



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 16, 2026 – 04:18 PM JST

PDB ID : 9VDX / pdb_00009vdx
Title : Serial synchrotron crystallography structure of a photosynthetic reaction center using a goniometer-compatible chip-based platform
Authors : Ghosh, S.; Banacore, A.; Neutze, R.; Branden, G.
Deposited on : 2025-06-09
Resolution : 2.80 Å(reported)

This is a wwPDB X-ray Structure 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/XrayValidationReportHelp>

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:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : 2.0
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.48.1

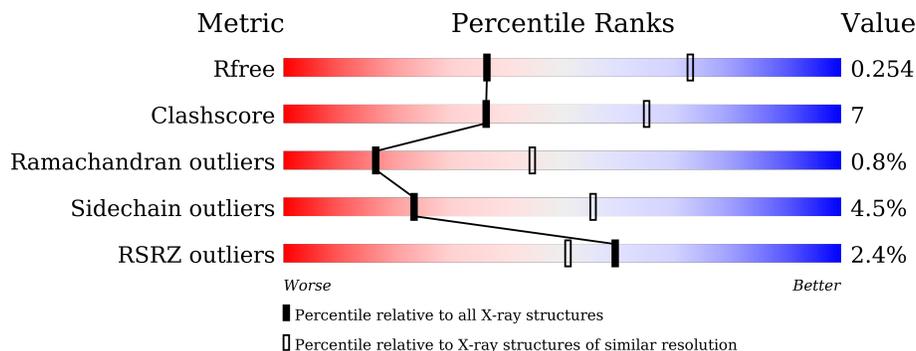
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	3657 (2.80-2.80)
Clashscore	180529	4123 (2.80-2.80)
Ramachandran outliers	177936	4071 (2.80-2.80)
Sidechain outliers	177891	4073 (2.80-2.80)
RSRZ outliers	164620	3659 (2.80-2.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower 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 electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	C	336	 2% (red), 82% (green), 16% (yellow), .. (grey)
2	H	258	 6% (red), 76% (green), 21% (yellow), . (grey)
3	L	273	 % (red), 88% (green), 12% (yellow)
4	M	323	 % (red), 82% (green), 16% (yellow), . (grey)

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

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
10	BCB	L	301	X	-	-	-
10	BCB	L	302	X	-	-	-
10	BCB	M	405	X	-	-	-
10	BCB	M	406	X	-	-	-
11	BPB	L	303	X	-	-	-
11	BPB	M	407	X	-	-	-

2 Entry composition

There are 15 unique types of molecules in this entry. The entry contains 10352 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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 Photosynthetic reaction center cytochrome c subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	C	332	2602	1640	466	478	18	0	0	0

- Molecule 2 is a protein called Reaction center protein H chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	258	2018	1292	344	380	2	0	0	0

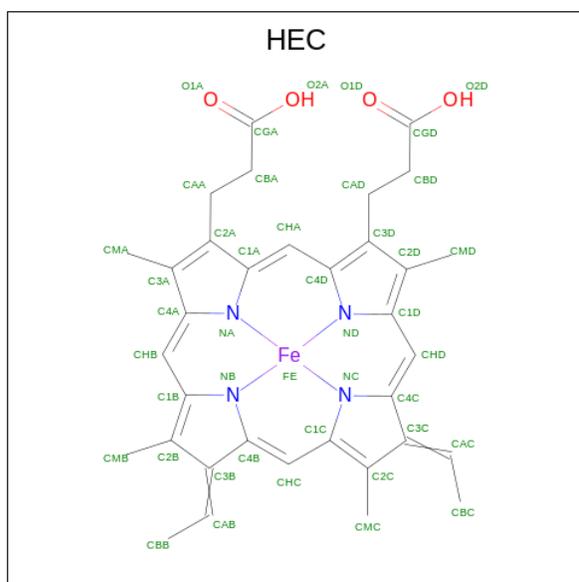
- Molecule 3 is a protein called Reaction center protein L chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	L	273	2172	1460	350	355	7	0	1	0

- Molecule 4 is a protein called Reaction center protein M chain.

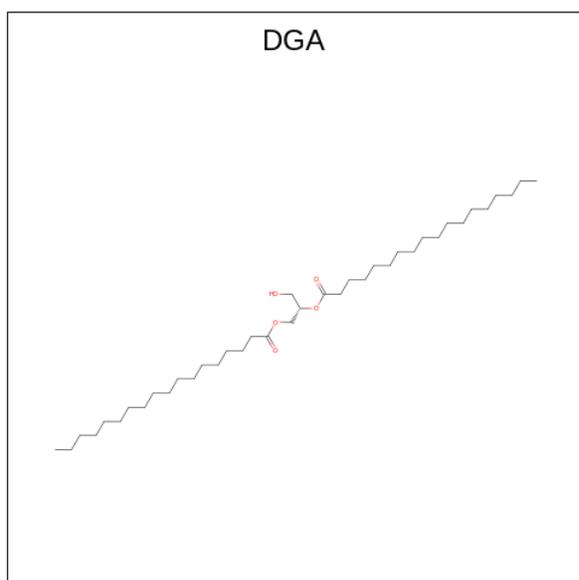
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	M	323	2555	1702	419	423	11	0	0	0

- Molecule 5 is HEME C (CCD ID: HEC) (formula: $C_{34}H_{34}FeN_4O_4$) (labeled as "Ligand of Interest" by depositor).



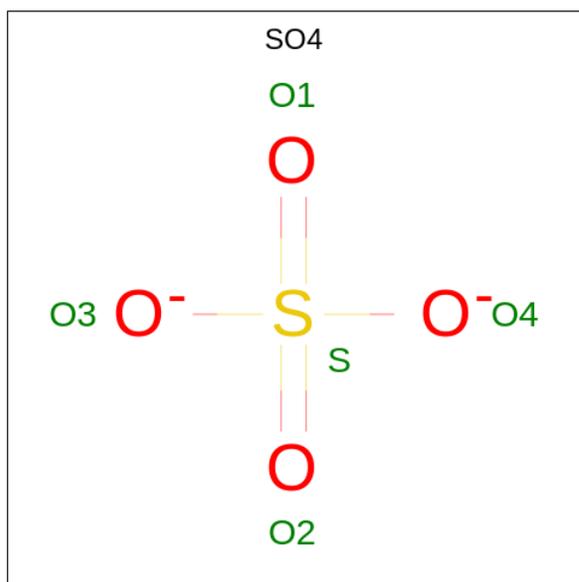
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Fe	N			O
5	C	1	43	34	1	4	4	0	0
5	C	1	43	34	1	4	4	0	0
5	C	1	43	34	1	4	4	0	0
5	C	1	43	34	1	4	4	0	0

- Molecule 6 is DIACYL GLYCEROL (CCD ID: DGA) (formula: $C_{39}H_{76}O_5$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	C	1	Total	C	O	0	0
			37	33	4		

- Molecule 7 is SULFATE ION (CCD ID: SO4) (formula: O₄S) (labeled as "Ligand of Interest" by depositor).



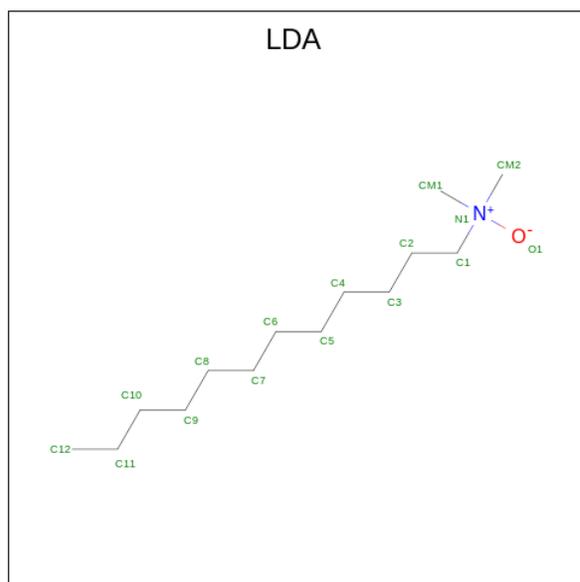
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	C	1	Total	O	S	0	0
			5	4	1		
7	C	1	Total	O	S	0	0
			5	4	1		
7	C	1	Total	O	S	0	0
			5	4	1		
7	H	1	Total	O	S	0	0
			5	4	1		
7	H	1	Total	O	S	0	0
			5	4	1		
7	H	1	Total	O	S	0	0
			5	4	1		
7	H	1	Total	O	S	0	0
			5	4	1		
7	M	1	Total	O	S	0	0
			5	4	1		
7	M	1	Total	O	S	0	0
			5	4	1		
7	M	1	Total	O	S	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	M	1	Total	O	S	0	0
			5	4	1		
7	M	1	Total	O	S	0	0
			5	4	1		
7	M	1	Total	O	S	0	0
			5	4	1		
7	M	1	Total	O	S	0	0
			5	4	1		

- Molecule 8 is LAURYL DIMETHYLAMINE-N-OXIDE (CCD ID: LDA) (formula: C₁₄H₃₁NO) (labeled as "Ligand of Interest" by depositor).



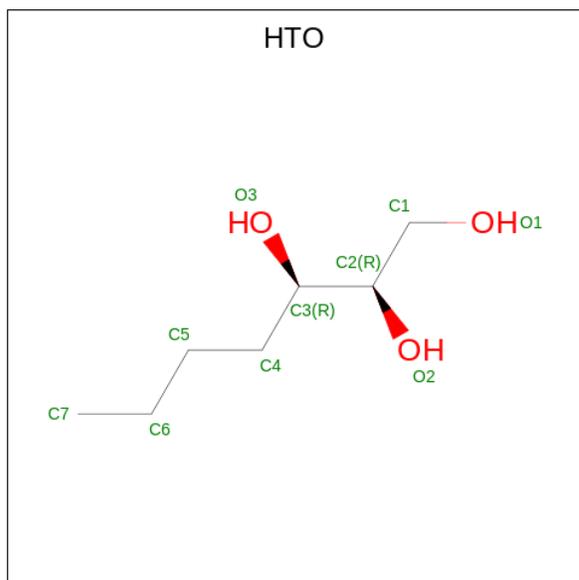
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	H	1	Total	C	N	O	0	0
			16	14	1	1		
8	H	1	Total	C	N	O	0	0
			16	14	1	1		
8	L	1	Total	C	N	O	0	0
			16	14	1	1		
8	L	1	Total	C	N	O	0	0
			16	14	1	1		
8	M	1	Total	C	N	O	0	0
			16	14	1	1		
8	M	1	Total	C	N	O	0	0
			16	14	1	1		

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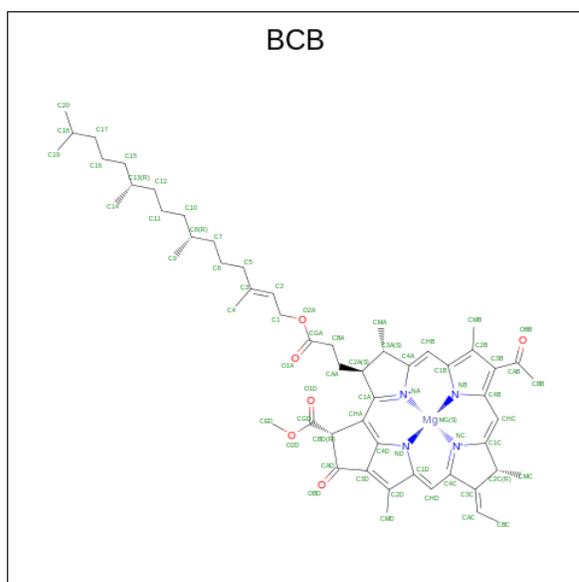
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
8	M	1	16	14	1	1	0	0

- Molecule 9 is HEPTANE-1,2,3-TRIOL (CCD ID: HTO) (formula: C₇H₁₆O₃) (labeled as "Ligand of Interest" by depositor).



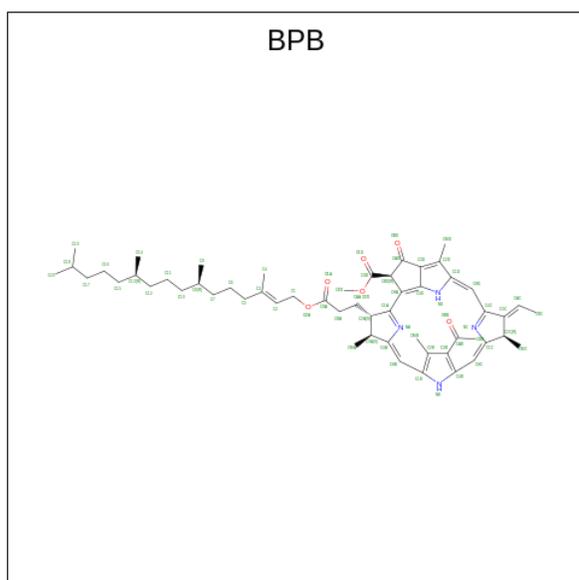
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
9	H	1	10	7	3	0	0
9	L	1	10	7	3	0	0
9	M	1	10	7	3	0	0

- Molecule 10 is BACTERIOCHLOROPHYLL B (CCD ID: BCB) (formula: C₅₅H₇₂MgN₄O₆) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Mg	N			O
10	L	1	Total	C	Mg	N	O	0	0
			66	55	1	4	6		
10	L	1	Total	C	Mg	N	O	0	0
			66	55	1	4	6		
10	M	1	Total	C	Mg	N	O	0	0
			66	55	1	4	6		
10	M	1	Total	C	Mg	N	O	0	0
			66	55	1	4	6		

- Molecule 11 is BACTERIOPHEOPHYTIN B (CCD ID: BPB) (formula: $C_{55}H_{74}N_4O_6$) (labeled as "Ligand of Interest" by depositor).

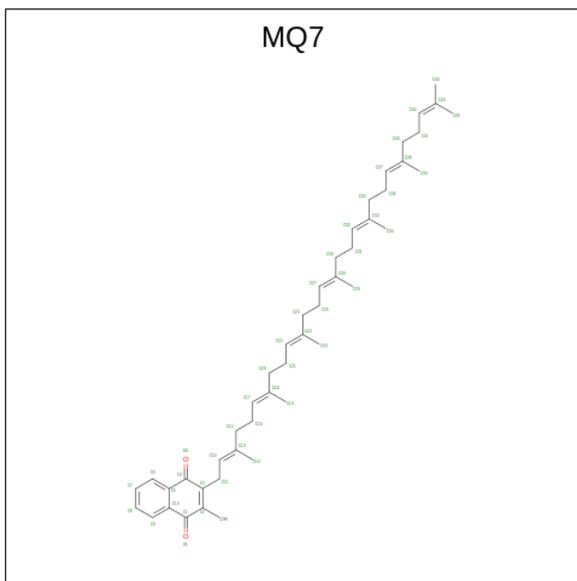


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
11	L	1	Total	C	N	O	0	0
			65	55	4	6		
11	M	1	Total	C	N	O	0	0
			65	55	4	6		

- Molecule 12 is FE (II) ION (CCD ID: FE2) (formula: Fe) (labeled as "Ligand of Interest" by depositor).

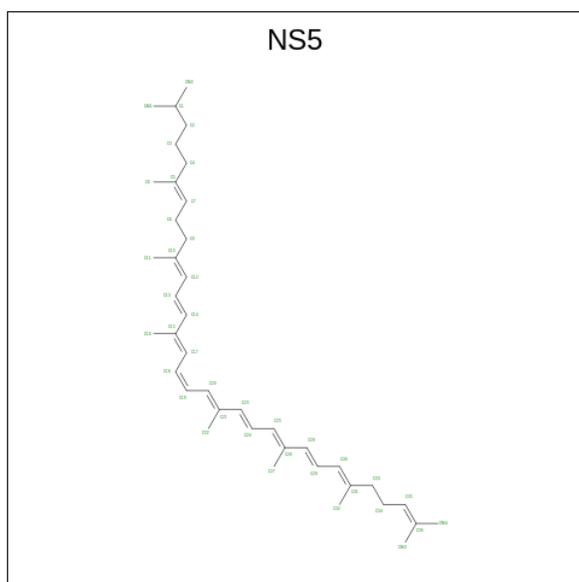
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	M	1	Total	Fe	0	0
			1	1		

- Molecule 13 is MENAQUINONE-7 (CCD ID: MQ7) (formula: C₄₆H₆₄O₂) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
13	M	1	Total	C	O	0	0
			48	46	2		

- Molecule 14 is 15-cis-1,2-dihydroneurosporene (CCD ID: NS5) (formula: C₄₀H₆₀) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
14	M	1	Total C 40 40	0	0

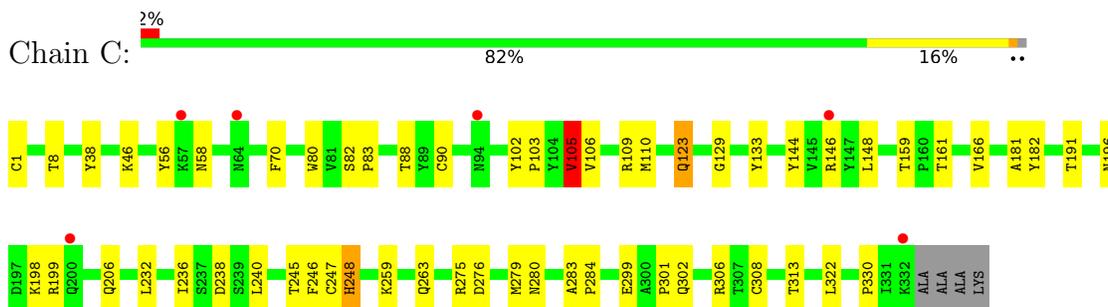
- Molecule 15 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
15	C	34	Total O 34 34	0	0
15	H	16	Total O 16 16	0	0
15	L	17	Total O 17 17	0	0
15	M	29	Total O 29 29	0	0

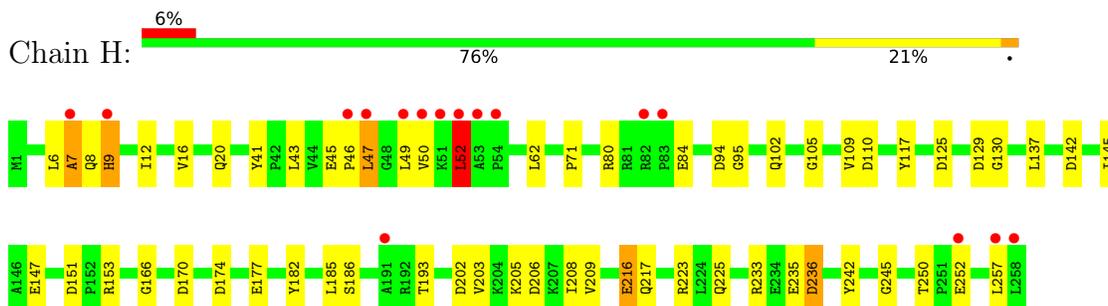
3 Residue-property plots [i](#)

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 electron 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 dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

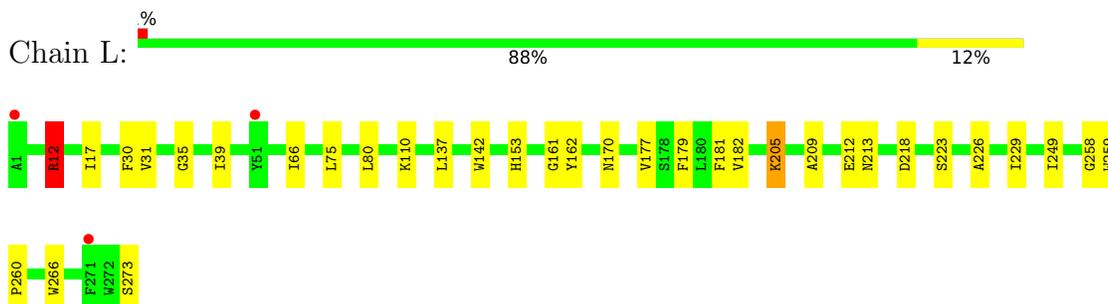
- Molecule 1: Photosynthetic reaction center cytochrome c subunit



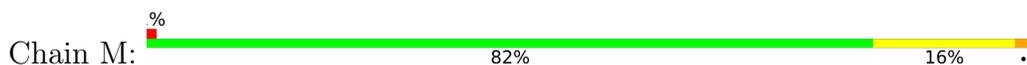
- Molecule 2: Reaction center protein H chain

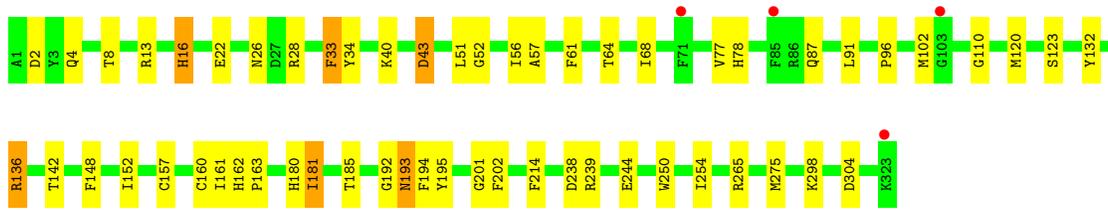


- Molecule 3: Reaction center protein L chain



- Molecule 4: Reaction center protein M chain





4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	223.80Å 223.80Å 113.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.80 – 2.80 36.80 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.6 (36.80-2.80) 99.6 (36.80-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.10 (at 1.43Å)	Xtrriage
Refinement program	REFMAC 8.0.010	Depositor
R, R_{free}	0.215 , 0.253 0.215 , 0.254	Depositor DCC
R_{free} test set	23557 reflections (4.57%)	wwPDB-VP
Wilson B-factor (Å ²)	-31.7	Xtrriage
Anisotropy	-0.632	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 53.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	10352	wwPDB-VP
Average B, all atoms (Å ²)	51.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.75% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: NS5, BPB, SO4, DGA, HEC, LDA, FME, MQ7, HTO, FE2, BCB

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	C	0.58	0/2669	1.09	1/3637 (0.0%)
2	H	0.58	0/2055	1.08	2/2807 (0.1%)
3	L	0.58	0/2267	1.03	1/3095 (0.0%)
4	M	0.58	0/2659	1.09	4/3637 (0.1%)
All	All	0.58	0/9650	1.07	8/13176 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	C	0	2
2	H	0	1
3	L	0	1
4	M	0	3
All	All	0	7

There are no bond length outliers.

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	206	ASP	CA-CB-CG	6.82	119.42	112.60
4	M	16	HIS	CA-CB-CG	6.41	120.21	113.80
1	C	105	VAL	N-CA-CB	5.77	117.30	110.55
4	M	33	PHE	CA-CB-CG	5.50	119.30	113.80
4	M	43	ASP	CB-CA-C	5.43	118.49	109.53

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	199	ARG	Sidechain
1	C	248	HIS	Peptide
2	H	223	ARG	Sidechain
3	L	12	ARG	Sidechain
4	M	13	ARG	Sidechain

5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	2602	0	2581	45	0
2	H	2018	0	2020	29	0
3	L	2172	0	2097	24	0
4	M	2555	0	2452	31	0
5	C	172	0	122	18	0
6	C	37	0	58	2	0
7	C	15	0	0	0	0
7	H	20	0	0	1	0
7	M	40	0	0	1	0
8	H	32	0	62	2	0
8	L	32	0	62	0	0
8	M	48	0	93	0	0
9	H	10	0	16	0	0
9	L	10	0	16	0	0
9	M	10	0	16	0	0
10	L	132	0	144	9	0
10	M	132	0	144	9	0
11	L	65	0	74	3	0
11	M	65	0	74	5	0
12	M	1	0	0	0	0
13	M	48	0	64	1	0
14	M	40	0	60	2	0
15	C	34	0	0	3	0
15	H	16	0	0	0	0
15	L	17	0	0	0	0
15	M	29	0	0	0	0
All	All	10352	0	10155	144	0

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

hydrogen atoms). The all-atom clashscore for this structure is 7.

The worst 5 of 144 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:247:CYS:SG	5:C:403:HEC:CAC	2.01	1.48
1:C:90:CYS:SG	5:C:401:HEC:CAC	2.06	1.44
1:C:308:CYS:SG	5:C:404:HEC:CAC	2.26	1.22
1:C:90:CYS:SG	5:C:401:HEC:CBC	2.47	1.02
1:C:308:CYS:SG	5:C:404:HEC:HAC	2.00	0.98

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

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	C	330/336 (98%)	317 (96%)	12 (4%)	1 (0%)	37	67
2	H	256/258 (99%)	236 (92%)	13 (5%)	7 (3%)	4	15
3	L	272/273 (100%)	261 (96%)	10 (4%)	1 (0%)	30	61
4	M	321/323 (99%)	309 (96%)	11 (3%)	1 (0%)	37	67
All	All	1179/1190 (99%)	1123 (95%)	46 (4%)	10 (1%)	16	44

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	H	7	ALA
1	C	58	ASN
2	H	9	HIS
2	H	50	VAL
2	H	52	LEU

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 X-ray entries followed by that with respect to entries of similar resolution.

