



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 04:00 AM UTC

PDB ID : 2H88 / pdb_00002h88
Title : Avian Mitochondrial Respiratory Complex II at 1.8 Angstrom Resolution
Authors : Huang, L.S.; Shen, J.T.; Wang, A.C.; Berry, E.A.
Deposited on : 2006-06-06
Resolution : 1.74 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)
Xtrriage (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

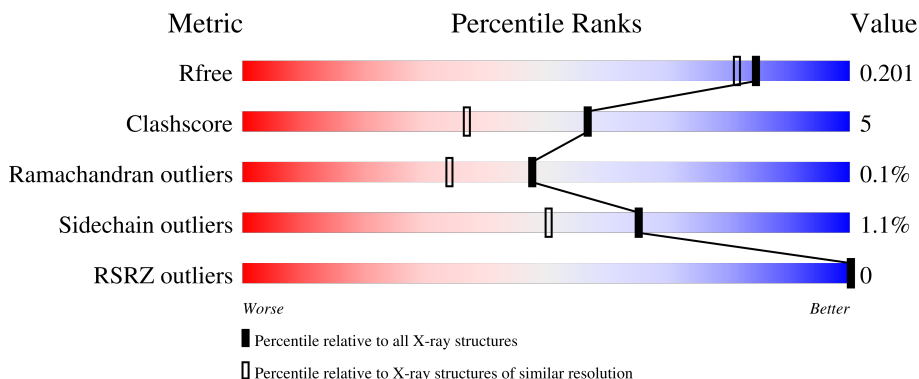
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.74 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	1187 (1.74-1.74)
Clashscore	190562	1207 (1.74-1.74)
Ramachandran outliers	187476	1200 (1.74-1.74)
Sidechain outliers	187428	1200 (1.74-1.74)
RSRZ outliers	180081	1188 (1.74-1.74)

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	621	 86% 12% ..
1	N	621	 86% 12% .
2	B	252	 85% 8% . 5%
2	O	252	 86% 9% 5%
3	C	140	 79% 19% ..

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Mol	Chain	Length	Quality of chain
3	P	140	 80% 19% ..
4	D	103	 83% 15% .
4	Q	103	 85% 13% .

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
14	BHG	C	141	X	-	-	-
14	BHG	P	205	X	-	-	-
6	AZI	A	623	-	X	-	-
6	AZI	N	623	-	X	-	-
8	TEO	A	1002	X	-	-	-
8	TEO	N	1002	X	-	-	-
9	UNL	N	1007	-	-	X	-
9	UNL	O	1006	-	-	X	-
9	UNL	P	208	-	-	X	-
9	UNL	P	209	-	-	X	-

2 Entry composition

There are 16 unique types of molecules in this entry. The entry contains 19414 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 SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUB-UNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	612	4726	2956	843	898	29	0	0	0
1	N	612	4726	2956	843	898	29	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	501	ARG	CYS	conflict	UNP Q9YHT1
A	556	LEU	PHE	conflict	UNP Q9YHT1
A	560	GLU	ASP	conflict	UNP Q9YHT1
N	501	ARG	CYS	conflict	UNP Q9YHT1
N	556	LEU	PHE	conflict	UNP Q9YHT1
N	560	GLU	ASP	conflict	UNP Q9YHT1

- Molecule 2 is a protein called Succinate dehydrogenase Ip subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	239	1916	1213	325	356	22	0	0	0
2	O	239	1916	1213	325	356	22	0	0	0

- Molecule 3 is a protein called SUCCINATE DEHYDROGENASE CYTOCHROME B, LARGE SUBUNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	139	1077	706	178	189	4	0	0	0
3	P	139	1077	706	178	189	4	0	0	0

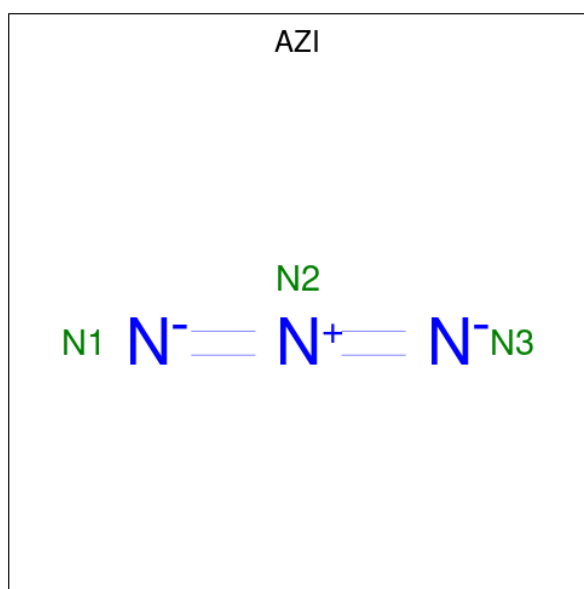
- Molecule 4 is a protein called Succinate dehydrogenase cytochrome B, small subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	101	Total 766	C 505	N 121	O 137	S 3	0	0	0
4	Q	101	Total 766	C 505	N 121	O 137	S 3	0	0	0

- Molecule 5 is POTASSIUM ION (CCD ID: K) (formula: K).

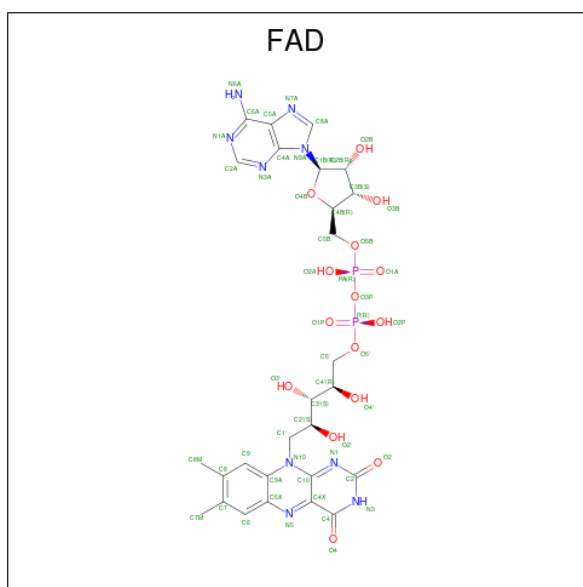
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total K 1 1	0	0
5	B	1	Total K 1 1	0	0
5	N	1	Total K 1 1	0	0
5	O	1	Total K 1 1	0	0

- Molecule 6 is AZIDE ION (CCD ID: AZI) (formula: N₃).



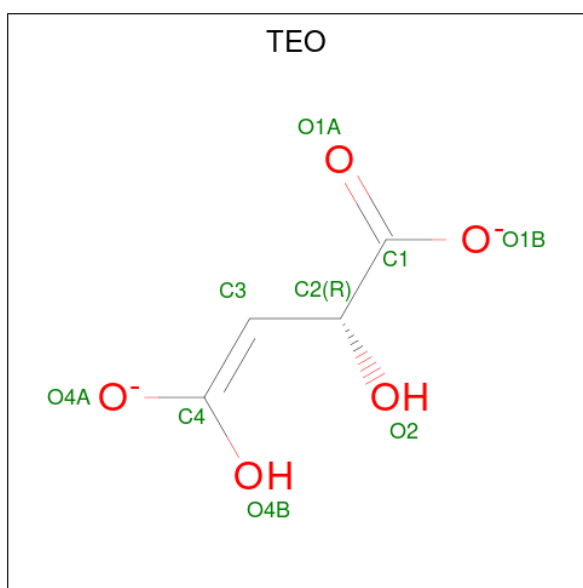
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total N 3 3	0	0
6	N	1	Total N 3 3	0	0

- Molecule 7 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
7	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
7	N	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 8 is MALATE LIKE INTERMEDIATE (CCD ID: TEO) (formula: $C_4H_4O_5$).

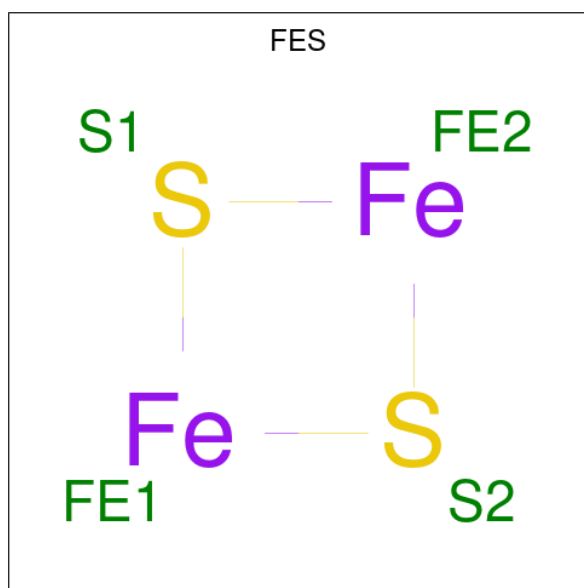


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf	
8	A	1	Total	C	O	0	0
			9	4	5		
8	N	1	Total	C	O	0	0
			9	4	5		

- Molecule 9 is UNKNOWN LIGAND (CCD ID: UNL) (formula:).

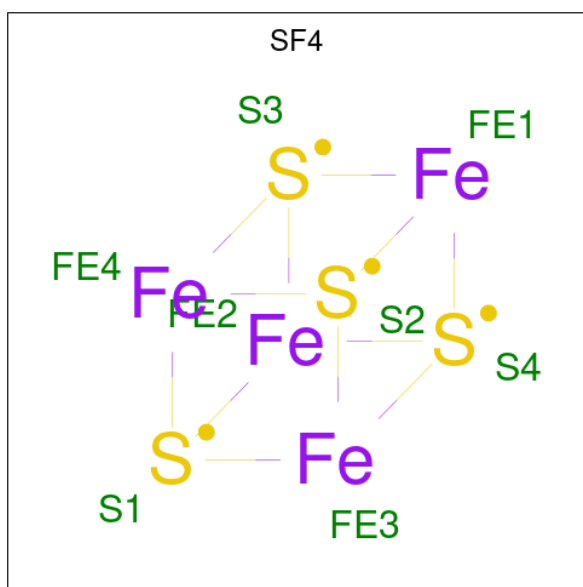
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	A	6	Total O 7 7	0	0
9	B	4	Total O 4 4	0	0
9	C	9	Total C O 16 6 10	0	0
9	D	11	Total C O 32 21 11	0	0
9	N	10	Total O 11 11	0	0
9	O	4	Total O 4 4	0	0
9	P	14	Total C O 22 6 16	0	0
9	Q	6	Total C O 16 12 4	0	0

- Molecule 10 is FE2/S2 (INORGANIC) CLUSTER (CCD ID: FES) (formula: Fe₂S₂).



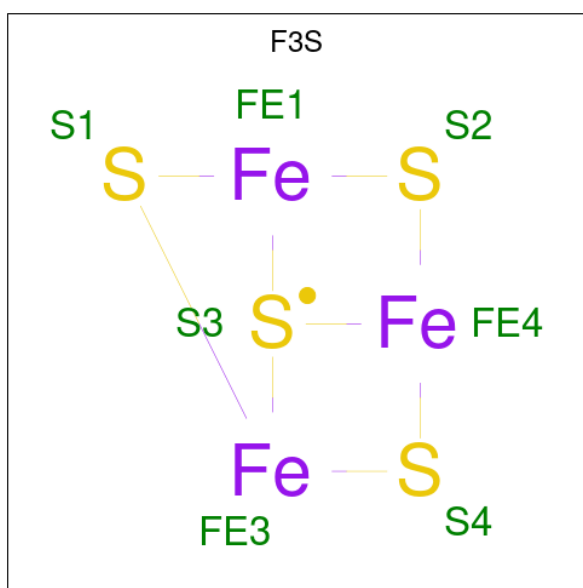
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
10	B	1	Total Fe S 4 2 2	0	0
10	O	1	Total Fe S 4 2 2	0	0

- Molecule 11 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe₄S₄).



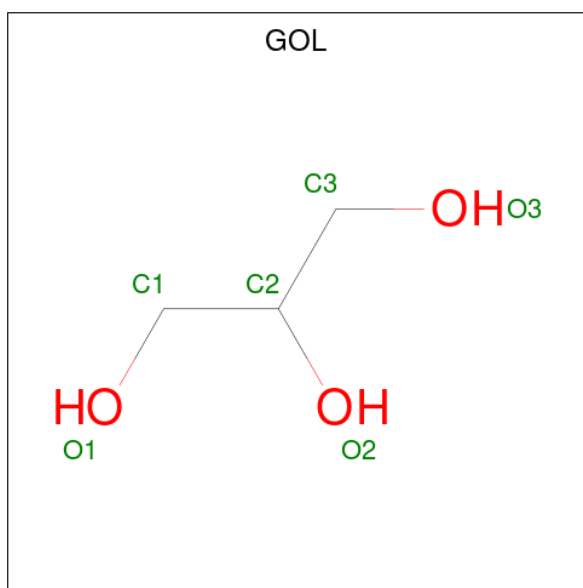
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
11	B	1	Total	Fe S	0	0
			8	4 4		
11	O	1	Total	Fe S	0	0
			8	4 4		

- Molecule 12 is FE3-S4 CLUSTER (CCD ID: F3S) (formula: Fe_3S_4).



