Full wwPDB X-ray Structure Validation Report (i)

Oct 5, 2023 – 01:57 AM EDT

PDB ID	:	6VBG
Title	:	Lactose permease complex with thiodigalactoside and nanobody 9043
Authors	:	Kumar, H.; Stroud, R.M.; Kaback, H.R.; Finer-Moore, J.; Smirnova, I.; Kasho, V.; Pardon, E.; Steyart, J.
Deposited on	:	2019-12-18
Resolution	:	2.80 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 (i) 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	:	FAILED
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (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 (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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 (i)

There are 5 unique types of molecules in this entry. The entry contains 16923 atoms, of which 8498 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 Galactoside permease.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	396	6365	2155	3201	478	509	22	0	0	0
1	B	397	6379	2159	3207	479	512	22	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	46	TRP	GLY	engineered mutation	UNP C6FW78
A	262	TRP	GLY	engineered mutation	UNP C6FW78
B	46	TRP	GLY	engineered mutation	UNP C6FW78
B	262	TRP	GLY	engineered mutation	UNP C6FW78

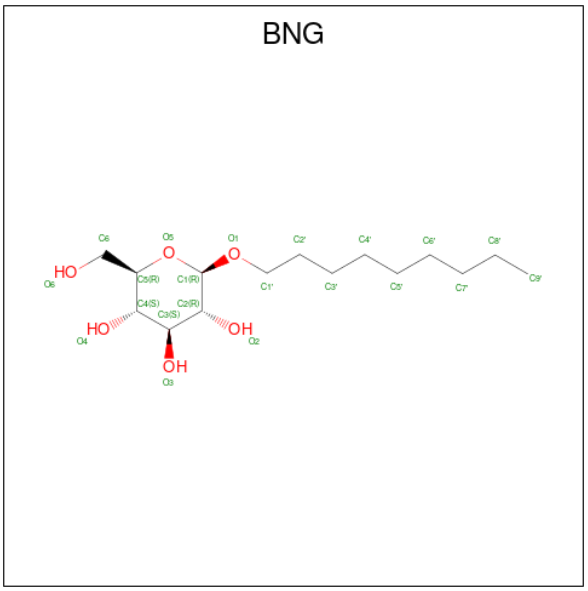
- Molecule 2 is a protein called nanobody 9043.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
2	C	121	1848	587	902	175	180	4	0	0	0
2	D	117	1780	563	874	163	176	4	0	0	0

- Molecule 3 is an oligosaccharide called beta-D-galactopyranose-(1-1)-1-thio-beta-D-galactopyranose.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	H	O	S			
3	E	2	45	12	22	10	1	0	0	0
3	F	2	45	12	22	10	1	0	0	0

- Molecule 4 is nonyl beta-D-glucopyranoside (three-letter code: BNG) (formula: $C_{15}H_{30}O_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
4	A	1	51	15	30	6	0	0
4	A	1	51	15	30	6	0	0
4	C	1	51	15	30	6	0	0
4	C	1	51	15	30	6	0	0
4	B	1	51	15	30	6	0	0
4	B	1	51	15	30	6	0	0
4	B	1	51	15	30	6	0	0
4	B	1	51	15	30	6	0	0
4	D	1	51	15	30	6	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	1	1	1	0	0
5	B	1	1	1	0	0

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

3 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α, β, γ	151.27Å 151.27Å 182.48Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	39.06 – 2.80	Depositor
% Data completeness (in resolution range)	96.9 (39.06-2.80)	Depositor
R_{merge}	0.22	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.42 (at 2.81Å)	Xtriage
Refinement program	PHENIX 1.15.2_3472, PHENIX 1.15.2_3472	Depositor
R, R_{free}	0.239 , 0.275	Depositor
Wilson B-factor (Å^2)	49.7	Xtriage
Anisotropy	0.192	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	0.056 for h,-h-k,-l	Xtriage
Total number of atoms	16923	wwPDB-VP
Average B, all atoms (Å^2)	81.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.70% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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)

4 monosaccharides 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	YIO	E	1	3	11,12,12	2.29	1 (9%)	15,17,17	1.23	1 (6%)
3	GAL	E	2	3	11,11,12	1.92	3 (27%)	15,15,17	1.09	2 (13%)
3	YIO	F	1	3	11,12,12	2.20	1 (9%)	15,17,17	1.72	3 (20%)
3	GAL	F	2	3	11,11,12	1.85	3 (27%)	15,15,17	0.86	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	YIO	E	1	3	-	2/2/22/22	0/1/1/1
3	GAL	E	2	3	-	0/2/19/22	0/1/1/1
3	YIO	F	1	3	-	0/2/22/22	0/1/1/1
3	GAL	F	2	3	-	0/2/19/22	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	1	YIO	O5-C1	7.03	1.53	1.42
3	F	1	YIO	O5-C1	6.59	1.52	1.42
3	E	2	GAL	O5-C1	4.15	1.50	1.43
3	F	2	GAL	O5-C1	3.96	1.50	1.43
3	E	2	GAL	O3-C3	2.55	1.49	1.43
3	E	2	GAL	C2-C3	-2.41	1.49	1.52
3	F	2	GAL	O3-C3	2.40	1.48	1.43
3	F	2	GAL	C2-C3	-2.30	1.49	1.52

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	F	1	YIO	O5-C1-C2	5.21	116.87	110.31
3	E	1	YIO	O5-C1-C2	3.72	115.00	110.31
3	E	2	GAL	C2-C3-C4	2.58	115.35	110.89
3	F	1	YIO	O5-C5-C4	2.29	113.86	109.69
3	F	1	YIO	C1-O5-C5	2.20	116.62	112.57
3	E	2	GAL	C3-C4-C5	2.00	113.81	110.24

There are no chirality outliers.