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	C	281/282 (100%)	271 (96%)	10 (4%)	30	64
2	H	212/212 (100%)	197 (93%)	15 (7%)	12	35
3	L	219/218 (100%)	213 (97%)	6 (3%)	40	74
4	M	249/249 (100%)	237 (95%)	12 (5%)	21	53
All	All	961/961 (100%)	918 (96%)	43 (4%)	23	55

5 of 43 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	L	205	LYS
4	M	43	ASP
3	L	249	ILE
4	M	26	ASN
4	M	102	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	302	GLN
2	H	92	GLN
2	H	220	ASN
2	H	102	GLN
1	C	123	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	FME	H	1	2	8,9,10	0.45	0	7,9,11	0.75	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
2	FME	H	1	2	-	4/7/9/11	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	H	1	FME	C-CA-CB-CG
2	H	1	FME	CB-CG-SD-CE
2	H	1	FME	N-CA-CB-CG
2	H	1	FME	CA-CB-CG-SD

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 39 ligands modelled in this entry, 1 is monoatomic - leaving 38 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$
7	SO4	H	704	-	4,4,4	0.35	0	6,6,6	0.11	0
7	SO4	C	408	-	4,4,4	0.34	0	6,6,6	0.09	0
10	BCB	L	301	3	63,74,74	1.81	14 (22%)	74,115,115	2.97	33 (44%)
7	SO4	M	411	-	4,4,4	0.38	0	6,6,6	0.34	0
8	LDA	H	706	-	12,15,15	0.28	0	14,17,17	0.71	1 (7%)
7	SO4	H	702	-	4,4,4	0.36	0	6,6,6	0.11	0
10	BCB	M	405	4	63,74,74	1.87	14 (22%)	74,115,115	3.23	25 (33%)
7	SO4	M	414	-	4,4,4	0.37	0	6,6,6	0.07	0
8	LDA	M	418	-	12,15,15	0.36	0	14,17,17	0.42	0
5	HEC	C	403	1	32,50,50	1.59	6 (18%)	24,82,82	2.10	10 (41%)
8	LDA	M	401	-	12,15,15	0.27	0	14,17,17	0.38	0
7	SO4	M	412	-	4,4,4	0.36	0	6,6,6	0.07	0
14	NS5	M	408	-	39,39,39	0.98	2 (5%)	44,46,46	1.97	11 (25%)
8	LDA	H	701	-	12,15,15	0.29	0	14,17,17	0.27	0
10	BCB	M	406	4	63,74,74	1.82	15 (23%)	74,115,115	3.08	26 (35%)
7	SO4	H	703	-	4,4,4	0.33	0	6,6,6	0.06	0
7	SO4	M	415	-	4,4,4	0.39	0	6,6,6	0.06	0
9	HTO	L	305	-	9,9,9	1.06	0	10,10,10	1.53	4 (40%)
11	BPB	L	303	-	49,70,70	1.97	9 (18%)	47,101,101	2.17	12 (25%)
7	SO4	M	413	-	4,4,4	0.38	0	6,6,6	0.14	0
8	LDA	M	417	-	12,15,15	0.18	0	14,17,17	0.24	0
7	SO4	C	406	-	4,4,4	0.35	0	6,6,6	0.05	0
7	SO4	M	410	-	4,4,4	0.34	0	6,6,6	0.14	0
9	HTO	H	707	-	9,9,9	0.79	0	10,10,10	1.31	2 (20%)
11	BPB	M	407	-	49,70,70	2.13	10 (20%)	47,101,101	2.21	9 (19%)
5	HEC	C	404	1	32,50,50	1.49	3 (9%)	24,82,82	2.03	8 (33%)
7	SO4	C	407	-	4,4,4	0.32	0	6,6,6	0.10	0
5	HEC	C	402	1	32,50,50	1.86	6 (18%)	24,82,82	2.08	4 (16%)
8	LDA	L	306	-	12,15,15	0.32	0	14,17,17	0.41	0
7	SO4	M	409	-	4,4,4	0.34	0	6,6,6	0.11	0
6	DGA	C	405	-	36,36,43	1.37	2 (5%)	38,38,45	1.35	5 (13%)
9	HTO	M	402	-	9,9,9	1.20	1 (11%)	10,10,10	1.67	3 (30%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
8	LDA	L	304	-	12,15,15	0.33	0	14,17,17	0.41	0
7	SO4	H	705	-	4,4,4	0.39	0	6,6,6	0.12	0
7	SO4	M	416	-	4,4,4	0.38	0	6,6,6	0.06	0
5	HEC	C	401	1	32,50,50	1.80	4 (12%)	24,82,82	1.84	5 (20%)
13	MQ7	M	404	-	49,49,49	1.41	3 (6%)	60,63,63	1.59	12 (20%)
10	BCB	L	302	3	63,74,74	1.79	15 (23%)	74,115,115	3.17	23 (31%)

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	BCB	L	301	3	3/3/21/26	7/37/137/137	-
8	LDA	H	706	-	-	8/13/13/13	-
10	BCB	M	405	4	3/3/21/26	12/37/137/137	-
8	LDA	M	418	-	-	7/13/13/13	-
5	HEC	C	403	1	-	2/10/54/54	-
8	LDA	M	401	-	-	4/13/13/13	-
14	NS5	M	408	-	-	11/43/43/43	-
8	LDA	H	701	-	-	6/13/13/13	-
10	BCB	M	406	4	3/3/21/26	12/37/137/137	-
9	HTO	L	305	-	-	1/10/10/10	-
11	BPB	L	303	-	1/1/18/23	10/37/105/105	0/5/6/6
8	LDA	M	417	-	-	5/13/13/13	-
9	HTO	H	707	-	-	6/10/10/10	-
11	BPB	M	407	-	1/1/18/23	9/37/105/105	0/5/6/6
5	HEC	C	404	1	-	2/10/54/54	-
5	HEC	C	402	1	-	3/10/54/54	-
8	LDA	L	306	-	-	12/13/13/13	-
6	DGA	C	405	-	-	14/37/37/45	-
9	HTO	M	402	-	-	1/10/10/10	-
8	LDA	L	304	-	-	5/13/13/13	-
13	MQ7	M	404	-	-	2/41/61/61	0/2/2/2
5	HEC	C	401	1	-	6/10/54/54	-
10	BCB	L	302	3	3/3/21/26	8/37/137/137	-

The worst 5 of 104 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
13	M	404	MQ7	C3-C2	7.41	1.48	1.35
11	L	303	BPB	CAC-C3C	7.33	1.52	1.33
5	C	401	HEC	C2B-C3B	-7.17	1.33	1.40
11	M	407	BPB	CAC-C3C	6.41	1.49	1.33
5	C	402	HEC	C2B-C3B	-6.24	1.34	1.40

The worst 5 of 193 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	L	302	BCB	C1C-NC-C4C	-18.17	98.54	106.71
10	M	406	BCB	C1C-NC-C4C	-18.02	98.60	106.71
10	M	405	BCB	C1C-NC-C4C	-16.64	99.23	106.71
10	L	301	BCB	C1C-NC-C4C	-14.97	99.97	106.71
10	M	405	BCB	O2D-CGD-CBD	10.01	129.06	111.27

5 of 14 chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
10	L	301	BCB	NC
10	L	301	BCB	NA
10	L	301	BCB	ND
10	L	302	BCB	NC
10	L	302	BCB	NA

5 of 153 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
8	H	706	LDA	C2-C1-N1-O1
8	H	706	LDA	C2-C1-N1-CM2
8	L	306	LDA	C2-C1-N1-O1
8	L	306	LDA	C2-C1-N1-CM1
8	L	306	LDA	C2-C1-N1-CM2

There are no ring outliers.

16 monomers are involved in 51 short contacts:

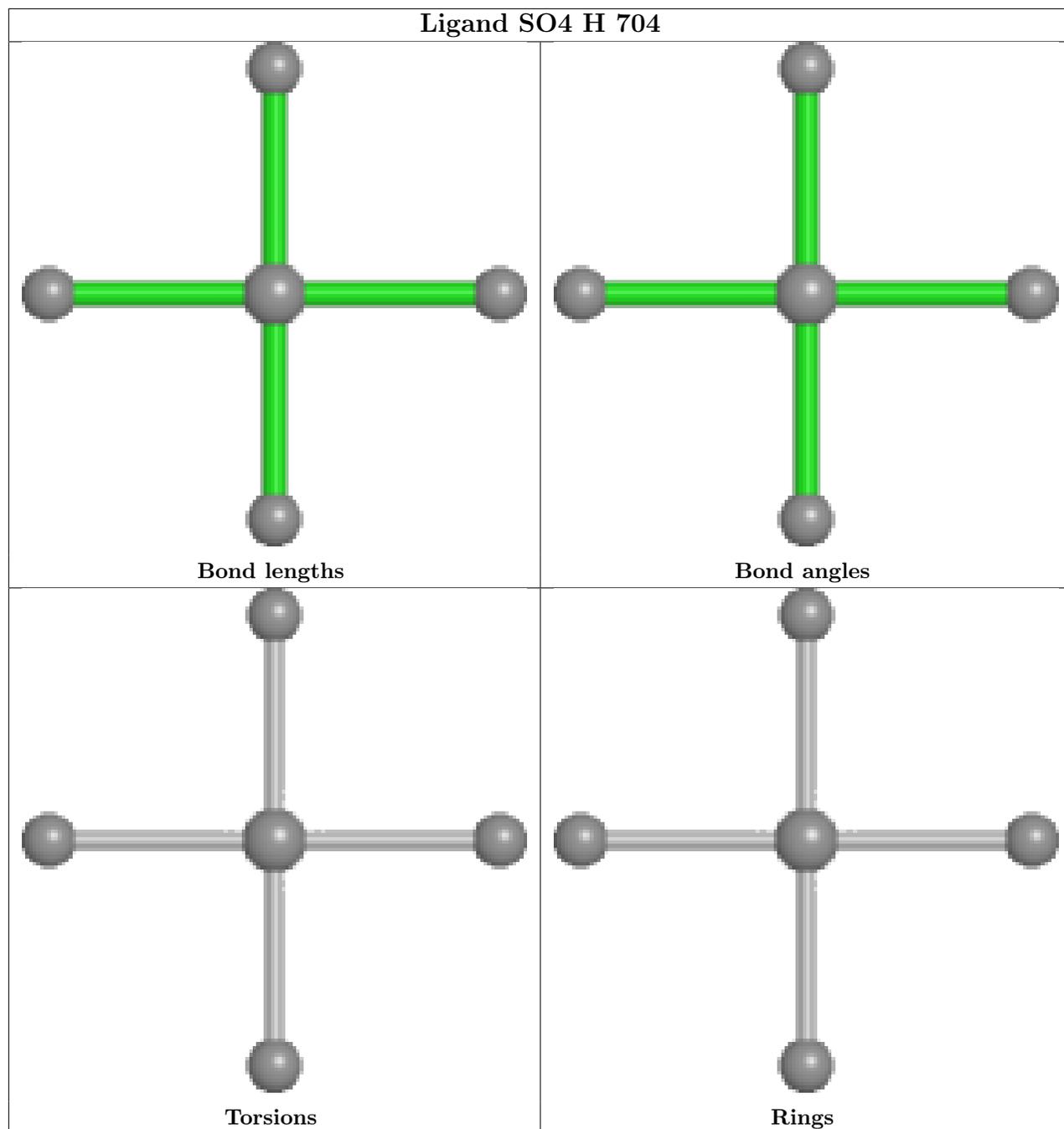
Mol	Chain	Res	Type	Clashes	Symm-Clashes
10	L	301	BCB	7	0
8	H	706	LDA	2	0
10	M	405	BCB	6	0
5	C	403	HEC	3	0

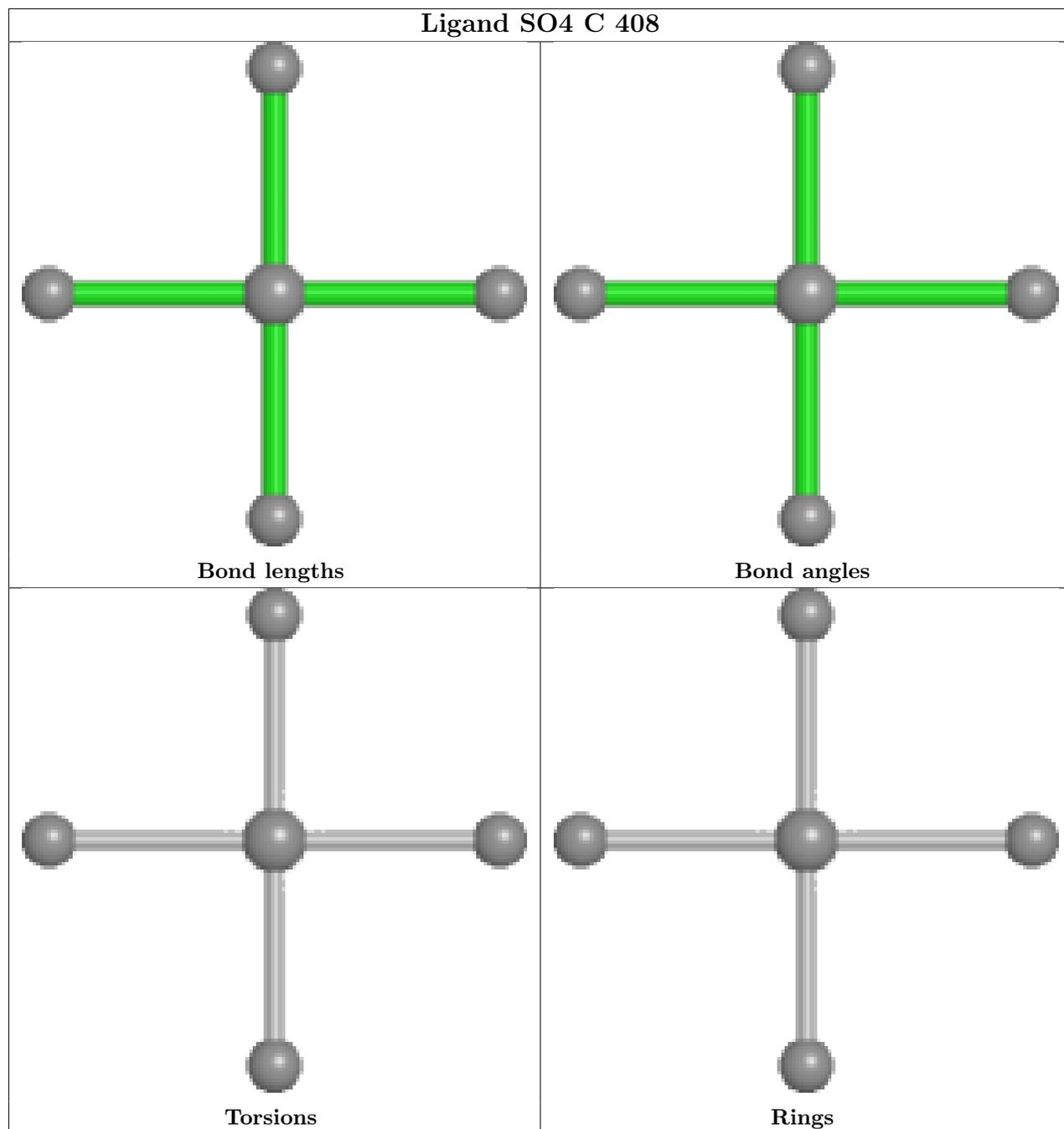
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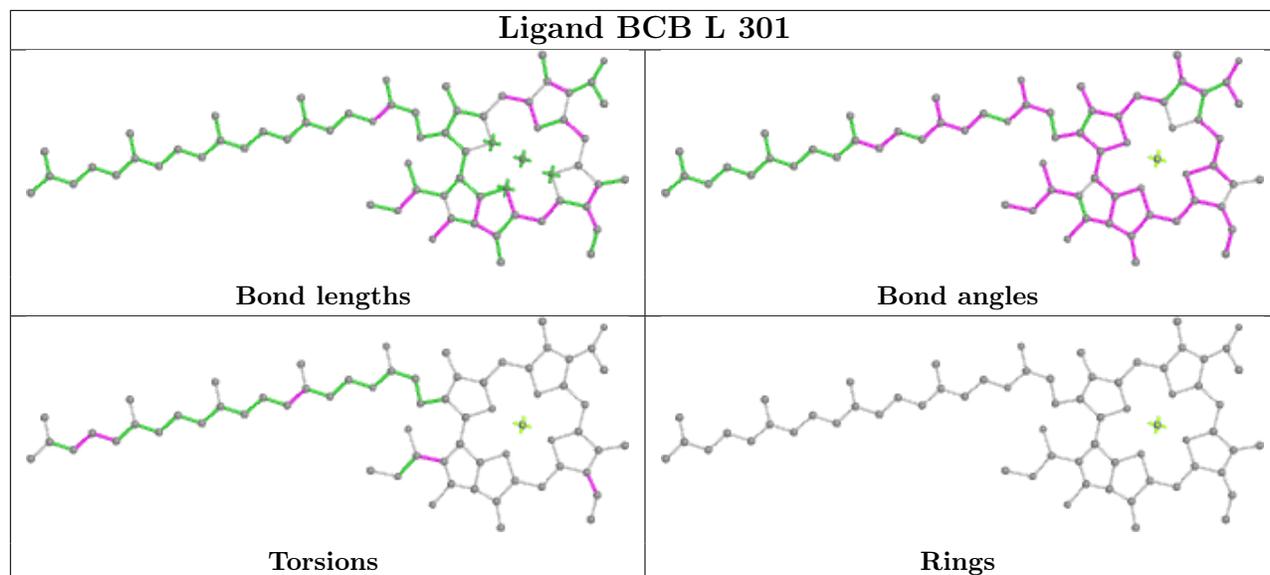
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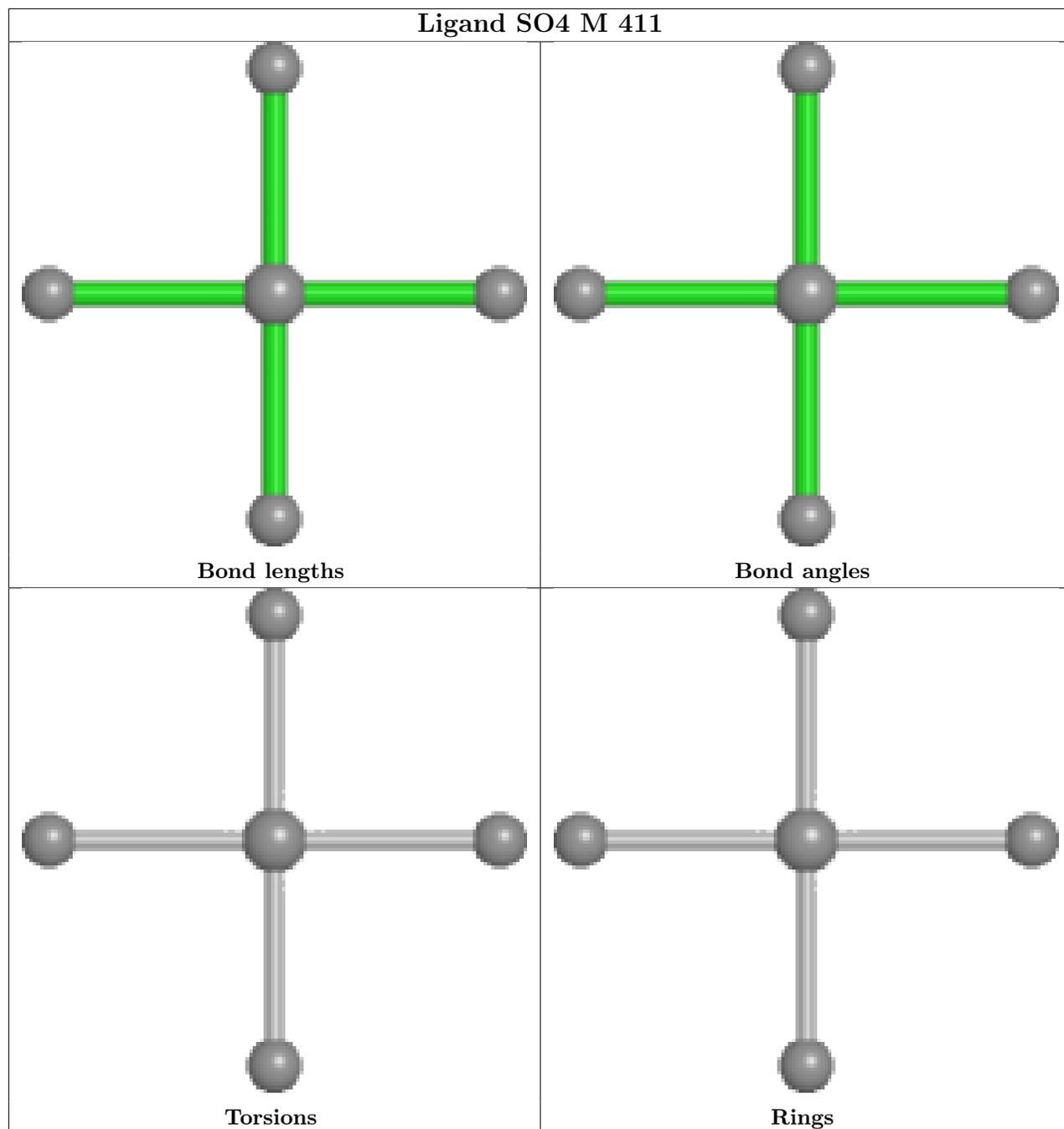
Mol	Chain	Res	Type	Clashes	Symm-Clashes
14	M	408	NS5	2	0
10	M	406	BCB	4	0
11	L	303	BPB	3	0
11	M	407	BPB	5	0
5	C	404	HEC	4	0
5	C	402	HEC	2	0
6	C	405	DGA	2	0
7	H	705	SO4	1	0
7	M	416	SO4	1	0
5	C	401	HEC	10	0
13	M	404	MQ7	1	0
10	L	302	BCB	2	0

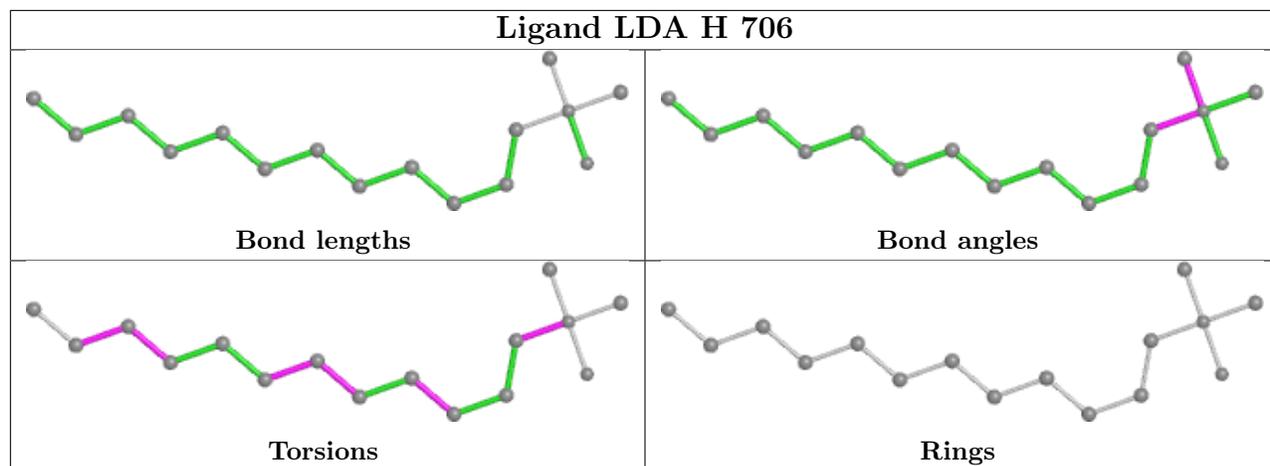
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

