



# Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 09:53 pm BST

PDB ID : 2W0H  
Title : X ray structure of Leishmania infantum Trypanothione reductase in complex with antimony and NADPH  
Authors : Baiocco, P.; Colotti, G.; Franceschini, S.; Ilari, A.  
Deposited on : 2008-08-18  
Resolution : 3.00 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.

---

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) : 1.13  
EDS : 2.11  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.11

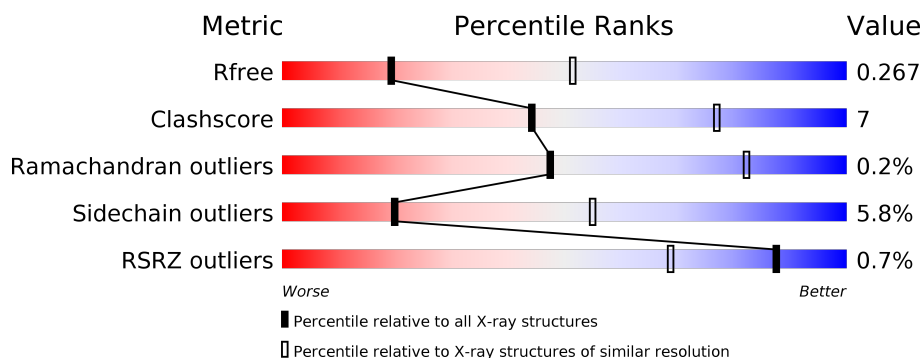
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 3.00 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	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

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  $\geq 3$ , 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  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	511	<div> <div>%</div> <div> <div></div> <div>79%</div> <div>14%</div> <div>• 5%</div> </div> </div>
1	B	511	<div> <div>%</div> <div> <div></div> <div>81%</div> <div>13%</div> <div>• 5%</div> </div> </div>

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	SB	A	1487	-	-	X	-
3	SB	B	1487	-	-	X	-
4	NDP	A	1488	X	-	-	-
4	NDP	B	1488	X	-	-	-

## 2 Entry composition [i](#)

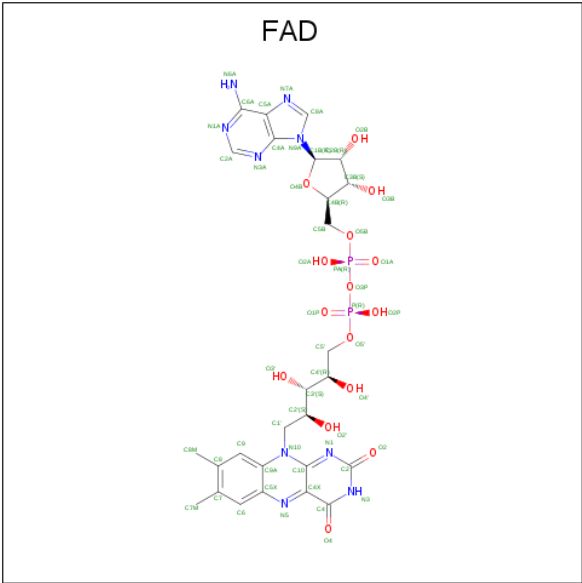
There are 6 unique types of molecules in this entry. The entry contains 7598 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 TRYPANOTHIONE REDUCTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	485	Total	C	N	O	S	0	0	0
			3672	2308	631	707	26			
1	B	487	Total	C	N	O	S	0	0	0
			3686	2317	633	710	26			

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

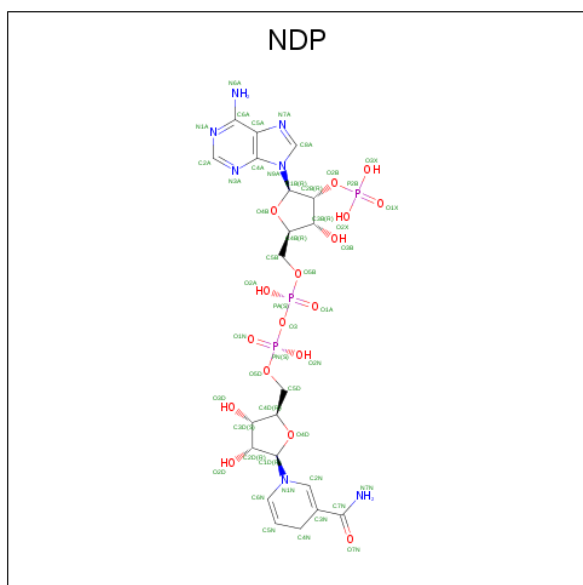


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
2	B	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 3 is ANTIMONY (III) ION (three-letter code: SB) (formula: Sb).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total Sb 1 1	0	0
3	A	1	Total Sb 1 1	0	0

- Molecule 4 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NDP) (formula:  $C_{21}H_{30}N_7O_{17}P_3$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total 48	C 21	N 7	O 17	P 3	0	0
4	B	1	Total 48	C 21	N 7	O 17	P 3	0	0

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



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

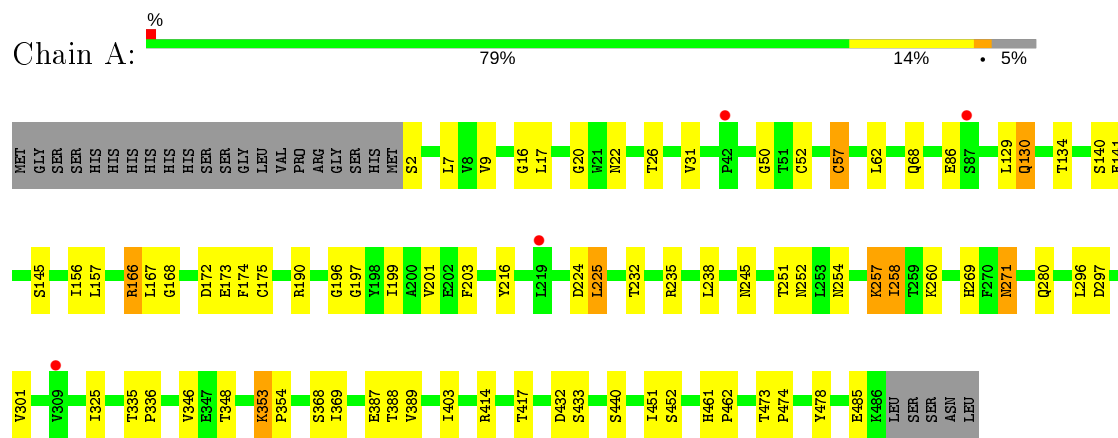
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	12	Total	O	0	0
			12	12		
6	B	14	Total	O	0	0
			14	14		