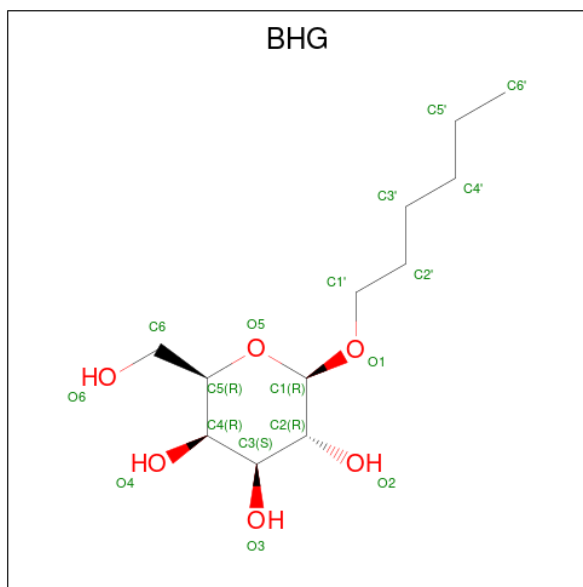
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	B	1	Total	Fe S	0	0
			7	3 4		
12	O	1	Total	Fe S	0	0
			7	3 4		

- Molecule 13 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
13	B	1	Total	C O	0	0
			6	3 3		
13	O	1	Total	C O	0	0
			6	3 3		

- Molecule 14 is hexyl beta-D-galactopyranoside (CCD ID: BHG) (formula: $C_{12}H_{24}O_6$).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
14	C	1	Total	C O	0	0
			18	12 6		

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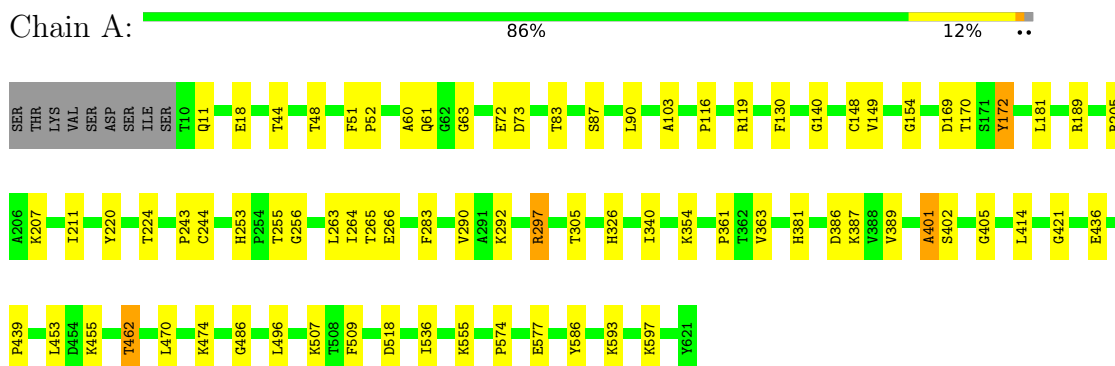
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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
16	P	99	Total O 99 99	0	0
16	Q	51	Total O 51 51	0	0

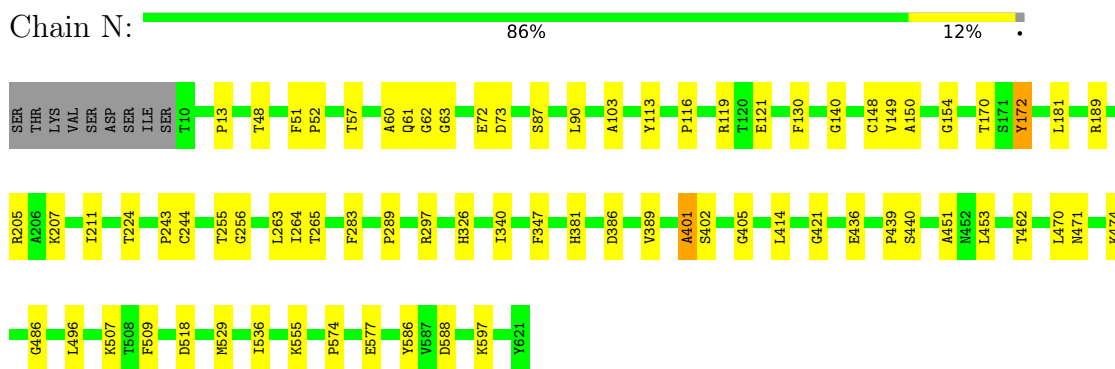
3 Residue-property plots [i](#)

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.

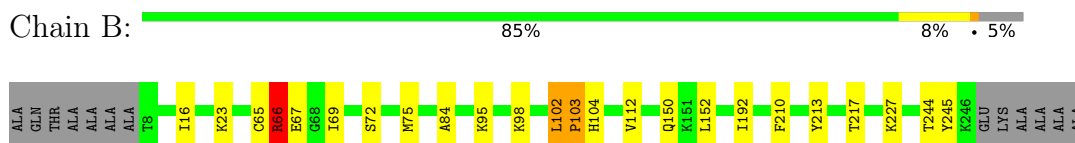
- Molecule 1: SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUBUNIT



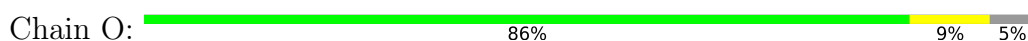
- Molecule 1: SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUBUNIT



- Molecule 2: Succinate dehydrogenase Ip subunit



- Molecule 2: Succinate dehydrogenase Ip subunit





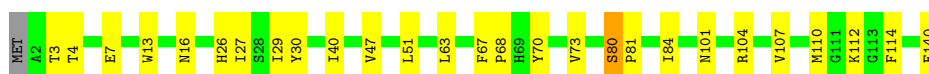
- Molecule 3: SUCCINATE DEHYDROGENASE CYTOCHROME B, LARGE SUBUNIT

Chain C: 79% 19% ..



- Molecule 3: SUCCINATE DEHYDROGENASE CYTOCHROME B, LARGE SUBUNIT

Chain P: 80% 19% ..



- Molecule 4: Succinate dehydrogenase cytochrome B, small subunit

Chain D: 83% 15% .



- Molecule 4: Succinate dehydrogenase cytochrome B, small subunit

Chain Q: 85% 13% .



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	119.97Å 199.39Å 68.06Å 90.00° 90.35° 90.00°	Depositor
Resolution (Å)	45.14 – 1.74 45.14 – 1.74	Depositor EDS
% Data completeness (in resolution range)	89.2 (45.14-1.74) 88.9 (45.14-1.74)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.12	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.11 (at 1.70Å)	Xtrriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.178 , 0.206 0.175 , 0.201	Depositor DCC
R_{free} test set	15106 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å ²)	23.0	Xtrriage
Anisotropy	0.319	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 47.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	0.227 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	19414	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.84% 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: F3S, UNL, FAD, BHG, FES, TEO, SF4, GOL, HEM, K, AZI

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	1.16	3/4827 (0.1%)	1.14	27/6535 (0.4%)
1	N	1.19	5/4827 (0.1%)	1.14	27/6535 (0.4%)
2	B	1.18	5/1958 (0.3%)	1.11	11/2640 (0.4%)
2	O	1.23	6/1958 (0.3%)	1.13	12/2640 (0.5%)
3	C	0.86	1/1106 (0.1%)	0.95	3/1503 (0.2%)
3	P	0.83	1/1106 (0.1%)	0.99	6/1503 (0.4%)
4	D	0.73	0/789	0.96	2/1082 (0.2%)
4	Q	0.69	0/789	0.93	2/1082 (0.2%)
All	All	1.11	21/17360 (0.1%)	1.10	90/23520 (0.4%)

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	1
1	N	0	1
3	C	0	1
3	P	0	1
All	All	0	4

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	O	66	ARG	CA-C	8.18	1.63	1.52
1	A	103	ALA	CA-CB	8.03	1.65	1.53
2	B	66	ARG	CA-C	7.89	1.63	1.52
2	O	112	VAL	CA-CB	7.78	1.61	1.53
2	O	84	ALA	CA-CB	7.66	1.65	1.53
1	N	103	ALA	CA-CB	6.76	1.62	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	112	VAL	CA-CB	6.47	1.60	1.53
2	B	84	ALA	CA-CB	6.17	1.63	1.53
1	N	57	THR	CA-CB	6.14	1.63	1.53
2	B	69	ILE	CA-CB	6.01	1.62	1.54
2	O	16	ILE	CA-CB	5.69	1.62	1.54
1	N	529	MET	SD-CE	5.46	1.93	1.79
1	A	83	THR	CA-CB	5.33	1.61	1.53
2	B	75	MET	SD-CE	5.33	1.92	1.79
2	O	69	ILE	CA-CB	5.21	1.61	1.54
1	N	149	VAL	CA-CB	5.17	1.59	1.53
1	N	451	ALA	CA-CB	5.10	1.61	1.53
2	O	187	ALA	N-CA	5.09	1.52	1.46
1	A	305	THR	CA-C	5.02	1.59	1.52
3	P	29	ILE	CA-CB	5.01	1.60	1.54
3	C	29	ILE	CA-CB	5.00	1.60	1.54

All (90) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	N	255	THR	N-CA-C	10.41	123.21	108.54
1	A	255	THR	N-CA-C	10.12	122.80	108.54
1	A	401	ALA	N-CA-C	8.73	121.95	111.82
1	N	401	ALA	N-CA-C	8.70	121.91	111.82
1	N	265	THR	N-CA-C	8.01	121.54	110.24
1	N	51	PHE	N-CA-C	-7.76	99.79	109.64
3	P	80	SER	CA-C-N	7.71	127.42	119.56
3	P	80	SER	C-N-CA	7.71	127.42	119.56
1	A	265	THR	N-CA-C	7.59	120.94	110.24
4	D	93	ILE	N-CA-C	7.36	117.88	110.23
2	B	72	SER	N-CA-C	7.24	119.25	111.36
4	Q	93	ILE	N-CA-C	7.00	117.51	110.23
2	O	65	CYS	N-CA-C	7.00	121.08	112.54
1	A	51	PHE	N-CA-C	-6.98	100.78	109.64
2	B	65	CYS	N-CA-C	6.93	121.33	113.01
2	B	213	TYR	N-CA-C	6.84	121.33	113.19
2	O	213	TYR	N-CA-C	6.74	121.21	113.19
2	O	16	ILE	N-CA-C	6.74	118.18	108.48
3	C	114	PHE	N-CA-C	6.66	121.41	113.28
1	N	61	GLN	N-CA-C	6.57	121.12	111.34
3	P	114	PHE	N-CA-C	6.54	121.25	113.28
1	A	61	GLN	N-CA-C	6.46	120.97	111.34
1	A	140	GLY	N-CA-C	6.30	128.10	113.18

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	52	PRO	N-CA-C	6.21	123.00	113.75
1	N	140	GLY	N-CA-C	6.20	127.87	113.18
1	N	421	GLY	N-CA-C	-6.15	105.35	112.73
2	O	72	SER	N-CA-C	6.15	118.06	111.36
3	C	63	LEU	CA-C-N	6.10	125.31	118.97
3	C	63	LEU	C-N-CA	6.10	125.31	118.97
2	O	102	LEU	CA-C-N	6.04	125.99	119.76
2	O	102	LEU	C-N-CA	6.04	125.99	119.76
2	O	9	SER	N-CA-C	6.01	117.80	110.41
1	A	90	LEU	N-CA-C	-6.01	105.99	113.38
1	N	90	LEU	N-CA-C	-5.99	105.28	113.30
3	P	63	LEU	CA-C-N	5.98	125.19	118.97
3	P	63	LEU	C-N-CA	5.98	125.19	118.97
1	A	149	VAL	N-CA-C	-5.94	98.15	106.53
1	A	518	ASP	N-CA-C	-5.93	104.73	111.07
2	B	210	PHE	N-CA-C	5.87	120.95	113.55
1	A	63	GLY	N-CA-C	5.87	118.71	110.38
1	N	149	VAL	N-CA-C	-5.85	98.29	106.53
1	N	52	PRO	N-CA-C	5.81	123.19	113.78
1	A	421	GLY	N-CA-C	-5.80	105.77	112.73
1	N	486	GLY	N-CA-C	5.80	119.65	112.64
1	A	266	GLU	N-CA-C	-5.79	105.32	112.38
1	N	283	PHE	N-CA-C	5.78	119.44	112.38
2	B	102	LEU	CA-C-N	5.78	125.71	119.76
2	B	102	LEU	C-N-CA	5.78	125.71	119.76
1	A	290	VAL	N-CA-C	5.77	116.00	110.74
1	A	119	ARG	N-CA-C	5.77	118.97	109.85
1	A	283	PHE	N-CA-C	5.74	119.38	112.38
2	O	79	GLY	CA-C-N	-5.71	118.24	122.18
2	O	79	GLY	C-N-CA	-5.71	118.24	122.18
1	N	518	ASP	N-CA-C	-5.71	104.96	111.07
2	B	16	ILE	N-CA-C	5.67	116.64	108.48
1	A	486	GLY	N-CA-C	5.64	119.46	112.64
1	A	244	CYS	N-CA-C	-5.62	102.14	110.46
2	B	23	LYS	CA-C-N	5.62	126.86	119.84
2	B	23	LYS	C-N-CA	5.62	126.86	119.84
1	A	292	LYS	CB-CA-C	-5.58	110.12	116.54
1	A	224	THR	N-CA-C	-5.57	106.49	113.28
4	Q	58	TYR	N-CA-C	5.52	120.90	113.72
1	N	113	TYR	N-CA-C	-5.52	106.50	113.18
1	N	148	CYS	N-CA-C	5.48	117.12	108.96
1	N	389	VAL	CA-C-O	5.45	122.17	119.12

