



## wwPDB EM Validation Summary Report ⓘ

Mar 15, 2026 – 07:50 AM UTC

PDB ID : 8BA0 / pdb\_00008ba0  
EMDB ID : EMD-15937  
Title : Drosophila melanogaster complex I in the Twisted state (Dm2)  
Authors : Agip, A.N.A.; Chung, I.; Sanchez-Martinez, A.; Whitworth, A.J.; Hirst, J.  
Deposited on : 2022-10-10  
Resolution : 3.68 Å (reported)  
Based on initial model : 6ZR2

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

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

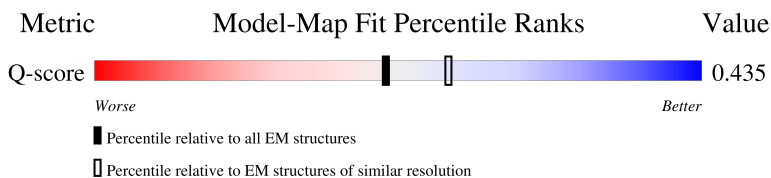
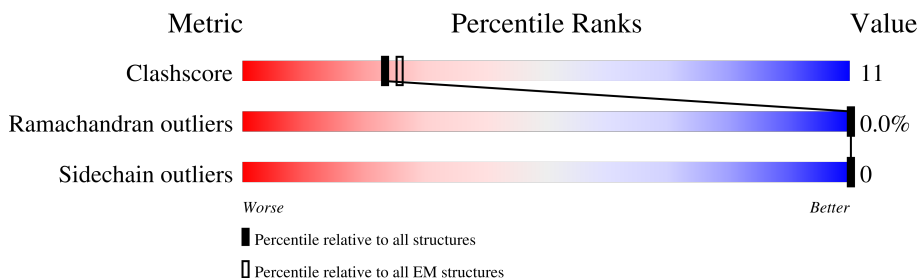
EMDB validation analysis : 0.0.1.dev132  
Mogul : 2022.3.0, CSD as543be (2022)  
MolProbity : 4-5-2 with Phenix2.0  
Buster-report : wwPDB partial adaption of 1.1.7 (2018)  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
EM percentile statistics : 202505.v01 (Using data in the EMDB archive up until May 2025)  
MapQ : 1.9.13  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

# 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 3.68 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)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	229148	23984	-
Ramachandran outliers	224038	23583	-
Sidechain outliers	223484	23102	-
Q-score	-	25397	11376 ( 3.18 - 4.18 )

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

Mol	Chain	Length	Quality of chain
1	A	117	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">19%</div> <div style="width: 100%; height: 15px; background: linear-gradient(to right, red, orange, yellow, green);"></div> <div style="text-align: center;">65%</div> <div style="text-align: center;">35%</div> </div>
2	B	182	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">7%</div> <div style="width: 100%; height: 15px; background: linear-gradient(to right, red, orange, yellow, green);"></div> <div style="text-align: center;">72%</div> <div style="text-align: center;">27%</div> </div>
3	C	209	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">9%</div> <div style="width: 100%; height: 15px; background: linear-gradient(to right, red, orange, yellow, green);"></div> <div style="text-align: center;">78%</div> <div style="text-align: center;">22%</div> </div>
4	D	428	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">14%</div> <div style="width: 100%; height: 15px; background: linear-gradient(to right, red, orange, yellow, green);"></div> <div style="text-align: center;">72%</div> <div style="text-align: center;">27%</div> </div>

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Mol	Chain	Length	Quality of chain
5	E	214	
6	F	439	
7	G	731	
8	H	315	
9	I	186	
10	J	167	
11	K	93	
12	L	577	
13	M	446	
14	N	341	
15	O	368	
16	P	377	
17	Q	130	
18	R	89	
19	T	152	
19	U	152	
20	V	118	
21	W	114	
22	X	174	
23	Y	167	
24	Z	146	
25	a	73	
26	b	66	
27	d	115	
28	e	100	

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Mol	Chain	Length	Quality of chain
29	f	56	48% 71% 29%
30	g	106	39% 73% 27%
31	h	145	17% 78% 22%
32	i	161	42% 78% 22%
33	j	59	49% 71% 29%
34	k	84	52% 81% 19%
35	l	144	38% 87% 13%
36	m	108	31% 81% 19%
37	n	134	38% 75% 25%
38	o	112	30% 81% 19%
39	p	151	16% 72% 28%
40	q	135	21% 72% 28%
41	r	103	23% 68% 18% 14%
42	s	62	35% 82% 18%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
43	SF4	F	502	-	-	X	-
43	SF4	G	801	-	-	X	-

## 2 Entry composition

There are 51 unique types of molecules in this entry. The entry contains 65912 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 NADH-ubiquinone oxidoreductase chain 3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	117	956	652	141	156	7	0	0

- Molecule 2 is a protein called LD31474p.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	182	1435	920	251	250	14	0	0

- Molecule 3 is a protein called NADH dehydrogenase [ubiquinone] iron-sulfur protein 3, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	C	209	1726	1103	303	315	5	0	0

- Molecule 4 is a protein called Complex I-49kD.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	D	428	3424	2196	577	628	23	0	0

- Molecule 5 is a protein called NADH dehydrogenase (Ubiquinone) 24 kDa subunit, isoform A.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	E	214	1679	1062	285	320	12	0	0

- Molecule 6 is a protein called NADH dehydrogenase [ubiquinone] flavoprotein 1, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
6	F	439	3367	2129	599	613	26	0	0

- Molecule 7 is a protein called NADH-ubiquinone oxidoreductase 75 kDa subunit, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
7	G	677	5146	3225	912	980	29	0	0

- Molecule 8 is a protein called NADH-ubiquinone oxidoreductase chain 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
8	H	315	2571	1764	367	418	22	0	0

- Molecule 9 is a protein called NADH dehydrogenase (ubiquinone) 23 kDa subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
9	I	186	1485	935	251	287	12	0	0

- Molecule 10 is a protein called NADH-ubiquinone oxidoreductase chain 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
10	J	167	1351	917	192	227	15	0	0

- Molecule 11 is a protein called NADH-ubiquinone oxidoreductase chain 4L.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
11	K	93	771	526	110	123	12	0	0

- Molecule 12 is a protein called NADH-ubiquinone oxidoreductase chain 5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
12	L	577	4606	3092	680	774	60	0	0

- Molecule 13 is a protein called NADH-ubiquinone oxidoreductase chain 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
13	M	446	3617	2459	533	583	42	0	0

- Molecule 14 is a protein called NADH-ubiquinone oxidoreductase chain 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
14	N	341	2796	1893	411	458	34	0	0

- Molecule 15 is a protein called NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 10, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
15	O	368	3007	1927	504	560	16	0	0

- Molecule 16 is a protein called NADH dehydrogenase (Ubiquinone) 39 kDa subunit, isoform A.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
16	P	377	3032	1934	546	542	10	0	0

- Molecule 17 is a protein called NADH dehydrogenase [ubiquinone] iron-sulfur protein 4, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
17	Q	130	1054	659	198	193	4	0	0

- Molecule 18 is a protein called NADH dehydrogenase [ubiquinone] iron-sulfur protein 6, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
18	R	89	716	453	130	129	4	0	0

- Molecule 19 is a protein called Acyl carrier protein, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
19	T	77	615	398	94	121	2	0	0

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Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
19	U	85	684	442	103	137	2	0	0

- Molecule 20 is a protein called NADH dehydrogenase (Ubiquinone) 13 kDa B subunit.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
20	V	118	922	588	162	168	4	0	0

- Molecule 21 is a protein called NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
21	W	114	968	620	172	170	6	0	0

- Molecule 22 is a protein called NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 8.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
22	X	174	1383	867	240	266	10	0	0

- Molecule 23 is a protein called NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 11.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
23	Y	167	1277	829	212	230	6	0	0

- Molecule 24 is a protein called NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 13.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
24	Z	146	1201	787	203	209	2	0	0

- Molecule 25 is a protein called NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
25	a	73	601	386	101	108	6	0	0

- Molecule 26 is a protein called RH45008p.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
26	b	66	519	327	95	96	1	0	0

- Molecule 27 is a protein called NADH dehydrogenase [ubiquinone] 1 subunit C2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
27	d	115	907	590	159	157	1	0	0

- Molecule 28 is a protein called NADH dehydrogenase [ubiquinone] iron-sulfur protein 5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
28	e	100	828	523	145	149	11	0	0

- Molecule 29 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
29	f	56	437	283	77	74	3	0	0

- Molecule 30 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 11, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
30	g	106	870	560	140	169	1	0	0

- Molecule 31 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 5, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
31	h	145	1234	795	213	223	3	0	0

- Molecule 32 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
32	i	161	1302	829	242	226	5	0	0

- Molecule 33 is a protein called GEO11417p1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
33	j	59	489	319	88	81	1	0	0

- Molecule 34 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
34	k	84	671	437	117	116	1	0	0

- Molecule 35 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 8, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
35	l	144	1201	783	191	223	4	0	0

- Molecule 36 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
36	m	108	892	571	163	157	1	0	0

- Molecule 37 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 9.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
37	n	134	1152	735	218	196	3	0	0

- Molecule 38 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 7.

Mol	Chain	Residues	Atoms					AltConf	Trace
38	o	112	Total	C	N	O	S	0	0
			937	596	163	169	9		

- Molecule 39 is a protein called NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 10.

Mol	Chain	Residues	Atoms					AltConf	Trace
39	p	151	Total	C	N	O	S	0	0
			1266	795	233	228	10		

- Molecule 40 is a protein called NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 12.

Mol	Chain	Residues	Atoms					AltConf	Trace
40	q	135	Total	C	N	O	S	0	0
			1130	735	189	201	5		

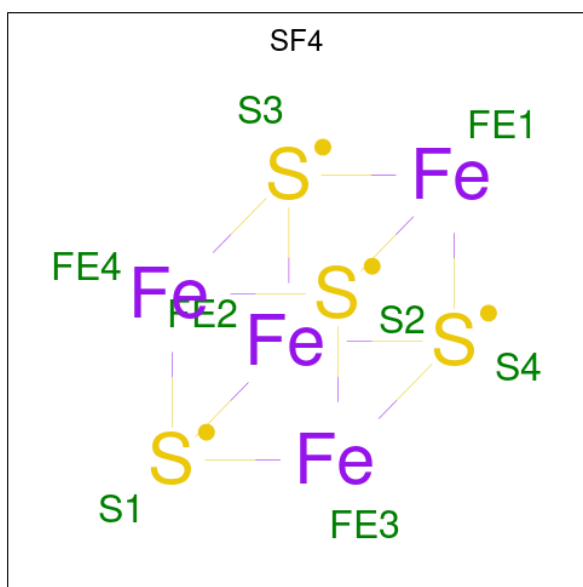
- Molecule 41 is a protein called NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 7.

Mol	Chain	Residues	Atoms					AltConf	Trace
41	r	89	Total	C	N	O	S	0	0
			724	457	136	130	1		

- Molecule 42 is a protein called NADH dehydrogenase [ubiquinone] flavoprotein 3, mitochondrial.

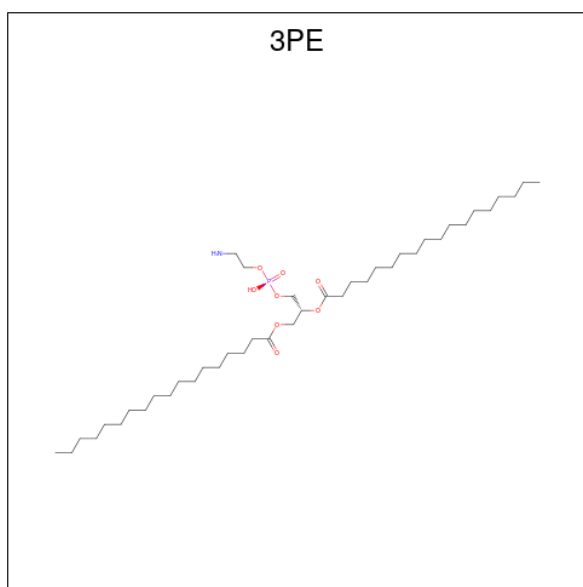
Mol	Chain	Residues	Atoms					AltConf	Trace
42	s	62	Total	C	N	O	S	0	0
			456	288	75	90	3		

- Molecule 43 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe<sub>4</sub>S<sub>4</sub>).



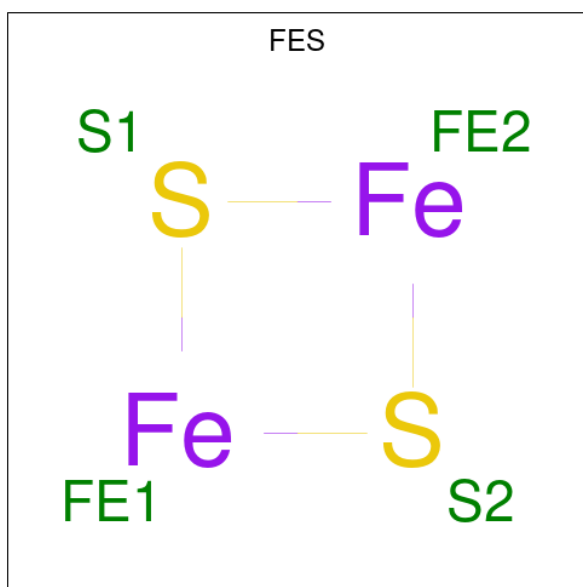
Mol	Chain	Residues	Atoms			AltConf
			Total	Fe	S	
43	B	1	8	4	4	0
43	F	1	8	4	4	0
43	G	1	8	4	4	0
43	G	1	8	4	4	0
43	I	1	8	4	4	0
43	I	1	8	4	4	0

- Molecule 44 is 1,2-Distearoyl-sn-glycerophosphoethanolamine (CCD ID: 3PE) (formula:  $C_{41}H_{82}NO_8P$ ).



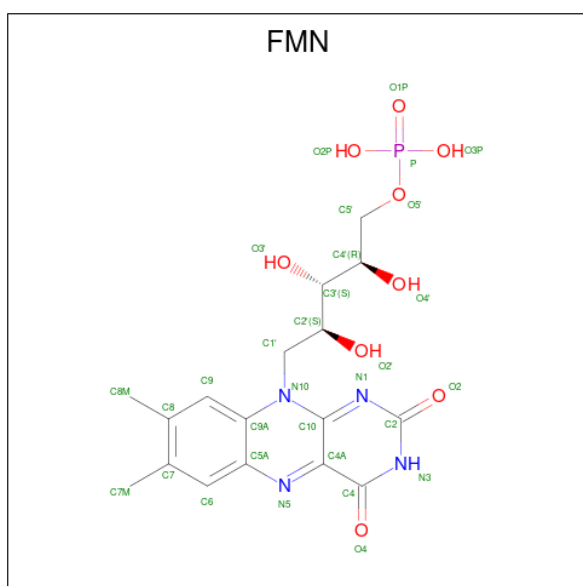
Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
44	B	1	42	32	1	8	1	0
44	B	1	26	16	1	8	1	0
44	L	1	35	25	1	8	1	0
44	Y	1	20	10	1	8	1	0
44	Y	1	22	12	1	8	1	0
44	Y	1	25	15	1	8	1	0

- Molecule 45 is FE2/S2 (INORGANIC) CLUSTER (CCD ID: FES) (formula: Fe<sub>2</sub>S<sub>2</sub>).



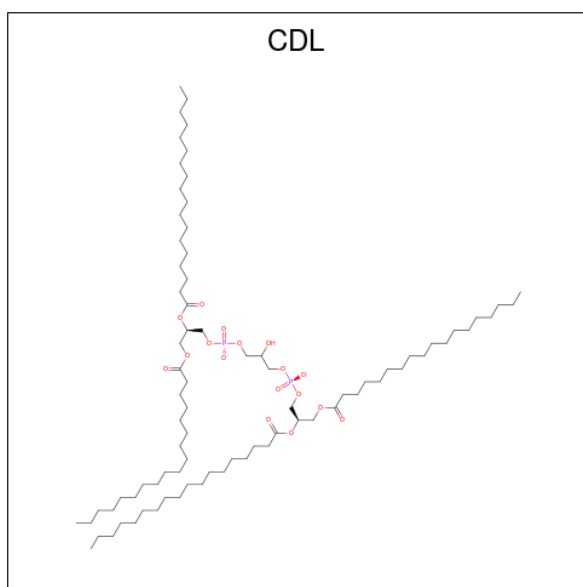
Mol	Chain	Residues	Atoms			AltConf
45	E	1	Total	Fe	S	0
			4	2	2	
45	G	1	Total	Fe	S	0
			4	2	2	

- Molecule 46 is FLAVIN MONONUCLEOTIDE (CCD ID: FMN) (formula:  $C_{17}H_{21}N_4O_9P$ ).



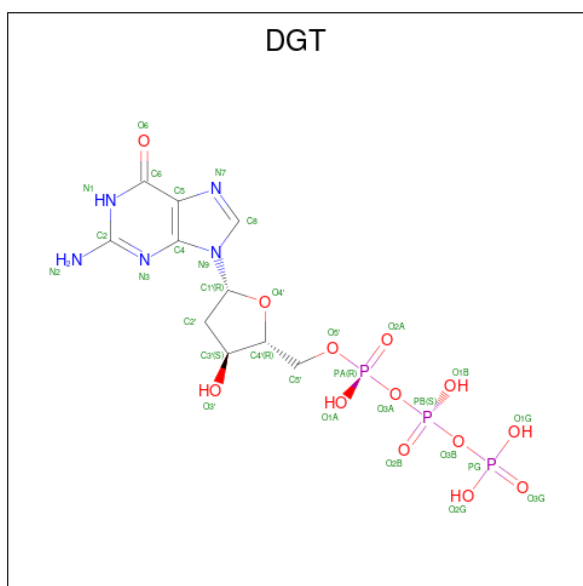
Mol	Chain	Residues	Atoms				AltConf	
46	F	1	Total	C	N	O	P	0
			31	17	4	9	1	

- Molecule 47 is CARDIOLIPIN (CCD ID: CDL) (formula:  $C_{81}H_{156}O_{17}P_2$ ).



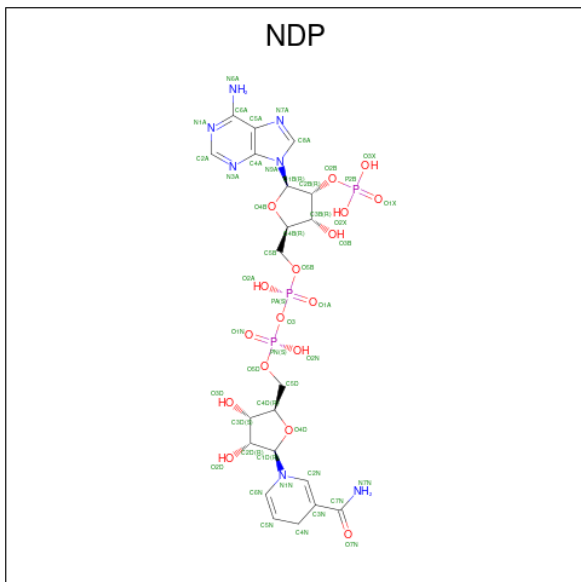
Mol	Chain	Residues	Atoms				AltConf
			Total	C	O	P	
47	M	1	55	36	17	2	0
47	P	1	41	22	17	2	0

- Molecule 48 is 2'-DEOXYGUANOSINE-5'-TRIPHOSPHATE (CCD ID: DGT) (formula:  $C_{10}H_{16}N_5O_{13}P_3$ ).



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

- Molecule 49 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (CCD ID: NDP) (formula:  $C_{21}H_{30}N_7O_{17}P_3$ ).

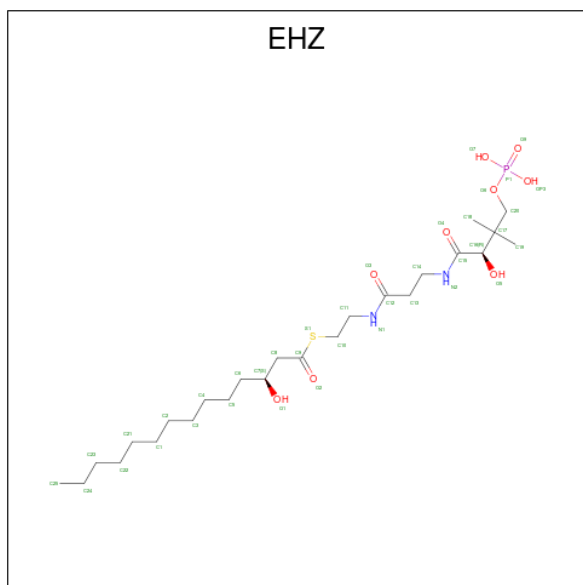


Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
49	P	1	48	21	7	17	3	0

- Molecule 50 is ZINC ION (CCD ID: ZN) (formula:  $Zn$ ).

Mol	Chain	Residues	Atoms		AltConf
			Total	Zn	
50	R	1	1	1	0

- Molecule 51 is  $\{S\}$ -[2-[3-[(2  $\{R\}$ )-3,3-dimethyl-2-oxidanyl-4-phosphonoxy-butanoyl]amino]propanoylamino]ethyl] (3  $\{S\}$ )-3-oxidanyltetradecanethioate (CCD ID: EHZ) (formula:  $C_{25}H_{49}N_2O_9PS$ ).

