



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 06:57 AM UTC

PDB ID : 4AAL / pdb_00004aal
Title : MacA wild-type oxidized
Authors : Seidel, J.
Deposited on : 2011-12-05
Resolution : 1.84 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

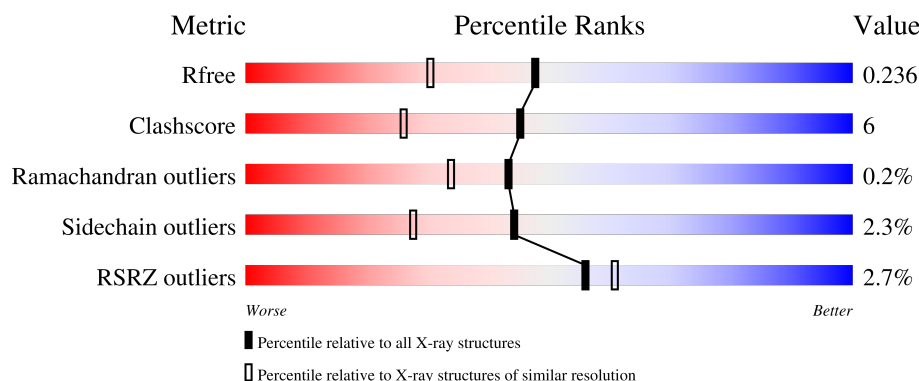
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

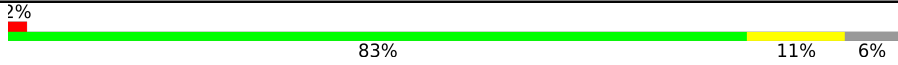
The reported resolution of this entry is 1.84 Å.

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	1296 (1.84-1.84)
Clashscore	190562	1329 (1.84-1.84)
Ramachandran outliers	187476	1318 (1.84-1.84)
Sidechain outliers	187428	1318 (1.84-1.84)
RSRZ outliers	180081	1296 (1.84-1.84)

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	341	
1	B	341	

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 5841 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 C551 PEROXIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	320	Total	C	N	O	S	0	3	0
			2447	1553	426	455	13			
1	B	319	Total	C	N	O	S	0	4	0
			2449	1553	426	457	13			

There are 34 discrepancies between the modelled and reference sequences:

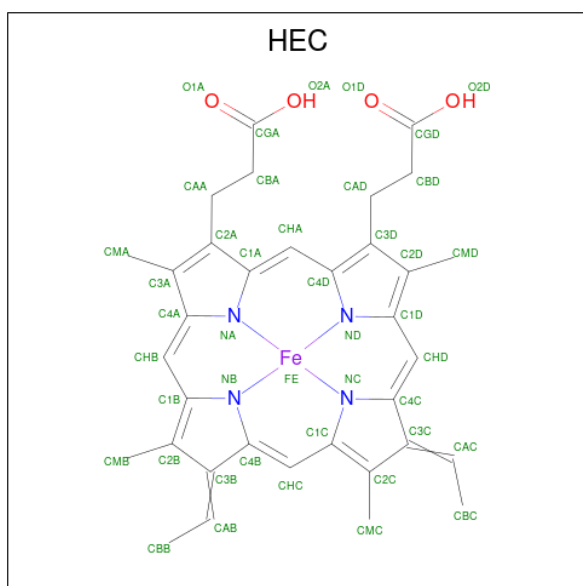
Chain	Residue	Modelled	Actual	Comment	Reference
A	6	TRP	-	expression tag	UNP Q74FY6
A	7	SER	-	expression tag	UNP Q74FY6
A	8	HIS	-	expression tag	UNP Q74FY6
A	9	PRO	-	expression tag	UNP Q74FY6
A	10	GLN	-	expression tag	UNP Q74FY6
A	11	PHE	-	expression tag	UNP Q74FY6
A	12	GLU	-	expression tag	UNP Q74FY6
A	13	LYS	-	expression tag	UNP Q74FY6
A	14	GLY	-	expression tag	UNP Q74FY6
A	15	ALA	-	expression tag	UNP Q74FY6
A	16	GLU	-	expression tag	UNP Q74FY6
A	17	THR	-	expression tag	UNP Q74FY6
A	18	ALA	-	expression tag	UNP Q74FY6
A	19	VAL	-	expression tag	UNP Q74FY6
A	20	PRO	-	expression tag	UNP Q74FY6
A	21	ASN	-	expression tag	UNP Q74FY6
A	22	SER	-	expression tag	UNP Q74FY6
B	6	TRP	-	expression tag	UNP Q74FY6
B	7	SER	-	expression tag	UNP Q74FY6
B	8	HIS	-	expression tag	UNP Q74FY6
B	9	PRO	-	expression tag	UNP Q74FY6
B	10	GLN	-	expression tag	UNP Q74FY6
B	11	PHE	-	expression tag	UNP Q74FY6
B	12	GLU	-	expression tag	UNP Q74FY6
B	13	LYS	-	expression tag	UNP Q74FY6

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Chain	Residue	Modelled	Actual	Comment	Reference
B	14	GLY	-	expression tag	UNP Q74FY6
B	15	ALA	-	expression tag	UNP Q74FY6
B	16	GLU	-	expression tag	UNP Q74FY6
B	17	THR	-	expression tag	UNP Q74FY6
B	18	ALA	-	expression tag	UNP Q74FY6
B	19	VAL	-	expression tag	UNP Q74FY6
B	20	PRO	-	expression tag	UNP Q74FY6
B	21	ASN	-	expression tag	UNP Q74FY6
B	22	SER	-	expression tag	UNP Q74FY6

- Molecule 2 is HEME C (CCD ID: HEC) (formula: $C_{34}H_{34}FeN_4O_4$).



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

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Ca	0	0
			1	1		
3	B	1	Total	Ca	0	0
			1	1		

- Molecule 4 is PHOSPHATE ION (CCD ID: PO4) (formula: O_4P).



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

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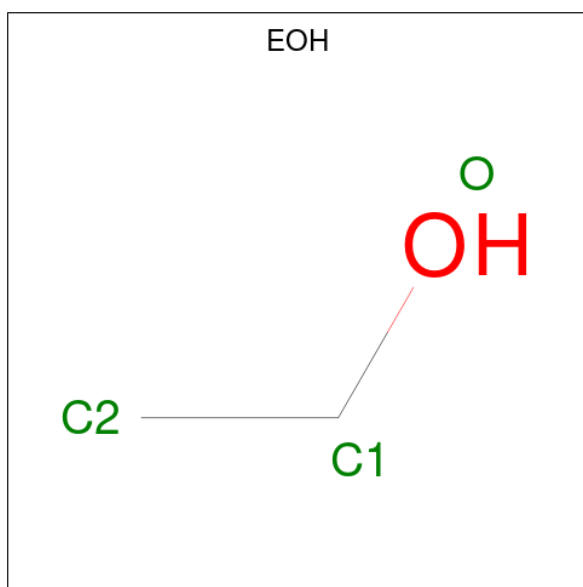
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total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

- Molecule 5 is ACETATE ION (CCD ID: ACT) (formula: C₂H₃O₂).