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	148	CYS	N-CA-C	5.45	117.07	108.96
1	A	389	VAL	CA-C-O	5.44	122.17	119.12
2	O	210	PHE	N-CA-C	5.39	120.34	113.55
4	D	58	TYR	N-CA-C	5.32	120.63	113.72
1	N	63	GLY	N-CA-C	5.30	117.91	110.38
1	N	119	ARG	N-CA-C	5.29	117.72	109.52
1	A	555	LYS	N-CA-C	5.28	118.98	112.54
2	O	23	LYS	CA-C-N	5.28	126.44	119.84
2	O	23	LYS	C-N-CA	5.28	126.44	119.84
1	N	588	ASP	N-CA-C	-5.27	99.93	108.41
1	N	244	CYS	N-CA-C	-5.21	102.48	110.14
1	N	62	GLY	N-CA-C	5.21	118.54	112.50
1	N	150	ALA	CB-CA-C	-5.19	110.57	116.54
1	A	297	ARG	N-CA-C	5.18	116.92	111.28
3	P	16	ASN	N-CA-C	5.16	116.98	111.36
2	B	244	THR	N-CA-C	5.13	120.39	113.72
1	N	224	THR	N-CA-C	-5.12	107.03	113.28
1	N	347	PHE	N-CA-C	5.08	119.63	113.38
2	B	103	PRO	N-CA-C	5.06	119.03	111.14
1	N	256	GLY	N-CA-C	-5.06	103.49	112.54
1	A	256	GLY	N-CA-C	-5.05	103.50	112.54
1	A	116	PRO	N-CA-C	5.04	119.29	112.48
1	A	44	THR	N-CA-C	5.03	117.59	109.40
1	N	555	LYS	N-CA-C	5.01	118.65	112.54
1	N	116	PRO	N-CA-C	5.01	119.24	112.48

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	172	TYR	Sidechain
3	C	30	TYR	Sidechain
1	N	172	TYR	Sidechain
3	P	30	TYR	Sidechain

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	4726	0	4609	37	0
1	N	4726	0	4609	35	0
2	B	1916	0	1913	11	0
2	O	1916	0	1913	8	0
3	C	1077	0	1112	25	0
3	P	1077	0	1112	21	0
4	D	766	0	761	12	0
4	Q	766	0	761	10	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
5	N	1	0	0	0	0
5	O	1	0	0	0	0
6	A	3	0	0	0	0
6	N	3	0	0	0	0
7	A	53	0	30	3	0
7	N	53	0	30	3	0
8	A	9	0	2	3	0
8	N	9	0	2	1	0
9	A	7	0	0	0	0
9	B	4	0	0	1	0
9	C	16	0	0	0	0
9	D	32	0	0	1	0
9	N	11	0	0	3	0
9	O	4	0	0	2	0
9	P	22	0	0	4	0
9	Q	16	0	0	0	0
10	B	4	0	0	0	0
10	O	4	0	0	0	0
11	B	8	0	0	0	0
11	O	8	0	0	0	0
12	B	7	0	0	0	0
12	O	7	0	0	0	0
13	B	6	0	8	1	0
13	O	6	0	8	1	0
14	C	18	0	24	0	0
14	P	18	0	24	0	0
15	C	41	0	24	0	0
15	P	41	0	24	0	0
16	A	579	0	0	8	0
16	B	296	0	0	4	0
16	C	104	0	0	3	0
16	D	51	0	0	1	0
16	N	569	0	0	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
16	O	281	0	0	0	0
16	P	99	0	0	0	0
16	Q	51	0	0	0	0
All	All	19414	0	16966	157	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 5.

All (157) 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)
9:O:1005:UNL:O1	9:O:1006:UNL:O1	1.69	1.09
1:N:13:PRO:O	9:N:1011:UNL:O1	1.75	1.04
9:B:1005:UNL:O1	9:B:1006:UNL:O1	1.84	0.96
4:Q:91:VAL:HG11	4:Q:99:MET:HE1	1.52	0.92
3:P:101:ASN:HD21	3:P:104:ARG:HH11	1.27	0.82
3:C:3:THR:HG22	3:C:7:GLU:HB2	1.63	0.79
3:P:3:THR:HG22	3:P:7:GLU:HB2	1.63	0.78
3:C:101:ASN:HD21	3:C:104:ARG:HH11	1.29	0.78
1:N:471:ASN:HB3	9:N:1007:UNL:O1	1.84	0.78
4:D:24:LEU:HB2	4:D:25:PRO:HD3	1.68	0.75
16:N:1533:HOH:O	2:O:88:LYS:HE2	1.86	0.75
4:Q:24:LEU:HB2	4:Q:25:PRO:HD3	1.67	0.74
3:C:26:HIS:CD2	3:C:27:ILE:H	2.05	0.74
1:N:205:ARG:NH2	1:N:440:SER:HA	2.02	0.74
1:A:207:LYS:NZ	1:A:436:GLU:OE1	2.21	0.74
1:N:205:ARG:HB3	16:N:1514:HOH:O	1.89	0.72
3:P:26:HIS:CD2	3:P:27:ILE:H	2.07	0.71
9:P:208:UNL:O1	9:P:209:UNL:O1	2.10	0.70
1:A:189:ARG:HD3	1:A:439:PRO:HB2	1.75	0.68
1:N:189:ARG:HD3	1:N:439:PRO:HB2	1.76	0.67
2:O:192:ILE:C	2:O:192:ILE:HD12	2.20	0.67
4:Q:22:GLY:O	4:Q:25:PRO:HD2	1.95	0.66
3:C:70:TYR:O	3:C:73:VAL:HG12	1.95	0.66
3:P:70:TYR:O	3:P:73:VAL:HG12	1.96	0.66
1:N:507:LYS:HE3	16:N:1170:HOH:O	1.95	0.66
2:B:192:ILE:HD12	2:B:192:ILE:C	2.21	0.65
1:N:471:ASN:CB	9:N:1007:UNL:O1	2.45	0.64
1:N:207:LYS:NZ	1:N:436:GLU:OE1	2.31	0.63
4:D:22:GLY:O	4:D:25:PRO:HD2	1.98	0.62
2:O:245:TYR:O	4:Q:4:LYS:NZ	2.32	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:387:LYS:HD3	16:A:2193:HOH:O	1.99	0.61
1:N:205:ARG:HH21	1:N:440:SER:HA	1.65	0.61
2:O:152:LEU:HD23	2:O:192:ILE:HD11	1.83	0.61
4:Q:95:LYS:HG3	4:Q:99:MET:HE2	1.82	0.61
1:N:207:LYS:NZ	1:N:436:GLU:HB2	2.15	0.61
3:P:67:PHE:HB3	3:P:68:PRO:HD3	1.83	0.60
1:A:401:ALA:N	1:A:402:SER:HA	2.16	0.60
3:C:67:PHE:HB3	3:C:68:PRO:HD3	1.84	0.60
4:Q:95:LYS:HG3	4:Q:99:MET:CE	2.31	0.59
2:B:152:LEU:HD23	2:B:192:ILE:HD11	1.84	0.58
1:N:401:ALA:N	1:N:402:SER:HA	2.18	0.58
2:B:245:TYR:O	4:D:4:LYS:NZ	2.36	0.58
1:N:207:LYS:HZ1	1:N:436:GLU:HB2	1.70	0.57
3:C:68:PRO:HA	4:D:99:MET:HE1	1.86	0.56
1:A:507:LYS:HE3	16:A:2733:HOH:O	2.05	0.55
2:O:152:LEU:HD23	2:O:192:ILE:CD1	2.36	0.55
3:C:140:GLU:OXT	4:D:101:TRP:HD1	1.90	0.55
3:C:140:GLU:OXT	4:D:101:TRP:CD1	2.60	0.55
2:B:152:LEU:HD23	2:B:192:ILE:CD1	2.37	0.54
4:D:63:THR:HB	4:D:64:PRO:HD3	1.90	0.54
1:A:169:ASP:HB2	16:A:2502:HOH:O	2.07	0.54
4:Q:63:THR:HB	4:Q:64:PRO:HD3	1.90	0.54
3:P:101:ASN:ND2	3:P:104:ARG:HH11	2.03	0.53
1:A:455:LYS:NZ	16:A:2885:HOH:O	2.41	0.53
1:A:207:LYS:NZ	1:A:436:GLU:HB2	2.25	0.52
3:C:110:MET:HE3	3:C:112:LYS:HD2	1.91	0.52
1:A:60:ALA:HB3	1:A:154:GLY:HA3	1.90	0.52
2:B:104:HIS:O	13:B:1009:GOL:H12	2.11	0.51
3:P:4:THR:OG1	3:P:7:GLU:HG3	2.11	0.51
3:P:110:MET:HE3	3:P:112:LYS:HD2	1.92	0.51
3:C:4:THR:OG1	3:C:7:GLU:HG3	2.10	0.51
1:A:593:LYS:HE3	16:A:2370:HOH:O	2.12	0.50
1:N:381:HIS:O	1:N:597:LYS:NZ	2.44	0.50
3:C:70:TYR:HA	3:C:73:VAL:HG12	1.93	0.50
3:P:70:TYR:HA	3:P:73:VAL:HG12	1.92	0.49
1:A:297:ARG:HH22	8:A:1002:TEO:C3	2.26	0.49
1:N:60:ALA:HB3	1:N:154:GLY:HA3	1.95	0.48
9:P:208:UNL:O1	9:P:209:UNL:O2	2.31	0.48
1:A:220:TYR:CG	1:A:363:VAL:HG21	2.47	0.48
2:O:192:ILE:C	2:O:192:ILE:CD1	2.85	0.48
1:A:381:HIS:O	1:A:597:LYS:NZ	2.47	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:N:496:LEU:HD12	1:N:536:ILE:HG21	1.95	0.47
1:N:574:PRO:HD2	1:N:577:GLU:HB2	1.97	0.47
3:C:3:THR:CG2	3:C:7:GLU:HB2	2.41	0.47
1:N:243:PRO:HB3	1:N:586:TYR:CZ	2.49	0.47
1:A:496:LEU:HD12	1:A:536:ILE:HG21	1.96	0.47
2:B:98:LYS:HE3	16:C:2230:HOH:O	2.15	0.47
2:B:95:LYS:NZ	16:B:2777:HOH:O	2.47	0.47
1:A:263:LEU:HG	1:A:264:ILE:N	2.28	0.47
1:N:263:LEU:HG	1:N:264:ILE:N	2.29	0.47
2:O:104:HIS:O	13:O:1009:GOL:H12	2.14	0.47
3:P:84:ILE:HD13	4:Q:103:ILE:HG22	1.97	0.47
1:N:121:GLU:HG2	16:N:1133:HOH:O	2.15	0.46
2:B:192:ILE:C	2:B:192:ILE:CD1	2.87	0.46
2:B:227:LYS:NZ	16:B:2656:HOH:O	2.45	0.46
4:D:66:LYS:HG3	16:D:2127:HOH:O	2.16	0.46
4:D:79:THR:HG21	9:D:107:UNL:C1	2.46	0.46
1:N:189:ARG:NH1	1:N:440:SER:O	2.38	0.46
1:A:297:ARG:HH22	8:A:1002:TEO:C4	2.30	0.45
1:A:11:GLN:HG3	16:A:2932:HOH:O	2.15	0.45
1:A:243:PRO:HB3	1:A:586:TYR:CZ	2.51	0.45
1:N:326:HIS:HD2	16:N:1422:HOH:O	1.99	0.45
3:C:101:ASN:ND2	3:C:104:ARG:HH11	2.05	0.45
1:N:453:LEU:C	1:N:453:LEU:HD23	2.41	0.45
3:C:70:TYR:O	3:C:73:VAL:CG1	2.64	0.45
1:N:414:LEU:HG	7:N:1001:FAD:C2	2.47	0.45
1:A:574:PRO:HD2	1:A:577:GLU:HB2	1.98	0.45
1:A:381:HIS:ND1	1:A:386:ASP:OD1	2.47	0.45
3:P:70:TYR:O	3:P:73:VAL:CG1	2.65	0.45
1:A:453:LEU:C	1:A:453:LEU:HD23	2.42	0.44
1:A:60:ALA:HA	7:A:1001:FAD:C5X	2.48	0.44
1:A:470:LEU:HD11	1:A:474:LYS:HE3	2.00	0.44
1:N:381:HIS:ND1	1:N:386:ASP:OD1	2.46	0.44
4:Q:22:GLY:C	4:Q:25:PRO:HD2	2.42	0.44
1:A:181:LEU:HD21	1:A:211:ILE:HD11	2.00	0.44
3:P:80:SER:HA	3:P:81:PRO:HD3	1.81	0.44
3:P:101:ASN:HD21	3:P:104:ARG:NH1	2.06	0.44
1:N:87:SER:HB2	1:N:405:GLY:HA3	1.98	0.44
1:A:340:ILE:C	1:A:340:ILE:HD12	2.43	0.43
1:N:60:ALA:HA	7:N:1001:FAD:C6	2.48	0.43
3:C:26:HIS:CG	3:C:27:ILE:H	2.37	0.43
1:N:60:ALA:HA	7:N:1001:FAD:C5X	2.47	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:N:507:LYS:HE2	1:N:509:PHE:CZ	2.53	0.43
9:O:1006:UNL:O1	9:P:208:UNL:O1	2.36	0.43
3:P:70:TYR:C	3:P:73:VAL:HG12	2.44	0.43
16:B:2845:HOH:O	4:D:4:LYS:CE	2.67	0.43
3:P:107:VAL:HA	3:P:110:MET:HE2	2.00	0.43
3:P:3:THR:CG2	3:P:7:GLU:HB2	2.41	0.43
3:C:11:ARG:HD2	16:C:2556:HOH:O	2.18	0.43
3:C:63:LEU:HA	3:C:64:PRO:HD3	1.86	0.43
1:A:326:HIS:HE1	16:A:2021:HOH:O	2.01	0.42
1:N:297:ARG:HH22	8:N:1002:TEO:C3	2.32	0.42
3:P:140:GLU:HG3	3:P:140:GLU:OXT	2.19	0.42
3:C:131:LEU:HD23	3:C:131:LEU:HA	1.90	0.42
3:C:140:GLU:OXT	3:C:140:GLU:HG3	2.19	0.42
4:D:22:GLY:C	4:D:25:PRO:HD2	2.43	0.42
1:N:170:THR:HB	1:N:172:TYR:CE1	2.54	0.42
3:C:70:TYR:C	3:C:73:VAL:HG12	2.43	0.42
3:P:47:VAL:O	3:P:51:LEU:HG	2.20	0.42
1:A:207:LYS:HZ2	1:A:436:GLU:HB2	1.84	0.42
1:A:87:SER:HB2	1:A:405:GLY:HA3	2.01	0.42
1:A:507:LYS:HE2	1:A:509:PHE:CZ	2.54	0.42
1:N:289:PRO:HD2	16:N:1215:HOH:O	2.19	0.42
3:C:34:LEU:HB3	3:C:35:PRO:HD3	2.01	0.42
1:N:326:HIS:HE1	16:N:1226:HOH:O	2.03	0.42
1:N:340:ILE:C	1:N:340:ILE:HD12	2.45	0.42
3:C:101:ASN:ND2	3:C:104:ARG:HD3	2.35	0.41
1:N:470:LEU:HD11	1:N:474:LYS:HE3	2.02	0.41
1:A:60:ALA:HA	7:A:1001:FAD:C6	2.49	0.41
1:A:170:THR:HB	1:A:172:TYR:CE1	2.54	0.41
3:C:47:VAL:O	3:C:51:LEU:HG	2.19	0.41
3:P:40:ILE:CG2	9:P:209:UNL:O2	2.69	0.41
2:B:102:LEU:HA	2:B:103:PRO:HD3	1.86	0.41
2:B:150:GLN:HG2	16:B:2054:HOH:O	2.19	0.41
3:C:76:SER:HB3	16:C:2741:HOH:O	2.20	0.41
1:N:181:LEU:HD21	1:N:211:ILE:HD11	2.03	0.41
4:Q:91:VAL:CG1	4:Q:99:MET:HE1	2.37	0.41
1:A:354:LYS:NZ	16:A:2177:HOH:O	2.52	0.41
1:A:462:THR:O	1:A:462:THR:CG2	2.68	0.41
3:C:107:VAL:HA	3:C:110:MET:HE2	2.01	0.40
4:D:30:TYR:N	4:D:31:PRO:HD3	2.37	0.40
1:A:18:GLU:CD	1:A:205:ARG:NH2	2.80	0.40
3:P:101:ASN:ND2	3:P:104:ARG:HD3	2.36	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:253:HIS:O	1:A:361:PRO:HA	2.21	0.40
1:A:414:LEU:HG	7:A:1001:FAD:C2	2.52	0.40
2:O:176:ASP:HB3	3:P:13:TRP:CZ2	2.57	0.40
1:A:297:ARG:HH22	8:A:1002:TEO:C2	2.35	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	610/621 (98%)	591 (97%)	19 (3%)	0	100	100
1	N	610/621 (98%)	591 (97%)	19 (3%)	0	100	100
2	B	237/252 (94%)	231 (98%)	5 (2%)	1 (0%)	30	16
2	O	237/252 (94%)	232 (98%)	4 (2%)	1 (0%)	30	16
3	C	137/140 (98%)	136 (99%)	1 (1%)	0	100	100
3	P	137/140 (98%)	136 (99%)	1 (1%)	0	100	100
4	D	99/103 (96%)	98 (99%)	1 (1%)	0	100	100
4	Q	99/103 (96%)	98 (99%)	1 (1%)	0	100	100
All	All	2166/2232 (97%)	2113 (98%)	51 (2%)	2 (0%)	48	34

