WORLDWIDE PDB
PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report (i)

May 18, 2020 – 01:55 pm BST

PDB ID	:	2BRA
Title	:	Structure of N-Terminal FAD Binding motif of mouse MICAL
Authors	:	Nadella, M.; Bianchet, M.A.; Gabelli, S.B.; Amzel, L.M.
Deposited on	:	2005-05-04
Resolution	:	2.00 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 following versions of software and data (see references (1)) were used in the production of this report:

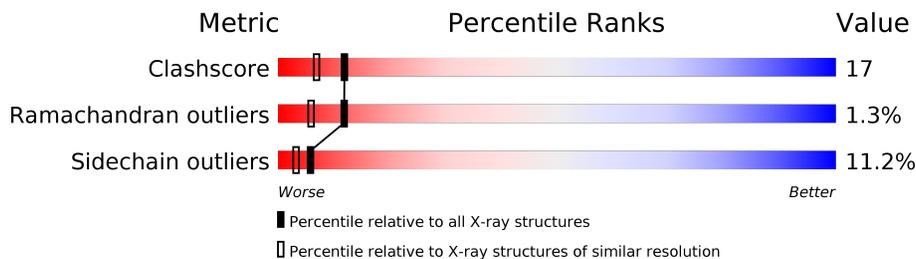|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 2.00 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	Percentile Ranks	Value
Clashscore		17
Ramachandran outliers		1.3%
Sidechain outliers		11.2%

Worse   *Better*

■ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

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 on the lower bar indicate the fraction of residues that contain outliers for >=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 <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	484	70% 21% 5% ••
1	B	484	68% 23% 7% •

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 8137 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 NEDD9 INTERACTING PROTEIN WITH CALPONIN HO-MOLOGY AND LIM DOMAINS.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	473	Total 3694	C 2360	N 663	O 658	S 13	0	0	0
1	B	478	Total 3719	C 2373	N 668	O 664	S 14	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	141	ALA	LYS	engineered mutation	UNP Q8VDP3
A	142	ALA	LYS	engineered mutation	UNP Q8VDP3
B	141	ALA	LYS	engineered mutation	UNP Q8VDP3
B	142	ALA	LYS	engineered mutation	UNP Q8VDP3

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).

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

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total 1	Cl 1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	324	Total 324	O 324	0	0
4	B	293	Total 293	O 293	0	0

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.

Note EDS was not executed.

• Molecule 1: NEDD9 INTERACTING PROTEIN WITH CALPONIN HOMOLOGY AND LIM DOMAINS
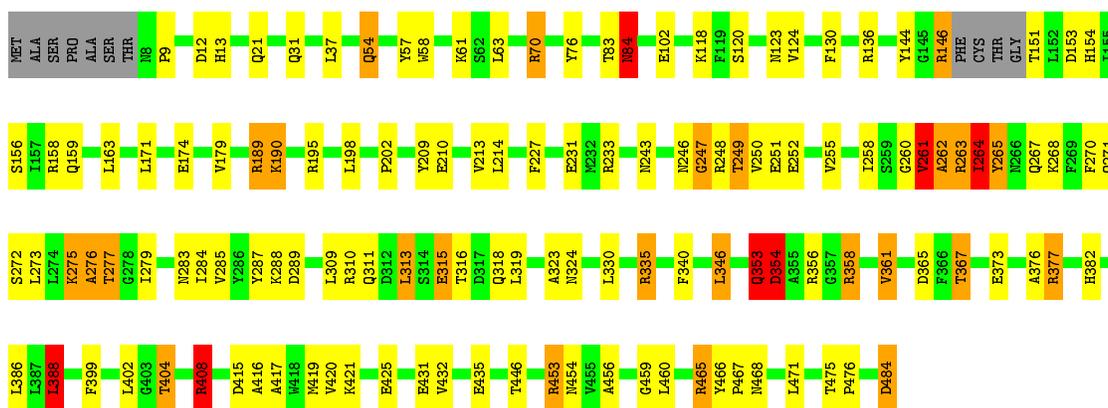
• Molecule 1: NEDD9 INTERACTING PROTEIN WITH CALPONIN HOMOLOGY AND LIM DOMAINS
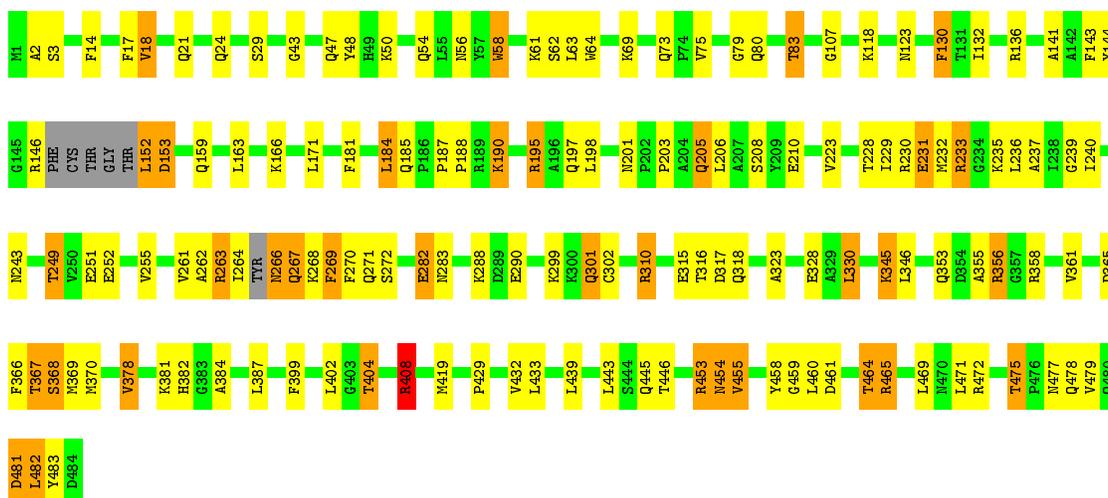
4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	72.97Å　　87.34Å　　80.81Å 90.00°　　111.68°　　90.00°	Depositor
Resolution (Å)	27.94　–　2.00	Depositor
% Data completeness (in resolution range)	100.0 (27.94-2.00)	Depositor
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.192　,　0.266	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	8137	wwPDB-VP
Average B, all atoms (Å^2)	35.0	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: FAD, CL

