



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 1, 2021 – 09:43 PM EDT

PDB ID : 2B7A  
Title : The structural basis of Janus Kinase 2 inhibition by a potent and specific pan-Janus kinase inhibitor  
Authors : Lucet, I.S.; Fantino, E.; Styles, M.; Bamert, R.; Patel, O.; Broughton, S.E.; Walter, M.; Burns, C.J.; Treutlein, H.; Wilks, A.F.; Rossjohn, J.  
Deposited on : 2005-10-04  
Resolution : 2.00 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.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

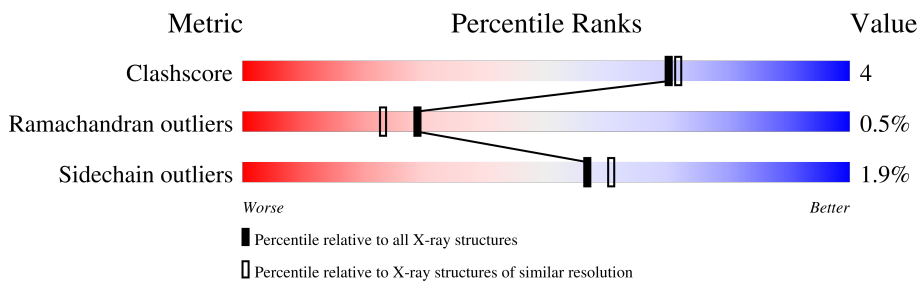
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.00 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))
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)

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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	293	 84% 13% ..
1	B	293	 89% 9% .

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 5203 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.

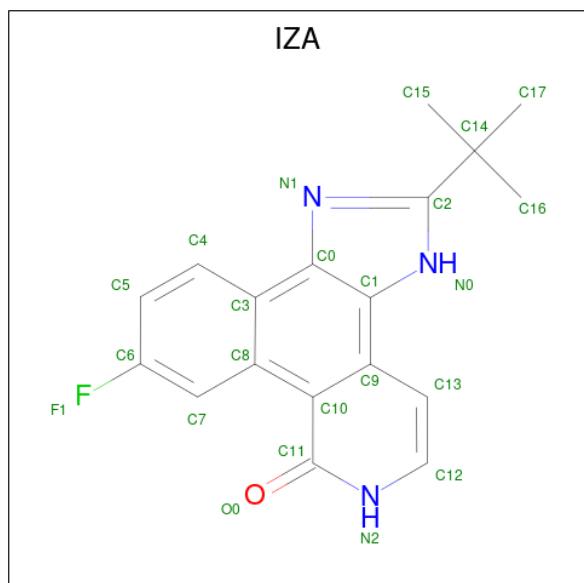
- Molecule 1 is a protein called Tyrosine-protein kinase JAK2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	286	Total	C	N	O	P	S	0	0	0
			2370	1504	407	443	2	14			
1	B	289	Total	C	N	O	P	S	0	0	0
			2392	1517	410	449	2	14			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1007	PTR	TYR	modified residue	UNP O60674
A	1008	PTR	TYR	modified residue	UNP O60674
A	1129	GLN	ASN	engineered mutation	UNP O60674
B	1007	PTR	TYR	modified residue	UNP O60674
B	1008	PTR	TYR	modified residue	UNP O60674
B	1129	GLN	ASN	engineered mutation	UNP O60674

- Molecule 2 is 2-TERT-BUTYL-9-FLUORO-3,6-DIHYDRO-7H-BENZ[H]-IMIDAZ[4,5-F]IS OQUINOLINE-7-ONE (three-letter code: IZA) (formula: C<sub>18</sub>H<sub>16</sub>FN<sub>3</sub>O).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 23	C 18	F 1	N 3	O 1	0	0
2	B	1	Total 23	C 18	F 1	N 3	O 1	0	0

- Molecule 3 is water.

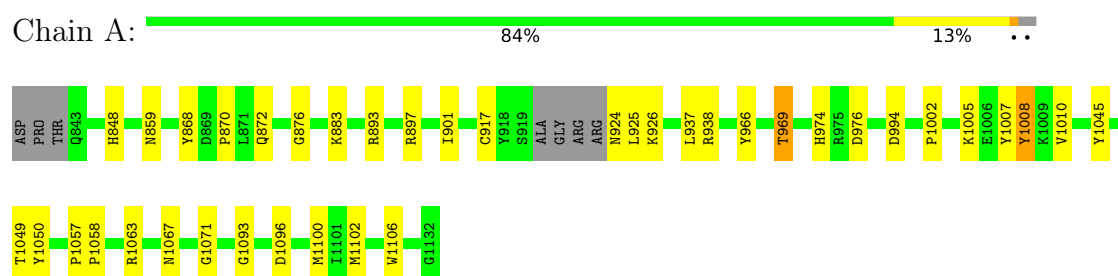
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	197	Total 197	O 197	0	0
3	B	198	Total 198	O 198	0	0

