



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 28, 2024 – 01:21 pm BST

PDB ID : 5IR6
Title : The structure of bd oxidase from *Geobacillus thermodenitrificans*
Authors : Safarian, S.; Mueller, H.; Rajendran, C.; Preu, J.; Ovchinnikov, S.; Kusumoto, T.; Hirose, T.; Langer, J.; Sakamoto, J.; Michel, H.
Deposited on : 2016-03-12
Resolution : 3.80 Å (reported)

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A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36.2
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36.2

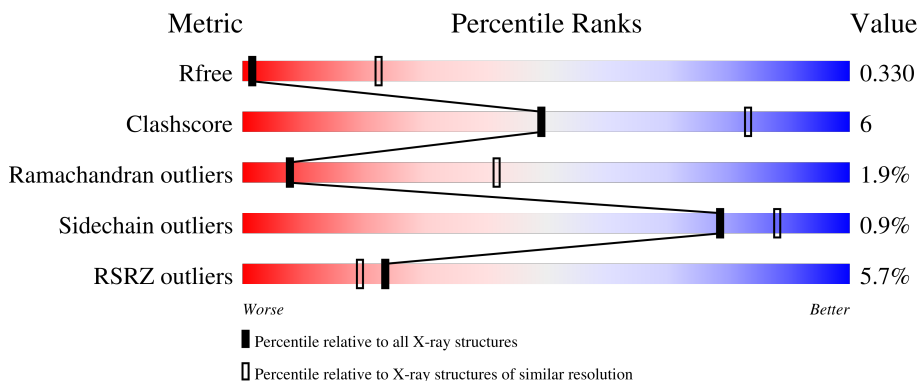
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1212 (4.00-3.60)
Clashscore	141614	1288 (4.00-3.60)
Ramachandran outliers	138981	1243 (4.00-3.60)
Sidechain outliers	138945	1237 (4.00-3.60)
RSRZ outliers	127900	1121 (4.00-3.60)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 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	448	 4% 78% 18% . .
2	B	342	 6% 90% 6% .
3	C	33	 9% 88% . 9%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	HEB	A	501	X	-	-	-
4	HEB	A	502	X	-	-	-

2 Entry composition i

There are 5 unique types of molecules in this entry. The entry contains 6471 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 Bd-type quinol oxidase subunit I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	432	3418	2270	555	574	19	0	0	0

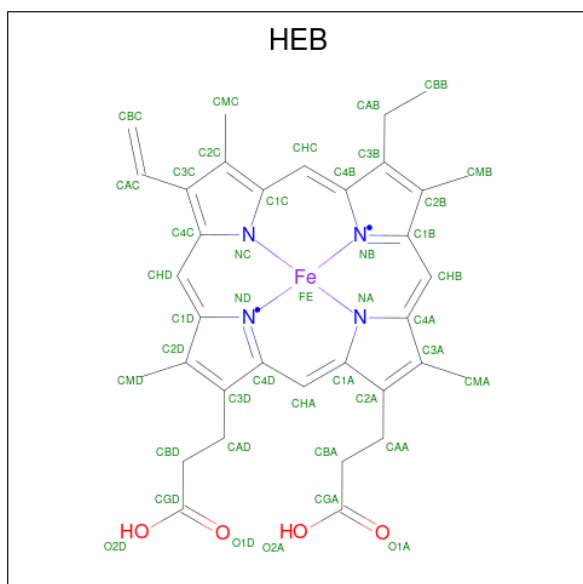
- Molecule 2 is a protein called Bd-type quinol oxidase subunit II.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	330	2689	1832	409	442	6	0	0	0

- Molecule 3 is a protein called Putative membrane protein.

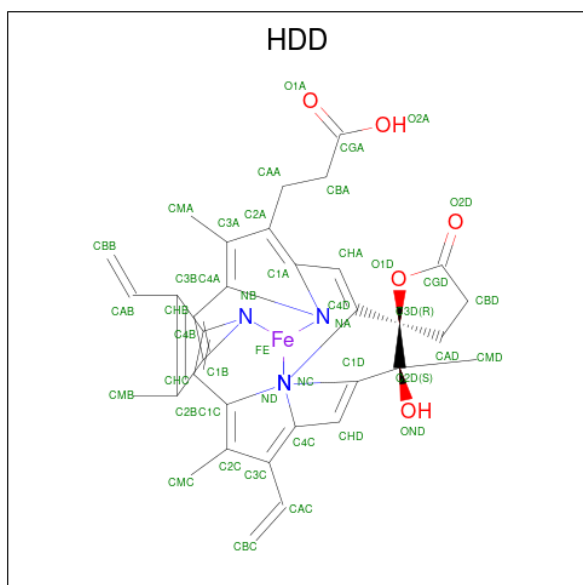
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	30	234	159	35	38	2	0	0	0

- Molecule 4 is HEME B/C (three-letter code: HEB) (formula: C₃₄H₃₄FeN₄O₄).



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

- Molecule 5 is CIS-HEME D HYDROXYCHLORIN GAMMA-SPIROLACTONE (three-letter code: HDD) (formula: $C_{34}H_{32}FeN_4O_5$).

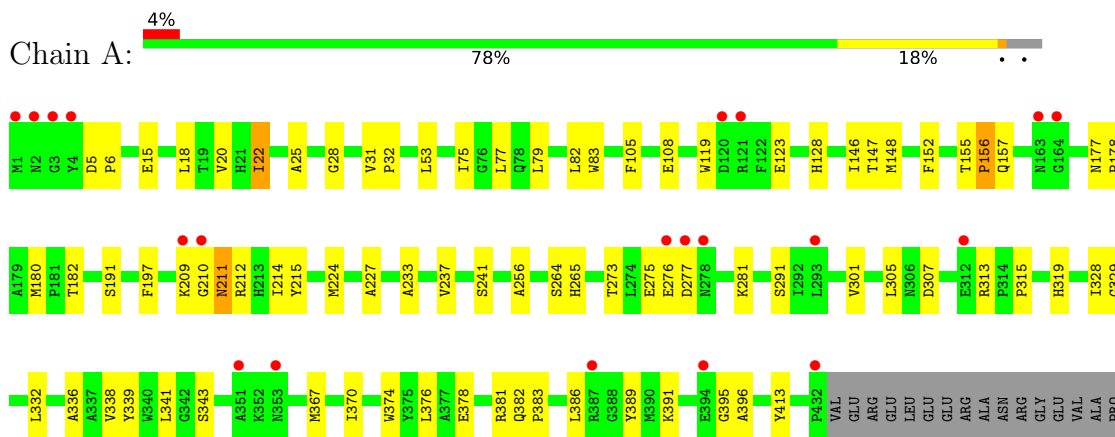


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
5	A	1	Total	C	Fe	N	O	0	0
			44	34	1	4	5		

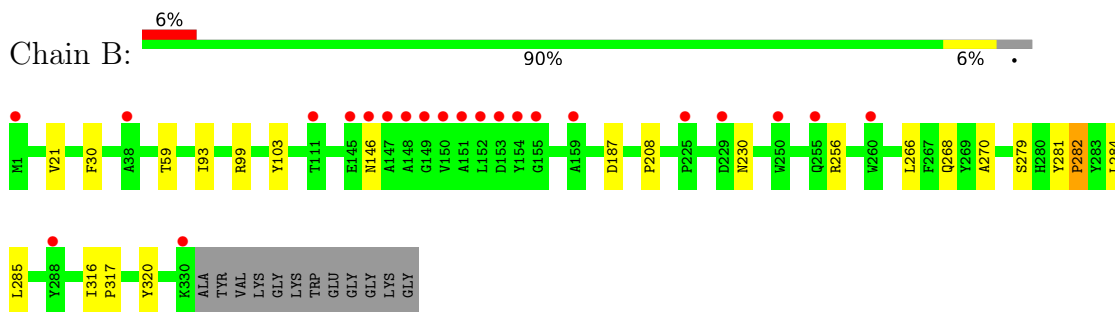
3 Residue-property plots [i](#)

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.

