Full wwPDB EM Validation Report ⓘ

Nov 25, 2024 – 12:44 PM EST

PDB ID	:	9E8G
EMDB ID	:	EMD-47719
Title	:	Nub1/Fat10-processing human 26S proteasome bound to Txnl1 with Rpt5 at top of spiral staircase
Authors	:	Arkinson, C.; Gee, C.L.; Martin, A.
Deposited on	:	2024-11-05
Resolution	:	3.01 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:

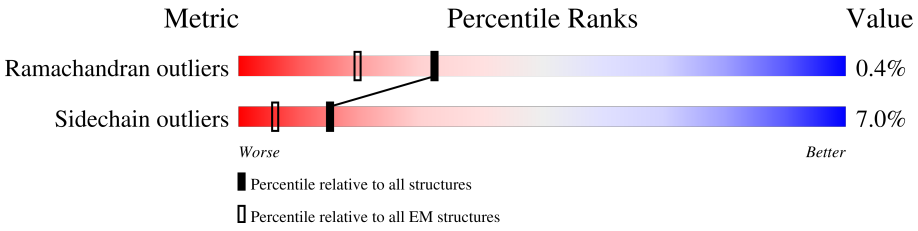
EMDB validation analysis	:	0.0.1.dev113
Mogul	:	2022.3.0, CSD as543be (2022)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, 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 3.01 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	87% 6% 7%
2	B	440	5% 85% 6% 10%
3	C	406	91% 5%
4	D	418	85% 5% 10%
5	E	389	23% 79% 9% 11%
6	F	439	78% 5% 17%
7	G	246	90% 7%
8	H	234	94% 5%
9	I	261	90% 5% 5%

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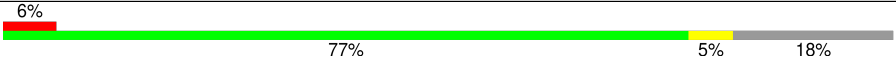
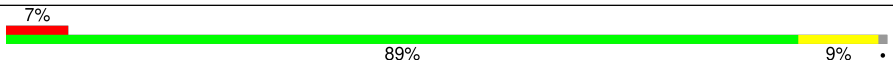
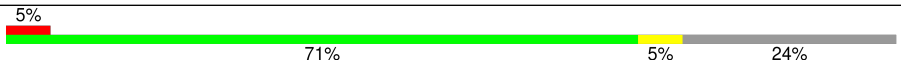
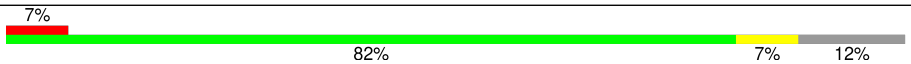
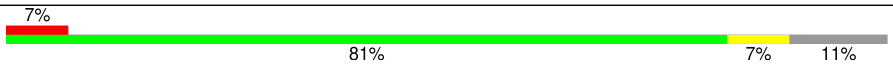
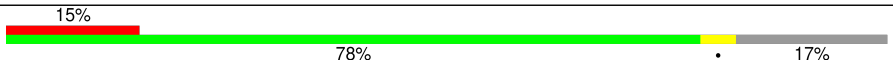
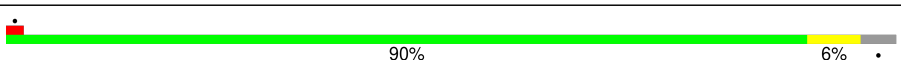
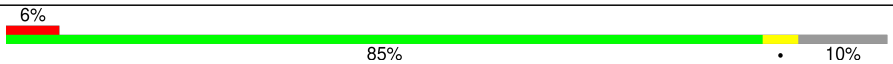
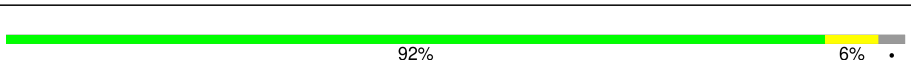
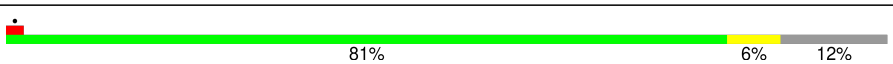
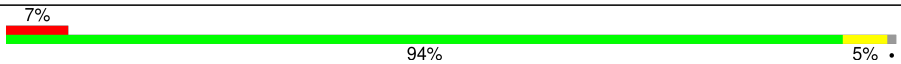
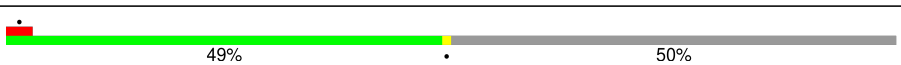
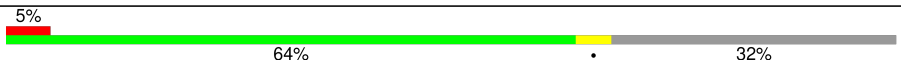
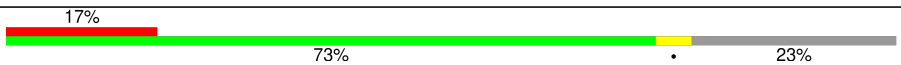
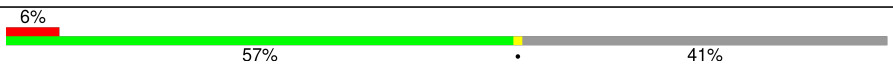
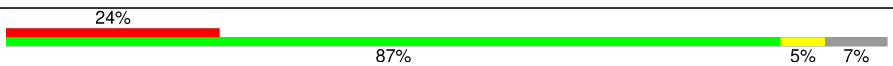
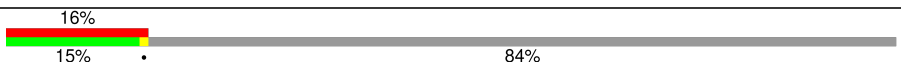
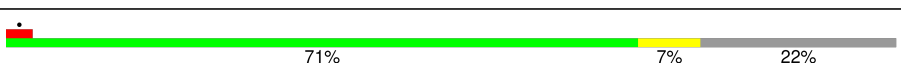
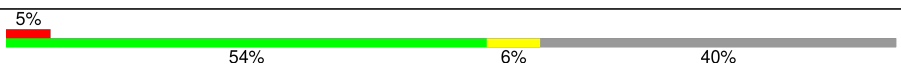
Mol	Chain	Length	Quality of chain
10	J	248	
11	K	241	
12	L	263	
13	M	255	
14	N	239	
15	P	277	
16	Q	205	
17	R	201	
18	S	263	
19	T	241	
20	U	953	
21	V	534	
22	W	456	
23	X	422	
24	Y	389	
25	Z	324	
26	a	376	
27	b	377	
28	c	424	
29	d	350	
30	e	70	
31	f	908	
32	g	601	
33	h	264	
34	u	289	

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Mol	Chain	Length	Quality of chain
35	v	12	100%

2 Entry composition

There are 39 unique types of molecules in this entry. The entry contains 82197 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	401	3163	1995	557	593	18	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	398	3126	1968	532	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	3051	1919	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	377	3018	1911	521	573	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	347	2750	1736	487	511	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	364	2850	1803	492	538	17	0	0

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

Mol	Chain	Residues	Atoms					AltConf	Trace
7	G	239	Total	C	N	O	S	0	0
			1831	1164	306	348	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
			1813	1158	307	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
			1908	1205	325	369	9		

- 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
			1813	1136	320	352	5		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
J	230	VAL	ALA	conflict	UNP O14818

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

Mol	Chain	Residues	Atoms					AltConf	Trace
11	K	231	Total	C	N	O	S	0	0
			1763	1106	292	355	10		

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	237	Total	C	N	O	S	0	0
			1845	1156	333	345	11		

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

Mol	Chain	Residues	Atoms					AltConf	Trace
13	M	240	Total	C	N	O	S	0	0
			1856	1178	314	353	11		

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

Mol	Chain	Residues	Atoms					AltConf	Trace
14	N	197	Total	C	N	O	S	0	0
			1482	928	253	289	12		

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

Mol	Chain	Residues	Atoms					AltConf	Trace
15	P	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	Q	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	R	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	S	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	T	213	Total	C	N	O	S	0	0
			1641	1041	281	309	10		

- Molecule 20 is a protein called 26S proteasome non-ATPase regulatory subunit 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
20	U	844	Total	C	N	O	S	0	0
			6588	4181	1119	1244	44		

- Molecule 21 is a protein called 26S proteasome non-ATPase regulatory subunit 3.

Mol	Chain	Residues	Atoms					AltConf	Trace
21	V	442	Total	C	N	O	S	0	0
			3602	2296	643	650	13		

- Molecule 22 is a protein called 26S proteasome non-ATPase regulatory subunit 12.

Mol	Chain	Residues	Atoms					AltConf	Trace
22	W	438	Total	C	N	O	S	0	0
			3570	2261	609	677	23		

- Molecule 23 is a protein called 26S proteasome non-ATPase regulatory subunit 11.

Mol	Chain	Residues	Atoms					AltConf	Trace
23	X	378	Total	C	N	O	S	0	0
			2994	1909	507	566	12		

- Molecule 24 is a protein called 26S proteasome non-ATPase regulatory subunit 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
24	Y	379	Total	C	N	O	S	0	0
			3123	1993	534	579	17		

- Molecule 25 is a protein called 26S proteasome non-ATPase regulatory subunit 7.

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

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

Mol	Chain	Residues	Atoms					AltConf	Trace
26	a	372	Total	C	N	O	S	0	0
			2991	1909	509	558	15		

- Molecule 27 is a protein called 26S proteasome non-ATPase regulatory subunit 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
27	b	190	Total	C	N	O	S	0	0
			1454	908	260	278	8		

- Molecule 28 is a protein called 26S proteasome non-ATPase regulatory subunit 14.

Mol	Chain	Residues	Atoms					AltConf	Trace
28	c	288	Total	C	N	O	S	0	0
			2264	1433	390	422	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
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

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Chain	Residue	Modelled	Actual	Comment	Reference
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
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

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Chain	Residue	Modelled	Actual	Comment	Reference
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
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

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

Mol	Chain	Residues	Atoms					AltConf	Trace
29	d	269	Total	C	N	O	S	0	0
			2188	1414	359	406	9		

- Molecule 30 is a protein called 26S proteasome complex subunit SEM1.

Mol	Chain	Residues	Atoms				AltConf	Trace
30	e	41	Total	C	N	O	0	0
			353	217	55	81		

- Molecule 31 is a protein called 26S proteasome non-ATPase regulatory subunit 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
31	f	842	Total	C	N	O	S	0	0
			6512	4117	1105	1245	45		

- Molecule 32 is a protein called Isoform 2 of NEDD8 ultimate buster 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
32	g	95	Total	C	N	O	S	0	0
			771	487	139	144	1		

- Molecule 33 is a protein called Proteasome subunit beta type-4.

Mol	Chain	Residues	Atoms					AltConf	Trace
33	h	206	Total	C	N	O	S	0	0
			1601	1010	277	303	11		

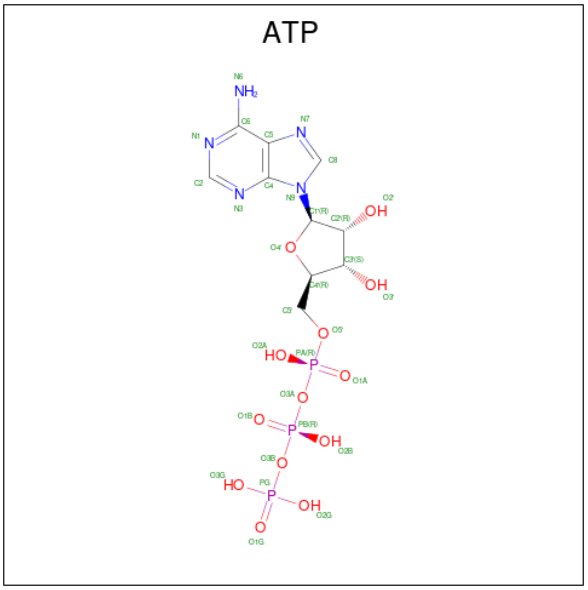
- Molecule 34 is a protein called Thioredoxin-like protein 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
34	u	172	Total	C	N	O	S	0	0
			1376	865	226	276	9		

- Molecule 35 is a protein called substrate peptide.

Mol	Chain	Residues	Atoms				AltConf	Trace
35	v	12	Total	C	N	O	0	0
			60	36	12	12		

- Molecule 36 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
36	A	1	Total	C	N	O	P	0
			31	10	5	13	3	
36	B	1	Total	C	N	O	P	0
			31	10	5	13	3	
36	F	1	Total	C	N	O	P	0
			31	10	5	13	3	

- Molecule 37 is MAGNESIUM ION (three-letter code: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

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

Continued on next page...

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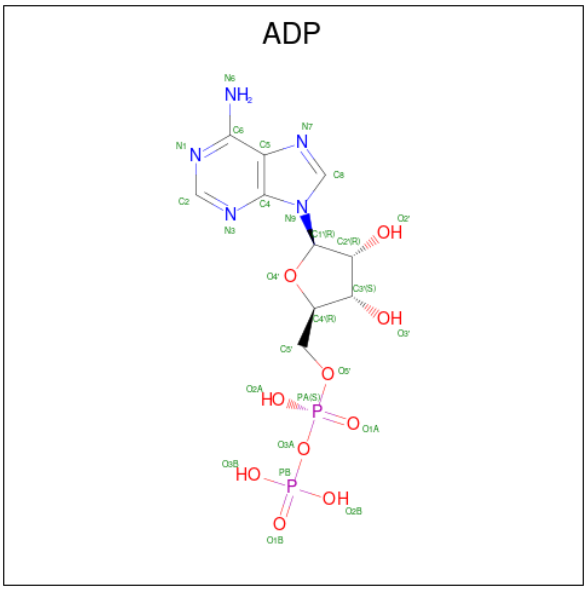
Mol	Chain	Residues	Atoms	AltConf
37	F	1	Total Mg 1 1	0

- Molecule 38 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
38	C	1	Total C N O P 27 10 5 10 2	0
38	D	1	Total C N O P 27 10 5 10 2	0
38	E	1	Total C N O P 27 10 5 10 2	0

- Molecule 39 is ZINC ION (three-letter code: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

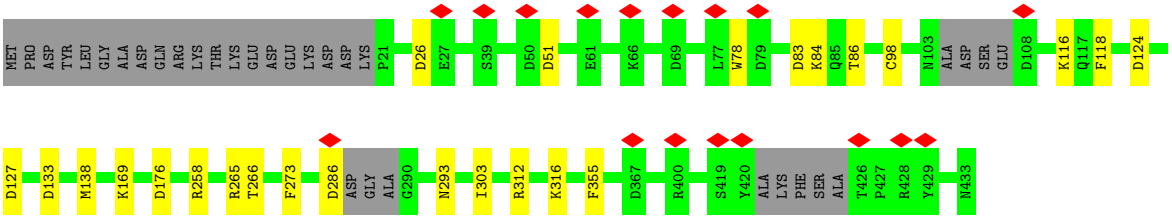
Mol	Chain	Residues	Atoms	AltConf
39	u	1	Total Zn 1 1	0

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.

