Full wwPDB X-ray Structure Validation Report (i)

Sep 3, 2023 – 09:44 AM EDT

PDB ID	:	3SVQ
Title	:	Structure of rat neuronal nitric oxide synthase heme domain in complex with 6-(((3R,4R)-4-(2-((2,2-Difluoro-2-(2,3-difluorophenyl)ethyl)amino)ethoxy)pyrrolidin-3-yl)methyl)-4-methylpyridin-2-amine
Authors	:	Li, H.; Poulos, T.L.
Deposited on	:	2011-07-12
Resolution	:	2.18 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 (i) 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 (i)) were used in the production of this report:

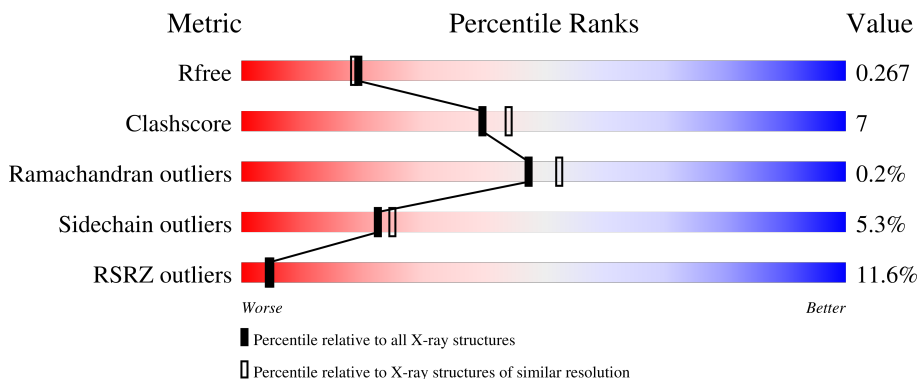|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & 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 2.18 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	Percentile Ranks	Value
Rfree		0.267
Clashscore		7
Ramachandran outliers		0.2%
Sidechain outliers		5.3%
RSRZ outliers		11.6%

Worse   *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

| Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	130704	6864 (2.20-2.16)
Clashscore	141614	7689 (2.20-2.16)
Ramachandran outliers	138981	7564 (2.20-2.16)
Sidechain outliers	138945	7564 (2.20-2.16)
RSRZ outliers	127900	6738 (2.20-2.16)

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 <=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	13% / 77% 17% • •
1	B	422	9% / 83% 14% • •

2   Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 6979 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	2	0
			3324	2128	567	608	21			
1	B	411	Total	C	N	O	S	0	2	0
			3351	2144	574	611	22			

- 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	B	1	Total	C	N	O	0	0
			17	9	5	3		

- Molecule 4 is 6-{[(3R,4R)-4-(2-{[2-(2,3-difluorophenyl)-2,2-difluoroethyl]amino}etho xy)pyrrolidin-3-yl]methyl}-4-methylpyridin-2-amine (three-letter code: JK4) (formula: $C_{21}H_{26}F_4N_4O$).
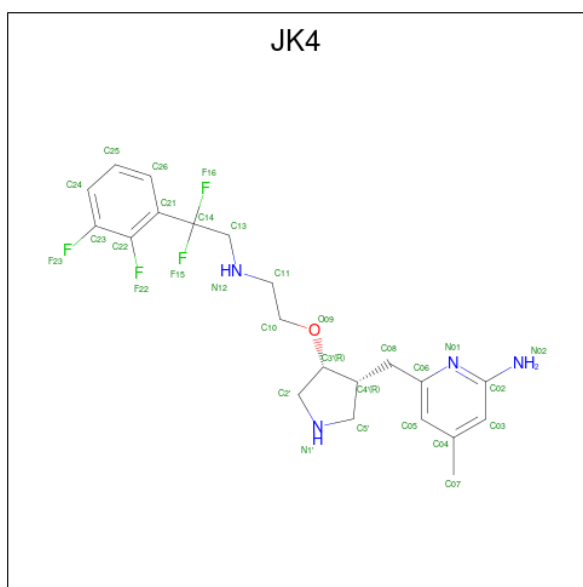
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	F	N	O	0	0
			30	21	4	4	1		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	B	1	Total 30	C 21	F 4	N 4	O 1	0	0

- Molecule 5 is ACETATE ION (three-letter code: ACT) (formula: $C_2H_3O_2$).

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

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

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

- Molecule 7 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	51	Total 51	O 51	0	0
7	B	64	Total 64	O 64	0	0

3 Residue-property plots ⓘ

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
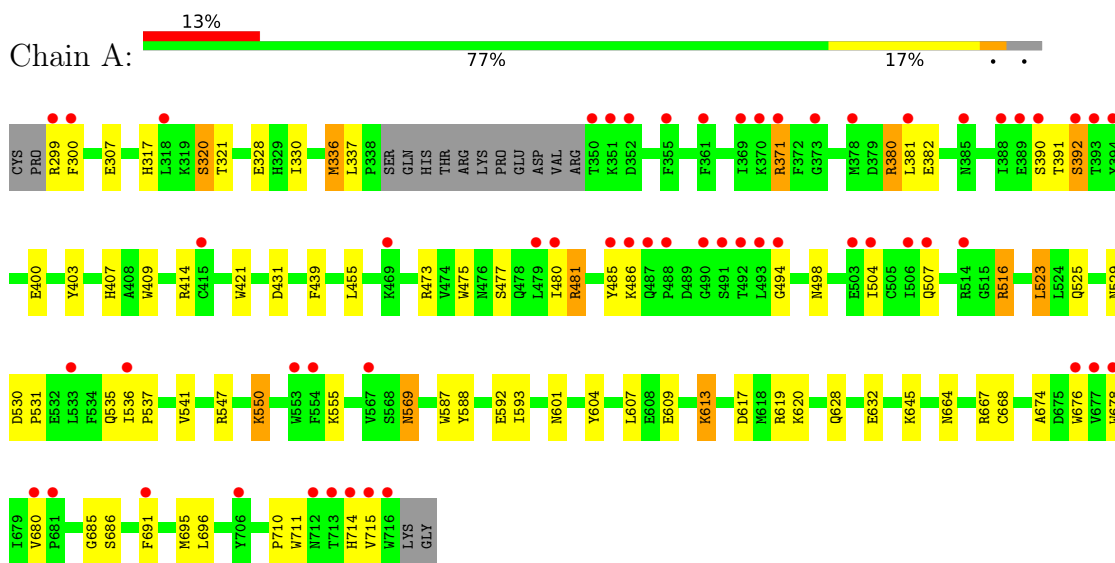
- Molecule 1: Nitric oxide synthase, brain
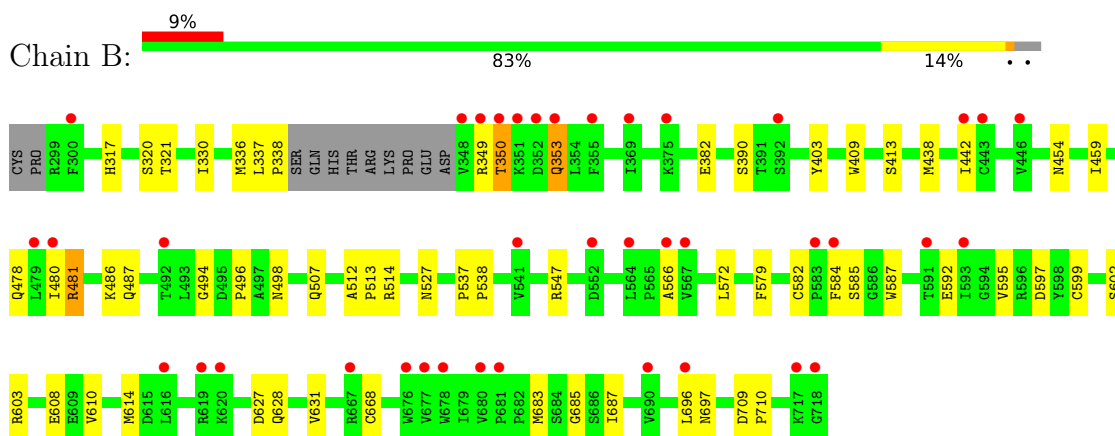
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	51.75Å　　111.13Å　　164.71Å 90.00°　　90.00°　　90.00°	Depositor
Resolution (Å)	43.82　–　2.18 43.82　–　2.18	Depositor EDS
% Data completeness (in resolution range)	97.2 (43.82-2.18) 97.2 (43.82-2.18)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.08	Depositor
$< I/\sigma(I) >$ [1]	1.23 (at 2.18Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.209　,　0.262 0.214　,　0.267	Depositor DCC
R_{free} test set	2460 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	49.7	Xtriage
Anisotropy	0.182	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 47.8	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	6979	wwPDB-VP
Average B, all atoms (Å^2)	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.64% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5   Model quality ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: ACT, H4B, JK4, ZN, HEM