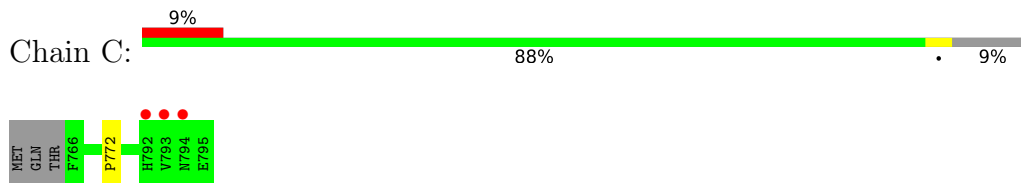
- Molecule 1: Bd-type quinol oxidase subunit I



- Molecule 2: Bd-type quinol oxidase subunit II



- Molecule 3: Putative membrane protein



4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	110.06Å 120.86Å 122.72Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 3.80 19.92 – 3.80	Depositor EDS
% Data completeness (in resolution range)	98.9 (20.00-3.80) 99.8 (19.92-3.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.22 (at 3.82Å)	Xtrriage
Refinement program	REFMAC 5.8.0073	Depositor
R, R_{free}	0.303 , 0.325 0.301 , 0.330	Depositor DCC
R_{free} test set	807 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å ²)	209.7	Xtrriage
Anisotropy	0.191	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.23 , 54.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	0.026 for -h,l,k	Xtrriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	6471	wwPDB-VP
Average B, all atoms (Å ²)	123.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.51% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: HDD, HEB

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	0.47	0/3518	0.57	0/4802
2	B	0.40	0/2781	0.50	0/3803
3	C	0.48	0/240	0.52	0/327
All	All	0.44	0/6539	0.54	0/8932

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 [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3418	0	3485	54	0
2	B	2689	0	2696	11	0
3	C	234	0	241	0	0
4	A	86	0	64	14	0
5	A	44	0	31	17	0
All	All	6471	0	6517	76	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 6.

All (76) 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)
4:A:501:HEB:HHD	4:A:501:HEB:HBC1	1.39	1.02
4:A:502:HEB:HBB1	5:A:503:HDD:HMA2	1.55	0.89
4:A:501:HEB:HBB2	4:A:501:HEB:HHC	1.63	0.80
1:A:147:THR:HA	5:A:503:HDD:O2A	1.95	0.66
1:A:146:ILE:HG13	5:A:503:HDD:O1A	1.98	0.64
1:A:152:PHE:O	1:A:389:TYR:OH	2.18	0.61
4:A:501:HEB:HBC1	4:A:501:HEB:CHD	2.15	0.60
2:B:99:ARG:NH2	2:B:103:TYR:OH	2.39	0.56
1:A:18:LEU:HB3	5:A:503:HDD:HAD2	1.91	0.53
4:A:501:HEB:HHD	4:A:501:HEB:CBC	2.25	0.52
1:A:386:LEU:HA	1:A:391:LYS:HA	1.92	0.51
2:B:316:ILE:HB	2:B:317:PRO:HD3	1.92	0.51
1:A:177:ASN:HB2	1:A:178:PRO:CD	2.41	0.51
1:A:182:THR:HB	1:A:241:SER:HB3	1.93	0.51
2:B:21:VAL:HG23	2:B:59:THR:HG22	1.93	0.51
1:A:374:TRP:CE2	5:A:503:HDD:O2D	2.65	0.50
1:A:5:ASP:N	1:A:6:PRO:HD2	2.27	0.50
1:A:275:GLU:O	1:A:277:ASP:N	2.45	0.50
1:A:374:TRP:CZ2	5:A:503:HDD:O2D	2.64	0.50
1:A:18:LEU:HB3	5:A:503:HDD:CAD	2.42	0.49
5:A:503:HDD:CBD	5:A:503:HDD:CHA	2.90	0.49
1:A:211:ASN:O	1:A:211:ASN:ND2	2.45	0.49
1:A:374:TRP:HA	4:A:501:HEB:HAD2	1.95	0.48
1:A:105:PHE:HA	1:A:108:GLU:HG2	1.95	0.47
1:A:382:GLN:N	1:A:383:PRO:CD	2.77	0.47
1:A:210:GLY:O	1:A:212:ARG:N	2.44	0.47
4:A:501:HEB:CHD	4:A:501:HEB:CBC	2.90	0.47
1:A:338:VAL:O	1:A:339:TYR:C	2.54	0.46
4:A:502:HEB:HMC2	5:A:503:HDD:CBD	2.45	0.46
1:A:18:LEU:HD21	1:A:75:ILE:HG12	1.97	0.46
1:A:197:PHE:CE1	1:A:227:ALA:HB1	2.51	0.46
2:B:281:TYR:HB3	2:B:282:PRO:HA	1.98	0.46
1:A:374:TRP:CZ3	4:A:501:HEB:HBD1	2.51	0.45
5:A:503:HDD:CHA	5:A:503:HDD:HBD1	2.46	0.45
2:B:317:PRO:HA	2:B:320:TYR:HB3	1.97	0.45
1:A:53:LEU:HD21	1:A:215:TYR:HB3	1.98	0.45
1:A:156:PRO:HB3	1:A:157:GLN:HA	1.99	0.45
1:A:329:GLY:CA	4:A:501:HEB:HMC2	2.47	0.45
1:A:31:VAL:N	1:A:32:PRO:HD2	2.31	0.44
4:A:501:HEB:HBB2	4:A:501:HEB:CHC	2.42	0.44
1:A:378:GLU:O	1:A:381:ARG:HB3	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:15:GLU:CD	5:A:503:HDD:HBC1	2.38	0.44
1:A:20:VAL:HG21	1:A:413:TYR:HB3	2.00	0.44
2:B:230:ASN:HB3	2:B:279:SER:HA	1.98	0.44
1:A:224:MET:CE	1:A:336:ALA:HA	2.48	0.44
1:A:256:ALA:O	1:A:319:HIS:ND1	2.48	0.44
1:A:18:LEU:HD13	5:A:503:HDD:HAD1	1.99	0.44
1:A:367:MET:O	1:A:370:ILE:HB	2.18	0.44
1:A:83:TRP:HA	1:A:395:GLY:O	2.18	0.43
1:A:146:ILE:CG1	5:A:503:HDD:O1A	2.66	0.43
1:A:22:ILE:HD12	1:A:22:ILE:HA	1.85	0.43
1:A:77:LEU:CB	2:B:93:ILE:HD11	2.49	0.43
1:A:177:ASN:HB2	1:A:178:PRO:HD2	2.01	0.43
1:A:273:THR:HB	1:A:281:LYS:HB2	2.00	0.43
2:B:284:LEU:O	2:B:285:LEU:HB3	2.18	0.43
1:A:148:MET:HG2	1:A:180:MET:HG3	2.01	0.42
2:B:266:LEU:O	2:B:270:ALA:CB	2.68	0.42
1:A:119:TRP:HA	1:A:128:HIS:NE2	2.34	0.42
4:A:501:HEB:HHC	4:A:501:HEB:CBB	2.42	0.42
1:A:378:GLU:OE2	5:A:503:HDD:NA	2.53	0.42
1:A:328:ILE:O	1:A:332:LEU:HB2	2.20	0.42
1:A:119:TRP:HA	1:A:128:HIS:CE1	2.54	0.42
2:B:266:LEU:O	2:B:270:ALA:HB2	2.19	0.41
4:A:501:HEB:HAC	4:A:501:HEB:HMC1	1.88	0.41
2:B:187:ASP:OD1	2:B:256:ARG:NH2	2.53	0.41
1:A:305:LEU:HD11	1:A:313:ARG:HB2	2.01	0.41
1:A:370:ILE:HG12	4:A:501:HEB:HBC2	2.02	0.41
1:A:264:SER:OG	1:A:265:HIS:N	2.53	0.41
1:A:264:SER:HA	1:A:301:VAL:HA	2.03	0.41
1:A:25:ALA:O	1:A:28:GLY:N	2.54	0.41
1:A:378:GLU:HG2	5:A:503:HDD:NC	2.35	0.41
1:A:233:ALA:O	1:A:237:VAL:HG22	2.20	0.40
1:A:82:LEU:O	1:A:396:ALA:HA	2.21	0.40
1:A:18:LEU:CB	5:A:503:HDD:HMD2	2.52	0.40
1:A:146:ILE:HG23	5:A:503:HDD:O1A	2.21	0.40
1:A:376:LEU:C	1:A:376:LEU:HD23	2.41	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	430/448 (96%)	364 (85%)	56 (13%)	10 (2%)	6	38
2	B	328/342 (96%)	290 (88%)	33 (10%)	5 (2%)	10	46
3	C	28/33 (85%)	20 (71%)	8 (29%)	0	100	100
All	All	786/823 (96%)	674 (86%)	97 (12%)	15 (2%)	8	42

