



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 3, 2023 – 04:49 AM EDT

PDB ID : 3W7O  
Title : Structure of Trypanosoma cruzi dihydroorotate dehydrogenase in complex with TT2-3-165  
Authors : Inaoka, D.K.; Iida, M.; Tabuchi, T.; Lee, N.; Hashimoto, S.; Matsuoka, S.; Kuranaga, T.; Shiba, T.; Sakamoto, K.; Suzuki, S.; Balogun, E.O.; Nara, T.; Aoki, T.; Inoue, M.; Honma, T.; Tanaka, A.; Harada, S.; Kita, K.  
Deposited on : 2013-03-02  
Resolution : 1.68 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](mailto: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>.

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The following versions of software and data (see [references](#) ①) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : 2.36  
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

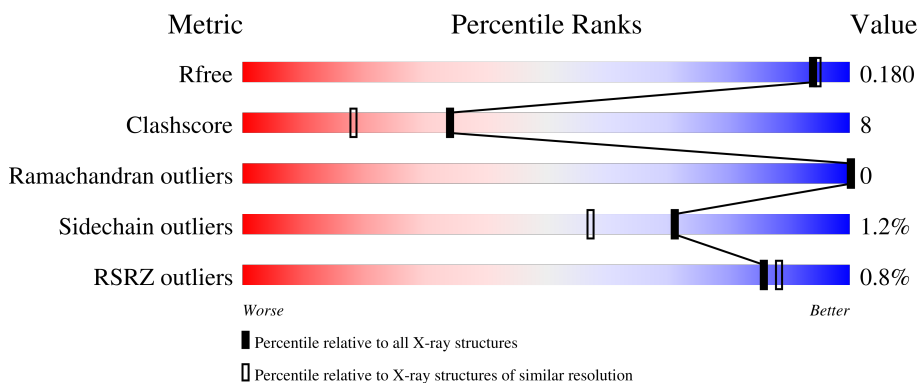
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.68 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	6780 (1.70-1.66)
Clashscore	141614	7310 (1.70-1.66)
Ramachandran outliers	138981	7173 (1.70-1.66)
Sidechain outliers	138945	7172 (1.70-1.66)
RSRZ outliers	127900	6661 (1.70-1.66)

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  $\geq 3$ , 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	313	 % 86% 13% .
1	B	313	 % 84% 15% .

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
3	GOL	B	403	-	X	-	-
3	GOL	B	406	-	-	X	-
3	GOL	B	412	-	-	X	-

## 2 Entry composition [i](#)

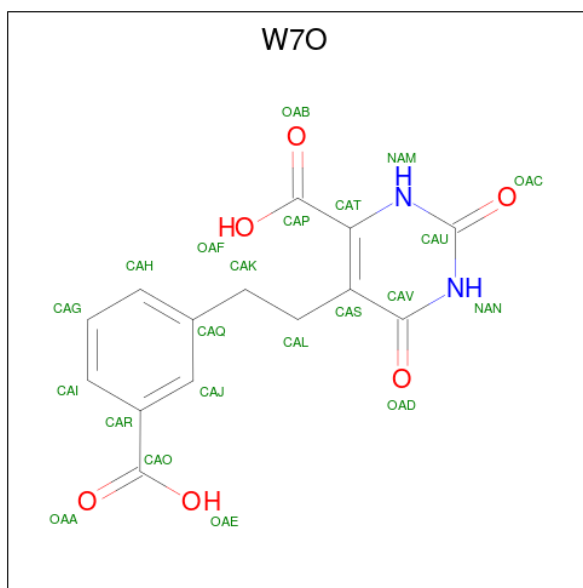
There are 6 unique types of molecules in this entry. The entry contains 5929 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Dihydroorotate dehydrogenase (fumarate).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	313	Total	C	N	O	S	0	9	0
			2457	1566	409	463	19			
1	B	313	Total	C	N	O	S	0	7	0
			2443	1559	410	456	18			

- Molecule 2 is 5-[2-(3-carboxyphenyl)ethyl]-2,6-dioxo-1,2,3,6-tetrahydropyrimidine-4-carboxylic acid (three-letter code: W7O) (formula: C<sub>14</sub>H<sub>12</sub>N<sub>2</sub>O<sub>6</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	Total	C	N	O	0	0
			22	14	2	6		
2	B	1	Total	C	N	O	0	0
			22	14	2	6		

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



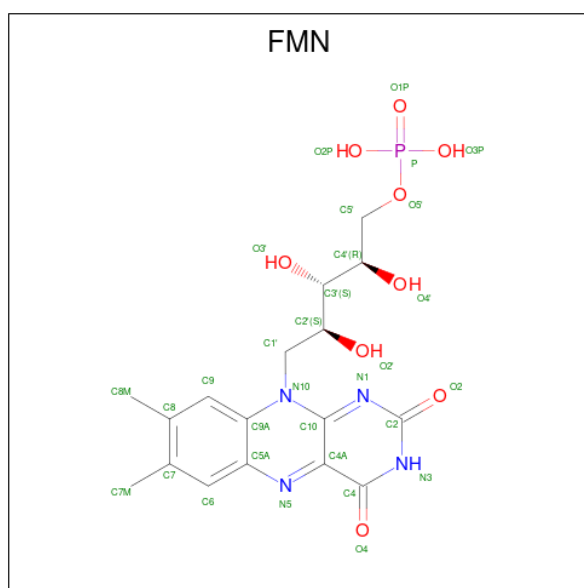
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 12 6 6	0	1
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	A	1	Total C O 6 3 3	0	0
3	B	1	Total C O 6 3 3	0	0
3	B	1	Total C O 6 3 3	0	0
3	B	1	Total C O 6 3 3	0	0
3	B	1	Total C O 6 3 3	0	0
3	B	1	Total C O 6 3 3	0	0

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

- Molecule 4 is FLAVIN MONONUCLEOTIDE (three-letter code: FMN) (formula: C<sub>17</sub>H<sub>21</sub>N<sub>4</sub>O<sub>9</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			31	17	4	9	1		
4	B	1	Total	C	N	O	P	0	0
			31	17	4	9	1		

- Molecule 5 is COBALT HEXAMMINE(III) (three-letter code: NCO) (formula: CoH<sub>18</sub>N<sub>6</sub>).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Co N	0	0
			7	1 6		

- Molecule 6 is water.

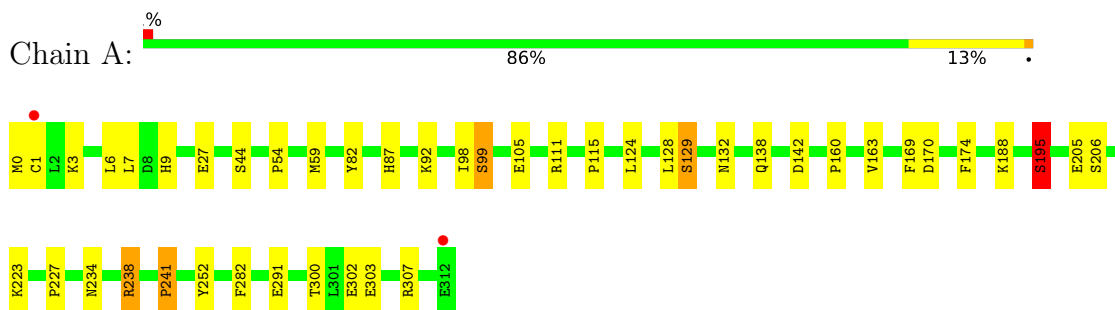
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	382	Total	O	0	4
			386	386		
6	B	389	Total	O	0	9
			398	398		



