



wwPDB EM Validation Summary Report ⓘ

Dec 10, 2022 – 07:12 pm GMT

PDB ID : 6RET
EMDB ID : EMD-4856
Title : Cryo-EM structure of Polytomella F-ATP synthase, Rotary substate 3C, monomer-masked refinement
Authors : Murphy, B.J.; Klusch, N.; Yildiz, O.; Kuhlbrandt, W.
Deposited on : 2019-04-12
Resolution : 4.30 Å(reported)

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

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

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.dev43
Mogul : 1.8.4, CSD as541be (2020)
MolProbity : 4.02b-467
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : 1.9.9
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.31.3

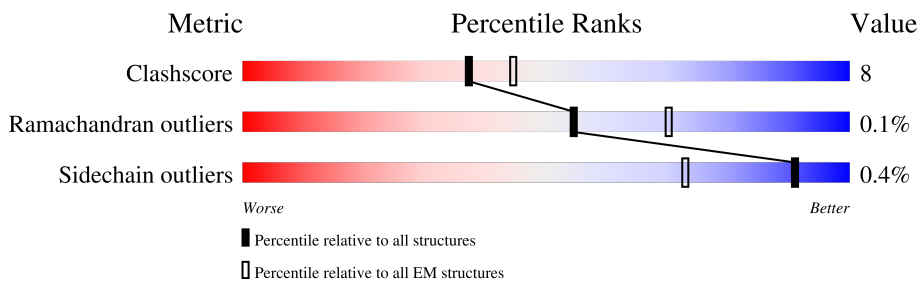
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 4.30 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)
Clashscore	158937	4297
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826

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

Mol	Chain	Length	Quality of chain
1	0	82	
2	1	618	
3	2	441	
4	3	325	
5	4	294	
6	5	123	
7	6	151	
8	7	190	

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Mol	Chain	Length	Quality of chain
9	8	89	38% 81% 18%
10	9	97	78% 91% 9%
11	A	127	57% 43% 15% 42%
11	B	127	56% 39% 20% 42%
11	C	127	52% 41% 17% 42%
11	D	127	53% 44% 13% 42%
11	E	127	57% 44% 14% 42%
11	F	127	54% 49% 9% 42%
11	G	127	57% 42% 17% 42%
11	H	127	56% 45% 13% 42%
11	I	127	56% 47% 11% 42%
11	J	127	57% 50% 8% 42%
12	M	327	30% 57% 9% 34%
13	P	229	55% 62% 22% 16%
14	Q	74	96% 68% 30%
15	R	199	86% 75% 14% 11%
16	S	317	79% 67% 21% 13%
17	T	562	78% 73% 20% 7%
17	U	562	88% 71% 21% 7%
17	V	562	72% 72% 20% 7%
18	X	574	92% 68% 26% 6%
18	Y	574	74% 72% 18% 9%
18	Z	574	84% 71% 23% 6%

2 Entry composition

There are 22 unique types of molecules in this entry. The entry contains 53756 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 ASA-10: Polytomella F-ATP synthase associated subunit 10.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	0	81	607	388	107	110	2	0	0

- Molecule 2 is a protein called ATP synthase associated protein ASA1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	1	595	4661	2958	798	900	5	0	0

- Molecule 3 is a protein called ASA-2: Polytomella F-ATP synthase associated subunit 2.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
3	2	441	3163	2020	532	611	0	0

- Molecule 4 is a protein called Mitochondrial F1F0 ATP synthase associated 32 kDa protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	3	245	1874	1204	299	370	1	0	0

- Molecule 5 is a protein called Mitochondrial ATP synthase associated protein ASA4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	4	290	2177	1385	356	434	2	0	0

- Molecule 6 is a protein called Mitochondrial F1F0 ATP synthase associated 14 kDa protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	5	123	986	640	172	170	4	0	0

- Molecule 7 is a protein called Mitochondrial ATP synthase subunit ASA6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
7	6	124	926	599	154	172	1	0	0

- Molecule 8 is a protein called Mitochondrial ATP synthase associated protein ASA7.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
8	7	176	1347	860	227	259	1	0	0

- Molecule 9 is a protein called Mitochondrial ATP synthase subunit ASA8.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
9	8	88	692	456	115	121	0	0

- Molecule 10 is a protein called ASA-9: Polytomella F-ATP synthase associated subunit 9.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
10	9	97	776	514	124	132	6	0	0

- Molecule 11 is a protein called Mitochondrial ATP synthase subunit c.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
11	A	74	514	340	83	88	3	0	0
11	B	74	514	340	83	88	3	0	0
11	C	74	514	340	83	88	3	0	0
11	D	74	514	340	83	88	3	0	0
11	E	74	514	340	83	88	3	0	0
11	F	74	514	340	83	88	3	0	0
11	G	74	514	340	83	88	3	0	0
11	H	74	514	340	83	88	3	0	0

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Mol	Chain	Residues	Atoms					AltConf	Trace
11	I	74	Total	C	N	O	S	0	0
			514	340	83	88	3		
11	J	74	Total	C	N	O	S	0	0
			514	340	83	88	3		

- Molecule 12 is a protein called Mitochondrial ATP synthase subunit 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
12	M	217	Total	C	N	O	S	0	0
			1640	1077	267	288	8		

- Molecule 13 is a protein called Mitochondrial ATP synthase subunit OSCP.

Mol	Chain	Residues	Atoms					AltConf	Trace
13	P	193	Total	C	N	O	S	0	0
			1532	988	250	290	4		

- Molecule 14 is a protein called epsilon: Polytomella F-ATP synthase epsilon subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
14	Q	72	Total	C	N	O	S	0	0
			561	358	102	99	2		

- Molecule 15 is a protein called Mitochondrial ATP synthase subunit delta.

Mol	Chain	Residues	Atoms					AltConf	Trace
15	R	177	Total	C	N	O	S	0	0
			1303	833	213	256	1		

- Molecule 16 is a protein called ATP synthase gamma chain, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
16	S	277	Total	C	N	O	S	0	0
			2130	1327	377	416	10		

- Molecule 17 is a protein called ATP synthase subunit alpha.

Mol	Chain	Residues	Atoms					AltConf	Trace
17	T	523	Total	C	N	O	S	0	0
			3979	2537	703	728	11		

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Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
17	U	523	3980	2537	703	729	11	0	0
17	V	520	3962	2527	700	724	11	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
T	266	ARG	LYS	conflict	UNP A0ZW40
U	266	ARG	LYS	conflict	UNP A0ZW40
V	266	ARG	LYS	conflict	UNP A0ZW40

- Molecule 18 is a protein called ATP synthase subunit beta.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
18	X	539	4095	2572	693	817	13	0	0
18	Y	521	3957	2485	670	789	13	0	0
18	Z	542	4115	2586	696	820	13	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
X	350	ALA	GLY	conflict	UNP A0ZW41
X	387	LEU	ARG	conflict	UNP A0ZW41
Y	350	ALA	GLY	conflict	UNP A0ZW41
Y	387	LEU	ARG	conflict	UNP A0ZW41
Z	350	ALA	GLY	conflict	UNP A0ZW41
Z	387	LEU	ARG	conflict	UNP A0ZW41

- Molecule 19 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		AltConf
19	M	1	Total	Zn	0
			1	1	

- Molecule 20 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: C₁₀H₁₆N₅O₁₃P₃).

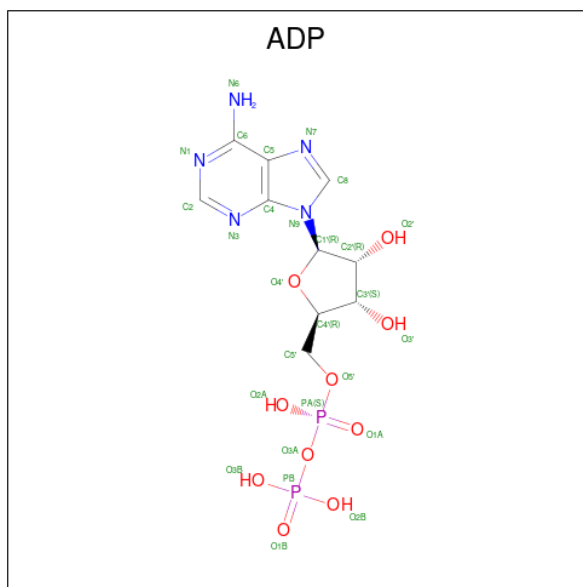


Mol	Chain	Residues	Atoms					AltConf
20	T	1	Total	C	N	O	P	0
			31	10	5	13	3	
20	U	1	Total	C	N	O	P	0
			31	10	5	13	3	
20	V	1	Total	C	N	O	P	0
			31	10	5	13	3	

- Molecule 21 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
21	T	1	Total	Mg	0
			1	1	
21	U	1	Total	Mg	0
			1	1	
21	V	1	Total	Mg	0
			1	1	
21	X	1	Total	Mg	0
			1	1	
21	Z	1	Total	Mg	0
			1	1	

- Molecule 22 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: C₁₀H₁₅N₅O₁₀P₂).

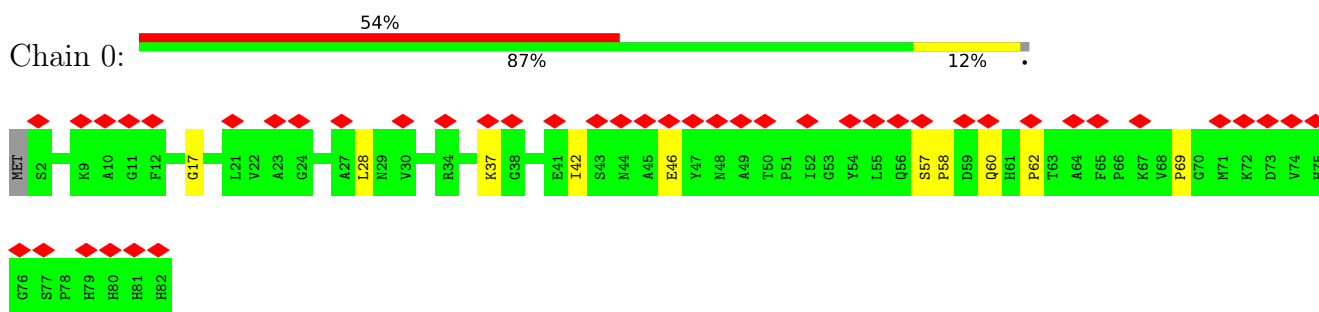


Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
22	X	1	27	10	5	10	2	0
22	Z	1	27	10	5	10	2	0

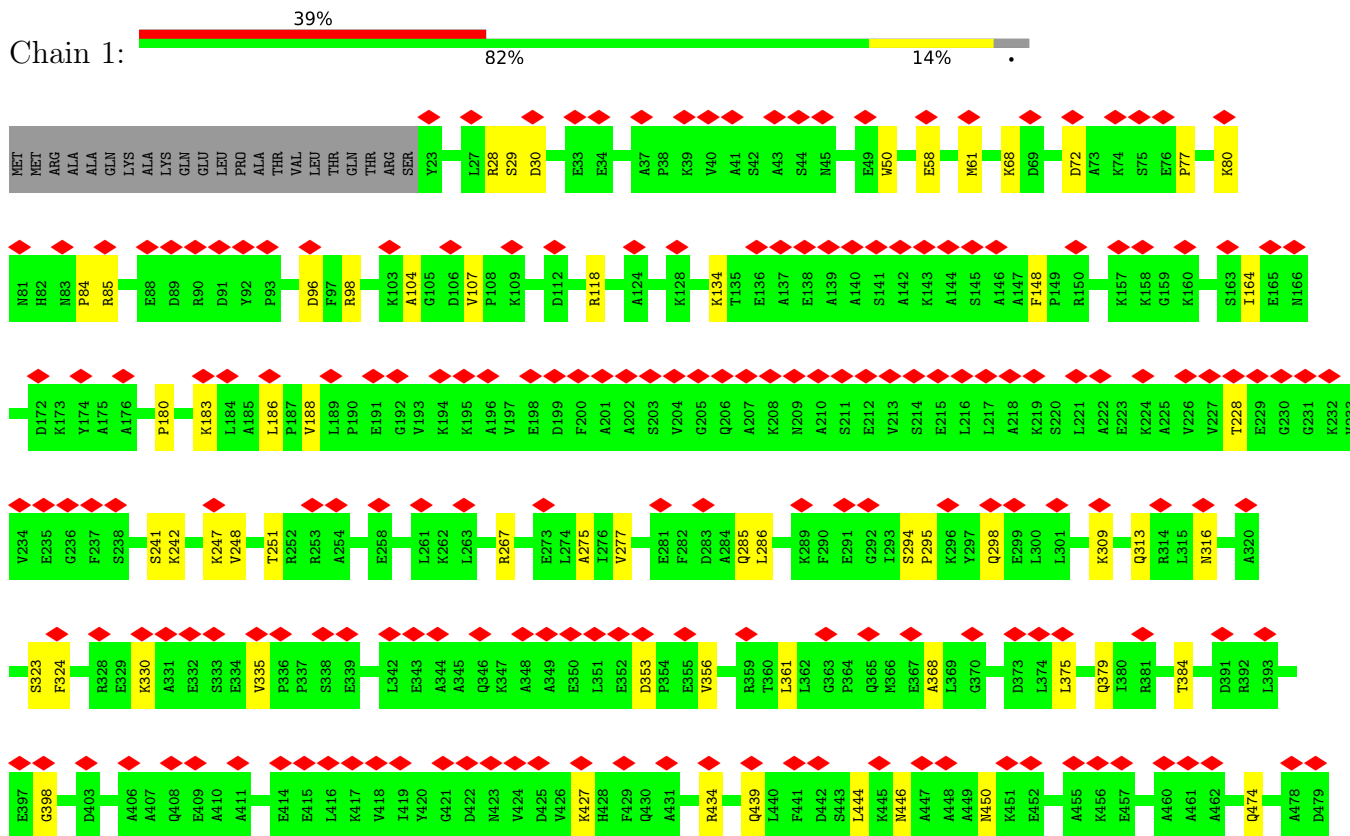
3 Residue-property plots [i](#)

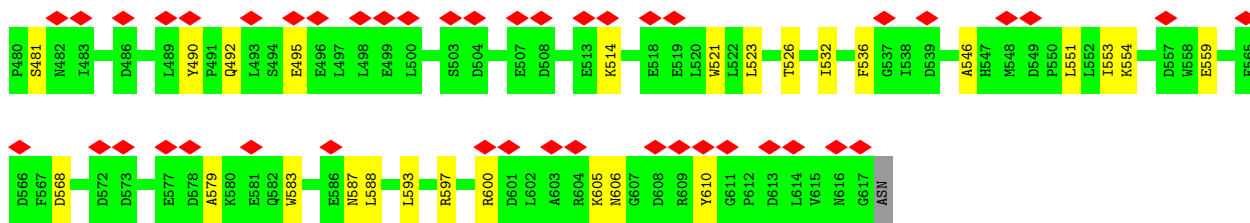
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion 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: ASA-10: Polytomella F-ATP synthase associated subunit 10

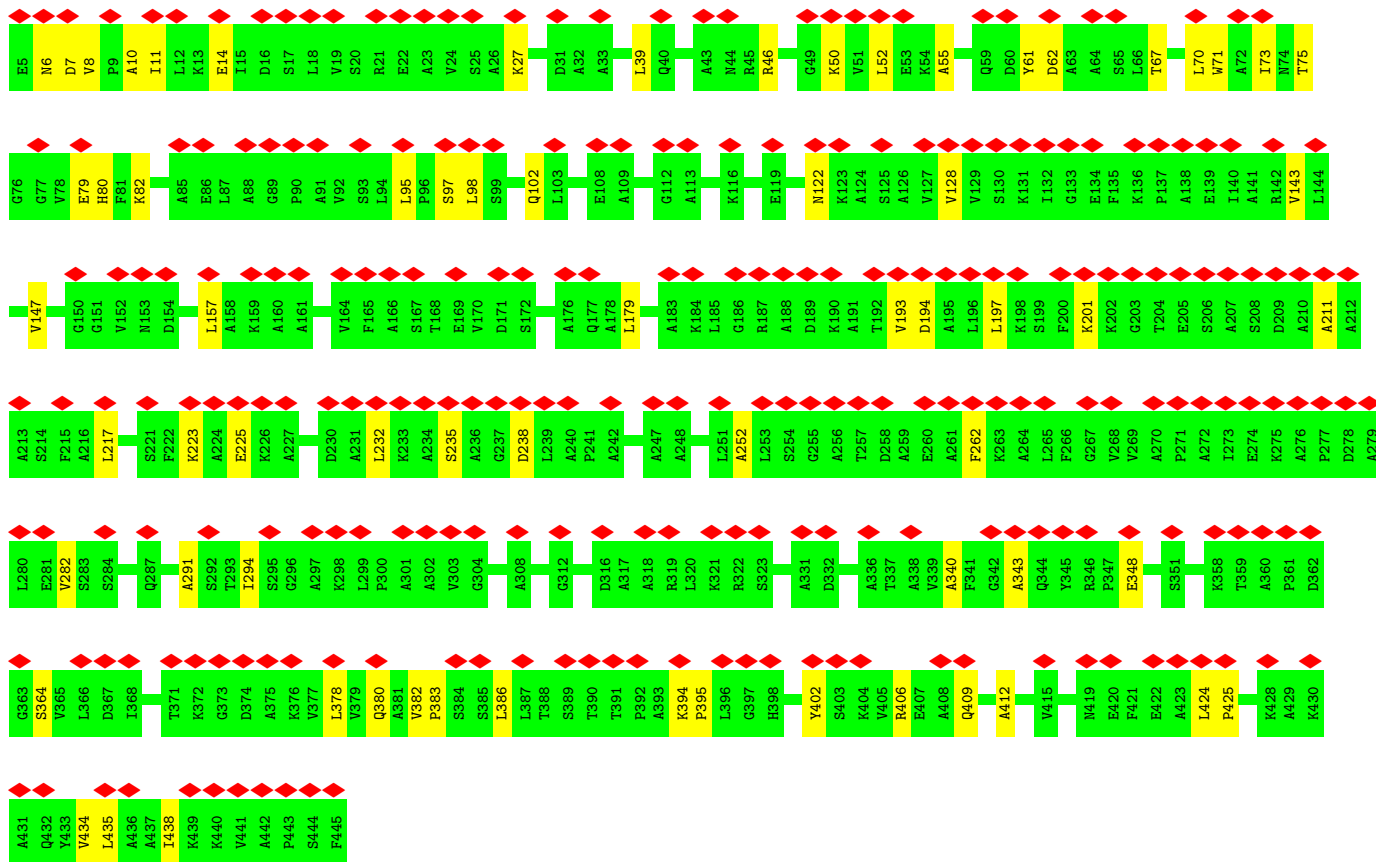
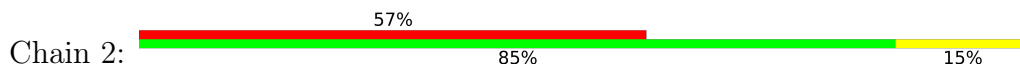


