



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 22, 2024 – 01:13 am BST

PDB ID : 8PWS
Title : Dye-decolourising peroxidase DtpB (56 kGy)
Authors : Lucic, M.; Worrall, J.A.R.; Hough, M.A.; Owen, R.L.; Strange, R.W.
Deposited on : 2023-07-21
Resolution : 1.75 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 : 4.02b-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

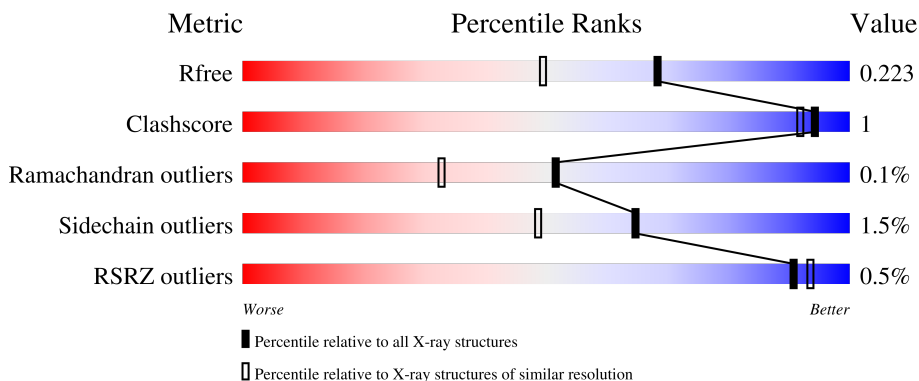
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.75 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	2340 (1.76-1.76)
Clashscore	141614	2466 (1.76-1.76)
Ramachandran outliers	138981	2437 (1.76-1.76)
Sidechain outliers	138945	2437 (1.76-1.76)
RSRZ outliers	127900	2298 (1.76-1.76)

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	306	92% 8% .
1	B	306	% 93% 7%
1	C	306	% 92% 8%
1	D	306	92% 7% .
1	E	306	% 93% 6% .

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Mol	Chain	Length	Quality of chain
1	F	306	 95%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 14727 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 Putative dye-decolorizing peroxidase (DyP), encapsulated subgroup.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	305	Total 2360	C 1483	N 411	O 456	S 10	0	4	0
1	B	305	Total 2334	C 1469	N 403	O 453	S 9	0	3	0
1	C	306	Total 2318	C 1461	N 400	O 448	S 9	0	0	0
1	D	306	Total 2343	C 1475	N 403	O 456	S 9	0	3	0
1	E	306	Total 2321	C 1462	N 400	O 450	S 9	0	0	0
1	F	306	Total 2315	C 1460	N 398	O 448	S 9	0	0	0

- Molecule 2 is OXYGEN ATOM (three-letter code: O) (formula: O).

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

- Molecule 3 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: C₃₄H₃₂FeN₄O₄) (labeled as "Ligand of Interest" by depositor).



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

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Mg	0	0
			1	1		
4	C	1	Total	Mg	0	0
			1	1		

- Molecule 5 is TETRAETHYLENE GLYCOL (three-letter code: PG4) (formula: C₈H₁₈O₅).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	D	1	Total	C O	0	0
			13	8 5		


- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	91	Total	O	0	0
			91	91		
6	B	61	Total	O	0	0
			61	61		
6	C	79	Total	O	0	0
			79	79		
6	D	76	Total	O	0	0
			76	76		
6	E	70	Total	O	0	0
			70	70		
6	F	80	Total	O	0	0
			80	80		

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 dye-decolorizing peroxidase (DyP), encapsulated subgroup

Chain A: 

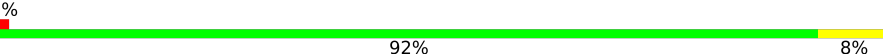


- Molecule 1: Putative dye-decolorizing peroxidase (DyP), encapsulated subgroup

Chain B: 



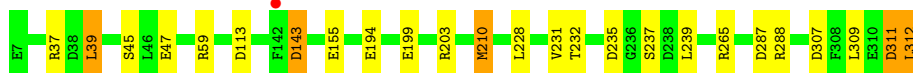
- Molecule 1: Putative dye-decolorizing peroxidase (DyP), encapsulated subgroup

Chain C: 



- Molecule 1: Putative dye-decolorizing peroxidase (DyP), encapsulated subgroup

Chain D: 



- Molecule 1: Putative dye-decolorizing peroxidase (DyP), encapsulated subgroup

Chain E: 



- Molecule 1: Putative dye-decolorizing peroxidase (DyP), encapsulated subgroup

Chain F:  95%



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	86.73Å 121.78Å 199.52Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.05 – 1.75 40.02 – 1.75	Depositor EDS
% Data completeness (in resolution range)	100.0 (40.05-1.75) 100.0 (40.02-1.75)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.08 (at 1.75Å)	Xtrriage
Refinement program	REFMAC 5.8.0419	Depositor
R, R_{free}	0.197 , 0.220 0.202 , 0.223	Depositor DCC
R_{free} test set	10674 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	19.9	Xtrriage
Anisotropy	0.167	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 34.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	14727	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.64% 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: MG, O, HEM, PG4

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	0.79	9/2410 (0.4%)	0.99	6/3271 (0.2%)
1	B	0.74	6/2384 (0.3%)	0.97	7/3239 (0.2%)
1	C	0.76	5/2368 (0.2%)	0.97	6/3218 (0.2%)
1	D	0.77	4/2393 (0.2%)	0.97	5/3252 (0.2%)
1	E	0.77	8/2371 (0.3%)	0.98	7/3222 (0.2%)
1	F	0.72	3/2365 (0.1%)	0.99	6/3214 (0.2%)
All	All	0.76	35/14291 (0.2%)	0.98	37/19416 (0.2%)

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	5
1	B	0	4
1	C	0	5
1	D	0	3
1	E	0	3
1	F	0	4
All	All	0	24

All (35) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	199	GLU	CD-OE1	12.43	1.39	1.25
1	D	199	GLU	CD-OE2	12.41	1.39	1.25
1	C	199	GLU	CD-OE2	9.87	1.36	1.25
1	E	199	GLU	CD-OE1	8.87	1.35	1.25
1	E	155	GLU	CD-OE2	-7.63	1.17	1.25
1	A	121	GLU	CD-OE1	7.60	1.34	1.25

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	199	GLU	CD-OE1	7.37	1.33	1.25
1	B	155	GLU	CD-OE1	-7.22	1.17	1.25
1	F	47	GLU	CD-OE1	-6.93	1.18	1.25
1	E	199	GLU	CD-OE2	6.92	1.33	1.25
1	B	47	GLU	CD-OE2	-6.64	1.18	1.25
1	C	271	GLU	CD-OE1	-6.55	1.18	1.25
1	F	47	GLU	CD-OE2	-6.42	1.18	1.25
1	A	199	GLU	CD-OE2	6.33	1.32	1.25
1	E	143	ASP	CG-OD1	6.22	1.39	1.25
1	E	88	GLU	CD-OE1	6.21	1.32	1.25
1	C	47	GLU	CD-OE2	-6.12	1.19	1.25
1	B	214	GLU	CD-OE2	-5.97	1.19	1.25
1	A	47	GLU	CD-OE2	-5.97	1.19	1.25
1	B	155	GLU	CD-OE2	-5.95	1.19	1.25
1	B	47	GLU	CD-OE1	-5.79	1.19	1.25
1	A	271	GLU	CD-OE1	-5.78	1.19	1.25
1	E	214	GLU	CD-OE2	-5.73	1.19	1.25
1	D	155	GLU	CD-OE1	-5.69	1.19	1.25
1	D	45	SER	CB-OG	-5.66	1.34	1.42
1	A	155	GLU	CD-OE1	-5.62	1.19	1.25
1	E	47	GLU	CD-OE1	-5.59	1.19	1.25
1	D	47	GLU	CD-OE2	-5.56	1.19	1.25
1	A	47	GLU	CD-OE1	-5.45	1.19	1.25
1	E	240	GLU	CD-OE1	-5.40	1.19	1.25
1	A	214	GLU	CD-OE2	-5.35	1.19	1.25
1	F	210	MET	CG-SD	5.31	1.95	1.81
1	A	33	GLU	CD-OE1	-5.24	1.19	1.25
1	C	45	SER	CB-OG	-5.14	1.35	1.42
1	B	69	GLU	CD-OE1	5.06	1.31	1.25

