Full wwPDB X-ray Structure Validation Report (i)

Aug 22, 2020 – 06:32 AM BST

PDB ID	:	5TUK
Title	:	Crystal structure of tetracycline destructase Tet(51)
Authors	:	Park, J.; Tolia, N.H.
Deposited on	:	2016-11-06
Resolution	:	1.85 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

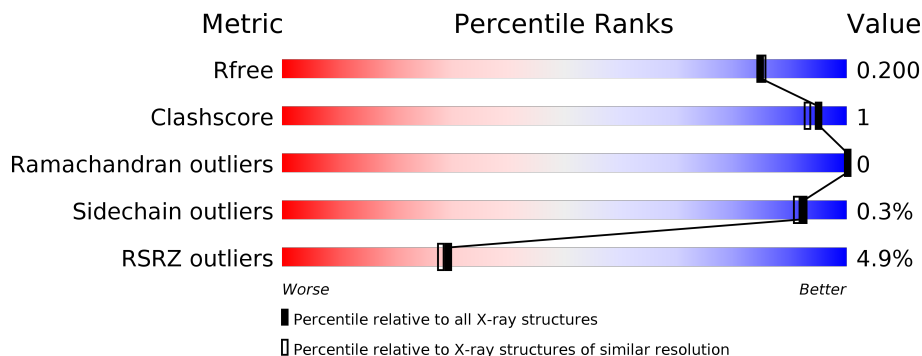|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.13.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.13.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.85 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.

Metric	Percentile Ranks	Value
Rfree		0.200
Clashscore		1
Ramachandran outliers		0
Sidechain outliers		0.3%
RSRZ outliers		4.9%

Worse — Better

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2469 (1.86-1.86)
Clashscore	141614	2625 (1.86-1.86)
Ramachandran outliers	138981	2592 (1.86-1.86)
Sidechain outliers	138945	2592 (1.86-1.86)
RSRZ outliers	127900	2436 (1.86-1.86)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% 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	408	3% — 88% · 9%
1	B	408	5% — 88% · 9%
1	C	408	5% — 87% · 10%
1	D	408	5% — 87% · 11%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 24761 atoms, of which 11781 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 Tetracycline destructase Tet(51).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	372	Total	C	H	N	O	S	0	0	0
			5896	1886	2923	516	555	16			
1	B	373	Total	C	H	N	O	S	0	3	0
			5949	1900	2956	520	556	17			
1	C	367	Total	C	H	N	O	S	0	0	0
			5816	1861	2888	508	543	16			
1	D	364	Total	C	H	N	O	S	0	0	0
			5766	1847	2858	505	540	16			

There are 84 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-20	MET	-	expression tag	UNP A0A0H4TFU4
A	-19	GLY	-	expression tag	UNP A0A0H4TFU4
A	-18	SER	-	expression tag	UNP A0A0H4TFU4
A	-17	SER	-	expression tag	UNP A0A0H4TFU4
A	-16	HIS	-	expression tag	UNP A0A0H4TFU4
A	-15	HIS	-	expression tag	UNP A0A0H4TFU4
A	-14	HIS	-	expression tag	UNP A0A0H4TFU4
A	-13	HIS	-	expression tag	UNP A0A0H4TFU4
A	-12	HIS	-	expression tag	UNP A0A0H4TFU4
A	-11	HIS	-	expression tag	UNP A0A0H4TFU4
A	-10	SER	-	expression tag	UNP A0A0H4TFU4
A	-9	SER	-	expression tag	UNP A0A0H4TFU4
A	-8	GLY	-	expression tag	UNP A0A0H4TFU4
A	-7	LEU	-	expression tag	UNP A0A0H4TFU4
A	-6	VAL	-	expression tag	UNP A0A0H4TFU4
A	-5	PRO	-	expression tag	UNP A0A0H4TFU4
A	-4	ARG	-	expression tag	UNP A0A0H4TFU4
A	-3	GLY	-	expression tag	UNP A0A0H4TFU4
A	-2	SER	-	expression tag	UNP A0A0H4TFU4
A	-1	HIS	-	expression tag	UNP A0A0H4TFU4
A	0	MET	-	expression tag	UNP A0A0H4TFU4

Continued on next page...

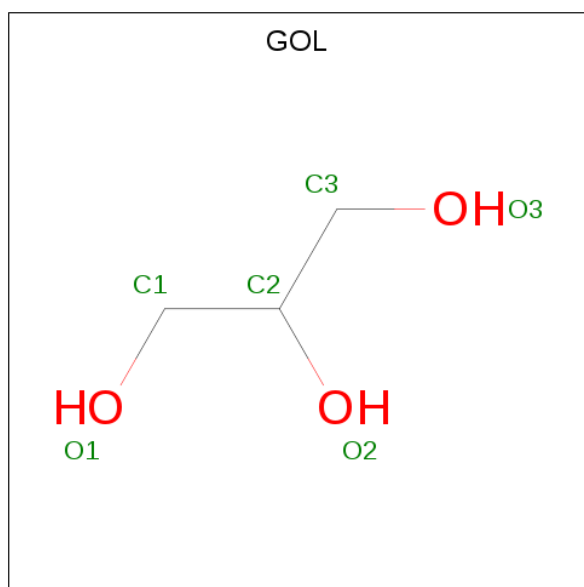*Continued from previous page...*

Chain	Residue	Modelled	Actual	Comment	Reference
B	-20	MET	-	expression tag	UNP A0A0H4TFU4
B	-19	GLY	-	expression tag	UNP A0A0H4TFU4
B	-18	SER	-	expression tag	UNP A0A0H4TFU4
B	-17	SER	-	expression tag	UNP A0A0H4TFU4
B	-16	HIS	-	expression tag	UNP A0A0H4TFU4
B	-15	HIS	-	expression tag	UNP A0A0H4TFU4
B	-14	HIS	-	expression tag	UNP A0A0H4TFU4
B	-13	HIS	-	expression tag	UNP A0A0H4TFU4
B	-12	HIS	-	expression tag	UNP A0A0H4TFU4
B	-11	HIS	-	expression tag	UNP A0A0H4TFU4
B	-10	SER	-	expression tag	UNP A0A0H4TFU4
B	-9	SER	-	expression tag	UNP A0A0H4TFU4
B	-8	GLY	-	expression tag	UNP A0A0H4TFU4
B	-7	LEU	-	expression tag	UNP A0A0H4TFU4
B	-6	VAL	-	expression tag	UNP A0A0H4TFU4
B	-5	PRO	-	expression tag	UNP A0A0H4TFU4
B	-4	ARG	-	expression tag	UNP A0A0H4TFU4
B	-3	GLY	-	expression tag	UNP A0A0H4TFU4
B	-2	SER	-	expression tag	UNP A0A0H4TFU4
B	-1	HIS	-	expression tag	UNP A0A0H4TFU4
B	0	MET	-	expression tag	UNP A0A0H4TFU4
C	-20	MET	-	expression tag	UNP A0A0H4TFU4
C	-19	GLY	-	expression tag	UNP A0A0H4TFU4
C	-18	SER	-	expression tag	UNP A0A0H4TFU4
C	-17	SER	-	expression tag	UNP A0A0H4TFU4
C	-16	HIS	-	expression tag	UNP A0A0H4TFU4
C	-15	HIS	-	expression tag	UNP A0A0H4TFU4
C	-14	HIS	-	expression tag	UNP A0A0H4TFU4
C	-13	HIS	-	expression tag	UNP A0A0H4TFU4
C	-12	HIS	-	expression tag	UNP A0A0H4TFU4
C	-11	HIS	-	expression tag	UNP A0A0H4TFU4
C	-10	SER	-	expression tag	UNP A0A0H4TFU4
C	-9	SER	-	expression tag	UNP A0A0H4TFU4
C	-8	GLY	-	expression tag	UNP A0A0H4TFU4
C	-7	LEU	-	expression tag	UNP A0A0H4TFU4
C	-6	VAL	-	expression tag	UNP A0A0H4TFU4
C	-5	PRO	-	expression tag	UNP A0A0H4TFU4
C	-4	ARG	-	expression tag	UNP A0A0H4TFU4
C	-3	GLY	-	expression tag	UNP A0A0H4TFU4
C	-2	SER	-	expression tag	UNP A0A0H4TFU4
C	-1	HIS	-	expression tag	UNP A0A0H4TFU4
C	0	MET	-	expression tag	UNP A0A0H4TFU4

