



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 23, 2023 – 07:00 AM EDT

PDB ID : 3E4E  
Title : Human cytochrome P450 2E1 in complex with the inhibitor 4-methylpyrazole  
Authors : Meneely, K.M.; Porubsky, P.R.; Scott, E.E.  
Deposited on : 2008-08-11  
Resolution : 2.60 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.35  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.35

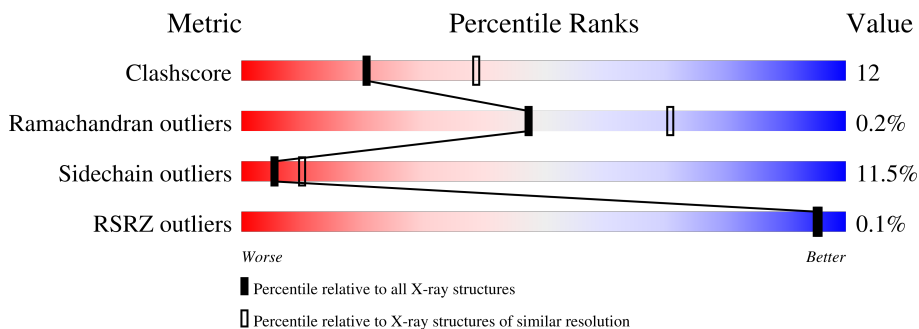
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.60 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))
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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

Mol	Chain	Length	Quality of chain
1	A	476	
1	B	476	

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	4PZ	A	501	-	-	X	-

## 2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 7707 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 2E1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	461	3777	2443	651	666	17	0	1	0
1	B	461	3766	2437	647	665	17	0	0	0

There are 28 discrepancies between the modelled and reference sequences:

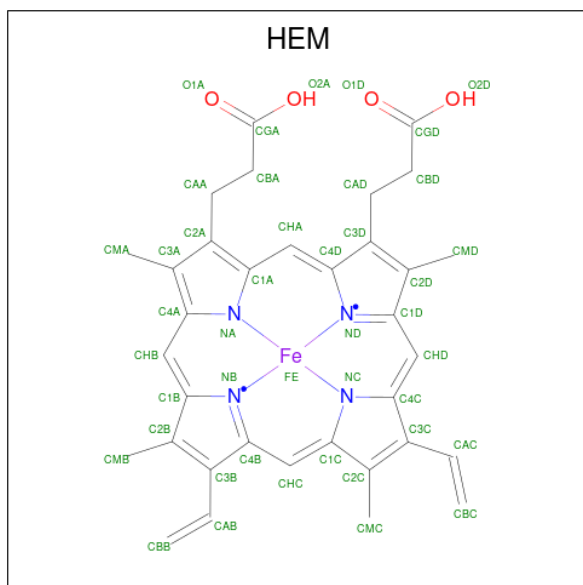
Chain	Residue	Modelled	Actual	Comment	Reference
A	22	MET	-	expression tag	UNP P05181
A	23	ALA	-	expression tag	UNP P05181
A	24	LYS	-	expression tag	UNP P05181
A	25	LYS	-	expression tag	UNP P05181
A	26	THR	-	expression tag	UNP P05181
A	27	SER	-	expression tag	UNP P05181
A	28	SER	-	expression tag	UNP P05181
A	29	LYS	-	expression tag	UNP P05181
A	30	GLY	-	expression tag	UNP P05181
A	31	LYS	-	expression tag	UNP P05181
A	494	HIS	-	expression tag	UNP P05181
A	495	HIS	-	expression tag	UNP P05181
A	496	HIS	-	expression tag	UNP P05181
A	497	HIS	-	expression tag	UNP P05181
B	22	MET	-	expression tag	UNP P05181
B	23	ALA	-	expression tag	UNP P05181
B	24	LYS	-	expression tag	UNP P05181
B	25	LYS	-	expression tag	UNP P05181
B	26	THR	-	expression tag	UNP P05181
B	27	SER	-	expression tag	UNP P05181
B	28	SER	-	expression tag	UNP P05181
B	29	LYS	-	expression tag	UNP P05181
B	30	GLY	-	expression tag	UNP P05181
B	31	LYS	-	expression tag	UNP P05181
B	494	HIS	-	expression tag	UNP P05181

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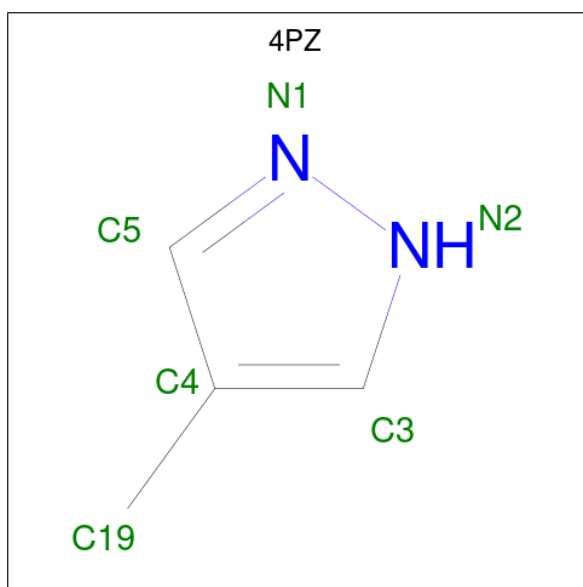
Chain	Residue	Modelled	Actual	Comment	Reference
B	495	HIS	-	expression tag	UNP P05181
B	496	HIS	-	expression tag	UNP P05181
B	497	HIS	-	expression tag	UNP P05181

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



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

- Molecule 3 is 4-methyl-1H-pyrazole (three-letter code: 4PZ) (formula:  $C_4H_6N_2$ ).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C N 6 4 2	0	0
3	B	1	Total C N 6 4 2	0	0