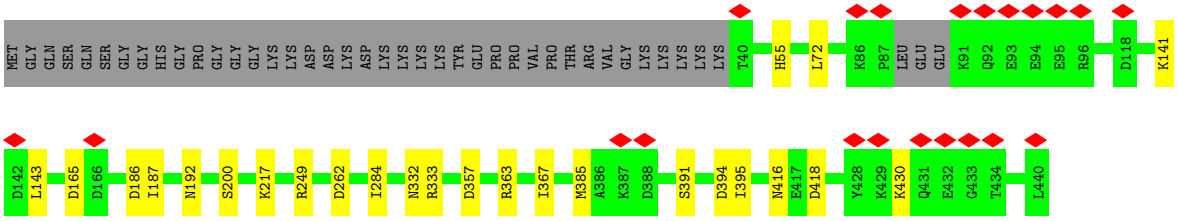
• Molecule 1: 26S proteasome regulatory subunit 7

Chain A:



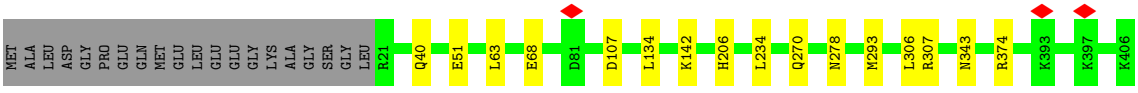
• Molecule 2: 26S proteasome regulatory subunit 4

Chain B:



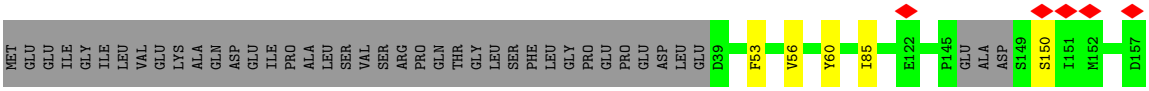
• Molecule 3: 26S protease regulatory subunit 8

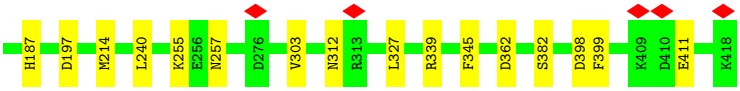
Chain C:



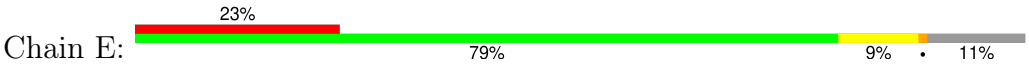
• Molecule 4: 26S proteasome regulatory subunit 6B

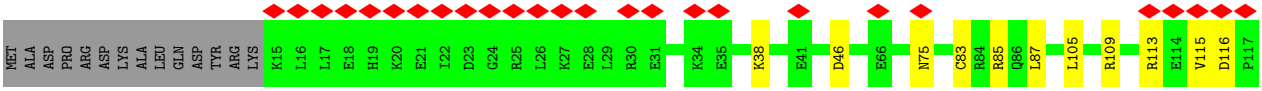
Chain D:

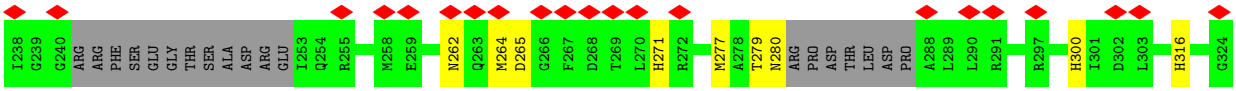


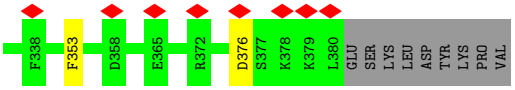


• Molecule 5: 26S protease regulatory subunit 10B

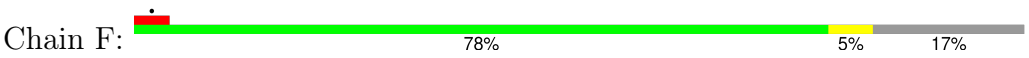


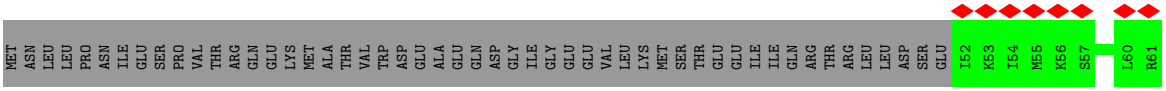


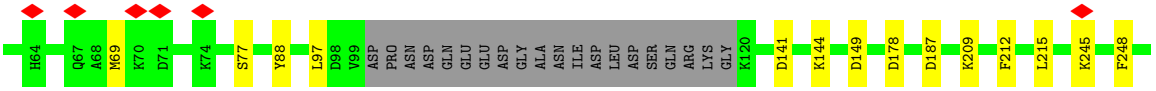


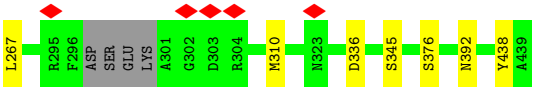


• Molecule 6: 26S proteasome regulatory subunit 6A

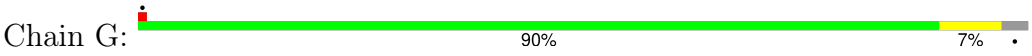




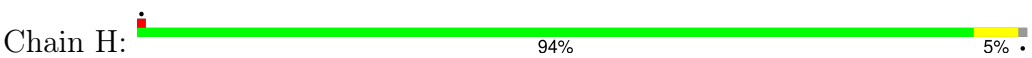


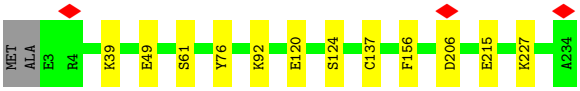


• Molecule 7: Proteasome subunit alpha type-6



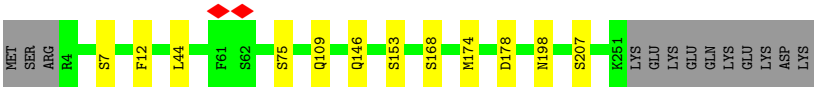
• Molecule 8: Proteasome subunit alpha type-2





• Molecule 9: Proteasome subunit alpha type-4

Chain I:

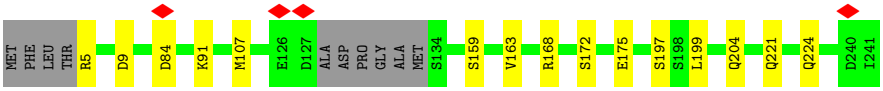


• Molecule 10: Proteasome subunit alpha type-7

Chain J:

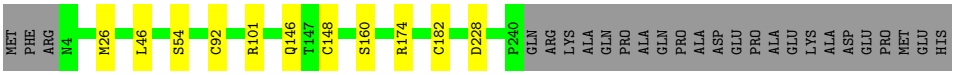
• Molecule 11: Proteasome subunit alpha type-5

Chain K:



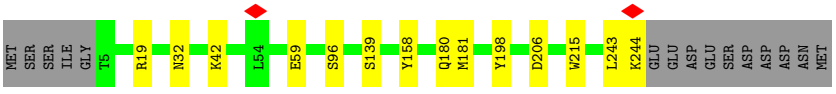
• Molecule 12: Proteasome subunit alpha type-1

Chain L:



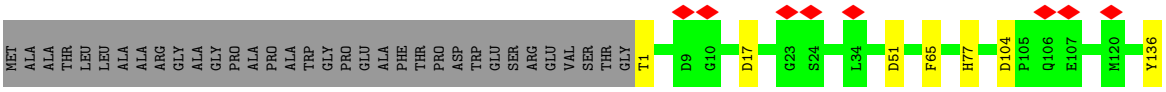
• Molecule 13: Proteasome subunit alpha type-3

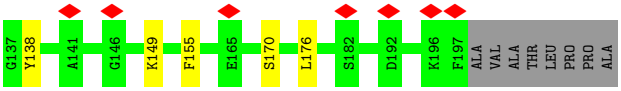
Chain M:



• Molecule 14: Proteasome subunit beta type-6

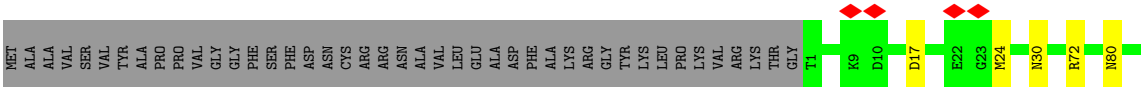
Chain N:

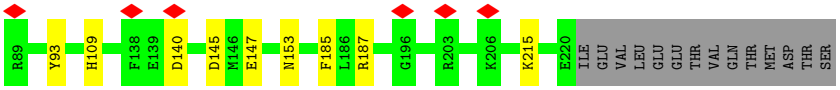




• Molecule 15: Proteasome subunit beta type-7

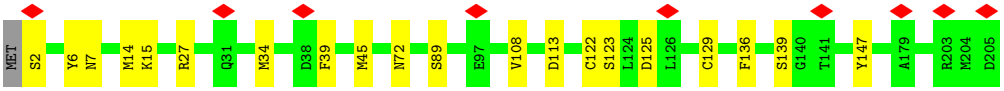
Chain P:





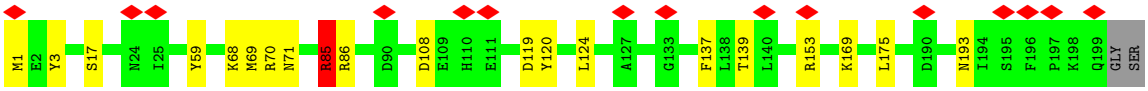
• Molecule 16: Proteasome subunit beta type-3

Chain Q:



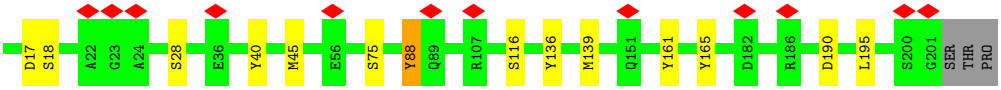
• Molecule 17: Proteasome subunit beta type-2

Chain R:



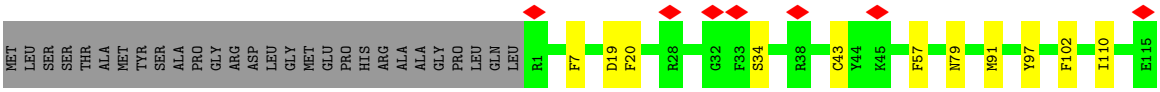
• Molecule 18: Proteasome subunit beta type-5

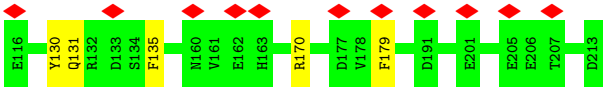
Chain S:



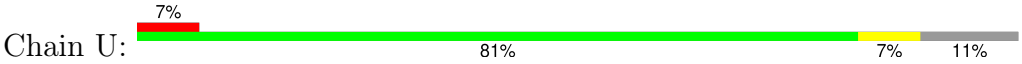
• Molecule 19: Proteasome subunit beta type-1

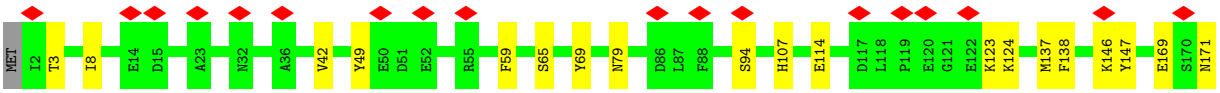
Chain T:

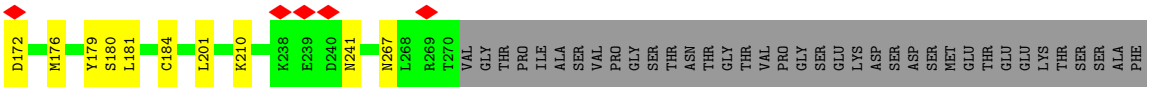


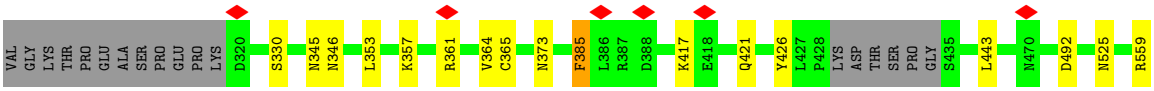


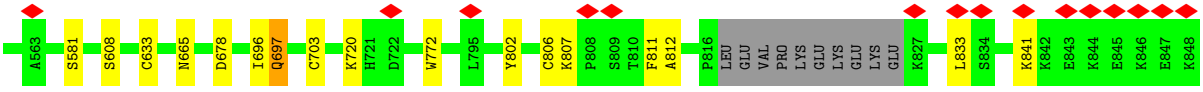
• Molecule 20: 26S proteasome non-ATPase regulatory subunit 1

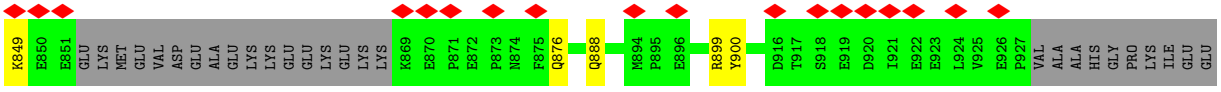




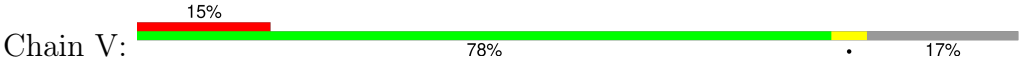


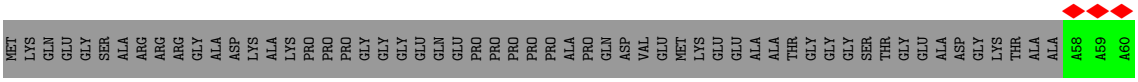


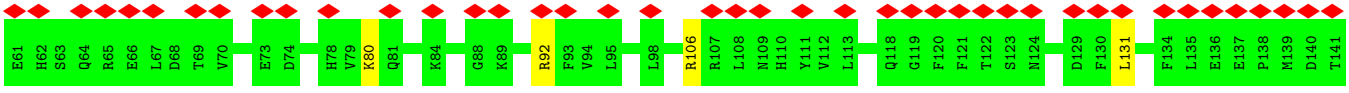


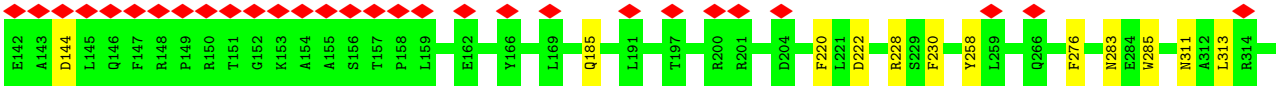


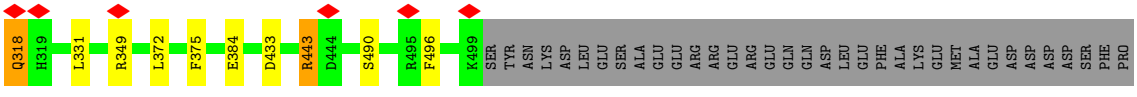
• Molecule 21: 26S proteasome non-ATPase regulatory subunit 3



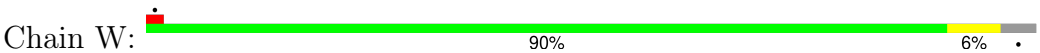


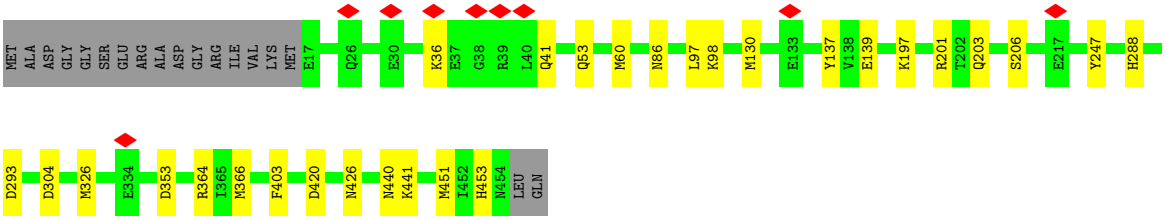




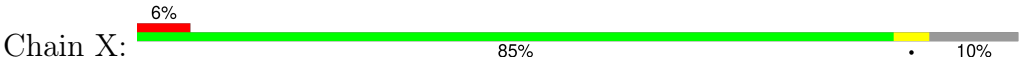


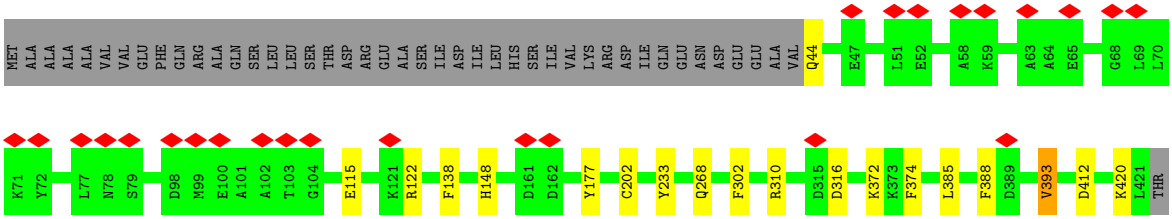
• Molecule 22: 26S proteasome non-ATPase regulatory subunit 12



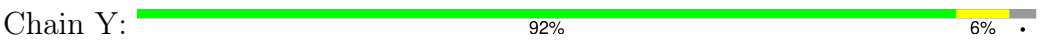


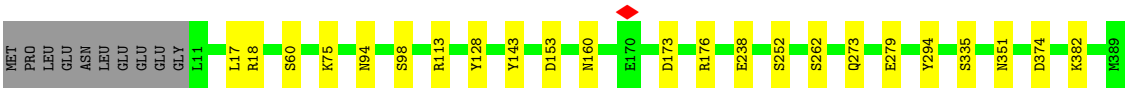
• Molecule 23: 26S proteasome non-ATPase regulatory subunit 11



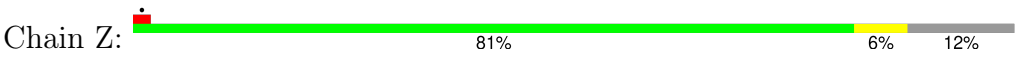


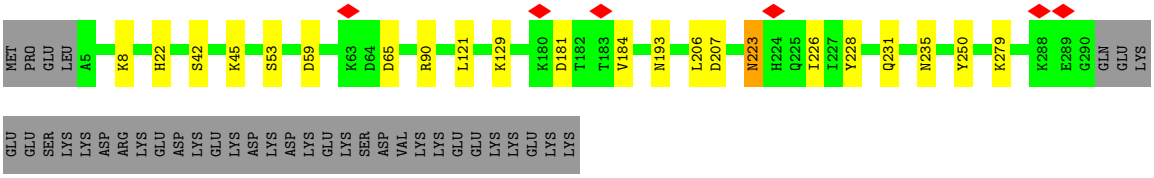
• Molecule 24: 26S proteasome non-ATPase regulatory subunit 6



