



# Full wwPDB X-ray Structure Validation Report ⓘ

Apr 4, 2022 – 08:05 PM EDT

PDB ID : 5UME  
Title : Crystal Structure of 5,10-Methylenetetrahydrofolate Reductase MetF from Haemophilus influenzae  
Authors : Kim, Y.; Mulligan, R.; Maltseva, N.; Grimshaw, S.; Anderson, W.F.; Joachimiak, A.; Center for Structural Genomics of Infectious Diseases (CS-GID)  
Deposited on : 2017-01-27  
Resolution : 2.70 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	:	<b>FAILED</b>
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	<b>FAILED</b>
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)	:	2.27

## 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 2.70 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 7 unique types of molecules in this entry. The entry contains 13964 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 5,10-methylenetetrahydrofolate reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	285	Total	C	N	O	S	0	0	0
			2276	1456	393	420	7			
1	B	262	Total	C	N	O	S	0	0	0
			2092	1341	361	383	7			
1	C	286	Total	C	N	O	S	0	1	0
			2286	1461	396	421	8			
1	D	289	Total	C	N	O	S	0	0	0
			2302	1472	399	424	7			
1	E	292	Total	C	N	O	S	0	0	0
			2323	1484	402	429	8			
1	F	282	Total	C	N	O	S	0	1	0
			2253	1442	391	413	7			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	expression tag	UNP P45208
A	-1	ASN	-	expression tag	UNP P45208
A	0	ALA	-	expression tag	UNP P45208
B	-2	SER	-	expression tag	UNP P45208
B	-1	ASN	-	expression tag	UNP P45208
B	0	ALA	-	expression tag	UNP P45208
C	-2	SER	-	expression tag	UNP P45208
C	-1	ASN	-	expression tag	UNP P45208
C	0	ALA	-	expression tag	UNP P45208
D	-2	SER	-	expression tag	UNP P45208
D	-1	ASN	-	expression tag	UNP P45208
D	0	ALA	-	expression tag	UNP P45208
E	-2	SER	-	expression tag	UNP P45208
E	-1	ASN	-	expression tag	UNP P45208
E	0	ALA	-	expression tag	UNP P45208
F	-2	SER	-	expression tag	UNP P45208
F	-1	ASN	-	expression tag	UNP P45208

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Chain	Residue	Modelled	Actual	Comment	Reference
F	0	ALA	-	expression tag	UNP P45208

- # FAD

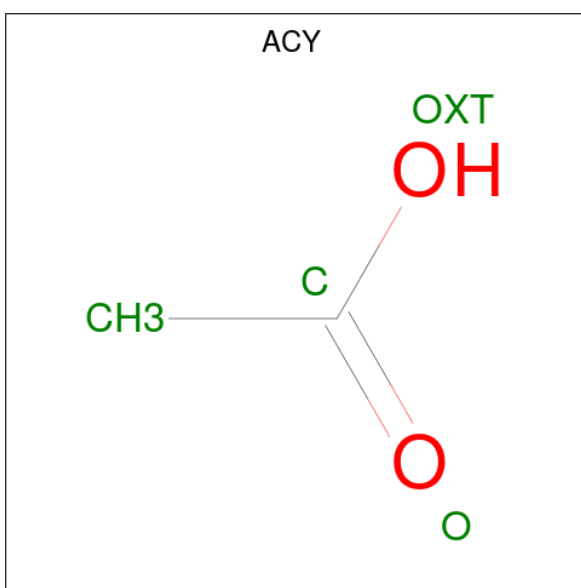
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 53	C 27	N 9	O 15	P 2	0	0
2	B	1	Total 53	C 27	N 9	O 15	P 2	0	0
2	C	1	Total 53	C 27	N 9	O 15	P 2	0	0
2	D	1	Total 53	C 27	N 9	O 15	P 2	0	0
2	E	1	Total 53	C 27	N 9	O 15	P 2	0	0
2	F	1	Total 53	C 27	N 9	O 15	P 2	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is ACETIC ACID (three-letter code: ACY) (formula: C<sub>2</sub>H<sub>4</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			4	2	2		
4	B	1	Total	C	O	0	0
			4	2	2		

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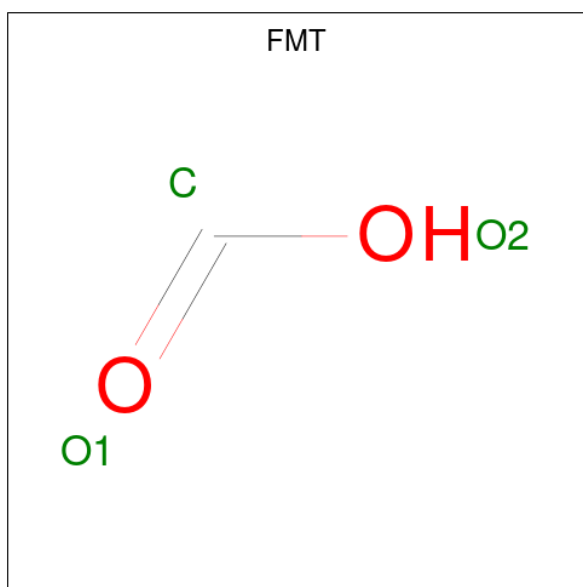
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	C	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	D	1	Total	C	O	0	0
			4	2	2		
4	E	1	Total	C	O	0	0
			4	2	2		
4	F	1	Total	C	O	0	0
			4	2	2		
4	F	1	Total	C	O	0	0
			4	2	2		

