



## wwPDB EM Validation Summary Report ⓘ

Nov 20, 2022 – 08:50 am GMT

PDB ID : 6HIZ  
EMDB ID : EMD-0233  
Title : Cryo-EM structure of the Trypanosoma brucei mitochondrial ribosome - This entry contains the head of the small mitoribosomal subunit  
Authors : Ramrath, D.J.F.; Niemann, M.; Leibundgut, M.; Bieri, P.; Prange, C.; Horn, E.K.; Leitner, A.; Boehringer, A.; Schneider, A.; Ban, N.  
Deposited on : 2018-08-31  
Resolution : 3.08 Å(reported)

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

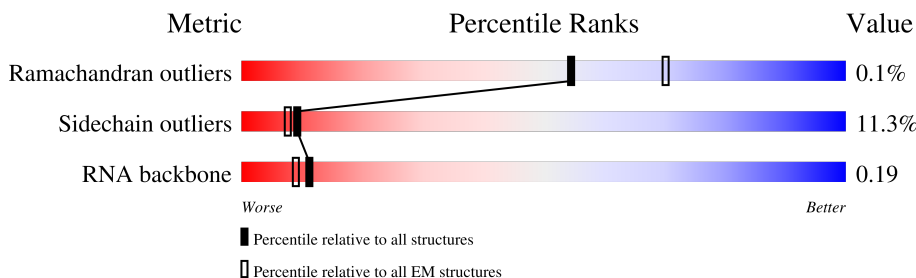
EMDB validation analysis : 0.0.1.dev43  
Mogul : 1.8.4, CSD as541be (2020)  
MolProbity : 4.02b-467  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
MapQ : 1.9.9  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry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

# 1 Overall quality at a glance i

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

The reported resolution of this entry is 3.08 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.











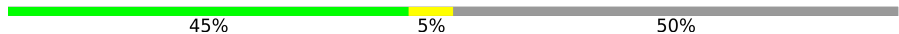









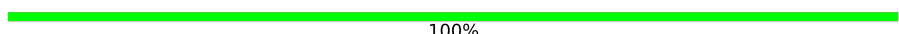
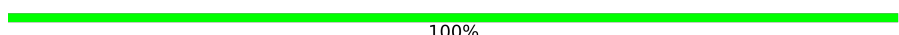
Metric	Whole archive (#Entries)	EM structures (#Entries)
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826
RNA backbone	4643	859

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

Mol	Chain	Length	Quality of chain
1	DA	1788	
2	DL	307	
3	DB	1181	
4	DC	1165	
5	DE	747	
6	DF	666	
7	DG	631	
8	DH	581	

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Mol	Chain	Length	Quality of chain
9	DJ	396	 71% 8% 20%
10	DK	324	 73% 5% 21%
11	DT	247	 86% 11%
12	DV	183	 77% 11% 13%
13	DW	179	 83% 7% 10%
14	DX	169	 75% 9% 17%
15	DY	163	 83% 12% 6%
16	CC	74	 84% 16%
17	CI	443	 45% 5% 50%
18	CJ	817	 88% 10%
19	CK	326	 14% 84%
20	CN	166	 83% 12% 5%
21	CR	320	 11% 86%
22	CS	244	 53% 5% 42%
23	Cg	498	 88% 9%
24	Ci	181	 79% 12% 9%
25	Ck	874	 73% 7% 20%
26	CA	611	 9% 14% 77%
27	UO	5	 100%
28	UP	7	 100%

## 2 Entry composition i

There are 33 unique types of molecules in this entry. The entry contains 76845 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called mS48.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	DA	131	993	629	174	186	4	0	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DA	894	HIS	ASN	conflict	UNP Q57UJ2
DA	1181	THR	ILE	conflict	UNP Q57UJ2
DA	1333	ALA	VAL	conflict	UNP Q57UJ2
DA	1700	ARG	HIS	conflict	UNP Q57UJ2
DA	1761	LYS	ARG	conflict	UNP Q57UJ2

- Molecule 2 is a protein called mS59.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	DL	143	1153	733	215	202	3	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DL	274	THR	ALA	conflict	UNP Q38BS2

- Molecule 3 is a protein called mS49.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	DB	1111	9148	5691	1717	1711	29	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DB	23	VAL	ALA	conflict	UNP Q586P5

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Chain	Residue	Modelled	Actual	Comment	Reference
DB	359	ILE	THR	conflict	UNP Q586P5
DB	384	GLN	HIS	conflict	UNP Q586P5
DB	402	THR	ILE	conflict	UNP Q586P5
DB	423	THR	ALA	conflict	UNP Q586P5
DB	586	ARG	HIS	conflict	UNP Q586P5
DB	593	ARG	LYS	conflict	UNP Q586P5
DB	647	SER	GLY	conflict	UNP Q586P5

- Molecule 4 is a protein called mS50.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	DC	1095	8748	5519	1544	1654	31	0	0

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DC	53	ALA	THR	conflict	UNP Q57YB5
DC	365	LYS	GLU	conflict	UNP Q57YB5
DC	385	THR	ALA	conflict	UNP Q57YB5
DC	405	ILE	VAL	conflict	UNP Q57YB5
DC	641	SER	PRO	conflict	UNP Q57YB5
DC	651	LYS	GLU	conflict	UNP Q57YB5
DC	731	GLU	ASP	conflict	UNP Q57YB5
DC	814	GLN	HIS	conflict	UNP Q57YB5
DC	1097	ALA	VAL	conflict	UNP Q57YB5
DC	1113	THR	ILE	conflict	UNP Q57YB5

- Molecule 5 is a protein called mS52.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	DE	590	4831	3075	874	863	19	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DE	514	THR	SER	conflict	UNP Q386Q7

- Molecule 6 is a protein called mS53.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	DF	590	4747	2979	896	847	25	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DF	18	THR	ALA	conflict	UNP Q38ET1
DF	258	ASP	ASN	conflict	UNP Q38ET1
DF	372	ASN	ASP	conflict	UNP Q38ET1
DF	406	ASN	SER	conflict	UNP Q38ET1
DF	510	ASP	GLY	conflict	UNP Q38ET1
DF	577	ALA	VAL	conflict	UNP Q38ET1
DF	636	UNK	GLY	conflict	UNP Q38ET1
DF	638	LYS	ARG	conflict	UNP Q38ET1

- Molecule 7 is a protein called mS54.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
7	DG	566	4575	2875	835	834	31	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DG	428	ASN	SER	conflict	UNP Q57ZP8
DG	429	GLY	SER	conflict	UNP Q57ZP8

- Molecule 8 is a protein called mS55.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
8	DH	564	4578	2872	850	834	22	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DH	191	HIS	GLN	conflict	UNP Q580V1
DH	194	PRO	ARG	conflict	UNP Q580V1
DH	488	GLY	SER	conflict	UNP Q580V1

- Molecule 9 is a protein called mS57.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
9	DJ	315	2572	1646	452	460	14	0	0

- Molecule 10 is a protein called mS58.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
10	DK	255	2007	1260	365	377	5	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DK	61	SER	PRO	conflict	UNP Q38BP1
DK	257	GLY	SER	conflict	UNP Q38BP1

- Molecule 11 is a protein called mS67.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
11	DT	239	2058	1321	364	362	11	0	0

- Molecule 12 is a protein called mS69.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
12	DV	160	1346	855	252	235	4	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DV	163	ALA	THR	conflict	UNP Q57UZ6

- Molecule 13 is a protein called mS70.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
13	DW	161	1359	866	260	228	5	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
DW	74	THR	MET	conflict	UNP Q383N9

- Molecule 14 is a protein called mS71.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
14	DX	141	1196	762	226	201	7	0	0

- Molecule 15 is a protein called mS72.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
15	DY	154	1293	827	245	216	5	0	0

- Molecule 16 is a protein called uS3m.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
16	CC	74	646	451	96	98	1	0	0

- Molecule 17 is a protein called uS9m.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
17	CI	222	1754	1101	330	313	10	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
CI	279	UNK	ARG	conflict	UNP Q57W62
CI	370	ALA	VAL	conflict	UNP Q57W62

- Molecule 18 is a protein called uS10m.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
18	CJ	800	6516	4119	1151	1216	30	0	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
CJ	311	LEU	TYR	conflict	UNP Q57Z45
CJ	484	HIS	ARG	conflict	UNP Q57Z45
CJ	488	SER	ASN	conflict	UNP Q57Z45
CJ	594	GLU	VAL	conflict	UNP Q57Z45

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Chain	Residue	Modelled	Actual	Comment	Reference
CJ	629	ARG	LYS	conflict	UNP Q57Z45

- Molecule 19 is a protein called uS11m.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
19	CK	52	438	272	90	74	2	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
CK	3	ARG	GLN	conflict	UNP Q389T7
CK	138	UNK	ILE	conflict	UNP Q389T7

- Molecule 20 is a protein called uS14m.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
20	CN	157	1322	843	251	220	8	0	0

- Molecule 21 is a protein called uS18m.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
21	CR	44	353	217	64	71	1	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
CR	8	ILE	VAL	conflict	UNP Q38AS2

- Molecule 22 is a protein called uS19m.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
22	CS	142	1175	761	210	198	6	0	0

There are 72 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
CS	-71	MET	-	initiating methionine	UNP Q584T8

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Chain	Residue	Modelled	Actual	Comment	Reference
CS	-70	ALA	-	expression tag	UNP Q584T8
CS	-69	PHE	-	expression tag	UNP Q584T8
CS	-68	ARG	-	expression tag	UNP Q584T8
CS	-67	ASN	-	expression tag	UNP Q584T8
CS	-66	THR	-	expression tag	UNP Q584T8
CS	-65	PHE	-	expression tag	UNP Q584T8
CS	-64	THR	-	expression tag	UNP Q584T8
CS	-63	THR	-	expression tag	UNP Q584T8
CS	-62	PRO	-	expression tag	UNP Q584T8
CS	-61	GLY	-	expression tag	UNP Q584T8
CS	-60	LYS	-	expression tag	UNP Q584T8
CS	-59	PHE	-	expression tag	UNP Q584T8
CS	-58	SER	-	expression tag	UNP Q584T8
CS	-57	THR	-	expression tag	UNP Q584T8
CS	-56	VAL	-	expression tag	UNP Q584T8
CS	-55	SER	-	expression tag	UNP Q584T8
CS	-54	LYS	-	expression tag	UNP Q584T8
CS	-53	ASN	-	expression tag	UNP Q584T8
CS	-52	ILE	-	expression tag	UNP Q584T8
CS	-51	VAL	-	expression tag	UNP Q584T8
CS	-50	LEU	-	expression tag	UNP Q584T8
CS	-49	LEU	-	expression tag	UNP Q584T8
CS	-48	LEU	-	expression tag	UNP Q584T8
CS	-47	ILE	-	expression tag	UNP Q584T8
CS	-46	TRP	-	expression tag	UNP Q584T8
CS	-45	ARG	-	expression tag	UNP Q584T8
CS	-44	VAL	-	expression tag	UNP Q584T8
CS	-43	LYS	-	expression tag	UNP Q584T8
CS	-42	VAL	-	expression tag	UNP Q584T8
CS	-41	PHE	-	expression tag	UNP Q584T8
CS	-40	LEU	-	expression tag	UNP Q584T8
CS	-39	ARG	-	expression tag	UNP Q584T8
CS	-38	ALA	-	expression tag	UNP Q584T8
CS	-37	GLU	-	expression tag	UNP Q584T8
CS	-36	GLY	-	expression tag	UNP Q584T8
CS	-35	PHE	-	expression tag	UNP Q584T8
CS	-34	ALA	-	expression tag	UNP Q584T8
CS	-33	HIS	-	expression tag	UNP Q584T8
CS	-32	SER	-	expression tag	UNP Q584T8
CS	-31	LEU	-	expression tag	UNP Q584T8
CS	-30	VAL	-	expression tag	UNP Q584T8
CS	-29	MET	-	expression tag	UNP Q584T8