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

- Molecule 6 is ETHANOL (CCD ID: EOH) (formula: C₂H₆O).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			3	2	1		

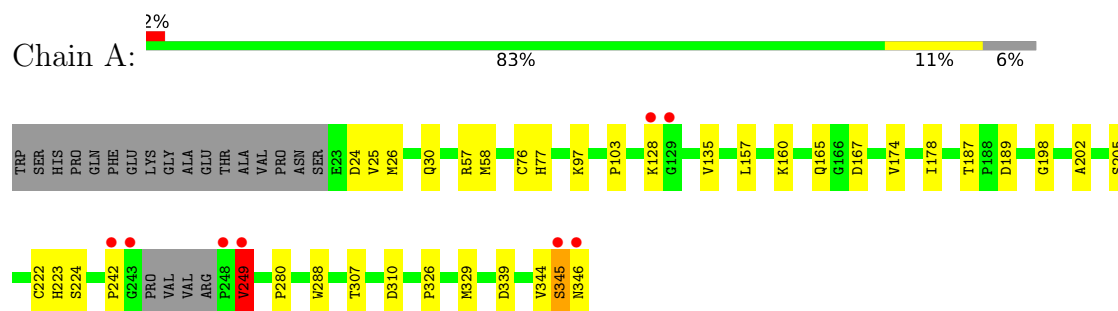
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	344	Total	O	0	0
			344	344		
7	B	285	Total	O	0	0
			285	285		

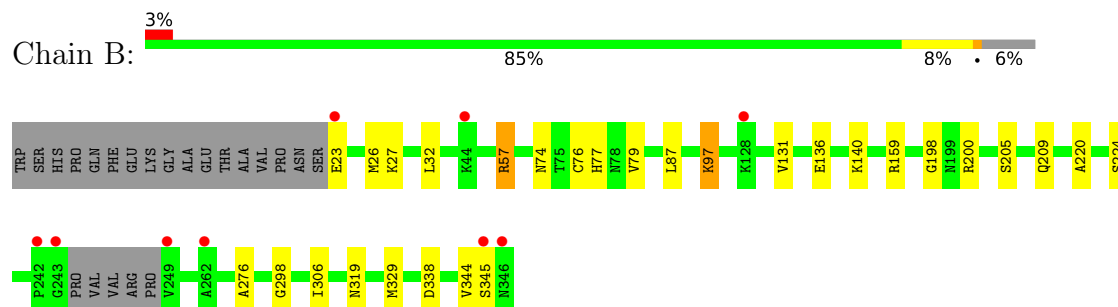
3 Residue-property plots [i](#)

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 C551 PEROXIDASE



• Molecule 1: CYTOCHROME C551 PEROXIDASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	118.03Å 118.03Å 242.04Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	102.06 – 1.84 102.06 – 1.84	Depositor EDS
% Data completeness (in resolution range)	98.0 (102.06-1.84) 98.4 (102.06-1.84)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.27 (at 1.84Å)	Xtriage
Refinement program	REFMAC 5.6.0113	Depositor
R, R_{free}	0.189 , 0.237 0.189 , 0.236	Depositor DCC
R_{free} test set	4284 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	27.6	Xtriage
Anisotropy	0.003	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 43.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	5841	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.82% 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: CA, HEC, ACT, PO4, EOH

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	1.27	5/2514 (0.2%)	1.22	4/3413 (0.1%)
1	B	1.21	2/2515 (0.1%)	1.17	2/3414 (0.1%)
All	All	1.24	7/5029 (0.1%)	1.20	6/6827 (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 (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	174	VAL	N-CA	6.42	1.54	1.46
1	A	77	HIS	ND1-CE1	5.80	1.38	1.32
1	B	77	HIS	CG-CD2	5.66	1.42	1.35
1	B	77	HIS	ND1-CE1	5.64	1.38	1.32
1	A	224	SER	CA-CB	5.62	1.62	1.53
1	A	223	HIS	CG-CD2	5.30	1.41	1.35
1	A	223	HIS	CE1-NE2	5.12	1.37	1.32

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	249	VAL	N-CA-C	7.47	124.88	109.34
1	B	57	ARG	NE-CZ-NH1	-6.89	114.61	121.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	189	ASP	N-CA-C	5.81	120.32	113.23
1	B	338	ASP	N-CA-C	-5.12	106.87	113.01
1	A	202	ALA	N-CA-C	-5.05	106.62	112.89
1	A	344	VAL	CB-CA-C	-5.01	103.65	110.77

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	128	LYS	Peptide
1	A	249	VAL	Peptide
1	B	344	VAL	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	2447	0	2446	27	0
1	B	2449	0	2444	28	0
2	A	86	0	60	7	0
2	B	86	0	61	7	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	55	0	0	1	0
4	B	60	0	0	1	0
5	A	12	0	9	0	0
5	B	12	0	9	1	0
6	A	3	0	6	0	0
7	A	344	0	0	8	1
7	B	285	0	0	9	1
All	All	5841	0	5035	58	1

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 6.

All (58) 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:B:76:CYS:SG	2:B:423:HEC:CAC	2.07	1.43
1:B:23:GLU:HG3	1:B:200:ARG:NH2	1.64	1.13
5:B:1362:ACT:H3	7:B:2282:HOH:O	1.50	1.10
1:B:76:CYS:SG	2:B:423:HEC:HAC	1.97	1.03
1:B:23:GLU:HB3	7:B:2001:HOH:O	1.64	0.97
1:A:329[B]:MET:SD	7:A:2306:HOH:O	2.24	0.95
1:A:57:ARG:HH12	1:A:329[B]:MET:HE2	1.40	0.87
1:B:76:CYS:SG	2:B:423:HEC:C3C	2.65	0.84
1:A:26:MET:HE3	1:A:30:GLN:HE22	1.43	0.83
1:A:222:CYS:SG	2:A:424:HEC:C3C	2.67	0.81
1:A:26:MET:HE3	1:A:30:GLN:NE2	1.97	0.80
1:B:23:GLU:CB	7:B:2001:HOH:O	2.24	0.79
1:A:76:CYS:SG	2:A:423:HEC:C3C	2.71	0.78
1:B:23:GLU:CG	1:B:200:ARG:NH2	2.45	0.77
1:B:74:ASN:HD21	1:B:79:VAL:H	1.32	0.77
1:B:23:GLU:HG3	1:B:200:ARG:HH21	1.49	0.76
1:B:76:CYS:SG	2:B:423:HEC:CBC	2.74	0.76
1:A:76:CYS:SG	2:A:423:HEC:CBC	2.73	0.75
1:B:57:ARG:NH1	7:B:2041:HOH:O	2.17	0.74
1:A:167:ASP:OD1	7:A:2195:HOH:O	2.05	0.73
1:A:222:CYS:SG	2:A:424:HEC:CBC	2.75	0.73
1:B:136[B]:GLU:HG3	7:B:2124:HOH:O	1.88	0.72
1:B:57:ARG:NH1	7:B:2040:HOH:O	2.15	0.72
1:A:345:SER:HA	7:A:2331:HOH:O	1.91	0.70
1:A:165:GLN:OE1	7:A:2191:HOH:O	2.11	0.68
1:B:26:MET:HE1	7:B:2189:HOH:O	1.96	0.66
1:B:26:MET:CE	7:B:2007:HOH:O	2.44	0.64
2:B:423:HEC:HMC3	2:B:423:HEC:HBC3	1.80	0.63
1:B:74:ASN:ND2	1:B:79:VAL:H	1.98	0.61
1:B:76:CYS:HG	2:B:423:HEC:HAC	1.65	0.60
1:A:57:ARG:NH1	1:A:329[B]:MET:HE2	2.13	0.60
1:A:339:ASP:OD1	7:A:2323:HOH:O	2.17	0.56
1:B:23:GLU:CG	1:B:200:ARG:CZ	2.83	0.56
1:B:97:LYS:HD3	7:B:2220:HOH:O	2.08	0.53
4:A:1351:PO4:O4	7:A:2278:HOH:O	2.19	0.52
1:B:23:GLU:HG2	1:B:200:ARG:CZ	2.39	0.52
1:A:25:VAL:HG12	7:A:2006:HOH:O	2.08	0.52
1:A:187:THR:HG22	1:A:326:PRO:HD3	1.92	0.50
1:B:159:ARG:NH2	4:B:1350:PO4:O4	2.39	0.49
1:B:26:MET:CE	1:B:198:GLY:HA2	2.44	0.47
1:A:97:LYS:HA	1:A:97:LYS:HE2	1.97	0.47
1:B:220:ALA:O	1:B:224:SER:HB3	2.14	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:76:CYS:CB	2:B:423:HEC:C3C	2.93	0.47
1:A:58:MET:SD	1:A:157:LEU:HD13	2.56	0.46
1:B:205:SER:O	1:B:209:GLN:HG3	2.16	0.44
1:B:298:GLY:HA3	1:B:306:ILE:HG12	2.00	0.44
1:A:26:MET:CE	1:A:198:GLY:HA2	2.48	0.44
1:A:157:LEU:HD23	1:A:160[B]:LYS:HE2	1.99	0.43
1:A:103:PRO:HD3	2:A:423:HEC:CAD	2.48	0.43
1:A:76:CYS:CB	2:A:423:HEC:C3C	2.96	0.43
1:A:280:PRO:HB3	1:A:288:TRP:CD2	2.53	0.43
1:A:339:ASP:CG	7:A:2323:HOH:O	2.60	0.42
1:B:276:ALA:HB2	1:B:319:ASN:HD22	1.84	0.42
1:A:24:ASP:OD1	1:A:24:ASP:C	2.63	0.41
1:A:178:ILE:HG21	2:A:423:HEC:HMB3	2.02	0.41
1:A:307:THR:O	1:A:310:ASP:HB2	2.20	0.41
1:B:329[A]:MET:HE3	1:B:329[A]:MET:HB3	1.59	0.41
1:A:329[A]:MET:HE3	1:A:329[A]:MET:HB3	1.90	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
7:A:2081:HOH:O	7:B:2264:HOH:O[8_445]	1.93	0.27