All (37) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	265	ARG	CG-CD-NE	-9.41	92.03	111.80
1	C	127	ARG	CG-CD-NE	-8.12	94.74	111.80
1	F	203	ARG	CG-CD-NE	-7.85	95.31	111.80
1	B	307	ASP	CB-CA-C	-7.42	95.56	110.40
1	D	113	ASP	CB-CG-OD1	-7.29	111.74	118.30
1	C	203	ARG	NE-CZ-NH2	7.00	123.80	120.30
1	B	210	MET	CA-CB-CG	-6.92	101.54	113.30
1	A	145	ARG	NE-CZ-NH2	-6.49	117.06	120.30
1	F	158	THR	N-CA-CB	-6.47	98.01	110.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	268	GLU	CB-CG-CD	-6.45	96.77	114.20
1	C	127	ARG	CB-CG-CD	-6.34	95.12	111.60
1	B	113	ASP	CB-CG-OD1	-6.30	112.63	118.30
1	E	276	ARG	NE-CZ-NH1	-6.28	117.16	120.30
1	E	265	ARG	NE-CZ-NH2	6.22	123.41	120.30
1	E	113	ASP	CB-CG-OD1	-6.19	112.73	118.30
1	B	203	ARG	NE-CZ-NH1	6.02	123.31	120.30
1	D	307	ASP	CB-CA-C	-5.95	98.50	110.40
1	C	218	ASP	CB-CA-C	-5.88	98.63	110.40
1	F	164	ARG	NE-CZ-NH2	5.88	123.24	120.30
1	A	210[A]	MET	CB-CG-SD	5.88	130.03	112.40
1	A	210[B]	MET	CB-CG-SD	5.88	130.03	112.40
1	C	288	ARG	NE-CZ-NH1	5.83	123.22	120.30
1	C	87	ARG	NE-CZ-NH1	-5.82	117.39	120.30
1	E	125	ARG	NE-CZ-NH1	-5.81	117.40	120.30
1	F	87	ARG	CG-CD-NE	-5.61	100.01	111.80
1	D	288	ARG	NE-CZ-NH2	-5.50	117.55	120.30
1	B	87	ARG	NE-CZ-NH1	-5.48	117.56	120.30
1	E	288	ARG	NE-CZ-NH1	5.45	123.02	120.30
1	A	37	ARG	CG-CD-NE	-5.37	100.52	111.80
1	A	232	THR	CA-CB-OG1	-5.34	97.78	109.00
1	A	111	ARG	CG-CD-NE	5.21	122.73	111.80
1	E	143	ASP	CB-CG-OD2	-5.20	113.62	118.30
1	B	111	ARG	CB-CA-C	-5.10	100.20	110.40
1	D	232	THR	CA-CB-OG1	-5.10	98.29	109.00
1	B	265	ARG	NE-CZ-NH1	5.08	122.84	120.30
1	E	232	THR	CA-CB-OG1	-5.07	98.36	109.00
1	F	141	TYR	CB-CG-CD1	-5.04	117.97	121.00

There are no chirality outliers.

All (24) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	125[A]	ARG	Sidechain
1	A	164	ARG	Sidechain
1	A	203	ARG	Sidechain
1	A	208	ARG	Sidechain
1	A	59	ARG	Sidechain
1	B	125[A]	ARG	Sidechain
1	B	163[A]	ARG	Sidechain
1	B	207	ARG	Sidechain
1	B	59	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	C	111	ARG	Sidechain
1	C	37	ARG	Sidechain
1	C	59	ARG	Sidechain
1	C	87	ARG	Sidechain
1	C	95	ARG	Sidechain
1	D	203	ARG	Sidechain
1	D	37	ARG	Sidechain
1	D	59	ARG	Sidechain
1	E	125	ARG	Sidechain
1	E	59	ARG	Sidechain
1	E	95	ARG	Sidechain
1	F	125	ARG	Sidechain
1	F	203	ARG	Sidechain
1	F	207	ARG	Sidechain
1	F	7	GLU	Peptide

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	2360	0	2292	8	0
1	B	2334	0	2251	4	0
1	C	2318	0	2241	11	0
1	D	2343	0	2260	9	0
1	E	2321	0	2243	6	0
1	F	2315	0	2236	3	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
2	F	1	0	0	0	0
3	A	43	0	30	1	0
3	B	43	0	30	0	0
3	C	43	0	30	0	0
3	D	43	0	30	0	0
3	E	43	0	30	2	0
3	F	43	0	30	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	1	0	0	0	0
4	C	1	0	0	0	0
5	D	13	0	18	0	0
6	A	91	0	0	0	0
6	B	61	0	0	1	0
6	C	79	0	0	2	0
6	D	76	0	0	0	0
6	E	70	0	0	0	0
6	F	80	0	0	1	0
All	All	14727	0	13721	36	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 1.

All (36) 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:F:125:ARG:HD3	6:F:549:HOH:O	1.86	0.75
1:C:210:MET:CE	1:E:210:MET:HB2	2.22	0.70
1:C:140:LYS:HB2	6:C:573:HOH:O	2.02	0.59
1:C:231:VAL:HG23	1:C:239:LEU:HB2	1.87	0.57
3:A:402:HEM:HMC1	3:A:402:HEM:HBC2	1.87	0.56
1:E:143:ASP:OD1	1:E:143:ASP:N	2.40	0.55
1:D:235:ASP:OD1	1:D:237:SER:OG	2.26	0.54
3:E:402:HEM:HBC2	3:E:402:HEM:HMC2	1.91	0.53
1:A:253:ARG:NH1	1:A:255:GLU:OE1	2.40	0.51
1:D:39:LEU:O	1:D:39:LEU:HG	2.10	0.51
1:F:14:LEU:HD23	1:F:242:LEU:HD22	1.93	0.51
1:D:311:ASP:OD1	1:D:311:ASP:C	2.48	0.51
1:D:143[A]:ASP:OD1	1:D:143[A]:ASP:N	2.43	0.51
1:A:127:ARG:CG	1:A:127:ARG:HH11	2.24	0.50
1:A:127:ARG:HH11	1:A:127:ARG:HG2	1.76	0.50
1:A:34:ASP:OD1	1:A:37:ARG:NH2	2.44	0.50
3:E:402:HEM:HBC2	3:E:402:HEM:CMC	2.41	0.50
6:B:560:HOH:O	1:F:210:MET:HB3	2.12	0.50
1:B:251[A]:VAL:HG12	1:E:123:MET:HG3	1.93	0.49
1:B:143:ASP:OD1	1:B:143:ASP:N	2.45	0.48
1:A:210[A]:MET:CE	1:D:210:MET:SD	3.02	0.48
1:C:210:MET:HE1	1:E:210:MET:HB2	1.96	0.47
1:C:210:MET:HE3	1:E:210:MET:HB2	1.95	0.47
1:A:251[B]:VAL:HG12	1:C:123:MET:HG3	1.98	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:228:LEU:HD12	1:C:287:ASP:HA	1.98	0.46
1:C:125:ARG:HD3	6:C:552:HOH:O	2.16	0.46
1:A:210[A]:MET:SD	1:D:210:MET:HB2	2.56	0.45
1:C:39:LEU:O	1:C:39:LEU:HG	2.15	0.45
1:D:231:VAL:HG23	1:D:239:LEU:HB2	1.99	0.44
1:C:87:ARG:NH2	1:C:271:GLU:OE1	2.51	0.43
1:B:251[A]:VAL:CG1	1:E:123:MET:HG3	2.48	0.42
1:B:300:LEU:HD23	1:B:301:PHE:N	2.36	0.41
1:C:39:LEU:HD22	1:C:126:LEU:HD11	2.02	0.41
1:A:127:ARG:CG	1:A:127:ARG:NH1	2.83	0.41
1:D:228:LEU:HD12	1:D:287:ASP:HA	2.03	0.40
1:D:309:LEU:HA	1:D:312:LEU:HD23	2.03	0.40

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	307/306 (100%)	300 (98%)	6 (2%)	1 (0%)	41	22
1	B	306/306 (100%)	302 (99%)	4 (1%)	0	100	100
1	C	304/306 (99%)	296 (97%)	7 (2%)	1 (0%)	41	22
1	D	307/306 (100%)	303 (99%)	4 (1%)	0	100	100
1	E	304/306 (99%)	300 (99%)	4 (1%)	0	100	100
1	F	304/306 (99%)	298 (98%)	6 (2%)	0	100	100
All	All	1832/1836 (100%)	1799 (98%)	31 (2%)	2 (0%)	51	33

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	142	PHE

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Mol	Chain	Res	Type
1	C	142	PHE

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	248/245 (101%)	246 (99%)	2 (1%)	81	72
1	B	242/245 (99%)	239 (99%)	3 (1%)	71	56
1	C	240/245 (98%)	239 (100%)	1 (0%)	91	87
1	D	244/245 (100%)	237 (97%)	7 (3%)	42	19
1	E	241/245 (98%)	235 (98%)	6 (2%)	47	25
1	F	239/245 (98%)	235 (98%)	4 (2%)	60	42
All	All	1454/1470 (99%)	1431 (98%)	23 (2%)	65	45

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	GLU
1	A	307	ASP
1	B	24	LEU
1	B	143	ASP
1	B	311	ASP
1	C	307	ASP
1	D	39	LEU
1	D	143[A]	ASP
1	D	143[B]	ASP
1	D	194	GLU
1	D	210	MET
1	D	311	ASP
1	D	312	LEU
1	E	143	ASP
1	E	210	MET
1	E	218	ASP
1	E	219	VAL

