



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 12, 2024 – 03:28 PM EDT

PDB ID : 3IA4
Title : Moritella profunda dihydrofolate reductase (DHFR) in complex with NADPH and methotrexate (MTX)
Authors : Levy, C.
Deposited on : 2009-07-13
Resolution : 1.70 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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : 1.20.1
EDS : 2.36.2
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36.2

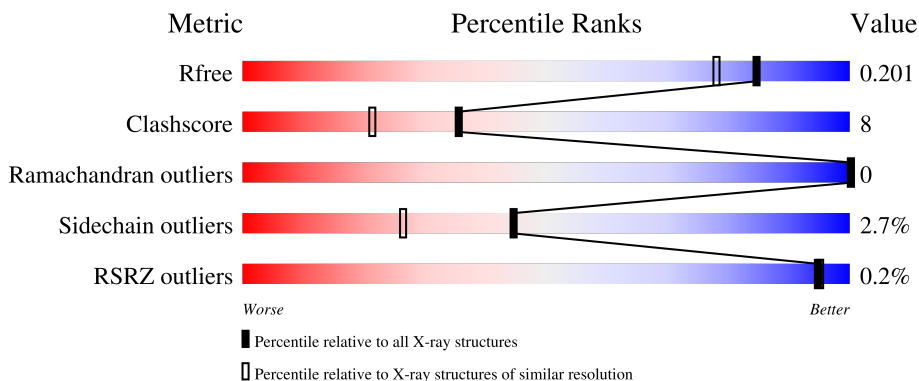
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


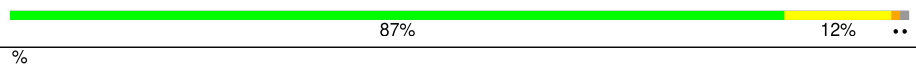
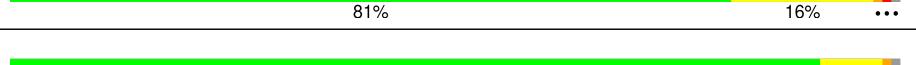

The reported resolution of this entry is 1.70 Å.

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	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (1.70-1.70)

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	162	 82% 16% ...
1	B	162	 87% 12% ..
1	C	162	 81% 16% ...
1	D	162	 91% 7% ..

2 Entry composition [i](#)

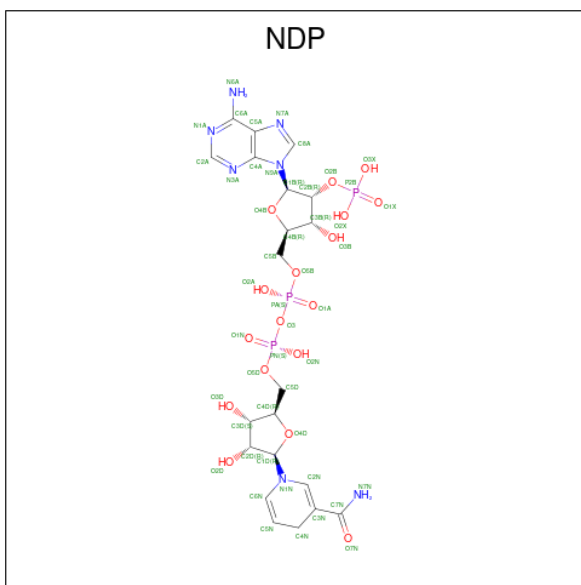
There are 4 unique types of molecules in this entry. The entry contains 6338 atoms, of which 7 are hydrogens and 0 are deuteriums.

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 Dihydrofolate reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
1	A	161	Total 1276	C 809	H 7	N 217	O 237	S 6	0	1	0
1	B	161	Total 1254	C 801	H 217	N 230	O 6	S	0	0	0
1	C	160	Total 1256	C 801	H 217	N 232	O 6	S	0	0	0
1	D	161	Total 1265	C 806	H 217	N 236	O 6	S	0	0	0

- Molecule 2 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NDP) (formula: $C_{21}H_{30}N_7O_{17}P_3$).



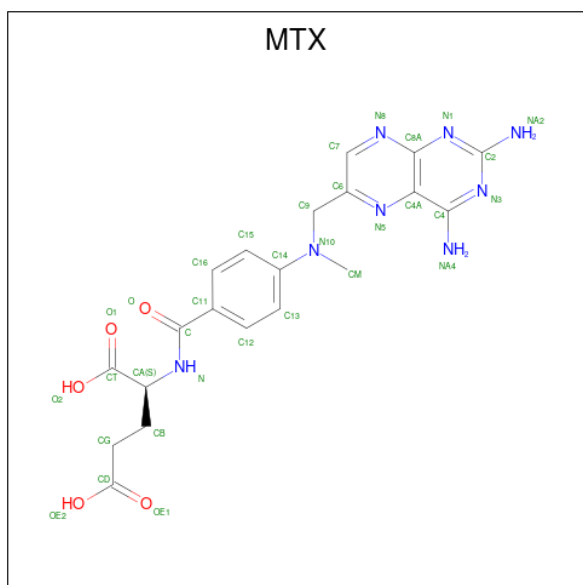
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
2	A	1	Total 48	C 21	N 7	O 17	P 3	0	0
2	B	1	Total 48	C 21	N 7	O 17	P 3	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
2	C	1	Total	C	N	O	P	0	0
			48	21	7	17	3		
2	D	1	Total	C	N	O	P	0	0
			48	21	7	17	3		

- Molecule 3 is METHOTREXATE (three-letter code: MTX) (formula: C₂₀H₂₂N₈O₅).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			33	20	8	5		
3	B	1	Total	C	N	O	0	0
			33	20	8	5		
3	C	1	Total	C	N	O	0	0
			33	20	8	5		
3	D	1	Total	C	N	O	0	0
			33	20	8	5		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	224	Total	O	0	0
			224	224		
4	B	232	Total	O	0	0
			232	232		
4	C	271	Total	O	0	0
			271	271		

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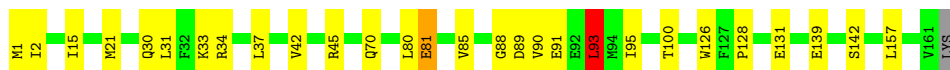
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	D	236	Total 236	O 236	0	0

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: Dihydrofolate reductase

Chain A:  82% 16% ...




- Molecule 1: Dihydrofolate reductase

Chain B:  87% 12% ..



- Molecule 1: Dihydrofolate reductase

Chain C:  81% 16% ...



- Molecule 1: Dihydrofolate reductase

Chain D:  91% 7% ..



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	183.87Å 44.99Å 97.37Å 90.00° 114.82° 90.00°	Depositor
Resolution (Å)	44.19 – 1.70 48.33 – 1.60	Depositor EDS
% Data completeness (in resolution range)	97.2 (44.19-1.70) 97.5 (48.33-1.60)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.17 (at 1.60Å)	Xtrriage
Refinement program	PHENIX (phenix.refine)	Depositor
R, R_{free}	0.154 , 0.199 0.155 , 0.201	Depositor DCC
R_{free} test set	4693 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	14.6	Xtrriage
Anisotropy	0.150	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 47.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	6338	wwPDB-VP
Average B, all atoms (Å ²)	18.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.64% 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: MTX, NDP

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.91	1/1300 (0.1%)	0.92	1/1772 (0.1%)
1	B	0.92	0/1282	0.91	0/1748
1	C	0.95	2/1283 (0.2%)	0.98	2/1747 (0.1%)
1	D	0.89	1/1293 (0.1%)	0.98	3/1762 (0.2%)
All	All	0.92	4/5158 (0.1%)	0.95	6/7029 (0.1%)

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	C	0	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	131	GLU	CG-CD	6.83	1.62	1.51
1	C	68	ASP	C-N	6.10	1.48	1.34
1	C	139	GLU	CB-CG	-5.11	1.42	1.52
1	D	160	ARG	CZ-NH1	5.08	1.39	1.33

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	68	ASP	O-C-N	-14.63	99.30	122.70
1	D	160	ARG	NE-CZ-NH2	-11.47	114.57	120.30
1	D	160	ARG	NE-CZ-NH1	9.43	125.02	120.30
1	A	93	LEU	CA-CB-CG	5.73	128.47	115.30
1	D	93	LEU	CA-CB-CG	5.57	128.11	115.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	58	ARG	NE-CZ-NH1	5.47	123.03	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	68	ASP	Mainchain

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	1269	7	1247	28	1
1	B	1254	0	1230	16	0
1	C	1256	0	1235	27	0
1	D	1265	0	1240	10	0
2	A	48	0	26	2	0
2	B	48	0	26	1	0
2	C	48	0	26	2	0
2	D	48	0	26	2	0
3	A	33	0	20	1	0
3	B	33	0	20	0	0
3	C	33	0	20	3	0
3	D	33	0	20	3	0
4	A	224	0	0	3	2
4	B	232	0	0	7	3
4	C	271	0	0	12	2
4	D	236	0	0	3	1
All	All	6331	7	5136	85	5

