



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 26, 2024 – 01:23 pm BST

PDB ID : 8QRD  
Title : OleP in complex with testosterone in high salt crystallization conditions  
Authors : Fata, F.; Costanzo, A.; Freda, I.; Gugole, E.; Bulfaro, G.; Barbizzi, L.; Di Renzo, M.; Savino, C.; Vallone, B.; Montemiglio, L.C.  
Deposited on : 2023-10-06  
Resolution : 2.30 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](mailto: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>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.37.1  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.37.1

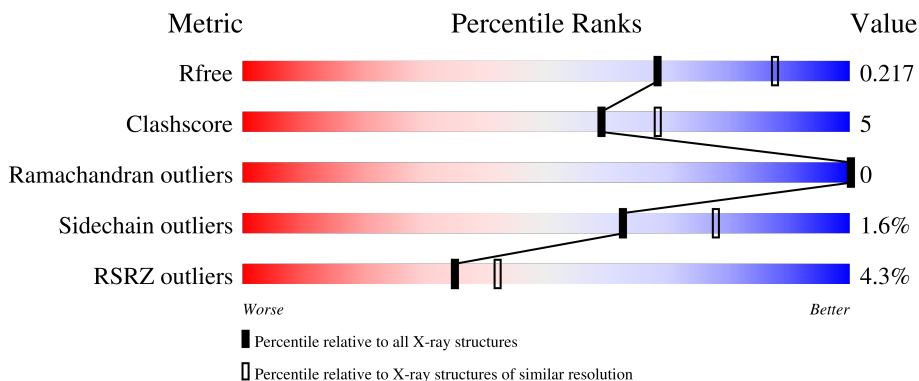
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	410	 2% 86% 11%
1	B	410	 88% 8%
1	C	410	 85% 11%
1	D	410	 2% 84% 13%
1	E	410	 8% 86% 10%

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Mol	Chain	Length	Quality of chain
1	F	410	

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

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	FMT	A	508	-	-	-	X
4	FMT	B	503	-	-	X	-
4	FMT	B	510	-	-	X	-
4	FMT	B	513	-	-	X	-
4	FMT	C	506	-	-	-	X
4	FMT	D	505	-	-	-	X
4	FMT	D	506	-	-	X	-
4	FMT	D	508	-	-	X	-
4	FMT	F	505	-	-	X	-

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 20262 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 Cytochrome P-450.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	398	Total 3169	C 1995	N 564	O 596	S 14	0	11	0
1	B	397	Total 3199	C 2015	N 567	O 598	S 19	0	19	0
1	C	396	Total 3215	C 2029	N 572	O 598	S 16	0	23	0
1	D	397	Total 3181	C 2004	N 563	O 598	S 16	0	15	0
1	E	395	Total 3128	C 1974	N 558	O 580	S 16	0	8	0
1	F	397	Total 3110	C 1955	N 558	O 584	S 13	0	3	0

There are 18 discrepancies between the modelled and reference sequences:

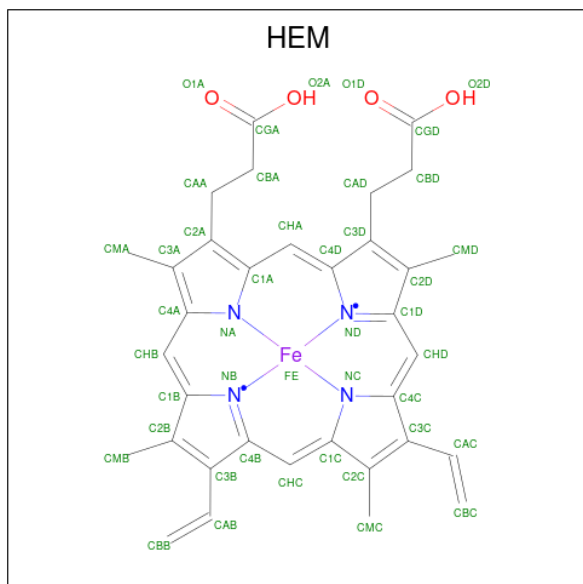
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP Q59819
A	-1	SER	-	expression tag	UNP Q59819
A	0	HIS	-	expression tag	UNP Q59819
B	-2	GLY	-	expression tag	UNP Q59819
B	-1	SER	-	expression tag	UNP Q59819
B	0	HIS	-	expression tag	UNP Q59819
C	-2	GLY	-	expression tag	UNP Q59819
C	-1	SER	-	expression tag	UNP Q59819
C	0	HIS	-	expression tag	UNP Q59819
D	-2	GLY	-	expression tag	UNP Q59819
D	-1	SER	-	expression tag	UNP Q59819
D	0	HIS	-	expression tag	UNP Q59819
E	-2	GLY	-	expression tag	UNP Q59819
E	-1	SER	-	expression tag	UNP Q59819
E	0	HIS	-	expression tag	UNP Q59819
F	-2	GLY	-	expression tag	UNP Q59819
F	-1	SER	-	expression tag	UNP Q59819

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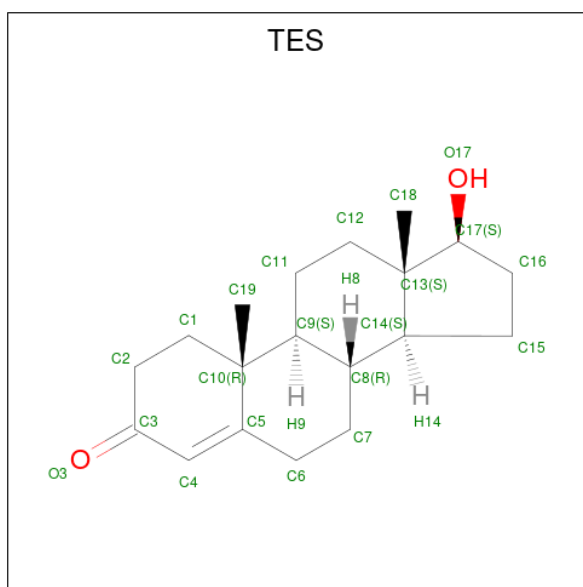
Chain	Residue	Modelled	Actual	Comment	Reference
F	0	HIS	-	expression tag	UNP Q59819

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula:  $C_{34}H_{32}FeN_4O_4$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Fe	N			O
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	C	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	D	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	E	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	F	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 3 is TESTOSTERONE (three-letter code: TES) (formula:  $C_{19}H_{28}O_2$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 21 19 2	0	0
3	B	1	Total C O 21 19 2	0	0
3	C	1	Total C O 21 19 2	0	0
3	D	1	Total C O 21 19 2	0	0
3	E	1	Total C O 21 19 2	0	0
3	F	1	Total C O 21 19 2	0	0

- Molecule 4 is FORMIC ACID (three-letter code: FMT) (formula: CH<sub>2</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 3 1 2	0	0
4	A	1	Total C O 3 1 2	0	0
4	A	1	Total C O 3 1 2	0	0
4	A	1	Total C O 3 1 2	0	0
4	A	1	Total C O 3 1 2	0	0
4	A	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total 3	C 1	O 2	0	0
4	B	1	Total 3	C 1	O 2	0	0
4	B	1	Total 3	C 1	O 2	0	0
4	B	1	Total 3	C 1	O 2	0	0
4	B	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	C	1	Total 3	C 1	O 2	0	0
4	D	1	Total 3	C 1	O 2	0	0
4	D	1	Total 3	C 1	O 2	0	0
4	D	1	Total 3	C 1	O 2	0	0
4	D	1	Total 3	C 1	O 2	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	D	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0
4	D	1	Total C O 3 1 2	0	0
4	E	1	Total C O 3 1 2	0	0
4	E	1	Total C O 3 1 2	0	0
4	E	1	Total C O 3 1 2	0	0
4	F	1	Total C O 3 1 2	0	0
4	F	1	Total C O 3 1 2	0	0
4	F	1	Total C O 3 1 2	0	0
4	F	1	Total C O 3 1 2	0	0
4	F	1	Total C O 3 1 2	0	0

- Molecule 5 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total Na 1 1	0	0
5	B	1	Total Na 1 1	0	0
5	C	1	Total Na 1 1	0	0
5	D	1	Total Na 1 1	0	0
5	E	1	Total Na 1 1	0	0
5	F	1	Total Na 1 1	0	0

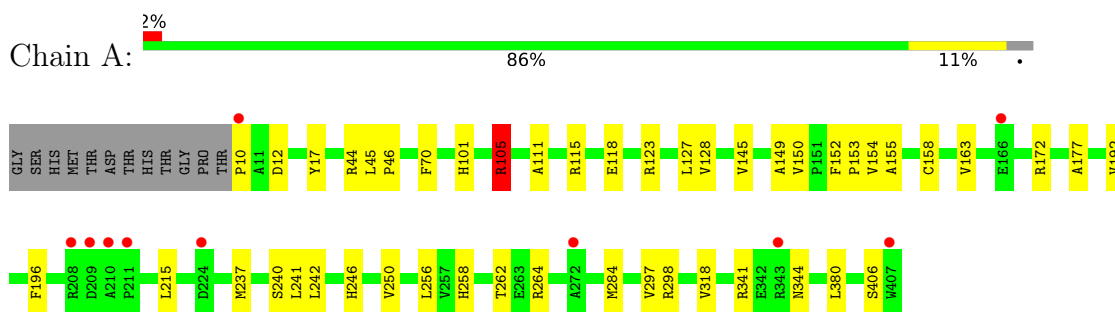
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	148	Total 148	O 148	0	0
6	B	154	Total 154	O 154	0	0
6	C	208	Total 208	O 208	0	0
6	D	86	Total 86	O 86	0	0
6	E	65	Total 65	O 65	0	0
6	F	71	Total 71	O 71	0	0

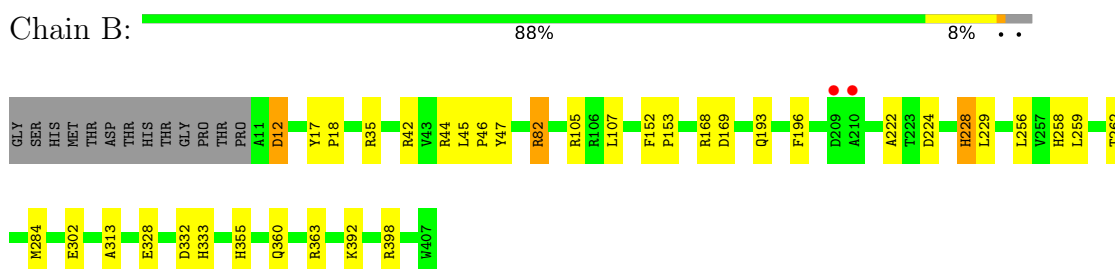
### 3 Residue-property plots [i](#)

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.

