



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 10:00 AM UTC

PDB ID : 6BZT / pdb_00006bzt
Title : Crystal structure of halogenase PltM L111Y mutant in complex with FAD
Authors : Pang, A.H.; Garneau-Tsodikova, S.; Tsodikov, O.V.
Deposited on : 2017-12-26
Resolution : 2.10 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

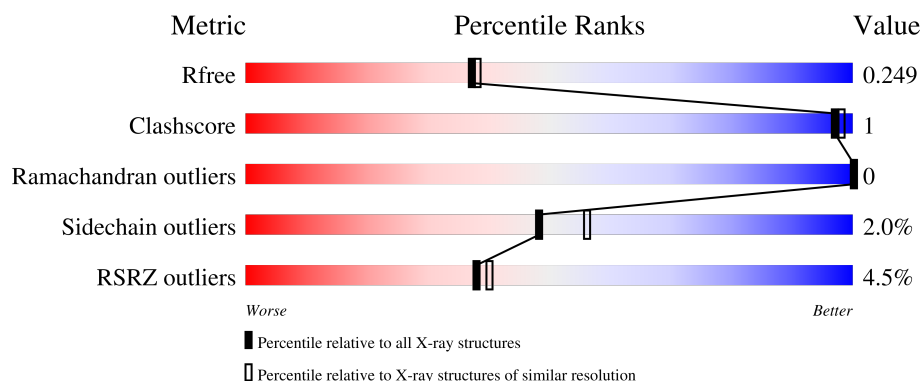
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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))
R_{free}	180053	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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 of 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 $\leq 5\%$. 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	522	3% 92% • •
1	B	522	4% 92% • •
1	C	522	2% 92% • •
1	D	522	8% 94% • •

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 17070 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 Halogenase PltM.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	501	Total	C	N	O	S	0	1	0
			3969	2533	700	725	11			
1	B	501	Total	C	N	O	S	0	2	0
			3977	2537	702	727	11			
1	C	501	Total	C	N	O	S	0	3	0
			3983	2540	703	729	11			
1	D	501	Total	C	N	O	S	0	1	0
			3970	2534	700	725	11			

There are 84 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	initiating methionine	UNP Q4KCZ3
A	-18	GLY	-	expression tag	UNP Q4KCZ3
A	-17	SER	-	expression tag	UNP Q4KCZ3
A	-16	SER	-	expression tag	UNP Q4KCZ3
A	-15	HIS	-	expression tag	UNP Q4KCZ3
A	-14	HIS	-	expression tag	UNP Q4KCZ3
A	-13	HIS	-	expression tag	UNP Q4KCZ3
A	-12	HIS	-	expression tag	UNP Q4KCZ3
A	-11	HIS	-	expression tag	UNP Q4KCZ3
A	-10	HIS	-	expression tag	UNP Q4KCZ3
A	-9	SER	-	expression tag	UNP Q4KCZ3
A	-8	SER	-	expression tag	UNP Q4KCZ3
A	-7	GLY	-	expression tag	UNP Q4KCZ3
A	-6	LEU	-	expression tag	UNP Q4KCZ3
A	-5	VAL	-	expression tag	UNP Q4KCZ3
A	-4	PRO	-	expression tag	UNP Q4KCZ3
A	-3	ARG	-	expression tag	UNP Q4KCZ3
A	-2	GLY	-	expression tag	UNP Q4KCZ3
A	-1	SER	-	expression tag	UNP Q4KCZ3
A	0	HIS	-	expression tag	UNP Q4KCZ3
A	111	TYR	LEU	engineered mutation	UNP Q4KCZ3

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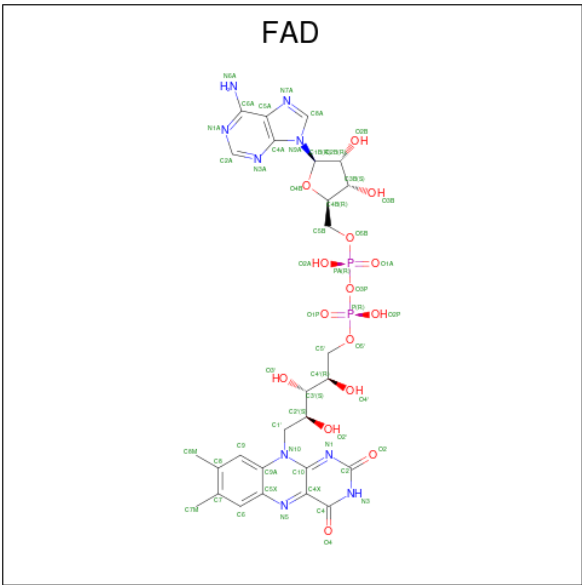
Chain	Residue	Modelled	Actual	Comment	Reference
B	-19	MET	-	initiating methionine	UNP Q4KCZ3
B	-18	GLY	-	expression tag	UNP Q4KCZ3
B	-17	SER	-	expression tag	UNP Q4KCZ3
B	-16	SER	-	expression tag	UNP Q4KCZ3
B	-15	HIS	-	expression tag	UNP Q4KCZ3
B	-14	HIS	-	expression tag	UNP Q4KCZ3
B	-13	HIS	-	expression tag	UNP Q4KCZ3
B	-12	HIS	-	expression tag	UNP Q4KCZ3
B	-11	HIS	-	expression tag	UNP Q4KCZ3
B	-10	HIS	-	expression tag	UNP Q4KCZ3
B	-9	SER	-	expression tag	UNP Q4KCZ3
B	-8	SER	-	expression tag	UNP Q4KCZ3
B	-7	GLY	-	expression tag	UNP Q4KCZ3
B	-6	LEU	-	expression tag	UNP Q4KCZ3
B	-5	VAL	-	expression tag	UNP Q4KCZ3
B	-4	PRO	-	expression tag	UNP Q4KCZ3
B	-3	ARG	-	expression tag	UNP Q4KCZ3
B	-2	GLY	-	expression tag	UNP Q4KCZ3
B	-1	SER	-	expression tag	UNP Q4KCZ3
B	0	HIS	-	expression tag	UNP Q4KCZ3
B	111	TYR	LEU	engineered mutation	UNP Q4KCZ3
C	-19	MET	-	initiating methionine	UNP Q4KCZ3
C	-18	GLY	-	expression tag	UNP Q4KCZ3
C	-17	SER	-	expression tag	UNP Q4KCZ3
C	-16	SER	-	expression tag	UNP Q4KCZ3
C	-15	HIS	-	expression tag	UNP Q4KCZ3
C	-14	HIS	-	expression tag	UNP Q4KCZ3
C	-13	HIS	-	expression tag	UNP Q4KCZ3
C	-12	HIS	-	expression tag	UNP Q4KCZ3
C	-11	HIS	-	expression tag	UNP Q4KCZ3
C	-10	HIS	-	expression tag	UNP Q4KCZ3
C	-9	SER	-	expression tag	UNP Q4KCZ3
C	-8	SER	-	expression tag	UNP Q4KCZ3
C	-7	GLY	-	expression tag	UNP Q4KCZ3
C	-6	LEU	-	expression tag	UNP Q4KCZ3
C	-5	VAL	-	expression tag	UNP Q4KCZ3
C	-4	PRO	-	expression tag	UNP Q4KCZ3
C	-3	ARG	-	expression tag	UNP Q4KCZ3
C	-2	GLY	-	expression tag	UNP Q4KCZ3
C	-1	SER	-	expression tag	UNP Q4KCZ3
C	0	HIS	-	expression tag	UNP Q4KCZ3
C	111	TYR	LEU	engineered mutation	UNP Q4KCZ3