All (2) torsion outliers are listed below:

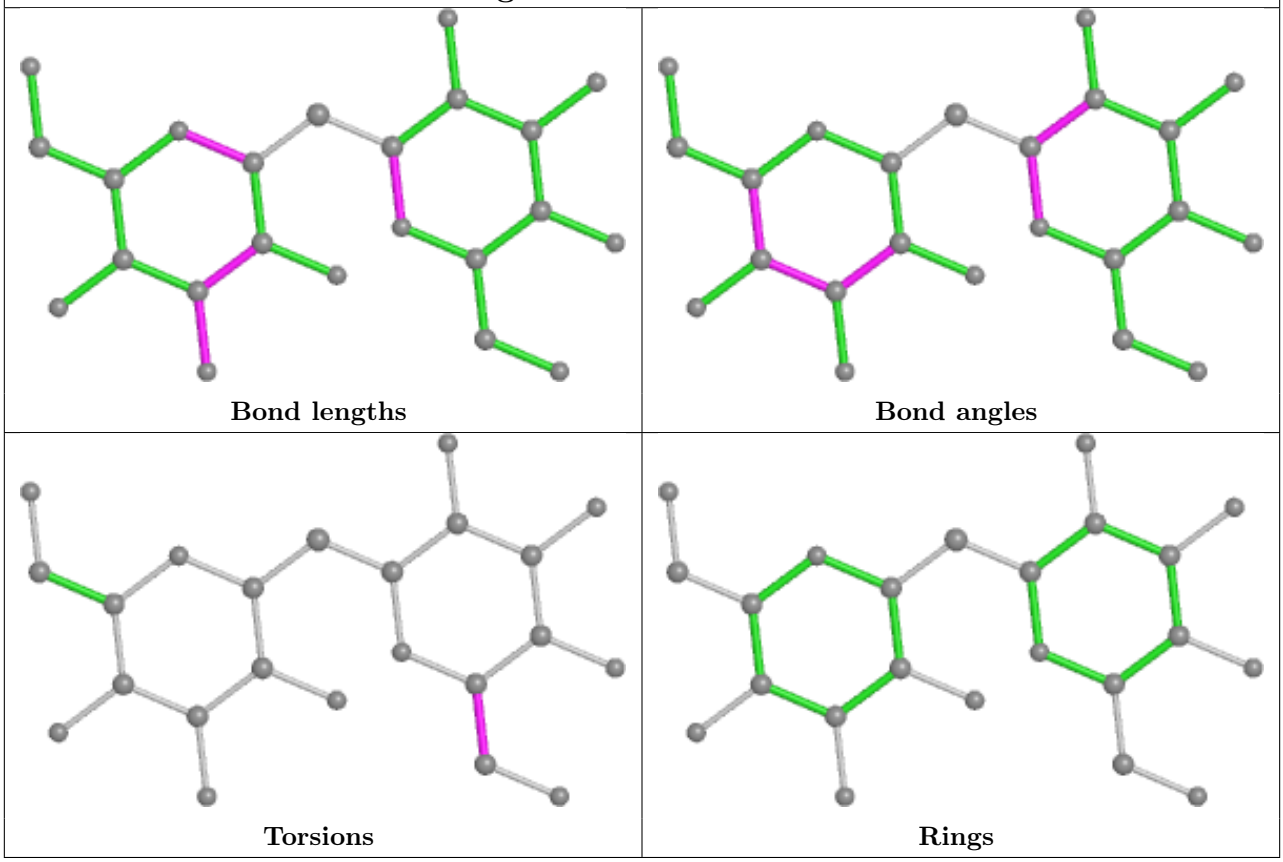
Mol	Chain	Res	Type	Atoms
3	E	1	YIO	O5-C5-C6-O6
3	E	1	YIO	C4-C5-C6-O6

There are no ring outliers.

