WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Aug 25, 2025 – 01:17 am BST

PDB ID	:	9I4U / pdb_00009i4u
Title	:	DtpB in complex with photocaged nitric oxide, 1.24 s, 32.2 microjoule, SSX
Authors	:	Smyth, P.; Williams, L.J.; Hough, M.A.; Worrall, J.A.R.; Owen, R.L.
Deposited on	:	2025-01-26
Resolution	:	2.40 Å(reported)

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

|		
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.45.1

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 2.40 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.
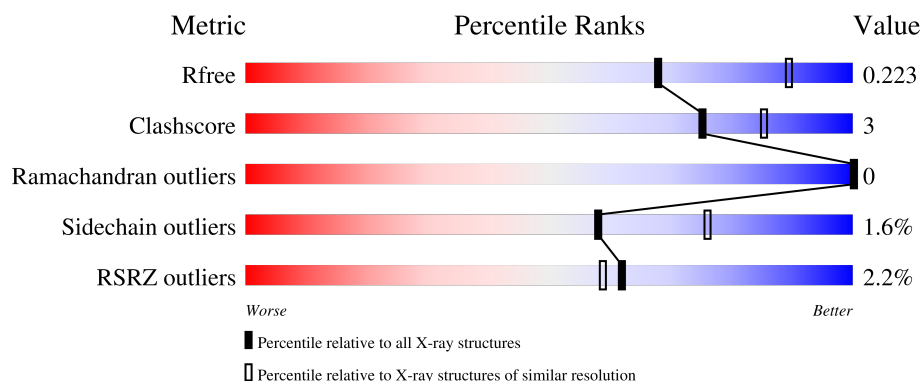
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	4642 (2.40-2.40)
Clashscore	180529	5218 (2.40-2.40)
Ramachandran outliers	177936	5158 (2.40-2.40)
Sidechain outliers	177891	5159 (2.40-2.40)
RSRZ outliers	164620	4642 (2.40-2.40)

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

Mol	Chain	Length	Quality of chain
1	A	329	2% / 88% / 5% / 7%
1	B	329	2% / 84% / 9% / · / 7%
1	C	329	2% / 86% / 7% / 7%
1	D	329	% / 87% / 6% / 7%
1	E	329	2% / 86% / 6% / 7%

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Mol	Chain	Length	Quality of chain
1	F	329	

2%

86%   7%   7%
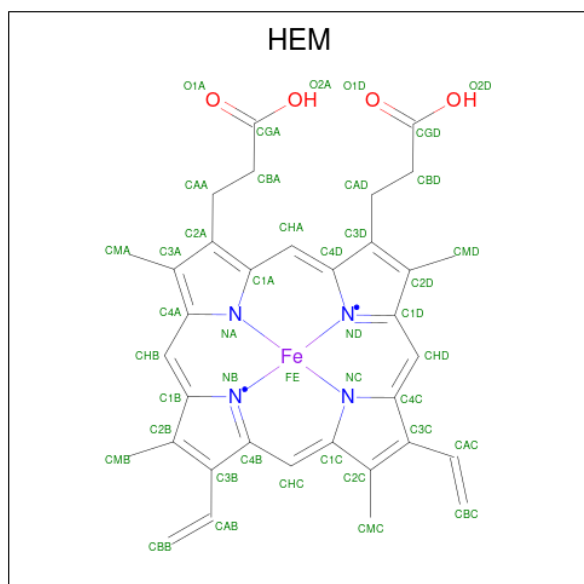
2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 14941 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.

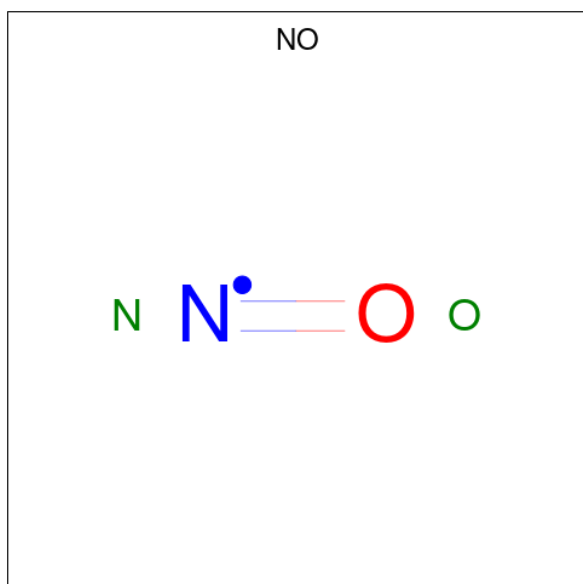- Molecule 1 is a protein called Dyp-type peroxidase family.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	F	307	Total	C	N	O	S	0	4	0
			2374	1489	409	467	9			
1	A	306	Total	C	N	O	S	0	4	0
			2366	1485	406	465	10			
1	B	306	Total	C	N	O	S	0	0	0
			2330	1466	402	453	9			
1	C	306	Total	C	N	O	S	0	6	0
			2384	1495	411	468	10			
1	D	306	Total	C	N	O	S	0	5	0
			2379	1492	413	465	9			
1	E	305	Total	C	N	O	S	0	2	0
			2341	1472	409	451	9			

- 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	F	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	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
2	E	1	Total 43	C 34	Fe 1	N 4	O 4	0	0

- Molecule 3 is NITRIC OXIDE (CCD ID: NO) (formula: NO) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	F	1	Total 2	N 1	O 1	0	0
3	A	1	Total 2	N 1	O 1	0	0
3	B	1	Total 2	N 1	O 1	0	0
3	C	1	Total 2	N 1	O 1	0	0
3	D	1	Total 2	N 1	O 1	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	E	1	Total 2	N 1	O 1	0	0

- Molecule 4 is water.

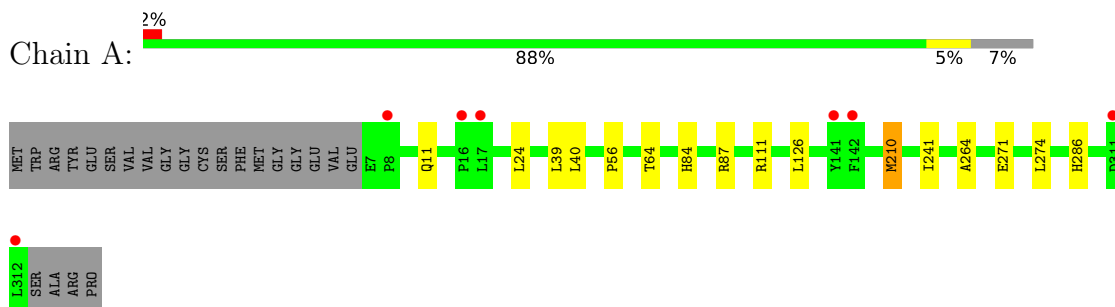| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	F	83	Total 83	O 83	0	0
4	A	90	Total 90	O 90	0	0
4	B	81	Total 81	O 81	0	0
4	C	78	Total 78	O 78	0	0
4	D	110	Total 110	O 110	0	0
4	E	55	Total 55	O 55	0	0

3 Residue-property plots (i)

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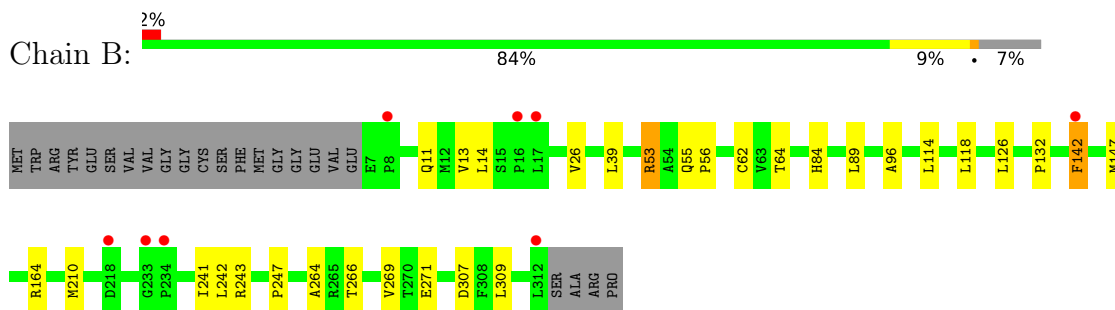
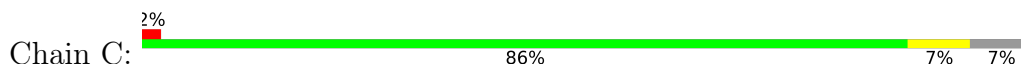• Molecule 1: Dyp-type peroxidase family
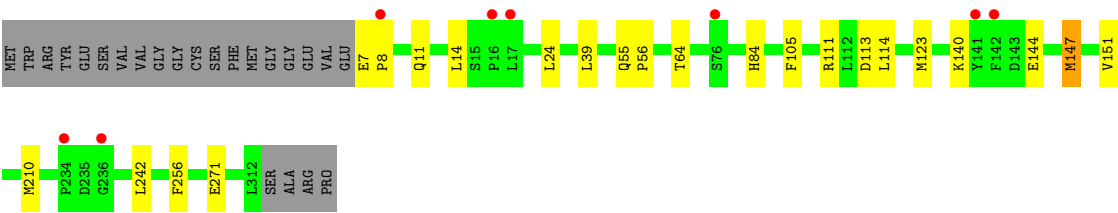
Chain F:

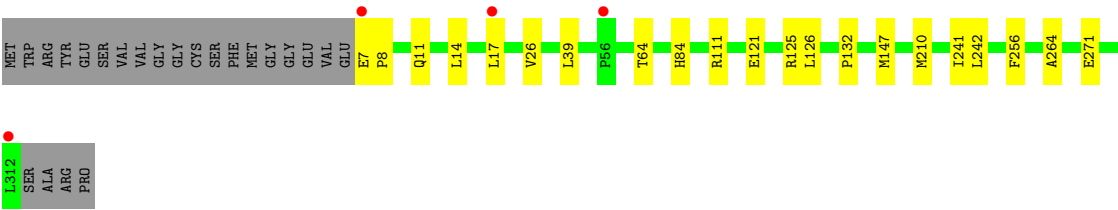

• Molecule 1: Dyp-type peroxidase family
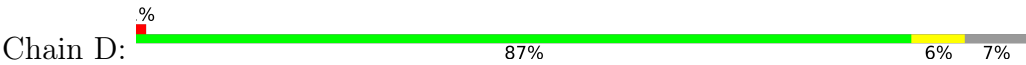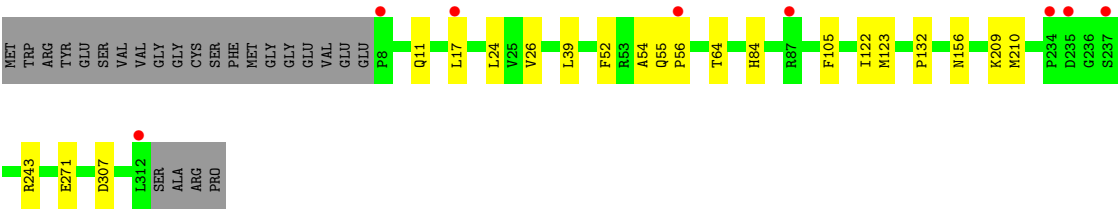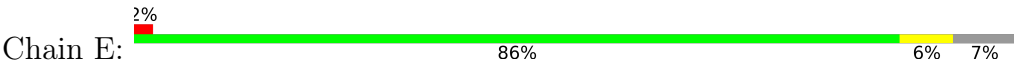
Chain A:

