



Full wwPDB EM Validation Report ⓘ

Nov 25, 2024 – 12:55 PM EST

PDB ID : 9E8O
EMDB ID : EMD-47726
Title : Nub1/Fat10-processing human 26S proteasome bound to Txnl1 with Rpt2 at top of spiral staircase and partially unfolded Eos
Authors : Arkinson, C.; Gee, C.L.; Martin, A.
Deposited on : 2024-11-05
Resolution : 3.10 Å(reported)

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

We welcome your comments at validation@mail.wwpdb.org

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>.

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

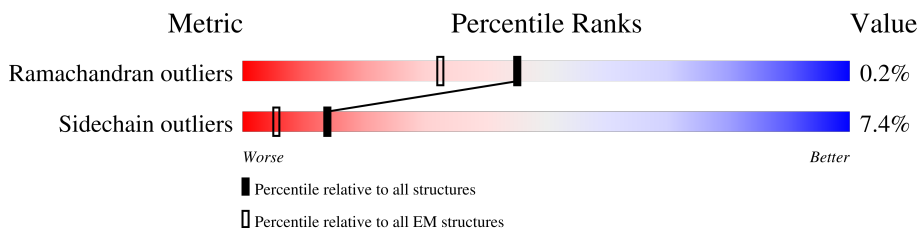
EMDB validation analysis : 0.0.1.dev113
Mogul : 2022.3.0, CSD as543be (2022)
MolProbity : 4.02b-467
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : 1.9.13
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.40

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.



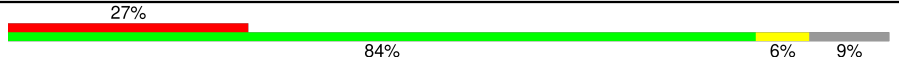
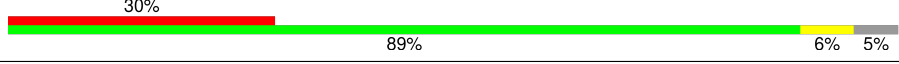
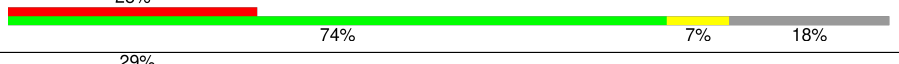

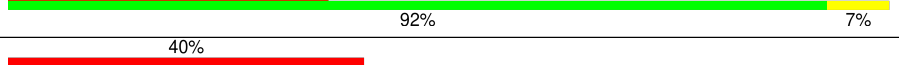
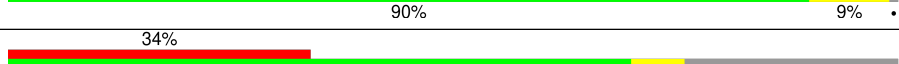
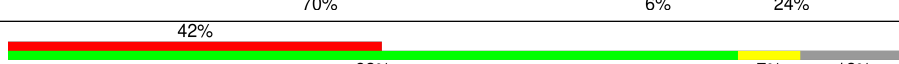
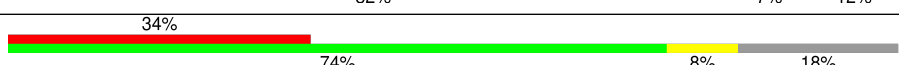
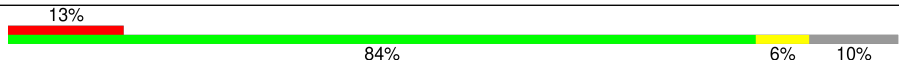


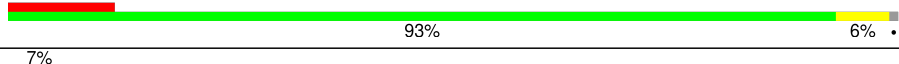
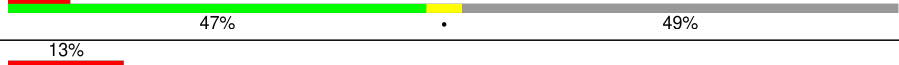

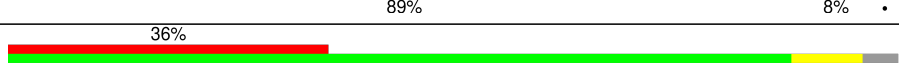




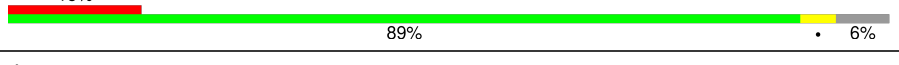

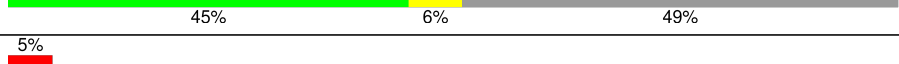
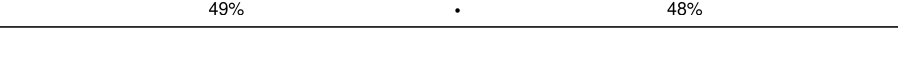


Metric	Whole archive (#Entries)	EM structures (#Entries)
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. 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	B	440	 6% 85% 6% 10%
2	C	406	 91% 5%
3	D	418	 88% 9%
4	c	424	 63% 33%
5	G	246	 15% 91% 6%
6	H	234	 94% 5%
7	I	261	 7% 90% 5% 5%
8	J	248	 17% 92% 5%
9	K	241	 20% 90% 8%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
10	L	263	
11	M	255	
12	N	239	
13	O	277	
14	P	205	
15	Q	201	
16	R	263	
17	S	241	
18	T	264	
19	X	422	
20	Y	389	
21	Z	324	
22	a	376	
23	b	377	
24	d	350	
25	f	908	
26	W	456	
27	V	534	
28	e	70	
29	A	433	
30	F	439	
31	E	389	
32	U	953	
33	g	390	
34	u	300	

2 Entry composition i

There are 38 unique types of molecules in this entry. The entry contains 83155 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 26S proteasome regulatory subunit 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	B	397	3124	1968	530	611	15	0	0

- Molecule 2 is a protein called 26S protease regulatory subunit 8.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	C	386	3053	1921	547	567	18	0	0

- Molecule 3 is a protein called 26S proteasome regulatory subunit 6B.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	D	380	3040	1923	524	580	13	0	0

- Molecule 4 is a protein called 26S proteasome non-ATPase regulatory subunit 14.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	c	282	2220	1407	380	414	19	0	0

There are 114 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
c	311	LEU	-	expression tag	UNP O00487
c	312	ILE	-	expression tag	UNP O00487
c	313	ASN	-	expression tag	UNP O00487
c	314	HIS	-	expression tag	UNP O00487
c	315	HIS	-	expression tag	UNP O00487
c	316	HIS	-	expression tag	UNP O00487
c	317	HIS	-	expression tag	UNP O00487
c	318	HIS	-	expression tag	UNP O00487
c	319	HIS	-	expression tag	UNP O00487

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
c	320	ASP	-	expression tag	UNP O00487
c	321	TYR	-	expression tag	UNP O00487
c	322	ASP	-	expression tag	UNP O00487
c	323	ILE	-	expression tag	UNP O00487
c	324	PRO	-	expression tag	UNP O00487
c	325	THR	-	expression tag	UNP O00487
c	326	THR	-	expression tag	UNP O00487
c	327	ALA	-	expression tag	UNP O00487
c	328	SER	-	expression tag	UNP O00487
c	329	GLU	-	expression tag	UNP O00487
c	330	ASN	-	expression tag	UNP O00487
c	331	LEU	-	expression tag	UNP O00487
c	332	TYR	-	expression tag	UNP O00487
c	333	PHE	-	expression tag	UNP O00487
c	334	GLN	-	expression tag	UNP O00487
c	335	GLY	-	expression tag	UNP O00487
c	336	GLU	-	expression tag	UNP O00487
c	337	LEU	-	expression tag	UNP O00487
c	338	GLY	-	expression tag	UNP O00487
c	339	MET	-	expression tag	UNP O00487
c	340	ARG	-	expression tag	UNP O00487
c	341	GLY	-	expression tag	UNP O00487
c	342	SER	-	expression tag	UNP O00487
c	343	ALA	-	expression tag	UNP O00487
c	344	GLY	-	expression tag	UNP O00487
c	345	LYS	-	expression tag	UNP O00487
c	346	ALA	-	expression tag	UNP O00487
c	347	GLY	-	expression tag	UNP O00487
c	348	GLU	-	expression tag	UNP O00487
c	349	GLY	-	expression tag	UNP O00487
c	350	GLU	-	expression tag	UNP O00487
c	351	ILE	-	expression tag	UNP O00487
c	352	PRO	-	expression tag	UNP O00487
c	353	ALA	-	expression tag	UNP O00487
c	354	PRO	-	expression tag	UNP O00487
c	355	LEU	-	expression tag	UNP O00487
c	356	ALA	-	expression tag	UNP O00487
c	357	GLY	-	expression tag	UNP O00487
c	358	THR	-	expression tag	UNP O00487
c	359	VAL	-	expression tag	UNP O00487
c	360	SER	-	expression tag	UNP O00487
c	361	LYS	-	expression tag	UNP O00487

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
c	362	ILE	-	expression tag	UNP O00487
c	363	LEU	-	expression tag	UNP O00487
c	364	VAL	-	expression tag	UNP O00487
c	365	LYS	-	expression tag	UNP O00487
c	366	GLU	-	expression tag	UNP O00487
c	367	GLY	-	expression tag	UNP O00487
c	368	ASP	-	expression tag	UNP O00487
c	369	THR	-	expression tag	UNP O00487
c	370	VAL	-	expression tag	UNP O00487
c	371	LYS	-	expression tag	UNP O00487
c	372	ALA	-	expression tag	UNP O00487
c	373	GLY	-	expression tag	UNP O00487
c	374	GLN	-	expression tag	UNP O00487
c	375	THR	-	expression tag	UNP O00487
c	376	VAL	-	expression tag	UNP O00487
c	377	LEU	-	expression tag	UNP O00487
c	378	VAL	-	expression tag	UNP O00487
c	379	LEU	-	expression tag	UNP O00487
c	380	GLU	-	expression tag	UNP O00487
c	381	ALA	-	expression tag	UNP O00487
c	382	MET	-	expression tag	UNP O00487
c	383	LYS	-	expression tag	UNP O00487
c	384	MET	-	expression tag	UNP O00487
c	385	GLU	-	expression tag	UNP O00487
c	386	THR	-	expression tag	UNP O00487
c	387	GLU	-	expression tag	UNP O00487
c	388	ILE	-	expression tag	UNP O00487
c	389	ASN	-	expression tag	UNP O00487
c	390	ALA	-	expression tag	UNP O00487
c	391	PRO	-	expression tag	UNP O00487
c	392	THR	-	expression tag	UNP O00487
c	393	ASP	-	expression tag	UNP O00487
c	394	GLY	-	expression tag	UNP O00487
c	395	LYS	-	expression tag	UNP O00487
c	396	VAL	-	expression tag	UNP O00487
c	397	GLU	-	expression tag	UNP O00487
c	398	LYS	-	expression tag	UNP O00487
c	399	VAL	-	expression tag	UNP O00487
c	400	LEU	-	expression tag	UNP O00487
c	401	VAL	-	expression tag	UNP O00487
c	402	LYS	-	expression tag	UNP O00487
c	403	GLU	-	expression tag	UNP O00487

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
c	404	ARG	-	expression tag	UNP O00487
c	405	ASP	-	expression tag	UNP O00487
c	406	ALA	-	expression tag	UNP O00487
c	407	VAL	-	expression tag	UNP O00487
c	408	GLN	-	expression tag	UNP O00487
c	409	GLY	-	expression tag	UNP O00487
c	410	GLY	-	expression tag	UNP O00487
c	411	GLN	-	expression tag	UNP O00487
c	412	GLY	-	expression tag	UNP O00487
c	413	LEU	-	expression tag	UNP O00487
c	414	ILE	-	expression tag	UNP O00487
c	415	LYS	-	expression tag	UNP O00487
c	416	ILE	-	expression tag	UNP O00487
c	417	GLY	-	expression tag	UNP O00487
c	418	VAL	-	expression tag	UNP O00487
c	419	HIS	-	expression tag	UNP O00487
c	420	HIS	-	expression tag	UNP O00487
c	421	HIS	-	expression tag	UNP O00487
c	422	HIS	-	expression tag	UNP O00487
c	423	HIS	-	expression tag	UNP O00487
c	424	HIS	-	expression tag	UNP O00487

- Molecule 5 is a protein called Proteasome subunit alpha type-6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	G	240	1867	1187	312	355	13	0	0

- Molecule 6 is a protein called Proteasome subunit alpha type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	H	232	1801	1149	304	342	6	0	0

- Molecule 7 is a protein called Proteasome subunit alpha type-4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
7	I	248	1933	1222	330	371	10	0	0

- Molecule 8 is a protein called Proteasome subunit alpha type-7.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
8	J	239	1860	1166	327	362	5	0	0

- Molecule 9 is a protein called Proteasome subunit alpha type-5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
9	K	238	1817	1142	303	361	11	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
K	83	LYS	ALA	conflict	UNP P28066

- Molecule 10 is a protein called Proteasome subunit alpha type-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
10	L	240	1876	1175	338	352	11	0	0

- Molecule 11 is a protein called Proteasome subunit alpha type-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
11	M	242	1890	1200	323	356	11	0	0

- Molecule 12 is a protein called Proteasome subunit beta type-6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
12	N	195	1462	913	250	287	12	0	0

- Molecule 13 is a protein called Proteasome subunit beta type-7.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
13	O	220	1645	1035	278	320	12	0	0

- Molecule 14 is a protein called Proteasome subunit beta type-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
14	P	204	1587	1010	264	294	19	0	0

- Molecule 15 is a protein called Proteasome subunit beta type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
15	Q	199	1588	1017	270	292	9	0	0

- Molecule 16 is a protein called Proteasome subunit beta type-5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
16	R	201	1559	982	274	294	9	0	0

- Molecule 17 is a protein called Proteasome subunit beta type-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
17	S	213	1641	1041	281	309	10	0	0

- Molecule 18 is a protein called Proteasome subunit beta type-4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
18	T	216	1683	1062	291	318	12	0	0

- Molecule 19 is a protein called 26S proteasome non-ATPase regulatory subunit 11.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
19	X	379	3001	1914	508	567	12	0	0

- Molecule 20 is a protein called 26S proteasome non-ATPase regulatory subunit 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
20	Y	378	3115	1987	533	578	17	0	0

- Molecule 21 is a protein called 26S proteasome non-ATPase regulatory subunit 7.

Mol	Chain	Residues	Atoms					AltConf	Trace
21	Z	286	Total	C	N	O	S	0	0
			2281	1457	392	427	5		

- Molecule 22 is a protein called 26S proteasome non-ATPase regulatory subunit 13.

Mol	Chain	Residues	Atoms					AltConf	Trace
22	a	373	Total	C	N	O	S	0	0
			2995	1911	510	559	15		

- Molecule 23 is a protein called 26S proteasome non-ATPase regulatory subunit 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
23	b	191	Total	C	N	O	S	0	0
			1458	910	261	279	8		

- Molecule 24 is a protein called 26S proteasome non-ATPase regulatory subunit 8.

Mol	Chain	Residues	Atoms					AltConf	Trace
24	d	250	Total	C	N	O	S	0	0
			2048	1331	335	373	9		

- Molecule 25 is a protein called 26S proteasome non-ATPase regulatory subunit 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
25	f	884	Total	C	N	O	S	0	0
			6836	4298	1169	1323	46		

- Molecule 26 is a protein called 26S proteasome non-ATPase regulatory subunit 12.

Mol	Chain	Residues	Atoms					AltConf	Trace
26	W	437	Total	C	N	O	S	0	0
			3564	2258	609	674	23		

- Molecule 27 is a protein called 26S proteasome non-ATPase regulatory subunit 3.

Mol	Chain	Residues	Atoms					AltConf	Trace
27	V	432	Total	C	N	O	S	0	0
			3527	2252	628	634	13		

- Molecule 28 is a protein called 26S proteasome complex subunit SEM1.

Mol	Chain	Residues	Atoms				AltConf	Trace
28	e	50	Total	C	N	O	0	0
			425	260	65	100		

- Molecule 29 is a protein called 26S proteasome regulatory subunit 7.

Mol	Chain	Residues	Atoms					AltConf	Trace
29	A	391	Total	C	N	O	S	0	0
			3074	1936	541	580	17		

- Molecule 30 is a protein called 26S proteasome regulatory subunit 6A.

Mol	Chain	Residues	Atoms					AltConf	Trace
30	F	359	Total	C	N	O	S	0	0
			2803	1774	483	529	17		

- Molecule 31 is a protein called 26S protease regulatory subunit 10B.

Mol	Chain	Residues	Atoms					AltConf	Trace
31	E	364	Total	C	N	O	S	0	0
			2887	1814	515	542	16		

- Molecule 32 is a protein called 26S proteasome non-ATPase regulatory subunit 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
32	U	829	Total	C	N	O	S	0	0
			6459	4098	1098	1218	45		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
U	320	ASN	ASP	conflict	UNP Q99460

- Molecule 33 is a protein called Ubiquitin, Green to red photoconvertible GFP-like protein EosFP.

