



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 19, 2026 – 12:09 AM UTC

PDB ID : 5LOQ / pdb_00005loq
Title : Structure of coproheme bound HemQ from *Listeria monocytogenes*
Authors : Puehringer, D.; Mlynek, G.; Hofbauer, S.; Djinovic-Carugo, K.; Obinger, C.
Deposited on : 2016-08-09
Resolution : 1.69 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
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)	:	2.49

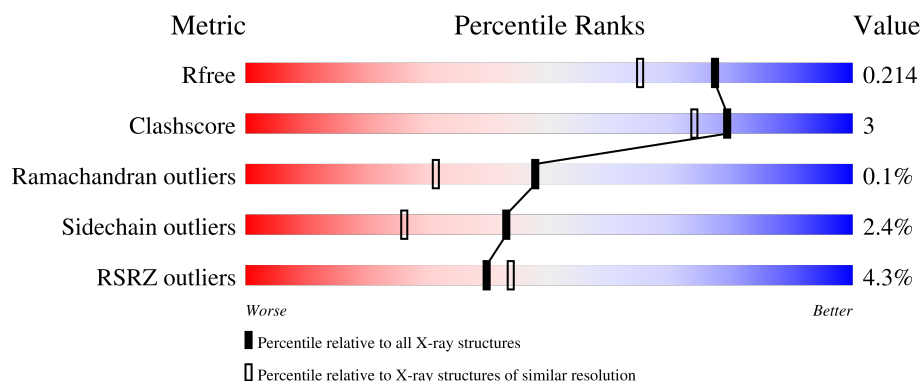
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.69 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}	180053	5551 (1.70-1.70)
Clashscore	190562	5924 (1.70-1.70)
Ramachandran outliers	187476	5846 (1.70-1.70)
Sidechain outliers	187428	5846 (1.70-1.70)
RSRZ outliers	180081	5554 (1.70-1.70)

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	A	250	5% 93% 6%
1	B	250	3% 90% 7%
1	C	250	5% 84% 9% 5%
1	D	250	3% 95% 5%
1	E	250	4% 90% 6%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 20536 atoms, of which 9740 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.

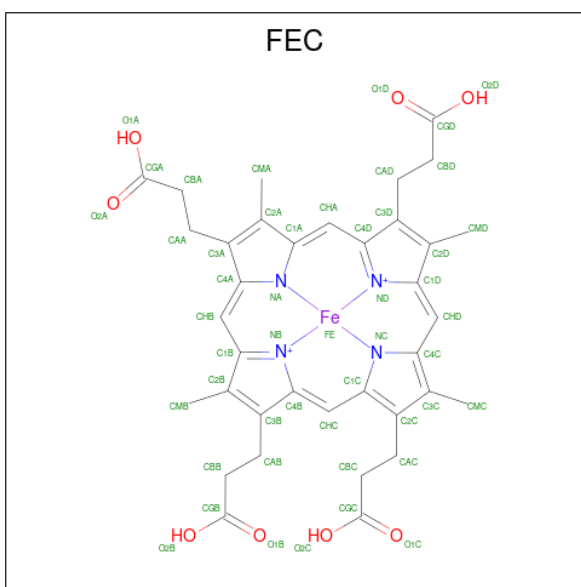
- Molecule 1 is a protein called Putative heme-dependent peroxidase lmo2113.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	248	Total	C	H	N	O	S	0	0	0
			3960	1292	1950	335	374	9			
1	B	233	Total	C	H	N	O	S	0	0	0
			3762	1228	1857	317	352	8			
1	C	237	Total	C	H	N	O	S	0	0	0
			3817	1245	1883	322	359	8			
1	D	250	Total	C	H	N	O	S	0	0	0
			3989	1301	1962	338	379	9			
1	E	235	Total	C	H	N	O	S	0	0	0
			3797	1241	1872	320	356	8			

- Molecule 2 is SODIUM ION (CCD ID: NA) (formula: Na).

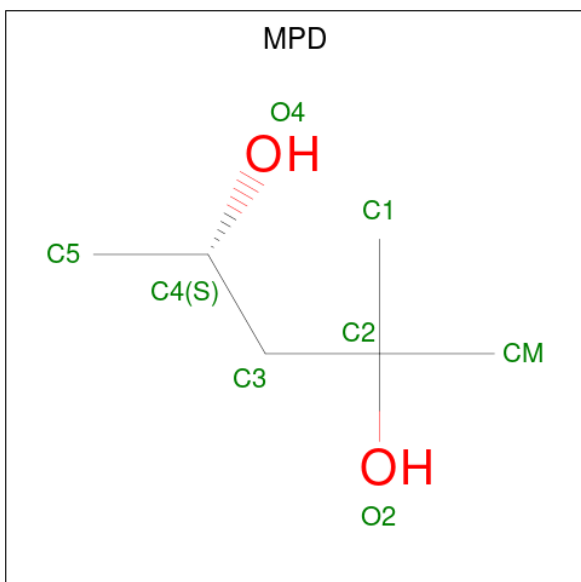
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Na	0	0
			1	1		
2	B	1	Total	Na	0	0
			1	1		
2	C	1	Total	Na	0	0
			1	1		
2	D	1	Total	Na	0	0
			1	1		
2	E	1	Total	Na	0	0
			1	1		

- Molecule 3 is 1,3,5,8-TETRAMETHYL-PORPHINE-2,4,6,7-TETRAPROPIONIC ACID FERROUS COMPLEX (CCD ID: FEC) (formula: C₃₆H₃₆FeN₄O₈).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total 81	C 36	Fe 1	H 32	N 4	O 8	0	0
3	B	1	Total 81	C 36	Fe 1	H 32	N 4	O 8	0	0
3	C	1	Total 81	C 36	Fe 1	H 32	N 4	O 8	0	0
3	D	1	Total 81	C 36	Fe 1	H 32	N 4	O 8	0	0
3	E	1	Total 81	C 36	Fe 1	H 32	N 4	O 8	0	0

- Molecule 4 is (4S)-2-METHYL-2,4-PENTANEDIOL (CCD ID: MPD) (formula: $C_6H_{14}O_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	H	O	0	0
			22	6	14	2		
4	B	1	Total	C	H	O	0	0
			22	6	14	2		
4	D	1	Total	C	H	O	0	0
			22	6	14	2		
4	E	1	Total	C	H	O	0	0
			22	6	14	2		

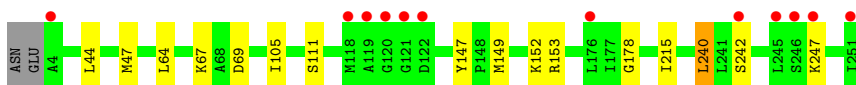
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	147	Total	O	0	0
			147	147		
5	B	123	Total	O	0	0
			123	123		
5	C	128	Total	O	0	0
			128	128		
5	D	169	Total	O	0	0
			169	169		
5	E	146	Total	O	0	0
			146	146		

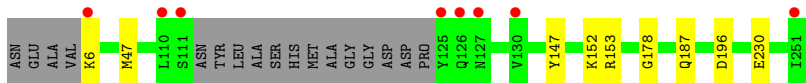
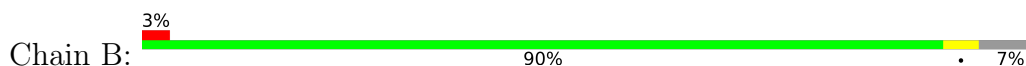
3 Residue-property plots [i](#)

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.