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-19	MET	-	initiating methionine	UNP Q4KCZ3
D	-18	GLY	-	expression tag	UNP Q4KCZ3
D	-17	SER	-	expression tag	UNP Q4KCZ3
D	-16	SER	-	expression tag	UNP Q4KCZ3
D	-15	HIS	-	expression tag	UNP Q4KCZ3
D	-14	HIS	-	expression tag	UNP Q4KCZ3
D	-13	HIS	-	expression tag	UNP Q4KCZ3
D	-12	HIS	-	expression tag	UNP Q4KCZ3
D	-11	HIS	-	expression tag	UNP Q4KCZ3
D	-10	HIS	-	expression tag	UNP Q4KCZ3
D	-9	SER	-	expression tag	UNP Q4KCZ3
D	-8	SER	-	expression tag	UNP Q4KCZ3
D	-7	GLY	-	expression tag	UNP Q4KCZ3
D	-6	LEU	-	expression tag	UNP Q4KCZ3
D	-5	VAL	-	expression tag	UNP Q4KCZ3
D	-4	PRO	-	expression tag	UNP Q4KCZ3
D	-3	ARG	-	expression tag	UNP Q4KCZ3
D	-2	GLY	-	expression tag	UNP Q4KCZ3
D	-1	SER	-	expression tag	UNP Q4KCZ3
D	0	HIS	-	expression tag	UNP Q4KCZ3
D	111	TYR	LEU	engineered mutation	UNP Q4KCZ3

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂).



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

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Cl	0	0
			1	1		
3	B	1	Total	Cl	0	0
			1	1		
3	C	1	Total	Cl	0	0
			1	1		
3	D	2	Total	Cl	0	0
			2	2		

- Molecule 4 is BROMIDE ION (CCD ID: BR) (formula: Br).

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

- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Ca	0	0
			1	1		
5	B	1	Total	Ca	0	0
			1	1		

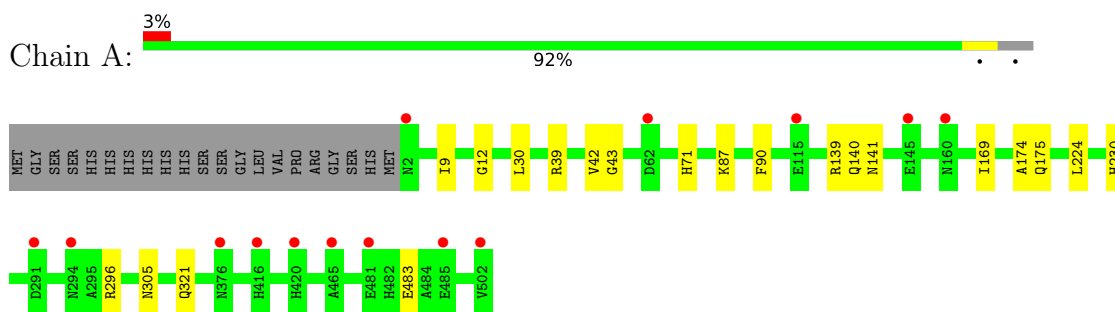
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	293	Total 293	O 293	0	0
6	B	244	Total 244	O 244	0	0
6	C	241	Total 241	O 241	0	0
6	D	165	Total 165	O 165	0	0

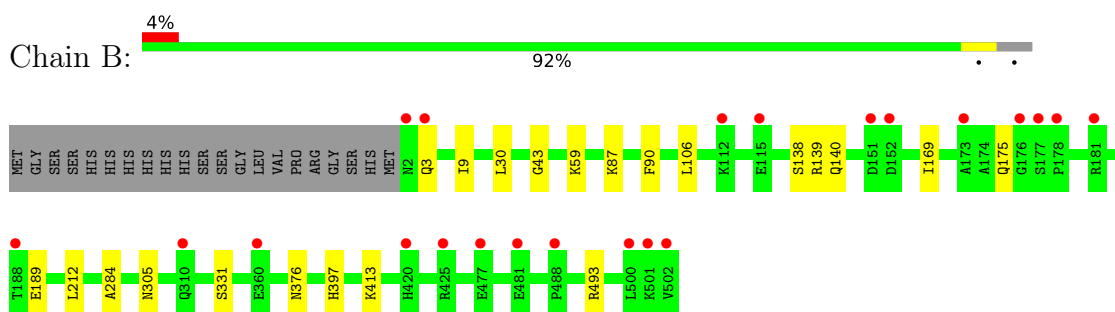
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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.

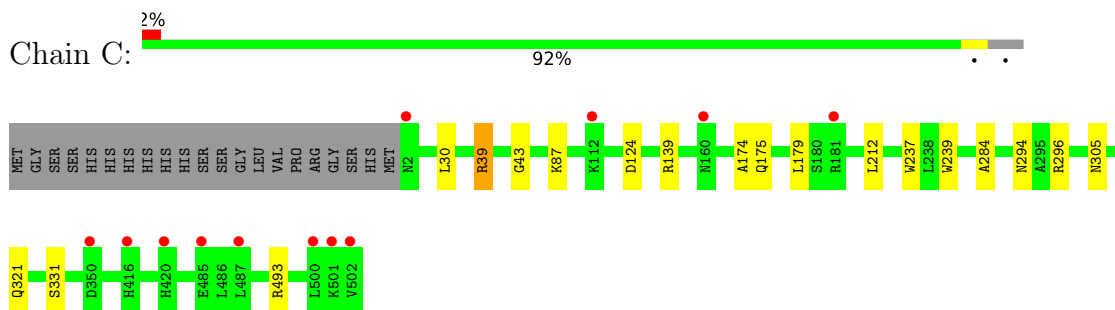
- Molecule 1: Halogenase PltM



- Molecule 1: Halogenase PltM

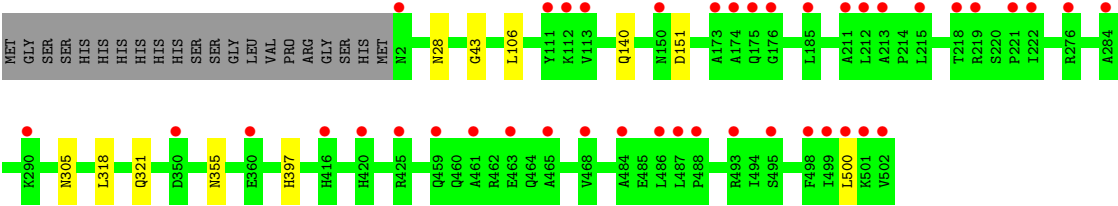


- Molecule 1: Halogenase PltM



- Molecule 1: Halogenase PltM





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	63.97Å 157.46Å 213.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.00 – 2.10 35.00 – 2.10	Depositor EDS
% Data completeness (in resolution range)	94.7 (35.00-2.10) 94.7 (35.00-2.10)	Depositor EDS
R_{merge}	0.20	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.52 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.8.0107	Depositor
R, R_{free}	0.207 , 0.244 0.213 , 0.249	Depositor DCC
R_{free} test set	5971 reflections (4.72%)	wwPDB-VP
Wilson B-factor (Å ²)	21.2	Xtriage
Anisotropy	0.210	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 28.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	17070	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.72% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: CL, BR, FAD, CA

