



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 21, 2020 – 01:17 AM BST

PDB ID : 4IMW  
Title : Structure of rat neuronal nitric oxide synthase in complex with 3,5-bis(2-(6-amino-4-methylpyridin-2-yl)ethyl)benzonitrile  
Authors : Li, H.; Poulos, T.L.  
Deposited on : 2013-01-03  
Resolution : 2.20 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.

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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 : 2.13.1  
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) : 2.13.1

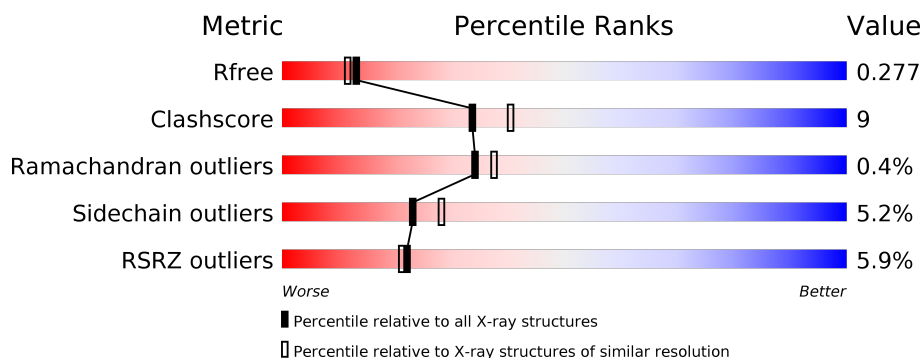
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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 on 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	<div> <div>8%</div> <div> <div></div> <div>74%</div> <div>21%</div> <div>• •</div> </div> </div>
1	B	422	<div> <div>4%</div> <div> <div></div> <div>78%</div> <div>18%</div> <div>• •</div> </div> </div>

## 2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 7001 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
1	A	407	Total	C	N	O	S	0	0	0
			3313	2121	566	605	21			
1	B	411	Total	C	N	O	S	0	0	0
			3345	2140	574	610	21			

- 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
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

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



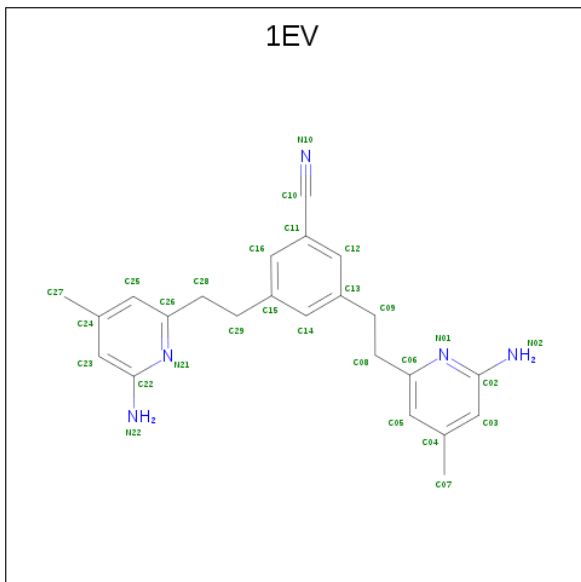
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			17	9	5	3		
3	A	1	Total	C	N	O	0	0
			17	9	5	3		

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



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

- Molecule 5 is 3,5-bis[2-(6-amino-4-methylpyridin-2-yl)ethyl]benzonitrile (three-letter code: 1EV) (formula: C<sub>23</sub>H<sub>25</sub>N<sub>5</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	N	0	0
			28	23	5		
5	B	1	Total	C	N	0	0
			28	23	5		

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

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

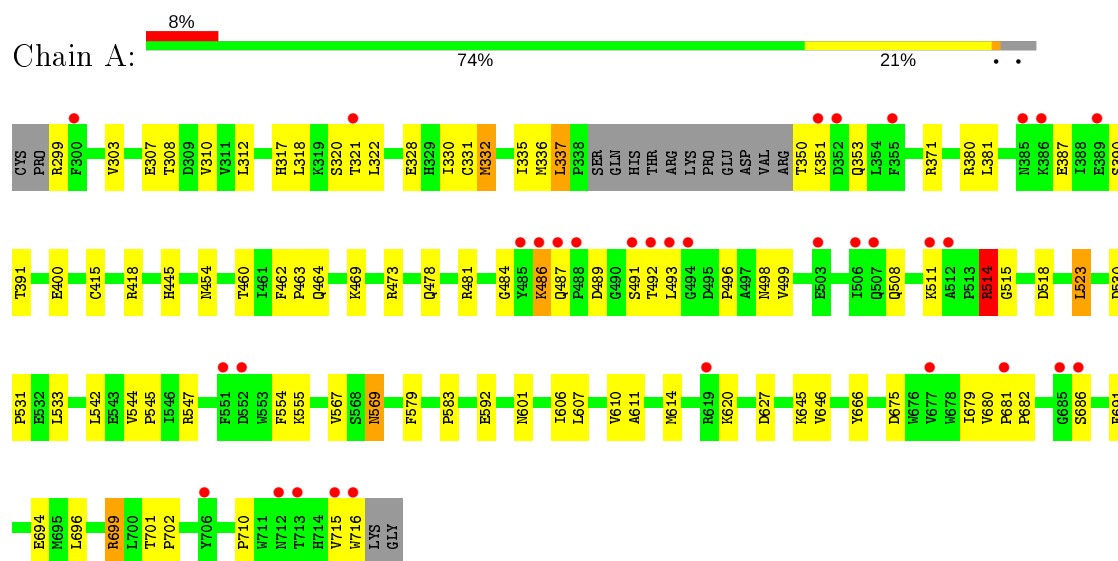
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	65	Total	O	0	0
			65	65		
7	B	93	Total	O	0	0
			93	93		

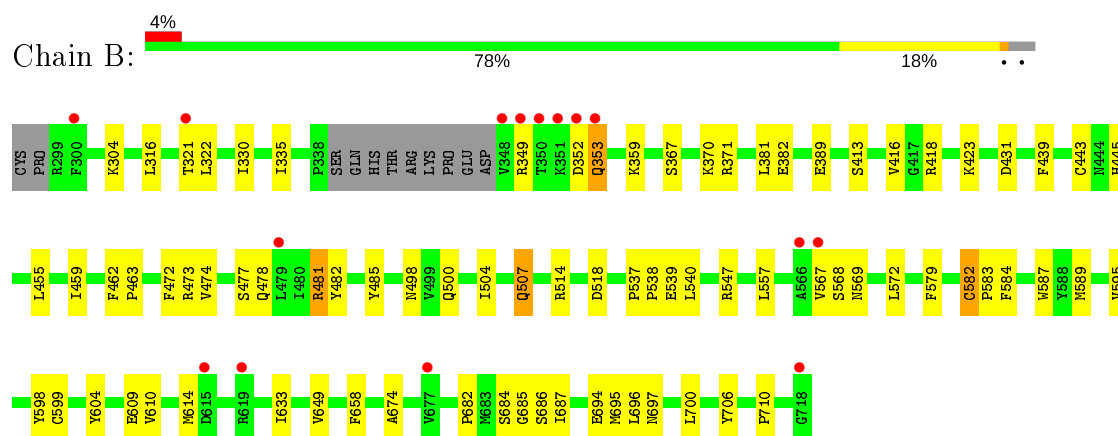
### 3 Residue-property plots [i](#)

