



wwPDB EM Validation Summary Report ⓘ

Nov 29, 2022 – 01:12 pm GMT

PDB ID : 7PQD
EMDB ID : EMD-13590
Title : Cryo-EM structure of the dimeric Rhodobacter sphaeroides RC-LH1 core complex at 2.9 Å: the structural basis for dimerisation
Authors : Qian, P.; Hunter, C.N.
Deposited on : 2021-09-17
Resolution : 2.90 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:

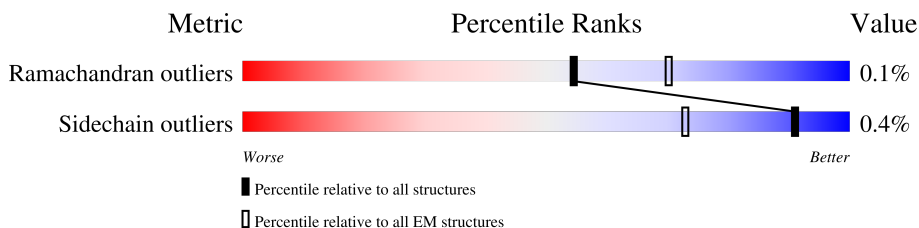
EMDB validation analysis : 0.0.1.dev43
Mogul : 1.8.4, CSD as541be (2020)
MolProbity : 4.02b-467
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : 1.9.9
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.31.3

1 Overall quality at a glance

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

The reported resolution of this entry is 2.90 Å.

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



Metric	Whole archive (#Entries)	EM structures (#Entries)
Ramachandran outliers	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	AA	58	78% 21%
1	AB	58	93% 5%
1	AC	58	95% 5%
1	AD	58	93% 5%
1	AE	58	93% 5%
1	AF	58	93% 5%
1	AG	58	93% 5%
1	AH	58	93% 5%
1	AI	58	93% 5%




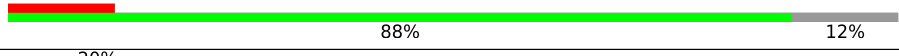
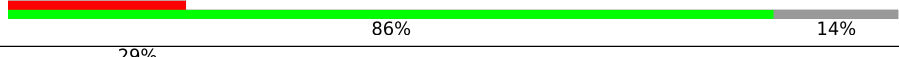



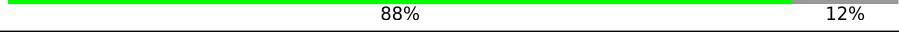
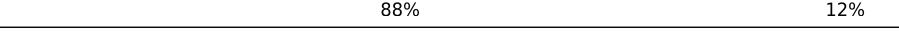
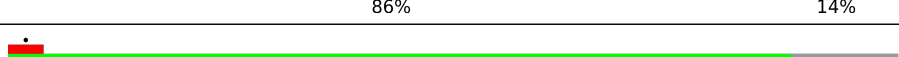
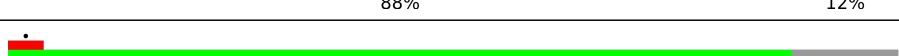

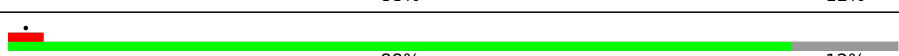
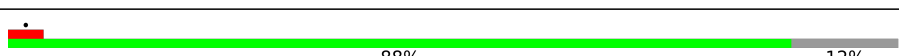
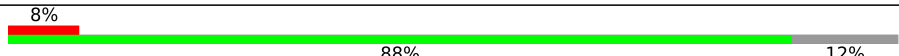





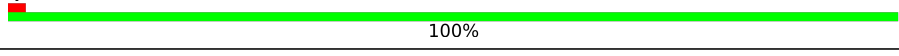
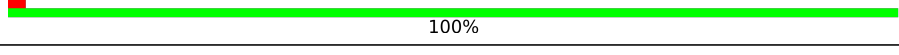
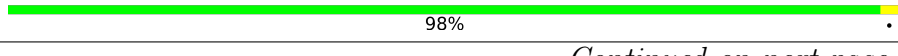

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Mol	Chain	Length	Quality of chain
1	AJ	58	95% 5%
1	AK	58	7% 93% 5%
1	AL	58	17% 93% 5%
1	AM	58	29% 93% 5%
1	AN	58	47% 88% 12%
1	aa	58	78% 21%
1	ab	58	93% 5%
1	ac	58	95% 5%
1	ad	58	93% 5%
1	ae	58	93% 5%
1	af	58	5% 93% 5%
1	ag	58	93% 5%
1	ah	58	93% 5%
1	ai	58	5% 93% 5%
1	aj	58	95% 5%
1	ak	58	7% 93% 5%
1	al	58	17% 93% 5%
1	am	58	29% 93% 5%
1	an	58	45% 88% 12%
2	BA	49	88% 12%
2	BB	49	88% 12%
2	BC	49	86% 14%
2	BD	49	88% 12%
2	BE	49	88% 12%
2	BF	49	8% 88% 12%

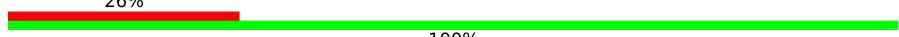
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Mol	Chain	Length	Quality of chain
2	BG	49	 88% 12%
2	BH	49	 88% 12%
2	BI	49	 88% 12% 8%
2	BJ	49	 88% 12% 12%
2	BK	49	 86% 14% 20%
2	BL	49	 86% 14% 29%
2	BM	49	 84% 14% 37%
2	BN	49	 73% 24% 41%
2	ba	49	 88% 12%
2	bb	49	 88% 12%
2	bc	49	 86% 14%
2	bd	49	 88% 12%
2	be	49	 88% 12%
2	bf	49	 88% 12% 8%
2	bg	49	 88% 12%
2	bh	49	 88% 12%
2	bi	49	 88% 12% 8%
2	bj	49	 88% 12% 12%
2	bk	49	 84% 14% 22%
2	bl	49	 86% 14% 29%
2	bm	49	 84% 14% 37%
2	bn	49	 73% 24% 43%
3	H	246	 100%
3	h	246	 100%
4	L	281	 98%

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Mol	Chain	Length	Quality of chain
4	l	281	 98%
5	M	307	 99%
5	m	307	 99%
6	UA	31	 29% 100%
6	UB	31	 26% 100%
6	ua	31	 29% 100%
6	ub	31	 26% 100%
7	UU	49	 12% 100%
7	uu	49	 12% 100%
8	X	55	 100%
8	x	55	 100%

2 Entry composition [i](#)

There are 19 unique types of molecules in this entry. The entry contains 45952 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 LH1-alpha.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	AA	46	Total 394	C 272	N 60	O 59	S 3	0	0
1	AB	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AC	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AD	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AE	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AF	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AG	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AH	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AI	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AJ	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AK	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AL	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AM	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	AN	51	Total 432	C 296	N 69	O 65	S 2	0	0
1	aa	46	Total 394	C 272	N 60	O 59	S 3	0	0
1	ab	55	Total 462	C 314	N 74	O 71	S 3	0	0
1	ac	55	Total 462	C 314	N 74	O 71	S 3	0	0

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Mol	Chain	Residues	Atoms					AltConf	Trace
1	ad	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	ae	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	af	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	ag	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	ah	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	ai	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	aj	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	ak	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	al	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	am	55	Total	C	N	O	S	0	0
			462	314	74	71	3		
1	an	51	Total	C	N	O	S	0	0
			432	296	69	65	2		

- Molecule 2 is a protein called LH1-beta.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	BA	43	Total	C	N	O	S	0	0
			351	236	55	59	1		
2	BB	43	Total	C	N	O	S	0	0
			351	236	55	59	1		
2	BC	42	Total	C	N	O	S	0	0
			343	230	54	58	1		
2	BD	43	Total	C	N	O	S	0	0
			351	236	55	59	1		
2	BE	43	Total	C	N	O	S	0	0
			351	236	55	59	1		
2	BF	43	Total	C	N	O	S	0	0
			351	236	55	59	1		
2	BG	43	Total	C	N	O	S	0	0
			351	236	55	59	1		
2	BH	43	Total	C	N	O	S	0	0
			351	236	55	59	1		

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Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	BI	43	351	236	55	59	1	0	0
2	BJ	43	351	236	55	59	1	0	0
2	BK	42	343	230	54	58	1	0	0
2	BL	42	343	230	54	58	1	0	0
2	BM	42	343	230	54	58	1	0	0
2	BN	37	308	207	49	51	1	0	0
2	ba	43	351	236	55	59	1	0	0
2	bb	43	351	236	55	59	1	0	0
2	bc	42	343	230	54	58	1	0	0
2	bd	43	351	236	55	59	1	0	0
2	be	43	351	236	55	59	1	0	0
2	bf	43	351	236	55	59	1	0	0
2	bg	43	351	236	55	59	1	0	0
2	bh	43	351	236	55	59	1	0	0
2	bi	43	351	236	55	59	1	0	0
2	bj	43	351	236	55	59	1	0	0
2	bk	42	343	230	54	58	1	0	0
2	bl	42	343	230	54	58	1	0	0
2	bm	42	343	230	54	58	1	0	0
2	bn	37	308	207	49	51	1	0	0

- Molecule 3 is a protein called RC-H.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	H	246	Total	C	N	O	S	0	0
			1866	1196	316	344	10		
3	h	246	Total	C	N	O	S	0	0
			1866	1196	316	344	10		

- Molecule 4 is a protein called RC-L.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	L	281	Total	C	N	O	S	0	0
			2231	1507	355	361	8		
4	l	281	Total	C	N	O	S	0	0
			2231	1507	355	361	8		

- Molecule 5 is a protein called Reaction center protein M chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	M	307	Total	C	N	O	S	0	0
			2444	1630	400	403	11		
5	m	307	Total	C	N	O	S	0	0
			2444	1630	400	403	11		

- Molecule 6 is a protein called PufZ.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	UA	31	Total	C	N	O	S	0	0
			244	165	39	35	5		
6	UB	31	Total	C	N	O	S	0	0
			244	165	39	35	5		
6	ua	31	Total	C	N	O	S	0	0
			244	165	39	35	5		
6	ub	31	Total	C	N	O	S	0	0
			244	165	39	35	5		

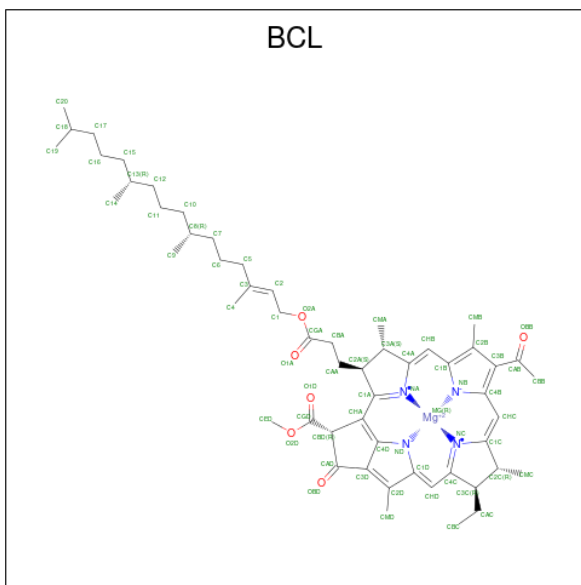
- Molecule 7 is a protein called PufY.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	UU	49	Total	C	N	O	S	0	0
			362	247	56	56	3		
7	uu	49	Total	C	N	O	S	0	0
			362	247	56	56	3		

- Molecule 8 is a protein called PufX.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	X	55	Total	C	N	O	S	0	0
			424	281	74	66	3		
8	x	55	Total	C	N	O	S	0	0
			424	281	74	66	3		

- Molecule 9 is BACTERIOCHLOROPHYLL A (three-letter code: BCL) (formula: C₅₅H₇₄MgN₄O₆) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
9	AA	1	Total	C	Mg	N	O	0
			66	55	1	4	6	
9	AB	1	Total	C	Mg	N	O	0
			66	55	1	4	6	
9	AC	1	Total	C	Mg	N	O	0
			66	55	1	4	6	
9	AD	1	Total	C	Mg	N	O	0
			66	55	1	4	6	
9	AE	1	Total	C	Mg	N	O	0
			66	55	1	4	6	
9	AF	1	Total	C	Mg	N	O	0
			66	55	1	4	6	
9	AG	1	Total	C	Mg	N	O	0
			66	55	1	4	6	
9	AH	1	Total	C	Mg	N	O	0
			66	55	1	4	6	
9	AI	1	Total	C	Mg	N	O	0
			66	55	1	4	6	

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Mol	Chain	Residues	Atoms					AltConf
			Total	C	Mg	N	O	
9	AJ	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	AK	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	AL	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	AM	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	AN	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BA	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BB	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BC	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BD	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BE	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BF	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BG	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BH	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BI	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BJ	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BK	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BL	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BM	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	BN	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	L	1	Total 132	C 110	Mg 2	N 8	O 12	0
9	L	1	Total 132	C 110	Mg 2	N 8	O 12	0

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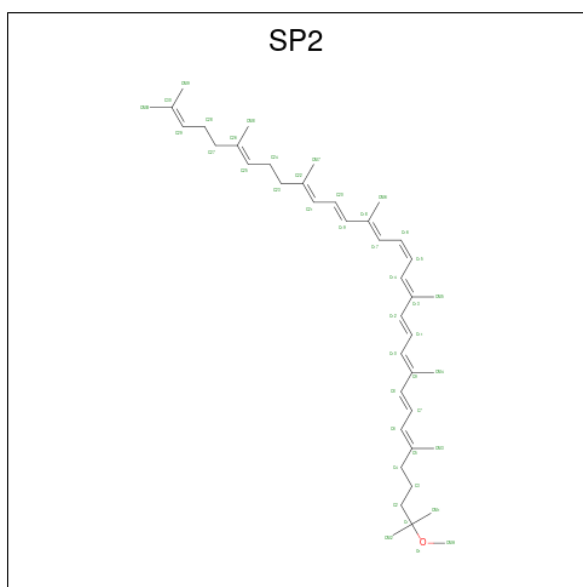
Mol	Chain	Residues	Atoms					AltConf
			Total	C	Mg	N	O	
9	M	1	Total 132	C 110	Mg 2	N 8	O 12	0
9	M	1	Total 132	C 110	Mg 2	N 8	O 12	0
9	aa	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ab	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ac	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ad	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ae	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	af	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ag	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ah	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ai	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	aj	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ak	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	al	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	am	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	an	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	ba	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bb	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bc	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bd	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	be	1	Total 66	C 55	Mg 1	N 4	O 6	0

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Mol	Chain	Residues	Atoms					AltConf
			Total	C	Mg	N	O	
9	bf	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bg	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bh	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bi	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bj	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bk	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bl	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bm	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	bn	1	Total 66	C 55	Mg 1	N 4	O 6	0
9	l	1	Total 132	C 110	Mg 2	N 8	O 12	0
9	l	1	Total 132	C 110	Mg 2	N 8	O 12	0
9	m	1	Total 132	C 110	Mg 2	N 8	O 12	0
9	m	1	Total 132	C 110	Mg 2	N 8	O 12	0

- Molecule 10 is 3,4-DIHYDROSPHEROIDENE (three-letter code: SP2) (formula: C₄₁H₆₂O).



Mol	Chain	Residues	Atoms			AltConf
			Total	C	O	
10	AA	1	42	41	1	0
10	AB	1	126	123	3	0
10	AB	1	126	123	3	0
10	AB	1	126	123	3	0
10	AC	1	84	82	2	0
10	AC	1	84	82	2	0
10	AE	1	42	41	1	0
10	AF	1	84	82	2	0
10	AF	1	84	82	2	0
10	AG	1	42	41	1	0
10	AH	1	42	41	1	0
10	AI	1	84	82	2	0
10	AI	1	84	82	2	0
10	AJ	1	84	82	2	0

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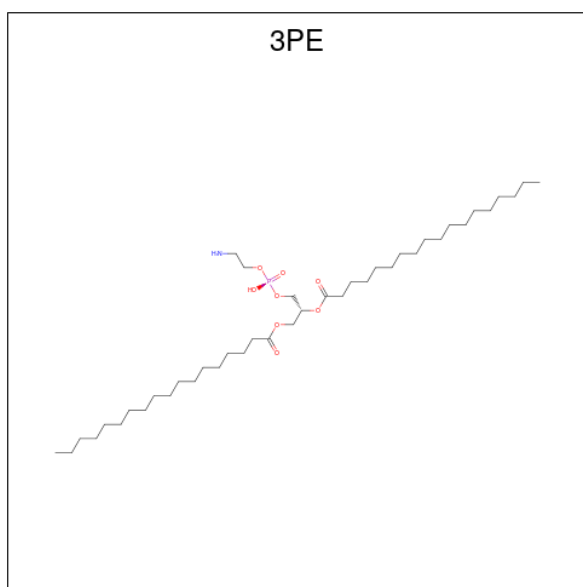
Mol	Chain	Residues	Atoms			AltConf
			Total	C	O	
10	AJ	1	84	82	2	0
10	AK	1	42	41	1	0
10	AM	1	42	41	1	0
10	BA	1	42	41	1	0
10	BC	1	42	41	1	0
10	BE	1	42	41	1	0
10	BF	1	42	41	1	0
10	BH	1	42	41	1	0
10	BJ	1	42	41	1	0
10	BK	1	42	41	1	0
10	BL	1	84	82	2	0
10	BL	1	84	82	2	0
10	M	1	42	41	1	0
10	ab	1	126	123	3	0
10	ab	1	126	123	3	0
10	ab	1	126	123	3	0
10	ac	1	84	82	2	0
10	ac	1	84	82	2	0
10	ad	1	42	41	1	0
10	ae	1	84	82	2	0
10	ae	1	84	82	2	0

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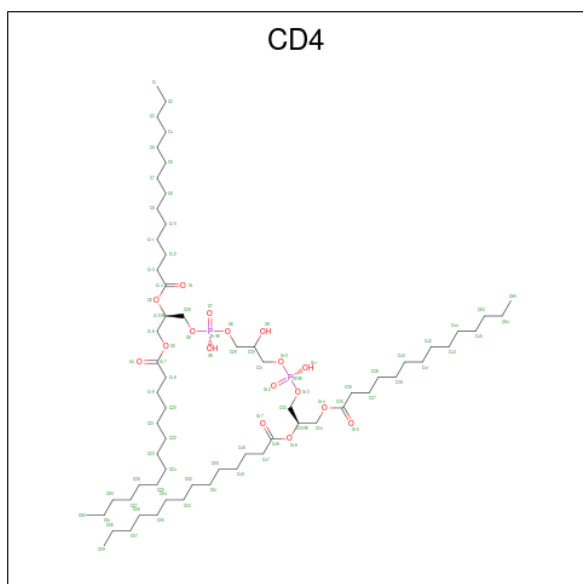
Mol	Chain	Residues	Atoms			AltConf
			Total	C	O	
10	af	1	126	123	3	0
10	af	1	126	123	3	0
10	af	1	126	123	3	0
10	ah	1	42	41	1	0
10	ai	1	84	82	2	0
10	ai	1	84	82	2	0
10	aj	1	84	82	2	0
10	aj	1	84	82	2	0
10	ak	1	42	41	1	0
10	al	1	42	41	1	0
10	am	1	42	41	1	0
10	ba	1	42	41	1	0
10	bb	1	42	41	1	0
10	bf	1	42	41	1	0
10	bh	1	42	41	1	0
10	bj	1	42	41	1	0
10	bk	1	42	41	1	0
10	bl	1	42	41	1	0
10	m	1	42	41	1	0

- Molecule 11 is 1,2-Distearoyl-sn-glycerophosphoethanolamine (three-letter code: 3PE) (formula: $C_{41}H_{82}NO_8P$).



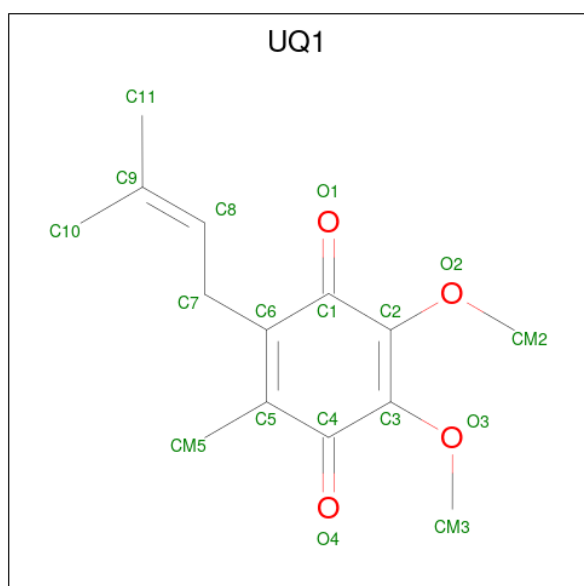
Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
11	AC	1	51	41	1	8	1	0
11	H	1	51	41	1	8	1	0
11	ac	1	51	41	1	8	1	0
11	h	1	51	41	1	8	1	0

- Molecule 12 is (2R,5R,11R,14R)-5,8,11-trihydroxy-5,11-dioxido-17-oxo-2,14-bis(tetradecanoxy)-4,6,10,12,16-pentaoxa-5,11-diphosphatriacont-1-yl tetradecanoate (three-letter code: CD4) (formula: $C_{65}H_{126}O_{17}P_2$).



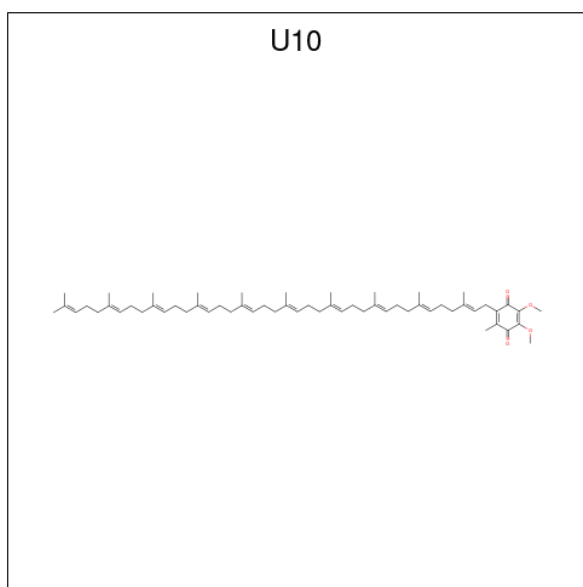
Mol	Chain	Residues	Atoms				AltConf
12	H	1	Total	C	O	P	0
			84	65	17	2	
12	M	1	Total	C	O	P	0
			84	65	17	2	
12	h	1	Total	C	O	P	0
			84	65	17	2	
12	m	1	Total	C	O	P	0
			84	65	17	2	

- Molecule 13 is UBIQUINONE-1 (three-letter code: UQ1) (formula: C₁₄H₁₈O₄).



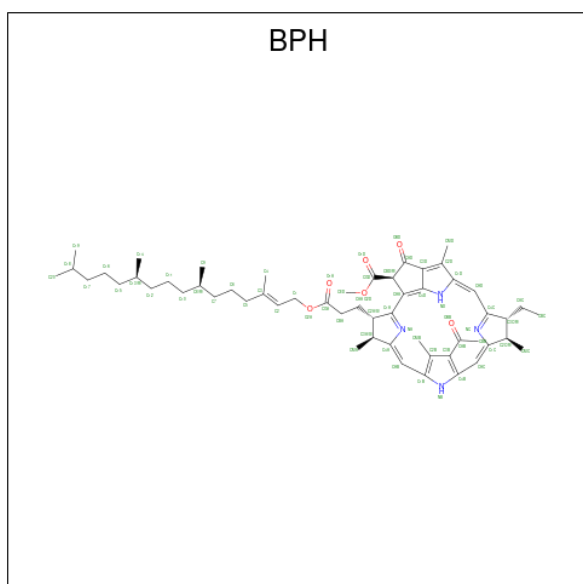
Mol	Chain	Residues	Atoms			AltConf
13	L	1	Total	C	O	0
			18	14	4	
13	l	1	Total	C	O	0
			18	14	4	

- Molecule 14 is UBIQUINONE-10 (three-letter code: U10) (formula: C₅₉H₉₀O₄) (labeled as "Ligand of Interest" by depositor).



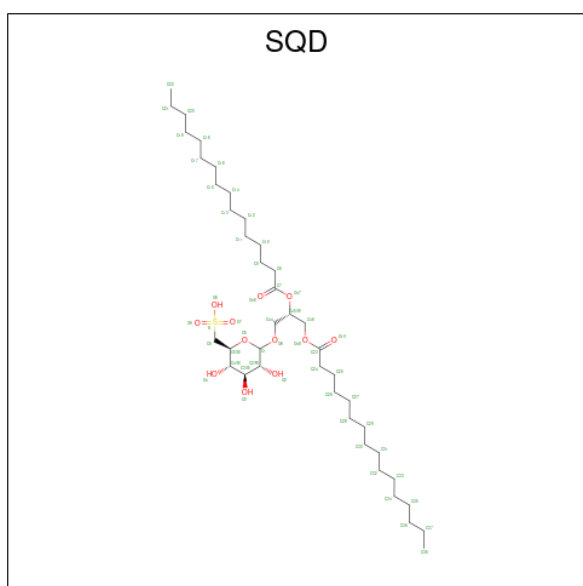
Mol	Chain	Residues	Atoms			AltConf
14	L	1	Total	C	O	0
			63	59	4	
14	M	1	Total	C	O	0
			63	59	4	
14	l	1	Total	C	O	0
			63	59	4	
14	m	1	Total	C	O	0
			63	59	4	

- Molecule 15 is BACTERIOPHEOPHYTIN A (three-letter code: BPH) (formula: $C_{55}H_{76}N_4O_6$) (labeled as "Ligand of Interest" by depositor).



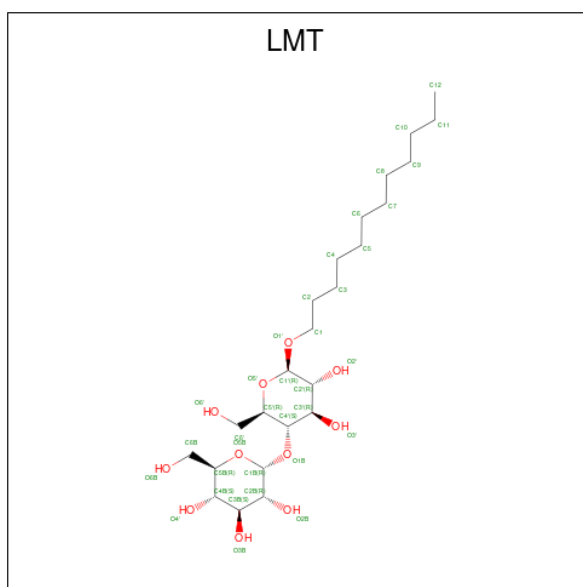
Mol	Chain	Residues	Atoms				AltConf
			Total	C	N	O	
15	L	1	Total 65	C 55	N 4	O 6	0
15	M	1	Total 65	C 55	N 4	O 6	0
15	l	1	Total 65	C 55	N 4	O 6	0
15	m	1	Total 65	C 55	N 4	O 6	0

- Molecule 16 is 1,2-DI-O-ACYL-3-O-[6-DEOXY-6-SULFO-ALPHA-D-GLUCOPYRANOSYL]-SN-GLYCEROL (three-letter code: SQD) (formula: C₄₁H₇₈O₁₂S) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf
			Total	C	O	S	
16	L	1	Total 54	C 41	O 12	S 1	0
16	x	1	Total 54	C 41	O 12	S 1	0

- Molecule 17 is DODECYL-BETA-D-MALTOSE (three-letter code: LMT) (formula: C₂₄H₄₆O₁₁).



Mol	Chain	Residues	Atoms		AltConf
17	M	1	Total	C O	0
			35	24 11	
17	m	1	Total	C O	0
			35	24 11	

- Molecule 18 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		AltConf
18	M	1	Total	Fe	0
			1	1	
18	m	1	Total	Fe	0
			1	1	

- Molecule 19 is water.

Mol	Chain	Residues	Atoms		AltConf
19	AB	2	Total	O	0
			2	2	
19	BB	1	Total	O	0
			1	1	
19	H	18	Total	O	0
			18	18	
19	L	27	Total	O	0
			27	27	
19	M	19	Total	O	0
			19	19	

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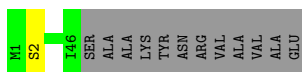
Mol	Chain	Residues	Atoms		AltConf
19	X	5	Total 5	O 5	0
19	ab	3	Total 3	O 3	0
19	h	18	Total 18	O 18	0
19	l	27	Total 27	O 27	0
19	m	19	Total 19	O 19	0
19	x	5	Total 5	O 5	0

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.

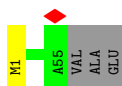
- Molecule 1: LH1-alpha

Chain AA:  78% 21%



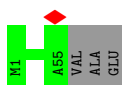
- Molecule 1: LH1-alpha

Chain AB:  93% 5%



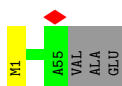
- Molecule 1: LH1-alpha

Chain AC:  95% 5%



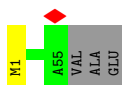
- Molecule 1: LH1-alpha

Chain AD:  93% 5%

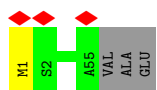


- Molecule 1: LH1-alpha

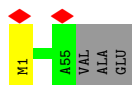
Chain AE:  93% 5%



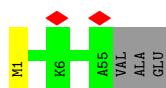
• Molecule 1: LH1-alpha



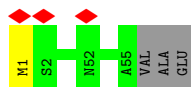
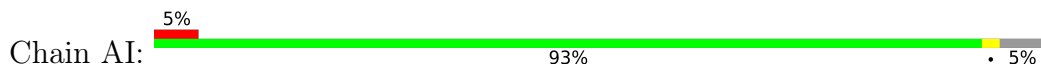
• Molecule 1: LH1-alpha



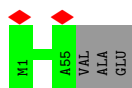
• Molecule 1: LH1-alpha



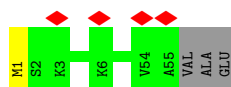
• Molecule 1: LH1-alpha



• Molecule 1: LH1-alpha

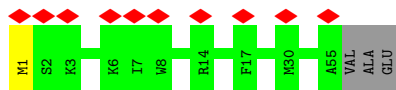


• Molecule 1: LH1-alpha

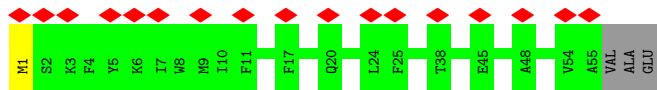


• Molecule 1: LH1-alpha

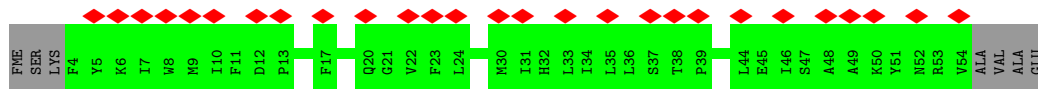
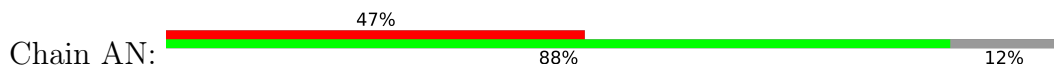




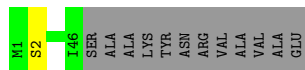
• Molecule 1: LH1-alpha



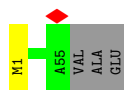
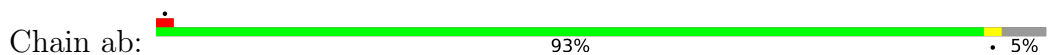
• Molecule 1: LH1-alpha



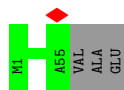
• Molecule 1: LH1-alpha



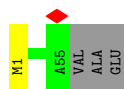
• Molecule 1: LH1-alpha



• Molecule 1: LH1-alpha

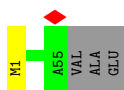


• Molecule 1: LH1-alpha

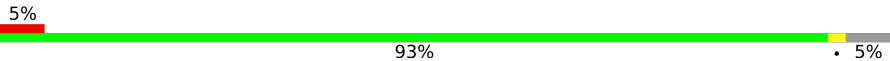


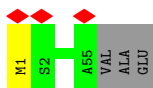
• Molecule 1: LH1-alpha

Chain ae:  93% • 5%



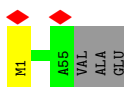
• Molecule 1: LH1-alpha

Chain af:  93% • 5%



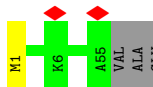
• Molecule 1: LH1-alpha

Chain ag:  93% • 5%



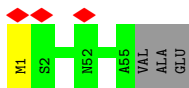
• Molecule 1: LH1-alpha

Chain ah:  93% • 5%



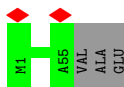
• Molecule 1: LH1-alpha

Chain ai:  93% • 5%



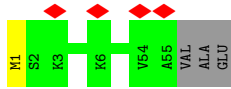
• Molecule 1: LH1-alpha

Chain aj:  95% • 5%

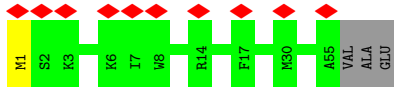


• Molecule 1: LH1-alpha

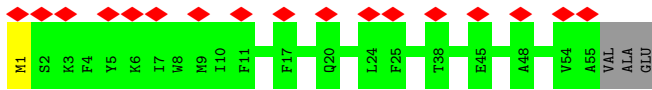
Chain ak:  93% • 5%



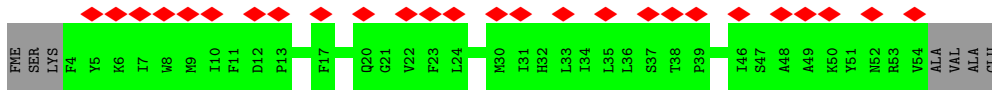
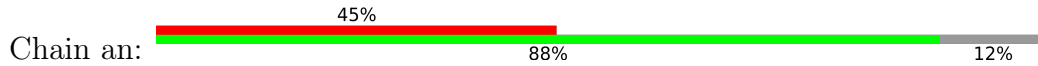
• Molecule 1: LH1-alpha



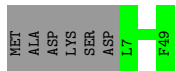
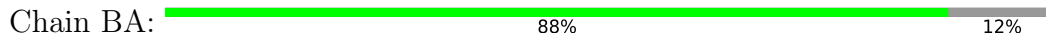
• Molecule 1: LH1-alpha



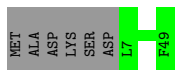
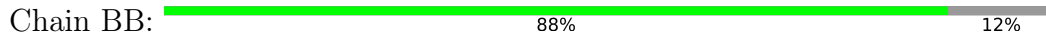
• Molecule 1: LH1-alpha



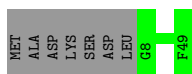
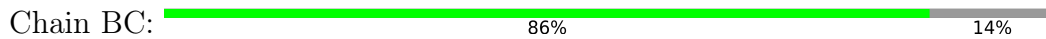
• Molecule 2: LH1-beta



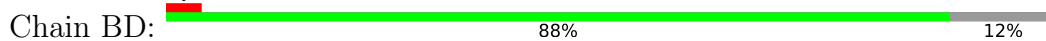
• Molecule 2: LH1-beta

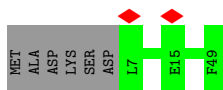


• Molecule 2: LH1-beta

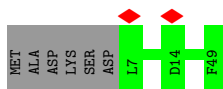
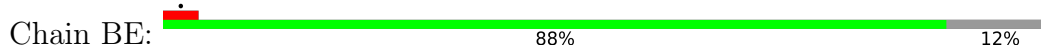


• Molecule 2: LH1-beta

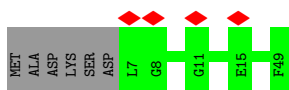
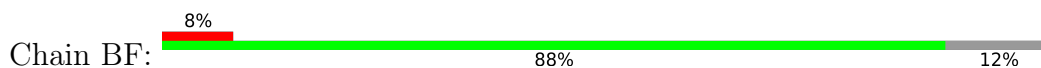




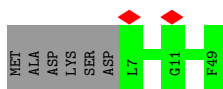
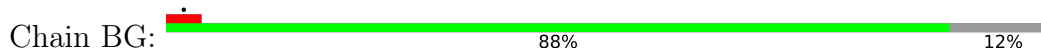
● Molecule 2: LH1-beta



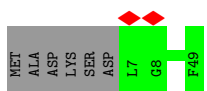
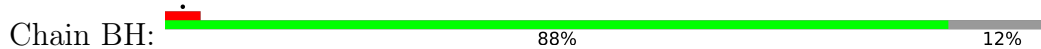
● Molecule 2: LH1-beta



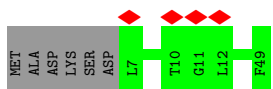
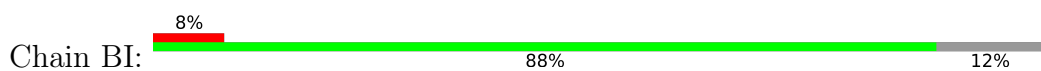
● Molecule 2: LH1-beta



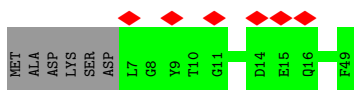
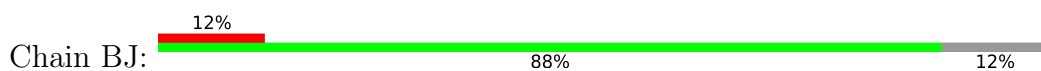
● Molecule 2: LH1-beta



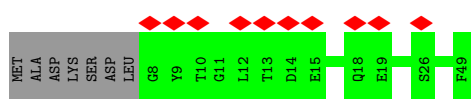
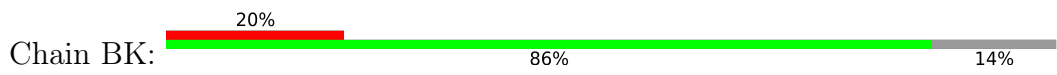
● Molecule 2: LH1-beta



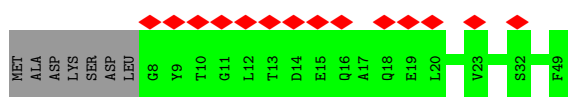
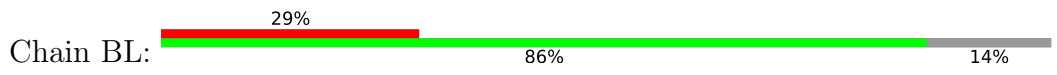
● Molecule 2: LH1-beta



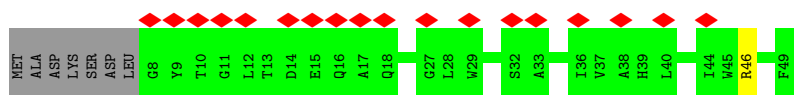
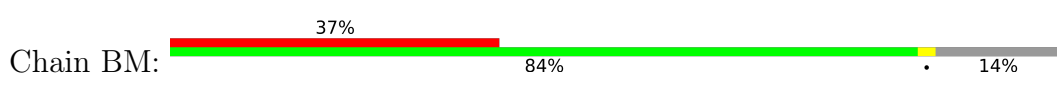
● Molecule 2: LH1-beta



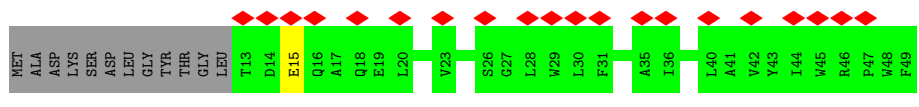
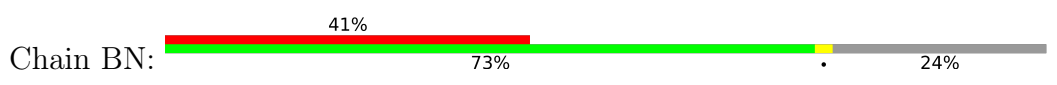
• Molecule 2: LH1-beta



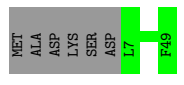
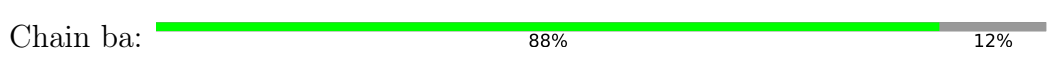
• Molecule 2: LH1-beta



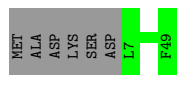
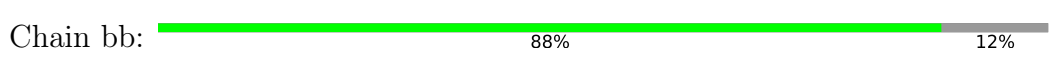
• Molecule 2: LH1-beta



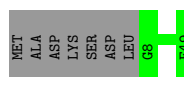
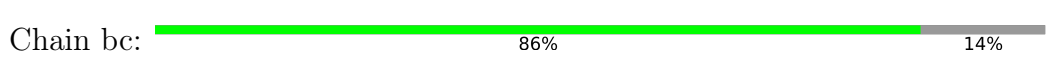
• Molecule 2: LH1-beta



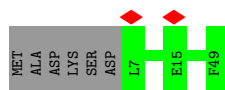
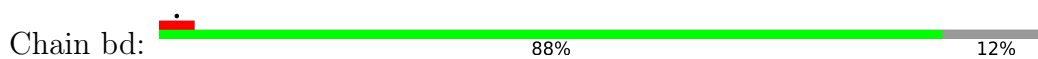
• Molecule 2: LH1-beta



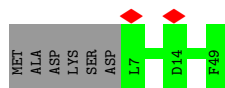
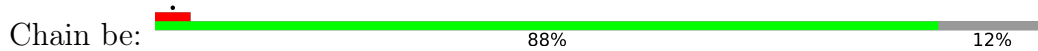
• Molecule 2: LH1-beta



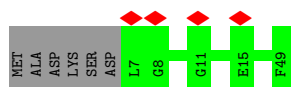
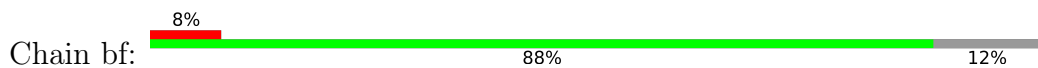
• Molecule 2: LH1-beta



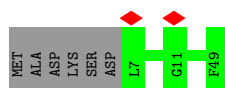
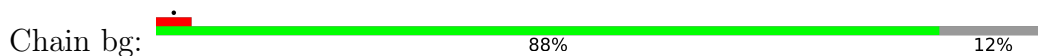
• Molecule 2: LH1-beta



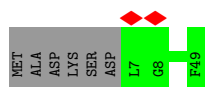
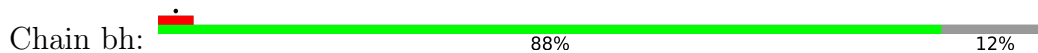
• Molecule 2: LH1-beta



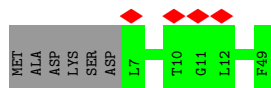
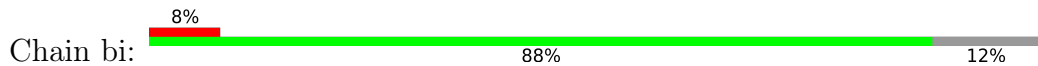
• Molecule 2: LH1-beta



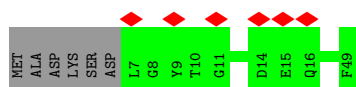
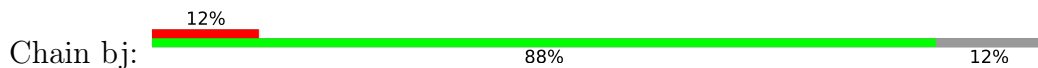
• Molecule 2: LH1-beta



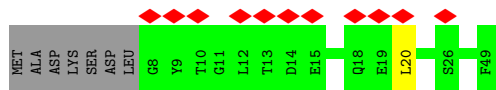
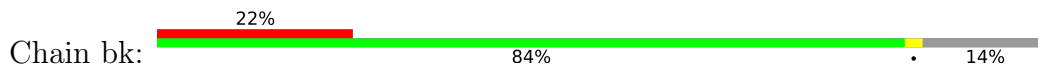
• Molecule 2: LH1-beta



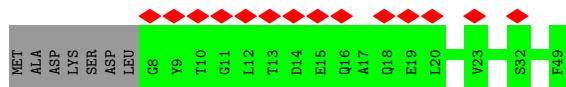
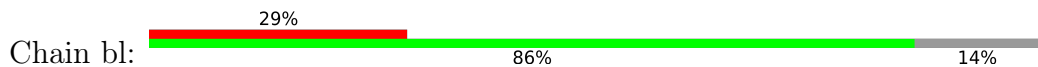
• Molecule 2: LH1-beta



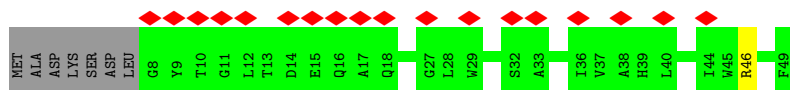
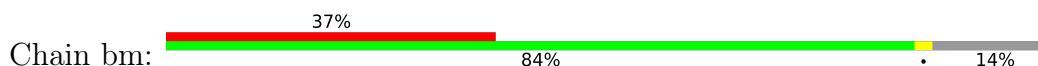
• Molecule 2: LH1-beta



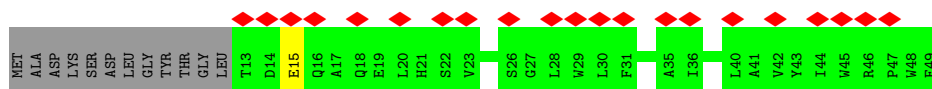
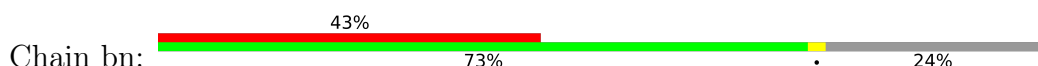
• Molecule 2: LH1-beta



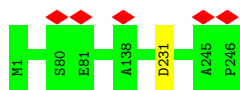
• Molecule 2: LH1-beta



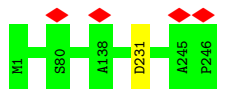
• Molecule 2: LH1-beta



• Molecule 3: RC-H



• Molecule 3: RC-H



• Molecule 4: RC-L



- Molecule 4: RC-L

Chain l:  98%



- Molecule 5: Reaction center protein M chain

Chain M:  99%



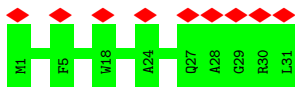
- Molecule 5: Reaction center protein M chain

Chain m:  99%



- Molecule 6: PufZ

Chain UA:  29%
100%



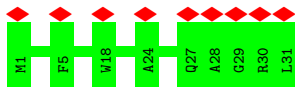
- Molecule 6: PufZ

Chain UB:  26%
100%



- Molecule 6: PufZ

Chain ua:  29%
100%

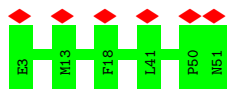


- Molecule 6: PufZ

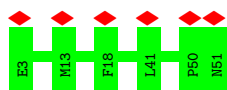
Chain ub:  26%
100%



- Molecule 7: PufY



- Molecule 7: PufY



- Molecule 8: PufX



There are no outlier residues recorded for this chain.

