



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 4, 2023 – 07:01 PM EDT

PDB ID : 3UFW  
Title : Structure of rat nitric oxide synthase heme domain in complex with 6-(((3R,4R)-4-((5-(6-aminopyridin-2-yl)pentyl)oxy)pyrrolidin-3-yl)methyl)-4-methylpyridin-2-amine  
Authors : Li, H.; Poulos, T.L.  
Deposited on : 2011-11-01  
Resolution : 2.00 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.35  
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) : 2.35

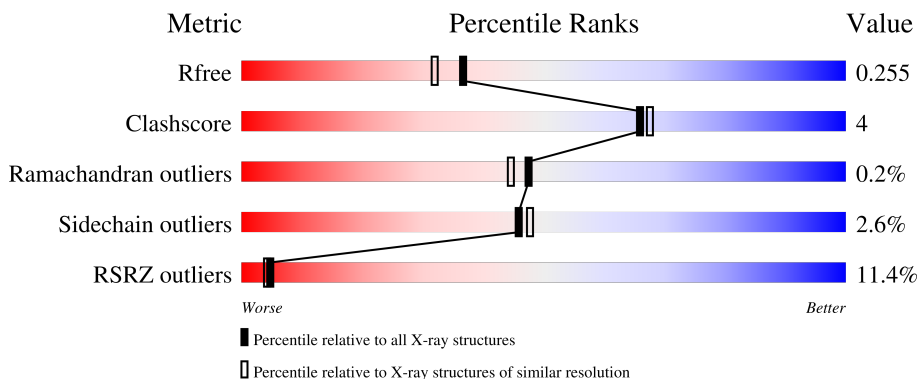
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.00 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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	422	
1	B	422	

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 7101 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 Nitric oxide synthase, brain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	407	Total 3318	C 2124	N 567	O 606	S 21	0	1	0
1	B	411	Total 3348	C 2142	N 574	O 610	S 22	0	1	0

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



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

- Molecule 3 is 5,6,7,8-TETRAHYDROBIOPTERIN (three-letter code: H4B) (formula:  $C_9H_{15}N_5O_3$ ).



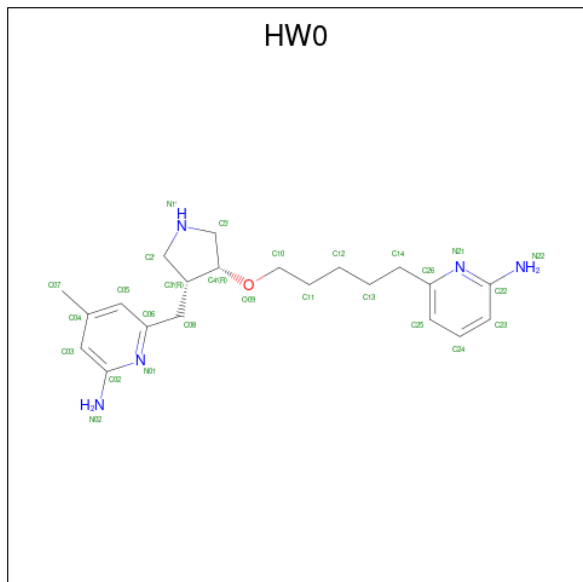
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	
			Total	C	N			O
3	A	1	17	9	5	3	0	0
3	B	1	17	9	5	3	0	0

- Molecule 4 is ACETATE ION (three-letter code: ACT) (formula:  $C_2H_3O_2$ ).



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

- Molecule 5 is 6-[[[(3R,4R)-4-[[5-(6-aminopyridin-2-yl)pentyl]oxy]pyrrolidin-3-yl]methyl]-4-methylpyridin-2-amine (three-letter code: HW0) (formula: C<sub>21</sub>H<sub>31</sub>N<sub>5</sub>O).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
5	A	1	27	21	5	1	0	0
5	B	1	27	21	5	1	0	0

- Molecule 6 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
6	A	1	1	1	0	0

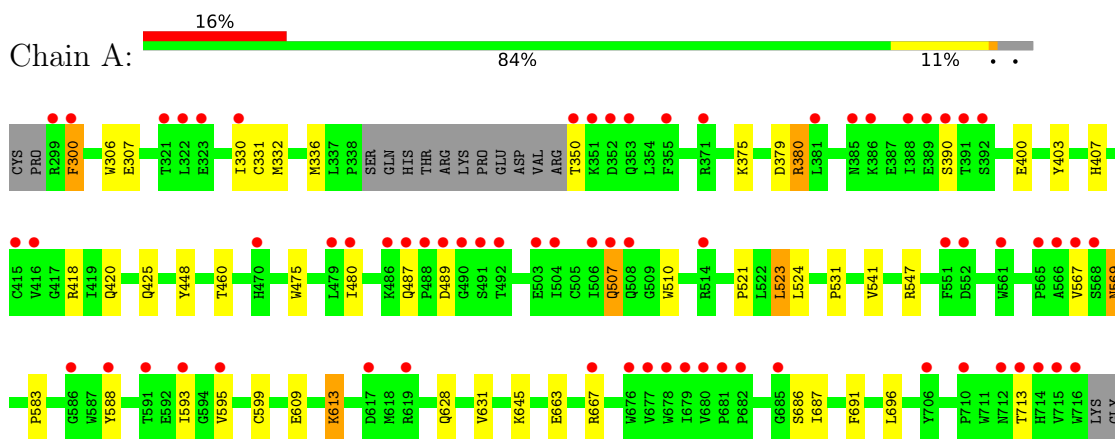
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
7	A	111	111	111	0	0
7	B	141	141	141	0	0

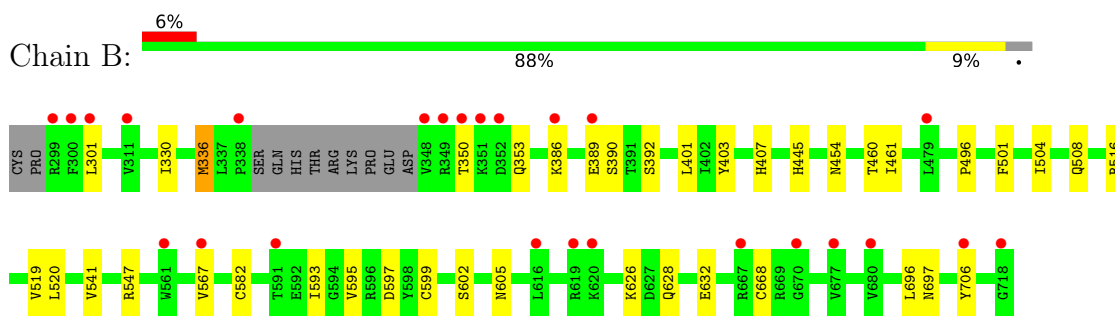
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Nitric oxide synthase, brain