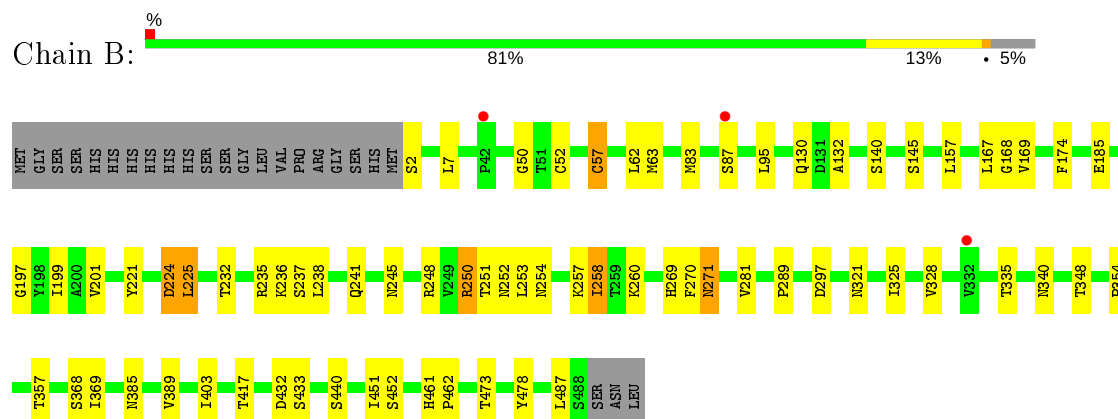
### 3 Residue-property plots [i](#)

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). 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: TRYPANOTHIONE REDUCTASE



#### • Molecule 1: TRYPANOTHIONE REDUCTASE



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	102.94Å 102.94Å 193.13Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	103.14 – 3.00 49.74 – 3.00	Depositor EDS
% Data completeness (in resolution range)	87.1 (103.14-3.00) 87.1 (49.74-3.00)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.20 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.238 , 0.262 0.239 , 0.267	Depositor DCC
$R_{free}$ test set	1788 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	67.2	Xtriage
Anisotropy	0.074	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 31.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.458 for h,-k,-l	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	7598	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	70.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.26% 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.



## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NDP, SO4, FAD, SB

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	0.34	0/3745	0.52	0/5071
1	B	0.35	0/3759	0.51	0/5090
All	All	0.34	0/7504	0.51	0/10161

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts

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	3672	0	3619	57	0
1	B	3686	0	3635	45	0
2	A	53	0	31	3	0
2	B	53	0	31	3	0
3	A	1	0	0	8	0
3	B	1	0	0	7	0
4	A	48	0	26	3	0
4	B	48	0	26	4	0
5	A	5	0	0	0	0
5	B	5	0	0	0	0
6	A	12	0	0	0	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	14	0	0	0	0
All	All	7598	0	7368	98	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 7.

All (98) 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:57:CYS:HB3	3:A:1487:SB:SB	1.68	1.70
1:A:57:CYS:CB	3:A:1487:SB:SB	2.40	1.50
1:A:52:CYS:SG	3:A:1487:SB:SB	2.77	1.23
1:B:52:CYS:SG	3:B:1487:SB:SB	2.89	1.10
1:A:57:CYS:SG	3:A:1487:SB:SB	2.95	1.04
1:A:389:VAL:HG22	1:A:478:TYR:HB2	1.47	0.96
1:B:389:VAL:HG22	1:B:478:TYR:HB2	1.47	0.96
1:A:57:CYS:HB2	3:A:1487:SB:SB	2.56	0.85
1:B:335:THR:OG1	3:B:1487:SB:SB	2.90	0.70
1:B:232:THR:HA	1:B:235:ARG:HD3	1.74	0.69
1:B:389:VAL:CG2	1:B:478:TYR:HB2	2.22	0.68
1:A:224:ASP:HB3	1:A:252:ASN:HD21	1.58	0.68
1:A:232:THR:HA	1:A:235:ARG:HD3	1.77	0.67
1:A:130:GLN:HA	1:A:130:GLN:HE21	1.60	0.65
1:A:389:VAL:CG2	1:A:478:TYR:HB2	2.24	0.65
1:A:224:ASP:HB3	1:A:252:ASN:ND2	2.12	0.64
1:A:174:PHE:CE1	1:A:260:LYS:HB2	2.32	0.64
1:A:461:HIS:ND1	3:B:1487:SB:SB	3.10	0.64
1:A:257:LYS:HB3	1:A:269:HIS:HD2	1.63	0.63
1:A:199:ILE:HB	4:A:1488:NDP:O2N	1.99	0.62
1:A:52:CYS:CB	3:A:1487:SB:SB	3.28	0.62
1:A:335:THR:OG1	3:A:1487:SB:SB	2.97	0.62
1:A:166:ARG:HG2	1:A:172:ASP:OD1	2.00	0.62
1:A:348:THR:HA	1:A:354:PRO:HA	1.85	0.58
1:A:166:ARG:NH2	1:A:175:CYS:O	2.38	0.57
1:B:348:THR:HA	1:B:354:PRO:HA	1.85	0.57
1:B:52:CYS:CB	3:B:1487:SB:SB	3.32	0.57
1:B:340:ASN:HD22	1:B:357:THR:HG23	1.70	0.56
3:A:1487:SB:SB	1:B:461:HIS:ND1	3.18	0.56
1:A:224:ASP:HA	1:A:251:THR:HB	1.89	0.55
1:B:224:ASP:HB3	1:B:252:ASN:HD21	1.71	0.54
1:B:174:PHE:CE1	1:B:260:LYS:HB2	2.44	0.53