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	66	ARG
2	O	66	ARG

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	497/506 (98%)	492 (99%)	5 (1%)	68	54
1	N	497/506 (98%)	492 (99%)	5 (1%)	68	54
2	B	214/219 (98%)	211 (99%)	3 (1%)	59	41
2	O	214/219 (98%)	210 (98%)	4 (2%)	50	28
3	C	118/119 (99%)	117 (99%)	1 (1%)	73	64
3	P	118/119 (99%)	118 (100%)	0	100	100
4	D	78/79 (99%)	77 (99%)	1 (1%)	61	43
4	Q	78/79 (99%)	77 (99%)	1 (1%)	61	43
All	All	1814/1846 (98%)	1794 (99%)	20 (1%)	65	50

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	48	THR
1	A	72	GLU
1	A	73	ASP
1	A	130	PHE
1	A	462	THR
2	B	66	ARG
2	B	67	GLU
2	B	217	THR
3	C	20	SER
4	D	14	ARG
1	N	48	THR
1	N	72	GLU
1	N	73	ASP
1	N	130	PHE
1	N	462	THR
2	O	66	ARG
2	O	67	GLU
2	O	217	THR
2	O	224	THR

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Mol	Chain	Res	Type
4	Q	14	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (21) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	326	HIS
1	A	452	ASN
1	A	526	GLN
2	B	121	GLN
2	B	137	GLN
2	B	144	GLN
3	C	26	HIS
3	C	66	GLN
3	C	101	ASN
4	D	9	HIS
4	D	69	ASN
1	N	326	HIS
1	N	452	ASN
1	N	526	GLN
2	O	121	GLN
2	O	137	GLN
2	O	144	GLN
3	P	26	HIS
3	P	66	GLN
3	P	101	ASN
4	Q	69	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 86 ligands modelled in this entry, 4 are monoatomic and 64 are unknown - leaving 18 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
13	GOL	B	1009	-	5,5,5	1.20	0	5,5,5	0.54	0
10	FES	B	1002	2	0,4,4	-	-	-	-	-
12	F3S	O	1004	2	0,9,9	-	-	-	-	-
14	BHG	C	141	-	18,18,18	1.80	4 (22%)	23,23,23	0.80	1 (4%)
6	AZI	A	623	-	2,2,2	3.36	2 (100%)	0,1,1	-	-
7	FAD	N	1001	1	58,58,58	2.48	17 (29%)	85,89,89	1.76	21 (24%)
6	AZI	N	623	-	2,2,2	3.23	2 (100%)	0,1,1	-	-
8	TEO	A	1002	-	5,8,8	3.29	2 (40%)	4,10,10	3.41	2 (50%)
7	FAD	A	1001	1	58,58,58	2.34	18 (31%)	85,89,89	1.81	22 (25%)
8	TEO	N	1002	-	5,8,8	3.50	3 (60%)	4,10,10	3.71	3 (75%)
15	HEM	C	142	3,4	48,48,50	1.53	9 (18%)	66,80,82	1.47	12 (18%)
10	FES	O	1002	2	0,4,4	-	-	-	-	-
11	SF4	O	1003	2	0,12,12	-	-	-	-	-
12	F3S	B	1004	2	0,9,9	-	-	-	-	-
13	GOL	O	1009	-	5,5,5	1.23	0	5,5,5	0.70	0
14	BHG	P	205	-	18,18,18	1.39	2 (11%)	23,23,23	0.65	0
11	SF4	B	1003	2	0,12,12	-	-	-	-	-
15	HEM	P	201	3,4	48,48,50	1.44	7 (14%)	66,80,82	1.46	13 (19%)

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
14	BHG	C	141	-	1/1/5/5	1/9/29/29	0/1/1/1
13	GOL	B	1009	-	-	2/4/4/4	-
10	FES	B	1002	2	-	-	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
12	F3S	O	1004	2	-	-	0/3/3/3
7	FAD	N	1001	1	-	8/34/50/50	0/6/6/6
7	FAD	A	1001	1	-	9/34/50/50	0/6/6/6
8	TEO	N	1002	-	1/1/3/4	4/6/8/8	-
8	TEO	A	1002	-	1/1/3/4	4/6/8/8	-
15	HEM	C	142	3,4	-	5/10/50/54	-
10	FES	O	1002	2	-	-	0/1/1/1
11	SF4	O	1003	2	-	-	0/6/5/5
12	F3S	B	1004	2	-	-	0/3/3/3
13	GOL	O	1009	-	-	4/4/4/4	-
14	BHG	P	205	-	1/1/5/5	1/9/29/29	0/1/1/1
11	SF4	B	1003	2	-	-	0/6/5/5
15	HEM	P	201	3,4	-	5/10/50/54	-

All (66) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	A	1001	FAD	PA-O3P	-10.08	1.48	1.59
7	N	1001	FAD	PA-O3P	-9.71	1.49	1.59
7	N	1001	FAD	P-O3P	6.71	1.66	1.59
8	A	1002	TEO	C2-C1	6.27	1.66	1.54
8	N	1002	TEO	C2-C1	6.17	1.66	1.54
7	A	1001	FAD	C4X-N5	5.03	1.41	1.30
14	C	141	BHG	O1-C1	4.89	1.48	1.40
7	N	1001	FAD	C2A-N1A	4.72	1.42	1.33
15	C	142	HEM	CAB-C3B	-4.21	1.42	1.50
15	P	201	HEM	CAB-C3B	-4.14	1.42	1.50
7	N	1001	FAD	C4X-N5	4.11	1.39	1.30
7	A	1001	FAD	C1'-C2'	4.09	1.58	1.52
7	N	1001	FAD	C2A-N3A	4.08	1.41	1.33
14	P	205	BHG	O1-C1	3.91	1.46	1.40
7	N	1001	FAD	C1'-C2'	3.85	1.58	1.52
6	A	623	AZI	N1-N2	-3.73	1.15	1.23
6	N	623	AZI	N1-N2	-3.65	1.15	1.23
8	N	1002	TEO	O2-C2	-3.55	1.38	1.43
8	A	1002	TEO	C3-C4	3.51	1.49	1.33
7	A	1001	FAD	P-O3P	3.47	1.63	1.59
7	A	1001	FAD	PA-O2A	-3.43	1.39	1.55
7	A	1001	FAD	C10-N1	3.40	1.40	1.33
7	A	1001	FAD	C4'-C3'	3.35	1.59	1.53
7	N	1001	FAD	C10-N1	3.33	1.40	1.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	A	1001	FAD	C6-C7	3.33	1.44	1.39
7	N	1001	FAD	C4'-C3'	3.30	1.59	1.53
7	N	1001	FAD	PA-O1A	-3.26	1.39	1.50
15	C	142	HEM	C1A-NA	3.18	1.45	1.39
7	A	1001	FAD	C9A-C5X	3.16	1.46	1.41
7	A	1001	FAD	PA-O1A	-3.14	1.39	1.50
15	C	142	HEM	FE-ND	3.10	2.04	1.94
7	N	1001	FAD	PA-O2A	-3.02	1.41	1.55
14	C	141	BHG	O5-C1	3.01	1.49	1.41
6	A	623	AZI	N3-N2	-2.95	1.17	1.23
7	N	1001	FAD	O2'-C2'	2.94	1.49	1.43
7	A	1001	FAD	C10-N10	2.93	1.43	1.37
7	A	1001	FAD	O2'-C2'	2.87	1.49	1.43
7	N	1001	FAD	C2B-C3B	2.82	1.61	1.53
15	P	201	HEM	CAA-C2A	2.81	1.58	1.51
15	P	201	HEM	CAC-C3C	-2.77	1.45	1.50
6	N	623	AZI	N3-N2	-2.75	1.17	1.23
15	C	142	HEM	FE-NA	-2.65	1.86	1.95
8	N	1002	TEO	C3-C4	2.63	1.45	1.33
7	A	1001	FAD	C2'-C3'	-2.62	1.48	1.53
7	N	1001	FAD	C9A-C5X	2.60	1.45	1.41
7	N	1001	FAD	C2-N3	2.58	1.44	1.39
14	P	205	BHG	C4-C5	2.49	1.58	1.53
14	C	141	BHG	C4-C5	2.46	1.58	1.53
15	C	142	HEM	C1B-C2B	2.46	1.49	1.44
15	C	142	HEM	FE-NC	2.41	2.03	1.95
14	C	141	BHG	C3-C2	2.39	1.58	1.52
7	A	1001	FAD	PA-O5B	-2.38	1.50	1.59
7	N	1001	FAD	C5A-N7A	-2.37	1.34	1.39
15	P	201	HEM	CMC-C2C	2.36	1.55	1.50
15	C	142	HEM	CMC-C2C	2.31	1.55	1.50
7	A	1001	FAD	C2A-N3A	2.28	1.38	1.33
7	N	1001	FAD	C6-C7	2.27	1.42	1.39
15	C	142	HEM	C4B-NB	2.26	1.43	1.38
7	A	1001	FAD	C7M-C7	2.23	1.55	1.51
15	P	201	HEM	CMB-C2B	2.18	1.55	1.50
7	A	1001	FAD	C2A-N1A	2.16	1.37	1.33
7	N	1001	FAD	PA-O5B	-2.16	1.50	1.59
15	P	201	HEM	FE-ND	2.10	2.01	1.94
15	P	201	HEM	C2A-C3A	-2.06	1.33	1.38
15	C	142	HEM	CAA-C2A	2.05	1.56	1.51
7	A	1001	FAD	C2B-C3B	2.05	1.58	1.53