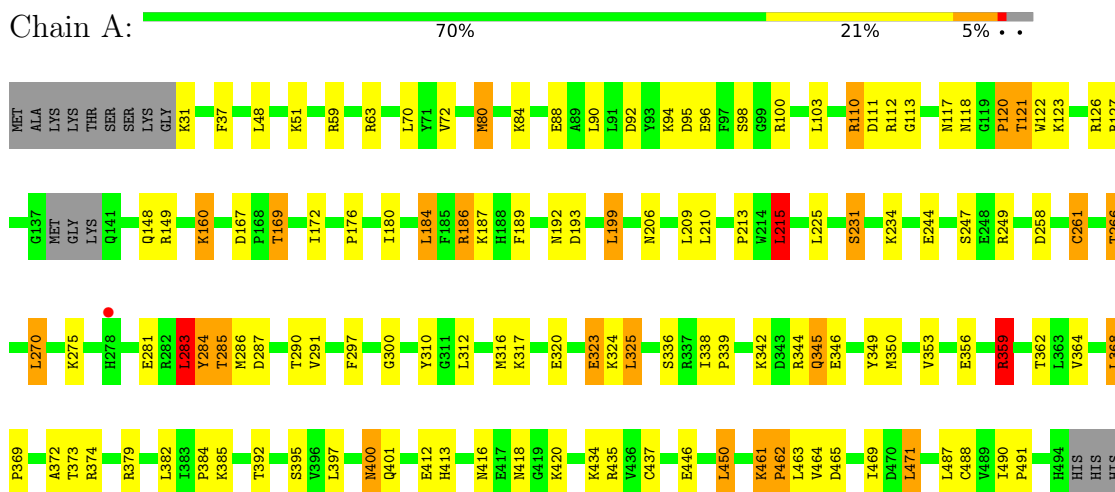
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	33	Total O 33 33	0	0
4	B	33	Total O 33 33	0	0

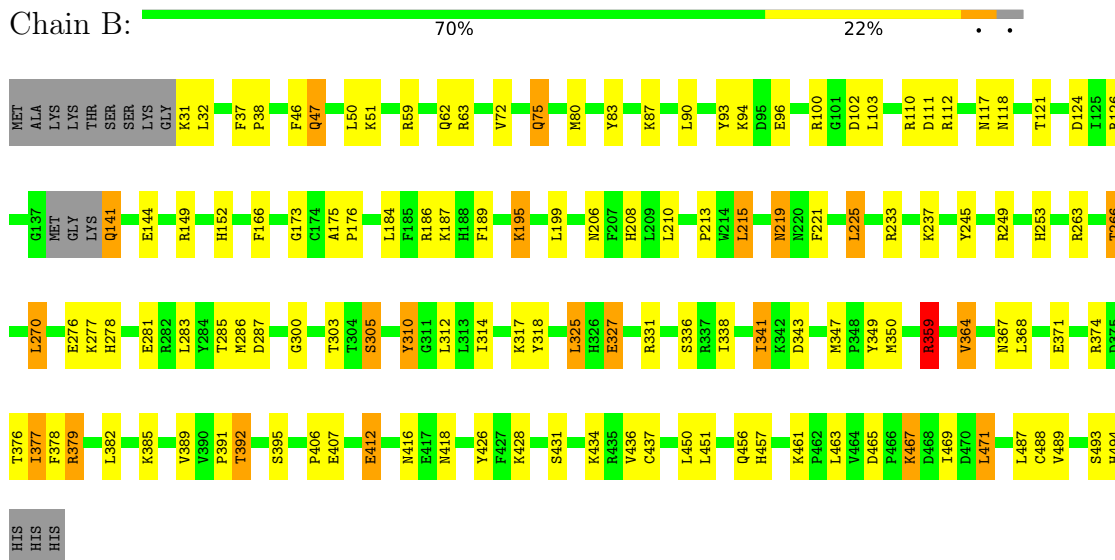
### 3 Residue-property plots i

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 2E1



- Molecule 1: Cytochrome P450 2E1



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	71.19Å 71.19Å 225.89Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.15 – 2.60 38.15 – 2.60	Depositor EDS
% Data completeness (in resolution range)	100.0 (38.15-2.60) 100.0 (38.15-2.60)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.97 (at 2.61Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.197 , 0.277 0.204 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	52.5	Xtrriage
Anisotropy	0.027	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 23.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.478 for h,-k,-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	7707	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	50.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.25% 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: 4PZ, 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	0.90	1/3882 (0.0%)	0.91	7/5257 (0.1%)
1	B	0.92	2/3871 (0.1%)	0.88	3/5243 (0.1%)
All	All	0.91	3/7753 (0.0%)	0.89	10/10500 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2
1	B	0	1
All	All	0	3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	219	ASN	CB-CG	5.83	1.64	1.51
1	A	244	GLU	CG-CD	5.03	1.59	1.51
1	B	426	TYR	CD1-CE1	-5.01	1.31	1.39

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	285	THR	N-CA-CB	8.29	126.06	110.30
1	A	285	THR	N-CA-C	-5.75	95.46	111.00
1	A	231	SER	N-CA-CB	-5.73	101.91	110.50
1	A	283	LEU	CA-CB-CG	5.67	128.34	115.30
1	A	215	LEU	CA-CB-CG	-5.31	103.09	115.30
1	A	284	TYR	N-CA-C	-5.17	97.04	111.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	284	TYR	CB-CA-C	5.14	120.69	110.40
1	B	215	LEU	CA-CB-CG	-5.09	103.58	115.30
1	B	463	LEU	CA-CB-CG	5.03	126.86	115.30
1	B	364	VAL	CB-CA-C	5.01	120.93	111.40

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	120	PRO	Peptide
1	A	359	ARG	Sidechain
1	B	359	ARG	Sidechain

## 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	3777	0	3775	95	0
1	B	3766	0	3762	77	0
2	A	43	0	30	17	0
2	B	43	0	30	8	0
3	A	6	0	5	6	0
3	B	6	0	5	2	0
4	A	33	0	0	5	0
4	B	33	0	0	1	0
All	All	7707	0	7607	186	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 12.

All (186) 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:184:LEU:O	1:A:266:THR:HG22	1.55	1.07
1:B:184:LEU:O	1:B:266:THR:HG22	1.63	0.97