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	319/341 (94%)	307 (96%)	11 (3%)	1 (0%)	36	25
1	B	319/341 (94%)	310 (97%)	9 (3%)	0	100	100
All	All	638/682 (94%)	617 (97%)	20 (3%)	1 (0%)	43	34

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	242	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	266/281 (95%)	261 (98%)	5 (2%)	50	34
1	B	266/281 (95%)	259 (97%)	7 (3%)	40	23
All	All	532/562 (95%)	520 (98%)	12 (2%)	44	27

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	135	VAL
1	A	205	SER
1	A	249	VAL
1	A	345	SER
1	A	346	ASN
1	B	27	LYS
1	B	32	LEU
1	B	87	LEU
1	B	97	LYS
1	B	131	VAL
1	B	140	LYS
1	B	345	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	139	ASN
1	A	209	GLN
1	A	325	GLN
1	A	346	ASN

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Mol	Chain	Res	Type
1	B	74	ASN
1	B	209	GLN
1	B	319	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 36 ligands modelled in this entry, 2 are monoatomic - leaving 34 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
4	PO4	B	1352	-	4,4,4	1.02	0	6,6,6	1.97	2 (33%)
4	PO4	A	1355	-	4,4,4	0.98	0	6,6,6	0.94	0
4	PO4	A	1349	-	4,4,4	1.39	1 (25%)	6,6,6	1.01	0
4	PO4	A	1350	-	4,4,4	0.93	0	6,6,6	1.98	2 (33%)
4	PO4	A	1352	-	4,4,4	0.91	0	6,6,6	0.93	0
4	PO4	B	1357	-	4,4,4	1.55	1 (25%)	6,6,6	0.73	0
5	ACT	B	1361	-	3,3,3	0.91	0	3,3,3	0.90	0
5	ACT	B	1362	-	3,3,3	0.85	0	3,3,3	0.65	0
4	PO4	A	1354	-	4,4,4	0.65	0	6,6,6	0.92	0
5	ACT	A	1359	-	3,3,3	0.68	0	3,3,3	1.05	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	ACT	A	1358	-	3,3,3	0.83	0	3,3,3	0.68	0
5	ACT	B	1360	-	3,3,3	0.86	0	3,3,3	1.23	0
2	HEC	B	424	1	46,50,50	1.79	9 (19%)	58,82,82	2.27	17 (29%)
4	PO4	B	1349	-	4,4,4	1.12	0	6,6,6	0.78	0
2	HEC	A	423	1	46,50,50	2.02	13 (28%)	58,82,82	2.46	18 (31%)
2	HEC	A	424	1	46,50,50	1.82	11 (23%)	58,82,82	2.31	16 (27%)
4	PO4	B	1350	-	4,4,4	0.98	0	6,6,6	1.07	0
4	PO4	B	1348	-	4,4,4	0.85	0	6,6,6	0.74	0
4	PO4	B	1351	-	4,4,4	1.01	0	6,6,6	0.75	0
4	PO4	B	1353	-	4,4,4	1.04	0	6,6,6	0.65	0
4	PO4	A	1353	-	4,4,4	0.99	0	6,6,6	0.87	0
4	PO4	A	1348	-	4,4,4	1.13	0	6,6,6	1.04	0
4	PO4	A	1351	-	4,4,4	0.92	0	6,6,6	0.80	0
5	ACT	A	1360	-	3,3,3	0.87	0	3,3,3	0.85	0
4	PO4	B	1355	-	4,4,4	0.89	0	6,6,6	1.11	1 (16%)
2	HEC	B	423	1	46,50,50	1.69	8 (17%)	58,82,82	2.69	21 (36%)
4	PO4	B	1354	-	4,4,4	0.89	0	6,6,6	1.41	0
4	PO4	A	1362	-	4,4,4	0.61	0	6,6,6	0.99	0
4	PO4	A	1357	-	4,4,4	1.21	0	6,6,6	1.99	2 (33%)
6	EOH	A	1361	-	2,2,2	0.36	0	1,1,1	0.72	0
4	PO4	B	1358	-	4,4,4	0.76	0	6,6,6	1.47	1 (16%)
4	PO4	B	1356	-	4,4,4	0.84	0	6,6,6	0.88	0
4	PO4	A	1356	-	4,4,4	0.89	0	6,6,6	1.73	2 (33%)
4	PO4	B	1359	-	4,4,4	0.96	0	6,6,6	1.04	0

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	HEC	B	423	1	-	8/14/54/54	-
2	HEC	A	423	1	-	8/14/54/54	-
2	HEC	A	424	1	-	5/14/54/54	-
2	HEC	B	424	1	-	6/14/54/54	-

All (43) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	424	HEC	CAC-C3C	5.52	1.52	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	423	HEC	CAC-C3C	5.13	1.51	1.35
2	A	423	HEC	C4B-NB	-4.91	1.30	1.39
2	B	424	HEC	CAC-C3C	4.72	1.50	1.35
2	B	423	HEC	CAB-C3B	4.33	1.49	1.35
2	A	423	HEC	CAB-C3B	4.28	1.48	1.35
2	B	424	HEC	CAB-C3B	4.25	1.48	1.35
2	A	424	HEC	CAB-C3B	4.23	1.48	1.35
2	B	423	HEC	CAC-C3C	4.12	1.48	1.35
2	A	423	HEC	C4A-C3A	-4.02	1.37	1.45
2	B	423	HEC	C4B-NB	-3.98	1.32	1.39
2	B	424	HEC	C1B-NB	-3.91	1.32	1.39
2	A	424	HEC	CBC-CAC	-3.83	1.35	1.49
2	B	424	HEC	CBC-CAC	-3.63	1.36	1.49
2	A	423	HEC	C1C-NC	-3.49	1.33	1.39
2	B	423	HEC	CBC-CAC	-3.45	1.36	1.49
2	B	423	HEC	C1B-NB	-3.34	1.33	1.39
2	A	424	HEC	C4B-NB	-3.19	1.33	1.39
2	A	423	HEC	C1B-NB	-3.10	1.33	1.39
2	A	424	HEC	C1B-NB	-3.10	1.33	1.39
2	B	423	HEC	C4A-C3A	-2.97	1.39	1.45
2	B	423	HEC	CBB-CAB	-2.93	1.38	1.49
2	A	423	HEC	C4C-NC	-2.92	1.34	1.39
2	A	423	HEC	C3C-C4C	-2.66	1.41	1.46
2	B	424	HEC	C4B-NB	-2.63	1.34	1.39
2	A	423	HEC	CBB-CAB	-2.61	1.39	1.49
2	B	423	HEC	C1D-C2D	2.60	1.49	1.43
4	B	1357	PO4	P-O1	2.57	1.56	1.50
2	A	424	HEC	CBB-CAB	-2.47	1.40	1.49
2	B	424	HEC	CBB-CAB	-2.44	1.40	1.49
2	B	424	HEC	C1D-ND	-2.42	1.35	1.39
4	A	1349	PO4	P-O1	2.42	1.56	1.50
2	A	424	HEC	C1C-NC	-2.39	1.35	1.39
2	A	424	HEC	CBD-CAD	2.36	1.60	1.51
2	A	423	HEC	CBD-CGD	2.35	1.56	1.50
2	B	424	HEC	CMC-C2C	2.28	1.55	1.50
2	A	423	HEC	CBC-CAC	-2.28	1.41	1.49
2	A	424	HEC	C1D-C2D	2.17	1.48	1.43
2	B	424	HEC	CMA-C3A	2.13	1.55	1.50
2	A	424	HEC	O1A-CGA	2.12	1.29	1.22
2	A	423	HEC	CHC-C4B	2.11	1.42	1.38
2	A	424	HEC	C3D-C2D	-2.11	1.33	1.38
2	A	423	HEC	C1D-C2D	2.07	1.48	1.43