- Molecule 1: Nitric oxide synthase, brain



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	51.90Å 111.25Å 164.08Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.49 – 2.00 38.49 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.3 (38.49-2.00) 99.3 (38.49-2.00)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	0.08	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.00 (at 2.00Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.196 , 0.244 0.212 , 0.255	Depositor DCC
$R_{free}$ test set	3186 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	41.0	Xtrriage
Anisotropy	0.247	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 49.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	7101	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	54.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.54% of the height of the origin peak. No significant pseudotranslation is detected.*

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

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

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: H4B, HEM, HW0, ZN, ACT

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	0.68	0/3414	0.69	0/4632
1	B	0.76	1/3444 (0.0%)	0.73	0/4669
All	All	0.72	1/6858 (0.0%)	0.71	0/9301

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	706	TYR	CD1-CE1	5.71	1.48	1.39

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	3318	0	3227	33	0
1	B	3348	0	3264	24	0
2	A	43	0	30	3	0
2	B	43	0	30	1	0
3	A	17	0	15	0	0
3	B	17	0	15	0	0
4	A	4	0	3	0	0
4	B	4	0	3	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	27	0	31	4	0
5	B	27	0	31	3	0
6	A	1	0	0	0	0
7	A	111	0	0	0	0
7	B	141	0	0	4	0
All	All	7101	0	6649	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 4.

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:A:567:VAL:CG2	5:A:800:HW0:H11	2.30	0.62
1:B:595:VAL:O	1:B:599:CYS:HB2	2.01	0.60
1:A:567:VAL:HG22	5:A:800:HW0:H11	1.83	0.60
1:A:336:MET:HG2	5:A:800:HW0:H32	1.86	0.56
2:A:750:HEM:HBA2	5:A:800:HW0:H7	1.87	0.56
1:B:605:ASN:ND2	7:B:224:HOH:O	2.33	0.56
1:A:523:LEU:HD22	1:A:531:PRO:HB2	1.88	0.56
1:A:380:ARG:HD3	1:A:400:GLU:OE1	2.05	0.55
1:A:609:GLU:O	1:A:613:LYS:HG2	2.06	0.55
1:A:307:GLU:HG3	7:B:12:HOH:O	2.06	0.54
2:A:750:HEM:HBC2	2:A:750:HEM:CMC	2.39	0.52
1:B:496:PRO:HB2	1:B:602:SER:O	2.10	0.52
1:A:663:GLU:O	1:A:667:ARG:HG2	2.11	0.51
2:A:750:HEM:HBC2	2:A:750:HEM:HMC1	1.93	0.51
1:B:668[B]:CYS:SG	7:B:185:HOH:O	2.06	0.50
1:A:403:TYR:CE1	1:A:407:HIS:CE1	3.00	0.50
1:B:445:HIS:C	1:B:445:HIS:CD2	2.85	0.50
1:B:567:VAL:CG2	5:B:800:HW0:H11	2.41	0.50
1:B:516:ARG:HD3	7:B:49:HOH:O	2.12	0.49
1:B:403:TYR:CE1	1:B:407:HIS:CE1	3.00	0.49
1:A:628:GLN:NE2	1:B:632:GLU:OE2	2.47	0.48
1:B:336:MET:HG2	5:B:800:HW0:H32	1.94	0.48
1:A:510:TRP:CE2	1:A:521:PRO:HD3	2.49	0.48
1:A:595:VAL:O	1:A:599:CYS:HB2	2.14	0.47
1:A:306:TRP:CE2	1:B:336:MET:HE3	2.50	0.47
1:B:401:LEU:HD11	1:B:461:ILE:HG21	1.97	0.47
2:B:750:HEM:HHC	2:B:750:HEM:HBB2	1.98	0.45
1:A:330:ILE:HD11	1:B:696:LEU:HD22	1.98	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:480:ILE:HD13	1:A:541:VAL:HG13	1.99	0.45
1:A:569:ASN:HD22	1:A:569:ASN:H	1.65	0.44
1:B:386:LYS:HA	1:B:389:GLU:HG2	2.00	0.44
1:A:425:GLN:HG2	1:A:448:TYR:CE2	2.52	0.44
1:A:475:TRP:CE2	1:A:531:PRO:HG3	2.53	0.44
1:A:475:TRP:HB2	1:A:523:LEU:HB3	2.00	0.43
1:A:588:TYR:CD1	1:A:593:ILE:HD11	2.53	0.43
1:A:524:LEU:O	1:A:531:PRO:HA	2.18	0.43
1:A:475:TRP:CZ2	1:A:531:PRO:HG3	2.53	0.43
1:A:569:ASN:H	1:A:569:ASN:ND2	2.16	0.43
1:A:696:LEU:HB3	1:B:330:ILE:HD11	2.00	0.43
1:B:504:ILE:O	1:B:508:GLN:HG2	2.18	0.43
5:B:800:HW0:H17	5:B:800:HW0:H14	1.86	0.43
1:B:460:THR:O	1:B:582:CYS:HA	2.19	0.42
1:A:631:VAL:HG11	1:B:628:GLN:HG3	2.00	0.42
1:A:687:ILE:HD12	1:B:626:LYS:HB3	2.00	0.42
1:B:519:VAL:HG21	1:B:541:VAL:HG11	2.02	0.42
1:B:501:PHE:CD2	1:B:520:LEU:HD13	2.53	0.42
1:A:686:SER:HA	1:A:691:PHE:CG	2.55	0.42
1:A:375:LYS:NZ	1:A:379:ASP:OD1	2.48	0.42
1:A:332:MET:CE	1:B:301:LEU:HD22	2.51	0.41
1:A:331:CYS:HB3	1:B:697:ASN:HB3	2.03	0.41
1:A:418:ARG:C	1:A:420:GLN:N	2.73	0.41
1:A:460:THR:O	1:A:583:PRO:HD2	2.21	0.41
1:A:507:GLN:O	1:A:507:GLN:HG2	2.20	0.41
1:B:593:ILE:HA	1:B:597:ASP:HB2	2.03	0.41

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	404/422 (96%)	388 (96%)	14 (4%)	2 (0%)	29	23
1	B	408/422 (97%)	399 (98%)	9 (2%)	0	100	100
All	All	812/844 (96%)	787 (97%)	23 (3%)	2 (0%)	47	44

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	300	PHE
1	A	489	ASP

### 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	364/377 (97%)	352 (97%)	12 (3%)	38	37
1	B	367/377 (97%)	360 (98%)	7 (2%)	57	61
All	All	731/754 (97%)	712 (97%)	19 (3%)	46	48

