



Full wwPDB EM Validation Report ⓘ

Apr 21, 2026 – 04:14 pm BST

PDB ID : 9QW5 / pdb_00009qw5
Title : Urate Oxidase from Aspergillus Flavus with its Inhibitor 9-Methyl Uric Acid by continuous serial electron diffraction (SerialED)
Authors : Hofer, G.; Wang, L.; Pacoste, L.; Hager, P.; Fonjallaz, A.; Scaletti Hutchinson, E.; Stenmark, P.; Di Palma, M.; Williams, L.; Worrall, J.; Steiner, R.; Xu, H.; Zou, X.
Deposited on : 2025-04-14
Resolution : 1.25 Å(reported)
Based on initial model : 4D12

This is a Full wwPDB EM Validation Report for a publicly released PDB/EMDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4-5-2 with Phenix2.0
Mogul : 1.8.4, CSD as541be (2020)
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

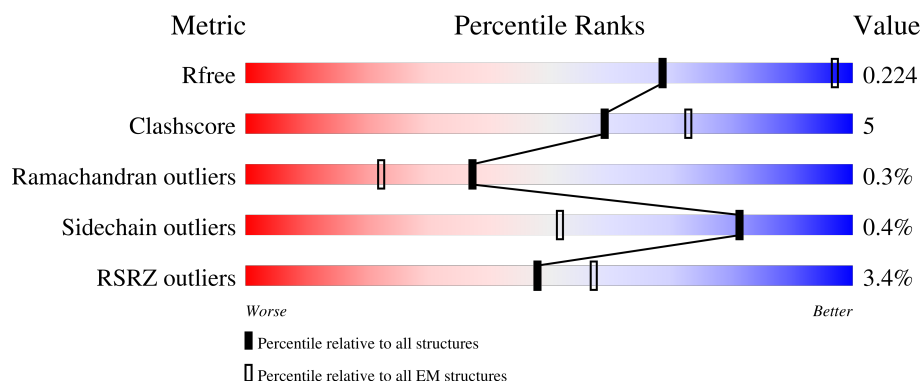
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON CRYSTALLOGRAPHY

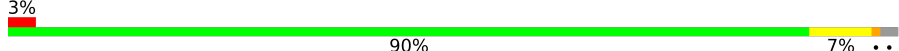
The reported resolution of this entry is 1.25 Å.

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)	EM structures (#Entries)
R_{free}	180332	208
Clashscore	229148	23984
Ramachandran outliers	224038	23583
Sidechain outliers	223484	23102
RSRZ outliers	180361	209

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	302	

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
2	MUA	A	401	-	X	-	-

2 Entry composition [i](#)

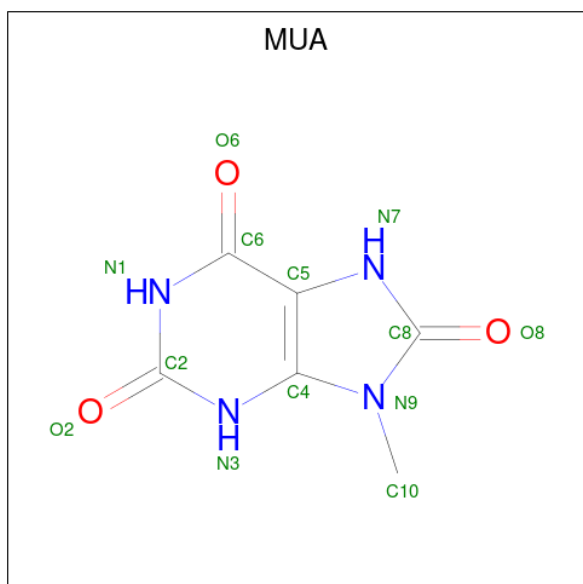
There are 3 unique types of molecules in this entry. The entry contains 5650 atoms, of which 2624 are hydrogens and 0 are deuteriums.