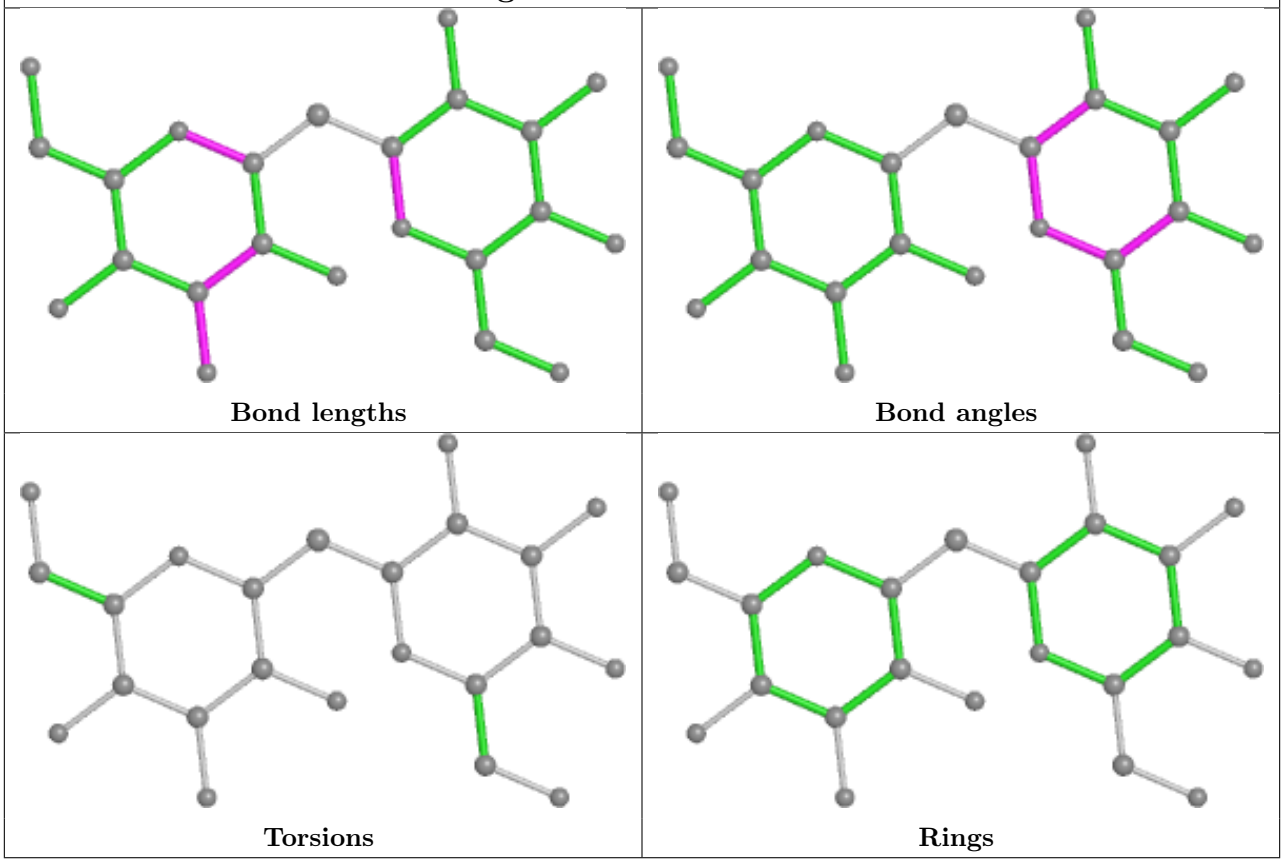
No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

Oligosaccharide Chain E



Oligosaccharide Chain F



4.6 Ligand geometry (i)

9 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	$\#\|Z\| > 2$
4	BNG	C	502	-	21,21,21	1.21	2 (9%)	26,26,26	1.31	2 (7%)
4	BNG	B	801	-	21,21,21	1.17	1 (4%)	26,26,26	1.51	4 (15%)
4	BNG	A	701	-	21,21,21	1.11	2 (9%)	26,26,26	0.94	1 (3%)
4	BNG	D	601	-	21,21,21	1.17	2 (9%)	26,26,26	1.05	1 (3%)
4	BNG	B	803	-	21,21,21	1.15	2 (9%)	26,26,26	0.93	0
4	BNG	C	501	-	21,21,21	1.06	1 (4%)	26,26,26	1.02	2 (7%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
4	BNG	B	802	-	21,21,21	1.25	2 (9%)	26,26,26	1.52	3 (11%)
4	BNG	A	702	-	21,21,21	1.15	1 (4%)	26,26,26	1.04	0
4	BNG	B	804	-	21,21,21	1.10	1 (4%)	26,26,26	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
4	BNG	C	502	-	-	8/12/32/32	0/1/1/1
4	BNG	B	801	-	-	5/12/32/32	0/1/1/1
4	BNG	A	701	-	-	8/12/32/32	0/1/1/1
4	BNG	D	601	-	-	4/12/32/32	0/1/1/1
4	BNG	B	803	-	-	7/12/32/32	0/1/1/1
4	BNG	C	501	-	-	6/12/32/32	0/1/1/1
4	BNG	B	802	-	-	7/12/32/32	0/1/1/1
4	BNG	A	702	-	-	1/12/32/32	0/1/1/1
4	BNG	B	804	-	-	5/12/32/32	0/1/1/1

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	801	BNG	O5-C1	4.10	1.52	1.41
4	C	502	BNG	O5-C1	4.08	1.52	1.41
4	B	803	BNG	O5-C1	3.90	1.51	1.41
4	A	701	BNG	O5-C1	3.60	1.51	1.41
4	D	601	BNG	O5-C1	3.49	1.50	1.41
4	A	702	BNG	O5-C1	3.47	1.50	1.41
4	B	804	BNG	O5-C1	3.45	1.50	1.41
4	B	802	BNG	O5-C1	3.31	1.50	1.41
4	C	501	BNG	O5-C1	3.12	1.49	1.41
4	B	802	BNG	O1-C1	-3.09	1.34	1.40
4	C	502	BNG	O1-C1	-2.52	1.35	1.40
4	D	601	BNG	O1-C1	-2.28	1.36	1.40
4	B	803	BNG	O1-C1	-2.06	1.36	1.40
4	A	701	BNG	O1-C1	-2.02	1.36	1.40

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	C	502	BNG	O1-C1-C2	4.69	115.63	108.30
4	B	802	BNG	C3-C4-C5	4.65	118.53	110.24
4	B	801	BNG	O1-C1-C2	3.59	113.90	108.30
4	B	802	BNG	O5-C5-C4	3.50	116.06	109.69
4	B	801	BNG	C1'-O1-C1	3.27	119.26	113.84
4	C	502	BNG	C1'-O1-C1	-2.91	109.02	113.84
4	B	801	BNG	O5-C1-O1	-2.88	103.17	109.97
4	D	601	BNG	C1'-O1-C1	2.51	118.00	113.84
4	B	802	BNG	C6-C5-C4	-2.48	107.20	113.00
4	B	801	BNG	O5-C1-C2	2.26	115.14	110.35
4	A	701	BNG	O5-C5-C4	2.25	113.78	109.69
4	C	501	BNG	C1-C2-C3	2.14	114.46	110.00
4	C	501	BNG	O1-C1-C2	-2.13	104.98	108.30

There are no chirality outliers.

