomal protein L15.

Mol	Chain	Residues	Atoms					AltConf	Trace
38	N	144	Total	C	N	O	S	0	0
			1052	653	207	190	2		

- Molecule 39 is a protein called 50S ribosomal protein L16.

Mol	Chain	Residues	Atoms					AltConf	Trace
39	O	136	Total	C	N	O	S	0	0
			1075	686	205	177	7		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
O	82	MS6	MET	conflict	UNP E6BI61

- Molecule 40 is a protein called 50S ribosomal protein L17.



Mol	Chain	Residues	Atoms					AltConf	Trace
40	P	118	Total	C	N	O	S	0	0
			945	585	194	161	5		

- Molecule 41 is a protein called 50S ribosomal protein L18.

Mol	Chain	Residues	Atoms					AltConf	Trace
41	Q	116	Total	C	N	O		0	0
			892	552	178	162			

- Molecule 42 is a protein called 50S ribosomal protein L19.

Mol	Chain	Residues	Atoms					AltConf	Trace
42	R	114	Total	C	N	O	S	0	0
			917	574	179	163	1		

- Molecule 43 is a protein called 50S ribosomal protein L20.

Mol	Chain	Residues	Atoms					AltConf	Trace
43	S	117	Total	C	N	O		0	0
			947	604	192	151			

- Molecule 44 is a protein called Ribosomal protein L21.

Mol	Chain	Residues	Atoms					AltConf	Trace
44	T	103	Total	C	N	O	S	0	0
			816	516	153	145	2		

- Molecule 45 is a protein called 50S ribosomal protein L22.

Mol	Chain	Residues	Atoms					AltConf	Trace
45	U	110	Total	C	N	O	S	0	0
			857	532	166	156	3		

- Molecule 46 is a protein called 50S ribosomal protein L23.

Mol	Chain	Residues	Atoms					AltConf	Trace
46	V	93	Total	C	N	O	S	0	0
			738	466	139	131	2		

- Molecule 47 is a protein called 50S ribosomal protein L24.



Mol	Chain	Residues	Atoms				AltConf	Trace
47	W	102	Total	C	N	O		
			779	492	146	141	0	0

- Molecule 48 is a protein called 50S ribosomal protein L25.

Mol	Chain	Residues	Atoms				AltConf	Trace
48	X	94	Total	C	N	O	S	
			753	479	137	134	3	0

- Molecule 49 is a protein called 50S ribosomal protein L27.

Mol	Chain	Residues	Atoms				AltConf	Trace
49	Y	76	Total	C	N	O	S	
			582	360	117	104	1	0

- Molecule 50 is a protein called 50S ribosomal protein L28.

Mol	Chain	Residues	Atoms				AltConf	Trace
50	Z	77	Total	C	N	O	S	
			625	388	129	106	2	0

- Molecule 51 is a protein called 50S ribosomal protein L29.

Mol	Chain	Residues	Atoms				AltConf	Trace
51	1	61	Total	C	N	O	S	
			495	305	97	92	1	0

- Molecule 52 is a protein called 50S ribosomal protein L30.

Mol	Chain	Residues	Atoms				AltConf	Trace
52	2	58	Total	C	N	O	S	
			449	281	87	79	2	0

- Molecule 53 is a protein called 50S ribosomal protein L31.

Mol	Chain	Residues	Atoms				AltConf	Trace
53	3	60	Total	C	N	O	S	
			474	293	90	85	6	0

- Molecule 54 is a protein called 50S ribosomal protein L32.



Mol	Chain	Residues	Atoms					AltConf	Trace
54	4	55	Total	C	N	O	S	0	0
			434	263	92	78	1		

- Molecule 55 is a protein called 50S ribosomal protein L33.

Mol	Chain	Residues	Atoms				AltConf	Trace
55	5	51	Total	C	N	O	0	0
			417	269	76	72		

- Molecule 56 is a protein called 50S ribosomal protein L34.

Mol	Chain	Residues	Atoms					AltConf	Trace
56	6	46	Total	C	N	O	S	0	0
			377	228	90	57	2		

- Molecule 57 is a protein called 50S ribosomal protein L35.

Mol	Chain	Residues	Atoms					AltConf	Trace
57	7	64	Total	C	N	O	S	0	0
			504	323	105	74	2		

- Molecule 58 is a protein called 50S ribosomal protein L36.

Mol	Chain	Residues	Atoms					AltConf	Trace
58	8	38	Total	C	N	O	S	0	0
			302	185	65	48	4		

- Molecule 59 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
59	a	89	Total	Mg	0
			89	89	
59	n	1	Total	Mg	0
			1	1	
59	u	1	Total	Mg	0
			1	1	
59	x	1	Total	Mg	0
			1	1	
59	y	1	Total	Mg	0
			1	1	
59	A	320	Total	Mg	0
			320	320	

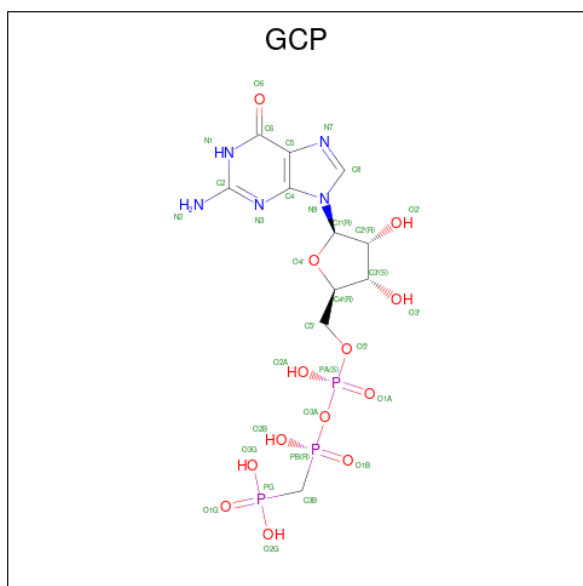
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Mol	Chain	Residues	Atoms		AltConf
59	B	8	Total	Mg	0
			8	8	
59	C	1	Total	Mg	0
			1	1	
59	D	1	Total	Mg	0
			1	1	
59	S	2	Total	Mg	0
			2	2	
59	4	1	Total	Mg	0
			1	1	
59	6	1	Total	Mg	0
			1	1	
59	7	1	Total	Mg	0
			1	1	

- Molecule 60 is PHOSPHOMETHYLPHOSPHONIC ACID GUANYLATE ESTER (three-letter code: GCP) (formula:  $C_{11}H_{18}N_5O_{13}P_3$ ).





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Mol	Chain	Residues	Atoms		AltConf
61	8	1	Total	Zn	0
			1	1	

- Molecule 62 is water.

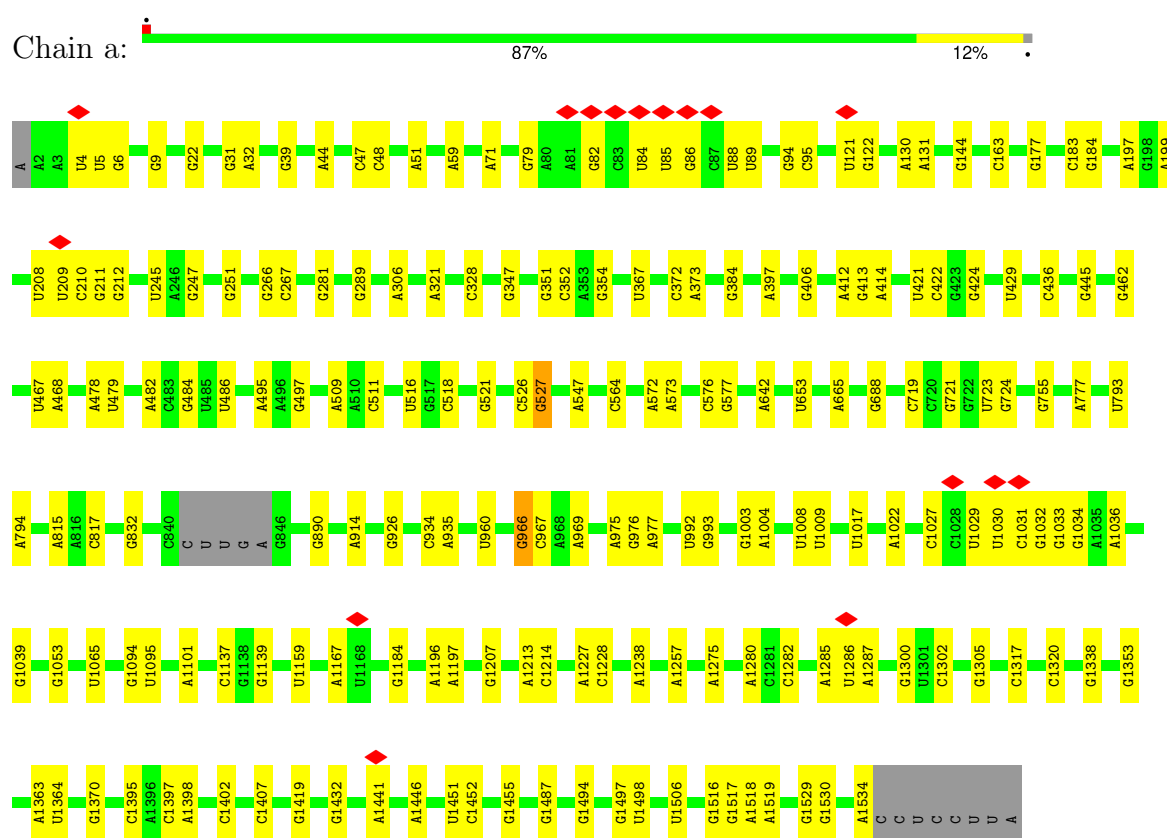
Mol	Chain	Residues	Atoms		AltConf
62	a	24	Total	O	0
			24	24	
62	A	117	Total	O	0
			117	117	
62	B	1	Total	O	0
			1	1	
62	N	1	Total	O	0
			1	1	
62	8	1	Total	O	0
			1	1	



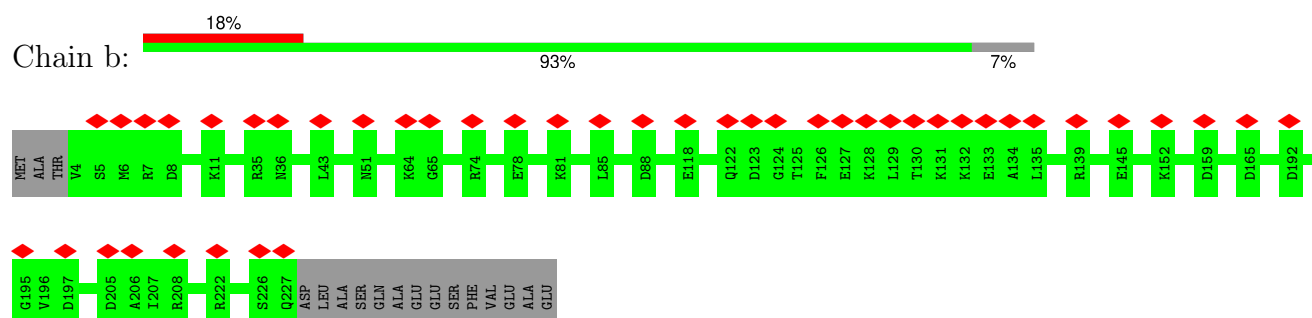
### 3 Residue-property plots [i](#)

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

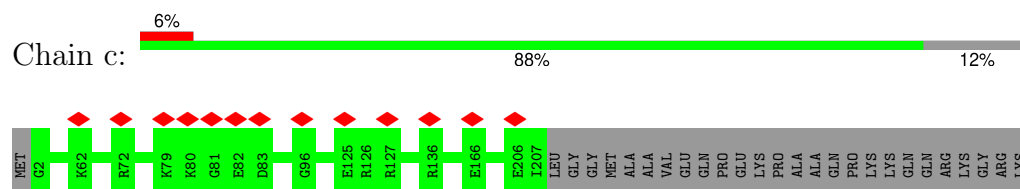


#### • Molecule 2: 30S ribosomal protein S2

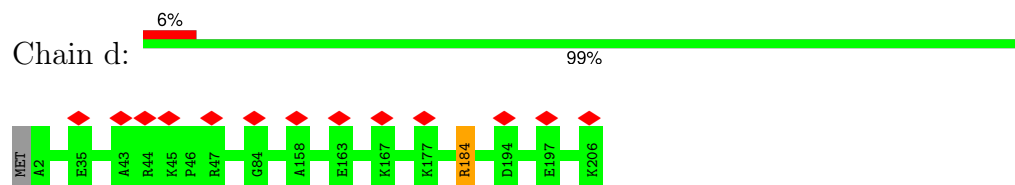




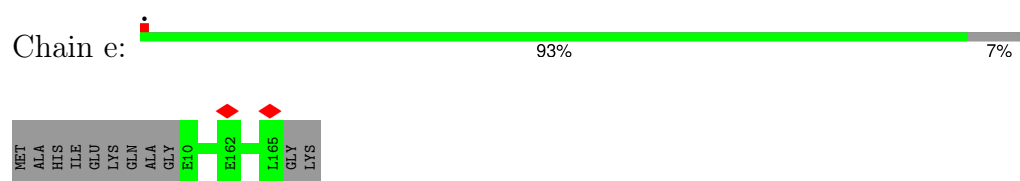
- Molecule 3: 30S ribosomal protein S3



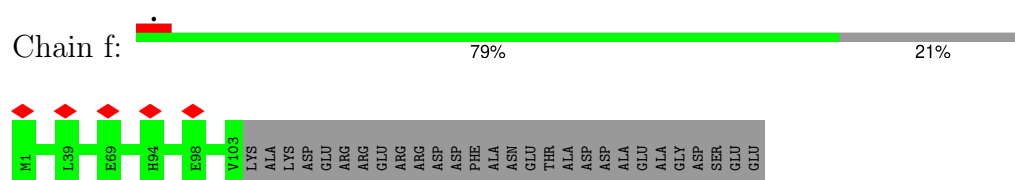
- Molecule 4: 30S ribosomal protein S4



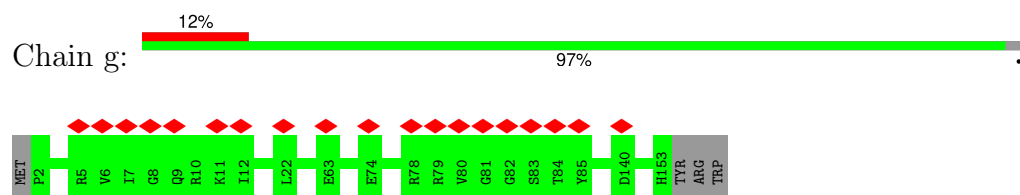
- Molecule 5: 30S ribosomal protein S5



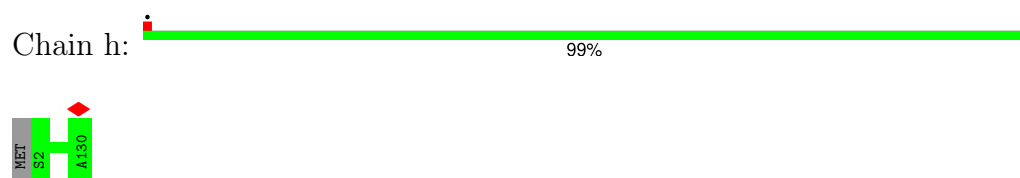
- Molecule 6: 30S ribosomal protein S6



- Molecule 7: 30S ribosomal protein S7



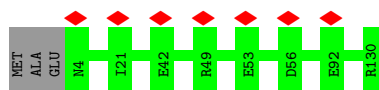
- Molecule 8: 30S ribosomal protein S8



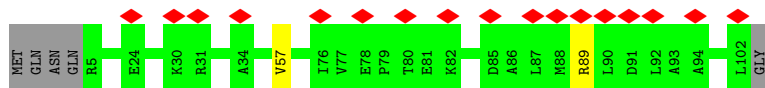
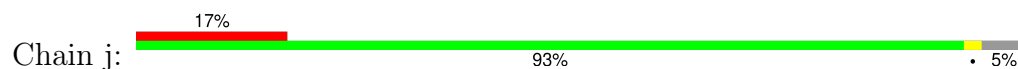
- Molecule 9: 30S ribosomal protein S9



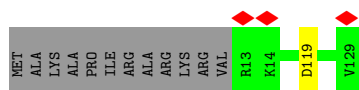




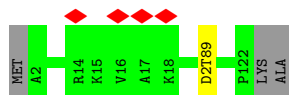
- Molecule 10: 30S ribosomal protein S10



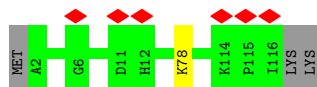
- Molecule 11: 30S ribosomal protein S11



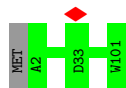
- Molecule 12: 30S ribosomal protein S12



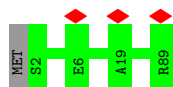
- Molecule 13: 30S ribosomal protein S13



- Molecule 14: 30S ribosomal protein S14

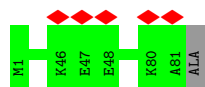


- Molecule 15: 30S ribosomal protein S15

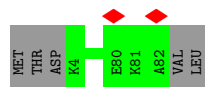


- Molecule 16: 30S ribosomal protein S16

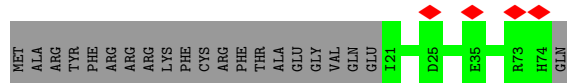




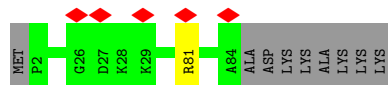
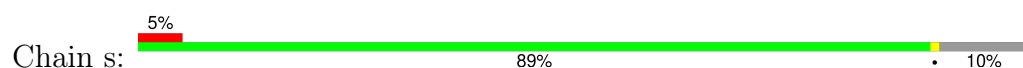
- Molecule 17: 30S ribosomal protein S17



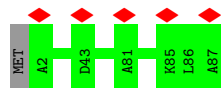
- Molecule 18: 30S ribosomal protein S18



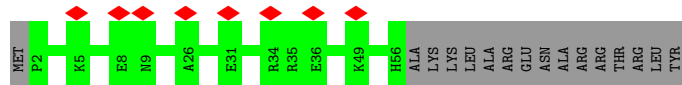
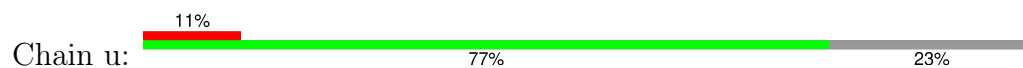
- Molecule 19: 30S ribosomal protein S19



