



wwPDB/EMDataBank EM Map/Model Validation Summary Report ⓘ

Sep 23, 2019 – 01:38 PM EDT

PDB ID : 6Q2S
EMDB ID: : EMD-20579
Title : Cryo-EM structure of RET/GFRa3/ARTN extracellular complex. The 3D refinement was applied with C2 symmetry.
Authors : Li, J.; Shang, G.J.; Chen, Y.J.; Brautigam, C.A.; Liou, J.; Zhang, X.W.; Bai, X.C.
Deposited on : 2019-08-08
Resolution : 3.80 Å(reported)

This is a wwPDB/EMDataBank EM Map/Model Validation Summary 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.

MolProbity : 4.02b-467
Mogul : 1.8.0 (224370), CSD as540be (2019)
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : 2.4

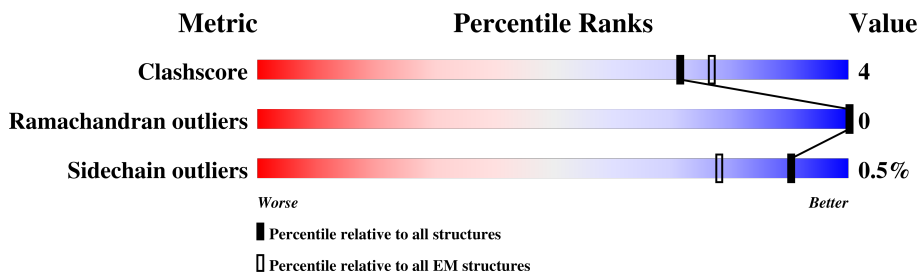
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.80 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)
Clashscore	136327	1886
Ramachandran outliers	132723	1663
Sidechain outliers	132532	1531

The table below summarises the geometric issues observed across the polymeric chains. The red, orange, yellow and green segments on the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	235	39% 58%
1	B	235	40% 58%
2	C	342	54% 42%
2	D	342	54% 42%
3	E	617	80% 12% 8%
3	F	617	80% 12% 8%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 13726 atoms, of which 0 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 Ubiquitin-like protein SMT3,Artemin.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	98	Total	C	N	O	S	0	0
			743	454	151	130	8		
1	B	98	Total	C	N	O	S	0	0
			743	454	151	130	8		

There are 48 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-14	MET	-	initiating methionine	UNP Q12306
A	-13	GLY	-	expression tag	UNP Q12306
A	-12	SER	-	expression tag	UNP Q12306
A	-11	SER	-	expression tag	UNP Q12306
A	-10	HIS	-	expression tag	UNP Q12306
A	-9	HIS	-	expression tag	UNP Q12306
A	-8	HIS	-	expression tag	UNP Q12306
A	-7	HIS	-	expression tag	UNP Q12306
A	-6	HIS	-	expression tag	UNP Q12306
A	-5	HIS	-	expression tag	UNP Q12306
A	-4	SER	-	expression tag	UNP Q12306
A	-3	SER	-	expression tag	UNP Q12306
A	-2	GLY	-	expression tag	UNP Q12306
A	-1	LEU	-	expression tag	UNP Q12306
A	0	VAL	-	expression tag	UNP Q12306
A	1	PRO	-	expression tag	UNP Q12306
A	2	ARG	-	expression tag	UNP Q12306
A	3	GLY	-	expression tag	UNP Q12306
A	4	SER	-	expression tag	UNP Q12306
A	5	HIS	-	expression tag	UNP Q12306
A	6	MET	-	expression tag	UNP Q12306
A	7	ALA	-	expression tag	UNP Q12306
A	8	SER	-	expression tag	UNP Q12306
A	107	SER	-	linker	UNP Q12306
B	-14	MET	-	initiating methionine	UNP Q12306
B	-13	GLY	-	expression tag	UNP Q12306

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-12	SER	-	expression tag	UNP Q12306
B	-11	SER	-	expression tag	UNP Q12306
B	-10	HIS	-	expression tag	UNP Q12306
B	-9	HIS	-	expression tag	UNP Q12306
B	-8	HIS	-	expression tag	UNP Q12306
B	-7	HIS	-	expression tag	UNP Q12306
B	-6	HIS	-	expression tag	UNP Q12306
B	-5	HIS	-	expression tag	UNP Q12306
B	-4	SER	-	expression tag	UNP Q12306
B	-3	SER	-	expression tag	UNP Q12306
B	-2	GLY	-	expression tag	UNP Q12306
B	-1	LEU	-	expression tag	UNP Q12306
B	0	VAL	-	expression tag	UNP Q12306
B	1	PRO	-	expression tag	UNP Q12306
B	2	ARG	-	expression tag	UNP Q12306
B	3	GLY	-	expression tag	UNP Q12306
B	4	SER	-	expression tag	UNP Q12306
B	5	HIS	-	expression tag	UNP Q12306
B	6	MET	-	expression tag	UNP Q12306
B	7	ALA	-	expression tag	UNP Q12306
B	8	SER	-	expression tag	UNP Q12306
B	107	SER	-	linker	UNP Q12306

- Molecule 2 is a protein called GDNF family receptor alpha-3.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	C	199	Total	C	N	O	S	0	0
			1527	942	283	277	25		
2	D	199	Total	C	N	O	S	0	0
			1527	942	283	277	25		

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	364	GLY	-	expression tag	UNP O60609
C	365	THR	-	expression tag	UNP O60609
C	366	HIS	-	expression tag	UNP O60609
C	367	HIS	-	expression tag	UNP O60609
C	368	HIS	-	expression tag	UNP O60609
C	369	HIS	-	expression tag	UNP O60609
C	370	HIS	-	expression tag	UNP O60609
C	371	HIS	-	expression tag	UNP O60609

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Chain	Residue	Modelled	Actual	Comment	Reference
C	372	HIS	-	expression tag	UNP O60609
C	373	HIS	-	expression tag	UNP O60609
D	364	GLY	-	expression tag	UNP O60609
D	365	THR	-	expression tag	UNP O60609
D	366	HIS	-	expression tag	UNP O60609
D	367	HIS	-	expression tag	UNP O60609
D	368	HIS	-	expression tag	UNP O60609
D	369	HIS	-	expression tag	UNP O60609
D	370	HIS	-	expression tag	UNP O60609
D	371	HIS	-	expression tag	UNP O60609
D	372	HIS	-	expression tag	UNP O60609
D	373	HIS	-	expression tag	UNP O60609

- Molecule 3 is a protein called Proto-oncogene tyrosine-protein kinase receptor Ret.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	E	570	Total	C	N	O	S	0	0
			4491	2827	792	843	29		
3	F	570	Total	C	N	O	S	0	0
			4491	2827	792	843	29		

There are 22 discrepancies between the modelled and reference sequences:

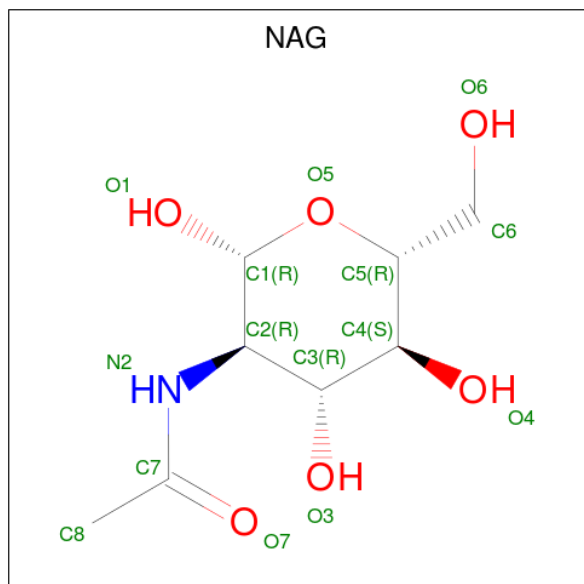
Chain	Residue	Modelled	Actual	Comment	Reference
E	114	HIS	ARG	conflict	UNP P07949
E	636	GLY	-	expression tag	UNP P07949
E	637	THR	-	expression tag	UNP P07949
E	638	HIS	-	expression tag	UNP P07949
E	639	HIS	-	expression tag	UNP P07949
E	640	HIS	-	expression tag	UNP P07949
E	641	HIS	-	expression tag	UNP P07949
E	642	HIS	-	expression tag	UNP P07949
E	643	HIS	-	expression tag	UNP P07949
E	644	HIS	-	expression tag	UNP P07949
E	645	HIS	-	expression tag	UNP P07949
F	114	HIS	ARG	conflict	UNP P07949
F	636	GLY	-	expression tag	UNP P07949
F	637	THR	-	expression tag	UNP P07949
F	638	HIS	-	expression tag	UNP P07949
F	639	HIS	-	expression tag	UNP P07949
F	640	HIS	-	expression tag	UNP P07949
F	641	HIS	-	expression tag	UNP P07949

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Chain	Residue	Modelled	Actual	Comment	Reference
F	642	HIS	-	expression tag	UNP P07949
F	643	HIS	-	expression tag	UNP P07949
F	644	HIS	-	expression tag	UNP P07949
F	645	HIS	-	expression tag	UNP P07949

- Molecule 4 is N-ACETYL-D-GLUCOSAMINE (three-letter code: NAG) (formula: $C_8H_{15}NO_6$) (labeled as "Ligand of Interest" by author).