All (15) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	214	ILE
1	A	211	ASN
1	A	276	GLU
2	B	30	PHE
1	A	191	SER
1	A	209	LYS
2	B	146	ASN
1	A	79	LEU
1	A	341	LEU
1	A	156	PRO
1	A	291	SER
2	B	268	GLN
2	B	208	PRO
1	A	315	PRO
2	B	282	PRO

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	357/370 (96%)	352 (99%)	5 (1%)	67	81
2	B	276/283 (98%)	276 (100%)	0	100	100
3	C	25/28 (89%)	24 (96%)	1 (4%)	31	59
All	All	658/681 (97%)	652 (99%)	6 (1%)	78	88

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	22	ILE
1	A	123	GLU
1	A	155	THR
1	A	307	ASP
1	A	343	SER
3	C	772	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

3 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	$\# Z > 2$
4	HEB	A	502	1	48,50,50	4.38	28 (58%)	55,82,82	5.25	38 (69%)
4	HEB	A	501	1	48,50,50	4.33	27 (56%)	55,82,82	5.22	32 (58%)
5	HDD	A	503	1	41,52,52	2.08	14 (34%)	31,89,89	2.97	17 (54%)

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
4	HEB	A	502	1	1/1/3/8	3/12/54/54	-
4	HEB	A	501	1	1/1/3/8	5/12/54/54	-
5	HDD	A	503	1	-	4/5/89/89	0/1/9/9

All (69) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	502	HEB	C3C-C2C	-12.75	1.22	1.40
4	A	501	HEB	C3C-C2C	-12.46	1.23	1.40
4	A	502	HEB	C4A-NA	7.92	1.55	1.39
4	A	501	HEB	C1A-C2A	-7.87	1.31	1.45
4	A	501	HEB	C4A-NA	7.56	1.54	1.39
4	A	502	HEB	C1A-C2A	-7.48	1.31	1.45
4	A	502	HEB	C1C-NC	7.40	1.51	1.36
4	A	501	HEB	C1B-C2B	-7.39	1.30	1.44
4	A	501	HEB	C1C-NC	7.37	1.51	1.36
4	A	502	HEB	C1B-C2B	-7.06	1.30	1.44
4	A	502	HEB	FE-ND	6.66	2.33	1.97
4	A	502	HEB	CHA-C4D	6.64	1.54	1.39
4	A	502	HEB	C4D-ND	6.55	1.52	1.38
4	A	501	HEB	C1D-C2D	-6.41	1.32	1.44
4	A	501	HEB	FE-ND	6.39	2.32	1.97
4	A	501	HEB	CHA-C4D	6.27	1.53	1.39
4	A	501	HEB	C4D-ND	6.19	1.51	1.38
4	A	502	HEB	C1D-C2D	-6.17	1.32	1.44
4	A	501	HEB	C2A-C3A	-5.64	1.24	1.36
4	A	502	HEB	C2A-C3A	-5.64	1.24	1.36
4	A	502	HEB	CHD-C1D	5.54	1.49	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	501	HEB	C3B-C2B	-5.49	1.25	1.36
4	A	501	HEB	CHD-C1D	5.46	1.49	1.35
4	A	502	HEB	C3B-C2B	-5.41	1.25	1.36
4	A	502	HEB	CHB-C4A	5.33	1.48	1.38
4	A	501	HEB	CHB-C4A	5.21	1.48	1.38
4	A	501	HEB	C4B-NB	5.12	1.49	1.40
4	A	502	HEB	C4B-NB	5.08	1.49	1.40
5	A	503	HDD	O1D-CGD	5.04	1.43	1.35
4	A	502	HEB	C4B-C3B	-5.01	1.36	1.45
5	A	503	HDD	C3B-C2B	4.95	1.47	1.40
4	A	501	HEB	C4C-NC	4.87	1.46	1.36
4	A	502	HEB	C4A-C3A	-4.75	1.36	1.45
4	A	501	HEB	CHC-C4B	4.71	1.47	1.35
4	A	501	HEB	C4A-C3A	-4.63	1.36	1.45
4	A	502	HEB	C4C-NC	4.39	1.45	1.36
4	A	502	HEB	CHB-C1B	4.33	1.49	1.39
4	A	502	HEB	C1B-NB	4.18	1.47	1.38
4	A	502	HEB	FE-NA	4.16	2.11	1.95
5	A	503	HDD	O1D-C3D	-4.04	1.40	1.46
4	A	501	HEB	FE-NA	4.01	2.11	1.95
4	A	502	HEB	CHA-C1A	3.98	1.46	1.38
4	A	501	HEB	CHB-C1B	3.97	1.48	1.39
4	A	502	HEB	CHC-C4B	3.95	1.45	1.35
4	A	501	HEB	C4B-C3B	-3.95	1.38	1.45
4	A	501	HEB	C1B-NB	3.93	1.46	1.38
4	A	501	HEB	C1C-CHC	3.90	1.51	1.41
5	A	503	HDD	C4D-ND	-3.72	1.31	1.37
4	A	502	HEB	CBC-CAC	3.46	1.52	1.29
4	A	501	HEB	CHA-C1A	3.40	1.45	1.38
4	A	502	HEB	C1C-CHC	3.36	1.50	1.41
4	A	501	HEB	CBC-CAC	3.33	1.51	1.29
4	A	501	HEB	FE-NB	3.29	2.15	1.97
5	A	503	HDD	CHD-C1D	-3.15	1.31	1.36
4	A	502	HEB	FE-NB	3.14	2.14	1.97
5	A	503	HDD	C3C-C2C	2.94	1.44	1.40
5	A	503	HDD	C1A-NA	-2.71	1.30	1.36
5	A	503	HDD	FE-ND	-2.70	1.85	1.95
4	A	502	HEB	C1A-NA	2.69	1.45	1.39
5	A	503	HDD	CAA-C2A	-2.67	1.48	1.52
5	A	503	HDD	C2A-C3A	2.42	1.44	1.37
5	A	503	HDD	C1D-ND	-2.36	1.33	1.37
4	A	501	HEB	FE-NC	2.34	2.15	1.96