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 (85) 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:81:GLU:N	1:A:81:GLU:OE1	2.03	0.91
1:C:49:GLU:HG2	4:C:893:HOH:O	1.76	0.83
1:C:21:MET:SD	4:C:814:HOH:O	2.36	0.83
1:A:1:MET:CE	1:A:90:VAL:HG22	2.10	0.81
1:C:1:MET:SD	4:C:869:HOH:O	2.39	0.79
1:A:21:MET:SD	4:A:820:HOH:O	2.41	0.77
1:A:1:MET:HE2	1:A:90:VAL:HG22	1.67	0.75
1:C:1:MET:HE1	1:C:88:GLY:O	1.87	0.75
1:B:18:ASP:O	1:B:20:LYS:HD3	1.88	0.73
1:C:93:LEU:HD23	4:C:869:HOH:O	1.87	0.73
1:A:1:MET:HE1	1:A:88:GLY:O	1.90	0.71
1:A:100[A]:THR:HG21	4:B:276:HOH:O	1.90	0.70
1:D:99:ALA:HB2	1:D:125:THR:HG22	1.75	0.69
1:C:138:ILE:HG13	1:C:159:GLU:HG3	1.76	0.68
1:B:42:VAL:HB	1:B:95:ILE:HD13	1.78	0.66
1:A:1:MET:HE2	1:A:90:VAL:CG2	2.25	0.66
1:B:136:GLN:NE2	4:B:778:HOH:O	2.28	0.65
1:A:1:MET:CE	1:A:90:VAL:CG2	2.74	0.64
1:A:42:VAL:HB	1:A:95:ILE:HD13	1.77	0.64
1:A:45:ARG:HD3	4:B:746:HOH:O	2.00	0.60
1:A:21:MET:CE	4:A:820:HOH:O	2.50	0.59
1:C:138:ILE:CG1	1:C:159:GLU:HG3	2.33	0.58
1:D:99:ALA:HB2	1:D:125:THR:CG2	2.32	0.58
1:B:137:GLU:OE1	4:B:764:HOH:O	2.17	0.58
1:C:34:ARG:NH2	4:C:692:HOH:O	2.25	0.57
1:C:49:GLU:CG	4:C:893:HOH:O	2.44	0.56
1:D:20:LYS:NZ	4:D:821:HOH:O	2.31	0.56
1:C:31:LEU:HB2	4:C:692:HOH:O	2.05	0.56
1:B:18:ASP:O	1:B:20:LYS:CD	2.54	0.56
1:D:160:ARG:NH2	4:D:451:HOH:O	2.39	0.55
1:A:100[A]:THR:HG23	4:B:217:HOH:O	2.05	0.55
1:A:81:GLU:OE1	1:A:81:GLU:CA	2.55	0.55
1:C:24:HIS:HE1	4:C:748:HOH:O	1.91	0.54
1:C:63:LEU:HD13	1:C:101:ILE:HD12	1.89	0.54
1:A:33:LYS:HE3	1:A:37:LEU:HD11	1.90	0.53
1:C:136:GLN:NE2	4:C:804:HOH:O	2.39	0.53
1:B:93:LEU:C	1:B:93:LEU:HD23	2.29	0.52
1:B:136:GLN:HG3	1:B:161:VAL:CG2	2.40	0.52
3:D:164:MTX:C	3:D:164:MTX:HG2	2.41	0.50
1:A:100[B]:THR:HG23	2:A:163:NDP:O1N	2.11	0.50
1:B:63:LEU:HD13	1:B:77:VAL:HG23	1.93	0.50
3:C:164:MTX:C6	3:C:164:MTX:H15	2.41	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1:MET:HE3	1:A:90:VAL:CG2	2.42	0.49
1:D:34:ARG:NH1	4:D:168:HOH:O	2.46	0.49
1:A:126:TRP:CZ3	1:B:128:PRO:HB3	2.48	0.49
1:C:140:HIS:HB2	1:C:154:ARG:CZ	2.44	0.48
1:D:21:MET:SD	3:D:164:MTX:C7	3.02	0.47
1:A:128:PRO:HB3	1:B:126:TRP:CZ3	2.49	0.47
1:C:140:HIS:ND1	1:C:154:ARG:NH1	2.63	0.47
1:C:139:GLU:HG3	1:C:157:LEU:HB3	1.96	0.47
1:C:65:ARG:NH2	4:C:715:HOH:O	2.47	0.47
1:D:93:LEU:C	1:D:93:LEU:HD12	2.36	0.47
1:A:1:MET:HE3	1:A:90:VAL:HG22	1.93	0.46
1:A:31:LEU:C	1:A:31:LEU:HD23	2.36	0.46
3:C:164:MTX:H13	3:C:164:MTX:HM1	1.77	0.46
1:C:127:PHE:CG	1:C:128:PRO:HD2	2.51	0.46
1:B:99:ALA:HB2	1:B:125:THR:HG22	1.98	0.46
1:A:93:LEU:C	1:A:93:LEU:HD13	2.37	0.45
1:B:42:VAL:HB	1:B:95:ILE:CD1	2.45	0.45
1:B:21:MET:CE	4:B:462:HOH:O	2.64	0.45
1:B:34:ARG:HD3	4:B:780:HOH:O	2.16	0.45
1:C:65:ARG:CZ	4:C:715:HOH:O	2.65	0.45
1:C:106:LEU:HD22	1:C:128:PRO:HB2	1.98	0.45
1:A:139:GLU:HB2	1:A:157:LEU:HB3	1.99	0.44
1:B:99:ALA:HB2	1:B:125:THR:CG2	2.47	0.44
1:C:21:MET:HE1	4:C:747:HOH:O	2.16	0.44
1:C:99:ALA:HB2	1:C:125:THR:CG2	2.47	0.43
1:D:127:PHE:CG	1:D:128:PRO:HD2	2.54	0.42
1:A:15:ILE:O	2:A:163:NDP:H2N	2.18	0.42
3:C:164:MTX:C6	3:C:164:MTX:C15	2.98	0.42
1:D:106:LEU:HD22	1:D:128:PRO:HB2	2.01	0.42
1:D:15:ILE:O	2:D:163:NDP:H2N	2.20	0.42
1:B:15:ILE:O	2:B:163:NDP:H2N	2.21	0.41
1:A:30:GLN:O	1:A:34:ARG:HG3	2.21	0.41
1:A:42:VAL:CG2	1:A:93:LEU:HD21	2.50	0.41
3:A:164:MTX:H13	3:A:164:MTX:HM1	1.81	0.41
1:A:85:VAL:HG12	4:A:340:HOH:O	2.19	0.41
1:C:100:THR:HG23	2:C:163:NDP:O1N	2.20	0.41
1:C:140:HIS:CG	1:C:154:ARG:NH2	2.89	0.41
1:A:2:ILE:HD12	1:A:91:GLU:OE2	2.21	0.40
1:C:99:ALA:HB2	1:C:125:THR:HG22	2.03	0.40
1:C:15:ILE:O	2:C:163:NDP:H2N	2.22	0.40
1:C:140:HIS:ND1	1:C:154:ARG:NH2	2.70	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:70:GLN:O	1:A:70:GLN:HG3	2.21	0.40
2:D:163:NDP:H42N	3:D:164:MTX:N5	2.36	0.40

All (5) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:C:883:HOH:O	4:C:884:HOH:O[4_554]	1.85	0.35
4:A:870:HOH:O	4:B:427:HOH:O[1_565]	2.13	0.07
1:A:89:ASP:O	4:C:501:HOH:O[4_544]	2.14	0.06
4:A:927:HOH:O	4:B:191:HOH:O[4_555]	2.18	0.02
4:B:897:HOH:O	4:D:935:HOH:O[3_445]	2.18	0.02

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	160/162 (99%)	158 (99%)	2 (1%)	0	100	100
1	B	159/162 (98%)	158 (99%)	1 (1%)	0	100	100
1	C	156/162 (96%)	155 (99%)	1 (1%)	0	100	100
1	D	159/162 (98%)	157 (99%)	2 (1%)	0	100	100
All	All	634/648 (98%)	628 (99%)	6 (1%)	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	133/137 (97%)	129 (97%)	4 (3%)	41	22
1	B	129/137 (94%)	125 (97%)	4 (3%)	40	21
1	C	131/137 (96%)	127 (97%)	4 (3%)	40	21
1	D	132/137 (96%)	130 (98%)	2 (2%)	65	51
All	All	525/548 (96%)	511 (97%)	14 (3%)	44	26

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	80	LEU
1	A	81	GLU
1	A	93	LEU
1	A	142	SER
1	B	20	LYS
1	B	49	GLU
1	B	60	ASN
1	B	80	LEU
1	C	1	MET
1	C	66	GLN
1	C	70	GLN
1	C	139	GLU
1	D	81	GLU
1	D	154	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	24	HIS

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](#)

8 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	MTX	A	164	-	35,35,35	1.84	3 (8%)	47,49,49	1.80	10 (21%)
2	NDP	A	163	-	47,52,52	1.15	2 (4%)	61,80,80	1.39	8 (13%)
2	NDP	C	163	-	47,52,52	1.16	4 (8%)	61,80,80	1.34	6 (9%)
3	MTX	C	164	-	35,35,35	1.91	4 (11%)	47,49,49	1.66	6 (12%)
3	MTX	B	164	-	35,35,35	1.75	4 (11%)	47,49,49	1.97	13 (27%)
3	MTX	D	164	-	35,35,35	1.66	4 (11%)	47,49,49	1.91	11 (23%)
2	NDP	B	163	-	47,52,52	1.31	5 (10%)	61,80,80	1.47	12 (19%)
2	NDP	D	163	-	47,52,52	1.00	4 (8%)	61,80,80	1.17	8 (13%)

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	MTX	A	164	-	-	3/25/25/25	0/3/3/3
2	NDP	A	163	-	-	3/30/77/77	0/5/5/5
2	NDP	C	163	-	-	5/30/77/77	0/5/5/5
3	MTX	C	164	-	-	3/25/25/25	0/3/3/3
3	MTX	B	164	-	-	1/25/25/25	0/3/3/3
3	MTX	D	164	-	-	3/25/25/25	0/3/3/3
2	NDP	B	163	-	-	4/30/77/77	0/5/5/5
2	NDP	D	163	-	-	4/30/77/77	0/5/5/5