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	300	PHE
1	A	350	THR
1	A	380	ARG
1	A	390	SER
1	A	487	GLN
1	A	507	GLN
1	A	523	LEU
1	A	547	ARG
1	A	569	ASN
1	A	613	LYS
1	A	645	LYS
1	A	713	THR
1	B	336	MET
1	B	350	THR

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Mol	Chain	Res	Type
1	B	353	GLN
1	B	390	SER
1	B	392	SER
1	B	454	ASN
1	B	547	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	353	GLN
1	A	364	GLN
1	A	407	HIS
1	A	440	ASN
1	A	454	ASN
1	A	569	ASN
1	A	605	ASN
1	A	628	GLN
1	A	697	ASN
1	B	385	ASN
1	B	454	ASN
1	B	507	GLN
1	B	508	GLN
1	B	527	ASN
1	B	535	GLN
1	B	601	ASN
1	B	605	ASN
1	B	697	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

Of 9 ligands modelled in this entry, 1 is monoatomic - leaving 8 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	ACT	B	860	-	3,3,3	0.80	0	3,3,3	0.50	0
2	HEM	A	750	1	41,50,50	1.96	9 (21%)	45,82,82	1.95	13 (28%)
3	H4B	A	760	-	16,18,18	0.98	0	11,26,26	2.95	6 (54%)
2	HEM	B	750	1	41,50,50	2.06	10 (24%)	45,82,82	1.73	8 (17%)
5	HW0	B	800	-	28,29,29	0.75	0	32,38,38	1.91	9 (28%)
5	HW0	A	800	-	28,29,29	0.82	0	32,38,38	1.86	8 (25%)
3	H4B	B	760	-	16,18,18	1.12	3 (18%)	11,26,26	2.38	5 (45%)
4	ACT	A	860	-	3,3,3	0.90	0	3,3,3	0.39	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	HEM	A	750	1	-	2/12/54/54	-
3	H4B	A	760	-	-	0/8/17/17	0/2/2/2
5	HW0	B	800	-	-	7/13/23/23	0/3/3/3
5	HW0	A	800	-	-	3/13/23/23	0/3/3/3
3	H4B	B	760	-	-	0/8/17/17	0/2/2/2
2	HEM	B	750	1	-	1/12/54/54	-

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	750	HEM	C3D-C2D	7.44	1.52	1.36
2	A	750	HEM	C3D-C2D	7.21	1.52	1.36
2	B	750	HEM	C3C-C2C	-4.92	1.33	1.40
2	A	750	HEM	C3C-C2C	-4.13	1.34	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	750	HEM	CMB-C2B	4.01	1.59	1.50
2	A	750	HEM	C3C-CAC	3.59	1.55	1.47
2	B	750	HEM	C3C-CAC	3.42	1.54	1.47
2	A	750	HEM	CMD-C2D	2.98	1.57	1.50
2	A	750	HEM	CMB-C2B	2.64	1.56	1.50
2	A	750	HEM	CAB-C3B	2.47	1.54	1.47
2	B	750	HEM	CAB-C3B	2.47	1.54	1.47
3	B	760	H4B	C7-C6	2.45	1.54	1.52
2	B	750	HEM	CMD-C2D	2.38	1.55	1.50
2	B	750	HEM	C4A-NA	2.38	1.41	1.36
2	A	750	HEM	FE-ND	2.37	2.08	1.96
2	B	750	HEM	CMA-C3A	2.33	1.56	1.51
2	B	750	HEM	FE-ND	2.30	2.08	1.96
2	B	750	HEM	CAD-C3D	2.29	1.57	1.51
2	A	750	HEM	FE-NB	2.28	2.08	1.96
3	B	760	H4B	C7-N8	2.20	1.48	1.44
3	B	760	H4B	C4-N3	2.07	1.36	1.33
2	A	750	HEM	O2D-CGD	-2.07	1.23	1.30

All (49) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	750	HEM	CBA-CAA-C2A	-6.79	101.03	112.62
5	B	800	HW0	C02-N01-C06	5.74	122.45	118.10
3	A	760	H4B	C4-C4A-N5	5.63	123.85	119.12
2	B	750	HEM	CBA-CAA-C2A	-5.16	103.82	112.62
5	A	800	HW0	C02-N01-C06	5.14	122.00	118.10
2	B	750	HEM	C4D-ND-C1D	5.02	110.25	105.07
3	B	760	H4B	C8A-C4A-C4	4.48	118.55	114.57
2	A	750	HEM	C4D-ND-C1D	4.01	109.22	105.07
3	B	760	H4B	C4-C4A-N5	3.85	122.35	119.12
5	A	800	HW0	N02-C02-N01	3.80	122.49	116.49
3	A	760	H4B	C8A-C4A-C4	3.75	117.90	114.57
5	B	800	HW0	C10-O09-C4'	3.56	122.13	113.87
3	A	760	H4B	N1-C2-N3	-3.52	119.89	125.42
3	A	760	H4B	C2-N1-C8A	3.44	122.25	114.54
5	A	800	HW0	C14-C26-N21	3.41	121.02	115.95
3	A	760	H4B	C2-N3-C4	3.19	121.00	115.93
2	B	750	HEM	CBD-CAD-C3D	-3.07	104.09	112.63
5	A	800	HW0	C2'-N1'-C5'	3.05	112.61	105.42
2	A	750	HEM	C2C-C3C-C4C	2.93	108.94	106.90
5	B	800	HW0	C24-C25-C26	2.79	122.41	118.93

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	750	HEM	C4B-C3B-C2B	2.77	109.31	107.11
5	B	800	HW0	C2'-N1'-C5'	2.76	111.92	105.42
2	B	750	HEM	C4B-CHC-C1C	2.75	126.18	122.56
5	B	800	HW0	C14-C26-N21	2.74	120.03	115.95
5	B	800	HW0	C05-C06-N01	-2.73	120.00	122.90
2	A	750	HEM	CHA-C4D-ND	2.71	127.73	124.38
5	B	800	HW0	C25-C24-C23	-2.71	116.41	120.25
2	A	750	HEM	CMD-C2D-C1D	2.69	129.14	125.04
5	B	800	HW0	N02-C02-N01	2.68	120.73	116.49
2	A	750	HEM	C4B-C3B-C2B	2.65	109.22	107.11
2	A	750	HEM	CHC-C4B-C3B	2.58	128.53	124.57
3	B	760	H4B	C2-N1-C8A	2.56	120.27	114.54
2	A	750	HEM	C1D-C2D-C3D	-2.54	104.29	106.96
2	A	750	HEM	CBD-CAD-C3D	-2.51	105.67	112.63
2	A	750	HEM	C1B-NB-C4B	2.49	107.65	105.07
3	B	760	H4B	C2-N3-C4	2.49	119.89	115.93
2	B	750	HEM	CMD-C2D-C1D	2.48	128.82	125.04
3	B	760	H4B	N1-C2-N3	-2.44	121.60	125.42
2	A	750	HEM	C4B-CHC-C1C	2.38	125.70	122.56
3	A	760	H4B	N2-C2-N3	2.35	120.90	117.25
2	A	750	HEM	CMA-C3A-C4A	-2.31	124.91	128.46
2	A	750	HEM	CHD-C1D-ND	-2.30	121.93	124.43
5	A	800	HW0	C08-C06-C05	-2.12	116.53	121.04
2	B	750	HEM	C4A-C3A-C2A	-2.10	105.53	107.00
5	A	800	HW0	O09-C10-C11	-2.09	102.22	109.56
5	A	800	HW0	C05-C06-N01	-2.09	120.69	122.90
2	B	750	HEM	CHA-C4D-ND	2.07	126.94	124.38
5	B	800	HW0	C25-C26-N21	-2.06	119.80	122.41
5	A	800	HW0	N22-C22-N21	2.02	119.68	116.49