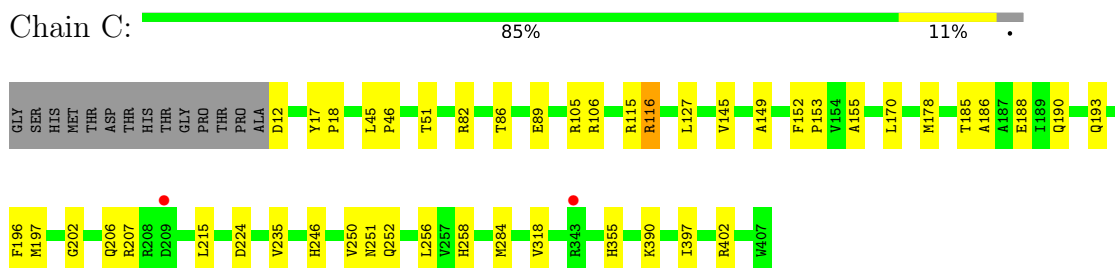
- Molecule 1: Cytochrome P-450



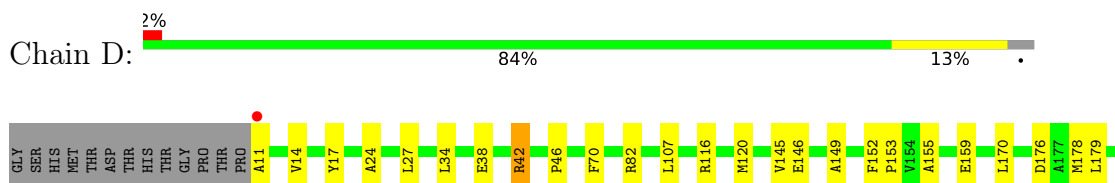
- Molecule 1: Cytochrome P-450

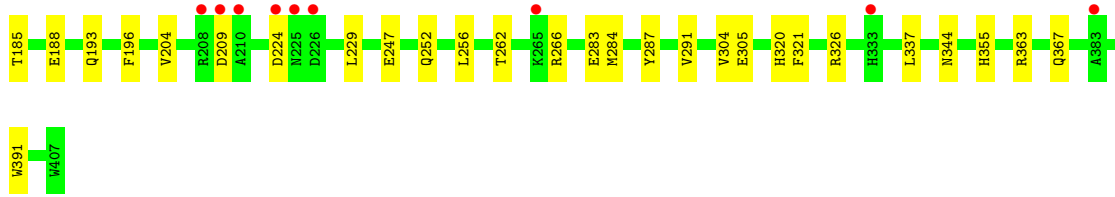


- Molecule 1: Cytochrome P-450

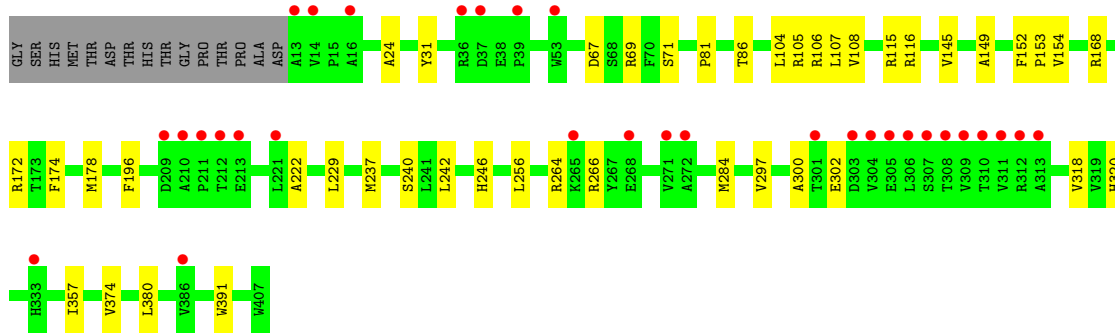
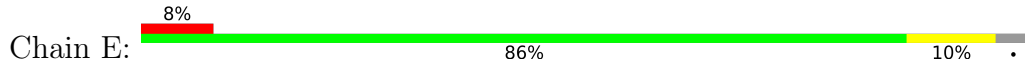


- Molecule 1: Cytochrome P-450

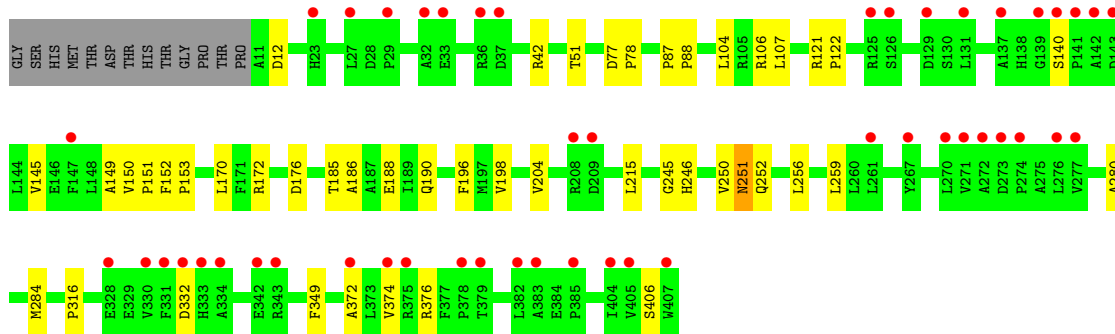
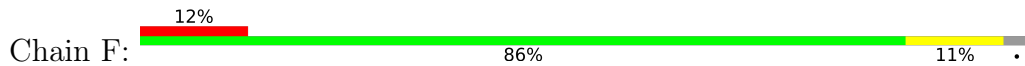




● Molecule 1: Cytochrome P-450



● Molecule 1: Cytochrome P-450



## 4 Data and refinement statistics i

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	248.19Å 109.74Å 160.13Å 90.00° 129.41° 90.00°	Depositor
Resolution (Å)	45.75 – 2.30 45.71 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.8 (45.75-2.30) 99.9 (45.71-2.30)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.78 (at 2.29Å)	Xtrriage
Refinement program	REFMAC 5.8.0419	Depositor
R, $R_{free}$	0.165 , 0.212 0.173 , 0.217	Depositor DCC
$R_{free}$ test set	7266 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.1	Xtrriage
Anisotropy	0.279	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 43.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.010 for -h-2*1,-k,l	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	20262	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	60.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 32.17 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 9.8166e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FMT, TES, NA, HEM

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
1	A	0.44	0/3252	0.86	0/4429
1	B	0.45	0/3299	0.83	0/4489
1	C	0.48	0/3345	0.91	0/4548
1	D	0.41	0/3281	0.86	0/4466
1	E	0.39	0/3210	0.81	0/4371
1	F	0.37	0/3183	0.82	0/4335
All	All	0.43	0/19570	0.85	0/26638

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

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3
1	B	0	4
1	C	0	2
1	D	0	4
1	E	0	3
All	All	0	16

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 16 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	105	ARG	Sidechain
1	A	115	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	A	341	ARG	Sidechain
1	B	105	ARG	Sidechain
1	B	82	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	A	3169	0	3152	33	0
1	B	3199	0	3197	24	0
1	C	3215	0	3247	30	0
1	D	3181	0	3173	41	0
1	E	3128	0	3132	26	0
1	F	3110	0	3086	29	0
2	A	43	0	30	0	0
2	B	43	0	30	0	0
2	C	43	0	30	0	0
2	D	43	0	30	0	0
2	E	43	0	30	0	0
2	F	43	0	30	4	0
3	A	21	0	28	1	0
3	B	21	0	28	0	0
3	C	21	0	28	0	0
3	D	21	0	28	0	0
3	E	21	0	28	1	0
3	F	21	0	28	0	0
4	A	18	0	8	2	0
4	B	39	0	21	7	0
4	C	36	0	21	0	0
4	D	21	0	9	6	0
4	E	9	0	5	1	0
4	F	15	0	8	3	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
5	C	1	0	0	0	0
5	D	1	0	0	0	0
5	E	1	0	0	0	0
5	F	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	148	0	0	2	0
6	B	154	0	0	2	0
6	C	208	0	0	5	0
6	D	86	0	0	2	0
6	E	65	0	0	1	0
6	F	71	0	0	0	0
All	All	20262	0	19407	182	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 5.

The worst 5 of 182 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:256:LEU:HD22	1:C:284:MET:HB3	1.66	0.75
1:A:127[A]:LEU:HD21	1:A:155:ALA:HB3	1.69	0.74
1:D:179:LEU:HD12	1:D:247:GLU:HG2	1.69	0.74
1:D:179:LEU:CD1	1:D:247:GLU:HG2	2.20	0.72
1:A:264:ARG:NH1	1:A:380:LEU:O	2.22	0.72

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	A	407/410 (99%)	396 (97%)	11 (3%)	0	100	100
1	B	413/410 (101%)	402 (97%)	11 (3%)	0	100	100
1	C	417/410 (102%)	410 (98%)	7 (2%)	0	100	100
1	D	410/410 (100%)	398 (97%)	12 (3%)	0	100	100
1	E	401/410 (98%)	385 (96%)	16 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	F	398/410 (97%)	388 (98%)	10 (2%)	0	100	100
All	All	2446/2460 (99%)	2379 (97%)	67 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	A	344/343 (100%)	341 (99%)	3 (1%)	78	89
1	B	350/343 (102%)	346 (99%)	4 (1%)	73	86
1	C	355/343 (104%)	349 (98%)	6 (2%)	60	76
1	D	347/343 (101%)	339 (98%)	8 (2%)	50	67
1	E	339/343 (99%)	336 (99%)	3 (1%)	78	89
1	F	335/343 (98%)	327 (98%)	8 (2%)	49	66
All	All	2070/2058 (101%)	2038 (98%)	32 (2%)	62	79

5 of 32 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	204	VAL
1	F	251	ASN
1	C	318	VAL
1	C	224	ASP
1	F	332	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	193	GLN
1	F	246	HIS
1	F	251	ASN

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Mol	Chain	Res	Type
1	D	193	GLN
1	E	193	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](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