• Molecule 1: Dyp-type peroxidase family

Chain B:

• Molecule 1: Dyp-type peroxidase family

Chain C:

MET TRP ARG TYR GLU SER VAL VAL GLY GLY CYS SER PHE MET GLY GLU VAL GLU **E7 P8** Q11 L14 S15 P16 L17 L24 L39 Q55 P56 T64 S76 H84 F105 R111 L112 D113 L114 M123 K140 Y141 F142 D143 E444 **M147** V151

M210 P234 D235 G236 L242 F256 E271 L312 SER ALA ARG PRO

• Molecule 1: Dyp-type peroxidase family

Chain D:

87% 6% 7%

MET TRP ARG TYR GLU SER VAL VAL GLY GLY CYS SER PHE MET GLY GLU VAL GLU **E7 P8** Q11 L14 L17 V26 L39 P56 T64 H84 R111 E121 R125 L126 P132 M147 M210 I241 L242 F256 A264 E271

L312 SER ALA ARG PRO

• Molecule 1: Dyp-type peroxidase family

Chain E:

2% 86% 6% 7%

MET TRP ARG TYR GLU SER VAL VAL GLY GLY CYS SER PHE MET GLY GLU VAL GLU GLU **P8** Q11 L17 L24 V25 V26 L39 F52 R53 A54 Q55 P56 T64 H84 R87 F105 I122 M123 P132 N156 K209 M210 P234 D235 G236 S237

R243 E271 D307 L312 SER ALA ARG PRO

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants	86.67Å　　121.38Å　　198.16Å	Depositor
a, b, c, α, β, γ	90.00°　　　90.00°　　　90.00°	
Resolution (Å)	76.87　–　2.40	Depositor
	76.87　–　2.40	EDS
% Data completeness	100.0 (76.87-2.40)	Depositor
(in resolution range)	100.0 (76.87-2.40)	EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.55 (at 2.40Å)	Xtriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.182　,　0.223	Depositor
	0.182　,　0.223	DCC
R_{free} test set	4160 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	33.8	Xtriage
Anisotropy	0.033	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 34.2	EDS
L-test for twinning[2]	$< \lvert L \rvert > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	14941	wwPDB-VP
Average B, all atoms (Å^2)	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.86% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< \lvert L \rvert >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5   Model quality ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: NO, HEM

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$|Z|$>5	RMSZ	#$|Z|$>5
1	A	0.45	0/2416	0.97	0/3281
1	B	0.46	0/2380	0.98	0/3234
1	C	0.45	0/2434	0.96	0/3305
1	D	0.46	0/2429	0.97	0/3297
1	E	0.45	0/2391	0.98	0/3246
1	F	0.46	0/2425	0.98	0/3294
All	All	0.45	0/14475	0.97	0/19657

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2   Too-close contacts ⓘ

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	2366	0	2278	10	0
1	B	2330	0	2251	21	0
1	C	2384	0	2297	19	0
1	D	2379	0	2294	12	0
1	E	2341	0	2271	17	0
1	F	2374	0	2281	12	0
2	A	43	0	30	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	43	0	30	0	0
2	C	43	0	30	0	0
2	D	43	0	30	0	0
2	E	43	0	30	0	0
2	F	43	0	30	1	0
3	A	2	0	0	0	0
3	B	2	0	0	1	0
3	C	2	0	0	0	0
3	D	2	0	0	0	0
3	E	2	0	0	0	0
3	F	2	0	0	0	0
4	A	90	0	0	1	0
4	B	81	0	0	1	0
4	C	78	0	0	0	0
4	D	110	0	0	0	0
4	E	55	0	0	0	0
4	F	83	0	0	0	0
All	All	14941	0	13852	82	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 3.

All (82) 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:F:11:GLN:HE22	1:F:64:THR:H	1.19	0.91
1:D:11:GLN:HE22	1:D:64:THR:H	1.22	0.87
1:E:11:GLN:HE22	1:E:64:THR:H	1.20	0.87
1:A:11:GLN:HE22	1:A:64:THR:H	1.26	0.80
1:C:11:GLN:HE22	1:C:64:THR:H	1.30	0.78
1:F:156:ASN:HD21	1:F:243:ARG:H	1.34	0.76
1:E:156:ASN:HD21	1:E:243:ARG:H	1.33	0.75
1:B:11:GLN:HE22	1:B:64:THR:H	1.35	0.72
1:A:84:HIS:HE1	1:A:271:GLU:OE2	1.74	0.70
1:D:84:HIS:HE1	1:D:271:GLU:OE2	1.74	0.69
1:C:210[A]:MET:HE1	1:E:210:MET:HB2	1.75	0.67
1:C:24:LEU:HD21	1:C:123:MET:HE3	1.77	0.67
1:B:55:GLN:HG3	1:B:56:PRO:HA	1.77	0.67
1:C:140:LYS:HE2	1:C:144:GLU:OE2	1.96	0.66
1:B:84:HIS:HE1	1:B:271:GLU:OE2	1.79	0.66
1:E:55:GLN:N	1:E:56:PRO:HD2	2.12	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:53:ARG:HG3	4:B:504:HOH:O	1.98	0.64
1:A:210[B]:MET:HE1	1:D:210:MET:HB2	1.81	0.63
1:E:84:HIS:HE1	1:E:271:GLU:OE2	1.85	0.60
1:C:147:MET:HE3	1:C:147:MET:HA	1.82	0.60
1:F:11:GLN:NE2	1:F:64:THR:H	1.95	0.58
1:D:147:MET:HG2	1:D:256:PHE:HB3	1.85	0.58
1:D:241:ILE:HG22	1:D:264:ALA:HB2	1.87	0.57
1:E:24:LEU:HD21	1:E:123:MET:HE3	1.88	0.56
1:F:147:MET:HG2	1:F:256:PHE:HB3	1.88	0.56
1:F:156:ASN:ND2	1:F:243:ARG:H	2.02	0.56
1:E:11:GLN:NE2	1:E:64:THR:H	1.99	0.55
1:F:84:HIS:HE1	1:F:271:GLU:OE2	1.90	0.54
1:F:39:LEU:HD22	1:F:126:LEU:HD11	1.89	0.53
1:B:142:PHE:CD2	1:E:54:ALA:HB2	2.44	0.53
1:C:84:HIS:HE1	1:C:271:GLU:OE2	1.93	0.52
1:B:243:ARG:HD2	3:B:402:NO:O	2.10	0.51
1:E:26:VAL:HG12	1:E:132:PRO:HA	1.91	0.51
1:E:156:ASN:ND2	1:E:243:ARG:H	2.06	0.51
1:C:210[A]:MET:SD	1:E:210:MET:HE3	2.50	0.51
1:B:14:LEU:HD23	1:B:242:LEU:HD22	1.92	0.51
1:C:147:MET:HG2	1:C:256:PHE:HB3	1.94	0.50
1:F:26:VAL:HG12	1:F:132:PRO:HA	1.94	0.49
1:E:39:LEU:HD21	1:E:122:ILE:HG23	1.94	0.49
1:D:14:LEU:HD23	1:D:242:LEU:HD22	1.95	0.49
1:D:121:GLU:OE1	1:D:125[B]:ARG:NH1	2.45	0.49
1:B:55:GLN:CG	1:B:56:PRO:HA	2.43	0.48
1:D:7:GLU:HB3	1:D:8:PRO:HD3	1.96	0.48
1:A:56:PRO:HD3	1:E:17:LEU:HD11	1.96	0.47
1:C:210[B]:MET:HE3	1:C:210[B]:MET:HB2	1.80	0.47
1:D:11:GLN:NE2	1:D:64:THR:H	2.01	0.47
1:B:241:ILE:HG22	1:B:264:ALA:HB2	1.96	0.46
1:B:26:VAL:HG12	1:B:132:PRO:HA	1.98	0.46
1:C:210[B]:MET:HE1	1:E:209:LYS:HG2	1.97	0.46
1:D:84:HIS:CE1	1:D:271:GLU:OE2	2.62	0.46
1:E:52:PHE:O	1:E:55:GLN:HB2	2.16	0.45
1:B:142:PHE:CE2	1:E:54:ALA:HB2	2.52	0.45
1:B:89:LEU:HB2	1:B:96:ALA:HB3	1.98	0.44
1:A:11:GLN:NE2	1:A:64:THR:H	2.04	0.44
1:B:266:THR:HG23	1:B:269:VAL:HG23	1.99	0.44
1:A:286:HIS:HD2	4:A:563:HOH:O	1.99	0.44
1:C:55:GLN:HB2	1:C:56:PRO:HA	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:F:401:HEM:HMC1	2:F:401:HEM:HBC2	1.99	0.43
1:C:14:LEU:HD23	1:C:242:LEU:HD22	2.00	0.43
1:D:26:VAL:HG12	1:D:132:PRO:HA	2.01	0.43
1:F:124:GLY:HA2	1:F:127:ARG:HD3	1.99	0.43
1:C:11:GLN:NE2	1:C:64:THR:H	2.06	0.42
1:C:24:LEU:HB3	1:C:105:PHE:HB2	2.00	0.42
1:C:147:MET:HA	1:C:147:MET:CE	2.48	0.42
1:C:7:GLU:HB2	1:C:8:PRO:HD3	2.01	0.42
1:F:145:ARG:HD2	1:B:210:MET:HE1	2.01	0.42
1:F:39:LEU:HD21	1:F:122:ILE:HG23	2.02	0.42
1:B:11:GLN:NE2	1:B:64:THR:H	2.10	0.42
1:B:39:LEU:HD22	1:B:126:LEU:HD11	2.01	0.42
1:B:62:CYS:HB2	1:B:118:LEU:HD21	2.01	0.42
1:B:142:PHE:N	1:B:142:PHE:CD1	2.87	0.42
1:C:111:ARG:HB3	1:C:113:ASP:OD1	2.20	0.42
1:B:147:MET:HE2	1:B:247:PRO:HB3	2.01	0.41
1:F:220:LYS:HA	1:F:221:PRO:HD3	1.95	0.41
1:E:24:LEU:HB3	1:E:105:PHE:HB2	2.03	0.41
1:A:241:ILE:HG22	1:A:264:ALA:HB2	2.03	0.40
1:B:84:HIS:CE1	1:B:271:GLU:OE2	2.67	0.40
1:A:84:HIS:CE1	1:A:271:GLU:OE2	2.64	0.40
1:A:111:ARG:HH22	1:C:140:LYS:HD3	1.87	0.40
1:A:39:LEU:HD22	1:A:126:LEU:HD11	2.04	0.40
1:B:53:ARG:HG2	1:C:151:VAL:HG21	2.04	0.40
1:D:39:LEU:HD22	1:D:126:LEU:HD11	2.04	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	308/329 (94%)	301 (98%)	7 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	304/329 (92%)	299 (98%)	5 (2%)	0	100	100
1	C	310/329 (94%)	305 (98%)	5 (2%)	0	100	100
1	D	309/329 (94%)	301 (97%)	8 (3%)	0	100	100
1	E	305/329 (93%)	298 (98%)	7 (2%)	0	100	100
1	F	309/329 (94%)	301 (97%)	8 (3%)	0	100	100
All	All	1845/1974 (94%)	1805 (98%)	40 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	249/263 (95%)	243 (98%)	6 (2%)	44	64
1	B	243/263 (92%)	236 (97%)	7 (3%)	37	58
1	C	251/263 (95%)	248 (99%)	3 (1%)	67	82
1	D	250/263 (95%)	248 (99%)	2 (1%)	79	90
1	E	244/263 (93%)	243 (100%)	1 (0%)	89	95
1	F	250/263 (95%)	245 (98%)	5 (2%)	50	70
All	All	1487/1578 (94%)	1463 (98%)	24 (2%)	58	76