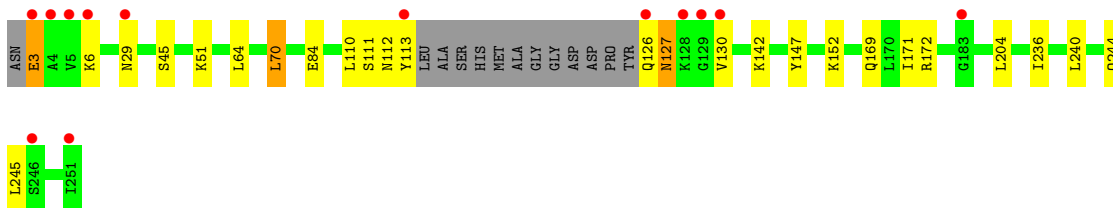
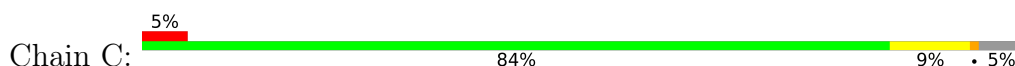
- Molecule 1: Putative heme-dependent peroxidase lmo2113



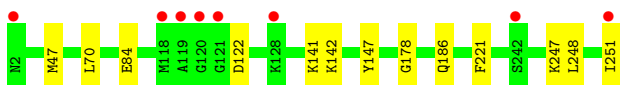
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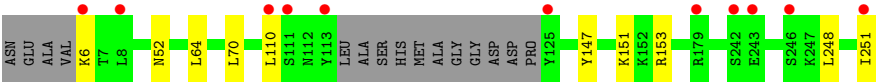


- Molecule 1: Putative heme-dependent peroxidase lmo2113



- Molecule 1: Putative heme-dependent peroxidase lmo2113





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	77.69Å 129.37Å 77.92Å 90.00° 105.52° 90.00°	Depositor
Resolution (Å)	49.00 – 1.69 49.00 – 1.69	Depositor EDS
% Data completeness (in resolution range)	97.9 (49.00-1.69) 86.4 (49.00-1.69)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.28 (at 1.69Å)	Xtriage
Refinement program	PHENIX dev_2443	Depositor
R, R_{free}	0.184 , 0.215 0.185 , 0.214	Depositor DCC
R_{free} test set	1991 reflections (1.22%)	wwPDB-VP
Wilson B-factor (Å ²)	20.6	Xtriage
Anisotropy	0.372	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 43.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.031 for l,-k,h	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	20536	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.85% 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: MPD, FEC, NA

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	0.52	0/2060	0.62	0/2784
1	B	0.51	0/1951	0.62	0/2633
1	C	0.50	0/1980	0.62	0/2673
1	D	0.53	0/2077	0.64	0/2807
1	E	0.50	0/1972	0.61	0/2662
All	All	0.51	0/10040	0.62	0/13559

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2010	1950	1950	12	0
1	B	1905	1857	1857	8	0
1	C	1934	1883	1883	20	0
1	D	2027	1962	1962	7	0
1	E	1925	1872	1872	7	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	1	0	0	0	0
2	E	1	0	0	0	0
3	A	49	32	32	6	0
3	B	49	32	32	6	0
3	C	49	32	32	6	0
3	D	49	32	32	4	0
3	E	49	32	32	5	0
4	A	8	14	14	0	0
4	B	8	14	14	1	0
4	D	8	14	14	1	0
4	E	8	14	14	1	0
5	A	147	0	0	1	0
5	B	123	0	0	2	0
5	C	128	0	0	1	0
5	D	169	0	0	0	0
5	E	146	0	0	2	0
All	All	10796	9740	9740	54	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 3.

All (54) 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:D:147:TYR:OH	3:D:302:FEC:HAA2	1.80	0.80
4:B:303:MPD:O4	5:B:401:HOH:O	2.03	0.77
1:A:147:TYR:OH	3:A:302:FEC:HAA2	1.90	0.71
1:C:111:SER:OG	3:C:302:FEC:O2C	2.08	0.66
1:A:69:ASP:OD1	5:A:401:HOH:O	2.14	0.64
1:B:147:TYR:OH	3:B:302:FEC:HAA2	1.99	0.62
1:E:147:TYR:OH	3:E:302:FEC:HBA1	1.99	0.61
3:D:302:FEC:HHA	3:D:302:FEC:HBD1	1.83	0.61
1:E:147:TYR:OH	3:E:302:FEC:HAA2	2.01	0.60
1:B:147:TYR:OH	3:B:302:FEC:CBA	2.51	0.59
1:C:113:TYR:CD1	1:C:171:ILE:HD13	2.41	0.55
1:C:147:TYR:OH	3:C:302:FEC:HAA2	2.06	0.55
1:D:247:LYS:HD3	4:D:303:MPD:H11	1.90	0.53
1:C:147:TYR:OH	3:C:302:FEC:HBA1	2.10	0.52
1:A:67:LYS:NZ	1:B:196:ASP:OD1	2.44	0.51
1:A:149:MET:SD	3:A:302:FEC:HBA2	2.50	0.51
1:B:147:TYR:OH	3:B:302:FEC:CAA	2.60	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:127:ASN:O	1:C:130:VAL:N	2.45	0.48
1:E:70:LEU:HD21	1:E:248:LEU:CD2	2.43	0.48
1:D:178:GLY:CA	3:D:302:FEC:HAD1	2.43	0.48
1:C:147:TYR:OH	3:C:302:FEC:CBA	2.62	0.47
1:C:113:TYR:CG	1:C:171:ILE:HD13	2.49	0.47
1:A:153:ARG:O	1:C:152:LYS:NZ	2.48	0.46
1:C:169:GLN:HG3	1:C:172:ARG:HH22	1.81	0.46
1:A:105:ILE:HG21	1:C:236:ILE:HD11	1.98	0.46
1:C:3:GLU:HG2	1:D:221:PHE:HB3	1.98	0.45
3:A:302:FEC:CBA	3:A:302:FEC:HHB	2.47	0.45
1:A:215:ILE:HD11	3:A:302:FEC:HAD1	1.97	0.45
4:E:303:MPD:H13	5:E:448:HOH:O	2.16	0.45
1:B:152:LYS:NZ	1:E:153:ARG:O	2.50	0.45
1:A:152:LYS:NZ	1:B:153:ARG:O	2.49	0.44
1:A:44:LEU:HD23	1:A:47:MET:HE2	1.99	0.44
1:A:240:LEU:CD2	5:B:401:HOH:O	2.64	0.44
1:C:245:LEU:HD13	1:C:245:LEU:C	2.42	0.44
1:E:147:TYR:OH	3:E:302:FEC:CBA	2.65	0.44
1:A:178:GLY:C	3:A:302:FEC:HMD3	2.43	0.44
3:B:302:FEC:HBC2	3:B:302:FEC:HHC	2.01	0.43
1:D:186:GLN:C	3:D:302:FEC:O2D	2.62	0.43
1:C:51:LYS:NZ	5:C:404:HOH:O	2.48	0.43
1:C:111:SER:CB	3:C:302:FEC:O2C	2.67	0.43
1:A:111:SER:OG	3:A:302:FEC:HBC1	2.17	0.42
1:C:70:LEU:HD12	1:C:70:LEU:N	2.33	0.42
1:D:70:LEU:HD21	1:D:248:LEU:CD2	2.48	0.42
1:C:126:GLN:O	1:C:127:ASN:C	2.62	0.42
1:B:187:GLN:OE1	3:B:302:FEC:HBD1	2.19	0.42
3:E:302:FEC:HHB	3:E:302:FEC:HAA1	1.93	0.41
1:C:6:LYS:O	1:C:112:ASN:HB3	2.20	0.41
1:E:151:LYS:NZ	5:E:417:HOH:O	2.53	0.41
1:B:178:GLY:HA2	3:B:302:FEC:HAD2	2.03	0.41
1:C:240:LEU:HD23	1:C:244:GLN:CB	2.51	0.41
1:C:204:LEU:HD21	3:C:302:FEC:HMA2	2.03	0.41
1:D:141:LYS:HE2	1:D:186:GLN:OE1	2.21	0.40
1:E:147:TYR:OH	3:E:302:FEC:CAA	2.69	0.40
1:C:126:GLN:OE1	1:C:126:GLN:HA	2.22	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	246/250 (98%)	243 (99%)	3 (1%)	0	100	100
1	B	229/250 (92%)	227 (99%)	2 (1%)	0	100	100
1	C	233/250 (93%)	228 (98%)	4 (2%)	1 (0%)	30	16
1	D	248/250 (99%)	245 (99%)	3 (1%)	0	100	100
1	E	231/250 (92%)	228 (99%)	3 (1%)	0	100	100
All	All	1187/1250 (95%)	1171 (99%)	15 (1%)	1 (0%)	48	31

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	127	ASN

5.3.2 Protein sidechains

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	213/215 (99%)	209 (98%)	4 (2%)	50	34
1	B	203/215 (94%)	200 (98%)	3 (2%)	57	43
1	C	206/215 (96%)	198 (96%)	8 (4%)	28	12
1	D	215/215 (100%)	210 (98%)	5 (2%)	44	27
1	E	205/215 (95%)	200 (98%)	5 (2%)	43	26
All	All	1042/1075 (97%)	1017 (98%)	25 (2%)	43	26