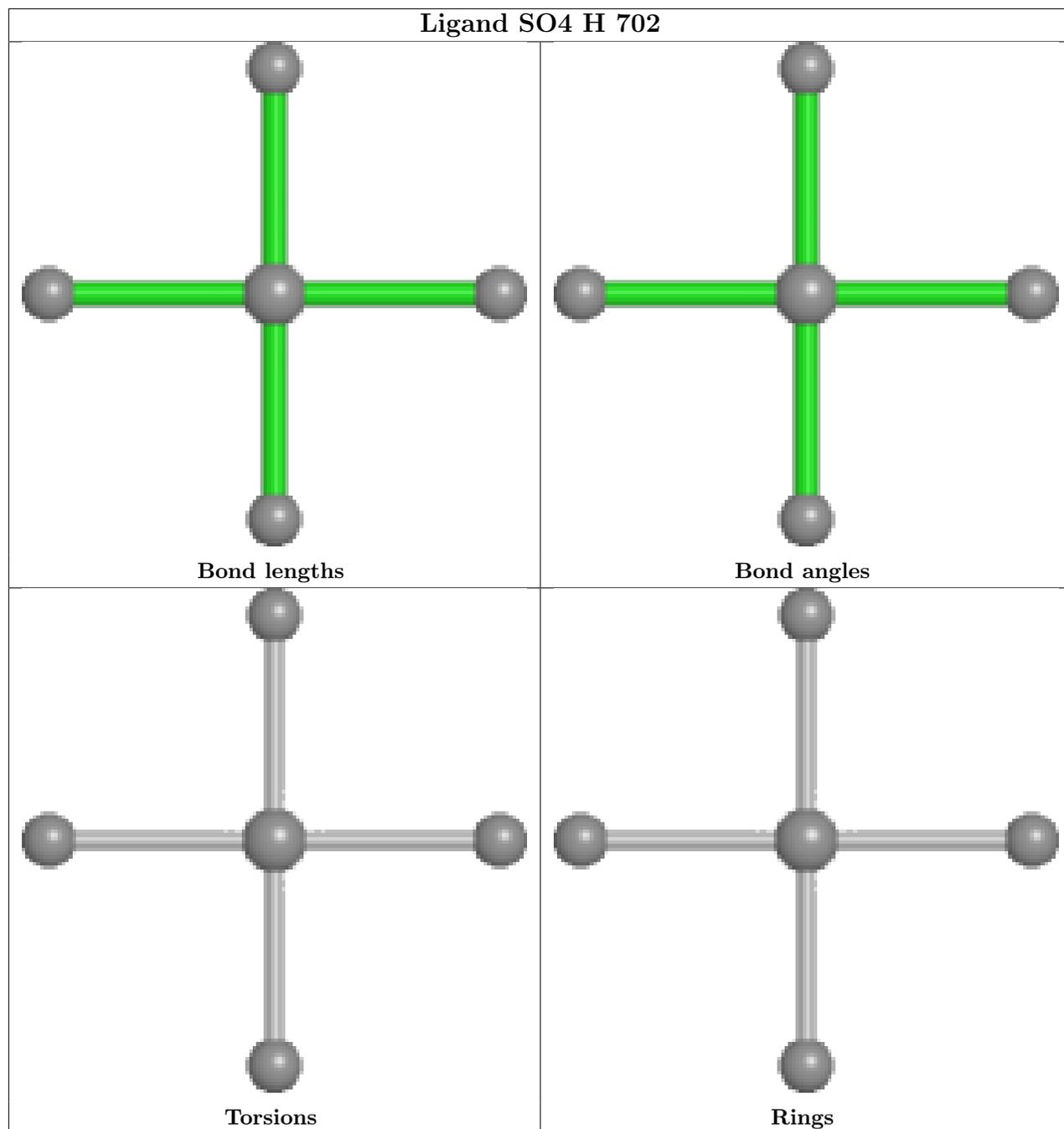


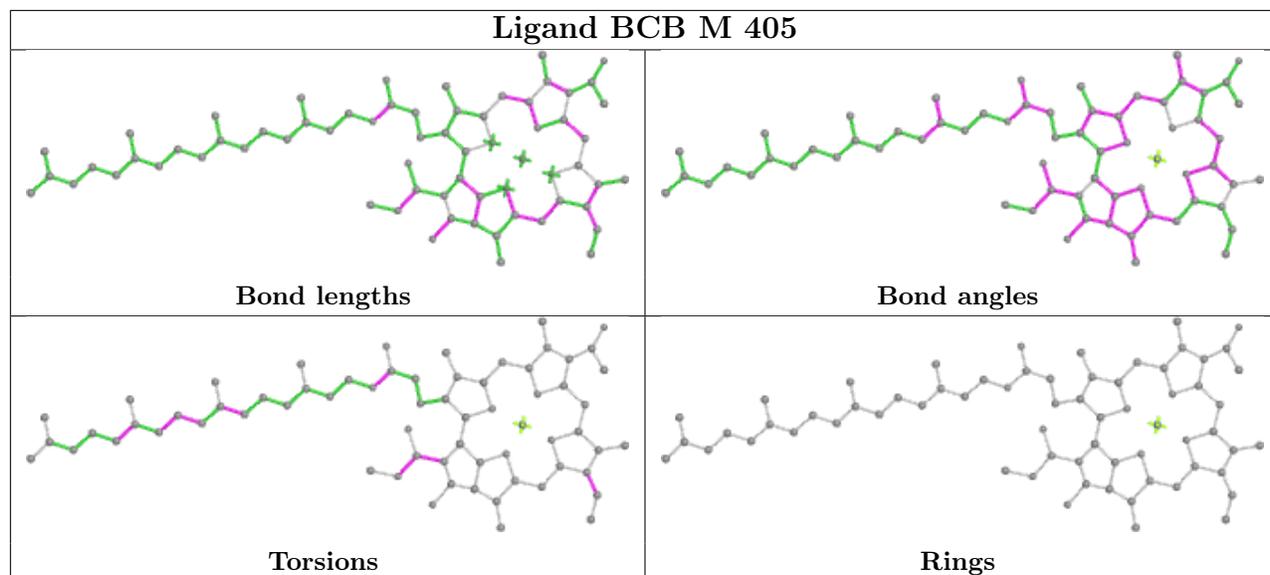


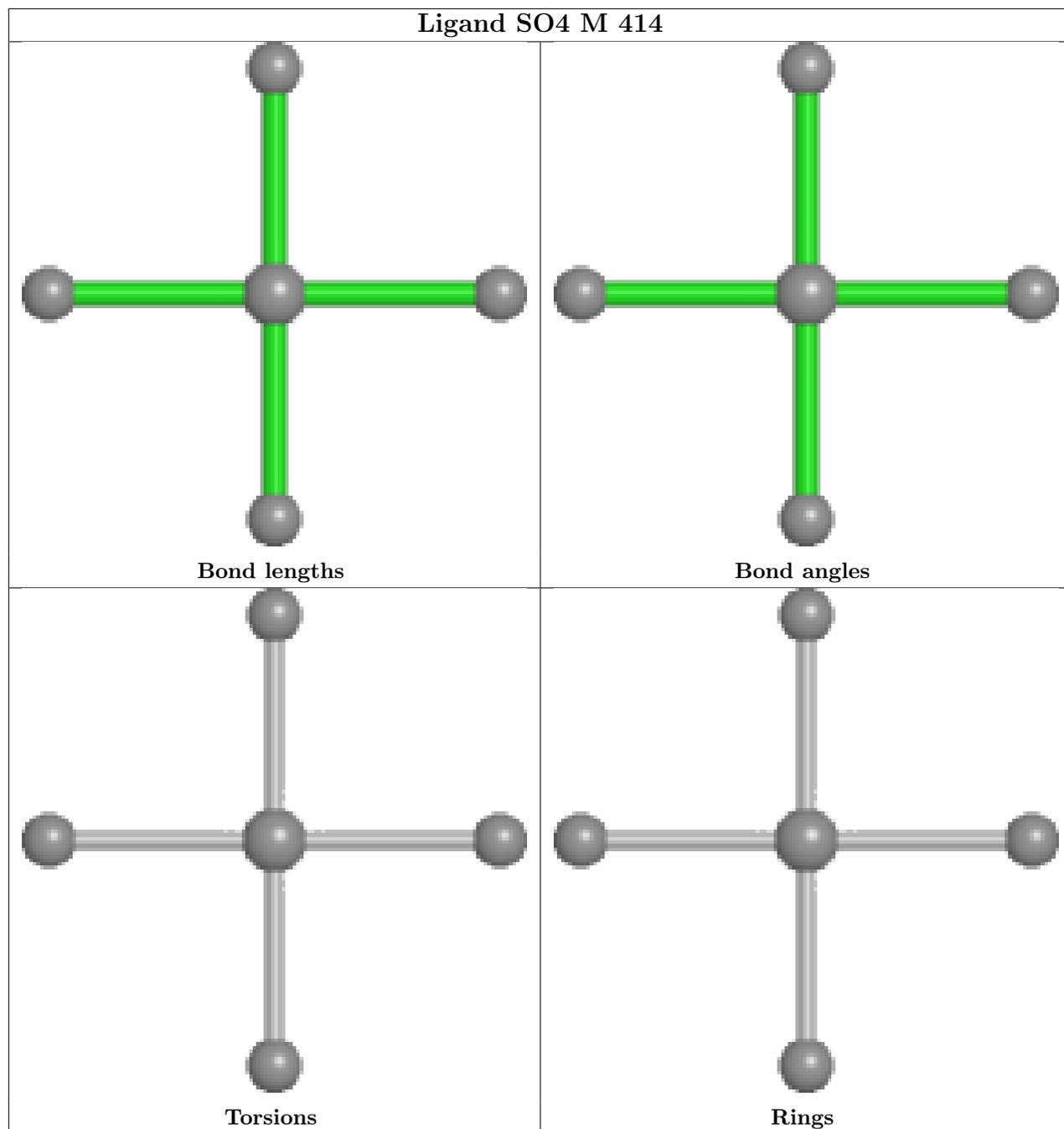


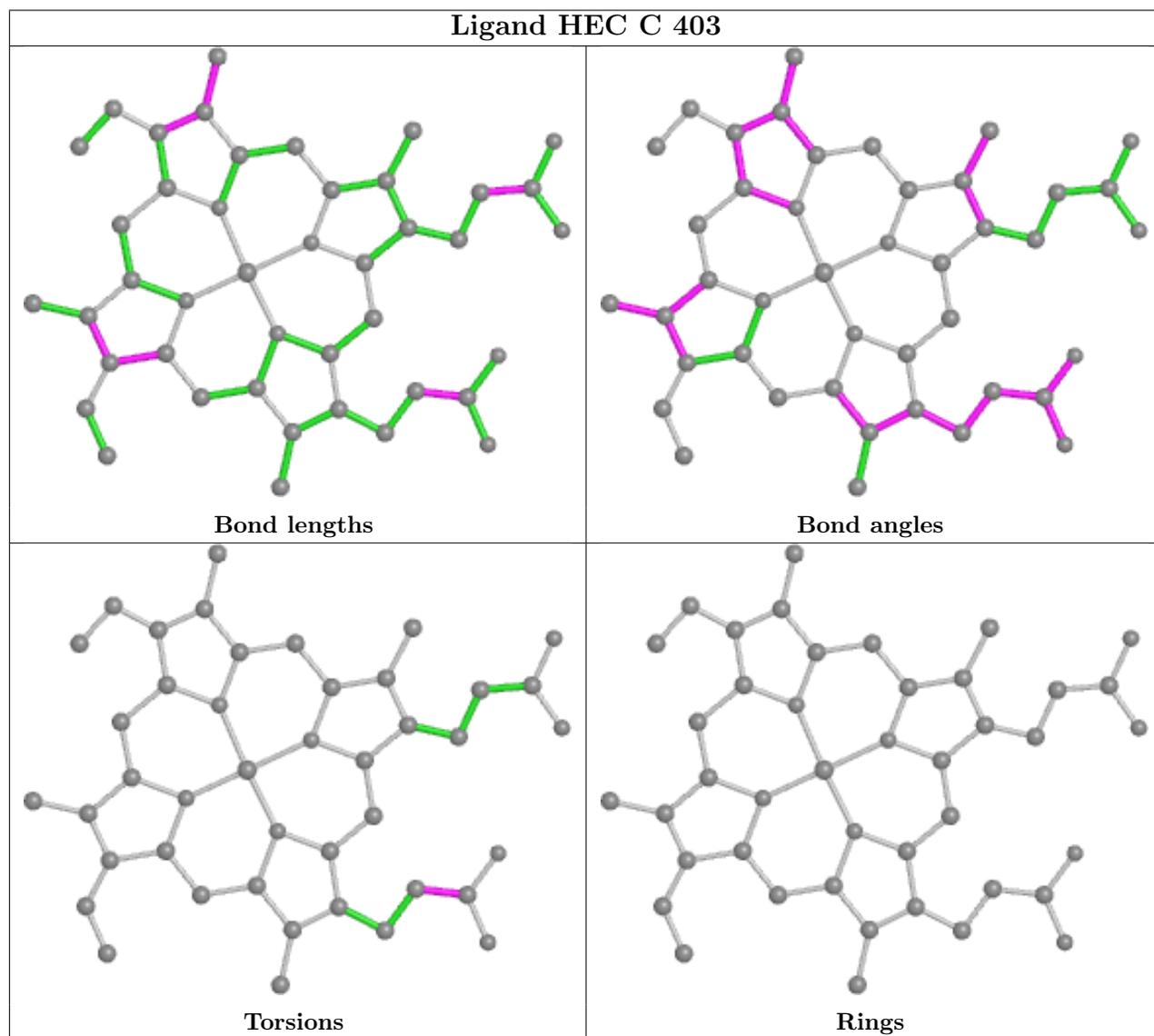
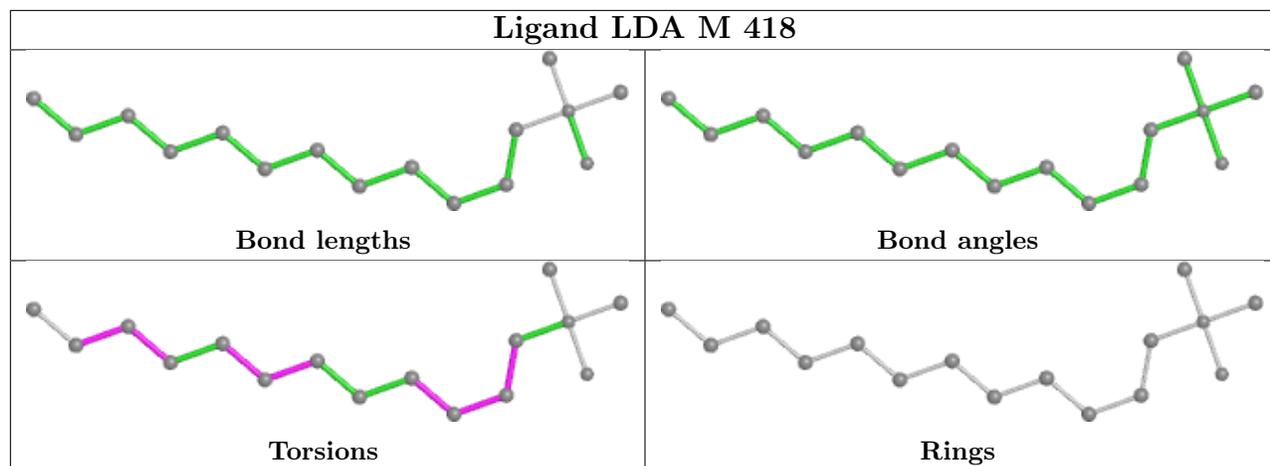


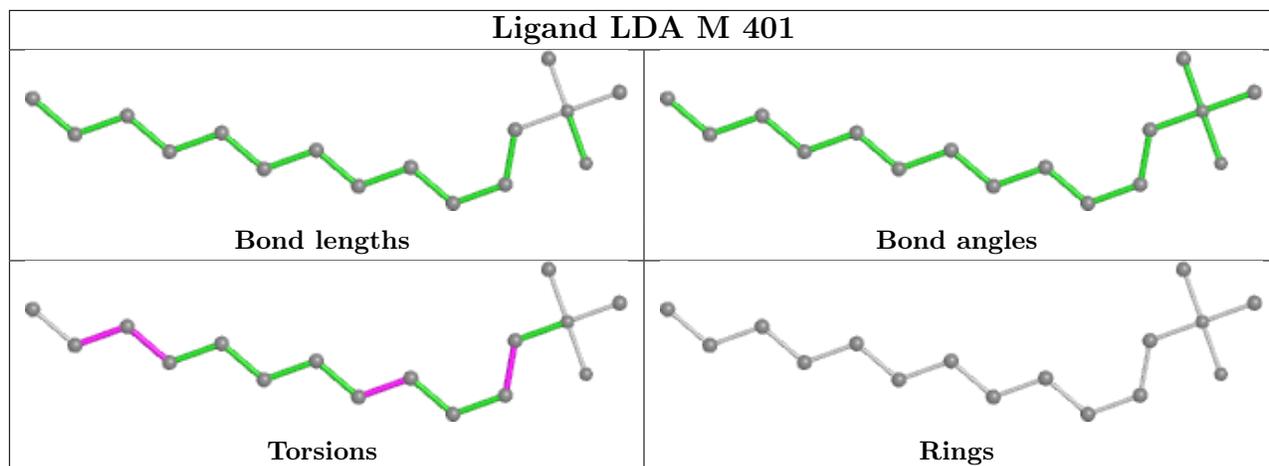


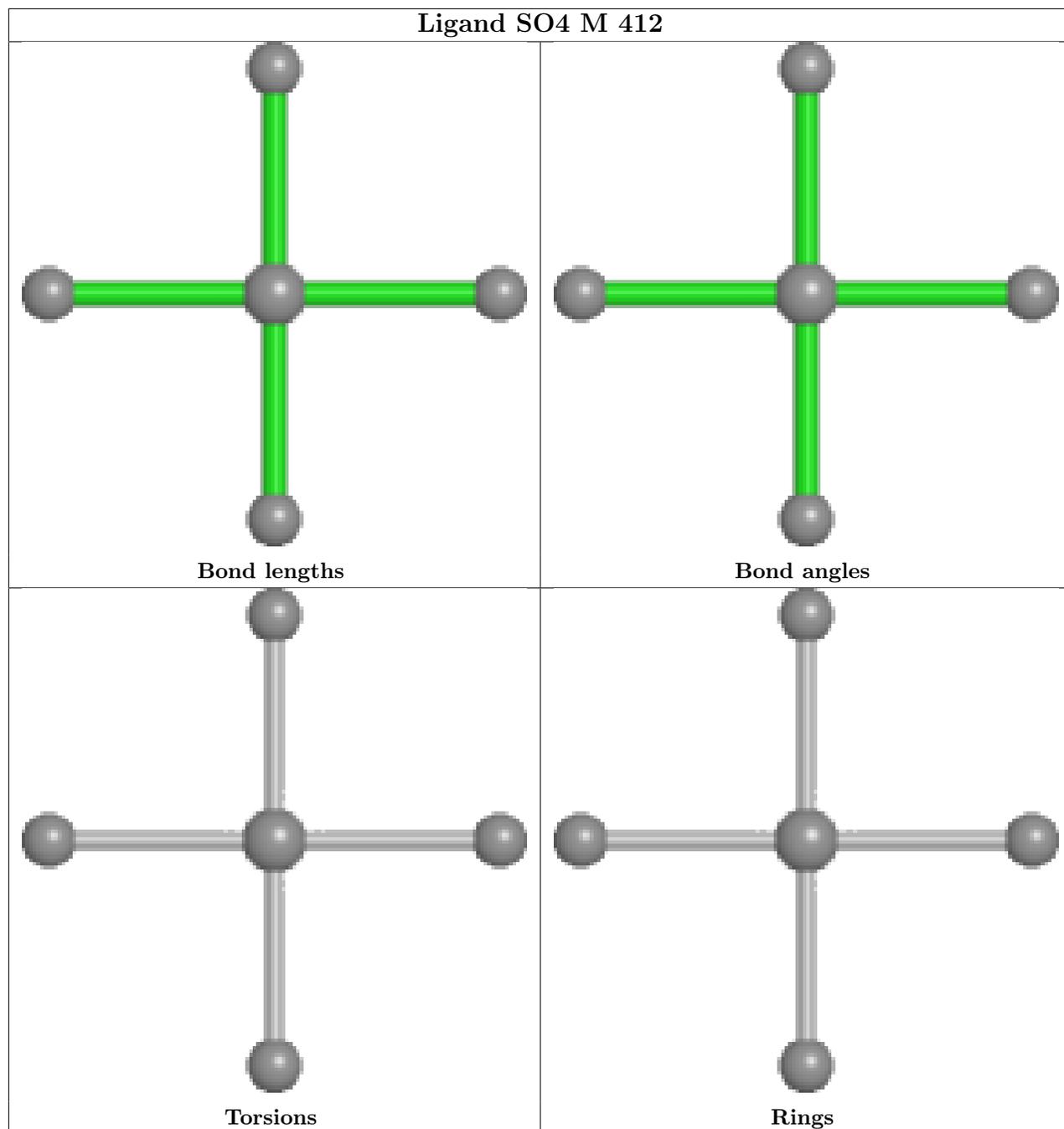


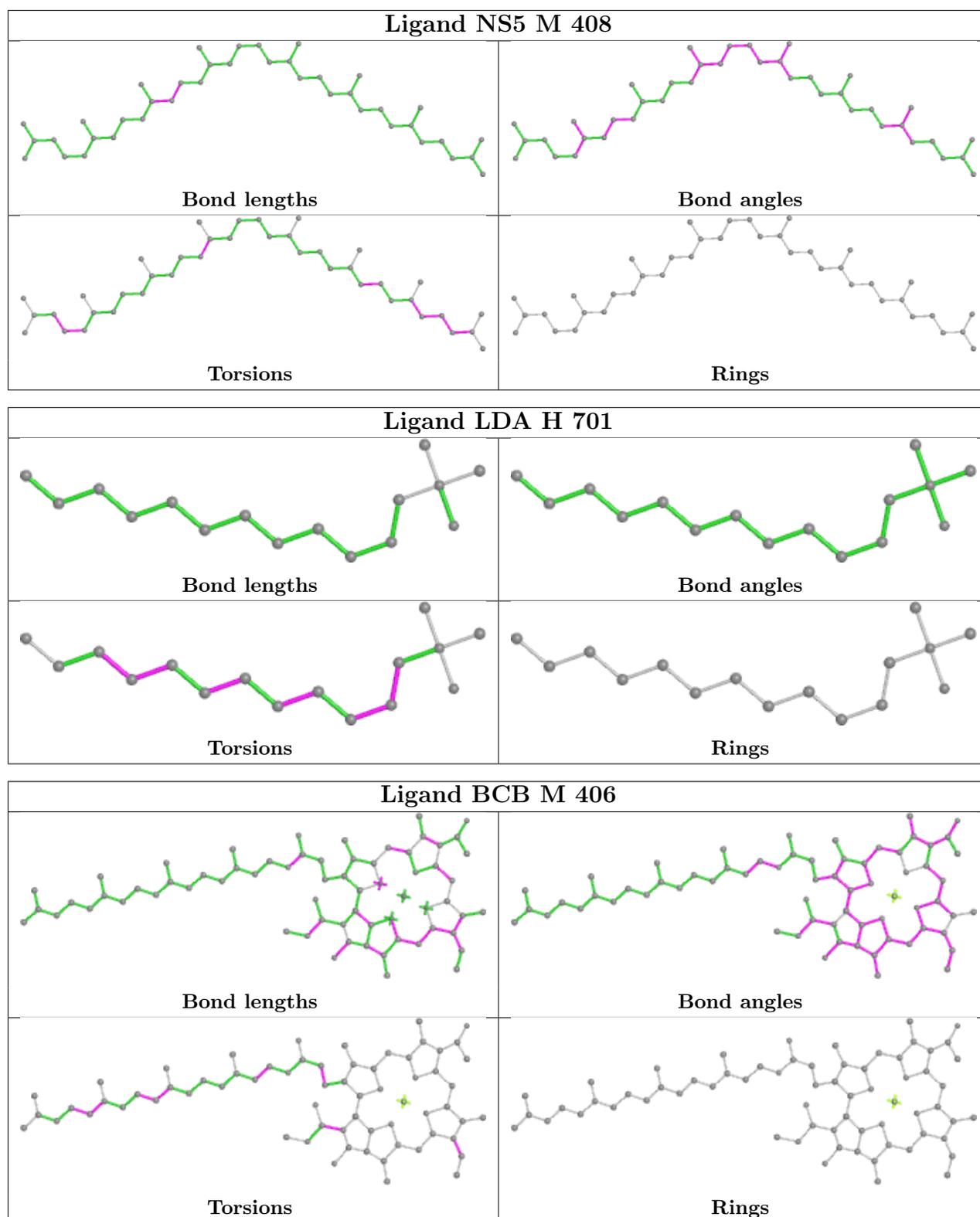


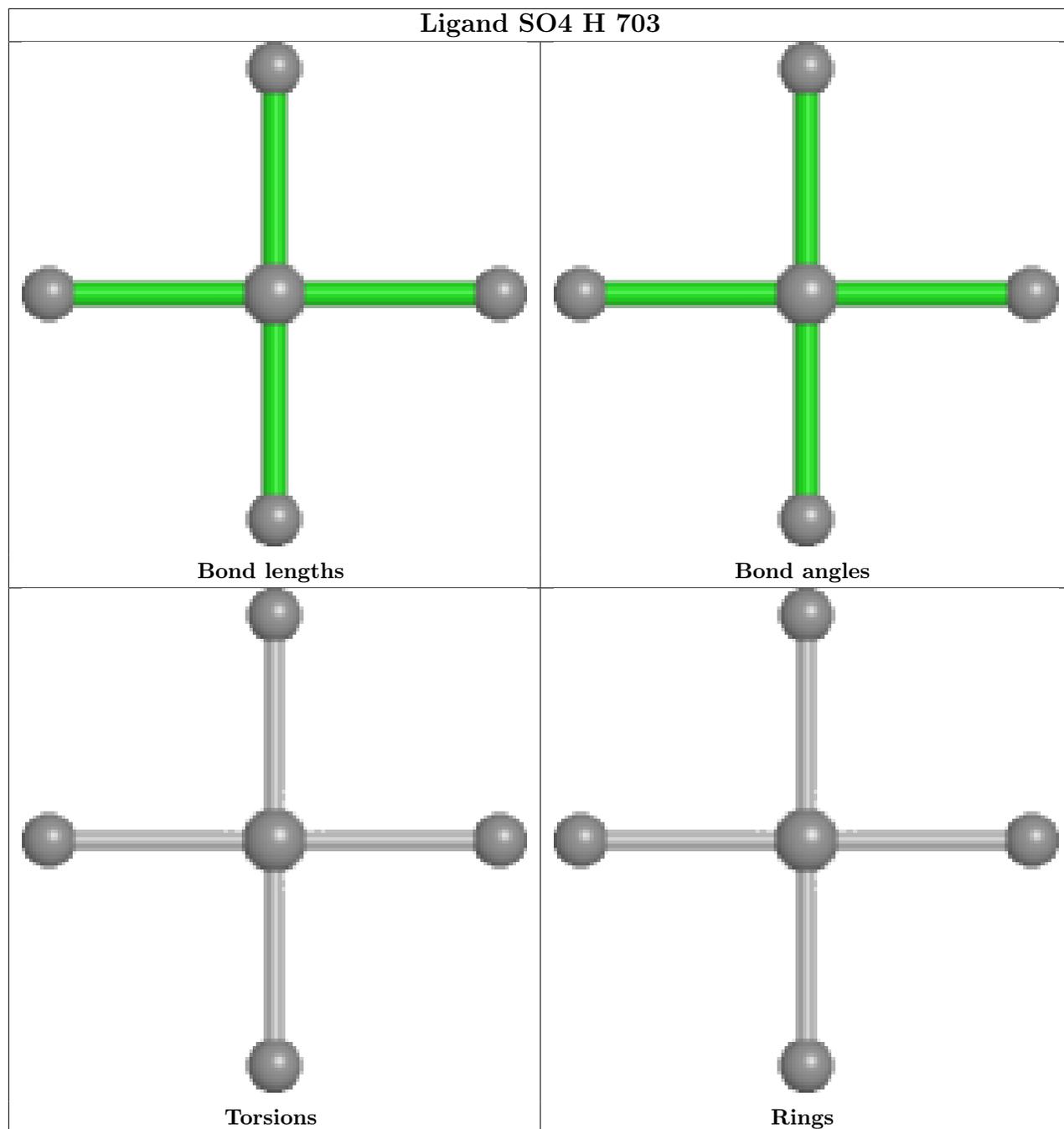


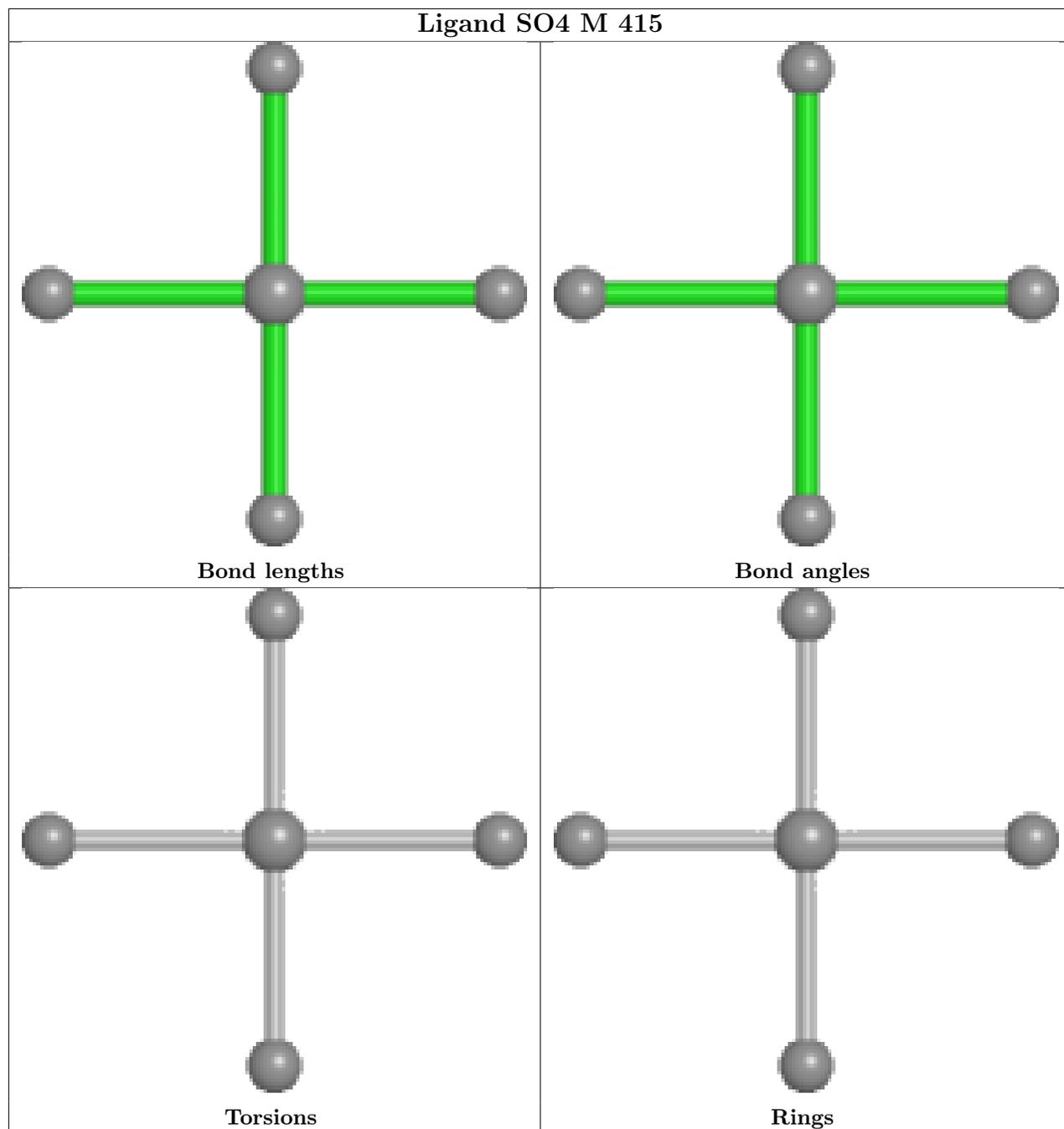


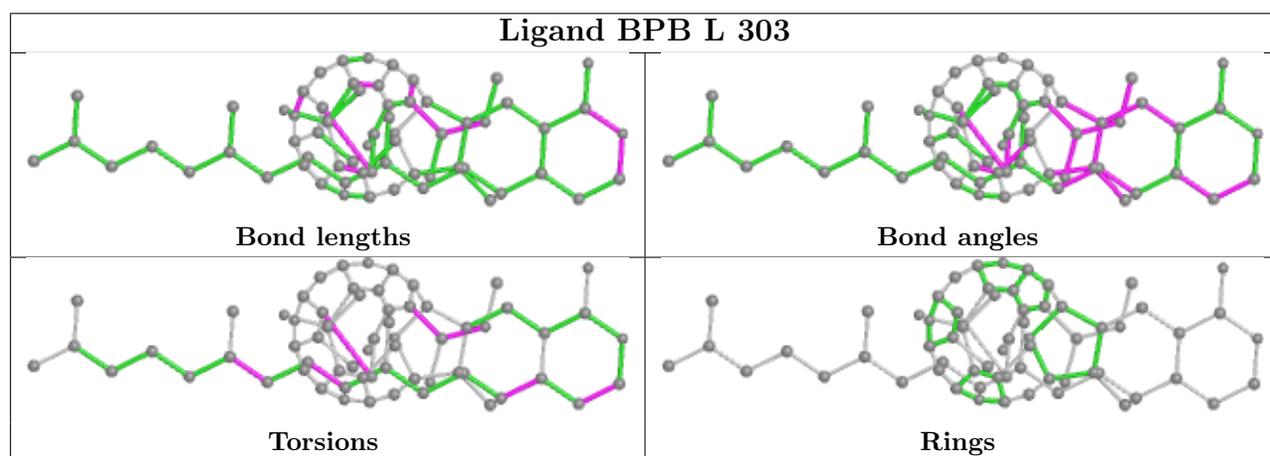
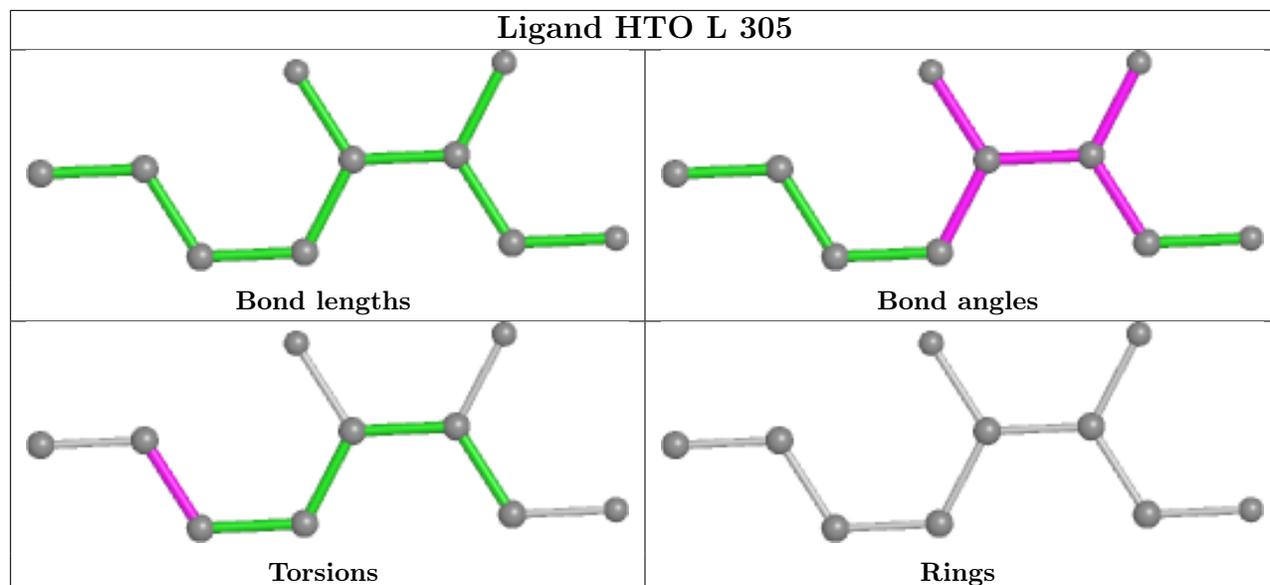