### 3 Residue-property plots

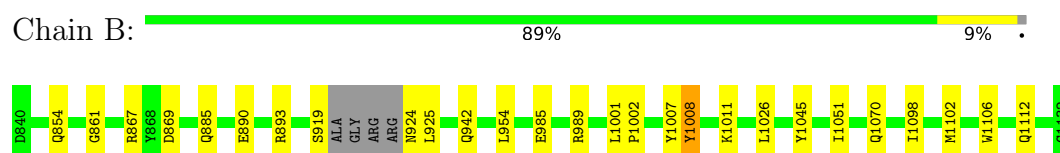
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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.

Note EDS was not executed.

#### • Molecule 1: Tyrosine-protein kinase JAK2



#### • Molecule 1: Tyrosine-protein kinase JAK2



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 41	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	111.27Å 111.27Å 70.58Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	100.00 – 2.00	Depositor
% Data completeness (in resolution range)	96.9 (100.00-2.00)	Depositor
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.209 , 0.249	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	5203	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	39.0	wwPDB-VP

## 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: PTR, IZA

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	0.33	0/2386	0.48	0/3208
1	B	0.32	0/2409	0.49	0/3241
All	All	0.32	0/4795	0.48	0/6449

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	2370	0	2334	21	0
1	B	2392	0	2352	13	0
2	A	23	0	16	1	0
2	B	23	0	16	1	0
3	A	197	0	0	0	0
3	B	198	0	0	0	0
All	All	5203	0	4718	34	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 4.

All (34) 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:966:TYR:O	1:A:969:THR:HG22	1.91	0.69
1:A:1045:TYR:HB2	1:A:1102:MET:HE3	1.83	0.61
1:B:919:SER:HG	1:B:924:ASN:N	1.99	0.60
1:B:1045:TYR:HB2	1:B:1102:MET:HE3	1.84	0.60
1:A:1002:PRO:HG2	1:A:1005:LYS:HB2	1.84	0.57
1:A:848:HIS:HD2	1:A:872:GLN:HE21	1.52	0.57
1:A:1008:PTR:HE1	1:A:1010:VAL:HB	1.87	0.56
1:B:890:GLU:HG2	1:B:893:ARG:HH22	1.72	0.54
1:B:861:GLY:HA2	1:B:885:GLN:HG2	1.91	0.53
1:A:917:CYS:HB3	1:A:926:LYS:HB2	1.90	0.52
1:B:985:GLU:OE1	1:B:989:ARG:HD2	2.11	0.50
1:A:883:LYS:HB3	1:A:926:LYS:HG2	1.94	0.49
1:A:974:HIS:HE1	1:A:994:ASP:O	1.96	0.49
1:A:1093:GLY:HA3	1:B:1112:GLN:O	2.14	0.48
1:B:867:ARG:HG2	1:B:869:ASP:HB2	1.95	0.47
1:A:1096:ASP:O	1:A:1100:MET:HG3	2.16	0.46
2:B:2002:IZA:O0	2:B:2002:IZA:H7	2.16	0.45
1:A:897:ARG:O	1:A:901:ILE:HG12	2.16	0.45
1:A:974:HIS:CE1	1:A:994:ASP:O	2.69	0.45
1:B:942:GLN:HG2	1:B:1051:ILE:HB	1.99	0.44
1:B:1102:MET:HE3	1:B:1106:TRP:HH2	1.83	0.44
1:A:1063:ARG:HG2	1:A:1067:ASN:HD21	1.84	0.43
1:A:893:ARG:HG2	1:A:897:ARG:HH21	1.82	0.43
1:A:1045:TYR:O	1:A:1049:THR:HG23	2.18	0.43
2:A:2001:IZA:O0	2:A:2001:IZA:H7	2.19	0.43
1:A:1057:PRO:HB2	1:A:1058:PRO:HD3	2.01	0.42
1:B:1002:PRO:HD3	1:B:1008:PTR:HD2	2.00	0.42
1:A:974:HIS:HD2	1:A:976:ASP:H	1.68	0.42
1:A:1102:MET:HE3	1:A:1106:TRP:HH2	1.84	0.42
1:B:861:GLY:HA2	1:B:885:GLN:CG	2.50	0.41
1:B:954:LEU:HD21	1:B:1098:ILE:HD12	2.02	0.41
1:A:848:HIS:CG	1:A:870:PRO:HA	2.55	0.41
1:A:1050:TYR:CD1	1:B:1112:GLN:HG3	2.55	0.41
1:A:868:TYR:O	1:A:876:GLY:HA3	2.22	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	280/293 (96%)	272 (97%)	6 (2%)	2 (1%)	22	16
1	B	283/293 (97%)	275 (97%)	7 (2%)	1 (0%)	34	30
All	All	563/586 (96%)	547 (97%)	13 (2%)	3 (0%)	29	23

