



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 4, 2026 – 05:44 PM EDT

PDB ID : 3W75 / pdb_00003w75
Title : Structure of Trypanosoma cruzi dihydroorotate dehydrogenase in complex with MII-4-149
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 : 2013-02-27
Resolution : 1.47 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](#) ①) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

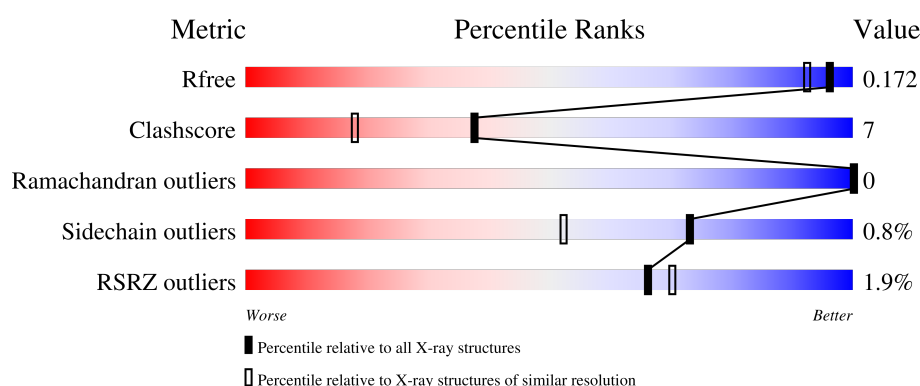
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.47 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	6779 (1.50-1.46)
Clashscore	190562	7025 (1.50-1.46)
Ramachandran outliers	187476	6917 (1.50-1.46)
Sidechain outliers	187428	6914 (1.50-1.46)
RSRZ outliers	180081	6781 (1.50-1.46)

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	313	% 78% 20% •
1	B	313	3% 86% 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
3	GOL	A	407	-	-	X	-
3	GOL	A	409	-	X	-	-

2 Entry composition [i](#)

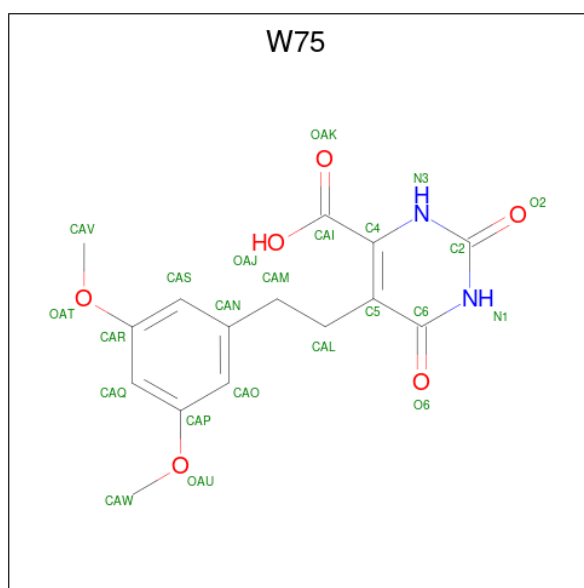
There are 6 unique types of molecules in this entry. The entry contains 5710 atoms, of which 0 are hydrogens and 0 are deuteriums.

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
1	A	313	Total	C	N	O	S	0	0	0
			2388	1530	396	444	18			
1	B	313	Total	C	N	O	S	0	0	0
			2388	1530	396	444	18			

- Molecule 2 is 5-[2-(3,5-dimethoxyphenyl)ethyl]-2,6-dioxo-1,2,3,6-tetrahydropyrimidine-4-carboxylic acid (CCD ID: W75) (formula: C₁₅H₁₆N₂O₆).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			23	15	2	6		
2	B	1	Total	C	N	O	0	1
			46	30	4	12		

- Molecule 3 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



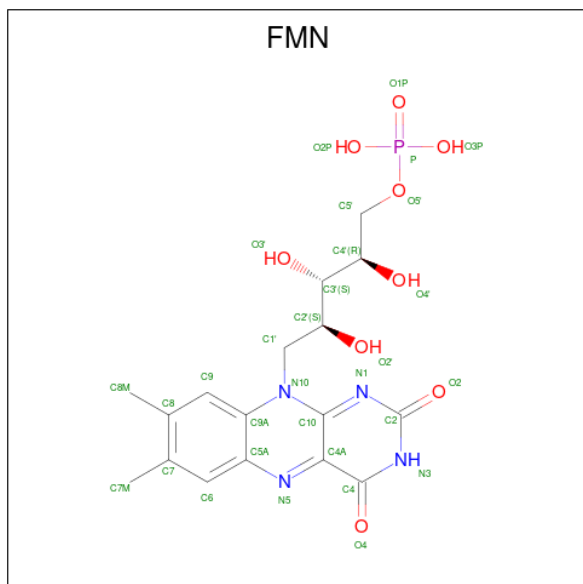
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total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

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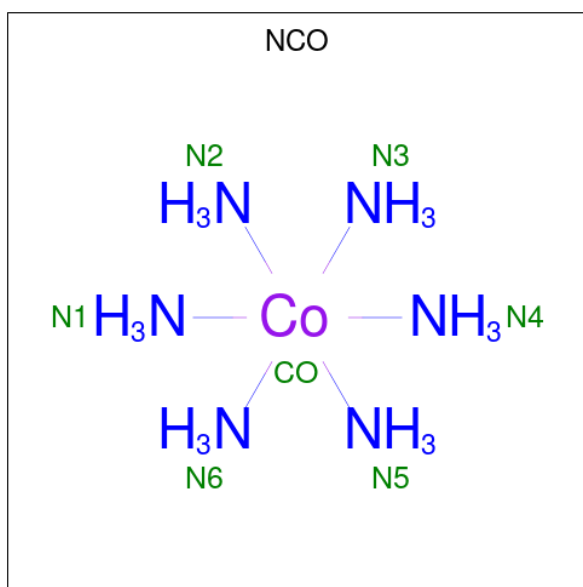
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 4 is FLAVIN MONONUCLEOTIDE (CCD ID: FMN) (formula: $C_{17}H_{21}N_4O_9P$).



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

- Molecule 5 is COBALT HEXAMMINE(III) (CCD ID: NCO) (formula: $\text{CoH}_{18}\text{N}_6$).



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

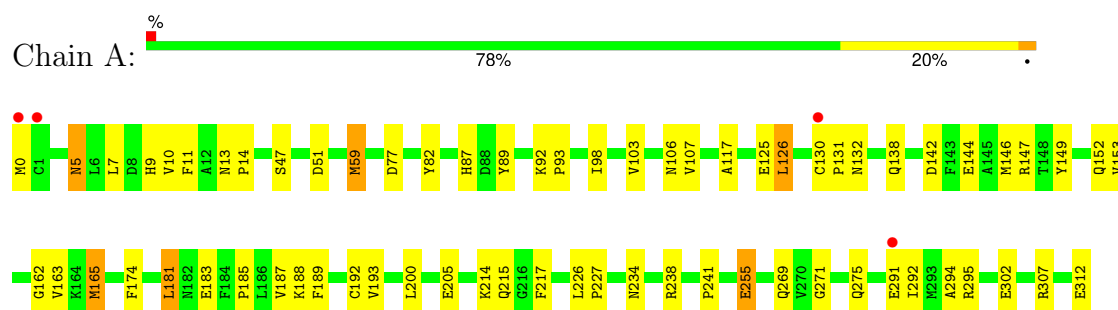
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	357	Total	O	0	0
			357	357		
6	B	349	Total	O	0	0
			349	349		