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	1.02	6/3776 (0.2%)	1.05	16/5116 (0.3%)
1	B	0.91	2/3800 (0.1%)	0.95	5/5147 (0.1%)
All	All	0.97	8/7576 (0.1%)	1.00	21/10263 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	2
All	All	0	3

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	58	TRP	CB-CG	6.42	1.61	1.50
1	A	209	TYR	CE2-CZ	5.62	1.45	1.38
1	A	174	GLU	CG-CD	5.56	1.60	1.51
1	A	174	GLU	CD-OE1	5.42	1.31	1.25
1	A	84	ASN	CB-CG	5.20	1.63	1.51

The worst 5 of 21 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	465	ARG	NE-CZ-NH2	-17.83	111.39	120.30
1	A	465	ARG	NE-CZ-NH1	14.93	127.76	120.30
1	B	465	ARG	NE-CZ-NH2	-11.45	114.58	120.30
1	B	465	ARG	NE-CZ-NH1	10.30	125.45	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	408	ARG	NE-CZ-NH1	9.97	125.28	120.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	353	GLN	Peptide
1	B	2	ALA	Peptide
1	B	481	ASP	Peptide

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	3694	0	3719	122	0
1	B	3719	0	3748	138	0
2	A	53	0	31	1	0
2	B	53	0	31	0	0
3	B	1	0	0	0	0
4	A	324	0	0	22	0
4	B	293	0	0	21	0
All	All	8137	0	7529	260	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 17.

The worst 5 of 260 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:B:453:ARG:HH11	1:B:453:ARG:HG2	1.02	1.14
1:B:459:GLY:H	1:B:464:THR:HG21	1.17	1.05
1:A:146:ARG:H	1:A:146:ARG:HD2	1.22	1.00
1:B:459:GLY:H	1:B:464:THR:CG2	1.77	0.96
1:B:453:ARG:NH1	1:B:453:ARG:HG2	1.80	0.92

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 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	469/484 (97%)	444 (95%)	19 (4%)	6 (1%)	12	6
1	B	472/484 (98%)	453 (96%)	13 (3%)	6 (1%)	12	6
All	All	941/968 (97%)	897 (95%)	32 (3%)	12 (1%)	12	6

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	262	ALA
1	A	276	ALA
1	A	354	ASP
1	B	3	SER
1	B	153	ASP

5.3.2 Protein sidechains (i)

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	381/389 (98%)	343 (90%)	38 (10%)	7	4
1	B	384/389 (99%)	336 (88%)	48 (12%)	4	2
All	All	765/778 (98%)	679 (89%)	86 (11%)	6	3

5 of 86 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	18	VAL

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Mol	Chain	Res	Type
1	B	190	LYS
1	B	455	VAL
1	B	62	SER
1	B	118	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 24 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	324	ASN
1	B	21	GLN
1	B	301	GLN
1	A	382	HIS
1	A	454	ASN