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	800	HW0	C11-C10-O09-C4'
5	B	800	HW0	C5'-C4'-O09-C10
5	A	800	HW0	C12-C13-C14-C26
5	B	800	HW0	C12-C13-C14-C26
5	B	800	HW0	O09-C10-C11-C12
5	B	800	HW0	C3'-C4'-O09-C10
5	B	800	HW0	C10-C11-C12-C13
5	A	800	HW0	C10-C11-C12-C13

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Mol	Chain	Res	Type	Atoms
5	B	800	HW0	C11-C12-C13-C14
2	B	750	HEM	C2A-CAA-CBA-CGA
5	A	800	HW0	C11-C12-C13-C14
2	A	750	HEM	CAA-CBA-CGA-O1A
2	A	750	HEM	CAA-CBA-CGA-O2A

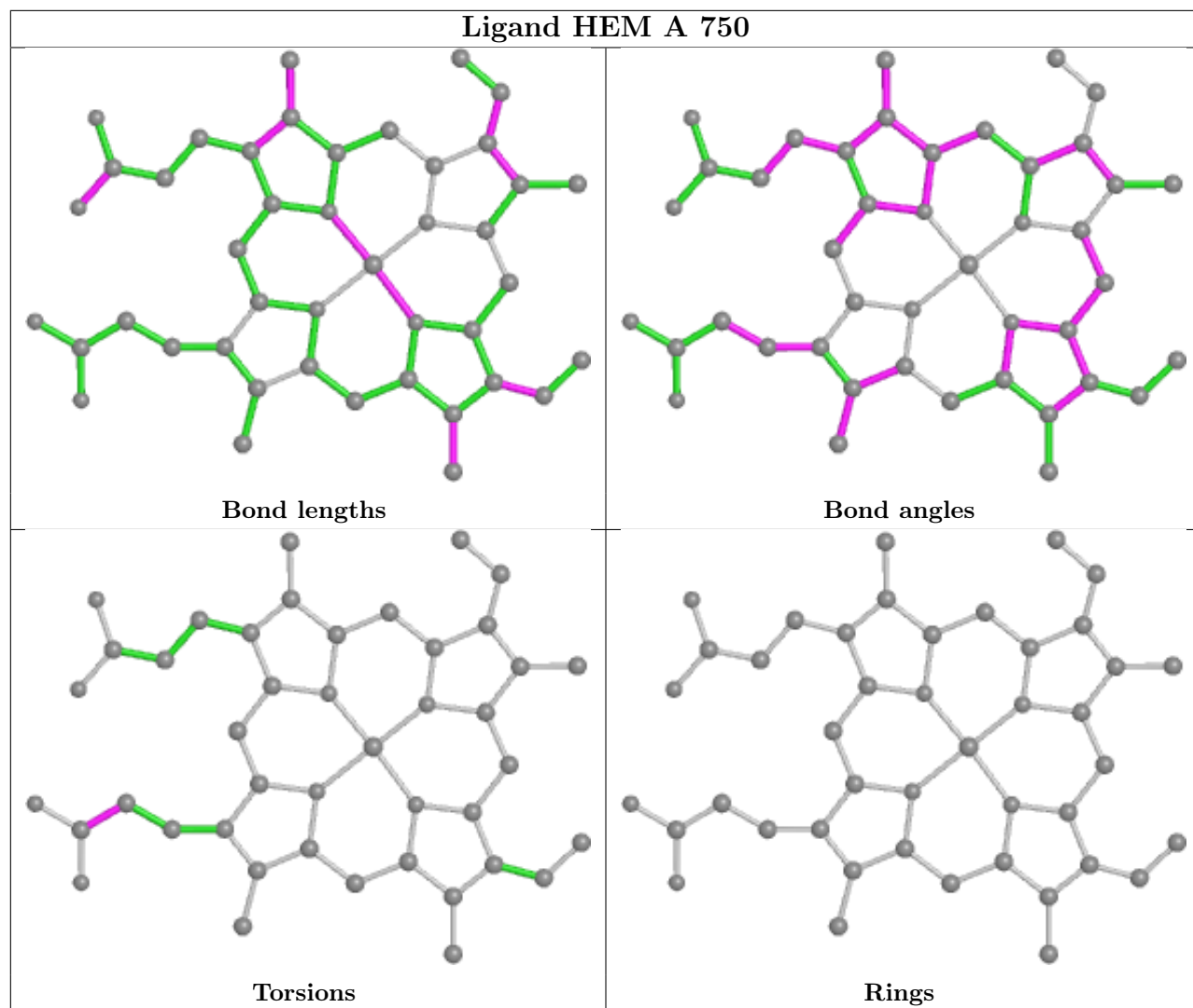
There are no ring outliers.

