



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 07:14 AM UTC

PDB ID : 8ACS / pdb_00008acs
Title : Crystal structure of FMO from Janthinobacterium svalbardensis
Authors : Polidori, N.; Galuska, P.; Gruber, K.
Deposited on : 2022-07-06
Resolution : 2.50 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

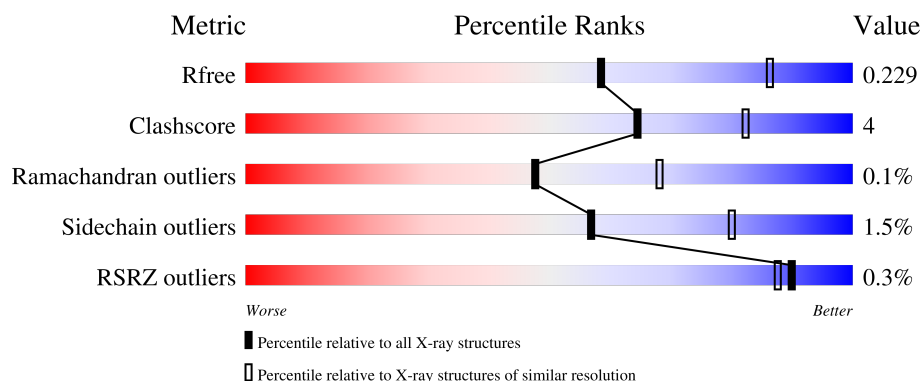
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	618	 88% 9% .
1	B	618	 85% 10% 5%
1	C	618	 86% 9% .
1	D	618	 85% 11% .

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 19066 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 FAD-dependent oxidoreductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	598	Total	C	N	O	S	0	1	0
			4660	2946	819	873	22			
1	B	589	Total	C	N	O	S	0	0	0
			4578	2901	798	857	22			
1	C	591	Total	C	N	O	S	0	1	0
			4608	2918	806	862	22			
1	D	597	Total	C	N	O	S	0	4	0
			4680	2961	821	875	23			

There are 64 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-15	HIS	-	expression tag	UNP A0A290WZ30
A	-14	HIS	-	expression tag	UNP A0A290WZ30
A	-13	HIS	-	expression tag	UNP A0A290WZ30
A	-12	HIS	-	expression tag	UNP A0A290WZ30
A	-11	HIS	-	expression tag	UNP A0A290WZ30
A	-10	HIS	-	expression tag	UNP A0A290WZ30
A	-9	SER	-	expression tag	UNP A0A290WZ30
A	-8	SER	-	expression tag	UNP A0A290WZ30
A	-7	GLY	-	expression tag	UNP A0A290WZ30
A	-6	GLU	-	expression tag	UNP A0A290WZ30
A	-5	ASN	-	expression tag	UNP A0A290WZ30
A	-4	LEU	-	expression tag	UNP A0A290WZ30
A	-3	TYR	-	expression tag	UNP A0A290WZ30
A	-2	PHE	-	expression tag	UNP A0A290WZ30
A	-1	GLN	-	expression tag	UNP A0A290WZ30
A	0	GLY	-	expression tag	UNP A0A290WZ30
B	-15	HIS	-	expression tag	UNP A0A290WZ30
B	-14	HIS	-	expression tag	UNP A0A290WZ30
B	-13	HIS	-	expression tag	UNP A0A290WZ30
B	-12	HIS	-	expression tag	UNP A0A290WZ30
B	-11	HIS	-	expression tag	UNP A0A290WZ30

