



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 13, 2023 – 09:17 PM EDT

PDB ID : 4QVQ  
Title : yCP beta5-M45I mutant in complex with bortezomib  
Authors : Huber, E.M.; Heinemeyer, W.; Groll, M.  
Deposited on : 2014-07-15  
Resolution : 2.60 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : **FAILED**  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : **FAILED**  
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) : 2.35.1

## 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 2.60 Å.

There are no overall percentile quality scores available for this entry.

MolProbity and EDS failed to run properly - the sequence quality summary graphics cannot be shown.

## 2 Entry composition

There are 18 unique types of molecules in this entry. The entry contains 50050 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 Proteasome subunit alpha type-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	250	Total	C	N	O	S	0	0	0
			1915	1219	315	377	4			
1	O	250	Total	C	N	O	S	0	0	0
			1915	1219	315	377	4			

- Molecule 2 is a protein called Proteasome subunit alpha type-3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	244	Total	C	N	O	S	0	0	0
			1904	1201	321	379	3			
2	P	244	Total	C	N	O	S	0	0	0
			1904	1201	321	379	3			

- Molecule 3 is a protein called Proteasome subunit alpha type-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	240	Total	C	N	O	S	0	0	0
			1881	1176	329	372	4			
3	Q	240	Total	C	N	O	S	0	0	0
			1881	1176	329	372	4			

- Molecule 4 is a protein called Proteasome subunit alpha type-5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	235	Total	C	N	O	S	0	0	0
			1813	1136	304	366	7			
4	R	235	Total	C	N	O	S	0	0	0
			1813	1136	304	366	7			

- Molecule 5 is a protein called Proteasome subunit alpha type-6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	231	Total	C	N	O	S	0	0	0
			1773	1114	307	348	4			
5	S	231	Total	C	N	O	S	0	0	0
			1773	1114	307	348	4			

- Molecule 6 is a protein called Probable proteasome subunit alpha type-7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	F	243	Total	C	N	O	S	0	0	0
			1892	1203	329	356	4			
6	T	243	Total	C	N	O	S	0	0	0
			1892	1203	329	356	4			

- Molecule 7 is a protein called Proteasome subunit alpha type-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	G	241	Total	C	N	O	S	0	0	0
			1907	1214	320	365	8			
7	U	241	Total	C	N	O	S	0	0	0
			1907	1214	320	365	8			

- Molecule 8 is a protein called Proteasome subunit beta type-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
8	H	226	Total	C	N	O	S	0	0	0
			1719	1082	298	332	7			
8	V	226	Total	C	N	O	S	0	0	0
			1719	1082	298	332	7			

- Molecule 9 is a protein called Proteasome subunit beta type-3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
9	I	204	Total	C	N	O	S	0	0	0
			1581	1010	258	305	8			
9	W	204	Total	C	N	O	S	0	0	0
			1581	1010	258	305	8			

- Molecule 10 is a protein called Proteasome subunit beta type-4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
10	J	195	Total	C	N	O	S	0	0	0
			1561	992	264	299	6			

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
10	X	195	1561	992	264	299	6	0	0	0

- Molecule 11 is a protein called Proteasome subunit beta type-5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
11	K	212	1644	1046	280	312	6	0	0	0
11	Y	212	1644	1046	280	312	6	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
K	45	ILE	MET	engineered mutation	UNP P30656
Y	45	ILE	MET	engineered mutation	UNP P30656

- Molecule 12 is a protein called Proteasome subunit beta type-6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
12	L	222	1757	1115	303	335	4	0	0	0
12	Z	222	1757	1115	303	335	4	0	0	0

- Molecule 13 is a protein called Proteasome subunit beta type-7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
13	M	233	1824	1154	312	351	7	0	0	0
13	a	233	1824	1154	312	351	7	0	0	0

- Molecule 14 is a protein called Proteasome subunit beta type-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
14	N	196	1512	955	250	300	7	0	0	0
14	b	196	1512	955	250	300	7	0	0	0

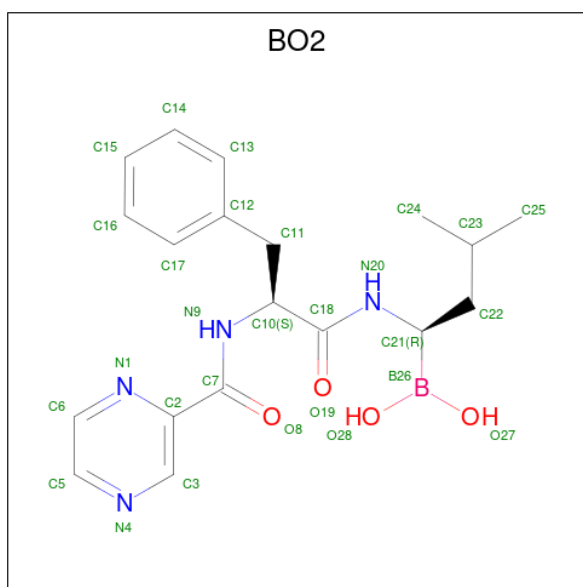
- Molecule 15 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
15	G	1	Total Mg 1 1	0	0
15	I	1	Total Mg 1 1	0	0
15	J	1	Total Mg 1 1	0	0
15	K	2	Total Mg 2 2	0	0
15	N	1	Total Mg 1 1	0	0
15	V	1	Total Mg 1 1	0	0
15	Y	1	Total Mg 1 1	0	0
15	Z	1	Total Mg 1 1	0	0