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Mol	Chain	Res	Type
1	E	235	ASP
1	E	307	ASP
1	F	90	ASP
1	F	111	ARG
1	F	158	THR
1	F	307	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 15 ligands modelled in this entry, 8 are monoatomic - leaving 7 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	HEM	B	402	2,1	41,50,50	1.49	7 (17%)	45,82,82	2.64	21 (46%)
3	HEM	C	402	2,1	41,50,50	1.65	6 (14%)	45,82,82	1.92	14 (31%)
3	HEM	F	402	2,1	41,50,50	1.76	8 (19%)	45,82,82	1.96	11 (24%)
3	HEM	A	402	2,1	41,50,50	1.53	8 (19%)	45,82,82	2.29	17 (37%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	HEM	D	402	2,1	41,50,50	1.57	8 (19%)	45,82,82	1.92	12 (26%)
5	PG4	D	403	-	12,12,12	0.97	0	11,11,11	0.72	0
3	HEM	E	402	2,1	41,50,50	1.70	10 (24%)	45,82,82	2.07	18 (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	HEM	B	402	2,1	-	5/12/54/54	-
3	HEM	C	402	2,1	-	6/12/54/54	-
3	HEM	F	402	2,1	-	4/12/54/54	-
3	HEM	A	402	2,1	-	6/12/54/54	-
3	HEM	D	402	2,1	-	4/12/54/54	-
5	PG4	D	403	-	-	8/10/10/10	-
3	HEM	E	402	2,1	-	5/12/54/54	-

All (47) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	402	HEM	C1B-NB	-4.67	1.32	1.40
3	A	402	HEM	C4D-ND	-4.57	1.32	1.40
3	E	402	HEM	C4D-ND	-4.37	1.32	1.40
3	E	402	HEM	C3B-C4B	4.37	1.53	1.44
3	D	402	HEM	C4D-C3D	4.29	1.52	1.45
3	F	402	HEM	CAA-C2A	4.13	1.58	1.52
3	D	402	HEM	C3C-C2C	-4.06	1.34	1.40
3	C	402	HEM	CHA-C4D	4.02	1.45	1.35
3	B	402	HEM	C1B-NB	-3.96	1.33	1.40
3	C	402	HEM	CHB-C1B	3.46	1.43	1.35
3	F	402	HEM	C3B-C4B	3.39	1.51	1.44
3	A	402	HEM	C4D-C3D	3.35	1.50	1.45
3	F	402	HEM	C4D-C3D	3.26	1.50	1.45
3	C	402	HEM	CMB-C2B	3.21	1.57	1.50
3	F	402	HEM	C3C-C2C	-3.16	1.36	1.40
3	F	402	HEM	C1A-CHA	-3.05	1.32	1.41
3	D	402	HEM	C1B-NB	-3.03	1.35	1.40
3	B	402	HEM	C3C-C2C	-3.02	1.36	1.40
3	E	402	HEM	O2D-CGD	-3.01	1.20	1.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	402	HEM	C1D-ND	-3.01	1.32	1.38
3	B	402	HEM	CMC-C2C	-3.00	1.44	1.51
3	D	402	HEM	C4D-ND	-2.96	1.35	1.40
3	A	402	HEM	C1B-NB	-2.87	1.35	1.40
3	E	402	HEM	C4B-NB	-2.86	1.32	1.38
3	E	402	HEM	C3D-C2D	-2.79	1.30	1.36
3	F	402	HEM	CHD-C1D	-2.78	1.33	1.41
3	A	402	HEM	FE-NB	2.64	2.09	1.96
3	C	402	HEM	C1B-C2B	2.59	1.49	1.44
3	F	402	HEM	C1B-NB	-2.57	1.35	1.40
3	B	402	HEM	CBA-CGA	2.52	1.56	1.50
3	A	402	HEM	CBD-CGD	2.51	1.56	1.50
3	C	402	HEM	C4D-ND	-2.50	1.36	1.40
3	E	402	HEM	CMA-C3A	-2.48	1.46	1.51
3	B	402	HEM	O1A-CGA	2.44	1.30	1.22
3	E	402	HEM	O1A-CGA	2.42	1.30	1.22
3	D	402	HEM	CHB-C1B	2.27	1.40	1.35
3	B	402	HEM	CHA-C4D	2.27	1.40	1.35
3	E	402	HEM	C3C-C2C	-2.24	1.37	1.40
3	B	402	HEM	C4D-ND	-2.21	1.36	1.40
3	A	402	HEM	O2D-CGD	-2.11	1.23	1.30
3	D	402	HEM	C4A-CHB	-2.08	1.35	1.41
3	E	402	HEM	FE-NB	2.07	2.07	1.96
3	F	402	HEM	CHA-C4D	2.06	1.40	1.35
3	D	402	HEM	CMB-C2B	2.05	1.55	1.50
3	A	402	HEM	C1D-ND	-2.04	1.34	1.38
3	D	402	HEM	O1A-CGA	2.02	1.28	1.22
3	A	402	HEM	C1A-NA	2.01	1.40	1.36

All (93) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	402	HEM	C1B-NB-C4B	7.34	112.65	105.07
3	B	402	HEM	C1B-NB-C4B	5.97	111.24	105.07
3	B	402	HEM	C3B-C2B-C1B	5.75	110.75	106.49
3	F	402	HEM	C1B-NB-C4B	5.53	110.78	105.07
3	B	402	HEM	CHC-C4B-NB	5.52	130.43	124.43
3	B	402	HEM	CHB-C1B-NB	5.26	130.88	124.38
3	C	402	HEM	C1B-NB-C4B	5.16	110.40	105.07
3	F	402	HEM	CHA-C4D-ND	4.81	130.32	124.38
3	A	402	HEM	CHC-C4B-NB	4.77	129.61	124.43
3	B	402	HEM	CMD-C2D-C1D	4.69	132.18	125.04

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	402	HEM	CHC-C4B-NB	4.45	129.26	124.43
3	D	402	HEM	CMC-C2C-C3C	4.36	132.84	124.68
3	A	402	HEM	C2D-C1D-ND	4.23	114.95	109.88
3	A	402	HEM	CHD-C1D-C2D	-4.20	118.42	124.98
3	B	402	HEM	O2D-CGD-CBD	4.17	127.42	114.03
3	D	402	HEM	C1B-NB-C4B	4.08	109.29	105.07
3	D	402	HEM	C2D-C1D-ND	3.94	114.60	109.88
3	D	402	HEM	CHC-C4B-NB	3.81	128.57	124.43
3	F	402	HEM	CHC-C4B-NB	3.81	128.57	124.43
3	D	402	HEM	CHD-C1D-C2D	-3.60	119.36	124.98
3	B	402	HEM	CAD-C3D-C2D	-3.57	121.22	127.88
3	E	402	HEM	C4B-CHC-C1C	3.57	127.26	122.56
3	E	402	HEM	O2D-CGD-O1D	-3.54	114.47	123.30
3	E	402	HEM	C3B-C2B-C1B	-3.53	103.86	106.49
3	D	402	HEM	C1D-C2D-C3D	-3.49	103.29	106.96
3	A	402	HEM	C4A-C3A-C2A	3.48	109.42	107.00
3	E	402	HEM	CMB-C2B-C1B	3.39	130.21	125.04
3	C	402	HEM	CHA-C4D-ND	3.38	128.56	124.38
3	B	402	HEM	C2C-C3C-C4C	-3.37	104.54	106.90
3	E	402	HEM	C1B-NB-C4B	3.34	108.52	105.07
3	F	402	HEM	CHA-C4D-C3D	-3.28	119.16	125.33
3	B	402	HEM	O1D-CGD-CBD	-3.26	112.59	123.08
3	E	402	HEM	CAB-C3B-C2B	-3.26	117.87	128.60
3	B	402	HEM	C1D-C2D-C3D	-3.23	103.56	106.96
3	A	402	HEM	C1D-C2D-C3D	-3.12	103.68	106.96
3	A	402	HEM	C3B-C2B-C1B	3.12	108.80	106.49
3	F	402	HEM	CMC-C2C-C3C	3.11	130.49	124.68
3	A	402	HEM	O2D-CGD-O1D	-3.10	115.58	123.30
3	F	402	HEM	O2A-CGA-CBA	3.08	123.92	114.03
3	D	402	HEM	CMA-C3A-C4A	-3.04	123.79	128.46
3	B	402	HEM	C4B-C3B-C2B	-3.02	104.72	107.11
3	A	402	HEM	C2B-C1B-NB	-2.97	106.32	109.84
3	C	402	HEM	CBA-CAA-C2A	2.96	117.67	112.62
3	F	402	HEM	CHD-C1D-C2D	-2.94	120.39	124.98
3	E	402	HEM	CHA-C4D-C3D	-2.93	119.83	125.33
3	B	402	HEM	CAD-C3D-C4D	2.92	129.76	124.66
3	E	402	HEM	O1A-CGA-CBA	-2.89	113.78	123.08
3	A	402	HEM	CHA-C4D-ND	2.86	127.91	124.38
3	E	402	HEM	CHC-C4B-NB	2.85	127.53	124.43
3	C	402	HEM	O2D-CGD-CBD	2.82	123.11	114.03
3	B	402	HEM	CAB-C3B-C2B	-2.82	119.31	128.60
3	C	402	HEM	CMD-C2D-C1D	2.80	129.30	125.04