Mol	Chain	Residues	Atoms				AltConf
4	C	1	Total	C	N	O	0
			14	8	1	5	
4	E	1	Total	C	N	O	0
			84	48	6	30	
4	E	1	Total	C	N	O	0
			84	48	6	30	
4	E	1	Total	C	N	O	0
			84	48	6	30	
4	E	1	Total	C	N	O	0
			84	48	6	30	
4	E	1	Total	C	N	O	0
			84	48	6	30	
4	D	1	Total	C	N	O	0
			14	8	1	5	
4	F	1	Total	C	N	O	0
			84	48	6	30	

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Mol	Chain	Residues	Atoms				AltConf
4	F	1	Total	C	N	O	0
			84	48	6	30	
4	F	1	Total	C	N	O	0
			84	48	6	30	
4	F	1	Total	C	N	O	0
			84	48	6	30	
4	F	1	Total	C	N	O	0
			84	48	6	30	
4	F	1	Total	C	N	O	0
			84	48	6	30	

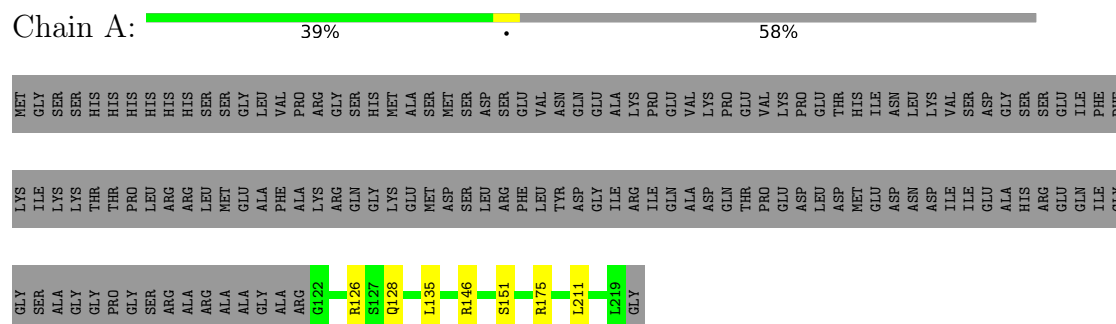
- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca) (labeled as "Ligand of Interest" by author).

Mol	Chain	Residues	Atoms		AltConf
5	F	4	Total	Ca	0
			4	4	
5	E	4	Total	Ca	0
			4	4	

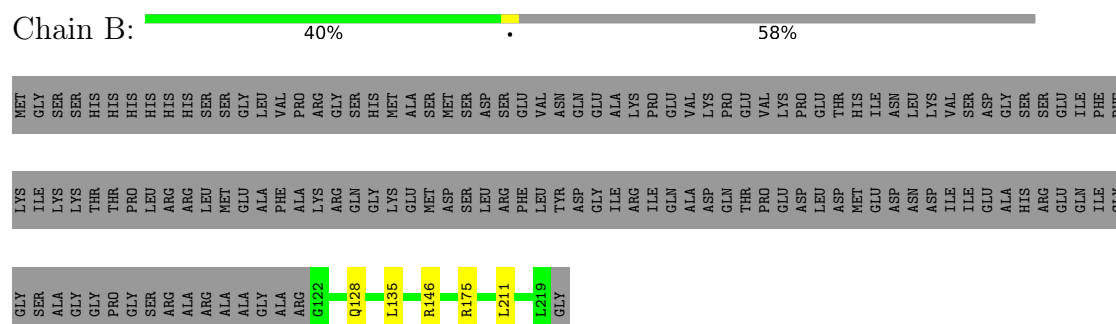
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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.

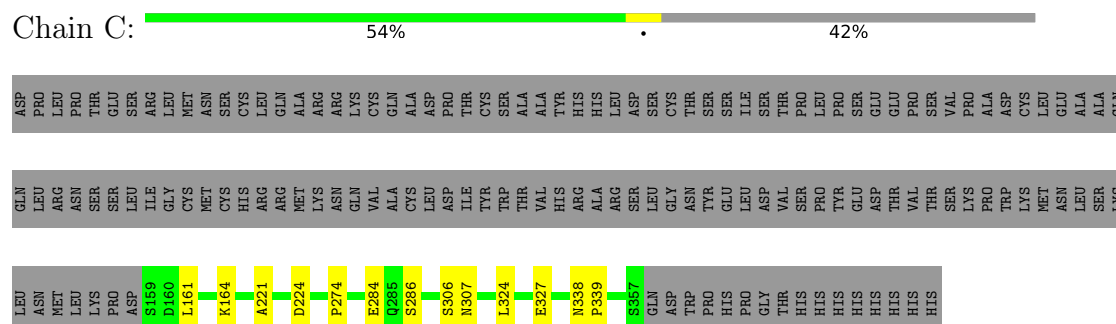
- Molecule 1: Ubiquitin-like protein SMT3,Artemin



- Molecule 1: Ubiquitin-like protein SMT3,Artemin

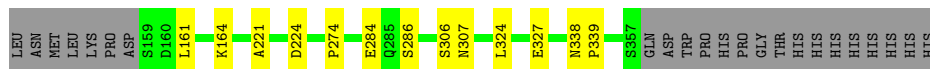


- Molecule 2: GDNF family receptor alpha-3

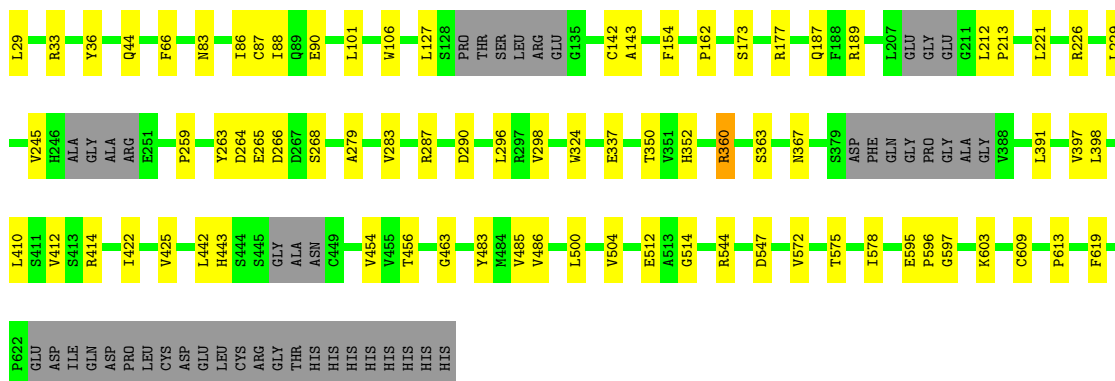


- Molecule 2: GDNF family receptor alpha-3

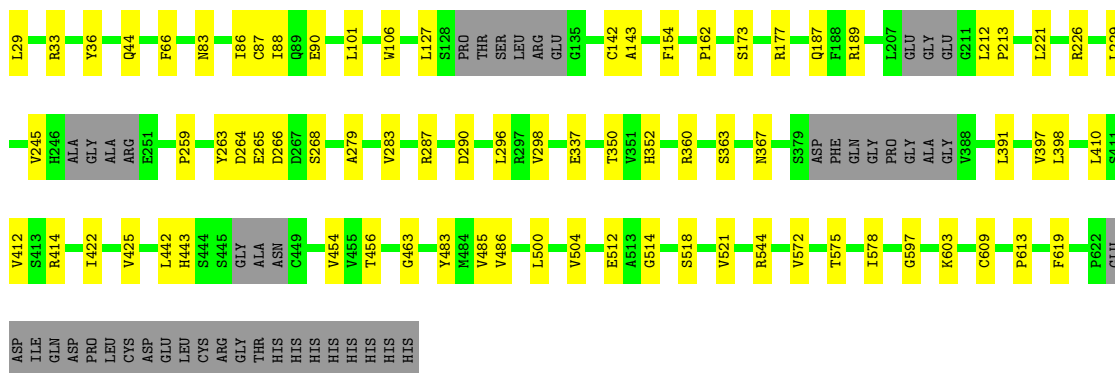




Chain E: 80% 12% 8%



Chain F: 80% 12% 8%



4 Experimental information

Property	Value	Source
Reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C2	Depositor
Number of particles used	114344	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	Not provided	Depositor
Maximum defocus (nm)	Not provided	Depositor
Magnification	46729	Depositor
Image detector	GATAN K2 QUANTUM (4k x 4k)	Depositor

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: CA, NAG

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 >2	RMSZ	# Z >2
1	A	0.40	0/758	0.57	0/1025
1	B	0.40	0/758	0.57	0/1025
2	C	0.38	0/1557	0.55	0/2104
2	D	0.38	0/1557	0.55	0/2104
3	E	0.40	0/4596	0.62	1/6247 (0.0%)
3	F	0.40	0/4596	0.62	1/6247 (0.0%)
All	All	0.39	0/13822	0.60	2/18752 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	268	SER	C-N-CA	6.13	137.02	121.70
3	F	268	SER	C-N-CA	6.11	136.97	121.70

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	743	0	744	7	0
1	B	743	0	744	6	0
2	C	1527	0	1488	6	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	1527	0	1488	6	0
3	E	4491	0	4342	41	0
3	F	4491	0	4342	39	0
4	C	14	0	13	0	0
4	D	14	0	13	0	0
4	E	84	0	78	1	0
4	F	84	0	78	1	0
5	E	4	0	0	0	0
5	F	4	0	0	0	0
All	All	13726	0	13330	103	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.