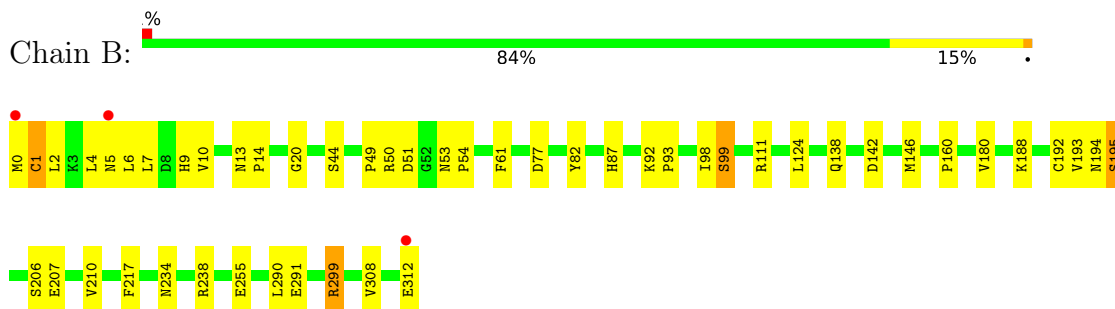
### 3 Residue-property plots [i](#)

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: Dihydroorotate dehydrogenase (fumarate)



- Molecule 1: Dihydroorotate dehydrogenase (fumarate)



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	67.97Å 71.88Å 129.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	27.74 – 1.68 27.74 – 1.68	Depositor EDS
% Data completeness (in resolution range)	96.4 (27.74-1.68) 96.4 (27.74-1.68)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.28 (at 1.68Å)	Xtrriage
Refinement program	REFMAC 5.7.0029	Depositor
R, $R_{free}$	0.141 , 0.178 0.145 , 0.180	Depositor DCC
$R_{free}$ test set	3560 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	13.0	Xtrriage
Anisotropy	0.038	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 52.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5929	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	15.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 26.72 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 2.5022e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: FMN, NCO, W7O, GOL

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	1.33	13/2509 (0.5%)	1.11	8/3398 (0.2%)
1	B	1.22	6/2495 (0.2%)	1.06	6/3377 (0.2%)
All	All	1.28	19/5004 (0.4%)	1.08	14/6775 (0.2%)

All (19) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	105	GLU	CD-OE2	-8.20	1.16	1.25
1	A	195	SER	CB-OG	-7.70	1.32	1.42
1	A	205	GLU	CD-OE1	-7.43	1.17	1.25
1	B	99	SER	CB-OG	-6.38	1.33	1.42
1	B	195	SER	CB-OG	-6.17	1.34	1.42
1	B	206	SER	CB-OG	-5.90	1.34	1.42
1	A	6	LEU	N-CA	5.87	1.58	1.46
1	A	206	SER	CB-OG	-5.86	1.34	1.42
1	A	302	GLU	CD-OE1	5.78	1.32	1.25
1	A	291	GLU	CD-OE2	5.63	1.31	1.25
1	A	291	GLU	CG-CD	5.62	1.60	1.51
1	A	115	PRO	N-CD	5.59	1.55	1.47
1	A	99	SER	CB-OG	-5.48	1.35	1.42
1	B	49	PRO	N-CD	5.46	1.55	1.47
1	A	227	PRO	N-CD	5.45	1.55	1.47
1	A	54	PRO	N-CD	5.43	1.55	1.47
1	A	241	PRO	N-CD	5.38	1.55	1.47
1	B	255	GLU	CD-OE1	-5.21	1.20	1.25
1	B	207	GLU	CD-OE1	-5.19	1.20	1.25

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	3	LYS	CD-CE-NZ	8.78	131.88	111.70
1	A	111	ARG	NE-CZ-NH1	7.37	123.98	120.30
1	A	238	ARG	NE-CZ-NH2	5.81	123.20	120.30
1	A	142	ASP	CB-CG-OD2	-5.80	113.08	118.30
1	B	299	ARG	NE-CZ-NH2	-5.77	117.42	120.30
1	A	238	ARG	NE-CZ-NH1	-5.70	117.45	120.30
1	B	51	ASP	CB-CG-OD2	-5.54	113.31	118.30
1	B	2	LEU	CA-CB-CG	5.41	127.73	115.30
1	A	282	PHE	CB-CG-CD2	5.37	124.56	120.80
1	B	142	ASP	CB-CG-OD2	-5.35	113.48	118.30
1	B	77	ASP	CB-CG-OD2	-5.32	113.51	118.30
1	B	4	LEU	CA-CB-CG	5.12	127.08	115.30
1	A	169	PHE	CB-CG-CD2	-5.10	117.23	120.80
1	A	174	PHE	CB-CG-CD1	5.01	124.31	120.80

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	2457	0	2437	30	0
1	B	2443	0	2438	52	0
2	A	22	0	10	0	0
2	B	22	0	10	0	0
3	A	60	0	79	6	0
3	B	72	0	95	25	0
4	A	31	0	19	0	0
4	B	31	0	19	1	0
5	A	7	0	0	0	0
6	A	386	0	0	8	0
6	B	398	0	0	13	0
All	All	5929	0	5107	86	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 8.

All (86) close contacts within the same asymmetric unit are listed below, sorted by their clash

magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:9:HIS:CE1	3:B:406:GOL:H11	1.95	1.01
1:B:0:MET:HG2	1:B:1:CYS:HA	1.47	0.96
1:B:50:ARG:HG2	3:B:413:GOL:H32	1.52	0.91
1:A:128:LEU:HD12	1:A:163:VAL:HG11	1.51	0.89
3:B:411:GOL:H2	6:B:866:HOH:O	1.72	0.88
1:B:50:ARG:CG	3:B:413:GOL:H32	2.05	0.85
1:A:128:LEU:HD12	1:A:163:VAL:CG1	2.09	0.82
1:B:238:ARG:HH22	3:B:412:GOL:H31	1.44	0.82
1:B:234:ASN:HD21	1:B:238:ARG:HE	1.28	0.81
1:A:128:LEU:CD1	1:A:163:VAL:HG11	2.13	0.79
1:B:0:MET:CG	1:B:1:CYS:HA	2.13	0.78
1:B:308:VAL:O	3:B:412:GOL:H12	1.86	0.75
1:B:9:HIS:ND1	3:B:406:GOL:H11	2.01	0.75
1:A:59:MET:CE	6:A:620:HOH:O	2.35	0.74
1:B:98:ILE:HD12	1:B:124:LEU:CD1	2.19	0.73
1:B:5:ASN:ND2	1:B:10:VAL:HG22	2.05	0.72
1:B:93:PRO:HA	3:B:406:GOL:H31	1.72	0.71
1:A:238:ARG:HH11	3:A:409:GOL:H12	1.56	0.71
1:B:5:ASN:HD21	1:B:10:VAL:HG22	1.56	0.69
1:A:128:LEU:CD1	1:A:163:VAL:CG1	2.69	0.69
1:B:195:SER:HB3	6:B:756:HOH:O	1.93	0.69
1:A:59:MET:HE3	6:A:620:HOH:O	1.91	0.68
1:B:9:HIS:CE1	3:B:406:GOL:C1	2.75	0.67
1:A:234:ASN:HD21	1:A:238:ARG:HE	1.42	0.67
1:B:238:ARG:NH2	3:B:412:GOL:H11	2.12	0.65
1:A:241:PRO:HA	3:A:404:GOL:H31	1.80	0.64
1:A:129:SER:HA	1:A:138:GLN:OE1	1.98	0.64
1:B:98:ILE:HD12	1:B:124:LEU:HD13	1.80	0.62
1:B:188:LYS:HD2	6:B:628:HOH:O	2.01	0.60
3:B:405:GOL:H32	6:B:787:HOH:O	2.01	0.60
1:B:82:TYR:OH	1:B:87:HIS:HD2	1.84	0.60
1:B:44:SER:HB3	1:B:99:SER:HB2	1.84	0.59
3:B:406:GOL:H12	6:B:511:HOH:O	2.05	0.57
1:B:9:HIS:HE1	3:B:406:GOL:H11	1.65	0.56
3:B:406:GOL:C1	6:B:511:HOH:O	2.54	0.56
1:A:82:TYR:OH	1:A:87:HIS:HD2	1.89	0.55
1:B:87:HIS:HE1	1:B:92:LYS:O	1.90	0.54
1:A:87:HIS:HE1	1:A:92:LYS:O	1.91	0.54
1:A:238:ARG:NH1	3:A:409:GOL:H32	2.23	0.54
1:B:238:ARG:NH2	3:B:412:GOL:H31	2.21	0.52
1:B:0:MET:CB	1:B:1:CYS:HA	2.39	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:7:LEU:O	1:A:9:HIS:HD2	1.93	0.52
1:B:111[B]:ARG:NH2	6:B:814:HOH:O	2.41	0.51
1:B:194:ASN:HB3	3:B:403:GOL:C1	2.41	0.51
1:B:6:LEU:CD2	6:B:781:HOH:O	2.59	0.50
1:B:194:ASN:HB3	3:B:403:GOL:H11	1.92	0.50
1:A:160:PRO:HB3	1:A:188:LYS:HG3	1.94	0.50
1:B:93:PRO:CA	3:B:406:GOL:H31	2.40	0.50
1:B:111[A]:ARG:NH2	6:B:774:HOH:O	2.24	0.50
1:B:6:LEU:HD21	6:B:781:HOH:O	2.10	0.49
3:A:403:GOL:H31	1:B:217:PHE:CE1	2.48	0.49
1:A:238:ARG:HH11	3:A:409:GOL:C1	2.24	0.49
1:B:160:PRO:HB3	1:B:188:LYS:HG3	1.95	0.49
1:B:9:HIS:HE1	3:B:406:GOL:C1	2.22	0.48
1:A:234:ASN:ND2	1:A:238:ARG:HE	2.08	0.48
1:B:61:PHE:CE1	3:B:407:GOL:H11	2.49	0.48
1:B:20:GLY:HA3	4:B:414:FMN:N5	2.29	0.48
1:B:50:ARG:CD	3:B:413:GOL:H32	2.44	0.48
1:B:238:ARG:HH22	3:B:412:GOL:H11	1.77	0.48
1:B:0:MET:HG3	1:B:290:LEU:HD11	1.95	0.47
1:B:299:ARG:HD2	6:B:844:HOH:O	2.13	0.47
1:B:234:ASN:ND2	1:B:238:ARG:HE	2.05	0.47
1:A:98:ILE:HG12	1:A:124:LEU:HD11	1.97	0.47
1:A:195:SER:HB3	6:A:769:HOH:O	2.14	0.47
1:A:300:THR:OG1	1:A:303[A]:GLU:HG3	2.15	0.46
1:B:7:LEU:O	1:B:9:HIS:HD2	1.99	0.46
1:A:27:GLU:OE1	3:A:410:GOL:H2	2.17	0.45
1:B:308:VAL:O	3:B:412:GOL:C1	2.62	0.44
1:A:132:ASN:ND2	6:A:783:HOH:O	2.50	0.44
1:B:291:GLU:CD	6:B:608:HOH:O	2.56	0.44
1:B:98:ILE:CD1	1:B:124:LEU:HD13	2.47	0.44
1:B:210:VAL:HG12	3:B:408:GOL:H12	2.00	0.44
1:A:128:LEU:CD1	1:A:163:VAL:HG13	2.46	0.44
1:A:307[A]:ARG:HD3	6:A:756:HOH:O	2.16	0.44
1:B:53:ASN:HB3	1:B:54:PRO:HD2	2.01	0.42
1:A:223:LYS:HG2	1:A:252:TYR:CE1	2.55	0.42
3:B:412:GOL:C3	6:B:555:HOH:O	2.68	0.42
1:A:170:ASP:OD2	1:B:138:GLN:HG2	2.20	0.42
1:A:132:ASN:HB3	6:A:783:HOH:O	2.20	0.41
1:B:146:MET:HE1	1:B:180:VAL:HB	2.03	0.41
1:B:5:ASN:O	1:B:6:LEU:HD23	2.20	0.41
1:B:192:CYS:HA	1:B:193:VAL:HA	1.91	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:44:SER:HB3	1:A:99:SER:HB3	2.02	0.41
1:A:132:ASN:O	6:A:793:HOH:O	2.22	0.41
1:B:13:ASN:HB2	1:B:14:PRO:HD2	2.03	0.41
1:A:9:HIS:HE1	6:A:526:HOH:O	2.04	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	320/313 (102%)	311 (97%)	9 (3%)	0	100	100
1	B	318/313 (102%)	311 (98%)	7 (2%)	0	100	100
All	All	638/626 (102%)	622 (98%)	16 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	267/258 (104%)	263 (98%)	4 (2%)	65	48
1	B	265/258 (103%)	263 (99%)	2 (1%)	81	72
All	All	532/516 (103%)	526 (99%)	6 (1%)	71	61

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

Mol	Chain	Res	Type
1	A	0	MET
1	A	1	CYS
1	A	129	SER
1	A	195	SER
1	B	1	CYS
1	B	312	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	9	HIS
1	A	87	HIS
1	A	132	ASN
1	A	152	GLN
1	A	234	ASN
1	B	5	ASN
1	B	9	HIS
1	B	87	HIS
1	B	138	GLN
1	B	234	ASN
1	B	275	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