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	503	HDD	C4C-NC	-2.23	1.31	1.36
4	A	502	HEB	FE-NC	2.22	2.14	1.96
4	A	501	HEB	C1A-NA	2.14	1.43	1.39
4	A	502	HEB	C3C-CAC	2.10	1.52	1.47
5	A	503	HDD	CHA-C4D	-2.07	1.32	1.36
5	A	503	HDD	C4A-CHB	2.02	1.46	1.41

All (87) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	501	HEB	C1D-C2D-C3D	16.10	123.88	106.96
4	A	502	HEB	C1D-C2D-C3D	14.98	122.70	106.96
4	A	502	HEB	C1B-C2B-C3B	13.09	120.72	106.96
4	A	501	HEB	C1B-C2B-C3B	13.05	120.67	106.96
4	A	501	HEB	C2D-C1D-ND	-11.03	96.77	109.84
4	A	502	HEB	C3D-C4D-ND	-10.70	99.99	110.36
4	A	502	HEB	C2A-C1A-NA	-10.49	100.12	110.32
4	A	501	HEB	C3D-C4D-ND	-10.45	100.23	110.36
4	A	502	HEB	C1A-C2A-C3A	10.07	120.25	107.13
4	A	502	HEB	C2D-C1D-ND	-9.96	98.04	109.84
4	A	501	HEB	C1D-ND-C4D	9.71	115.10	105.07
4	A	502	HEB	C2B-C1B-NB	-9.54	98.45	109.88
4	A	501	HEB	C1A-C2A-C3A	9.39	119.36	107.13
4	A	502	HEB	C1D-ND-C4D	9.08	114.45	105.07
4	A	501	HEB	C2A-C1A-NA	-8.97	101.59	110.32
4	A	502	HEB	C3B-C4B-NB	-8.57	100.62	110.17
4	A	501	HEB	C2B-C1B-NB	-8.51	99.69	109.88
4	A	501	HEB	C3B-C4B-NB	-8.23	101.01	110.17
5	A	503	HDD	C4A-C3A-C2A	-8.01	101.42	107.00
4	A	502	HEB	C3C-C4C-NC	-7.63	99.35	109.21
4	A	501	HEB	C3C-C4C-NC	-7.47	99.55	109.21
4	A	501	HEB	CMC-C2C-C1C	-6.39	118.64	128.46
4	A	502	HEB	CHB-C1B-C2B	6.02	134.38	124.98
4	A	501	HEB	CHB-C1B-C2B	5.66	133.82	124.98
4	A	501	HEB	CMB-C2B-C1B	-5.53	116.62	125.04
4	A	502	HEB	CMC-C2C-C1C	-5.46	120.08	128.46
4	A	502	HEB	C3A-C4A-NA	-5.39	99.74	109.69
5	A	503	HDD	C3C-C4C-NC	5.37	116.15	109.21
4	A	502	HEB	CMD-C2D-C1D	-5.14	117.21	125.04
4	A	501	HEB	C3A-C4A-NA	-5.04	100.39	109.69
4	A	501	HEB	CHA-C4D-ND	5.00	129.85	124.42
4	A	501	HEB	CMD-C2D-C1D	-4.89	117.59	125.04

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	502	HEB	CHA-C1A-NA	4.70	129.53	124.44
4	A	502	HEB	CMB-C2B-C1B	-4.37	118.39	125.04
4	A	501	HEB	CHA-C1A-NA	4.37	129.16	124.44
5	A	503	HDD	C2B-C3B-C4B	-4.36	103.85	106.90
4	A	502	HEB	CHA-C4D-ND	4.32	129.11	124.42
5	A	503	HDD	OND-C2D-CMD	-4.20	101.85	109.59
5	A	503	HDD	C2D-C1D-CHD	-4.17	117.40	124.28
4	A	502	HEB	CHA-C4D-C3D	4.12	130.90	124.84
4	A	501	HEB	CHC-C4B-C3B	4.11	133.04	125.33
4	A	501	HEB	CAA-C2A-C1A	-4.03	117.29	124.89
5	A	503	HDD	CAD-CBD-CGD	-3.93	98.48	104.56
4	A	502	HEB	C4B-NB-C1B	3.89	109.09	105.07
4	A	502	HEB	CAA-C2A-C3A	-3.82	120.77	127.88
5	A	503	HDD	CMB-C2B-C3B	3.77	131.73	124.68
5	A	503	HDD	CMD-C2D-C1D	-3.60	106.23	112.63
4	A	501	HEB	CHD-C1D-ND	3.56	128.78	124.38
4	A	502	HEB	C4A-C3A-C2A	3.54	112.12	106.94
5	A	503	HDD	CAA-CBA-CGA	-3.46	104.05	113.76
4	A	501	HEB	CHA-C4D-C3D	3.45	129.92	124.84
4	A	502	HEB	CHA-C1A-C2A	3.35	130.35	124.94
4	A	501	HEB	C4A-C3A-C2A	3.30	111.77	106.94
4	A	502	HEB	CHB-C4A-NA	3.30	128.01	124.44
4	A	502	HEB	CHB-C4A-C3A	3.23	132.25	125.48
4	A	501	HEB	CHB-C4A-C3A	3.17	132.13	125.48
4	A	502	HEB	CAA-C2A-C1A	-3.14	118.97	124.89
4	A	502	HEB	CHC-C4B-C3B	3.14	131.22	125.33
4	A	501	HEB	C4B-NB-C1B	3.14	108.31	105.07
5	A	503	HDD	C4C-CHD-C1D	-3.13	123.91	130.12
4	A	502	HEB	CHC-C4B-NB	3.06	128.16	124.38
4	A	502	HEB	C4B-C3B-C2B	2.89	111.11	106.90
4	A	501	HEB	CHB-C4A-NA	2.81	127.48	124.44
4	A	501	HEB	CMD-C2D-C3D	-2.79	118.53	126.12
4	A	502	HEB	CHD-C1D-C2D	2.79	134.44	126.72
4	A	501	HEB	CHD-C1D-C2D	2.79	134.44	126.72
4	A	502	HEB	CMC-C2C-C3C	-2.72	119.59	124.68
5	A	503	HDD	CAA-C2A-C3A	2.69	134.98	127.25
5	A	503	HDD	O1D-CGD-O2D	2.67	123.19	120.80
4	A	501	HEB	CHA-C1A-C2A	2.66	129.25	124.94
4	A	502	HEB	CHD-C1D-ND	2.54	127.51	124.38
4	A	502	HEB	CHB-C1B-NB	2.53	127.16	124.42
5	A	503	HDD	CMC-C2C-C1C	2.52	132.34	128.46
4	A	501	HEB	O2A-CGA-CBA	2.52	122.12	114.03