All (74) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	N	1001	FAD	N3A-C2A-N1A	-6.58	118.62	128.58
7	A	1001	FAD	N3A-C2A-N1A	-6.44	118.84	128.58
8	N	1002	TEO	O1B-C1-O1A	5.97	137.63	124.08
8	A	1002	TEO	O1B-C1-O1A	5.41	136.35	124.08
7	N	1001	FAD	C4'-C3'-C2'	-4.13	106.69	113.57
7	A	1001	FAD	C4'-C3'-C2'	-4.01	106.89	113.57
7	A	1001	FAD	C2A-N3A-C4A	3.92	121.40	111.83
7	A	1001	FAD	C4-C4X-N5	3.82	123.49	118.21
7	N	1001	FAD	C4-C4X-N5	3.75	123.39	118.21
7	N	1001	FAD	C4A-N9A-C8A	3.71	109.63	105.74
7	A	1001	FAD	C4A-N9A-C8A	3.68	109.60	105.74
15	P	201	HEM	CHC-C1C-NC	-3.68	120.45	124.45
15	C	142	HEM	C4A-NA-C1A	-3.49	100.14	105.82
8	A	1002	TEO	O1A-C1-C2	-3.36	114.46	122.52
15	P	201	HEM	C4A-NA-C1A	-3.34	100.37	105.82
15	C	142	HEM	CHC-C1C-NC	-3.29	120.87	124.45
8	N	1002	TEO	O1A-C1-C2	-3.22	114.80	122.52
7	N	1001	FAD	C2A-N3A-C4A	3.21	119.68	111.83
7	A	1001	FAD	N3A-C4A-N9A	3.08	132.41	127.17
15	P	201	HEM	C4C-NC-C1C	-3.03	100.88	105.82
15	C	142	HEM	CAD-C3D-C4D	2.99	129.91	124.70
15	P	201	HEM	CAD-C3D-C4D	2.89	129.74	124.70
7	A	1001	FAD	C5A-C4A-N3A	-2.89	122.74	126.72
7	N	1001	FAD	N3A-C4A-N9A	2.85	132.02	127.17
15	C	142	HEM	C4C-NC-C1C	-2.83	101.21	105.82
7	N	1001	FAD	C9A-C5X-N5	-2.76	119.53	122.45
15	P	201	HEM	CMA-C3A-C4A	2.75	129.60	125.42
7	A	1001	FAD	O2P-P-O3P	2.74	114.69	107.27
7	A	1001	FAD	O5'-C5'-C4'	2.74	116.68	109.36
7	N	1001	FAD	O3'-C3'-C2'	-2.68	102.84	108.93
7	A	1001	FAD	C9A-C5X-N5	-2.65	119.64	122.45
7	A	1001	FAD	O2'-C2'-C3'	-2.65	103.05	109.25
7	N	1001	FAD	O2'-C2'-C3'	-2.64	103.07	109.25
7	N	1001	FAD	C9A-N10-C10	2.64	124.77	120.75
15	P	201	HEM	C3C-C4C-NC	2.63	114.50	109.64
7	A	1001	FAD	C5X-N5-C4X	2.63	122.34	118.09
7	N	1001	FAD	O5'-C5'-C4'	2.60	116.31	109.36
7	A	1001	FAD	C4X-C4-N3	2.60	119.86	113.25
15	C	142	HEM	C3C-C4C-NC	2.59	114.44	109.64
15	C	142	HEM	CAD-C3D-C2D	-2.59	123.02	127.87
7	N	1001	FAD	N9A-C8A-N7A	-2.57	110.29	113.94
7	A	1001	FAD	N9A-C8A-N7A	-2.57	110.29	113.94

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	N	1001	FAD	C4X-C4-N3	2.43	119.44	113.25
15	P	201	HEM	CAD-C3D-C2D	-2.41	123.35	127.87
7	A	1001	FAD	C9A-N10-C10	2.40	124.41	120.75
7	A	1001	FAD	O3'-C3'-C2'	-2.38	103.52	108.93
15	C	142	HEM	CMA-C3A-C4A	2.37	129.03	125.42
8	N	1002	TEO	O1B-C1-C2	-2.37	107.47	113.00
7	A	1001	FAD	C10-C4X-N5	-2.35	120.02	124.81
7	A	1001	FAD	C8M-C8-C9	-2.34	115.45	119.57
14	C	141	BHG	C1'-O1-C1	2.32	117.65	113.68
7	N	1001	FAD	O3P-P-O1P	-2.32	103.72	110.70
15	C	142	HEM	C3D-C4D-ND	-2.31	107.64	110.17
7	A	1001	FAD	C4A-N9A-C1B	-2.26	121.36	126.63
15	C	142	HEM	C4A-CHB-C1B	-2.23	121.01	126.25
15	P	201	HEM	C3D-C4D-ND	-2.22	107.74	110.17
15	P	201	HEM	C2A-C1A-NA	2.22	112.61	110.15
7	A	1001	FAD	C10-N1-C2	2.20	121.61	116.85
15	P	201	HEM	C1C-CHC-C4B	2.20	130.69	126.02
7	N	1001	FAD	C10-C4X-N5	-2.18	120.35	124.81
7	N	1001	FAD	C4A-N9A-C1B	-2.17	121.55	126.63
7	N	1001	FAD	C5X-N5-C4X	2.17	121.60	118.09
7	N	1001	FAD	O2A-PA-O1A	2.14	122.39	112.44
15	C	142	HEM	CHD-C4C-NC	-2.13	122.13	124.45
15	C	142	HEM	C3A-C4A-NA	2.10	113.51	110.14
7	A	1001	FAD	O2A-PA-O1A	2.10	122.20	112.44
15	C	142	HEM	C2A-C1A-NA	2.10	112.48	110.15
7	N	1001	FAD	C5A-C4A-N3A	-2.08	123.85	126.72
15	P	201	HEM	C2C-C1C-NC	2.08	113.48	109.64
15	P	201	HEM	CAC-C3C-C2C	2.05	131.01	126.75
15	P	201	HEM	C4C-C3C-C2C	-2.05	104.86	107.22
7	N	1001	FAD	O2P-P-O3P	2.05	112.80	107.27
7	N	1001	FAD	C8M-C8-C9	-2.03	115.99	119.57
7	A	1001	FAD	O3P-P-O1P	-2.01	104.67	110.70

All (4) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
8	A	1002	TEO	C2
8	N	1002	TEO	C2
14	C	141	BHG	C4
14	P	205	BHG	C4

All (43) torsion outliers are listed below:

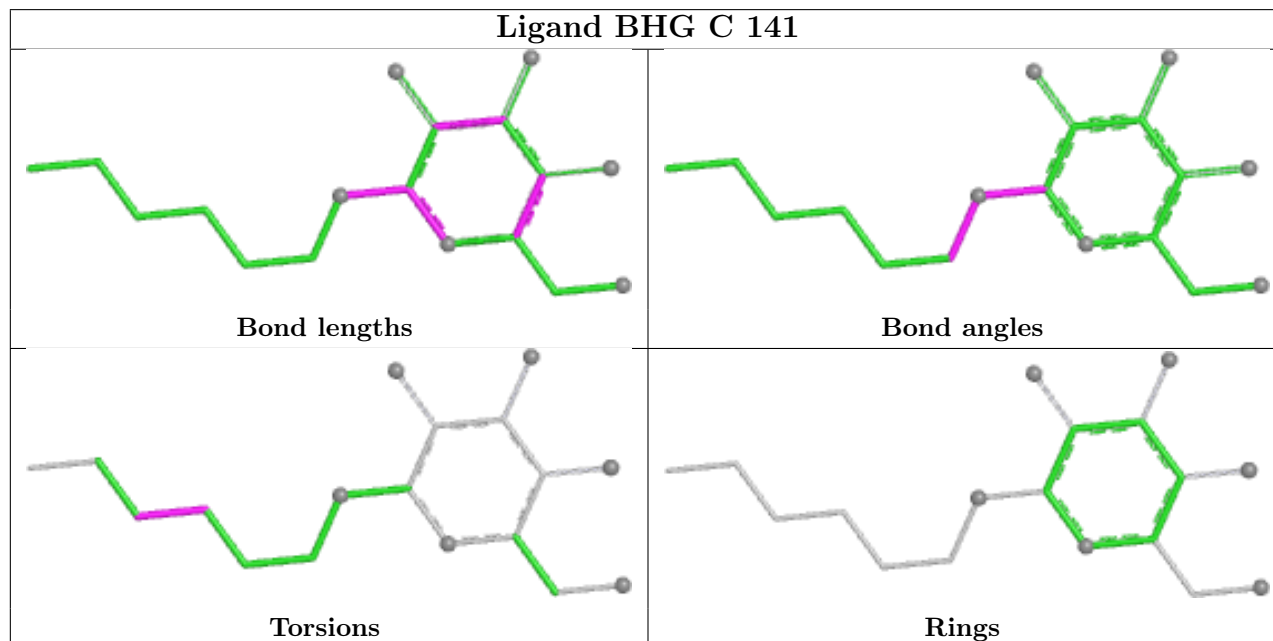
Mol	Chain	Res	Type	Atoms
7	A	1001	FAD	N10-C1'-C2'-O2'
7	A	1001	FAD	O4'-C4'-C5'-O5'
7	A	1001	FAD	C5'-O5'-P-O2P
7	A	1001	FAD	C5'-O5'-P-O3P
7	N	1001	FAD	N10-C1'-C2'-O2'
7	N	1001	FAD	N10-C1'-C2'-C3'
7	N	1001	FAD	O4'-C4'-C5'-O5'
7	N	1001	FAD	C5'-O5'-P-O2P
7	N	1001	FAD	C5'-O5'-P-O3P
8	A	1002	TEO	O1A-C1-C2-O2
8	A	1002	TEO	C1-C2-C3-C4
8	A	1002	TEO	O2-C2-C3-C4
8	N	1002	TEO	C1-C2-C3-C4
8	N	1002	TEO	O2-C2-C3-C4
8	A	1002	TEO	O1B-C1-C2-O2
8	N	1002	TEO	O1A-C1-C2-O2
8	N	1002	TEO	O1B-C1-C2-O2
13	B	1009	GOL	C1-C2-C3-O3
13	O	1009	GOL	O1-C1-C2-C3
13	O	1009	GOL	C1-C2-C3-O3
13	O	1009	GOL	O2-C2-C3-O3
14	P	205	BHG	C3'-C4'-C5'-C6'
7	A	1001	FAD	PA-O3P-P-O5'
7	N	1001	FAD	PA-O3P-P-O5'
13	B	1009	GOL	O2-C2-C3-O3
7	A	1001	FAD	N10-C1'-C2'-C3'
7	A	1001	FAD	C5'-O5'-P-O1P
7	A	1001	FAD	C3'-C4'-C5'-O5'
15	P	201	HEM	C2A-CAA-CBA-CGA
15	C	142	HEM	C2A-CAA-CBA-CGA
15	C	142	HEM	CAD-CBD-CGD-O2D
15	P	201	HEM	CAD-CBD-CGD-O2D
15	C	142	HEM	CAA-CBA-CGA-O2A
14	C	141	BHG	C2'-C3'-C4'-C5'
13	O	1009	GOL	O1-C1-C2-O2
15	C	142	HEM	CAD-CBD-CGD-O1D
15	P	201	HEM	CAA-CBA-CGA-O2A
15	P	201	HEM	CAD-CBD-CGD-O1D
15	C	142	HEM	CAA-CBA-CGA-O1A
15	P	201	HEM	CAA-CBA-CGA-O1A
7	A	1001	FAD	PA-O3P-P-O2P
7	N	1001	FAD	PA-O3P-P-O2P
7	N	1001	FAD	P-O3P-PA-O1A