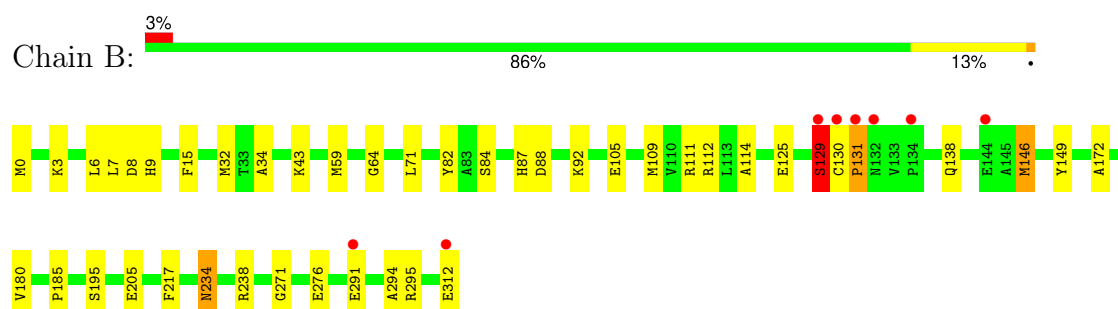
3 Residue-property plots

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, α , β , γ	67.73Å 71.60Å 129.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.87 – 1.47 36.87 – 1.47	Depositor EDS
% Data completeness (in resolution range)	96.7 (36.87-1.47) 96.7 (36.87-1.47)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.74 (at 1.47Å)	Xtrriage
Refinement program	REFMAC 5.7.0029	Depositor
R, R_{free}	0.138 , 0.166 0.147 , 0.172	Depositor DCC
R_{free} test set	5199 reflections (4.84%)	wwPDB-VP
Wilson B-factor (Å ²)	11.8	Xtrriage
Anisotropy	0.030	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 38.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	5710	wwPDB-VP
Average B, all atoms (Å ²)	14.0	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 22.69 % 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 5.4152e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: FMN, NCO, W75, 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	1.63	31/2440 (1.3%)	1.36	6/3305 (0.2%)
1	B	1.60	22/2440 (0.9%)	1.33	3/3305 (0.1%)
All	All	1.62	53/4880 (1.1%)	1.35	9/6610 (0.1%)

All (53) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	130	CYS	CA-C	10.40	1.63	1.52
1	B	146	MET	SD-CE	-8.64	1.57	1.79
1	B	130	CYS	C-O	8.15	1.32	1.24
1	A	255	GLU	C-O	-7.89	1.14	1.24
1	A	5	ASN	CA-C	-7.71	1.43	1.52
1	A	11	PHE	C-O	-7.66	1.15	1.24
1	B	112	ARG	C-O	-7.50	1.14	1.24
1	A	200	LEU	CA-C	-7.21	1.44	1.52
1	B	172	ALA	CA-C	-7.21	1.43	1.52
1	B	130	CYS	N-CA	-7.06	1.39	1.45
1	A	103	VAL	N-CA	-6.97	1.38	1.46
1	A	165	MET	C-O	-6.94	1.15	1.24
1	A	59	MET	SD-CE	-6.93	1.62	1.79
1	A	294	ALA	C-O	6.90	1.32	1.24
1	B	125	GLU	C-O	-6.86	1.16	1.24
1	B	3	LYS	CA-C	-6.77	1.44	1.52
1	A	77	ASP	C-O	-6.73	1.16	1.24
1	A	51	ASP	C-O	-6.59	1.15	1.24
1	B	15	PHE	C-O	-6.23	1.16	1.23
1	A	271	GLY	N-CA	-6.21	1.40	1.45
1	B	185	PRO	N-CA	-6.06	1.39	1.47
1	A	125	GLU	C-O	-6.04	1.17	1.24
1	B	129	SER	CB-OG	5.96	1.54	1.42
1	B	111	ARG	C-O	-5.82	1.17	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	153	VAL	CA-CB	5.75	1.61	1.54
1	A	181	LEU	N-CA	-5.73	1.39	1.46
1	B	114	ALA	CA-CB	-5.72	1.48	1.54
1	B	88	ASP	C-O	5.69	1.30	1.23
1	B	234	ASN	CG-ND2	-5.67	1.21	1.33
1	A	147	ARG	C-O	-5.67	1.17	1.24
1	A	126	LEU	N-CA	-5.62	1.39	1.46
1	B	64	GLY	CA-C	-5.61	1.44	1.52
1	A	149	TYR	N-CA	-5.58	1.39	1.46
1	A	215	GLN	CD-NE2	-5.58	1.21	1.33
1	B	149	TYR	N-CA	-5.51	1.39	1.46
1	A	59	MET	CA-C	-5.46	1.46	1.52
1	A	117	ALA	CA-CB	-5.45	1.45	1.53
1	B	6	LEU	CB-CG	-5.43	1.42	1.53
1	A	144	GLU	C-O	-5.36	1.17	1.24
1	B	205	GLU	N-CA	5.34	1.52	1.46
1	A	269	GLN	CA-CB	-5.32	1.45	1.53
1	A	187	VAL	CA-C	-5.28	1.48	1.53
1	A	146	MET	C-O	-5.27	1.18	1.24
1	A	142	ASP	C-O	-5.26	1.17	1.23
1	A	183	GLU	N-CA	5.25	1.52	1.46
1	A	174	PHE	C-O	-5.24	1.18	1.24
1	B	32	MET	CA-CB	-5.22	1.45	1.53
1	B	84	SER	C-O	-5.21	1.17	1.24
1	A	255	GLU	CD-OE1	-5.21	1.15	1.25
1	A	187	VAL	C-O	5.19	1.30	1.23
1	A	185	PRO	N-CA	-5.09	1.40	1.47
1	A	292	ILE	CB-CG1	-5.06	1.43	1.53
1	B	276	GLU	C-O	-5.02	1.18	1.24

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	165	MET	CG-SD-CE	-7.45	84.51	100.90
1	B	271	GLY	O-C-N	7.01	125.78	121.85
1	B	111	ARG	NE-CZ-NH2	6.50	125.05	119.20
1	A	107	VAL	N-CA-C	5.76	116.50	110.62
1	A	152	GLN	CA-C-O	5.29	126.03	120.42
1	A	205	GLU	CB-CG-CD	5.28	121.57	112.60
1	A	307	ARG	CG-CD-NE	-5.28	100.39	112.00
1	B	131	PRO	N-CA-C	5.04	122.85	112.47
1	A	47	SER	O-C-N	5.02	127.44	122.12

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2388	0	2391	45	0
1	B	2388	0	2391	22	0
2	A	23	0	15	0	0
2	B	46	0	30	5	0
3	A	48	0	63	9	0
3	B	42	0	56	2	0
4	A	31	0	19	0	0
4	B	31	0	19	0	0
5	B	7	0	0	0	0
6	A	357	0	0	13	0
6	B	349	0	0	4	0
All	All	5710	0	4984	70	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 7.