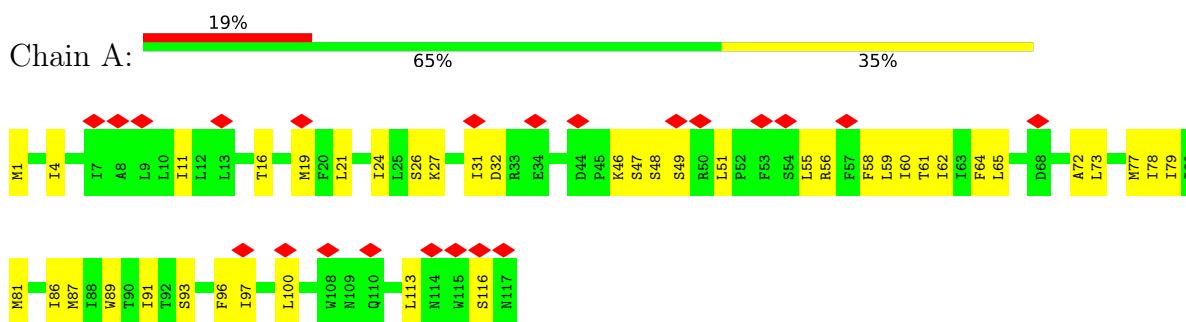


Mol	Chain	Residues	Atoms					AltConf		
			Total	C	N	O	P		S	
51	T	1	Total	37	25	2	8	1	1	0
51	U	1	Total	37	25	2	8	1	1	0

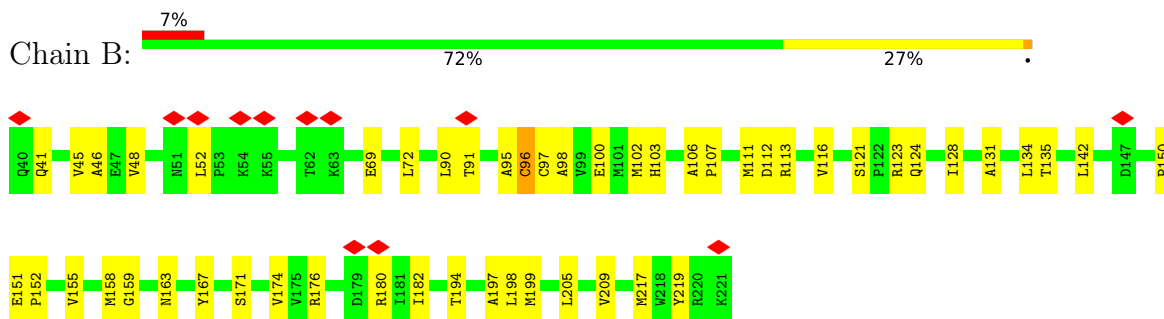
### 3 Residue-property plots [i](#)

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.

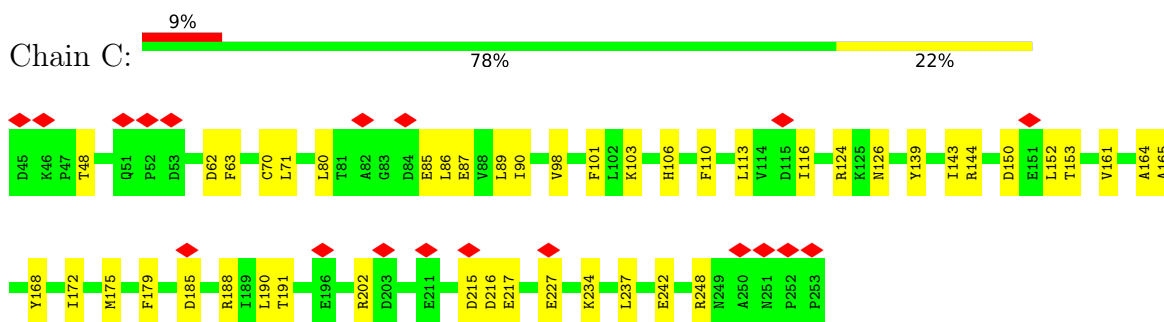
- Molecule 1: NADH-ubiquinone oxidoreductase chain 3



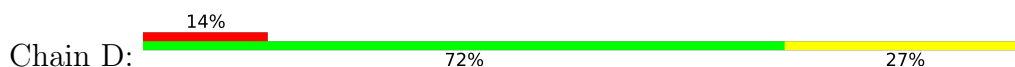
- Molecule 2: LD31474p

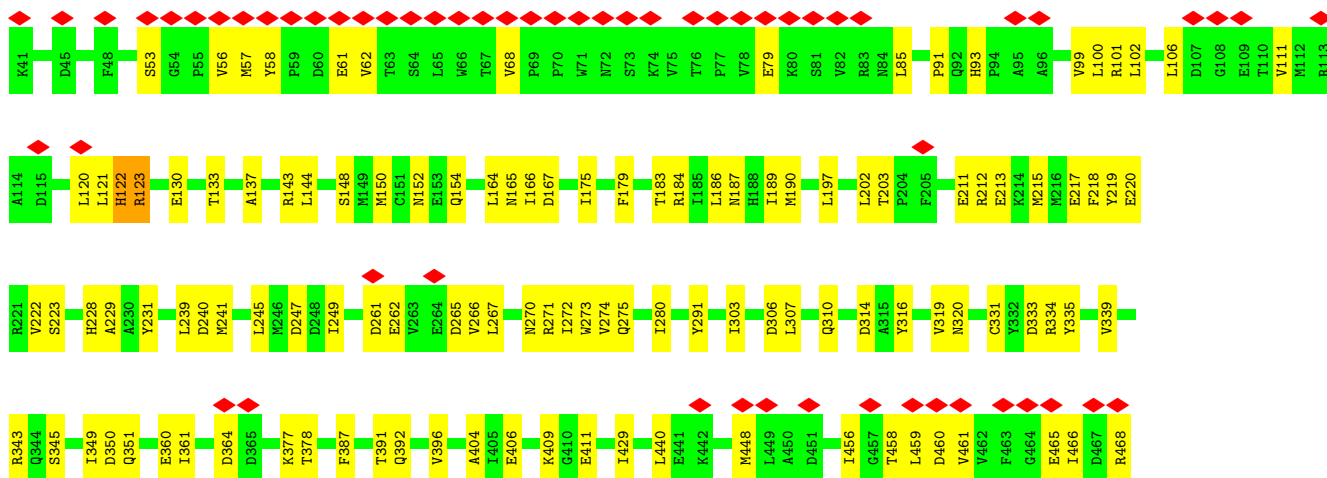


- Molecule 3: NADH dehydrogenase [ubiquinone] iron-sulfur protein 3, mitochondrial

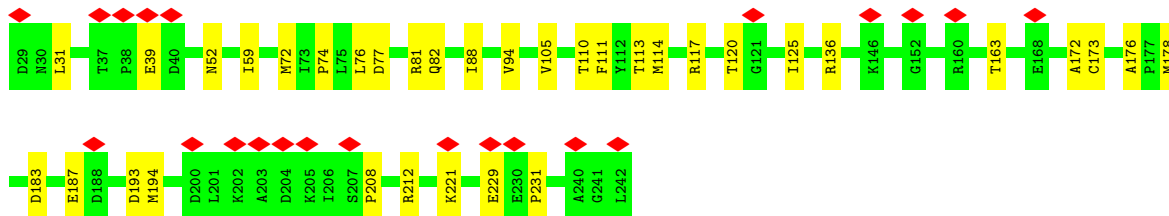
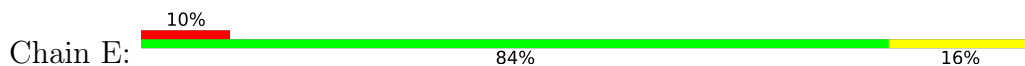


- Molecule 4: Complex I-49kD

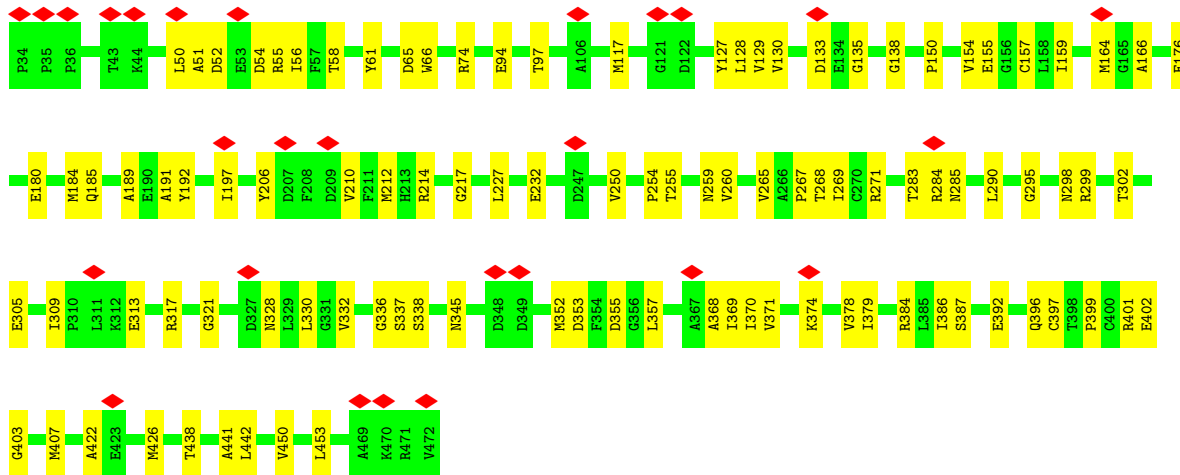
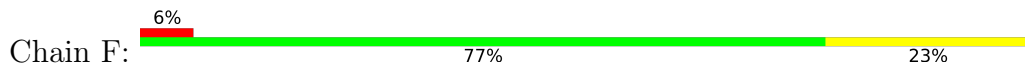




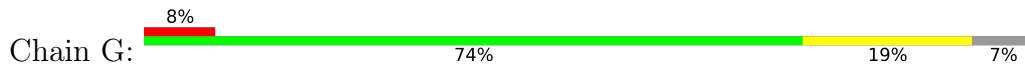
• Molecule 5: NADH dehydrogenase (Ubiquinone) 24 kDa subunit, isoform A

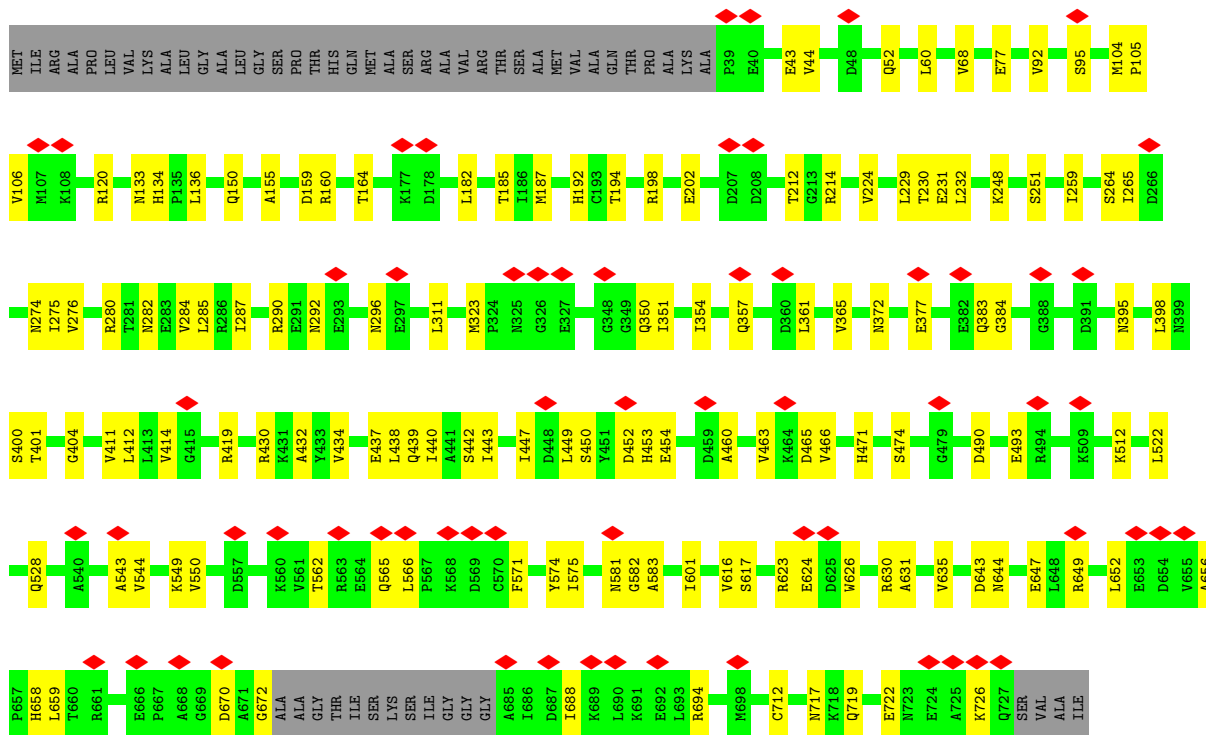


• Molecule 6: NADH dehydrogenase [ubiquinone] flavoprotein 1, mitochondrial

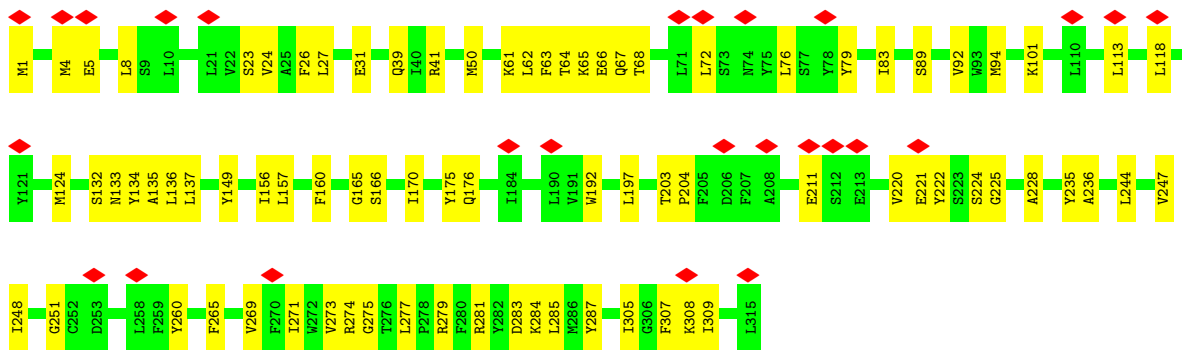
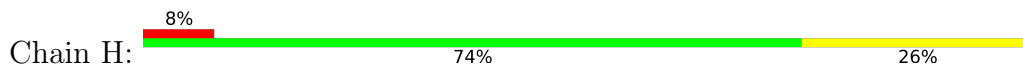


• Molecule 7: NADH-ubiquinone oxidoreductase 75 kDa subunit, mitochondrial

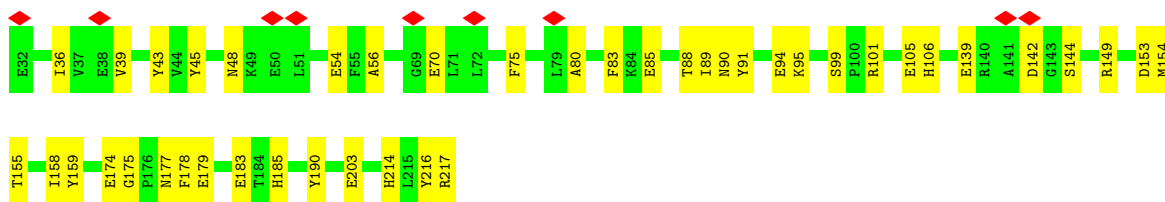
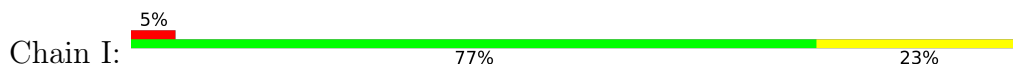




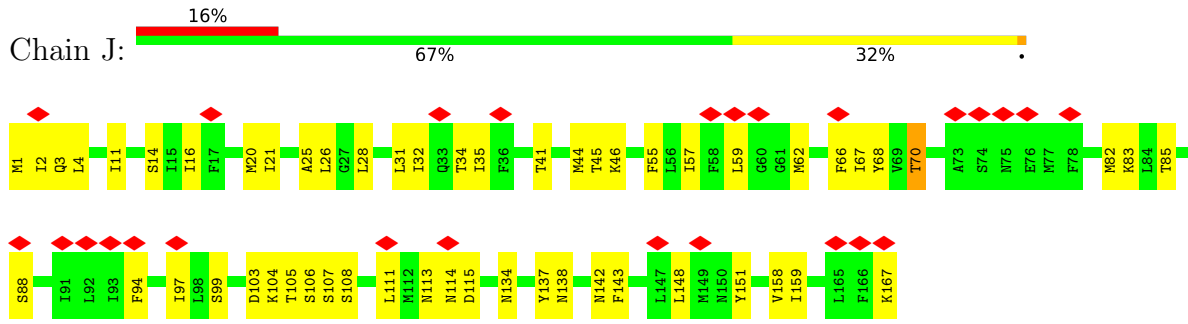
• Molecule 8: NADH-ubiquinone oxidoreductase chain 1



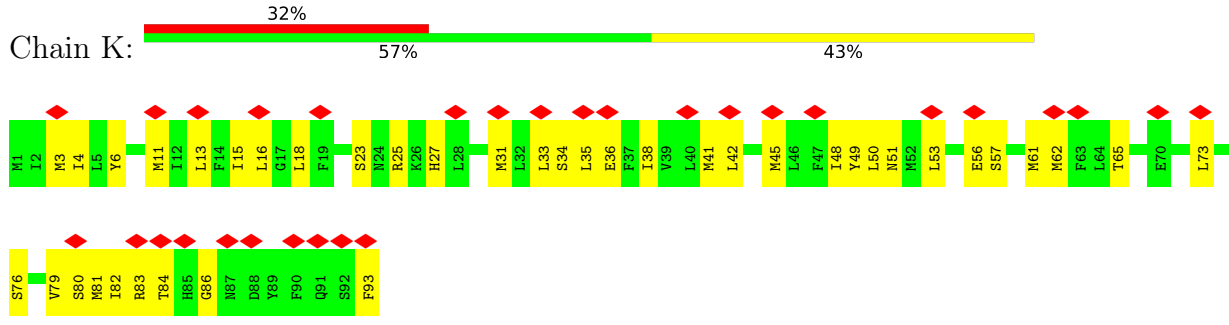
• Molecule 9: NADH dehydrogenase (ubiquinone) 23 kDa subunit



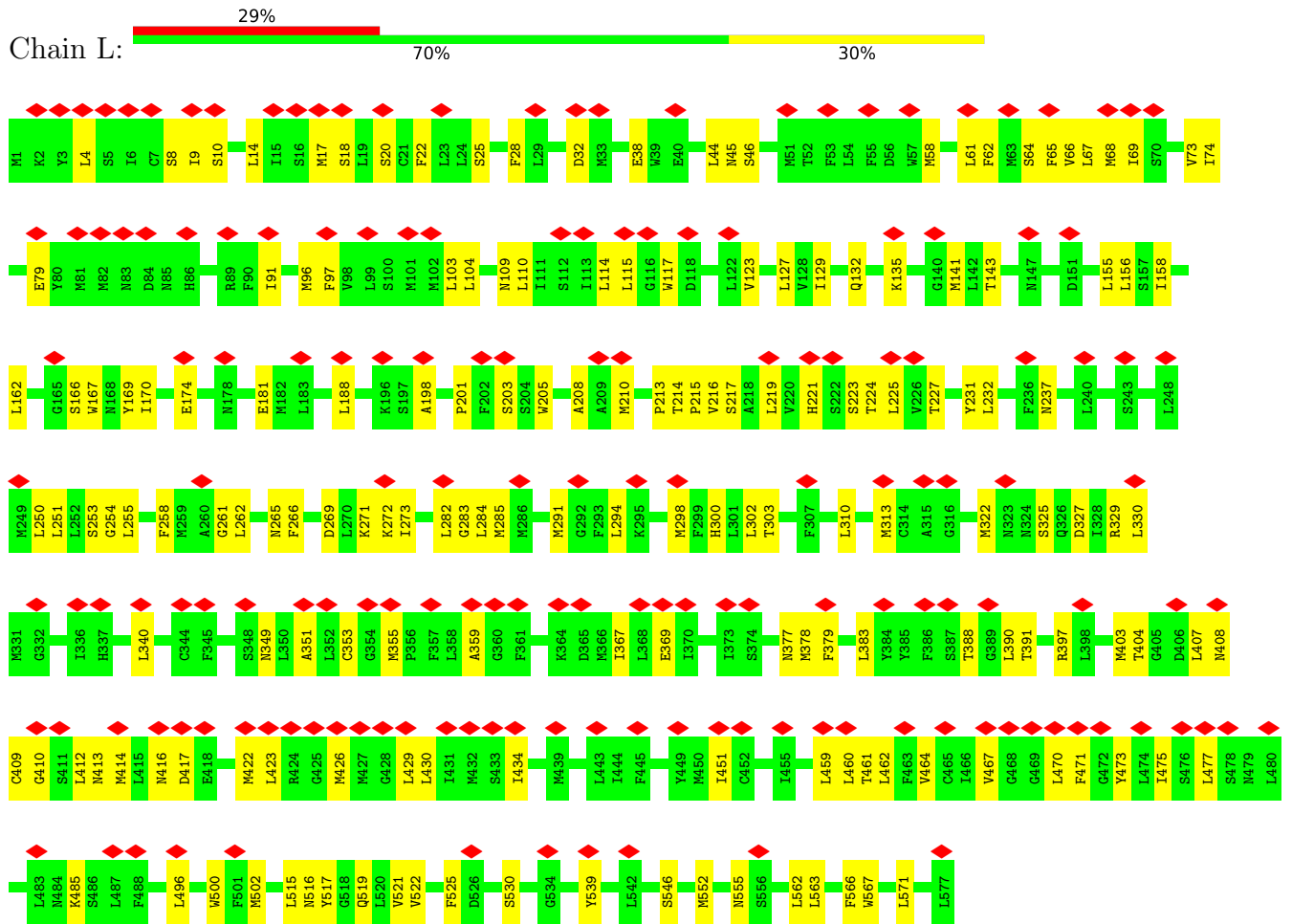
• Molecule 10: NADH-ubiquinone oxidoreductase chain 6



