



Full wwPDB X-ray Structure Validation Report ⓘ

Sep 2, 2023 – 12:35 PM EDT

PDB ID : 3QJU
Title : The structure of and photolytic induced changes of carbon monoxide binding to the cytochrome ba3-oxidase from *Thermus thermophilus*
Authors : Liu, B.; Zhang, Y.; Sage, J.T.; Doukov, T.; Chen, Y.; Stout, C.D.; Fee, J.A.
Deposited on : 2011-01-30
Resolution : 2.90 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 ⓘ 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 ⓘ](#)) 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

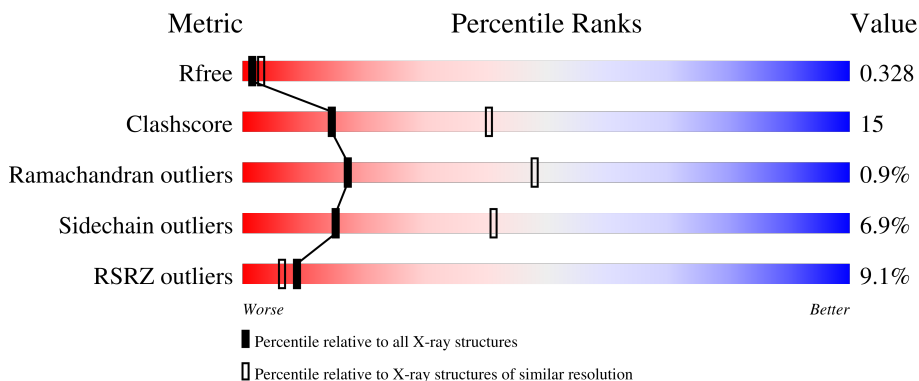
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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 $\leq 5\%$. 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	568	 9% 62% 33% 5%
2	B	168	 7% 68% 26% 5%
3	C	34	 12% 56% 38% 5%

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 6037 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 c oxidase subunit 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	552	4367	2962	699	690	16	0	0	0

There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	MET	-	expression tag	UNP Q5SJ79
A	-4	HIS	-	expression tag	UNP Q5SJ79
A	-3	HIS	-	expression tag	UNP Q5SJ79
A	-2	HIS	-	expression tag	UNP Q5SJ79
A	-1	HIS	-	expression tag	UNP Q5SJ79
A	0	HIS	-	expression tag	UNP Q5SJ79
A	1	HIS	-	expression tag	UNP Q5SJ79

- Molecule 2 is a protein called Cytochrome c oxidase subunit 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	166	1298	844	216	234	4	0	0	0

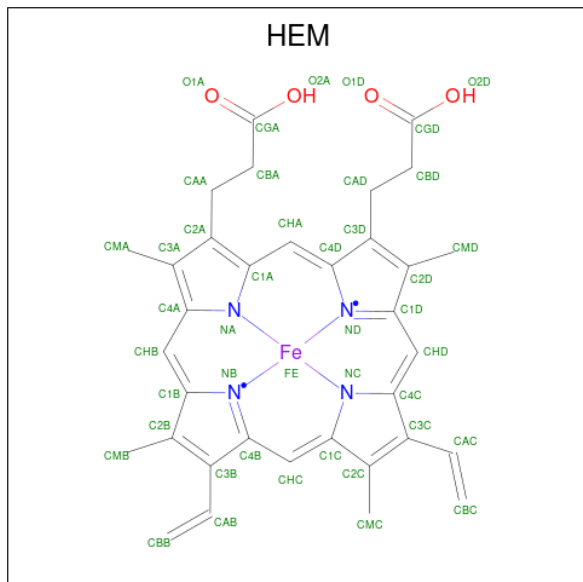
- Molecule 3 is a protein called Cytochrome c oxidase polypeptide 2A.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	C	33	259	179	39	41	0	0	0

- Molecule 4 is COPPER (I) ION (three-letter code: CU1) (formula: Cu).

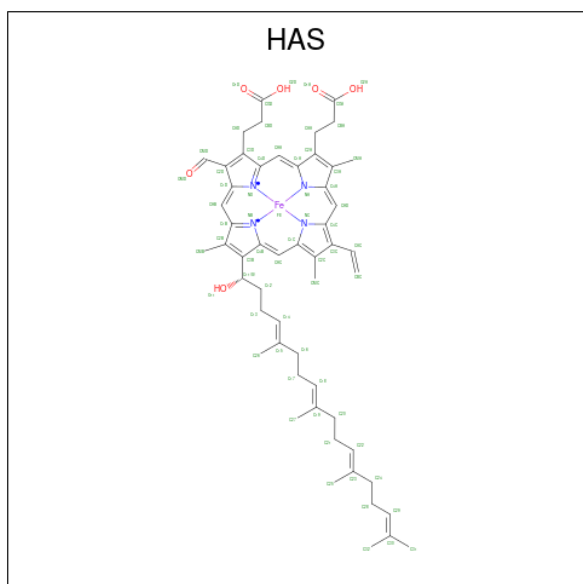
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Cu	0	0
			1	1		

- Molecule 5 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



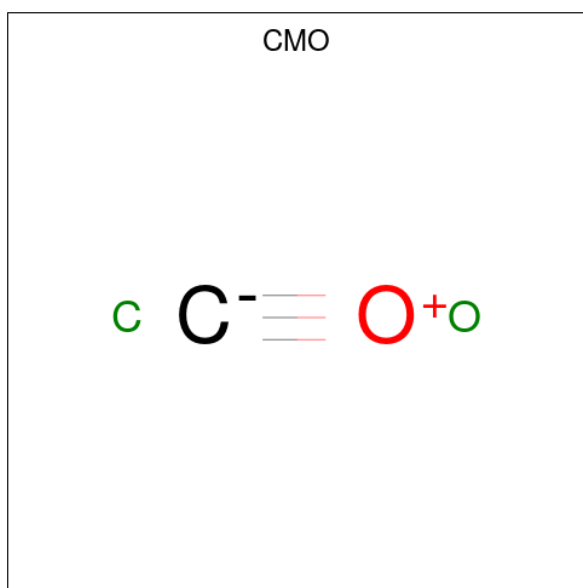
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Fe	N			O
5	A	1	43	34	1	4	4	0	0

- Molecule 6 is HEME-AS (three-letter code: HAS) (formula: $C_{54}H_{64}FeN_4O_6$).