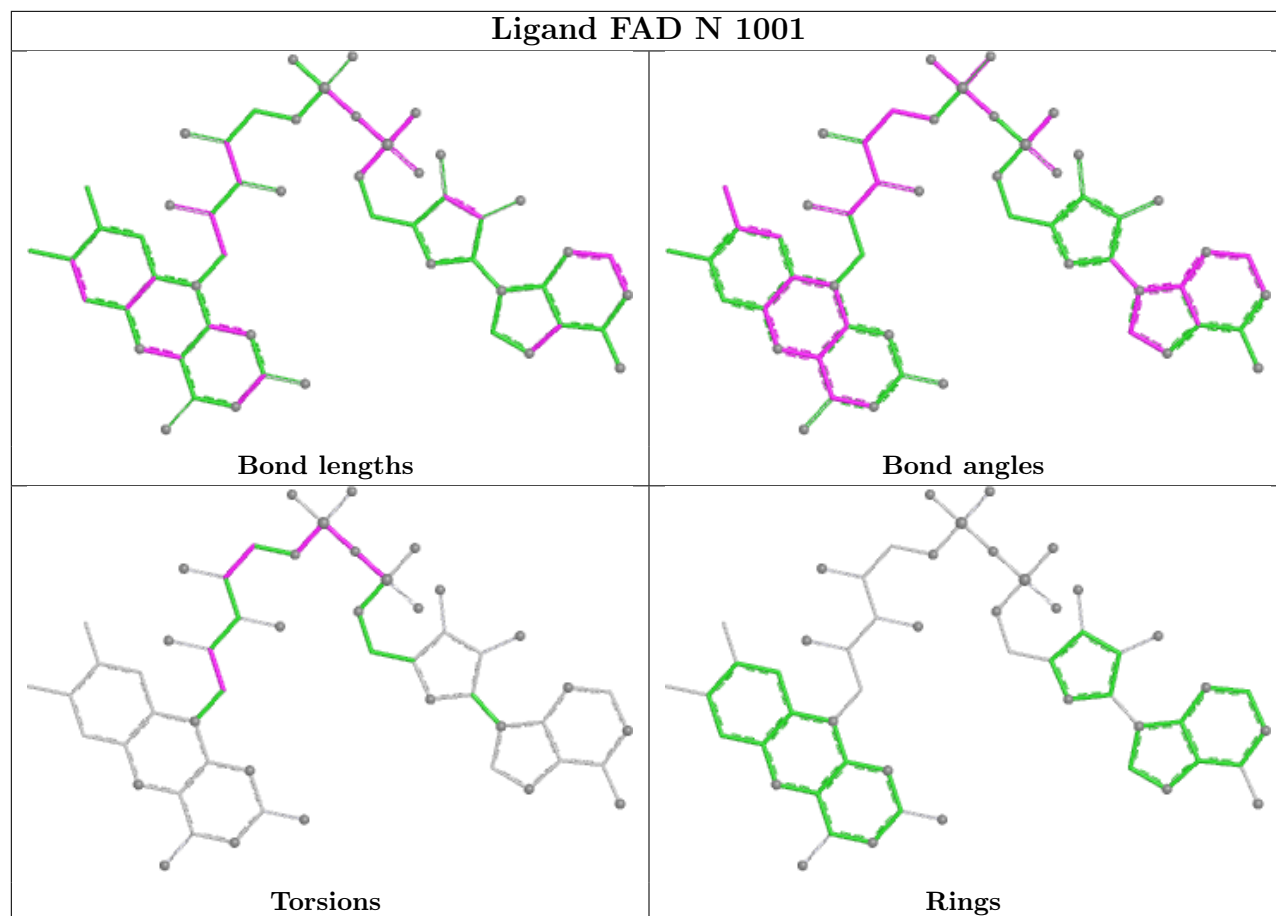
There are no ring outliers.

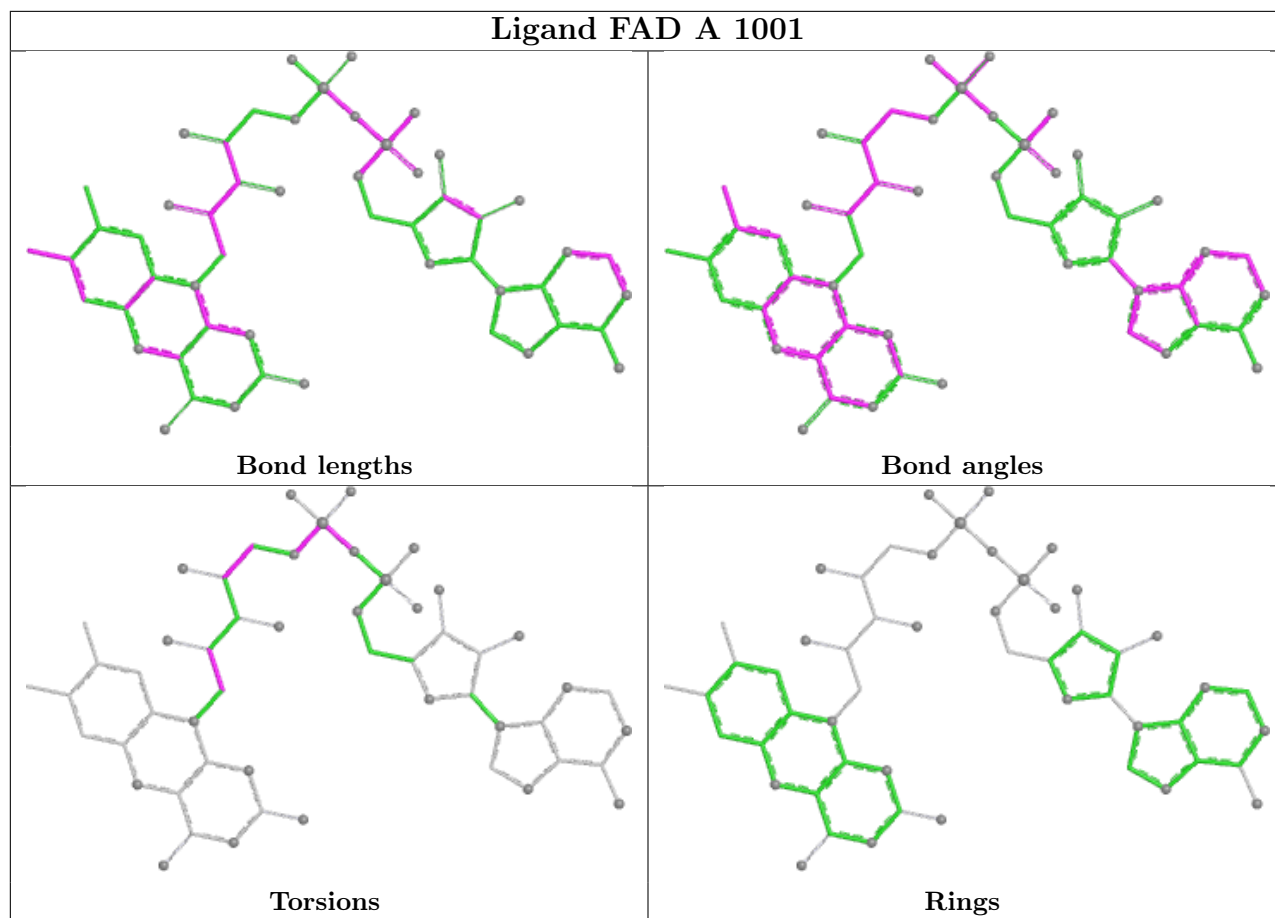
6 monomers are involved in 12 short contacts:

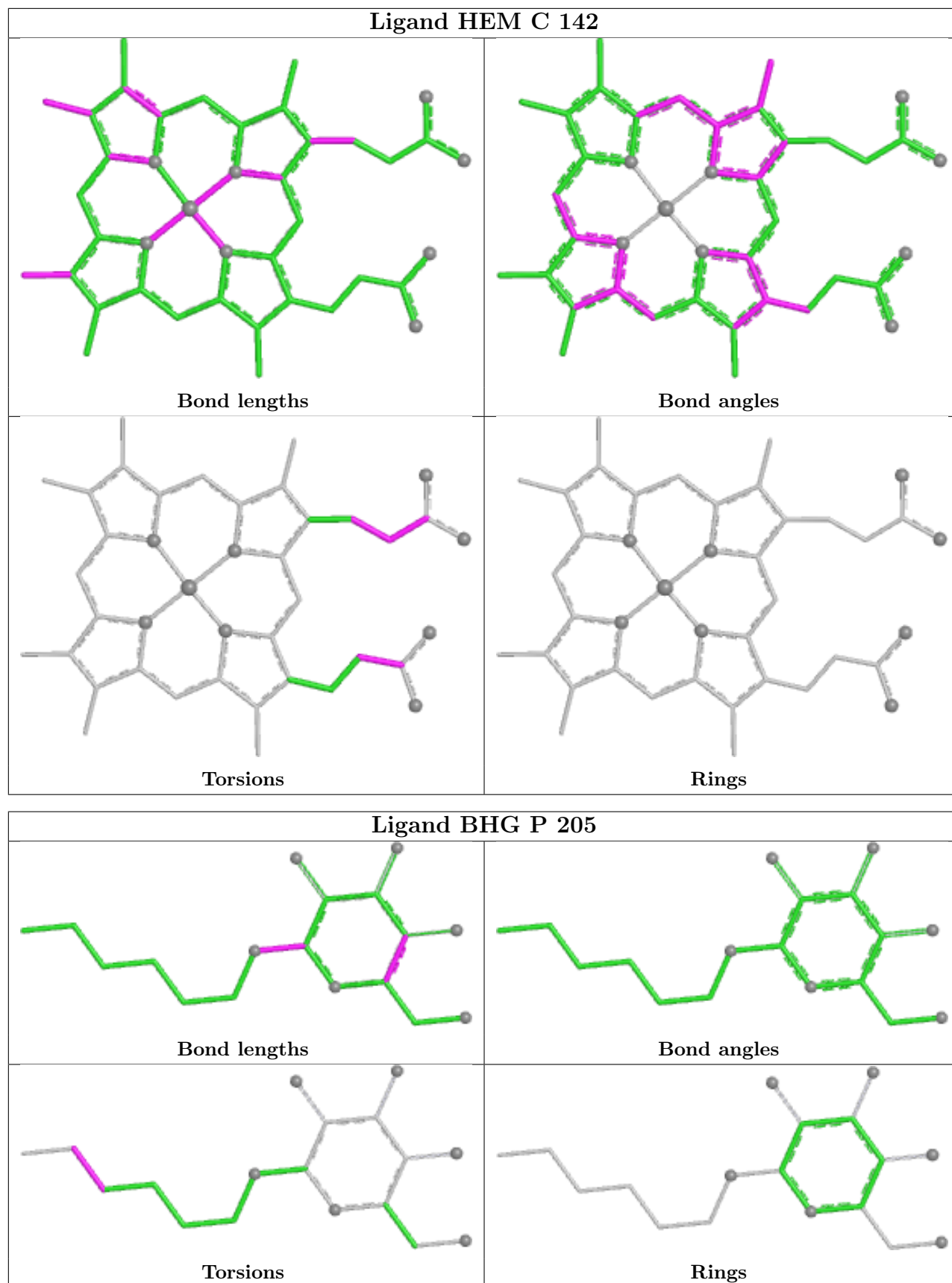
Mol	Chain	Res	Type	Clashes	Symm-Clashes
13	B	1009	GOL	1	0
7	N	1001	FAD	3	0
8	A	1002	TEO	3	0
7	A	1001	FAD	3	0
8	N	1002	TEO	1	0
13	O	1009	GOL	1	0

