Full wwPDB X-ray Structure Validation Report (i)

Jan 29, 2024 – 04:58 PM EST

PDB ID	:	1F4T
Title	:	THERMOPHILIC P450: CYP119 FROM SULFOLOBUS SOLFACTARICUS WITH 4-PHENYLIMIDAZOLE BOUND
Authors	:	Yano, J.K.; Koo, L.S.; Schuller, D.J.; Li, H.; Ortiz de Montellano, P.R.; Poulos, T.L.
Deposited on	:	2000-06-09
Resolution	:	1.93 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:

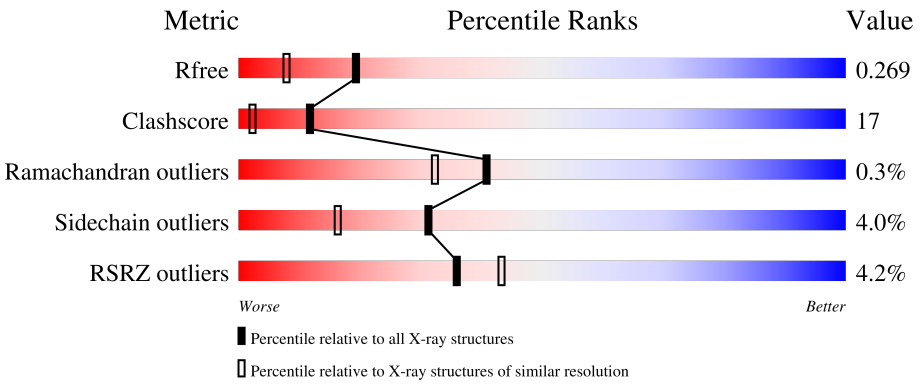
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

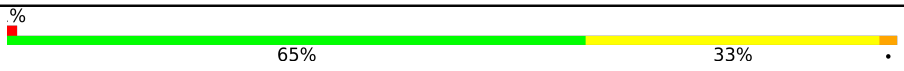
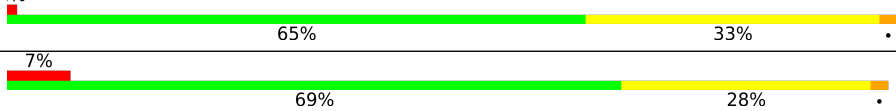
The reported resolution of this entry is 1.93 Å.

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	4310 (1.96-1.92)
Clashscore	141614	1023 (1.94-1.94)
Ramachandran outliers	138981	1007 (1.94-1.94)
Sidechain outliers	138945	1007 (1.94-1.94)
RSRZ outliers	127900	4250 (1.96-1.92)

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	368	
1	B	368	

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
3	SO4	B	369	-	-	X	-

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 6774 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.

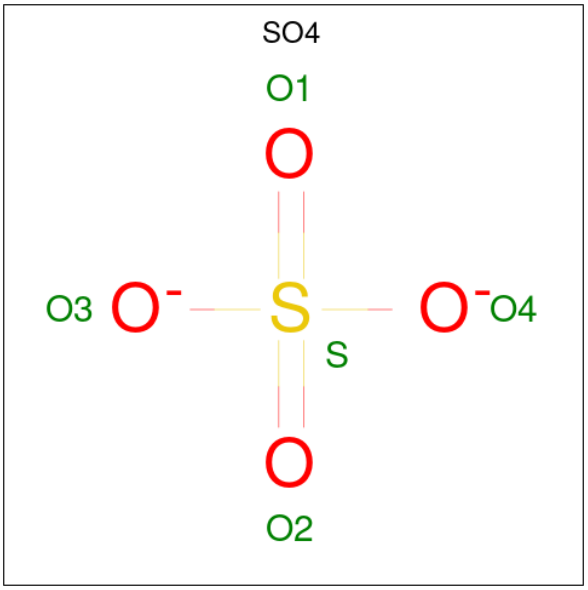
- Molecule 1 is a protein called CYTOCHROME P450 119.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	367	3018	1932	519	561	6	0	0	0
1	B	367	3018	1932	519	561	6	0	0	0

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
3	A	1	5	4	1	0	0

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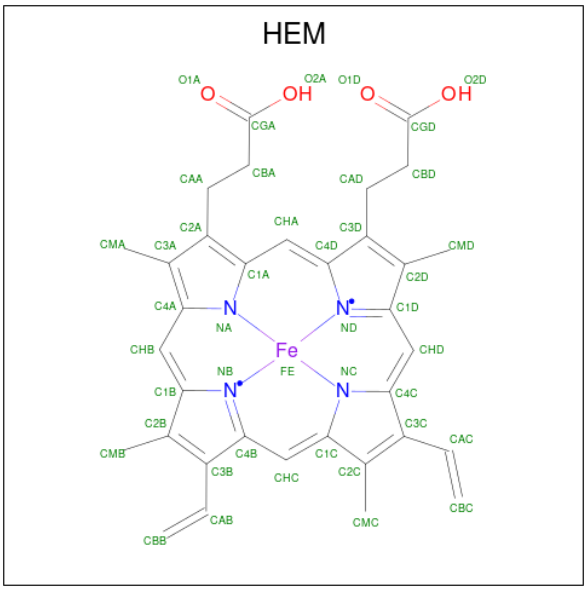
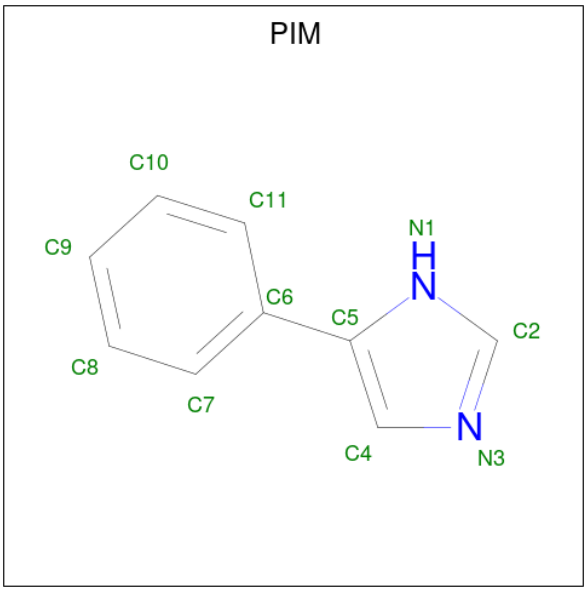
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
3	B	1	5	4	1	0	0

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

- Molecule 5 is 4-PHENYL-1H-IMIDAZOLE (three-letter code: PIM) (formula: $C_9H_8N_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	N		
5	A	1	11	9	2	0	0
			Total	C	N		
5	B	1	11	9	2	0	0

- Molecule 6 is water.