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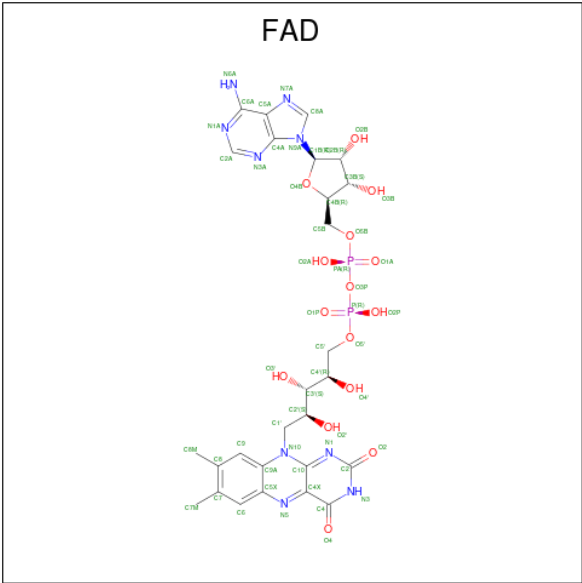
Chain	Residue	Modelled	Actual	Comment	Reference
B	-10	HIS	-	expression tag	UNP A0A290WZ30
B	-9	SER	-	expression tag	UNP A0A290WZ30
B	-8	SER	-	expression tag	UNP A0A290WZ30
B	-7	GLY	-	expression tag	UNP A0A290WZ30
B	-6	GLU	-	expression tag	UNP A0A290WZ30
B	-5	ASN	-	expression tag	UNP A0A290WZ30
B	-4	LEU	-	expression tag	UNP A0A290WZ30
B	-3	TYR	-	expression tag	UNP A0A290WZ30
B	-2	PHE	-	expression tag	UNP A0A290WZ30
B	-1	GLN	-	expression tag	UNP A0A290WZ30
B	0	GLY	-	expression tag	UNP A0A290WZ30
C	-15	HIS	-	expression tag	UNP A0A290WZ30
C	-14	HIS	-	expression tag	UNP A0A290WZ30
C	-13	HIS	-	expression tag	UNP A0A290WZ30
C	-12	HIS	-	expression tag	UNP A0A290WZ30
C	-11	HIS	-	expression tag	UNP A0A290WZ30
C	-10	HIS	-	expression tag	UNP A0A290WZ30
C	-9	SER	-	expression tag	UNP A0A290WZ30
C	-8	SER	-	expression tag	UNP A0A290WZ30
C	-7	GLY	-	expression tag	UNP A0A290WZ30
C	-6	GLU	-	expression tag	UNP A0A290WZ30
C	-5	ASN	-	expression tag	UNP A0A290WZ30
C	-4	LEU	-	expression tag	UNP A0A290WZ30
C	-3	TYR	-	expression tag	UNP A0A290WZ30
C	-2	PHE	-	expression tag	UNP A0A290WZ30
C	-1	GLN	-	expression tag	UNP A0A290WZ30
C	0	GLY	-	expression tag	UNP A0A290WZ30
D	-15	HIS	-	expression tag	UNP A0A290WZ30
D	-14	HIS	-	expression tag	UNP A0A290WZ30
D	-13	HIS	-	expression tag	UNP A0A290WZ30
D	-12	HIS	-	expression tag	UNP A0A290WZ30
D	-11	HIS	-	expression tag	UNP A0A290WZ30
D	-10	HIS	-	expression tag	UNP A0A290WZ30
D	-9	SER	-	expression tag	UNP A0A290WZ30
D	-8	SER	-	expression tag	UNP A0A290WZ30
D	-7	GLY	-	expression tag	UNP A0A290WZ30
D	-6	GLU	-	expression tag	UNP A0A290WZ30
D	-5	ASN	-	expression tag	UNP A0A290WZ30
D	-4	LEU	-	expression tag	UNP A0A290WZ30
D	-3	TYR	-	expression tag	UNP A0A290WZ30
D	-2	PHE	-	expression tag	UNP A0A290WZ30
D	-1	GLN	-	expression tag	UNP A0A290WZ30

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Chain	Residue	Modelled	Actual	Comment	Reference
D	0	GLY	-	expression tag	UNP A0A290WZ30

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
2	B	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
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 GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		
3	A	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total	C	O	0	0
			6	3	3		
3	B	1	Total	C	O	0	0
			6	3	3		
3	C	1	Total	C	O	0	0
			6	3	3		
3	C	1	Total	C	O	0	0
			6	3	3		
3	C	1	Total	C	O	0	0
			6	3	3		

- Molecule 4 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			7	4	3		
4	B	1	Total	C	O	0	0
			7	4	3		
4	C	1	Total	C	O	0	0
			7	4	3		
4	D	1	Total	C	O	0	0
			7	4	3		
4	D	1	Total	C	O	0	0
			7	4	3		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	57	Total	O	0	0
			57	57		
5	B	69	Total	O	0	0
			69	69		
5	C	47	Total	O	0	0
			47	47		
5	D	54	Total	O	0	0
			54	54		