- Molecule 2: ATP synthase associated protein ASA1

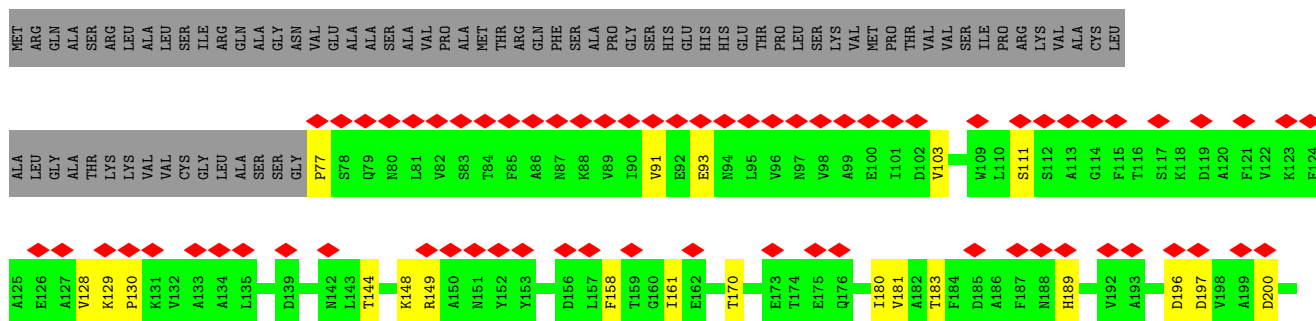
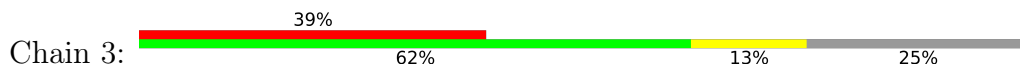


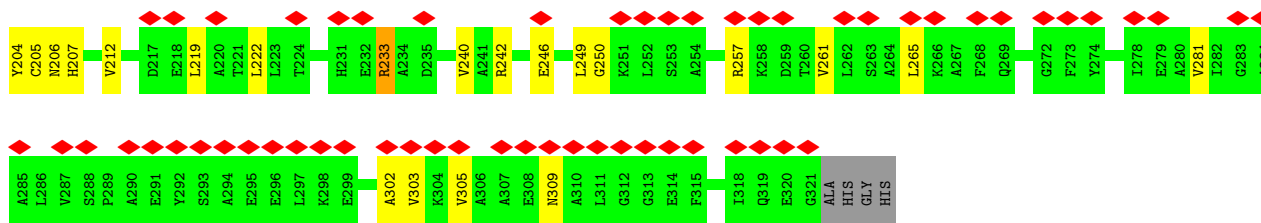


• Molecule 3: ASA-2: Polytomella F-ATP synthase associated subunit 2

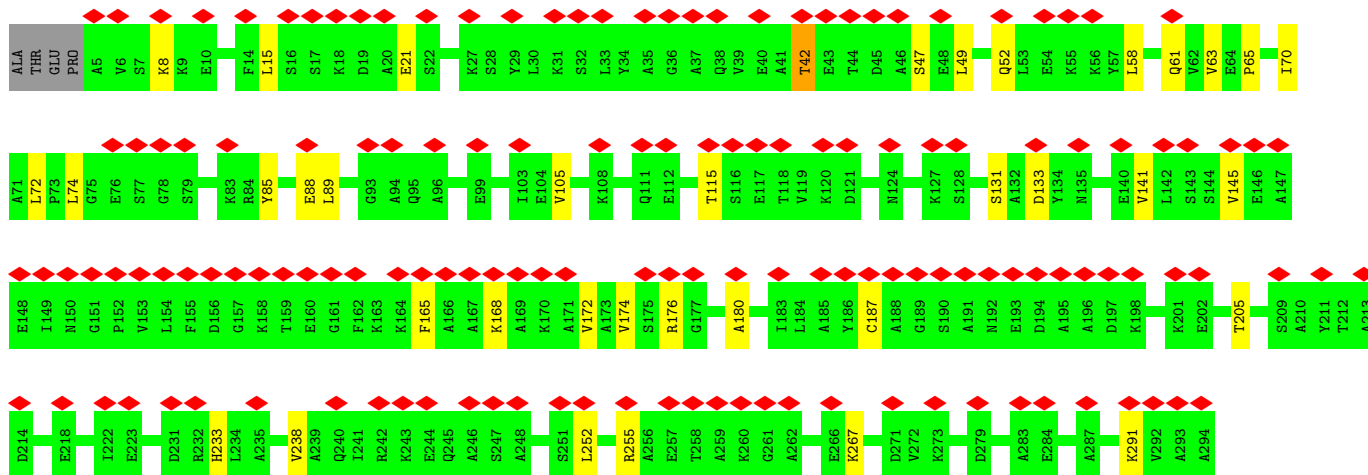
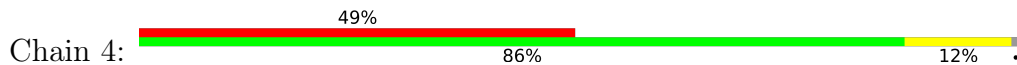


• Molecule 4: Mitochondrial F1F0 ATP synthase associated 32 kDa protein

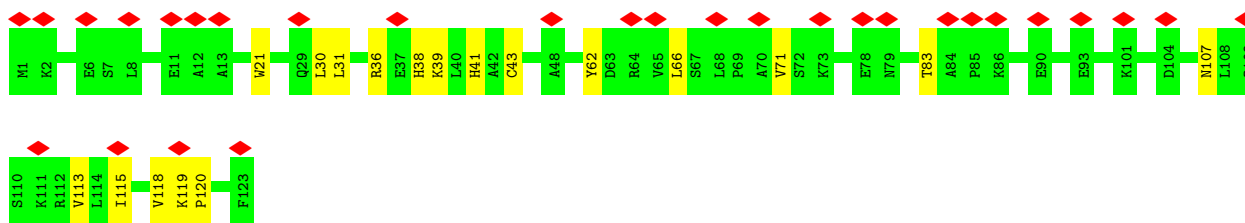
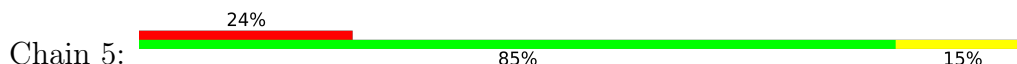




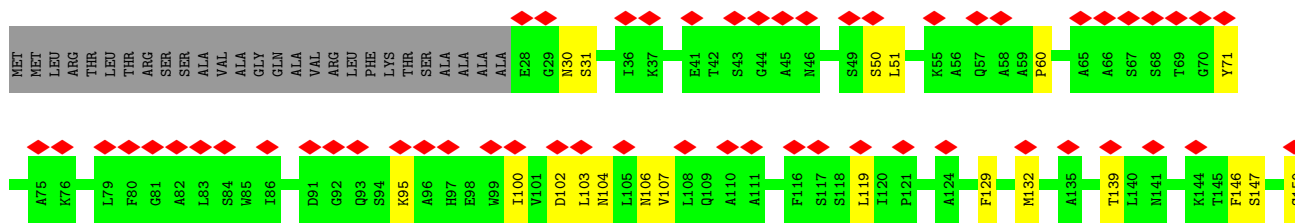
• Molecule 5: Mitochondrial ATP synthase associated protein ASA4



• Molecule 6: Mitochondrial F1F0 ATP synthase associated 14 kDa protein

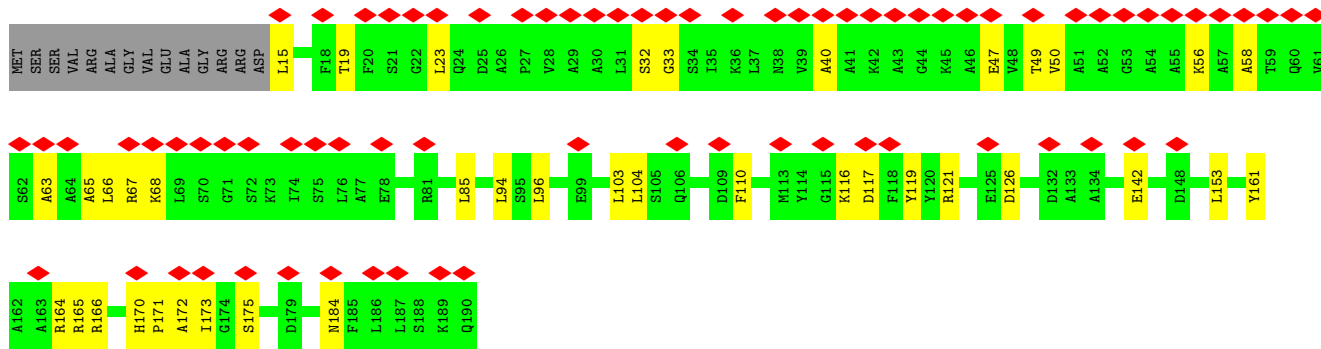
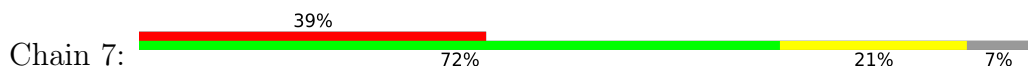


• Molecule 7: Mitochondrial ATP synthase subunit ASA6

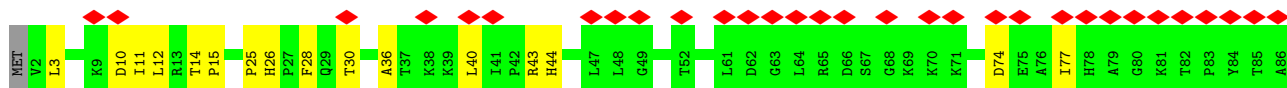
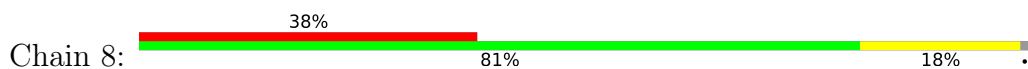


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L161

● Molecule 8: Mitochondrial ATP synthase associated protein ASA7

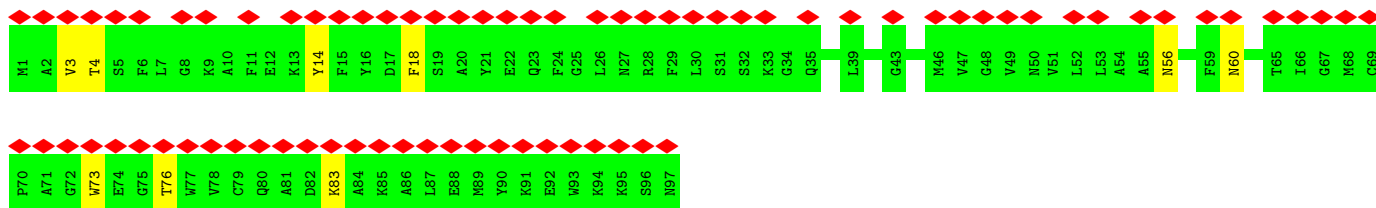
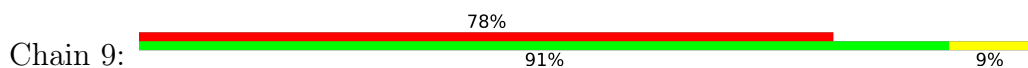


● Molecule 9: Mitochondrial ATP synthase subunit ASA8

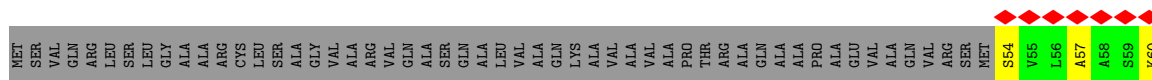
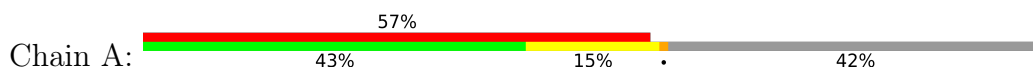


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G87
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G88
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H89

● Molecule 10: ASA-9: Polytomella F-ATP synthase associated subunit 9

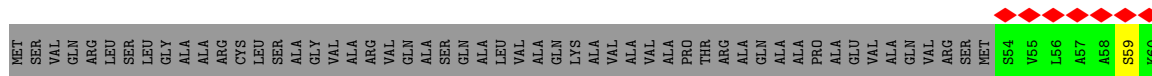
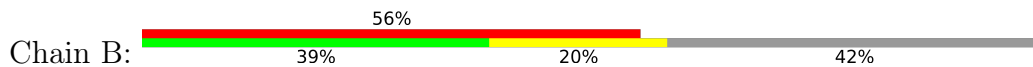


● Molecule 11: Mitochondrial ATP synthase subunit c

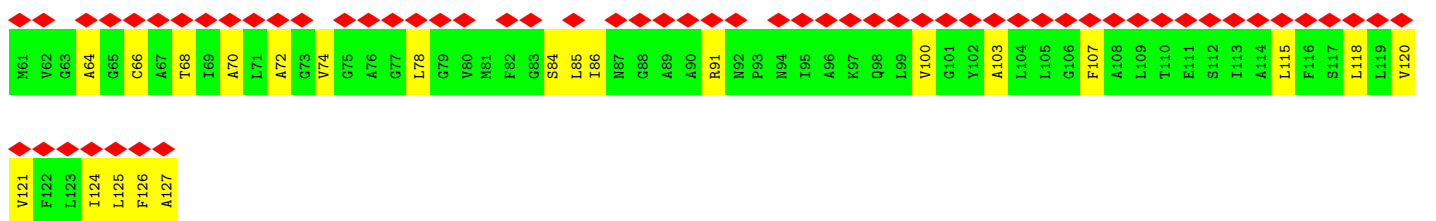
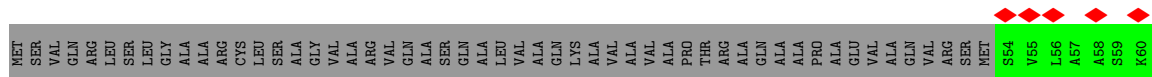
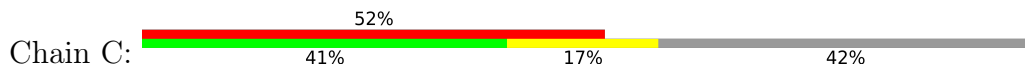




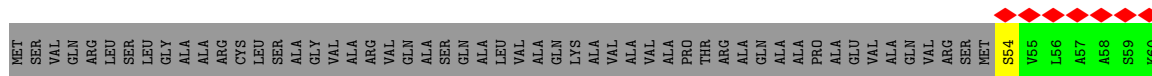
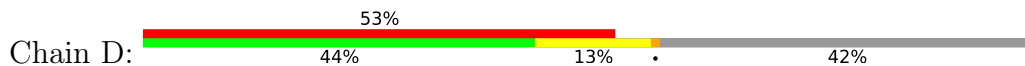
• Molecule 11: Mitochondrial ATP synthase subunit c



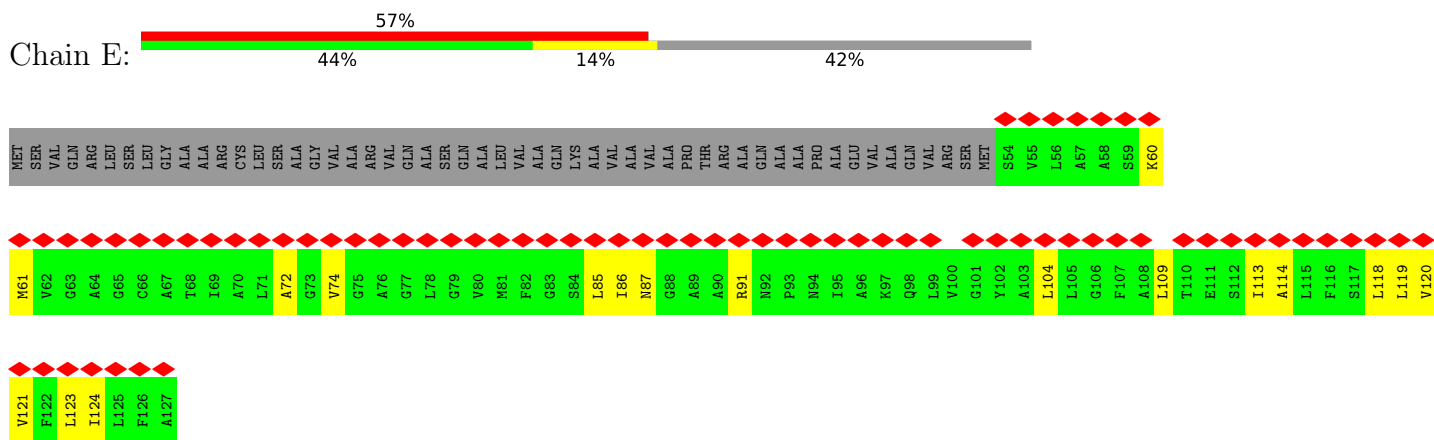
• Molecule 11: Mitochondrial ATP synthase subunit c



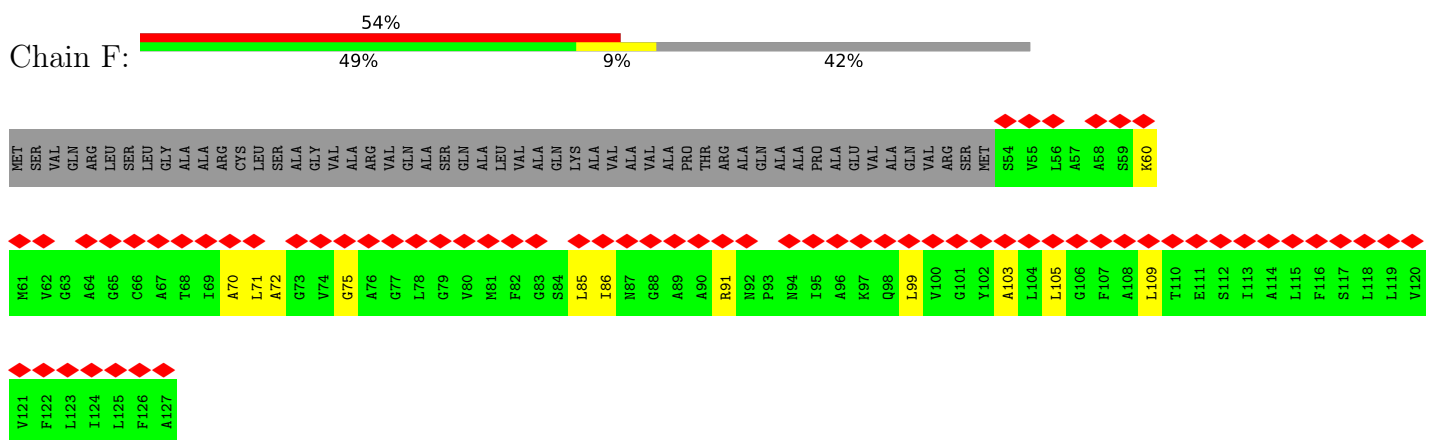
• Molecule 11: Mitochondrial ATP synthase subunit c



