



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 15, 2020 – 08:08 pm BST

PDB ID : 1AHV  
Title : STRUCTURE OF THE OCTAMERIC FLAVOENZYME VANILLYL-ALCOHOL OXIDASE IN COMPLEX WITH 2-NITRO-P-CRESOL  
Authors : Mattevi, A.  
Deposited on : 1997-04-10  
Resolution : 3.10 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](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 : 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

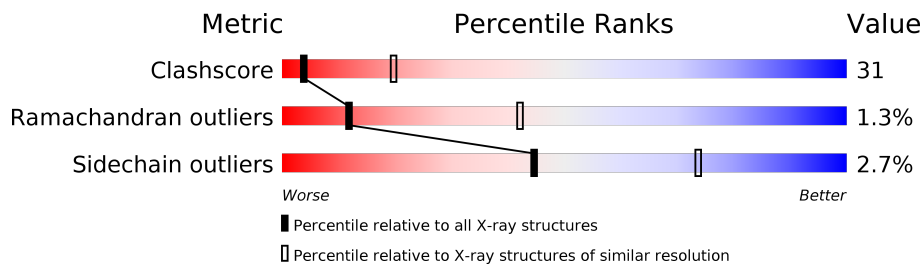
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.10 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)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	1184 (3.10-3.10)
Ramachandran outliers	138981	1141 (3.10-3.10)
Sidechain outliers	138945	1141 (3.10-3.10)

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  $\geq 3$ , 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	560	
1	B	560	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	NCR	A	601	-	-	X	-
3	NCR	B	601	-	-	X	-

## 2 Entry composition [i](#)

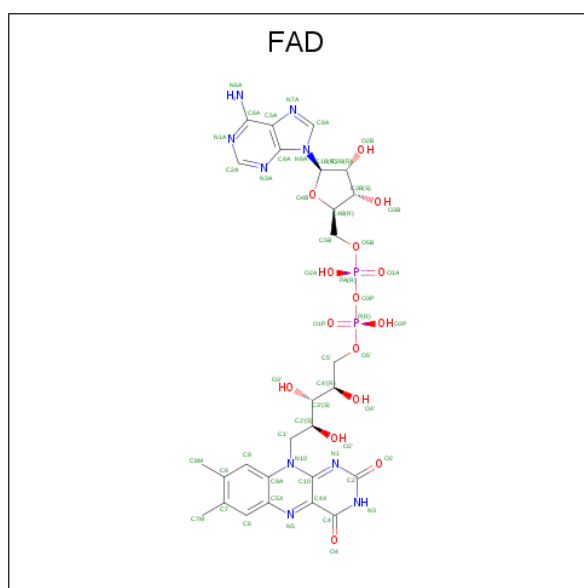
There are 3 unique types of molecules in this entry. The entry contains 8910 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 VANILLYL-ALCOHOL OXIDASE.

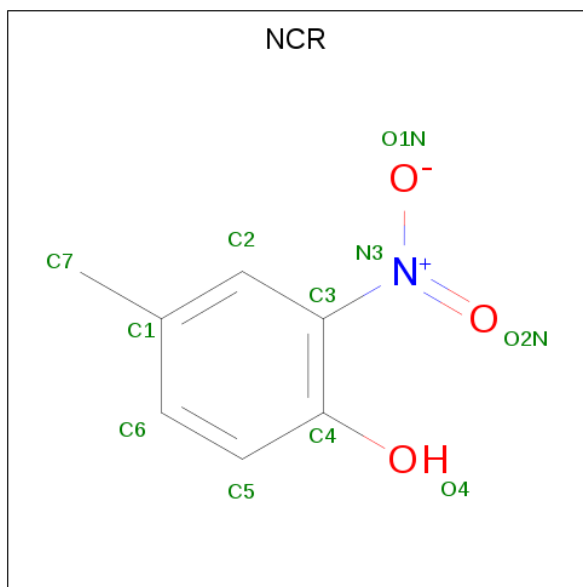
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	555	Total 4391	C 2817	N 751	O 799	S 24	28	0	0
1	B	555	Total 4391	C 2817	N 751	O 799	S 24	28	0	0

- 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
			Total	C	N	O	P		
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 2-NITRO-P-CRESOL (three-letter code: NCR) (formula:  $C_7H_7NO_3$ ).