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:199:ILE:HB	4:B:1488:NDP:O2N	2.09	0.52
1:B:201:VAL:HG12	1:B:368:SER:HB3	1.90	0.52
1:B:199:ILE:HG13	4:B:1488:NDP:H5N	1.92	0.51
1:A:417:THR:HG21	1:A:451:ILE:HB	1.93	0.51
1:B:224:ASP:HA	1:B:251:THR:HB	1.95	0.49
1:A:201:VAL:HG12	1:A:368:SER:HB3	1.93	0.48
1:B:221:TYR:HE1	4:B:1488:NDP:H2B	1.78	0.48
1:A:62:LEU:HD22	1:B:403:ILE:HD12	1.94	0.48
1:B:157:LEU:HD11	1:B:325:ILE:HG12	1.95	0.48
1:B:224:ASP:HB3	1:B:252:ASN:ND2	2.28	0.48
1:A:140:SER:HB3	1:A:145:SER:CB	2.44	0.47
1:A:68:GLN:HG3	1:A:369:ILE:HD12	1.96	0.47
1:B:132:ALA:O	1:B:321:ASN:ND2	2.47	0.47
1:B:417:THR:HG21	1:B:451:ILE:HB	1.97	0.47
1:A:296:LEU:HB3	1:A:301:VAL:HB	1.97	0.47
1:A:140:SER:HB3	1:A:145:SER:HB3	1.96	0.47
1:A:403:ILE:HD12	1:B:62:LEU:HD22	1.95	0.47
1:B:50:GLY:HA2	2:B:1486:FAD:O3B	2.14	0.47
1:A:462:PRO:HG3	1:B:57:CYS:SG	2.55	0.47
1:A:166:ARG:HG3	1:A:172:ASP:OD2	2.15	0.47
1:B:253:LEU:HD11	1:B:270:PHE:HB3	1.97	0.47
1:A:199:ILE:HG23	1:A:203:PHE:CD2	2.50	0.47
1:B:140:SER:HB3	1:B:145:SER:HB3	1.96	0.47
1:B:225:LEU:HD11	1:B:236:LYS:HG3	1.98	0.46
1:A:57:CYS:HB2	2:A:1486:FAD:C4X	2.46	0.45
1:B:130:GLN:HE21	1:B:130:GLN:HA	1.81	0.45
1:B:257:LYS:HB3	1:B:269:HIS:CD2	2.52	0.45
1:B:197:GLY:HA3	4:B:1488:NDP:H52A	1.98	0.45
1:A:22:ASN:HB2	1:A:346:VAL:HG21	1.98	0.45
1:A:197:GLY:HA3	4:A:1488:NDP:H52A	1.99	0.45
1:A:129:LEU:HD21	1:A:156:ILE:HG21	1.99	0.45
1:A:157:LEU:HD11	1:A:325:ILE:HG12	1.99	0.44
1:B:57:CYS:HB2	2:B:1486:FAD:C4X	2.48	0.44
1:A:190:ARG:HG2	1:A:216:TYR:CE1	2.52	0.44
1:B:140:SER:HB3	1:B:145:SER:CB	2.48	0.44
1:B:248:ARG:HE	1:B:250:ARG:HD2	1.83	0.44
1:A:196:GLY:H	4:A:1488:NDP:H3B	1.83	0.43
1:B:254:ASN:H	1:B:271:ASN:HB2	1.83	0.43
1:A:257:LYS:C	1:A:258:ILE:HG13	2.39	0.43
1:A:353:LYS:H	1:A:353:LYS:HG3	1.63	0.43
1:A:22:ASN:HB3	1:A:346:VAL:HG11	2.01	0.42

*Continued on next page...*

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:335:THR:CB	3:B:1487:SB:SB	3.48	0.42
1:B:185:GLU:CD	1:B:185:GLU:H	2.22	0.42
1:B:237:SER:O	1:B:241:GLN:HG3	2.19	0.42
1:A:129:LEU:HD22	1:A:156:ILE:HD13	2.01	0.42
1:A:57:CYS:SG	1:B:462:PRO:HG3	2.59	0.42
1:B:257:LYS:C	1:B:258:ILE:HG13	2.40	0.42
1:B:52:CYS:HB2	3:B:1487:SB:SB	3.00	0.42
1:A:50:GLY:HA2	2:A:1486:FAD:O3B	2.19	0.42
1:A:473:THR:HA	1:A:474:PRO:HD3	1.92	0.41
1:A:254:ASN:H	1:A:271:ASN:HB2	1.85	0.41
1:B:289:PRO:HB3	1:B:328:VAL:HA	2.02	0.41
1:A:20:GLY:HA2	1:A:31:VAL:HG11	2.03	0.41
2:B:1486:FAD:H9	2:B:1486:FAD:H1'1	1.79	0.41
1:A:225:LEU:HB3	1:A:235:ARG:NH2	2.35	0.41
1:A:57:CYS:HB2	2:A:1486:FAD:C4	2.51	0.41
1:A:336:PRO:HG3	1:B:461:HIS:HB2	2.03	0.41
1:A:461:HIS:CE1	3:B:1487:SB:SB	3.54	0.41
1:B:461:HIS:HA	1:B:462:PRO:HA	1.87	0.41
1:A:387:GLU:HG2	1:A:388:THR:H	1.86	0.40
1:A:432:ASP:O	1:A:433:SER:HB2	2.21	0.40
1:B:432:ASP:O	1:B:433:SER:HB2	2.21	0.40
1:B:63:MET:HG2	1:B:95:LEU:HD21	2.03	0.40
1:A:9:VAL:HG11	1:A:16:GLY:HA2	2.02	0.40
1:A:199:ILE:HG23	1:A:203:PHE:HD2	1.85	0.40
1:A:130:GLN:HB3	1:A:134:THR:HB	2.03	0.40

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	483/511 (94%)	444 (92%)	38 (8%)	1 (0%)	47 82

Continued on next page...

*Continued from previous page...*

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	B	485/511 (95%)	442 (91%)	42 (9%)	1 (0%)	47 82
All	All	968/1022 (95%)	886 (92%)	80 (8%)	2 (0%)	47 82

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	168	GLY
1	B	168	GLY

### 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 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	394/417 (94%)	370 (94%)	24 (6%)	18 53
1	B	396/417 (95%)	374 (94%)	22 (6%)	21 56
All	All	790/834 (95%)	744 (94%)	46 (6%)	20 55

All (46) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	SER
1	A	7	LEU
1	A	17	LEU
1	A	26	THR
1	A	57	CYS
1	A	86	GLU
1	A	130	GLN
1	A	141	GLU
1	A	166	ARG
1	A	167	LEU
1	A	173	GLU
1	A	225	LEU
1	A	238	LEU
1	A	245	ASN

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	A	257	LYS
1	A	258	ILE
1	A	271	ASN
1	A	280	GLN
1	A	297	ASP
1	A	353	LYS
1	A	414	ARG
1	A	440	SER
1	A	452	SER
1	A	485	GLU
1	B	2	SER
1	B	7	LEU
1	B	57	CYS
1	B	83	MET
1	B	87	SER
1	B	167	LEU
1	B	169	VAL
1	B	224	ASP
1	B	225	LEU
1	B	238	LEU
1	B	245	ASN
1	B	250	ARG
1	B	258	ILE
1	B	271	ASN
1	B	281	VAL
1	B	297	ASP
1	B	369	ILE
1	B	385	ASN
1	B	440	SER
1	B	452	SER
1	B	473	THR
1	B	487	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	130	GLN
1	A	252	ASN
1	A	295	GLN
1	A	340	ASN
1	B	130	GLN
1	B	208	ASN

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	B	252	ASN
1	B	269	HIS
1	B	295	GLN
1	B	340	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 8 ligands modelled in this entry, 2 are monoatomic - leaving 6 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	$\# Z  > 2$
5	SO4	A	1489	-	4,4,4	0.15	0	6,6,6	0.13	0
2	FAD	B	1486	-	51,58,58	1.42	6 (11%)	60,89,89	1.57	7 (11%)
2	FAD	A	1486	-	51,58,58	1.41	6 (11%)	60,89,89	1.54	6 (10%)
4	NDP	A	1488	-	45,52,52	2.07	11 (24%)	53,80,80	1.05	4 (7%)
5	SO4	B	1489	-	4,4,4	0.13	0	6,6,6	0.12	0
4	NDP	B	1488	-	45,52,52	2.07	12 (26%)	53,80,80	1.02	4 (7%)