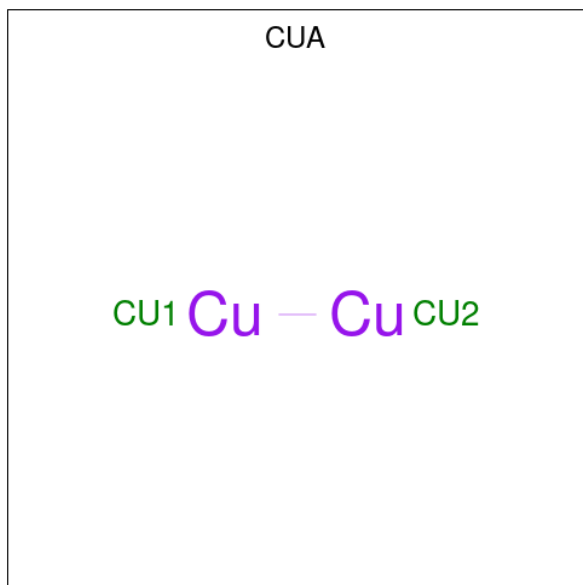
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Fe	N			O
6	A	1	65	54	1	4	6	0	0

- Molecule 7 is CARBON MONOXIDE (three-letter code: CMO) (formula: CO).



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

- Molecule 8 is DINUCLEAR COPPER ION (three-letter code: CUA) (formula: Cu₂).

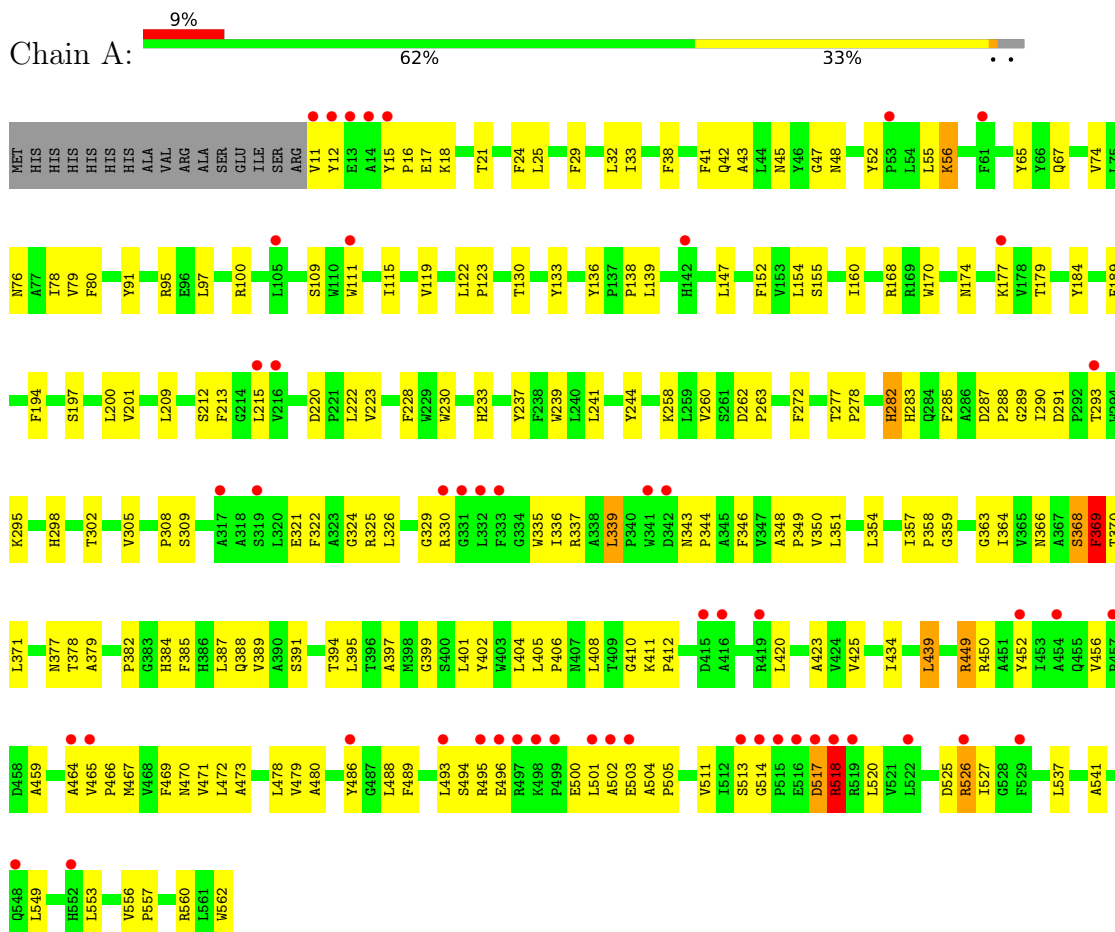


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	B	1	Total	Cu	0	0
			2	2		

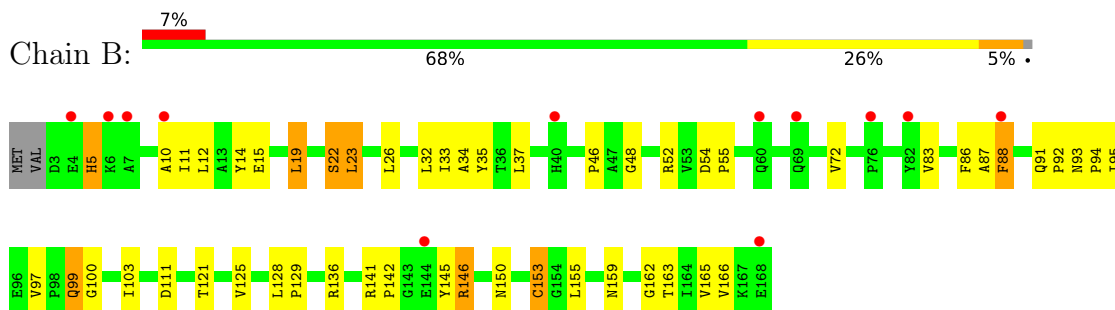
3 Residue-property plots i

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 c oxidase subunit 1

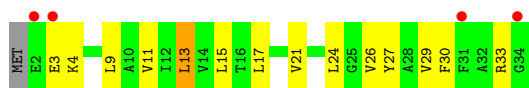


- Molecule 2: Cytochrome c oxidase subunit 2



- Molecule 3: Cytochrome c oxidase polypeptide 2A

Chain C:  12% 56% 38% ..



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	109.75Å 109.75Å 164.77Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.91 – 2.90 19.91 – 2.90	Depositor EDS
% Data completeness (in resolution range)	95.7 (19.91-2.90) 95.7 (19.91-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.11	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.21 (at 2.88Å)	Xtrriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.286 , 0.329 0.284 , 0.328	Depositor DCC
R_{free} test set	1127 reflections (5.14%)	wwPDB-VP
Wilson B-factor (Å ²)	82.3	Xtrriage
Anisotropy	0.235	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 28.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.52$, $\langle L^2 \rangle = 0.36$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	6037	wwPDB-VP
Average B, all atoms (Å ²)	68.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.31% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: CUA, HAS, HEM, CMO, CU1

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	0.71	2/4524 (0.0%)	0.75	0/6210
2	B	0.70	1/1335 (0.1%)	0.72	0/1822
3	C	0.94	0/265	0.89	0/359
All	All	0.72	3/6124 (0.0%)	0.75	0/8391

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	153	CYS	CB-SG	-7.04	1.70	1.82
1	A	500	GLU	CD-OE1	6.30	1.32	1.25
1	A	189	PHE	CE1-CZ	5.65	1.48	1.37

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	4367	0	4476	156	0
2	B	1298	0	1280	33	0
3	C	259	0	279	8	0
4	A	1	0	0	0	0
5	A	43	0	30	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	65	0	62	10	0
7	A	2	0	0	0	0
8	B	2	0	0	0	0
All	All	6037	0	6127	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 15.

