Full wwPDB EM Validation Report ⓘ

Nov 25, 2024 – 12:38 PM EST

PDB ID	:	9E8Q
EMDB ID	:	EMD-47727
Title	:	Nub1/Fat10-processing human 26S proteasome with Rpt2 at top of spiral staircase
Authors	:	Arkinson, C.; Gee, C.L.; Martin, A.
Deposited on	:	2024-11-05
Resolution	:	3.16 Å(reported)

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

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

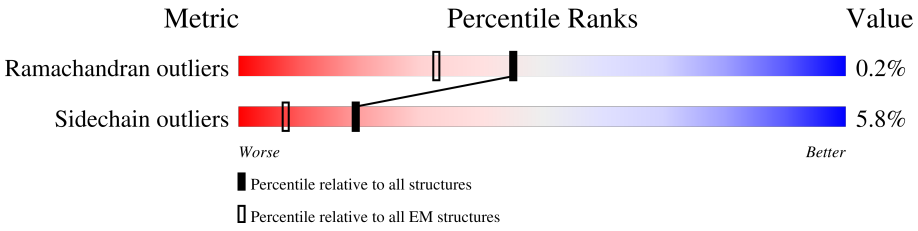
EMDB validation analysis	:	0.0.1.dev113
Mogul	:	2022.3.0, CSD as543be (2022)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA,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

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 3.16 Å.

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



Metric	Whole archive (#Entries)	EM structures (#Entries)
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 <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion < 40%). The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	433	23% 85% 5% 10%
2	B	440	8% 84% 6% 10%
3	C	406	92% 5%
4	D	418	87% 9%
5	E	389	9% 90% 6%
6	F	439	34% 77% 5% 18%
7	G	246	20% 93%
8	H	234	10% 94% 5%
9	I	261	13% 89% 7% 5%

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Mol	Chain	Length	Quality of chain
10	J	248	13% 92%
11	K	241	12% 95%
12	L	263	20% 87% 9%
13	M	255	35% 90% 5% 5%
14	N	239	46% 77% 5% 18%
15	O	277	46% 76% 21%
16	P	205	62% 95% 5%
17	Q	201	52% 95%
18	R	263	42% 72% 5% 24%
19	S	241	46% 81% 7% 12%
20	T	264	42% 76% 6% 18%
21	U	953	23% 85% 13%
22	V	534	52% 77% 19%
23	W	456	72% 89% 7%
24	X	422	33% 86% 10%
25	Y	389	39% 90% 7%
26	Z	324	20% 84% 12%
27	a	376	70% 94% 5%
28	b	377	37% 47% 49%
29	c	424	6% 63% 33%
30	d	350	59% 67% 29%
31	e	70	53% 60% 11% 29%
32	f	908	61% 90% 7%
33	v	26	27% 85% 15%

2 Entry composition (i)

There are 37 unique types of molecules in this entry. The entry contains 80403 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 7.

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

- Molecule 2 is a protein called 26S proteasome regulatory subunit 4.

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

- Molecule 3 is a protein called 26S protease regulatory subunit 8.

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

- Molecule 4 is a protein called 26S proteasome regulatory subunit 6B.

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

- Molecule 5 is a protein called 26S protease regulatory subunit 10B.

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

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

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

- Molecule 7 is a protein called Proteasome subunit alpha type-6.

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

- Molecule 8 is a protein called Proteasome subunit alpha type-2.

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

- Molecule 9 is a protein called Proteasome subunit alpha type-4.

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

- Molecule 10 is a protein called Proteasome subunit alpha type-7.

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

- Molecule 11 is a protein called Proteasome subunit alpha type-5.

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

There is a discrepancy between the modelled and reference sequences:

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

- Molecule 12 is a protein called Proteasome subunit alpha type-1.

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

- Molecule 13 is a protein called Proteasome subunit alpha type-3.

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

- Molecule 14 is a protein called Proteasome subunit beta type-6.

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

- Molecule 15 is a protein called Proteasome subunit beta type-7.

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

- Molecule 16 is a protein called Proteasome subunit beta type-3.

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

- Molecule 17 is a protein called Proteasome subunit beta type-2.

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

- Molecule 18 is a protein called Proteasome subunit beta type-5.

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

- Molecule 19 is a protein called Proteasome subunit beta type-1.

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

- Molecule 20 is a protein called Proteasome subunit beta type-4.

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

- Molecule 21 is a protein called 26S proteasome non-ATPase regulatory subunit 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
21	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 22 is a protein called 26S proteasome non-ATPase regulatory subunit 3.

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

- Molecule 23 is a protein called 26S proteasome non-ATPase regulatory subunit 12.

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

- Molecule 24 is a protein called 26S proteasome non-ATPase regulatory subunit 11.

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

- Molecule 25 is a protein called 26S proteasome non-ATPase regulatory subunit 6.

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

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

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

- Molecule 27 is a protein called 26S proteasome non-ATPase regulatory subunit 13.

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

- Molecule 28 is a protein called 26S proteasome non-ATPase regulatory subunit 4.

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

- Molecule 29 is a protein called 26S proteasome non-ATPase regulatory subunit 14.

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

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
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

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Chain	Residue	Modelled	Actual	Comment	Reference
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
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

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Chain	Residue	Modelled	Actual	Comment	Reference
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
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

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Chain	Residue	Modelled	Actual	Comment	Reference
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 30 is a protein called 26S proteasome non-ATPase regulatory subunit 8.

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

- Molecule 31 is a protein called 26S proteasome complex subunit SEM1.

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

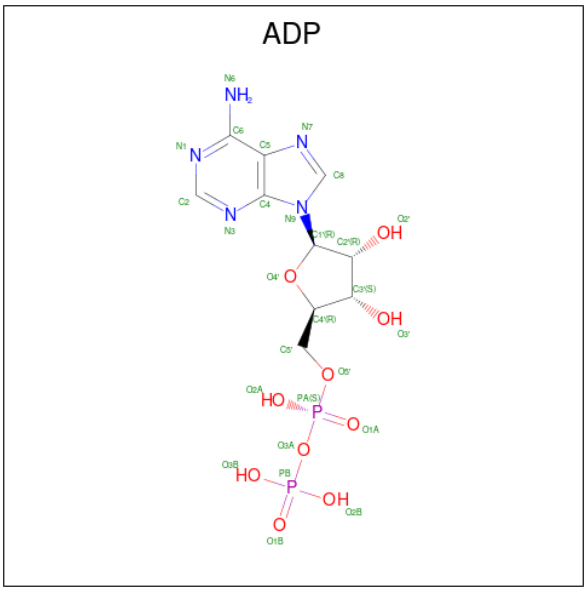
- Molecule 32 is a protein called 26S proteasome non-ATPase regulatory subunit 2.

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

- Molecule 33 is a protein called Substrate polypeptide.

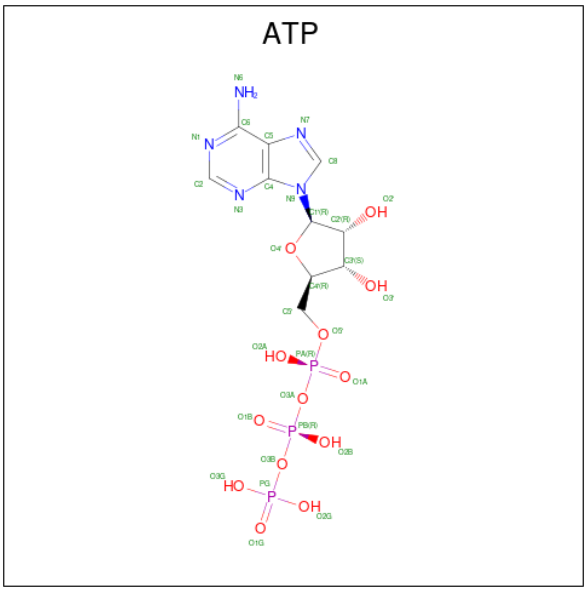
Mol	Chain	Residues	Atoms				AltConf	Trace
33	v	22	Total	C	N	O	0	0
			110	66	22	22		

- Molecule 34 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$) (labeled as "Ligand of Interest" by depositor).



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

- 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
35	B	1	Total	C	N	O	P	0
			31	10	5	13	3	
35	C	1	Total	C	N	O	P	0
			31	10	5	13	3	

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

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

- Molecule 37 is ZINC ION (three-letter code: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

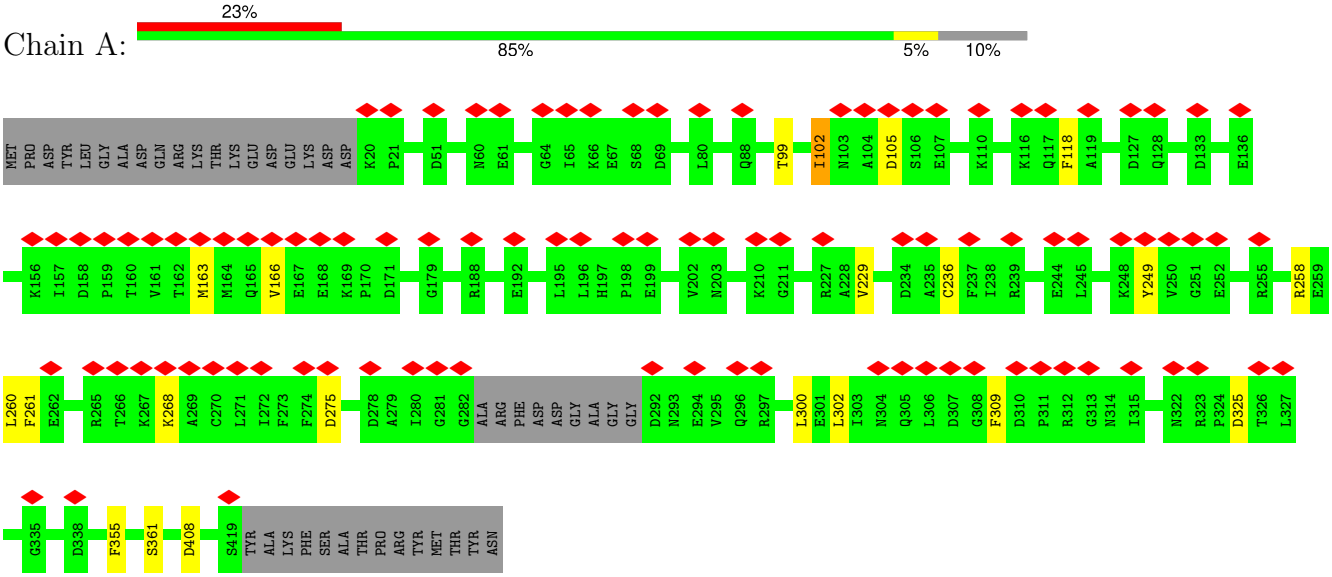
Mol	Chain	Residues	Atoms		AltConf
37	c	1	Total	Zn	0
			1	1	

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.

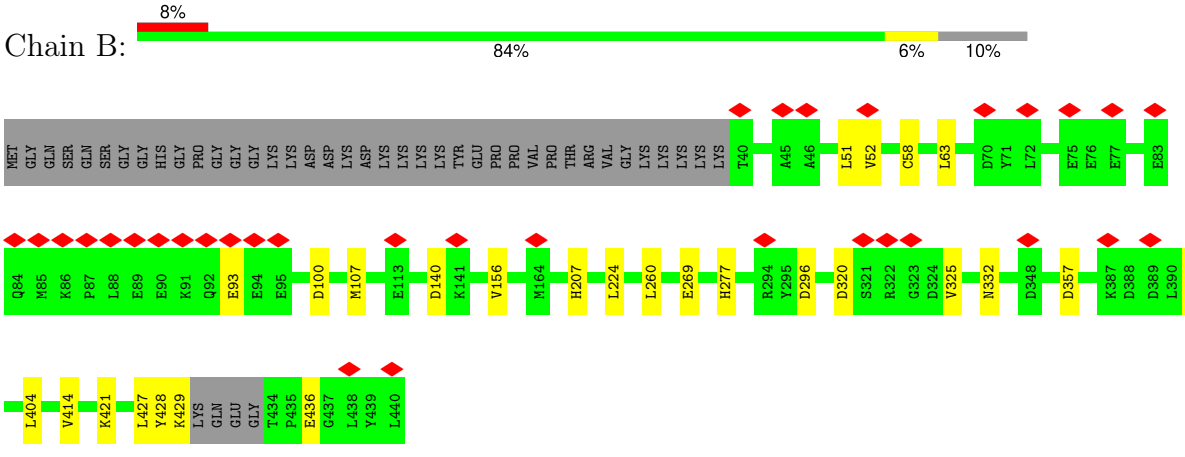
• Molecule 1: 26S proteasome regulatory subunit 7

Chain A:



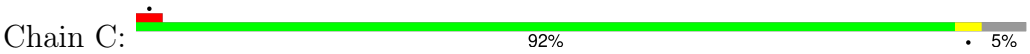
• Molecule 2: 26S proteasome regulatory subunit 4

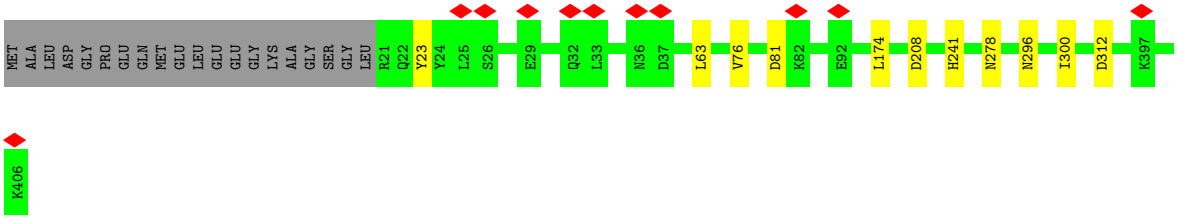
Chain B:



• Molecule 3: 26S protease regulatory subunit 8

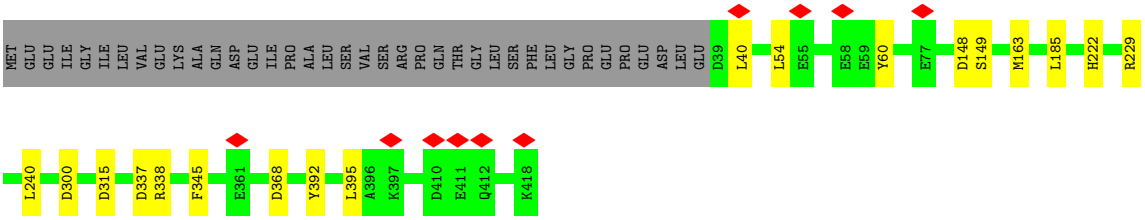
Chain C:





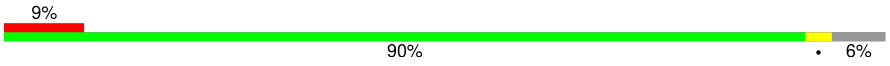
• Molecule 4: 26S proteasome regulatory subunit 6B

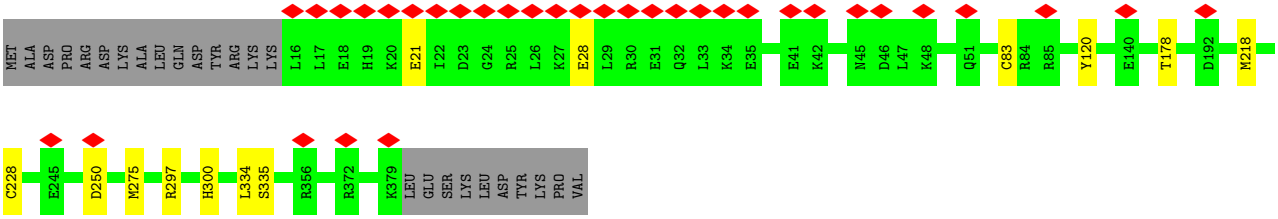
Chain D:



• Molecule 5: 26S protease regulatory subunit 10B

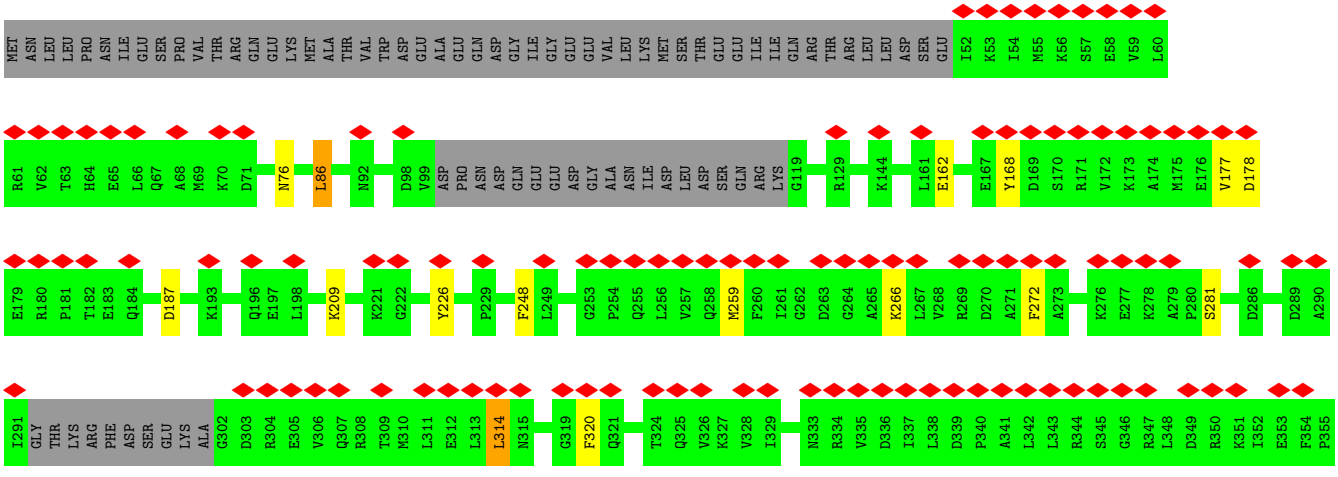
Chain E:

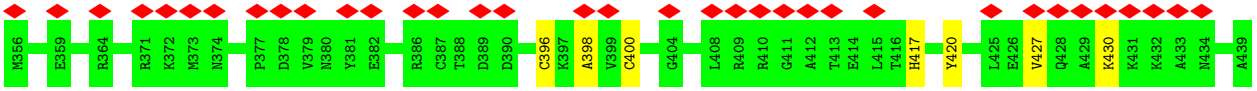




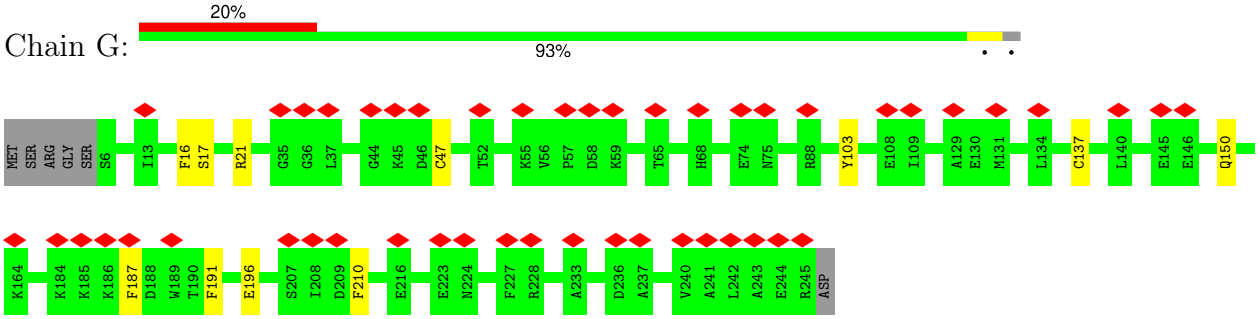
• Molecule 6: 26S proteasome regulatory subunit 6A

Chain F:

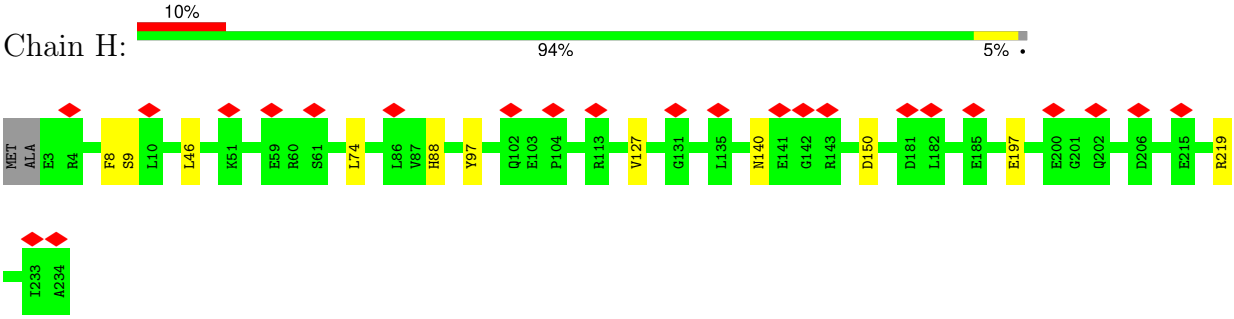




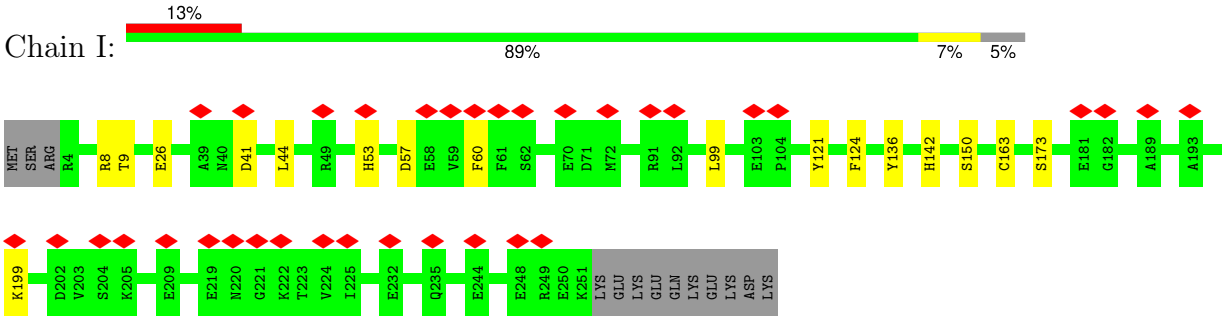
• Molecule 7: Proteasome subunit alpha type-6



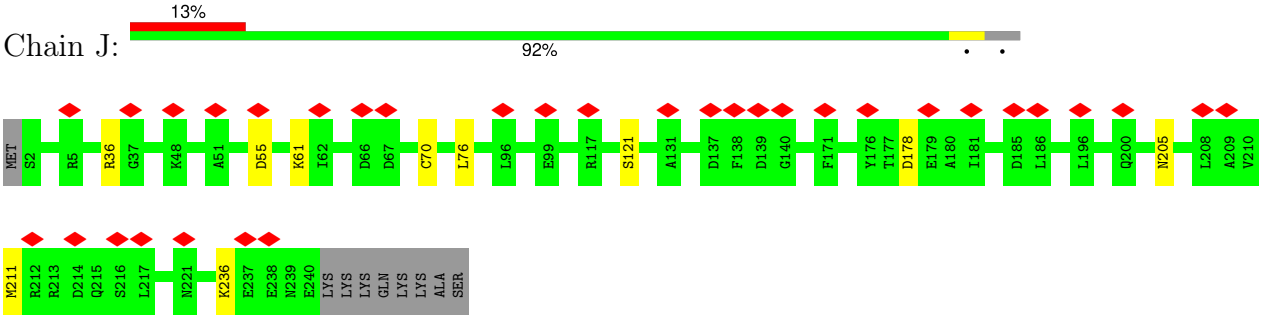
• Molecule 8: Proteasome subunit alpha type-2



• Molecule 9: Proteasome subunit alpha type-4

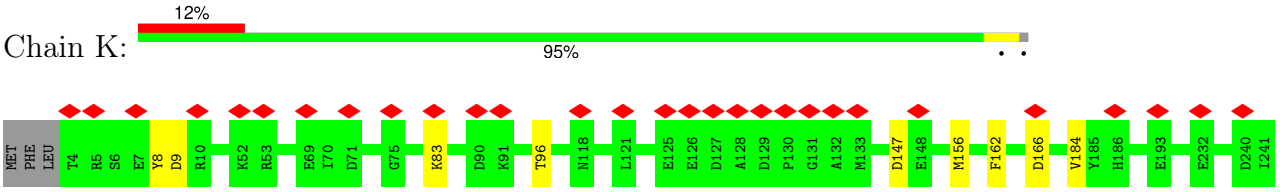


• Molecule 10: Proteasome subunit alpha type-7



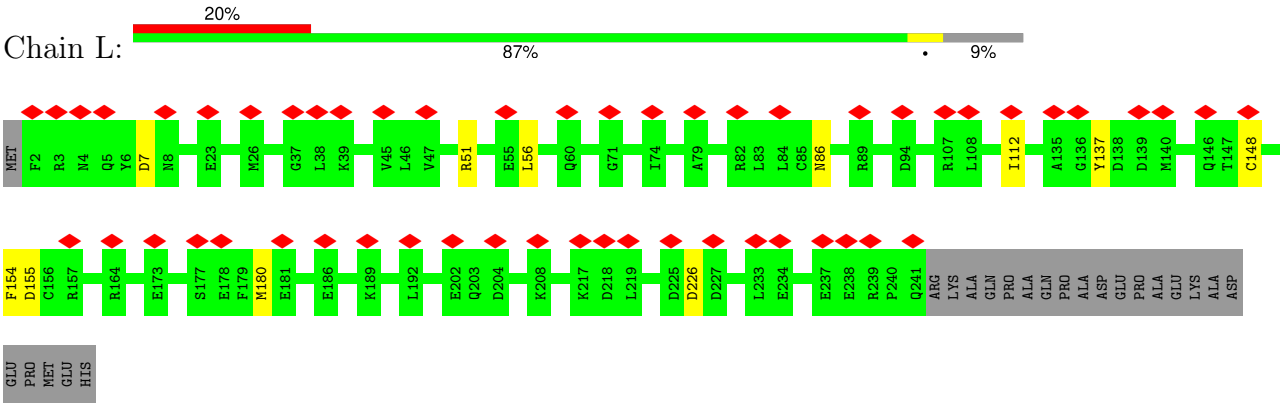
• Molecule 11: Proteasome subunit alpha type-5

Chain K:



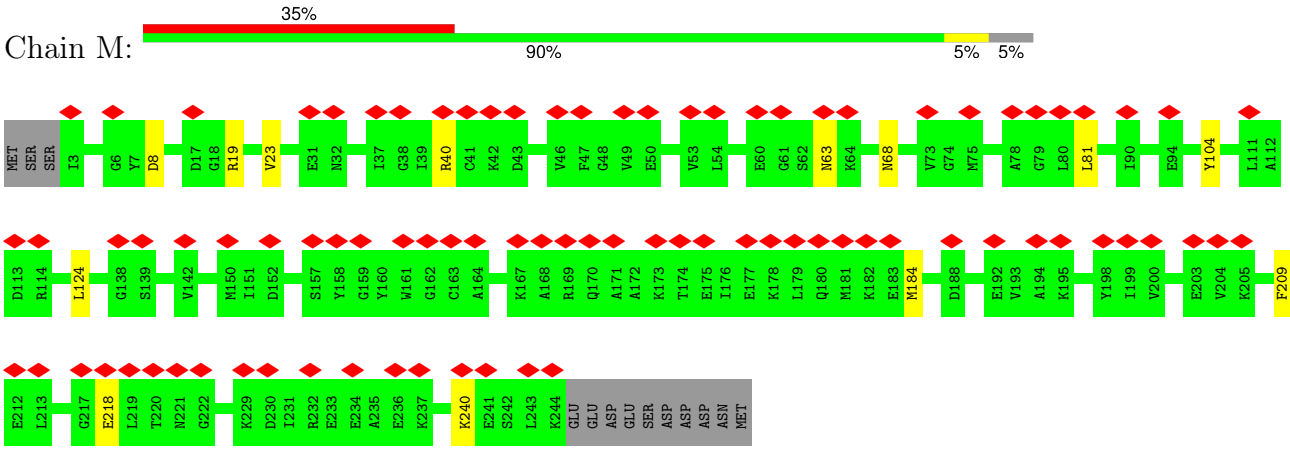
• Molecule 12: Proteasome subunit alpha type-1

Chain L:



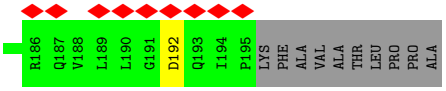
• Molecule 13: Proteasome subunit alpha type-3

Chain M:



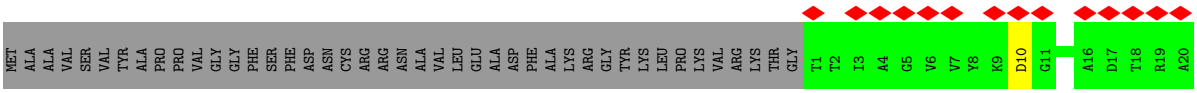
• Molecule 14: Proteasome subunit beta type-6

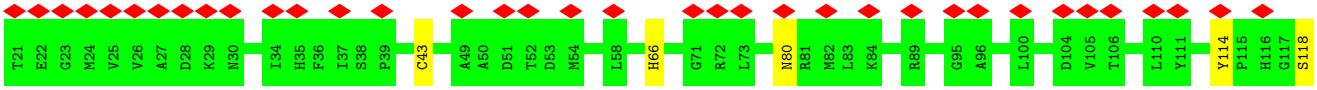
Chain N:

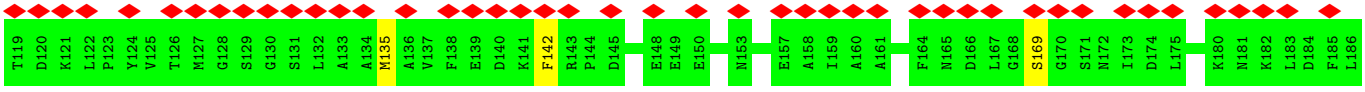


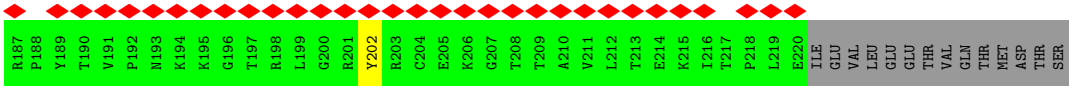
• Molecule 15: Proteasome subunit beta type-7

Chain O:



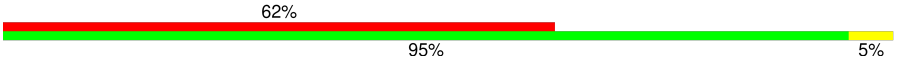


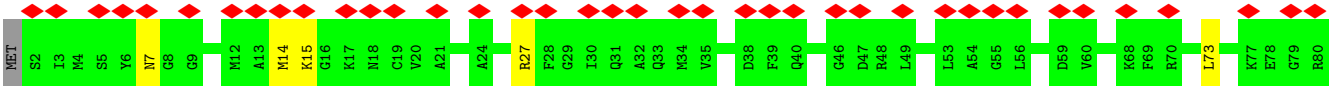


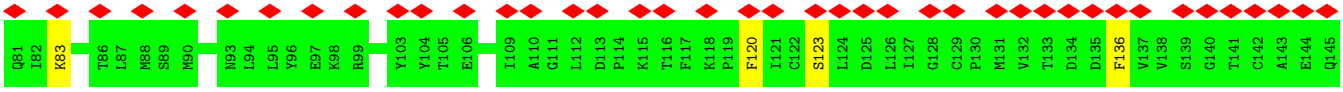


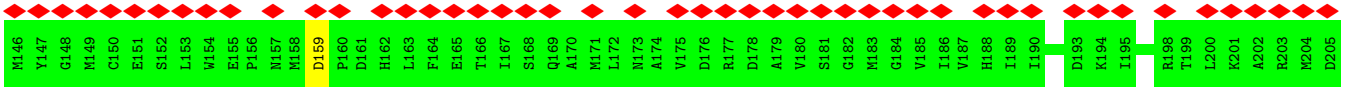
• Molecule 16: Proteasome subunit beta type-3

Chain P:



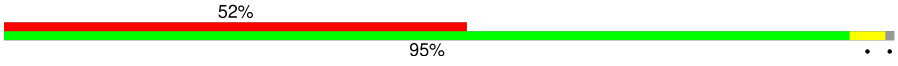


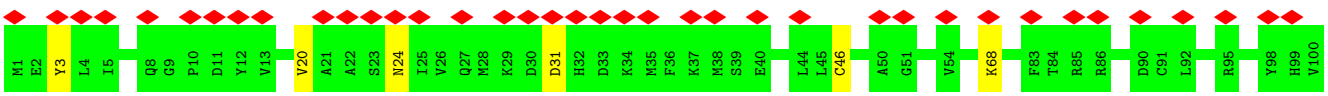


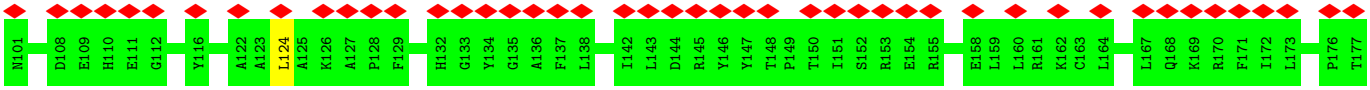


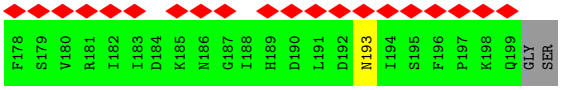
• Molecule 17: Proteasome subunit beta type-2

Chain Q:



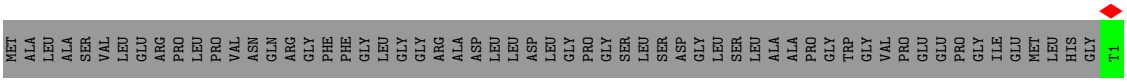


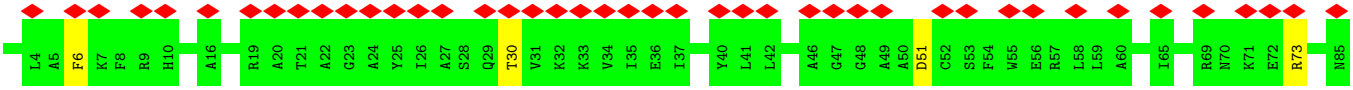


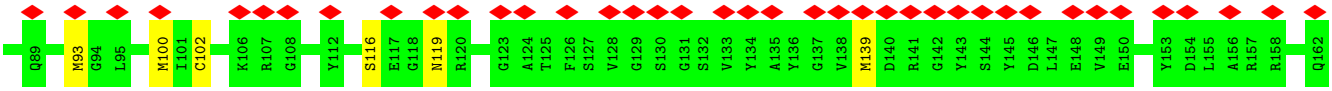


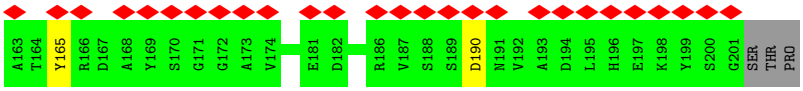
• Molecule 18: Proteasome subunit beta type-5

Chain R:



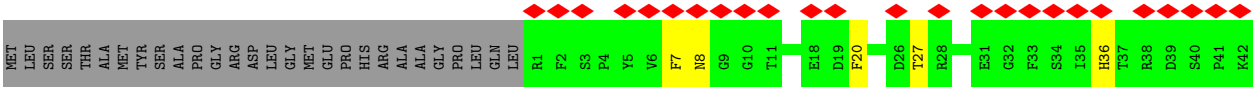


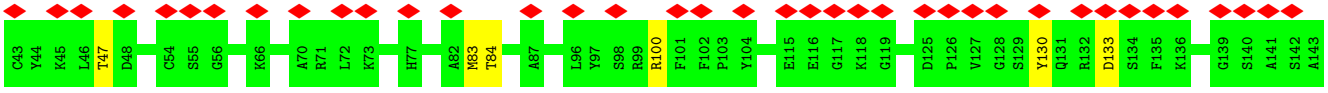


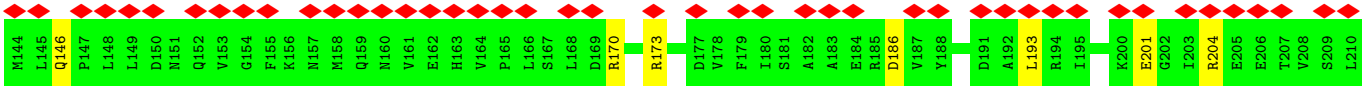


• Molecule 19: Proteasome subunit beta type-1

Chain S:

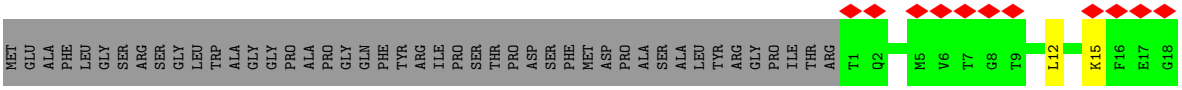


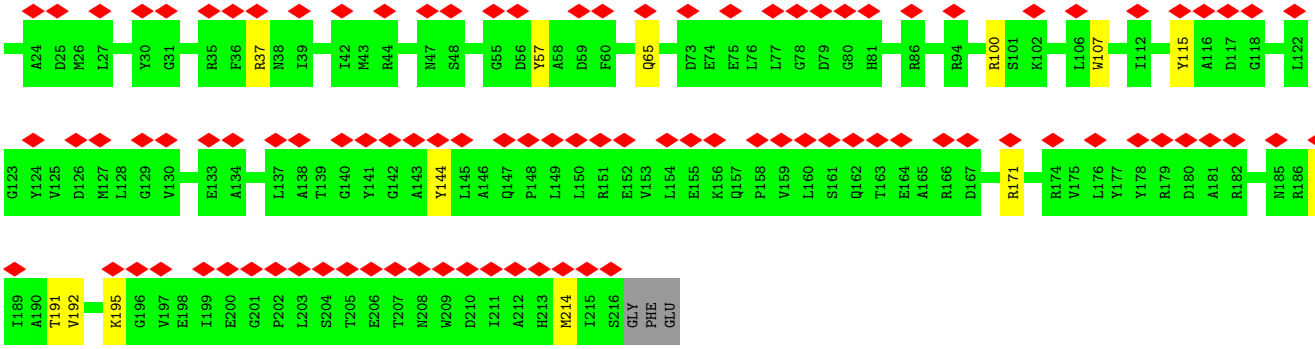




• Molecule 20: Proteasome subunit beta type-4

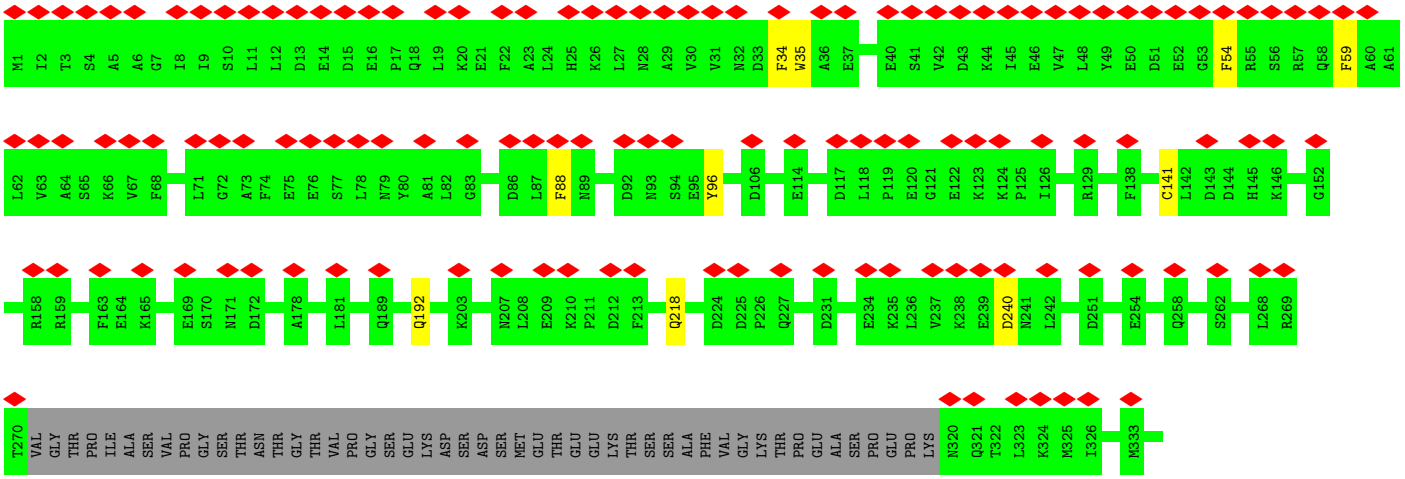
Chain T:





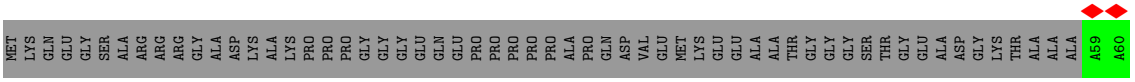
• Molecule 21: 26S proteasome non-ATPase regulatory subunit 1

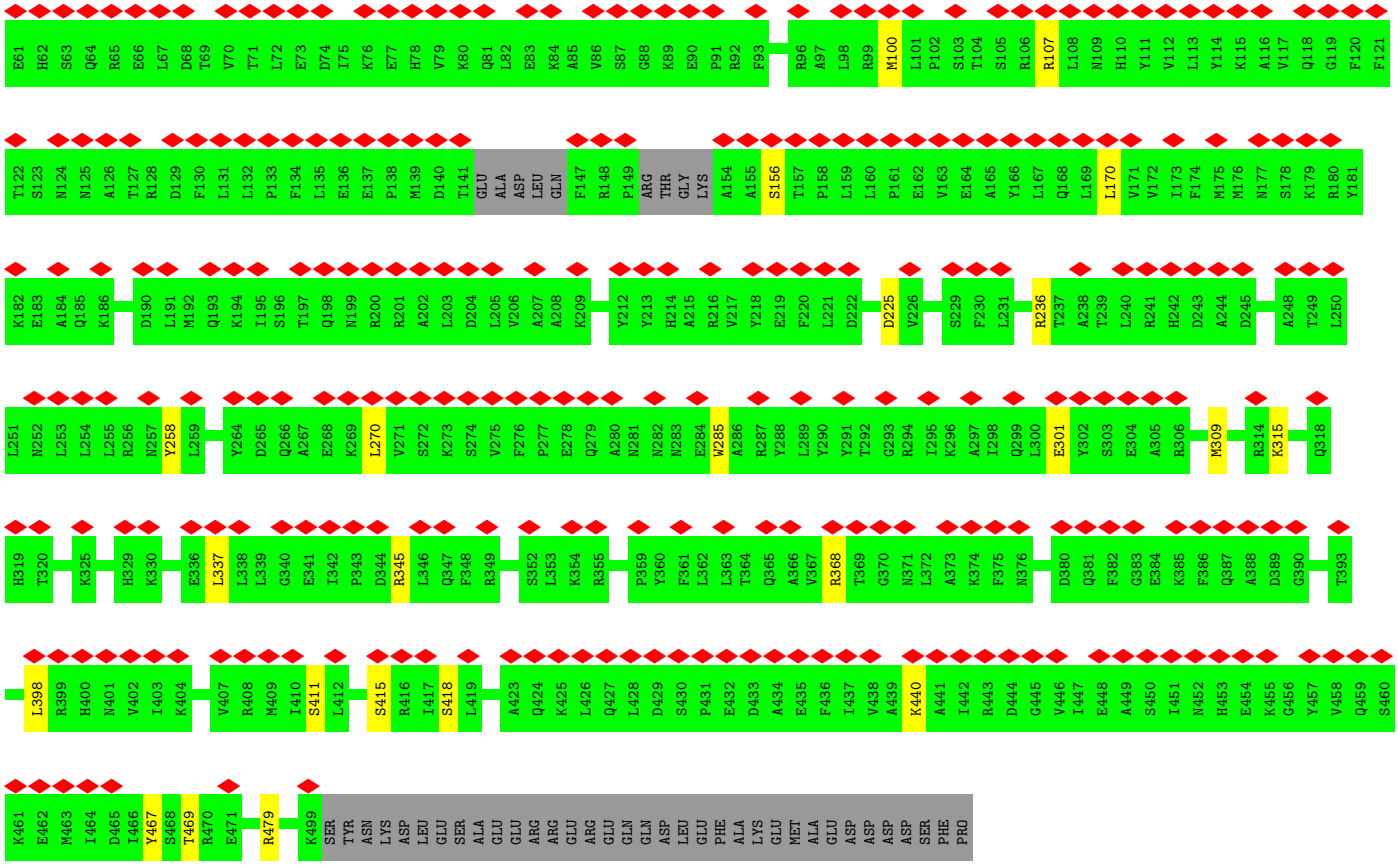
Chain U:



• Molecule 22: 26S proteasome non-ATPase regulatory subunit 3

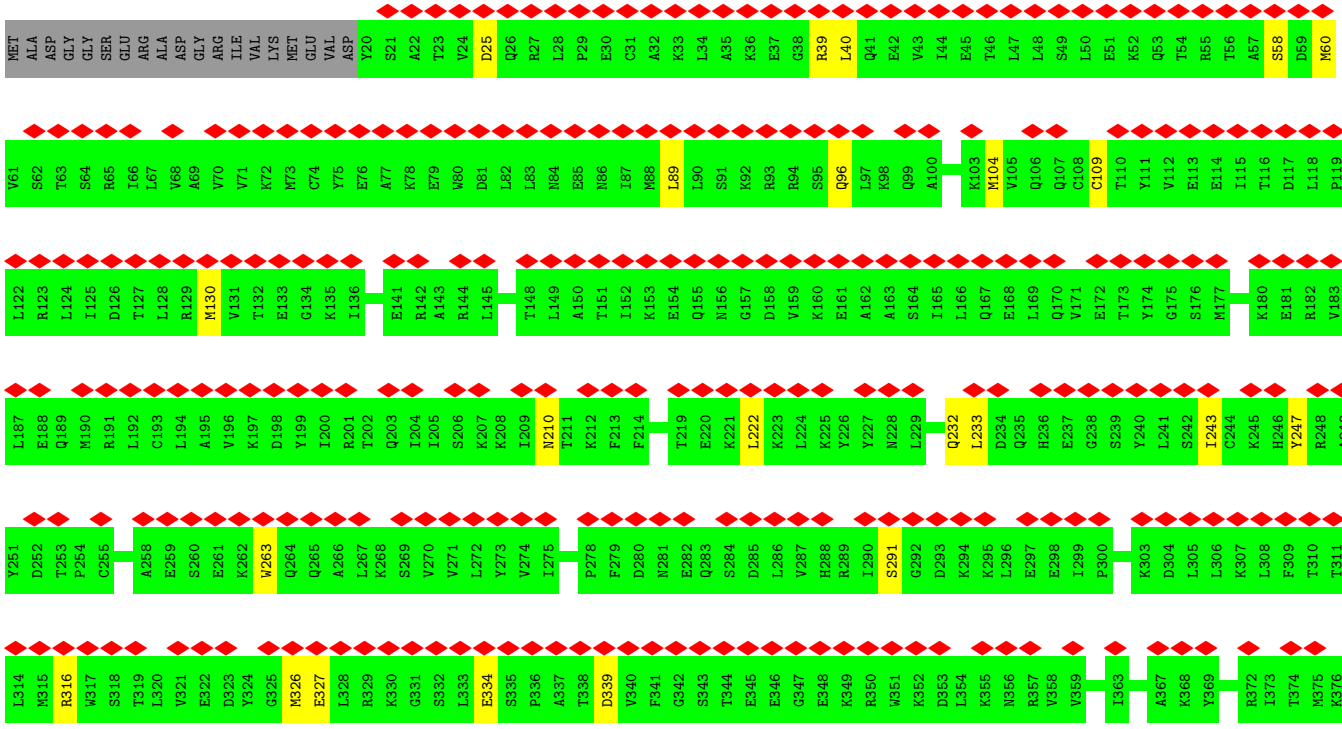
Chain V:

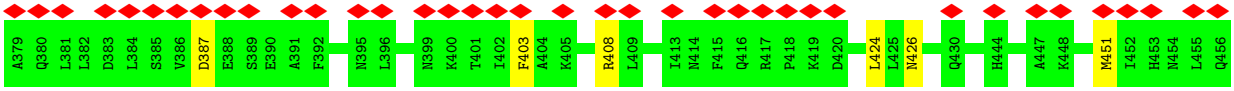




• Molecule 23: 26S proteasome non-ATPase regulatory subunit 12

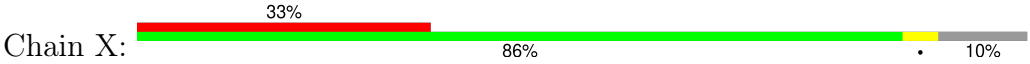
Chain W:

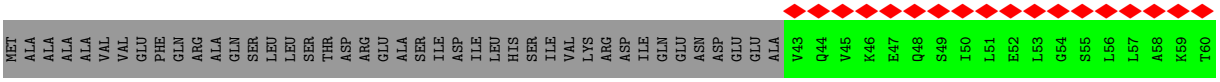


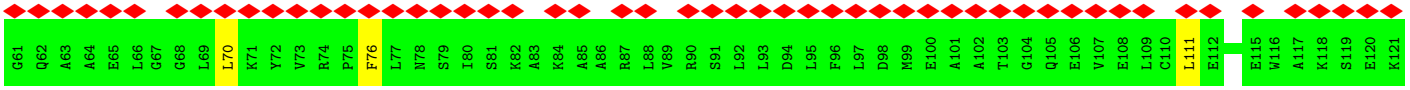


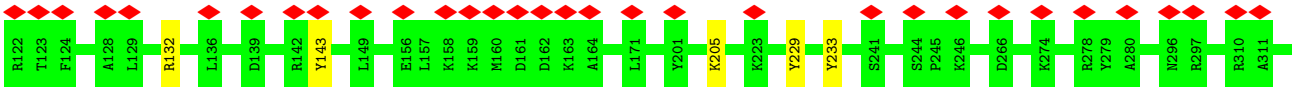
• Molecule 24: 26S proteasome non-ATPase regulatory subunit 11

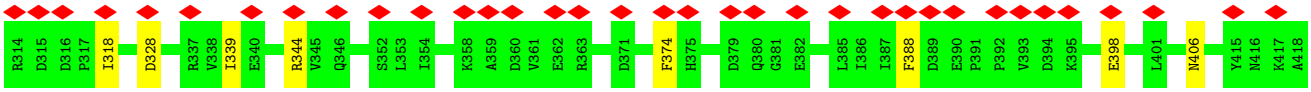
Chain X:





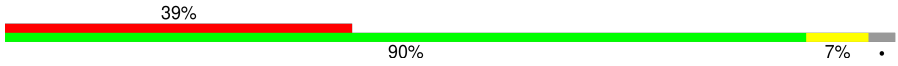


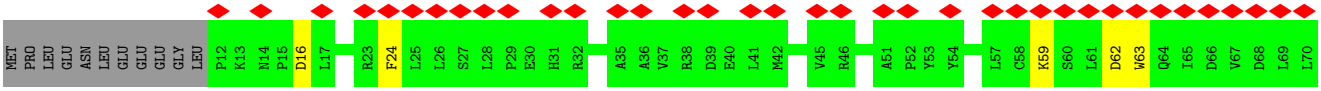


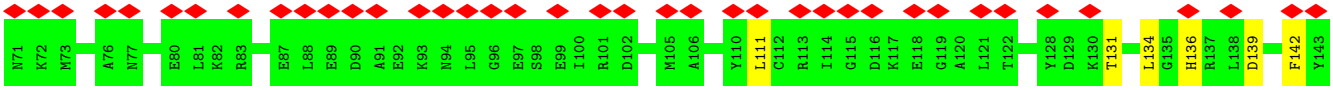


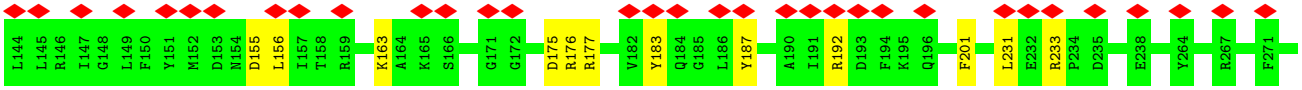
• Molecule 25: 26S proteasome non-ATPase regulatory subunit 6

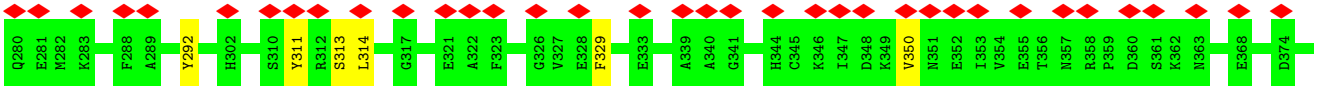
Chain Y:

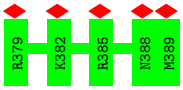






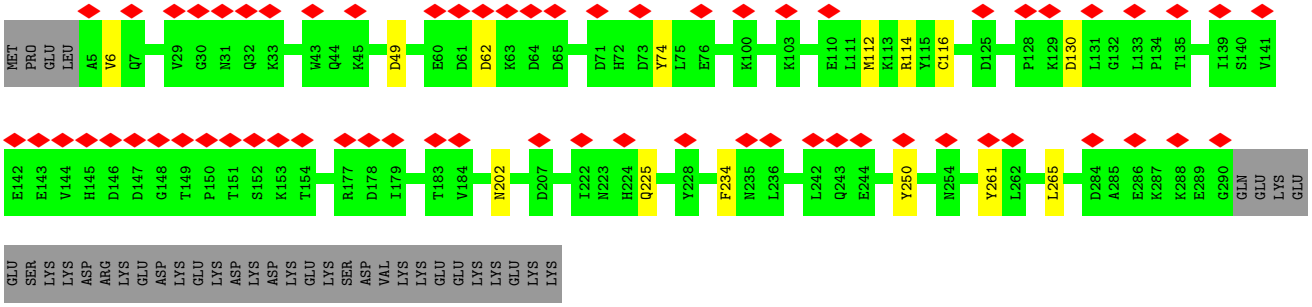






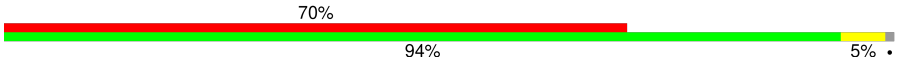
• Molecule 26: 26S proteasome non-ATPase regulatory subunit 7

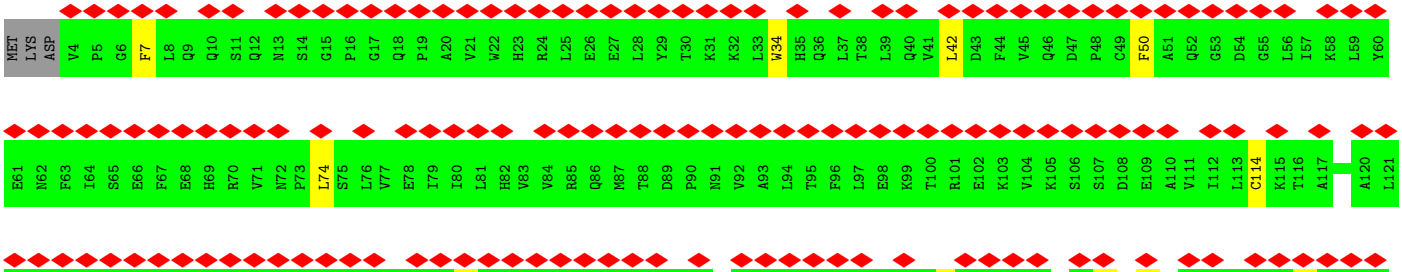
Chain Z:



• Molecule 27: 26S proteasome non-ATPase regulatory subunit 13

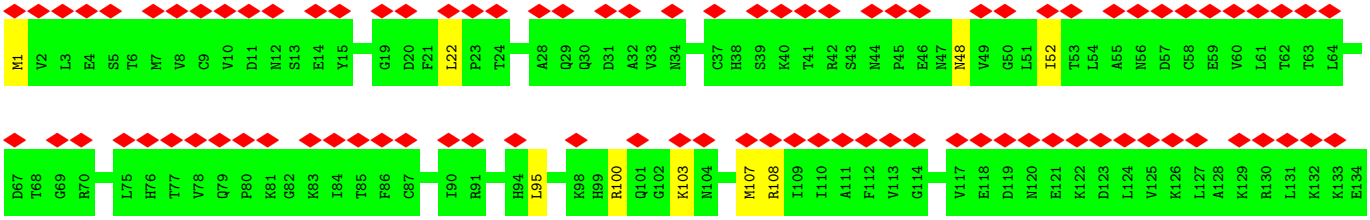
Chain a:

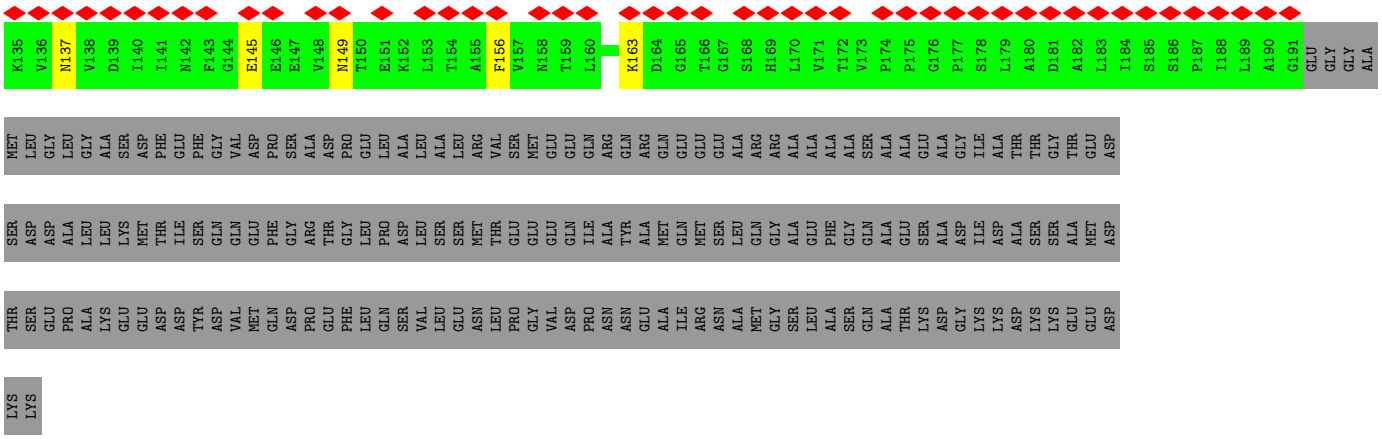




• Molecule 28: 26S proteasome non-ATPase regulatory subunit 4

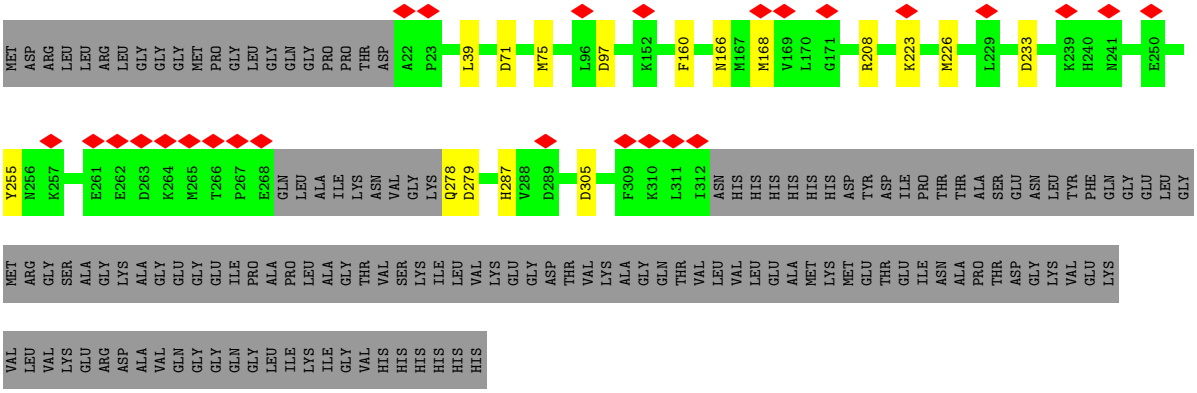
Chain b:





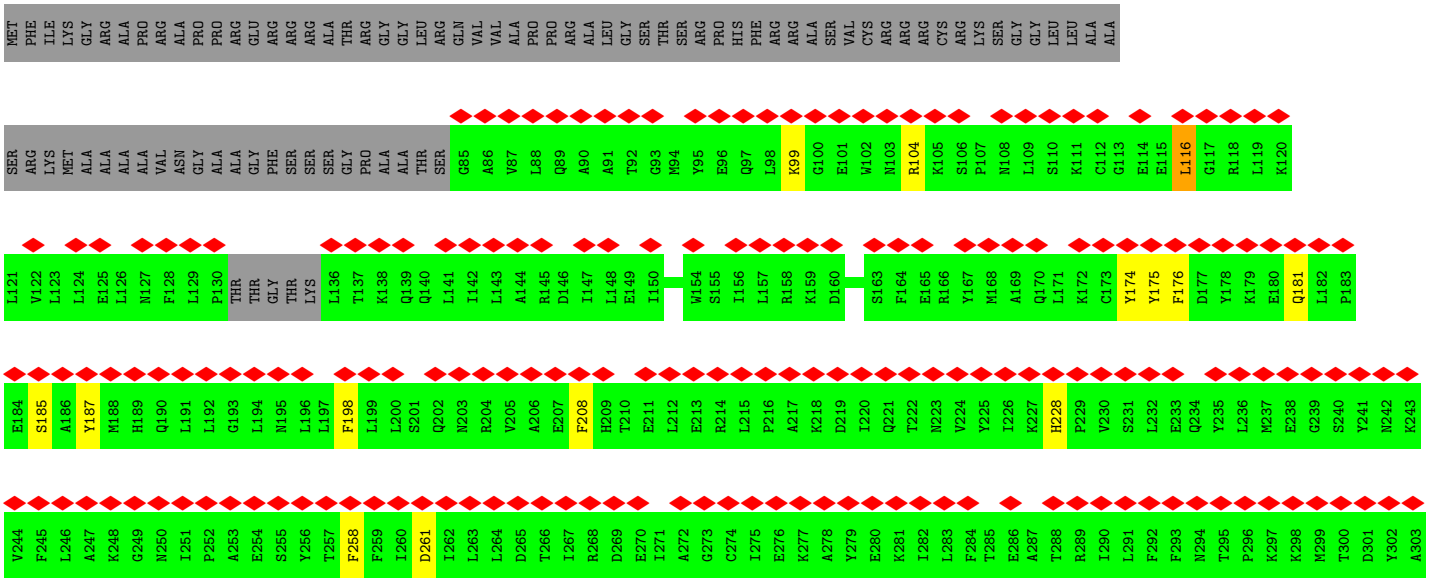
• Molecule 29: 26S proteasome non-ATPase regulatory subunit 14

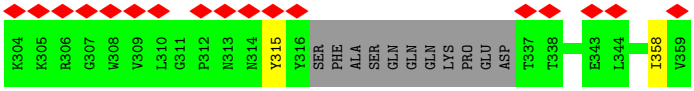
Chain c:



• Molecule 30: 26S proteasome non-ATPase regulatory subunit 8

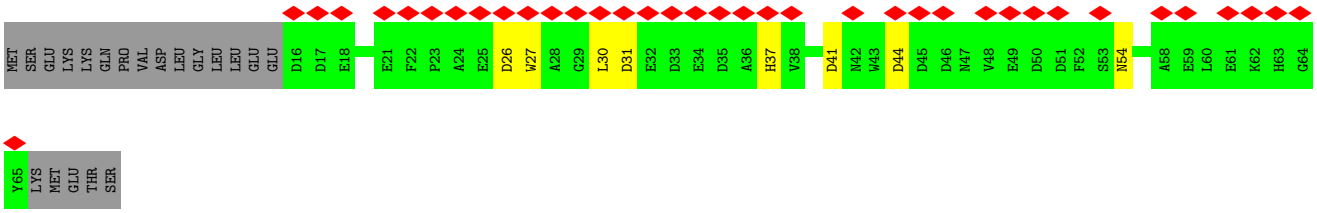
Chain d:





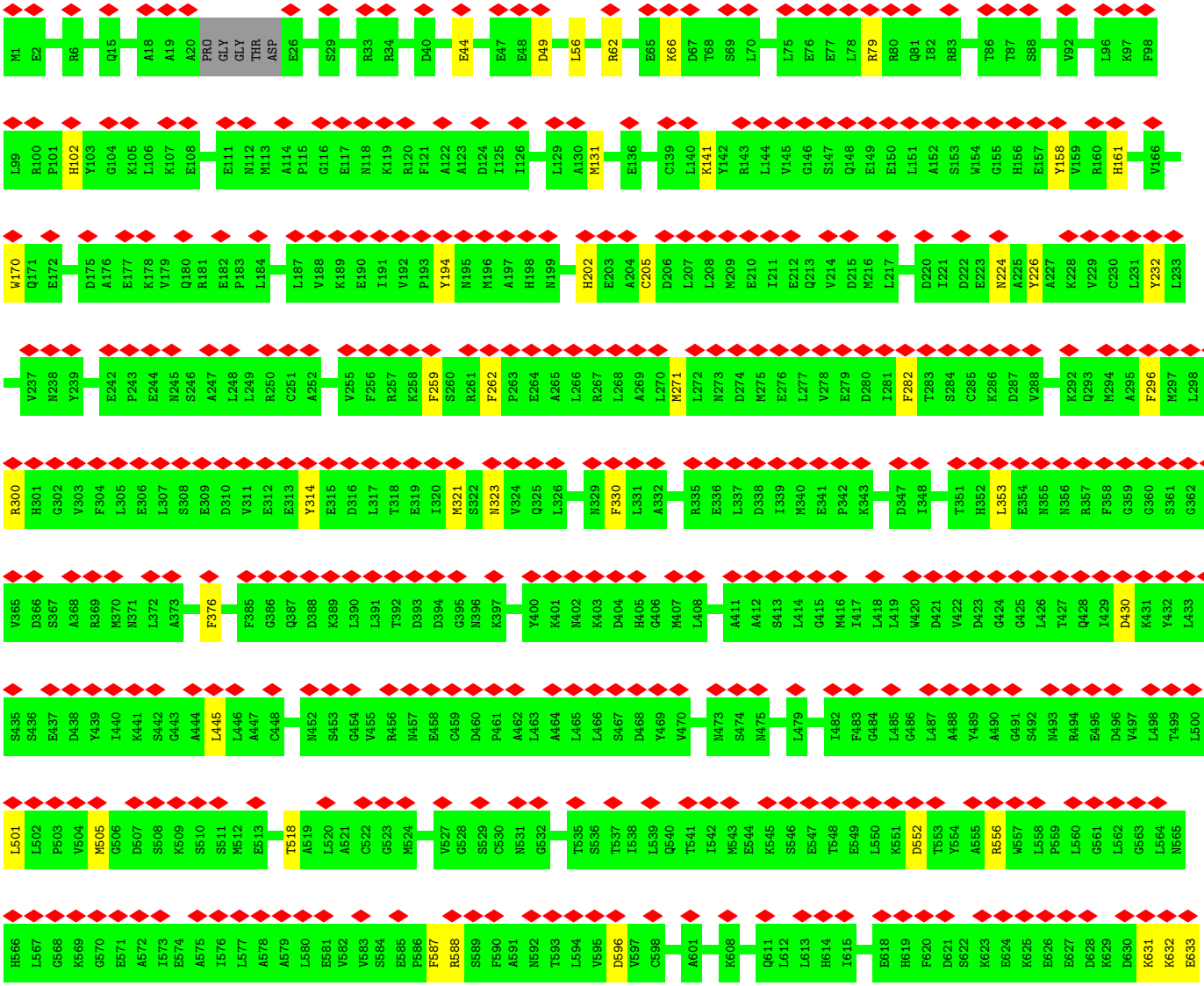
• Molecule 31: 26S proteasome complex subunit SEM1

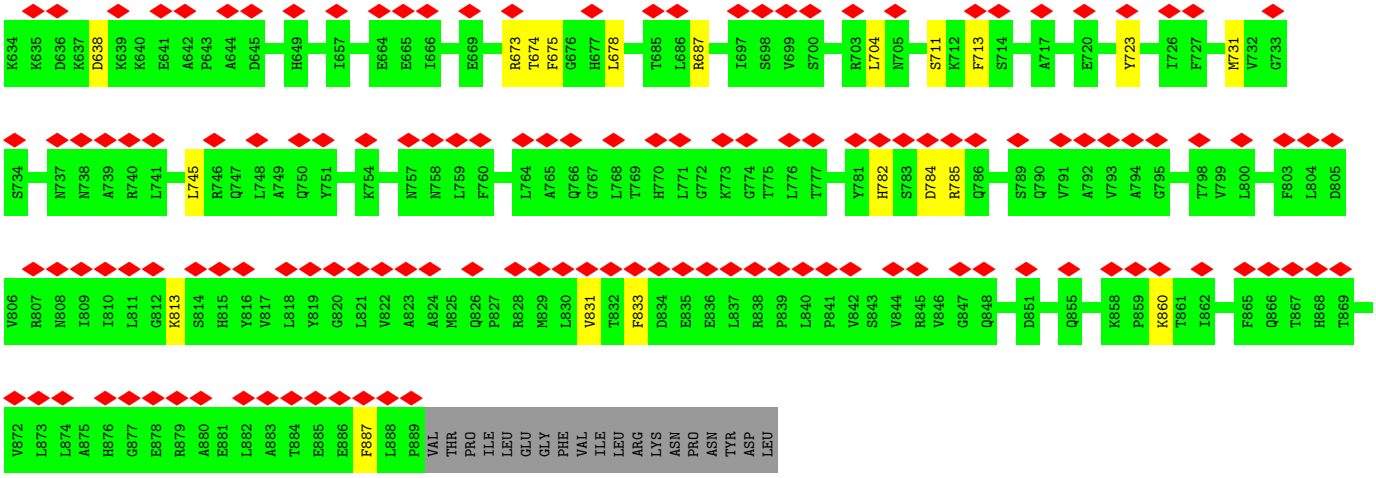
Chain e:



• Molecule 32: 26S proteasome non-ATPase regulatory subunit 2

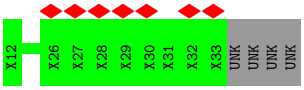
Chain f:





- Molecule 33: Substrate polypeptide

Chain v:



4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	31177	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 ($e^-/Å^2$)	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	0.937	Depositor
Minimum map value	-0.448	Depositor
Average map value	0.002	Depositor
Map value standard deviation	0.032	Depositor
Recommended contour level	0.15	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 (i)

5.1 Standard geometry (i)

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

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$\|Z\|$ >5	RMSZ	#$\|Z\|$ >5
1	A	0.29	0/3121	0.60	2/4212 (0.0%)
2	B	0.32	0/3170	0.56	1/4278 (0.0%)
3	C	0.34	0/3094	0.53	0/4158
4	D	0.35	0/3090	0.54	2/4168 (0.0%)
5	E	0.32	0/2930	0.58	1/3944 (0.0%)
6	F	0.33	1/2840 (0.0%)	0.67	4/3828 (0.1%)
7	G	0.28	0/1901	0.52	0/2572
8	H	0.29	0/1840	0.50	0/2495
9	I	0.28	0/1963	0.54	0/2650
10	J	0.28	0/1886	0.56	0/2551
11	K	0.29	0/1845	0.52	1/2490 (0.0%)
12	L	0.29	0/1911	0.57	1/2584 (0.0%)
13	M	0.28	0/1925	0.53	0/2592
14	N	0.27	0/1487	0.59	0/2013
15	O	0.27	0/1672	0.56	0/2267
16	P	0.26	0/1616	0.59	0/2180
17	Q	0.28	0/1621	0.61	0/2194
18	R	0.29	0/1590	0.58	0/2147
19	S	0.27	0/1671	0.55	0/2252
20	T	0.27	0/1716	0.62	0/2323
21	U	0.27	0/6574	0.51	0/8899
22	V	0.27	0/3595	0.58	2/4851 (0.0%)
23	W	0.27	0/3611	0.62	3/4855 (0.1%)
24	X	0.27	0/3045	0.54	2/4105 (0.0%)
25	Y	0.28	0/3173	0.59	0/4273
26	Z	0.28	0/2323	0.56	0/3147
27	a	0.26	0/3053	0.57	1/4133 (0.0%)
28	b	0.26	0/1478	0.59	0/2001
29	c	0.32	0/2262	0.52	0/3059
30	d	0.29	0/2090	0.60	2/2820 (0.1%)
31	e	0.27	0/437	0.56	0/595
32	f	0.29	0/6948	0.63	4/9387 (0.0%)

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#|Z| >5	RMSZ	#|Z| >5
All	All	0.29	1/81478 (0.0%)	0.57	26/110023 (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
27	a	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	F	396	CYS	CB-SG	6.34	1.93	1.82

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
6	F	400	CYS	CA-CB-SG	14.74	140.54	114.00
22	V	170	LEU	CA-CB-CG	6.94	131.26	115.30
6	F	400	CYS	N-CA-CB	-6.53	98.84	110.60
6	F	314	LEU	CA-CB-CG	6.52	130.29	115.30
27	a	42	LEU	CA-CB-CG	6.52	130.29	115.30
2	B	63	LEU	CA-CB-CG	6.16	129.46	115.30
23	W	233	LEU	CA-CB-CG	6.10	129.34	115.30
22	V	398	LEU	CA-CB-CG	5.99	129.07	115.30
32	f	271	MET	CA-CB-CG	5.78	123.12	113.30
32	f	552	ASP	CB-CG-OD1	5.74	123.47	118.30
11	K	156	MET	C-N-CA	5.69	135.93	121.70
6	F	86	LEU	CA-CB-CG	5.67	128.34	115.30
24	X	70	LEU	CA-CB-CG	5.62	128.23	115.30
30	d	116	LEU	CA-CB-CG	5.46	127.86	115.30
4	D	395	LEU	CA-CB-CG	5.41	127.74	115.30
5	E	334	LEU	CA-CB-CG	5.41	127.74	115.30
32	f	445	LEU	CA-CB-CG	5.39	127.70	115.30
4	D	148	ASP	CB-CG-OD1	5.33	123.09	118.30
24	X	111	LEU	CA-CB-CG	5.29	127.47	115.30
1	A	102	ILE	CG1-CB-CG2	-5.25	99.85	111.40
30	d	175	TYR	CA-CB-CG	5.24	123.36	113.40
12	L	56	LEU	CA-CB-CG	5.21	127.28	115.30
1	A	302	LEU	CA-CB-CG	5.19	127.25	115.30
23	W	424	LEU	CA-CB-CG	5.16	127.16	115.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
23	W	89	LEU	CA-CB-CG	5.11	127.06	115.30
32	f	56	LEU	CA-CB-CG	5.07	126.95	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
27	a	341	LEU	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	A	387/433 (89%)	348 (90%)	37 (10%)	2 (0%)	25 57
2	B	393/440 (89%)	350 (89%)	38 (10%)	5 (1%)	10 37
3	C	384/406 (95%)	355 (92%)	29 (8%)	0	100 100
4	D	378/418 (90%)	358 (95%)	19 (5%)	1 (0%)	37 66
5	E	360/389 (92%)	342 (95%)	18 (5%)	0	100 100
6	F	353/439 (80%)	311 (88%)	38 (11%)	4 (1%)	12 40
7	G	238/246 (97%)	228 (96%)	10 (4%)	0	100 100
8	H	230/234 (98%)	217 (94%)	13 (6%)	0	100 100
9	I	246/261 (94%)	230 (94%)	16 (6%)	0	100 100
10	J	237/248 (96%)	221 (93%)	16 (7%)	0	100 100
11	K	236/241 (98%)	233 (99%)	3 (1%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
12	L	238/263 (90%)	226 (95%)	12 (5%)	0	100	100
13	M	240/255 (94%)	234 (98%)	6 (2%)	0	100	100
14	N	193/239 (81%)	188 (97%)	5 (3%)	0	100	100
15	O	218/277 (79%)	211 (97%)	7 (3%)	0	100	100
16	P	202/205 (98%)	193 (96%)	9 (4%)	0	100	100
17	Q	197/201 (98%)	183 (93%)	14 (7%)	0	100	100
18	R	199/263 (76%)	192 (96%)	7 (4%)	0	100	100
19	S	211/241 (88%)	203 (96%)	8 (4%)	0	100	100
20	T	214/264 (81%)	203 (95%)	11 (5%)	0	100	100
21	U	823/953 (86%)	796 (97%)	27 (3%)	0	100	100
22	V	426/534 (80%)	408 (96%)	18 (4%)	0	100	100
23	W	433/456 (95%)	401 (93%)	32 (7%)	0	100	100
24	X	377/422 (89%)	363 (96%)	12 (3%)	2 (0%)	25	57
25	Y	376/389 (97%)	322 (86%)	52 (14%)	2 (0%)	25	57
26	Z	283/324 (87%)	245 (87%)	38 (13%)	0	100	100
27	a	371/376 (99%)	340 (92%)	30 (8%)	1 (0%)	37	66
28	b	189/377 (50%)	164 (87%)	25 (13%)	0	100	100
29	c	278/424 (66%)	260 (94%)	18 (6%)	0	100	100
30	d	244/350 (70%)	221 (91%)	22 (9%)	1 (0%)	30	61
31	e	48/70 (69%)	39 (81%)	9 (19%)	0	100	100
32	f	880/908 (97%)	726 (82%)	154 (18%)	0	100	100
All	All	10082/11546 (87%)	9311 (92%)	753 (8%)	18 (0%)	45	72

All (18) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
6	F	86	LEU
24	X	318	ILE
24	X	339	ILE
30	d	358	ILE
2	B	156	VAL
4	D	338	ARG
6	F	427	VAL
25	Y	111	LEU
2	B	93	GLU

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Mol	Chain	Res	Type
27	a	343	LEU
2	B	436	GLU
25	Y	350	VAL
2	B	414	VAL
6	F	177	VAL
6	F	398	ALA
1	A	102	ILE
1	A	166	VAL
2	B	52	VAL

5.3.2 Protein sidechains

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	339/372 (91%)	321 (95%)	18 (5%)	19 47
2	B	351/385 (91%)	329 (94%)	22 (6%)	15 42
3	C	338/352 (96%)	327 (97%)	11 (3%)	33 60
4	D	333/366 (91%)	318 (96%)	15 (4%)	23 52
5	E	318/341 (93%)	306 (96%)	12 (4%)	28 56
6	F	306/379 (81%)	289 (94%)	17 (6%)	17 45
7	G	202/210 (96%)	191 (95%)	11 (5%)	18 46
8	H	187/191 (98%)	176 (94%)	11 (6%)	16 43
9	I	202/221 (91%)	185 (92%)	17 (8%)	9 31
10	J	197/211 (93%)	187 (95%)	10 (5%)	20 48
11	K	198/204 (97%)	190 (96%)	8 (4%)	27 55
12	L	202/224 (90%)	192 (95%)	10 (5%)	20 49
13	M	198/212 (93%)	185 (93%)	13 (7%)	14 40
14	N	152/181 (84%)	141 (93%)	11 (7%)	12 37
15	O	178/228 (78%)	168 (94%)	10 (6%)	17 45
16	P	172/174 (99%)	162 (94%)	10 (6%)	17 44
17	Q	168/171 (98%)	160 (95%)	8 (5%)	21 50