- Molecule 20: 30S ribosomal protein S20



- Molecule 21: 30S ribosomal protein S21



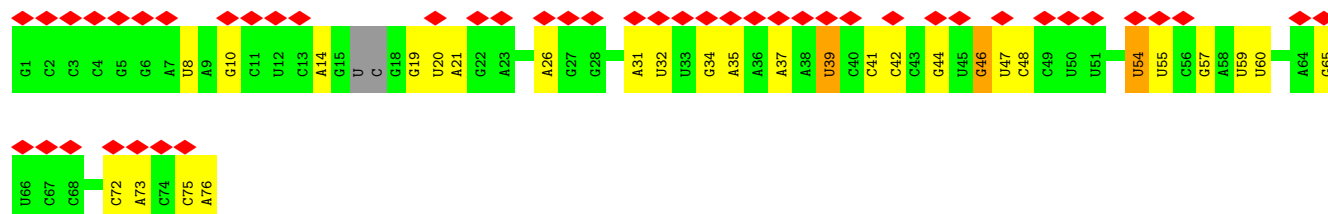
- Molecule 22: P-site phenylalanyl-tRNA



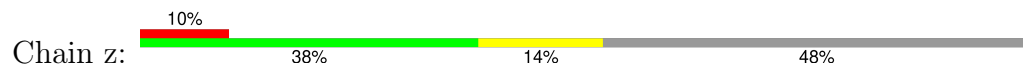




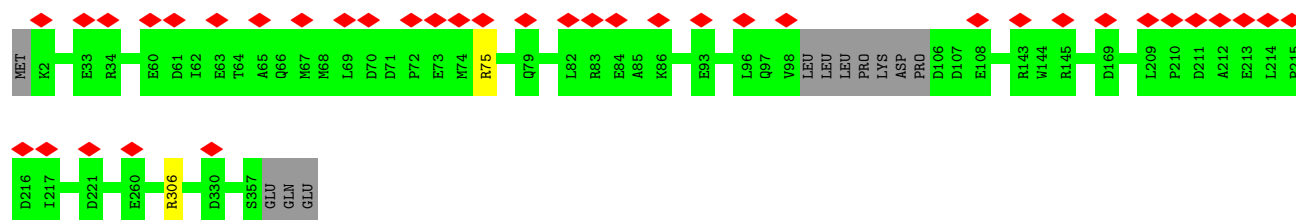
• Molecule 22: P-site phenylalanyl-tRNA



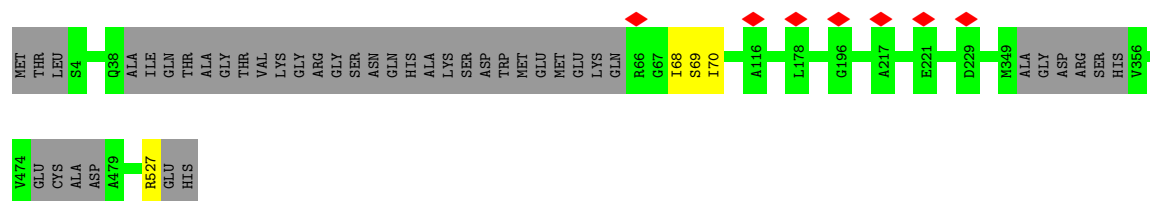
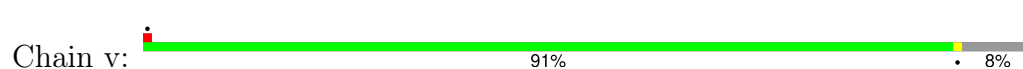
• Molecule 23: F-UAA mRNA



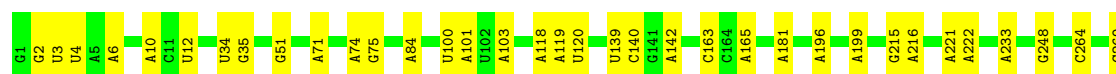
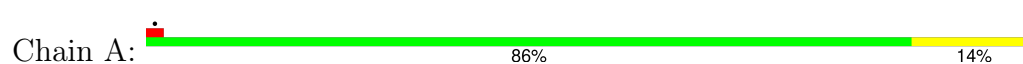
• Molecule 24: Peptide chain release factor 1



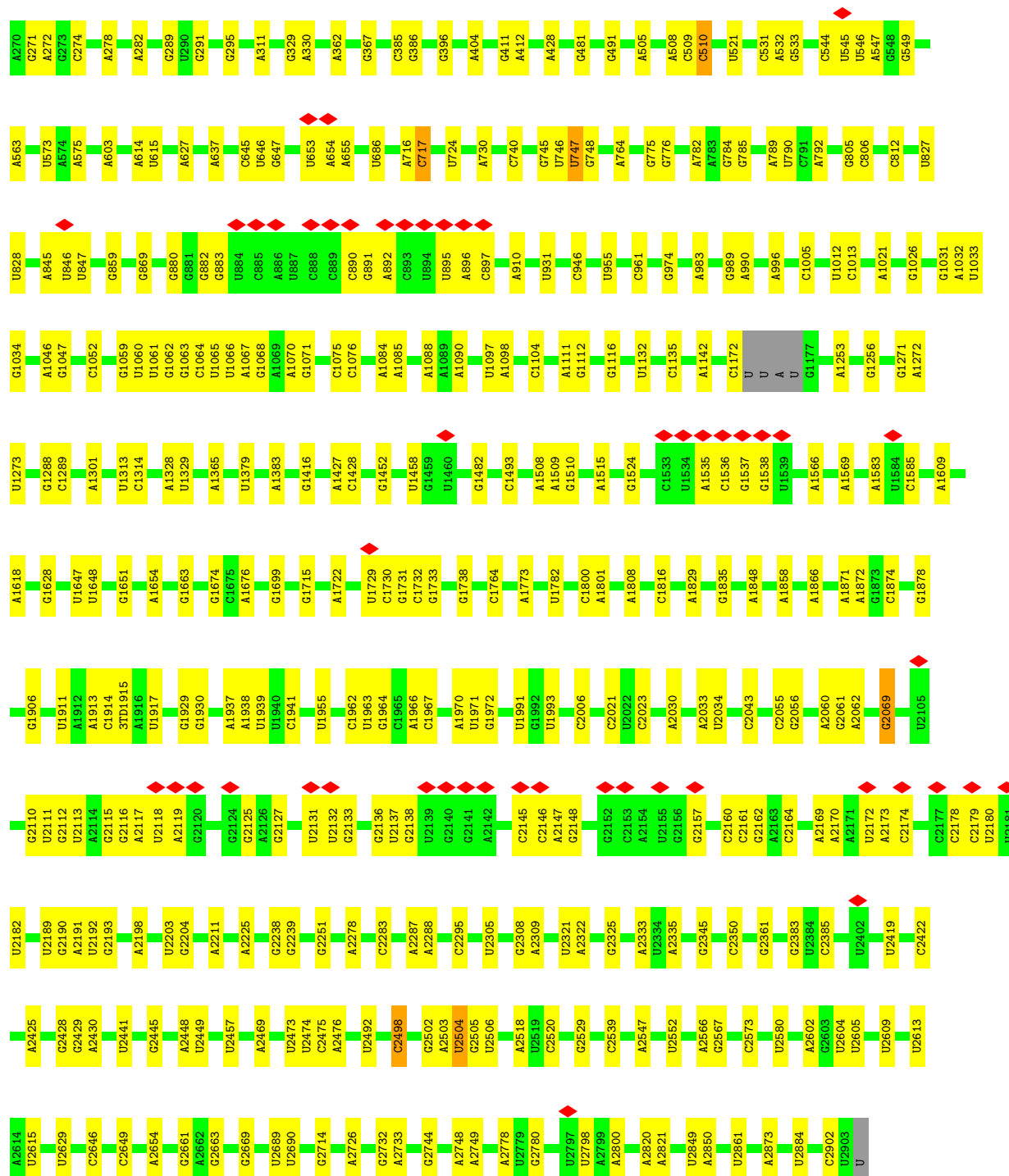
• Molecule 25: Peptide chain release factor RF3



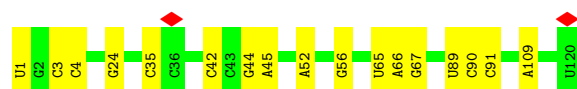
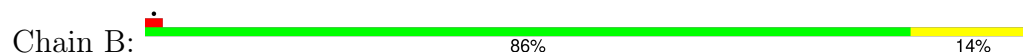
• Molecule 26: 23S Ribosomal RNA





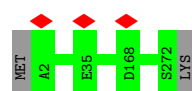


• Molecule 27: 5S Ribosomal RNA

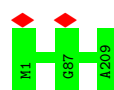


• Molecule 28: 50S ribosomal protein L2

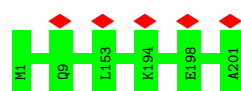




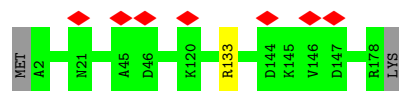
- Chain D:  100%



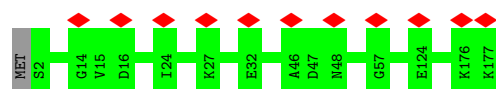
- Chain E: 



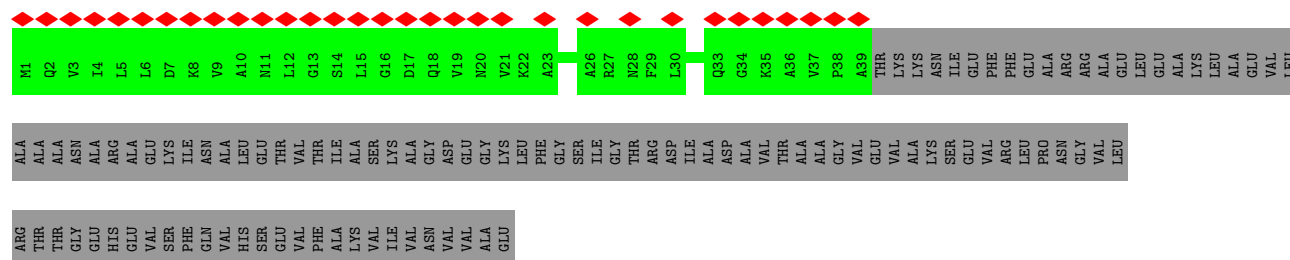
- Chain F:  98%



- Chain G:  6% 99%

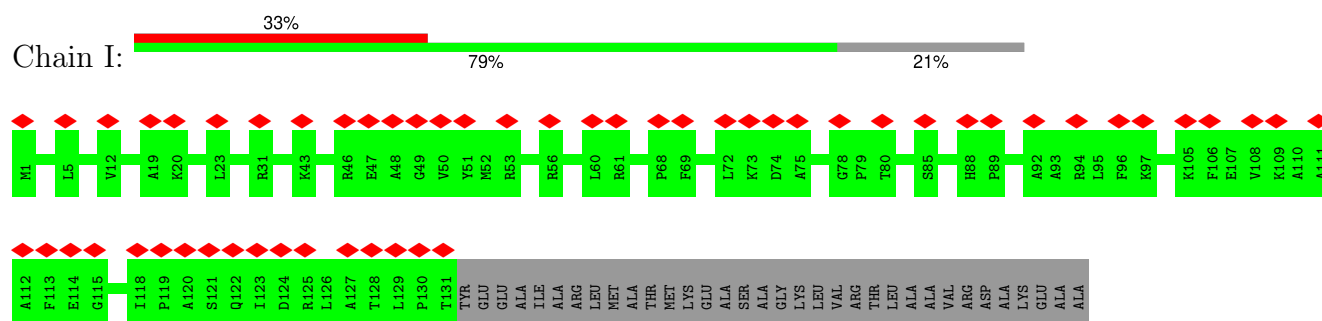


- Chain H:  21% 26% 74%

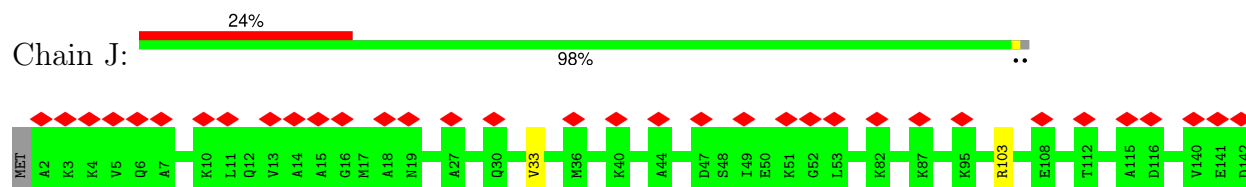


- WORLDWIDE  
 **PDB**  
PROTEIN DATA BANK

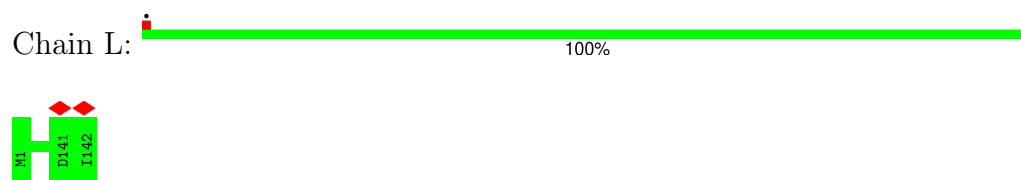




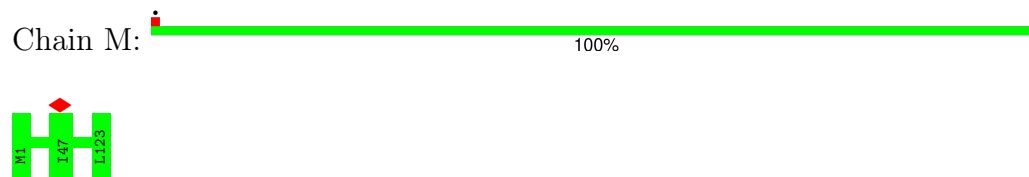
- Molecule 35: 50S ribosomal protein L11



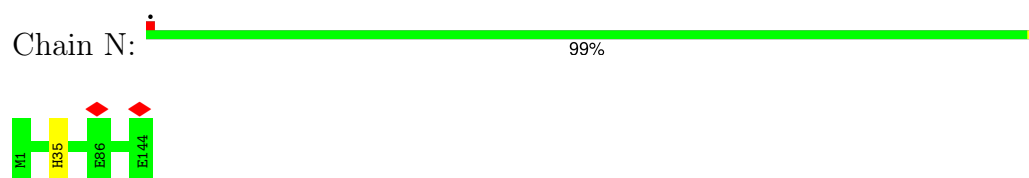
- Molecule 36: 50S ribosomal protein L13



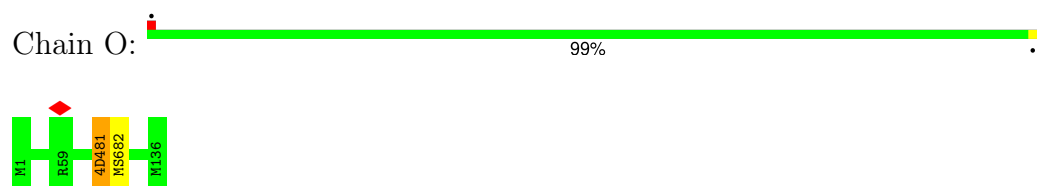
- Molecule 37: 50S ribosomal protein L14



- Molecule 38: 50S ribosomal protein L15



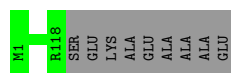
- Molecule 39: 50S ribosomal protein L16



- Molecule 40: 50S ribosomal protein L17

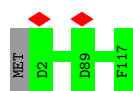


Chain P:  93% 7%



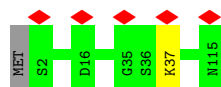
- Molecule 41: 50S ribosomal protein L18

Chain Q:  99%



- Molecule 42: 50S ribosomal protein L19

Chain R:  98%



- Molecule 43: 50S ribosomal protein L20

Chain S:  99%



- Molecule 44: Ribosomal protein L21

Chain T:  100%



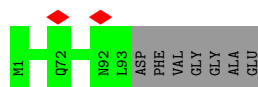
- Molecule 45: 50S ribosomal protein L22

Chain U:  100%



- Molecule 46: 50S ribosomal protein L23

Chain V:  93% 7%

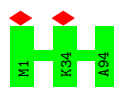




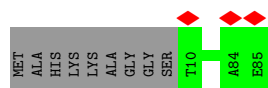
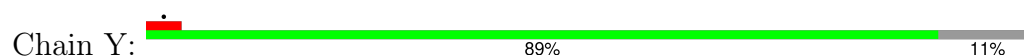
- Molecule 47: 50S ribosomal protein L24



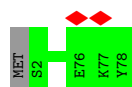
- Molecule 48: 50S ribosomal protein L25



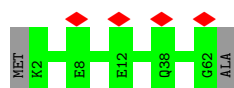
- Molecule 49: 50S ribosomal protein L27



- Molecule 50: 50S ribosomal protein L28



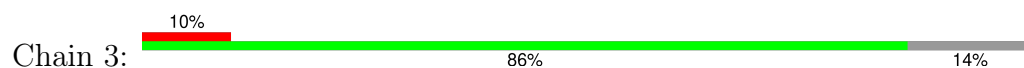
- Molecule 51: 50S ribosomal protein L29



- Molecule 52: 50S ribosomal protein L30



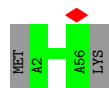
- Molecule 53: 50S ribosomal protein L31



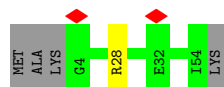
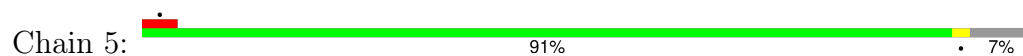




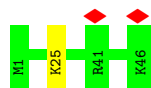
- Molecule 54: 50S ribosomal protein L32



- Molecule 55: 50S ribosomal protein L33



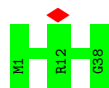
- Molecule 56: 50S ribosomal protein L34



- Molecule 57: 50S ribosomal protein L35



- Molecule 58: 50S ribosomal protein L36





## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	31256	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 ( $e^-/\text{\AA}^2$ )	40.44	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	96000	Depositor
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	25.251	Depositor
Minimum map value	-14.192	Depositor
Average map value	0.001	Depositor
Map value standard deviation	1.011	Depositor
Recommended contour level	3.7	Depositor
Map size (Å)	435.2, 435.2, 435.2	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.85, 0.85, 0.85	Depositor



## 5 Model quality ⓘ

### 5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: H2U, 5MC, MIA, 1MG, PSU, 4OC, OMU, MA6, MS6, 4SU, D2T, GCP, MG, 5MU, 2MG, G7M, UR3, 3TD, 7MG, OMG, 2MA, 6MZ, MEQ, 4D4, ZN, IAS, OMC