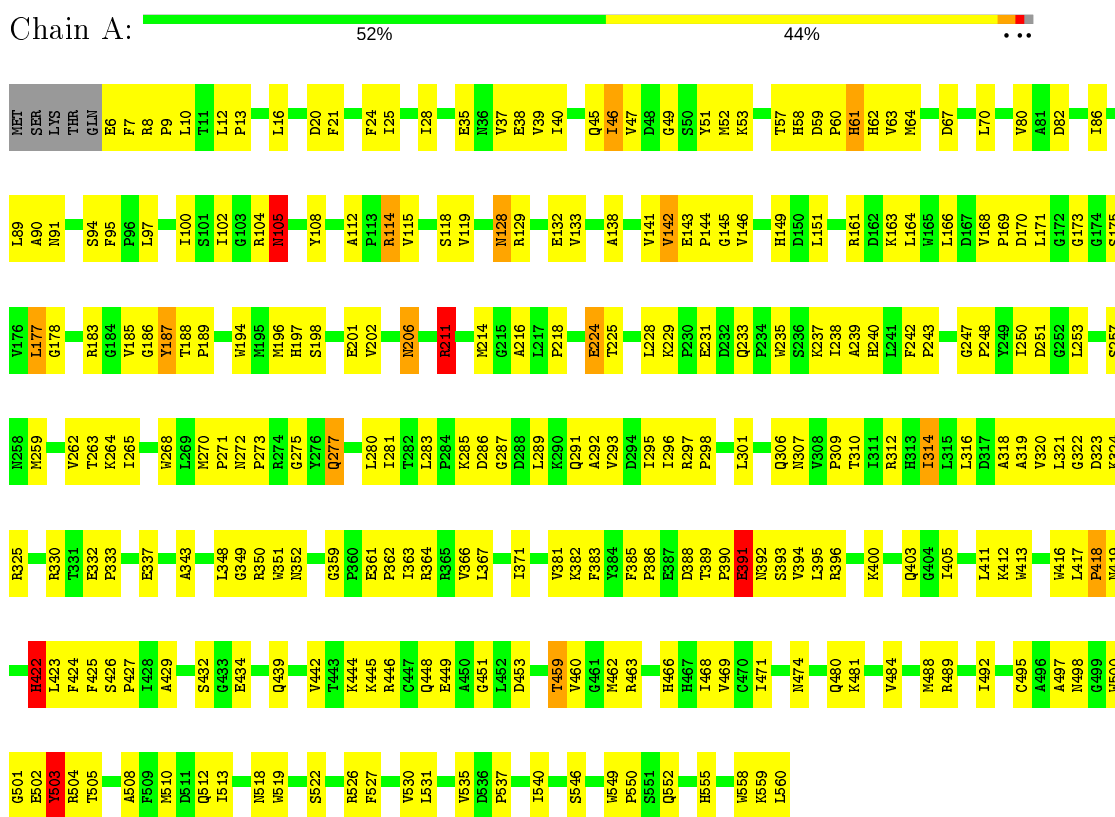
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	
			Total	C	N			O
3	A	1	11	7	1	3	0	0
3	B	1	11	7	1	3	0	0

### 3 Residue-property plots

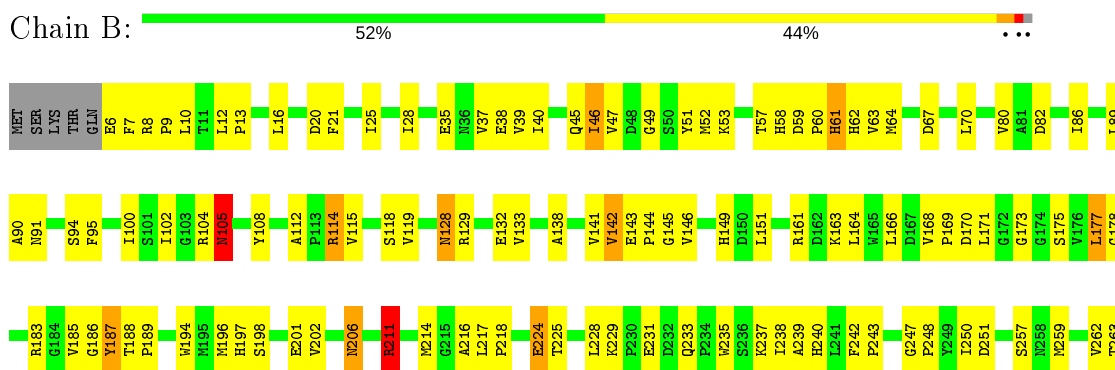
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according 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: VANILLYL-ALCOHOL OXIDASE