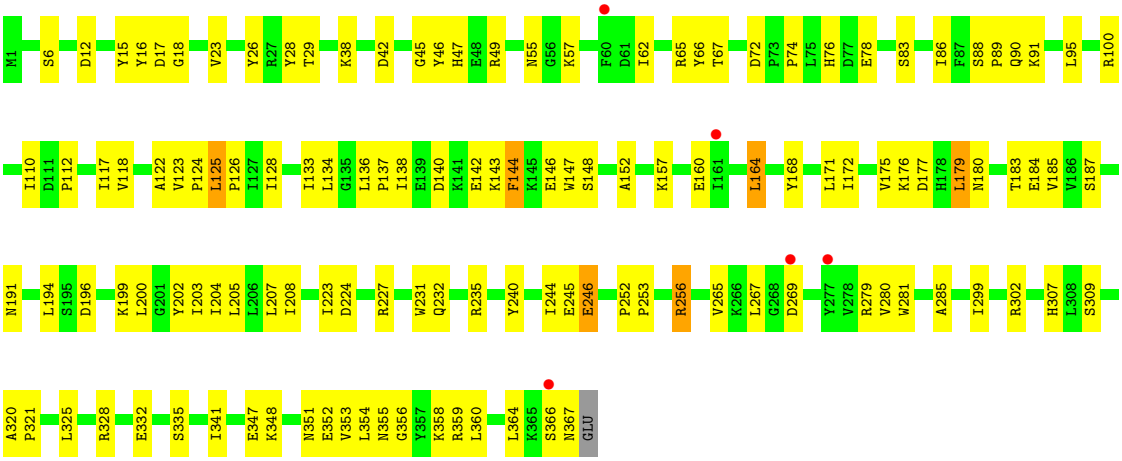
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
6	A	363	363	363	0	0
			Total	O		
6	B	256	256	256	0	0

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.

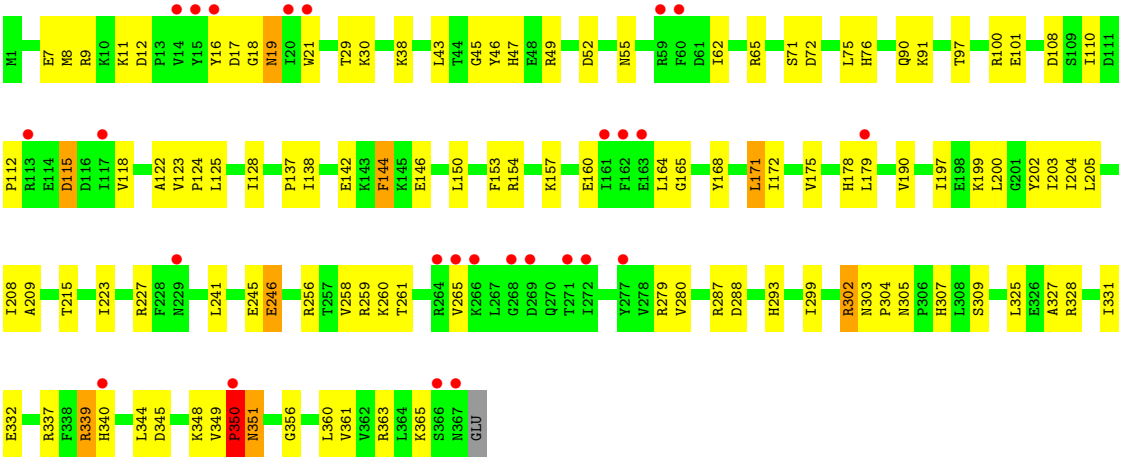
• Molecule 1: CYTOCHROME P450 119

Chain A:



• Molecule 1: CYTOCHROME P450 119

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	76.96Å 114.60Å 185.20Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.40 – 1.93 44.39 – 1.92	Depositor EDS
% Data completeness (in resolution range)	93.5 (44.40-1.93) 92.8 (44.39-1.92)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.72 (at 1.92Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.225 , 0.274 0.224 , 0.269	Depositor DCC
R_{free} test set	3121 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å^2)	30.6	Xtriage
Anisotropy	0.438	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 44.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	6774	wwPDB-VP
Average B, all atoms (Å^2)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.28% 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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, PIM, 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	0.33	0/3082	0.60	0/4165
1	B	0.33	0/3082	0.56	0/4165
All	All	0.33	0/6164	0.58	0/8330

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 (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	3018	0	3047	107	0
1	B	3018	0	3047	109	0
2	A	1	0	0	0	0
3	A	5	0	0	0	0
3	B	5	0	0	2	0
4	A	43	0	30	1	0
4	B	43	0	30	2	0
5	A	11	0	8	0	0
5	B	11	0	8	0	0
6	A	363	0	0	11	0
6	B	256	0	0	16	0
All	All	6774	0	6170	215	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 17.