All (82) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	424	HEC	CBB-CAB-C3B	-8.98	109.49	127.43
2	A	423	HEC	CBB-CAB-C3B	-8.50	110.44	127.43
2	B	423	HEC	CBB-CAB-C3B	-8.02	111.41	127.43
2	B	424	HEC	CBB-CAB-C3B	-7.71	112.03	127.43
2	B	423	HEC	C4B-NB-C1B	7.50	118.05	105.82
2	B	423	HEC	CHC-C4B-NB	6.99	132.06	124.45
2	A	424	HEC	C4B-NB-C1B	6.72	116.77	105.82
2	A	423	HEC	C4B-NB-C1B	6.61	116.60	105.82
2	B	424	HEC	C4B-NB-C1B	5.84	115.35	105.82
2	A	423	HEC	CHC-C4B-NB	5.12	130.02	124.45
2	B	423	HEC	CBD-CAD-C3D	-4.98	98.77	112.53
2	B	423	HEC	CHB-C4A-NA	4.54	129.40	124.45
2	B	423	HEC	CHD-C4C-NC	4.52	129.38	124.45
2	B	424	HEC	CHB-C4A-NA	4.43	129.27	124.45
2	A	423	HEC	CHD-C4C-NC	4.39	129.23	124.45
2	B	423	HEC	C2A-C1A-NA	-4.24	106.23	110.32
2	A	424	HEC	CHC-C4B-NB	4.09	128.90	124.45
2	A	423	HEC	O2A-CGA-CBA	3.94	126.45	114.00
2	B	424	HEC	CBC-CAC-C3C	-3.86	119.71	127.43
2	A	423	HEC	CHB-C4A-NA	3.86	128.66	124.45
2	B	423	HEC	CBC-CAC-C3C	-3.77	119.90	127.43
2	B	424	HEC	O2D-CGD-CBD	3.72	125.76	114.00
2	A	424	HEC	O2D-CGD-CBD	3.65	125.54	114.00
2	B	423	HEC	C3D-C4D-ND	3.61	114.16	110.15
2	B	424	HEC	C4C-NC-C1C	3.59	111.67	105.82
2	B	423	HEC	C2B-C1B-NB	-3.57	104.42	110.14
2	B	424	HEC	CHA-C4D-ND	3.51	130.23	123.86
4	B	1352	PO4	O4-P-O3	3.45	118.64	107.91
4	A	1357	PO4	O3-P-O2	3.42	118.56	107.91
2	B	424	HEC	C2A-C1A-NA	-3.40	107.05	110.32
2	A	423	HEC	C2A-C1A-NA	-3.35	107.09	110.32
2	A	424	HEC	CHB-C4A-NA	3.32	128.07	124.45
2	A	423	HEC	C4C-NC-C1C	3.31	111.21	105.82
2	A	424	HEC	C4C-NC-C1C	3.30	111.20	105.82
2	A	424	HEC	C2B-C1B-NB	-3.28	104.88	110.14
2	B	424	HEC	CHA-C4D-C3D	-3.27	118.15	125.30
2	B	423	HEC	CAA-CBA-CGA	-3.23	105.10	113.67
2	B	424	HEC	CHD-C4C-NC	3.22	127.96	124.45
2	A	423	HEC	CBD-CAD-C3D	-3.17	103.77	112.53
2	A	424	HEC	CHD-C4C-NC	3.13	127.86	124.45
2	A	423	HEC	O1A-CGA-CBA	-3.12	113.19	123.09
2	A	423	HEC	CAA-CBA-CGA	-3.07	105.53	113.67

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	423	HEC	O2D-CGD-O1D	-3.03	115.54	123.33
2	B	423	HEC	CHA-C4D-C3D	-3.02	118.69	125.30
2	A	424	HEC	CHD-C1D-ND	2.94	129.19	123.86
4	A	1350	PO4	O3-P-O1	-2.88	100.76	110.95
2	A	423	HEC	C2B-C1B-NB	-2.87	105.54	110.14
2	B	424	HEC	O2A-CGA-CBA	2.86	123.02	114.00
2	B	423	HEC	O2D-CGD-CBD	2.84	122.96	114.00
2	B	424	HEC	CHC-C4B-NB	2.83	127.53	124.45
2	B	423	HEC	C4C-NC-C1C	2.81	110.40	105.82
2	A	424	HEC	CBD-CAD-C3D	-2.78	104.84	112.53
2	A	424	HEC	O2D-CGD-O1D	-2.73	116.32	123.33
2	B	424	HEC	CHA-C1A-NA	2.71	127.40	124.45
2	A	424	HEC	CHD-C1D-C2D	-2.71	119.57	127.43
4	A	1350	PO4	O4-P-O1	2.69	120.46	110.95
4	A	1356	PO4	O2-P-O1	2.65	120.34	110.95
2	A	423	HEC	CAA-C2A-C3A	-2.64	122.93	127.87
2	A	424	HEC	CHA-C4D-C3D	-2.61	119.58	125.30
2	B	423	HEC	CAA-C2A-C3A	-2.58	123.03	127.87
2	A	424	HEC	CHA-C4D-ND	2.51	128.42	123.86
2	B	423	HEC	CHB-C1B-NB	2.50	128.39	123.86
2	B	424	HEC	CBD-CAD-C3D	-2.46	105.73	112.53
4	A	1357	PO4	O2-P-O1	-2.43	102.36	110.95
2	B	423	HEC	O1A-CGA-CBA	-2.43	115.39	123.09
2	B	423	HEC	O2A-CGA-CBA	2.42	121.66	114.00
2	B	423	HEC	C4A-NA-C1A	2.42	109.76	105.82
2	A	423	HEC	CHA-C1A-NA	2.38	127.05	124.45
2	B	423	HEC	CHA-C1A-NA	2.37	127.03	124.45
2	A	423	HEC	CAA-C2A-C1A	2.36	129.66	124.85
2	B	424	HEC	O1D-CGD-CBD	-2.31	115.75	123.09
4	A	1356	PO4	O4-P-O1	-2.27	102.94	110.95
2	B	424	HEC	C2B-C1B-NB	-2.25	106.53	110.14
2	B	423	HEC	C4D-C3D-C2D	-2.22	103.43	106.87
2	A	423	HEC	CHD-C1D-C2D	-2.21	121.02	127.43
2	A	424	HEC	CBA-CAA-C2A	-2.20	106.45	112.53
2	A	423	HEC	CBA-CAA-C2A	-2.18	106.49	112.53
4	B	1358	PO4	O4-P-O2	2.15	114.59	107.91
4	B	1352	PO4	O3-P-O2	-2.10	101.37	107.91
4	B	1355	PO4	O4-P-O3	2.09	114.40	107.91
2	B	424	HEC	CHD-C1D-C2D	-2.06	121.45	127.43
2	A	424	HEC	CAD-C3D-C4D	2.00	128.85	124.94

There are no chirality outliers.