The worst 5 of 103 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)
3:E:44:GLN:HE21	3:E:154:PHE:HB2	1.59	0.68
3:E:279:ALA:H	3:E:296:LEU:HD11	1.59	0.68
3:F:44:GLN:HE21	3:F:154:PHE:HB2	1.59	0.67
3:F:279:ALA:H	3:F:296:LEU:HD11	1.59	0.67
1:A:175:ARG:H	1:B:128:GLN:HE22	1.45	0.65

There are no symmetry-related clashes.

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 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	96/235 (41%)	92 (96%)	4 (4%)	0	100	100
1	B	96/235 (41%)	92 (96%)	4 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	C	197/342 (58%)	185 (94%)	12 (6%)	0	100	100
2	D	197/342 (58%)	185 (94%)	12 (6%)	0	100	100
3	E	558/617 (90%)	509 (91%)	49 (9%)	0	100	100
3	F	558/617 (90%)	509 (91%)	49 (9%)	0	100	100
All	All	1702/2388 (71%)	1572 (92%)	130 (8%)	0	100	100

There are no Ramachandran outliers to report.

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	82/195 (42%)	82 (100%)	0	100	100
1	B	82/195 (42%)	82 (100%)	0	100	100
2	C	171/302 (57%)	170 (99%)	1 (1%)	87	94
2	D	171/302 (57%)	170 (99%)	1 (1%)	87	94
3	E	501/537 (93%)	498 (99%)	3 (1%)	87	94
3	F	501/537 (93%)	498 (99%)	3 (1%)	87	94
All	All	1508/2068 (73%)	1500 (100%)	8 (0%)	90	96

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	E	544	ARG
3	F	544	ARG
3	F	266	ASP
3	E	360	ARG
2	D	338	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
3	E	443	HIS
1	B	128	GLN
3	F	333	HIS
3	E	403	HIS
3	F	187	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 22 ligands modelled in this entry, 8 are monoatomic - leaving 14 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	$\# Z > 2$
4	NAG	C	1100	2	14,14,15	0.21	0	17,19,21	0.45	0
4	NAG	D	1100	2	14,14,15	0.21	0	17,19,21	0.46	0
4	NAG	E	701	3	14,14,15	0.23	0	17,19,21	0.54	0
4	NAG	E	702	3	14,14,15	0.52	0	17,19,21	0.42	0
4	NAG	E	703	3	14,14,15	0.32	0	17,19,21	0.48	0
4	NAG	E	704	3	14,14,15	0.46	0	17,19,21	0.47	0
4	NAG	E	705	3	14,14,15	0.41	0	17,19,21	0.52	0
4	NAG	E	706	3	14,14,15	0.82	1 (7%)	17,19,21	0.60	0
4	NAG	F	701	3	14,14,15	0.24	0	17,19,21	0.54	0
4	NAG	F	702	3	14,14,15	0.52	0	17,19,21	0.42	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	NAG	F	703	3	14,14,15	0.32	0	17,19,21	0.47	0
4	NAG	F	704	3	14,14,15	0.46	0	17,19,21	0.47	0
4	NAG	F	705	3	14,14,15	0.42	0	17,19,21	0.52	0
4	NAG	F	706	3	14,14,15	0.81	0	17,19,21	0.61	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	NAG	C	1100	2	-	2/6/23/26	0/1/1/1
4	NAG	D	1100	2	-	2/6/23/26	0/1/1/1
4	NAG	E	701	3	-	2/6/23/26	0/1/1/1
4	NAG	E	702	3	-	2/6/23/26	0/1/1/1
4	NAG	E	703	3	-	2/6/23/26	0/1/1/1
4	NAG	E	704	3	-	1/6/23/26	0/1/1/1
4	NAG	E	705	3	-	2/6/23/26	0/1/1/1
4	NAG	E	706	3	-	2/6/23/26	0/1/1/1
4	NAG	F	701	3	-	2/6/23/26	0/1/1/1
4	NAG	F	702	3	-	2/6/23/26	0/1/1/1
4	NAG	F	703	3	-	2/6/23/26	0/1/1/1
4	NAG	F	704	3	-	1/6/23/26	0/1/1/1
4	NAG	F	705	3	-	2/6/23/26	0/1/1/1
4	NAG	F	706	3	-	2/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	E	706	NAG	C1-C2	2.04	1.55	1.52

There are no bond angle outliers.

There are no chirality outliers.

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	F	702	NAG	C4-C5-C6-O6
4	E	702	NAG	C4-C5-C6-O6

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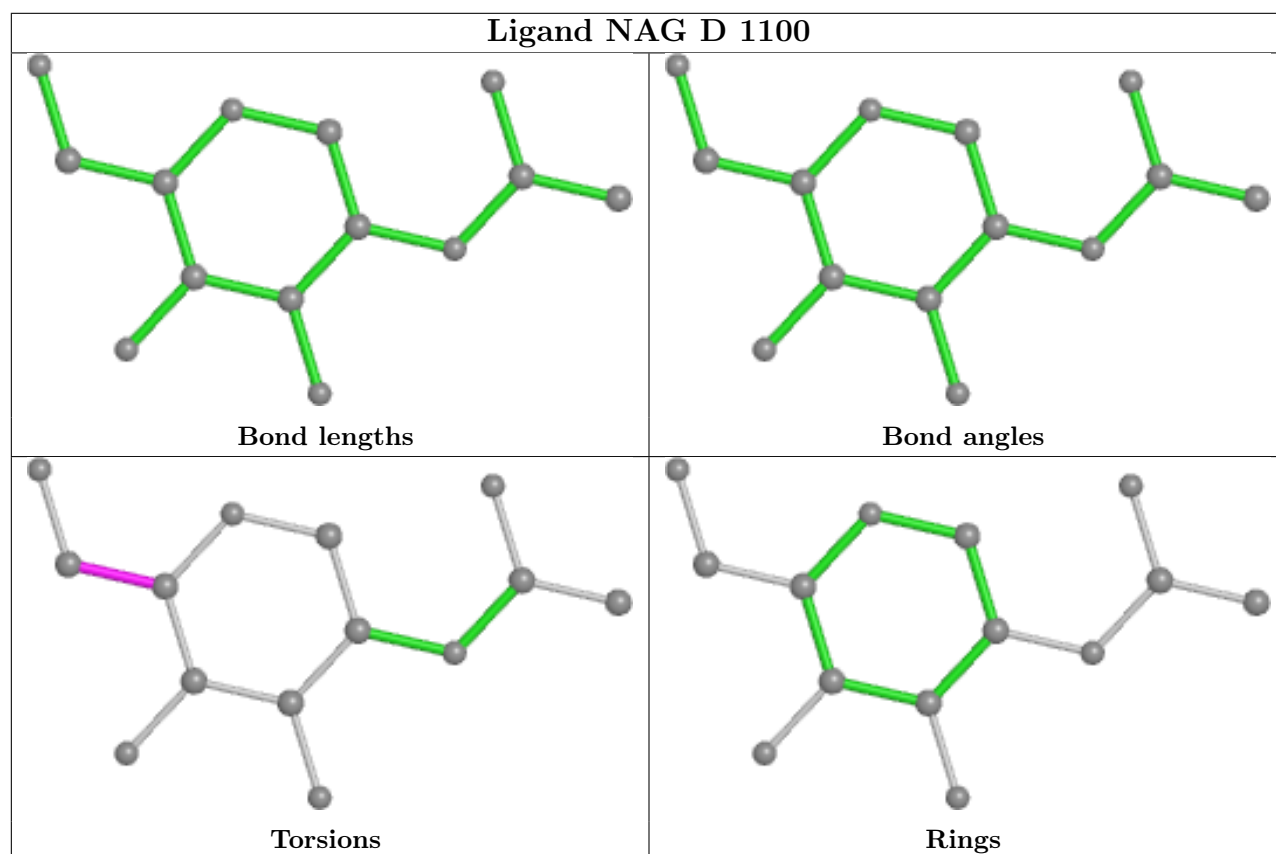
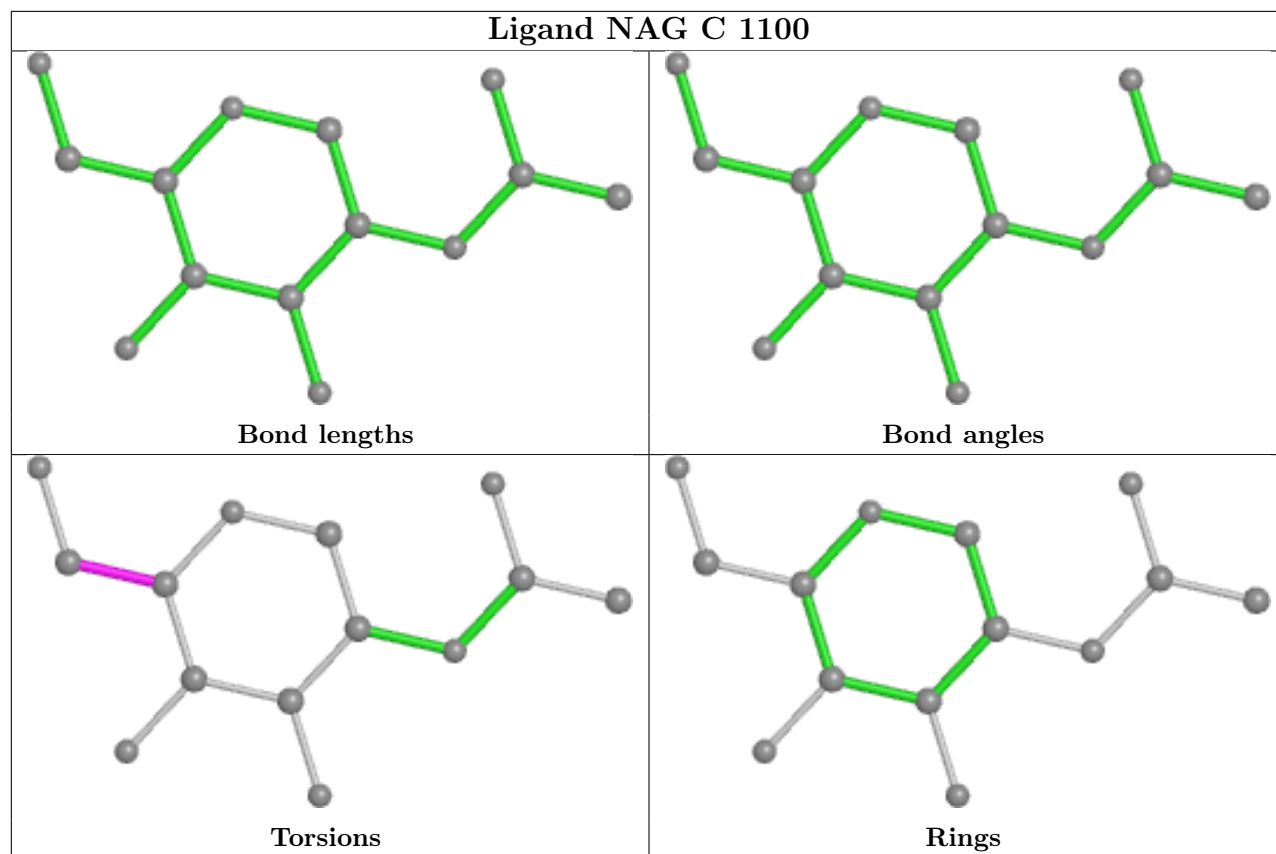
Mol	Chain	Res	Type	Atoms
4	F	703	NAG	C4-C5-C6-O6
4	E	703	NAG	C4-C5-C6-O6
4	F	702	NAG	O5-C5-C6-O6