- Molecule 5 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula:  $C_2H_6O_2$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			4	2	2		
5	F	1	Total	C	O	0	0
			4	2	2		

- Molecule 6 is FORMIC ACID (three-letter code: FMT) (formula:  $CH_2O_2$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	B	1	Total	C	O	0	0
			3	1	2		
6	C	1	Total	C	O	0	0
			3	1	2		
6	C	1	Total	C	O	0	0
			3	1	2		
6	D	1	Total	C	O	0	0
			3	1	2		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	10	Total	O	0	0
			10	10		
7	B	4	Total	O	0	0
			4	4		
7	C	8	Total	O	0	0
			8	8		
7	D	8	Total	O	0	0
			8	8		
7	E	9	Total	O	0	0
			9	9		
7	F	9	Total	O	0	0
			9	9		

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 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	90.06Å 134.96Å 182.99Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.73 – 2.70	Depositor
% Data completeness (in resolution range)	98.5 (43.73-2.70)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.12	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.87 (at 2.69Å)	Xtriage
Refinement program	PHENIX 1.11.1_2575	Depositor
R, $R_{free}$	0.169 , 0.228	Depositor
Wilson B-factor (Å <sup>2</sup> )	74.8	Xtriage
Anisotropy	0.354	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	13964	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	89.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.91% 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](#)

23 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	ACY	C	303	-	1,3,3	1.09	0	0,3,3	-	-
4	ACY	D	303	-	1,3,3	1.96	0	0,3,3	-	-
4	ACY	D	301	-	1,3,3	1.67	0	0,3,3	-	-
2	FAD	D	300	-	51,58,58	1.35	5 (9%)	60,89,89	2.26	8 (13%)
2	FAD	F	300	-	51,58,58	1.22	5 (9%)	60,89,89	2.30	8 (13%)
4	ACY	A	302	-	1,3,3	1.67	0	0,3,3	-	-
3	SO4	B	301	-	4,4,4	0.56	0	6,6,6	1.23	0
4	ACY	B	302	-	1,3,3	1.62	0	0,3,3	-	-
2	FAD	B	300	-	51,58,58	1.17	5 (9%)	60,89,89	2.24	7 (11%)
6	FMT	D	304	-	0,2,2	-	-	0,1,1	-	-
2	FAD	C	300	-	51,58,58	1.19	4 (7%)	60,89,89	2.22	7 (11%)
5	EDO	F	303	-	3,3,3	0.58	0	2,2,2	0.31	0
6	FMT	B	303	-	0,2,2	-	-	0,1,1	-	-
4	ACY	F	301	-	1,3,3	1.47	0	0,3,3	-	-
5	EDO	A	303	-	3,3,3	0.73	0	2,2,2	0.70	0
3	SO4	A	301	-	4,4,4	0.31	0	6,6,6	1.00	0
6	FMT	C	301	-	0,2,2	-	-	0,1,1	-	-
4	ACY	E	301	-	1,3,3	2.31	1 (100%)	0,3,3	-	-
4	ACY	F	302	-	1,3,3	1.94	0	0,3,3	-	-
2	FAD	E	300	-	51,58,58	1.26	5 (9%)	60,89,89	2.23	7 (11%)
2	FAD	A	300	-	51,58,58	1.19	6 (11%)	60,89,89	2.29	7 (11%)
6	FMT	C	302	-	0,2,2	-	-	0,1,1	-	-
4	ACY	D	302	-	1,3,3	1.81	0	0,3,3	-	-

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	FAD	E	300	-	-	5/30/50/50	0/6/6/6
2	FAD	A	300	-	-	7/30/50/50	0/6/6/6
5	EDO	F	303	-	-	1/1/1/1	-
2	FAD	B	300	-	-	6/30/50/50	0/6/6/6
2	FAD	D	300	-	-	5/30/50/50	0/6/6/6
2	FAD	F	300	-	-	1/30/50/50	0/6/6/6

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FAD	C	300	-	-	4/30/50/50	0/6/6/6
5	EDO	A	303	-	-	1/1/1/1	-