### 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

27 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
5	NCO	A	412	-	6,6,6	2.46	4 (66%)	-		
3	GOL	B	408	-	5,5,5	1.55	1 (20%)	5,5,5	1.79	1 (20%)
3	GOL	B	404	-	5,5,5	0.64	0	5,5,5	1.05	0
3	GOL	B	407	-	5,5,5	1.27	0	5,5,5	1.48	1 (20%)
3	GOL	B	403	-	5,5,5	1.66	1 (20%)	5,5,5	2.25	3 (60%)
3	GOL	A	406	-	5,5,5	0.79	0	5,5,5	1.50	1 (20%)
3	GOL	B	411	-	5,5,5	0.31	0	5,5,5	0.91	0
2	W7O	A	401	-	22,23,23	2.03	4 (18%)	29,32,32	1.80	9 (31%)
3	GOL	B	412	-	5,5,5	0.47	0	5,5,5	0.75	0
3	GOL	A	405	-	5,5,5	1.04	0	5,5,5	1.22	0
3	GOL	A	404	-	5,5,5	0.63	0	5,5,5	0.82	0
3	GOL	A	410	-	5,5,5	1.26	0	5,5,5	1.30	0
3	GOL	A	409	-	5,5,5	0.86	0	5,5,5	1.16	0
3	GOL	B	405	-	5,5,5	0.94	0	5,5,5	0.95	0
3	GOL	B	406	-	5,5,5	0.81	0	5,5,5	2.25	1 (20%)
4	FMN	A	411	-	33,33,33	1.54	6 (18%)	48,50,50	1.43	10 (20%)
4	FMN	B	414	-	33,33,33	1.43	5 (15%)	48,50,50	1.25	4 (8%)
2	W7O	B	401	-	22,23,23	1.78	4 (18%)	29,32,32	1.99	8 (27%)
3	GOL	A	402[B]	-	5,5,5	0.86	0	5,5,5	0.76	0
3	GOL	B	402	-	5,5,5	1.08	0	5,5,5	0.56	0
3	GOL	A	408	-	5,5,5	0.90	0	5,5,5	1.50	1 (20%)
3	GOL	A	402[A]	-	5,5,5	1.12	0	5,5,5	0.73	0
3	GOL	B	413	-	5,5,5	1.52	1 (20%)	5,5,5	1.26	1 (20%)
3	GOL	B	410	-	5,5,5	1.03	1 (20%)	5,5,5	1.56	2 (40%)
3	GOL	B	409	-	5,5,5	0.53	0	5,5,5	0.68	0
3	GOL	A	403	-	5,5,5	0.78	0	5,5,5	1.15	1 (20%)
3	GOL	A	407	-	5,5,5	1.32	0	5,5,5	1.20	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GOL	B	408	-	-	3/4/4/4	-
3	GOL	B	404	-	-	2/4/4/4	-
3	GOL	B	407	-	-	2/4/4/4	-
3	GOL	B	403	-	-	3/4/4/4	-
3	GOL	A	406	-	-	4/4/4/4	-
3	GOL	B	411	-	-	4/4/4/4	-
2	W7O	A	401	-	-	4/13/13/13	0/2/2/2
3	GOL	B	412	-	-	2/4/4/4	-
3	GOL	A	405	-	-	4/4/4/4	-
3	GOL	A	404	-	-	4/4/4/4	-
3	GOL	A	410	-	-	0/4/4/4	-
3	GOL	A	409	-	-	4/4/4/4	-
3	GOL	B	405	-	-	0/4/4/4	-
3	GOL	B	406	-	-	2/4/4/4	-
4	FMN	A	411	-	-	1/18/18/18	0/3/3/3
4	FMN	B	414	-	-	2/18/18/18	0/3/3/3
2	W7O	B	401	-	-	2/13/13/13	0/2/2/2
3	GOL	A	402[B]	-	-	0/4/4/4	-
3	GOL	B	402	-	-	0/4/4/4	-
3	GOL	A	408	-	-	2/4/4/4	-
3	GOL	A	402[A]	-	-	0/4/4/4	-
3	GOL	B	413	-	-	2/4/4/4	-
3	GOL	B	410	-	-	1/4/4/4	-
3	GOL	B	409	-	-	2/4/4/4	-
3	GOL	A	403	-	-	0/4/4/4	-
3	GOL	A	407	-	-	2/4/4/4	-

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	W7O	CAK-CAQ	-5.10	1.36	1.51
2	A	401	W7O	CAR-CAO	-4.96	1.38	1.49
2	B	401	W7O	CAR-CAO	-4.53	1.39	1.49
2	B	401	W7O	CAT-NAM	4.29	1.47	1.38
4	B	414	FMN	C4-N3	-3.95	1.31	1.38
4	A	411	FMN	C2'-C3'	-3.66	1.46	1.53
4	A	411	FMN	C5'-C4'	3.25	1.56	1.51
5	A	412	NCO	CO-N4	3.18	2.08	1.96
4	A	411	FMN	C4A-N5	3.07	1.36	1.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	414	FMN	O4-C4	3.04	1.29	1.23
3	B	403	GOL	O3-C3	3.03	1.55	1.42
5	A	412	NCO	CO-N6	3.01	2.07	1.96
5	A	412	NCO	CO-N2	2.92	2.07	1.96
2	B	401	W7O	CAK-CAQ	-2.91	1.43	1.51
3	B	408	GOL	O2-C2	2.91	1.52	1.43
2	A	401	W7O	CAL-CAS	-2.87	1.43	1.51
2	A	401	W7O	CAJ-CAR	2.80	1.43	1.39
4	B	414	FMN	C4A-N5	2.75	1.36	1.30
4	A	411	FMN	C6-C5A	2.50	1.43	1.40
4	B	414	FMN	C2'-C3'	-2.47	1.48	1.53
5	A	412	NCO	CO-N1	2.42	2.05	1.96
2	B	401	W7O	CAV-CAS	-2.40	1.40	1.44
4	A	411	FMN	C9A-C5A	2.40	1.45	1.41
3	B	413	GOL	O1-C1	2.33	1.52	1.42
4	A	411	FMN	O4-C4	2.06	1.27	1.23
4	B	414	FMN	C2-N3	-2.05	1.34	1.39
3	B	410	GOL	O2-C2	2.04	1.49	1.43

All (43) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	W7O	CAS-CAV-NAN	5.31	119.66	115.69
3	B	406	GOL	C3-C2-C1	-4.23	95.25	111.70
2	A	401	W7O	CAR-CAJ-CAQ	-3.82	115.57	120.86
4	A	411	FMN	O4-C4-C4A	-3.82	116.47	126.60
2	A	401	W7O	CAI-CAR-CAJ	3.69	123.60	119.24
2	B	401	W7O	CAP-CAT-CAS	3.53	126.08	122.74
2	B	401	W7O	OAD-CAV-NAN	-3.32	113.75	120.12
2	A	401	W7O	CAP-CAT-CAS	3.31	125.87	122.74
2	B	401	W7O	CAV-NAN-CAU	-3.15	121.80	126.34
3	B	403	GOL	O1-C1-C2	3.09	125.04	110.20
4	A	411	FMN	C4-N3-C2	-3.06	119.98	125.64
2	B	401	W7O	CAL-CAS-CAV	2.96	120.60	116.64
4	B	414	FMN	O4-C4-C4A	-2.93	118.82	126.60
3	B	408	GOL	O2-C2-C1	2.87	121.75	109.12
2	A	401	W7O	OAF-CAP-CAT	-2.85	112.06	116.76
3	A	408	GOL	O2-C2-C1	-2.84	96.61	109.12
4	B	414	FMN	C7M-C7-C6	2.80	124.67	119.49
2	A	401	W7O	CAH-CAG-CAI	-2.76	116.32	120.25
4	A	411	FMN	O2-C2-N1	-2.75	117.28	121.83
2	B	401	W7O	NAM-CAU-NAN	2.71	120.15	115.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	411	FMN	O5'-C5'-C4'	2.70	116.58	109.36
2	A	401	W7O	OAD-CAV-CAS	-2.66	121.29	124.54
3	A	406	GOL	O2-C2-C1	2.64	120.77	109.12
2	A	401	W7O	CAS-CAV-NAN	2.63	117.65	115.69
2	A	401	W7O	CAL-CAS-CAV	2.59	120.11	116.64
4	A	411	FMN	C4A-C10-N1	-2.52	118.88	124.73
3	B	403	GOL	O3-C3-C2	2.48	122.08	110.20
3	B	403	GOL	O2-C2-C1	-2.46	98.28	109.12
4	B	414	FMN	C4-C4A-N5	2.41	121.66	118.23
4	A	411	FMN	C4A-C4-N3	2.33	119.11	113.19
3	B	410	GOL	O2-C2-C3	2.31	119.31	109.12
2	B	401	W7O	CAR-CAJ-CAQ	-2.29	117.68	120.86
3	B	410	GOL	C3-C2-C1	-2.28	102.82	111.70
3	B	407	GOL	O1-C1-C2	2.19	120.71	110.20
4	A	411	FMN	C10-N1-C2	2.16	121.22	116.90
4	A	411	FMN	N3-C2-N1	2.14	123.58	119.38
3	B	413	GOL	O1-C1-C2	-2.13	99.97	110.20
3	A	403	GOL	O1-C1-C2	-2.12	100.04	110.20
4	A	411	FMN	O4-C4-N3	2.10	124.14	120.12
2	A	401	W7O	CAV-NAN-CAU	-2.10	123.32	126.34
4	B	414	FMN	P-O5'-C5'	2.08	124.03	118.30
2	B	401	W7O	OAC-CAU-NAN	-2.07	117.92	121.82
4	A	411	FMN	O2P-P-O1P	2.01	118.55	110.68

There are no chirality outliers.