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	51.69Å 111.39Å 164.18Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.71 – 2.20 43.74 – 2.15	Depositor EDS
% Data completeness (in resolution range)	99.4 (40.71-2.20) 99.4 (43.74-2.15)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	0.07	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.23 (at 2.16Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.213 , 0.273 0.221 , 0.277	Depositor DCC
$R_{free}$ test set	2606 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	37.6	Xtriage
Anisotropy	0.952	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 46.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	7001	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.15% 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: HEM, ZN, ACT, H4B, 1EV

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	0.72	0/3406	0.72	0/4621
1	B	0.80	2/3438 (0.1%)	0.76	0/4661
All	All	0.76	2/6844 (0.0%)	0.74	0/9282

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	582	CYS	CB-SG	6.41	1.93	1.82
1	B	706	TYR	CD1-CE1	5.16	1.47	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	3313	0	3221	61	0
1	B	3345	0	3259	54	0
2	A	43	0	30	2	0
2	B	43	0	30	8	0
3	A	34	0	30	4	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	28	0	25	3	0
5	B	28	0	25	2	0
6	A	1	0	0	0	0
7	A	65	0	0	7	0
7	B	93	0	0	5	0
All	All	7001	0	6626	115	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 9.

All (115) 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:B:353:GLN:H	1:B:353:GLN:HE21	1.12	0.97
3:A:805:H4B:N2	2:B:801:HEM:O1A	2.11	0.82
1:A:484:GLY:HA3	7:A:924:HOH:O	1.85	0.77
1:A:473:ARG:NH2	1:A:710:PRO:HD3	2.01	0.75
1:B:459:ILE:HD11	1:B:582:CYS:HB2	1.75	0.69
1:B:587:TRP:H	2:B:801:HEM:HAB	1.57	0.69
1:A:332:MET:HG2	1:A:335:ILE:HG13	1.75	0.69
1:A:478:GLN:HB2	1:A:481:ARG:HG3	1.76	0.68
1:B:584:PHE:CD1	2:B:801:HEM:HAC	2.29	0.67
1:A:487:GLN:HB2	1:A:491:SER:O	2.00	0.61
1:B:610:VAL:O	1:B:614:MET:HG3	1.99	0.61
1:B:473:ARG:NH2	1:B:710:PRO:HD3	2.16	0.61
1:A:303:VAL:HG23	1:A:312:LEU:HB2	1.82	0.60
1:B:353:GLN:H	1:B:353:GLN:NE2	1.90	0.60
1:A:484:GLY:CA	7:A:924:HOH:O	2.48	0.59
1:B:316:LEU:HD21	1:B:700:LEU:HD11	1.85	0.59
1:A:337:LEU:HD21	5:A:804:1EV:H21	1.84	0.58
1:A:554:PHE:HB3	7:A:950:HOH:O	2.02	0.58
1:B:431:ASP:OD2	7:B:969:HOH:O	2.17	0.58
1:A:322:LEU:HD13	1:A:699:ARG:HH21	1.67	0.58
1:A:317:HIS:O	1:A:320:SER:HB3	2.05	0.57
1:B:610:VAL:HG21	1:B:633:ILE:HD11	1.88	0.56
1:A:682:PRO:HB2	1:B:686:SER:HB3	1.88	0.55
1:A:686:SER:HB3	1:B:682:PRO:HB2	1.87	0.55
1:A:675:ASP:O	1:A:679:ILE:HG12	2.07	0.55
1:A:303:VAL:CG2	1:A:312:LEU:HB2	2.38	0.54
3:A:805:H4B:N3	2:B:801:HEM:O1A	2.41	0.54
1:A:493:LEU:HA	7:A:949:HOH:O	2.07	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:523:LEU:HD22	1:A:531:PRO:HB2	1.90	0.53
1:B:507:GLN:NE2	7:B:963:HOH:O	2.40	0.53
1:B:474:VAL:HG11	1:B:568:SER:HB2	1.89	0.53
1:A:569:ASN:H	1:A:569:ASN:HD22	1.56	0.53
1:B:584:PHE:CD1	2:B:801:HEM:CAC	2.92	0.53
2:B:801:HEM:HBA2	5:B:802:1EV:H5	1.91	0.53
1:A:508:GLN:HE22	1:A:716:TRP:HE1	1.57	0.53
3:A:805:H4B:C2	2:B:801:HEM:O1A	2.55	0.53
1:B:462:PHE:HB3	1:B:463:PRO:CD	2.39	0.53
1:A:694:GLU:HB3	1:B:335:ILE:HD13	1.91	0.53
1:A:592:GLU:OE1	5:A:804:1EV:N01	2.42	0.53
1:B:478:GLN:HB2	1:B:481:ARG:HG3	1.92	0.51
1:A:321:THR:HG21	1:A:701:THR:HG22	1.92	0.51
1:A:614:MET:HG3	7:A:951:HOH:O	2.10	0.51
1:B:359:LYS:HG3	1:B:381:LEU:HD21	1.92	0.51
1:A:606:ILE:O	1:A:610:VAL:HG23	2.11	0.50
1:A:332:MET:HG2	1:A:335:ILE:CG1	2.39	0.50
1:B:459:ILE:HG13	1:B:583:PRO:O	2.10	0.50
1:B:595:VAL:O	1:B:599:CYS:HB2	2.12	0.50
1:A:317:HIS:O	1:A:320:SER:CB	2.60	0.50
1:B:481:ARG:HD3	1:B:498:ASN:ND2	2.27	0.50
1:B:598:TYR:HA	1:B:604:TYR:HB2	1.93	0.49
1:A:487:GLN:HE21	1:A:514:ARG:HH11	1.60	0.49
1:A:523:LEU:CD2	1:A:531:PRO:HB2	2.41	0.49
1:B:482:TYR:HA	1:B:518:ASP:O	2.13	0.49
1:A:496:PRO:O	1:A:499:VAL:HG23	2.12	0.49
2:B:801:HEM:C1C	5:B:802:1EV:H13	2.47	0.49
1:A:686:SER:HA	1:A:691:PHE:CG	2.48	0.48
2:A:801:HEM:HHC	2:A:801:HEM:HBB2	1.96	0.48
1:B:416:VAL:HB	7:B:919:HOH:O	2.12	0.47
1:B:589:MET:HA	1:B:649:VAL:O	2.14	0.47
1:A:380:ARG:HD3	1:A:400:GLU:OE1	2.13	0.47
1:A:307:GLU:HG3	7:B:915:HOH:O	2.14	0.47
1:B:463:PRO:HG2	1:B:472:PHE:CZ	2.48	0.47
1:A:614:MET:CG	7:A:951:HOH:O	2.62	0.47
1:B:413:SER:HA	1:B:418:ARG:NH1	2.29	0.47
1:A:445:HIS:C	1:A:445:HIS:CD2	2.89	0.46
1:A:460:THR:O	1:A:583:PRO:HD2	2.14	0.46
1:B:557:LEU:HD21	1:B:609:GLU:HG2	1.96	0.46
1:A:680:VAL:HA	1:A:681:PRO:HD3	1.84	0.46
1:A:542:LEU:HD21	1:A:646:VAL:HG22	1.98	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:445:HIS:C	1:B:445:HIS:CD2	2.89	0.46
1:A:321:THR:HG23	1:A:322:LEU:HG	1.97	0.46
1:A:299:ARG:O	1:A:318:LEU:HD11	2.16	0.45
1:A:701:THR:OG1	1:A:702:PRO:HA	2.16	0.45
1:A:330:ILE:HD11	1:B:696:LEU:HB3	1.98	0.45
1:B:439:PHE:CE2	1:B:443:CYS:SG	3.10	0.45
1:B:567:VAL:O	1:B:583:PRO:HA	2.17	0.45
1:B:455:LEU:CD1	1:B:455:LEU:N	2.80	0.44
1:A:312:LEU:HD13	1:A:666:TYR:CD1	2.52	0.44
1:B:539:GLU:HG3	7:B:922:HOH:O	2.16	0.44
1:A:515:GLY:N	1:A:518:ASP:OD2	2.50	0.44
1:B:557:LEU:CD2	1:B:609:GLU:HG2	2.48	0.44
1:B:582:CYS:O	1:B:583:PRO:C	2.56	0.44
1:A:607:LEU:HD11	1:B:687:ILE:HG21	1.99	0.44
1:A:569:ASN:H	1:A:569:ASN:ND2	2.16	0.43
1:A:387:GLU:O	1:A:391:THR:OG1	2.28	0.43
1:A:686:SER:OG	1:B:595:VAL:CG1	2.66	0.43
1:B:500:GLN:O	1:B:504:ILE:HG13	2.18	0.43
1:A:415:CYS:HB3	1:A:418:ARG:HG3	2.01	0.43
1:B:485:TYR:CZ	1:B:514:ARG:HA	2.54	0.43
1:A:464:GLN:HB3	1:A:579:PHE:CE2	2.54	0.43
1:A:308:THR:HB	1:A:310:VAL:HG23	2.00	0.42
1:A:321:THR:HG23	1:A:322:LEU:H	1.84	0.42
1:A:544:VAL:HA	1:A:545:PRO:HD2	1.90	0.42
1:B:370:LYS:HA	1:B:370:LYS:HD3	1.81	0.42
1:B:304:LYS:O	1:B:694:GLU:HG3	2.19	0.42
1:B:684:SER:O	1:B:685:GLY:C	2.57	0.42
1:B:674:ALA:HB3	1:B:695:MET:HB3	2.00	0.42
1:A:498:ASN:C	7:A:924:HOH:O	2.58	0.42
1:A:530:ASP:HA	1:A:531:PRO:HD3	1.76	0.42
1:A:331:CYS:HB3	1:B:697:ASN:HB3	2.02	0.42
1:B:316:LEU:CD2	1:B:700:LEU:HD11	2.49	0.42
1:B:537:PRO:HA	1:B:538:PRO:HD3	1.82	0.42
1:B:477:SER:HA	1:B:569:ASN:HB3	2.01	0.42
3:A:802:H4B:H71	3:A:802:H4B:O10	2.19	0.41
1:B:370:LYS:O	1:B:371:ARG:HD3	2.20	0.41
1:B:572:LEU:HB3	1:B:579:PHE:HB2	2.01	0.41
1:B:481:ARG:HD3	1:B:498:ASN:HD21	1.85	0.41
1:B:658:PHE:O	1:B:658:PHE:CG	2.74	0.41
1:A:462:PHE:HB3	1:A:463:PRO:CD	2.50	0.41
1:A:486:LYS:HE2	1:A:486:LYS:HB3	1.73	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:523:LEU:HG	1:A:533:LEU:CD2	2.51	0.41
2:A:801:HEM:C1C	5:A:804:1EV:H13	2.56	0.40
1:A:567:VAL:O	1:A:583:PRO:HA	2.21	0.40
1:A:696:LEU:HB3	1:B:330:ILE:HD11	2.04	0.40
1:A:610:VAL:O	1:A:611:ALA:C	2.60	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	403/422 (96%)	378 (94%)	23 (6%)	2 (0%)	29	31
1	B	407/422 (96%)	390 (96%)	16 (4%)	1 (0%)	47	55
All	All	810/844 (96%)	768 (95%)	39 (5%)	3 (0%)	34	37