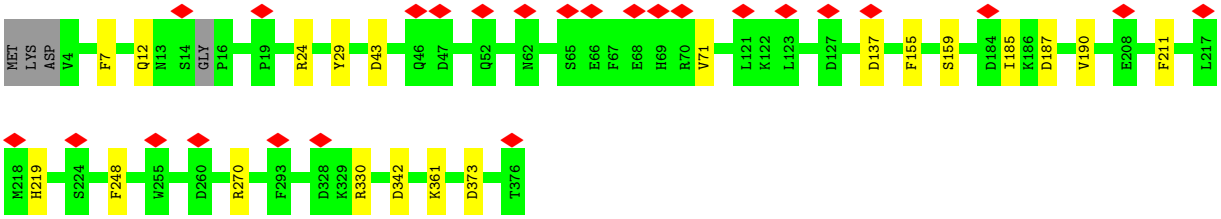


• Molecule 25: 26S proteasome non-ATPase regulatory subunit 7

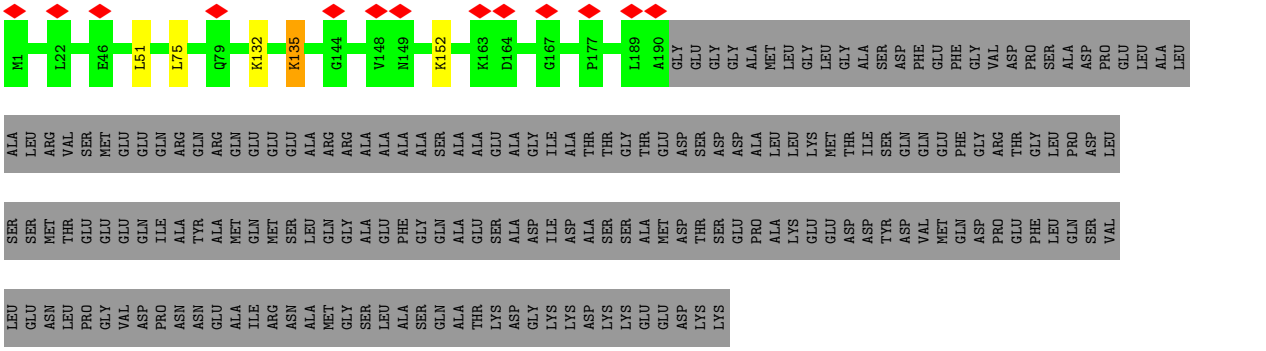




• Molecule 26: 26S proteasome non-ATPase regulatory subunit 13

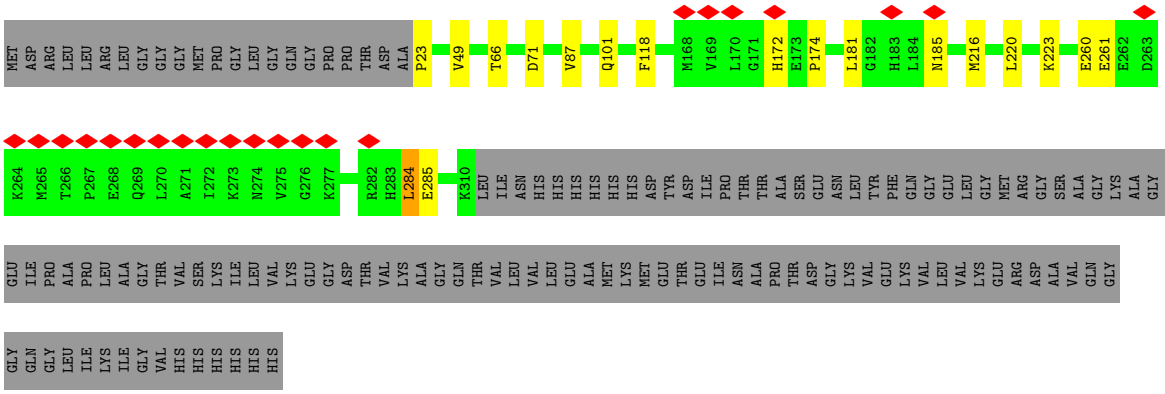


• Molecule 27: 26S proteasome non-ATPase regulatory subunit 4



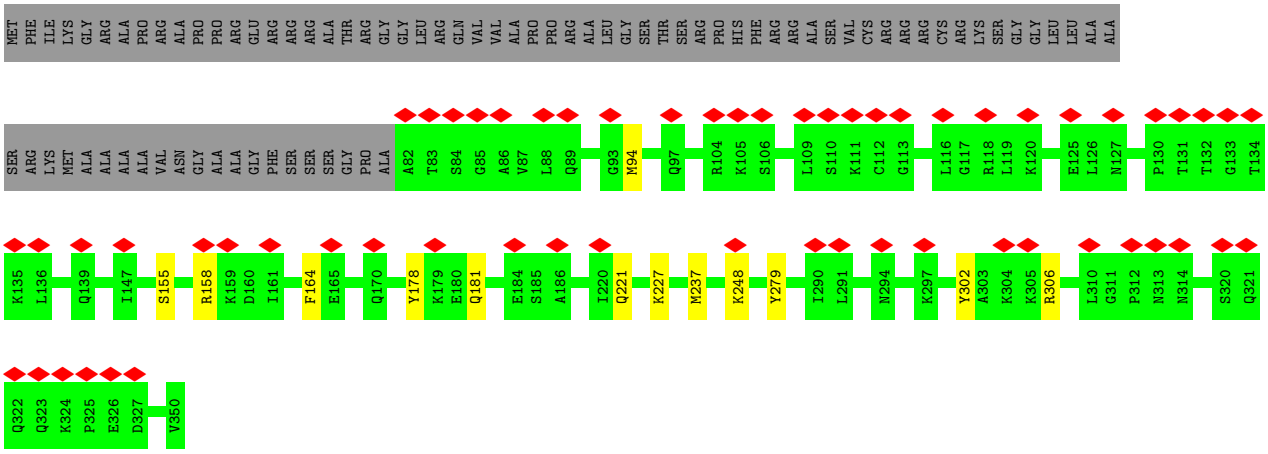
• Molecule 28: 26S proteasome non-ATPase regulatory subunit 14

Chain c:



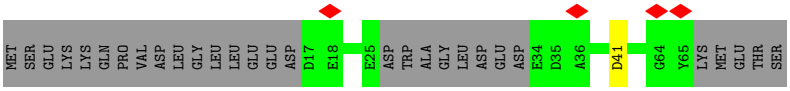
• Molecule 29: 26S proteasome non-ATPase regulatory subunit 8

Chain d:



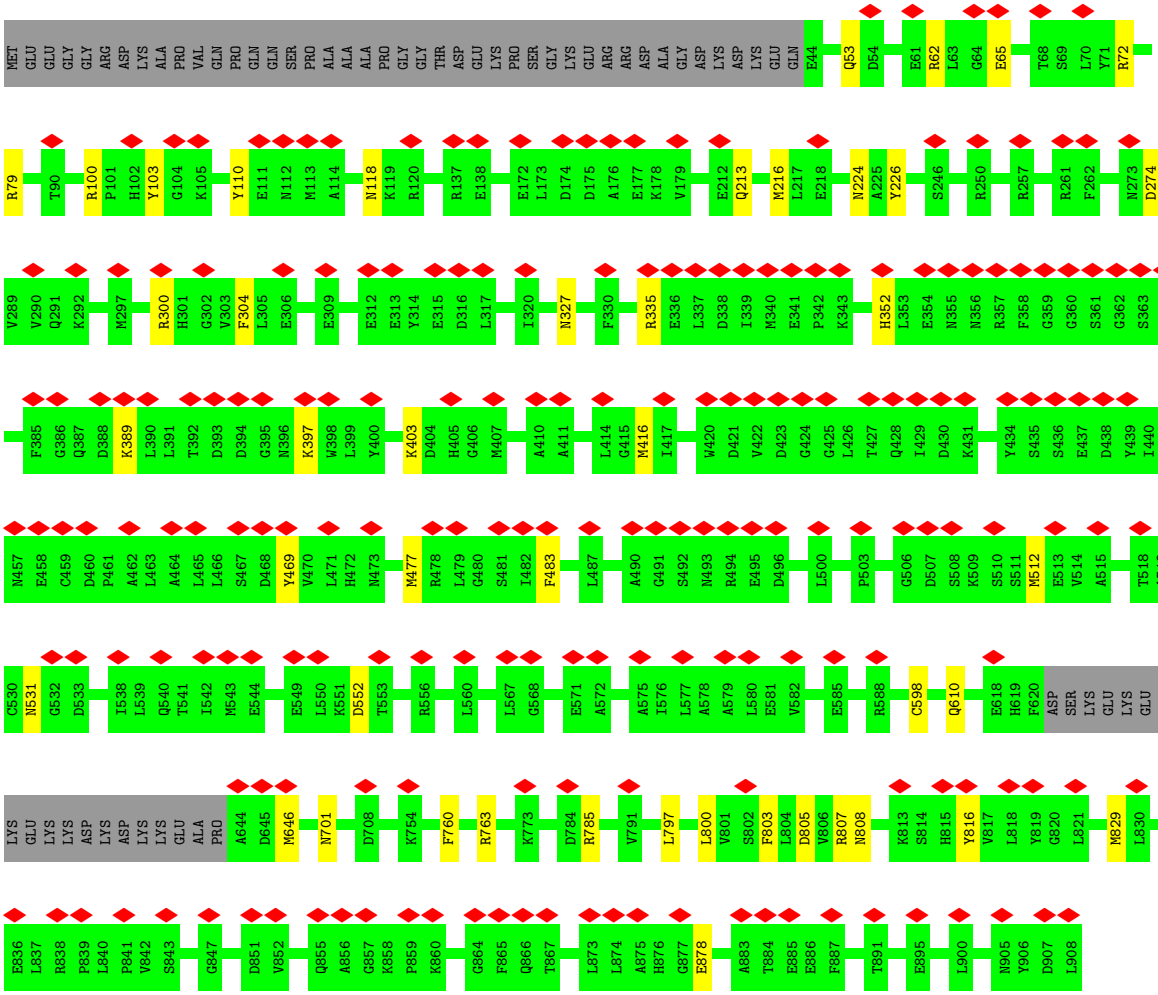
• Molecule 30: 26S proteasome complex subunit SEM1

Chain e:



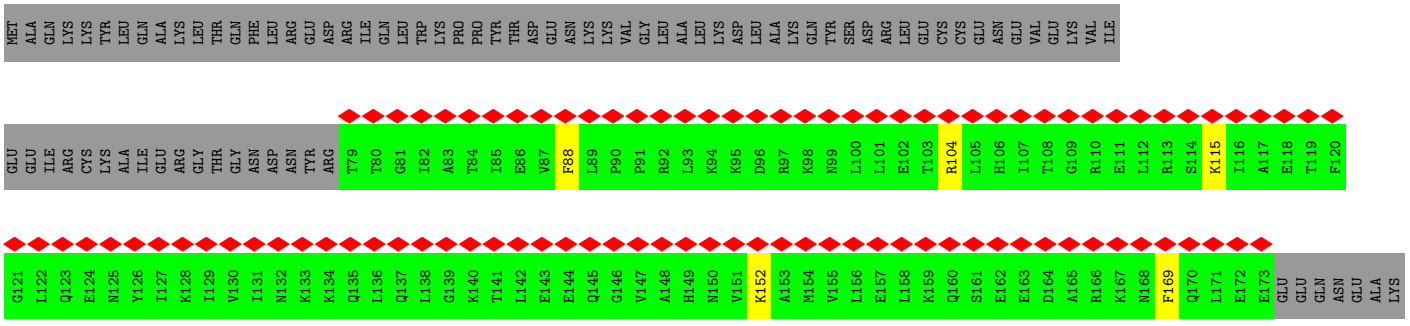
• Molecule 31: 26S proteasome non-ATPase regulatory subunit 2

Chain f:



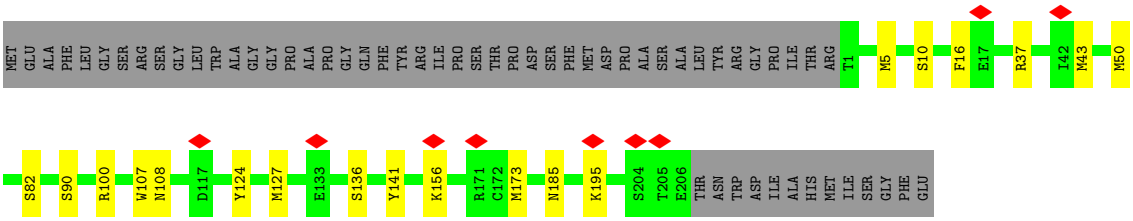
• Molecule 32: Isoform 2 of NEDD8 ultimate buster 1

Chain g:



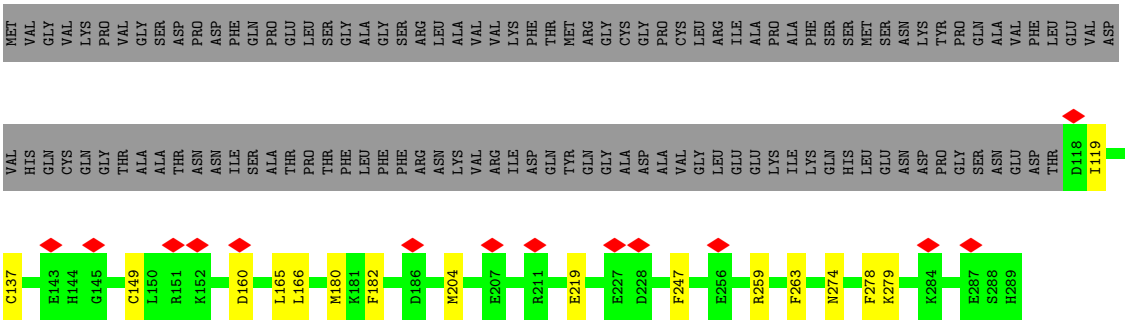
• Molecule 33: Proteasome subunit beta type-4

Chain h:



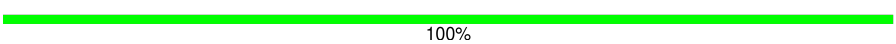
• Molecule 34: Thioredoxin-like protein 1

Chain u:



• Molecule 35: substrate peptide

Chain v:



There are no outlier residues recorded for this chain.

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	95437	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	0.771	Depositor
Minimum map value	-0.285	Depositor
Average map value	0.004	Depositor
Map value standard deviation	0.034	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

5.1 Standard geometry

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

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	0.28	0/3213	0.51	0/4333
2	B	0.31	0/3171	0.52	0/4276
3	C	0.27	0/3092	0.48	0/4154
4	D	0.27	0/3067	0.48	0/4135
5	E	0.29	0/2789	0.48	0/3751
6	F	0.32	1/2888 (0.0%)	0.49	0/3889
7	G	0.27	0/1864	0.47	0/2527
8	H	0.28	0/1852	0.47	0/2507
9	I	0.26	0/1938	0.48	0/2622
10	J	0.26	0/1838	0.48	0/2493
11	K	0.27	0/1789	0.45	0/2417
12	L	0.26	0/1880	0.49	0/2545
13	M	0.27	0/1891	0.46	0/2552
14	N	0.26	0/1508	0.50	0/2040
15	P	0.25	0/1672	0.49	0/2267
16	Q	0.28	0/1616	0.49	0/2180
17	R	0.34	0/1621	0.63	2/2194 (0.1%)
18	S	0.44	3/1590 (0.2%)	0.51	1/2147 (0.0%)
19	T	0.26	0/1671	0.48	0/2252
20	U	0.36	5/6700 (0.1%)	0.57	8/9057 (0.1%)
21	V	0.28	0/3672	0.50	2/4957 (0.0%)
22	W	0.25	0/3618	0.46	0/4868
23	X	0.25	0/3038	0.43	0/4095
24	Y	0.27	0/3181	0.46	0/4285
25	Z	0.30	0/2324	0.52	3/3150 (0.1%)
26	a	0.25	0/3048	0.44	0/4124
27	b	0.26	0/1474	0.49	0/1996
28	c	0.38	0/2306	0.56	2/3117 (0.1%)
29	d	0.26	0/2234	0.45	0/3018
30	e	0.24	0/362	0.36	0/490
31	f	0.25	0/6623	0.47	1/8965 (0.0%)
32	g	0.23	0/778	0.48	0/1041

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\|>5$	RMSZ	$\#\|Z\|>5$
33	h	0.26	0/1631	0.52	0/2206
34	u	0.34	0/1403	0.52	0/1892
All	All	0.29	9/83342 (0.0%)	0.49	19/112542 (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
1	A	0	3
17	R	0	2
20	U	0	1
21	V	0	1
25	Z	0	1
28	c	0	1
All	All	0	9

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
18	S	88	TYR	CE2-CZ	-9.88	1.25	1.38
20	U	697	GLN	CG-CD	8.77	1.71	1.51
18	S	88	TYR	CG-CD2	-8.07	1.28	1.39
20	U	697	GLN	CD-OE1	-7.50	1.07	1.24
20	U	697	GLN	CD-NE2	6.51	1.49	1.32
20	U	385	PHE	CE2-CZ	-5.99	1.25	1.37
18	S	88	TYR	CE1-CZ	-5.65	1.31	1.38
6	F	88	TYR	CZ-OH	-5.53	1.28	1.37
20	U	385	PHE	CG-CD2	-5.38	1.30	1.38

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
20	U	697	GLN	CG-CD-NE2	-13.39	84.56	116.70
20	U	697	GLN	CB-CA-C	13.02	136.43	110.40
20	U	697	GLN	CG-CD-OE1	12.44	146.47	121.60
20	U	697	GLN	CA-CB-CG	-9.61	92.26	113.40
25	Z	223	ASN	CB-CG-ND2	-9.40	94.13	116.70
20	U	697	GLN	OE1-CD-NE2	-9.08	101.01	121.90
21	V	443	ARG	NE-CZ-NH2	-8.82	115.89	120.30
17	R	124	LEU	CB-CG-CD2	-8.31	96.88	111.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
28	c	174	PRO	CB-CA-C	-7.52	93.20	112.00
17	R	85	ARG	NE-CZ-NH2	-7.25	116.68	120.30
25	Z	223	ASN	N-CA-CB	6.01	121.42	110.60
20	U	353	LEU	CB-CG-CD2	5.80	120.86	111.00
25	Z	223	ASN	CB-CA-C	-5.67	99.06	110.40
20	U	697	GLN	N-CA-CB	-5.51	100.68	110.60
21	V	443	ARG	NE-CZ-NH1	5.45	123.03	120.30
18	S	88	TYR	CZ-CE2-CD2	5.33	124.60	119.80
20	U	696	ILE	C-N-CA	-5.30	108.46	121.70
28	c	23	PRO	N-CA-CB	5.20	109.54	103.30
31	f	797	LEU	CA-CB-CG	5.16	127.17	115.30

There are no chirality outliers.