In the tables below, 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 Uricase.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	H	N	O		
1	A	296	5185	1633	2612	439	490	11	41
									0

- Molecule 2 is 9-METHYL URIC ACID (CCD ID: MUA) (formula: $C_6H_6N_4O_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	H	N	O	
2	A	1	19	6	6	4	3	0
2	A	1	19	6	6	4	3	0

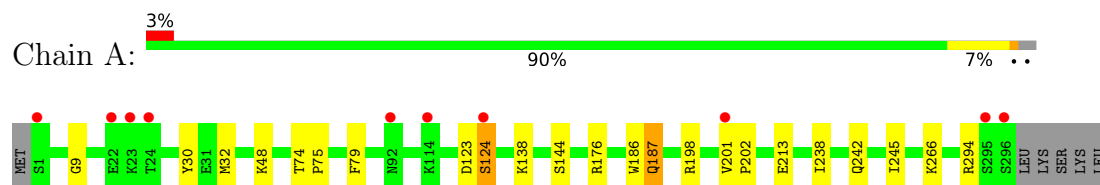
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		AltConf
3	A	427	Total	O	0
			427	427	

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. 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. 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: Uricase



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	80.58Å 94.49Å 103.89Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	17.49 – 1.25 17.49 – 1.25	Depositor EDS
% Data completeness (in resolution range)	99.9 (17.49-1.25) 99.8 (17.49-1.25)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.18 (at 1.25Å)	Xtriage
Refinement program	unknown	Depositor
R, R_{free}	0.191 , 0.203 0.220 , 0.224	Depositor DCC
R_{free} test set	1078 reflections (0.99%)	wwPDB-VP
Wilson B-factor (Å ²)	10.1	Xtriage
Anisotropy	0.128	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.26 , 20.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.40$, $\langle L^2 \rangle = 0.23$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5650	wwPDB-VP
Average B, all atoms (Å ²)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.98% 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: CSO, MUA

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	0.61	0/2740	0.64	0/3708

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2573	2612	2551	23	0
2	A	26	12	12	2	0
3	A	427	0	0	7	2
All	All	3026	2624	2563	24	2

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 5.

All (24) 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)
2:A:402:MUA:O6	3:A:503:HOH:O	2.00	0.79

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:187[B]:GLN:OE1	3:A:502:HOH:O	1.99	0.78
1:A:138[B]:LYS:NZ	3:A:507:HOH:O	2.18	0.75
1:A:201[B]:VAL:HG23	1:A:202:PRO:HD3	1.71	0.72
1:A:176:ARG:HH12	2:A:401:MUA:HN3	1.36	0.71
1:A:213[B]:GLU:OE1	3:A:504:HOH:O	2.14	0.66
1:A:266:LYS:O	3:A:505:HOH:O	2.14	0.65
1:A:198:ARG:HA	1:A:201[A]:VAL:HG23	1.87	0.55
1:A:198:ARG:O	1:A:201[B]:VAL:HG22	2.07	0.54
1:A:198:ARG:HA	1:A:201[B]:VAL:HG13	1.89	0.54
1:A:32[C]:MET:HE1	1:A:79:PHE:CE2	2.43	0.54
1:A:201[B]:VAL:CG2	1:A:202:PRO:HD3	2.41	0.49
1:A:74[B]:THR:HA	1:A:75:PRO:C	2.38	0.49
1:A:238:ILE:HG22	1:A:245[B]:ILE:CD1	2.45	0.47
1:A:74[A]:THR:HG22	3:A:673:HOH:O	2.15	0.46
1:A:48[B]:LYS:HD2	3:A:879:HOH:O	2.18	0.43
1:A:144:SER:HB2	1:A:186:TRP:NE1	2.33	0.43
1:A:30:TYR:CE1	1:A:74[B]:THR:HG21	2.55	0.42
1:A:30:TYR:CD1	1:A:74[B]:THR:HG21	2.55	0.42
1:A:242:GLN:HG3	1:A:245[A]:ILE:HG12	2.02	0.42
1:A:238:ILE:HG22	1:A:245[B]:ILE:HD11	2.01	0.41
1:A:245[A]:ILE:O	1:A:294[A]:ARG:NH1	2.46	0.41
1:A:123[B]:ASP:O	1:A:124[B]:SER:CB	2.67	0.40

All (2) 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)
3:A:536:HOH:O	3:A:626:HOH:O[4_566]	2.09	0.11
3:A:918:HOH:O	3:A:918:HOH:O[2_665]	2.18	0.02

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 PDB entries followed by that with respect to all EM entries.