- Molecule 1: FAD-dependent oxidoreductase

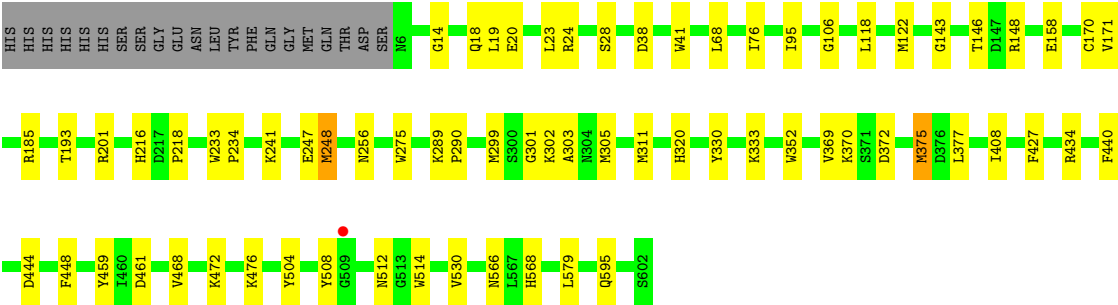
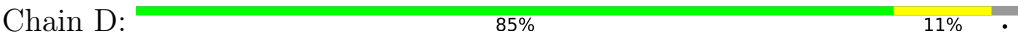
- Molecule 1: FAD-dependent oxidoreductase

- Molecule 1: FAD-dependent oxidoreductase





● Molecule 1: FAD-dependent oxidoreductase



4 Data and refinement statistics

Property	Value	Source
Space group	P 2 ₁ 2 ₁ 2	Depositor
Cell constants a, b, c, α , β , γ	142.30Å 316.36Å 65.65Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.44 – 2.50 49.44 – 2.50	Depositor EDS
% Data completeness (in resolution range)	89.0 (49.44-2.50) 84.8 (49.44-2.50)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.60 (at 2.51Å)	Xtrriage
Refinement program	PHENIX 19	Depositor
R, R_{free}	0.182 , 0.229 0.182 , 0.229	Depositor DCC
R_{free} test set	4616 reflections (4.46%)	wwPDB-VP
Wilson B-factor (Å ²)	42.8	Xtrriage
Anisotropy	0.928	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 27.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	19066	wwPDB-VP
Average B, all atoms (Å ²)	45.0	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 20.39 % 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 8.7894e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: FAD, PEG, GOL

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	0.41	0/4771	0.60	0/6461
1	B	0.40	0/4687	0.57	0/6348
1	C	0.40	0/4718	0.57	0/6389
1	D	0.41	0/4793	0.60	0/6491
All	All	0.40	0/18969	0.59	0/25689

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	4660	0	4567	38	0
1	B	4578	0	4491	37	0
1	C	4608	0	4516	34	0
1	D	4680	0	4577	47	0
2	A	53	0	31	2	0
2	B	53	0	31	2	0
2	C	53	0	31	1	0
2	D	53	0	31	2	0
3	A	18	0	23	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	24	0	32	1	0
3	C	24	0	32	1	0
4	A	7	0	10	0	0
4	B	7	0	10	1	0
4	C	7	0	10	0	0
4	D	14	0	20	3	0
5	A	57	0	0	1	0
5	B	69	0	0	0	0
5	C	47	0	0	0	0
5	D	54	0	0	1	0
All	All	19066	0	18412	146	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 4.

