



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 5, 2023 – 02:13 PM EST

PDB ID : 2B7R
Title : Structure of E378D mutant flavocytochrome c3
Authors : Pankhurst, K.L.; Mowat, C.G.; Rothery, E.L.; Miles, C.S.; Walkinshaw, M.D.;
Reid, G.A.; Chapman, S.K.
Deposited on : 2005-10-05
Resolution : 1.70 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 : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
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) : 2.36

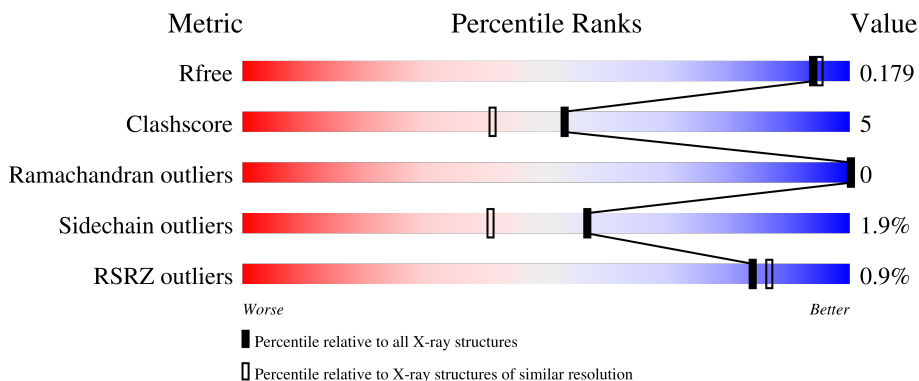
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (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.

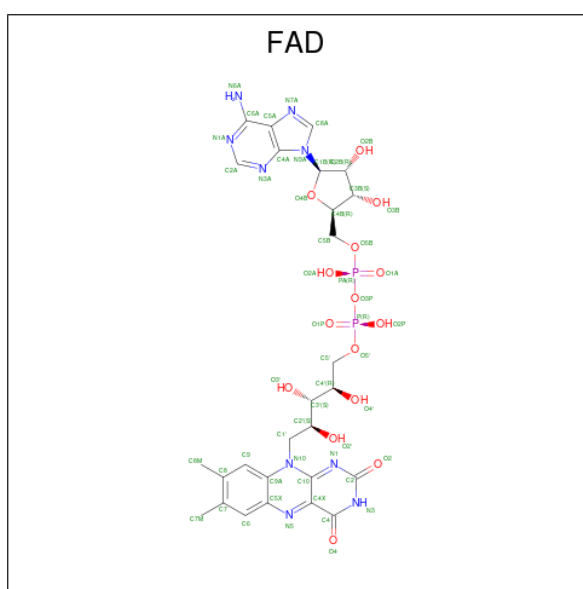
Mol	Chain	Length	Quality of chain
1	A	571	

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	FAD	A	1805	X	-	-	-

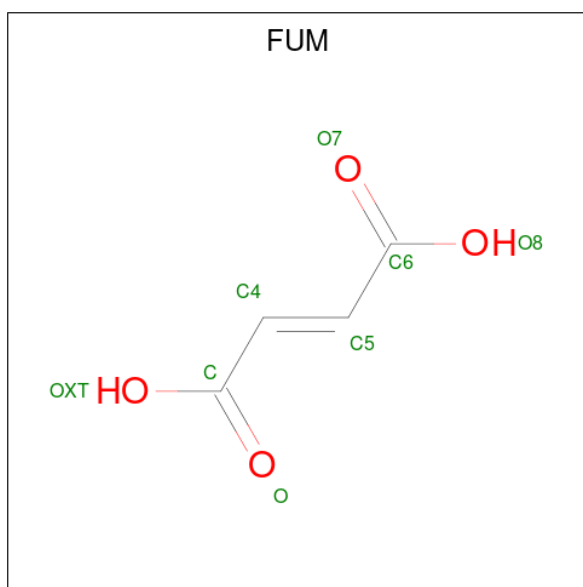
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
3	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
3	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
3	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
3	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 4 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
4	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 5 is FUMARIC ACID (three-letter code: FUM) (formula: $C_4H_4O_4$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			8	4	4		

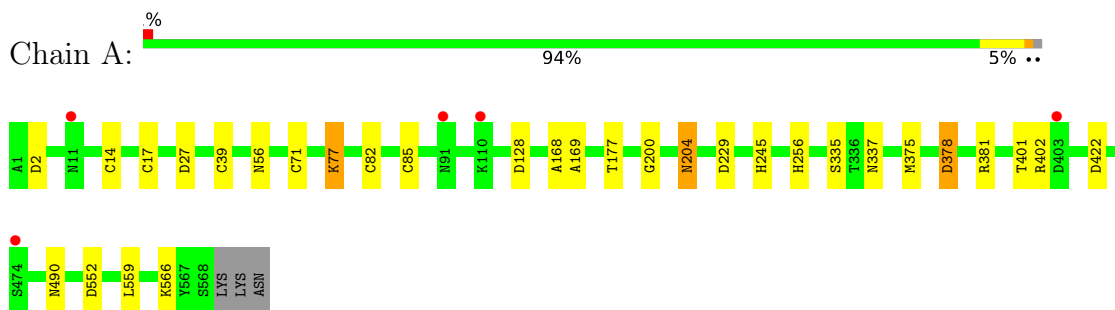
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1084	Total	O	0	0
			1084	1084		

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: Fumarate reductase flavoprotein subunit



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	45.96Å 92.88Å 79.49Å 90.00° 91.17° 90.00°	Depositor
Resolution (Å)	20.00 – 1.70 19.72 – 1.70	Depositor EDS
% Data completeness (in resolution range)	98.2 (20.00-1.70) 98.2 (19.72-1.70)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.43 (at 1.69Å)	Xtrriage
Refinement program	REFMAC 5.2.0003	Depositor
R, R_{free}	0.156 , 0.180 0.155 , 0.179	Depositor DCC
R_{free} test set	3629 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å ²)	14.5	Xtrriage
Anisotropy	0.060	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.40 , 72.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.024 for h,-k,-l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5494	wwPDB-VP
Average B, all atoms (Å ²)	18.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.60% 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: NA, FUM, HEM, FAD

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	0.69	0/4246	0.74	6/5746 (0.1%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	2	ASP	CB-CG-OD2	6.62	124.26	118.30
1	A	378	ASP	CB-CG-OD2	6.06	123.75	118.30
1	A	552	ASP	CB-CG-OD1	5.78	123.50	118.30
1	A	128	ASP	CB-CG-OD2	5.45	123.20	118.30
1	A	422	ASP	CB-CG-OD2	5.17	122.95	118.30
1	A	27	ASP	CB-CG-OD2	5.15	122.93	118.30

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	4176	0	4074	41	0
2	A	1	0	0	0	0
3	A	172	0	120	20	0
4	A	53	0	29	8	0
5	A	8	0	1	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	1084	0	0	3	0
All	All	5494	0	4224	41	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.