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Chain	Residue	Modelled	Actual	Comment	Reference
CS	-28	LEU	-	expression tag	UNP Q584T8
CS	-27	PRO	-	expression tag	UNP Q584T8
CS	-26	VAL	-	expression tag	UNP Q584T8
CS	-25	SER	-	expression tag	UNP Q584T8
CS	-24	LEU	-	expression tag	UNP Q584T8
CS	-23	TYR	-	expression tag	UNP Q584T8
CS	-22	SER	-	expression tag	UNP Q584T8
CS	-21	LYS	-	expression tag	UNP Q584T8
CS	-20	ILE	-	expression tag	UNP Q584T8
CS	-19	LEU	-	expression tag	UNP Q584T8
CS	-18	LEU	-	expression tag	UNP Q584T8
CS	-17	CYS	-	expression tag	UNP Q584T8
CS	-16	ASP	-	expression tag	UNP Q584T8
CS	-15	VAL	-	expression tag	UNP Q584T8
CS	-14	LYS	-	expression tag	UNP Q584T8
CS	-13	LYS	-	expression tag	UNP Q584T8
CS	-12	LYS	-	expression tag	UNP Q584T8
CS	-11	ILE	-	expression tag	UNP Q584T8
CS	-10	VAL	-	expression tag	UNP Q584T8
CS	-9	TYR	-	expression tag	UNP Q584T8
CS	-8	PHE	-	expression tag	UNP Q584T8
CS	-7	HIS	-	expression tag	UNP Q584T8
CS	-6	CYS	-	expression tag	UNP Q584T8
CS	-5	CYS	-	expression tag	UNP Q584T8
CS	-4	THR	-	expression tag	UNP Q584T8
CS	-3	ARG	-	expression tag	UNP Q584T8
CS	-2	LYS	-	expression tag	UNP Q584T8
CS	-1	LYS	-	expression tag	UNP Q584T8
CS	0	SER	-	expression tag	UNP Q584T8

- Molecule 23 is a protein called mS29.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
23	Cg	482	3904	2499	684	701	20	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
Cg	181	VAL	ALA	conflict	UNP Q585C2
Cg	498	ARG	MET	conflict	UNP Q585C2

- Molecule 24 is a protein called mS33.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
24	Ci	165	1348	848	247	244	9	0	0

- Molecule 25 is a protein called mS35.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
25	Ck	703	5596	3503	1017	1050	26	0	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
Ck	107	SER	LEU	conflict	UNP Q387C7
Ck	144	PHE	LEU	conflict	UNP Q387C7
Ck	253	TYR	PHE	conflict	UNP Q387C7
Ck	339	GLU	VAL	conflict	UNP Q387C7
Ck	871	GLY	GLU	conflict	UNP Q387C7

- Molecule 26 is a RNA chain called RNA (143-MER).

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
26	CA	143	3030	1364	522	1001	143	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
CA	473	U	G	conflict	GB 343546

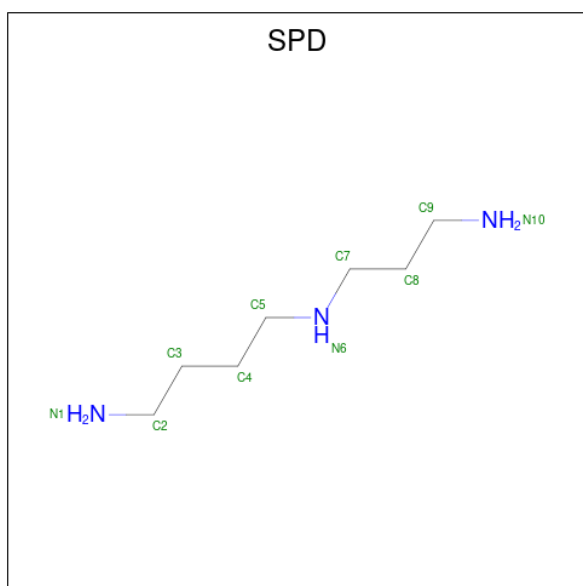
- Molecule 27 is a protein called Unknown protein.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
27	UO	5	30	20	5	5	0	0

- Molecule 28 is a protein called Unknown protein.

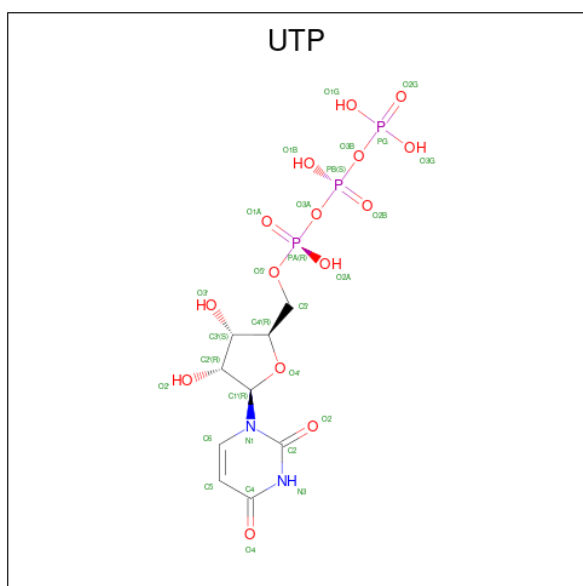
Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
28	UP	7	42	28	7	7	0	0

- Molecule 29 is SPERMIDINE (three-letter code: SPD) (formula:  $C_7H_{19}N_3$ ).



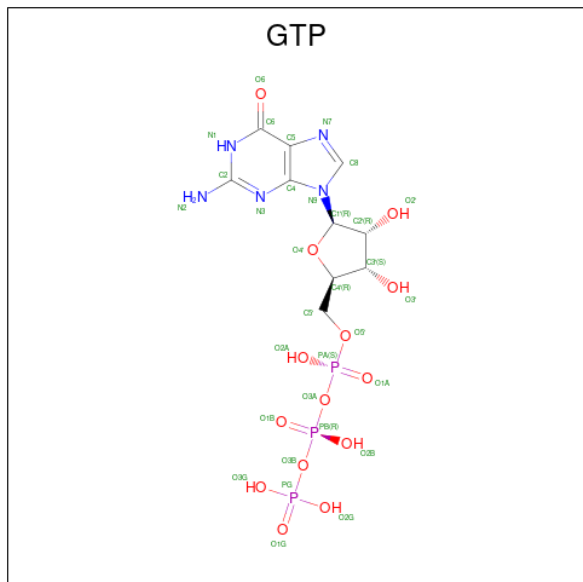
Mol	Chain	Residues	Atoms			AltConf
29	DL	1	Total	C	N	0
			10	7	3	
29	CA	1	Total	C	N	0
			10	7	3	

- Molecule 30 is URIDINE 5'-TRIPHOSPHATE (three-letter code: UTP) (formula:  $C_9H_{15}N_2O_{15}P_3$ ).



Mol	Chain	Residues	Atoms					AltConf
30	DJ	1	Total	C	N	O	P	0
			29	9	2	15	3	

- Molecule 31 is GUANOSINE-5'-TRIPHOSPHATE (three-letter code: GTP) (formula:  $C_{10}H_{16}N_5O_{14}P_3$ ).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
31	Cg	1	32	10	5	14	3	0

- Molecule 32 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
			Total	Mg	
32	Cg	1	1	1	0
32	CA	2	2	2	0

- Molecule 33 is water.

Mol	Chain	Residues	Atoms		AltConf
			Total	O	
33	Cg	3	3	3	0



Table with multiple rows of amino acid sequences and validation metrics.

• Molecule 2: mS59

Chain DL: 43% 53%

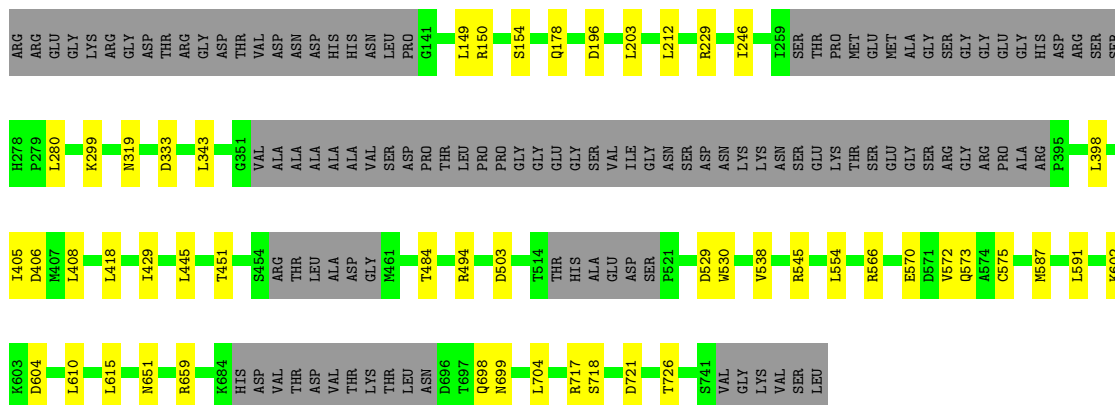
Table with multiple rows of amino acid sequences and validation metrics for molecule mS59.

P271 T286 F306 ASP

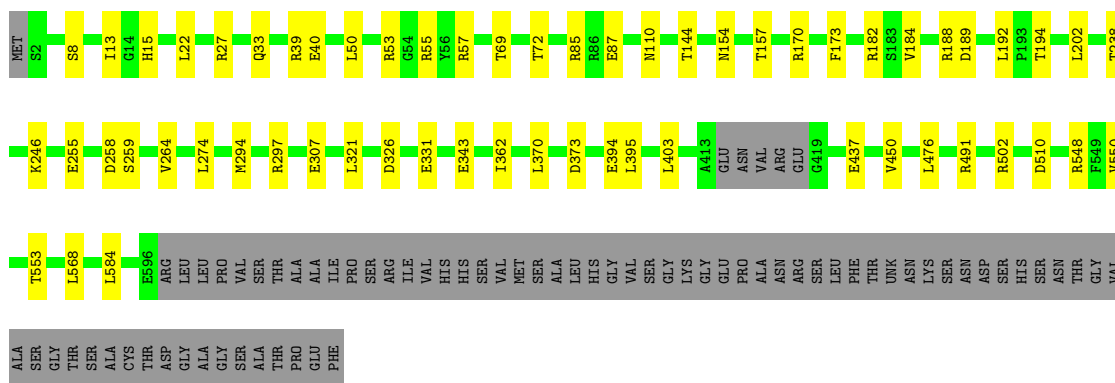
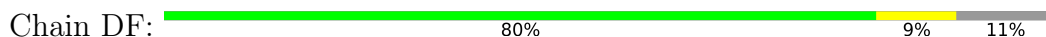