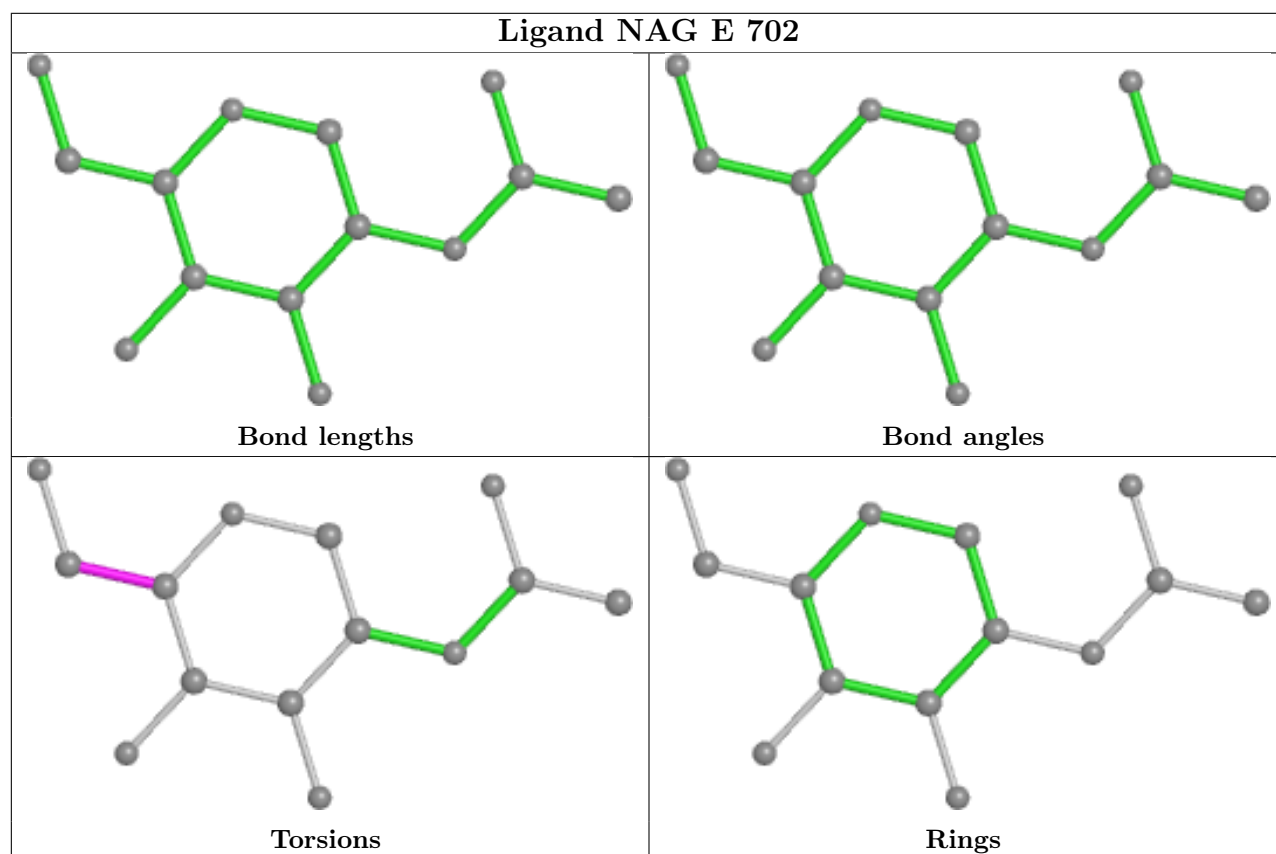
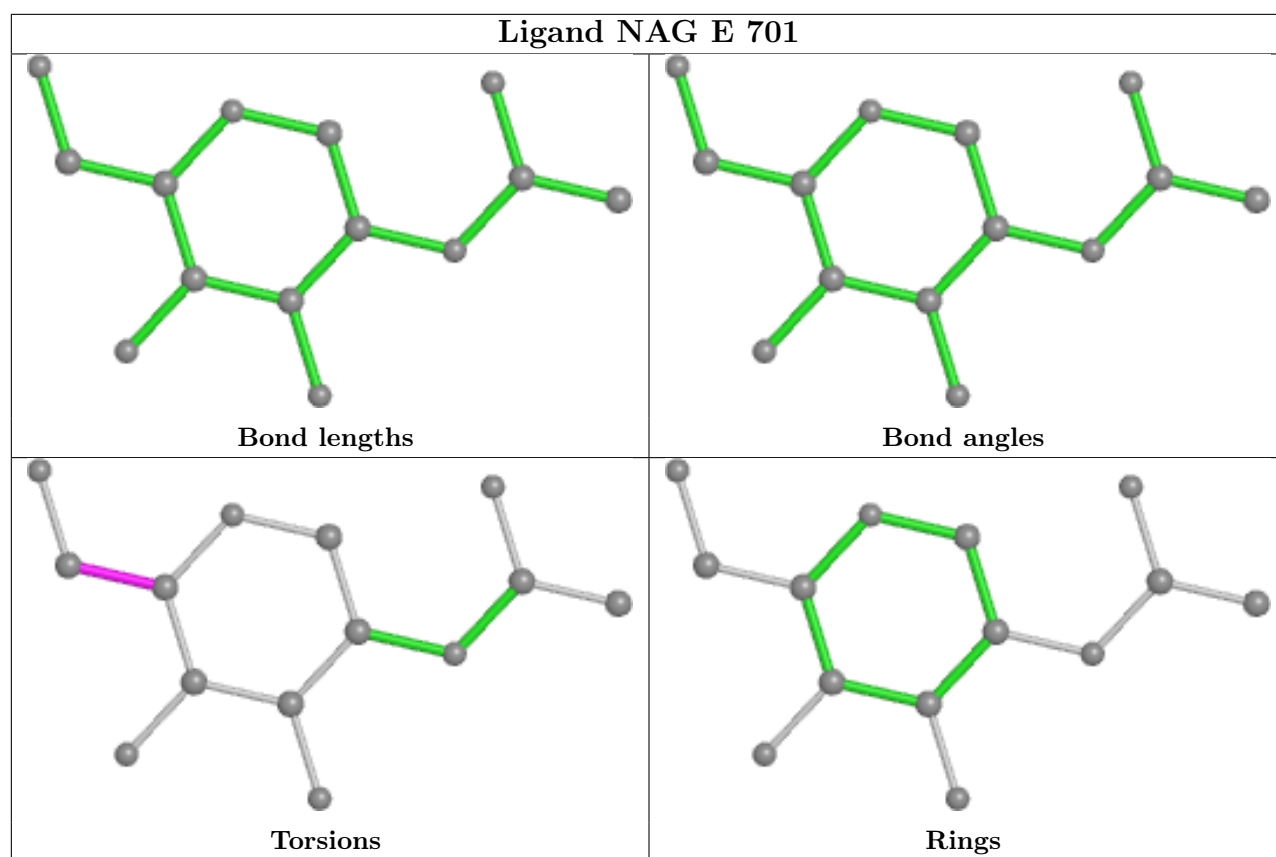
There are no ring outliers.