All (41) 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:A:14:CYS:SG	3:A:801:HEM:HAB	1.62	1.38
1:A:82:CYS:SG	3:A:804:HEM:HAB	1.61	1.32
1:A:71:CYS:SG	3:A:803:HEM:HAC	1.91	1.07
1:A:375:MET:CE	4:A:1805:FAD:H6	1.86	1.05
1:A:375:MET:HE2	4:A:1805:FAD:H6	1.35	1.02
1:A:14:CYS:HG	3:A:801:HEM:CAB	1.58	1.01
1:A:17:CYS:SG	3:A:801:HEM:HAC	1.99	1.01
1:A:229:ASP:H	1:A:256:HIS:HE1	1.14	0.92
1:A:85:CYS:SG	3:A:804:HEM:HAC	2.16	0.86
1:A:39:CYS:HG	3:A:802:HEM:CAC	1.91	0.83
1:A:169:ALA:O	6:A:2598:HOH:O	1.96	0.82
1:A:375:MET:CE	4:A:1805:FAD:C6	2.56	0.82
1:A:204:ASN:HD22	1:A:204:ASN:H	1.28	0.81
1:A:229:ASP:H	1:A:256:HIS:CE1	2.03	0.75
1:A:378:ASP:OD1	1:A:381:ARG:NH2	2.25	0.68
1:A:82:CYS:SG	3:A:804:HEM:CBB	2.79	0.68
1:A:200:GLY:HA3	1:A:204:ASN:HD21	1.60	0.66
1:A:82:CYS:SG	3:A:804:HEM:C3B	2.91	0.62
1:A:375:MET:HE1	4:A:1805:FAD:H6	1.78	0.60
1:A:204:ASN:H	1:A:204:ASN:ND2	1.98	0.59
1:A:375:MET:HE2	4:A:1805:FAD:C6	2.20	0.59
1:A:17:CYS:SG	3:A:801:HEM:C3C	2.96	0.58
1:A:71:CYS:SG	3:A:803:HEM:CBC	2.91	0.57
1:A:85:CYS:SG	3:A:804:HEM:C3C	3.02	0.53
1:A:71:CYS:SG	3:A:803:HEM:C3C	3.00	0.52
1:A:177:THR:OG1	1:A:245:HIS:HE1	1.91	0.52
1:A:402:ARG:HH22	5:A:1806:FUM:C4	2.24	0.51
1:A:14:CYS:SG	3:A:801:HEM:CBB	2.91	0.50
1:A:82:CYS:CB	3:A:804:HEM:HAB	2.39	0.49
1:A:85:CYS:SG	3:A:804:HEM:CBC	2.97	0.49
1:A:375:MET:HE1	4:A:1805:FAD:C6	2.38	0.49
1:A:229:ASP:N	1:A:256:HIS:HE1	1.96	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:77:LYS:HG2	6:A:2151:HOH:O	2.13	0.47
1:A:17:CYS:SG	3:A:801:HEM:CBC	2.97	0.46
1:A:39:CYS:SG	3:A:802:HEM:C3C	3.07	0.46
1:A:566:LYS:HG3	6:A:2235:HOH:O	2.17	0.45
1:A:14:CYS:SG	3:A:801:HEM:C3B	2.99	0.44
1:A:39:CYS:HG	3:A:802:HEM:CBC	2.30	0.44
1:A:168:ALA:HA	4:A:1805:FAD:N5	2.35	0.42
1:A:375:MET:SD	4:A:1805:FAD:C6	3.07	0.42
1:A:204:ASN:ND2	1:A:204:ASN:N	2.69	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	566/571 (99%)	552 (98%)	14 (2%)	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	429/445 (96%)	421 (98%)	8 (2%)	57 41

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	ASN
1	A	77	LYS
1	A	204	ASN
1	A	335	SER
1	A	337	ASN
1	A	401	THR
1	A	490	ASN
1	A	559	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	56	ASN
1	A	116	GLN
1	A	201	GLN
1	A	204	ASN
1	A	245	HIS
1	A	256	HIS
1	A	269	ASN
1	A	490	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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 7 ligands modelled in this entry, 1 is monoatomic - leaving 6 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
5	FUM	A	1806	-	7,7,7	2.77	4 (57%)	8,8,8	1.20	1 (12%)
3	HEM	A	804	1	41,50,50	2.03	10 (24%)	45,82,82	1.84	8 (17%)
3	HEM	A	801	1	41,50,50	1.96	9 (21%)	45,82,82	2.18	13 (28%)
4	FAD	A	1805	-	53,58,58	2.13	19 (35%)	68,89,89	2.07	17 (25%)
3	HEM	A	803	1	41,50,50	2.00	7 (17%)	45,82,82	1.77	11 (24%)
3	HEM	A	802	1	41,50,50	1.96	7 (17%)	45,82,82	2.01	10 (22%)

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
5	FUM	A	1806	-	-	2/5/5/5	-
3	HEM	A	804	1	-	7/12/54/54	-
3	HEM	A	801	1	-	6/12/54/54	-
4	FAD	A	1805	-	1/1/9/9	6/30/50/50	0/6/6/6
3	HEM	A	803	1	-	4/12/54/54	-
3	HEM	A	802	1	-	4/12/54/54	-

All (56) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	802	HEM	C3D-C2D	7.85	1.53	1.36
3	A	803	HEM	C3D-C2D	7.60	1.52	1.36
3	A	801	HEM	C3D-C2D	7.50	1.52	1.36
3	A	804	HEM	C3D-C2D	7.50	1.52	1.36
4	A	1805	FAD	C6-C5X	6.28	1.49	1.40
4	A	1805	FAD	C2A-N3A	4.81	1.39	1.32
3	A	804	HEM	C3C-CAC	4.55	1.57	1.47
3	A	802	HEM	C3C-CAC	4.33	1.56	1.47
4	A	1805	FAD	C6-C7	-4.26	1.33	1.39
4	A	1805	FAD	C4'-C3'	4.18	1.61	1.53
3	A	801	HEM	C3C-CAC	4.01	1.56	1.47

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	1806	FUM	O-C	3.91	1.33	1.23
3	A	803	HEM	C3C-CAC	3.86	1.55	1.47
4	A	1805	FAD	O2'-C2'	3.85	1.51	1.43
5	A	1806	FUM	O8-C6	-3.77	1.20	1.30
4	A	1805	FAD	C5X-N5	3.66	1.46	1.39
3	A	803	HEM	C3C-C2C	-3.58	1.35	1.40
4	A	1805	FAD	C9A-N10	3.56	1.47	1.41
3	A	804	HEM	C3C-C2C	-3.52	1.35	1.40
5	A	1806	FUM	O7-C6	3.51	1.32	1.23
3	A	803	HEM	CAA-C2A	3.38	1.57	1.52
5	A	1806	FUM	OXT-C	-3.37	1.21	1.30
3	A	801	HEM	C3C-C2C	-3.22	1.35	1.40
3	A	803	HEM	FE-ND	3.17	2.12	1.96
4	A	1805	FAD	C2-N1	3.13	1.44	1.36
3	A	802	HEM	C3C-C2C	-3.12	1.36	1.40
3	A	804	HEM	FE-ND	2.98	2.11	1.96
3	A	802	HEM	CAB-C3B	2.93	1.55	1.47
3	A	803	HEM	CAB-C3B	2.90	1.55	1.47
4	A	1805	FAD	O4-C4	-2.89	1.18	1.23
3	A	804	HEM	CAB-C3B	2.82	1.55	1.47
3	A	801	HEM	CAB-C3B	2.81	1.55	1.47
4	A	1805	FAD	C10-N1	-2.77	1.27	1.33
4	A	1805	FAD	O3'-C3'	2.72	1.49	1.43
3	A	801	HEM	CAA-C2A	2.71	1.56	1.52
3	A	801	HEM	FE-ND	2.59	2.09	1.96
3	A	801	HEM	FE-NB	2.54	2.09	1.96
4	A	1805	FAD	O3B-C3B	2.50	1.48	1.43
3	A	802	HEM	CMB-C2B	2.44	1.56	1.50
3	A	804	HEM	CMB-C2B	2.42	1.55	1.50
3	A	802	HEM	CAA-C2A	2.32	1.55	1.52
3	A	801	HEM	CMB-C2B	2.30	1.55	1.50
4	A	1805	FAD	C9A-C5X	2.29	1.45	1.41
4	A	1805	FAD	C8-C7	2.28	1.46	1.40
3	A	802	HEM	FE-ND	2.28	2.08	1.96
4	A	1805	FAD	C2-N3	2.18	1.44	1.39
3	A	804	HEM	FE-NB	2.17	2.07	1.96
3	A	804	HEM	CMD-C2D	2.16	1.55	1.50
4	A	1805	FAD	C5'-C4'	-2.14	1.48	1.51
3	A	803	HEM	CMD-C2D	2.13	1.55	1.50
3	A	804	HEM	CAA-C2A	2.12	1.55	1.52
4	A	1805	FAD	O4B-C1B	-2.11	1.38	1.41
3	A	804	HEM	CMA-C3A	2.10	1.56	1.51