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	402	HEM	CAD-C3D-C4D	2.80	129.55	124.66
3	F	402	HEM	C2D-C1D-ND	2.79	113.23	109.88
3	F	402	HEM	C3B-C2B-C1B	2.78	108.55	106.49
3	E	402	HEM	C4D-C3D-C2D	-2.77	102.86	106.90
3	C	402	HEM	CHB-C1B-NB	2.76	127.80	124.38
3	C	402	HEM	C3C-C4C-NC	-2.75	105.75	110.94
3	D	402	HEM	O1D-CGD-CBD	-2.74	114.28	123.08
3	A	402	HEM	O2D-CGD-CBD	2.73	122.81	114.03
3	E	402	HEM	C3D-C4D-ND	2.69	113.16	110.17
3	D	402	HEM	CMD-C2D-C1D	2.68	129.12	125.04
3	B	402	HEM	C2B-C1B-NB	-2.67	106.67	109.84
3	B	402	HEM	C4C-CHD-C1D	2.67	126.08	122.56
3	C	402	HEM	CMC-C2C-C3C	2.61	129.56	124.68
3	A	402	HEM	CHB-C1B-NB	2.60	127.59	124.38
3	D	402	HEM	CHA-C4D-ND	2.56	127.54	124.38
3	D	402	HEM	O2D-CGD-CBD	2.49	122.02	114.03
3	B	402	HEM	O2A-CGA-CBA	2.48	122.00	114.03
3	C	402	HEM	C2D-C1D-ND	2.47	112.84	109.88
3	E	402	HEM	C2B-C1B-NB	2.43	112.72	109.84
3	C	402	HEM	CHD-C1D-C2D	-2.43	121.18	124.98
3	B	402	HEM	CHD-C1D-C2D	-2.40	121.23	124.98
3	B	402	HEM	CMC-C2C-C3C	2.39	129.15	124.68
3	A	402	HEM	CBB-CAB-C3B	-2.36	115.86	127.62
3	E	402	HEM	CMA-C3A-C4A	-2.33	124.88	128.46
3	B	402	HEM	C2D-C1D-ND	2.31	112.64	109.88
3	E	402	HEM	CHD-C1D-C2D	-2.30	121.39	124.98
3	B	402	HEM	CAB-C3B-C4B	2.30	135.18	124.47
3	A	402	HEM	C4B-CHC-C1C	2.26	125.54	122.56
3	A	402	HEM	CHA-C4D-C3D	-2.25	121.11	125.33
3	C	402	HEM	O1D-CGD-CBD	-2.20	116.01	123.08
3	F	402	HEM	CAB-C3B-C2B	2.18	135.79	128.60
3	D	402	HEM	CAB-C3B-C2B	2.17	135.74	128.60
3	E	402	HEM	C3C-C4C-NC	-2.13	106.92	110.94
3	B	402	HEM	O1A-CGA-CBA	-2.12	116.29	123.08
3	A	402	HEM	CMC-C2C-C3C	2.09	128.59	124.68
3	F	402	HEM	O2D-CGD-CBD	2.09	120.73	114.03
3	A	402	HEM	CAB-C3B-C2B	-2.08	121.75	128.60
3	E	402	HEM	CHA-C4D-ND	2.08	126.94	124.38
3	E	402	HEM	CHD-C1D-ND	2.04	126.65	124.43
3	C	402	HEM	CHA-C4D-C3D	-2.03	121.51	125.33
3	C	402	HEM	CBB-CAB-C3B	-2.03	117.51	127.62

There are no chirality outliers.

All (38) torsion outliers are listed below:

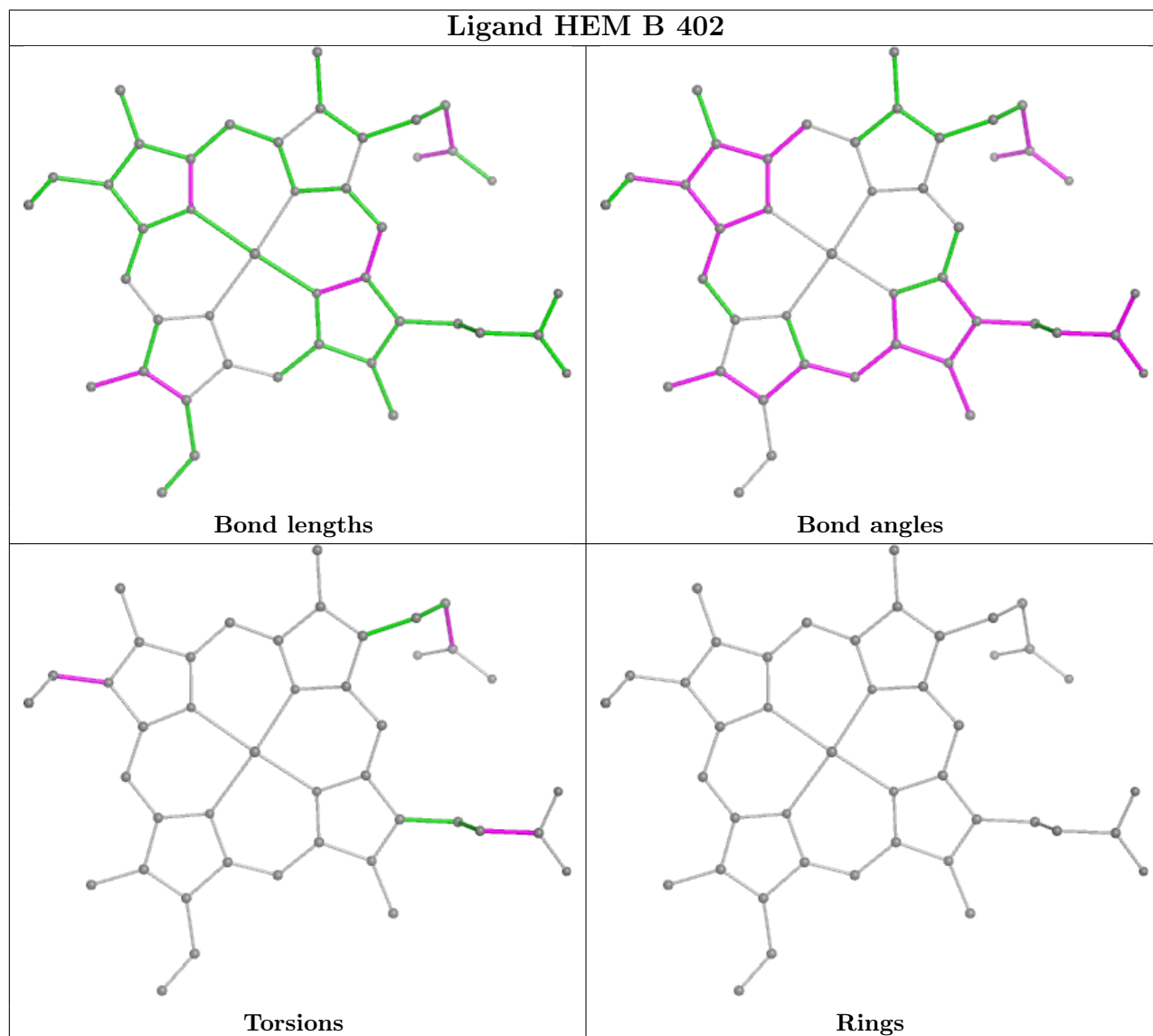
Mol	Chain	Res	Type	Atoms
5	D	403	PG4	O3-C5-C6-O4
5	D	403	PG4	O2-C3-C4-O3
3	A	402	HEM	C2B-C3B-CAB-CBB
3	B	402	HEM	C2B-C3B-CAB-CBB
3	E	402	HEM	C2B-C3B-CAB-CBB
3	A	402	HEM	C4B-C3B-CAB-CBB
5	D	403	PG4	C3-C4-O3-C5
5	D	403	PG4	C4-C3-O2-C2
5	D	403	PG4	O1-C1-C2-O2
5	D	403	PG4	O4-C7-C8-O5
5	D	403	PG4	C6-C5-O3-C4
5	D	403	PG4	C1-C2-O2-C3
3	C	402	HEM	CAA-CBA-CGA-O2A
3	C	402	HEM	C2A-CAA-CBA-CGA
3	F	402	HEM	CAA-CBA-CGA-O2A
3	D	402	HEM	CAD-CBD-CGD-O2D
3	D	402	HEM	CAD-CBD-CGD-O1D
3	E	402	HEM	CAA-CBA-CGA-O2A
3	F	402	HEM	CAA-CBA-CGA-O1A
3	B	402	HEM	CAD-CBD-CGD-O2D
3	C	402	HEM	CAA-CBA-CGA-O1A
3	F	402	HEM	CAD-CBD-CGD-O2D
3	C	402	HEM	CAD-CBD-CGD-O1D
3	E	402	HEM	CAD-CBD-CGD-O1D
3	B	402	HEM	CAD-CBD-CGD-O1D
3	E	402	HEM	CAD-CBD-CGD-O2D
3	F	402	HEM	CAD-CBD-CGD-O1D
3	D	402	HEM	CAA-CBA-CGA-O2A
3	A	402	HEM	CAA-CBA-CGA-O2A
3	A	402	HEM	CAD-CBD-CGD-O1D
3	B	402	HEM	CAA-CBA-CGA-O1A
3	E	402	HEM	CAA-CBA-CGA-O1A
3	C	402	HEM	C4B-C3B-CAB-CBB
3	A	402	HEM	CAD-CBD-CGD-O2D
3	B	402	HEM	CAA-CBA-CGA-O2A
3	C	402	HEM	CAD-CBD-CGD-O2D
3	D	402	HEM	CAA-CBA-CGA-O1A
3	A	402	HEM	CAA-CBA-CGA-O1A