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	0.52	0/4070	0.81	0/5527
1	B	0.52	0/4078	0.82	0/5538
1	C	0.52	0/4084	0.81	0/5546
1	D	0.54	0/4071	0.82	0/5528
All	All	0.52	0/16303	0.82	0/22139

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 [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	3969	0	3906	9	0
1	B	3977	0	3911	9	0
1	C	3983	0	3915	8	0
1	D	3970	0	3908	2	0
2	A	53	0	31	2	0
2	B	53	0	31	2	0
2	C	53	0	31	3	0
2	D	53	0	31	2	0
3	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	2	0	0	0	0
4	A	4	0	0	0	0
4	B	2	0	0	0	0
4	C	2	0	0	0	0
4	D	1	0	0	0	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
6	A	293	0	0	1	0
6	B	244	0	0	2	0
6	C	241	0	0	0	0
6	D	165	0	0	0	0
All	All	17070	0	15764	28	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 1.

All (28) 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:331:SER:OG	2:B:601:FAD:N3	2.37	0.57
1:B:493:ARG:NE	1:B:493:ARG:HA	2.20	0.56
1:B:376[B]:ASN:ND2	6:B:701:HOH:O	2.39	0.55
1:C:39:ARG:NH2	1:C:124:ASP:OD2	2.40	0.54
1:D:43:GLY:HA2	2:D:601:FAD:C4X	2.38	0.53
1:C:43:GLY:HA2	2:C:601:FAD:C4X	2.39	0.53
1:A:12:GLY:HA2	1:A:39:ARG:NH2	2.25	0.52
1:B:43:GLY:HA2	2:B:601:FAD:C4X	2.41	0.51
1:B:138:SER:HB3	6:B:804:HOH:O	2.12	0.50
1:C:30:LEU:HD11	1:C:139:ARG:HD3	1.93	0.50
1:A:174:ALA:HA	1:A:321:GLN:HB3	1.94	0.49
1:A:43:GLY:HA2	2:A:601:FAD:C4X	2.45	0.47
1:A:90:PHE:CD1	1:A:230:HIS:HE1	2.32	0.47
1:B:87:LYS:NZ	1:B:90:PHE:CE1	2.83	0.46
1:C:174:ALA:HA	1:C:321:GLN:HB3	1.97	0.46
1:D:321:GLN:HG3	2:D:601:FAD:H5'1	1.99	0.45
1:C:321:GLN:CG	2:C:601:FAD:H3'	2.47	0.44
1:B:9:ILE:HD11	1:B:169:ILE:HD11	2.00	0.43
1:C:237:TRP:CZ3	1:C:239:TRP:HB3	2.55	0.42
1:C:331[A]:SER:OG	2:C:601:FAD:N3	2.52	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:30:LEU:HD11	1:A:139:ARG:HD3	2.01	0.41
1:B:30:LEU:HD11	1:B:139:ARG:HD3	2.02	0.41
1:A:87:LYS:NZ	1:A:90:PHE:CE1	2.89	0.41
1:C:212:LEU:HD21	1:C:284:ALA:O	2.20	0.41
1:A:71:HIS:HE1	6:A:964:HOH:O	2.03	0.41
1:B:212:LEU:HD21	1:B:284:ALA:O	2.21	0.41
1:A:321:GLN:HG3	2:A:601:FAD:H5'1	2.04	0.40
1:A:9:ILE:HD11	1:A:169:ILE:HD11	2.02	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	500/522 (96%)	490 (98%)	10 (2%)	0	100	100
1	B	501/522 (96%)	491 (98%)	10 (2%)	0	100	100
1	C	502/522 (96%)	492 (98%)	10 (2%)	0	100	100
1	D	500/522 (96%)	489 (98%)	11 (2%)	0	100	100
All	All	2003/2088 (96%)	1962 (98%)	41 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	423/440 (96%)	415 (98%)	8 (2%)	50	58
1	B	424/440 (96%)	415 (98%)	9 (2%)	47	54
1	C	425/440 (97%)	417 (98%)	8 (2%)	50	58
1	D	423/440 (96%)	414 (98%)	9 (2%)	47	54
All	All	1695/1760 (96%)	1661 (98%)	34 (2%)	48	56

All (34) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	42	VAL
1	A	140	GLN
1	A	141	ASN
1	A	175	GLN
1	A	224	LEU
1	A	296	ARG
1	A	305	ASN
1	A	483	GLU
1	B	3	GLN
1	B	59	LYS
1	B	106	LEU
1	B	140	GLN
1	B	175	GLN
1	B	189	GLU
1	B	305	ASN
1	B	397	HIS
1	B	413	LYS
1	C	39	ARG
1	C	87	LYS
1	C	175	GLN
1	C	179	LEU
1	C	294	ASN
1	C	296	ARG
1	C	305	ASN
1	C	493	ARG
1	D	28	ASN
1	D	106	LEU
1	D	140	GLN
1	D	151	ASP
1	D	305	ASN
1	D	318	LEU
1	D	355	ASN
1	D	397	HIS

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Mol	Chain	Res	Type
1	D	500	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (26) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	71	HIS
1	A	98	ASN
1	A	140	GLN
1	A	321	GLN
1	B	96	GLN
1	B	98	ASN
1	B	182	GLN
1	B	321	GLN
1	B	405	ASN
1	B	420	HIS
1	B	453	GLN
1	B	460	GLN
1	C	71	HIS
1	C	96	GLN
1	C	98	ASN
1	C	230	HIS
1	C	294	ASN
1	C	321	GLN
1	C	378	GLN
1	C	405	ASN
1	C	456	GLN
1	D	36	GLN
1	D	78	HIS
1	D	98	ASN
1	D	376	ASN
1	D	460	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 20 ligands modelled in this entry, 16 are monoatomic - leaving 4 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	D	601	-	58,58,58	1.62	11 (18%)	85,89,89	1.73	19 (22%)
2	FAD	B	601	-	58,58,58	1.60	11 (18%)	85,89,89	1.67	16 (18%)
2	FAD	C	601	-	58,58,58	1.58	11 (18%)	85,89,89	1.68	18 (21%)
2	FAD	A	601	-	58,58,58	1.62	11 (18%)	85,89,89	1.68	19 (22%)

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	D	601	-	-	5/34/50/50	0/6/6/6
2	FAD	B	601	-	-	0/34/50/50	0/6/6/6
2	FAD	C	601	-	-	1/34/50/50	0/6/6/6
2	FAD	A	601	-	-	2/34/50/50	0/6/6/6