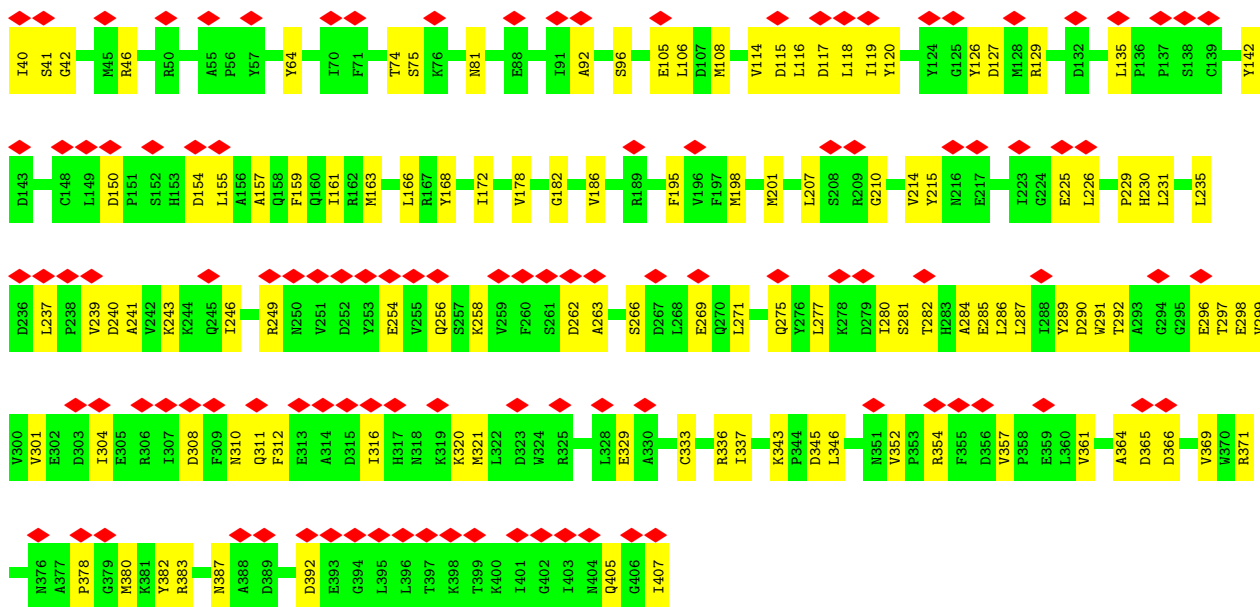
• Molecule 11: NADH-ubiquinone oxidoreductase chain 4L



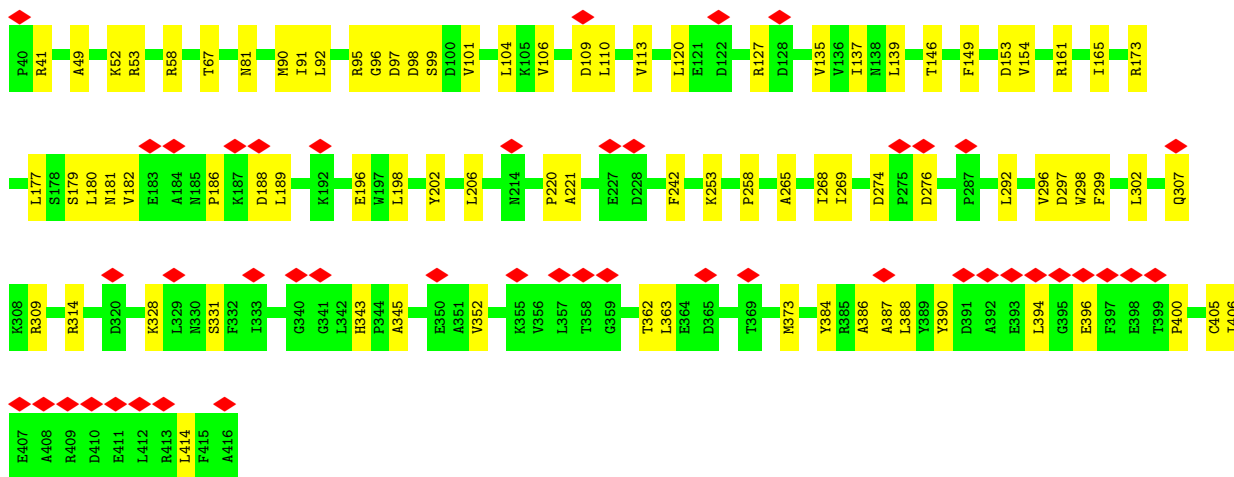
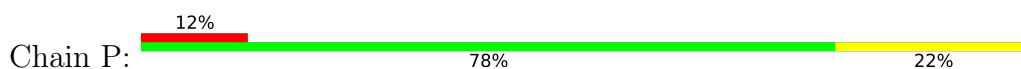
• Molecule 12: NADH-ubiquinone oxidoreductase chain 5



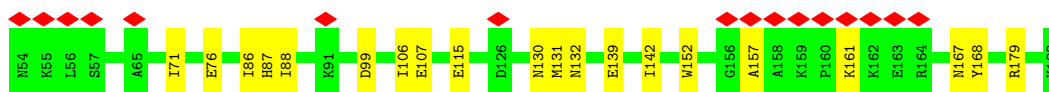
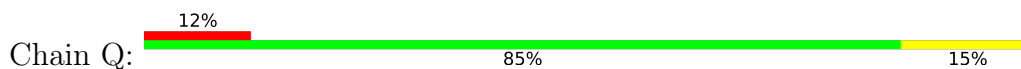




• Molecule 16: NADH dehydrogenase (Ubiquinone) 39 kDa subunit, isoform A

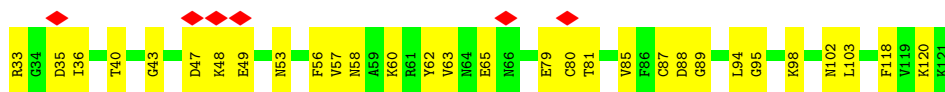


• Molecule 17: NADH dehydrogenase [ubiquinone] iron-sulfur protein 4, mitochondrial

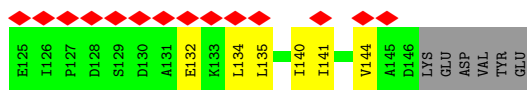
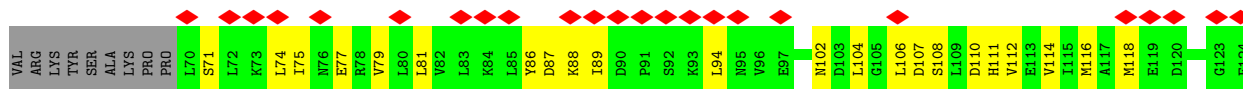
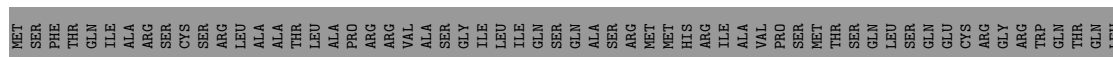
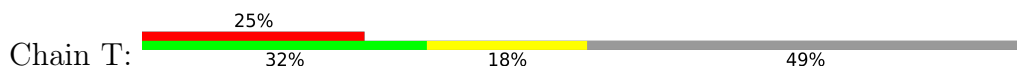


• Molecule 18: NADH dehydrogenase [ubiquinone] iron-sulfur protein 6, mitochondrial

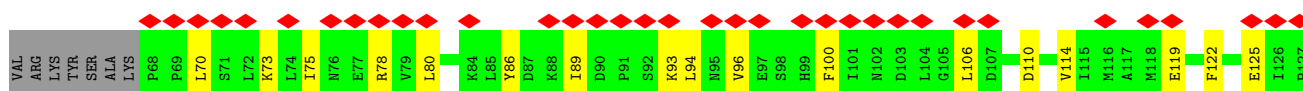
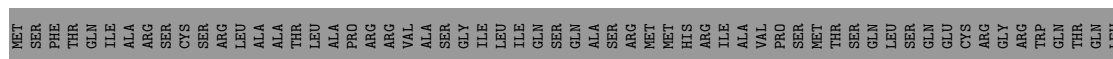




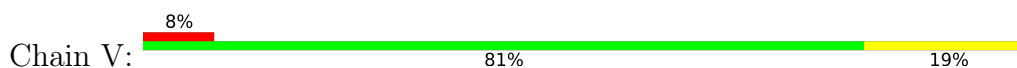
- Molecule 19: Acyl carrier protein, mitochondrial



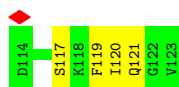
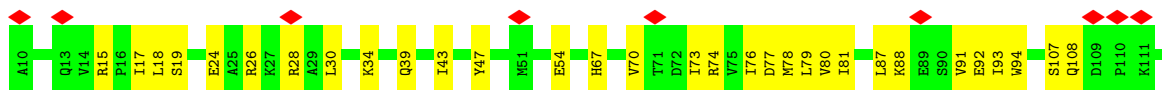
- Molecule 19: Acyl carrier protein, mitochondrial



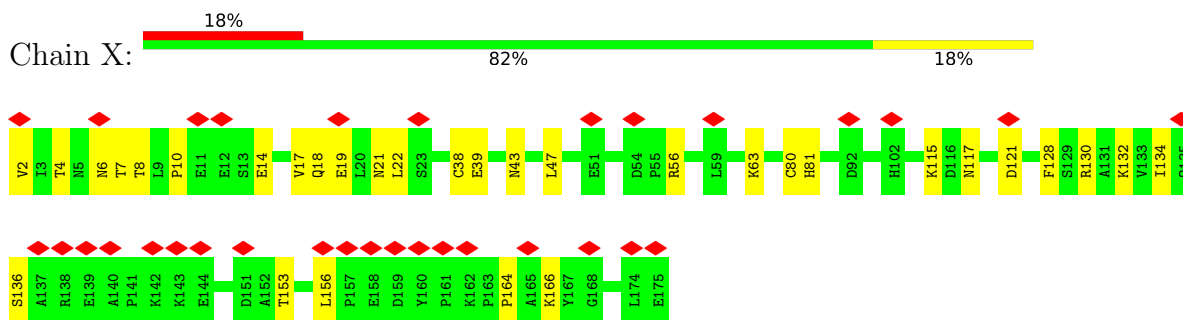
- Molecule 20: NADH dehydrogenase (Ubiquinone) 13 kDa B subunit



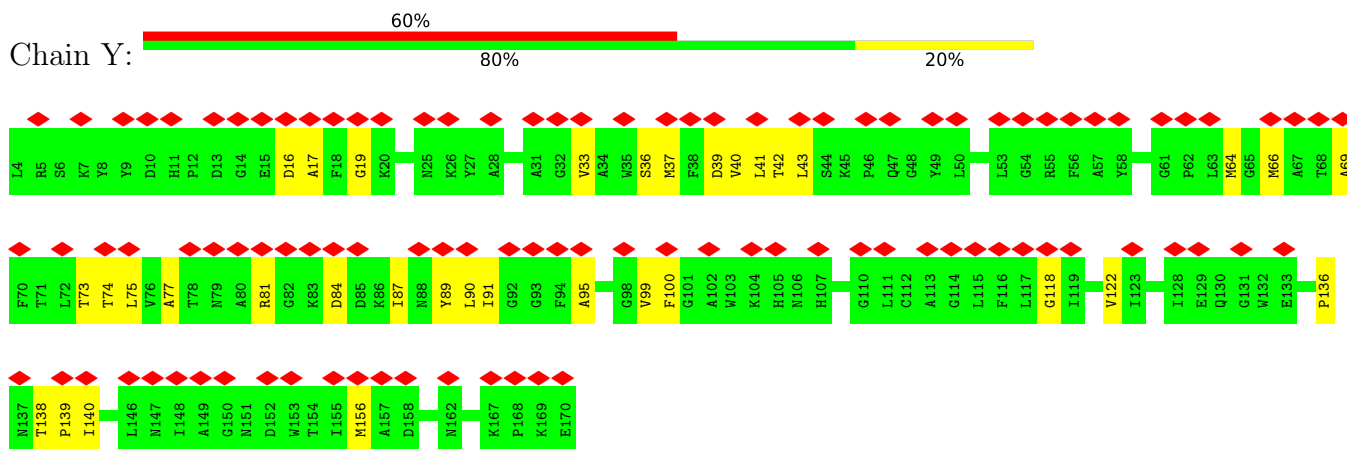
- Molecule 21: NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 6



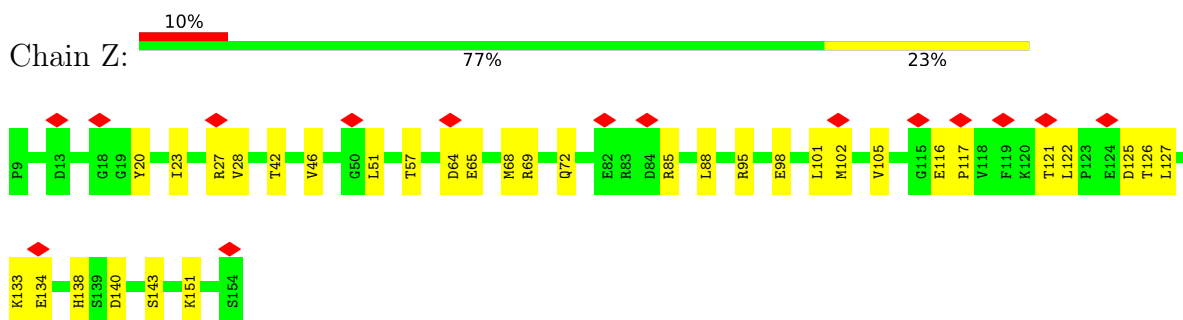
- Molecule 22: NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 8



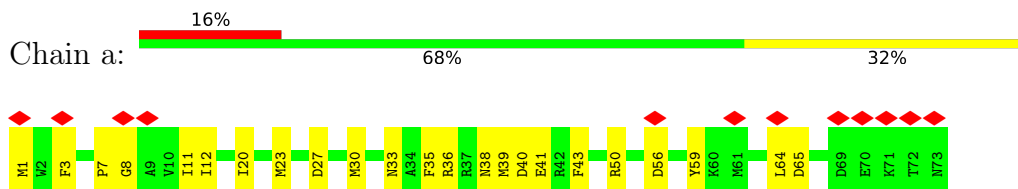
- Molecule 23: NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 11



- Molecule 24: NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 13



- Molecule 25: NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 1

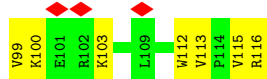
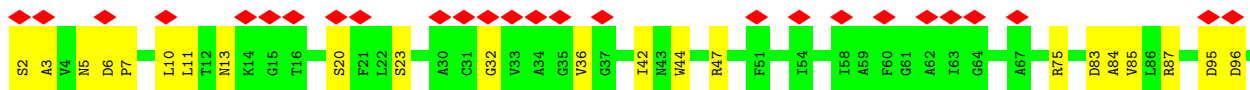
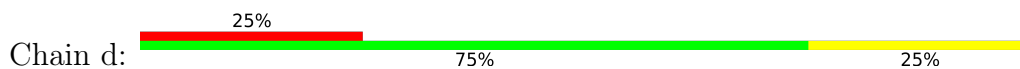


- Molecule 26: RH45008p

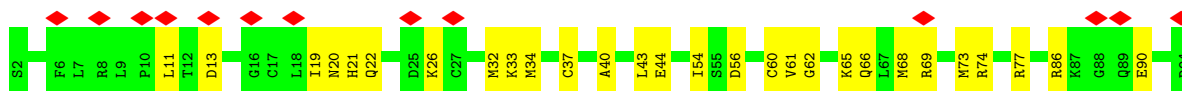




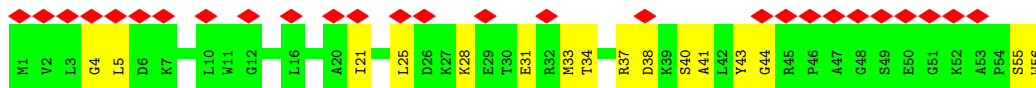
- Molecule 27: NADH dehydrogenase [ubiquinone] 1 subunit C2



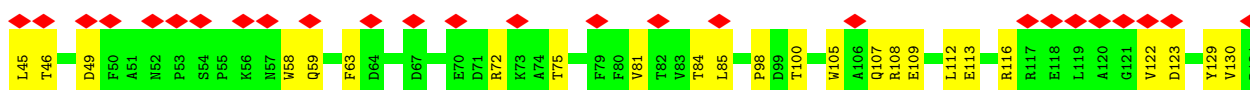
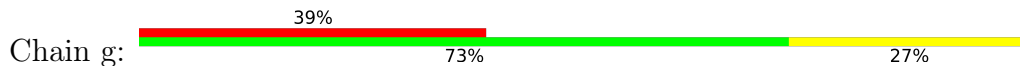
- Molecule 28: NADH dehydrogenase [ubiquinone] iron-sulfur protein 5



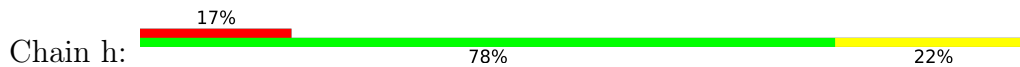
- Molecule 29: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 1

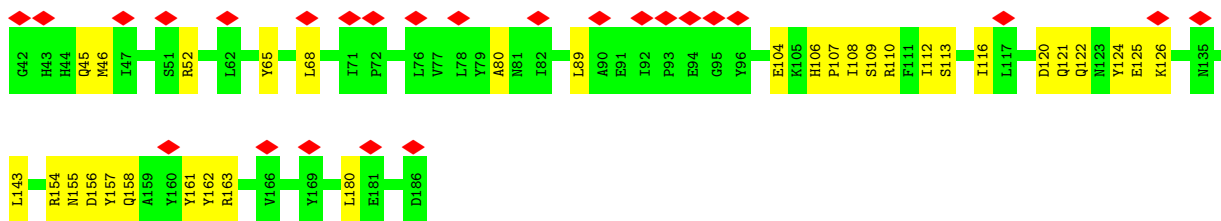


- Molecule 30: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 11, mitochondrial

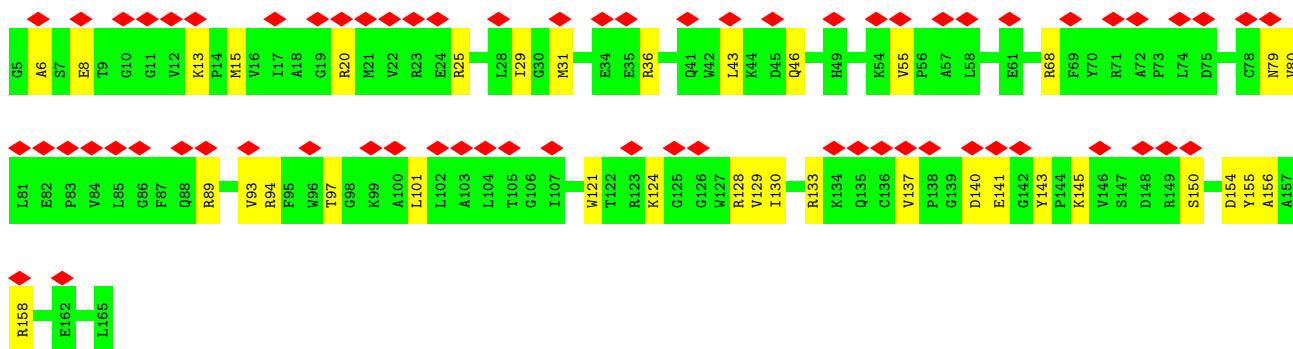
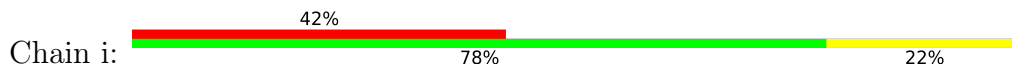


- Molecule 31: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 5, mitochondrial

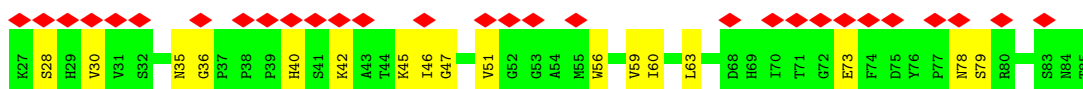




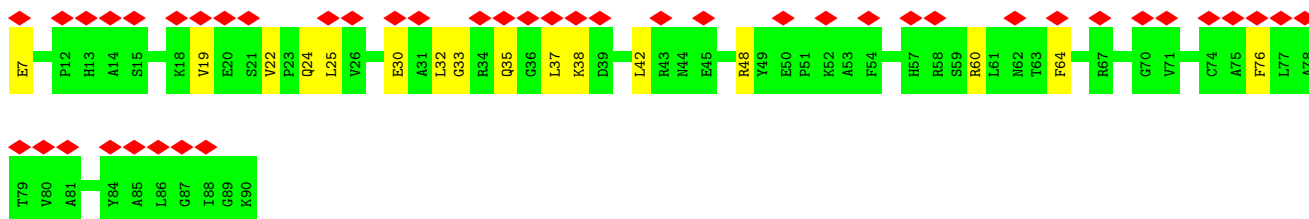
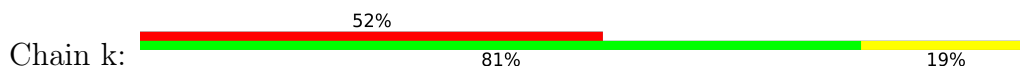
- Molecule 32: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 6



