



# Full wwPDB X-ray Structure Validation Report ⓘ

May 24, 2020 – 07:19 pm BST

PDB ID : 4I6G  
Title : a vertebrate cryptochrome with FAD  
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Deposited on : 2012-11-29  
Resolution : 2.20 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 : 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

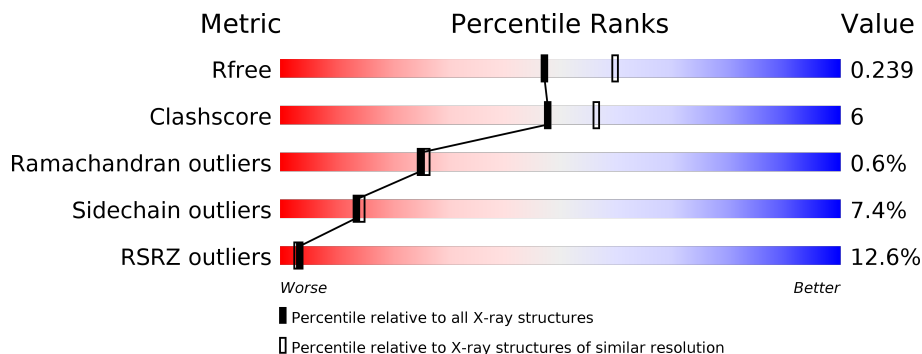
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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	512	 9% 77% 14% • 7%
1	B	512	 14% 73% 18% • 7%

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 8109 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 Cryptochrome-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	476	Total 3867	2484	681	683	19	0	0	0
1	B	476	Total 3873	2487	684	683	19	0	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	27	9	15	2	0	0
2	B	1	Total 53	27	9	15	2	0	0

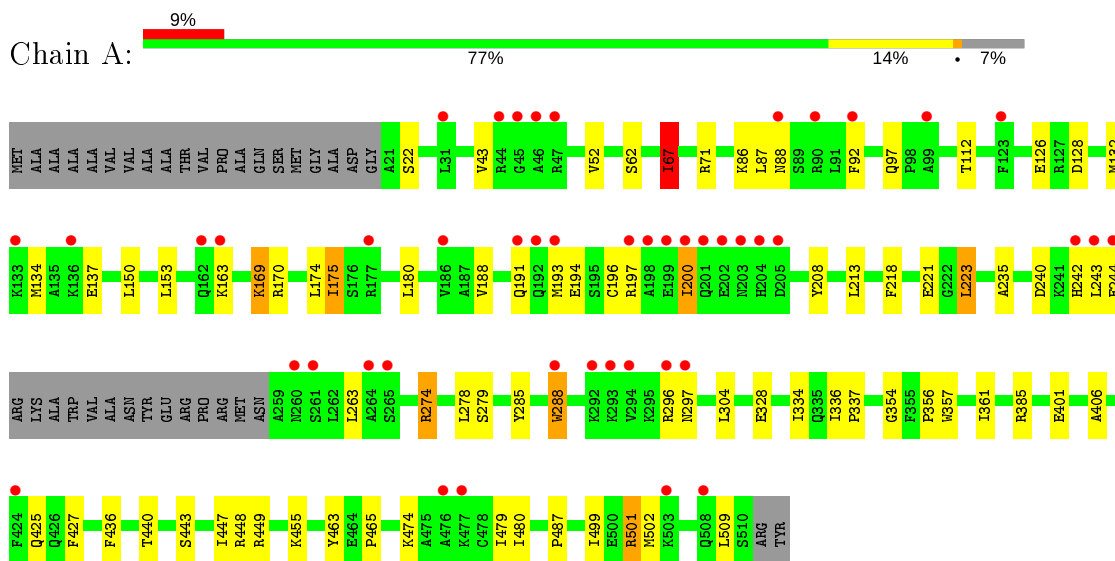
- Molecule 3 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
3	A	150	Total 150	O 150	0	0
3	B	113	Total 113	O 113	0	0