Of 64 ligands modelled in this entry, 6 are monoatomic - leaving 58 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
4	FMT	D	503	-	2,2,2	0.99	0	1,1,1	0.29	0
4	FMT	B	515	-	2,2,2	1.02	0	1,1,1	0.25	0
3	TES	D	502	-	24,24,24	0.38	0	39,39,39	0.66	0
4	FMT	B	513	-	2,2,2	1.35	0	1,1,1	0.18	0
2	HEM	E	501	1	41,50,50	1.38	5 (12%)	45,82,82	1.79	9 (20%)
4	FMT	C	511	-	2,2,2	1.26	0	1,1,1	0.14	0
4	FMT	B	514	-	2,2,2	1.67	1 (50%)	1,1,1	0.00	0
4	FMT	B	512	-	2,2,2	1.14	0	1,1,1	0.21	0
2	HEM	C	501	1	41,50,50	1.37	7 (17%)	45,82,82	1.89	10 (22%)
3	TES	B	502	-	24,24,24	0.38	0	39,39,39	0.65	0
4	FMT	F	507	-	2,2,2	1.45	1 (50%)	1,1,1	0.03	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	FMT	A	507	-	2,2,2	1.08	0	1,1,1	0.24	0
4	FMT	B	504	-	2,2,2	1.51	1 (50%)	1,1,1	0.07	0
4	FMT	A	506	-	2,2,2	0.84	0	1,1,1	0.34	0
4	FMT	C	513	-	2,2,2	1.38	0	1,1,1	0.13	0
4	FMT	C	506	-	2,2,2	1.15	0	1,1,1	0.22	0
4	FMT	B	503	-	2,2,2	0.80	0	1,1,1	0.31	0
4	FMT	D	506	-	2,2,2	1.07	0	1,1,1	0.18	0
4	FMT	C	509	-	2,2,2	1.33	0	1,1,1	0.14	0
4	FMT	B	511	-	2,2,2	1.20	0	1,1,1	0.20	0
4	FMT	C	503	-	2,2,2	1.22	0	1,1,1	0.11	0
4	FMT	C	512	-	2,2,2	0.88	0	1,1,1	0.34	0
4	FMT	A	505	-	2,2,2	1.14	0	1,1,1	0.23	0
3	TES	E	502	-	24,24,24	0.37	0	39,39,39	0.84	0
4	FMT	D	505	-	2,2,2	0.99	0	1,1,1	0.30	0
2	HEM	B	501	1	41,50,50	1.38	7 (17%)	45,82,82	1.83	8 (17%)
4	FMT	B	508	-	2,2,2	1.29	0	1,1,1	0.21	0
4	FMT	C	505	-	2,2,2	1.12	0	1,1,1	0.19	0
4	FMT	A	503	-	2,2,2	1.30	0	1,1,1	0.16	0
4	FMT	D	504	-	2,2,2	0.95	0	1,1,1	0.29	0
4	FMT	E	503	-	2,2,2	1.15	0	1,1,1	0.15	0
4	FMT	C	504	-	2,2,2	1.18	0	1,1,1	0.22	0
4	FMT	B	506	-	2,2,2	1.07	0	1,1,1	0.24	0
4	FMT	F	504	-	2,2,2	0.84	0	1,1,1	0.35	0
2	HEM	D	501	1	41,50,50	1.40	6 (14%)	45,82,82	1.88	10 (22%)
4	FMT	D	508	-	2,2,2	1.74	1 (50%)	1,1,1	0.07	0
3	TES	C	502	-	24,24,24	0.37	0	39,39,39	0.91	2 (5%)
4	FMT	C	508	-	2,2,2	1.78	1 (50%)	1,1,1	0.06	0
3	TES	F	502	-	24,24,24	0.38	0	39,39,39	0.83	0
4	FMT	A	504	-	2,2,2	1.13	0	1,1,1	0.27	0
4	FMT	D	509	-	2,2,2	1.07	0	1,1,1	0.20	0
4	FMT	C	507	-	2,2,2	1.34	0	1,1,1	0.08	0
4	FMT	F	506	-	2,2,2	1.16	0	1,1,1	0.20	0
3	TES	A	502	-	24,24,24	0.38	0	39,39,39	0.66	0
4	FMT	B	505	-	2,2,2	1.50	1 (50%)	1,1,1	0.12	0
4	FMT	B	510	-	2,2,2	1.58	1 (50%)	1,1,1	0.05	0
2	HEM	A	501	1	41,50,50	1.38	6 (14%)	45,82,82	1.83	9 (20%)
4	FMT	A	508	-	2,2,2	1.37	0	1,1,1	0.04	0
4	FMT	D	507	-	2,2,2	1.38	0	1,1,1	0.14	0
4	FMT	F	505	-	2,2,2	1.34	0	1,1,1	0.01	0
4	FMT	B	509	-	2,2,2	1.21	0	1,1,1	0.21	0
2	HEM	F	501	1	41,50,50	1.38	7 (17%)	45,82,82	1.87	10 (22%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	FMT	C	510	-	2,2,2	1.27	0	1,1,1	0.16	0
4	FMT	C	514	-	2,2,2	1.44	1 (50%)	1,1,1	0.05	0
4	FMT	E	505	-	2,2,2	1.46	1 (50%)	1,1,1	0.06	0
4	FMT	F	503	-	2,2,2	1.14	0	1,1,1	0.24	0
4	FMT	B	507	-	2,2,2	1.09	0	1,1,1	0.23	0
4	FMT	E	504	-	2,2,2	1.42	1 (50%)	1,1,1	0.12	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	HEM	C	501	1	-	2/12/54/54	-
2	HEM	A	501	1	-	2/12/54/54	-
3	TES	D	502	-	-	-	0/4/4/4
2	HEM	D	501	1	-	2/12/54/54	-
2	HEM	E	501	1	-	0/12/54/54	-
2	HEM	F	501	1	-	2/12/54/54	-
3	TES	C	502	-	-	-	0/4/4/4
3	TES	E	502	-	-	-	0/4/4/4
3	TES	F	502	-	-	-	0/4/4/4
2	HEM	B	501	1	-	2/12/54/54	-
3	TES	B	502	-	-	-	0/4/4/4
3	TES	A	502	-	-	-	0/4/4/4

The worst 5 of 48 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	501	HEM	C1B-NB	-3.88	1.33	1.40
2	A	501	HEM	C1B-NB	-3.79	1.33	1.40
2	B	501	HEM	C1B-NB	-3.70	1.33	1.40
2	F	501	HEM	C1B-NB	-3.70	1.33	1.40
2	C	501	HEM	C1B-NB	-3.70	1.33	1.40

The worst 5 of 58 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	501	HEM	CHC-C4B-NB	5.42	130.32	124.43
2	D	501	HEM	CHC-C4B-NB	5.26	130.15	124.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	501	HEM	CHC-C4B-NB	5.11	129.99	124.43
2	F	501	HEM	CHC-C4B-NB	5.05	129.92	124.43
2	B	501	HEM	CHC-C4B-NB	4.99	129.85	124.43

There are no chirality outliers.

5 of 10 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	501	HEM	C2B-C3B-CAB-CBB
2	F	501	HEM	C2B-C3B-CAB-CBB
2	F	501	HEM	C4B-C3B-CAB-CBB
2	C	501	HEM	C4B-C3B-CAB-CBB
2	A	501	HEM	C2B-C3B-CAB-CBB

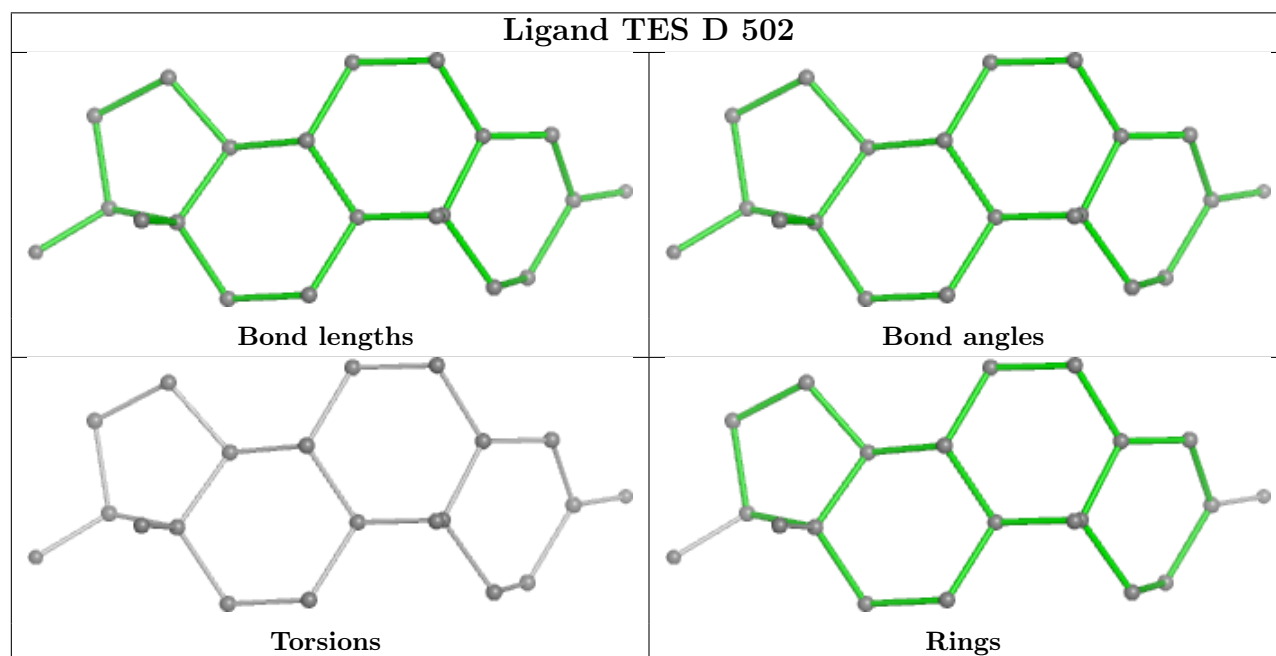
There are no ring outliers.

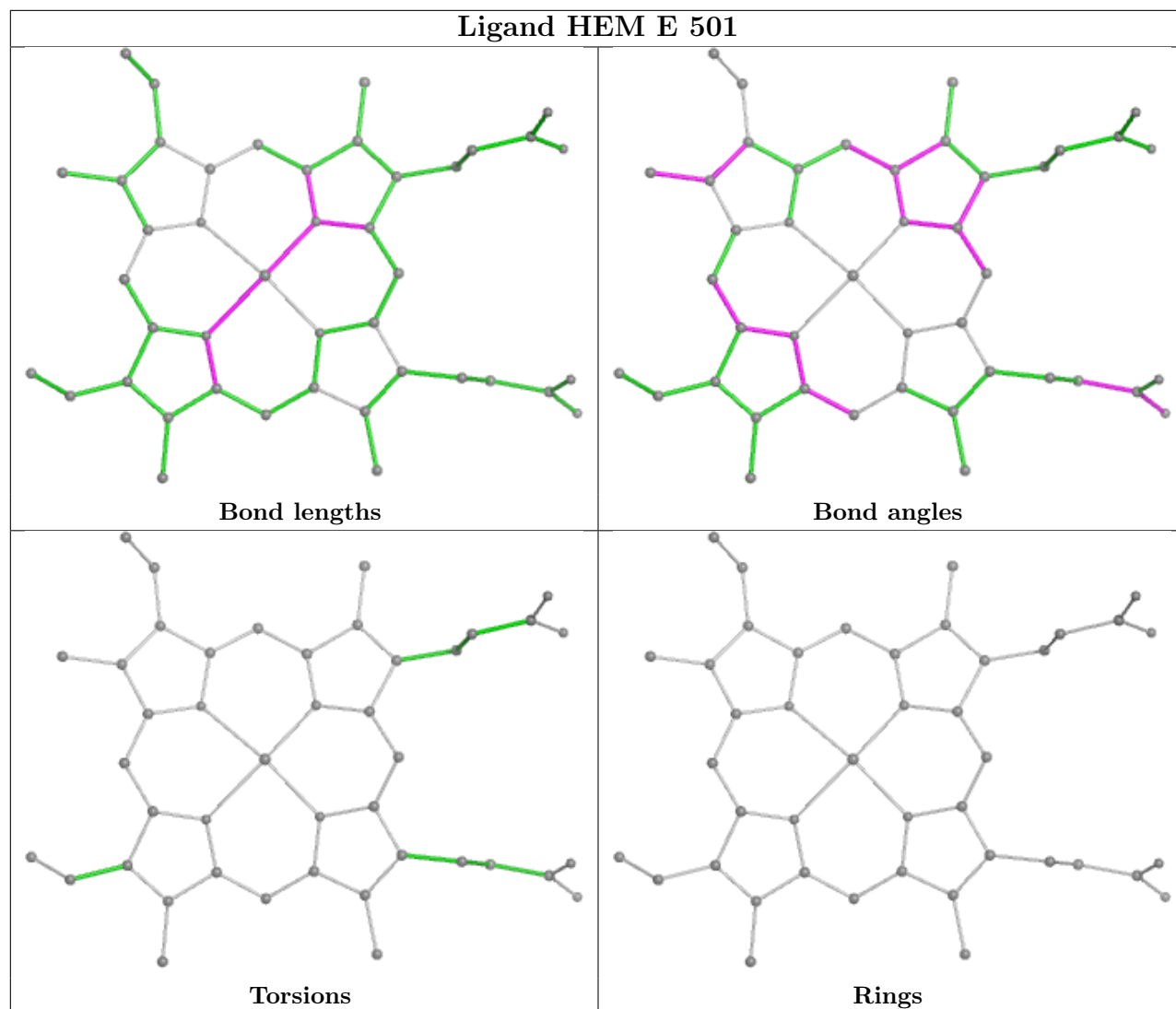
13 monomers are involved in 25 short contacts:

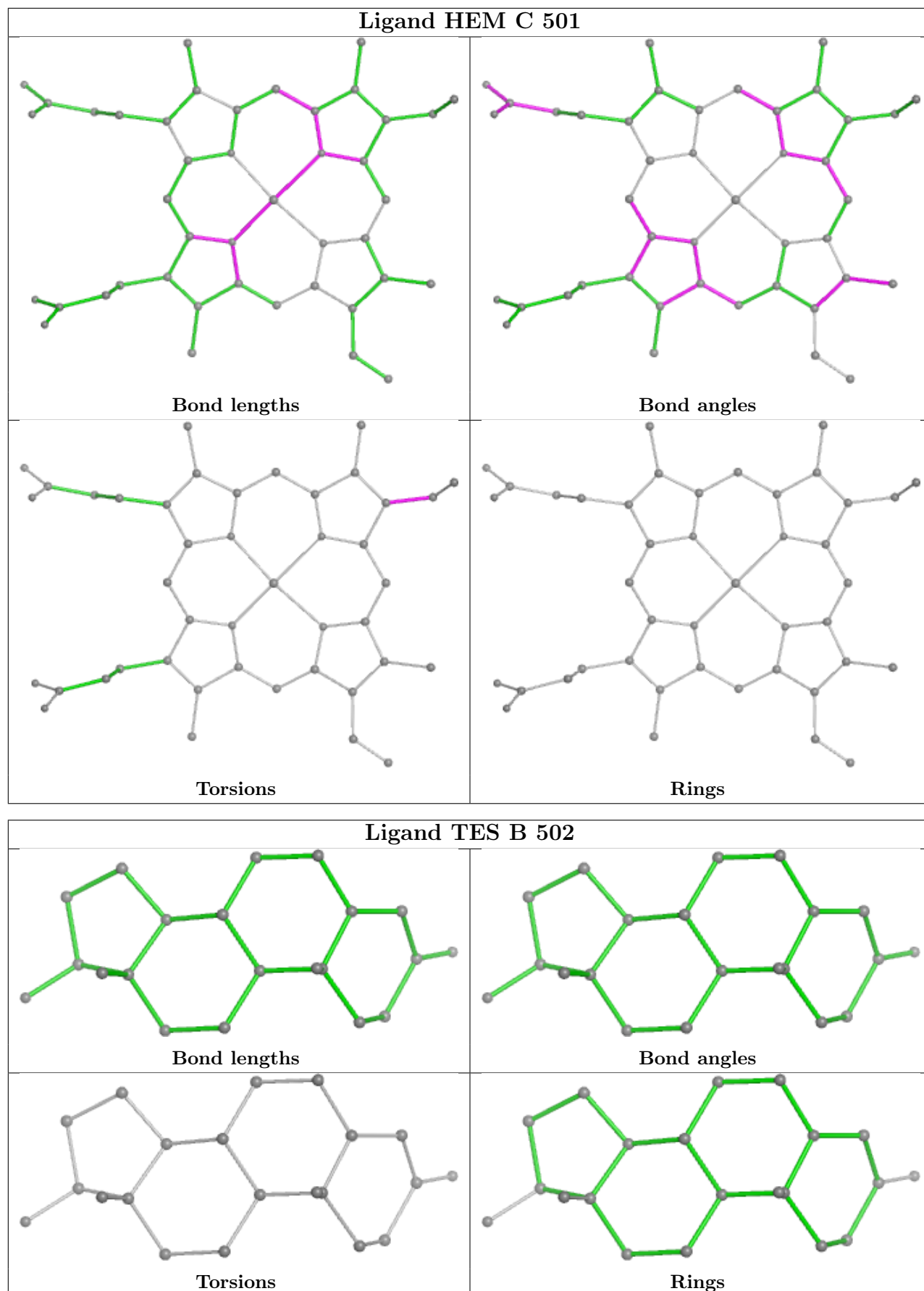
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	513	FMT	2	0
4	B	503	FMT	2	0
4	D	506	FMT	3	0
3	E	502	TES	1	0
4	A	503	FMT	1	0
4	D	508	FMT	3	0
3	A	502	TES	1	0
4	B	510	FMT	2	0
4	A	508	FMT	1	0
4	F	505	FMT	3	0
4	B	509	FMT	1	0
2	F	501	HEM	4	0
4	E	504	FMT	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier.

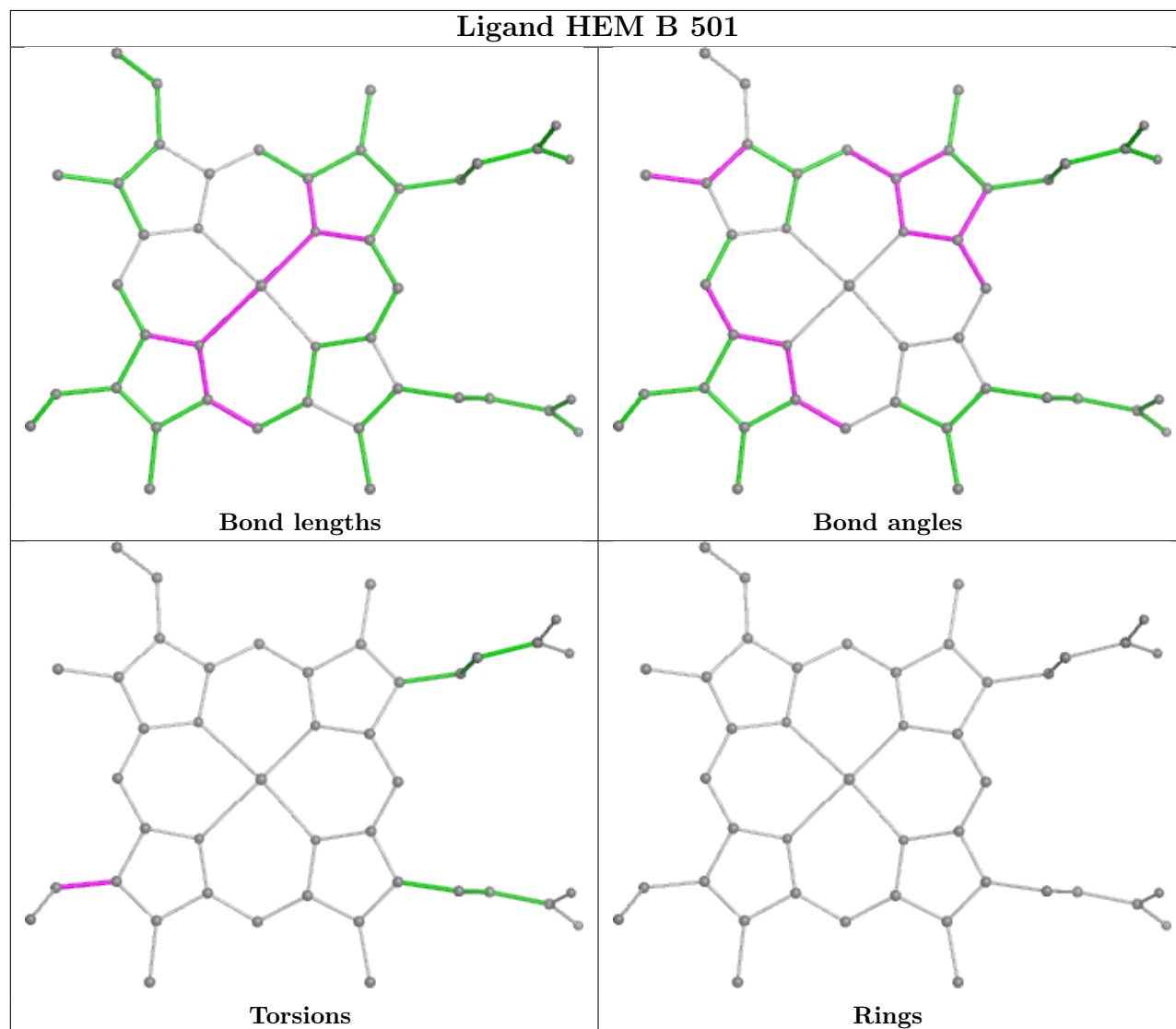
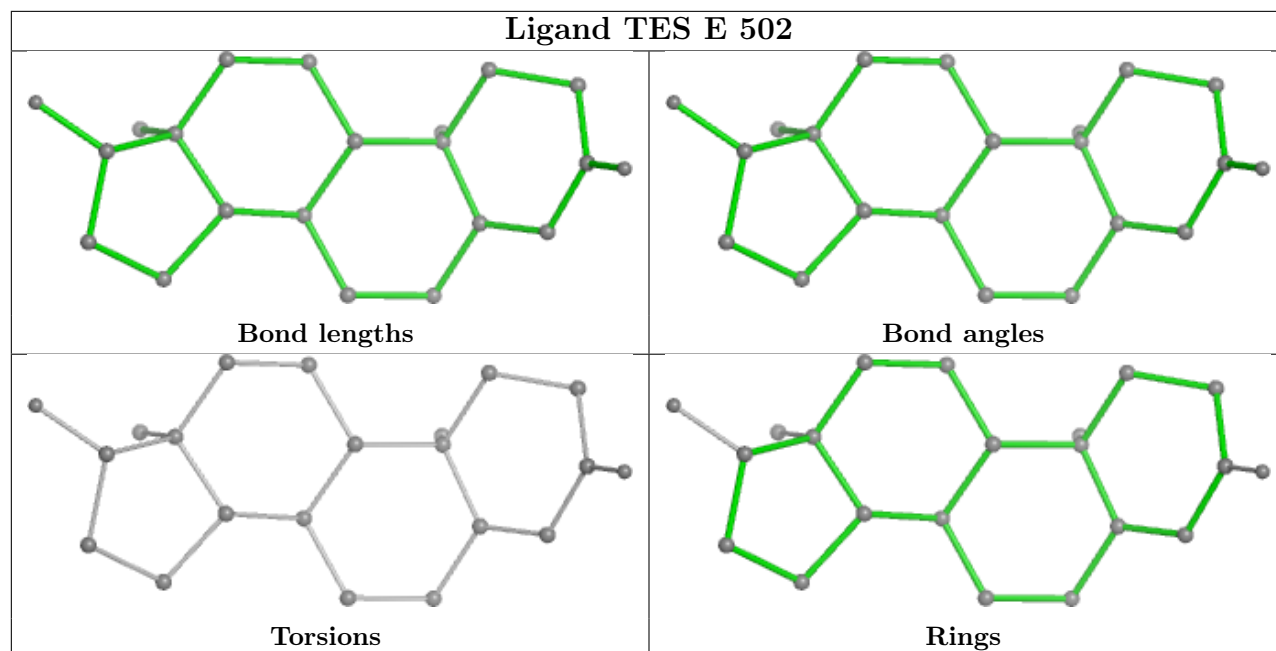
The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