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:233:HIS:NE2	1:A:237:TYR:CE2	1.88	1.38
1:A:233:HIS:NE2	1:A:237:TYR:HE2	1.26	1.28
1:A:449:ARG:HD2	1:A:450:ARG:HG3	1.35	1.09
1:A:518:ARG:HG2	1:A:518:ARG:HH21	1.11	1.08
1:A:233:HIS:CD2	1:A:237:TYR:HE2	1.84	0.96
1:A:518:ARG:HH21	1:A:518:ARG:CG	1.79	0.95
1:A:357:ILE:HB	1:A:358:PRO:HD3	1.51	0.93
1:A:47:GLY:HA3	1:A:471:VAL:HG23	1.52	0.92
1:A:233:HIS:CD2	1:A:237:TYR:CE2	2.58	0.91
1:A:321:GLU:O	1:A:325:ARG:HG2	1.76	0.85
1:A:410:GLY:CA	1:A:502:ALA:HB2	2.08	0.84
1:A:518:ARG:HG2	1:A:518:ARG:NH2	1.83	0.82
1:A:262:ASP:HB2	1:A:511:VAL:HG11	1.66	0.77
1:A:449:ARG:HH12	6:A:801:HAS:CGA	1.97	0.77
6:A:801:HAS:H253	3:C:11:VAL:HG11	1.66	0.76
1:A:357:ILE:HB	1:A:358:PRO:CD	2.16	0.75
1:A:410:GLY:HA3	1:A:502:ALA:HB2	1.71	0.73
1:A:76:ASN:HB3	5:A:800:HEM:CAC	2.20	0.72
1:A:291:ASP:OD2	1:A:293:THR:HB	1.91	0.71
1:A:76:ASN:O	1:A:80:PHE:HB3	1.92	0.69
1:A:160:ILE:HD13	1:A:194:PHE:HB2	1.74	0.69
1:A:262:ASP:HB3	1:A:263:PRO:HD3	1.75	0.69
2:B:141:ARG:O	2:B:145:TYR:OH	2.04	0.69
1:A:379:ALA:HB1	1:A:439:LEU:HD12	1.76	0.68
1:A:272:PHE:CZ	1:A:308:PRO:HB2	2.29	0.67
1:A:465:VAL:HG23	1:A:466:PRO:HD3	1.76	0.67
1:A:38:PHE:O	1:A:42:GLN:HG3	1.95	0.67
2:B:97:VAL:O	2:B:166:VAL:HA	1.95	0.67
1:A:197:SER:O	1:A:201:VAL:HG23	1.95	0.66
1:A:411:LYS:HG2	1:A:496:GLU:O	1.97	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:111:TRP:O	1:A:115:ILE:HG13	1.97	0.65
2:B:142:PRO:HA	2:B:166:VAL:CG2	2.26	0.64
2:B:46:PRO:HG3	2:B:125:VAL:HG23	1.78	0.64
1:A:220:ASP:HB3	1:A:223:VAL:HG22	1.80	0.64
1:A:174:ASN:HB3	1:A:177:LYS:HD3	1.78	0.64
2:B:166:VAL:O	2:B:166:VAL:HG23	2.00	0.62
1:A:115:ILE:O	1:A:119:VAL:HG23	2.01	0.61
1:A:239:TRP:HE3	6:A:801:HAS:CBC	2.14	0.60
1:A:395:LEU:HD22	1:A:425:VAL:HG13	1.84	0.60
1:A:562:TRP:HA	2:B:155:LEU:HG	1.84	0.59
2:B:54:ASP:OD1	2:B:55:PRO:HD2	2.03	0.59
2:B:19:LEU:HD22	2:B:23:LEU:HD22	1.85	0.59
1:A:298:HIS:HE1	1:A:541:ALA:O	1.86	0.58
1:A:371:LEU:HD11	3:C:27:TYR:HD1	1.68	0.58
1:A:263:PRO:HB3	1:A:520:LEU:HD23	1.86	0.58
2:B:94:PRO:HB2	2:B:165:VAL:CG2	2.34	0.58
1:A:282:HIS:CD2	1:A:283:HIS:CD2	2.92	0.58
1:A:348:ALA:HA	1:A:425:VAL:HG11	1.86	0.58
1:A:368:SER:HB3	2:B:33:ILE:HD11	1.84	0.58
1:A:24:PHE:HZ	1:A:109:SER:HG	1.51	0.58
2:B:86:PHE:O	2:B:88:PHE:N	2.38	0.57
1:A:465:VAL:HG23	1:A:466:PRO:CD	2.35	0.56
1:A:122:LEU:HB2	1:A:123:PRO:CD	2.36	0.56
1:A:122:LEU:HB2	1:A:123:PRO:HD3	1.87	0.56
2:B:10:ALA:O	2:B:14:TYR:HD1	1.89	0.55
1:A:366:ASN:HB3	6:A:801:HAS:CMD	2.36	0.55
1:A:366:ASN:HB3	6:A:801:HAS:C2D	2.37	0.55
1:A:518:ARG:CG	1:A:518:ARG:NH2	2.50	0.55
1:A:97:LEU:HD22	1:A:170:TRP:CD1	2.41	0.54
1:A:11:VAL:HG22	1:A:503:GLU:HG3	1.88	0.54
1:A:200:LEU:HD12	1:A:200:LEU:O	2.07	0.54
1:A:282:HIS:HA	1:A:285:PHE:CZ	2.42	0.54
1:A:223:VAL:HG12	1:A:549:LEU:HB3	1.88	0.54
1:A:382:PRO:HB2	1:A:439:LEU:HG	1.90	0.54
1:A:41:PHE:CE2	1:A:55:LEU:HB2	2.44	0.53
1:A:357:ILE:HG23	3:C:15:LEU:HD13	1.91	0.52
1:A:389:VAL:HB	6:A:801:HAS:HBC2	1.92	0.52
1:A:464:ALA:O	1:A:467:MET:HB2	2.09	0.52
1:A:29:PHE:CE1	1:A:401:LEU:HD11	2.45	0.52
1:A:228:PHE:CD2	1:A:228:PHE:C	2.83	0.52
1:A:33:ILE:HD11	1:A:488:LEU:CD2	2.40	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:11:VAL:HG13	1:A:18:LYS:HD3	1.93	0.51
1:A:11:VAL:HG21	1:A:502:ALA:HB3	1.92	0.51
1:A:76:ASN:HB3	5:A:800:HEM:C3C	2.45	0.51
1:A:410:GLY:HA2	1:A:502:ALA:HB2	1.88	0.51
1:A:11:VAL:O	1:A:15:TYR:O	2.29	0.51
1:A:95:ARG:HA	1:A:95:ARG:NH2	2.26	0.51
2:B:166:VAL:CG2	2:B:166:VAL:O	2.58	0.50
1:A:277:THR:N	1:A:278:PRO:CD	2.74	0.50
1:A:209:LEU:O	1:A:213:PHE:CD1	2.65	0.50
1:A:364:ILE:O	1:A:368:SER:OG	2.30	0.50
1:A:79:VAL:HA	1:A:152:PHE:CZ	2.47	0.49
1:A:321:GLU:HA	1:A:335:TRP:CE3	2.47	0.49
2:B:22:SER:O	2:B:26:LEU:HB2	2.13	0.49
1:A:262:ASP:HB2	1:A:511:VAL:CG1	2.41	0.49
1:A:21:THR:OG1	1:A:91:TYR:HB2	2.13	0.49
1:A:52:TYR:O	1:A:56:LYS:HB2	2.12	0.49
1:A:336:ILE:HA	1:A:339:LEU:HD22	1.94	0.48
1:A:479:VAL:O	1:A:480:ALA:C	2.52	0.48
1:A:329:GLY:HA3	1:A:335:TRP:HA	1.94	0.48
1:A:456:VAL:HG23	1:A:456:VAL:O	2.13	0.48
1:A:363:GLY:O	1:A:366:ASN:HB2	2.14	0.48
1:A:136:TYR:O	1:A:139:LEU:HB2	2.13	0.47
1:A:405:LEU:N	1:A:406:PRO:CD	2.77	0.47
1:A:43:ALA:O	1:A:470:ASN:HB3	2.13	0.47