Mol	Chain	Residues	Atoms					AltConf	Trace
33	g	200	Total	C	N	O	S	0	0
			1622	1044	274	292	12		

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
g	176	LYS	ASN	conflict	UNP Q5S6Z9
g	228	CR8	HIS	conflict	UNP Q5S6Z9
g	?	-	TYR	deletion	UNP Q5S6Z9
g	?	-	GLY	deletion	UNP Q5S6Z9
g	235	LYS	GLU	conflict	UNP Q5S6Z9
g	239	ASN	HIS	conflict	UNP Q5S6Z9
g	267	ASN	ILE	conflict	UNP Q5S6Z9
g	286	TYR	HIS	conflict	UNP Q5S6Z9
g	288	THR	VAL	conflict	UNP Q5S6Z9
g	323	GLU	THR	conflict	UNP Q5S6Z9
g	354	ALA	TYR	conflict	UNP Q5S6Z9
g	392	TYR	-	expression tag	UNP Q5S6Z9

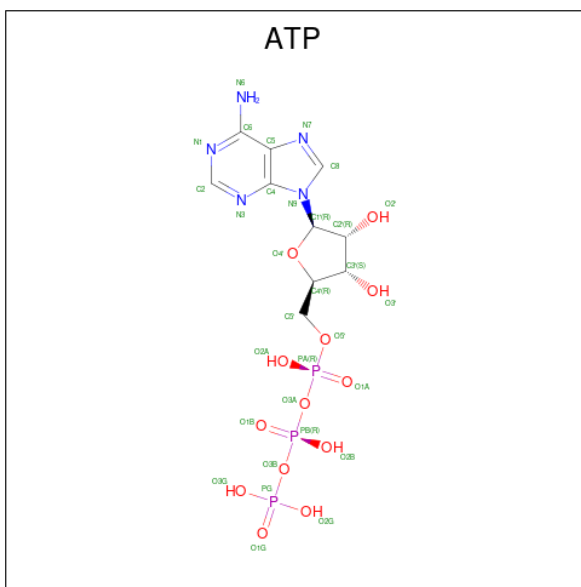
- Molecule 34 is a protein called Thioredoxin-like protein 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
34	u	155	1240	783	199	250	8	0	0

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
u	-10	GLY	-	expression tag	UNP O43396
u	-9	HIS	-	expression tag	UNP O43396
u	-8	MET	-	expression tag	UNP O43396
u	-7	ASP	-	expression tag	UNP O43396
u	-6	TYR	-	expression tag	UNP O43396
u	-5	LYS	-	expression tag	UNP O43396
u	-4	ASP	-	expression tag	UNP O43396
u	-3	ASP	-	expression tag	UNP O43396
u	-2	ASP	-	expression tag	UNP O43396
u	-1	ASP	-	expression tag	UNP O43396
u	0	LYS	-	expression tag	UNP O43396

- Molecule 35 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
35	B	1	31	10	5	13	3	0
35	C	1	31	10	5	13	3	0

- Molecule 36 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
			Total	Mg	
36	B	1	1	1	0
36	C	1	1	1	0
36	D	1	1	1	0

- Molecule 37 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: C₁₀H₁₅N₅O₁₀P₂) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
37	D	1	Total	C	N	O	P	0
			27	10	5	10	2	
37	A	1	Total	C	N	O	P	0
			27	10	5	10	2	
37	F	1	Total	C	N	O	P	0
			27	10	5	10	2	
37	E	1	Total	C	N	O	P	0
			27	10	5	10	2	

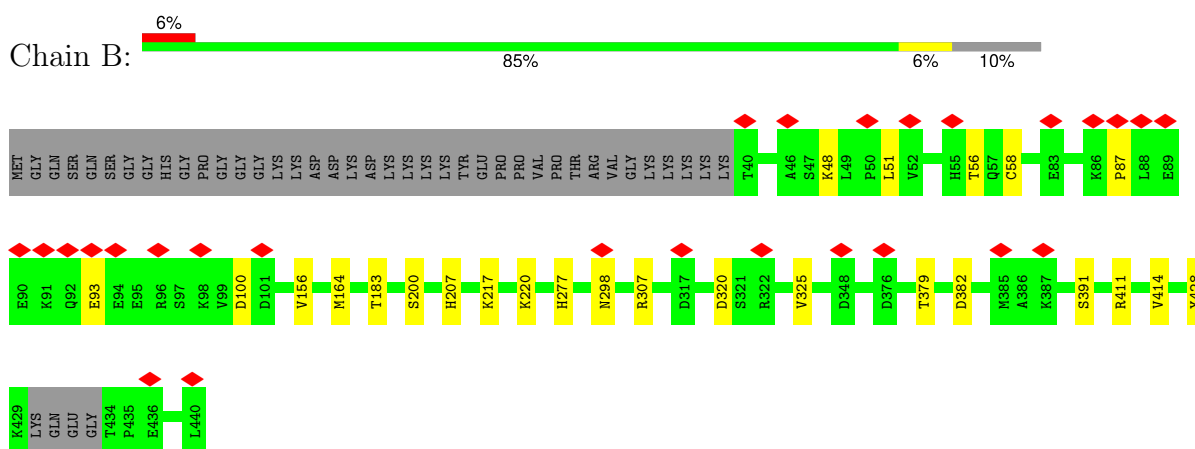
- Molecule 38 is ZINC ION (three-letter code: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
			Total	Zn	
38	c	1	Total	Zn	0
			1	1	

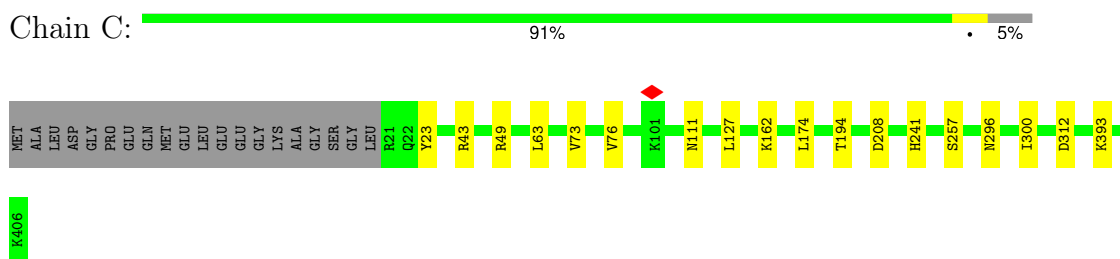
3 Residue-property plots [i](#)

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.

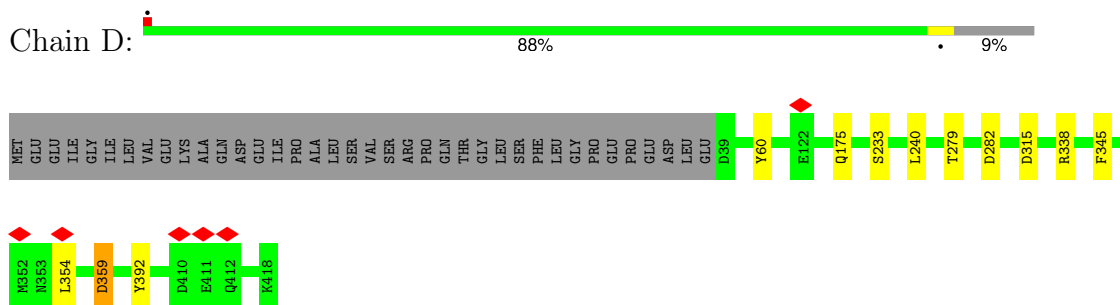
- Molecule 1: 26S proteasome regulatory subunit 4



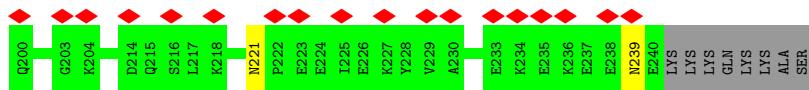
- Molecule 2: 26S protease regulatory subunit 8



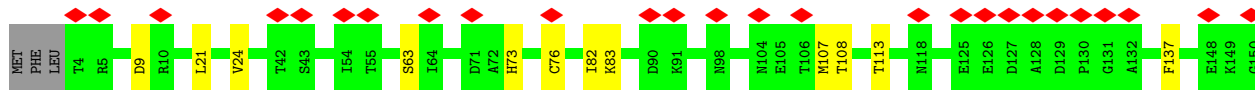
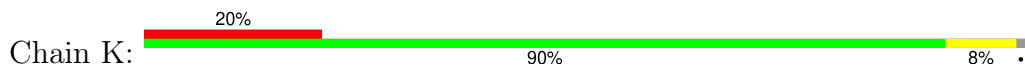
- Molecule 3: 26S proteasome regulatory subunit 6B



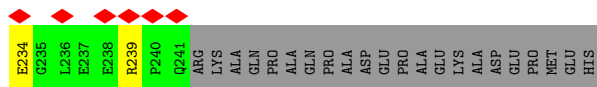
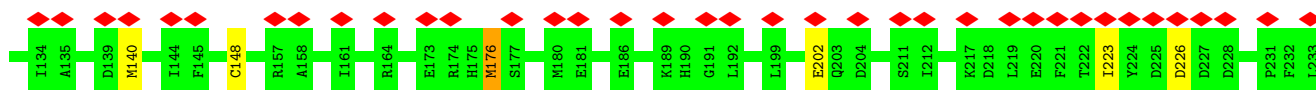
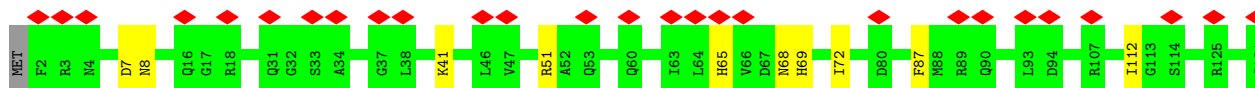
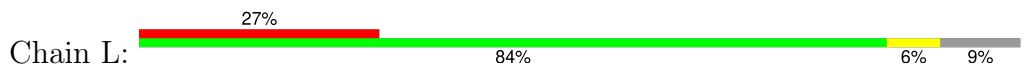
- Molecule 4: 26S proteasome non-ATPase regulatory subunit 14



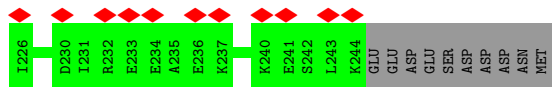
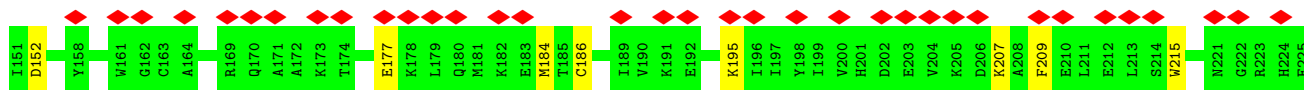
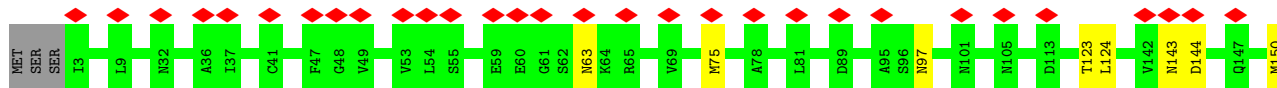
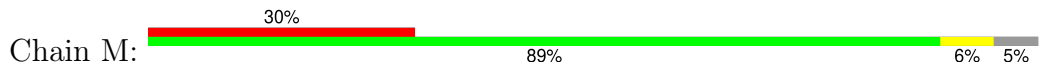
• Molecule 9: Proteasome subunit alpha type-5



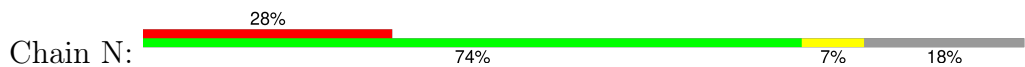
• Molecule 10: Proteasome subunit alpha type-1

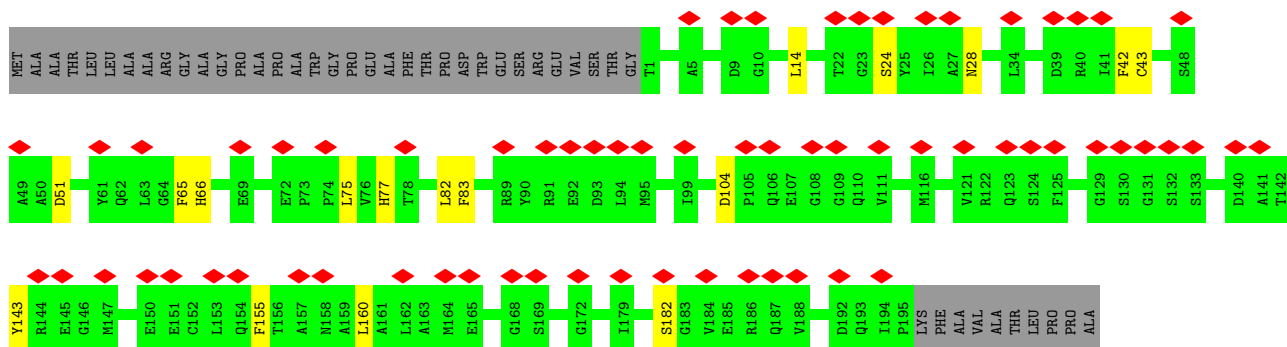


• Molecule 11: Proteasome subunit alpha type-3

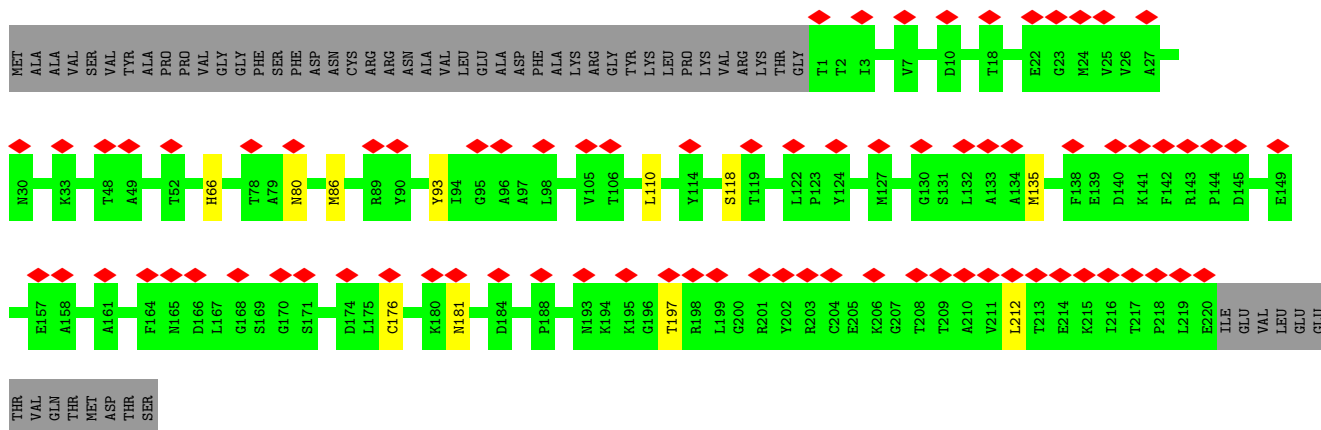


• Molecule 12: Proteasome subunit beta type-6

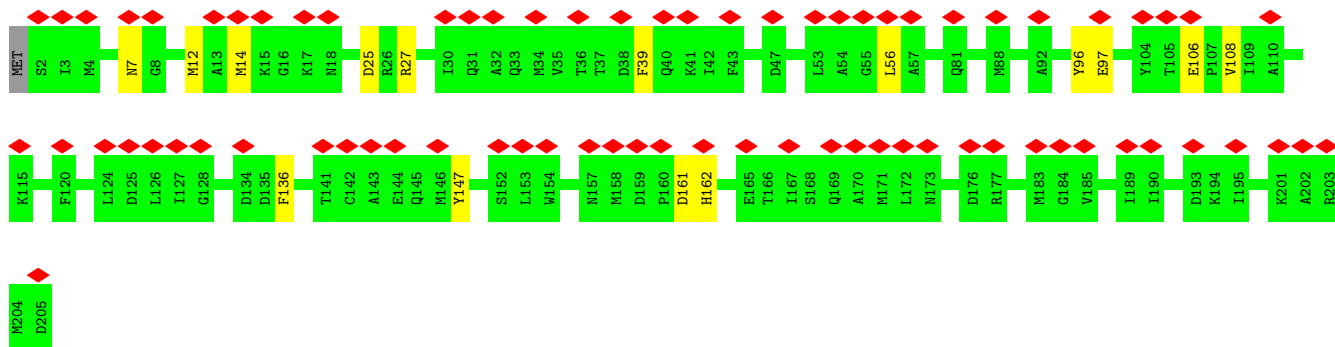




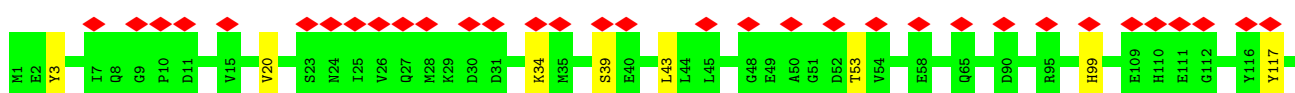
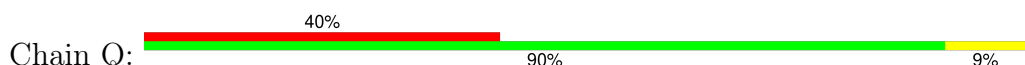
• Molecule 13: Proteasome subunit beta type-7

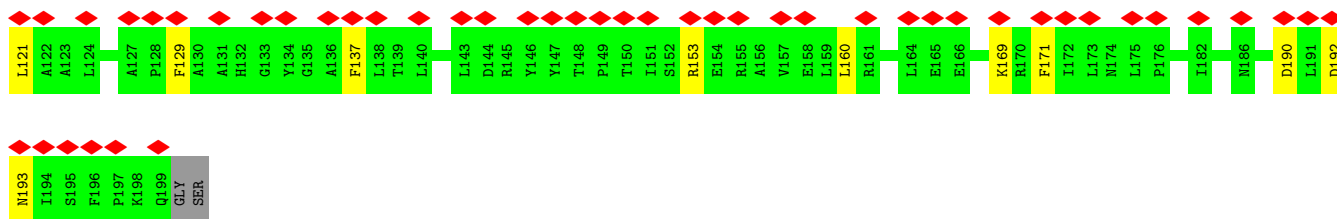


• Molecule 14: Proteasome subunit beta type-3

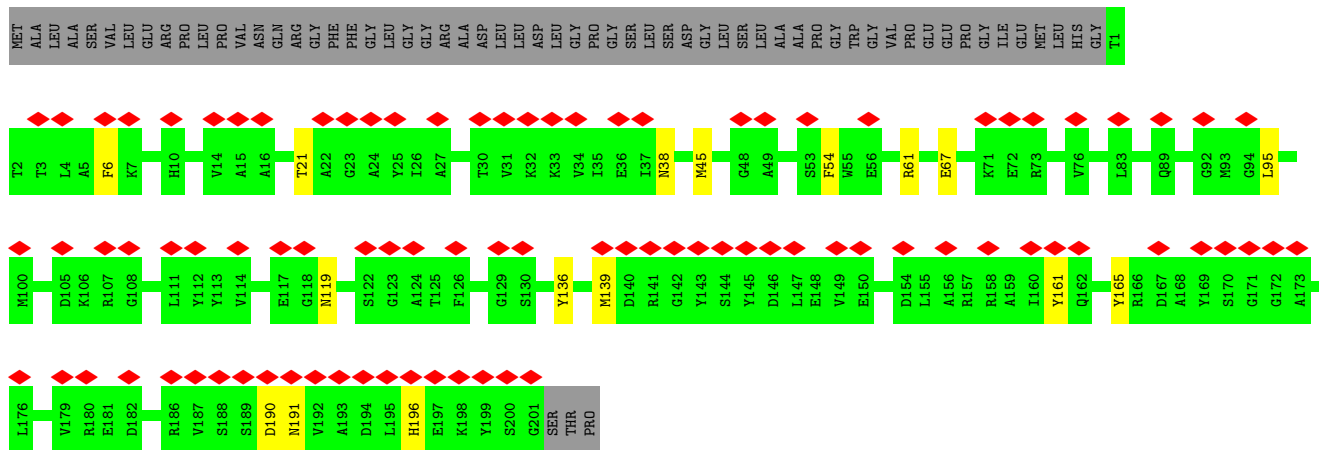


• Molecule 15: Proteasome subunit beta type-2

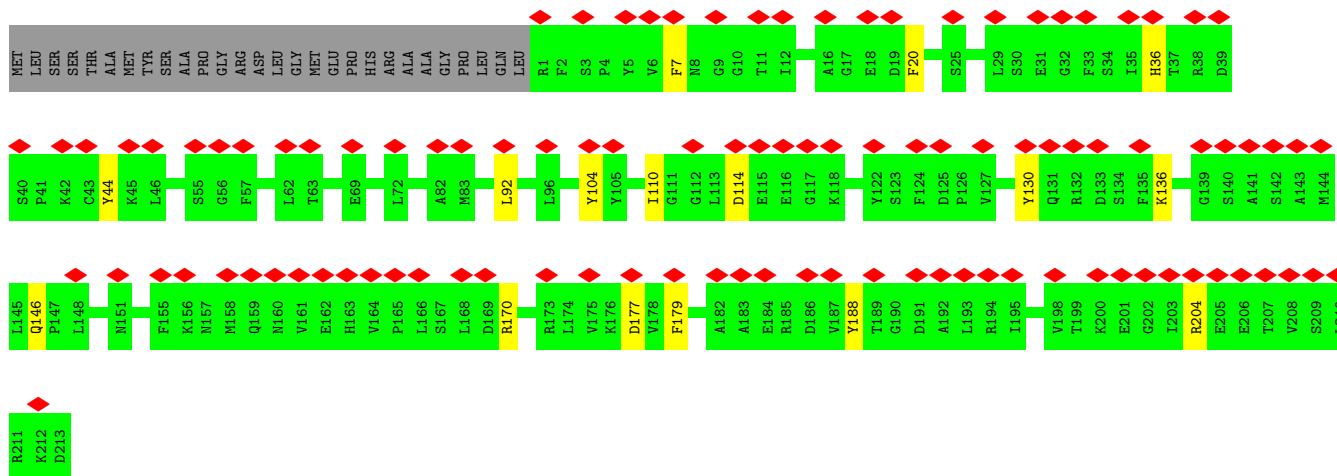
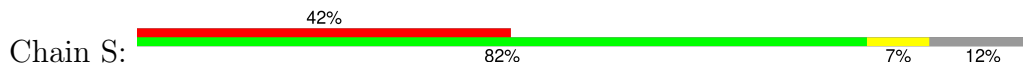