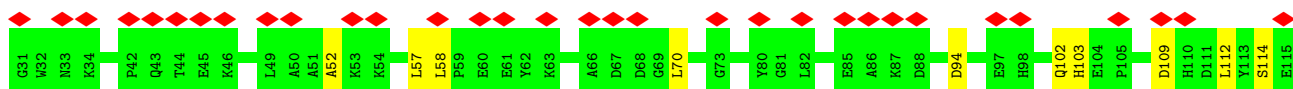
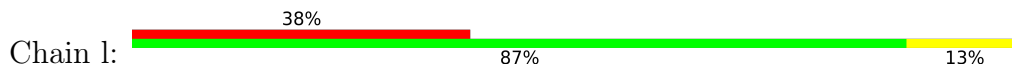
- Molecule 33: GEO11417p1

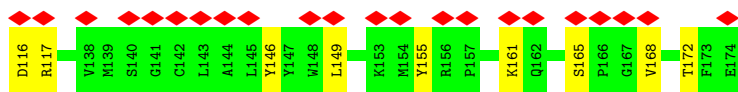


- Molecule 34: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 3

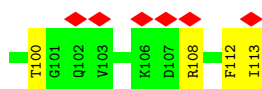
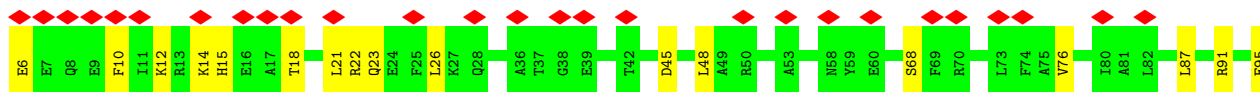
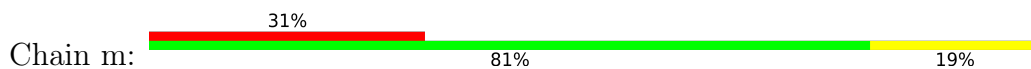


- Molecule 35: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 8, mitochondrial

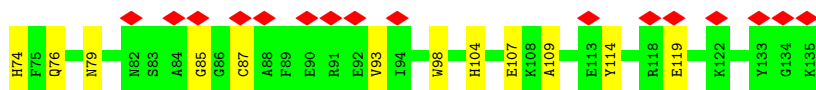
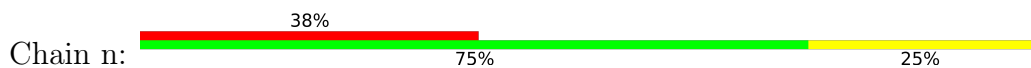




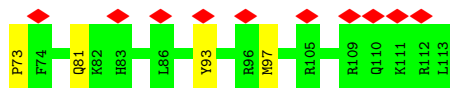
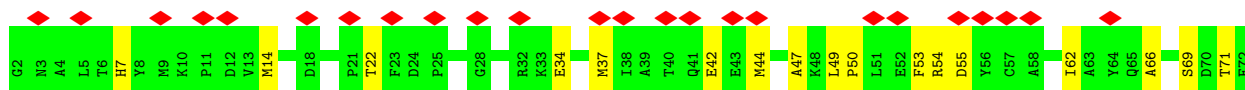
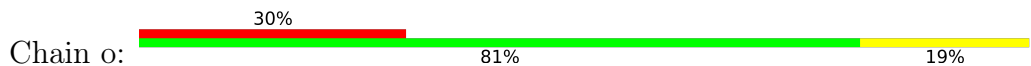
- Molecule 36: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 4



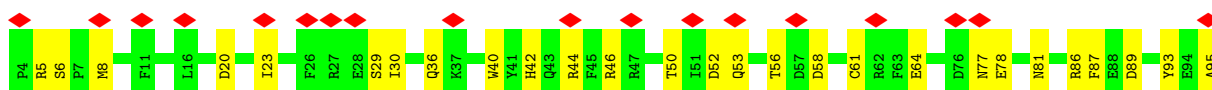
- Molecule 37: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 9



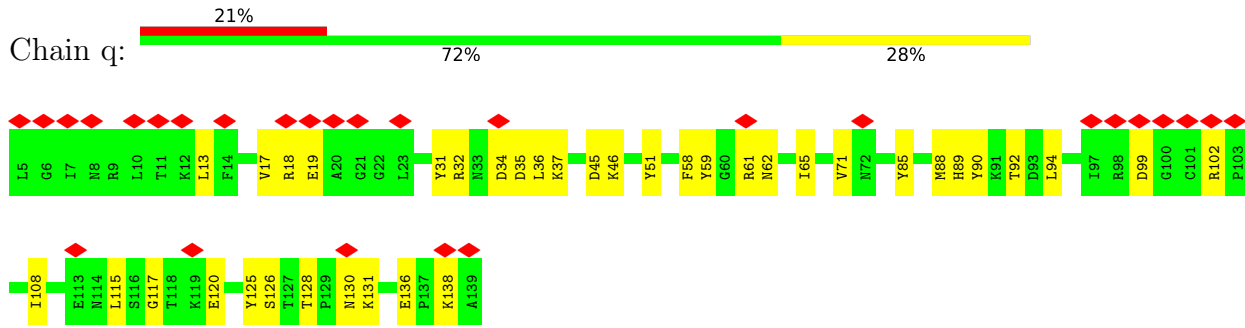
- Molecule 38: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 7



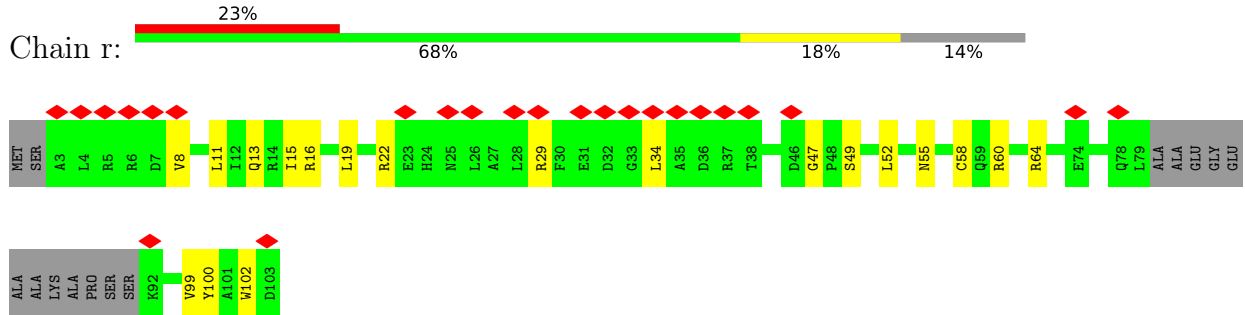
- Molecule 39: NADH dehydrogenase [ubiquinone] 1 beta subcomplex subunit 10



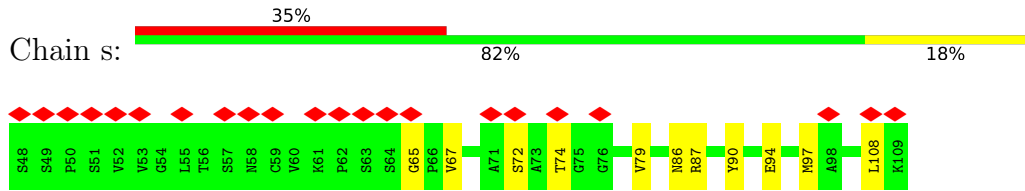
- Molecule 40: NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 12



• Molecule 41: NADH dehydrogenase [ubiquinone] 1 alpha subcomplex subunit 7



• Molecule 42: NADH dehydrogenase [ubiquinone] flavoprotein 3, mitochondrial



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	12343	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 ( $e^-/\text{\AA}^2$ )	41.88	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	130000	Depositor
Image detector	GATAN K2 QUANTUM (4k x 4k)	Depositor
Maximum map value	0.093	Depositor
Minimum map value	-0.016	Depositor
Average map value	-0.000	Depositor
Map value standard deviation	0.002	Depositor
Recommended contour level	0.014	Depositor
Map size ( $\text{\AA}$ )	471.59998, 471.59998, 471.59998	wwPDB
Map dimensions	450, 450, 450	wwPDB
Map angles ( $^\circ$ )	90.0, 90.0, 90.0	wwPDB
Pixel spacing ( $\text{\AA}$ )	1.048, 1.048, 1.048	Depositor

## 5 Model quality i

### 5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: 3PE, FES, DGT, 2MR, CDL, NDP, ZN, EHZ, FMN, SF4

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	0/979	0.45	0/1325
2	B	0.40	0/1473	0.54	0/1997
3	C	0.32	0/1774	0.44	0/2412
4	D	0.33	0/3495	0.45	0/4737
5	E	0.29	0/1718	0.41	0/2328
6	F	0.30	0/3447	0.45	0/4659
7	G	0.29	0/5229	0.42	0/7088
8	H	0.30	0/2651	0.43	0/3593
9	I	0.38	0/1518	0.48	0/2050
10	J	0.28	0/1377	0.53	2/1863 (0.1%)
11	K	0.31	0/792	0.51	0/1066
12	L	0.26	0/4726	0.42	0/6396
13	M	0.29	0/3723	0.41	0/5045
14	N	0.30	0/2875	0.46	0/3890
15	O	0.23	0/3082	0.43	0/4168
16	P	0.27	0/3108	0.45	0/4205
17	Q	0.30	0/1082	0.43	0/1465
18	R	0.32	0/733	0.42	0/987
19	T	0.22	0/624	0.45	0/843
19	U	0.24	0/696	0.53	0/940
20	V	0.25	0/942	0.41	0/1278
21	W	0.29	0/988	0.47	0/1329
22	X	0.24	0/1416	0.43	0/1911
23	Y	0.19	0/1314	0.35	0/1784
24	Z	0.26	0/1239	0.44	0/1682
25	a	0.29	0/614	0.49	0/827
26	b	0.25	0/528	0.46	0/714
27	d	0.22	0/935	0.42	0/1271
28	e	0.28	0/846	0.52	0/1128
29	f	0.27	0/448	0.62	0/600
30	g	0.27	0/895	0.48	0/1222
31	h	0.27	0/1269	0.45	0/1714

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
32	i	0.24	0/1338	0.50	0/1808
33	j	0.22	0/513	0.39	0/704
34	k	0.25	0/690	0.51	0/936
35	l	0.23	0/1250	0.41	0/1701
36	m	0.23	0/913	0.46	0/1222
37	n	0.24	0/1185	0.47	0/1597
38	o	0.20	0/960	0.47	0/1290
39	p	0.31	0/1299	0.51	0/1752
40	q	0.28	0/1169	0.39	0/1585
41	r	0.26	0/740	0.46	0/1003
42	s	0.24	0/469	0.43	0/637
All	All	0.28	0/67062	0.45	2/90752 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	J	70	THR	OG1-CB-CG2	5.85	120.99	109.30
10	J	70	THR	CA-CB-CG2	5.26	119.44	110.50

There are no chirality outliers.

There are no planarity outliers.

## 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	A	956	0	1030	45	0
2	B	1435	0	1446	46	0
3	C	1726	0	1673	41	0
4	D	3424	0	3396	106	0
5	E	1679	0	1657	28	0
6	F	3367	0	3350	76	0
7	G	5146	0	5189	98	0
8	H	2571	0	2628	80	0
9	I	1485	0	1422	46	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
10	J	1351	0	1461	56	0
11	K	771	0	793	36	0
12	L	4606	0	4742	144	0
13	M	3617	0	3750	96	0
14	N	2796	0	2879	93	0
15	O	3007	0	2945	90	0
16	P	3032	0	3030	66	0
17	Q	1054	0	1029	17	0
18	R	716	0	700	25	0
19	T	615	0	625	25	0
19	U	684	0	687	19	0
20	V	922	0	946	17	0
21	W	968	0	991	40	0
22	X	1383	0	1328	38	0
23	Y	1277	0	1258	24	0
24	Z	1201	0	1211	35	0
25	a	601	0	603	22	0
26	b	519	0	517	14	0
27	d	907	0	896	26	0
28	e	828	0	809	31	0
29	f	437	0	448	14	0
30	g	870	0	822	31	0
31	h	1234	0	1198	33	0
32	i	1302	0	1295	30	0
33	j	489	0	455	13	0
34	k	671	0	671	16	0
35	l	1201	0	1107	19	0
36	m	892	0	885	20	0
37	n	1152	0	1124	29	0
38	o	937	0	920	22	0
39	p	1266	0	1217	38	0
40	q	1130	0	1085	32	0
41	r	724	0	727	22	0
42	s	456	0	440	9	0
43	B	8	0	0	0	0
43	F	8	0	0	2	0
43	G	16	0	0	2	0
43	I	16	0	0	0	0
44	B	68	0	84	2	0
44	L	35	0	44	3	0
44	Y	67	0	56	0	0
45	E	4	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
45	G	4	0	0	0	0
46	F	31	0	19	1	0
47	M	55	0	54	1	0
47	P	41	0	26	0	0
48	O	31	0	12	4	0
49	P	48	0	26	2	0
50	R	1	0	0	0	0
51	T	37	0	0	1	0
51	U	37	0	0	1	0
All	All	65912	0	65706	1452	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 11.

The worst 5 of 1452 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)
4:D:203:THR:OG1	8:H:275:GLY:O	1.82	0.97
11:K:81:MET:HE1	14:N:58:LEU:HD23	1.50	0.93
13:M:121:ILE:HD11	14:N:250:LEU:HD23	1.52	0.91
19:T:112:VAL:HG21	21:W:30:LEU:HD12	1.55	0.89
5:E:111:PHE:O	7:G:214:ARG:NH2	2.04	0.89

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	A	115/117 (98%)	110 (96%)	5 (4%)	0	100	100
2	B	180/182 (99%)	167 (93%)	12 (7%)	1 (1%)	21	52

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	C	207/209 (99%)	185 (89%)	22 (11%)	0	100	100
4	D	425/428 (99%)	397 (93%)	27 (6%)	1 (0%)	43	71
5	E	212/214 (99%)	195 (92%)	17 (8%)	0	100	100
6	F	437/439 (100%)	405 (93%)	32 (7%)	0	100	100
7	G	673/731 (92%)	622 (92%)	51 (8%)	0	100	100
8	H	313/315 (99%)	282 (90%)	31 (10%)	0	100	100
9	I	184/186 (99%)	174 (95%)	10 (5%)	0	100	100
10	J	165/167 (99%)	150 (91%)	15 (9%)	0	100	100
11	K	91/93 (98%)	84 (92%)	7 (8%)	0	100	100
12	L	575/577 (100%)	535 (93%)	40 (7%)	0	100	100
13	M	444/446 (100%)	412 (93%)	32 (7%)	0	100	100
14	N	339/341 (99%)	317 (94%)	22 (6%)	0	100	100
15	O	366/368 (100%)	328 (90%)	38 (10%)	0	100	100
16	P	375/377 (100%)	345 (92%)	30 (8%)	0	100	100
17	Q	128/130 (98%)	111 (87%)	17 (13%)	0	100	100
18	R	87/89 (98%)	80 (92%)	7 (8%)	0	100	100
19	T	75/152 (49%)	70 (93%)	5 (7%)	0	100	100
19	U	83/152 (55%)	69 (83%)	14 (17%)	0	100	100
20	V	116/118 (98%)	110 (95%)	6 (5%)	0	100	100
21	W	112/114 (98%)	105 (94%)	7 (6%)	0	100	100
22	X	172/174 (99%)	157 (91%)	15 (9%)	0	100	100
23	Y	165/167 (99%)	157 (95%)	8 (5%)	0	100	100
24	Z	144/146 (99%)	138 (96%)	6 (4%)	0	100	100
25	a	71/73 (97%)	67 (94%)	4 (6%)	0	100	100
26	b	64/66 (97%)	58 (91%)	6 (9%)	0	100	100
27	d	113/115 (98%)	109 (96%)	4 (4%)	0	100	100
28	e	98/100 (98%)	92 (94%)	6 (6%)	0	100	100
29	f	54/56 (96%)	42 (78%)	12 (22%)	0	100	100
30	g	104/106 (98%)	95 (91%)	9 (9%)	0	100	100
31	h	143/145 (99%)	132 (92%)	11 (8%)	0	100	100
32	i	159/161 (99%)	147 (92%)	12 (8%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
33	j	57/59 (97%)	53 (93%)	4 (7%)	0	100	100
34	k	82/84 (98%)	64 (78%)	17 (21%)	1 (1%)	10	39
35	l	142/144 (99%)	125 (88%)	17 (12%)	0	100	100
36	m	106/108 (98%)	93 (88%)	13 (12%)	0	100	100
37	n	132/134 (98%)	125 (95%)	7 (5%)	0	100	100
38	o	110/112 (98%)	99 (90%)	11 (10%)	0	100	100
39	p	149/151 (99%)	136 (91%)	13 (9%)	0	100	100
40	q	133/135 (98%)	123 (92%)	10 (8%)	0	100	100
41	r	85/103 (82%)	81 (95%)	4 (5%)	0	100	100
42	s	60/62 (97%)	51 (85%)	9 (15%)	0	100	100
All	All	8045/8346 (96%)	7397 (92%)	645 (8%)	3 (0%)	100	100

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	96	CYS
34	k	38	LYS
4	D	122	HIS

### 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	110/110 (100%)	110 (100%)	0	100	100
2	B	152/152 (100%)	152 (100%)	0	100	100
3	C	187/187 (100%)	187 (100%)	0	100	100
4	D	367/367 (100%)	367 (100%)	0	100	100
5	E	185/185 (100%)	185 (100%)	0	100	100
6	F	351/351 (100%)	351 (100%)	0	100	100
7	G	546/582 (94%)	546 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
8	H	282/282 (100%)	282 (100%)	0	100	100
9	I	159/159 (100%)	159 (100%)	0	100	100
10	J	161/161 (100%)	161 (100%)	0	100	100
11	K	88/88 (100%)	88 (100%)	0	100	100
12	L	518/518 (100%)	518 (100%)	0	100	100
13	M	404/404 (100%)	404 (100%)	0	100	100
14	N	317/317 (100%)	317 (100%)	0	100	100
15	O	324/324 (100%)	324 (100%)	0	100	100
16	P	319/319 (100%)	319 (100%)	0	100	100
17	Q	114/114 (100%)	114 (100%)	0	100	100
18	R	77/77 (100%)	77 (100%)	0	100	100
19	T	71/136 (52%)	71 (100%)	0	100	100
19	U	79/136 (58%)	79 (100%)	0	100	100
20	V	97/97 (100%)	97 (100%)	0	100	100
21	W	107/107 (100%)	107 (100%)	0	100	100
22	X	150/150 (100%)	150 (100%)	0	100	100
23	Y	128/128 (100%)	128 (100%)	0	100	100
24	Z	128/128 (100%)	128 (100%)	0	100	100
25	a	65/65 (100%)	65 (100%)	0	100	100
26	b	52/52 (100%)	52 (100%)	0	100	100
27	d	93/93 (100%)	93 (100%)	0	100	100
28	e	88/88 (100%)	88 (100%)	0	100	100
29	f	43/43 (100%)	43 (100%)	0	100	100
30	g	95/95 (100%)	95 (100%)	0	100	100
31	h	130/130 (100%)	130 (100%)	0	100	100
32	i	133/133 (100%)	133 (100%)	0	100	100
33	j	51/51 (100%)	51 (100%)	0	100	100
34	k	69/69 (100%)	69 (100%)	0	100	100
35	l	121/121 (100%)	121 (100%)	0	100	100
36	m	89/89 (100%)	89 (100%)	0	100	100
37	n	117/117 (100%)	117 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
38	o	101/101 (100%)	101 (100%)	0	100	100
39	p	135/135 (100%)	135 (100%)	0	100	100
40	q	116/116 (100%)	116 (100%)	0	100	100
41	r	78/86 (91%)	78 (100%)	0	100	100
42	s	50/50 (100%)	50 (100%)	0	100	100
All	All	7047/7213 (98%)	7047 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 46 such sidechains are listed below:

Mol	Chain	Res	Type
19	T	111	HIS
27	d	93	HIS
19	U	76	ASN
21	W	13	GLN
30	g	104	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](#)

1 non-standard protein/DNA/RNA residue is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
4	2MR	D	123	4	10,12,13	2.42	2 (20%)	5,13,15	4.12	2 (40%)

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
4	2MR	D	123	4	-	1/10/13/15	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	123	2MR	CZ-NH2	5.44	1.44	1.33
4	D	123	2MR	CZ-NE	5.00	1.44	1.34

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	D	123	2MR	NE-CZ-NH2	-8.69	111.51	119.48
4	D	123	2MR	CG-CD-NE	-2.28	105.80	112.20