All (51) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	C	501	BNG	O5-C1-O1-C1'
4	C	501	BNG	C2'-C1'-O1-C1
4	C	502	BNG	C2-C1-O1-C1'
4	C	502	BNG	O5-C1-O1-C1'
4	B	801	BNG	O5-C1-O1-C1'
4	B	802	BNG	C2'-C1'-O1-C1
4	C	502	BNG	C1'-C2'-C3'-C4'
4	A	701	BNG	C4-C5-C6-O6
4	A	701	BNG	O5-C5-C6-O6
4	B	803	BNG	C4-C5-C6-O6
4	C	502	BNG	O5-C5-C6-O6
4	B	803	BNG	O5-C5-C6-O6
4	A	701	BNG	C2-C1-O1-C1'
4	D	601	BNG	C2-C1-O1-C1'
4	C	502	BNG	C4-C5-C6-O6
4	A	701	BNG	O5-C1-O1-C1'
4	B	804	BNG	O5-C1-O1-C1'
4	B	802	BNG	O1-C1'-C2'-C3'
4	B	803	BNG	C2-C1-O1-C1'
4	A	701	BNG	C2'-C3'-C4'-C5'
4	C	502	BNG	O1-C1'-C2'-C3'
4	B	803	BNG	O5-C1-O1-C1'
4	B	804	BNG	C4-C5-C6-O6
4	C	501	BNG	C4'-C5'-C6'-C7'
4	C	501	BNG	O1-C1'-C2'-C3'

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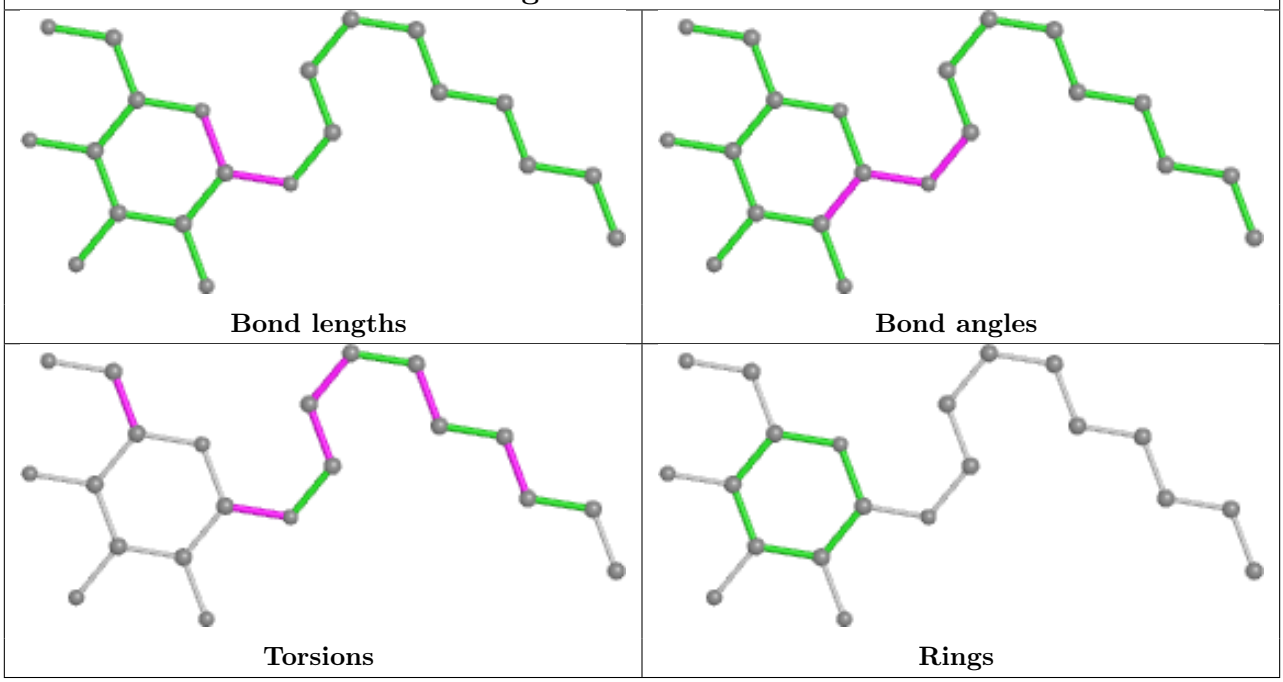
Mol	Chain	Res	Type	Atoms
4	D	601	BNG	C1'-C2'-C3'-C4'
4	B	801	BNG	C2-C1-O1-C1'
4	B	804	BNG	O5-C5-C6-O6
4	B	802	BNG	O5-C5-C6-O6
4	C	502	BNG	C5'-C6'-C7'-C8'
4	A	701	BNG	C3'-C4'-C5'-C6'
4	B	802	BNG	C5'-C6'-C7'-C8'
4	C	501	BNG	C5'-C6'-C7'-C8'
4	B	803	BNG	C3'-C4'-C5'-C6'
4	B	804	BNG	C3'-C4'-C5'-C6'
4	A	702	BNG	C3'-C4'-C5'-C6'
4	C	502	BNG	C3'-C4'-C5'-C6'
4	B	802	BNG	C4'-C5'-C6'-C7'
4	A	701	BNG	C4'-C5'-C6'-C7'
4	B	802	BNG	C3'-C4'-C5'-C6'
4	C	501	BNG	C3'-C4'-C5'-C6'
4	D	601	BNG	C3'-C4'-C5'-C6'
4	B	802	BNG	C1'-C2'-C3'-C4'
4	B	804	BNG	C4'-C5'-C6'-C7'
4	B	801	BNG	C3'-C4'-C5'-C6'
4	B	803	BNG	C2'-C3'-C4'-C5'
4	B	801	BNG	C4'-C5'-C6'-C7'
4	B	801	BNG	C1'-C2'-C3'-C4'
4	D	601	BNG	O1-C1'-C2'-C3'
4	B	803	BNG	C4'-C5'-C6'-C7'
4	A	701	BNG	C6'-C7'-C8'-C9'

There are no ring outliers.