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	0.73	0/3423	0.74	0/4644
1	B	0.81	0/3450	0.77	0/4677
All	All	0.77	0/6873	0.75	0/9321

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2   Too-close contacts ⓘ

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	3324	0	3233	56	0
1	B	3351	0	3269	42	0
2	A	43	0	30	3	0
2	B	43	0	30	8	0
3	A	17	0	15	0	0
3	B	17	0	15	1	0
4	A	30	0	26	5	0
4	B	30	0	26	5	0
5	A	4	0	3	0	0
5	B	4	0	3	0	0
6	A	1	0	0	0	0

Continued on next page...

W O R L D W I D E
wwPDB
PROTEIN DATA BANK

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	51	0	0	1	0
7	B	64	0	0	2	0
All	All	6979	0	6650	98	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 7.

All (98) 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)
2:B:750:HEM:HBA2	4:B:800:JK4:F15	1.53	0.99
1:B:592:GLU:OE1	4:B:800:JK4:H26	1.71	0.90
1:B:587:TRP:H	2:B:750:HEM:HAB	1.37	0.89
1:A:523:LEU:HD22	1:A:531:PRO:HB2	1.60	0.83
2:A:750:HEM:HMC2	2:A:750:HEM:HBC2	1.66	0.77
1:A:592:GLU:OE1	4:A:800:JK4:H26	1.88	0.73
1:A:317:HIS:O	1:A:320:SER:HB3	1.89	0.73
1:A:371:ARG:CG	1:A:371:ARG:HH21	2.06	0.67
1:A:380:ARG:HD3	1:A:400:GLU:OE1	1.95	0.67
2:A:750:HEM:HBC2	2:A:750:HEM:CMC	2.25	0.66
1:A:337:LEU:HD21	4:A:800:JK4:H03	1.77	0.66
1:A:371:ARG:HH21	1:A:371:ARG:HG2	1.64	0.62
1:B:481:ARG:HD3	1:B:498:ASN:ND2	2.14	0.62
1:B:494:GLY:O	1:B:496:PRO:HD3	2.00	0.60
2:A:750:HEM:HBA1	4:A:800:JK4:F15	1.90	0.60
1:A:371:ARG:HG2	1:A:371:ARG:NH2	2.15	0.59
1:A:391:THR:O	1:A:392:SER:OG	2.19	0.59
1:A:592:GLU:CD	4:A:800:JK4:H26	2.25	0.57
1:B:592:GLU:CD	4:B:800:JK4:H26	2.26	0.56
1:B:595:VAL:O	1:B:599:CYS:HB2	2.05	0.56
1:A:481:ARG:HD3	1:A:498:ASN:HD21	1.71	0.56
1:B:481:ARG:HD3	1:B:498:ASN:HD21	1.71	0.55
1:A:307[B]:GLU:OE2	1:B:602[B]:SER:OG	2.20	0.55
1:A:569:ASN:C	1:A:569:ASN:HD22	2.10	0.55
1:A:632:GLU:OE2	1:B:628:GLN:NE2	2.40	0.54
1:B:566:ALA:HB2	1:B:585:SER:HB3	1.89	0.53
1:A:473:ARG:NH2	1:A:710:PRO:HD3	2.23	0.53
1:B:566:ALA:CB	1:B:585:SER:HB3	2.38	0.53
1:A:439:PHE:HZ	1:A:537:PRO:HD3	1.72	0.53
1:B:349:ARG:HG2	1:B:353:GLN:HG3	1.91	0.52
2:B:750:HEM:O1A	3:B:760:H4B:N3	2.35	0.52

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:504:ILE:HG23	1:A:507:GLN:NE2	2.25	0.51
1:A:391:THR:O	1:A:392:SER:CB	2.59	0.51
1:A:480:ILE:HD13	1:A:541:VAL:HG13	1.93	0.50
1:A:336:MET:CE	1:A:678:TRP:HZ2	2.24	0.50
1:B:350:THR:O	1:B:353:GLN:HG2	2.12	0.50
1:B:478:GLN:HA	1:B:566:ALA:O	2.11	0.49
1:A:592:GLU:OE2	4:A:800:JK4:H26	2.13	0.49
1:B:608:GLU:HG3	7:B:24:HOH:O	2.13	0.48
1:A:710:PRO:O	1:A:714:HIS:N	2.45	0.48
1:B:480:ILE:HA	7:B:28:HOH:O	2.13	0.48
1:A:617:ASP:OD2	1:A:619:ARG:HB2	2.13	0.48
1:B:631:VAL:HG22	1:B:683:MET:HE1	1.95	0.48
1:A:455:LEU:HD12	1:A:587:TRP:CB	2.45	0.46
1:A:525:GLN:HG3	1:A:529:ASN:O	2.15	0.46
1:A:504:ILE:HG23	1:A:507:GLN:HE22	1.81	0.46
1:A:414:ARG:HD3	1:A:678:TRP:CD2	2.50	0.46
1:B:336:MET:HG2	4:B:800:JK4:H07B	1.96	0.46
1:A:664:ASN:O	1:A:668:CYS:HB2	2.16	0.46
1:B:487:GLN:HE22	1:B:514:ARG:NH2	2.12	0.46
1:A:607:LEU:HD11	1:B:687:ILE:HG21	1.97	0.46
1:B:587:TRP:O	2:B:750:HEM:HMB3	2.16	0.46
1:B:587:TRP:N	2:B:750:HEM:HAB	2.18	0.46
1:B:438:MET:O	1:B:442:ILE:HG13	2.16	0.45
1:A:330:ILE:HD11	1:B:696:LEU:HB3	1.98	0.45
1:A:588:TYR:CD1	1:A:593:ILE:HD11	2.50	0.45
2:B:750:HEM:CMC	2:B:750:HEM:HBC2	2.46	0.45
1:A:676:TRP:CE2	1:A:680:VAL:HG21	2.52	0.45
1:A:481:ARG:HD3	1:A:498:ASN:ND2	2.31	0.44
1:A:475:TRP:HB2	1:A:523:LEU:HB3	2.00	0.44
1:B:409:TRP:CZ3	2:B:750:HEM:HMC3	2.52	0.44
1:B:459:ILE:HD11	1:B:582:CYS:HB2	1.99	0.44
1:A:685:GLY:O	1:A:691:PHE:HB2	2.18	0.44
1:A:336:MET:HE2	1:A:336:MET:HB3	1.90	0.44
1:A:409:TRP:CE3	1:A:421:TRP:HA	2.53	0.44
1:A:516:ARG:NH1	1:A:604:TYR:HD2	2.16	0.43
1:B:413:SER:OG	1:B:697:ASN:ND2	2.51	0.43
1:A:686:SER:HA	1:A:691:PHE:CG	2.52	0.43
1:B:317:HIS:O	1:B:320:SER:HB2	2.18	0.43
1:A:330:ILE:O	1:A:330:ILE:HG23	2.17	0.43
1:A:477:SER:HA	1:A:569:ASN:HB3	2.01	0.43
1:B:481:ARG:CD	1:B:498:ASN:HD21	2.32	0.43