All (146) 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:248:MET:HG3	1:C:248:MET:HB3	1.36	1.03
1:D:158:GLU:OE2	1:D:256[A]:ASN:ND2	2.05	0.88
1:C:157:GLN:NE2	1:C:161:GLU:OE2	2.21	0.74
1:B:76:ILE:HD11	1:B:95:ILE:HD12	1.68	0.73
1:B:248:MET:HB3	1:D:248:MET:HB2	1.71	0.72
1:B:248:MET:HG3	1:D:248:MET:HA	1.73	0.70
1:A:248:MET:HA	1:C:248:MET:HG3	1.75	0.69
1:D:303:ALA:HA	1:D:508:TYR:HD1	1.58	0.69
1:D:23:LEU:HD22	1:D:68:LEU:HD21	1.77	0.67
1:B:459:TYR:CE2	1:B:461:ASP:HA	2.30	0.67
1:D:216[A]:HIS:HE1	4:D:702:PEG:H41	1.59	0.67
1:D:459:TYR:CE2	1:D:461:ASP:HA	2.30	0.66
1:D:301:GLY:HA3	1:D:514:TRP:HE1	1.61	0.65
1:A:23:LEU:HD22	1:A:68:LEU:HD21	1.80	0.64
1:A:377:LEU:HD21	1:A:423:ARG:CZ	2.29	0.63
1:D:20:GLU:OE2	1:D:24:ARG:NH2	2.33	0.62
1:D:185:ARG:HH22	4:D:703:PEG:H12	1.66	0.60
1:C:459:TYR:CE2	1:C:461:ASP:HA	2.40	0.57
1:C:297:THR:HG1	1:C:514:TRP:CG	2.23	0.56
1:A:205:SER:HA	1:A:208:LYS:HE2	1.88	0.55
1:A:512:ASN:HB3	1:A:530:VAL:HG23	1.90	0.54
1:B:177:GLN:HG2	2:B:701:FAD:O1P	2.07	0.54
1:B:352:TRP:NE1	1:B:472:LYS:HB3	2.22	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:357:ASP:OD1	1:B:474:LYS:NZ	2.28	0.54
1:C:76:ILE:HD11	1:C:95:ILE:HD12	1.90	0.54
1:C:177:GLN:CD	2:C:701:FAD:H5'2	2.33	0.54
1:B:177:GLN:CD	2:B:701:FAD:H5'2	2.34	0.53
1:C:52:LYS:NZ	3:C:706:GOL:O3	2.41	0.53
1:D:143:GLY:O	1:D:148:ARG:NH2	2.42	0.53
1:D:303:ALA:HA	1:D:508:TYR:CD1	2.43	0.52
1:B:23:LEU:HD22	1:B:68:LEU:HD21	1.91	0.52
1:D:216[A]:HIS:CE1	4:D:702:PEG:H41	2.43	0.51
1:D:299:MET:C	1:D:301:GLY:H	2.18	0.51
1:A:480:GLY:HA3	1:D:38:ASP:OD2	2.11	0.50
1:B:104:GLY:HA3	1:B:121:THR:O	2.12	0.50
1:A:214:CYS:SG	1:C:140:ALA:HB2	2.52	0.50
1:A:161:GLU:OE1	1:A:166:ARG:NH1	2.43	0.50
1:B:236:PHE:CE1	1:B:375:MET:HE3	2.47	0.50
1:C:122:MET:HG2	1:C:579:LEU:HD13	1.94	0.49
1:D:301:GLY:O	1:D:302:LYS:HB2	2.12	0.49
1:D:201:ARG:HD2	1:D:247:GLU:OE2	2.13	0.48
1:D:370:LYS:HE2	1:D:427:PHE:CD1	2.47	0.48
1:B:122:MET:HG2	1:B:579:LEU:HD13	1.95	0.48
1:D:448[A]:PHE:HB2	5:D:810:HOH:O	2.13	0.48
1:B:432:GLU:HG3	1:B:438:LEU:HD12	1.95	0.48
1:C:305:MET:HE3	1:C:306:PRO:HD2	1.96	0.48
1:D:19:LEU:HD23	1:D:76:ILE:HD13	1.94	0.48
1:A:52:LYS:HE2	1:A:594:GLY:HA3	1.96	0.48
1:B:233:TRP:CG	1:B:234:PRO:HD2	2.49	0.48
1:D:122:MET:HG2	1:D:579:LEU:HD13	1.94	0.47
1:B:8:HIS:HB3	1:B:91:LEU:HD21	1.96	0.47
1:B:248:MET:C	1:D:248:MET:HE2	2.39	0.47
1:A:302:LYS:NZ	1:A:302:LYS:H	2.13	0.47
1:B:236:PHE:HE1	1:B:375:MET:HE3	1.79	0.47
1:B:301:GLY:O	1:B:508:TYR:HB3	2.14	0.47
1:A:302:LYS:CE	1:A:513:GLY:HA3	2.45	0.47
1:D:275:TRP:O	1:D:289:LYS:HA	2.16	0.46
1:C:421:ARG:HG2	1:C:440:PHE:CE2	2.50	0.46
1:A:177:GLN:CD	2:A:701:FAD:H5'2	2.41	0.46
1:A:68:LEU:HD23	1:A:68:LEU:HA	1.77	0.46
1:A:248:MET:CG	1:C:248:MET:HB3	2.25	0.46
1:B:52:LYS:NZ	4:B:702:PEG:H41	2.30	0.46
1:C:410:ALA:O	1:C:414:LYS:HG3	2.16	0.46
1:C:429:ALA:O	1:C:433:GLU:HG3	2.16	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:41:TRP:CD2	1:D:118:LEU:HD23	2.51	0.46
1:A:204:ASP:O	1:A:208:LYS:HG3	2.16	0.46
1:A:376:ASP:HB2	1:A:377:LEU:HD22	1.98	0.46
1:C:233:TRP:CG	1:C:234:PRO:HD2	2.51	0.46
1:B:157:GLN:NE2	1:B:161:GLU:OE2	2.49	0.45
1:C:476:LYS:HB3	1:C:476:LYS:HE3	1.69	0.45
1:C:529:LYS:HE2	1:C:602:SER:OXT	2.16	0.45
1:B:23:LEU:O	1:B:72:GLN:NE2	2.49	0.45
1:D:171:VAL:HB	1:D:290:PRO:HG3	1.98	0.45
1:A:467:LEU:HB3	1:A:473:ILE:HG13	1.98	0.45
1:A:196:ILE:HD12	1:A:261:THR:HG21	1.97	0.45