1:A:456:VAL:HG23	1:A:459:ALA:HB3	1.96	0.47
2:B:94:PRO:HB2	2:B:165:VAL:HG23	1.95	0.47
1:A:379:ALA:O	1:A:439:LEU:HB3	2.15	0.47
1:A:459:ALA:O	2:B:146:ARG:NH1	2.38	0.47
1:A:412:PRO:HB3	1:A:501:LEU:HD21	1.96	0.47
1:A:346:PHE:CE1	1:A:350:VAL:HG21	2.50	0.47
1:A:67:GLN:HA	1:A:130:THR:HG23	1.97	0.47
1:A:434:ILE:HG22	1:A:473:ALA:HB2	1.96	0.47
2:B:34:ALA:HA	2:B:37:LEU:HB2	1.96	0.47
1:A:378:THR:O	1:A:449:ARG:HB3	2.14	0.46
1:A:449:ARG:NH1	6:A:801:HAS:CGA	2.74	0.46
1:A:12:TYR:O	1:A:16:PRO:CA	2.63	0.46
1:A:154:LEU:O	1:A:155:SER:C	2.54	0.46
1:A:295:LYS:HB2	1:A:369:PHE:CZ	2.51	0.46
1:A:290:ILE:O	1:A:295:LYS:HE3	2.15	0.46
1:A:556:VAL:CG1	2:B:55:PRO:HG3	2.46	0.46
1:A:466:PRO:HA	1:A:469:PHE:HD2	1.81	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:99:GLN:OE1	2:B:142:PRO:HB3	2.16	0.46
1:A:357:ILE:CB	1:A:358:PRO:CD	2.92	0.46
3:C:17:LEU:O	3:C:21:VAL:HG23	2.15	0.46
1:A:556:VAL:HG21	2:B:129:PRO:HB2	1.98	0.45
1:A:337:ARG:HA	1:A:337:ARG:HD2	1.67	0.45
1:A:525:ASP:O	1:A:527:ILE:N	2.49	0.45
1:A:97:LEU:HD22	1:A:170:TRP:CG	2.51	0.45
6:A:801:HAS:OMD	6:A:801:HAS:HBB	2.17	0.45
2:B:32:LEU:O	2:B:35:TYR:HB3	2.17	0.45
1:A:494:SER:C	1:A:496:GLU:H	2.19	0.45
1:A:287:ASP:O	1:A:295:LYS:NZ	2.47	0.45
3:C:26:VAL:O	3:C:30:PHE:N	2.41	0.44
1:A:15:TYR:HB2	1:A:18:LYS:HD2	1.99	0.44
1:A:289:GLY:HA2	2:B:48:GLY:O	2.18	0.44
1:A:399:GLY:O	1:A:402:TYR:HD2	2.00	0.44
1:A:489:PHE:HD2	1:A:493:LEU:HD13	1.82	0.44
2:B:92:PRO:HD2	2:B:95:ILE:HG12	1.98	0.44
1:A:24:PHE:HZ	1:A:109:SER:OG	1.99	0.44
1:A:343:ASN:HA	1:A:344:PRO:HD2	1.91	0.44
1:A:348:ALA:O	1:A:395:LEU:HB3	2.17	0.44
1:A:377:ASN:HB3	2:B:150:ASN:O	2.17	0.44
1:A:514:GLY:HA2	2:B:5:HIS:NE2	2.33	0.44
2:B:142:PRO:HA	2:B:166:VAL:HG23	1.98	0.44
1:A:11:VAL:HG21	1:A:502:ALA:CB	2.47	0.44
1:A:15:TYR:HA	1:A:17:GLU:OE1	2.18	0.44
1:A:346:PHE:O	1:A:349:PRO:HD2	2.18	0.44
1:A:526:ARG:HE	1:A:526:ARG:HB3	1.59	0.44
1:A:379:ALA:C	1:A:382:PRO:HD2	2.39	0.43
1:A:138:PRO:HB3	1:A:557:PRO:O	2.19	0.43
1:A:16:PRO:HD2	1:A:100:ARG:HH11	1.83	0.43
1:A:420:LEU:O	1:A:423:ALA:HB3	2.19	0.43
1:A:404:LEU:O	1:A:408:LEU:HG	2.18	0.43
2:B:83:VAL:HG13	2:B:95:ILE:HD11	2.00	0.43
3:C:3:GLU:CD	3:C:4:LYS:H	2.22	0.43
1:A:122:LEU:CB	1:A:123:PRO:CD	2.96	0.43
1:A:517:ASP:O	1:A:518:ARG:C	2.57	0.43
1:A:504:ALA:HA	1:A:505:PRO:HD3	1.84	0.42
2:B:12:LEU:O	2:B:15:GLU:HB3	2.18	0.42
3:C:9:LEU:O	3:C:13:LEU:HB2	2.19	0.42
1:A:179:THR:HG21	1:A:184:TYR:HA	2.01	0.42
1:A:282:HIS:HA	1:A:285:PHE:CE1	2.55	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:387:LEU:O	1:A:391:SER:HB3	2.19	0.42
1:A:241:LEU:HA	1:A:244:TYR:HB2	2.00	0.42
1:A:382:PRO:HA	1:A:385:PHE:CZ	2.55	0.42
1:A:420:LEU:HD21	1:A:486:TYR:HD2	1.85	0.42
1:A:517:ASP:OD2	1:A:517:ASP:N	2.52	0.42
1:A:560:ARG:HG3	1:A:562:TRP:CZ2	2.55	0.42
1:A:359:GLY:HA3	1:A:388:GLN:NE2	2.35	0.42
1:A:298:HIS:CE1	1:A:541:ALA:O	2.71	0.41
1:A:401:LEU:O	1:A:406:PRO:HD3	2.20	0.41
1:A:74:VAL:O	1:A:78:ILE:HB	2.20	0.41
1:A:358:PRO:HB2	1:A:387:LEU:HD13	2.02	0.41
1:A:495:ARG:HA	1:A:495:ARG:HD3	1.86	0.41
2:B:93:ASN:HD21	2:B:162:GLY:HA2	1.84	0.41
1:A:45:ASN:ND2	1:A:65:TYR:CZ	2.88	0.41
1:A:357:ILE:HG12	6:A:801:HAS:H212	2.01	0.41
1:A:401:LEU:O	1:A:405:LEU:HB2	2.20	0.41
2:B:91:GLN:HA	2:B:92:PRO:C	2.38	0.41
1:A:258:LYS:HG3	1:A:322:PHE:HE1	1.85	0.41
1:A:223:VAL:HG11	1:A:553:LEU:CD2	2.51	0.41
1:A:260:VAL:HB	2:B:11:ILE:HD13	2.02	0.41
1:A:324:GLY:CA	1:A:339:LEU:CD1	2.98	0.41
1:A:394:THR:O	1:A:397:ALA:HB3	2.21	0.41
1:A:537:LEU:HD23	1:A:537:LEU:HA	1.88	0.41
1:A:222:LEU:HD21	1:A:288:PRO:O	2.21	0.41
1:A:119:VAL:HG11	1:A:147:LEU:HD23	2.02	0.40
1:A:233:HIS:HE2	1:A:237:TYR:HH	1.69	0.40
1:A:405:LEU:N	1:A:406:PRO:HD2	2.36	0.40
2:B:103:ILE:O	2:B:136:ARG:HA	2.21	0.40
1:A:302:THR:CG2	6:A:801:HAS:HMB2	2.51	0.40
1:A:449:ARG:HD2	1:A:450:ARG:CG	2.26	0.40
3:C:29:VAL:HG12	3:C:33:ARG:HD2	2.02	0.40
1:A:351:LEU:HD12	1:A:425:VAL:HG12	2.03	0.40
1:A:220:ASP:OD2	2:B:52:ARG:NH1	2.50	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	550/568 (97%)	500 (91%)	46 (8%)	4 (1%)	22	54
2	B	164/168 (98%)	145 (88%)	16 (10%)	3 (2%)	8	29
3	C	31/34 (91%)	28 (90%)	3 (10%)	0	100	100
All	All	745/770 (97%)	673 (90%)	65 (9%)	7 (1%)	17	48