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:431:ASP:OD2	1:A:431:ASP:C	2.57	0.42
1:A:550:LYS:HB2	1:A:550:LYS:HE3	1.75	0.42
1:B:537:PRO:HA	1:B:538:PRO:HD3	1.76	0.42
1:A:494:GLY:HA2	1:A:516:ARG:HG3	2.01	0.42
1:A:536:ILE:O	1:A:537:PRO:C	2.57	0.42
1:A:628:GLN:HG2	1:B:631:VAL:HG11	2.02	0.42
1:A:516:ARG:N	7:A:79:HOH:O	2.52	0.42
1:B:597:ASP:OD1	1:B:603:ARG:NH1	2.52	0.42
1:B:610:VAL:O	1:B:614:MET:HG3	2.19	0.42
1:B:512:ALA:HA	1:B:513:PRO:HD3	1.96	0.42
1:A:299:ARG:HG3	1:A:299:ARG:O	2.19	0.41
1:B:337:LEU:HA	1:B:338:PRO:HD2	1.94	0.41
1:B:403:TYR:CD2	1:B:403:TYR:C	2.92	0.41
1:B:478:GLN:NE2	4:B:800:JK4:H11A	2.36	0.41
1:A:696:LEU:HB3	1:B:330:ILE:HD11	2.02	0.41
1:B:584:PHE:CD1	2:B:750:HEM:CAC	3.04	0.41
1:A:475:TRP:CZ3	1:A:711:TRP:HB3	2.55	0.41
1:A:676:TRP:CZ2	1:A:680:VAL:HG21	2.56	0.41
1:A:609:GLU:O	1:A:613:LYS:HG2	2.21	0.41
1:A:530:ASP:HA	1:A:531:PRO:HD3	1.90	0.40
1:A:674:ALA:HB3	1:A:695:MET:HB3	2.03	0.40
1:B:572:LEU:HB3	1:B:579:PHE:HB2	2.03	0.40
1:A:403:TYR:CE1	1:A:407:HIS:CE1	3.10	0.40
1:B:709:ASP:HA	1:B:710:PRO:HD3	1.87	0.40
1:A:455:LEU:HD12	1:A:587:TRP:HB3	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	405/422 (96%)	388 (96%)	16 (4%)	1 (0%)	47	52

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	409/422 (97%)	395 (97%)	13 (3%)	1 (0%)	47	52
All	All	814/844 (96%)	783 (96%)	29 (4%)	2 (0%)	47	52

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	685	GLY
1	A	392	SER

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	365/377 (97%)	338 (93%)	27 (7%)	13	13
1	B	368/377 (98%)	354 (96%)	14 (4%)	33	39
All	All	733/754 (97%)	692 (94%)	41 (6%)	22	23

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	300	PHE
1	A	320	SER
1	A	321	THR
1	A	328	GLU
1	A	336	MET
1	A	371	ARG
1	A	380	ARG
1	A	381	LEU
1	A	382	GLU
1	A	390	SER
1	A	481	ARG
1	A	485	TYR
1	A	486	LYS
1	A	516	ARG

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	523	LEU
1	A	535	GLN
1	A	547	ARG
1	A	550	LYS
1	A	555	LYS
1	A	569	ASN
1	A	601[A]	ASN
1	A	601[B]	ASN
1	A	613	LYS
1	A	620	LYS
1	A	645	LYS
1	A	667	ARG
1	A	715	VAL
1	B	321	THR
1	B	350	THR
1	B	353	GLN
1	B	382	GLU
1	B	390	SER
1	B	454	ASN
1	B	481	ARG
1	B	486	LYS
1	B	507	GLN
1	B	527	ASN
1	B	547	ARG
1	B	627	ASP
1	B	668[A]	CYS
1	B	668[B]	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	353	GLN
1	A	454	ASN
1	A	507	GLN
1	A	527	ASN
1	A	569	ASN
1	A	605	ASN
1	A	642	GLN
1	A	697	ASN
1	B	454	ASN
1	B	601	ASN
1	B	605	ASN

Continued from previous page...

Mol	Chain	Res	Type
1	B	628	GLN
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	$\#|Z| > 2$
5	ACT	A	860	-	3,3,3	0.65	0	3,3,3	1.12	0
2	HEM	A	750	1	41,50,50	1.88	7 (17%)	45,82,82	1.87	10 (22%)
5	ACT	B	860	-	3,3,3	0.83	0	3,3,3	0.41	0
3	H4B	B	760	-	16,18,18	1.22	1 (6%)	11,26,26	2.92	6 (54%)
4	JK4	B	800	-	30,32,32	0.92	1 (3%)	32,45,45	2.43	12 (37%)
3	H4B	A	760	-	16,18,18	0.94	1 (6%)	11,26,26	3.49	7 (63%)
2	HEM	B	750	1	41,50,50	1.92	9 (21%)	45,82,82	1.82	10 (22%)
4	JK4	A	800	-	30,32,32	1.03	2 (6%)	32,45,45	2.10	9 (28%)

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	B	760	-	-	0/8/17/17	0/2/2/2
4	JK4	B	800	-	-	1/17/29/29	0/3/3/3
3	H4B	A	760	-	-	0/8/17/17	0/2/2/2
2	HEM	B	750	1	-	4/12/54/54	-
4	JK4	A	800	-	-	6/17/29/29	0/3/3/3