All (31) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	300	FAD	C4X-C10	5.89	1.44	1.38
2	E	300	FAD	C4X-C10	5.48	1.44	1.38
2	C	300	FAD	C4X-C10	5.42	1.44	1.38
2	F	300	FAD	C4X-C10	5.38	1.44	1.38
2	B	300	FAD	C4X-C10	5.34	1.44	1.38
2	A	300	FAD	C4X-C10	5.21	1.44	1.38
2	D	300	FAD	C4-N3	4.21	1.40	1.33
2	F	300	FAD	C4-N3	3.74	1.39	1.33
2	E	300	FAD	C4-N3	3.71	1.39	1.33
2	C	300	FAD	C4-N3	3.46	1.39	1.33
2	D	300	FAD	C5X-N5	3.29	1.40	1.35
2	A	300	FAD	C4-N3	3.24	1.38	1.33
2	B	300	FAD	C4-N3	2.78	1.37	1.33
2	B	300	FAD	C4X-C4	2.71	1.46	1.41
2	E	300	FAD	C5X-N5	2.66	1.39	1.35
2	E	300	FAD	C9A-N10	2.58	1.42	1.38
2	D	300	FAD	C9A-N10	2.58	1.42	1.38
2	C	300	FAD	C4X-C4	2.58	1.45	1.41
2	B	300	FAD	C9A-N10	2.52	1.41	1.38
2	F	300	FAD	C9A-N10	2.31	1.41	1.38
4	E	301	ACY	CH3-C	2.31	1.51	1.48
2	F	300	FAD	C4X-C4	2.30	1.45	1.41
2	C	300	FAD	C9A-N10	2.27	1.41	1.38
2	E	300	FAD	C4X-C4	2.25	1.45	1.41
2	D	300	FAD	C4X-C4	2.25	1.45	1.41
2	F	300	FAD	C4X-N5	-2.19	1.30	1.33
2	A	300	FAD	C4X-N5	-2.16	1.30	1.33
2	B	300	FAD	C5X-N5	2.11	1.38	1.35
2	A	300	FAD	C4X-C4	2.11	1.45	1.41
2	A	300	FAD	C9A-N10	2.10	1.41	1.38
2	A	300	FAD	C5X-N5	2.08	1.38	1.35

All (44) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	300	FAD	C2-N3-C4	13.24	126.32	115.14

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	F	300	FAD	C2-N3-C4	13.08	126.19	115.14
2	B	300	FAD	C2-N3-C4	13.06	126.17	115.14
2	D	300	FAD	C2-N3-C4	12.92	126.05	115.14
2	C	300	FAD	C2-N3-C4	12.87	126.01	115.14
2	E	300	FAD	C2-N3-C4	12.81	125.96	115.14
2	D	300	FAD	C4X-C4-N3	-7.29	113.46	123.43
2	B	300	FAD	C4X-C4-N3	-7.02	113.83	123.43
2	F	300	FAD	C4X-C4-N3	-7.01	113.84	123.43
2	A	300	FAD	C4X-C4-N3	-7.01	113.85	123.43
2	C	300	FAD	C4X-C4-N3	-6.81	114.12	123.43
2	E	300	FAD	C4X-C4-N3	-6.81	114.12	123.43
2	F	300	FAD	C10-C4X-N5	4.97	124.70	121.26
2	A	300	FAD	C10-C4X-N5	4.91	124.65	121.26
2	D	300	FAD	C10-C4X-N5	4.76	124.55	121.26
2	B	300	FAD	C10-C4X-N5	4.50	124.37	121.26
2	C	300	FAD	C10-C4X-N5	4.49	124.36	121.26
2	E	300	FAD	C10-C4X-N5	4.47	124.35	121.26
2	A	300	FAD	C10-C4X-C4	-4.05	117.27	119.95
2	E	300	FAD	C10-C4X-C4	-3.94	117.35	119.95
2	C	300	FAD	C10-C4X-C4	-3.86	117.39	119.95
2	F	300	FAD	C10-C4X-C4	-3.82	117.42	119.95
2	B	300	FAD	C10-C4X-C4	-3.69	117.51	119.95
2	F	300	FAD	C4X-C10-N10	-3.65	116.55	120.30
2	D	300	FAD	C10-C4X-C4	-3.62	117.56	119.95
2	C	300	FAD	C4X-C10-N10	-3.54	116.66	120.30
2	B	300	FAD	C4X-C10-N10	-3.44	116.77	120.30
2	E	300	FAD	C4X-C10-N10	-3.43	116.78	120.30
2	A	300	FAD	C4X-C10-N10	-3.41	116.80	120.30
2	D	300	FAD	C1'-N10-C9A	3.38	120.95	118.29
2	A	300	FAD	C1'-N10-C9A	3.37	120.94	118.29
2	D	300	FAD	C4X-C10-N10	-3.30	116.91	120.30
2	F	300	FAD	C1'-N10-C9A	3.26	120.86	118.29
2	B	300	FAD	C1'-N10-C9A	3.22	120.82	118.29
2	E	300	FAD	C1'-N10-C9A	3.19	120.80	118.29
2	C	300	FAD	C1'-N10-C9A	2.94	120.60	118.29
2	F	300	FAD	C5A-C6A-N6A	2.29	123.83	120.35
2	B	300	FAD	C5A-C6A-N6A	2.28	123.82	120.35
2	D	300	FAD	C5A-C6A-N6A	2.26	123.79	120.35
2	F	300	FAD	P-O3P-PA	-2.24	125.14	132.83
2	A	300	FAD	C5A-C6A-N6A	2.20	123.69	120.35
2	D	300	FAD	C4'-C3'-C2'	2.15	117.84	113.36
2	E	300	FAD	C5A-C6A-N6A	2.15	123.62	120.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	300	FAD	C5A-C6A-N6A	2.11	123.56	120.35

There are no chirality outliers.