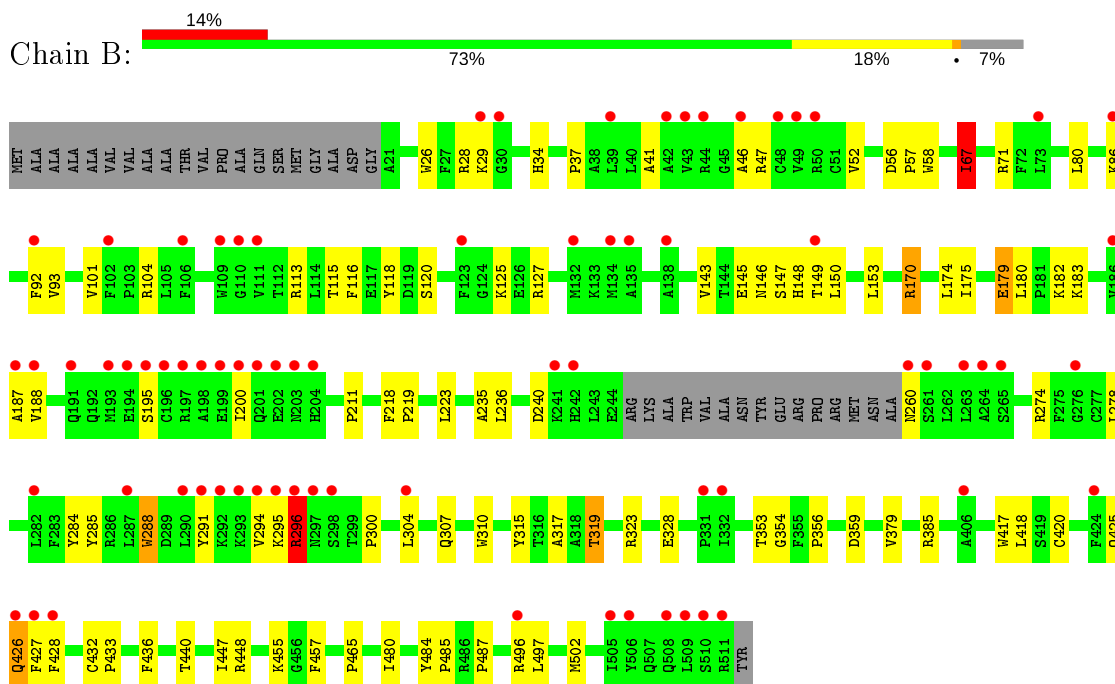
### 3 Residue-property plots [i](#)

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: Cryptochrome-2



- Molecule 1: Cryptochrome-2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	97.53Å 97.53Å 128.82Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.62 – 2.20 43.61 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.9 (43.62-2.20) 96.0 (43.61-2.20)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	0.06	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.69 (at 2.20Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.8.1_1168)	Depositor
R, $R_{free}$	0.197 , 0.238 0.199 , 0.239	Depositor DCC
$R_{free}$ test set	2010 reflections (3.28%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	43.6	Xtrriage
Anisotropy	0.120	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 51.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.053 for h,-k,-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	8109	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	69.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 60.09 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.6016e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 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	0.46	0/3979	0.58	1/5399 (0.0%)
1	B	0.40	0/3985	0.56	1/5406 (0.0%)
All	All	0.43	0/7964	0.57	2/10805 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	67	ILE	CB-CA-C	-5.22	101.15	111.60
1	A	67	ILE	CB-CA-C	-5.00	101.59	111.60

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	3867	0	3797	41	0
1	B	3873	0	3805	52	0
2	A	53	0	31	0	0
2	B	53	0	31	5	0
3	A	150	0	0	5	0
3	B	113	0	0	8	0
All	All	8109	0	7664	94	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 6.