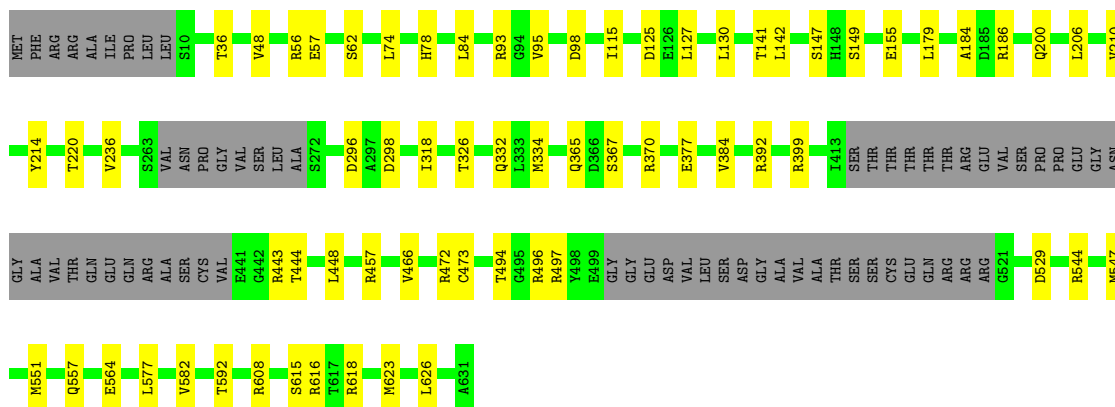
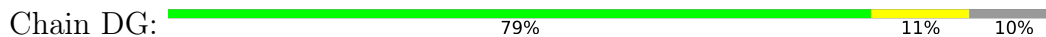




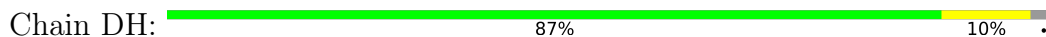
• Molecule 6: mS53



• Molecule 7: mS54



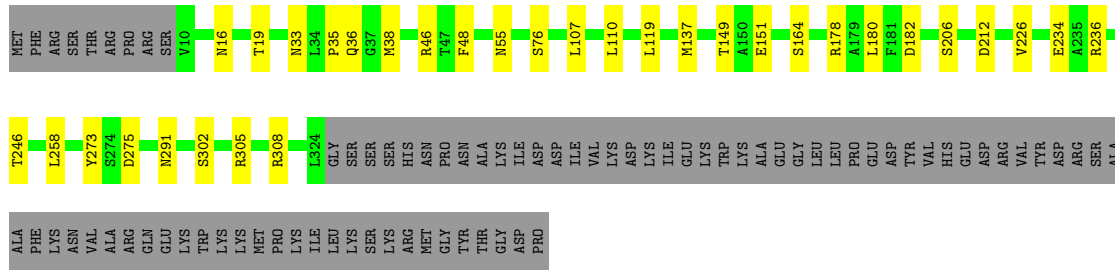
• Molecule 8: mS55





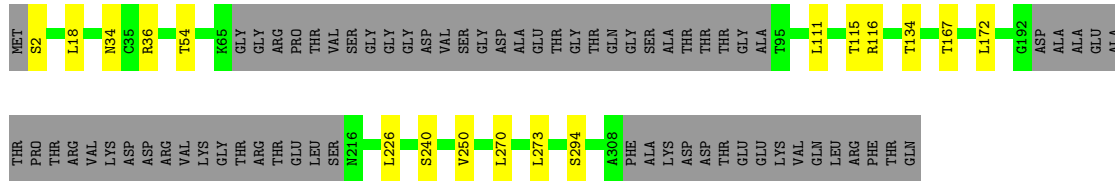
- Molecule 9: mS57

Chain DJ:



- Molecule 10: mS58

Chain DK:



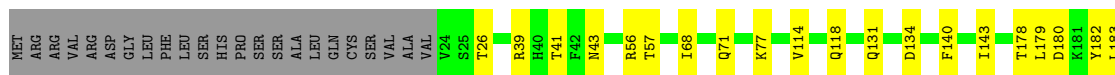
- Molecule 11: mS67

Chain DT:



- Molecule 12: mS69

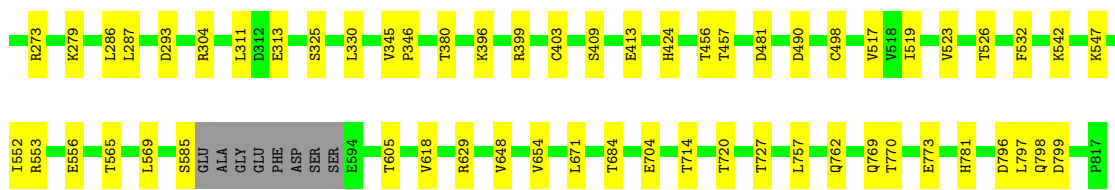
Chain DV:



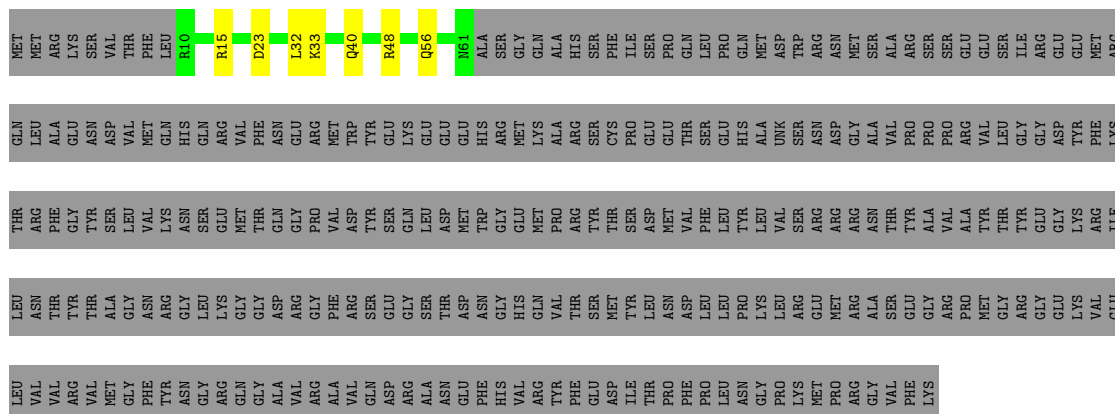
- Molecule 13: mS70

Chain DW:

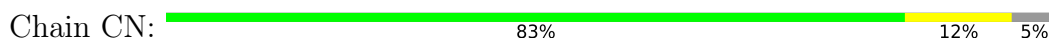




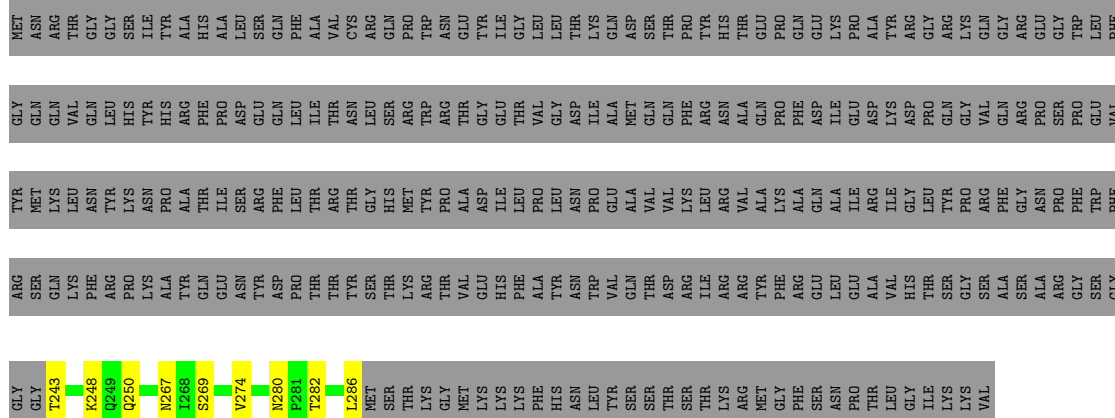
• Molecule 19: uS11m



• Molecule 20: uS14m

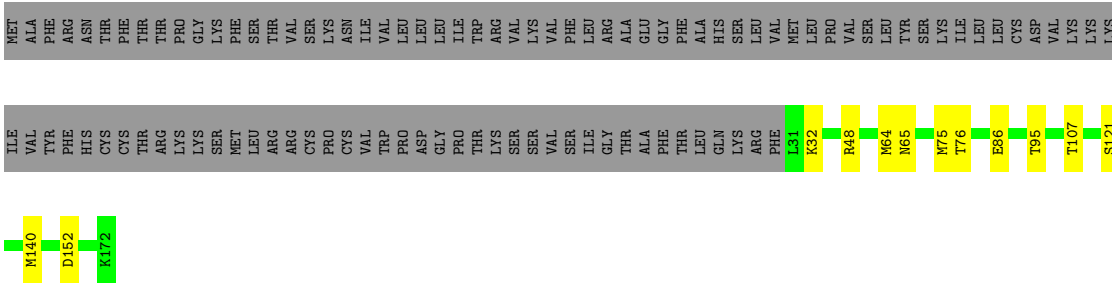


• Molecule 21: uS18m

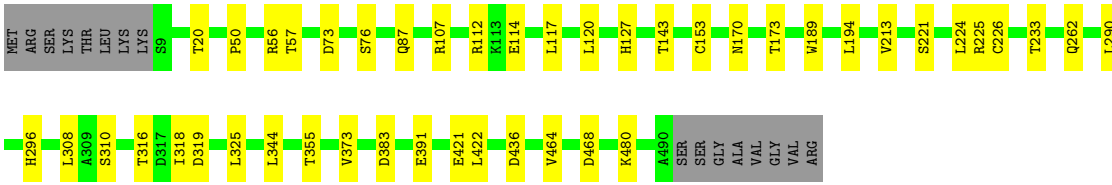
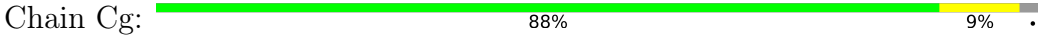