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	0.39	0/36450	0.80	0/56856
2	b	0.29	0/1785	0.52	0/2404
3	c	0.27	0/1651	0.54	0/2225
4	d	0.28	0/1665	0.54	0/2227
5	e	0.28	0/1165	0.53	0/1568
6	f	0.28	0/858	0.56	0/1160
7	g	0.26	0/1206	0.53	0/1617
8	h	0.28	0/989	0.53	0/1326
9	i	0.27	0/1034	0.57	0/1375
10	j	0.27	0/796	0.61	0/1077
11	k	0.29	0/884	0.57	0/1191
12	l	0.32	0/945	0.60	0/1268
13	m	0.28	0/900	0.59	0/1204
14	n	0.27	0/817	0.56	0/1088
15	o	0.32	0/722	0.58	0/964
16	p	0.29	0/653	0.58	0/877
17	q	0.31	0/650	0.57	0/871
18	r	0.28	0/453	0.56	0/609
19	s	0.29	0/680	0.56	0/915
20	t	0.27	0/676	0.51	0/895
21	u	0.27	0/467	0.58	0/620
22	x	0.44	1/1651 (0.1%)	0.83	0/2569
22	y	0.26	0/1605	0.88	0/2497
23	z	0.38	0/259	0.75	0/400
24	w	0.29	0/2788	0.55	0/3753
25	v	0.33	0/3738	0.57	0/5071
26	A	0.45	0/69147	0.82	11/107869 (0.0%)
27	B	0.45	1/2876 (0.0%)	0.85	0/4483
28	C	0.31	0/2121	0.58	0/2852
29	D	0.31	0/1576	0.54	0/2119
30	E	0.29	0/1571	0.51	0/2113



Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
31	F	0.27	0/1434	0.52	0/1926
32	G	0.28	0/1343	0.53	0/1816
33	H	0.26	0/290	0.53	0/392
34	I	0.31	0/1001	0.60	0/1350
35	J	0.26	0/1046	0.53	0/1410
36	L	0.31	0/1152	0.51	0/1551
37	M	0.30	0/955	0.58	0/1279
38	N	0.28	0/1061	0.57	0/1412
39	O	0.29	0/1073	0.55	0/1433
40	P	0.28	0/958	0.60	0/1281
41	Q	0.29	0/902	0.56	0/1209
42	R	0.29	0/929	0.55	0/1242
43	S	0.32	0/960	0.51	0/1278
44	T	0.32	0/829	0.55	0/1107
45	U	0.27	0/864	0.54	0/1156
46	V	0.28	0/744	0.52	0/994
47	W	0.30	0/787	0.56	0/1051
48	X	0.28	0/766	0.53	0/1025
49	Y	0.29	0/589	0.55	0/779
50	Z	0.29	0/635	0.56	0/848
51	1	0.24	0/496	0.49	0/660
52	2	0.27	0/453	0.55	0/605
53	3	0.29	0/481	0.54	0/640
54	4	0.28	0/440	0.57	0/588
55	5	0.31	0/424	0.55	0/565
56	6	0.26	0/380	0.63	0/498
57	7	0.27	0/513	0.55	0/676
58	8	0.27	0/303	0.59	0/397
All	All	0.39	2/164586 (0.0%)	0.75	11/245231 (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
4	d	0	1
38	N	0	1
39	O	0	2
47	W	0	1
All	All	0	5

All (2) bond length outliers are listed below:



Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
22	x	1	G	OP3-P	-10.90	1.48	1.61
27	B	1	U	OP3-P	-10.54	1.48	1.61

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
26	A	1313	U	C2-N1-C1'	7.19	126.32	117.70
26	A	790	U	C2-N1-C1'	7.02	126.12	117.70
26	A	1314	C	C2-N1-C1'	6.41	125.85	118.80
26	A	2174	C	N1-C2-O2	6.13	122.58	118.90
26	A	2321	U	C2-N1-C1'	5.70	124.54	117.70
26	A	510	C	N1-C2-O2	5.64	122.28	118.90
26	A	2160	C	N1-C2-O2	5.53	122.22	118.90
26	A	2174	C	N3-C2-O2	-5.44	118.09	121.90
26	A	2539	C	C2-N1-C1'	5.12	124.44	118.80
26	A	717	C	N1-C2-O2	5.12	121.97	118.90
26	A	1963	U	N3-C2-O2	-5.03	118.68	122.20

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
38	N	35	HIS	Peptide
39	O	81	4D4	Mainchain
39	O	82	MS6	Peptide
47	W	99	ASN	Peptide
4	d	184	ARG	Sidechain

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

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

## 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	b	222/241 (92%)	201 (90%)	21 (10%)	0	100	100
3	c	204/233 (88%)	190 (93%)	14 (7%)	0	100	100
4	d	203/206 (98%)	198 (98%)	5 (2%)	0	100	100
5	e	154/167 (92%)	149 (97%)	5 (3%)	0	100	100
6	f	101/131 (77%)	96 (95%)	5 (5%)	0	100	100
7	g	150/156 (96%)	138 (92%)	12 (8%)	0	100	100
8	h	127/130 (98%)	122 (96%)	5 (4%)	0	100	100
9	i	125/130 (96%)	121 (97%)	4 (3%)	0	100	100
10	j	96/103 (93%)	91 (95%)	4 (4%)	1 (1%)	13	42
11	k	113/129 (88%)	109 (96%)	4 (4%)	0	100	100
12	l	118/124 (95%)	110 (93%)	8 (7%)	0	100	100
13	m	113/118 (96%)	107 (95%)	6 (5%)	0	100	100
14	n	98/101 (97%)	96 (98%)	2 (2%)	0	100	100
15	o	86/89 (97%)	79 (92%)	7 (8%)	0	100	100
16	p	79/82 (96%)	76 (96%)	3 (4%)	0	100	100
17	q	77/84 (92%)	68 (88%)	9 (12%)	0	100	100
18	r	52/75 (69%)	52 (100%)	0	0	100	100
19	s	81/92 (88%)	77 (95%)	4 (5%)	0	100	100
20	t	84/87 (97%)	81 (96%)	3 (4%)	0	100	100
21	u	53/71 (75%)	52 (98%)	1 (2%)	0	100	100
24	w	345/360 (96%)	320 (93%)	25 (7%)	0	100	100
25	v	479/529 (90%)	421 (88%)	58 (12%)	0	100	100
28	C	269/273 (98%)	259 (96%)	10 (4%)	0	100	100
29	D	206/209 (99%)	197 (96%)	9 (4%)	0	100	100
30	E	199/201 (99%)	192 (96%)	7 (4%)	0	100	100
31	F	175/179 (98%)	169 (97%)	6 (3%)	0	100	100
32	G	174/177 (98%)	163 (94%)	11 (6%)	0	100	100
33	H	37/149 (25%)	33 (89%)	4 (11%)	0	100	100
34	I	129/165 (78%)	99 (77%)	30 (23%)	0	100	100
35	J	139/142 (98%)	119 (86%)	19 (14%)	1 (1%)	19	51
36	L	140/142 (99%)	138 (99%)	2 (1%)	0	100	100
37	M	121/123 (98%)	115 (95%)	6 (5%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
38	N	142/144 (99%)	134 (94%)	8 (6%)	0	100	100
39	O	132/136 (97%)	127 (96%)	5 (4%)	0	100	100
40	P	116/127 (91%)	112 (97%)	4 (3%)	0	100	100
41	Q	114/117 (97%)	106 (93%)	8 (7%)	0	100	100
42	R	112/115 (97%)	107 (96%)	5 (4%)	0	100	100
43	S	115/118 (98%)	114 (99%)	1 (1%)	0	100	100
44	T	101/103 (98%)	96 (95%)	5 (5%)	0	100	100
45	U	108/110 (98%)	107 (99%)	1 (1%)	0	100	100
46	V	91/100 (91%)	81 (89%)	10 (11%)	0	100	100
47	W	100/104 (96%)	91 (91%)	9 (9%)	0	100	100
48	X	92/94 (98%)	88 (96%)	4 (4%)	0	100	100
49	Y	74/85 (87%)	71 (96%)	3 (4%)	0	100	100
50	Z	75/78 (96%)	71 (95%)	4 (5%)	0	100	100
51	1	59/63 (94%)	55 (93%)	4 (7%)	0	100	100
52	2	56/59 (95%)	55 (98%)	1 (2%)	0	100	100
53	3	56/70 (80%)	51 (91%)	5 (9%)	0	100	100
54	4	53/57 (93%)	50 (94%)	3 (6%)	0	100	100
55	5	49/55 (89%)	48 (98%)	1 (2%)	0	100	100
56	6	44/46 (96%)	44 (100%)	0	0	100	100
57	7	62/65 (95%)	60 (97%)	1 (2%)	1 (2%)	8	31
58	8	36/38 (95%)	36 (100%)	0	0	100	100
All	All	6536/7082 (92%)	6142 (94%)	391 (6%)	3 (0%)	100	100

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
35	J	33	VAL
10	j	57	VAL
57	7	32	ILE

### 5.3.2 Protein sidechains ⓘ

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



entries.

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	b	186/199 (94%)	186 (100%)	0	100	100
3	c	170/190 (90%)	170 (100%)	0	100	100
4	d	172/173 (99%)	171 (99%)	1 (1%)	84	91
5	e	119/126 (94%)	119 (100%)	0	100	100
6	f	90/112 (80%)	90 (100%)	0	100	100
7	g	125/129 (97%)	125 (100%)	0	100	100
8	h	104/105 (99%)	104 (100%)	0	100	100
9	i	105/107 (98%)	105 (100%)	0	100	100
10	j	86/90 (96%)	85 (99%)	1 (1%)	67	83
11	k	89/98 (91%)	89 (100%)	0	100	100
12	l	101/103 (98%)	101 (100%)	0	100	100
13	m	93/96 (97%)	92 (99%)	1 (1%)	70	84
14	n	83/84 (99%)	83 (100%)	0	100	100
15	o	76/77 (99%)	76 (100%)	0	100	100
16	p	65/65 (100%)	65 (100%)	0	100	100
17	q	73/78 (94%)	73 (100%)	0	100	100
18	r	47/65 (72%)	47 (100%)	0	100	100
19	s	72/79 (91%)	71 (99%)	1 (1%)	62	81
20	t	65/66 (98%)	65 (100%)	0	100	100
21	u	48/61 (79%)	48 (100%)	0	100	100
24	w	289/300 (96%)	287 (99%)	2 (1%)	81	90
25	v	368/453 (81%)	364 (99%)	4 (1%)	70	84
28	C	216/218 (99%)	216 (100%)	0	100	100
29	D	163/163 (100%)	163 (100%)	0	100	100
30	E	165/165 (100%)	165 (100%)	0	100	100
31	F	148/150 (99%)	147 (99%)	1 (1%)	81	90
32	G	137/138 (99%)	137 (100%)	0	100	100
33	H	30/114 (26%)	30 (100%)	0	100	100
34	I	100/123 (81%)	100 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
35	J	109/110 (99%)	108 (99%)	1 (1%)	75	88
36	L	116/116 (100%)	116 (100%)	0	100	100
37	M	104/104 (100%)	104 (100%)	0	100	100
38	N	103/103 (100%)	103 (100%)	0	100	100
39	O	107/107 (100%)	107 (100%)	0	100	100
40	P	98/103 (95%)	98 (100%)	0	100	100
41	Q	86/87 (99%)	86 (100%)	0	100	100
42	R	99/100 (99%)	98 (99%)	1 (1%)	73	86
43	S	89/90 (99%)	89 (100%)	0	100	100
44	T	84/84 (100%)	84 (100%)	0	100	100
45	U	93/93 (100%)	93 (100%)	0	100	100
46	V	80/84 (95%)	80 (100%)	0	100	100
47	W	83/85 (98%)	83 (100%)	0	100	100
48	X	78/78 (100%)	78 (100%)	0	100	100
49	Y	58/63 (92%)	58 (100%)	0	100	100
50	Z	67/68 (98%)	67 (100%)	0	100	100
51	1	54/55 (98%)	54 (100%)	0	100	100
52	2	48/49 (98%)	48 (100%)	0	100	100
53	3	54/62 (87%)	54 (100%)	0	100	100
54	4	46/48 (96%)	46 (100%)	0	100	100
55	5	46/49 (94%)	45 (98%)	1 (2%)	47	71
56	6	38/38 (100%)	37 (97%)	1 (3%)	41	68
57	7	51/52 (98%)	51 (100%)	0	100	100
58	8	34/34 (100%)	34 (100%)	0	100	100
All	All	5410/5789 (94%)	5395 (100%)	15 (0%)	90	95

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	d	184	ARG
10	j	89	ARG
13	m	78	LYS
19	s	81	ARG
24	w	75	ARG

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Mol	Chain	Res	Type
24	w	306	ARG
25	v	68	ILE
25	v	69	SER
25	v	70	ILE
25	v	527	ARG
31	F	133	ARG
35	J	103	ARG
42	R	37	LYS
55	5	28	ARG
56	6	25	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (60) such sidechains are listed below:

Mol	Chain	Res	Type
2	b	177	ASN
3	c	139	GLN
3	c	176	HIS
4	d	126	ASN
4	d	140	ASN
5	e	19	ASN
5	e	77	ASN
5	e	78	ASN
5	e	121	HIS
6	f	94	HIS
8	h	18	GLN
8	h	38	ASN
9	i	81	HIS
9	i	126	GLN
10	j	64	GLN
11	k	15	GLN
11	k	81	ASN
11	k	118	HIS
12	l	96	HIS
13	m	100	GLN
13	m	105	ASN
14	n	66	GLN
15	o	51	HIS
16	p	26	ASN
19	s	83	HIS
20	t	21	ASN
21	u	9	ASN
24	w	296	ASN

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Mol	Chain	Res	Type
25	v	80	HIS
25	v	142	ASN
25	v	184	HIS
25	v	262	ASN
25	v	306	ASN
25	v	409	GLN
28	C	53	HIS
28	C	128	ASN
28	C	142	HIS
29	D	130	GLN
29	D	134	HIS
29	D	185	ASN
30	E	97	ASN
30	E	115	GLN
31	F	52	ASN
32	G	45	HIS
32	G	48	ASN
35	J	19	ASN
36	L	40	HIS
36	L	47	HIS
39	O	97	GLN
40	P	23	ASN
44	T	86	GLN
44	T	91	GLN
45	U	7	HIS
45	U	57	ASN
46	V	70	HIS
48	X	49	ASN
49	Y	46	HIS
50	Z	16	ASN
53	3	48	GLN
56	6	29	GLN

### 5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	a	1523/1542 (98%)	185 (12%)	0
22	x	74/76 (97%)	13 (17%)	0
22	y	71/76 (93%)	25 (35%)	0
23	z	10/21 (47%)	3 (30%)	0
26	A	2893/2904 (99%)	377 (13%)	12 (0%)

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Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
27	B	119/120 (99%)	14 (11%)	2 (1%)
All	All	4690/4739 (98%)	617 (13%)	14 (0%)

All (617) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	a	4	U
1	a	5	U
1	a	6	G
1	a	9	G
1	a	22	G
1	a	31	G
1	a	32	A
1	a	39	G
1	a	44	A
1	a	47	C
1	a	48	C
1	a	51	A
1	a	59	A
1	a	71	A
1	a	79	G
1	a	82	G
1	a	84	U
1	a	85	U
1	a	86	G
1	a	88	U
1	a	89	U
1	a	94	G
1	a	95	C
1	a	121	U
1	a	122	G
1	a	130	A
1	a	131	A
1	a	144	G
1	a	163	C
1	a	177	G
1	a	183	C
1	a	184	G
1	a	197	A
1	a	199	A
1	a	208	U
1	a	209	U

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Mol	Chain	Res	Type
1	a	210	C
1	a	211	G
1	a	212	G
1	a	245	U
1	a	247	G
1	a	251	G
1	a	266	G
1	a	267	C
1	a	281	G
1	a	289	G
1	a	306	A
1	a	321	A
1	a	328	C
1	a	347	G
1	a	351	G
1	a	352	C
1	a	354	G
1	a	367	U
1	a	372	C
1	a	373	A
1	a	384	G
1	a	397	A
1	a	406	G
1	a	412	A
1	a	413	G
1	a	414	A
1	a	421	U
1	a	422	C
1	a	424	G
1	a	429	U
1	a	436	C
1	a	445	G
1	a	462	G
1	a	467	U
1	a	468	A
1	a	478	A
1	a	479	U
1	a	482	A
1	a	484	G
1	a	486	U
1	a	495	A
1	a	497	G

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Mol	Chain	Res	Type
1	a	509	A
1	a	511	C
1	a	518	C
1	a	521	G
1	a	526	C
1	a	527	G7M
1	a	547	A
1	a	564	C
1	a	572	A
1	a	573	A
1	a	576	C
1	a	577	G
1	a	642	A
1	a	653	U
1	a	665	A
1	a	688	G
1	a	719	C
1	a	721	G
1	a	723	U
1	a	724	G
1	a	755	G
1	a	777	A
1	a	793	U
1	a	794	A
1	a	815	A
1	a	817	C
1	a	832	G
1	a	890	G
1	a	914	A
1	a	926	G
1	a	934	C
1	a	935	A
1	a	960	U
1	a	966	2MG
1	a	969	A
1	a	975	A
1	a	976	G
1	a	977	A
1	a	992	U
1	a	993	G
1	a	1003	G
1	a	1004	A

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Mol	Chain	Res	Type
1	a	1008	U
1	a	1009	U
1	a	1017	U
1	a	1022	A
1	a	1027	C
1	a	1029	U
1	a	1030	U
1	a	1031	C
1	a	1032	G
1	a	1033	G
1	a	1034	G
1	a	1036	A
1	a	1039	G
1	a	1053	G
1	a	1065	U
1	a	1094	G
1	a	1095	U
1	a	1101	A
1	a	1137	C
1	a	1139	G
1	a	1159	U
1	a	1167	A
1	a	1184	G
1	a	1196	A
1	a	1197	A
1	a	1213	A
1	a	1214	C
1	a	1227	A
1	a	1228	C
1	a	1238	A
1	a	1257	A
1	a	1275	A
1	a	1280	A
1	a	1282	C
1	a	1285	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

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Mol	Chain	Res	Type
1	a	1338	G
1	a	1353	G
1	a	1363	A
1	a	1364	U
1	a	1370	G
1	a	1395	C
1	a	1397	C
1	a	1398	A
1	a	1419	G
1	a	1432	G
1	a	1441	A
1	a	1446	A
1	a	1451	U
1	a	1452	C
1	a	1455	G
1	a	1487	G
1	a	1494	G
1	a	1497	G
1	a	1506	U
1	a	1517	G
1	a	1529	G
1	a	1530	G
1	a	1534	A
22	x	12	U
22	x	13	C
22	x	17	C
22	x	19	G
22	x	20	U
22	x	22	G
22	x	45	U
22	x	47	U
22	x	48	C
22	x	49	C
22	x	55	PSU
22	x	64	A
22	x	76	A
22	y	10	G
22	y	14	A
22	y	19	G
22	y	20	U
22	y	21	A
22	y	26	A