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	1805	FAD	C4A-N3A	2.10	1.38	1.35
3	A	801	HEM	CMD-C2D	2.08	1.55	1.50
4	A	1805	FAD	C4X-C4	2.05	1.52	1.44

All (60) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	802	HEM	C4D-ND-C1D	7.87	113.20	105.07
3	A	801	HEM	C4D-ND-C1D	7.82	113.15	105.07
3	A	804	HEM	C4D-ND-C1D	7.03	112.33	105.07
4	A	1805	FAD	O3B-C3B-C2B	-6.04	92.29	111.82
4	A	1805	FAD	O2B-C2B-C3B	5.71	130.28	111.82
3	A	801	HEM	C1B-NB-C4B	5.36	110.61	105.07
3	A	803	HEM	C4D-ND-C1D	5.27	110.51	105.07
3	A	802	HEM	C1B-NB-C4B	4.70	109.92	105.07
4	A	1805	FAD	O4'-C4'-C3'	-4.36	98.51	109.10
4	A	1805	FAD	C9A-C5X-N5	-4.31	117.75	122.43
4	A	1805	FAD	C9-C8-C7	4.06	125.49	119.67
3	A	804	HEM	C4B-CHC-C1C	3.85	127.64	122.56
4	A	1805	FAD	O4'-C4'-C5'	3.75	118.35	109.92
3	A	803	HEM	CMA-C3A-C4A	-3.68	122.80	128.46
4	A	1805	FAD	C3B-C2B-C1B	3.44	106.15	100.98
3	A	801	HEM	CMA-C3A-C4A	-3.38	123.26	128.46
4	A	1805	FAD	O2B-C2B-C1B	3.37	123.30	110.85
4	A	1805	FAD	O5'-C5'-C4'	-3.36	100.39	109.36
4	A	1805	FAD	C8M-C8-C9	-3.30	113.39	119.49
4	A	1805	FAD	O2'-C2'-C1'	3.30	117.78	109.80
4	A	1805	FAD	C1B-N9A-C4A	3.29	132.43	126.64
3	A	803	HEM	C4A-C3A-C2A	3.26	109.27	107.00
3	A	802	HEM	C4C-CHD-C1D	3.01	126.53	122.56
3	A	803	HEM	CBD-CAD-C3D	-3.00	104.30	112.63
3	A	804	HEM	CHD-C1D-ND	2.94	127.63	124.43
3	A	804	HEM	C1B-NB-C4B	2.94	108.11	105.07
3	A	801	HEM	C2B-C1B-NB	-2.88	106.42	109.84
3	A	804	HEM	CBA-CAA-C2A	-2.87	107.73	112.62
3	A	801	HEM	C4C-CHD-C1D	2.85	126.32	122.56
3	A	803	HEM	C1B-NB-C4B	2.84	108.00	105.07
3	A	801	HEM	C3D-C4D-ND	-2.78	107.08	110.17
3	A	804	HEM	C4C-CHD-C1D	2.73	126.16	122.56
3	A	802	HEM	C2B-C1B-NB	-2.68	106.66	109.84
3	A	801	HEM	CHD-C1D-ND	2.68	127.35	124.43
3	A	801	HEM	CHC-C4B-NB	2.59	127.24	124.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	803	HEM	C4B-CHC-C1C	2.58	125.96	122.56
3	A	801	HEM	CHA-C4D-ND	2.54	127.52	124.38
3	A	804	HEM	CAD-C3D-C4D	2.54	129.09	124.66
4	A	1805	FAD	N3A-C2A-N1A	-2.53	124.72	128.68
3	A	802	HEM	CMA-C3A-C4A	-2.50	124.63	128.46
3	A	802	HEM	C4B-CHC-C1C	2.47	125.81	122.56
3	A	801	HEM	C4B-CHC-C1C	2.44	125.78	122.56
4	A	1805	FAD	C6-C5X-C9A	2.44	122.39	118.94
3	A	801	HEM	CBD-CAD-C3D	-2.43	105.86	112.63
3	A	803	HEM	CAD-C3D-C4D	2.43	128.91	124.66
3	A	802	HEM	C3B-C2B-C1B	2.42	108.28	106.49
3	A	802	HEM	CBA-CAA-C2A	-2.38	108.56	112.62
4	A	1805	FAD	C7M-C7-C8	2.37	125.60	120.74
5	A	1806	FUM	OXT-C-O	-2.34	117.80	122.67
3	A	801	HEM	C4B-C3B-C2B	2.32	108.96	107.11
3	A	802	HEM	C3D-C4D-ND	-2.29	107.61	110.17
3	A	803	HEM	C3B-C2B-C1B	2.27	108.17	106.49
3	A	803	HEM	C3C-C4C-NC	-2.25	106.70	110.94
4	A	1805	FAD	C4A-C5A-N7A	-2.20	107.11	109.40
3	A	801	HEM	O2D-CGD-CBD	2.09	120.76	114.03
3	A	803	HEM	CHC-C4B-C3B	2.09	127.76	124.57
3	A	803	HEM	CMD-C2D-C1D	2.07	128.19	125.04
3	A	804	HEM	C3D-C4D-ND	-2.05	107.88	110.17
3	A	802	HEM	C4A-C3A-C2A	2.01	108.39	107.00
4	A	1805	FAD	O4-C4-N3	-2.00	116.28	120.12

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	1805	FAD	C2B

All (29) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1805	FAD	N10-C1'-C2'-O2'
4	A	1805	FAD	C2'-C3'-C4'-C5'
4	A	1805	FAD	C2'-C3'-C4'-O4'
4	A	1805	FAD	O3'-C3'-C4'-C5'
5	A	1806	FUM	C4-C5-C6-O7
5	A	1806	FUM	C4-C5-C6-O8
3	A	801	HEM	C2B-C3B-CAB-CBB
3	A	801	HEM	C4B-C3B-CAB-CBB