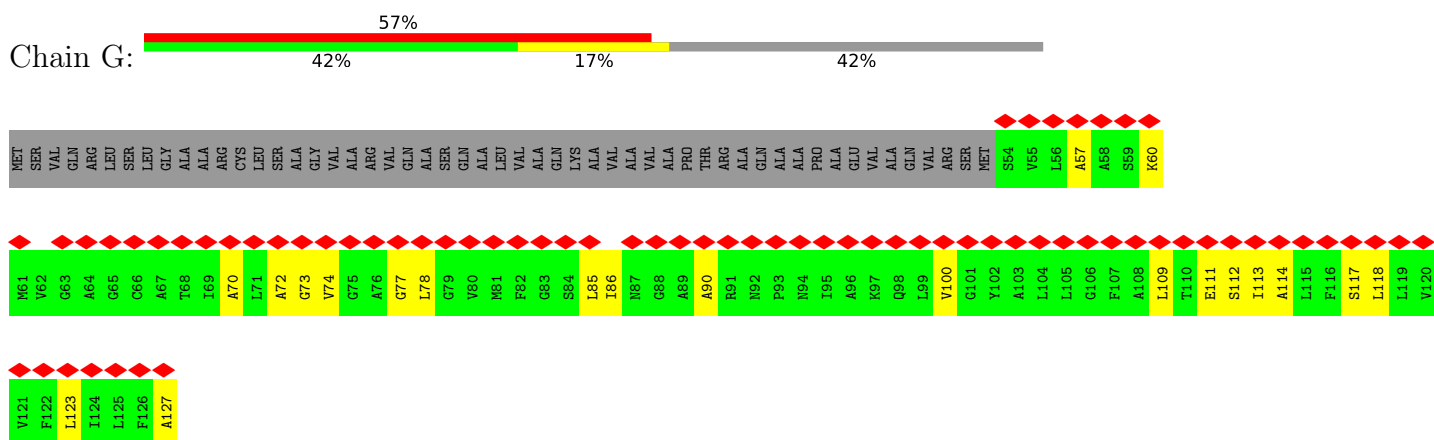
• Molecule 11: Mitochondrial ATP synthase subunit c



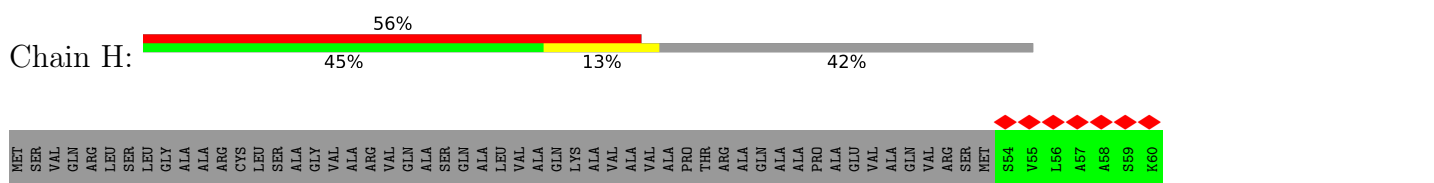
• Molecule 11: Mitochondrial ATP synthase subunit c

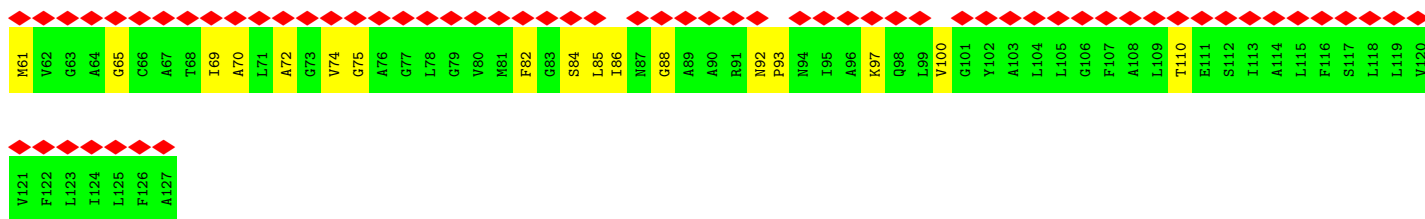


• Molecule 11: Mitochondrial ATP synthase subunit c

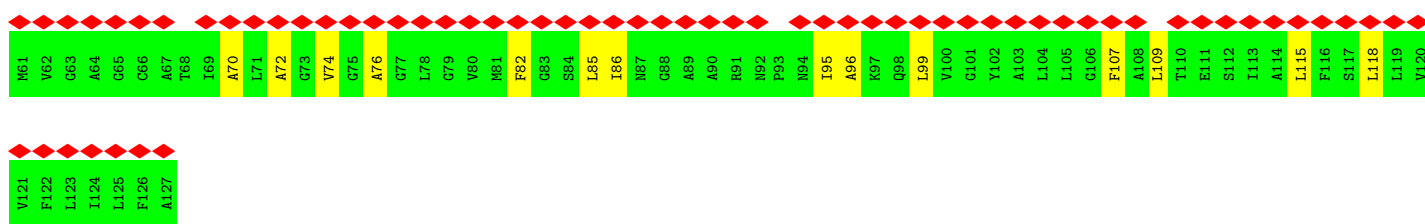
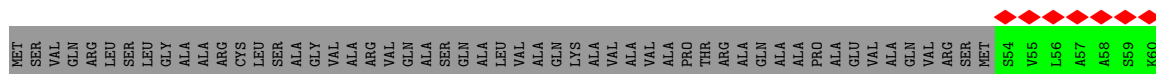


• Molecule 11: Mitochondrial ATP synthase subunit c

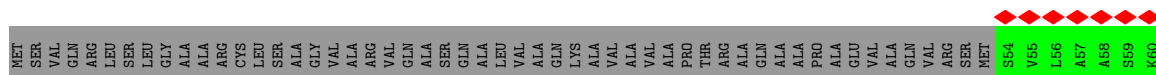




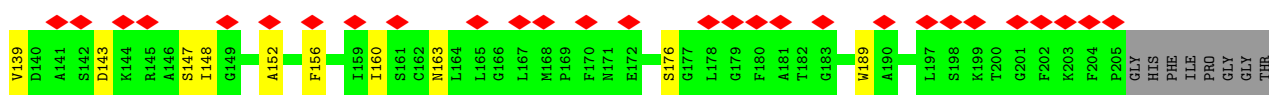
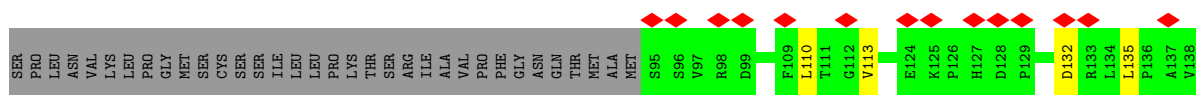
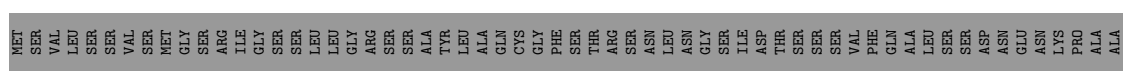
• Molecule 11: Mitochondrial ATP synthase subunit c

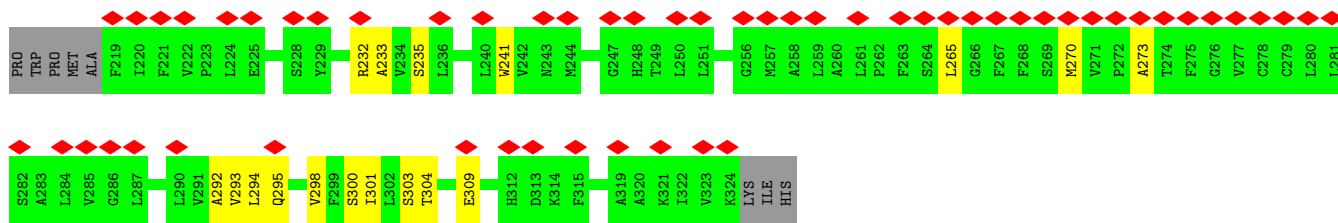


• Molecule 11: Mitochondrial ATP synthase subunit c

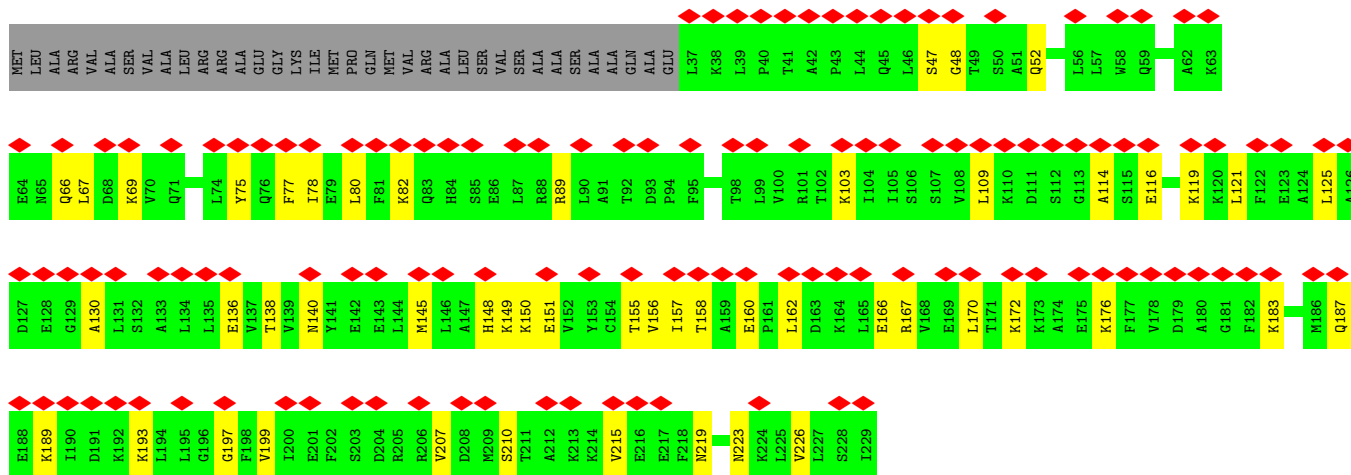


• Molecule 12: Mitochondrial ATP synthase subunit 6

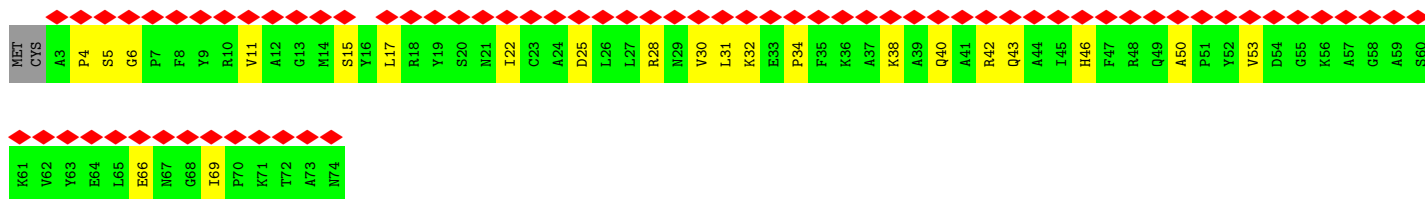




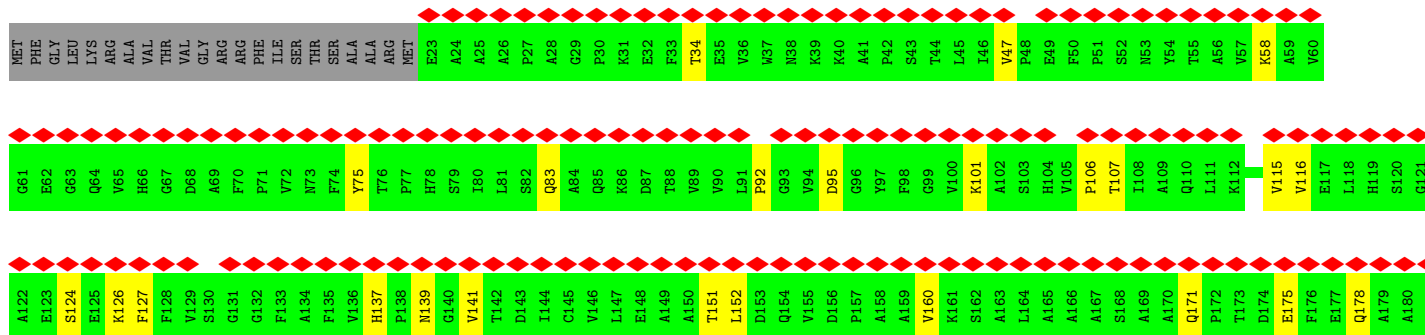
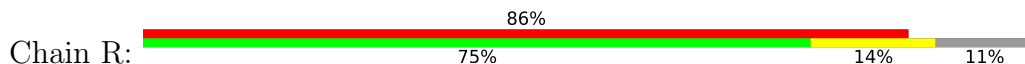
• Molecule 13: Mitochondrial ATP synthase subunit OSCP



• Molecule 14: epsilon: Polytomella F-ATP synthase epsilon subunit

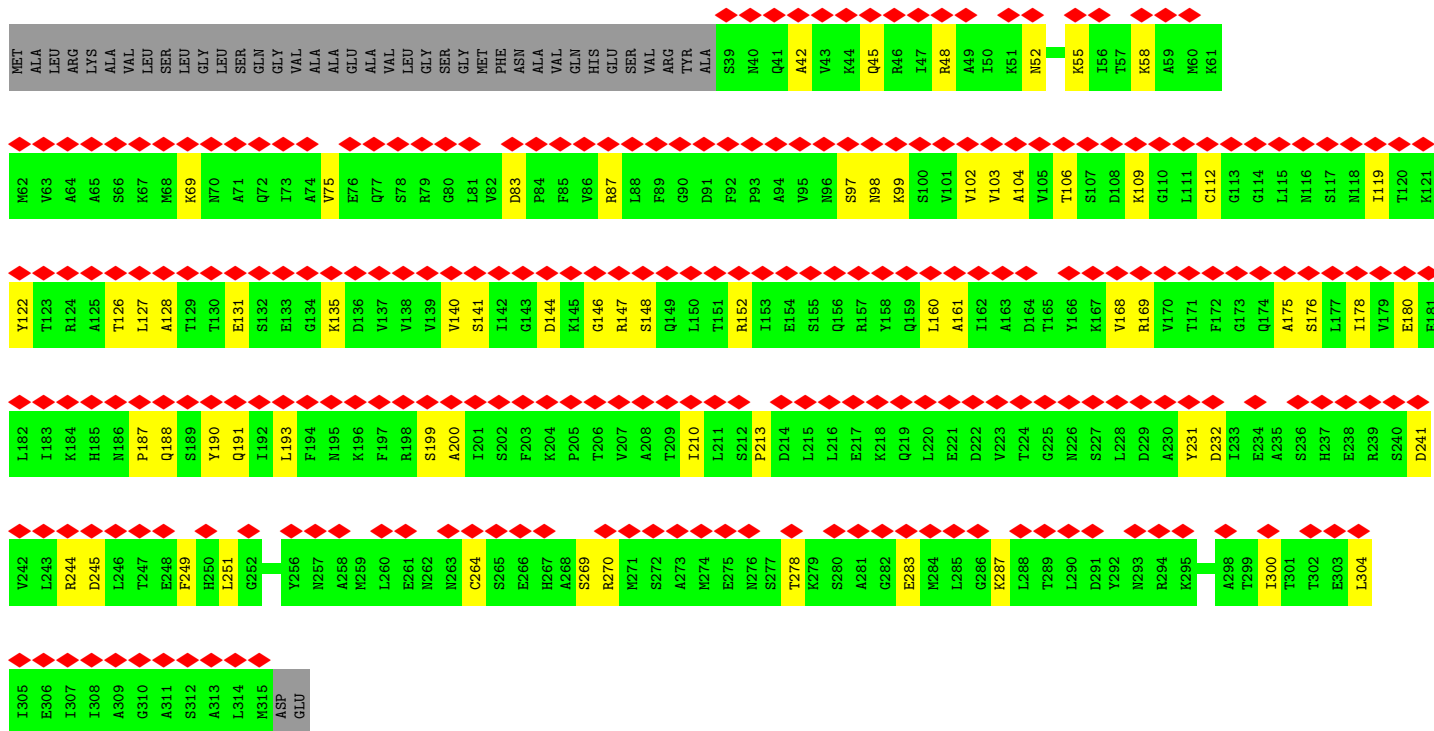
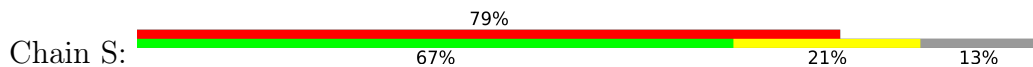


• Molecule 15: Mitochondrial ATP synthase subunit delta

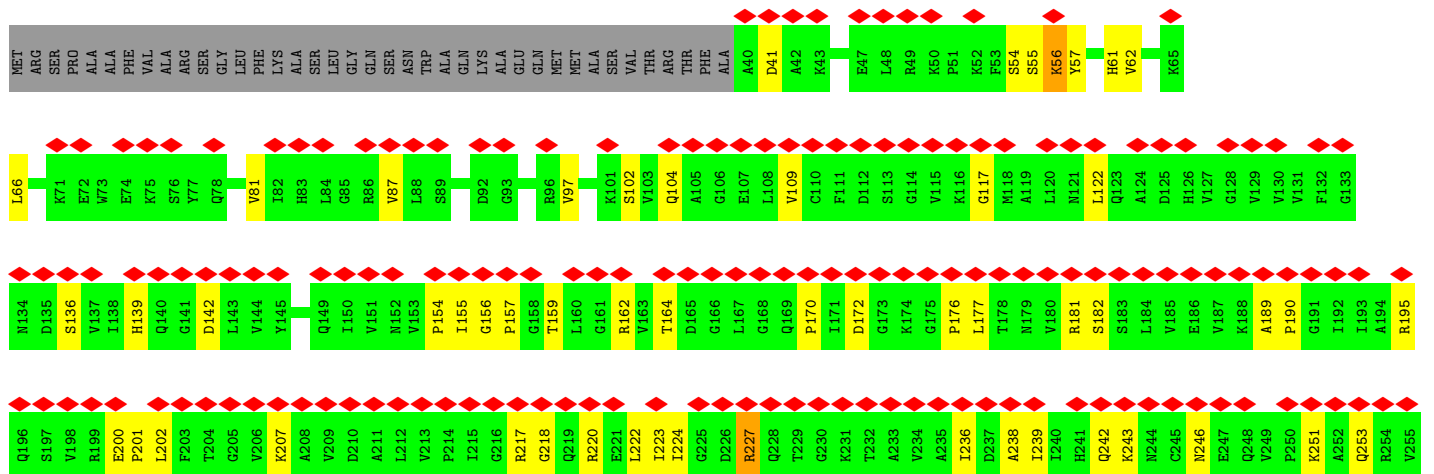
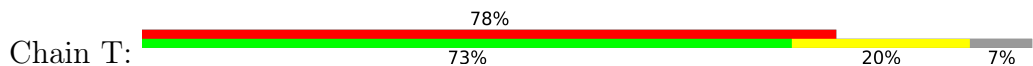


