



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 05:57 PM UTC

PDB ID : 4H24 / pdb_00004h24
Title : Cytochrome P450BM3-CIS cyclopropanation catalyst
Authors : Coelho, P.S.; Wang, Z.J.; Ener, M.E.; Baril, S.A.; Kannan, A.; Arnold, F.H.;
Brustad, E.M.
Deposited on : 2012-09-11
Resolution : 2.50 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

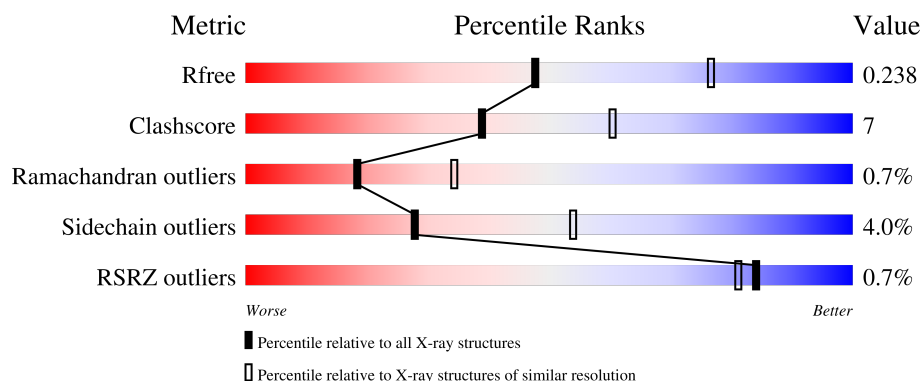
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	470	79% 16% ..
1	B	470	% 80% 16% ..
1	C	470	% 78% 17% ..
1	D	470	% 77% 18% ..

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 14761 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-BM3 variant P450BM3-Cis.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	457	Total	C	N	O	S	0	2	0
			3624	2317	615	675	17			
1	B	452	Total	C	N	O	S	0	0	0
			3589	2297	613	662	17			
1	C	456	Total	C	N	O	S	0	0	0
			3605	2309	615	664	17			
1	D	455	Total	C	N	O	S	0	0	0
			3574	2284	611	662	17			

There are 76 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	78	ALA	VAL	engineered mutation	UNP P14779
A	87	VAL	PHE	engineered mutation	UNP P14779
A	142	SER	PRO	engineered mutation	UNP P14779
A	175	ILE	THR	engineered mutation	UNP P14779
A	184	VAL	ALA	engineered mutation	UNP P14779
A	226	ARG	SER	engineered mutation	UNP P14779
A	236	GLN	HIS	engineered mutation	UNP P14779
A	252	GLY	GLU	engineered mutation	UNP P14779
A	268	ALA	THR	engineered mutation	UNP P14779
A	290	VAL	ALA	engineered mutation	UNP P14779
A	353	VAL	LEU	engineered mutation	UNP P14779
A	366	VAL	ILE	engineered mutation	UNP P14779
A	442	LYS	GLU	engineered mutation	UNP P14779
A	464	HIS	-	expression tag	UNP P14779
A	465	HIS	-	expression tag	UNP P14779
A	466	HIS	-	expression tag	UNP P14779
A	467	HIS	-	expression tag	UNP P14779
A	468	HIS	-	expression tag	UNP P14779
A	469	HIS	-	expression tag	UNP P14779
B	78	ALA	VAL	engineered mutation	UNP P14779
B	87	VAL	PHE	engineered mutation	UNP P14779

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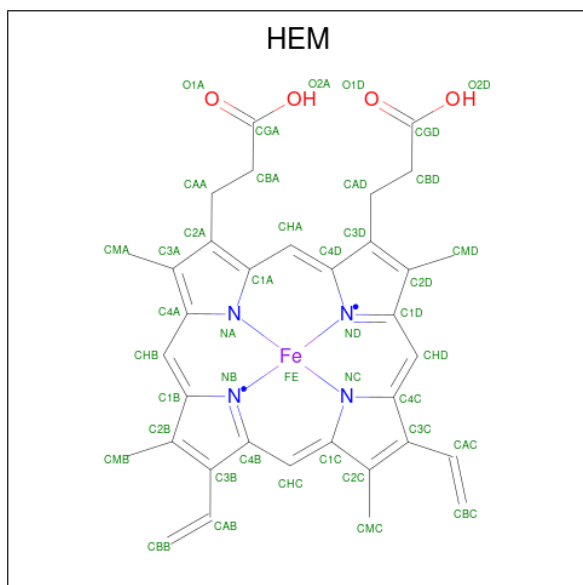
Chain	Residue	Modelled	Actual	Comment	Reference
B	142	SER	PRO	engineered mutation	UNP P14779
B	175	ILE	THR	engineered mutation	UNP P14779
B	184	VAL	ALA	engineered mutation	UNP P14779
B	226	ARG	SER	engineered mutation	UNP P14779
B	236	GLN	HIS	engineered mutation	UNP P14779
B	252	GLY	GLU	engineered mutation	UNP P14779
B	268	ALA	THR	engineered mutation	UNP P14779
B	290	VAL	ALA	engineered mutation	UNP P14779
B	353	VAL	LEU	engineered mutation	UNP P14779
B	366	VAL	ILE	engineered mutation	UNP P14779
B	442	LYS	GLU	engineered mutation	UNP P14779
B	464	HIS	-	expression tag	UNP P14779
B	465	HIS	-	expression tag	UNP P14779
B	466	HIS	-	expression tag	UNP P14779
B	467	HIS	-	expression tag	UNP P14779
B	468	HIS	-	expression tag	UNP P14779
B	469	HIS	-	expression tag	UNP P14779
C	78	ALA	VAL	engineered mutation	UNP P14779
C	87	VAL	PHE	engineered mutation	UNP P14779
C	142	SER	PRO	engineered mutation	UNP P14779
C	175	ILE	THR	engineered mutation	UNP P14779
C	184	VAL	ALA	engineered mutation	UNP P14779
C	226	ARG	SER	engineered mutation	UNP P14779
C	236	GLN	HIS	engineered mutation	UNP P14779
C	252	GLY	GLU	engineered mutation	UNP P14779
C	268	ALA	THR	engineered mutation	UNP P14779
C	290	VAL	ALA	engineered mutation	UNP P14779
C	353	VAL	LEU	engineered mutation	UNP P14779
C	366	VAL	ILE	engineered mutation	UNP P14779
C	442	LYS	GLU	engineered mutation	UNP P14779
C	464	HIS	-	expression tag	UNP P14779
C	465	HIS	-	expression tag	UNP P14779
C	466	HIS	-	expression tag	UNP P14779
C	467	HIS	-	expression tag	UNP P14779
C	468	HIS	-	expression tag	UNP P14779
C	469	HIS	-	expression tag	UNP P14779
D	78	ALA	VAL	engineered mutation	UNP P14779
D	87	VAL	PHE	engineered mutation	UNP P14779
D	142	SER	PRO	engineered mutation	UNP P14779
D	175	ILE	THR	engineered mutation	UNP P14779
D	184	VAL	ALA	engineered mutation	UNP P14779
D	226	ARG	SER	engineered mutation	UNP P14779

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Chain	Residue	Modelled	Actual	Comment	Reference
D	236	GLN	HIS	engineered mutation	UNP P14779
D	252	GLY	GLU	engineered mutation	UNP P14779
D	268	ALA	THR	engineered mutation	UNP P14779
D	290	VAL	ALA	engineered mutation	UNP P14779
D	353	VAL	LEU	engineered mutation	UNP P14779
D	366	VAL	ILE	engineered mutation	UNP P14779
D	442	LYS	GLU	engineered mutation	UNP P14779
D	464	HIS	-	expression tag	UNP P14779
D	465	HIS	-	expression tag	UNP P14779
D	466	HIS	-	expression tag	UNP P14779
D	467	HIS	-	expression tag	UNP P14779
D	468	HIS	-	expression tag	UNP P14779
D	469	HIS	-	expression tag	UNP P14779

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



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

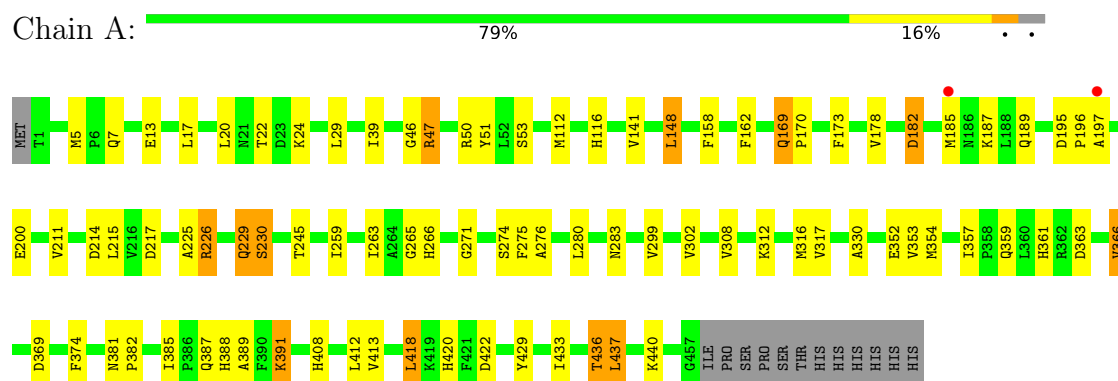
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	72	Total 72	O 72	0	0
3	B	41	Total 41	O 41	0	0
3	C	46	Total 46	O 46	0	0
3	D	38	Total 38	O 38	0	0