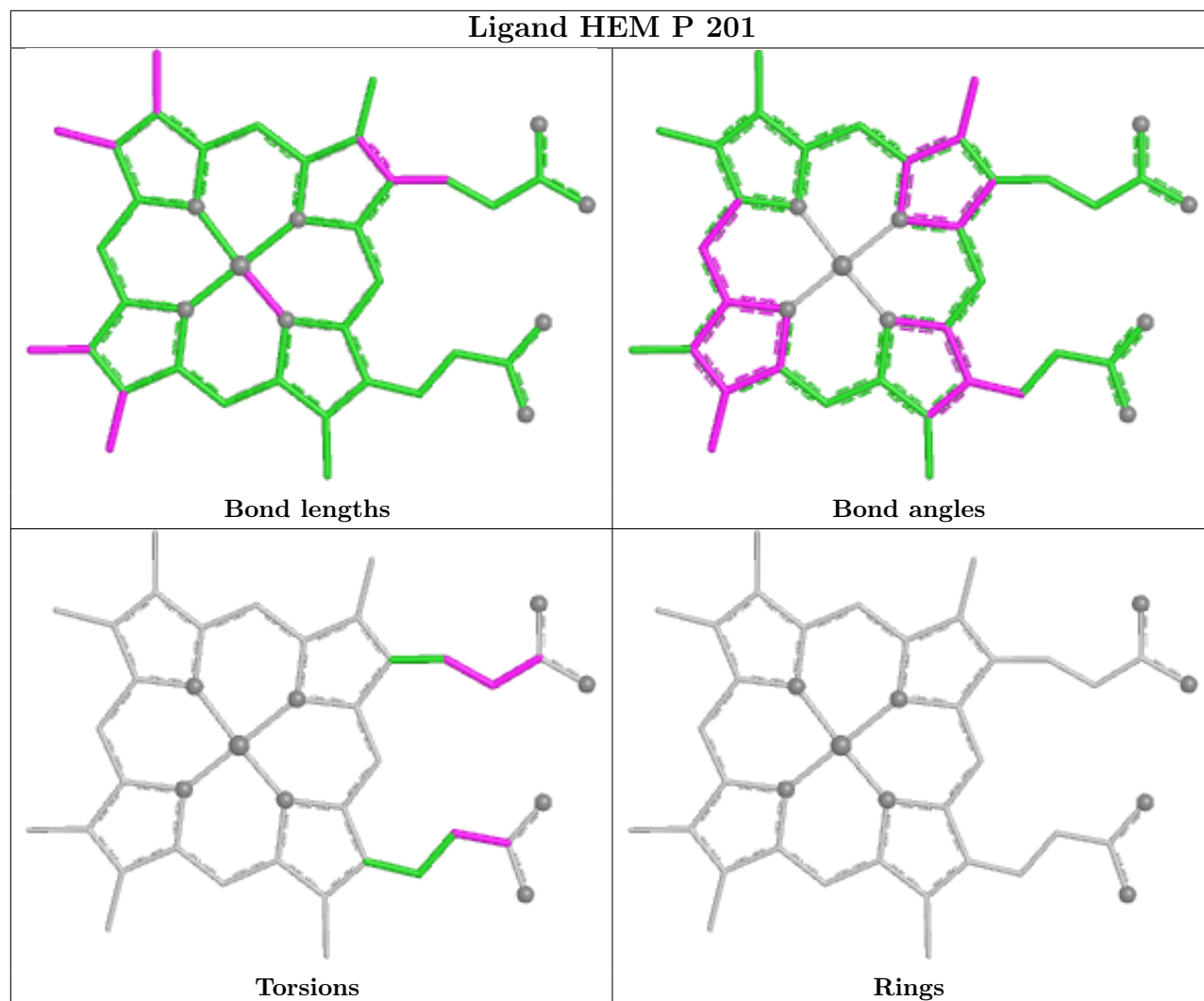
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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











5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [\(i\)](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	612/621 (98%)	-1.26	0 100 100	14, 23, 45, 74	0
1	N	612/621 (98%)	-1.30	0 100 100	12, 22, 43, 69	0
2	B	239/252 (94%)	-1.32	0 100 100	15, 24, 41, 70	0
2	O	239/252 (94%)	-1.36	0 100 100	14, 23, 37, 69	0
3	C	139/140 (99%)	-1.04	0 100 100	21, 35, 50, 61	0
3	P	139/140 (99%)	-0.89	0 100 100	21, 37, 81, 92	0
4	D	101/103 (98%)	-0.87	0 100 100	26, 42, 58, 66	0
4	Q	101/103 (98%)	-0.75	0 100 100	27, 47, 69, 79	0
All	All	2182/2232 (97%)	-1.21	0 100 100	12, 25, 54, 92	0

There are no RSRZ outliers to report.

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [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(\AA^2)	Q<0.9
9	UNL	A	1006	1/-	0.94	0.09	63,63,63,63	0
9	UNL	A	1008	1/-	0.94	0.07	64,64,64,64	0
9	UNL	P	217	1/-	0.94	0.06	113,113,113,113	0
9	UNL	C	149	1/-	0.95	0.12	81,81,81,81	0
9	UNL	D	254	1/-	0.95	0.07	67,67,67,67	0
9	UNL	B	1008	1/-	0.95	0.06	69,69,69,69	0
9	UNL	Q	256	1/-	0.95	0.07	84,84,84,84	0
9	UNL	C	237	1/-	0.96	0.06	66,66,66,66	0
9	UNL	D	253	1/-	0.96	0.10	72,72,72,72	0
9	UNL	A	1004	1/-	0.96	0.06	61,61,61,61	0
9	UNL	N	1006	1/-	0.96	0.13	54,54,54,54	0
9	UNL	N	1008	1/-	0.96	0.09	65,65,65,65	0
6	AZI	A	623	3/3	0.96	0.07	62,62,63,64	0
9	UNL	A	1007	2/-	0.96	0.09	65,65,65,66	0
9	UNL	D	251	1/-	0.97	0.06	73,73,73,73	0
9	UNL	D	252	1/-	0.97	0.05	73,73,73,73	0
9	UNL	C	146	4/-	0.97	0.10	108,109,109,109	0
9	UNL	C	148	1/-	0.97	0.07	56,56,56,56	0
9	UNL	N	1003	2/-	0.97	0.07	114,114,114,114	0
9	UNL	N	1004	1/-	0.97	0.11	60,60,60,60	0
9	UNL	N	1005	1/-	0.97	0.07	76,76,76,76	0
9	UNL	B	1007	1/-	0.97	0.10	61,61,61,61	0
6	AZI	N	623	3/3	0.97	0.07	68,68,70,71	0
9	UNL	O	1006	1/-	0.97	0.07	54,54,54,54	0
9	UNL	O	1007	1/-	0.97	0.10	59,59,59,59	0
9	UNL	D	119	1/-	0.97	0.07	63,63,63,63	0
9	UNL	P	230	1/-	0.97	0.10	69,69,69,69	0
9	UNL	P	240	1/-	0.97	0.06	56,56,56,56	0
9	UNL	Q	219	1/-	0.97	0.13	60,60,60,60	0
9	UNL	Q	228	1/-	0.97	0.05	64,64,64,64	0
9	UNL	D	250	1/-	0.97	0.07	73,73,73,73	0
14	BHG	C	141	18/18	0.97	0.07	48,70,75,75	0
9	UNL	N	1007	1/-	0.98	0.10	44,44,44,44	0
9	UNL	D	249	1/-	0.98	0.11	72,72,72,72	0
9	UNL	N	1009	1/-	0.98	0.06	54,54,54,54	0
9	UNL	N	1010	1/-	0.98	0.08	60,60,60,60	0
9	UNL	N	1011	1/-	0.98	0.07	37,37,37,37	0
9	UNL	N	1012	1/-	0.98	0.06	53,53,53,53	0
9	UNL	A	1005	1/-	0.98	0.07	63,63,63,63	0
9	UNL	A	1003	1/-	0.98	0.09	69,69,69,69	0
9	UNL	O	1008	1/-	0.98	0.07	63,63,63,63	0
9	UNL	P	208	1/-	0.98	0.06	44,44,44,44	0
9	UNL	P	209	2/-	0.98	0.06	49,49,49,49	0

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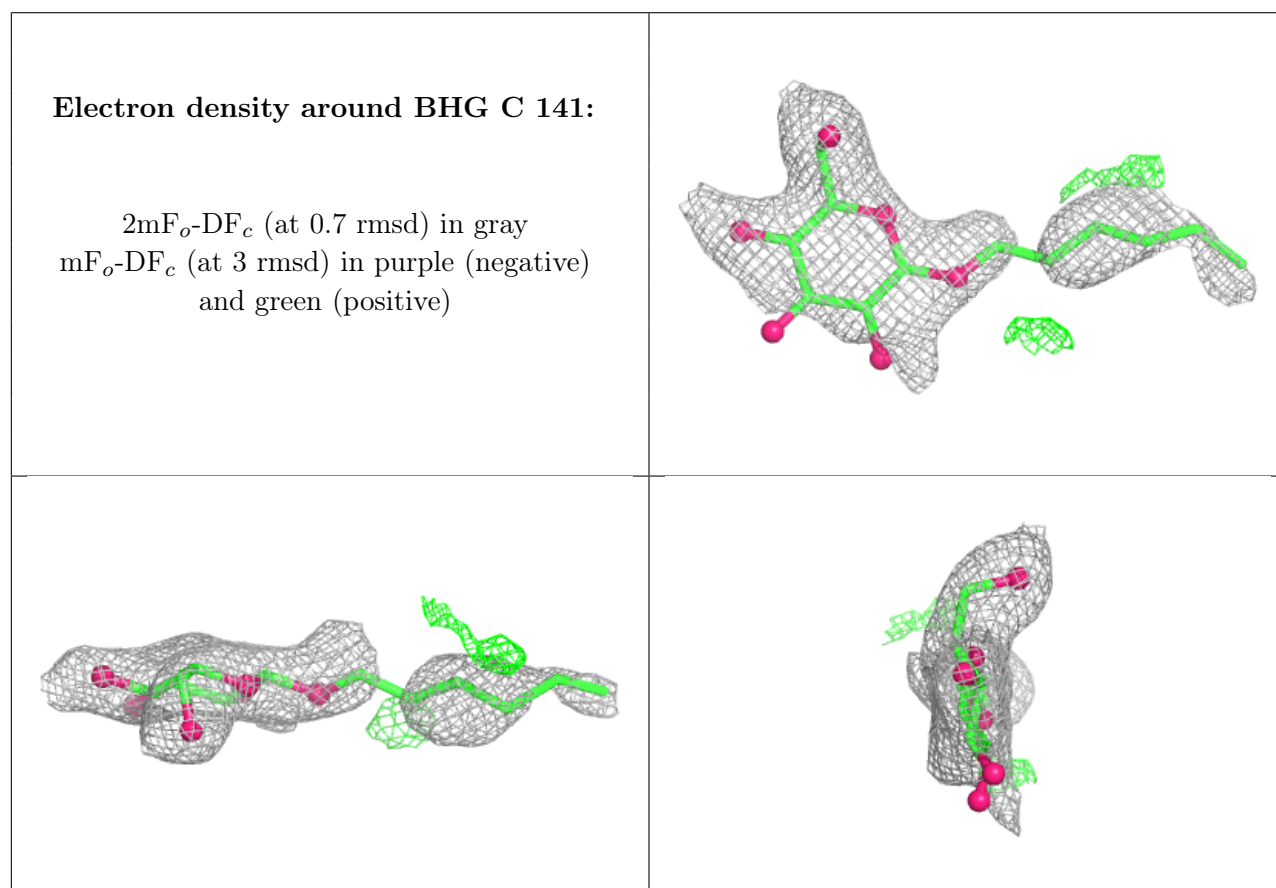
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
9	UNL	P	214	4/-	0.98	0.10	94,94,94,95	0
9	UNL	P	215	4/-	0.98	0.05	74,74,75,76	0
9	UNL	P	216	1/-	0.98	0.06	53,53,53,53	0
9	UNL	C	144	1/-	0.98	0.11	62,62,62,62	0
9	UNL	P	220	2/-	0.98	0.09	81,81,81,81	0
9	UNL	C	238	1/-	0.98	0.07	59,59,59,59	0
9	UNL	P	231	1/-	0.98	0.07	74,74,74,74	0
9	UNL	P	232	1/-	0.98	0.08	61,61,61,61	0
9	UNL	D	107	6/-	0.98	0.06	66,68,69,70	0
9	UNL	P	241	1/-	0.98	0.08	59,59,59,59	0
9	UNL	P	242	1/-	0.98	0.08	57,57,57,57	0
9	UNL	Q	213	5/-	0.98	0.07	74,74,74,74	0
9	UNL	D	108	1/-	0.98	0.07	63,63,63,63	0
9	UNL	D	114	8/-	0.98	0.07	61,63,64,65	0
9	UNL	D	116	10/-	0.98	0.07	65,66,69,69	0
9	UNL	B	1006	1/-	0.98	0.07	60,60,60,60	0
9	UNL	O	1005	1/-	0.99	0.04	35,35,35,35	0
9	UNL	C	143	2/-	0.99	0.08	65,65,65,65	0
5	K	N	622	1/1	0.99	0.03	25,25,25,25	0
9	UNL	Q	212	7/-	0.99	0.07	74,75,76,76	0
9	UNL	C	145	4/-	0.99	0.07	100,100,100,100	0
9	UNL	Q	218	1/-	0.99	0.03	53,53,53,53	0
9	UNL	P	229	1/-	0.99	0.08	54,54,54,54	0
8	TEO	N	1002	9/9	0.99	0.03	17,18,19,20	1
9	UNL	C	147	1/-	0.99	0.05	59,59,59,59	0
13	GOL	B	1009	6/6	0.99	0.03	33,36,38,38	0
13	GOL	O	1009	6/6	0.99	0.04	35,40,41,43	0
9	UNL	B	1005	1/-	0.99	0.04	39,39,39,39	0
14	BHG	P	205	18/18	0.99	0.05	36,42,59,61	0
15	HEM	C	142	41/43	0.99	0.04	27,32,49,52	0
7	FAD	N	1001	53/53	1.00	0.02	11,14,18,21	0
10	FES	B	1002	4/4	1.00	0.01	14,16,16,16	0
10	FES	O	1002	4/4	1.00	0.01	13,14,14,15	0
11	SF4	B	1003	8/8	1.00	0.01	17,19,19,19	0
11	SF4	O	1003	8/8	1.00	0.01	16,17,18,18	0
12	F3S	B	1004	7/7	1.00	0.01	18,20,21,22	0
12	F3S	O	1004	7/7	1.00	0.01	19,20,21,22	0
8	TEO	A	1002	9/9	1.00	0.02	18,20,23,24	1
5	K	O	253	1/1	1.00	0.08	39,39,39,39	0
5	K	B	253	1/1	1.00	0.07	38,38,38,38	0
5	K	A	622	1/1	1.00	0.03	24,24,24,24	0
7	FAD	A	1001	53/53	1.00	0.02	12,14,18,22	0