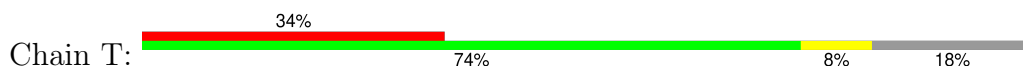
- Molecule 16: Proteasome subunit beta type-5

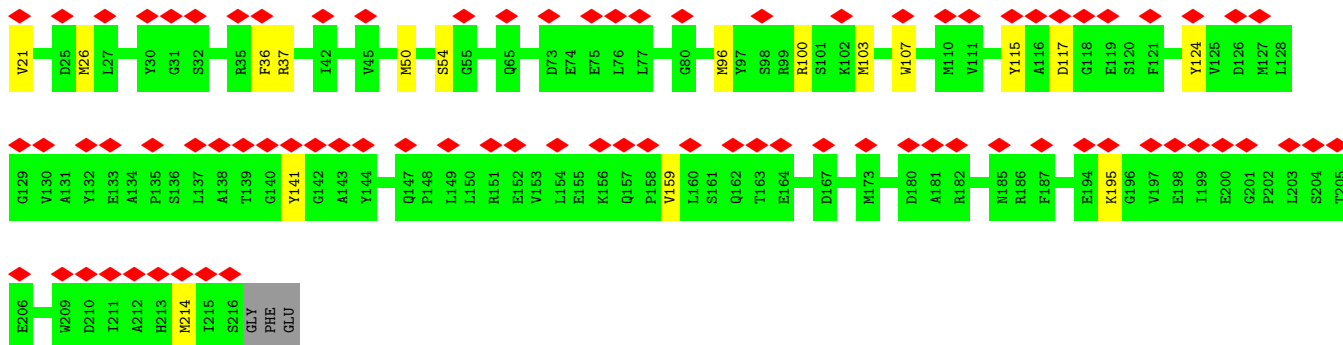


- Molecule 17: Proteasome subunit beta type-1

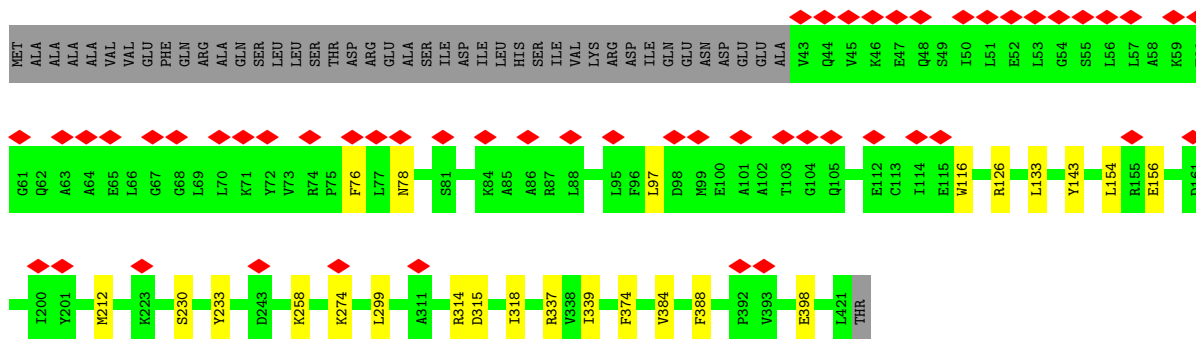
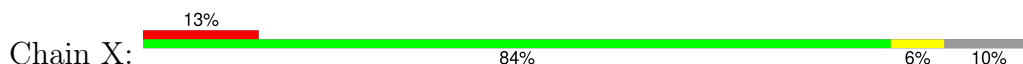


- Molecule 18: Proteasome subunit beta type-4

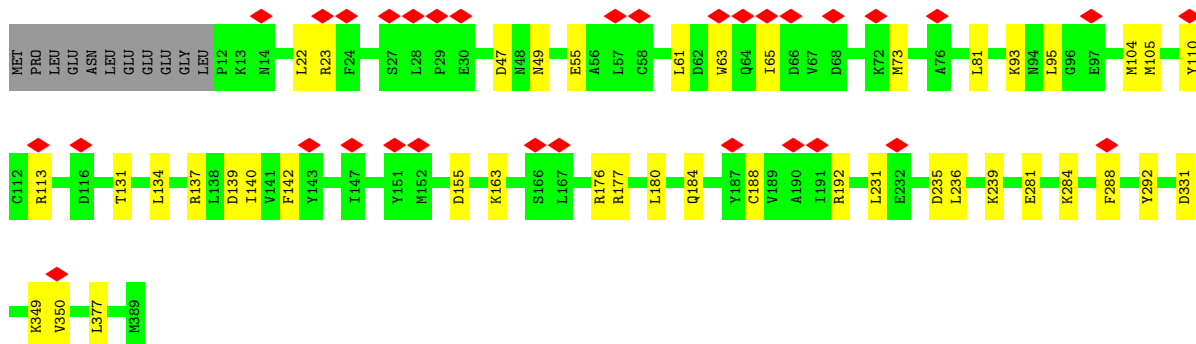
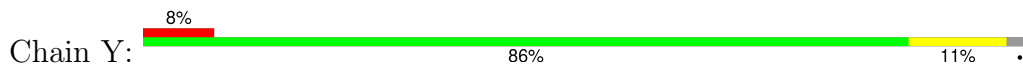




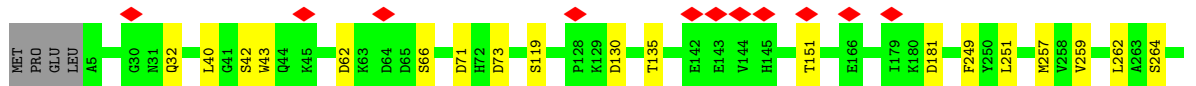
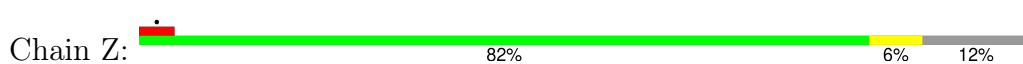
• Molecule 19: 26S proteasome non-ATPase regulatory subunit 11



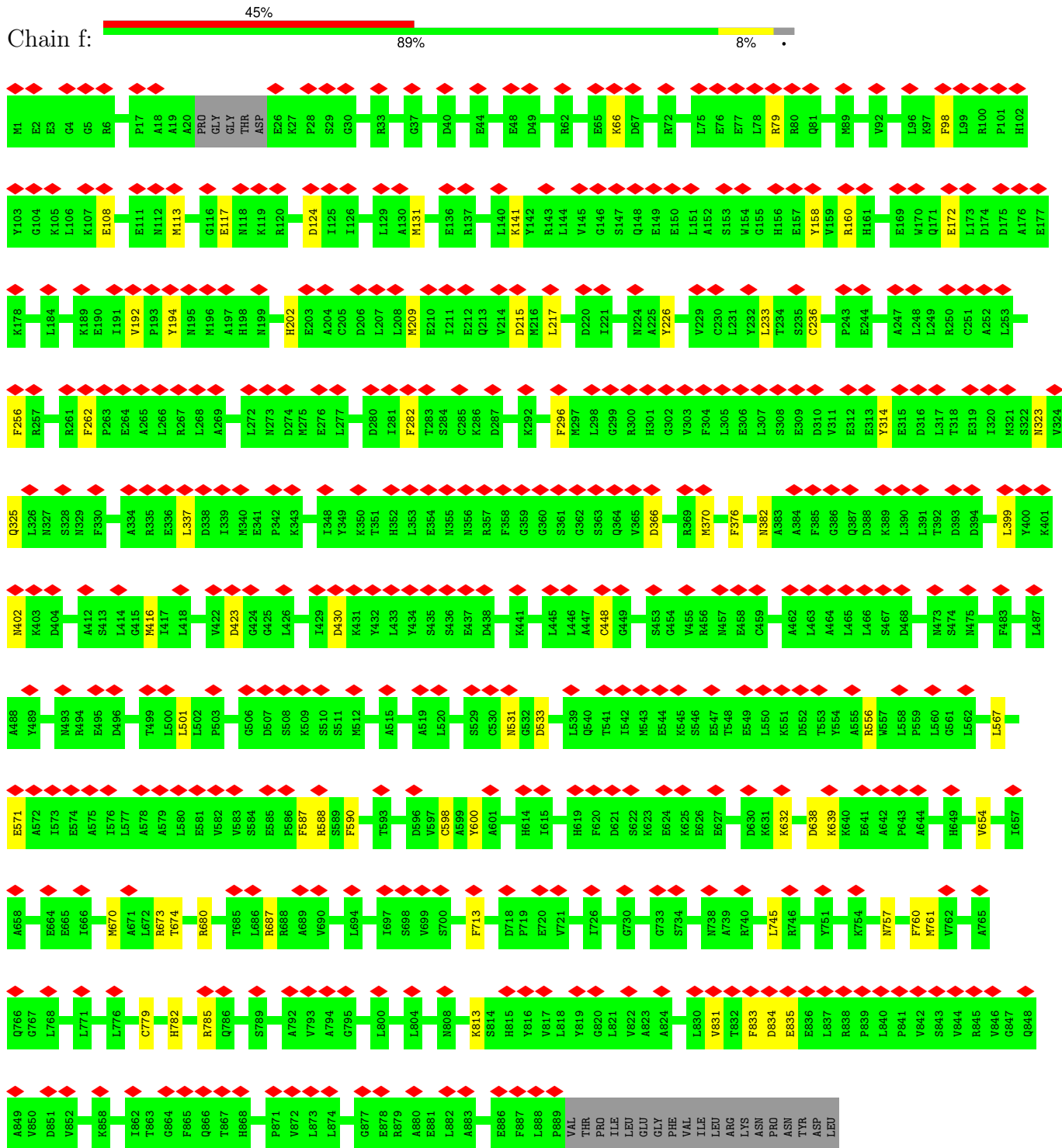
• Molecule 20: 26S proteasome non-ATPase regulatory subunit 6



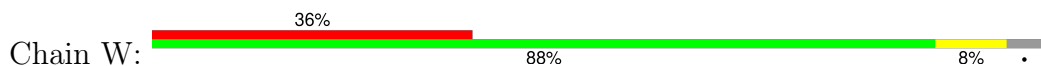
• Molecule 21: 26S proteasome non-ATPase regulatory subunit 7

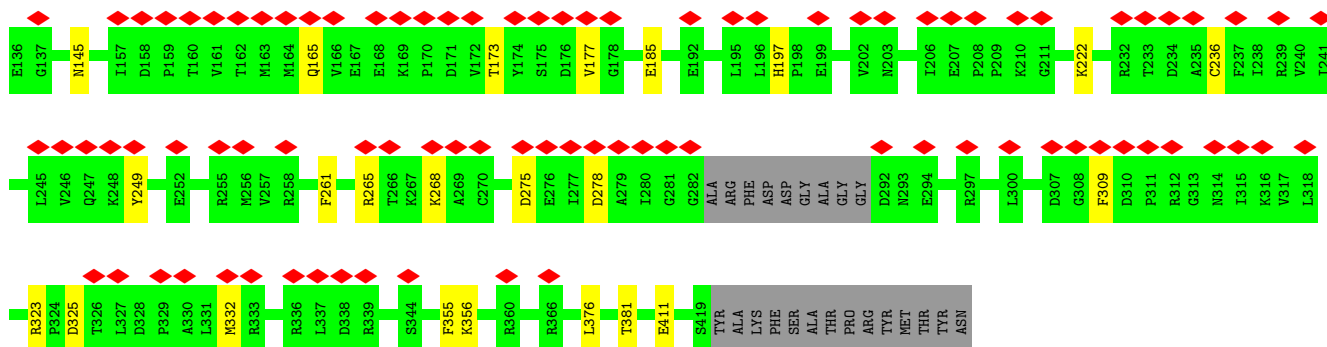


• Molecule 25: 26S proteasome non-ATPase regulatory subunit 2

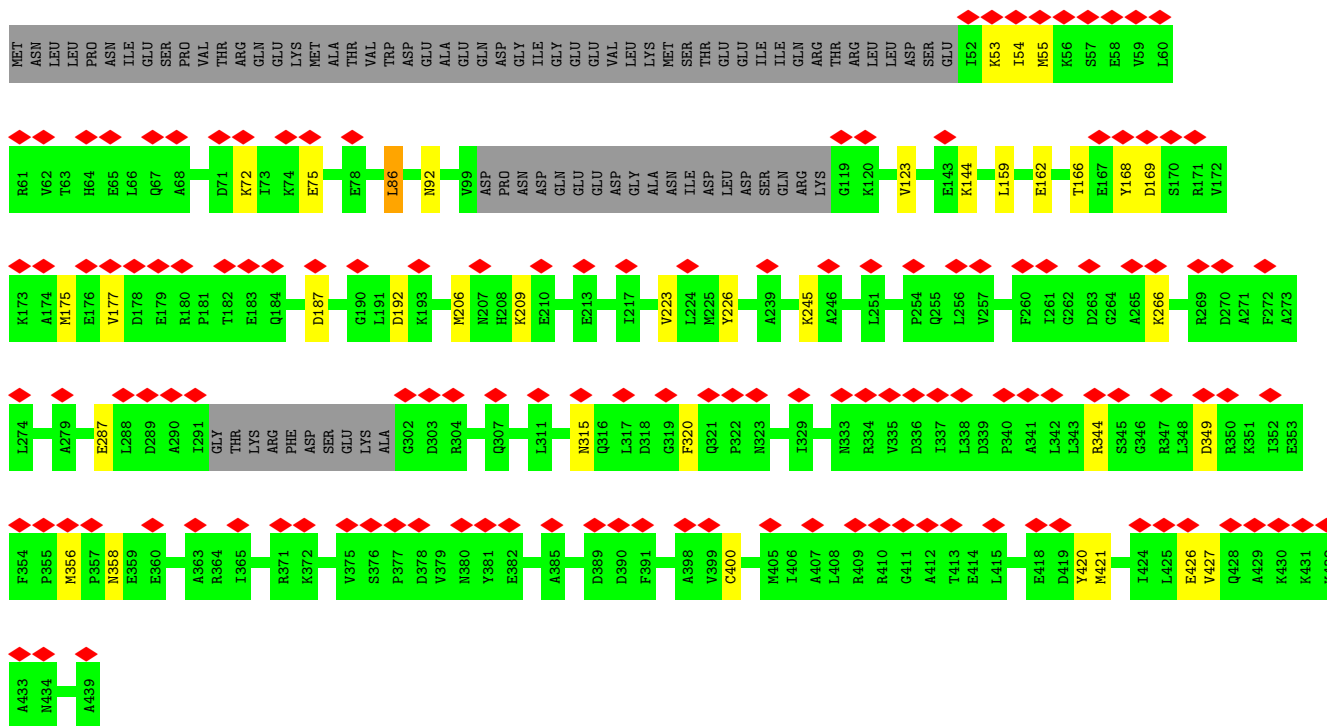
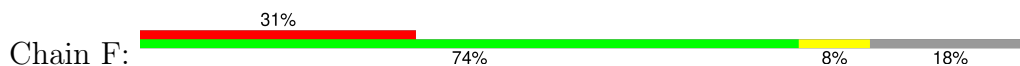


• Molecule 26: 26S proteasome non-ATPase regulatory subunit 12

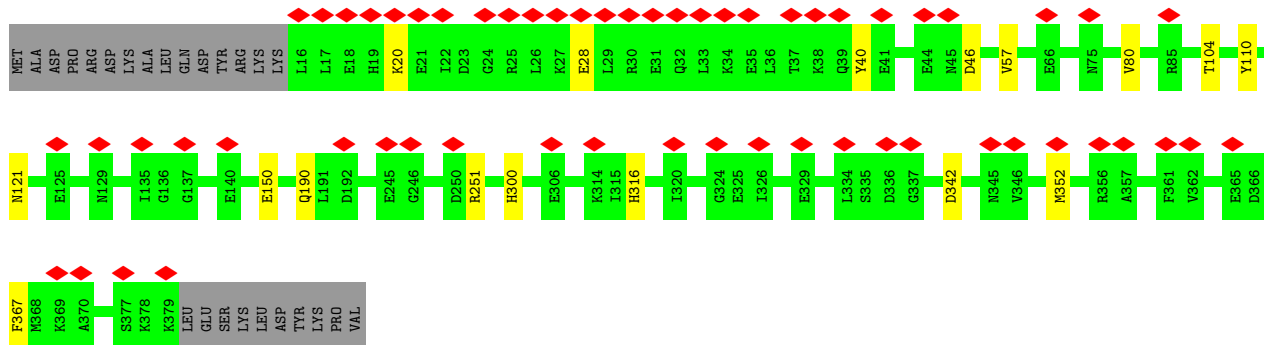
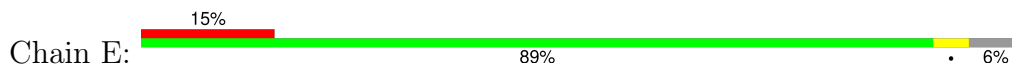