All (94) 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:354:GLY:HA3	1:A:487:PRO:HA	1.56	0.87
1:A:87:LEU:HD13	1:A:193:MET:HG3	1.68	0.75
1:B:354:GLY:HA3	1:B:487:PRO:HA	1.67	0.74
1:B:127:ARG:NH1	3:B:1111:HOH:O	2.20	0.73
1:A:443:SER:O	1:A:448:ARG:NH2	2.24	0.70
1:B:29:LYS:HD3	1:B:148:HIS:CE1	2.27	0.69
1:B:448:ARG:HG2	1:B:455:LYS:HA	1.77	0.66
1:A:334:ILE:HD12	1:A:509:LEU:HD11	1.79	0.65
1:A:427:PHE:O	3:A:1148:HOH:O	2.13	0.65
1:B:120:SER:HB2	1:B:319:THR:HG23	1.78	0.65
1:B:179:GLU:OE2	3:B:1070:HOH:O	2.15	0.64
1:B:46:ALA:HB1	1:B:195:SER:HB2	1.81	0.63
1:A:474:LYS:HG3	1:A:479:ILE:HD11	1.81	0.62
1:B:436:PHE:O	1:B:440:THR:HG23	2.00	0.61
1:A:501:ARG:HG3	1:A:501:ARG:HH11	1.64	0.61
1:A:436:PHE:O	1:A:440:THR:HG23	2.00	0.61
1:A:401:GLU:OE2	3:A:1103:HOH:O	2.16	0.60
1:B:34:HIS:HA	1:B:187:ALA:HB2	1.83	0.60
1:B:93:VAL:HG11	1:B:211:PRO:HD3	1.82	0.60
1:A:448:ARG:HG2	1:A:455:LYS:HA	1.84	0.59
1:B:118:TYR:HB3	1:B:146:ASN:HA	1.87	0.57
1:B:294:VAL:O	1:B:296:ARG:NH2	2.38	0.57
1:A:200:ILE:H	1:A:200:ILE:HD13	1.70	0.56
1:A:194:GLU:OE2	1:A:197:ARG:NH2	2.39	0.55
1:B:385:ARG:CZ	1:B:428:PHE:HB3	2.35	0.55
1:A:67:ILE:HG23	1:A:218:PHE:CD1	2.42	0.55
1:B:356:PRO:HB2	1:B:447:ILE:HD13	1.88	0.55
1:A:357:TRP:O	1:A:361:ILE:HG12	2.07	0.54
1:A:501:ARG:HG3	1:A:501:ARG:NH1	2.22	0.54
1:B:118:TYR:OH	1:B:125:LYS:HD3	2.06	0.54
1:A:274:ARG:HD2	1:A:406:ALA:O	2.08	0.54
1:B:41:ALA:O	1:B:113:ARG:NH1	2.42	0.53
1:B:26:TRP:HB3	1:B:116:PHE:HB3	1.89	0.53
1:B:307:GLN:HB2	2:B:900:FAD:O4B	2.09	0.53
1:B:317:ALA:O	3:B:1053:HOH:O	2.19	0.51
1:B:307:GLN:HG3	2:B:900:FAD:H51A	1.91	0.51
1:B:385:ARG:HH21	1:B:428:PHE:HD2	1.58	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:71:ARG:NH2	3:A:1071:HOH:O	2.29	0.51
1:A:501:ARG:CG	1:A:501:ARG:HH11	2.23	0.51
1:B:149:THR:OG1	3:B:1035:HOH:O	2.19	0.51
1:B:67:ILE:HG23	1:B:218:PHE:CD1	2.46	0.50
1:A:499:ILE:HD13	1:B:58:TRP:HE1	1.77	0.50
1:B:310:TRP:HH2	1:B:417:TRP:CH2	2.31	0.49
1:A:208:TYR:O	3:A:1056:HOH:O	2.19	0.49
1:A:235:ALA:HB1	1:A:278:LEU:HB2	1.94	0.49
1:A:22:SER:H	1:A:112:THR:HB	1.78	0.48
1:B:34:HIS:CE1	1:B:236:LEU:HD21	2.48	0.48
2:B:900:FAD:O3'	2:B:900:FAD:H2B	2.14	0.48
1:A:128:ASP:O	1:A:132:MET:HG2	2.13	0.48
1:A:169:LYS:HE3	1:A:169:LYS:HB3	1.63	0.48
1:B:323:ARG:NH2	1:B:328:GLU:O	2.39	0.47
1:A:354:GLY:CA	1:A:487:PRO:HA	2.38	0.47
1:B:385:ARG:NH2	1:B:428:PHE:HB3	2.30	0.46
1:B:354:GLY:HA3	1:B:487:PRO:CA	2.42	0.46
1:B:71:ARG:NH2	3:B:1041:HOH:O	2.32	0.46
1:A:354:GLY:HA3	1:A:487:PRO:CA	2.35	0.45
1:A:43:VAL:HG23	1:A:196:CYS:SG	2.57	0.45
1:A:188:VAL:HB	1:A:193:MET:HE3	1.98	0.45
1:B:484:TYR:CD1	1:B:485:PRO:HD2	2.51	0.45
1:A:242:HIS:O	1:A:244:GLU:N	2.50	0.45
1:B:420:CYS:SG	1:B:428:PHE:HB2	2.57	0.45
1:B:71:ARG:NE	3:B:1041:HOH:O	2.40	0.45
1:B:448:ARG:NH1	1:B:457:PHE:O	2.51	0.44
1:B:465:PRO:HB2	1:B:480:ILE:HD11	1.98	0.44
1:A:71:ARG:HD3	1:A:213:LEU:HD11	1.99	0.44
1:B:285:TYR:HA	1:B:288:TRP:HB2	1.98	0.44
1:B:153:LEU:HD21	1:B:315:TYR:HB3	2.00	0.44
1:A:285:TYR:HA	1:A:288:TRP:HB2	1.99	0.44
1:A:356:PRO:HB2	1:A:447:ILE:HD13	1.99	0.44
1:B:432:CYS:HA	1:B:433:PRO:HD2	1.87	0.44
1:B:426:GLN:CD	1:B:426:GLN:H	2.21	0.43
1:B:115:THR:HG22	1:B:143:VAL:HB	2.00	0.43
1:B:291:TYR:CG	1:B:300:PRO:HB3	2.54	0.43
1:A:465:PRO:HB2	1:A:480:ILE:HD11	2.00	0.43
1:B:235:ALA:HB1	1:B:278:LEU:HB2	2.01	0.42
1:B:359:ASP:OD2	1:B:484:TYR:OH	2.32	0.42
1:A:175:ILE:HD12	1:A:175:ILE:HA	1.85	0.42
1:B:182:LYS:HG3	3:B:1029:HOH:O	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:353:THR:O	1:B:359:ASP:OD2	2.38	0.42
1:B:56:ASP:HA	1:B:57:PRO:HD3	1.85	0.42
1:A:336:ILE:HA	1:A:337:PRO:HD3	1.91	0.41
1:B:37:PRO:HB2	1:B:145:GLU:HG3	2.01	0.41
1:B:67:ILE:H	1:B:67:ILE:HG13	1.62	0.41
1:A:263:LEU:HA	1:A:263:LEU:HD13	1.84	0.41
1:A:440:THR:HG22	1:B:219:PRO:HG3	2.01	0.41
1:B:52:VAL:HG12	1:B:92:PHE:HB2	2.02	0.41
1:B:170:ARG:NH1	1:B:170:ARG:HA	2.35	0.41
2:B:900:FAD:H3B	2:B:900:FAD:O3P	2.21	0.41
1:B:284:TYR:CE2	1:B:288:TRP:HD1	2.38	0.41
1:A:425:GLN:NE2	3:A:1134:HOH:O	2.52	0.41
2:B:900:FAD:N6A	3:B:1018:HOH:O	2.36	0.41
1:A:52:VAL:HG12	1:A:92:PHE:HB2	2.03	0.41
1:A:447:ILE:HD11	1:A:463:TYR:CD1	2.55	0.41
1:A:134:MET:O	1:A:137:GLU:HG2	2.21	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	472/512 (92%)	450 (95%)	18 (4%)	4 (1%)	19	19
1	B	472/512 (92%)	442 (94%)	28 (6%)	2 (0%)	34	37
All	All	944/1024 (92%)	892 (94%)	46 (5%)	6 (1%)	25	26