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	518	ARG
2	B	87	ALA
2	B	88	PHE
1	A	384	HIS
1	A	330	ARG
1	A	369	PHE
2	B	100	GLY

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	448/462 (97%)	421 (94%)	27 (6%)	19	49
2	B	136/138 (99%)	123 (90%)	13 (10%)	8	25
3	C	26/27 (96%)	24 (92%)	2 (8%)	13	35
All	All	610/627 (97%)	568 (93%)	42 (7%)	15	41

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	25	LEU
1	A	32	LEU
1	A	48	ASN
1	A	56	LYS
1	A	133	TYR
1	A	168	ARG
1	A	212	SER
1	A	215	LEU
1	A	230	TRP
1	A	282	HIS
1	A	305	VAL
1	A	309	SER
1	A	326	LEU
1	A	339	LEU
1	A	354	LEU
1	A	368	SER
1	A	369	PHE
1	A	370	THR
1	A	439	LEU
1	A	449	ARG
1	A	452	TYR
1	A	472	LEU
1	A	478	LEU
1	A	513	SER
1	A	517	ASP
1	A	518	ARG
1	A	526	ARG
2	B	5	HIS
2	B	19	LEU
2	B	22	SER
2	B	23	LEU
2	B	72	VAL
2	B	99	GLN
2	B	111	ASP
2	B	121	THR
2	B	128	LEU
2	B	146	ARG
2	B	153	CYS
2	B	159	ASN
2	B	163	THR
3	C	13	LEU
3	C	24	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	45	ASN
1	A	76	ASN
1	A	254	GLN
1	A	298	HIS
1	A	366	ASN
1	A	417	GLN
2	B	8	HIS
2	B	69	GLN
2	B	93	ASN
2	B	117	HIS
2	B	122	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 5 ligands modelled in this entry, 1 is monoatomic - leaving 4 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	$\# Z > 2$
8	CUA	B	802	2	0,1,1	-	-	-		

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	HEM	A	800	1	41,50,50	1.85	6 (14%)	45,82,82	1.60	10 (22%)
6	HAS	A	801	1	57,72,72	2.68	16 (28%)	48,109,109	1.90	12 (25%)
7	CMO	A	563	-	0,1,1	-	-	-	-	-

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	HEM	A	800	1	-	4/12/54/54	-
6	HAS	A	801	1	-	8/40/122/122	-

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	801	HAS	C2D-C3D	10.96	1.46	1.36
5	A	800	HEM	C3D-C2D	7.10	1.51	1.36
6	A	801	HAS	CHC-C4B	6.57	1.48	1.37
6	A	801	HAS	CHA-C4D	6.36	1.48	1.37
6	A	801	HAS	CHD-C4A	5.03	1.48	1.39
6	A	801	HAS	C1D-C2D	-4.86	1.38	1.45
6	A	801	HAS	C3C-C2C	4.46	1.46	1.40
6	A	801	HAS	CHD-C4C	4.23	1.47	1.39
6	A	801	HAS	CHB-C1D	4.09	1.47	1.39
5	A	800	HEM	C3C-CAC	4.09	1.56	1.47
6	A	801	HAS	CHA-C1A	4.04	1.49	1.40
5	A	800	HEM	C3C-C2C	-4.03	1.34	1.40
6	A	801	HAS	CHB-C1B	4.02	1.46	1.39
6	A	801	HAS	CHC-C1C	3.36	1.47	1.40
6	A	801	HAS	C3C-C4C	3.20	1.48	1.40
6	A	801	HAS	C2A-C3A	3.19	1.47	1.37
5	A	800	HEM	CMB-C2B	2.61	1.56	1.50
6	A	801	HAS	C14-C15	2.60	1.39	1.33
5	A	800	HEM	CAB-C3B	2.40	1.54	1.47
6	A	801	HAS	C3B-C2B	2.39	1.40	1.34
6	A	801	HAS	CMD-C2D	2.18	1.48	1.44
5	A	800	HEM	FE-ND	2.06	2.07	1.96