All (9) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	258	ARG	Sidechain
1	A	265	ARG	Sidechain
1	A	312	ARG	Sidechain
17	R	85	ARG	Sidechain
17	R	86	ARG	Sidechain
20	U	697	GLN	Sidechain
21	V	443	ARG	Sidechain
25	Z	223	ASN	Sidechain
28	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	A	393/433 (91%)	363 (92%)	28 (7%)	2 (0%)	25 59
2	B	394/440 (90%)	361 (92%)	32 (8%)	1 (0%)	37 69
3	C	384/406 (95%)	352 (92%)	31 (8%)	1 (0%)	37 69
4	D	373/418 (89%)	335 (90%)	35 (9%)	3 (1%)	16 49
5	E	341/389 (88%)	290 (85%)	37 (11%)	14 (4%)	2 12
6	F	358/439 (82%)	340 (95%)	17 (5%)	1 (0%)	37 69
7	G	237/246 (96%)	230 (97%)	6 (2%)	1 (0%)	30 64
8	H	230/234 (98%)	226 (98%)	4 (2%)	0	100 100
9	I	246/261 (94%)	239 (97%)	7 (3%)	0	100 100
10	J	237/248 (96%)	231 (98%)	6 (2%)	0	100 100
11	K	227/241 (94%)	219 (96%)	8 (4%)	0	100 100
12	L	235/263 (89%)	227 (97%)	8 (3%)	0	100 100
13	M	238/255 (93%)	228 (96%)	10 (4%)	0	100 100
14	N	195/239 (82%)	190 (97%)	5 (3%)	0	100 100
15	P	218/277 (79%)	213 (98%)	5 (2%)	0	100 100
16	Q	202/205 (98%)	196 (97%)	6 (3%)	0	100 100
17	R	197/201 (98%)	191 (97%)	6 (3%)	0	100 100
18	S	199/263 (76%)	195 (98%)	4 (2%)	0	100 100
19	T	211/241 (88%)	196 (93%)	15 (7%)	0	100 100
20	U	834/953 (88%)	771 (92%)	58 (7%)	5 (1%)	22 55
21	V	440/534 (82%)	416 (94%)	23 (5%)	1 (0%)	44 76
22	W	436/456 (96%)	416 (95%)	19 (4%)	1 (0%)	44 76
23	X	376/422 (89%)	358 (95%)	17 (4%)	1 (0%)	37 69
24	Y	377/389 (97%)	371 (98%)	6 (2%)	0	100 100
25	Z	284/324 (88%)	269 (95%)	13 (5%)	2 (1%)	19 52
26	a	368/376 (98%)	344 (94%)	21 (6%)	3 (1%)	16 49
27	b	188/377 (50%)	161 (86%)	26 (14%)	1 (0%)	25 59
28	c	286/424 (68%)	248 (87%)	34 (12%)	4 (1%)	9 35
29	d	267/350 (76%)	255 (96%)	12 (4%)	0	100 100
30	e	37/70 (53%)	37 (100%)	0	0	100 100
31	f	838/908 (92%)	789 (94%)	49 (6%)	0	100 100
32	g	93/601 (16%)	90 (97%)	3 (3%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
33	h	204/264 (77%)	197 (97%)	7 (3%)	0	100 100
34	u	170/289 (59%)	162 (95%)	5 (3%)	3 (2%)	7 30
All	All	10313/12436 (83%)	9706 (94%)	563 (6%)	44 (0%)	32 64

All (44) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	D	85	ILE
4	D	339	ARG
5	E	85	ARG
5	E	116	ASP
5	E	203	ILE
5	E	207	TYR
7	G	184	LYS
20	U	42	VAL
20	U	812	ALA
23	X	393	VAL
25	Z	184	VAL
27	b	135	LYS
28	c	285	GLU
34	u	278	PHE
1	A	116	LYS
1	A	293	ASN
2	B	395	ILE
3	C	134	LEU
5	E	115	VAL
5	E	209	GLY
5	E	218	MET
5	E	224	ASP
20	U	171	ASN
22	W	41	GLN
28	c	172	HIS
5	E	212	ALA
5	E	220	ASN
6	F	209	LYS
20	U	172	ASP
4	D	303	VAL
5	E	206	LYS
20	U	3	THR
21	V	318	GLN
26	a	71	VAL

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Mol	Chain	Res	Type
26	a	185	ILE
28	c	284	LEU
34	u	279	LYS
5	E	279	THR
26	a	190	VAL
28	c	223	LYS
5	E	215	ILE
5	E	204	VAL
25	Z	226	ILE
34	u	119	ILE

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	A	347/372 (93%)	327 (94%)	20 (6%)	17 46
2	B	351/385 (91%)	327 (93%)	24 (7%)	13 40
3	C	338/352 (96%)	323 (96%)	15 (4%)	24 56
4	D	331/366 (90%)	313 (95%)	18 (5%)	18 49
5	E	303/341 (89%)	272 (90%)	31 (10%)	6 23
6	F	311/379 (82%)	292 (94%)	19 (6%)	15 44
7	G	195/210 (93%)	178 (91%)	17 (9%)	8 30
8	H	190/191 (100%)	178 (94%)	12 (6%)	15 43
9	I	195/221 (88%)	183 (94%)	12 (6%)	15 44
10	J	183/212 (86%)	164 (90%)	19 (10%)	5 22
11	K	192/204 (94%)	177 (92%)	15 (8%)	10 35
12	L	198/224 (88%)	187 (94%)	11 (6%)	17 48
13	M	192/212 (91%)	178 (93%)	14 (7%)	11 37
14	N	154/181 (85%)	142 (92%)	12 (8%)	10 35
15	P	178/228 (78%)	164 (92%)	14 (8%)	10 34
16	Q	172/174 (99%)	152 (88%)	20 (12%)	4 18

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
17	R	168/171 (98%)	150 (89%)	18 (11%)	5 21
18	S	156/202 (77%)	142 (91%)	14 (9%)	8 29
19	T	175/199 (88%)	159 (91%)	16 (9%)	7 28
20	U	720/816 (88%)	660 (92%)	60 (8%)	9 32
21	V	390/460 (85%)	365 (94%)	25 (6%)	14 43
22	W	403/416 (97%)	375 (93%)	28 (7%)	13 40
23	X	325/362 (90%)	306 (94%)	19 (6%)	17 46
24	Y	335/344 (97%)	312 (93%)	23 (7%)	13 40
25	Z	257/295 (87%)	238 (93%)	19 (7%)	11 37
26	a	333/336 (99%)	316 (95%)	17 (5%)	20 51
27	b	167/312 (54%)	162 (97%)	5 (3%)	36 68
28	c	252/359 (70%)	240 (95%)	12 (5%)	21 53
29	d	237/294 (81%)	224 (94%)	13 (6%)	18 48
30	e	37/63 (59%)	36 (97%)	1 (3%)	40 70
31	f	709/763 (93%)	662 (93%)	47 (7%)	14 41
32	g	85/527 (16%)	80 (94%)	5 (6%)	16 46
33	h	169/215 (79%)	150 (89%)	19 (11%)	5 20
34	u	156/253 (62%)	143 (92%)	13 (8%)	9 32
All	All	8904/10639 (84%)	8277 (93%)	627 (7%)	15 39

All (627) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	26	ASP
1	A	51	ASP
1	A	78	TRP
1	A	83	ASP
1	A	84	LYS
1	A	86	THR
1	A	98	CYS
1	A	118	PHE
1	A	124	ASP
1	A	127	ASP
1	A	133	ASP
1	A	138	MET
1	A	169	LYS

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Mol	Chain	Res	Type
1	A	176	ASP
1	A	266	THR
1	A	273	PHE
1	A	286	ASP
1	A	303	ILE
1	A	316	LYS
1	A	355	PHE
2	B	55	HIS
2	B	72	LEU
2	B	141	LYS
2	B	143	LEU
2	B	165	ASP
2	B	186	ASP
2	B	187	ILE
2	B	192	ASN
2	B	200	SER
2	B	217	LYS
2	B	249	ARG
2	B	262	ASP
2	B	284	ILE
2	B	332	ASN
2	B	333	ARG
2	B	357	ASP
2	B	363	ARG
2	B	367	ILE
2	B	385	MET
2	B	391	SER
2	B	394	ASP
2	B	416	ASN
2	B	418	ASP
2	B	430	LYS
3	C	40	GLN
3	C	51	GLU
3	C	63	LEU
3	C	68	GLU
3	C	107	ASP
3	C	142	LYS
3	C	206	HIS
3	C	234	LEU
3	C	270	GLN
3	C	278	ASN
3	C	293	MET

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Mol	Chain	Res	Type
3	C	306	LEU
3	C	307	ARG
3	C	343	ASN
3	C	374	ARG
4	D	53	PHE
4	D	56	VAL
4	D	60	TYR
4	D	150	SER
4	D	187	HIS
4	D	197	ASP
4	D	214	MET
4	D	240	LEU
4	D	255	LYS
4	D	257	ASN
4	D	312	ASN
4	D	327	LEU
4	D	345	PHE
4	D	362	ASP
4	D	382	SER
4	D	398	ASP
4	D	399	PHE
4	D	411	GLU
5	E	38	LYS
5	E	46	ASP
5	E	75	ASN
5	E	83	CYS
5	E	87	LEU
5	E	105	LEU
5	E	109	ARG
5	E	113	ARG
5	E	123	SER
5	E	159	PHE
5	E	200	SER
5	E	203	ILE
5	E	204	VAL
5	E	206	LYS
5	E	207	TYR
5	E	208	ILE
5	E	213	ARG
5	E	214	LEU
5	E	215	ILE
5	E	221	TYR

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Mol	Chain	Res	Type
5	E	230	ILE
5	E	262	ASN
5	E	264	MET
5	E	265	ASP
5	E	271	HIS
5	E	277	MET
5	E	280	ASN
5	E	300	HIS
5	E	316	HIS
5	E	353	PHE
5	E	376	ASP
6	F	69	MET
6	F	77	SER
6	F	97	LEU
6	F	141	ASP
6	F	144	LYS
6	F	149	ASP
6	F	178	ASP
6	F	187	ASP
6	F	212	PHE
6	F	215	LEU
6	F	245	LYS
6	F	248	PHE
6	F	267	LEU
6	F	310	MET
6	F	336	ASP
6	F	345	SER
6	F	376	SER
6	F	392	ASN
6	F	438	TYR
7	G	17	SER
7	G	29	PHE
7	G	34	GLN
7	G	39	SER
7	G	45	LYS
7	G	52	THR
7	G	64	SER
7	G	93	ARG
7	G	96	TYR
7	G	115	CYS
7	G	132	ARG
7	G	178	PHE

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Mol	Chain	Res	Type
7	G	191	PHE
7	G	210	PHE
7	G	221	THR
7	G	227	PHE
7	G	236	ASP
8	H	39	LYS
8	H	49	GLU
8	H	61	SER
8	H	76	TYR
8	H	92	LYS
8	H	120	GLU
8	H	124	SER
8	H	137	CYS
8	H	156	PHE
8	H	206	ASP
8	H	215	GLU
8	H	227	LYS
9	I	7	SER
9	I	12	PHE
9	I	44	LEU
9	I	75	SER
9	I	109	GLN
9	I	146	GLN
9	I	153	SER
9	I	168	SER
9	I	174	MET
9	I	178	ASP
9	I	198	ASN
9	I	207	SER
10	J	4	ASP
10	J	11	SER
10	J	38	ARG
10	J	39	ASP
10	J	54	GLN
10	J	57	ARG
10	J	67	ASP
10	J	76	LEU
10	J	91	CYS
10	J	93	SER
10	J	96	LEU
10	J	100	ASP
10	J	118	TYR

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Mol	Chain	Res	Type
10	J	121	SER
10	J	130	SER
10	J	137	ASP
10	J	167	SER
10	J	184	ASP
10	J	215	GLN
11	K	5	ARG
11	K	9	ASP
11	K	84	ASP
11	K	91	LYS
11	K	107	MET
11	K	159	SER
11	K	163	VAL
11	K	168	ARG
11	K	172	SER
11	K	175	GLU
11	K	197	SER
11	K	199	LEU
11	K	204	GLN
11	K	221	GLN
11	K	224	GLN
12	L	26	MET
12	L	46	LEU
12	L	54	SER
12	L	92	CYS
12	L	101	ARG
12	L	146	GLN
12	L	148	CYS
12	L	160	SER
12	L	174	ARG
12	L	182	CYS
12	L	228	ASP
13	M	19	ARG
13	M	32	ASN
13	M	42	LYS
13	M	59	GLU
13	M	96	SER
13	M	139	SER
13	M	158	TYR
13	M	180	GLN
13	M	181	MET
13	M	198	TYR

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Mol	Chain	Res	Type
13	M	206	ASP
13	M	215	TRP
13	M	243	LEU
13	M	244	LYS
14	N	1	THR
14	N	17	ASP
14	N	51	ASP
14	N	65	PHE
14	N	77	HIS
14	N	104	ASP
14	N	136	TYR
14	N	138	TYR
14	N	149	LYS
14	N	155	PHE
14	N	170	SER
14	N	176	LEU
15	P	17	ASP
15	P	24	MET
15	P	30	ASN
15	P	72	ARG
15	P	80	ASN
15	P	93	TYR
15	P	109	HIS
15	P	140	ASP
15	P	145	ASP
15	P	147	GLU
15	P	153	ASN
15	P	185	PHE
15	P	187	ARG
15	P	215	LYS
16	Q	2	SER
16	Q	6	TYR
16	Q	7	ASN
16	Q	14	MET
16	Q	15	LYS
16	Q	27	ARG
16	Q	34	MET
16	Q	39	PHE
16	Q	45	MET
16	Q	72	ASN
16	Q	89	SER
16	Q	108	VAL

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Mol	Chain	Res	Type
16	Q	113	ASP
16	Q	122	CYS
16	Q	123	SER
16	Q	125	ASP
16	Q	129	CYS
16	Q	136	PHE
16	Q	139	SER
16	Q	147	TYR
17	R	1	MET
17	R	3	TYR
17	R	17	SER
17	R	59	TYR
17	R	68	LYS
17	R	69	MET
17	R	70	ARG
17	R	71	ASN
17	R	85	ARG
17	R	108	ASP
17	R	119	ASP
17	R	120	TYR
17	R	137	PHE
17	R	139	THR
17	R	153	ARG
17	R	169	LYS
17	R	175	LEU
17	R	193	ASN
18	S	17	ASP
18	S	18	SER
18	S	28	SER
18	S	40	TYR
18	S	45	MET
18	S	75	SER
18	S	88	TYR
18	S	116	SER
18	S	136	TYR
18	S	139	MET
18	S	161	TYR
18	S	165	TYR
18	S	190	ASP
18	S	195	LEU
19	T	7	PHE
19	T	19	ASP

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Mol	Chain	Res	Type
19	T	20	PHE
19	T	34	SER
19	T	43	CYS
19	T	57	PHE
19	T	79	ASN
19	T	91	MET
19	T	97	TYR
19	T	102	PHE
19	T	110	ILE
19	T	130	TYR
19	T	131	GLN
19	T	135	PHE
19	T	170	ARG
19	T	179	PHE
20	U	8	ILE
20	U	49	TYR
20	U	59	PHE
20	U	65	SER
20	U	69	TYR
20	U	79	ASN
20	U	94	SER
20	U	107	HIS
20	U	114	GLU
20	U	123	LYS
20	U	124	LYS
20	U	137	MET
20	U	138	PHE
20	U	146	LYS
20	U	147	TYR
20	U	169	GLU
20	U	176	MET
20	U	179	TYR
20	U	180	SER
20	U	181	LEU
20	U	184	CYS
20	U	201	LEU
20	U	210	LYS
20	U	241	ASN
20	U	267	ASN
20	U	330	SER
20	U	345	ASN
20	U	346	ASN

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Mol	Chain	Res	Type
20	U	357	LYS
20	U	361	ARG
20	U	364	VAL
20	U	365	CYS
20	U	373	ASN
20	U	385	PHE
20	U	417	LYS
20	U	421	GLN
20	U	426	TYR
20	U	443	LEU
20	U	492	ASP
20	U	525	ASN
20	U	559	ARG
20	U	581	SER
20	U	608	SER
20	U	633	CYS
20	U	665	ASN
20	U	678	ASP
20	U	703	CYS
20	U	720	LYS
20	U	772	TRP
20	U	802	TYR
20	U	806	CYS
20	U	807	LYS
20	U	811	PHE
20	U	833	LEU
20	U	841	LYS
20	U	849	LYS
20	U	876	GLN
20	U	888	GLN
20	U	899	ARG
20	U	900	TYR
21	V	80	LYS
21	V	92	ARG
21	V	106	ARG
21	V	131	LEU
21	V	144	ASP
21	V	185	GLN
21	V	220	PHE
21	V	222	ASP
21	V	228	ARG
21	V	230	PHE