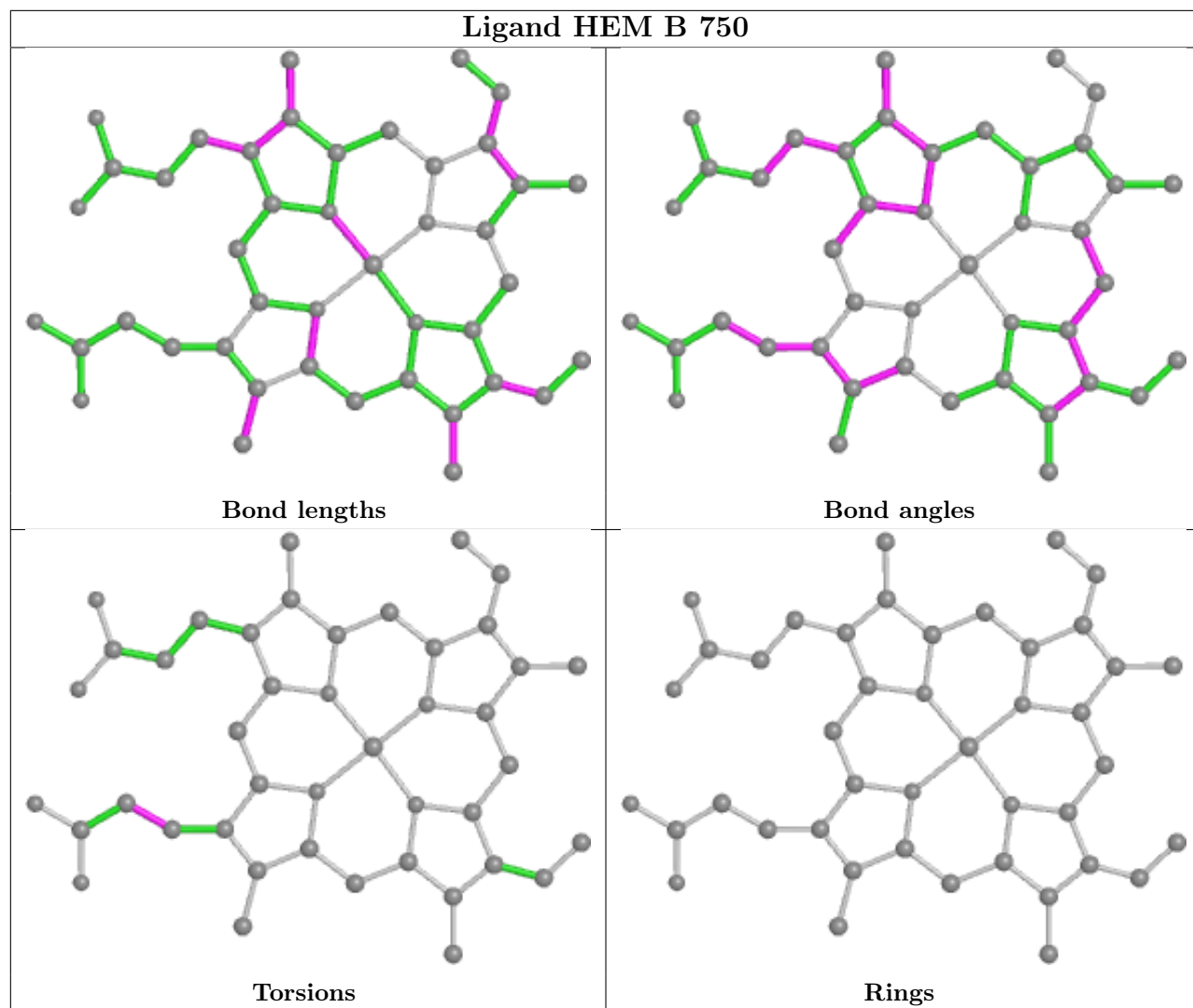
4 monomers are involved in 10 short contacts:

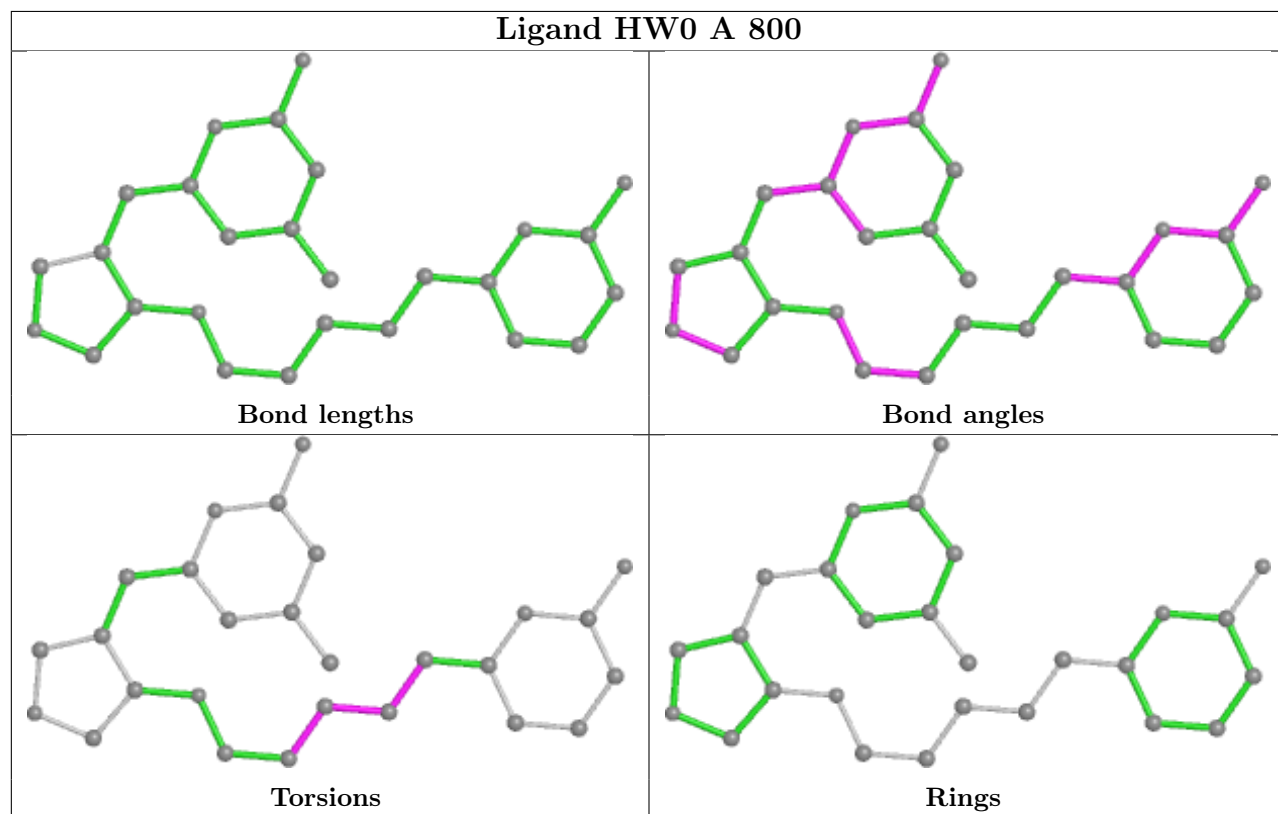
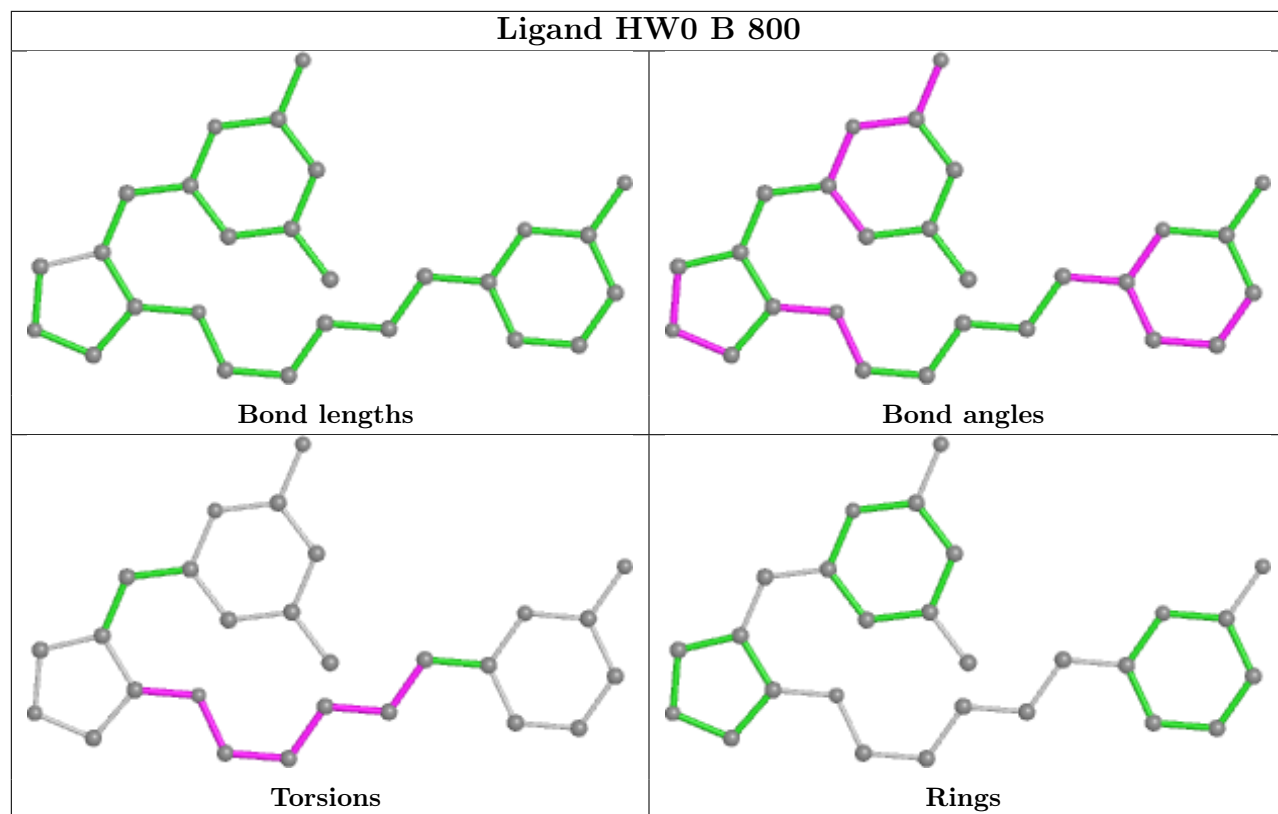
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	750	HEM	3	0
2	B	750	HEM	1	0
5	B	800	HW0	3	0
5	A	800	HW0	4	0