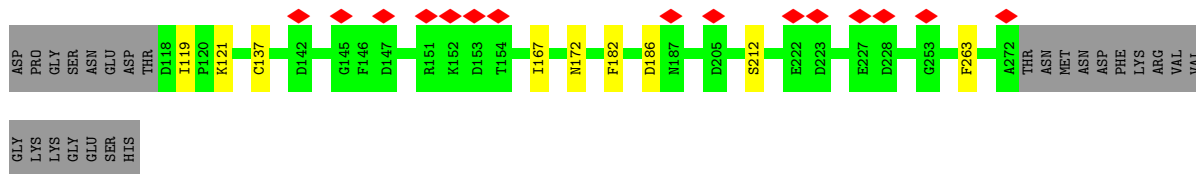


• Molecule 30: 26S proteasome regulatory subunit 6A



• Molecule 31: 26S protease regulatory subunit 10B





4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	73136	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 ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	1700	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor
Maximum map value	1.216	Depositor
Minimum map value	-0.584	Depositor
Average map value	0.004	Depositor
Map value standard deviation	0.044	Depositor
Recommended contour level	0.17	Depositor
Map size (Å)	356.32, 356.32, 356.32	wwPDB
Map dimensions	340, 340, 340	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.048, 1.048, 1.048	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CR8, ADP, ZN, MG, ATP

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	B	0.28	0/3170	0.52	1/4278 (0.0%)
2	C	0.30	0/3094	0.51	0/4158
3	D	0.32	0/3090	0.52	0/4168
4	c	0.36	0/2262	0.51	0/3059
5	G	0.28	0/1901	0.51	0/2572
6	H	0.28	0/1840	0.51	0/2495
7	I	0.27	0/1963	0.53	0/2650
8	J	0.26	0/1886	0.54	0/2551
9	K	0.28	0/1845	0.52	0/2490
10	L	0.27	0/1911	0.55	1/2584 (0.0%)
11	M	0.27	0/1925	0.53	0/2592
12	N	0.26	0/1487	0.57	1/2013 (0.0%)
13	O	0.26	0/1672	0.53	0/2267
14	P	0.27	0/1616	0.58	0/2180
15	Q	0.26	0/1621	0.56	2/2194 (0.1%)
16	R	0.27	0/1590	0.54	0/2147
17	S	0.26	0/1671	0.55	1/2252 (0.0%)
18	T	0.26	0/1716	0.58	0/2323
19	X	0.27	0/3045	0.48	0/4105
20	Y	0.33	0/3173	0.61	0/4273
21	Z	0.33	0/2323	0.54	0/3147
22	a	0.27	0/3053	0.52	0/4133
23	b	0.27	0/1478	0.55	0/2001
24	d	0.28	0/2090	0.56	0/2820
25	f	0.28	0/6948	0.58	1/9387 (0.0%)
26	W	0.27	0/3611	0.56	0/4855
27	V	0.28	0/3595	0.52	1/4851 (0.0%)
28	e	0.32	0/437	0.58	0/595
29	A	0.29	0/3121	0.56	0/4212
30	F	0.29	0/2840	0.59	0/3828
31	E	0.28	0/2930	0.53	0/3944
32	U	0.31	0/6574	0.49	1/8899 (0.0%)

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
33	g	0.43	2/1635 (0.1%)	0.61	3/2197 (0.1%)
34	u	0.28	0/1265	0.50	0/1711
All	All	0.29	2/84378 (0.0%)	0.54	12/113931 (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	c	0	1
20	Y	0	3
22	a	0	1
All	All	0	5

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
33	g	230	ASN	C-N	9.43	1.55	1.34
33	g	225	ALA	C-N	8.95	1.54	1.34

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
33	g	225	ALA	O-C-N	8.34	136.04	122.70
33	g	225	ALA	CA-C-N	-8.02	99.55	117.20
27	V	170	LEU	CA-CB-CG	6.45	130.14	115.30
15	Q	121	LEU	CA-CB-CG	6.40	130.01	115.30
17	S	92	LEU	CA-CB-CG	5.90	128.88	115.30
10	L	176	MET	CB-CG-SD	5.75	129.63	112.40
32	U	244	MET	CB-CG-SD	5.53	128.97	112.40
25	f	217	LEU	CA-CB-CG	5.38	127.68	115.30
33	g	232	VAL	N-CA-CB	-5.34	99.75	111.50
15	Q	160	LEU	CA-CB-CG	5.33	127.55	115.30
1	B	51	LEU	CA-CB-CG	5.21	127.28	115.30
12	N	160	LEU	CB-CG-CD1	5.10	119.67	111.00

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
20	Y	110	TYR	Peptide
20	Y	113	ARG	Peptide
20	Y	349	LYS	Peptide
22	a	341	LEU	Peptide
4	c	49	VAL	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 [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	
1	B	393/440 (89%)	352 (90%)	38 (10%)	3 (1%)	16	48
2	C	384/406 (95%)	356 (93%)	28 (7%)	0	100	100
3	D	378/418 (90%)	354 (94%)	22 (6%)	2 (0%)	25	58
4	c	278/424 (66%)	252 (91%)	24 (9%)	2 (1%)	19	51
5	G	238/246 (97%)	227 (95%)	11 (5%)	0	100	100
6	H	230/234 (98%)	215 (94%)	15 (6%)	0	100	100
7	I	246/261 (94%)	237 (96%)	9 (4%)	0	100	100
8	J	237/248 (96%)	221 (93%)	16 (7%)	0	100	100
9	K	236/241 (98%)	227 (96%)	8 (3%)	1 (0%)	30	63
10	L	238/263 (90%)	227 (95%)	11 (5%)	0	100	100
11	M	240/255 (94%)	232 (97%)	8 (3%)	0	100	100
12	N	193/239 (81%)	186 (96%)	7 (4%)	0	100	100
13	O	218/277 (79%)	211 (97%)	7 (3%)	0	100	100
14	P	202/205 (98%)	192 (95%)	10 (5%)	0	100	100
15	Q	197/201 (98%)	190 (96%)	7 (4%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
16	R	199/263 (76%)	196 (98%)	3 (2%)	0	100	100
17	S	211/241 (88%)	205 (97%)	6 (3%)	0	100	100
18	T	214/264 (81%)	203 (95%)	11 (5%)	0	100	100
19	X	377/422 (89%)	362 (96%)	13 (3%)	2 (0%)	25	58
20	Y	376/389 (97%)	325 (86%)	49 (13%)	2 (0%)	25	58
21	Z	283/324 (87%)	240 (85%)	42 (15%)	1 (0%)	30	63
22	a	371/376 (99%)	339 (91%)	31 (8%)	1 (0%)	37	68
23	b	189/377 (50%)	168 (89%)	21 (11%)	0	100	100
24	d	244/350 (70%)	223 (91%)	20 (8%)	1 (0%)	30	63
25	f	880/908 (97%)	753 (86%)	126 (14%)	1 (0%)	48	79
26	W	433/456 (95%)	404 (93%)	29 (7%)	0	100	100
27	V	426/534 (80%)	404 (95%)	22 (5%)	0	100	100
28	e	48/70 (69%)	36 (75%)	12 (25%)	0	100	100
29	A	387/433 (89%)	346 (89%)	37 (10%)	4 (1%)	13	42
30	F	353/439 (80%)	310 (88%)	39 (11%)	4 (1%)	12	39
31	E	360/389 (92%)	336 (93%)	24 (7%)	0	100	100
32	U	823/953 (86%)	797 (97%)	26 (3%)	0	100	100
33	g	189/390 (48%)	167 (88%)	22 (12%)	0	100	100
34	u	153/300 (51%)	146 (95%)	7 (5%)	0	100	100
All	All	10424/12236 (85%)	9639 (92%)	761 (7%)	24 (0%)	45	74

All (24) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
19	X	318	ILE
19	X	339	ILE
24	d	358	ILE
29	A	222	LYS
30	F	86	LEU
1	B	93	GLU
1	B	156	VAL
4	c	311	LEU
20	Y	111	LEU
29	A	102	ILE
29	A	103	ASN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
30	F	427	VAL
3	D	338	ARG
21	Z	181	ASP
29	A	36	TYR
1	B	414	VAL
3	D	359	ASP
4	c	267	PRO
9	K	82	ILE
20	Y	350	VAL
22	a	343	LEU
25	f	834	ASP
30	F	177	VAL
30	F	287	GLU

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	B	351/385 (91%)	330 (94%)	21 (6%)	16 44
2	C	338/352 (96%)	320 (95%)	18 (5%)	19 48
3	D	333/366 (91%)	322 (97%)	11 (3%)	33 62
4	c	248/359 (69%)	237 (96%)	11 (4%)	24 54
5	G	202/210 (96%)	187 (93%)	15 (7%)	11 36
6	H	187/191 (98%)	176 (94%)	11 (6%)	16 44
7	I	202/221 (91%)	189 (94%)	13 (6%)	14 42
8	J	197/211 (93%)	185 (94%)	12 (6%)	15 43
9	K	198/204 (97%)	179 (90%)	19 (10%)	7 26
10	L	202/224 (90%)	184 (91%)	18 (9%)	8 29
11	M	198/212 (93%)	182 (92%)	16 (8%)	9 33
12	N	152/181 (84%)	136 (90%)	16 (10%)	5 22
13	O	178/228 (78%)	167 (94%)	11 (6%)	15 43
14	P	172/174 (99%)	157 (91%)	15 (9%)	8 31

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
15	Q	168/171 (98%)	152 (90%)	16 (10%)	7	26
16	R	156/202 (77%)	140 (90%)	16 (10%)	6	22
17	S	175/199 (88%)	160 (91%)	15 (9%)	8	31
18	T	178/215 (83%)	158 (89%)	20 (11%)	5	20
19	X	326/362 (90%)	302 (93%)	24 (7%)	11	36
20	Y	334/344 (97%)	296 (89%)	38 (11%)	4	19
21	Z	257/295 (87%)	238 (93%)	19 (7%)	11	36
22	a	333/336 (99%)	312 (94%)	21 (6%)	15	42
23	b	167/312 (54%)	153 (92%)	14 (8%)	9	32
24	d	221/294 (75%)	206 (93%)	15 (7%)	13	40
25	f	742/763 (97%)	672 (91%)	70 (9%)	7	27
26	W	402/416 (97%)	367 (91%)	35 (9%)	8	31
27	V	383/460 (83%)	370 (97%)	13 (3%)	32	62
28	e	44/63 (70%)	34 (77%)	10 (23%)	0	3
29	A	339/372 (91%)	310 (91%)	29 (9%)	8	31
30	F	306/379 (81%)	273 (89%)	33 (11%)	5	21
31	E	318/341 (93%)	301 (95%)	17 (5%)	19	48
32	U	705/816 (86%)	682 (97%)	23 (3%)	33	62
33	g	171/338 (51%)	151 (88%)	20 (12%)	4	18
34	u	141/263 (54%)	132 (94%)	9 (6%)	14	42
All	All	9024/10459 (86%)	8360 (93%)	664 (7%)	14	36

All (664) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	48	LYS
1	B	56	THR
1	B	58	CYS
1	B	87	PRO
1	B	100	ASP
1	B	164	MET
1	B	183	THR
1	B	200	SER
1	B	207	HIS
1	B	217	LYS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	220	LYS
1	B	277	HIS
1	B	298	ASN
1	B	307	ARG
1	B	320	ASP
1	B	325	VAL
1	B	379	THR
1	B	382	ASP
1	B	391	SER
1	B	411	ARG
1	B	428	TYR
2	C	23	TYR
2	C	43	ARG
2	C	49	ARG
2	C	63	LEU
2	C	73	VAL
2	C	76	VAL
2	C	111	ASN
2	C	127	LEU
2	C	162	LYS
2	C	174	LEU
2	C	194	THR
2	C	208	ASP
2	C	241	HIS
2	C	257	SER
2	C	296	ASN
2	C	300	ILE
2	C	312	ASP
2	C	393	LYS
3	D	60	TYR
3	D	175	GLN
3	D	233	SER
3	D	240	LEU
3	D	279	THR
3	D	282	ASP
3	D	315	ASP
3	D	345	PHE
3	D	354	LEU
3	D	359	ASP
3	D	392	TYR
4	c	122	LEU
4	c	132	SER

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
4	c	136	LEU
4	c	143	VAL
4	c	145	VAL
4	c	160	PHE
4	c	166	ASN
4	c	279	ASP
4	c	287	HIS
4	c	289	ASP
4	c	303	MET
5	G	16	PHE
5	G	37	LEU
5	G	52	THR
5	G	67	THR
5	G	70	PHE
5	G	80	MET
5	G	83	MET
5	G	86	ASP
5	G	96	TYR
5	G	115	CYS
5	G	144	ASP
5	G	178	PHE
5	G	190	THR
5	G	196	GLU
5	G	210	PHE
6	H	4	ARG
6	H	8	PHE
6	H	9	SER
6	H	46	LEU
6	H	49	GLU
6	H	60	ARG
6	H	74	LEU
6	H	107	THR
6	H	127	VAL
6	H	156	PHE
6	H	181	ASP
7	I	8	ARG
7	I	9	THR
7	I	12	PHE
7	I	60	PHE
7	I	68	LEU
7	I	116	ASP
7	I	121	TYR

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
7	I	124	PHE
7	I	136	TYR
7	I	141	LYS
7	I	151	ASP
7	I	184	MET
7	I	217	THR
8	J	45	VAL
8	J	48	LYS
8	J	55	ASP
8	J	67	ASP
8	J	70	CYS
8	J	71	MET
8	J	76	LEU
8	J	143	ARG
8	J	148	ASP
8	J	178	ASP
8	J	221	ASN
8	J	239	ASN
9	K	9	ASP
9	K	21	LEU
9	K	24	VAL
9	K	63	SER
9	K	73	HIS
9	K	76	CYS
9	K	83	LYS
9	K	107	MET
9	K	108	THR
9	K	113	THR
9	K	137	PHE
9	K	166	ASP
9	K	185	TYR
9	K	197	SER
9	K	198	SER
9	K	211	ASN
9	K	213	THR
9	K	214	ASN
9	K	240	ASP
10	L	7	ASP
10	L	8	ASN
10	L	41	LYS
10	L	51	ARG
10	L	65	HIS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
10	L	68	ASN
10	L	69	HIS
10	L	72	ILE
10	L	87	PHE
10	L	112	ILE
10	L	140	MET
10	L	148	CYS
10	L	176	MET
10	L	202	GLU
10	L	223	ILE
10	L	226	ASP
10	L	234	GLU
10	L	239	ARG
11	M	63	ASN
11	M	75	MET
11	M	97	ASN
11	M	123	THR
11	M	124	LEU
11	M	143	ASN
11	M	144	ASP
11	M	150	MET
11	M	152	ASP
11	M	177	GLU
11	M	184	MET
11	M	186	CYS
11	M	195	LYS
11	M	207	LYS
11	M	209	PHE
11	M	215	TRP
12	N	14	LEU
12	N	24	SER
12	N	28	ASN
12	N	42	PHE
12	N	43	CYS
12	N	51	ASP
12	N	65	PHE
12	N	66	HIS
12	N	75	LEU
12	N	77	HIS
12	N	82	LEU
12	N	83	PHE
12	N	104	ASP

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
12	N	143	TYR
12	N	155	PHE
12	N	182	SER
13	O	66	HIS
13	O	80	ASN
13	O	86	MET
13	O	93	TYR
13	O	110	LEU
13	O	118	SER
13	O	135	MET
13	O	176	CYS
13	O	181	ASN
13	O	197	THR
13	O	212	LEU
14	P	7	ASN
14	P	12	MET
14	P	14	MET
14	P	25	ASP
14	P	27	ARG
14	P	39	PHE
14	P	56	LEU
14	P	96	TYR
14	P	97	GLU
14	P	106	GLU
14	P	108	VAL
14	P	136	PHE
14	P	147	TYR
14	P	161	ASP
14	P	162	HIS
15	Q	3	TYR
15	Q	20	VAL
15	Q	34	LYS
15	Q	39	SER
15	Q	43	LEU
15	Q	53	THR
15	Q	99	HIS
15	Q	117	TYR
15	Q	129	PHE
15	Q	137	PHE
15	Q	153	ARG
15	Q	169	LYS
15	Q	171	PHE

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
15	Q	190	ASP
15	Q	192	ASP
15	Q	193	ASN
16	R	6	PHE
16	R	21	THR
16	R	38	ASN
16	R	45	MET
16	R	54	PHE
16	R	61	ARG
16	R	67	GLU
16	R	95	LEU
16	R	119	ASN
16	R	136	TYR
16	R	139	MET
16	R	161	TYR
16	R	165	TYR
16	R	190	ASP
16	R	191	ASN
16	R	196	HIS
17	S	7	PHE
17	S	20	PHE
17	S	36	HIS
17	S	44	TYR
17	S	104	TYR
17	S	110	ILE
17	S	114	ASP
17	S	130	TYR
17	S	136	LYS
17	S	146	GLN
17	S	170	ARG
17	S	177	ASP
17	S	179	PHE
17	S	188	TYR
17	S	204	ARG
18	T	3	ASN
18	T	5	MET
18	T	7	THR
18	T	21	VAL
18	T	26	MET
18	T	36	PHE
18	T	37	ARG
18	T	50	MET

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
18	T	54	SER
18	T	96	MET
18	T	100	ARG
18	T	103	MET
18	T	107	TRP
18	T	115	TYR
18	T	117	ASP
18	T	124	TYR
18	T	141	TYR
18	T	159	VAL
18	T	195	LYS
18	T	214	MET
19	X	76	PHE
19	X	78	ASN
19	X	97	LEU
19	X	116	TRP
19	X	126	ARG
19	X	133	LEU
19	X	143	TYR
19	X	154	LEU
19	X	156	GLU
19	X	168	GLU
19	X	177	TYR
19	X	212	MET
19	X	230	SER
19	X	233	TYR
19	X	258	LYS
19	X	274	LYS
19	X	299	LEU
19	X	314	ARG
19	X	315	ASP
19	X	337	ARG
19	X	374	PHE
19	X	384	VAL
19	X	388	PHE
19	X	398	GLU
20	Y	22	LEU
20	Y	23	ARG
20	Y	47	ASP
20	Y	49	ASN
20	Y	55	GLU
20	Y	61	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
20	Y	63	TRP
20	Y	65	ILE
20	Y	73	MET
20	Y	81	LEU
20	Y	93	LYS
20	Y	95	LEU
20	Y	104	MET
20	Y	105	MET
20	Y	131	THR
20	Y	134	LEU
20	Y	137	ARG
20	Y	139	ASP
20	Y	140	ILE
20	Y	142	PHE
20	Y	155	ASP
20	Y	163	LYS
20	Y	176	ARG
20	Y	177	ARG
20	Y	180	LEU
20	Y	184	GLN
20	Y	188	CYS
20	Y	192	ARG
20	Y	231	LEU
20	Y	235	ASP
20	Y	236	LEU
20	Y	239	LYS
20	Y	281	GLU
20	Y	284	LYS
20	Y	288	PHE
20	Y	292	TYR
20	Y	331	ASP
20	Y	377	LEU
21	Z	32	GLN
21	Z	40	LEU
21	Z	42	SER
21	Z	43	TRP
21	Z	62	ASP
21	Z	66	SER
21	Z	71	ASP
21	Z	73	ASP
21	Z	119	SER
21	Z	130	ASP