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
D	-20	MET	-	expression tag	UNP A0A0H4TFU4
D	-19	GLY	-	expression tag	UNP A0A0H4TFU4
D	-18	SER	-	expression tag	UNP A0A0H4TFU4
D	-17	SER	-	expression tag	UNP A0A0H4TFU4
D	-16	HIS	-	expression tag	UNP A0A0H4TFU4
D	-15	HIS	-	expression tag	UNP A0A0H4TFU4
D	-14	HIS	-	expression tag	UNP A0A0H4TFU4
D	-13	HIS	-	expression tag	UNP A0A0H4TFU4
D	-12	HIS	-	expression tag	UNP A0A0H4TFU4
D	-11	HIS	-	expression tag	UNP A0A0H4TFU4
D	-10	SER	-	expression tag	UNP A0A0H4TFU4
D	-9	SER	-	expression tag	UNP A0A0H4TFU4
D	-8	GLY	-	expression tag	UNP A0A0H4TFU4
D	-7	LEU	-	expression tag	UNP A0A0H4TFU4
D	-6	VAL	-	expression tag	UNP A0A0H4TFU4
D	-5	PRO	-	expression tag	UNP A0A0H4TFU4
D	-4	ARG	-	expression tag	UNP A0A0H4TFU4
D	-3	GLY	-	expression tag	UNP A0A0H4TFU4
D	-2	SER	-	expression tag	UNP A0A0H4TFU4
D	-1	HIS	-	expression tag	UNP A0A0H4TFU4
D	0	MET	-	expression tag	UNP A0A0H4TFU4

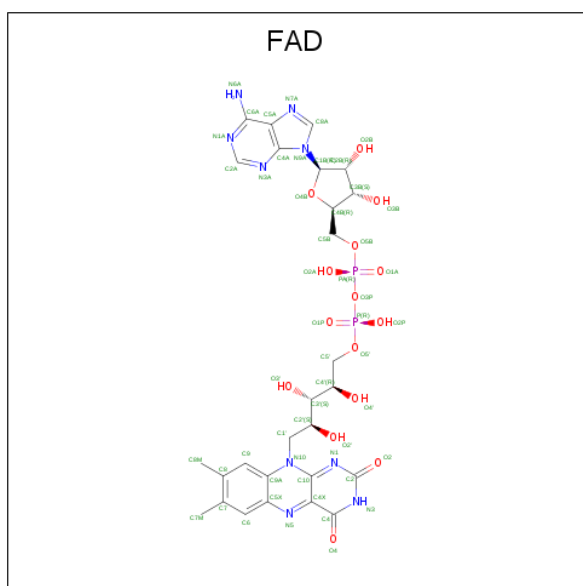- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	H	O	0	0
			14	3	8	3		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	B	1	Total 14	C 3	H 8	O 3	0	0
2	C	1	Total 14	C 3	H 8	O 3	0	0
2	D	1	Total 14	C 3	H 8	O 3	0	0

- Molecule 3 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total 84	C 27	H 31	N 9	O 15	P 2	0	0
3	B	1	Total 84	C 27	H 31	N 9	O 15	P 2	0	0
3	C	1	Total 84	C 27	H 31	N 9	O 15	P 2	0	0
3	D	1	Total 84	C 27	H 31	N 9	O 15	P 2	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	279	Total 279	O 279	0	0
4	B	224	Total 224	O 224	0	0

Continued on next page...

Continued from previous page...

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	232	Total 232	O 232	0	0
4	D	207	Total 207	O 207	0	0

3 Residue-property plots ⓘ

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.
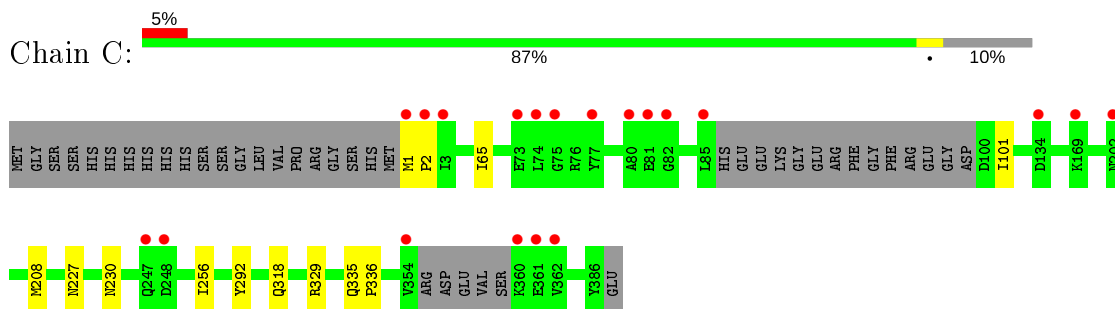
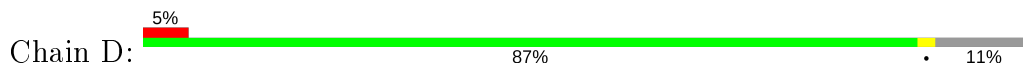- Molecule 1: Tetracycline destructase Tet(51)
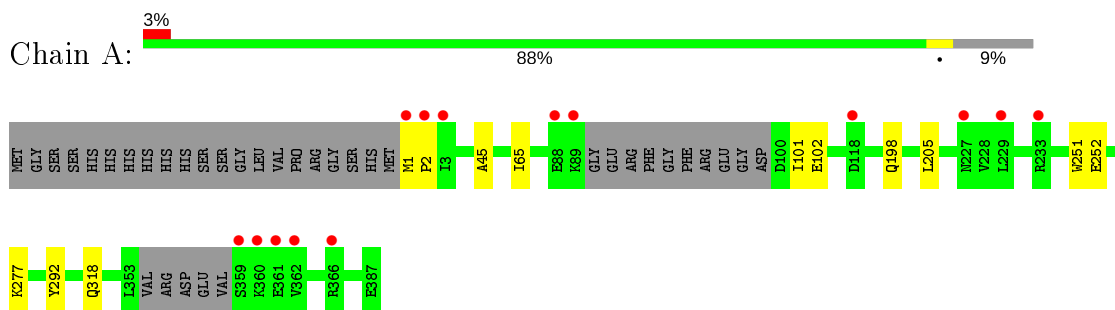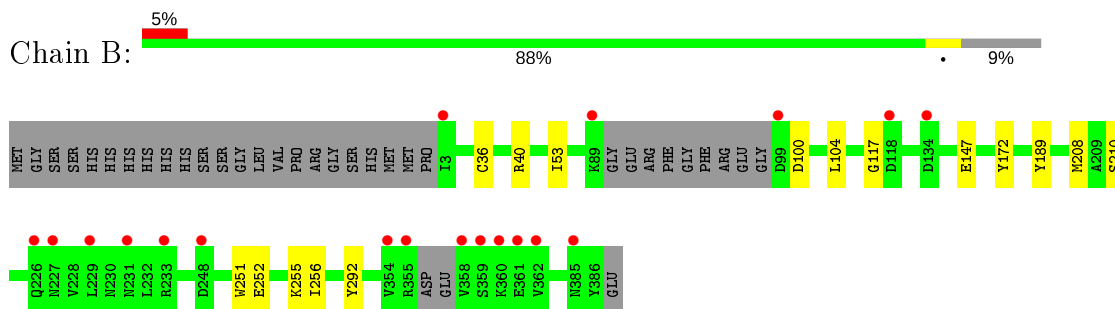
Chain A:

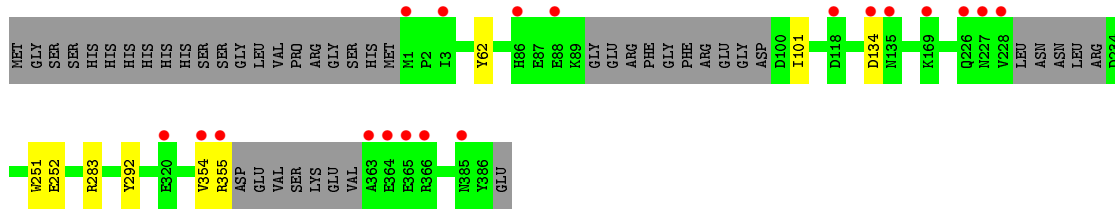- Molecule 1: Tetracycline destructase Tet(51)

Chain B:

- Molecule 1: Tetracycline destructase Tet(51)

Chain C:

- Molecule 1: Tetracycline destructase Tet(51)

Chain D:

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	83.49Å 81.69Å 127.13Å 90.00° 96.79° 90.00°	Depositor
Resolution (Å)	19.90 – 1.85 19.90 – 1.85	Depositor EDS
% Data completeness (in resolution range)	99.8 (19.90-1.85) 99.8 (19.90-1.85)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.47 (at 1.85Å)	Xtriage
Refinement program	PHENIX dev_1616	Depositor
R, R_{free}	0.167 , 0.200 0.171 , 0.200	Depositor DCC
R_{free} test set	1998 reflections (1.38%)	wwPDB-VP
Wilson B-factor (Å^2)	21.4	Xtriage
Anisotropy	0.445	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.46 , 54.8	EDS
L-test for twinning[2]	$< |L| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	24761	wwPDB-VP
Average B, all atoms (Å^2)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.83% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[1] Intensities estimated from amplitudes.
[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: GOL, 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	0.38	0/3029	0.57	0/4081
1	B	0.41	0/3057	0.60	0/4119
1	C	0.39	0/2983	0.56	0/4021
1	D	0.37	0/2963	0.56	0/3991
All	All	0.39	0/12032	0.57	0/16212

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	2973	2923	2931	8	0
1	B	2993	2956	2962	11	0
1	C	2928	2888	2897	7	0
1	D	2908	2858	2866	4	0
2	A	6	8	8	0	0
2	B	6	8	8	2	0
2	C	6	8	8	0	0
2	D	6	8	8	0	0
3	A	53	31	31	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	53	31	31	0	0
3	C	53	31	31	0	0
3	D	53	31	31	0	0
4	A	279	0	0	1	0
4	B	224	0	0	2	0
4	C	232	0	0	2	0
4	D	207	0	0	0	0
All	All	12980	11781	11812	29	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 (29) 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:277:LYS:NZ	1:B:172:TYR:O	2.22	0.73
1:B:53[B]:ILE:HD11	1:B:100:ASP:HA	1.84	0.60
1:A:198:GLN:CG	1:A:205:LEU:HD11	2.37	0.55
1:B:36[B]:CYS:SG	1:B:40:ARG:HD2	2.48	0.54
1:B:210:SER:HA	2:B:401:GOL:H12	1.89	0.54
1:A:65:ILE:HG22	1:A:101:ILE:HG21	1.92	0.52
1:B:208:MET:HE3	1:B:256:ILE:HD11	1.92	0.50
1:C:65:ILE:HG22	1:C:101:ILE:HG21	1.94	0.49
1:C:227:ASN:HD21	1:C:230:ASN:H	1.60	0.49
1:C:329:ARG:NH2	4:C:513:HOH:O	2.46	0.48
1:A:1:MET:HB2	1:A:2:PRO:CD	2.44	0.48
1:B:117:GLY:O	4:B:501:HOH:O	2.20	0.47
1:C:318:GLN:OE1	4:C:501:HOH:O	2.20	0.47
1:A:318:GLN:NE2	4:A:501:HOH:O	2.34	0.47
1:D:134:ASP:O	1:D:283:ARG:NH2	2.48	0.47
1:C:1:MET:N	1:C:2:PRO:HD2	2.29	0.46
1:D:62:TYR:CE1	1:D:101:ILE:HD11	2.51	0.46
1:B:147:GLU:OE2	4:B:502:HOH:O	2.20	0.45
1:B:104:LEU:HD11	2:B:401:GOL:H32	1.96	0.45
1:B:208:MET:CE	1:B:256:ILE:HG12	2.47	0.45
1:C:335:GLN:HB3	1:C:336:PRO:HD3	1.99	0.43
1:B:189:TYR:CZ	1:B:255:LYS:HG2	2.55	0.42
1:D:251:TRP:CG	1:D:252:GLU:N	2.88	0.42
1:A:251:TRP:CG	1:A:252:GLU:N	2.88	0.42
1:A:45:ALA:HB1	1:A:102:GLU:HG2	2.02	0.41
1:B:251:TRP:CG	1:B:252:GLU:N	2.88	0.41

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:1:MET:CB	1:A:2:PRO:CD	2.99	0.41
1:D:354:VAL:O	1:D:355:ARG:HB2	2.21	0.41
1:C:208:MET:CE	1:C:256:ILE:HD11	2.51	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	366/408 (90%)	359 (98%)	7 (2%)	0	100	100
1	B	370/408 (91%)	365 (99%)	5 (1%)	0	100	100
1	C	361/408 (88%)	352 (98%)	9 (2%)	0	100	100
1	D	356/408 (87%)	347 (98%)	9 (2%)	0	100	100
All	All	1453/1632 (89%)	1423 (98%)	30 (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	319/349 (91%)	318 (100%)	1 (0%)	92	91
1	B	323/349 (93%)	322 (100%)	1 (0%)	92	91