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	801	HAS	CMC-C2C-C3C	-5.33	114.71	124.68
6	A	801	HAS	C4B-C3B-C2B	-5.03	103.62	108.79
5	A	800	HEM	CBA-CAA-C2A	-4.97	104.14	112.62
6	A	801	HAS	CAD-CBD-CGD	-4.52	103.87	113.60
5	A	800	HEM	C4D-ND-C1D	3.74	108.94	105.07
6	A	801	HAS	OMD-CMD-C2D	-3.60	119.26	125.03
5	A	800	HEM	CAD-C3D-C4D	3.49	130.76	124.66
6	A	801	HAS	CAA-CBA-CGA	-3.16	104.91	113.76
6	A	801	HAS	C1D-CHB-C1B	3.03	127.39	119.86
5	A	800	HEM	C4C-CHD-C1D	2.70	126.12	122.56
6	A	801	HAS	C25-C23-C24	2.66	119.75	115.27
6	A	801	HAS	CHB-C1D-C2D	-2.65	122.43	126.66
5	A	800	HEM	CBB-CAB-C3B	-2.46	115.36	127.62
5	A	800	HEM	C4D-C3D-C2D	-2.43	103.35	106.90
5	A	800	HEM	CMD-C2D-C1D	2.41	128.71	125.04
6	A	801	HAS	O2A-CGA-CBA	2.37	121.66	114.03
6	A	801	HAS	C32-C30-C31	2.33	119.74	114.60
6	A	801	HAS	CAD-C3D-C4D	2.26	130.86	124.62
5	A	800	HEM	C4B-C3B-C2B	2.10	108.78	107.11
5	A	800	HEM	CMA-C3A-C4A	-2.10	125.23	128.46
5	A	800	HEM	C4B-CHC-C1C	2.08	125.30	122.56
6	A	801	HAS	C4D-CHA-C1A	2.07	124.28	118.67

There are no chirality outliers.

All (12) torsion outliers are listed below:

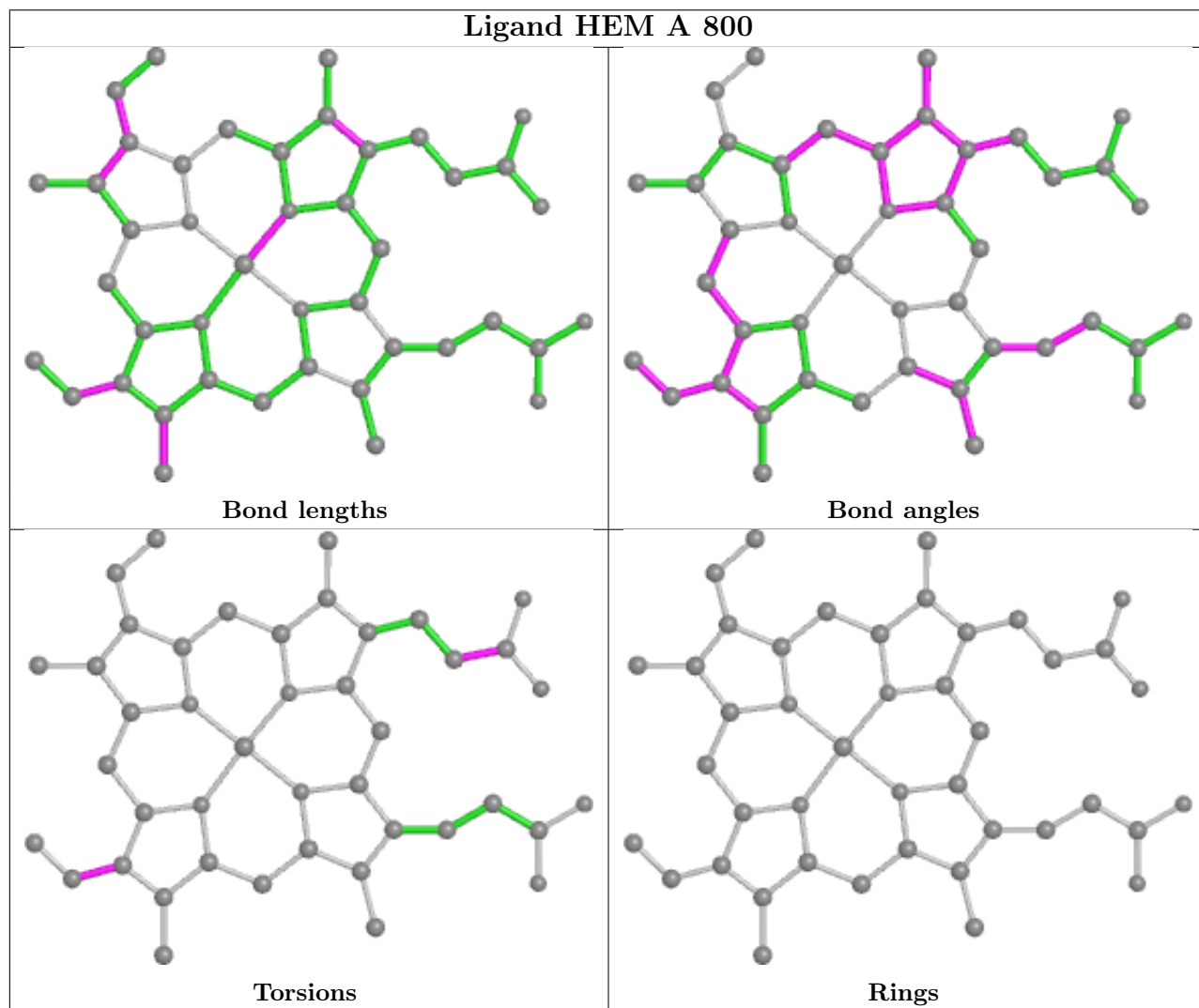
Mol	Chain	Res	Type	Atoms
5	A	800	HEM	C2B-C3B-CAB-CBB
5	A	800	HEM	C4B-C3B-CAB-CBB
6	A	801	HAS	C19-C20-C21-C22
6	A	801	HAS	C3D-C2D-CMD-OMD
5	A	800	HEM	CAD-CBD-CGD-O1D
6	A	801	HAS	CAD-CBD-CGD-O1D
6	A	801	HAS	CAA-CBA-CGA-O1A
6	A	801	HAS	CAD-CBD-CGD-O2D
5	A	800	HEM	CAD-CBD-CGD-O2D
6	A	801	HAS	CAA-CBA-CGA-O2A
6	A	801	HAS	C1D-C2D-CMD-OMD
6	A	801	HAS	C15-C16-C17-C18