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	64	LEU
1	A	240	LEU
1	A	242	SER
1	A	247	LYS
1	B	6	LYS
1	B	47	MET
1	B	230	GLU
1	C	3	GLU
1	C	29	ASN
1	C	45	SER
1	C	64	LEU
1	C	70	LEU
1	C	84	GLU
1	C	110	LEU
1	C	142	LYS
1	D	47	MET
1	D	84	GLU
1	D	122	ASP
1	D	142	LYS
1	D	251	ILE
1	E	6	LYS
1	E	52	ASN
1	E	64	LEU
1	E	110	LEU
1	E	251	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	168	GLN
1	E	168	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 14 ligands modelled in this entry, 5 are monoatomic - leaving 9 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$
3	FEC	D	302	1	48,56,56	1.70	10 (20%)	50,90,90	2.08	15 (30%)
4	MPD	B	303	-	7,7,7	0.47	0	9,10,10	0.47	0
3	FEC	E	302	1	48,56,56	1.68	8 (16%)	50,90,90	2.19	20 (40%)
4	MPD	A	303	-	7,7,7	0.35	0	9,10,10	0.44	0
4	MPD	D	303	-	7,7,7	0.39	0	9,10,10	0.44	0
3	FEC	B	302	1	48,56,56	1.71	7 (14%)	50,90,90	2.30	24 (48%)
4	MPD	E	303	-	7,7,7	0.46	0	9,10,10	0.53	0
3	FEC	C	302	-	48,56,56	1.71	6 (12%)	50,90,90	2.16	21 (42%)
3	FEC	A	302	1	48,56,56	1.65	8 (16%)	50,90,90	2.17	20 (40%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	FEC	D	302	1	-	7/20/120/120	-
4	MPD	B	303	-	-	0/5/5/5	-
3	FEC	E	302	1	-	4/20/120/120	-
4	MPD	A	303	-	-	1/5/5/5	-
4	MPD	D	303	-	-	2/5/5/5	-
3	FEC	B	302	1	-	6/20/120/120	-
4	MPD	E	303	-	-	0/5/5/5	-
3	FEC	C	302	-	-	6/20/120/120	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	FEC	A	302	1	-	1/20/120/120	-

All (39) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	302	FEC	C1A-C2A	4.83	1.45	1.39
3	E	302	FEC	C1A-C2A	4.78	1.45	1.39
3	B	302	FEC	C1A-C2A	4.55	1.44	1.39
3	D	302	FEC	C1A-C2A	4.48	1.44	1.39
3	B	302	FEC	CAD-C3D	4.37	1.57	1.51
3	E	302	FEC	C4C-C3C	4.30	1.44	1.39
3	C	302	FEC	C4C-C3C	4.22	1.44	1.39
3	B	302	FEC	C4C-C3C	4.19	1.44	1.39
3	E	302	FEC	CAD-C3D	4.07	1.57	1.51
3	D	302	FEC	C4C-C3C	4.05	1.44	1.39
3	A	302	FEC	C1A-C2A	4.04	1.44	1.39
3	B	302	FEC	CMD-C2D	4.01	1.56	1.50
3	A	302	FEC	C4C-C3C	3.95	1.44	1.39
3	C	302	FEC	CMD-C2D	3.86	1.56	1.50
3	C	302	FEC	CAD-C3D	3.84	1.57	1.51
3	A	302	FEC	CAD-C3D	3.80	1.56	1.51
3	D	302	FEC	CMD-C2D	3.61	1.56	1.50
3	A	302	FEC	CMD-C2D	3.45	1.56	1.50
3	E	302	FEC	CMD-C2D	3.39	1.55	1.50
3	D	302	FEC	CAD-C3D	3.00	1.55	1.51
3	D	302	FEC	CMB-C2B	2.92	1.55	1.50
3	A	302	FEC	CHB-C4A	-2.87	1.35	1.39
3	D	302	FEC	CMA-C2A	2.67	1.56	1.51
3	D	302	FEC	CHD-C4C	-2.58	1.35	1.39
3	B	302	FEC	CMA-C2A	2.52	1.56	1.51
3	C	302	FEC	CMA-C2A	2.44	1.56	1.51
3	E	302	FEC	CMA-C2A	2.43	1.56	1.51
3	A	302	FEC	CMA-C2A	2.42	1.56	1.51
3	B	302	FEC	CHD-C4C	-2.35	1.35	1.39
3	D	302	FEC	CHB-C4A	-2.35	1.35	1.39
3	A	302	FEC	CMC-C3C	2.35	1.56	1.51
3	C	302	FEC	CHD-C4C	-2.31	1.35	1.39
3	D	302	FEC	CMC-C3C	2.29	1.56	1.51
3	A	302	FEC	CHD-C4C	-2.27	1.36	1.39
3	E	302	FEC	CMC-C3C	2.26	1.56	1.51
3	B	302	FEC	CAB-C3B	2.21	1.54	1.51
3	E	302	FEC	CHB-C4A	-2.19	1.36	1.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	302	FEC	CAB-C3B	2.19	1.54	1.51
3	E	302	FEC	CHD-C4C	-2.01	1.36	1.39

All (100) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	302	FEC	CHC-C4B-NB	5.50	126.26	121.16
3	B	302	FEC	C4A-NA-C1A	5.43	109.40	105.14
3	E	302	FEC	CBD-CAD-C3D	5.39	127.30	112.54
3	A	302	FEC	CBD-CAD-C3D	5.32	127.09	112.54
3	B	302	FEC	CBD-CAD-C3D	5.31	127.07	112.54
3	D	302	FEC	CBD-CAD-C3D	5.30	127.04	112.54
3	B	302	FEC	CBA-CAA-C3A	4.87	120.72	112.54
3	A	302	FEC	CHC-C4B-NB	4.68	125.50	121.16
3	D	302	FEC	C4A-NA-C1A	4.51	108.68	105.14
3	C	302	FEC	CHC-C4B-NB	4.50	125.33	121.16
3	A	302	FEC	C4A-NA-C1A	4.48	108.66	105.14
3	E	302	FEC	CHC-C4B-NB	4.29	125.14	121.16
3	C	302	FEC	CBD-CAD-C3D	4.28	124.25	112.54
3	A	302	FEC	CHA-C4D-ND	4.22	125.08	121.16
3	B	302	FEC	CHC-C4B-NB	4.00	124.87	121.16
3	C	302	FEC	CHA-C4D-ND	3.87	124.75	121.16
3	B	302	FEC	CHD-C1D-ND	3.84	124.72	121.16
3	A	302	FEC	CBB-CAB-C3B	-3.82	102.08	112.54
3	D	302	FEC	CHD-C1D-ND	3.76	124.64	121.16
3	C	302	FEC	CBA-CAA-C3A	3.75	118.84	112.54
3	E	302	FEC	C4A-NA-C1A	3.66	108.01	105.14
3	D	302	FEC	O2D-CGD-O1D	3.63	132.67	123.33
3	C	302	FEC	C4A-NA-C1A	3.58	107.95	105.14
3	E	302	FEC	CHD-C1D-ND	3.51	124.42	121.16
3	C	302	FEC	CHD-C1D-ND	3.46	124.37	121.16
3	D	302	FEC	CHA-C4D-ND	3.42	124.33	121.16
3	E	302	FEC	CBA-CAA-C3A	3.39	118.24	112.54
3	E	302	FEC	O1A-CGA-O2A	3.39	132.05	123.33
3	E	302	FEC	CHB-C1B-NB	3.36	124.27	121.16
3	B	302	FEC	O1A-CGA-O2A	3.35	131.94	123.33
3	E	302	FEC	CHA-C4D-ND	3.31	124.23	121.16
3	C	302	FEC	C4D-CHA-C1A	3.26	127.74	116.07
3	E	302	FEC	C4B-CHC-C1C	3.21	127.57	116.07
3	E	302	FEC	C4D-CHA-C1A	3.17	127.43	116.07
3	B	302	FEC	C4D-CHA-C1A	3.17	127.41	116.07
3	D	302	FEC	C4B-CHC-C1C	3.16	127.38	116.07