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
21	Z	135	THR
21	Z	151	THR
21	Z	249	PHE
21	Z	251	LEU
21	Z	257	MET
21	Z	259	VAL
21	Z	262	LEU
21	Z	264	SER
21	Z	284	ASP
22	a	58	LYS
22	a	61	GLU
22	a	63	PHE
22	a	67	PHE
22	a	97	LEU
22	a	114	CYS
22	a	123	LEU
22	a	124	ASN
22	a	133	GLU
22	a	139	GLU
22	a	156	TYR
22	a	169	HIS
22	a	184	ASP
22	a	205	LEU
22	a	238	TYR
22	a	247	ARG
22	a	252	LYS
22	a	291	LEU
22	a	292	THR
22	a	335	TRP
22	a	363	MET
23	b	1	MET
23	b	20	ASP
23	b	22	LEU
23	b	25	ARG
23	b	36	VAL
23	b	56	ASN
23	b	57	ASP
23	b	65	THR
23	b	71	ILE
23	b	75	LEU
23	b	83	LYS
23	b	95	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
23	b	139	ASP
23	b	150	THR
24	d	95	TYR
24	d	104	ARG
24	d	154	TRP
24	d	176	PHE
24	d	177	ASP
24	d	178	TYR
24	d	185	SER
24	d	188	MET
24	d	248	LYS
24	d	258	PHE
24	d	260	ILE
24	d	274	CYS
24	d	294	ASN
24	d	315	TYR
24	d	357	MET
25	f	66	LYS
25	f	79	ARG
25	f	98	PHE
25	f	108	GLU
25	f	113	MET
25	f	117	GLU
25	f	124	ASP
25	f	131	MET
25	f	141	LYS
25	f	158	TYR
25	f	160	ARG
25	f	172	GLU
25	f	192	VAL
25	f	194	TYR
25	f	202	HIS
25	f	209	MET
25	f	215	ASP
25	f	226	TYR
25	f	233	LEU
25	f	236	CYS
25	f	256	PHE
25	f	262	PHE
25	f	282	PHE
25	f	296	PHE
25	f	314	TYR

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
25	f	323	ASN
25	f	325	GLN
25	f	337	LEU
25	f	366	ASP
25	f	370	MET
25	f	376	PHE
25	f	382	ASN
25	f	399	LEU
25	f	402	ASN
25	f	416	MET
25	f	423	ASP
25	f	430	ASP
25	f	448	CYS
25	f	501	LEU
25	f	531	ASN
25	f	533	ASP
25	f	556	ARG
25	f	567	LEU
25	f	571	GLU
25	f	587	PHE
25	f	588	ARG
25	f	590	PHE
25	f	598	CYS
25	f	600	TYR
25	f	632	LYS
25	f	638	ASP
25	f	639	LYS
25	f	654	VAL
25	f	670	MET
25	f	673	ARG
25	f	674	THR
25	f	680	ARG
25	f	687	ARG
25	f	713	PHE
25	f	745	LEU
25	f	757	ASN
25	f	760	PHE
25	f	761	MET
25	f	779	CYS
25	f	782	HIS
25	f	785	ARG
25	f	813	LYS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
25	f	831	VAL
25	f	833	PHE
25	f	835	GLU
26	W	39	ARG
26	W	40	LEU
26	W	60	MET
26	W	67	LEU
26	W	73	MET
26	W	98	LYS
26	W	109	CYS
26	W	130	MET
26	W	146	THR
26	W	166	LEU
26	W	169	LEU
26	W	193	CYS
26	W	198	ASP
26	W	222	LEU
26	W	223	LYS
26	W	226	TYR
26	W	243	ILE
26	W	251	TYR
26	W	280	ASP
26	W	288	HIS
26	W	294	LYS
26	W	323	ASP
26	W	326	MET
26	W	340	VAL
26	W	378	MET
26	W	382	LEU
26	W	392	PHE
26	W	403	PHE
26	W	406	VAL
26	W	413	ILE
26	W	424	LEU
26	W	437	SER
26	W	440	ASN
26	W	441	LYS
26	W	444	HIS
27	V	94	VAL
27	V	103	SER
27	V	107	ARG
27	V	134	PHE

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
27	V	224	LEU
27	V	225	ASP
27	V	240	LEU
27	V	332	LEU
27	V	400	HIS
27	V	418	SER
27	V	467	TYR
27	V	469	THR
27	V	471	GLU
28	e	30	LEU
28	e	31	ASP
28	e	37	HIS
28	e	38	VAL
28	e	41	ASP
28	e	45	ASP
28	e	47	ASN
28	e	49	GLU
28	e	54	ASN
28	e	56	LEU
29	A	29	ASP
29	A	40	THR
29	A	62	LEU
29	A	105	ASP
29	A	118	PHE
29	A	122	VAL
29	A	135	GLU
29	A	145	ASN
29	A	165	GLN
29	A	173	THR
29	A	177	VAL
29	A	185	GLU
29	A	197	HIS
29	A	236	CYS
29	A	249	TYR
29	A	261	PHE
29	A	265	ARG
29	A	268	LYS
29	A	275	ASP
29	A	278	ASP
29	A	309	PHE
29	A	323	ARG
29	A	325	ASP

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
29	A	332	MET
29	A	355	PHE
29	A	356	LYS
29	A	376	LEU
29	A	381	THR
29	A	411	GLU
30	F	53	LYS
30	F	54	ILE
30	F	55	MET
30	F	72	LYS
30	F	75	GLU
30	F	86	LEU
30	F	92	ASN
30	F	123	VAL
30	F	144	LYS
30	F	159	LEU
30	F	162	GLU
30	F	166	THR
30	F	168	TYR
30	F	169	ASP
30	F	175	MET
30	F	187	ASP
30	F	192	ASP
30	F	206	MET
30	F	209	LYS
30	F	223	VAL
30	F	226	TYR
30	F	245	LYS
30	F	266	LYS
30	F	315	ASN
30	F	320	PHE
30	F	344	ARG
30	F	349	ASP
30	F	356	MET
30	F	358	ASN
30	F	400	CYS
30	F	420	TYR
30	F	421	MET
30	F	426	GLU
31	E	20	LYS
31	E	28	GLU
31	E	40	TYR

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
31	E	46	ASP
31	E	57	VAL
31	E	80	VAL
31	E	104	THR
31	E	110	TYR
31	E	121	ASN
31	E	150	GLU
31	E	190	GLN
31	E	251	ARG
31	E	300	HIS
31	E	316	HIS
31	E	342	ASP
31	E	352	MET
31	E	367	PHE
32	U	12	LEU
32	U	25	HIS
32	U	32	ASN
32	U	54	PHE
32	U	57	ARG
32	U	59	PHE
32	U	69	TYR
32	U	70	HIS
32	U	71	LEU
32	U	184	CYS
32	U	218	GLN
32	U	320	ASN
32	U	321	GLN
32	U	347	ASN
32	U	423	MET
32	U	438	GLN
32	U	452	ASN
32	U	457	ILE
32	U	486	MET
32	U	737	LEU
32	U	794	ASP
32	U	805	ASN
32	U	923	GLU
33	g	154	ASN
33	g	161	TYR
33	g	186	HIS
33	g	187	HIS
33	g	247	SER

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
33	g	274	MET
33	g	279	PHE
33	g	280	TYR
33	g	285	PHE
33	g	290	PHE
33	g	300	LYS
33	g	321	ASP
33	g	322	ILE
33	g	324	MET
33	g	326	LEU
33	g	356	PHE
33	g	369	ASP
33	g	376	TYR
33	g	382	HIS
33	g	383	SER
34	u	119	ILE
34	u	121	LYS
34	u	137	CYS
34	u	167	ILE
34	u	172	ASN
34	u	182	PHE
34	u	186	ASP
34	u	212	SER
34	u	263	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (35) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	57	GLN
1	B	92	GLN
3	D	222	HIS
3	D	380	GLN
4	c	278	GLN
5	G	75	ASN
9	K	224	GLN
11	M	221	ASN
11	M	224	HIS
14	P	33	GLN
16	R	89	GLN
17	S	58	HIS
18	T	61	GLN
18	T	81	HIS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
21	Z	102	HIS
21	Z	104	ASN
21	Z	202	ASN
22	a	129	GLN
22	a	193	GLN
23	b	44	ASN
23	b	56	ASN
24	d	223	ASN
25	f	161	HIS
25	f	566	HIS
27	V	400	HIS
29	A	103	ASN
29	A	247	GLN
30	F	83	ASN
31	E	55	GLN
31	E	225	HIS
31	E	254	GLN
32	U	267	ASN
32	U	320	ASN
32	U	596	ASN
33	g	355	HIS

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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	$\# Z > 2$
33	CR8	g	228	33	20,27,28	6.63	10 (50%)	15,37,39	4.18	7 (46%)

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
33	CR8	g	228	33	-	4/8/25/26	0/3/3/3

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
33	g	228	CR8	C4-C11	-17.95	1.01	1.46
33	g	228	CR8	C12-C11	-17.69	1.02	1.46
33	g	228	CR8	C5-C7	9.96	1.69	1.41
33	g	228	CR8	C6-C7	8.88	1.66	1.41
33	g	228	CR8	CA2-C2	-4.28	1.34	1.41
33	g	228	CR8	CA2-C8	3.42	1.55	1.41
33	g	228	CR8	O2-C2	2.91	1.40	1.32
33	g	228	CR8	C1-N2	2.71	1.38	1.34
33	g	228	CR8	CA3-C3	2.17	1.54	1.49
33	g	228	CR8	C1-CA1	2.15	1.54	1.50

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
33	g	228	CR8	C6-C7-C5	-9.93	94.19	115.81
33	g	228	CR8	C4-C11-C12	7.44	130.50	116.67
33	g	228	CR8	C6-C12-C11	5.81	129.13	121.25
33	g	228	CR8	O13-C11-C12	-4.30	114.63	121.56
33	g	228	CR8	C5-C4-C11	4.25	127.02	121.25
33	g	228	CR8	O13-C11-C4	-4.15	114.87	121.56
33	g	228	CR8	C12-C6-C7	-3.39	118.89	122.10

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
33	g	228	CR8	C7-C8-CA2-C2
33	g	228	CR8	C7-C8-CA2-N2
33	g	228	CR8	CA1-C20-C21-N22
33	g	228	CR8	CA1-C20-C21-C23

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 10 ligands modelled in this entry, 4 are monoatomic - leaving 6 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
37	ADP	E	501	-	24,29,29	0.87	0	29,45,45	1.23	2 (6%)
37	ADP	D	501	36	24,29,29	0.84	0	29,45,45	1.32	3 (10%)
37	ADP	A	501	-	24,29,29	0.89	0	29,45,45	1.18	2 (6%)
37	ADP	F	501	-	24,29,29	0.87	1 (4%)	29,45,45	1.21	3 (10%)
35	ATP	C	501	36	28,33,33	0.82	0	34,52,52	0.62	1 (2%)
35	ATP	B	501	36	28,33,33	0.90	2 (7%)	34,52,52	0.63	1 (2%)

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
37	ADP	E	501	-	-	4/12/32/32	0/3/3/3
37	ADP	D	501	36	-	3/12/32/32	0/3/3/3
37	ADP	A	501	-	-	0/12/32/32	0/3/3/3
37	ADP	F	501	-	-	3/12/32/32	0/3/3/3
35	ATP	C	501	36	-	5/18/38/38	0/3/3/3
35	ATP	B	501	36	-	4/18/38/38	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
35	B	501	ATP	PB-O3B	-2.43	1.56	1.59
35	B	501	ATP	PA-O3A	-2.00	1.57	1.59
37	F	501	ADP	O4'-C1'	2.00	1.43	1.40

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
37	A	501	ADP	N3-C2-N1	-3.64	123.73	128.67
37	D	501	ADP	N3-C2-N1	-3.59	123.79	128.67
37	F	501	ADP	N3-C2-N1	-3.58	123.81	128.67
37	E	501	ADP	N3-C2-N1	-3.37	124.10	128.67
37	E	501	ADP	C4-C5-N7	-2.90	106.27	109.34
37	A	501	ADP	C4-C5-N7	-2.49	106.71	109.34
37	D	501	ADP	C4-C5-N7	-2.46	106.74	109.34
35	B	501	ATP	C5-C6-N6	2.35	123.88	120.31
37	D	501	ADP	C4'-O4'-C1'	2.33	112.06	109.92
35	C	501	ATP	C5-C6-N6	2.31	123.83	120.31
37	F	501	ADP	C4-C5-N7	-2.07	107.15	109.34
37	F	501	ADP	O4'-C1'-N9	2.06	111.48	108.75

There are no chirality outliers.

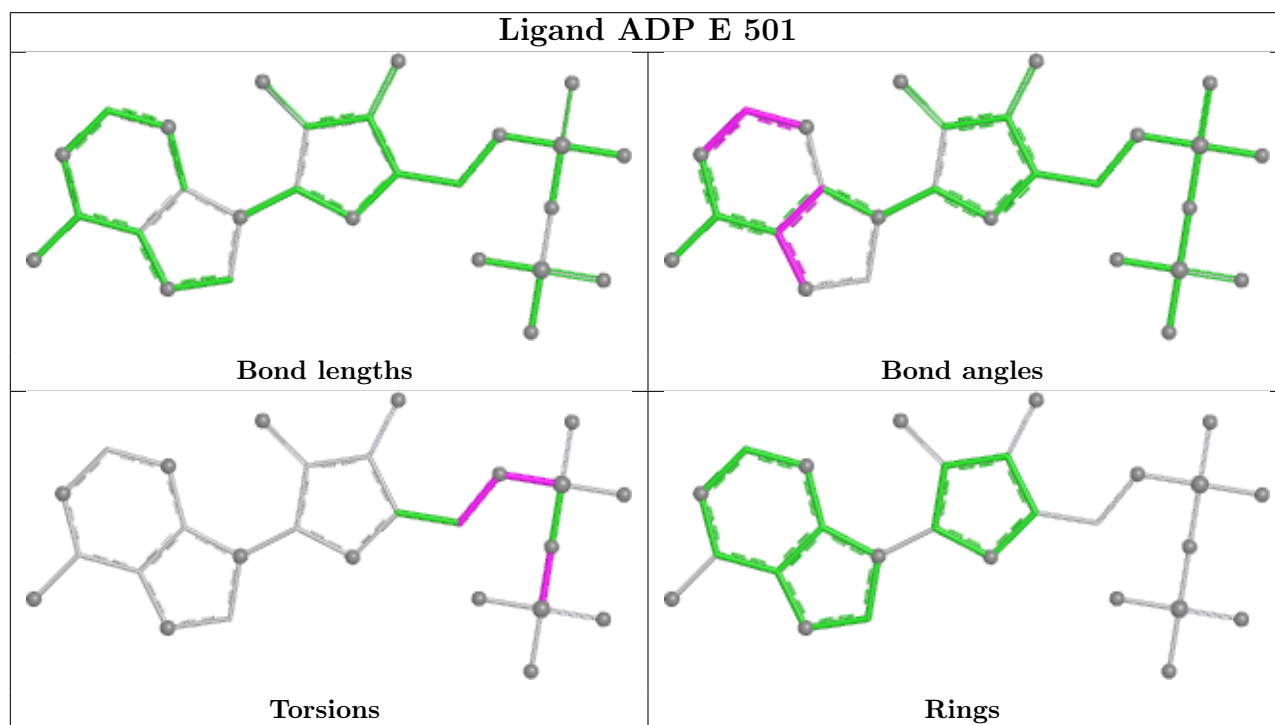
All (19) torsion outliers are listed below:

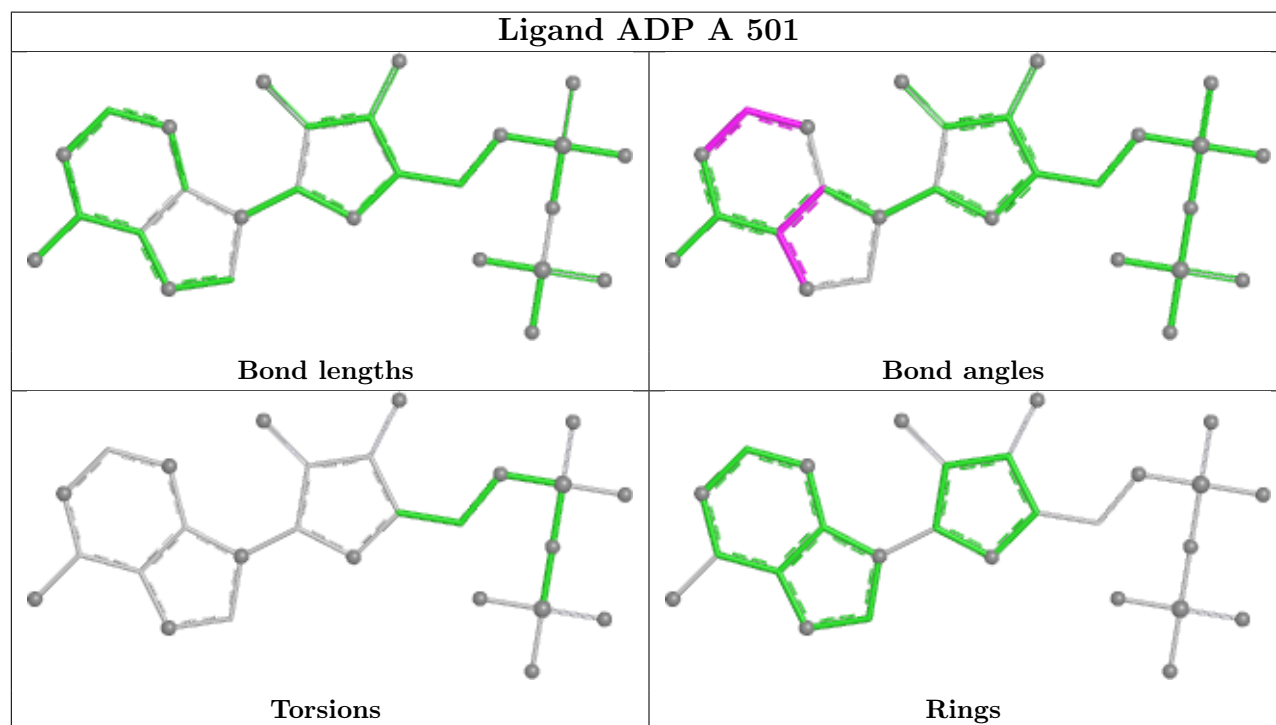
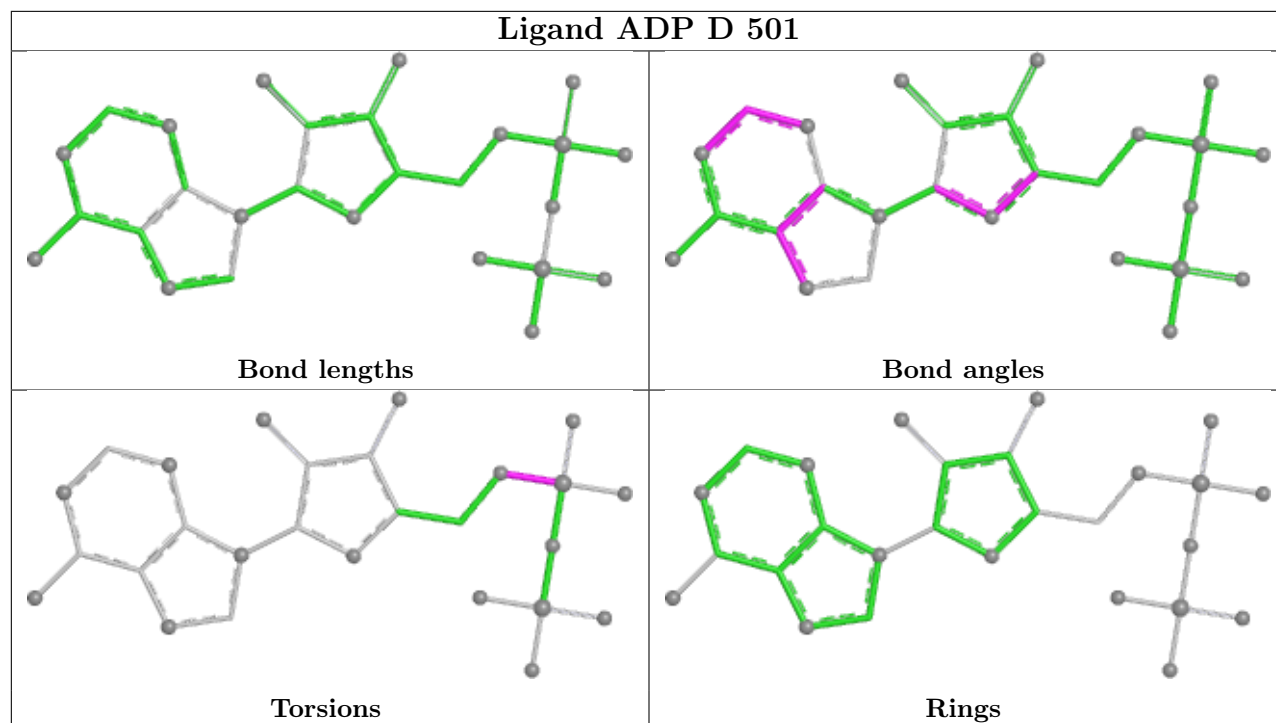
Mol	Chain	Res	Type	Atoms
35	B	501	ATP	C5'-O5'-PA-O1A
35	B	501	ATP	C5'-O5'-PA-O3A
35	C	501	ATP	PB-O3B-PG-O2G
37	D	501	ADP	C5'-O5'-PA-O1A
37	D	501	ADP	C5'-O5'-PA-O2A
37	D	501	ADP	C5'-O5'-PA-O3A
37	F	501	ADP	C5'-O5'-PA-O1A
37	F	501	ADP	C5'-O5'-PA-O2A
37	F	501	ADP	C5'-O5'-PA-O3A
37	E	501	ADP	C5'-O5'-PA-O2A
37	E	501	ADP	C5'-O5'-PA-O3A
35	B	501	ATP	C5'-O5'-PA-O2A
35	C	501	ATP	C5'-O5'-PA-O1A
37	E	501	ADP	C4'-C5'-O5'-PA
35	C	501	ATP	PB-O3B-PG-O1G
37	E	501	ADP	PA-O3A-PB-O1B
35	C	501	ATP	PG-O3B-PB-O1B
35	C	501	ATP	PG-O3B-PB-O2B
35	B	501	ATP	PG-O3B-PB-O2B

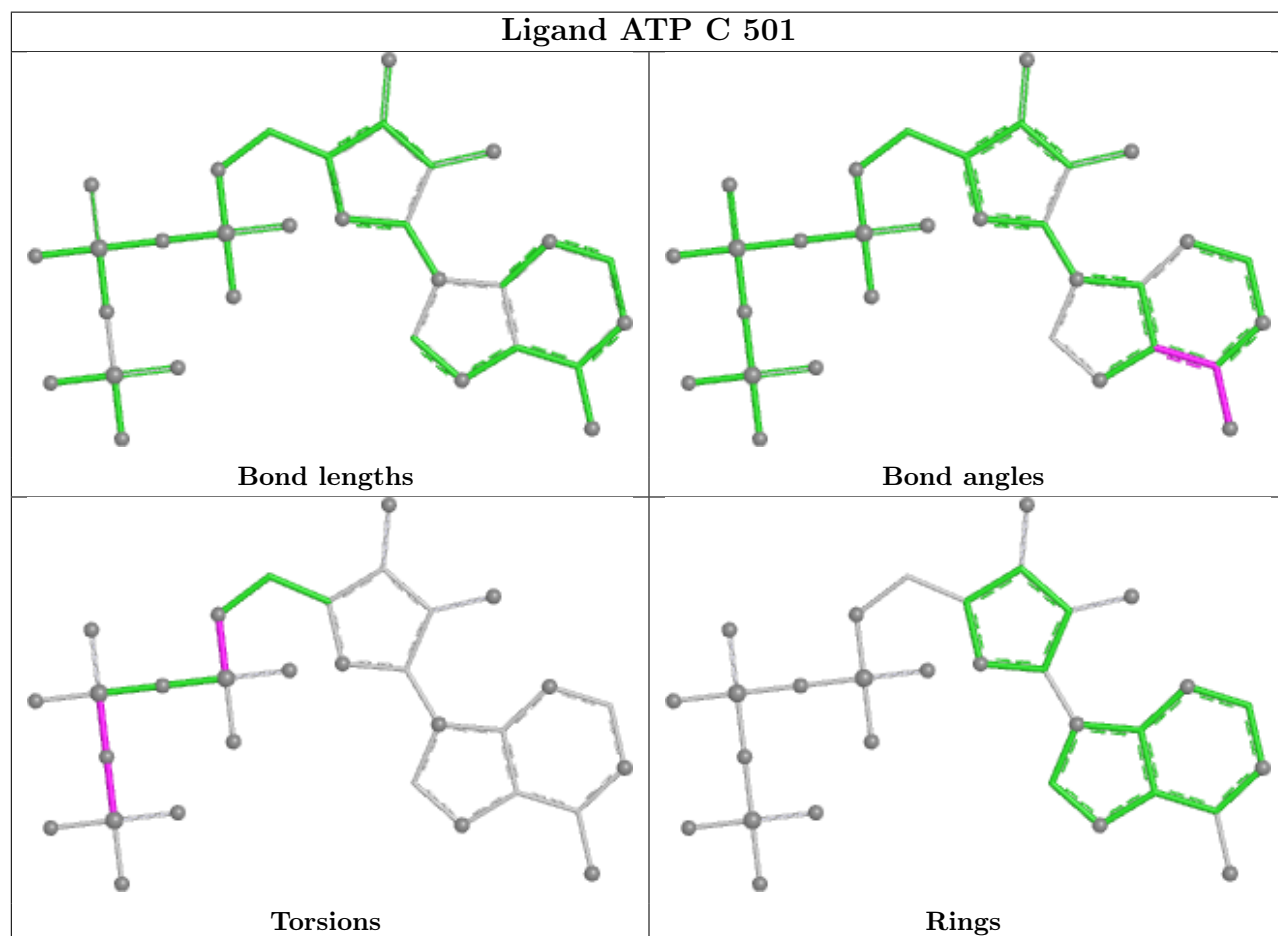
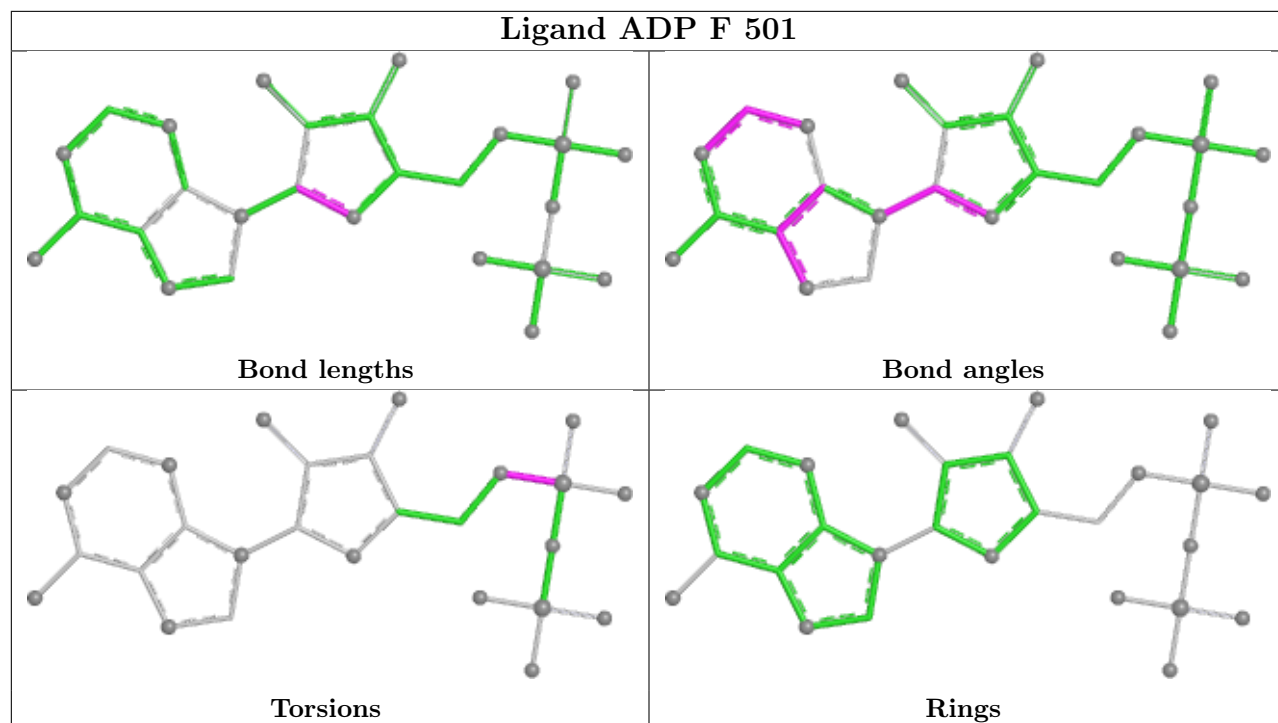
There are no ring outliers.

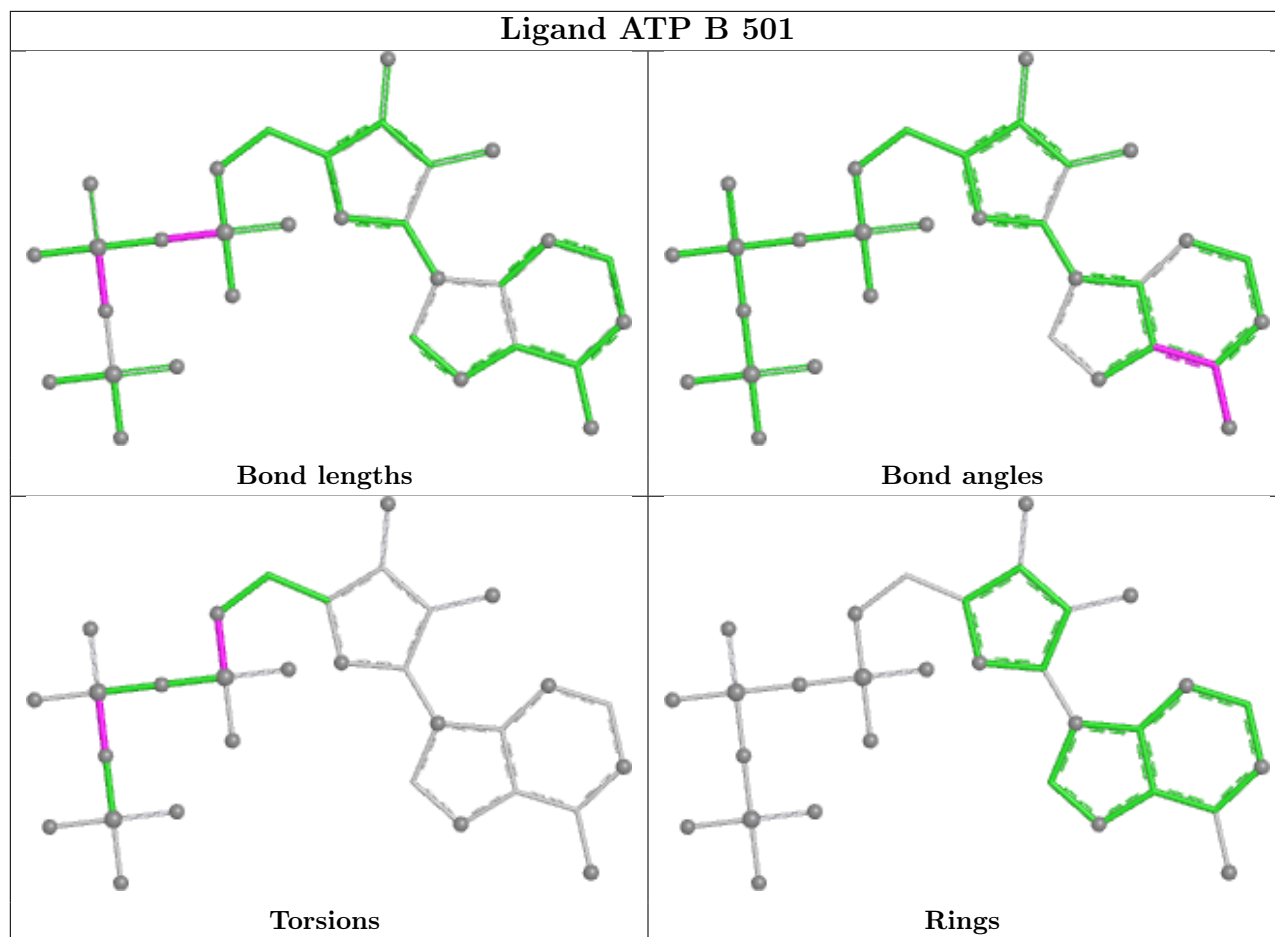
No monomer is involved in short contacts.

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
26	W	1
31	E	1
21	Z	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	W	416:GLN	C	417:ARG	N	6.76
1	E	273:VAL	C	274:LYS	N	5.62
1	Z	289:GLU	C	290:GLY	N	3.16

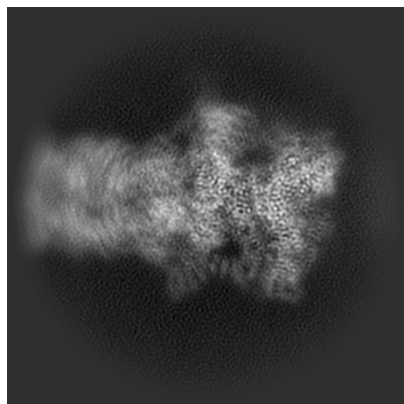
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-47726. These allow visual inspection of the internal detail of the map and identification of artifacts.

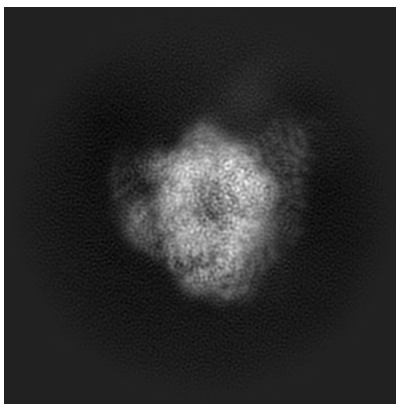
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

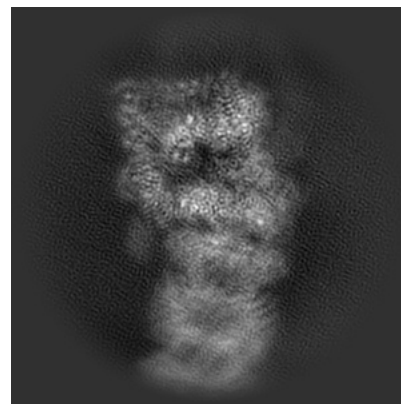
6.1.1 Primary map



X

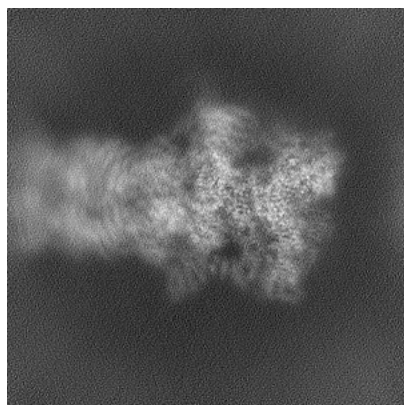


Y

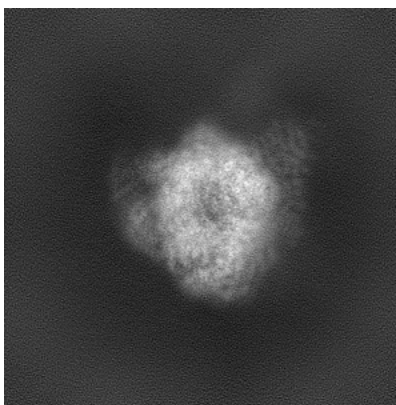


Z

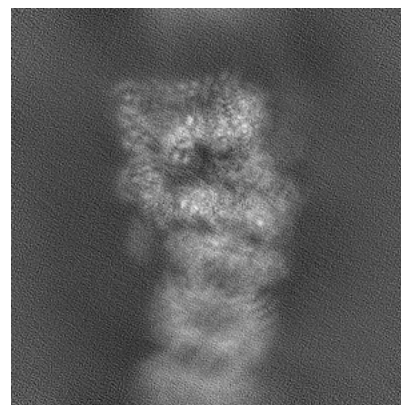
6.1.2 Raw map



X



Y

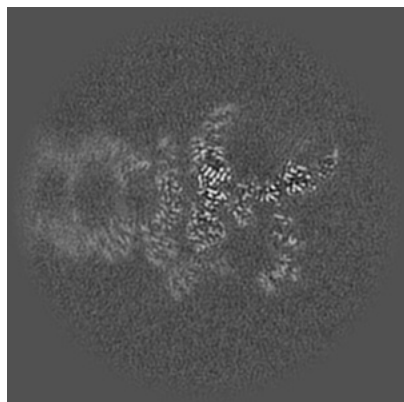


Z

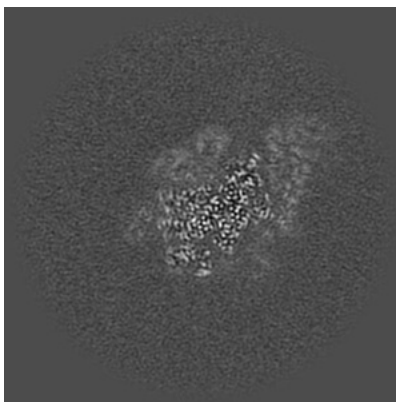
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