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:283:LEU:O	1:A:283:LEU:HD12	1.63	0.97
1:A:123:LYS:HE2	1:A:127:ARG:HH22	1.28	0.96
1:A:416:ASN:HD21	1:A:420:LYS:HB2	1.29	0.95
1:A:437:CYS:SG	2:A:500:HEM:NC	2.39	0.95
1:A:285:THR:HG22	1:A:287:ASP:H	1.29	0.95
1:A:437:CYS:SG	2:A:500:HEM:NB	2.44	0.91
1:A:283:LEU:O	1:A:284:TYR:CD2	2.25	0.89
1:B:285:THR:HG22	1:B:287:ASP:H	1.37	0.89
1:A:111:ASP:HA	1:A:117:ASN:HB3	1.57	0.84
2:B:500:HEM:HMC2	2:B:500:HEM:HBC2	1.60	0.83
1:A:416:ASN:ND2	1:A:420:LYS:HB2	1.94	0.83
1:B:392:THR:HG22	1:B:395:SER:OG	1.78	0.82
1:A:283:LEU:O	1:A:283:LEU:CD1	2.29	0.80
1:A:437:CYS:SG	2:A:500:HEM:NA	2.58	0.77
1:A:186:ARG:HG2	1:A:186:ARG:O	1.85	0.77
1:A:111:ASP:HA	1:A:117:ASN:CB	2.15	0.76
1:A:437:CYS:SG	2:A:500:HEM:ND	2.58	0.75
1:A:111:ASP:C	1:A:117:ASN:HB3	2.08	0.74
1:A:342:LYS:HD3	4:A:523:HOH:O	1.87	0.73
1:A:110:ARG:HD3	4:A:521:HOH:O	1.88	0.73
1:A:111:ASP:CA	1:A:117:ASN:HB3	2.18	0.73
1:A:283:LEU:O	1:A:284:TYR:CG	2.43	0.72
1:B:285:THR:HG22	1:B:287:ASP:N	2.05	0.71
2:B:500:HEM:HBC2	2:B:500:HEM:CMC	2.19	0.70
1:A:323:GLU:HA	1:A:323:GLU:OE1	1.90	0.70
1:B:392:THR:CG2	1:B:395:SER:OG	2.40	0.70
1:A:184:LEU:O	1:A:266:THR:CG2	2.36	0.69
2:B:500:HEM:HBB2	2:B:500:HEM:HMB2	1.73	0.69
1:B:72:VAL:O	1:B:75:GLN:HG2	1.93	0.69
1:A:461:LYS:HG3	1:A:488:CYS:HB2	1.75	0.68
1:B:186:ARG:HD3	1:B:263:ARG:O	1.92	0.68
1:A:285:THR:HG22	1:A:287:ASP:N	2.07	0.67
1:A:283:LEU:HD12	1:A:284:TYR:CD2	2.30	0.66
1:B:359:ARG:NH2	1:B:406:PRO:HA	2.11	0.66
1:A:123:LYS:HE2	1:A:127:ARG:NH2	2.06	0.66
1:A:167:ASP:OD1	1:A:169:THR:CG2	2.45	0.65
1:B:359:ARG:HH21	1:B:406:PRO:HA	1.62	0.65
1:B:184:LEU:O	1:B:266:THR:CG2	2.43	0.64
1:A:206:ASN:O	1:A:210:LEU:HD12	1.99	0.63
1:A:167:ASP:OD1	1:A:169:THR:HG22	1.99	0.63
1:A:338:ILE:HG13	1:A:339:PRO:HD2	1.82	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:359:ARG:NH1	1:A:413:HIS:ND1	2.47	0.62
1:A:356:GLU:OE2	1:A:359:ARG:NH1	2.31	0.62
1:B:51:LYS:HG3	1:B:213:PRO:HG3	1.80	0.61
2:A:500:HEM:NA	3:A:501:4PZ:N2	2.48	0.60
1:B:310:TYR:O	1:B:314:ILE:HG13	2.01	0.60
2:B:500:HEM:HBB2	2:B:500:HEM:CMB	2.31	0.60
1:B:493:SER:O	1:B:494:HIS:HB2	2.02	0.60
1:A:113:GLY:HA3	1:A:291:VAL:HG12	1.84	0.60
1:B:233:ARG:O	1:B:237:LYS:HG3	2.02	0.60
1:B:37:PHE:HD1	1:B:38:PRO:HD2	1.67	0.59
1:A:392:THR:HG22	1:A:395:SER:OG	2.02	0.59
1:A:300:GLY:HA2	2:A:500:HEM:HMC2	1.83	0.59
1:B:80:MET:O	1:B:392:THR:HB	2.03	0.58
1:B:327:GLU:OE1	1:B:331:ARG:NH2	2.36	0.58
1:B:124:ASP:HB2	1:B:283:LEU:HD21	1.84	0.58
1:A:96:GLU:N	1:A:96:GLU:OE1	2.35	0.58
1:A:98:SER:O	1:A:435:ARG:HD2	2.04	0.58
2:A:500:HEM:NB	3:A:501:4PZ:N2	2.52	0.57
2:A:500:HEM:NC	3:A:501:4PZ:N2	2.53	0.57
1:B:31:LYS:HG3	1:B:32:LEU:N	2.19	0.57
1:B:208:HIS:HE1	4:B:519:HOH:O	1.87	0.56
1:A:400:ASN:HD22	1:A:400:ASN:H	1.53	0.56
2:A:500:HEM:ND	3:A:501:4PZ:N2	2.54	0.56
1:A:281:GLU:O	1:A:281:GLU:HG2	2.06	0.55
1:A:283:LEU:HD12	1:A:284:TYR:CE2	2.41	0.55
1:A:80:MET:O	1:A:392:THR:HB	2.06	0.55
1:A:316:MET:SD	1:A:462:PRO:HB3	2.46	0.55
2:A:500:HEM:C4D	3:A:501:4PZ:H3	2.42	0.55
1:A:247:SER:HA	1:A:290:THR:HG21	1.88	0.54
1:A:148:GLN:HG2	1:A:338:ILE:HG12	1.88	0.54
1:B:173:GLY:O	1:B:176:PRO:HD2	2.07	0.54
1:A:374[A]:ARG:NH1	4:A:524:HOH:O	2.34	0.53
1:B:285:THR:HG22	1:B:286:MET:N	2.23	0.53
1:A:247:SER:HA	1:A:290:THR:CG2	2.38	0.53
1:B:493:SER:O	1:B:494:HIS:CB	2.57	0.52
1:A:48:LEU:HD21	1:A:70:LEU:HD21	1.92	0.52
1:B:359:ARG:NH2	1:B:406:PRO:O	2.43	0.52
1:B:100:ARG:O	1:B:110:ARG:NH2	2.42	0.52
1:B:456:GLN:HB3	1:B:457:HIS:HD2	1.75	0.51
1:B:436:VAL:O	1:B:437:CYS:C	2.49	0.51
2:A:500:HEM:HBB2	2:A:500:HEM:HMB2	1.93	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:93:TYR:HB3	1:B:96:GLU:HB2	1.92	0.51
1:A:120:PRO:N	1:A:121:THR:HG22	2.26	0.51
1:A:359:ARG:NH1	1:A:413:HIS:CE1	2.79	0.50
1:B:389:VAL:O	1:B:391:PRO:HD3	2.11	0.50
1:A:373:THR:O	1:A:385:LYS:HD2	2.12	0.50
1:B:300:GLY:HA2	2:B:500:HEM:HMC2	1.94	0.49
1:A:123:LYS:CE	1:A:127:ARG:HH22	2.14	0.49
1:A:209:LEU:HB3	1:A:215:LEU:HD13	1.93	0.49
1:B:303:THR:HG23	3:B:501:4PZ:H5	1.94	0.49
1:A:167:ASP:OD1	1:A:169:THR:HG23	2.12	0.49
1:B:175:ALA:HB3	1:B:176:PRO:HD3	1.95	0.49
1:B:461:LYS:HB3	1:B:488:CYS:HB2	1.95	0.49