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Mol	Chain	Res	Type	Atoms
3	A	802	HEM	C2B-C3B-CAB-CBB
3	A	803	HEM	C2B-C3B-CAB-CBB
3	A	804	HEM	C2B-C3B-CAB-CBB
3	A	804	HEM	C4B-C3B-CAB-CBB
3	A	804	HEM	C2D-C3D-CAD-CBD
3	A	804	HEM	C4D-C3D-CAD-CBD
4	A	1805	FAD	O3'-C3'-C4'-O4'
3	A	803	HEM	CAA-CBA-CGA-O1A
3	A	804	HEM	CAA-CBA-CGA-O2A
4	A	1805	FAD	O4B-C4B-C5B-O5B
3	A	803	HEM	CAA-CBA-CGA-O2A
3	A	804	HEM	CAA-CBA-CGA-O1A
3	A	801	HEM	CAA-CBA-CGA-O2A
3	A	801	HEM	CAD-CBD-CGD-O1D
3	A	801	HEM	CAA-CBA-CGA-O1A
3	A	801	HEM	CAD-CBD-CGD-O2D
3	A	802	HEM	C4B-C3B-CAB-CBB
3	A	803	HEM	C4B-C3B-CAB-CBB
3	A	802	HEM	CAD-CBD-CGD-O2D
3	A	802	HEM	CAD-CBD-CGD-O1D
3	A	804	HEM	CAD-CBD-CGD-O1D

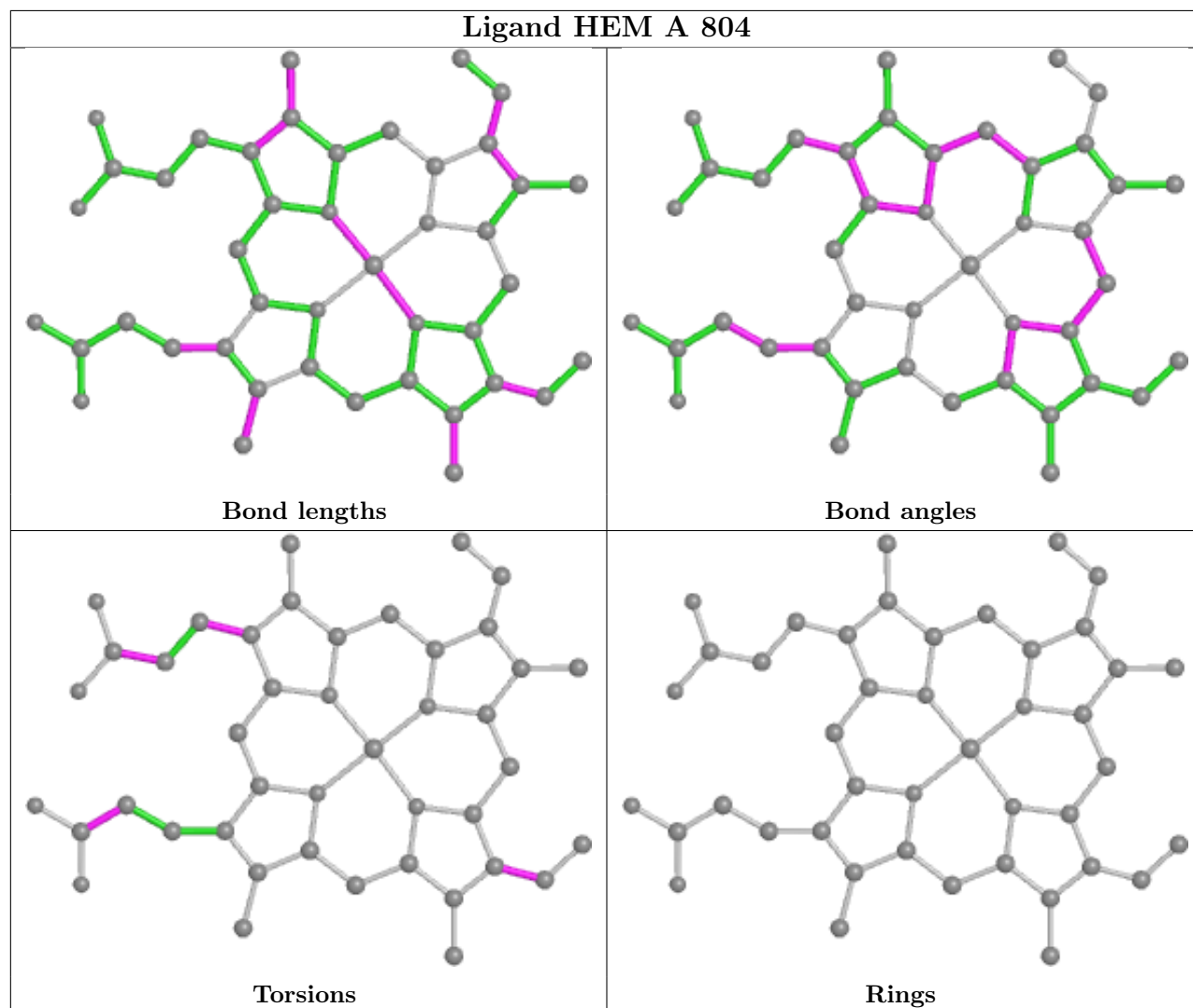
There are no ring outliers.

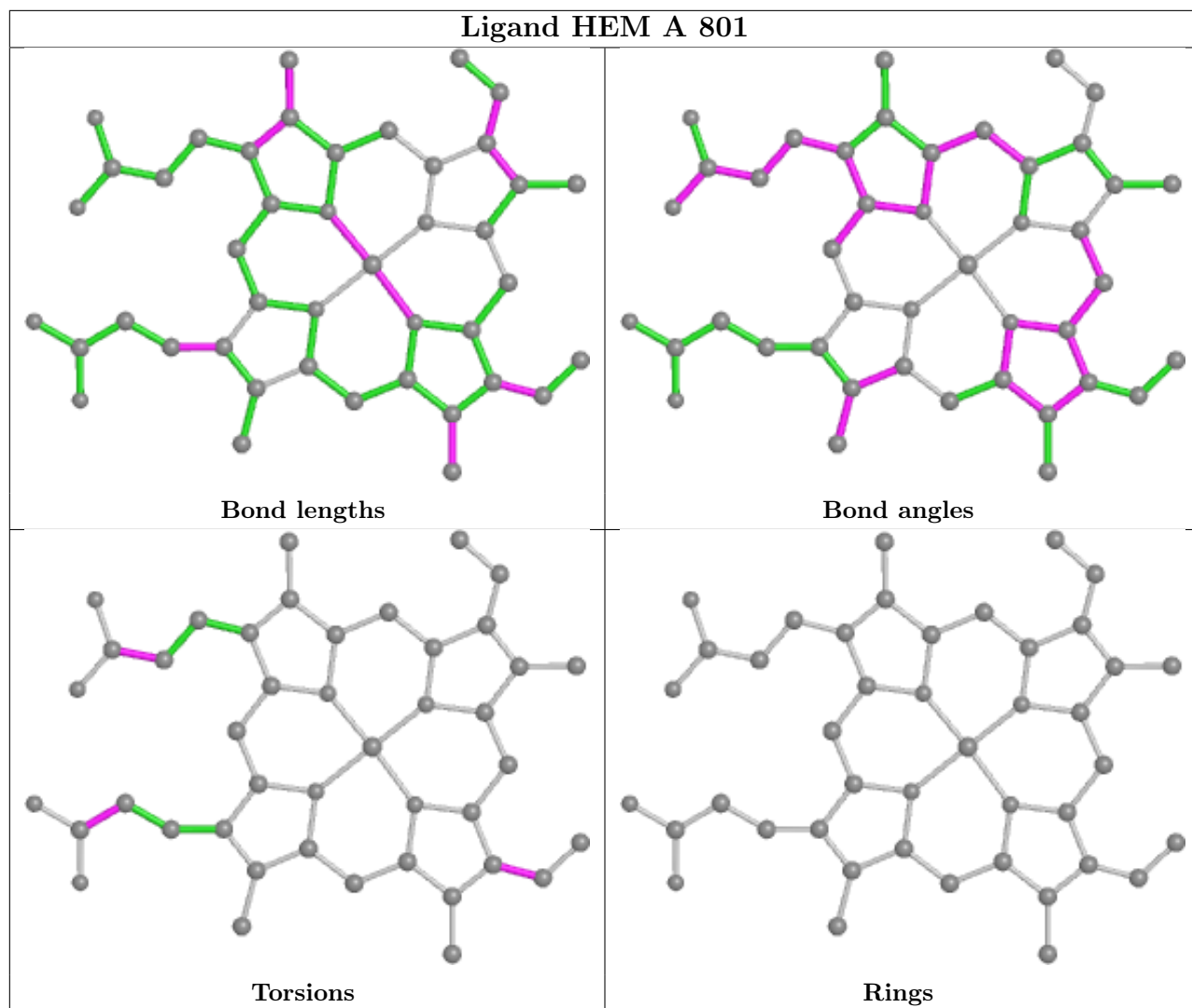
6 monomers are involved in 29 short contacts:

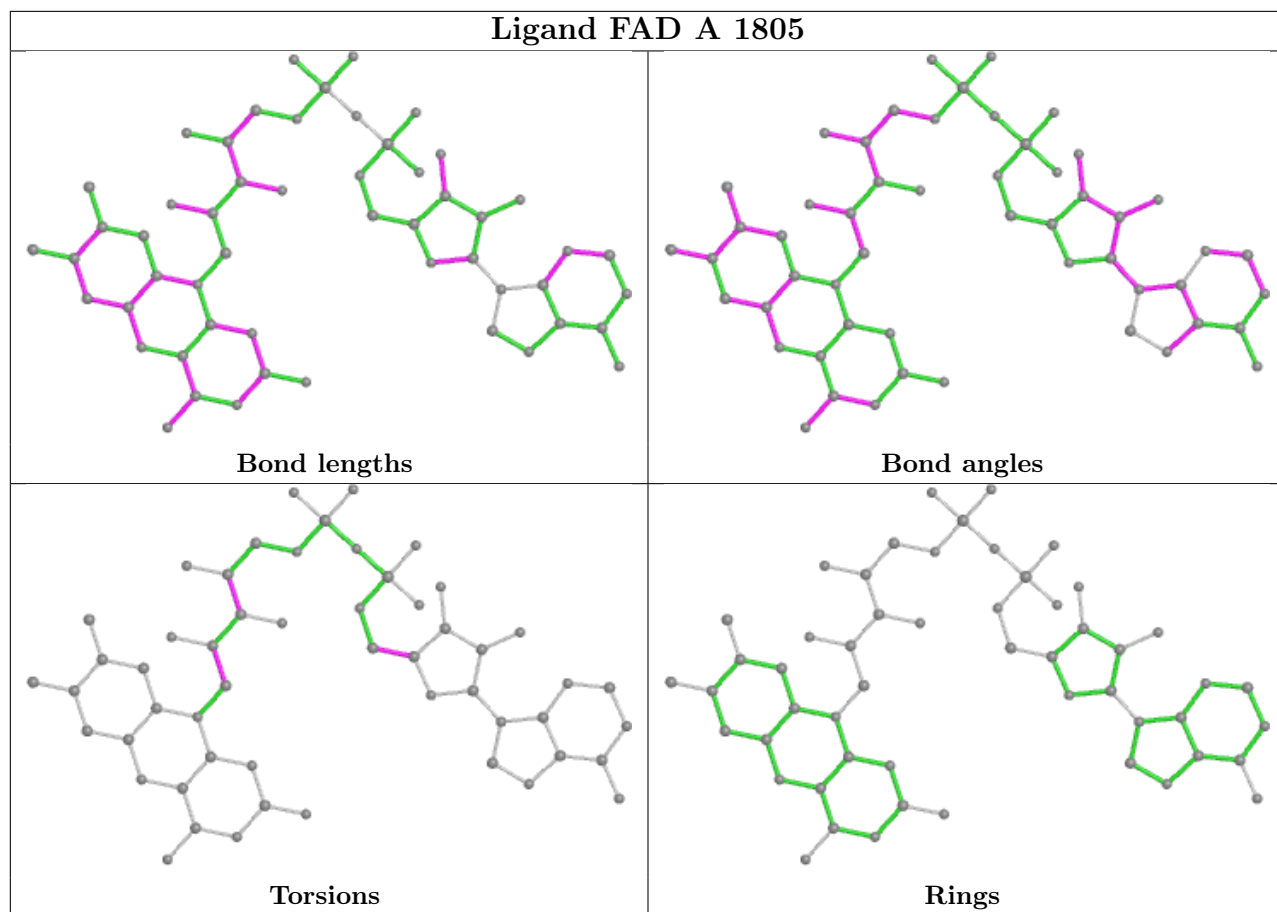
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	1806	FUM	1	0
3	A	804	HEM	7	0
3	A	801	HEM	7	0
4	A	1805	FAD	8	0
3	A	803	HEM	3	0
3	A	802	HEM	3	0