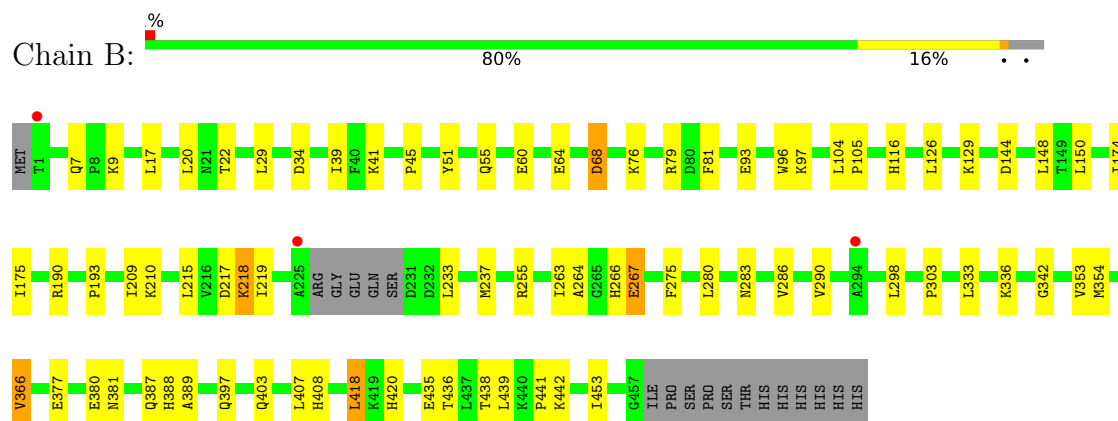
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

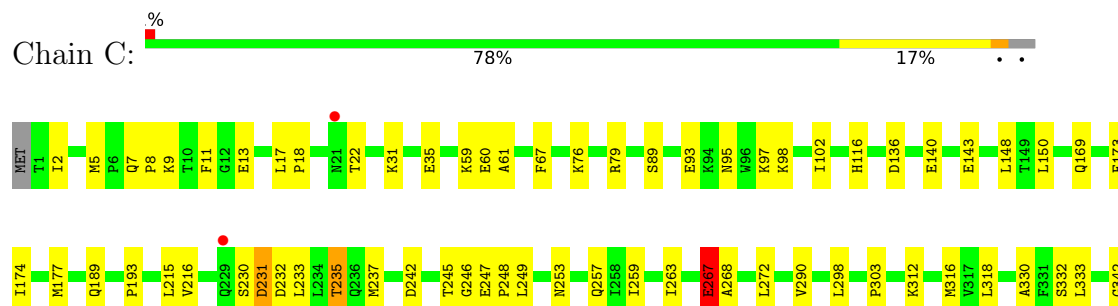
• Molecule 1: Cytochrome P450-BM3 variant P450BM3-Cis



• Molecule 1: Cytochrome P450-BM3 variant P450BM3-Cis

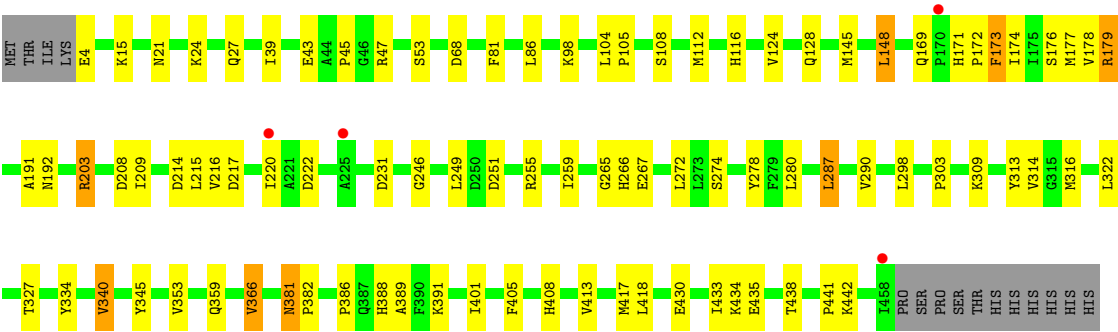
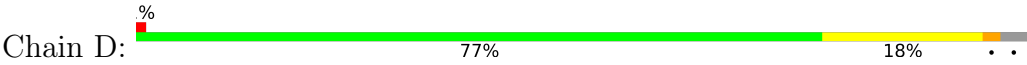


• Molecule 1: Cytochrome P450-BM3 variant P450BM3-Cis





● Molecule 1: Cytochrome P450-BM3 variant P450BM3-Cis



4 Data and refinement statistics

Property	Value	Source
Space group	I 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	187.79Å 62.74Å 210.28Å 90.00° 115.75° 90.00°	Depositor
Resolution (Å)	48.58 – 2.50 48.58 – 2.50	Depositor EDS
% Data completeness (in resolution range)	98.6 (48.58-2.50) 77.9 (48.58-2.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.05	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.93 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.184 , 0.247 (Not available) , 0.238	Depositor DCC
R_{free} test set	3821 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	47.4	Xtriage
Anisotropy	0.055	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 36.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	14761	wwPDB-VP
Average B, all atoms (Å ²)	47.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.73% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 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	1.02	1/3712 (0.0%)	1.16	20/5030 (0.4%)
1	B	1.00	0/3670	1.11	11/4965 (0.2%)
1	C	0.96	1/3687 (0.0%)	1.06	16/4992 (0.3%)
1	D	0.95	1/3656 (0.0%)	1.10	7/4955 (0.1%)
All	All	0.98	3/14725 (0.0%)	1.11	54/19942 (0.3%)

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	C	0	1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	357	ILE	CA-CB	7.28	1.58	1.53
1	A	299	VAL	CA-CB	5.11	1.60	1.54
1	D	389	ALA	CA-CB	-5.01	1.44	1.53

All (54) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	436	THR	CA-C-N	-8.76	106.08	120.71
1	B	436	THR	C-N-CA	-8.76	106.08	120.71
1	A	391	LYS	CA-C-N	-8.18	111.36	119.87
1	A	391	LYS	C-N-CA	-8.18	111.36	119.87
1	C	405	PHE	N-CA-C	-7.07	103.00	111.69
1	A	5	MET	N-CA-C	6.64	118.01	109.65

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	169	GLN	CA-C-N	-6.54	111.66	119.84
1	D	169	GLN	C-N-CA	-6.54	111.66	119.84
1	A	283	ASN	CA-C-N	6.53	126.76	119.32
1	A	283	ASN	C-N-CA	6.53	126.76	119.32
1	C	232	ASP	N-CA-C	6.12	116.51	108.07
1	A	436	THR	CA-C-N	-6.04	112.23	120.44
1	A	436	THR	C-N-CA	-6.04	112.23	120.44
1	C	95	ASN	N-CA-C	6.01	119.87	112.54
1	C	391	LYS	CA-C-N	-6.01	113.62	119.87
1	C	391	LYS	C-N-CA	-6.01	113.62	119.87
1	A	302	VAL	CA-C-N	-5.98	113.81	120.14
1	A	302	VAL	C-N-CA	-5.98	113.81	120.14
1	B	175	ILE	N-CA-C	-5.85	105.14	110.82
1	B	263	ILE	N-CA-C	5.84	115.97	110.30
1	C	357	ILE	CA-C-N	-5.80	113.70	119.56
1	C	357	ILE	C-N-CA	-5.80	113.70	119.56
1	D	86	LEU	N-CA-C	5.70	117.49	111.28
1	B	453	ILE	CA-C-N	5.58	125.53	119.78
1	B	453	ILE	C-N-CA	5.58	125.53	119.78
1	C	242	ASP	CA-C-N	5.52	125.35	119.28
1	C	242	ASP	C-N-CA	5.52	125.35	119.28
1	A	274	SER	N-CA-CB	5.50	118.05	110.07
1	C	357	ILE	N-CA-CB	5.49	113.96	110.50
1	B	283	ASN	CA-C-N	5.47	125.56	119.32
1	B	283	ASN	C-N-CA	5.47	125.56	119.32
1	B	403	GLN	N-CA-C	5.44	117.66	111.02
1	B	264	ALA	N-CA-C	-5.40	105.50	111.71
1	C	437	LEU	N-CA-C	-5.39	105.84	112.90
1	C	169	GLN	CA-C-N	-5.38	114.70	120.03
1	C	169	GLN	C-N-CA	-5.38	114.70	120.03
1	D	340	VAL	CB-CA-C	-5.38	102.64	110.81
1	B	436	THR	O-C-N	-5.28	115.57	122.59
1	D	173	PHE	N-CA-C	-5.26	106.80	113.43
1	D	278	TYR	N-CA-C	-5.26	105.44	111.07
1	C	436	THR	CA-C-N	-5.25	111.86	121.52
1	C	436	THR	C-N-CA	-5.25	111.86	121.52
1	A	7	GLN	CA-C-N	-5.23	115.19	120.21
1	A	7	GLN	C-N-CA	-5.23	115.19	120.21
1	C	436	THR	N-CA-C	-5.17	99.79	110.80
1	A	429	TYR	N-CA-C	5.10	117.63	110.23
1	A	437	LEU	N-CA-C	-5.09	105.64	111.14
1	A	169[A]	GLN	CA-C-N	-5.07	114.72	119.89

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	169[A]	GLN	C-N-CA	-5.07	114.72	119.89
1	A	169[B]	GLN	CA-C-N	-5.07	114.72	119.89
1	A	169[B]	GLN	C-N-CA	-5.07	114.72	119.89
1	A	245	THR	CB-CA-C	-5.04	102.66	109.16
1	D	246	GLY	N-CA-C	-5.03	107.11	114.61
1	A	141	VAL	N-CA-C	5.01	115.13	110.42

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	421	PHE	Peptide

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3624	0	3554	45	0
1	B	3589	0	3543	44	0
1	C	3605	0	3554	50	0
1	D	3574	0	3481	50	0
2	A	43	0	30	3	0
2	B	43	0	30	2	0
2	C	43	0	30	6	0
2	D	43	0	30	3	0
3	A	72	0	0	1	0
3	B	41	0	0	2	0
3	C	46	0	0	2	0
3	D	38	0	0	2	0
All	All	14761	0	14252	195	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 7.