1:B:392:THR:HG22	1:B:395:SER:HG	1.77	0.48
1:B:456:GLN:HB3	1:B:457:HIS:CD2	2.48	0.48
1:B:206:ASN:O	1:B:210:LEU:HD12	2.12	0.48
1:A:122:TRP:HH2	1:A:434:LYS:HD2	1.78	0.48
1:A:187:LYS:HD3	1:A:189:PHE:CZ	2.48	0.48
1:B:112:ARG:O	1:B:117:ASN:HB2	2.14	0.48
1:A:186:ARG:O	1:A:186:ARG:CG	2.61	0.47
1:A:342:LYS:O	1:A:345:GLN:HG3	2.14	0.47
1:A:469:ILE:HG22	1:A:471:LEU:HD13	1.96	0.47
2:A:500:HEM:ND	3:A:501:4PZ:C3	2.77	0.47
1:B:317:LYS:HD3	1:B:471:LEU:HD22	1.97	0.47
1:A:362:THR:HG22	1:A:397:LEU:HD12	1.96	0.47
1:A:126:ARG:NH1	2:A:500:HEM:O1D	2.47	0.47
1:A:400:ASN:OD1	1:A:401:GLN:NE2	2.48	0.47
1:B:469:ILE:HG22	1:B:471:LEU:HD13	1.96	0.47
1:B:285:THR:CG2	1:B:286:MET:N	2.77	0.47
1:B:416:ASN:OD1	1:B:418:ASN:HB2	2.15	0.47
1:A:112:ARG:N	1:A:117:ASN:HB3	2.30	0.46
1:B:118:ASN:ND2	1:B:371:GLU:OE2	2.44	0.45
1:B:149:ARG:HH21	1:B:152:HIS:CG	2.35	0.45
1:A:392:THR:HG22	1:A:395:SER:HG	1.80	0.45
1:A:446:GLU:O	1:A:450:LEU:HB2	2.16	0.45
1:B:32:LEU:HD23	1:B:382:LEU:O	2.17	0.45
1:A:400:ASN:ND2	4:A:510:HOH:O	2.44	0.45
1:B:173:GLY:HA2	1:B:305:SER:HB2	1.99	0.45
2:A:500:HEM:HBD1	2:A:500:HEM:HHA	1.99	0.45
1:B:124:ASP:CB	1:B:283:LEU:HD21	2.46	0.44
1:A:283:LEU:CD1	1:A:284:TYR:CE2	3.00	0.44
1:A:325:LEU:HD11	1:A:350:MET:HA	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:325:LEU:HD13	1:A:349:TYR:HD2	1.83	0.44
1:A:317:LYS:CD	1:A:471:LEU:HD22	2.47	0.44
2:A:500:HEM:HBB2	2:A:500:HEM:CMB	2.48	0.44
1:A:300:GLY:HA2	2:A:500:HEM:CMC	2.47	0.44
1:B:110:ARG:NH2	1:B:118:ASN:HB2	2.33	0.44
2:B:500:HEM:HMC2	2:B:500:HEM:CBC	2.41	0.44
1:A:176:PRO:O	1:A:180:ILE:HG22	2.18	0.44
1:B:325:LEU:HD13	1:B:349:TYR:CD2	2.52	0.44
1:A:167:ASP:CG	1:A:169:THR:HG23	2.39	0.43
1:A:110:ARG:NH2	1:A:118:ASN:HB2	2.33	0.43
1:A:258:ASP:OD1	1:A:261:CYS:HB2	2.18	0.43
1:B:325:LEU:HD13	1:B:349:TYR:HD2	1.82	0.43
1:A:59:ARG:HH12	1:A:63:ARG:NH2	2.16	0.43
1:A:88:GLU:O	1:A:92:ASP:HB2	2.18	0.43
1:A:199:LEU:HD12	1:A:199:LEU:HA	1.90	0.43
1:A:266:THR:O	1:A:270:LEU:HD22	2.18	0.43
1:A:463:LEU:O	1:A:464:VAL:HG13	2.18	0.43
1:A:368:LEU:HB2	2:A:500:HEM:HAA2	2.01	0.43
1:A:51:LYS:HG2	1:A:213:PRO:HG3	2.01	0.43
1:B:47:GLN:HE21	1:B:47:GLN:HB2	1.60	0.43
1:B:111:ASP:O	1:B:112:ARG:HG3	2.19	0.43
1:B:245:TYR:CD2	1:B:245:TYR:C	2.91	0.43
1:B:343:ASP:O	1:B:347:MET:HG3	2.19	0.43
1:A:59:ARG:HH12	1:A:63:ARG:HH21	1.66	0.43
1:B:126:ARG:NH1	2:B:500:HEM:O1D	2.45	0.43
1:B:221:PHE:HB2	1:B:225:LEU:HD22	2.00	0.42
1:A:359:ARG:NH1	1:A:413:HIS:HD1	2.17	0.42
1:A:285:THR:HG22	1:A:286:MET:N	2.35	0.42
1:B:317:LYS:HG2	1:B:318:TYR:CZ	2.54	0.42
1:A:382:LEU:HG	1:A:384:PRO:HD3	2.02	0.42
1:A:490:ILE:HA	1:A:491:PRO:HD3	1.86	0.42
1:B:378:PHE:O	1:B:379:ARG:C	2.58	0.42
1:B:431:SER:CB	2:B:500:HEM:HBA1	2.50	0.42
1:B:110:ARG:HH21	1:B:118:ASN:HB2	1.85	0.42
1:B:350:MET:HE1	1:B:451:LEU:HD23	2.00	0.42
1:B:374:ARG:O	1:B:376:THR:OG1	2.34	0.42
1:B:412:GLU:CD	1:B:412:GLU:H	2.23	0.42
1:A:160:LYS:HE3	1:A:160:LYS:HB2	1.81	0.42
1:A:400:ASN:H	1:A:400:ASN:ND2	2.17	0.42
1:B:62:GLN:HA	1:B:62:GLN:OE1	2.20	0.41
1:A:338:ILE:HG13	1:A:339:PRO:CD	2.46	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:102:ASP:OD1	1:B:110:ARG:HD3	2.20	0.41
1:B:141:GLN:HE21	1:B:141:GLN:HA	1.85	0.41
1:B:303:THR:CG2	3:B:501:4PZ:H5	2.50	0.41
1:B:467:LYS:HA	1:B:467:LYS:HE3	2.03	0.41
1:A:84:LYS:HG2	1:A:379:ARG:NH1	2.36	0.41
1:A:100:ARG:HD3	1:A:369:PRO:O	2.21	0.41
1:B:195:LYS:HD3	1:B:195:LYS:HA	1.88	0.41
1:B:144:GLU:OE1	1:B:341:ILE:HG13	2.20	0.41
1:A:325:LEU:HD21	1:A:353:VAL:HG11	2.02	0.41
1:B:187:LYS:HD3	1:B:189:PHE:CZ	2.55	0.41
1:B:96:GLU:OE1	1:B:96:GLU:N	2.52	0.40
1:B:166:PHE:CE2	1:B:489:VAL:HG22	2.57	0.40
1:B:367:ASN:HB2	1:B:391:PRO:O	2.22	0.40
1:A:96:GLU:O	1:A:372:ALA:HA	2.21	0.40
1:A:412:GLU:CD	1:A:412:GLU:H	2.25	0.40
1:A:435:ARG:N	4:A:531:HOH:O	2.40	0.40
1:B:83:TYR:OH	1:B:87:LYS:HE2	2.21	0.40
1:B:377:ILE:O	1:B:377:ILE:CG2	2.70	0.40
1:B:266:THR:O	1:B:270:LEU:HD22	2.22	0.40
1:B:407:GLU:OE1	1:B:407:GLU:N	2.42	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	458/476 (96%)	421 (92%)	36 (8%)	1 (0%)	47 71
1	B	457/476 (96%)	427 (93%)	29 (6%)	1 (0%)	47 71
All	All	915/952 (96%)	848 (93%)	65 (7%)	2 (0%)	47 71