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	296	ARG
1	A	243	LEU

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Mol	Chain	Res	Type
1	A	223	LEU
1	A	297	ASN
1	B	147	SER
1	A	221	GLU

### 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	410/434 (94%)	382 (93%)	28 (7%)	16	17
1	B	411/434 (95%)	378 (92%)	33 (8%)	12	12
All	All	821/868 (95%)	760 (93%)	61 (7%)	13	14

All (61) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	62	SER
1	A	67	ILE
1	A	86	LYS
1	A	88	ASN
1	A	97	GLN
1	A	126	GLU
1	A	150	LEU
1	A	153	LEU
1	A	163	LYS
1	A	169	LYS
1	A	170	ARG
1	A	174	LEU
1	A	175	ILE
1	A	180	LEU
1	A	191	GLN
1	A	200	ILE
1	A	223	LEU
1	A	240	ASP
1	A	274	ARG

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	A	279	SER
1	A	288	TRP
1	A	296	ARG
1	A	304	LEU
1	A	328	GLU
1	A	385	ARG
1	A	449	ARG
1	A	501	ARG
1	A	502	MET
1	B	28	ARG
1	B	47	ARG
1	B	67	ILE
1	B	80	LEU
1	B	86	LYS
1	B	101	VAL
1	B	104	ARG
1	B	150	LEU
1	B	170	ARG
1	B	174	LEU
1	B	175	ILE
1	B	179	GLU
1	B	180	LEU
1	B	183	LYS
1	B	188	VAL
1	B	200	ILE
1	B	223	LEU
1	B	240	ASP
1	B	260	ASN
1	B	274	ARG
1	B	288	TRP
1	B	295	LYS
1	B	296	ARG
1	B	304	LEU
1	B	319	THR
1	B	379	VAL
1	B	418	LEU
1	B	425	GLN
1	B	426	GLN
1	B	427	PHE
1	B	496	ARG
1	B	497	LEU
1	B	502	MET

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	426	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](#)

2 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	900	-	51,58,58	1.84	11 (21%)	60,89,89	2.00	12 (20%)
2	FAD	B	900	-	51,58,58	1.77	11 (21%)	60,89,89	2.32	13 (21%)

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	900	-	-	3/30/50/50	0/6/6/6

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	FAD	B	900	-	-	9/30/50/50	0/6/6/6

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	900	FAD	C4X-C10	7.53	1.46	1.38
2	B	900	FAD	C4X-C10	6.74	1.45	1.38
2	B	900	FAD	C2-N3	-3.77	1.30	1.38
2	A	900	FAD	C2-N3	-3.21	1.31	1.38
2	B	900	FAD	C6-C5X	-3.03	1.37	1.41
2	B	900	FAD	C4-C4X	3.03	1.46	1.41
2	A	900	FAD	C6-C5X	-3.02	1.37	1.41
2	A	900	FAD	C4-C4X	3.00	1.46	1.41
2	A	900	FAD	C1'-N10	-2.84	1.45	1.48
2	A	900	FAD	C2-N1	-2.65	1.32	1.38
2	A	900	FAD	C2B-C1B	-2.52	1.49	1.53
2	B	900	FAD	C2B-C1B	-2.51	1.50	1.53
2	B	900	FAD	C5'-C4'	-2.48	1.48	1.51
2	B	900	FAD	C9A-C5X	2.31	1.47	1.42
2	A	900	FAD	C9A-C5X	2.26	1.47	1.42
2	B	900	FAD	C2-N1	-2.24	1.33	1.38
2	A	900	FAD	C8-C7	2.22	1.46	1.40
2	A	900	FAD	C5A-N7A	-2.14	1.32	1.39
2	B	900	FAD	C4-N3	-2.07	1.29	1.33
2	B	900	FAD	O4B-C4B	-2.05	1.40	1.45
2	B	900	FAD	C5A-C4A	2.03	1.46	1.40
2	A	900	FAD	C4A-N3A	-2.03	1.32	1.35