- Molecule 16 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
16	G	1	Total Cl 1 1	0	0
16	N	1	Total Cl 1 1	0	0
16	U	1	Total Cl 1 1	0	0
16	b	1	Total Cl 1 1	0	0

- Molecule 17 is N-[(1R)-1-(DIHYDROXYBORYL)-3-METHYLBUTYL]-N-(PYRAZIN-2-YLCARBONYL)-L-PHENYLALANINAMIDE (three-letter code: BO2) (formula: C<sub>19</sub>H<sub>25</sub>BN<sub>4</sub>O<sub>4</sub>).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	B	C	N	O		
17	H	1	Total 28	B 1	C 19	N 4	O 4	0	0
17	K	1	Total 28	B 1	C 19	N 4	O 4	0	0
17	N	1	Total 28	B 1	C 19	N 4	O 4	0	0
17	V	1	Total 28	B 1	C 19	N 4	O 4	0	0
17	Y	1	Total 28	B 1	C 19	N 4	O 4	0	0
17	b	1	Total 28	B 1	C 19	N 4	O 4	0	0

- Molecule 18 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
18	A	20	Total 20	O 20	0	0
18	B	15	Total 15	O 15	0	0
18	C	20	Total 20	O 20	0	0
18	D	7	Total 7	O 7	0	0
18	E	6	Total 6	O 6	0	0
18	F	18	Total 18	O 18	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
18	G	24	Total O 24 24	0	0
18	H	38	Total O 38 38	0	0
18	I	17	Total O 17 17	0	0
18	J	17	Total O 17 17	0	0
18	K	25	Total O 25 25	0	0
18	L	29	Total O 29 29	0	0
18	M	29	Total O 29 29	0	0
18	N	15	Total O 15 15	0	0
18	O	9	Total O 9 9	0	0
18	P	12	Total O 12 12	0	0
18	Q	10	Total O 10 10	0	0
18	R	7	Total O 7 7	0	0
18	S	6	Total O 6 6	0	0
18	T	11	Total O 11 11	0	0
18	U	18	Total O 18 18	0	0
18	V	18	Total O 18 18	0	0
18	W	18	Total O 18 18	0	0
18	X	17	Total O 17 17	0	0
18	Y	18	Total O 18 18	0	0
18	Z	24	Total O 24 24	0	0
18	a	34	Total O 34 34	0	0

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<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
18	b	21	Total	O	0	0
			21	21		

MolProbity and EDS failed to run properly - this section is therefore empty.

### 3 Data and refinement statistics

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	136.67Å 300.62Å 145.52Å 90.00° 113.19° 90.00°	Depositor
Resolution (Å)	15.00 – 2.60	Depositor
% Data completeness (in resolution range)	99.1 (15.00-2.60)	Depositor
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.44 (at 2.61Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.195 , 0.219	Depositor
Wilson B-factor (Å <sup>2</sup> )	56.5	Xtrriage
Anisotropy	0.116	Xtrriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	50050	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	65.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.19% of the height of the origin peak. No significant pseudotranslation is detected.*

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

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 4 Model quality [i](#)

### 4.1 Standard geometry [i](#)

MolProbity failed to run properly - this section is therefore empty.

### 4.2 Too-close contacts [i](#)

MolProbity failed to run properly - this section is therefore empty.

### 4.3 Torsion angles [i](#)

#### 4.3.1 Protein backbone [i](#)

MolProbity failed to run properly - this section is therefore empty.

#### 4.3.2 Protein sidechains [i](#)

MolProbity failed to run properly - this section is therefore empty.

#### 4.3.3 RNA [i](#)

MolProbity failed to run properly - this section is therefore empty.

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

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

### 4.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

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

Of 19 ligands modelled in this entry, 13 are monoatomic - leaving 6 for Mogul analysis.