All (30) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	164	MTX	O-C	6.83	1.39	1.23
3	A	164	MTX	O-C	6.74	1.39	1.23
3	D	164	MTX	O-C	6.69	1.38	1.23
3	B	164	MTX	O-C	6.48	1.38	1.23
3	C	164	MTX	C7-N8	5.94	1.41	1.31
2	B	163	NDP	O4B-C1B	5.29	1.47	1.40
3	A	164	MTX	C7-N8	5.26	1.40	1.31
2	C	163	NDP	O4B-C1B	4.36	1.46	1.40
3	B	164	MTX	C7-N8	4.26	1.39	1.31
2	A	163	NDP	O4B-C1B	4.04	1.46	1.40
3	D	164	MTX	C7-N8	3.86	1.38	1.31
3	B	164	MTX	C4-N3	3.44	1.40	1.33
2	B	163	NDP	P2B-O2B	3.31	1.65	1.59
2	C	163	NDP	PN-O3	3.16	1.62	1.59
3	A	164	MTX	C6-N5	3.04	1.37	1.32
3	B	164	MTX	C6-N5	2.93	1.37	1.32
2	D	163	NDP	O4B-C1B	2.66	1.44	1.40
2	A	163	NDP	PA-O3	2.57	1.62	1.59
2	D	163	NDP	C2A-N3A	2.49	1.35	1.32
2	B	163	NDP	C6N-C5N	2.42	1.40	1.33
2	C	163	NDP	P2B-O2B	2.41	1.63	1.59
3	D	164	MTX	C6-N5	2.37	1.36	1.32
3	D	164	MTX	CM-N10	2.36	1.49	1.46
2	D	163	NDP	C6N-C5N	2.36	1.40	1.33
3	C	164	MTX	O2-CT	-2.36	1.23	1.30
2	D	163	NDP	P2B-O2B	2.25	1.63	1.59
2	B	163	NDP	C1B-N9A	-2.21	1.44	1.49
2	B	163	NDP	PN-O3	2.20	1.61	1.59
3	C	164	MTX	C2-NA2	-2.15	1.29	1.33
2	C	163	NDP	C6N-C5N	2.01	1.39	1.33

All (74) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	164	MTX	N1-C2-N3	-5.69	119.98	127.21
2	A	163	NDP	N3A-C2A-N1A	-5.47	121.25	128.67
3	A	164	MTX	C6-C7-N8	-5.18	118.17	123.14
3	B	164	MTX	N1-C2-N3	-5.13	120.69	127.21
3	B	164	MTX	C4A-C4-N3	-4.94	115.00	120.84
3	A	164	MTX	N1-C2-N3	-4.93	120.94	127.21
3	D	164	MTX	N1-C2-N3	-4.78	121.13	127.21
3	B	164	MTX	C7-C6-N5	-4.41	118.01	120.87

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	164	MTX	CG-CB-CA	-4.32	105.19	113.16
2	B	163	NDP	C4B-O4B-C1B	4.11	113.69	109.92
3	D	164	MTX	C4-C4A-N5	-3.95	117.28	120.33
3	D	164	MTX	C9-N10-C14	3.91	124.91	120.17
3	B	164	MTX	NA2-C2-N3	3.79	122.91	117.22
3	D	164	MTX	NA2-C2-N3	3.69	122.76	117.22
3	C	164	MTX	NA2-C2-N3	3.57	122.58	117.22
3	D	164	MTX	C7-C6-N5	-3.48	118.61	120.87
3	B	164	MTX	C2-N1-C8A	3.44	119.20	115.48
3	C	164	MTX	C2-N1-C8A	3.39	119.14	115.48
2	B	163	NDP	N3A-C2A-N1A	-3.31	124.17	128.67
3	A	164	MTX	C2-N1-C8A	3.26	119.00	115.48
3	C	164	MTX	C7-C6-N5	-3.26	118.76	120.87
3	D	164	MTX	C15-C16-C11	-3.21	117.37	120.80
2	B	163	NDP	C4A-C5A-N7A	-3.08	106.08	109.34
3	A	164	MTX	C7-C6-N5	3.06	122.86	120.87
3	A	164	MTX	NA2-C2-N3	3.05	121.80	117.22
2	B	163	NDP	C6N-N1N-C2N	2.95	122.48	119.32
3	D	164	MTX	N8-C8A-N1	2.91	118.94	115.77
3	A	164	MTX	C15-C16-C11	-2.90	117.70	120.80
2	C	163	NDP	N6A-C6A-N1A	2.87	124.48	118.33
2	D	163	NDP	O2A-PA-O1A	2.86	125.75	112.44
2	C	163	NDP	O3D-C3D-C2D	-2.85	102.67	111.82
2	C	163	NDP	O4D-C1D-N1N	-2.83	102.69	108.08
3	A	164	MTX	N8-C8A-N1	2.76	118.77	115.77
3	D	164	MTX	C16-C15-C14	2.67	123.68	120.30
2	B	163	NDP	C1D-N1N-C2N	-2.66	116.75	121.14
2	C	163	NDP	C6N-N1N-C2N	2.63	122.13	119.32
3	B	164	MTX	C4A-C4-NA4	2.62	124.31	120.31
2	B	163	NDP	O2B-C2B-C1B	-2.60	100.91	110.05
2	B	163	NDP	O7N-C7N-C3N	-2.57	116.05	120.90
2	C	163	NDP	N3A-C2A-N1A	-2.54	125.23	128.67
2	A	163	NDP	C3N-C7N-N7N	2.49	122.10	117.67
2	D	163	NDP	N3A-C2A-N1A	-2.44	125.36	128.67
2	B	163	NDP	N6A-C6A-N1A	2.42	123.51	118.33
2	A	163	NDP	C4A-C5A-N7A	-2.40	106.80	109.34
2	B	163	NDP	O4B-C4B-C3B	-2.38	100.43	105.15
3	A	164	MTX	OE2-CD-CG	2.37	121.48	114.00
3	C	164	MTX	CG-CB-CA	-2.36	108.80	113.16
2	A	163	NDP	C3N-C2N-N1N	-2.36	119.74	123.20
3	B	164	MTX	CG-CB-CA	-2.33	108.87	113.16
3	B	164	MTX	N8-C8A-N1	2.30	118.28	115.77

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	164	MTX	CM-N10-C14	2.28	123.36	119.59
3	B	164	MTX	OE2-CD-CG	2.27	121.18	114.00
3	A	164	MTX	OE2-CD-OE1	-2.27	117.49	123.33
2	D	163	NDP	O2B-C2B-C1B	-2.26	102.11	110.05
3	B	164	MTX	C2-N3-C4	2.24	123.12	116.72
2	D	163	NDP	O4D-C1D-C2D	-2.23	101.85	106.62
3	C	164	MTX	O2-CT-O1	-2.22	119.03	124.08
3	A	164	MTX	C8A-C4A-N5	-2.20	119.89	122.35
2	B	163	NDP	C5A-C6A-N1A	-2.20	114.99	120.23
2	D	163	NDP	C3N-C7N-N7N	2.19	121.56	117.67
2	C	163	NDP	O2X-P2B-O1X	2.16	119.25	110.83
2	A	163	NDP	C3B-C2B-C1B	-2.15	98.69	102.81
3	B	164	MTX	C4-C4A-N5	-2.14	118.68	120.33
2	B	163	NDP	C1B-N9A-C4A	-2.13	122.91	126.64
3	D	164	MTX	C4A-C4-N3	-2.11	118.34	120.84
2	A	163	NDP	C1D-N1N-C2N	-2.11	117.67	121.14
2	A	163	NDP	O2X-P2B-O1X	2.09	118.97	110.83
2	D	163	NDP	O2B-P2B-O1X	-2.07	101.96	109.33
2	D	163	NDP	O2X-P2B-O1X	2.03	118.76	110.83
2	B	163	NDP	O3D-C3D-C4D	-2.03	105.25	111.08
3	B	164	MTX	CB-CA-CT	-2.03	105.54	110.35
3	B	164	MTX	C6-N5-C4A	2.02	121.03	118.17
2	D	163	NDP	N6A-C6A-N1A	2.02	122.64	118.33
2	A	163	NDP	O2B-P2B-O1X	-2.00	102.20	109.33

There are no chirality outliers.

All (26) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	163	NDP	PA-O3-PN-O5D
2	D	163	NDP	PA-O3-PN-O5D
2	B	163	NDP	PA-O3-PN-O5D
2	C	163	NDP	PA-O3-PN-O5D
3	A	164	MTX	C6-C9-N10-CM
2	C	163	NDP	O4D-C1D-N1N-C2N
2	C	163	NDP	C2B-O2B-P2B-O3X
2	D	163	NDP	O4D-C1D-N1N-C2N
2	A	163	NDP	O4D-C1D-N1N-C2N
2	B	163	NDP	O4D-C1D-N1N-C2N
2	A	163	NDP	C2N-C3N-C7N-N7N
2	B	163	NDP	C2D-C1D-N1N-C2N
2	D	163	NDP	C2D-C1D-N1N-C2N