All (70) 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:A:98:ILE:HD11	1:A:126:LEU:CD1	2.01	0.90
1:A:9:HIS:CE1	3:A:407:GOL:H11	2.07	0.89
1:B:129:SER:HA	1:B:138:GLN:NE2	1.91	0.86
1:A:214:LYS:HE3	6:A:821:HOH:O	1.78	0.82
1:A:9:HIS:ND1	3:A:407:GOL:H11	1.94	0.82
1:A:98:ILE:HD11	1:A:126:LEU:HD12	1.64	0.80
1:A:188:LYS:HE3	6:A:728:HOH:O	1.82	0.79
1:B:131:PRO:HD3	2:B:401[A]:W75:H12	1.66	0.78
1:A:234:ASN:HD21	1:A:238:ARG:HE	1.33	0.76
1:A:132:ASN:HB3	6:A:856:HOH:O	1.88	0.74
1:B:71:LEU:HD22	2:B:401[B]:W75:H9	1.68	0.73
1:B:234:ASN:HD21	1:B:238:ARG:HE	1.36	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:407:GOL:H12	6:A:543:HOH:O	1.91	0.70
1:A:132:ASN:ND2	1:A:138:GLN:HE21	1.89	0.70
1:B:129:SER:HA	1:B:138:GLN:HE21	1.59	0.68
1:B:59:MET:CE	6:B:756:HOH:O	2.40	0.68
1:A:89:TYR:HB3	3:A:407:GOL:H32	1.76	0.67
3:A:407:GOL:C1	6:A:543:HOH:O	2.47	0.63
1:B:59:MET:HE3	6:B:756:HOH:O	1.99	0.62
1:A:82:TYR:OH	1:A:87:HIS:HD2	1.82	0.62
1:A:98:ILE:C	1:A:98:ILE:HD12	2.25	0.61
1:A:241:PRO:HA	3:A:404:GOL:H12	1.82	0.59
1:A:59:MET:HE3	6:A:697:HOH:O	2.02	0.59
1:A:98:ILE:CD1	1:A:126:LEU:HD12	2.31	0.59
1:B:7:LEU:O	1:B:9:HIS:HD2	1.85	0.59
1:B:291:GLU:OE2	1:B:295:ARG:NH1	2.36	0.58
1:B:82:TYR:OH	1:B:87:HIS:HD2	1.86	0.58
1:A:5:ASN:ND2	1:A:10:VAL:HG22	2.19	0.57
1:A:188:LYS:CE	6:A:728:HOH:O	2.45	0.57
1:A:7:LEU:O	1:A:9:HIS:HD2	1.88	0.57
1:A:59:MET:CE	6:A:697:HOH:O	2.55	0.55
1:B:234:ASN:ND2	1:B:238:ARG:HE	2.05	0.55
1:A:214:LYS:CE	6:A:821:HOH:O	2.45	0.55
1:A:234:ASN:ND2	1:A:238:ARG:HE	2.01	0.54
1:A:98:ILE:HD13	1:A:106:ASN:OD1	2.08	0.53
1:A:98:ILE:HD11	1:A:126:LEU:HD13	1.85	0.53
1:A:291:GLU:OE1	1:A:295:ARG:HG3	2.08	0.53
1:A:98:ILE:CD1	1:A:106:ASN:OD1	2.57	0.52
1:A:93:PRO:HA	3:A:407:GOL:H31	1.92	0.52
1:A:87:HIS:HE1	1:A:92:LYS:O	1.92	0.51
1:A:5:ASN:HD21	1:A:10:VAL:HG22	1.73	0.51
1:B:87:HIS:HE1	1:B:92:LYS:O	1.93	0.51
1:A:163:VAL:HG23	1:A:163:VAL:O	2.11	0.51
1:B:146:MET:HE2	1:B:180:VAL:HG11	1.93	0.51
1:B:43:LYS:NZ	2:B:401[B]:W75:OAK	2.45	0.49
1:A:98:ILE:HD12	1:A:98:ILE:O	2.13	0.48
1:A:132:ASN:CB	6:A:856:HOH:O	2.56	0.47
1:A:255:GLU:OE1	6:A:752:HOH:O	2.21	0.46
1:A:165:MET:HE2	1:A:181:LEU:HD11	1.97	0.46
1:B:131:PRO:HD3	2:B:401[A]:W75:CAW	2.43	0.46
1:A:217:PHE:CE1	3:B:403:GOL:H31	2.53	0.44
1:A:241:PRO:HA	3:A:404:GOL:C1	2.48	0.44
1:B:129:SER:HA	1:B:138:GLN:HE22	1.75	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:162:GLY:HA3	1:A:189:PHE:CZ	2.54	0.43
1:A:130:CYS:HB2	1:A:131:PRO:CD	2.49	0.43
1:A:13:ASN:HB2	1:A:14:PRO:HD2	2.01	0.42
1:B:8:ASP:HB3	6:B:847:HOH:O	2.18	0.42
2:B:401[A]:W75:OAJ	2:B:401[A]:W75:H5	2.19	0.42
1:A:130:CYS:HB2	1:A:131:PRO:HD2	2.00	0.42
1:B:34:ALA:HB3	3:B:402:GOL:H12	2.02	0.42
1:A:132:ASN:ND2	1:A:138:GLN:NE2	2.64	0.41
3:A:402:GOL:H12	1:B:217:PHE:CE1	2.56	0.41
1:A:275:GLN:NE2	6:A:639:HOH:O	2.45	0.41
1:A:132:ASN:HD21	1:A:138:GLN:HE21	1.66	0.41
1:B:195:SER:HB3	6:B:774:HOH:O	2.20	0.41
1:B:0:MET:HE1	1:B:294:ALA:HB2	2.02	0.41
1:A:192:CYS:HA	1:A:193:VAL:HA	1.94	0.40
1:B:105:GLU:HG2	1:B:109:MET:HE2	2.03	0.40
1:A:0:MET:HE2	6:A:804:HOH:O	2.20	0.40
1:A:226:LEU:HB3	1:A:227:PRO:HD3	2.04	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	311/313 (99%)	303 (97%)	8 (3%)	0	100	100
1	B	311/313 (99%)	302 (97%)	9 (3%)	0	100	100
All	All	622/626 (99%)	605 (97%)	17 (3%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	258/258 (100%)	256 (99%)	2 (1%)	73	52
1	B	258/258 (100%)	256 (99%)	2 (1%)	73	52
All	All	516/516 (100%)	512 (99%)	4 (1%)	73	52

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	302	GLU
1	A	312	GLU
1	B	129	SER
1	B	312	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	5	ASN
1	A	9	HIS
1	A	87	HIS
1	A	132	ASN
1	A	234	ASN
1	A	275	GLN
1	B	5	ASN
1	B	9	HIS
1	B	87	HIS
1	B	138	GLN
1	B	215	GLN
1	B	234	ASN
1	B	275	GLN

5.3.3 RNA ⓘ

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](#)

21 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	$\# Z > 2$
3	GOL	A	402	-	5,5,5	0.58	0	5,5,5	0.70	0
3	GOL	B	402	-	5,5,5	0.86	0	5,5,5	3.56	3 (60%)
3	GOL	A	407	-	5,5,5	1.04	0	5,5,5	2.21	1 (20%)
2	W75	A	401	-	24,24,24	1.46	5 (20%)	31,33,33	2.44	11 (35%)
5	NCO	B	410	-	6,6,6	4.72	6 (100%)	-	-	-
2	W75	B	401[B]	-	24,24,24	1.71	7 (29%)	31,33,33	2.45	11 (35%)
3	GOL	A	408	-	5,5,5	0.36	0	5,5,5	0.63	0
4	FMN	B	409	-	33,33,33	1.38	6 (18%)	48,50,50	1.49	10 (20%)
3	GOL	B	407	-	5,5,5	0.47	0	5,5,5	0.69	0
2	W75	B	401[A]	-	24,24,24	1.89	10 (41%)	31,33,33	1.54	4 (12%)
3	GOL	A	406	-	5,5,5	1.07	1 (20%)	5,5,5	1.35	1 (20%)
3	GOL	B	408	-	5,5,5	1.04	1 (20%)	5,5,5	1.15	1 (20%)
3	GOL	A	409	-	5,5,5	3.00	3 (60%)	5,5,5	2.95	4 (80%)
3	GOL	A	404	-	5,5,5	0.65	0	5,5,5	0.88	0
3	GOL	B	406	-	5,5,5	0.49	0	5,5,5	0.88	0
3	GOL	B	405	-	5,5,5	0.45	0	5,5,5	0.70	0
4	FMN	A	410	-	33,33,33	1.51	5 (15%)	48,50,50	1.46	7 (14%)
3	GOL	A	403	-	5,5,5	1.00	0	5,5,5	0.48	0
3	GOL	A	405	-	5,5,5	0.68	0	5,5,5	0.92	0
3	GOL	B	404	-	5,5,5	0.66	0	5,5,5	1.31	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	GOL	B	403	-	5,5,5	0.54	0	5,5,5	0.85	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	A	402	-	-	0/4/4/4	-
3	GOL	B	402	-	-	1/4/4/4	-
3	GOL	A	407	-	-	4/4/4/4	-
2	W75	A	401	-	-	2/13/13/13	0/2/2/2
2	W75	B	401[B]	-	-	5/13/13/13	0/2/2/2
3	GOL	A	408	-	-	2/4/4/4	-
4	FMN	B	409	-	-	1/18/18/18	0/3/3/3
3	GOL	B	407	-	-	0/4/4/4	-
2	W75	B	401[A]	-	-	3/13/13/13	0/2/2/2
3	GOL	A	406	-	-	0/4/4/4	-
3	GOL	B	408	-	-	2/4/4/4	-
3	GOL	A	409	-	-	0/4/4/4	-
3	GOL	A	404	-	-	4/4/4/4	-
3	GOL	B	406	-	-	0/4/4/4	-
3	GOL	B	405	-	-	1/4/4/4	-
4	FMN	A	410	-	-	3/18/18/18	0/3/3/3
3	GOL	A	403	-	-	0/4/4/4	-
3	GOL	A	405	-	-	0/4/4/4	-
3	GOL	B	404	-	-	4/4/4/4	-
3	GOL	B	403	-	-	0/4/4/4	-