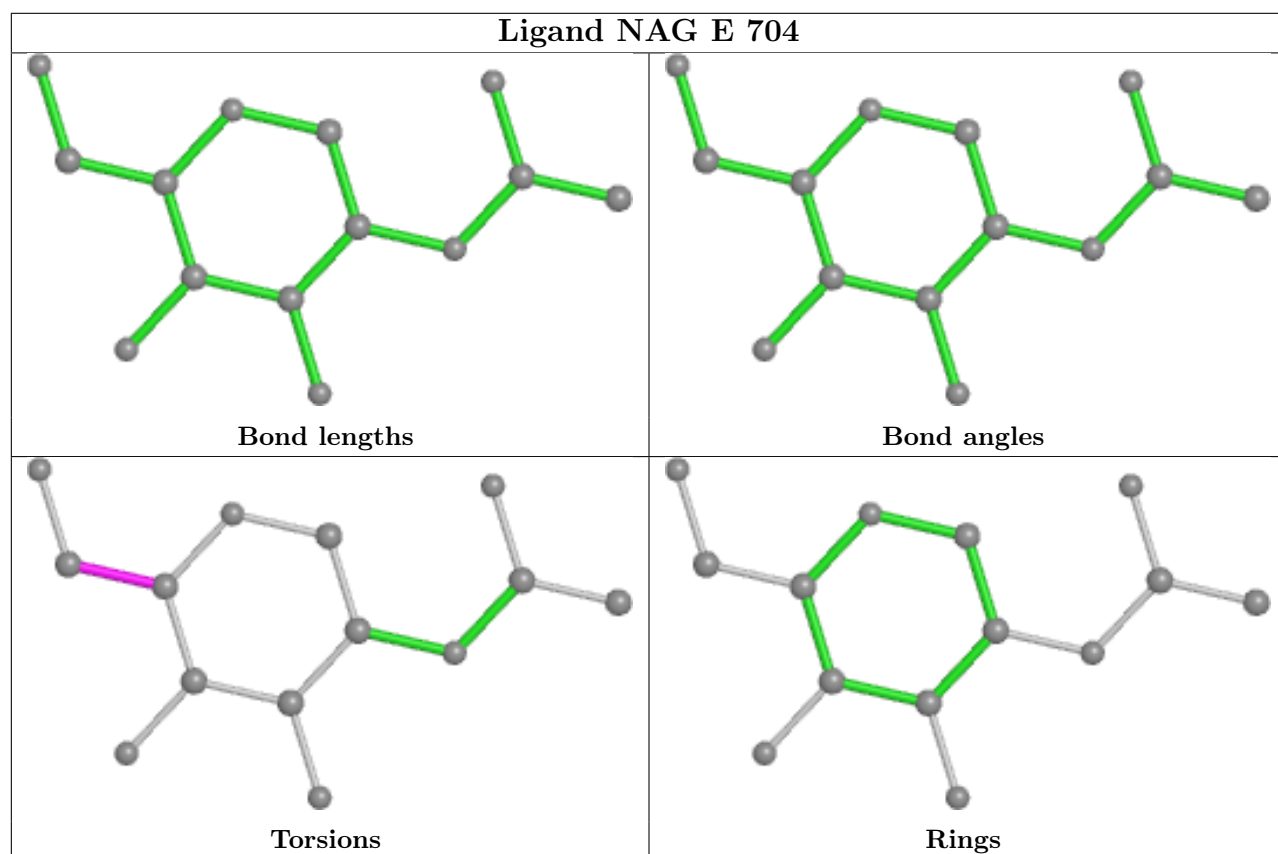
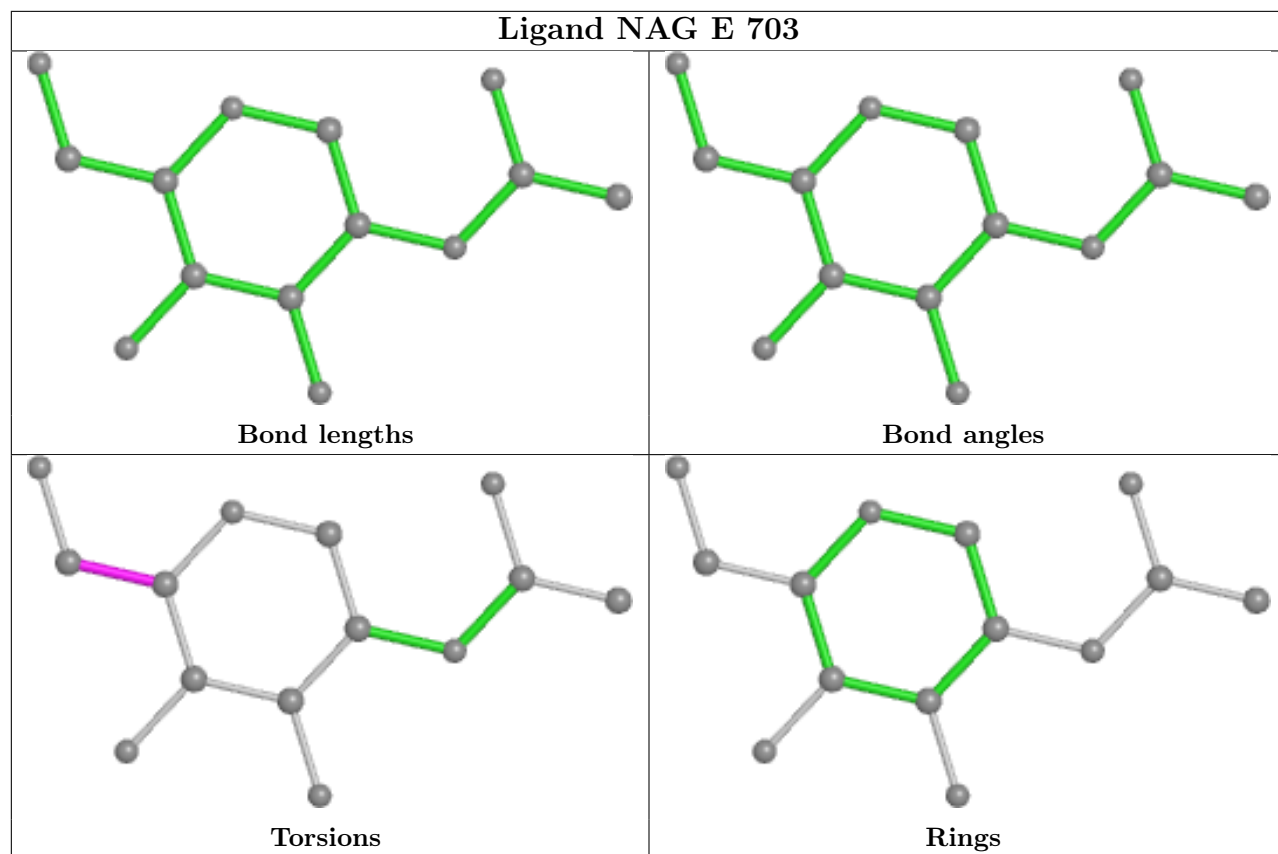
2 monomers are involved in 2 short contacts:

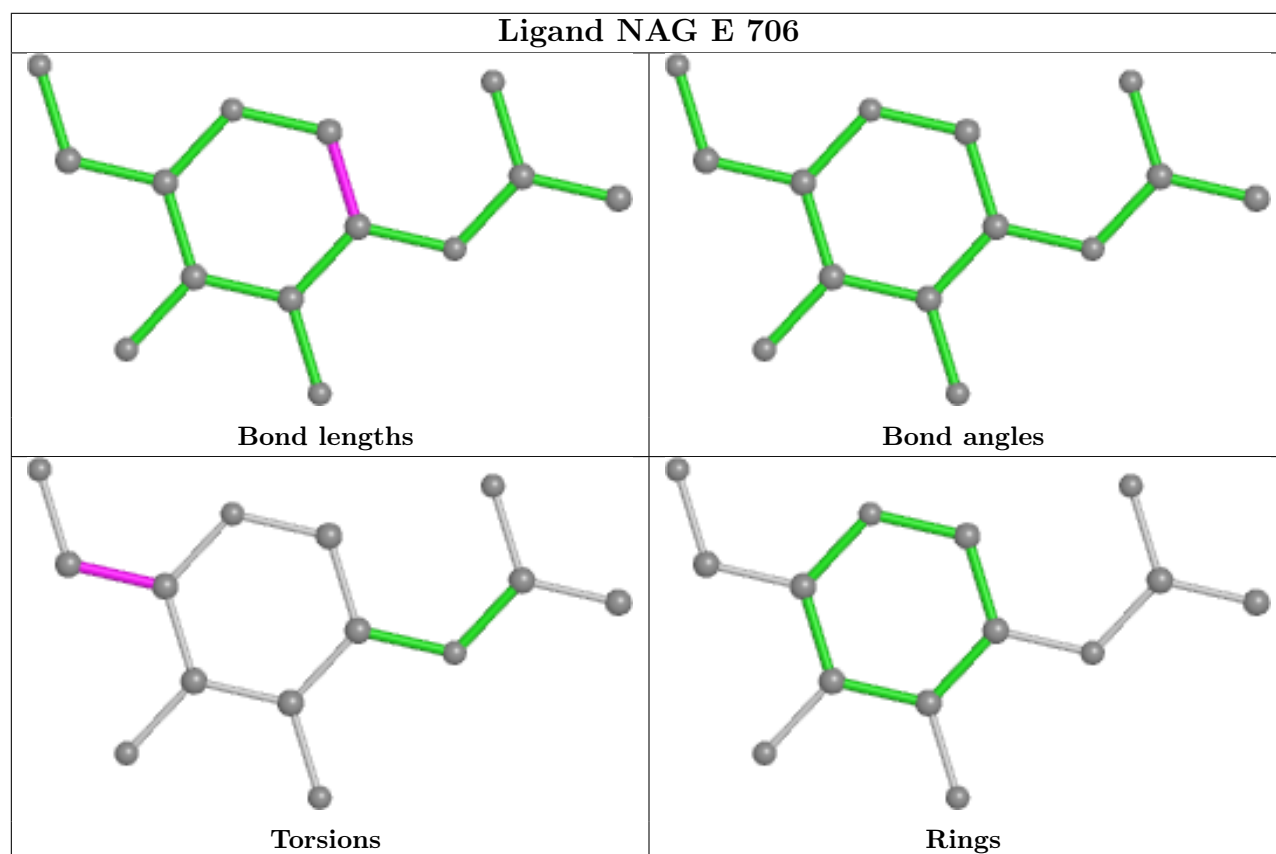
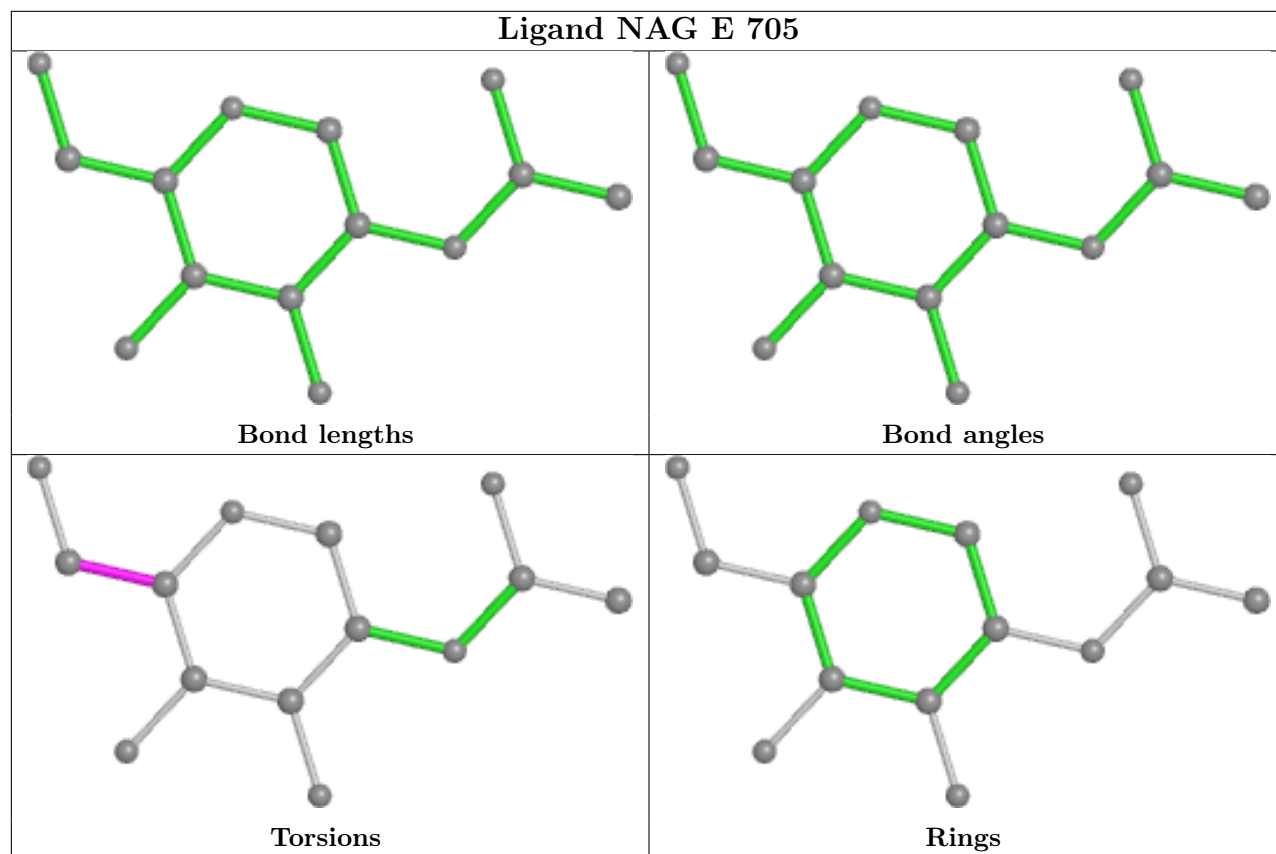
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	E	706	NAG	1	0
4	F	706	NAG	1	0