• Molecule 22: uS19m

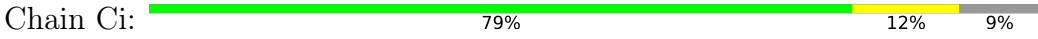




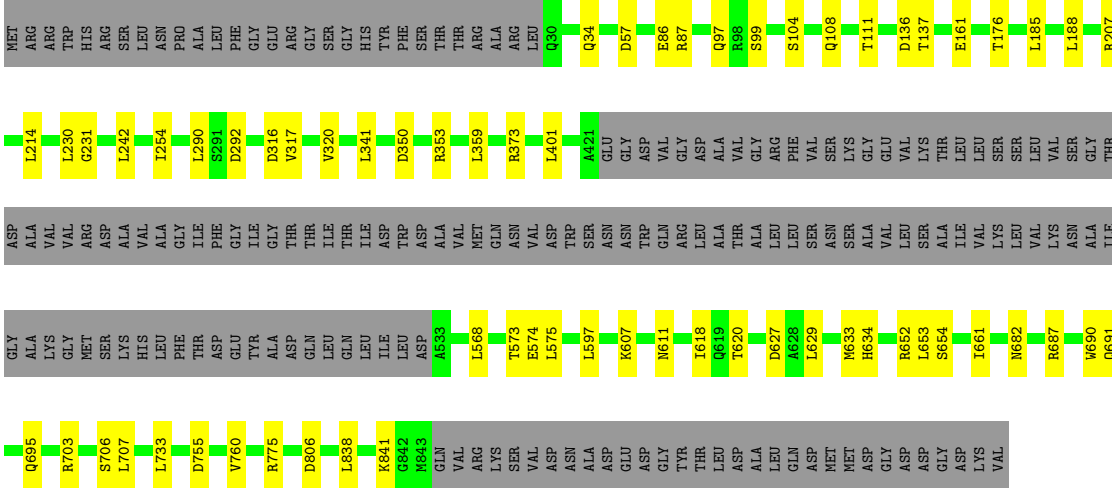
• Molecule 23: mS29



• Molecule 24: mS33

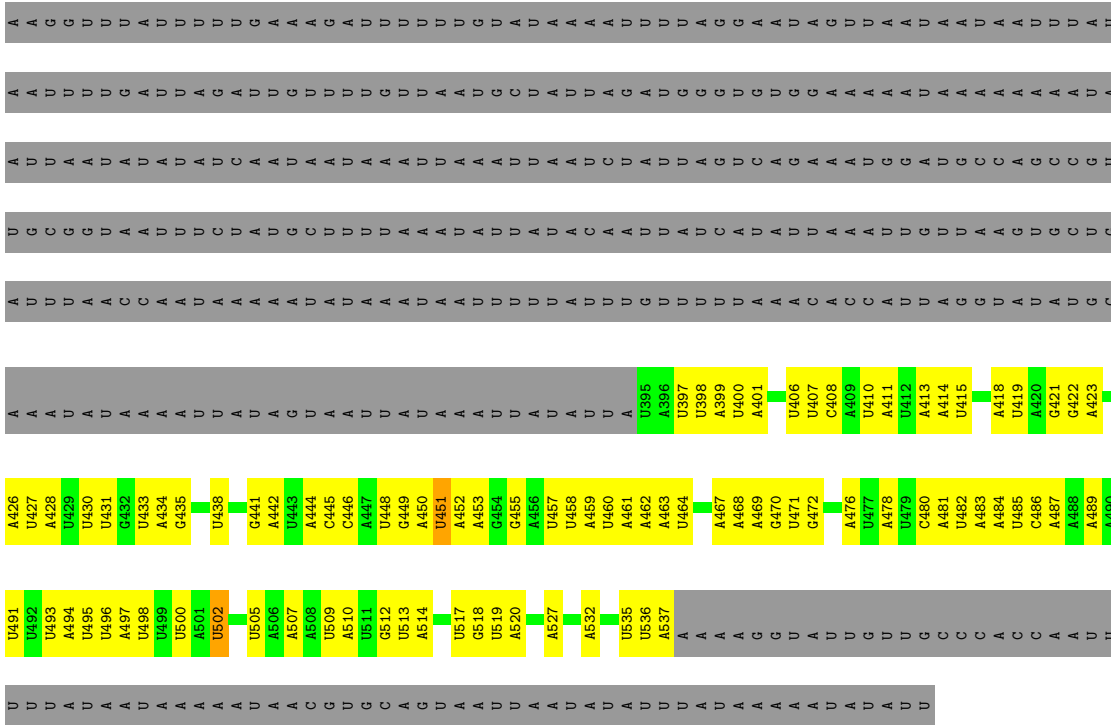


• Molecule 25: mS35



• Molecule 26: RNA (143-MER)





- Molecule 27: Unknown protein

Chain UO:  100%

There are no outlier residues recorded for this chain.

- Molecule 28: Unknown protein

Chain UP:  100%

There are no outlier residues recorded for this chain.

## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	101308	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	40	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	0.587	Depositor
Minimum map value	-0.258	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.016	Depositor
Recommended contour level	0.01	Depositor
Map size (Å)	444.8, 444.8, 444.8	wwPDB
Map dimensions	320, 320, 320	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.39, 1.39, 1.39	Depositor



## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GTP, MG, UTP, SPD

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	DA	0.34	0/1010	0.54	1/1369 (0.1%)
2	DL	0.45	0/1185	0.62	0/1601
3	DB	0.44	0/9369	0.62	0/12692
4	DC	0.41	0/8952	0.57	0/12145
5	DE	0.41	0/4955	0.59	0/6708
6	DF	0.43	0/4856	0.62	2/6581 (0.0%)
7	DG	0.40	0/4674	0.58	0/6333
8	DH	0.46	0/4684	0.62	2/6347 (0.0%)
9	DJ	0.46	0/2649	0.65	0/3598
10	DK	0.45	0/2045	0.59	0/2759
11	DT	0.50	0/2133	0.66	0/2889
12	DV	0.47	0/1382	0.66	1/1871 (0.1%)
13	DW	0.41	0/1407	0.55	0/1916
14	DX	0.45	0/1231	0.66	1/1654 (0.1%)
15	DY	0.50	0/1334	0.63	0/1810
16	CC	0.50	0/666	0.72	0/900
17	CI	0.46	0/1783	0.65	1/2395 (0.0%)
18	CJ	0.52	1/6705 (0.0%)	0.65	0/9124
19	CK	0.41	0/448	0.60	0/600
20	CN	0.50	0/1361	0.67	0/1840
21	CR	0.43	0/361	0.70	0/490
22	CS	0.45	0/1209	0.64	0/1626
23	Cg	0.46	0/4025	0.63	0/5467
24	Ci	0.49	0/1388	0.73	1/1878 (0.1%)
25	Ck	0.42	0/5696	0.61	2/7705 (0.0%)
26	CA	0.59	0/3392	1.07	9/5275 (0.2%)
All	All	0.45	1/78900 (0.0%)	0.65	20/107573 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a

sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
2	DL	0	2
3	DB	0	2
4	DC	0	2
7	DG	0	2
9	DJ	0	1
11	DT	0	1
14	DX	0	1
18	CJ	0	1
23	Cg	0	1
24	Ci	0	1
25	Ck	0	1
All	All	0	15

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
18	CJ	424	HIS	CG-CD2	-8.20	1.21	1.35

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
26	CA	451	U	C2-N1-C1'	7.45	126.64	117.70
26	CA	502	U	C5-C6-N1	-6.87	119.27	122.70
26	CA	422	G	N3-C4-C5	6.34	131.77	128.60
26	CA	451	U	N1-C2-O2	6.29	127.20	122.80
26	CA	451	U	N3-C2-O2	-6.18	117.88	122.20

There are no chirality outliers.

5 of 15 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	DB	383	ARG	Sidechain
3	DB	586	ARG	Sidechain
4	DC	497	PRO	Peptide
2	DL	269	MET	Peptide
2	DL	270	THR	Peptide

## 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

### 5.3.1 Protein backbone

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	DA	129/1788 (7%)	126 (98%)	3 (2%)	0	100	100
2	DL	139/307 (45%)	130 (94%)	9 (6%)	0	100	100
3	DB	1109/1181 (94%)	1078 (97%)	29 (3%)	2 (0%)	47	77
4	DC	1087/1165 (93%)	1052 (97%)	34 (3%)	1 (0%)	51	82
5	DE	576/747 (77%)	564 (98%)	11 (2%)	1 (0%)	47	77
6	DF	586/666 (88%)	569 (97%)	16 (3%)	1 (0%)	47	77
7	DG	558/631 (88%)	543 (97%)	14 (2%)	1 (0%)	47	77
8	DH	560/581 (96%)	540 (96%)	20 (4%)	0	100	100
9	DJ	313/396 (79%)	304 (97%)	8 (3%)	1 (0%)	41	71
10	DK	249/324 (77%)	240 (96%)	9 (4%)	0	100	100
11	DT	237/247 (96%)	233 (98%)	4 (2%)	0	100	100
12	DV	158/183 (86%)	151 (96%)	6 (4%)	1 (1%)	25	57
13	DW	159/179 (89%)	153 (96%)	6 (4%)	0	100	100
14	DX	139/169 (82%)	133 (96%)	6 (4%)	0	100	100
15	DY	152/163 (93%)	148 (97%)	4 (3%)	0	100	100
16	CC	72/74 (97%)	68 (94%)	3 (4%)	1 (1%)	11	38
17	CI	218/443 (49%)	210 (96%)	8 (4%)	0	100	100
18	CJ	796/817 (97%)	765 (96%)	30 (4%)	1 (0%)	51	82
19	CK	50/326 (15%)	47 (94%)	3 (6%)	0	100	100
20	CN	155/166 (93%)	150 (97%)	5 (3%)	0	100	100
21	CR	42/320 (13%)	40 (95%)	2 (5%)	0	100	100
22	CS	140/244 (57%)	135 (96%)	5 (4%)	0	100	100
23	Cg	480/498 (96%)	461 (96%)	19 (4%)	0	100	100
24	Ci	163/181 (90%)	155 (95%)	8 (5%)	0	100	100
25	Ck	699/874 (80%)	671 (96%)	26 (4%)	2 (0%)	41	71

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	8966/12670 (71%)	8666 (97%)	288 (3%)	12 (0%)	54	82

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
9	DJ	36	GLN
12	DV	57	THR
18	CJ	799	ASP
3	DB	1033	TYR
25	Ck	231	GLY

### 5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	DA	111/1514 (7%)	102 (92%)	9 (8%)	11	37
2	DL	123/263 (47%)	112 (91%)	11 (9%)	9	33
3	DB	976/1030 (95%)	874 (90%)	102 (10%)	7	25
4	DC	927/985 (94%)	808 (87%)	119 (13%)	4	17
5	DE	519/644 (81%)	464 (89%)	55 (11%)	6	24
6	DF	500/560 (89%)	443 (89%)	57 (11%)	5	22
7	DG	490/543 (90%)	426 (87%)	64 (13%)	4	16
8	DH	493/504 (98%)	434 (88%)	59 (12%)	5	19
9	DJ	275/347 (79%)	244 (89%)	31 (11%)	6	22
10	DK	209/261 (80%)	192 (92%)	17 (8%)	11	37
11	DT	220/228 (96%)	195 (89%)	25 (11%)	5	22
12	DV	145/165 (88%)	127 (88%)	18 (12%)	4	18
13	DW	148/163 (91%)	136 (92%)	12 (8%)	11	37
14	DX	124/149 (83%)	111 (90%)	13 (10%)	7	25
15	DY	137/146 (94%)	118 (86%)	19 (14%)	3	14
16	CC	73/73 (100%)	62 (85%)	11 (15%)	3	11

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
17	CI	186/370 (50%)	164 (88%)	22 (12%)	5	20
18	CJ	709/723 (98%)	628 (89%)	81 (11%)	5	22
19	CK	47/283 (17%)	40 (85%)	7 (15%)	3	12
20	CN	142/150 (95%)	122 (86%)	20 (14%)	3	14
21	CR	41/279 (15%)	32 (78%)	9 (22%)	1	3
22	CS	126/220 (57%)	114 (90%)	12 (10%)	8	29
23	Cg	424/437 (97%)	380 (90%)	44 (10%)	7	25
24	Ci	144/160 (90%)	124 (86%)	20 (14%)	3	14
25	Ck	608/747 (81%)	549 (90%)	59 (10%)	8	28
All	All	7897/10944 (72%)	7001 (89%)	896 (11%)	9	22

5 of 896 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
8	DH	450	ASN
25	Ck	703	ARG
13	DW	74	THR
25	Ck	633	MET
23	Cg	296	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 194 such sidechains are listed below:

Mol	Chain	Res	Type
11	DT	139	HIS
18	CJ	134	GLN
11	DT	219	GLN
13	DW	121	HIS
18	CJ	621	ASN

### 5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
26	CA	142/611 (23%)	85 (59%)	2 (1%)

5 of 85 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
26	CA	397	U
26	CA	398	U
26	CA	399	A
26	CA	400	U
26	CA	401	A

All (2) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
26	CA	512	G
26	CA	527	A

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

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 7 ligands modelled in this entry, 3 are monoatomic - leaving 4 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	$\# Z  > 2$
29	SPD	CA	703	-	9,9,9	0.40	0	8,8,8	0.58	0
31	GTP	Cg	501	32	26,34,34	1.26	3 (11%)	32,54,54	1.83	9 (28%)
29	SPD	DL	401	-	9,9,9	0.40	0	8,8,8	1.04	0
30	UTP	DJ	401	-	22,30,30	1.86	7 (31%)	27,47,47	1.27	3 (11%)

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
29	SPD	CA	703	-	-	5/7/7/7	-
31	GTP	Cg	501	32	-	6/18/38/38	0/3/3/3
29	SPD	DL	401	-	-	2/7/7/7	-
30	UTP	DJ	401	-	-	11/20/38/38	0/2/2/2

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
30	DJ	401	UTP	C6-N1	4.09	1.40	1.35
30	DJ	401	UTP	O4'-C1'	3.71	1.46	1.41
31	Cg	501	GTP	C5-C6	-3.70	1.39	1.47
30	DJ	401	UTP	C4-N3	3.65	1.39	1.33
30	DJ	401	UTP	C2'-C1'	2.44	1.57	1.53

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
31	Cg	501	GTP	O3G-PG-O3B	4.60	120.05	104.64
31	Cg	501	GTP	C2-N1-C6	-4.23	117.31	125.10
31	Cg	501	GTP	PB-O3B-PG	-2.66	123.69	132.83
31	Cg	501	GTP	N2-C2-N3	-2.66	114.57	119.74
31	Cg	501	GTP	C8-N7-C5	2.63	108.00	102.99

There are no chirality outliers.