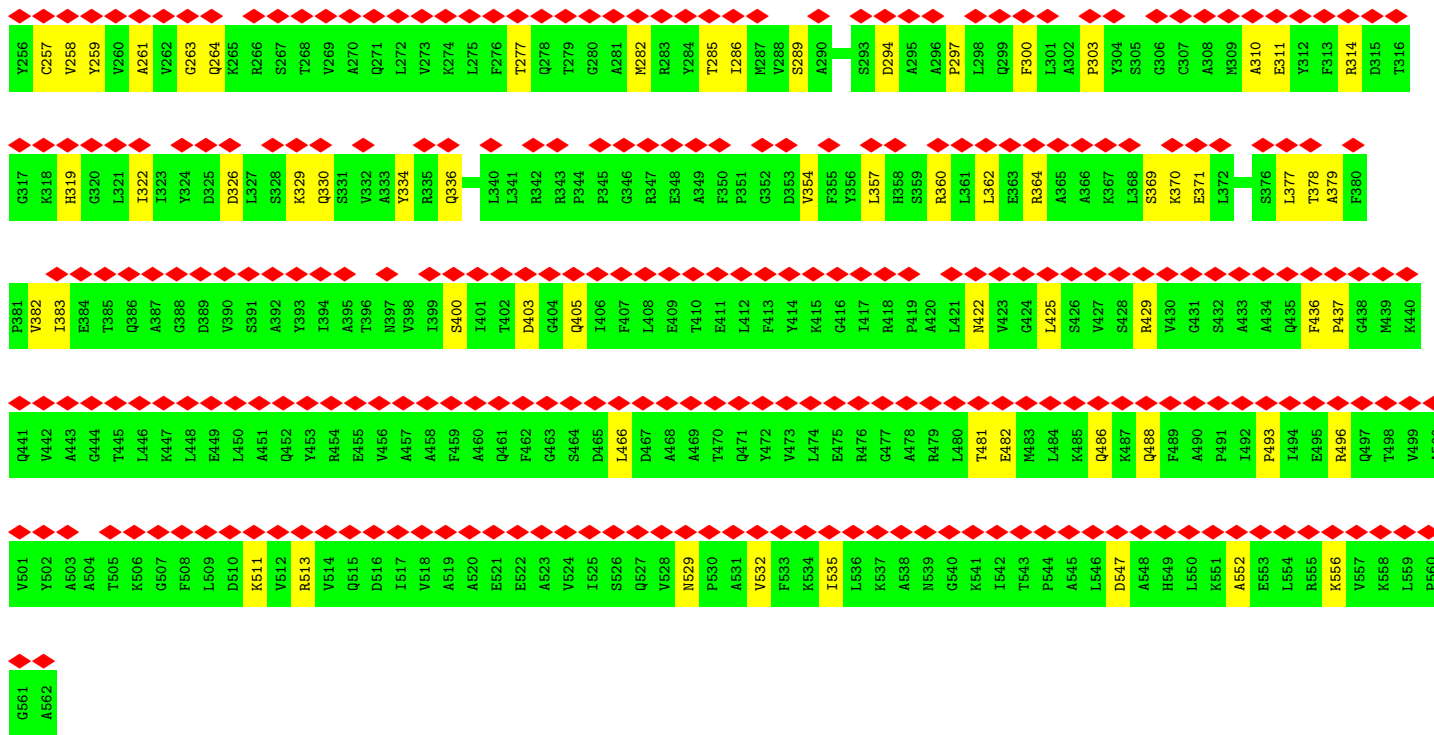


• Molecule 16: ATP synthase gamma chain, mitochondrial

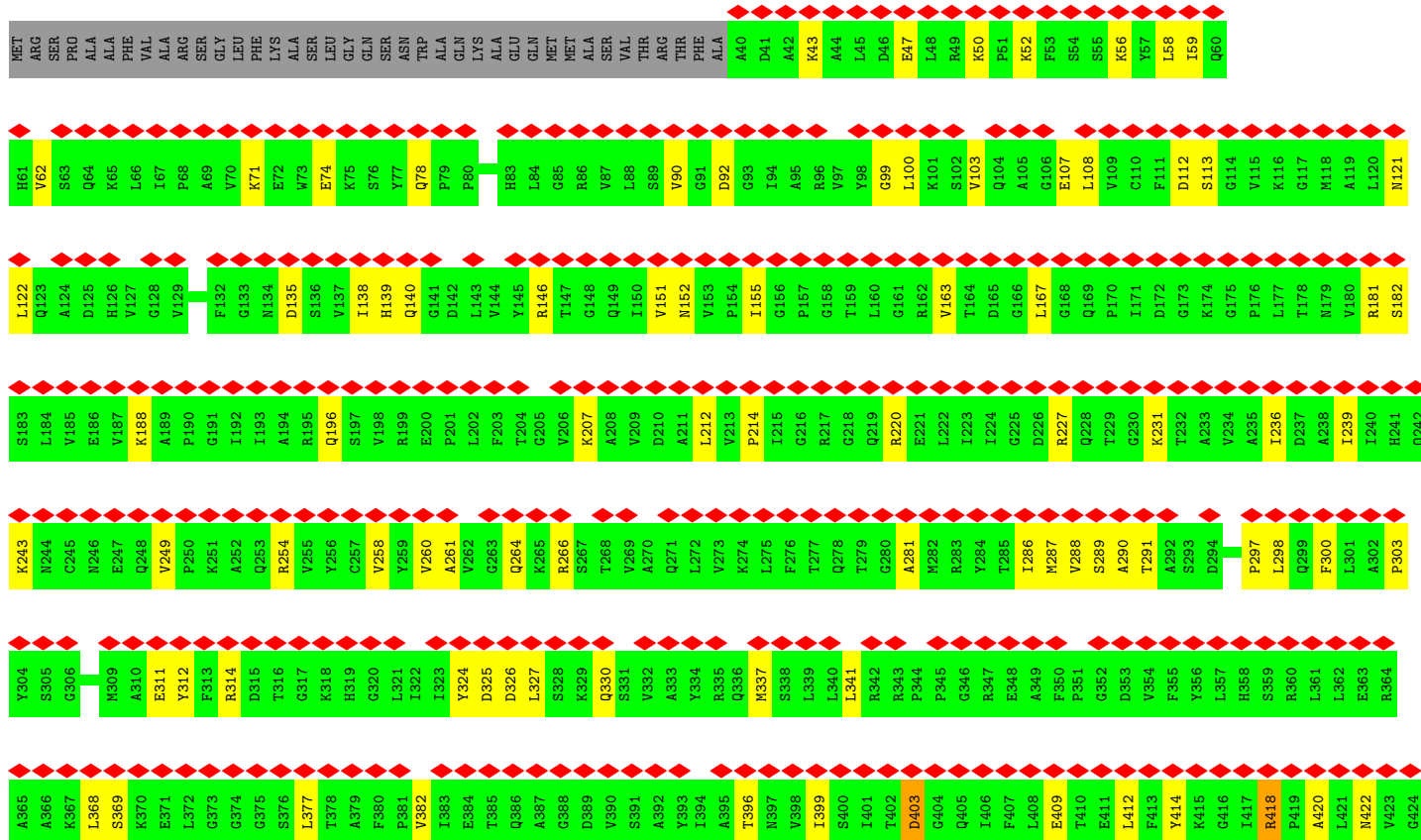
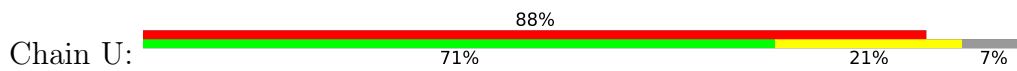


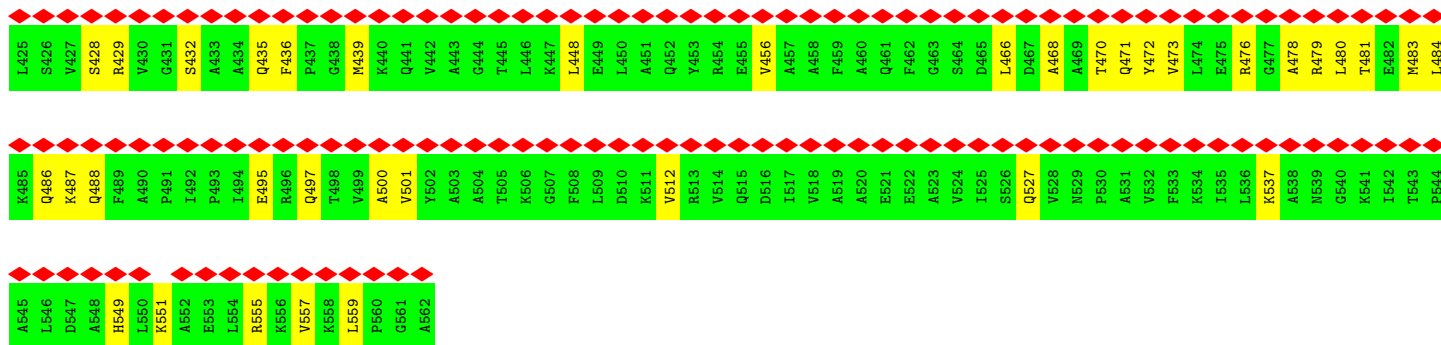
• Molecule 17: ATP synthase subunit alpha