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	C	314/349 (90%)	313 (100%)	1 (0%)	92 91
1	D	311/349 (89%)	310 (100%)	1 (0%)	92 91
All	All	1267/1396 (91%)	1263 (100%)	4 (0%)	92 91

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	292	TYR
1	B	292	TYR
1	C	292	TYR
1	D	292	TYR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

8 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
3	FAD	B	402	-	51,58,58	1.77	5 (9%)	60,89,89	2.15	10 (16%)
2	GOL	A	401	-	5,5,5	0.23	0	5,5,5	0.64	0
2	GOL	C	401	-	5,5,5	0.41	0	5,5,5	0.71	0
2	GOL	B	401	-	5,5,5	0.35	0	5,5,5	1.06	0
2	GOL	D	401	-	5,5,5	0.58	0	5,5,5	1.40	1 (20%)
3	FAD	A	402	-	51,58,58	1.79	5 (9%)	60,89,89	2.19	12 (20%)
3	FAD	C	402	-	51,58,58	1.76	6 (11%)	60,89,89	2.21	11 (18%)
3	FAD	D	402	-	51,58,58	1.88	7 (13%)	60,89,89	2.24	11 (18%)

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
3	FAD	B	402	-	-	11/30/50/50	0/6/6/6
2	GOL	A	401	-	-	0/4/4/4	-
2	GOL	C	401	-	-	2/4/4/4	-
2	GOL	B	401	-	-	1/4/4/4	-
2	GOL	D	401	-	-	2/4/4/4	-
3	FAD	A	402	-	-	8/30/50/50	0/6/6/6
3	FAD	C	402	-	-	9/30/50/50	0/6/6/6
3	FAD	D	402	-	-	9/30/50/50	0/6/6/6

All (23) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	402	FAD	C4X-C10	9.02	1.47	1.38
3	A	402	FAD	C4X-C10	8.89	1.47	1.38
3	C	402	FAD	C4X-C10	8.48	1.47	1.38
3	B	402	FAD	C4X-C10	8.35	1.47	1.38
3	B	402	FAD	C4-C4X	4.02	1.48	1.41
3	C	402	FAD	C4-C4X	3.81	1.47	1.41
3	D	402	FAD	C9A-C5X	3.80	1.50	1.42
3	D	402	FAD	C9A-N10	3.70	1.43	1.38
3	B	402	FAD	C9A-C5X	3.68	1.49	1.42
3	C	402	FAD	C9A-C5X	3.66	1.49	1.42
3	D	402	FAD	C4-C4X	3.53	1.47	1.41
3	A	402	FAD	C9A-C5X	3.53	1.49	1.42
3	C	402	FAD	C8-C7	3.48	1.49	1.40

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	402	FAD	C8-C7	3.41	1.49	1.40
3	A	402	FAD	C4-C4X	3.27	1.47	1.41
3	D	402	FAD	C8-C7	3.27	1.49	1.40
3	B	402	FAD	C8-C7	3.20	1.48	1.40
3	A	402	FAD	C9A-N10	3.19	1.42	1.38
3	B	402	FAD	C9A-N10	2.92	1.42	1.38
3	C	402	FAD	C9A-N10	2.55	1.42	1.38
3	D	402	FAD	O4B-C1B	2.24	1.44	1.41
3	D	402	FAD	C10-N1	2.18	1.36	1.33
3	C	402	FAD	C2-N3	-2.06	1.34	1.38

All (45) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	B	402	FAD	C4-N3-C2	9.19	122.90	115.14
3	A	402	FAD	C4-N3-C2	9.10	122.82	115.14
3	D	402	FAD	C1'-N10-C9A	8.87	125.27	118.29
3	C	402	FAD	C1'-N10-C9A	8.54	125.01	118.29
3	C	402	FAD	C4-N3-C2	8.48	122.30	115.14
3	D	402	FAD	C4-N3-C2	8.06	121.95	115.14
3	A	402	FAD	C1'-N10-C9A	7.68	124.34	118.29
3	B	402	FAD	C1'-N10-C9A	7.31	124.05	118.29
3	C	402	FAD	C4-C4X-C10	-6.58	115.59	119.95
3	D	402	FAD	C4-C4X-C10	-6.53	115.63	119.95
3	A	402	FAD	C4-C4X-C10	-5.53	116.29	119.95
3	B	402	FAD	C4-C4X-C10	-5.36	116.40	119.95
3	B	402	FAD	C4X-C4-N3	-4.00	117.97	123.43
3	A	402	FAD	C4X-C4-N3	-3.93	118.06	123.43
3	A	402	FAD	C4X-N5-C5X	3.33	120.10	116.77
3	C	402	FAD	C4-C4X-N5	3.29	122.36	118.60
3	C	402	FAD	C4X-C4-N3	-3.27	118.96	123.43
3	D	402	FAD	C4-C4X-N5	3.27	122.33	118.60
3	D	402	FAD	C9A-N10-C10	-3.25	117.65	121.91
3	C	402	FAD	C9A-N10-C10	-3.23	117.68	121.91
3	A	402	FAD	N3A-C2A-N1A	-3.17	123.72	128.68
3	B	402	FAD	C9A-N10-C10	-3.10	117.86	121.91
3	A	402	FAD	C4-C4X-N5	3.09	122.12	118.60
3	D	402	FAD	C4X-C4-N3	-3.07	119.23	123.43
3	D	402	FAD	N3A-C2A-N1A	-3.04	123.93	128.68
3	B	402	FAD	C4X-N5-C5X	3.02	119.79	116.77
3	B	402	FAD	N3A-C2A-N1A	-2.90	124.15	128.68
3	C	402	FAD	N3A-C2A-N1A	-2.87	124.19	128.68

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	D	402	FAD	C5'-C4'-C3'	2.86	117.72	112.20
3	D	402	FAD	C4X-N5-C5X	2.76	119.53	116.77
3	B	402	FAD	C4-C4X-N5	2.70	121.69	118.60
3	B	402	FAD	O2A-PA-O1A	2.64	125.27	112.24
3	C	402	FAD	C4X-N5-C5X	2.60	119.36	116.77
3	D	402	FAD	O3'-C3'-C2'	-2.49	102.79	108.81
3	A	402	FAD	C9A-N10-C10	-2.47	118.67	121.91
3	A	402	FAD	C5'-C4'-C3'	2.42	116.88	112.20
3	D	402	FAD	O2A-PA-O1A	2.38	124.02	112.24
3	B	402	FAD	O4'-C4'-C5'	-2.27	104.81	109.92
3	A	402	FAD	O4B-C1B-C2B	-2.26	103.62	106.93
3	C	402	FAD	C5'-C4'-C3'	2.24	116.54	112.20
3	C	402	FAD	O2A-PA-O1A	2.21	123.19	112.24
2	D	401	GOL	O3-C3-C2	-2.21	99.63	110.20
3	C	402	FAD	C5X-C9A-N10	2.01	119.17	117.72
3	A	402	FAD	O3'-C3'-C2'	-2.01	103.96	108.81
3	A	402	FAD	C1B-N9A-C4A	-2.00	123.12	126.64

There are no chirality outliers.