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
17	BO2	b	201	14	25,29,29	1.58	5 (20%)	32,38,38	1.45	4 (12%)
17	BO2	H	301	8	25,29,29	1.63	5 (20%)	32,38,38	1.34	3 (9%)
17	BO2	K	301	11	25,29,29	1.61	5 (20%)	32,38,38	1.35	4 (12%)
17	BO2	V	301	8	25,29,29	1.61	5 (20%)	32,38,38	1.35	4 (12%)
17	BO2	N	201	14	25,29,29	1.60	5 (20%)	32,38,38	1.43	4 (12%)
17	BO2	Y	301	11	25,29,29	1.60	5 (20%)	32,38,38	1.37	4 (12%)

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
17	BO2	b	201	14	-	4/22/28/28	0/2/2/2
17	BO2	H	301	8	-	6/22/28/28	0/2/2/2
17	BO2	K	301	11	-	0/22/28/28	0/2/2/2
17	BO2	V	301	8	-	6/22/28/28	0/2/2/2
17	BO2	N	201	14	-	4/22/28/28	0/2/2/2
17	BO2	Y	301	11	-	0/22/28/28	0/2/2/2

All (30) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
17	H	301	BO2	C2-C7	-4.56	1.39	1.50
17	K	301	BO2	C2-C7	-4.55	1.39	1.50
17	V	301	BO2	C2-C7	-4.51	1.39	1.50
17	Y	301	BO2	C2-C7	-4.51	1.39	1.50
17	N	201	BO2	C2-C7	-4.49	1.39	1.50
17	b	201	BO2	C2-C7	-4.39	1.39	1.50
17	H	301	BO2	C11-C12	-4.38	1.40	1.51
17	K	301	BO2	C11-C12	-4.34	1.40	1.51
17	Y	301	BO2	C11-C12	-4.29	1.41	1.51
17	b	201	BO2	C11-C12	-4.27	1.41	1.51
17	V	301	BO2	C11-C12	-4.26	1.41	1.51
17	N	201	BO2	C11-C12	-4.24	1.41	1.51
17	Y	301	BO2	C3-N4	2.95	1.40	1.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
17	K	301	BO2	C3-N4	2.93	1.40	1.34
17	V	301	BO2	C3-N4	2.88	1.40	1.34
17	H	301	BO2	C3-N4	2.85	1.40	1.34
17	N	201	BO2	C3-N4	2.84	1.40	1.34
17	V	301	BO2	C6-N1	2.81	1.40	1.34
17	N	201	BO2	C6-N1	2.80	1.40	1.34
17	H	301	BO2	C6-N1	2.77	1.40	1.34
17	K	301	BO2	C6-N1	2.75	1.40	1.34
17	Y	301	BO2	C6-N1	2.74	1.40	1.34
17	b	201	BO2	C6-N1	2.72	1.40	1.34
17	b	201	BO2	C3-N4	2.71	1.40	1.34
17	H	301	BO2	C5-N4	2.35	1.40	1.33
17	K	301	BO2	C5-N4	2.33	1.40	1.33
17	V	301	BO2	C5-N4	2.33	1.40	1.33
17	Y	301	BO2	C5-N4	2.33	1.40	1.33
17	b	201	BO2	C5-N4	2.20	1.40	1.33
17	N	201	BO2	C5-N4	2.10	1.40	1.33

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
17	b	201	BO2	C21-C22-C23	-4.98	109.13	115.39
17	N	201	BO2	C21-C22-C23	-4.92	109.22	115.39
17	V	301	BO2	C21-C22-C23	-4.07	110.29	115.39
17	H	301	BO2	C21-C22-C23	-3.93	110.46	115.39
17	Y	301	BO2	C21-C22-C23	-3.87	110.53	115.39
17	K	301	BO2	C21-C22-C23	-3.79	110.63	115.39
17	Y	301	BO2	C6-N1-C2	3.49	121.46	116.93
17	H	301	BO2	C6-N1-C2	3.46	121.42	116.93
17	K	301	BO2	C6-N1-C2	3.45	121.41	116.93
17	V	301	BO2	C6-N1-C2	3.38	121.32	116.93
17	b	201	BO2	C6-N1-C2	3.19	121.07	116.93
17	N	201	BO2	C6-N1-C2	3.15	121.02	116.93
17	V	301	BO2	C12-C11-C10	-2.27	107.13	113.39
17	N	201	BO2	C18-C10-N9	-2.26	105.01	111.16
17	H	301	BO2	C12-C11-C10	-2.25	107.17	113.39
17	b	201	BO2	C18-C10-N9	-2.21	105.14	111.16
17	Y	301	BO2	C18-C10-N9	-2.21	105.15	111.16
17	b	201	BO2	C11-C10-N9	-2.18	106.20	110.79
17	K	301	BO2	C18-C10-N9	-2.12	105.39	111.16
17	Y	301	BO2	C6-C5-N4	-2.11	119.32	121.95
17	N	201	BO2	C11-C10-N9	-2.07	106.42	110.79

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
17	V	301	BO2	C6-C5-N4	-2.04	119.41	121.95
17	K	301	BO2	C6-C5-N4	-2.01	119.44	121.95

There are no chirality outliers.