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	900	FAD	C4-N3-C2	8.35	122.19	115.14
2	B	900	FAD	C4-N3-C2	7.68	121.63	115.14
2	B	900	FAD	O4'-C4'-C5'	-7.25	93.62	109.92
2	B	900	FAD	C1'-N10-C9A	6.58	123.47	118.29
2	A	900	FAD	C1'-N10-C9A	5.56	122.67	118.29
2	B	900	FAD	C4-C4X-C10	-4.97	116.66	119.95
2	A	900	FAD	C4X-C4-N3	-4.33	117.51	123.43
2	B	900	FAD	C4X-N5-C5X	4.05	120.82	116.77
2	A	900	FAD	C4-C4X-C10	-4.05	117.27	119.95
2	B	900	FAD	O5'-C5'-C4'	-4.02	98.64	109.36
2	A	900	FAD	C9A-N10-C10	-3.68	117.09	121.91

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	900	FAD	C4X-N5-C5X	3.65	120.42	116.77
2	B	900	FAD	C9A-N10-C10	-3.59	117.21	121.91
2	A	900	FAD	N3A-C2A-N1A	-3.33	123.47	128.68
2	B	900	FAD	C5X-C9A-N10	3.32	120.12	117.72
2	B	900	FAD	C4X-C4-N3	-3.29	118.93	123.43
2	A	900	FAD	C4-C4X-N5	3.04	122.07	118.60
2	B	900	FAD	N3A-C2A-N1A	-2.89	124.16	128.68
2	B	900	FAD	C4-C4X-N5	2.87	121.88	118.60
2	A	900	FAD	C5X-C9A-N10	2.63	119.62	117.72
2	A	900	FAD	C4'-C3'-C2'	-2.40	108.37	113.36
2	B	900	FAD	C4A-C5A-N7A	-2.39	106.91	109.40
2	A	900	FAD	O3B-C3B-C4B	-2.02	105.19	111.05
2	A	900	FAD	O2P-P-O1P	2.02	122.24	112.24
2	B	900	FAD	C2A-N1A-C6A	2.01	122.19	118.75

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	900	FAD	C5B-O5B-PA-O2A
2	B	900	FAD	C3'-C4'-C5'-O5'
2	B	900	FAD	O4'-C4'-C5'-O5'
2	B	900	FAD	C5'-O5'-P-O1P
2	B	900	FAD	C5'-O5'-P-O2P
2	B	900	FAD	C5'-O5'-P-O3P
2	B	900	FAD	O3'-C3'-C4'-C5'
2	B	900	FAD	C2'-C3'-C4'-C5'
2	A	900	FAD	C5B-O5B-PA-O3P
2	B	900	FAD	O4B-C4B-C5B-O5B
2	B	900	FAD	PA-O3P-P-O1P
2	A	900	FAD	C5B-O5B-PA-O1A