- Molecule 8: PufX



There are no outlier residues recorded for this chain.

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C2	Depositor
Number of particles used	58945	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 ($e^-/\text{\AA}^2$)	45.36	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	120000	Depositor
Image detector	FEI FALCON IV (4k x 4k)	Depositor
Maximum map value	0.210	Depositor
Minimum map value	-0.113	Depositor
Average map value	0.000	Depositor
Map value standard deviation	0.005	Depositor
Recommended contour level	0.0222	Depositor
Map size (Å)	332.8, 332.8, 332.8	wwPDB
Map dimensions	512, 512, 512	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	0.65, 0.65, 0.65	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CD4, BPH, U10, BCL, SP2, UQ1, FE, SQD, FME, LMT, 3PE

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	AA	0.26	0/397	0.46	0/539
1	AB	0.26	0/466	0.48	0/632
1	AC	0.26	0/466	0.51	0/632
1	AD	0.25	0/466	0.47	0/632
1	AE	0.26	0/466	0.51	0/632
1	AF	0.26	0/466	0.47	0/632
1	AG	0.26	0/466	0.50	0/632
1	AH	0.26	0/466	0.52	0/632
1	AI	0.25	0/466	0.47	0/632
1	AJ	0.26	0/466	0.49	0/632
1	AK	0.26	0/466	0.50	0/632
1	AL	0.26	0/466	0.51	0/632
1	AM	0.26	0/466	0.46	0/632
1	AN	0.26	0/446	0.51	0/606
1	aa	0.26	0/397	0.46	0/539
1	ab	0.25	0/466	0.48	0/632
1	ac	0.26	0/466	0.51	0/632
1	ad	0.25	0/466	0.47	0/632
1	ae	0.26	0/466	0.51	0/632
1	af	0.26	0/466	0.47	0/632
1	ag	0.26	0/466	0.50	0/632
1	ah	0.26	0/466	0.52	0/632
1	ai	0.26	0/466	0.47	0/632
1	aj	0.25	0/466	0.49	0/632
1	ak	0.26	0/466	0.50	0/632
1	al	0.27	0/466	0.50	0/632
1	am	0.26	0/466	0.47	0/632
1	an	0.26	0/446	0.51	0/606
2	BA	0.23	0/364	0.45	0/499
2	BB	0.23	0/364	0.44	0/499
2	BC	0.23	0/356	0.43	0/488
2	BD	0.24	0/364	0.43	0/499

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
2	BE	0.23	0/364	0.43	0/499
2	BF	0.23	0/364	0.44	0/499
2	BG	0.23	0/364	0.43	0/499
2	BH	0.23	0/364	0.44	0/499
2	BI	0.23	0/364	0.45	0/499
2	BJ	0.23	0/364	0.45	0/499
2	BK	0.23	0/356	0.48	0/488
2	BL	0.24	0/356	0.42	0/488
2	BM	0.23	0/356	0.41	0/488
2	BN	0.23	0/320	0.42	0/439
2	ba	0.23	0/364	0.46	0/499
2	bb	0.23	0/364	0.44	0/499
2	bc	0.23	0/356	0.43	0/488
2	bd	0.23	0/364	0.43	0/499
2	be	0.23	0/364	0.43	0/499
2	bf	0.23	0/364	0.44	0/499
2	bg	0.23	0/364	0.43	0/499
2	bh	0.23	0/364	0.44	0/499
2	bi	0.24	0/364	0.46	0/499
2	bj	0.23	0/364	0.44	0/499
2	bk	0.24	0/356	0.43	0/488
2	bl	0.23	0/356	0.43	0/488
2	bm	0.23	0/356	0.42	0/488
2	bn	0.24	0/320	0.41	0/439
3	H	0.24	0/1916	0.50	0/2609
3	h	0.24	0/1916	0.50	0/2609
4	L	0.26	0/2319	0.46	0/3175
4	l	0.26	0/2319	0.46	0/3175
5	M	0.24	0/2537	0.46	0/3464
5	m	0.24	0/2537	0.46	0/3464
6	UA	0.26	0/250	0.49	0/334
6	UB	0.27	0/250	0.49	0/334
6	ua	0.26	0/250	0.50	0/334
6	ub	0.27	0/250	0.49	0/334
7	UU	0.27	0/373	0.42	0/505
7	uu	0.27	0/373	0.42	0/505
8	X	0.24	0/436	0.54	0/589
8	x	0.24	0/436	0.53	0/589
All	All	0.25	0/39072	0.47	0/53242

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
2	BM	0	1
2	bm	0	1
All	All	0	2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	BM	46	ARG	Sidechain
2	bm	46	ARG	Sidechain

5.2 Too-close contacts [i](#)

Due to software issues we are unable to calculate clashes - this section is therefore empty.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	AA	44/58 (76%)	43 (98%)	0	1 (2%)	6	23
1	AB	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AC	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AD	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AE	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AF	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AG	53/58 (91%)	52 (98%)	1 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	AH	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AI	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AJ	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AK	53/58 (91%)	53 (100%)	0	0	100	100
1	AL	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AM	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	AN	49/58 (84%)	48 (98%)	1 (2%)	0	100	100
1	aa	44/58 (76%)	43 (98%)	0	1 (2%)	6	23
1	ab	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	ac	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	ad	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	ae	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	af	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	ag	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	ah	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	ai	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	aj	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	ak	53/58 (91%)	53 (100%)	0	0	100	100
1	al	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	am	53/58 (91%)	52 (98%)	1 (2%)	0	100	100
1	an	49/58 (84%)	48 (98%)	1 (2%)	0	100	100
2	BA	41/49 (84%)	41 (100%)	0	0	100	100
2	BB	41/49 (84%)	40 (98%)	1 (2%)	0	100	100
2	BC	40/49 (82%)	39 (98%)	1 (2%)	0	100	100
2	BD	41/49 (84%)	41 (100%)	0	0	100	100
2	BE	41/49 (84%)	41 (100%)	0	0	100	100
2	BF	41/49 (84%)	41 (100%)	0	0	100	100
2	BG	41/49 (84%)	41 (100%)	0	0	100	100
2	BH	41/49 (84%)	40 (98%)	1 (2%)	0	100	100
2	BI	41/49 (84%)	40 (98%)	1 (2%)	0	100	100
2	BJ	41/49 (84%)	41 (100%)	0	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	BK	40/49 (82%)	39 (98%)	1 (2%)	0	100	100
2	BL	40/49 (82%)	39 (98%)	1 (2%)	0	100	100
2	BM	40/49 (82%)	40 (100%)	0	0	100	100
2	BN	35/49 (71%)	34 (97%)	1 (3%)	0	100	100
2	ba	41/49 (84%)	41 (100%)	0	0	100	100
2	bb	41/49 (84%)	40 (98%)	1 (2%)	0	100	100
2	bc	40/49 (82%)	40 (100%)	0	0	100	100
2	bd	41/49 (84%)	41 (100%)	0	0	100	100
2	be	41/49 (84%)	41 (100%)	0	0	100	100
2	bf	41/49 (84%)	41 (100%)	0	0	100	100
2	bg	41/49 (84%)	41 (100%)	0	0	100	100
2	bh	41/49 (84%)	40 (98%)	1 (2%)	0	100	100
2	bi	41/49 (84%)	40 (98%)	1 (2%)	0	100	100
2	bj	41/49 (84%)	41 (100%)	0	0	100	100
2	bk	40/49 (82%)	39 (98%)	1 (2%)	0	100	100
2	bl	40/49 (82%)	39 (98%)	1 (2%)	0	100	100
2	bm	40/49 (82%)	40 (100%)	0	0	100	100
2	bn	35/49 (71%)	34 (97%)	1 (3%)	0	100	100
3	H	244/246 (99%)	237 (97%)	7 (3%)	0	100	100
3	h	244/246 (99%)	237 (97%)	7 (3%)	0	100	100
4	L	279/281 (99%)	271 (97%)	7 (2%)	1 (0%)	34	66
4	l	279/281 (99%)	271 (97%)	7 (2%)	1 (0%)	34	66
5	M	305/307 (99%)	294 (96%)	10 (3%)	1 (0%)	41	71
5	m	305/307 (99%)	294 (96%)	10 (3%)	1 (0%)	41	71
6	UA	29/31 (94%)	27 (93%)	2 (7%)	0	100	100
6	UB	29/31 (94%)	27 (93%)	2 (7%)	0	100	100
6	ua	29/31 (94%)	27 (93%)	2 (7%)	0	100	100
6	ub	29/31 (94%)	27 (93%)	2 (7%)	0	100	100
7	UU	47/49 (96%)	47 (100%)	0	0	100	100
7	uu	47/49 (96%)	47 (100%)	0	0	100	100
8	X	53/55 (96%)	50 (94%)	3 (6%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
8	x	53/55 (96%)	50 (94%)	3 (6%)	0	100	100
All	All	4558/4996 (91%)	4453 (98%)	99 (2%)	6 (0%)	54	82

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	AA	2	SER
1	aa	2	SER
5	M	195	ASN
5	m	195	ASN
4	L	31	VAL

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	AA	42/50 (84%)	42 (100%)	0	100	100
1	AB	48/50 (96%)	48 (100%)	0	100	100
1	AC	48/50 (96%)	48 (100%)	0	100	100
1	AD	48/50 (96%)	48 (100%)	0	100	100
1	AE	48/50 (96%)	48 (100%)	0	100	100
1	AF	48/50 (96%)	48 (100%)	0	100	100
1	AG	48/50 (96%)	48 (100%)	0	100	100
1	AH	48/50 (96%)	48 (100%)	0	100	100
1	AI	48/50 (96%)	48 (100%)	0	100	100
1	AJ	48/50 (96%)	48 (100%)	0	100	100
1	AK	48/50 (96%)	48 (100%)	0	100	100
1	AL	48/50 (96%)	48 (100%)	0	100	100
1	AM	48/50 (96%)	48 (100%)	0	100	100
1	AN	46/50 (92%)	46 (100%)	0	100	100
1	aa	42/50 (84%)	42 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	ab	48/50 (96%)	48 (100%)	0	100	100
1	ac	48/50 (96%)	48 (100%)	0	100	100
1	ad	48/50 (96%)	48 (100%)	0	100	100
1	ae	48/50 (96%)	48 (100%)	0	100	100
1	af	48/50 (96%)	48 (100%)	0	100	100
1	ag	48/50 (96%)	48 (100%)	0	100	100
1	ah	48/50 (96%)	48 (100%)	0	100	100
1	ai	48/50 (96%)	48 (100%)	0	100	100
1	aj	48/50 (96%)	48 (100%)	0	100	100
1	ak	48/50 (96%)	48 (100%)	0	100	100
1	al	48/50 (96%)	48 (100%)	0	100	100
1	am	48/50 (96%)	48 (100%)	0	100	100
1	an	46/50 (92%)	46 (100%)	0	100	100
2	BA	35/40 (88%)	35 (100%)	0	100	100
2	BB	35/40 (88%)	35 (100%)	0	100	100
2	BC	34/40 (85%)	34 (100%)	0	100	100
2	BD	35/40 (88%)	35 (100%)	0	100	100
2	BE	35/40 (88%)	35 (100%)	0	100	100
2	BF	35/40 (88%)	35 (100%)	0	100	100
2	BG	35/40 (88%)	35 (100%)	0	100	100
2	BH	35/40 (88%)	35 (100%)	0	100	100
2	BI	35/40 (88%)	35 (100%)	0	100	100
2	BJ	35/40 (88%)	35 (100%)	0	100	100
2	BK	34/40 (85%)	34 (100%)	0	100	100
2	BL	34/40 (85%)	34 (100%)	0	100	100
2	BM	34/40 (85%)	34 (100%)	0	100	100
2	BN	31/40 (78%)	30 (97%)	1 (3%)	39	73
2	ba	35/40 (88%)	35 (100%)	0	100	100
2	bb	35/40 (88%)	35 (100%)	0	100	100
2	bc	34/40 (85%)	34 (100%)	0	100	100
2	bd	35/40 (88%)	35 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	be	35/40 (88%)	35 (100%)	0	100	100
2	bf	35/40 (88%)	35 (100%)	0	100	100
2	bg	35/40 (88%)	35 (100%)	0	100	100
2	bh	35/40 (88%)	35 (100%)	0	100	100
2	bi	35/40 (88%)	35 (100%)	0	100	100
2	bj	35/40 (88%)	35 (100%)	0	100	100
2	bk	34/40 (85%)	33 (97%)	1 (3%)	42	76
2	bl	34/40 (85%)	34 (100%)	0	100	100
2	bm	34/40 (85%)	34 (100%)	0	100	100
2	bn	31/40 (78%)	30 (97%)	1 (3%)	39	73
3	H	198/198 (100%)	197 (100%)	1 (0%)	88	96
3	h	198/198 (100%)	197 (100%)	1 (0%)	88	96
4	L	220/220 (100%)	216 (98%)	4 (2%)	59	85
4	l	220/220 (100%)	216 (98%)	4 (2%)	59	85
5	M	240/240 (100%)	238 (99%)	2 (1%)	81	94
5	m	240/240 (100%)	238 (99%)	2 (1%)	81	94
6	UA	22/22 (100%)	22 (100%)	0	100	100
6	UB	22/22 (100%)	22 (100%)	0	100	100
6	ua	22/22 (100%)	22 (100%)	0	100	100
6	ub	22/22 (100%)	22 (100%)	0	100	100
7	UU	33/33 (100%)	33 (100%)	0	100	100
7	uu	33/33 (100%)	33 (100%)	0	100	100
8	X	42/42 (100%)	42 (100%)	0	100	100
8	x	42/42 (100%)	42 (100%)	0	100	100
All	All	3846/4074 (94%)	3829 (100%)	17 (0%)	91	97

5 of 17 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	l	272	TRP
5	m	263	GLU
5	M	263	GLU
2	bk	20	LEU
2	bn	15	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	ad	20	GLN
1	ae	20	GLN
2	bj	18	GLN
1	af	52	ASN
1	AF	52	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](#)

26 non-standard protein/DNA/RNA residues are 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	$\# Z > 2$
1	FME	AA	1	1	8,9,10	0.92	0	7,9,11	0.93	0
1	FME	AC	1	1	8,9,10	0.96	0	7,9,11	0.91	0
1	FME	ab	1	1	8,9,10	0.91	0	7,9,11	1.29	1 (14%)
1	FME	al	1	1	8,9,10	0.90	0	7,9,11	1.22	1 (14%)
1	FME	ae	1	1	8,9,10	0.91	0	7,9,11	1.13	1 (14%)
1	FME	AB	1	1	8,9,10	0.91	0	7,9,11	1.29	1 (14%)
1	FME	AI	1	1	8,9,10	0.92	0	7,9,11	1.10	1 (14%)
1	FME	AJ	1	1	8,9,10	0.96	0	7,9,11	1.03	0
1	FME	ac	1	1	8,9,10	0.95	0	7,9,11	0.89	0
1	FME	ad	1	1	8,9,10	0.88	0	7,9,11	1.22	1 (14%)
1	FME	AL	1	1	8,9,10	0.90	0	7,9,11	1.22	1 (14%)
1	FME	ai	1	1	8,9,10	0.92	0	7,9,11	1.10	1 (14%)
1	FME	ah	1	1	8,9,10	0.91	0	7,9,11	1.05	1 (14%)
1	FME	ag	1	1	8,9,10	0.90	0	7,9,11	1.42	1 (14%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
1	FME	AE	1	1	8,9,10	0.91	0	7,9,11	1.13	1 (14%)
1	FME	af	1	1	8,9,10	0.91	0	7,9,11	1.27	1 (14%)
1	FME	ak	1	1	8,9,10	0.94	0	7,9,11	1.36	2 (28%)
1	FME	AF	1	1	8,9,10	0.91	0	7,9,11	1.28	1 (14%)
1	FME	AG	1	1	8,9,10	0.90	0	7,9,11	1.42	1 (14%)
1	FME	AH	1	1	8,9,10	0.91	0	7,9,11	1.06	1 (14%)
1	FME	aa	1	1	8,9,10	0.93	0	7,9,11	0.84	0
1	FME	AD	1	1	8,9,10	0.88	0	7,9,11	1.22	1 (14%)
1	FME	AM	1	1	8,9,10	0.91	0	7,9,11	1.11	1 (14%)
1	FME	aj	1	1	8,9,10	0.96	0	7,9,11	1.03	0
1	FME	am	1	1	8,9,10	0.91	0	7,9,11	1.11	1 (14%)
1	FME	AK	1	1	8,9,10	0.94	0	7,9,11	1.37	2 (28%)

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
1	FME	AA	1	1	-	1/7/9/11	-
1	FME	AC	1	1	-	1/7/9/11	-
1	FME	ab	1	1	-	0/7/9/11	-
1	FME	al	1	1	-	3/7/9/11	-
1	FME	ae	1	1	-	0/7/9/11	-
1	FME	AB	1	1	-	0/7/9/11	-
1	FME	AI	1	1	-	0/7/9/11	-
1	FME	AJ	1	1	-	4/7/9/11	-
1	FME	ac	1	1	-	1/7/9/11	-
1	FME	ad	1	1	-	0/7/9/11	-
1	FME	AL	1	1	-	3/7/9/11	-
1	FME	ai	1	1	-	0/7/9/11	-
1	FME	ah	1	1	-	0/7/9/11	-
1	FME	ag	1	1	-	1/7/9/11	-
1	FME	AE	1	1	-	0/7/9/11	-
1	FME	af	1	1	-	0/7/9/11	-
1	FME	ak	1	1	-	2/7/9/11	-
1	FME	AF	1	1	-	0/7/9/11	-
1	FME	AG	1	1	-	1/7/9/11	-
1	FME	AH	1	1	-	0/7/9/11	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	FME	aa	1	1	-	1/7/9/11	-
1	FME	AD	1	1	-	0/7/9/11	-
1	FME	AM	1	1	-	1/7/9/11	-
1	FME	aj	1	1	-	4/7/9/11	-
1	FME	am	1	1	-	1/7/9/11	-
1	FME	AK	1	1	-	2/7/9/11	-

There are no bond length outliers.

The worst 5 of 22 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	AG	1	FME	C-CA-N	3.16	115.44	109.73
1	ag	1	FME	C-CA-N	3.15	115.42	109.73
1	AB	1	FME	C-CA-N	2.71	114.63	109.73
1	ab	1	FME	C-CA-N	2.71	114.62	109.73
1	AF	1	FME	C-CA-N	2.61	114.44	109.73

There are no chirality outliers.

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	AA	1	FME	N-CA-CB-CG
1	AG	1	FME	O-C-CA-CB
1	AK	1	FME	O-C-CA-CB
1	ag	1	FME	O-C-CA-CB
1	ak	1	FME	O-C-CA-CB

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 142 ligands modelled in this entry, 2 are monoatomic - leaving 140 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
10	SP2	AB	102	-	41,41,41	0.24	0	47,50,50	0.31	0
10	SP2	ah	102	-	41,41,41	0.27	0	47,50,50	0.28	0
9	BCL	AA	1001	-	58,74,74	1.30	4 (6%)	69,115,115	1.38	9 (13%)
14	U10	l	303	-	63,63,63	2.70	17 (26%)	76,79,79	1.59	20 (26%)
10	SP2	af	102	-	41,41,41	0.29	0	47,50,50	0.27	0
10	SP2	AG	101	-	41,41,41	0.31	0	47,50,50	0.50	0
9	BCL	ae	101	-	58,74,74	1.29	4 (6%)	69,115,115	1.38	9 (13%)
9	BCL	AE	102	-	58,74,74	1.29	4 (6%)	69,115,115	1.38	9 (13%)
10	SP2	ba	101	-	41,41,41	0.25	0	47,50,50	0.40	0
15	BPH	L	305	-	51,70,70	0.87	1 (1%)	52,101,101	1.13	6 (11%)
9	BCL	BC	101	-	58,74,74	1.30	5 (8%)	69,115,115	1.53	13 (18%)
9	BCL	AL	1001	-	58,74,74	1.33	4 (6%)	69,115,115	1.35	10 (14%)
9	BCL	AD	1001	-	58,74,74	1.30	4 (6%)	69,115,115	1.38	9 (13%)
9	BCL	L	304	-	58,74,74	1.26	4 (6%)	69,115,115	1.30	10 (14%)
10	SP2	ak	102	-	41,41,41	0.25	0	47,50,50	0.44	0
10	SP2	BC	102	-	41,41,41	0.38	0	47,50,50	0.45	0
9	BCL	AH	101	-	58,74,74	1.33	5 (8%)	69,115,115	1.32	9 (13%)
9	BCL	AG	102	-	58,74,74	1.30	5 (8%)	69,115,115	1.34	9 (13%)
9	BCL	al	1001	-	58,74,74	1.33	4 (6%)	69,115,115	1.40	10 (14%)
13	UQ1	L	302	-	18,18,18	0.79	0	22,25,25	1.78	5 (22%)
17	LMT	M	1001	-	36,36,36	1.12	5 (13%)	47,47,47	0.98	1 (2%)
15	BPH	M	1003	-	51,70,70	0.88	1 (1%)	52,101,101	1.18	7 (13%)
9	BCL	BH	102	-	58,74,74	1.31	4 (6%)	69,115,115	1.47	14 (20%)
12	CD4	m	1005	-	83,83,83	0.48	0	89,95,95	1.05	5 (5%)
9	BCL	AI	102	-	58,74,74	1.33	4 (6%)	69,115,115	1.40	10 (14%)
9	BCL	AC	101	-	58,74,74	1.30	5 (8%)	69,115,115	1.32	9 (13%)
10	SP2	BK	102	-	41,41,41	0.31	0	47,50,50	0.40	0
9	BCL	BE	1001	-	58,74,74	1.28	4 (6%)	69,115,115	1.42	11 (15%)
9	BCL	m	1004	-	58,74,74	1.25	3 (5%)	69,115,115	1.38	9 (13%)
9	BCL	bl	101	-	58,74,74	1.30	4 (6%)	69,115,115	1.33	11 (15%)
10	SP2	BE	1002	-	41,41,41	0.28	0	47,50,50	0.31	0
10	SP2	ab	103	-	41,41,41	0.22	0	47,50,50	0.35	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
9	BCL	ah	101	-	58,74,74	1.33	5 (8%)	69,115,115	1.32	9 (13%)
10	SP2	ae	102	-	41,41,41	0.34	0	47,50,50	0.31	0
10	SP2	ab	101	-	41,41,41	0.24	0	47,50,50	0.59	1 (2%)
9	BCL	ai	102	-	58,74,74	1.33	4 (6%)	69,115,115	1.41	10 (14%)
9	BCL	AM	1001	-	58,74,74	1.34	5 (8%)	69,115,115	1.35	9 (13%)
9	BCL	ac	102	-	58,74,74	1.30	5 (8%)	69,115,115	1.30	9 (13%)
10	SP2	AM	1000	-	41,41,41	0.27	0	47,50,50	0.42	0
16	SQD	L	306	-	53,54,54	1.50	4 (7%)	62,65,65	1.71	8 (12%)
9	BCL	BJ	102	-	58,74,74	1.27	5 (8%)	69,115,115	1.36	11 (15%)
10	SP2	ac	104	-	41,41,41	0.36	0	47,50,50	0.42	0
17	LMT	m	1001	-	36,36,36	1.12	5 (13%)	47,47,47	0.98	1 (2%)
9	BCL	BK	101	-	58,74,74	1.29	5 (8%)	69,115,115	1.32	10 (14%)
10	SP2	af	104	-	41,41,41	0.31	0	47,50,50	0.32	0
10	SP2	aj	103	-	41,41,41	0.32	0	47,50,50	0.54	0
14	U10	m	1003	-	63,63,63	2.66	17 (26%)	76,79,79	1.75	18 (23%)
14	U10	M	1007	-	63,63,63	2.66	17 (26%)	76,79,79	1.74	18 (23%)
9	BCL	an	101	-	58,74,74	1.35	5 (8%)	69,115,115	1.32	10 (14%)
10	SP2	AF	101	-	41,41,41	0.27	0	47,50,50	0.27	0
9	BCL	bg	101	-	58,74,74	1.31	4 (6%)	69,115,115	1.34	11 (15%)
14	U10	L	303	-	63,63,63	2.70	17 (26%)	76,79,79	1.59	20 (26%)
10	SP2	AB	104	-	41,41,41	0.32	0	47,50,50	0.37	0
10	SP2	AE	101	-	41,41,41	0.34	0	47,50,50	0.40	0
10	SP2	ae	103	-	41,41,41	0.28	0	47,50,50	0.31	0
9	BCL	BD	101	-	58,74,74	1.29	4 (6%)	69,115,115	1.37	10 (14%)
9	BCL	BG	101	-	58,74,74	1.31	4 (6%)	69,115,115	1.36	11 (15%)
9	BCL	bk	101	-	58,74,74	1.29	5 (8%)	69,115,115	1.32	10 (14%)
9	BCL	M	1002	-	58,74,74	1.26	3 (5%)	69,115,115	1.42	11 (15%)
10	SP2	AB	103	-	41,41,41	0.30	0	47,50,50	0.55	1 (2%)
10	SP2	ai	103	-	41,41,41	0.44	0	47,50,50	0.82	2 (4%)
9	BCL	BI	101	-	58,74,74	1.30	4 (6%)	69,115,115	1.34	9 (13%)
10	SP2	BL	103	-	41,41,41	0.48	0	47,50,50	0.49	0
10	SP2	AJ	102	-	41,41,41	0.25	0	47,50,50	0.42	0
9	BCL	BF	101	-	58,74,74	1.31	4 (6%)	69,115,115	1.31	10 (14%)
10	SP2	bk	102	-	41,41,41	0.32	0	47,50,50	0.44	0
9	BCL	AB	101	-	58,74,74	1.34	5 (8%)	69,115,115	1.47	12 (17%)
10	SP2	bh	101	-	41,41,41	0.34	0	47,50,50	0.46	0
10	SP2	AC	103	-	41,41,41	0.31	0	47,50,50	0.37	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
9	BCL	bf	101	-	58,74,74	1.31	4 (6%)	69,115,115	1.31	10 (14%)
10	SP2	AF	103	-	41,41,41	0.30	0	47,50,50	0.31	0
10	SP2	AK	102	-	41,41,41	0.25	0	47,50,50	0.45	0
12	CD4	H	302	-	83,83,83	0.48	0	89,95,95	0.93	6 (6%)
10	SP2	BA	101	-	41,41,41	0.28	0	47,50,50	0.30	0
9	BCL	ad	1001	-	58,74,74	1.30	4 (6%)	69,115,115	1.39	9 (13%)
9	BCL	am	1001	-	58,74,74	1.34	5 (8%)	69,115,115	1.35	9 (13%)
11	3PE	AC	102	-	50,50,50	0.51	0	53,55,55	0.66	2 (3%)
16	SQD	x	100	-	53,54,54	1.49	4 (7%)	62,65,65	1.69	9 (14%)
9	BCL	aa	1001	-	58,74,74	1.30	4 (6%)	69,115,115	1.38	10 (14%)
11	3PE	h	301	-	50,50,50	0.52	0	53,55,55	0.49	1 (1%)
9	BCL	af	101	-	58,74,74	1.32	4 (6%)	69,115,115	1.33	9 (13%)
9	BCL	AN	101	-	58,74,74	1.35	5 (8%)	69,115,115	1.32	10 (14%)
9	BCL	bm	1001	-	58,74,74	1.30	5 (8%)	69,115,115	1.34	10 (14%)
10	SP2	AI	101	-	41,41,41	0.38	0	47,50,50	0.93	2 (4%)
10	SP2	BJ	101	-	41,41,41	0.24	0	47,50,50	0.30	0
10	SP2	bf	102	-	41,41,41	0.28	0	47,50,50	0.37	0
10	SP2	M	1005	-	41,41,41	0.29	0	47,50,50	0.50	0
9	BCL	AK	101	-	58,74,74	1.33	5 (8%)	69,115,115	1.41	10 (14%)
12	CD4	M	1004	-	83,83,83	0.48	0	89,95,95	1.05	5 (5%)
10	SP2	AH	102	-	41,41,41	0.27	0	47,50,50	0.29	0
9	BCL	bd	101	-	58,74,74	1.29	4 (6%)	69,115,115	1.37	10 (14%)
9	BCL	M	1008	-	58,74,74	1.25	3 (5%)	69,115,115	1.38	9 (13%)
9	BCL	ak	101	-	58,74,74	1.33	5 (8%)	69,115,115	1.40	10 (14%)
10	SP2	AC	104	-	41,41,41	0.34	0	47,50,50	0.42	0
10	SP2	AI	103	-	41,41,41	0.44	0	47,50,50	0.80	2 (4%)
9	BCL	l	301	-	58,74,74	1.26	4 (6%)	69,115,115	1.30	10 (14%)
9	BCL	ba	102	-	58,74,74	1.29	3 (5%)	69,115,115	1.44	12 (17%)
9	BCL	bi	101	-	58,74,74	1.29	4 (6%)	69,115,115	1.34	10 (14%)
9	BCL	BN	101	-	58,74,74	1.33	5 (8%)	69,115,115	1.37	10 (14%)
12	CD4	h	302	-	83,83,83	0.48	0	89,95,95	0.93	6 (6%)
9	BCL	bb	1001	-	58,74,74	1.29	4 (6%)	69,115,115	1.42	12 (17%)
9	BCL	bn	101	-	58,74,74	1.33	5 (8%)	69,115,115	1.37	10 (14%)
9	BCL	BB	1001	-	58,74,74	1.29	4 (6%)	69,115,115	1.41	12 (17%)
9	BCL	AF	102	-	58,74,74	1.31	4 (6%)	69,115,115	1.33	9 (13%)
15	BPH	l	302	-	51,70,70	0.87	1 (1%)	52,101,101	1.13	6 (11%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
10	SP2	BL	101	-	41,41,41	0.31	0	47,50,50	0.31	0
9	BCL	BL	102	-	58,74,74	1.30	4 (6%)	69,115,115	1.33	11 (15%)
10	SP2	bj	101	-	41,41,41	0.26	0	47,50,50	0.29	0
9	BCL	bj	102	-	58,74,74	1.27	5 (8%)	69,115,115	1.36	11 (15%)
9	BCL	ag	101	-	58,74,74	1.29	5 (8%)	69,115,115	1.34	9 (13%)
10	SP2	bb	1002	-	41,41,41	0.39	0	47,50,50	0.42	0
9	BCL	bc	101	-	58,74,74	1.30	5 (8%)	69,115,115	1.53	13 (18%)
10	SP2	al	1002	-	41,41,41	0.36	0	47,50,50	0.39	0
9	BCL	m	1006	-	58,74,74	1.26	3 (5%)	69,115,115	1.42	11 (15%)
9	BCL	aj	101	-	58,74,74	1.34	5 (8%)	69,115,115	1.40	12 (17%)
13	UQ1	l	304	-	18,18,18	0.79	0	22,25,25	1.78	5 (22%)
10	SP2	am	1000	-	41,41,41	0.23	0	47,50,50	0.39	0
10	SP2	bl	102	-	41,41,41	0.48	0	47,50,50	0.50	0
10	SP2	BH	101	-	41,41,41	0.31	0	47,50,50	0.51	0
9	BCL	bh	102	-	58,74,74	1.31	4 (6%)	69,115,115	1.47	14 (20%)
9	BCL	be	1001	-	58,74,74	1.28	4 (6%)	69,115,115	1.42	11 (15%)
9	BCL	BM	1001	-	58,74,74	1.30	5 (8%)	69,115,115	1.34	10 (14%)
10	SP2	ai	101	-	41,41,41	0.39	0	47,50,50	0.94	2 (4%)
9	BCL	BA	102	-	58,74,74	1.29	4 (6%)	69,115,115	1.44	12 (17%)
11	3PE	ac	101	-	50,50,50	0.51	0	53,55,55	0.66	2 (3%)
10	SP2	ad	1002	-	41,41,41	0.34	0	47,50,50	0.47	0
10	SP2	ac	103	-	41,41,41	0.23	0	47,50,50	0.39	0
10	SP2	m	1007	-	41,41,41	0.21	0	47,50,50	0.52	0
10	SP2	ab	104	-	41,41,41	0.25	0	47,50,50	0.30	0
9	BCL	AJ	101	-	58,74,74	1.34	5 (8%)	69,115,115	1.41	12 (17%)
9	BCL	l	305	-	58,74,74	1.26	4 (6%)	69,115,115	1.35	11 (15%)
10	SP2	AA	1002	-	41,41,41	0.21	0	47,50,50	0.58	1 (2%)
15	BPH	m	1002	-	51,70,70	0.88	1 (1%)	52,101,101	1.18	7 (13%)
10	SP2	BF	102	-	41,41,41	0.29	0	47,50,50	0.37	0
9	BCL	ab	102	-	58,74,74	1.34	4 (6%)	69,115,115	1.45	11 (15%)
10	SP2	af	103	-	41,41,41	0.34	0	47,50,50	0.40	0
10	SP2	aj	102	-	41,41,41	0.26	0	47,50,50	0.30	0
9	BCL	L	301	-	58,74,74	1.26	4 (6%)	69,115,115	1.35	11 (15%)
11	3PE	H	301	-	50,50,50	0.52	0	53,55,55	0.49	1 (1%)
10	SP2	AJ	103	-	41,41,41	0.36	0	47,50,50	0.48	0

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
10	SP2	AB	102	-	-	3/47/47/47	-
10	SP2	ah	102	-	-	4/47/47/47	-
9	BCL	AA	1001	-	-	3/37/137/137	-
14	U10	l	303	-	-	16/63/87/87	0/1/1/1
10	SP2	af	102	-	-	5/47/47/47	-
10	SP2	AG	101	-	-	4/47/47/47	-
9	BCL	ae	101	-	-	6/37/137/137	-
9	BCL	AE	102	-	-	6/37/137/137	-
10	SP2	ba	101	-	-	7/47/47/47	-
15	BPH	L	305	-	-	6/37/105/105	0/5/6/6
9	BCL	BC	101	-	-	8/37/137/137	-
9	BCL	AL	1001	-	-	4/37/137/137	-
9	BCL	AD	1001	-	-	3/37/137/137	-
9	BCL	L	304	-	-	1/37/137/137	-
10	SP2	ak	102	-	-	8/47/47/47	-
10	SP2	BC	102	-	-	3/47/47/47	-
9	BCL	AH	101	-	-	4/37/137/137	-
9	BCL	AG	102	-	-	0/37/137/137	-
9	BCL	al	1001	-	-	4/37/137/137	-
13	UQ1	L	302	-	-	4/9/33/33	0/1/1/1
17	LMT	M	1001	-	-	4/21/61/61	0/2/2/2
15	BPH	M	1003	-	-	4/37/105/105	0/5/6/6
9	BCL	BH	102	-	-	5/37/137/137	-
12	CD4	m	1005	-	-	12/94/94/94	-
9	BCL	AI	102	-	-	10/37/137/137	-
9	BCL	AC	101	-	-	6/37/137/137	-
10	SP2	BK	102	-	-	8/47/47/47	-
9	BCL	BE	1001	-	-	5/37/137/137	-
9	BCL	m	1004	-	-	1/37/137/137	-
9	BCL	bl	101	-	-	9/37/137/137	-
10	SP2	BE	1002	-	-	7/47/47/47	-
10	SP2	ab	103	-	-	5/47/47/47	-
9	BCL	ah	101	-	-	2/37/137/137	-
10	SP2	ae	102	-	-	1/47/47/47	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
10	SP2	ab	101	-	-	5/47/47/47	-
9	BCL	ai	102	-	-	10/37/137/137	-
9	BCL	AM	1001	-	-	0/37/137/137	-
9	BCL	ac	102	-	-	8/37/137/137	-
10	SP2	AM	1000	-	-	8/47/47/47	-
16	SQD	L	306	-	-	15/49/69/69	0/1/1/1
9	BCL	BJ	102	-	-	6/37/137/137	-
10	SP2	ac	104	-	-	7/47/47/47	-
17	LMT	m	1001	-	-	4/21/61/61	0/2/2/2
9	BCL	BK	101	-	-	6/37/137/137	-
10	SP2	af	104	-	-	3/47/47/47	-
10	SP2	aj	103	-	-	9/47/47/47	-
14	U10	m	1003	-	-	10/63/87/87	0/1/1/1
14	U10	M	1007	-	-	10/63/87/87	0/1/1/1
9	BCL	an	101	-	-	7/37/137/137	-
10	SP2	AF	101	-	-	6/47/47/47	-
9	BCL	bg	101	-	-	6/37/137/137	-
14	U10	L	303	-	-	16/63/87/87	0/1/1/1
10	SP2	AB	104	-	-	6/47/47/47	-
10	SP2	AE	101	-	-	2/47/47/47	-
10	SP2	ae	103	-	-	7/47/47/47	-
9	BCL	BD	101	-	-	1/37/137/137	-
9	BCL	BG	101	-	-	4/37/137/137	-
9	BCL	bk	101	-	-	6/37/137/137	-
9	BCL	M	1002	-	-	2/37/137/137	-
10	SP2	AB	103	-	-	7/47/47/47	-
10	SP2	ai	103	-	-	3/47/47/47	-
9	BCL	BI	101	-	-	7/37/137/137	-
10	SP2	BL	103	-	-	2/47/47/47	-
10	SP2	AJ	102	-	-	5/47/47/47	-
9	BCL	BF	101	-	-	6/37/137/137	-
10	SP2	bk	102	-	-	6/47/47/47	-
9	BCL	AB	101	-	-	4/37/137/137	-
10	SP2	bh	101	-	-	2/47/47/47	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
10	SP2	AC	103	-	-	3/47/47/47	-
9	BCL	bf	101	-	-	7/37/137/137	-
10	SP2	AF	103	-	-	4/47/47/47	-
10	SP2	AK	102	-	-	8/47/47/47	-
12	CD4	H	302	-	-	21/94/94/94	-
10	SP2	BA	101	-	-	6/47/47/47	-
9	BCL	ad	1001	-	-	3/37/137/137	-
9	BCL	am	1001	-	-	0/37/137/137	-
11	3PE	AC	102	-	-	22/54/54/54	-
16	SQD	x	100	-	-	5/49/69/69	0/1/1/1
9	BCL	aa	1001	-	-	3/37/137/137	-
11	3PE	h	301	-	-	11/54/54/54	-
9	BCL	af	101	-	-	7/37/137/137	-
9	BCL	AN	101	-	-	6/37/137/137	-
9	BCL	bm	1001	-	-	9/37/137/137	-
10	SP2	AI	101	-	-	2/47/47/47	-
10	SP2	BJ	101	-	-	7/47/47/47	-
10	SP2	bf	102	-	-	2/47/47/47	-
10	SP2	M	1005	-	-	3/47/47/47	-
9	BCL	AK	101	-	-	7/37/137/137	-
12	CD4	M	1004	-	-	12/94/94/94	-
10	SP2	AH	102	-	-	4/47/47/47	-
9	BCL	bd	101	-	-	1/37/137/137	-
9	BCL	M	1008	-	-	1/37/137/137	-
9	BCL	ak	101	-	-	8/37/137/137	-
10	SP2	AC	104	-	-	7/47/47/47	-
10	SP2	AI	103	-	-	4/47/47/47	-
9	BCL	l	301	-	-	1/37/137/137	-
9	BCL	ba	102	-	-	5/37/137/137	-
9	BCL	bi	101	-	-	7/37/137/137	-
9	BCL	BN	101	-	-	7/37/137/137	-
12	CD4	h	302	-	-	21/94/94/94	-
9	BCL	bb	1001	-	-	4/37/137/137	-
9	BCL	bn	101	-	-	7/37/137/137	-
9	BCL	BB	1001	-	-	4/37/137/137	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
9	BCL	AF	102	-	-	6/37/137/137	-
15	BPH	l	302	-	-	7/37/105/105	0/5/6/6
10	SP2	BL	101	-	-	5/47/47/47	-
9	BCL	BL	102	-	-	9/37/137/137	-
10	SP2	bj	101	-	-	7/47/47/47	-
9	BCL	bj	102	-	-	6/37/137/137	-
9	BCL	ag	101	-	-	0/37/137/137	-
10	SP2	bb	1002	-	-	9/47/47/47	-
9	BCL	bc	101	-	-	8/37/137/137	-
10	SP2	al	1002	-	-	4/47/47/47	-
9	BCL	m	1006	-	-	2/37/137/137	-
9	BCL	aj	101	-	-	5/37/137/137	-
13	UQ1	l	304	-	-	4/9/33/33	0/1/1/1
10	SP2	am	1000	-	-	2/47/47/47	-
10	SP2	bl	102	-	-	2/47/47/47	-
10	SP2	BH	101	-	-	5/47/47/47	-
9	BCL	bh	102	-	-	5/37/137/137	-
9	BCL	be	1001	-	-	5/37/137/137	-
9	BCL	BM	1001	-	-	9/37/137/137	-
10	SP2	ai	101	-	-	8/47/47/47	-
9	BCL	BA	102	-	-	5/37/137/137	-
11	3PE	ac	101	-	-	22/54/54/54	-
10	SP2	ad	1002	-	-	6/47/47/47	-
10	SP2	ac	103	-	-	2/47/47/47	-
10	SP2	m	1007	-	-	5/47/47/47	-
10	SP2	ab	104	-	-	4/47/47/47	-
9	BCL	AJ	101	-	-	5/37/137/137	-
9	BCL	l	305	-	-	1/37/137/137	-
10	SP2	AA	1002	-	-	5/47/47/47	-
15	BPH	m	1002	-	-	4/37/105/105	0/5/6/6
10	SP2	BF	102	-	-	2/47/47/47	-
9	BCL	ab	102	-	-	4/37/137/137	-
10	SP2	af	103	-	-	8/47/47/47	-
10	SP2	aj	102	-	-	4/47/47/47	-
9	BCL	L	301	-	-	1/37/137/137	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
11	3PE	H	301	-	-	11/54/54/54	-
10	SP2	AJ	103	-	-	8/47/47/47	-

The worst 5 of 366 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
16	x	100	SQD	O8-S	6.37	1.70	1.47
16	L	306	SQD	O8-S	6.36	1.70	1.47
14	l	303	U10	C43-C44	6.18	1.47	1.33
14	L	303	U10	C43-C44	6.18	1.47	1.33
14	M	1007	U10	C38-C39	6.17	1.47	1.33

The worst 5 of 833 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
16	x	100	SQD	O8-S-C6	-6.75	94.98	105.74
16	L	306	SQD	O8-S-C6	-6.73	95.01	105.74
16	x	100	SQD	O7-S-C6	5.54	113.52	106.94
16	L	306	SQD	O7-S-C6	5.47	113.44	106.94
16	x	100	SQD	O9-S-C6	5.35	113.30	106.94

There are no chirality outliers.