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	302	FEC	C4B-CHC-C1C	3.15	127.35	116.07
3	C	302	FEC	O2D-CGD-O1D	3.09	131.27	123.33
3	B	302	FEC	CHA-C4D-ND	3.03	123.97	121.16
3	C	302	FEC	O1A-CGA-O2A	2.97	130.97	123.33
3	D	302	FEC	CBB-CAB-C3B	-2.97	104.42	112.54
3	D	302	FEC	C4D-CHA-C1A	2.97	126.68	116.07
3	A	302	FEC	CHD-C1D-ND	2.95	123.89	121.16
3	B	302	FEC	C4B-CHC-C1C	2.89	126.41	116.07
3	A	302	FEC	CBA-CAA-C3A	2.88	117.38	112.54
3	E	302	FEC	CMC-C3C-C2C	2.84	130.31	124.94
3	D	302	FEC	C3D-C4D-ND	-2.84	107.83	114.64
3	B	302	FEC	O2D-CGD-O1D	2.84	130.62	123.33
3	C	302	FEC	C3D-C4D-ND	-2.81	107.92	114.64
3	A	302	FEC	CAA-C3A-C2A	2.75	135.14	127.25
3	E	302	FEC	O1D-CGD-CBD	-2.75	114.38	123.09
3	A	302	FEC	C4B-CHC-C1C	2.73	125.84	116.07
3	A	302	FEC	CMC-C3C-C2C	2.70	130.04	124.94
3	E	302	FEC	O2A-CGA-CBA	-2.69	114.55	123.09
3	A	302	FEC	CMA-C2A-C3A	2.68	130.00	124.94
3	B	302	FEC	C3D-C4D-ND	-2.66	108.26	114.64
3	A	302	FEC	C1B-CHB-C4A	2.66	125.59	116.07
3	A	302	FEC	C4D-CHA-C1A	2.64	125.53	116.07
3	E	302	FEC	CBB-CAB-C3B	-2.63	105.33	112.54
3	B	302	FEC	CMD-C2D-C1D	-2.62	120.02	124.73
3	C	302	FEC	O2A-CGA-CBA	-2.62	114.78	123.09
3	B	302	FEC	CMA-C2A-C3A	2.62	129.88	124.94
3	A	302	FEC	O2D-CGD-O1D	2.61	130.05	123.33
3	E	302	FEC	O2D-CGD-O1D	2.61	130.04	123.33
3	B	302	FEC	CBB-CAB-C3B	-2.59	105.44	112.54
3	B	302	FEC	O1D-CGD-CBD	-2.59	114.89	123.09
3	E	302	FEC	C3B-C4B-NB	-2.51	108.62	114.64
3	A	302	FEC	CAD-C3D-C2D	2.51	132.57	127.87
3	B	302	FEC	O2A-CGA-CBA	-2.50	115.16	123.09
3	B	302	FEC	CAA-C3A-C2A	2.49	134.41	127.25
3	C	302	FEC	CHB-C1B-NB	2.46	123.44	121.16
3	C	302	FEC	CMD-C2D-C1D	-2.45	120.32	124.73
3	A	302	FEC	C1D-CHD-C4C	2.44	124.82	116.07
3	D	302	FEC	CMC-C3C-C2C	2.44	129.55	124.94
3	B	302	FEC	CAD-C3D-C2D	2.44	132.43	127.87
3	A	302	FEC	C3D-C4D-ND	-2.43	108.82	114.64
3	E	302	FEC	C1B-CHB-C4A	2.43	124.75	116.07
3	B	302	FEC	C1B-CHB-C4A	2.42	124.74	116.07

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	302	FEC	C1B-CHB-C4A	2.42	124.73	116.07
3	C	302	FEC	O1D-CGD-CBD	-2.42	115.43	123.09
3	C	302	FEC	CMC-C3C-C2C	2.40	129.47	124.94
3	A	302	FEC	O1D-CGD-CBD	-2.39	115.52	123.09
3	E	302	FEC	C3D-C4D-ND	-2.38	108.94	114.64
3	A	302	FEC	O2A-CGA-CBA	-2.38	115.56	123.09
3	B	302	FEC	CHB-C1B-NB	2.36	123.34	121.16
3	C	302	FEC	CAD-C3D-C2D	2.35	132.27	127.87
3	B	302	FEC	O2C-CGC-CBC	2.33	121.37	114.00
3	B	302	FEC	CMC-C3C-C2C	2.31	129.29	124.94
3	C	302	FEC	CBB-CAB-C3B	-2.31	106.23	112.54
3	D	302	FEC	C1B-CHB-C4A	2.30	124.29	116.07
3	D	302	FEC	C1D-CHD-C4C	2.22	124.02	116.07
3	D	302	FEC	O1D-CGD-CBD	-2.21	116.10	123.09
3	C	302	FEC	C1D-CHD-C4C	2.16	123.79	116.07
3	E	302	FEC	CMD-C2D-C1D	-2.14	120.89	124.73
3	C	302	FEC	C3B-C4B-NB	-2.13	109.55	114.64
3	B	302	FEC	C1D-CHD-C4C	2.12	123.67	116.07
3	E	302	FEC	C1D-CHD-C4C	2.07	123.47	116.07
3	D	302	FEC	C1C-NC-C4C	-2.04	103.54	105.14
3	A	302	FEC	C3B-C4B-NB	-2.03	109.79	114.64
3	B	302	FEC	C4B-C3B-C2B	-2.01	105.42	113.37

There are no chirality outliers.

All (27) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	D	302	FEC	C3A-CAA-CBA-CGA
3	D	302	FEC	C4D-C3D-CAD-CBD
3	D	302	FEC	C2D-C3D-CAD-CBD
3	A	302	FEC	C3A-CAA-CBA-CGA
3	D	302	FEC	C2C-CAC-CBC-CGC
3	E	302	FEC	C3A-CAA-CBA-CGA
3	B	302	FEC	C2C-CAC-CBC-CGC
3	C	302	FEC	C3A-CAA-CBA-CGA
4	D	303	MPD	C2-C3-C4-O4
4	A	303	MPD	C2-C3-C4-C5
4	D	303	MPD	C2-C3-C4-C5
3	D	302	FEC	C3D-CAD-CBD-CGD
3	B	302	FEC	CAD-CBD-CGD-O1D
3	E	302	FEC	CAD-CBD-CGD-O1D
3	B	302	FEC	CAD-CBD-CGD-O2D

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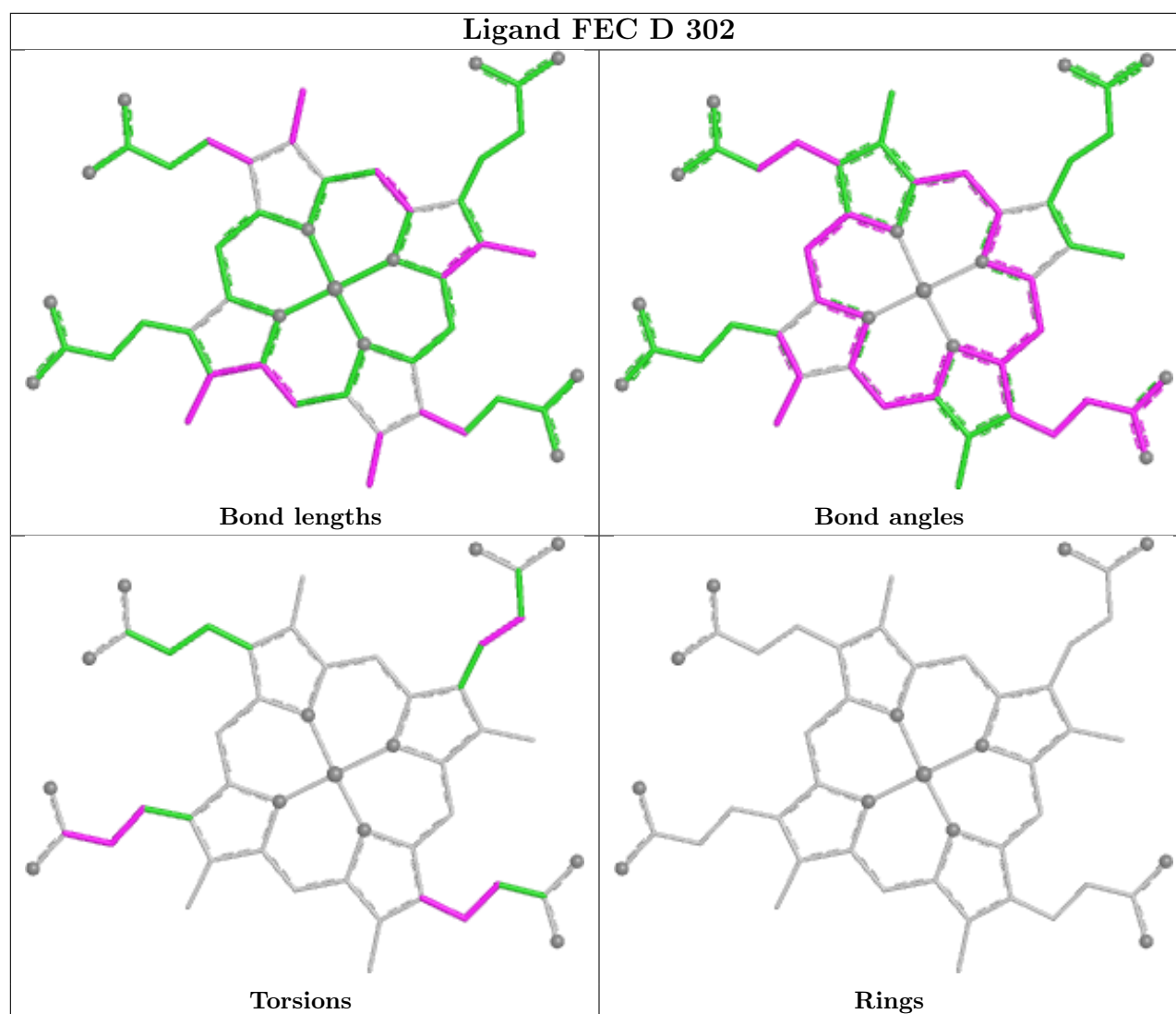
Mol	Chain	Res	Type	Atoms
3	B	302	FEC	CAC-CBC-CGC-O2C
3	E	302	FEC	CAD-CBD-CGD-O2D
3	D	302	FEC	CAC-CBC-CGC-O2C
3	E	302	FEC	C2B-C3B-CAB-CBB
3	C	302	FEC	CAC-CBC-CGC-O2C
3	B	302	FEC	CAC-CBC-CGC-O1C
3	D	302	FEC	CAC-CBC-CGC-O1C
3	B	302	FEC	C1C-C2C-CAC-CBC
3	C	302	FEC	CAD-CBD-CGD-O1D
3	C	302	FEC	CAD-CBD-CGD-O2D
3	C	302	FEC	CAC-CBC-CGC-O1C
3	C	302	FEC	C2B-C3B-CAB-CBB