All (52) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	W7O	OAF-CAP-CAT-NAM
2	B	401	W7O	OAF-CAP-CAT-NAM
3	A	404	GOL	O1-C1-C2-C3
3	A	404	GOL	C1-C2-C3-O3
3	A	406	GOL	O1-C1-C2-C3
3	A	408	GOL	O1-C1-C2-C3
3	A	409	GOL	O1-C1-C2-O2
3	A	409	GOL	O1-C1-C2-C3
3	A	409	GOL	C1-C2-C3-O3
3	B	403	GOL	C1-C2-C3-O3
3	B	403	GOL	O2-C2-C3-O3
3	B	406	GOL	O1-C1-C2-C3
3	B	407	GOL	O1-C1-C2-C3
3	B	409	GOL	C1-C2-C3-O3

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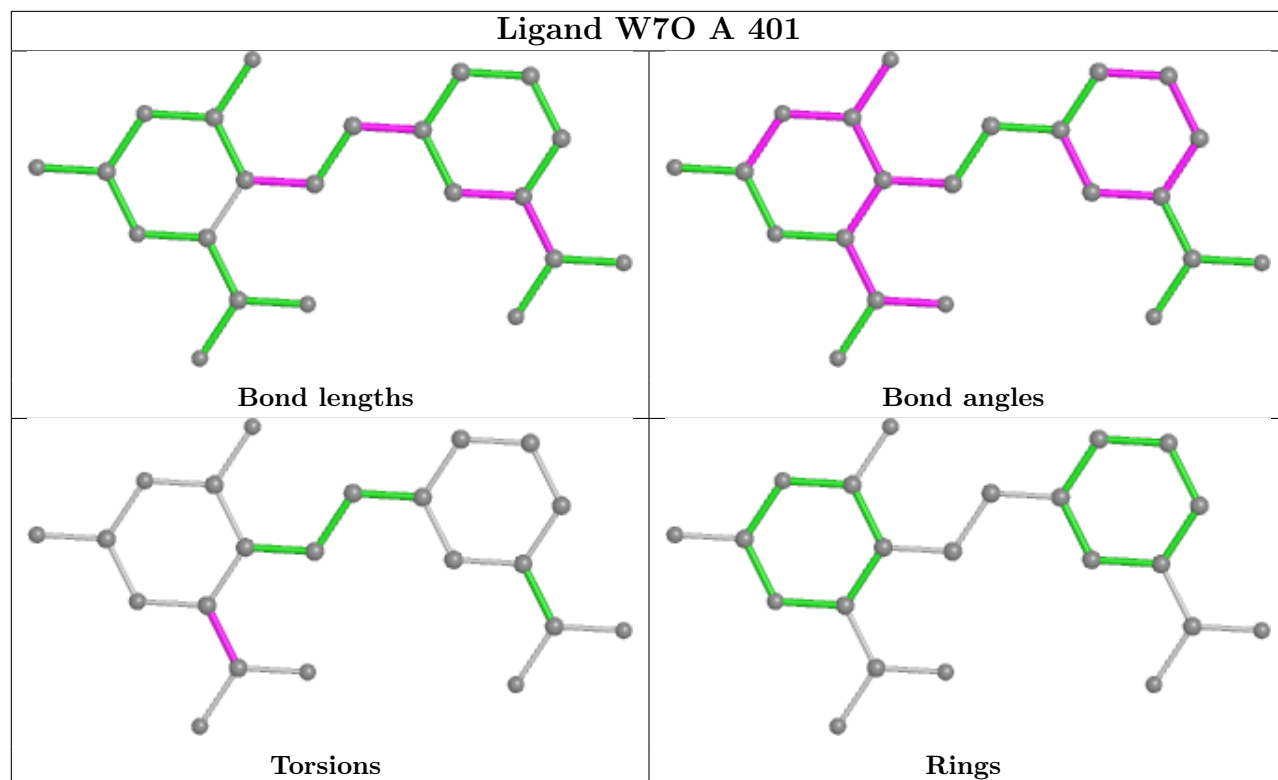
Mol	Chain	Res	Type	Atoms
3	B	409	GOL	O2-C2-C3-O3
3	B	411	GOL	O1-C1-C2-C3
3	B	411	GOL	C1-C2-C3-O3
3	B	412	GOL	C1-C2-C3-O3
3	B	413	GOL	O1-C1-C2-O2
3	B	413	GOL	O1-C1-C2-C3
3	A	404	GOL	O2-C2-C3-O3
3	A	405	GOL	O2-C2-C3-O3
3	A	408	GOL	O1-C1-C2-O2
3	B	407	GOL	O1-C1-C2-O2
3	A	405	GOL	O1-C1-C2-C3
3	A	405	GOL	C1-C2-C3-O3
3	A	406	GOL	C1-C2-C3-O3
3	A	407	GOL	C1-C2-C3-O3
3	B	404	GOL	C1-C2-C3-O3
3	B	408	GOL	O1-C1-C2-C3
3	A	404	GOL	O1-C1-C2-O2
3	A	405	GOL	O1-C1-C2-O2
3	A	406	GOL	O1-C1-C2-O2
3	A	406	GOL	O2-C2-C3-O3
3	A	407	GOL	O2-C2-C3-O3
3	A	409	GOL	O2-C2-C3-O3
3	B	411	GOL	O1-C1-C2-O2
3	B	411	GOL	O2-C2-C3-O3
3	B	412	GOL	O2-C2-C3-O3
3	B	406	GOL	O1-C1-C2-O2
3	B	410	GOL	O1-C1-C2-O2
4	A	411	FMN	C4'-C5'-O5'-P
4	B	414	FMN	C4'-C5'-O5'-P
3	B	408	GOL	O1-C1-C2-O2
3	B	404	GOL	O2-C2-C3-O3
2	A	401	W7O	OAF-CAP-CAT-CAS
3	B	403	GOL	O1-C1-C2-C3
2	A	401	W7O	OAB-CAP-CAT-NAM
2	B	401	W7O	OAB-CAP-CAT-NAM
4	B	414	FMN	C2'-C3'-C4'-O4'
3	B	408	GOL	O2-C2-C3-O3
2	A	401	W7O	OAB-CAP-CAT-CAS