All (30) torsion outliers are listed below:

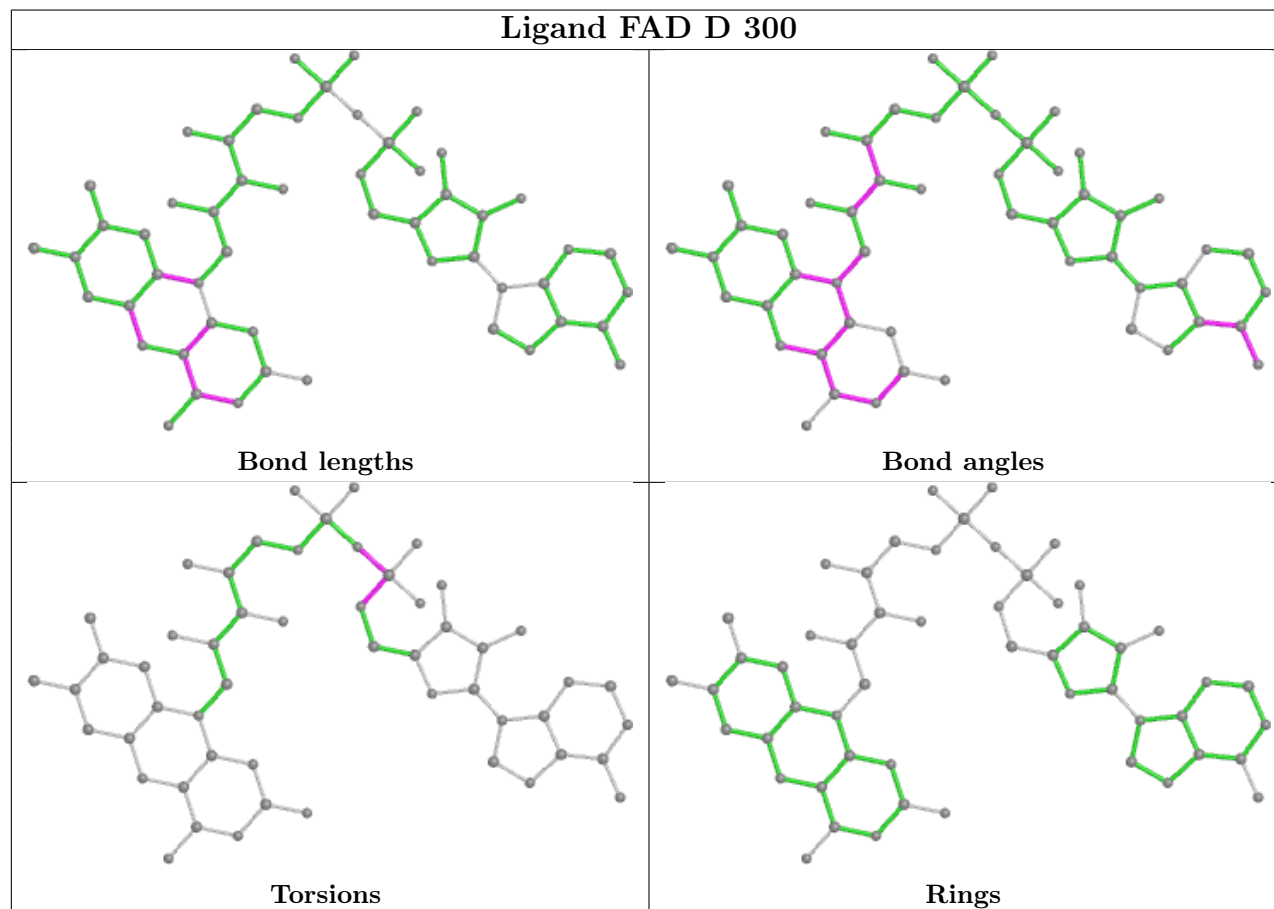
Mol	Chain	Res	Type	Atoms
2	A	300	FAD	C1'-C2'-C3'-C4'
2	B	300	FAD	C5B-O5B-PA-O1A
2	B	300	FAD	C5B-O5B-PA-O3P
2	B	300	FAD	C3'-C4'-C5'-O5'
2	D	300	FAD	C5B-O5B-PA-O1A
2	D	300	FAD	C5B-O5B-PA-O3P
2	E	300	FAD	C5B-O5B-PA-O3P
2	A	300	FAD	O2'-C2'-C3'-C4'
5	A	303	EDO	O1-C1-C2-O2
2	C	300	FAD	O4B-C4B-C5B-O5B
2	B	300	FAD	P-O3P-PA-O1A
2	C	300	FAD	P-O3P-PA-O1A
2	E	300	FAD	P-O3P-PA-O1A
2	B	300	FAD	O4'-C4'-C5'-O5'
2	C	300	FAD	C3B-C4B-C5B-O5B
2	A	300	FAD	P-O3P-PA-O1A
2	D	300	FAD	C5B-O5B-PA-O2A
2	E	300	FAD	C5B-O5B-PA-O1A
2	E	300	FAD	C5B-O5B-PA-O2A
2	A	300	FAD	C1'-C2'-C3'-O3'
2	A	300	FAD	O4B-C4B-C5B-O5B
5	F	303	EDO	O1-C1-C2-O2
2	E	300	FAD	P-O3P-PA-O2A
2	A	300	FAD	O2'-C2'-C3'-O3'
2	C	300	FAD	P-O3P-PA-O2A
2	D	300	FAD	P-O3P-PA-O1A
2	A	300	FAD	C3B-C4B-C5B-O5B
2	B	300	FAD	P-O3P-PA-O2A
2	D	300	FAD	P-O3P-PA-O2A
2	F	300	FAD	P-O3P-PA-O2A