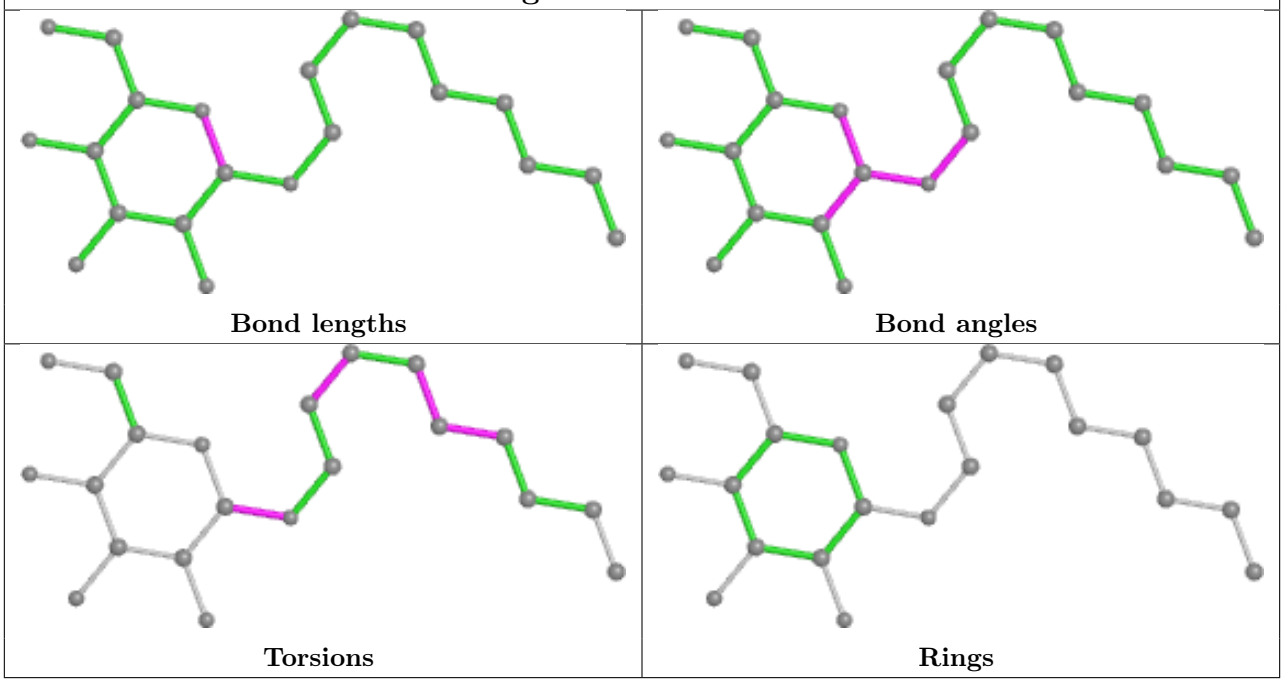
No monomer is involved in short contacts.

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 then 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.