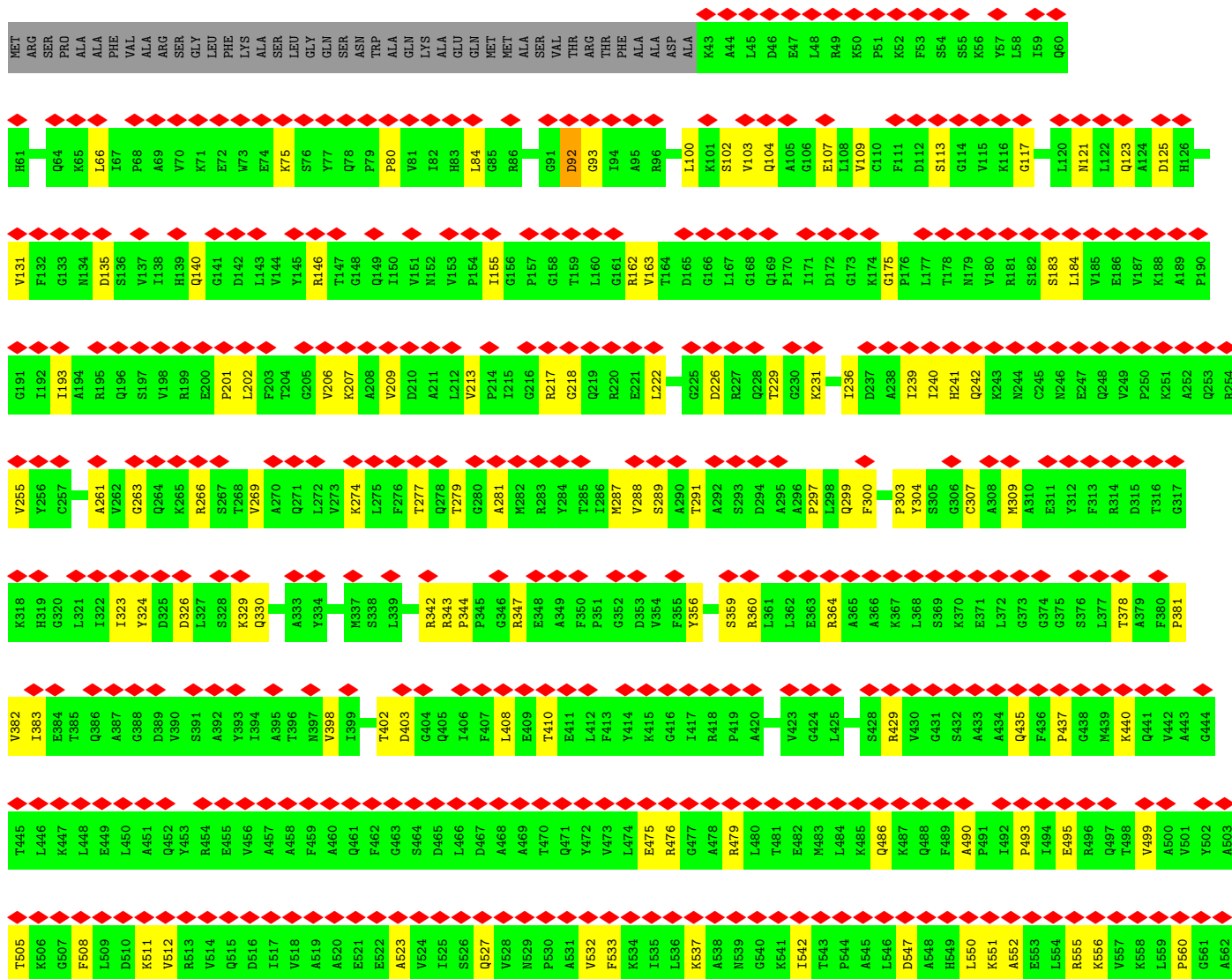


● Molecule 17: ATP synthase subunit alpha

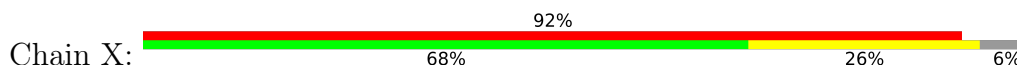




• Molecule 17: ATP synthase subunit alpha

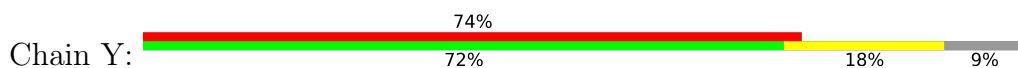


• Molecule 18: ATP synthase subunit beta

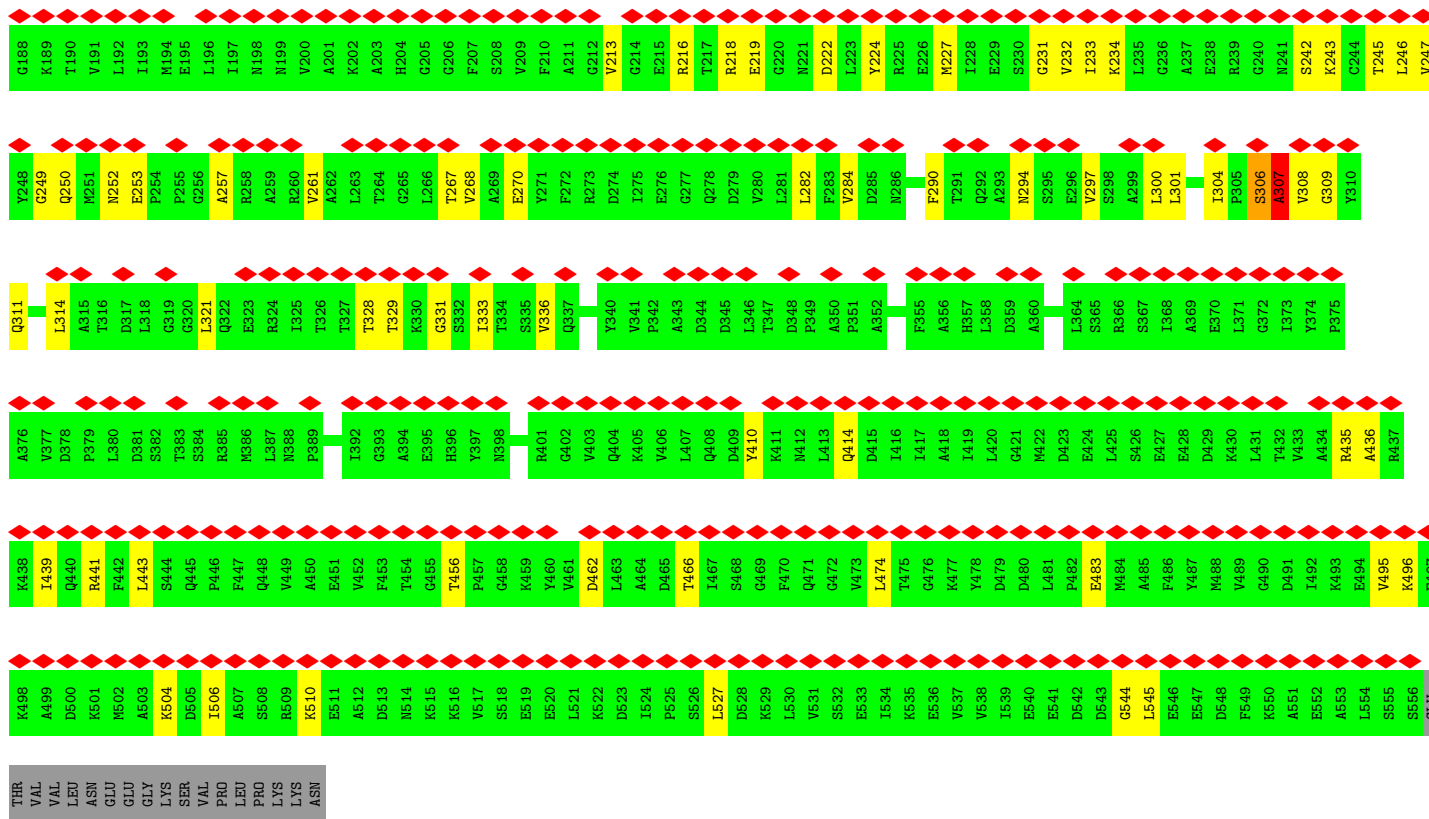


MET	ALA	LEU	ARG	TYR	ALA	ALA	GLY	LEU	ALA	LYS	ASN	ASN	VAL	VAL	GLN	ARG	GLN	GLN	GLY	ALA	ALA	SER	LEU	ILE	ASN	ALA	ARG	ALA	PHE	ALA	ALA	GLU	PRO	ALA	ALA	PRO	PRO	ILE	D36	A37	G38	Y39	V40	S41	Q42	V43	P46	V47	V48	F52	D53	G54	E55	L56	P57	S58	I59	L60				
S61	S62	L63	E64	V65	E66	G67	S69	V70	R71	V72	L73	V74	L74	E75	V76	A77	Q78	H79	M80	G81	D82	N83	T84	V85	R86	C87	I88	A89	M90	N91	D92	S92	T93	D94	G95	L96	V97	R98	G99	I100	K101	V102	V103	B51	D104	F52	I105	G106	S107	I108	L109	K110	L111	V112	G113	I114	R115	G116	R117	L118	G119	R120
I121	M122	M123	V124	I125	G126	E127	P128	V129	D130	E131	Q132	G133	P134	I135	D136	A137	D138	D139	I140	A201	A262	K203	H204	G205	L266	F207	S208	V209	F210	A211	G212	G214	E215	R216	T217	R218	E219	G220	M221	D222	L223	V224	K225	E226	M227	I228	E229	S230	G231	V232	I233	K234	L235	G236	A237	R238	G239	I240				
L181	F182	G183	G184	A185	G186	V187	G188	K189	T190	V191	L192	M193	M194	E195	L196	H197	M198	M199	V200	K201	A262	K203	H204	G205	L266	F207	S208	V209	F210	A211	G212	G214	E215	R216	T217	R218	E219	G220	M221	D222	L223	V224	K225	E226	M227	I228	E229	S230	G231	V232	I233	K234	L235	G236	A237	R238	G239	I240				
N241	S242	K243	C244	T245	L246	V247	V248	G249	K250	M251	N252	E253	P254	P255	G256	A257	R258	A259	R260	V261	A262	L263	T264	G265	L266	T267	V268	A269	E270	Y271	F272	R273	D274	L275	E276	G277	Q278	D279	V280	L281	F283	V284	D285	N286	L287	F288	R289	F290	T291	A352	A353	A354	A355	H357	L358	A359	L300					
L301	G302	R303	I304	P305	S306	A307	V308	G309	Y310	M311	P312	L313	L314	A315	T316	D317	L318	G319	G320	L321	Q322	E323	R324	I325	T326	T327	T328	T329	K330	G331	S332	T333	T334	S335	V336	Q337	A338	V339	Y340	Y341	P342	A343	D344	D345	L346	T347	D348	P349	A350	P351	A352	T353	N294	S295	E296	V297	A299	L300				
T361	T362	V363	L364	S365	R366	S367	I368	A369	E370	L371	G372	I373	Y374	P375	A376	V377	D378	P379	L380	D381	S382	T383	S384	R385	M386	L387	N388	P389	N390	V391	I392	G393	A394	E395	H396	Y397	N398	V399	A400	R401	G402	V403	Q404	R405	V406	L407	Q408	D409	Y410	K411	N412	L413	Q414	D415	I416	I417	A418	I419	L420			
G421	M422	D423	E424	L425	S426	E427	E428	D429	K430	L431	T432	V433	A434	R435	A436	R437	K438	A439	Q440	R441	F442	L443	S444	Q445	P446	P447	Q448	V449	A450	E451	V452	P453	T454	G455	T456	P457	G458	K459	Y460	V461	D462	L463	A464	D465	T466	I467	S468	G469	F470	Q471	G472	V473	L474	T475	G476	K477	A478	D479	D480			
L481	P482	E483	M484	A485	F486	Y487	M488	V489	G490	A491	I492	K493	E494	V495	K496	E497	K498	A499	D500	K501	M502	A503	K504	D505	I506	A507	S508	P509	K510	E511	A512	D513	N514	K515	K516	V517	S518	E519	E520	L521	K522	D523	I524	P525	S526	L527	D528	K529	L530	V531	S532	E533	I534	K535	E536	V537	V538	I539	E540			
E541	D542	D543	G544	L545	E546	E547	D548	F549	K550	A551	E552	A553	L554	S555	S556	E557	T558	V559	V560	L561	N562	E563	E564	G565	K566	S567	V568	P569	L570	P571	K572	K573	N574																													

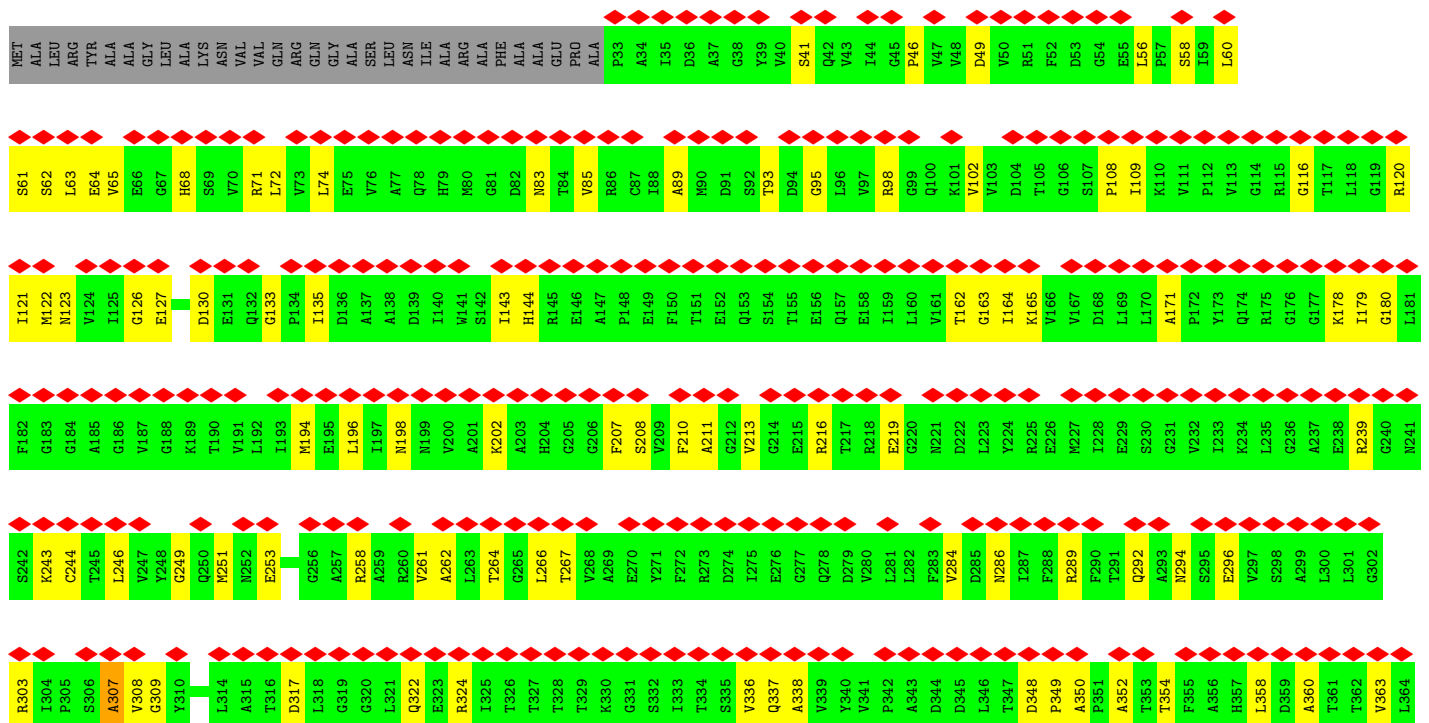
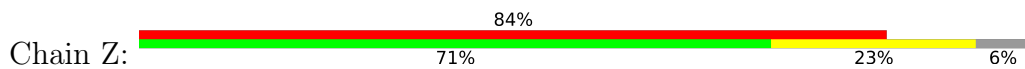
• Molecule 18: ATP synthase subunit beta



MET	ALA	LEU	ARG	TYR	ALA	ALA	GLY	LEU	ALA	LYS	ASN	ASN	VAL	VAL	GLN	ARG	GLN	GLN	GLY	ALA	ALA	SER	LEU	ILE	ASN	ALA	ARG	ALA	PHE	ALA	ALA	GLU	PRO	ALA	ALA	PRO	PRO	ILE	D36	A37	G38	Y39	Q42	V43	P46	V47	V48	D49	V50	R51	F52	D53	G54	E55	L56	I59	L60	S61	S62	L63
E64	V65	E66	G67	H68	S69	V70	R71	V72	V73	M80	S142	G81	D82	N83	T84	I88	A89	M90	D91	S92	T93	D94	G95	L96	V97	R98	Q100	K101	V102	V103	D104	T105	G106	S107	P108	I109	K110	V111	D53	G54	E55	L56	G116	I117	L118	G119	R120	I121	M122	M123	V124	I125	G126	E127	V128					
V129	D130	E131	Q132	G133	P134	I135	A137	A138	D139	I140	W141	I142	I143	H144	R145	E146	A147	P148	E149	F150	T151	E152	Q153	S154	T155	E156	Q157	E158	I159	L160	V161	G163	I164	K165	V166	V167	D168	L169	L170	A171	V172	Y173	R174	R175	G176	G177	K178	I179	L181	F182	G183	G184	A185	G186	V187					



• Molecule 18: ATP synthase subunit beta



S365	R366	S367	I368	A369	E370	L371	G372	I373	Y374	P375	A376	V377	D378	P379	L380	D381	S382	T383	S384	R385	M386	L387	N388	P389	N390	V391	I392	G393	A394	E395	H396	Y397	N398	V399	A400	R401	G402	V403	Q404	K405	V406	L407	Q408	D409	Y410	K411	N412	L413	Q414	D415	I416	I417	A418	I419	L420	G421	M422	D423	E424
L425	S426	E427	E428	D429	K430	L431	T432	V433	A434	R435	A436	R437	K438	I439	Q440	R441	F442	L443	S444	Q445	P446	F447	Q448	V449	A450	E451	V452	F453	T454	G455	T456	P457	G458	K459	Y460	V461	D462	L463	A464	D465	T466	I467	S468	G469	F470	Q471	G472	V473	L474	T475	G476	K477	Y478	D479	D480	L481	P482	E483	M484
A485	F486	Y487	M488	V489	G490	D491	I492	K493	E494	V495	K496	E497	K498	A499	D500	K501	M502	A503	K504	D505	I506	A507	S508	R509	K510	E511	A512	D513	N514	K515	K516	V517	S518	E519	E520	L521	K522	D523	I524	P525	S526	L527	D528	K529	L530	V531	S532	E533	I534	K535	E536	V537	V538	I539	E540	E541	D542	D543	G544
L545	E546	E547	D548	F549	K550	A551	E552	A553	L554	S555	S556	E557	T558	V559	V560	L561	N562	E563	E564	G565	K566	S567	V568	P569	L570	P571	K572	K573	N574																														

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	8173	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	35	Depositor
Minimum defocus (nm)	-400	Depositor
Maximum defocus (nm)	-5000	Depositor
Magnification	75000	Depositor
Image detector	FEI FALCON III (4k x 4k)	Depositor
Maximum map value	0.123	Depositor
Minimum map value	-0.076	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.006	Depositor
Recommended contour level	0.04	Depositor
Map size (Å)	505.44, 505.44, 505.44	wwPDB
Map dimensions	480, 480, 480	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.053, 1.053, 1.053	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: ZN, ADP, MG, ATP

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	0	0.34	0/628	0.50	0/856
2	1	0.35	0/4750	0.52	0/6434
3	2	0.31	0/3212	0.52	0/4371
4	3	0.35	0/1911	0.55	1/2601 (0.0%)
5	4	0.34	0/2216	0.49	0/3000
6	5	0.39	0/1011	0.55	0/1376
7	6	0.35	0/946	0.54	0/1287
8	7	0.39	0/1374	0.52	0/1865
9	8	0.35	0/715	0.55	0/974
10	9	0.32	0/802	0.50	0/1084
11	A	0.29	0/520	0.53	0/704
11	B	0.29	0/520	0.56	0/704
11	C	0.30	0/519	0.61	0/701
11	D	0.34	0/520	0.57	0/704
11	E	0.33	0/520	0.52	0/704
11	F	0.28	0/520	0.48	0/704
11	G	0.28	0/520	0.56	0/704
11	H	0.29	0/520	0.56	0/704
11	I	0.28	0/520	0.48	0/704
11	J	0.29	0/520	0.55	1/704 (0.1%)
12	M	0.37	0/1683	0.60	0/2295
13	P	0.35	0/1553	0.54	0/2093
14	Q	0.33	0/574	0.54	0/774
15	R	0.34	0/1336	0.52	0/1827
16	S	0.33	0/2153	0.56	0/2901
17	T	0.36	0/4048	0.59	1/5481 (0.0%)
17	U	0.34	0/4049	0.57	0/5481
17	V	0.37	0/4031	0.56	1/5456 (0.0%)
18	X	0.34	0/4155	0.56	0/5630
18	Y	0.37	0/4015	0.55	0/5440
18	Z	0.37	0/4176	0.57	0/5659
All	All	0.35	0/54537	0.55	4/73922 (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
5	4	0	1
6	5	0	1
13	P	0	1
18	X	0	1
18	Y	0	1
18	Z	0	1
All	All	0	6

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
4	3	77	PRO	N-CA-CB	5.91	110.39	103.30
17	V	92	ASP	CB-CG-OD1	5.66	123.39	118.30
11	J	115	LEU	CA-CB-CG	5.35	127.60	115.30
17	T	466	LEU	CA-CB-CG	5.31	127.51	115.30

There are no chirality outliers.

5 of 6 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
5	4	47	SER	Peptide
6	5	119	LYS	Peptide
13	P	148	HIS	Mainchain
18	X	307	ALA	Peptide
18	Y	307	ALA	Peptide

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

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	0	607	0	584	9	0
2	1	4661	0	4695	59	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	2	3163	0	3262	44	0
4	3	1874	0	1826	27	0
5	4	2177	0	2169	29	0
6	5	986	0	1021	16	0
7	6	926	0	941	17	0
8	7	1347	0	1345	37	0
9	8	692	0	694	14	0
10	9	776	0	757	5	0
11	A	514	0	554	16	0
11	B	514	0	554	22	0
11	C	514	0	553	18	0
11	D	514	0	554	13	0
11	E	514	0	554	15	0
11	F	514	0	554	13	0
11	G	514	0	554	17	0
11	H	514	0	554	14	0
11	I	514	0	554	14	0
11	J	514	0	554	8	0
12	M	1640	0	1665	22	0
13	P	1532	0	1603	38	0
14	Q	561	0	565	16	0
15	R	1303	0	1266	18	0
16	S	2130	0	2180	43	0
17	T	3979	0	4120	80	0
17	U	3980	0	4119	84	0
17	V	3962	0	4105	85	0
18	X	4095	0	4113	95	0
18	Y	3957	0	3967	64	0
18	Z	4115	0	4138	86	0
19	M	1	0	0	0	0
20	T	31	0	12	1	0
20	U	31	0	12	1	0
20	V	31	0	12	1	0
21	T	1	0	0	0	0
21	U	1	0	0	0	0
21	V	1	0	0	0	0
21	X	1	0	0	0	0
21	Z	1	0	0	0	0
22	X	27	0	12	3	0
22	Z	27	0	12	0	0
All	All	53756	0	54734	884	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including

hydrogen atoms). The all-atom clashscore for this structure is 8.

The worst 5 of 884 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
18:X:498:LYS:O	18:X:502:MET:HG3	1.11	1.25
18:X:498:LYS:O	18:X:502:MET:CG	2.03	1.05
17:V:222:LEU:HD13	17:V:381:PRO:HG2	1.47	0.95
17:V:222:LEU:CD1	17:V:381:PRO:HG2	2.08	0.82
18:X:503:ALA:O	18:X:506:ILE:HG22	1.83	0.79

There are no symmetry-related clashes.

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	0	79/82 (96%)	72 (91%)	7 (9%)	0	100	100
2	1	593/618 (96%)	563 (95%)	30 (5%)	0	100	100
3	2	439/441 (100%)	415 (94%)	23 (5%)	1 (0%)	47	81
4	3	243/325 (75%)	230 (95%)	13 (5%)	0	100	100
5	4	288/294 (98%)	275 (96%)	13 (4%)	0	100	100
6	5	121/123 (98%)	109 (90%)	11 (9%)	1 (1%)	19	60
7	6	122/151 (81%)	105 (86%)	17 (14%)	0	100	100
8	7	174/190 (92%)	169 (97%)	5 (3%)	0	100	100
9	8	86/89 (97%)	76 (88%)	10 (12%)	0	100	100
10	9	95/97 (98%)	83 (87%)	12 (13%)	0	100	100
11	A	72/127 (57%)	70 (97%)	2 (3%)	0	100	100
11	B	72/127 (57%)	71 (99%)	1 (1%)	0	100	100
11	C	71/127 (56%)	68 (96%)	3 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
11	D	72/127 (57%)	70 (97%)	2 (3%)	0	100	100
11	E	72/127 (57%)	68 (94%)	4 (6%)	0	100	100
11	F	72/127 (57%)	71 (99%)	1 (1%)	0	100	100
11	G	72/127 (57%)	71 (99%)	1 (1%)	0	100	100
11	H	72/127 (57%)	70 (97%)	2 (3%)	0	100	100
11	I	72/127 (57%)	70 (97%)	2 (3%)	0	100	100
11	J	72/127 (57%)	70 (97%)	2 (3%)	0	100	100
12	M	213/327 (65%)	203 (95%)	10 (5%)	0	100	100
13	P	191/229 (83%)	176 (92%)	15 (8%)	0	100	100
14	Q	70/74 (95%)	62 (89%)	8 (11%)	0	100	100
15	R	175/199 (88%)	159 (91%)	16 (9%)	0	100	100
16	S	275/317 (87%)	261 (95%)	14 (5%)	0	100	100
17	T	521/562 (93%)	483 (93%)	37 (7%)	1 (0%)	47	81
17	U	521/562 (93%)	493 (95%)	28 (5%)	0	100	100
17	V	518/562 (92%)	490 (95%)	27 (5%)	1 (0%)	47	81
18	X	537/574 (94%)	498 (93%)	38 (7%)	1 (0%)	47	81
18	Y	519/574 (90%)	490 (94%)	26 (5%)	3 (1%)	25	65
18	Z	540/574 (94%)	496 (92%)	43 (8%)	1 (0%)	47	81
All	All	7039/8234 (86%)	6607 (94%)	423 (6%)	9 (0%)	54	85

5 of 9 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
18	X	308	VAL
18	Y	308	VAL
18	Z	308	VAL
3	2	383	PRO
18	Y	307	ALA

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	0	63/64 (98%)	63 (100%)	0	100	100
2	1	493/512 (96%)	491 (100%)	2 (0%)	91	94
3	2	312/312 (100%)	312 (100%)	0	100	100
4	3	195/258 (76%)	194 (100%)	1 (0%)	88	93
5	4	220/223 (99%)	219 (100%)	1 (0%)	88	93
6	5	107/107 (100%)	107 (100%)	0	100	100
7	6	96/115 (84%)	96 (100%)	0	100	100
8	7	140/150 (93%)	140 (100%)	0	100	100
9	8	71/72 (99%)	71 (100%)	0	100	100
10	9	79/79 (100%)	78 (99%)	1 (1%)	69	82
11	A	50/86 (58%)	49 (98%)	1 (2%)	55	73
11	B	50/86 (58%)	50 (100%)	0	100	100
11	C	50/86 (58%)	50 (100%)	0	100	100
11	D	50/86 (58%)	49 (98%)	1 (2%)	55	73
11	E	50/86 (58%)	50 (100%)	0	100	100
11	F	50/86 (58%)	50 (100%)	0	100	100
11	G	50/86 (58%)	50 (100%)	0	100	100
11	H	50/86 (58%)	50 (100%)	0	100	100
11	I	50/86 (58%)	50 (100%)	0	100	100
11	J	50/86 (58%)	50 (100%)	0	100	100
12	M	178/272 (65%)	178 (100%)	0	100	100
13	P	171/196 (87%)	169 (99%)	2 (1%)	71	84
14	Q	56/58 (97%)	55 (98%)	1 (2%)	59	77
15	R	134/151 (89%)	134 (100%)	0	100	100
16	S	235/265 (89%)	235 (100%)	0	100	100
17	T	419/448 (94%)	416 (99%)	3 (1%)	84	90
17	U	419/448 (94%)	415 (99%)	4 (1%)	76	86
17	V	418/448 (93%)	417 (100%)	1 (0%)	93	96
18	X	447/469 (95%)	446 (100%)	1 (0%)	93	96
18	Y	430/469 (92%)	428 (100%)	2 (0%)	88	93
18	Z	449/469 (96%)	449 (100%)	0	100	100

Continued on next page...