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	859	ASN
1	A	1071	GLY
1	B	1070	GLN

### 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	259/265 (98%)	254 (98%)	5 (2%)	57	61
1	B	262/265 (99%)	257 (98%)	5 (2%)	57	61
All	All	521/530 (98%)	511 (98%)	10 (2%)	57	61

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	924	ASN
1	A	925	LEU
1	A	937	LEU

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Mol	Chain	Res	Type
1	A	938	ARG
1	A	969	THR
1	B	854	GLN
1	B	925	LEU
1	B	1001	LEU
1	B	1011	LYS
1	B	1026	LEU

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	848	HIS
1	A	909	ASN
1	A	955	GLN
1	A	974	HIS
1	A	1067	ASN
1	B	843	GLN
1	B	886	HIS
1	B	909	ASN
1	B	944	HIS
1	B	955	GLN
1	B	1111	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

4 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	PTR	B	1008	1	15,16,17	1.98	1 (6%)	19,22,24	0.64	0
1	PTR	B	1007	1	15,16,17	2.00	1 (6%)	19,22,24	0.57	0
1	PTR	A	1008	1	15,16,17	1.99	1 (6%)	19,22,24	0.61	0
1	PTR	A	1007	1	15,16,17	1.95	1 (6%)	19,22,24	0.60	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
1	PTR	B	1008	1	-	2/10/11/13	0/1/1/1
1	PTR	B	1007	1	-	0/10/11/13	0/1/1/1
1	PTR	A	1008	1	-	0/10/11/13	0/1/1/1
1	PTR	A	1007	1	-	0/10/11/13	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	1008	PTR	OH-CZ	-7.44	1.23	1.40
1	B	1007	PTR	OH-CZ	-7.39	1.23	1.40
1	B	1008	PTR	OH-CZ	-7.33	1.24	1.40
1	A	1007	PTR	OH-CZ	-7.18	1.24	1.40

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	1008	PTR	CZ-OH-P-O1P
1	B	1008	PTR	CZ-OH-P-O3P

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	1008	PTR	1	0
1	A	1008	PTR	1	0

## 5.5 Carbohydrates [i](#)

There are no monosaccharides 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	IZA	A	2001	-	21,26,26	2.44	9 (42%)	28,41,41	1.44	6 (21%)
2	IZA	B	2002	-	21,26,26	2.42	8 (38%)	28,41,41	1.44	6 (21%)

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	IZA	A	2001	-	-	3/6/6/6	0/4/4/4
2	IZA	B	2002	-	-	3/6/6/6	0/4/4/4

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	2001	IZA	C4-C3	-5.57	1.29	1.41
2	B	2002	IZA	C4-C3	-5.47	1.29	1.41
2	A	2001	IZA	F1-C6	4.90	1.48	1.36
2	B	2002	IZA	F1-C6	4.85	1.48	1.36
2	A	2001	IZA	C8-C10	4.70	1.50	1.41
2	B	2002	IZA	C8-C10	4.57	1.50	1.41
2	A	2001	IZA	C4-C5	-3.07	1.30	1.36
2	B	2002	IZA	C4-C5	-3.05	1.30	1.36
2	A	2001	IZA	C3-C0	-2.83	1.39	1.45
2	B	2002	IZA	C3-C0	-2.73	1.39	1.45

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2002	IZA	C9-C1	-2.72	1.39	1.45
2	A	2001	IZA	C9-C1	-2.64	1.40	1.45
2	B	2002	IZA	C13-C12	2.48	1.39	1.36
2	A	2001	IZA	C13-C12	2.46	1.39	1.36
2	B	2002	IZA	C7-C6	2.20	1.39	1.36
2	A	2001	IZA	C7-C6	2.02	1.39	1.36
2	A	2001	IZA	C11-N2	2.00	1.36	1.33