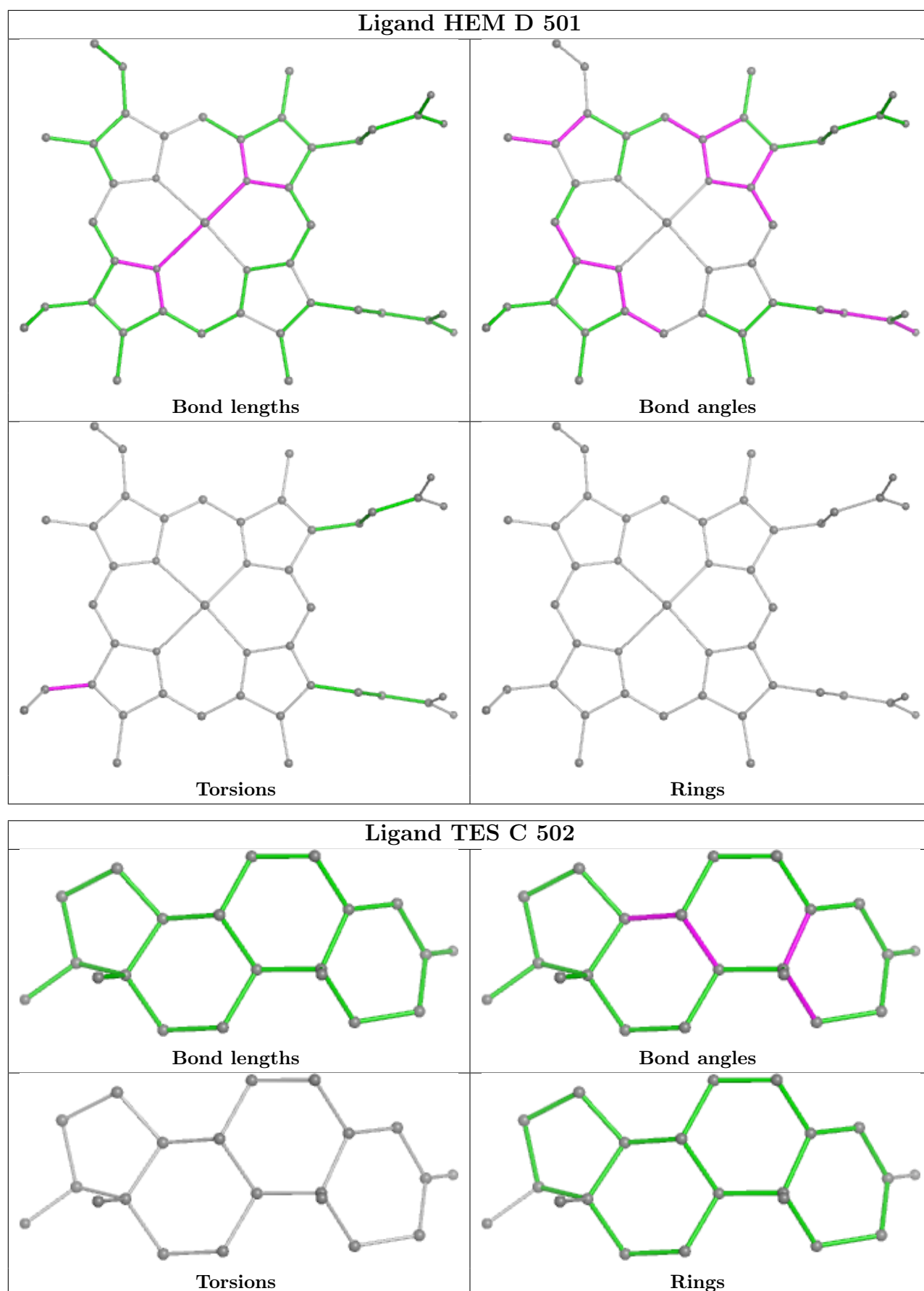


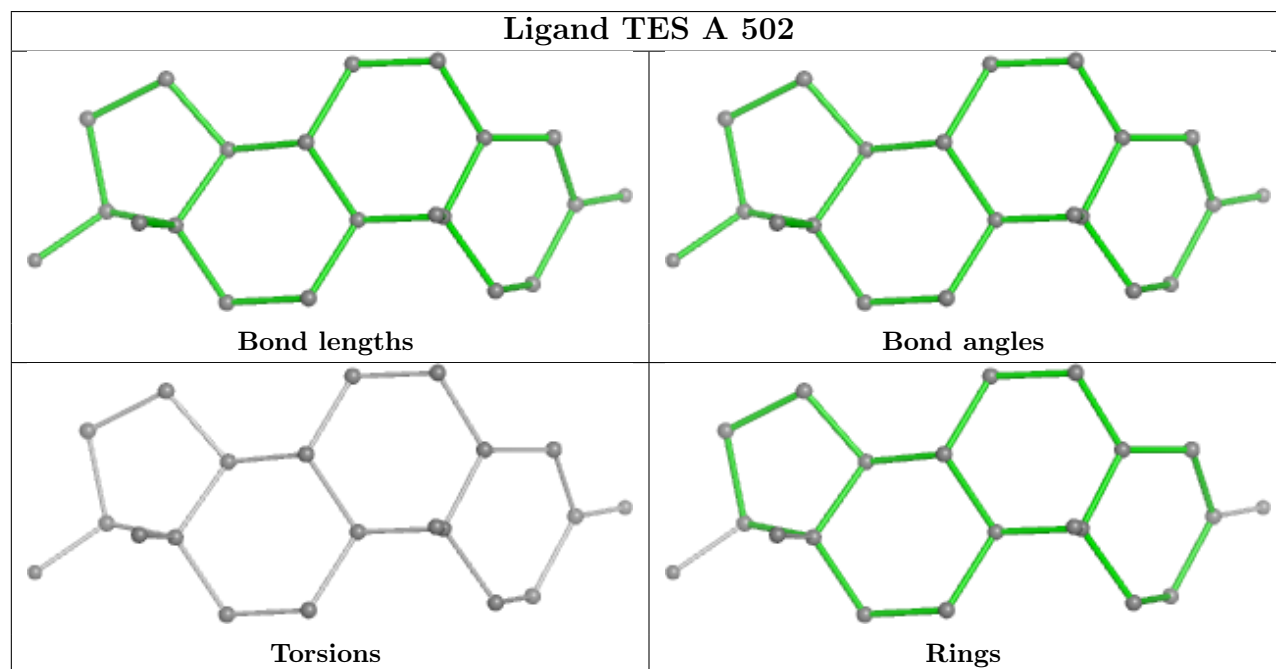
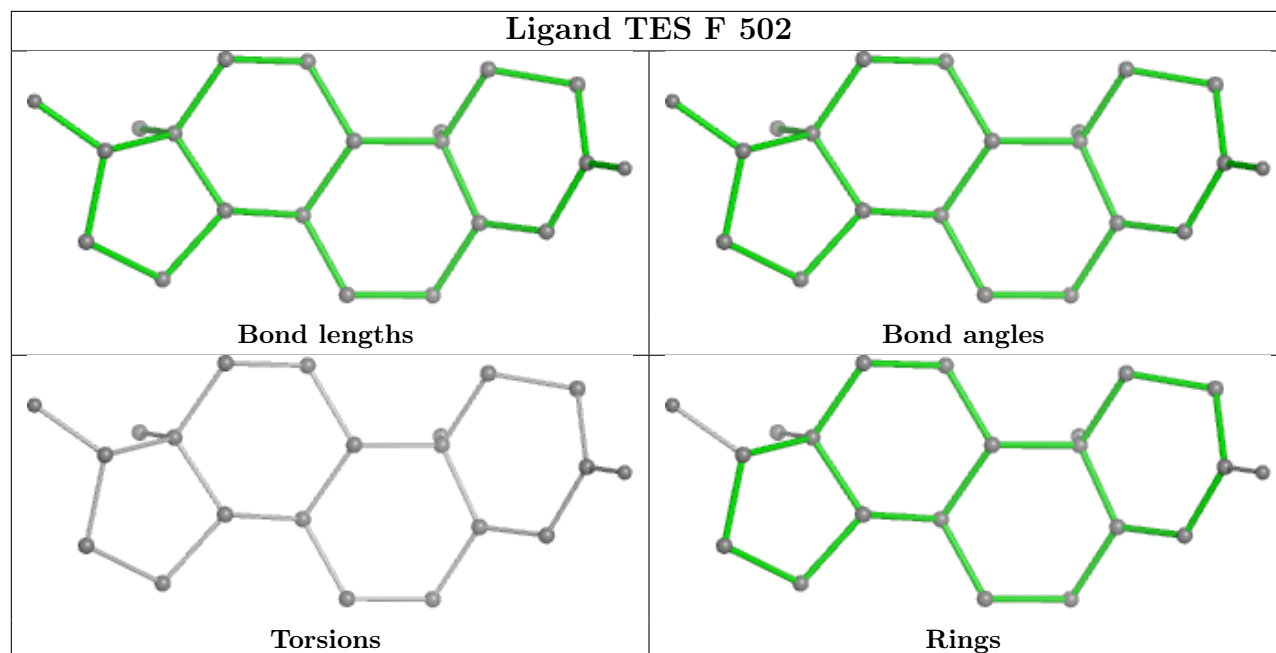