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	489	ASP
1	A	514	ARG
1	B	322	LEU

### 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	363/377 (96%)	337 (93%)	26 (7%)	14	15
1	B	366/377 (97%)	354 (97%)	12 (3%)	38	49
All	All	729/754 (97%)	691 (95%)	38 (5%)	23	28

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	328	GLU
1	A	332	MET
1	A	336	MET
1	A	337	LEU
1	A	350	THR
1	A	351	LYS
1	A	353	GLN
1	A	371	ARG
1	A	381	LEU
1	A	390	SER
1	A	454	ASN
1	A	469	LYS
1	A	486	LYS
1	A	492	THR
1	A	511	LYS
1	A	514	ARG
1	A	523	LEU
1	A	547	ARG
1	A	555	LYS
1	A	569	ASN
1	A	601	ASN
1	A	620	LYS
1	A	627	ASP
1	A	645	LYS
1	A	699	ARG
1	A	715	VAL
1	B	321	THR
1	B	349	ARG
1	B	352	ASP
1	B	353	GLN
1	B	367	SER
1	B	382	GLU
1	B	389	GLU
1	B	423	LYS
1	B	481	ARG

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Mol	Chain	Res	Type
1	B	507	GLN
1	B	540	LEU
1	B	547	ARG

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

Mol	Chain	Res	Type
1	A	454	ASN
1	A	507	GLN
1	A	508	GLN
1	A	569	ASN
1	A	601	ASN
1	A	605	ASN
1	A	642	GLN
1	A	697	ASN
1	B	353	GLN
1	B	364	GLN
1	B	385	ASN
1	B	425	GLN
1	B	454	ASN
1	B	507	GLN
1	B	508	GLN
1	B	605	ASN
1	B	642	GLN
1	B	697	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates ⓘ