All (44) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	601	FAD	C9A-C5X	5.84	1.50	1.41
2	D	601	FAD	C9A-C5X	5.79	1.50	1.41
2	C	601	FAD	C9A-C5X	5.79	1.50	1.41
2	B	601	FAD	C9A-C5X	5.76	1.50	1.41
2	D	601	FAD	C5A-C4A	4.92	1.47	1.39
2	A	601	FAD	C5A-C4A	4.89	1.47	1.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	601	FAD	C5A-C4A	4.83	1.47	1.39
2	B	601	FAD	C5A-C4A	4.69	1.47	1.39
2	A	601	FAD	C8-C7	3.83	1.50	1.40
2	B	601	FAD	C8-C7	3.77	1.50	1.40
2	D	601	FAD	C8-C7	3.77	1.50	1.40
2	C	601	FAD	C8-C7	3.68	1.49	1.40
2	D	601	FAD	C5A-C6A	3.01	1.49	1.41
2	A	601	FAD	C5A-C6A	2.87	1.49	1.41
2	C	601	FAD	C5A-C6A	2.85	1.48	1.41
2	B	601	FAD	C1'-C2'	2.61	1.56	1.52
2	B	601	FAD	C5A-N7A	-2.54	1.34	1.39
2	B	601	FAD	C5A-C6A	2.53	1.48	1.41
2	D	601	FAD	C8A-N7A	2.51	1.36	1.31
2	D	601	FAD	P-O3P	2.48	1.62	1.59
2	A	601	FAD	C4-N3	-2.46	1.34	1.38
2	A	601	FAD	C8A-N7A	2.46	1.36	1.31
2	B	601	FAD	C4-N3	-2.44	1.34	1.38
2	D	601	FAD	C4X-N5	2.39	1.35	1.30
2	C	601	FAD	C4X-N5	2.39	1.35	1.30
2	C	601	FAD	C5A-N7A	-2.37	1.34	1.39
2	D	601	FAD	PA-O3P	2.32	1.62	1.59
2	A	601	FAD	C10-N10	2.31	1.42	1.37
2	C	601	FAD	C4-N3	-2.30	1.34	1.38
2	D	601	FAD	C4-N3	-2.30	1.34	1.38
2	A	601	FAD	P-O3P	2.28	1.62	1.59
2	C	601	FAD	C8A-N7A	2.28	1.36	1.31
2	A	601	FAD	C5A-N7A	-2.22	1.35	1.39
2	A	601	FAD	C4X-N5	2.21	1.35	1.30
2	D	601	FAD	C5A-N7A	-2.21	1.35	1.39
2	B	601	FAD	C4A-N9A	-2.19	1.33	1.37
2	D	601	FAD	C10-N10	2.18	1.42	1.37
2	B	601	FAD	P-O3P	2.17	1.61	1.59
2	B	601	FAD	C8A-N7A	2.14	1.35	1.31
2	A	601	FAD	PA-O3P	2.10	1.61	1.59
2	C	601	FAD	C10-N10	2.09	1.41	1.37
2	C	601	FAD	P-O3P	2.03	1.61	1.59
2	C	601	FAD	PA-O3P	2.02	1.61	1.59
2	B	601	FAD	C10-N10	2.01	1.41	1.37

All (72) bond angle outliers are listed below:

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	601	FAD	C5A-C4A-N3A	-5.95	118.52	126.72
2	A	601	FAD	C5A-C4A-N3A	-5.87	118.63	126.72
2	C	601	FAD	C5A-C4A-N3A	-5.85	118.66	126.72
2	B	601	FAD	C5A-C4A-N3A	-5.72	118.84	126.72
2	B	601	FAD	N3A-C4A-N9A	4.88	135.47	127.17
2	C	601	FAD	N3A-C4A-N9A	4.85	135.41	127.17
2	A	601	FAD	N3A-C4A-N9A	4.72	135.20	127.17
2	D	601	FAD	N3A-C4A-N9A	4.48	134.79	127.17
2	D	601	FAD	C4-C4X-N5	4.27	124.11	118.21
2	C	601	FAD	C4-C4X-N5	4.02	123.77	118.21
2	D	601	FAD	C2A-N3A-C4A	4.02	121.65	111.83
2	A	601	FAD	C2A-N3A-C4A	3.97	121.52	111.83
2	D	601	FAD	N3A-C2A-N1A	-3.92	122.65	128.58
2	A	601	FAD	N3A-C2A-N1A	-3.88	122.71	128.58
2	D	601	FAD	C4A-C5A-N7A	-3.85	106.17	110.58
2	C	601	FAD	C2A-N3A-C4A	3.84	121.21	111.83
2	C	601	FAD	N3A-C2A-N1A	-3.79	122.85	128.58
2	B	601	FAD	C2A-N3A-C4A	3.65	120.75	111.83
2	B	601	FAD	C4-C4X-N5	3.57	123.14	118.21
2	A	601	FAD	C4-C4X-N5	3.52	123.06	118.21
2	A	601	FAD	C4A-C5A-N7A	-3.48	106.61	110.58
2	B	601	FAD	N3A-C2A-N1A	-3.46	123.34	128.58
2	C	601	FAD	C4A-C5A-N7A	-3.45	106.64	110.58
2	B	601	FAD	C4A-N9A-C8A	3.11	109.00	105.74
2	B	601	FAD	C4X-C10-N10	3.08	120.90	116.48
2	B	601	FAD	C4A-C5A-N7A	-3.05	107.10	110.58
2	C	601	FAD	C4A-N9A-C8A	2.99	108.88	105.74
2	D	601	FAD	C5A-N7A-C8A	2.94	108.07	103.45
2	B	601	FAD	C1'-C2'-C3'	2.86	117.42	109.66
2	C	601	FAD	C5A-N7A-C8A	2.83	107.90	103.45
2	A	601	FAD	C4A-N9A-C8A	2.77	108.65	105.74
2	A	601	FAD	C5A-N7A-C8A	2.73	107.75	103.45
2	A	601	FAD	C4X-C10-N1	-2.69	118.01	124.59
2	D	601	FAD	C10-N1-C2	2.62	122.53	116.85
2	B	601	FAD	C4X-C10-N1	-2.62	118.16	124.59
2	D	601	FAD	O4B-C1B-N9A	2.62	113.12	108.09
2	D	601	FAD	C4X-C10-N1	-2.59	118.25	124.59
2	C	601	FAD	C4X-C10-N1	-2.43	118.64	124.59
2	D	601	FAD	C6A-C5A-N7A	2.41	136.73	132.09
2	A	601	FAD	C10-N1-C2	2.40	122.05	116.85
2	D	601	FAD	C4A-N9A-C8A	2.39	108.25	105.74