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Mol	Chain	Res	Type
22	y	31	A
22	y	34	G
22	y	35	A
22	y	39	PSU
22	y	41	C
22	y	42	C
22	y	44	G
22	y	46	7MG
22	y	47	U
22	y	48	C
22	y	54	5MU
22	y	57	G
22	y	59	U
22	y	60	U
22	y	65	G
22	y	72	C
22	y	73	A
22	y	75	C
22	y	76	A
23	z	12	A
23	z	20	U
23	z	21	A
26	A	2	G
26	A	4	U
26	A	6	A
26	A	10	A
26	A	12	U
26	A	34	U
26	A	35	G
26	A	51	G
26	A	71	A
26	A	74	A
26	A	75	G
26	A	84	A
26	A	100	U
26	A	101	A
26	A	103	A
26	A	118	A
26	A	119	A
26	A	120	U
26	A	139	U
26	A	140	C

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Mol	Chain	Res	Type
26	A	142	A
26	A	163	C
26	A	165	A
26	A	181	A
26	A	196	A
26	A	199	A
26	A	215	G
26	A	216	A
26	A	221	A
26	A	222	A
26	A	233	A
26	A	248	G
26	A	264	C
26	A	269	C
26	A	271	G
26	A	272	A
26	A	274	C
26	A	278	A
26	A	282	A
26	A	289	G
26	A	291	G
26	A	295	G
26	A	311	A
26	A	329	G
26	A	330	A
26	A	362	A
26	A	367	G
26	A	385	C
26	A	386	G
26	A	396	G
26	A	404	A
26	A	411	G
26	A	412	A
26	A	428	A
26	A	481	G
26	A	491	G
26	A	505	A
26	A	508	A
26	A	509	C
26	A	510	C
26	A	521	U
26	A	531	C

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Mol	Chain	Res	Type
26	A	532	A
26	A	533	G
26	A	544	C
26	A	545	U
26	A	546	U
26	A	547	A
26	A	549	G
26	A	563	A
26	A	573	U
26	A	575	A
26	A	603	A
26	A	614	A
26	A	615	U
26	A	627	A
26	A	637	A
26	A	645	C
26	A	646	U
26	A	647	G
26	A	653	U
26	A	654	A
26	A	655	A
26	A	686	U
26	A	716	A
26	A	717	C
26	A	724	U
26	A	730	A
26	A	740	C
26	A	747	5MU
26	A	748	G
26	A	764	A
26	A	775	G
26	A	776	G
26	A	782	A
26	A	784	G
26	A	785	G
26	A	789	A
26	A	792	A
26	A	805	G
26	A	806	C
26	A	812	C
26	A	827	U
26	A	828	U

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Mol	Chain	Res	Type
26	A	845	A
26	A	846	U
26	A	847	U
26	A	859	G
26	A	869	G
26	A	880	G
26	A	882	G
26	A	883	G
26	A	890	C
26	A	891	G
26	A	892	A
26	A	895	U
26	A	896	A
26	A	897	C
26	A	910	A
26	A	931	U
26	A	946	C
26	A	961	C
26	A	974	G
26	A	983	A
26	A	989	G
26	A	990	A
26	A	996	A
26	A	1005	C
26	A	1012	U
26	A	1013	C
26	A	1021	A
26	A	1026	G
26	A	1032	A
26	A	1033	U
26	A	1034	G
26	A	1046	A
26	A	1047	G
26	A	1052	C
26	A	1059	G
26	A	1060	U
26	A	1061	U
26	A	1062	G
26	A	1063	G
26	A	1064	C
26	A	1065	U
26	A	1066	U

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Mol	Chain	Res	Type
26	A	1067	A
26	A	1068	G
26	A	1070	A
26	A	1071	G
26	A	1075	C
26	A	1076	C
26	A	1084	A
26	A	1085	A
26	A	1088	A
26	A	1090	A
26	A	1097	U
26	A	1098	A
26	A	1104	C
26	A	1112	G
26	A	1116	G
26	A	1132	U
26	A	1135	C
26	A	1142	A
26	A	1172	C
26	A	1253	A
26	A	1256	G
26	A	1271	G
26	A	1272	A
26	A	1273	U
26	A	1288	G
26	A	1289	C
26	A	1301	A
26	A	1329	U
26	A	1365	A
26	A	1379	U
26	A	1383	A
26	A	1416	G
26	A	1427	A
26	A	1428	C
26	A	1452	G
26	A	1458	U
26	A	1482	G
26	A	1493	C
26	A	1508	A
26	A	1509	A
26	A	1510	G
26	A	1515	A

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Mol	Chain	Res	Type
26	A	1524	G
26	A	1535	A
26	A	1536	C
26	A	1537	G
26	A	1538	G
26	A	1566	A
26	A	1569	A
26	A	1583	A
26	A	1585	C
26	A	1609	A
26	A	1628	G
26	A	1647	U
26	A	1648	U
26	A	1651	G
26	A	1654	A
26	A	1663	G
26	A	1674	G
26	A	1676	A
26	A	1699	G
26	A	1715	G
26	A	1722	A
26	A	1729	U
26	A	1730	C
26	A	1731	G
26	A	1732	C
26	A	1733	G
26	A	1738	G
26	A	1764	C
26	A	1773	A
26	A	1782	U
26	A	1800	C
26	A	1801	A
26	A	1808	A
26	A	1816	C
26	A	1829	A
26	A	1848	A
26	A	1858	A
26	A	1866	A
26	A	1871	A
26	A	1872	A
26	A	1874	C
26	A	1878	G

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Mol	Chain	Res	Type
26	A	1906	G
26	A	1913	A
26	A	1914	C
26	A	1929	G
26	A	1930	G
26	A	1937	A
26	A	1938	A
26	A	1941	C
26	A	1955	U
26	A	1964	G
26	A	1966	A
26	A	1967	C
26	A	1970	A
26	A	1971	U
26	A	1972	G
26	A	1991	U
26	A	1993	U
26	A	2006	C
26	A	2021	C
26	A	2023	C
26	A	2033	A
26	A	2034	U
26	A	2043	C
26	A	2055	C
26	A	2056	G
26	A	2060	A
26	A	2061	G
26	A	2062	A
26	A	2069	G7M
26	A	2110	G
26	A	2111	U
26	A	2112	G
26	A	2113	U
26	A	2115	G
26	A	2116	G
26	A	2117	A
26	A	2118	U
26	A	2119	A
26	A	2125	G
26	A	2127	G
26	A	2131	U
26	A	2132	U

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Mol	Chain	Res	Type
26	A	2133	G
26	A	2136	G
26	A	2137	U
26	A	2138	G
26	A	2145	C
26	A	2146	C
26	A	2147	A
26	A	2148	G
26	A	2157	G
26	A	2161	C
26	A	2162	G
26	A	2164	C
26	A	2169	A
26	A	2170	A
26	A	2172	U
26	A	2173	A
26	A	2178	C
26	A	2179	C
26	A	2180	U
26	A	2182	U
26	A	2189	U
26	A	2190	G
26	A	2192	U
26	A	2193	G
26	A	2198	A
26	A	2203	U
26	A	2204	G
26	A	2211	A
26	A	2225	A
26	A	2238	G
26	A	2239	G
26	A	2278	A
26	A	2283	C
26	A	2287	A
26	A	2288	A
26	A	2295	C
26	A	2305	U
26	A	2308	G
26	A	2309	A
26	A	2322	A
26	A	2325	G
26	A	2333	A

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Mol	Chain	Res	Type
26	A	2335	A
26	A	2345	G
26	A	2350	C
26	A	2361	G
26	A	2383	G
26	A	2385	C
26	A	2419	U
26	A	2422	C
26	A	2425	A
26	A	2428	G
26	A	2429	G
26	A	2430	A
26	A	2441	U
26	A	2448	A
26	A	2469	A
26	A	2474	U
26	A	2475	C
26	A	2476	A
26	A	2492	U
26	A	2498	OMC
26	A	2502	G
26	A	2504	PSU
26	A	2505	G
26	A	2506	U
26	A	2518	A
26	A	2520	C
26	A	2529	G
26	A	2547	A
26	A	2566	A
26	A	2567	G
26	A	2573	C
26	A	2602	A
26	A	2609	U
26	A	2613	U
26	A	2615	U
26	A	2629	U
26	A	2646	C
26	A	2649	C
26	A	2654	A
26	A	2661	G
26	A	2663	G
26	A	2669	G

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Mol	Chain	Res	Type
26	A	2689	U
26	A	2690	U
26	A	2714	G
26	A	2726	A
26	A	2732	G
26	A	2733	A
26	A	2744	G
26	A	2748	A
26	A	2749	A
26	A	2778	A
26	A	2780	G
26	A	2798	U
26	A	2800	A
26	A	2820	A
26	A	2821	A
26	A	2849	U
26	A	2850	A
26	A	2861	U
26	A	2873	A
26	A	2884	U
26	A	2902	C
27	B	4	C
27	B	24	G
27	B	35	C
27	B	42	C
27	B	44	G
27	B	45	A
27	B	52	A
27	B	56	G
27	B	65	U
27	B	67	G
27	B	89	U
27	B	90	C
27	B	91	C
27	B	109	A

All (14) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
26	A	3	U
26	A	271	G
26	A	784	G

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Mol	Chain	Res	Type
26	A	895	U
26	A	1026	G
26	A	1031	G
26	A	1084	A
26	A	1111	A
26	A	1328	A
26	A	2189	U
26	A	2191	A
26	A	2473	U
27	B	3	C
27	B	66	A

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

53 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	MA6	a	1519	1	19,26,27	0.98	1 (5%)	18,38,41	2.28	7 (38%)
26	2MG	A	1835	26	18,26,27	0.91	1 (5%)	16,38,41	1.23	2 (12%)
26	PSU	A	1917	26	18,21,22	1.45	4 (22%)	21,30,33	2.06	3 (14%)
26	PSU	A	2457	26	18,21,22	1.41	5 (27%)	21,30,33	2.12	5 (23%)
22	PSU	y	55	22	18,21,22	1.37	2 (11%)	21,30,33	2.02	4 (19%)
26	OMC	A	2498	59,26	19,22,23	0.82	0	25,31,34	0.98	1 (4%)
22	5MU	x	54	22	19,22,23	1.35	5 (26%)	27,32,35	2.22	6 (22%)
29	MEQ	D	150	29	8,9,10	0.48	0	5,10,12	0.23	0
26	2MG	A	2445	26	18,26,27	0.89	1 (5%)	16,38,41	1.34	3 (18%)
1	G7M	a	527	1	20,26,27	1.18	2 (10%)	16,39,42	0.54	0
26	PSU	A	2580	26	18,21,22	1.42	5 (27%)	21,30,33	2.04	4 (19%)
26	5MU	A	747	26	19,22,23	1.38	4 (21%)	27,32,35	2.10	6 (22%)
26	6MZ	A	2030	26	17,25,26	0.88	1 (5%)	15,36,39	2.37	4 (26%)
26	OMU	A	2552	26	19,22,23	1.27	3 (15%)	25,31,34	1.85	5 (20%)



Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
22	4SU	y	8	22	18,21,22	1.91	4 (22%)	25,30,33	2.42	5 (20%)
22	PSU	y	39	22	18,21,22	1.36	2 (11%)	21,30,33	2.10	4 (19%)
26	1MG	A	745	26	19,26,27	0.87	1 (5%)	18,39,42	1.09	2 (11%)
1	2MG	a	1207	1	18,26,27	0.92	1 (5%)	16,38,41	1.41	4 (25%)
22	PSU	y	32	22	18,21,22	1.36	2 (11%)	21,30,33	2.03	4 (19%)
26	3TD	A	1915	59,26	19,22,23	4.22	7 (36%)	23,32,35	1.82	2 (8%)
22	MIA	x	37	22	24,31,32	2.28	3 (12%)	22,44,47	2.48	8 (36%)
22	PSU	x	39	22	18,21,22	1.32	2 (11%)	21,30,33	2.23	3 (14%)
1	2MG	a	1516	1	18,26,27	0.91	1 (5%)	16,38,41	1.53	5 (31%)
1	UR3	a	1498	1	19,22,23	0.93	0	26,32,35	1.70	2 (7%)
11	IAS	k	119	11	6,7,8	0.96	0	3,8,10	1.48	1 (33%)
26	PSU	A	955	26	18,21,22	1.45	4 (22%)	21,30,33	2.08	3 (14%)
22	PSU	x	55	22	18,21,22	1.41	2 (11%)	21,30,33	2.08	3 (14%)
22	5MU	y	54	22	19,22,23	1.39	5 (26%)	27,32,35	2.23	7 (25%)
1	5MC	a	967	1	19,22,23	1.49	3 (15%)	26,32,35	1.09	2 (7%)
26	PSU	A	1911	26	18,21,22	1.37	3 (16%)	21,30,33	2.05	4 (19%)
26	PSU	A	2604	26	18,21,22	1.43	3 (16%)	21,30,33	2.08	4 (19%)
26	PSU	A	746	59,26	18,21,22	1.42	3 (16%)	21,30,33	1.95	3 (14%)
1	5MC	a	1407	1	19,22,23	1.47	3 (15%)	26,32,35	1.12	3 (11%)
1	PSU	a	516	1	18,21,22	1.40	3 (16%)	21,30,33	2.06	4 (19%)
26	PSU	A	2504	26	18,21,22	1.40	3 (16%)	21,30,33	2.05	4 (19%)
12	D2T	l	89	12	8,9,10	1.83	1 (12%)	6,11,13	2.50	3 (50%)
26	H2U	A	2449	26	18,21,22	1.20	3 (16%)	19,30,33	0.87	1 (5%)
22	7MG	y	46	22	23,26,27	1.26	3 (13%)	27,39,42	2.78	8 (29%)
39	4D4	O	81	39	9,11,12	2.53	2 (22%)	7,13,15	0.86	0
1	2MG	a	966	1	18,26,27	0.90	1 (5%)	16,38,41	1.43	5 (31%)
22	4SU	x	8	22	18,21,22	1.95	4 (22%)	25,30,33	1.97	4 (16%)
26	2MA	A	2503	59,26	18,25,26	0.69	0	20,37,40	2.00	4 (20%)
22	7MG	x	46	22	23,26,27	1.30	3 (13%)	27,39,42	2.65	7 (25%)
22	MIA	y	37	22	17,24,32	0.95	1 (5%)	16,35,47	1.26	2 (12%)
1	MA6	a	1518	1	19,26,27	0.96	1 (5%)	18,38,41	2.24	7 (38%)
26	5MU	A	1939	26	19,22,23	1.36	4 (21%)	27,32,35	2.19	6 (22%)
26	OMG	A	2251	26,22	19,26,27	0.88	1 (5%)	21,38,41	1.07	2 (9%)
26	5MC	A	1962	26	19,22,23	1.48	3 (15%)	26,32,35	1.13	3 (11%)
1	4OC	a	1402	59,1	20,23,24	0.75	0	25,32,35	0.96	1 (4%)



Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
26	PSU	A	2605	26	18,21,22	1.40	3 (16%)	21,30,33	2.09	4 (19%)
26	6MZ	A	1618	26	17,25,26	0.90	1 (5%)	15,36,39	2.40	4 (26%)
26	G7M	A	2069	26	20,26,27	1.17	2 (10%)	16,39,42	0.65	0
22	PSU	x	32	22	18,21,22	1.40	4 (22%)	21,30,33	2.06	3 (14%)

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	MA6	a	1519	1	-	4/7/29/30	0/3/3/3
26	2MG	A	1835	26	-	2/5/27/28	0/3/3/3
26	PSU	A	1917	26	-	2/7/25/26	0/2/2/2
26	PSU	A	2457	26	-	0/7/25/26	0/2/2/2
22	PSU	y	55	22	-	0/7/25/26	0/2/2/2
26	OMC	A	2498	59,26	-	1/9/27/28	0/2/2/2
22	5MU	x	54	22	-	0/7/25/26	0/2/2/2
29	MEQ	D	150	29	-	2/8/9/11	-
26	2MG	A	2445	26	-	0/5/27/28	0/3/3/3
1	G7M	a	527	1	-	2/3/25/26	0/3/3/3
26	PSU	A	2580	26	-	0/7/25/26	0/2/2/2
26	5MU	A	747	26	-	0/7/25/26	0/2/2/2
26	6MZ	A	2030	26	-	2/5/27/28	0/3/3/3
26	OMU	A	2552	26	-	1/9/27/28	0/2/2/2
22	4SU	y	8	22	-	0/7/25/26	0/2/2/2
22	PSU	y	39	22	-	1/7/25/26	0/2/2/2
26	1MG	A	745	26	-	0/3/25/26	0/3/3/3
1	2MG	a	1207	1	-	2/5/27/28	0/3/3/3
22	PSU	y	32	22	-	0/7/25/26	0/2/2/2
26	3TD	A	1915	59,26	-	0/7/25/26	0/2/2/2
22	MIA	x	37	22	-	5/11/33/34	0/3/3/3
22	PSU	x	39	22	-	0/7/25/26	0/2/2/2
1	2MG	a	1516	1	-	0/5/27/28	0/3/3/3
1	UR3	a	1498	1	-	0/7/25/26	0/2/2/2
11	IAS	k	119	11	-	1/7/7/8	-
26	PSU	A	955	26	-	0/7/25/26	0/2/2/2
22	PSU	x	55	22	-	3/7/25/26	0/2/2/2
22	5MU	y	54	22	-	3/7/25/26	0/2/2/2

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	5MC	a	967	1	-	0/7/25/26	0/2/2/2
26	PSU	A	1911	26	-	0/7/25/26	0/2/2/2
26	PSU	A	2604	26	-	0/7/25/26	0/2/2/2
26	PSU	A	746	59,26	-	4/7/25/26	0/2/2/2
1	5MC	a	1407	1	-	0/7/25/26	0/2/2/2
1	PSU	a	516	1	-	0/7/25/26	0/2/2/2
26	PSU	A	2504	26	-	2/7/25/26	0/2/2/2
12	D2T	l	89	12	-	1/7/12/14	-
26	H2U	A	2449	26	-	0/7/38/39	0/2/2/2
22	7MG	y	46	22	-	5/7/37/38	0/3/3/3
39	4D4	O	81	39	-	2/11/12/14	-
1	2MG	a	966	1	-	2/5/27/28	0/3/3/3
22	4SU	x	8	22	-	0/7/25/26	0/2/2/2
26	2MA	A	2503	59,26	-	1/3/25/26	0/3/3/3
22	7MG	x	46	22	-	0/7/37/38	0/3/3/3
22	MIA	y	37	22	-	2/3/25/34	0/3/3/3
1	MA6	a	1518	1	-	1/7/29/30	0/3/3/3
26	5MU	A	1939	26	-	0/7/25/26	0/2/2/2
26	OMG	A	2251	26,22	-	0/5/27/28	0/3/3/3
26	5MC	A	1962	26	-	0/7/25/26	0/2/2/2
1	4OC	a	1402	59,1	-	2/9/29/30	0/2/2/2
26	PSU	A	2605	26	-	0/7/25/26	0/2/2/2
26	6MZ	A	1618	26	-	0/5/27/28	0/3/3/3
26	G7M	A	2069	26	-	3/3/25/26	0/3/3/3
22	PSU	x	32	22	-	0/7/25/26	0/2/2/2