All (27) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	423	HEC	C2B-C3B-CAB-CBB
2	A	423	HEC	C4B-C3B-CAB-CBB
2	A	423	HEC	C2C-C3C-CAC-CBC
2	A	423	HEC	C4C-C3C-CAC-CBC
2	A	424	HEC	C2B-C3B-CAB-CBB
2	A	424	HEC	C4B-C3B-CAB-CBB
2	A	424	HEC	C2C-C3C-CAC-CBC
2	A	424	HEC	C4C-C3C-CAC-CBC
2	B	423	HEC	C2B-C3B-CAB-CBB
2	B	423	HEC	C4B-C3B-CAB-CBB
2	B	423	HEC	C2C-C3C-CAC-CBC
2	B	423	HEC	C4C-C3C-CAC-CBC
2	B	424	HEC	C2B-C3B-CAB-CBB
2	B	424	HEC	C4B-C3B-CAB-CBB
2	B	424	HEC	C2C-C3C-CAC-CBC
2	B	424	HEC	C4C-C3C-CAC-CBC
2	A	423	HEC	CAD-CBD-CGD-O2D
2	B	423	HEC	CAD-CBD-CGD-O2D
2	B	423	HEC	CAD-CBD-CGD-O1D
2	A	423	HEC	CAD-CBD-CGD-O1D
2	B	424	HEC	CAA-CBA-CGA-O2A
2	B	423	HEC	CAA-CBA-CGA-O1A
2	A	423	HEC	CAA-CBA-CGA-O2A
2	B	423	HEC	CAA-CBA-CGA-O2A
2	A	423	HEC	CAA-CBA-CGA-O1A
2	B	424	HEC	CAA-CBA-CGA-O1A
2	A	424	HEC	CAA-CBA-CGA-O1A

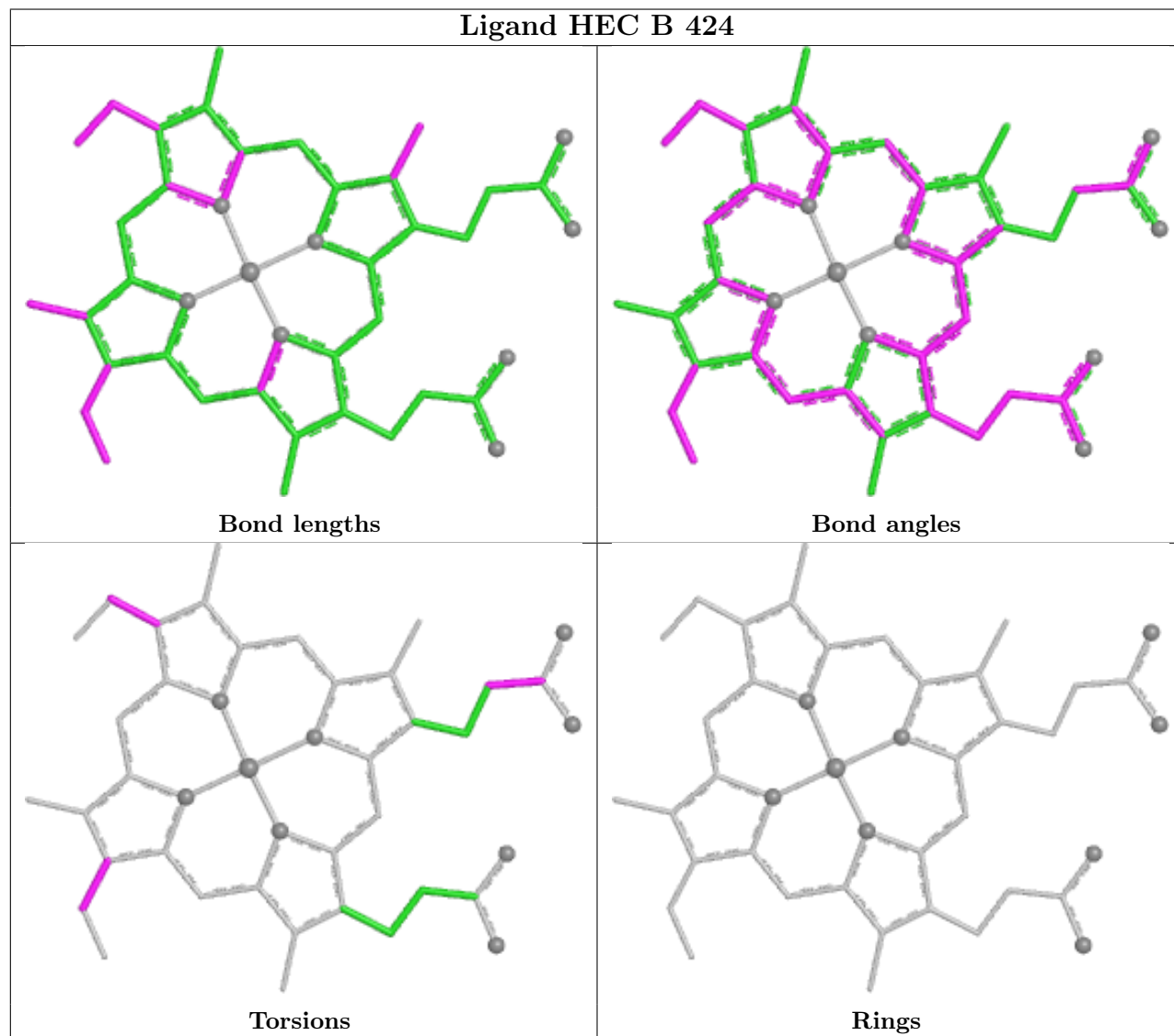
There are no ring outliers.

6 monomers are involved in 17 short contacts:

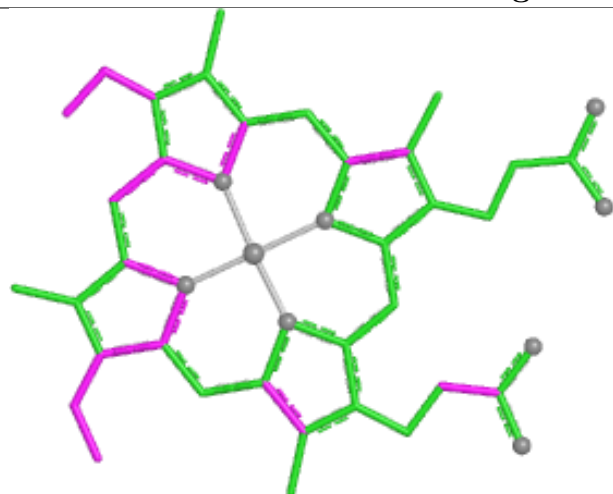
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	1362	ACT	1	0
2	A	423	HEC	5	0
2	A	424	HEC	2	0
4	B	1350	PO4	1	0
4	A	1351	PO4	1	0
2	B	423	HEC	7	0

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

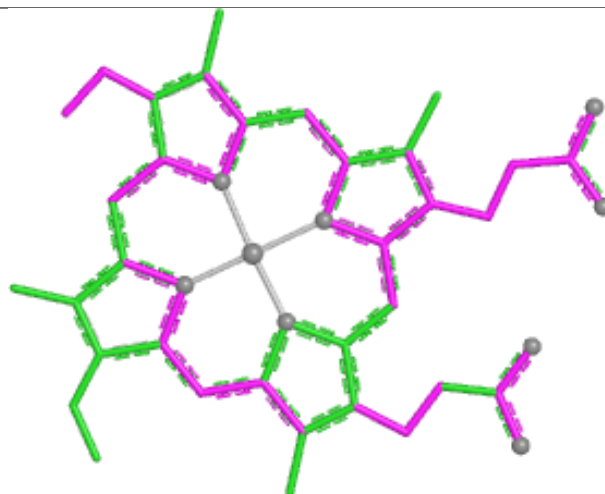
addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. 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.