5 of 818 torsion outliers are listed below:

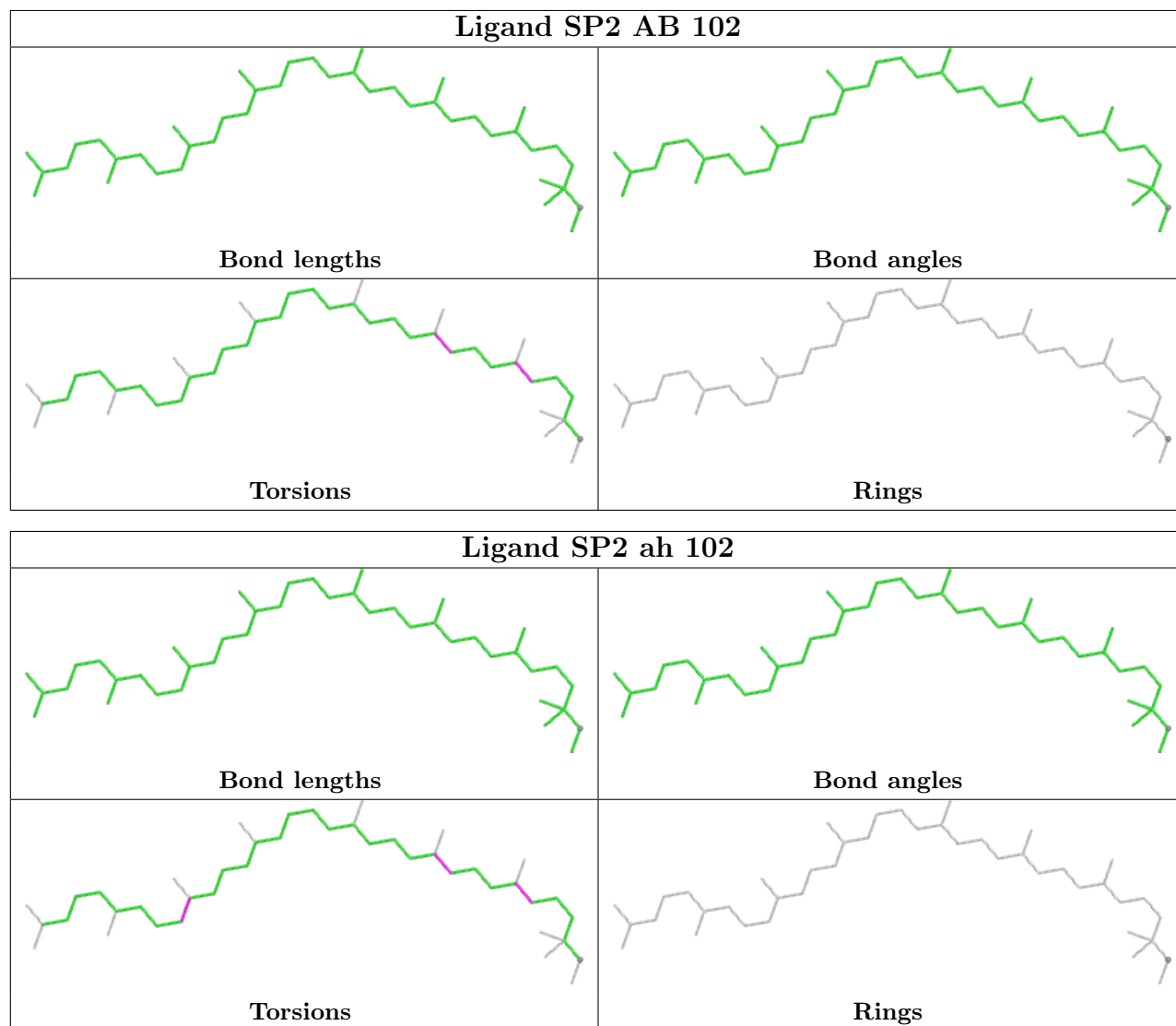
Mol	Chain	Res	Type	Atoms
9	AJ	101	BCL	C4-C3-C5-C6
9	AK	101	BCL	CHA-CBD-CGD-O1D
9	AK	101	BCL	CHA-CBD-CGD-O2D
9	AK	101	BCL	C2-C3-C5-C6
9	AK	101	BCL	C4-C3-C5-C6

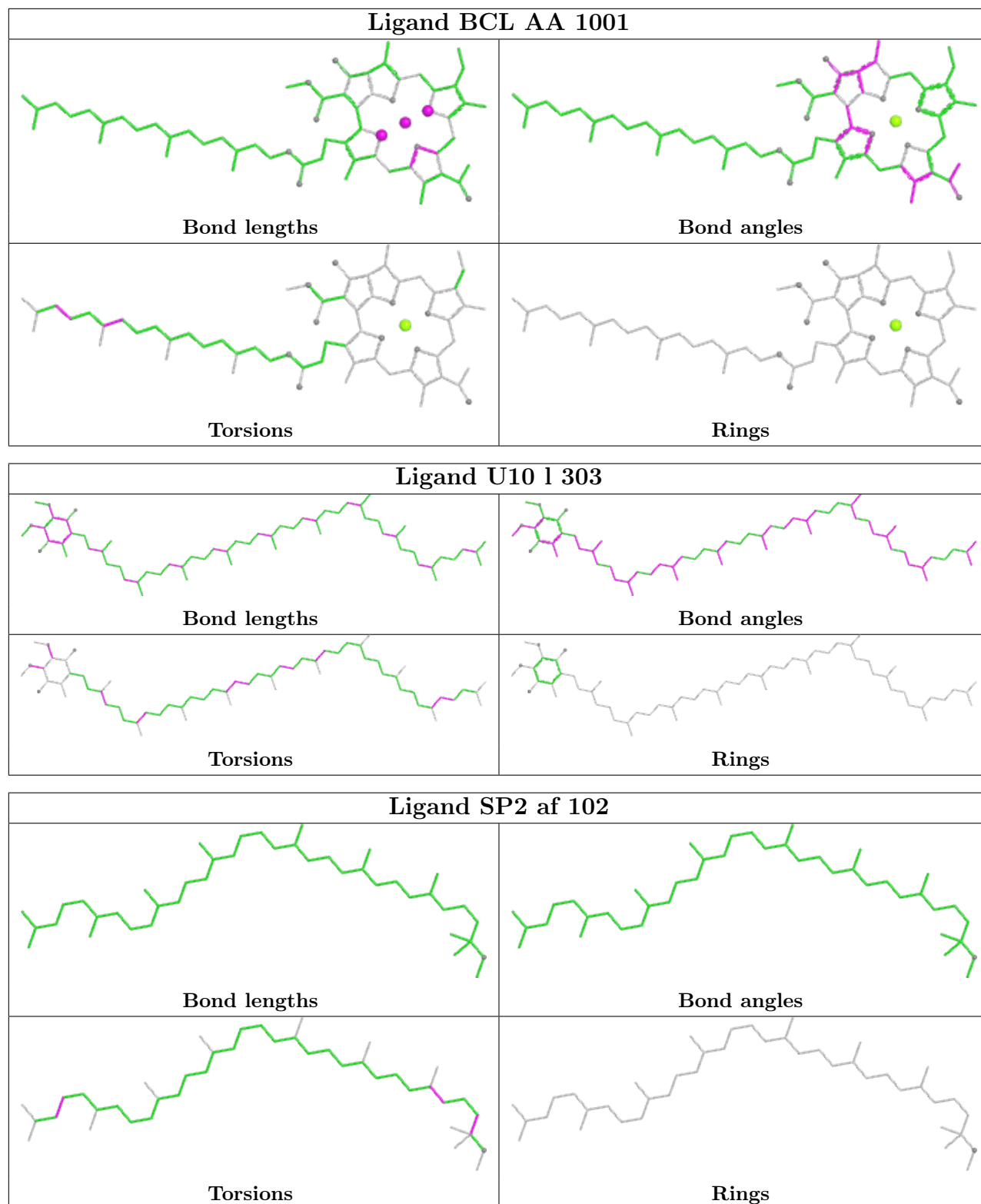
There are no ring outliers.

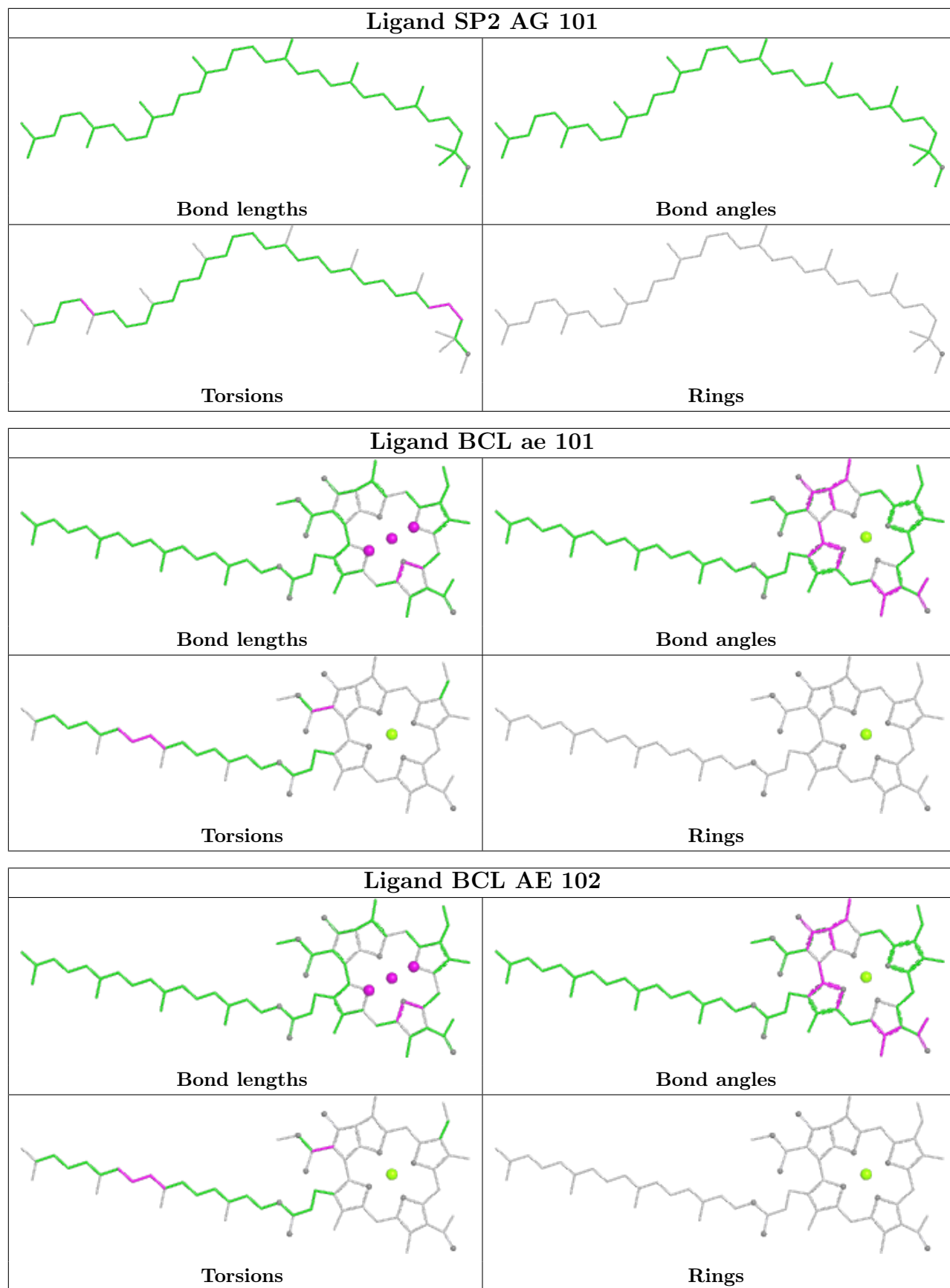
No monomer is involved in short contacts.

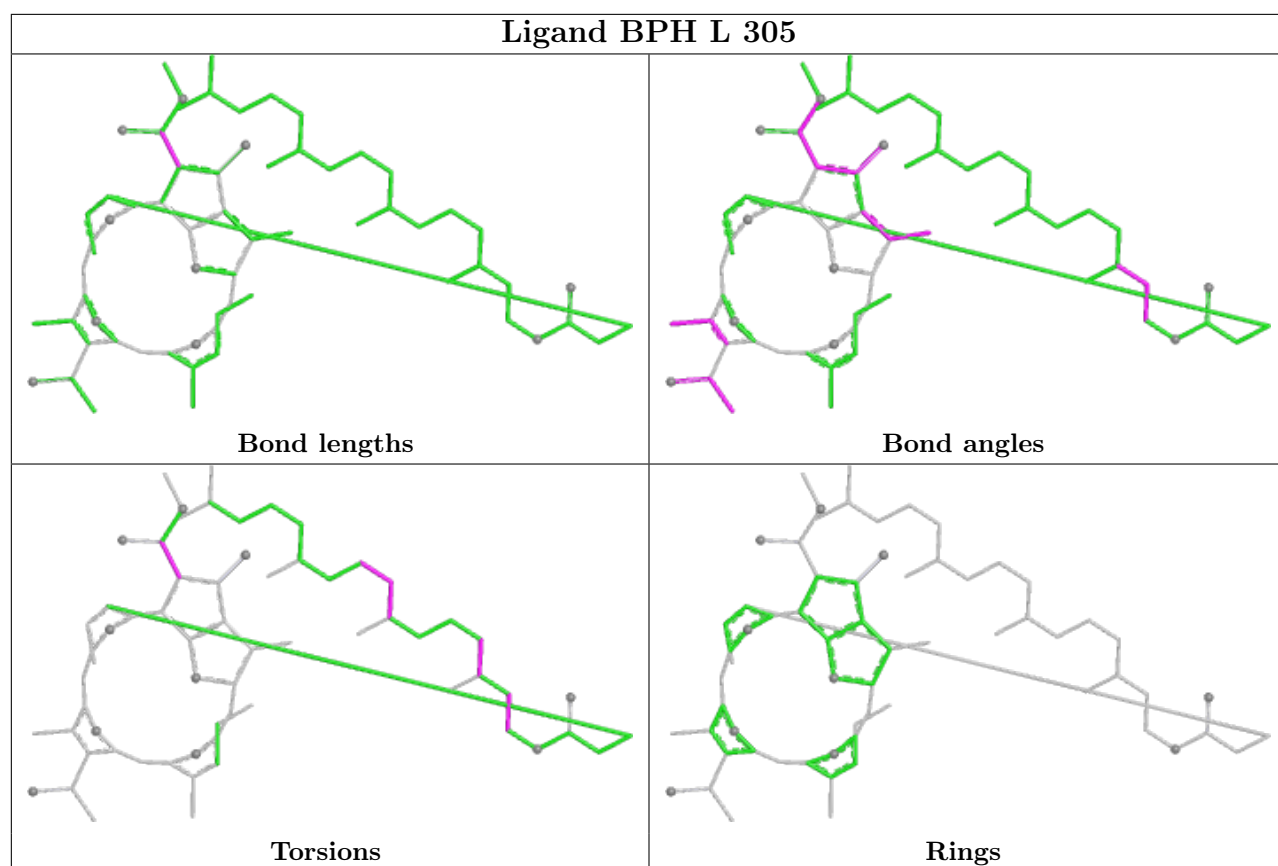
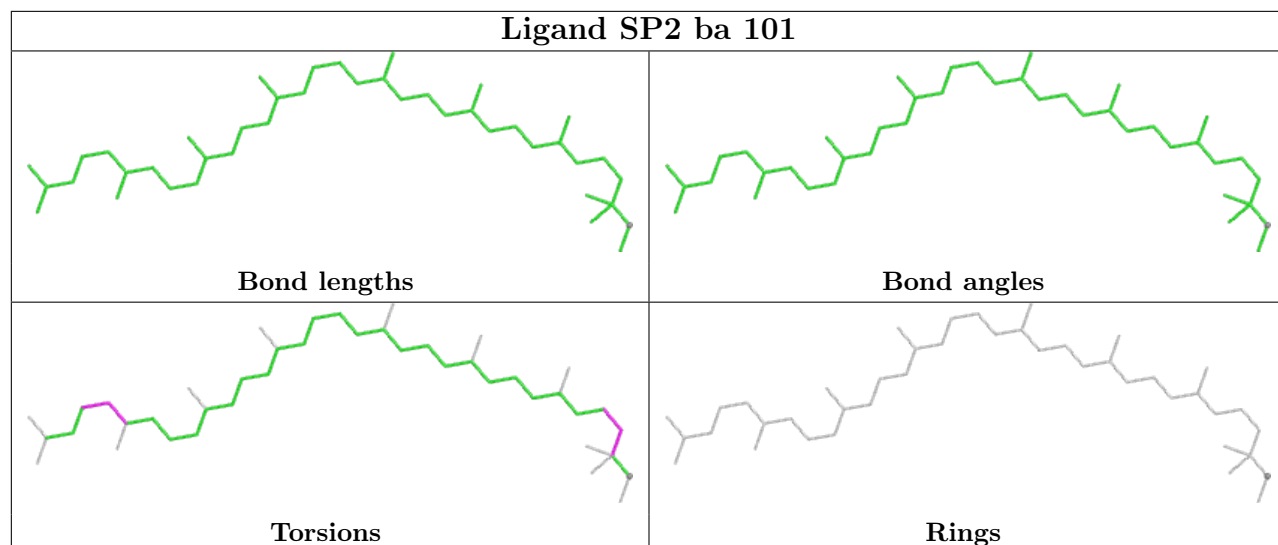
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring

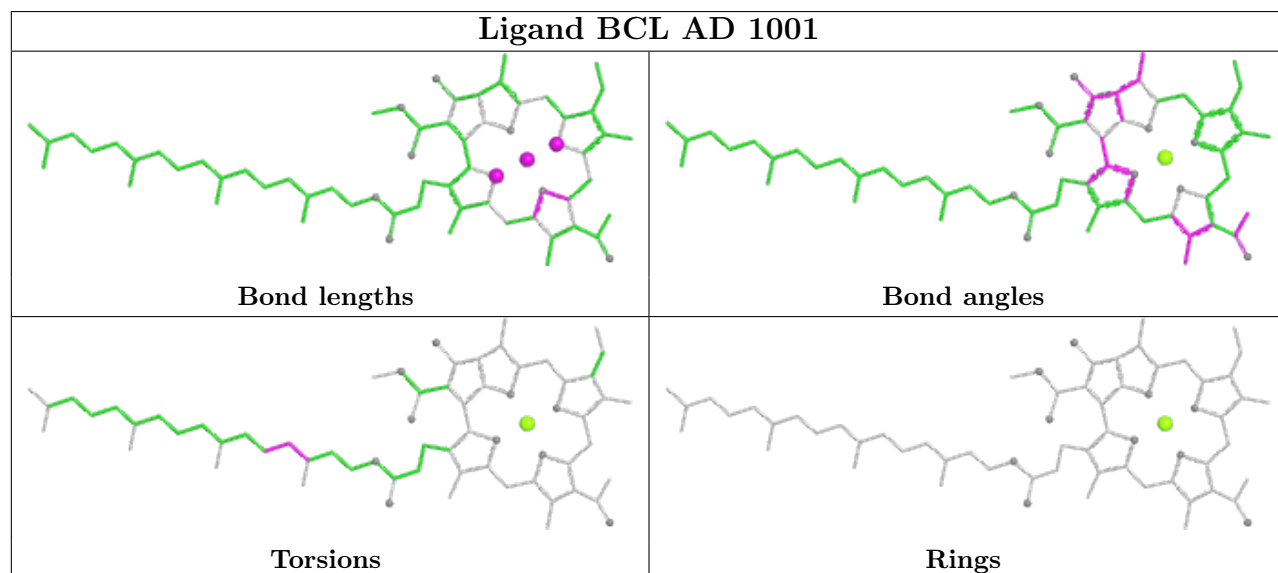
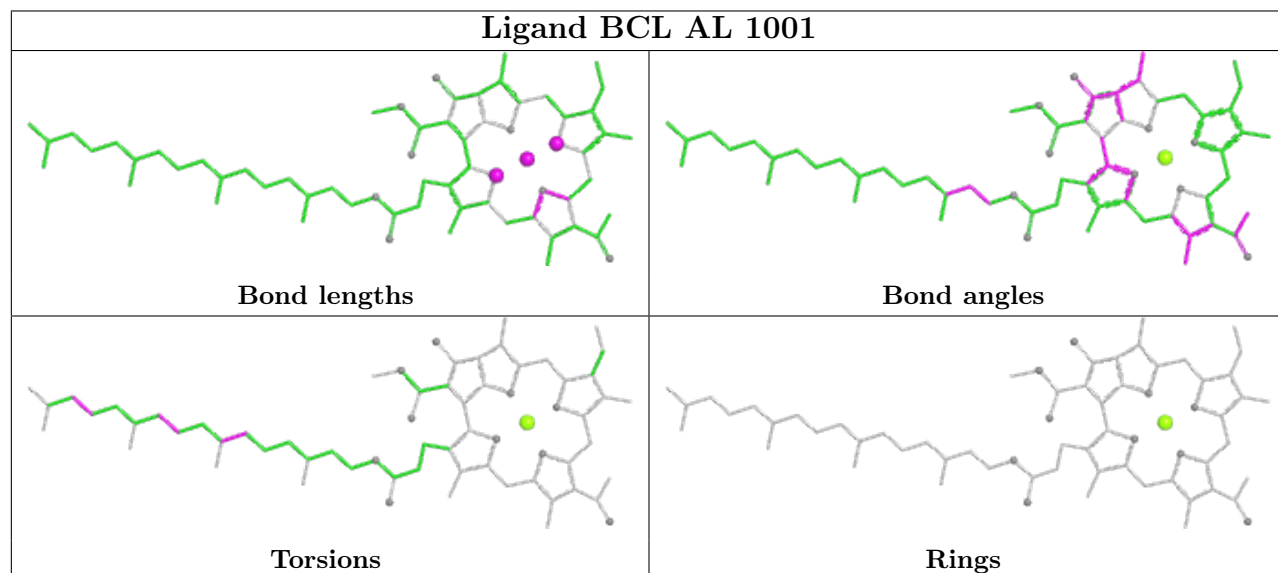
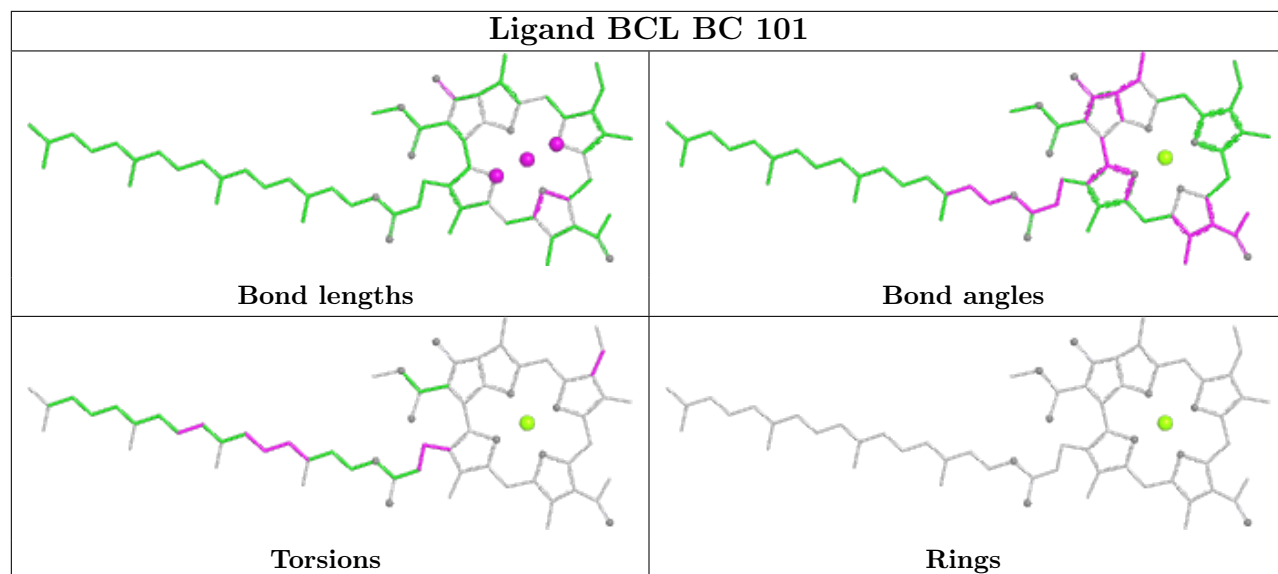
in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

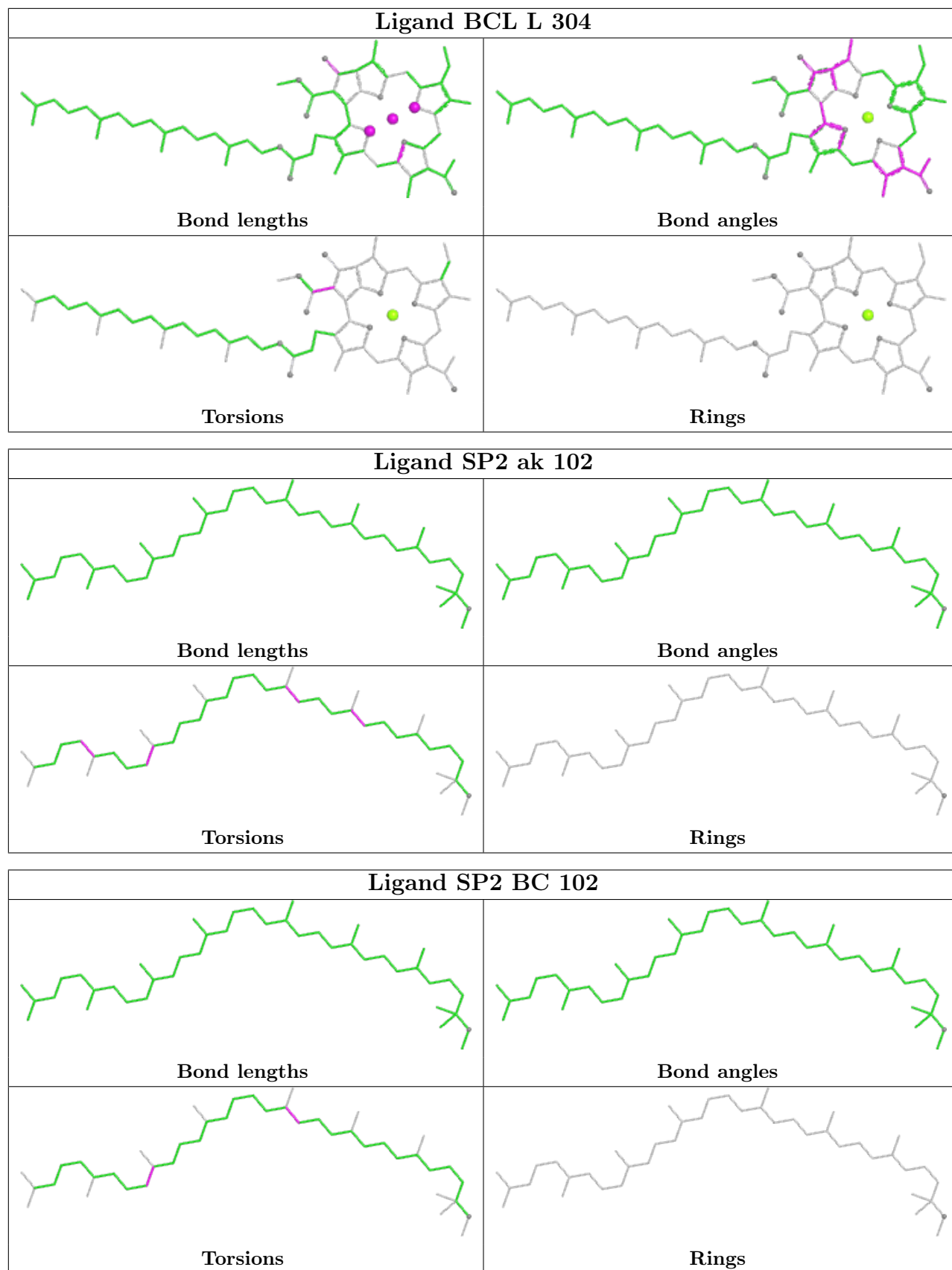


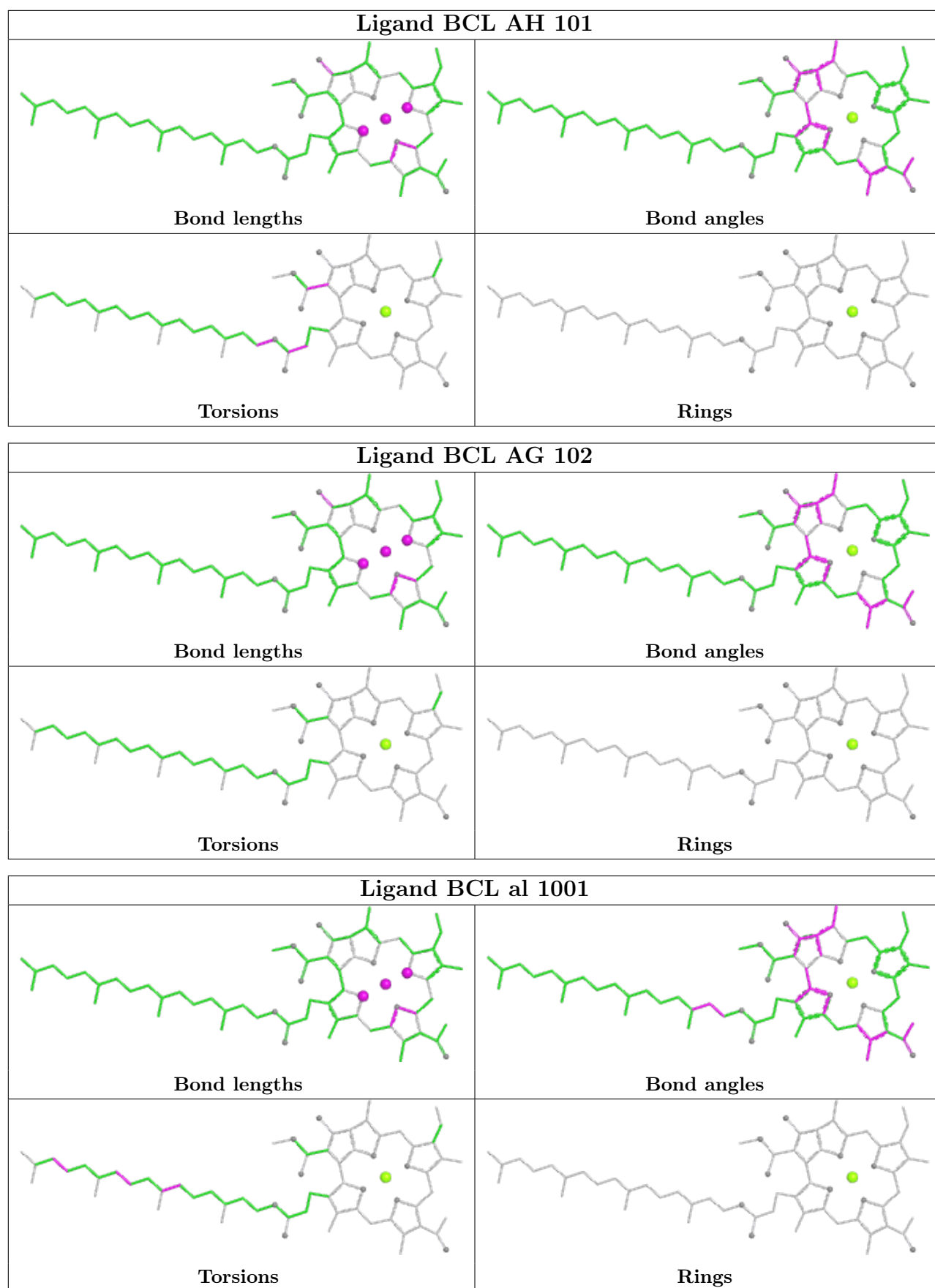


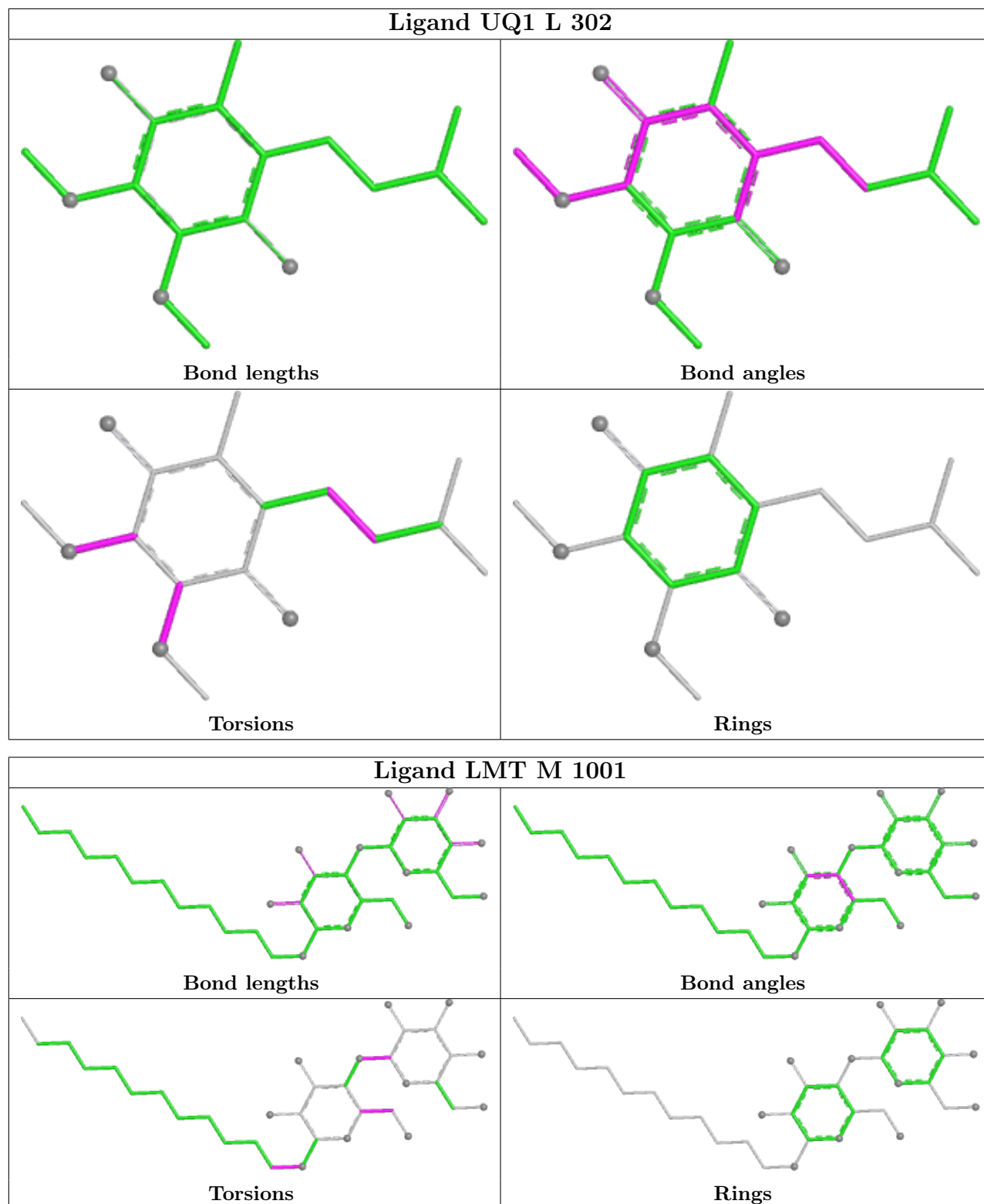


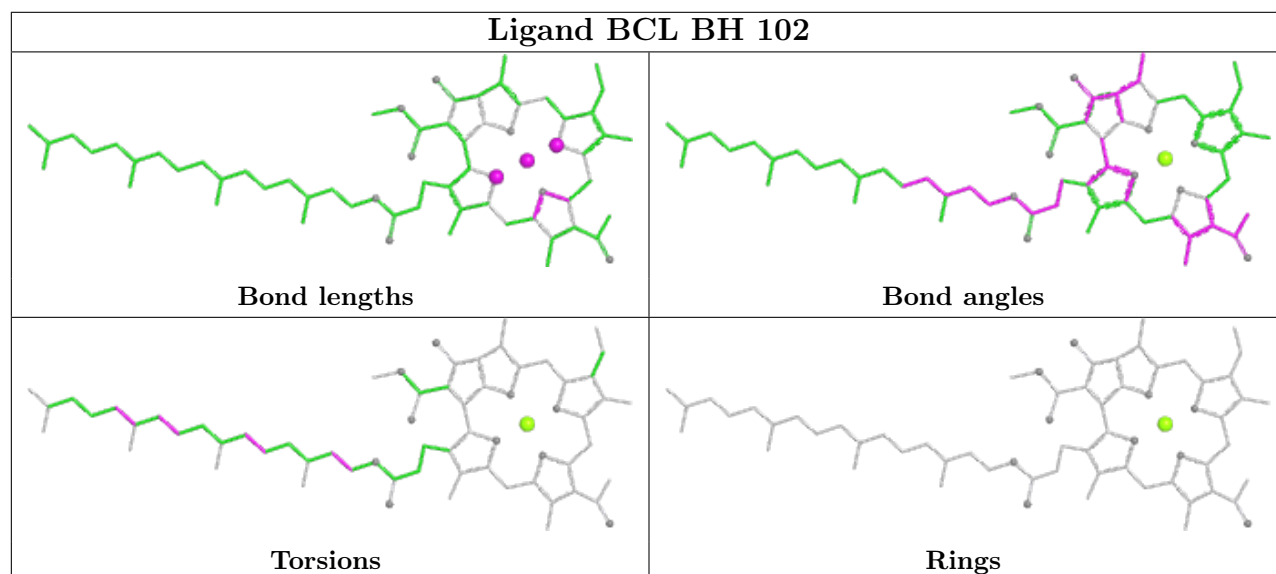
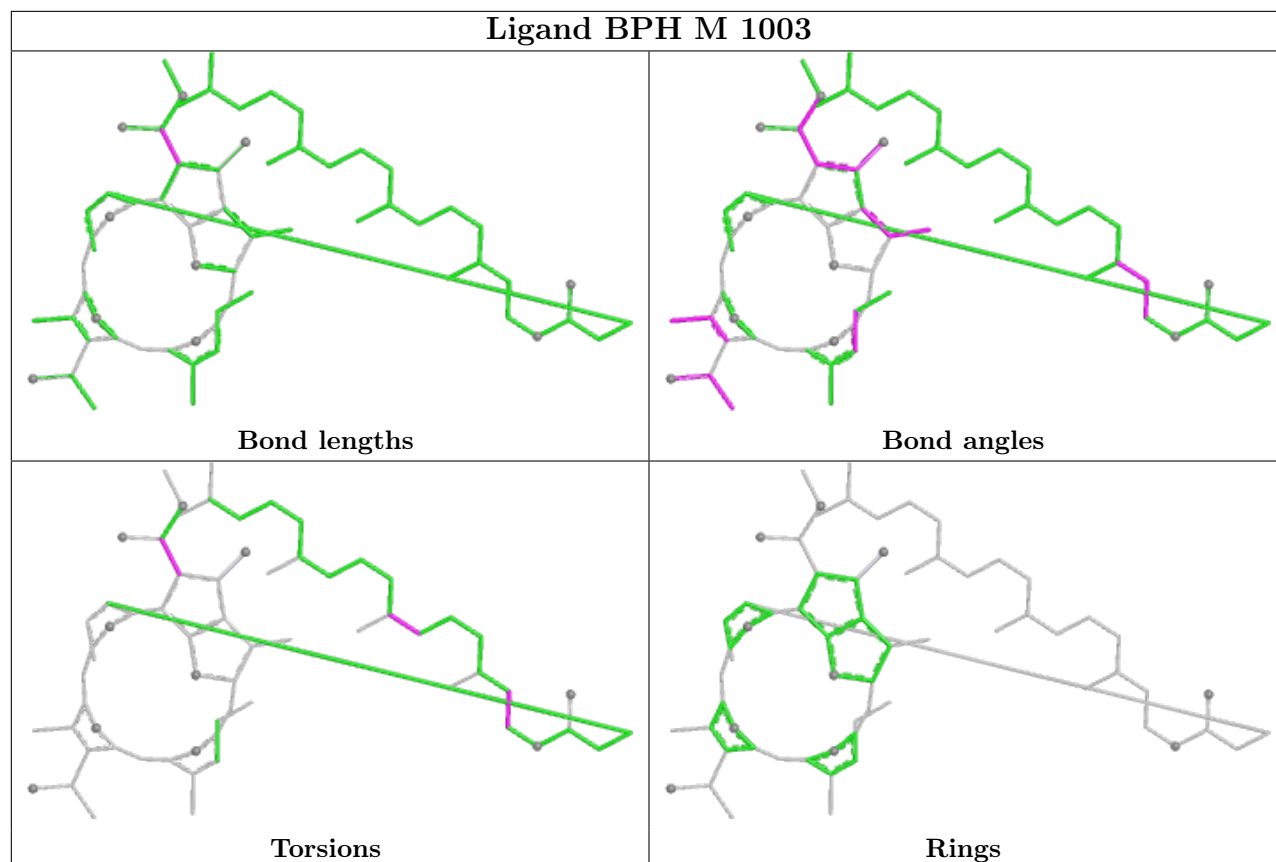