All (126) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
26	A	1915	3TD	C6-C5	12.68	1.49	1.35
26	A	1915	3TD	C2-N1	9.67	1.49	1.37
22	x	37	MIA	C2-S10	-7.56	1.69	1.75
22	x	37	MIA	C13-C14	6.89	1.53	1.32
39	O	81	4D4	CZ-NE	6.17	1.45	1.33
26	A	1915	3TD	C6-N1	5.80	1.45	1.36
1	a	967	5MC	C5-C4	5.23	1.48	1.44
22	y	8	4SU	C4-S4	-5.19	1.59	1.68
26	A	1962	5MC	C5-C4	5.14	1.48	1.44
22	x	8	4SU	C4-S4	-5.08	1.59	1.68
1	a	1407	5MC	C5-C4	5.05	1.47	1.44

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
26	A	1915	3TD	C2-N3	4.86	1.48	1.38
12	l	89	D2T	CB-CA	-4.30	1.53	1.54
22	x	8	4SU	C4-N3	-3.85	1.33	1.37
22	y	8	4SU	C4-N3	-3.73	1.33	1.37
22	y	39	PSU	C6-C5	3.52	1.39	1.35
1	a	527	G7M	C5-C4	3.45	1.46	1.39
26	A	2069	G7M	C5-C4	3.37	1.45	1.39
22	y	55	PSU	C6-C5	3.35	1.39	1.35
22	x	46	7MG	C4-N9	-3.33	1.33	1.37
22	x	55	PSU	C6-C5	3.30	1.38	1.35
22	y	32	PSU	C6-C5	3.26	1.38	1.35
22	y	46	7MG	C5-C4	3.18	1.47	1.37
26	A	746	PSU	C6-C5	3.15	1.38	1.35
26	A	1917	PSU	C6-C5	3.13	1.38	1.35
22	x	46	7MG	C5-C4	3.13	1.47	1.37
26	A	2604	PSU	C6-C5	3.12	1.38	1.35
26	A	955	PSU	C6-C5	3.11	1.38	1.35
22	x	8	4SU	C5-C4	-3.08	1.38	1.42
39	O	81	4D4	CZ-NH1	3.06	1.45	1.34
26	A	2449	H2U	C2-N3	-3.03	1.32	1.38
26	A	2504	PSU	C6-C5	3.01	1.38	1.35
26	A	2605	PSU	C4-N3	-2.97	1.33	1.38
26	A	2552	OMU	C4-N3	-2.97	1.33	1.38
22	y	46	7MG	C4-N9	-2.96	1.34	1.37
26	A	1917	PSU	C4-N3	-2.96	1.33	1.38
1	a	516	PSU	C6-C5	2.93	1.38	1.35
26	A	2605	PSU	C6-C5	2.92	1.38	1.35
26	A	2604	PSU	C4-N3	-2.92	1.33	1.38
26	A	1939	5MU	C4-N3	-2.87	1.33	1.38
26	A	2457	PSU	C4-N3	-2.87	1.33	1.38
26	A	1911	PSU	C6-C5	2.87	1.38	1.35
26	A	747	5MU	C4-N3	-2.86	1.33	1.38
22	x	32	PSU	C6-C5	2.86	1.38	1.35
26	A	2504	PSU	C4-N3	-2.85	1.33	1.38
22	x	39	PSU	C6-C5	2.83	1.38	1.35
26	A	955	PSU	C4-N3	-2.82	1.33	1.38
26	A	1911	PSU	C4-N3	-2.81	1.33	1.38
1	a	516	PSU	C4-N3	-2.80	1.33	1.38
22	y	54	5MU	C2-N1	2.78	1.42	1.38
22	x	32	PSU	C4-N3	-2.76	1.33	1.38
22	y	8	4SU	C5-C4	-2.75	1.39	1.42
26	A	2580	PSU	C6-C5	2.74	1.38	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
26	A	2449	H2U	C4-N3	-2.74	1.33	1.37
26	A	746	PSU	C4-N3	-2.73	1.33	1.38
26	A	1915	3TD	C4-N3	2.72	1.46	1.40
26	A	2457	PSU	C6-C5	2.72	1.38	1.35
22	y	55	PSU	C4-N3	-2.71	1.33	1.38
26	A	1835	2MG	C6-N1	-2.71	1.33	1.37
26	A	1915	3TD	O2-C2	-2.70	1.18	1.23
26	A	2580	PSU	C4-N3	-2.70	1.33	1.38
22	y	32	PSU	C4-N3	-2.68	1.33	1.38
22	y	37	MIA	C2-N3	2.66	1.36	1.32
22	x	55	PSU	C4-N3	-2.66	1.33	1.38
22	x	54	5MU	C4-N3	-2.65	1.33	1.38
26	A	2552	OMU	C2-N3	-2.63	1.33	1.38
1	a	966	2MG	C6-N1	-2.62	1.33	1.37
1	a	1407	5MC	C6-C5	2.62	1.38	1.34
1	a	1207	2MG	C6-N1	-2.61	1.33	1.37
26	A	747	5MU	C6-C5	2.59	1.38	1.34
22	y	54	5MU	C4-N3	-2.58	1.34	1.38
26	A	2445	2MG	C6-N1	-2.57	1.33	1.37
26	A	1939	5MU	C6-C5	2.57	1.38	1.34
26	A	2069	G7M	C6-N1	-2.55	1.33	1.37
22	x	8	4SU	C2-N3	-2.54	1.33	1.38
26	A	1962	5MC	C6-N1	-2.53	1.33	1.38
26	A	2251	OMG	C6-N1	-2.52	1.33	1.37
26	A	2449	H2U	C2-N1	-2.52	1.32	1.35
22	x	39	PSU	C4-N3	-2.51	1.34	1.38
26	A	1962	5MC	C6-C5	2.51	1.38	1.34
26	A	1939	5MU	C6-N1	-2.51	1.33	1.38
22	y	54	5MU	C6-C5	2.49	1.38	1.34
1	a	527	G7M	C6-N1	-2.47	1.34	1.37
1	a	1516	2MG	C6-N1	-2.46	1.34	1.37
22	y	39	PSU	C4-N3	-2.46	1.34	1.38
1	a	967	5MC	C6-N1	-2.43	1.33	1.38
1	a	967	5MC	C6-C5	2.42	1.38	1.34
1	a	1407	5MC	C6-N1	-2.42	1.33	1.38
22	x	54	5MU	C6-N1	-2.42	1.33	1.38
22	x	54	5MU	C6-C5	2.41	1.38	1.34
26	A	747	5MU	C6-N1	-2.40	1.33	1.38
26	A	1618	6MZ	C6-C5	2.39	1.48	1.44
26	A	2580	PSU	O4'-C1'	-2.38	1.40	1.43
22	x	46	7MG	C6-N1	-2.36	1.34	1.38
26	A	2030	6MZ	C6-C5	2.34	1.48	1.44

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
26	A	1939	5MU	C2-N3	-2.32	1.33	1.38
22	x	37	MIA	C6-C5	2.31	1.48	1.44
26	A	955	PSU	C2-N1	-2.31	1.33	1.36
26	A	747	5MU	C2-N3	-2.30	1.34	1.38
1	a	1519	MA6	C6-C5	2.29	1.48	1.44
26	A	1915	3TD	O4-C4	-2.28	1.18	1.23
22	y	8	4SU	C2-N3	-2.27	1.34	1.38
26	A	2604	PSU	C2-N3	-2.26	1.33	1.37
22	y	54	5MU	C6-N1	-2.24	1.34	1.38
26	A	2605	PSU	C2-N3	-2.23	1.33	1.37
26	A	955	PSU	C2-N3	-2.21	1.33	1.37
26	A	745	1MG	C2-N1	2.19	1.41	1.37
1	a	1518	MA6	C6-C5	2.16	1.48	1.44
1	a	516	PSU	C2-N3	-2.16	1.33	1.37
26	A	2580	PSU	C2-N1	-2.15	1.33	1.36
26	A	2552	OMU	C5-C4	-2.15	1.39	1.43
22	y	46	7MG	C6-N1	-2.14	1.34	1.38
22	x	54	5MU	C4-C5	2.14	1.48	1.44
26	A	1911	PSU	C2-N3	-2.13	1.34	1.37
22	y	54	5MU	C4-C5	2.13	1.48	1.44
22	x	32	PSU	C2-N3	-2.12	1.34	1.37
26	A	1917	PSU	C2-N3	-2.12	1.34	1.37
22	x	54	5MU	C2-N1	2.11	1.41	1.38
26	A	1917	PSU	C2-N1	-2.11	1.33	1.36
26	A	2504	PSU	C2-N3	-2.11	1.34	1.37
26	A	746	PSU	C2-N3	-2.10	1.34	1.37
26	A	2580	PSU	C2-N3	-2.10	1.34	1.37
26	A	2457	PSU	C2-N3	-2.07	1.34	1.37
26	A	2457	PSU	C2-N1	-2.06	1.34	1.36
22	x	32	PSU	C2-N1	-2.05	1.34	1.36
26	A	2457	PSU	O4'-C1'	-2.01	1.41	1.43

All (191) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
22	x	46	7MG	N9-C4-N3	9.02	138.68	125.46
22	y	46	7MG	N9-C4-N3	8.97	138.61	125.46
22	x	37	MIA	C12-C13-C14	-8.07	112.53	127.01
22	y	8	4SU	C4-N3-C2	-7.44	120.18	127.31
26	A	2503	2MA	C2-N3-C4	7.14	121.22	115.46
1	a	1498	UR3	C4-N3-C2	-6.68	119.21	124.58
22	x	39	PSU	N1-C2-N3	6.61	122.14	115.17

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
26	A	1917	PSU	N1-C2-N3	6.60	122.13	115.17
26	A	2604	PSU	N1-C2-N3	6.54	122.07	115.17
22	x	32	PSU	N1-C2-N3	6.54	122.06	115.17
22	x	55	PSU	N1-C2-N3	6.53	122.06	115.17
26	A	2457	PSU	N1-C2-N3	6.51	122.04	115.17
26	A	955	PSU	N1-C2-N3	6.51	122.03	115.17
26	A	2030	6MZ	C2-N1-C6	6.51	121.65	116.60
26	A	1618	6MZ	C2-N1-C6	6.48	121.63	116.60
26	A	2605	PSU	N1-C2-N3	6.48	122.00	115.17
22	y	39	PSU	N1-C2-N3	6.41	121.93	115.17
26	A	1911	PSU	N1-C2-N3	6.40	121.92	115.17
26	A	2504	PSU	N1-C2-N3	6.39	121.91	115.17
1	a	516	PSU	N1-C2-N3	6.37	121.89	115.17
22	y	32	PSU	N1-C2-N3	6.33	121.84	115.17
22	y	55	PSU	N1-C2-N3	6.30	121.82	115.17
26	A	2580	PSU	N1-C2-N3	6.23	121.74	115.17
22	y	8	4SU	C5-C4-N3	6.22	120.53	114.75
26	A	746	PSU	N1-C2-N3	6.16	121.67	115.17
26	A	1915	3TD	N1-C2-N3	5.84	120.37	116.13
22	y	46	7MG	C5-C4-N3	-5.71	117.42	128.13
22	x	8	4SU	C5-C4-N3	5.60	119.95	114.75
22	x	46	7MG	N9-C8-N7	-5.58	95.47	103.37
22	x	8	4SU	C4-N3-C2	-5.46	122.08	127.31
22	x	54	5MU	C4-N3-C2	-5.42	120.23	127.34
26	A	1939	5MU	C4-N3-C2	-5.38	120.29	127.34
26	A	1939	5MU	N3-C2-N1	5.37	121.88	114.89
22	x	46	7MG	C5-C4-N3	-5.29	118.21	128.13
22	y	46	7MG	N9-C8-N7	-5.19	96.02	103.37
26	A	747	5MU	N3-C2-N1	5.12	121.56	114.89
26	A	747	5MU	C4-N3-C2	-5.07	120.69	127.34
22	x	54	5MU	N3-C2-N1	5.07	121.49	114.89
26	A	2552	OMU	C4-N3-C2	-5.05	120.34	126.61
22	y	54	5MU	C4-N3-C2	-5.03	120.74	127.34
1	a	1519	MA6	C2-N1-C6	4.87	121.62	116.84
1	a	1518	MA6	C2-N1-C6	4.83	121.58	116.84
22	x	39	PSU	O2-C2-N1	-4.81	117.83	122.79
22	y	54	5MU	N3-C2-N1	4.77	121.10	114.89
22	x	54	5MU	C5-C4-N3	4.73	119.44	115.32
22	y	46	7MG	C2-N3-C4	4.73	120.44	112.30
22	x	39	PSU	C4-N3-C2	-4.61	120.03	126.37
26	A	2552	OMU	N3-C2-N1	4.51	120.76	114.89
22	y	54	5MU	O4-C4-C5	-4.51	119.76	124.92

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
22	y	54	5MU	C5-C4-N3	4.49	119.23	115.32
22	y	8	4SU	N3-C2-N1	4.47	120.71	114.89
26	A	1618	6MZ	C9-N6-C6	-4.47	118.71	122.85
12	l	89	D2T	CB1-SB-CB	4.47	110.39	102.36
22	x	54	5MU	O4-C4-C5	-4.44	119.84	124.92
26	A	1939	5MU	C5-C4-N3	4.36	119.11	115.32
26	A	747	5MU	C5-C4-N3	4.35	119.11	115.32
22	y	39	PSU	C4-N3-C2	-4.35	120.38	126.37
26	A	1939	5MU	O4-C4-C5	-4.32	119.98	124.92
26	A	2605	PSU	C4-N3-C2	-4.31	120.43	126.37
26	A	2457	PSU	C4-N3-C2	-4.28	120.47	126.37
26	A	1915	3TD	C4-N3-C2	-4.26	120.11	124.61
26	A	1911	PSU	C4-N3-C2	-4.24	120.53	126.37
22	x	46	7MG	C2-N3-C4	4.24	119.60	112.30
26	A	747	5MU	O4-C4-C5	-4.22	120.08	124.92
26	A	2604	PSU	C4-N3-C2	-4.15	120.65	126.37
26	A	2504	PSU	C4-N3-C2	-4.14	120.67	126.37
22	y	55	PSU	C4-N3-C2	-4.09	120.74	126.37
1	a	1518	MA6	N1-C6-N6	4.08	121.55	116.83
22	y	32	PSU	C4-N3-C2	-4.08	120.75	126.37
26	A	955	PSU	C4-N3-C2	-4.05	120.79	126.37
22	x	32	PSU	C4-N3-C2	-4.05	120.79	126.37
22	x	55	PSU	C4-N3-C2	-4.04	120.81	126.37
1	a	516	PSU	C4-N3-C2	-4.04	120.81	126.37
22	x	55	PSU	O2-C2-N1	-4.03	118.63	122.79
26	A	746	PSU	C4-N3-C2	-4.02	120.83	126.37
26	A	2457	PSU	O2-C2-N1	-3.98	118.69	122.79
22	y	8	4SU	C5-C4-S4	-3.97	119.77	124.31
26	A	2580	PSU	C4-N3-C2	-3.94	120.94	126.37
26	A	2552	OMU	C5-C4-N3	3.94	120.31	114.80
22	x	37	MIA	C11-S10-C2	-3.92	99.31	102.25
26	A	1917	PSU	C4-N3-C2	-3.86	121.06	126.37
22	x	37	MIA	C16-C14-C13	-3.85	111.09	122.66
26	A	1939	5MU	C5-C6-N1	-3.83	119.15	123.31
22	y	39	PSU	O2-C2-N1	-3.80	118.87	122.79
26	A	1618	6MZ	N3-C2-N1	-3.79	123.53	128.67
26	A	2030	6MZ	N3-C2-N1	-3.76	123.57	128.67
26	A	1917	PSU	O2-C2-N1	-3.74	118.93	122.79
22	y	37	MIA	N3-C2-N1	-3.68	123.67	128.67
1	a	1519	MA6	C9-N6-C6	-3.66	109.31	119.40
22	x	32	PSU	O2-C2-N1	-3.65	119.02	122.79
22	y	32	PSU	O2-C2-N1	-3.65	119.02	122.79

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	a	1519	MA6	C10-N6-C6	-3.64	109.36	119.40
26	A	955	PSU	O2-C2-N1	-3.63	119.05	122.79
26	A	2030	6MZ	C9-N6-C6	-3.62	119.49	122.85
1	a	1519	MA6	N1-C6-N6	3.62	121.01	116.83
1	a	1518	MA6	C10-N6-C6	-3.61	109.44	119.40
1	a	516	PSU	O2-C2-N1	-3.61	119.07	122.79
22	x	37	MIA	C15-C14-C13	-3.58	111.91	122.66
26	A	2504	PSU	O2-C2-N1	-3.57	119.11	122.79
1	a	1519	MA6	N3-C2-N1	-3.56	123.84	128.67
26	A	746	PSU	O2-C2-N1	-3.55	119.12	122.79
26	A	2580	PSU	O2-C2-N1	-3.55	119.13	122.79
1	a	1498	UR3	C5-C4-N3	3.55	119.71	115.04
22	x	8	4SU	C5-C4-S4	-3.54	120.27	124.31
1	a	1518	MA6	N3-C2-N1	-3.52	123.90	128.67
22	y	55	PSU	O2-C2-N1	-3.52	119.16	122.79
22	y	54	5MU	C1'-N1-C2	3.44	123.77	117.59
26	A	747	5MU	C5-C6-N1	-3.39	119.63	123.31
26	A	2605	PSU	O2-C2-N1	-3.37	119.31	122.79
26	A	1911	PSU	O2-C2-N1	-3.35	119.33	122.79
26	A	2604	PSU	O2-C2-N1	-3.33	119.36	122.79
1	a	1518	MA6	C9-N6-C6	-3.31	110.26	119.40
22	x	54	5MU	C5-C6-N1	-3.29	119.74	123.31
22	y	46	7MG	C5-C6-N1	3.28	116.71	110.94
26	A	1939	5MU	O2-C2-N1	-3.22	118.60	122.80
22	x	8	4SU	N3-C2-N1	3.17	119.02	114.89
22	y	54	5MU	C1'-N1-C6	-3.14	115.97	121.15
26	A	1962	5MC	C5-C6-N1	-3.09	119.96	123.31
1	a	967	5MC	C5-C6-N1	-3.04	120.01	123.31
26	A	745	1MG	C8-N7-C5	3.03	107.70	102.55
12	l	89	D2T	OD2-CG-CB	3.00	119.64	113.15
26	A	2445	2MG	C8-N7-C5	2.97	107.61	102.55
1	a	1407	5MC	C5-C6-N1	-2.97	120.08	123.31
1	a	1407	5MC	C5-C4-N3	-2.93	118.75	121.75
22	y	54	5MU	C5-C6-N1	-2.92	120.14	123.31
26	A	2030	6MZ	C4-C5-N7	-2.91	106.26	109.34
1	a	1516	2MG	C8-N7-C5	2.91	107.50	102.55
26	A	2552	OMU	O4-C4-C5	-2.89	120.17	125.16
1	a	1207	2MG	C8-N7-C5	2.85	107.41	102.55
26	A	1835	2MG	C8-N7-C5	2.83	107.37	102.55
1	a	1516	2MG	N1-C2-N2	2.80	119.42	116.56
26	A	1962	5MC	C5-C4-N3	-2.79	118.90	121.75
22	y	46	7MG	O6-C6-C5	-2.76	120.85	127.62