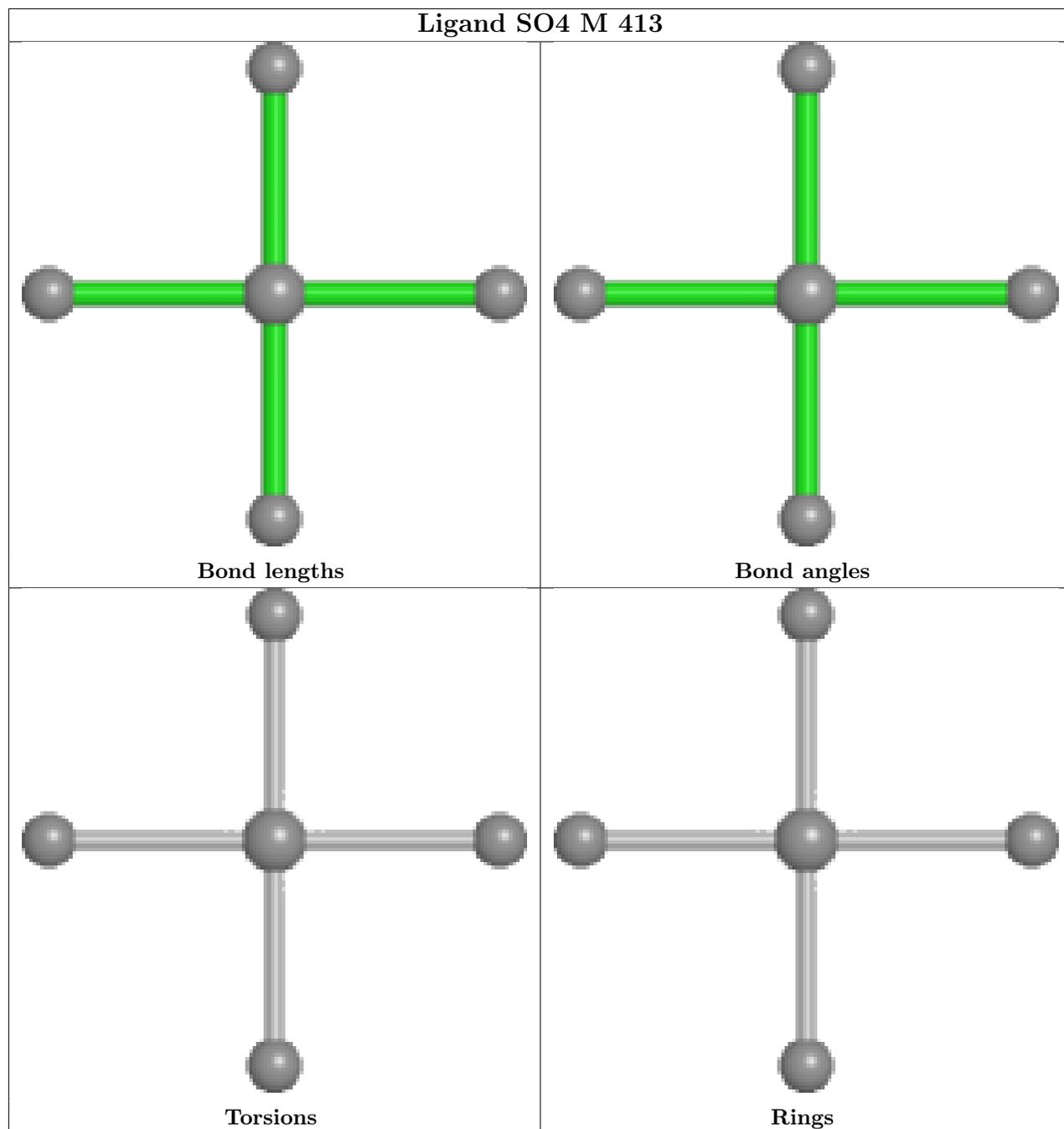


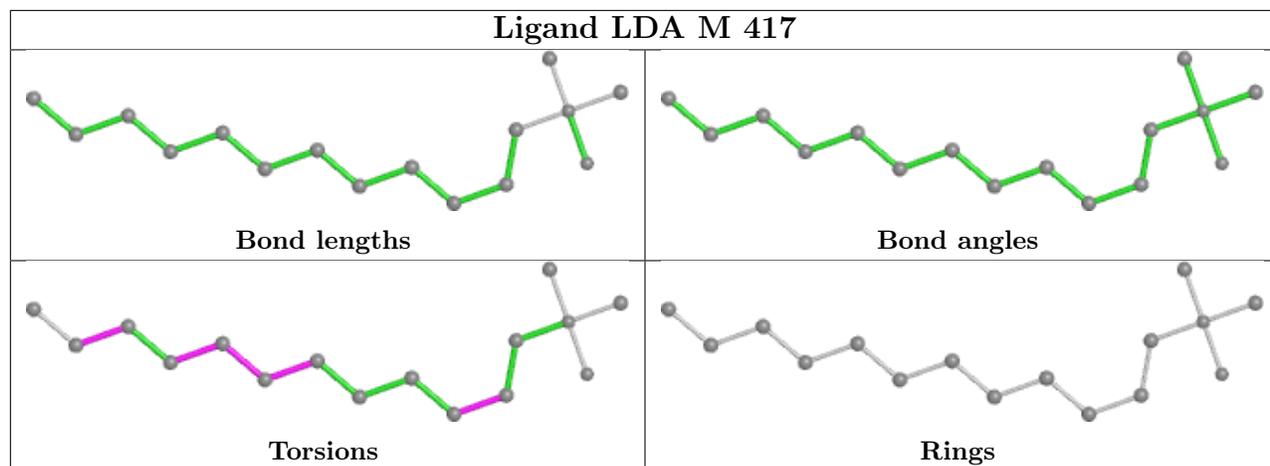


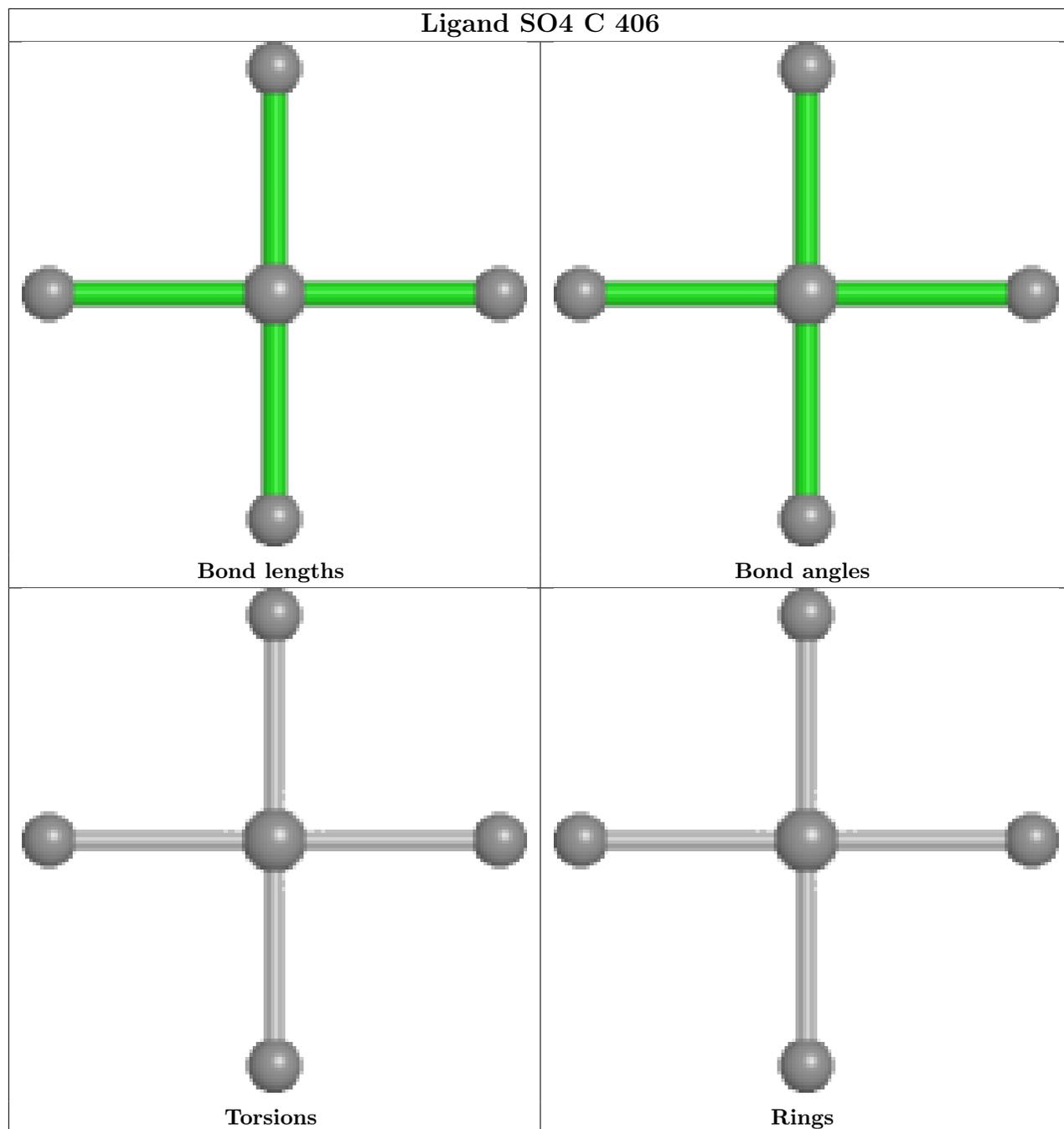


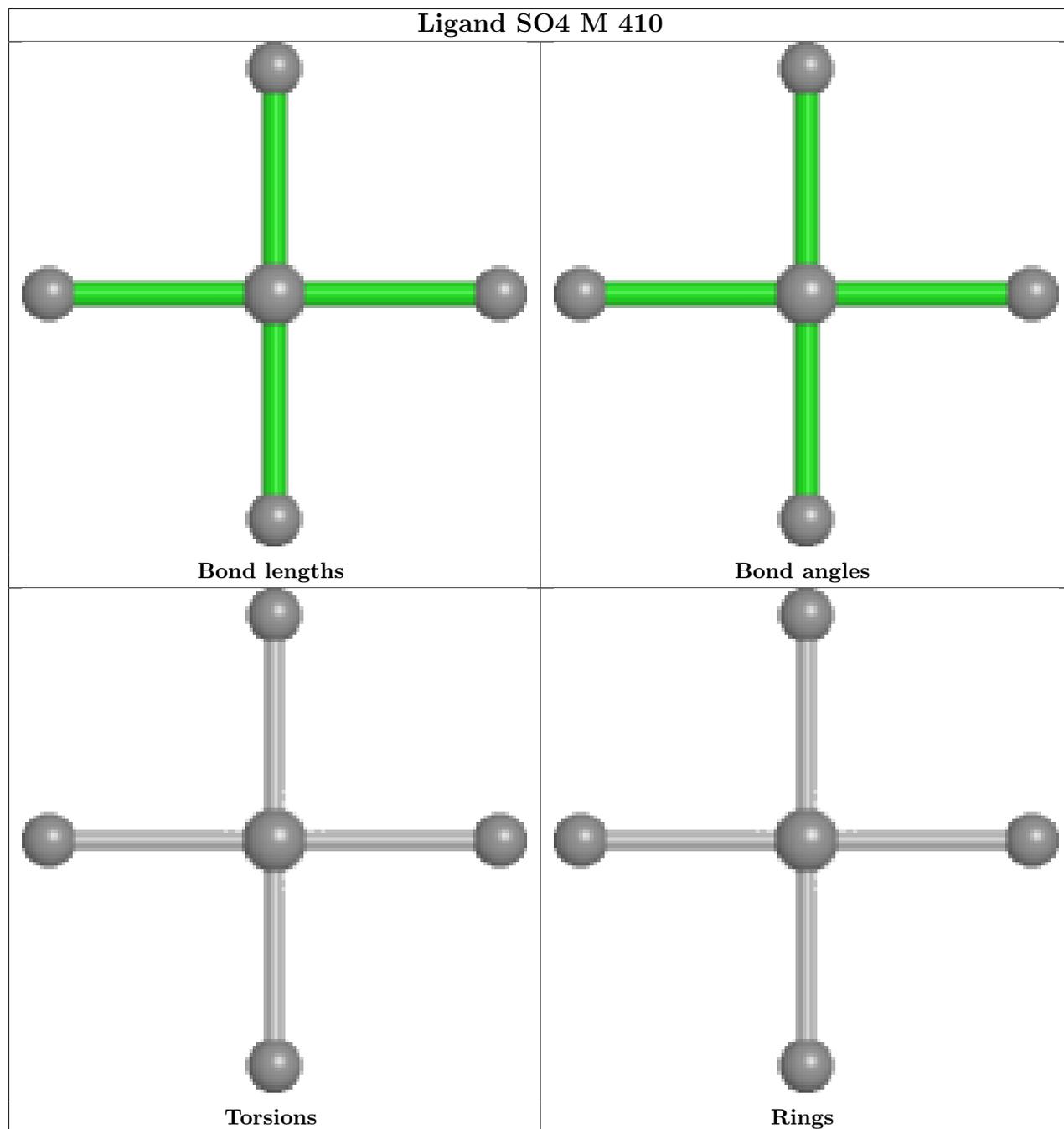


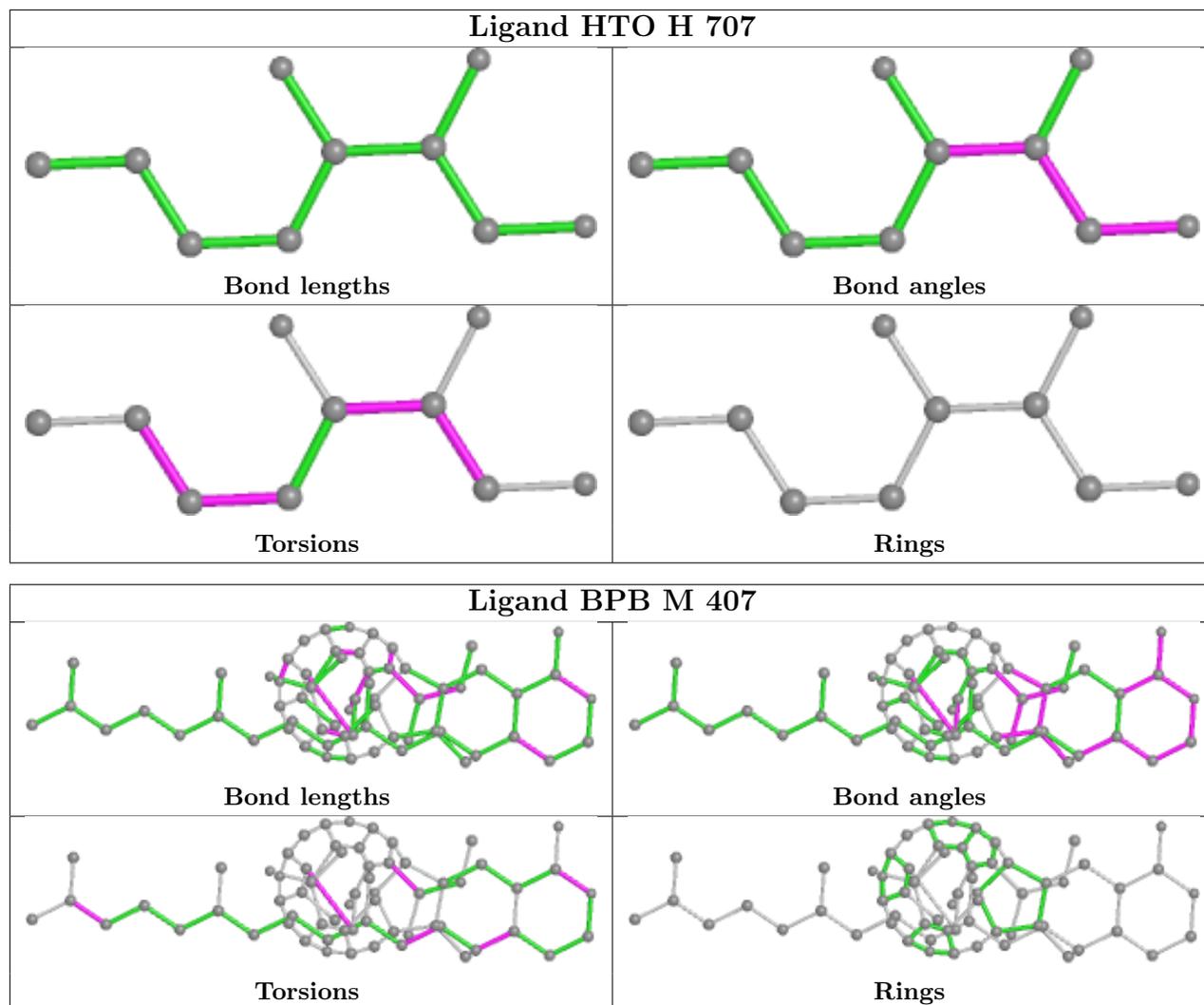


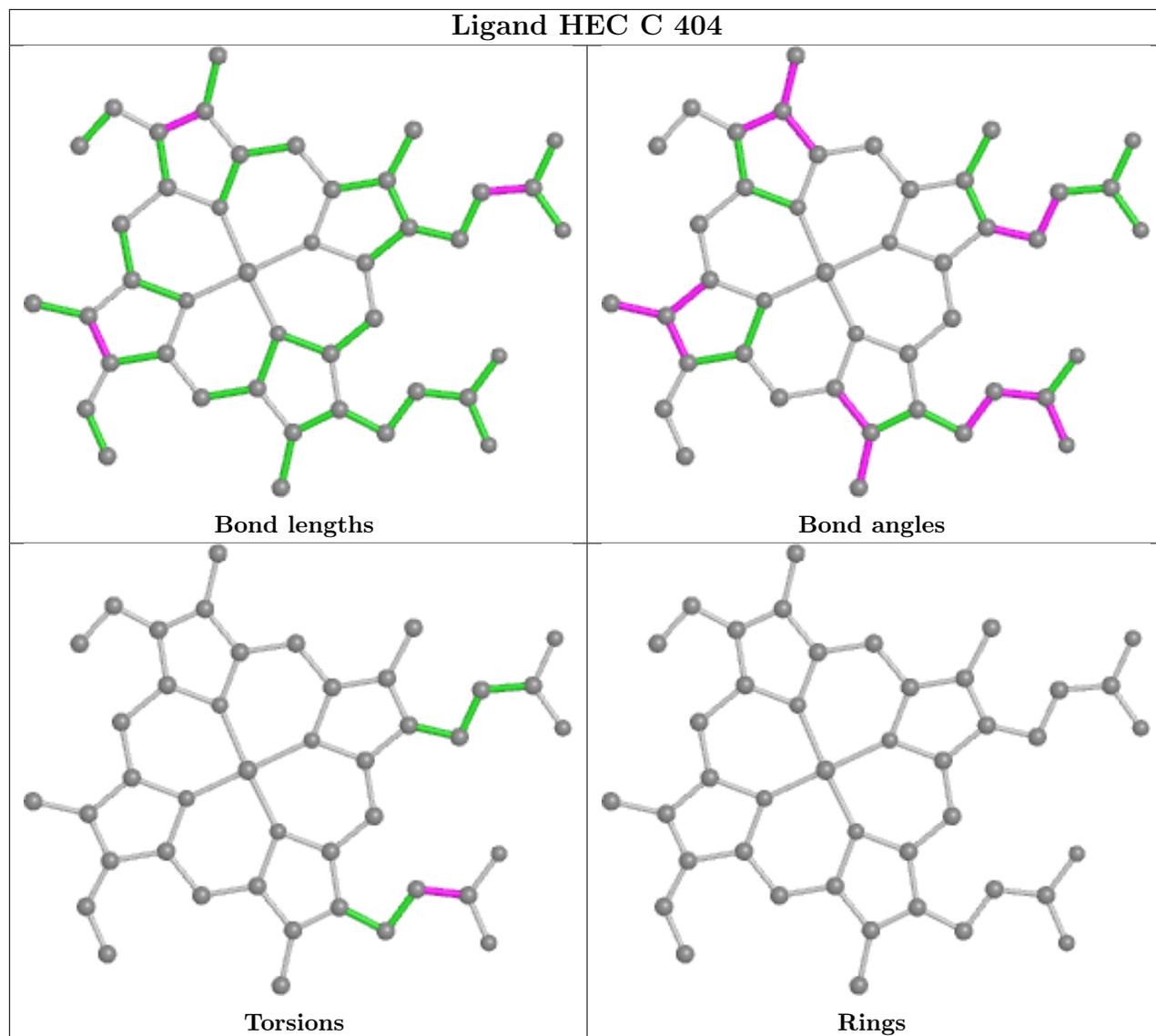


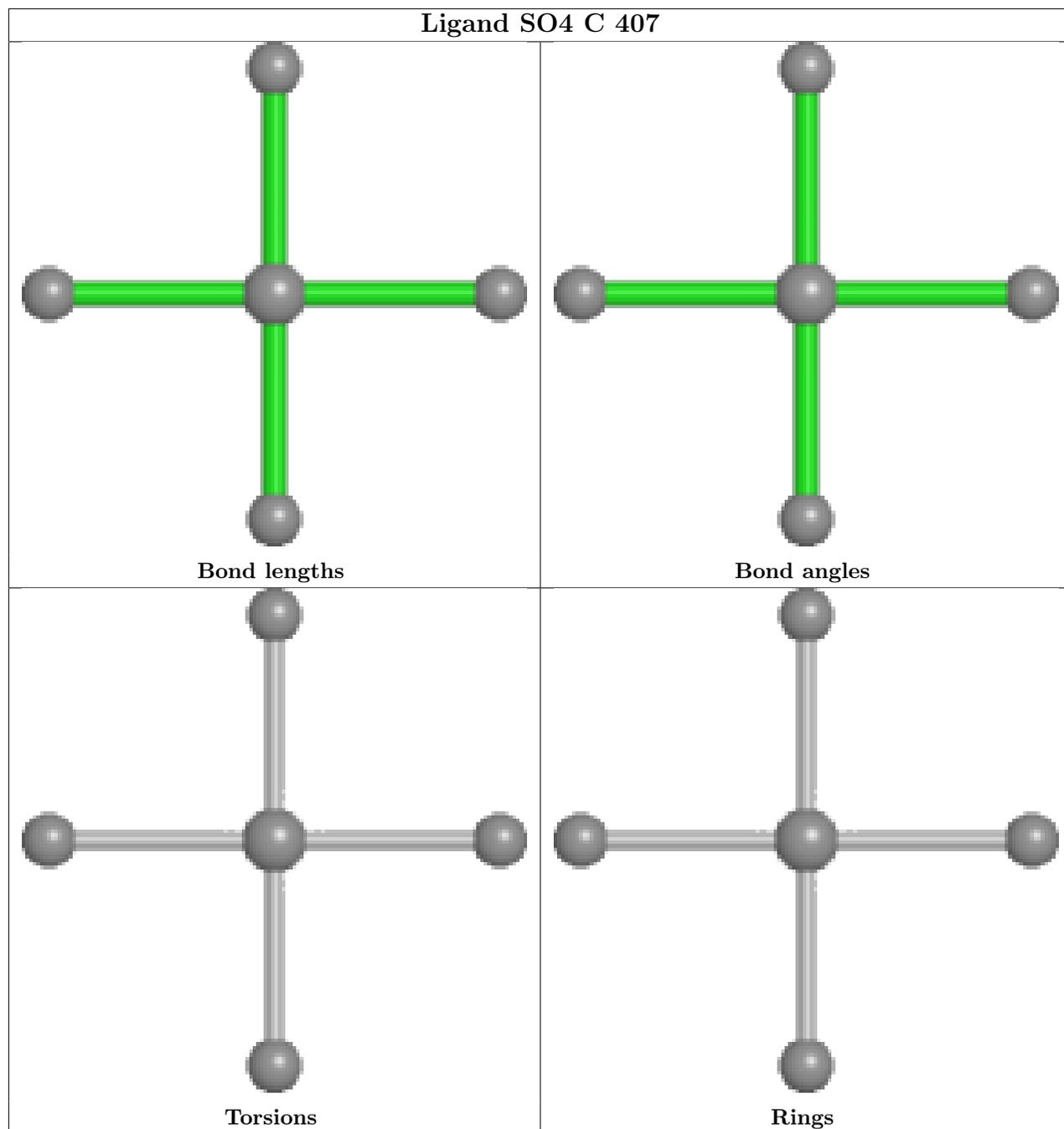


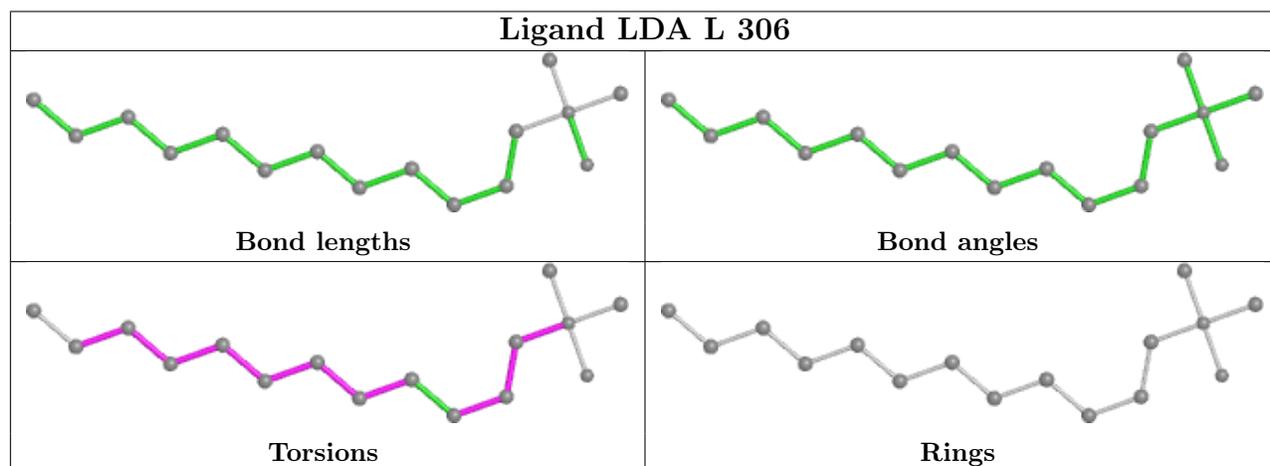
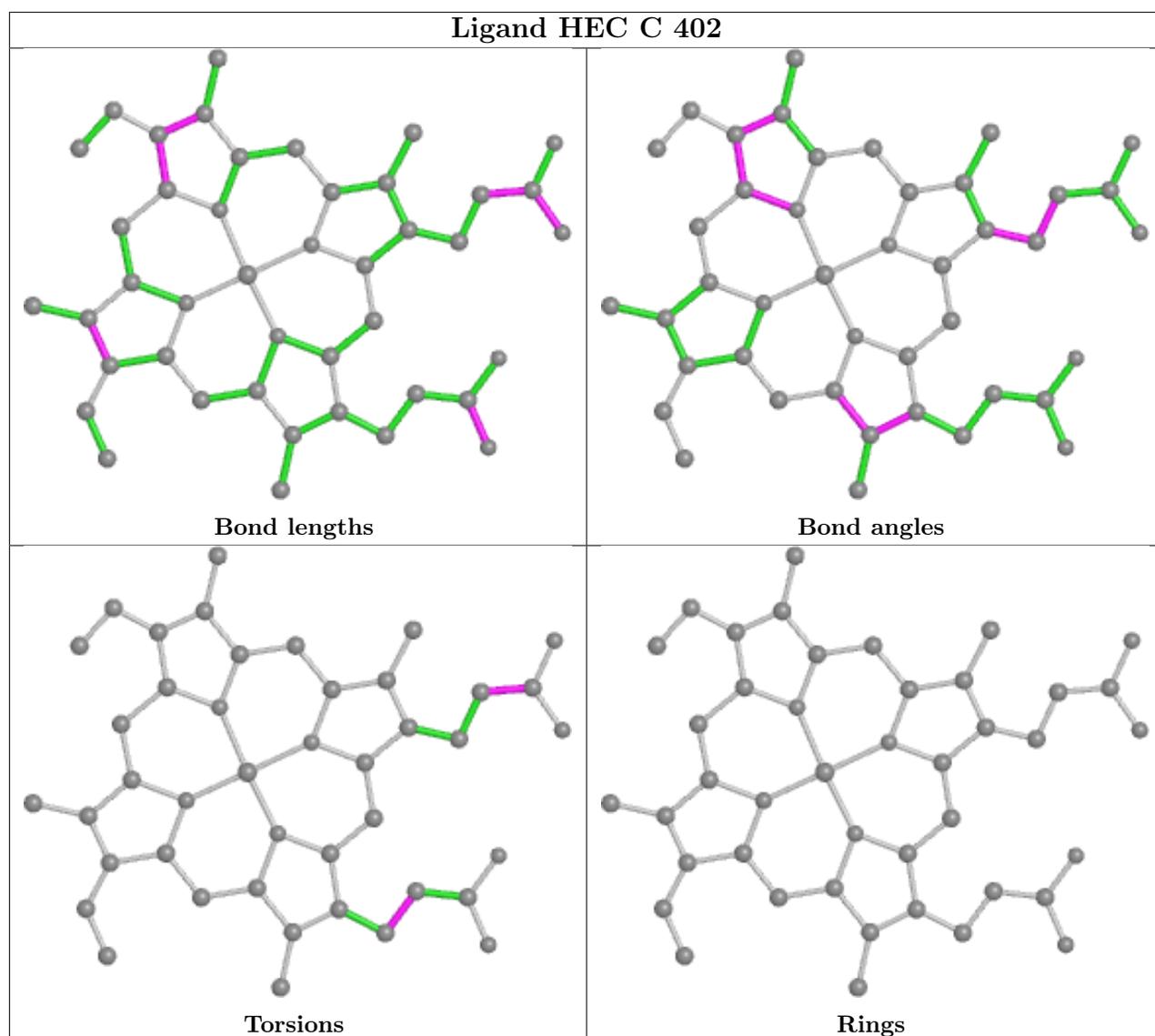