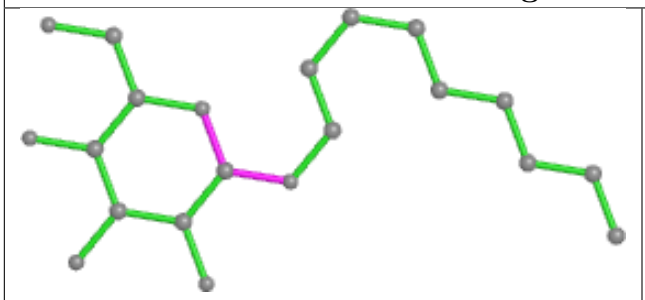
Ligand BNG C 502



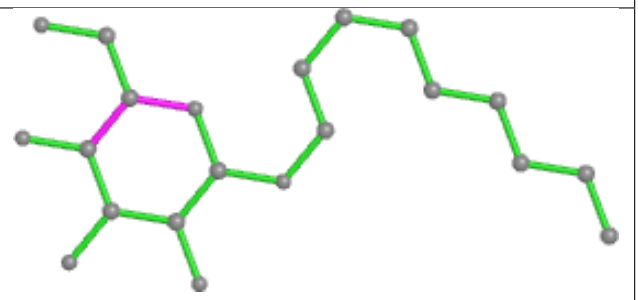
Ligand BNG B 801



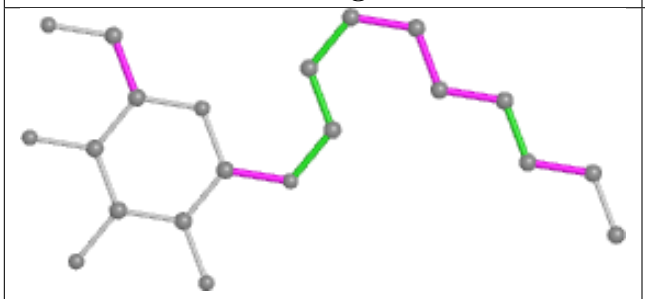
Ligand BNG A 701



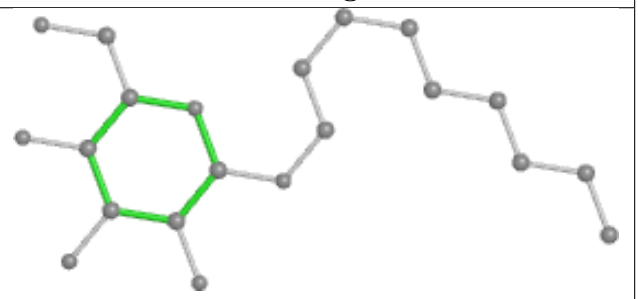
Bond lengths



Bond angles

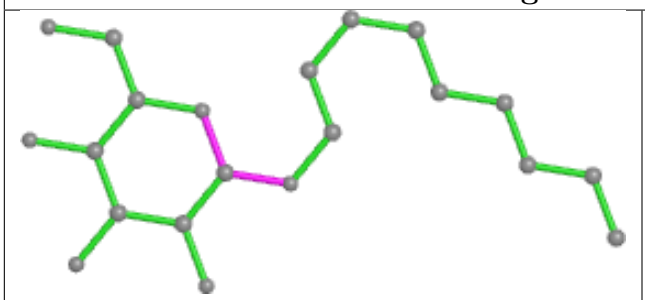


Torsions

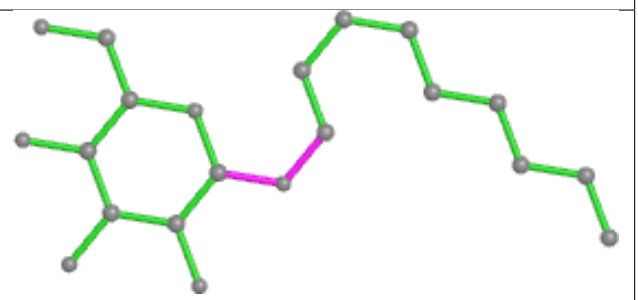


Rings

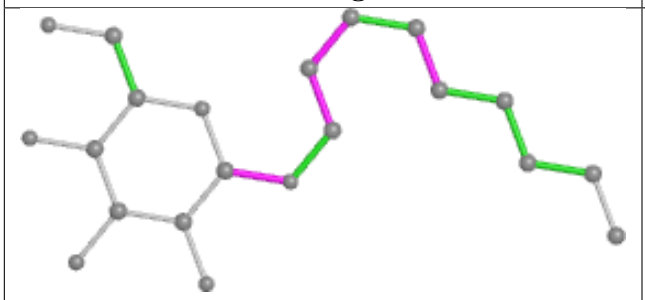
Ligand BNG D 601



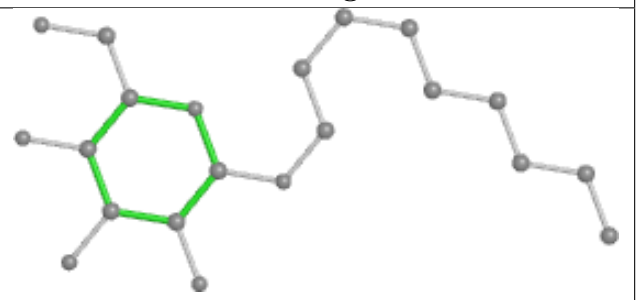
Bond lengths



Bond angles

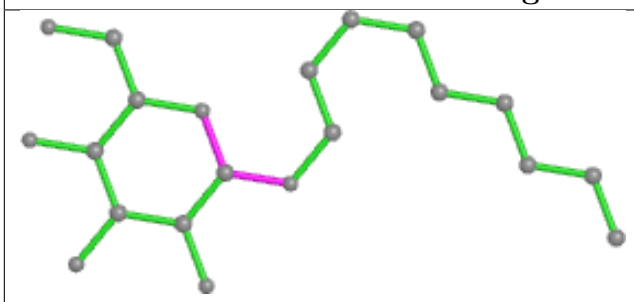


Torsions

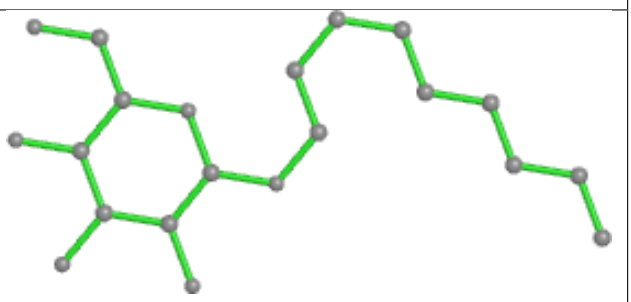


Rings

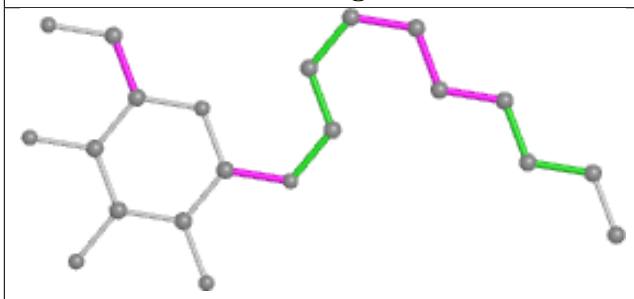
Ligand BNG B 803