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	D	123	2MR	O-C-CA-CB

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	D	123	2MR	1	0

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 22 ligands modelled in this entry, 1 is monoatomic - leaving 21 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
43	SF4	I	302	9	0,12,12	-	-	-		
44	3PE	L	601	-	34,34,50	1.05	4 (11%)	37,39,55	1.24	2 (5%)
43	SF4	F	502	6	0,12,12	-	-	-		
47	CDL	M	501	-	54,54,99	1.16	6 (11%)	60,66,111	1.18	3 (5%)
44	3PE	B	302	-	41,41,50	0.97	4 (9%)	44,46,55	0.99	2 (4%)
43	SF4	G	802	7	0,12,12	-	-	-		
45	FES	G	803	7	0,4,4	-	-	-		
51	EHZ	T	201	19	31,36,37	1.55	5 (16%)	36,44,47	1.66	4 (11%)
45	FES	E	301	5	0,4,4	-	-	-		
44	3PE	Y	302	-	21,21,50	1.29	4 (19%)	24,26,55	1.31	2 (8%)
44	3PE	Y	301	-	19,19,50	1.30	3 (15%)	22,24,55	0.96	1 (4%)
48	DGT	O	501	-	32,33,33	3.45	15 (46%)	48,52,52	1.92	12 (25%)
43	SF4	I	301	9	0,12,12	-	-	-		
44	3PE	B	303	-	25,25,50	1.22	4 (16%)	28,30,55	1.36	2 (7%)
46	FMN	F	501	-	33,33,33	2.60	10 (30%)	48,50,50	1.71	12 (25%)
47	CDL	P	502	-	40,40,99	1.28	5 (12%)	46,52,111	1.13	4 (8%)
43	SF4	B	301	2	0,12,12	-	-	-		
49	NDP	P	501	-	51,52,52	3.91	26 (50%)	71,80,80	2.10	18 (25%)
51	EHZ	U	201	19	31,36,37	1.62	6 (19%)	36,44,47	1.64	7 (19%)
44	3PE	Y	303	-	24,24,50	1.24	4 (16%)	27,29,55	1.13	2 (7%)
43	SF4	G	801	7	0,12,12	-	-	-		

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
43	SF4	I	302	9	-	-	0/6/5/5
44	3PE	L	601	-	-	16/38/38/54	-
47	CDL	M	501	-	-	34/64/64/110	-
43	SF4	F	502	6	-	-	0/6/5/5
44	3PE	B	302	-	-	18/45/45/54	-
43	SF4	G	802	7	-	-	0/6/5/5

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
45	FES	G	803	7	-	-	0/1/1/1
51	EHZ	T	201	19	-	9/42/44/45	-
45	FES	E	301	5	-	-	0/1/1/1
44	3PE	Y	302	-	-	11/25/25/54	-
44	3PE	Y	301	-	-	14/22/22/54	-
48	DGT	O	501	-	-	7/22/34/34	0/3/3/3
43	SF4	I	301	9	-	-	0/6/5/5
44	3PE	B	303	-	-	10/29/29/54	-
46	FMN	F	501	-	-	12/18/18/18	0/3/3/3
47	CDL	P	502	-	-	19/49/49/110	-
43	SF4	B	301	2	-	-	0/6/5/5
49	NDP	P	501	-	-	10/34/77/77	0/5/5/5
51	EHZ	U	201	19	-	9/42/44/45	-
44	3PE	Y	303	-	-	14/28/28/54	-
43	SF4	G	801	7	-	-	0/6/5/5

The worst 5 of 96 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
49	P	501	NDP	C2B-C1B	-9.29	1.30	1.53
49	P	501	NDP	PA-O3	9.00	1.69	1.59
48	O	501	DGT	C3'-C4'	-8.33	1.31	1.53
49	P	501	NDP	O4B-C1B	8.08	1.60	1.42
49	P	501	NDP	O4D-C1D	8.01	1.60	1.42

The worst 5 of 71 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
51	T	201	EHZ	C8-C9-S1	6.47	121.73	113.56
49	P	501	NDP	C4A-N9A-C1B	-5.80	113.06	126.63
49	P	501	NDP	N6A-C6A-N1A	-5.73	105.62	118.38
49	P	501	NDP	N3A-C2A-N1A	-5.57	120.16	128.58
48	O	501	DGT	C5-C4-N3	-5.43	119.75	128.39

There are no chirality outliers.

5 of 183 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
44	B	303	3PE	O13-C11-C12-N

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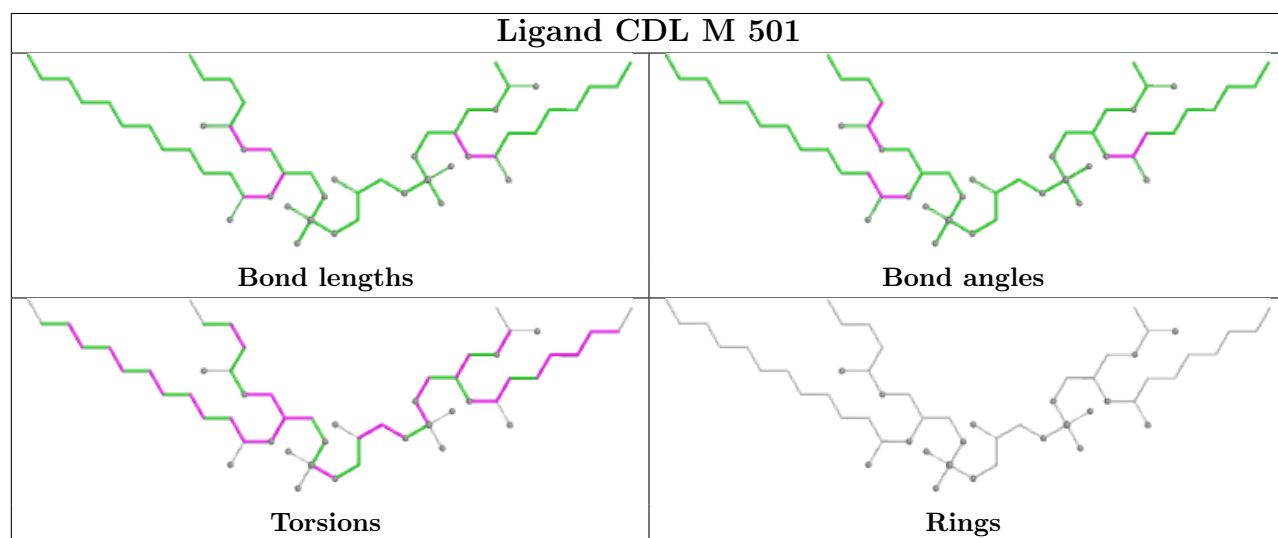
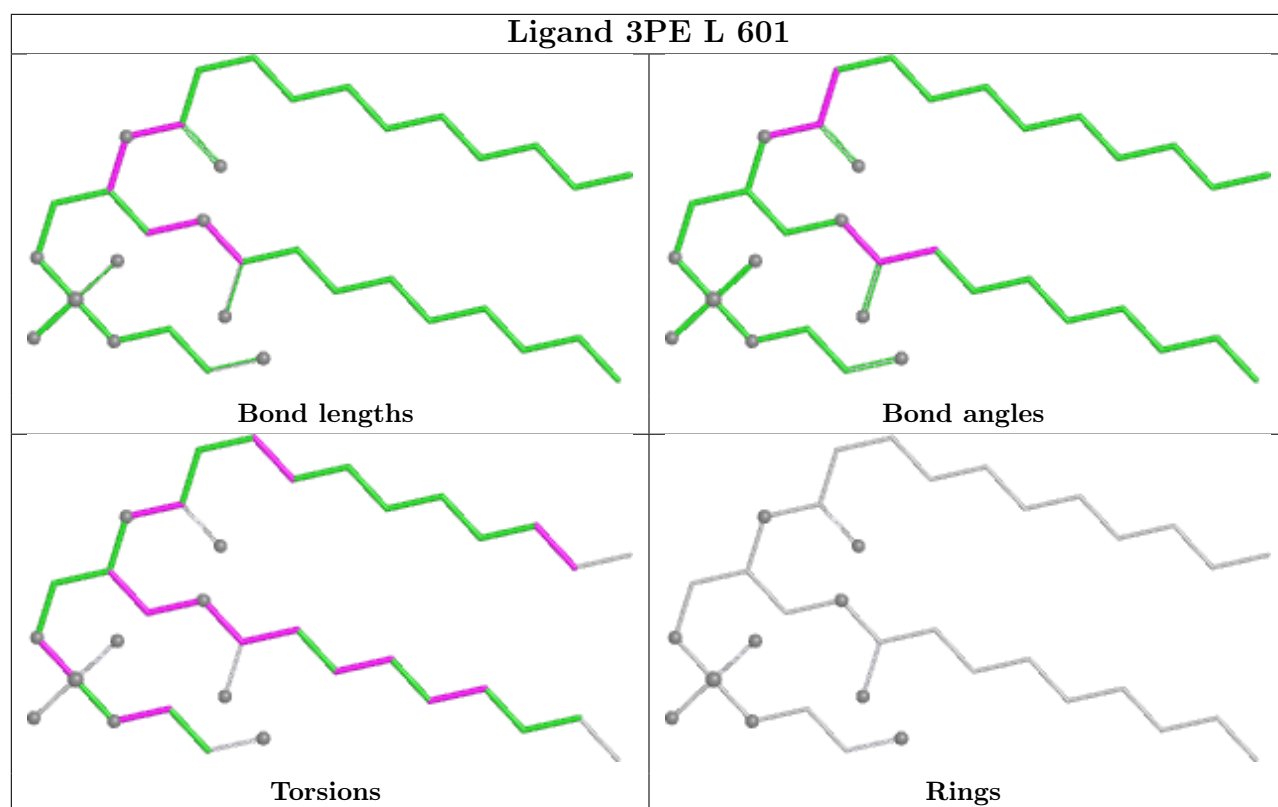
Mol	Chain	Res	Type	Atoms
44	L	601	3PE	C1-O11-P-O12
44	L	601	3PE	C1-O11-P-O13
44	L	601	3PE	C1-O11-P-O14
44	Y	301	3PE	C1-O11-P-O12

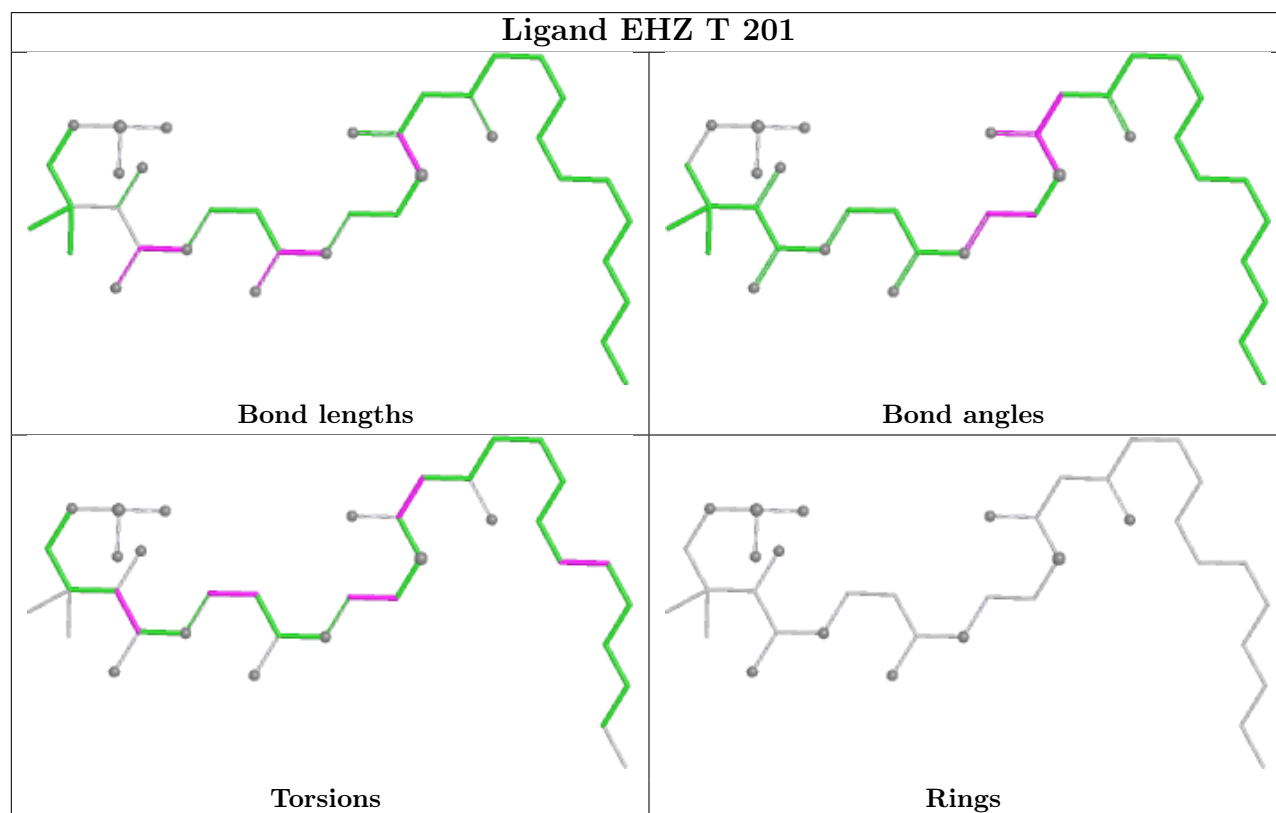
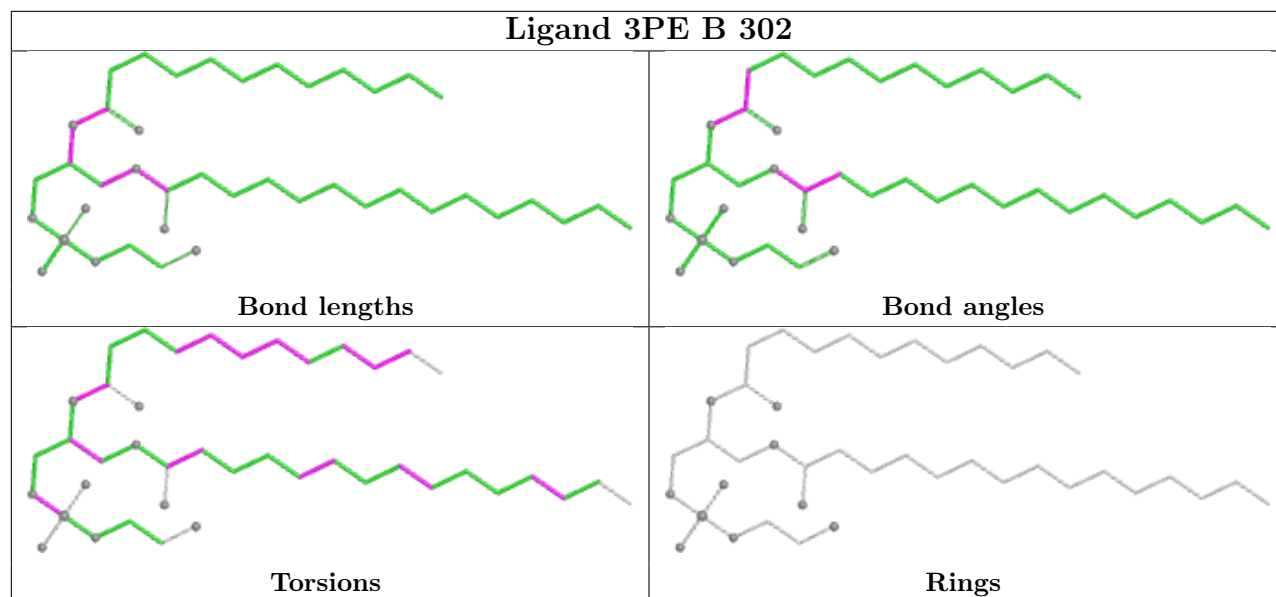
There are no ring outliers.

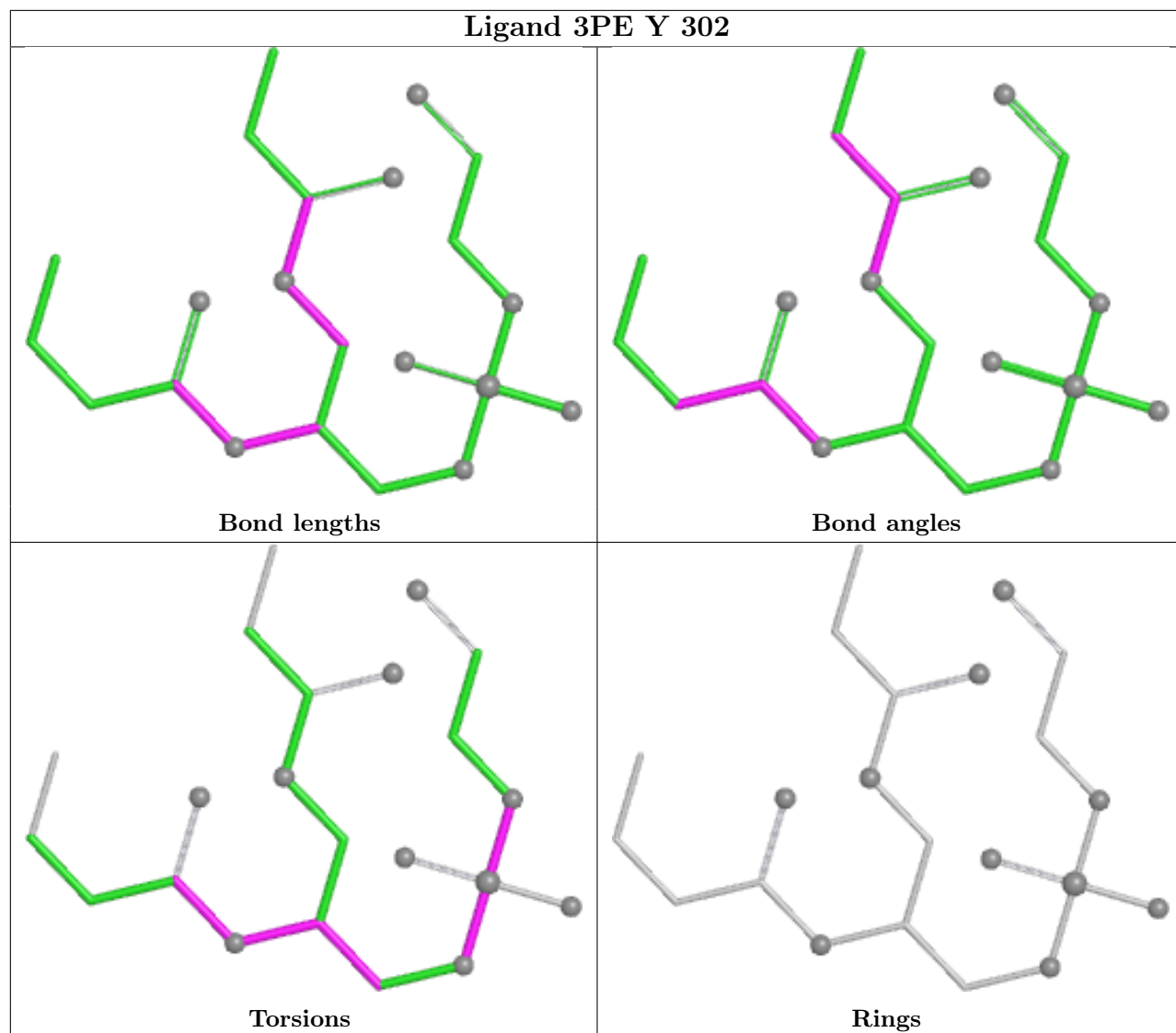
11 monomers are involved in 20 short contacts:

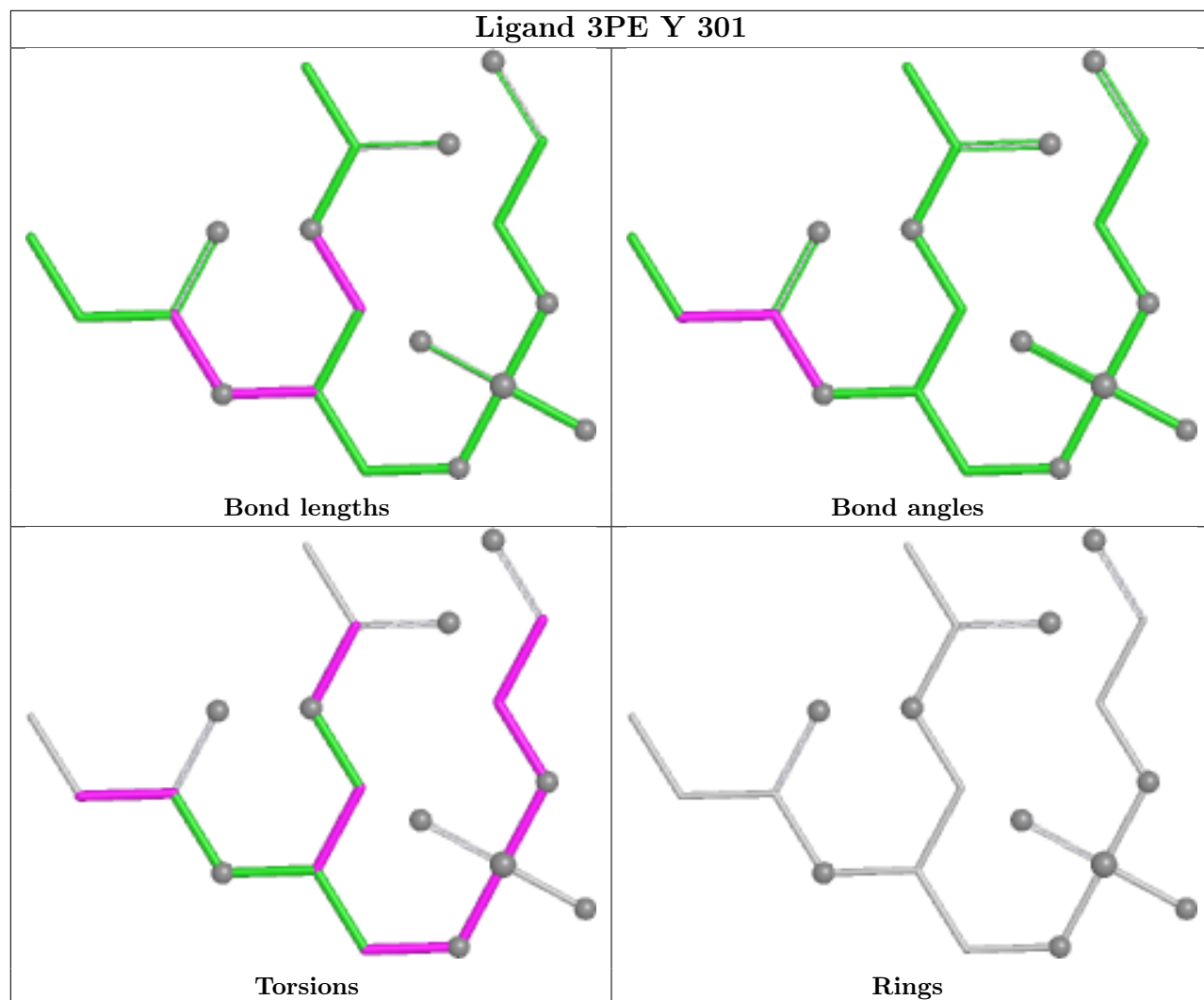
Mol	Chain	Res	Type	Clashes	Symm-Clashes
44	L	601	3PE	3	0
43	F	502	SF4	2	0
47	M	501	CDL	1	0
44	B	302	3PE	2	0
51	T	201	EHZ	1	0
45	E	301	FES	1	0
48	O	501	DGT	4	0
46	F	501	FMN	1	0
49	P	501	NDP	2	0
51	U	201	EHZ	1	0
43	G	801	SF4	2	0