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	37	ARG
1	F	111	ARG
1	F	265	ARG
1	F	274	LEU
1	F	296	VAL
1	A	24	LEU
1	A	40	LEU
1	A	87	ARG

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Mol	Chain	Res	Type
1	A	210[A]	MET
1	A	210[B]	MET
1	A	274	LEU
1	B	13	VAL
1	B	53	ARG
1	B	114	LEU
1	B	142	PHE
1	B	164	ARG
1	B	307	ASP
1	B	309	LEU
1	C	39	LEU
1	C	114	LEU
1	C	147	MET
1	D	17	LEU
1	D	111	ARG
1	E	307	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (20) such sidechains are listed below:

Mol	Chain	Res	Type
1	F	11	GLN
1	F	55	GLN
1	F	84	HIS
1	F	156	ASN
1	A	11	GLN
1	A	55	GLN
1	A	84	HIS
1	A	133	GLN
1	B	11	GLN
1	B	84	HIS
1	B	133	GLN
1	C	11	GLN
1	C	84	HIS
1	D	11	GLN
1	D	84	HIS
1	D	286	HIS
1	E	11	GLN
1	E	84	HIS
1	E	133	GLN
1	E	156	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

12 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	C	401	3,1	41,50,50	1.28	5 (12%)	45,82,82	1.61	7 (15%)
3	NO	F	402	2	0,1,1	-	-	-		
3	NO	A	402	2	0,1,1	-	-	-		
2	HEM	F	401	3,1	41,50,50	1.27	5 (12%)	45,82,82	1.67	8 (17%)
3	NO	B	402	2	0,1,1	-	-	-		
3	NO	C	402	2	0,1,1	-	-	-		
3	NO	D	402	2	0,1,1	-	-	-		
2	HEM	D	401	3,1	41,50,50	1.29	4 (9%)	45,82,82	1.68	7 (15%)
2	HEM	B	401	3,1	41,50,50	1.27	4 (9%)	45,82,82	1.70	7 (15%)
2	HEM	A	401	3,1	41,50,50	1.27	5 (12%)	45,82,82	1.66	8 (17%)
2	HEM	E	401	3,1	41,50,50	1.29	6 (14%)	45,82,82	1.73	7 (15%)
3	NO	E	402	2	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
2	HEM	C	401	3,1	-	6/12/54/54	-
2	HEM	F	401	3,1	-	6/12/54/54	-
2	HEM	D	401	3,1	-	6/12/54/54	-
2	HEM	B	401	3,1	-	6/12/54/54	-
2	HEM	A	401	3,1	-	6/12/54/54	-
2	HEM	E	401	3,1	-	6/12/54/54	-

All (29) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	401	HEM	C1B-NB	-3.32	1.34	1.40
2	D	401	HEM	C1B-NB	-3.30	1.34	1.40
2	F	401	HEM	C1B-NB	-3.19	1.34	1.40
2	B	401	HEM	C1B-NB	-3.12	1.34	1.40
2	A	401	HEM	C1B-NB	-3.11	1.34	1.40
2	C	401	HEM	C1B-NB	-3.07	1.35	1.40
2	E	401	HEM	C4D-ND	-3.03	1.35	1.40
2	C	401	HEM	C4D-ND	-2.97	1.35	1.40
2	C	401	HEM	FE-NB	2.96	2.11	1.96
2	A	401	HEM	C4D-ND	-2.95	1.35	1.40
2	B	401	HEM	C4D-ND	-2.90	1.35	1.40
2	D	401	HEM	C4D-ND	-2.87	1.35	1.40
2	E	401	HEM	FE-NB	2.87	2.11	1.96
2	A	401	HEM	FE-NB	2.86	2.11	1.96
2	F	401	HEM	C4D-ND	-2.83	1.35	1.40
2	F	401	HEM	FE-NB	2.83	2.10	1.96
2	B	401	HEM	FE-NB	2.82	2.10	1.96
2	D	401	HEM	FE-NB	2.78	2.10	1.96
2	B	401	HEM	CHB-C1B	2.40	1.41	1.35
2	D	401	HEM	CHB-C1B	2.33	1.40	1.35
2	F	401	HEM	CHB-C1B	2.25	1.40	1.35
2	C	401	HEM	C3B-C4B	2.21	1.49	1.44
2	C	401	HEM	CHB-C1B	2.20	1.40	1.35
2	E	401	HEM	CHB-C1B	2.16	1.40	1.35
2	A	401	HEM	CHB-C1B	2.15	1.40	1.35
2	E	401	HEM	C3B-C4B	2.06	1.49	1.44
2	E	401	HEM	C1D-ND	-2.04	1.34	1.38
2	F	401	HEM	C3B-C4B	2.03	1.48	1.44
2	A	401	HEM	C3B-C4B	2.02	1.48	1.44

All (44) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	401	HEM	CHC-C4B-NB	5.27	130.16	124.43
2	E	401	HEM	CHC-C4B-NB	5.17	130.04	124.43
2	D	401	HEM	CHC-C4B-NB	4.91	129.77	124.43
2	F	401	HEM	CHC-C4B-NB	4.83	129.68	124.43
2	D	401	HEM	C1B-NB-C4B	4.71	109.94	105.07
2	A	401	HEM	CHC-C4B-NB	4.60	129.43	124.43
2	C	401	HEM	CHC-C4B-NB	4.49	129.31	124.43
2	B	401	HEM	C1B-NB-C4B	4.18	109.39	105.07
2	A	401	HEM	C1B-NB-C4B	4.06	109.27	105.07
2	E	401	HEM	C1B-NB-C4B	4.05	109.25	105.07
2	F	401	HEM	C1B-NB-C4B	4.04	109.24	105.07
2	E	401	HEM	CHD-C1D-ND	3.82	128.58	124.43
2	C	401	HEM	CHD-C1D-ND	3.76	128.52	124.43
2	C	401	HEM	C1B-NB-C4B	3.74	108.94	105.07
2	D	401	HEM	CHD-C1D-ND	3.54	128.28	124.43
2	B	401	HEM	CHD-C1D-ND	3.45	128.18	124.43
2	F	401	HEM	CHD-C1D-ND	3.43	128.16	124.43
2	A	401	HEM	CHD-C1D-ND	3.37	128.10	124.43
2	A	401	HEM	CHB-C1B-NB	3.12	128.24	124.38
2	F	401	HEM	CHB-C1B-NB	3.08	128.19	124.38
2	E	401	HEM	CHB-C1B-NB	3.08	128.19	124.38
2	D	401	HEM	CHB-C1B-NB	3.07	128.18	124.38
2	E	401	HEM	CHA-C4D-ND	3.00	128.09	124.38
2	B	401	HEM	CHA-C4D-ND	2.96	128.04	124.38
2	A	401	HEM	CHA-C4D-ND	2.94	128.01	124.38
2	C	401	HEM	CHA-C4D-ND	2.93	128.00	124.38
2	E	401	HEM	CHD-C1D-C2D	-2.93	120.41	124.98
2	B	401	HEM	CHB-C1B-NB	2.84	127.89	124.38
2	C	401	HEM	CHB-C1B-NB	2.81	127.86	124.38
2	F	401	HEM	CHA-C4D-ND	2.78	127.81	124.38
2	D	401	HEM	CHD-C1D-C2D	-2.68	120.79	124.98
2	B	401	HEM	CHD-C1D-C2D	-2.64	120.85	124.98
2	D	401	HEM	CHA-C4D-ND	2.57	127.56	124.38
2	C	401	HEM	CHD-C1D-C2D	-2.48	121.10	124.98
2	F	401	HEM	CHD-C1D-C2D	-2.48	121.11	124.98
2	A	401	HEM	CHD-C1D-C2D	-2.35	121.30	124.98
2	B	401	HEM	CHA-C4D-C3D	-2.31	121.00	125.33
2	F	401	HEM	O2A-CGA-CBA	2.29	121.39	114.03
2	C	401	HEM	CHA-C4D-C3D	-2.14	121.32	125.33
2	F	401	HEM	CHA-C4D-C3D	-2.07	121.44	125.33
2	A	401	HEM	CHA-C4D-C3D	-2.07	121.44	125.33
2	E	401	HEM	CHA-C4D-C3D	-2.06	121.47	125.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	401	HEM	O2D-CGD-CBD	2.05	120.62	114.03
2	D	401	HEM	O2D-CGD-CBD	2.03	120.54	114.03

There are no chirality outliers.

All (36) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	F	401	HEM	C2B-C3B-CAB-CBB
2	F	401	HEM	C4B-C3B-CAB-CBB
2	A	401	HEM	C2B-C3B-CAB-CBB
2	A	401	HEM	C4B-C3B-CAB-CBB
2	B	401	HEM	C2B-C3B-CAB-CBB
2	B	401	HEM	C4B-C3B-CAB-CBB
2	C	401	HEM	C2B-C3B-CAB-CBB
2	C	401	HEM	C4B-C3B-CAB-CBB
2	D	401	HEM	C2B-C3B-CAB-CBB
2	D	401	HEM	C4B-C3B-CAB-CBB
2	E	401	HEM	C2B-C3B-CAB-CBB
2	E	401	HEM	C4B-C3B-CAB-CBB
2	C	401	HEM	CAD-CBD-CGD-O2D
2	C	401	HEM	CAA-CBA-CGA-O2A
2	F	401	HEM	CAA-CBA-CGA-O2A
2	B	401	HEM	CAA-CBA-CGA-O2A
2	E	401	HEM	CAA-CBA-CGA-O2A
2	A	401	HEM	CAA-CBA-CGA-O2A
2	E	401	HEM	CAD-CBD-CGD-O1D
2	E	401	HEM	CAD-CBD-CGD-O2D
2	E	401	HEM	CAA-CBA-CGA-O1A
2	C	401	HEM	CAA-CBA-CGA-O1A
2	C	401	HEM	CAD-CBD-CGD-O1D
2	F	401	HEM	CAA-CBA-CGA-O1A
2	A	401	HEM	CAA-CBA-CGA-O1A
2	B	401	HEM	CAA-CBA-CGA-O1A
2	B	401	HEM	CAD-CBD-CGD-O1D
2	B	401	HEM	CAD-CBD-CGD-O2D
2	D	401	HEM	CAD-CBD-CGD-O2D
2	A	401	HEM	CAD-CBD-CGD-O1D
2	A	401	HEM	CAD-CBD-CGD-O2D
2	D	401	HEM	CAD-CBD-CGD-O1D
2	F	401	HEM	CAD-CBD-CGD-O1D
2	F	401	HEM	CAD-CBD-CGD-O2D
2	D	401	HEM	CAA-CBA-CGA-O2A