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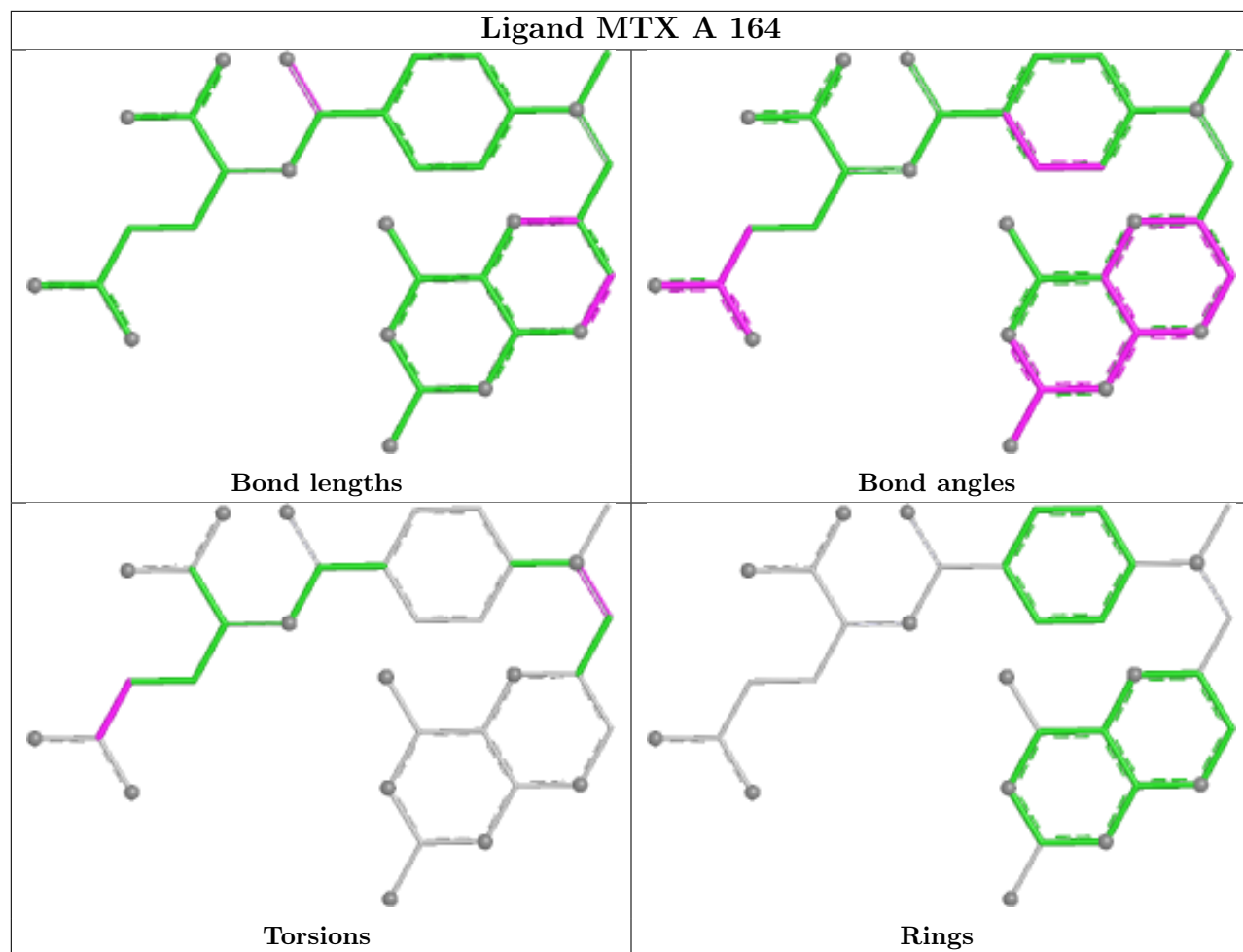
Mol	Chain	Res	Type	Atoms
3	A	164	MTX	OE2-CD-CG-CB
3	B	164	MTX	C6-C9-N10-CM
3	C	164	MTX	C6-C9-N10-CM
3	D	164	MTX	C6-C9-N10-CM
3	D	164	MTX	OE2-CD-CG-CB
2	C	163	NDP	C2D-C1D-N1N-C2N
3	A	164	MTX	OE1-CD-CG-CB
3	C	164	MTX	OE2-CD-CG-CB
2	B	163	NDP	C2B-O2B-P2B-O3X
2	C	163	NDP	C2B-O2B-P2B-O2X
2	D	163	NDP	C2B-O2B-P2B-O3X
3	C	164	MTX	OE1-CD-CG-CB
3	D	164	MTX	OE1-CD-CG-CB

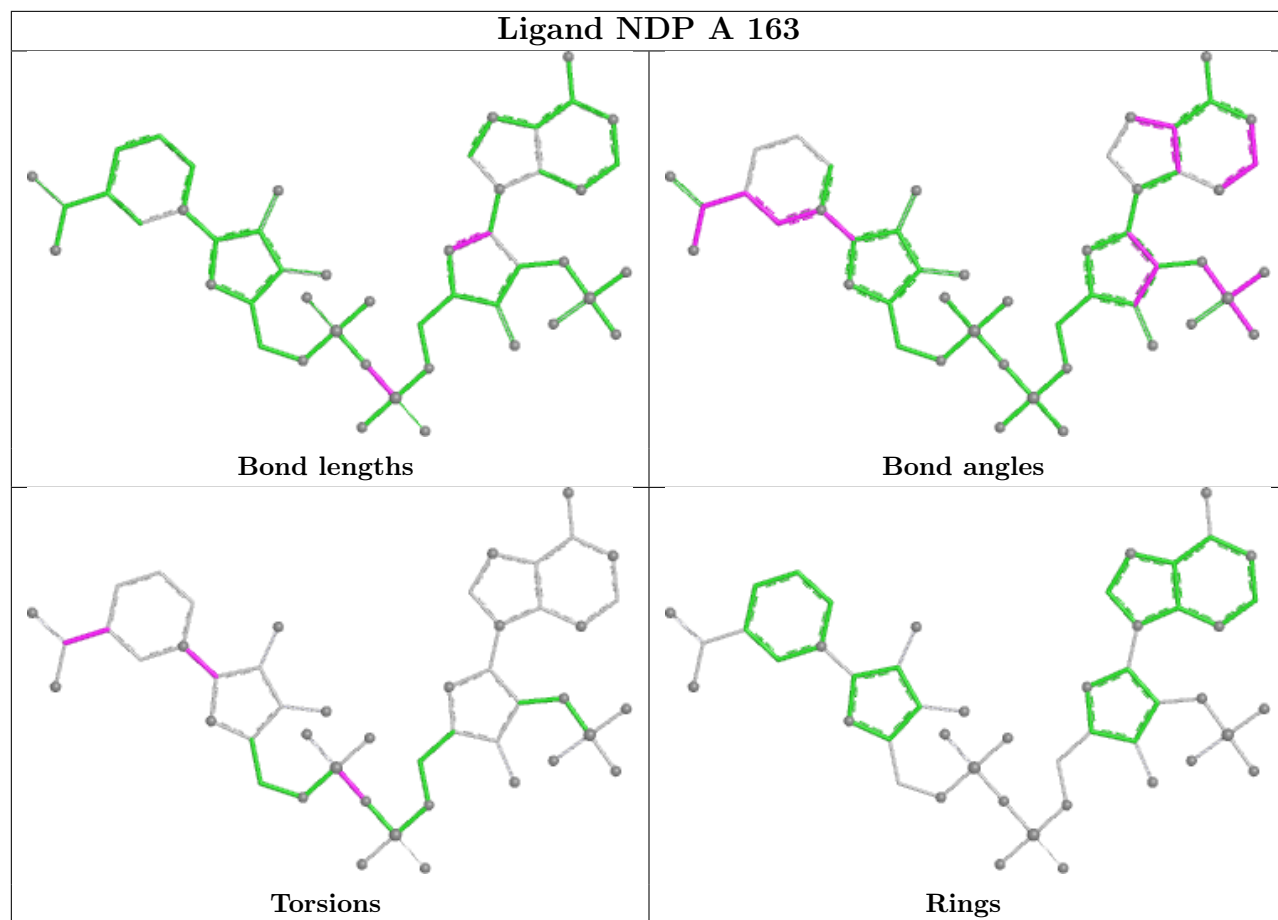
There are no ring outliers.

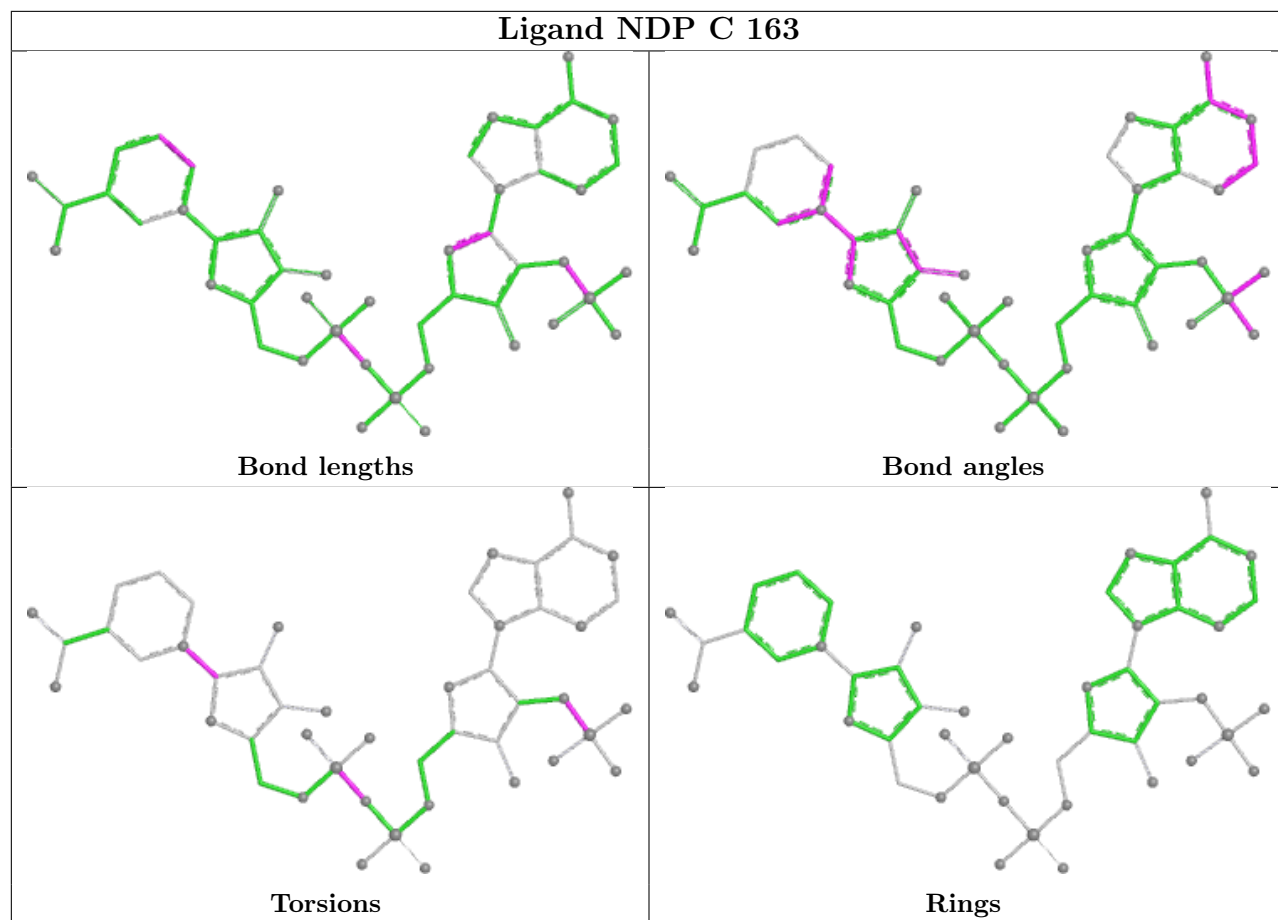
7 monomers are involved in 13 short contacts:

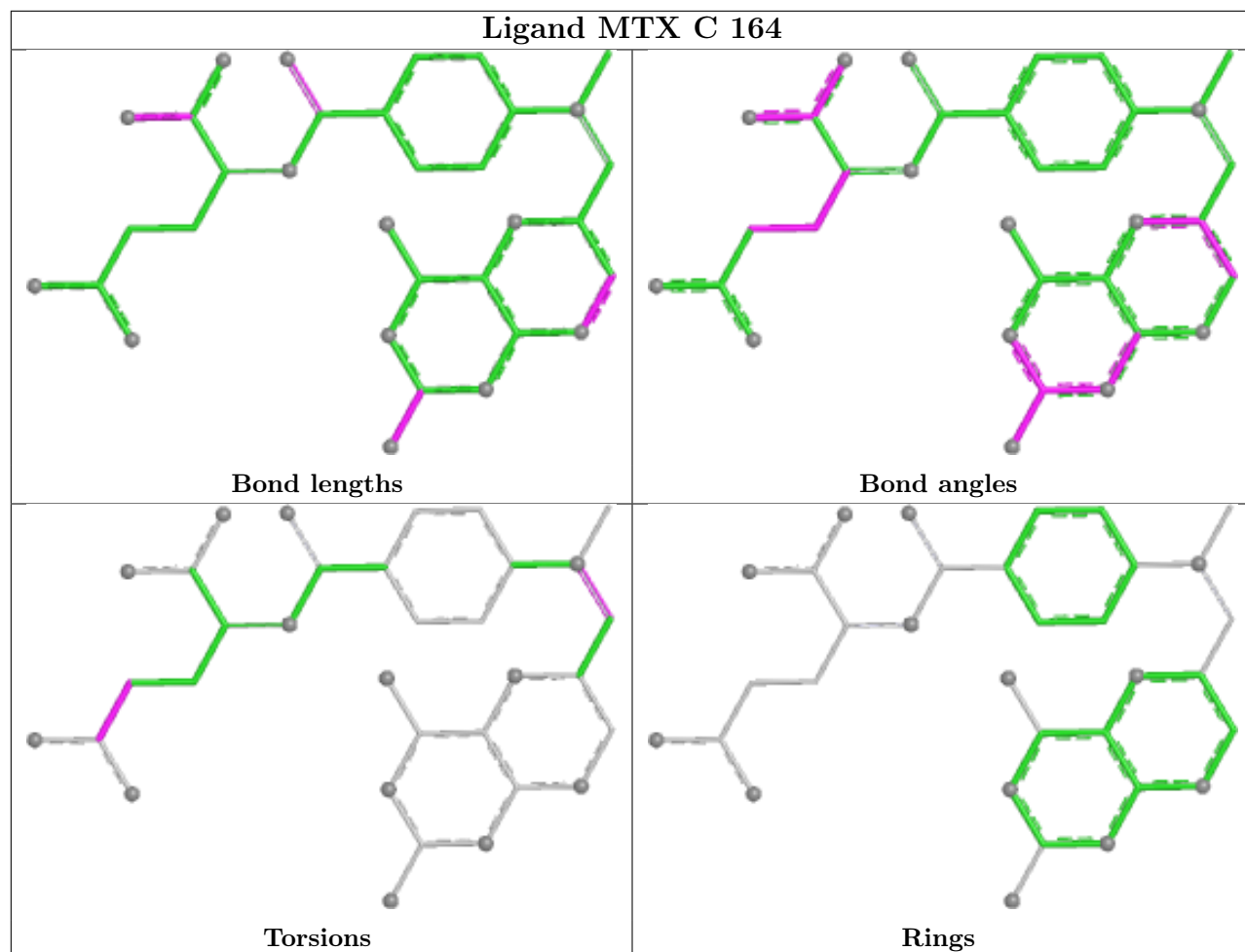
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	164	MTX	1	0
2	A	163	NDP	2	0
2	C	163	NDP	2	0
3	C	164	MTX	3	0
3	D	164	MTX	3	0
2	B	163	NDP	1	0
2	D	163	NDP	2	0

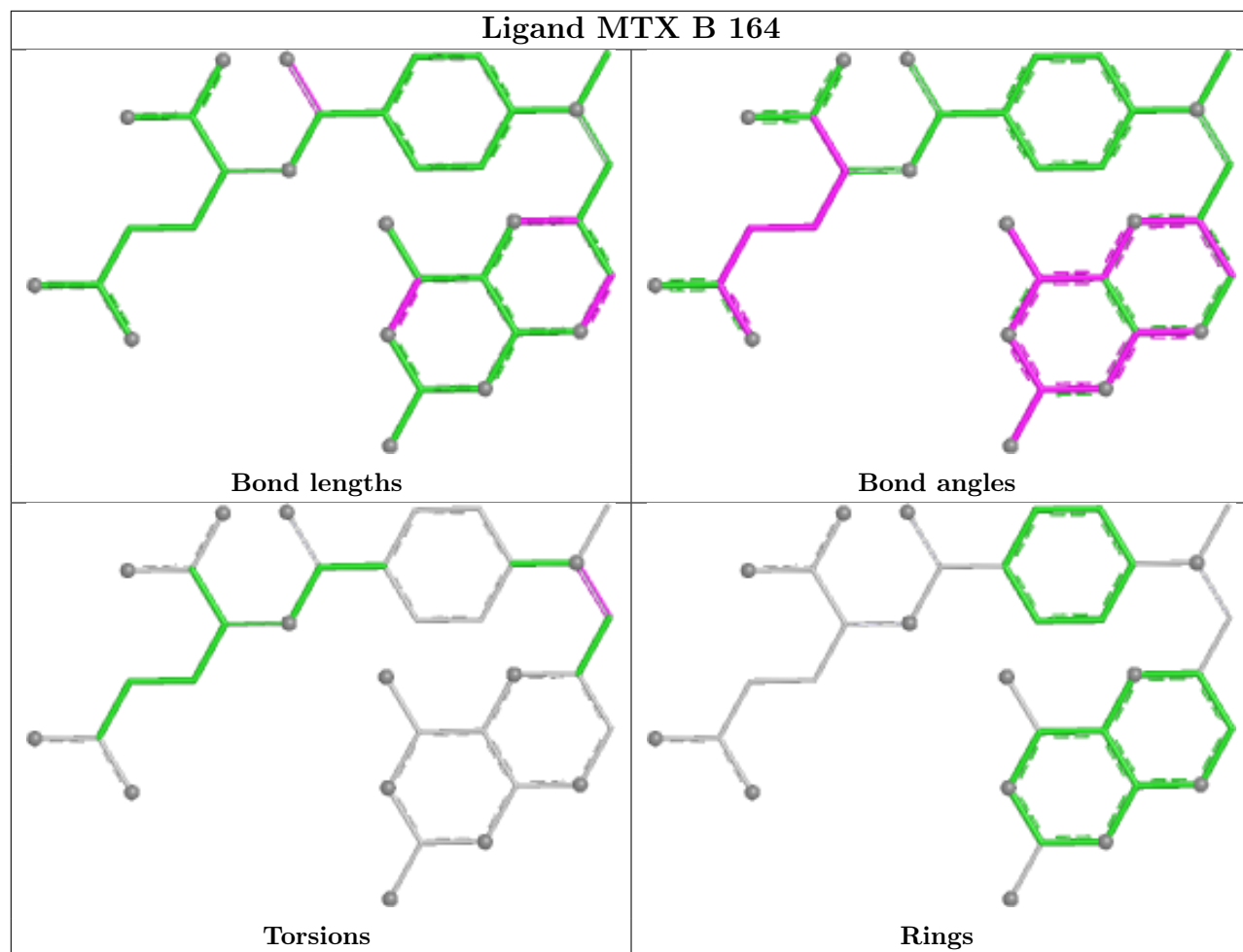
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