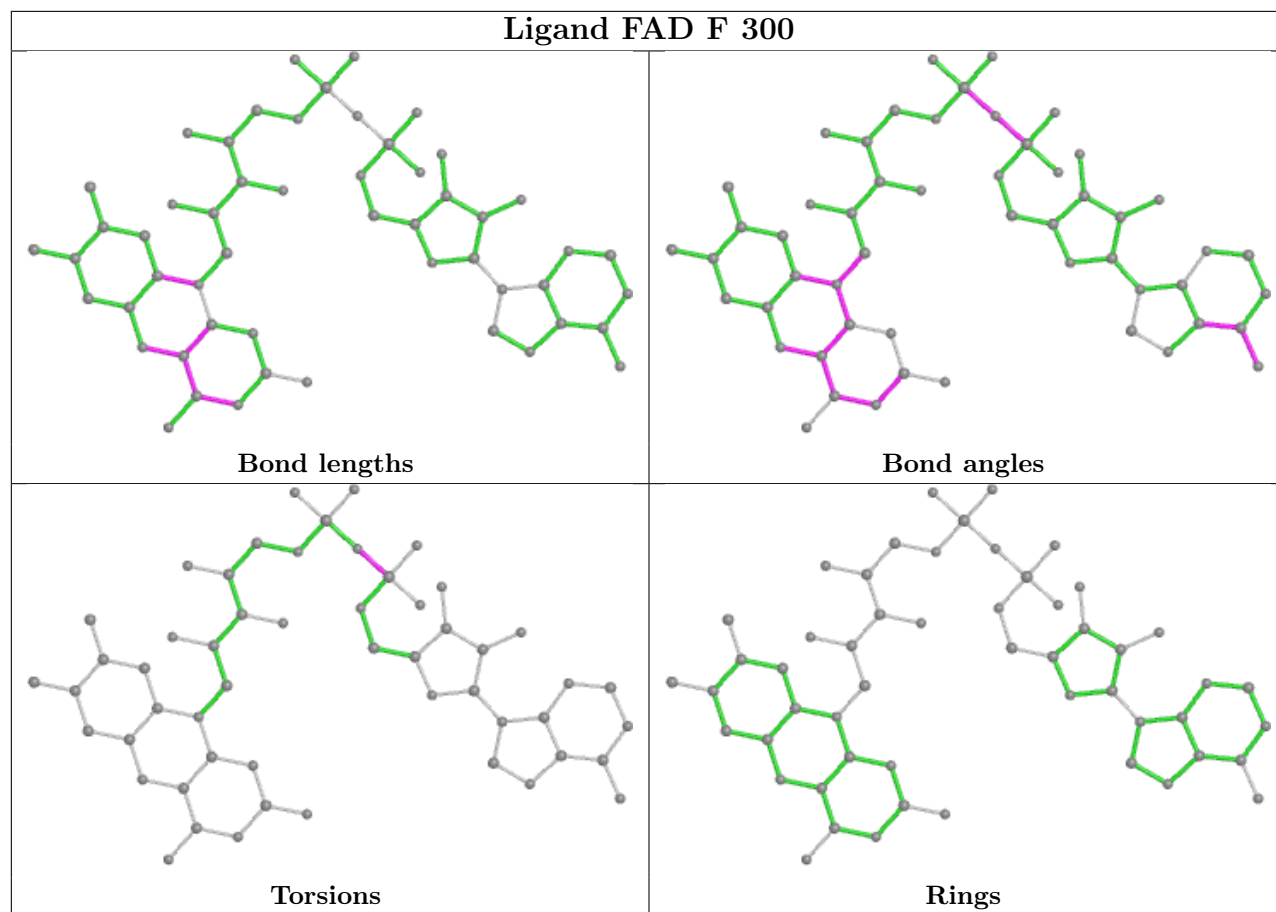
There are no ring outliers.