- Molecule 1: VANILLYL-ALCOHOL OXIDASE



K264	E337	P427	T605
L265	E337	I428	A508
W268	A343	A429	F509
P271	L348	K430	M510
N272	G349	V431	D511
P273	R350	S432	Q512
R274	W351	G438	I513
G275	N352	E434	N518
Y276	N352	Q439	W519
Q277	G359	V442	W519
L280	P360	T443	S522
I281	E361	K444	R526
L283	P362	K445	F527
P284	I363	R446	V530
K285	R364	C447	L531
D286	R365	Q448	V535
G287	V366	E449	D536
D288	L367	A450	P537
L289	I371	I452	P537
K290	V381	D453	I540
Q291	K382	T459	S546
A292	F383	V460	W549
V293	Y384	G461	P550
D294	F385	M462	S551
I295	P386	R463	Q552
I296	E387	E464	H555
R297	D388	M465	W558
P298	T389	H466	K559
L301	P390	H467	L560
Q306	N392	I468	
N307	S393	V469	
V308	V394	C470	
F309	L395	I471	
T310	R396	M474	
I311	K400	Q480	
R312	K400	K481	
H313	Q403	V484	
I314	G404	M488	
L315	I405	R489	
L316	L411	I492	
D317	K412	C495	
A318	K412	A496	
A319	W413	A497	
V320	W413	N498	
L321	W416	G499	
G322	L417	H500	
D323	L417	G501	
K324	P418	E502	
R325	N419	Y503	
R330	R422	R504	
I331	L423		
E332	F424		
P333	F425		
	S426		

## 4 Data and refinement statistics

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

Property	Value	Source
Space group	I 4	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	140.62Å 140.62Å 132.51Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 3.10	Depositor
% Data completeness (in resolution range)	94.3 (30.00-3.10)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.62	Depositor
Refinement program	TNT 5E	Depositor
R, $R_{free}$	0.205 , 0.240	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	8910	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	27.0	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: NCR, FAD

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	0.33	0/4511	1.02	13/6131 (0.2%)
1	B	0.33	0/4511	1.02	13/6131 (0.2%)
All	All	0.33	0/9022	1.02	26/12262 (0.2%)

There are no bond length outliers.

The worst 5 of 26 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	187	TYR	N-CA-C	7.66	131.68	111.00
1	B	187	TYR	N-CA-C	7.65	131.66	111.00
1	B	7	PHE	N-CA-C	7.37	130.89	111.00
1	A	7	PHE	N-CA-C	7.36	130.87	111.00
1	B	129	ARG	N-CA-C	6.96	129.79	111.00

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	4391	0	4330	278	0
1	B	4391	0	4330	278	0
2	A	53	0	29	6	0
2	B	53	0	29	6	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	11	0	6	6	0
3	B	11	0	6	7	0
All	All	8910	0	8730	539	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 31.

The worst 5 of 539 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:A:510:MET:HE1	1:A:546:SER:H	1.16	1.10
1:A:314:ILE:HD11	1:A:350:ARG:HG3	1.32	1.08
1:B:314:ILE:HD11	1:B:350:ARG:HG3	1.32	1.08
2:A:600:FAD:H8A	2:A:600:FAD:H51A	1.38	1.02
2:B:600:FAD:H51A	2:B:600:FAD:H8A	1.38	1.02

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	553/560 (99%)	510 (92%)	36 (6%)	7 (1%)	12 42
1	B	553/560 (99%)	509 (92%)	37 (7%)	7 (1%)	12 42
All	All	1106/1120 (99%)	1019 (92%)	73 (7%)	14 (1%)	12 42

5 of 14 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	46	ILE
1	A	49	GLY

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Mol	Chain	Res	Type
1	A	170	ASP
1	A	418	PRO
1	B	49	GLY

### 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	475/482 (98%)	462 (97%)	13 (3%)	44	74
1	B	475/482 (98%)	462 (97%)	13 (3%)	44	74
All	All	950/964 (98%)	924 (97%)	26 (3%)	44	74

5 of 26 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	422	HIS
1	B	105	ASN
1	B	422	HIS
1	A	503	TYR
1	B	61	HIS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 30 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	498	ASN
1	B	84	GLN
1	B	485	GLN
1	B	61	HIS
1	B	91	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](#)

4 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
2	FAD	A	600	1	51,58,58	1.12	3 (5%)	60,89,89	1.51	4 (6%)
3	NCR	A	601	-	10,11,11	0.69	0	11,15,15	1.18	0
3	NCR	B	601	-	10,11,11	0.69	0	11,15,15	1.19	0
2	FAD	B	600	1	51,58,58	1.12	3 (5%)	60,89,89	1.51	4 (6%)