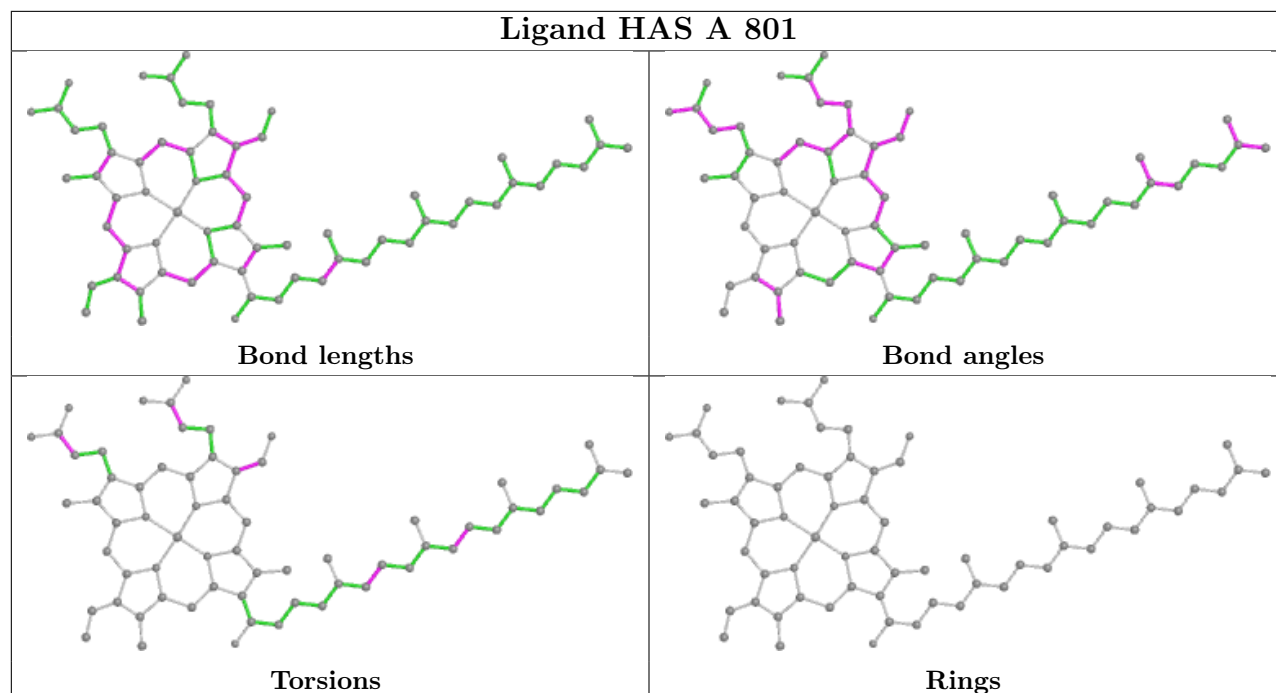
There are no ring outliers.

2 monomers are involved in 12 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	800	HEM	2	0
6	A	801	HAS	10	0

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





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	552/568 (97%)	0.45	52 (9%) 8 6	47, 66, 95, 112	0
2	B	166/168 (98%)	0.55	12 (7%) 15 11	51, 70, 103, 135	0
3	C	33/34 (97%)	0.36	4 (12%) 4 3	51, 56, 76, 82	0
All	All	751/770 (97%)	0.47	68 (9%) 9 6	47, 66, 96, 135	0

All (68) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	14	ALA	7.4
2	B	7	ALA	7.1
1	A	13	GLU	6.9
1	A	502	ALA	6.4
1	A	498	LYS	6.1
1	A	503	GLU	6.1
1	A	342	ASP	6.0
1	A	497	ARG	5.8
2	B	168	GLU	5.7
1	A	11	VAL	5.3
1	A	499	PRO	5.1
1	A	330	ARG	5.1
1	A	495	ARG	5.0
3	C	2	GLU	5.0
1	A	496	GLU	4.9
2	B	6	LYS	4.9
1	A	331	GLY	4.8
2	B	4	GLU	4.6
1	A	12	TYR	4.5
1	A	493	LEU	4.1
2	B	88	PHE	4.1
3	C	3	GLU	3.7
1	A	332	LEU	3.6

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Mol	Chain	Res	Type	RSRZ
1	A	501	LEU	3.5
1	A	464	ALA	3.4
1	A	552	HIS	3.4
1	A	514	GLY	3.3
1	A	515	PRO	3.3
1	A	333	PHE	3.3
3	C	34	GLY	3.2
1	A	216	VAL	3.1
2	B	60	GLN	3.1
1	A	293	THR	3.0
1	A	341	TRP	3.0
1	A	105	LEU	3.0
1	A	465	VAL	3.0
1	A	486	TYR	2.9
1	A	215	LEU	2.9
1	A	15	TYR	2.9
2	B	144	GLU	2.8
1	A	452	TYR	2.7
1	A	415	ASP	2.7
1	A	529	PHE	2.6
1	A	53	PRO	2.6
1	A	319	SER	2.5
1	A	516	GLU	2.5
2	B	76	PRO	2.4
1	A	522	LEU	2.4
1	A	519	ARG	2.4
1	A	419	ARG	2.4
1	A	111	TRP	2.4
1	A	317	ALA	2.4
1	A	513	SER	2.4
1	A	177	LYS	2.4
1	A	61	PHE	2.3
2	B	82	TYR	2.3
1	A	526	ARG	2.2
1	A	548	GLN	2.2
1	A	454	ALA	2.2
2	B	69	GLN	2.2
3	C	31	PHE	2.1
1	A	457	PRO	2.1
1	A	518	ARG	2.1
1	A	142	HIS	2.1
1	A	517	ASP	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	416	ALA	2.0
2	B	40	HIS	2.0
2	B	10	ALA	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](#)