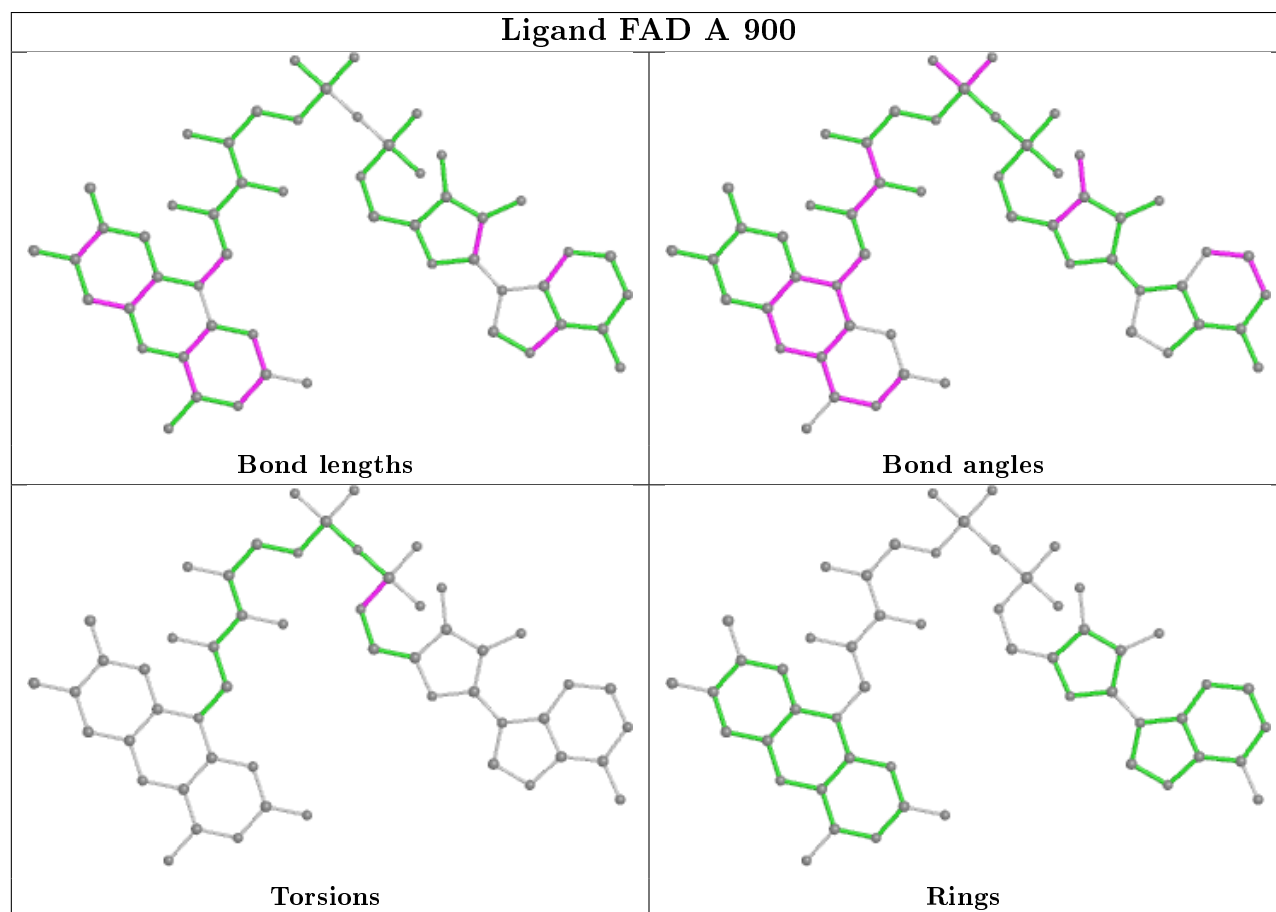
There are no ring outliers.

1 monomer is involved in 5 short contacts:

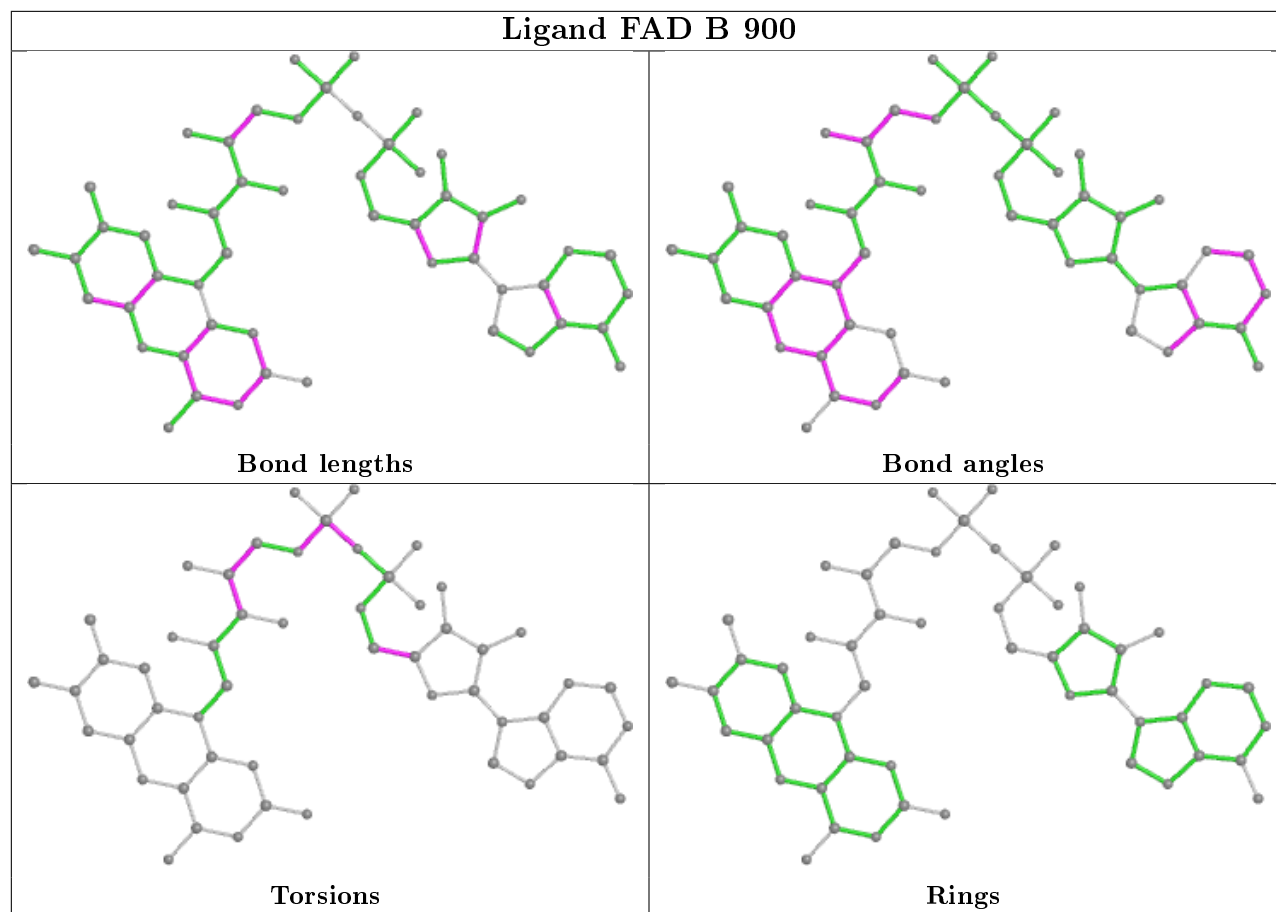
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	900	FAD	5	0