All (42) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	402	FAD	C5'-O5'-P-O1P
2	C	401	GOL	C1-C2-C3-O3
2	C	401	GOL	O2-C2-C3-O3
2	D	401	GOL	C1-C2-C3-O3
2	D	401	GOL	O2-C2-C3-O3
3	A	402	FAD	C5'-O5'-P-O1P
3	C	402	FAD	C5'-O5'-P-O1P
3	D	402	FAD	C5'-O5'-P-O1P
3	B	402	FAD	O3'-C3'-C4'-O4'
3	B	402	FAD	C2'-C3'-C4'-O4'
2	B	401	GOL	O1-C1-C2-C3
3	B	402	FAD	O3'-C3'-C4'-C5'
3	B	402	FAD	C2'-C3'-C4'-C5'
3	C	402	FAD	C2'-C3'-C4'-C5'
3	C	402	FAD	O3'-C3'-C4'-O4'
3	C	402	FAD	O3'-C3'-C4'-C5'
3	C	402	FAD	C2'-C3'-C4'-O4'
3	A	402	FAD	C2'-C3'-C4'-O4'
3	A	402	FAD	C2'-C3'-C4'-C5'
3	D	402	FAD	C2'-C3'-C4'-C5'

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms
3	B	402	FAD	O4B-C4B-C5B-O5B
3	A	402	FAD	O3'-C3'-C4'-C5'
3	D	402	FAD	O3'-C3'-C4'-C5'
3	A	402	FAD	C5'-O5'-P-O3P
3	C	402	FAD	C5'-O5'-P-O3P
3	C	402	FAD	O4B-C4B-C5B-O5B
3	B	402	FAD	P-O3P-PA-O1A
3	D	402	FAD	P-O3P-PA-O1A
3	B	402	FAD	C5'-O5'-P-O2P
3	A	402	FAD	C5'-O5'-P-O2P
3	C	402	FAD	C5'-O5'-P-O2P
3	D	402	FAD	C5'-O5'-P-O2P
3	A	402	FAD	O3'-C3'-C4'-O4'
3	D	402	FAD	C2'-C3'-C4'-O4'
3	B	402	FAD	C3B-C4B-C5B-O5B
3	D	402	FAD	O3'-C3'-C4'-O4'
3	A	402	FAD	O4B-C4B-C5B-O5B
3	D	402	FAD	O4B-C4B-C5B-O5B
3	B	402	FAD	C5'-O5'-P-O3P
3	D	402	FAD	C5'-O5'-P-O3P
3	C	402	FAD	C3B-C4B-C5B-O5B
3	B	402	FAD	P-O3P-PA-O2A

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	401	GOL	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 then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand FAD B 402