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Mol	Chain	Res	Type	Atoms
2	D	401	HEM	CAA-CBA-CGA-O1A

There are no ring outliers.
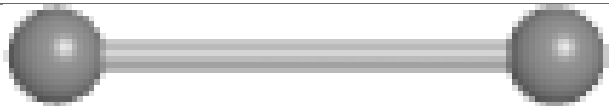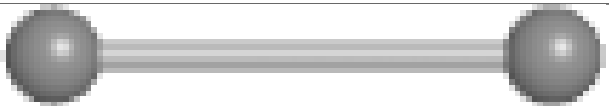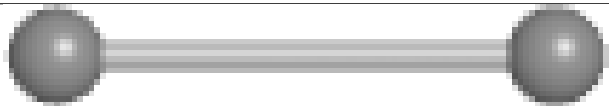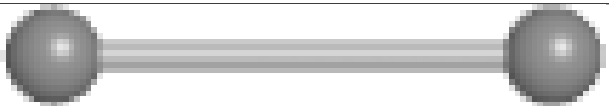
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	F	401	HEM	1	0
3	B	402	NO	1	0

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

Ligand HEM C 401

Bond lengths

Bond angles

Torsions

Rings

Ligand NO F 402

Bond lengths

Bond angles

Torsions

Rings

Ligand NO A 402

Bond lengths

Bond angles

Torsions

Rings

Ligand HEM F 401

Bond lengths

Bond angles
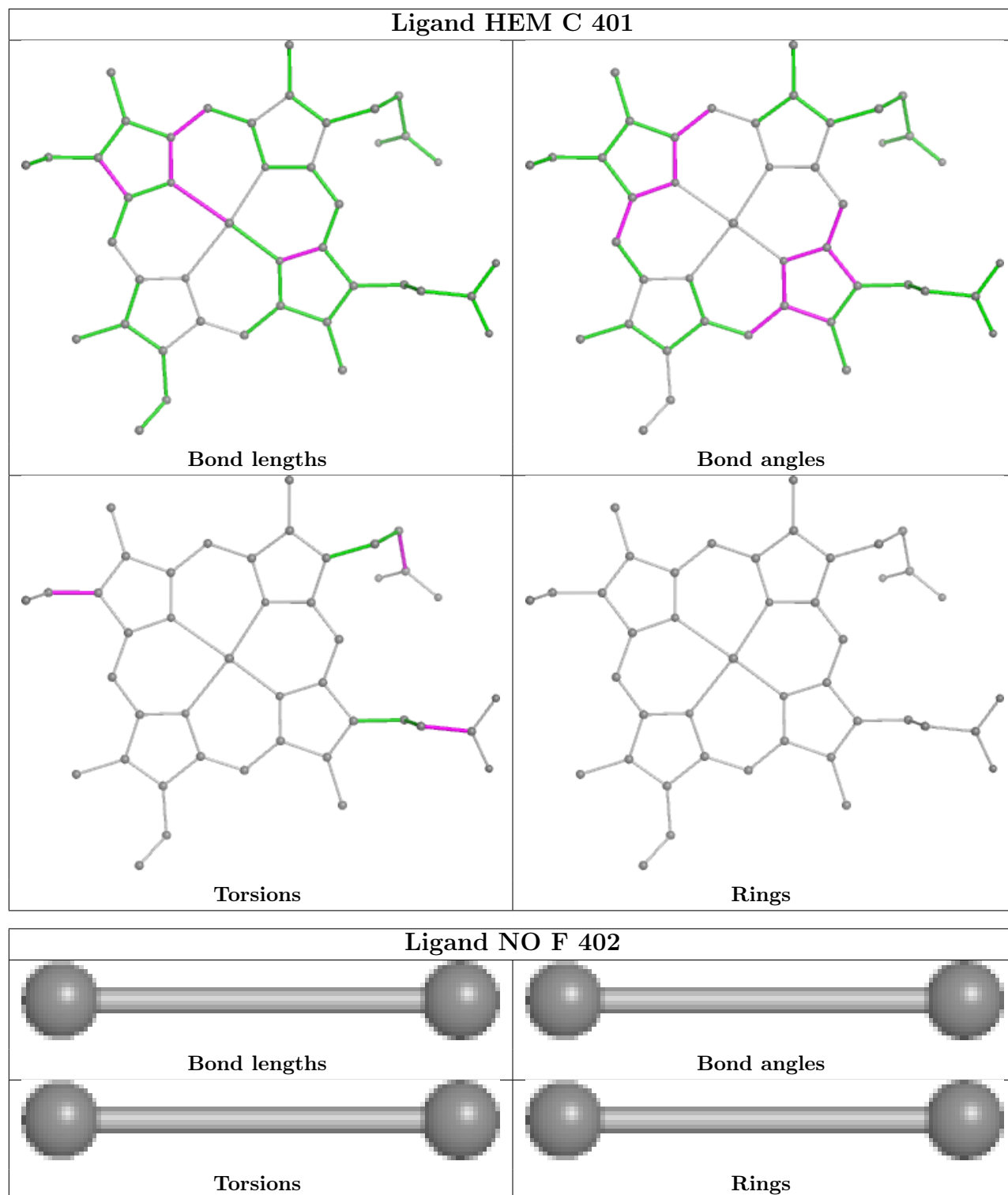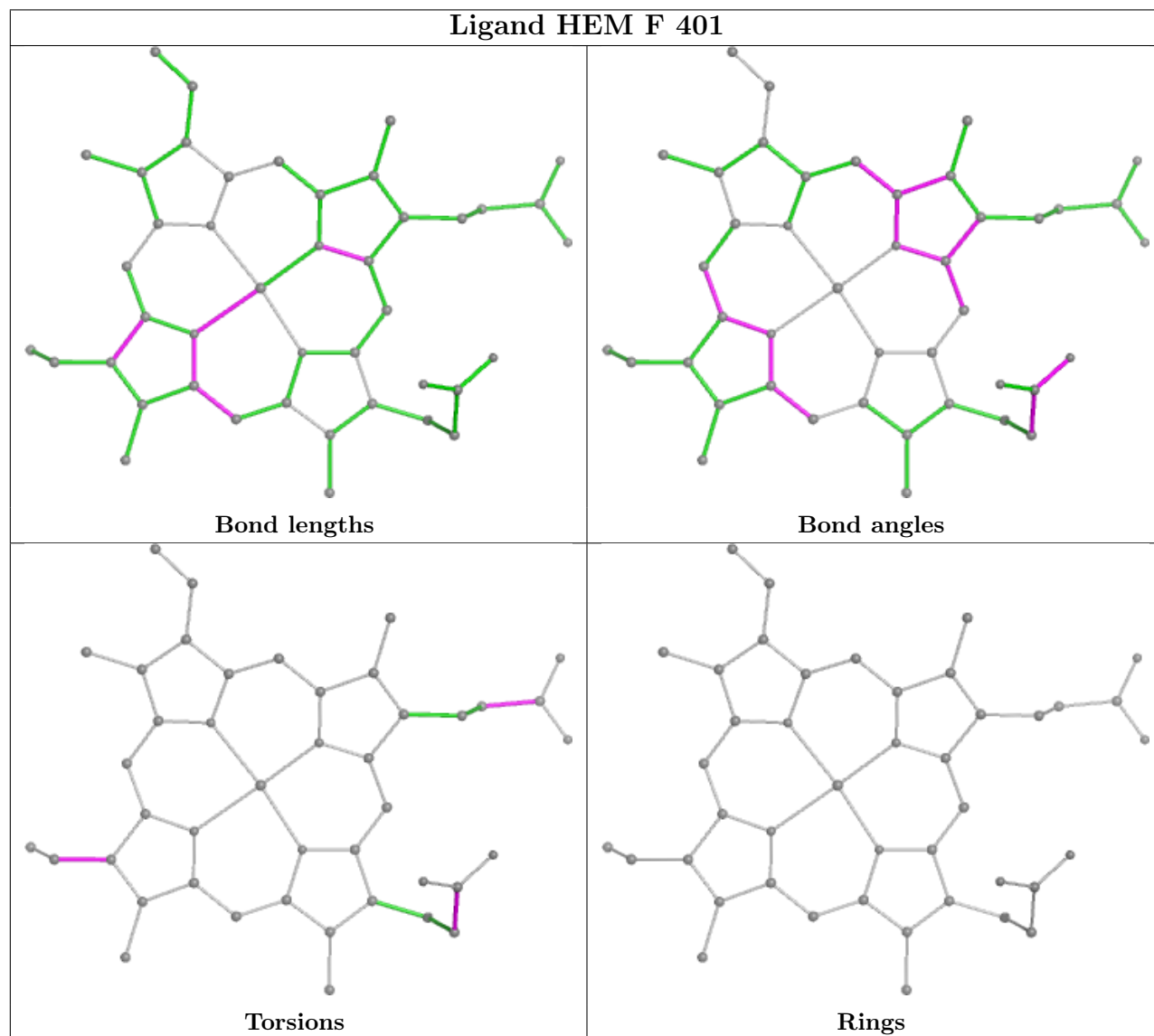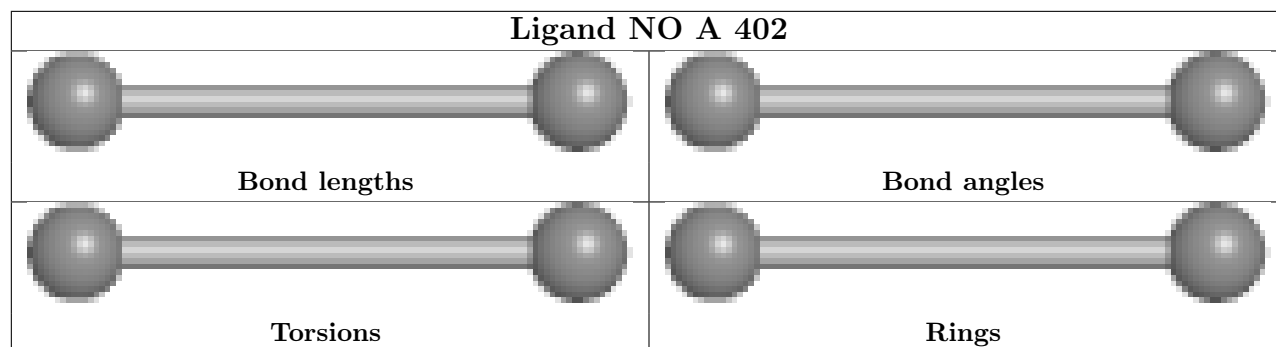
Torsions