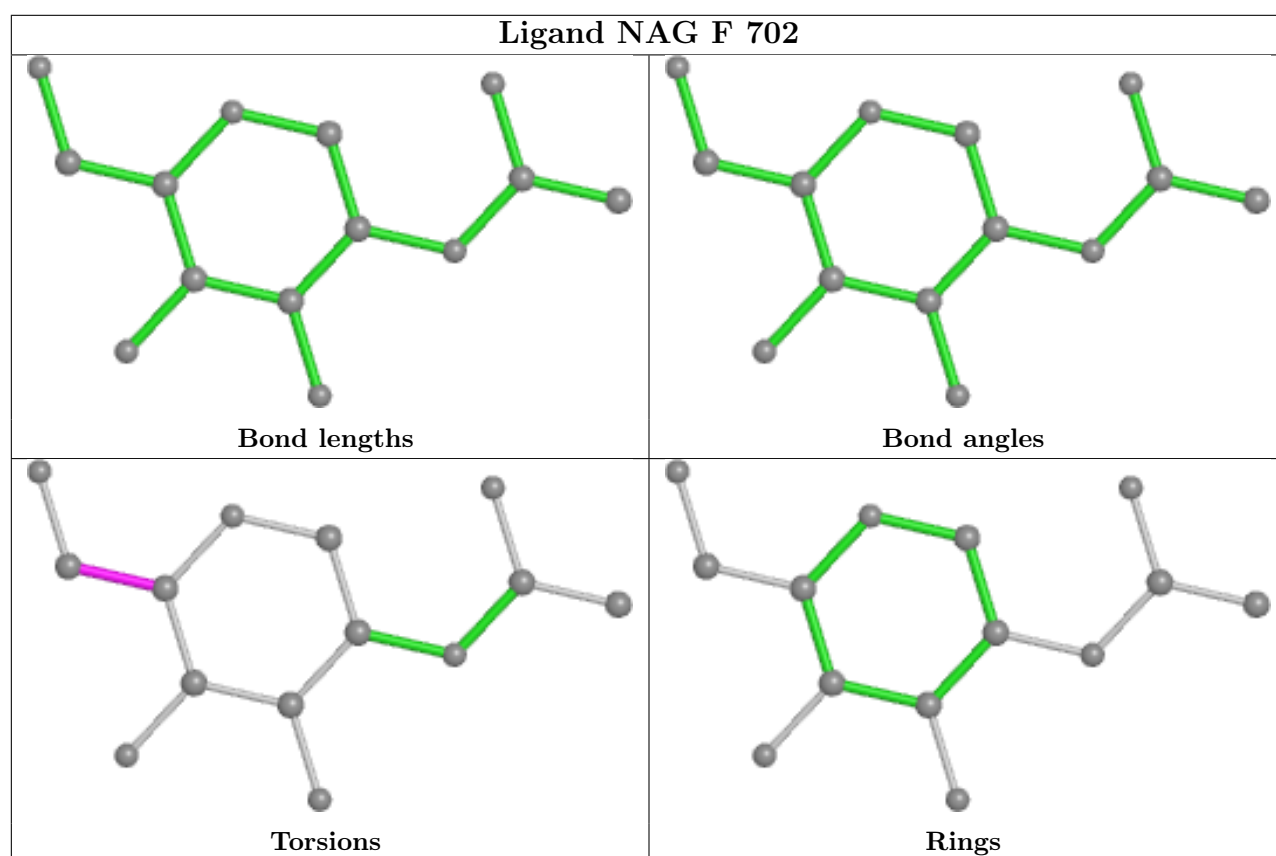
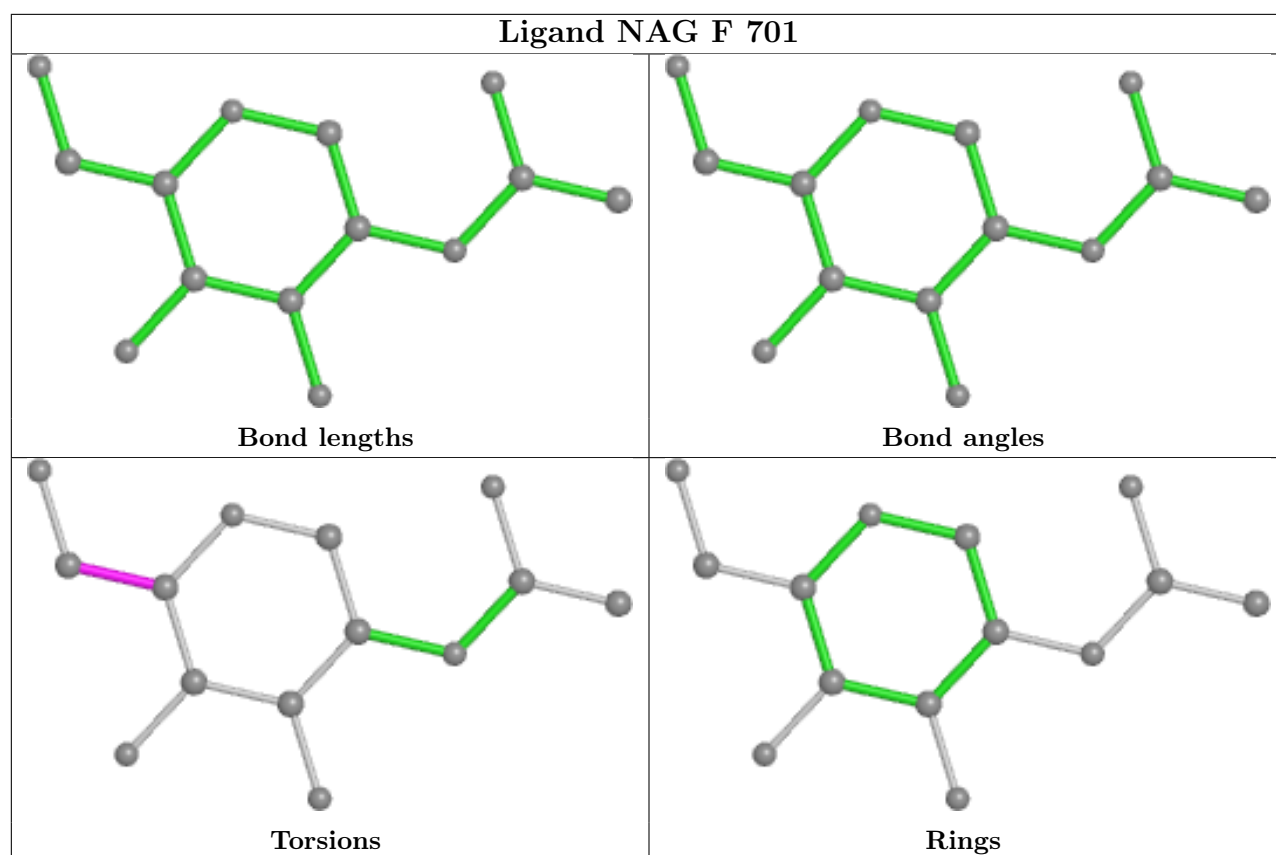
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

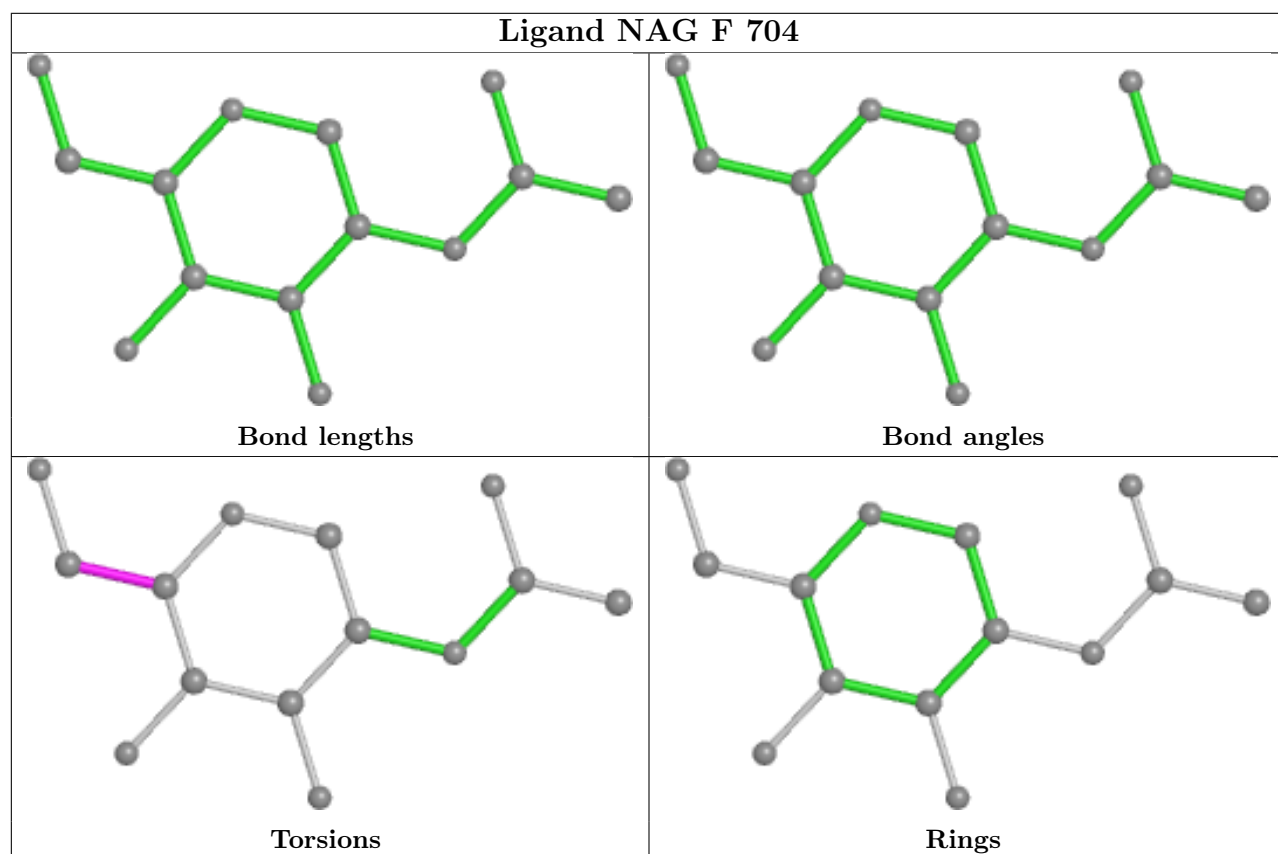
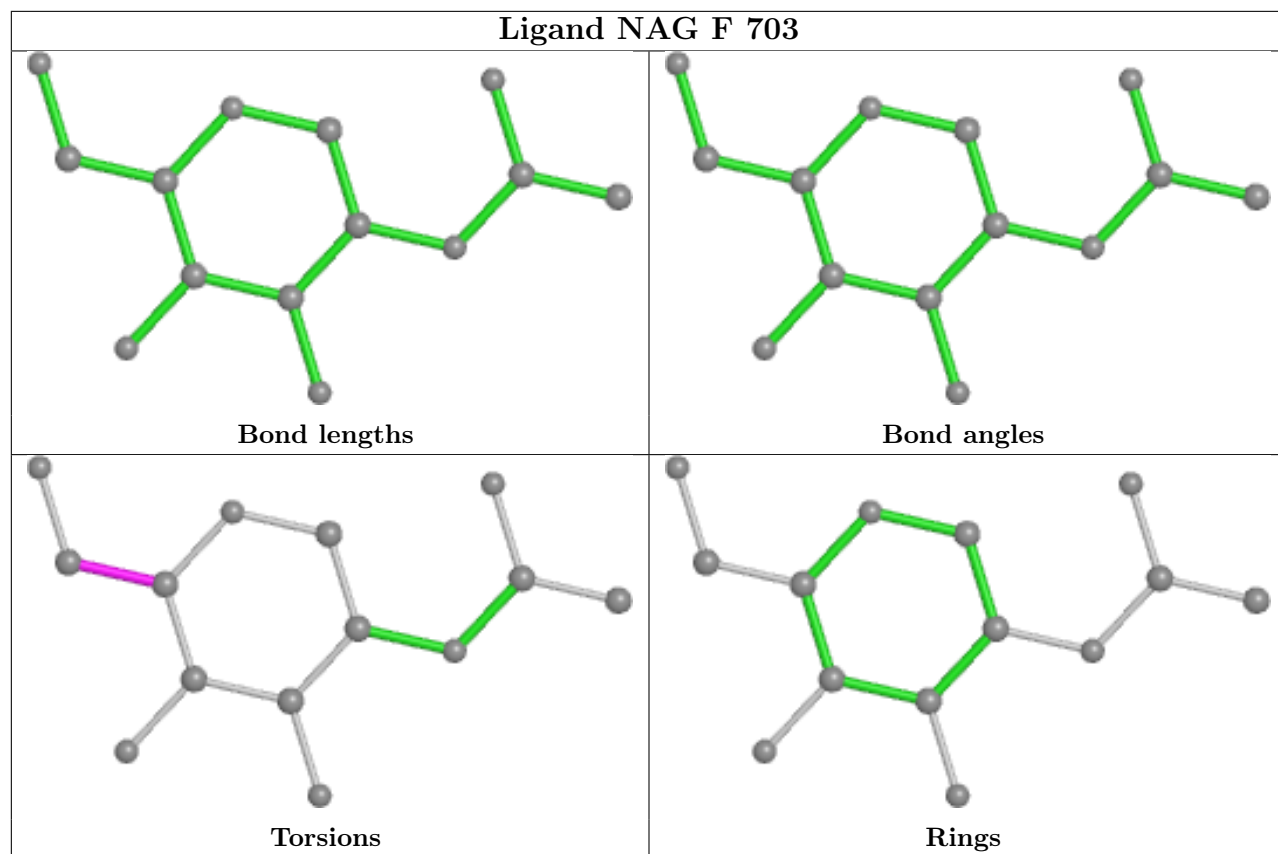