All (20) torsion outliers are listed below:

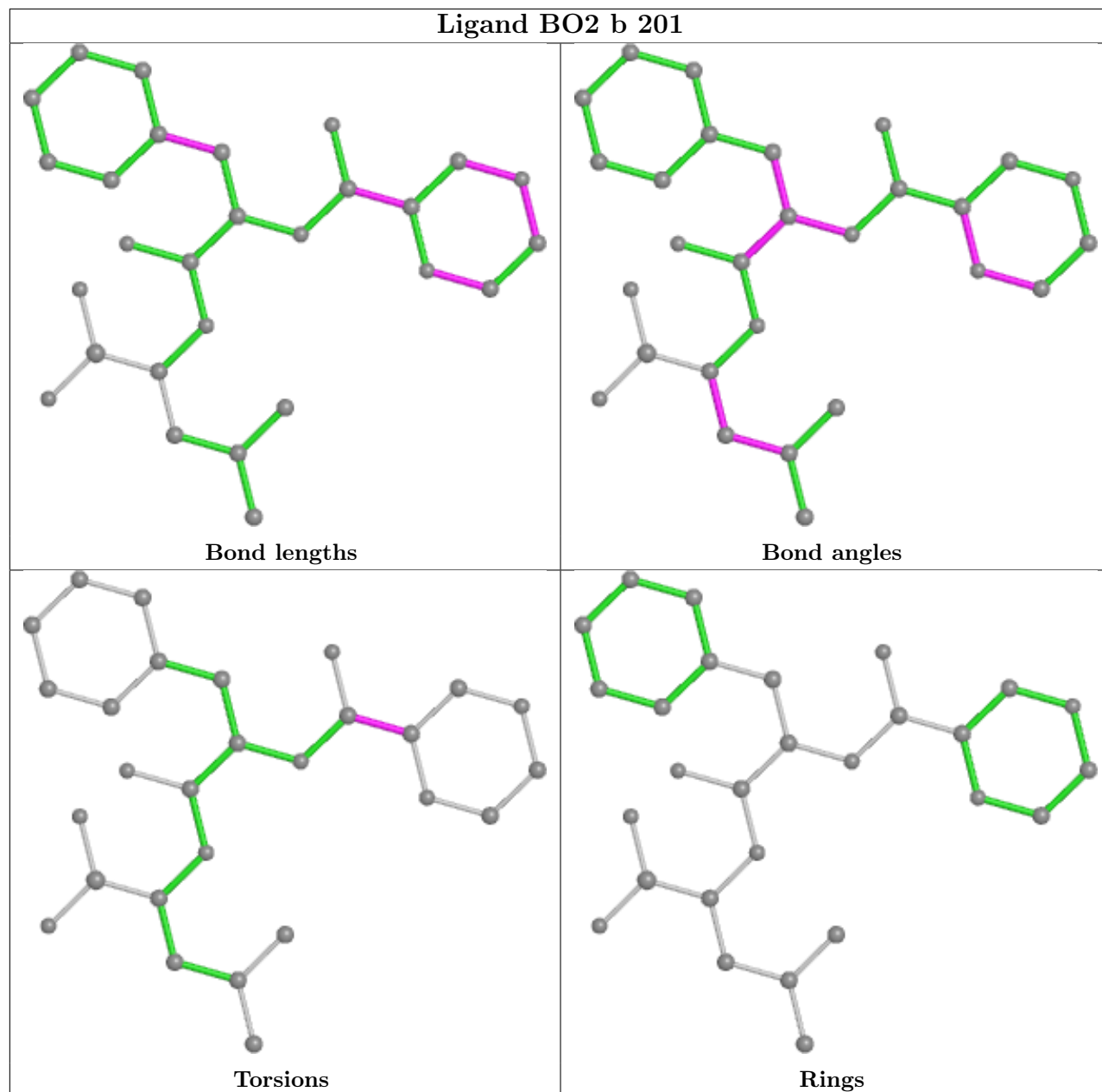
Mol	Chain	Res	Type	Atoms
17	H	301	BO2	C3-C2-C7-O8
17	H	301	BO2	C3-C2-C7-N9
17	H	301	BO2	C21-C22-C23-C24
17	H	301	BO2	C21-C22-C23-C25
17	V	301	BO2	C3-C2-C7-O8
17	V	301	BO2	C3-C2-C7-N9
17	V	301	BO2	C21-C22-C23-C24
17	V	301	BO2	C21-C22-C23-C25
17	H	301	BO2	N1-C2-C7-O8
17	V	301	BO2	N1-C2-C7-O8
17	H	301	BO2	N1-C2-C7-N9
17	V	301	BO2	N1-C2-C7-N9
17	N	201	BO2	N1-C2-C7-O8
17	b	201	BO2	N1-C2-C7-O8
17	N	201	BO2	N1-C2-C7-N9
17	b	201	BO2	N1-C2-C7-N9
17	N	201	BO2	C3-C2-C7-O8
17	N	201	BO2	C3-C2-C7-N9
17	b	201	BO2	C3-C2-C7-N9
17	b	201	BO2	C3-C2-C7-O8