All (195) 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:162:PHE:HE1	1:A:215:LEU:HD21	1.24	0.98
1:C:405:PHE:CD1	2:C:500:HEM:HBB1	2.01	0.95
1:B:116:HIS:HD2	1:B:408:HIS:HE2	1.07	0.93
1:D:112:MET:HE1	1:D:405:PHE:HA	1.51	0.89
1:A:162:PHE:CE1	1:A:215:LEU:HD21	2.07	0.87
1:A:312:LYS:HG2	1:A:316:MET:HE1	1.55	0.87
1:C:9:LYS:HE3	3:C:645:HOH:O	1.75	0.86
1:D:290:VAL:CG1	1:D:418:LEU:HD13	2.09	0.83
1:C:312:LYS:HE3	1:C:316:MET:HE3	1.62	0.81
1:D:290:VAL:HG12	1:D:418:LEU:HD13	1.63	0.81
1:B:387:GLN:HG3	1:B:388:HIS:CD2	2.16	0.79
1:A:312:LYS:HG2	1:A:316:MET:CE	2.12	0.78
1:C:405:PHE:HD1	2:C:500:HEM:HBB1	1.50	0.75
1:C:330:ALA:HB1	1:C:354:MET:CE	2.17	0.75
1:D:112:MET:CE	1:D:405:PHE:HA	2.17	0.75
1:D:145:MET:HE1	1:D:417:MET:SD	2.26	0.75
1:C:267:GLU:HA	1:C:267:GLU:OE2	1.85	0.74
1:A:436:THR:OG1	1:A:437:LEU:N	2.17	0.74
1:B:290:VAL:HG11	1:B:418:LEU:HD13	1.69	0.72
1:D:309:LYS:HE2	3:D:634:HOH:O	1.88	0.72
1:C:312:LYS:HE3	1:C:316:MET:CE	2.19	0.72
1:B:116:HIS:CD2	1:B:408:HIS:HE2	2.00	0.71
1:B:290:VAL:CG1	1:B:418:LEU:HD13	2.22	0.70
1:C:233:LEU:HG	1:C:237:MET:HE3	1.74	0.69
1:C:436:THR:OG1	1:C:437:LEU:N	2.22	0.69
1:D:251:ASP:O	1:D:255:ARG:HG3	1.94	0.68
1:B:298:LEU:HD22	1:B:303:PRO:HB3	1.76	0.68
1:A:116:HIS:HD2	1:A:408:HIS:NE2	1.92	0.67
1:B:55:GLN:NE2	1:B:387:GLN:O	2.26	0.67
1:A:388:HIS:HA	1:A:391:LYS:HD3	1.77	0.66
1:C:245:THR:O	1:C:247:GLU:N	2.23	0.66
1:B:7:GLN:HG3	1:B:41:LYS:HB3	1.78	0.65
1:A:162:PHE:HE1	1:A:215:LEU:CD2	2.05	0.65
1:D:174:ILE:O	1:D:178:VAL:HG23	1.96	0.65
1:B:420:HIS:HD2	3:B:604:HOH:O	1.79	0.64
1:A:420:HIS:HE1	3:A:662:HOH:O	1.80	0.63
1:B:377:GLU:O	1:B:380:GLU:HG2	1.99	0.63
1:B:217:ASP:OD1	1:B:255:ARG:NH1	2.32	0.63
1:D:177:MET:HE1	1:D:266:HIS:NE2	2.14	0.63
1:B:79:ARG:HH12	1:B:93:GLU:CD	2.07	0.62
1:C:116:HIS:HD2	1:C:408:HIS:NE2	1.99	0.60
1:D:290:VAL:CG1	1:D:418:LEU:CD1	2.79	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:381:ASN:H	1:D:381:ASN:HD22	1.48	0.60
1:D:290:VAL:HG11	1:D:418:LEU:CD1	2.32	0.60
1:C:364:LYS:C	1:C:366:VAL:H	2.10	0.60
1:B:126:LEU:HD22	1:B:148:LEU:HD13	1.84	0.59
2:C:500:HEM:HBB2	2:C:500:HEM:CMB	2.31	0.59
1:B:150:LEU:HD22	1:B:174:ILE:CG1	2.33	0.59
2:A:500:HEM:HMC2	2:A:500:HEM:HBC2	1.85	0.58
1:C:79:ARG:NH2	1:C:93:GLU:OE1	2.37	0.57
1:A:112:MET:HE3	1:A:112:MET:HA	1.84	0.57
1:C:79:ARG:HH21	1:C:89:SER:HA	1.69	0.57
1:C:298:LEU:HD22	1:C:303:PRO:HB3	1.86	0.57
1:D:381:ASN:HD22	1:D:381:ASN:N	2.03	0.56
1:A:173:PHE:CD1	1:A:215:LEU:HD23	2.41	0.56
1:D:124:VAL:O	1:D:128:GLN:HG3	2.07	0.55
1:B:190:ARG:HH11	1:B:190:ARG:HG2	1.71	0.54
1:A:312:LYS:CG	1:A:316:MET:CE	2.85	0.54
1:A:312:LYS:O	1:A:316:MET:HE3	2.07	0.53
1:D:24:LYS:HA	1:D:435:GLU:HG3	1.91	0.53
1:D:98:LYS:HD3	1:D:249:LEU:HD23	1.89	0.53
1:C:403:GLN:NE2	3:C:642:HOH:O	2.39	0.53
1:D:272:LEU:HD13	1:D:322:LEU:CD2	2.39	0.52
1:B:51:TYR:CE2	1:B:354:MET:HG2	2.44	0.52
1:D:298:LEU:HD22	1:D:303:PRO:HB3	1.89	0.52
2:B:500:HEM:HBB2	2:B:500:HEM:HMB2	1.90	0.52
1:D:265:GLY:HA2	2:D:500:HEM:CMC	2.40	0.52
1:B:20:LEU:HD21	1:B:29:LEU:HG	1.91	0.51
1:D:313:TYR:HA	1:D:316:MET:HE3	1.92	0.51
1:B:387:GLN:CG	1:B:388:HIS:CD2	2.93	0.51
1:C:116:HIS:HE1	1:C:303:PRO:O	1.93	0.51
1:B:267:GLU:HA	1:B:267:GLU:OE1	2.10	0.51
1:B:366:VAL:HG11	1:B:389:ALA:HB1	1.91	0.51
2:B:500:HEM:HBB2	2:B:500:HEM:CMB	2.41	0.50
1:C:330:ALA:HB1	1:C:354:MET:HE1	1.93	0.50
1:C:59:LYS:HG3	1:C:388:HIS:HD2	1.76	0.50
1:A:148:LEU:HD21	1:A:413:VAL:HG21	1.93	0.50
1:D:366:VAL:HG22	1:D:386:PRO:HG2	1.93	0.50
1:B:366:VAL:HG11	1:B:389:ALA:CB	2.42	0.50
1:C:17:LEU:HD11	1:C:189:GLN:HA	1.93	0.49
1:A:17:LEU:HG	1:A:189:GLN:NE2	2.27	0.49
1:B:218:LYS:O	1:B:219:ILE:C	2.55	0.49
2:C:500:HEM:CMB	2:C:500:HEM:CBB	2.91	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:216:VAL:HG21	1:C:259:ILE:HG13	1.94	0.49
1:D:214:ASP:O	1:D:217:ASP:HB2	2.13	0.49
1:D:179:ARG:NH2	1:D:208:ASP:OD1	2.46	0.48
1:C:76:LYS:O	1:C:79:ARG:HB2	2.12	0.48
1:A:259:ILE:HG22	1:A:263:ILE:HD12	1.96	0.48
1:B:420:HIS:CD2	3:B:604:HOH:O	2.61	0.48
1:C:272:LEU:HD21	1:C:318:LEU:HD22	1.96	0.48
1:D:39:ILE:HG21	1:D:345:TYR:CE2	2.49	0.48
1:D:108:SER:O	1:D:112:MET:HG2	2.14	0.48
1:A:330:ALA:HB1	1:A:354:MET:CE	2.44	0.47
1:C:102:ILE:HD13	1:C:249:LEU:HG	1.95	0.47
1:D:388:HIS:HA	1:D:391:LYS:HE2	1.96	0.47
1:A:265:GLY:HA2	2:A:500:HEM:C2C	2.50	0.47
1:C:150:LEU:HD22	1:C:174:ILE:HG12	1.95	0.47
1:C:268:ALA:HB1	2:C:500:HEM:HBC2	1.95	0.47
1:C:31:LYS:O	1:C:35:GLU:HG3	2.14	0.47
1:A:211:VAL:O	1:A:214:ASP:HB2	2.15	0.47
1:C:140:GLU:HB3	1:C:143:GLU:OE1	2.14	0.47
1:C:290:VAL:HG11	1:C:418:LEU:HD13	1.95	0.47
1:D:214:ASP:HA	1:D:217:ASP:HB2	1.97	0.47
1:A:112:MET:HE3	1:A:112:MET:CA	2.45	0.47
1:B:129:LYS:NZ	1:B:144:ASP:OD1	2.48	0.47
1:D:381:ASN:HA	1:D:382:PRO:HD3	1.78	0.47
1:B:150:LEU:HD22	1:B:174:ILE:HG13	1.96	0.46
1:C:387:GLN:O	1:C:388:HIS:HB2	2.15	0.46
1:C:405:PHE:CD1	2:C:500:HEM:CBB	2.88	0.46
1:D:265:GLY:HA2	2:D:500:HEM:HMC2	1.98	0.46
1:A:17:LEU:HG	1:A:189:GLN:HE22	1.81	0.46
1:A:39:ILE:HA	1:A:51:TYR:O	2.15	0.46
1:A:53:SER:HB3	1:A:359:GLN:HB3	1.98	0.46
1:A:229:GLN:O	1:A:230:SER:HB3	2.16	0.46
1:C:364:LYS:C	1:C:366:VAL:N	2.73	0.46
1:D:81:PHE:HB3	1:D:209:ILE:HG12	1.97	0.46
1:D:265:GLY:HA2	2:D:500:HEM:C2C	2.50	0.46
1:A:178:VAL:O	1:A:182:ASP:HB2	2.15	0.45
1:C:177:MET:HG3	1:C:263:ILE:HG12	1.98	0.45
1:D:203:ARG:HE	1:D:203:ARG:HB3	1.48	0.45
1:B:60:GLU:OE2	1:B:342:GLY:HA2	2.16	0.45
1:B:64:GLU:OE2	1:B:397:GLN:HG2	2.16	0.45
1:D:274:SER:HB3	1:D:441:PRO:HD2	1.97	0.45
1:A:312:LYS:CG	1:A:316:MET:HE1	2.37	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:17:LEU:HB3	1:C:18:PRO:HD3	1.98	0.45
1:A:116:HIS:CD2	1:A:408:HIS:NE2	2.79	0.45
1:D:104:LEU:HB3	1:D:105:PRO:HD3	1.97	0.45
1:D:280:LEU:HB3	1:D:287:LEU:HD12	1.99	0.45
1:B:215:LEU:O	1:B:215:LEU:HG	2.16	0.45
1:C:231:ASP:OD1	1:C:235:THR:HG21	2.17	0.45
1:C:253:ASN:O	1:C:257:GLN:HG2	2.17	0.45
1:B:76:LYS:O	1:B:79:ARG:HB2	2.17	0.45
1:C:366:VAL:HG22	1:C:386:PRO:HG2	1.98	0.45
1:B:17:LEU:HD22	1:B:45:PRO:HD2	1.99	0.44
1:B:267:GLU:HG3	1:B:438:THR:OG1	2.17	0.44
1:B:407:LEU:HD23	1:B:407:LEU:HA	1.82	0.44
1:C:332:SER:C	1:C:333:LEU:HG	2.42	0.44
1:D:215:LEU:C	1:D:217:ASP:N	2.73	0.44
1:A:317:VAL:HG13	1:A:374:PHE:HZ	1.82	0.44
1:B:104:LEU:HB3	1:B:105:PRO:HD3	1.99	0.44
1:B:280:LEU:CD2	1:B:286:VAL:HG12	2.48	0.43
1:B:81:PHE:HB3	1:B:209:ILE:HG12	2.01	0.43
1:B:233:LEU:HG	1:B:237:MET:HE3	2.00	0.43
1:C:419:LYS:HD3	1:C:420:HIS:CE1	2.54	0.43
1:D:15:LYS:HB3	1:D:43:GLU:O	2.19	0.43
1:D:148:LEU:HD21	1:D:413:VAL:HG21	2.00	0.43
1:D:171:HIS:C	1:D:173:PHE:H	2.27	0.43
1:A:308:VAL:HG21	1:A:412:LEU:HB2	2.01	0.43
1:B:290:VAL:HG12	1:B:418:LEU:HD13	2.00	0.43
1:B:435:GLU:HG2	1:B:439:LEU:CD2	2.49	0.42
1:D:309:LYS:CE	3:D:634:HOH:O	2.56	0.42
1:A:46:GLY:O	1:A:47:ARG:HB3	2.20	0.42
1:B:96:TRP:O	1:B:97:LYS:C	2.63	0.42
1:C:391:LYS:HA	1:C:391:LYS:HD2	1.90	0.42
1:A:366:VAL:HG11	1:A:389:ALA:HB1	2.01	0.42
1:A:158:PHE:CD1	1:A:158:PHE:N	2.87	0.42
1:A:195:ASP:C	1:A:197:ALA:H	2.28	0.42
1:A:225:ALA:O	1:A:226:ARG:CB	2.67	0.42
1:B:190:ARG:HH11	1:B:190:ARG:CG	2.33	0.42
1:B:377:GLU:O	1:B:380:GLU:CG	2.65	0.42
1:C:61:ALA:HA	1:C:67:PHE:CD2	2.55	0.42
1:D:327:THR:O	1:D:438:THR:HA	2.20	0.42
1:C:7:GLN:HG3	1:C:8:PRO:HD2	2.01	0.42
1:A:381:ASN:HA	1:A:382:PRO:HD2	1.94	0.42
1:B:39:ILE:HA	1:B:51:TYR:O	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:290:VAL:HG13	1:D:314:VAL:HG22	2.02	0.42
1:A:50:ARG:NH1	1:A:352:GLU:O	2.49	0.41
1:C:60:GLU:OE2	1:C:342:GLY:HA2	2.20	0.41
1:D:68:ASP:HB3	1:D:334:TYR:CE1	2.55	0.41
1:A:363:ASP:OD1	1:A:363:ASP:C	2.60	0.41
1:D:220:ILE:O	1:D:220:ILE:HG22	2.19	0.41
1:C:453:ILE:HA	1:C:454:PRO:HD3	1.94	0.41
1:B:275:PHE:CE2	1:B:441:PRO:HD3	2.56	0.41
1:D:116:HIS:HD2	1:D:408:HIS:NE2	2.19	0.41
1:A:20:LEU:HD21	1:A:29:LEU:HG	2.02	0.41
1:A:169[B]:GLN:HG2	1:A:170:PRO:O	2.21	0.41
1:A:271:GLY:HA2	1:A:440:LYS:HG3	2.03	0.41
2:A:500:HEM:HBC2	2:A:500:HEM:CMC	2.50	0.41
1:C:148:LEU:HD21	1:C:413:VAL:HG21	2.03	0.41
1:D:53:SER:HB3	1:D:359:GLN:HB3	2.02	0.41
1:D:216:VAL:HG21	1:D:259:ILE:HG13	2.02	0.41
1:C:97:LYS:HA	1:C:97:LYS:HD2	1.86	0.41
1:C:98:LYS:HE2	1:C:248:PRO:O	2.21	0.41
1:D:27:GLN:OE1	1:D:433:ILE:HB	2.21	0.40
1:D:434:LYS:HB2	1:D:442:LYS:HB2	2.01	0.40
1:A:275:PHE:O	1:A:276:ALA:C	2.64	0.40
1:B:68:ASP:OD2	1:B:336:LYS:HE2	2.21	0.40
1:C:9:LYS:HD3	1:C:11:PHE:CZ	2.57	0.40
1:C:419:LYS:HE2	1:C:453:ILE:HG21	2.02	0.40
1:D:116:HIS:HE1	1:D:303:PRO:O	2.05	0.40
1:A:214:ASP:O	1:A:217:ASP:HB2	2.22	0.40
1:A:357:ILE:HG22	1:A:361:HIS:CE1	2.56	0.40
1:C:173:PHE:CD1	1:C:173:PHE:C	3.00	0.40
1:A:24:LYS:HE2	1:A:433:ILE:O	2.22	0.40
1:A:280:LEU:HD12	1:A:418:LEU:HD11	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	457/470 (97%)	426 (93%)	26 (6%)	5 (1%)	11	22
1	B	448/470 (95%)	428 (96%)	19 (4%)	1 (0%)	43	63
1	C	454/470 (97%)	427 (94%)	25 (6%)	2 (0%)	30	49
1	D	453/470 (96%)	432 (95%)	17 (4%)	4 (1%)	14	27
All	All	1812/1880 (96%)	1713 (94%)	87 (5%)	12 (1%)	18	34