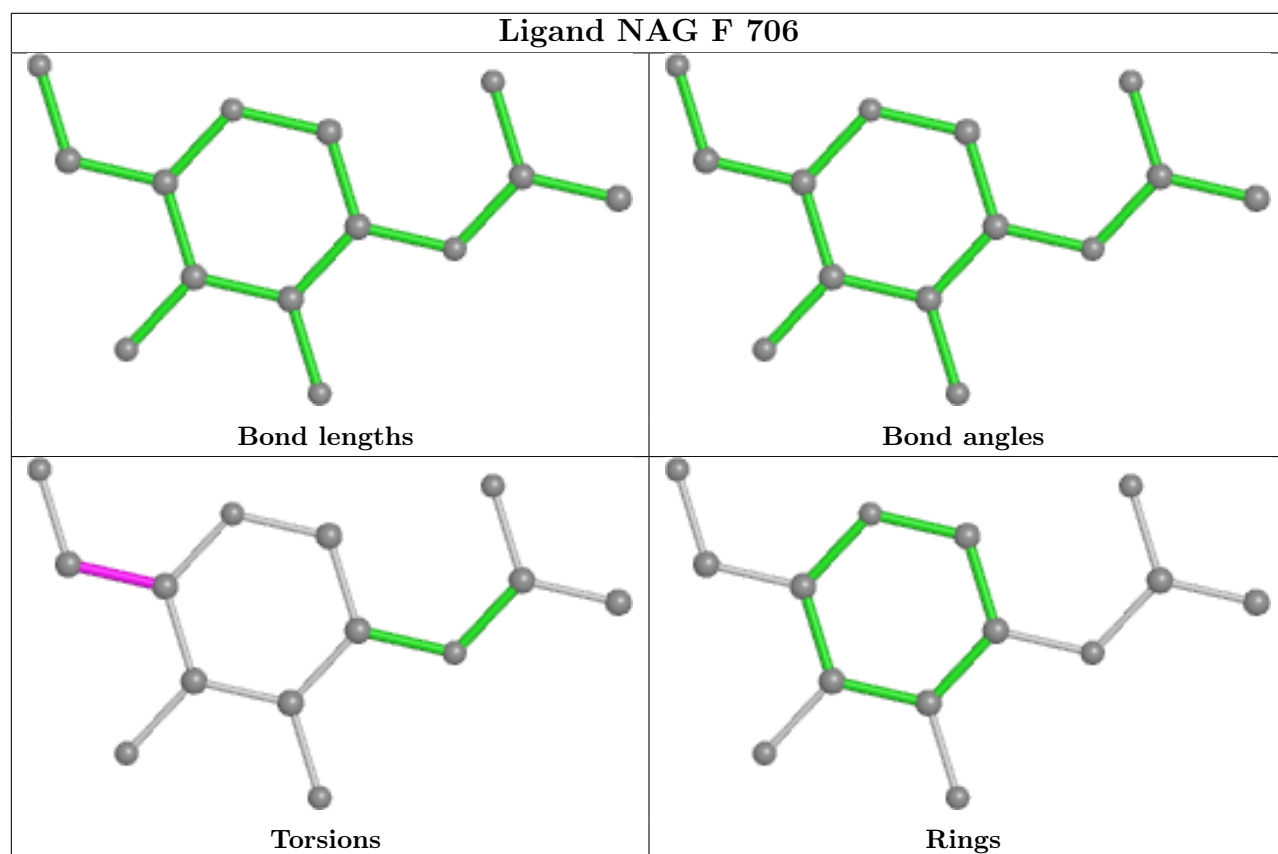
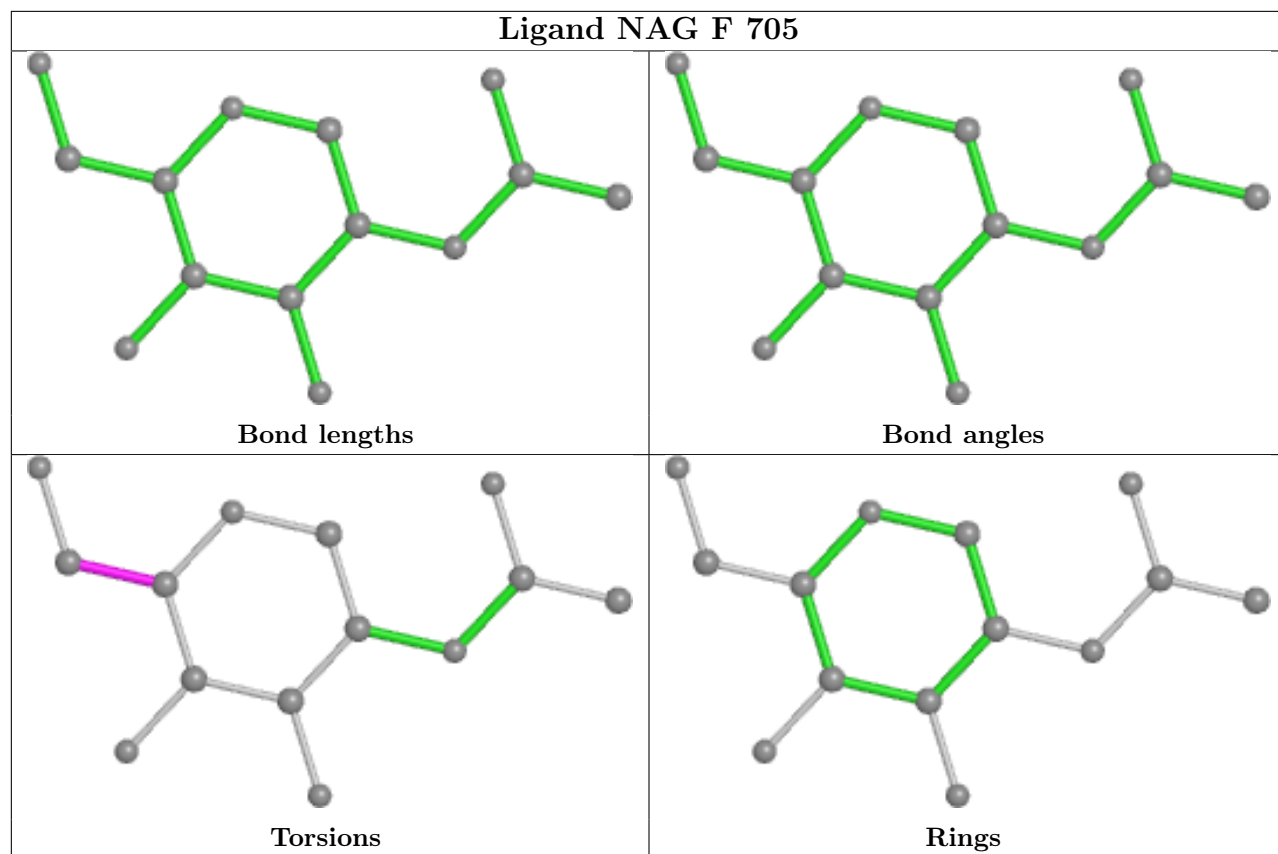












5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.