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 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 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
2	FAD	A	1485	-	51,58,58	1.66	13 (25%)	60,89,89	1.66	14 (23%)
2	FAD	B	1485	-	51,58,58	1.52	8 (15%)	60,89,89	1.51	8 (13%)

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	A	1485	-	-	3/30/50/50	0/6/6/6
2	FAD	B	1485	-	-	4/30/50/50	0/6/6/6

The worst 5 of 21 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1485	FAD	C10-N1	5.36	1.40	1.33
2	B	1485	FAD	C10-N1	5.21	1.39	1.33
2	B	1485	FAD	C1'-N10	4.25	1.52	1.48
2	A	1485	FAD	C2A-N3A	3.83	1.38	1.32
2	A	1485	FAD	C4X-N5	3.49	1.38	1.33

The worst 5 of 22 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1485	FAD	C4-N3-C2	5.49	119.78	115.14
2	B	1485	FAD	N3A-C2A-N1A	-5.26	120.46	128.68
2	A	1485	FAD	C4X-N5-C5X	3.94	120.70	116.77
2	A	1485	FAD	C4-N3-C2	3.90	118.44	115.14
2	A	1485	FAD	C5B-C4B-C3B	-3.29	102.85	115.18

There are no chirality outliers.
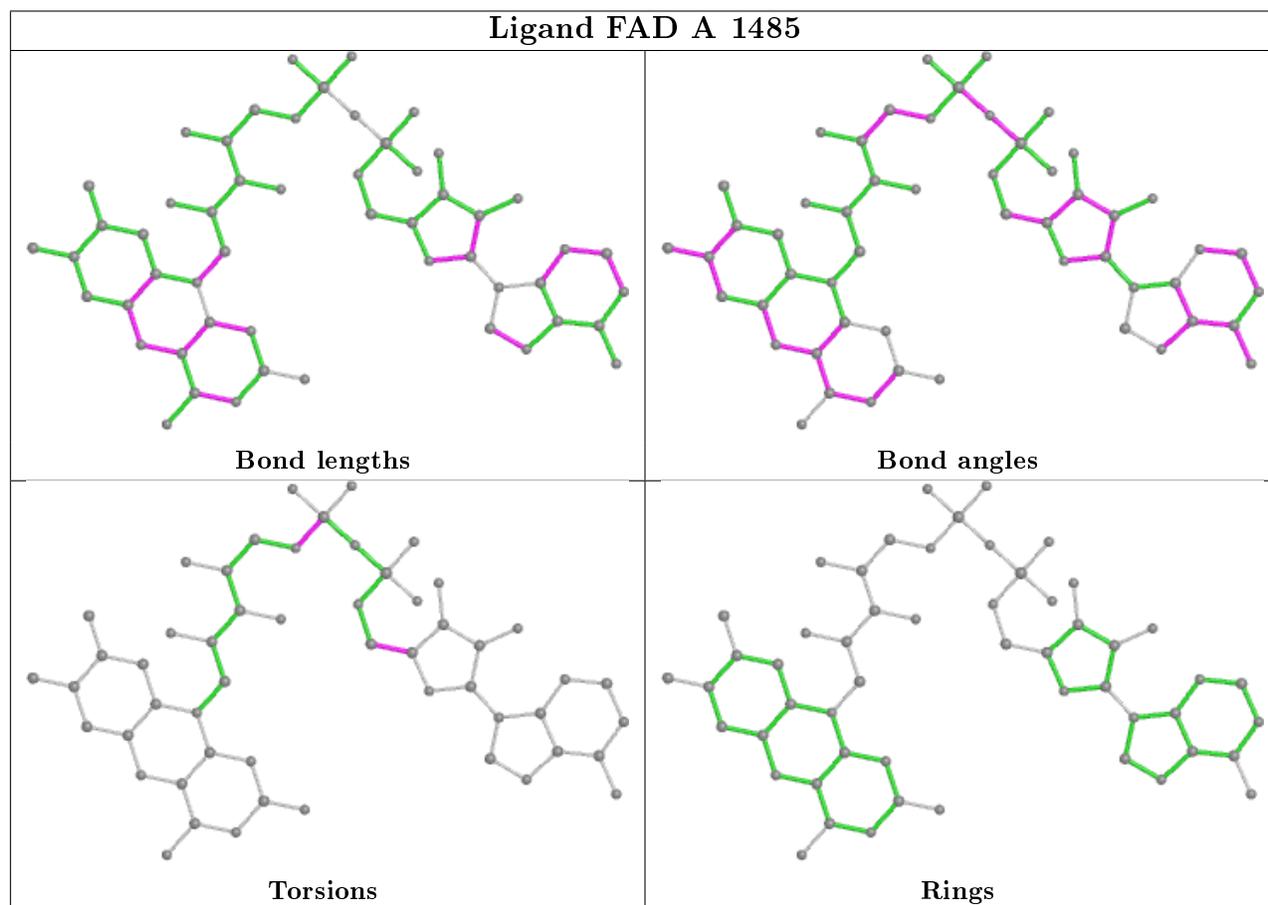
5 of 7 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1485	FAD	C5'-O5'-P-O2P
2	A	1485	FAD	C5'-O5'-P-O3P
2	B	1485	FAD	C5'-O5'-P-O2P
2	B	1485	FAD	C5'-O5'-P-O3P
2	B	1485	FAD	O4B-C4B-C5B-O5B