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	5632/6445 (87%)	5611 (100%)	21 (0%)	91 94

5 of 21 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
17	U	227	ARG
17	V	213	VAL
18	Y	456	THR
18	X	53	ASP
17	U	418	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 71 such sidechains are listed below:

Mol	Chain	Res	Type
18	Y	174	GLN
18	Y	278	GLN
18	Z	294	ASN
13	P	66	GLN
12	M	163	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 11 ligands modelled in this entry, 6 are monoatomic - leaving 5 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
22	ADP	X	601	21	24,29,29	0.92	1 (4%)	29,45,45	1.48	4 (13%)
20	ATP	V	1001	21	26,33,33	0.92	1 (3%)	31,52,52	1.80	6 (19%)
20	ATP	U	1001	21	26,33,33	0.92	1 (3%)	31,52,52	1.56	5 (16%)
20	ATP	T	1001	21	26,33,33	0.89	1 (3%)	31,52,52	1.56	5 (16%)
22	ADP	Z	601	21	24,29,29	0.95	1 (4%)	29,45,45	1.55	4 (13%)

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
22	ADP	X	601	21	-	3/12/32/32	0/3/3/3
20	ATP	V	1001	21	-	1/18/38/38	0/3/3/3
20	ATP	U	1001	21	-	0/18/38/38	0/3/3/3
20	ATP	T	1001	21	-	4/18/38/38	0/3/3/3
22	ADP	Z	601	21	-	1/12/32/32	0/3/3/3

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
20	U	1001	ATP	C5-C4	2.39	1.47	1.40
20	V	1001	ATP	C5-C4	2.32	1.47	1.40
22	X	601	ADP	C5-C4	2.21	1.46	1.40
20	T	1001	ATP	C5-C4	2.15	1.46	1.40
22	Z	601	ADP	C5-C4	2.09	1.46	1.40

The worst 5 of 24 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
20	V	1001	ATP	PA-O3A-PB	-4.65	116.87	132.83
20	V	1001	ATP	C3'-C2'-C1'	3.85	106.78	100.98
20	V	1001	ATP	PB-O3B-PG	-3.79	119.82	132.83
20	T	1001	ATP	PB-O3B-PG	-3.70	120.14	132.83
22	Z	601	ADP	PA-O3A-PB	-3.67	120.22	132.83

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

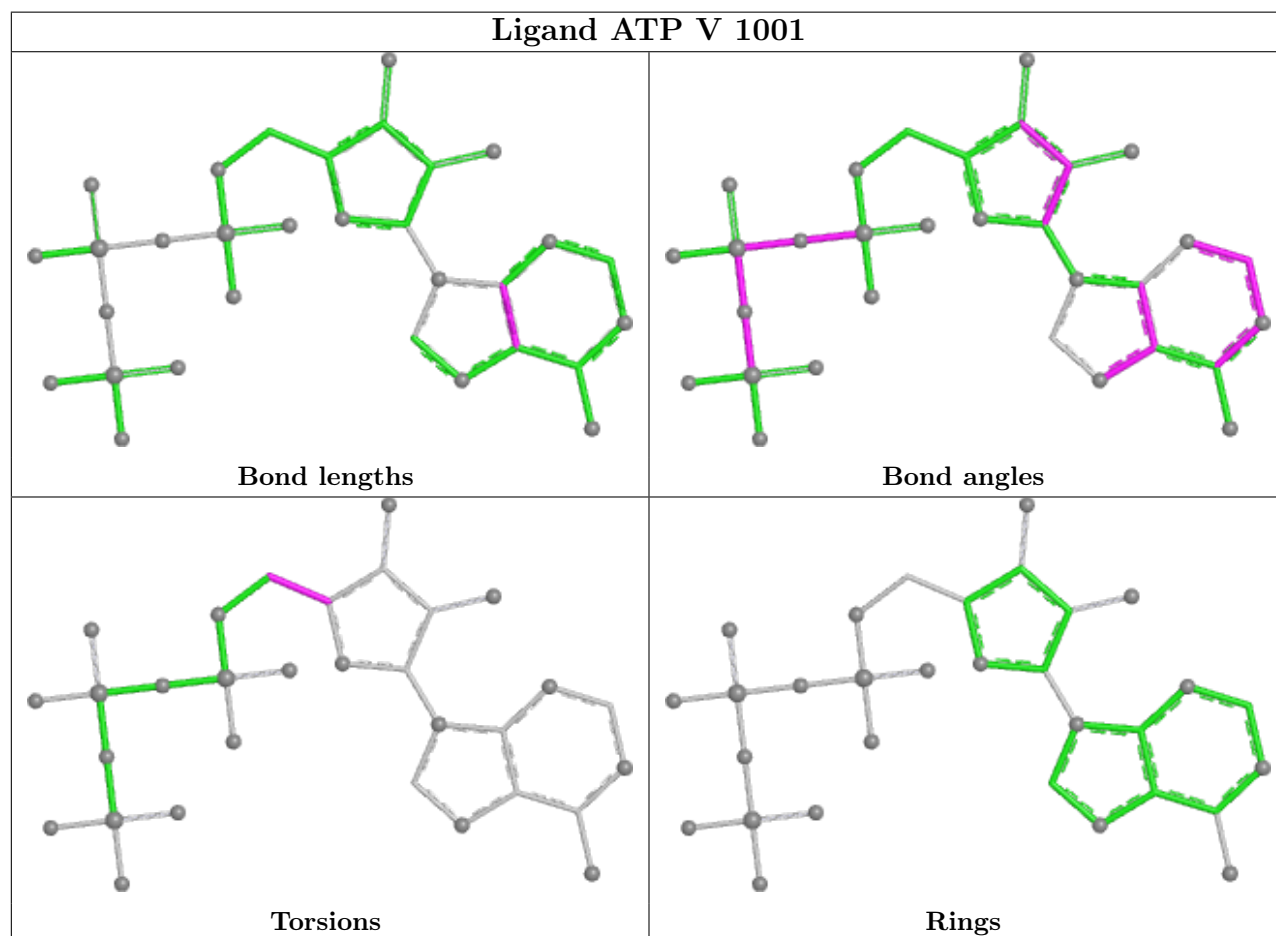
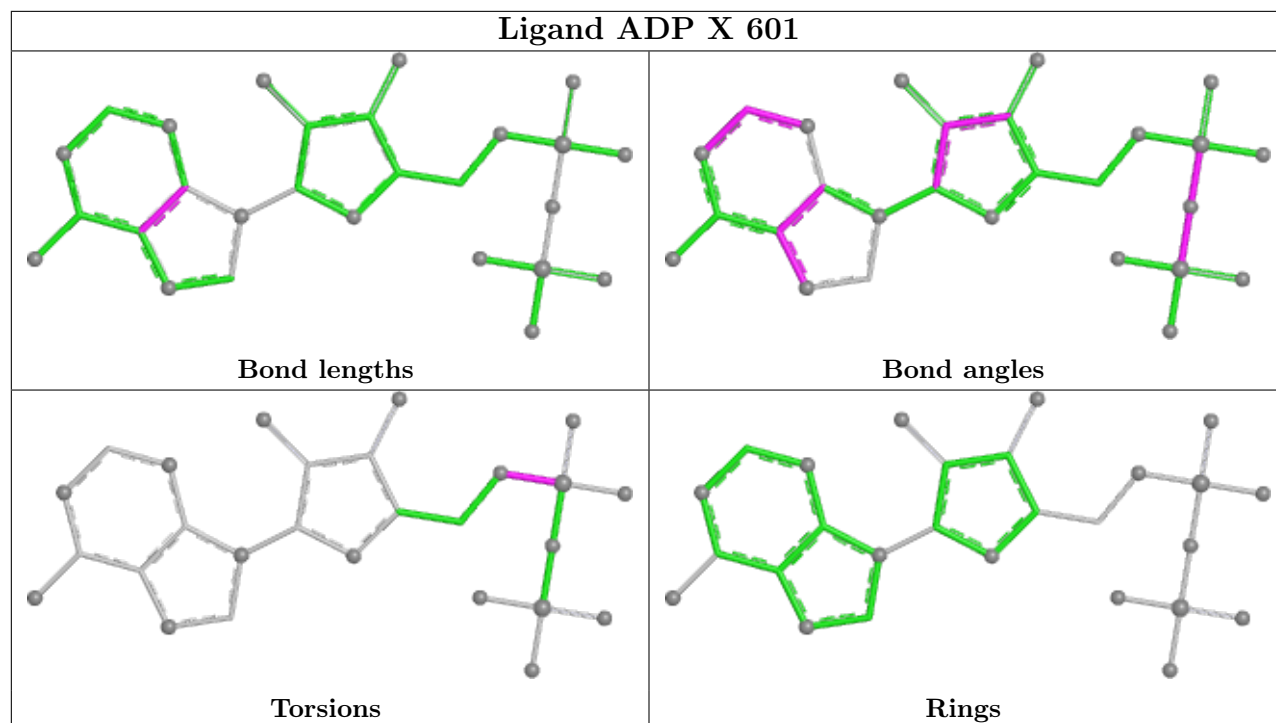
Mol	Chain	Res	Type	Atoms
20	T	1001	ATP	O4'-C4'-C5'-O5'
22	X	601	ADP	C5'-O5'-PA-O1A
22	X	601	ADP	C5'-O5'-PA-O3A
20	T	1001	ATP	C3'-C4'-C5'-O5'
22	Z	601	ADP	O4'-C4'-C5'-O5'

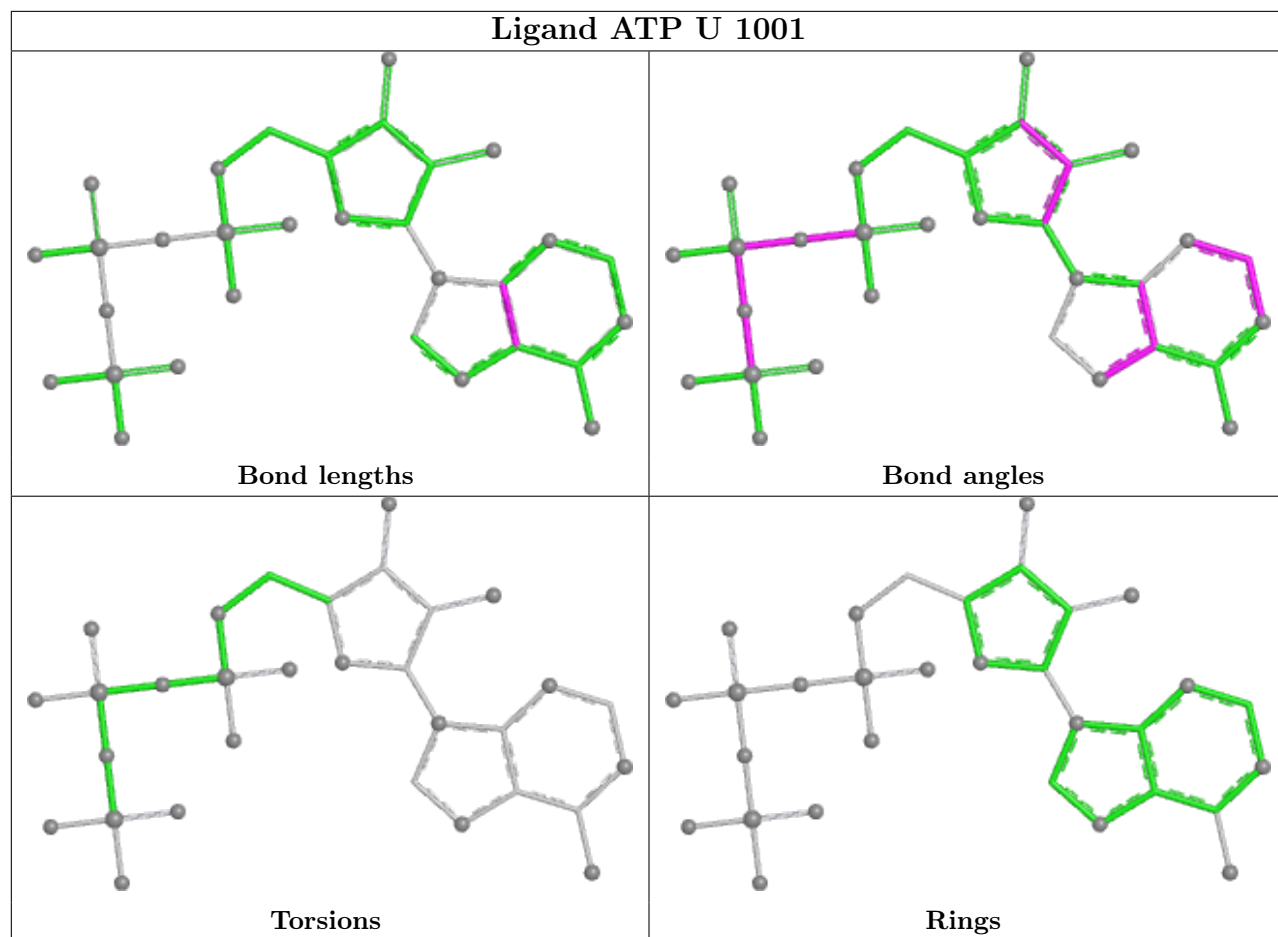
There are no ring outliers.

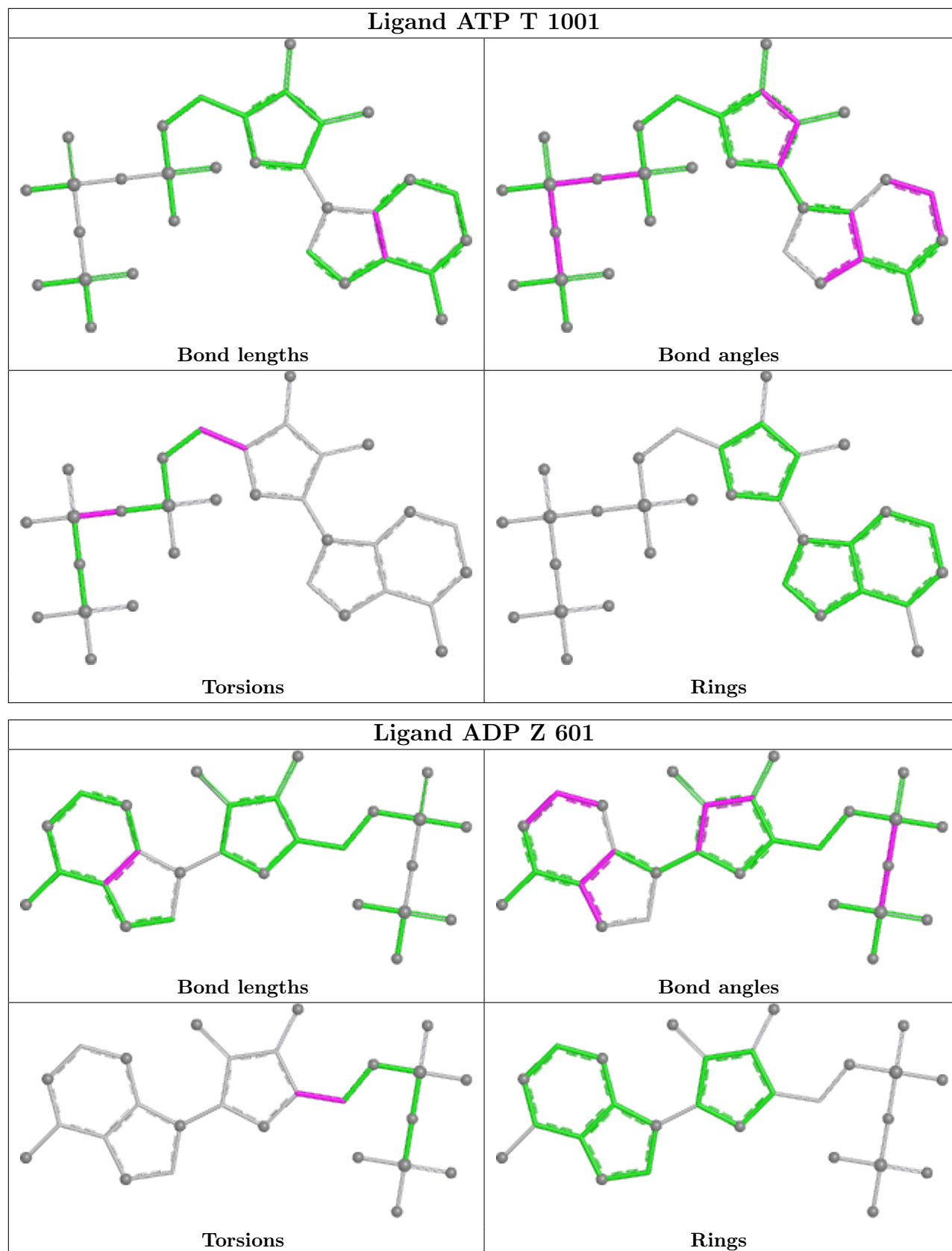
4 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
22	X	601	ADP	3	0
20	V	1001	ATP	1	0
20	U	1001	ATP	1	0
20	T	1001	ATP	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.







5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
11	C	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	C	126:PHE	C	127:ALA	N	3.47

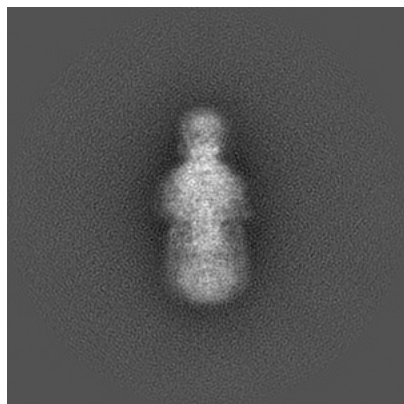
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-4856. These allow visual inspection of the internal detail of the map and identification of artifacts.