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	NDP	A	1488	-	4/4/14/17	11/30/77/77	0/5/5/5
2	FAD	A	1486	-	-	3/30/50/50	0/6/6/6
4	NDP	B	1488	-	4/4/14/17	10/30/77/77	0/5/5/5
2	FAD	B	1486	-	-	2/30/50/50	0/6/6/6

All (35) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	1488	NDP	P2B-O2X	6.25	1.78	1.54
4	A	1488	NDP	P2B-O2X	6.23	1.78	1.54
4	B	1488	NDP	P2B-O3X	6.12	1.78	1.54
4	A	1488	NDP	P2B-O3X	6.06	1.78	1.54
4	A	1488	NDP	PA-O2A	5.04	1.79	1.55
4	B	1488	NDP	PA-O2A	5.03	1.78	1.55
4	A	1488	NDP	PN-O2N	4.93	1.78	1.55
2	A	1486	FAD	C10-N1	4.90	1.39	1.33
4	B	1488	NDP	PN-O2N	4.87	1.78	1.55
2	B	1486	FAD	C10-N1	4.65	1.39	1.33
2	B	1486	FAD	C2A-N3A	4.16	1.38	1.32
2	A	1486	FAD	C2A-N3A	4.11	1.38	1.32
2	B	1486	FAD	C4X-N5	3.77	1.38	1.33
4	A	1488	NDP	C6N-C5N	3.63	1.39	1.33
2	A	1486	FAD	C4X-N5	3.63	1.38	1.33
4	B	1488	NDP	C6N-C5N	3.60	1.39	1.33
2	B	1486	FAD	C4-N3	3.06	1.38	1.33
2	A	1486	FAD	C4-N3	2.95	1.38	1.33
2	B	1486	FAD	C1'-N10	2.89	1.51	1.48
4	B	1488	NDP	P2B-O1X	2.73	1.59	1.50
4	A	1488	NDP	P2B-O1X	2.70	1.59	1.50
2	A	1486	FAD	C1'-N10	2.68	1.51	1.48
2	B	1486	FAD	C2A-N1A	2.62	1.38	1.33
2	A	1486	FAD	C2A-N1A	2.56	1.38	1.33
4	A	1488	NDP	C5A-C4A	2.51	1.47	1.40
4	B	1488	NDP	C5A-C4A	2.49	1.47	1.40
4	A	1488	NDP	PA-O1A	2.38	1.59	1.50
4	B	1488	NDP	PA-O1A	2.38	1.59	1.50
4	B	1488	NDP	PN-O1N	2.36	1.59	1.50
4	A	1488	NDP	PN-O1N	2.35	1.59	1.50
4	B	1488	NDP	C2N-C3N	2.18	1.41	1.34
4	A	1488	NDP	C2A-N3A	2.16	1.35	1.32

*Continued on next page...*



*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	1488	NDP	O4B-C1B	2.12	1.44	1.41
4	A	1488	NDP	C2N-C3N	2.10	1.40	1.34
4	B	1488	NDP	C2A-N3A	2.07	1.35	1.32

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1486	FAD	C4-N3-C2	5.99	120.20	115.14
2	A	1486	FAD	C4-N3-C2	5.80	120.04	115.14
2	B	1486	FAD	N3A-C2A-N1A	-5.51	120.07	128.68
2	A	1486	FAD	N3A-C2A-N1A	-5.46	120.15	128.68
2	A	1486	FAD	C4X-N5-C5X	4.17	120.94	116.77
2	B	1486	FAD	C4X-N5-C5X	3.82	120.59	116.77
4	B	1488	NDP	N3A-C2A-N1A	-3.64	123.00	128.68
4	A	1488	NDP	N3A-C2A-N1A	-3.53	123.16	128.68
2	B	1486	FAD	P-O3P-PA	-3.26	121.63	132.83
2	B	1486	FAD	C5X-C9A-N10	3.05	119.93	117.72
2	A	1486	FAD	P-O3P-PA	-2.83	123.12	132.83
4	B	1488	NDP	C3D-C2D-C1D	2.80	106.74	101.43
4	A	1488	NDP	C3D-C2D-C1D	2.64	106.45	101.43
2	A	1486	FAD	C5X-C9A-N10	2.61	119.61	117.72
4	A	1488	NDP	C4A-C5A-N7A	-2.51	106.79	109.40
4	A	1488	NDP	PN-O3-PA	-2.49	124.30	132.83
2	B	1486	FAD	C4X-C4-N3	-2.42	120.13	123.43
2	A	1486	FAD	C4X-C4-N3	-2.31	120.28	123.43
4	B	1488	NDP	C4A-C5A-N7A	-2.28	107.03	109.40
2	B	1486	FAD	C1'-N10-C9A	2.17	120.00	118.29
4	B	1488	NDP	PN-O3-PA	-2.04	125.83	132.83

All (8) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
4	A	1488	NDP	C4B
4	A	1488	NDP	C4D
4	A	1488	NDP	C2B
4	A	1488	NDP	C3B
4	B	1488	NDP	C4B
4	B	1488	NDP	C4D
4	B	1488	NDP	C2B
4	B	1488	NDP	C3B

All (26) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1488	NDP	C5D-O5D-PN-O3
4	A	1488	NDP	C5D-O5D-PN-O1N
4	A	1488	NDP	C3D-C4D-C5D-O5D
2	A	1486	FAD	O4B-C4B-C5B-O5B
4	B	1488	NDP	C5D-O5D-PN-O3
4	B	1488	NDP	C3D-C4D-C5D-O5D
4	A	1488	NDP	O4D-C1D-N1N-C2N
4	B	1488	NDP	O4D-C1D-N1N-C2N
2	B	1486	FAD	O4B-C4B-C5B-O5B
2	B	1486	FAD	C3B-C4B-C5B-O5B
4	A	1488	NDP	O4B-C4B-C5B-O5B
4	A	1488	NDP	C3B-C4B-C5B-O5B
4	B	1488	NDP	O4B-C4B-C5B-O5B
4	A	1488	NDP	O4D-C4D-C5D-O5D
2	A	1486	FAD	C3B-C4B-C5B-O5B
4	B	1488	NDP	C3B-C4B-C5B-O5B
4	B	1488	NDP	O4D-C4D-C5D-O5D
4	B	1488	NDP	C4D-C5D-O5D-PN
4	A	1488	NDP	C4D-C5D-O5D-PN
4	B	1488	NDP	C5D-O5D-PN-O1N
4	B	1488	NDP	C5D-O5D-PN-O2N
4	B	1488	NDP	PN-O3-PA-O1A
2	A	1486	FAD	P-O3P-PA-O1A
4	A	1488	NDP	PA-O3-PN-O2N
4	A	1488	NDP	C5D-O5D-PN-O2N
4	A	1488	NDP	C4B-C5B-O5B-PA