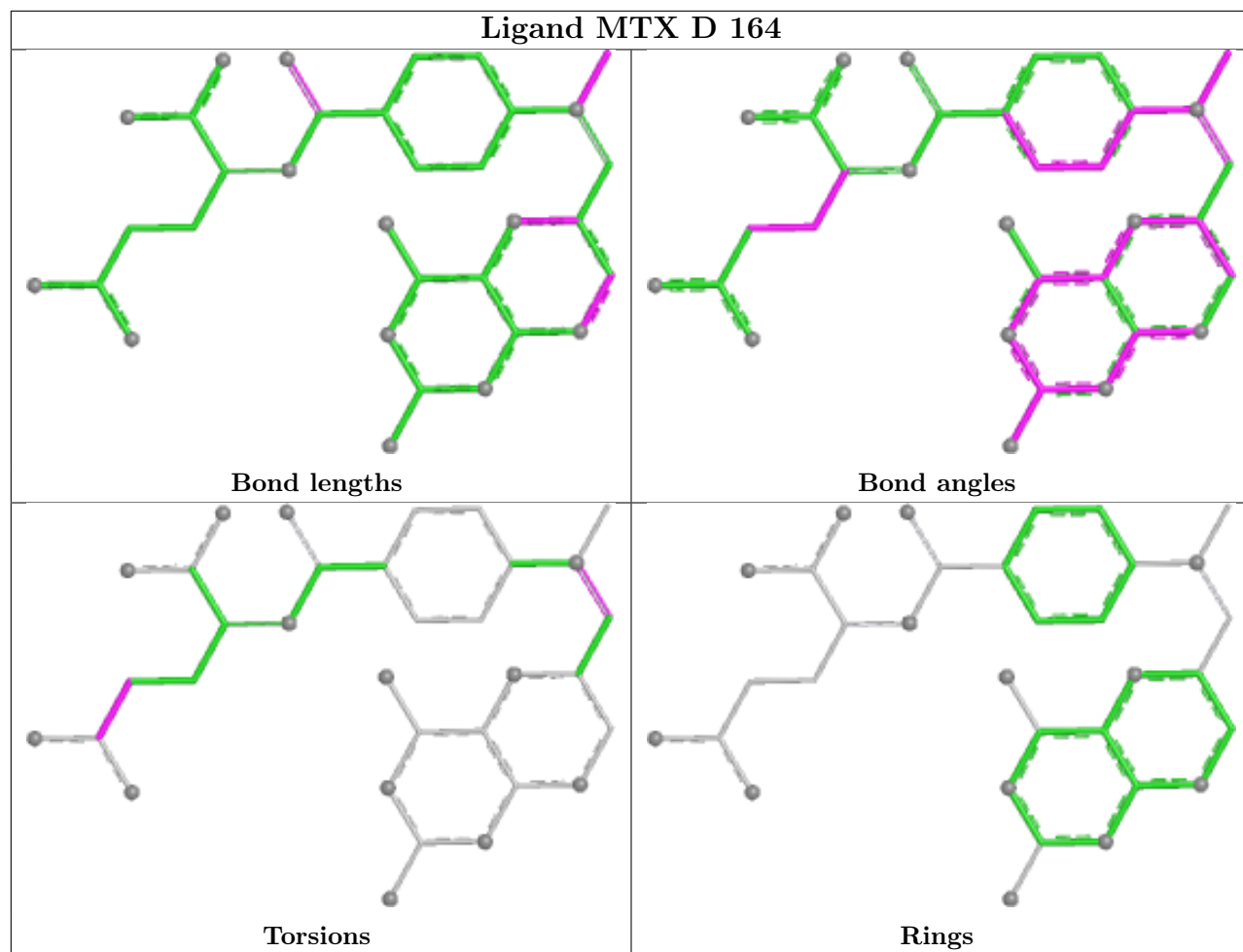


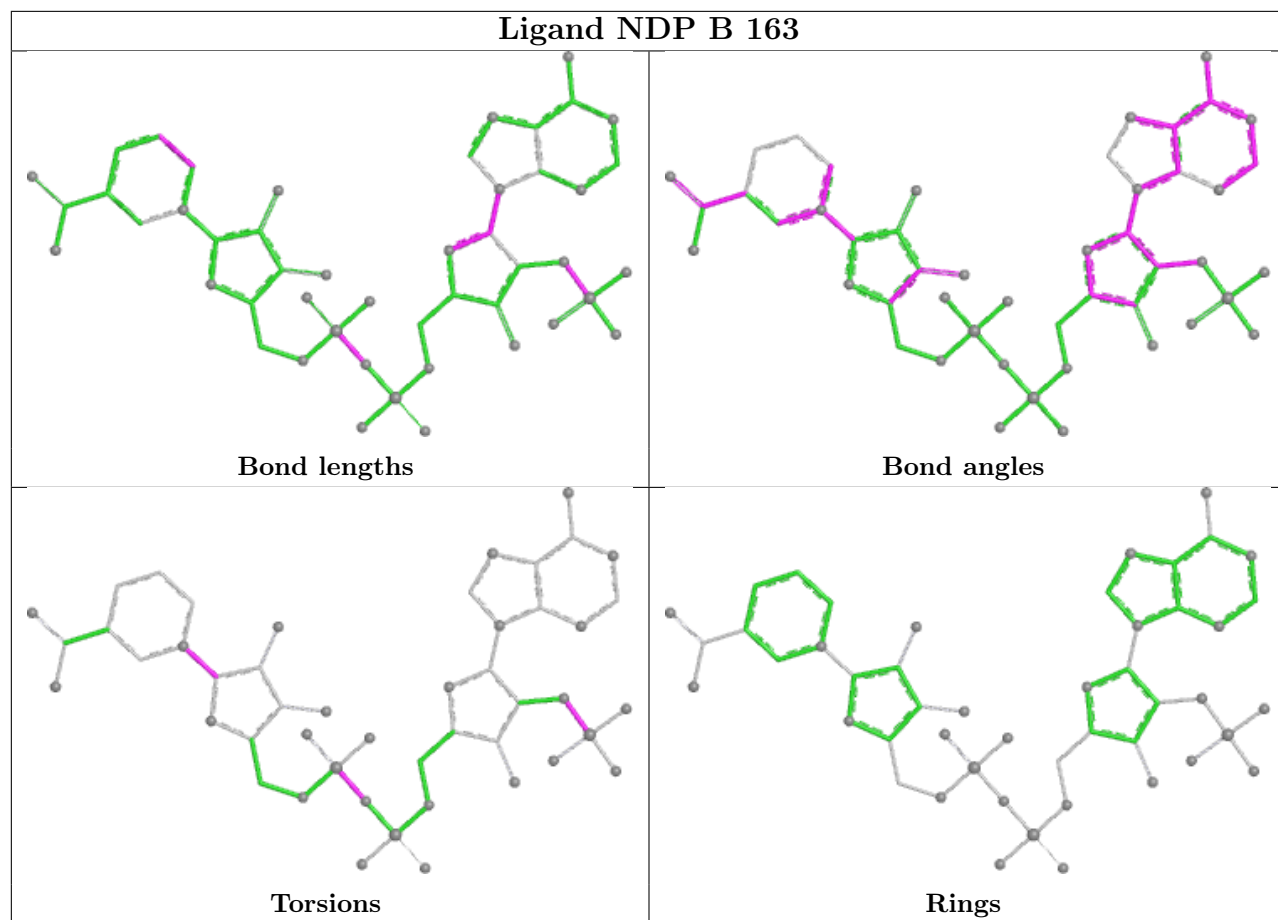


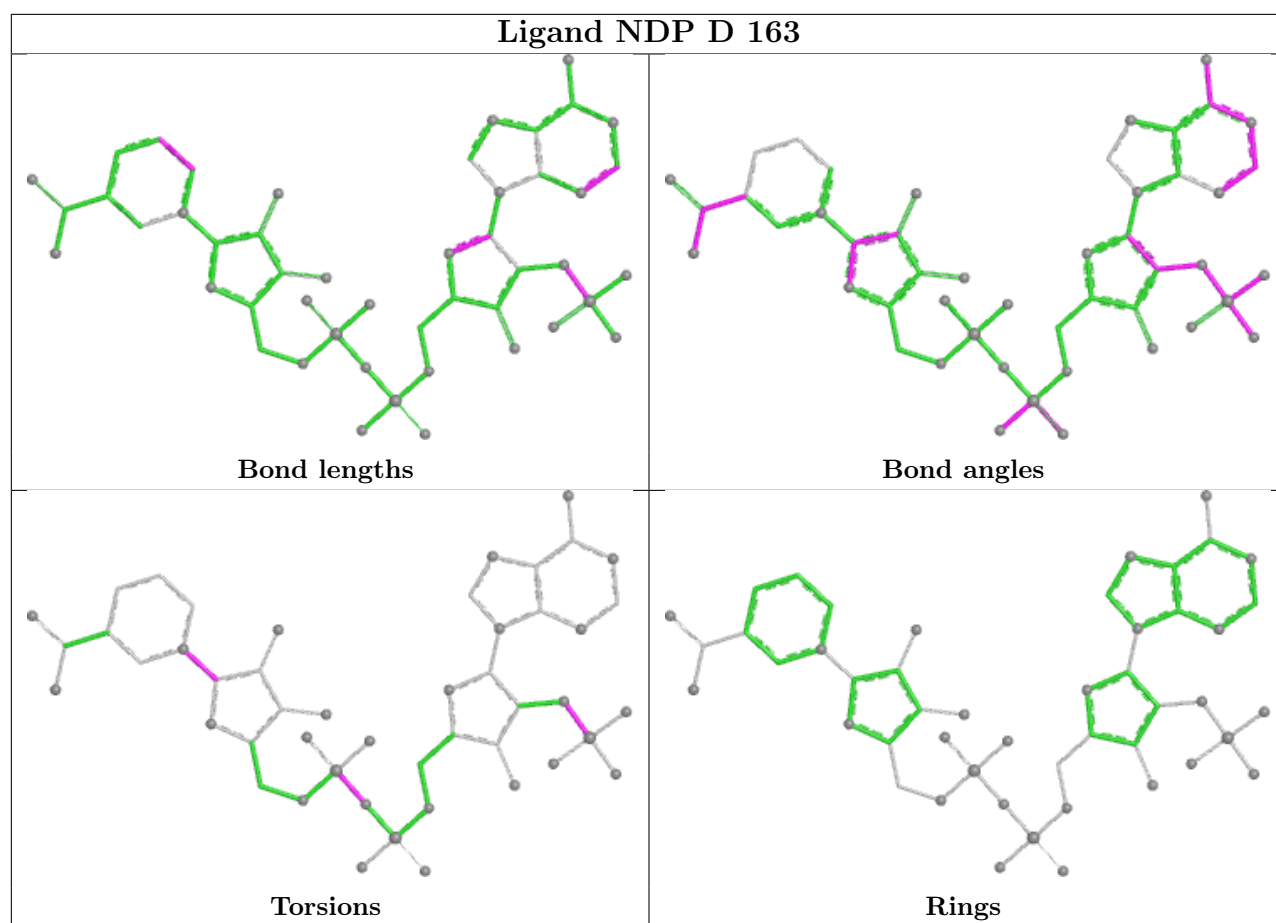












5.7 Other polymers [\(i\)](#)

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	161/162 (99%)	-0.54	0 100 100	8, 16, 25, 34	0
1	B	161/162 (99%)	-0.63	0 100 100	8, 15, 23, 31	0
1	C	160/162 (98%)	-0.54	1 (0%) 89 91	7, 14, 25, 34	0
1	D	161/162 (99%)	-0.60	0 100 100	8, 16, 26, 38	0
All	All	643/648 (99%)	-0.58	1 (0%) 95 95	7, 15, 26, 38	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	68	ASP	2.2