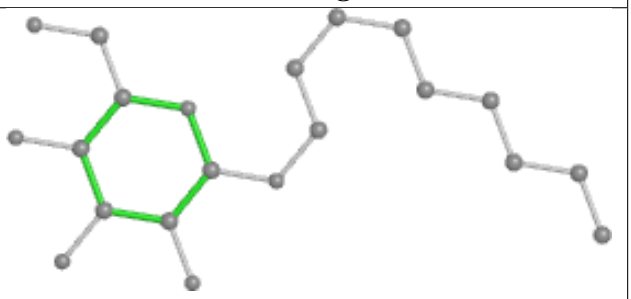
Bond lengths



Bond angles

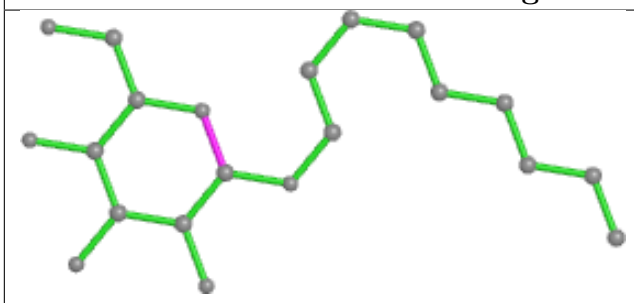


Torsions

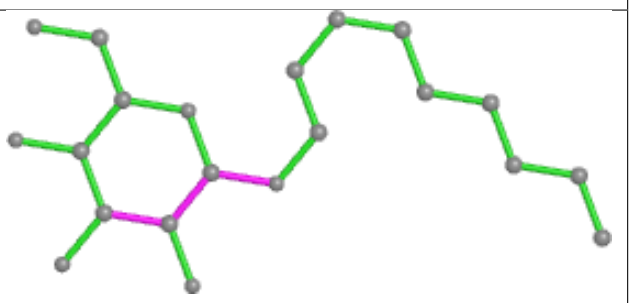


Rings

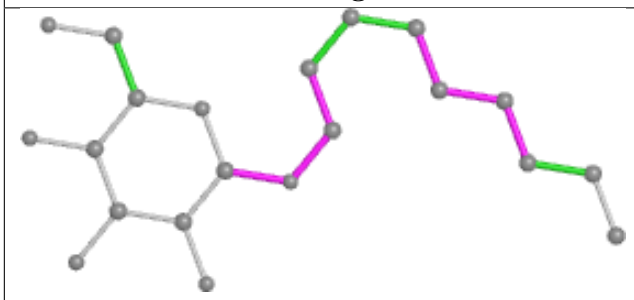
Ligand BNG C 501



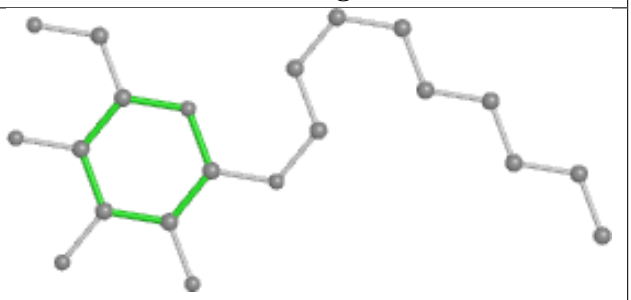
Bond lengths



Bond angles

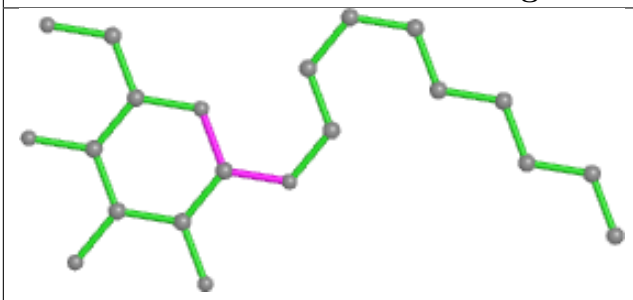


Torsions

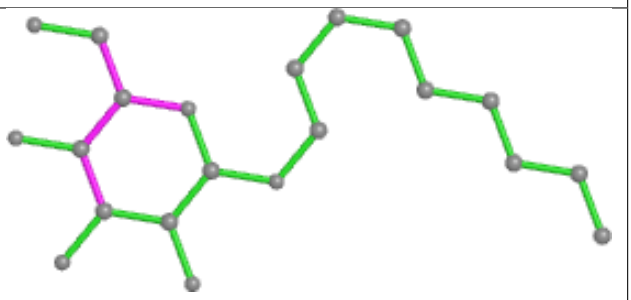


Rings

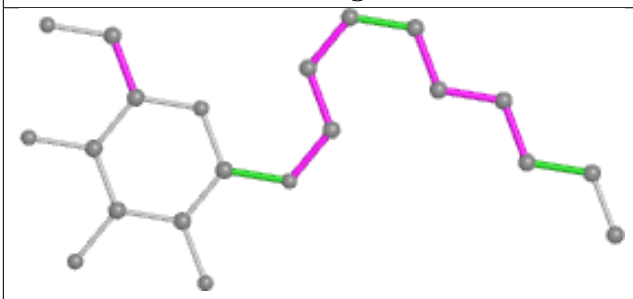
Ligand BNG B 802



Bond lengths



Bond angles



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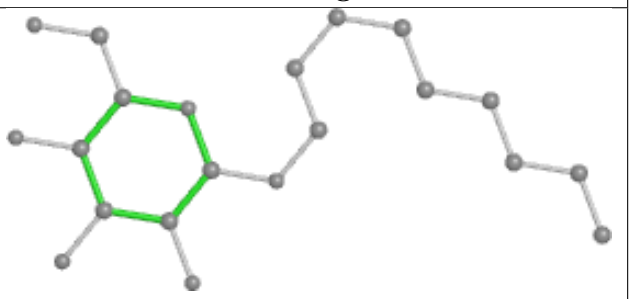
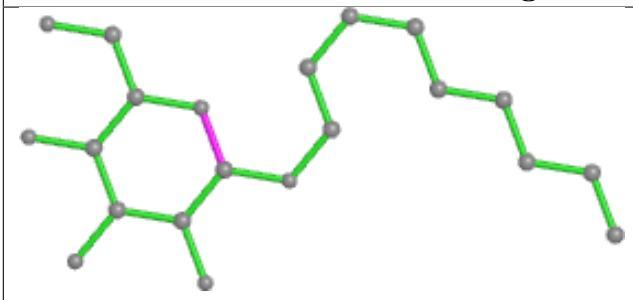