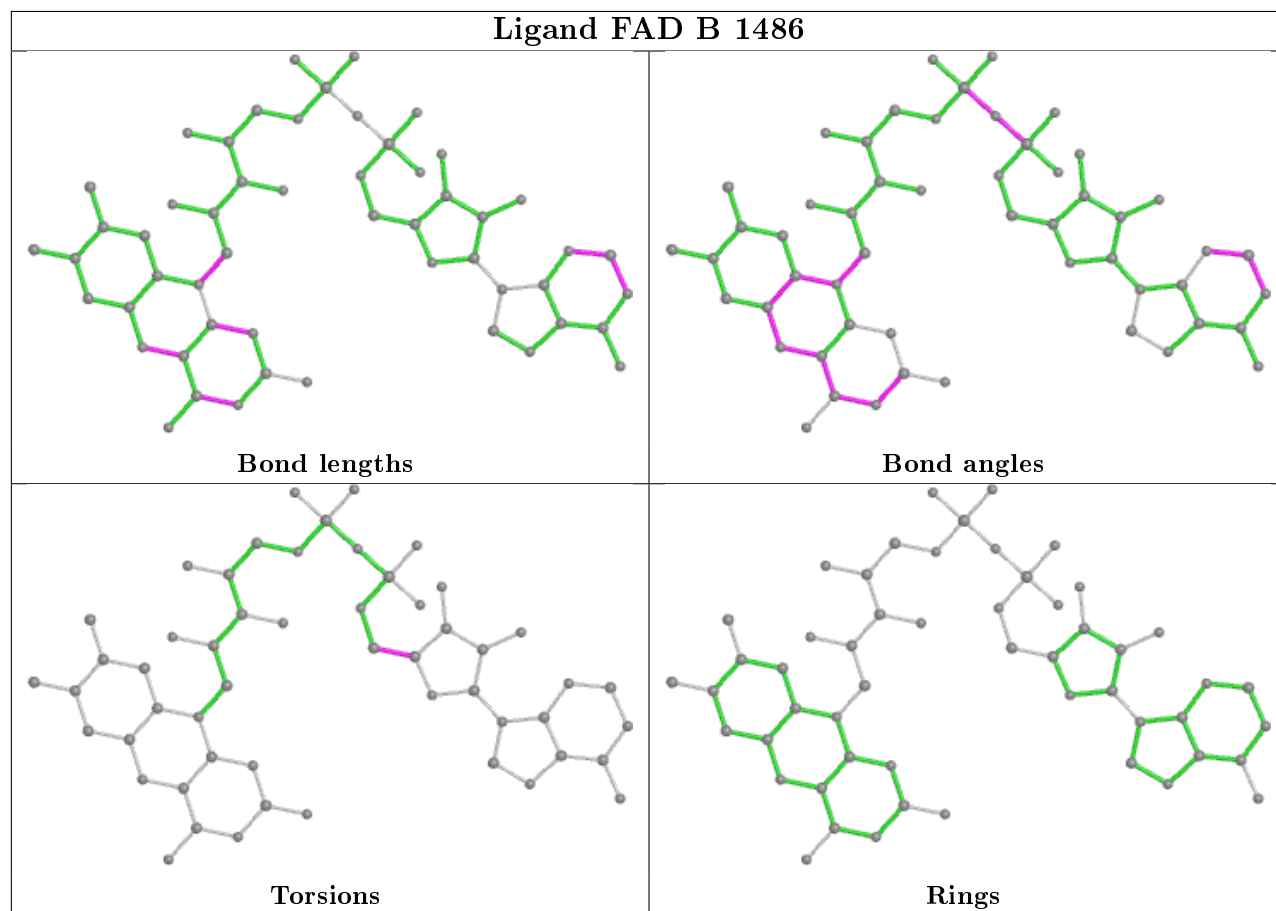
There are no ring outliers.

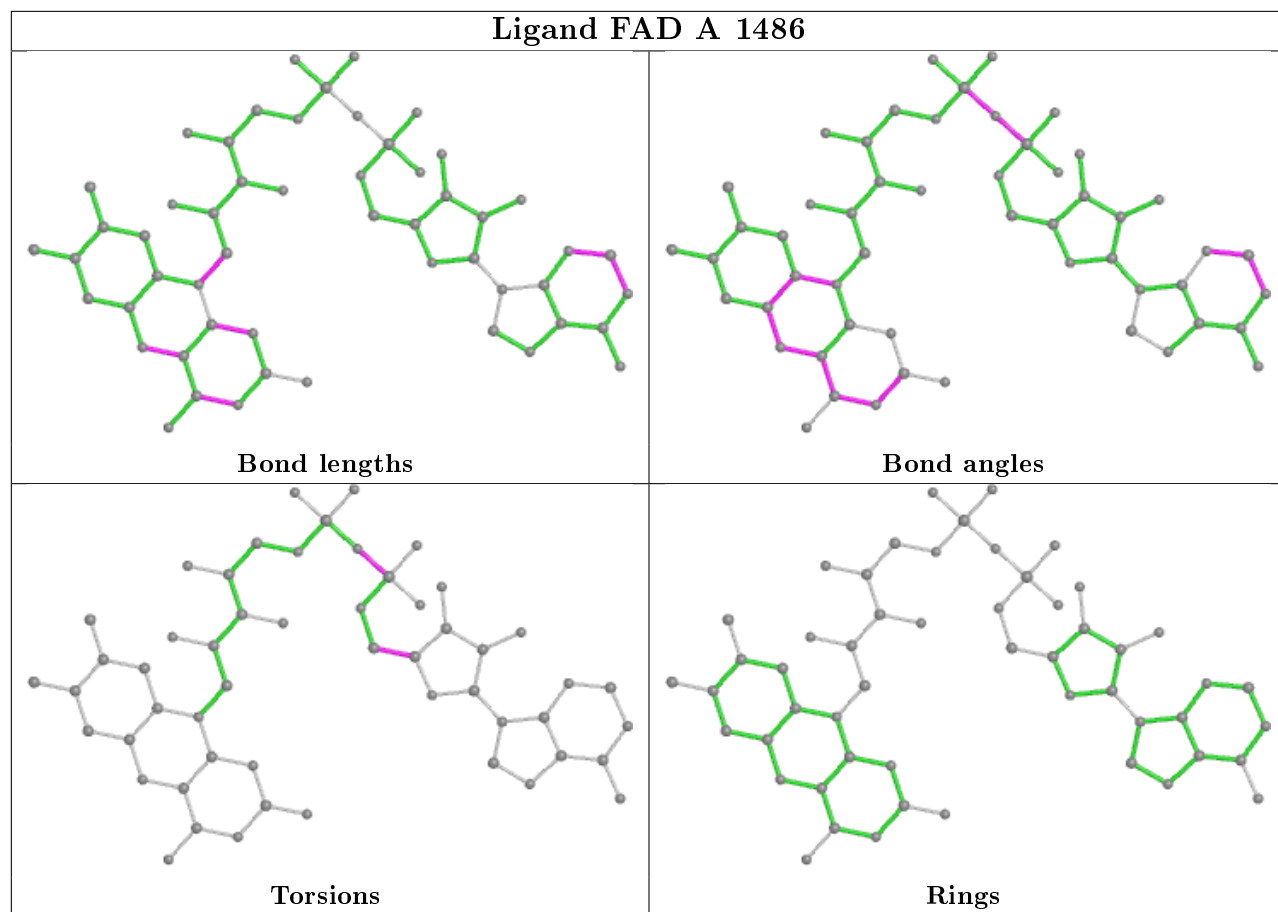
4 monomers are involved in 13 short contacts:

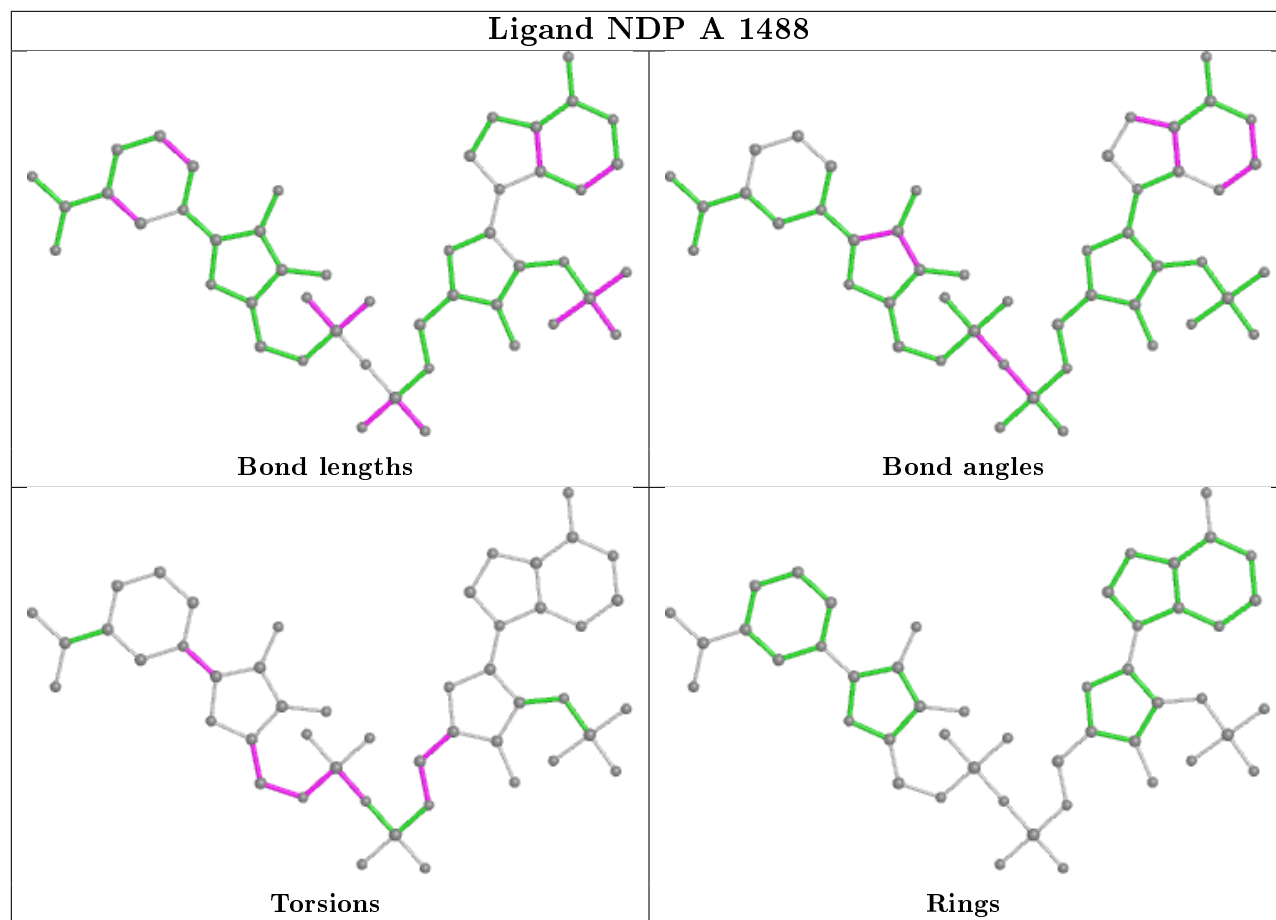
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1486	FAD	3	0
2	A	1486	FAD	3	0
4	A	1488	NDP	3	0
4	B	1488	NDP	4	0