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	503	HDD	C1A-CHA-C4D	-2.50	125.16	130.12
4	A	502	HEB	C4A-NA-C1A	2.48	107.78	105.35
4	A	501	HEB	CMA-C3A-C4A	-2.45	120.40	124.71
4	A	501	HEB	CAA-C2A-C3A	-2.43	123.34	127.88
5	A	503	HDD	CMA-C3A-C2A	2.36	129.38	124.94
4	A	501	HEB	C4B-C3B-C2B	2.35	110.32	106.90
5	A	503	HDD	OND-C2D-C1D	2.33	116.64	111.92
4	A	502	HEB	CMD-C2D-C3D	-2.22	120.09	126.12
4	A	502	HEB	O2D-CGD-CBD	2.21	121.12	114.03
5	A	503	HDD	OND-C2D-C3D	2.11	115.68	110.45
4	A	502	HEB	CAB-C3B-C4B	-2.09	122.10	124.81
4	A	502	HEB	C1A-CHA-C4D	-2.07	121.60	126.06
4	A	502	HEB	O2A-CGA-CBA	2.02	120.52	114.03

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	501	HEB	NA
4	A	502	HEB	NA

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	501	HEB	C4B-C3B-CAB-CBB
5	A	503	HDD	C1A-C2A-CAA-CBA
5	A	503	HDD	C3A-C2A-CAA-CBA
4	A	501	HEB	C2B-C3B-CAB-CBB
4	A	501	HEB	CAD-CBD-CGD-O2D
4	A	502	HEB	CAD-CBD-CGD-O1D
5	A	503	HDD	CAA-CBA-CGA-O1A
5	A	503	HDD	CAA-CBA-CGA-O2A
4	A	501	HEB	CAD-CBD-CGD-O1D
4	A	502	HEB	CAD-CBD-CGD-O2D
4	A	502	HEB	C3D-CAD-CBD-CGD
4	A	501	HEB	CAA-CBA-CGA-O2A

There are no ring outliers.

3 monomers are involved in 29 short contacts:

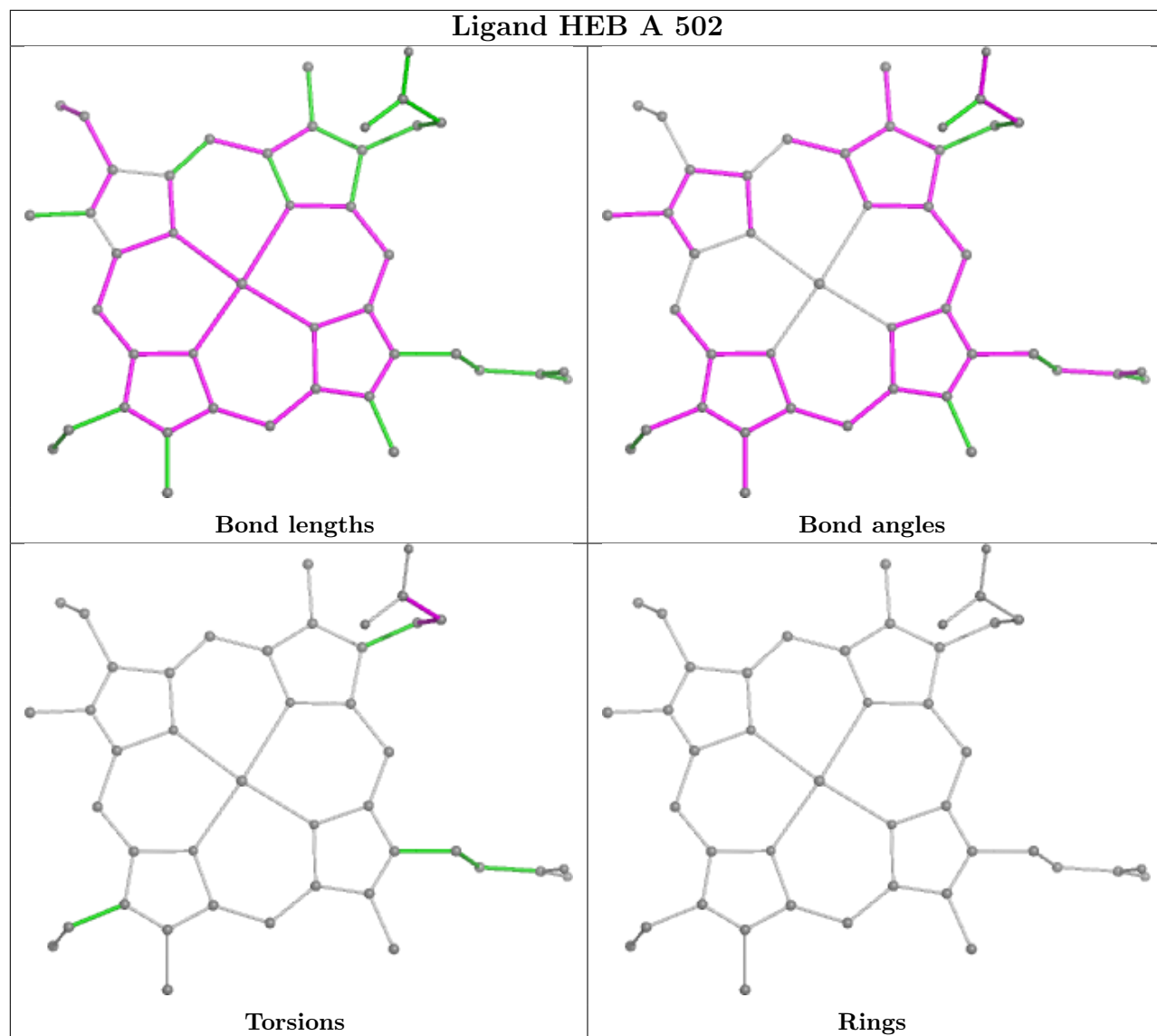
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	502	HEB	2	0