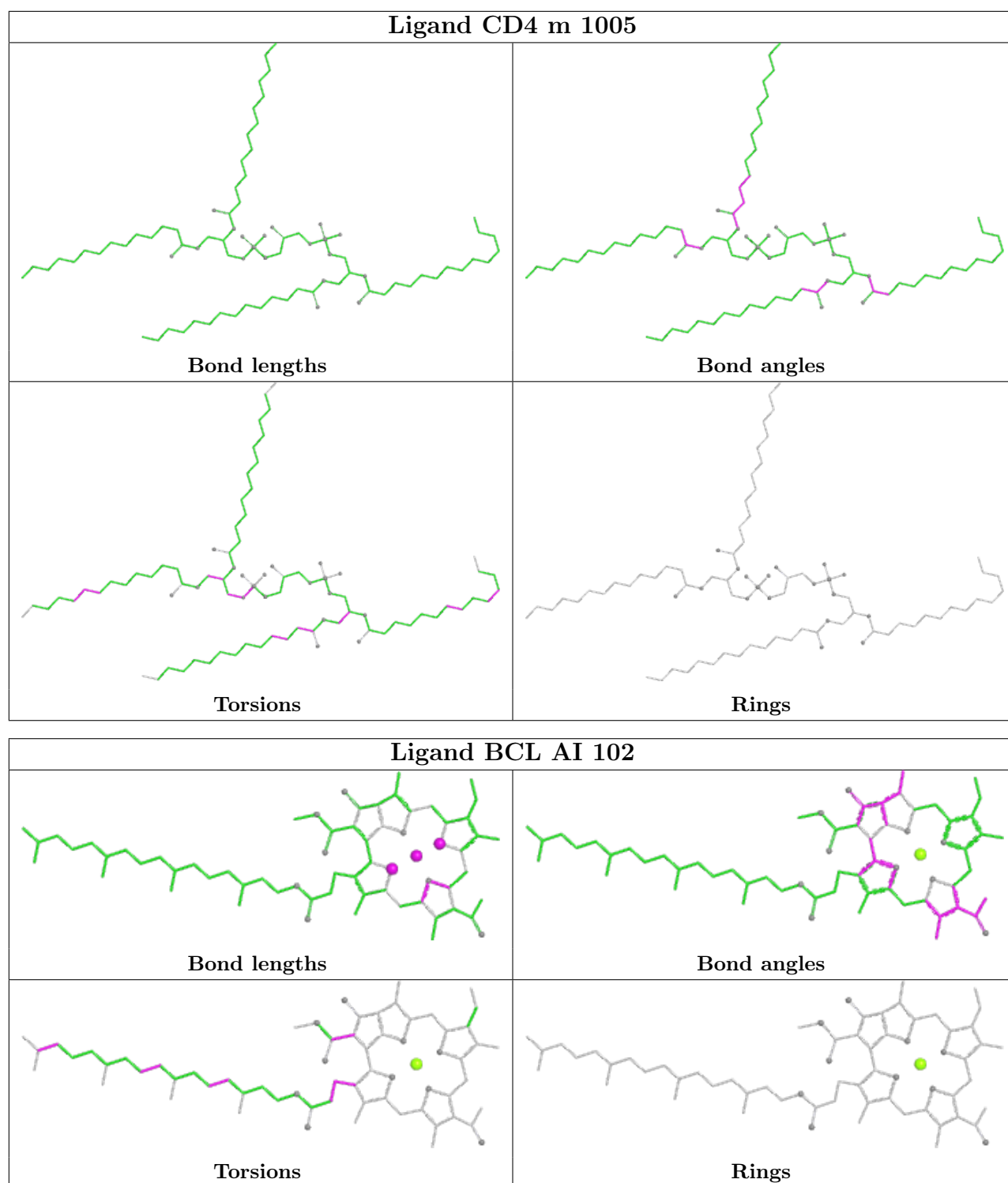


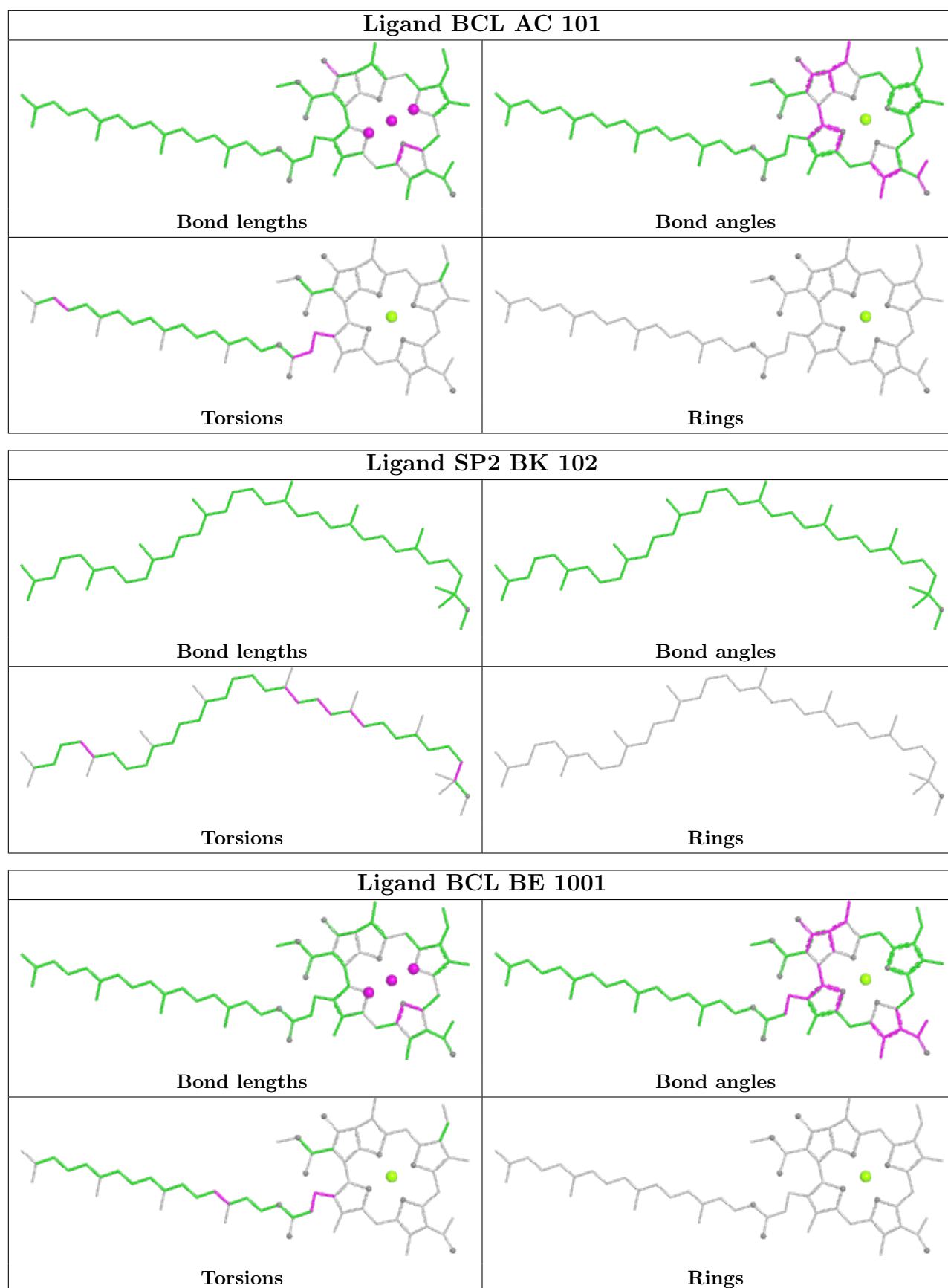


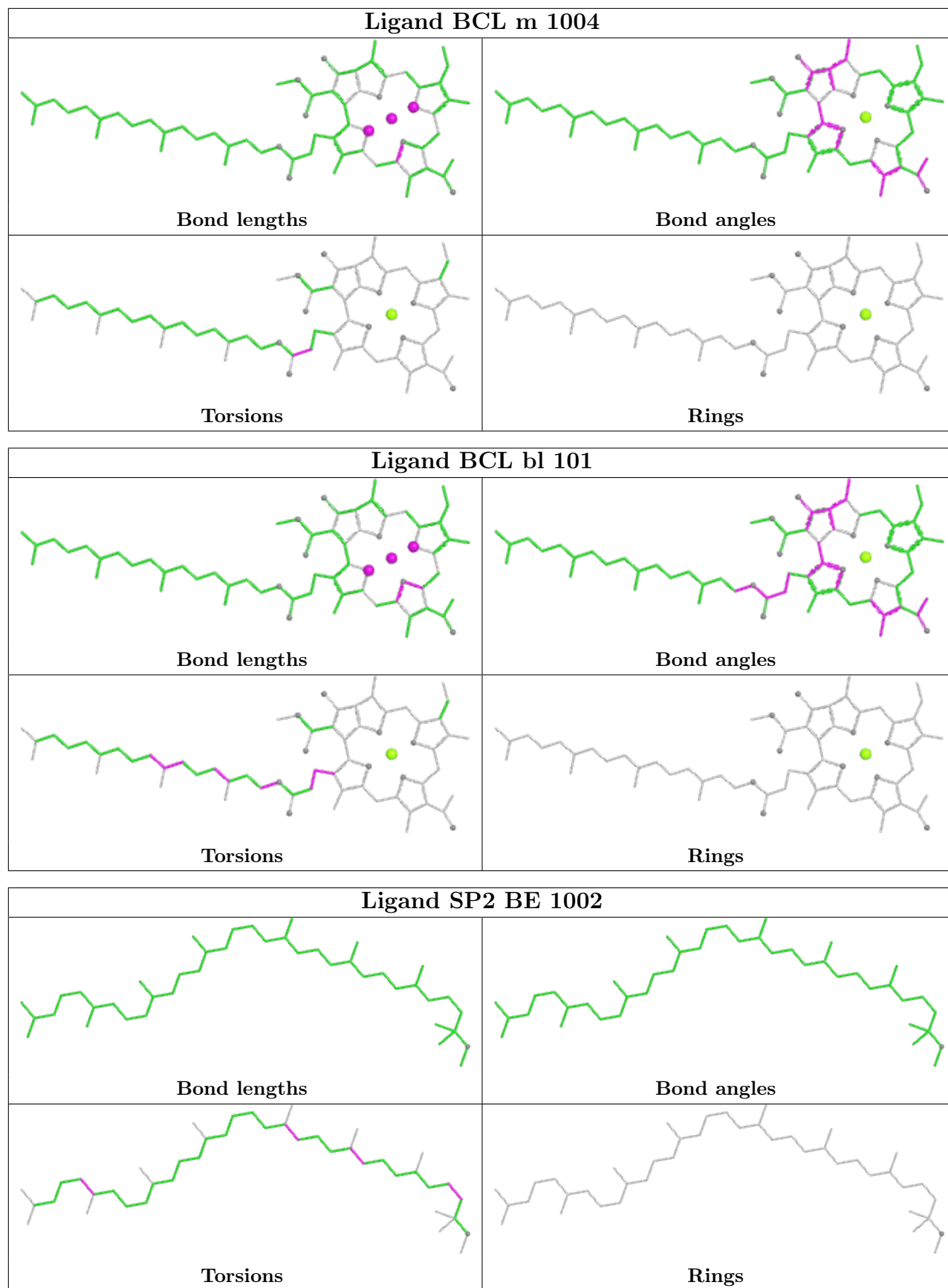


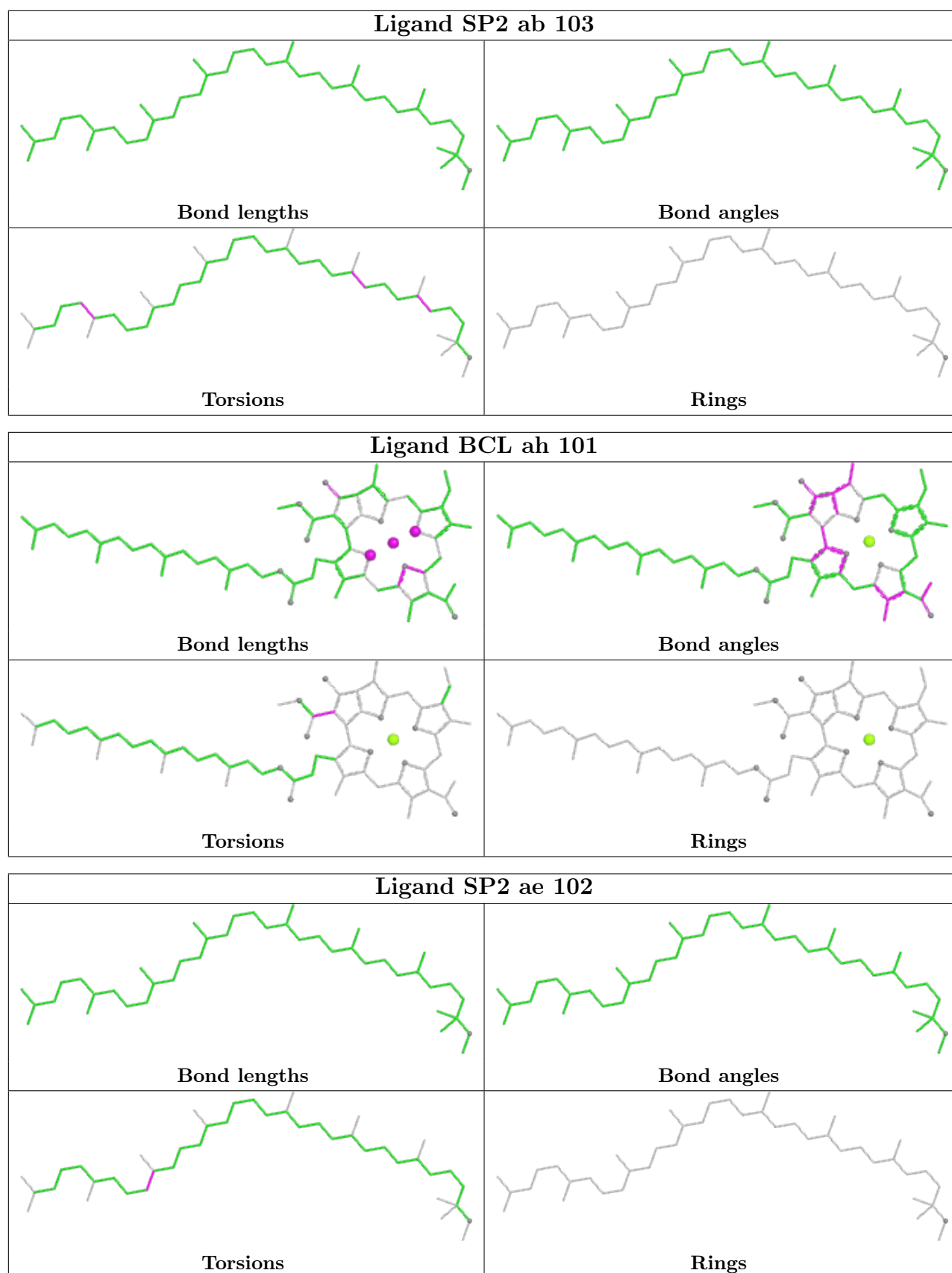


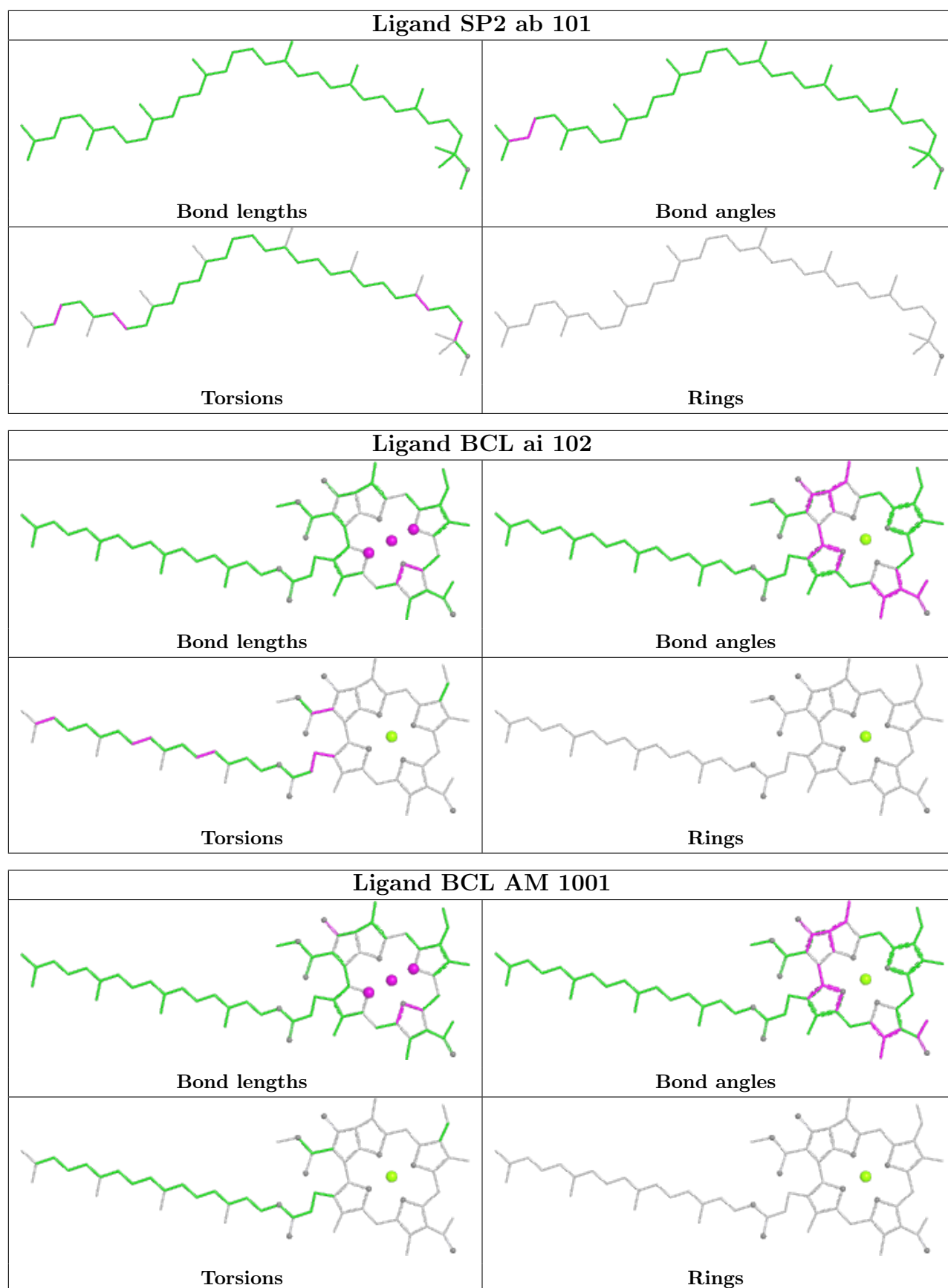


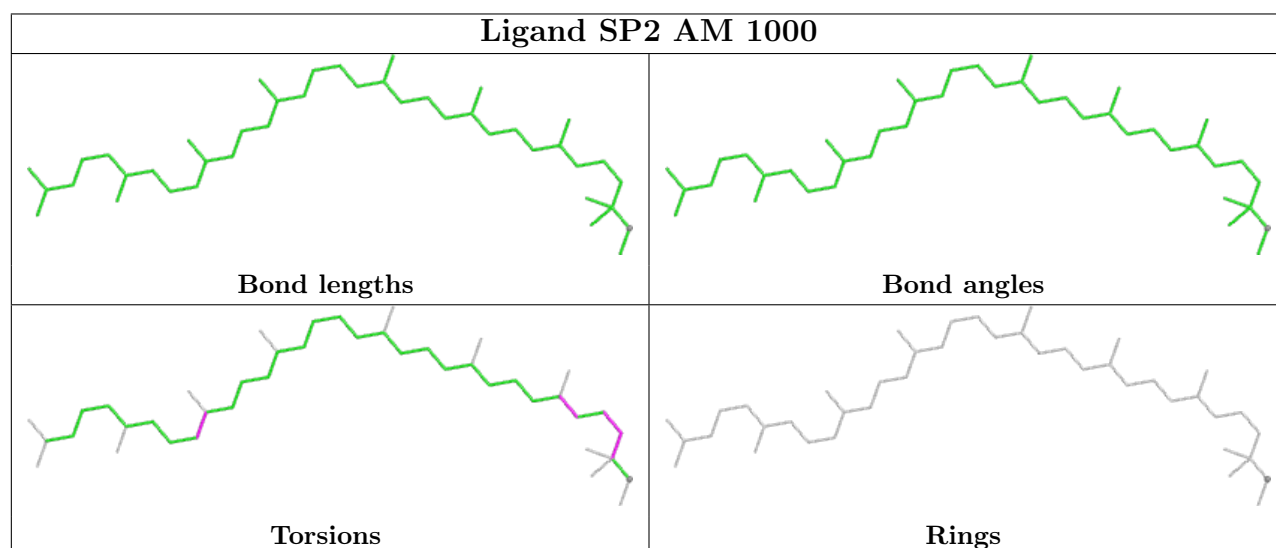
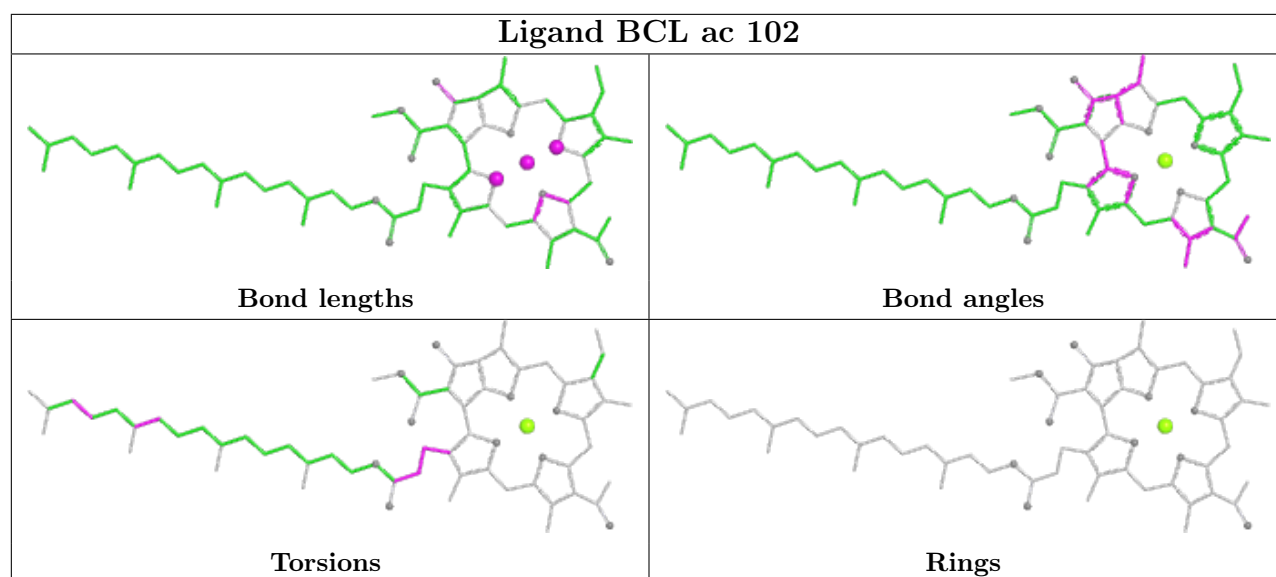


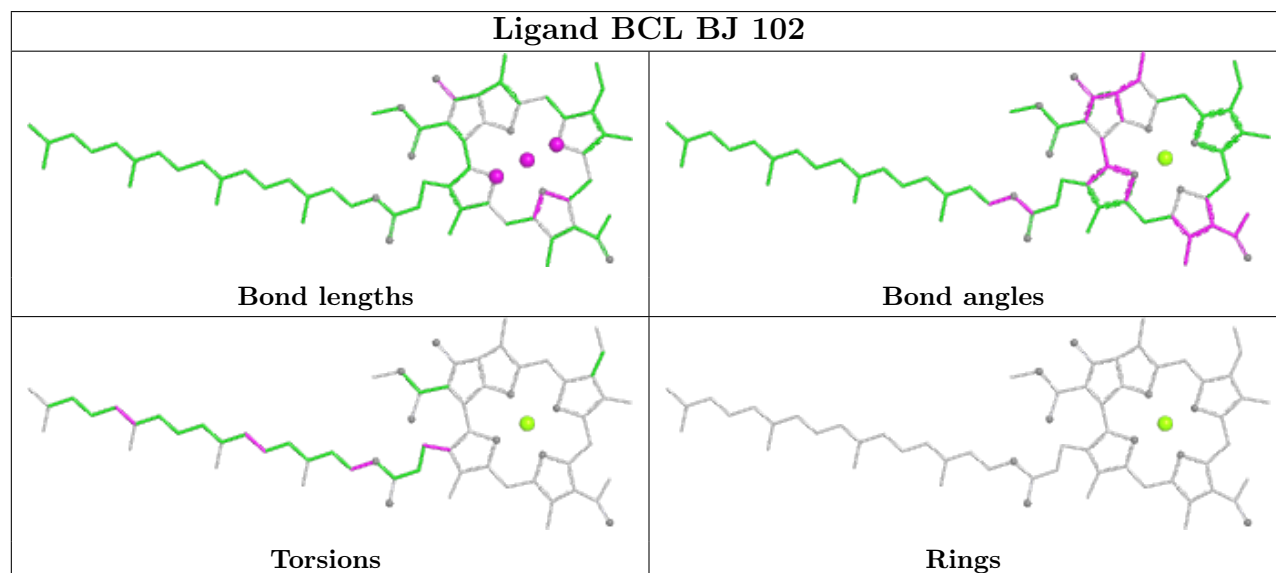
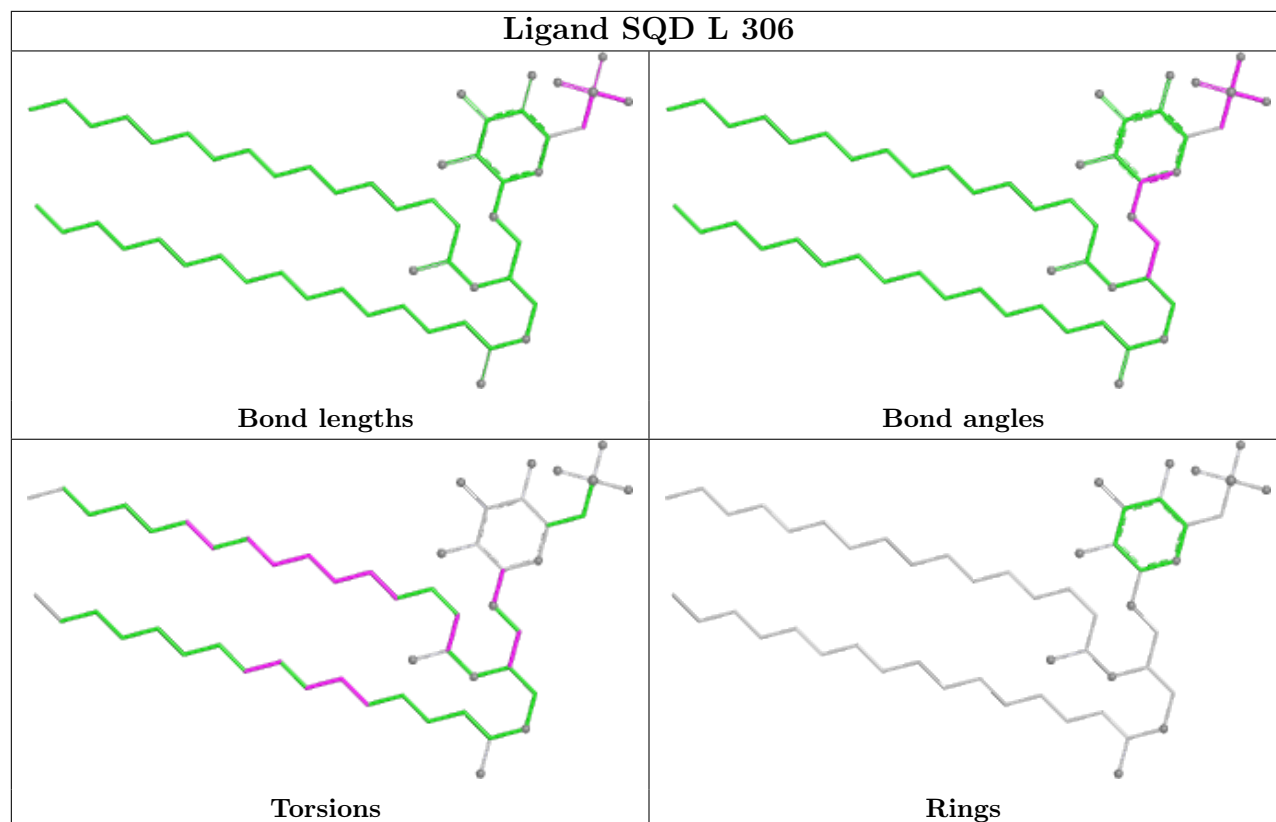


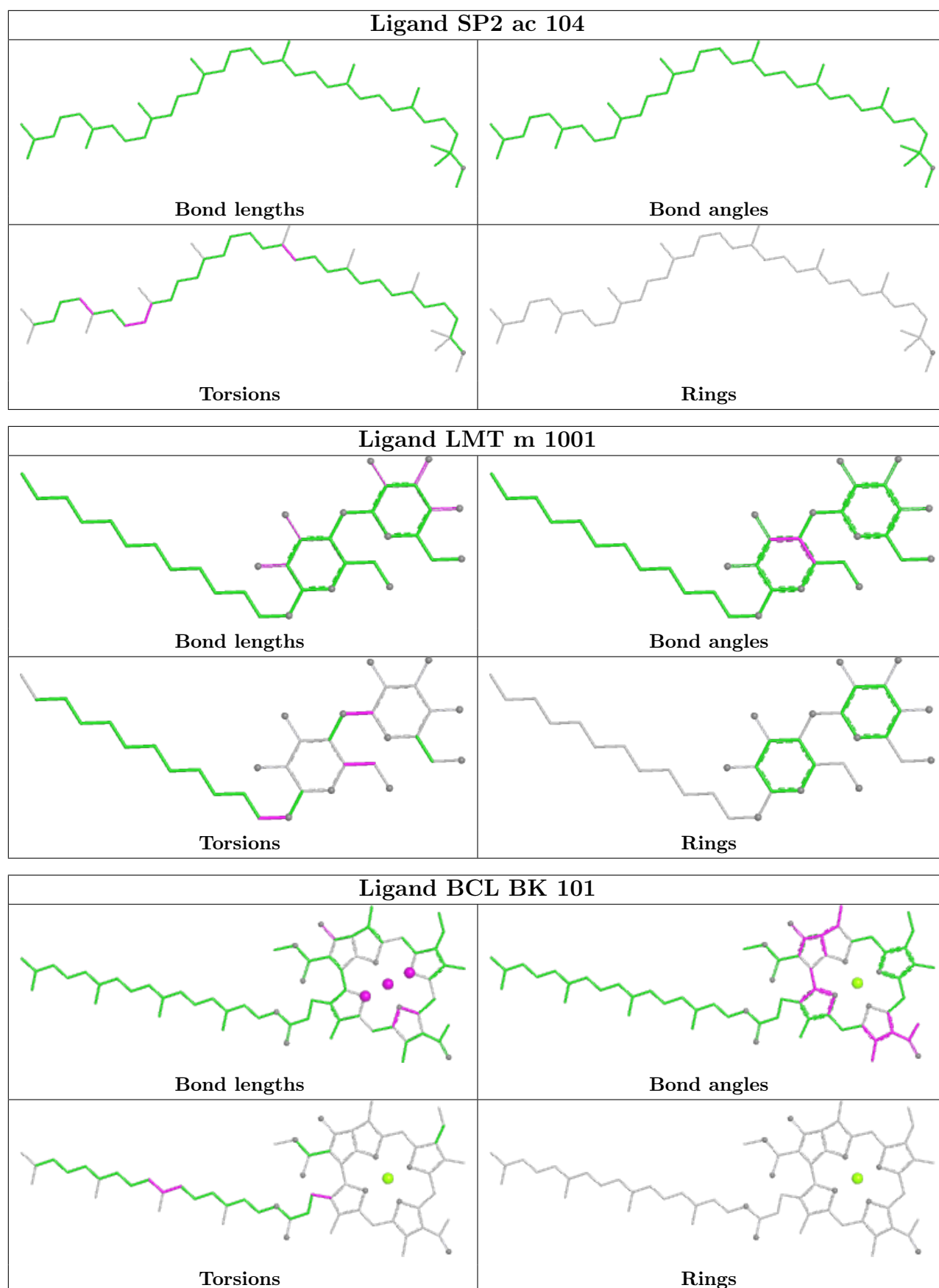


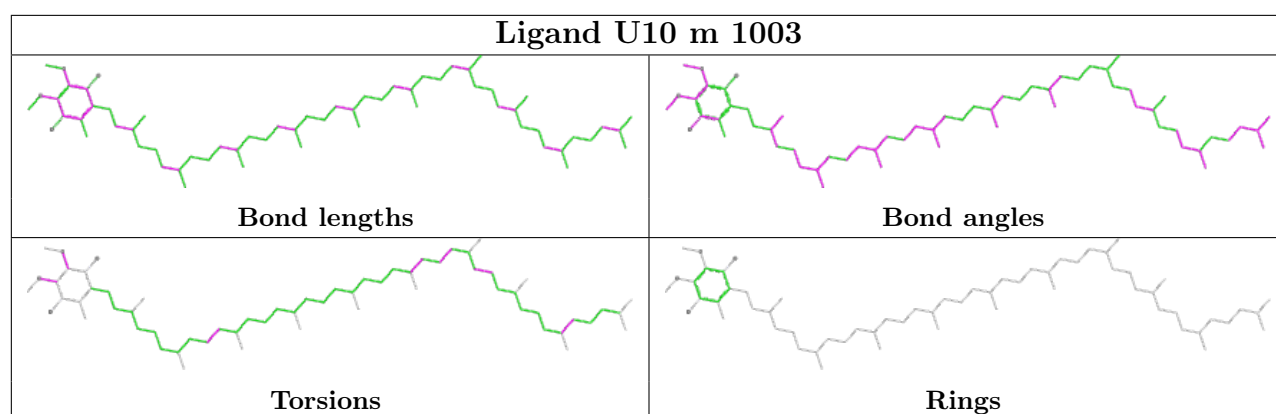
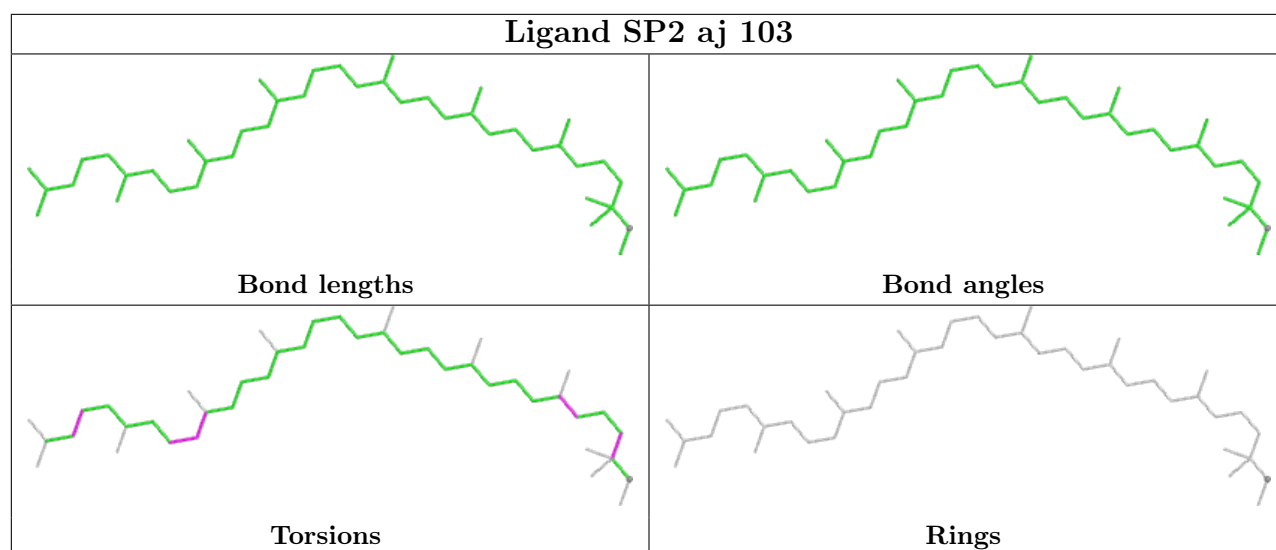
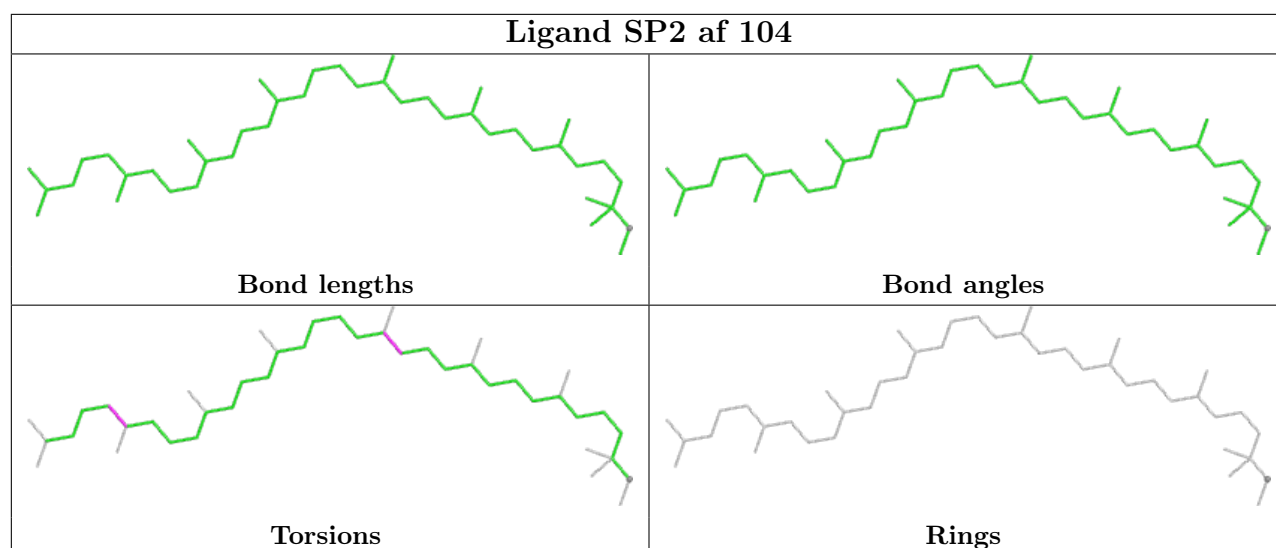


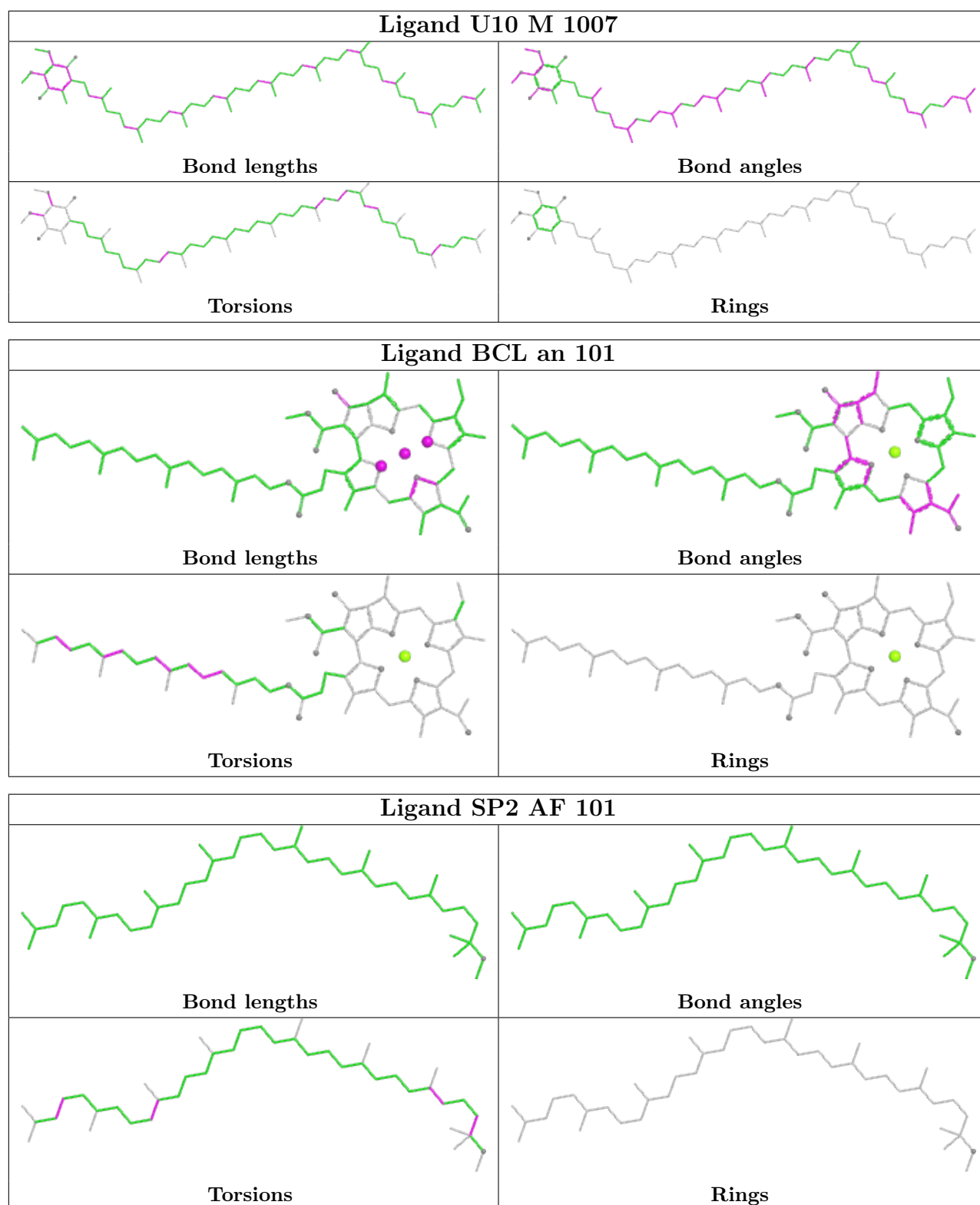


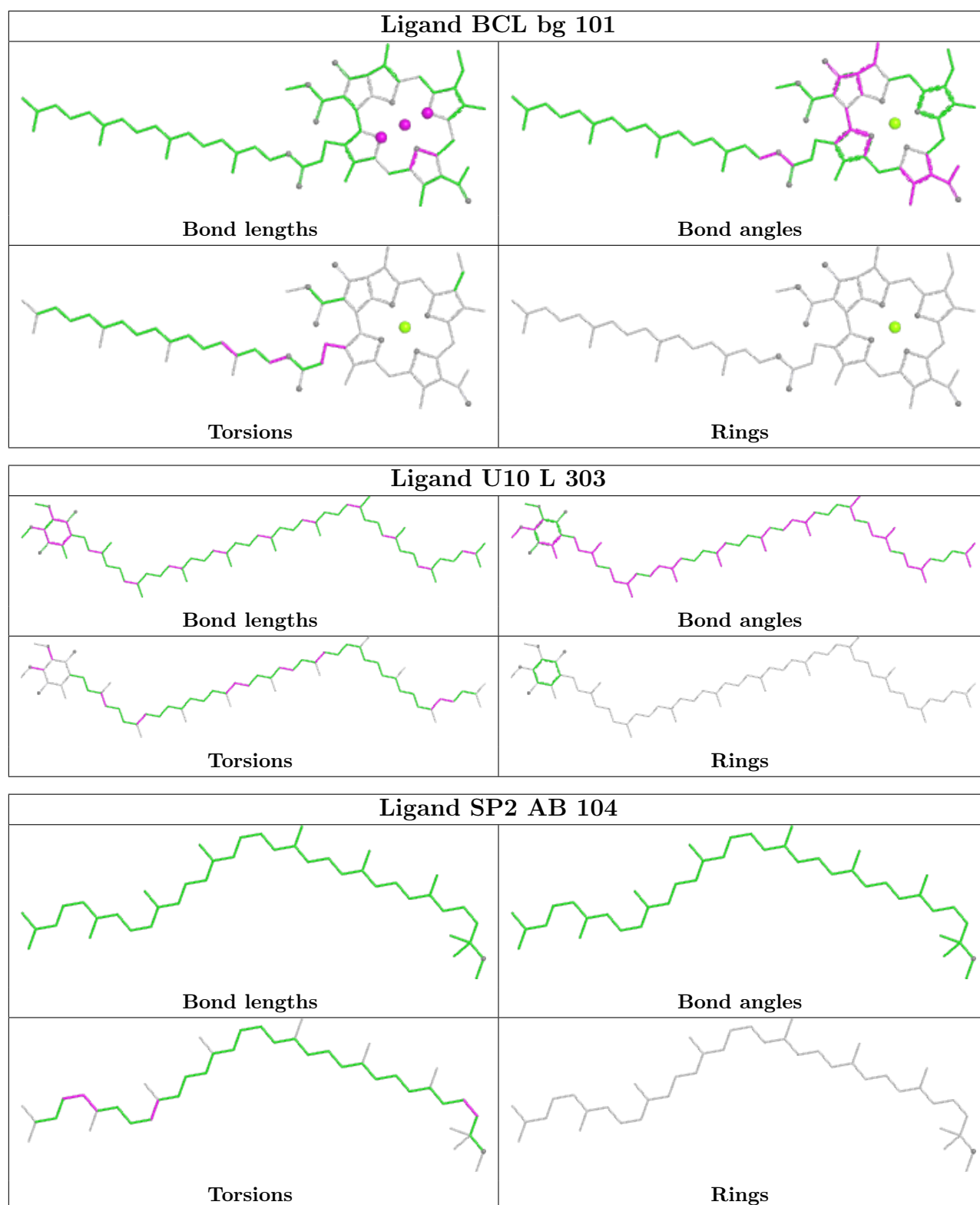


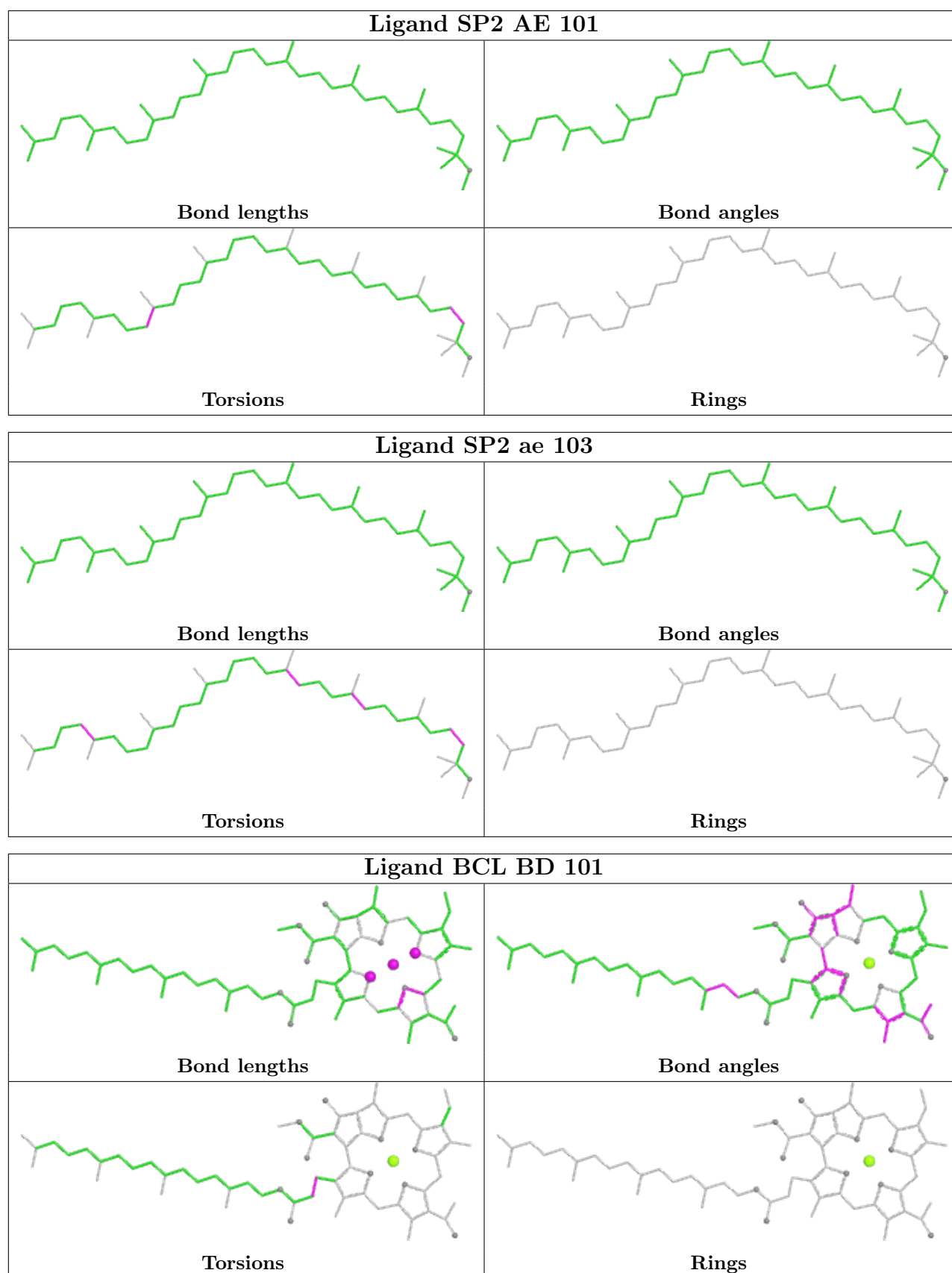


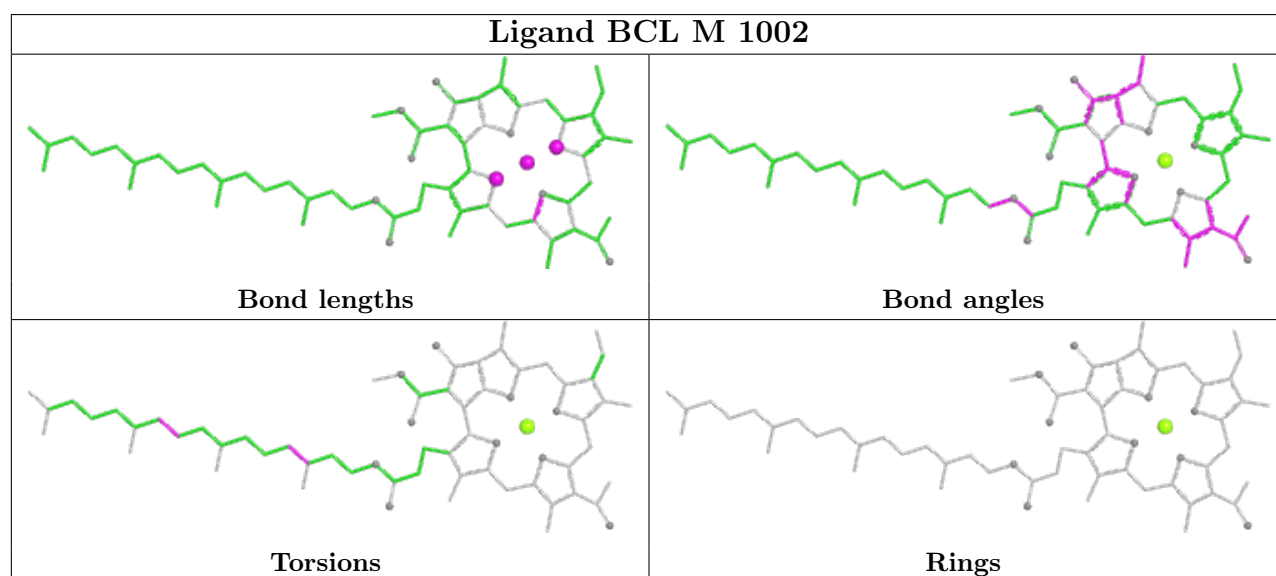
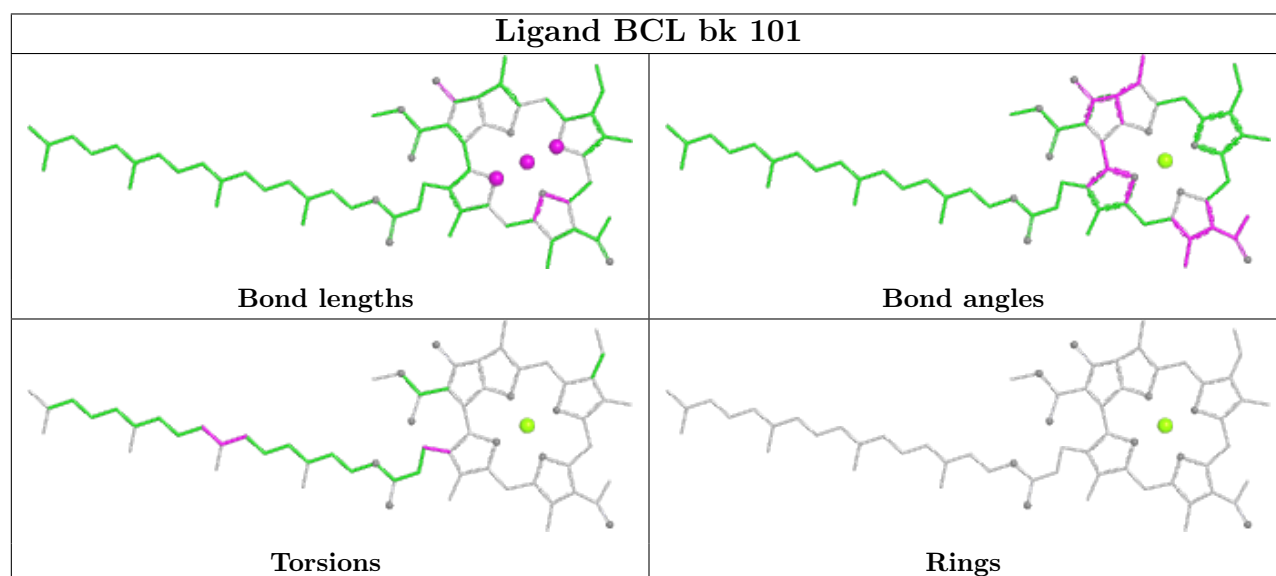
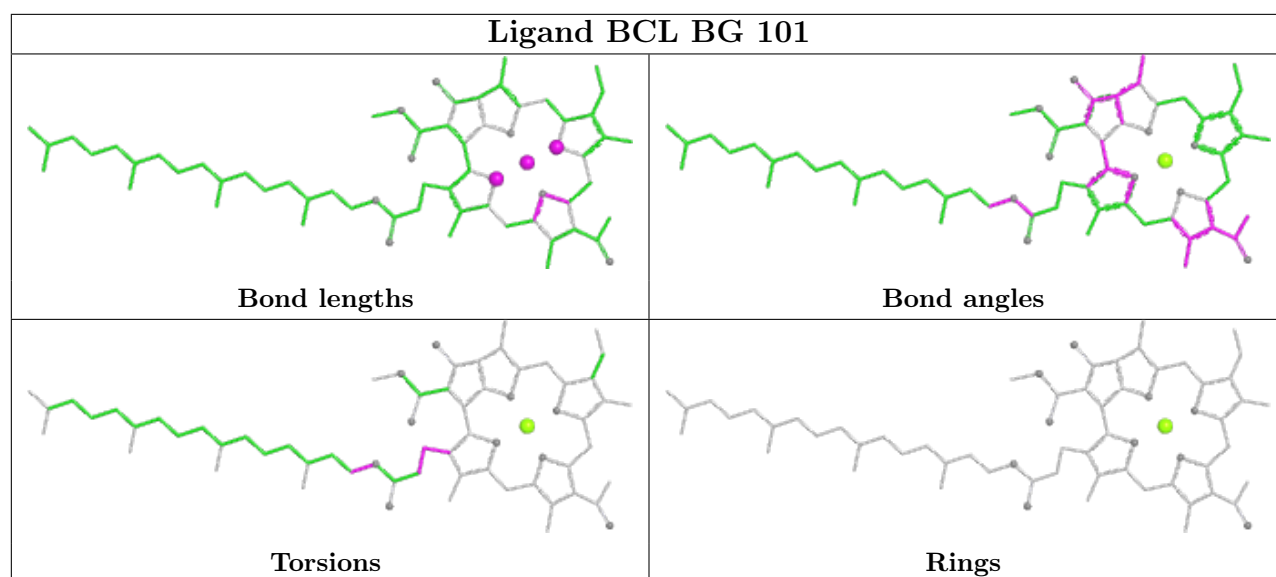