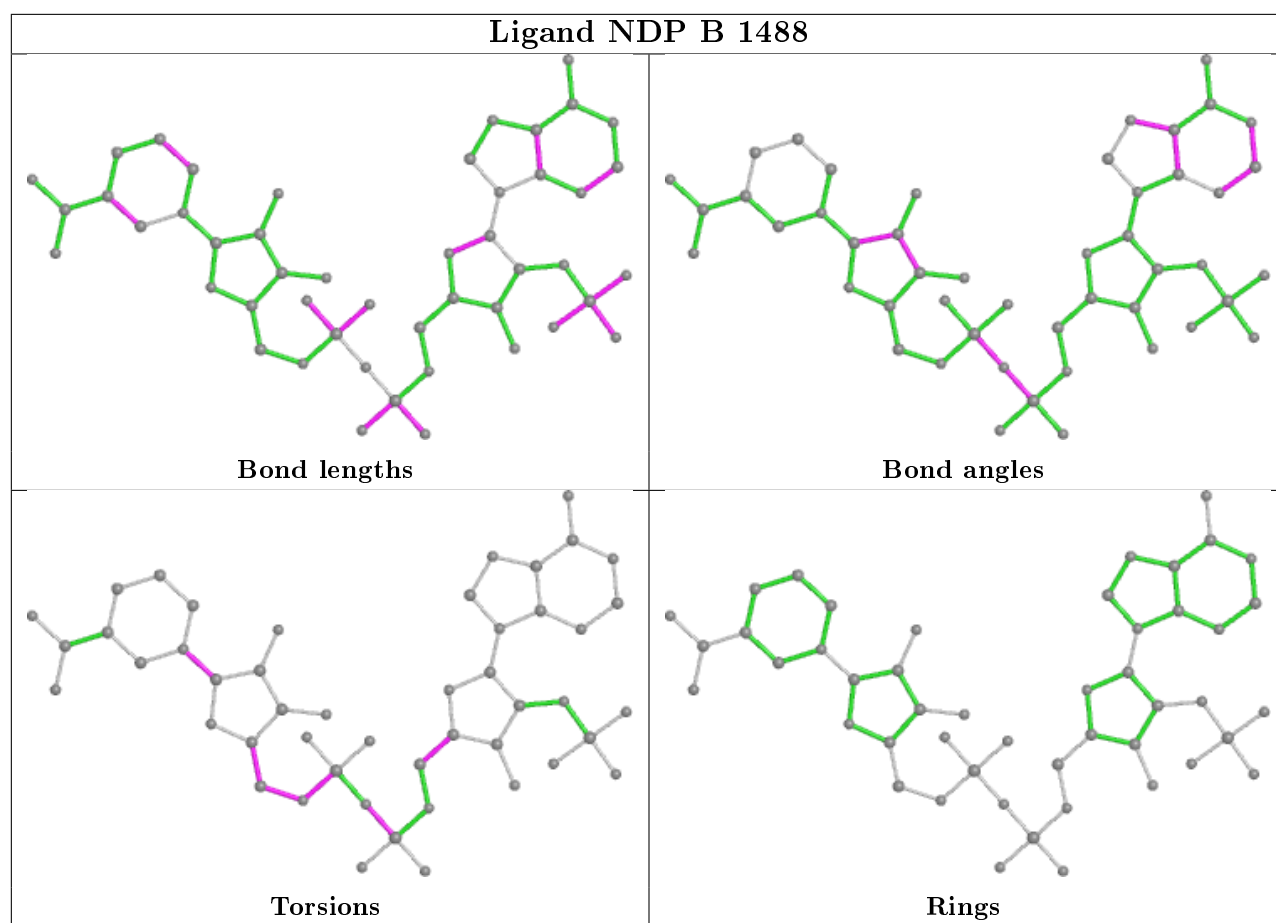
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

### 6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	485/511 (94%)	0.41	4 (0%) 86 65	55, 69, 82, 92	0
1	B	487/511 (95%)	0.43	3 (0%) 89 72	55, 69, 82, 92	0
All	All	972/1022 (95%)	0.42	7 (0%) 87 69	55, 69, 82, 92	0

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	42	PRO	2.8
1	B	87	SER	2.7
1	B	332	VAL	2.3
1	A	219	LEU	2.1
1	B	42	PRO	2.1
1	A	309	VAL	2.1
1	A	87	SER	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates [i](#)

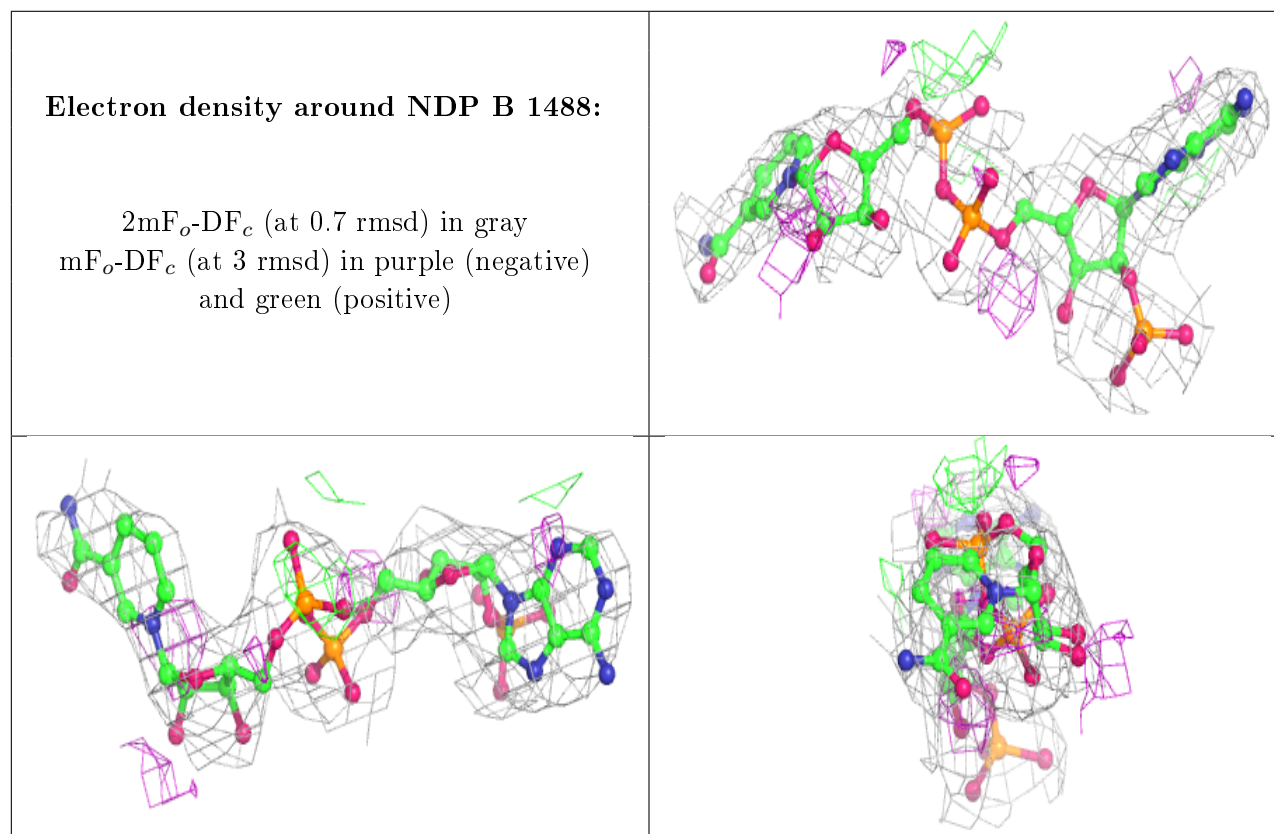
There are no carbohydrates in this entry.