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	600	1	-	5/30/50/50	0/6/6/6
3	NCR	A	601	-	-	0/2/4/4	0/1/1/1
3	NCR	B	601	-	-	0/2/4/4	0/1/1/1
2	FAD	B	600	1	-	5/30/50/50	0/6/6/6

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	600	FAD	C4X-C10	4.32	1.43	1.38
2	A	600	FAD	C4X-C10	4.22	1.43	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	600	FAD	C4-N3	3.64	1.39	1.33
2	A	600	FAD	C4-N3	3.62	1.39	1.33
2	A	600	FAD	C2-N1	-2.73	1.32	1.38

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	600	FAD	C4-N3-C2	7.58	121.54	115.14
2	B	600	FAD	C4-N3-C2	7.56	121.52	115.14
2	A	600	FAD	C4X-C4-N3	-5.17	116.36	123.43
2	B	600	FAD	C4X-C4-N3	-5.14	116.41	123.43
2	B	600	FAD	C1'-N10-C9A	2.50	120.26	118.29

There are no chirality outliers.

5 of 10 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	600	FAD	C3'-C4'-C5'-O5'
2	B	600	FAD	C3'-C4'-C5'-O5'
2	A	600	FAD	C4'-C5'-O5'-P
2	B	600	FAD	C4'-C5'-O5'-P
2	A	600	FAD	O4'-C4'-C5'-O5'

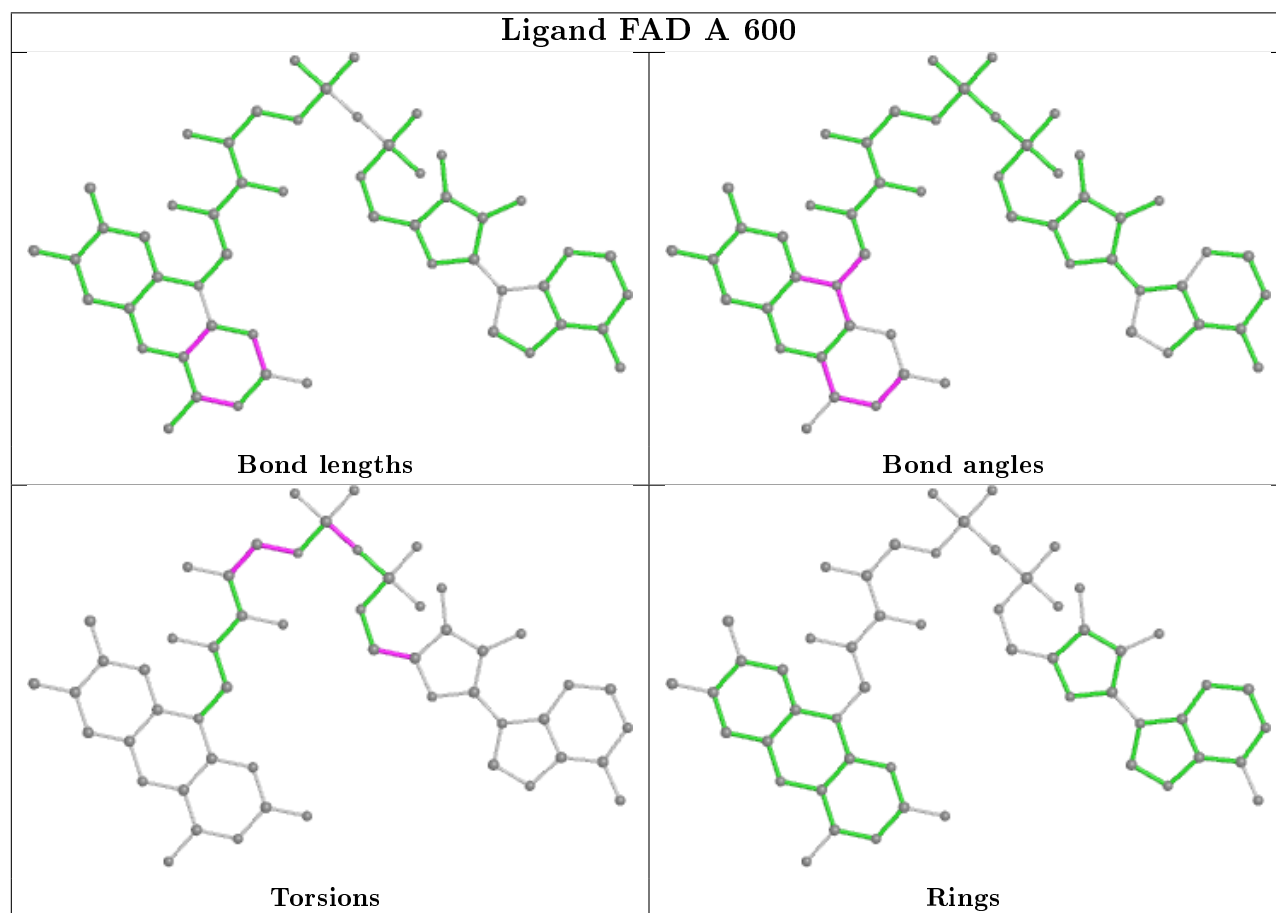
There are no ring outliers.