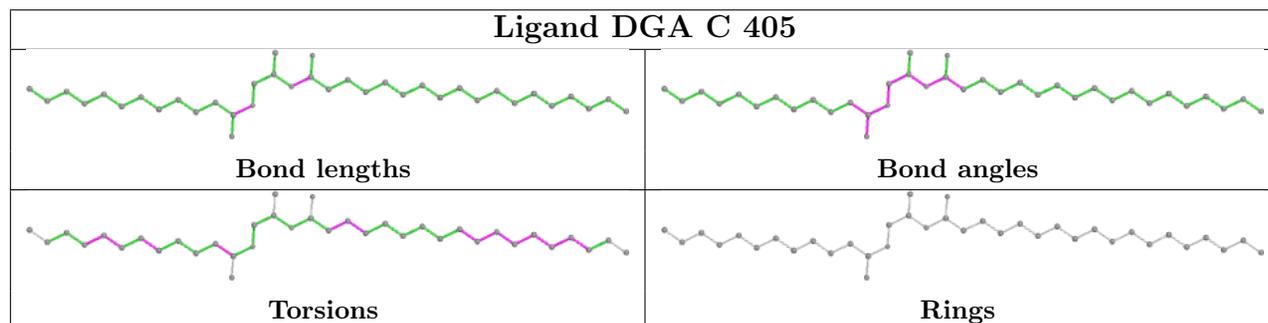
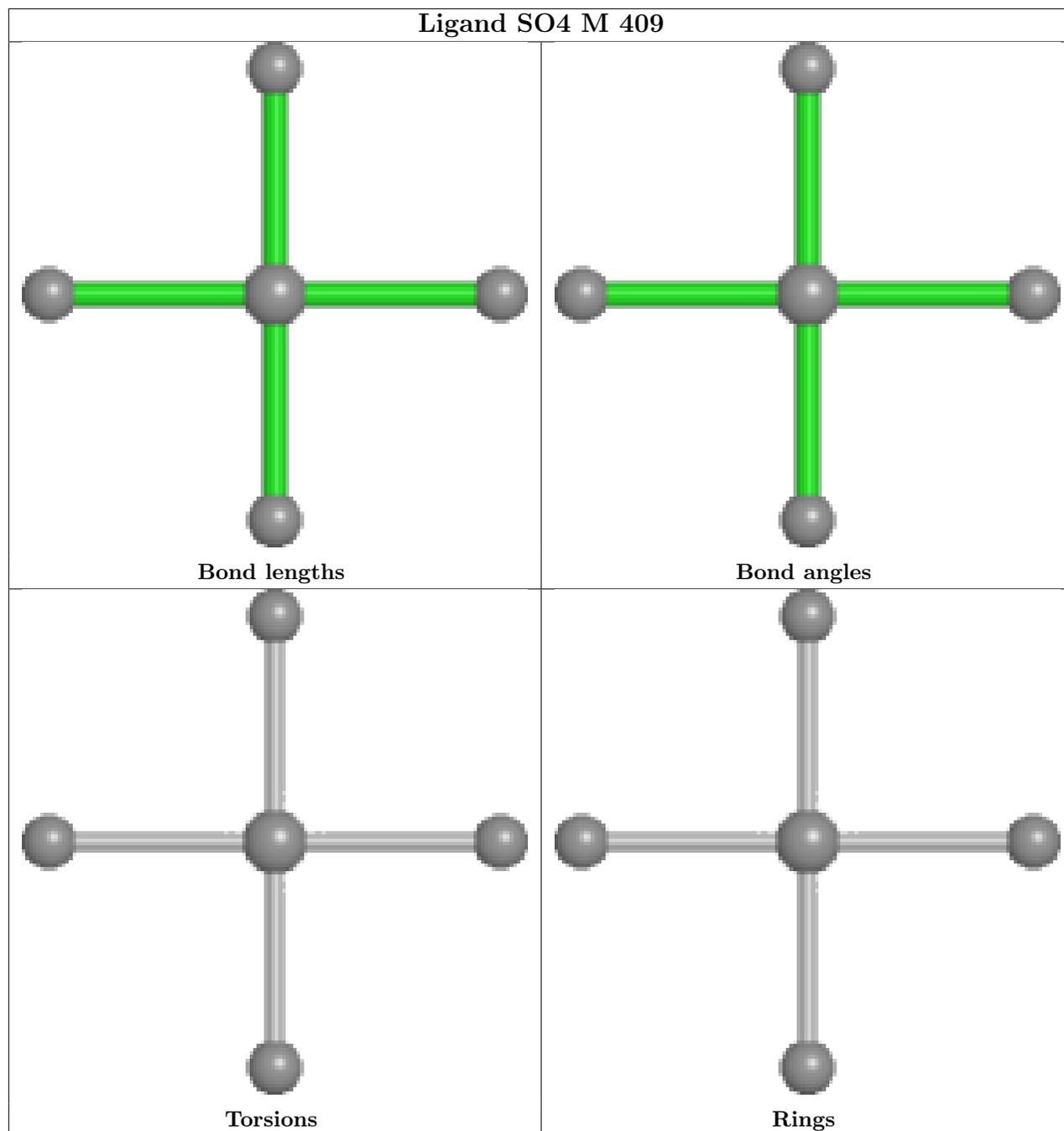


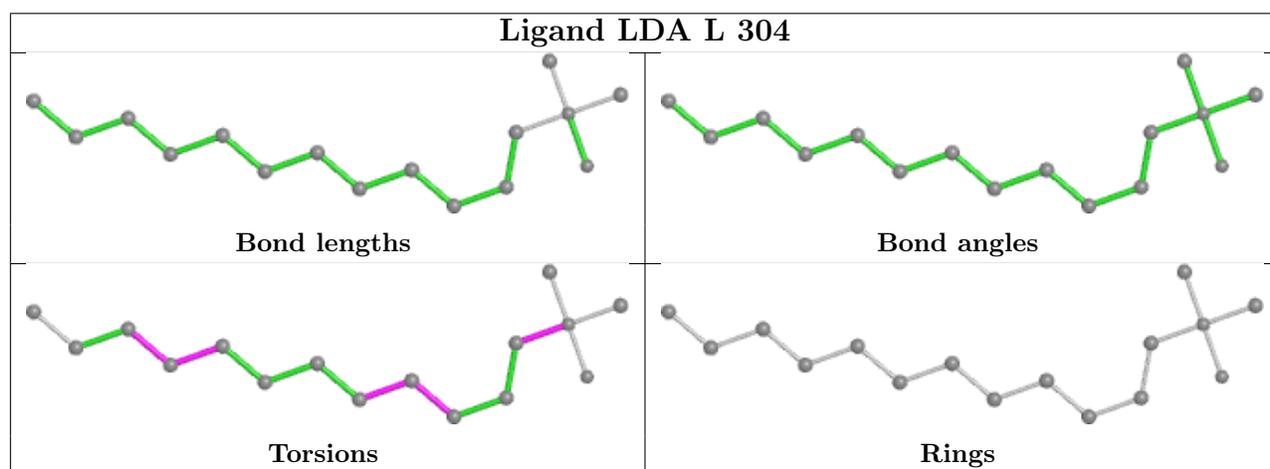
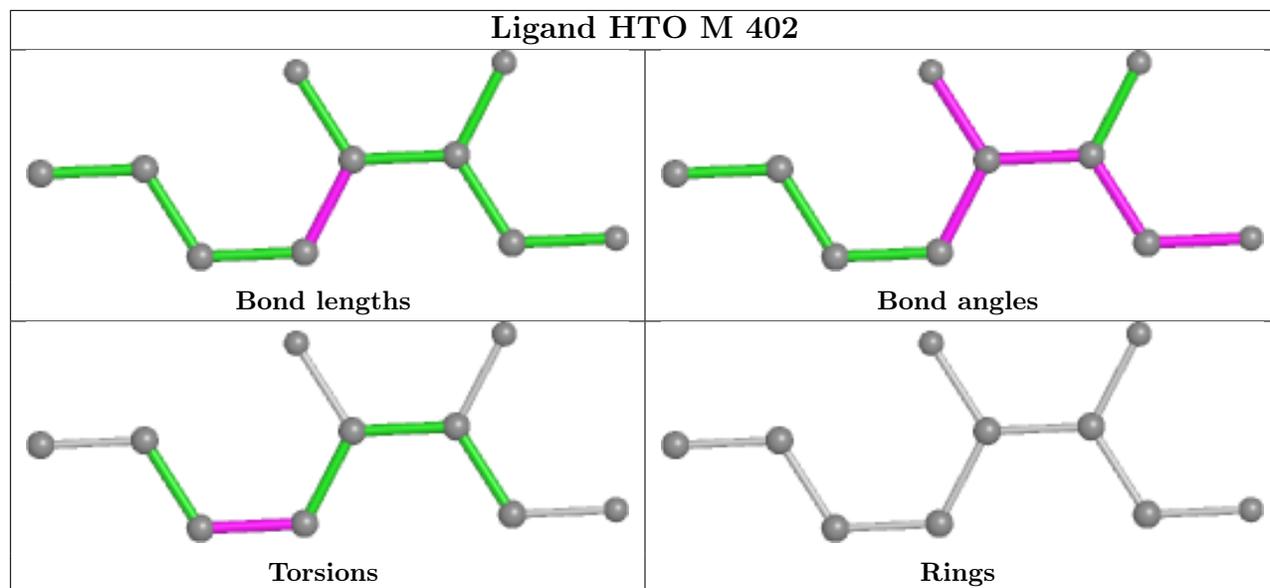


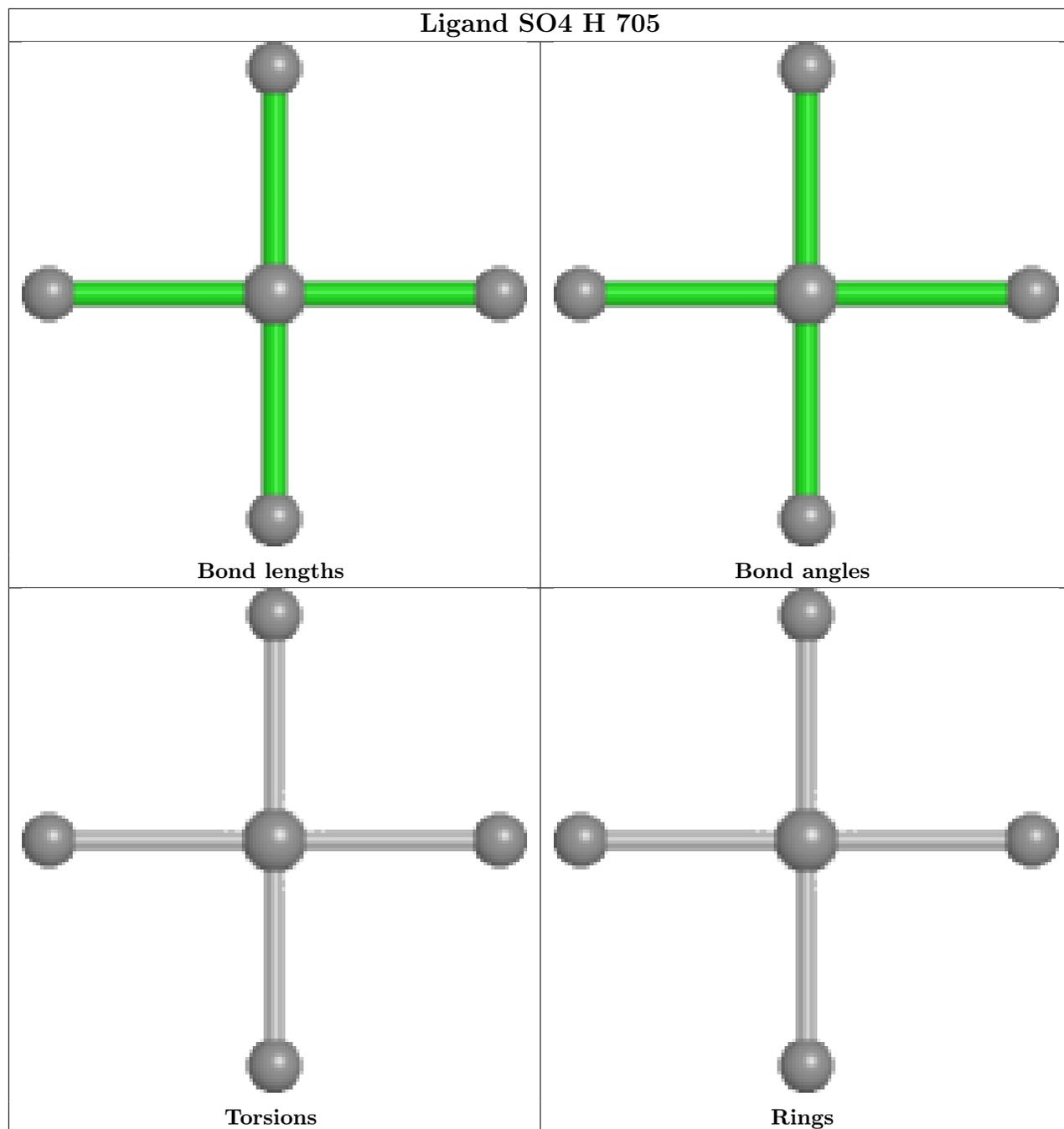


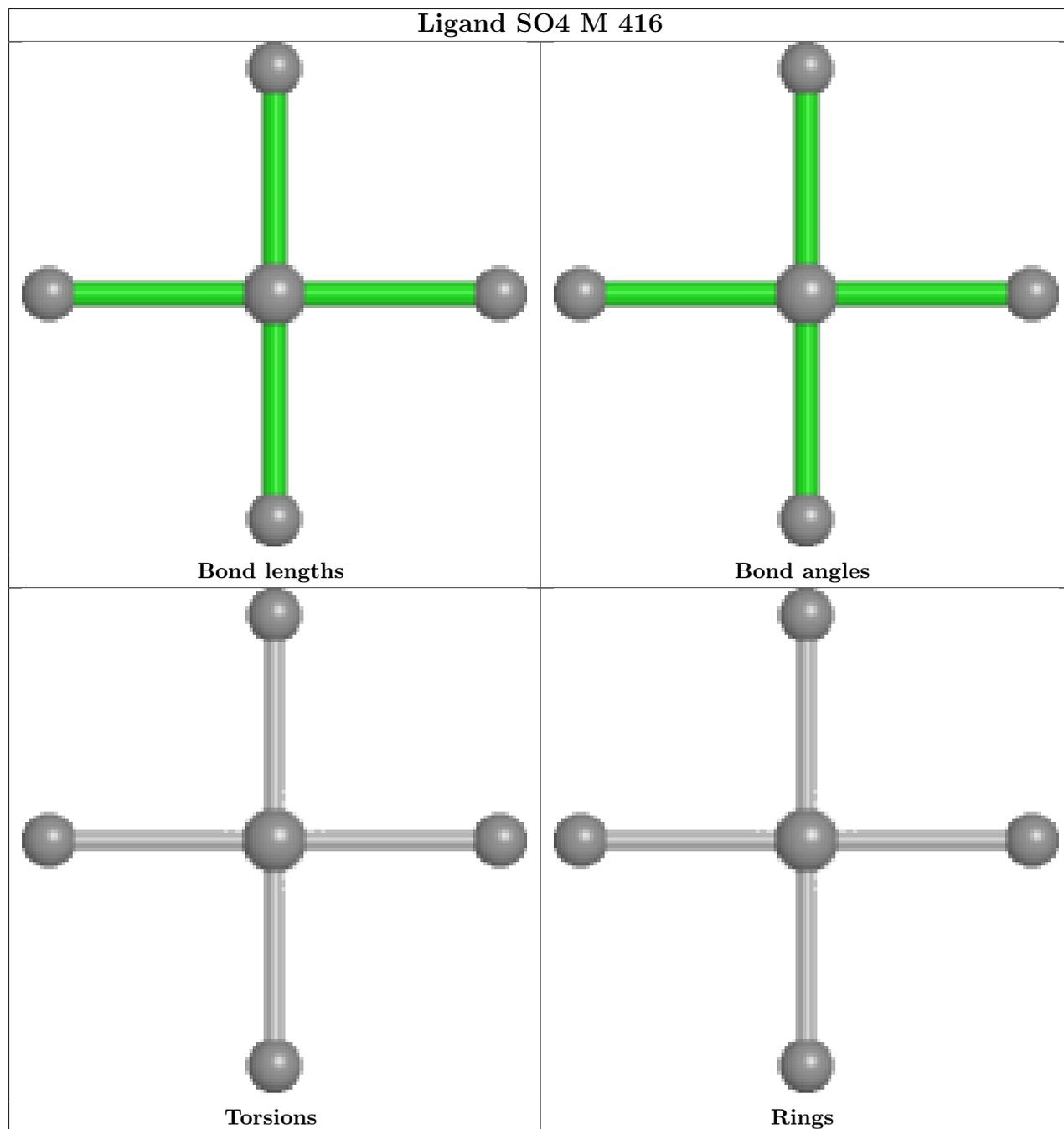


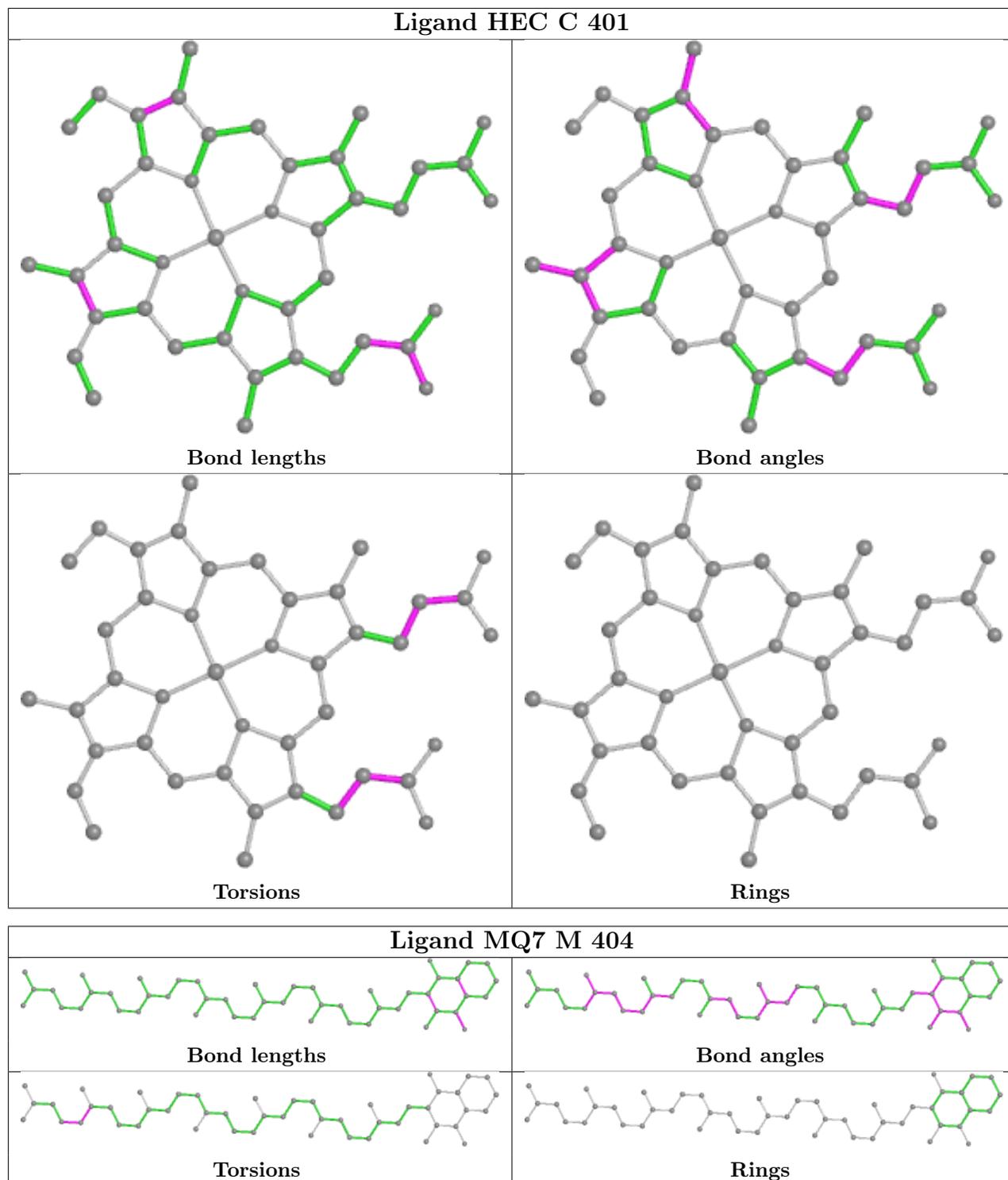


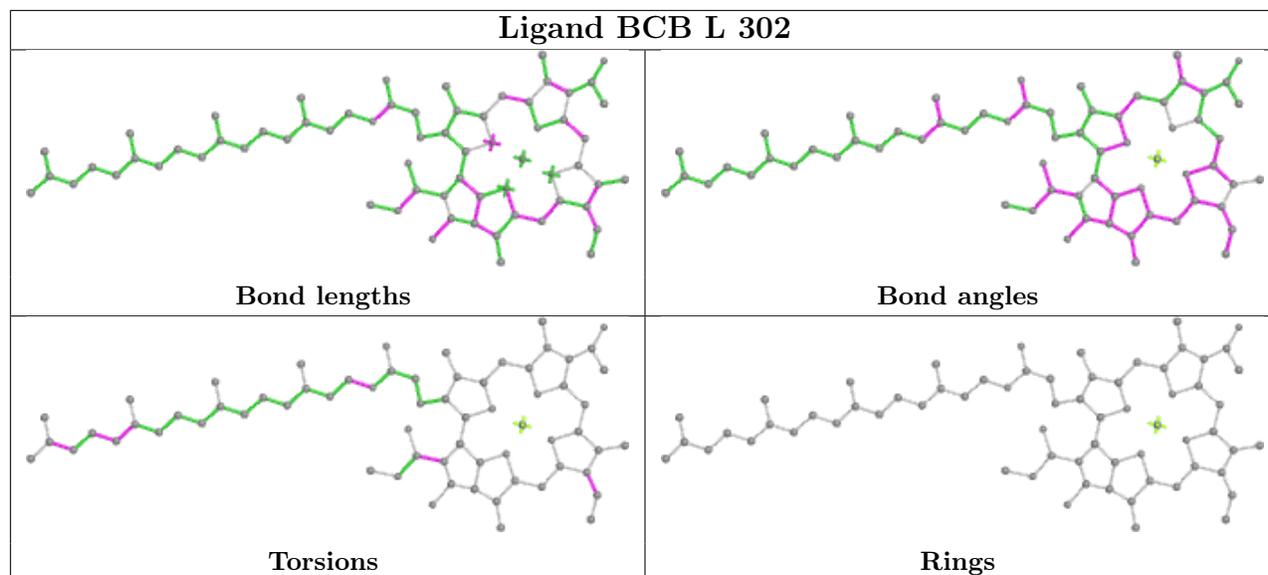












5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	C	332/336 (98%)	-0.16	6 (1%) 67 60	30, 48, 79, 107	0
2	H	257/258 (99%)	0.31	16 (6%) 28 21	31, 55, 105, 190	0
3	L	273/273 (100%)	-0.42	3 (1%) 77 71	26, 41, 72, 107	1 (0%)
4	M	323/323 (100%)	-0.25	4 (1%) 76 69	24, 44, 77, 97	0
All	All	1185/1190 (99%)	-0.14	29 (2%) 59 51	24, 47, 82, 190	1 (0%)

The worst 5 of 29 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	H	54	PRO	7.7
2	H	53	ALA	6.6
2	H	50	VAL	6.6
2	H	52	LEU	5.6
2	H	49	LEU	4.3

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q < 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	FME	H	1	10/11	0.89	0.16	50,57,76,88	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands i

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

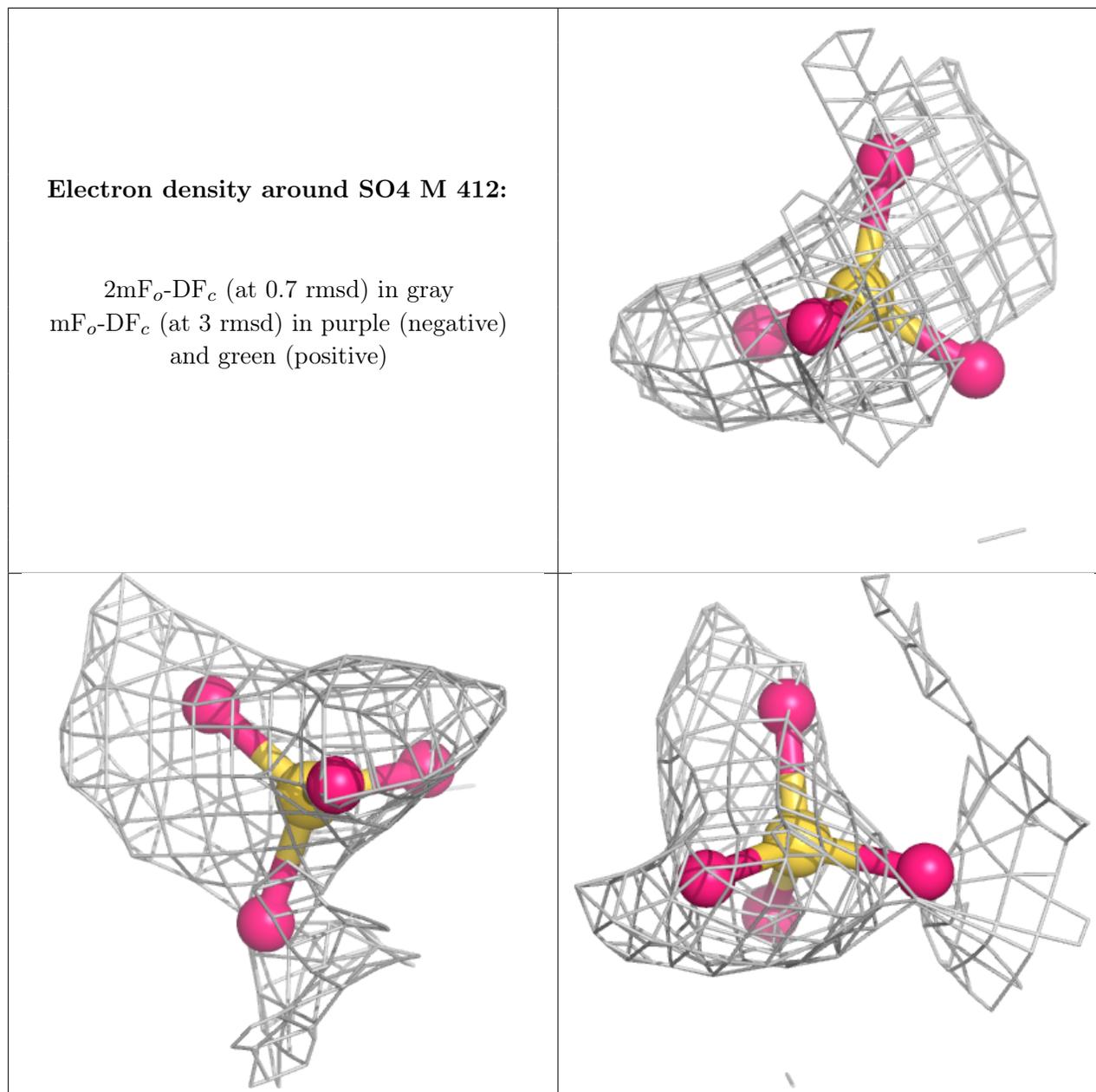
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
7	SO4	M	412	5/5	0.52	0.18	172,173,180,189	0
7	SO4	M	414	5/5	0.58	0.16	173,179,186,191	0
9	HTO	M	402	10/10	0.58	0.38	60,85,94,97	0
7	SO4	C	407	5/5	0.62	0.19	76,80,81,86	5
7	SO4	M	416	5/5	0.64	0.24	234,252,256,269	0
9	HTO	L	305	10/10	0.66	0.32	74,85,95,102	0
7	SO4	C	406	5/5	0.71	0.15	129,133,138,144	0
6	DGA	C	405	37/44	0.72	0.32	69,100,131,140	0
7	SO4	H	703	5/5	0.73	0.13	109,116,128,147	0
8	LDA	M	418	16/16	0.76	0.35	74,101,122,127	0
7	SO4	M	415	5/5	0.78	0.16	185,192,195,197	0
8	LDA	M	417	16/16	0.81	0.38	91,104,132,138	0
8	LDA	L	306	16/16	0.82	0.31	69,90,110,114	0
7	SO4	C	408	5/5	0.83	0.15	56,60,65,67	5
9	HTO	H	707	10/10	0.84	0.21	55,80,85,95	0
7	SO4	H	704	5/5	0.85	0.24	56,58,63,63	5
8	LDA	L	304	16/16	0.86	0.33	99,120,136,136	0
7	SO4	M	410	5/5	0.87	0.14	75,82,88,99	0
7	SO4	M	413	5/5	0.87	0.16	52,53,57,60	5
8	LDA	M	401	16/16	0.89	0.26	71,92,125,138	0
14	NS5	M	408	40/40	0.89	0.21	41,65,103,108	0
8	LDA	H	706	16/16	0.90	0.23	51,83,108,110	0
11	BPB	M	407	65/65	0.93	0.15	36,44,139,149	0
7	SO4	H	702	5/5	0.93	0.14	79,82,87,88	0
13	MQ7	M	404	48/48	0.94	0.12	30,37,74,88	0
10	BCB	M	405	66/66	0.95	0.14	28,36,129,137	0
8	LDA	H	701	16/16	0.96	0.12	36,50,61,64	0
10	BCB	M	406	66/66	0.96	0.09	22,28,48,51	0
7	SO4	M	411	5/5	0.96	0.08	47,49,56,68	0
10	BCB	L	301	66/66	0.96	0.09	22,31,45,51	0
10	BCB	L	302	66/66	0.96	0.10	27,31,59,68	0
7	SO4	M	409	5/5	0.97	0.08	59,61,66,67	0
5	HEC	C	401	43/43	0.97	0.09	40,51,73,78	0
11	BPB	L	303	65/65	0.97	0.07	22,29,40,44	0
5	HEC	C	402	43/43	0.98	0.07	33,46,55,61	0
5	HEC	C	403	43/43	0.98	0.08	26,35,44,48	0
5	HEC	C	404	43/43	0.98	0.08	30,39,56,81	0