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
26	A	2251	OMG	C8-N7-C5	2.74	107.21	102.55
1	a	1519	MA6	C10-N6-C9	-2.73	107.41	116.18
1	a	966	2MG	C8-N7-C5	2.71	107.16	102.55
26	A	2503	2MA	C2-N1-C6	2.70	122.25	118.10
1	a	1519	MA6	C4-C5-N7	-2.68	106.50	109.34
26	A	2498	OMC	O2-C2-N3	-2.66	118.13	122.33
22	x	46	7MG	C5-C6-N1	2.64	115.59	110.94
26	A	1618	6MZ	C4-C5-N7	-2.64	106.55	109.34
1	a	966	2MG	CM2-N2-C2	-2.64	117.98	123.65
22	x	37	MIA	C4-C5-N7	-2.58	106.61	109.34
26	A	2552	OMU	O2-C2-N1	-2.57	119.45	122.80
22	x	54	5MU	O2-C2-N1	-2.56	119.46	122.80
22	y	37	MIA	C4-C5-N7	-2.56	106.64	109.34
22	y	46	7MG	N2-C2-N3	-2.55	114.69	119.67
1	a	967	5MC	C5-C4-N3	-2.54	119.15	121.75
1	a	1518	MA6	C4-C5-N7	-2.53	106.66	109.34
22	x	37	MIA	N3-C2-N1	-2.52	122.42	127.03
22	x	46	7MG	C5-C4-N9	-2.51	103.11	106.33
1	a	1207	2MG	CM2-N2-C2	-2.48	118.31	123.65
26	A	745	1MG	C5-C6-N1	2.48	117.55	113.96
11	k	119	IAS	OD1-CG-CB	-2.46	118.22	125.38
22	x	37	MIA	C2-N1-C6	2.41	121.70	117.42
26	A	2580	PSU	O4'-C1'-C2'	2.40	108.47	105.15
26	A	2503	2MA	C4-C5-N7	-2.39	106.81	109.34
26	A	2503	2MA	C5-C6-N1	-2.38	118.03	120.84
1	a	1516	2MG	N2-C2-N3	-2.35	117.52	120.51
1	a	966	2MG	N1-C2-N2	2.33	118.94	116.56
1	a	1207	2MG	N1-C2-N2	2.31	118.92	116.56
1	a	1402	4OC	C6-C5-C4	2.29	119.76	117.00
22	y	46	7MG	C2-N1-C6	-2.29	120.97	125.11
1	a	1518	MA6	C10-N6-C9	-2.27	108.89	116.18
1	a	516	PSU	O4'-C1'-C2'	2.24	108.25	105.15
22	x	46	7MG	O6-C6-C5	-2.22	122.18	127.62
1	a	1516	2MG	CM2-N2-C2	-2.20	118.91	123.65
22	y	55	PSU	C5-C6-N1	-2.19	119.10	122.14
26	A	2457	PSU	O4'-C1'-C2'	2.18	108.16	105.15
1	a	966	2MG	N2-C2-N3	-2.17	117.74	120.51
26	A	2251	OMG	C5-C6-N1	2.15	118.17	114.07
26	A	747	5MU	O2-C2-N1	-2.15	120.00	122.80
1	a	1516	2MG	C5-C6-N1	2.15	118.16	114.07
22	y	8	4SU	C1'-N1-C2	2.14	121.43	117.59
26	A	1911	PSU	C5-C6-N1	-2.13	119.18	122.14

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
26	A	2445	2MG	C5-C6-N1	2.12	118.12	114.07
1	a	1407	5MC	O2-C2-N3	-2.11	119.00	122.33
26	A	1835	2MG	C5-C6-N1	2.11	118.09	114.07
26	A	2604	PSU	C5-C6-N1	-2.10	119.23	122.14
26	A	2445	2MG	CM2-N2-C2	-2.09	119.15	123.65
26	A	1962	5MC	O2-C2-N3	-2.09	119.04	122.33
26	A	2605	PSU	C5-C6-N1	-2.09	119.25	122.14
1	a	966	2MG	C5-C6-N1	2.08	118.03	114.07
26	A	2449	H2U	C5-C6-N1	-2.07	105.26	111.52
12	l	89	D2T	OD2-CG-OD1	-2.05	119.42	124.08
1	a	1207	2MG	C5-C6-N1	2.04	117.97	114.07
22	y	32	PSU	C5-C6-N1	-2.04	119.31	122.14
26	A	2457	PSU	C5-C6-N1	-2.03	119.32	122.14
22	x	37	MIA	C16-C14-C15	-2.03	109.92	114.59
26	A	2504	PSU	C5-C6-N1	-2.02	119.34	122.14
22	y	39	PSU	C5-C6-N1	-2.01	119.34	122.14

There are no chirality outliers.

All (56) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	a	1207	2MG	N1-C2-N2-CM2
1	a	1207	2MG	N3-C2-N2-CM2
1	a	1402	4OC	O4'-C4'-C5'-O5'
1	a	1519	MA6	O4'-C4'-C5'-O5'
1	a	1519	MA6	C3'-C4'-C5'-O5'
1	a	1519	MA6	C5-C6-N6-C9
22	x	37	MIA	N6-C12-C13-C14
22	x	37	MIA	C12-C13-C14-C15
22	x	37	MIA	C12-C13-C14-C16
22	y	37	MIA	C3'-C4'-C5'-O5'
22	y	46	7MG	C4'-C5'-O5'-P
39	O	81	4D4	C-CA-CB-CG
39	O	81	4D4	NE-CD-CG-CB
26	A	746	PSU	C2'-C1'-C5-C4
26	A	746	PSU	O4'-C1'-C5-C4
26	A	746	PSU	C2'-C1'-C5-C6
26	A	1835	2MG	N1-C2-N2-CM2
26	A	1835	2MG	N3-C2-N2-CM2
22	x	55	PSU	C3'-C4'-C5'-O5'
22	y	46	7MG	C3'-C4'-C5'-O5'
22	y	54	5MU	C3'-C4'-C5'-O5'

*Continued on next page...*



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Mol	Chain	Res	Type	Atoms
22	y	54	5MU	O4'-C4'-C5'-O5'
26	A	1917	PSU	C3'-C4'-C5'-O5'
26	A	2504	PSU	O4'-C4'-C5'-O5'
1	a	527	G7M	O4'-C4'-C5'-O5'
1	a	527	G7M	C3'-C4'-C5'-O5'
1	a	966	2MG	C3'-C4'-C5'-O5'
22	x	55	PSU	O4'-C4'-C5'-O5'
22	y	37	MIA	O4'-C4'-C5'-O5'
22	y	46	7MG	O4'-C4'-C5'-O5'
26	A	1917	PSU	O4'-C4'-C5'-O5'
29	D	150	MEQ	NE2-CD-CG-CB
29	D	150	MEQ	OE1-CD-CG-CB
1	a	1402	4OC	C3'-C4'-C5'-O5'
1	a	1519	MA6	N1-C6-N6-C9
1	a	966	2MG	O4'-C4'-C5'-O5'
26	A	2504	PSU	C3'-C4'-C5'-O5'
22	y	46	7MG	C2'-C1'-N9-C8
26	A	2030	6MZ	O4'-C4'-C5'-O5'
26	A	2069	G7M	O4'-C4'-C5'-O5'
26	A	2069	G7M	C3'-C4'-C5'-O5'
1	a	1518	MA6	N1-C6-N6-C9
22	x	37	MIA	N1-C6-N6-C12
22	y	39	PSU	O4'-C1'-C5-C4
26	A	2030	6MZ	C3'-C4'-C5'-O5'
11	k	119	IAS	O-C-CA-N
22	y	54	5MU	C2'-C1'-N1-C6
22	x	55	PSU	C4'-C5'-O5'-P
26	A	2069	G7M	C4'-C5'-O5'-P
26	A	746	PSU	O4'-C1'-C5-C6
12	l	89	D2T	CG-CB-SB-CB1
22	y	46	7MG	O4'-C1'-N9-C8
26	A	2503	2MA	O4'-C4'-C5'-O5'
26	A	2552	OMU	O4'-C4'-C5'-O5'
26	A	2498	OMC	C2'-C1'-N1-C2
22	x	37	MIA	C5-C6-N6-C12

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates

There are no oligosaccharides in this entry.



## 5.6 Ligand geometry

Of 431 ligands modelled in this entry, 430 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$
60	GCP	v	601	-	27,34,34	1.44	5 (18%)	35,54,54	1.92	7 (20%)

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
60	GCP	v	601	-	-	1/15/38/38	0/3/3/3

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
60	v	601	GCP	C5-C6	4.22	1.48	1.41
60	v	601	GCP	PG-O2G	2.73	1.61	1.55
60	v	601	GCP	PG-O3G	2.72	1.61	1.55
60	v	601	GCP	PB-O3A	2.19	1.60	1.58
60	v	601	GCP	O4'-C1'	2.08	1.43	1.40

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
60	v	601	GCP	C2-N3-C4	5.22	121.11	115.48
60	v	601	GCP	C2-N1-C6	4.57	122.32	115.96
60	v	601	GCP	PB-O3A-PA	-4.02	119.25	132.37
60	v	601	GCP	C5-C6-N1	-4.00	118.08	123.42
60	v	601	GCP	N3-C2-N1	-3.41	122.88	127.21
60	v	601	GCP	C4-C5-N7	-2.71	106.47	109.34
60	v	601	GCP	C4-C5-C6	-2.68	117.13	121.23

There are no chirality outliers.



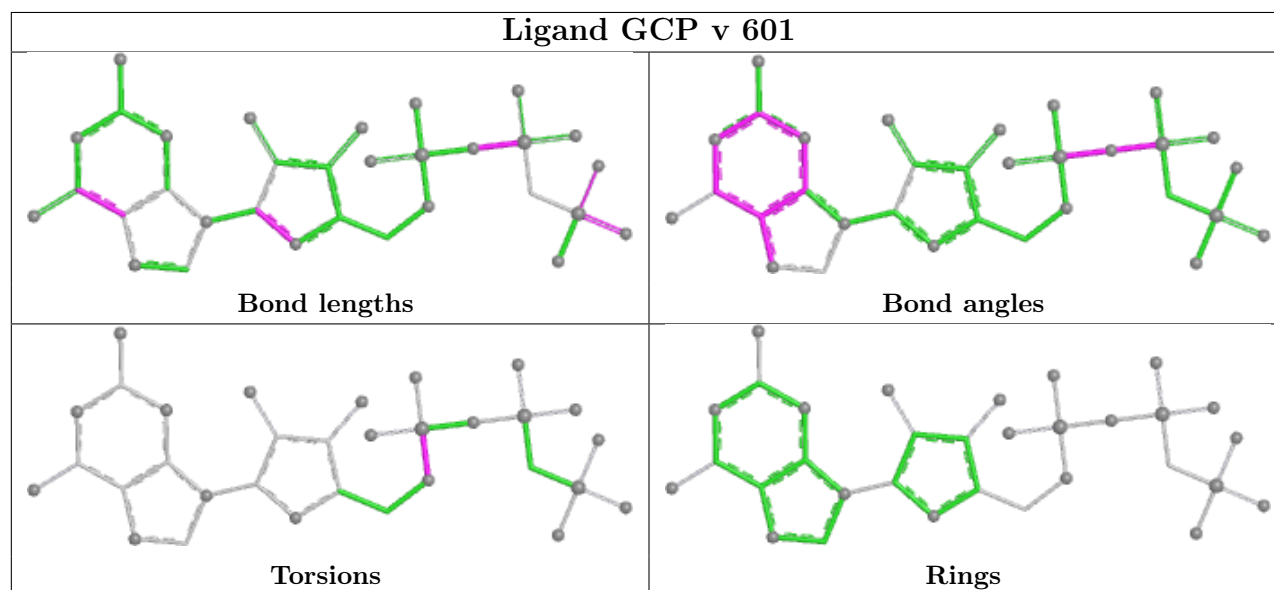
All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
60	v	601	GCP	C5'-O5'-PA-O2A

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.



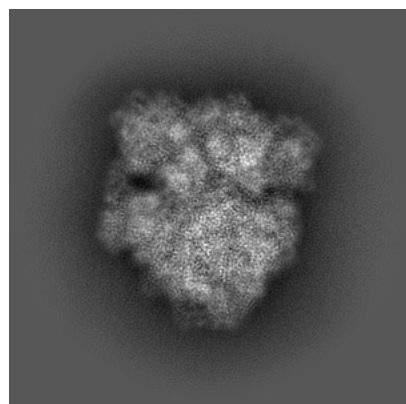
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-29627. These allow visual inspection of the internal detail of the map and identification of artifacts.

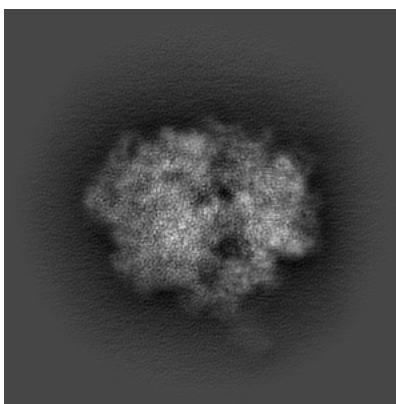
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