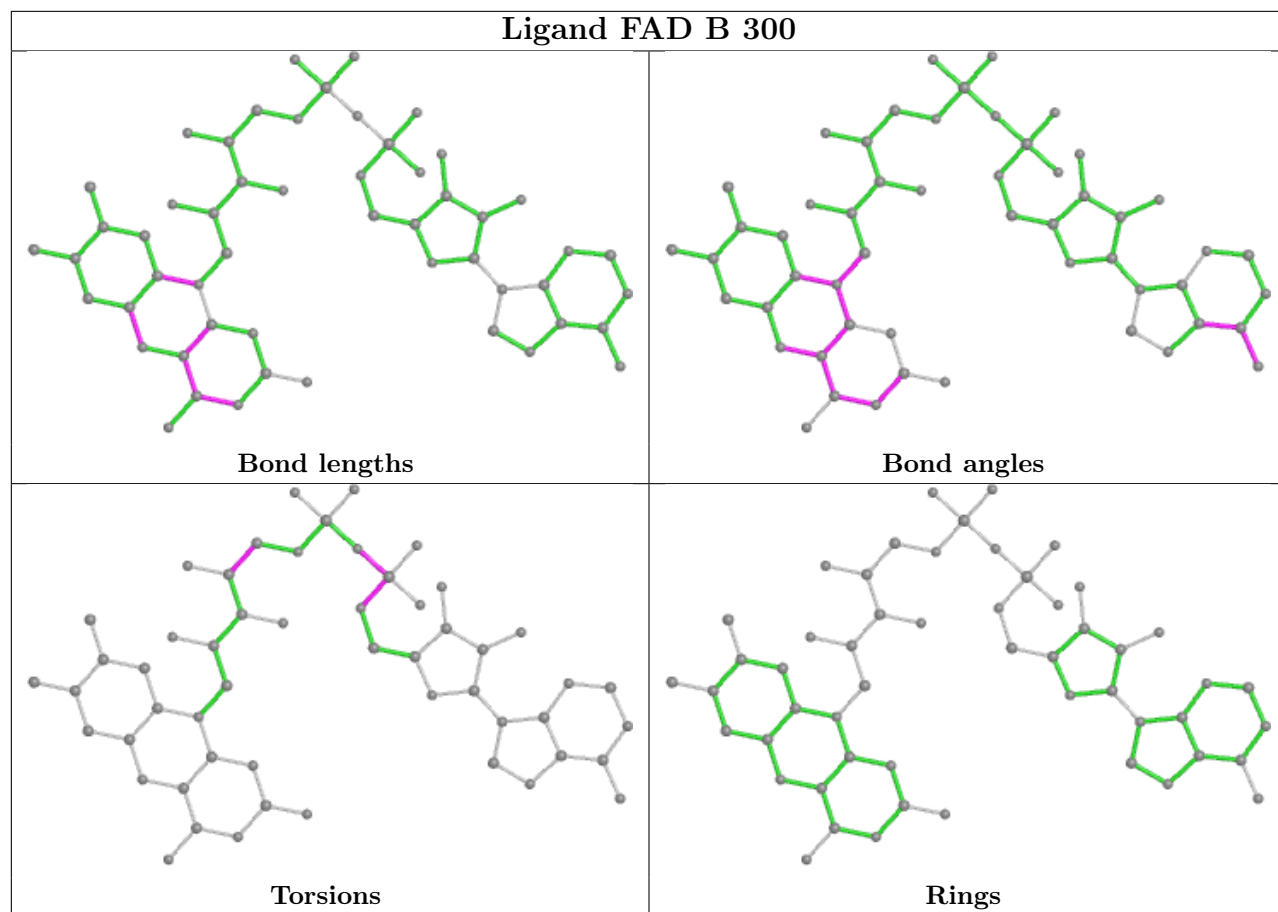
No monomer is involved in short contacts.