Rings

Ligand NO B 402

Bond lengths

Bond angles

Torsions

Rings

Ligand NO C 402

Bond lengths

Bond angles

Torsions

Rings

Ligand NO D 402

Bond lengths

Bond angles

Torsions

Rings

Ligand HEM D 401

Bond lengths

Bond angles

Torsions

Rings

Ligand HEM B 401

Bond lengths

Bond angles

Torsions

Rings

Ligand HEM A 401

Bond lengths

Bond angles

Torsions

Rings

Ligand HEM E 401

Bond lengths

Bond angles

Torsions

Rings

Ligand NO E 402

Bond lengths

Bond angles

Torsions

Rings
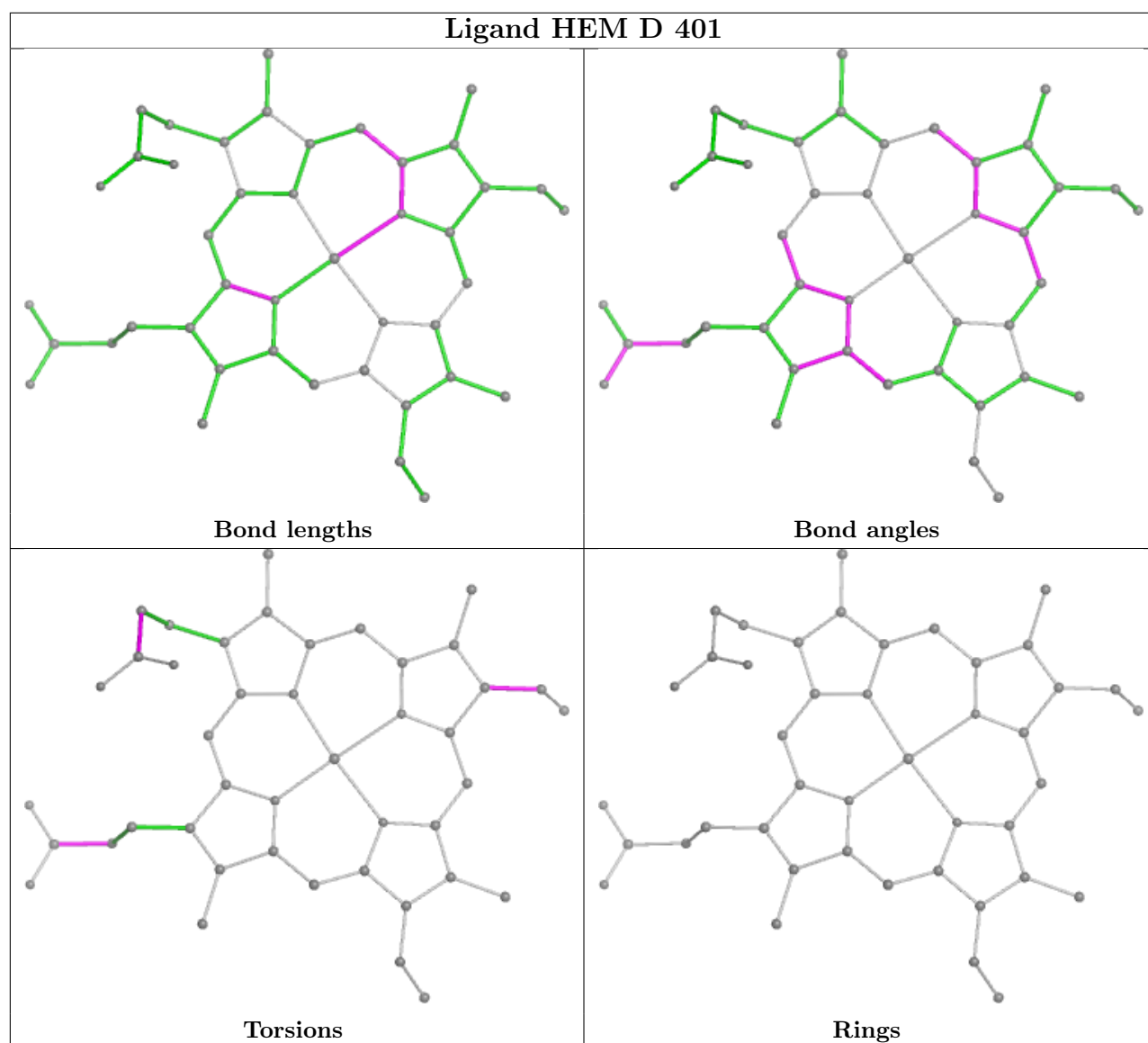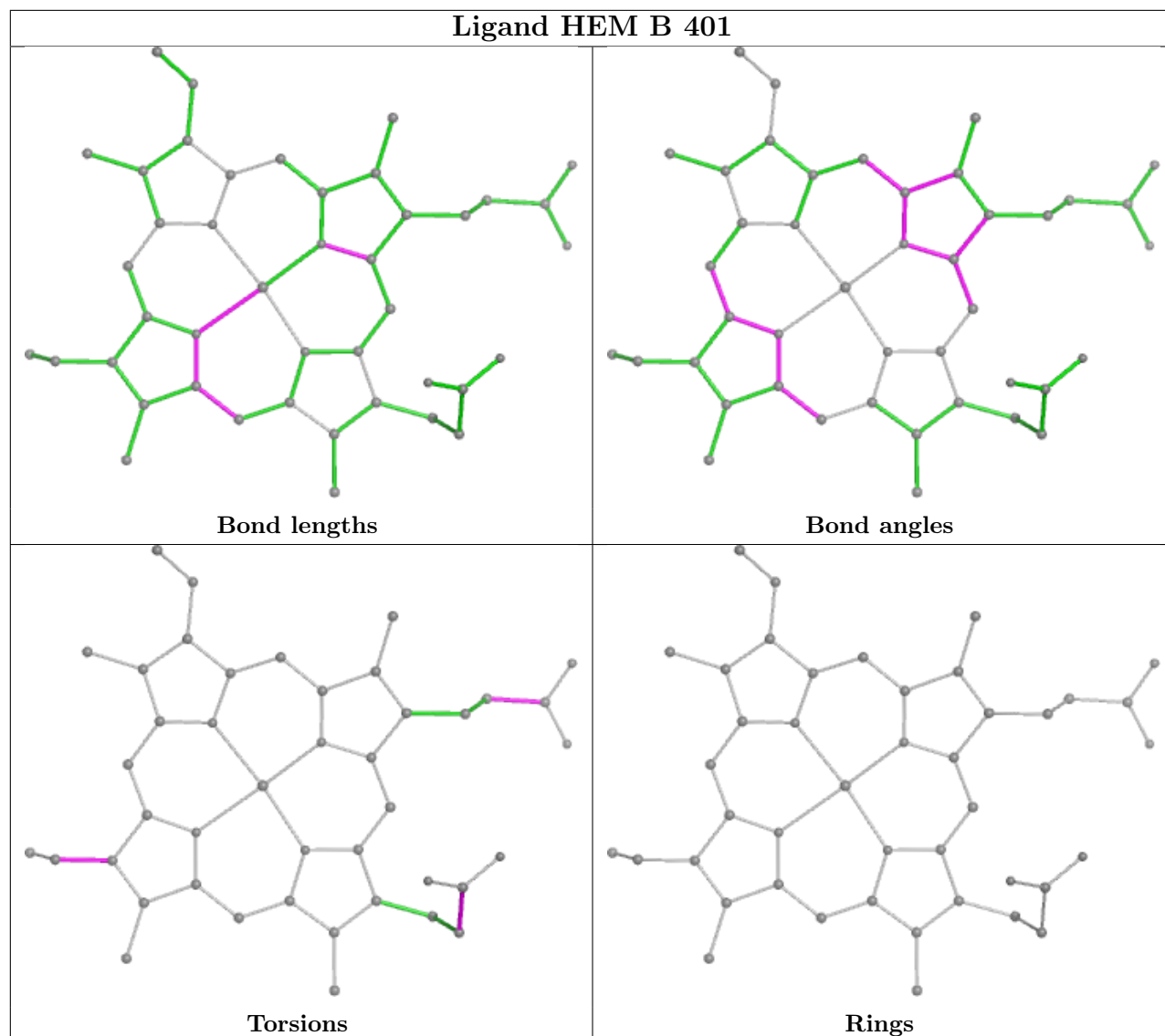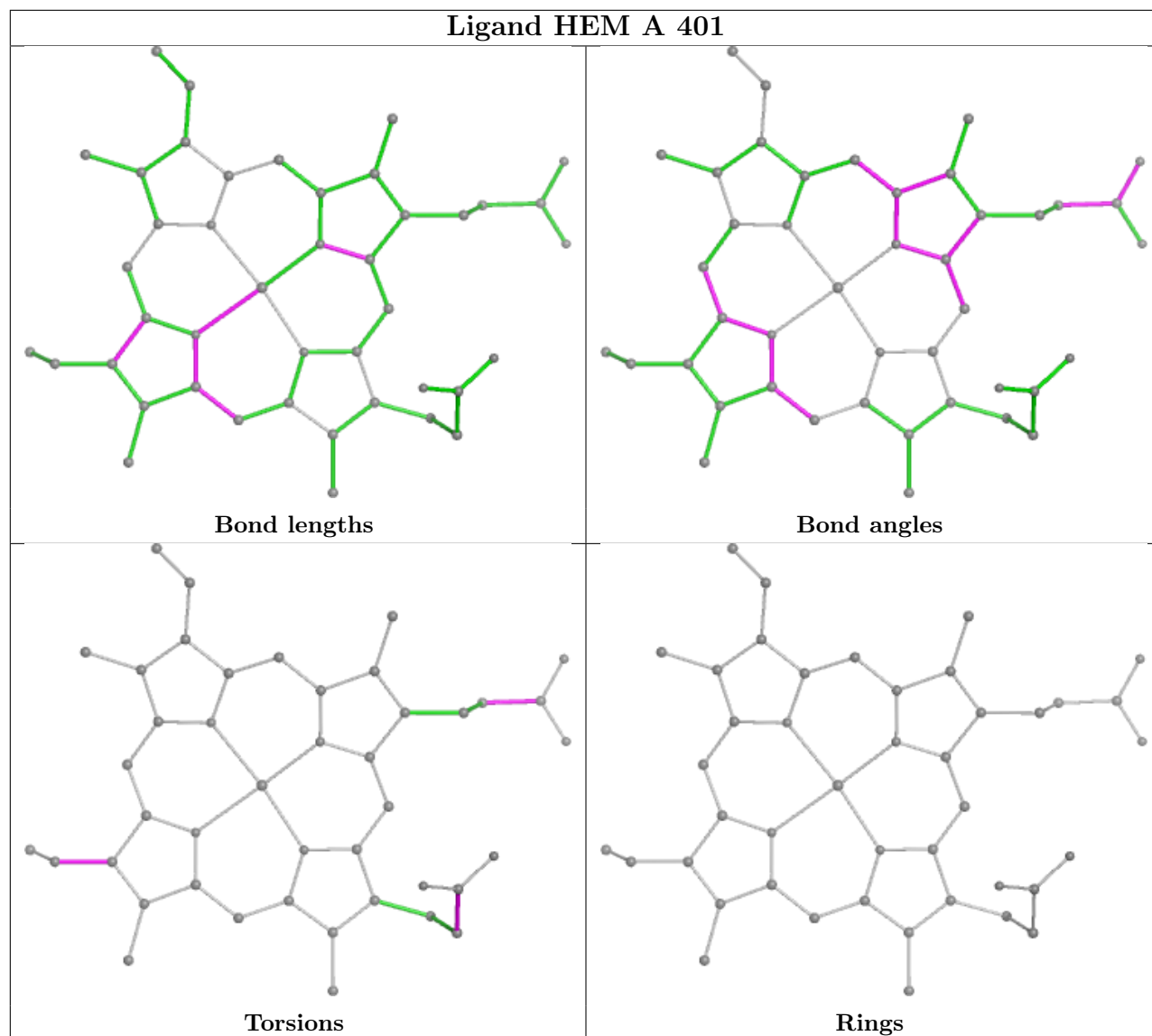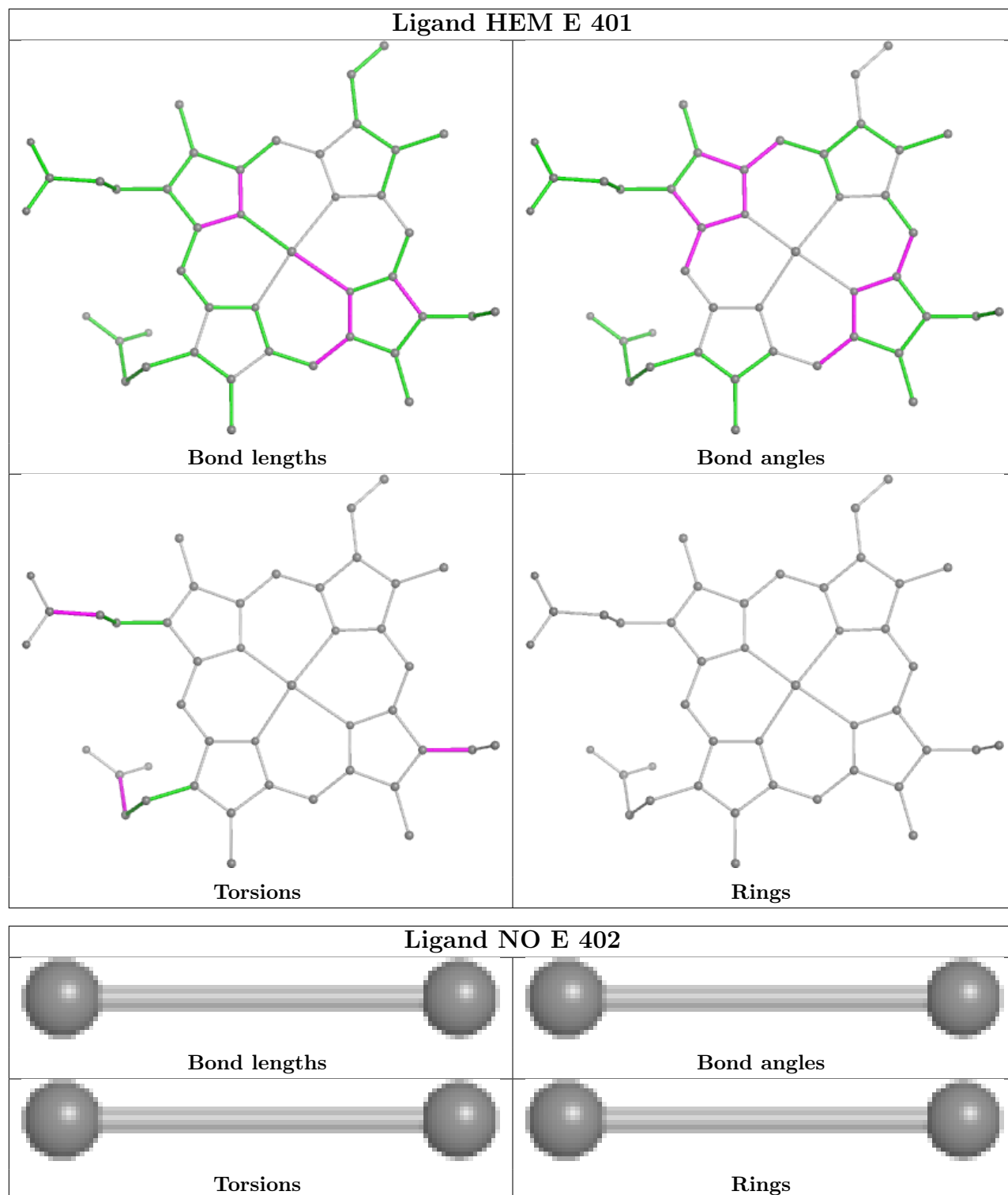
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	306/329 (93%)	-0.28	7 (2%)	61	58	12, 30, 58, 87	4 (1%)
1	B	306/329 (93%)	-0.24	8 (2%)	57	54	21, 32, 60, 97	0
1	C	306/329 (93%)	-0.25	8 (2%)	57	54	14, 31, 57, 88	6 (1%)
1	D	306/329 (93%)	-0.34	4 (1%)	74	71	12, 29, 51, 79	5 (1%)
1	E	305/329 (92%)	-0.10	8 (2%)	57	54	17, 35, 63, 89	2 (0%)
1	F	307/329 (93%)	-0.25	5 (1%)	70	67	15, 31, 58, 97	4 (1%)
All	All	1836/1974 (93%)	-0.24	40 (2%)	62	59	12, 31, 58, 97	21 (1%)