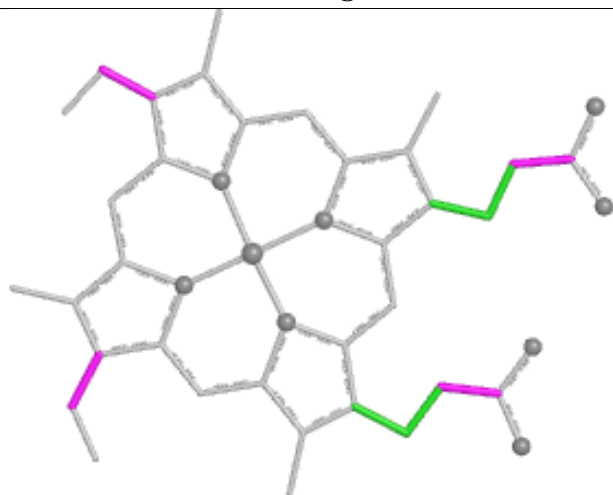
Ligand HEC A 423



Bond lengths



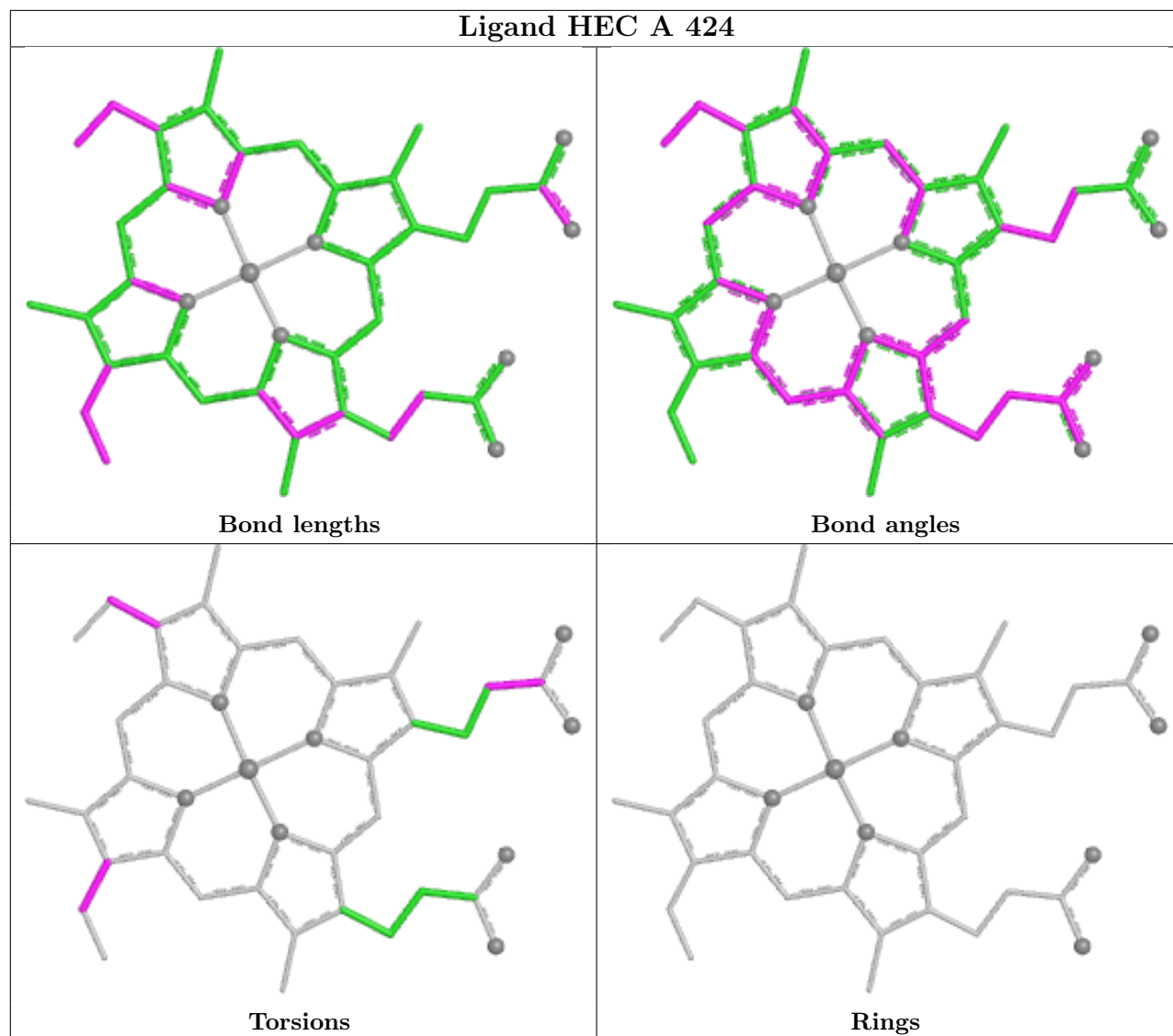
Bond angles

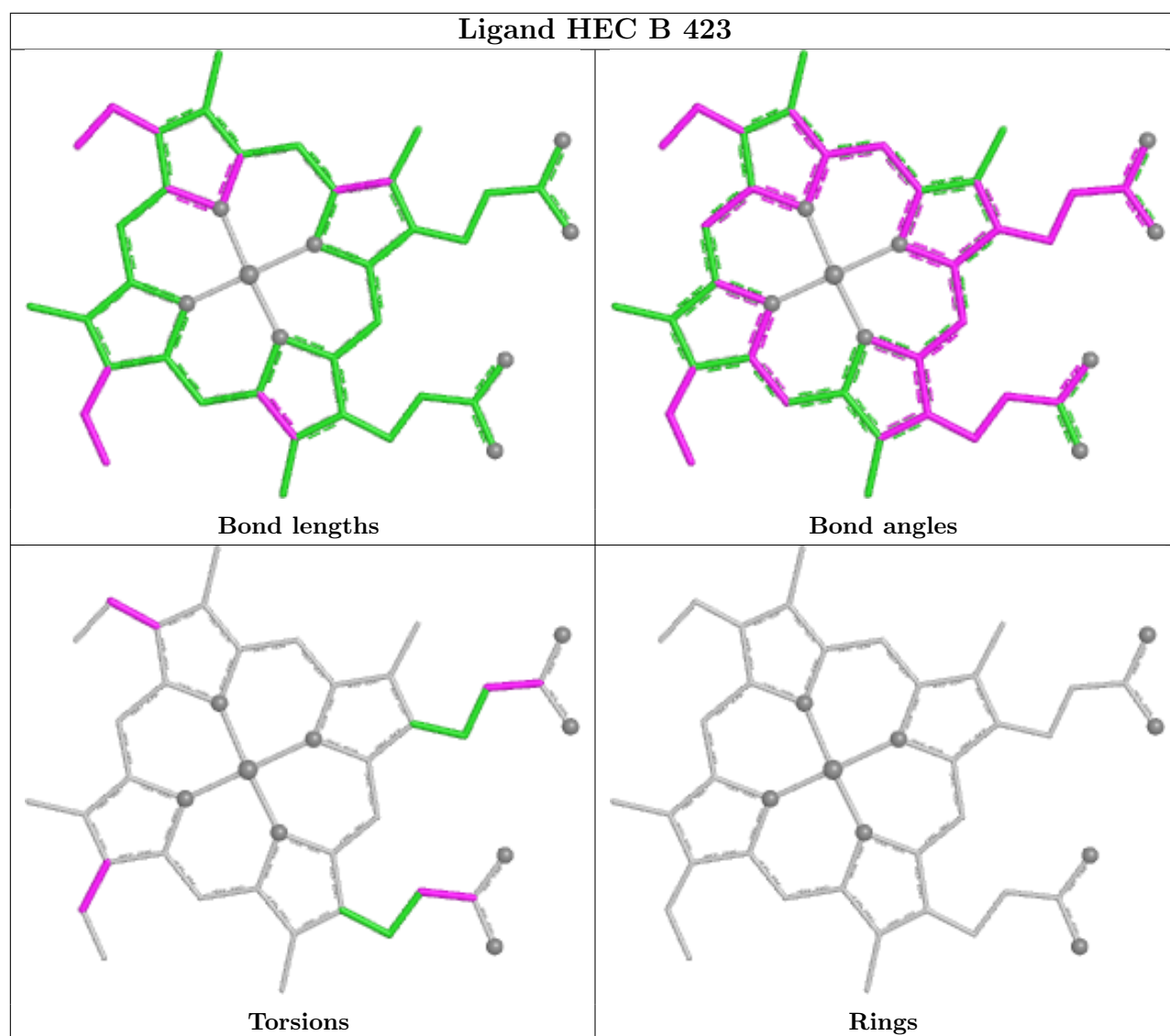


Torsions



Rings





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

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	320/341 (93%)	-0.11	8 (2%) 58 64	17, 31, 56, 98	3 (0%)
1	B	319/341 (93%)	-0.11	9 (2%) 55 60	18, 32, 54, 124	4 (1%)
All	All	639/682 (93%)	-0.11	17 (2%) 56 61	17, 31, 55, 124	7 (1%)

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	248	PRO	6.3
1	B	249	VAL	6.2
1	B	44[A]	LYS	5.5
1	A	243	GLY	5.4
1	A	249	VAL	4.4
1	A	346	ASN	4.2
1	B	346	ASN	4.1
1	B	345	SER	3.2
1	A	129	GLY	3.0
1	B	243	GLY	2.8
1	A	242	PRO	2.8
1	A	345	SER	2.8
1	B	128	LYS	2.7
1	A	128	LYS	2.7
1	B	262	ALA	2.6
1	B	23	GLU	2.5
1	B	242	PRO	2.3

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

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

6.3 Carbohydrates ⓘ

There are no 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.

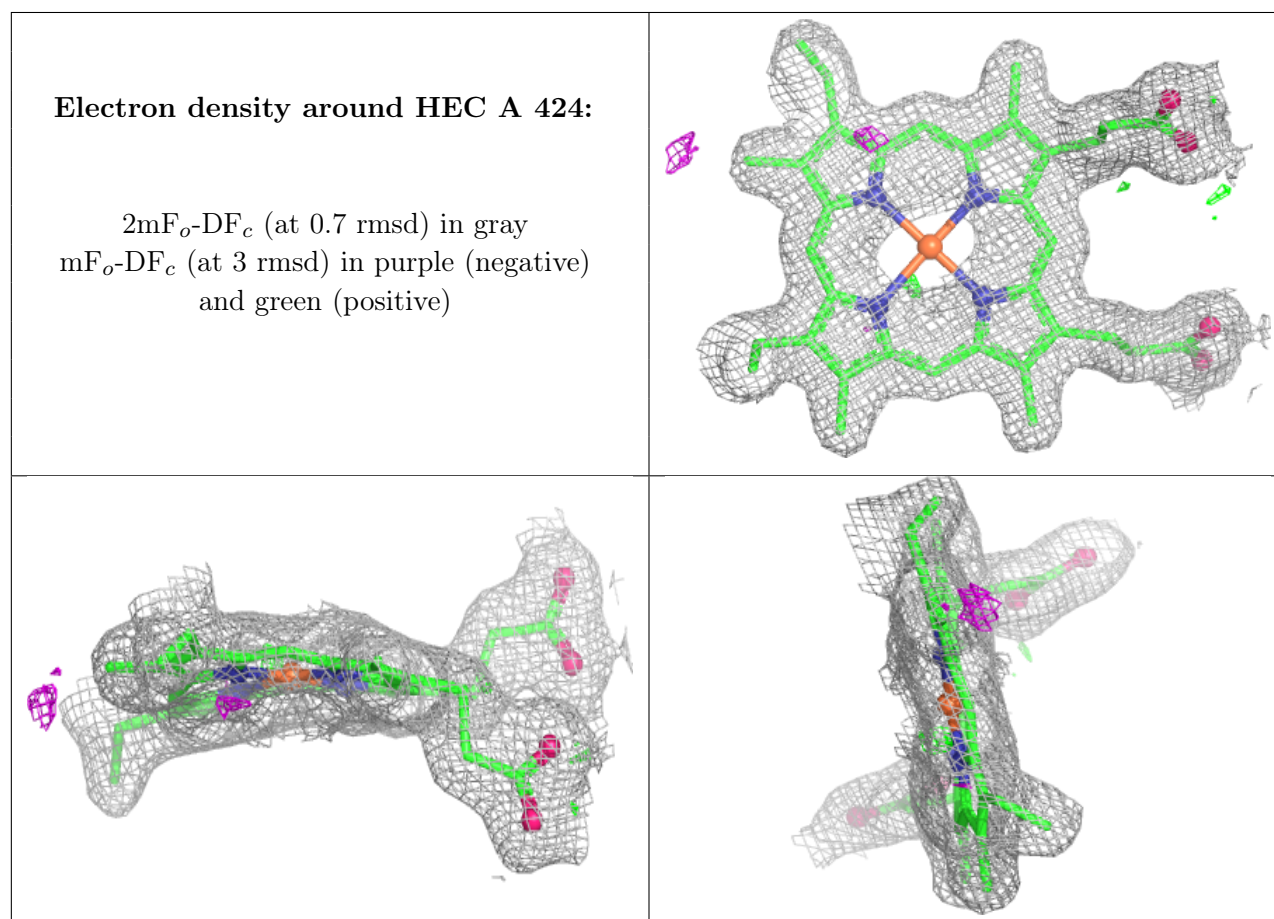
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	ACT	B	1361	4/4	0.60	0.22	78,82,83,89	0
4	PO4	A	1349	5/5	0.66	0.15	65,71,89,102	0
4	PO4	B	1348	5/5	0.69	0.13	81,89,105,107	0