All (12) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	47	ARG
1	A	226	ARG
1	C	246	GLY
1	D	191	ALA
1	D	222	ASP
1	A	196	PRO
1	A	229	GLN
1	A	230	SER
1	C	267	GLU
1	D	45	PRO
1	D	172	PRO
1	B	193	PRO

5.3.2 Protein sidechains ⓘ

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	384/411 (93%)	369 (96%)	15 (4%)	28	55
1	B	381/411 (93%)	367 (96%)	14 (4%)	30	57
1	C	381/411 (93%)	367 (96%)	14 (4%)	30	57
1	D	374/411 (91%)	357 (96%)	17 (4%)	24	49
All	All	1520/1644 (92%)	1460 (96%)	60 (4%)	28	55

All (60) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	13	GLU
1	A	22	THR
1	A	148	LEU
1	A	182	ASP
1	A	185	MET
1	A	187	LYS
1	A	200	GLU
1	A	266	HIS
1	A	353	VAL
1	A	366	VAL
1	A	369	ASP
1	A	385	ILE
1	A	387	GLN
1	A	418	LEU
1	A	422	ASP
1	B	9	LYS
1	B	22	THR
1	B	34	ASP
1	B	68	ASP
1	B	210	LYS
1	B	218	LYS
1	B	266	HIS
1	B	267	GLU
1	B	333	LEU
1	B	353	VAL
1	B	366	VAL
1	B	381	ASN
1	B	418	LEU
1	B	442	LYS
1	C	2	ILE
1	C	5	MET
1	C	13	GLU
1	C	22	THR
1	C	136	ASP
1	C	193	PRO
1	C	215	LEU
1	C	230	SER
1	C	231	ASP
1	C	235	THR
1	C	267	GLU
1	C	353	VAL
1	C	366	VAL