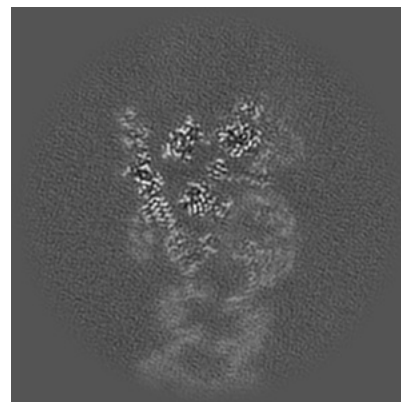
6.2.1 Primary map



X Index: 170

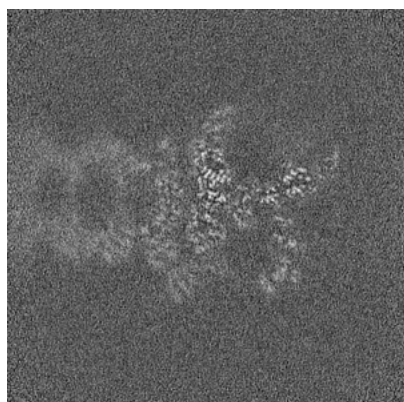


Y Index: 170

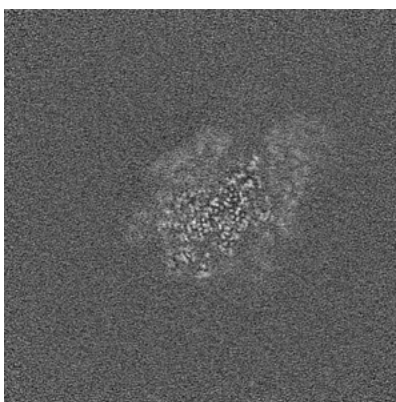


Z Index: 170

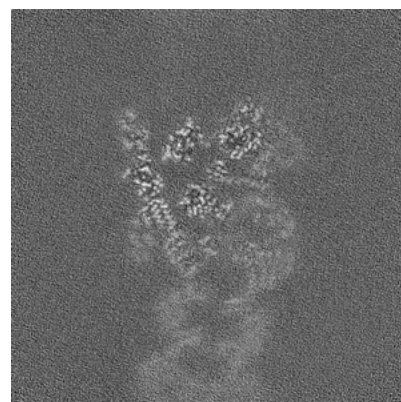
6.2.2 Raw map



X Index: 170



Y Index: 170

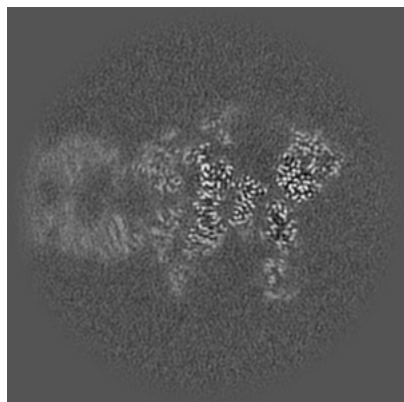


Z Index: 170

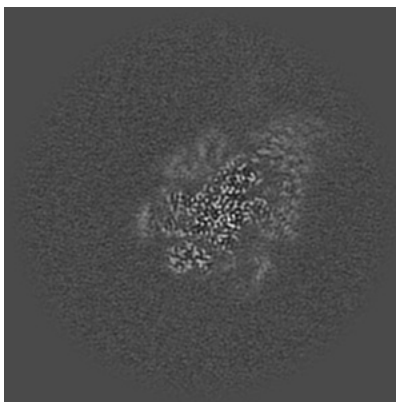
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

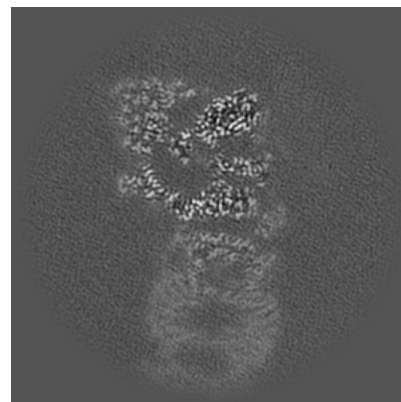
6.3.1 Primary map



X Index: 178

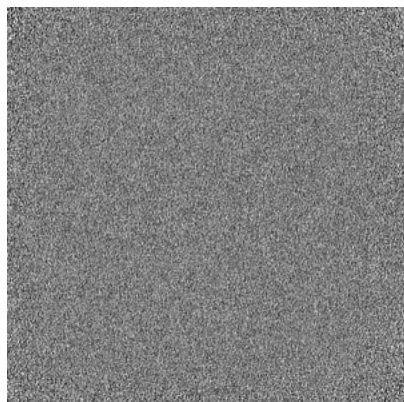


Y Index: 173

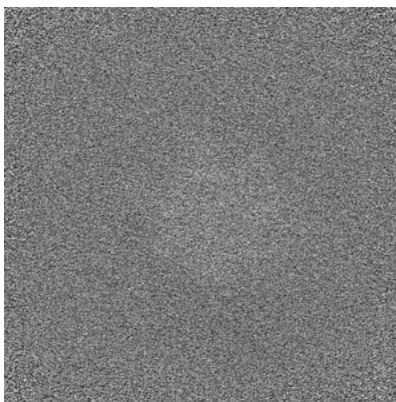


Z Index: 190

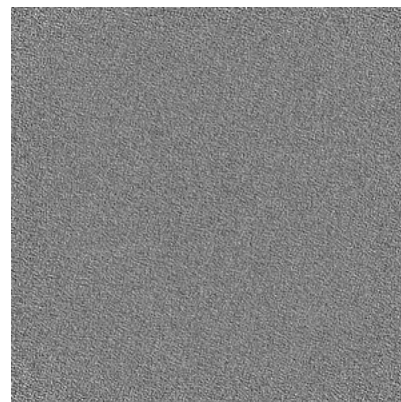
6.3.2 Raw map



X Index: 0



Y Index: 0

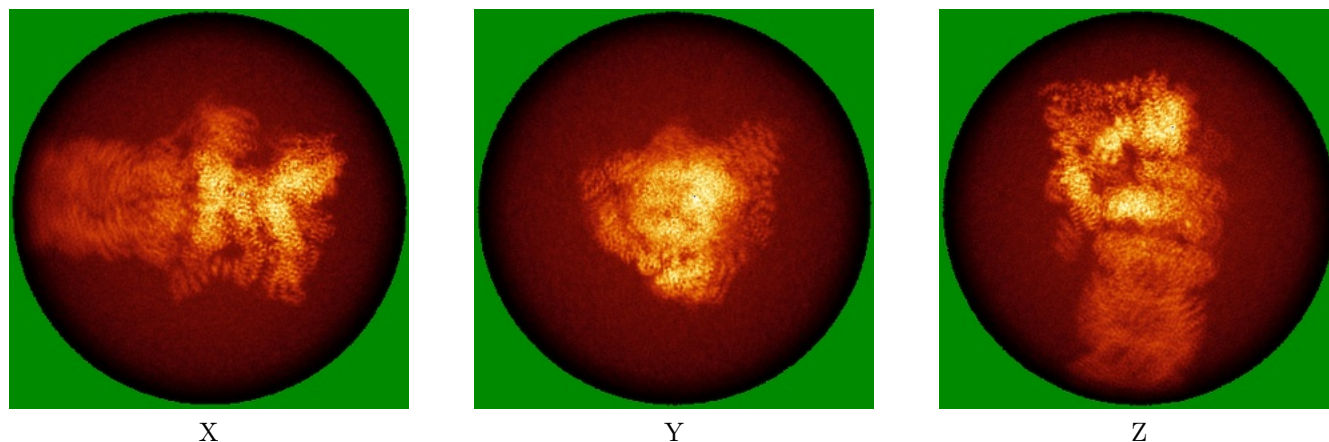


Z Index: 0

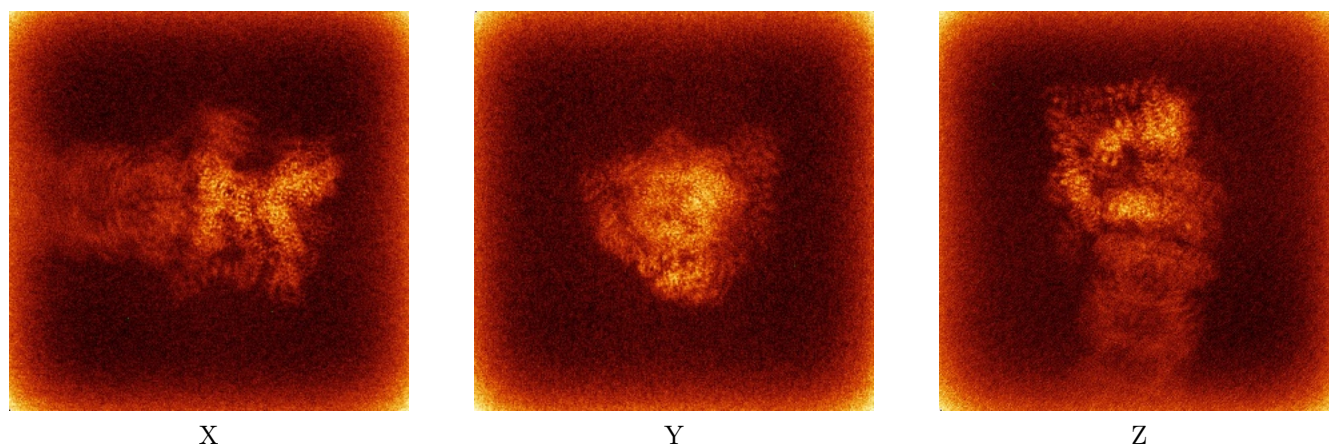
The images above show the largest variance slices of the map in three orthogonal directions.

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

6.4.1 Primary map



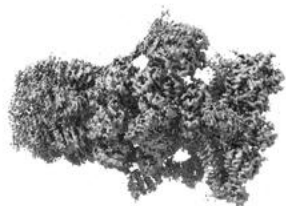
6.4.2 Raw map



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



X



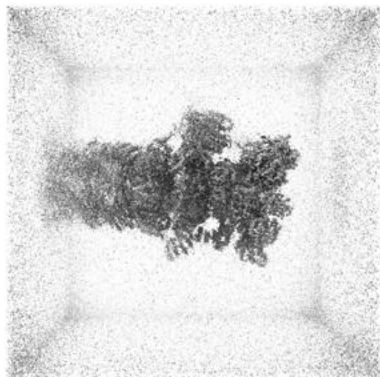
Y



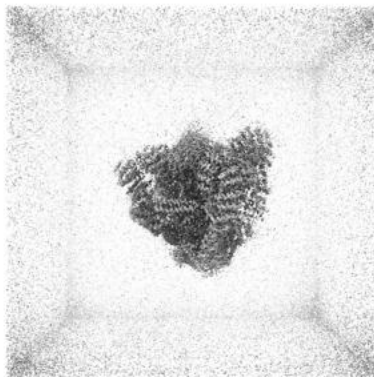
Z

The images above show the 3D surface view of the map at the recommended contour level 0.17. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

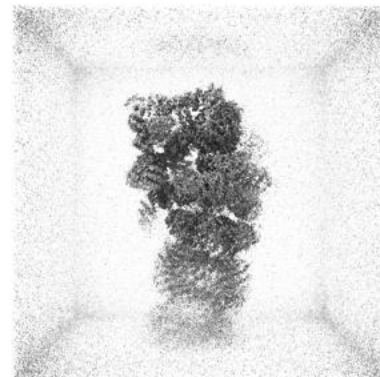
6.5.2 Raw map



X



Y



Z

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.

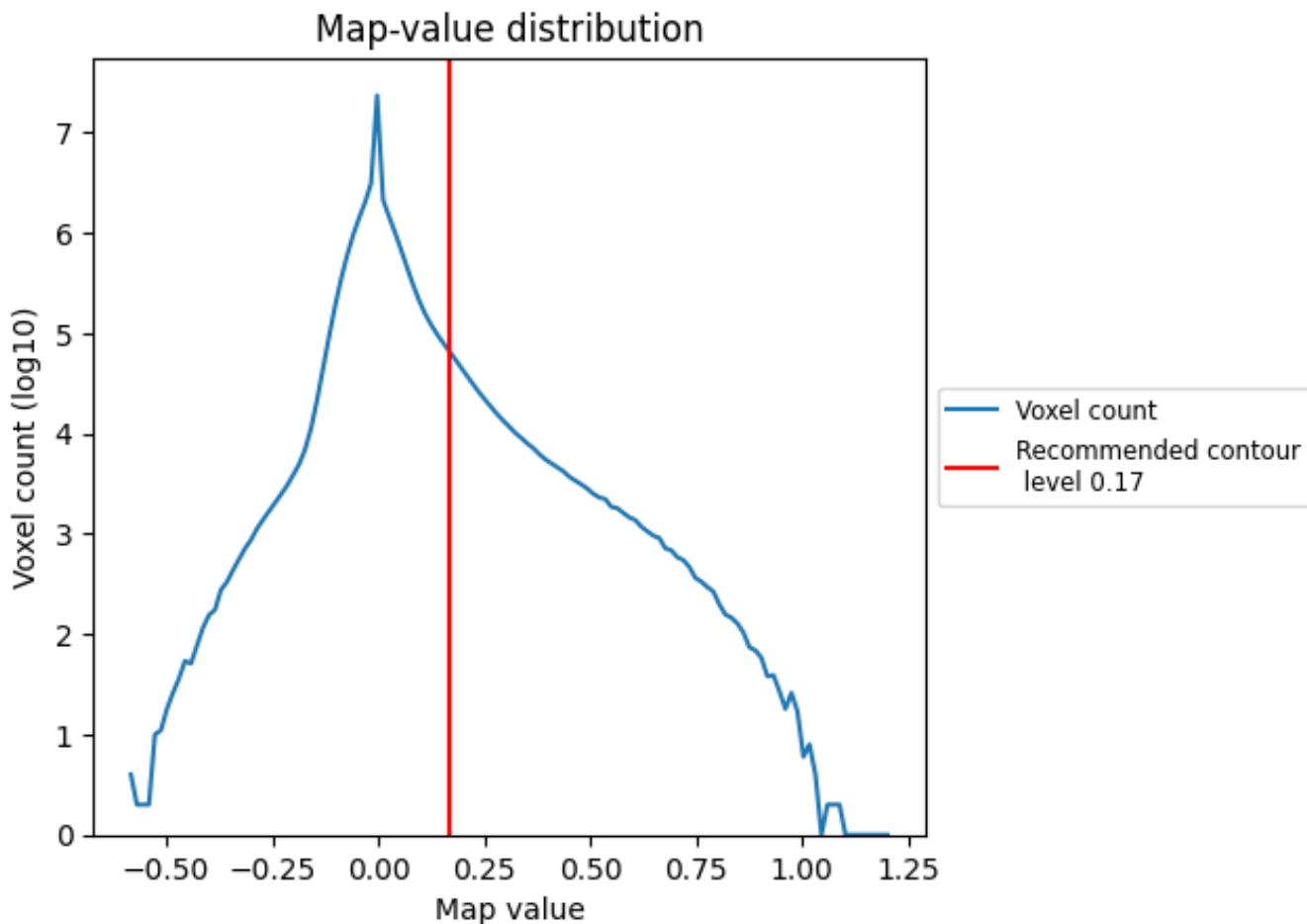
6.6 Mask visualisation [i](#)

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

7 Map analysis [i](#)

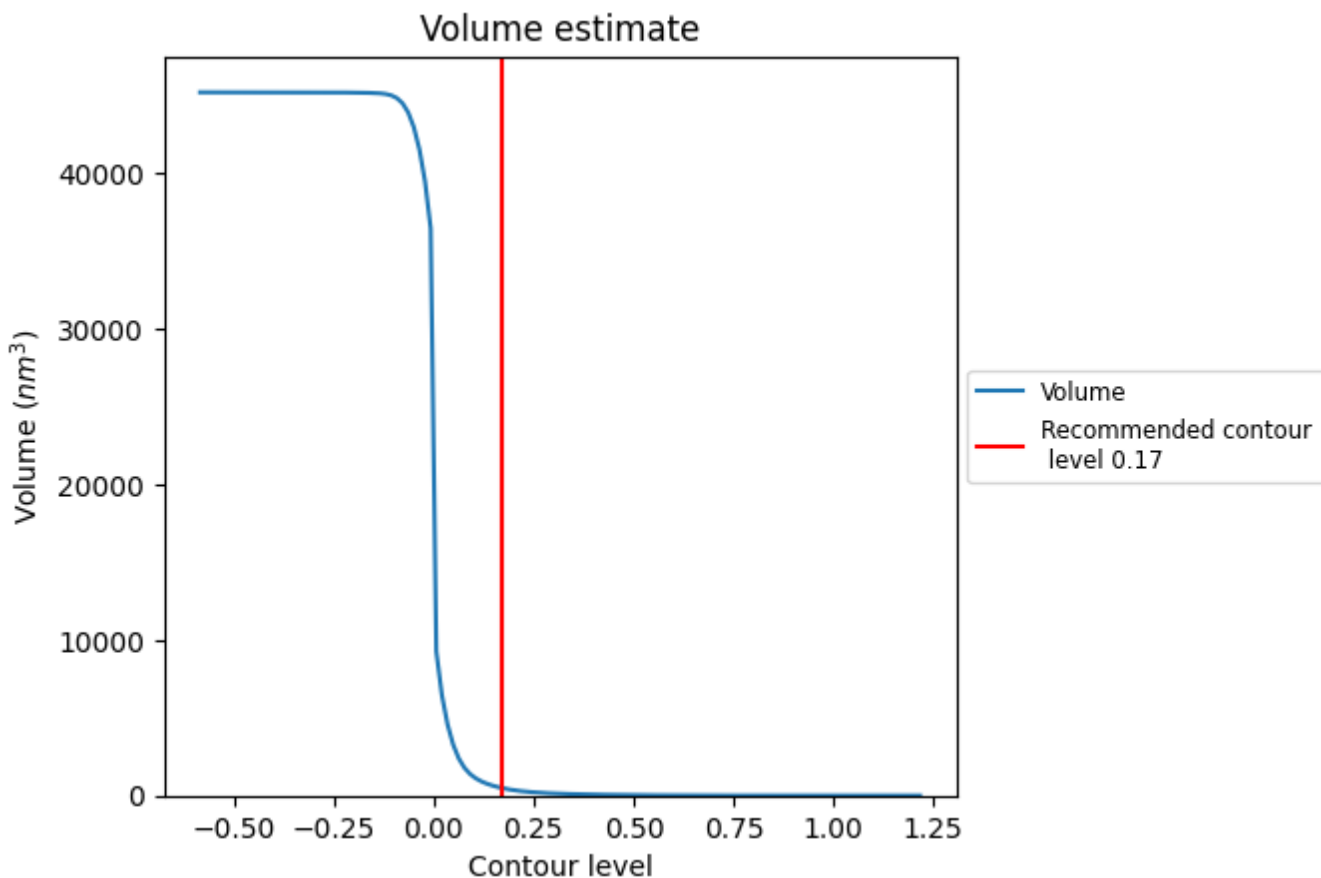
This section contains the results of statistical analysis of the map.