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD A 402

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD C 402

Bond lengths

Bond angles

Torsions

Rings

Ligand FAD D 402

Bond lengths

Bond angles

Torsions

Rings
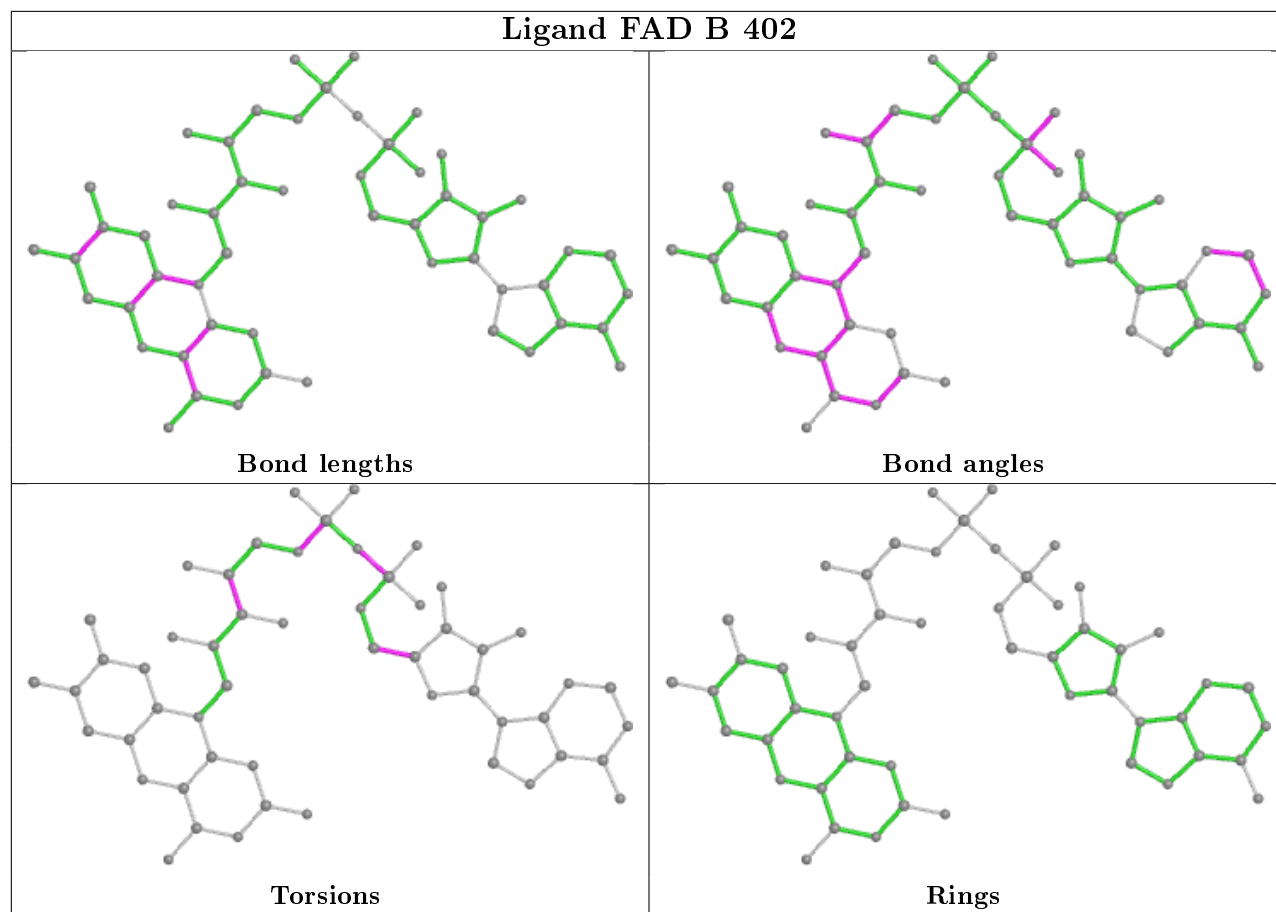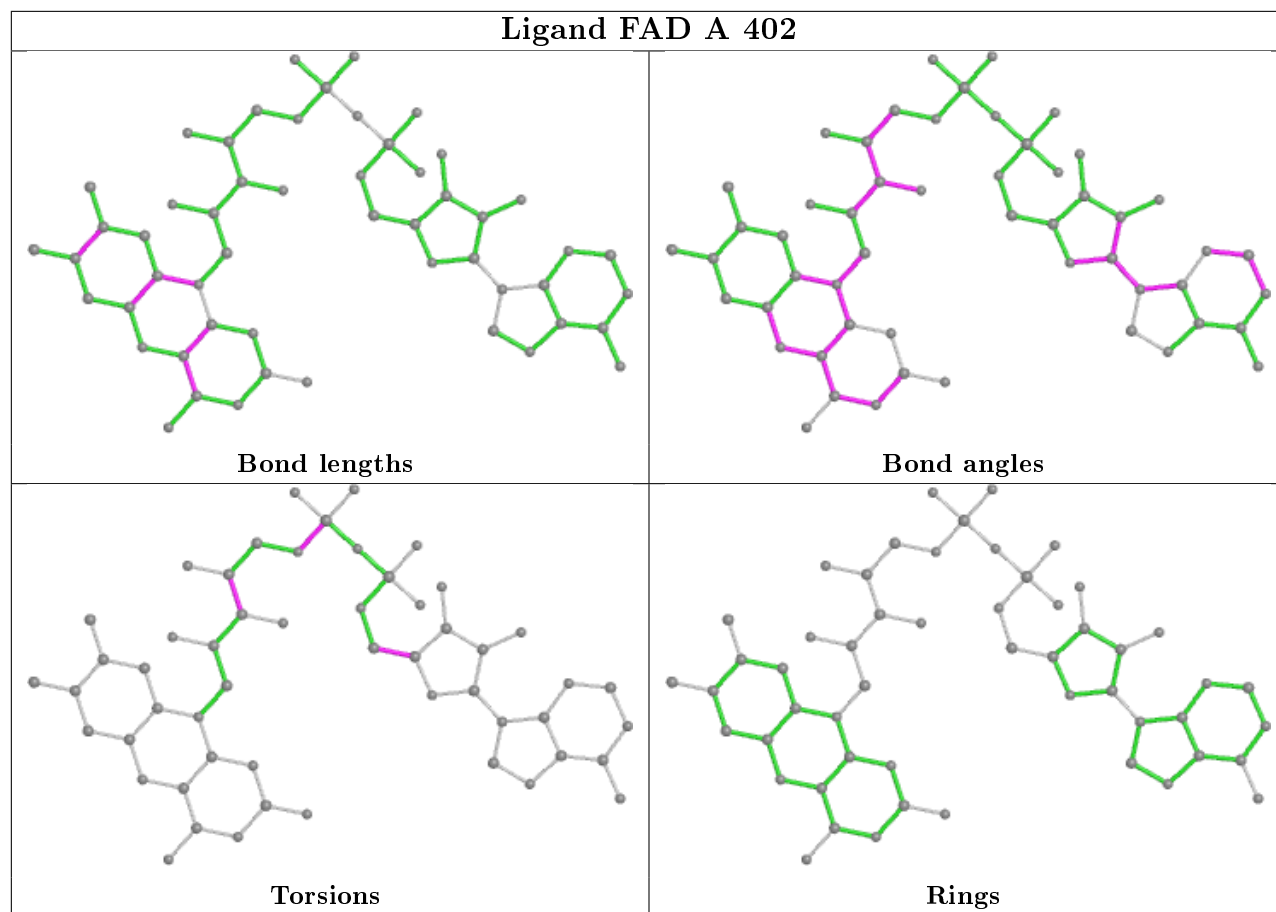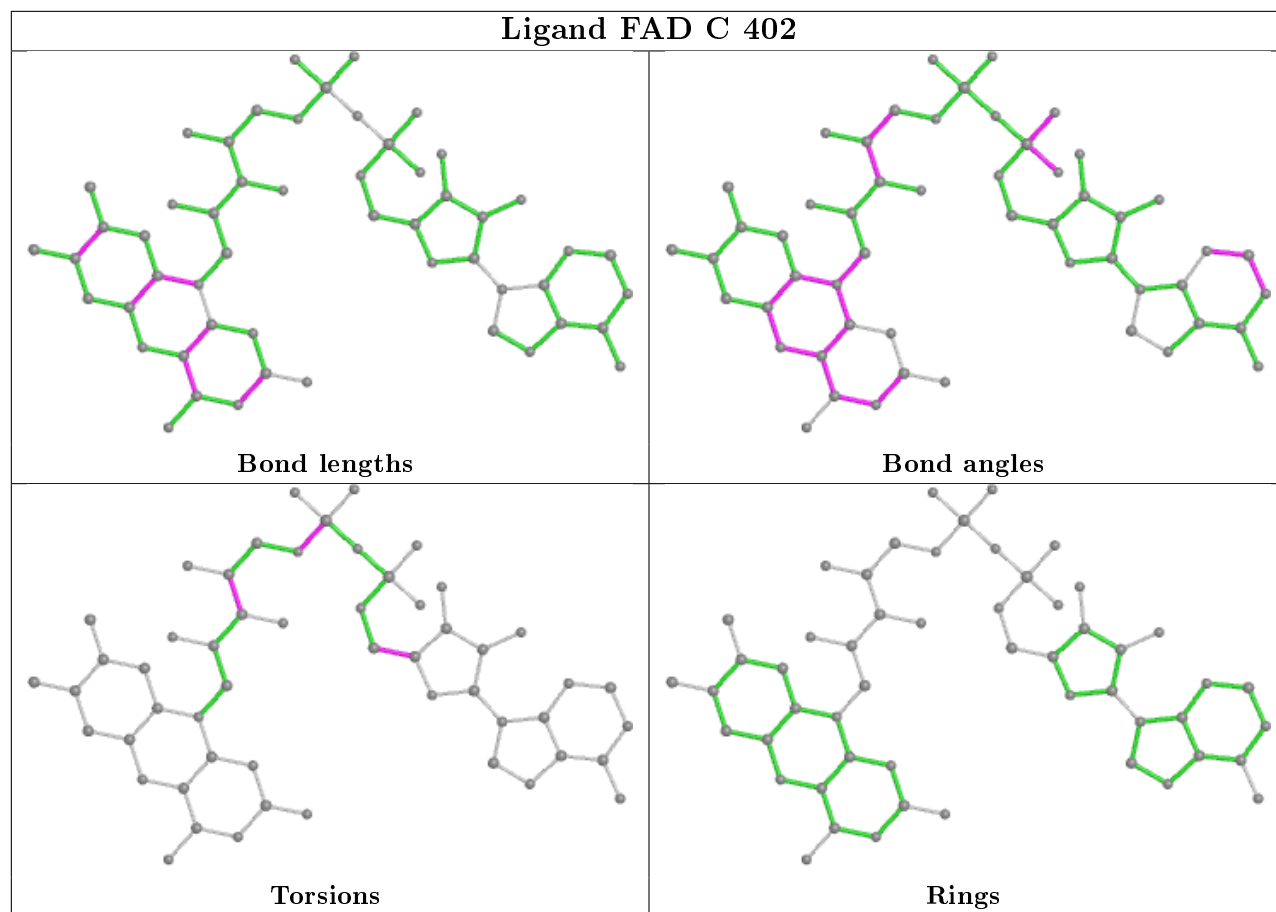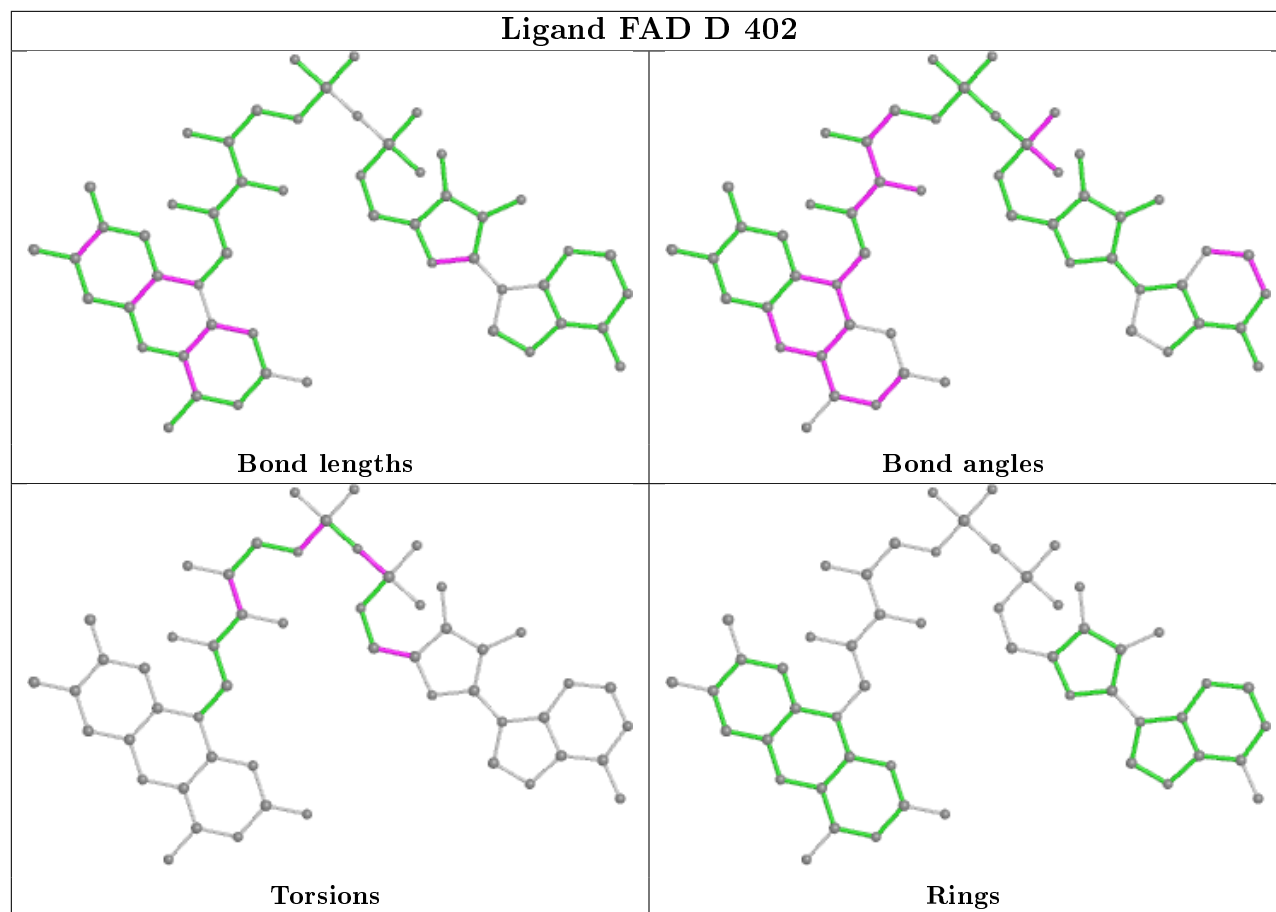
5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