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	379	ARG
1	A	462	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	417/428 (97%)	367 (88%)	50 (12%)	5 9
1	B	416/428 (97%)	370 (89%)	46 (11%)	6 11
All	All	833/856 (97%)	737 (88%)	96 (12%)	5 10

All (96) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	31	LYS
1	A	37	PHE
1	A	72	VAL
1	A	80	MET
1	A	90	LEU
1	A	94	LYS
1	A	95	ASP
1	A	103	LEU
1	A	110	ARG
1	A	121	THR
1	A	149	ARG
1	A	160	LYS
1	A	169	THR
1	A	172	ILE
1	A	184	LEU
1	A	186	ARG
1	A	192	ASN
1	A	193	ASP
1	A	199	LEU
1	A	215	LEU
1	A	225	LEU
1	A	231	SER

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	A	234	LYS
1	A	249	ARG
1	A	261	CYS
1	A	266	THR
1	A	270	LEU
1	A	275	LYS
1	A	283	LEU
1	A	297	PHE
1	A	310	TYR
1	A	312	LEU
1	A	320	GLU
1	A	323	GLU
1	A	324	LYS
1	A	325	LEU
1	A	336	SER
1	A	344	ARG
1	A	345	GLN
1	A	346	GLU
1	A	359	ARG
1	A	364	VAL
1	A	368	LEU
1	A	400	ASN
1	A	418	ASN
1	A	450	LEU
1	A	461	LYS
1	A	465	ASP
1	A	471	LEU
1	A	487	LEU
1	B	46	PHE
1	B	47	GLN
1	B	50	LEU
1	B	59	ARG
1	B	63	ARG
1	B	75	GLN
1	B	90	LEU
1	B	94	LYS
1	B	103	LEU
1	B	121	THR
1	B	141	GLN
1	B	195	LYS
1	B	199	LEU
1	B	215	LEU

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Mol	Chain	Res	Type
1	B	219	ASN
1	B	225	LEU
1	B	249	ARG
1	B	253	HIS
1	B	266	THR
1	B	270	LEU
1	B	276	GLU
1	B	277	LYS
1	B	278	HIS
1	B	281	GLU
1	B	305	SER
1	B	310	TYR
1	B	312	LEU
1	B	325	LEU
1	B	327	GLU
1	B	336	SER
1	B	338	ILE
1	B	341	ILE
1	B	359	ARG
1	B	364	VAL
1	B	368	LEU
1	B	377	ILE
1	B	385	LYS
1	B	392	THR
1	B	412	GLU
1	B	428	LYS
1	B	434	LYS
1	B	450	LEU
1	B	465	ASP
1	B	467	LYS
1	B	471	LEU
1	B	487	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	135	ASN
1	A	141	GLN
1	A	148	GLN
1	A	278	HIS
1	B	47	GLN
1	B	141	GLN

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Mol	Chain	Res	Type
1	B	164	GLN
1	B	220	ASN
1	B	494	HIS

### 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](#)

4 ligands are modelled in this entry.

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
2	HEM	B	500	1,3	41,50,50	1.95	10 (24%)	45,82,82	1.66	11 (24%)
2	HEM	A	500	1,3	41,50,50	1.96	10 (24%)	45,82,82	1.55	11 (24%)
3	4PZ	B	501	2	6,6,6	1.08	1 (16%)	3,7,7	4.11	3 (100%)
3	4PZ	A	501	2	6,6,6	1.28	1 (16%)	3,7,7	3.95	3 (100%)

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	B	500	1,3	-	4/12/54/54	-
2	HEM	A	500	1,3	-	4/12/54/54	-
3	4PZ	B	501	2	-	-	0/1/1/1
3	4PZ	A	501	2	-	-	0/1/1/1

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	500	HEM	C3D-C2D	5.92	1.49	1.36
2	A	500	HEM	C3C-C2C	-5.82	1.32	1.40
2	B	500	HEM	C3D-C2D	5.54	1.48	1.36
2	B	500	HEM	C3C-C2C	-5.46	1.32	1.40
2	B	500	HEM	C3C-CAC	3.63	1.55	1.47
2	A	500	HEM	C3C-CAC	3.62	1.55	1.47
2	B	500	HEM	CAA-C2A	3.41	1.57	1.52
2	A	500	HEM	CAA-C2A	3.12	1.56	1.52
2	B	500	HEM	CAB-C3B	2.85	1.55	1.47
2	A	500	HEM	CAB-C3B	2.78	1.55	1.47
3	A	501	4PZ	N1-N2	2.71	1.43	1.37
2	A	500	HEM	C1A-NA	2.53	1.41	1.36
2	B	500	HEM	C1A-NA	2.43	1.41	1.36
2	B	500	HEM	CMA-C3A	2.34	1.56	1.51
2	A	500	HEM	C4A-NA	2.27	1.40	1.36
2	A	500	HEM	C4B-NB	2.24	1.43	1.38
2	A	500	HEM	CMD-C2D	2.24	1.55	1.50
3	B	501	4PZ	N1-N2	2.13	1.41	1.37
2	A	500	HEM	CMB-C2B	2.11	1.55	1.50
2	B	500	HEM	C1A-CHA	-2.11	1.35	1.41
2	B	500	HEM	C4B-NB	2.03	1.43	1.38
2	B	500	HEM	FE-NB	-2.03	1.86	1.96