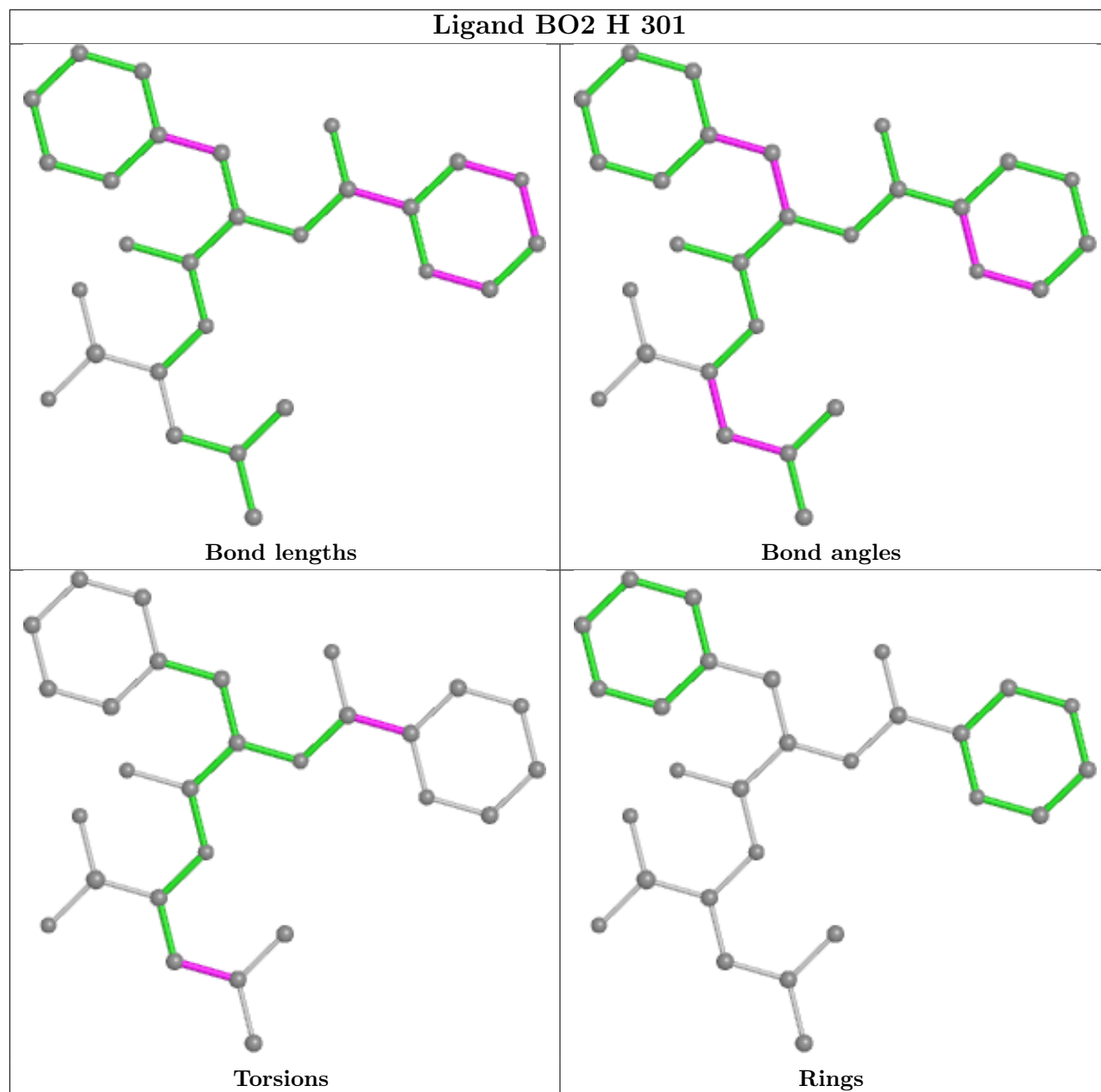
There are no ring outliers.

No monomer is involved in short contacts.