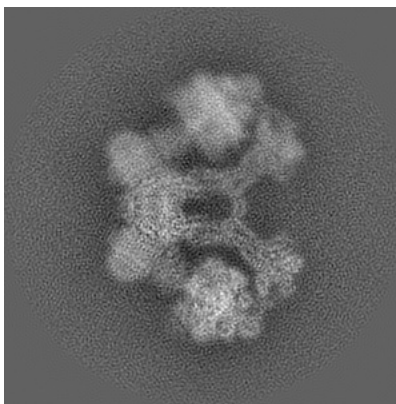
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections [i](#)

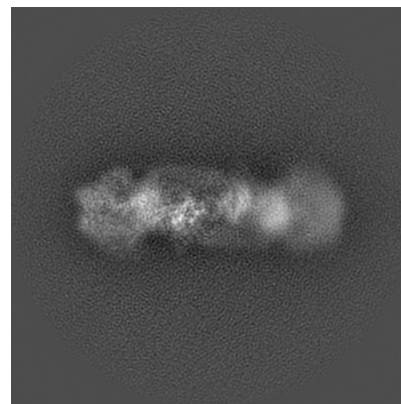
6.1.1 Primary map



X

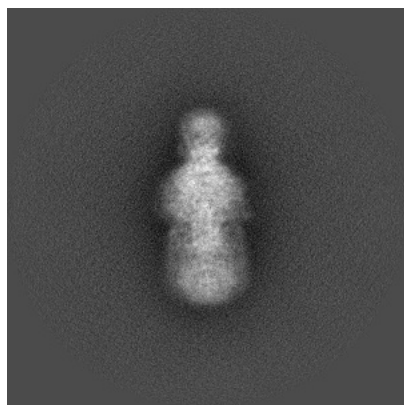


Y

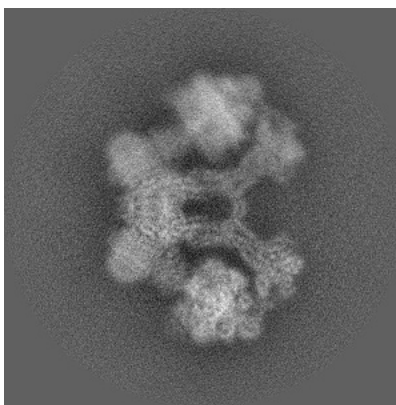


Z

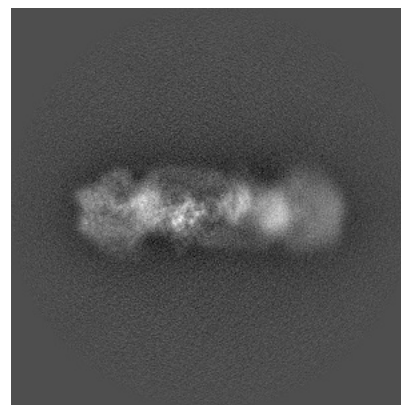
6.1.2 Raw map



X



Y

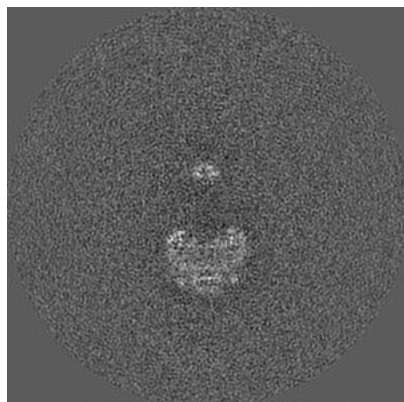


Z

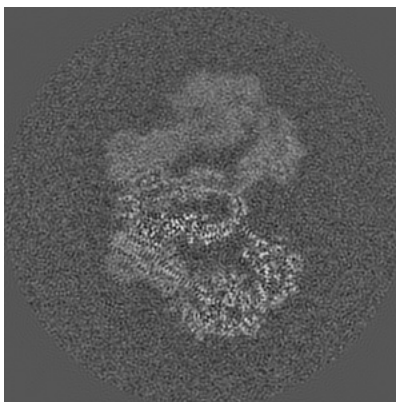
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

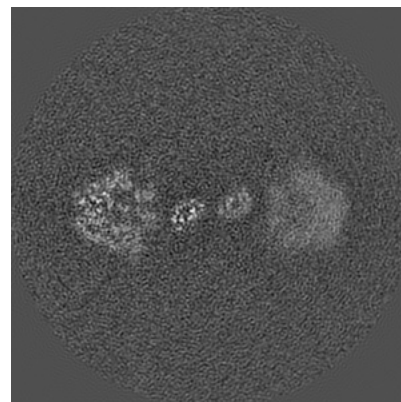
6.2.1 Primary map



X Index: 240

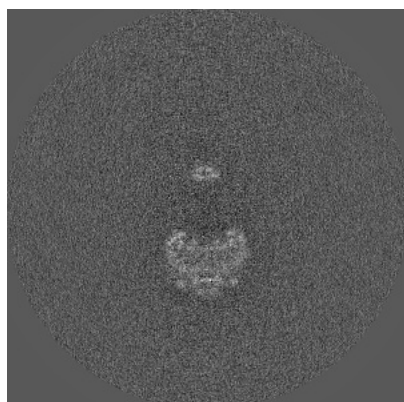


Y Index: 240

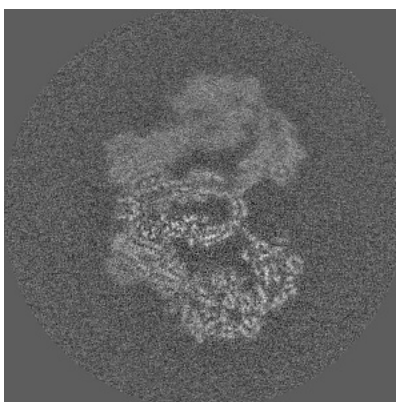


Z Index: 240

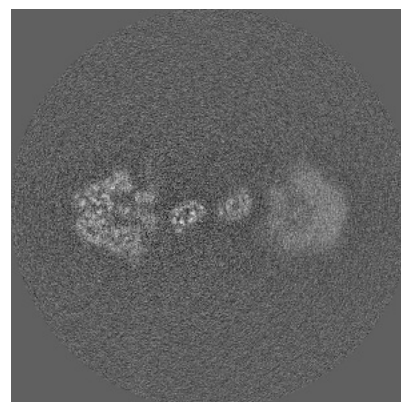
6.2.2 Raw map



X Index: 240



Y Index: 240

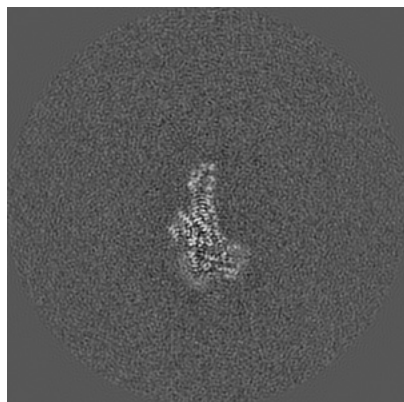


Z Index: 240

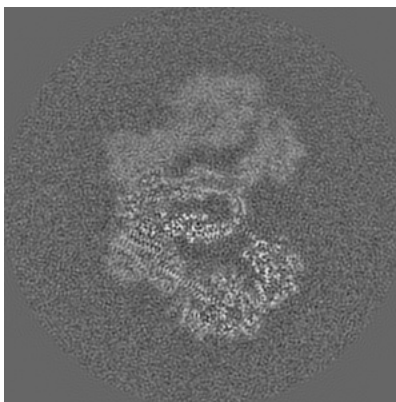
The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices [i](#)

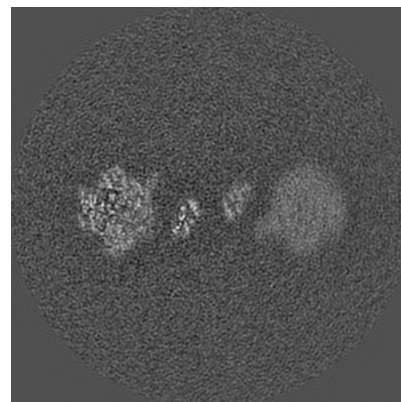
6.3.1 Primary map



X Index: 217

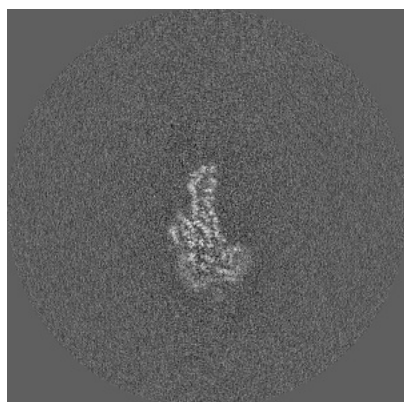


Y Index: 241

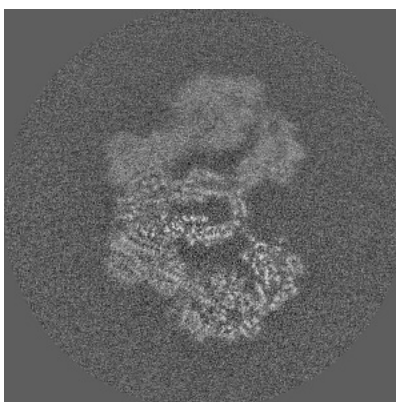


Z Index: 263

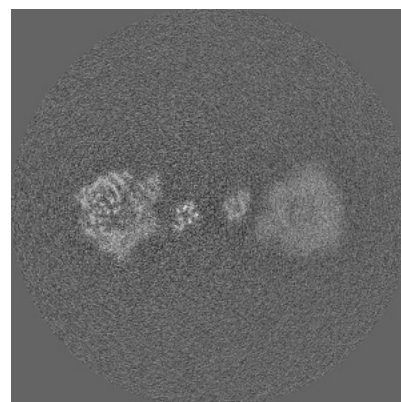
6.3.2 Raw map



X Index: 216



Y Index: 241



Z Index: 252

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

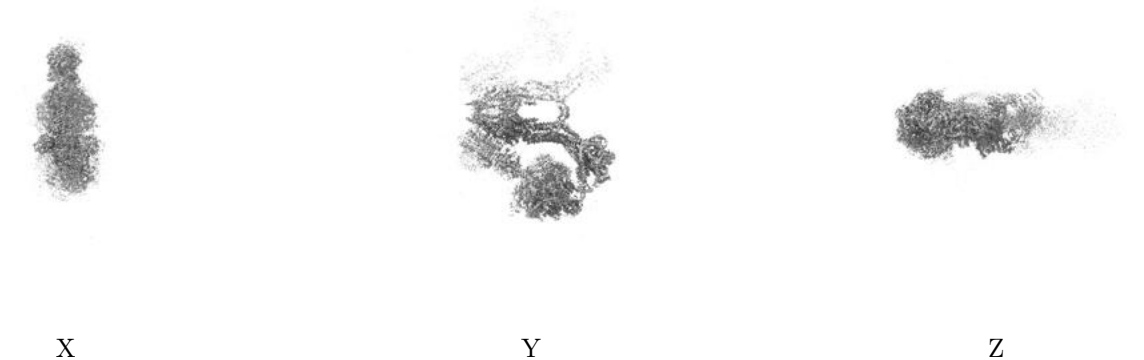
6.4 Orthogonal surface views [i](#)

6.4.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.04. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.4.2 Raw map



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

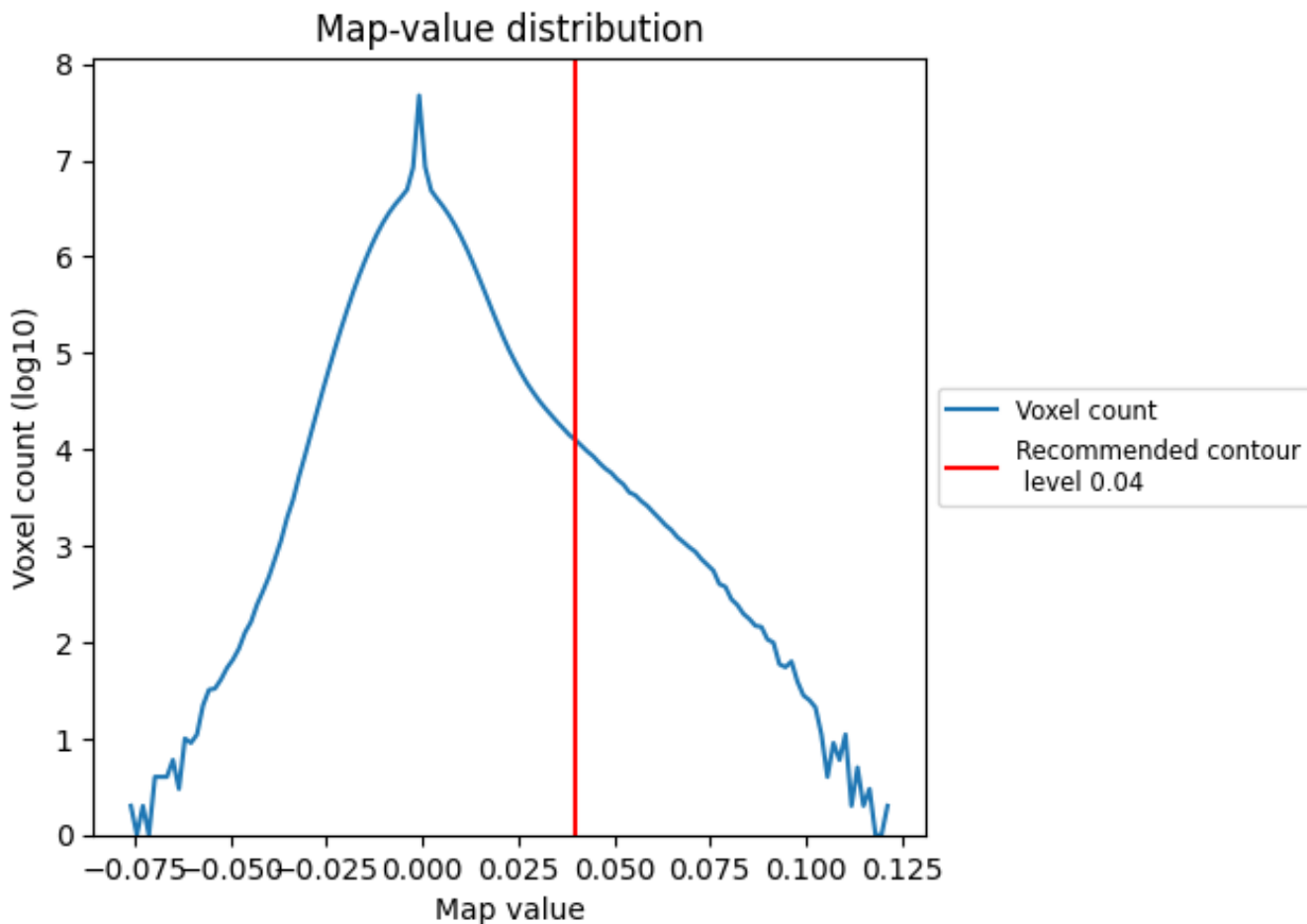
6.5 Mask visualisation [i](#)

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

7 Map analysis [i](#)

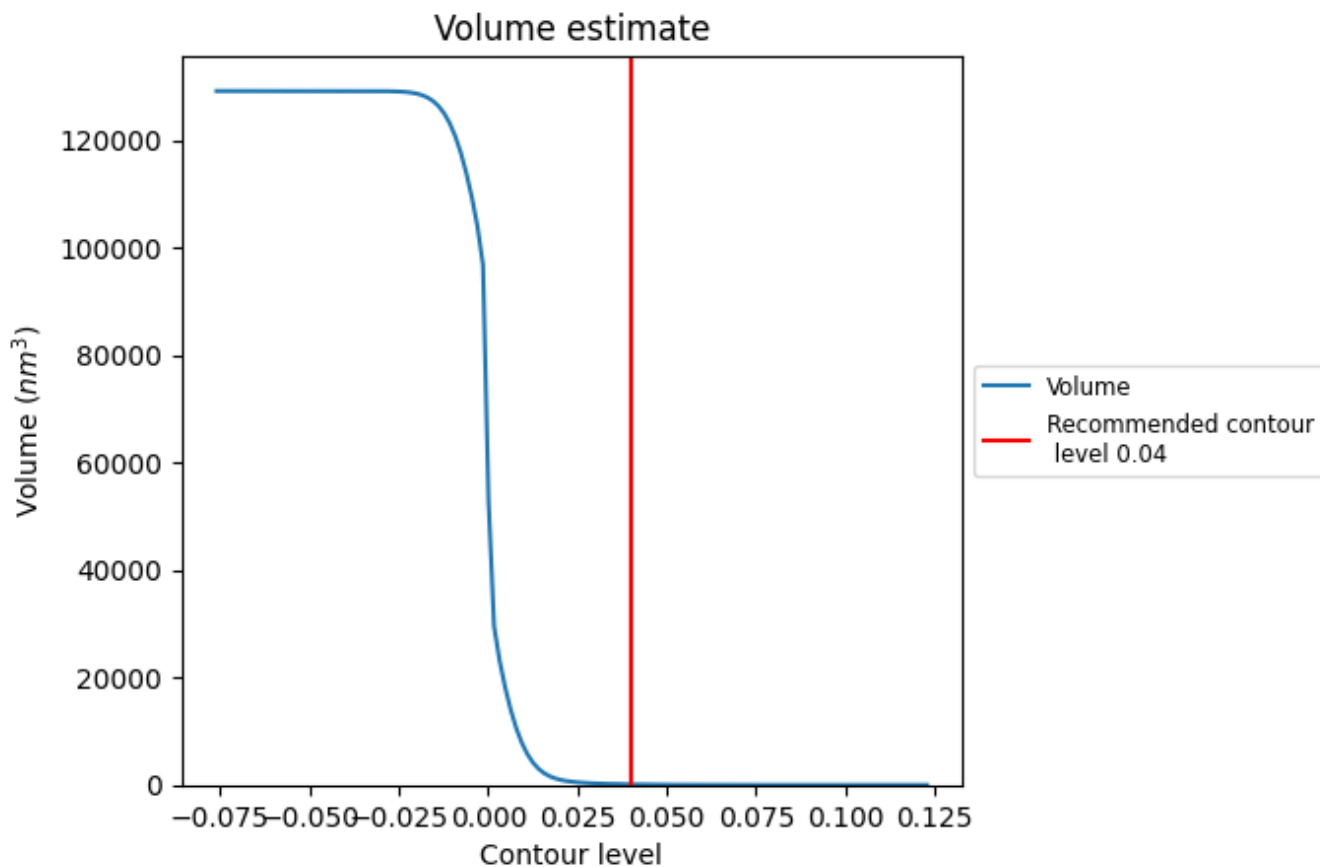
This section contains the results of statistical analysis of the map.