All (44) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	410	NCO	CO-N5	5.94	2.15	1.96
4	A	410	FMN	C4-N3	-5.20	1.29	1.38
5	B	410	NCO	CO-N6	5.07	2.12	1.96
5	B	410	NCO	CO-N2	4.79	2.12	1.96
5	B	410	NCO	CO-N1	4.47	2.10	1.96
5	B	410	NCO	CO-N3	4.29	2.10	1.96
2	B	401[B]	W75	OAJ-CAI	-4.18	1.19	1.30
2	B	401[A]	W75	CAS-CAN	4.15	1.46	1.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	409	GOL	O3-C3	4.00	1.59	1.42
3	A	409	GOL	C1-C2	3.93	1.66	1.51
2	A	401	W75	OAU-CAW	-3.56	1.32	1.42
5	B	410	NCO	CO-N4	3.33	2.07	1.96
3	A	409	GOL	O1-C1	3.19	1.55	1.42
4	A	410	FMN	C4A-N5	3.13	1.37	1.30
2	B	401[B]	W75	OAU-CAW	-3.10	1.34	1.42
2	A	401	W75	CAM-CAN	-2.97	1.43	1.51
2	B	401[B]	W75	C4-N3	2.89	1.44	1.38
2	B	401[A]	W75	CAQ-CAR	2.85	1.43	1.39
4	B	409	FMN	C1'-C2'	-2.82	1.48	1.52
4	B	409	FMN	C4-N3	-2.77	1.33	1.38
2	B	401[A]	W75	OAU-CAP	2.76	1.43	1.37
2	B	401[A]	W75	OAT-CAV	2.61	1.50	1.42
2	B	401[A]	W75	C2-N1	-2.56	1.33	1.37
4	A	410	FMN	O4-C4	2.56	1.28	1.23
4	B	409	FMN	C4A-N5	2.55	1.36	1.30
4	B	409	FMN	C2-N3	-2.53	1.33	1.39
2	B	401[A]	W75	CAM-CAN	-2.44	1.44	1.51
2	B	401[B]	W75	CAM-CAN	-2.35	1.45	1.51
2	B	401[B]	W75	C6-C5	-2.33	1.40	1.44
2	B	401[B]	W75	CAM-CAL	2.32	1.63	1.52
4	A	410	FMN	C9-C8	-2.32	1.36	1.39
3	A	406	GOL	O2-C2	2.29	1.50	1.43
2	A	401	W75	C4-N3	2.26	1.43	1.38
4	A	410	FMN	C6-C5A	-2.23	1.36	1.40
4	B	409	FMN	C6-C7	-2.22	1.36	1.39
4	B	409	FMN	O4-C4	2.20	1.27	1.23
2	B	401[A]	W75	C4-CAI	2.19	1.51	1.48
2	B	401[A]	W75	CAS-CAR	2.17	1.42	1.39
2	B	401[A]	W75	OAU-CAW	2.16	1.48	1.42
2	B	401[A]	W75	CAL-C5	-2.11	1.45	1.51
2	A	401	W75	O2-C2	2.09	1.27	1.23
2	A	401	W75	OAU-CAP	2.08	1.41	1.37
3	B	408	GOL	C3-C2	2.05	1.59	1.51
2	B	401[B]	W75	CAS-CAR	2.01	1.42	1.39

All (53) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	401	W75	CAO-CAN-CAS	-6.42	110.27	119.01
2	B	401[B]	W75	CAW-OAU-CAP	-6.00	104.62	117.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	402	GOL	O2-C2-C1	-5.81	85.12	109.18
2	A	401	W75	CAP-CAO-CAN	5.28	125.53	119.76
2	B	401[B]	W75	OAJ-CAI-OAK	-5.20	111.52	123.90
2	B	401[A]	W75	CAP-CAO-CAN	5.19	125.43	119.76
2	A	401	W75	CAR-CAS-CAN	4.97	125.20	119.76
4	A	410	FMN	C4-C4A-N5	4.63	124.60	118.21
4	B	409	FMN	C4-C4A-N5	4.39	124.27	118.21
2	B	401[B]	W75	CAI-C4-C5	-4.31	117.34	123.88
3	A	407	GOL	C3-C2-C1	-4.16	96.53	111.80
2	B	401[B]	W75	OAK-CAI-C4	4.16	127.44	120.20
2	A	401	W75	C5-C6-N1	4.14	118.85	115.70
3	A	409	GOL	C3-C2-C1	4.10	126.83	111.80
2	A	401	W75	CAM-CAN-CAS	3.93	127.14	120.54
2	B	401[B]	W75	C5-C6-N1	3.91	118.67	115.70
3	B	402	GOL	C3-C2-C1	3.75	125.54	111.80
4	A	410	FMN	C4A-C4-N3	3.66	122.58	113.25
3	A	409	GOL	O3-C3-C2	3.65	126.81	110.38
2	B	401[B]	W75	CAI-C4-N3	3.59	123.79	114.87
4	A	410	FMN	C4-N3-C2	-3.50	119.42	125.64
2	A	401	W75	OAK-CAI-C4	-3.40	114.29	120.20
2	B	401[B]	W75	CAV-OAT-CAR	-3.38	110.25	117.50
4	A	410	FMN	O4-C4-C4A	-3.23	118.00	126.53
3	B	402	GOL	O2-C2-C3	-3.23	95.81	109.18
4	B	409	FMN	C9A-C5A-N5	-3.23	119.03	122.45
2	B	401[B]	W75	CAR-CAS-CAN	2.89	122.92	119.76
2	B	401[A]	W75	CAV-OAT-CAR	2.87	123.66	117.50
4	B	409	FMN	O4-C4-C4A	-2.85	119.00	126.53
4	B	409	FMN	O2-C2-N1	-2.83	117.09	121.80
4	B	409	FMN	C5A-C9A-N10	2.83	120.53	117.97
2	B	401[B]	W75	CAP-CAO-CAN	2.80	122.82	119.76
2	A	401	W75	C6-N1-C2	-2.72	122.62	126.37
4	B	409	FMN	C4A-C10-N10	2.62	120.23	116.48
2	B	401[A]	W75	OAK-CAI-C4	-2.61	115.66	120.20
2	B	401[A]	W75	N1-C2-N3	2.60	119.82	115.74
4	B	409	FMN	C4A-C4-N3	2.58	119.83	113.25
2	B	401[B]	W75	OAJ-CAI-C4	2.52	120.73	116.73
3	A	409	GOL	O1-C1-C2	2.52	121.72	110.38
2	B	401[B]	W75	CAO-CAN-CAS	-2.39	115.75	119.01
4	A	410	FMN	C10-C4A-N5	-2.38	119.95	124.81
2	A	401	W75	CAI-C4-C5	2.35	127.44	123.88
3	A	409	GOL	O2-C2-C3	-2.35	99.46	109.18
2	A	401	W75	CAW-OAU-CAP	-2.27	112.64	117.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	401	W75	N1-C2-N3	2.20	119.19	115.74
3	A	406	GOL	O2-C2-C3	2.18	118.19	109.18
4	A	410	FMN	C4A-C10-N10	2.13	119.53	116.48
4	B	409	FMN	C6-C5A-N5	2.12	121.96	118.44
4	B	409	FMN	C10-C4A-N5	-2.12	120.49	124.81
3	B	408	GOL	C3-C2-C1	2.08	119.43	111.80
4	B	409	FMN	C9A-N10-C10	-2.07	117.59	120.75
4	A	410	FMN	C9A-C9-C8	2.03	123.30	119.22
2	A	401	W75	O6-C6-N1	-2.02	116.32	120.11

There are no chirality outliers.

All (32) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	W75	N3-C4-CAI-OAJ
2	B	401[A]	W75	N3-C4-CAI-OAJ
2	B	401[B]	W75	N3-C4-CAI-OAJ
2	B	401[B]	W75	C5-CAL-CAM-CAN
3	A	404	GOL	O1-C1-C2-C3
3	A	404	GOL	C1-C2-C3-O3
3	A	404	GOL	O2-C2-C3-O3
3	A	407	GOL	O1-C1-C2-C3
3	A	408	GOL	C1-C2-C3-O3
3	B	402	GOL	O2-C2-C3-O3
3	B	404	GOL	O1-C1-C2-C3
2	B	401[B]	W75	CAS-CAR-OAT-CAV
2	B	401[B]	W75	CAQ-CAR-OAT-CAV
3	A	407	GOL	O1-C1-C2-O2
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	408	GOL	O2-C2-C3-O3
3	B	404	GOL	O1-C1-C2-O2
3	A	407	GOL	O2-C2-C3-O3
3	B	404	GOL	O2-C2-C3-O3
3	B	408	GOL	O1-C1-C2-O2
4	B	409	FMN	C4'-C5'-O5'-P
2	B	401[A]	W75	CAQ-CAR-OAT-CAV
4	A	410	FMN	C4'-C5'-O5'-P
2	B	401[B]	W75	CAO-CAP-OAU-CAW
4	A	410	FMN	O3'-C3'-C4'-O4'