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1485	FAD	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 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 FAD A 1485

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD B 1485

Bond lengths

Bond angles

Torsions

Rings
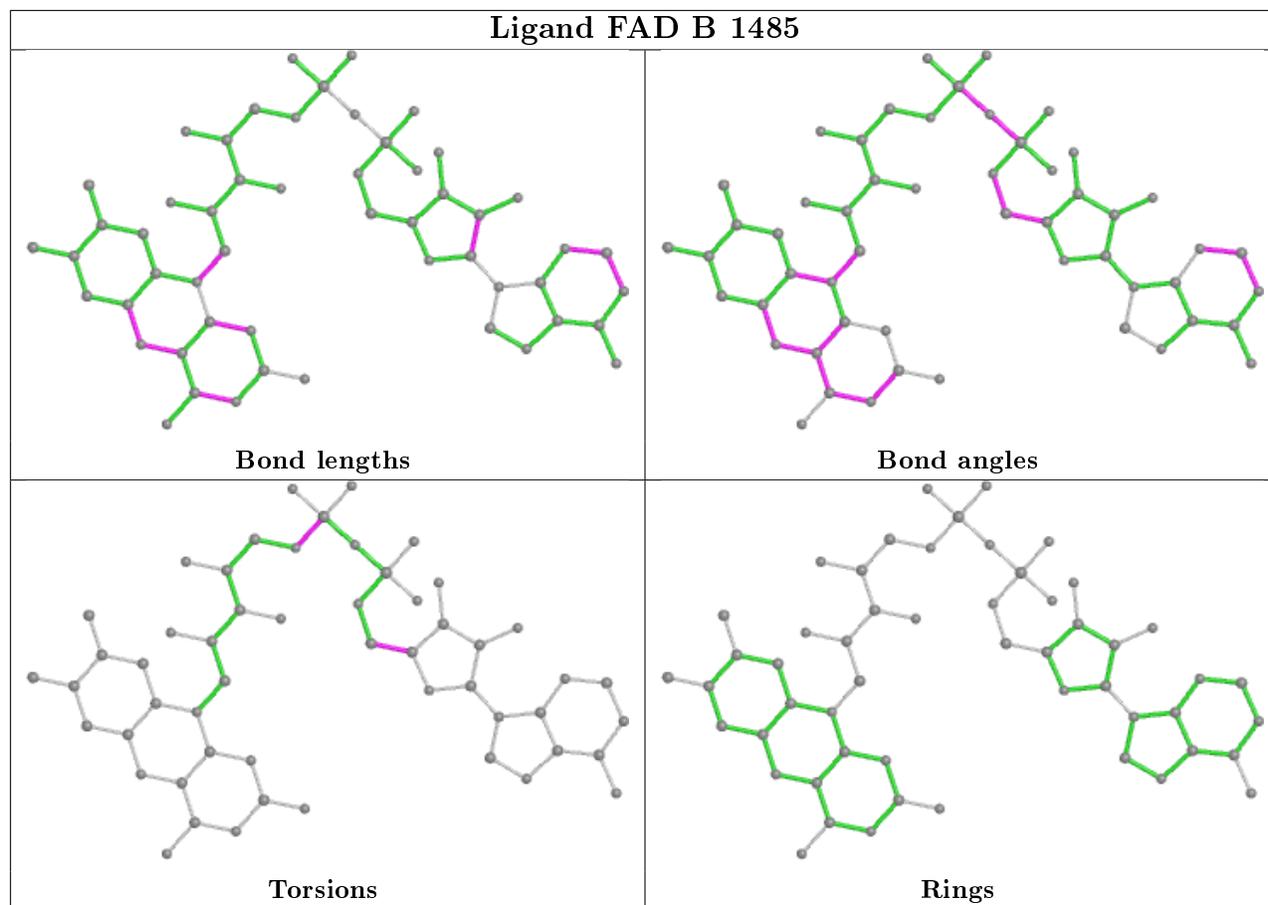
5.7 Other polymers (i)

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 (i)

6.1 Protein, DNA and RNA chains (i)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.