4	PO4	A	1350	5/5	0.73	0.12	61,71,86,87	0
4	PO4	B	1357	5/5	0.74	0.14	60,81,98,103	0
4	PO4	A	1354	5/5	0.76	0.13	70,70,81,93	0
4	PO4	A	1362	5/5	0.77	0.11	68,78,83,97	0
4	PO4	A	1355	5/5	0.78	0.11	60,67,81,84	0
4	PO4	B	1356	5/5	0.79	0.15	68,91,97,97	0
5	ACT	B	1362	4/4	0.79	0.17	43,45,51,68	0
4	PO4	A	1351	5/5	0.80	0.13	67,74,96,99	0
4	PO4	B	1350	5/5	0.80	0.10	74,79,86,89	0
4	PO4	B	1358	5/5	0.81	0.11	55,61,74,77	0
4	PO4	B	1353	5/5	0.82	0.11	69,74,84,86	0
4	PO4	A	1348	5/5	0.82	0.12	58,60,77,90	0
5	ACT	A	1360	4/4	0.84	0.15	54,61,67,72	0
4	PO4	A	1356	5/5	0.84	0.12	63,63,66,73	0
5	ACT	A	1358	4/4	0.84	0.15	58,58,66,69	0
5	ACT	B	1360	4/4	0.85	0.14	50,59,61,66	0
4	PO4	B	1355	5/5	0.86	0.10	66,68,75,81	0
4	PO4	B	1349	5/5	0.87	0.11	67,70,79,80	0
4	PO4	B	1352	5/5	0.87	0.11	62,63,67,71	0
4	PO4	B	1354	5/5	0.88	0.10	51,59,60,62	0
4	PO4	A	1352	5/5	0.88	0.07	66,73,81,82	0
4	PO4	B	1359	5/5	0.89	0.10	53,60,68,80	0
6	EOH	A	1361	3/3	0.89	0.22	50,50,54,55	0
4	PO4	B	1351	5/5	0.91	0.08	53,64,66,69	0
5	ACT	A	1359	4/4	0.92	0.10	56,58,59,61	0
4	PO4	A	1353	5/5	0.93	0.07	42,56,63,68	0
4	PO4	A	1357	5/5	0.94	0.08	43,53,60,65	0
2	HEC	A	424	43/43	0.98	0.06	23,27,31,32	0
2	HEC	A	423	43/43	0.99	0.05	19,22,29,31	0