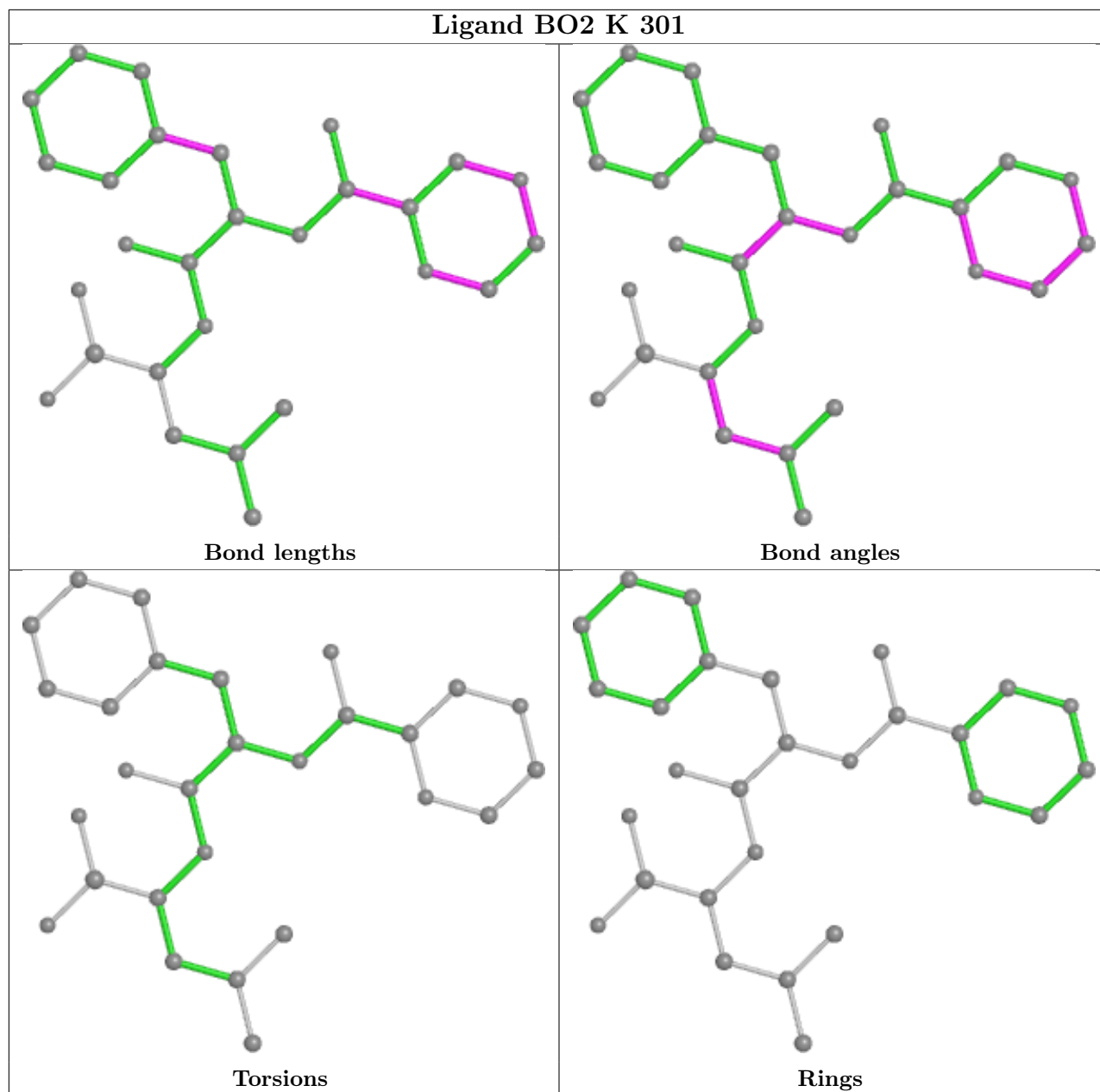
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

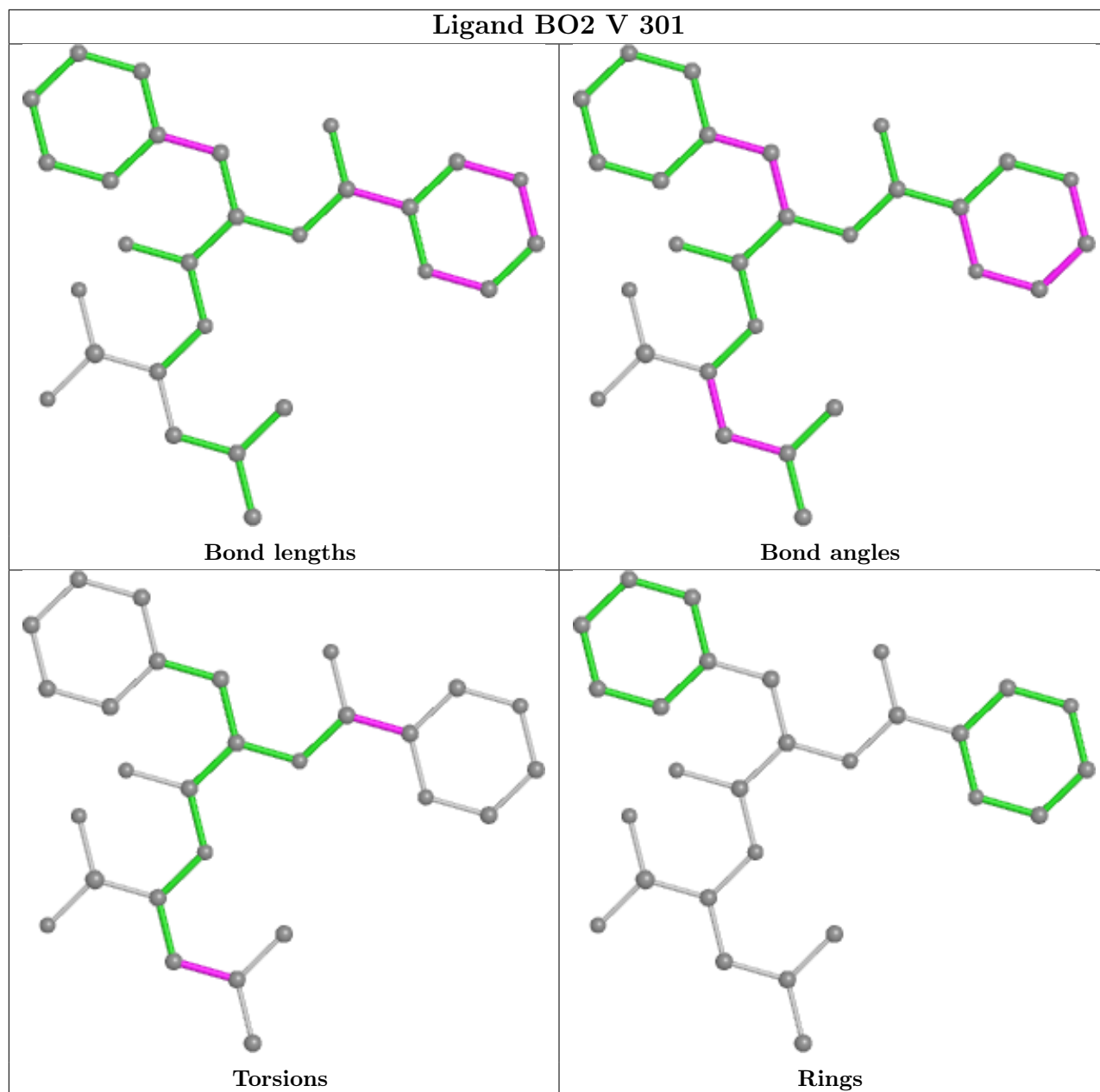
equivalents in the CSD to analyse the geometry.