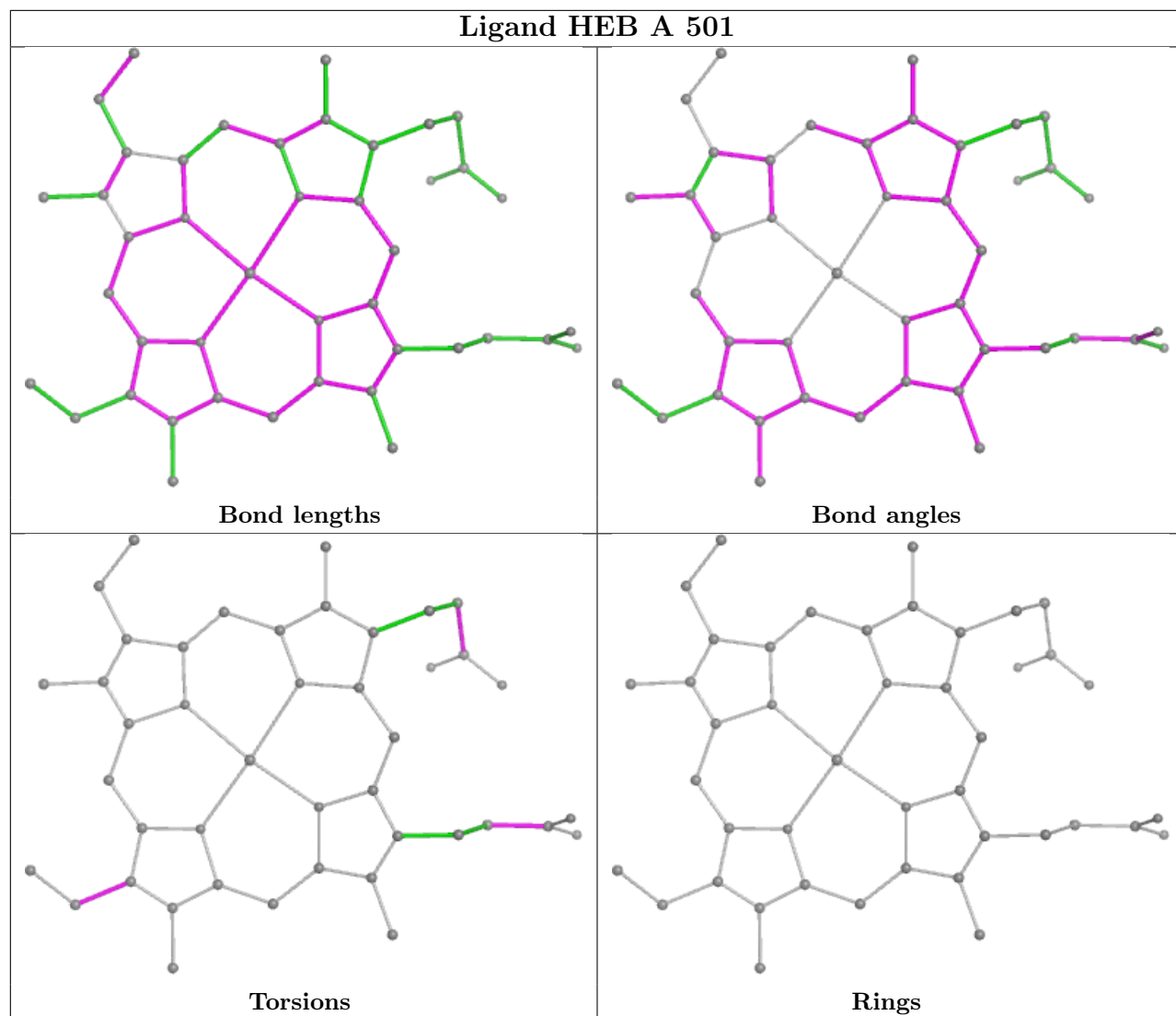
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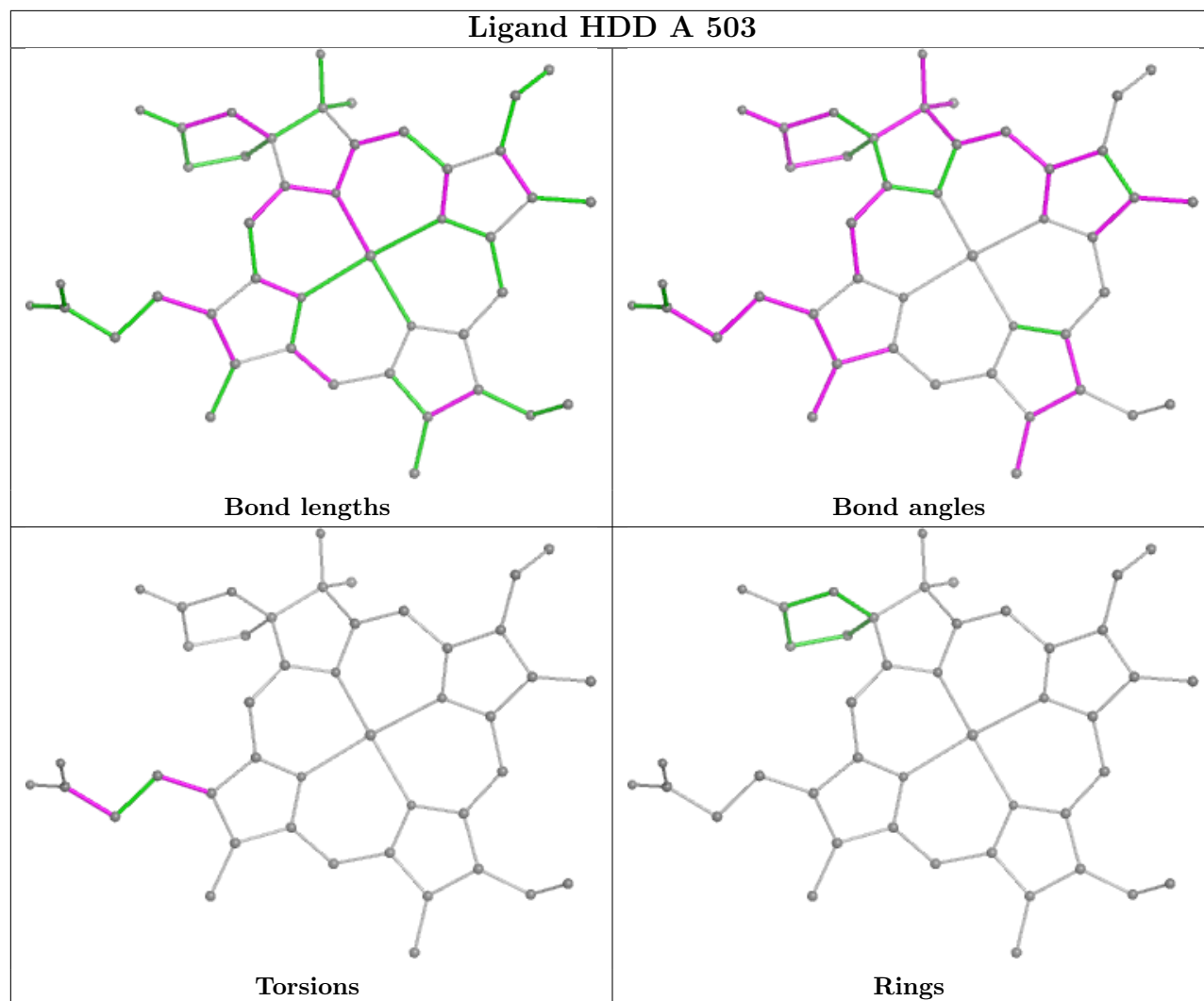
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	501	HEB	12	0
5	A	503	HDD	17	0