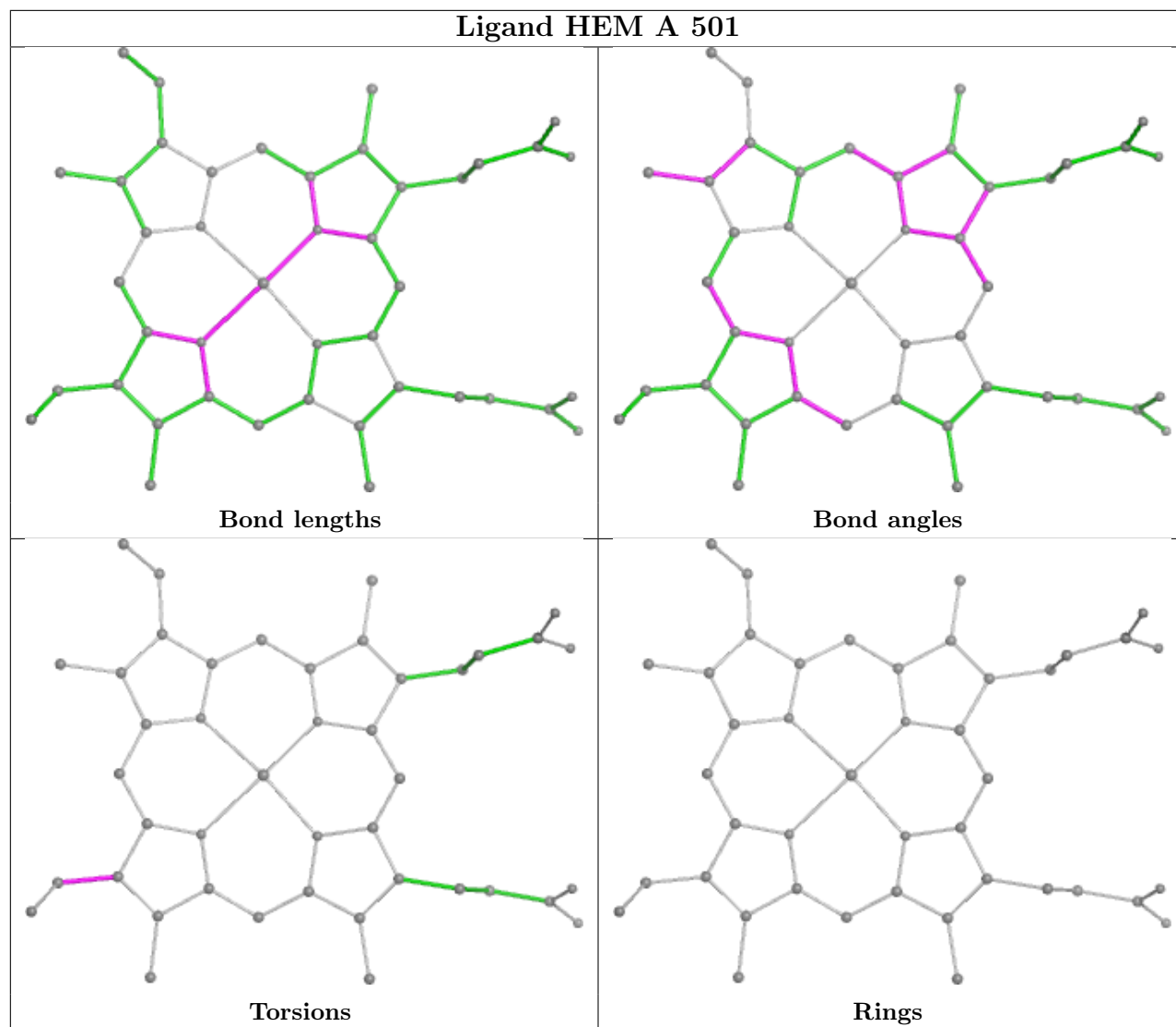


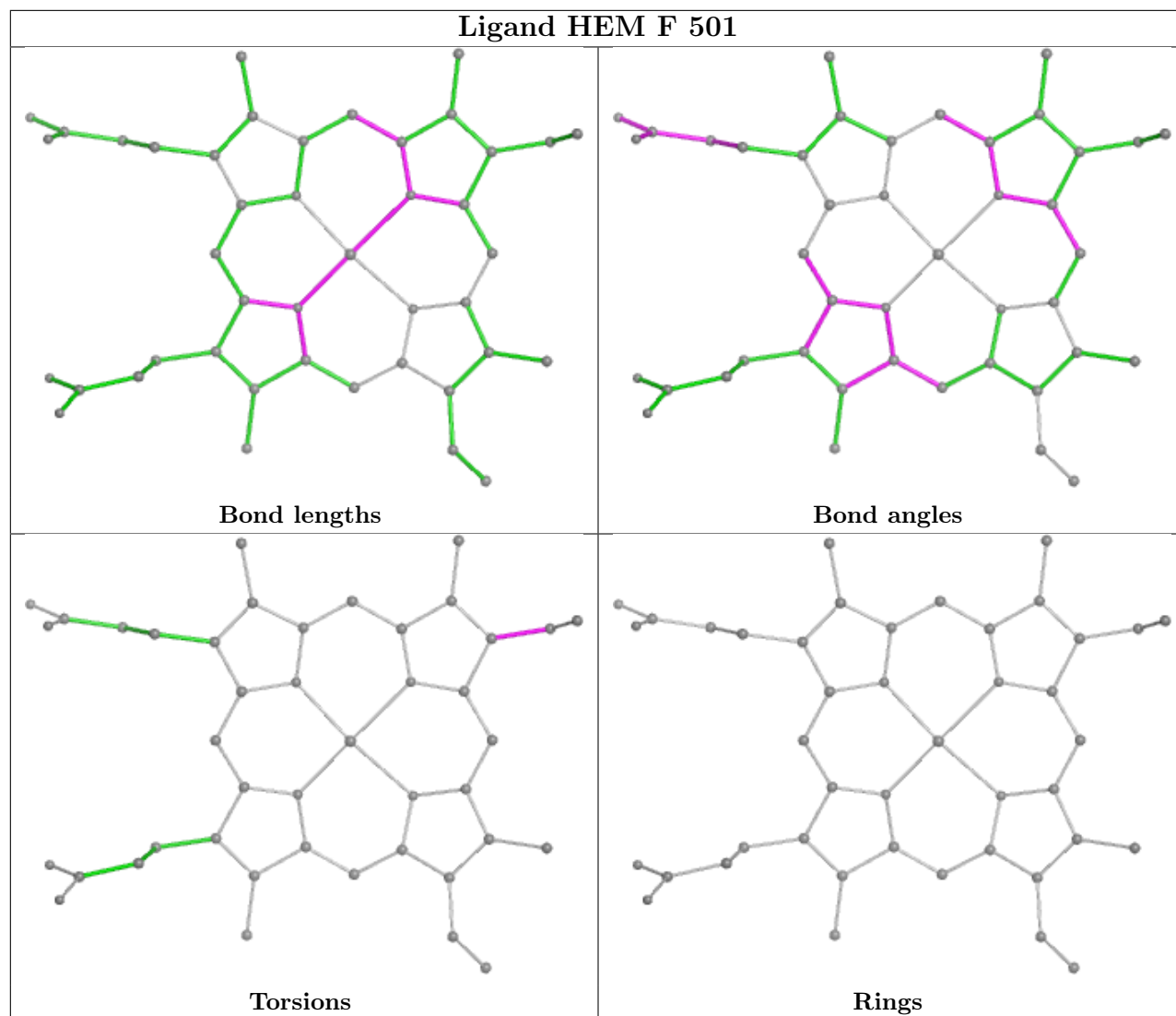












## 5.7 Other polymers [i](#)

There are no such residues in this entry.

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

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	398/410 (97%)	-0.05	10 (2%) 57 64	33, 54, 81, 126	0
1	B	397/410 (96%)	-0.22	2 (0%) 91 94	33, 50, 79, 129	0
1	C	396/410 (96%)	-0.20	2 (0%) 91 94	33, 45, 67, 99	0
1	D	397/410 (96%)	-0.03	10 (2%) 57 64	39, 59, 86, 137	0
1	E	395/410 (96%)	0.22	31 (7%) 13 17	47, 65, 97, 151	0
1	F	397/410 (96%)	0.42	48 (12%) 4 6	45, 70, 117, 135	0
All	All	2380/2460 (96%)	0.02	103 (4%) 35 42	33, 57, 100, 151	0

The worst 5 of 103 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	142	ALA	7.1
1	E	209	ASP	6.3
1	A	210	ALA	5.9
1	F	271	VAL	5.7
1	D	225[A]	ASN	5.4

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

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates [i](#)

There are no monosaccharides 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
4	FMT	A	507	3/3	0.36	0.28	98,98,99,105	0
4	FMT	D	505	3/3	0.50	0.48	86,86,92,94	0
4	FMT	B	510	3/3	0.59	0.39	63,63,83,87	0
4	FMT	C	513	3/3	0.64	0.31	67,67,76,83	0
4	FMT	C	508	3/3	0.64	0.32	66,66,68,87	0
4	FMT	D	507	3/3	0.67	0.25	65,65,78,85	0
4	FMT	A	504	3/3	0.69	0.27	76,76,79,84	0
4	FMT	D	504	3/3	0.70	0.17	83,83,86,88	0
4	FMT	F	505	3/3	0.70	0.27	71,71,76,88	0
4	FMT	C	506	3/3	0.73	0.67	78,78,85,90	0
4	FMT	F	507	3/3	0.73	0.26	62,62,74,79	0
4	FMT	C	507	3/3	0.75	0.27	66,66,73,77	0
4	FMT	A	508	3/3	0.76	0.63	53,53,69,72	0
4	FMT	B	506	3/3	0.76	0.13	74,74,75,83	0
4	FMT	C	509	3/3	0.80	0.34	64,64,77,80	0
4	FMT	C	514	3/3	0.81	0.24	57,57,71,76	0
4	FMT	C	510	3/3	0.81	0.48	65,65,69,75	0
4	FMT	B	507	3/3	0.81	0.25	78,78,85,89	0
4	FMT	B	508	3/3	0.82	0.33	75,75,83,85	0
4	FMT	B	504	3/3	0.82	0.34	68,68,71,84	0
4	FMT	B	514	3/3	0.82	0.35	60,60,67,75	0
4	FMT	A	503	3/3	0.83	0.25	71,71,71,89	0
4	FMT	B	509	3/3	0.83	0.32	62,62,71,80	0
4	FMT	F	503	3/3	0.84	0.19	79,79,82,83	0
4	FMT	C	511	3/3	0.84	0.25	63,63,70,75	0
4	FMT	E	503	3/3	0.84	0.24	68,68,81,83	0
4	FMT	D	503	3/3	0.86	0.30	93,93,95,99	0
4	FMT	A	506	3/3	0.86	0.25	68,68,71,80	0
4	FMT	F	506	3/3	0.87	0.19	76,76,81,90	0
4	FMT	B	515	3/3	0.88	0.30	64,64,76,77	0
4	FMT	B	512	3/3	0.88	0.40	71,71,76,80	0
4	FMT	B	511	3/3	0.89	0.25	65,65,73,75	0
4	FMT	A	505	3/3	0.89	0.29	64,64,76,78	0
4	FMT	B	513	3/3	0.89	0.33	57,57,61,64	0
4	FMT	E	505	3/3	0.89	0.34	60,60,65,74	0
4	FMT	D	508	3/3	0.90	0.24	47,47,55,60	0
4	FMT	C	504	3/3	0.91	0.23	73,73,73,79	0

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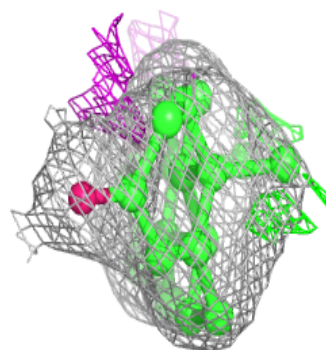
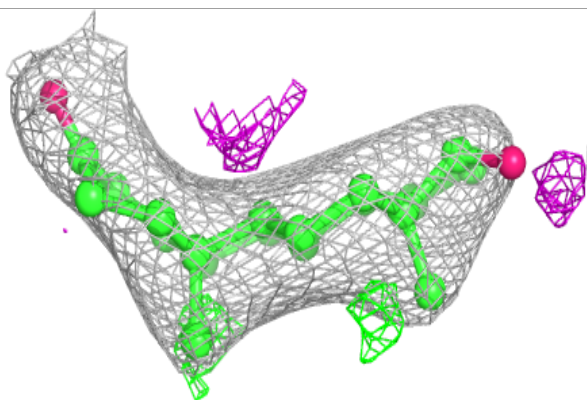
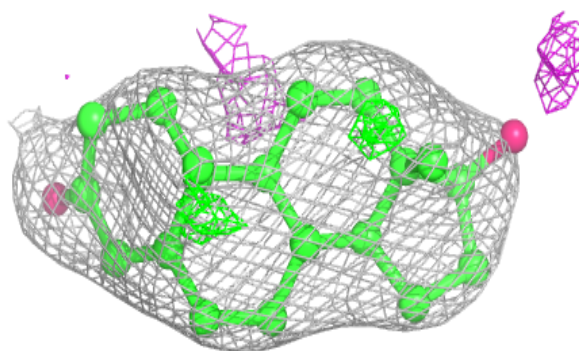
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	TES	F	502	21/21	0.92	0.19	61,64,68,76	0
4	FMT	B	505	3/3	0.92	0.48	67,67,69,85	0
4	FMT	B	503	3/3	0.92	0.15	61,61,61,64	0
4	FMT	C	503	3/3	0.92	0.13	52,52,61,65	0
4	FMT	F	504	3/3	0.93	0.11	71,71,73,74	0
4	FMT	D	509	3/3	0.93	0.15	70,70,73,76	0
3	TES	A	502	21/21	0.94	0.15	45,53,60,63	0
5	NA	E	506	1/1	0.94	0.28	56,56,56,56	0
5	NA	F	508	1/1	0.94	0.17	56,56,56,56	0
4	FMT	C	505	3/3	0.95	0.30	58,58,70,70	0
3	TES	E	502	21/21	0.95	0.16	51,55,59,59	0
4	FMT	D	506	3/3	0.95	0.14	56,56,64,68	0
4	FMT	E	504	3/3	0.96	0.31	51,51,61,69	0
5	NA	B	516	1/1	0.96	0.19	49,49,49,49	0
3	TES	C	502	21/21	0.96	0.17	41,46,53,59	0
3	TES	D	502	21/21	0.96	0.14	50,52,59,61	0
4	FMT	C	512	3/3	0.97	0.26	52,52,54,64	0
2	HEM	F	501	43/43	0.97	0.14	47,56,62,76	0
2	HEM	E	501	43/43	0.97	0.14	44,47,53,61	0
2	HEM	C	501	43/43	0.98	0.15	28,33,39,48	0
3	TES	B	502	21/21	0.98	0.14	38,44,48,55	0
5	NA	A	509	1/1	0.98	0.10	55,55,55,55	0
2	HEM	D	501	43/43	0.98	0.14	36,40,51,56	0
5	NA	C	515	1/1	0.98	0.26	48,48,48,48	0
5	NA	D	510	1/1	0.98	0.24	61,61,61,61	0
2	HEM	A	501	43/43	0.98	0.15	32,36,43,53	0
2	HEM	B	501	43/43	0.98	0.13	29,33,39,50	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.