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
18	R	156/202 (77%)	144 (92%)	12 (8%)	10 34
19	S	175/199 (88%)	157 (90%)	18 (10%)	6 22
20	T	178/215 (83%)	163 (92%)	15 (8%)	9 31
21	U	705/816 (86%)	686 (97%)	19 (3%)	40 65
22	V	383/460 (83%)	362 (94%)	21 (6%)	18 46
23	W	402/416 (97%)	375 (93%)	27 (7%)	13 39
24	X	326/362 (90%)	313 (96%)	13 (4%)	27 55
25	Y	334/344 (97%)	307 (92%)	27 (8%)	9 32
26	Z	257/295 (87%)	243 (95%)	14 (5%)	18 46
27	a	333/336 (99%)	316 (95%)	17 (5%)	20 48
28	b	167/312 (54%)	153 (92%)	14 (8%)	9 31
29	c	248/359 (69%)	232 (94%)	16 (6%)	14 41
30	d	221/294 (75%)	207 (94%)	14 (6%)	15 42
31	e	44/63 (70%)	36 (82%)	8 (18%)	1 6
32	f	742/763 (97%)	683 (92%)	59 (8%)	10 33
All	All	8712/9858 (88%)	8204 (94%)	508 (6%)	19 44

All (508) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	99	THR
1	A	105	ASP
1	A	118	PHE
1	A	163	MET
1	A	229	VAL
1	A	236	CYS
1	A	249	TYR
1	A	258	ARG
1	A	260	LEU
1	A	261	PHE
1	A	268	LYS
1	A	275	ASP
1	A	300	LEU
1	A	309	PHE
1	A	325	ASP
1	A	355	PHE
1	A	361	SER

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Mol	Chain	Res	Type
1	A	408	ASP
2	B	51	LEU
2	B	58	CYS
2	B	100	ASP
2	B	107	MET
2	B	140	ASP
2	B	207	HIS
2	B	224	LEU
2	B	260	LEU
2	B	269	GLU
2	B	277	HIS
2	B	296	ASP
2	B	320	ASP
2	B	325	VAL
2	B	332	ASN
2	B	357	ASP
2	B	391	SER
2	B	394	ASP
2	B	404	LEU
2	B	421	LYS
2	B	427	LEU
2	B	428	TYR
2	B	429	LYS
3	C	23	TYR
3	C	63	LEU
3	C	76	VAL
3	C	81	ASP
3	C	174	LEU
3	C	208	ASP
3	C	241	HIS
3	C	278	ASN
3	C	296	ASN
3	C	300	ILE
3	C	312	ASP
4	D	40	LEU
4	D	54	LEU
4	D	60	TYR
4	D	149	SER
4	D	163	MET
4	D	185	LEU
4	D	222	HIS
4	D	229	ARG

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Mol	Chain	Res	Type
4	D	240	LEU
4	D	300	ASP
4	D	315	ASP
4	D	337	ASP
4	D	345	PHE
4	D	368	ASP
4	D	392	TYR
5	E	21	GLU
5	E	28	GLU
5	E	83	CYS
5	E	120	TYR
5	E	178	THR
5	E	218	MET
5	E	228	CYS
5	E	250	ASP
5	E	275	MET
5	E	297	ARG
5	E	300	HIS
5	E	335	SER
6	F	76	ASN
6	F	162	GLU
6	F	168	TYR
6	F	178	ASP
6	F	187	ASP
6	F	209	LYS
6	F	226	TYR
6	F	248	PHE
6	F	259	MET
6	F	266	LYS
6	F	272	PHE
6	F	281	SER
6	F	314	LEU
6	F	320	PHE
6	F	417	HIS
6	F	420	TYR
6	F	430	LYS
7	G	16	PHE
7	G	17	SER
7	G	21	ARG
7	G	47	CYS
7	G	103	TYR
7	G	137	CYS

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Mol	Chain	Res	Type
7	G	150	GLN
7	G	187	PHE
7	G	191	PHE
7	G	196	GLU
7	G	210	PHE
8	H	8	PHE
8	H	9	SER
8	H	46	LEU
8	H	74	LEU
8	H	88	HIS
8	H	97	TYR
8	H	127	VAL
8	H	140	ASN
8	H	150	ASP
8	H	197	GLU
8	H	219	ARG
9	I	8	ARG
9	I	9	THR
9	I	26	GLU
9	I	41	ASP
9	I	44	LEU
9	I	53	HIS
9	I	57	ASP
9	I	60	PHE
9	I	99	LEU
9	I	121	TYR
9	I	124	PHE
9	I	136	TYR
9	I	142	HIS
9	I	150	SER
9	I	163	CYS
9	I	173	SER
9	I	199	LYS
10	J	36	ARG
10	J	55	ASP
10	J	61	LYS
10	J	70	CYS
10	J	76	LEU
10	J	121	SER
10	J	178	ASP
10	J	205	ASN
10	J	211	MET

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Mol	Chain	Res	Type
10	J	236	LYS
11	K	8	TYR
11	K	9	ASP
11	K	83	LYS
11	K	96	THR
11	K	147	ASP
11	K	162	PHE
11	K	166	ASP
11	K	184	VAL
12	L	7	ASP
12	L	51	ARG
12	L	86	ASN
12	L	112	ILE
12	L	137	TYR
12	L	148	CYS
12	L	154	PHE
12	L	155	ASP
12	L	180	MET
12	L	226	ASP
13	M	8	ASP
13	M	19	ARG
13	M	23	VAL
13	M	40	ARG
13	M	63	ASN
13	M	68	ASN
13	M	81	LEU
13	M	104	TYR
13	M	124	LEU
13	M	184	MET
13	M	209	PHE
13	M	218	GLU
13	M	240	LYS
14	N	14	LEU
14	N	28	ASN
14	N	51	ASP
14	N	61	TYR
14	N	65	PHE
14	N	113	SER
14	N	125	PHE
14	N	155	PHE
14	N	164	MET
14	N	182	SER

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Mol	Chain	Res	Type
14	N	192	ASP
15	O	10	ASP
15	O	43	CYS
15	O	66	HIS
15	O	80	ASN
15	O	114	TYR
15	O	118	SER
15	O	135	MET
15	O	142	PHE
15	O	169	SER
15	O	202	TYR
16	P	7	ASN
16	P	14	MET
16	P	15	LYS
16	P	27	ARG
16	P	73	LEU
16	P	83	LYS
16	P	120	PHE
16	P	123	SER
16	P	136	PHE
16	P	159	ASP
17	Q	3	TYR
17	Q	20	VAL
17	Q	24	ASN
17	Q	31	ASP
17	Q	46	CYS
17	Q	68	LYS
17	Q	124	LEU
17	Q	193	ASN
18	R	6	PHE
18	R	30	THR
18	R	51	ASP
18	R	73	ARG
18	R	93	MET
18	R	100	MET
18	R	102	CYS
18	R	116	SER
18	R	119	ASN
18	R	139	MET
18	R	165	TYR
18	R	190	ASP
19	S	7	PHE

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Mol	Chain	Res	Type
19	S	8	ASN
19	S	20	PHE
19	S	27	THR
19	S	36	HIS
19	S	47	THR
19	S	83	MET
19	S	84	THR
19	S	100	ARG
19	S	130	TYR
19	S	133	ASP
19	S	146	GLN
19	S	170	ARG
19	S	173	ARG
19	S	186	ASP
19	S	193	LEU
19	S	201	GLU
19	S	204	ARG
20	T	12	LEU
20	T	15	LYS
20	T	37	ARG
20	T	57	TYR
20	T	65	GLN
20	T	100	ARG
20	T	107	TRP
20	T	115	TYR
20	T	144	TYR
20	T	171	ARG
20	T	187	PHE
20	T	191	THR
20	T	192	VAL
20	T	195	LYS
20	T	214	MET
21	U	34	PHE
21	U	35	TRP
21	U	54	PHE
21	U	59	PHE
21	U	88	PHE
21	U	96	TYR
21	U	141	CYS
21	U	192	GLN
21	U	218	GLN
21	U	240	ASP

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Mol	Chain	Res	Type
21	U	373	ASN
21	U	374	SER
21	U	438	GLN
21	U	443	LEU
21	U	486	MET
21	U	608	SER
21	U	635	SER
21	U	903	PHE
21	U	918	SER
22	V	100	MET
22	V	107	ARG
22	V	156	SER
22	V	225	ASP
22	V	236	ARG
22	V	258	TYR
22	V	270	LEU
22	V	285	TRP
22	V	301	GLU
22	V	309	MET
22	V	315	LYS
22	V	337	LEU
22	V	345	ARG
22	V	368	ARG
22	V	411	SER
22	V	415	SER
22	V	418	SER
22	V	440	LYS
22	V	467	TYR
22	V	469	THR
22	V	479	ARG
23	W	25	ASP
23	W	39	ARG
23	W	40	LEU
23	W	58	SER
23	W	60	MET
23	W	96	GLN
23	W	104	MET
23	W	109	CYS
23	W	130	MET
23	W	210	ASN
23	W	222	LEU
23	W	232	GLN

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Mol	Chain	Res	Type
23	W	243	ILE
23	W	247	TYR
23	W	263	TRP
23	W	291	SER
23	W	316	ARG
23	W	326	MET
23	W	327	GLU
23	W	334	GLU
23	W	339	ASP
23	W	378	MET
23	W	387	ASP
23	W	403	PHE
23	W	408	ARG
23	W	426	ASN
23	W	451	MET
24	X	76	PHE
24	X	132	ARG
24	X	143	TYR
24	X	205	LYS
24	X	229	TYR
24	X	233	TYR
24	X	328	ASP
24	X	344	ARG
24	X	374	PHE
24	X	388	PHE
24	X	398	GLU
24	X	406	ASN
24	X	421	LEU
25	Y	16	ASP
25	Y	24	PHE
25	Y	59	LYS
25	Y	62	ASP
25	Y	63	TRP
25	Y	131	THR
25	Y	134	LEU
25	Y	136	HIS
25	Y	139	ASP
25	Y	142	PHE
25	Y	155	ASP
25	Y	156	LEU
25	Y	163	LYS
25	Y	175	ASP

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Mol	Chain	Res	Type
25	Y	176	ARG
25	Y	177	ARG
25	Y	183	TYR
25	Y	187	TYR
25	Y	192	ARG
25	Y	201	PHE
25	Y	231	LEU
25	Y	233	ARG
25	Y	292	TYR
25	Y	311	TYR
25	Y	313	SER
25	Y	314	LEU
25	Y	329	PHE
26	Z	6	VAL
26	Z	49	ASP
26	Z	62	ASP
26	Z	74	TYR
26	Z	112	MET
26	Z	114	ARG
26	Z	116	CYS
26	Z	130	ASP
26	Z	202	ASN
26	Z	225	GLN
26	Z	234	PHE
26	Z	250	TYR
26	Z	261	TYR
26	Z	265	LEU
27	a	7	PHE
27	a	34	TRP
27	a	50	PHE
27	a	74	LEU
27	a	114	CYS
27	a	141	MET
27	a	163	TYR
27	a	171	SER
27	a	174	LYS
27	a	182	CYS
27	a	222	LEU
27	a	247	ARG
27	a	252	LYS
27	a	284	ARG
27	a	291	LEU

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Mol	Chain	Res	Type
27	a	332	HIS
27	a	335	TRP
28	b	1	MET
28	b	22	LEU
28	b	48	ASN
28	b	52	ILE
28	b	95	LEU
28	b	100	ARG
28	b	103	LYS
28	b	107	MET
28	b	108	ARG
28	b	137	ASN
28	b	145	GLU
28	b	149	ASN
28	b	156	PHE
28	b	163	LYS
29	c	39	LEU
29	c	71	ASP
29	c	75	MET
29	c	97	ASP
29	c	160	PHE
29	c	166	ASN
29	c	168	MET
29	c	208	ARG
29	c	223	LYS
29	c	226	MET
29	c	233	ASP
29	c	255	TYR
29	c	278	GLN
29	c	279	ASP
29	c	287	HIS
29	c	305	ASP
30	d	99	LYS
30	d	104	ARG
30	d	116	LEU
30	d	174	TYR
30	d	176	PHE
30	d	181	GLN
30	d	185	SER
30	d	187	TYR
30	d	198	PHE
30	d	208	PHE

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Mol	Chain	Res	Type
30	d	228	HIS
30	d	258	PHE
30	d	261	ASP
30	d	315	TYR
31	e	26	ASP
31	e	27	TRP
31	e	30	LEU
31	e	31	ASP
31	e	37	HIS
31	e	41	ASP
31	e	44	ASP
31	e	54	ASN
32	f	44	GLU
32	f	49	ASP
32	f	62	ARG
32	f	66	LYS
32	f	79	ARG
32	f	102	HIS
32	f	131	MET
32	f	141	LYS
32	f	158	TYR
32	f	161	HIS
32	f	170	TRP
32	f	194	TYR
32	f	202	HIS
32	f	205	CYS
32	f	224	ASN
32	f	226	TYR
32	f	232	TYR
32	f	259	PHE
32	f	262	PHE
32	f	282	PHE
32	f	296	PHE
32	f	300	ARG
32	f	314	TYR
32	f	321	MET
32	f	323	ASN
32	f	330	PHE
32	f	353	LEU
32	f	376	PHE
32	f	430	ASP
32	f	501	LEU

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Mol	Chain	Res	Type
32	f	505	MET
32	f	518	THR
32	f	556	ARG
32	f	587	PHE
32	f	588	ARG
32	f	596	ASP
32	f	631	LYS
32	f	632	LYS
32	f	633	GLU
32	f	638	ASP
32	f	673	ARG
32	f	674	THR
32	f	675	PHE
32	f	678	LEU
32	f	687	ARG
32	f	704	LEU
32	f	711	SER
32	f	713	PHE
32	f	723	TYR
32	f	731	MET
32	f	745	LEU
32	f	782	HIS
32	f	784	ASP
32	f	785	ARG
32	f	813	LYS
32	f	831	VAL
32	f	833	PHE
32	f	860	LYS
32	f	887	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (44) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	305	GLN
1	A	379	ASN
3	C	32	GLN
4	D	99	ASN
4	D	257	ASN
4	D	301	GLN
4	D	380	GLN
5	E	254	GLN
6	F	436	GLN

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Mol	Chain	Res	Type
9	I	119	GLN
9	I	146	GLN
10	J	205	ASN
12	L	43	HIS
13	M	120	HIS
13	M	180	GLN
16	P	93	ASN
17	Q	32	HIS
17	Q	55	GLN
20	T	61	GLN
20	T	81	HIS
20	T	162	GLN
21	U	149	GLN
21	U	453	HIS
21	U	503	GLN
22	V	81	GLN
22	V	109	ASN
22	V	177	ASN
25	Y	48	ASN
25	Y	184	GLN
26	Z	223	ASN
27	a	13	ASN
27	a	129	GLN
27	a	257	GLN
27	a	290	GLN
27	a	332	HIS
28	b	56	ASN
29	c	237	HIS
29	c	241	ASN
29	c	283	HIS
30	d	153	GLN
30	d	209	HIS
32	f	325	GLN
32	f	329	ASN
32	f	738	ASN

5.3.3 RNA

There are no RNA molecules in this entry.

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 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	$\#\|Z\| > 2$
34	ADP	F	501	-	24,29,29	0.92	1 (4%)	29,45,45	1.21	2 (6%)
34	ADP	D	501	36	24,29,29	0.84	0	29,45,45	1.35	4 (13%)
34	ADP	A	501	-	24,29,29	0.87	0	29,45,45	1.19	2 (6%)
34	ADP	E	501	-	24,29,29	0.86	0	29,45,45	1.36	3 (10%)
35	ATP	B	501	36	28,33,33	1.08	2 (7%)	34,52,52	0.67	1 (2%)
35	ATP	C	501	36	28,33,33	0.97	1 (3%)	34,52,52	0.65	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
34	ADP	F	501	-	-	4/12/32/32	0/3/3/3
34	ADP	D	501	36	-	2/12/32/32	0/3/3/3
34	ADP	A	501	-	-	5/12/32/32	0/3/3/3
34	ADP	E	501	-	-	5/12/32/32	0/3/3/3
35	ATP	B	501	36	-	4/18/38/38	0/3/3/3
35	ATP	C	501	36	-	3/18/38/38	0/3/3/3

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
35	B	501	ATP	PA-O3A	-3.37	1.55	1.59
35	C	501	ATP	PA-O3A	-3.10	1.56	1.59
35	B	501	ATP	PB-O3B	-2.73	1.56	1.59
34	F	501	ADP	O4'-C1'	2.34	1.44	1.40

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
34	A	501	ADP	N3-C2-N1	-3.59	123.79	128.67
34	F	501	ADP	N3-C2-N1	-3.46	123.98	128.67
34	D	501	ADP	N3-C2-N1	-3.31	124.18	128.67
34	E	501	ADP	O4'-C1'-N9	3.15	112.92	108.75
34	E	501	ADP	N3-C2-N1	-2.87	124.77	128.67
34	E	501	ADP	C4-C5-N7	-2.85	106.33	109.34
34	A	501	ADP	C4-C5-N7	-2.54	106.66	109.34
34	D	501	ADP	O4'-C1'-N9	-2.52	105.40	108.75
34	D	501	ADP	C4-C5-N7	-2.41	106.79	109.34
35	C	501	ATP	C5-C6-N6	2.33	123.86	120.31
35	B	501	ATP	C5-C6-N6	2.31	123.83	120.31
34	D	501	ADP	C4'-O4'-C1'	2.21	111.95	109.92
34	F	501	ADP	C4-C5-N7	-2.15	107.07	109.34

There are no chirality outliers.

All (23) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
34	A	501	ADP	C5'-O5'-PA-O1A
34	A	501	ADP	C5'-O5'-PA-O2A
34	A	501	ADP	C5'-O5'-PA-O3A
34	D	501	ADP	C3'-C4'-C5'-O5'
34	E	501	ADP	C5'-O5'-PA-O1A
34	E	501	ADP	C5'-O5'-PA-O2A
34	E	501	ADP	C5'-O5'-PA-O3A
34	F	501	ADP	C5'-O5'-PA-O3A
35	B	501	ATP	C5'-O5'-PA-O1A
35	B	501	ATP	C5'-O5'-PA-O3A
34	D	501	ADP	O4'-C4'-C5'-O5'
34	F	501	ADP	C3'-C4'-C5'-O5'
34	F	501	ADP	O4'-C4'-C5'-O5'
35	C	501	ATP	PA-O3A-PB-O1B
34	A	501	ADP	O4'-C4'-C5'-O5'

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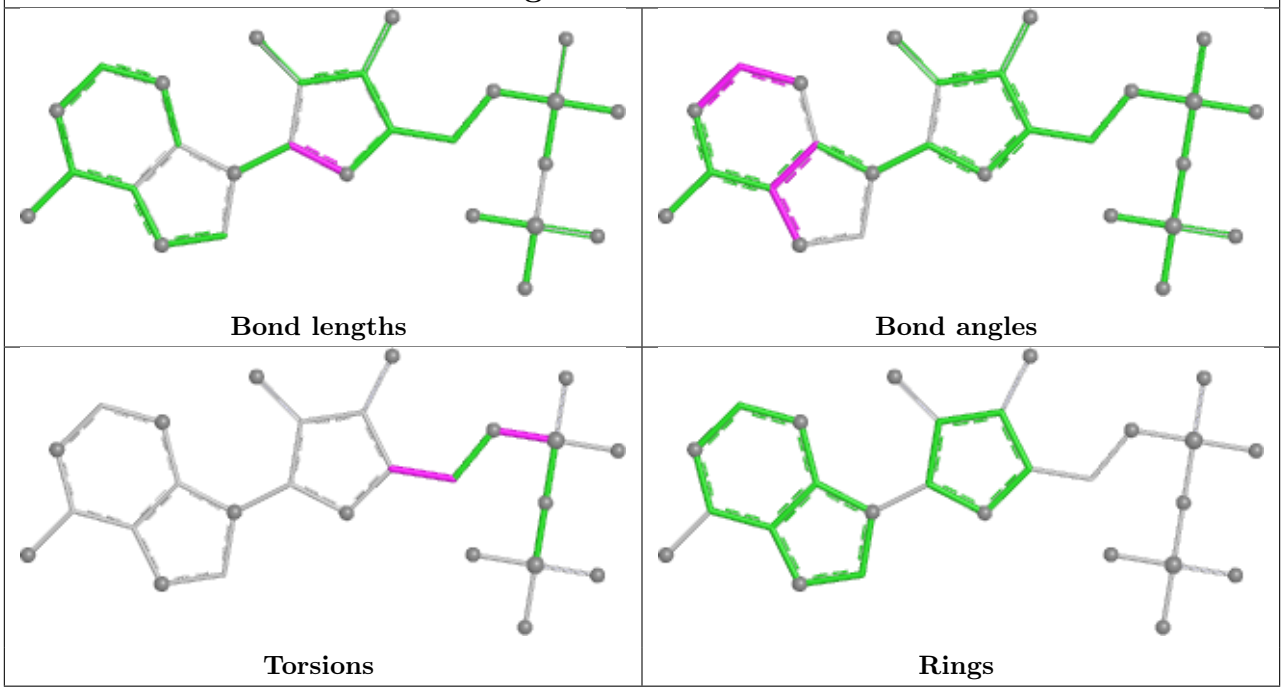
Mol	Chain	Res	Type	Atoms
34	F	501	ADP	C5'-O5'-PA-O1A
35	B	501	ATP	C5'-O5'-PA-O2A
34	E	501	ADP	C4'-C5'-O5'-PA
34	E	501	ADP	PB-O3A-PA-O2A
35	C	501	ATP	PA-O3A-PB-O2B
35	C	501	ATP	PB-O3B-PG-O1G
35	B	501	ATP	PB-O3B-PG-O3G
34	A	501	ADP	C3'-C4'-C5'-O5'

There are no ring outliers.