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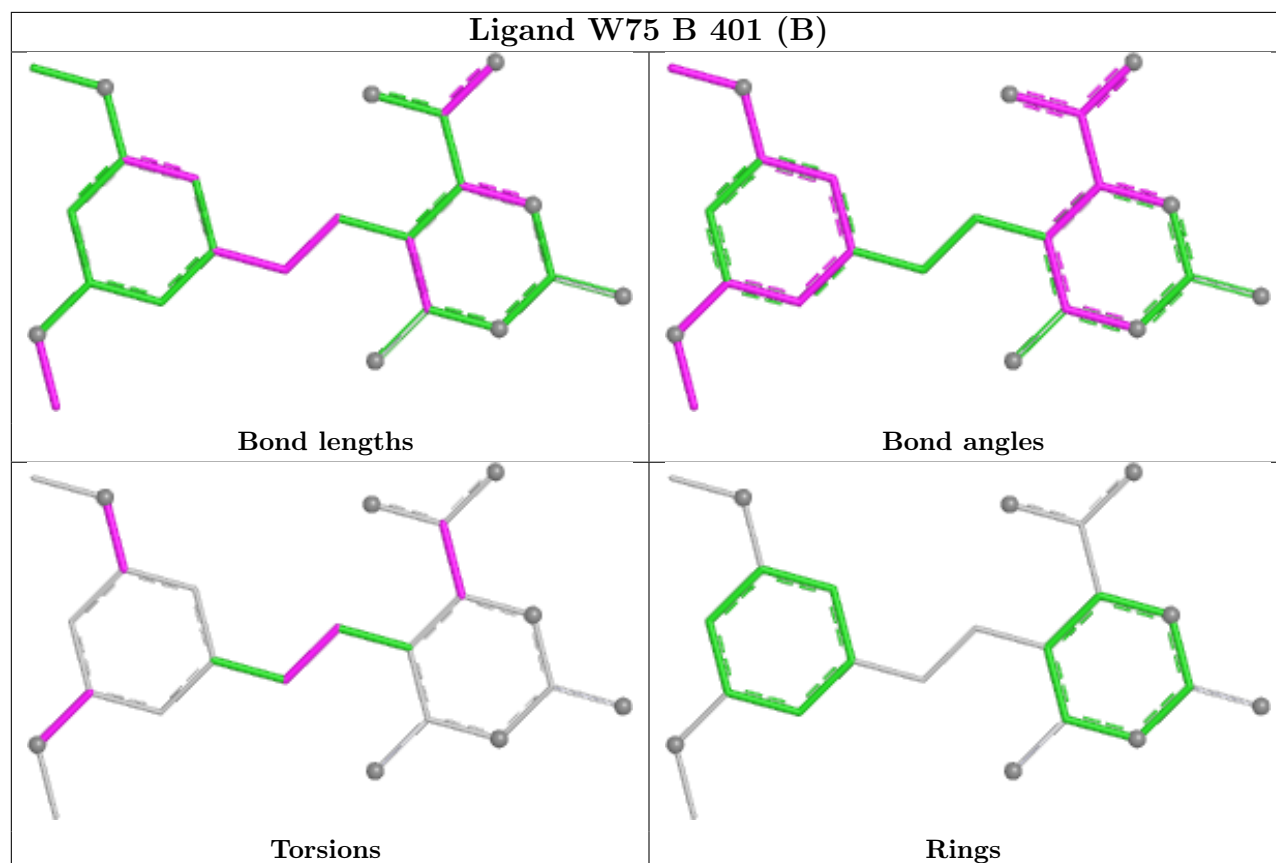
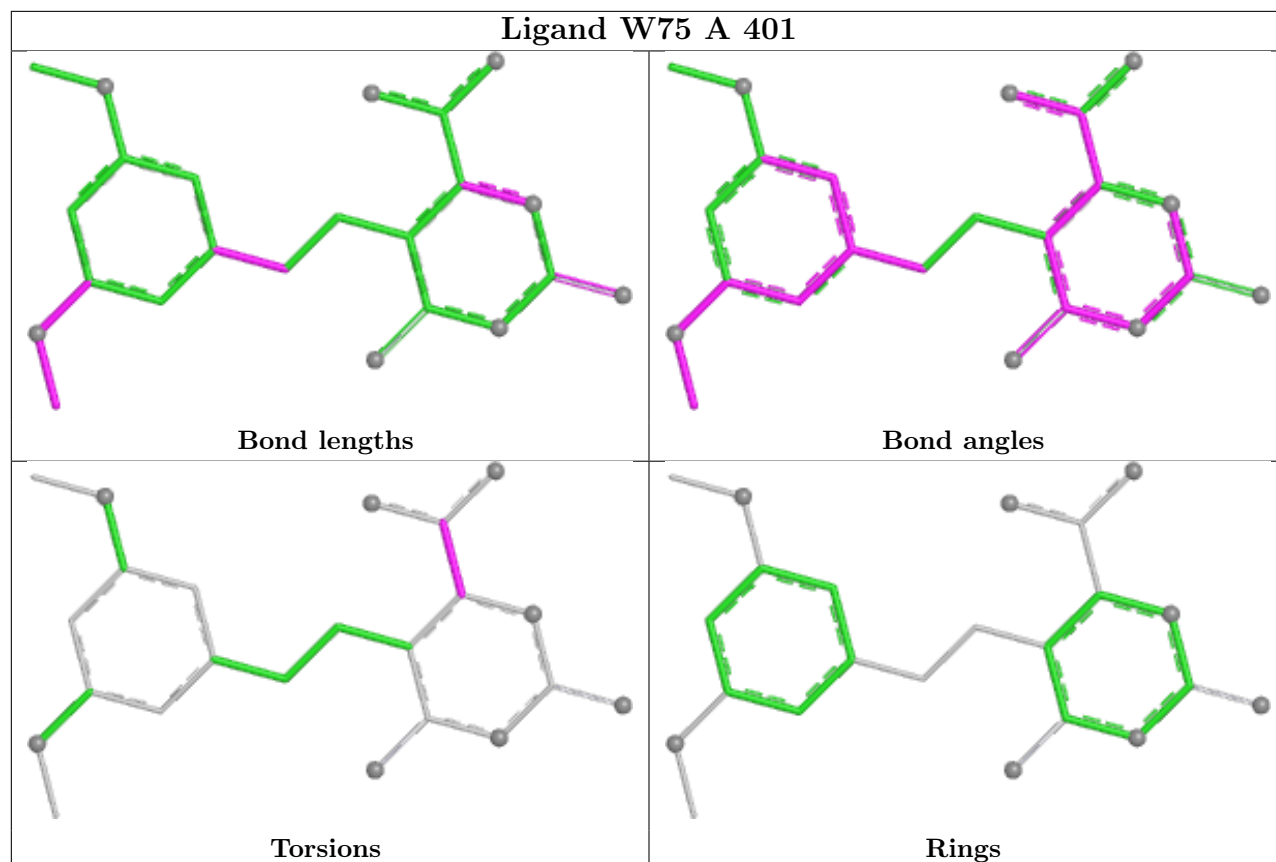
Mol	Chain	Res	Type	Atoms
3	B	405	GOL	C1-C2-C3-O3
2	A	401	W75	N3-C4-CAI-OAK
2	B	401[A]	W75	N3-C4-CAI-OAK
4	A	410	FMN	C2'-C3'-C4'-O4'