Rings

Ligand BNG A 702



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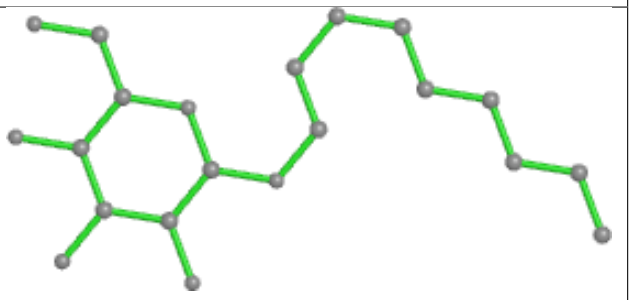
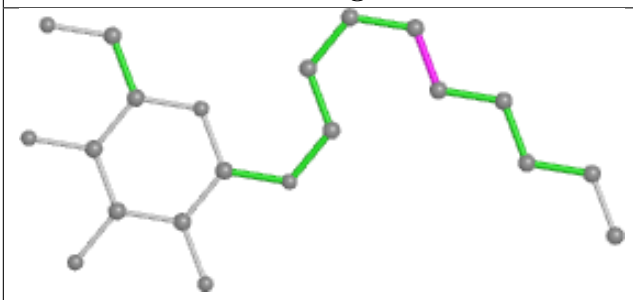


Bond angles



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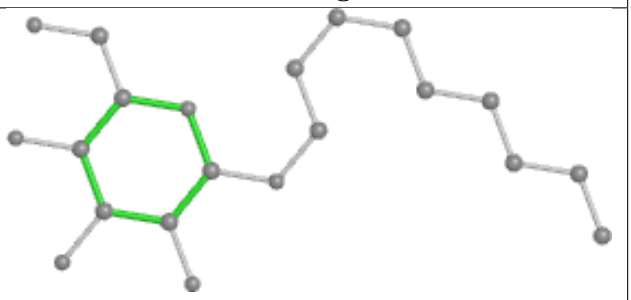
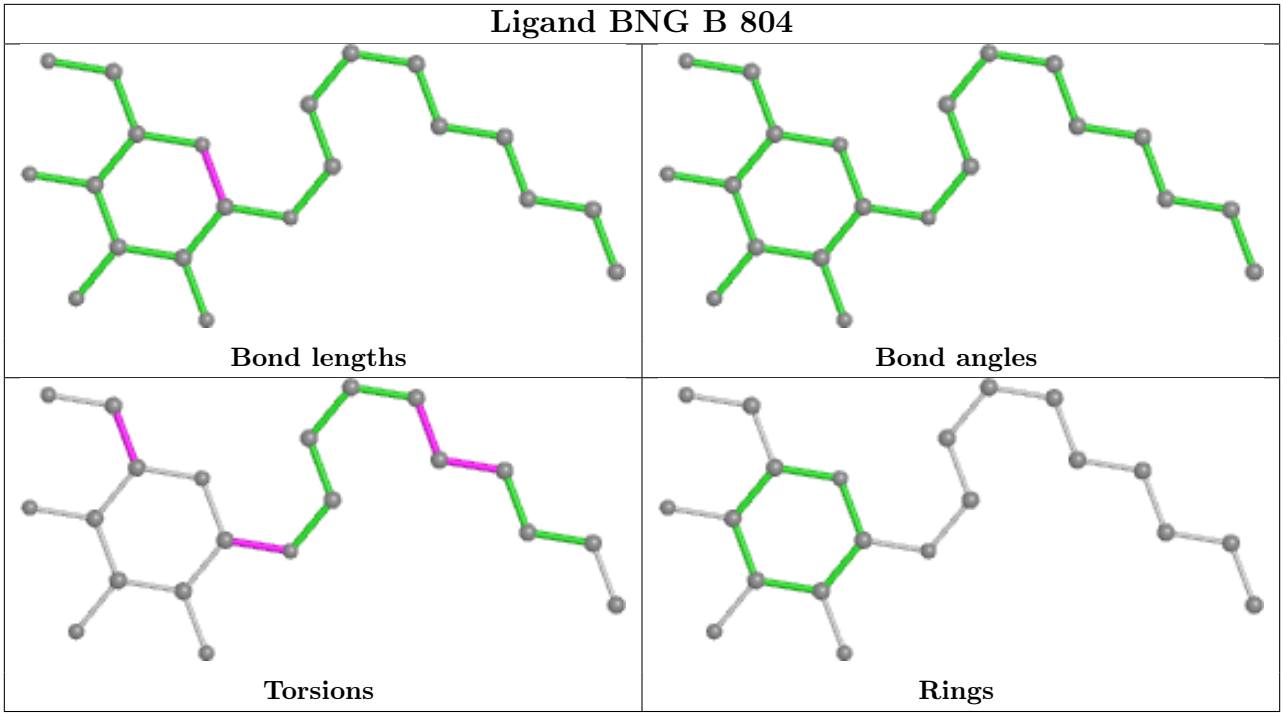


Rings



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.