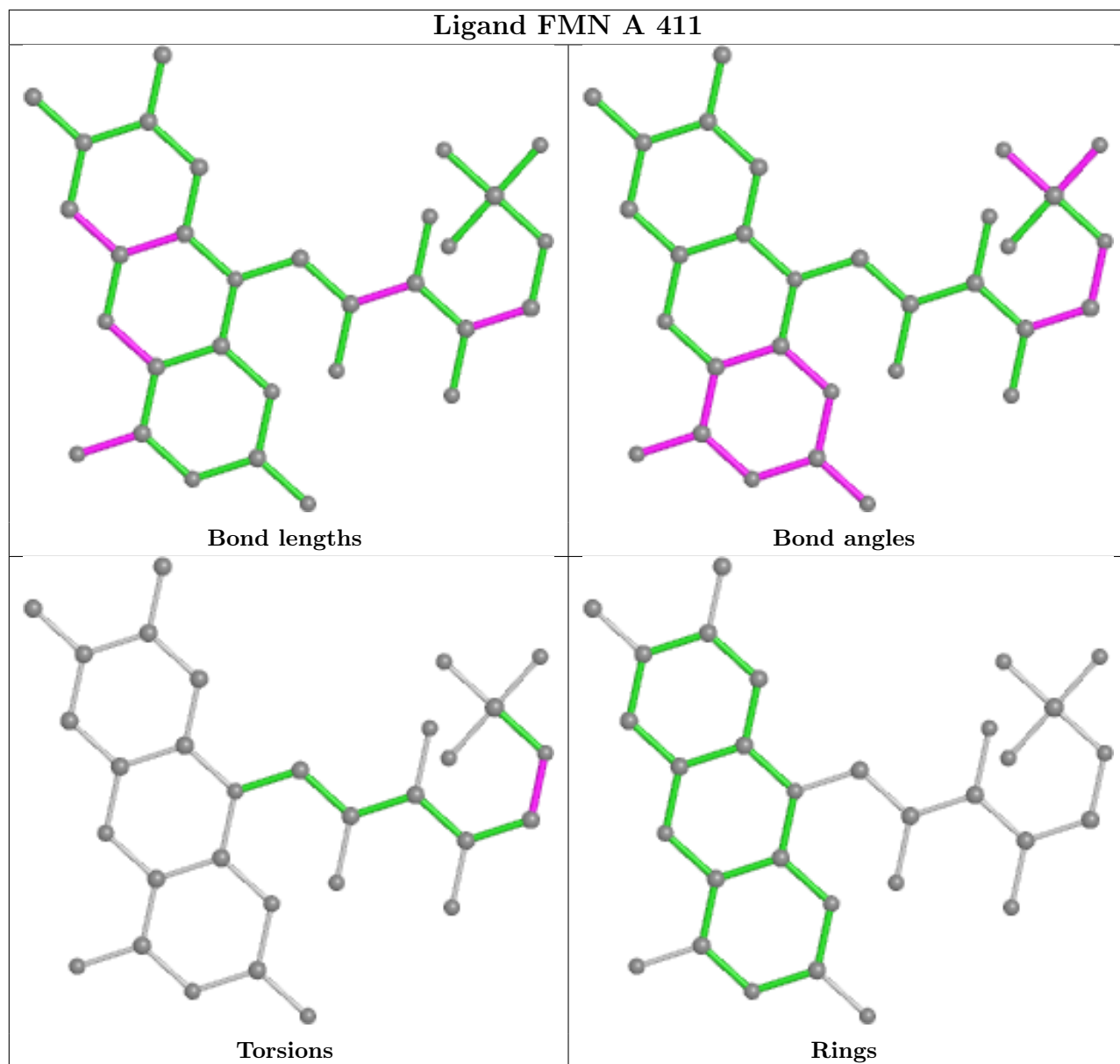
There are no ring outliers.

13 monomers are involved in 32 short contacts:

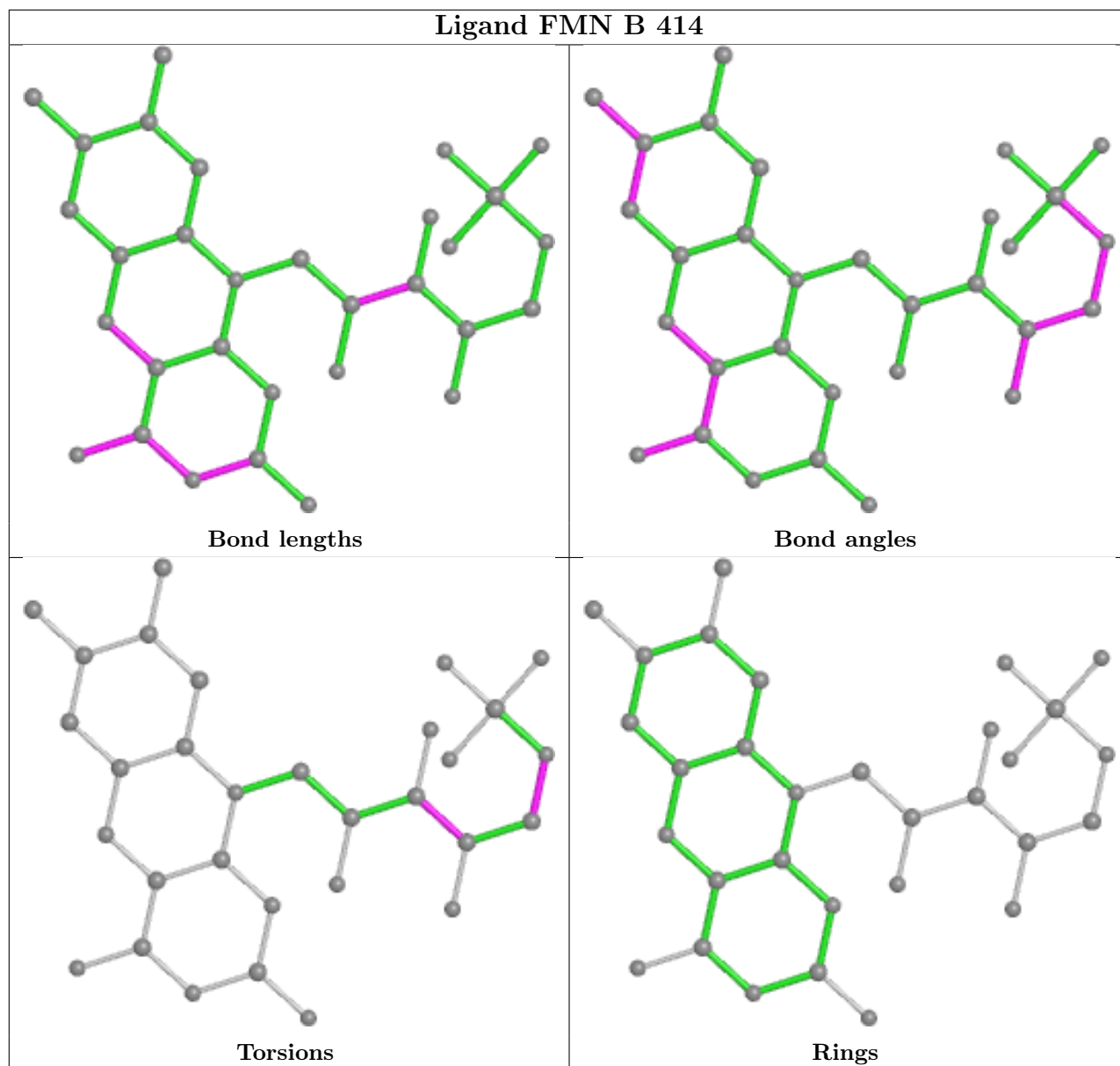
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	408	GOL	1	0
3	B	407	GOL	1	0
3	B	403	GOL	2	0
3	B	411	GOL	1	0
3	B	412	GOL	7	0
3	A	404	GOL	1	0
3	A	410	GOL	1	0
3	A	409	GOL	3	0
3	B	405	GOL	1	0
3	B	406	GOL	9	0
4	B	414	FMN	1	0
3	B	413	GOL	3	0
3	A	403	GOL	1	0