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	501	4PZ	C3-C4-C5	6.06	115.58	104.12
3	A	501	4PZ	C3-C4-C5	5.79	115.08	104.12
2	A	500	HEM	CAD-CBD-CGD	-3.72	105.59	113.60
2	B	500	HEM	CMC-C2C-C3C	3.19	130.65	124.68
2	B	500	HEM	C3D-C4D-ND	3.19	113.72	110.17
2	B	500	HEM	C1B-NB-C4B	-3.03	101.94	105.07
3	A	501	4PZ	C19-C4-C3	-2.99	121.48	127.92
2	B	500	HEM	CMD-C2D-C1D	2.89	129.43	125.04
2	B	500	HEM	CBD-CAD-C3D	-2.82	104.78	112.63

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	500	HEM	C1D-C2D-C3D	-2.78	104.03	106.96
2	A	500	HEM	C1D-C2D-C3D	-2.73	104.09	106.96
3	B	501	4PZ	C19-C4-C3	-2.70	122.10	127.92
2	B	500	HEM	C2D-C1D-ND	2.62	113.02	109.88
2	B	500	HEM	O2A-CGA-CBA	2.61	122.42	114.03
3	B	501	4PZ	C19-C4-C5	-2.60	122.32	127.92
2	A	500	HEM	CMD-C2D-C1D	2.51	128.86	125.04
2	A	500	HEM	CHA-C4D-C3D	-2.45	120.73	125.33
2	A	500	HEM	C1B-NB-C4B	-2.41	102.58	105.07
2	A	500	HEM	C2D-C1D-ND	2.41	112.77	109.88
2	B	500	HEM	CHA-C4D-C3D	-2.38	120.87	125.33
2	B	500	HEM	C2C-C3C-C4C	2.35	108.54	106.90
2	A	500	HEM	O2A-CGA-CBA	2.21	121.14	114.03
2	A	500	HEM	CHC-C4B-NB	2.16	126.78	124.43
2	A	500	HEM	CMC-C2C-C3C	2.08	128.58	124.68
3	A	501	4PZ	C19-C4-C5	-2.07	123.45	127.92
2	A	500	HEM	CHA-C4D-ND	2.07	126.94	124.38
2	B	500	HEM	C4B-CHC-C1C	-2.03	119.88	122.56
2	A	500	HEM	CMA-C3A-C4A	-2.01	125.38	128.46

There are no chirality outliers.

All (8) torsion outliers are listed below:

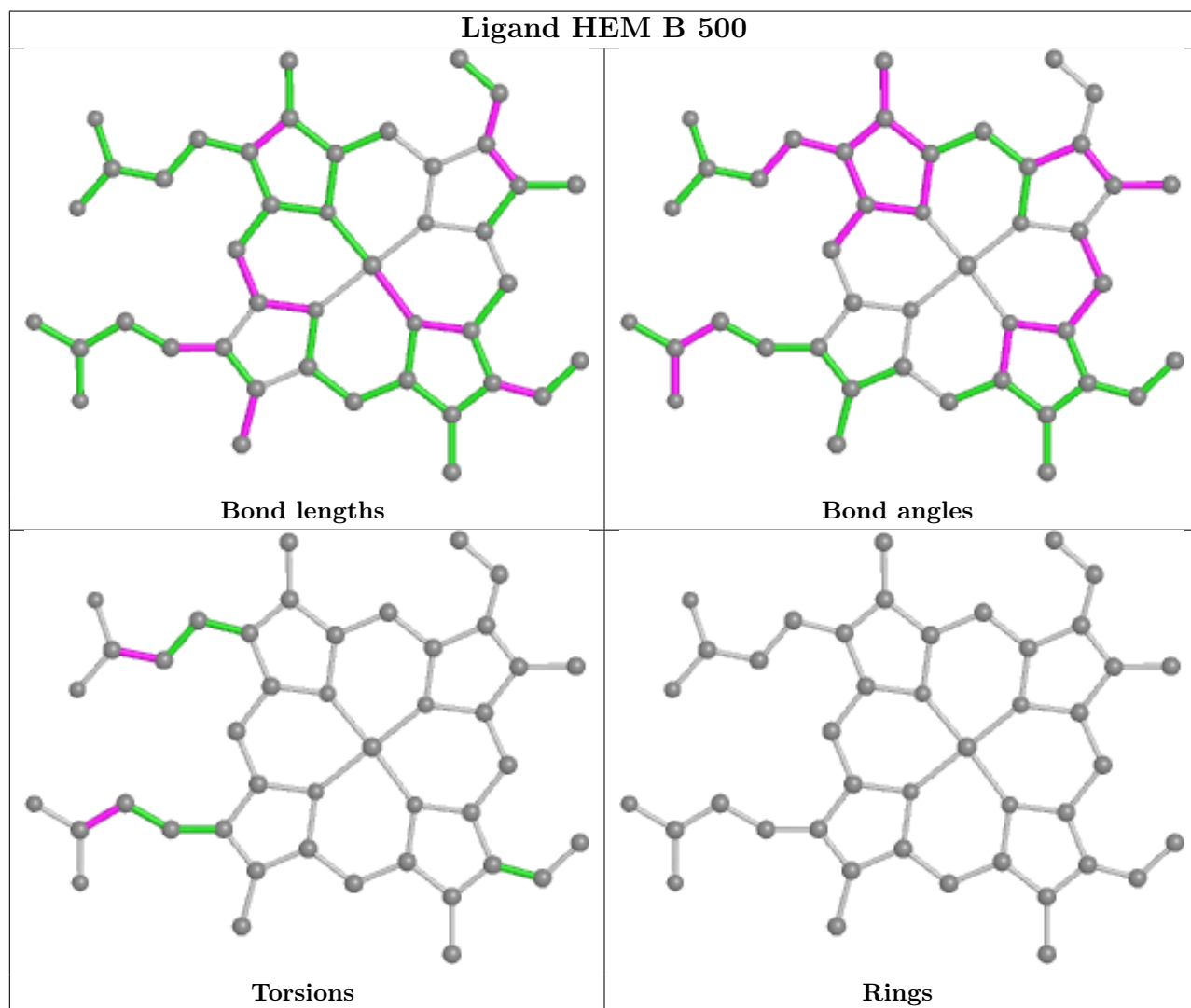
Mol	Chain	Res	Type	Atoms
2	A	500	HEM	CAD-CBD-CGD-O1D
2	A	500	HEM	CAD-CBD-CGD-O2D
2	A	500	HEM	CAA-CBA-CGA-O2A
2	B	500	HEM	CAA-CBA-CGA-O2A
2	A	500	HEM	C4D-C3D-CAD-CBD
2	B	500	HEM	CAA-CBA-CGA-O1A
2	B	500	HEM	CAD-CBD-CGD-O1D
2	B	500	HEM	CAD-CBD-CGD-O2D