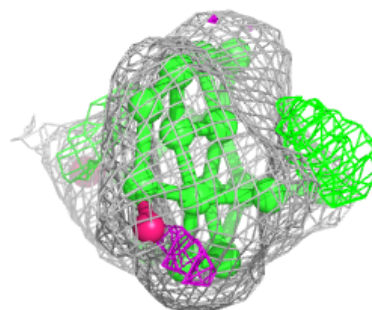
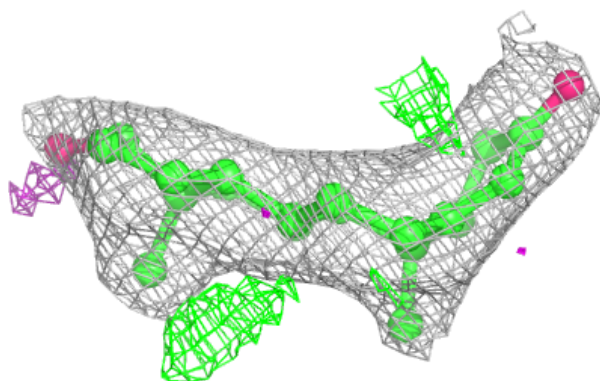
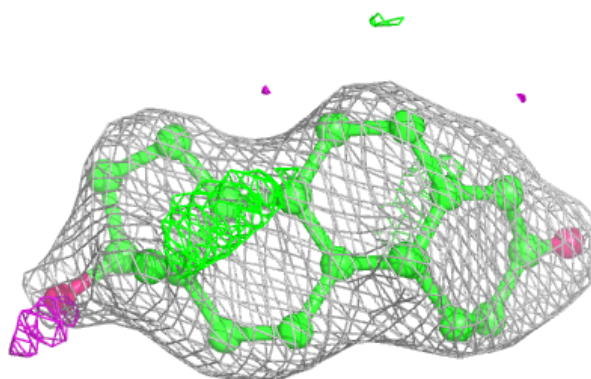


**Electron density around TES F 502:**

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

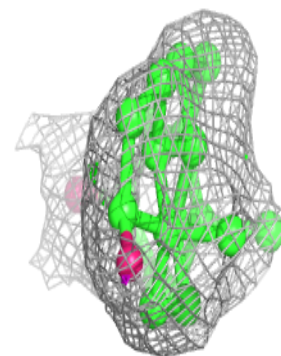
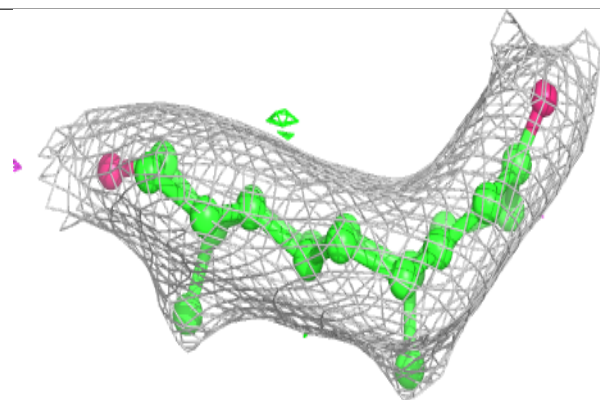
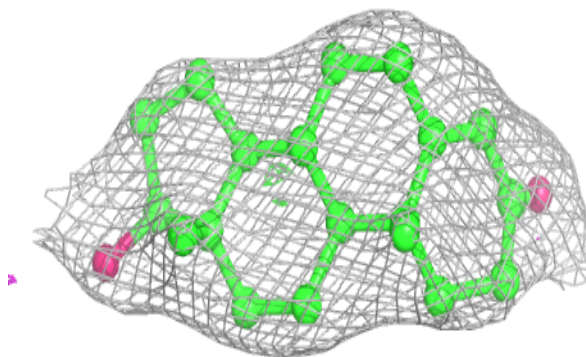
**Electron density around TES A 502:**

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

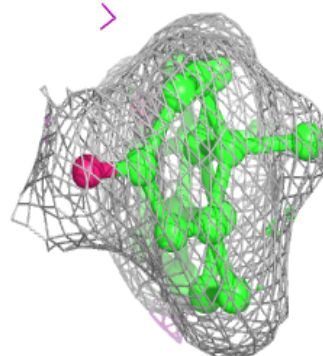
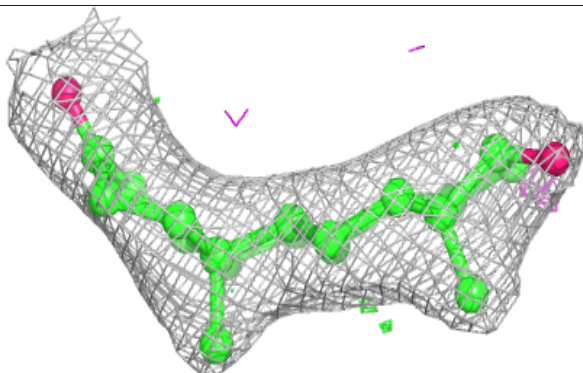
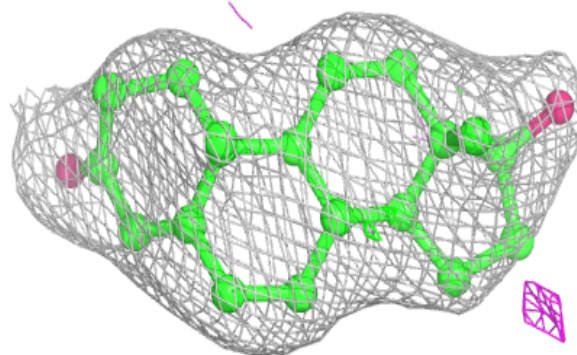


**Electron density around TES E 502:**

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

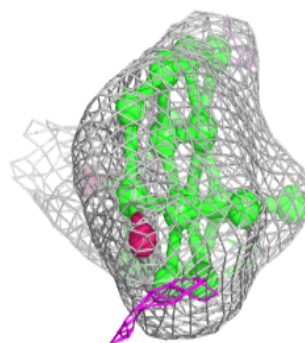
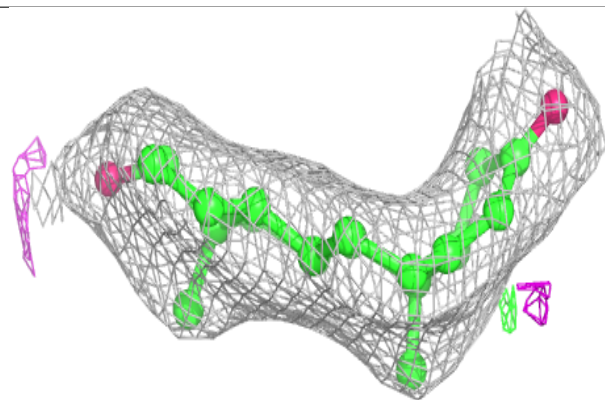
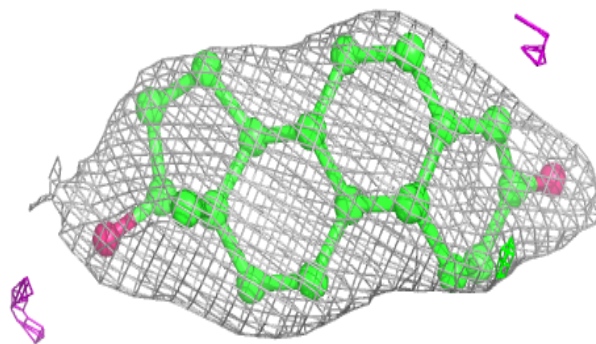
**Electron density around TES C 502:**

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

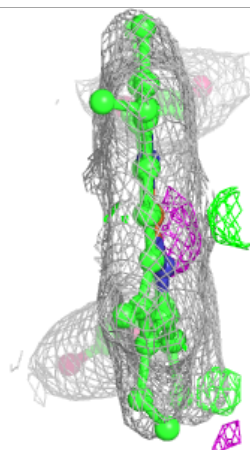
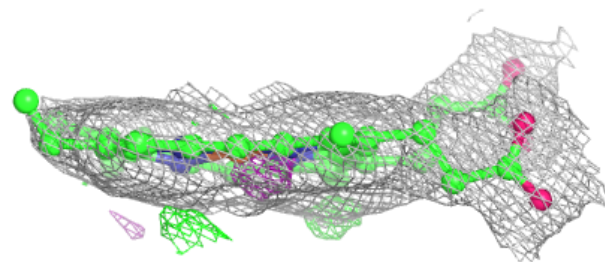
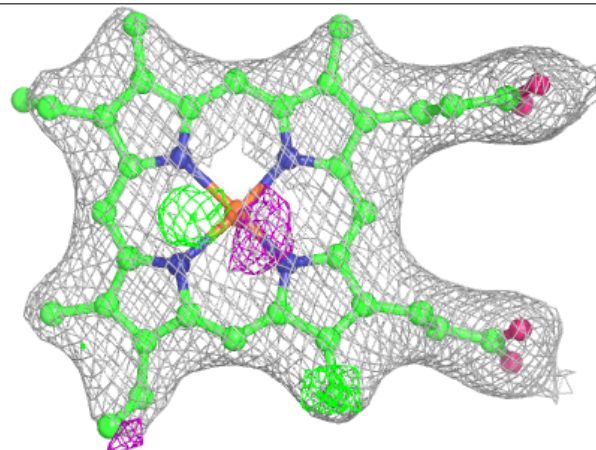


**Electron density around TES D 502:**

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

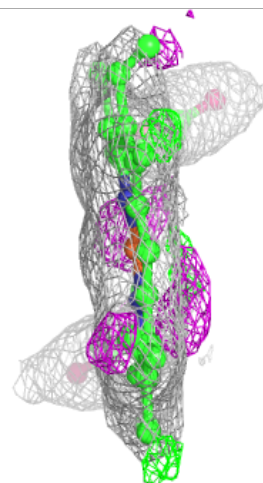
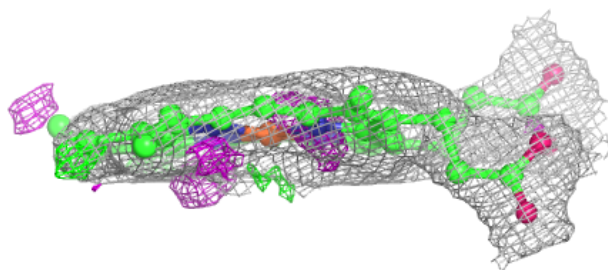
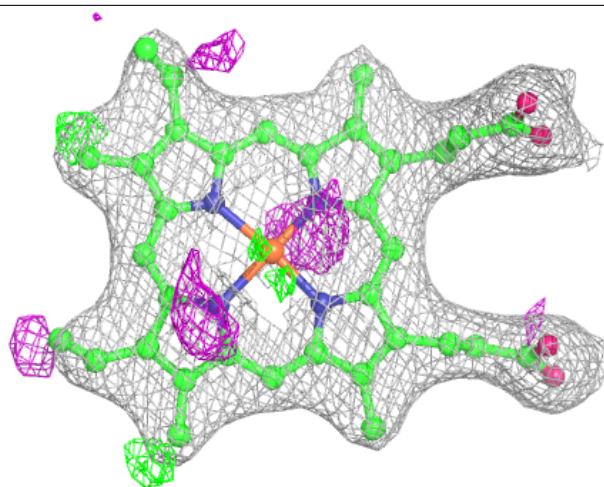
**Electron density around HEM F 501:**