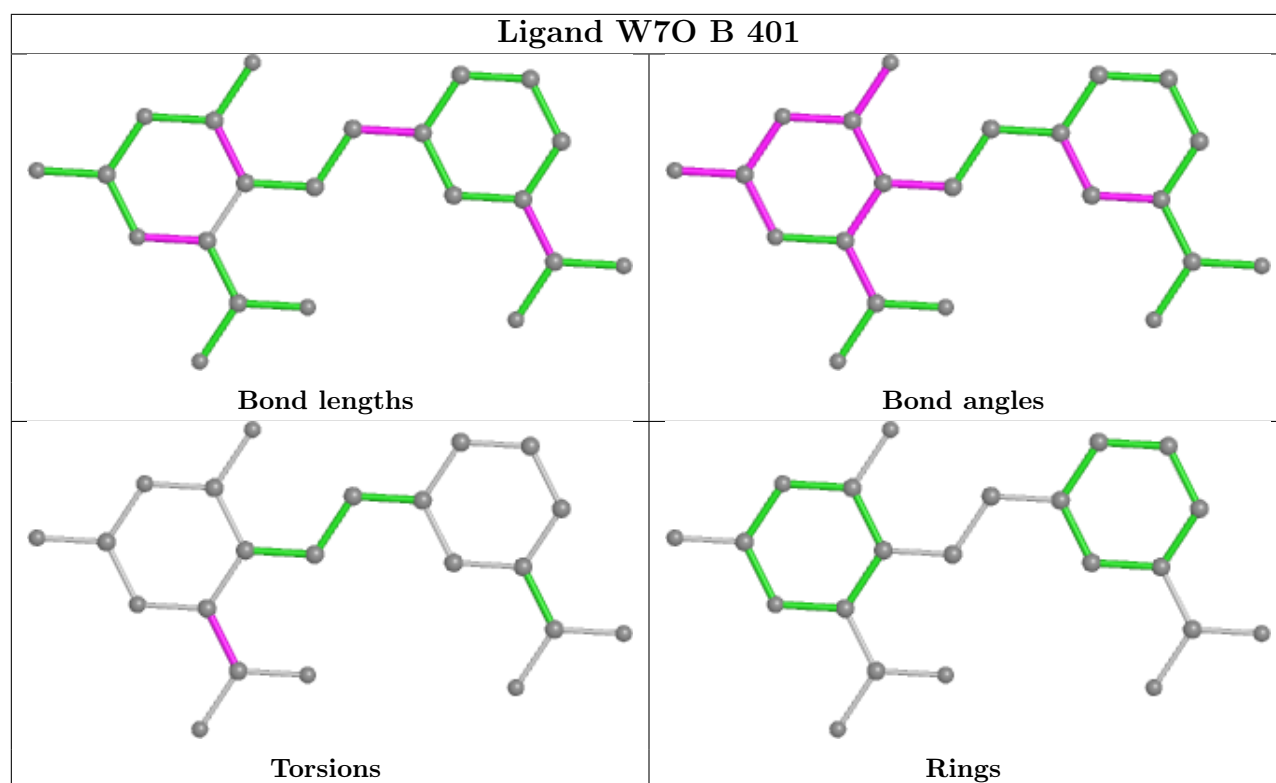
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	313/313 (100%)	-0.34	2 (0%) 89 91	7, 12, 22, 49	0
1	B	313/313 (100%)	-0.33	3 (0%) 82 85	7, 12, 25, 58	0
All	All	626/626 (100%)	-0.34	5 (0%) 86 88	7, 12, 24, 58	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1	CYS	5.2
1	B	0	MET	4.3
1	A	312	GLU	3.8
1	B	312	GLU	2.8
1	B	5	ASN	2.6

### 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](#)

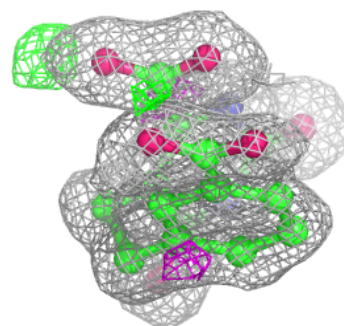
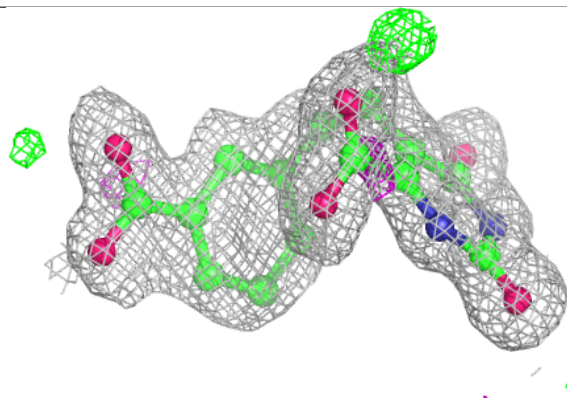
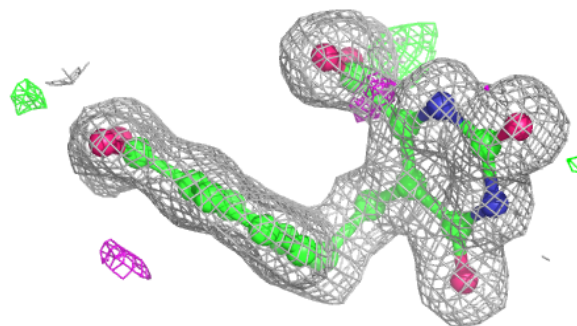
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	GOL	B	405	6/6	0.65	0.24	43,51,54,56	0
3	GOL	B	411	6/6	0.69	0.23	49,51,55,55	0
3	GOL	A	409	6/6	0.76	0.36	30,35,42,53	0
3	GOL	B	409	6/6	0.79	0.21	45,47,55,58	0
3	GOL	A	405	6/6	0.80	0.29	19,32,35,37	0
3	GOL	B	408	6/6	0.80	0.26	24,35,43,49	0
3	GOL	A	408	6/6	0.81	0.16	34,38,42,49	0
3	GOL	B	410	6/6	0.82	0.14	25,37,38,44	0
3	GOL	A	407	6/6	0.82	0.15	33,40,43,44	0
3	GOL	B	413	6/6	0.82	0.39	20,30,32,37	0
3	GOL	A	406	6/6	0.84	0.20	25,33,36,39	0
3	GOL	B	404	6/6	0.84	0.18	35,42,48,53	0
3	GOL	A	410	6/6	0.85	0.22	17,30,32,38	0
3	GOL	B	407	6/6	0.87	0.16	27,34,34,40	0
3	GOL	B	403	6/6	0.88	0.18	18,30,32,40	0
3	GOL	A	404	6/6	0.89	0.21	28,39,41,42	0
3	GOL	B	412	6/6	0.90	0.25	30,36,41,42	0
3	GOL	B	406	6/6	0.92	0.36	26,35,36,40	0
3	GOL	B	402	6/6	0.93	0.09	19,20,21,26	0
3	GOL	A	403	6/6	0.95	0.06	16,17,18,20	0
2	W7O	A	401	22/22	0.95	0.08	9,13,24,33	0
2	W7O	B	401	22/22	0.96	0.07	8,11,20,21	0
3	GOL	A	402[A]	6/6	0.97	0.09	11,13,14,15	6
3	GOL	A	402[B]	6/6	0.97	0.09	11,14,15,15	6
4	FMN	A	411	31/31	0.98	0.07	6,7,9,11	0
4	FMN	B	414	31/31	0.98	0.06	6,8,9,10	0
5	NCO	A	412	7/7	0.99	0.07	10,10,11,11	0