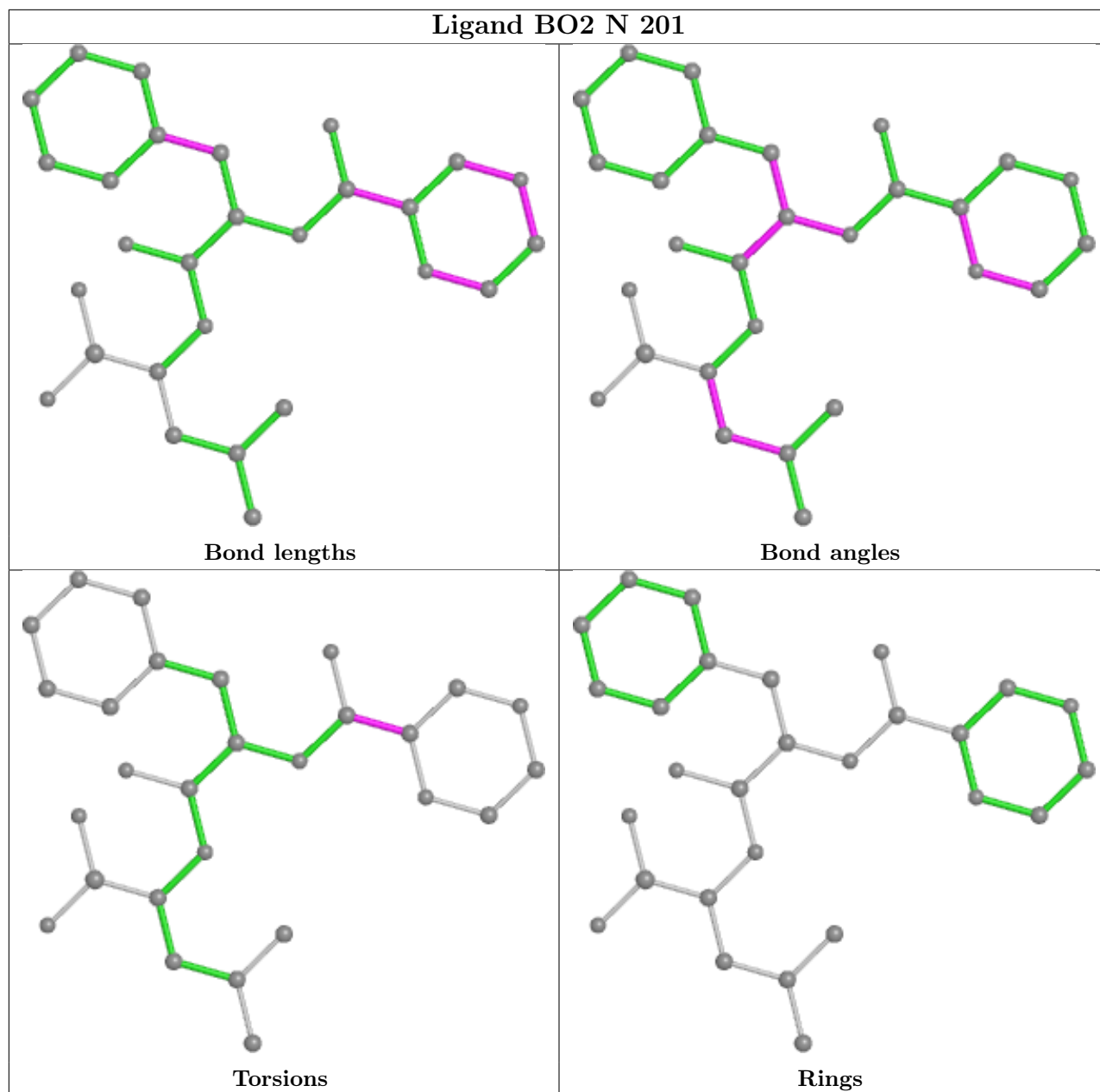


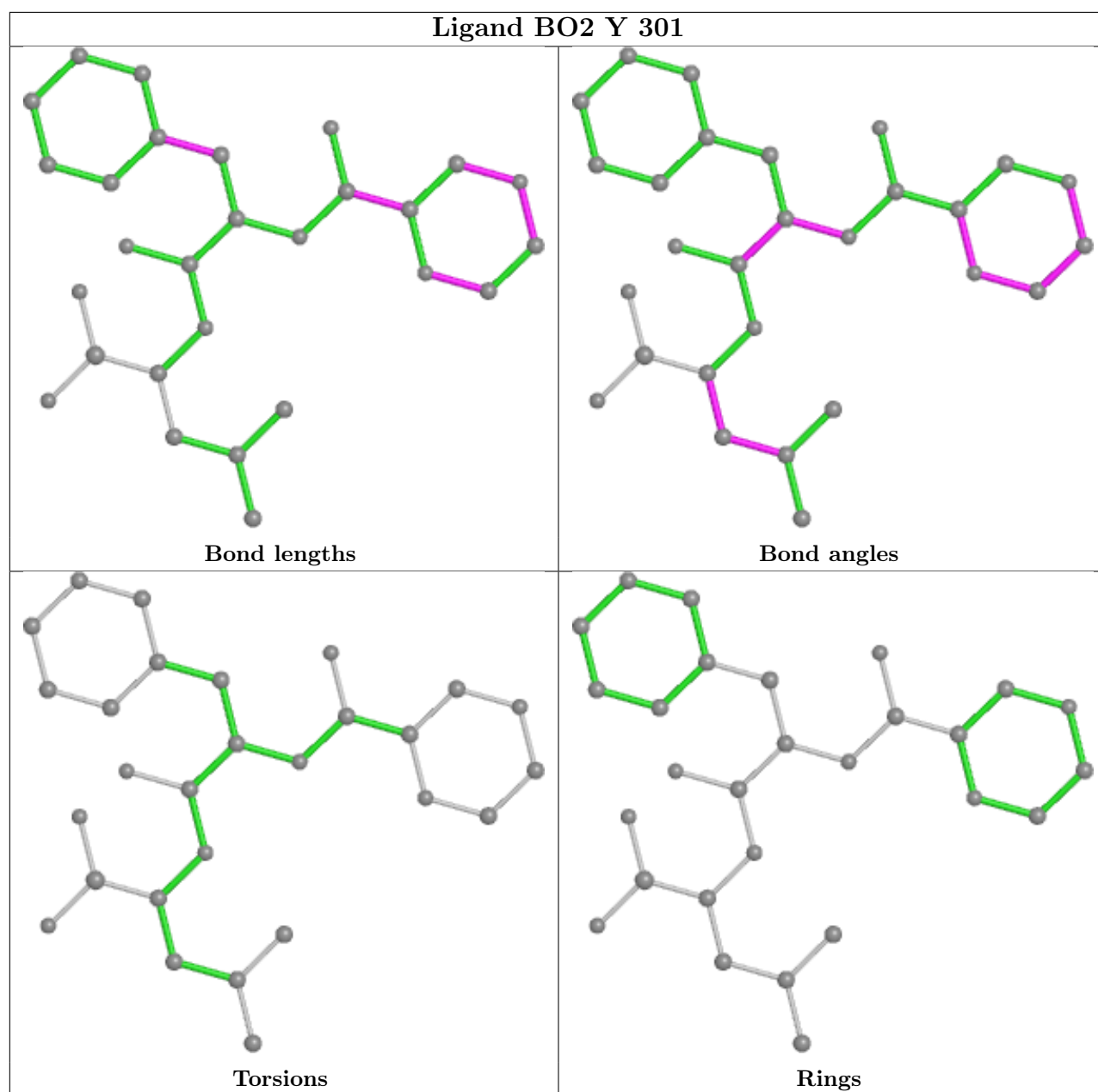












#### 4.7 Other polymers [i](#)

There are no such residues in this entry.

#### 4.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 5 Fit of model and data [i](#)

### 5.1 Protein, DNA and RNA chains [i](#)

EDS failed to run properly - this section is therefore empty.

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

EDS failed to run properly - this section is therefore empty.

### 5.3 Carbohydrates [i](#)

EDS failed to run properly - this section is therefore empty.

### 5.4 Ligands [i](#)

EDS failed to run properly - this section is therefore empty.

### 5.5 Other polymers [i](#)

EDS failed to run properly - this section is therefore empty.