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







5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	432/448 (96%)	-0.35	20 (4%) 32 28	50, 90, 158, 205	0
2	B	330/342 (96%)	-0.19	22 (6%) 17 14	78, 151, 202, 224	0
3	C	30/33 (90%)	-0.22	3 (10%) 7 6	71, 118, 179, 194	0
All	All	792/823 (96%)	-0.28	45 (5%) 23 19	50, 120, 192, 224	0

All (45) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	277	ASP	6.2
1	A	2	ASN	6.1
1	A	3	GLY	6.0
1	A	1	MET	5.3
2	B	148	ALA	4.9
2	B	147	ALA	4.4
2	B	149	GLY	4.0
1	A	4	TYR	3.8
2	B	151	ALA	3.7
2	B	225	PRO	3.4
1	A	276	GLU	3.3
1	A	210	GLY	3.2
2	B	250	TRP	3.2
3	C	794	ASN	3.2
1	A	351	ALA	3.2
2	B	154	TYR	3.1
2	B	229	ASP	3.0
1	A	432	PRO	2.9
2	B	155	GLY	2.9
3	C	793	VAL	2.9
1	A	209	LYS	2.9
1	A	394	GLU	2.9
2	B	145	GLU	2.8

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Mol	Chain	Res	Type	RSRZ
2	B	152	LEU	2.8
2	B	288	TYR	2.8
1	A	164	GLY	2.7
2	B	150	VAL	2.7
2	B	153	ASP	2.6
2	B	111	THR	2.5
1	A	120	ASP	2.5
2	B	1	MET	2.5
1	A	163	ASN	2.5
2	B	330	LYS	2.4
2	B	38	ALA	2.4
1	A	387	ARG	2.4
1	A	353	ASN	2.3
2	B	159	ALA	2.3
3	C	792	HIS	2.3
1	A	293	LEU	2.2
1	A	278	ASN	2.2
2	B	255	GLN	2.2
2	B	146	ASN	2.1
1	A	312	GLU	2.1
2	B	260	TRP	2.1
1	A	121	ARG	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 monosaccharides in this entry.

6.4 Ligands [\(i\)](#)

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

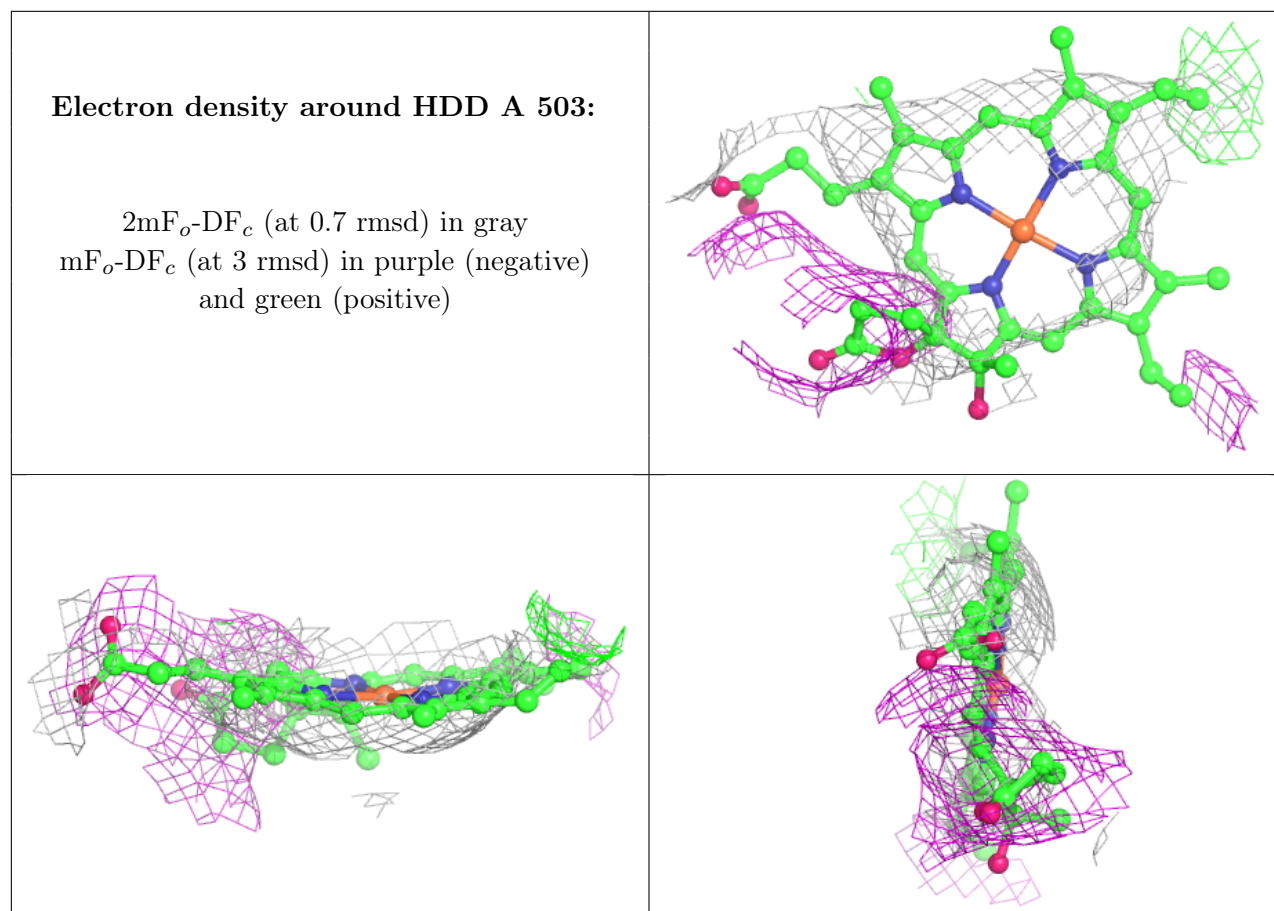
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	HDD	A	503	44/44	0.86	0.34	113,113,113,113	0