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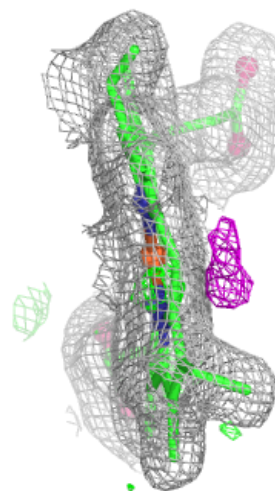
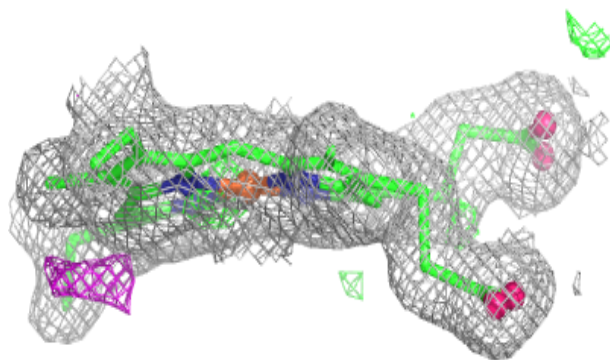
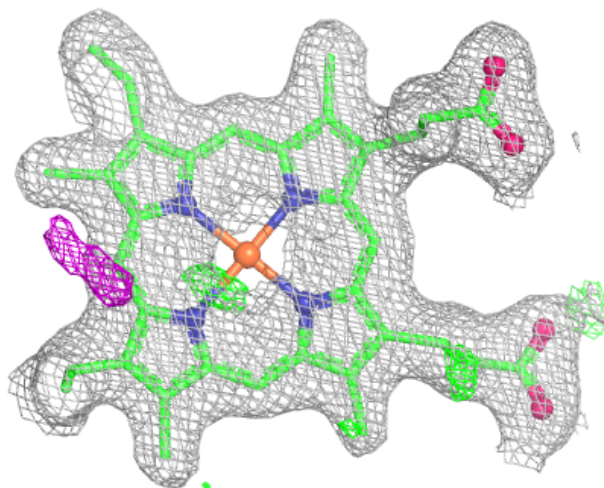
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	HEC	B	423	43/43	0.99	0.05	21,23,31,40	0
2	HEC	B	424	43/43	0.99	0.05	23,29,33,35	0
3	CA	A	425	1/1	1.00	0.02	25,25,25,25	0
3	CA	B	425	1/1	1.00	0.01	25,25,25,25	0

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.



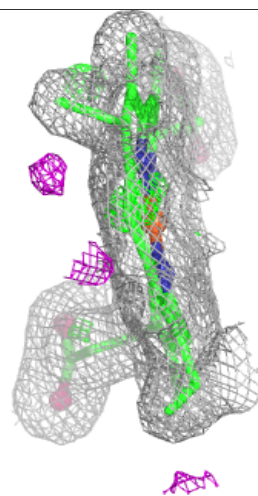
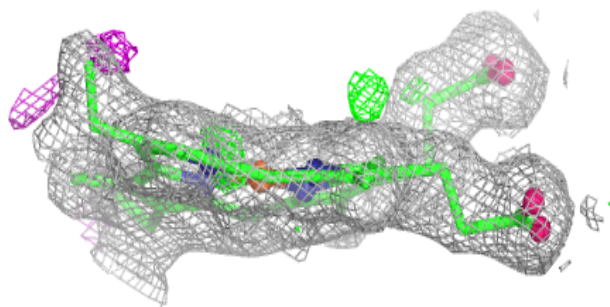
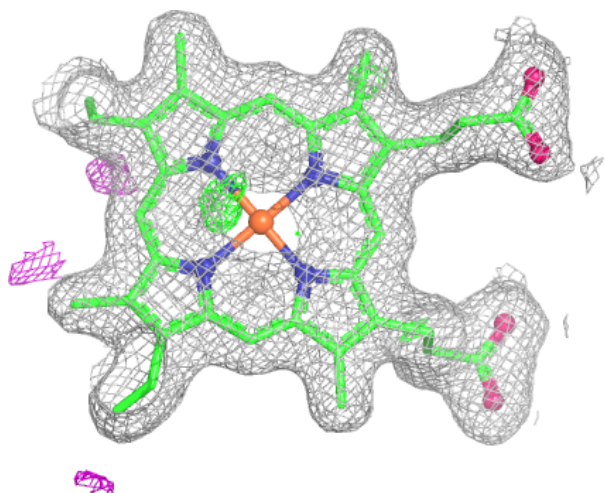
Electron density around HEC A 423:

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



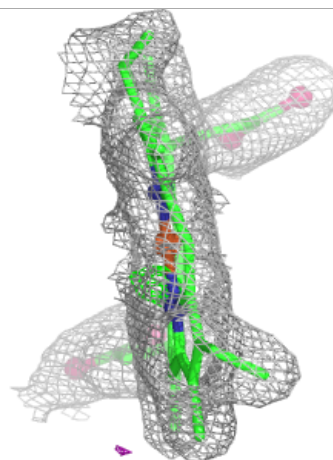
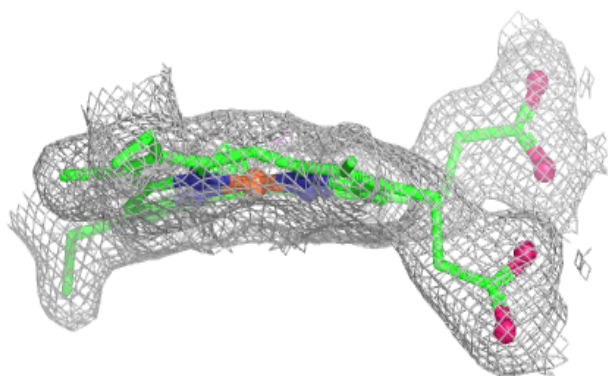
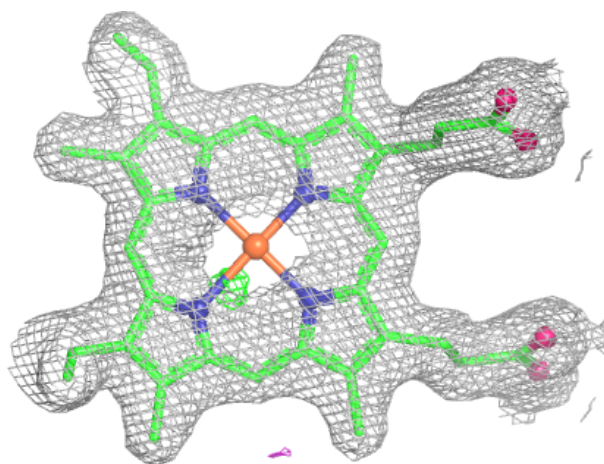
Electron density around HEC B 423:

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



Electron density around HEC B 424:

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



6.5 Other polymers [i](#)

There are no such residues in this entry.