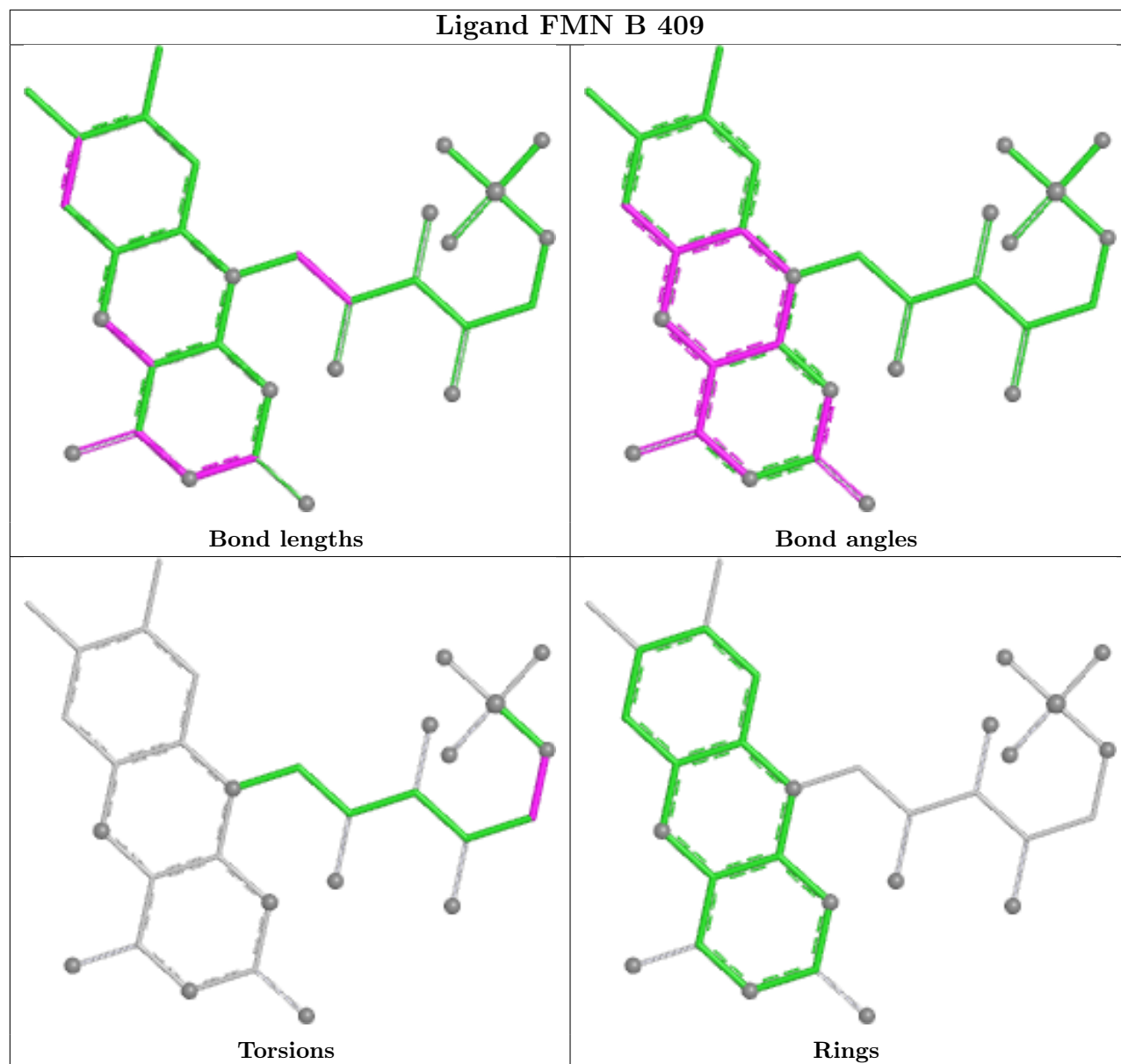
There are no ring outliers.

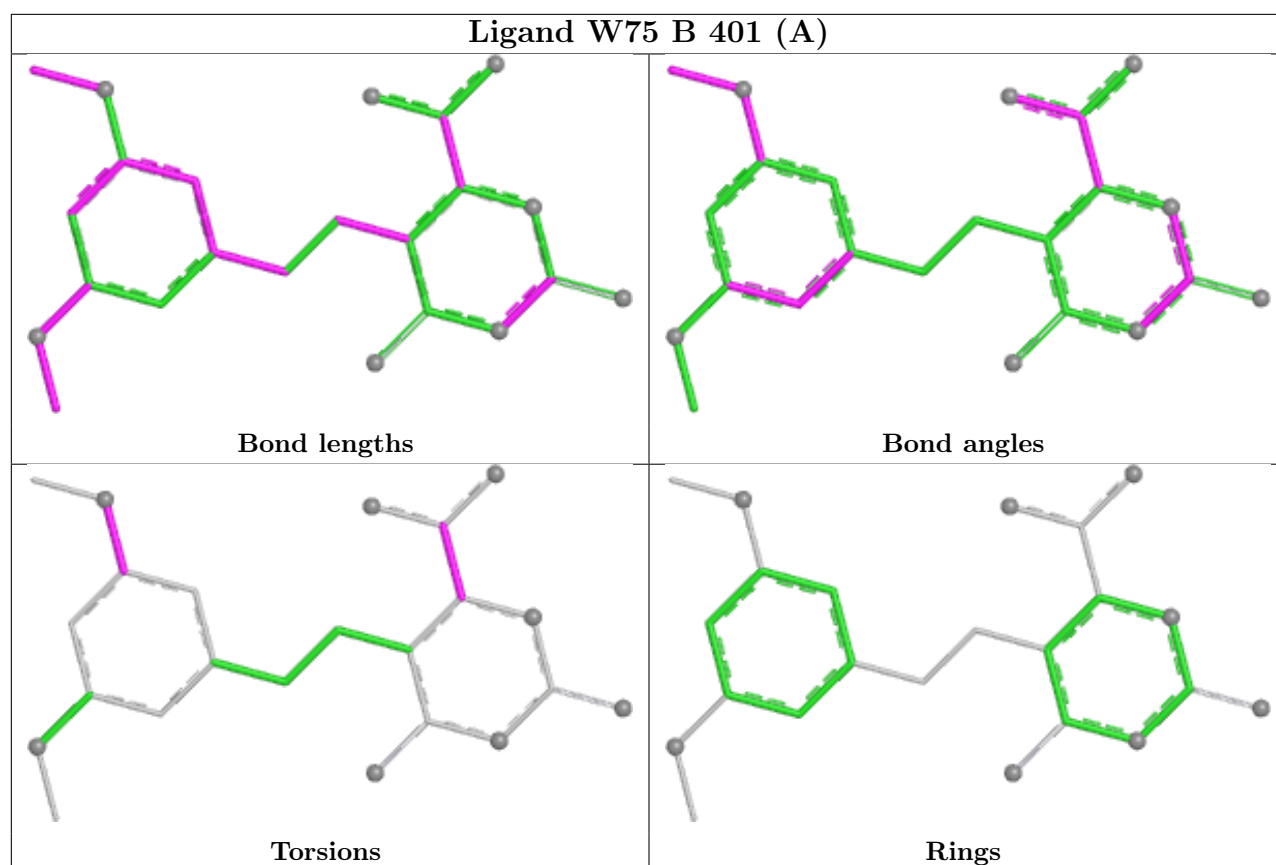
7 monomers are involved in 16 short contacts:

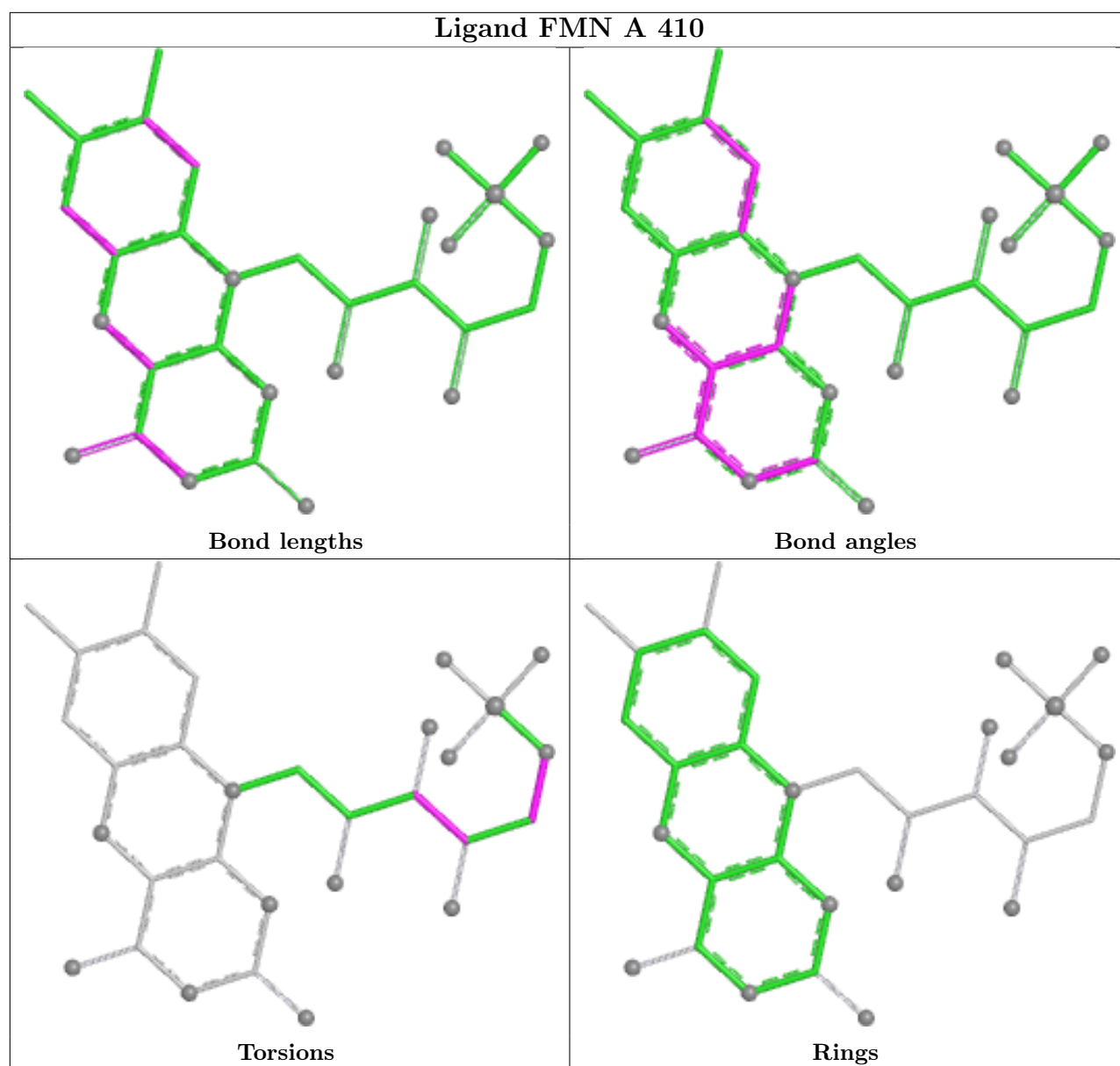
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	402	GOL	1	0
3	B	402	GOL	1	0
3	A	407	GOL	6	0
2	B	401[B]	W75	2	0
2	B	401[A]	W75	3	0
3	A	404	GOL	2	0
3	B	403	GOL	1	0