All (215) 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:6:SER:HB3	6:A:760:HOH:O	1.65	0.97
1:A:47:HIS:HE1	1:A:72:ASP:H	1.18	0.91
1:B:256:ARG:HH11	1:B:279:ARG:HD2	1.39	0.86
1:A:62:ILE:HD12	1:A:164:LEU:HD13	1.63	0.80
1:A:223:ILE:O	1:A:227:ARG:HG3	1.81	0.80
1:A:47:HIS:CE1	1:A:72:ASP:H	2.00	0.79
1:B:71:SER:HB2	1:B:75:LEU:HD12	1.65	0.79
1:A:38:LYS:HD3	1:A:265:VAL:HG12	1.65	0.79
1:A:200:LEU:O	1:A:204:ILE:HG12	1.83	0.79
1:A:142:GLU:O	1:A:146:GLU:HG3	1.85	0.77
1:B:287:ARG:NH1	6:B:660:HOH:O	2.18	0.77
1:A:348:LYS:NZ	1:A:355:ASN:HD22	1.82	0.77
1:A:49:ARG:HD2	1:A:66:TYR:OH	1.86	0.76
1:B:344:LEU:HB2	1:B:361:VAL:HG23	1.67	0.75
1:B:43:LEU:HD21	1:B:260:LYS:HB2	1.69	0.74
1:B:7:GLU:HG3	1:B:11:LYS:NZ	2.03	0.74
1:A:246:GLU:HG3	1:A:299:ILE:O	1.89	0.72
1:A:196:ASP:O	1:A:200:LEU:HD13	1.89	0.71
1:B:246:GLU:HG3	1:B:299:ILE:O	1.89	0.71
1:B:47:HIS:CE1	1:B:72:ASP:H	2.09	0.70
1:B:47:HIS:HE1	1:B:72:ASP:H	1.40	0.70
1:A:235:ARG:HH11	1:A:335:SER:HB2	1.55	0.70
1:A:207:LEU:O	1:A:207:LEU:HD23	1.91	0.70
1:A:29:THR:HG23	1:A:280:VAL:CG1	2.21	0.70
1:B:171:LEU:HD21	1:B:208:ILE:HD11	1.73	0.69
1:B:204:ILE:HG23	1:B:208:ILE:HD12	1.75	0.68
1:A:62:ILE:CD1	1:A:164:LEU:HD13	2.24	0.68
1:A:267:LEU:HD21	6:A:689:HOH:O	1.92	0.68
1:A:223:ILE:HG22	1:A:227:ARG:HD2	1.76	0.67
1:A:348:LYS:HZ1	1:A:355:ASN:HD22	1.43	0.67
1:B:100:ARG:NH1	6:B:548:HOH:O	2.27	0.67
1:B:90:GLN:HB2	6:B:575:HOH:O	1.94	0.66
1:A:74:PRO:O	1:A:78:GLU:HG3	1.95	0.66
1:A:224:ASP:HA	1:A:227:ARG:HD3	1.77	0.66
1:B:345:ASP:O	1:B:361:VAL:HG22	1.96	0.66
1:B:256:ARG:NH1	1:B:279:ARG:HD2	2.10	0.66
1:A:207:LEU:HD22	1:A:208:ILE:HG13	1.78	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:144:PHE:CZ	1:A:207:LEU:HD21	2.31	0.65
1:A:140:ASP:OD2	1:A:143:LYS:HE2	1.97	0.64
1:B:52:ASP:HA	1:B:55:ASN:ND2	2.13	0.64
1:B:29:THR:HG23	1:B:280:VAL:CG1	2.28	0.64
1:A:348:LYS:NZ	1:A:355:ASN:ND2	2.46	0.63
1:A:23:VAL:HG11	6:A:689:HOH:O	2.00	0.62
1:A:45:GLY:O	1:A:49:ARG:HG2	1.99	0.62
1:B:302:ARG:HG2	1:B:305:ASN:ND2	2.14	0.61
1:A:133:ILE:O	1:A:183:THR:HG21	2.00	0.61
1:B:307:HIS:HD2	1:B:309:SER:H	1.49	0.61
1:B:29:THR:HG23	1:B:280:VAL:HG13	1.83	0.61
1:B:339:ARG:NE	1:B:340:HIS:H	1.99	0.60
1:B:223:ILE:HG22	1:B:227:ARG:CD	2.31	0.60
1:A:76:HIS:HD2	6:A:693:HOH:O	1.85	0.59
1:A:352:GLU:HB3	6:A:772:HOH:O	2.01	0.59
1:B:123:VAL:HB	1:B:124:PRO:HD3	1.83	0.59
1:A:194:LEU:O	1:A:199:LYS:HE3	2.03	0.59
1:B:38:LYS:HD3	1:B:265:VAL:HG11	1.84	0.59
1:B:245:GLU:OE1	1:B:307:HIS:HE1	1.87	0.58
1:B:142:GLU:O	1:B:146:GLU:HG3	2.03	0.58
1:B:138:ILE:HG23	1:B:144:PHE:HD1	1.68	0.58
1:B:303:ASN:ND2	1:B:304:PRO:HA	2.19	0.57
1:A:240:TYR:O	1:A:244:ILE:HG12	2.03	0.57
1:B:138:ILE:HA	1:B:144:PHE:CE1	2.40	0.57
1:B:7:GLU:HG3	1:B:11:LYS:HZ2	1.68	0.57
1:B:241:LEU:HD13	1:B:328:ARG:NH1	2.20	0.57
1:B:49:ARG:CZ	6:B:638:HOH:O	2.53	0.57
1:B:76:HIS:HE1	4:B:410:HEM:O2D	1.88	0.57
1:B:339:ARG:HE	1:B:339:ARG:HA	1.69	0.57
1:B:197:ILE:HG12	6:B:438:HOH:O	2.05	0.56
1:B:223:ILE:HD11	1:B:360:LEU:HG	1.86	0.56
1:B:52:ASP:HA	1:B:55:ASN:HD21	1.71	0.56
1:B:246:GLU:CG	1:B:299:ILE:O	2.53	0.56
1:A:176:LYS:HA	1:A:179:LEU:CD2	2.36	0.56
1:A:148:SER:HA	1:A:208:ILE:HG23	1.87	0.56
1:A:256:ARG:HB3	1:A:281:TRP:HA	1.88	0.56