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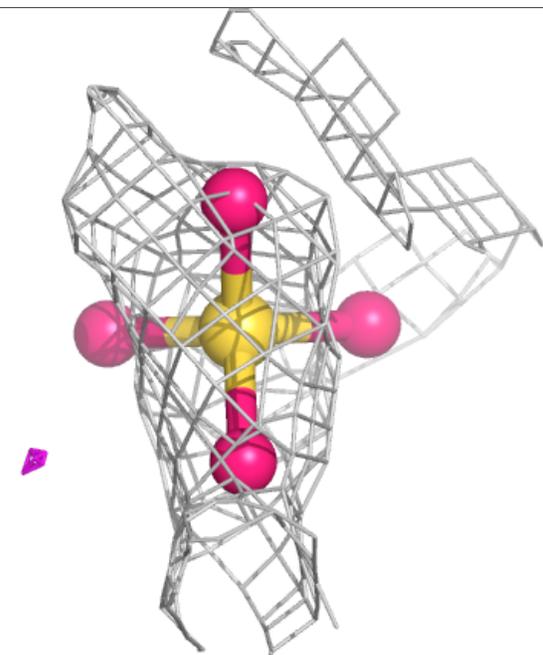
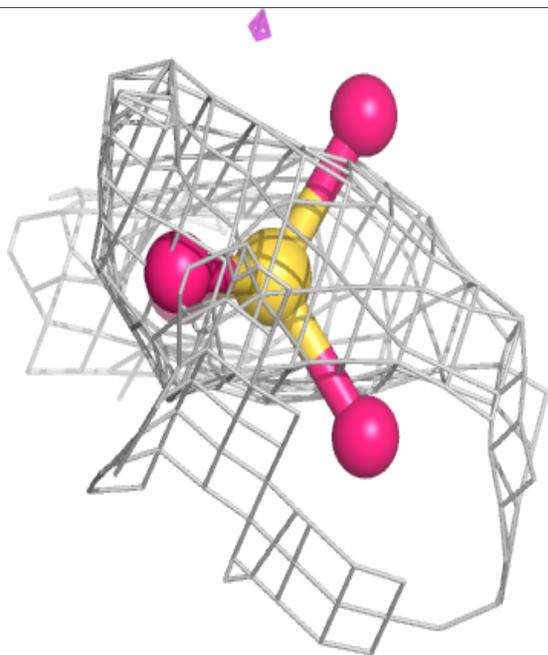
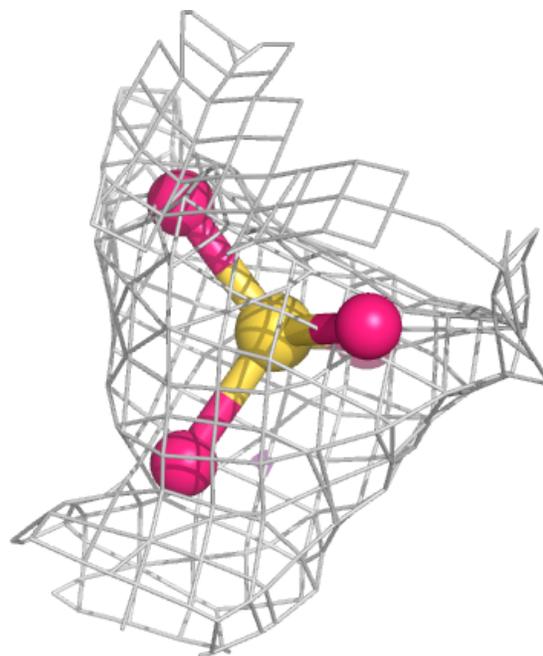
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
7	SO4	H	705	5/5	0.99	0.08	47,48,49,49	5
12	FE2	M	403	1/1	1.00	0.01	35,35,35,35	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



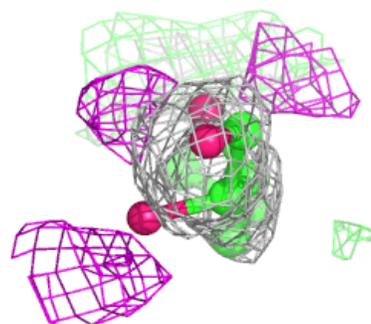
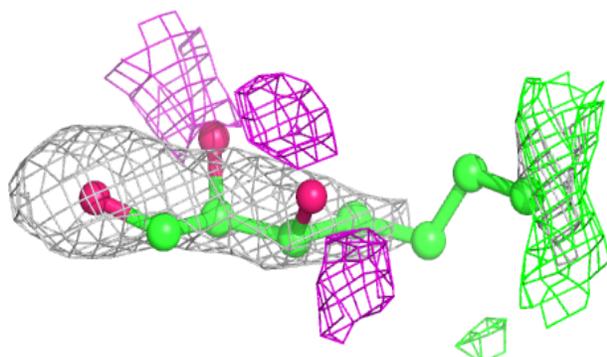
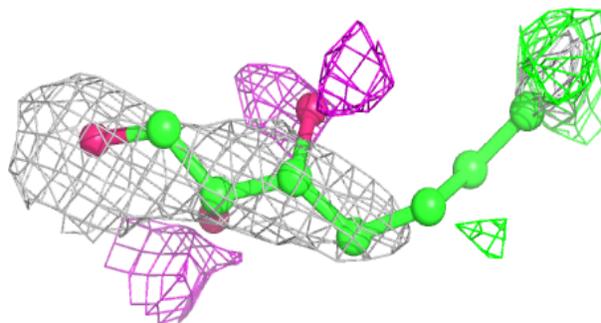
Electron density around SO4 M 414:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

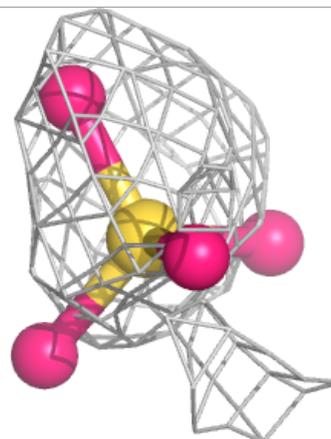
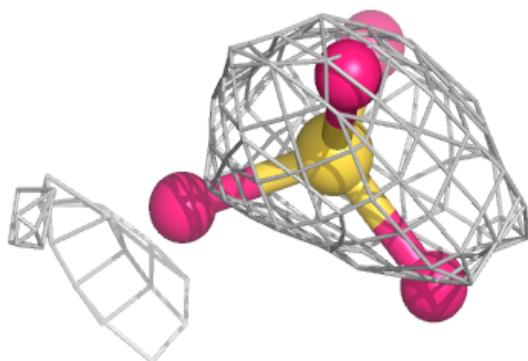
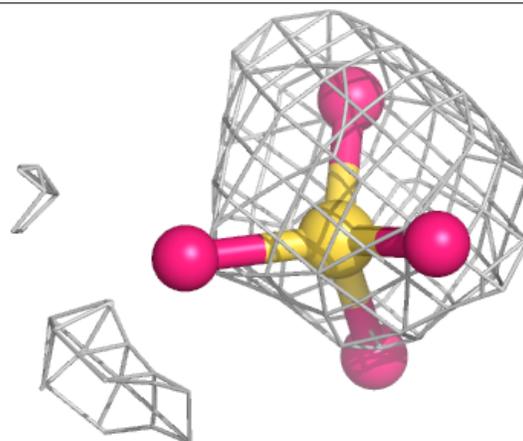


Electron density around HTO M 402:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

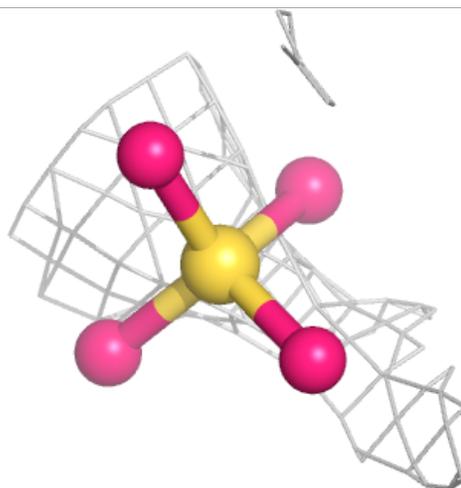
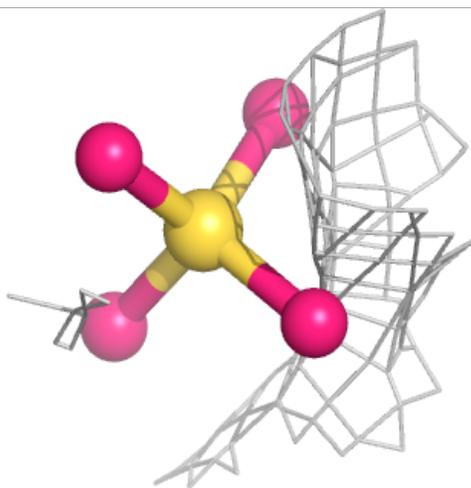
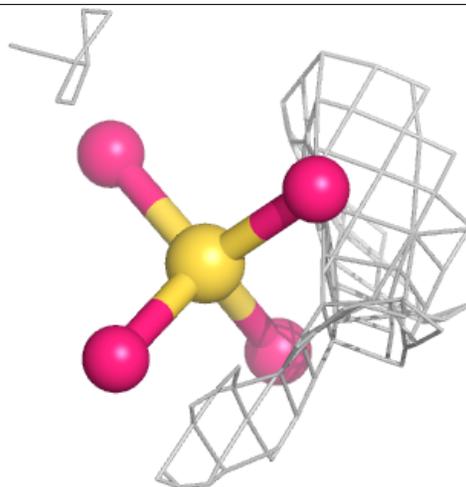
**Electron density around SO4 C 407:**

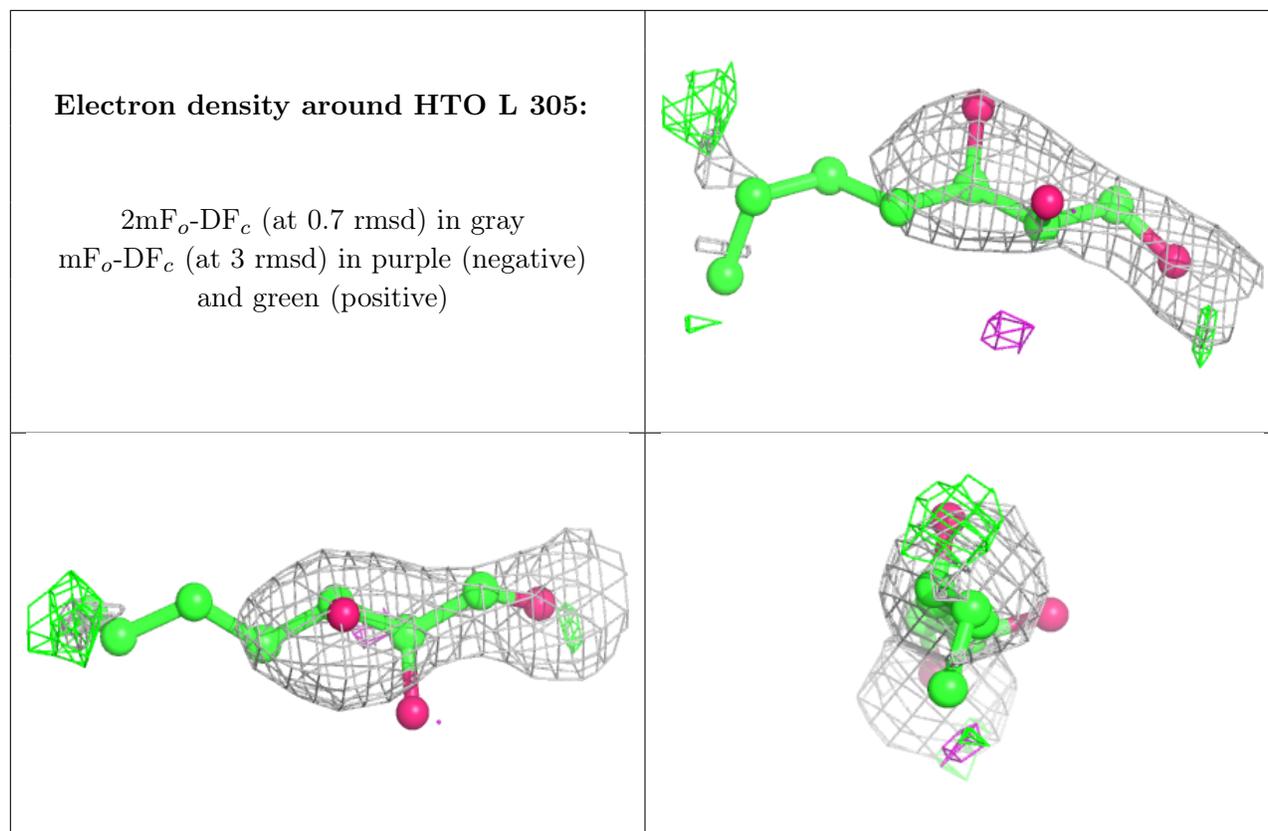
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and green (positive)



Electron density around SO4 M 416:

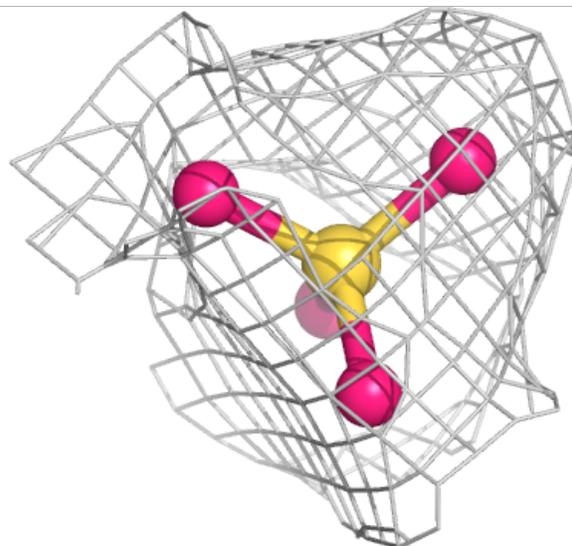
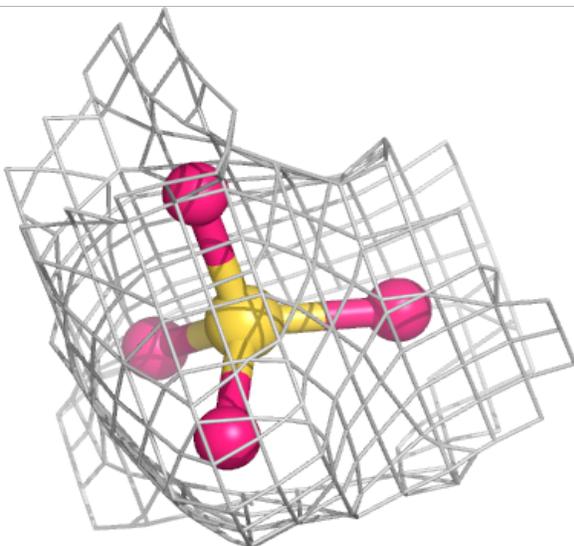
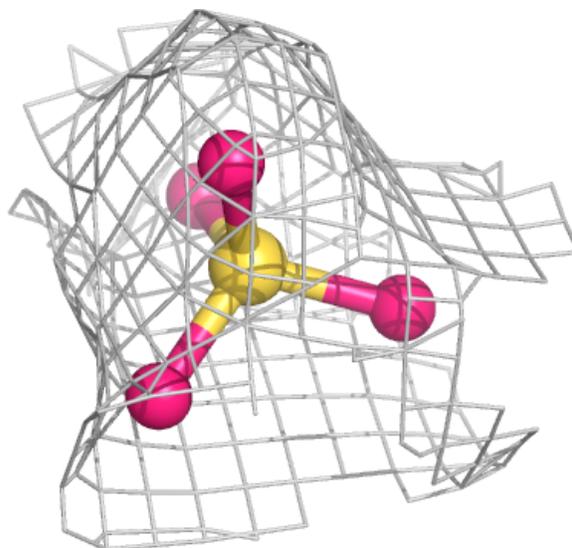
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and green (positive)





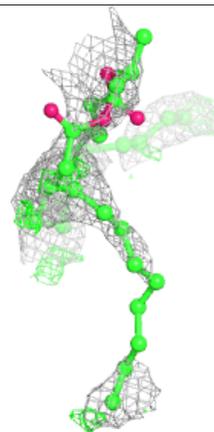
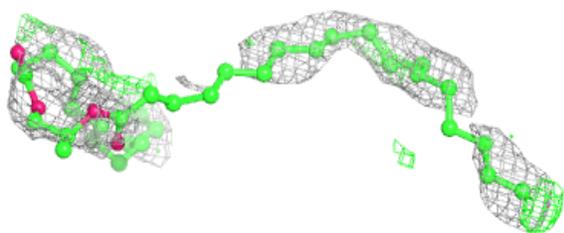
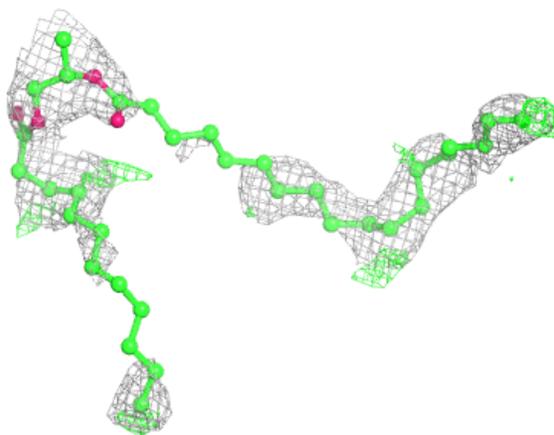
Electron density around SO4 C 406:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



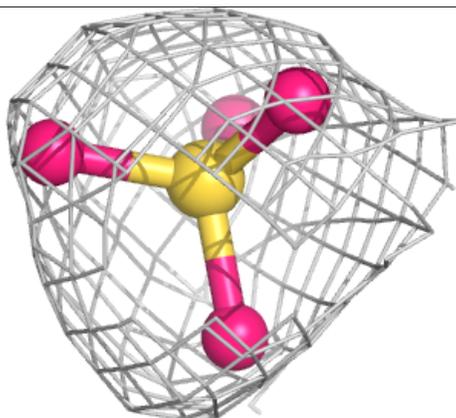
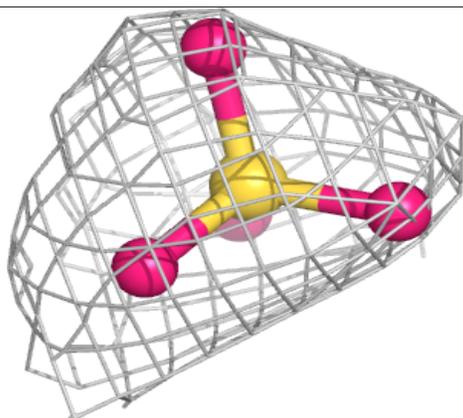
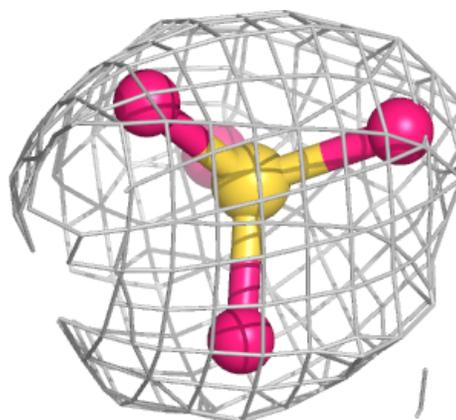
Electron density around DGA C 405:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

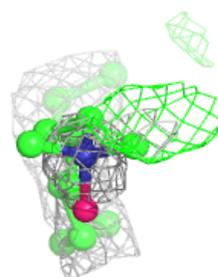
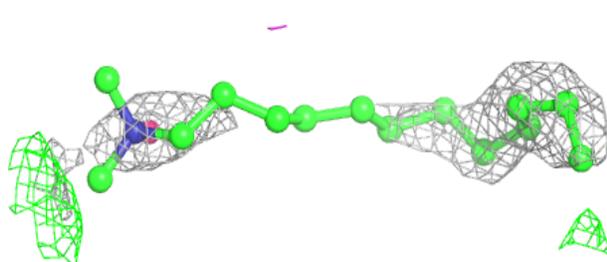
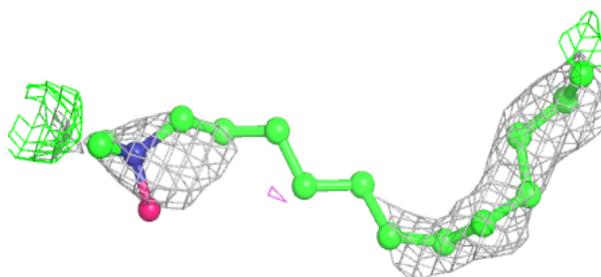


Electron density around SO4 H 703:

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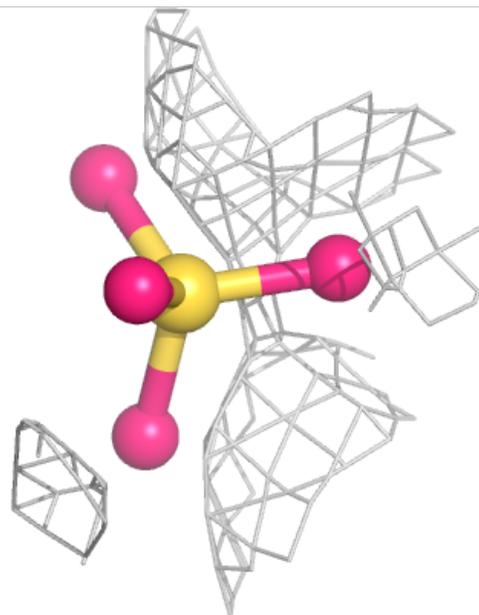
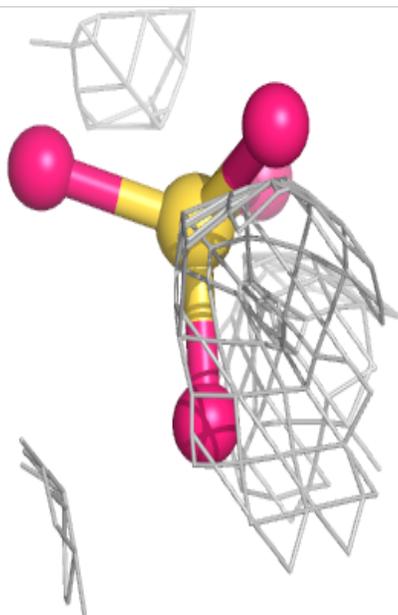
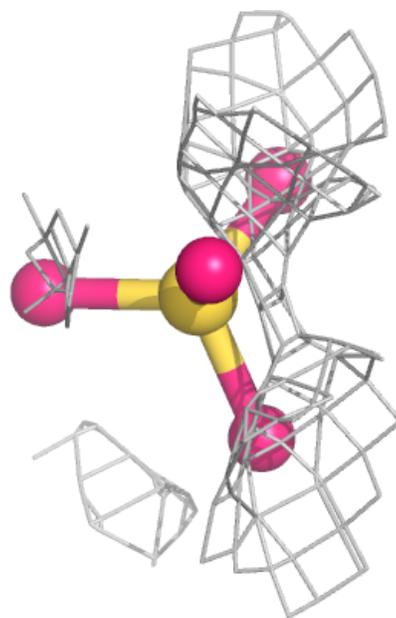
**Electron density around LDA M 418:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
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and green (positive)



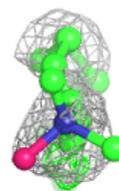
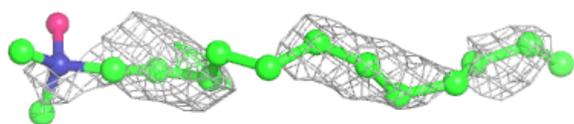
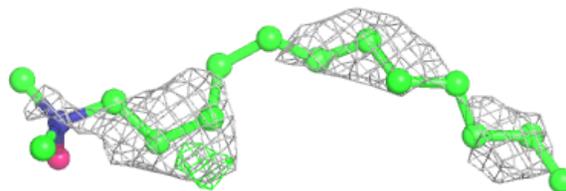
Electron density around SO4 M 415:

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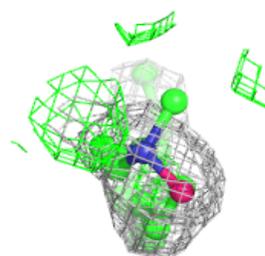
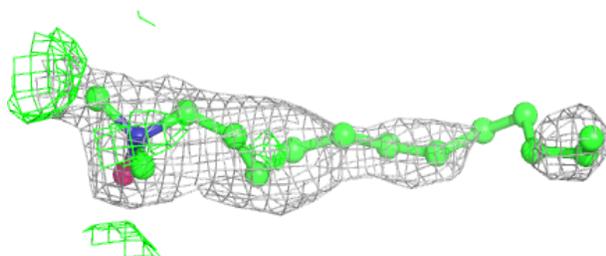
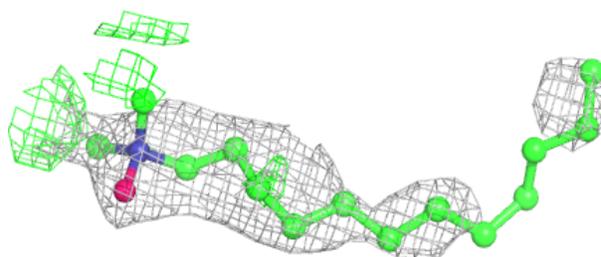


Electron density around LDA M 417:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
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and green (positive)