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

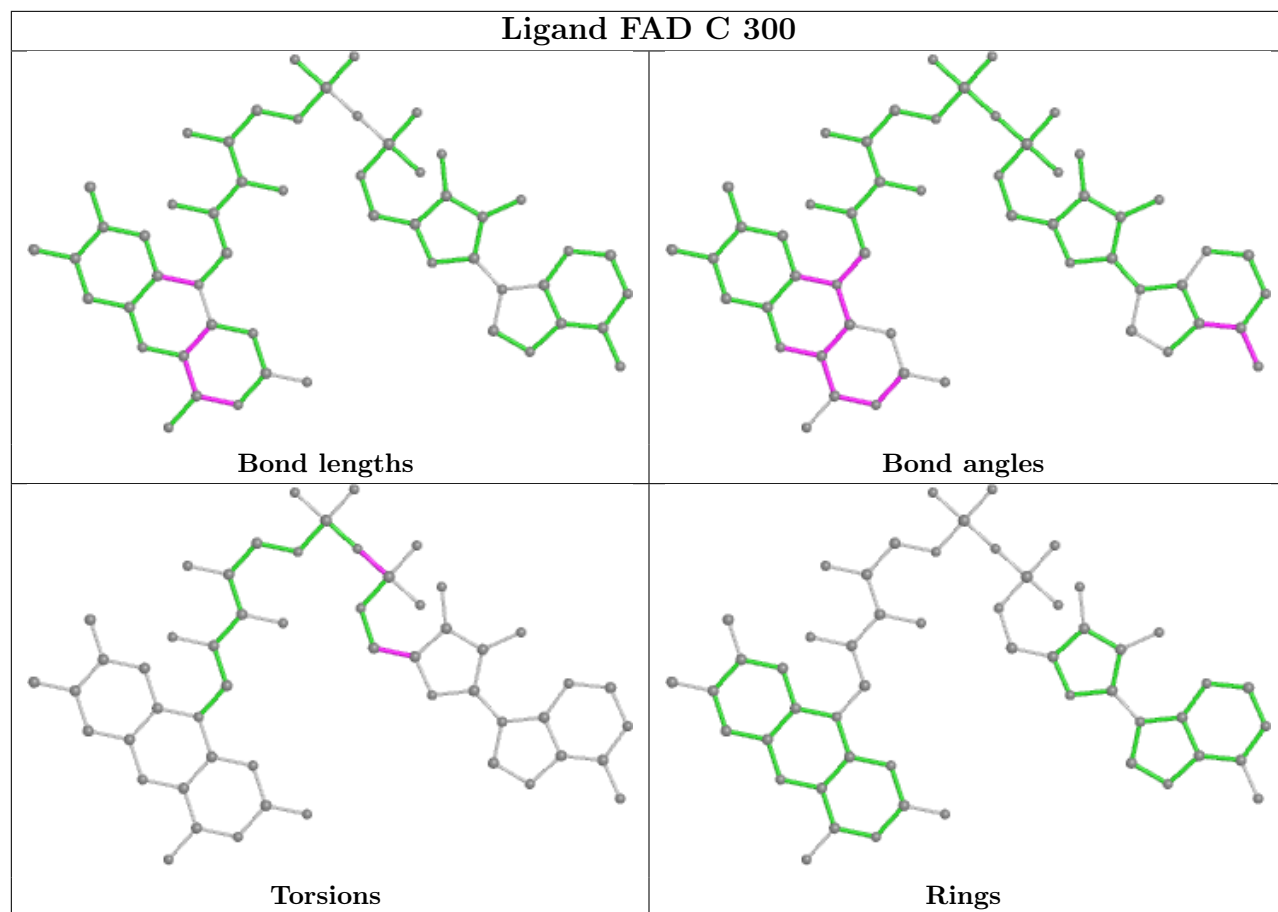
addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. 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.