1:B:350:PRO:O	1:B:351:ASN:O	2.25	0.55
1:B:43:LEU:CD2	1:B:260:LYS:HB2	2.35	0.55
1:A:245:GLU:OE1	1:A:307:HIS:HE1	1.89	0.55
1:B:150:LEU:HD13	3:B:369:SO4:O4	2.07	0.55
1:B:49:ARG:NH1	1:B:65:ARG:HH12	2.05	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:348:LYS:HZ1	1:A:355:ASN:ND2	2.04	0.54
1:A:12:ASP:HB3	1:A:15:TYR:HB2	1.90	0.54
1:B:9:ARG:HD2	6:B:460:HOH:O	2.06	0.54
1:A:351:ASN:OD1	1:A:353:VAL:HG12	2.08	0.54
1:B:122:ALA:HB1	1:B:215:THR:HG23	1.89	0.54
1:B:349:VAL:HG13	1:B:350:PRO:HD2	1.90	0.54
1:A:90:GLN:CD	1:A:90:GLN:H	2.12	0.54
1:A:95:LEU:HD11	1:A:133:ILE:HG12	1.90	0.53
1:A:347:GLU:OE1	1:A:359:ARG:NH1	2.40	0.53
1:B:157:LYS:HD3	1:B:160:GLU:OE2	2.08	0.53
1:B:345:ASP:H	1:B:361:VAL:CG2	2.22	0.53
1:A:67:THR:HB	1:A:205:LEU:HD22	1.91	0.53
1:A:144:PHE:HZ	1:A:207:LEU:HD21	1.73	0.53
1:B:205:LEU:HD21	4:B:410:HEM:HMD3	1.91	0.53
1:A:172:ILE:HG23	1:A:200:LEU:HD23	1.91	0.52
1:A:148:SER:HA	1:A:208:ILE:CG2	2.40	0.52
1:B:241:LEU:HD13	1:B:328:ARG:HH11	1.74	0.52
1:A:28:TYR:HB3	6:A:689:HOH:O	2.09	0.52
1:A:123:VAL:HB	1:A:124:PRO:HD3	1.91	0.52
1:B:223:ILE:HG22	1:B:227:ARG:HD3	1.90	0.52
1:B:128:ILE:HA	1:B:138:ILE:HD11	1.93	0.51
1:B:223:ILE:HG22	1:B:227:ARG:HD2	1.91	0.51
1:A:140:ASP:CG	1:A:143:LYS:HG3	2.31	0.51
1:A:76:HIS:HE1	4:A:410:HEM:O2D	1.94	0.51
1:A:246:GLU:CG	1:A:299:ILE:O	2.59	0.51
1:B:110:ILE:O	1:B:112:PRO:HD3	2.11	0.51
1:A:26:TYR:HA	1:A:285:ALA:HB1	1.94	0.50
1:A:38:LYS:HB3	1:A:265:VAL:HG11	1.94	0.50
1:A:118:VAL:HA	1:A:122:ALA:HB3	1.94	0.50
1:B:363:ARG:NH2	6:B:667:HOH:O	2.43	0.50
1:B:38:LYS:HD3	1:B:265:VAL:CG1	2.42	0.50
1:B:327:ALA:O	1:B:331:ILE:HG12	2.12	0.50
1:A:341:ILE:HA	1:A:364:LEU:HD23	1.93	0.49
1:B:16:TYR:HB2	1:B:21:TRP:CZ3	2.47	0.49
1:B:30:LYS:NZ	6:B:648:HOH:O	2.41	0.49
1:B:150:LEU:HD11	1:B:154:ARG:HE	1.76	0.49
1:A:117:ILE:HD11	1:A:360:LEU:HD22	1.93	0.49
1:A:100:ARG:NH1	6:A:697:HOH:O	2.45	0.49
1:A:152:ALA:HB1	1:A:354:LEU:HD11	1.93	0.49
1:B:49:ARG:NH1	1:B:65:ARG:NH1	2.61	0.48
1:A:235:ARG:HG2	1:A:240:TYR:OH	2.13	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:256:ARG:NH1	6:B:661:HOH:O	2.45	0.48
1:B:223:ILE:CG2	1:B:227:ARG:HD2	2.43	0.48
1:B:223:ILE:HG12	1:B:360:LEU:HD11	1.93	0.48
1:A:125:LEU:HB3	1:A:126:PRO:HD3	1.95	0.48
1:A:49:ARG:HA	6:A:437:HOH:O	2.13	0.48
1:A:89:PRO:HD2	1:A:90:GLN:HE22	1.79	0.48
1:A:136:LEU:CD1	1:A:207:LEU:HD12	2.44	0.48
1:A:199:LYS:O	1:A:203:ILE:HG12	2.13	0.48
1:B:303:ASN:HD22	1:B:304:PRO:HA	1.78	0.48
1:A:42:ASP:OD1	1:A:47:HIS:HB2	2.14	0.48
1:B:16:TYR:HB2	1:B:21:TRP:CE3	2.49	0.48
1:B:118:VAL:HA	1:B:122:ALA:HB3	1.95	0.48
1:B:165:GLY:HA3	3:B:369:SO4:O1	2.13	0.48
1:A:83:SER:O	1:A:86:ILE:HG22	2.14	0.48
1:A:136:LEU:HD13	1:A:207:LEU:HD12	1.95	0.48
1:A:62:ILE:HB	1:A:65:ARG:HG3	1.96	0.47
1:A:88:SER:OG	1:A:91:LYS:HG3	2.14	0.47
1:B:17:ASP:OD1	1:B:19:ASN:HB3	2.13	0.47
1:B:38:LYS:O	1:B:261:THR:HA	2.14	0.47
1:B:178:HIS:HB3	6:B:577:HOH:O	2.14	0.47
1:A:175:VAL:O	1:A:179:LEU:HD13	2.15	0.47
1:B:16:TYR:CZ	1:B:18:GLY:HA2	2.50	0.47
1:A:366:SER:O	1:A:367:ASN:HB2	2.15	0.47
1:B:246:GLU:OE1	1:B:246:GLU:HA	2.15	0.47
1:A:86:ILE:HG13	1:A:185:VAL:HG21	1.96	0.47
1:B:45:GLY:HA2	6:B:419:HOH:O	2.15	0.47
1:A:110:ILE:O	1:A:112:PRO:HD3	2.15	0.47