5 of 24 torsion outliers are listed below:

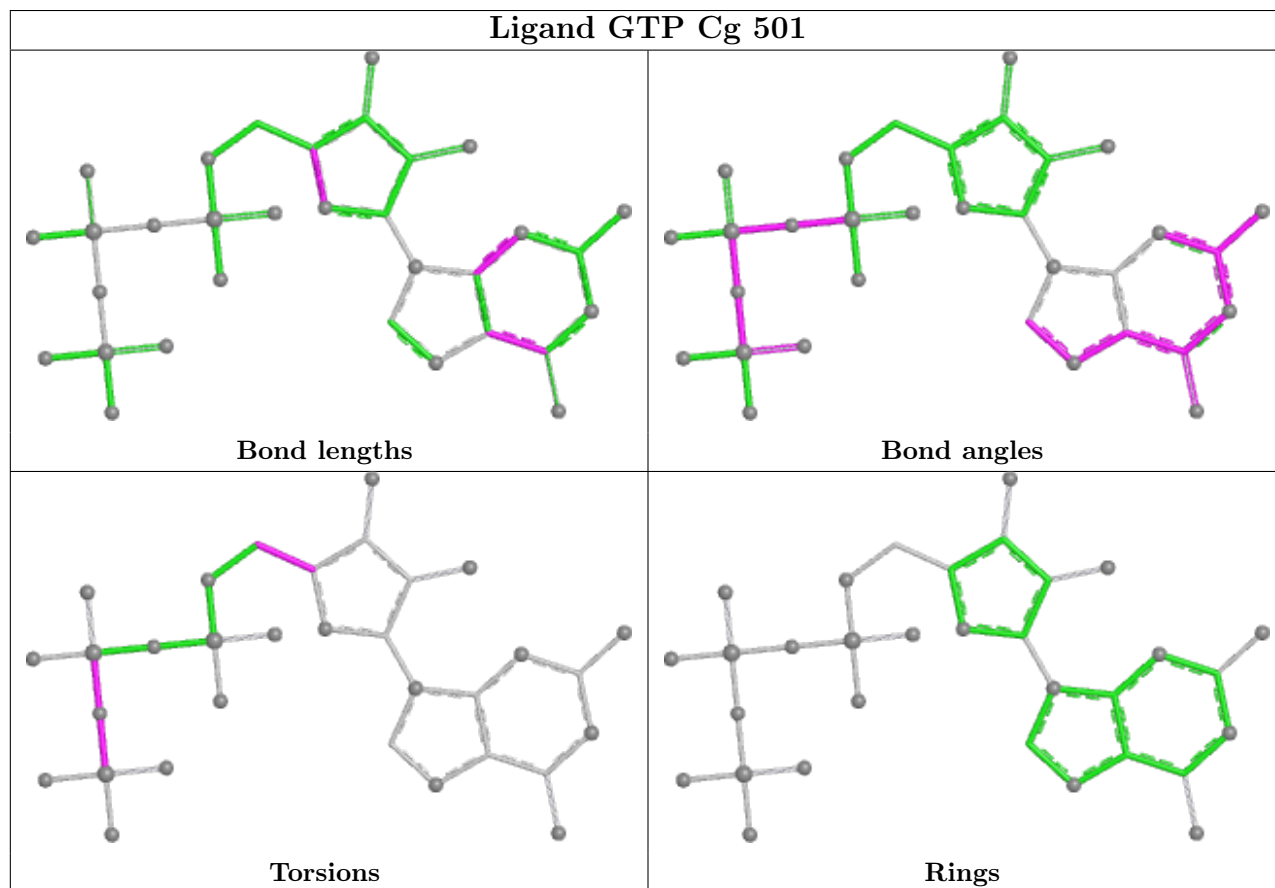
Mol	Chain	Res	Type	Atoms
30	DJ	401	UTP	C5'-O5'-PA-O1A
30	DJ	401	UTP	C5'-O5'-PA-O2A
30	DJ	401	UTP	C5'-O5'-PA-O3A
30	DJ	401	UTP	O4'-C4'-C5'-O5'
30	DJ	401	UTP	O4'-C1'-N1-C6

There are no ring outliers.

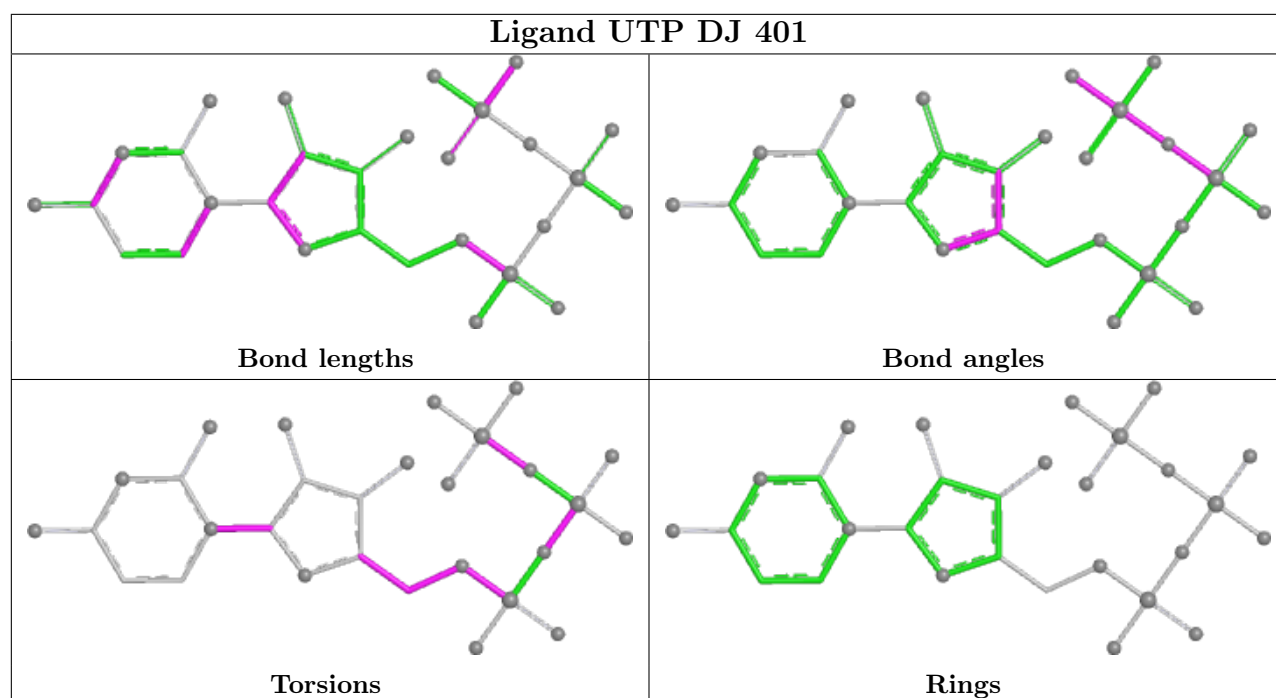
No monomer is involved in short contacts.

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.

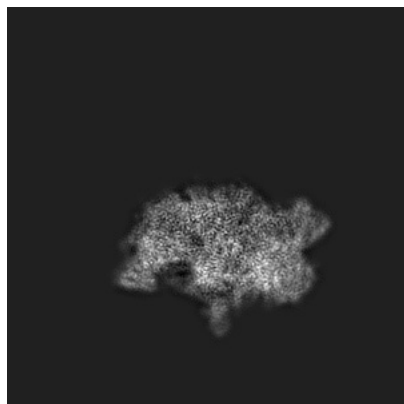
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-0233. These allow visual inspection of the internal detail of the map and identification of artifacts.

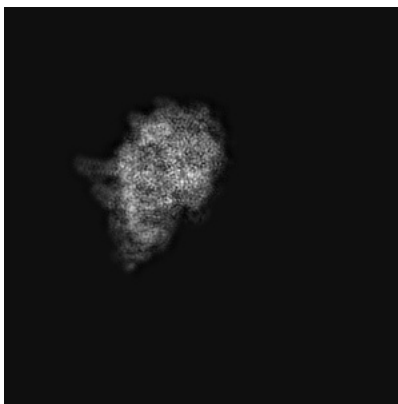
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

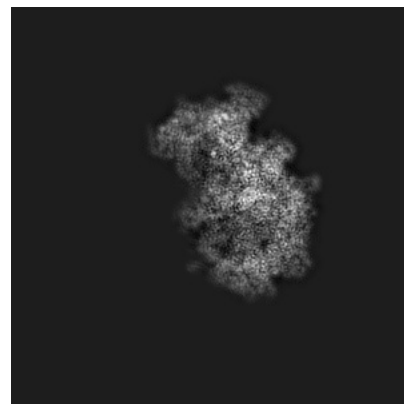
#### 6.1.1 Primary map



X

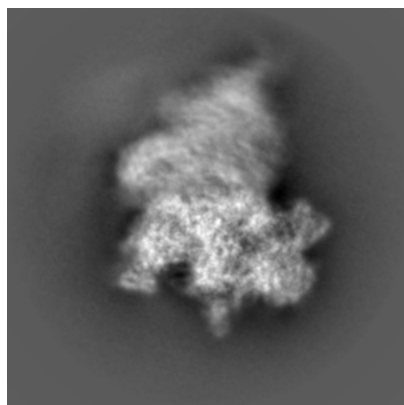


Y

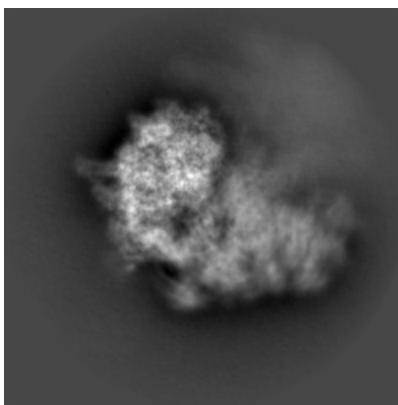


Z

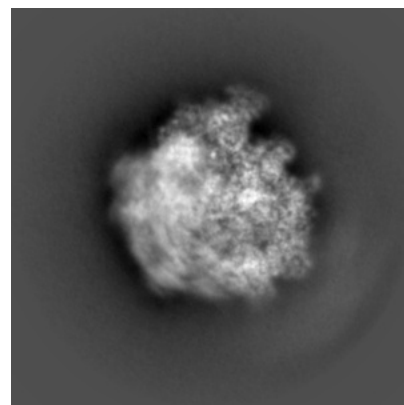
#### 6.1.2 Raw map



X



Y

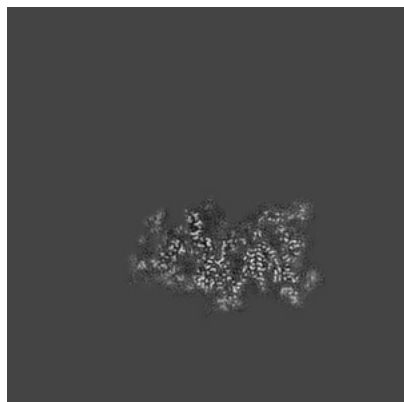


Z

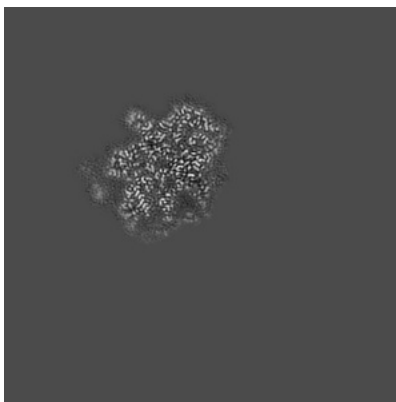
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