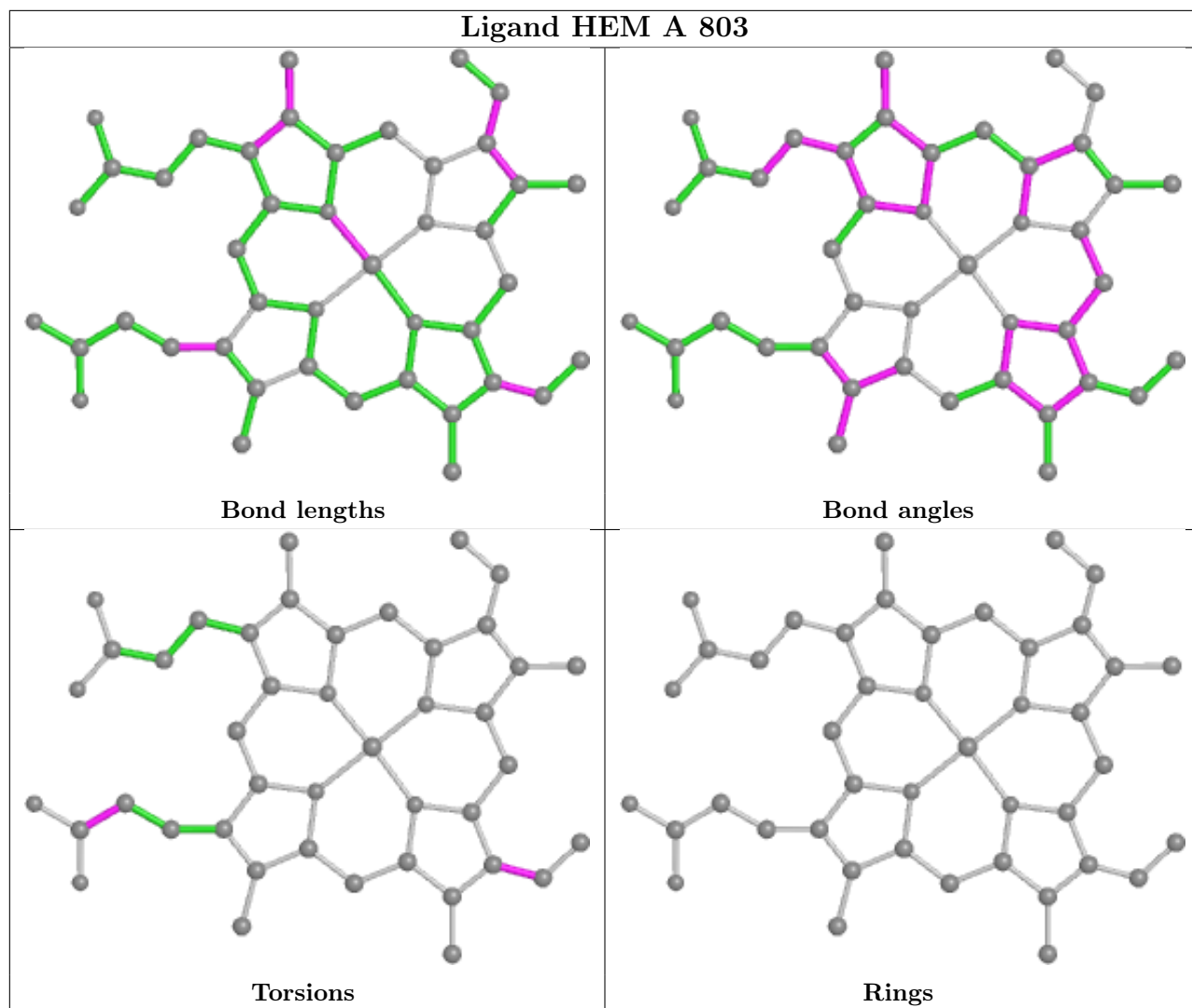
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

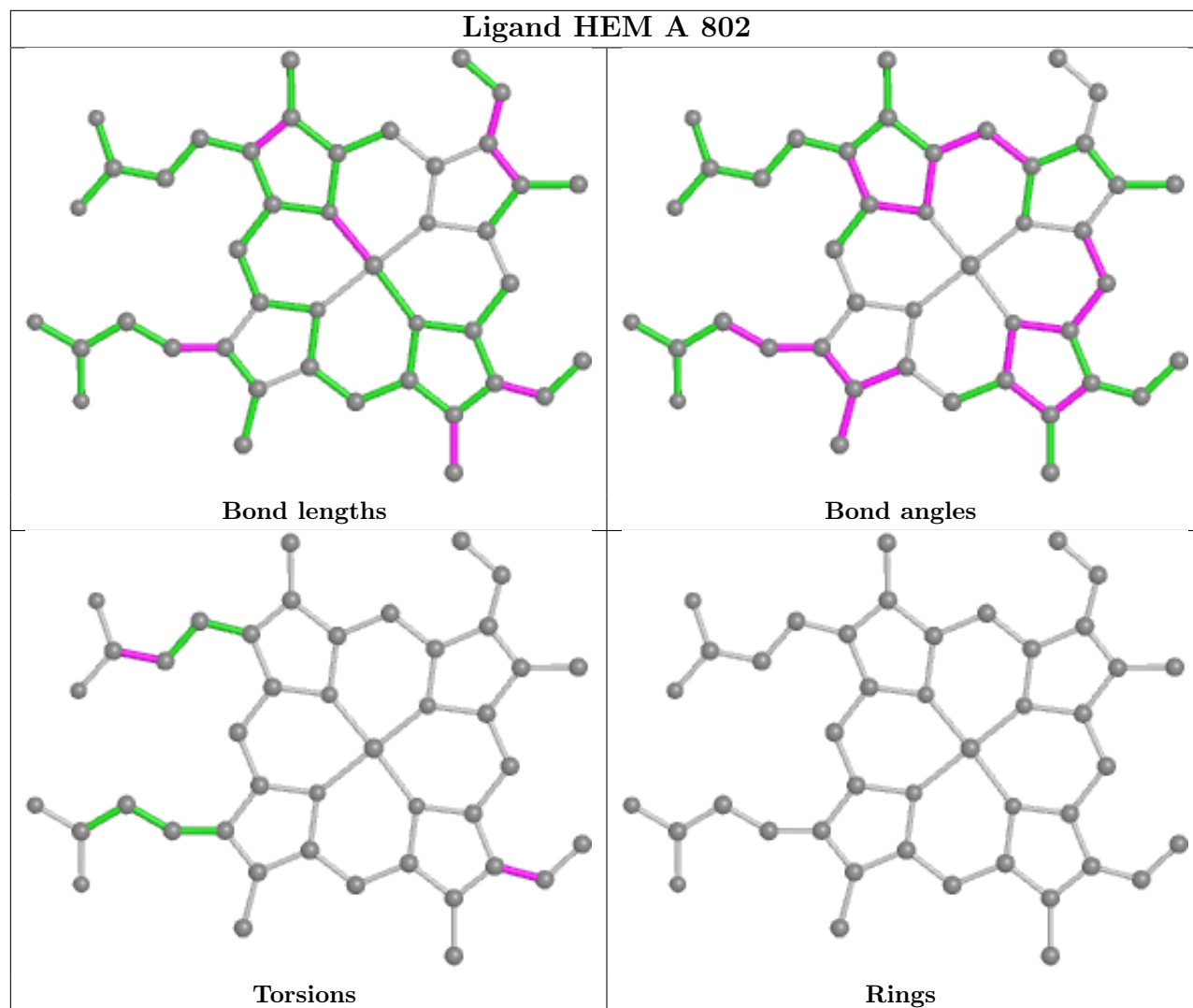
any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.











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	568/571 (99%)	-0.26	5 (0%) 84 87	6, 13, 22, 29	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	474	SER	2.5
1	A	11	ASN	2.1
1	A	110	LYS	2.0
1	A	403	ASP	2.0
1	A	91	ASN	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 [i](#)