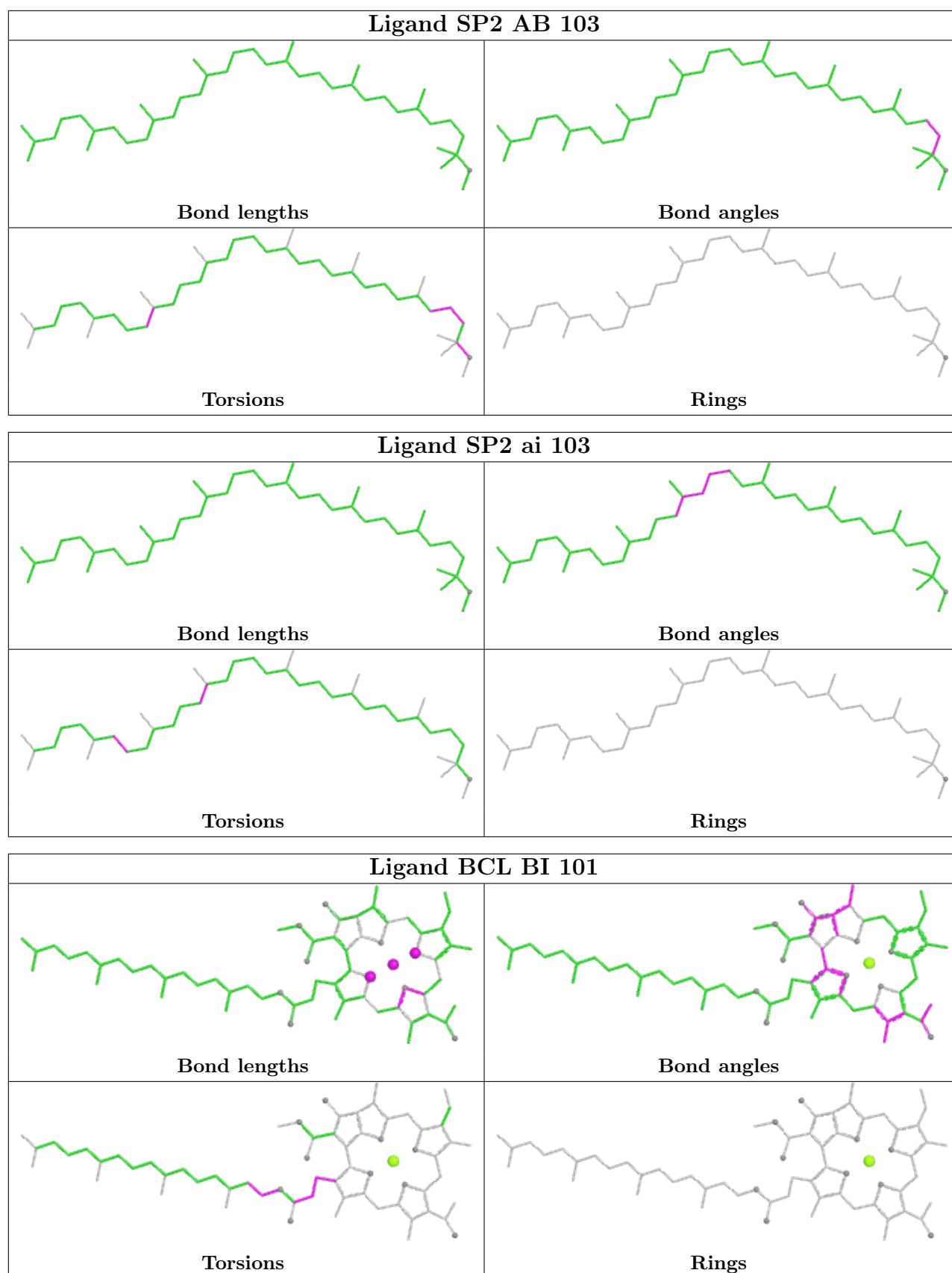


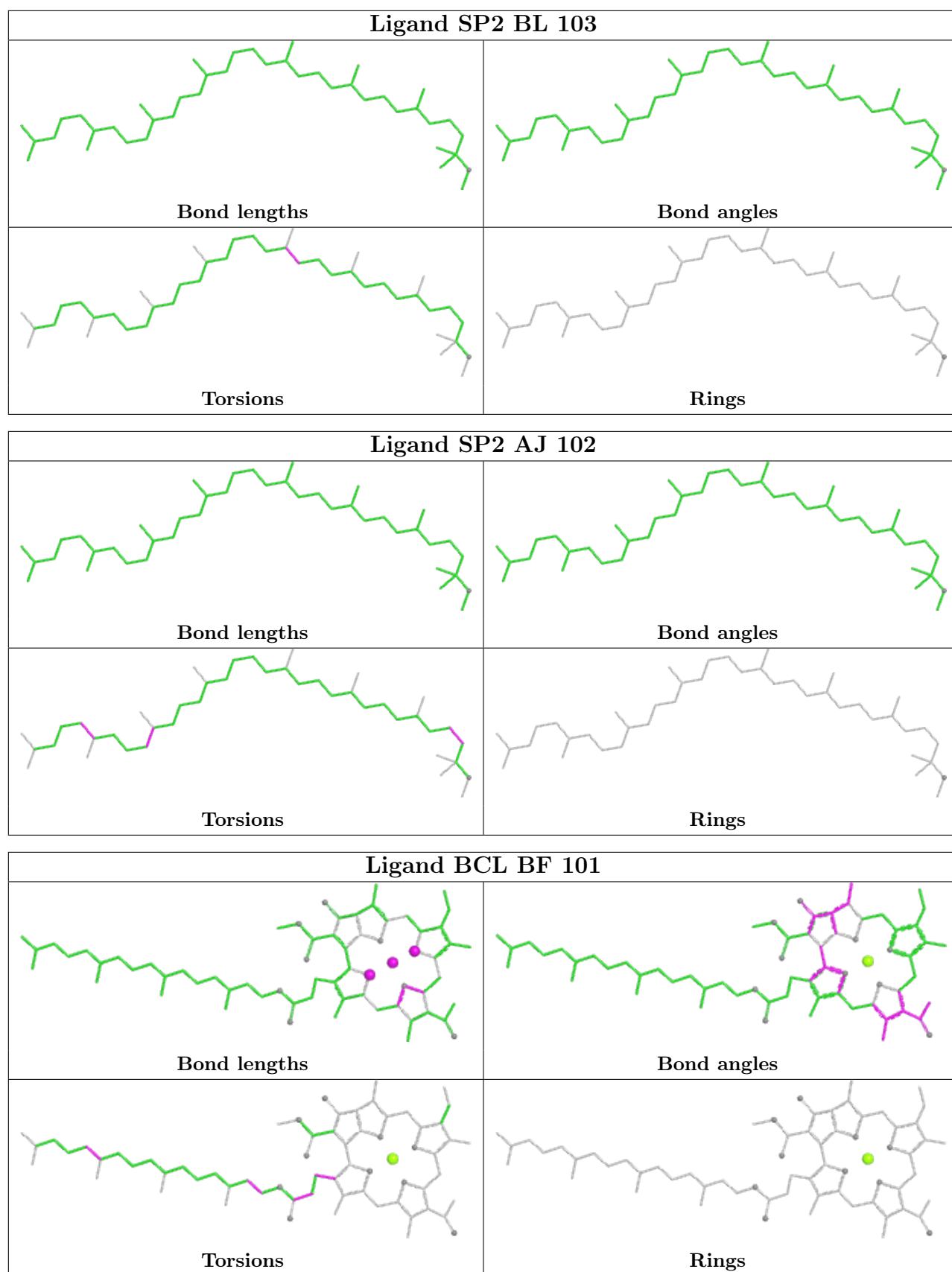


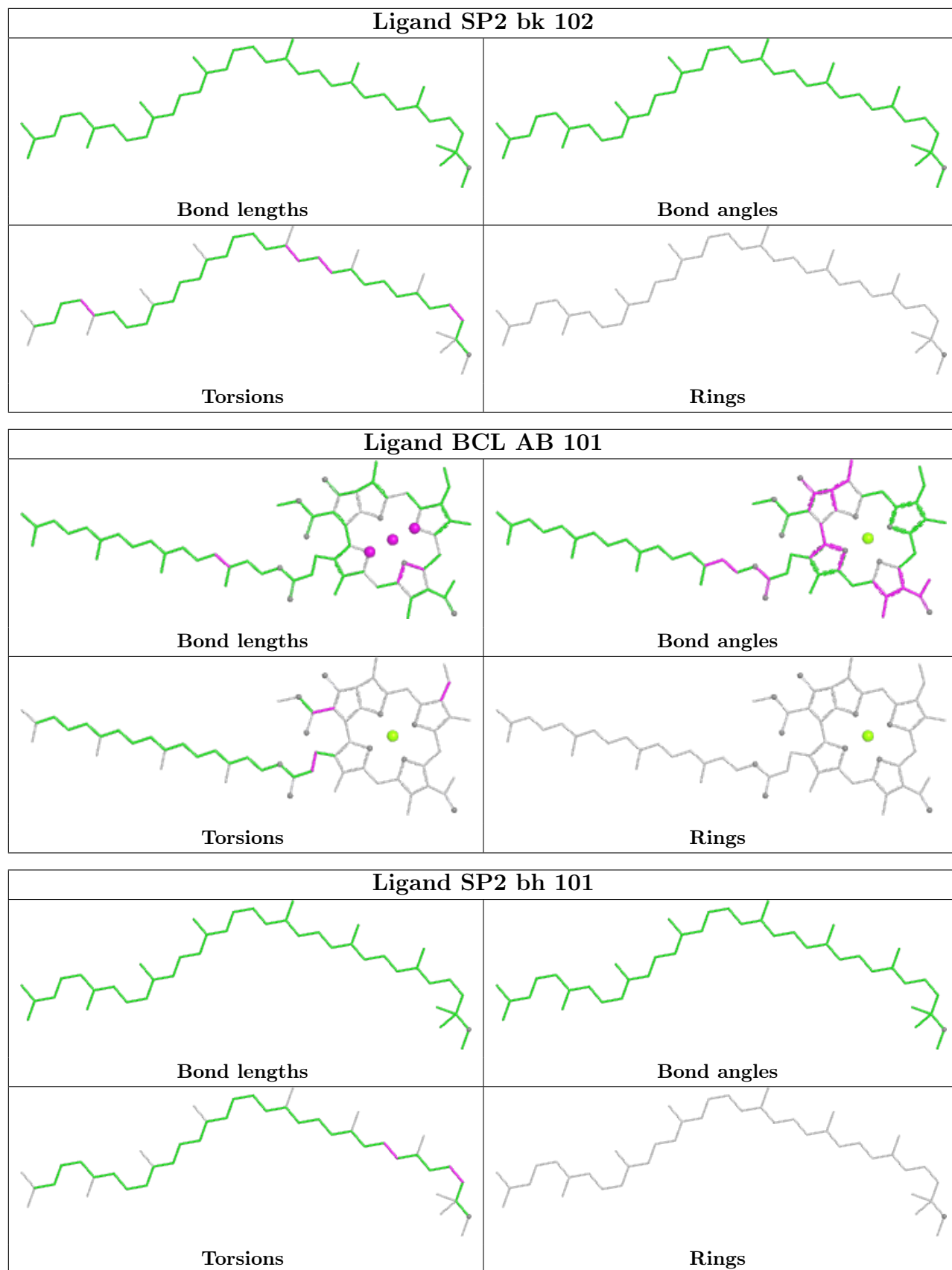


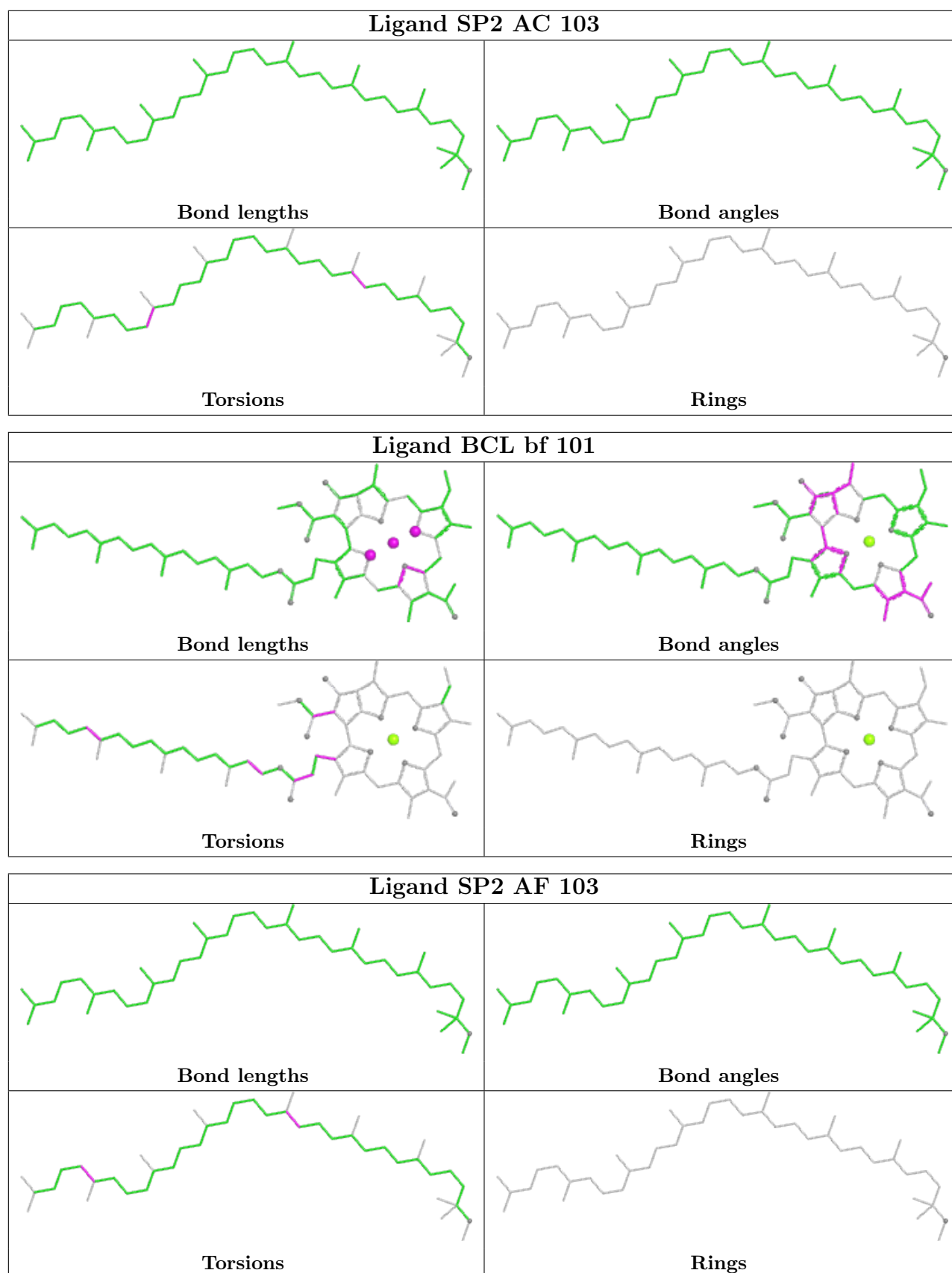


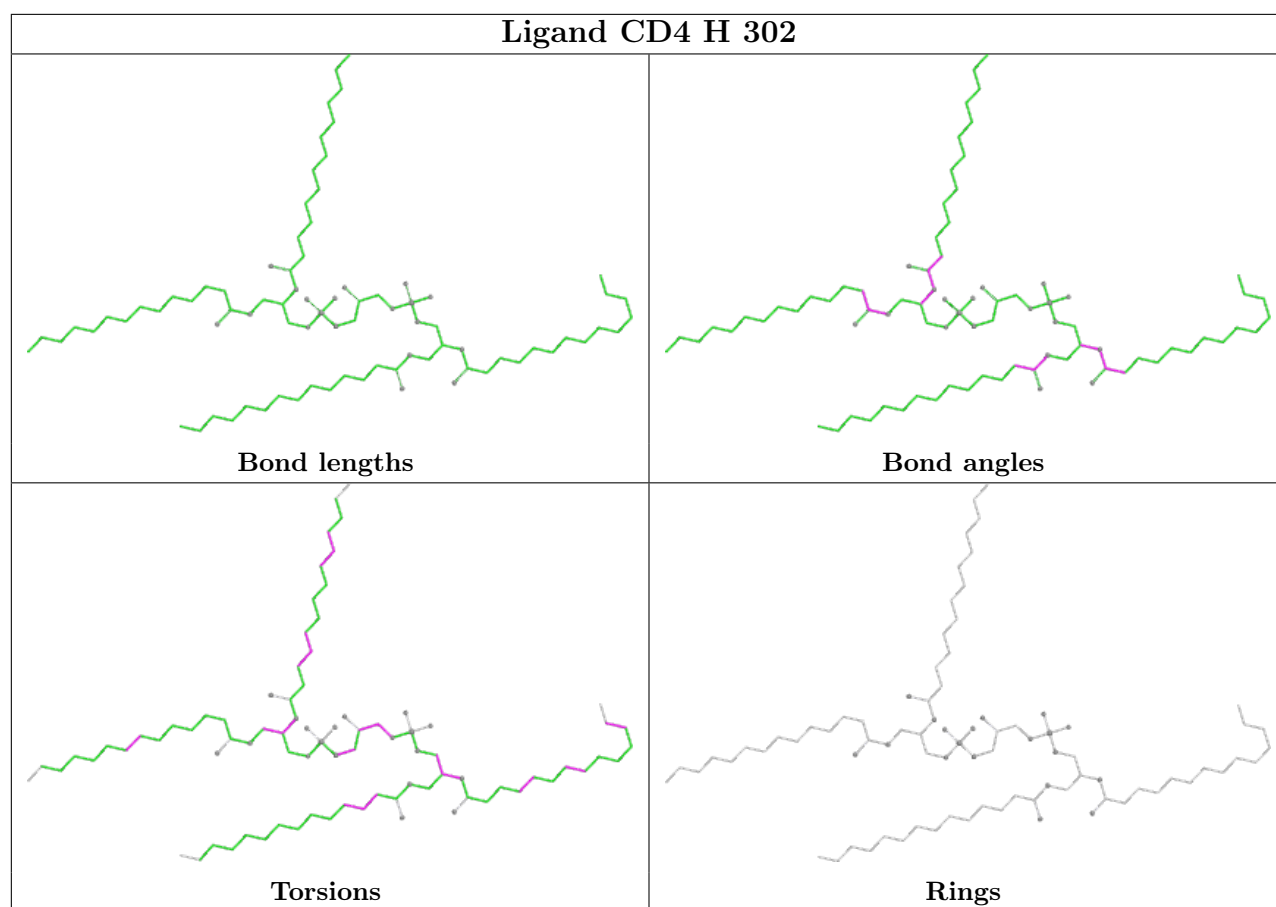
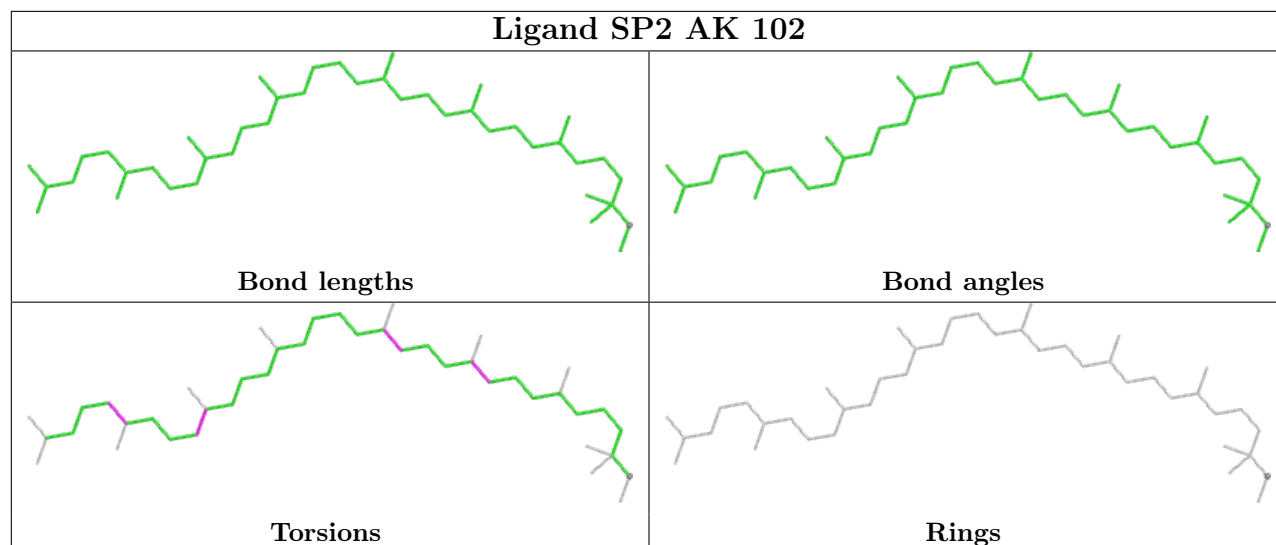


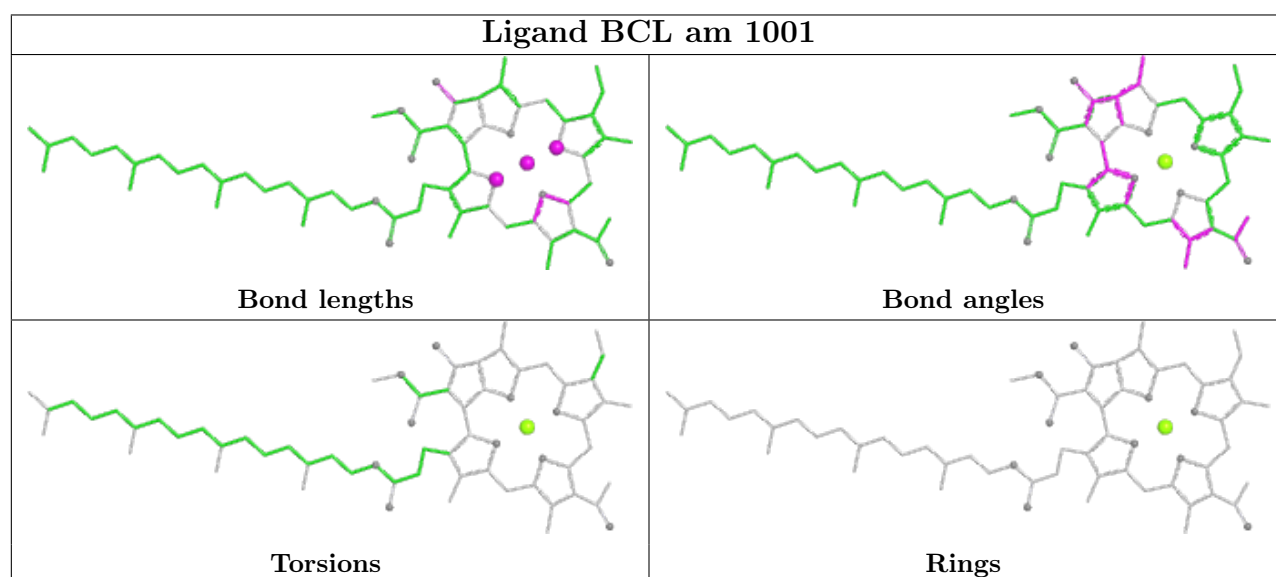
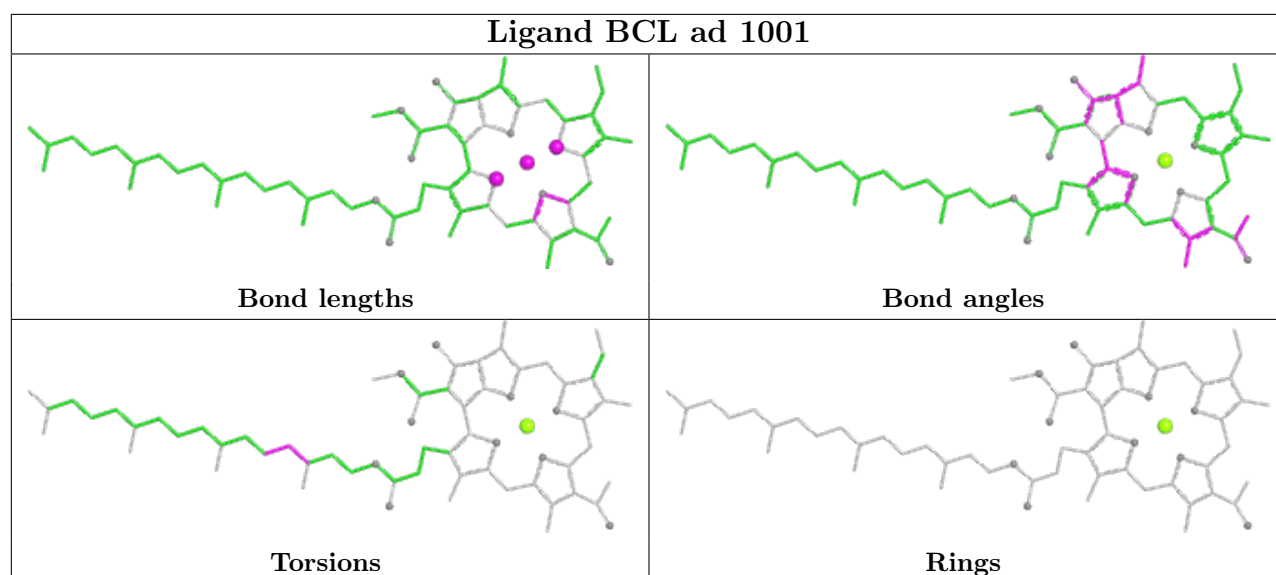
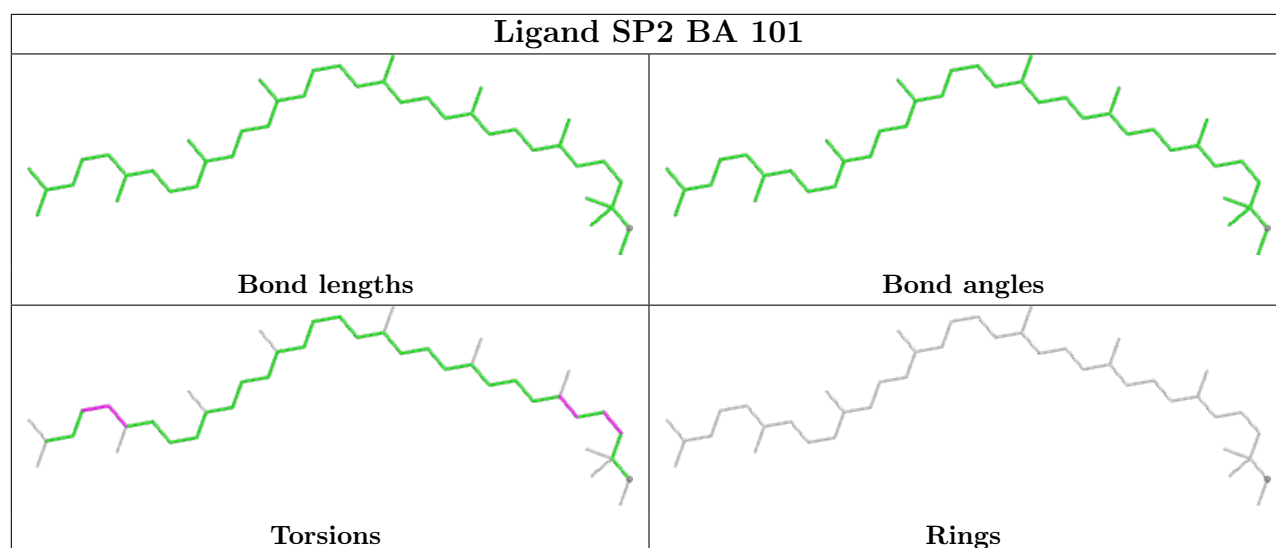


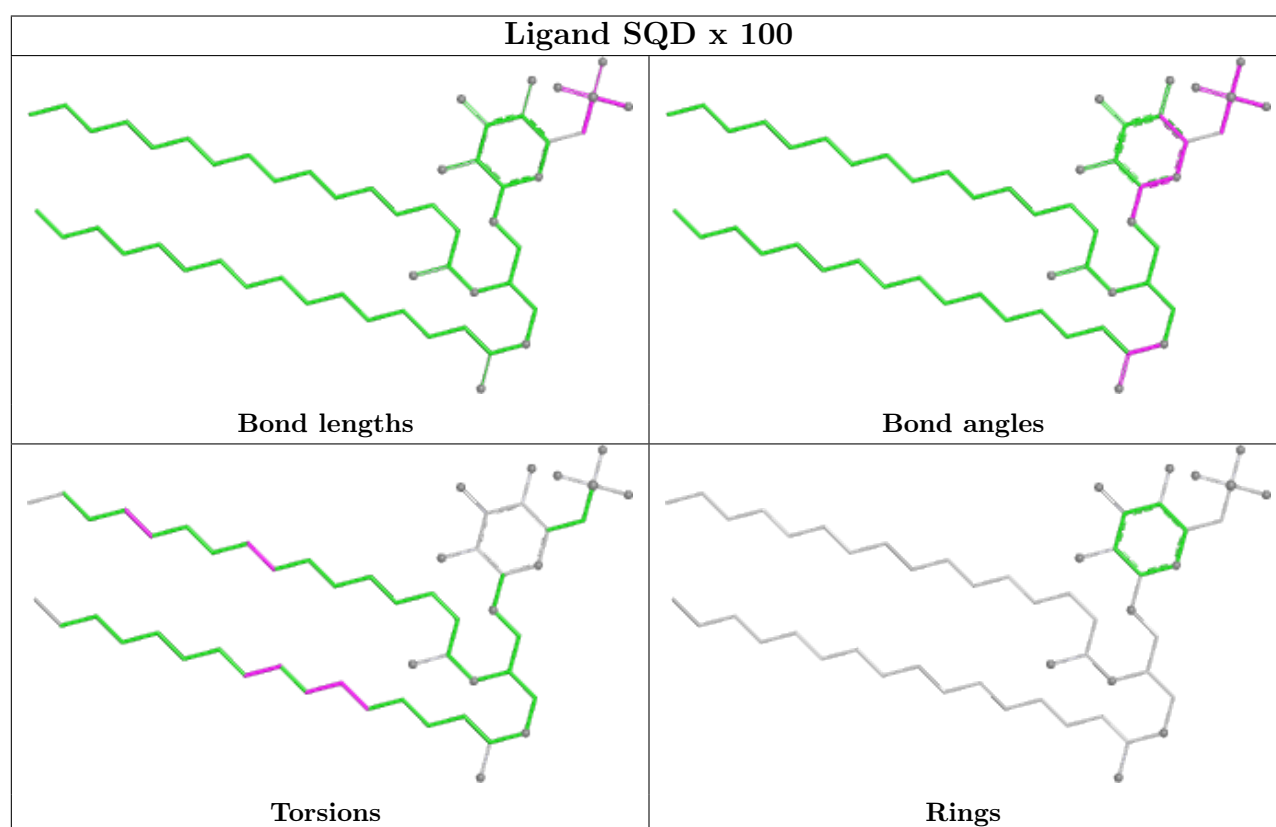
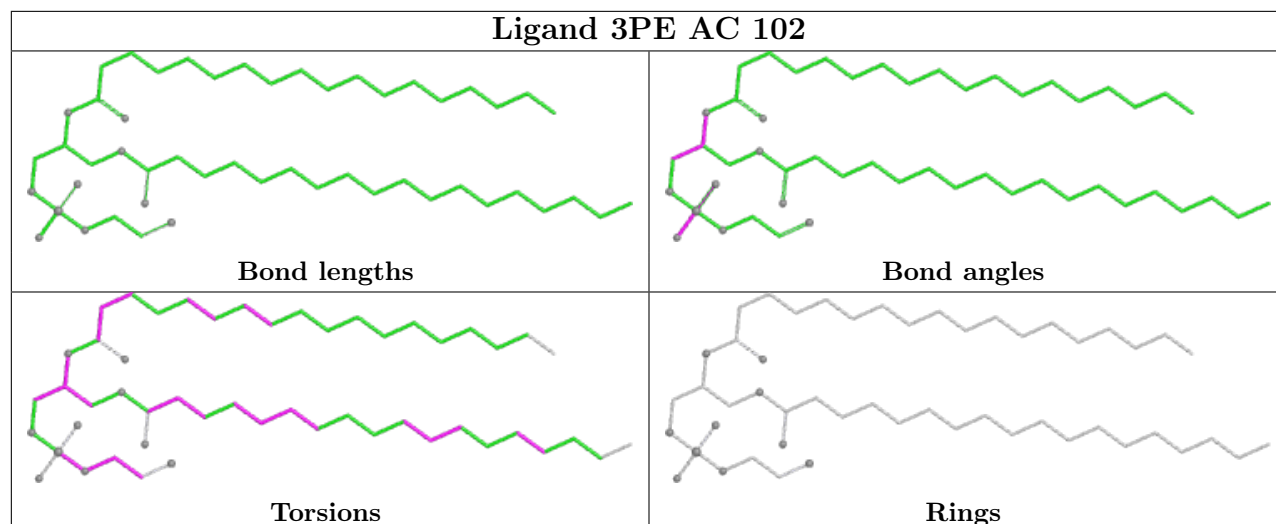