1:A:27:ASP:OD2	1:A:30:GLY:HA3	2.16	0.45
1:B:44:LEU:HD22	1:B:51:LEU:HD22	1.99	0.45
1:B:434:ARG:HG2	1:B:468:VAL:O	2.17	0.45
1:B:479:VAL:HG21	1:B:491:LEU:HD13	1.99	0.45
1:D:68:LEU:HD23	1:D:68:LEU:HA	1.71	0.45
1:D:330:TYR:HD1	1:D:333:LYS:HD2	1.80	0.45
1:D:370:LYS:HE2	1:D:427:PHE:CG	2.52	0.45
1:C:23:LEU:O	1:C:72:GLN:NE2	2.50	0.45
1:D:512:ASN:HB3	1:D:530:VAL:HG23	1.98	0.45
1:A:177:GLN:HG2	2:A:701:FAD:O1P	2.17	0.44
1:C:248:MET:HE1	1:C:251:LYS:HE2	1.98	0.44
1:B:446:GLY:O	1:B:450:LYS:HG3	2.17	0.44
1:A:143:GLY:O	1:A:148:ARG:NH2	2.49	0.44
1:C:442:ASP:OD2	1:C:537:THR:HB	2.18	0.44
1:B:91:LEU:HD23	1:B:91:LEU:HA	1.81	0.44
1:B:330:TYR:CE1	1:B:501:LEU:HD22	2.52	0.44
1:C:476:LYS:HE2	1:C:495:THR:HG21	2.00	0.44
1:B:209:ARG:HB3	1:B:213:LEU:HD13	1.99	0.43
1:A:209:ARG:CB	1:A:213:LEU:HD13	2.48	0.43
1:B:6:ASN:OD1	1:B:83:HIS:ND1	2.52	0.43
1:D:459:TYR:CZ	1:D:461:ASP:HA	2.54	0.43
1:A:306:PRO:HG3	1:A:506:THR:HG21	2.01	0.43
1:B:92:GLN:HB3	1:B:107:PHE:CZ	2.54	0.43
1:C:213:LEU:C	1:C:213:LEU:HD23	2.44	0.43
1:A:209:ARG:HB3	1:A:213:LEU:HD13	2.01	0.43
1:B:210:TYR:CG	1:B:211:LYS:N	2.87	0.43
1:D:305:MET:HE1	1:D:320:HIS:HB2	2.00	0.43
1:C:104:GLY:HA3	1:C:121:THR:O	2.19	0.42
1:D:305:MET:HE1	1:D:320:HIS:N	2.34	0.42
1:A:432:GLU:HG3	1:A:438:LEU:HD12	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:188:GLN:HG3	1:C:226:TYR:CZ	2.54	0.42
1:C:352:TRP:NE1	1:C:472:LYS:HB3	2.35	0.42
1:A:493:ASP:HA	1:D:408:ILE:HG22	2.00	0.42
1:C:68:LEU:HA	1:C:68:LEU:HD23	1.82	0.42
1:D:370:LYS:NZ	1:D:461:ASP:OD2	2.52	0.42
1:A:302:LYS:HE3	1:A:302:LYS:HB3	1.71	0.42
1:A:541:PRO:HB2	1:A:600:HIS:CE1	2.55	0.42
1:D:440:PHE:O	1:D:444:ASP:HA	2.19	0.42
1:B:396:LYS:HD3	3:B:704:GOL:H32	2.02	0.41
1:B:14:GLY:O	1:B:18:GLN:HG3	2.20	0.41
1:B:254:GLU:OE2	1:D:241:LYS:NZ	2.53	0.41
1:D:95:ILE:HG12	1:D:106:GLY:C	2.46	0.41
1:D:352:TRP:NE1	1:D:472:LYS:HB3	2.35	0.41
1:A:7:PRO:O	1:A:10:LEU:HG	2.21	0.41
1:A:122:MET:HG2	1:A:579:LEU:HD13	2.02	0.41
1:A:440:PHE:O	1:A:444:ASP:HA	2.21	0.41
1:D:311:MET:HE3	1:D:504:TYR:CZ	2.56	0.41
1:C:169:TYR:CE2	1:C:585:MET:HB2	2.56	0.41
1:A:210:TYR:CE1	1:A:327:PRO:HD2	2.56	0.41
1:A:459:TYR:CE2	1:A:461:ASP:HA	2.56	0.41
2:D:701:FAD:O2'	2:D:701:FAD:H9	2.21	0.41
1:C:194:ILE:HD13	1:C:258:TRP:CZ2	2.56	0.41
1:B:162:LEU:HD23	1:B:256:ASN:ND2	2.36	0.41
1:C:312:ASP:OD1	1:C:313:VAL:HG23	2.21	0.41
1:C:446:GLY:O	1:C:450:LYS:HG3	2.20	0.41
1:D:233:TRP:CG	1:D:234:PRO:HD2	2.56	0.41
1:A:377:LEU:HD21	1:A:423:ARG:NH2	2.36	0.41
1:D:566:ASN:HB2	2:D:701:FAD:O2	2.21	0.41
1:D:218:PRO:HG3	1:D:375[A]:MET:SD	2.61	0.40
1:A:462:VAL:HG11	5:A:851:HOH:O	2.20	0.40
1:B:52:LYS:HE2	1:B:594:GLY:HA3	2.03	0.40
1:B:248:MET:CB	1:D:248:MET:HB2	2.45	0.40
1:C:432:GLU:HG3	1:C:438:LEU:HD12	2.03	0.40
1:D:170:CYS:O	1:D:193:THR:HA	2.21	0.40
1:D:377:LEU:HD23	1:D:377:LEU:HA	1.88	0.40
1:D:434:ARG:HG2	1:D:468:VAL:O	2.21	0.40
1:A:41:TRP:CE2	1:A:118:LEU:HD23	2.57	0.40
1:A:151:TRP:O	1:A:155:ARG:HG2	2.22	0.40
1:C:328:ASP:OD1	1:C:328:ASP:N	2.53	0.40
1:D:14:GLY:O	1:D:18:GLN:HG3	2.21	0.40
1:C:213:LEU:HD22	1:C:239:LYS:HB3	2.04	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	597/618 (97%)	585 (98%)	11 (2%)	1 (0%)	43	63
1	B	585/618 (95%)	573 (98%)	11 (2%)	1 (0%)	43	63
1	C	588/618 (95%)	577 (98%)	11 (2%)	0	100	100
1	D	599/618 (97%)	583 (97%)	16 (3%)	0	100	100
All	All	2369/2472 (96%)	2318 (98%)	49 (2%)	2 (0%)	48	68