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

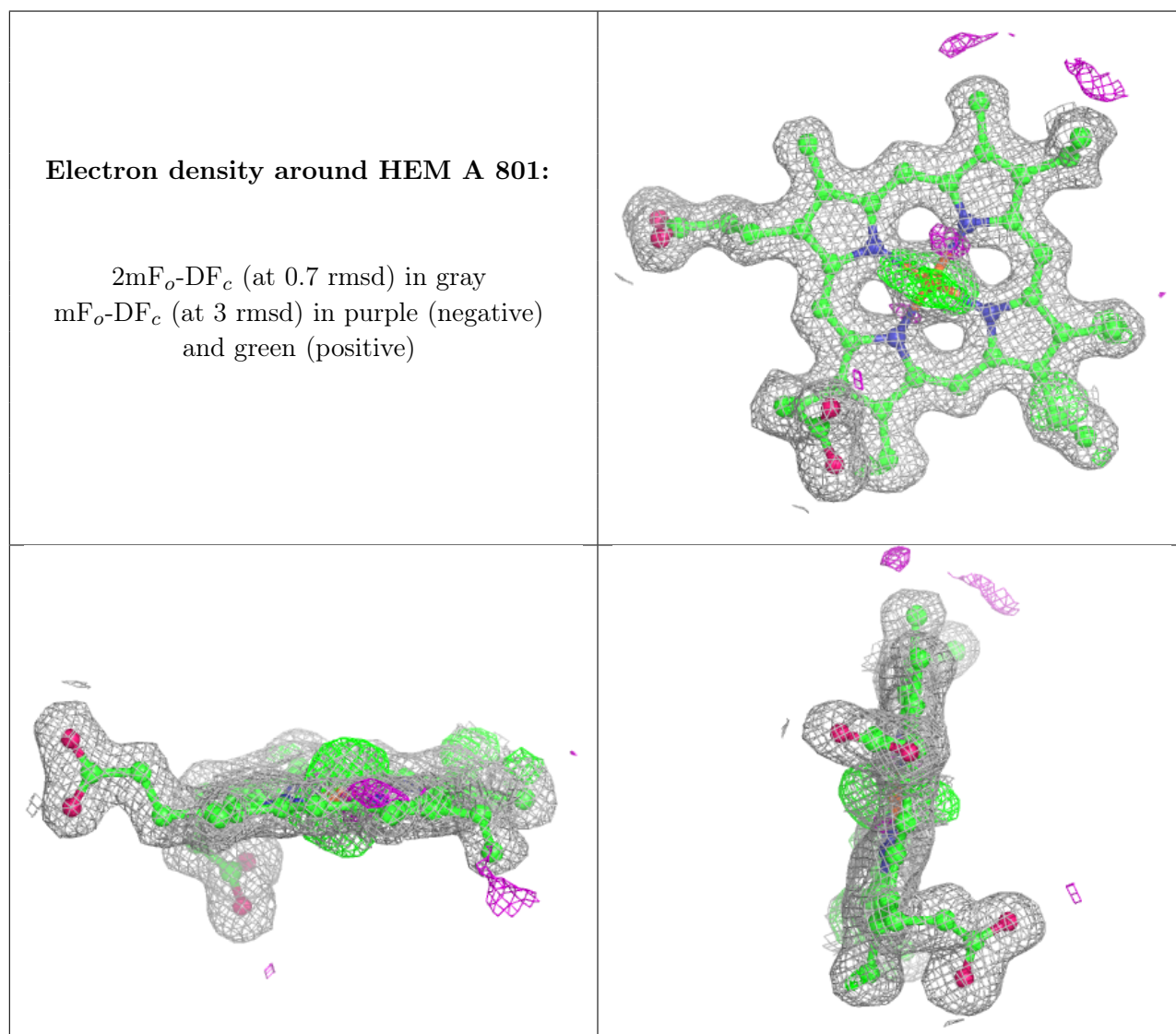
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	HEM	A	801	43/43	0.95	0.12	10,14,18,23	0
3	HEM	A	802	43/43	0.95	0.12	12,16,24,29	0

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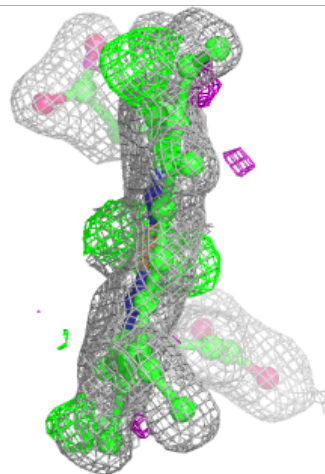
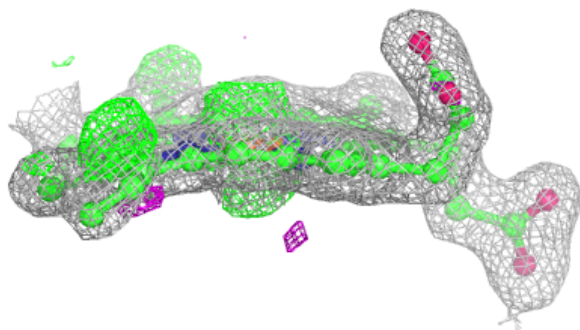
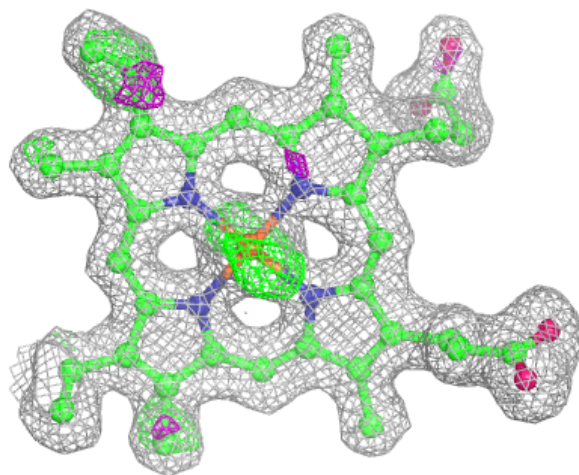
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	HEM	A	803	43/43	0.96	0.10	9,13,25,32	0
4	FAD	A	1805	53/53	0.97	0.07	6,8,11,12	0
3	HEM	A	804	43/43	0.98	0.08	7,10,13,14	0
2	NA	A	1810	1/1	0.99	0.05	8,8,8,8	0
5	FUM	A	1806	8/8	0.99	0.07	10,11,13,13	0

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.



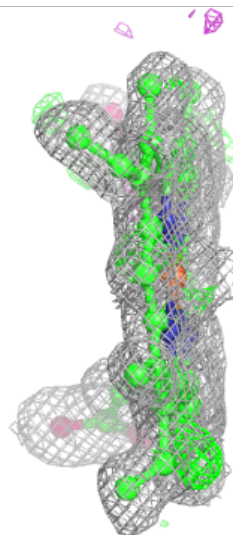
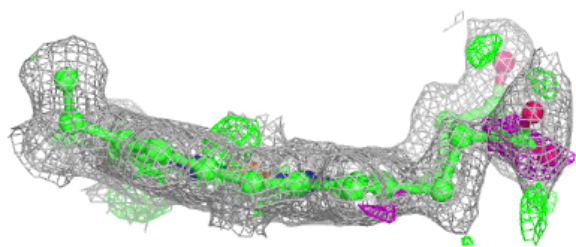
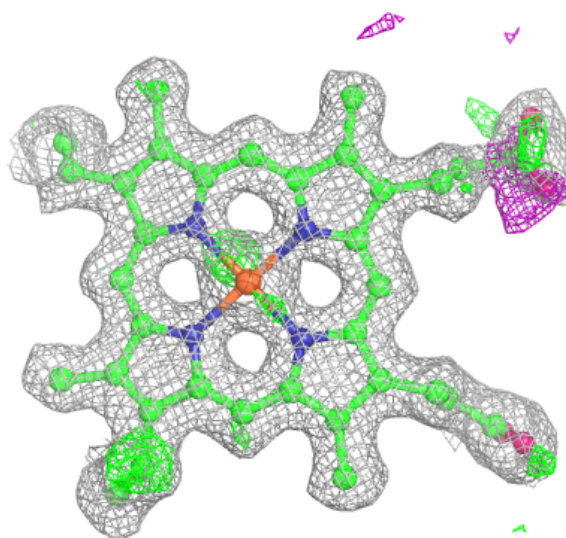
Electron density around HEM A 802:

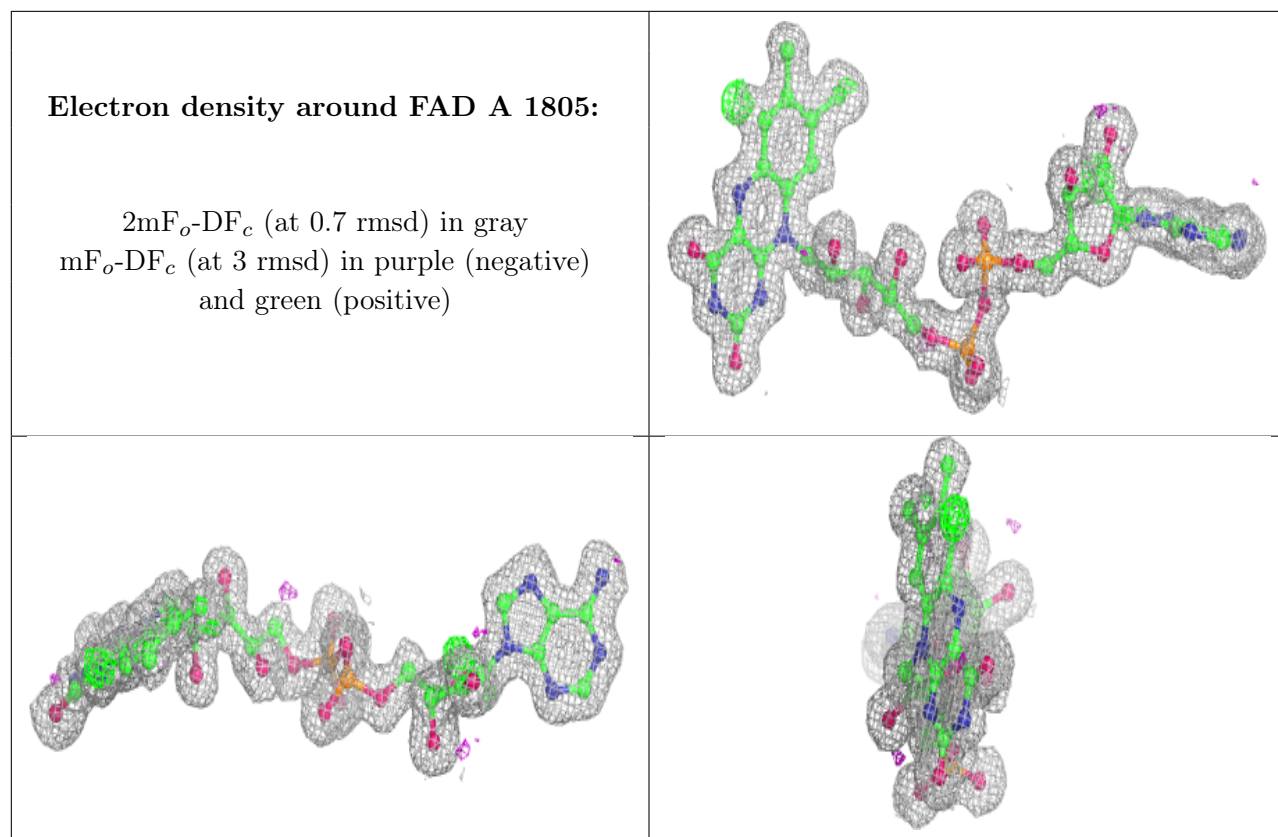
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

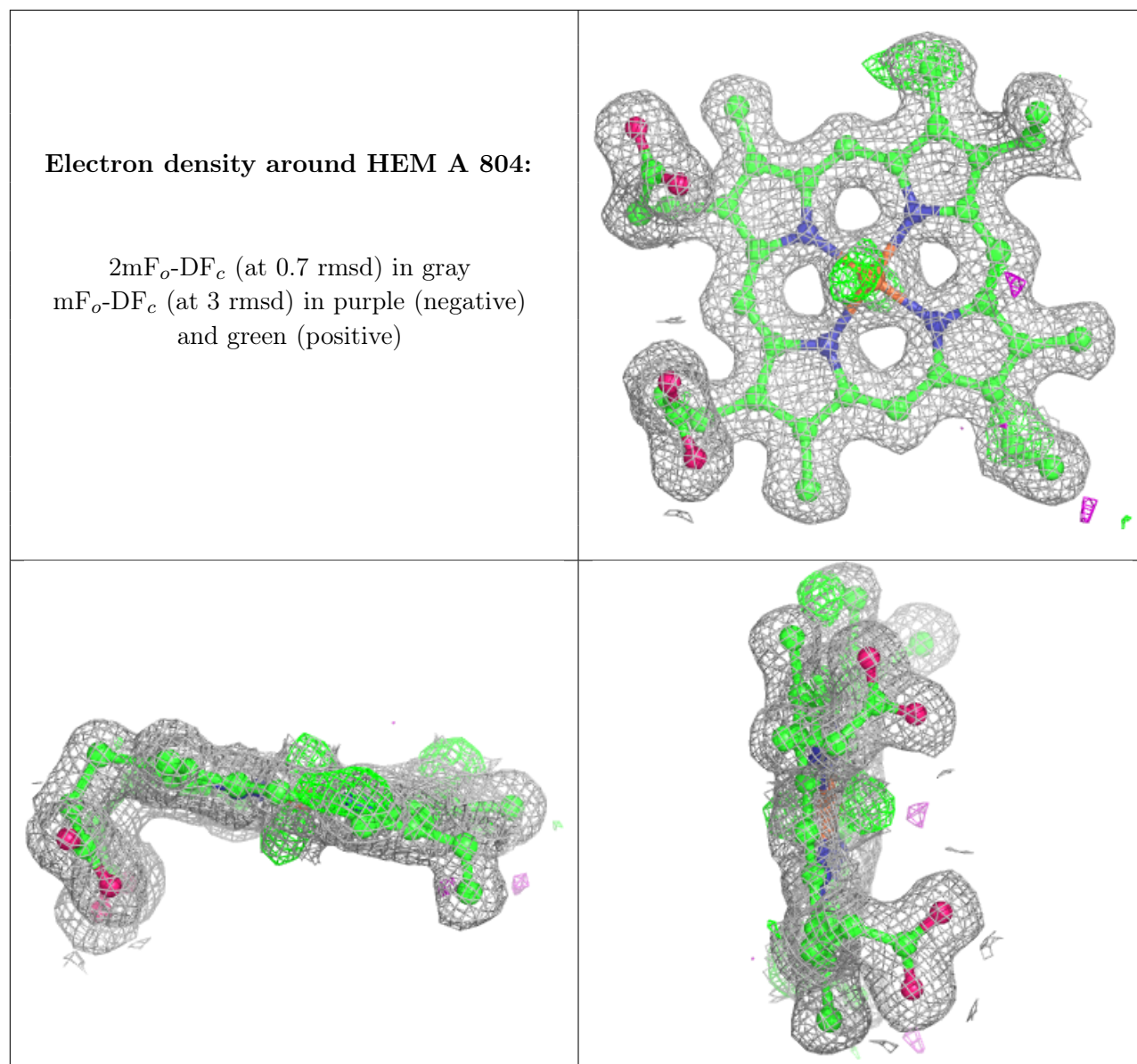


Electron density around HEM A 803:

$2mF_o-DF_c$ (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.