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, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	407/422 (96%)	0.86	68 (16%) <b>1</b> <b>1</b>	32, 58, 99, 122	0
1	B	411/422 (97%)	0.38	25 (6%) <b>21</b> <b>20</b>	30, 47, 71, 96	0
All	All	818/844 (96%)	0.62	93 (11%) <b>5</b> <b>4</b>	30, 51, 91, 122	0

All (93) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	716	TRP	8.6
1	B	300	PHE	7.2
1	A	488	PRO	7.0
1	A	352	ASP	6.7
1	B	348	VAL	5.7
1	A	351	LYS	5.6
1	B	350	THR	5.4
1	B	718	GLY	5.3
1	A	355	PHE	5.1
1	A	486	LYS	5.1
1	B	619	ARG	4.8
1	A	489	ASP	4.6
1	A	714	HIS	4.5
1	A	713	THR	4.0
1	A	715	VAL	4.0
1	A	507	GLN	3.8
1	A	506	ILE	3.8
1	A	300	PHE	3.7
1	B	351	LYS	3.6
1	A	389	GLU	3.6
1	A	619	ARG	3.5
1	A	490	GLY	3.5
1	A	491	SER	3.4
1	A	322	LEU	3.3

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	A	503	GLU	3.2
1	A	353	GLN	3.1
1	A	567	VAL	3.1
1	B	677	VAL	2.9
1	A	470	HIS	2.9
1	A	350	THR	2.8
1	A	591	THR	2.8
1	A	388	ILE	2.8
1	A	593	ILE	2.8
1	A	321	THR	2.8
1	B	591	THR	2.8
1	B	389	GLU	2.8
1	A	299	ARG	2.8
1	A	390	SER	2.8
1	A	391	THR	2.7
1	A	706	TYR	2.7
1	A	680	VAL	2.7
1	A	681	PRO	2.7
1	A	677	VAL	2.6
1	A	678	TRP	2.6
1	A	514	ARG	2.6
1	A	682	PRO	2.6
1	B	567	VAL	2.6
1	A	679	ILE	2.6
1	A	552	ASP	2.6
1	B	352	ASP	2.6
1	A	386	LYS	2.6
1	A	392	SER	2.5
1	B	620	LYS	2.5
1	A	415	CYS	2.5
1	A	416	VAL	2.5
1	B	667	ARG	2.5
1	A	385	ASN	2.5
1	B	299	ARG	2.5
1	B	479	LEU	2.5
1	A	551	PHE	2.5
1	B	561	TRP	2.5
1	A	561	TRP	2.4
1	A	568	SER	2.4
1	A	685	GLY	2.4
1	B	349	ARG	2.4
1	A	712	ASN	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	480	ILE	2.4
1	A	504	ILE	2.4
1	B	670	GLY	2.4
1	A	487	GLN	2.4
1	A	479	LEU	2.3
1	B	706	TYR	2.3
1	A	617	ASP	2.3
1	A	586	GLY	2.3
1	A	710	PRO	2.3
1	A	565	PRO	2.2
1	B	680	VAL	2.2
1	A	492	THR	2.2
1	A	323	GLU	2.2
1	B	338	PRO	2.2
1	A	595	VAL	2.2
1	A	371	ARG	2.2
1	A	566	ALA	2.2
1	B	301	LEU	2.1
1	A	588	TYR	2.1
1	A	508	GLN	2.1
1	A	381	LEU	2.1
1	B	616	LEU	2.1
1	A	667	ARG	2.1
1	A	676	TRP	2.1
1	A	330	ILE	2.0
1	B	386	LYS	2.0
1	B	311	VAL	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.