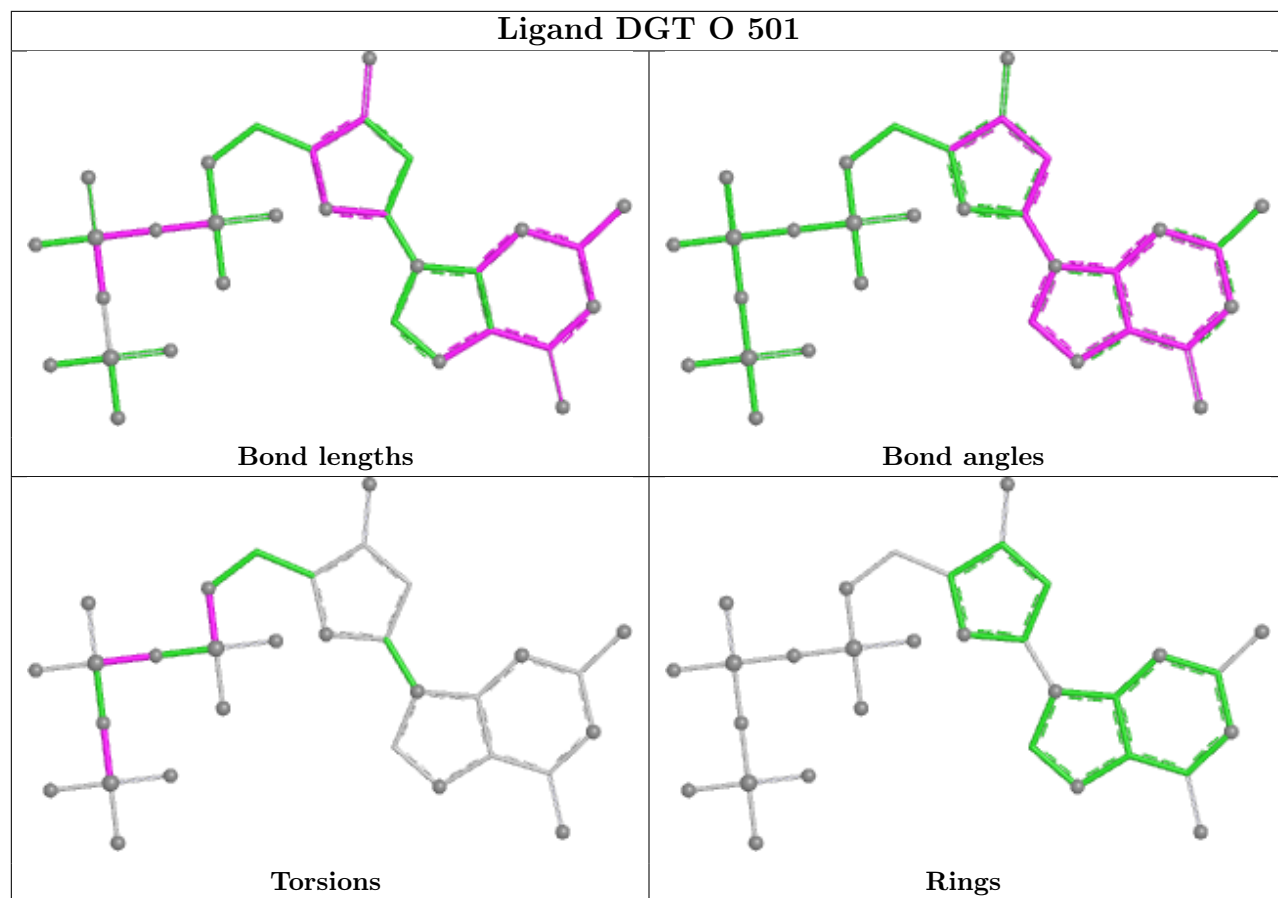
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

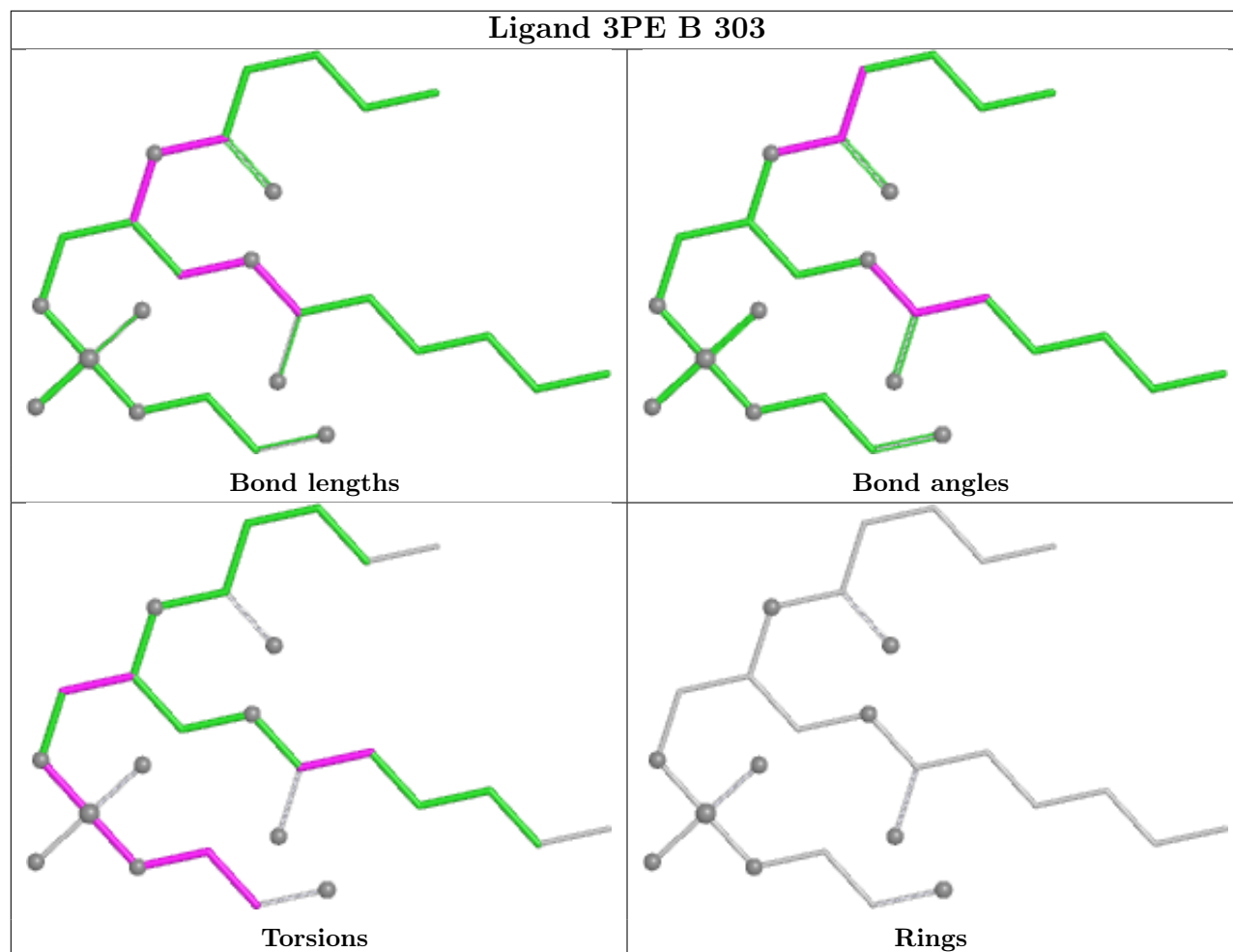


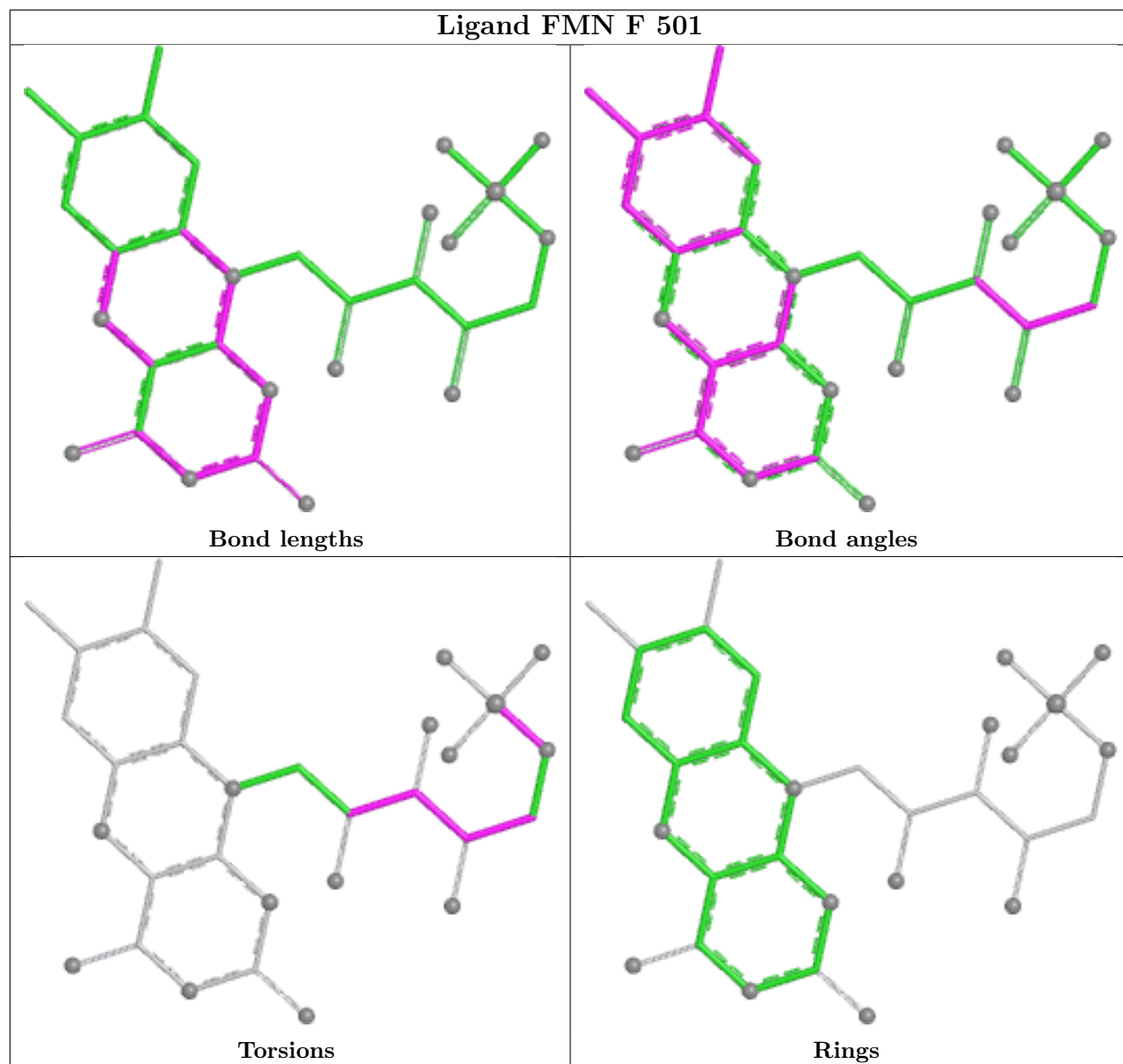


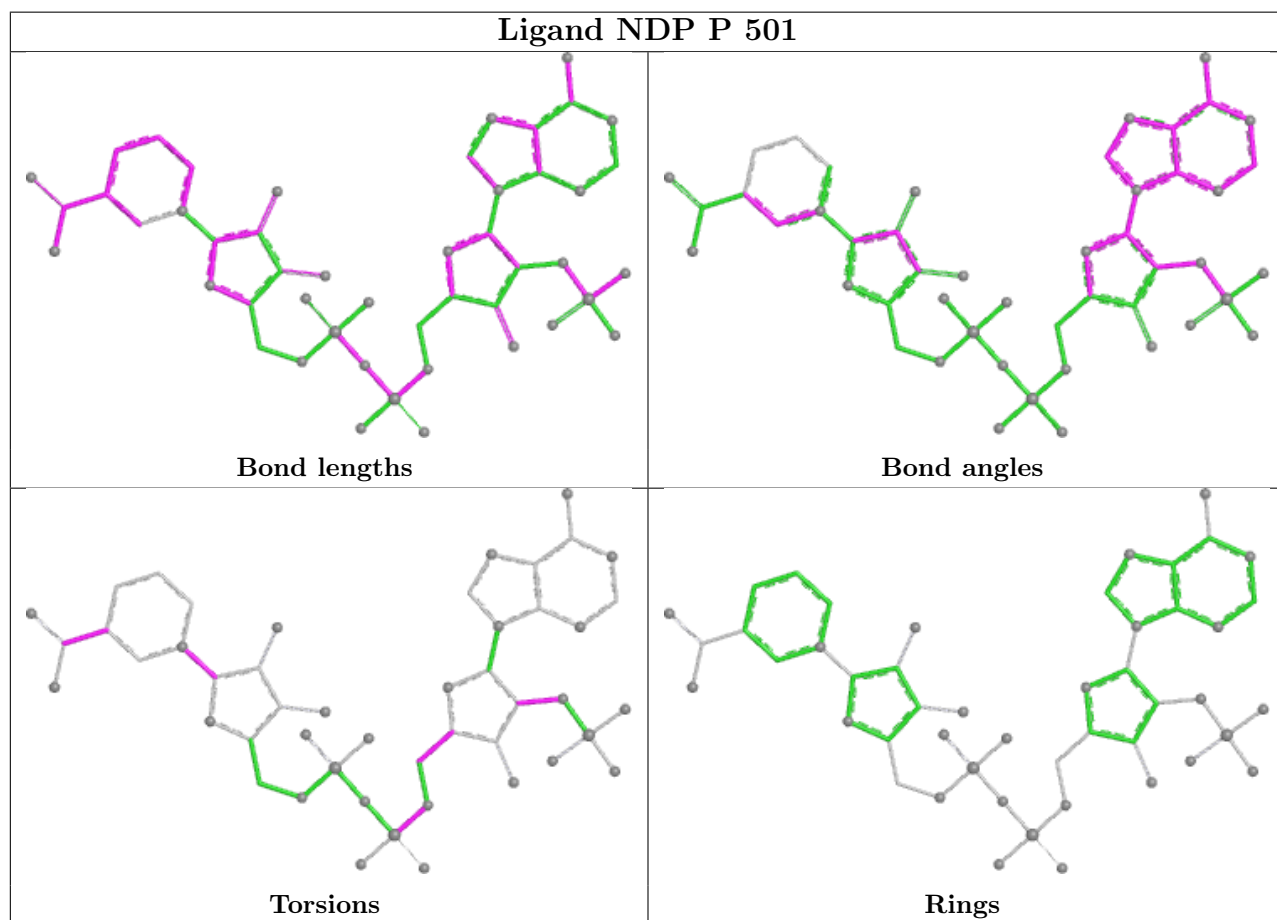
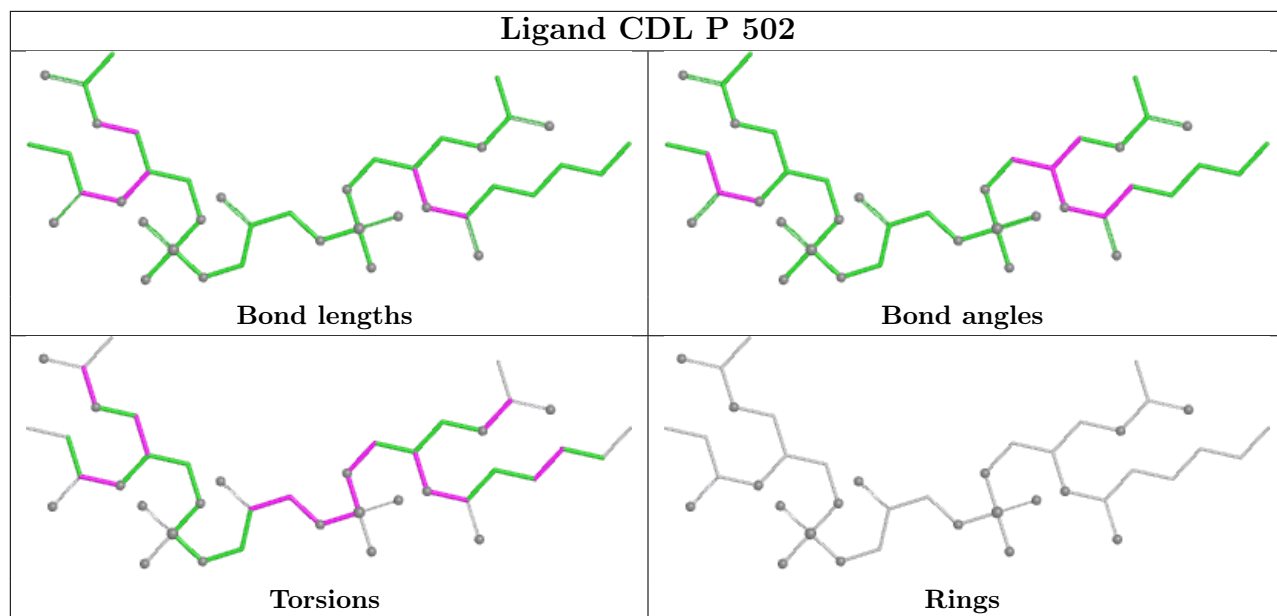