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Mol	Chain	Res	Type
21	V	258	TYR
21	V	276	PHE
21	V	283	ASN
21	V	285	TRP
21	V	311	ASN
21	V	313	LEU
21	V	318	GLN
21	V	331	LEU
21	V	349	ARG
21	V	372	LEU
21	V	375	PHE
21	V	384	GLU
21	V	433	ASP
21	V	490	SER
21	V	496	PHE
22	W	36	LYS
22	W	53	GLN
22	W	60	MET
22	W	86	ASN
22	W	97	LEU
22	W	98	LYS
22	W	130	MET
22	W	137	TYR
22	W	139	GLU
22	W	197	LYS
22	W	201	ARG
22	W	203	GLN
22	W	206	SER
22	W	247	TYR
22	W	288	HIS
22	W	293	ASP
22	W	304	ASP
22	W	326	MET
22	W	353	ASP
22	W	364	ARG
22	W	366	MET
22	W	403	PHE
22	W	420	ASP
22	W	426	ASN
22	W	440	ASN
22	W	441	LYS
22	W	451	MET

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Mol	Chain	Res	Type
22	W	453	HIS
23	X	44	GLN
23	X	115	GLU
23	X	122	ARG
23	X	138	PHE
23	X	148	HIS
23	X	177	TYR
23	X	202	CYS
23	X	233	TYR
23	X	268	GLN
23	X	302	PHE
23	X	310	ARG
23	X	316	ASP
23	X	372	LYS
23	X	374	PHE
23	X	385	LEU
23	X	388	PHE
23	X	393	VAL
23	X	412	ASP
23	X	420	LYS
24	Y	17	LEU
24	Y	18	ARG
24	Y	60	SER
24	Y	75	LYS
24	Y	94	ASN
24	Y	98	SER
24	Y	113	ARG
24	Y	128	TYR
24	Y	143	TYR
24	Y	153	ASP
24	Y	160	ASN
24	Y	173	ASP
24	Y	176	ARG
24	Y	238	GLU
24	Y	252	SER
24	Y	262	SER
24	Y	273	GLN
24	Y	279	GLU
24	Y	294	TYR
24	Y	335	SER
24	Y	351	ASN
24	Y	374	ASP

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Mol	Chain	Res	Type
24	Y	382	LYS
25	Z	8	LYS
25	Z	22	HIS
25	Z	42	SER
25	Z	45	LYS
25	Z	53	SER
25	Z	59	ASP
25	Z	65	ASP
25	Z	90	ARG
25	Z	121	LEU
25	Z	129	LYS
25	Z	181	ASP
25	Z	193	ASN
25	Z	206	LEU
25	Z	207	ASP
25	Z	228	TYR
25	Z	231	GLN
25	Z	235	ASN
25	Z	250	TYR
25	Z	279	LYS
26	a	7	PHE
26	a	12	GLN
26	a	24	ARG
26	a	29	TYR
26	a	43	ASP
26	a	137	ASP
26	a	155	PHE
26	a	159	SER
26	a	187	ASP
26	a	211	PHE
26	a	219	HIS
26	a	248	PHE
26	a	270	ARG
26	a	330	ARG
26	a	342	ASP
26	a	361	LYS
26	a	373	ASP
27	b	51	LEU
27	b	75	LEU
27	b	132	LYS
27	b	135	LYS
27	b	152	LYS

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Mol	Chain	Res	Type
28	c	66	THR
28	c	71	ASP
28	c	87	VAL
28	c	101	GLN
28	c	118	PHE
28	c	181	LEU
28	c	185	ASN
28	c	216	MET
28	c	220	LEU
28	c	260	GLU
28	c	261	GLU
28	c	284	LEU
29	d	94	MET
29	d	155	SER
29	d	158	ARG
29	d	164	PHE
29	d	178	TYR
29	d	181	GLN
29	d	221	GLN
29	d	227	LYS
29	d	237	MET
29	d	248	LYS
29	d	279	TYR
29	d	302	TYR
29	d	306	ARG
30	e	41	ASP
31	f	53	GLN
31	f	62	ARG
31	f	65	GLU
31	f	72	ARG
31	f	79	ARG
31	f	100	ARG
31	f	103	TYR
31	f	110	TYR
31	f	118	ASN
31	f	213	GLN
31	f	216	MET
31	f	224	ASN
31	f	226	TYR
31	f	274	ASP
31	f	300	ARG
31	f	304	PHE

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Mol	Chain	Res	Type
31	f	327	ASN
31	f	335	ARG
31	f	352	HIS
31	f	370	MET
31	f	389	LYS
31	f	397	LYS
31	f	403	LYS
31	f	416	MET
31	f	469	TYR
31	f	477	MET
31	f	483	PHE
31	f	512	MET
31	f	524	MET
31	f	529	SER
31	f	531	ASN
31	f	552	ASP
31	f	598	CYS
31	f	610	GLN
31	f	646	MET
31	f	701	ASN
31	f	760	PHE
31	f	763	ARG
31	f	785	ARG
31	f	800	LEU
31	f	803	PHE
31	f	805	ASP
31	f	807	ARG
31	f	808	ASN
31	f	816	TYR
31	f	829	MET
31	f	878	GLU
32	g	88	PHE
32	g	104	ARG
32	g	115	LYS
32	g	152	LYS
32	g	169	PHE
33	h	5	MET
33	h	10	SER
33	h	16	PHE
33	h	37	ARG
33	h	43	MET
33	h	50	MET

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Mol	Chain	Res	Type
33	h	82	SER
33	h	90	SER
33	h	100	ARG
33	h	107	TRP
33	h	108	ASN
33	h	124	TYR
33	h	127	MET
33	h	136	SER
33	h	141	TYR
33	h	156	LYS
33	h	173	MET
33	h	185	ASN
33	h	195	LYS
34	u	137	CYS
34	u	149	CYS
34	u	160	ASP
34	u	165	LEU
34	u	166	LEU
34	u	180	MET
34	u	182	PHE
34	u	204	MET
34	u	219	GLU
34	u	247	PHE
34	u	259	ARG
34	u	263	PHE
34	u	274	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (51) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	358	HIS
1	A	433	ASN
2	B	368	HIS
3	C	36	ASN
3	C	205	HIS
5	E	194	ASN
5	E	220	ASN
5	E	225	HIS
6	F	374	ASN
6	F	436	GLN
9	I	109	GLN
9	I	198	ASN

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Mol	Chain	Res	Type
10	J	92	GLN
11	K	221	GLN
12	L	146	GLN
16	Q	65	GLN
16	Q	188	HIS
17	R	55	GLN
17	R	65	GLN
17	R	71	ASN
17	R	82	ASN
18	S	175	ASN
20	U	218	GLN
20	U	321	GLN
20	U	346	ASN
20	U	362	ASN
20	U	412	HIS
21	V	118	GLN
21	V	168	GLN
22	W	440	ASN
24	Y	273	GLN
25	Z	193	ASN
25	Z	202	ASN
26	a	62	ASN
28	c	44	HIS
28	c	176	GLN
28	c	185	ASN
28	c	194	HIS
28	c	206	ASN
28	c	214	GLN
28	c	219	ASN
28	c	221	HIS
28	c	232	GLN
29	d	338	GLN
31	f	610	GLN
31	f	701	ASN
31	f	786	GLN
34	u	249	GLN
34	u	252	GLN
34	u	274	ASN
34	u	276	ASN

5.3.3 RNA (i)

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 12 ligands modelled in this entry, 6 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	$\#\|Z\| > 2$
36	ATP	B	501	37	28,33,33	0.72	0	34,52,52	0.75	1 (2%)
38	ADP	C	501	37	24,29,29	0.86	0	29,45,45	1.23	2 (6%)
36	ATP	F	501	37	28,33,33	0.64	0	34,52,52	0.65	1 (2%)
38	ADP	D	501	-	24,29,29	0.75	0	29,45,45	0.78	1 (3%)
36	ATP	A	501	37	28,33,33	0.76	0	34,52,52	0.80	1 (2%)
38	ADP	E	501	-	24,29,29	0.91	1 (4%)	29,45,45	1.30	2 (6%)

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
36	ATP	B	501	37	-	7/18/38/38	0/3/3/3
38	ADP	C	501	37	-	4/12/32/32	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
36	ATP	F	501	37	-	3/18/38/38	0/3/3/3
38	ADP	D	501	-	-	1/12/32/32	0/3/3/3
36	ATP	A	501	37	-	4/18/38/38	0/3/3/3
38	ADP	E	501	-	-	3/12/32/32	0/3/3/3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
38	E	501	ADP	O4'-C1'	2.15	1.43	1.40

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
38	E	501	ADP	N3-C2-N1	-4.40	122.69	128.67
38	C	501	ADP	N3-C2-N1	-3.65	123.72	128.67
38	E	501	ADP	C4-C5-N7	-2.68	106.50	109.34
38	C	501	ADP	C4-C5-N7	-2.52	106.67	109.34
36	B	501	ATP	C5-C6-N6	2.39	123.95	120.31
36	F	501	ATP	C5-C6-N6	2.38	123.94	120.31
38	D	501	ADP	C5-C6-N6	2.31	123.83	120.31
36	A	501	ATP	C5-C6-N6	2.26	123.76	120.31

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
36	A	501	ATP	C5'-O5'-PA-O1A
36	A	501	ATP	C5'-O5'-PA-O2A
36	A	501	ATP	C5'-O5'-PA-O3A
36	B	501	ATP	PB-O3B-PG-O2G
36	B	501	ATP	PB-O3B-PG-O3G
36	F	501	ATP	C5'-O5'-PA-O2A
38	E	501	ADP	C5'-O5'-PA-O1A
38	C	501	ADP	O4'-C4'-C5'-O5'
38	E	501	ADP	C3'-C4'-C5'-O5'
36	B	501	ATP	PG-O3B-PB-O2B
36	B	501	ATP	O4'-C4'-C5'-O5'
36	F	501	ATP	C5'-O5'-PA-O1A
38	C	501	ADP	C5'-O5'-PA-O1A
38	C	501	ADP	C5'-O5'-PA-O2A

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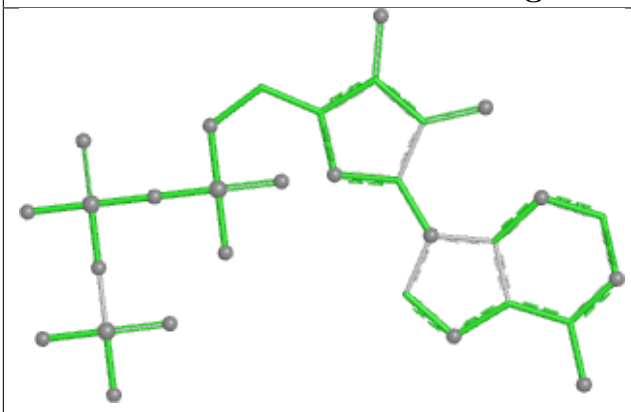
Mol	Chain	Res	Type	Atoms
38	C	501	ADP	C5'-O5'-PA-O3A
36	F	501	ATP	PG-O3B-PB-O1B
36	B	501	ATP	C3'-C4'-C5'-O5'
36	B	501	ATP	C4'-C5'-O5'-PA
38	E	501	ADP	O4'-C4'-C5'-O5'
36	B	501	ATP	PG-O3B-PB-O1B
38	D	501	ADP	O4'-C4'-C5'-O5'
36	A	501	ATP	PA-O3A-PB-O2B

There are no ring outliers.

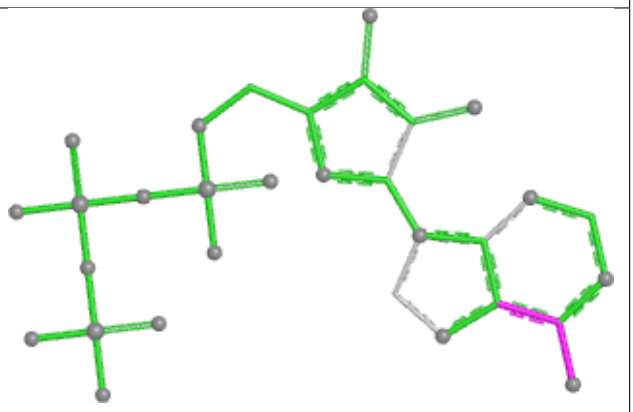
No monomer is involved in short contacts.

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 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.