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



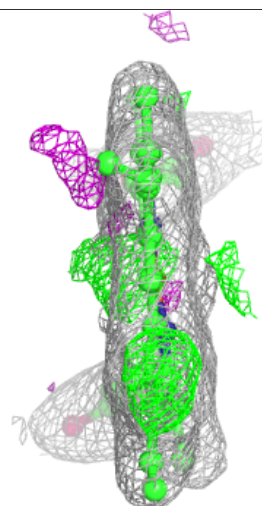
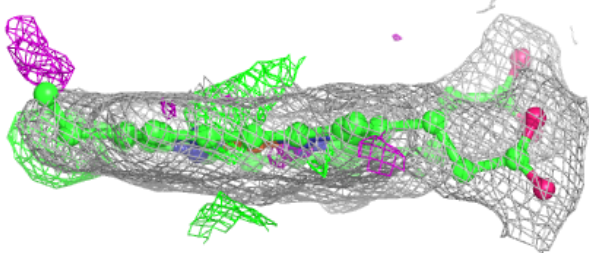
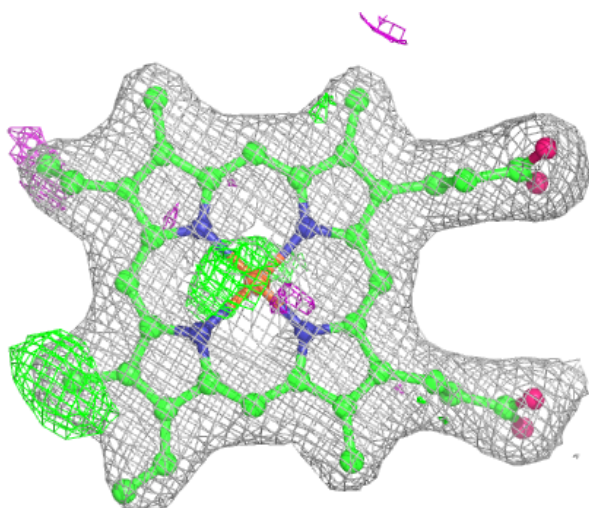
**Electron density around HEM E 501:**

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



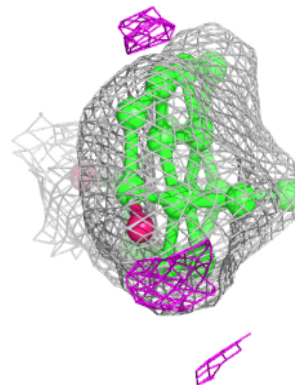
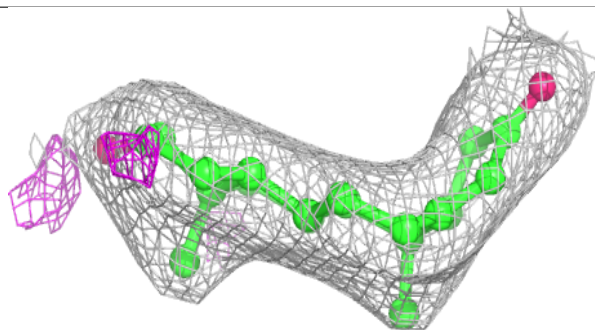
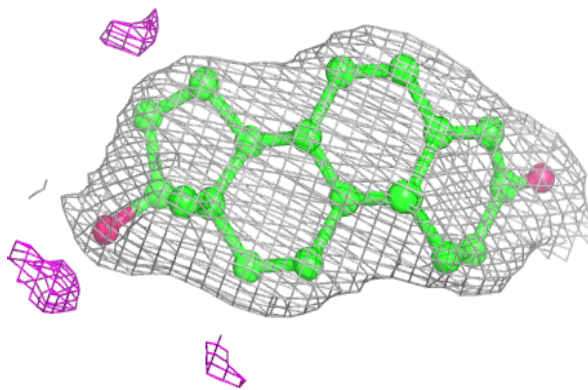
**Electron density around HEM C 501:**

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



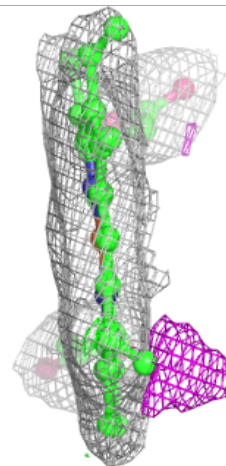
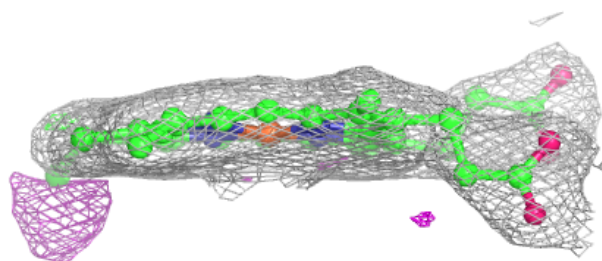
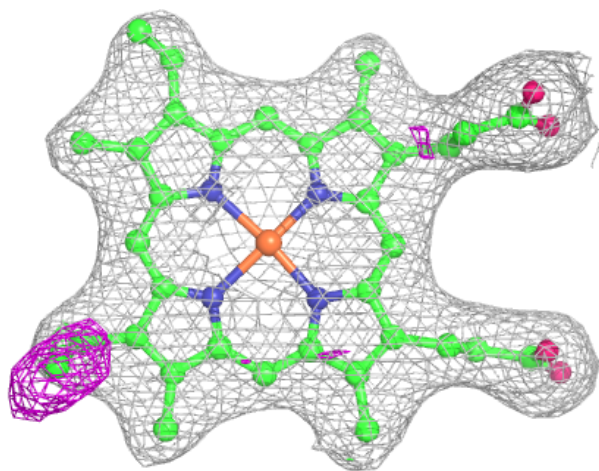
**Electron density around TES B 502:**

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



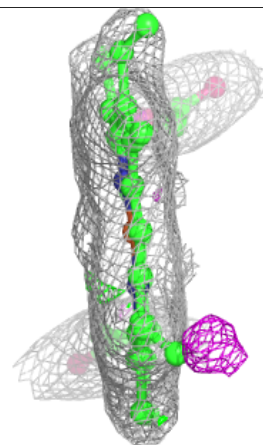
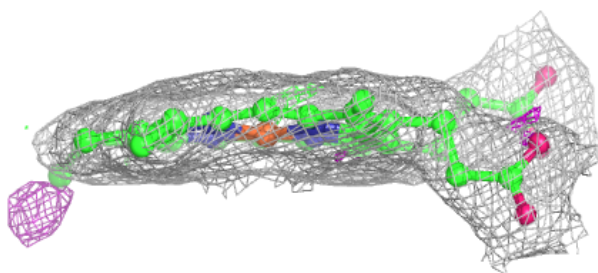
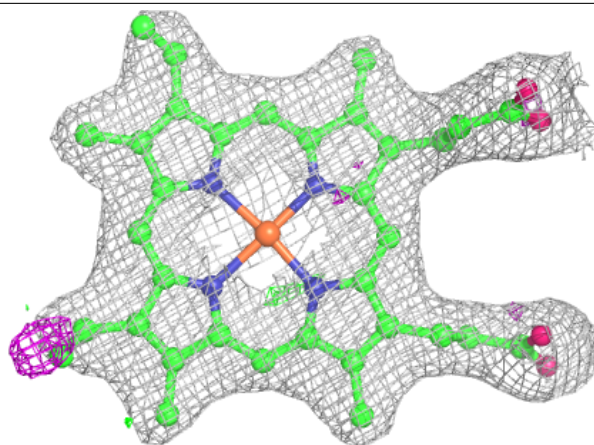
**Electron density around HEM D 501:**

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

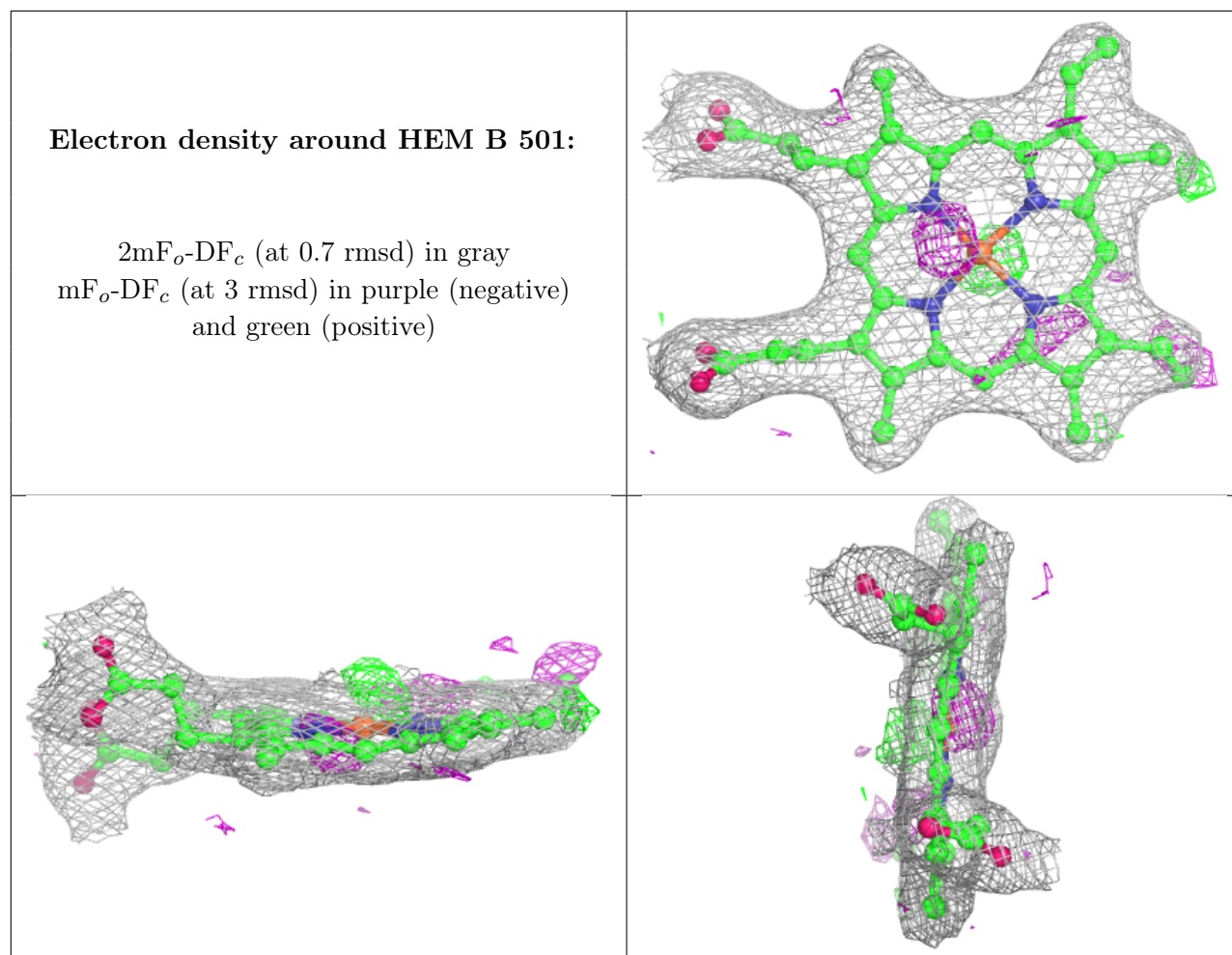


**Electron density around HEM A 501:**

$2mF_o-DF_c$  (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.