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	332/302 (110%)	325 (98%)	5 (2%)	2 (1%)	21 5

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	124[A]	SER
1	A	124[B]	SER

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 PDB entries followed by that with respect to all EM entries.

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	300/267 (112%)	298 (99%)	2 (1%)	76 47

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	187[B]	GLN
1	A	187[C]	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	12	ASN
1	A	129	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

2 non-standard protein/DNA/RNA residues 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	$\# Z > 2$
1	CSO	A	35[B]	1	3,6,7	0.72	0	0,6,8	-	-
1	CSO	A	35[A]	1	3,6,7	0.88	0	0,6,8	-	-

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
1	CSO	A	35[B]	1	-	0/1/5/7	-
1	CSO	A	35[A]	1	-	0/1/5/7	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 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	$\# Z > 2$
2	MUA	A	401	-	12,14,14	4.34	9 (75%)	14,21,21	2.83	8 (57%)
2	MUA	A	402	-	12,14,14	4.79	8 (66%)	14,21,21	2.61	5 (35%)

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
2	MUA	A	401	-	-	-	0/2/2/2
2	MUA	A	402	-	-	-	0/2/2/2

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	402	MUA	O8-C8	9.34	1.40	1.23
2	A	402	MUA	O6-C6	8.94	1.40	1.23
2	A	402	MUA	O2-C2	8.17	1.40	1.23
2	A	401	MUA	O8-C8	7.18	1.36	1.23
2	A	401	MUA	O6-C6	6.85	1.36	1.23
2	A	401	MUA	O2-C2	6.83	1.37	1.23
2	A	401	MUA	C8-N9	-4.69	1.30	1.38
2	A	401	MUA	C6-N1	-3.81	1.31	1.38
2	A	401	MUA	C2-N3	-3.67	1.31	1.37
2	A	401	MUA	C8-N7	-3.49	1.31	1.38
2	A	402	MUA	C8-N9	-3.08	1.33	1.38
2	A	402	MUA	C6-N1	-3.02	1.33	1.38
2	A	402	MUA	C2-N3	-2.90	1.32	1.37
2	A	402	MUA	C8-N7	-2.61	1.33	1.38
2	A	401	MUA	C2-N1	-2.58	1.33	1.37
2	A	402	MUA	C2-N1	-2.50	1.33	1.37
2	A	401	MUA	C4-N3	-2.49	1.32	1.37

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	402	MUA	N3-C4-N9	5.72	135.98	126.90
2	A	401	MUA	C6-N1-C2	-5.20	118.84	126.34
2	A	401	MUA	N3-C2-N1	5.19	124.14	115.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	402	MUA	N3-C2-N1	4.43	122.93	115.80
2	A	402	MUA	C6-N1-C2	-4.26	120.19	126.34
2	A	401	MUA	N3-C4-N9	3.93	133.14	126.90
2	A	401	MUA	O6-C6-C5	-3.24	119.81	127.24
2	A	401	MUA	O2-C2-N3	-2.96	116.24	121.82
2	A	402	MUA	O6-C6-C5	-2.84	120.72	127.24
2	A	401	MUA	C10-N9-C8	2.28	126.83	123.82
2	A	401	MUA	C5-C6-N1	2.28	119.10	112.31
2	A	401	MUA	C5-N7-C8	-2.27	106.21	109.47
2	A	402	MUA	C5-C6-N1	2.12	118.62	112.31

There are no chirality outliers.