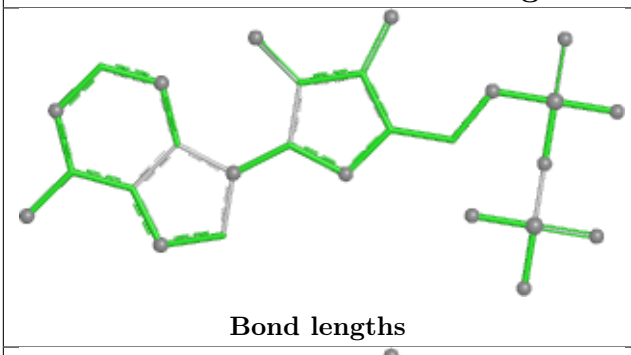
No monomer is involved in short contacts.

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 then 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.

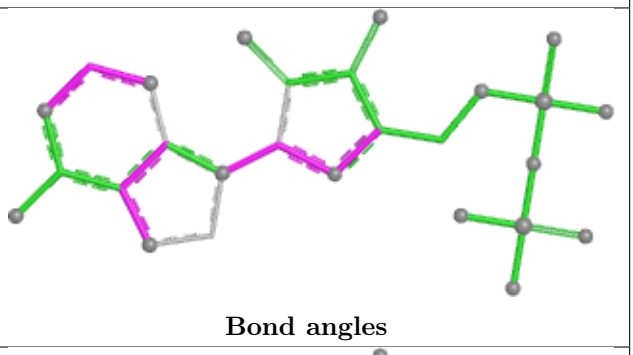
Ligand ADP F 501



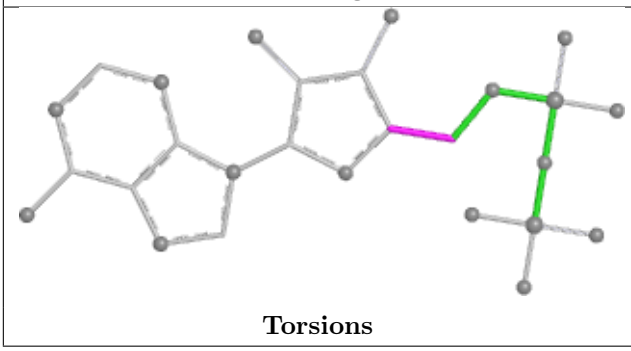
Ligand ADP D 501



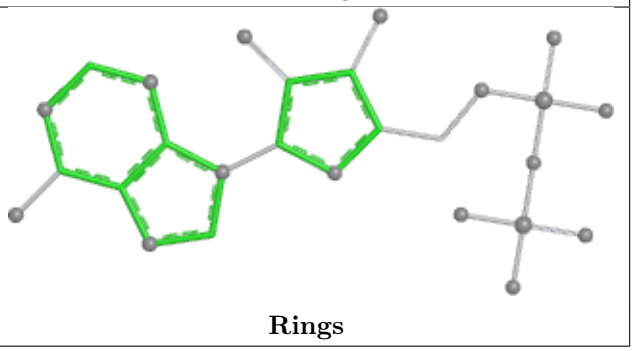
Bond lengths



Bond angles

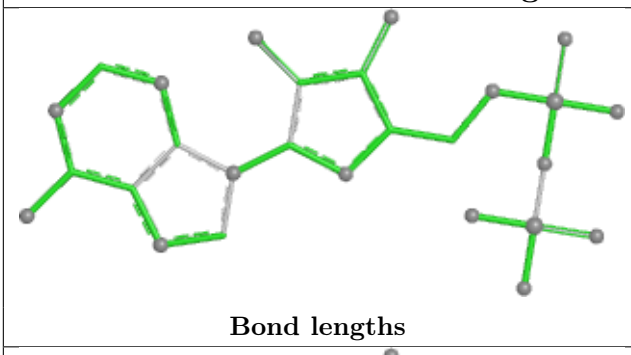


Torsions

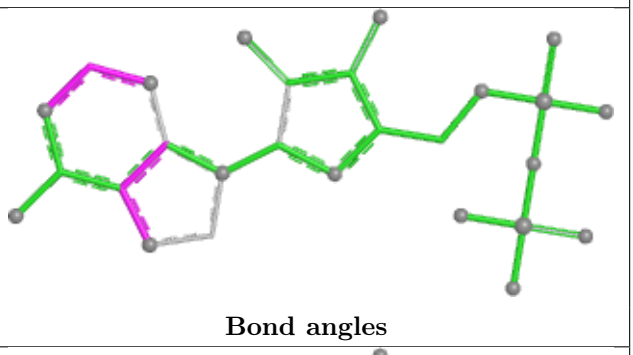


Rings

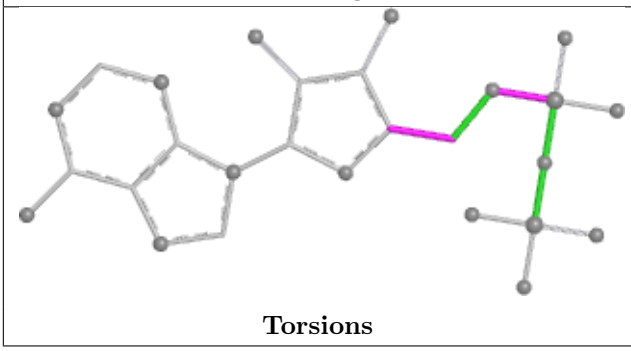
Ligand ADP A 501



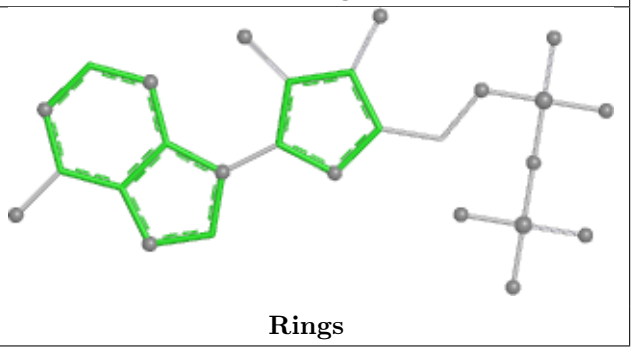
Bond lengths



Bond angles

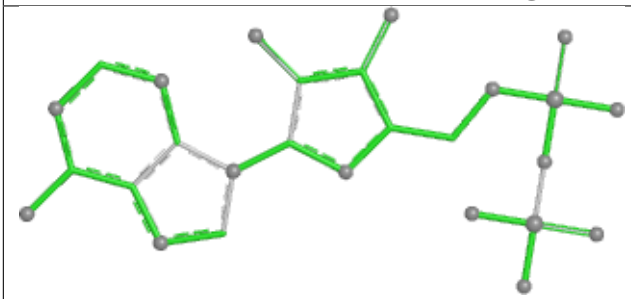


Torsions

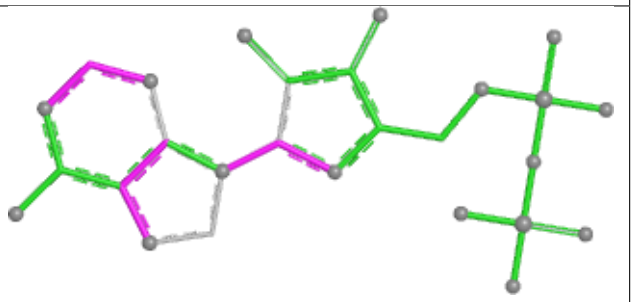


Rings

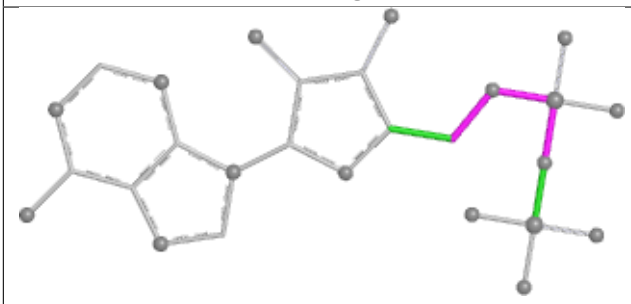
Ligand ADP E 501



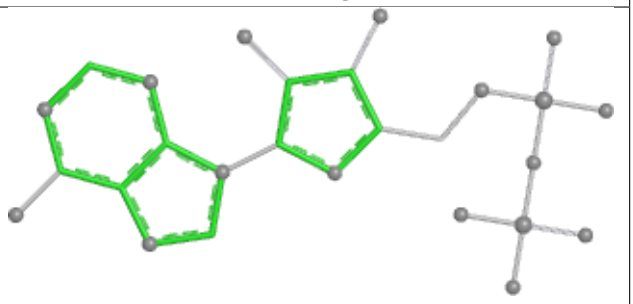
Bond lengths



Bond angles

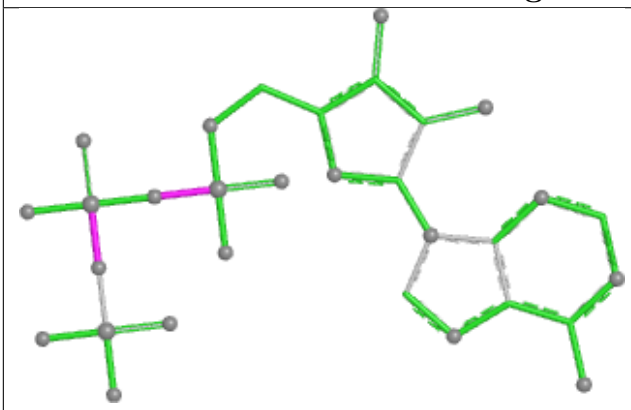


Torsions

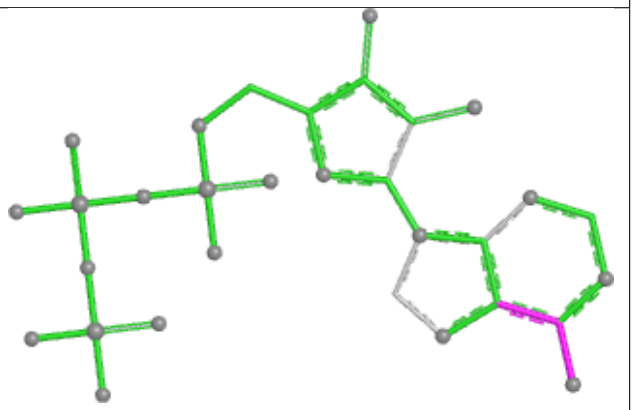


Rings

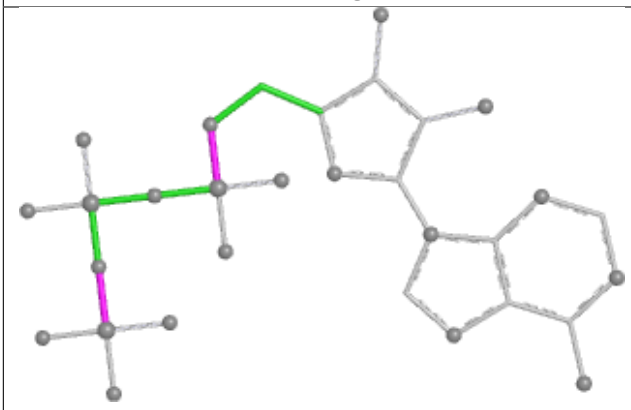
Ligand ATP B 501



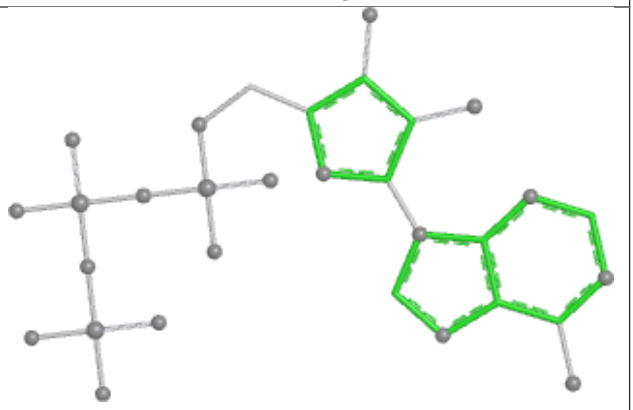
Bond lengths



Bond angles

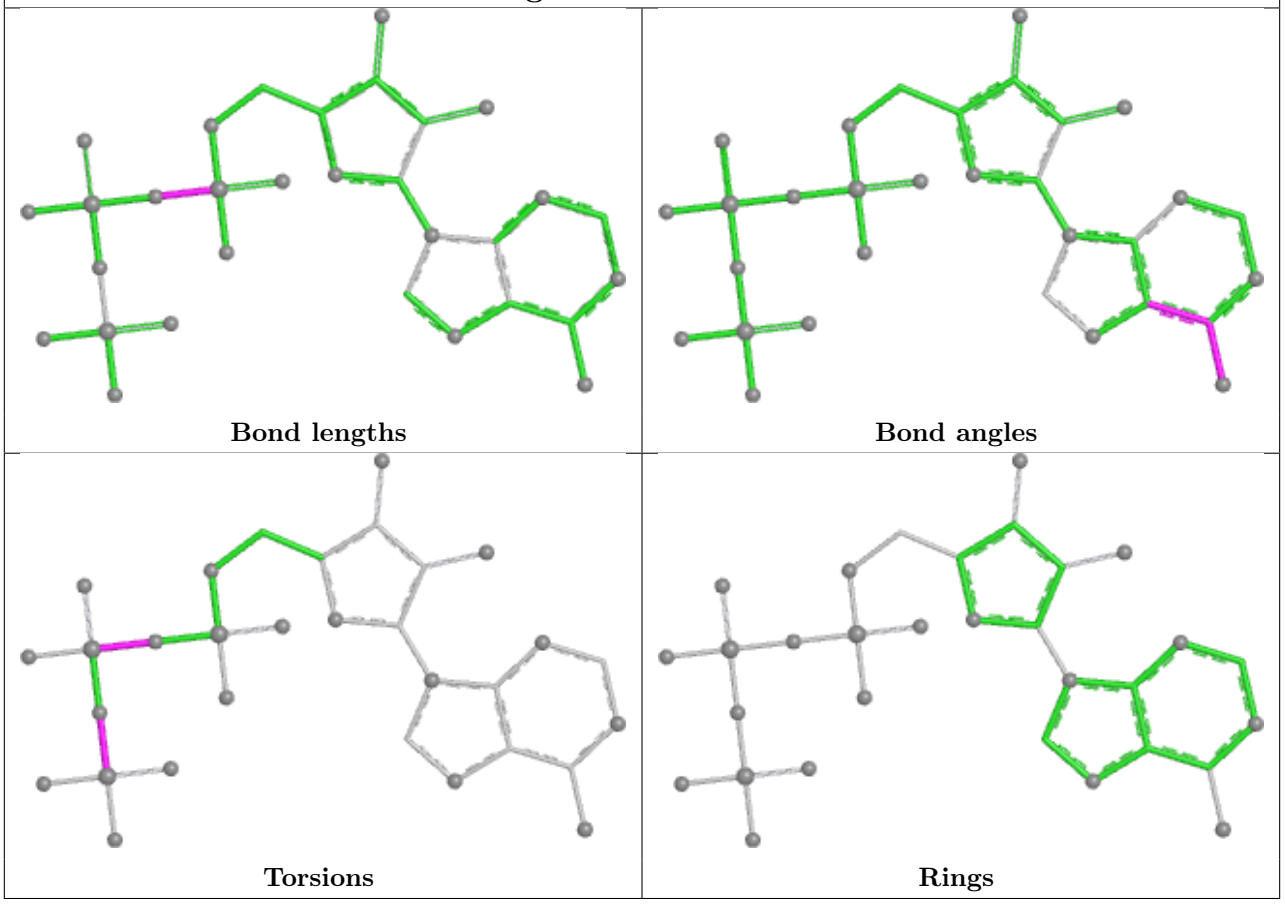


Torsions



Rings

Ligand ATP C 501



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
23	W	1
5	E	1
26	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	6.83
1	E	273:VAL	C	274:LYS	N	6.55
1	Z	289:GLU	C	290:GLY	N	3.21

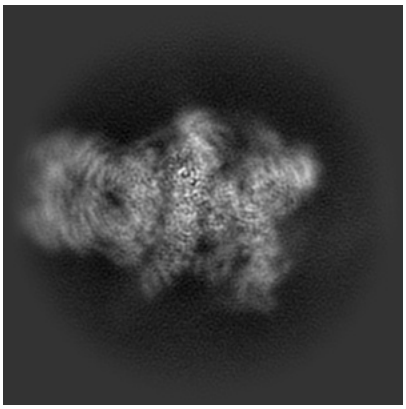
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-47727. These allow visual inspection of the internal detail of the map and identification of artifacts.