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
3	H4B	A	805	-	16,18,18	1.24	1 (6%)	11,26,26	3.01	7 (63%)
4	ACT	B	803	-	1,3,3	0.49	0	0,3,3	0.00	-
4	ACT	A	803	-	1,3,3	0.95	0	0,3,3	0.00	-
5	1EV	A	804	-	30,30,30	1.38	1 (3%)	41,41,41	1.85	9 (21%)
2	HEM	A	801	1	27,50,50	2.05	8 (29%)	17,82,82	1.85	4 (23%)
2	HEM	B	801	1	27,50,50	2.09	8 (29%)	17,82,82	1.99	6 (35%)
5	1EV	B	802	-	30,30,30	1.49	1 (3%)	41,41,41	2.18	13 (31%)
3	H4B	A	802	-	16,18,18	0.79	0	11,26,26	2.95	7 (63%)

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	H4B	A	805	-	-	3/8/17/17	0/2/2/2
5	1EV	A	804	-	-	2/12/12/12	0/3/3/3
2	HEM	A	801	1	-	3/6/54/54	-
2	HEM	B	801	1	-	0/6/54/54	-
5	1EV	B	802	-	-	6/12/12/12	0/3/3/3
3	H4B	A	802	-	-	3/8/17/17	0/2/2/2

All (19) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	802	1EV	C11-C10	-6.93	1.29	1.44
5	A	804	1EV	C11-C10	-6.70	1.29	1.44
2	A	801	HEM	C3B-C2B	-5.11	1.33	1.40
2	B	801	HEM	C3D-C2D	4.72	1.51	1.37

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	HEM	C3D-C2D	4.51	1.51	1.37
2	B	801	HEM	C3C-C2C	-4.45	1.34	1.40
2	A	801	HEM	C3C-C2C	-4.07	1.34	1.40
2	B	801	HEM	C3B-C2B	-3.68	1.35	1.40
2	B	801	HEM	C3C-CAC	3.49	1.55	1.47
2	B	801	HEM	C3B-CAB	3.11	1.54	1.47
2	A	801	HEM	C3C-CAC	2.83	1.53	1.47
2	A	801	HEM	C3B-CAB	2.76	1.53	1.47
2	B	801	HEM	C4A-NA	2.56	1.41	1.36
2	A	801	HEM	CMC-C2C	2.25	1.56	1.51
3	A	805	H4B	C7-N8	2.21	1.48	1.44
2	A	801	HEM	CAA-C2A	2.08	1.55	1.52
2	B	801	HEM	CMA-C3A	2.06	1.55	1.51
2	A	801	HEM	C1A-CHA	-2.03	1.35	1.41
2	B	801	HEM	CMB-C2B	2.03	1.56	1.51

All (46) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	802	1EV	C22-N21-C26	7.41	123.72	118.10
3	A	805	H4B	C4-C4A-C8A	7.11	120.88	114.57
5	A	804	1EV	C22-N21-C26	7.01	123.41	118.10
3	A	802	H4B	C4-C4A-N5	4.74	123.10	119.12
5	B	802	1EV	C02-N01-C06	4.50	121.51	118.10
3	A	802	H4B	C4-N3-C2	4.37	122.87	115.93
3	A	802	H4B	C4-C4A-C8A	4.28	118.38	114.57
5	A	804	1EV	C02-N01-C06	4.08	121.19	118.10
2	B	801	HEM	CAD-CBD-CGD	-4.02	105.92	112.67
2	A	801	HEM	C4C-C3C-C2C	3.83	109.57	106.90
2	B	801	HEM	CAA-CBA-CGA	-3.81	106.28	112.67
5	B	802	1EV	C08-C06-N01	3.80	121.61	115.95
3	A	802	H4B	N3-C2-N1	-3.69	119.62	125.42
2	A	801	HEM	C1D-C2D-C3D	-3.54	104.54	107.00
5	B	802	1EV	C05-C06-N01	-3.51	119.18	122.90
5	B	802	1EV	C09-C13-C14	3.48	126.25	120.54
5	A	804	1EV	C05-C06-N01	-3.41	119.29	122.90
3	A	805	H4B	N2-C2-N3	3.30	122.38	117.25
5	B	802	1EV	C25-C26-N21	-3.27	119.44	122.90
2	A	801	HEM	CBD-CAD-C3D	-3.18	106.62	112.48
3	A	805	H4B	N3-C2-N1	-3.13	120.51	125.42
5	A	804	1EV	C09-C08-C06	-3.13	105.98	112.99
2	B	801	HEM	C4C-C3C-C2C	3.04	109.02	106.90

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	805	H4B	C4-N3-C2	3.01	120.71	115.93
5	B	802	1EV	C09-C13-C12	-2.90	115.78	120.54
5	A	804	1EV	C08-C06-N01	2.84	120.18	115.95
2	B	801	HEM	C1D-C2D-C3D	-2.82	105.04	107.00
5	A	804	1EV	C25-C26-N21	-2.77	119.96	122.90
3	A	805	H4B	C2-N1-C8A	2.74	120.69	114.54
5	B	802	1EV	N02-C02-N01	2.73	120.80	116.49
5	B	802	1EV	C28-C26-N21	2.72	120.00	115.95
5	B	802	1EV	C24-C25-C26	-2.65	118.58	120.32
5	A	804	1EV	C24-C25-C26	-2.63	118.60	120.32
3	A	802	H4B	C2-N1-C8A	2.44	120.02	114.54
3	A	802	H4B	N2-C2-N3	2.41	121.00	117.25
5	A	804	1EV	C28-C26-N21	2.30	119.38	115.95
2	B	801	HEM	CBD-CAD-C3D	-2.26	108.31	112.48
5	B	802	1EV	N22-C22-N21	2.25	120.04	116.49
5	B	802	1EV	C11-C12-C13	2.24	122.57	120.29
3	A	805	H4B	C4-C4A-N5	2.24	121.00	119.12
3	A	805	H4B	C4A-C4-N3	-2.17	117.83	124.01
5	A	804	1EV	N22-C22-N21	2.12	119.85	116.49
2	A	801	HEM	CMC-C2C-C3C	2.11	128.63	124.68
3	A	802	H4B	C4A-C4-N3	-2.11	118.02	124.01
5	B	802	1EV	C25-C24-C23	2.10	120.59	118.09
2	B	801	HEM	CMB-C2B-C3B	2.04	128.50	124.68

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	805	H4B	C7-C6-C9-O9
2	A	801	HEM	C1A-C2A-CAA-CBA
2	A	801	HEM	C3A-C2A-CAA-CBA
2	A	801	HEM	C2A-CAA-CBA-CGA
3	A	802	H4B	C7-C6-C9-O9
3	A	802	H4B	C7-C6-C9-C10
5	B	802	1EV	C08-C09-C13-C14
5	A	804	1EV	C16-C15-C29-C28
5	B	802	1EV	C08-C09-C13-C12
5	A	804	1EV	C14-C15-C29-C28
5	B	802	1EV	N21-C26-C28-C29
3	A	805	H4B	C7-C6-C9-C10
5	B	802	1EV	C25-C26-C28-C29
5	B	802	1EV	C16-C15-C29-C28