### 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	NDP	B	1488	48/48	0.93	0.27	74,78,82,83	0
4	NDP	A	1488	48/48	0.94	0.25	74,78,82,82	0
5	SO4	A	1489	5/5	0.95	0.24	36,37,37,37	5
5	SO4	B	1489	5/5	0.96	0.29	35,35,36,36	5
2	FAD	A	1486	53/53	0.97	0.29	55,60,65,65	0
2	FAD	B	1486	53/53	0.98	0.29	55,60,65,65	0
3	SB	A	1487	1/1	0.99	0.23	55,55,55,55	1
3	SB	B	1487	1/1	0.99	0.23	51,51,51,51	1

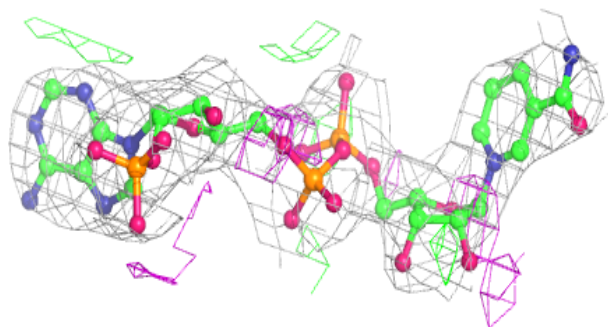
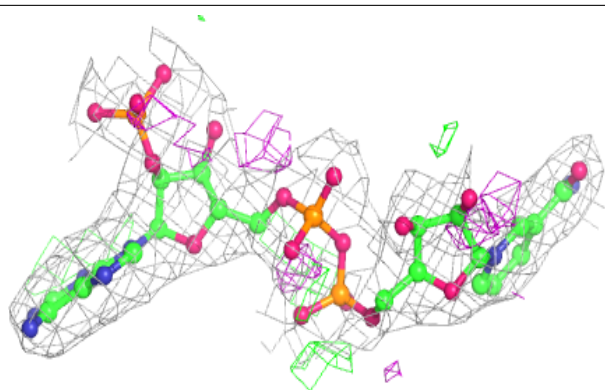
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



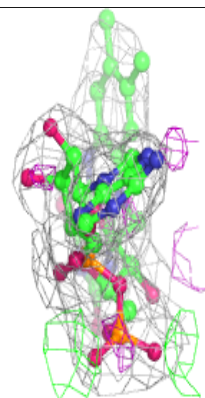
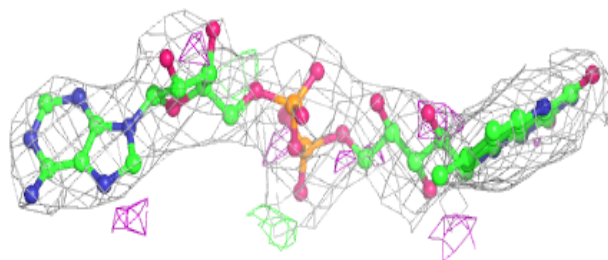
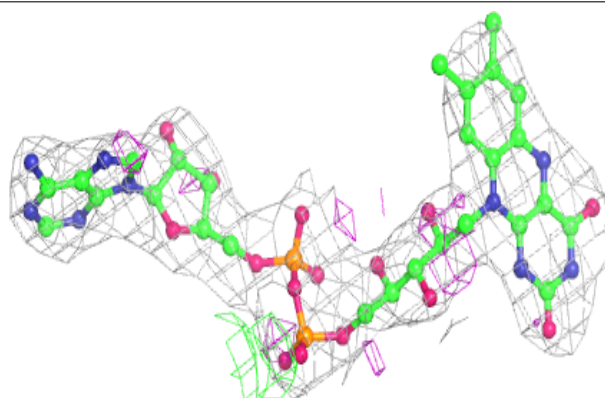


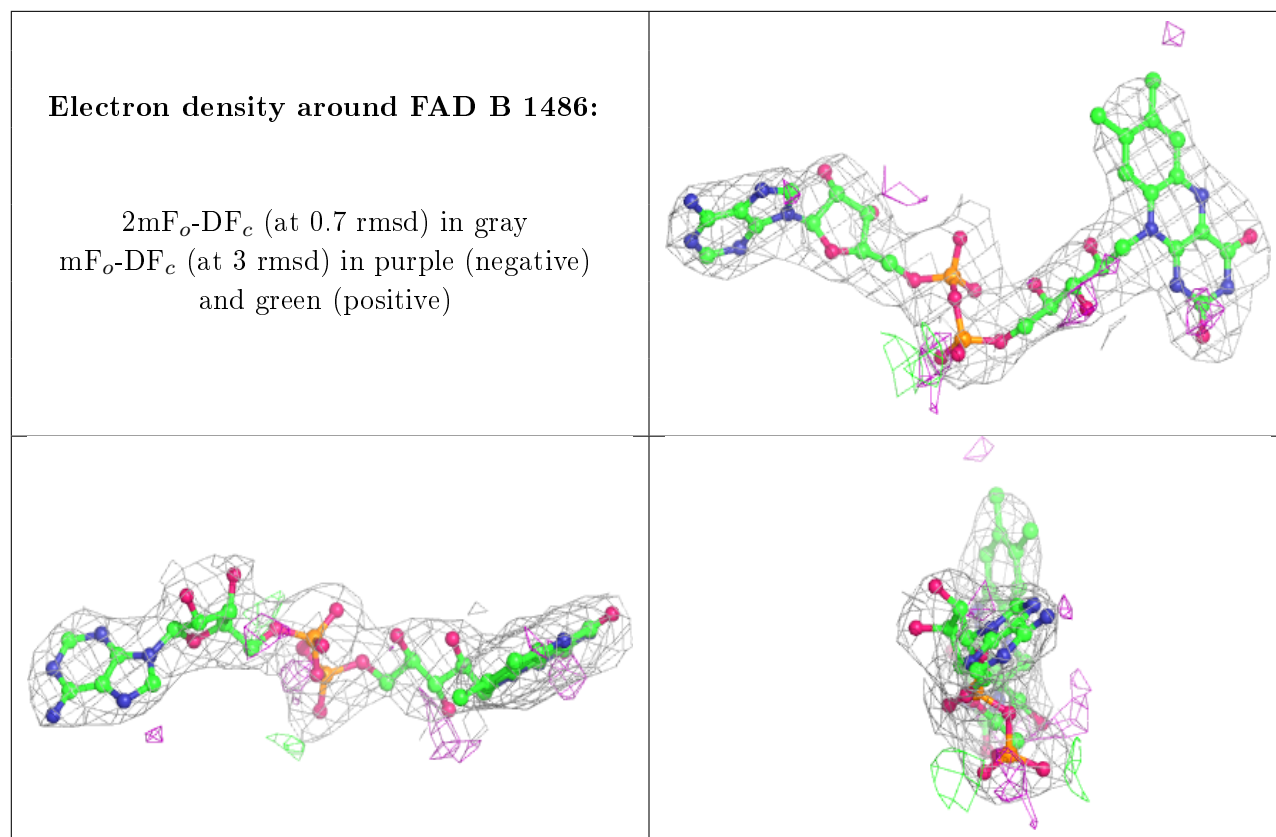
**Electron density around NDP A 1488:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

**Electron density around FAD A 1486:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.