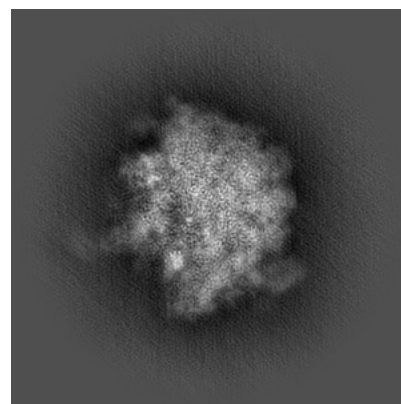
#### 6.1.1 Primary map



X

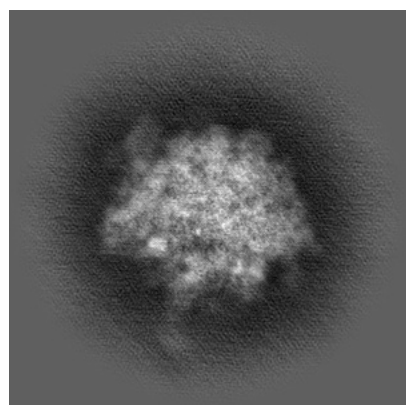


Y

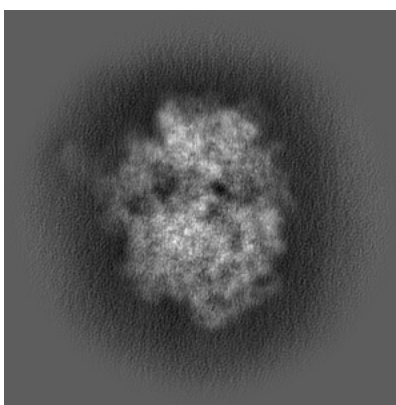


Z

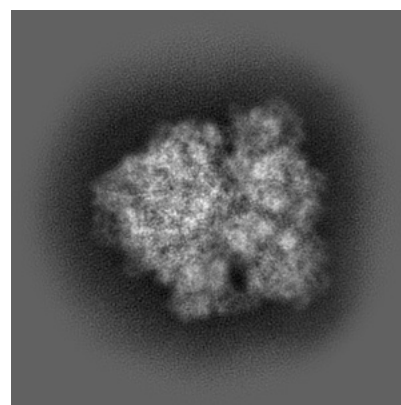
#### 6.1.2 Raw map



X



Y



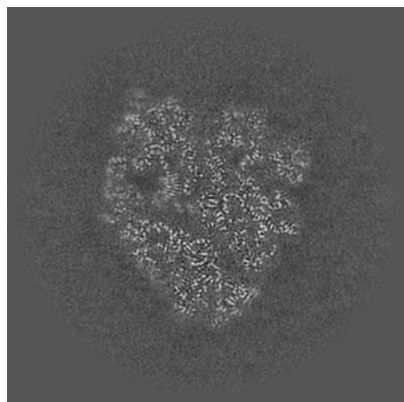
Z

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

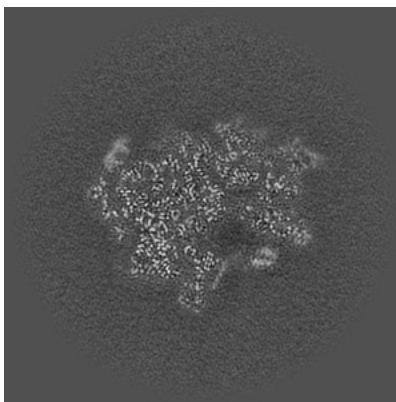


## 6.2 Central slices [i](#)

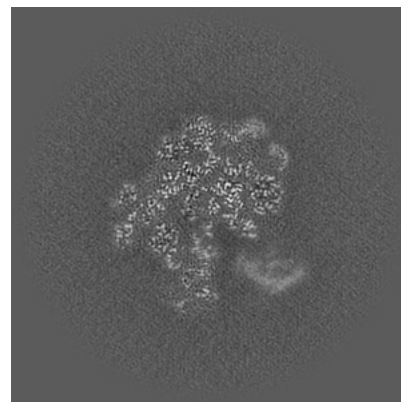
### 6.2.1 Primary map



X Index: 256

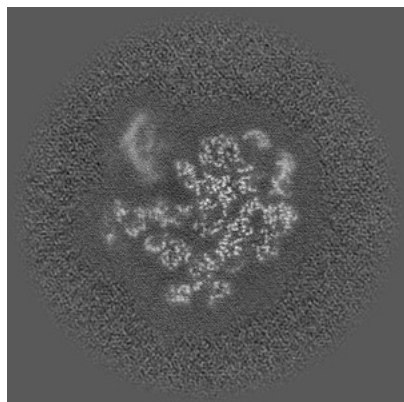


Y Index: 256

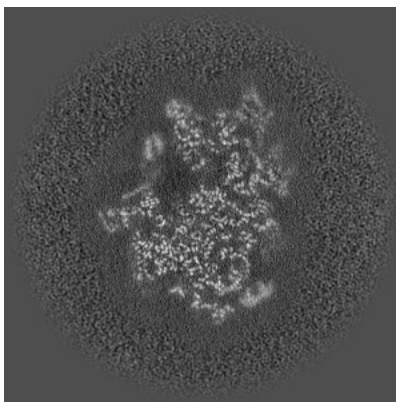


Z Index: 256

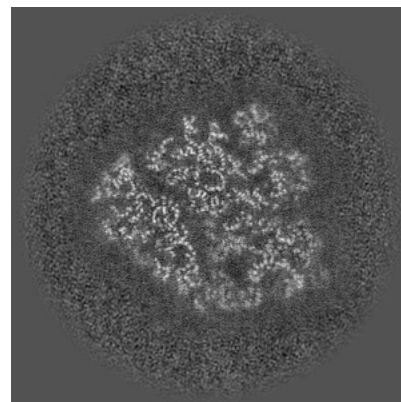
### 6.2.2 Raw map



X Index: 256



Y Index: 256



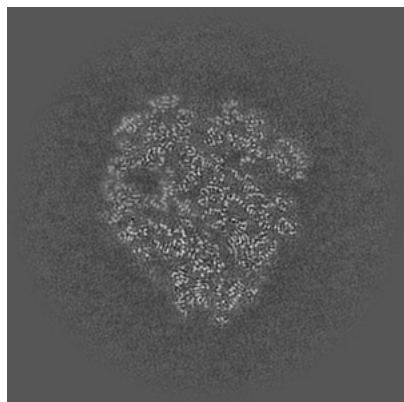
Z Index: 256

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

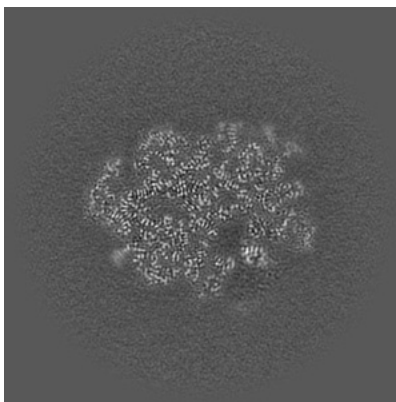


## 6.3 Largest variance slices [i](#)

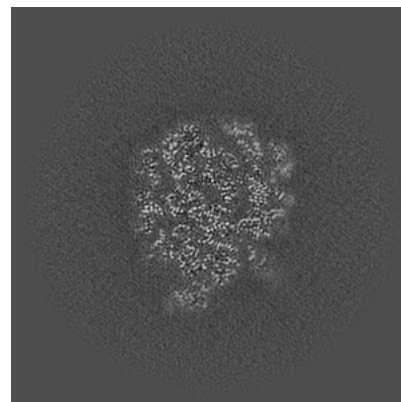
### 6.3.1 Primary map



X Index: 252

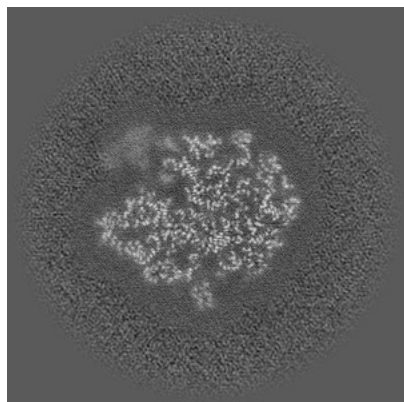


Y Index: 272

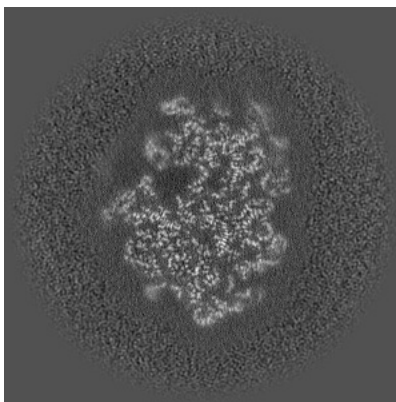


Z Index: 210

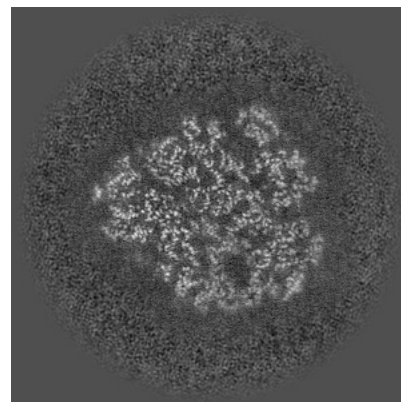
### 6.3.2 Raw map



X Index: 231



Y Index: 267



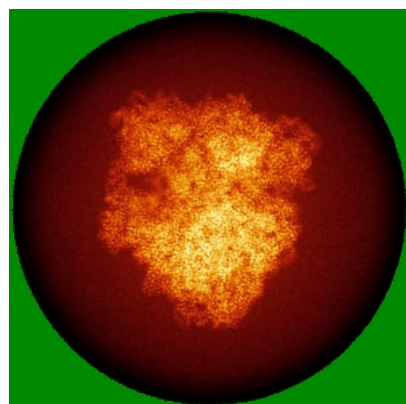
Z Index: 252

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

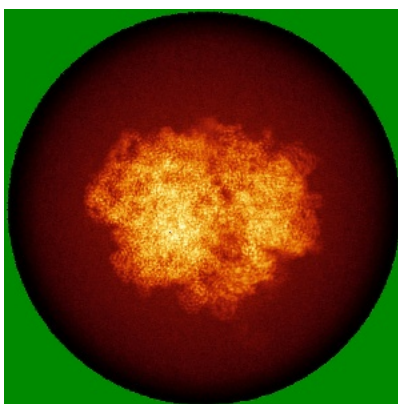


## 6.4 Orthogonal standard-deviation projections (False-color) [i](#)

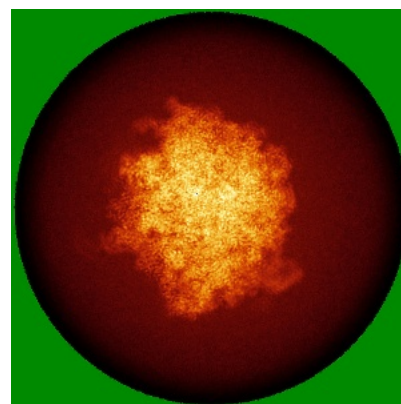
### 6.4.1 Primary map



X

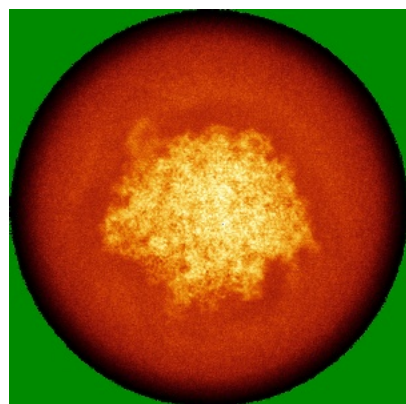


Y

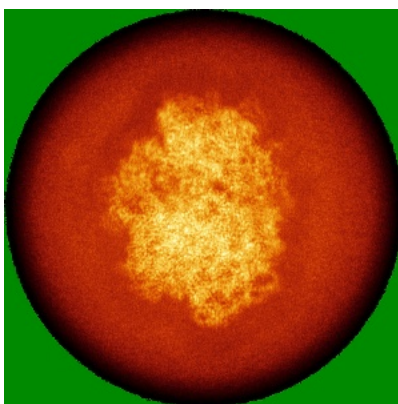


Z

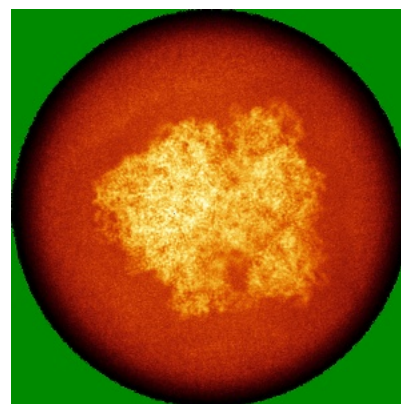
### 6.4.2 Raw map



X



Y



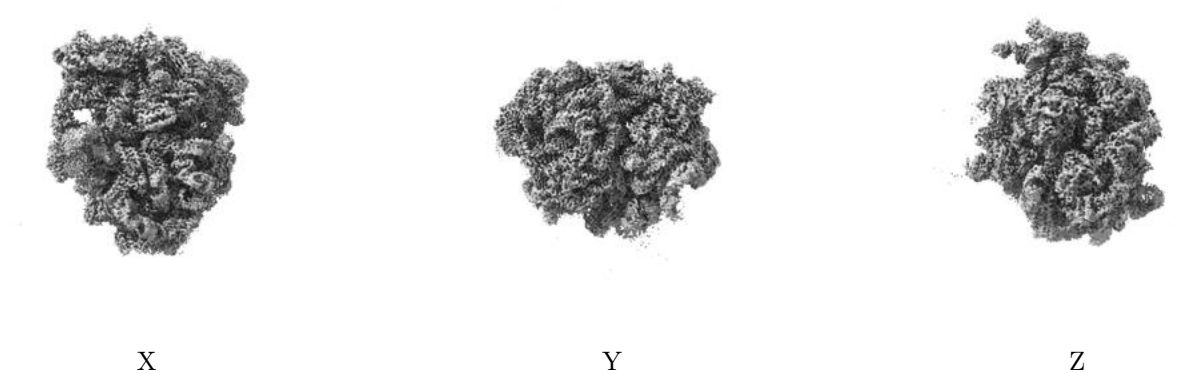
Z

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.



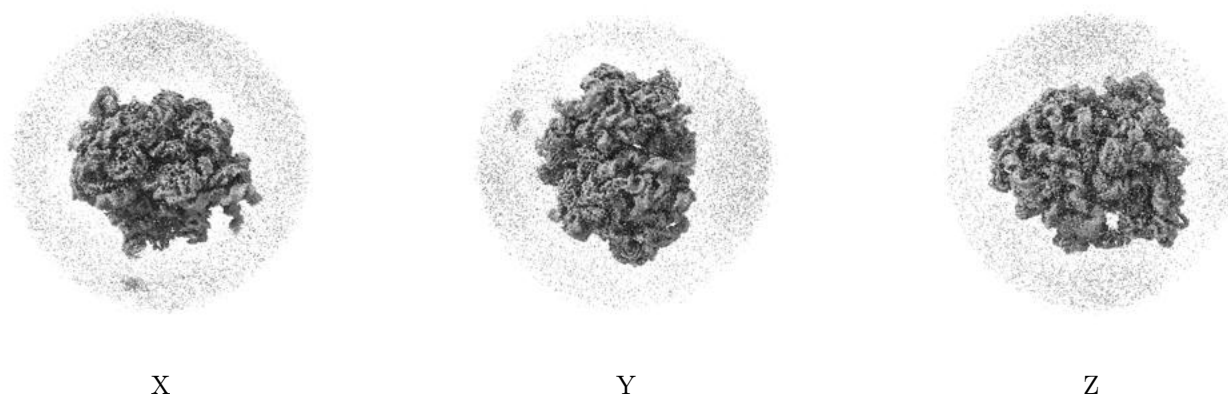
## 6.5 Orthogonal surface views [i](#)

### 6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 3.7. 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](#)

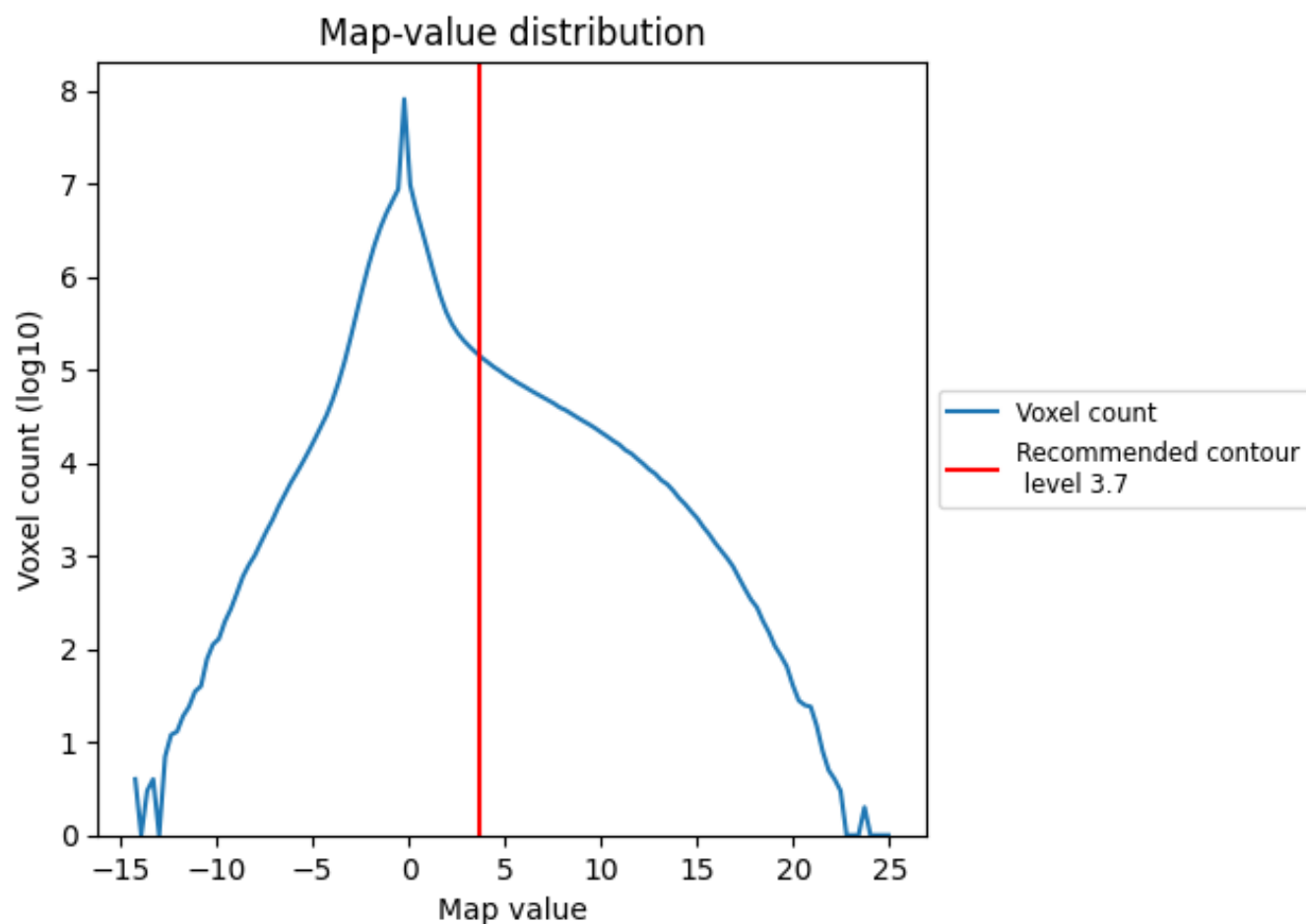
This section was not generated. No masks/segmentation were deposited.



## 7 Map analysis [i](#)

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

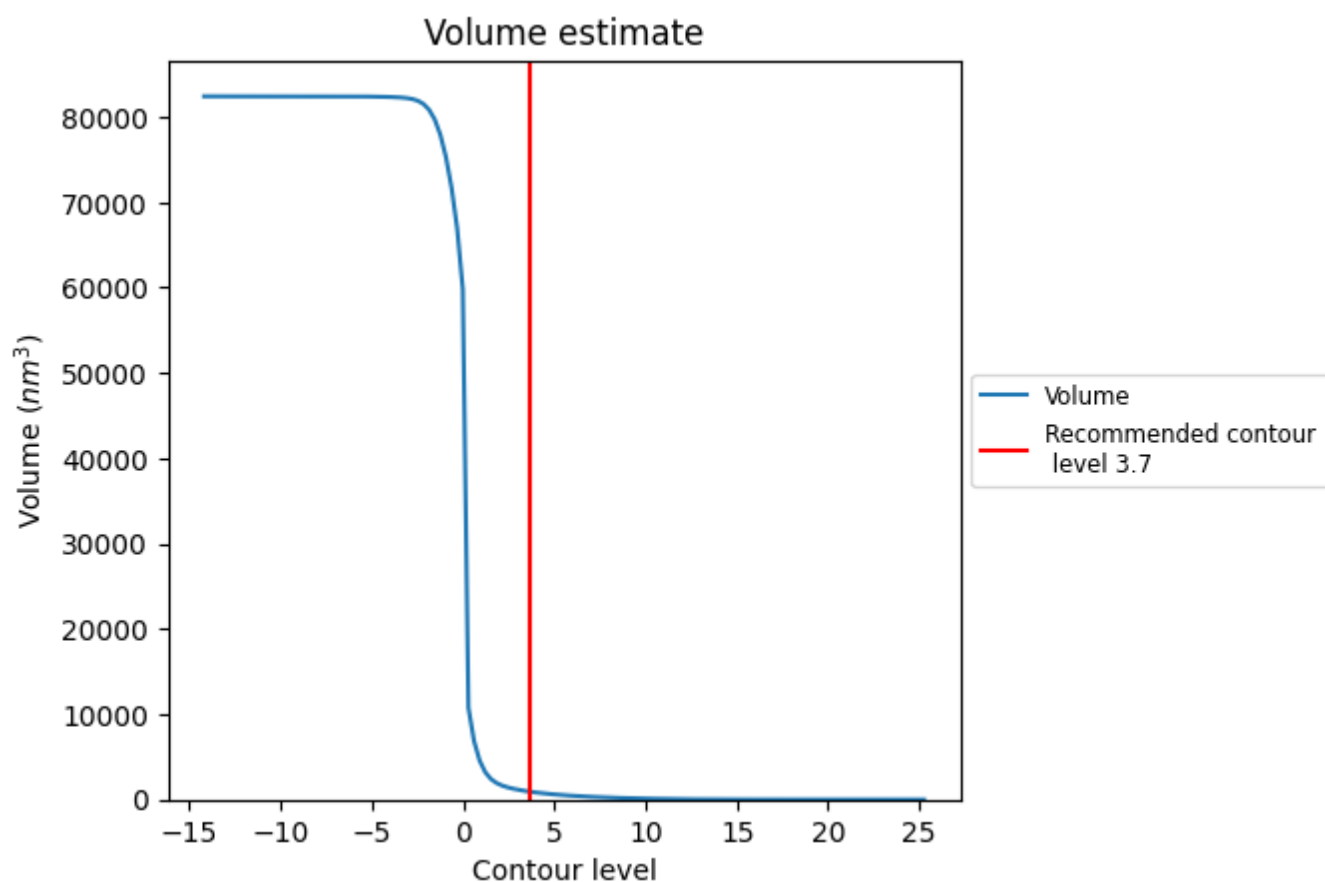
### 7.1 Map-value distribution [i](#)



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](#)