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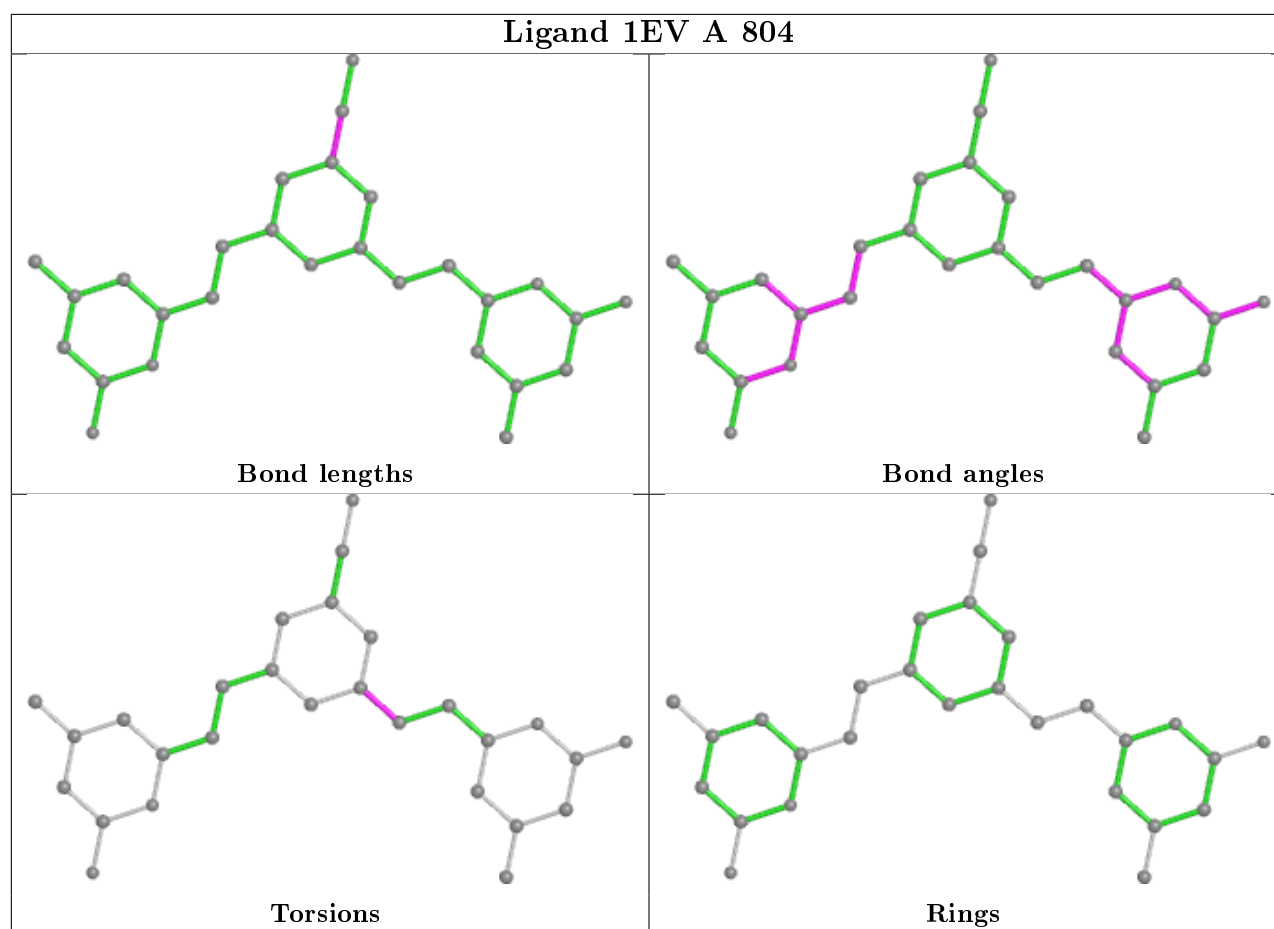
Mol	Chain	Res	Type	Atoms
3	A	805	H4B	N5-C6-C9-O9
3	A	802	H4B	N5-C6-C9-O9
5	B	802	1EV	C14-C15-C29-C28

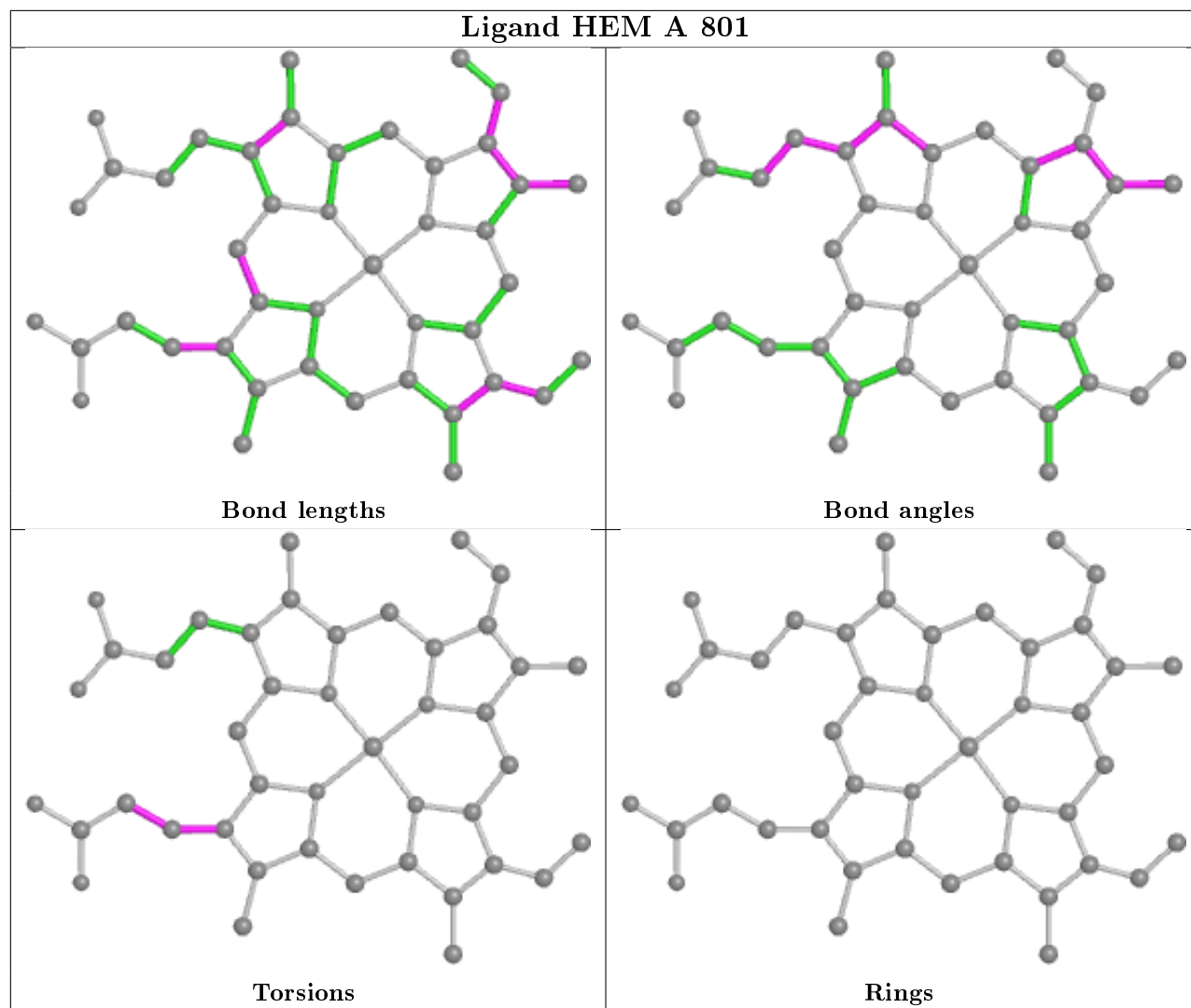
There are no ring outliers.