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	372/408 (91%)	-0.09	14 (3%)	40	38	11, 22, 46, 70	0
1	B	373/408 (91%)	0.04	19 (5%)	28	26	14, 23, 52, 83	0
1	C	367/408 (89%)	0.09	20 (5%)	25	24	13, 24, 50, 80	0
1	D	364/408 (89%)	0.10	19 (5%)	27	26	15, 25, 50, 93	0
All	All	1476/1632 (90%)	0.03	72 (4%)	29	28	11, 24, 50, 93	0

All (72) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	229	LEU	7.8
1	D	355	ARG	6.7
1	C	1	MET	6.7
1	D	364	GLU	6.5
1	D	1	MET	5.7
1	B	227	ASN	5.7
1	B	233	ARG	5.2
1	D	228	VAL	4.8
1	B	3	ILE	4.7
1	D	363	ALA	4.7
1	D	3	ILE	4.7
1	D	227	ASN	4.7
1	B	358	VAL	4.6
1	A	89	LYS	4.5
1	A	233	ARG	4.4
1	A	360	LYS	4.4
1	B	362	VAL	4.4
1	A	1	MET	4.2
1	D	134	ASP	4.1
1	B	118	ASP	4.1
1	C	3	ILE	4.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	359	SER	3.8
1	C	2	PRO	3.7
1	B	231	ASN	3.7
1	D	365	GLU	3.7
1	B	355	ARG	3.6
1	C	361	GLU	3.5
1	A	3	ILE	3.5
1	A	2	PRO	3.5
1	B	360	LYS	3.5
1	D	354	VAL	3.5
1	C	77	TYR	3.4
1	C	354	VAL	3.4
1	C	81	GLU	3.4
1	D	366	ARG	3.3
1	B	226	GLN	3.3
1	B	354	VAL	3.2
1	C	362	VAL	3.2
1	C	74	LEU	3.1
1	C	85	LEU	3.1
1	B	385	ASN	3.0
1	C	169	LYS	2.9
1	B	99	ASP	2.9
1	D	88	GLU	2.8
1	D	385	ASN	2.7
1	B	89	LYS	2.6
1	B	248	ASP	2.6
1	C	82	GLY	2.6
1	C	360	LYS	2.5
1	A	366	ARG	2.5
1	A	118	ASP	2.5
1	B	134	ASP	2.5
1	C	73	GLU	2.5
1	A	362	VAL	2.4
1	B	361	GLU	2.4
1	B	359	SER	2.3
1	D	169	LYS	2.3
1	C	247	GLN	2.3
1	A	88	GLU	2.2
1	A	361	GLU	2.2
1	C	134	ASP	2.2
1	C	80	ALA	2.2
1	A	227	ASN	2.2