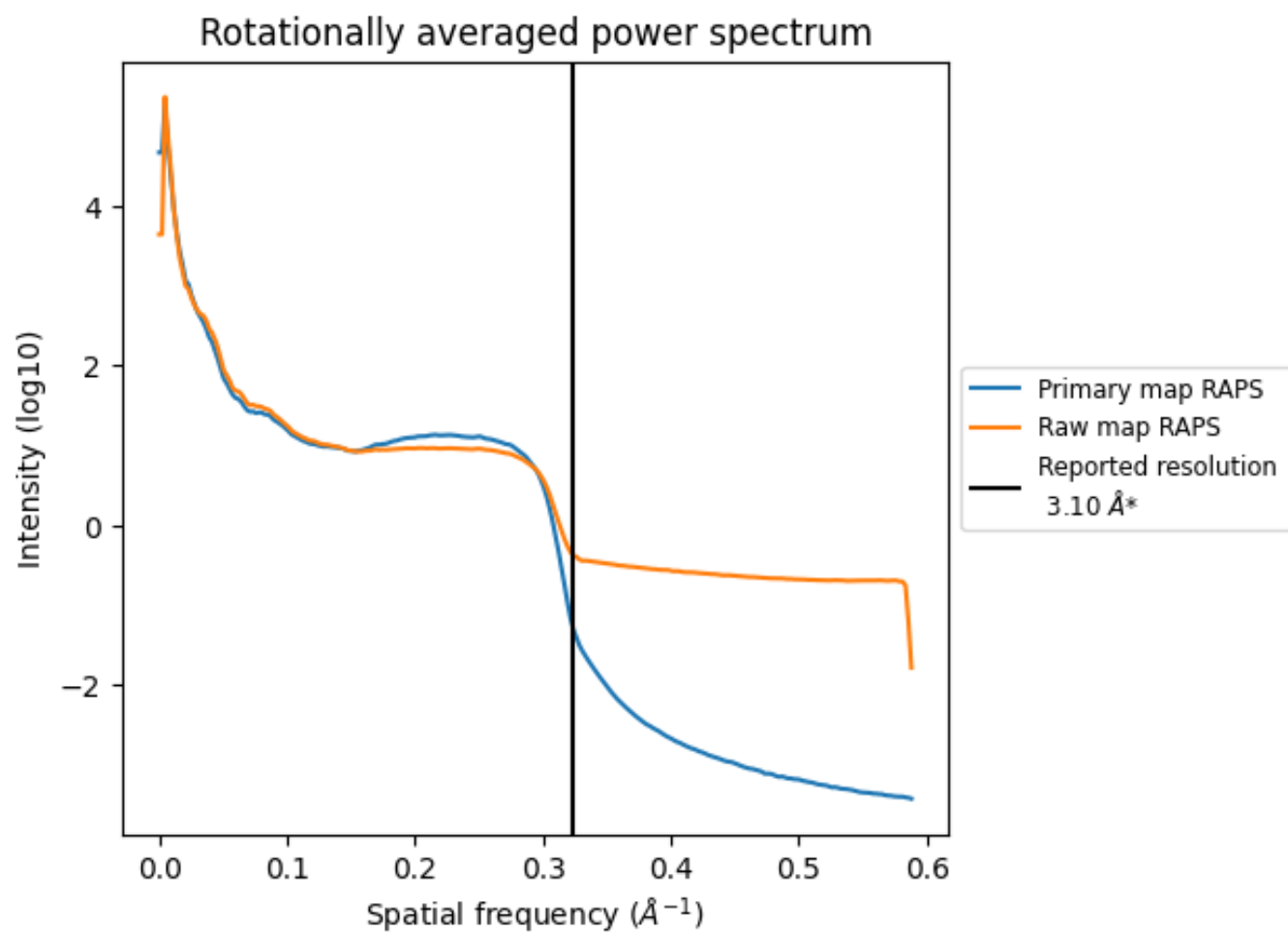


The volume at the recommended contour level is 909 nm<sup>3</sup>; this corresponds to an approximate mass of 821 kDa.

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 ⓘ



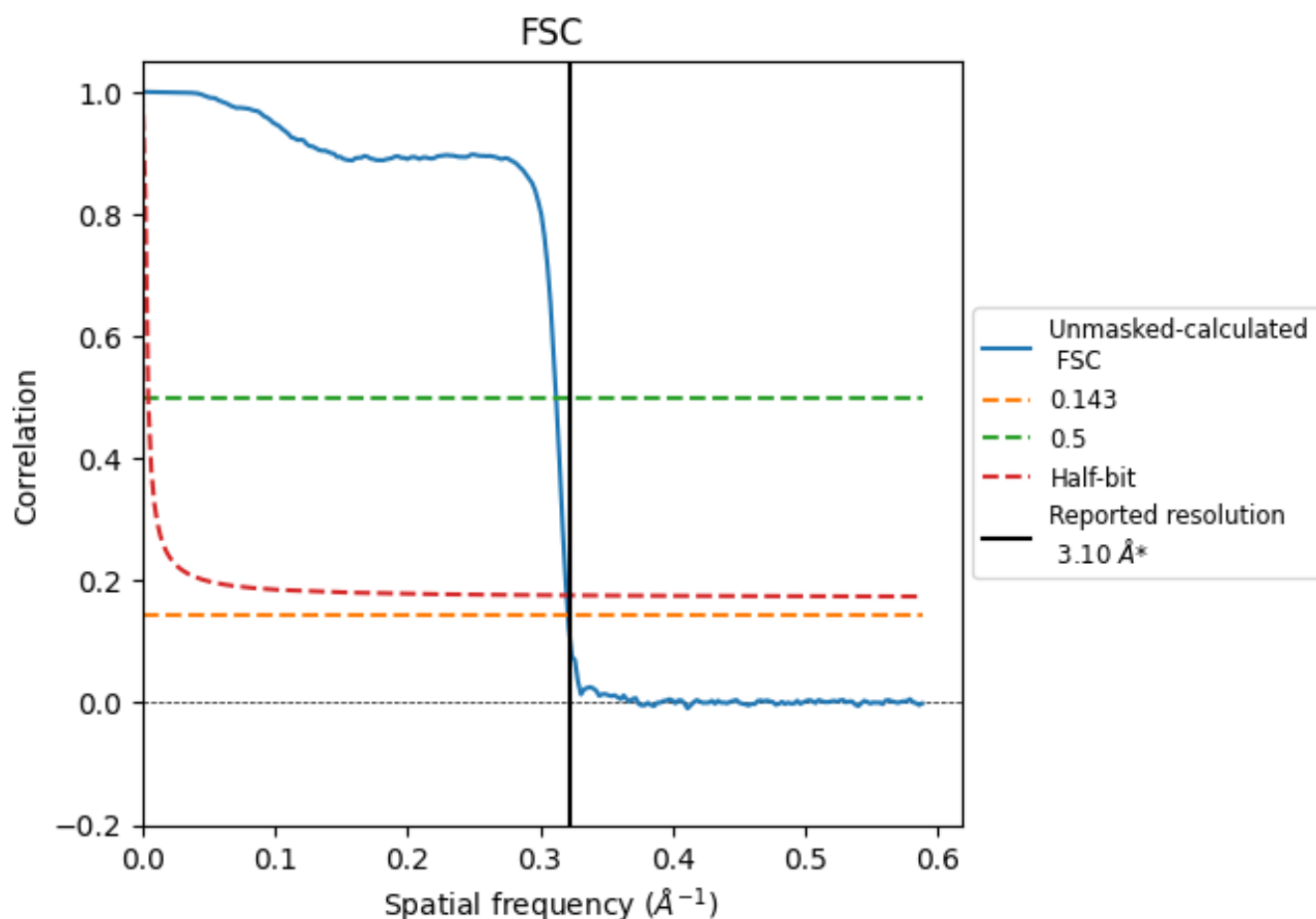
\*Reported resolution corresponds to spatial frequency of 0.323  $\text{\AA}^{-1}$



## 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 0.323  $\text{\AA}^{-1}$



## 8.2 Resolution estimates [i](#)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.10	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.11	3.20	3.12

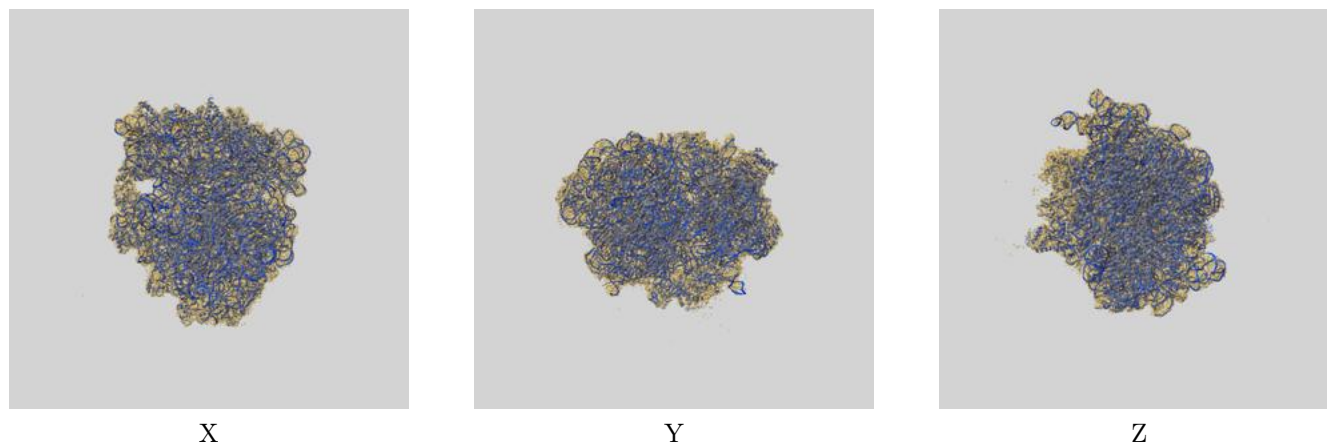
\*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.



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

This section contains information regarding the fit between EMDB map EMD-29627 and PDB model 8FZG. Per-residue inclusion information can be found in section 3 on page 17.

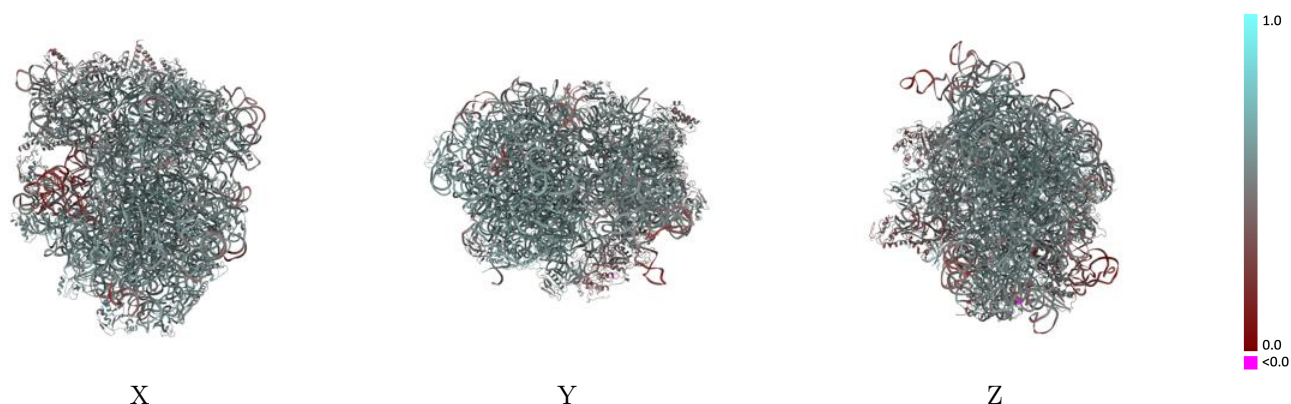
### 9.1 Map-model overlay [i](#)



The images above show the 3D surface view of the map at the recommended contour level 3.7 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.

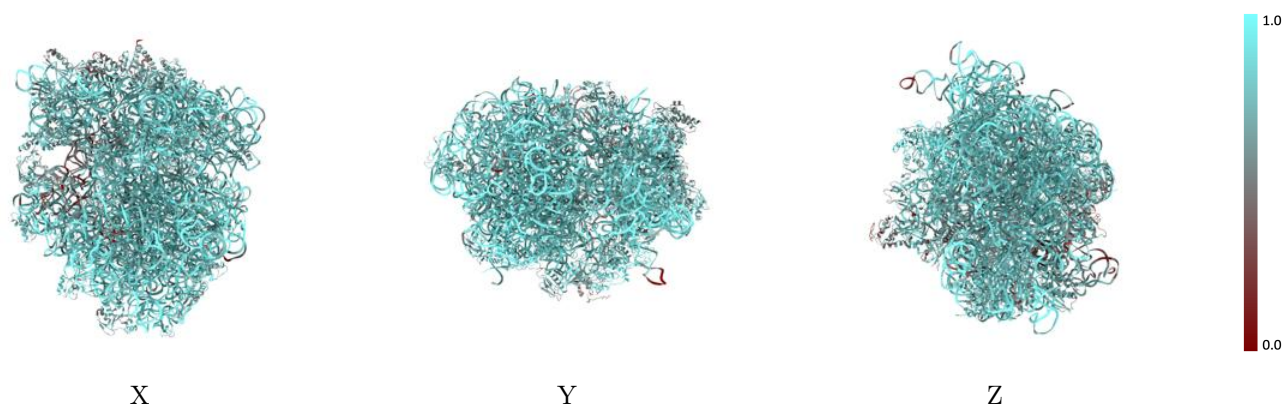


## 9.2 Q-score mapped to coordinate model [i](#)



The images above show the model with each residue coloured according 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.

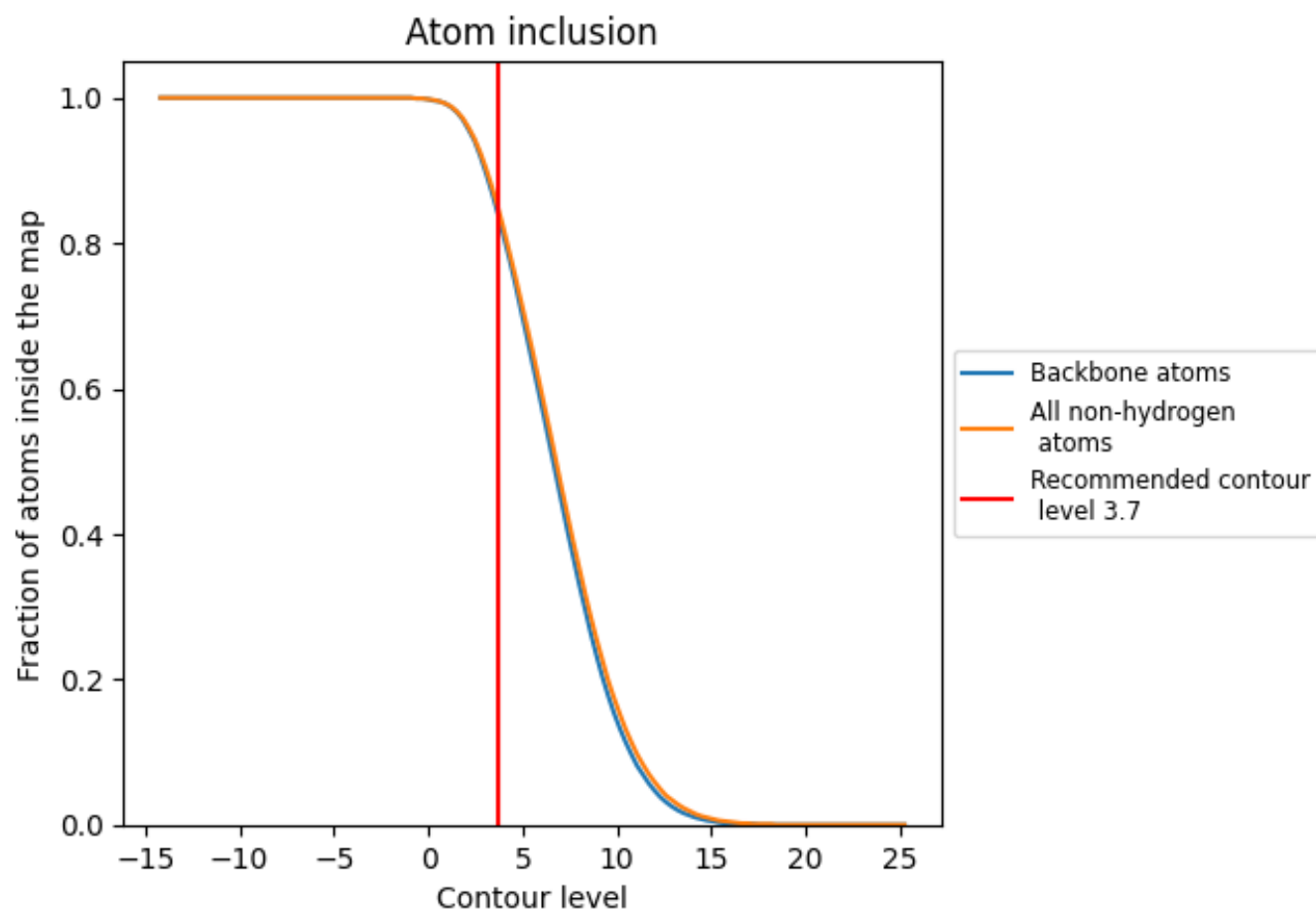
## 9.3 Atom inclusion mapped to coordinate model [i](#)



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 (3.7).



## 9.4 Atom inclusion [i](#)









































































At the recommended contour level, 84% of all backbone atoms, 85% 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 (3.7) and Q-score for the entire model and for each chain.



















































Chain	Atom inclusion	Q-score
All	 0.8490	 0.5370
1	 0.7740	 0.5530
2	 0.8420	 0.5740
3	 0.6690	 0.4920
4	 0.8520	 0.5880
5	 0.7990	 0.5540
6	 0.8650	 0.5940
7	 0.8780	 0.6010
8	 0.8570	 0.5850
A	 0.9050	 0.5500
B	 0.8960	 0.5380
C	 0.8510	 0.5920
D	 0.8490	 0.5820
E	 0.8170	 0.5680
F	 0.7530	 0.5270
G	 0.7350	 0.5310
H	 0.1550	 0.4190
I	 0.4560	 0.3480
J	 0.6020	 0.3850
L	 0.8550	 0.5890
M	 0.8100	 0.5880
N	 0.8460	 0.5790
O	 0.8370	 0.5890
P	 0.8860	 0.5990
Q	 0.8020	 0.5540
R	 0.7860	 0.5780
S	 0.9000	 0.5920
T	 0.8420	 0.5720
U	 0.8410	 0.5790
V	 0.7880	 0.5680
W	 0.7730	 0.5440
X	 0.8020	 0.5650
Y	 0.8520	 0.5920
Z	 0.8140	 0.5750
a	 0.8930	 0.5320



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Chain	Atom inclusion	Q-score
b	 0.5710	 0.4660
c	 0.7270	 0.5300
d	 0.7370	 0.5100
e	 0.7950	 0.5490
f	 0.7350	 0.4930
g	 0.6330	 0.4820
h	 0.7950	 0.5600
i	 0.7350	 0.5090
j	 0.6730	 0.4750
k	 0.7430	 0.5230
l	 0.8010	 0.5720
m	 0.7310	 0.5290
n	 0.7780	 0.5310
o	 0.7750	 0.5360
p	 0.7910	 0.5410
q	 0.7580	 0.5500
r	 0.7470	 0.5350
s	 0.7530	 0.5270
t	 0.7660	 0.5490
u	 0.6050	 0.4970
v	 0.8900	 0.4390
w	 0.6780	 0.5090
x	 0.8360	 0.5380
y	 0.3720	 0.2810
z	 0.7500	 0.5340