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

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

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

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

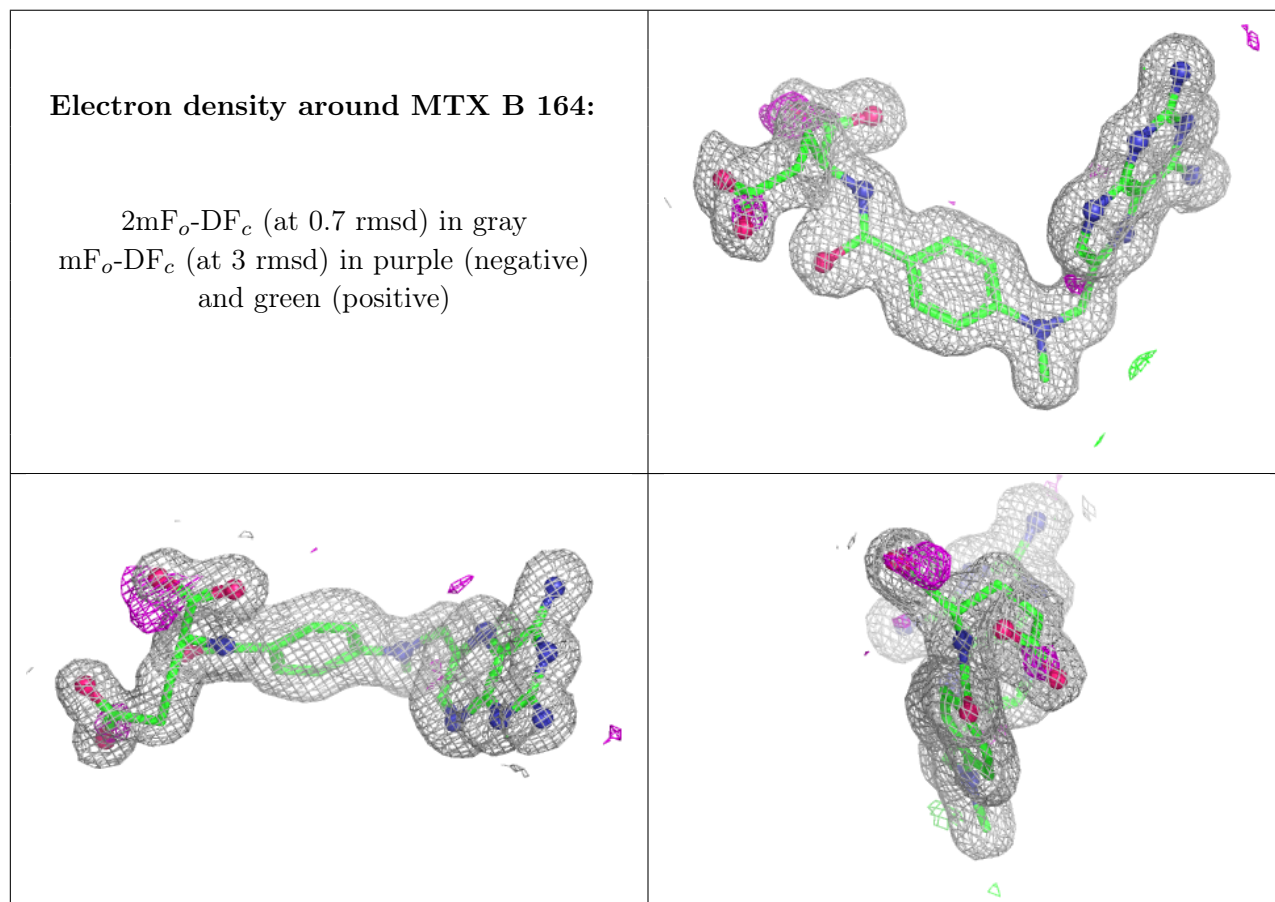
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	MTX	B	164	33/33	0.94	0.09	7,18,31,32	0

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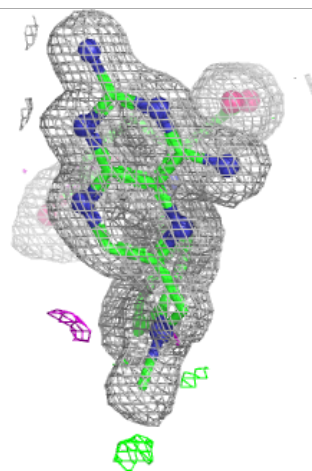
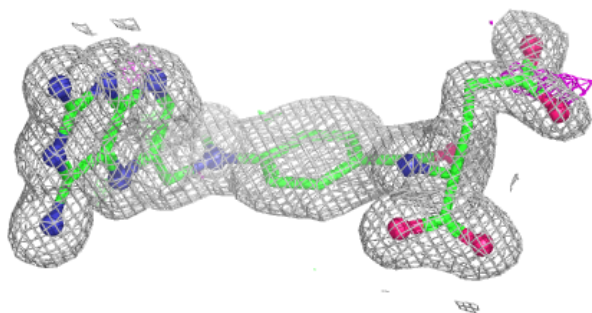
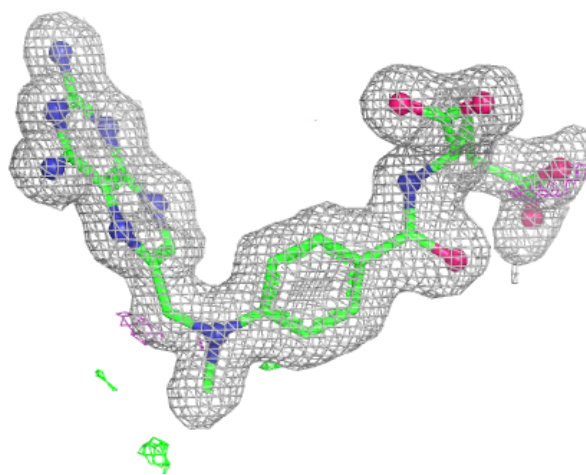
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	MTX	D	164	33/33	0.95	0.08	8,18,32,35	0
3	MTX	C	164	33/33	0.96	0.08	7,18,33,36	0
3	MTX	A	164	33/33	0.96	0.08	8,18,34,40	0
2	NDP	C	163	48/48	0.98	0.06	8,11,15,16	0
2	NDP	D	163	48/48	0.98	0.05	7,12,16,18	0
2	NDP	A	163	48/48	0.99	0.05	8,13,17,21	0
2	NDP	B	163	48/48	0.99	0.05	8,12,18,19	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.



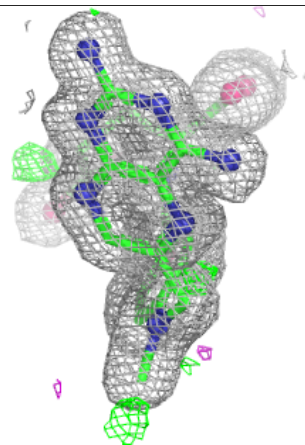
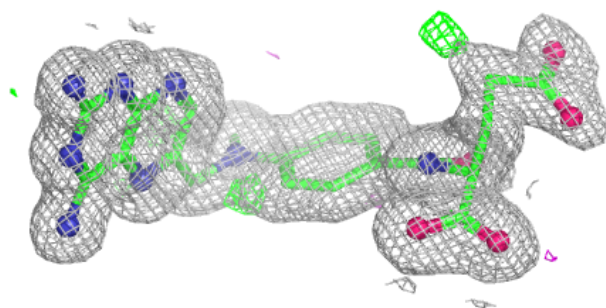
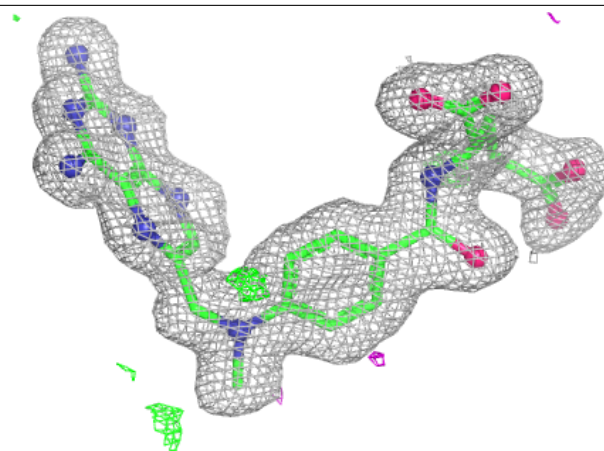
Electron density around MTX D 164:

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



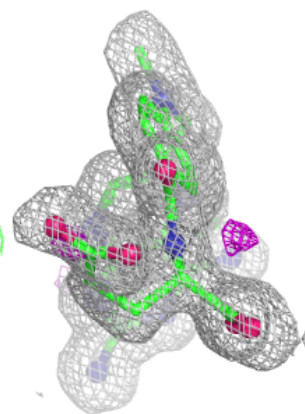
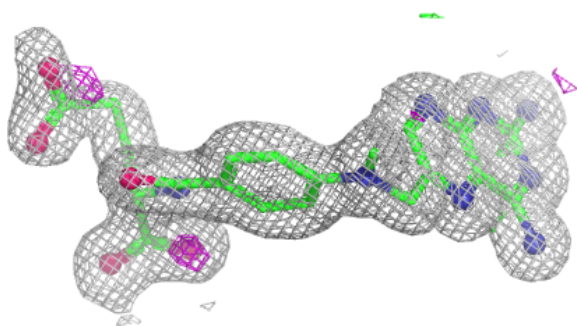
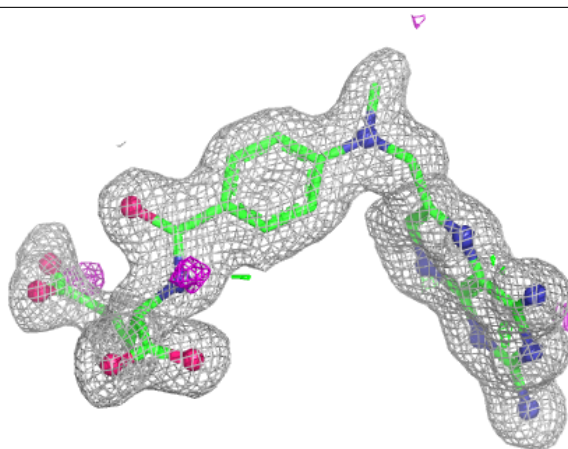
Electron density around MTX C 164:

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

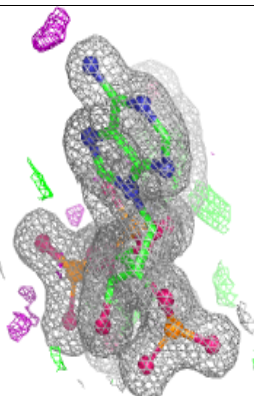
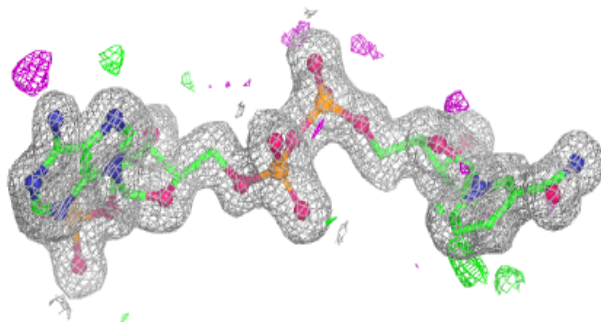
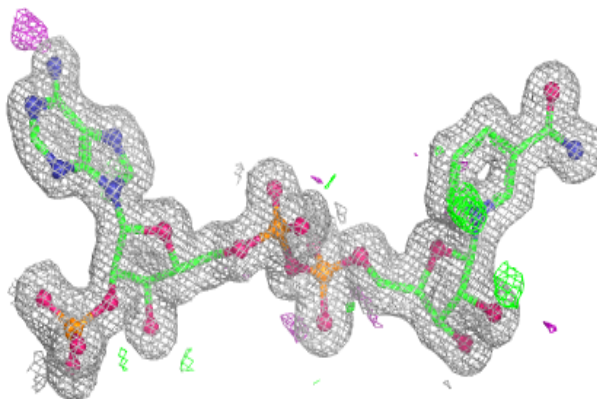


Electron density around MTX A 164:

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

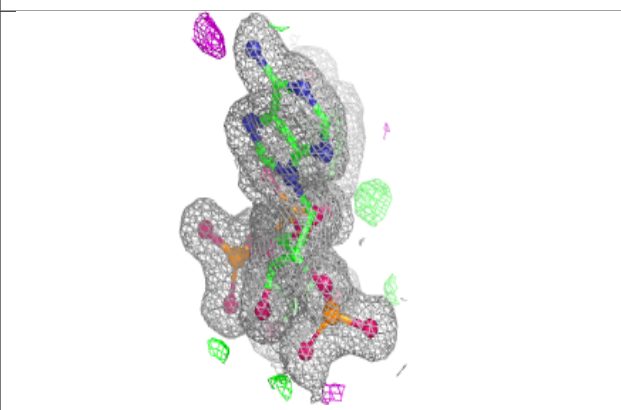
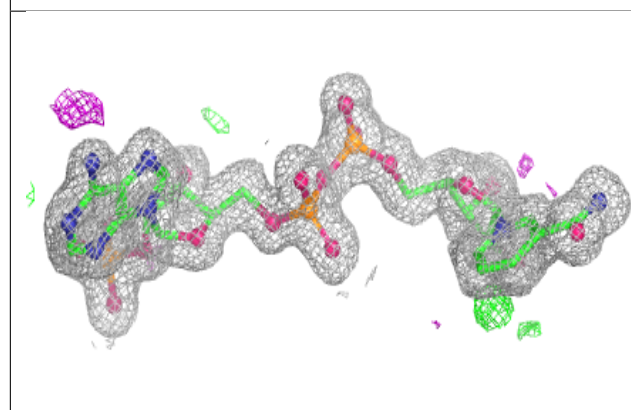
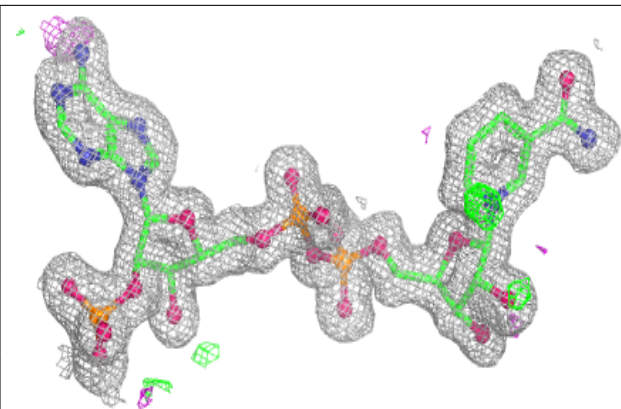
**Electron density around NDP C 163:**

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

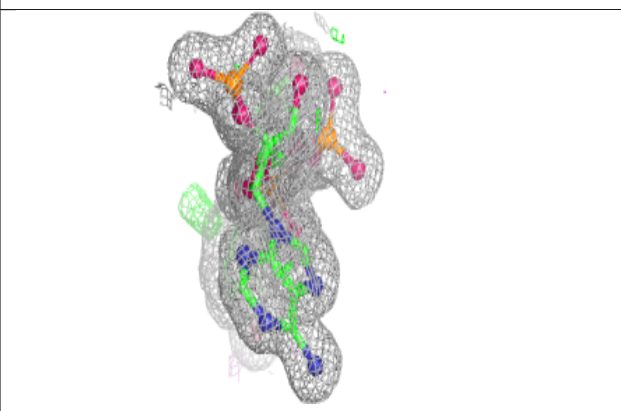
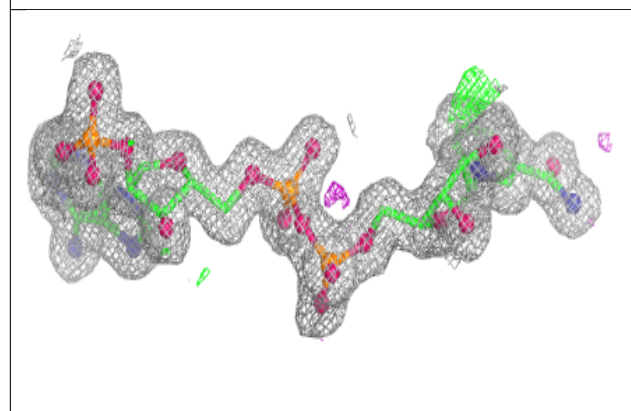
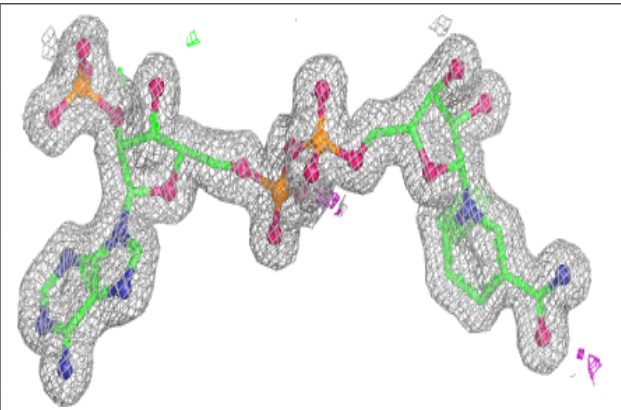


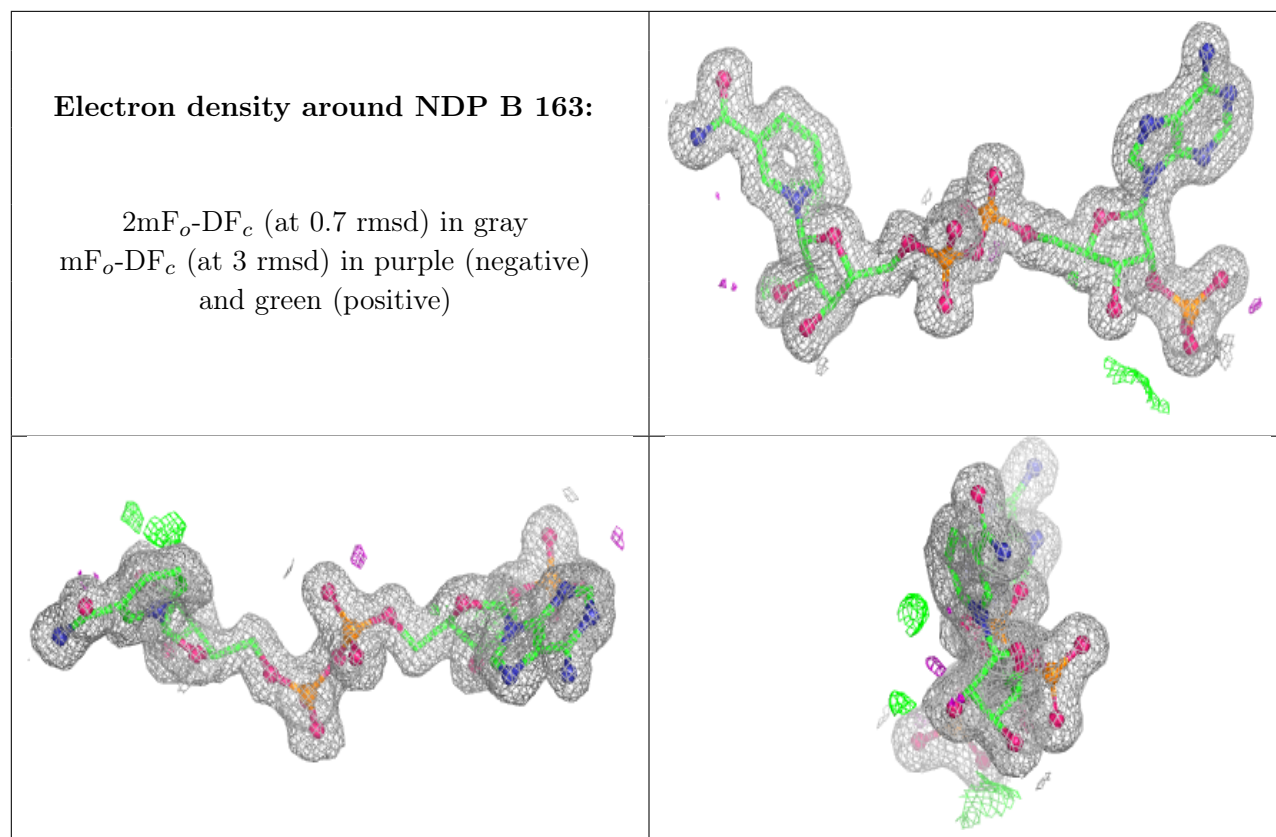
Electron density around NDP D 163:

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

**Electron density around NDP A 163:**

$2mF_o-DF_c$ (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.