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	17	LEU	4.4
1	E	235	ASP	4.2
1	A	312	LEU	3.8
1	C	234	PRO	3.5
1	E	234	PRO	3.4
1	A	142	PHE	3.4
1	B	142	PHE	3.4
1	E	237	SER	3.4
1	A	17	LEU	3.2
1	C	16	PRO	3.1
1	A	16	PRO	3.1
1	D	17	LEU	3.1
1	F	234	PRO	3.1
1	F	313	SER	3.1
1	F	143	ASP	3.0
1	B	234	PRO	3.0
1	B	16	PRO	3.0
1	F	8	PRO	3.0
1	E	56	PRO	2.9

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Mol	Chain	Res	Type	RSRZ
1	D	312	LEU	2.7
1	C	17	LEU	2.6
1	C	142	PHE	2.6
1	C	76	SER	2.5
1	C	141	TYR	2.4
1	D	7	GLU	2.4
1	C	8	PRO	2.4
1	A	311	ASP	2.3
1	B	218	ASP	2.3
1	D	56	PRO	2.3
1	A	141	TYR	2.2
1	E	17	LEU	2.2
1	B	8	PRO	2.2
1	E	8	PRO	2.2
1	C	236	GLY	2.1
1	B	233	GLY	2.1
1	E	87	ARG	2.1
1	A	8	PRO	2.1
1	F	7	GLU	2.1
1	B	312	LEU	2.1
1	E	312	LEU	2.0

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(Å^2)	Q<0.9
3	NO	B	402	2/2	0.95	0.20	28,28,28,28	2
3	NO	F	402	2/2	0.96	0.20	26,26,26,26	2

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
2	HEM	F	401	43/43	0.96	0.08	26,27,30,32	0
2	HEM	B	401	43/43	0.97	0.07	25,26,27,27	0
3	NO	A	402	2/2	0.97	0.08	22,22,22,22	2
2	HEM	D	401	43/43	0.97	0.07	24,25,29,30	0
3	NO	C	402	2/2	0.97	0.09	26,26,26,27	2
2	HEM	A	401	43/43	0.98	0.05	21,23,24,25	0
2	HEM	E	401	43/43	0.98	0.06	22,23,25,26	0
2	HEM	C	401	43/43	0.98	0.06	24,25,26,27	0
3	NO	D	402	2/2	0.98	0.10	24,24,24,24	2
3	NO	E	402	2/2	0.98	0.07	23,23,23,23	2

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.
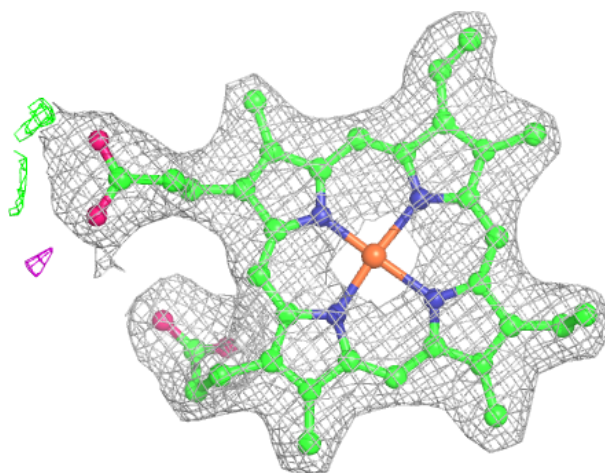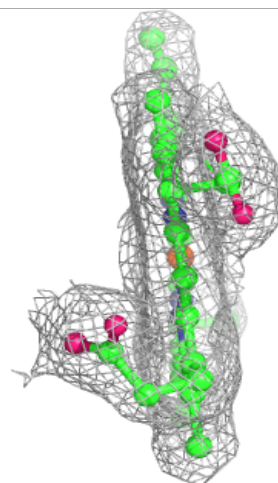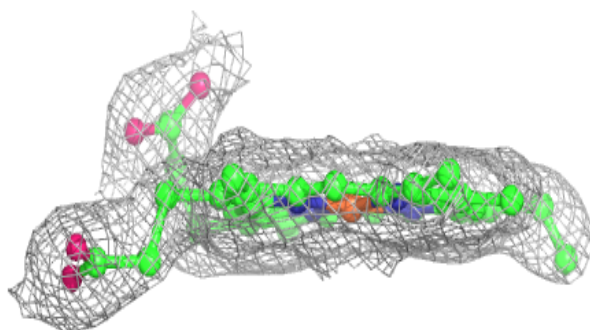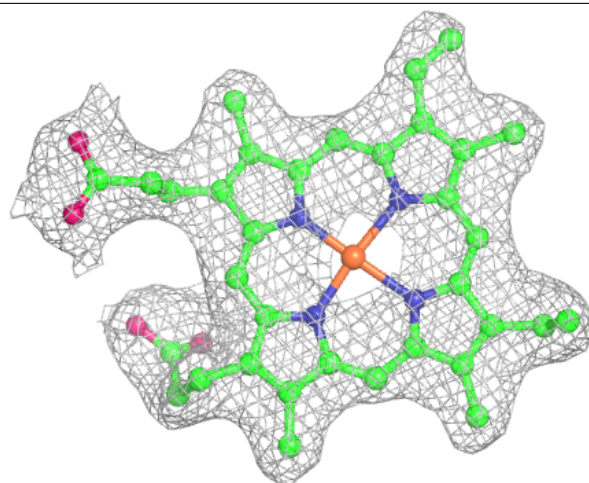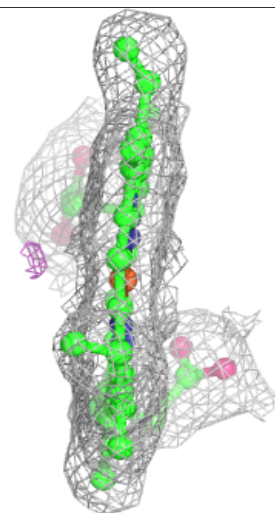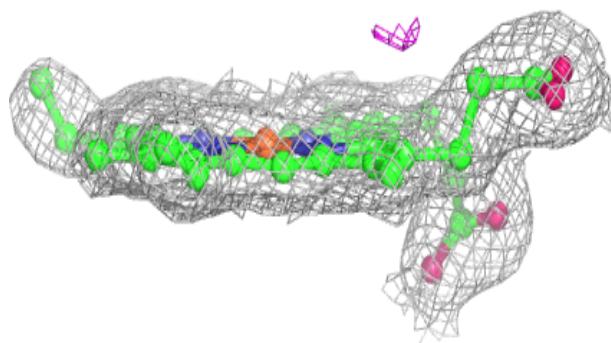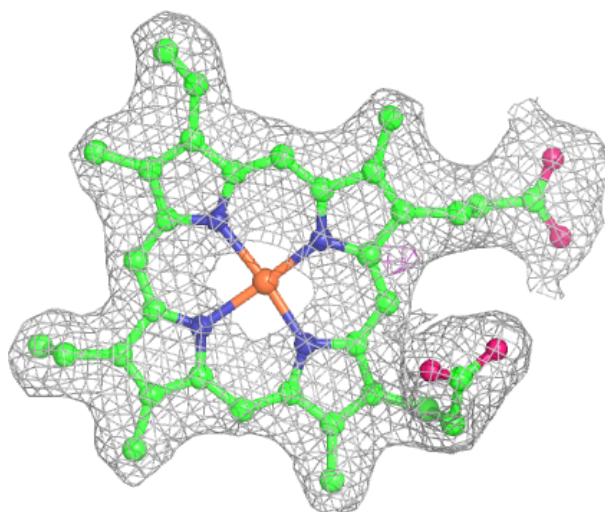