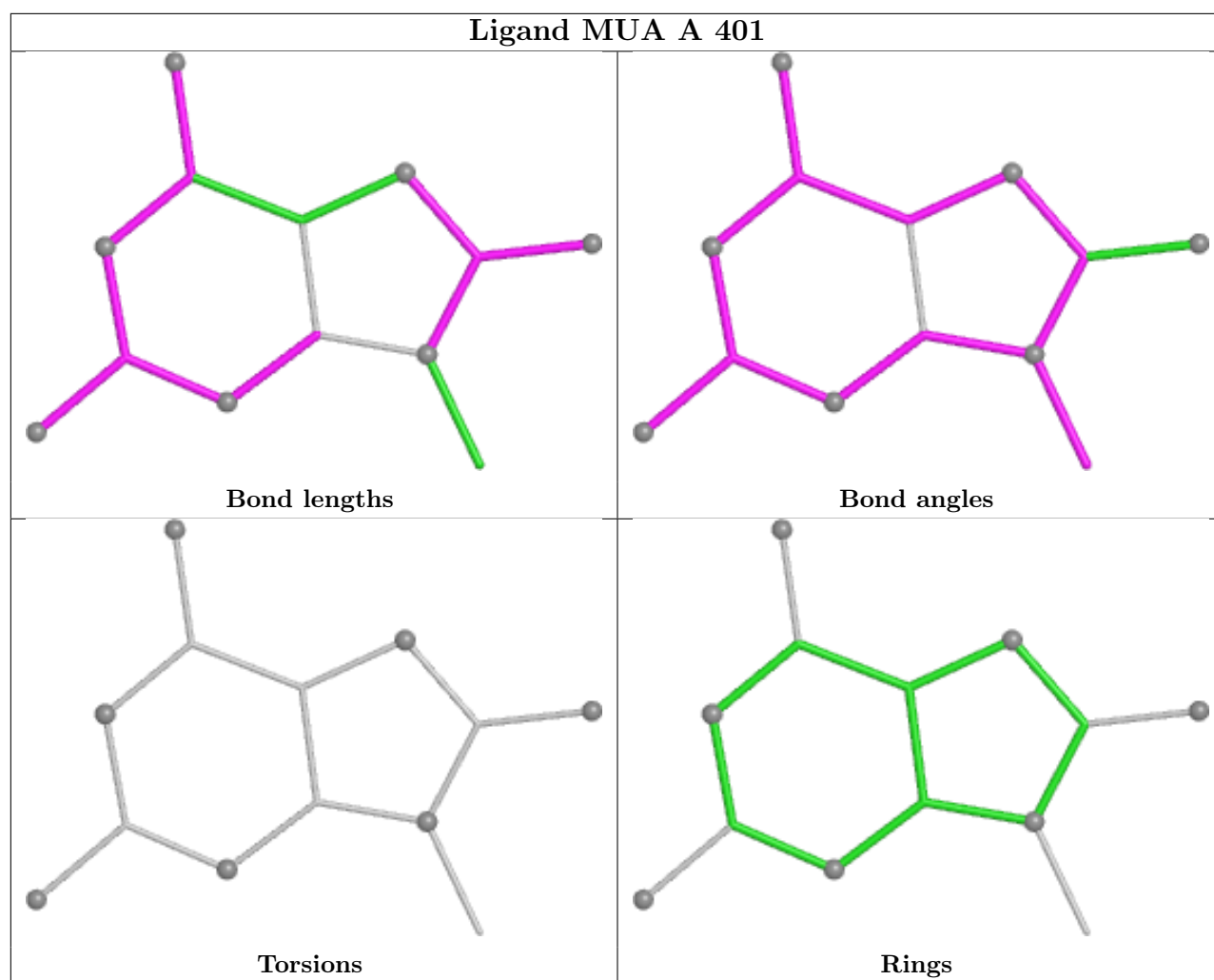
There are no torsion outliers.