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Mol	Chain	Res	Type
1	C	418	LEU
1	D	4	GLU
1	D	21	ASN
1	D	47	ARG
1	D	148	LEU
1	D	176	SER
1	D	179	ARG
1	D	192	ASN
1	D	203	ARG
1	D	231	ASP
1	D	267	GLU
1	D	287	LEU
1	D	340	VAL
1	D	353	VAL
1	D	366	VAL
1	D	381	ASN
1	D	401	ILE
1	D	430	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (34) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	92	HIS
1	A	116	HIS
1	A	128	GLN
1	A	159	ASN
1	A	201	ASN
1	A	285	HIS
1	A	420	HIS
1	B	21	ASN
1	B	70	ASN
1	B	73	GLN
1	B	116	HIS
1	B	397	GLN
1	B	403	GLN
1	B	420	HIS
1	C	73	GLN
1	C	116	HIS
1	C	128	GLN
1	C	169	GLN
1	C	201	ASN
1	C	310	GLN

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Mol	Chain	Res	Type
1	C	388	HIS
1	C	403	GLN
1	C	428	ASN
1	D	21	ASN
1	D	73	GLN
1	D	101	ASN
1	D	116	HIS
1	D	189	GLN
1	D	285	HIS
1	D	359	GLN
1	D	381	ASN
1	D	397	GLN
1	D	403	GLN
1	D	404	GLN

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 oligosaccharides 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	A	500	1,3	50,50,50	1.84	9 (18%)	67,82,82	1.31	8 (11%)
2	HEM	C	500	1,3	50,50,50	1.92	10 (20%)	67,82,82	1.64	15 (22%)
2	HEM	B	500	1	50,50,50	1.80	9 (18%)	67,82,82	1.52	11 (16%)
2	HEM	D	500	1	50,50,50	1.86	10 (20%)	67,82,82	1.26	8 (11%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	HEM	A	500	1,3	-	3/14/54/54	-
2	HEM	C	500	1,3	-	4/14/54/54	-
2	HEM	B	500	1	-	2/14/54/54	-
2	HEM	D	500	1	-	4/14/54/54	-

All (38) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	500	HEM	C3D-C2D	8.15	1.54	1.36
2	D	500	HEM	C3D-C2D	8.10	1.54	1.36
2	A	500	HEM	C3D-C2D	7.97	1.53	1.36
2	B	500	HEM	C3D-C2D	6.94	1.51	1.36
2	A	500	HEM	FE-NA	4.30	2.09	1.95
2	B	500	HEM	FE-NC	4.26	2.09	1.95
2	C	500	HEM	FE-ND	4.00	2.07	1.94
2	A	500	HEM	CMB-C2B	3.77	1.58	1.50
2	C	500	HEM	FE-NB	3.61	2.06	1.94
2	C	500	HEM	FE-NC	3.51	2.06	1.95
2	B	500	HEM	FE-ND	3.45	2.05	1.94
2	D	500	HEM	FE-NA	3.40	2.06	1.95
2	A	500	HEM	FE-ND	3.27	2.05	1.94
2	D	500	HEM	FE-ND	3.24	2.04	1.94
2	B	500	HEM	CMC-C2C	3.18	1.57	1.50
2	D	500	HEM	CMB-C2B	3.17	1.57	1.50
2	C	500	HEM	FE-NA	3.16	2.05	1.95
2	D	500	HEM	FE-NB	3.07	2.04	1.94
2	D	500	HEM	CMC-C2C	2.78	1.56	1.50
2	B	500	HEM	CMB-C2B	2.72	1.56	1.50
2	C	500	HEM	CMB-C2B	2.67	1.56	1.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	500	HEM	CAB-C3B	2.65	1.54	1.47
2	A	500	HEM	CMC-C2C	2.65	1.56	1.50
2	C	500	HEM	CAC-C3C	2.61	1.54	1.47
2	D	500	HEM	CAC-C3C	2.61	1.54	1.47
2	C	500	HEM	C3C-C2C	-2.48	1.32	1.37
2	D	500	HEM	FE-NC	2.44	2.03	1.95
2	A	500	HEM	O1A-CGA	2.40	1.29	1.22
2	B	500	HEM	CAC-C3C	2.39	1.53	1.47
2	D	500	HEM	CAB-C3B	2.37	1.53	1.47
2	C	500	HEM	CAB-C3B	2.36	1.53	1.47
2	A	500	HEM	CAB-C3B	2.29	1.53	1.47
2	B	500	HEM	CMD-C2D	2.26	1.55	1.50
2	B	500	HEM	CMA-C3A	2.25	1.55	1.50
2	A	500	HEM	FE-NB	2.19	2.01	1.94
2	A	500	HEM	CAC-C3C	2.13	1.53	1.47
2	C	500	HEM	CMC-C2C	2.11	1.55	1.50
2	D	500	HEM	CMA-C3A	2.05	1.55	1.50

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	500	HEM	C4D-ND-C1D	4.69	110.76	105.21
2	B	500	HEM	C4D-ND-C1D	4.47	110.50	105.21
2	B	500	HEM	CHC-C4B-NB	4.39	129.15	124.42
2	D	500	HEM	C4D-ND-C1D	3.72	109.61	105.21
2	C	500	HEM	C4C-C3C-C2C	3.38	109.75	106.81
2	A	500	HEM	C4D-ND-C1D	3.37	109.20	105.21
2	C	500	HEM	CHC-C4B-NB	3.23	127.90	124.42
2	B	500	HEM	CHD-C1D-ND	3.21	127.88	124.42
2	B	500	HEM	CAD-C3D-C4D	3.19	130.26	124.70
2	B	500	HEM	CBD-CAD-C3D	-3.13	103.88	112.53
2	D	500	HEM	C1D-C2D-C3D	-3.12	103.70	106.98
2	D	500	HEM	CBD-CAD-C3D	-3.10	103.95	112.53
2	C	500	HEM	CBA-CAA-C2A	-3.09	104.00	112.53
2	C	500	HEM	CBB-CAB-C3B	-3.03	112.39	127.53
2	A	500	HEM	C4B-C3B-C2B	3.01	110.04	107.28
2	A	500	HEM	C3B-C2B-C1B	-2.99	104.17	106.41
2	D	500	HEM	CHC-C4B-NB	2.95	127.60	124.42
2	C	500	HEM	CMC-C2C-C1C	2.90	129.83	124.73
2	A	500	HEM	C2A-C1A-NA	-2.89	106.95	110.15
2	C	500	HEM	C1B-NB-C4B	2.83	108.56	105.21
2	C	500	HEM	C3B-C4B-NB	-2.76	107.49	109.47

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	500	HEM	CHD-C4C-NC	2.74	127.44	124.45
2	B	500	HEM	C4C-C3C-C2C	2.58	109.05	106.81
2	C	500	HEM	CMD-C2D-C1D	2.54	129.01	125.03
2	B	500	HEM	O1D-CGD-CBD	-2.50	115.15	123.09
2	C	500	HEM	C1D-C2D-C3D	-2.45	104.40	106.98
2	D	500	HEM	O1A-CGA-CBA	-2.41	115.45	123.09
2	C	500	HEM	CBD-CAD-C3D	-2.33	106.10	112.53
2	C	500	HEM	C4B-C3B-C2B	2.32	109.42	107.28
2	D	500	HEM	O2A-CGA-CBA	2.30	121.28	114.00
2	B	500	HEM	O2D-CGD-CBD	2.30	121.27	114.00
2	D	500	HEM	C4C-C3C-C2C	2.26	108.77	106.81
2	A	500	HEM	C4D-C3D-C2D	-2.25	103.61	106.89
2	B	500	HEM	O2A-CGA-CBA	2.22	121.03	114.00
2	B	500	HEM	C1B-NB-C4B	2.22	107.84	105.21
2	D	500	HEM	C1B-NB-C4B	2.22	107.83	105.21
2	A	500	HEM	CBB-CAB-C3B	-2.22	116.45	127.53
2	C	500	HEM	C2B-C1B-NB	-2.21	107.30	109.84
2	B	500	HEM	C3B-C4B-NB	-2.20	107.89	109.47
2	A	500	HEM	CMA-C3A-C2A	2.20	130.30	125.62
2	A	500	HEM	CAA-C2A-C1A	-2.15	120.74	124.94
2	C	500	HEM	CMC-C2C-C3C	-2.04	123.48	128.43

There are no chirality outliers.