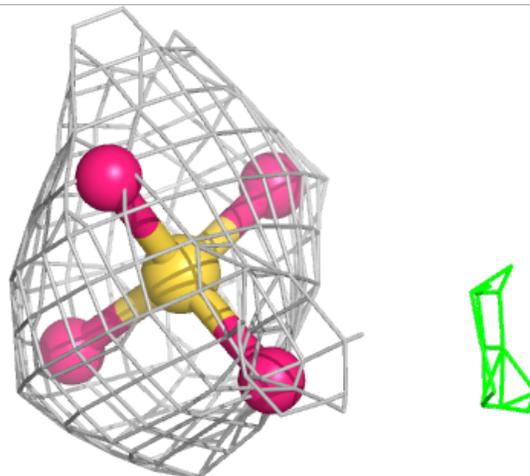
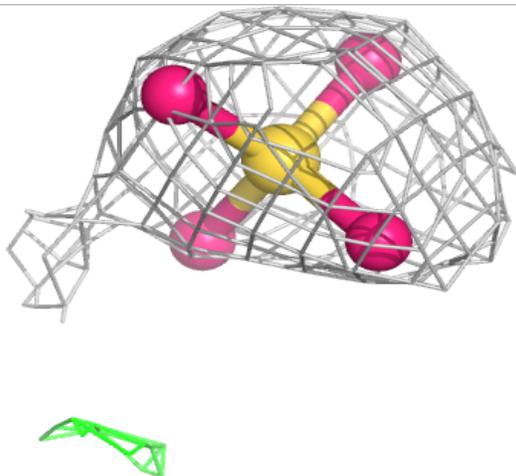
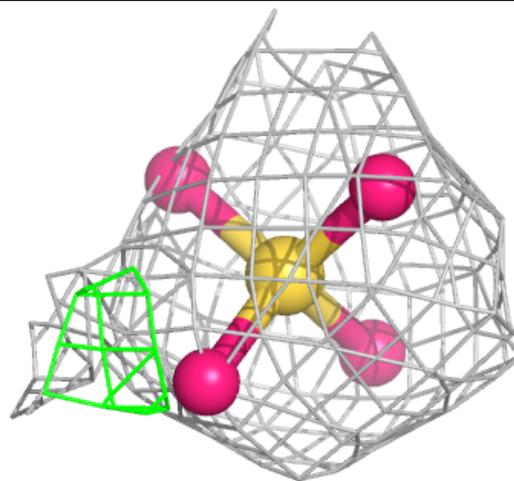
**Electron density around LDA L 306:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
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and green (positive)



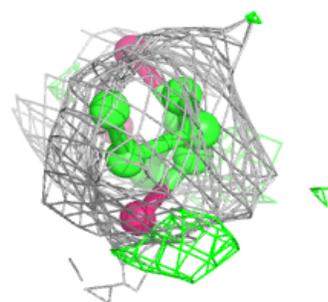
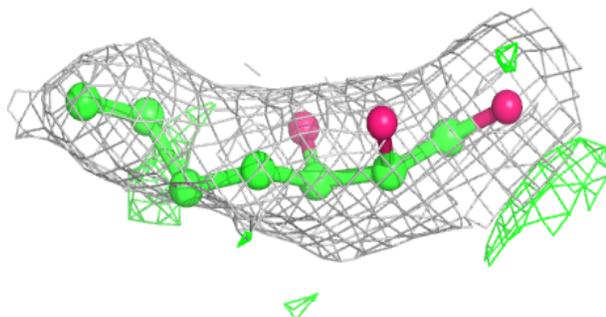
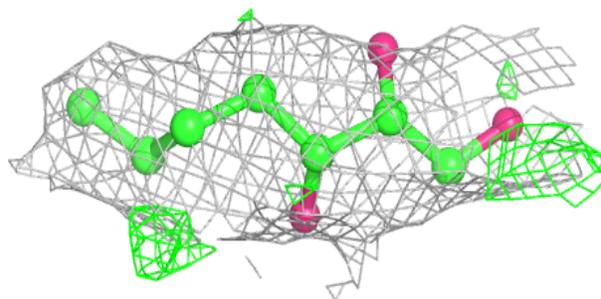
Electron density around SO4 C 408:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
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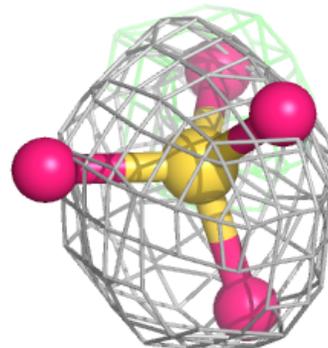
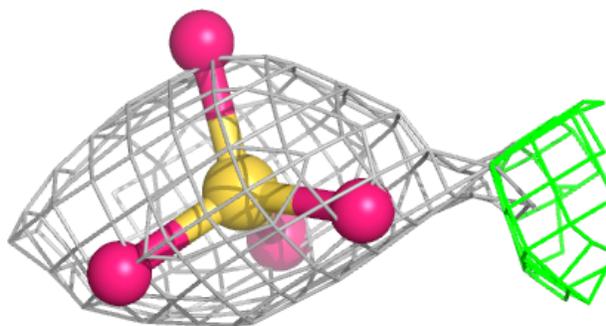
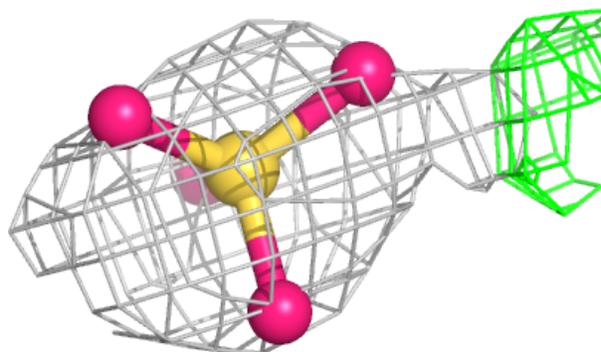


Electron density around HTO H 707:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

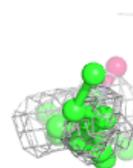
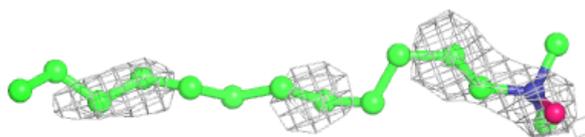
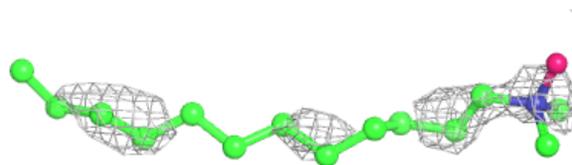
**Electron density around SO4 H 704:**

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and green (positive)



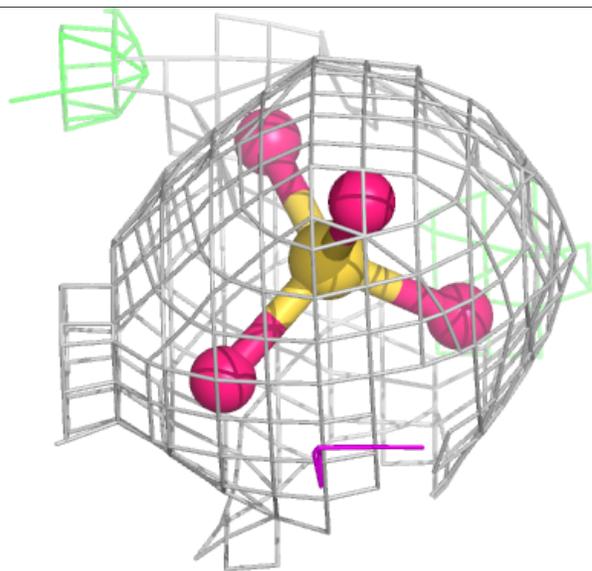
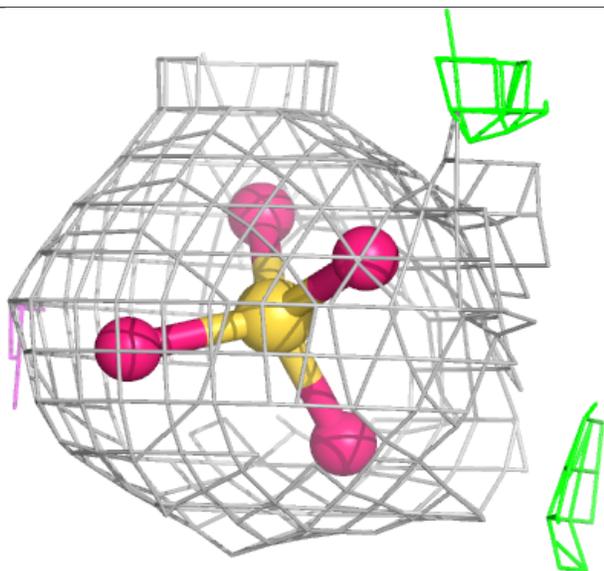
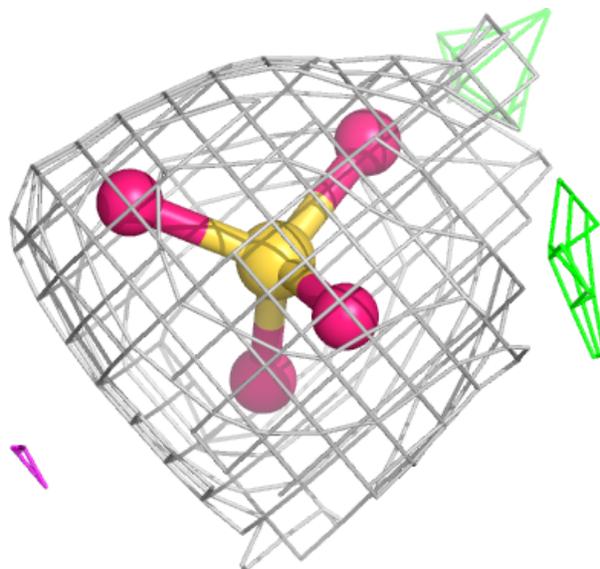
Electron density around LDA L 304:

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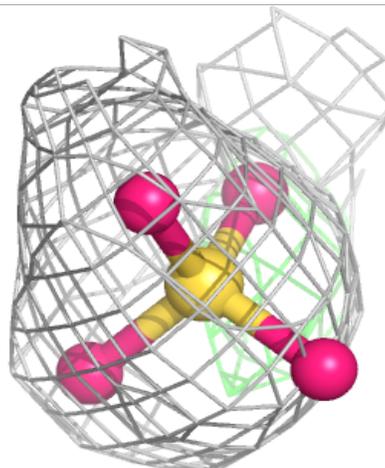
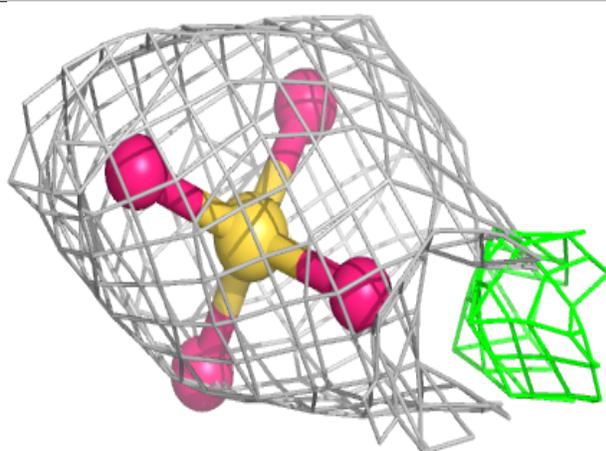
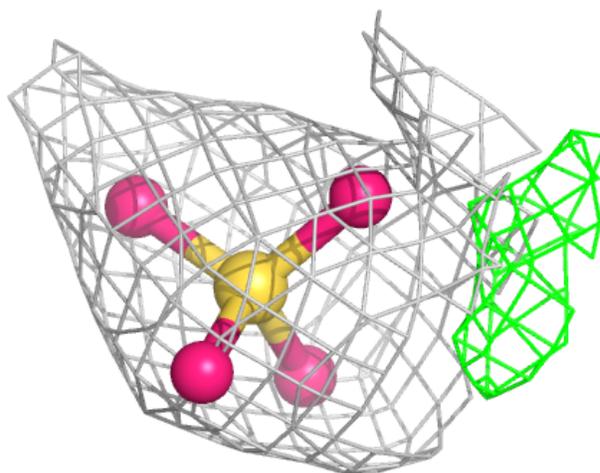
Electron density around SO4 M 410:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
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and green (positive)



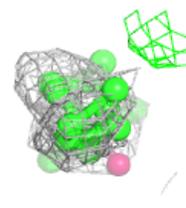
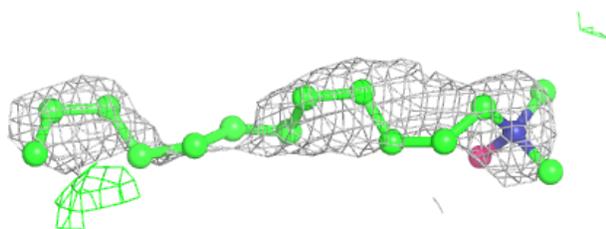
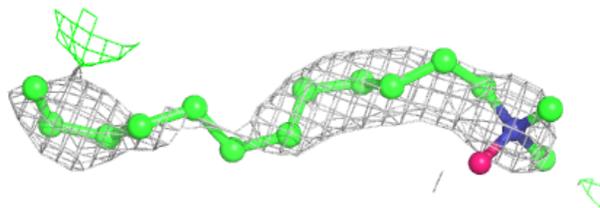
Electron density around SO4 M 413:

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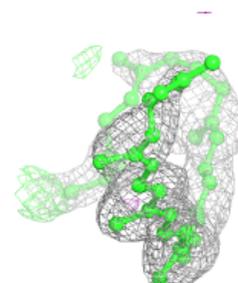
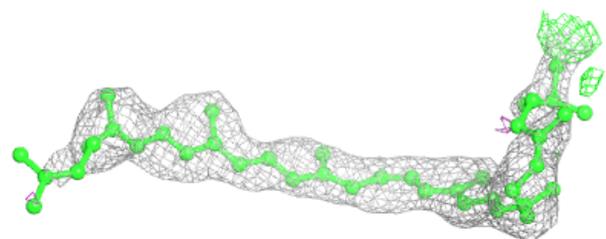
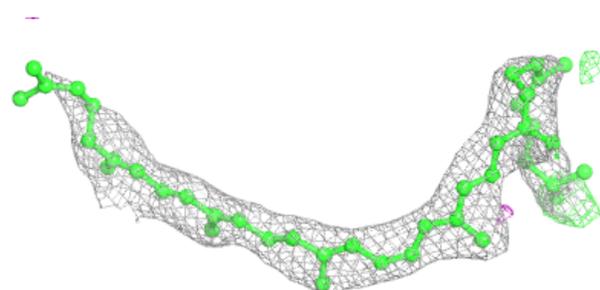


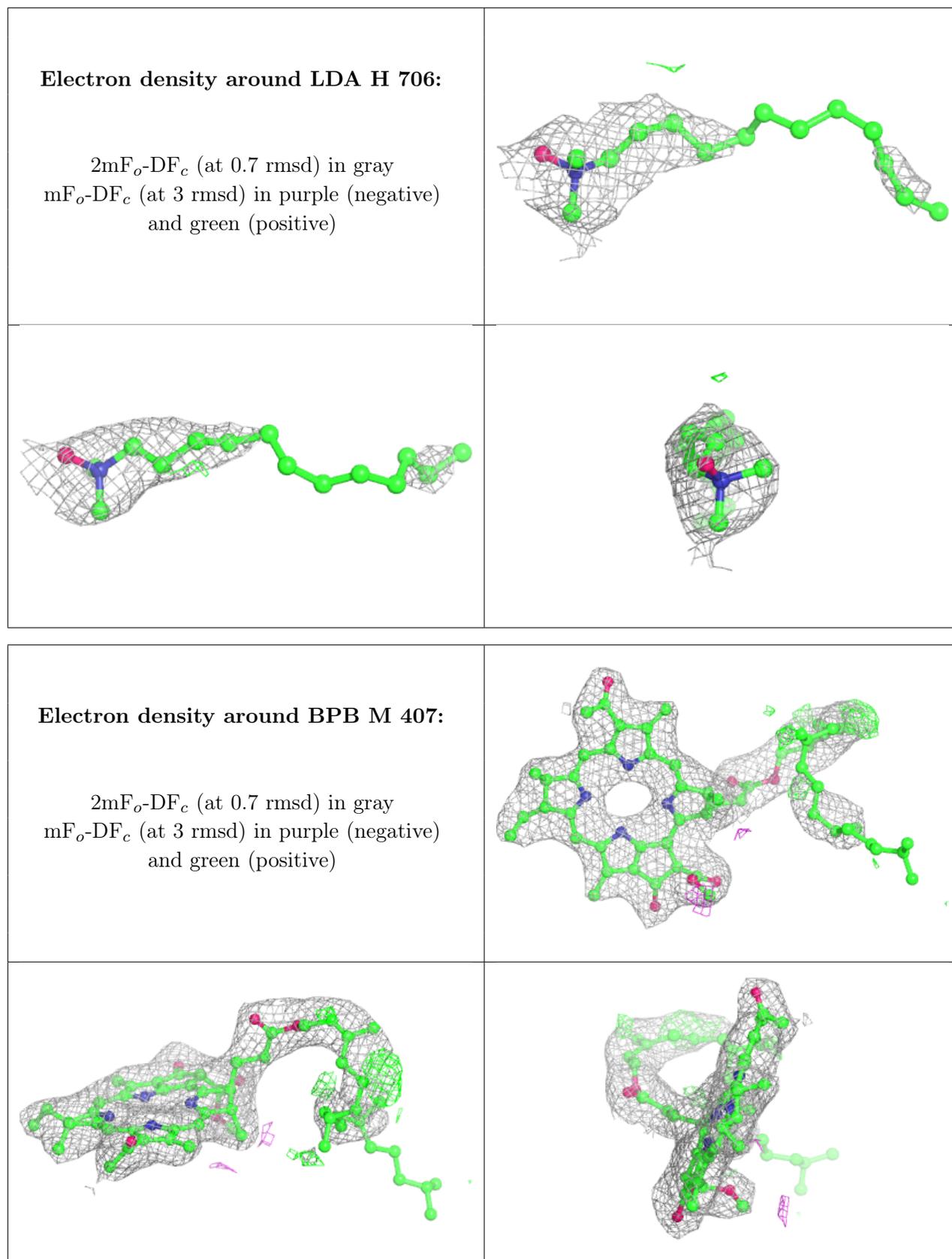
Electron density around LDA M 401:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
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**Electron density around NS5 M 408:**

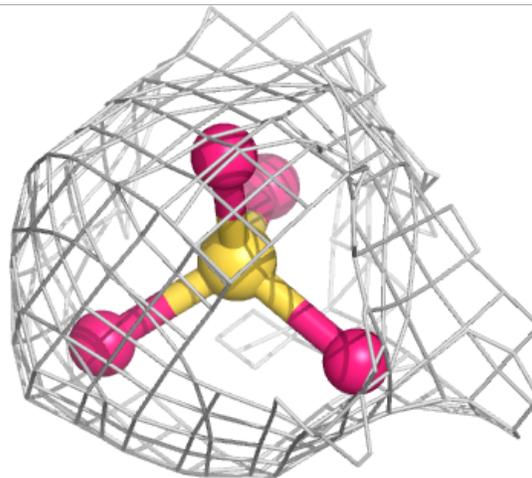
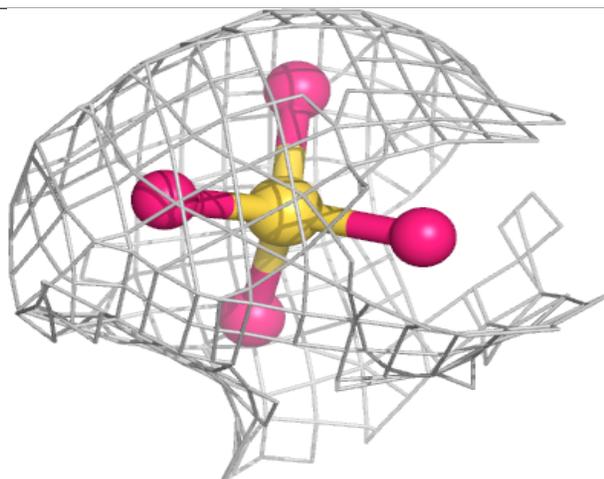
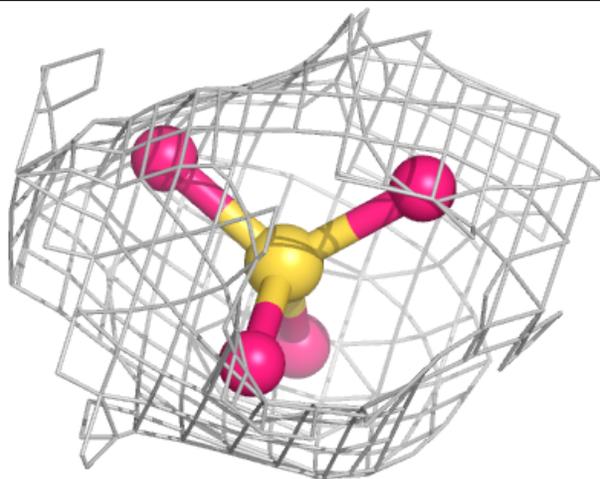
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and green (positive)





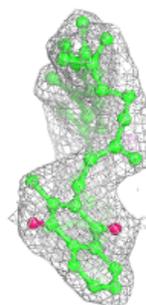
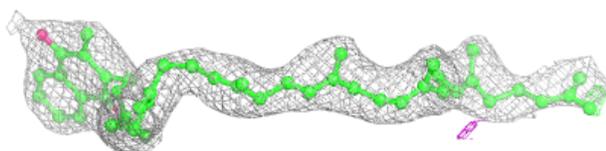
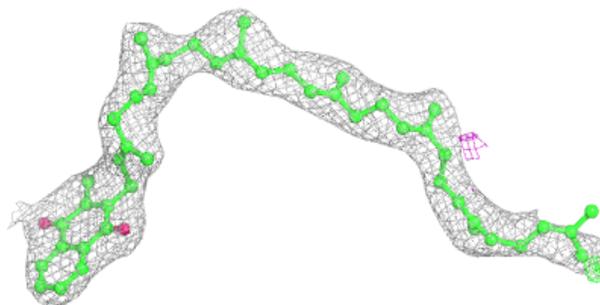
Electron density around SO4 H 702:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

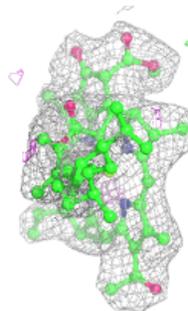
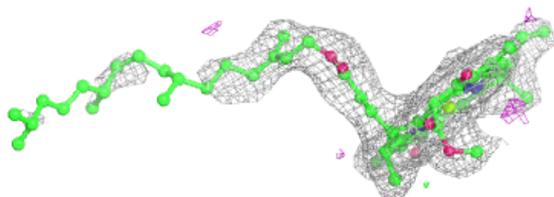
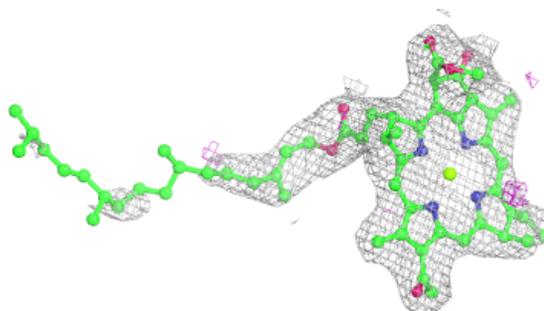


Electron density around MQ7 M 404:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

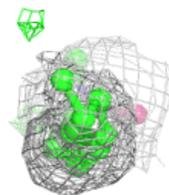
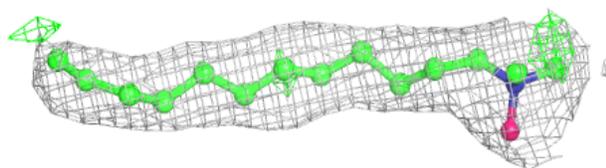
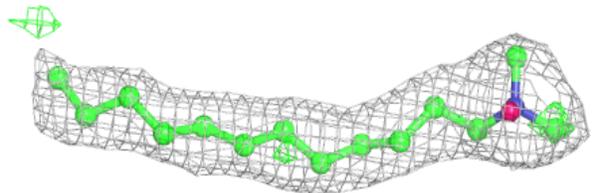
**Electron density around BCB M 405:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

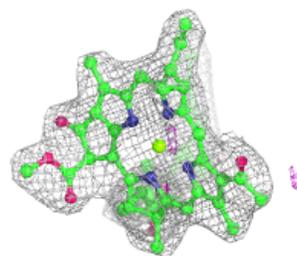
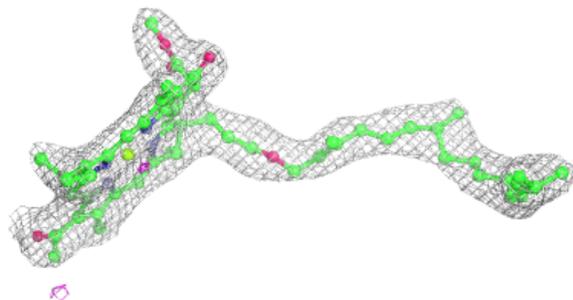
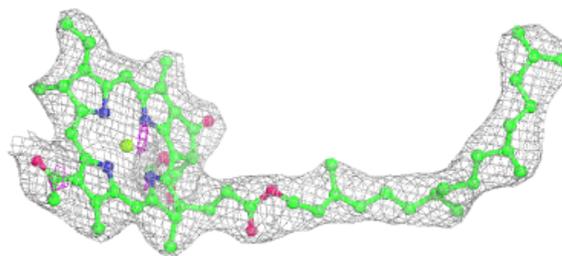


Electron density around LDA H 701:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

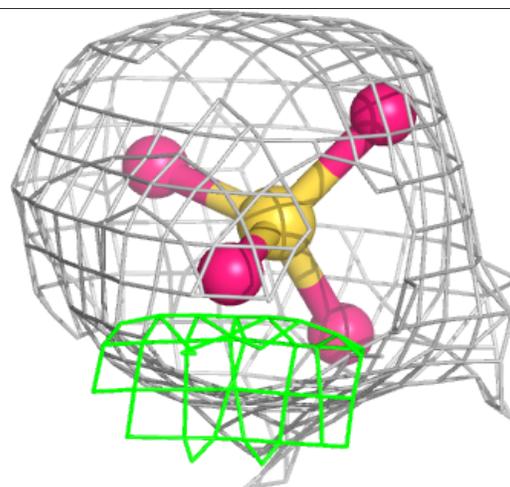
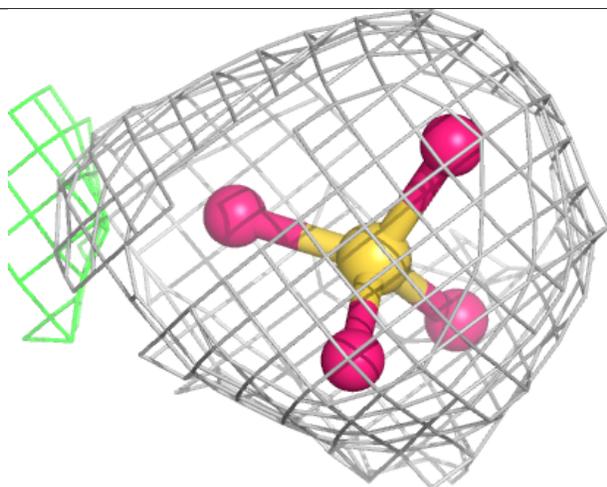
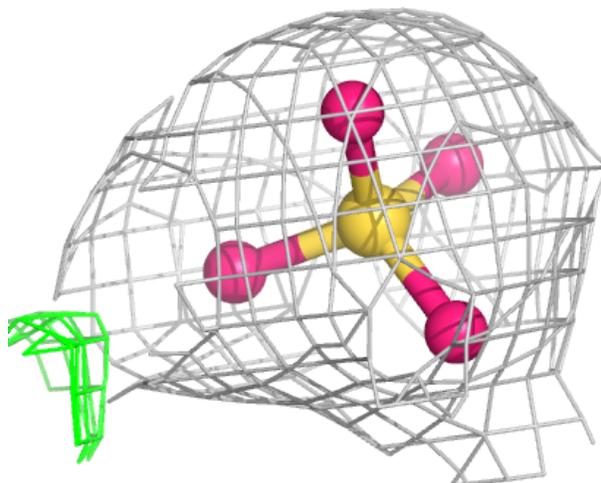
**Electron density around BCB M 406:**