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

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	476/512 (92%)	0.44	46 (9%) <b>7</b>   <b>6</b>	30, 57, 115, 148	0
1	B	476/512 (92%)	0.85	74 (15%) <b>2</b>   <b>1</b>	33, 72, 131, 161	0
All	All	952/1024 (92%)	0.65	120 (12%) <b>3</b>   <b>3</b>	30, 65, 125, 161	0

All (120) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	510	SER	12.5
1	B	202	GLU	8.5
1	B	511	ARG	7.1
1	B	290	LEU	7.0
1	B	44	ARG	6.8
1	B	204	HIS	6.8
1	B	191	GLN	6.6
1	B	506	TYR	6.4
1	B	296	ARG	6.3
1	B	50	ARG	6.2
1	B	200	ILE	6.1
1	B	199	GLU	5.7
1	B	203	ASN	5.6
1	B	509	LEU	5.6
1	A	203	ASN	5.6
1	A	202	GLU	5.5
1	B	198	ALA	5.5
1	B	424	PHE	5.4
1	A	199	GLU	5.2
1	B	242	HIS	5.2
1	B	264	ALA	5.1
1	B	293	LYS	5.0
1	B	426	GLN	5.0
1	B	291	TYR	5.0

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	A	200	ILE	4.9
1	A	264	ALA	4.8
1	A	296	ARG	4.8
1	B	505	ILE	4.6
1	A	297	ASN	4.6
1	B	294	VAL	4.5
1	B	297	ASN	4.5
1	B	295	LYS	4.3
1	B	86	LYS	4.2
1	B	193	MET	4.1
1	B	197	ARG	3.9
1	A	92	PHE	3.8
1	A	503	LYS	3.8
1	A	260	ASN	3.7
1	B	195	SER	3.6
1	B	201	GLN	3.6
1	B	46	ALA	3.6
1	A	162	GLN	3.6
1	B	427	PHE	3.5
1	B	111	VAL	3.5
1	B	188	VAL	3.5
1	A	204	HIS	3.5
1	B	109	TRP	3.5
1	B	102	PHE	3.4
1	A	476	ALA	3.4
1	A	294	VAL	3.4
1	B	292	LYS	3.4
1	A	293	LYS	3.3
1	B	106	PHE	3.3
1	B	287	LEU	3.2
1	A	193	MET	3.2
1	A	88	ASN	3.2
1	A	508	GLN	3.1
1	B	194	GLU	3.1
1	A	292	LYS	3.1
1	A	191	GLN	3.0
1	B	49	VAL	3.0
1	B	260	ASN	3.0
1	B	132	MET	2.9
1	B	298	SER	2.9
1	A	45	GLY	2.9
1	B	92	PHE	2.9

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	B	39	LEU	2.9
1	B	134	MET	2.9
1	A	205	ASP	2.8
1	B	304	LEU	2.8
1	A	424	PHE	2.8
1	A	201	GLN	2.8
1	A	123	PHE	2.7
1	A	197	ARG	2.7
1	A	198	ALA	2.7
1	B	428	PHE	2.7
1	A	177	ARG	2.6
1	B	73	LEU	2.6
1	B	110	GLY	2.6
1	A	244	GLU	2.6
1	A	186	VAL	2.6
1	A	47	ARG	2.5
1	A	242	HIS	2.5
1	A	288	TRP	2.5
1	A	133	LYS	2.5
1	B	29	LYS	2.5
1	B	265	SER	2.5
1	A	31	LEU	2.5
1	A	44	ARG	2.5
1	B	135	ALA	2.4
1	B	30	GLY	2.4
1	A	477	LYS	2.4
1	A	192	GLN	2.4
1	B	123	PHE	2.4
1	B	496	ARG	2.3
1	B	261	SER	2.3
1	B	48	CYS	2.3
1	B	138	ALA	2.3
1	B	331	PRO	2.3
1	B	332	ILE	2.3
1	A	261	SER	2.3
1	B	42	ALA	2.2
1	B	282	LEU	2.2
1	A	136	LYS	2.2
1	A	99	ALA	2.2
1	B	263	LEU	2.1
1	A	163	LYS	2.1
1	B	43	VAL	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	508	GLN	2.1
1	A	46	ALA	2.1
1	A	90	ARG	2.1
1	A	265	SER	2.1
1	A	243	LEU	2.1
1	B	149	THR	2.1
1	B	187	ALA	2.1
1	B	406	ALA	2.1
1	B	276	GLY	2.0
1	B	196	CYS	2.0
1	B	186	VAL	2.0
1	B	241	LYS	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](#)