1:A:307:HIS:HD2	1:A:309:SER:H	1.61	0.47
1:A:90:GLN:H	1:A:90:GLN:NE2	2.12	0.46
1:A:328:ARG:HD3	1:A:332:GLU:OE2	2.15	0.46
1:A:175:VAL:O	1:A:179:LEU:HD22	2.16	0.46
1:B:256:ARG:HH11	1:B:279:ARG:CD	2.20	0.46
1:A:320:ALA:HB3	1:A:321:PRO:HD3	1.98	0.46
1:A:147:TRP:HB3	1:A:208:ILE:HD13	1.97	0.46
1:B:227:ARG:HG2	6:B:518:HOH:O	2.16	0.46
1:A:328:ARG:O	1:A:332:GLU:HB2	2.15	0.46
1:B:138:ILE:HG12	1:B:144:PHE:CE1	2.51	0.45
1:A:55:ASN:OD1	1:A:57:LYS:HG3	2.17	0.45
1:B:179:LEU:HG	1:B:190:VAL:CG2	2.47	0.45
1:B:150:LEU:O	1:B:153:PHE:HB3	2.16	0.45
1:B:258:VAL:HG12	1:B:259:ARG:N	2.31	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:177:ASP:HB3	1:B:137:PRO:HG3	1.98	0.45
1:B:90:GLN:HG2	1:B:91:LYS:N	2.32	0.45
1:A:134:LEU:O	1:A:183:THR:HG22	2.17	0.45
1:B:171:LEU:HD11	1:B:208:ILE:CD1	2.47	0.45
1:A:207:LEU:HD22	1:A:208:ILE:CG1	2.47	0.44
1:B:199:LYS:O	1:B:203:ILE:HG12	2.17	0.44
1:B:328:ARG:O	1:B:332:GLU:HG3	2.17	0.44
1:A:348:LYS:HD2	1:A:356:GLY:O	2.18	0.44
1:B:293:HIS:HD2	6:B:626:HOH:O	2.00	0.44
1:A:347:GLU:OE2	1:A:358:LYS:HD3	2.18	0.44
1:A:136:LEU:HA	1:A:137:PRO:HD3	1.72	0.44
1:B:348:LYS:HE3	1:B:356:GLY:O	2.18	0.44
1:B:179:LEU:HG	1:B:190:VAL:HG21	1.98	0.44
1:A:15:TYR:CE1	1:A:17:ASP:HB3	2.53	0.43
1:A:176:LYS:HA	1:A:179:LEU:HD22	2.00	0.43
1:A:175:VAL:HG21	1:A:204:ILE:CD1	2.47	0.43
1:B:49:ARG:NE	6:B:638:HOH:O	2.51	0.43
1:B:287:ARG:CZ	6:B:660:HOH:O	2.63	0.43
1:A:183:THR:OG1	1:A:184:GLU:N	2.51	0.43
1:B:62:ILE:CD1	1:B:164:LEU:HD13	2.49	0.43
1:B:138:ILE:HA	1:B:144:PHE:HE1	1.82	0.43
1:B:340:HIS:HB2	1:B:365:LYS:HG3	2.00	0.43
1:A:16:TYR:CE2	1:A:18:GLY:HA2	2.54	0.43
1:B:62:ILE:HB	1:B:65:ARG:HG3	2.01	0.43
1:A:231:TRP:N	6:A:755:HOH:O	2.52	0.43
1:B:108:ASP:OD2	1:B:337:ARG:NH1	2.52	0.43
1:B:227:ARG:NH1	6:B:656:HOH:O	2.49	0.43
1:B:205:LEU:O	1:B:209:ALA:HB3	2.19	0.42
1:A:207:LEU:HD23	1:A:207:LEU:C	2.39	0.42
1:A:29:THR:HG23	1:A:280:VAL:HG12	1.98	0.42
1:B:246:GLU:HG3	1:B:299:ILE:C	2.40	0.42
1:B:62:ILE:HD13	1:B:164:LEU:HD13	2.01	0.42
1:A:232:GLN:NE2	6:A:564:HOH:O	2.41	0.42
1:B:97:THR:O	1:B:101:GLU:HG3	2.20	0.42
1:A:176:LYS:HE3	1:A:200:LEU:HD21	2.02	0.42
1:A:180:ASN:ND2	6:A:659:HOH:O	2.53	0.42
1:B:345:ASP:H	1:B:361:VAL:HG23	1.83	0.42
1:B:172:ILE:HG23	1:B:200:LEU:HD21	2.01	0.42
1:A:187:SER:O	1:A:191:ASN:ND2	2.53	0.41
1:B:9:ARG:HD3	1:B:288:ASP:HA	2.02	0.41
1:B:8:MET:O	1:B:12:ASP:C	2.58	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:175:VAL:CG1	1:A:179:LEU:HD11	2.51	0.41
1:A:348:LYS:HE3	1:A:348:LYS:HB3	1.85	0.41
1:B:115:ASP:O	1:B:361:VAL:HA	2.21	0.41
1:A:128:ILE:HA	1:A:138:ILE:HD11	2.03	0.41
1:A:246:GLU:OE1	1:A:246:GLU:HA	2.21	0.41
1:B:223:ILE:HD11	1:B:360:LEU:CG	2.51	0.41
1:B:7:GLU:HG2	1:B:11:LYS:HD3	2.03	0.41
1:B:171:LEU:O	1:B:175:VAL:HG23	2.20	0.41
1:B:349:VAL:CG1	1:B:350:PRO:HD2	2.51	0.41
1:B:179:LEU:HD11	1:B:203:ILE:HG13	2.03	0.41
1:A:157:LYS:HD3	1:A:160:GLU:OE2	2.21	0.40
1:A:246:GLU:HG3	1:A:299:ILE:C	2.42	0.40
1:A:38:LYS:HD3	1:A:265:VAL:CG1	2.44	0.40
1:A:252:PRO:HA	1:A:253:PRO:HD3	1.85	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	365/368 (99%)	351 (96%)	14 (4%)	0	100	100
1	B	365/368 (99%)	344 (94%)	19 (5%)	2 (0%)	29	17
All	All	730/736 (99%)	695 (95%)	33 (4%)	2 (0%)	41	32