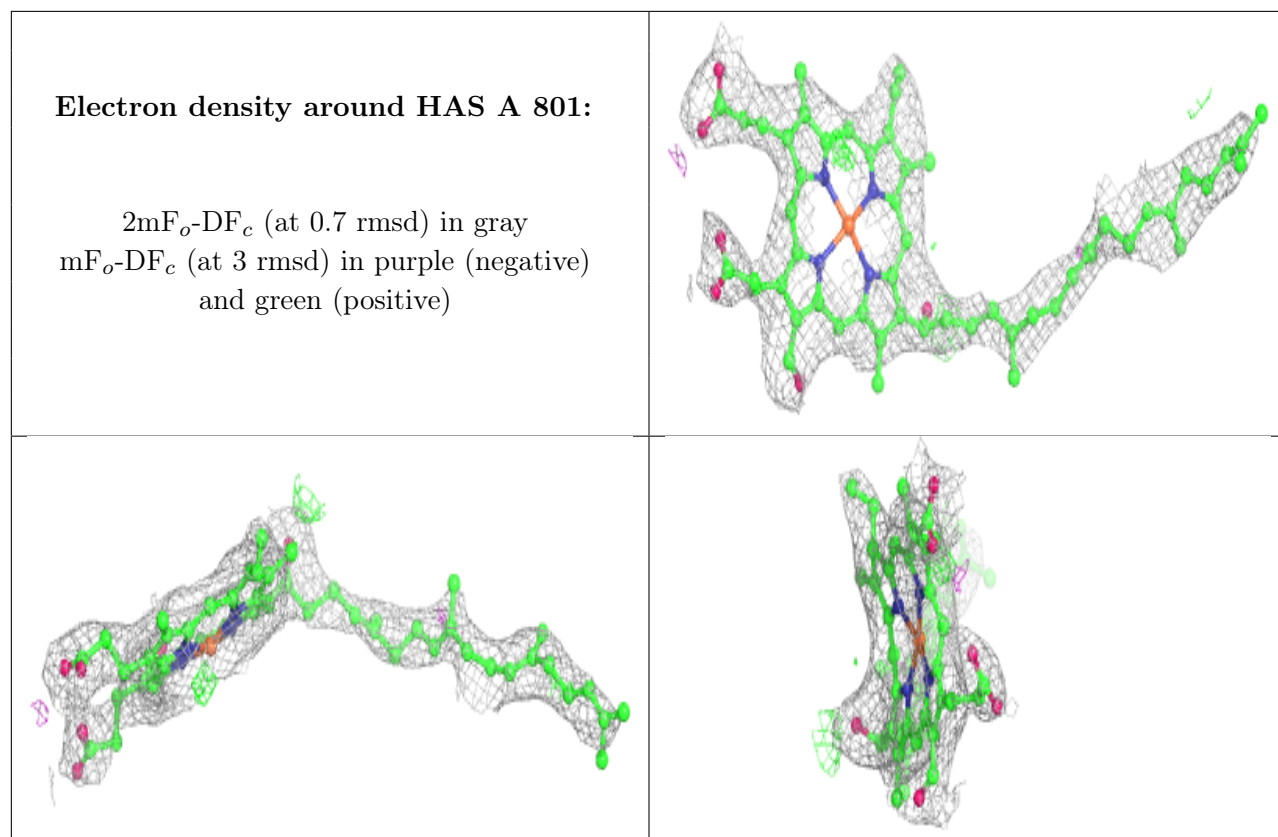
There are no monosaccharides in this entry.

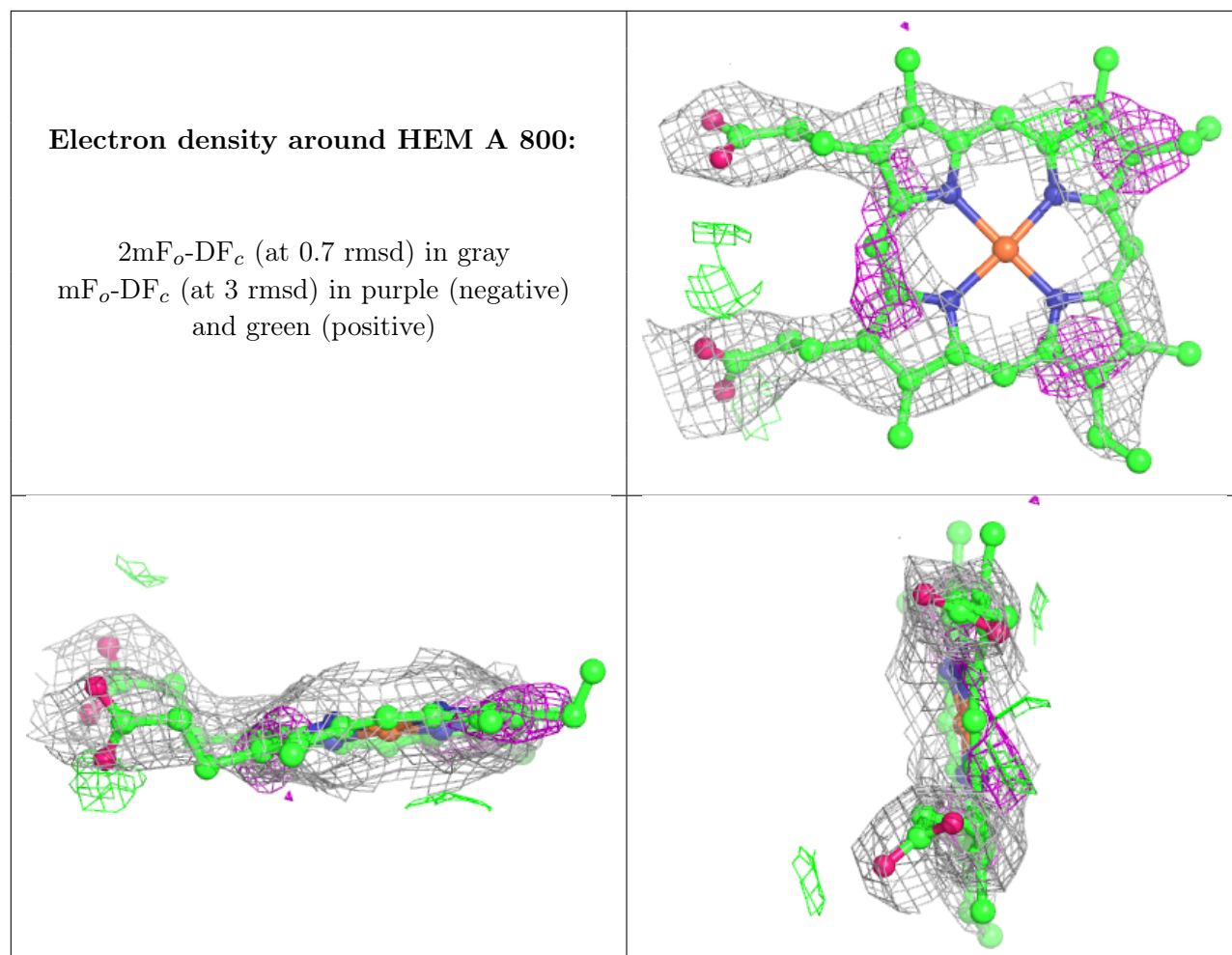
6.4 Ligands [i](#)

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
6	HAS	A	801	65/65	0.92	0.20	40,40,40,40	0
8	CUA	B	802	2/2	0.94	0.05	40,40,40,40	0
5	HEM	A	800	43/43	0.96	0.17	40,40,40,40	0
7	CMO	A	563	2/2	0.98	0.10	40,40,40,40	0
4	CU1	A	803	1/1	0.98	0.06	40,40,40,40	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.