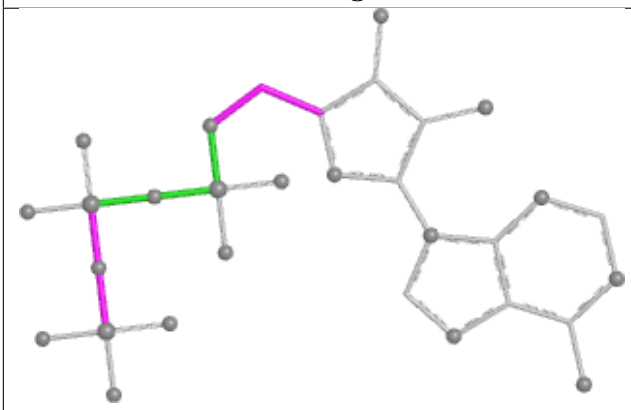
Ligand ATP B 501



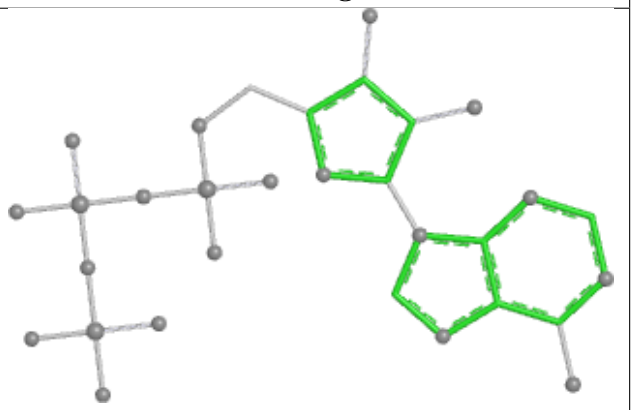
Bond lengths



Bond angles

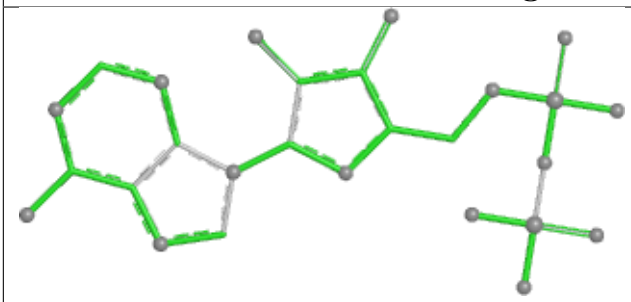


Torsions

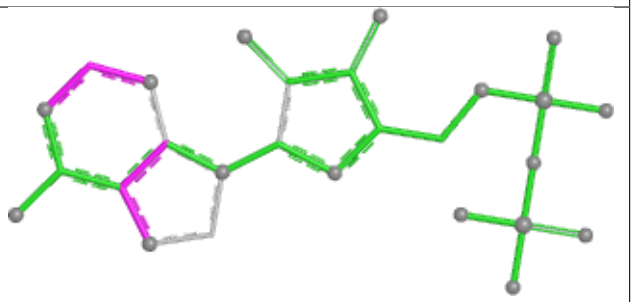


Rings

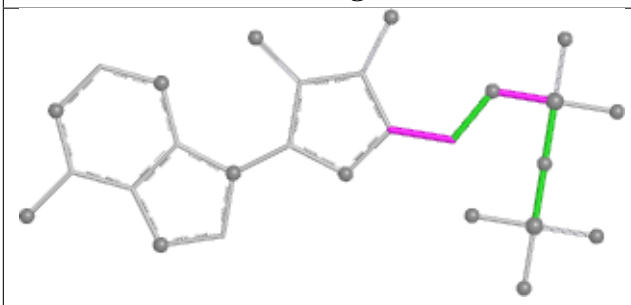
Ligand ADP C 501



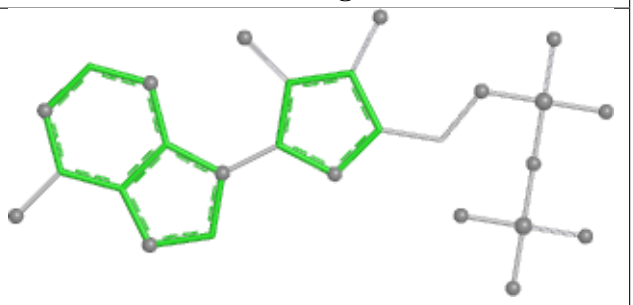
Bond lengths



Bond angles

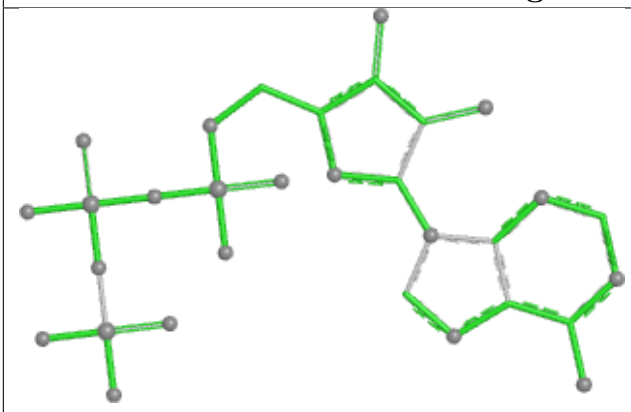


Torsions

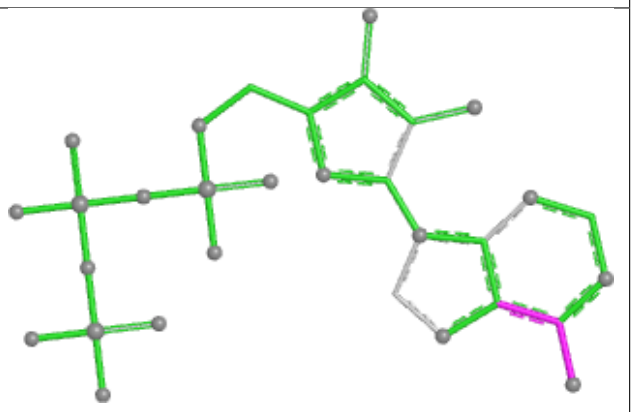


Rings

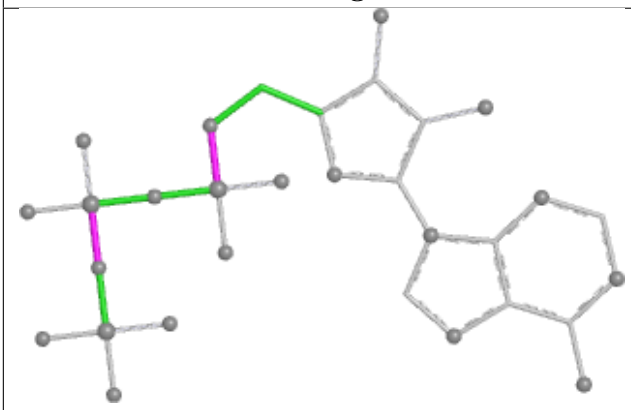
Ligand ATP F 501



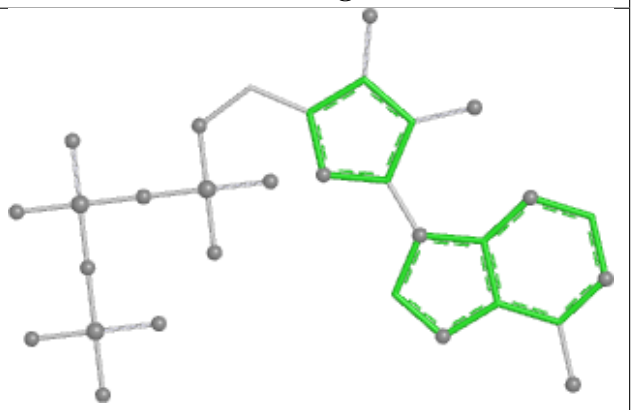
Bond lengths



Bond angles

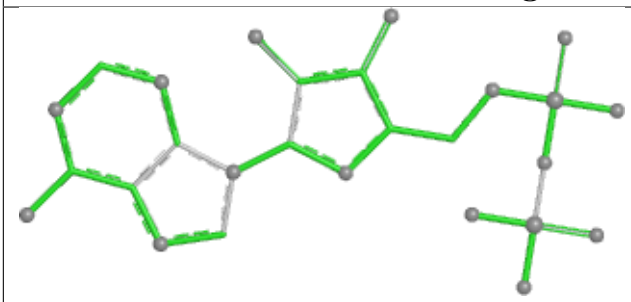


Torsions

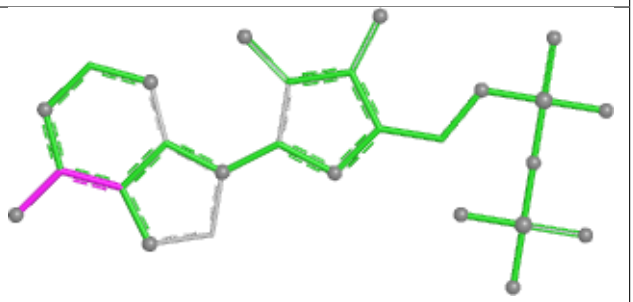


Rings

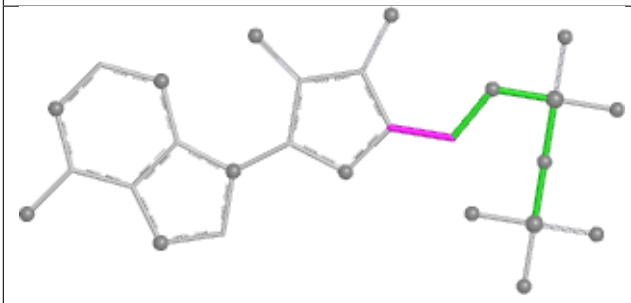
Ligand ADP D 501



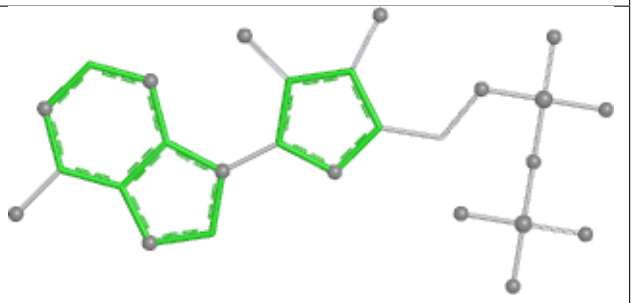
Bond lengths



Bond angles

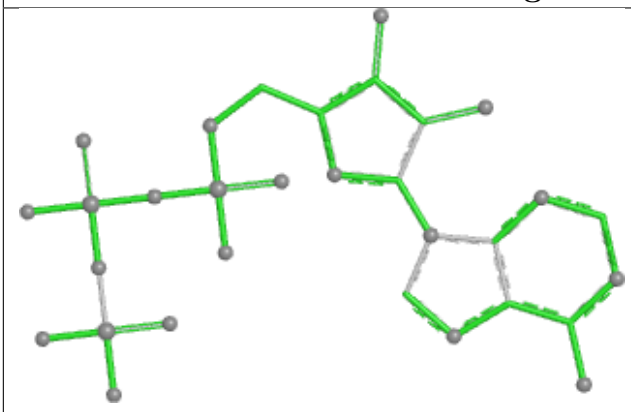


Torsions

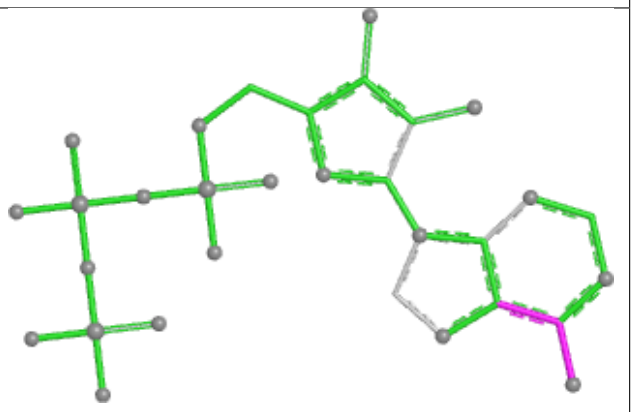


Rings

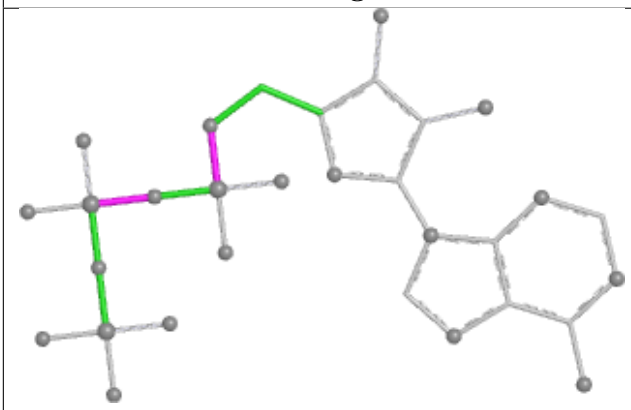
Ligand ATP A 501



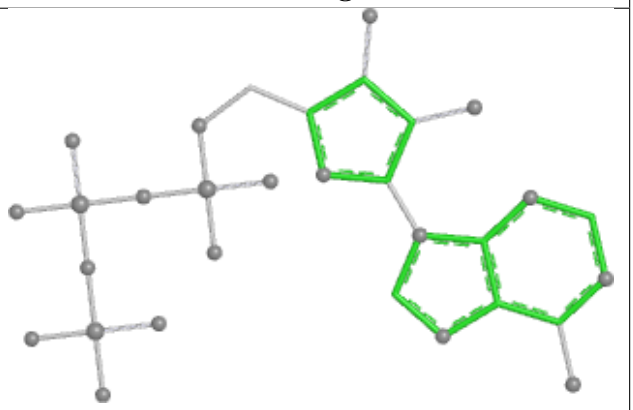
Bond lengths



Bond angles

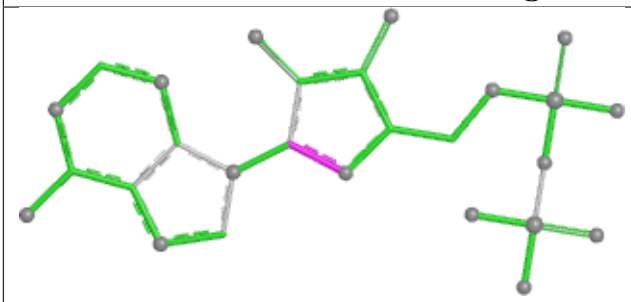


Torsions

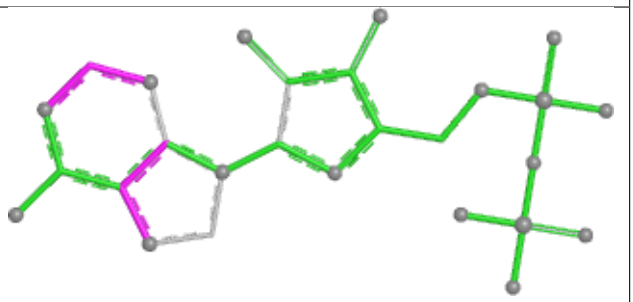


Rings

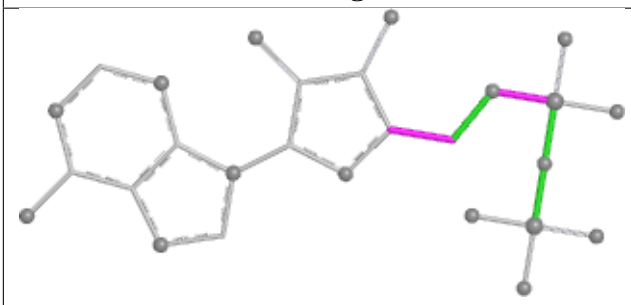
Ligand ADP E 501



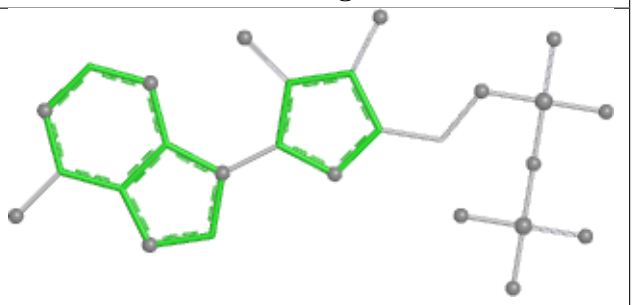
Bond lengths



Bond angles



Torsions



Rings

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

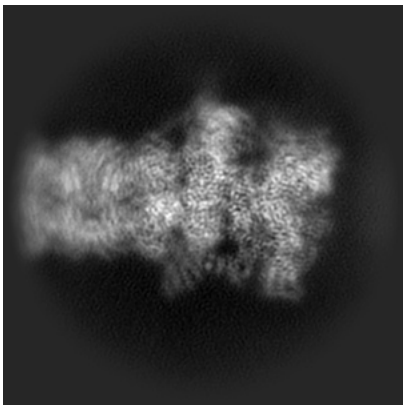
6 Map visualisation

This section contains visualisations of the EMDB entry EMD-47719. These allow visual inspection of the internal detail of the map and identification of artifacts.

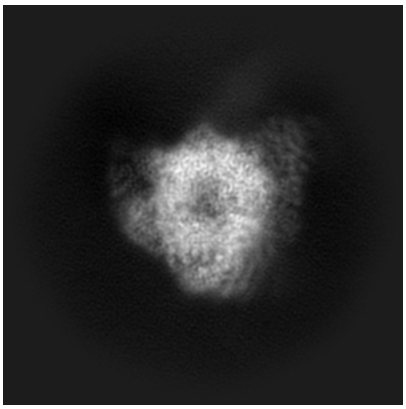
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections

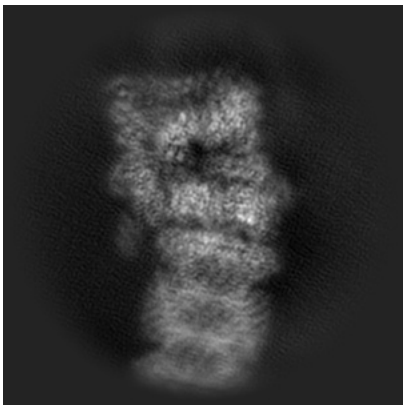
6.1.1 Primary map



X

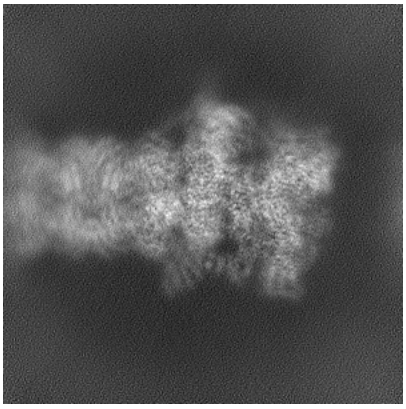


Y

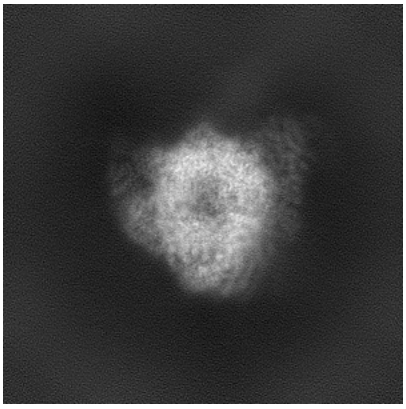


Z

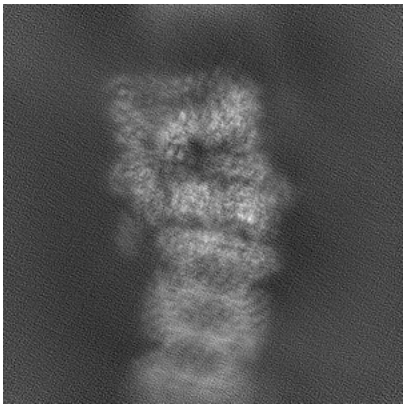
6.1.2 Raw map



X



Y

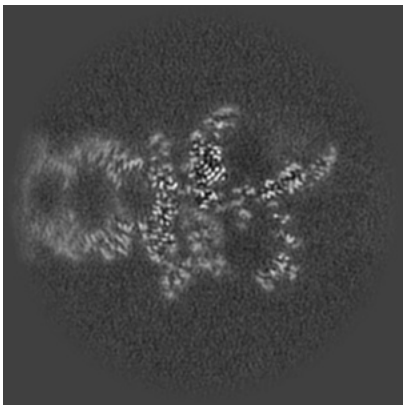


Z

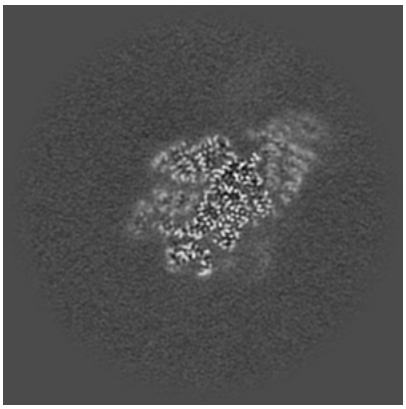
The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