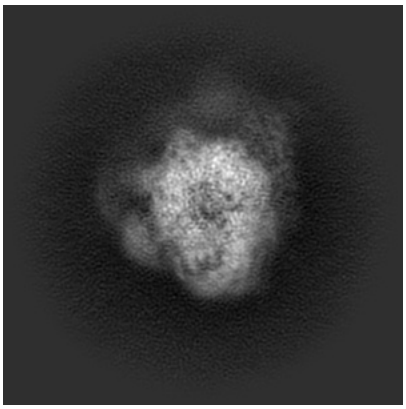
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections

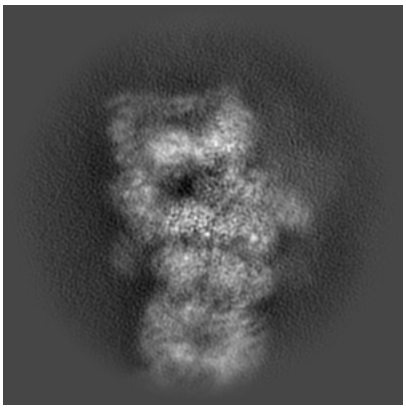
6.1.1 Primary map



X

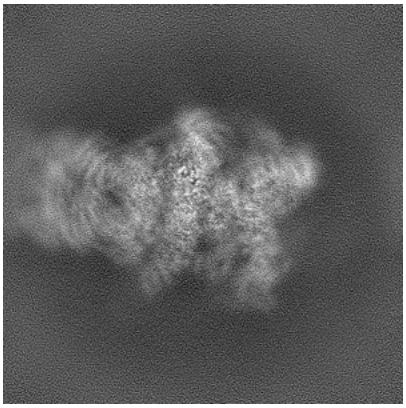


Y

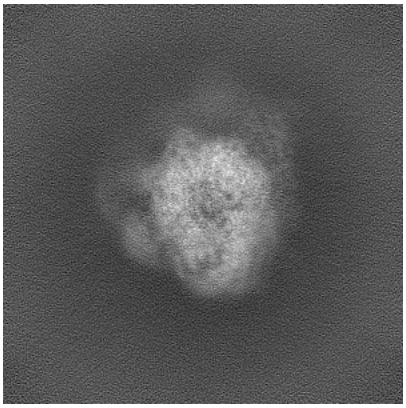


Z

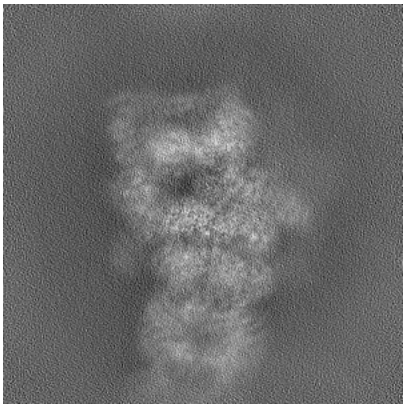
6.1.2 Raw map



X



Y

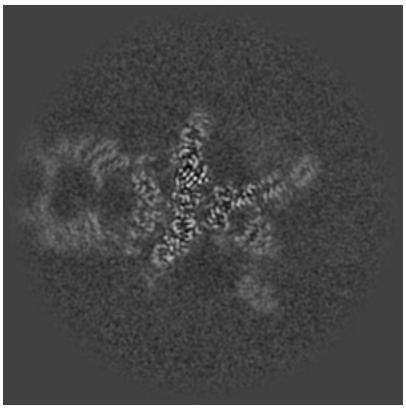


Z

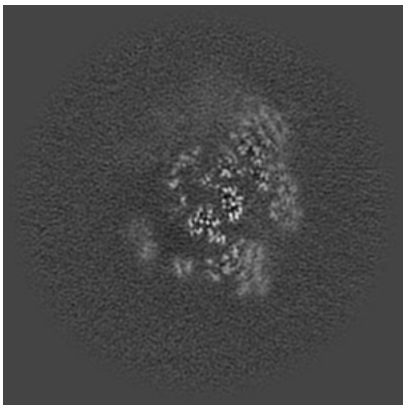
The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

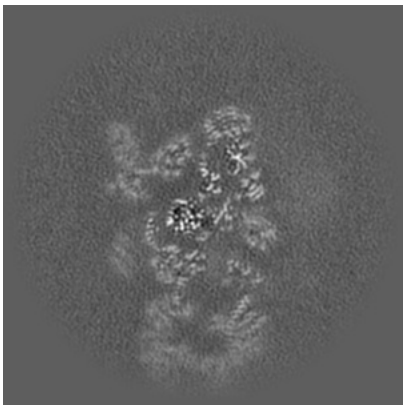
6.2.1 Primary map



X Index: 170

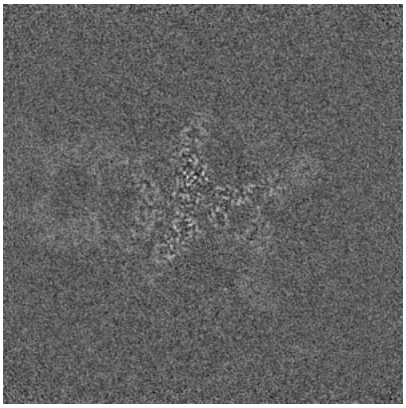


Y Index: 170

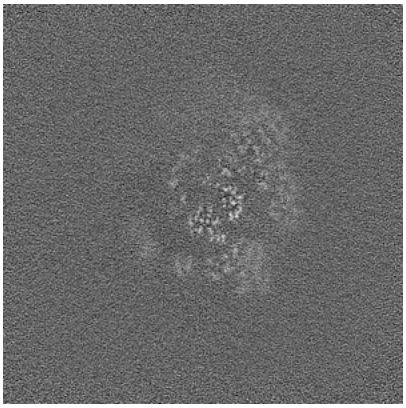


Z Index: 170

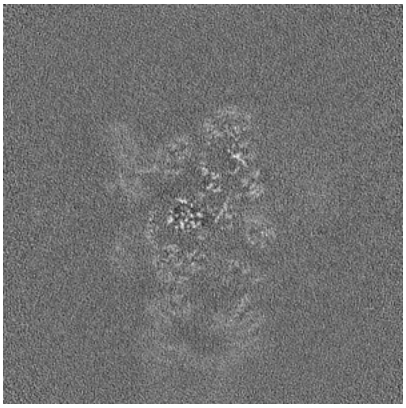
6.2.2 Raw map



X Index: 170



Y Index: 170

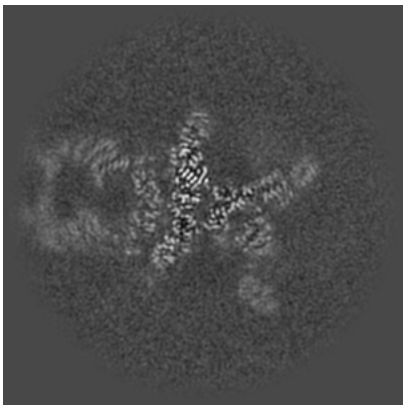


Z Index: 170

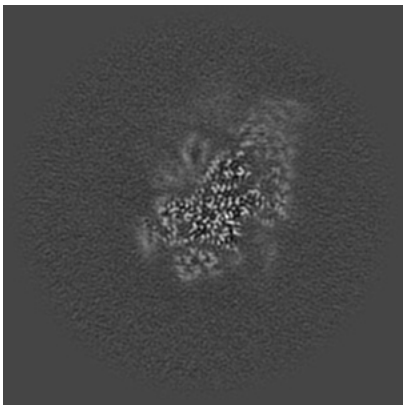
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

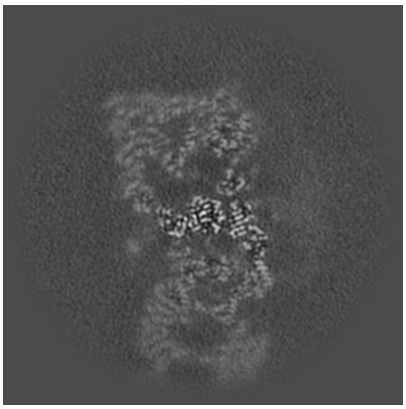
6.3.1 Primary map



X Index: 171

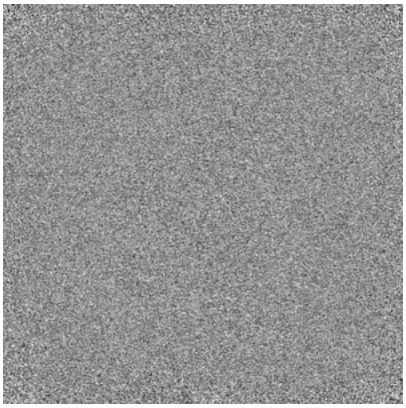


Y Index: 157

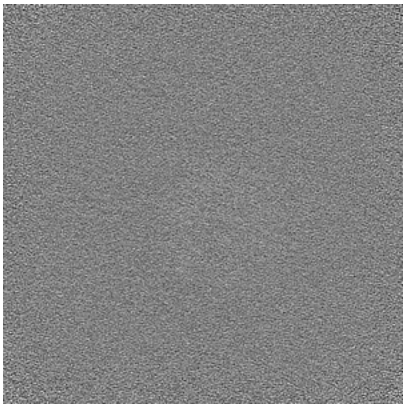


Z Index: 192

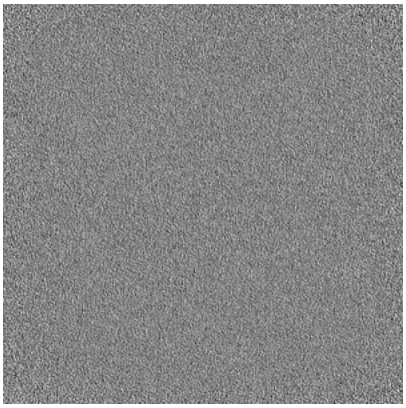
6.3.2 Raw map



X Index: 0



Y Index: 0

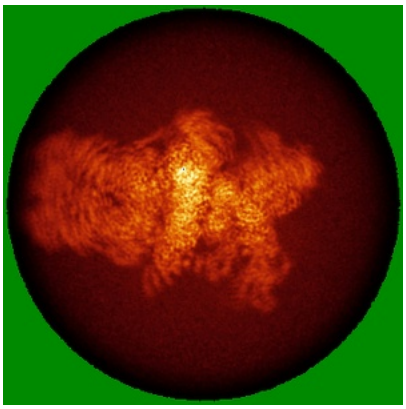


Z Index: 0

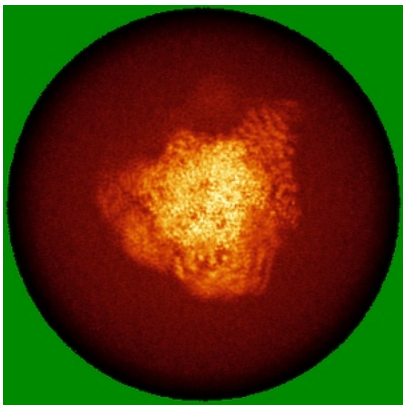
The images above show the largest variance slices of the map in three orthogonal directions.

6.4 Orthogonal standard-deviation projections (False-color) (i)

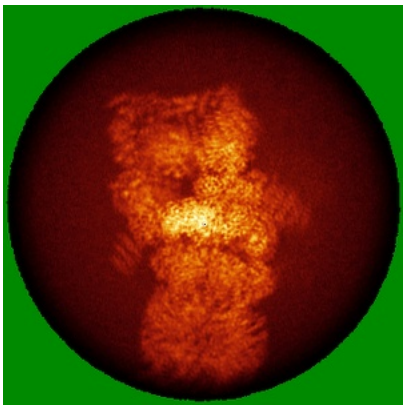
6.4.1 Primary map



X

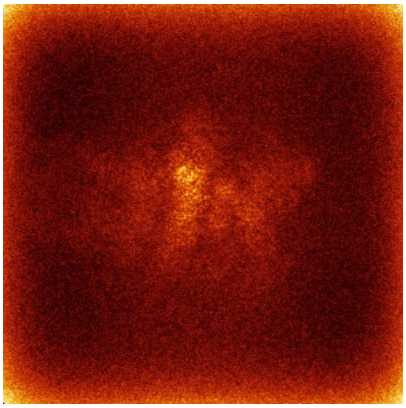


Y

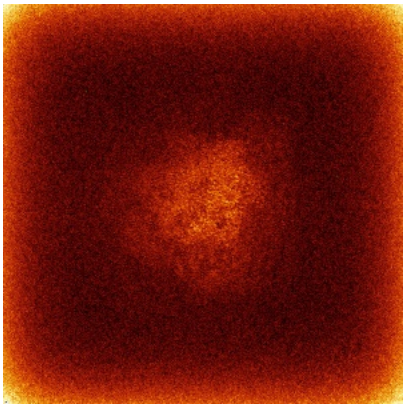


Z

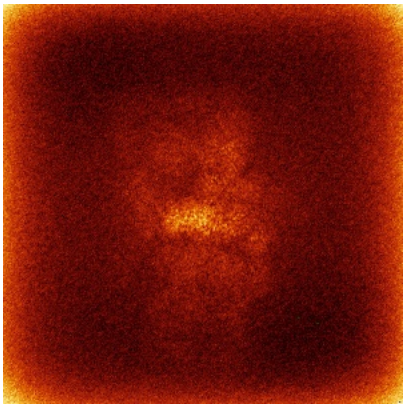
6.4.2 Raw map



X



Y

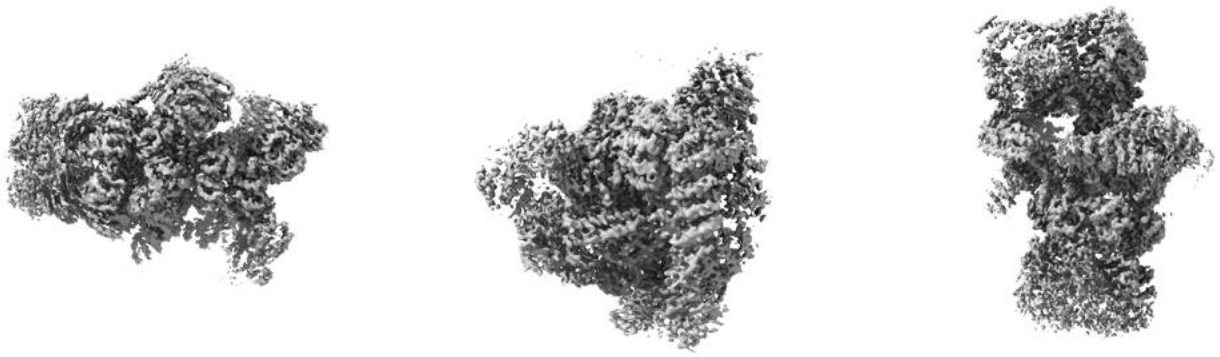


Z

The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.

6.5 Orthogonal surface views (i)

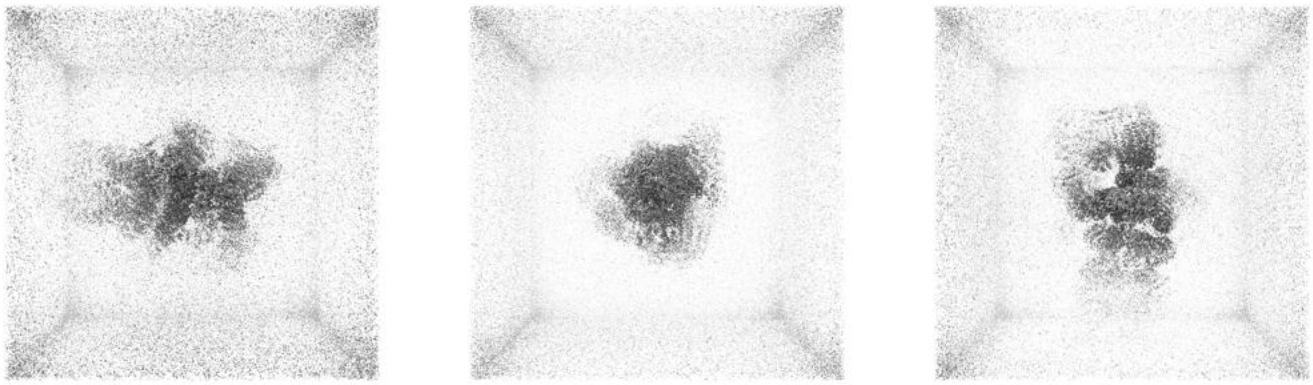
6.5.1 Primary map



X Y Z

The images above show the 3D surface view of the map at the recommended contour level 0.15. 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.

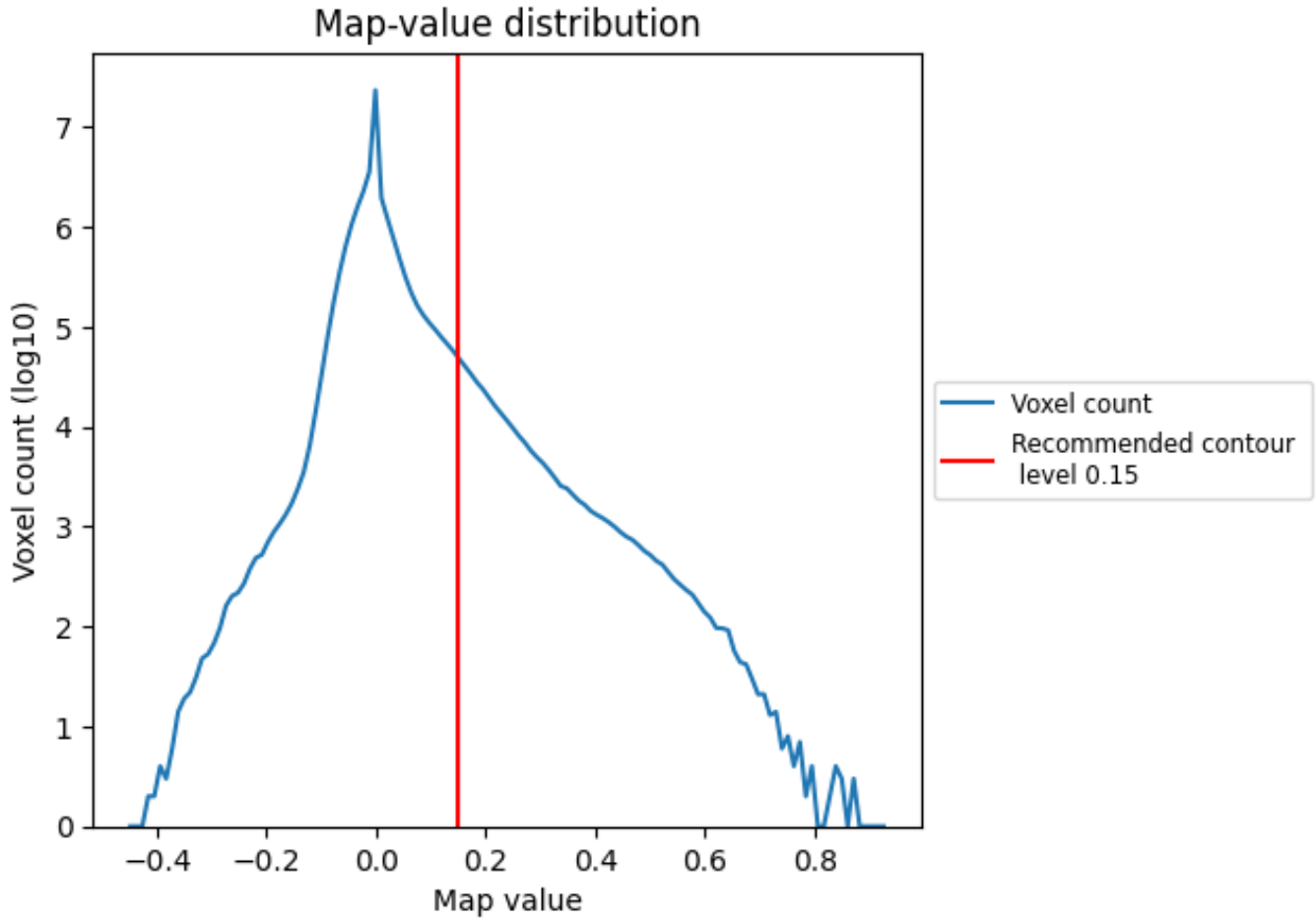
6.6 Mask visualisation (i)

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

7 Map analysis

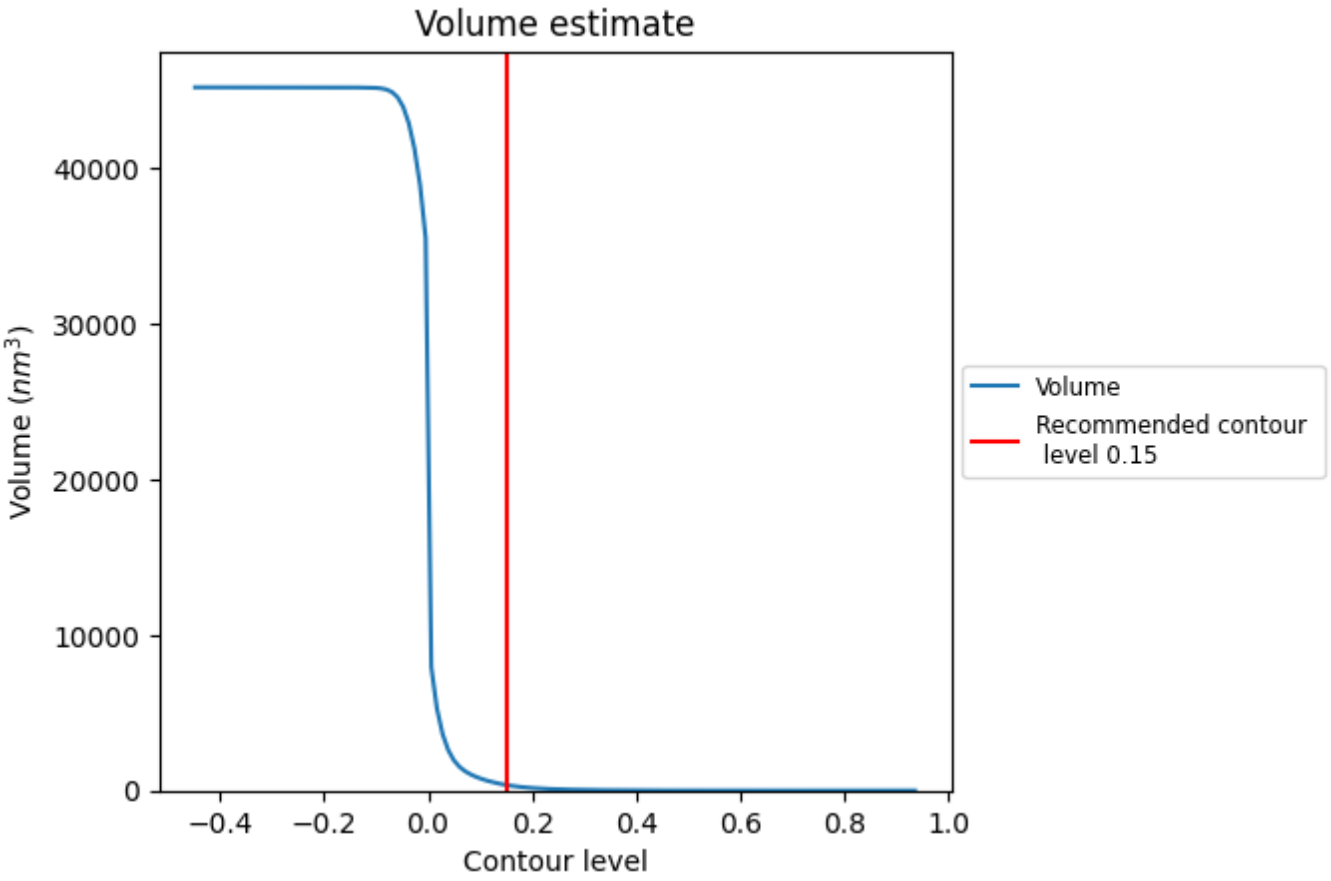
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution



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.