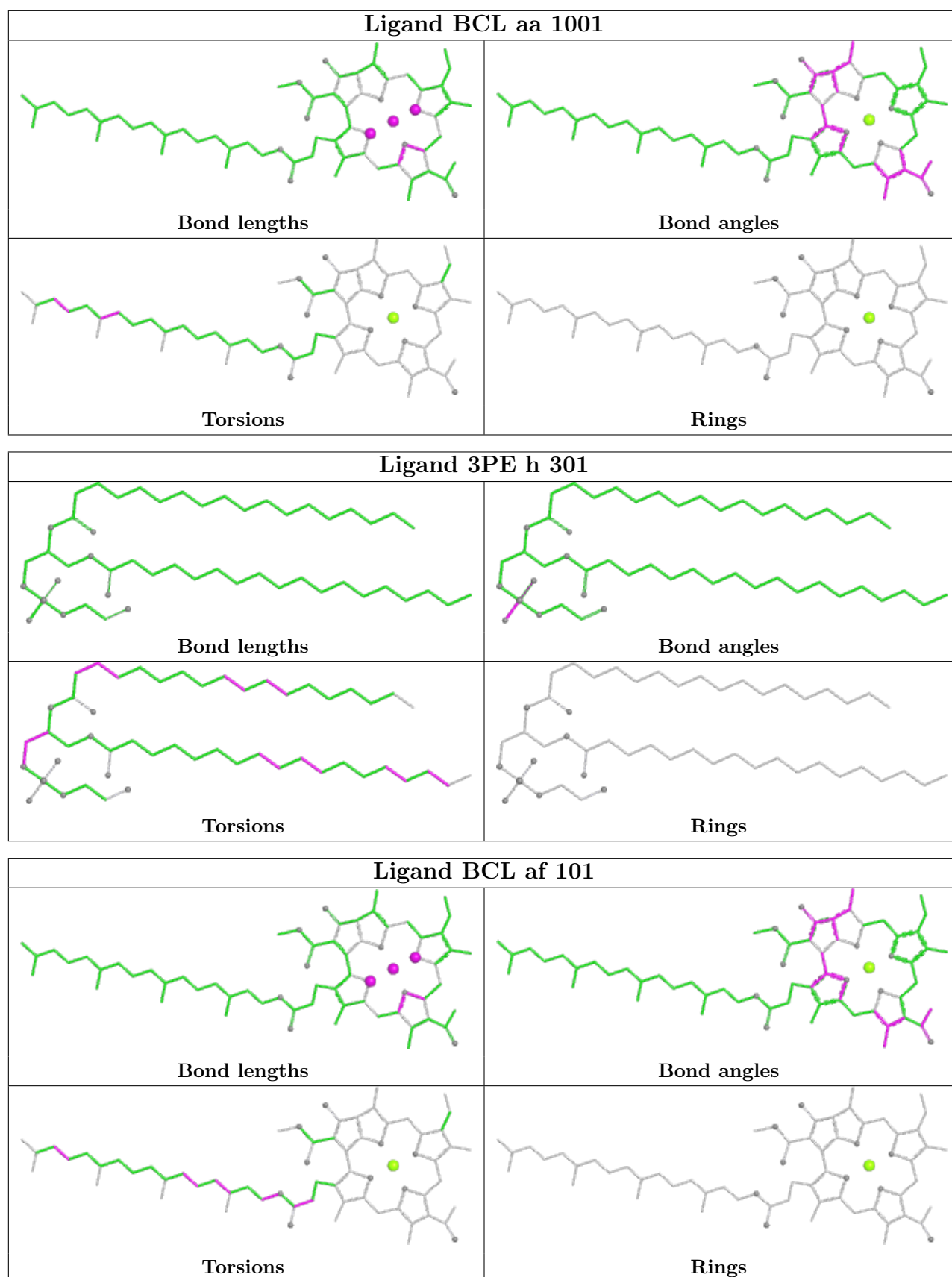


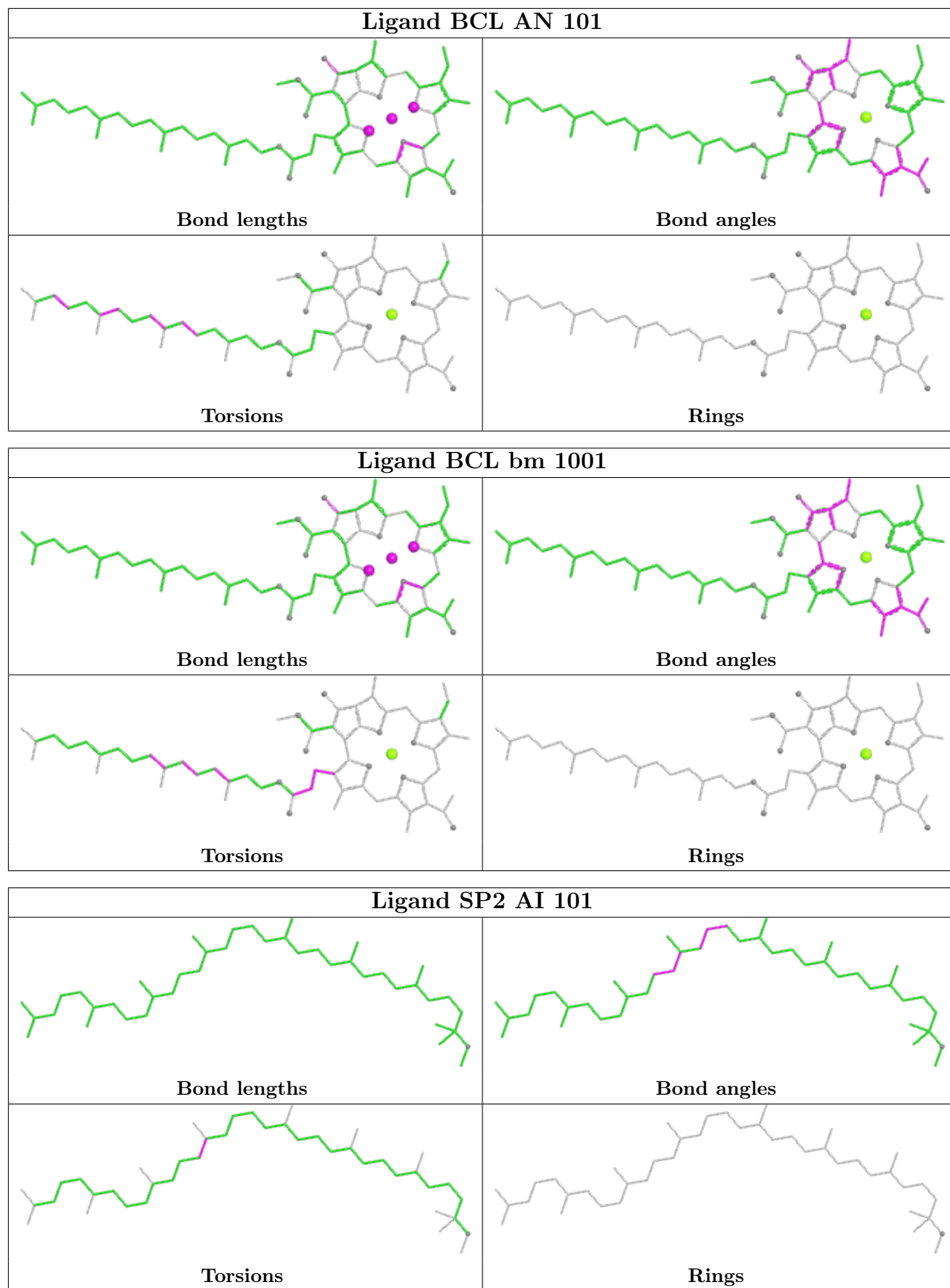


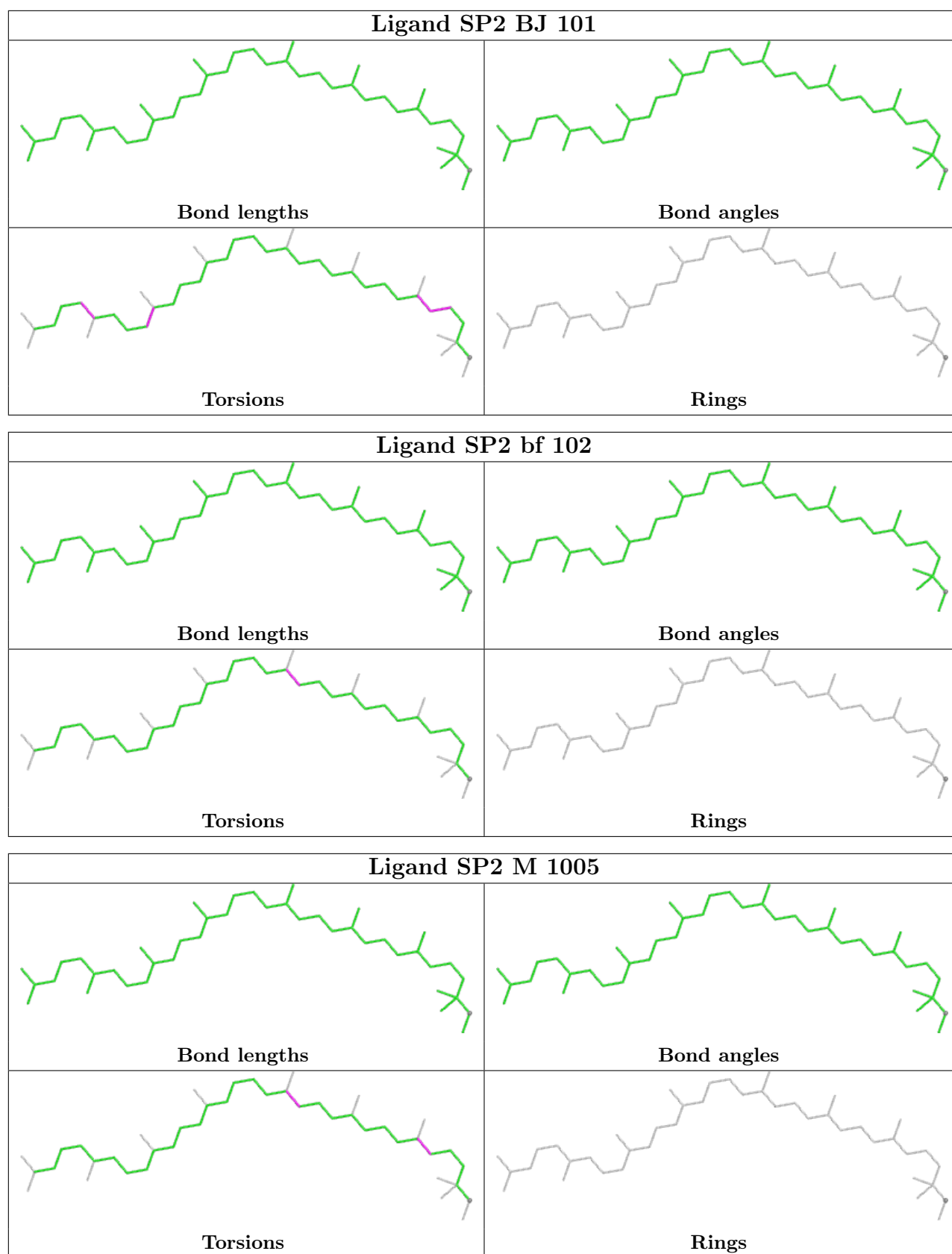


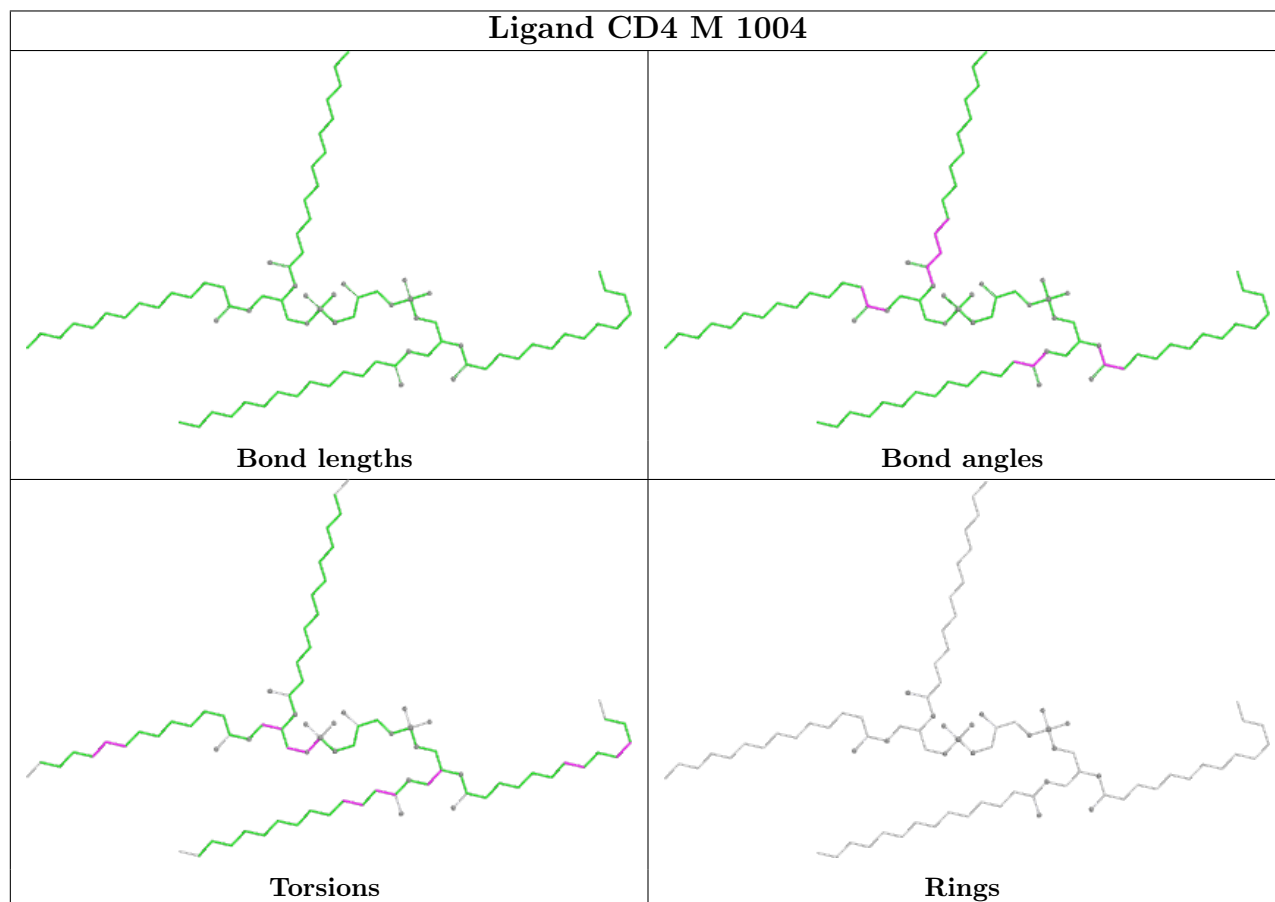
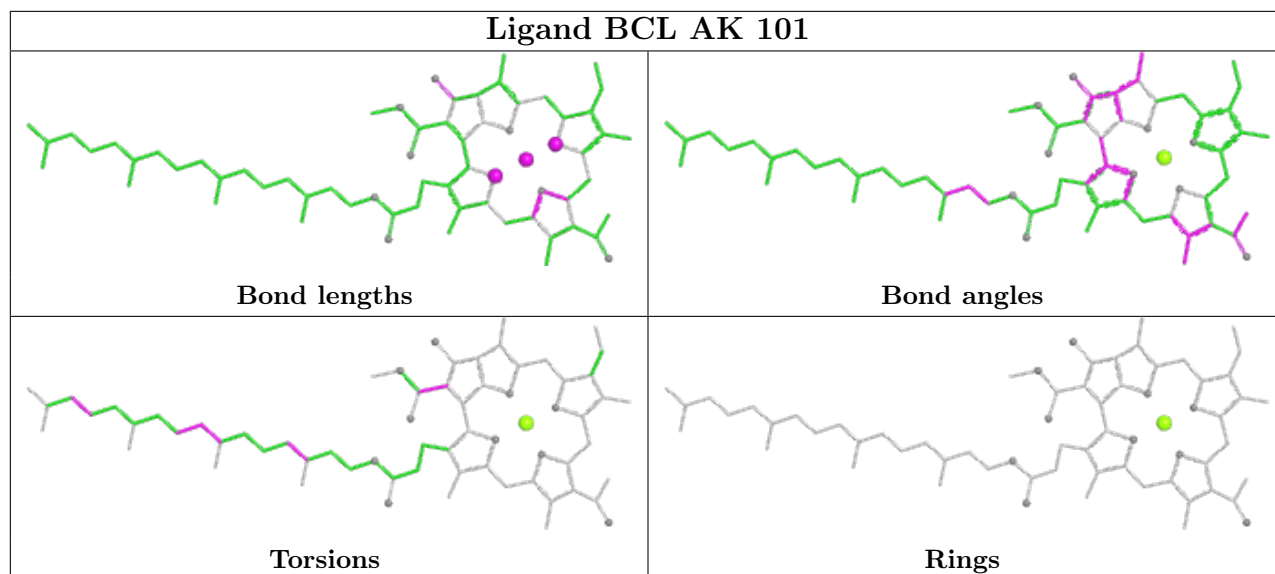


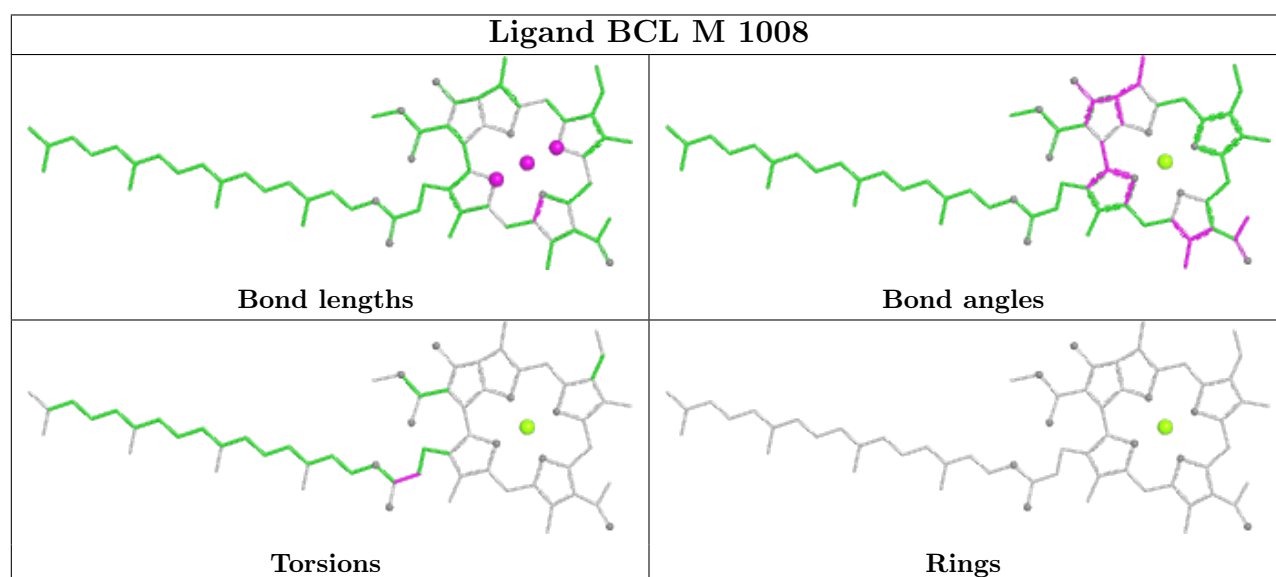
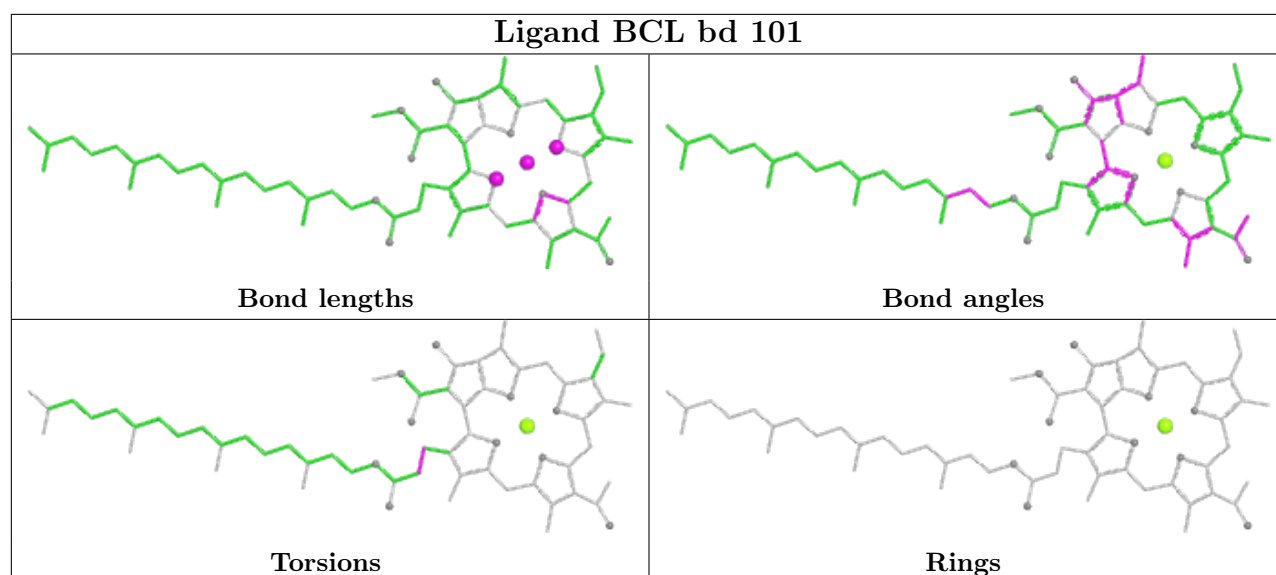
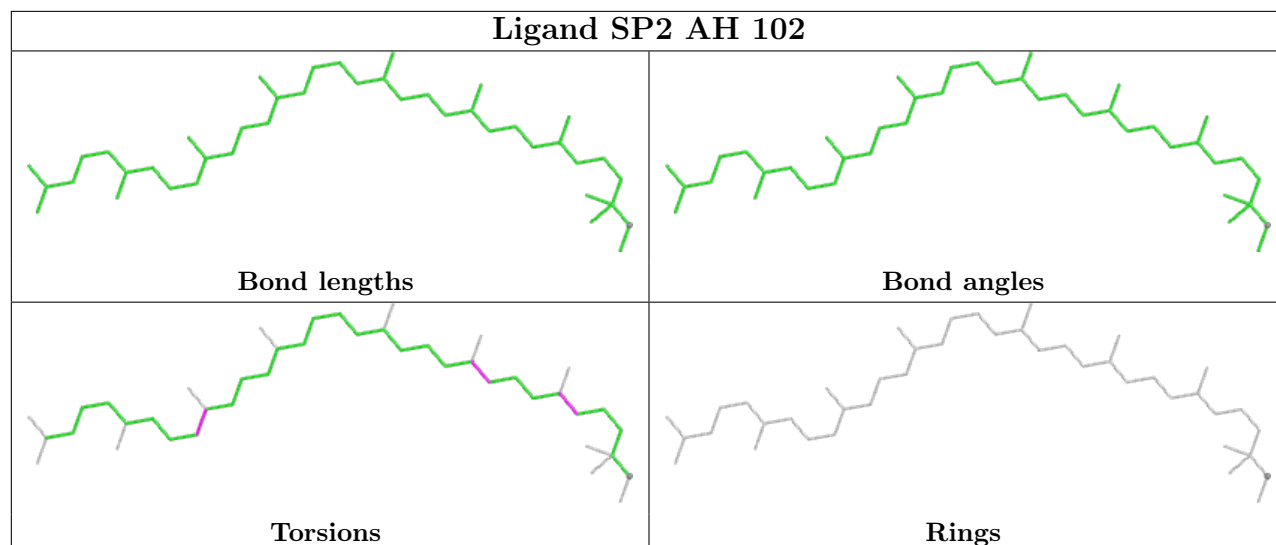


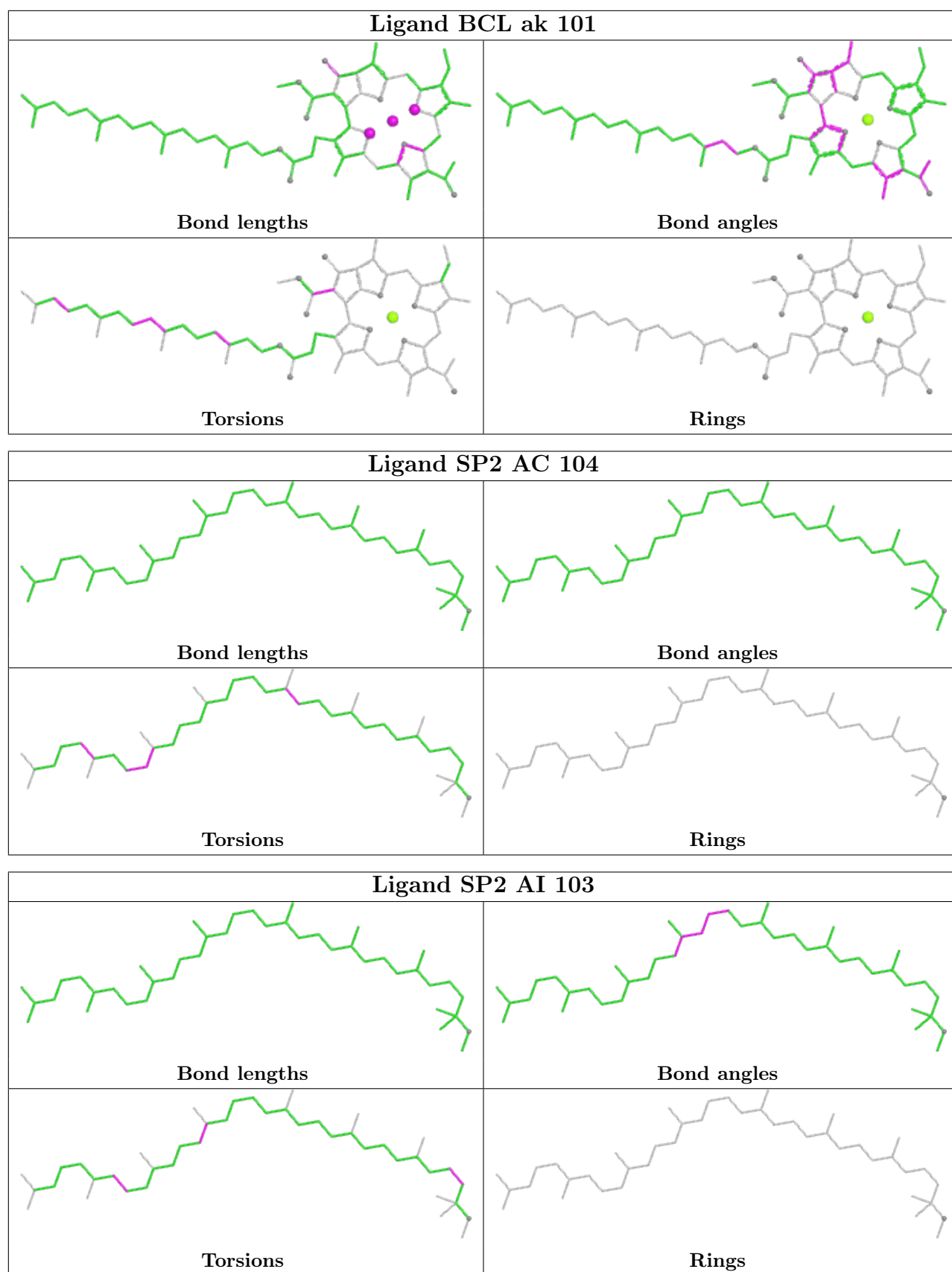


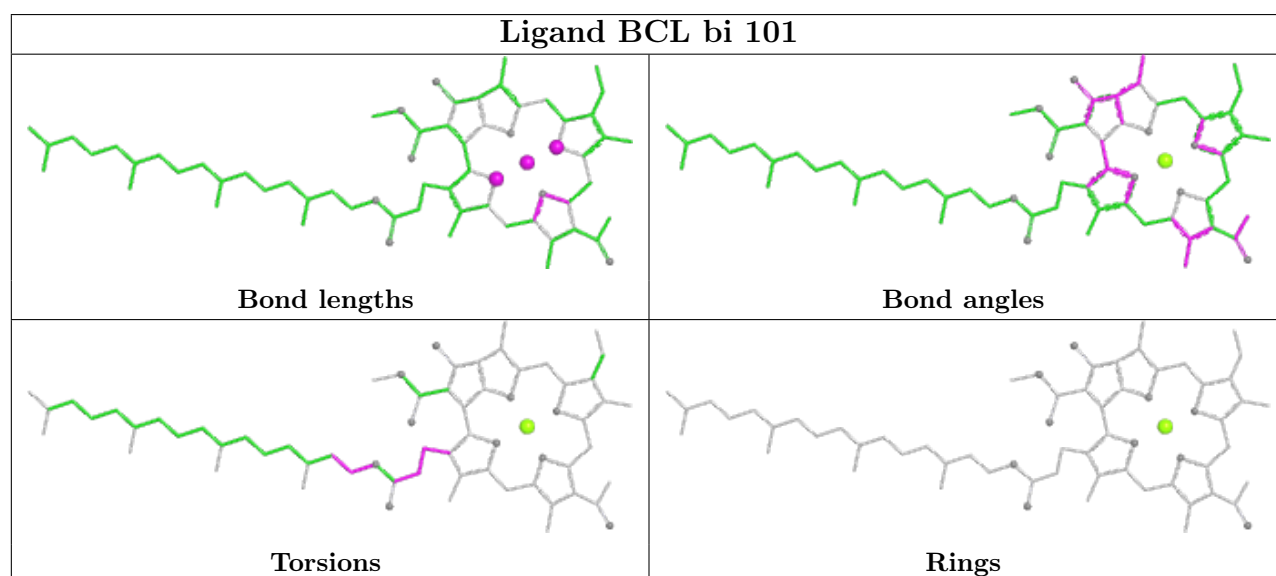
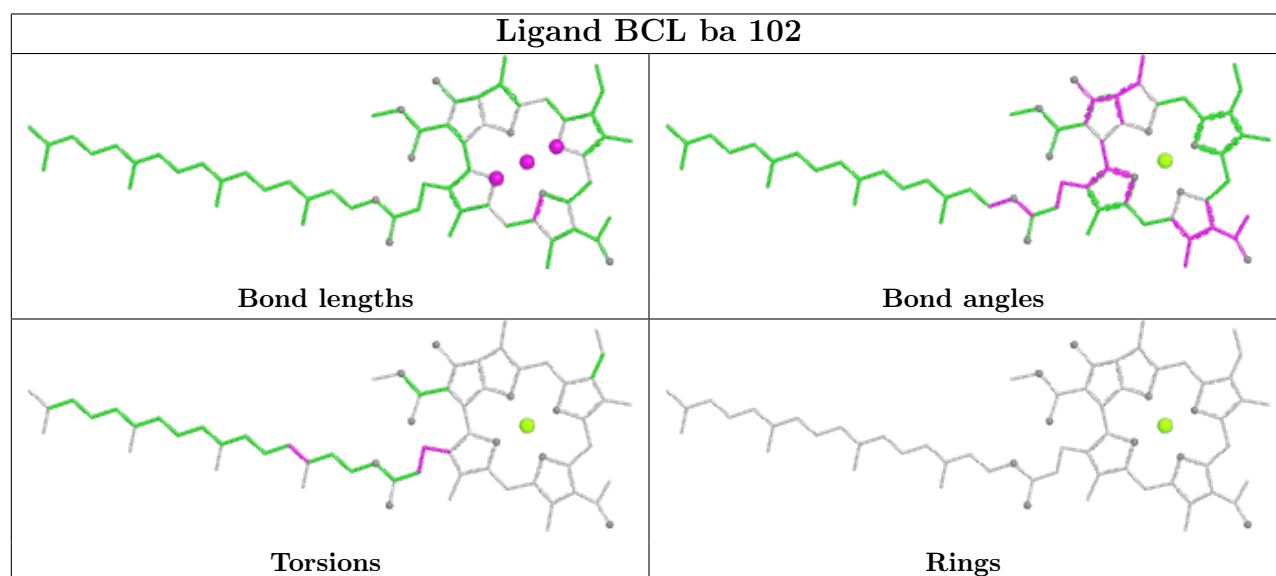
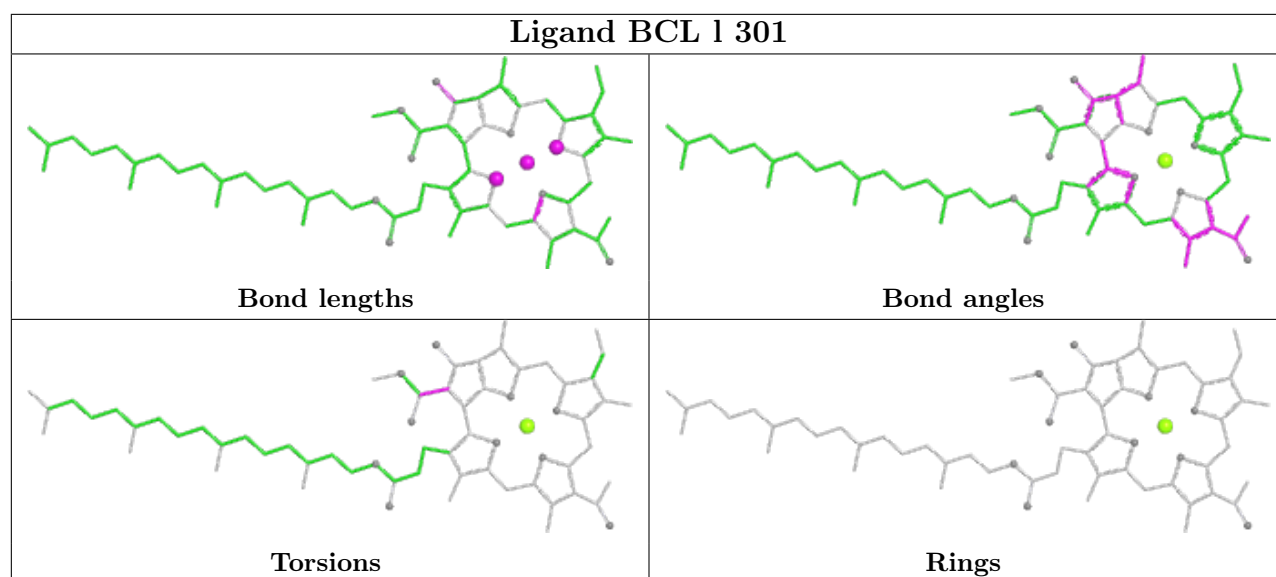


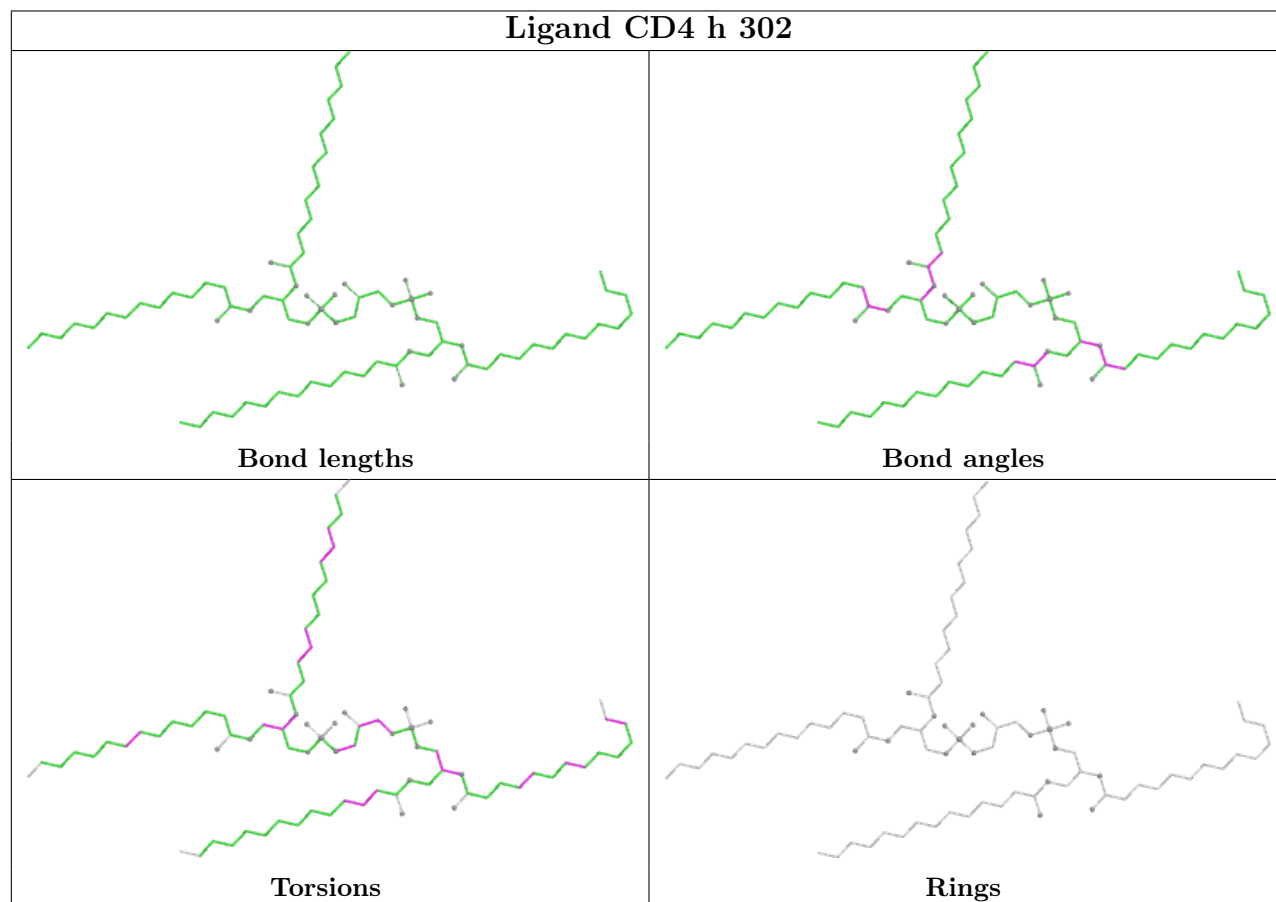
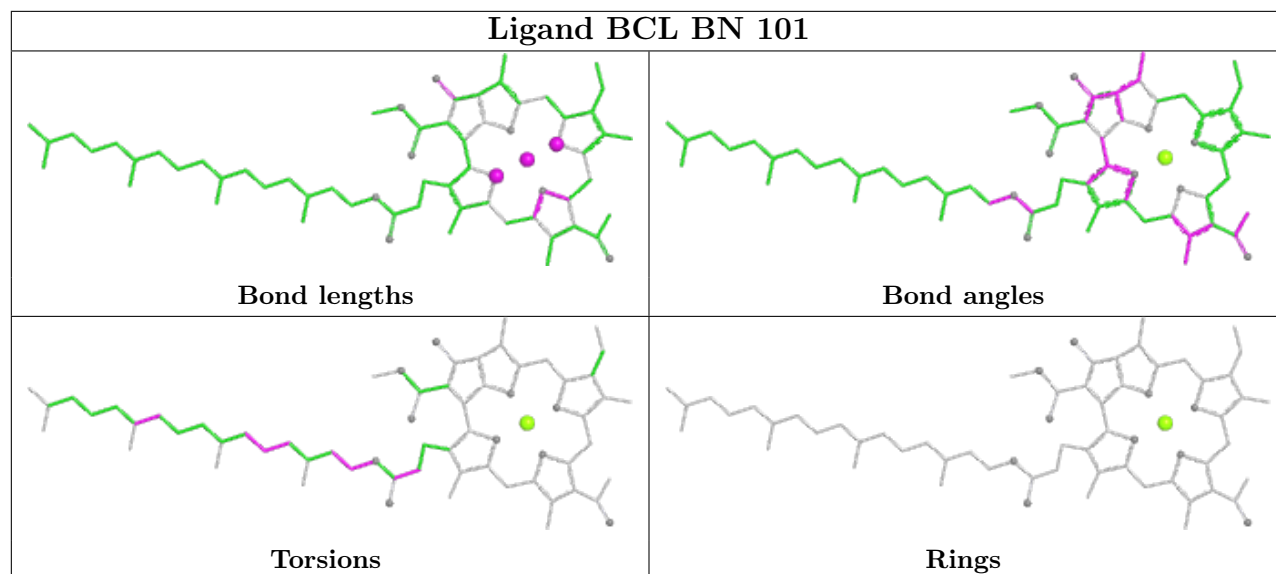


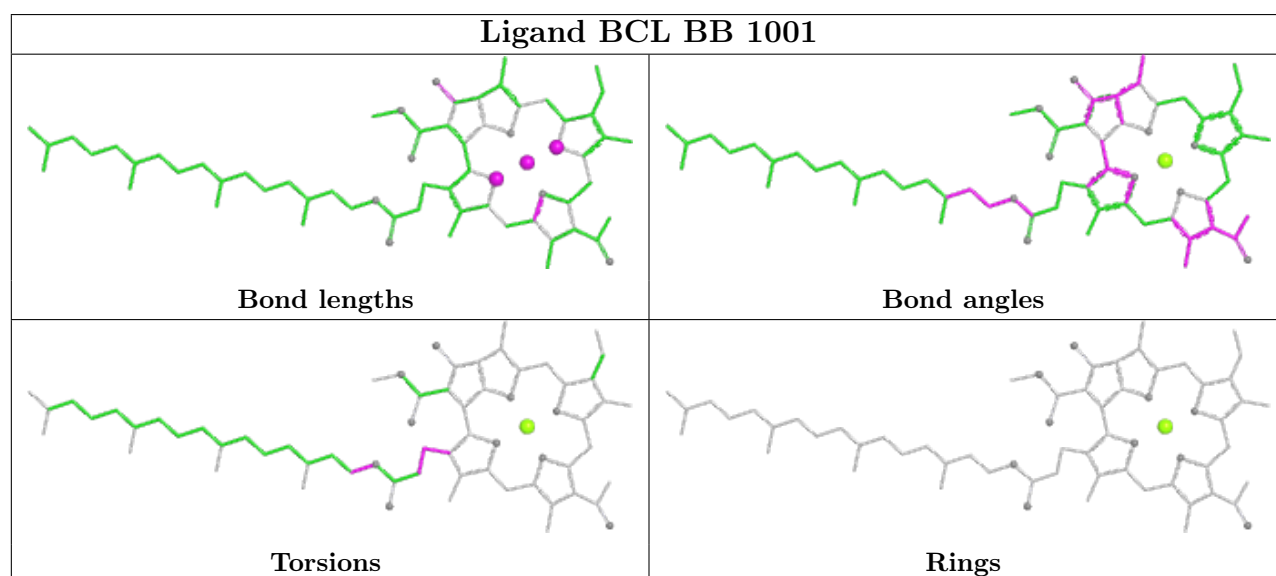
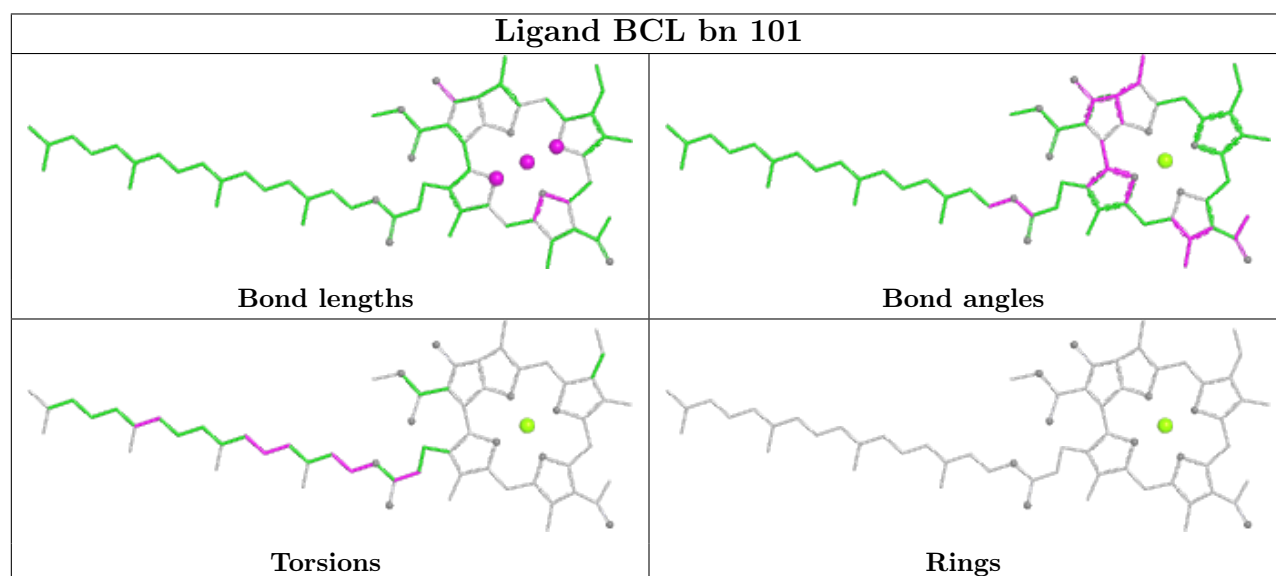
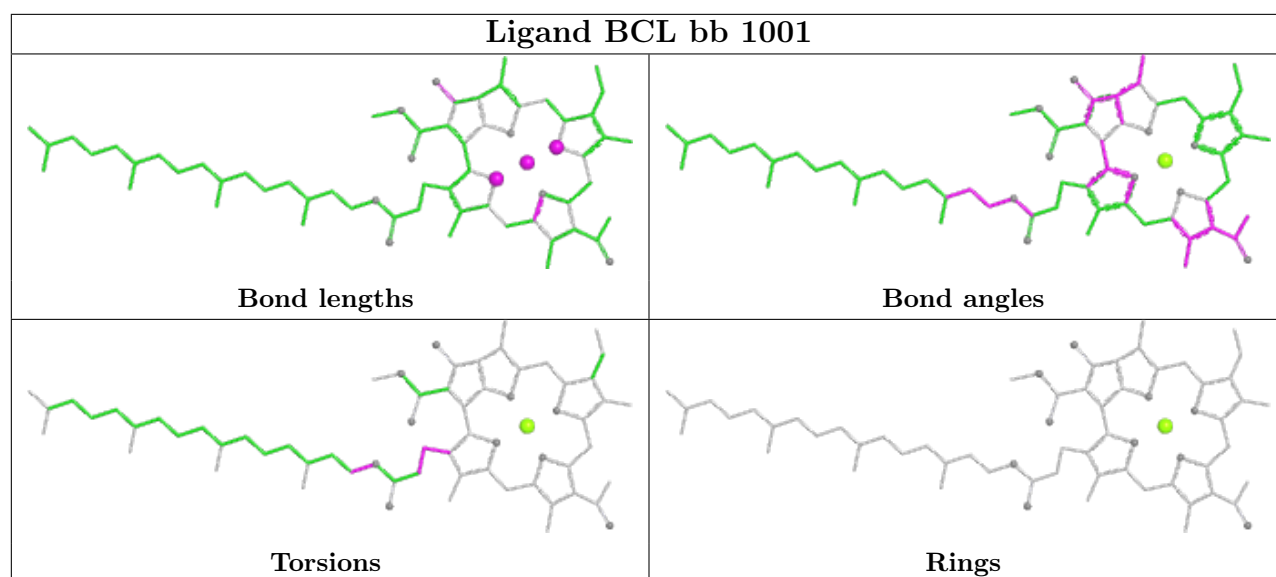


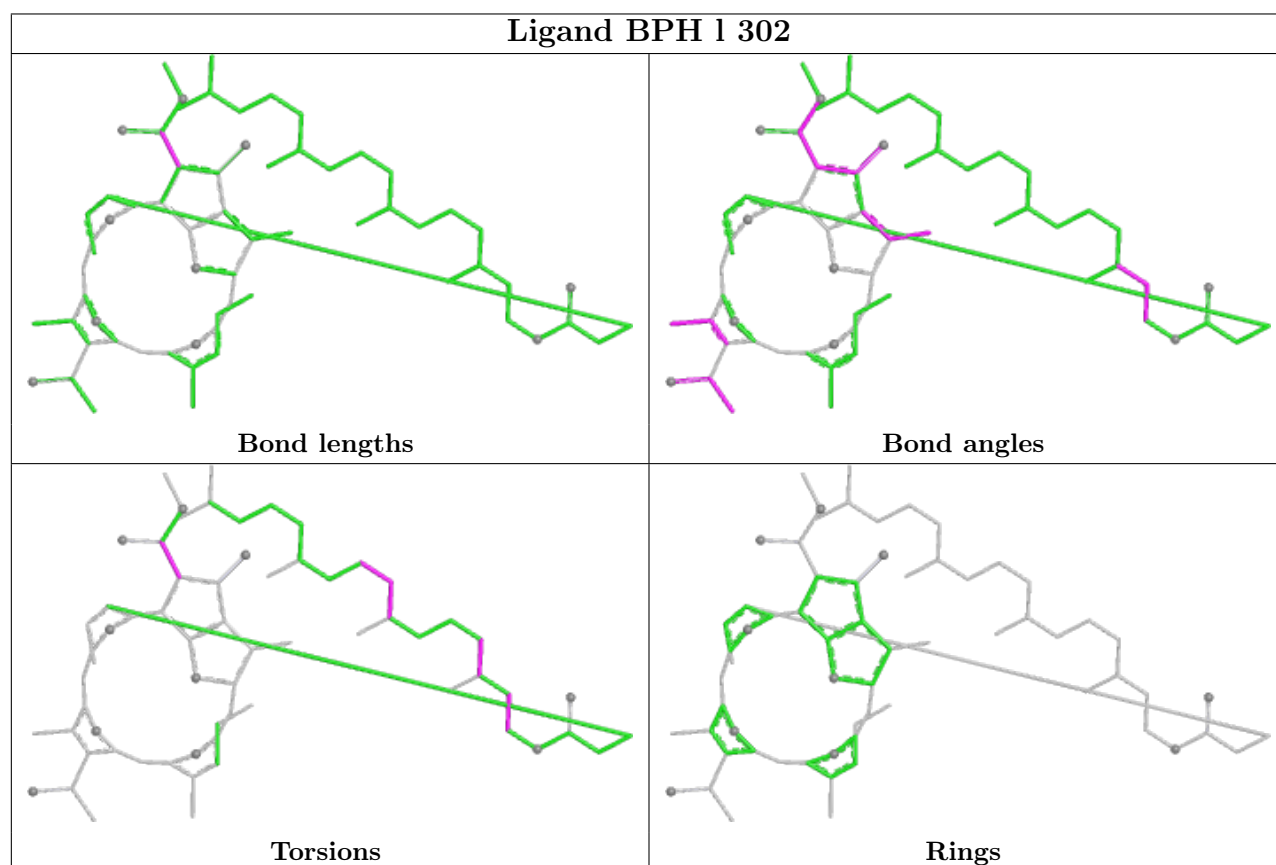
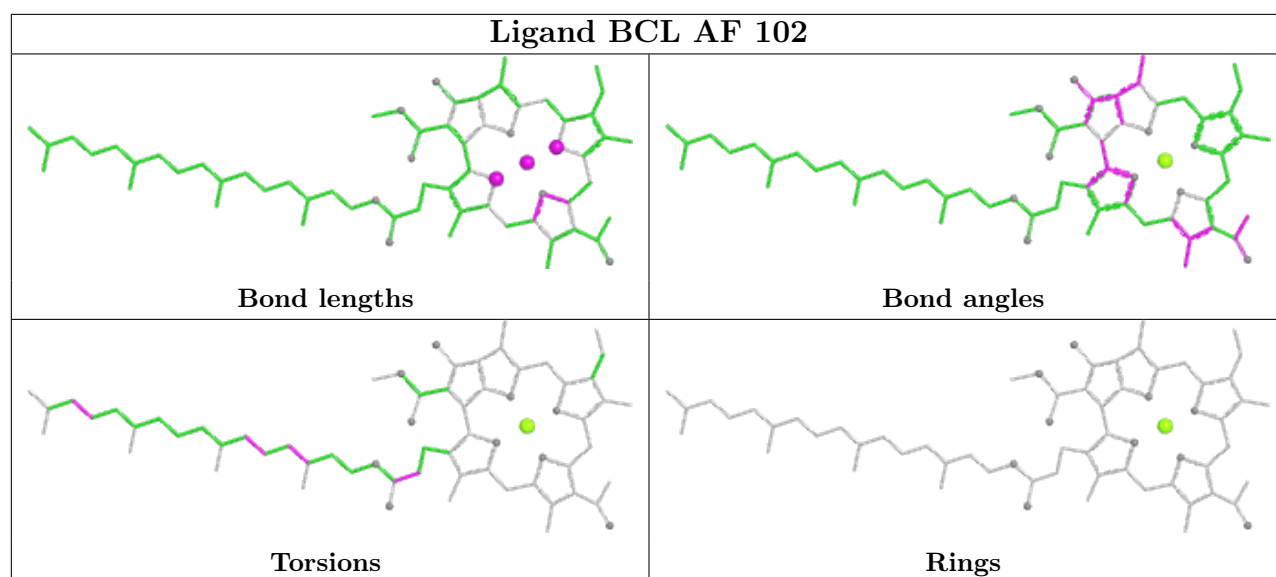