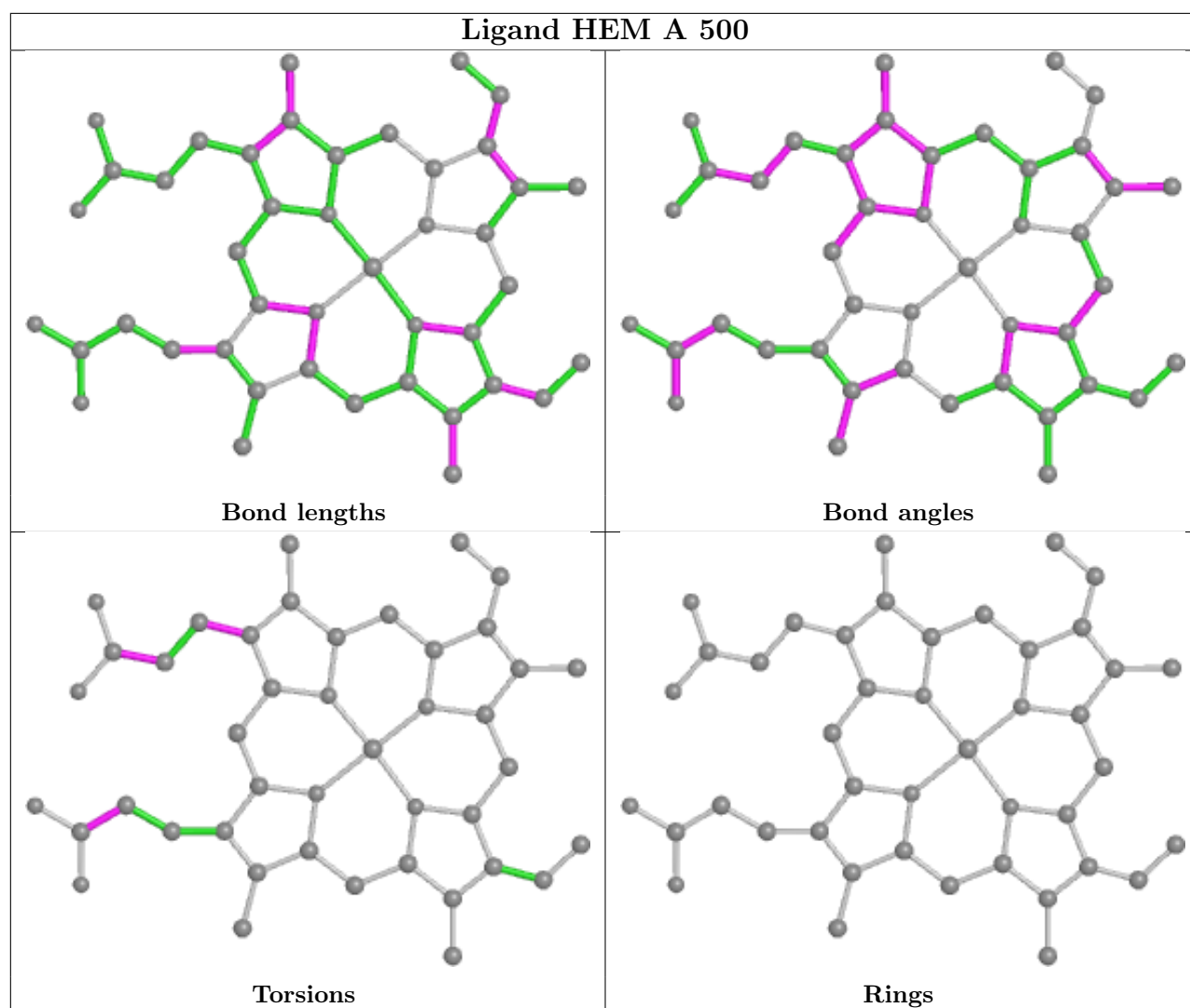
There are no ring outliers.

4 monomers are involved in 27 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	500	HEM	8	0
2	A	500	HEM	17	0
3	B	501	4PZ	2	0
3	A	501	4PZ	6	0

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





## 5.7 Other polymers [i](#)

There are no such residues in this entry.

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

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	461/476 (96%)	-0.29	1 (0%) 95   95	31, 49, 73, 95	0
1	B	461/476 (96%)	-0.28	0 100   100	31, 49, 72, 92	0
All	All	922/952 (96%)	-0.29	1 (0%) 95   95	31, 49, 72, 95	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	278	HIS	4.0