7.1 Map-value distribution [i](#)



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

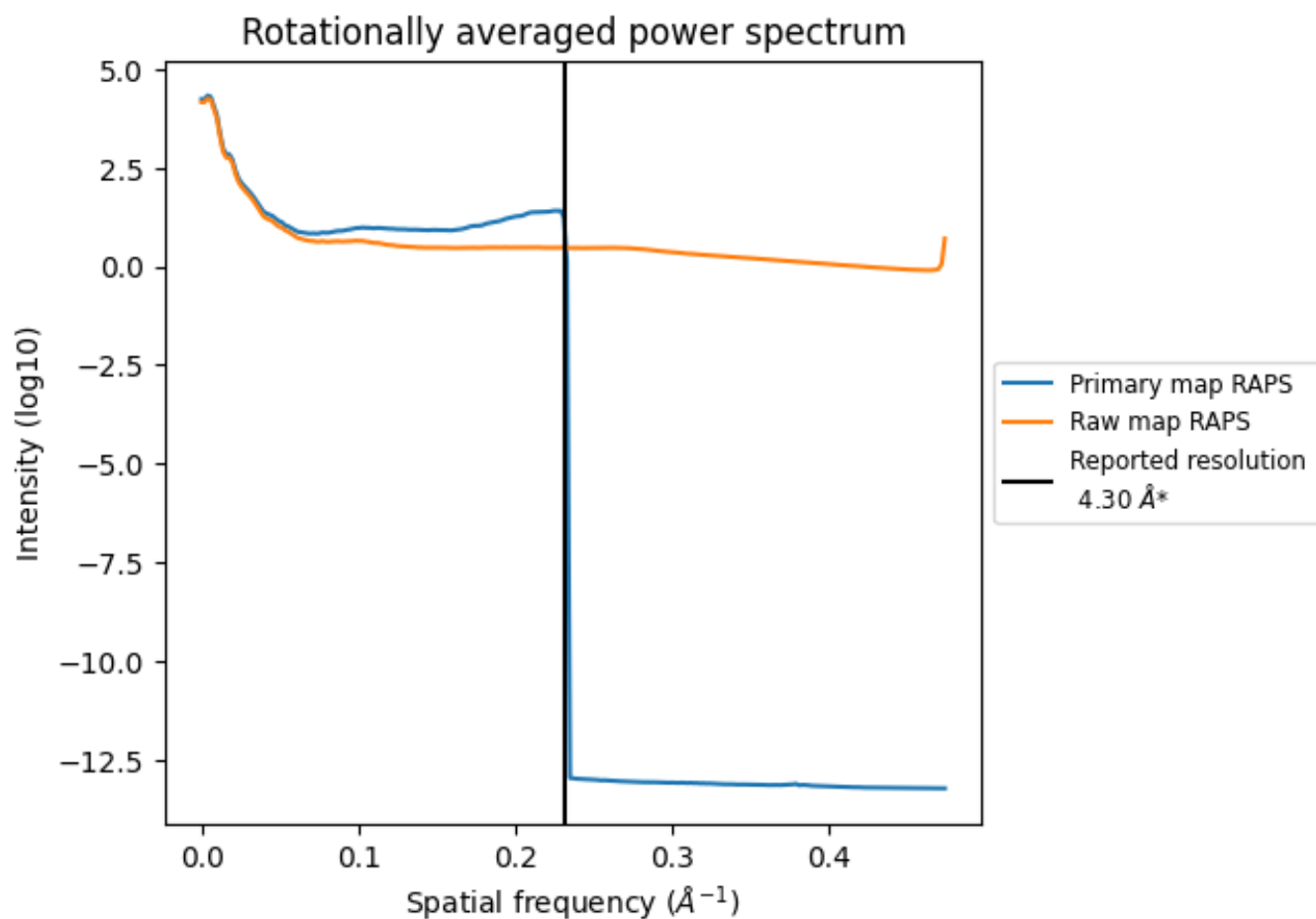
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 114 nm^3 ; this corresponds to an approximate mass of 103 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](#)

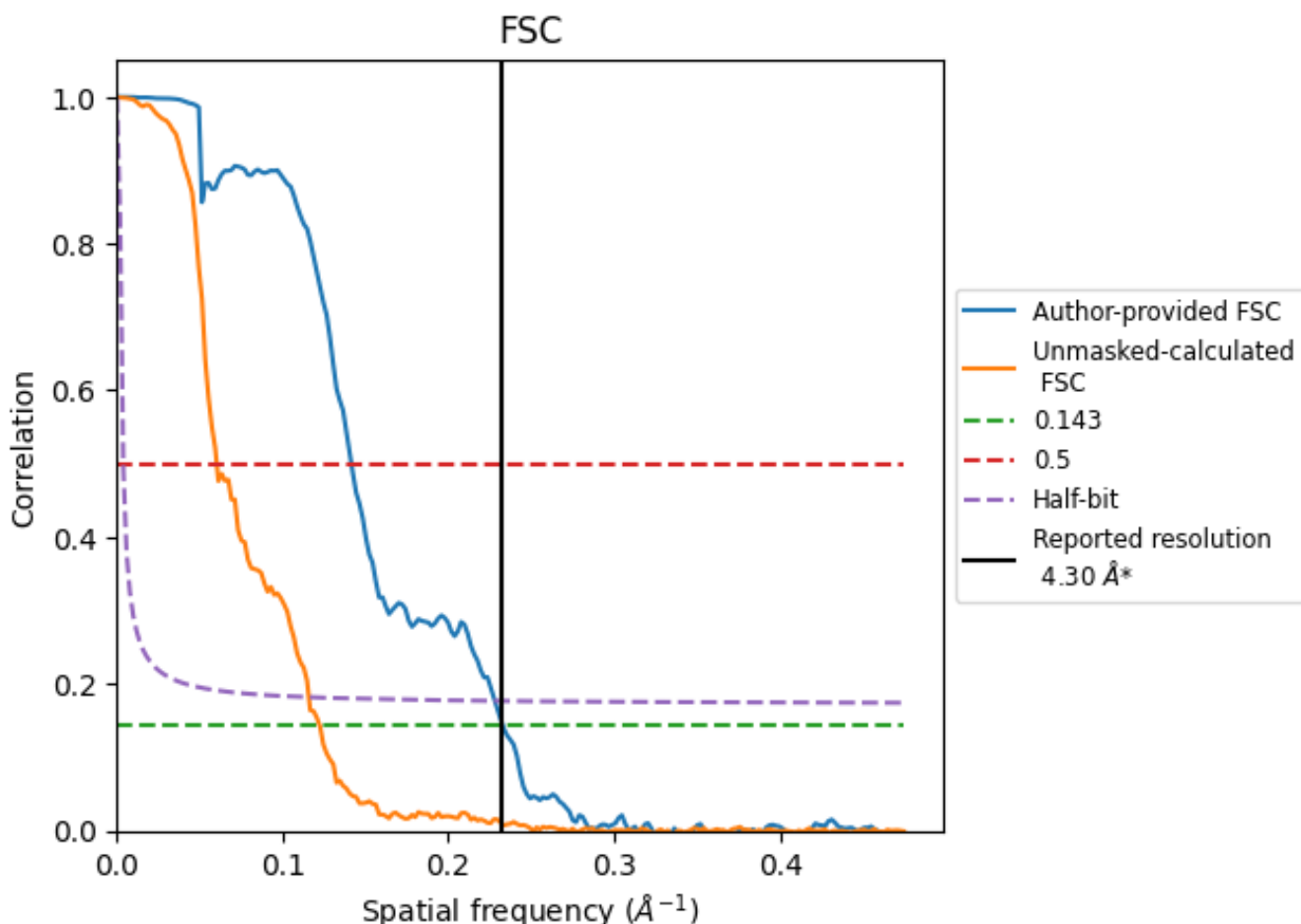


*Reported resolution corresponds to spatial frequency of 0.233 Å⁻¹

8 Fourier-Shell correlation [i](#)

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

8.1 FSC [i](#)



*Reported resolution corresponds to spatial frequency of 0.233 Å⁻¹

8.2 Resolution estimates [i](#)

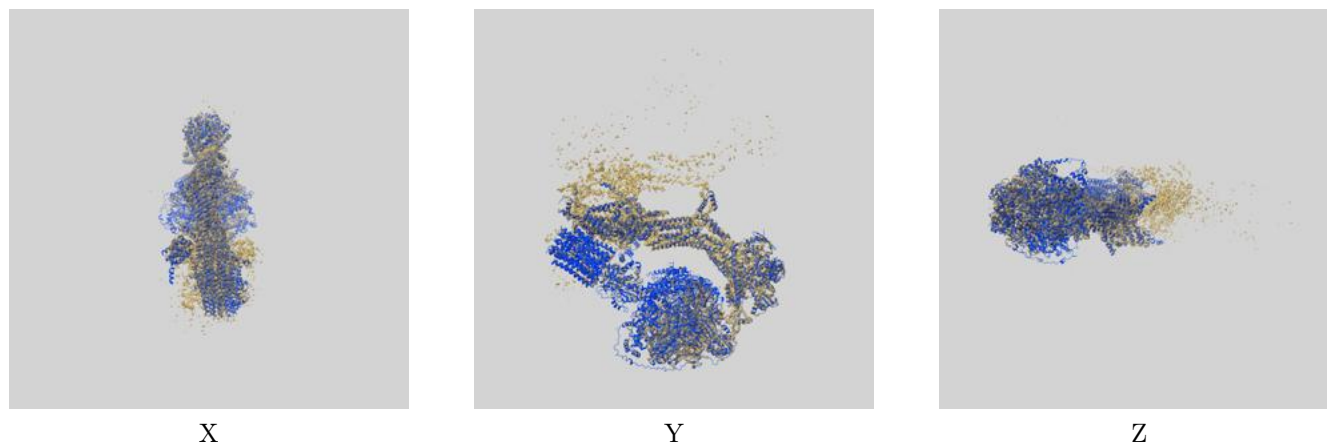
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	4.30	-	-
Author-provided FSC curve	4.30	7.07	4.39
Unmasked-calculated*	8.17	16.58	8.63

*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 8.17 differs from the reported value 4.3 by more than 10 %

9 Map-model fit [i](#)

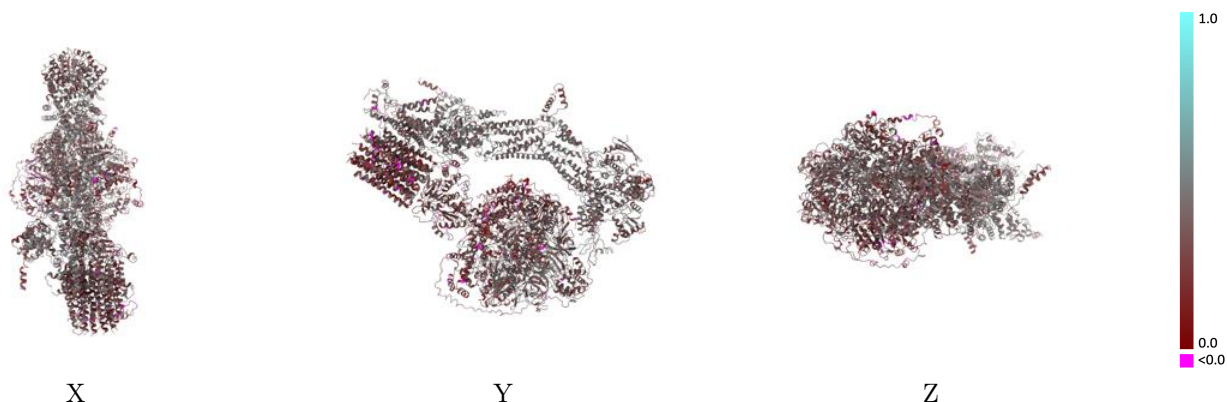
This section contains information regarding the fit between EMDB map EMD-4856 and PDB model 6RET. Per-residue inclusion information can be found in section 3 on page 10.

9.1 Map-model overlay [i](#)



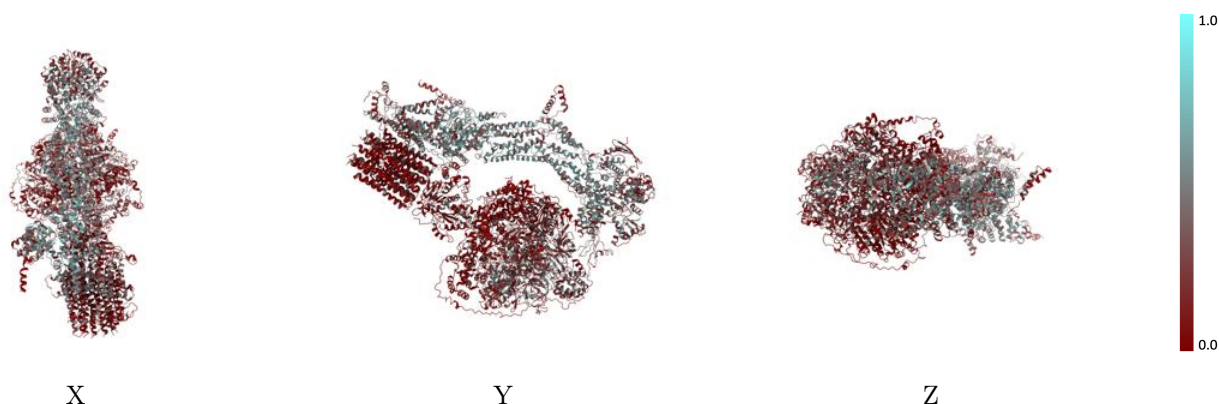
The images above show the 3D surface view of the map at the recommended contour level 0.04 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



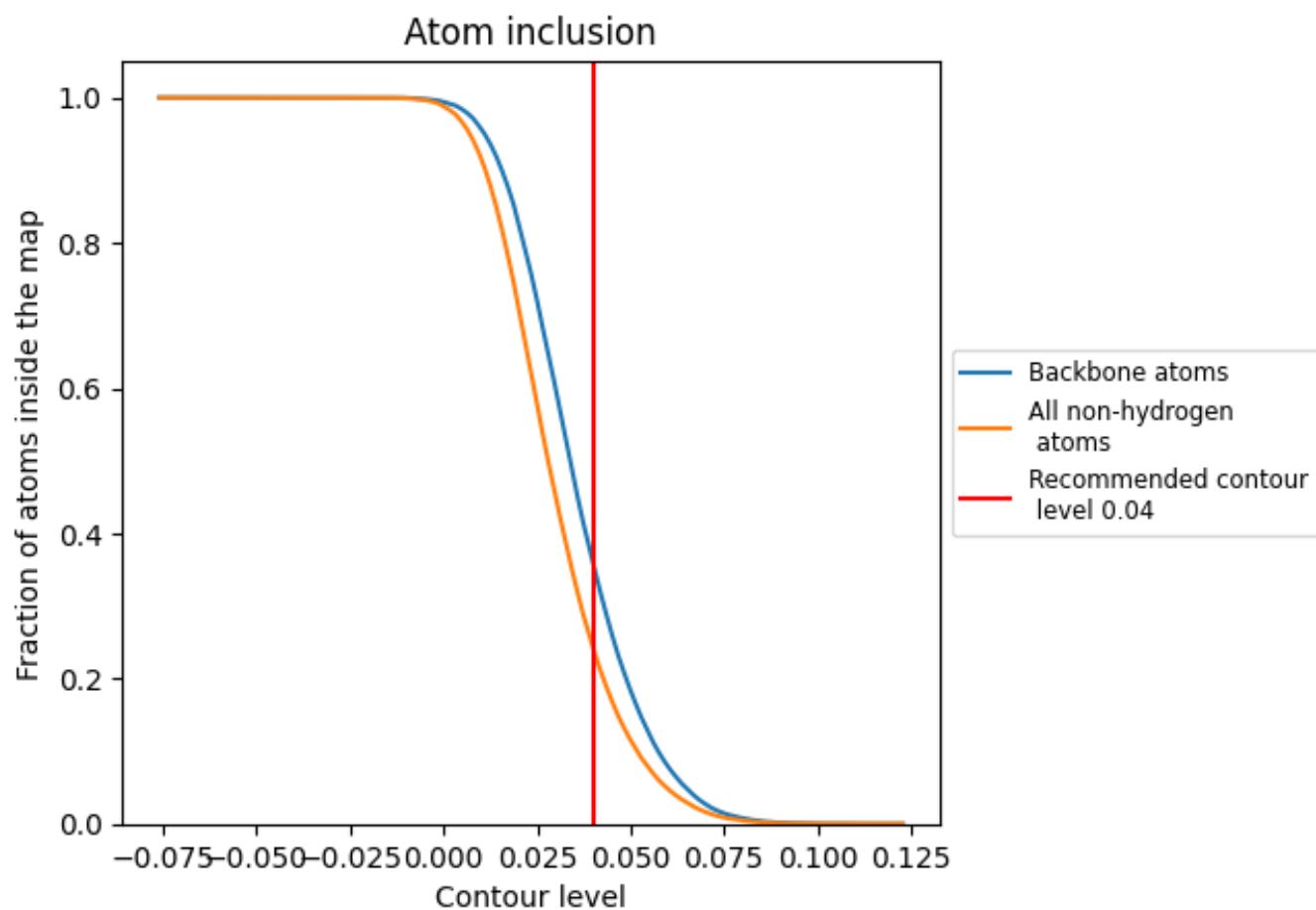
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions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

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



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.04).

































































9.4 Atom inclusion [i](#)



At the recommended contour level, 36% of all backbone atoms, 24% 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 (0.04) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.2420	 0.3470
0	 0.3561	 0.4160
1	 0.4564	 0.4220
2	 0.3570	 0.3830
3	 0.3788	 0.3880
4	 0.3911	 0.4040
5	 0.5355	 0.4430
6	 0.4315	 0.4230
7	 0.4493	 0.4180
8	 0.4351	 0.4180
9	 0.2461	 0.3570
A	 0.0685	 0.2400
B	 0.0470	 0.2690
C	 0.1135	 0.2780
D	 0.1781	 0.3040
E	 0.1194	 0.3150
F	 0.1057	 0.2940
G	 0.0665	 0.2270
H	 0.1155	 0.3000
I	 0.1115	 0.2750
J	 0.0861	 0.2690
M	 0.4015	 0.4080
P	 0.3028	 0.3670
Q	 0.0769	 0.3120
R	 0.0625	 0.2970
S	 0.1515	 0.3080
T	 0.1944	 0.3360
U	 0.1049	 0.2850
V	 0.2422	 0.3530
X	 0.0576	 0.2860
Y	 0.1957	 0.3300
Z	 0.1640	 0.3350