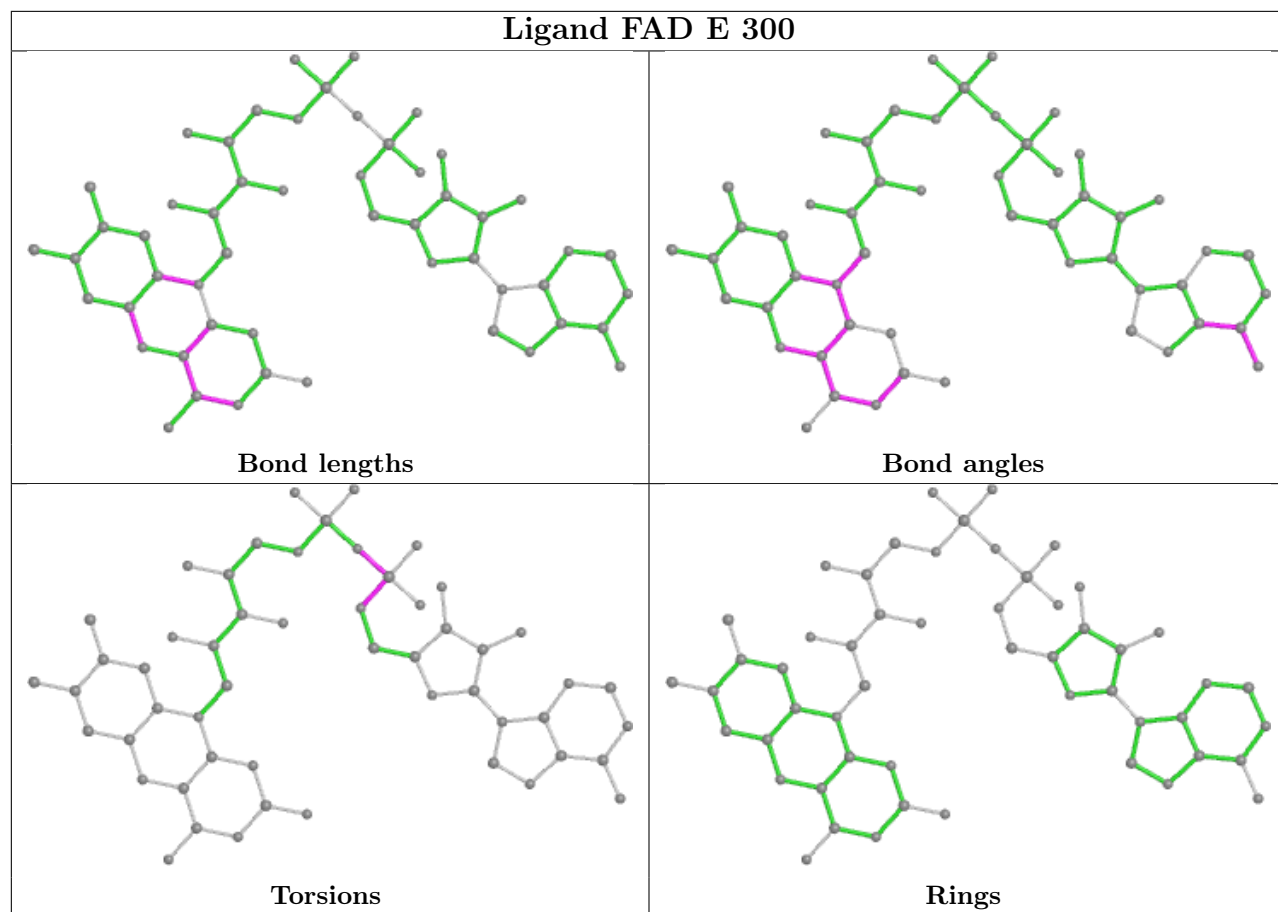


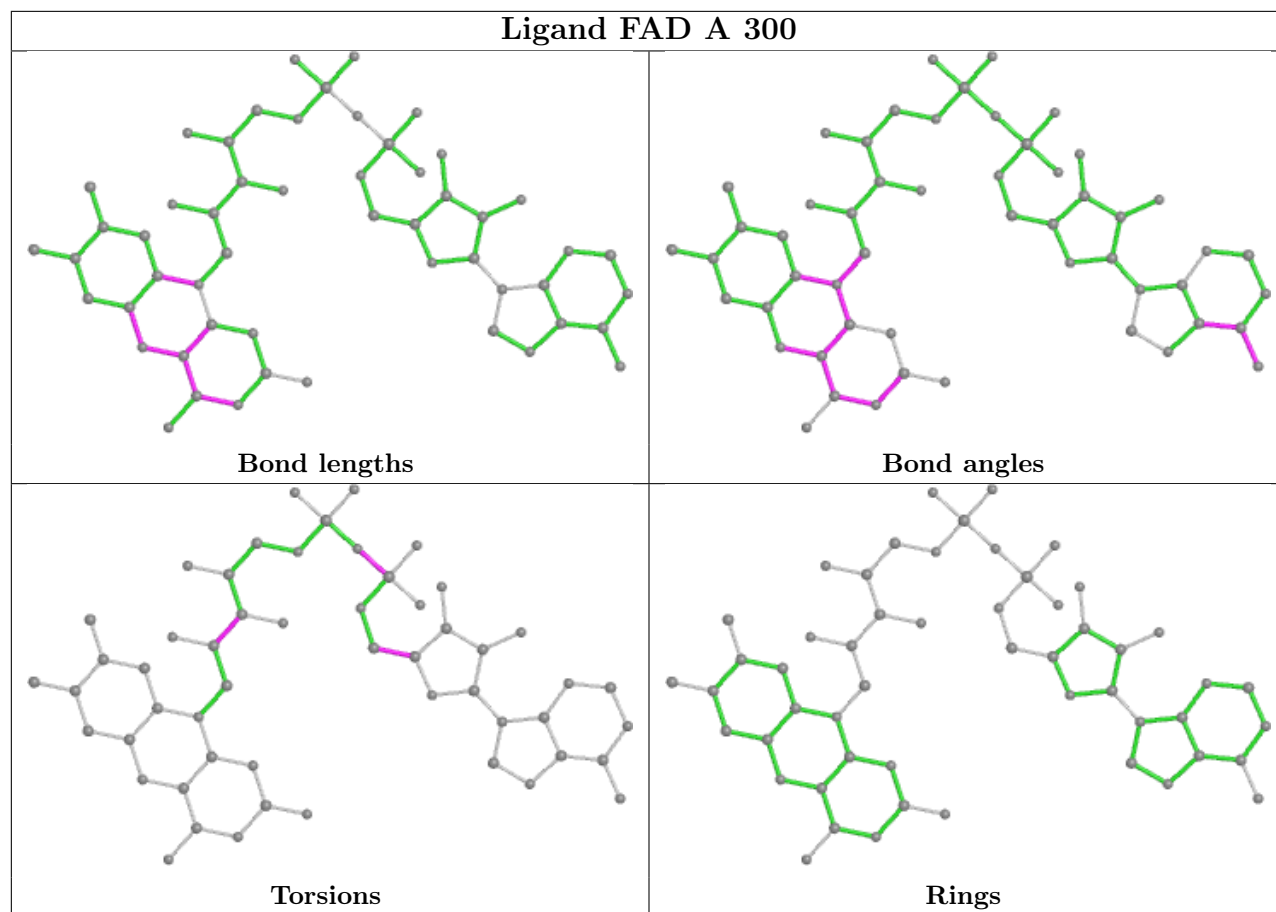












#### 4.7 Other polymers [i](#)

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

### 5.1 Protein, DNA and RNA chains

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

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

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

### 5.3 Carbohydrates

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

### 5.4 Ligands

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

### 5.5 Other polymers

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