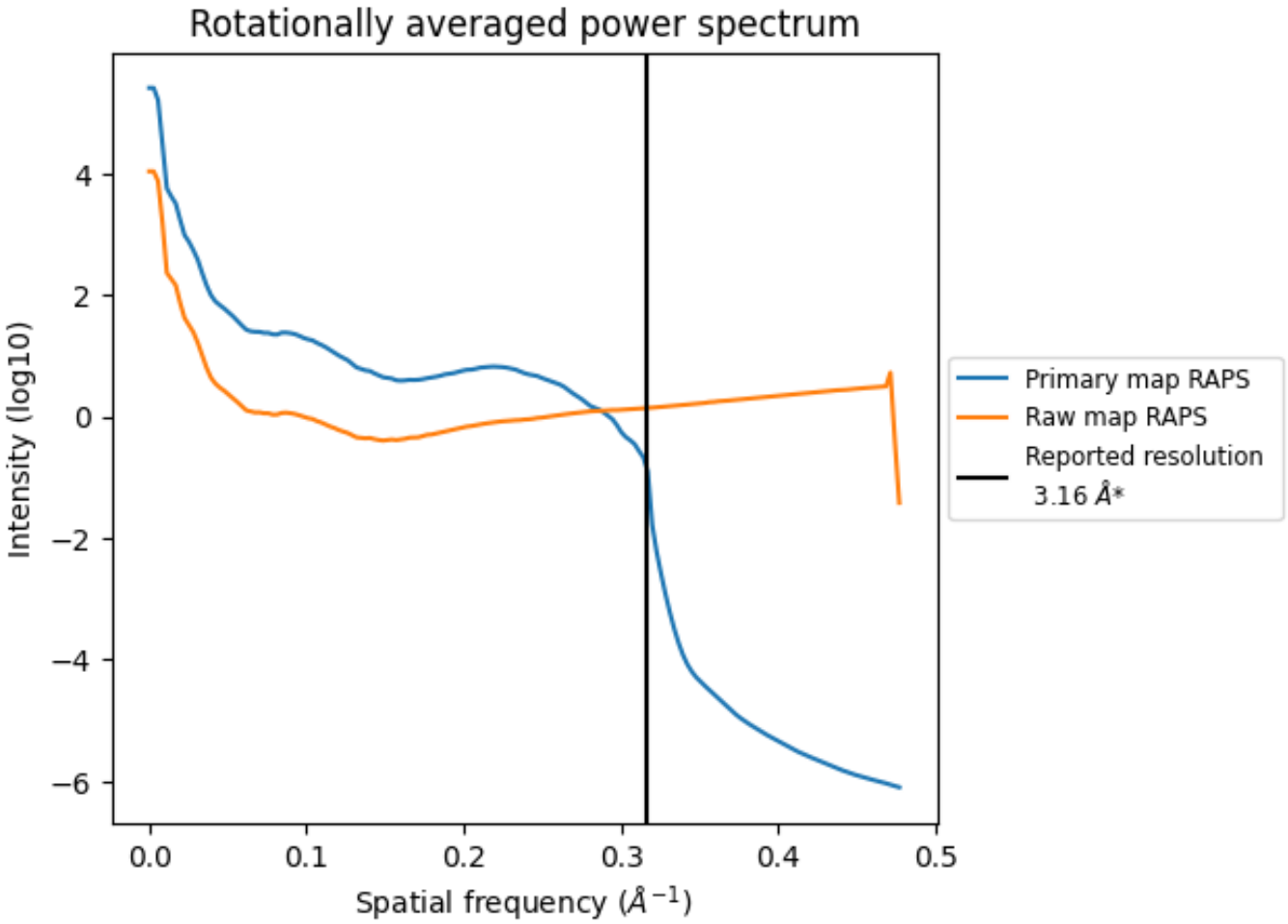
7.2 Volume estimate



The volume at the recommended contour level is 361 nm^3; this corresponds to an approximate mass of 326 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)

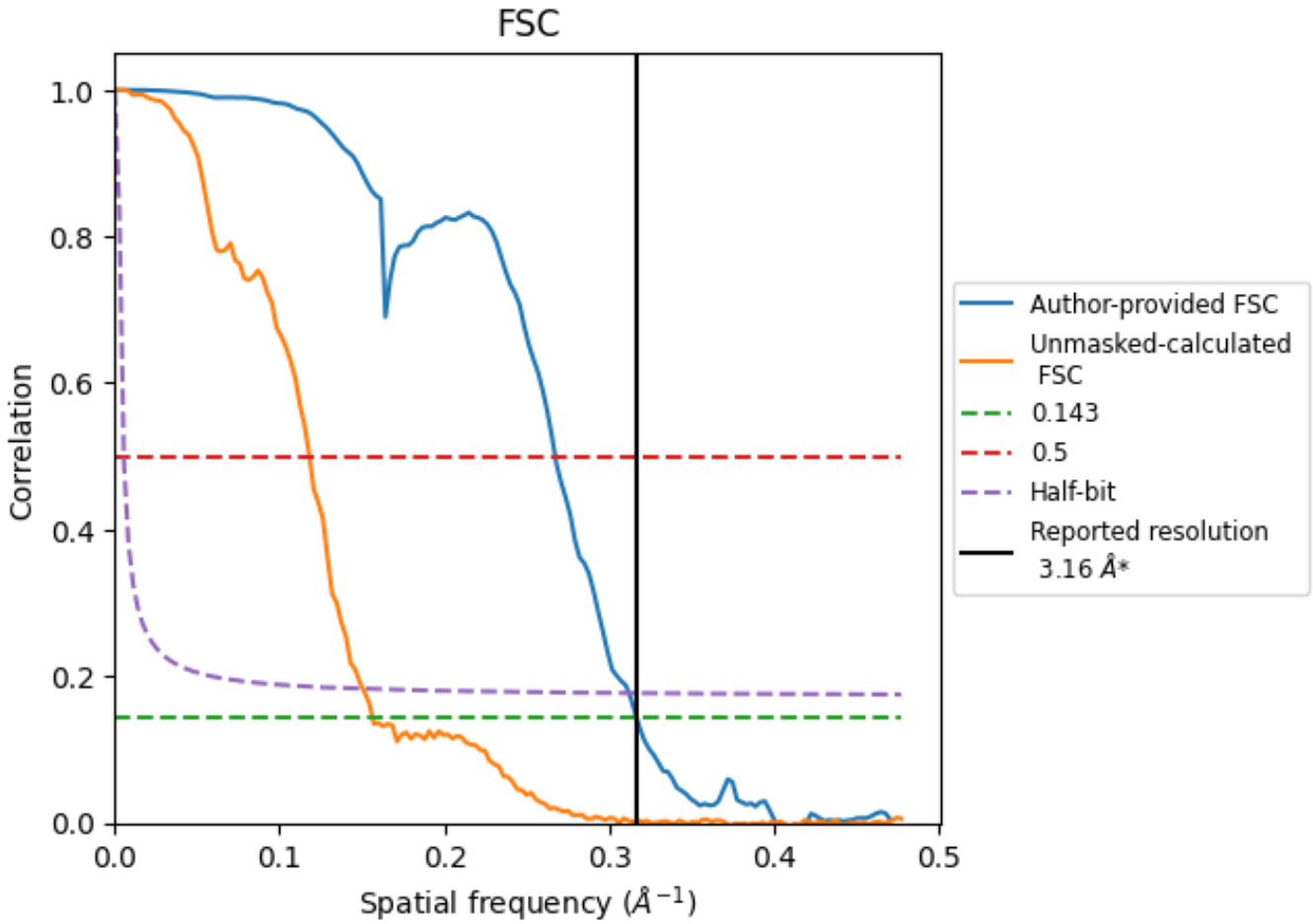


*Reported resolution corresponds to spatial frequency of 0.316 Å^{-1}

8 Fourier-Shell correlation

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



*Reported resolution corresponds to spatial frequency of 0.316 $Å^{-1}$

8.2 Resolution estimates (i)

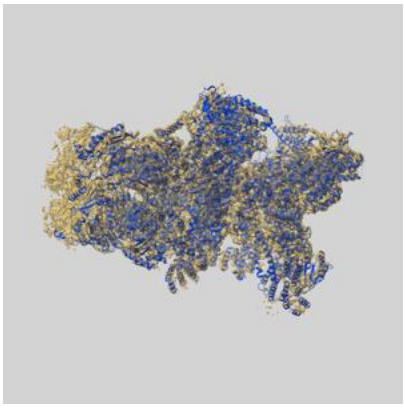
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.16	-	-
Author-provided FSC curve	3.16	3.74	3.21
Unmasked-calculated*	6.40	8.47	6.64

*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 6.40 differs from the reported value 3.16 by more than 10 %

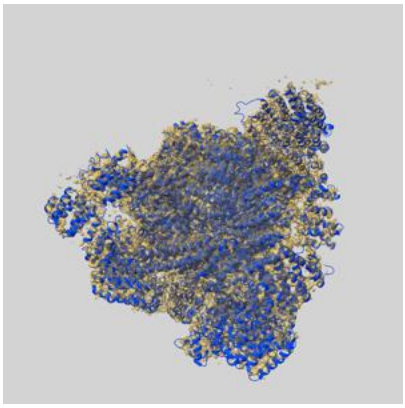
9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-47727 and PDB model 9E8Q. Per-residue inclusion information can be found in section 3 on page 14.

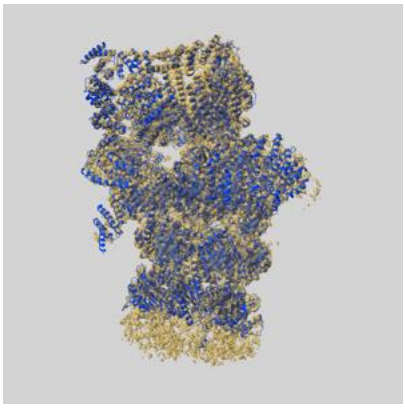
9.1 Map-model overlay



X



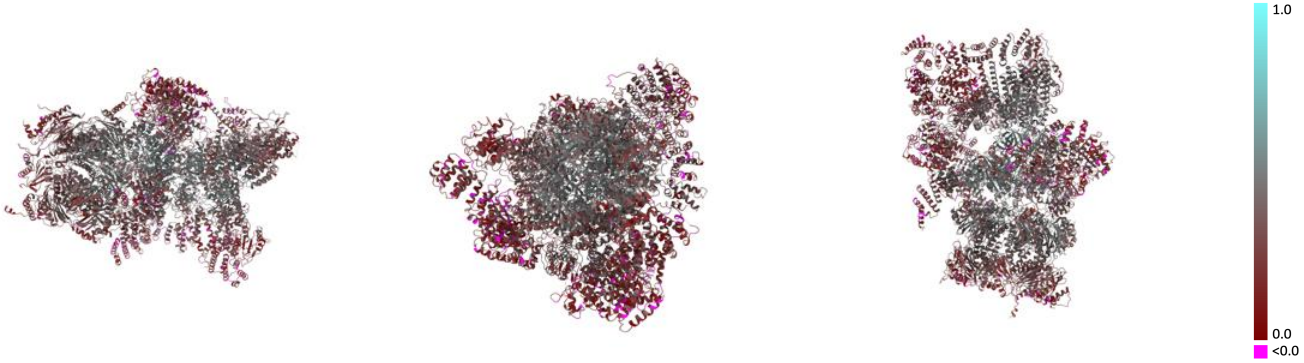
Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.15 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.

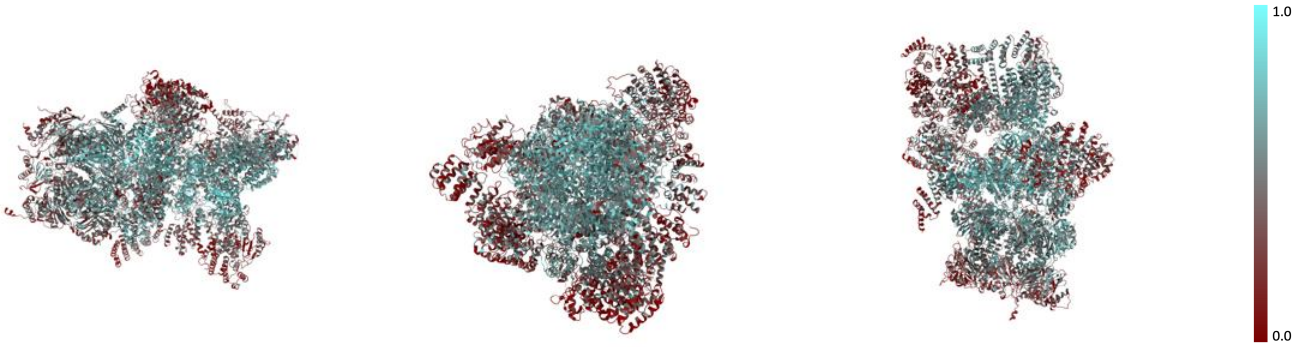
9.2 Q-score mapped to coordinate model (i)



X Y Z

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

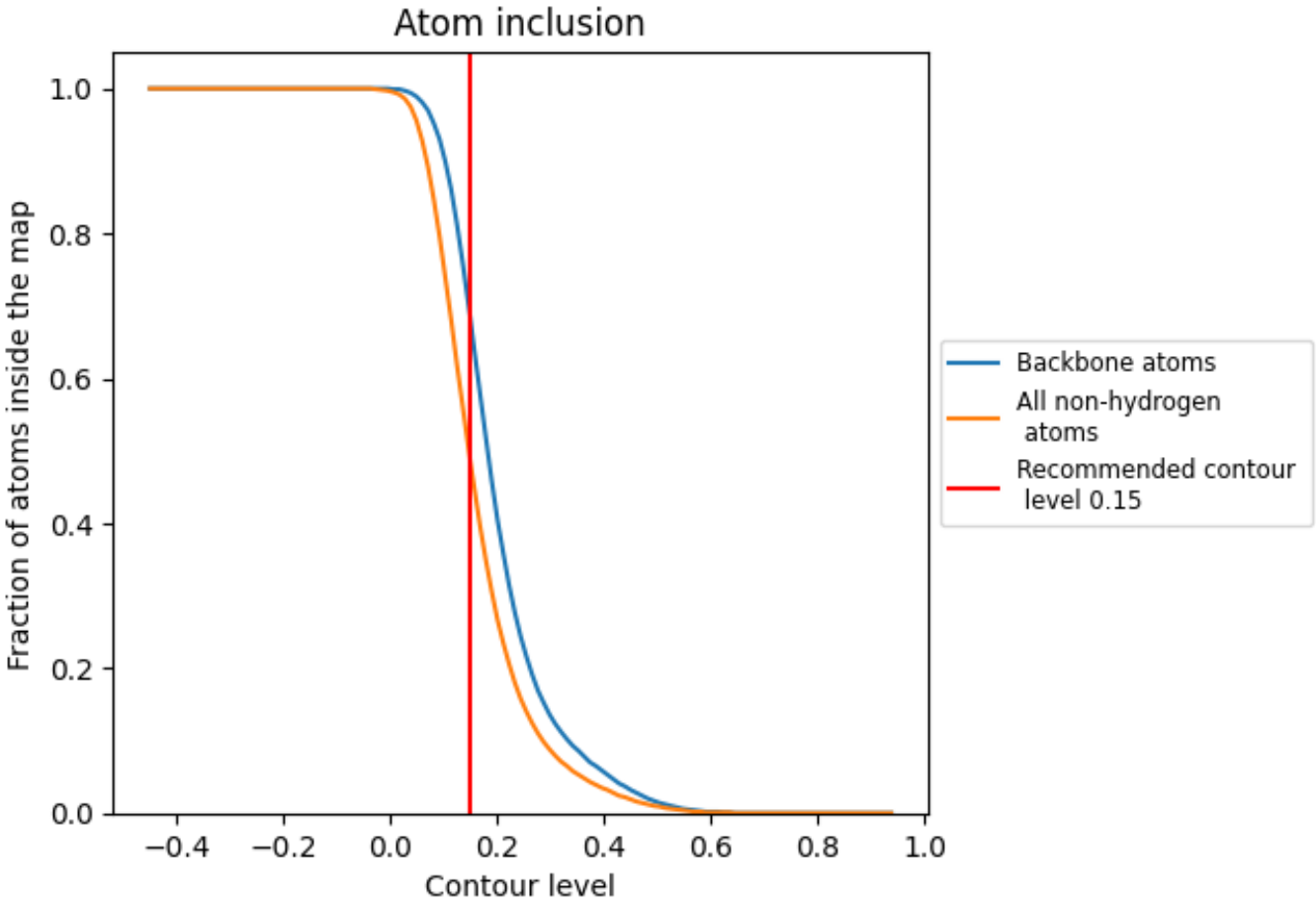
9.3 Atom inclusion mapped to coordinate model (i)



X Y Z

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 (0.15).

9.4 Atom inclusion (i)



At the recommended contour level, 68% of all backbone atoms, 49% 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 (0.15) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.4860	0.3390
A	0.5620	0.3610
B	0.7080	0.4670
C	0.7880	0.5070
D	0.7750	0.4990
E	0.7130	0.4390
F	0.4380	0.2920
G	0.5550	0.3890
H	0.6230	0.4390
I	0.5860	0.4180
J	0.5920	0.4130
K	0.6300	0.4330
L	0.5630	0.3820
M	0.5040	0.3530
N	0.3940	0.3150
O	0.3270	0.3130
P	0.3400	0.3070
Q	0.3880	0.3060
R	0.4020	0.2990
S	0.3850	0.2940
T	0.3880	0.2810
U	0.5410	0.3640
V	0.3170	0.2420
W	0.2360	0.1820
X	0.4870	0.3270
Y	0.4640	0.2690
Z	0.5490	0.3690
a	0.2920	0.2170
b	0.2620	0.2460
c	0.7050	0.4540
d	0.1820	0.1940
e	0.2340	0.2330
f	0.3310	0.2490
v	0.6180	0.5270