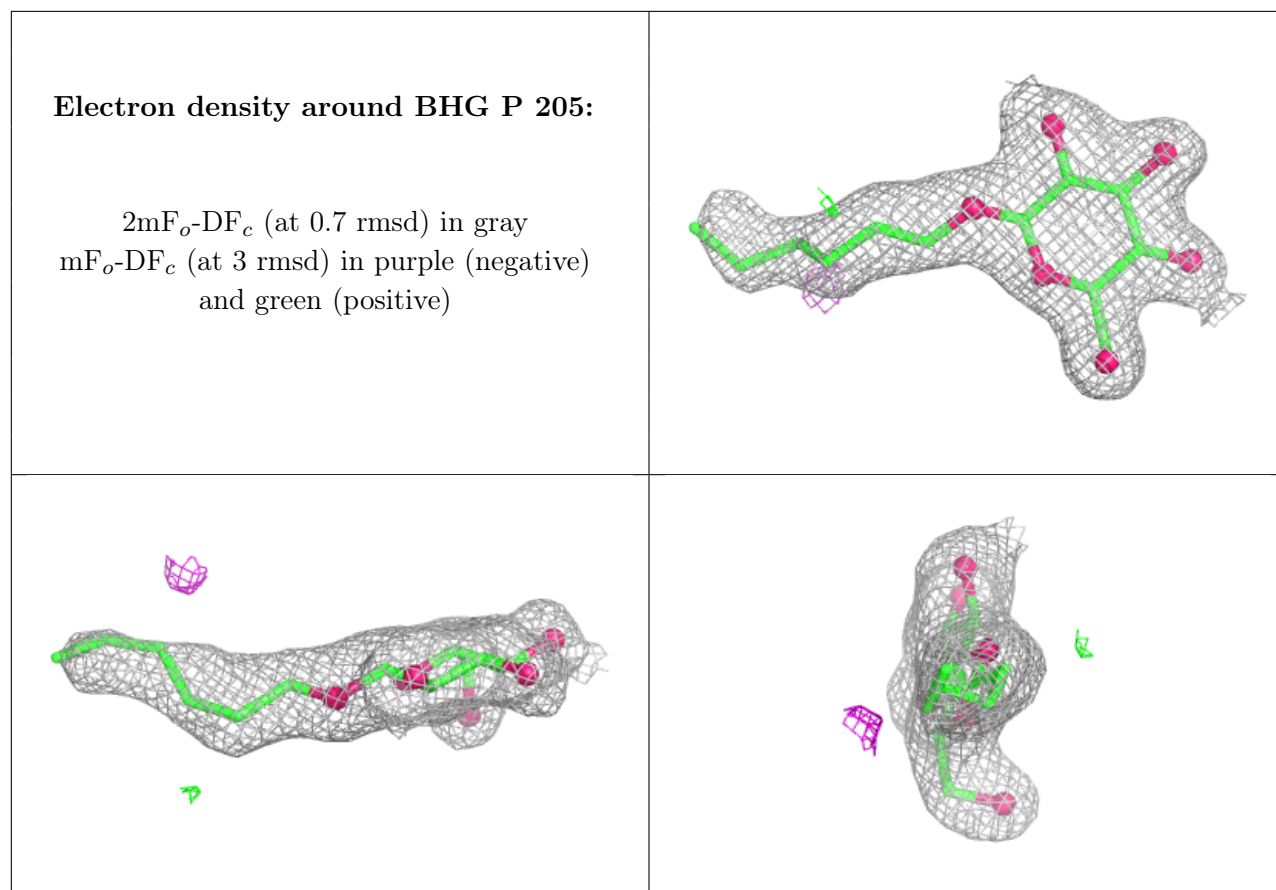
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
15	HEM	P	201	41/43	1.00	0.04	28,33,50,53	0

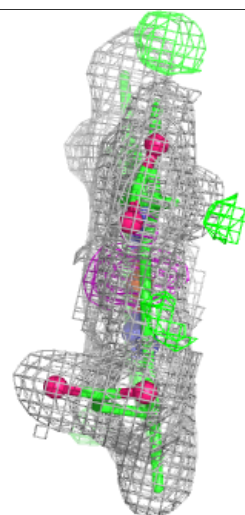
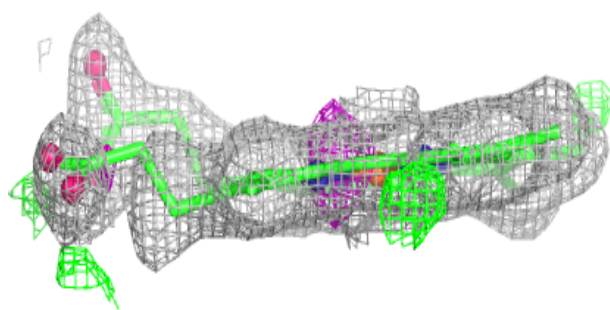
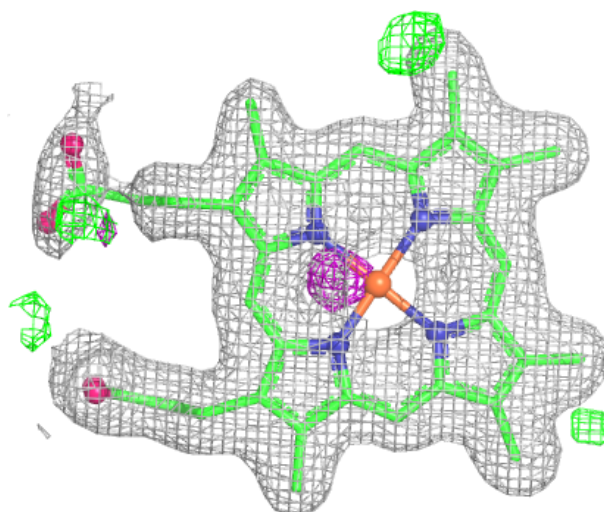
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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





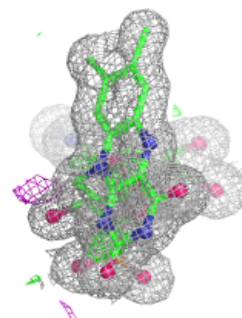
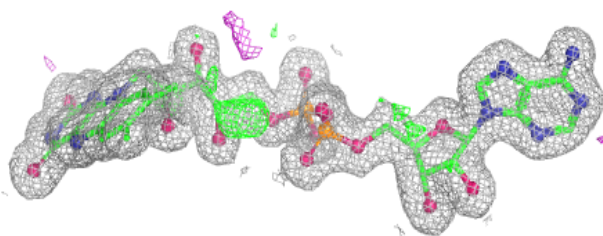
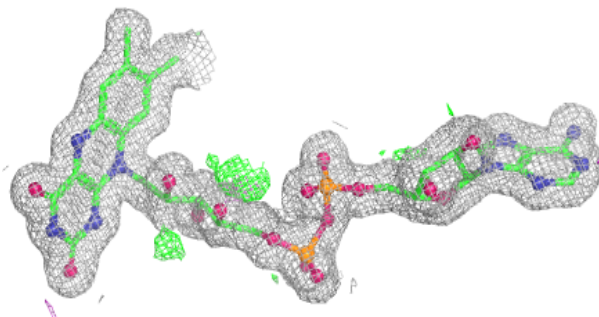
Electron density around HEM C 142:

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

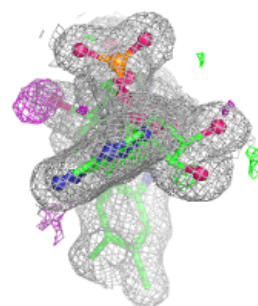
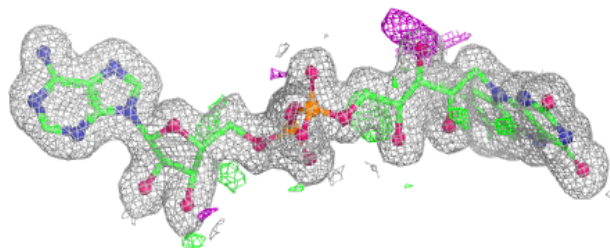
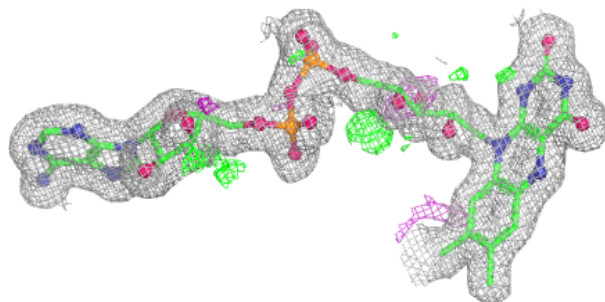


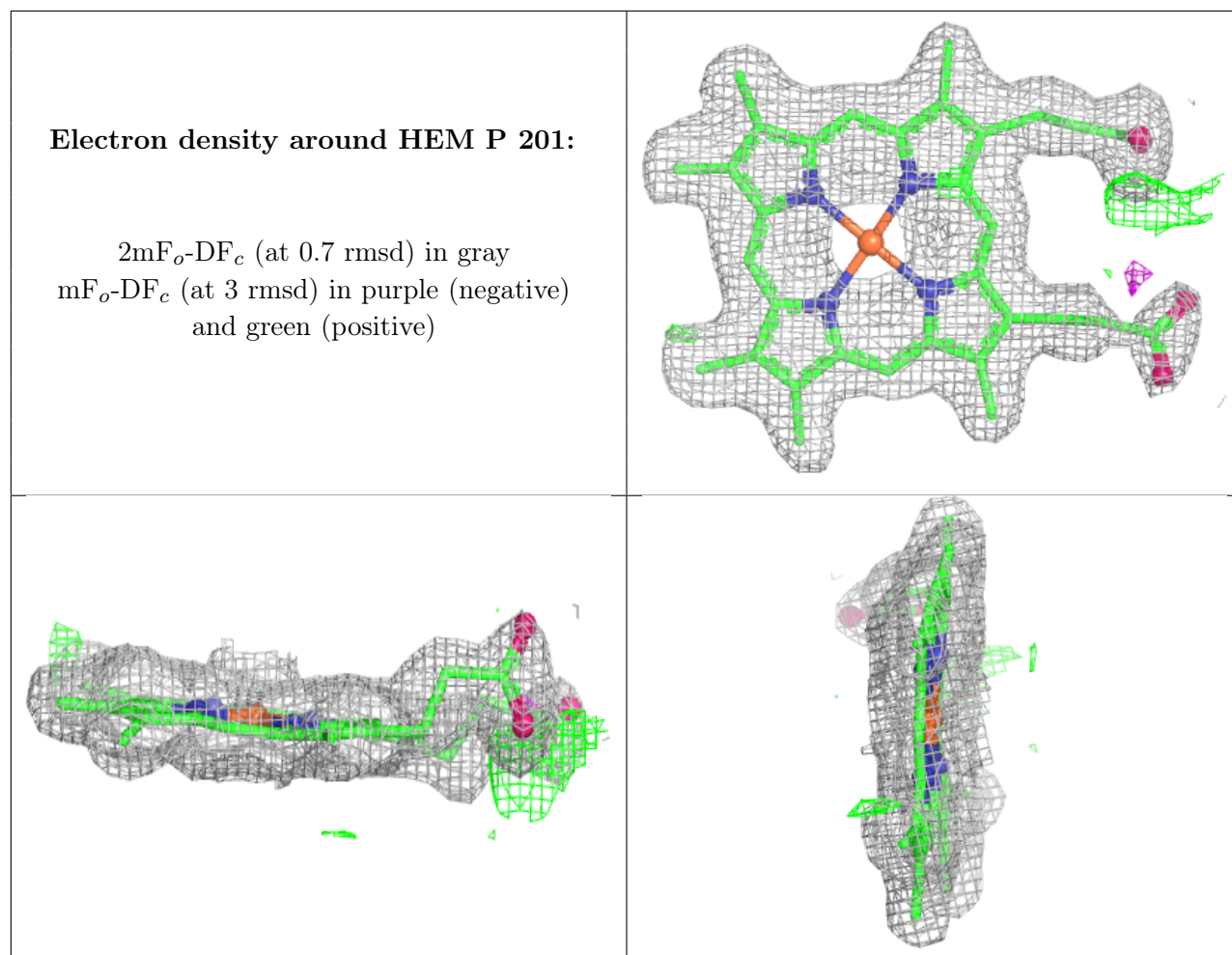
Electron density around FAD N 1001:

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

**Electron density around FAD A 1001:**

$2mF_o-DF_c$ (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.