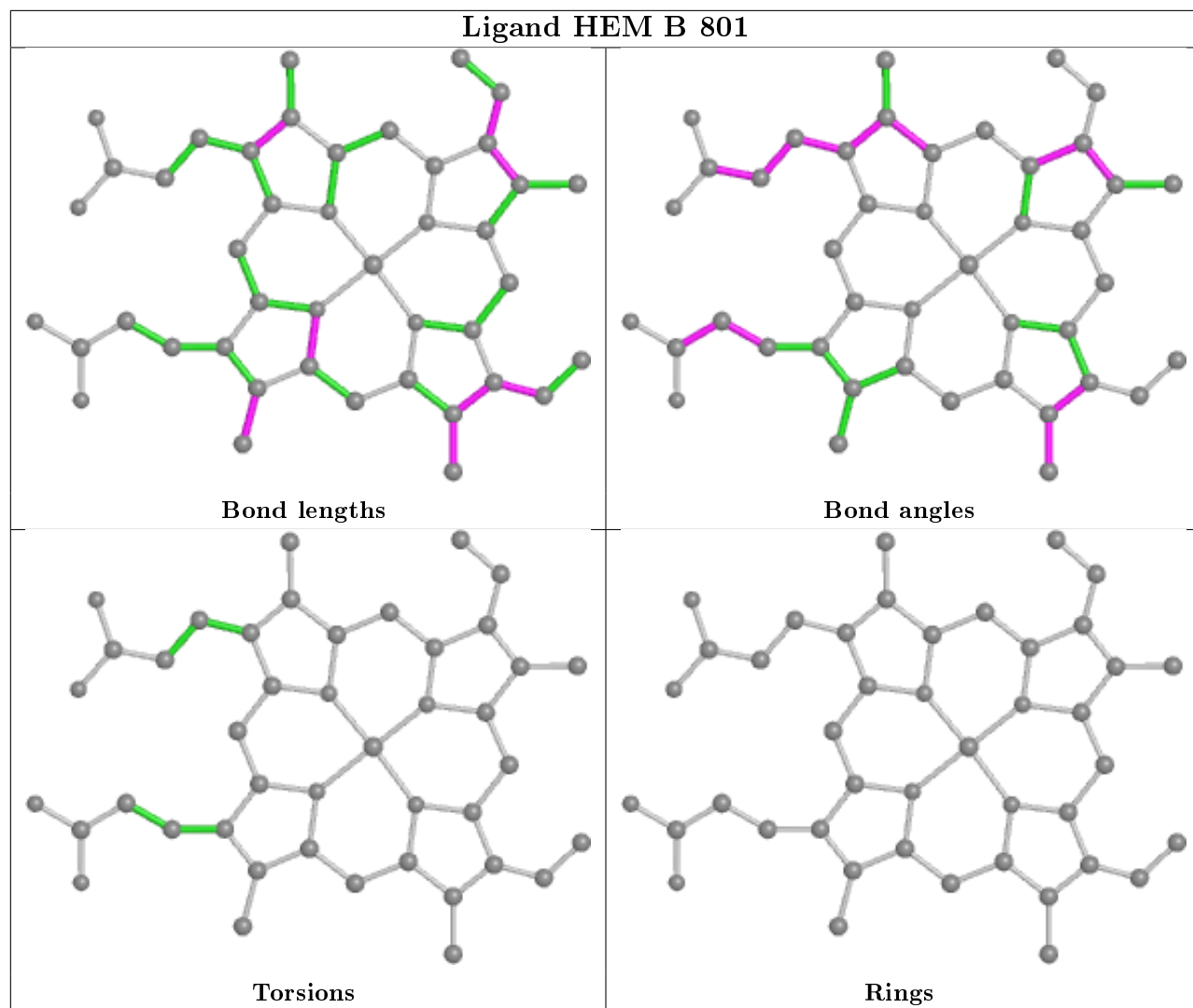
6 monomers are involved in 13 short contacts:

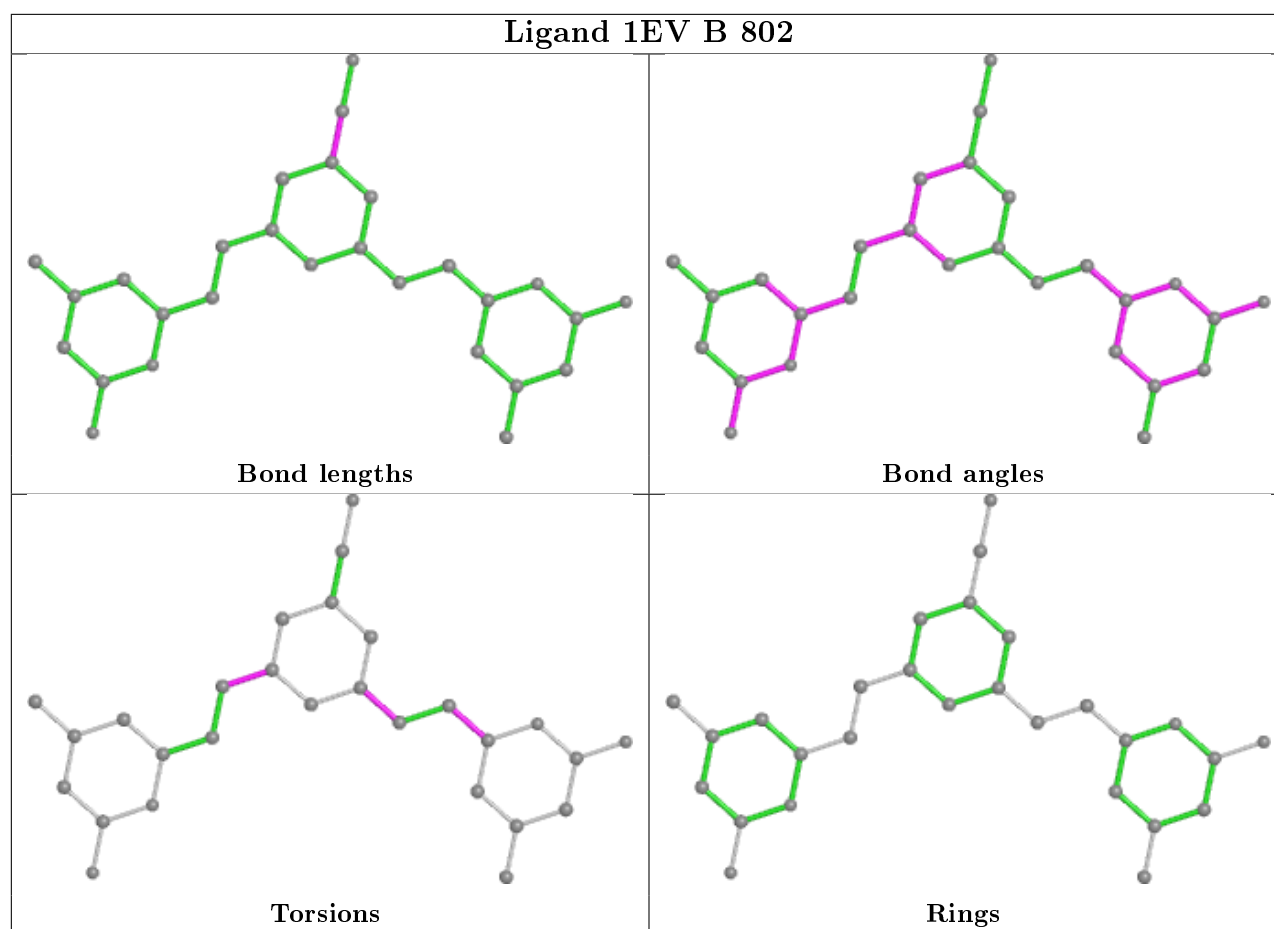
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	805	H4B	3	0
5	A	804	1EV	3	0
2	A	801	HEM	2	0
2	B	801	HEM	8	0
5	B	802	1EV	2	0
3	A	802	H4B	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