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	601	FAD	C4X-C10-N10	2.38	119.88	116.48
2	D	601	FAD	C4X-C4-N3	2.36	119.25	113.25
2	D	601	FAD	C4X-C10-N10	2.34	119.83	116.48
2	D	601	FAD	C5X-N5-C4X	2.33	121.85	118.09
2	B	601	FAD	C10-N1-C2	2.32	121.87	116.85
2	B	601	FAD	C5A-N7A-C8A	2.32	107.09	103.45
2	C	601	FAD	N9A-C8A-N7A	-2.32	110.65	113.94
2	C	601	FAD	C10-N1-C2	2.29	121.81	116.85
2	B	601	FAD	C10-C4X-N5	-2.28	120.15	124.81
2	D	601	FAD	C10-C4X-N5	-2.27	120.18	124.81
2	D	601	FAD	C5'-C4'-C3'	-2.25	107.97	112.22
2	A	601	FAD	C4X-C4-N3	2.25	118.97	113.25
2	A	601	FAD	C4X-C10-N10	2.24	119.69	116.48
2	A	601	FAD	C6A-C5A-N7A	2.22	136.37	132.09
2	C	601	FAD	C1'-C2'-C3'	2.20	115.61	109.66
2	D	601	FAD	N9A-C8A-N7A	-2.19	110.82	113.94
2	A	601	FAD	N9A-C8A-N7A	-2.19	110.83	113.94
2	C	601	FAD	C10-C4X-N5	-2.19	120.34	124.81
2	C	601	FAD	C4X-C4-N3	2.18	118.80	113.25
2	C	601	FAD	C2A-N1A-C6A	2.14	122.24	118.73
2	C	601	FAD	C5X-N5-C4X	2.13	121.53	118.09
2	D	601	FAD	C2A-N1A-C6A	2.12	122.22	118.73
2	B	601	FAD	O2-C2-N1	-2.09	118.32	121.80
2	B	601	FAD	O2P-P-O1P	2.09	122.17	112.44
2	A	601	FAD	C5X-N5-C4X	2.08	121.45	118.09
2	A	601	FAD	C1'-C2'-C3'	2.06	115.23	109.66
2	A	601	FAD	O3P-P-O1P	-2.06	104.52	110.70
2	C	601	FAD	C6A-C5A-N7A	2.05	136.04	132.09
2	A	601	FAD	C10-C4X-N5	-2.04	120.64	124.81
2	B	601	FAD	C1'-N10-C9A	2.04	124.59	120.63
2	A	601	FAD	C2A-N1A-C6A	2.00	122.02	118.73

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	D	601	FAD	C2'-C3'-C4'-C5'
2	D	601	FAD	C2'-C3'-C4'-O4'
2	D	601	FAD	O3'-C3'-C4'-C5'
2	D	601	FAD	O3'-C3'-C4'-O4'
2	A	601	FAD	C2'-C3'-C4'-O4'
2	C	601	FAD	C2'-C3'-C4'-O4'

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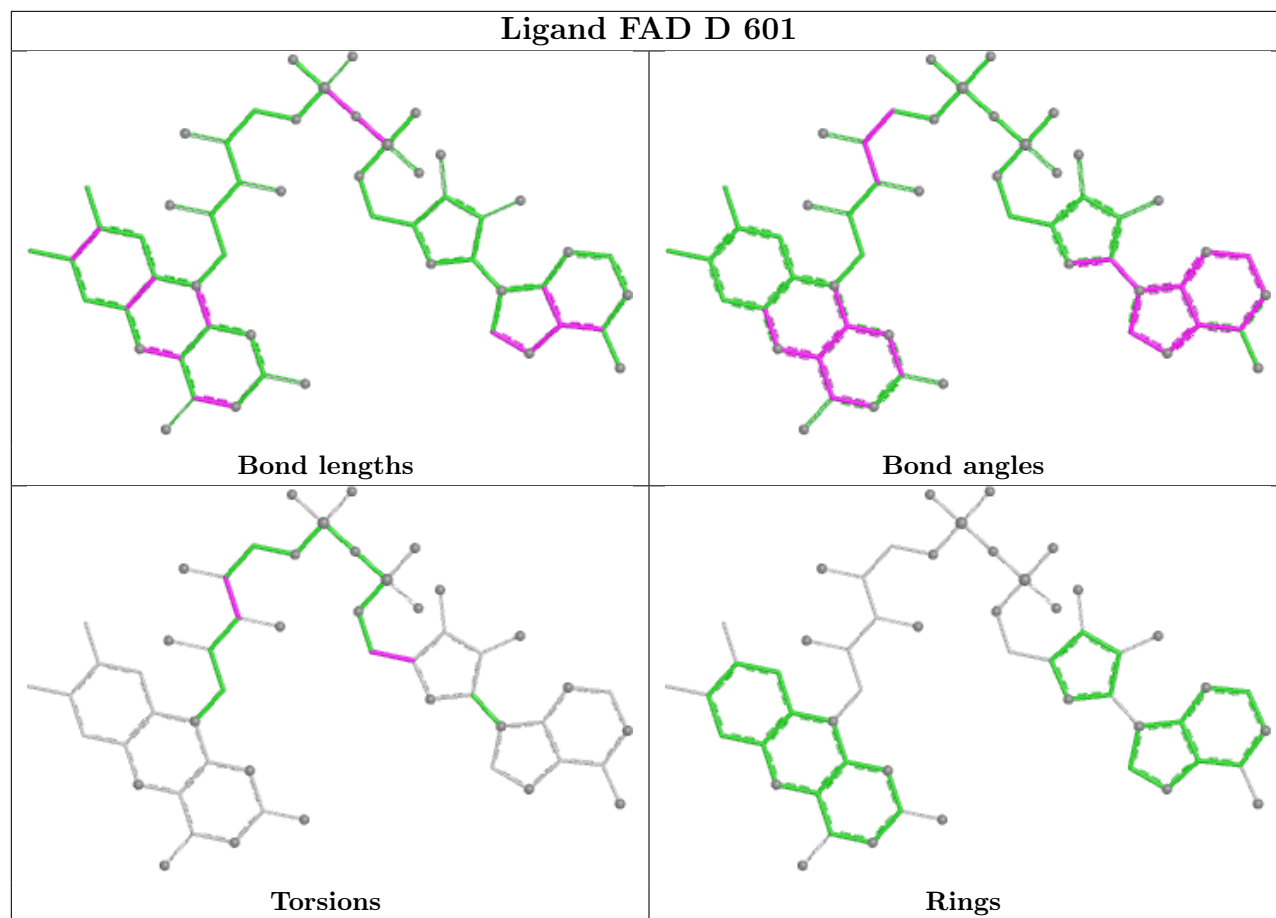
Mol	Chain	Res	Type	Atoms
2	A	601	FAD	O4B-C4B-C5B-O5B
2	D	601	FAD	O4B-C4B-C5B-O5B