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	750	HEM	C3D-C2D	7.42	1.52	1.36
2	B	750	HEM	C3D-C2D	7.22	1.52	1.36
2	B	750	HEM	C3C-C2C	-4.36	1.34	1.40
2	A	750	HEM	C3C-C2C	-3.59	1.35	1.40
2	A	750	HEM	CMB-C2B	3.16	1.57	1.50
2	B	750	HEM	C3C-CAC	3.06	1.54	1.47
4	A	800	JK4	F15-C14	-2.90	1.31	1.37
3	B	760	H4B	C7-N8	2.89	1.49	1.44
2	A	750	HEM	CMC-C2C	2.71	1.58	1.51
2	A	750	HEM	CMD-C2D	2.60	1.56	1.50
2	A	750	HEM	CAB-C3B	2.58	1.54	1.47
2	B	750	HEM	CMB-C2B	2.53	1.56	1.50
2	B	750	HEM	CMD-C2D	2.52	1.56	1.50
2	B	750	HEM	CAA-C2A	2.49	1.55	1.52
4	A	800	JK4	F16-C14	-2.48	1.32	1.37
2	A	750	HEM	C3C-CAC	2.30	1.52	1.47
2	B	750	HEM	CMA-C3A	2.30	1.56	1.51
4	B	800	JK4	F15-C14	-2.20	1.32	1.37
2	B	750	HEM	C1A-NA	2.09	1.40	1.36
2	B	750	HEM	C4A-NA	2.08	1.40	1.36
3	A	760	H4B	C2-N2	2.04	1.38	1.33

All (54) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	760	H4B	C4-C4A-N5	7.52	125.43	119.12
4	B	800	JK4	C02-N01-C06	7.34	123.66	118.10
2	A	750	HEM	CBA-CAA-C2A	-7.31	100.14	112.62

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	800	JK4	C02-N01-C06	6.42	122.97	118.10
3	B	760	H4B	C8A-C4A-C4	6.41	120.26	114.57
2	B	750	HEM	CBA-CAA-C2A	-5.11	103.90	112.62
3	A	760	H4B	N1-C2-N3	-5.07	117.47	125.42
2	B	750	HEM	C4B-C3B-C2B	4.42	110.63	107.11
3	A	760	H4B	C2-N1-C8A	4.37	124.33	114.54
4	B	800	JK4	F23-C23-C22	-4.31	112.24	118.30
2	A	750	HEM	C2C-C3C-C4C	4.25	109.87	106.90
2	B	750	HEM	C4D-ND-C1D	4.04	109.25	105.07
4	B	800	JK4	F22-C22-C21	3.81	125.95	118.92
3	B	760	H4B	C2-N3-C4	3.78	121.94	115.93
4	A	800	JK4	F23-C23-C24	3.60	126.62	118.59
4	A	800	JK4	C5'-N1'-C2'	3.59	113.89	105.42
2	B	750	HEM	CHC-C4B-NB	3.55	128.29	124.43
4	B	800	JK4	F23-C23-C24	3.52	126.44	118.59
4	B	800	JK4	C04-C05-C06	-3.37	118.11	120.32
4	A	800	JK4	C11-N12-C13	3.35	120.12	113.35
4	B	800	JK4	F22-C22-C23	-3.35	112.15	119.11
4	A	800	JK4	F23-C23-C22	-3.34	113.60	118.30
2	A	750	HEM	C4D-ND-C1D	3.25	108.44	105.07
4	A	800	JK4	C05-C06-N01	-3.21	119.49	122.90
3	A	760	H4B	C2-N3-C4	3.20	121.01	115.93
3	B	760	H4B	N1-C2-N3	-3.18	120.44	125.42
3	A	760	H4B	N2-C2-N3	2.97	121.87	117.25
2	B	750	HEM	CBB-CAB-C3B	-2.97	112.85	127.62
2	B	750	HEM	CBD-CAD-C3D	-2.97	104.38	112.63
4	B	800	JK4	C11-N12-C13	2.92	119.26	113.35
2	B	750	HEM	C2C-C3C-C4C	2.92	108.94	106.90
4	B	800	JK4	C10-C11-N12	2.89	118.53	111.44
3	B	760	H4B	C4-C4A-N5	2.79	121.47	119.12
3	B	760	H4B	C2-N1-C8A	2.69	120.56	114.54
4	B	800	JK4	C05-C06-N01	-2.66	120.08	122.90
4	B	800	JK4	C5'-N1'-C2'	2.65	111.67	105.42
2	A	750	HEM	CHA-C4D-ND	2.65	127.65	124.38
2	A	750	HEM	CMC-C2C-C3C	2.55	129.45	124.68
2	B	750	HEM	CHB-C1B-NB	2.41	127.36	124.38
3	A	760	H4B	C8A-C4A-C4	2.38	116.69	114.57
2	B	750	HEM	CMD-C2D-C1D	2.36	128.63	125.04
2	A	750	HEM	C4B-C3B-C2B	2.33	108.97	107.11
4	A	800	JK4	F22-C22-C21	2.32	123.19	118.92
3	B	760	H4B	C4A-C4-N3	-2.23	117.67	124.01
2	A	750	HEM	CHA-C4D-C3D	-2.23	121.15	125.33

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	760	H4B	N2-C2-N1	2.19	120.66	117.25
4	B	800	JK4	C26-C25-C24	-2.19	117.14	120.25
4	A	800	JK4	F22-C22-C23	-2.18	114.57	119.11
4	B	800	JK4	N02-C02-N01	2.14	119.87	116.49
4	A	800	JK4	F16-C14-C21	2.12	113.34	110.31
2	A	750	HEM	CAB-C3B-C2B	-2.11	121.65	128.60
2	A	750	HEM	CMD-C2D-C1D	2.05	128.16	125.04
2	B	750	HEM	C3C-C4C-NC	-2.04	107.08	110.94
2	A	750	HEM	CHC-C4B-C3B	2.02	127.66	124.57

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	750	HEM	C2B-C3B-CAB-CBB
2	B	750	HEM	C4B-C3B-CAB-CBB
4	A	800	JK4	N01-C06-C08-C4'
4	A	800	JK4	C2'-C3'-O09-C10
4	B	800	JK4	N01-C06-C08-C4'
4	A	800	JK4	C4'-C3'-O09-C10
4	A	800	JK4	O09-C10-C11-N12
4	A	800	JK4	C14-C13-N12-C11
2	B	750	HEM	CAA-CBA-CGA-O2A
2	B	750	HEM	CAA-CBA-CGA-O1A
2	A	750	HEM	CAD-CBD-CGD-O2D
2	A	750	HEM	CAD-CBD-CGD-O1D
4	A	800	JK4	C05-C06-C08-C4'