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	45	VAL
1	B	45	VAL

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	484/501 (97%)	480 (99%)	4 (1%)	73	88
1	B	476/501 (95%)	468 (98%)	8 (2%)	53	78
1	C	479/501 (96%)	472 (98%)	7 (2%)	57	80
1	D	486/501 (97%)	476 (98%)	10 (2%)	47	74
All	All	1925/2004 (96%)	1896 (98%)	29 (2%)	57	80

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	LEU
1	A	28	SER
1	A	302	LYS
1	A	372	ASP
1	B	24	ARG
1	B	28	SER
1	B	105	VAL
1	B	251	LYS
1	B	375	MET
1	B	476	LYS
1	B	510	SER
1	B	511	MET
1	C	28	SER
1	C	157	GLN
1	C	372	ASP
1	C	375	MET
1	C	486	SER
1	C	510	SER
1	C	568	HIS
1	D	28	SER
1	D	146	THR
1	D	248	MET
1	D	369	VAL
1	D	372	ASP
1	D	375[A]	MET
1	D	375[B]	MET
1	D	476	LYS
1	D	568	HIS
1	D	595	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	6	ASN
1	A	256	ASN
1	A	318	GLN
1	A	367	HIS
1	A	413	GLN
1	B	33	GLN
1	B	157	GLN
1	B	599	HIS