All (13) torsion outliers are listed below:

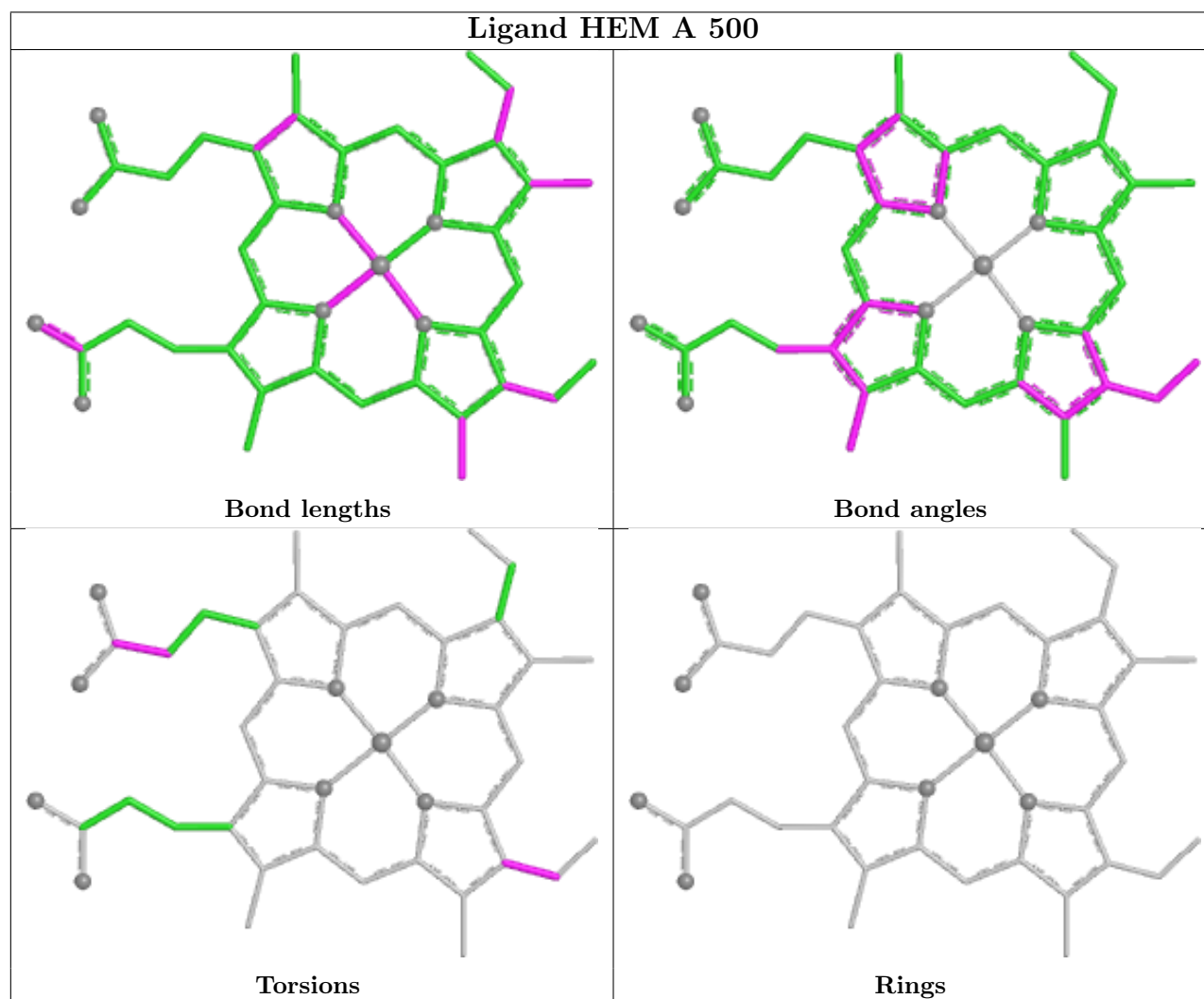
Mol	Chain	Res	Type	Atoms
2	C	500	HEM	C2C-C3C-CAC-CBC
2	C	500	HEM	C4C-C3C-CAC-CBC
2	D	500	HEM	C2B-C3B-CAB-CBB
2	B	500	HEM	CAD-CBD-CGD-O1D
2	B	500	HEM	CAD-CBD-CGD-O2D
2	A	500	HEM	CAD-CBD-CGD-O2D
2	C	500	HEM	CAA-CBA-CGA-O2A
2	D	500	HEM	C4B-C3B-CAB-CBB
2	C	500	HEM	CAA-CBA-CGA-O1A
2	A	500	HEM	CAD-CBD-CGD-O1D
2	D	500	HEM	CAD-CBD-CGD-O2D
2	D	500	HEM	CAD-CBD-CGD-O1D
2	A	500	HEM	C2B-C3B-CAB-CBB

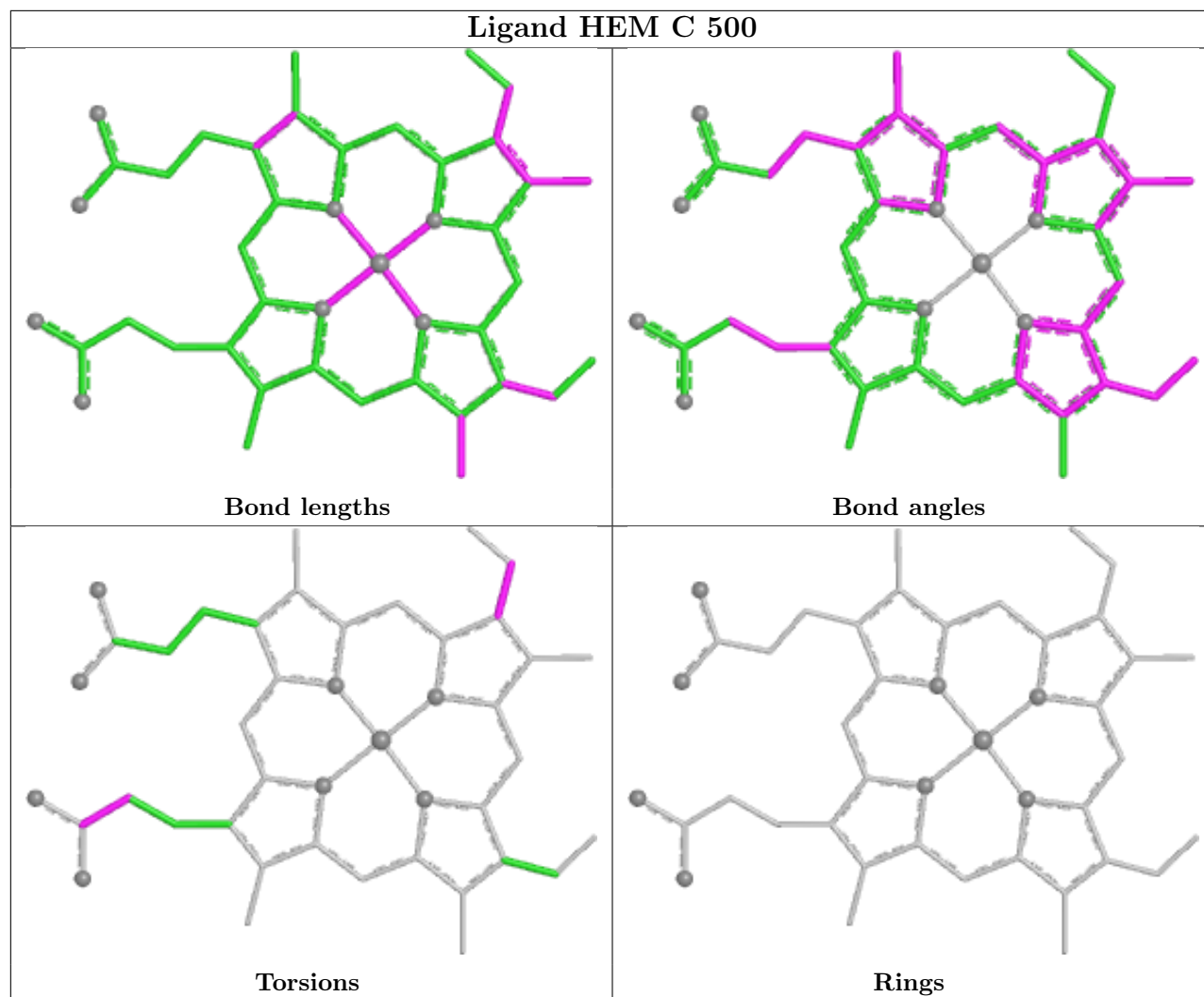
There are no ring outliers.