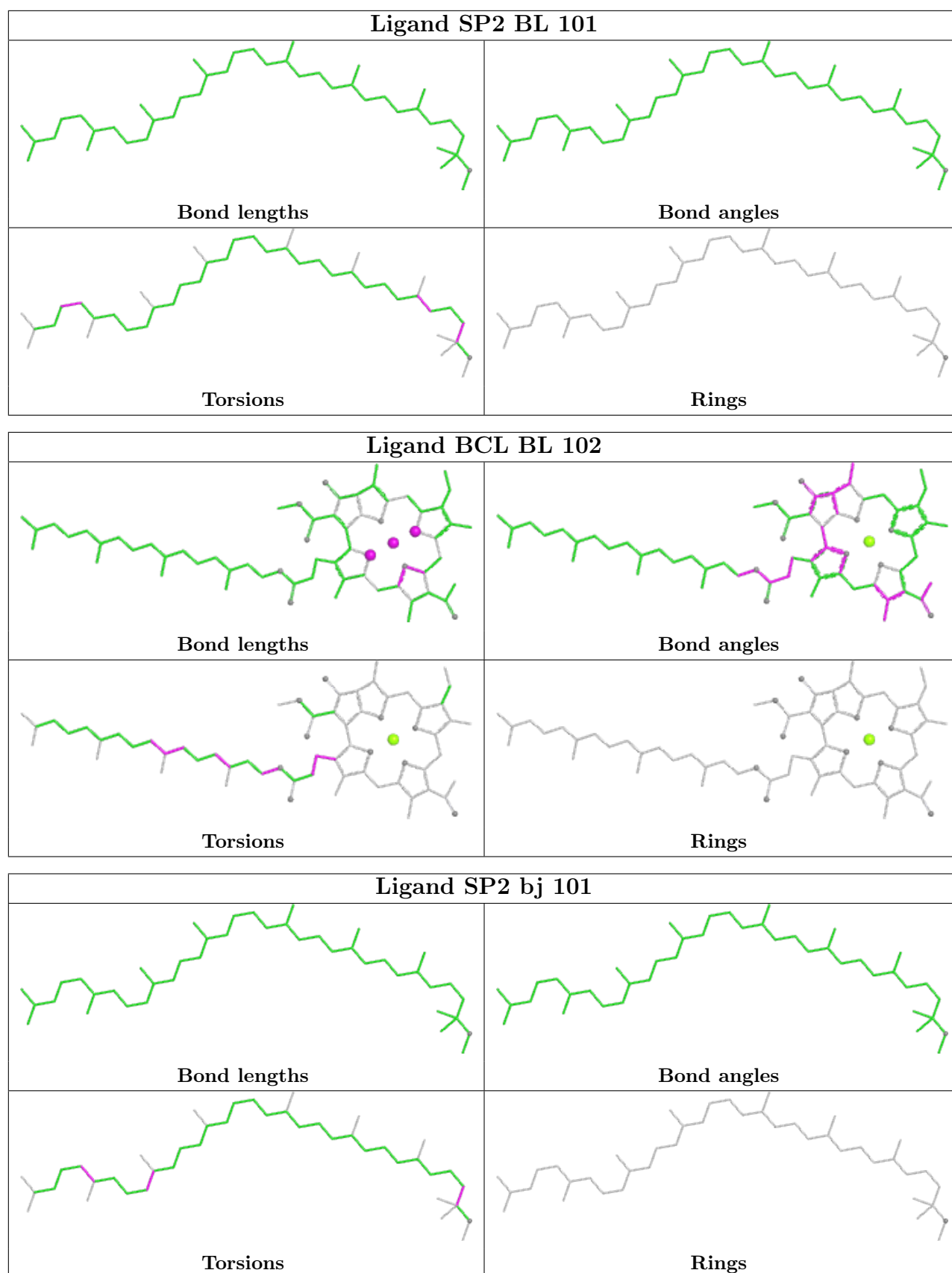


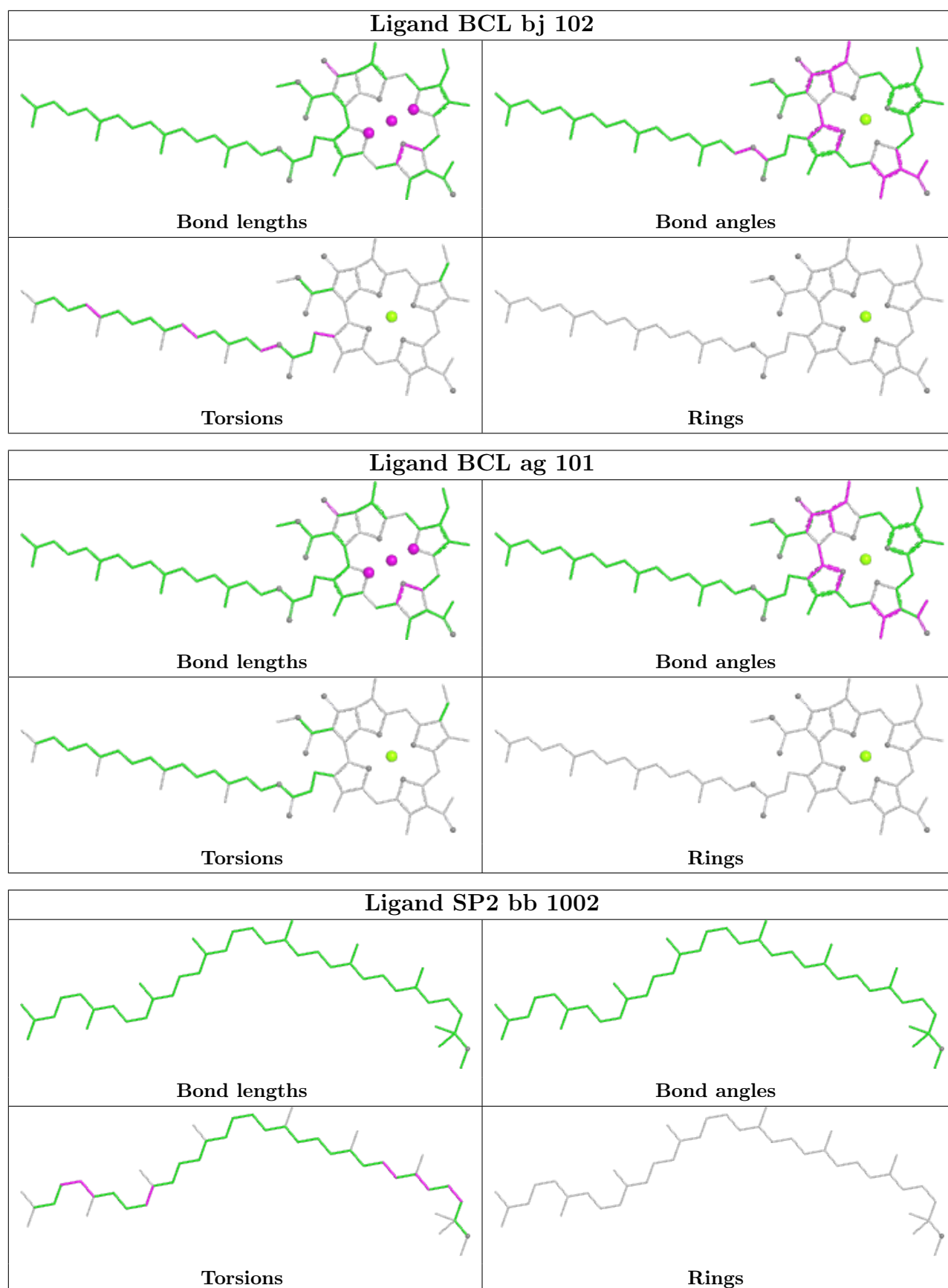


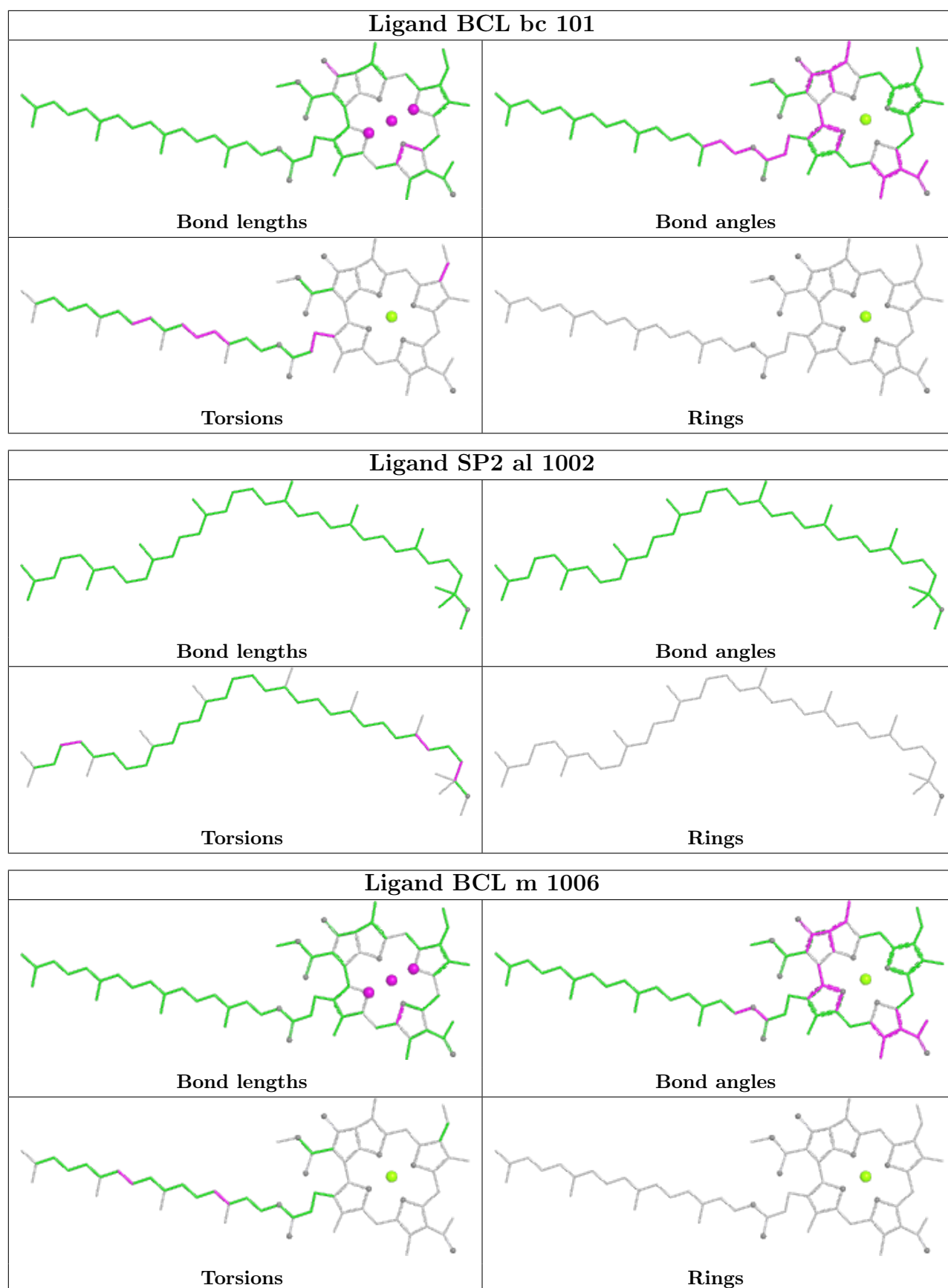


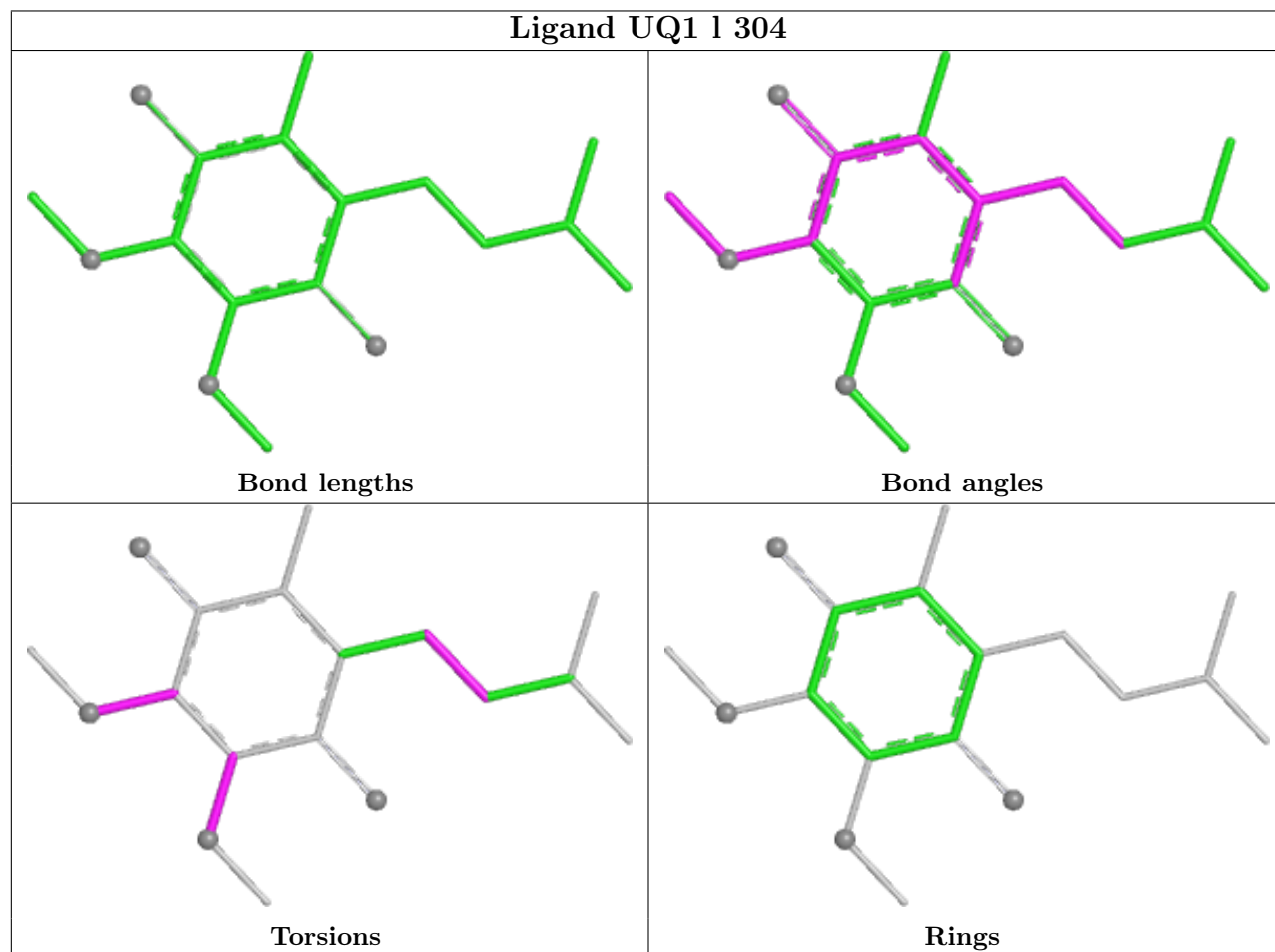
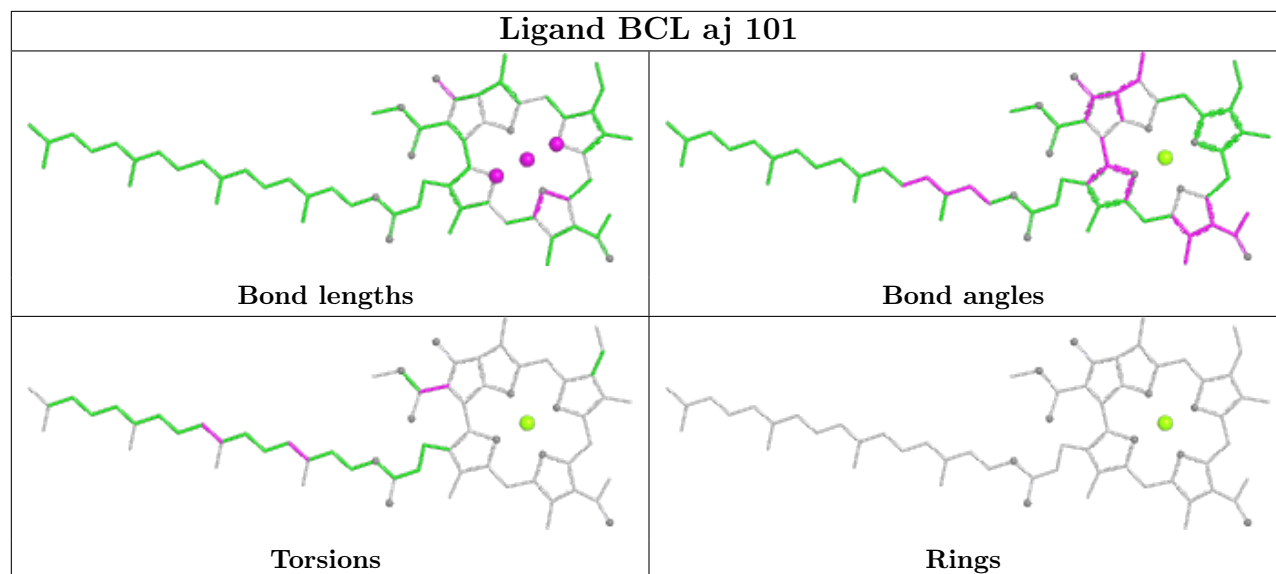


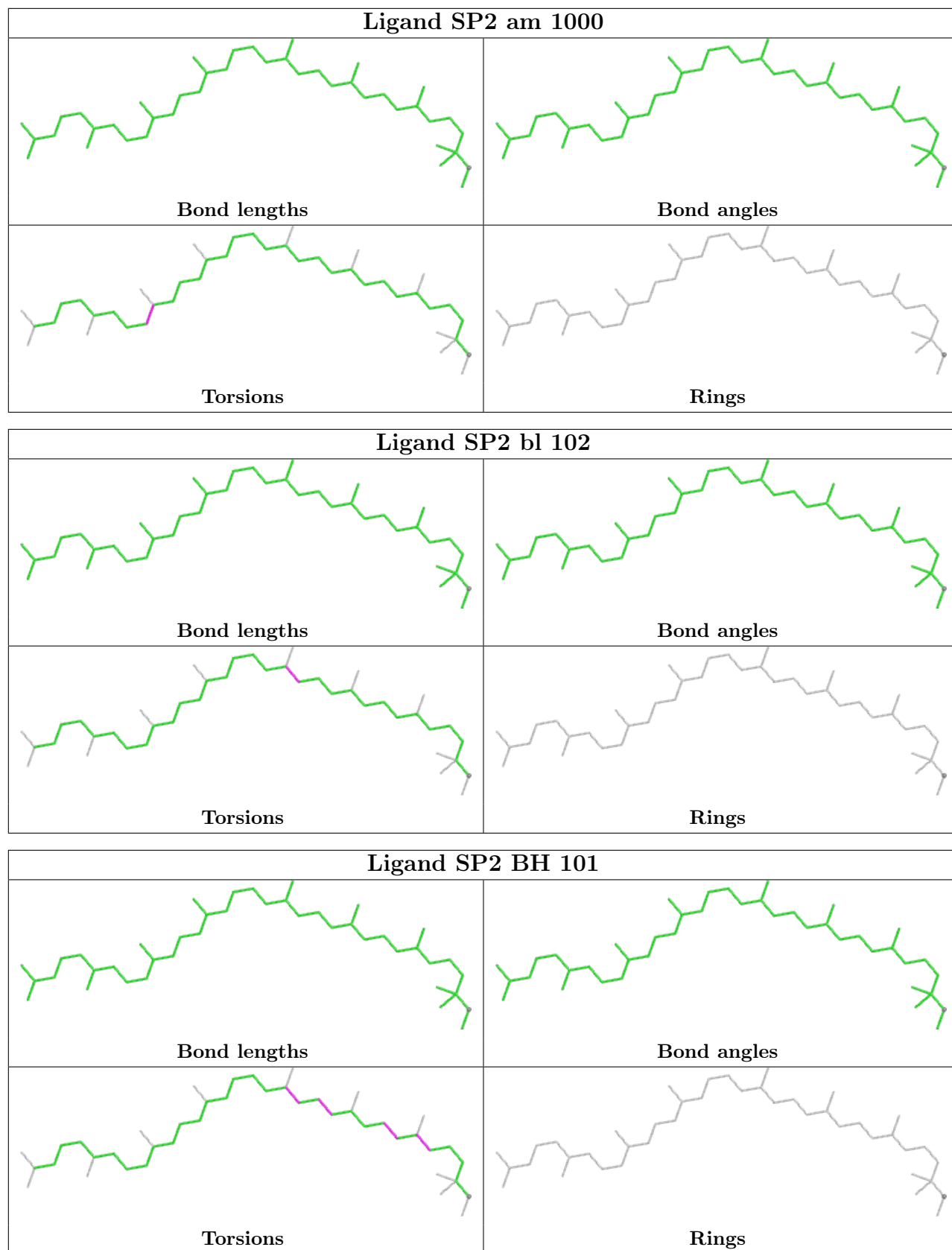


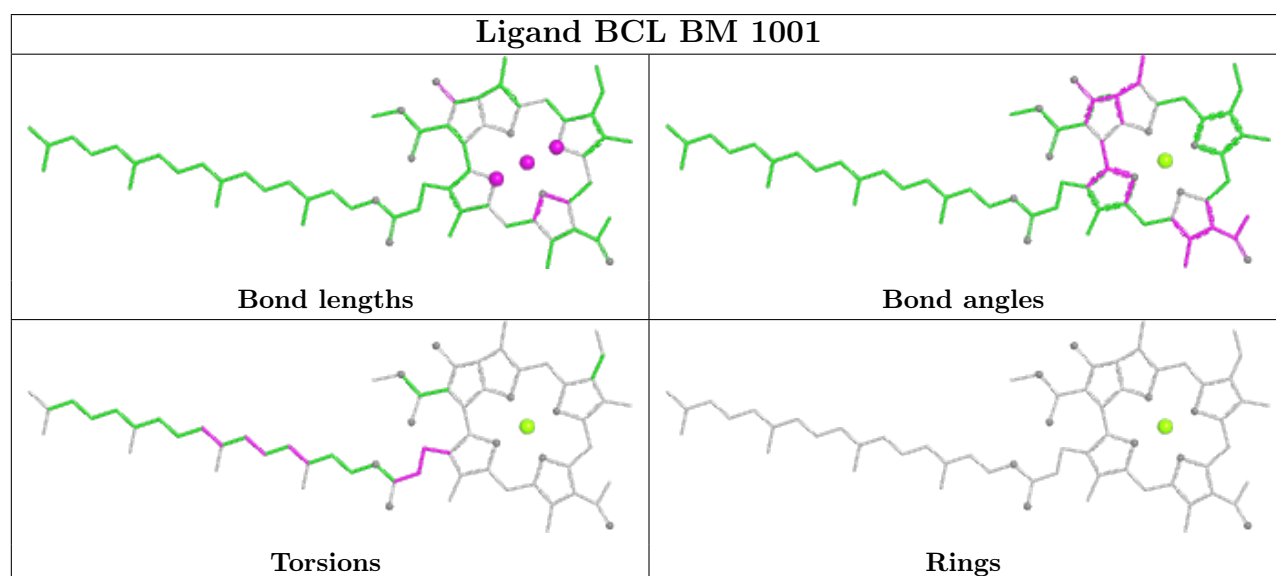
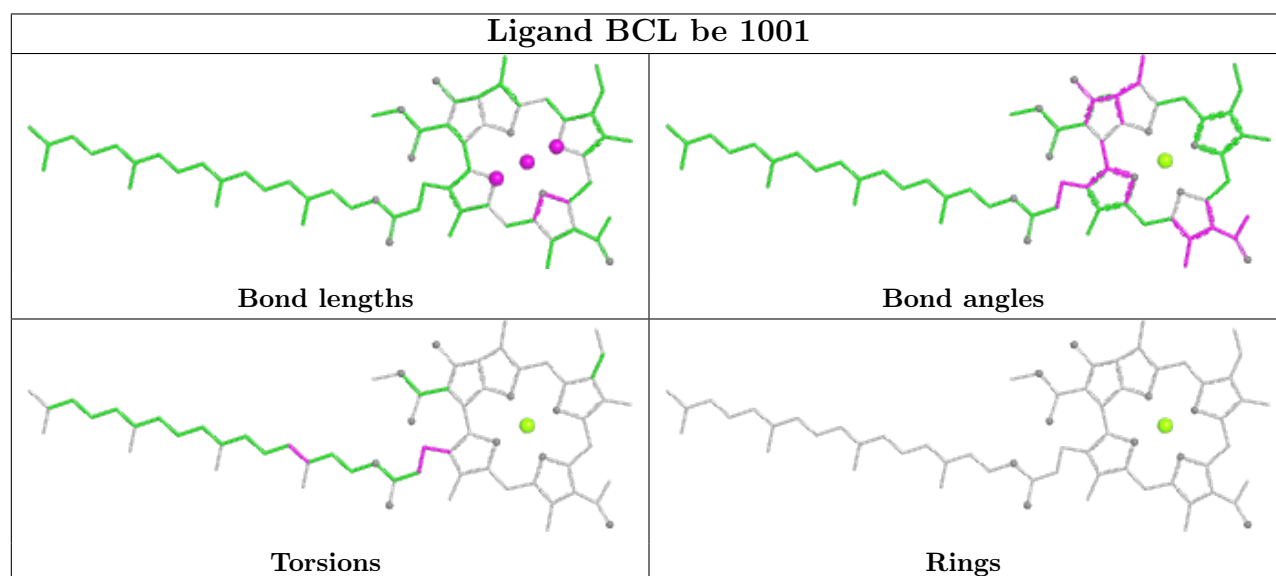
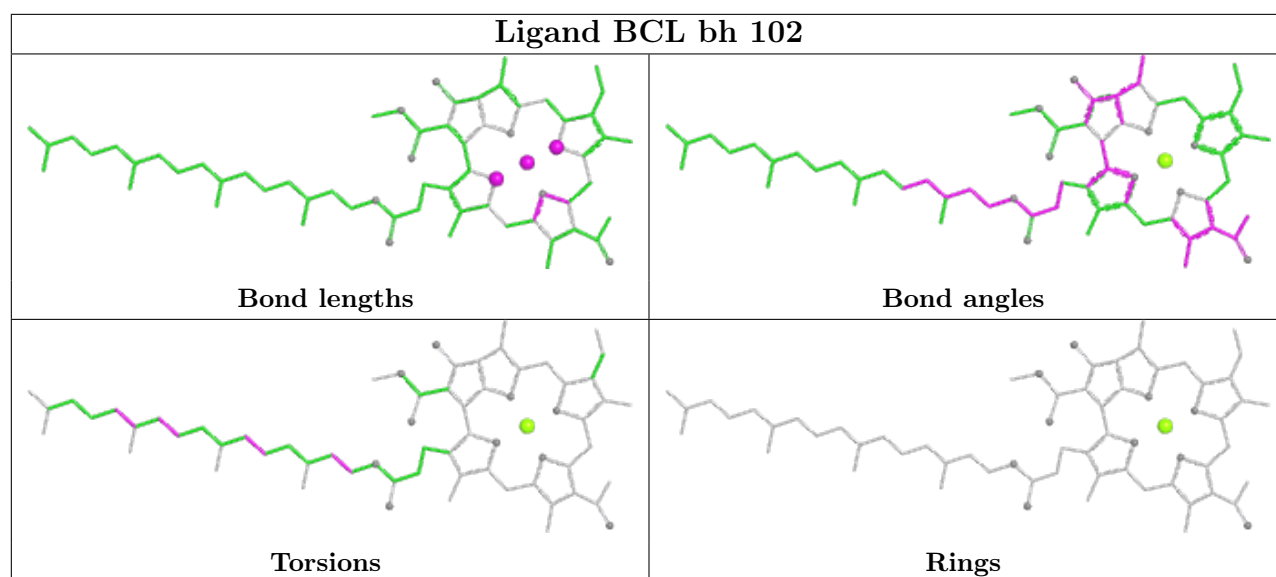


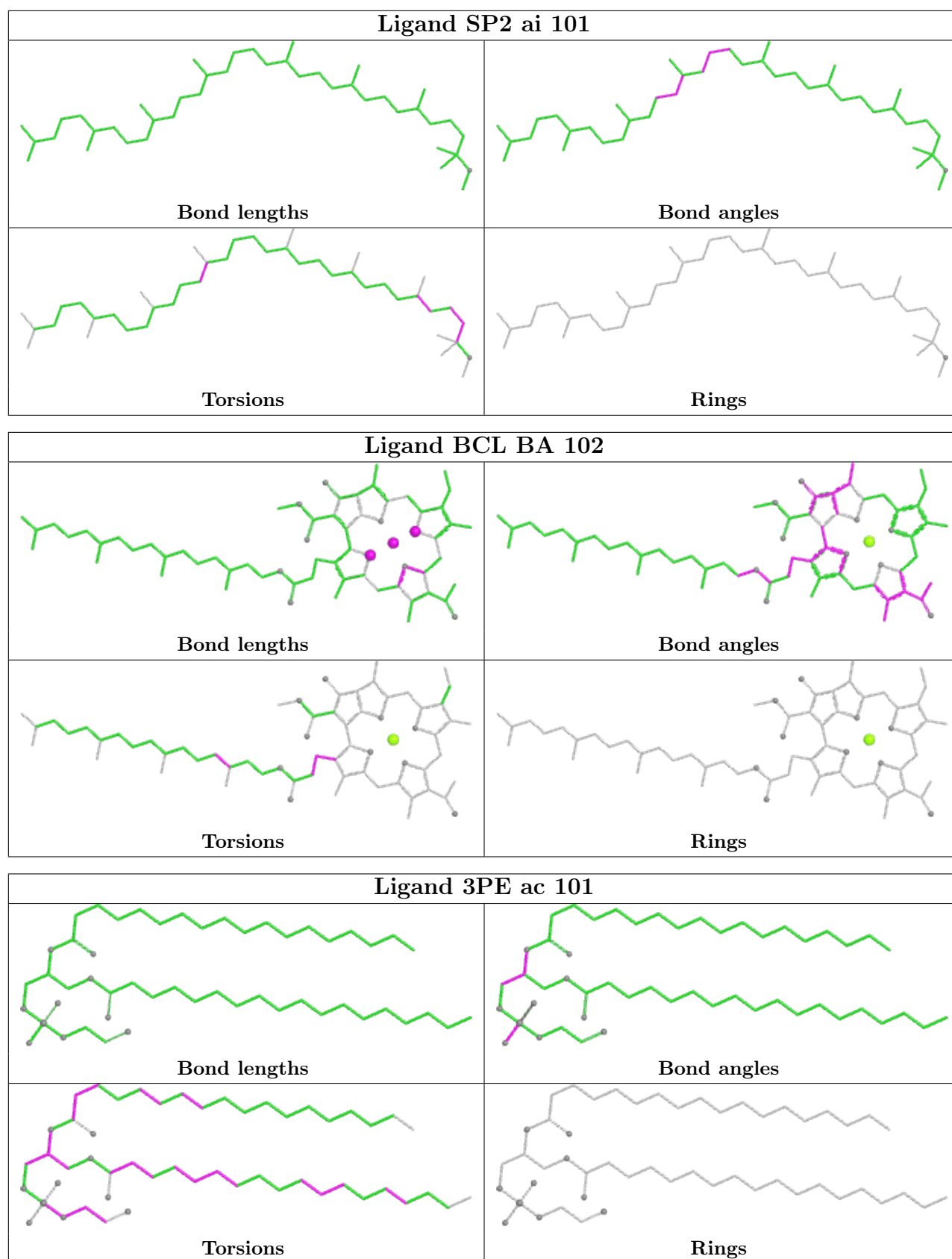


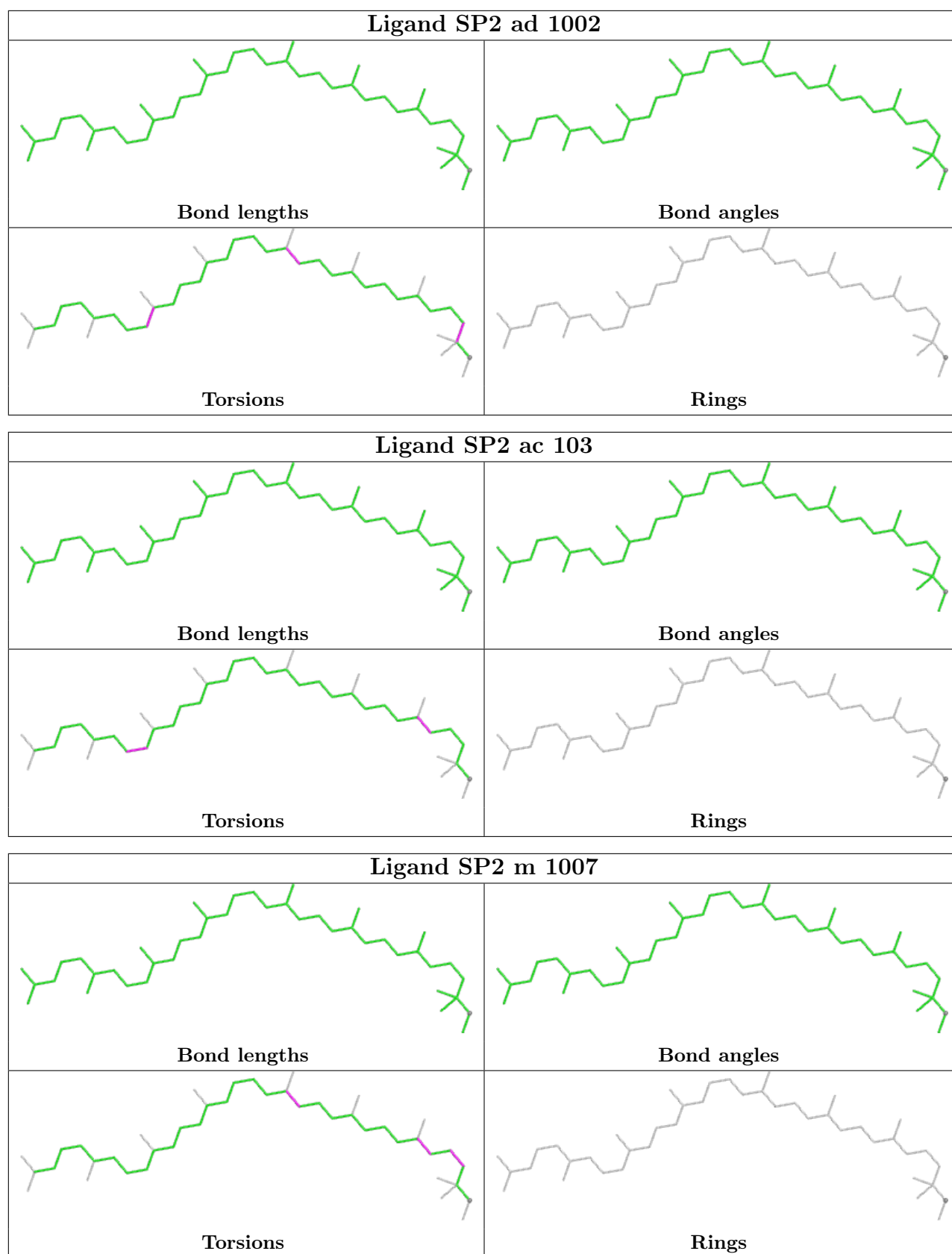


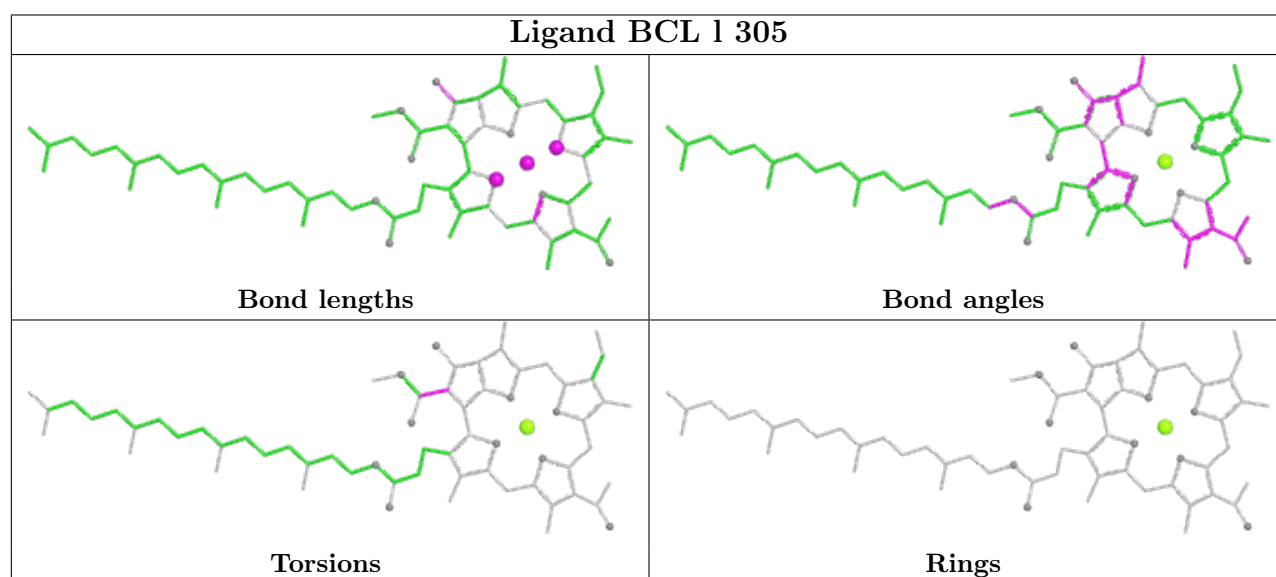
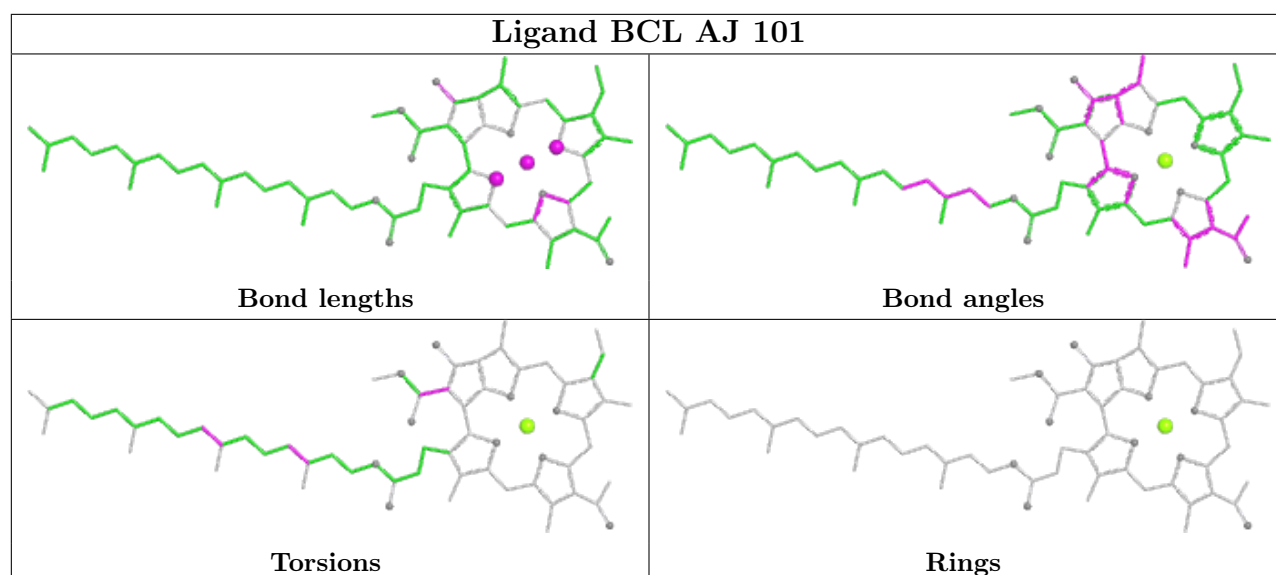
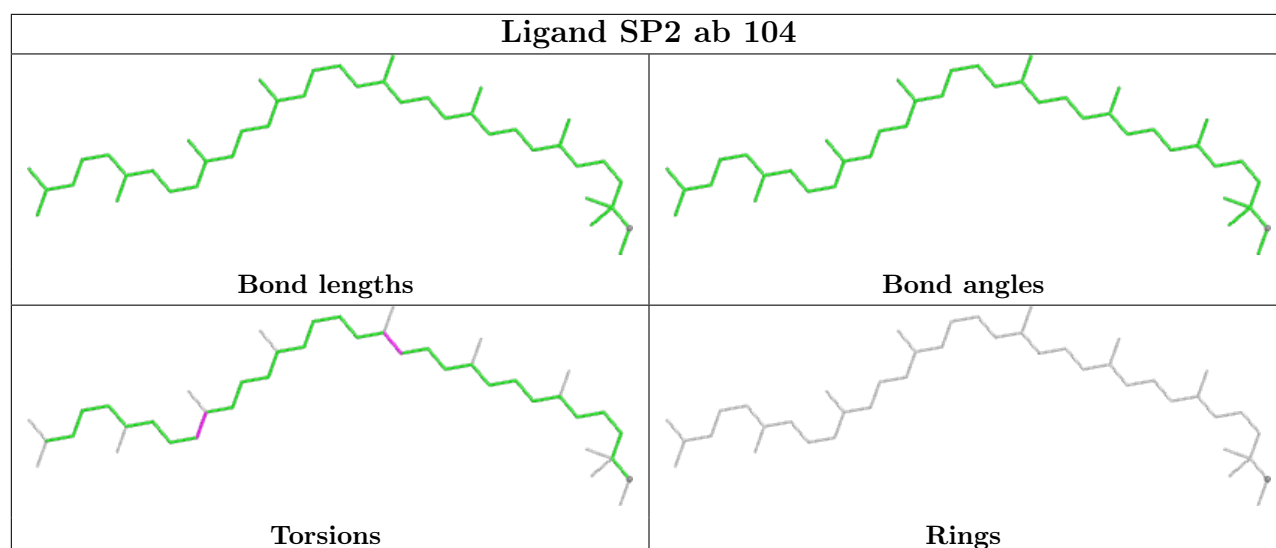