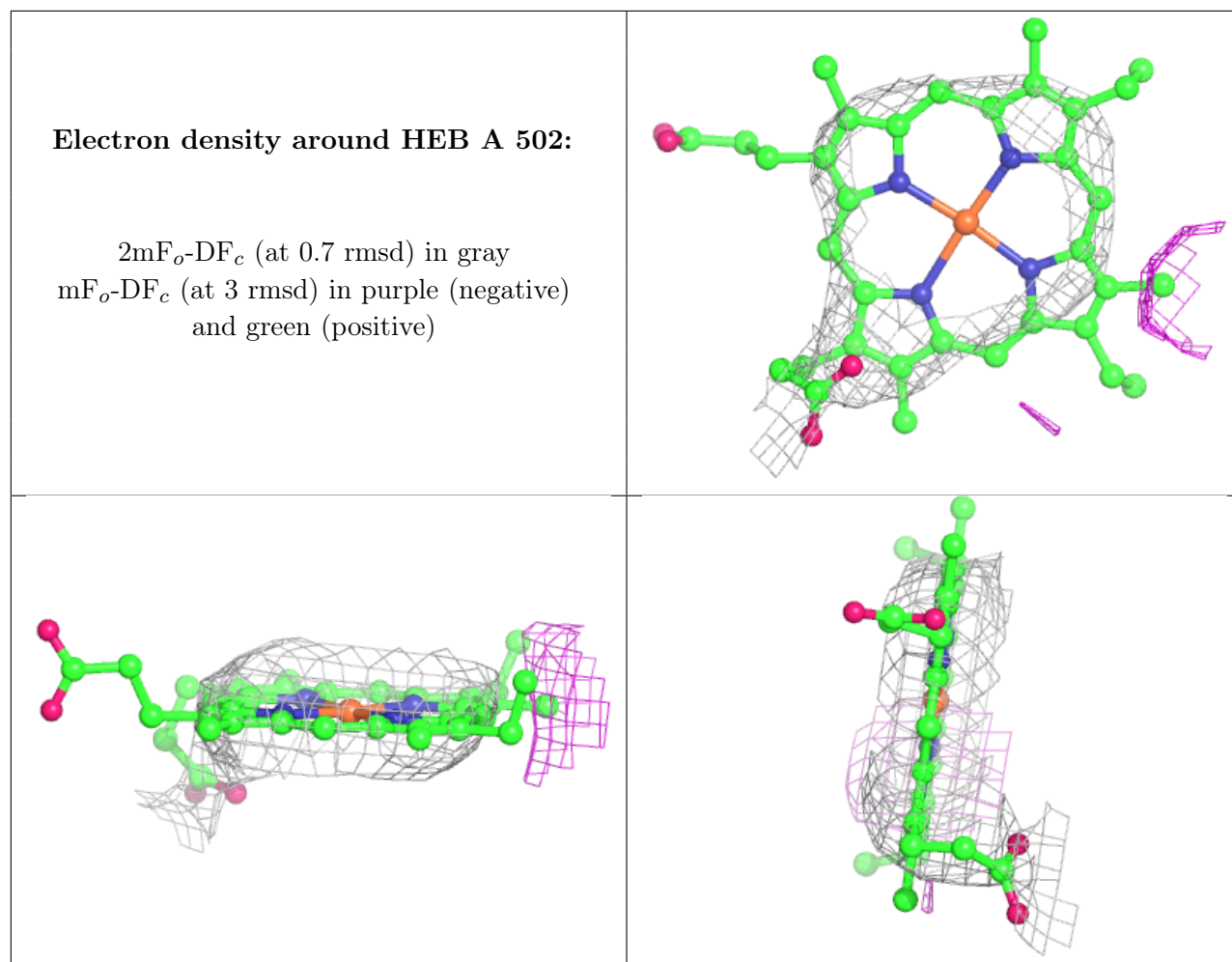
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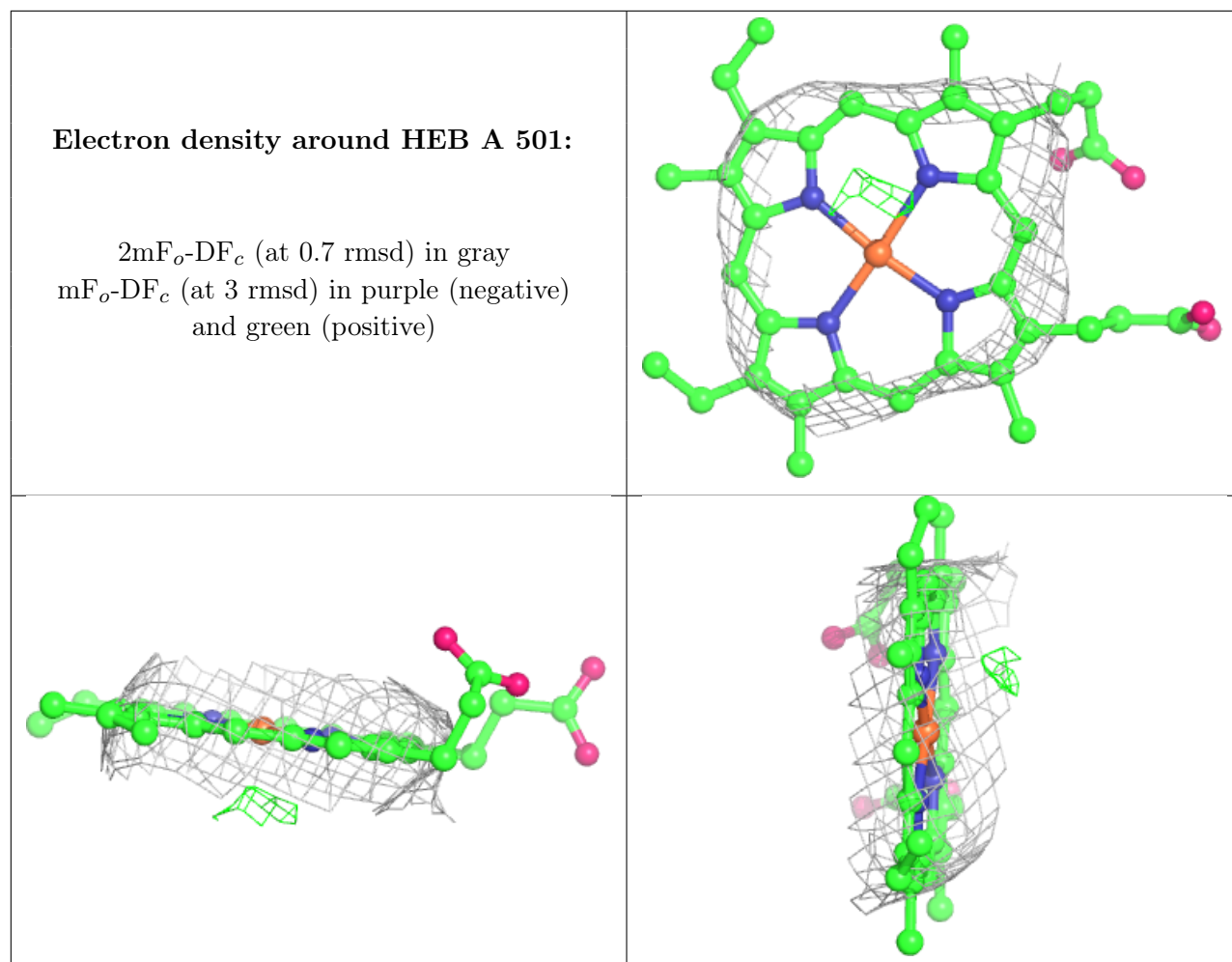
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	HEB	A	502	43/43	0.97	0.22	92,92,92,92	0
4	HEB	A	501	43/43	0.97	0.22	75,75,75,75	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.







6.5 Other polymers [i](#)

There are no such residues in this entry.