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	351	ASN
1	B	350	PRO

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	337/338 (100%)	323 (96%)	14 (4%)	30	14
1	B	337/338 (100%)	324 (96%)	13 (4%)	32	17
All	All	674/676 (100%)	647 (96%)	27 (4%)	31	16

All (27) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	46	TYR
1	A	125	LEU
1	A	144	PHE
1	A	164	LEU
1	A	168	TYR
1	A	171	LEU
1	A	179	LEU
1	A	202	TYR
1	A	246	GLU
1	A	256	ARG
1	A	269	ASP
1	A	279	ARG
1	A	302	ARG
1	A	325	LEU
1	B	19	ASN
1	B	46	TYR
1	B	115	ASP
1	B	125	LEU
1	B	144	PHE
1	B	168	TYR
1	B	171	LEU
1	B	202	TYR
1	B	246	GLU
1	B	302	ARG
1	B	325	LEU
1	B	339	ARG
1	B	350	PRO

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	19	ASN
1	A	34	ASN
1	A	47	HIS
1	A	76	HIS
1	A	90	GLN
1	A	180	ASN
1	A	191	ASN
1	A	307	HIS
1	A	355	ASN
1	B	19	ASN
1	B	34	ASN
1	B	47	HIS
1	B	76	HIS
1	B	229	ASN
1	B	232	GLN
1	B	303	ASN
1	B	307	HIS
1	B	355	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	$\#\|Z\| > 2$
3	SO4	B	369	-	4,4,4	0.66	0	6,6,6	0.39	0
4	HEM	A	410	5,1	41,50,50	1.31	6 (14%)	45,82,82	1.17	4 (8%)
5	PIM	A	411	4	9,12,12	2.21	4 (44%)	7,15,15	1.82	3 (42%)
3	SO4	A	370	-	4,4,4	0.64	0	6,6,6	0.37	0
5	PIM	B	411	4	9,12,12	2.27	4 (44%)	7,15,15	1.79	2 (28%)
4	HEM	B	410	5,1	41,50,50	1.47	7 (17%)	45,82,82	1.02	2 (4%)

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	PIM	A	411	4	-	0/0/4/4	0/2/2/2
4	HEM	A	410	5,1	-	0/12/54/54	-
5	PIM	B	411	4	-	0/0/4/4	0/2/2/2
4	HEM	B	410	5,1	-	0/12/54/54	-

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	410	HEM	C3C-CAC	-4.70	1.38	1.47
5	B	411	PIM	C8-C7	3.90	1.45	1.36
5	A	411	PIM	C8-C7	3.84	1.45	1.36
4	B	410	HEM	C3C-C2C	-3.68	1.35	1.40
4	A	410	HEM	C3C-CAC	-3.36	1.40	1.47
4	A	410	HEM	CBB-CAB	3.25	1.46	1.30
5	A	411	PIM	C10-C11	3.15	1.43	1.36
5	B	411	PIM	C10-C11	3.02	1.43	1.36
4	A	410	HEM	CAB-C3B	-2.87	1.39	1.47
4	B	410	HEM	C1A-NA	2.65	1.41	1.36
4	B	410	HEM	CBB-CAB	2.58	1.43	1.30
5	B	411	PIM	C4-N3	-2.49	1.32	1.36
4	B	410	HEM	CHB-C1B	2.45	1.41	1.35
5	A	411	PIM	C4-C5	-2.36	1.35	1.40
5	B	411	PIM	C4-C5	-2.32	1.36	1.40
4	B	410	HEM	CAB-C3B	-2.31	1.41	1.47
4	B	410	HEM	C4A-NA	2.28	1.40	1.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	411	PIM	C4-N3	-2.14	1.33	1.36
4	A	410	HEM	CBC-CAC	2.12	1.43	1.29
4	A	410	HEM	CHA-C4D	2.07	1.40	1.35
4	A	410	HEM	CHB-C1B	2.04	1.40	1.35

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	A	411	PIM	C4-N3-C2	2.98	110.43	105.78
5	B	411	PIM	C4-N3-C2	2.89	110.29	105.78
4	B	410	HEM	CAD-C3D-C4D	2.64	129.27	124.66
4	A	410	HEM	CAD-C3D-C4D	2.48	128.99	124.66
4	B	410	HEM	C4B-CHC-C1C	2.35	125.66	122.56
4	A	410	HEM	C4C-CHD-C1D	2.33	125.63	122.56
5	B	411	PIM	C7-C6-C11	2.26	120.66	118.65
5	A	411	PIM	C7-C6-C11	2.21	120.61	118.65
4	A	410	HEM	CAD-C3D-C2D	-2.18	123.83	127.88
5	A	411	PIM	C9-C10-C11	-2.12	117.47	120.44
4	A	410	HEM	C2D-C1D-ND	2.12	112.42	109.88

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

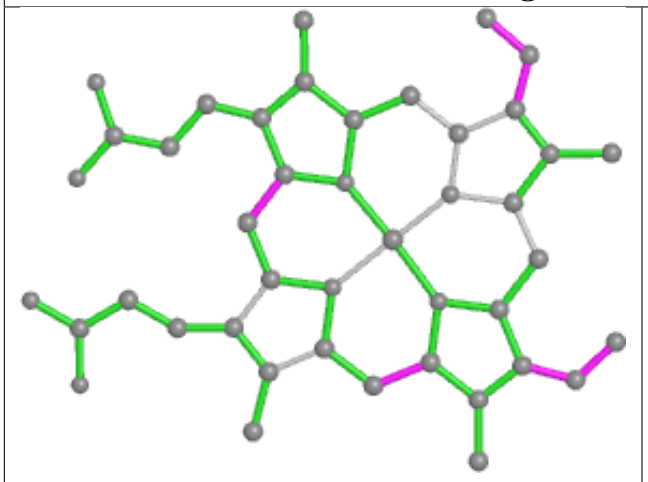
3 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	369	SO4	2	0
4	A	410	HEM	1	0
4	B	410	HEM	2	0

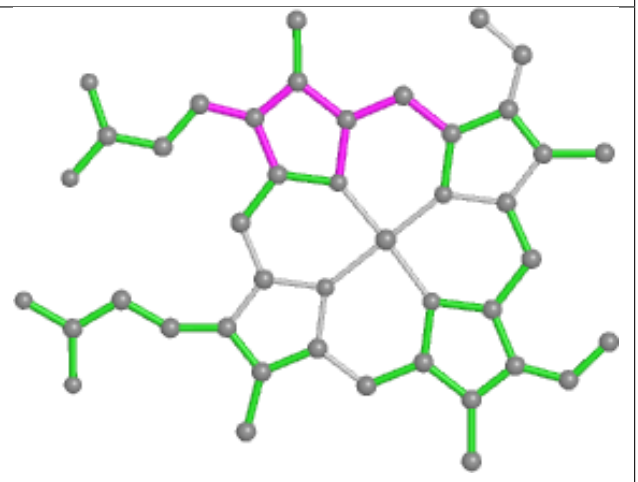
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