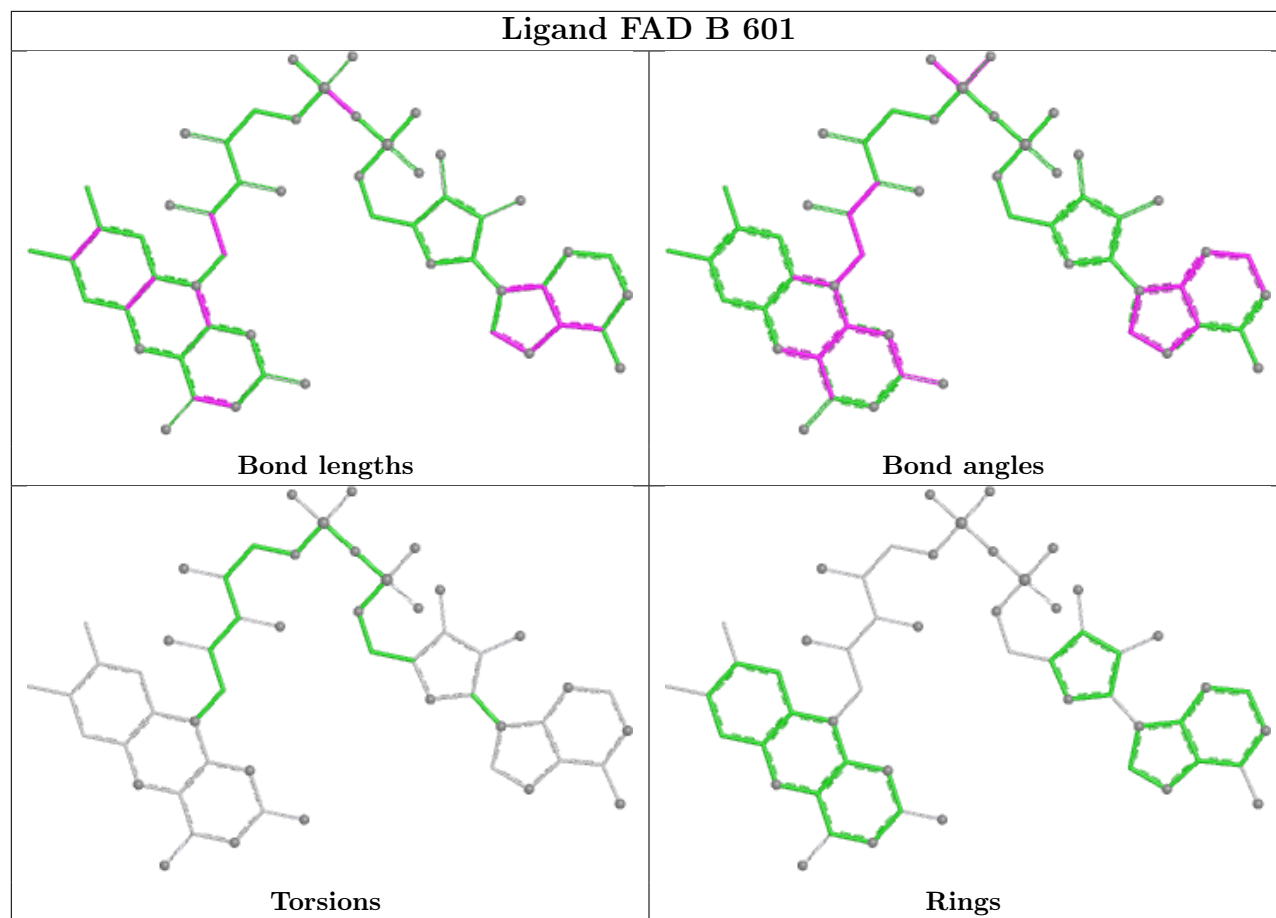
There are no ring outliers.

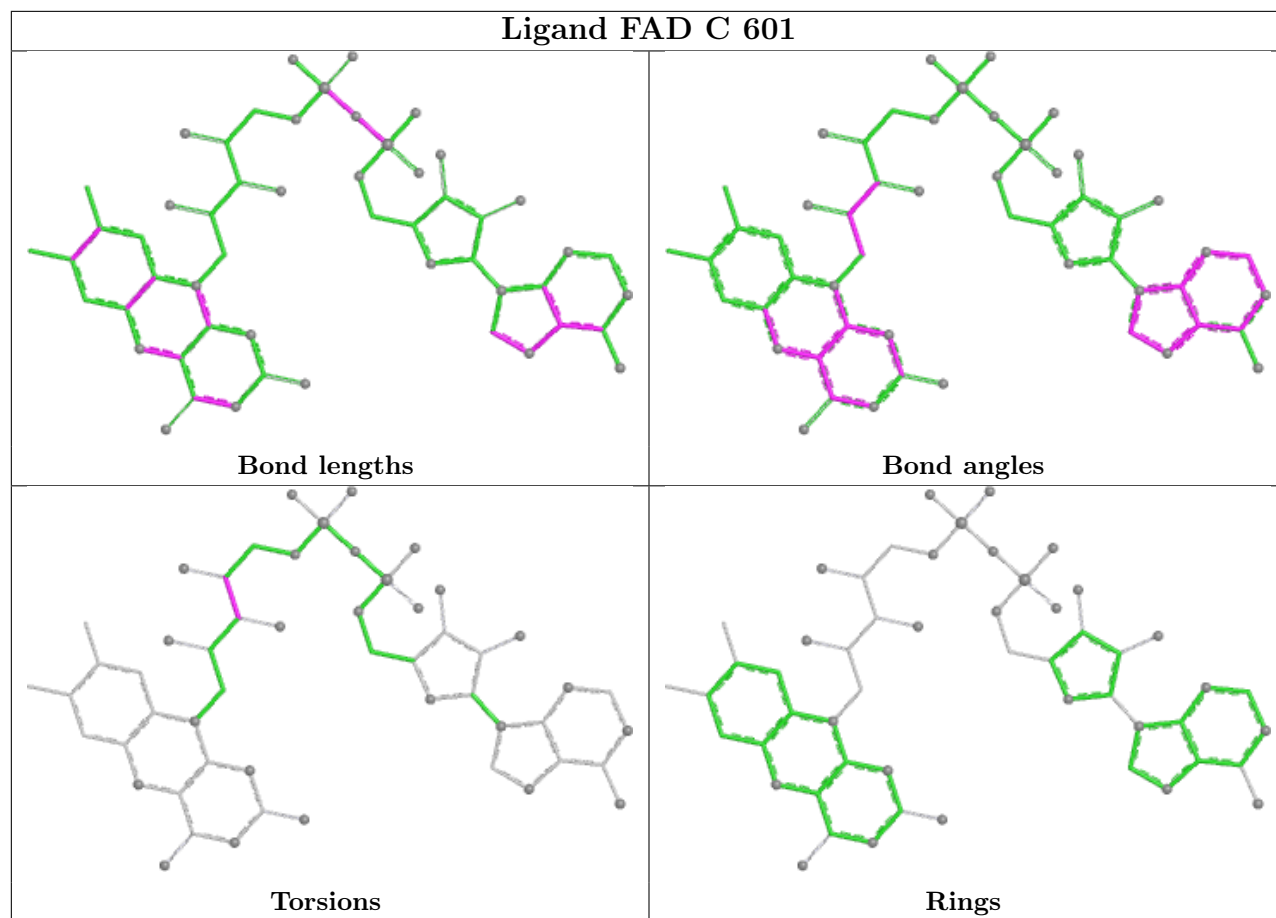
4 monomers are involved in 9 short contacts:

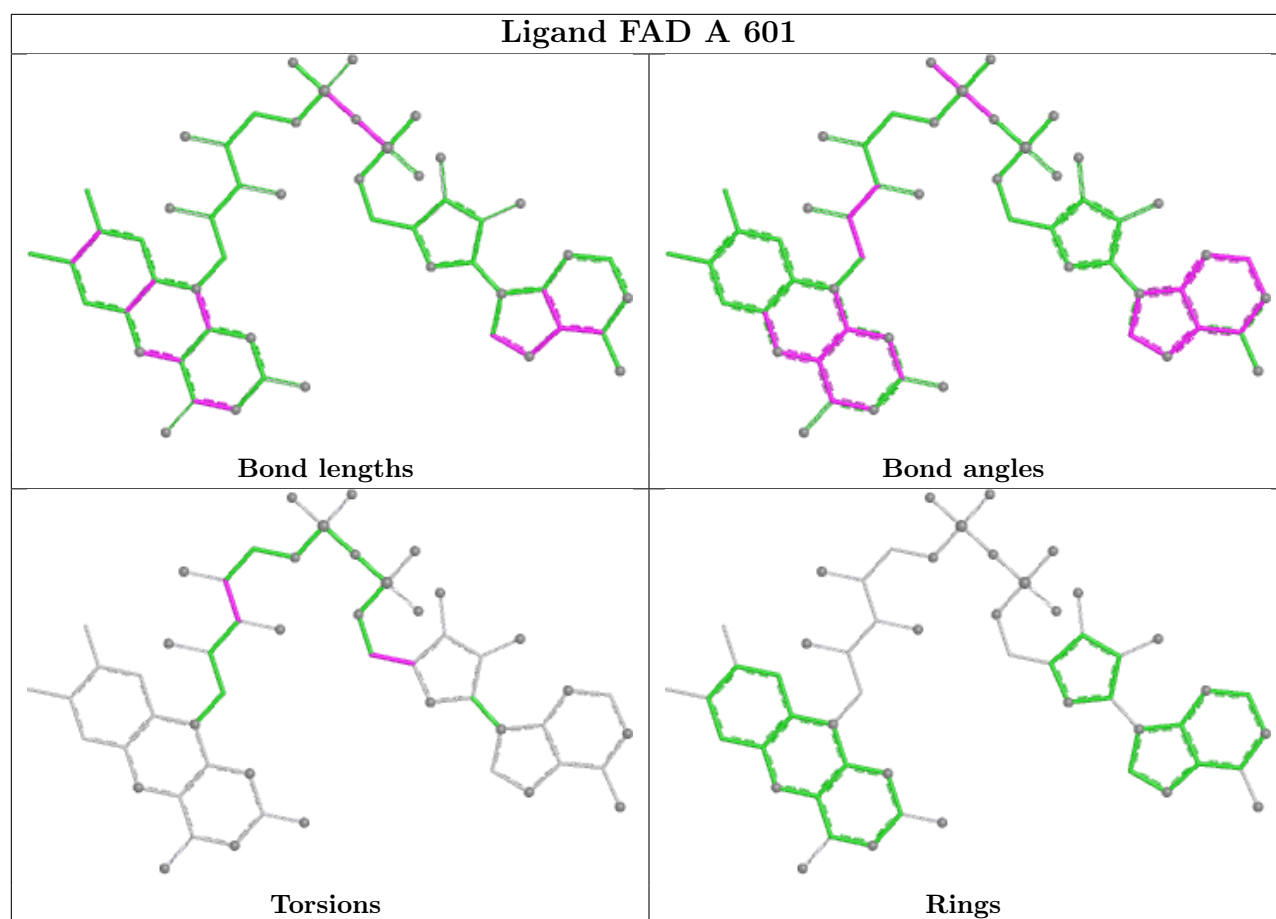
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	601	FAD	2	0
2	B	601	FAD	2	0
2	C	601	FAD	3	0
2	A	601	FAD	2	0

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, 95th 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 ²)	Q<0.9
1	A	501/522 (95%)	0.18	14 (2%) 55 57	9, 20, 32, 44	1 (0%)
1	B	501/522 (95%)	0.36	22 (4%) 39 41	9, 21, 39, 64	2 (0%)
1	C	501/522 (95%)	0.29	12 (2%) 59 62	9, 21, 37, 77	3 (0%)
1	D	501/522 (95%)	0.79	42 (8%) 17 18	13, 29, 52, 89	1 (0%)
All	All	2004/2088 (95%)	0.40	90 (4%) 38 40	9, 22, 44, 89	7 (0%)

All (90) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	502	VAL	7.0
1	B	502	VAL	6.1
1	D	500	LEU	5.1
1	D	173	ALA	5.0
1	C	502	VAL	4.6
1	C	2	ASN	4.5
1	D	465	ALA	4.1
1	A	2	ASN	4.1
1	D	350	ASP	3.8
1	B	2	ASN	3.6
1	C	500	LEU	3.6
1	D	501	LYS	3.5
1	D	111	TYR	3.4
1	A	420	HIS	3.3
1	C	501	LYS	3.3
1	D	174	ALA	3.3
1	B	500	LEU	3.2
1	A	502	VAL	3.2
1	D	498	PHE	3.2
1	D	484	ALA	3.1
1	D	215	LEU	3.1

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Mol	Chain	Res	Type	RSRZ
1	D	112	LYS	3.1
1	D	2	ASN	3.1
1	D	420	HIS	3.1
1	A	115	GLU	3.0
1	B	420	HIS	3.0
1	B	481	GLU	3.0
1	B	177	SER	3.0
1	D	176	GLY	2.9
1	B	151	ASP	2.9
1	D	499	ILE	2.9
1	D	461	ALA	2.9
1	A	485	GLU	2.8
1	C	112	LYS	2.8
1	D	219	ARG	2.7
1	D	486	LEU	2.7
1	D	218	THR	2.7
1	B	488	PRO	2.7
1	B	181	ARG	2.7
1	B	425	ARG	2.7
1	C	416	HIS	2.7
1	D	213	ALA	2.6
1	B	310	GLN	2.6
1	A	160	ASN	2.6
1	D	488	PRO	2.6
1	A	62	ASP	2.5
1	D	487	LEU	2.5
1	D	360	GLU	2.5
1	C	420	HIS	2.5
1	D	113	VAL	2.5
1	C	350	ASP	2.4
1	D	284	ALA	2.4
1	D	185	LEU	2.4
1	A	416	HIS	2.4
1	A	291	ASP	2.4
1	C	487	LEU	2.4
1	D	222	ILE	2.4
1	B	115	GLU	2.4
1	B	360	GLU	2.4
1	A	294	ASN	2.4
1	C	160	ASN	2.3
1	B	112	LYS	2.3
1	D	468	VAL	2.3

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Mol	Chain	Res	Type	RSRZ
1	D	175	GLN	2.2
1	D	493	ARG	2.2
1	D	290	LYS	2.2
1	D	495	SER	2.2
1	D	221	PRO	2.2
1	D	211	ALA	2.2
1	D	276	ARG	2.2
1	B	501	LYS	2.2
1	B	152	ASP	2.2
1	A	481	GLU	2.1
1	D	459	GLN	2.1
1	D	425	ARG	2.1
1	B	173	ALA	2.1
1	D	212	LEU	2.1
1	A	376	ASN	2.1
1	C	485	GLU	2.1
1	D	463	GLU	2.1
1	B	178	PRO	2.1
1	D	416	HIS	2.1
1	A	465	ALA	2.1
1	D	150	ASN	2.1
1	B	188	THR	2.1
1	B	176	GLY	2.1
1	B	477	GLU	2.0
1	C	181	ARG	2.0
1	A	145	GLU	2.0
1	B	3	GLN	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 oligosaccharides 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,