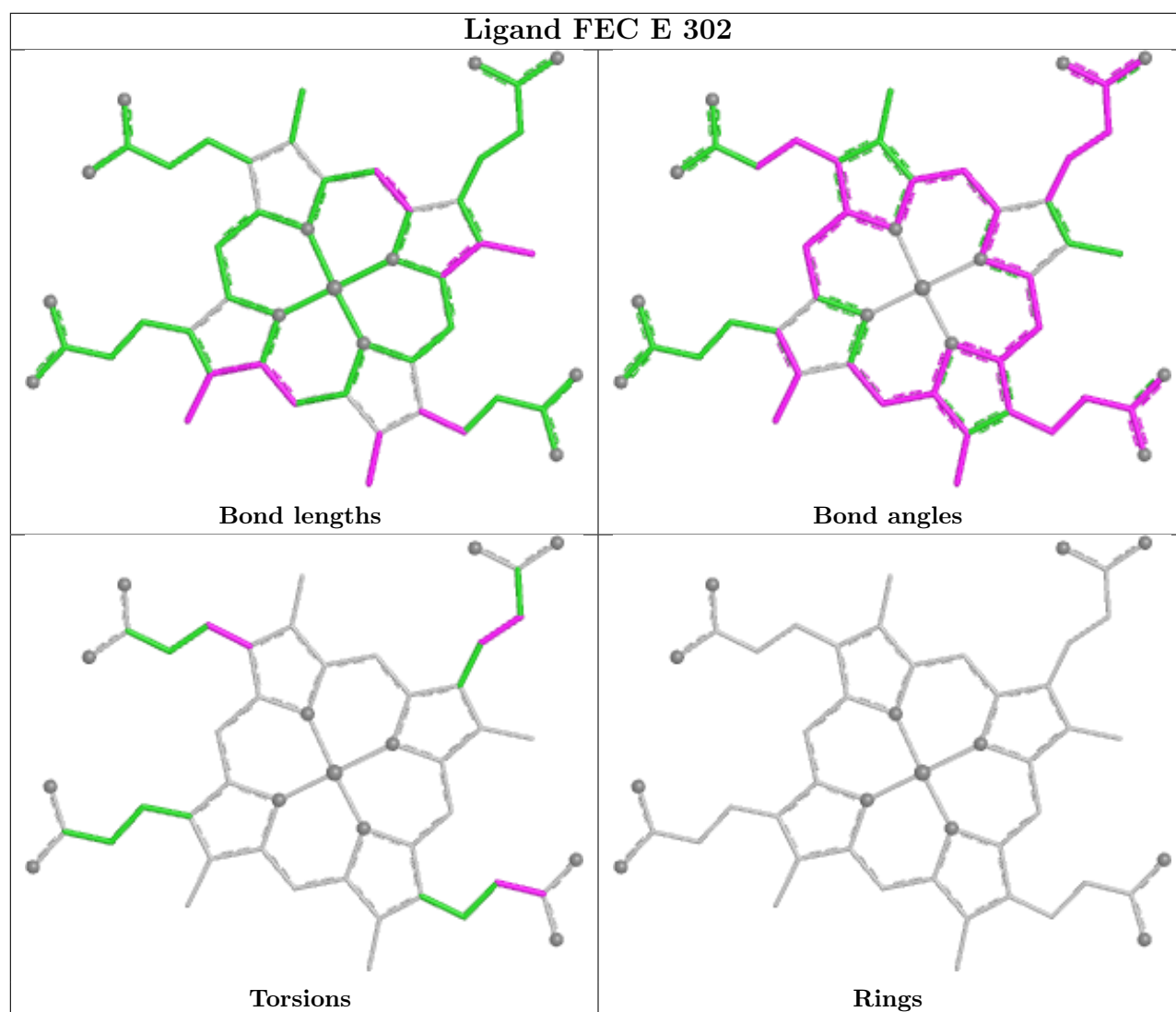
There are no ring outliers.

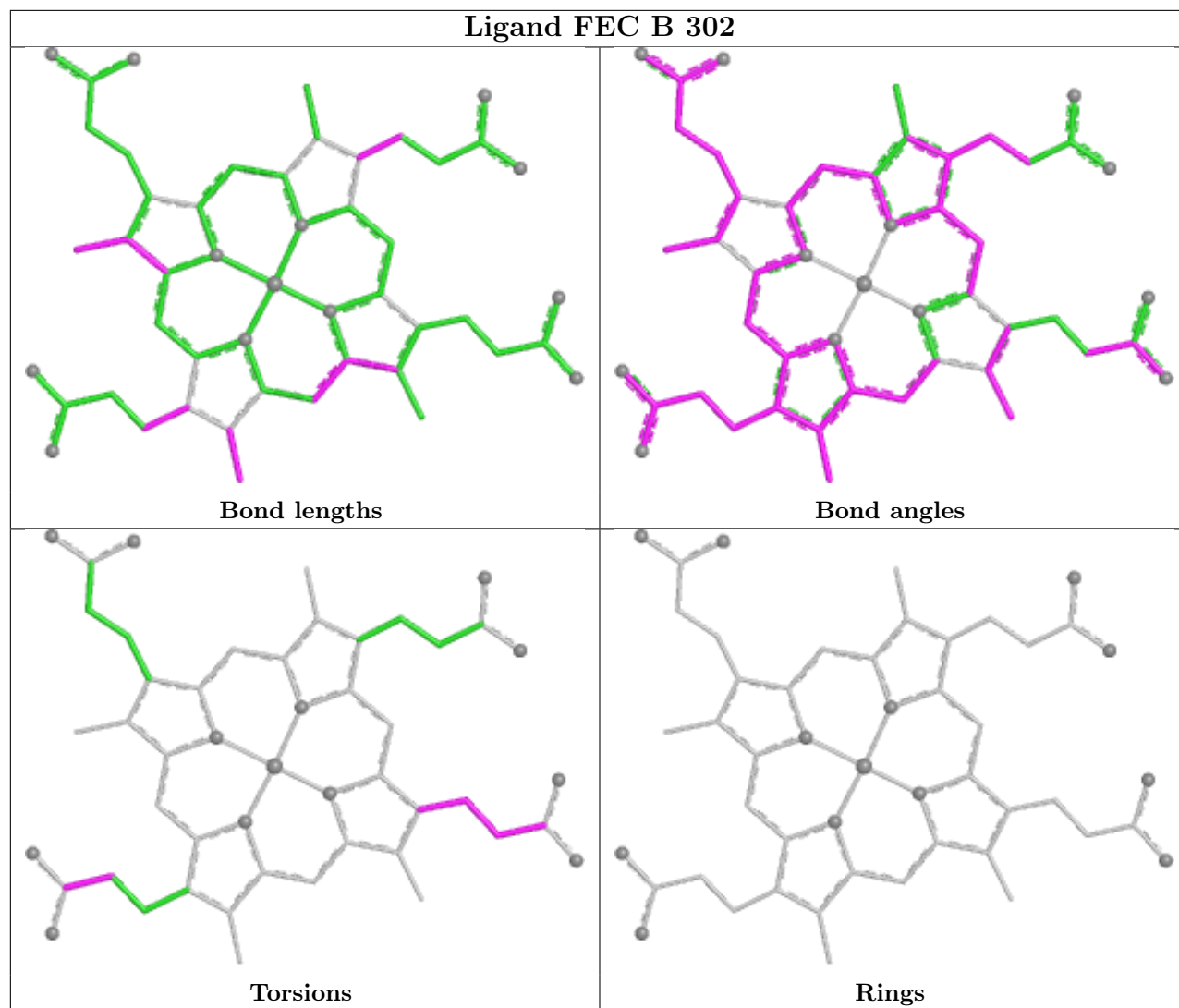
8 monomers are involved in 30 short contacts:

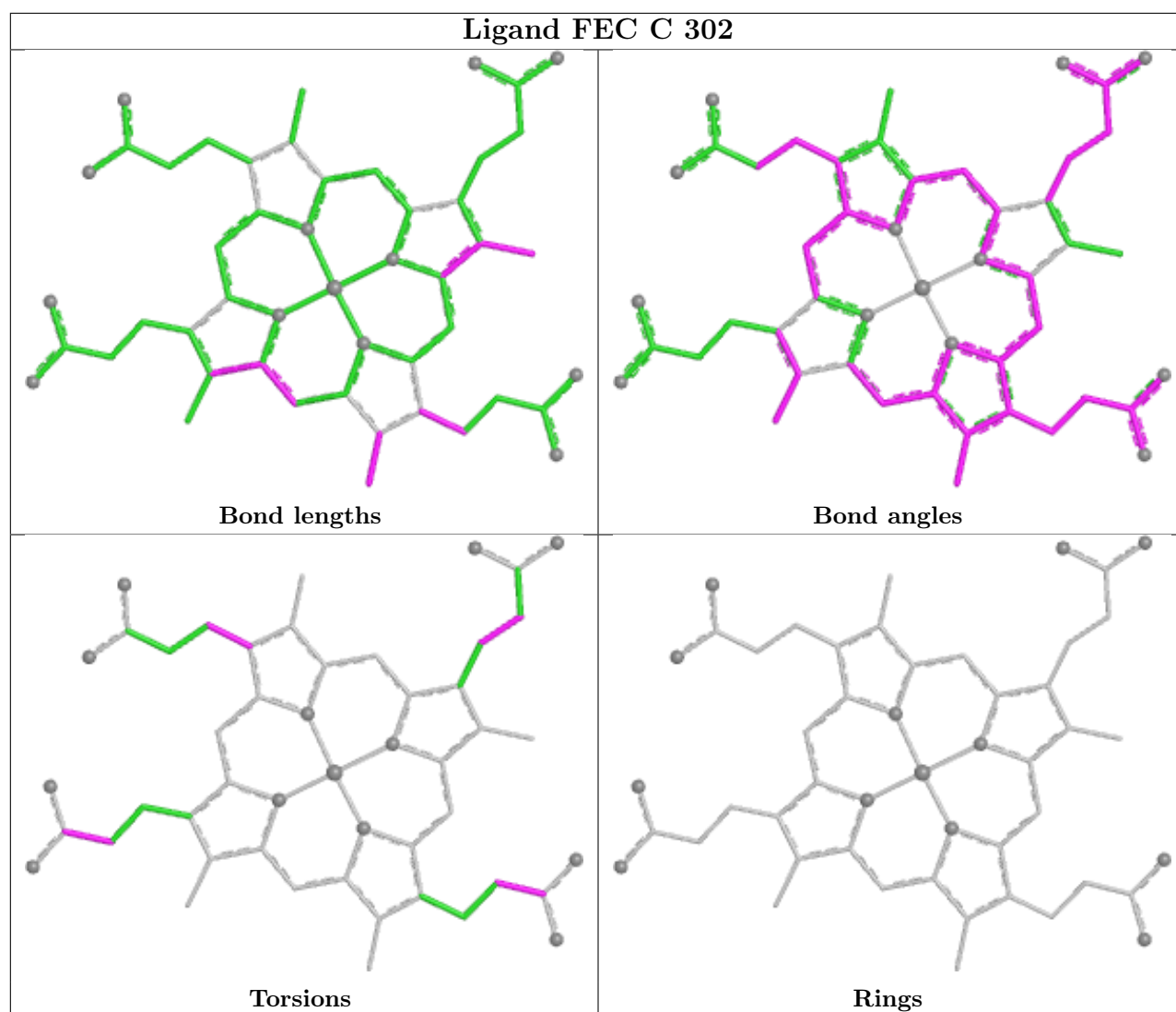
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	302	FEC	4	0
4	B	303	MPD	1	0
3	E	302	FEC	5	0
4	D	303	MPD	1	0
3	B	302	FEC	6	0
4	E	303	MPD	1	0
3	C	302	FEC	6	0
3	A	302	FEC	6	0

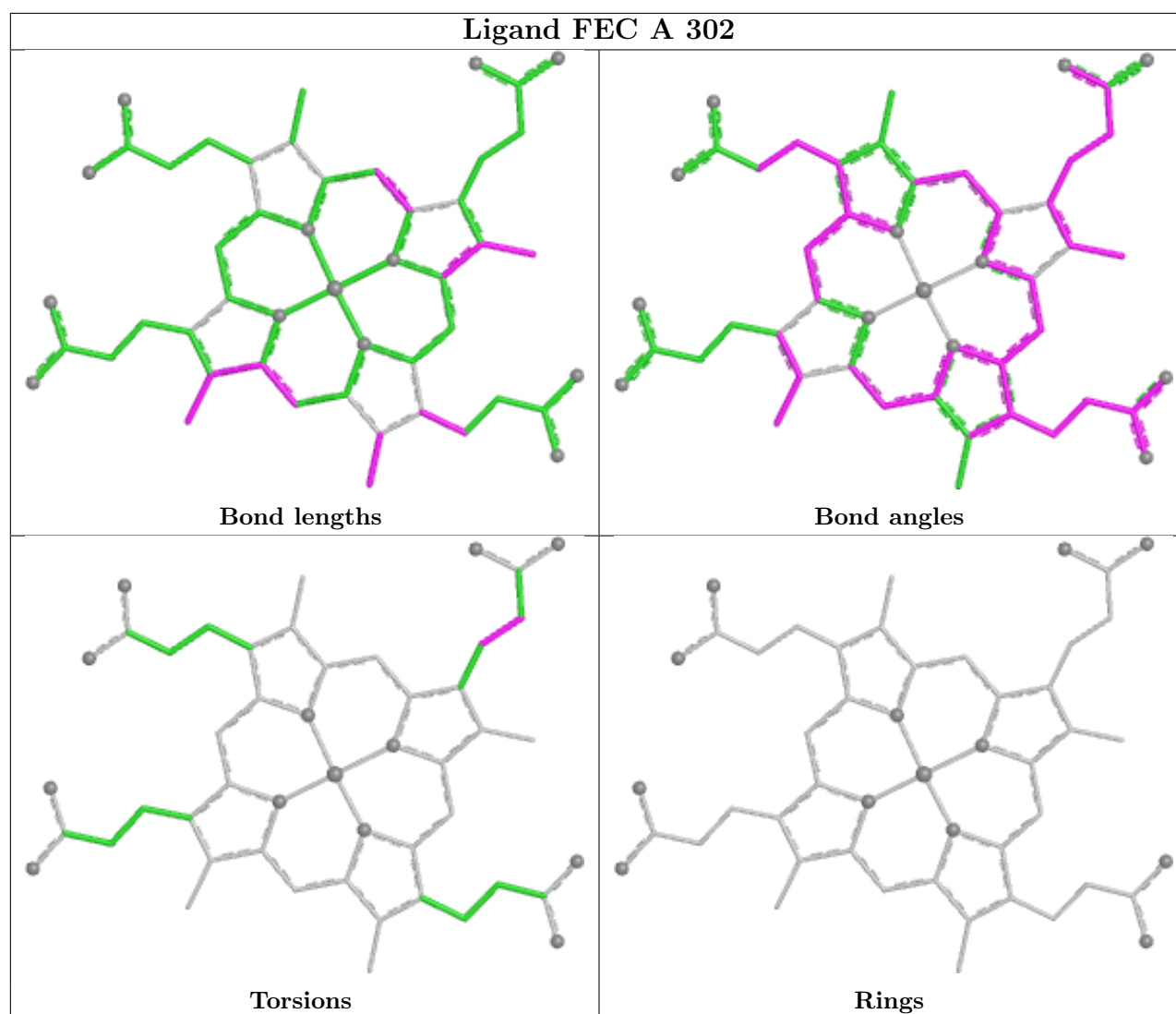
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