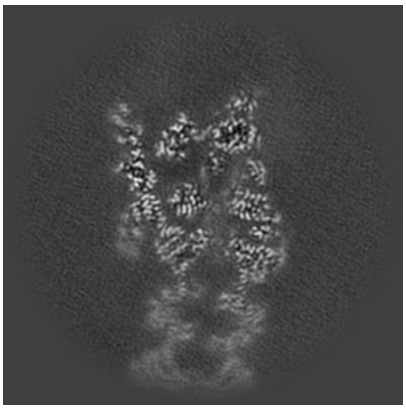
6.2.1 Primary map



X Index: 170

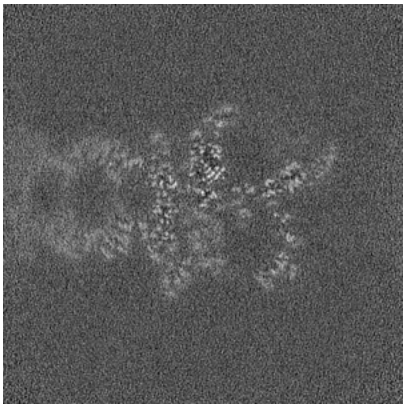


Y Index: 170

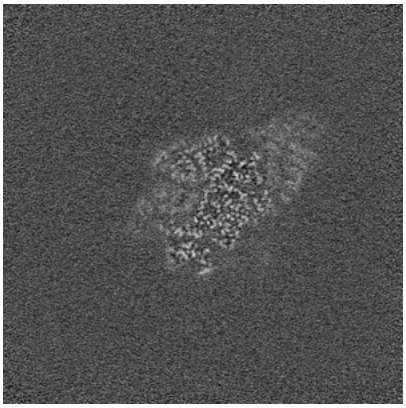


Z Index: 170

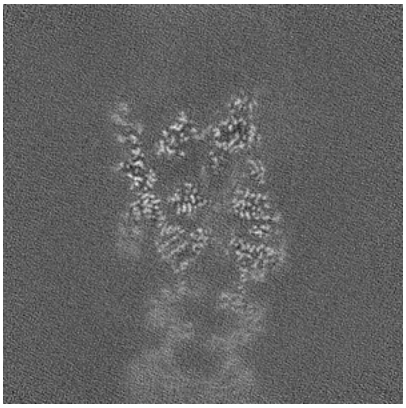
6.2.2 Raw map



X Index: 170



Y Index: 170

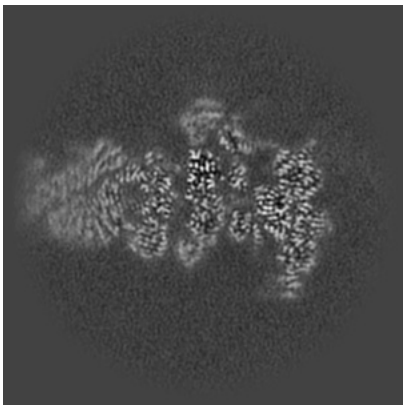


Z Index: 170

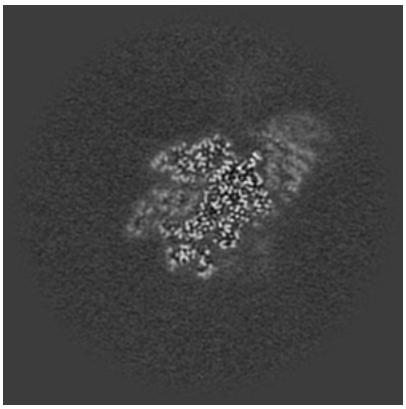
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

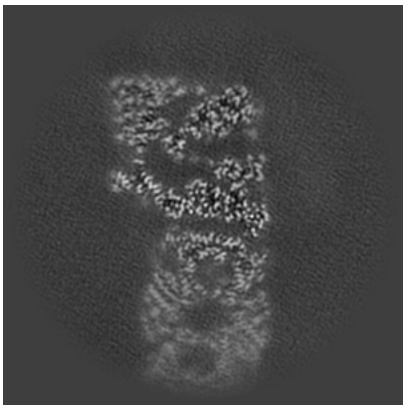
6.3.1 Primary map



X Index: 200

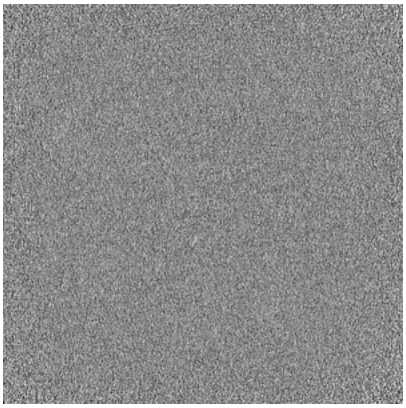


Y Index: 169

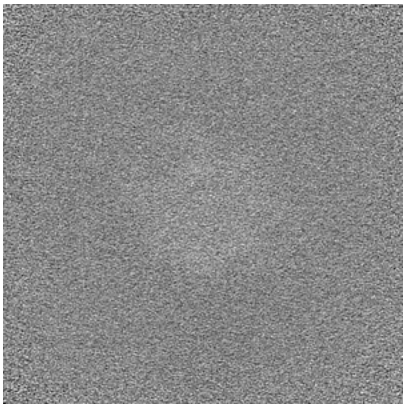


Z Index: 192

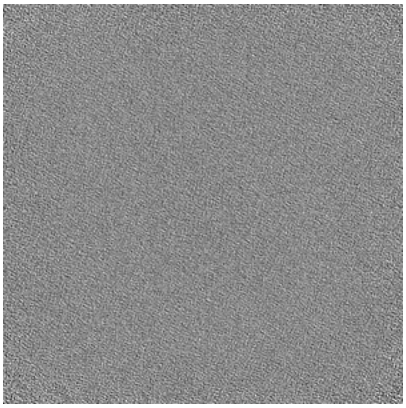
6.3.2 Raw map



X Index: 0



Y Index: 0

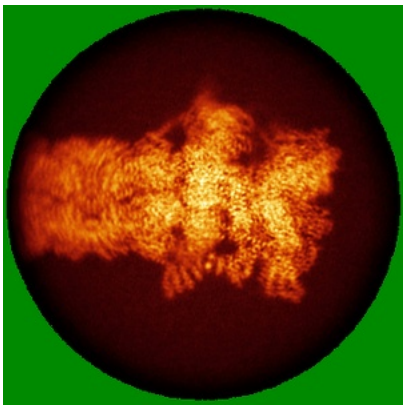


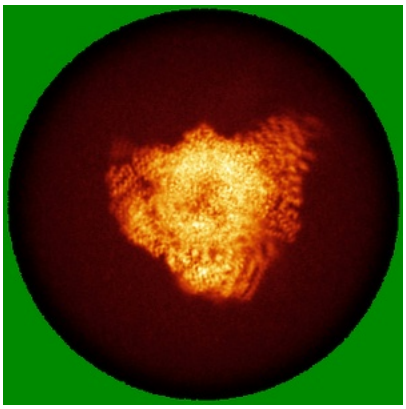
Z Index: 0

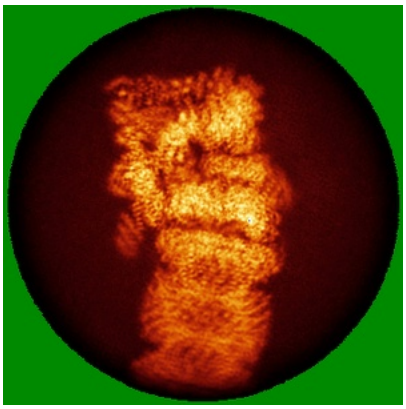
The images above show the largest variance slices of the map in three orthogonal directions.

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

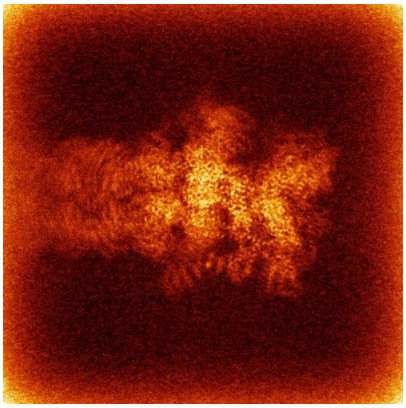
6.4.1 Primary map

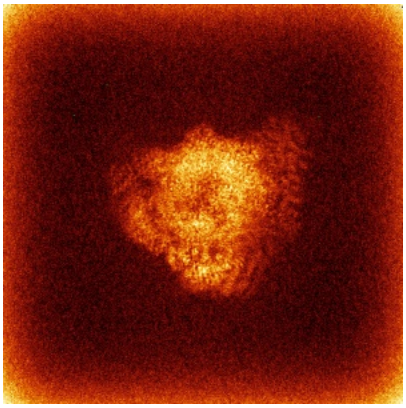

X

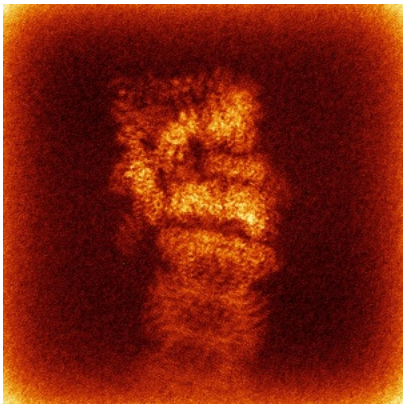

Y


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.

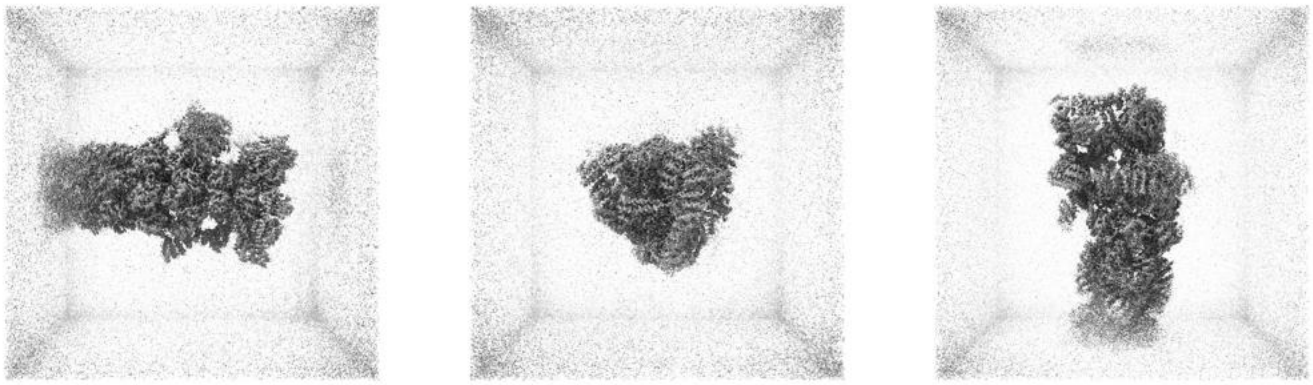
6.5 Orthogonal surface views (i)

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.

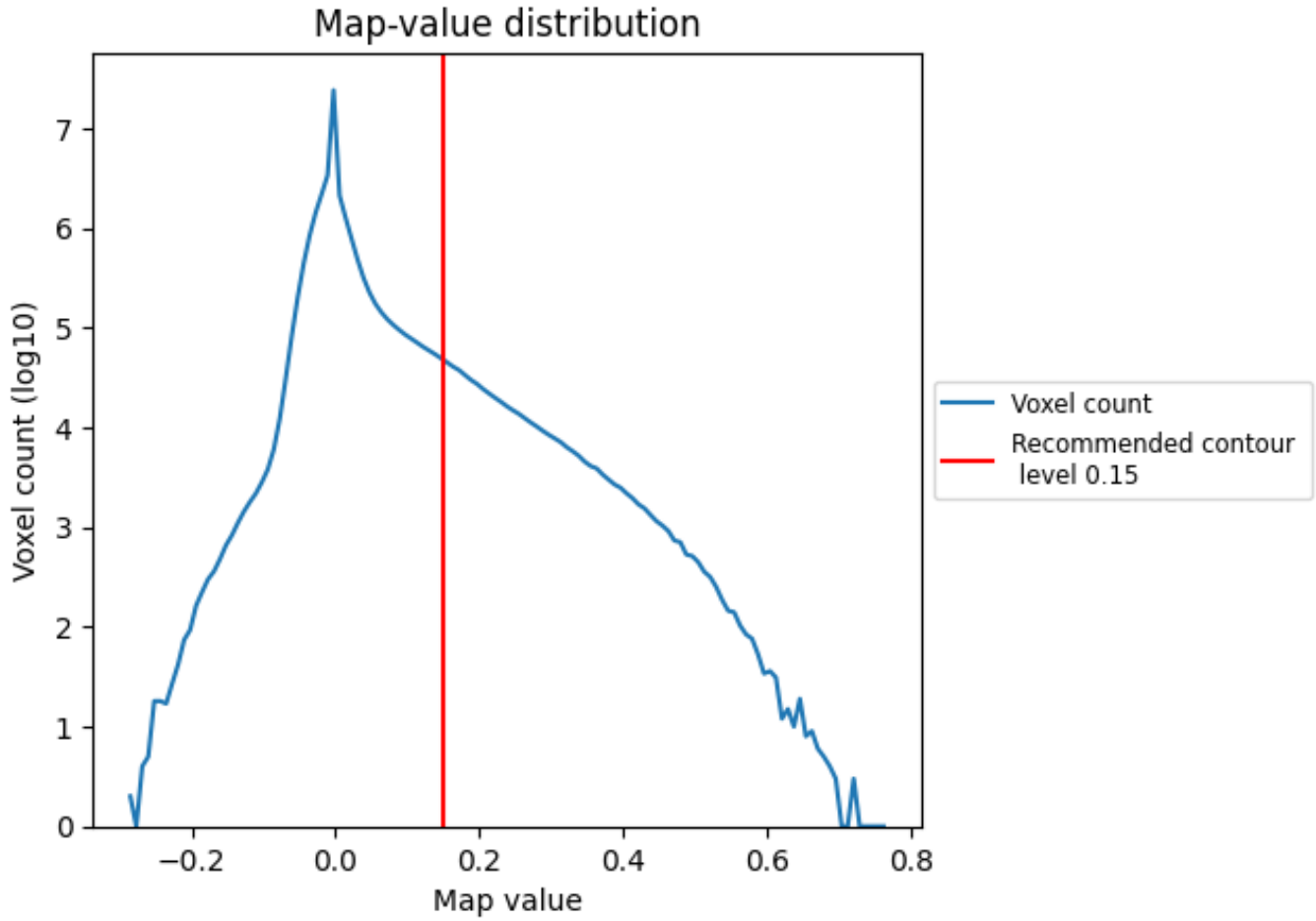
6.6 Mask visualisation (i)

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

7 Map analysis

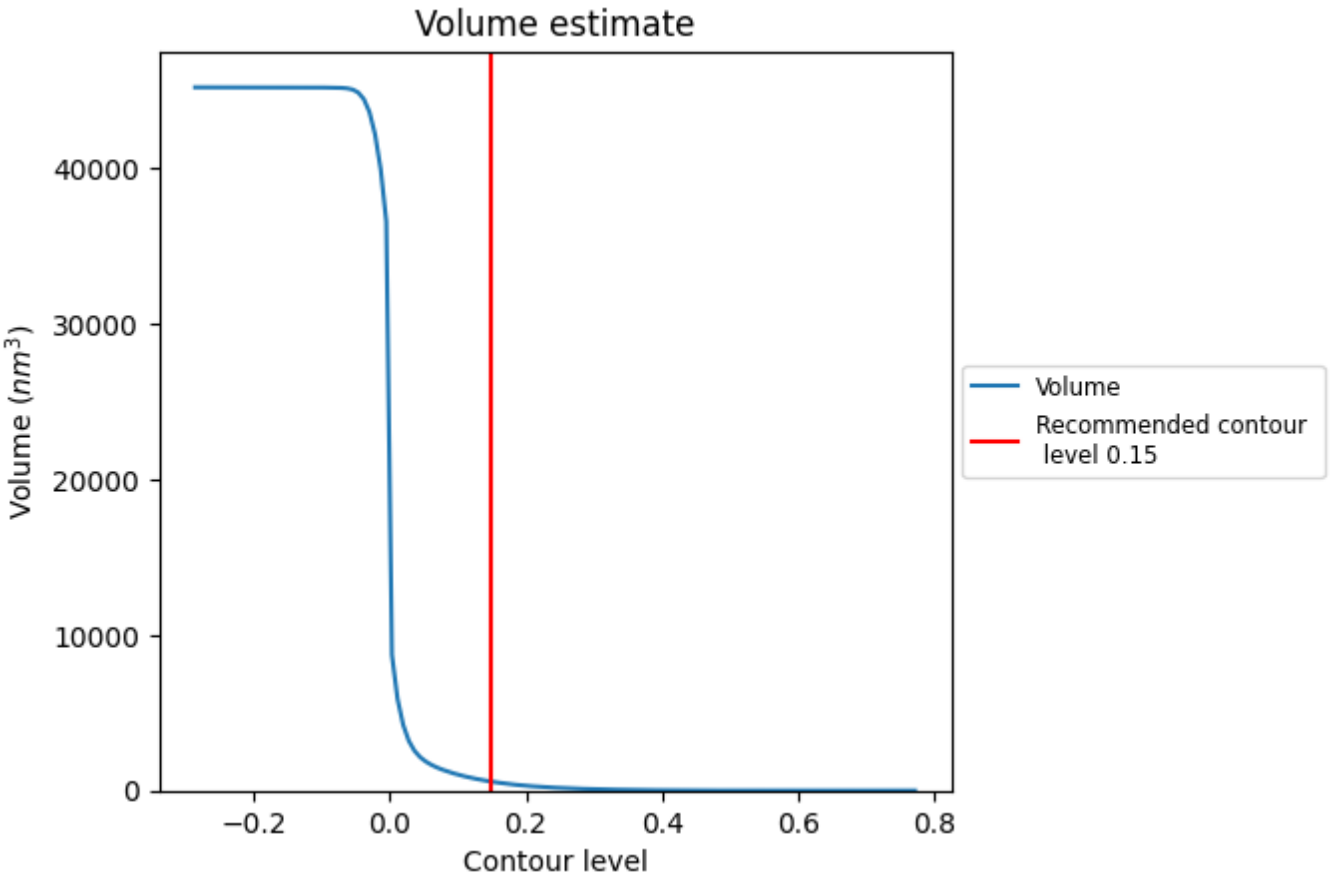
This section contains the results of statistical analysis of the map.

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.