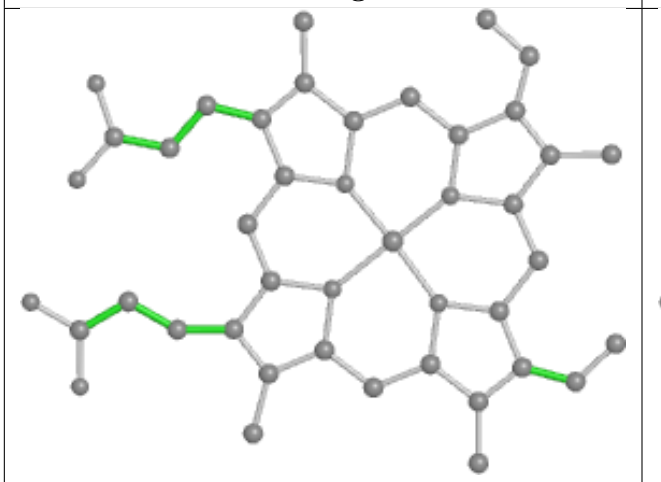
Ligand HEM A 410



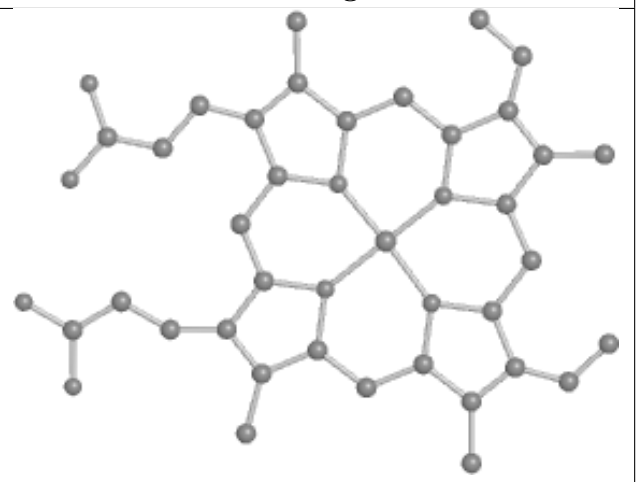
Bond lengths



Bond angles

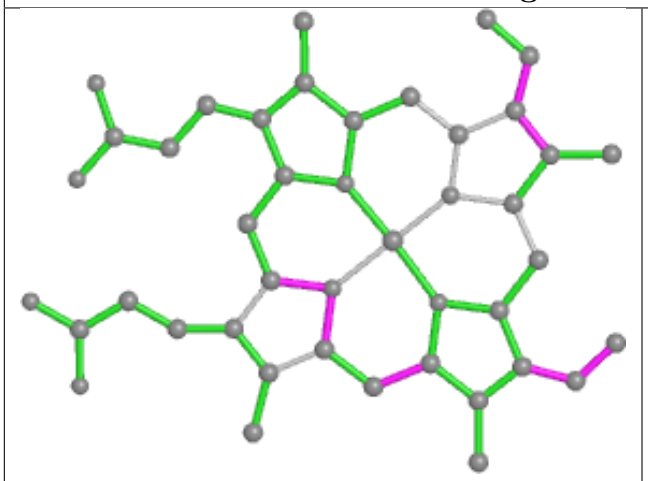


Torsions

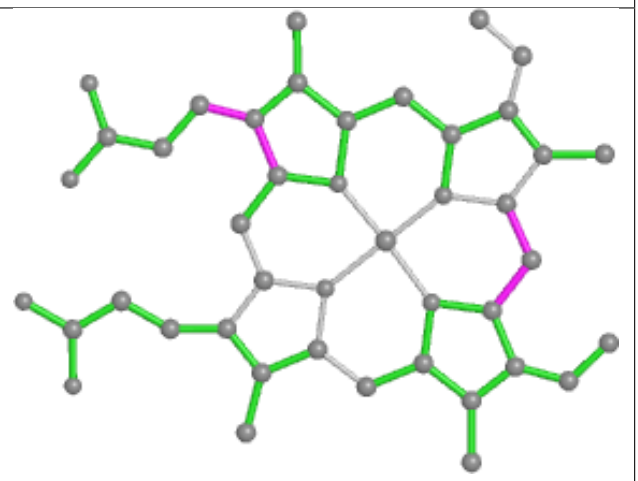


Rings

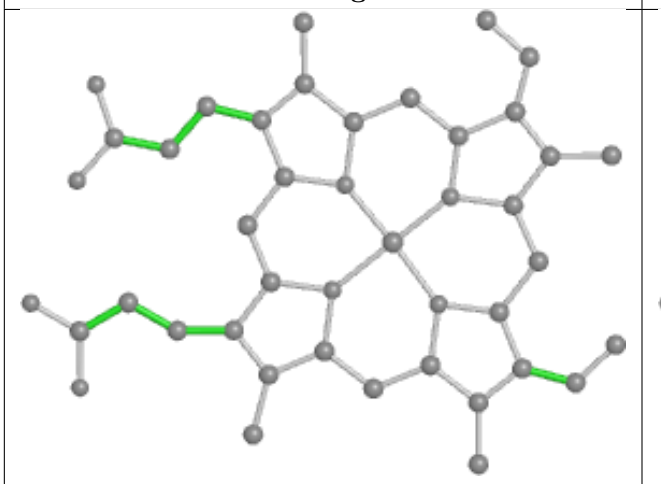
Ligand HEM B 410



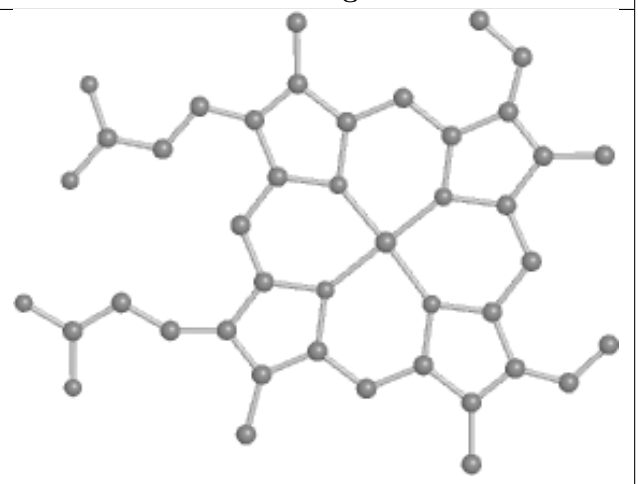
Bond lengths



Bond angles



Torsions



Rings

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	367/368 (99%)	0.21	5 (1%)	75	80	24, 36, 51, 64	0
1	B	367/368 (99%)	0.39	26 (7%)	16	22	21, 39, 65, 75	0
All	All	734/736 (99%)	0.30	31 (4%)	36	43	21, 37, 59, 75	0