## 5.7 Other polymers [i](#)

There are no such residues in this entry.

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

There are no chain breaks in this entry.

## 6 Fit of model and data

### 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%)	0.52	33 (8%) 12 10	26, 57, 93, 121	0
1	B	411/422 (97%)	0.23	15 (3%) 42 41	24, 46, 69, 92	0
All	All	818/844 (96%)	0.38	48 (5%) 22 21	24, 50, 90, 121	0

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	718	GLY	6.7
1	A	488	PRO	5.6
1	A	716	TRP	5.2
1	B	300	PHE	5.1
1	A	486	LYS	4.9
1	B	348	VAL	4.1
1	A	493	LEU	4.1
1	A	355	PHE	4.1
1	A	352	ASP	4.0
1	B	350	THR	3.9
1	A	713	THR	3.8
1	B	619	ARG	3.8
1	A	507	GLN	3.8
1	A	551	PHE	3.7
1	A	494	GLY	3.5
1	A	712	ASN	3.4
1	A	706	TYR	3.1
1	A	503	GLU	3.1
1	B	351	LYS	3.1
1	A	386	LYS	3.1
1	B	321	THR	3.0
1	A	492	THR	3.0
1	A	300	PHE	3.0
1	A	552	ASP	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	385	ASN	2.8
1	B	352	ASP	2.8
1	A	487	GLN	2.7
1	A	511	LYS	2.7
1	A	677	VAL	2.6
1	B	353	GLN	2.6
1	A	351	LYS	2.6
1	B	349	ARG	2.5
1	A	715	VAL	2.5
1	A	321	THR	2.4
1	B	567	VAL	2.4
1	A	506	ILE	2.4
1	B	566	ALA	2.4
1	B	677	VAL	2.4
1	A	685	GLY	2.4
1	A	389	GLU	2.3
1	A	512	ALA	2.3
1	B	479	LEU	2.3
1	A	491	SER	2.3
1	A	619	ARG	2.2
1	A	686	SER	2.1
1	B	615	ASP	2.1
1	A	681	PRO	2.0
1	A	485	TYR	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.

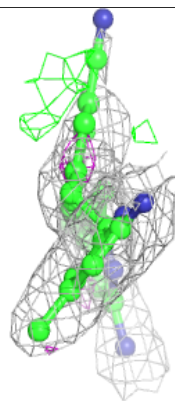
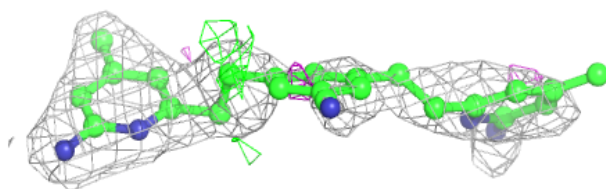
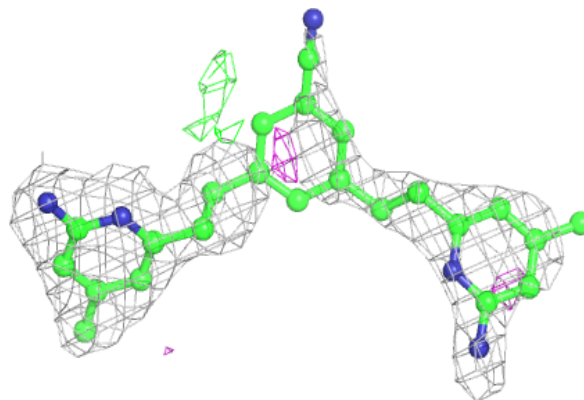


Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
5	1EV	A	804	28/28	0.86	0.27	31,72,74,75	0
5	1EV	B	802	28/28	0.89	0.28	31,69,71,72	0
3	H4B	A	805	17/17	0.90	0.21	50,54,60,63	0
3	H4B	A	802	17/17	0.92	0.19	51,53,60,61	0
2	HEM	A	801	43/43	0.96	0.18	28,34,53,62	0
4	ACT	A	803	4/4	0.96	0.19	57,57,58,60	0
4	ACT	B	803	4/4	0.96	0.12	57,57,58,59	0
2	HEM	B	801	43/43	0.97	0.20	32,38,47,54	0
6	ZN	A	806	1/1	0.99	0.10	47,47,47,47	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.