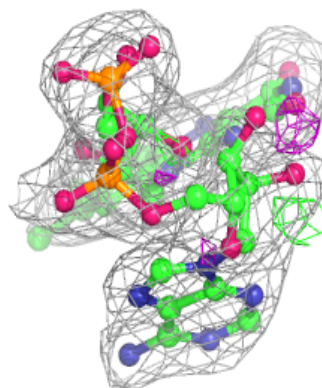
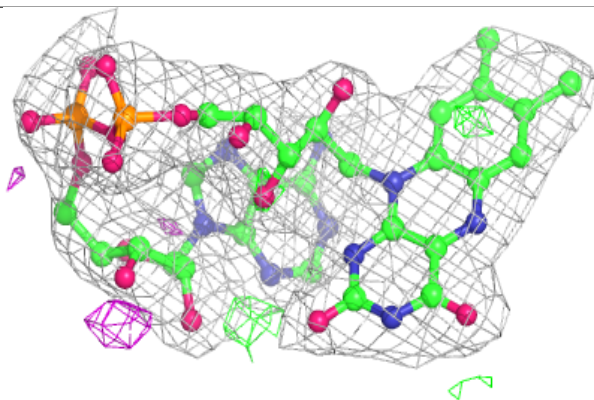
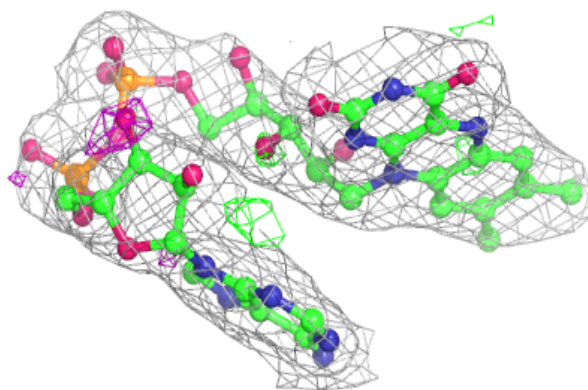
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	FAD	B	900	53/53	0.86	0.18	63,83,123,183	0
2	FAD	A	900	53/53	0.93	0.15	43,65,92,137	0

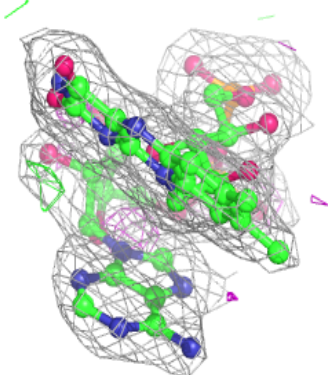
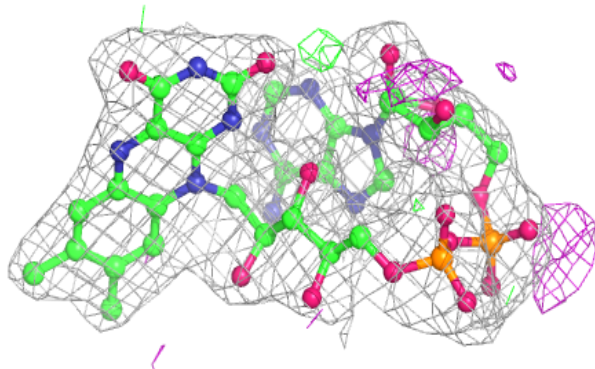
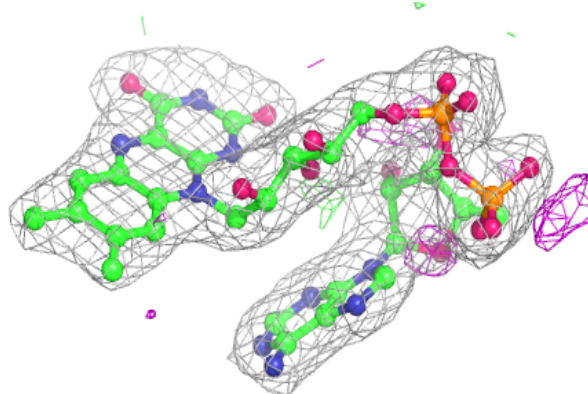
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

**Electron density around FAD B 900:**

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

**Electron density around FAD A 900:**

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



## 6.5 Other polymers

There are no such residues in this entry.