There are no ring outliers.
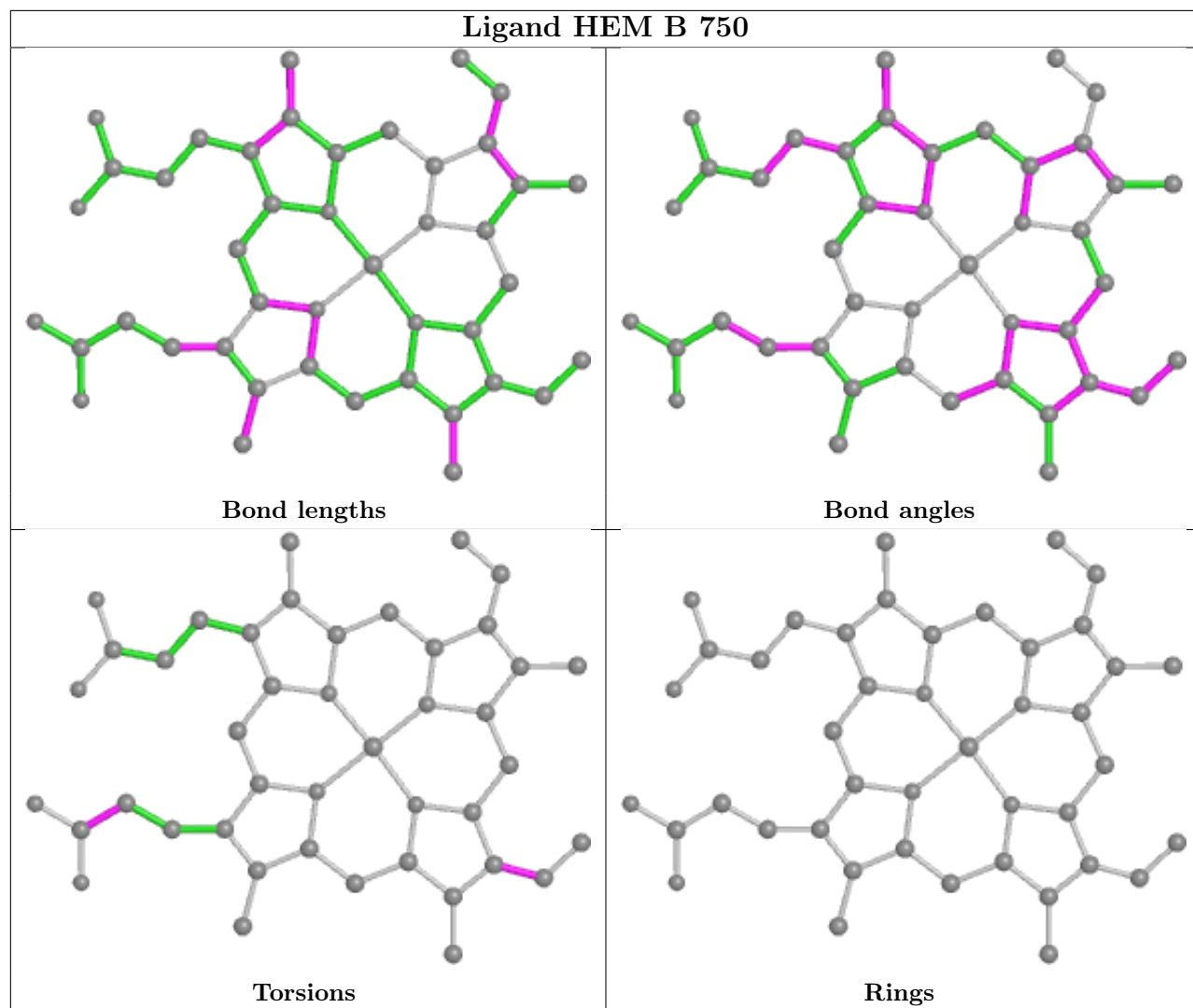
5 monomers are involved in 19 short contacts:

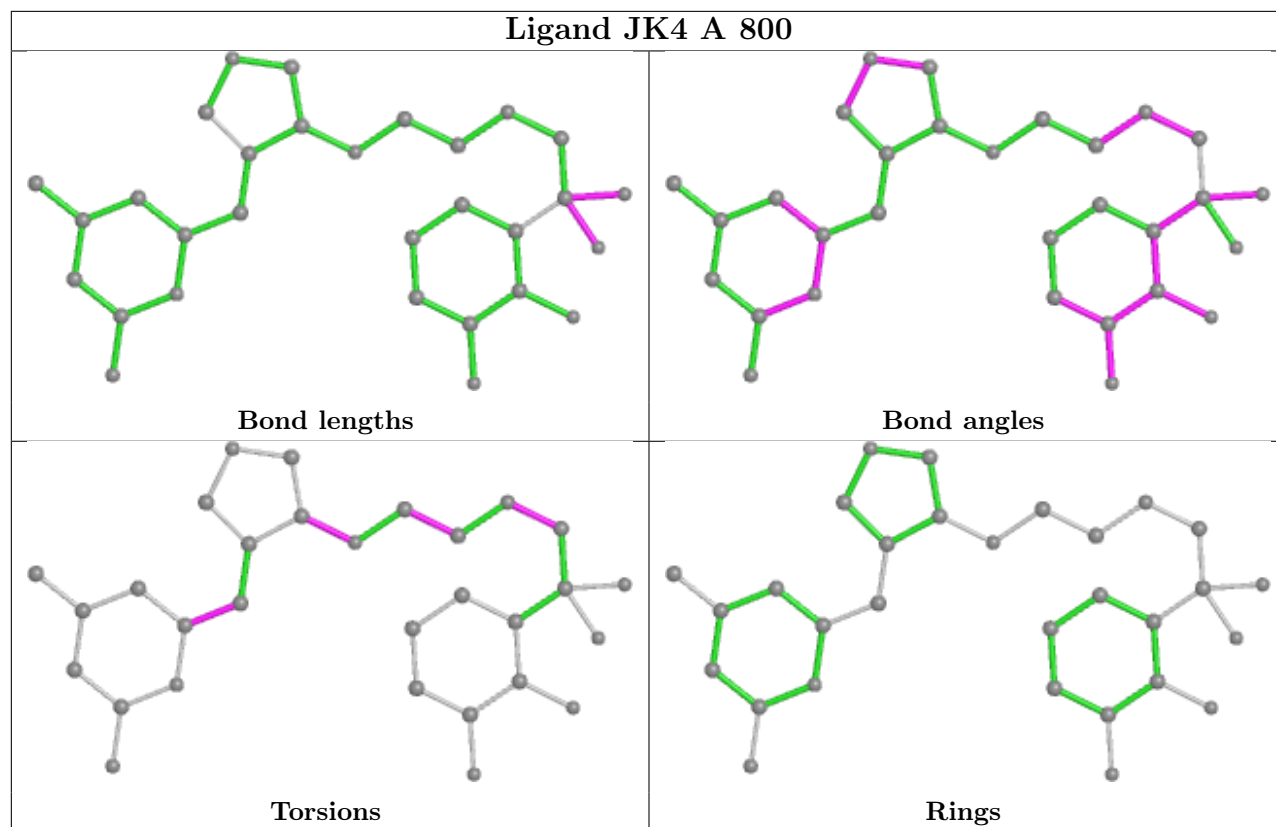| Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	750	HEM	3	0
3	B	760	H4B	1	0
4	B	800	JK4	5	0
2	B	750	HEM	8	0
4	A	800	JK4	5	0

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 then 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.