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	D	86	HIS	2.2
1	D	135	ASN	2.2
1	D	320	GLU	2.2
1	C	248	ASP	2.2
1	C	75	GLY	2.1
1	D	118	ASP	2.1
1	C	202	ASN	2.0
1	D	226	GLN	2.0
1	A	229	LEU	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 monosaccharides 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
2	GOL	B	401	6/6	0.77	0.23	35,47,56,59	0
2	GOL	C	401	6/6	0.89	0.13	31,38,45,48	0
2	GOL	D	401	6/6	0.90	0.11	20,27,38,38	0
2	GOL	A	401	6/6	0.94	0.10	23,29,36,36	0
3	FAD	B	402	53/53	0.98	0.08	12,16,20,22	0
3	FAD	A	402	53/53	0.98	0.07	10,15,20,23	0
3	FAD	C	402	53/53	0.98	0.07	10,16,21,22	0
3	FAD	D	402	53/53	0.98	0.07	12,19,23,26	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 402:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
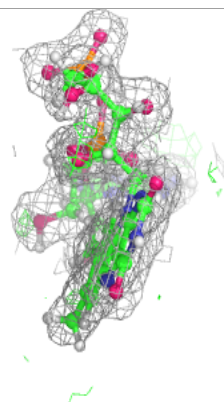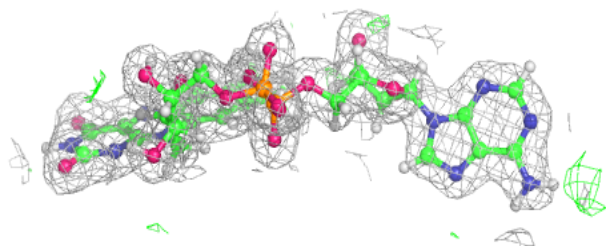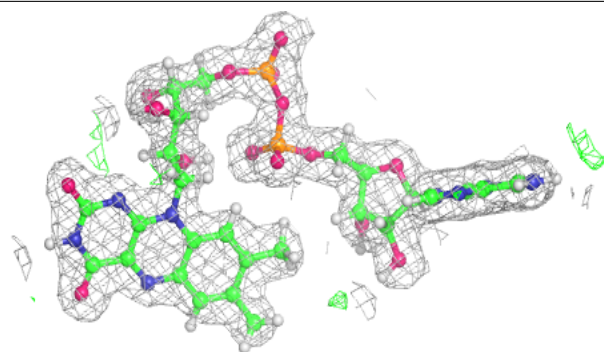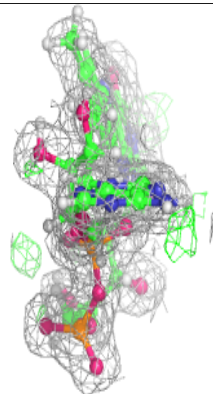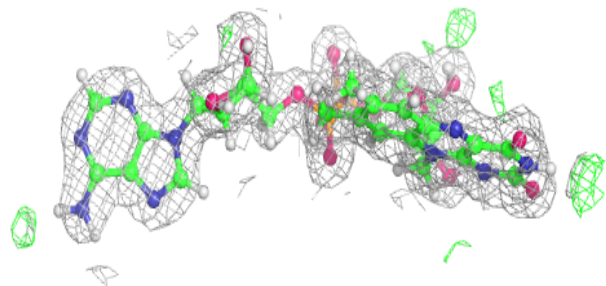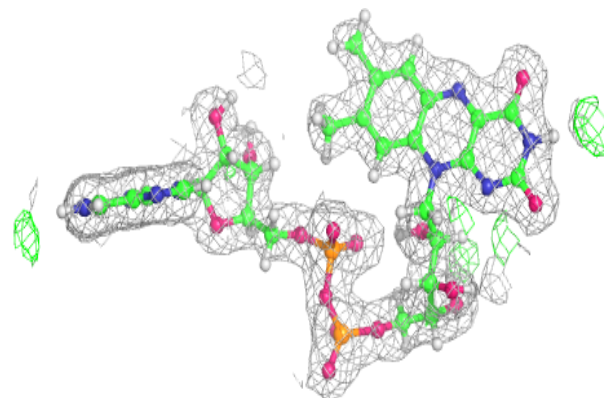mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
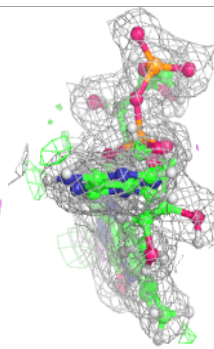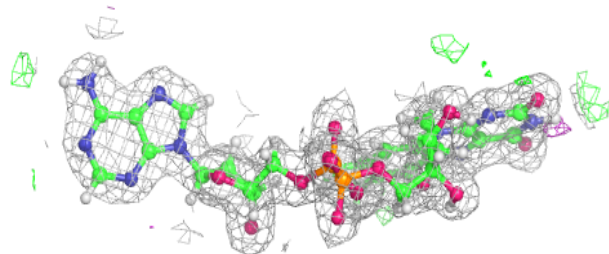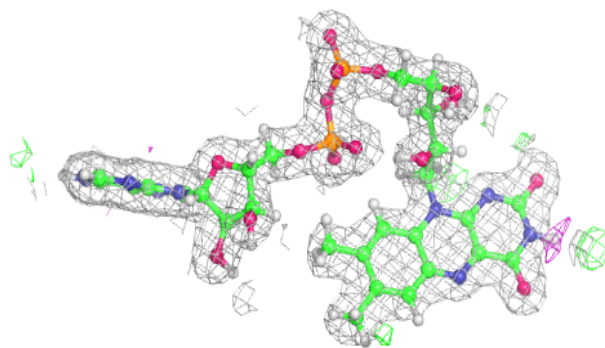
Electron density around FAD A 402:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
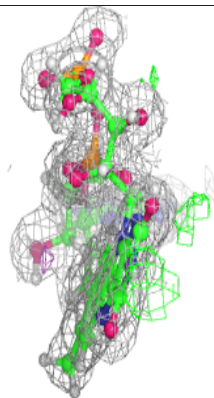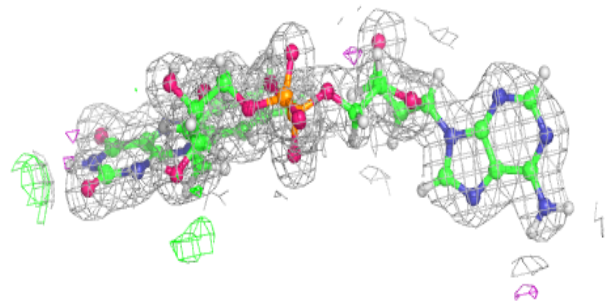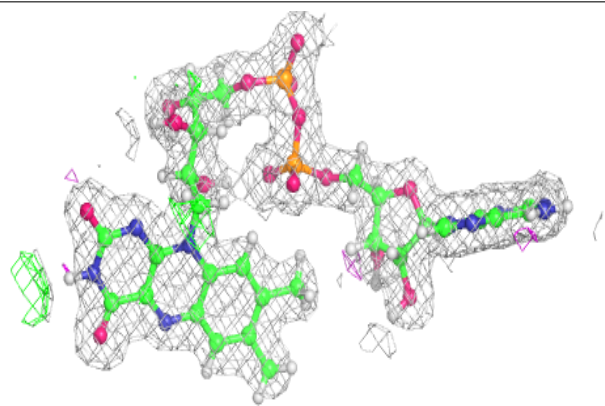
Electron density around FAD C 402:

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

Electron density around FAD D 402:

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

6.5 Other polymers (i)

There are no such residues in this entry.