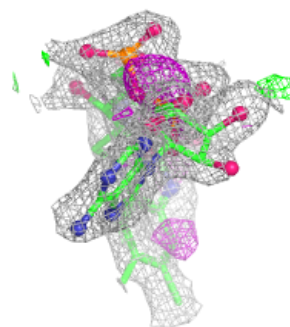
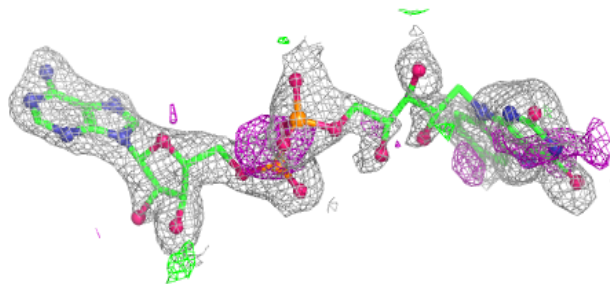
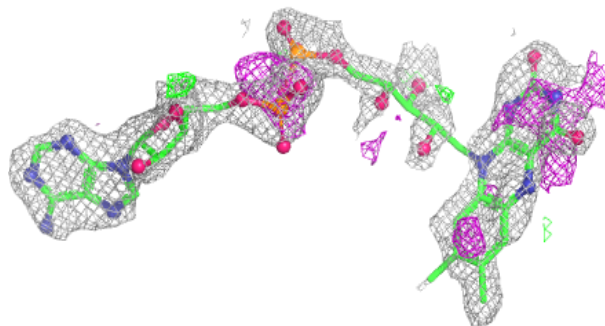
median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	CA	B	605	1/1	0.76	0.24	37,37,37,37	0
5	CA	A	607	1/1	0.77	0.24	37,37,37,37	0
2	FAD	B	601	53/53	0.78	0.15	37,41,44,44	0
2	FAD	D	601	53/53	0.80	0.14	36,39,42,42	0
4	BR	D	604	1/1	0.82	0.14	78,78,78,78	0
3	CL	D	602	1/1	0.82	0.34	50,50,50,50	0
4	BR	A	605	1/1	0.82	0.12	84,84,84,84	0
4	BR	B	604	1/1	0.84	0.16	78,78,78,78	0
3	CL	C	602	1/1	0.86	0.34	44,44,44,44	0
4	BR	B	603	1/1	0.86	0.13	76,76,76,76	0
2	FAD	C	601	53/53	0.86	0.11	27,29,30,30	0
2	FAD	A	601	53/53	0.88	0.10	27,28,29,29	0
3	CL	A	602	1/1	0.88	0.58	58,58,58,58	0
4	BR	C	603	1/1	0.89	0.34	41,41,41,41	0
3	CL	B	602	1/1	0.89	0.39	48,48,48,48	0
4	BR	A	606	1/1	0.94	0.18	39,39,39,39	0
3	CL	D	603	1/1	0.95	0.07	49,49,49,49	0
4	BR	A	604	1/1	0.96	0.12	69,69,69,69	0
4	BR	C	604	1/1	0.98	0.28	37,37,37,37	0
4	BR	A	603	1/1	0.99	0.05	30,30,30,30	0

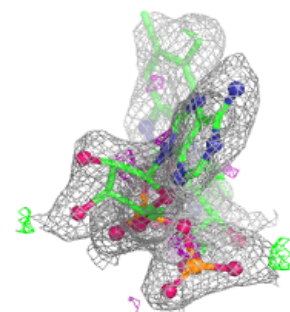
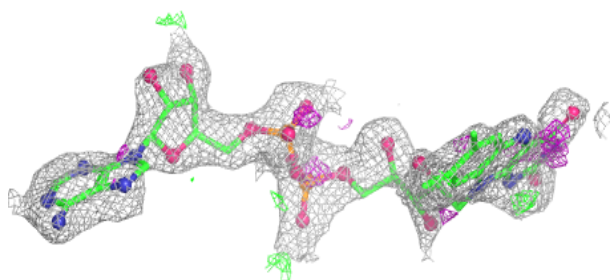
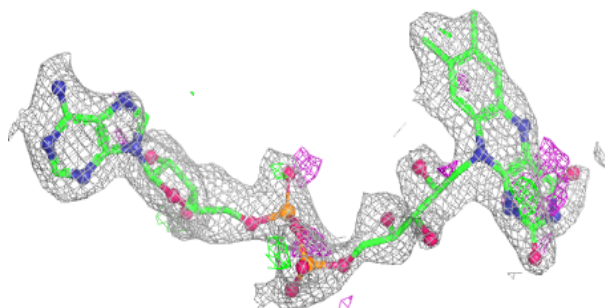
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FAD B 601:

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

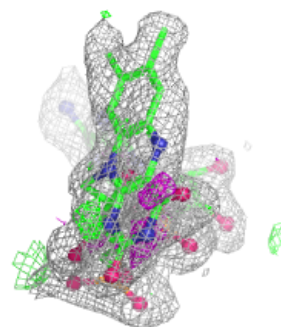
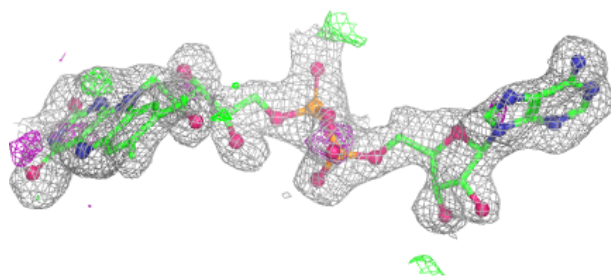
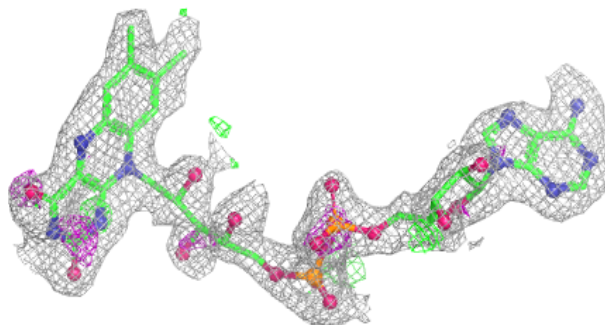
**Electron density around FAD D 601:**

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

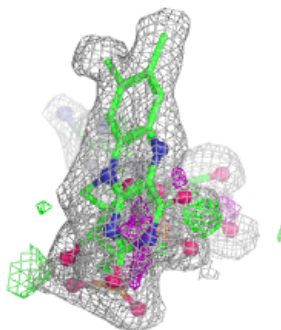
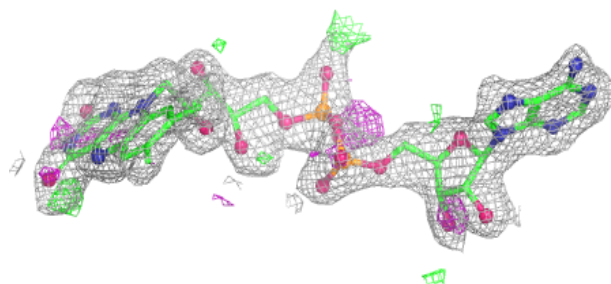
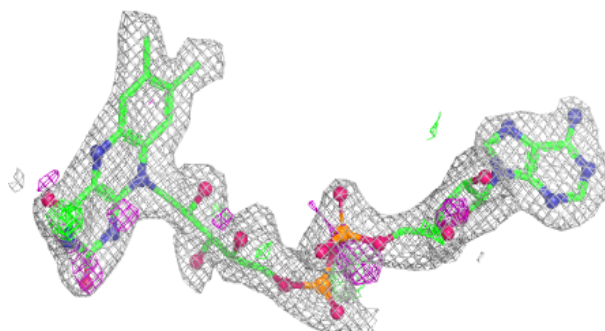


Electron density around FAD C 601:

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

**Electron density around FAD A 601:**

$2mF_o-DF_c$ (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.