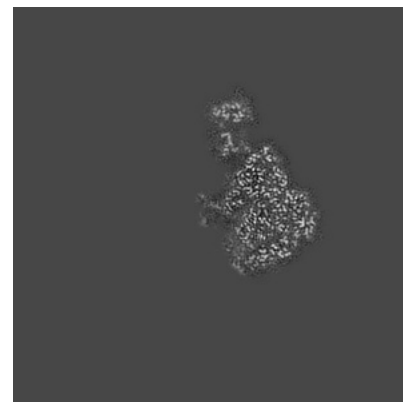
### 6.2.1 Primary map



X Index: 160

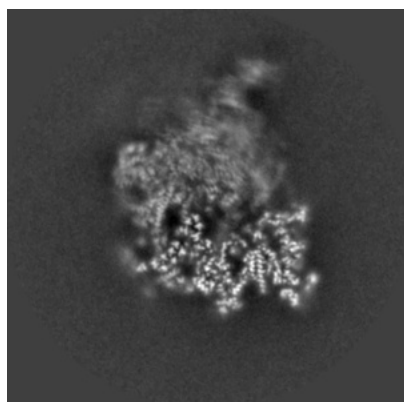


Y Index: 160

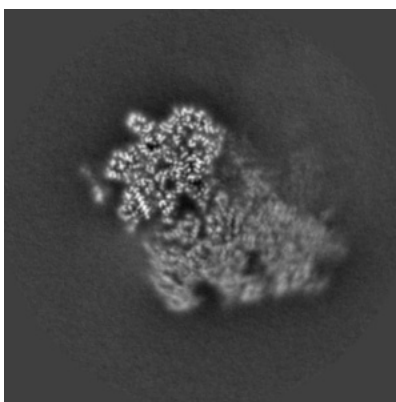


Z Index: 160

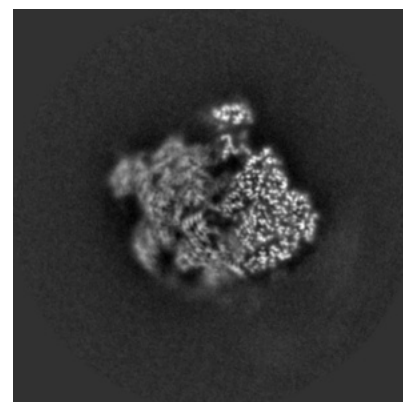
### 6.2.2 Raw map



X Index: 160



Y Index: 160



Z Index: 160

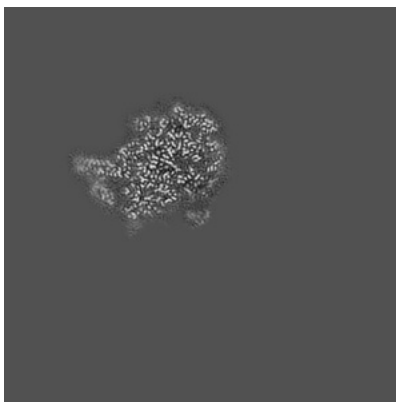
The images above show central slices of the map in three orthogonal directions.

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

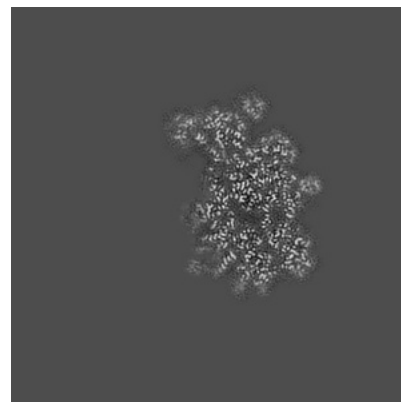
### 6.3.1 Primary map



X Index: 187

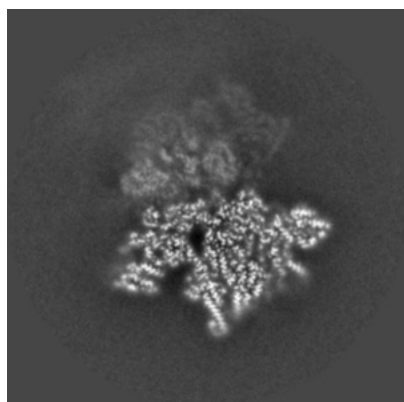


Y Index: 167

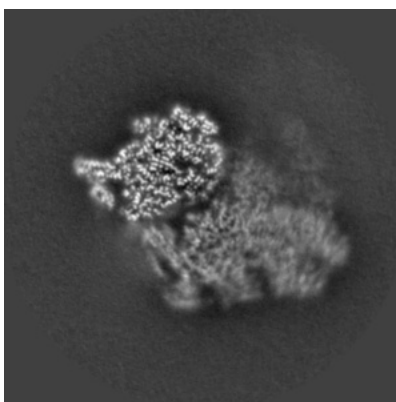


Z Index: 131

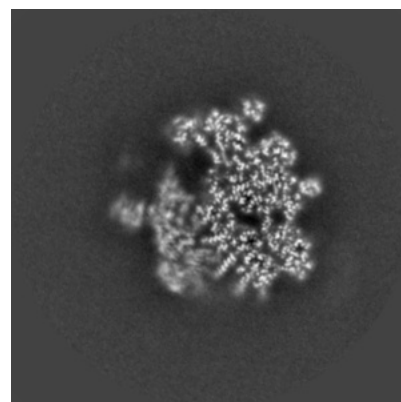
### 6.3.2 Raw map



X Index: 187



Y Index: 167

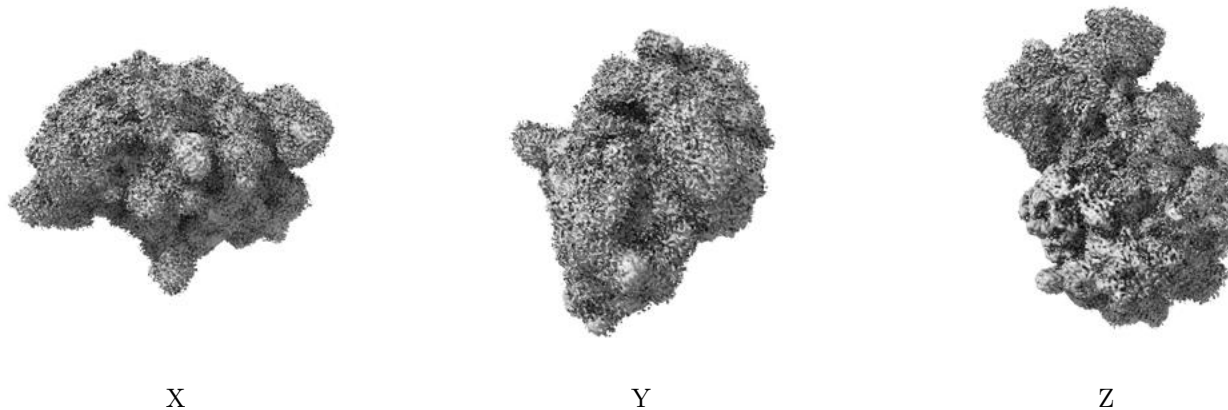


Z Index: 131

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

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

### 6.4.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.01. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

### 6.4.2 Raw map



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

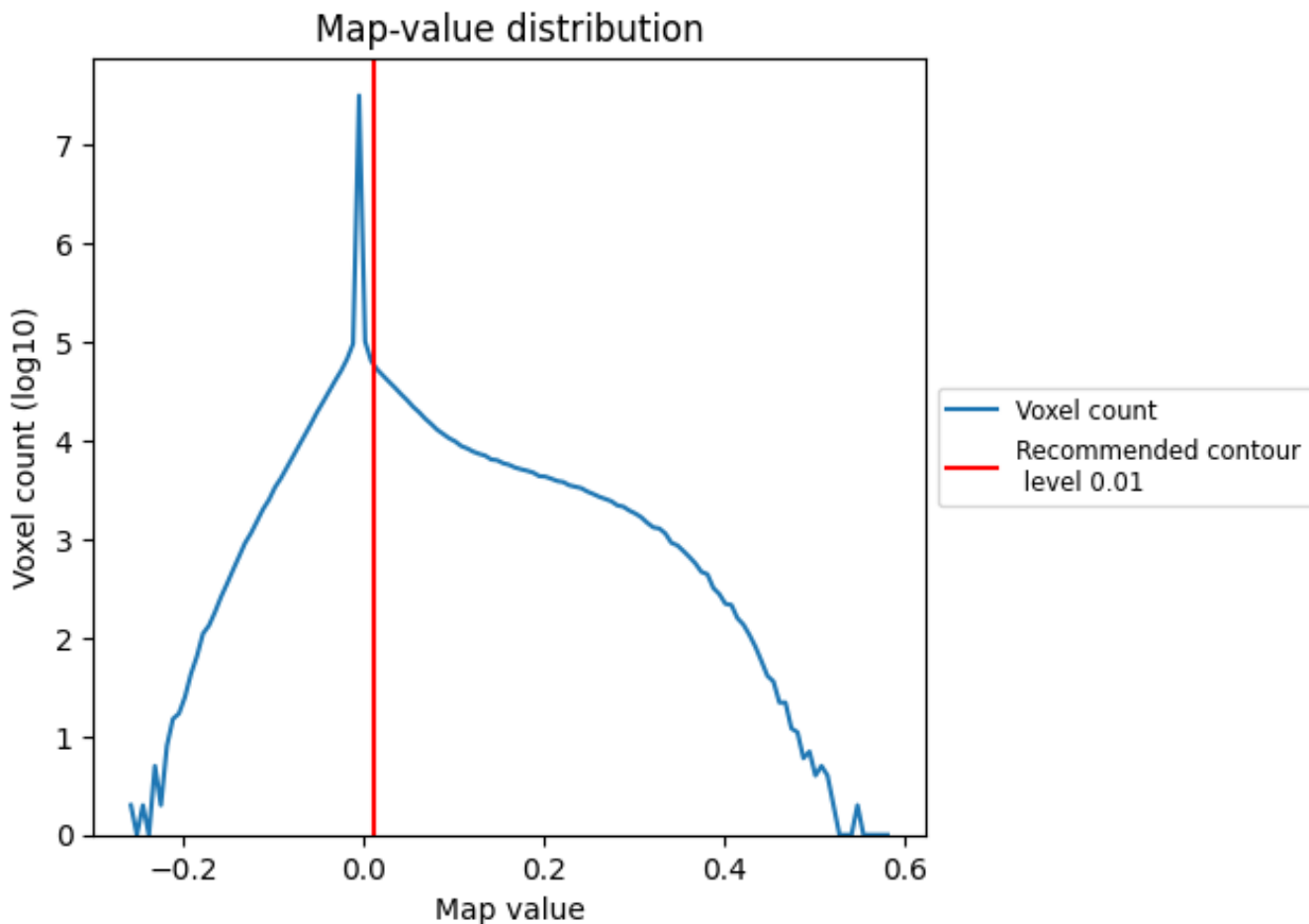
## 6.5 Mask visualisation [i](#)