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2002	IZA	C4-C5-C6	3.08	122.26	118.74
2	A	2001	IZA	C4-C5-C6	2.99	122.17	118.74
2	A	2001	IZA	C13-C12-N2	-2.84	121.02	123.81
2	B	2002	IZA	C8-C3-C0	-2.80	116.93	119.72
2	B	2002	IZA	C5-C6-C7	-2.76	120.19	123.23
2	A	2001	IZA	C5-C6-C7	-2.69	120.25	123.23
2	A	2001	IZA	C8-C3-C0	-2.61	117.12	119.72
2	B	2002	IZA	C13-C12-N2	-2.53	121.31	123.81
2	A	2001	IZA	C6-C7-C8	-2.51	117.64	119.43
2	B	2002	IZA	C6-C7-C8	-2.48	117.66	119.43
2	B	2002	IZA	C12-N2-C11	2.30	121.92	116.43
2	A	2001	IZA	C12-N2-C11	2.27	121.86	116.43

There are no chirality outliers.

All (6) torsion outliers are listed below:

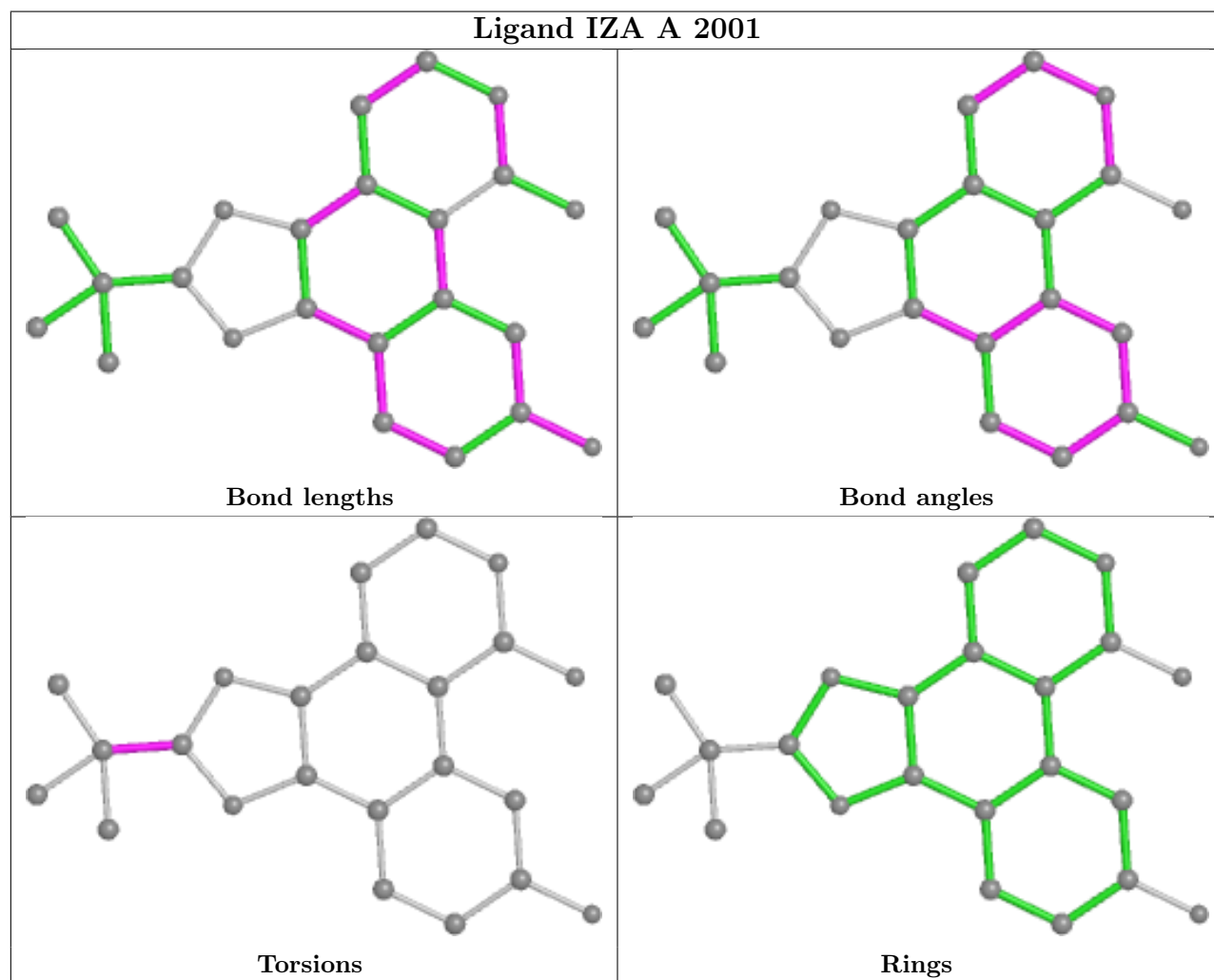
Mol	Chain	Res	Type	Atoms
2	A	2001	IZA	C16-C14-C2-N0
2	A	2001	IZA	C15-C14-C2-N0
2	B	2002	IZA	C16-C14-C2-N0
2	B	2002	IZA	C17-C14-C2-N0
2	B	2002	IZA	C15-C14-C2-N0
2	A	2001	IZA	C17-C14-C2-N0