Ligand HEM A 750

Bond lengths

Bond angles

Torsions

Rings

Ligand JK4 B 800

Bond lengths

Bond angles

Torsions

Rings

Ligand HEM B 750

Bond lengths

Bond angles

Torsions

Rings

Ligand JK4 A 800

Bond lengths

Bond angles

Torsions

Rings
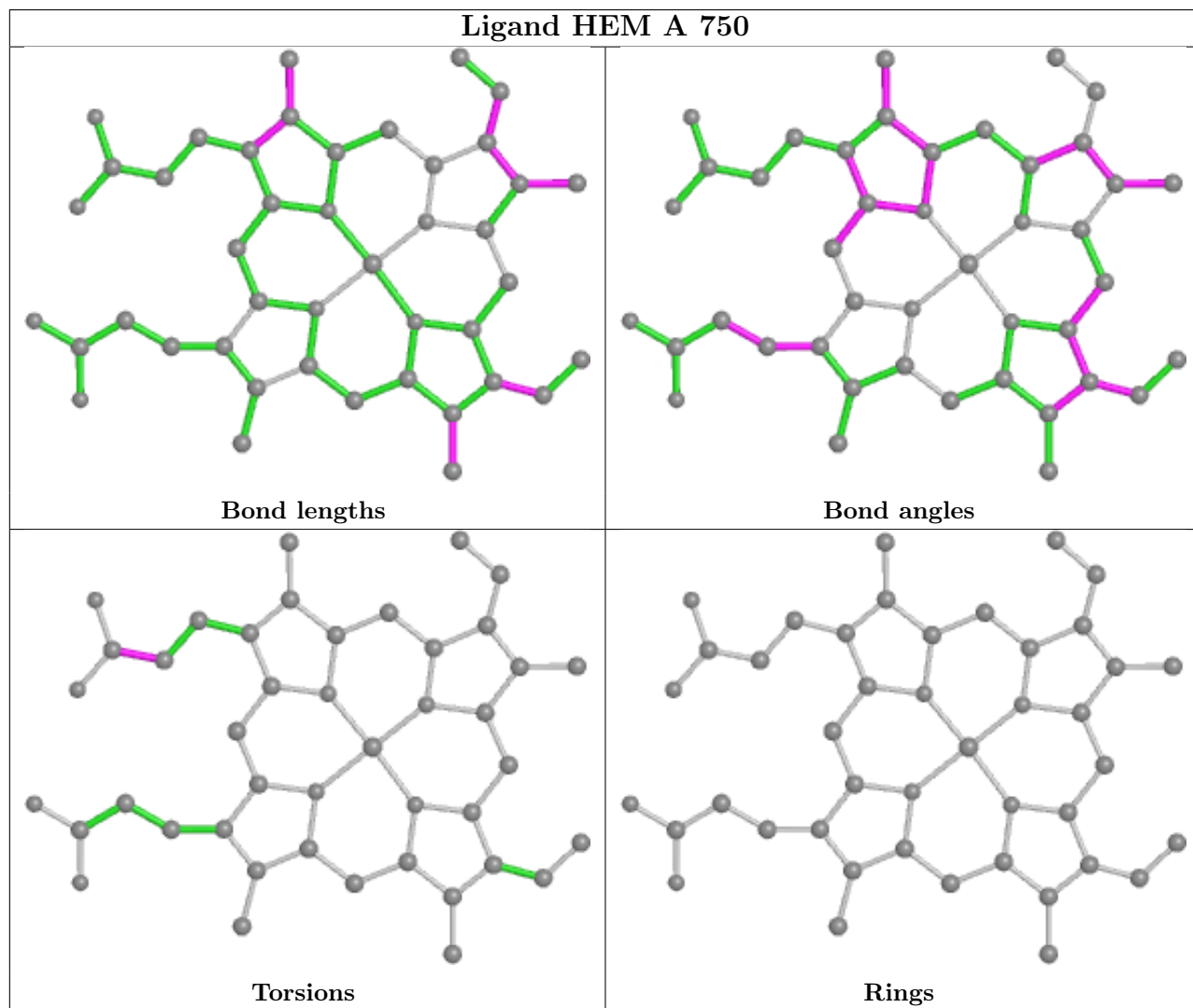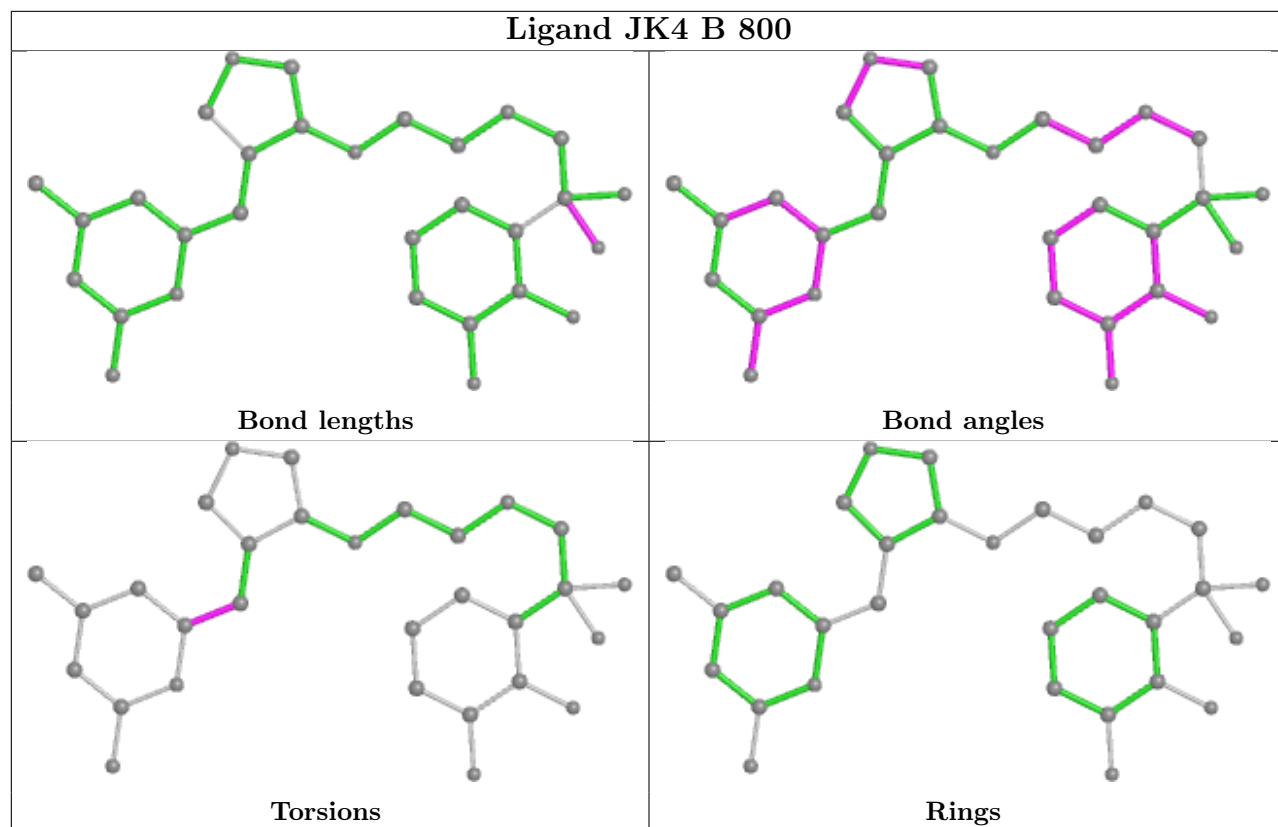
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å²)	Q<0.9
1	A	407/422 (96%)	0.82	56 (13%)	2	3	36, 65, 105, 134	0
1	B	411/422 (97%)	0.60	39 (9%)	8	8	33, 55, 83, 111	0
All	All	818/844 (96%)	0.71	95 (11%)	4	5	33, 59, 100, 134	0