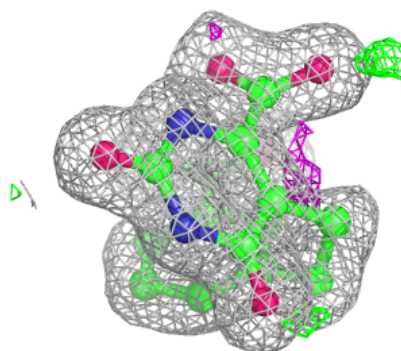
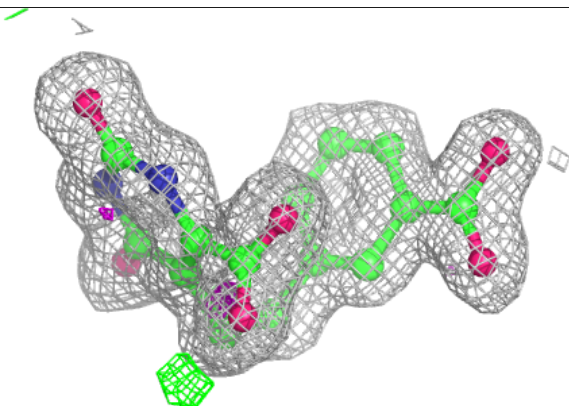
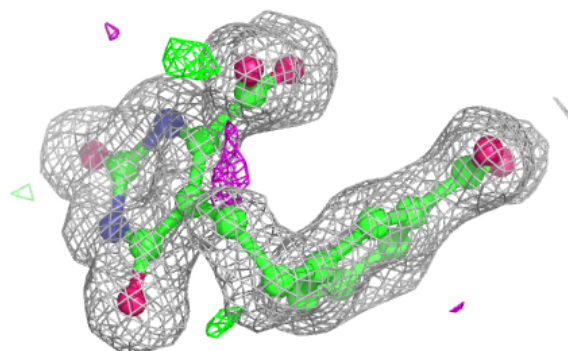
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

**Electron density around W7O 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)

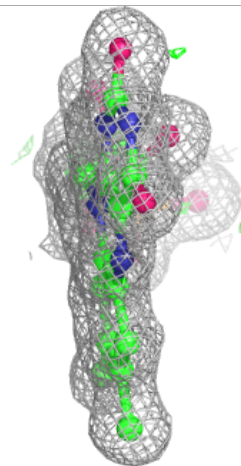
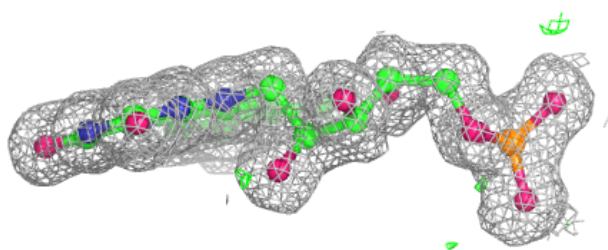
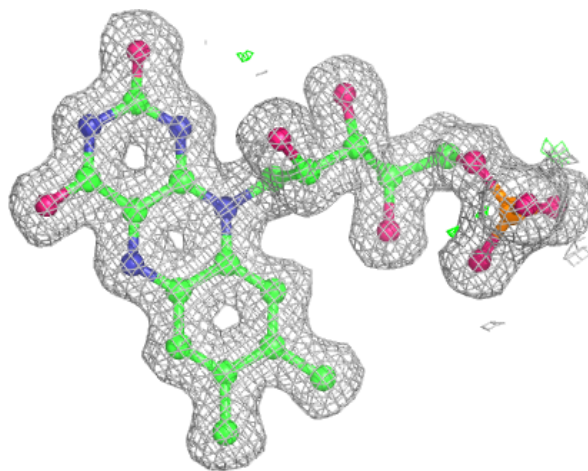
**Electron density around W7O B 401:**

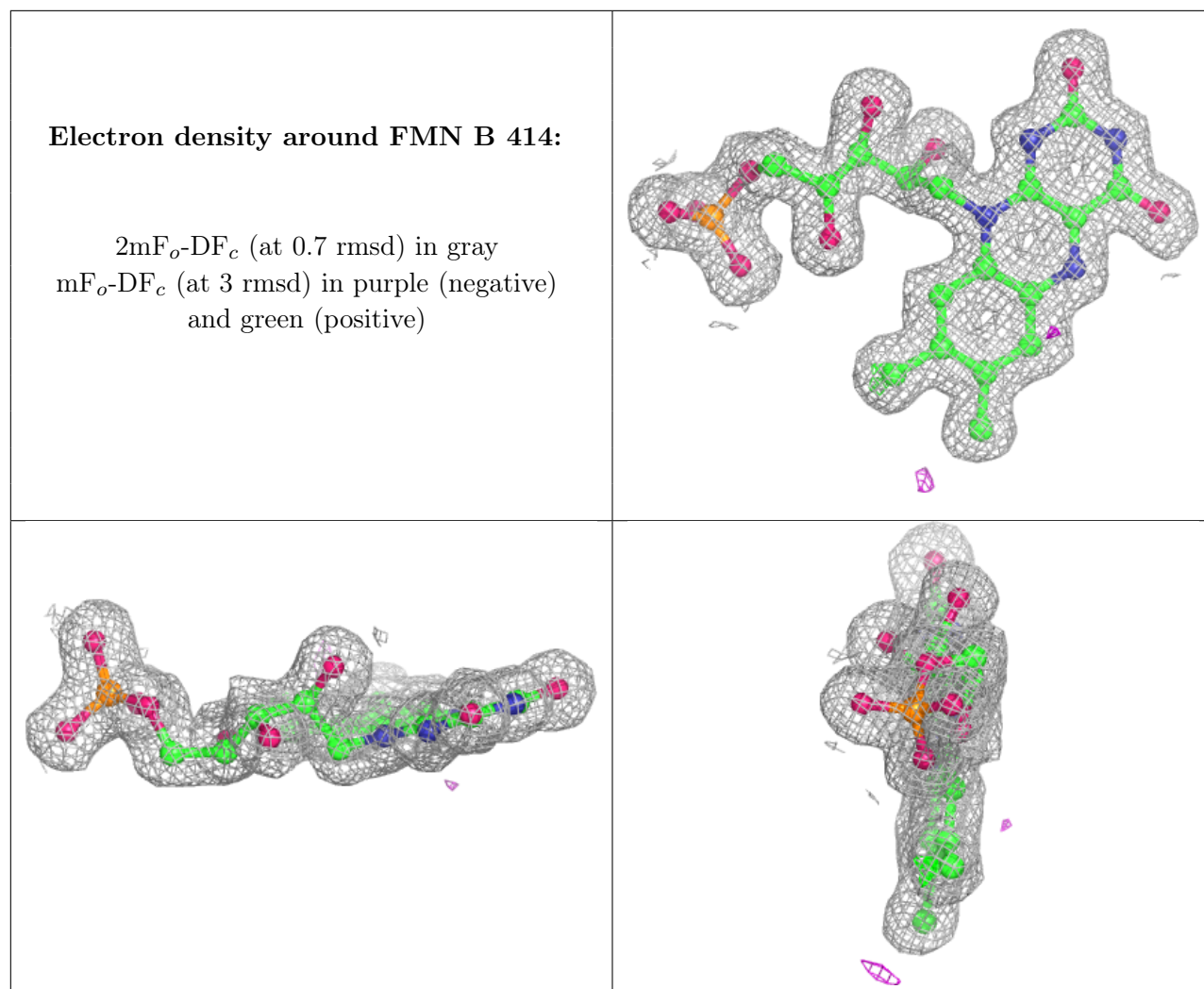
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around FMN A 411:**

$2mF_o-DF_c$  (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.