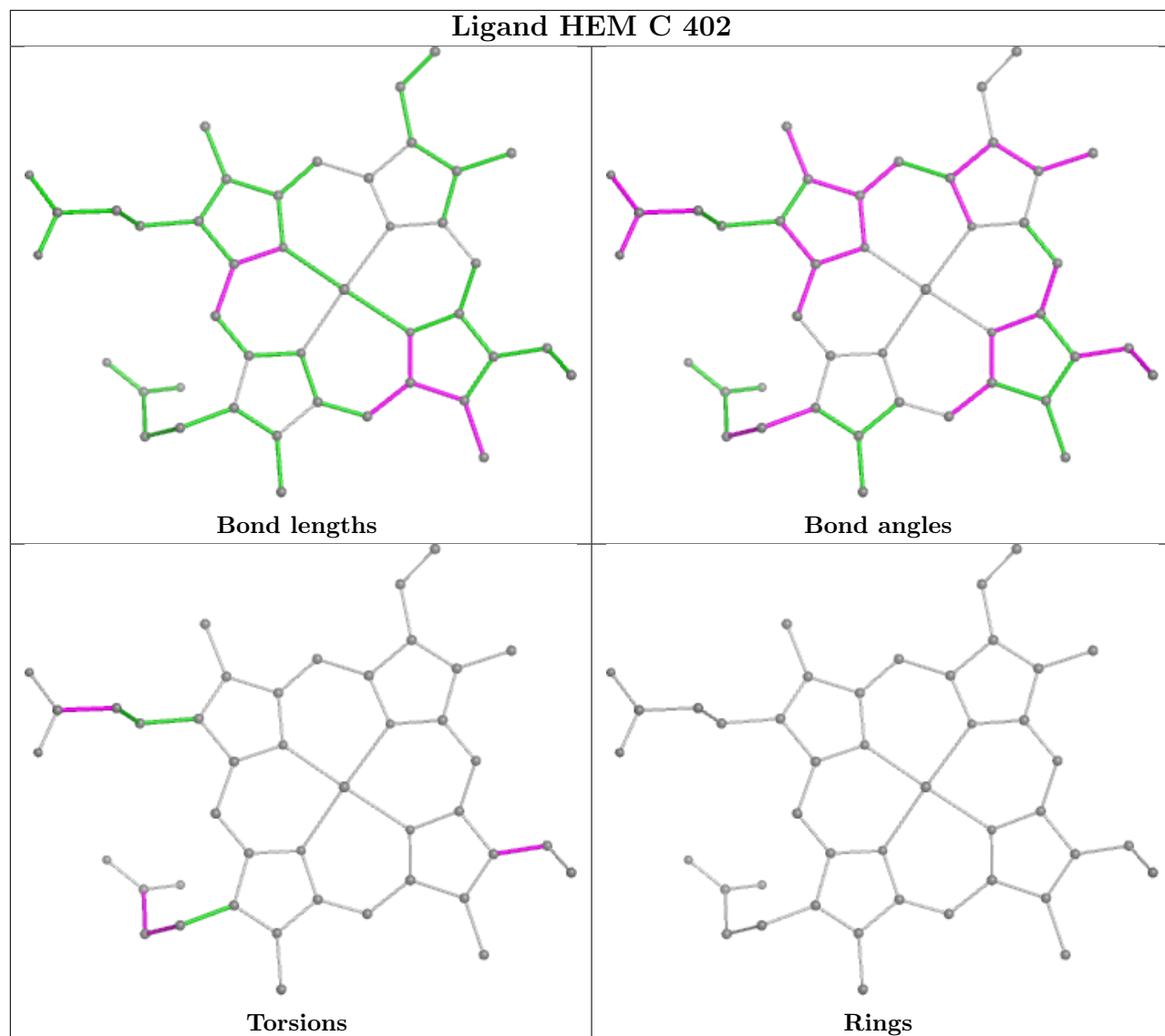
There are no ring outliers.

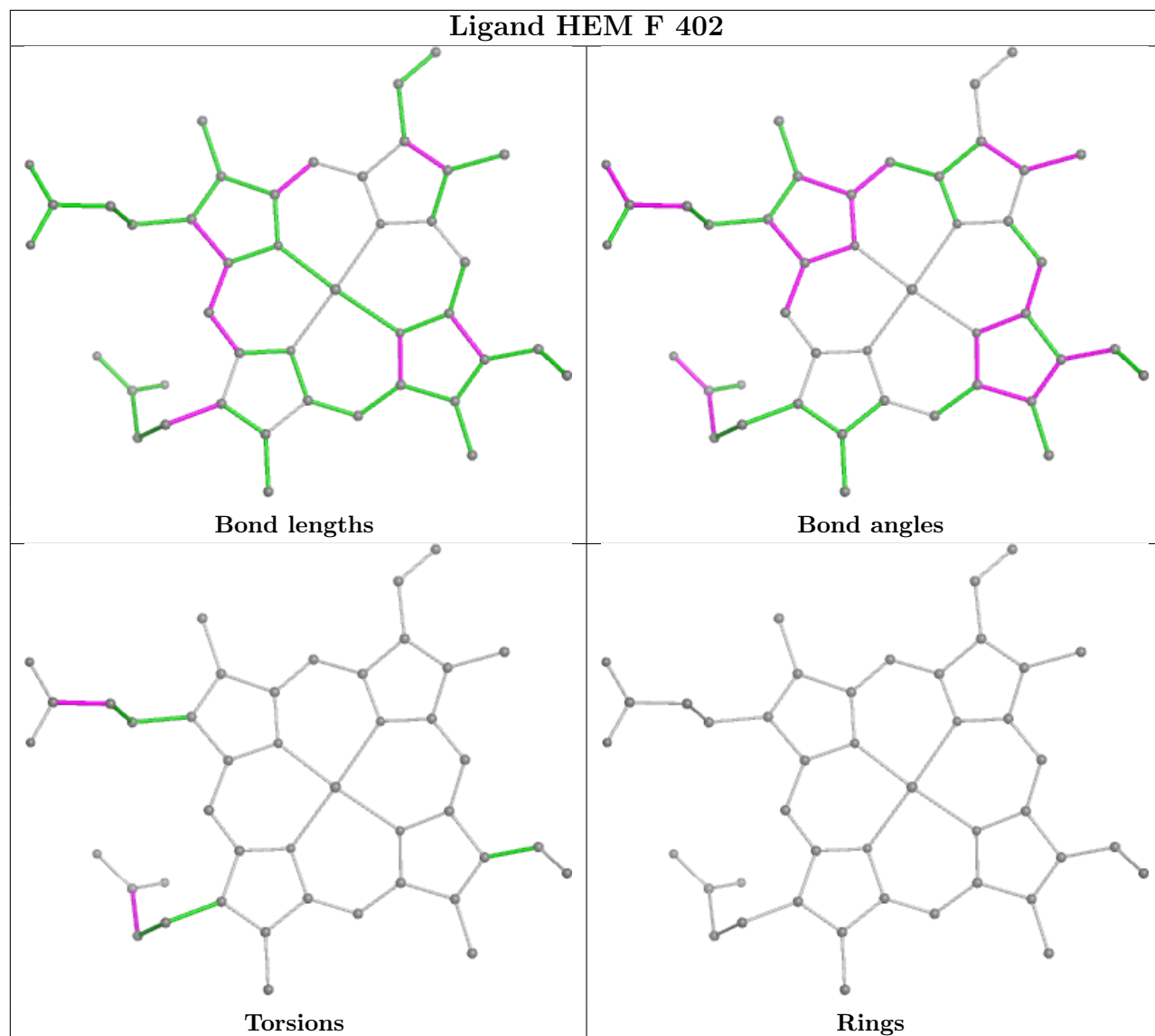
2 monomers are involved in 3 short contacts:

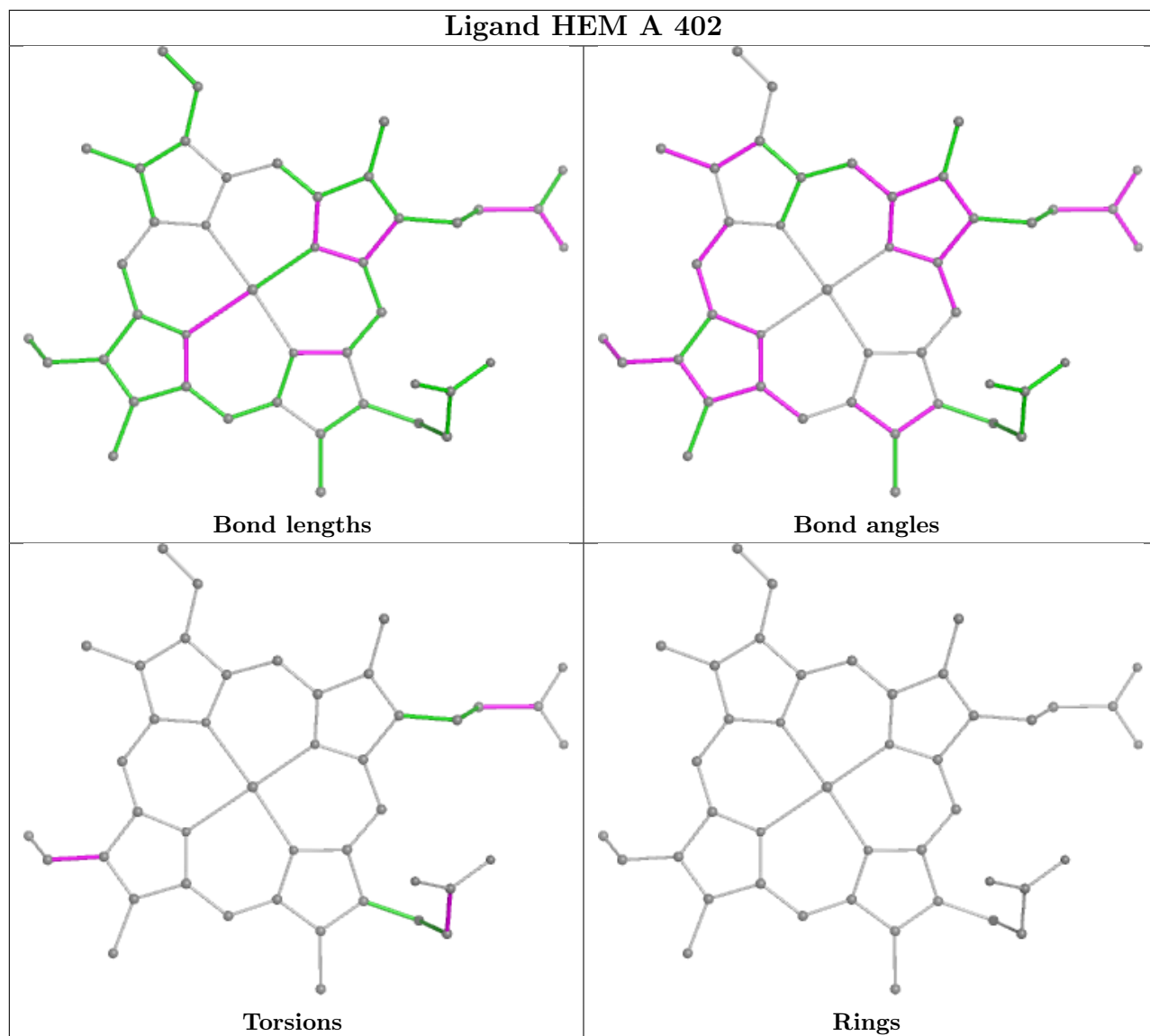
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	402	HEM	1	0
3	E	402	HEM	2	0

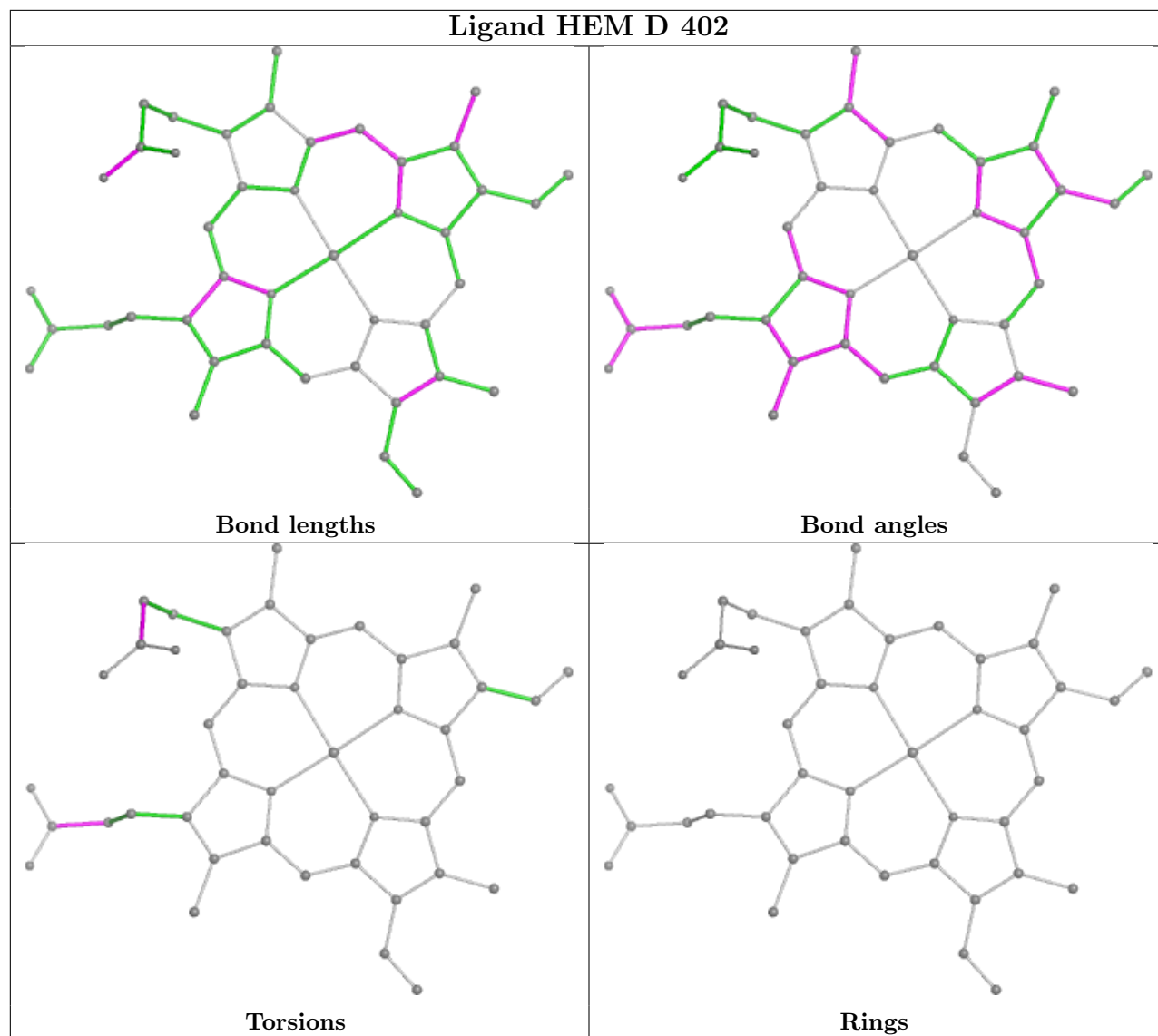
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