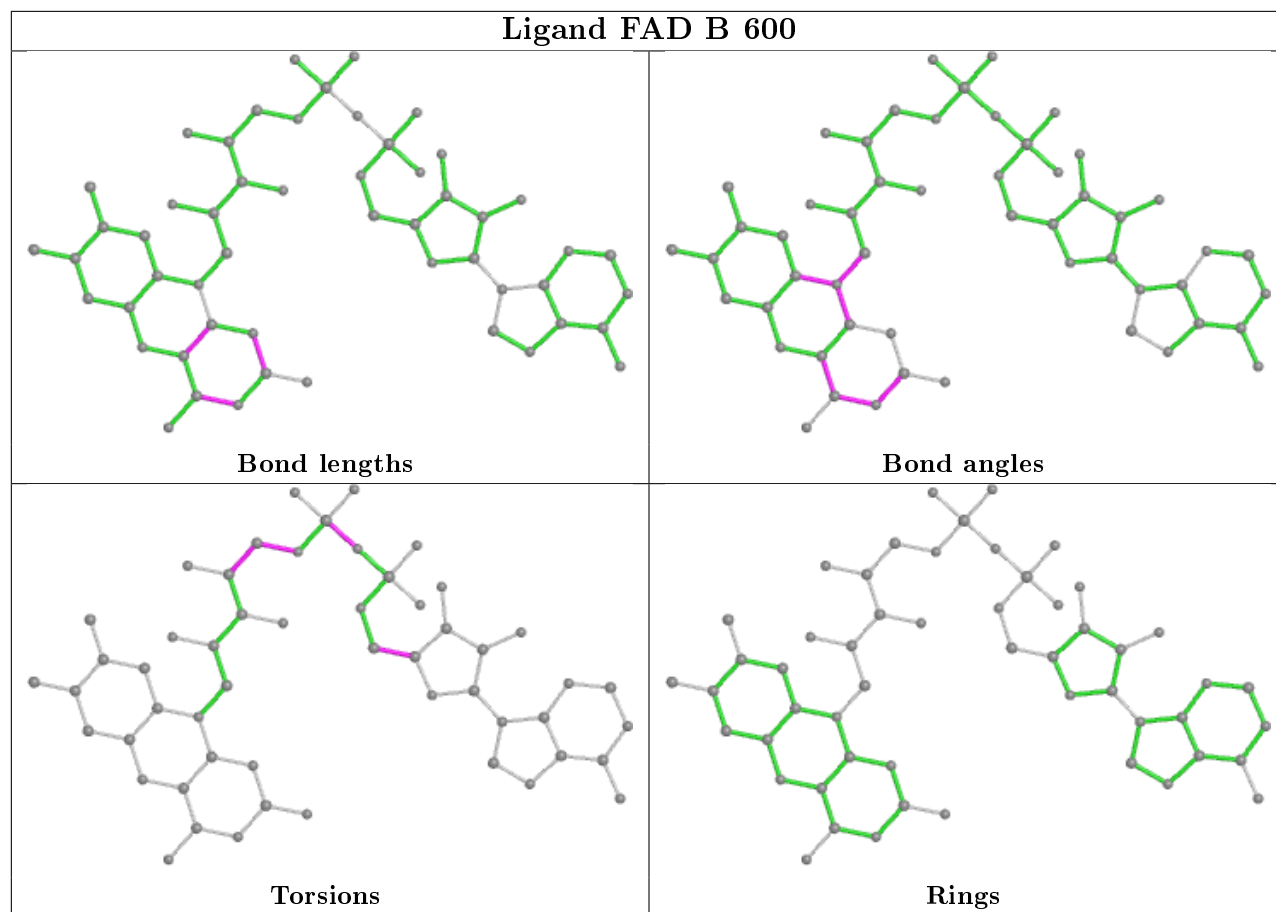
4 monomers are involved in 23 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	600	FAD	6	0
3	A	601	NCR	6	0
3	B	601	NCR	7	0
2	B	600	FAD	6	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.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.