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Mol	Chain	Res	Type
1	C	33	GLN
1	C	67	GLN
1	C	188	GLN
1	C	318	GLN
1	C	395	ASN
1	C	599	HIS
1	D	142	HIS
1	D	188	GLN
1	D	318	GLN
1	D	413	GLN
1	D	595	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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

20 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	D	701	-	58,58,58	0.58	0	85,89,89	0.71	2 (2%)
3	GOL	C	702	-	5,5,5	0.78	0	5,5,5	1.26	1 (20%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	PEG	B	702	-	6,6,6	0.19	0	5,5,5	0.28	0
3	GOL	A	702	-	5,5,5	1.34	1 (20%)	5,5,5	1.17	0
4	PEG	A	705	-	6,6,6	0.29	0	5,5,5	0.11	0
4	PEG	D	702	-	6,6,6	0.15	0	5,5,5	0.24	0
4	PEG	C	703	-	6,6,6	0.43	0	5,5,5	0.32	0
2	FAD	A	701	-	58,58,58	0.40	0	85,89,89	0.54	1 (1%)
3	GOL	C	706	-	5,5,5	0.84	0	5,5,5	1.30	1 (20%)
3	GOL	A	703	-	5,5,5	0.65	0	5,5,5	1.20	1 (20%)
2	FAD	B	701	-	58,58,58	0.44	0	85,89,89	0.59	1 (1%)
3	GOL	C	705	-	5,5,5	0.66	0	5,5,5	1.28	1 (20%)
4	PEG	D	703	-	6,6,6	0.40	0	5,5,5	0.26	0
3	GOL	B	706	-	5,5,5	0.88	0	5,5,5	1.11	1 (20%)
3	GOL	B	705	-	5,5,5	0.92	0	5,5,5	1.12	0
3	GOL	B	704	-	5,5,5	1.51	1 (20%)	5,5,5	1.02	0
3	GOL	A	704	-	5,5,5	0.90	0	5,5,5	1.09	0
3	GOL	B	703	-	5,5,5	1.04	0	5,5,5	0.95	0
3	GOL	C	704	-	5,5,5	0.74	0	5,5,5	1.17	0
2	FAD	C	701	-	58,58,58	0.51	0	85,89,89	0.63	1 (1%)

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	701	-	-	9/34/50/50	0/6/6/6
3	GOL	C	702	-	-	2/4/4/4	-
4	PEG	B	702	-	-	2/4/4/4	-
3	GOL	A	702	-	-	2/4/4/4	-
4	PEG	A	705	-	-	1/4/4/4	-
4	PEG	D	702	-	-	3/4/4/4	-
4	PEG	C	703	-	-	3/4/4/4	-
2	FAD	A	701	-	-	11/34/50/50	0/6/6/6
3	GOL	C	706	-	-	2/4/4/4	-
3	GOL	A	703	-	-	4/4/4/4	-
2	FAD	B	701	-	-	11/34/50/50	0/6/6/6
3	GOL	C	705	-	-	1/4/4/4	-
4	PEG	D	703	-	-	2/4/4/4	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GOL	B	706	-	-	0/4/4/4	-
3	GOL	B	705	-	-	2/4/4/4	-
3	GOL	B	704	-	-	2/4/4/4	-
3	GOL	A	704	-	-	0/4/4/4	-
3	GOL	B	703	-	-	2/4/4/4	-
3	GOL	C	704	-	-	0/4/4/4	-
2	FAD	C	701	-	-	8/34/50/50	0/6/6/6

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	704	GOL	C1-C2	2.74	1.62	1.51
3	A	702	GOL	O2-C2	-2.54	1.36	1.43

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	701	FAD	C4'-C3'-C2'	-3.28	108.11	113.57
2	C	701	FAD	O5'-P-O1P	2.97	120.70	108.94
3	C	705	GOL	C3-C2-C1	-2.37	103.12	111.80
2	A	701	FAD	O5'-P-O1P	2.34	118.21	108.94
3	C	706	GOL	C3-C2-C1	-2.26	103.49	111.80
2	B	701	FAD	O5'-P-O1P	2.24	117.81	108.94
3	A	703	GOL	C3-C2-C1	-2.12	104.00	111.80
2	D	701	FAD	C5'-C4'-C3'	-2.10	108.25	112.22
3	B	706	GOL	C3-C2-C1	-2.08	104.15	111.80
3	C	702	GOL	C3-C2-C1	-2.07	104.20	111.80

There are no chirality outliers.