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, 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	313/313 (100%)	-0.28	4 (1%) 75 79	6, 11, 23, 44	0
1	B	313/313 (100%)	-0.30	8 (2%) 57 61	6, 10, 23, 44	0
All	All	626/626 (100%)	-0.29	12 (1%) 66 70	6, 11, 23, 44	0

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	130	CYS	4.5
1	B	131	PRO	3.8
1	B	129	SER	3.4
1	A	0	MET	2.7
1	A	291	GLU	2.7
1	B	132	ASN	2.5
1	A	1	CYS	2.5
1	B	134	PRO	2.4
1	B	291	GLU	2.1
1	B	144	GLU	2.1
1	B	312	GLU	2.1
1	A	130	CYS	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 oligosaccharides in this entry.

6.4 Ligands ⓘ

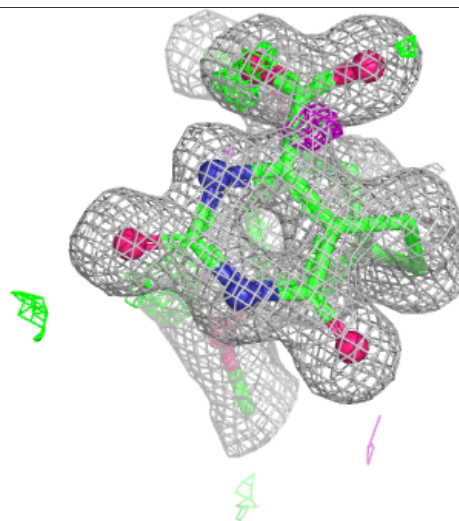
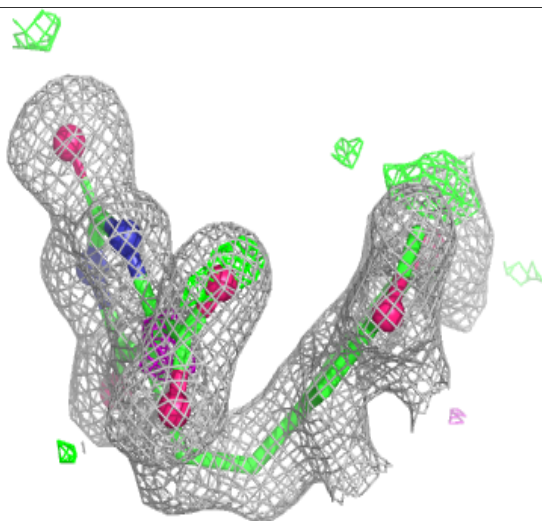
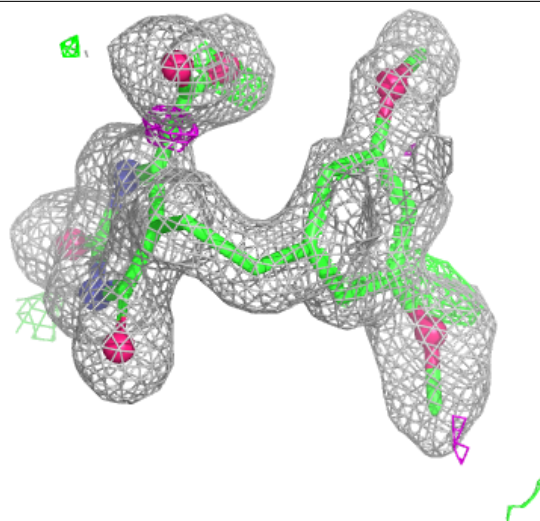
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	GOL	A	408	6/6	0.74	0.17	44,45,48,55	0
3	GOL	B	407	6/6	0.76	0.15	39,42,45,45	0
3	GOL	B	405	6/6	0.80	0.14	31,37,41,41	0
3	GOL	A	404	6/6	0.83	0.13	29,36,39,43	0
3	GOL	B	406	6/6	0.85	0.12	31,33,36,38	0
3	GOL	A	406	6/6	0.87	0.12	24,29,33,42	0
3	GOL	B	404	6/6	0.88	0.14	22,37,40,41	0
3	GOL	A	405	6/6	0.89	0.12	28,35,38,38	0
3	GOL	A	409	6/6	0.89	0.12	15,22,24,31	0
3	GOL	A	407	6/6	0.89	0.13	21,35,36,46	0
3	GOL	A	402	6/6	0.92	0.09	21,22,25,28	0
3	GOL	B	402	6/6	0.93	0.10	15,18,19,19	0
3	GOL	B	408	6/6	0.93	0.09	17,20,29,33	0
3	GOL	B	403	6/6	0.94	0.08	18,20,23,25	0
2	W75	B	401[A]	23/23	0.95	0.07	3,6,13,16	23
3	GOL	A	403	6/6	0.95	0.09	13,14,16,17	0
2	W75	B	401[B]	23/23	0.95	0.07	9,15,26,34	23
2	W75	A	401	23/23	0.98	0.04	6,8,10,16	0
4	FMN	A	410	31/31	0.99	0.03	5,6,8,8	0
4	FMN	B	409	31/31	0.99	0.03	5,6,8,10	0
5	NCO	B	410	7/7	0.99	0.06	10,10,12,12	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.

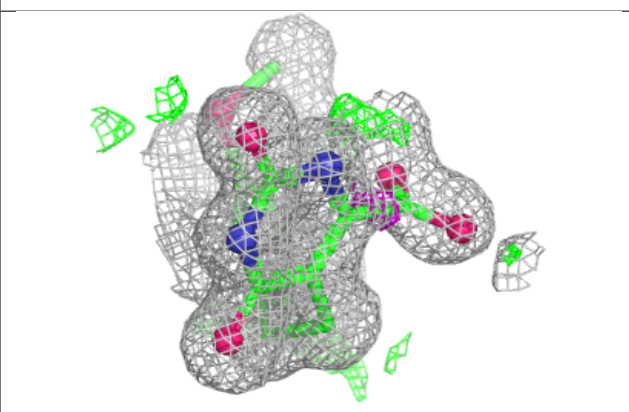
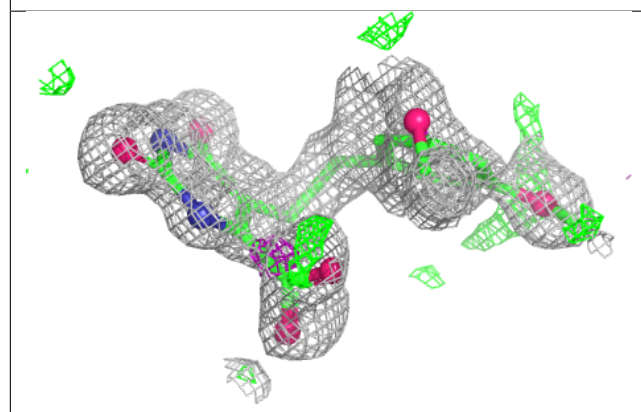
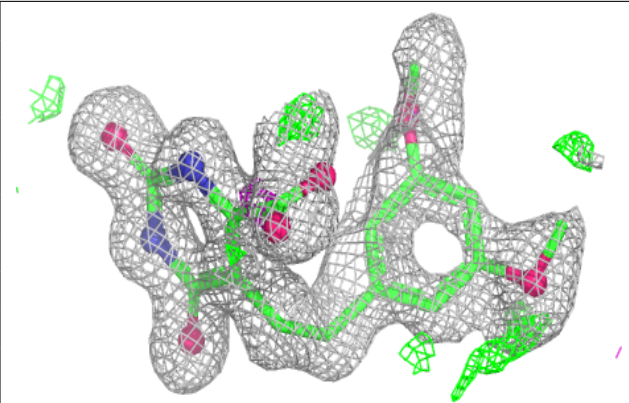
Electron density around W75 B 401 (A):