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

## 7 Map analysis [i](#)

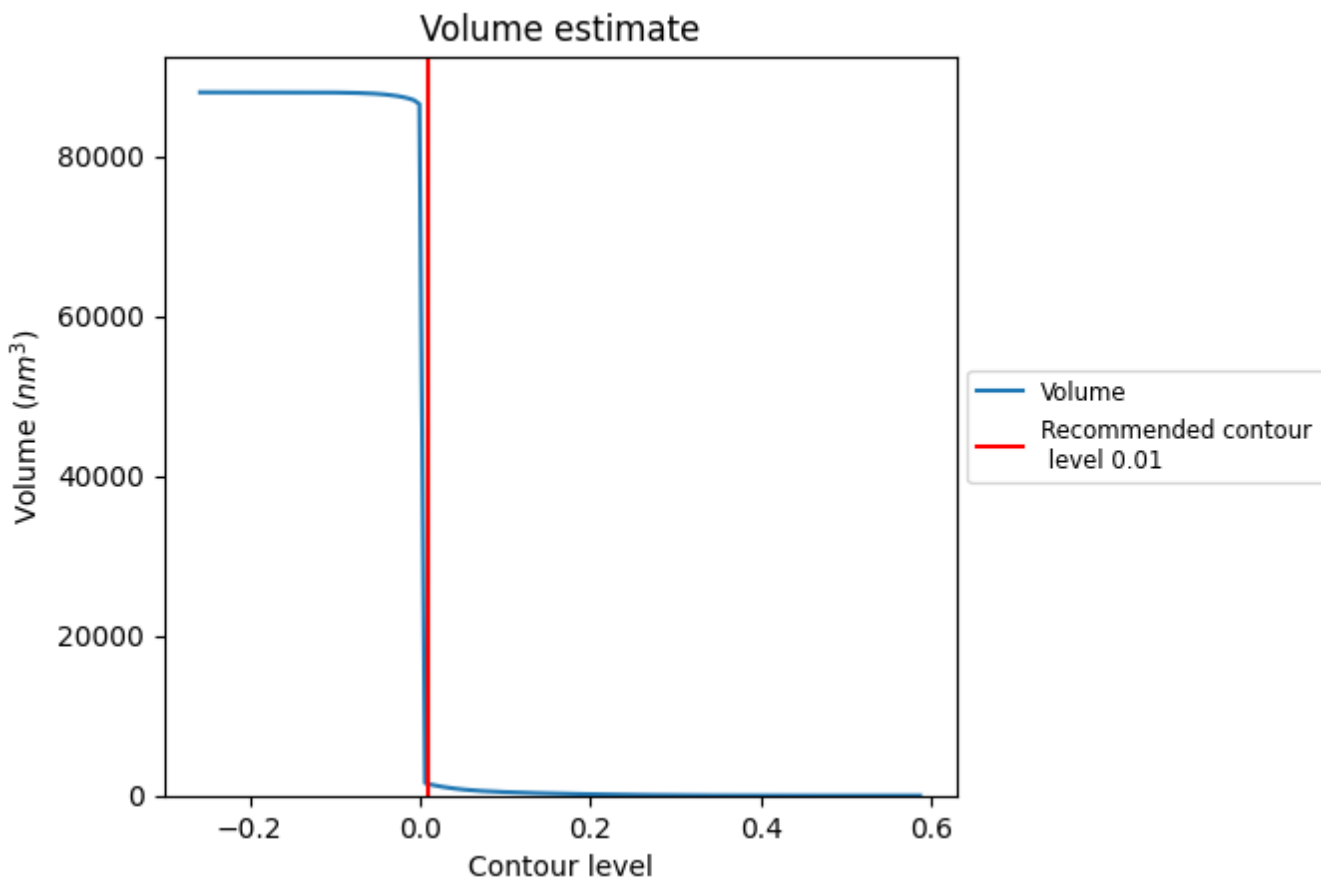
This section contains the results of statistical analysis of the map.

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



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

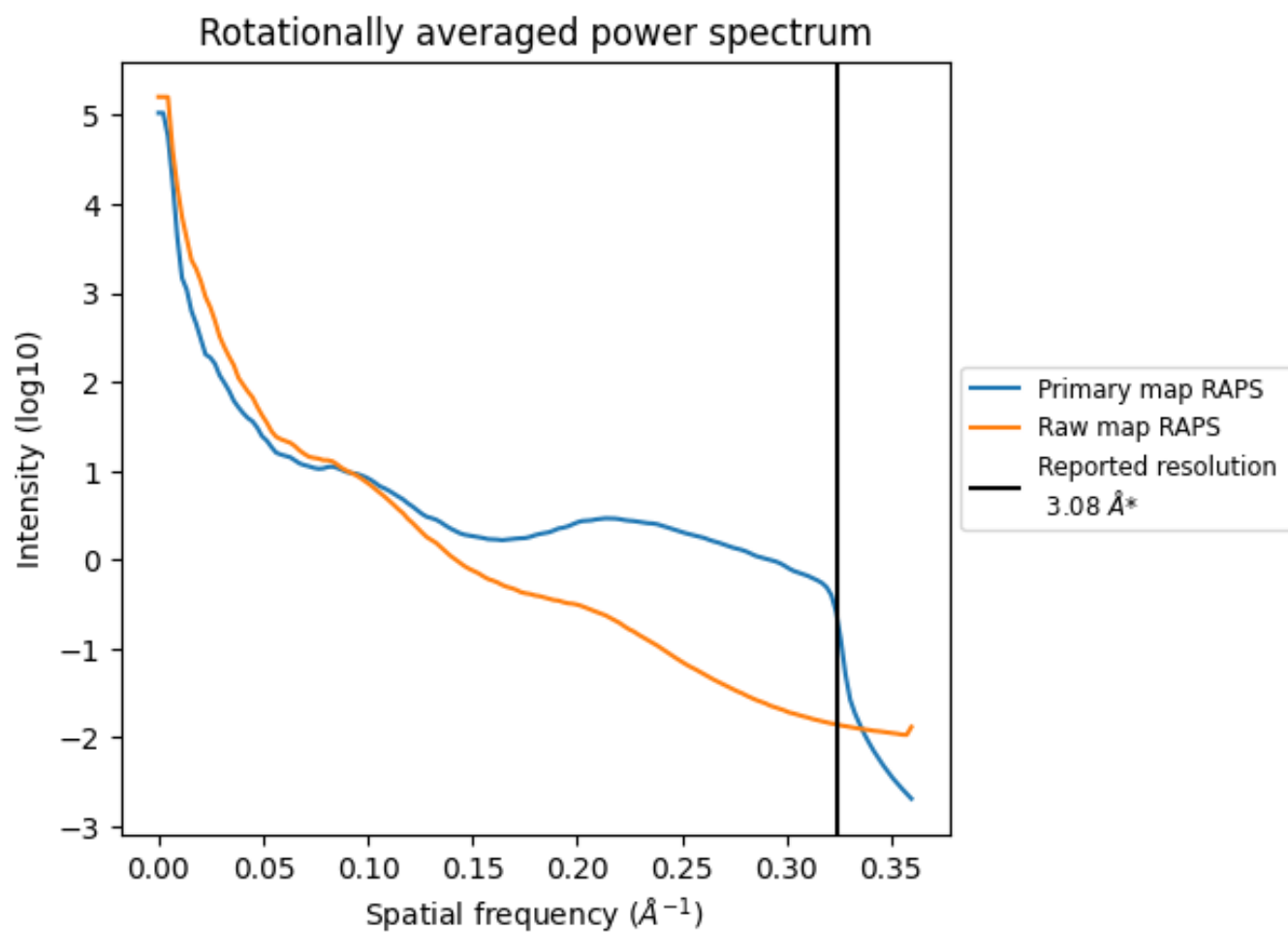
## 7.2 Volume estimate [i](#)



The volume at the recommended contour level is 1453  $\text{nm}^3$ ; this corresponds to an approximate mass of 1312 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 i



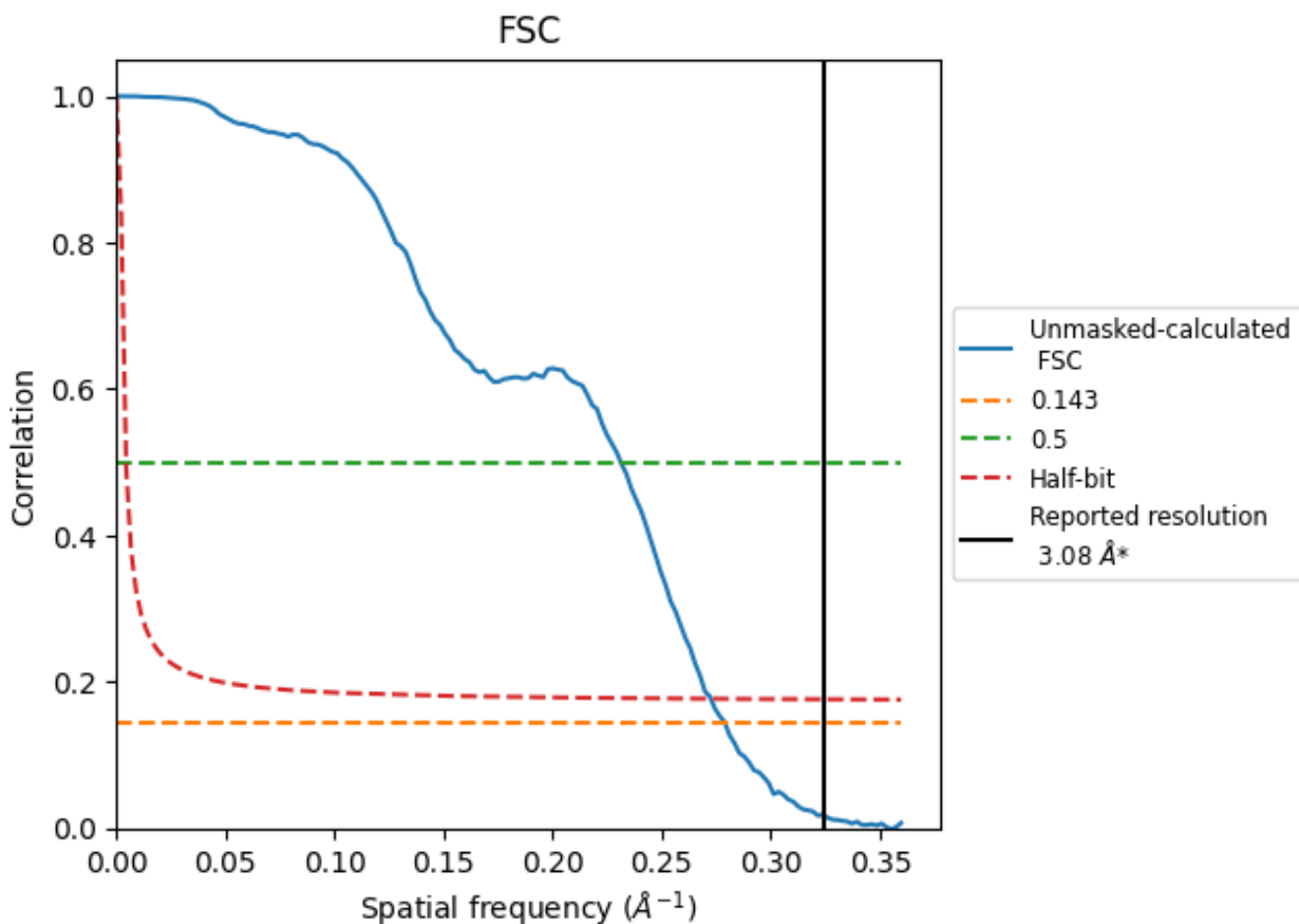
\*Reported resolution corresponds to spatial frequency of 0.325 Å<sup>-1</sup>