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.

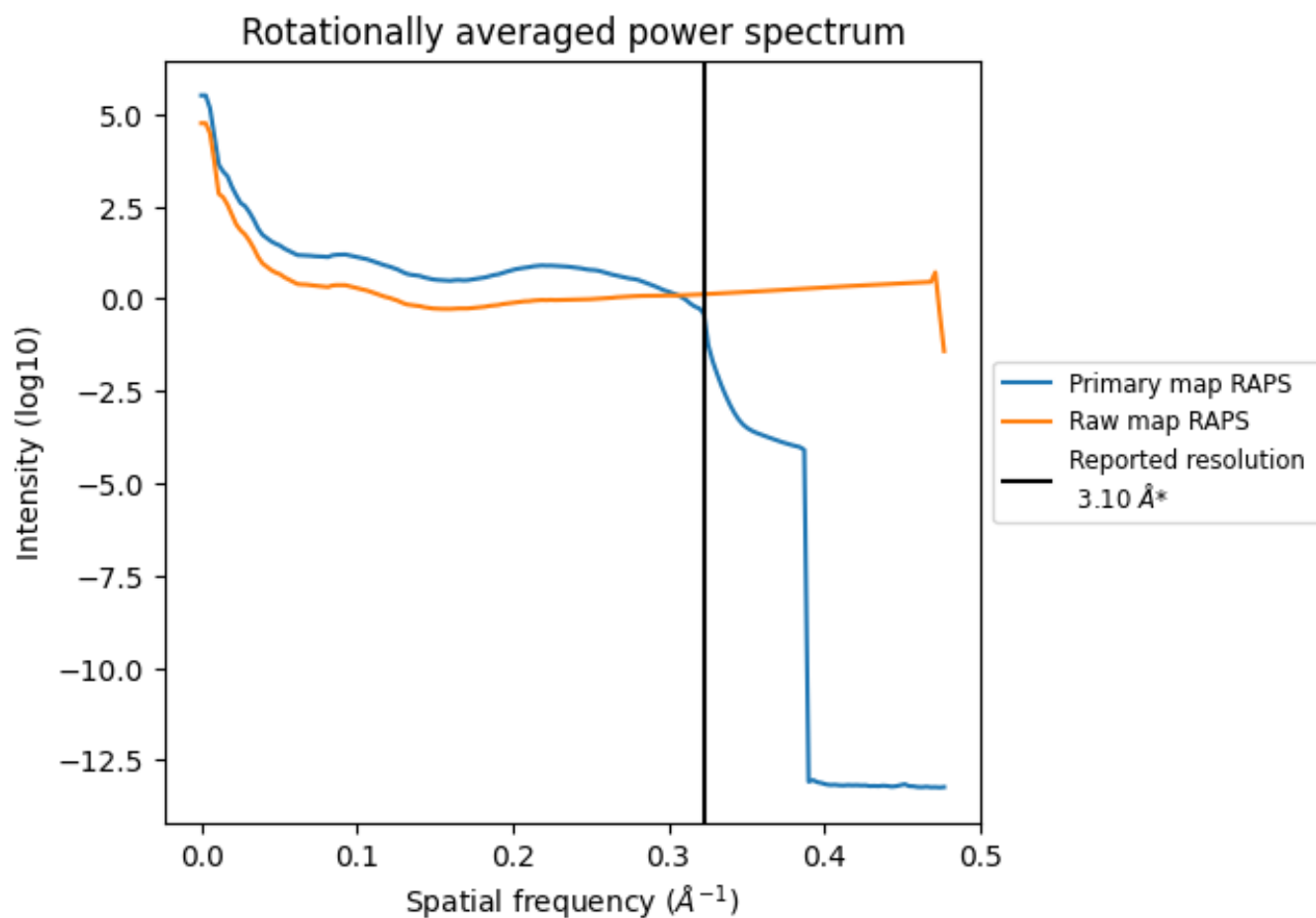
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 493 nm³; this corresponds to an approximate mass of 445 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](#)

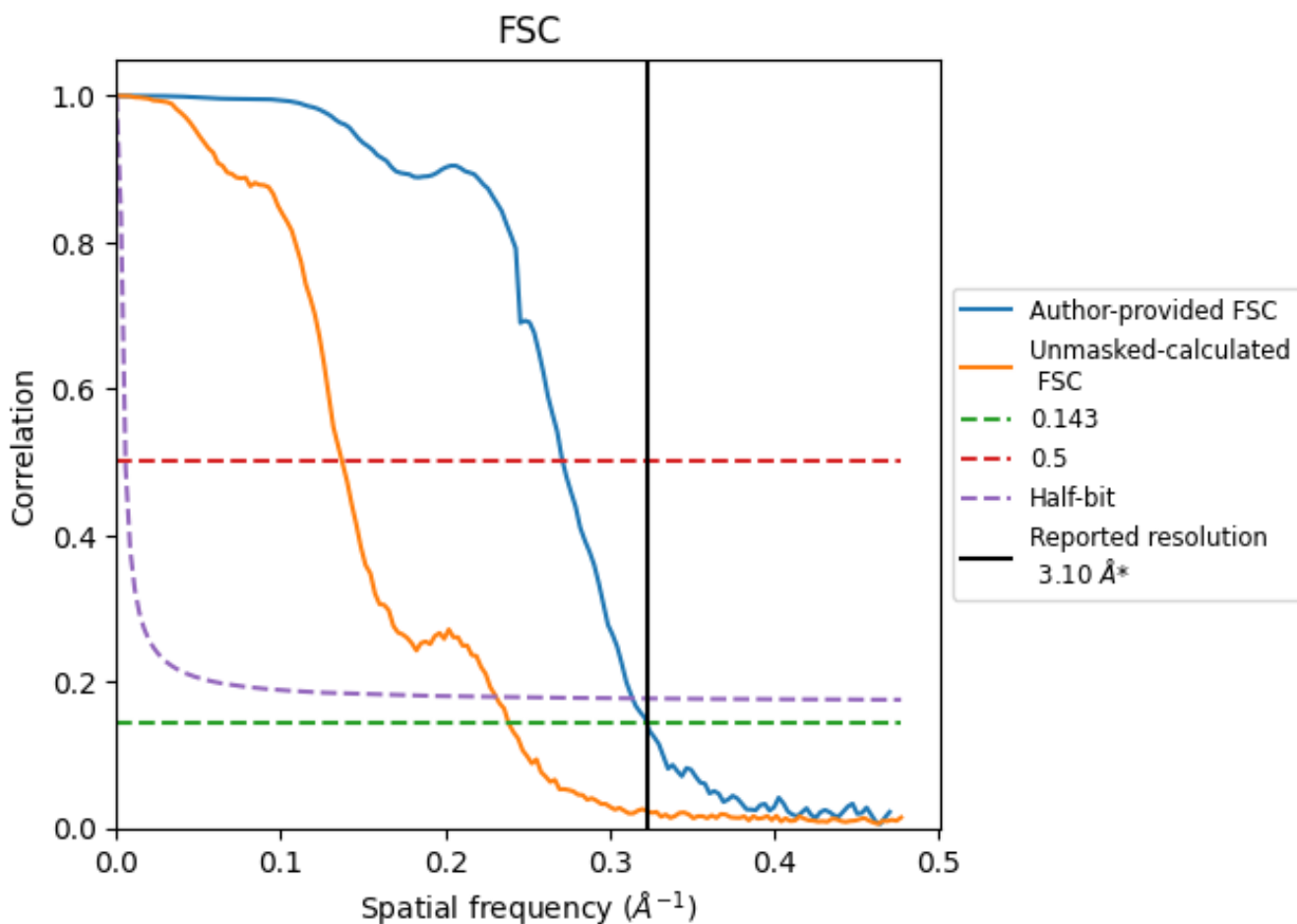


*Reported resolution corresponds to spatial frequency of 0.323 Å⁻¹

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 Å⁻¹

8.2 Resolution estimates [i](#)

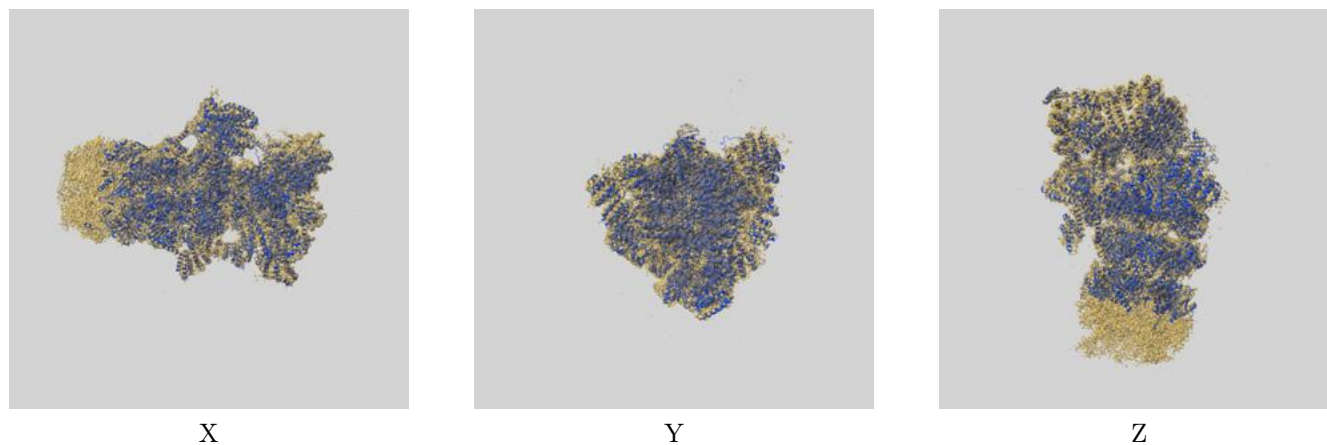
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.10	-	-
Author-provided FSC curve	3.10	3.68	3.19
Unmasked-calculated*	4.19	7.28	4.33

*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 4.19 differs from the reported value 3.1 by more than 10 %

9 Map-model fit [i](#)

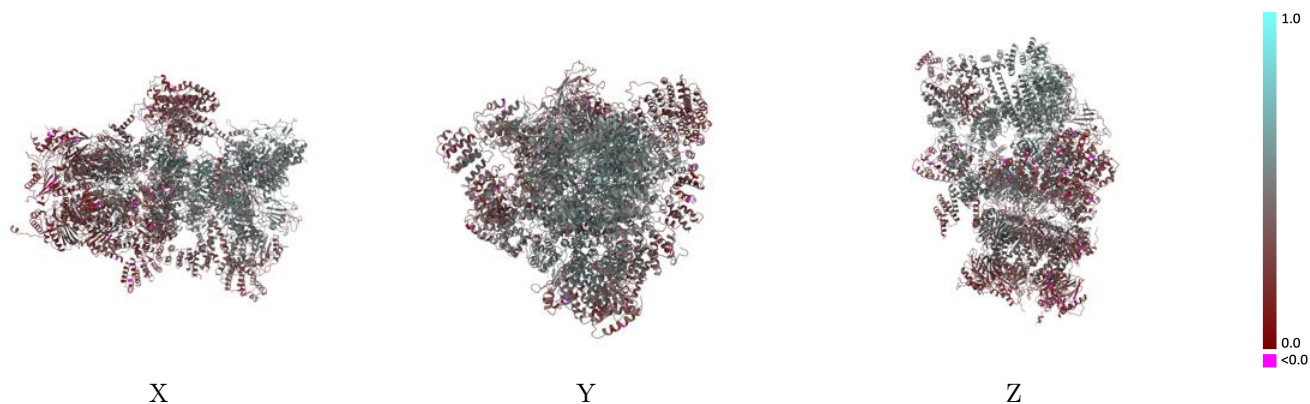
This section contains information regarding the fit between EMDB map EMD-47726 and PDB model 9E8O. Per-residue inclusion information can be found in section 3 on page 15.

9.1 Map-model overlay [i](#)



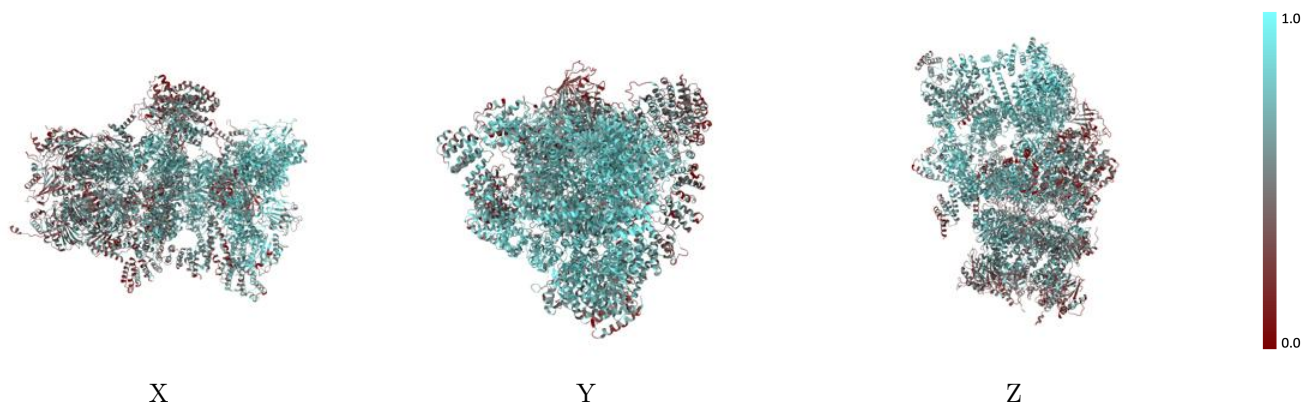
The images above show the 3D surface view of the map at the recommended contour level 0.17 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



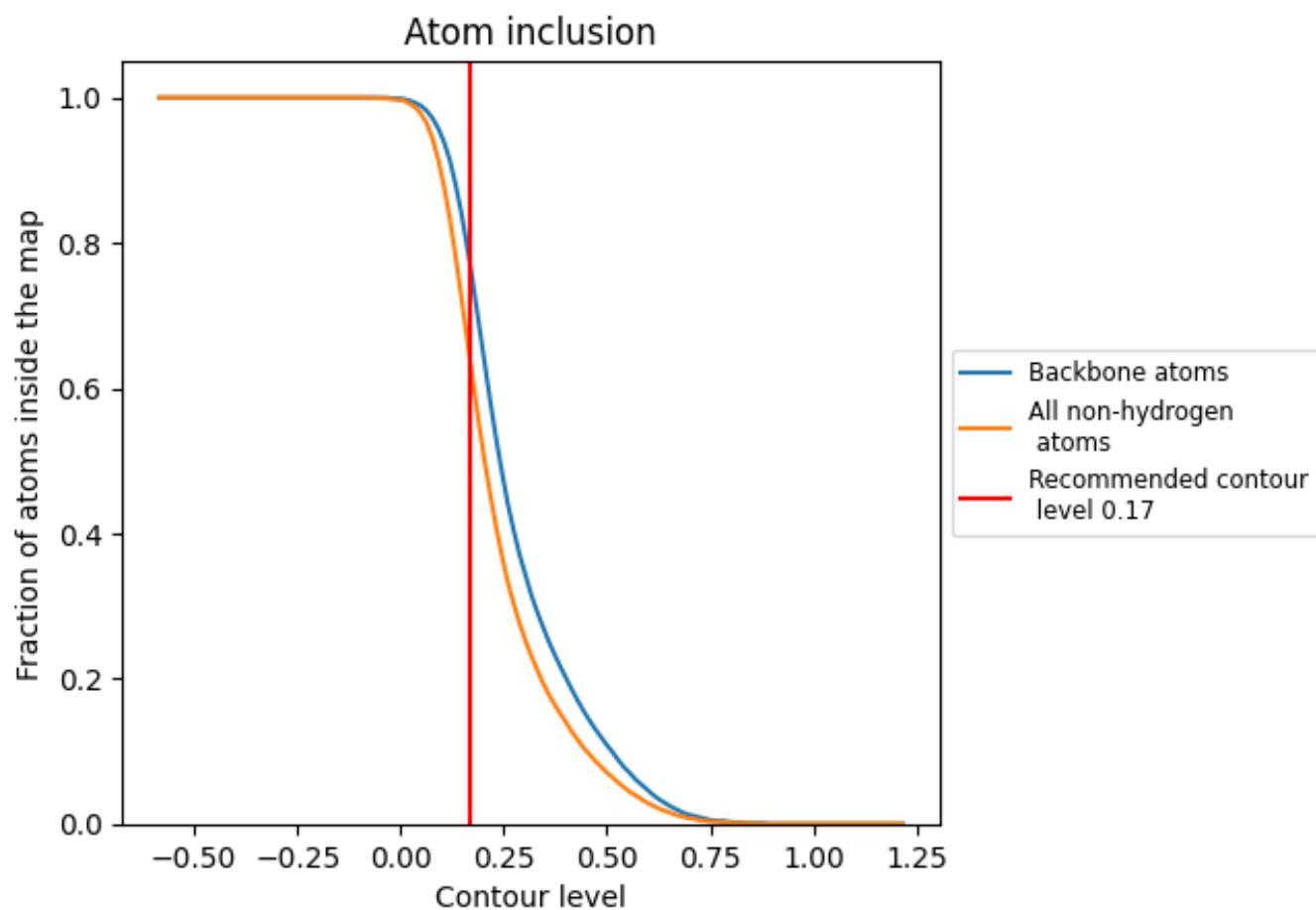
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.17).







































































9.4 Atom inclusion [i](#)



At the recommended contour level, 77% of all backbone atoms, 63% 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 (0.17) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.6320	 0.4010
A	 0.5720	 0.3890
B	 0.7330	 0.4860
C	 0.8390	 0.5360
D	 0.8330	 0.5250
E	 0.6740	 0.4320
F	 0.4790	 0.3320
G	 0.6080	 0.3840
H	 0.7390	 0.4610
I	 0.6790	 0.4310
J	 0.6060	 0.3930
K	 0.5900	 0.3820
L	 0.5240	 0.3390
M	 0.5230	 0.3310
N	 0.5230	 0.3090
O	 0.5080	 0.3290
P	 0.4940	 0.3140
Q	 0.4660	 0.2950
R	 0.4560	 0.2810
S	 0.4210	 0.2660
T	 0.4690	 0.2570
U	 0.8200	 0.5120
V	 0.7070	 0.4460
W	 0.5220	 0.3200
X	 0.7150	 0.4190
Y	 0.7570	 0.4110
Z	 0.7930	 0.4840
a	 0.6840	 0.3990
b	 0.6800	 0.4160
c	 0.8400	 0.5390
d	 0.6170	 0.3790
e	 0.5800	 0.3160
f	 0.4330	 0.2940
g	 0.3200	 0.4020
u	 0.6860	 0.4820