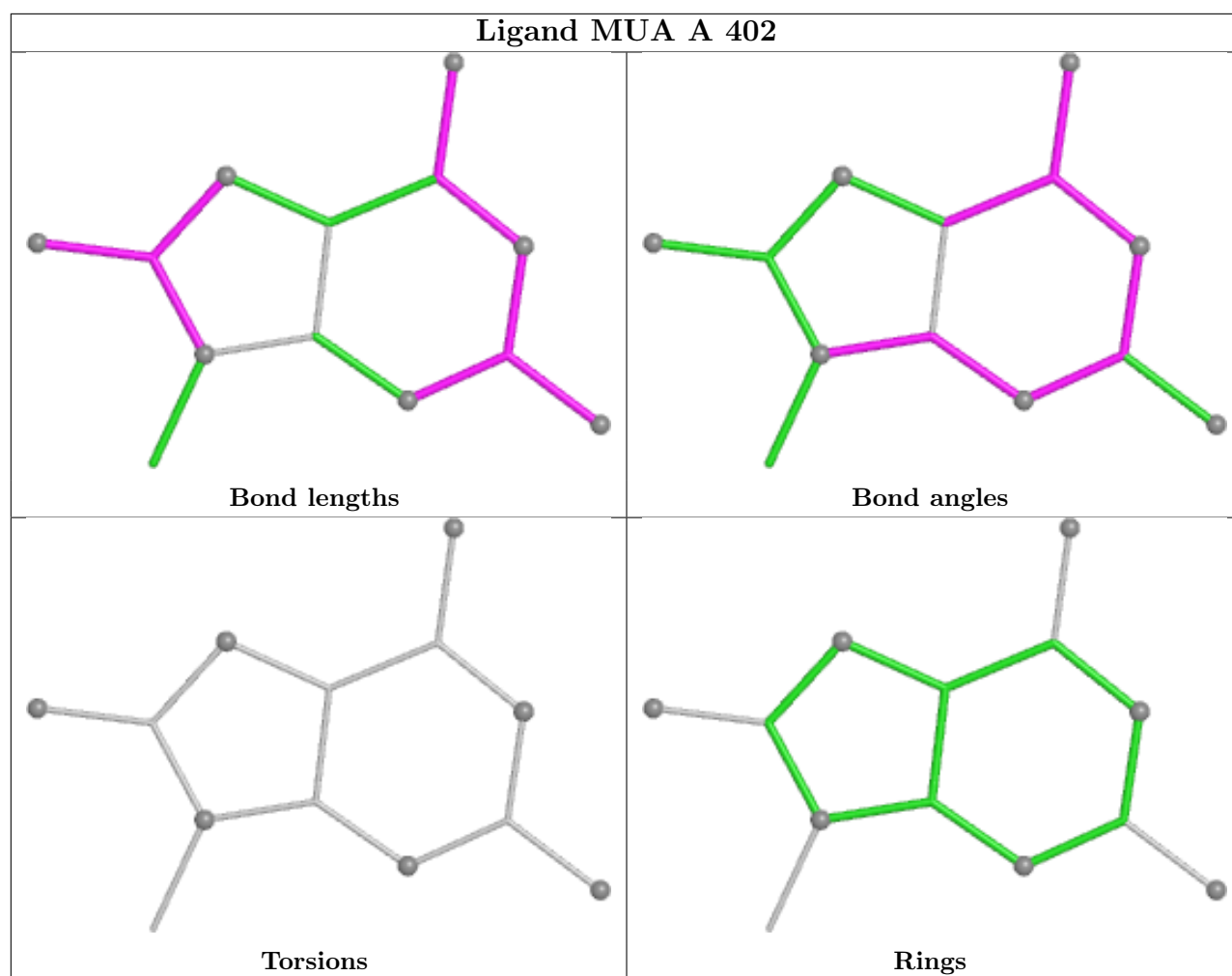
There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	MUA	1	0
2	A	402	MUA	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.