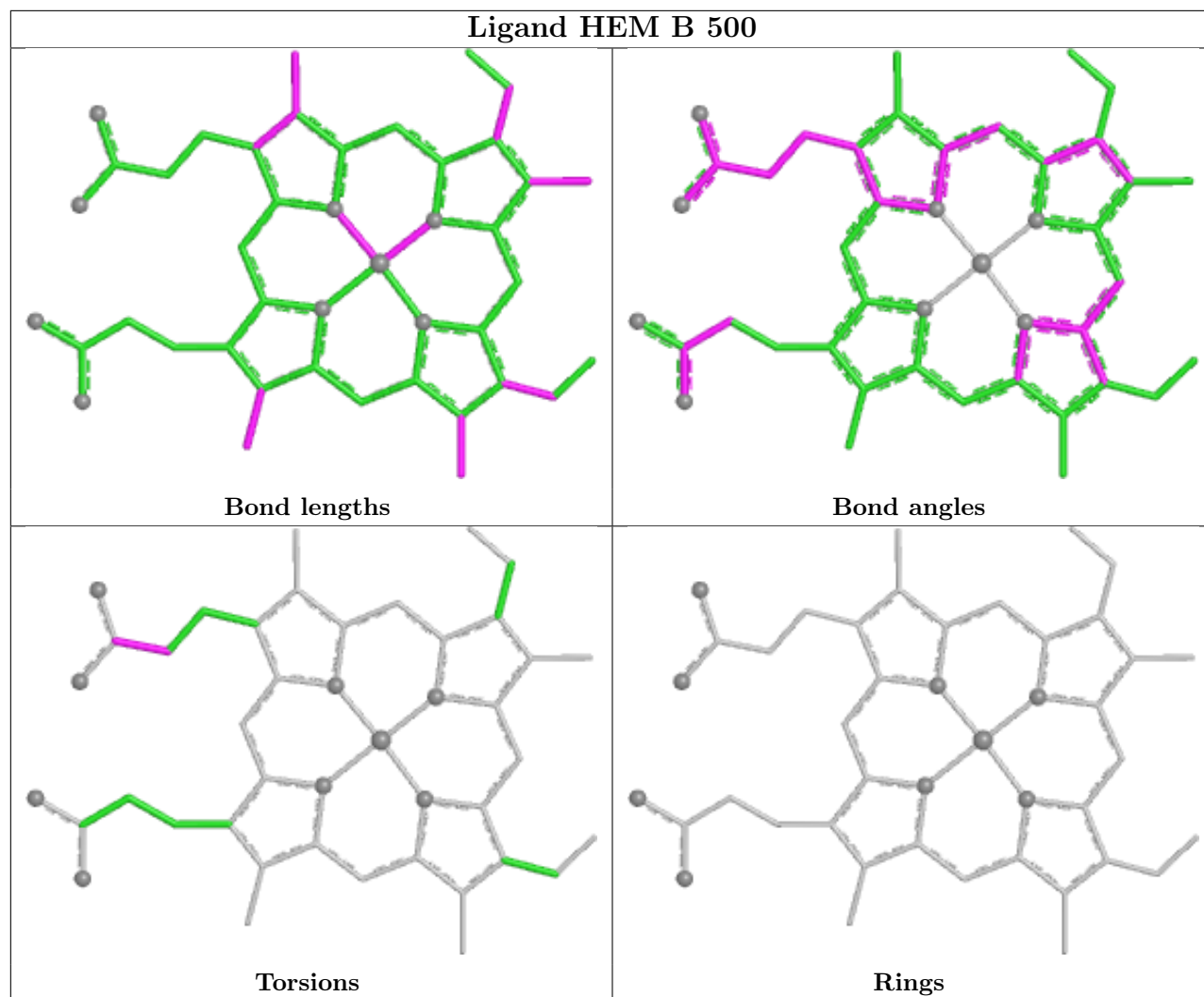
4 monomers are involved in 14 short contacts:

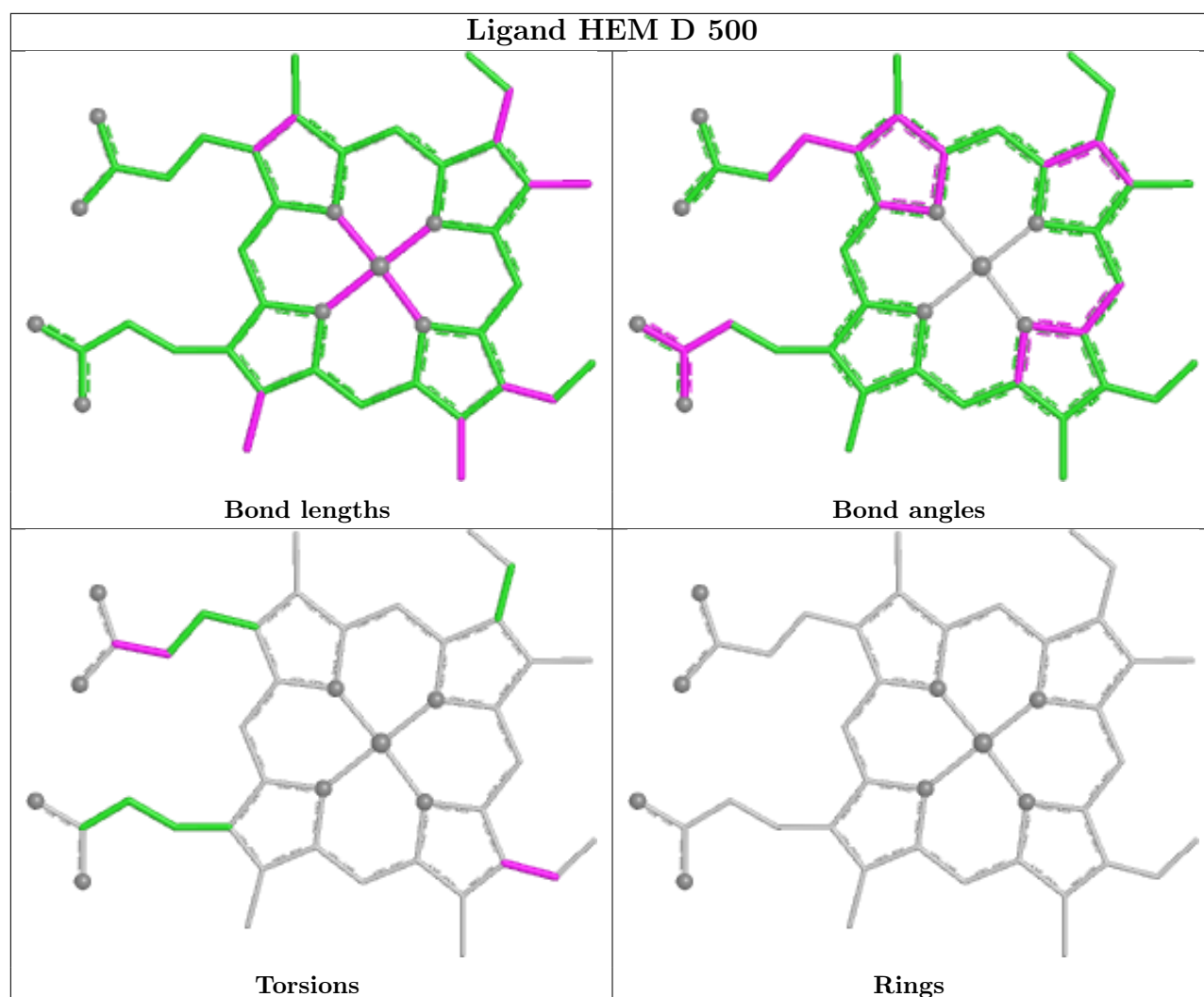
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	500	HEM	3	0
2	C	500	HEM	6	0
2	B	500	HEM	2	0
2	D	500	HEM	3	0

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, 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	457/470 (97%)	-0.43	2 (0%) 88 86	27, 42, 72, 108	2 (0%)
1	B	452/470 (96%)	-0.43	3 (0%) 84 81	28, 47, 78, 97	0
1	C	456/470 (97%)	-0.41	3 (0%) 84 81	29, 47, 70, 95	0
1	D	455/470 (96%)	-0.39	4 (0%) 81 78	31, 45, 71, 94	0
All	All	1820/1880 (96%)	-0.41	12 (0%) 84 81	27, 45, 74, 108	2 (0%)

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	458	ILE	3.1
1	A	197	ALA	3.0
1	B	294	ALA	2.9
1	B	225	ALA	2.8
1	C	229	GLN	2.6
1	A	185	MET	2.5
1	C	21	ASN	2.5
1	D	225	ALA	2.4
1	B	1	THR	2.3
1	D	220	ILE	2.1
1	C	456	GLY	2.1
1	D	170	PRO	2.1

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](#)

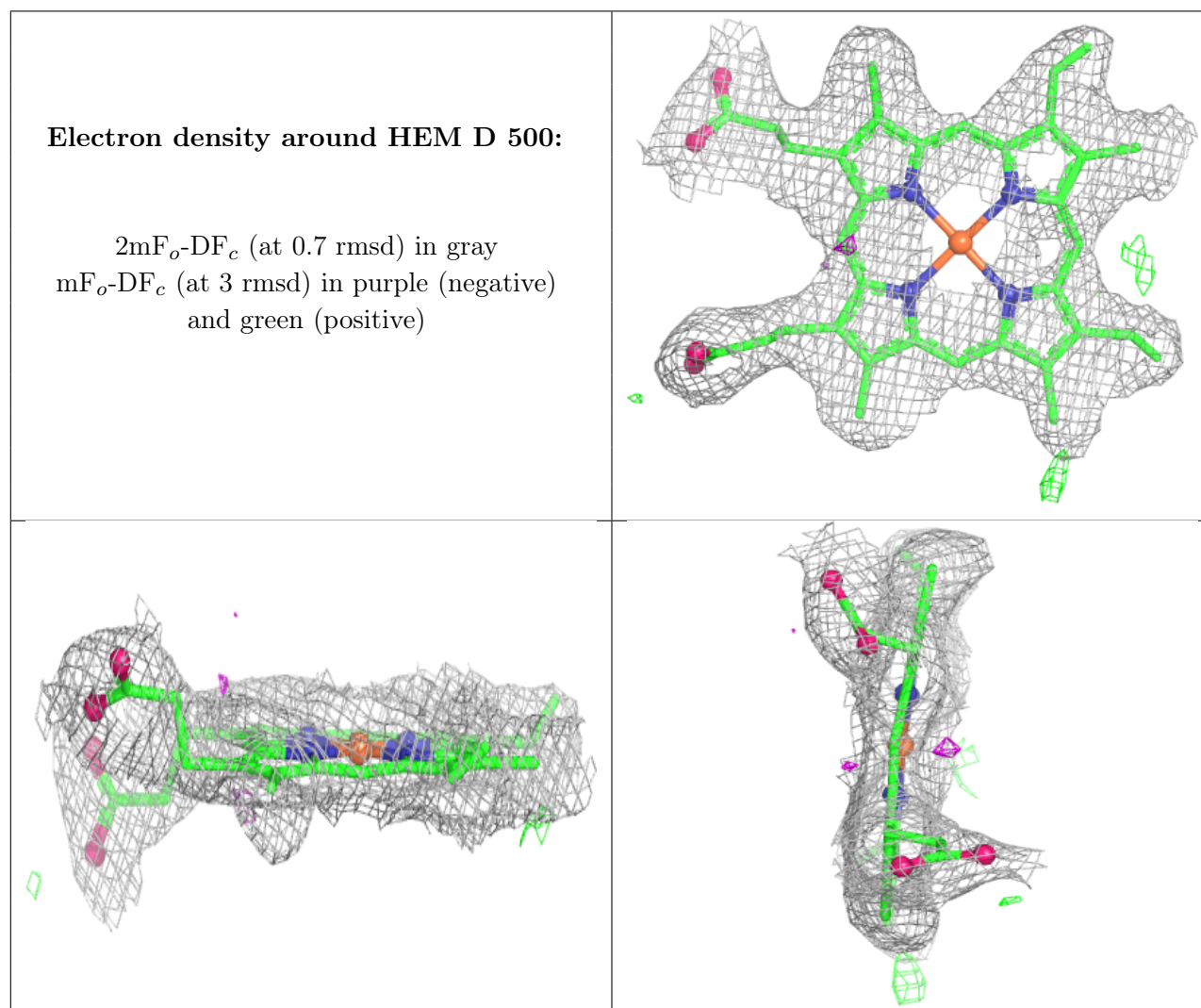
There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