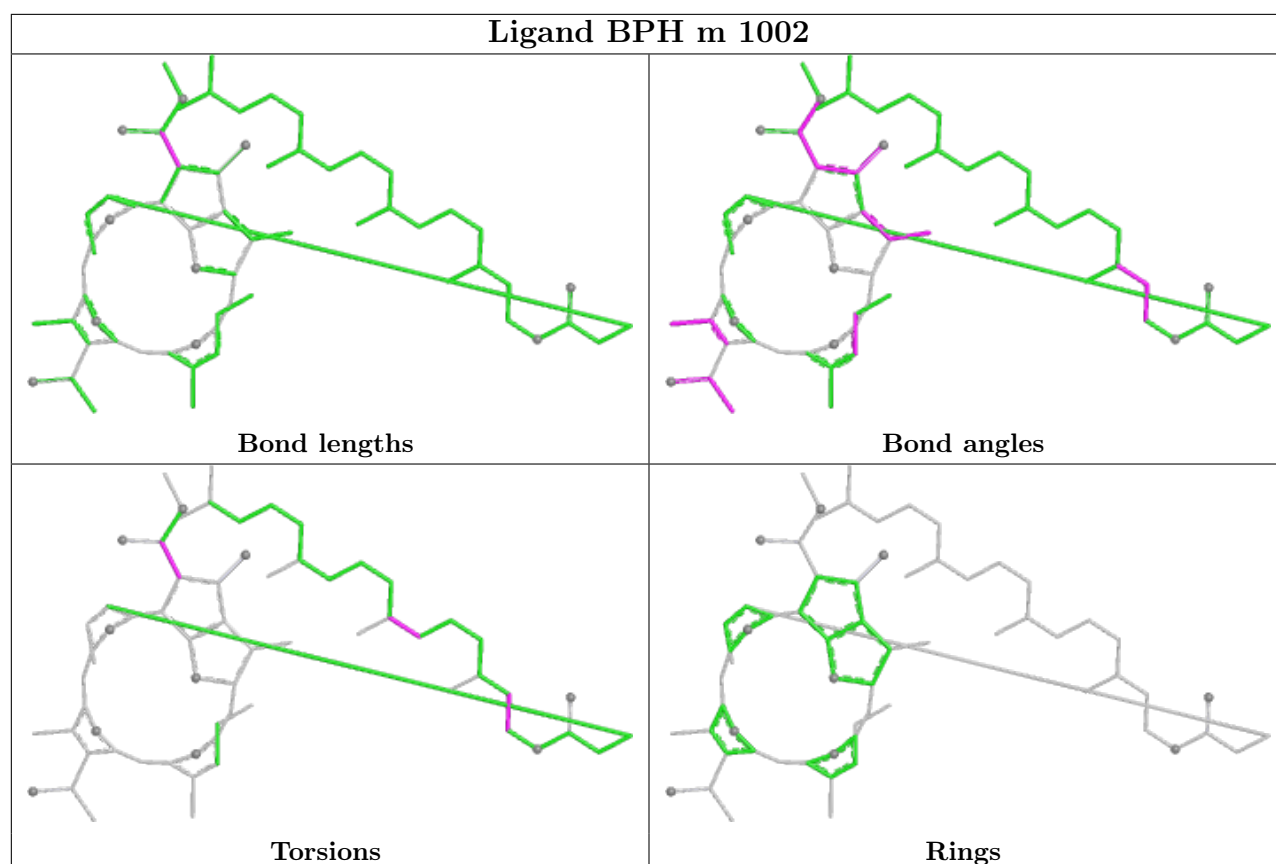
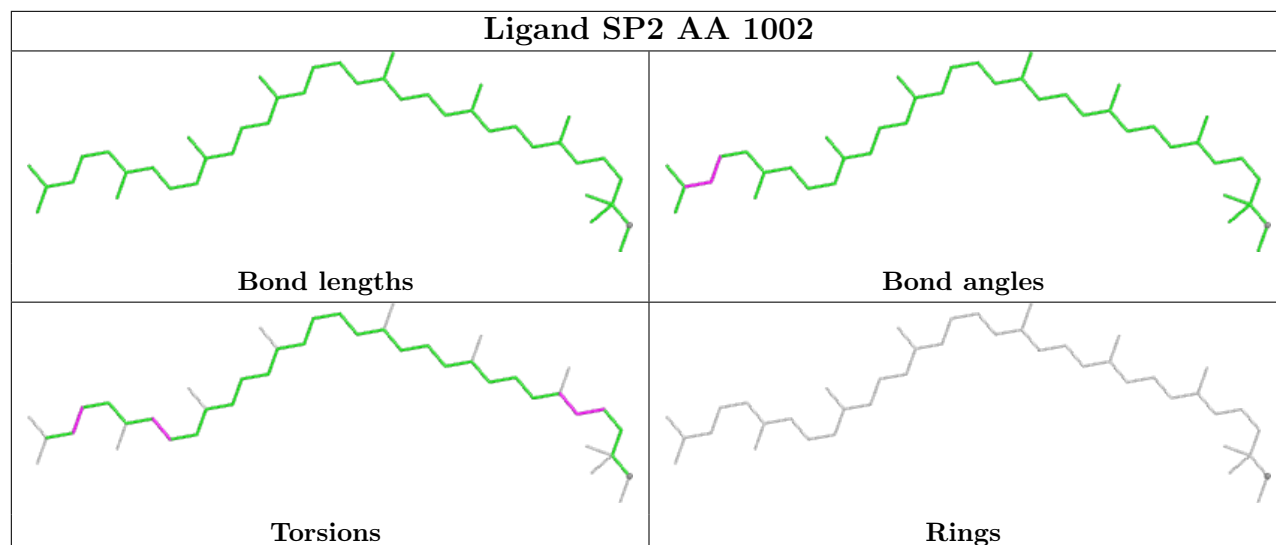


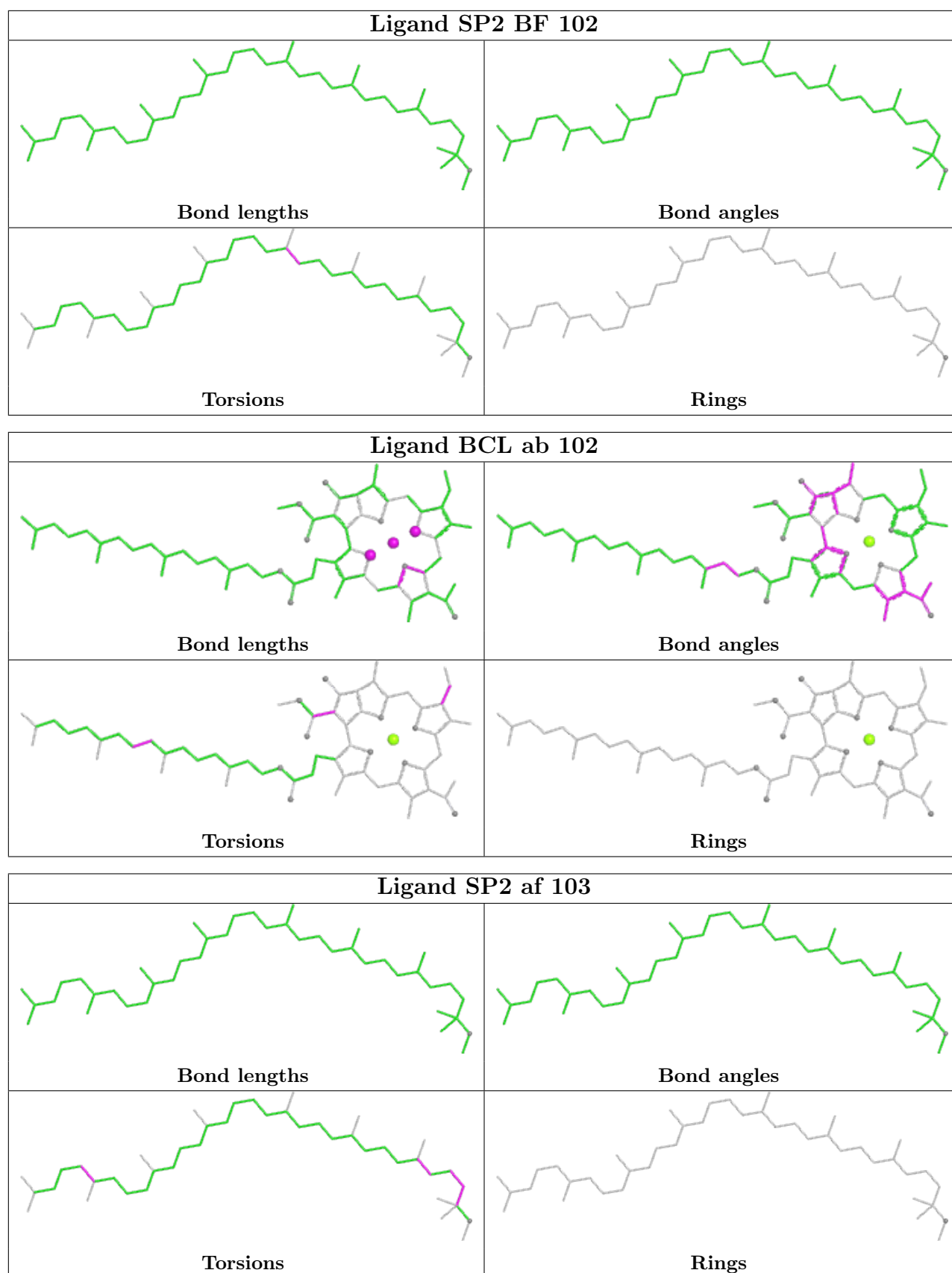


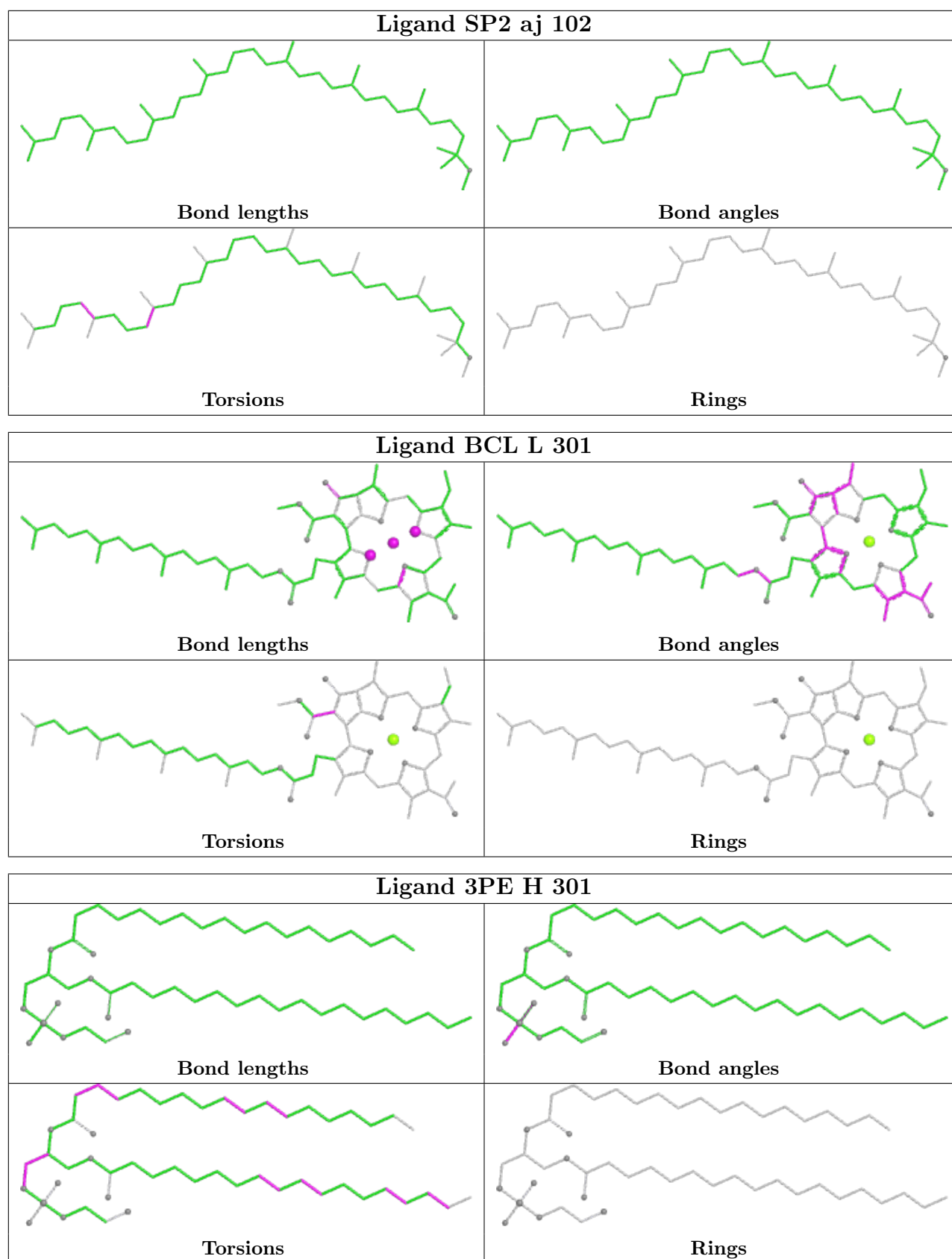


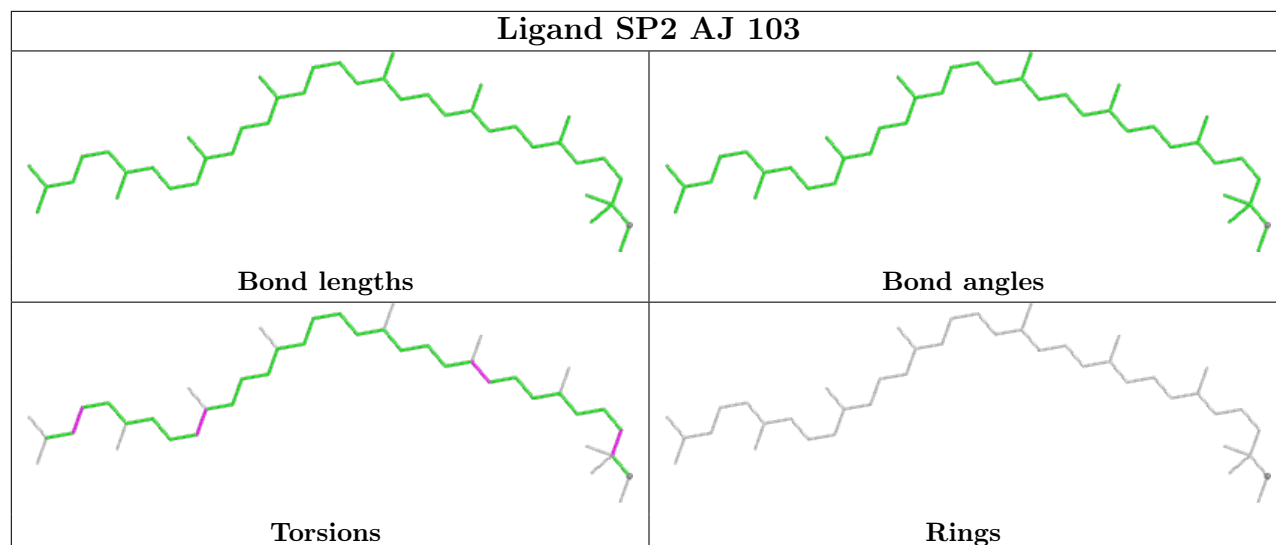












5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

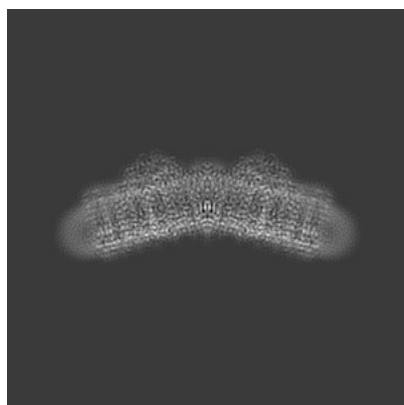
6 Map visualisation [i](#)

This section contains visualisations of the EMDB entry EMD-13590. These allow visual inspection of the internal detail of the map and identification of artifacts.

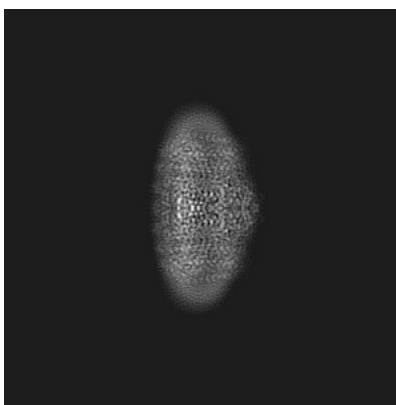
No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1 Orthogonal projections [i](#)

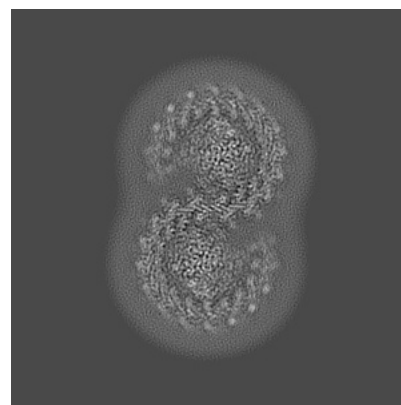
6.1.1 Primary map



X



Y

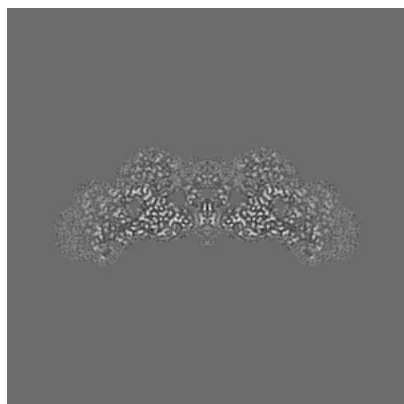


Z

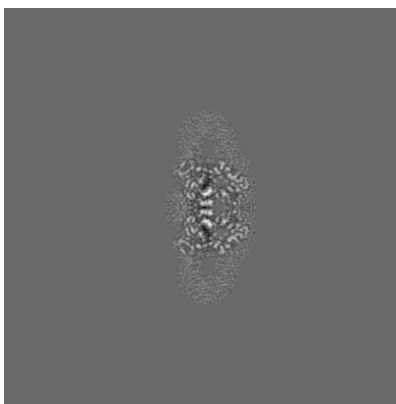
The images above show the map projected in three orthogonal directions.

6.2 Central slices [i](#)

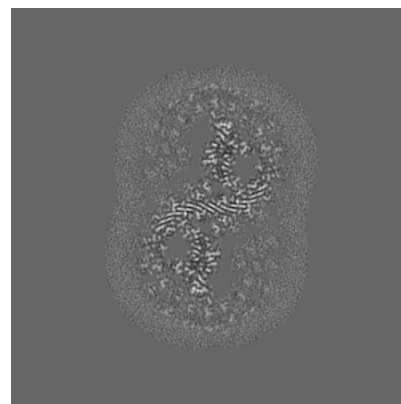
6.2.1 Primary map



X Index: 256



Y Index: 256

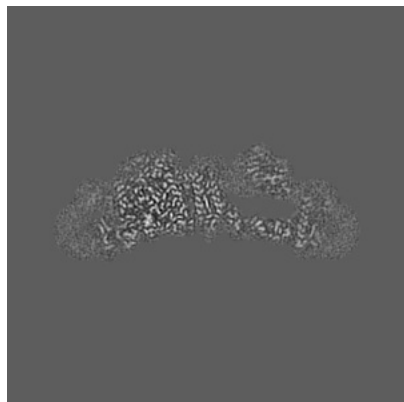


Z Index: 256

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

6.3 Largest variance slices [i](#)

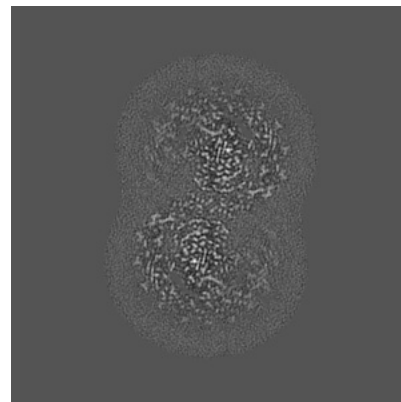
6.3.1 Primary map



X Index: 239



Y Index: 187

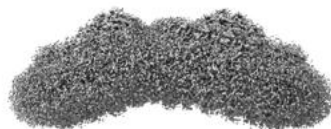


Z Index: 236

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



X



Y



Z

The images above show the 3D surface view of the map at the recommended contour level 0.0222. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

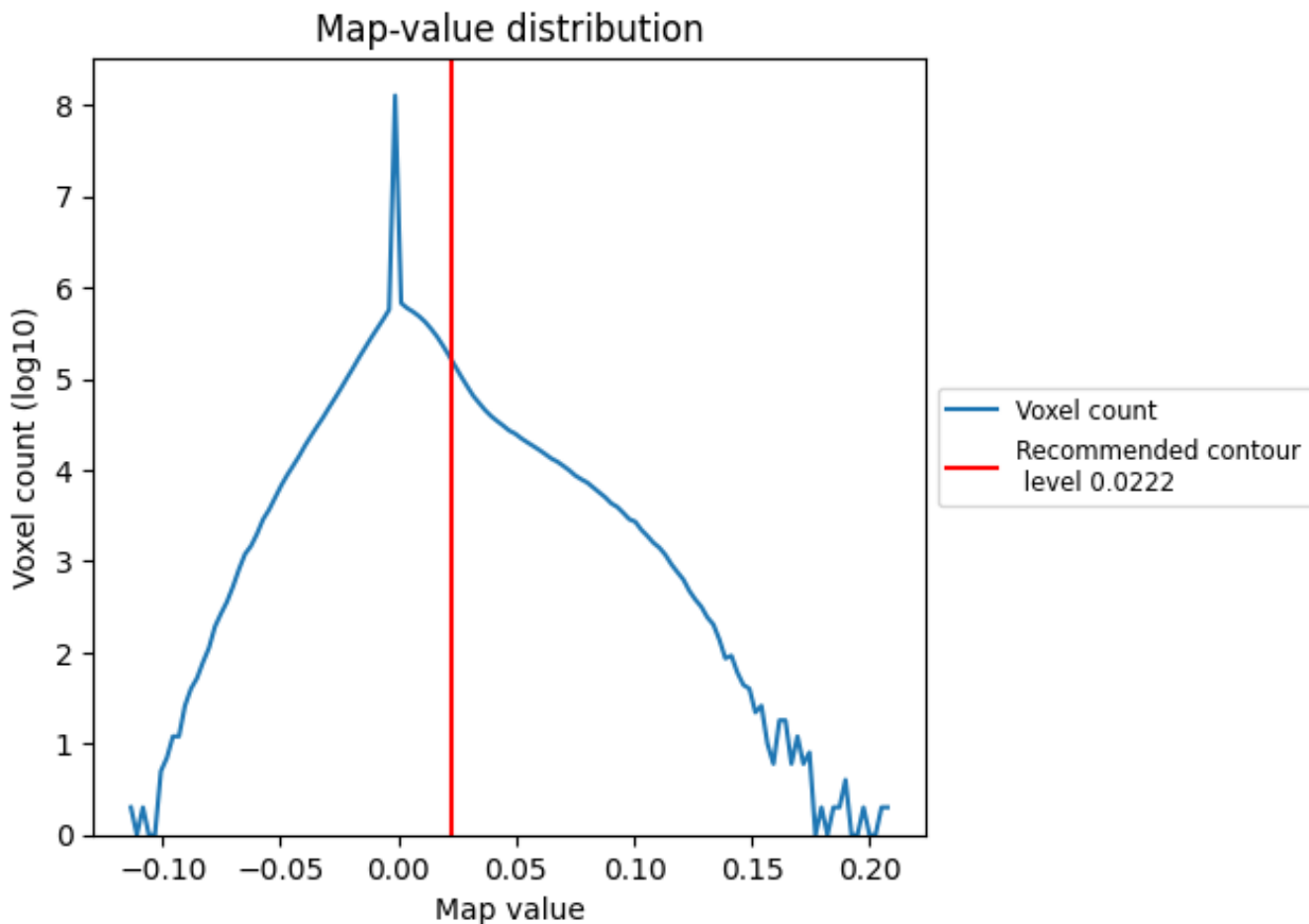
6.5 Mask visualisation

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

7 Map analysis [i](#)

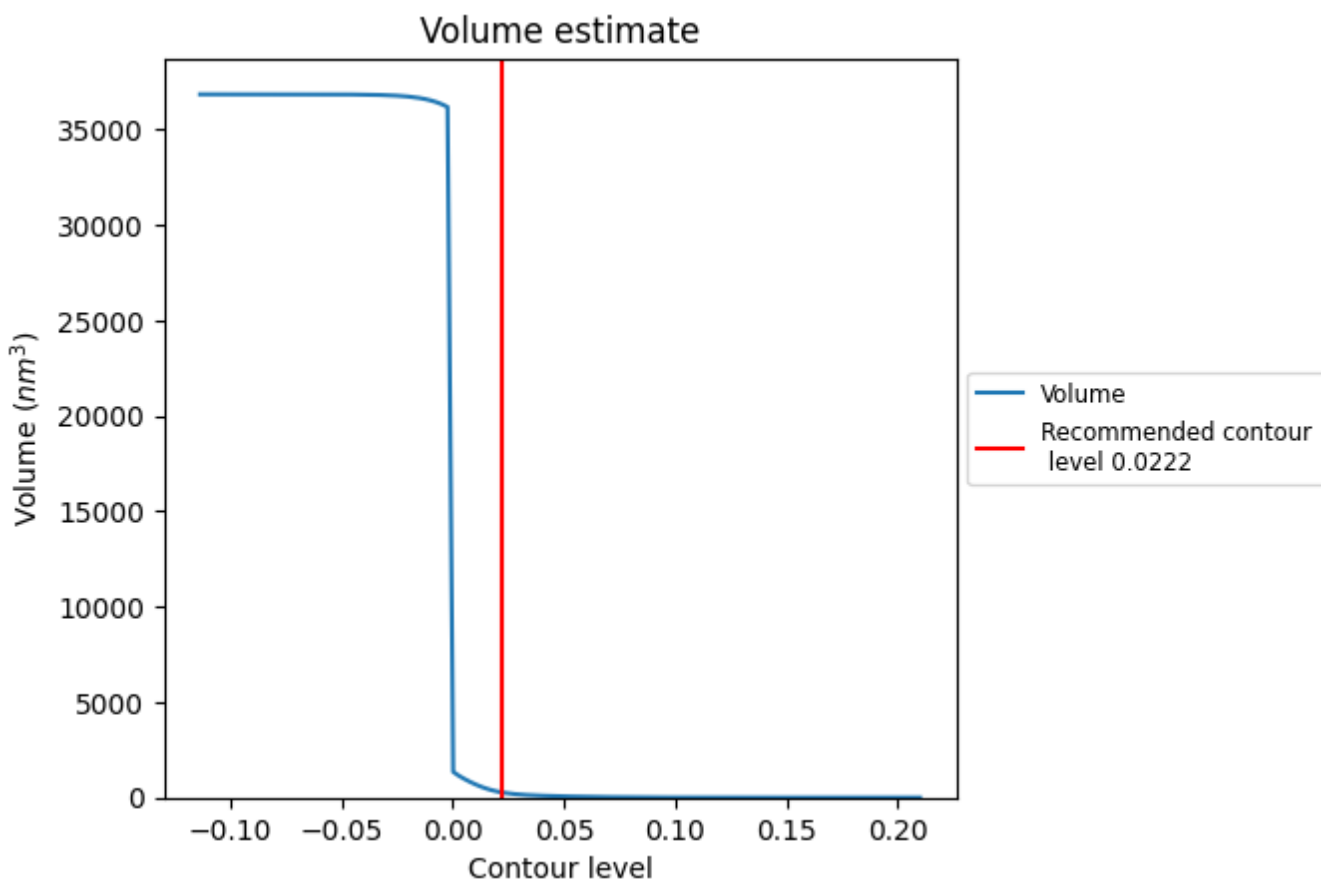
This section contains the results of statistical analysis of the map.

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.

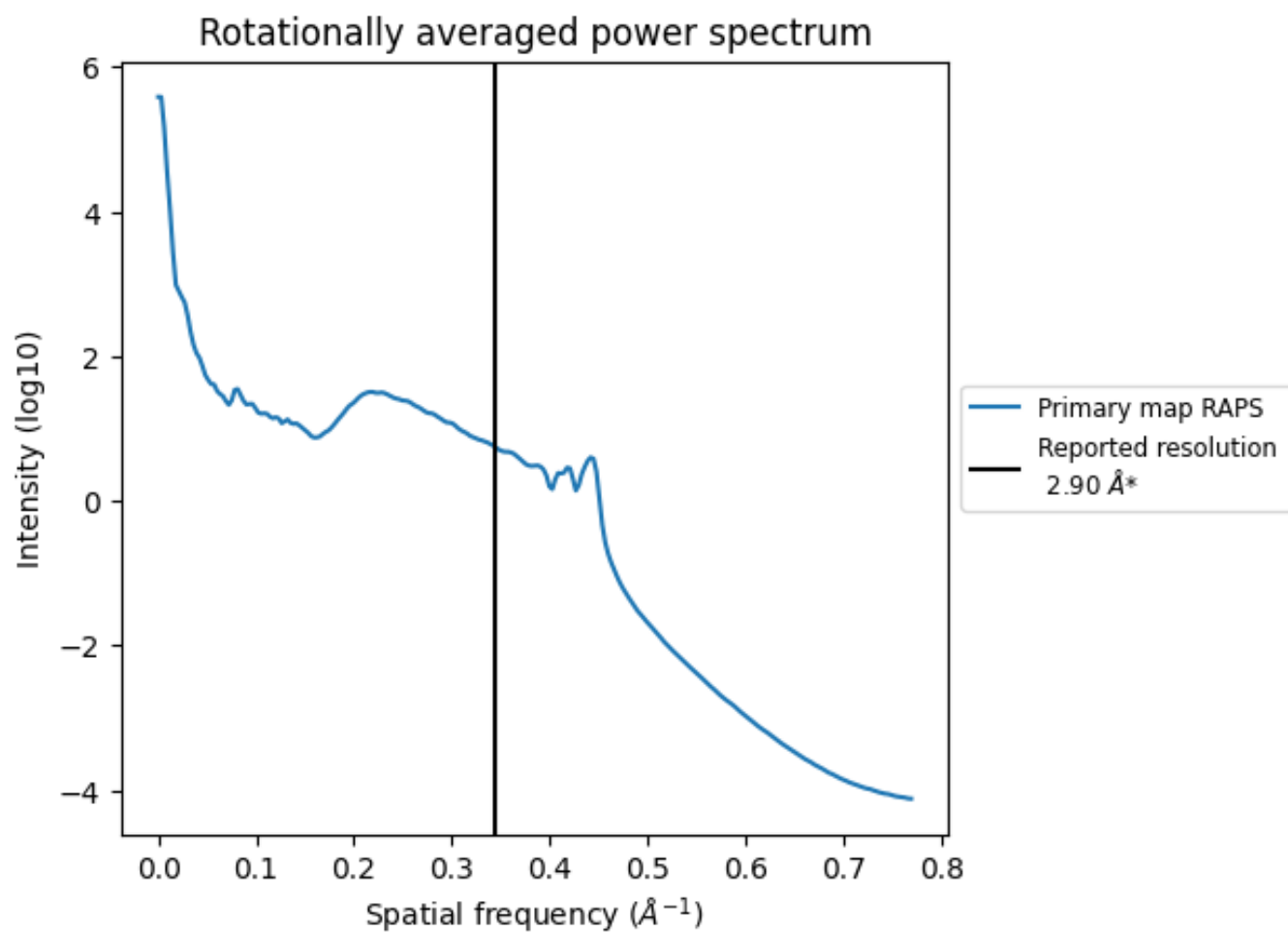
7.2 Volume estimate [i](#)



The volume at the recommended contour level is 271 nm³; this corresponds to an approximate mass of 245 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](#)

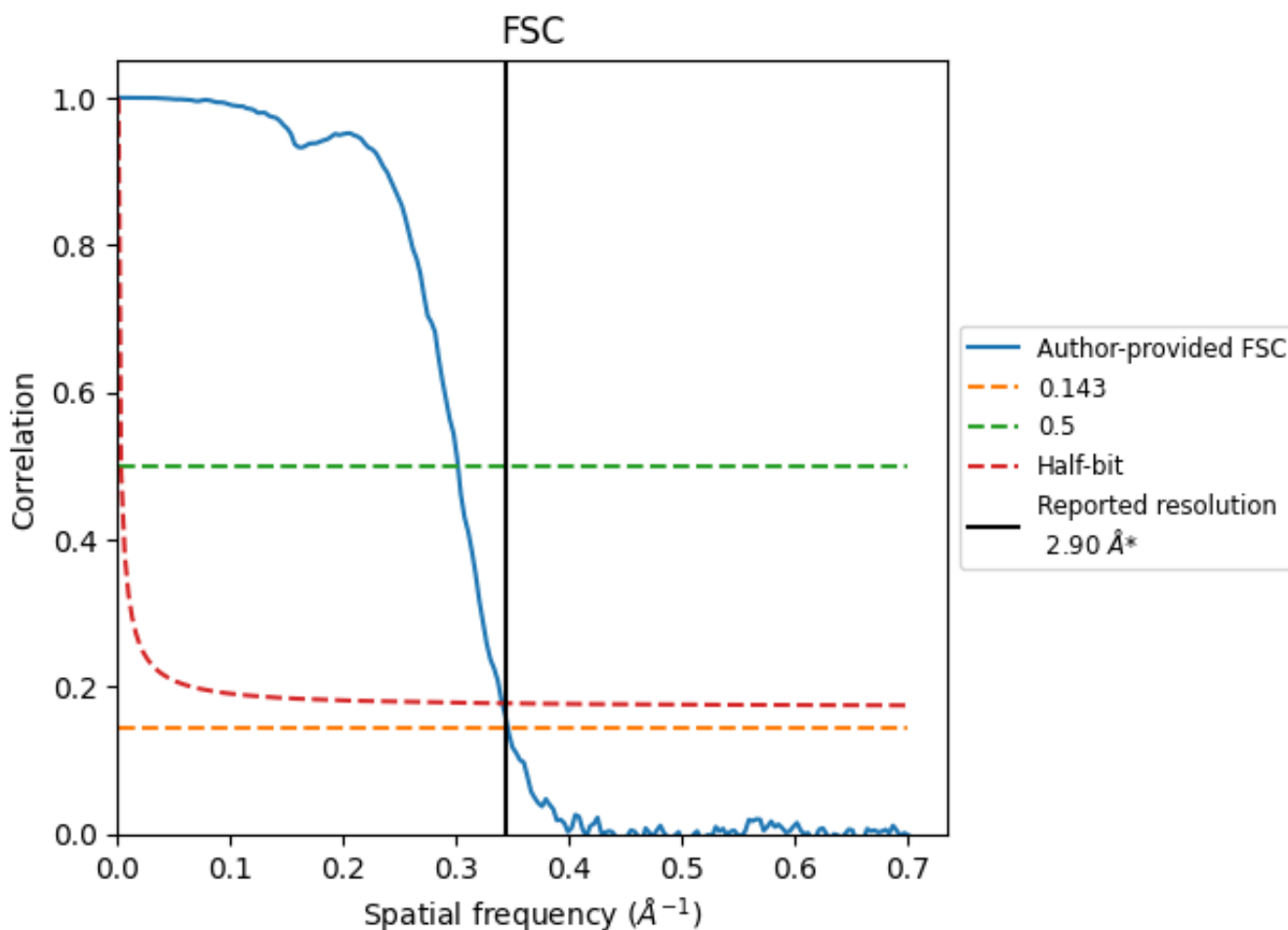


*Reported resolution corresponds to spatial frequency of 0.345 Å⁻¹

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 0.345 Å⁻¹

8.2 Resolution estimates [i](#)

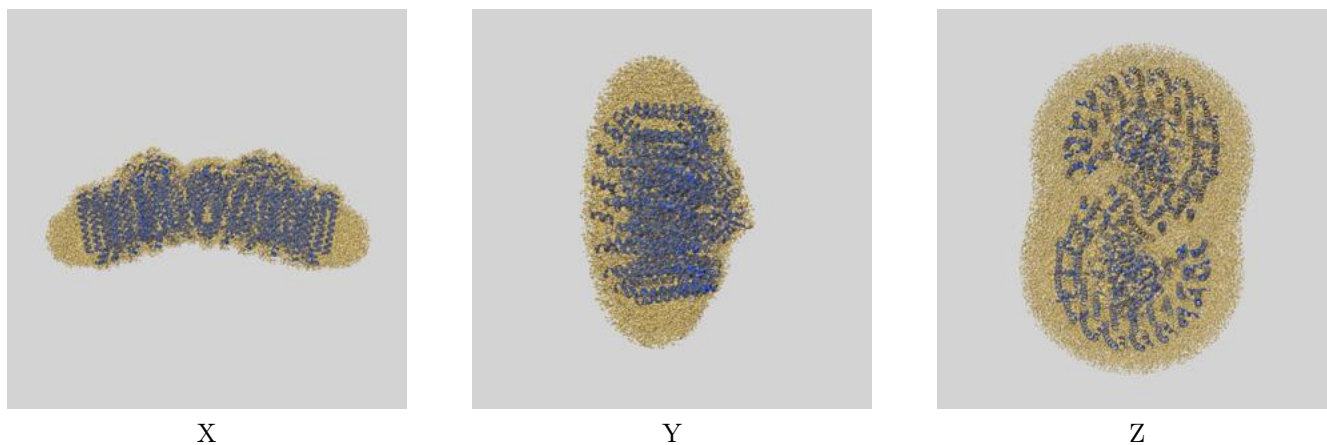
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	2.90	-	-
Author-provided FSC curve	2.89	3.31	2.93
Unmasked-calculated*	-	-	-

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.

9 Map-model fit [i](#)

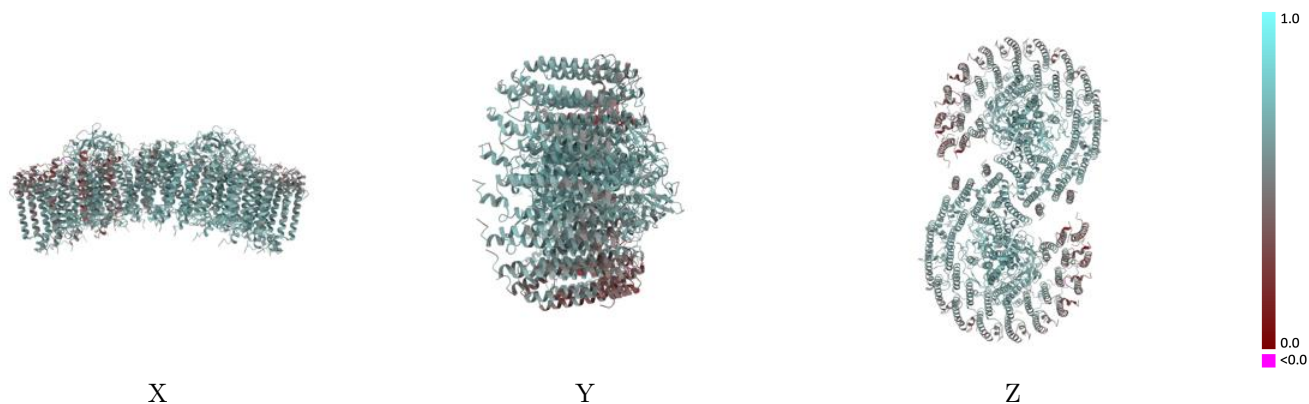
This section contains information regarding the fit between EMDB map EMD-13590 and PDB model 7PQD. Per-residue inclusion information can be found in section 3 on page 23.

9.1 Map-model overlay [i](#)



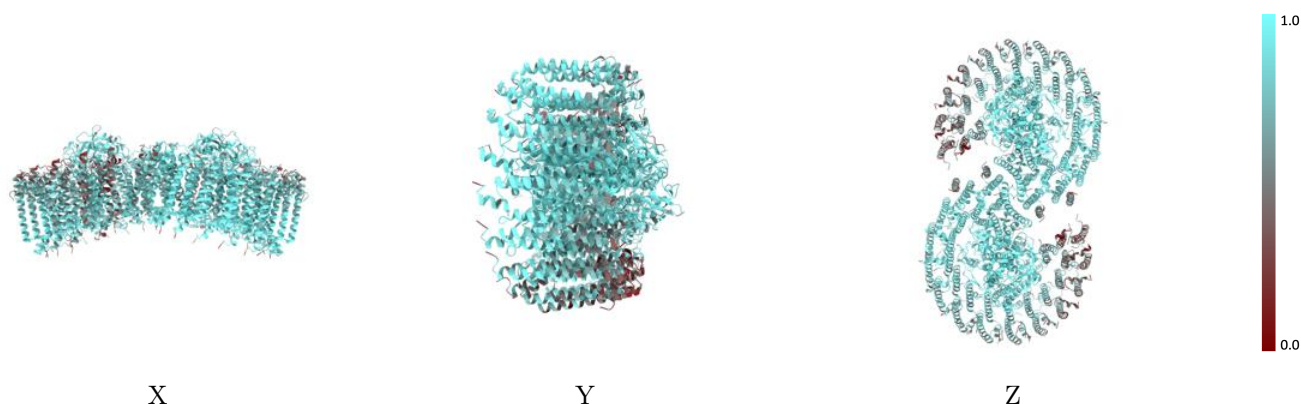
The images above show the 3D surface view of the map at the recommended contour level 0.0222 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

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



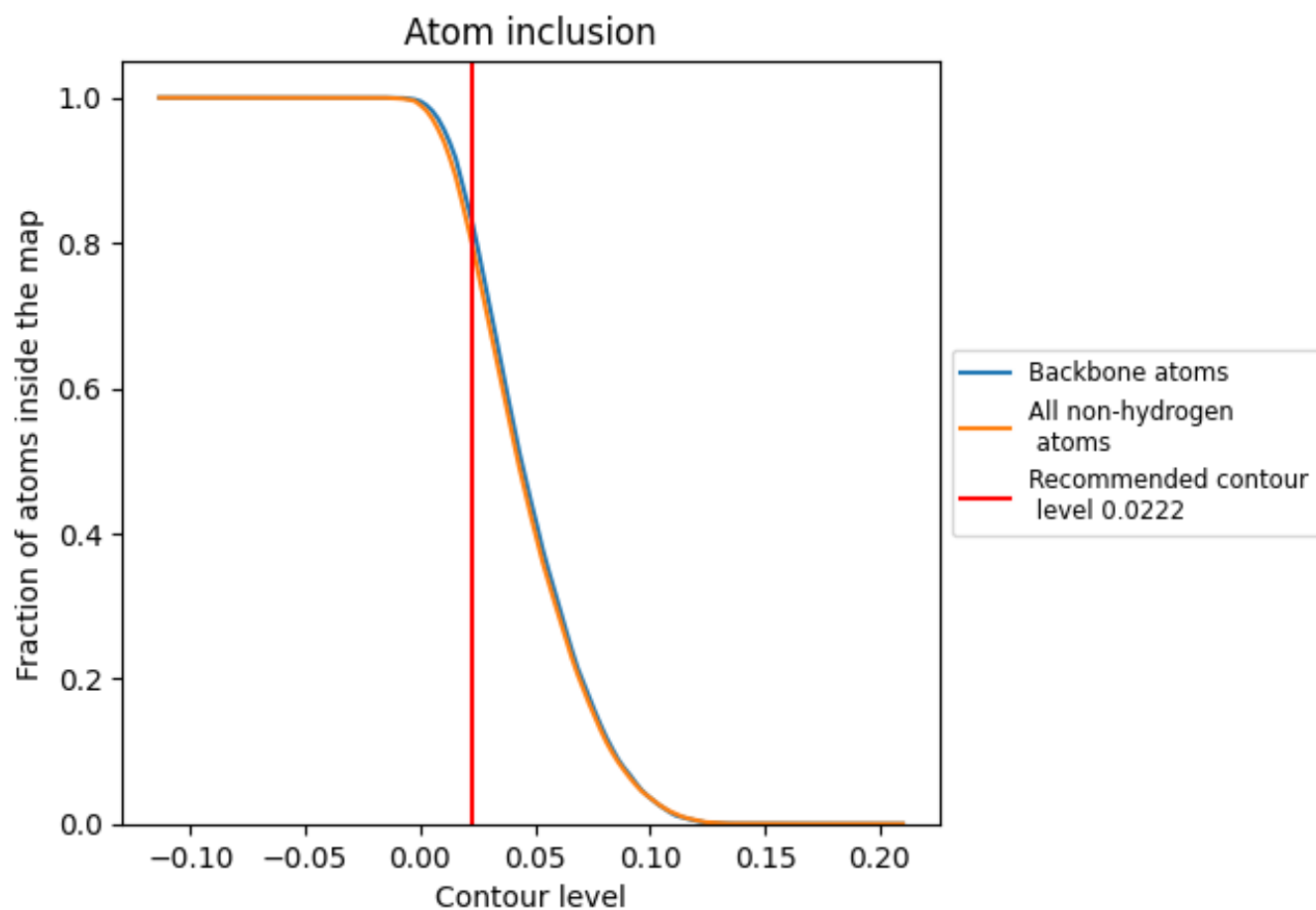
The images above show the model with each residue coloured according to its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.0222).







































































9.4 Atom inclusion [i](#)



At the recommended contour level, 83% of all backbone atoms, 80% 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 (0.0222) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	 0.8033	 0.5820
AA	 0.9286	 0.6410
AB	 0.9061	 0.6380
AC	 0.8591	 0.6070
AD	 0.8967	 0.6180
AE	 0.8649	 0.6020
AF	 0.7839	 0.5740
AG	 0.7946	 0.5730
AH	 0.8036	 0.5820
AI	 0.7772	 0.5600
AJ	 0.7538	 0.5510
AK	 0.7171	 0.5250
AL	 0.6530	 0.4990
AM	 0.5297	 0.4500
AN	 0.4244	 0.4020
BA	 0.9172	 0.6430
BB	 0.9062	 0.6310
BC	 0.8497	 0.6010
BD	 0.8321	 0.5970
BE	 0.7852	 0.5670
BF	 0.7360	 0.5340
BG	 0.7728	 0.5640
BH	 0.7315	 0.5280
BI	 0.7383	 0.5350
BJ	 0.7114	 0.5300
BK	 0.6219	 0.4780
BL	 0.5447	 0.4430
BM	 0.4761	 0.3910
BN	 0.4132	 0.3840
H	 0.8817	 0.6140
L	 0.9617	 0.6740
M	 0.9422	 0.6590
UA	 0.5294	 0.4460
UB	 0.5756	 0.5110
UU	 0.6657	 0.5290



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Chain	Atom inclusion	Q-score
X	 0.9279	 0.6460
aa	 0.9263	 0.6390
ab	 0.9124	 0.6400
ac	 0.8514	 0.6090
ad	 0.8721	 0.6040
ae	 0.8375	 0.5880
af	 0.7778	 0.5690
ag	 0.8070	 0.5770
ah	 0.7982	 0.5810
ai	 0.7739	 0.5580
aj	 0.7571	 0.5500
ak	 0.7117	 0.5230
al	 0.6378	 0.4960
am	 0.5261	 0.4480
an	 0.4306	 0.4000
ba	 0.9105	 0.6440
bb	 0.8904	 0.6310
bc	 0.8866	 0.6120
bd	 0.8321	 0.5960
be	 0.8173	 0.5830
bf	 0.7338	 0.5340
bg	 0.7753	 0.5620
bh	 0.7293	 0.5270
bi	 0.7309	 0.5360
bj	 0.7069	 0.5280
bk	 0.6219	 0.4850
bl	 0.5444	 0.4400
bm	 0.4761	 0.3890
bn	 0.4077	 0.3840
h	 0.8807	 0.6140
l	 0.9637	 0.6740
m	 0.9429	 0.6600
ua	 0.5252	 0.4480
ub	 0.5756	 0.5080
uu	 0.6657	 0.5310
x	 0.9170	 0.6390