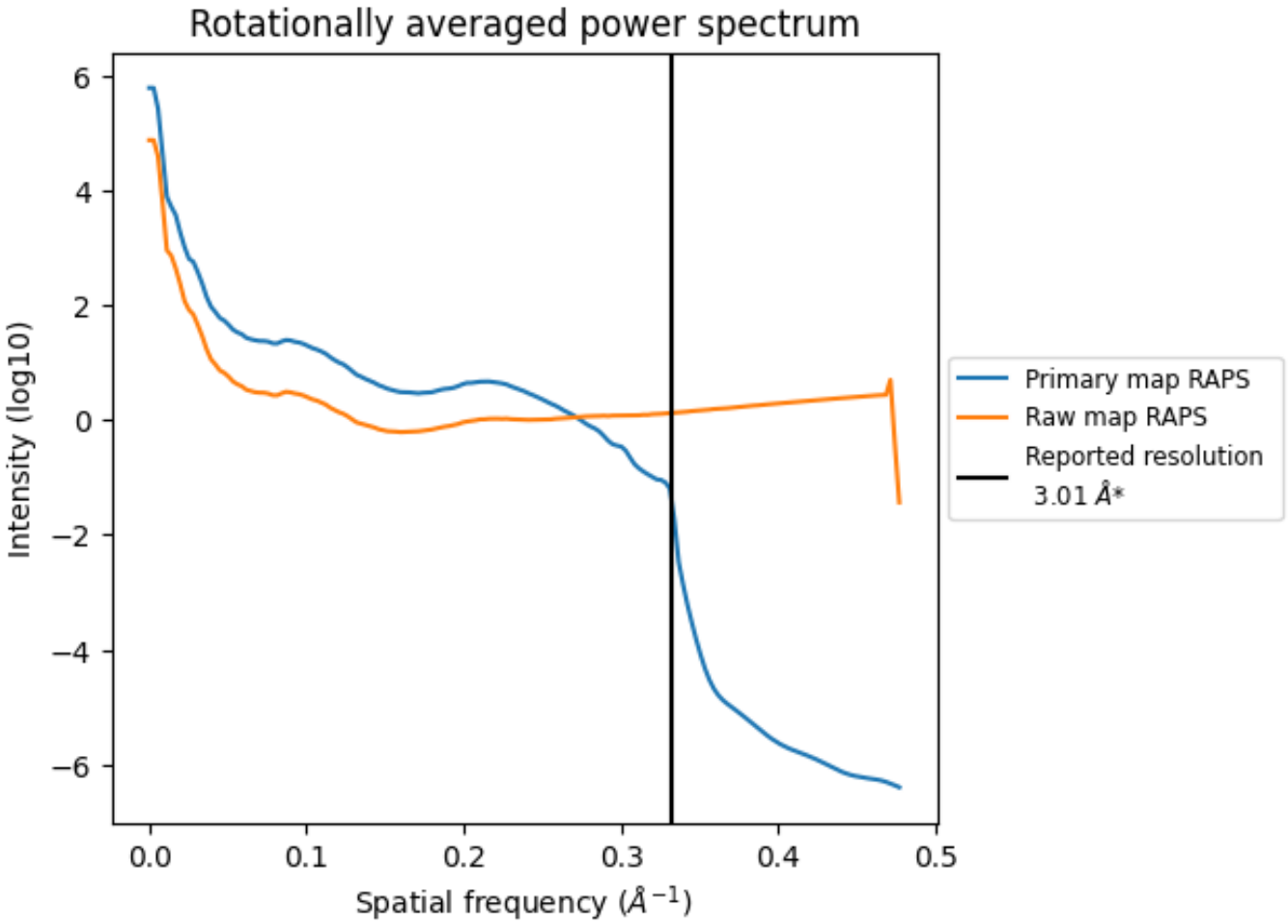
7.2 Volume estimate



The volume at the recommended contour level is 574 nm^3; this corresponds to an approximate mass of 518 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)

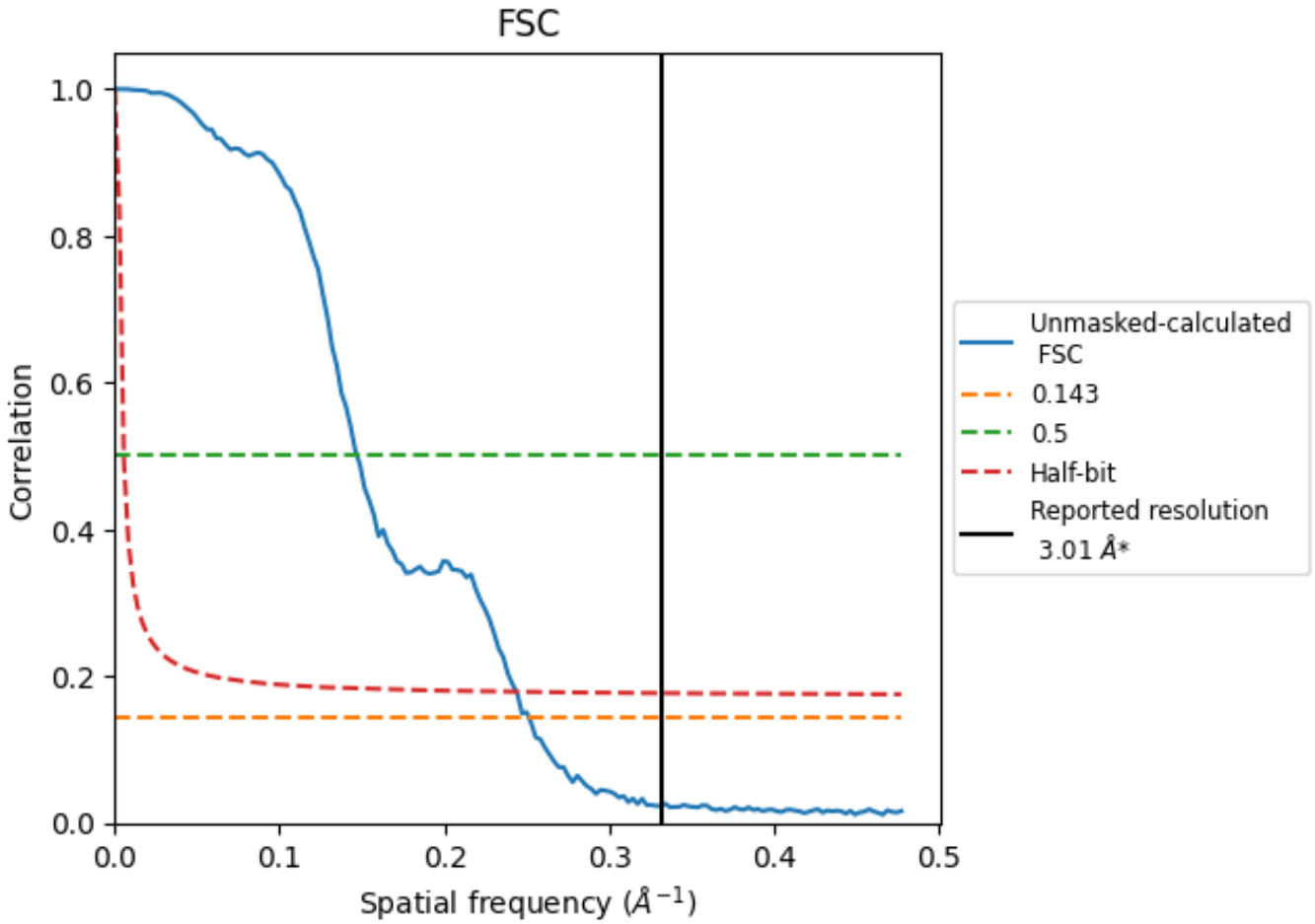


*Reported resolution corresponds to spatial frequency of 0.332 Å^{-1}

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 0.332 Å^{-1}

8.2 Resolution estimates (i)

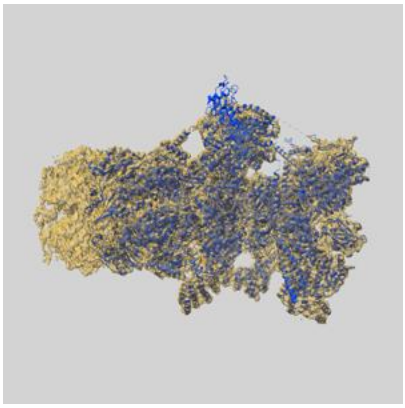
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.01	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	3.98	6.80	4.11

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 3.98 differs from the reported value 3.01 by more than 10 %

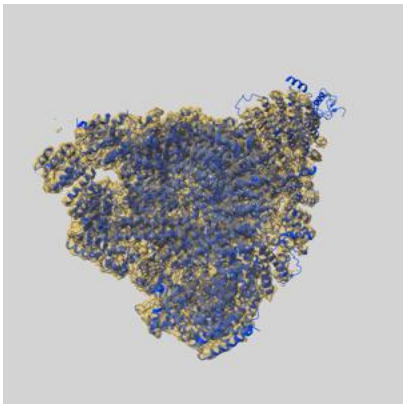
9 Map-model fit

This section contains information regarding the fit between EMDB map EMD-47719 and PDB model 9E8G. Per-residue inclusion information can be found in section 3 on page 15.

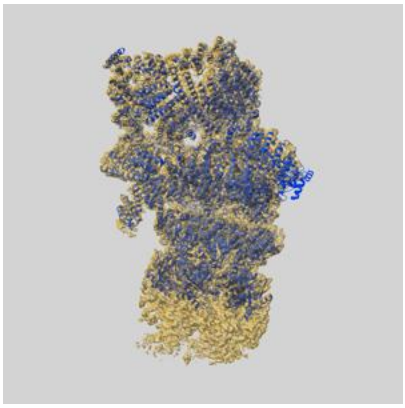
9.1 Map-model overlay



X



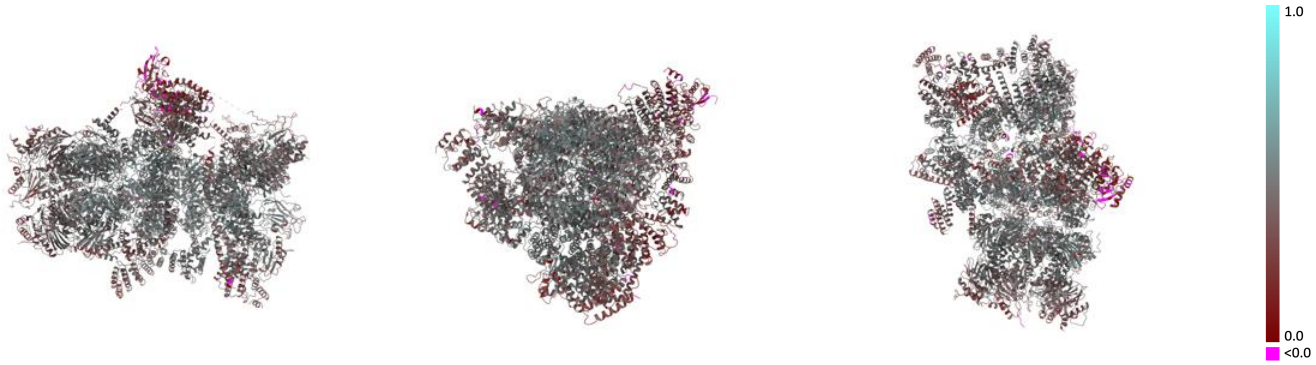
Y



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.

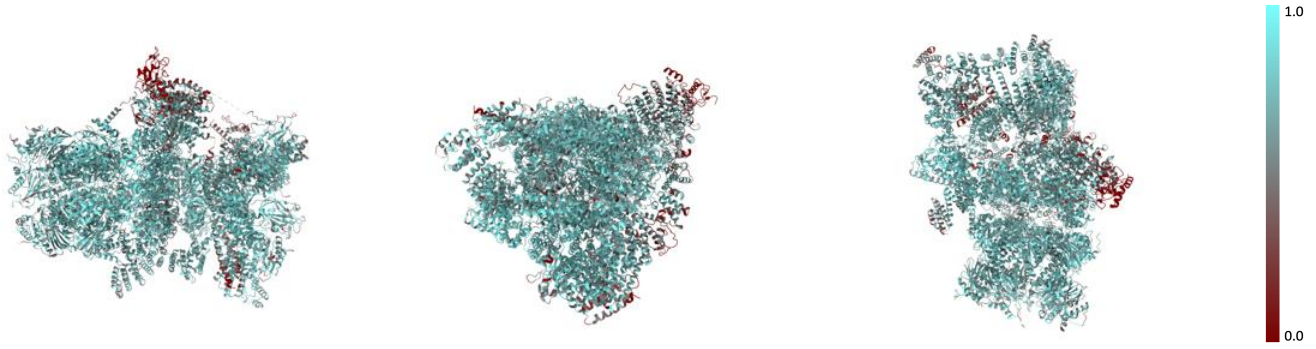
9.2 Q-score mapped to coordinate model



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.

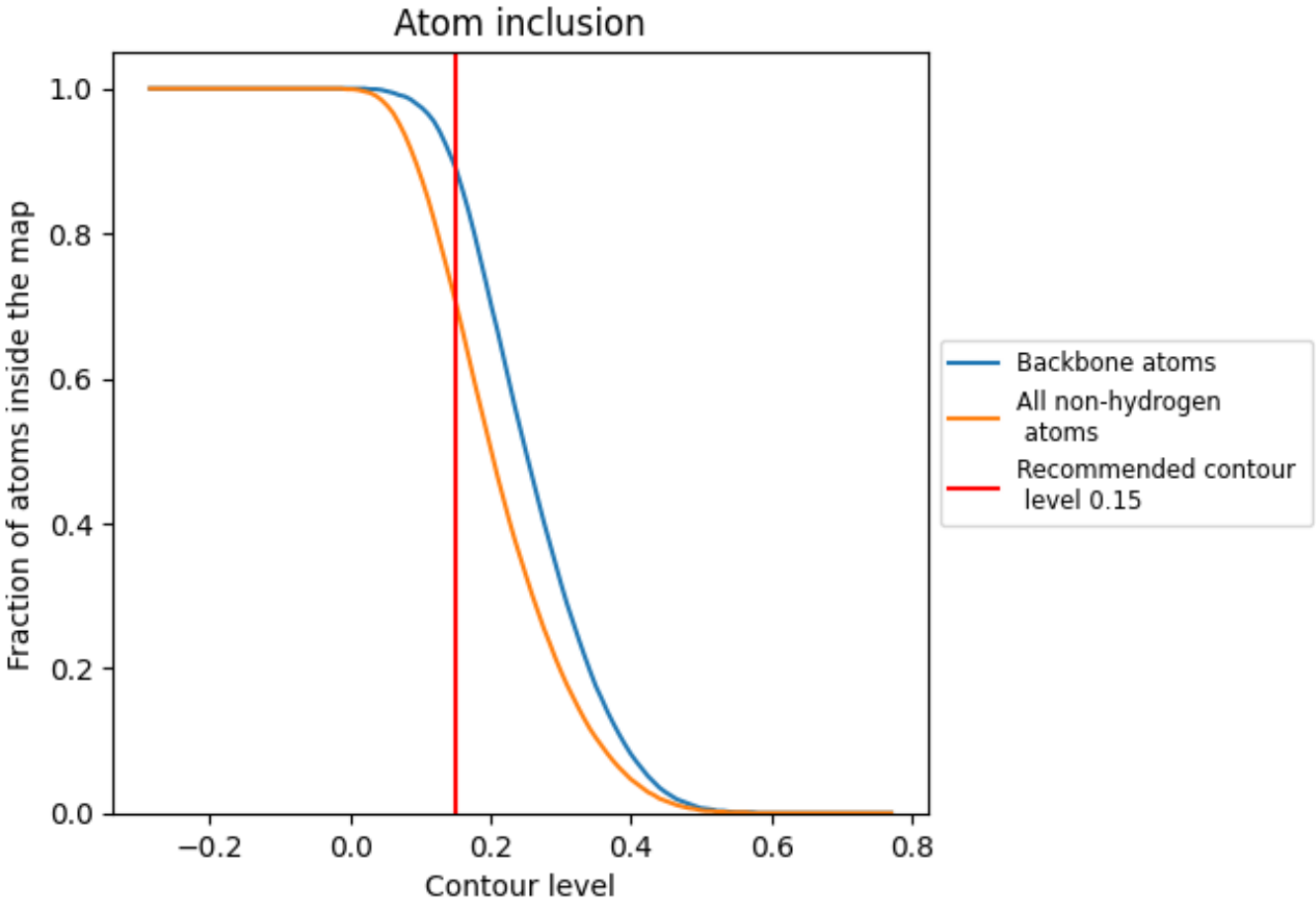
9.3 Atom inclusion mapped to coordinate model



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, 89% of all backbone atoms, 71% 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	0.7060	0.4300
A	0.7700	0.4910
B	0.7550	0.4890
C	0.7820	0.5010
D	0.7700	0.4930
E	0.5510	0.3450
F	0.7240	0.4710
G	0.7730	0.4720
H	0.7890	0.4830
I	0.7840	0.4720
J	0.7720	0.4640
K	0.7760	0.4810
L	0.7920	0.4860
M	0.7620	0.4580
N	0.6900	0.3960
P	0.7120	0.4070
Q	0.7090	0.4020
R	0.6830	0.3810
S	0.7120	0.3920
T	0.7030	0.3860
U	0.6980	0.4290
V	0.6310	0.3820
W	0.7340	0.4360
X	0.7550	0.4440
Y	0.8320	0.4690
Z	0.7730	0.4870
a	0.7110	0.4070
b	0.6950	0.4420
c	0.7280	0.4740
d	0.5840	0.3570
e	0.7560	0.4460
f	0.5580	0.3320
g	0.0030	0.1250
h	0.6930	0.3790
u	0.6670	0.4670
v	0.8830	0.5600