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

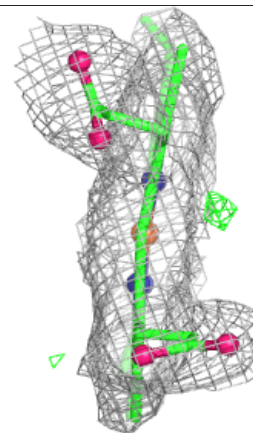
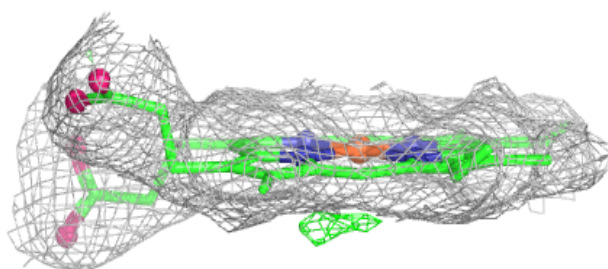
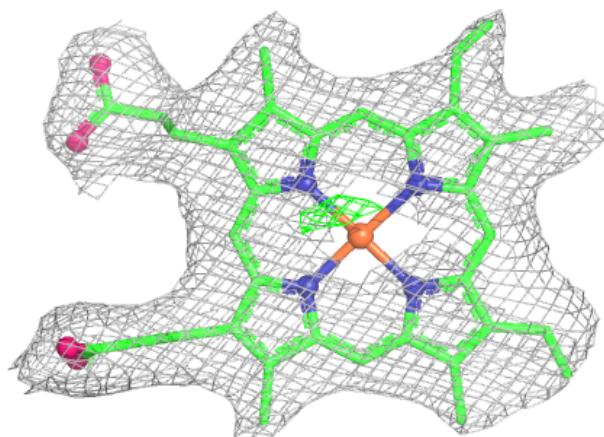
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	HEM	D	500	43/43	0.97	0.07	28,33,37,40	0
2	HEM	B	500	43/43	0.98	0.05	29,33,38,42	0
2	HEM	C	500	43/43	0.98	0.06	28,37,41,44	0
2	HEM	A	500	43/43	0.98	0.06	20,26,32,39	0

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.



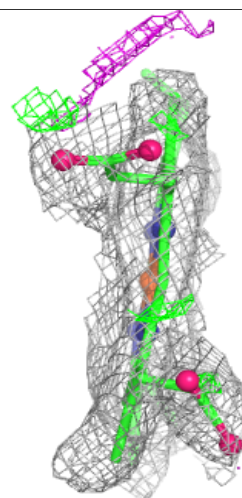
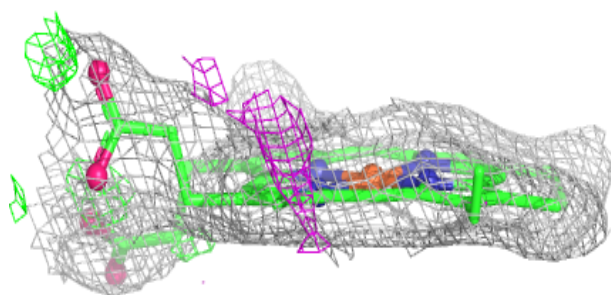
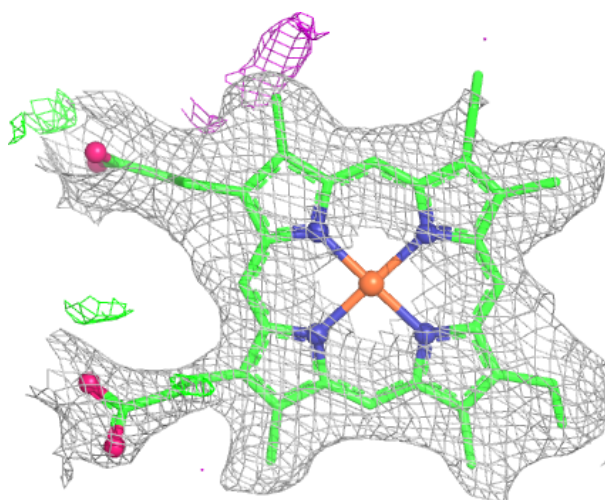
Electron density around HEM B 500:

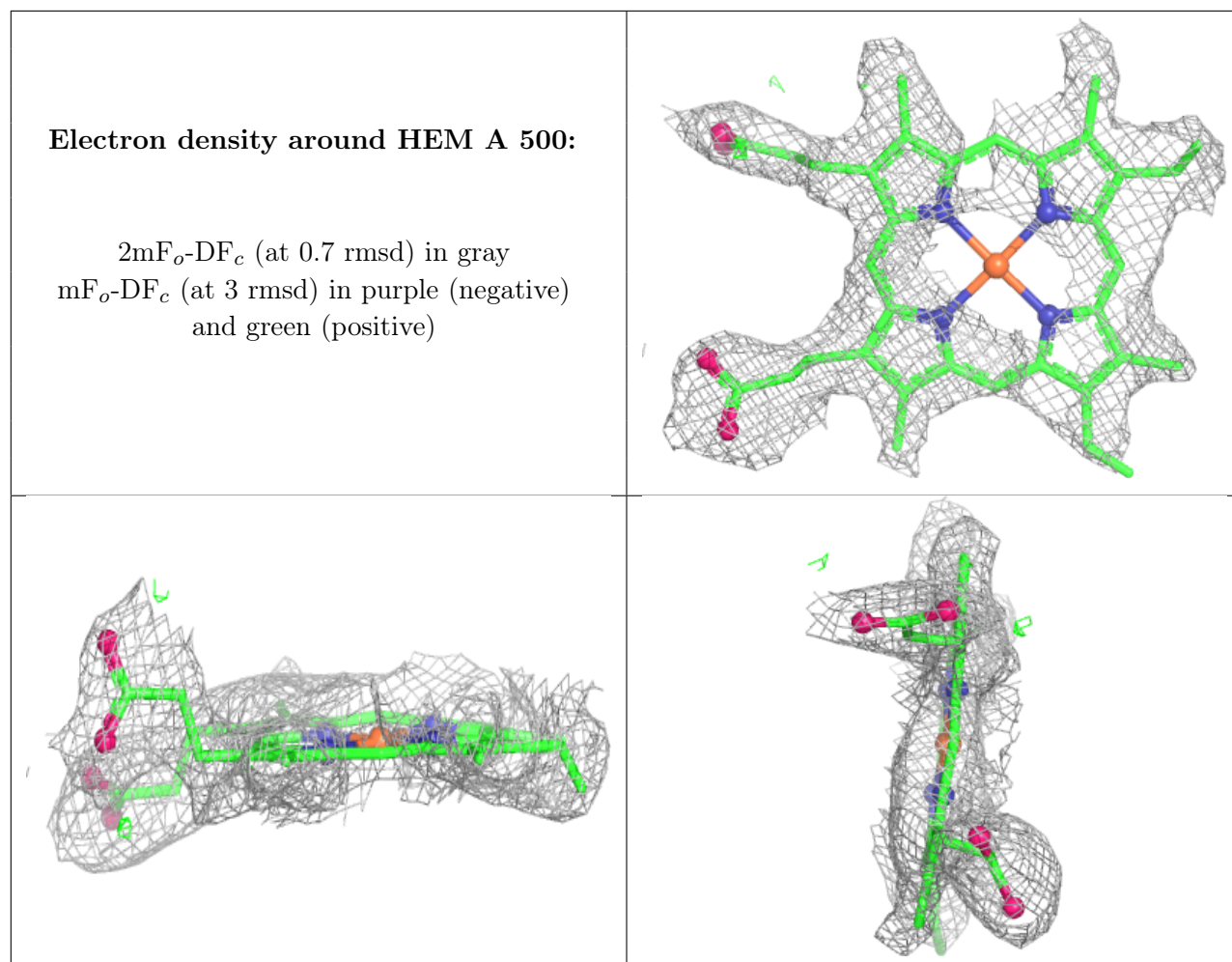
$2mF_o - DF_c$ (at 0.7 rmsd) in gray
 $mF_o - DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM C 500:

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





6.5 Other polymers ⓘ

There are no such residues in this entry.