All (95) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	488	PRO	9.2
1	B	300	PHE	6.3
1	B	351	LYS	5.8
1	A	351	LYS	5.8
1	A	715	VAL	5.7
1	B	350	THR	5.6
1	B	348	VAL	5.5
1	A	716	TRP	5.3
1	A	373	GLY	5.0
1	B	352	ASP	5.0
1	A	350	THR	4.3
1	B	619	ARG	4.2
1	A	300	PHE	4.1
1	B	718	GLY	4.1
1	A	713	THR	3.9
1	A	318	LEU	3.9
1	A	486	LYS	3.6
1	B	353	GLN	3.6
1	A	554	PHE	3.5
1	A	493	LEU	3.4
1	A	370	LYS	3.4
1	A	485	TYR	3.3
1	A	299	ARG	3.2
1	A	487	GLN	3.2

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	385	ASN	3.1
1	B	677	VAL	3.1
1	B	680	VAL	3.1
1	A	355	PHE	3.1
1	A	352	ASP	3.0
1	A	494	GLY	3.0
1	A	714	HIS	2.9
1	A	389	GLU	2.9
1	A	469	LYS	2.9
1	B	479	LEU	2.9
1	B	620	LYS	2.9
1	B	591	THR	2.9
1	A	507	GLN	2.8
1	A	381	LEU	2.8
1	A	676	TRP	2.8
1	B	717	LYS	2.8
1	B	593	ILE	2.8
1	A	706	TYR	2.7
1	B	392	SER	2.7
1	A	553	TRP	2.6
1	A	503	GLU	2.6
1	A	415	CYS	2.6
1	B	349	ARG	2.6
1	A	536	ILE	2.6
1	A	678	TRP	2.6
1	B	567	VAL	2.5
1	B	480	ILE	2.5
1	B	443	CYS	2.5
1	B	442	ILE	2.5
1	A	388	ILE	2.5
1	A	712	ASN	2.5
1	A	479	LEU	2.5
1	B	564	LEU	2.4
1	A	504	ILE	2.4
1	B	446	VAL	2.4
1	A	480	ILE	2.4
1	B	541	VAL	2.3
1	A	492	THR	2.3
1	B	375	LYS	2.3
1	A	677	VAL	2.3
1	A	394	TYR	2.3
1	A	680	VAL	2.3

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	552	ASP	2.3
1	A	514	ARG	2.3
1	A	533	LEU	2.3
1	A	681	PRO	2.2
1	B	681	PRO	2.2
1	B	676	TRP	2.2
1	B	678	TRP	2.2
1	A	361	PHE	2.2
1	B	584	PHE	2.2
1	B	667	ARG	2.2
1	A	567	VAL	2.1
1	B	369	ILE	2.1
1	B	696	LEU	2.1
1	B	355	PHE	2.1
1	B	492	THR	2.1
1	B	583	PRO	2.1
1	A	490	GLY	2.1
1	A	390	SER	2.1
1	A	378	MET	2.1
1	B	616	LEU	2.1
1	A	691	PHE	2.1
1	A	506	ILE	2.0
1	A	393	THR	2.0
1	A	491	SER	2.0
1	A	369	ILE	2.0
1	A	392	SER	2.0
1	B	566	ALA	2.0
1	A	371	ARG	2.0
1	B	690	VAL	2.0

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

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

6.3 Carbohydrates ⓘ

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	JK4	B	800	30/30	0.73	0.28	61,68,73,78	0
4	JK4	A	800	30/30	0.75	0.31	73,90,96,96	0
3	H4B	A	760	17/17	0.91	0.18	45,52,58,58	0
3	H4B	B	760	17/17	0.93	0.21	39,44,51,54	0
5	ACT	B	860	4/4	0.95	0.12	67,68,68,69	0
5	ACT	A	860	4/4	0.97	0.12	67,67,68,68	0
2	HEM	A	750	43/43	0.97	0.21	37,45,59,67	0
2	HEM	B	750	43/43	0.98	0.20	38,45,55,59	0
6	ZN	A	900	1/1	0.99	0.12	56,56,56,56	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.
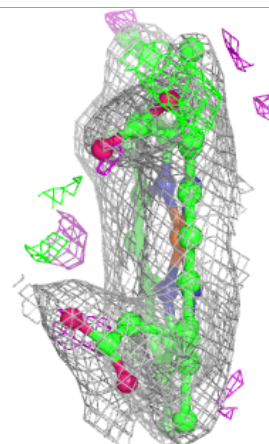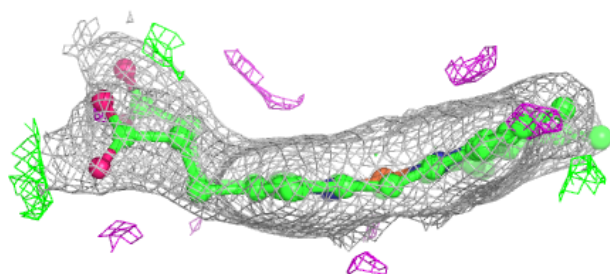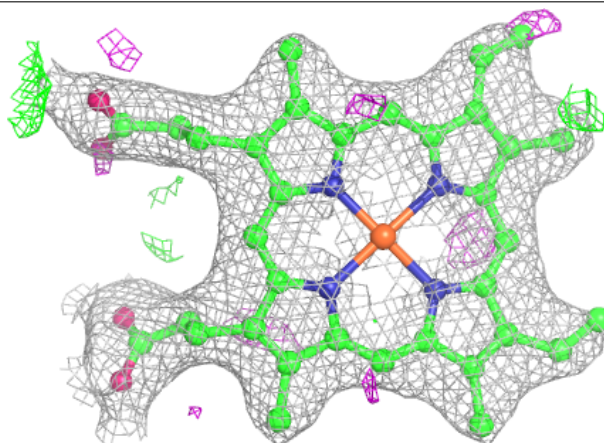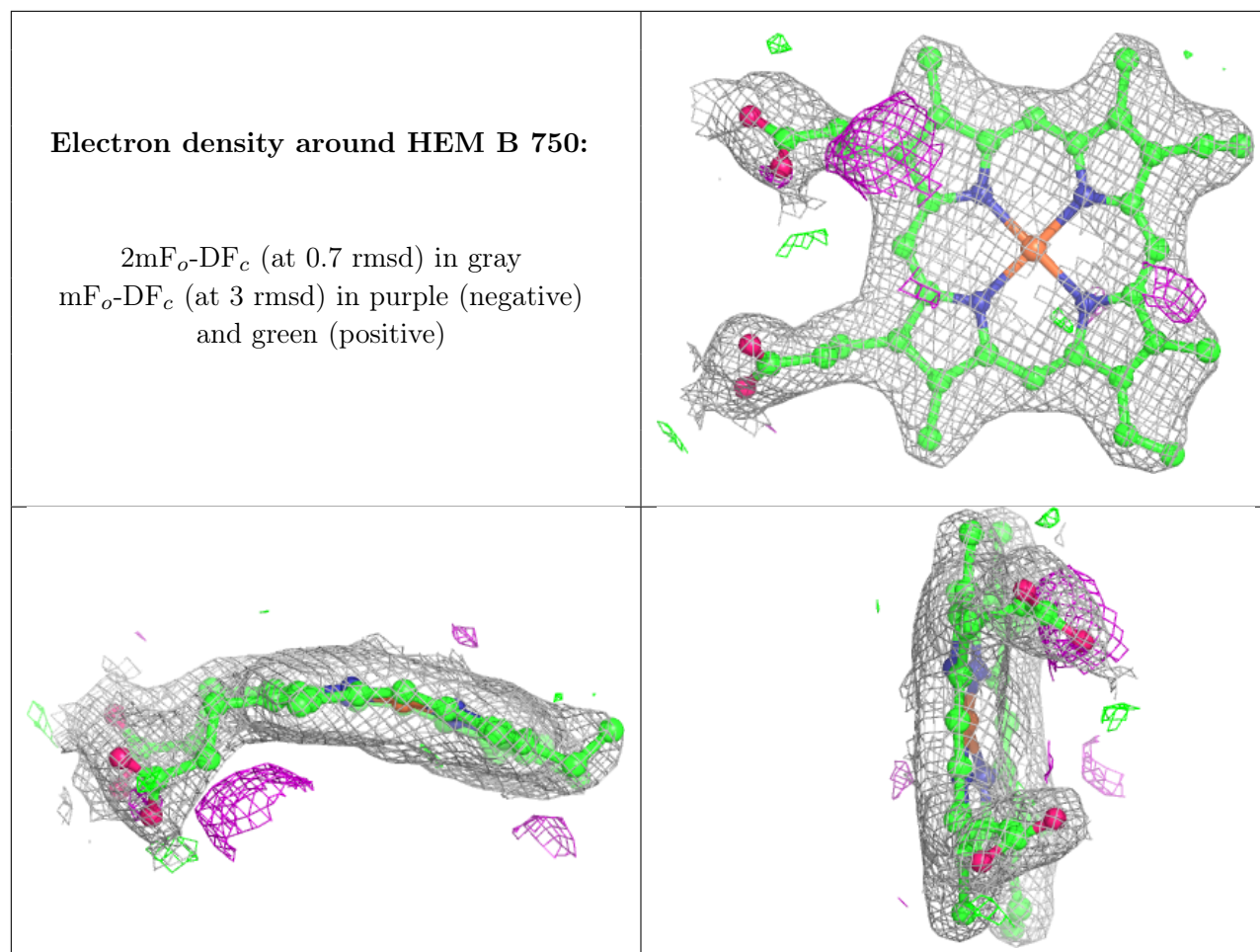