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

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

### 6.3 Carbohydrates [i](#)

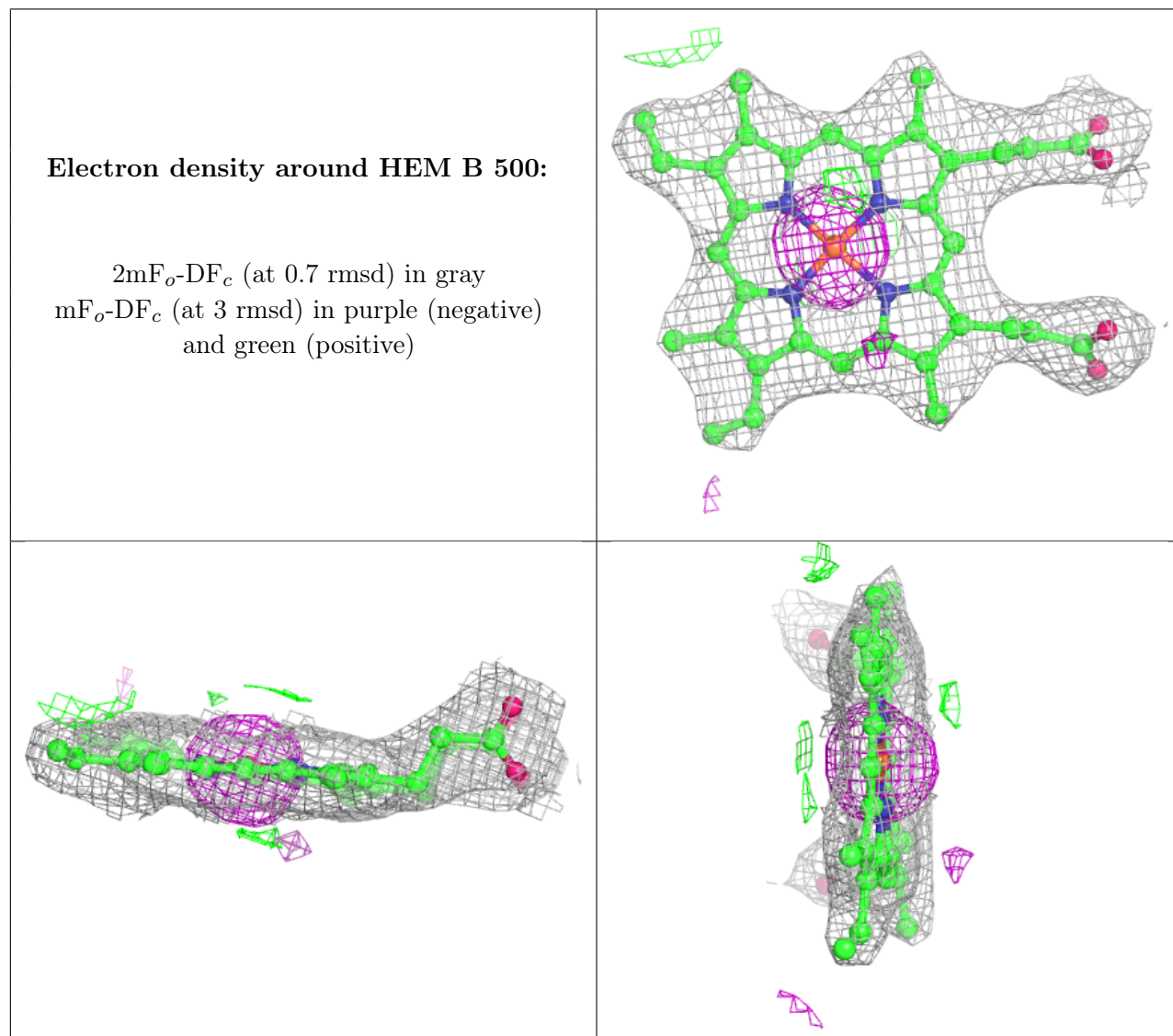
There are no monosaccharides in this entry.

### 6.4 Ligands [i](#)

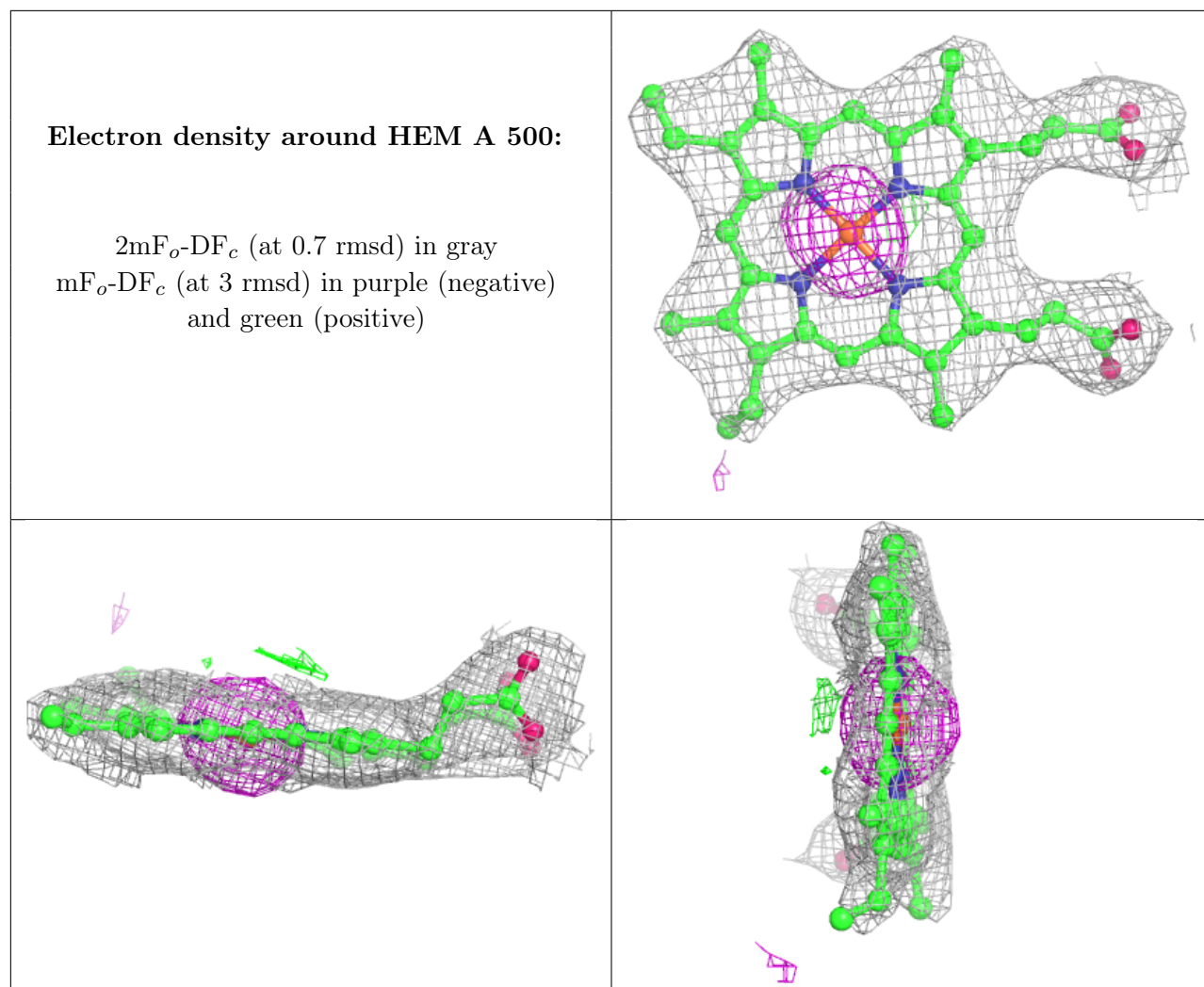
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	4PZ	B	501	6/6	0.93	0.17	53,54,55,57	0
2	HEM	B	500	43/43	0.95	0.14	13,32,42,43	0
2	HEM	A	500	43/43	0.95	0.15	13,33,44,45	0
3	4PZ	A	501	6/6	0.97	0.13	54,56,58,59	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.







## 6.5 Other polymers [\(i\)](#)

There are no such residues in this entry.