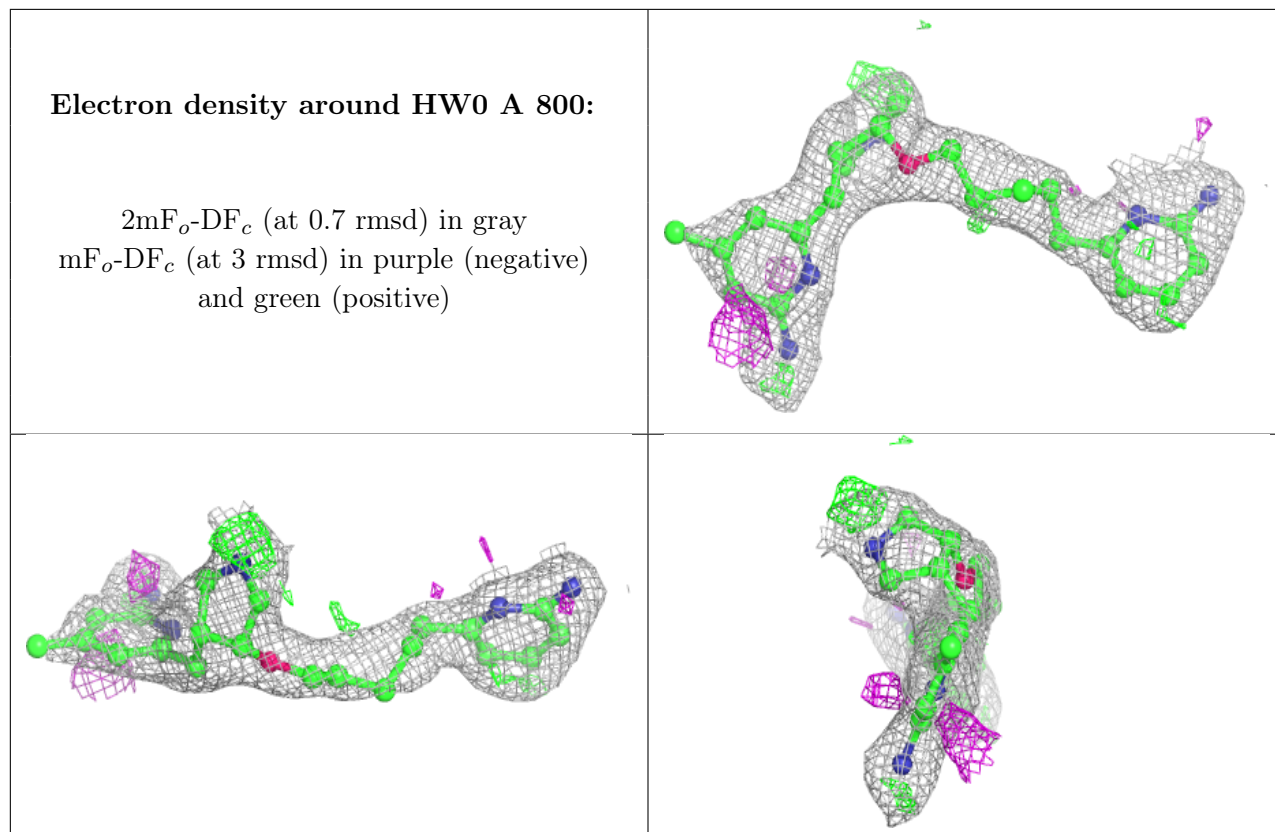
## 6.4 Ligands [i](#)

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,

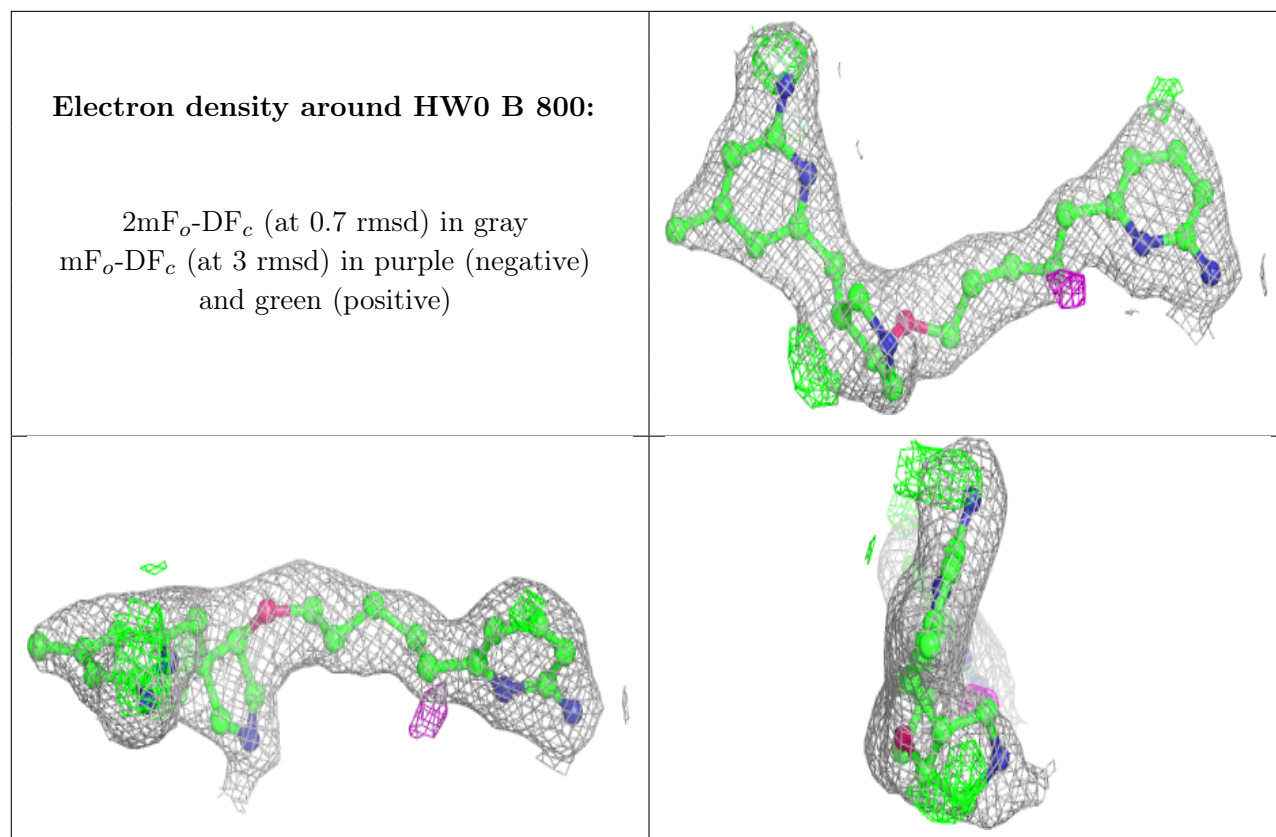
median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
5	HW0	A	800	27/27	0.84	0.28	34,55,62,63	0
5	HW0	B	800	27/27	0.90	0.25	34,52,57,57	0
4	ACT	B	860	4/4	0.95	0.10	54,56,56,57	0
3	H4B	A	760	17/17	0.96	0.20	37,41,45,46	0
3	H4B	B	760	17/17	0.96	0.18	32,37,42,44	0
4	ACT	A	860	4/4	0.96	0.34	59,60,60,61	0
2	HEM	A	750	43/43	0.97	0.25	31,36,48,52	0
2	HEM	B	750	43/43	0.97	0.21	30,35,47,53	0
6	ZN	A	900	1/1	1.00	0.07	44,44,44,44	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.