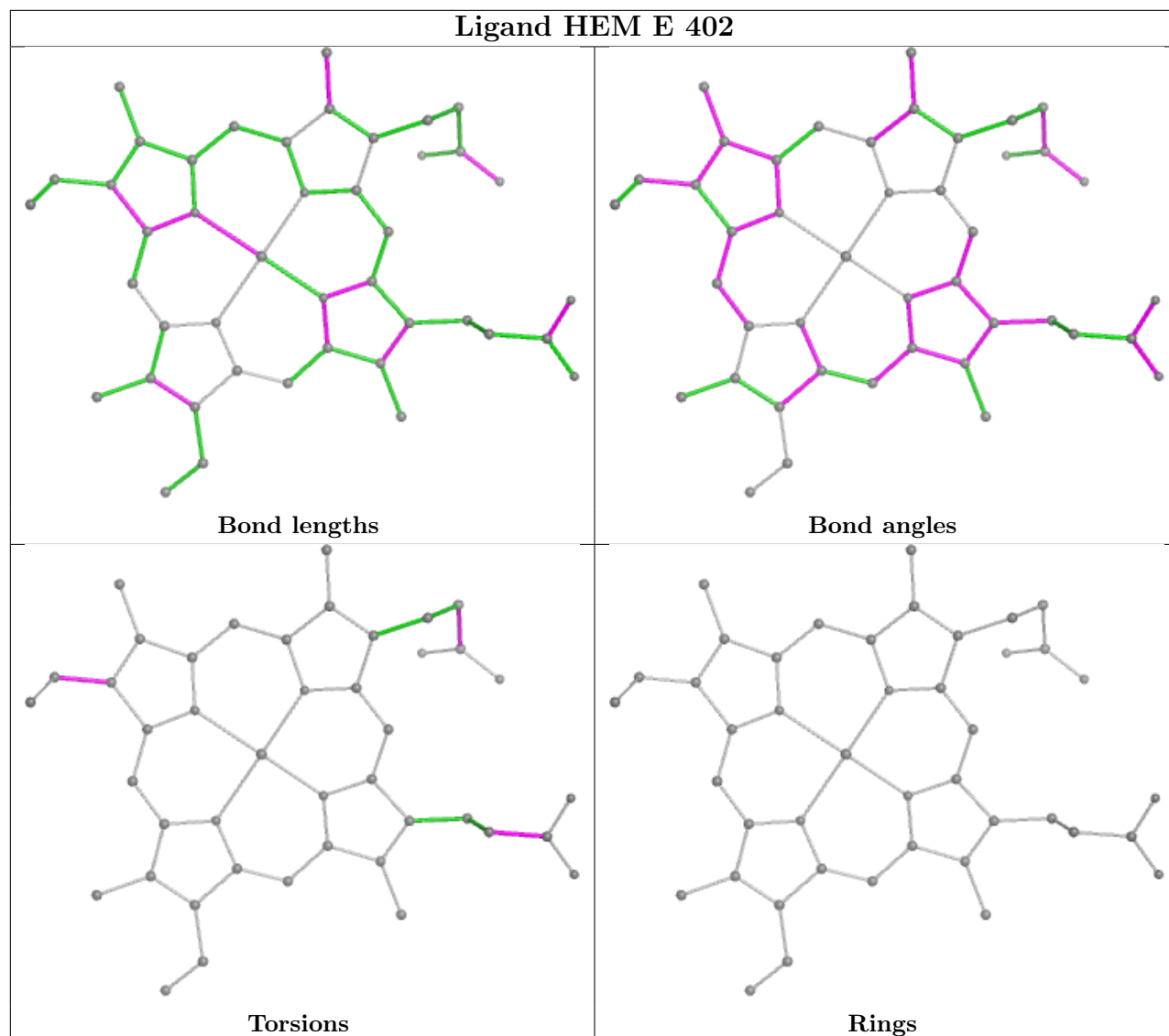












5.7 Other polymers [i](#)

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	A	305/306 (99%)	-0.63	0 100 100	16, 23, 51, 69	0
1	B	305/306 (99%)	-0.52	3 (0%) 82 87	18, 28, 57, 83	0
1	C	306/306 (100%)	-0.57	2 (0%) 87 92	16, 26, 55, 96	0
1	D	306/306 (100%)	-0.59	1 (0%) 94 95	16, 25, 57, 83	0
1	E	306/306 (100%)	-0.44	3 (0%) 82 87	18, 26, 57, 98	0
1	F	306/306 (100%)	-0.63	0 100 100	16, 26, 55, 92	0
All	All	1834/1836 (99%)	-0.56	9 (0%) 91 93	16, 26, 56, 98	0

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	234	PRO	5.6
1	C	234	PRO	4.5
1	E	235	ASP	3.5
1	B	234	PRO	3.1
1	D	142	PHE	2.9
1	E	233	GLY	2.7
1	B	7	GLU	2.4
1	C	170	ALA	2.0
1	B	283	SER	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 monosaccharides in this entry.

6.4 Ligands

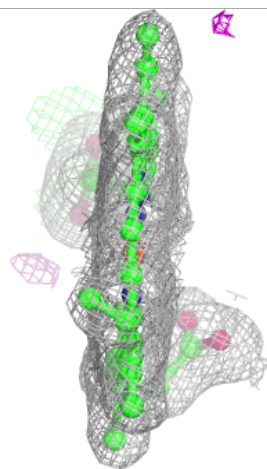
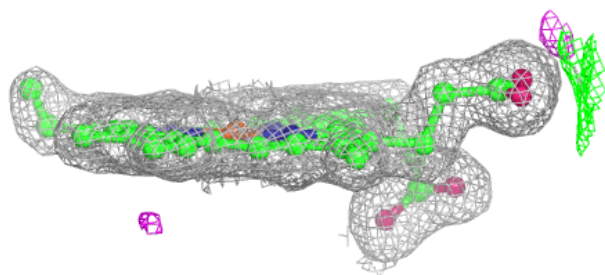
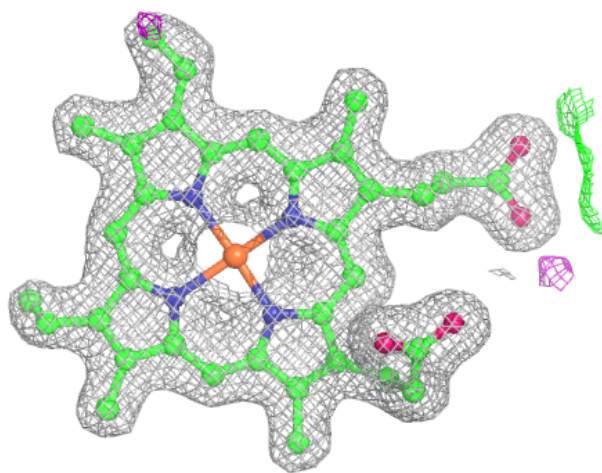
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	MG	C	403	1/1	0.72	0.07	42,42,42,42	0
5	PG4	D	403	13/13	0.83	0.09	44,55,62,66	0
2	O	E	401	1/1	0.97	0.10	23,23,23,23	1
2	O	F	401	1/1	0.98	0.11	19,19,19,19	1
2	O	C	401	1/1	0.98	0.08	23,23,23,23	0
2	O	A	401	1/1	0.98	0.09	21,21,21,21	0
3	HEM	A	402	43/43	0.99	0.05	17,21,25,27	0
3	HEM	B	402	43/43	0.99	0.05	15,19,23,27	0
3	HEM	C	402	43/43	0.99	0.05	19,23,28,33	0
3	HEM	D	402	43/43	0.99	0.05	16,17,23,31	0
3	HEM	E	402	43/43	0.99	0.05	17,21,24,27	0
3	HEM	F	402	43/43	0.99	0.05	16,19,23,32	0
2	O	B	401	1/1	0.99	0.10	21,21,21,21	1
2	O	D	401	1/1	0.99	0.09	17,17,17,17	1
4	MG	A	403	1/1	1.00	0.02	19,19,19,19	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.

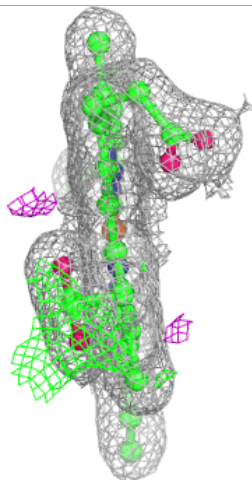
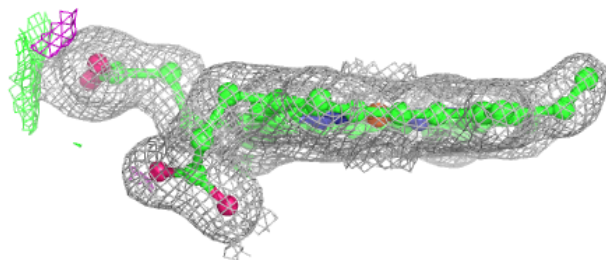
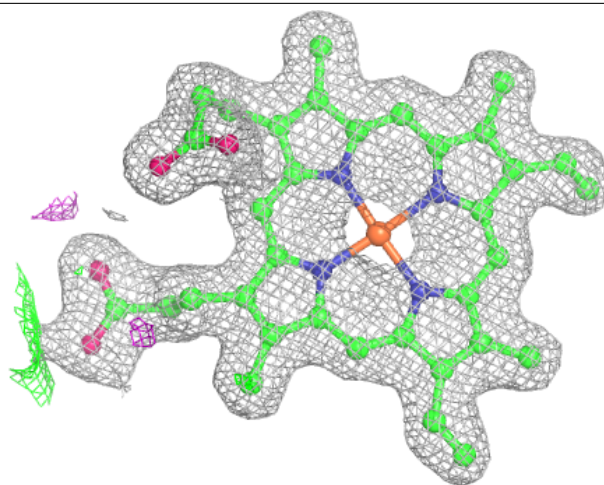
Electron density around HEM A 402:

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



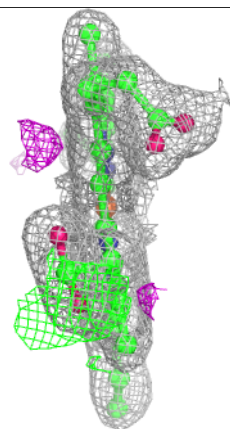
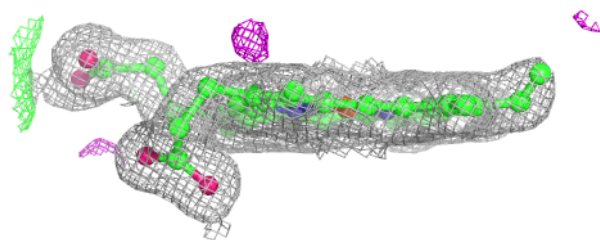
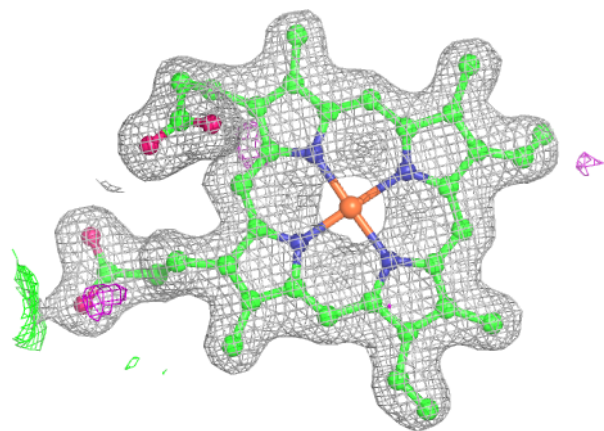
Electron density around HEM B 402:

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



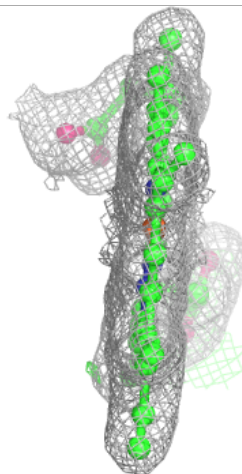
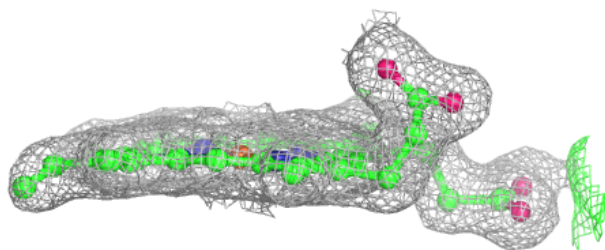
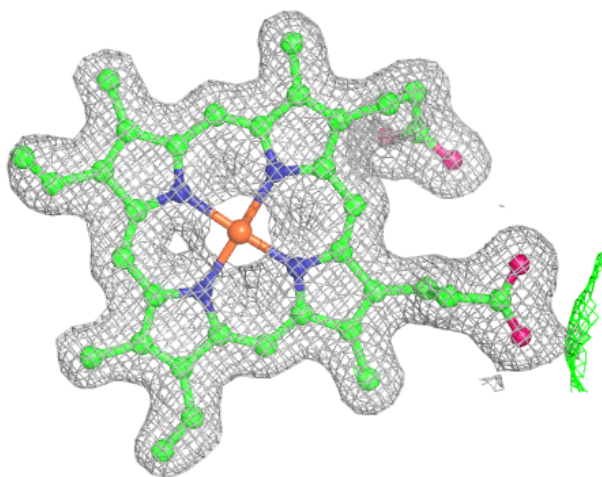
Electron density around HEM C 402:

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



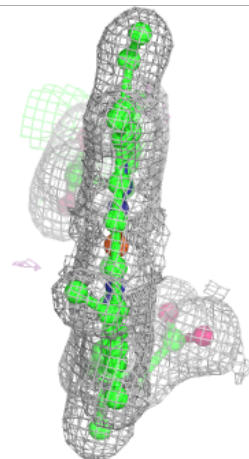
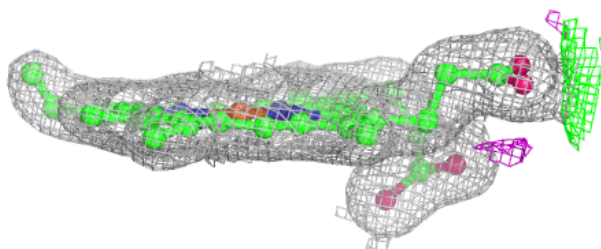
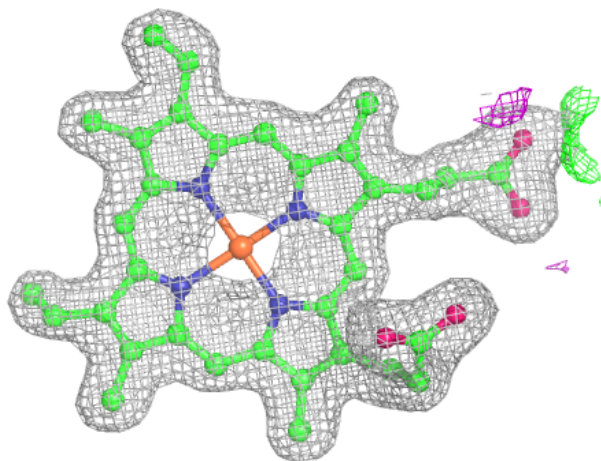
Electron density around HEM D 402:

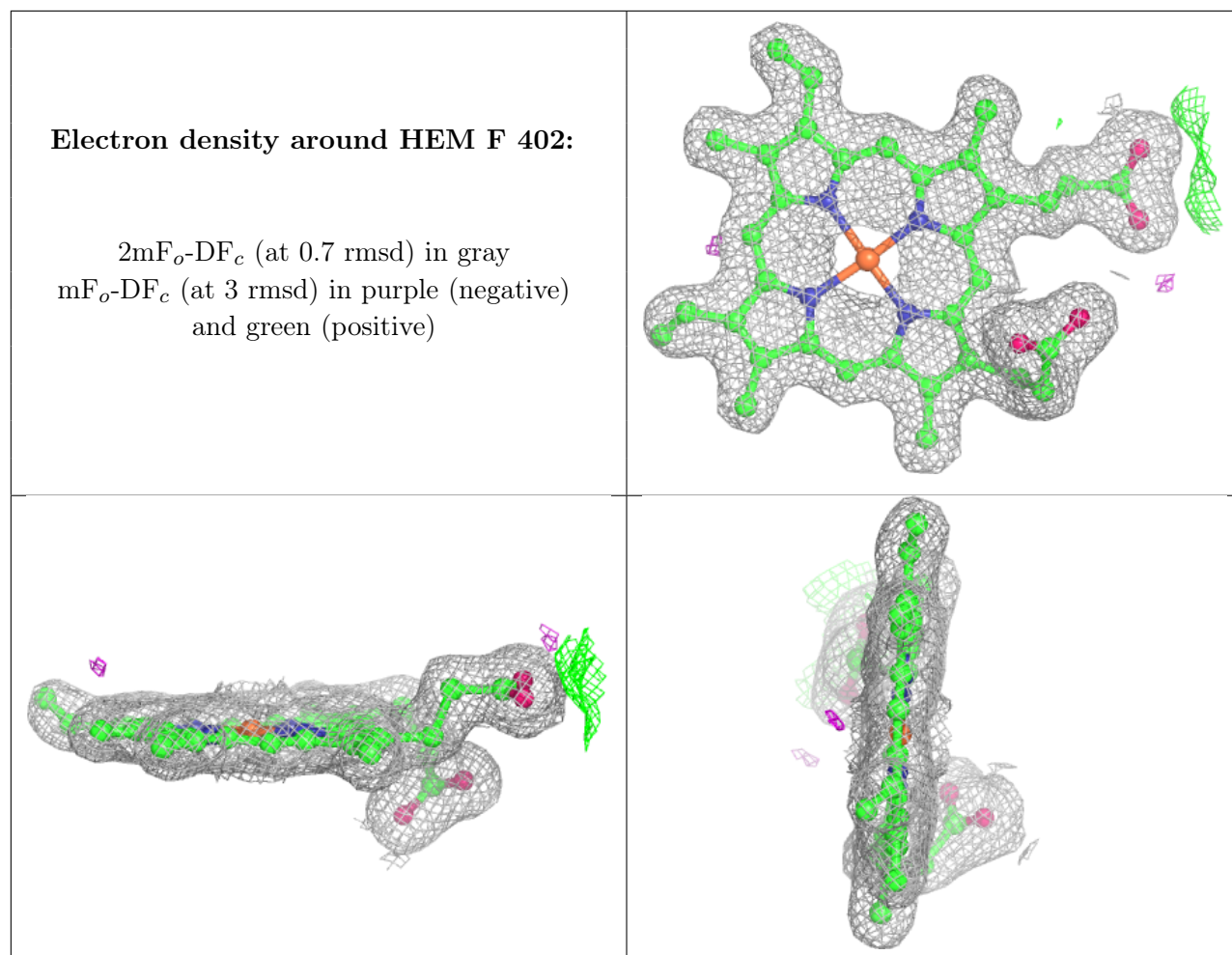
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM E 402:

$2mF_o-DF_c$ (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.