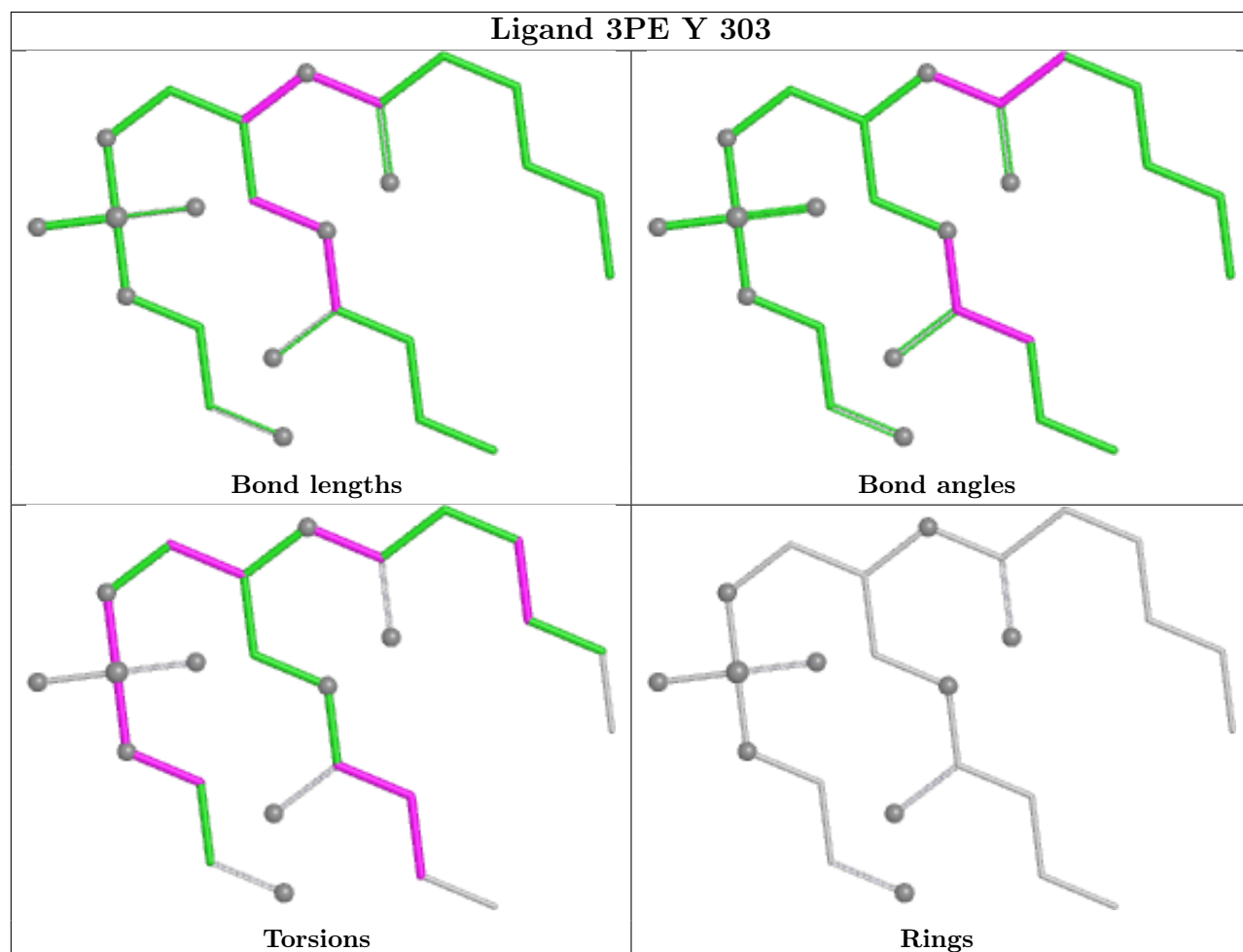
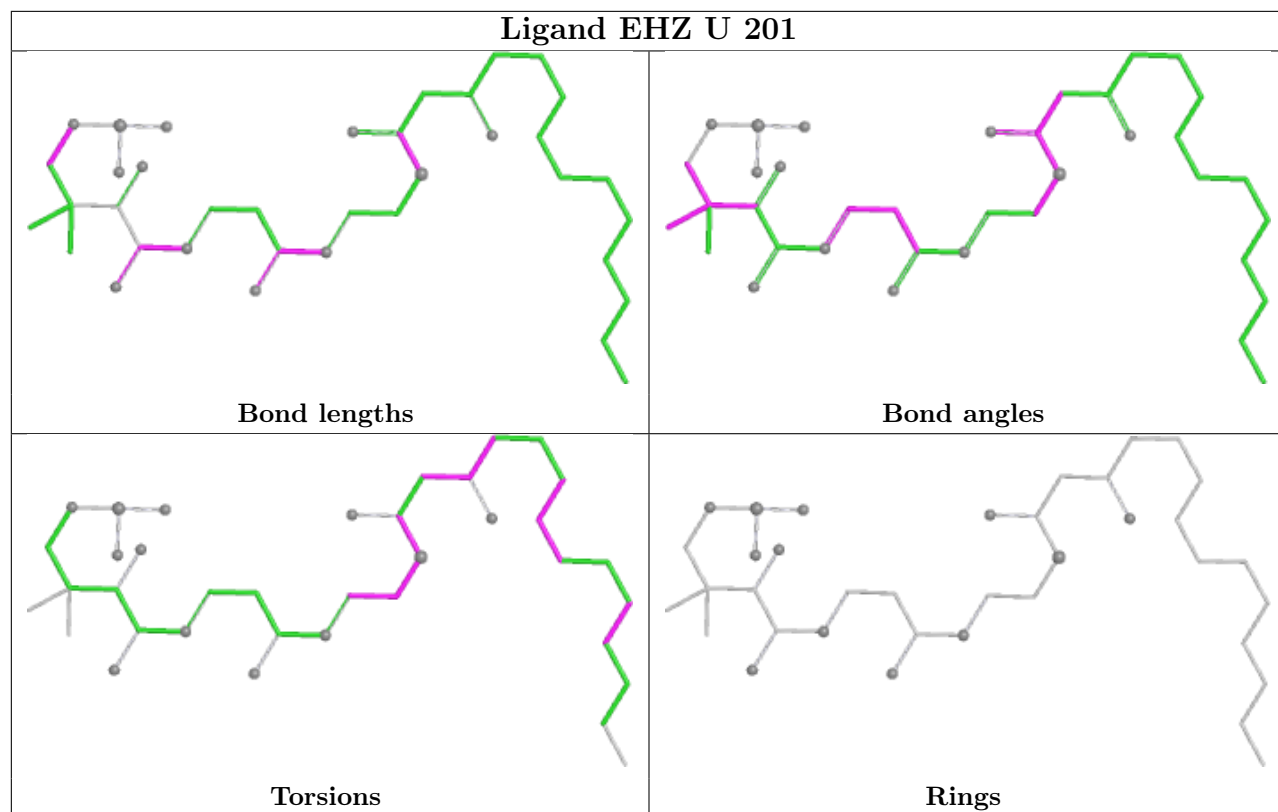












## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

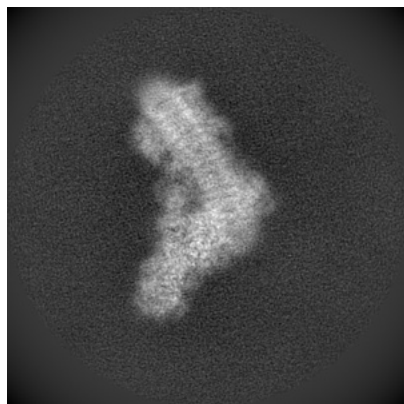
## 6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-15937. These allow visual inspection of the internal detail of the map and identification of artifacts.

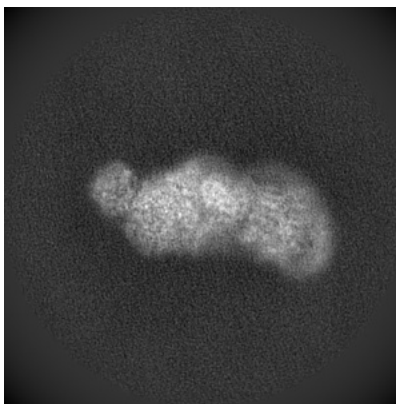
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

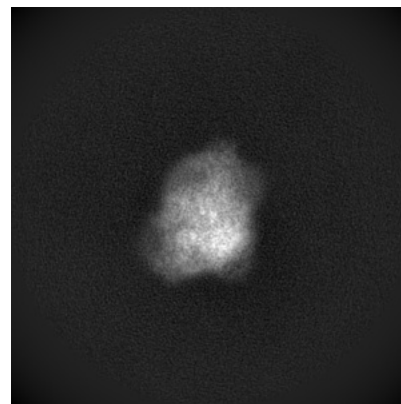
#### 6.1.1 Primary map



X

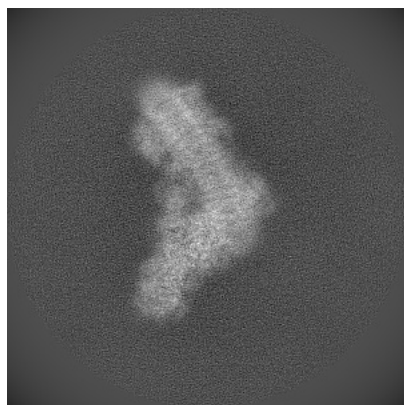


Y

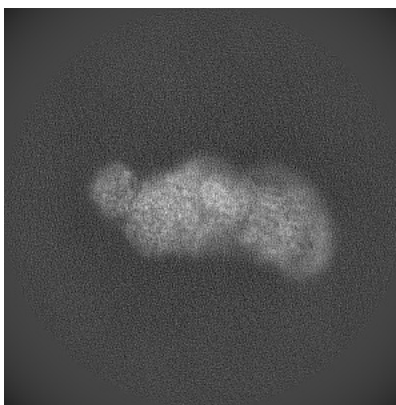


Z

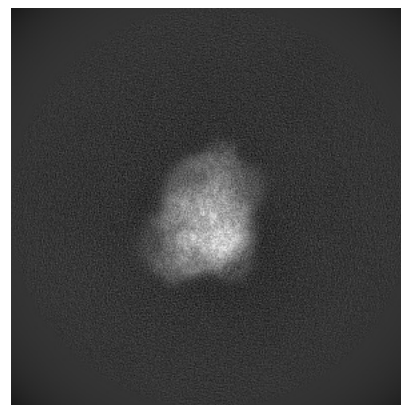
#### 6.1.2 Raw map



X



Y

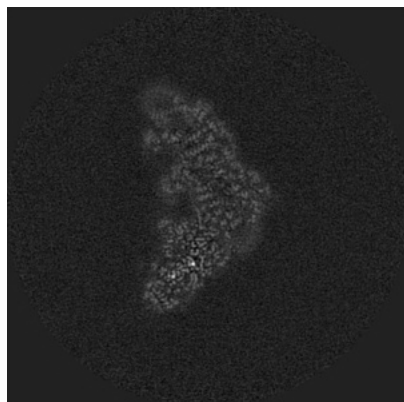


Z

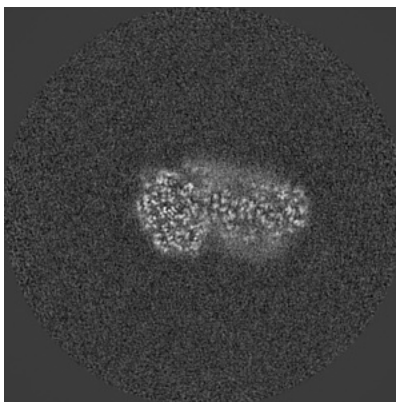
The images above show the map projected in three orthogonal directions.

## 6.2 Central slices [i](#)

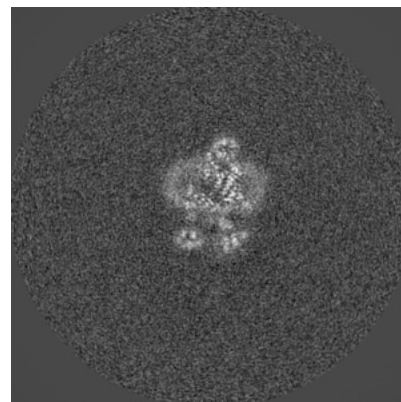
### 6.2.1 Primary map



X Index: 225

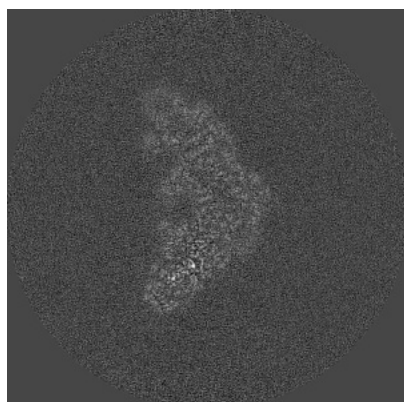


Y Index: 225

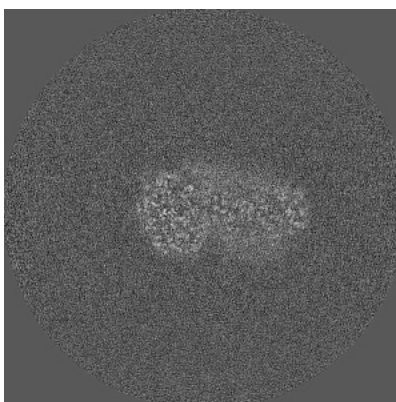


Z Index: 225

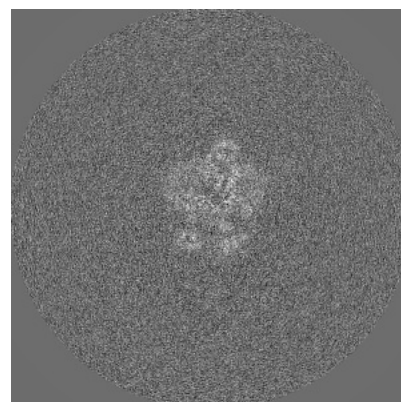
### 6.2.2 Raw map



X Index: 225



Y Index: 225

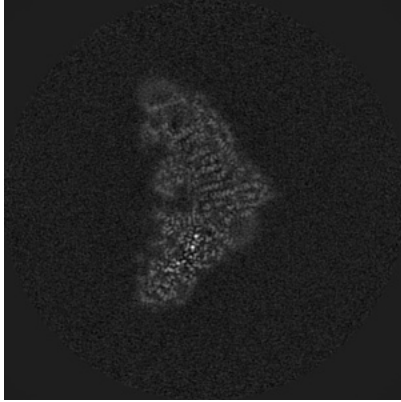


Z Index: 225

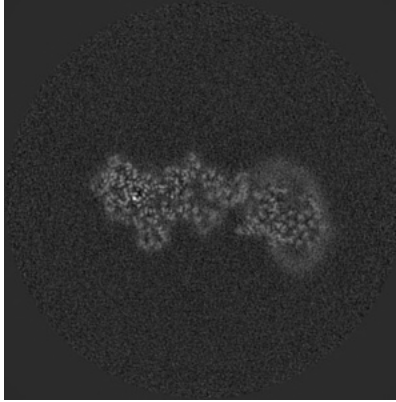
The images above show central slices of the map in three orthogonal directions.

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

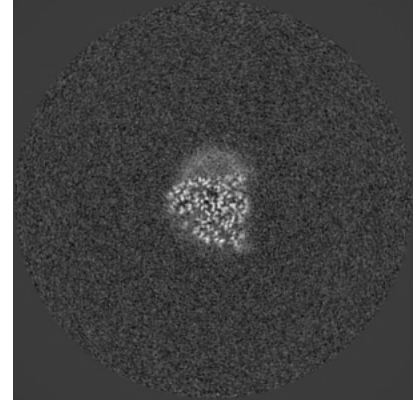
### 6.3.1 Primary map



X Index: 228

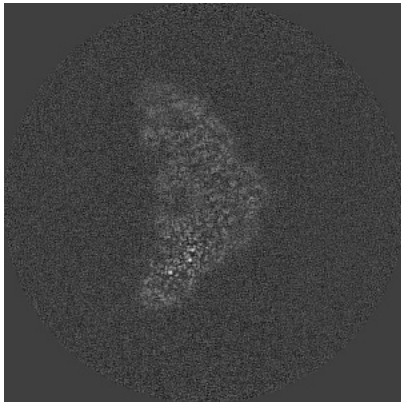


Y Index: 188

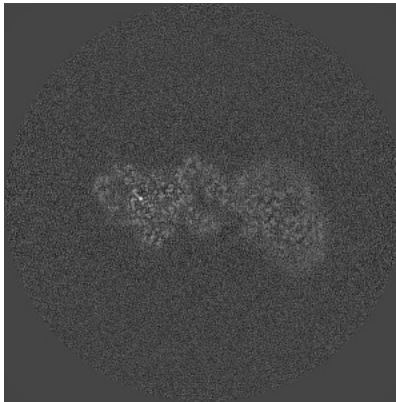


Z Index: 188

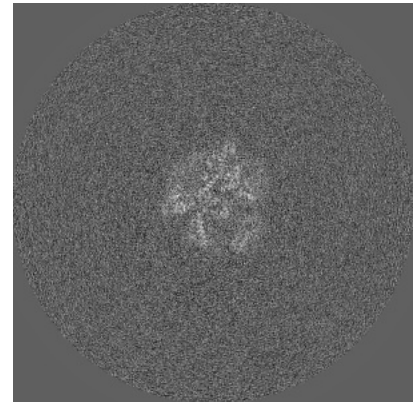
### 6.3.2 Raw map



X Index: 226



Y Index: 195

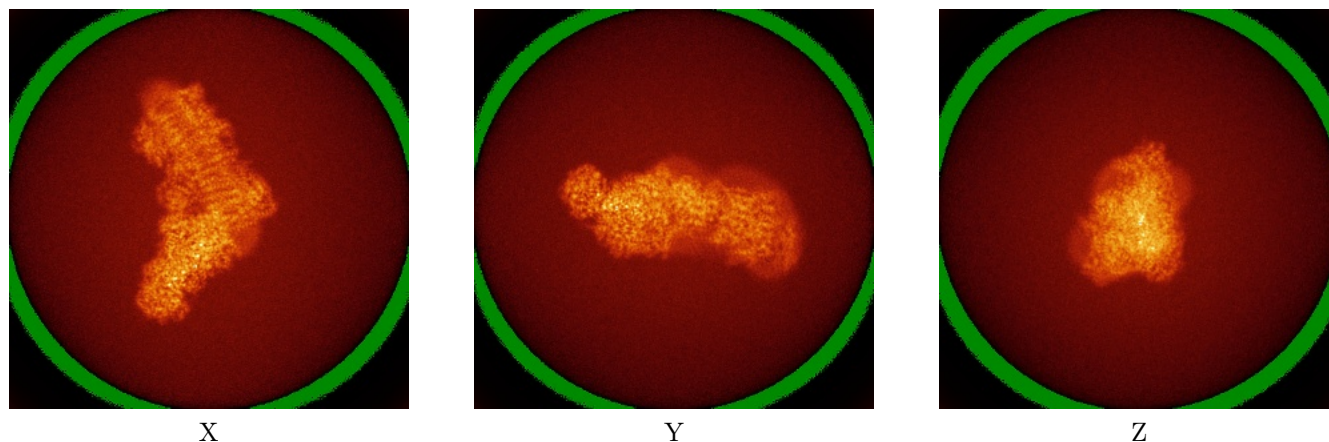


Z Index: 215

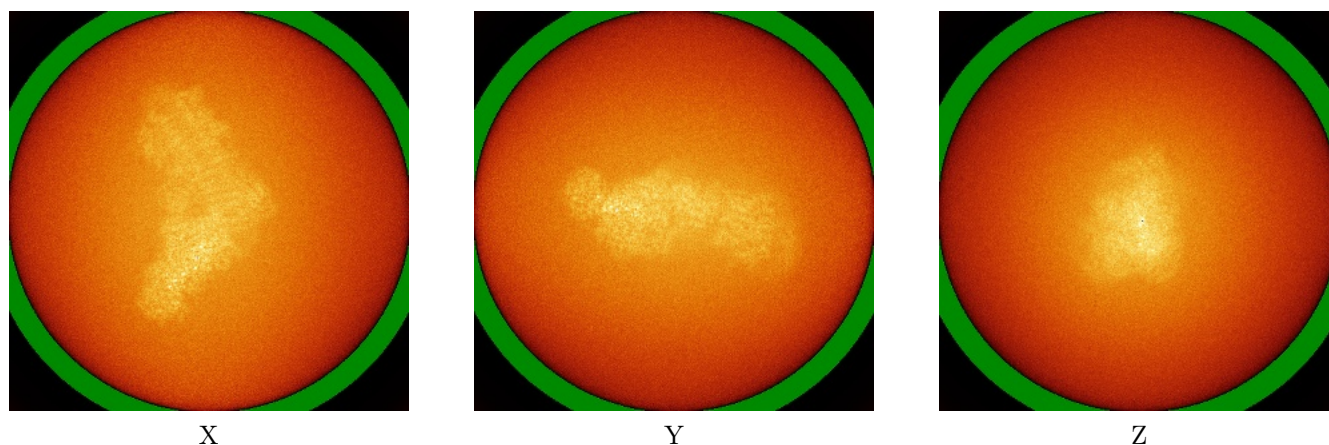
The images above show the largest variance slices of the map in three orthogonal directions.

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

### 6.4.1 Primary map



### 6.4.2 Raw map



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

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

This section was not generated.

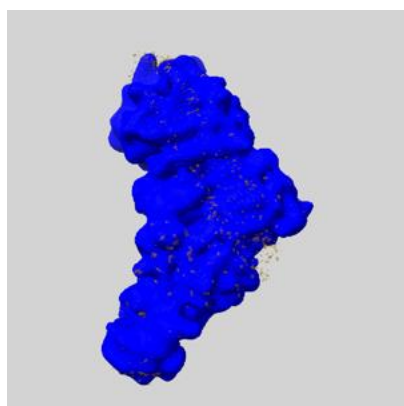
## 6.6 Mask visualisation [i](#)

This section shows the 3D surface view of the primary map at 50% transparency overlaid with the specified mask at 0% transparency

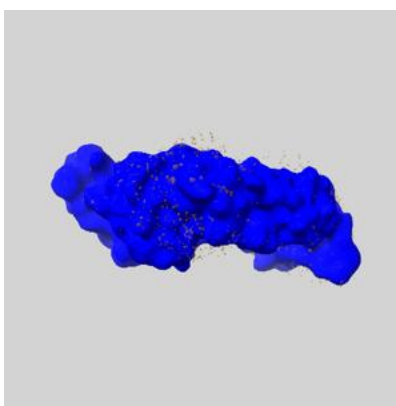
A mask typically either:

- Encompasses the whole structure
- Separates out a domain, a functional unit, a monomer or an area of interest from a larger structure

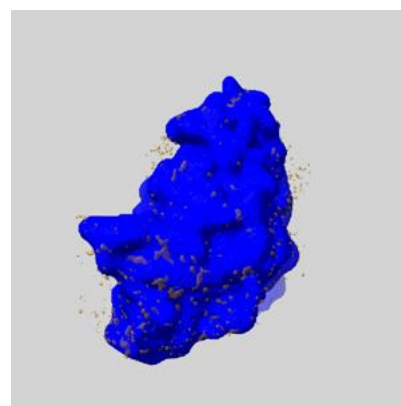
### 6.6.1 emd\_15937\_msk\_1.map [i](#)