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

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

### 8.1 FSC [i](#)



\*Reported resolution corresponds to spatial frequency of 0.325 Å<sup>-1</sup>

## 8.2 Resolution estimates [i](#)

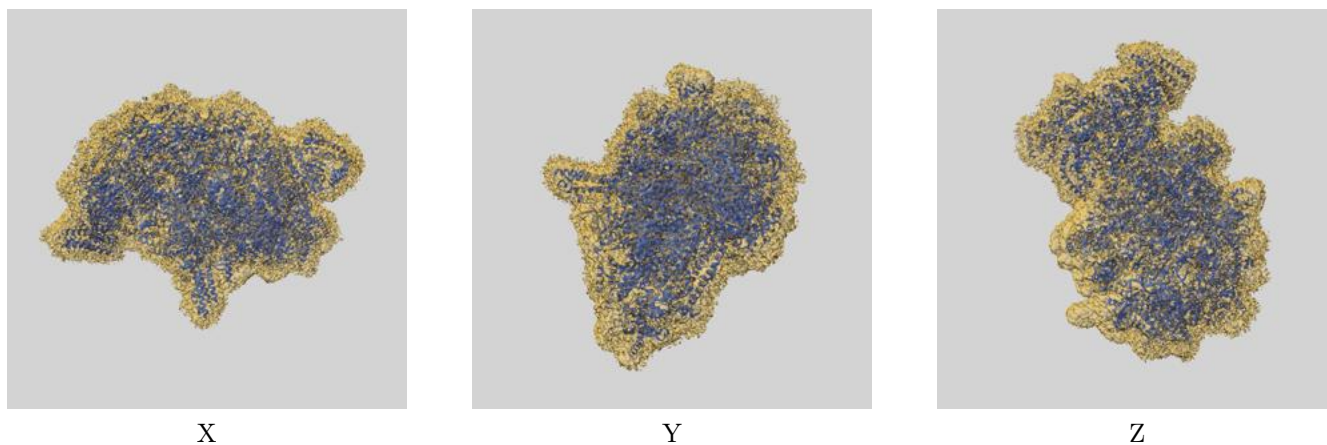
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.08	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.58	4.33	3.67

\*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 3.58 differs from the reported value 3.08 by more than 10 %

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

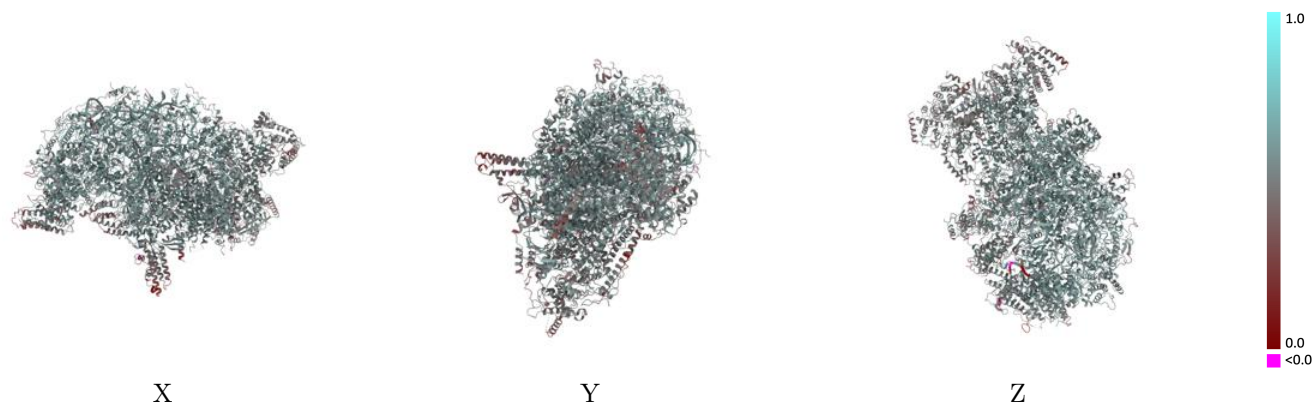
This section contains information regarding the fit between EMDB map EMD-0233 and PDB model 6HIZ. Per-residue inclusion information can be found in section 3 on page 15.

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



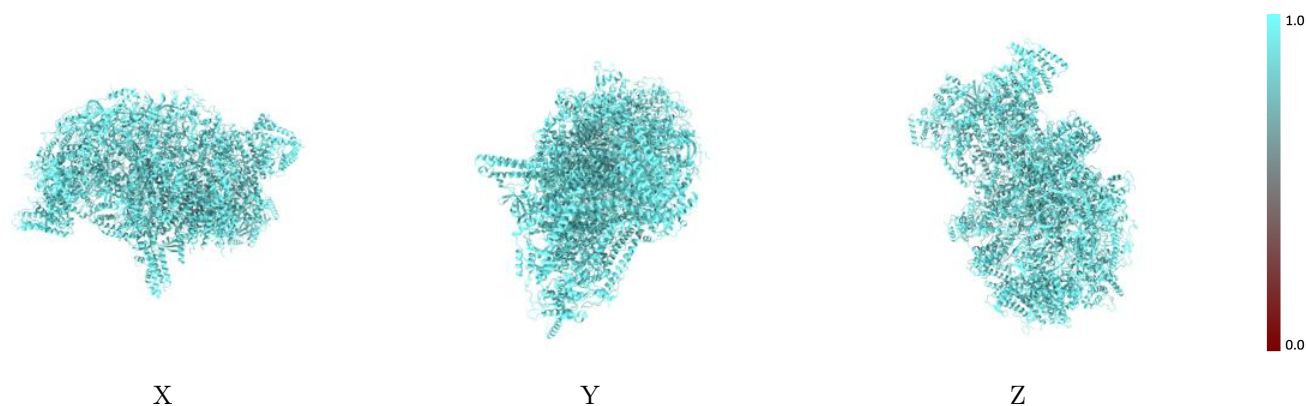
The images above show the 3D surface view of the map at the recommended contour level 0.01 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



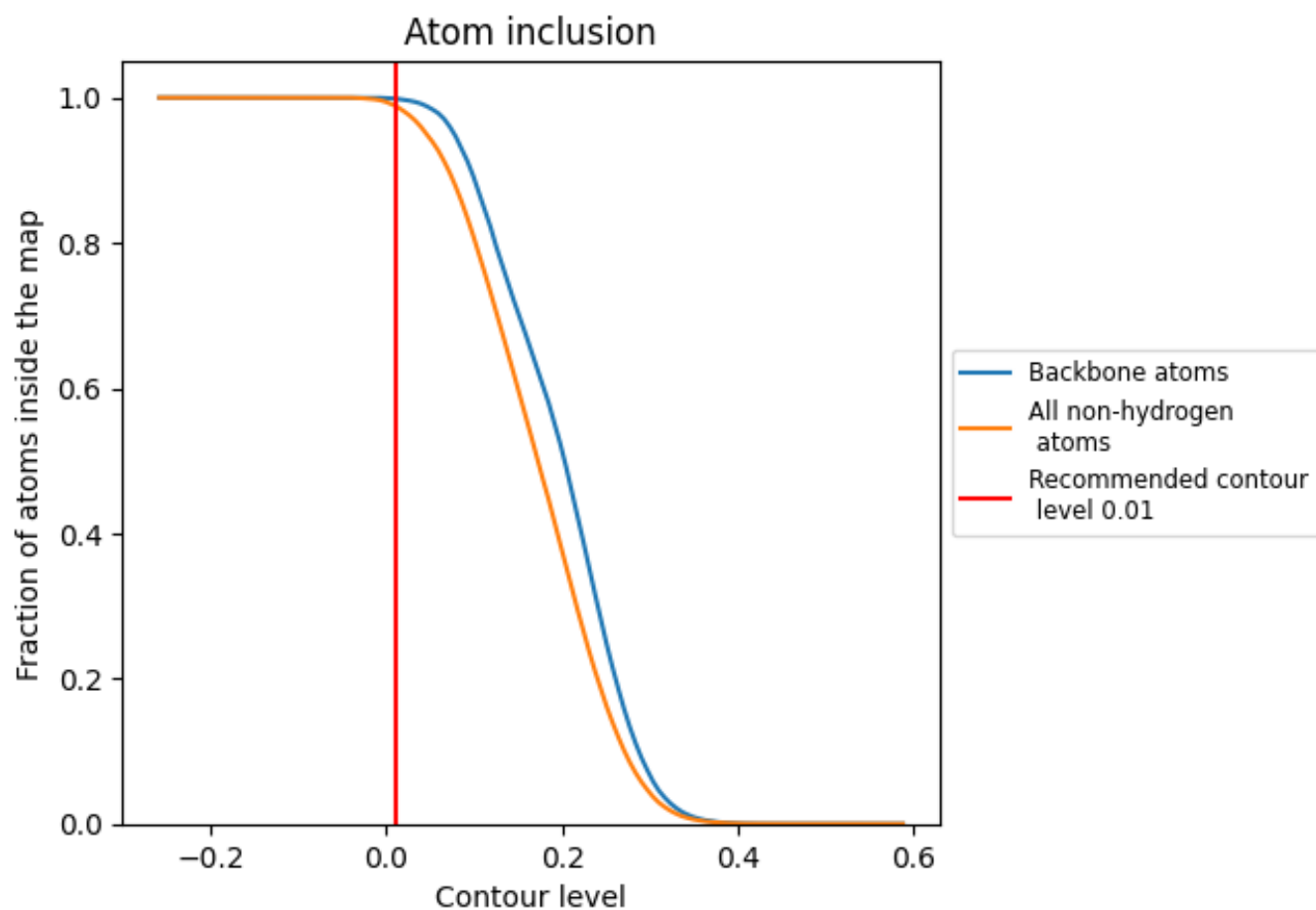
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

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



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.01).



























































## 9.4 Atom inclusion [i](#)



At the recommended contour level, 100% of all backbone atoms, 99% of all non-hydrogen atoms, are inside the map.

## 9.5 Map-model fit summary

The table lists the average atom inclusion at the recommended contour level (0.01) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.9887	 0.5340
CA	 0.9944	 0.5550
CC	 0.9719	 0.5570
CI	 0.9859	 0.5660
CJ	 0.9880	 0.5560
CK	 0.9976	 0.5570
CN	 0.9937	 0.5830
CR	 0.9798	 0.5220
CS	 0.9939	 0.5730
Cg	 0.9937	 0.5550
Ci	 0.9893	 0.5670
Ck	 0.9857	 0.5040
DA	 0.9765	 0.4800
DB	 0.9832	 0.5310
DC	 0.9920	 0.4960
DE	 0.9930	 0.5000
DF	 0.9930	 0.5530
DG	 0.9912	 0.5060
DH	 0.9872	 0.5440
DJ	 0.9921	 0.5570
DK	 0.9888	 0.5270
DL	 0.9540	 0.5040
DT	 0.9930	 0.5690
DV	 0.9923	 0.5670
DW	 0.9901	 0.5550
DX	 0.9896	 0.5560
DY	 0.9952	 0.5700
UO	 1.0000	 0.5160
UP	 1.0000	 0.4590