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



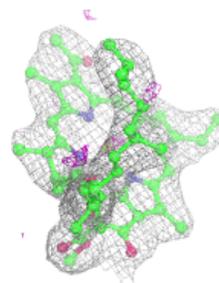
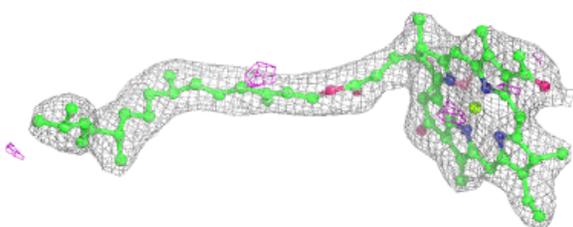
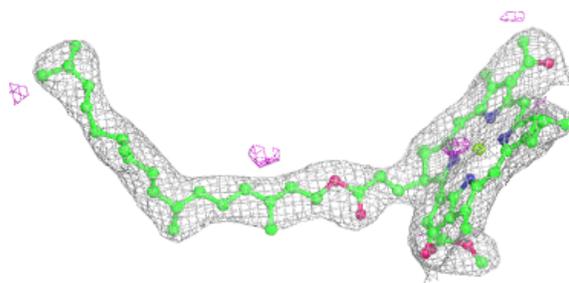
Electron density around SO4 M 411:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

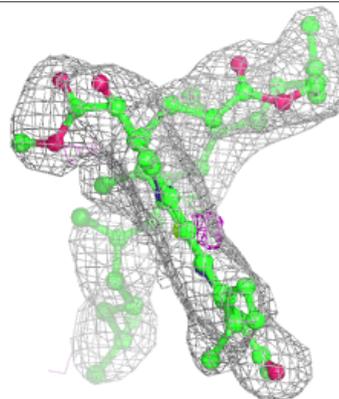
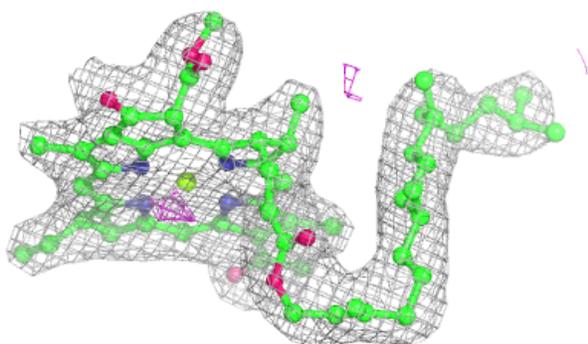
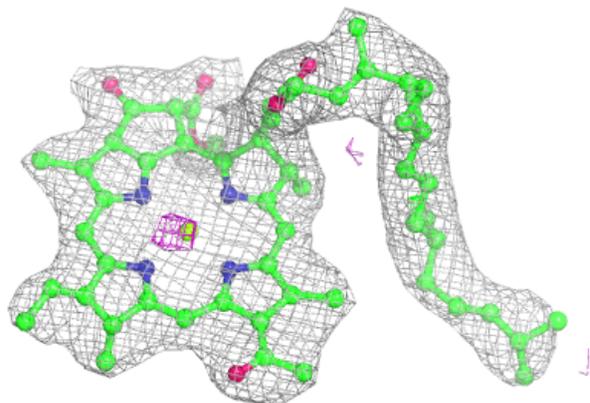


Electron density around BCB L 301:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

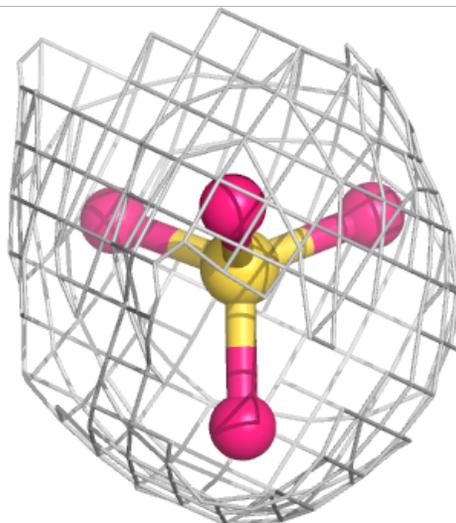
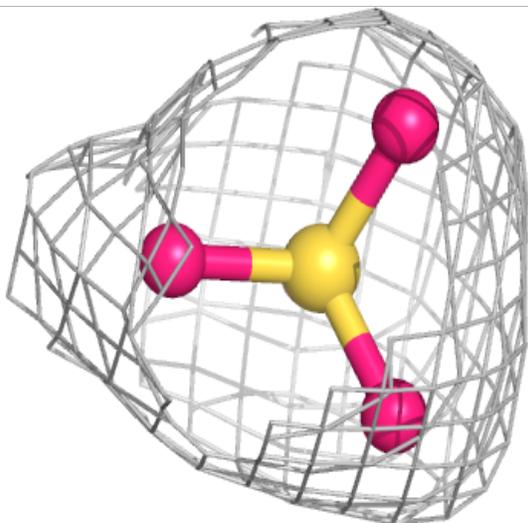
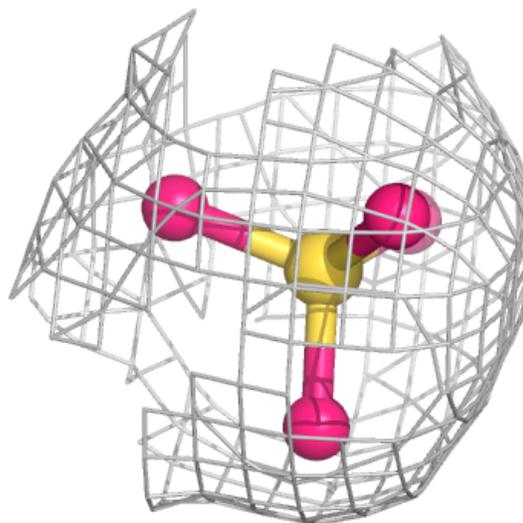
**Electron density around BCB L 302:**

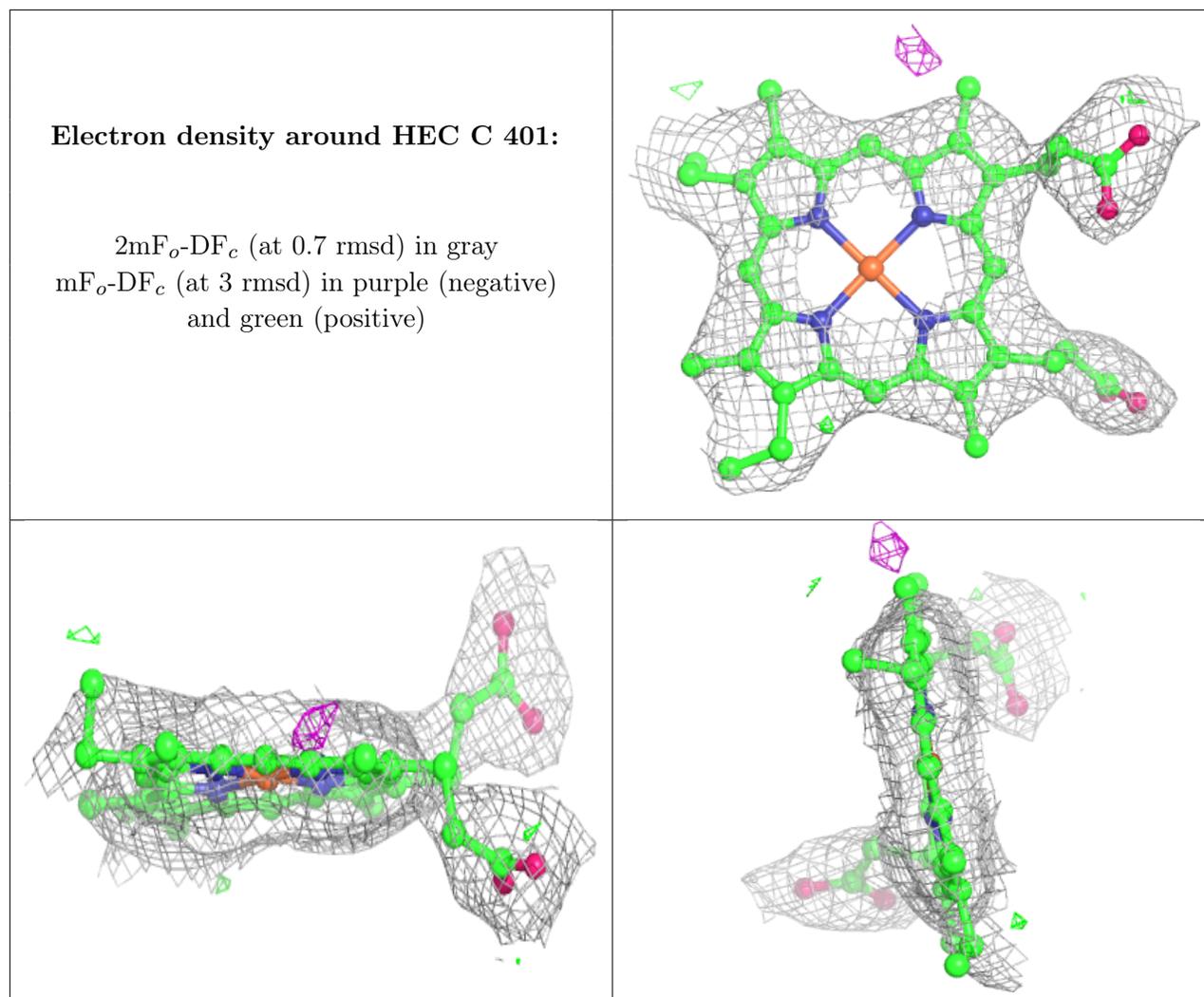
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around SO4 M 409:

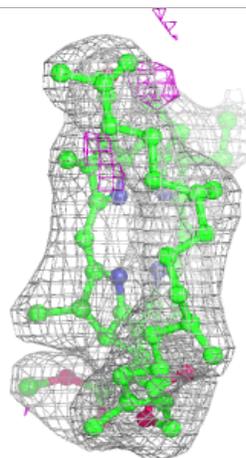
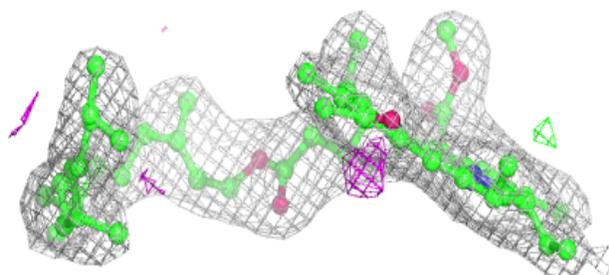
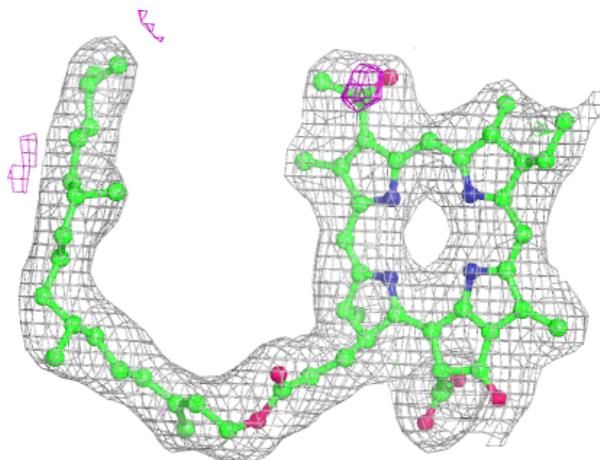
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

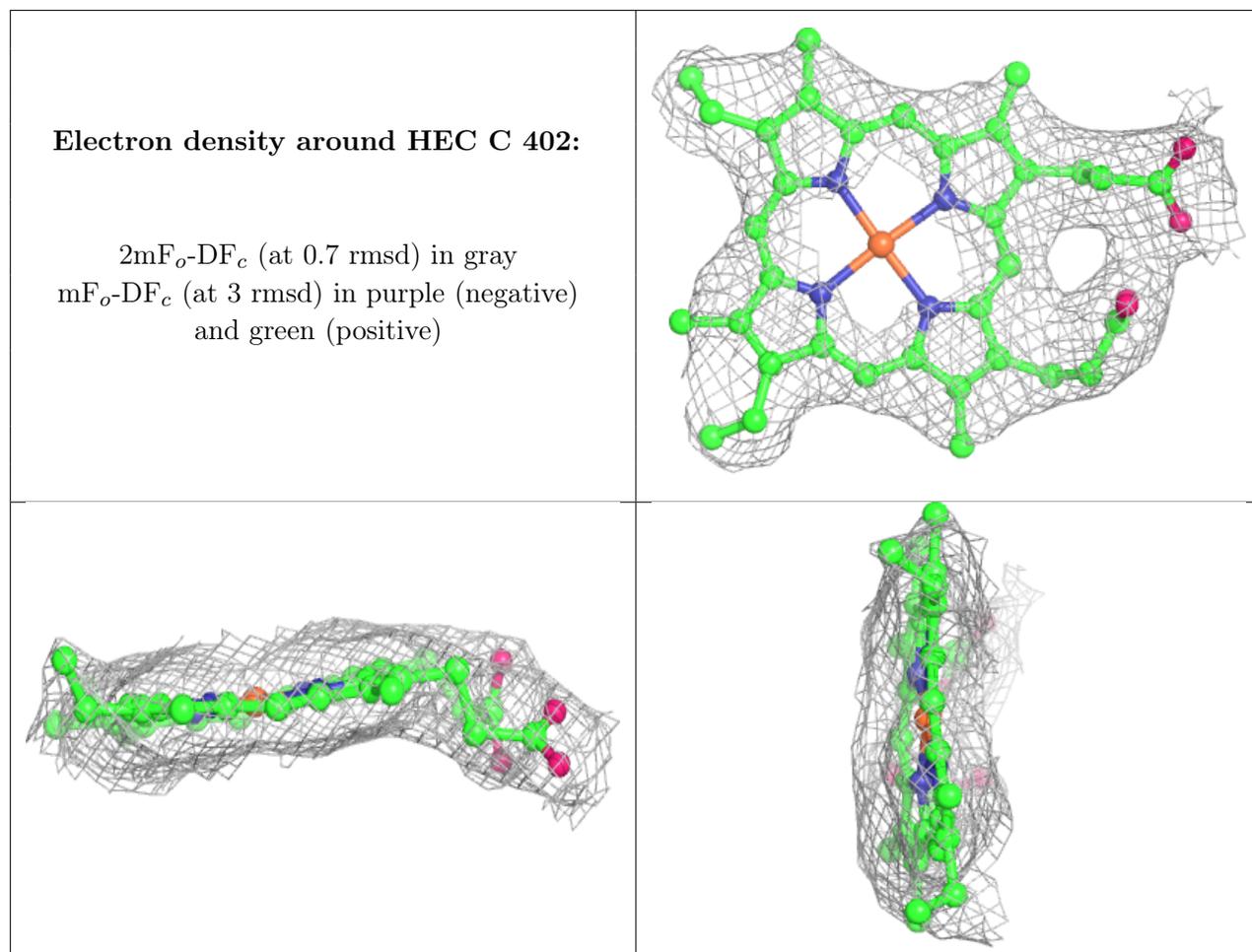


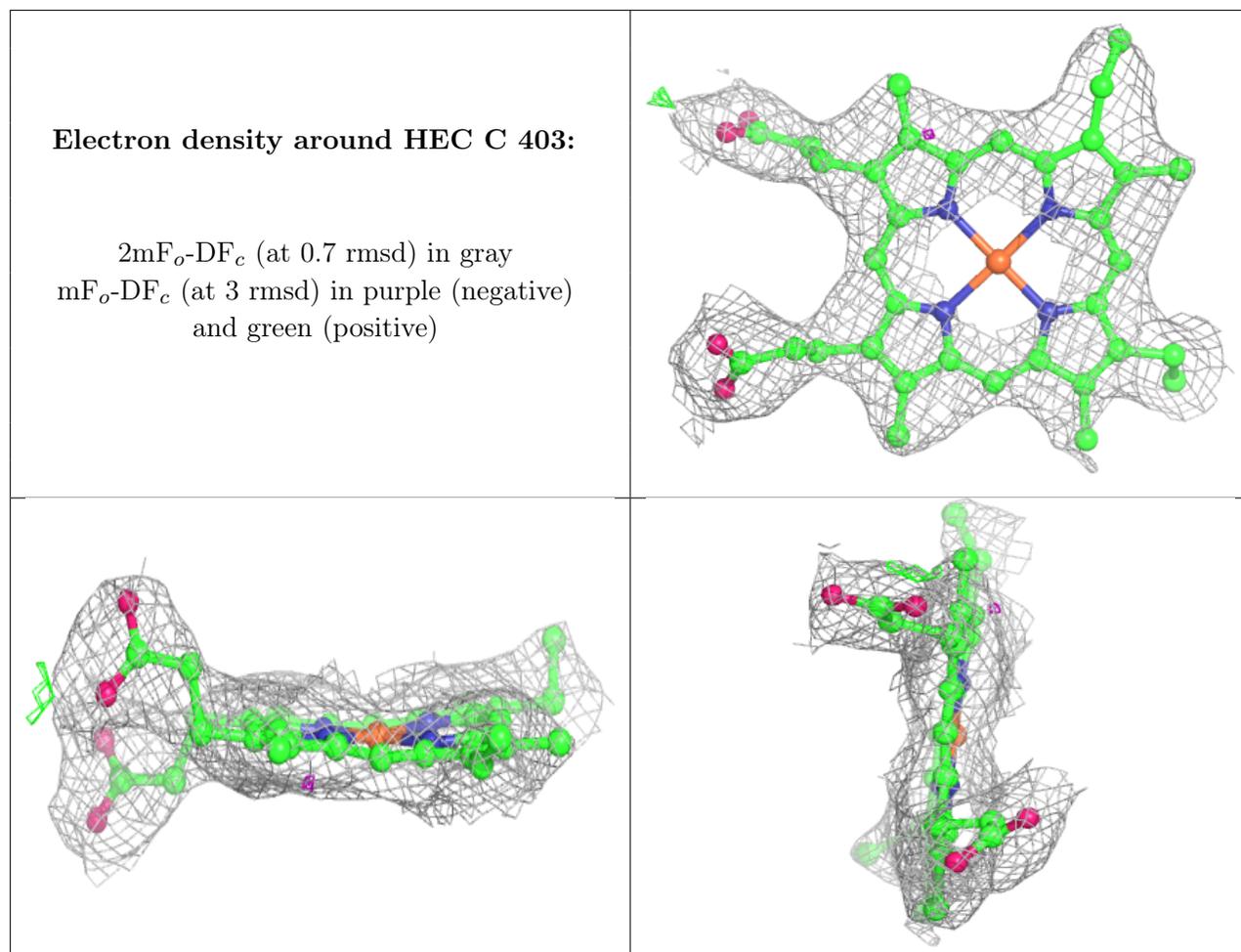


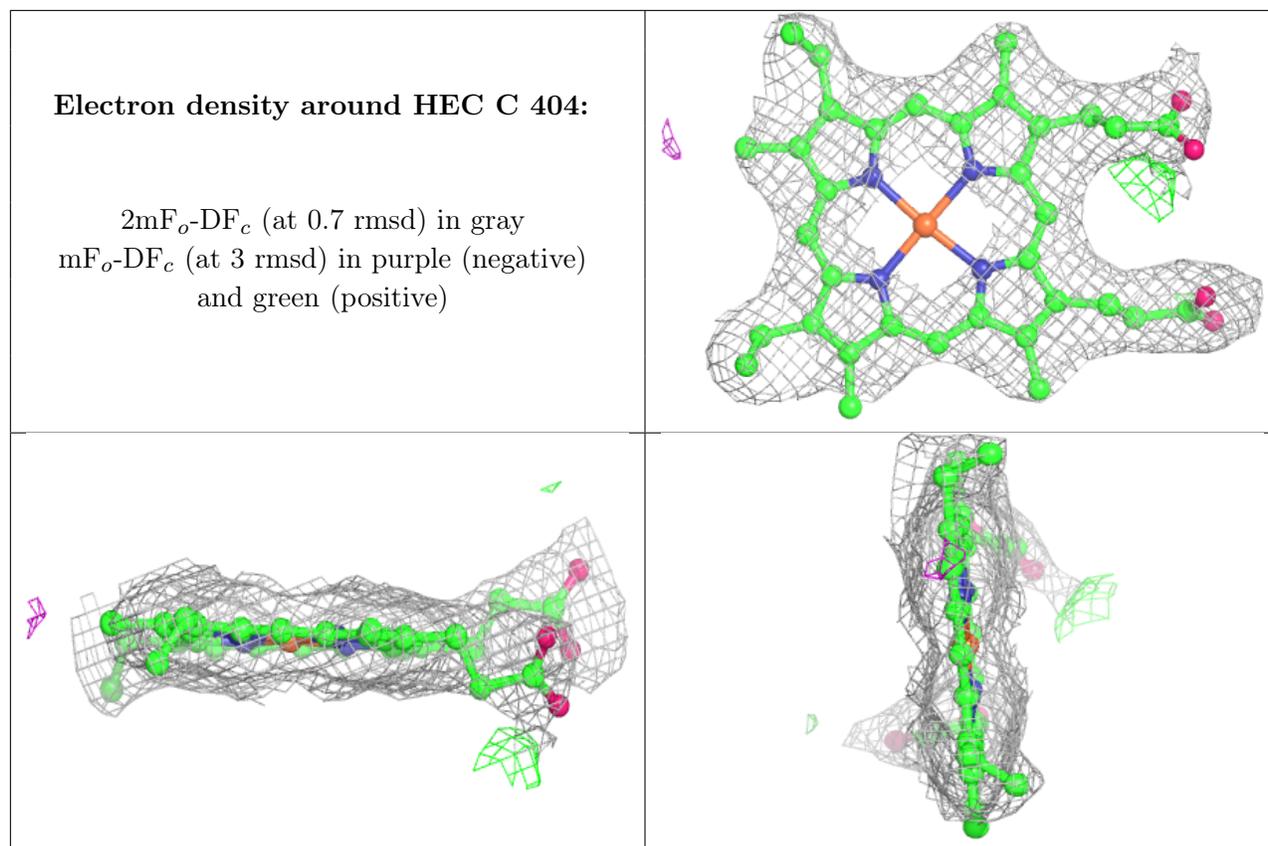
Electron density around BPB L 303:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



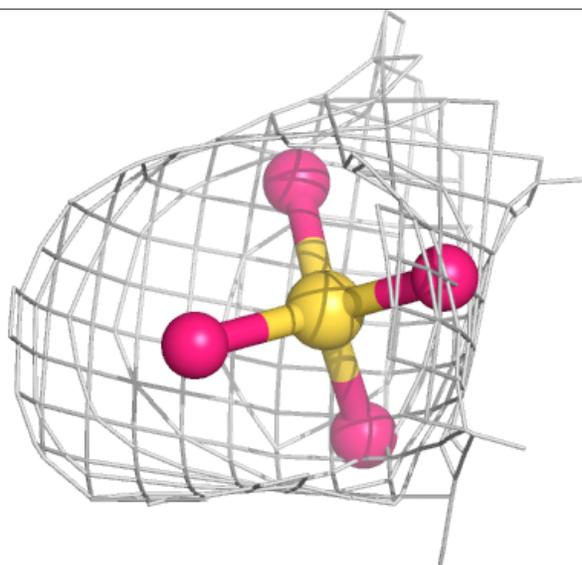
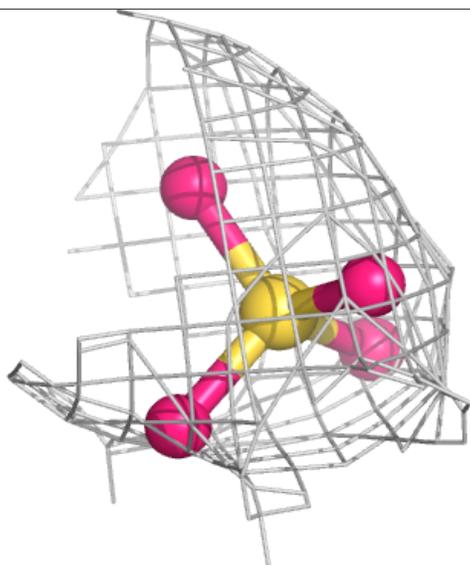
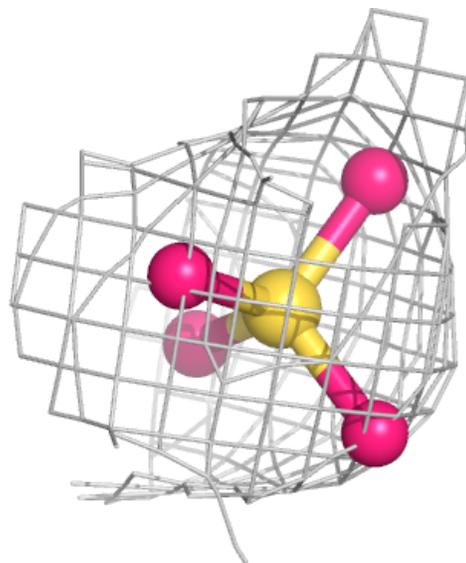


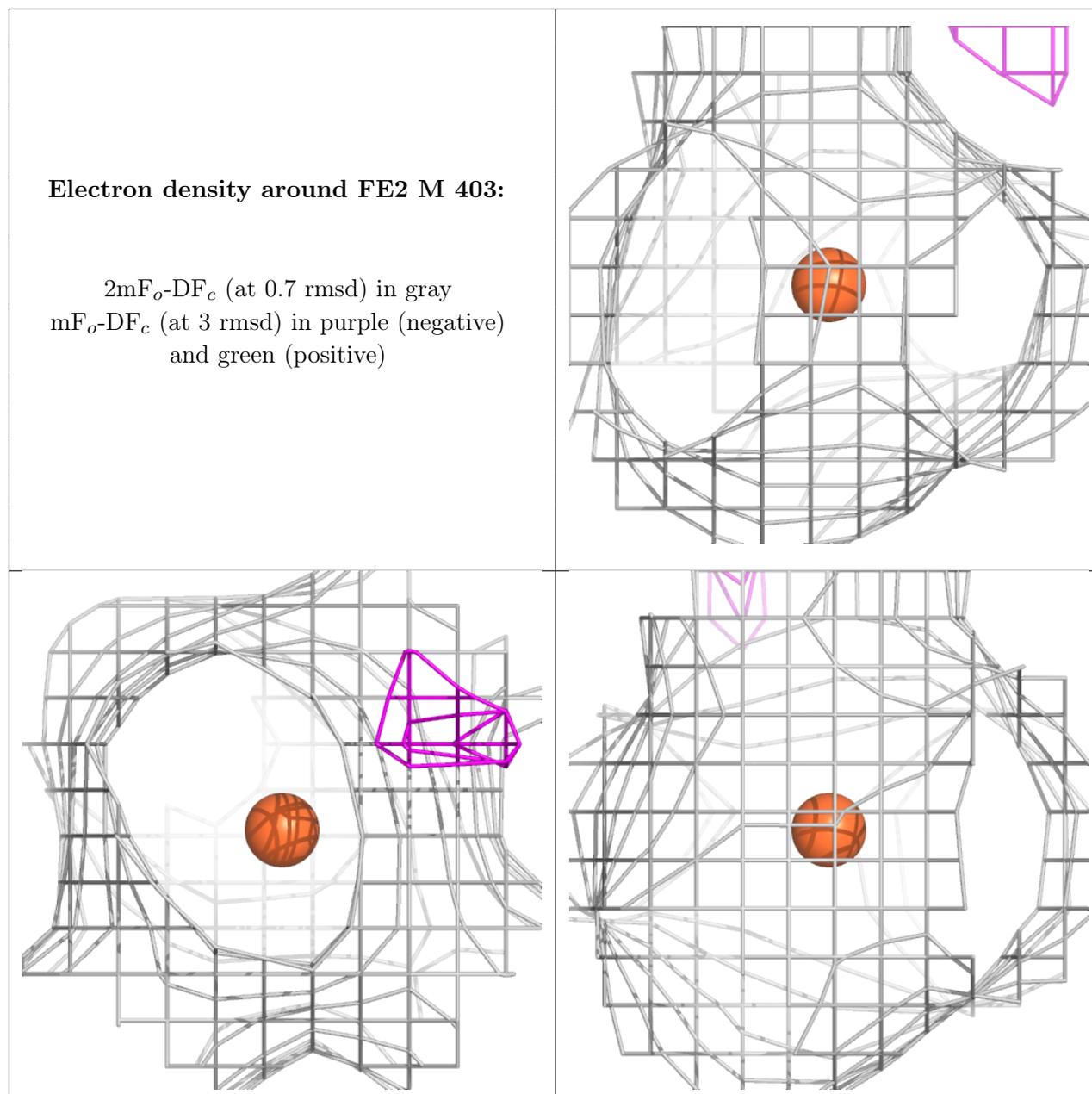




Electron density around SO4 H 705:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





6.5 Other polymers [i](#)

There are no such residues in this entry.