Electron density around JK4 B 800:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)
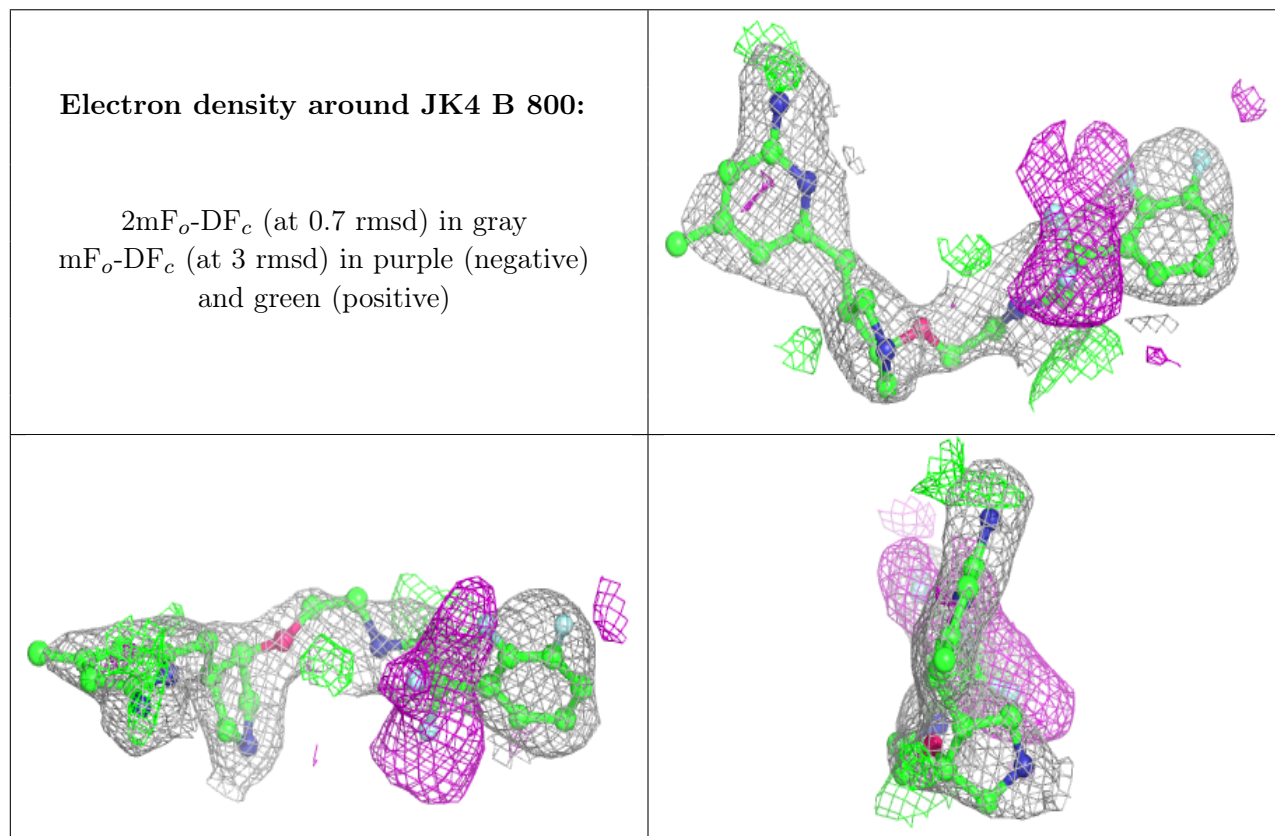
Electron density around JK4 A 800:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
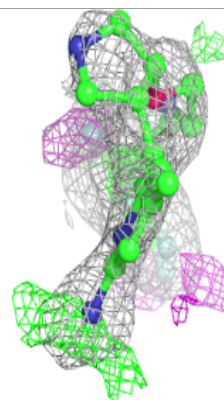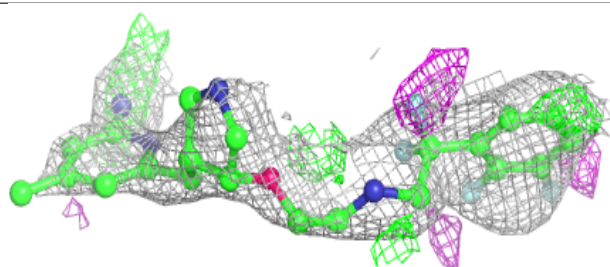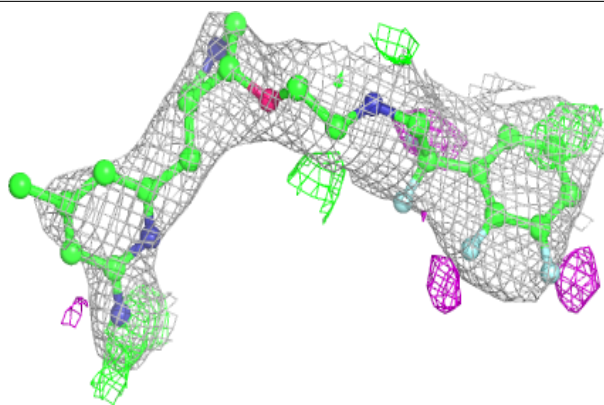
Electron density around HEM A 750:

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 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 ⓘ

There are no such residues in this entry.