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



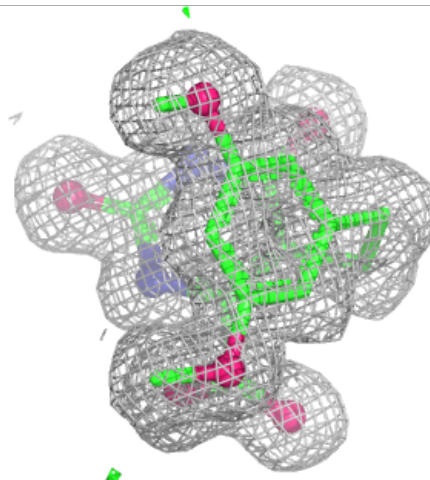
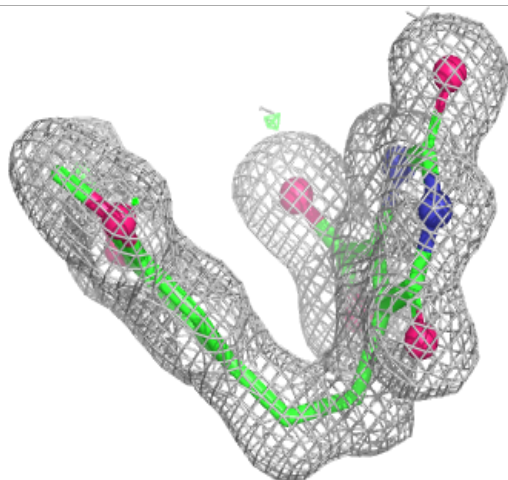
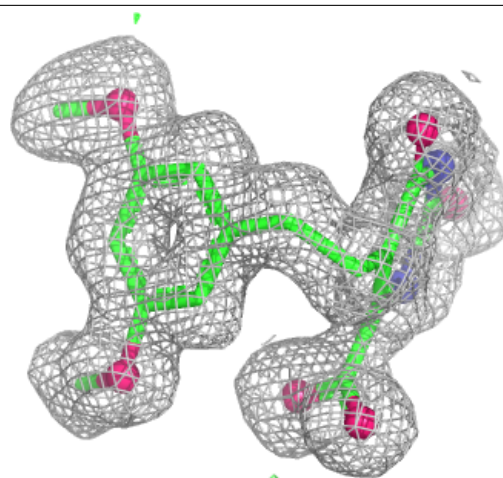
Electron density around W75 B 401 (B):

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



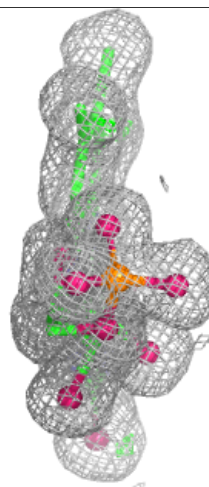
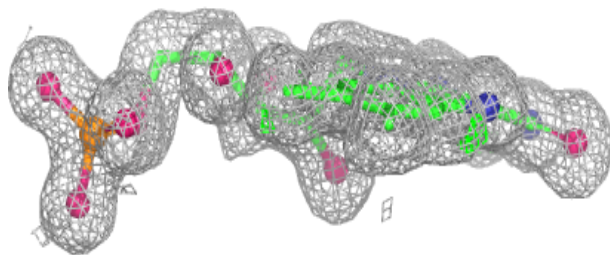
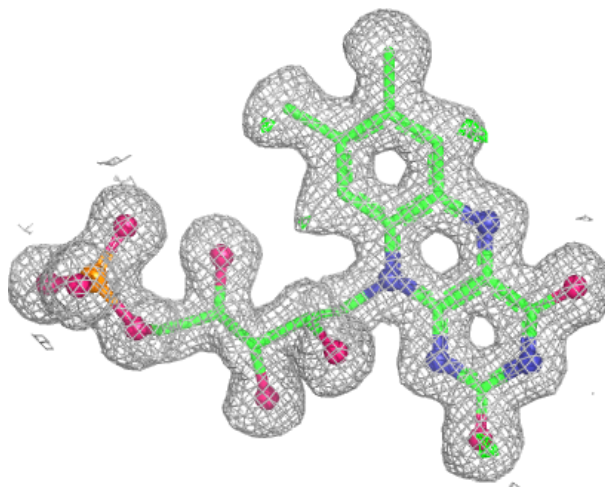
Electron density around W75 A 401:

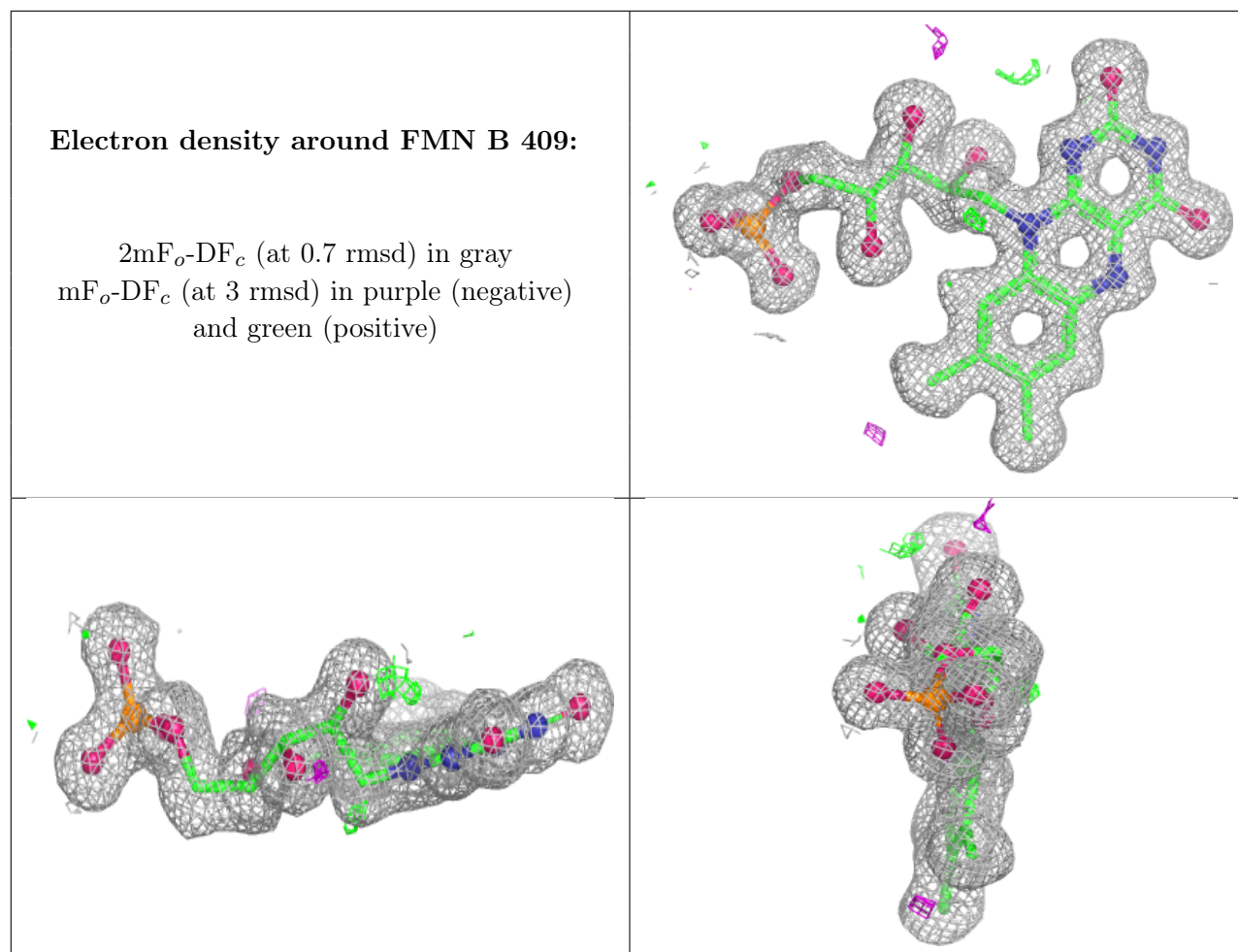
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around FMN A 410:

$2mF_o-DF_c$ (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.