Electron density around NO B 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)
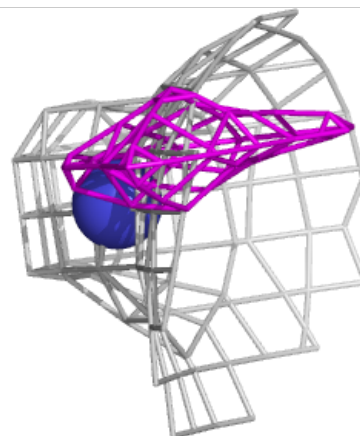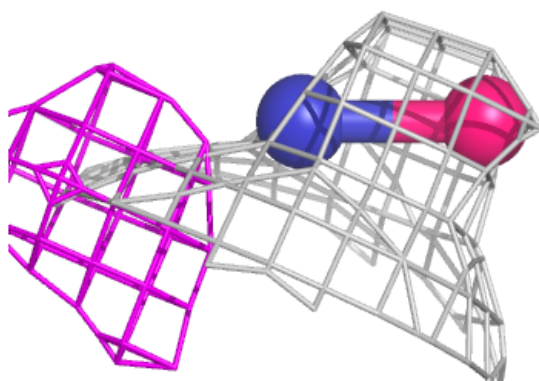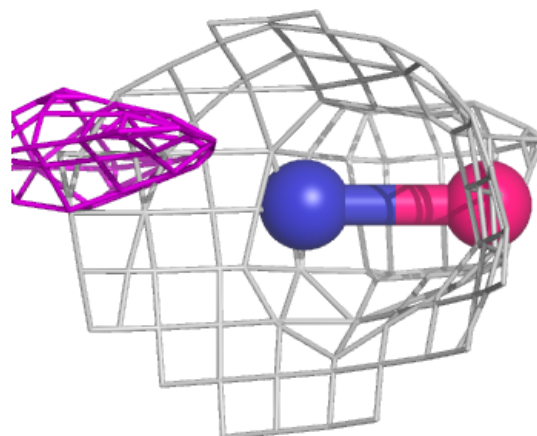
Electron density around NO F 402:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
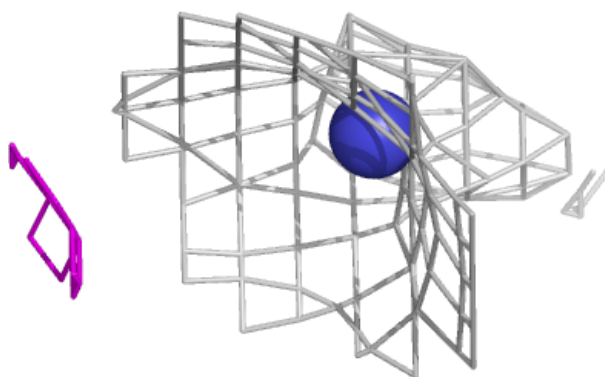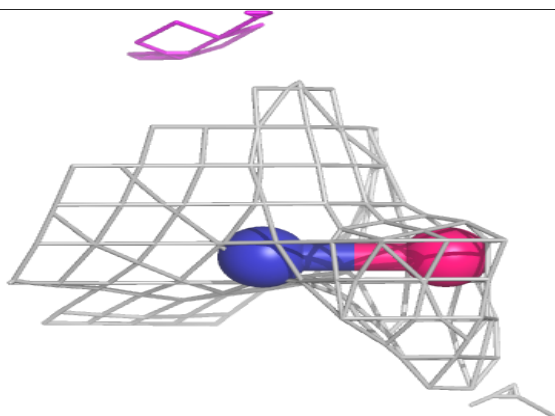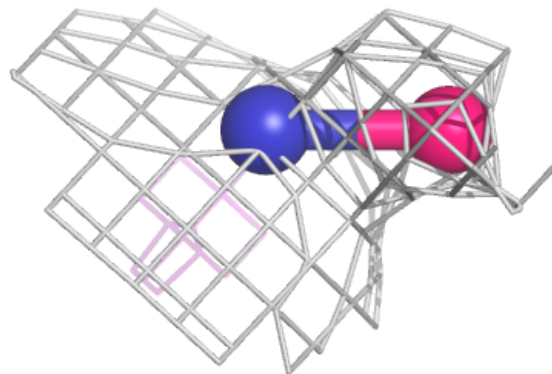
Electron density around HEM F 401:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
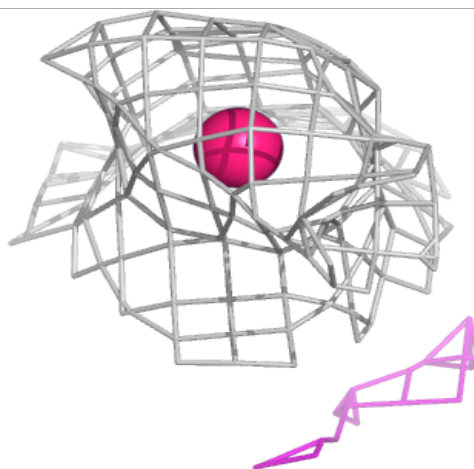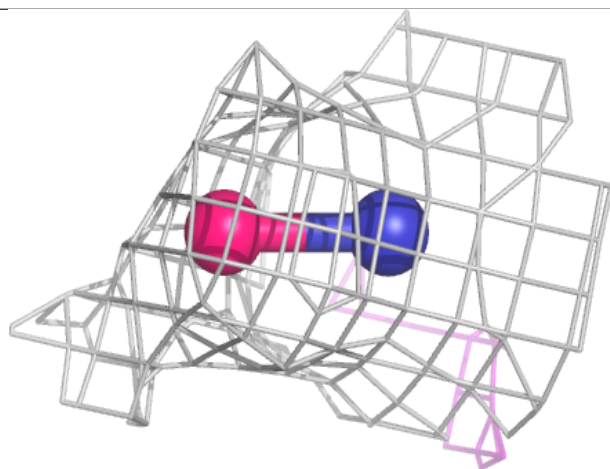and green (positive)
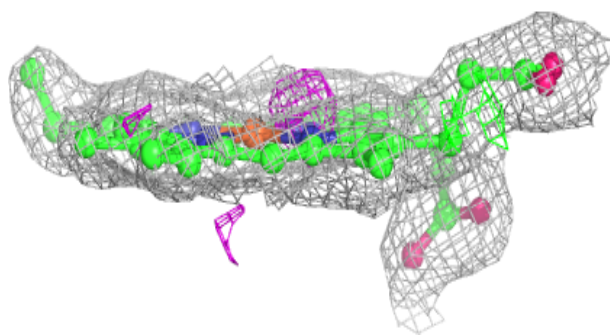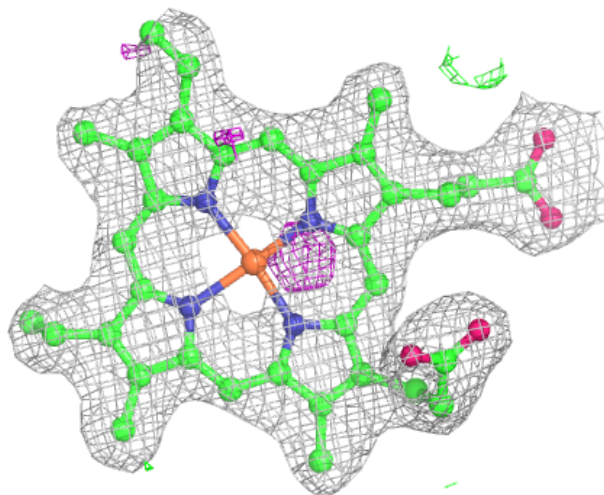
Electron density around HEM B 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
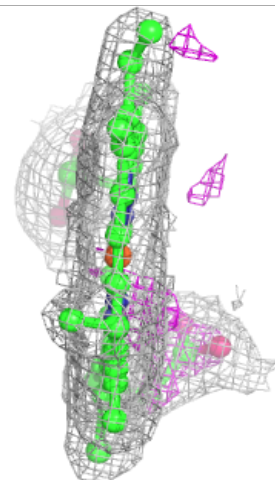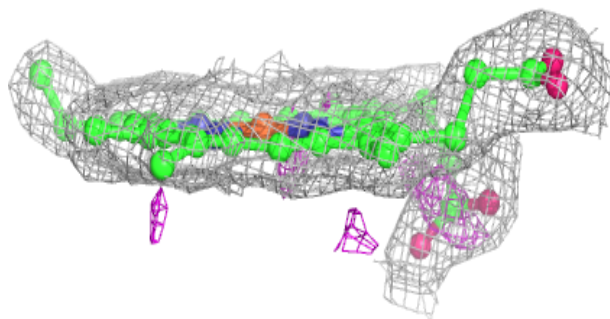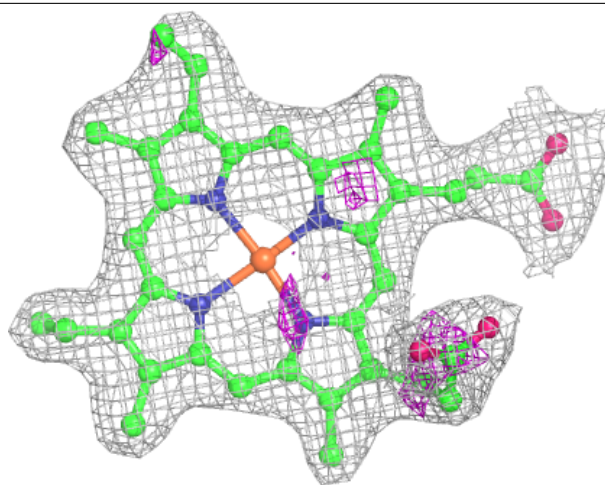
Electron density around NO A 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
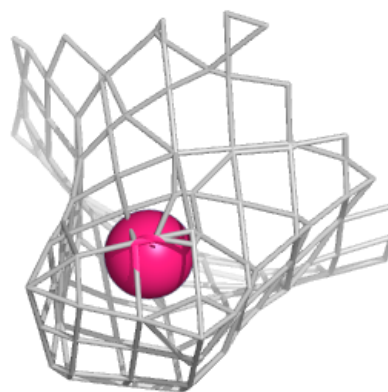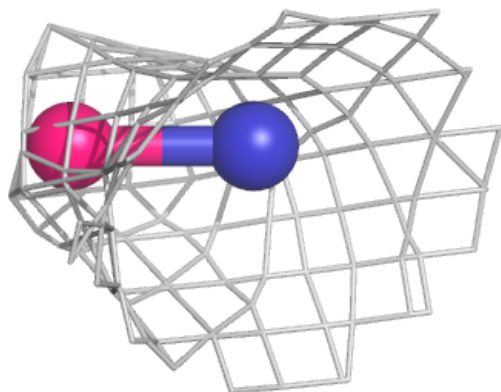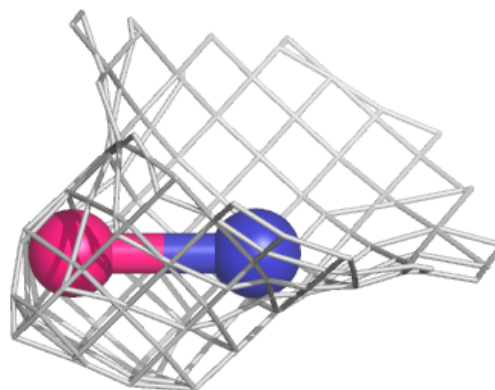
Electron density around HEM D 401:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
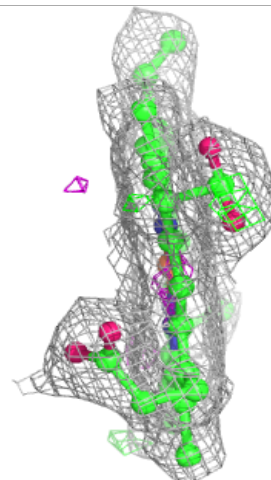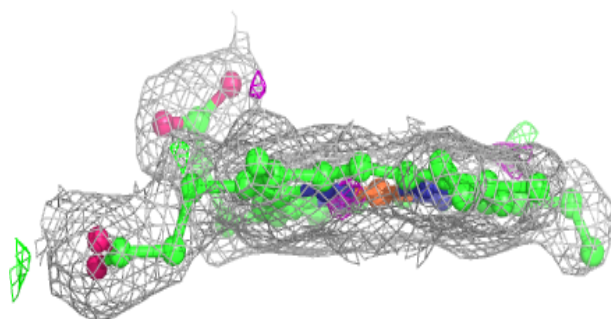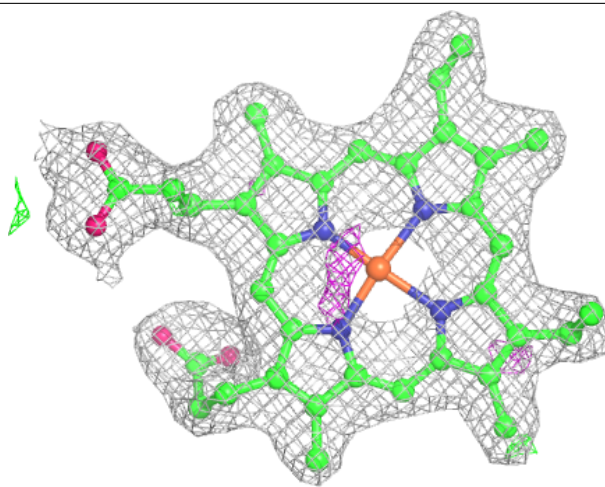
Electron density around NO C 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
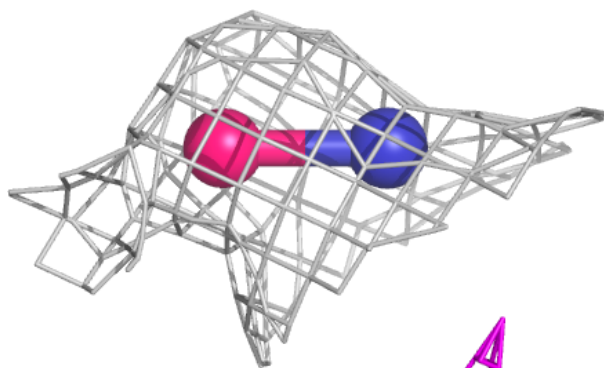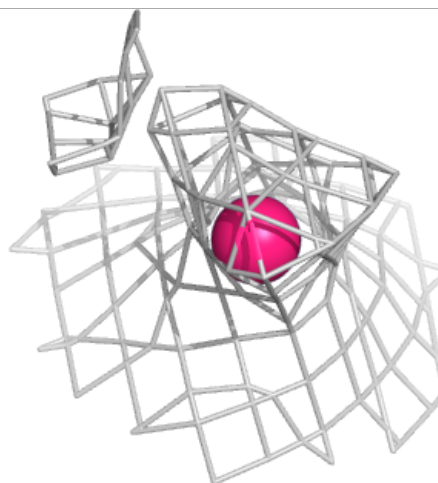and green (positive)
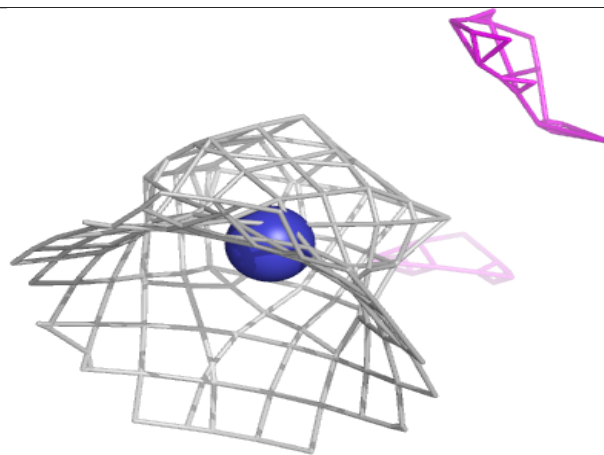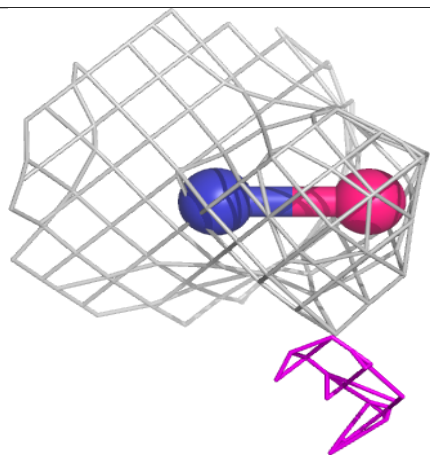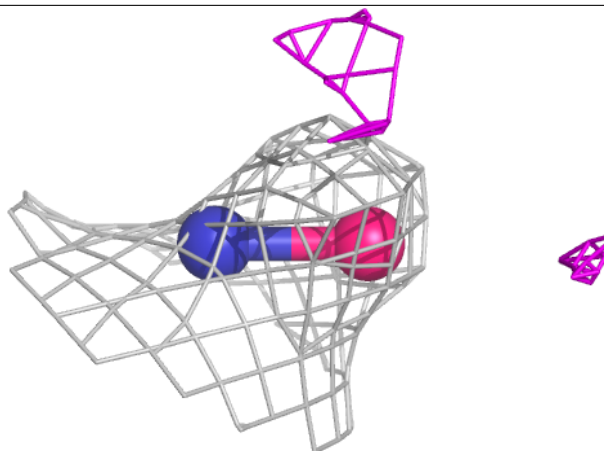
Electron density around HEM A 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
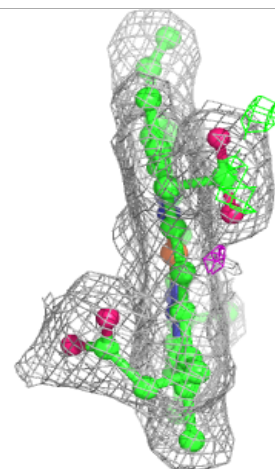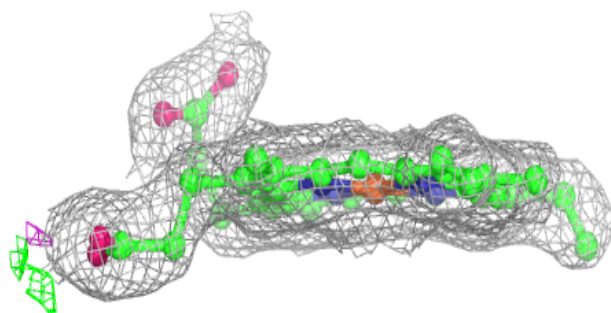
Electron density around HEM E 401:

$2mF_o$-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 401:

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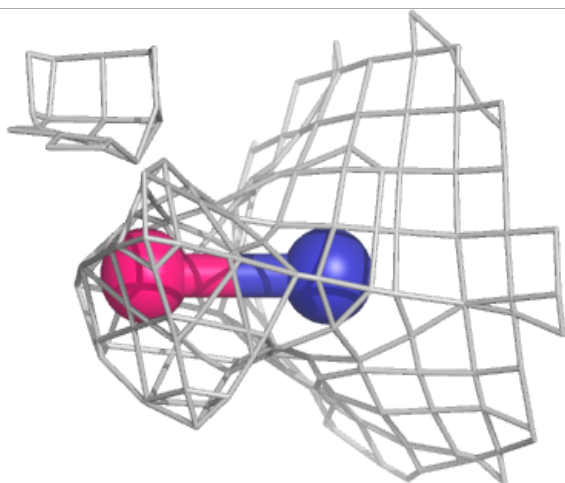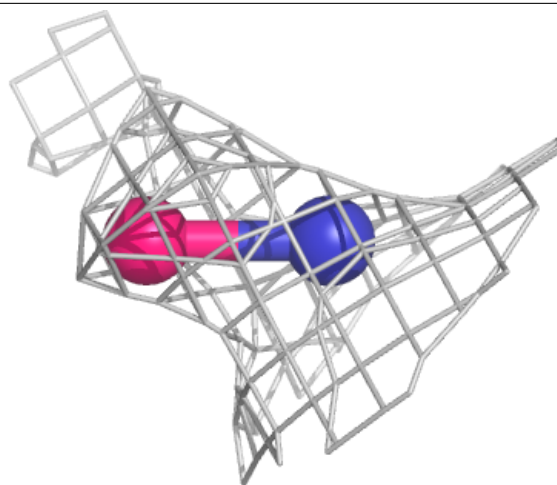mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around NO D 402:

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

Electron density around NO E 402:

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.