6.1 Protein, DNA and RNA chains

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	A	248/250 (99%)	0.24	12 (4%) 35 39	25, 39, 69, 141	0
1	B	233/250 (93%)	0.22	8 (3%) 48 52	24, 37, 69, 144	0
1	C	237/250 (94%)	0.23	13 (5%) 30 34	23, 37, 82, 172	0
1	D	250/250 (100%)	0.10	8 (3%) 50 54	22, 34, 63, 185	0
1	E	235/250 (94%)	0.20	11 (4%) 36 40	23, 36, 82, 124	0
All	All	1203/1250 (96%)	0.20	52 (4%) 40 44	22, 37, 74, 185	0

All (52) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	119	ALA	5.9
1	D	120	GLY	5.6
1	E	113	TYR	4.8
1	C	113	TYR	4.4
1	D	121	GLY	4.2
1	B	125	TYR	4.2
1	B	111	SER	4.1
1	E	125	TYR	4.1
1	C	128	LYS	4.1
1	C	5	VAL	4.0
1	A	251	ILE	3.7
1	A	4	ALA	3.7
1	C	129	GLY	3.6
1	D	251	ILE	3.5
1	C	4	ALA	3.4
1	C	3	GLU	3.3
1	A	118	MET	3.3
1	E	111	SER	3.1
1	D	2	ASN	3.0
1	E	243	GLU	2.9

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Mol	Chain	Res	Type	RSRZ
1	C	29	ASN	2.9
1	C	130	VAL	2.8
1	E	251	ILE	2.8
1	A	121	GLY	2.8
1	D	128	LYS	2.7
1	E	242	SER	2.7
1	B	126	GLN	2.6
1	A	246	SER	2.5
1	D	118	MET	2.5
1	C	126	GLN	2.5
1	C	6	LYS	2.5
1	B	127	ASN	2.5
1	A	120	GLY	2.5
1	E	6	LYS	2.5
1	A	247	LYS	2.4
1	A	119	ALA	2.4
1	B	251	ILE	2.4
1	A	242	SER	2.3
1	B	130	VAL	2.3
1	B	6	LYS	2.3
1	D	242	SER	2.2
1	E	246	SER	2.2
1	A	176	LEU	2.2
1	A	245	LEU	2.2
1	C	251	ILE	2.2
1	B	110	LEU	2.1
1	C	246	SER	2.1
1	C	183	GLY	2.1
1	E	8	LEU	2.1
1	E	110	LEU	2.1
1	E	179	ARG	2.0
1	A	122	ASP	2.0

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 oligosaccharides in this entry.

6.4 Ligands

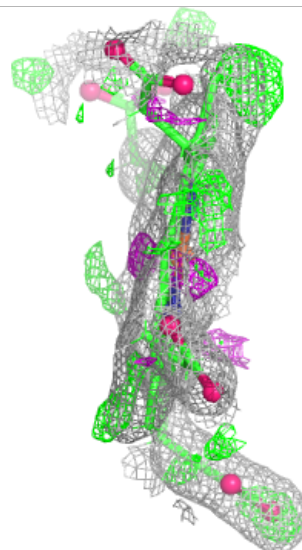
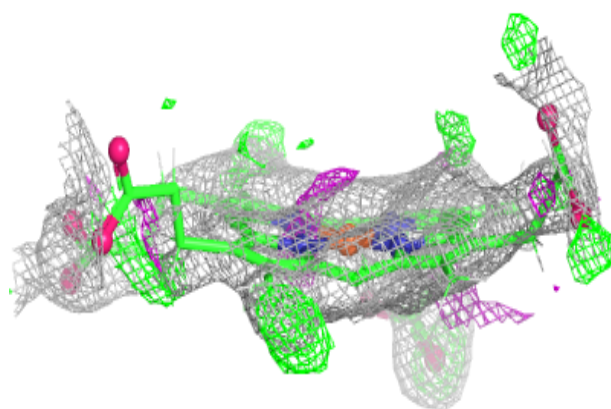
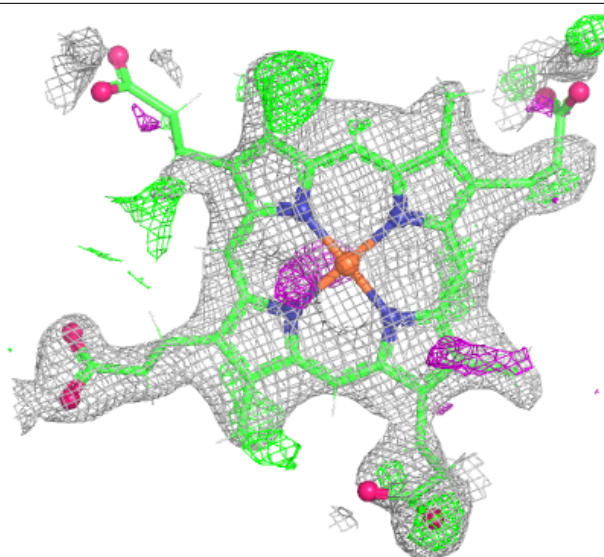
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	MPD	B	303	8/8	0.77	0.24	79,96,100,101	0
3	FEC	E	302	49/49	0.84	0.22	64,80,116,129	0
3	FEC	C	302	49/49	0.84	0.22	49,73,91,100	81
4	MPD	A	303	8/8	0.85	0.24	75,90,107,108	0
4	MPD	D	303	8/8	0.86	0.22	80,96,108,108	0
3	FEC	B	302	49/49	0.87	0.22	62,80,118,130	0
4	MPD	E	303	8/8	0.89	0.18	65,78,83,84	0
3	FEC	D	302	49/49	0.91	0.17	33,49,105,119	0
3	FEC	A	302	49/49	0.91	0.16	34,54,99,112	0
2	NA	B	301	1/1	0.98	0.04	26,26,26,26	0
2	NA	C	301	1/1	0.98	0.04	26,26,26,26	0
2	NA	E	301	1/1	0.98	0.07	19,19,19,19	0
2	NA	A	301	1/1	0.99	0.04	25,25,25,25	0
2	NA	D	301	1/1	0.99	0.03	23,23,23,23	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.

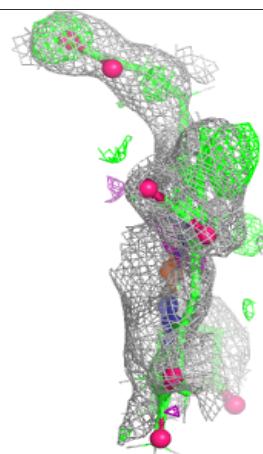
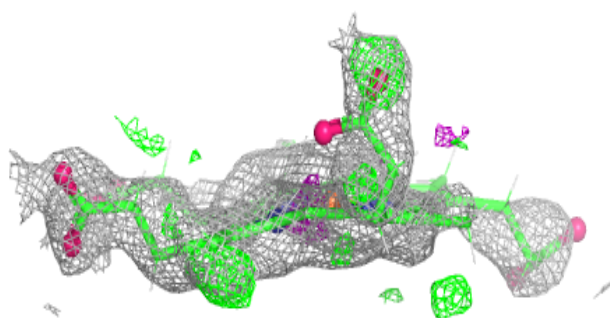
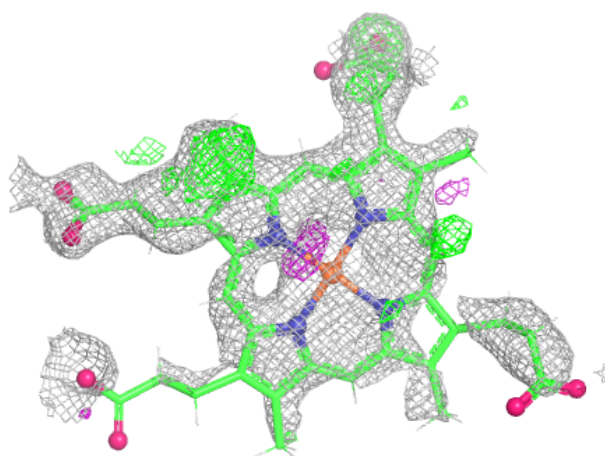
Electron density around FEC E 302:

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



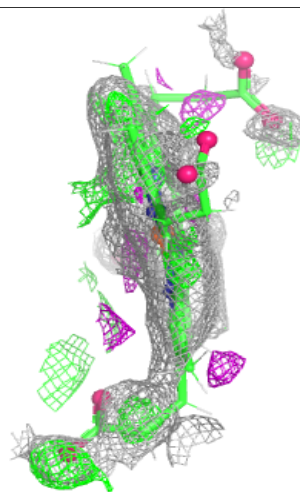
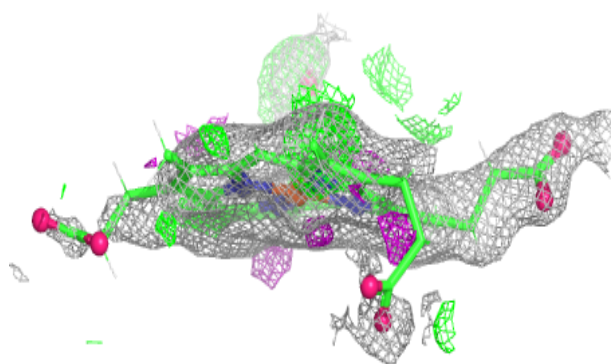
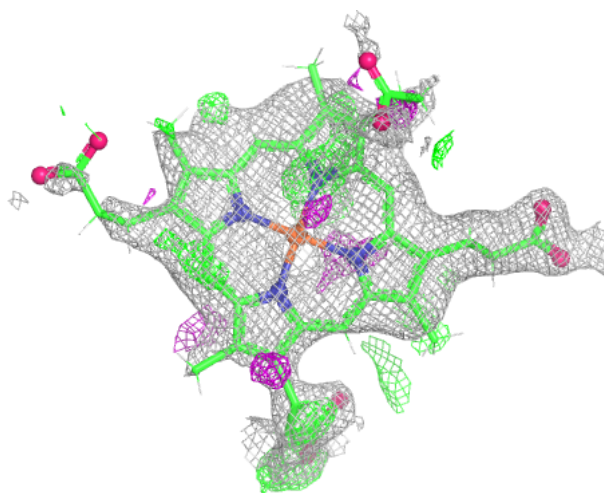
Electron density around FEC C 302:

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



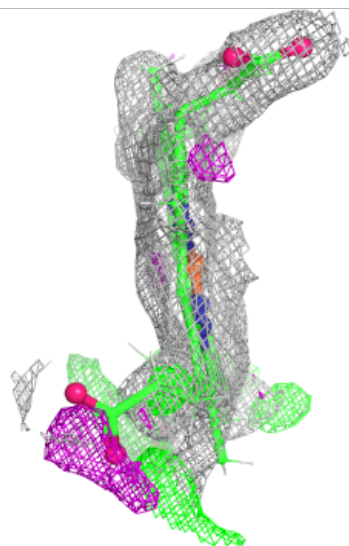
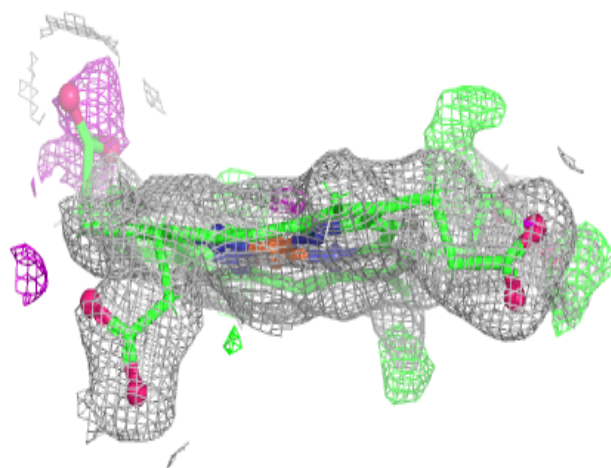
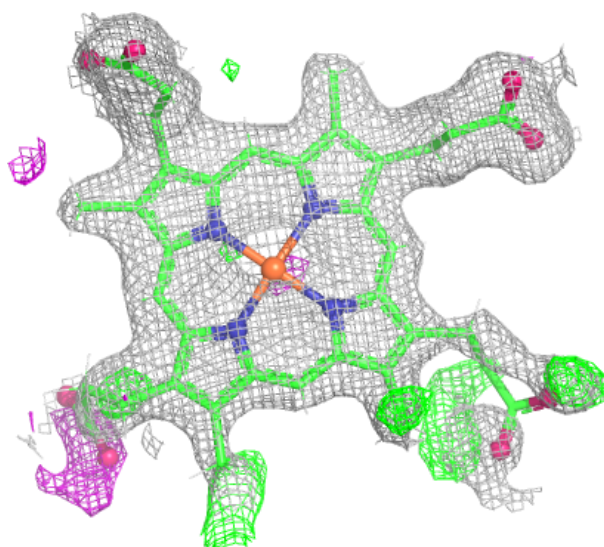
Electron density around FEC B 302:

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



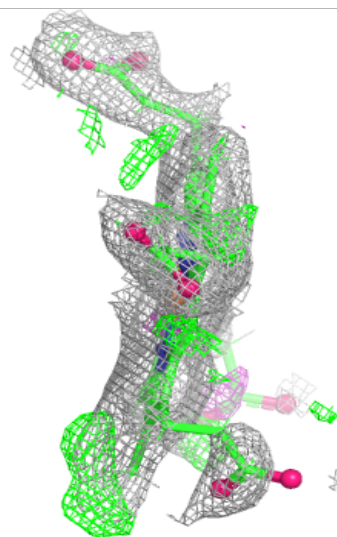
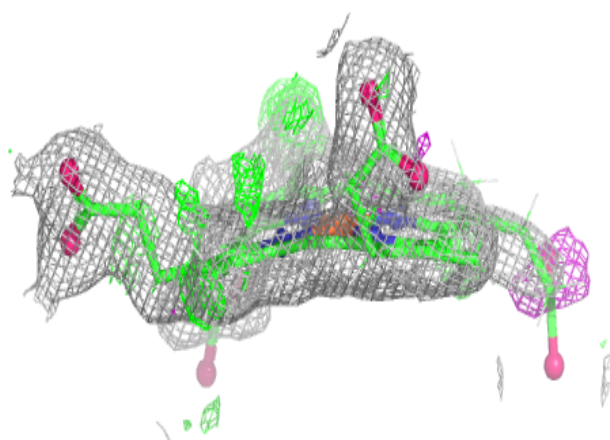
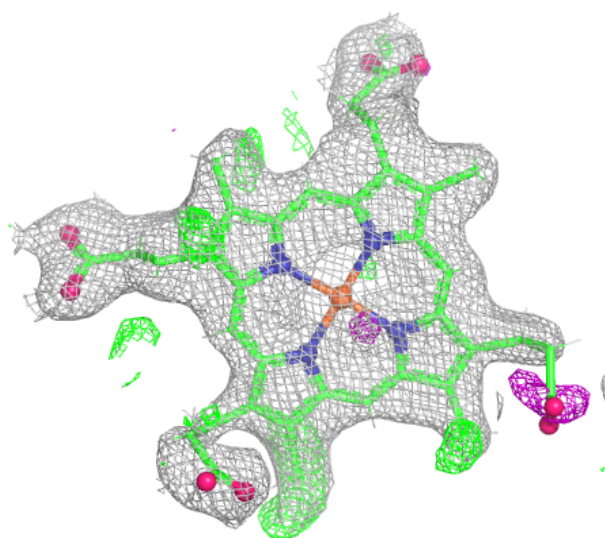
Electron density around FEC D 302:

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



Electron density around FEC A 302:

$2mF_o-DF_c$ (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.