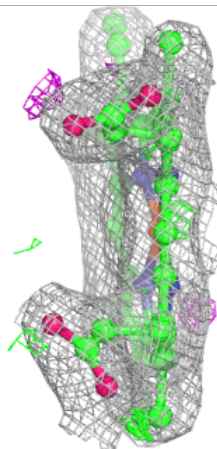
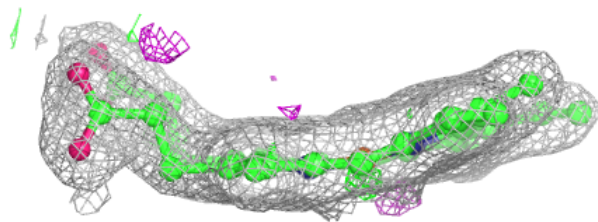
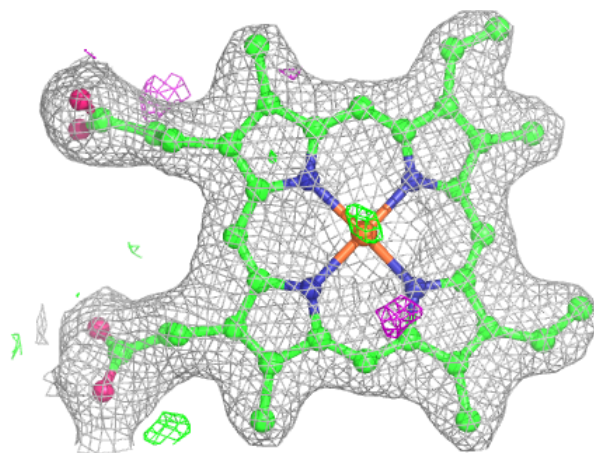


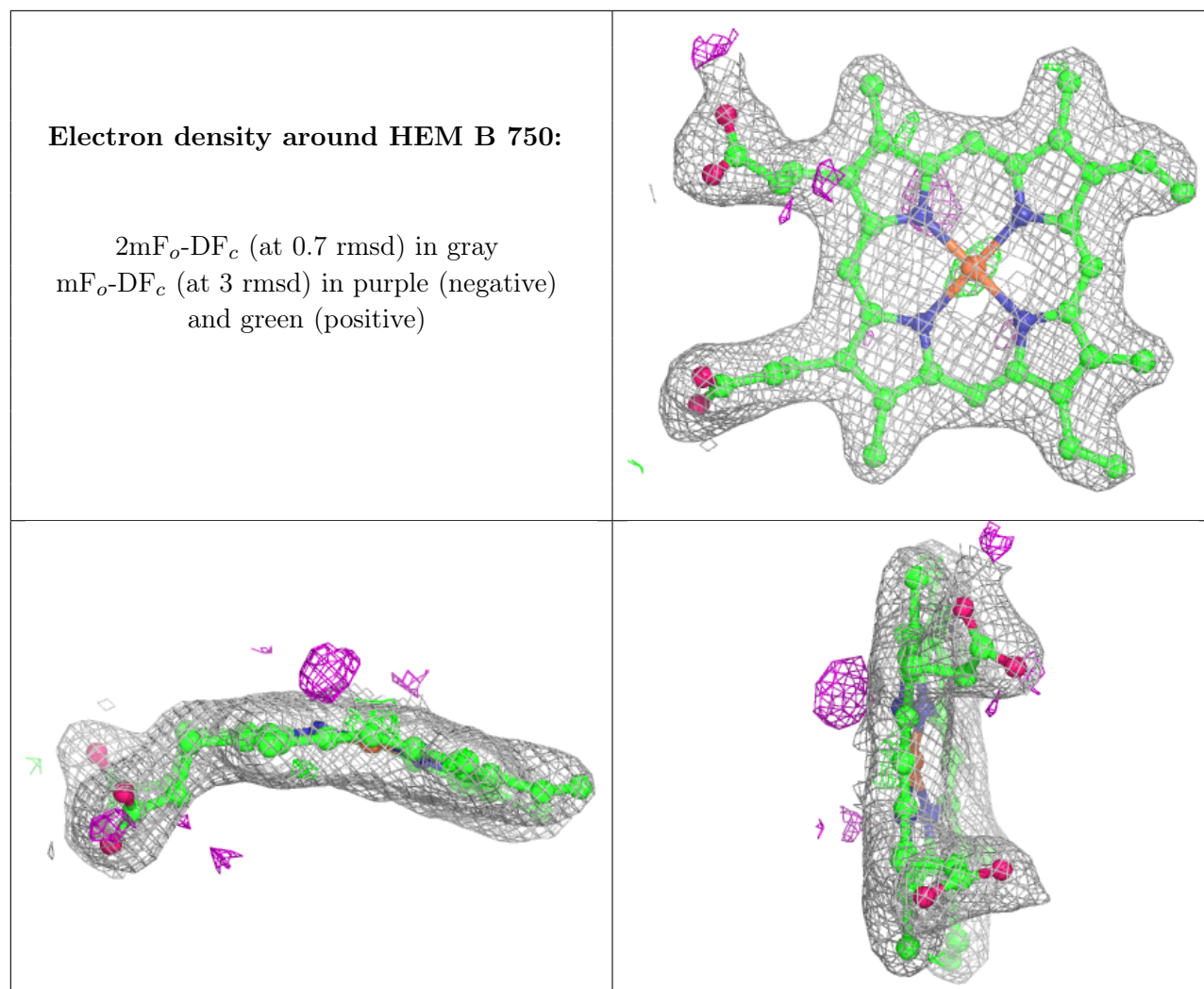




**Electron density around HEM A 750:**

$2mF_o-DF_c$  (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.