X



Y

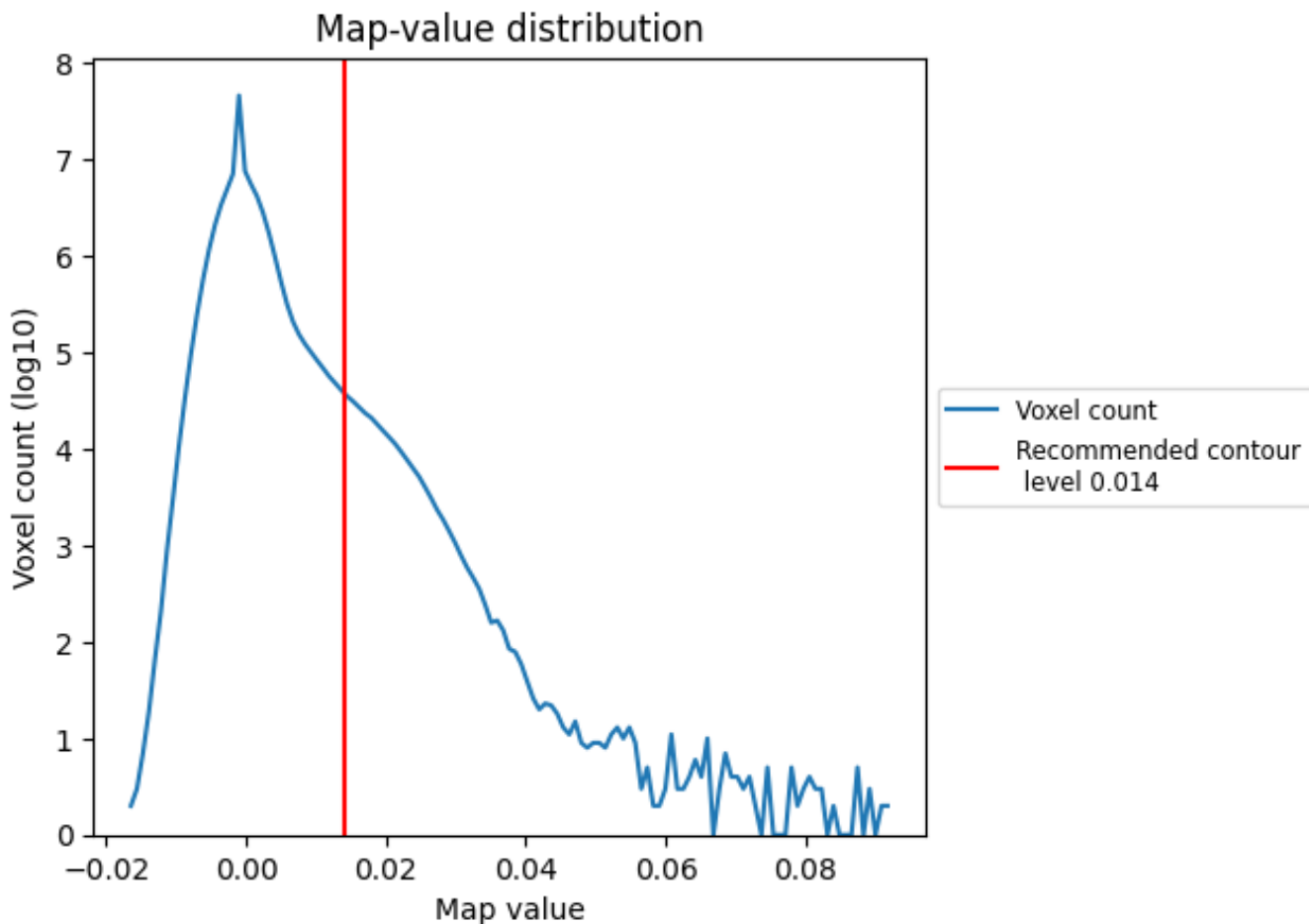


Z

## 7 Map analysis [i](#)

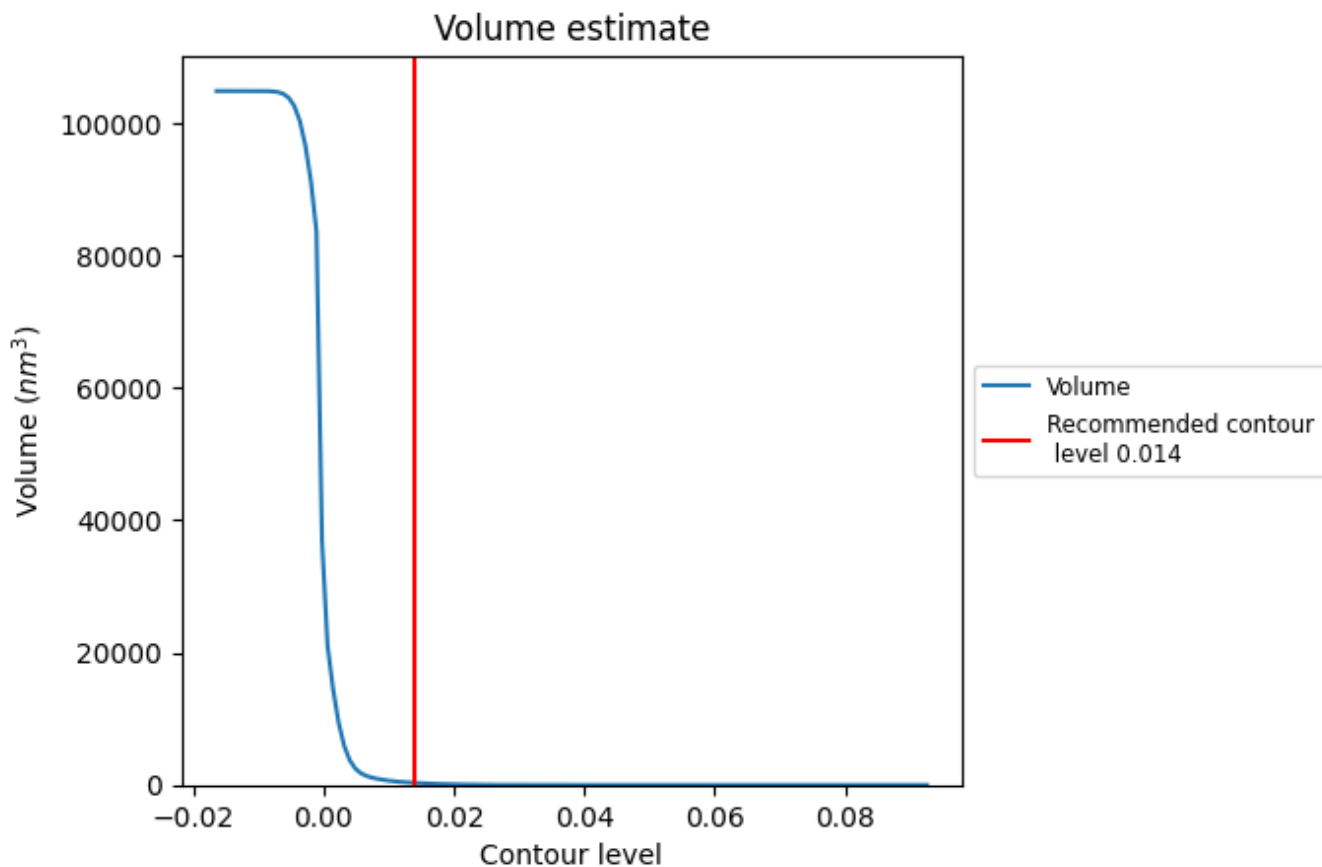
This section contains the results of statistical analysis of the map.

### 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.

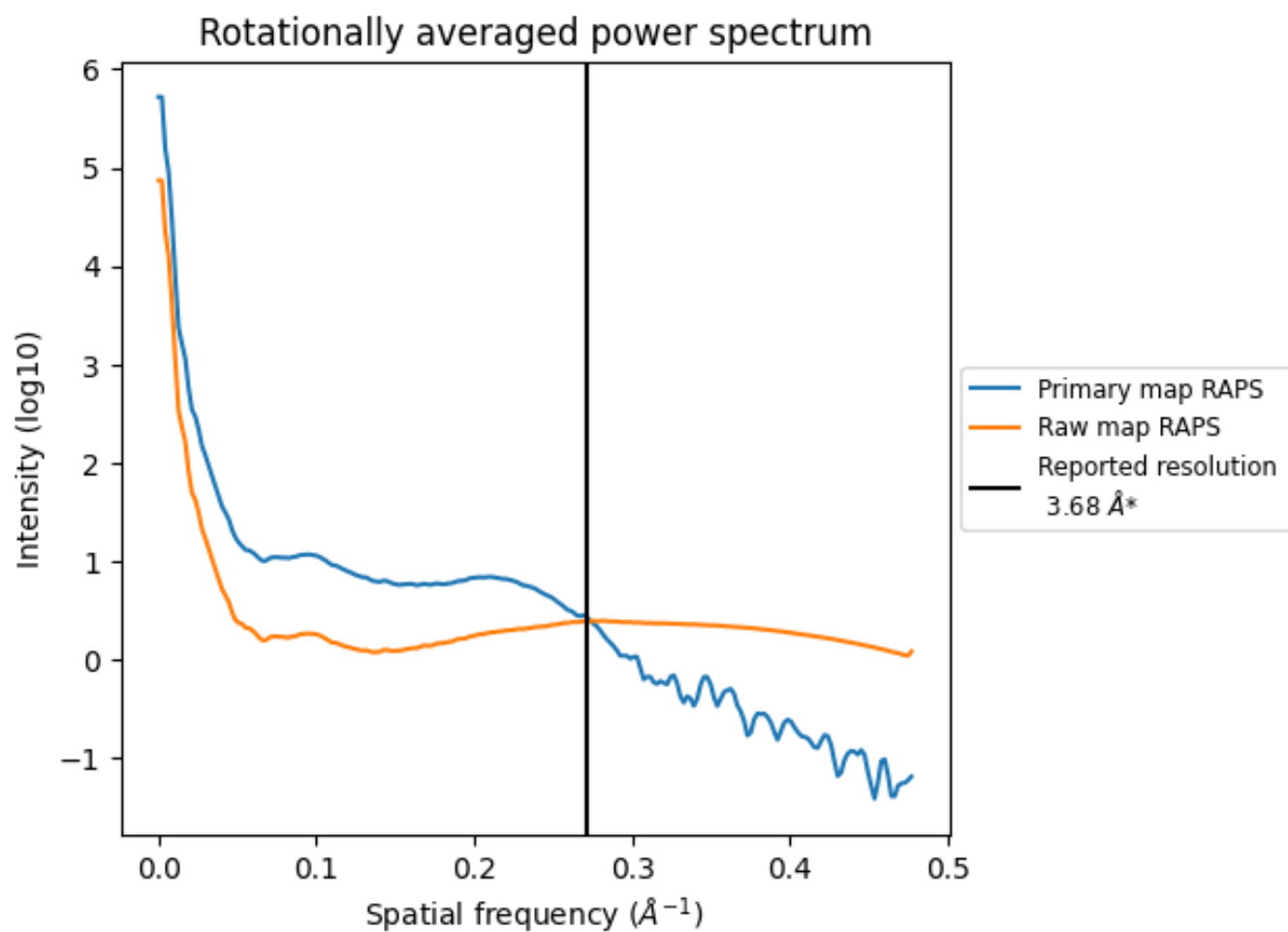
## 7.2 Volume estimate [\(i\)](#)



The volume at the recommended contour level is 306  $\text{nm}^3$ ; this corresponds to an approximate mass of 277 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

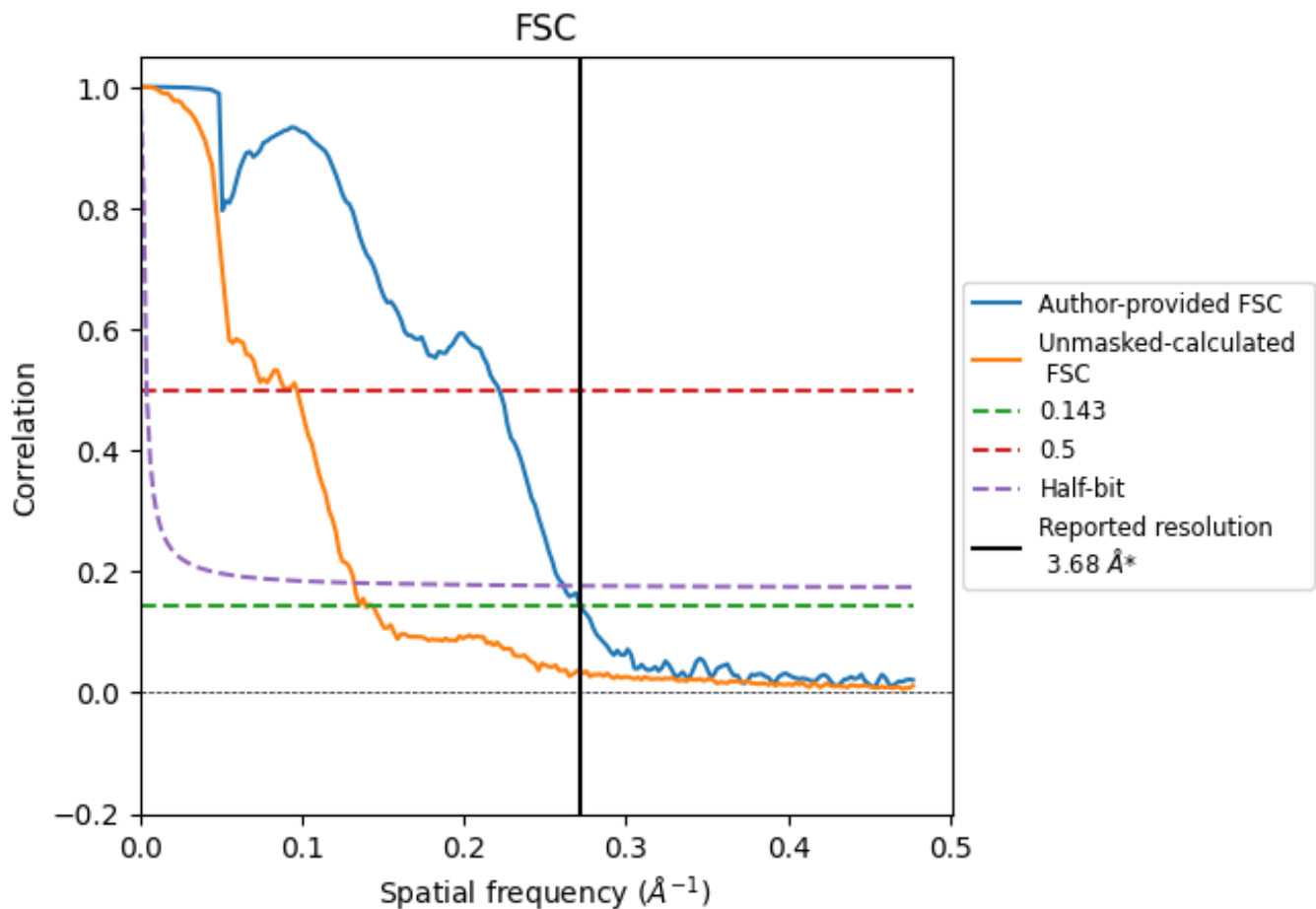


\*Reported resolution corresponds to spatial frequency of 0.272 Å<sup>-1</sup>

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

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

### 8.1 FSC [i](#)



\*Reported resolution corresponds to spatial frequency of 0.272 Å<sup>-1</sup>

## 8.2 Resolution estimates [i](#)

Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	3.68	-	-
Author-provided FSC curve	3.68	4.51	3.82
Unmasked-calculated*	7.16	10.34	7.56

\*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 7.16 differs from the reported value 3.68 by more than 10 %

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

This section contains information regarding the fit between EMDB map EMD-15937 and PDB model 8BA0. Per-residue inclusion information can be found in section 3 on page 18.

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

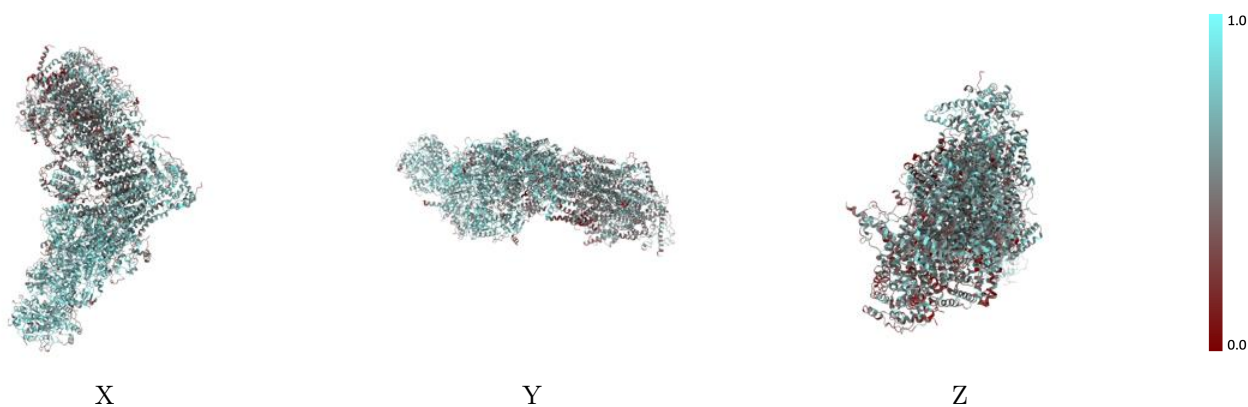
This section was not generated.

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



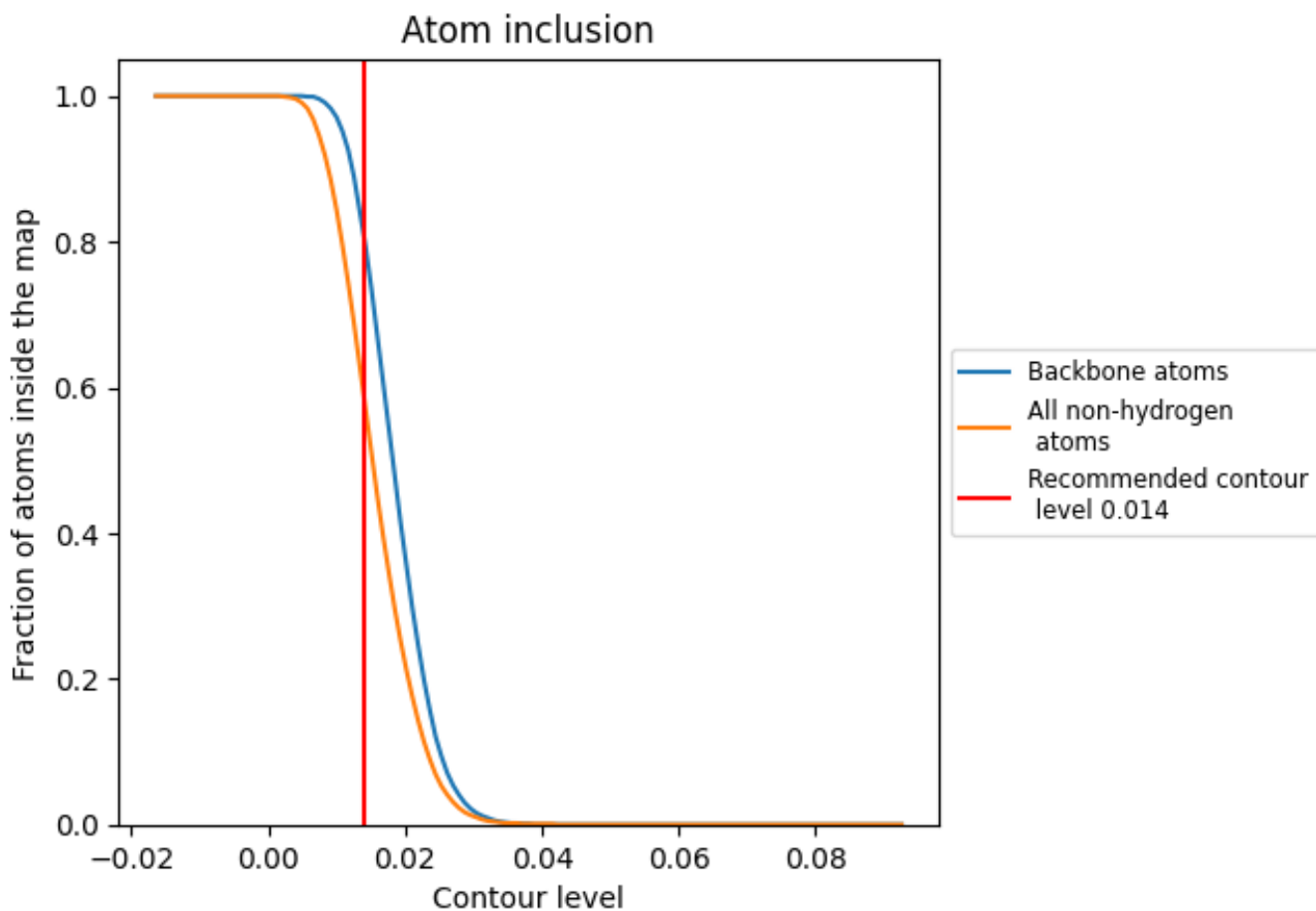
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.014).







































































## 9.4 Atom inclusion [i](#)



At the recommended contour level, 81% of all backbone atoms, 59% 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 (0.014) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.5860	 0.4350
A	 0.5360	 0.4170
B	 0.6870	 0.4910
C	 0.6970	 0.4850
D	 0.6480	 0.4690
E	 0.6550	 0.4450
F	 0.6990	 0.4630
G	 0.6740	 0.4700
H	 0.6250	 0.4540
I	 0.7260	 0.4840
J	 0.5520	 0.4190
K	 0.5080	 0.3880
L	 0.5020	 0.4150
M	 0.5280	 0.4370
N	 0.5530	 0.4160
O	 0.5270	 0.3950
P	 0.6500	 0.4570
Q	 0.6790	 0.4770
R	 0.7190	 0.4840
T	 0.3900	 0.3360
U	 0.3560	 0.3490
V	 0.6260	 0.4280
W	 0.6280	 0.4340
X	 0.5960	 0.4400
Y	 0.3630	 0.3980
Z	 0.6770	 0.4570
a	 0.6050	 0.4390
b	 0.6110	 0.4360
d	 0.5470	 0.4220
e	 0.6250	 0.4280
f	 0.4200	 0.4020
g	 0.4780	 0.4170
h	 0.5780	 0.4270
i	 0.4700	 0.3860
j	 0.4530	 0.3710



*Continued on next page...*

*Continued from previous page...*

Chain	Atom inclusion	Q-score
k	 0.4210	 0.3490
l	 0.4920	 0.4160
m	 0.5080	 0.4120
n	 0.4850	 0.3810
o	 0.5100	 0.3770
p	 0.6110	 0.4220
q	 0.6420	 0.4640
r	 0.5670	 0.4520
s	 0.5100	 0.4130