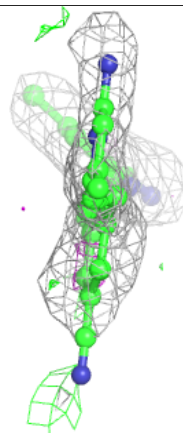
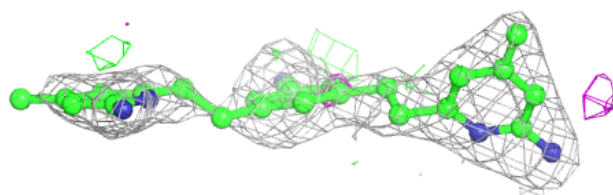
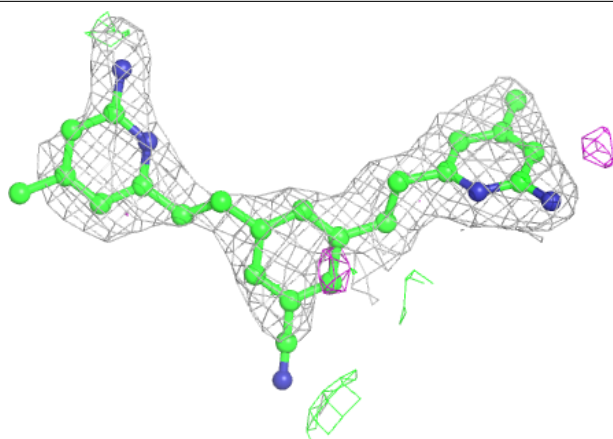
**Electron density around 1EV A 804:**

2mF<sub>o</sub>-DF<sub>c</sub> (at 0.7 rmsd) in gray  
mF<sub>o</sub>-DF<sub>c</sub> (at 3 rmsd) in purple (negative)  
and green (positive)



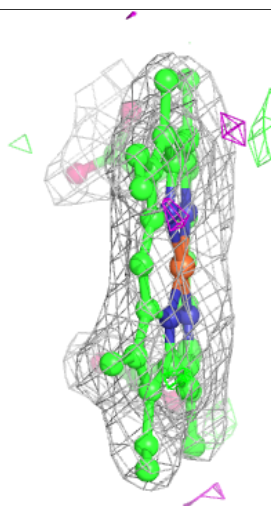
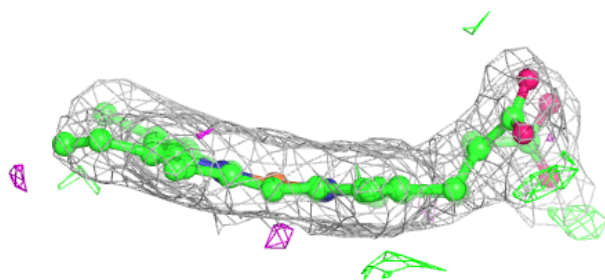
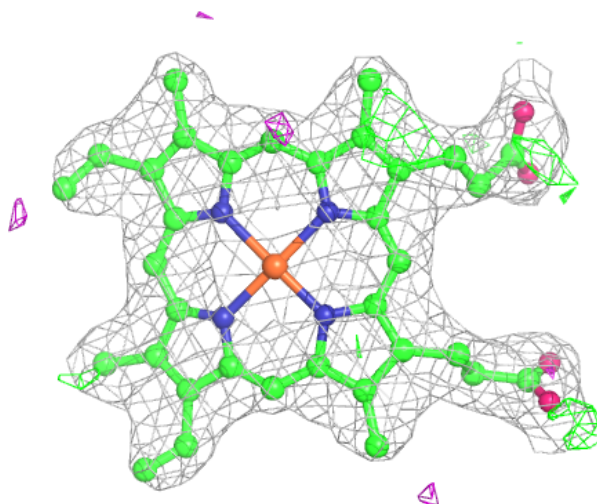
**Electron density around 1EV B 802:**

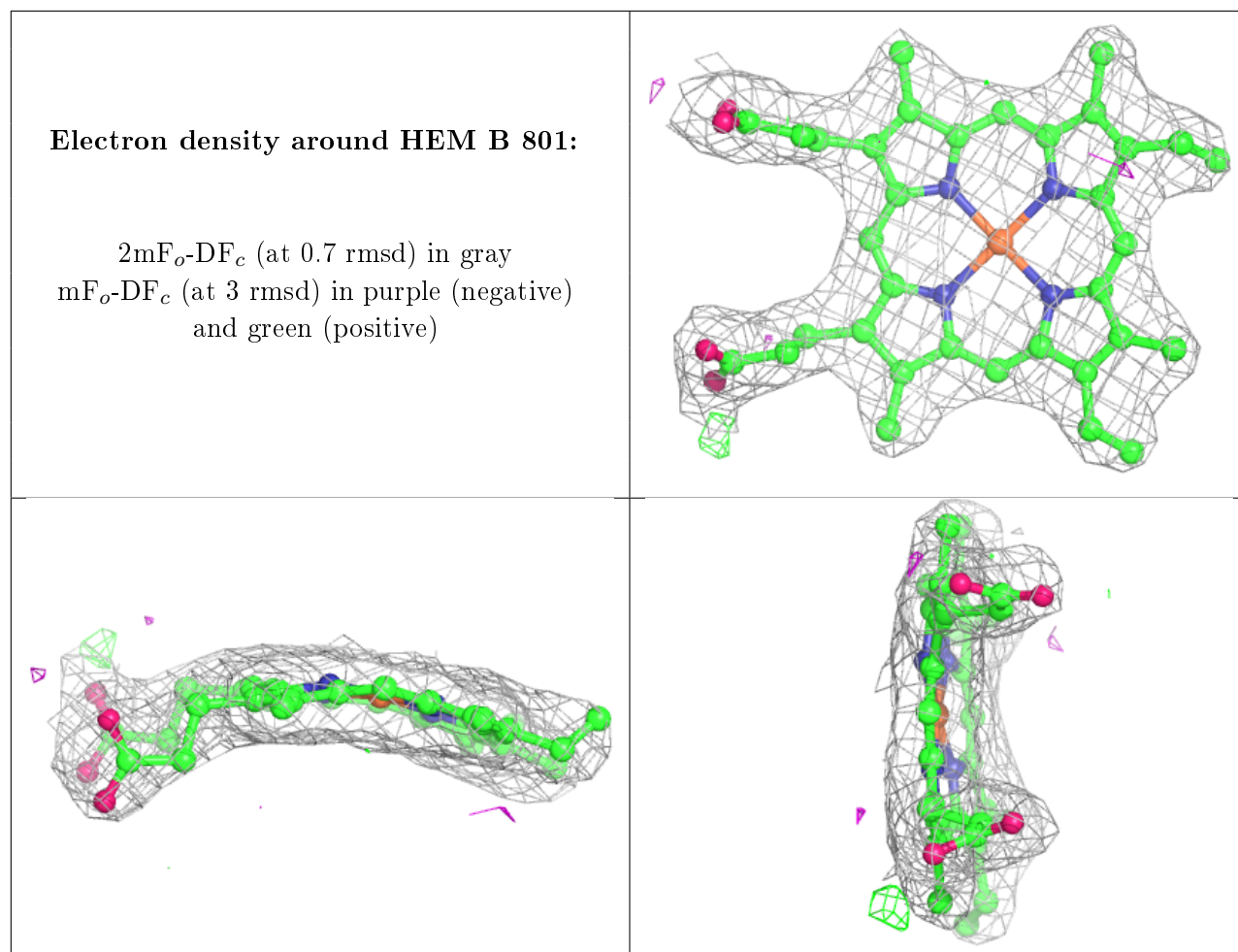
$2mF_o - DF_c$  (at 0.7 rmsd) in gray  
 $mF_o - DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around HEM A 801:**

$2mF_o-DF_c$  (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.