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	162	PHE	5.1
1	B	268	GLY	4.9
1	A	366	SER	3.5
1	B	272	ILE	3.5
1	B	266	LYS	3.4
1	B	15	TYR	3.3
1	B	367	ASN	3.2
1	B	161	ILE	3.1
1	B	60	PHE	3.1
1	B	20	ILE	3.0
1	B	229	ASN	3.0
1	B	366	SER	3.0
1	B	16	TYR	2.9
1	B	277	TYR	2.9
1	B	59	ARG	2.9
1	A	60	PHE	2.7
1	B	340	HIS	2.7
1	B	113	ARG	2.5
1	B	265	VAL	2.5
1	B	179	LEU	2.4
1	B	269	ASP	2.4
1	B	163	GLU	2.4
1	B	117	ILE	2.4
1	B	271	THR	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	277	TYR	2.3
1	B	350	PRO	2.2
1	B	21	TRP	2.2
1	A	269	ASP	2.2
1	B	14	VAL	2.1
1	A	161	ILE	2.1
1	B	264	ARG	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)

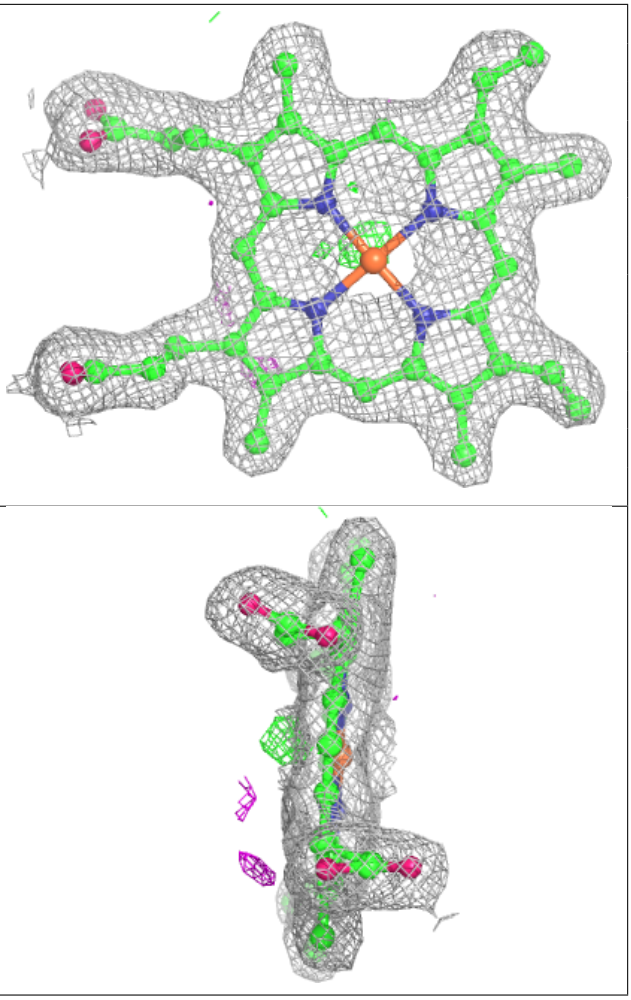
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	SO4	B	369	5/5	0.91	0.18	69,69,70,70	0
5	PIM	A	411	11/11	0.94	0.10	29,29,30,31	0
5	PIM	B	411	11/11	0.96	0.12	28,30,33,34	0
4	HEM	A	410	43/43	0.97	0.12	23,25,29,32	0
4	HEM	B	410	43/43	0.97	0.11	21,23,28,28	0
3	SO4	A	370	5/5	0.98	0.14	52,52,53,53	0
2	ZN	A	369	1/1	0.99	0.07	37,37,37,37	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.

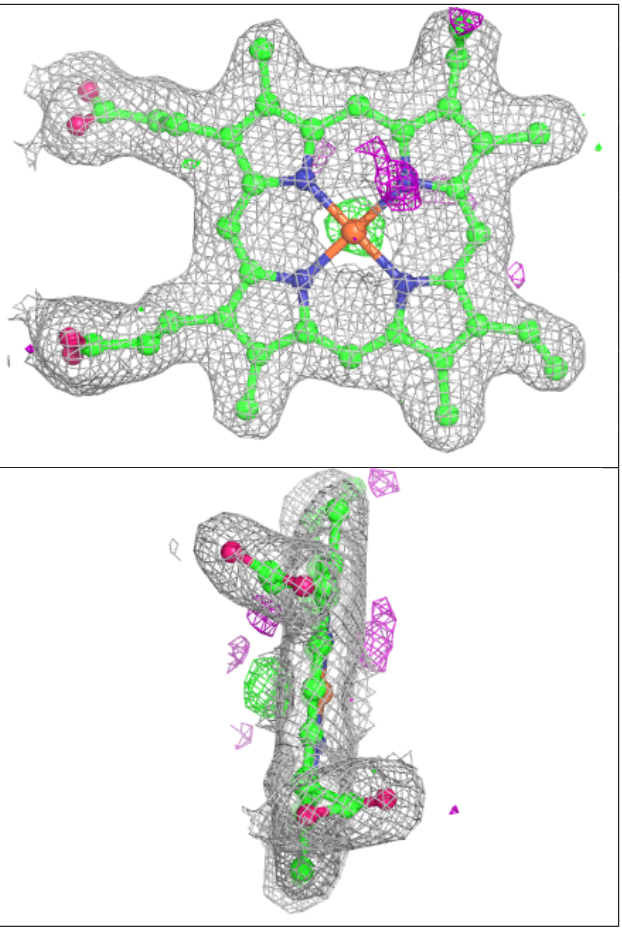
Electron density around HEM A 410:

$2mF_o$-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 410:

$2mF_o$-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.