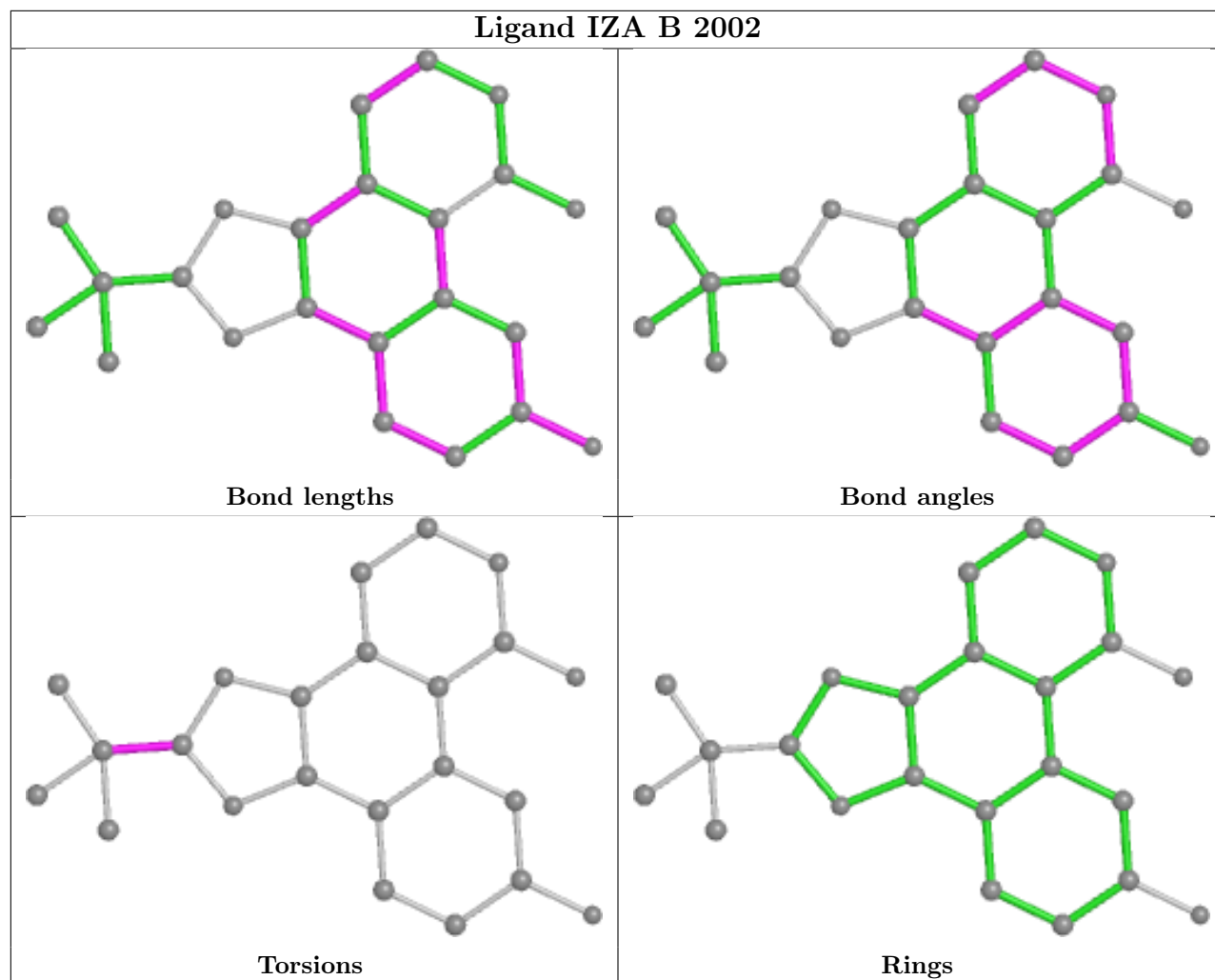
There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	2001	IZA	1	0
2	B	2002	IZA	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

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.