All (67) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	701	FAD	N10-C1'-C2'-O2'
2	A	701	FAD	N10-C1'-C2'-C3'
2	A	701	FAD	C1'-C2'-C3'-C4'
2	A	701	FAD	C3'-C4'-C5'-O5'
2	A	701	FAD	O4'-C4'-C5'-O5'
2	A	701	FAD	C5'-O5'-P-O2P
2	A	701	FAD	C5'-O5'-P-O3P
2	B	701	FAD	N10-C1'-C2'-O2'

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Mol	Chain	Res	Type	Atoms
2	B	701	FAD	N10-C1'-C2'-C3'
2	B	701	FAD	C3'-C4'-C5'-O5'
2	B	701	FAD	O4'-C4'-C5'-O5'
2	B	701	FAD	C5'-O5'-P-O2P
2	B	701	FAD	C5'-O5'-P-O3P
2	C	701	FAD	N10-C1'-C2'-O2'
2	C	701	FAD	N10-C1'-C2'-C3'
2	C	701	FAD	C3'-C4'-C5'-O5'
2	C	701	FAD	O4'-C4'-C5'-O5'
2	C	701	FAD	C5'-O5'-P-O2P
2	C	701	FAD	C5'-O5'-P-O3P
2	D	701	FAD	N10-C1'-C2'-O2'
2	D	701	FAD	N10-C1'-C2'-C3'
2	D	701	FAD	O3'-C3'-C4'-O4'
2	D	701	FAD	O3'-C3'-C4'-C5'
3	A	702	GOL	C1-C2-C3-O3
3	A	703	GOL	C1-C2-C3-O3
3	B	704	GOL	O1-C1-C2-C3
3	C	702	GOL	C1-C2-C3-O3
3	C	702	GOL	O2-C2-C3-O3
4	D	703	PEG	C1-C2-O2-C3
2	D	701	FAD	C2'-C3'-C4'-O4'
2	D	701	FAD	C2'-C3'-C4'-C5'
4	D	702	PEG	C4-C3-O2-C2
4	C	703	PEG	O2-C3-C4-O4
3	B	703	GOL	C1-C2-C3-O3
3	B	705	GOL	C1-C2-C3-O3
3	C	706	GOL	O1-C1-C2-C3
4	D	702	PEG	O1-C1-C2-O2
3	A	702	GOL	O2-C2-C3-O3
3	A	703	GOL	O2-C2-C3-O3
3	B	704	GOL	O1-C1-C2-O2
2	A	701	FAD	O2'-C2'-C3'-C4'
2	D	701	FAD	C3'-C4'-C5'-O5'
4	A	705	PEG	O2-C3-C4-O4
3	B	705	GOL	O2-C2-C3-O3
4	B	702	PEG	O1-C1-C2-O2
2	A	701	FAD	O2'-C2'-C3'-O3'
3	B	703	GOL	O2-C2-C3-O3
2	D	701	FAD	PA-O3P-P-O5'
3	C	706	GOL	O1-C1-C2-O2
4	C	703	PEG	C4-C3-O2-C2

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Mol	Chain	Res	Type	Atoms
4	D	703	PEG	C4-C3-O2-C2
2	B	701	FAD	O2'-C2'-C3'-O3'
4	D	702	PEG	O2-C3-C4-O4
2	B	701	FAD	O2'-C2'-C3'-C4'
2	A	701	FAD	P-O3P-PA-O1A
2	B	701	FAD	P-O3P-PA-O1A
2	D	701	FAD	O4'-C4'-C5'-O5'
3	C	705	GOL	O1-C1-C2-C3
3	A	703	GOL	O1-C1-C2-O2
4	C	703	PEG	C1-C2-O2-C3
2	A	701	FAD	C1'-C2'-C3'-O3'
2	B	701	FAD	C1'-C2'-C3'-O3'
3	A	703	GOL	O1-C1-C2-C3
2	C	701	FAD	P-O3P-PA-O2A
4	B	702	PEG	O2-C3-C4-O4
2	C	701	FAD	O2'-C2'-C3'-C4'
2	B	701	FAD	P-O3P-PA-O2A

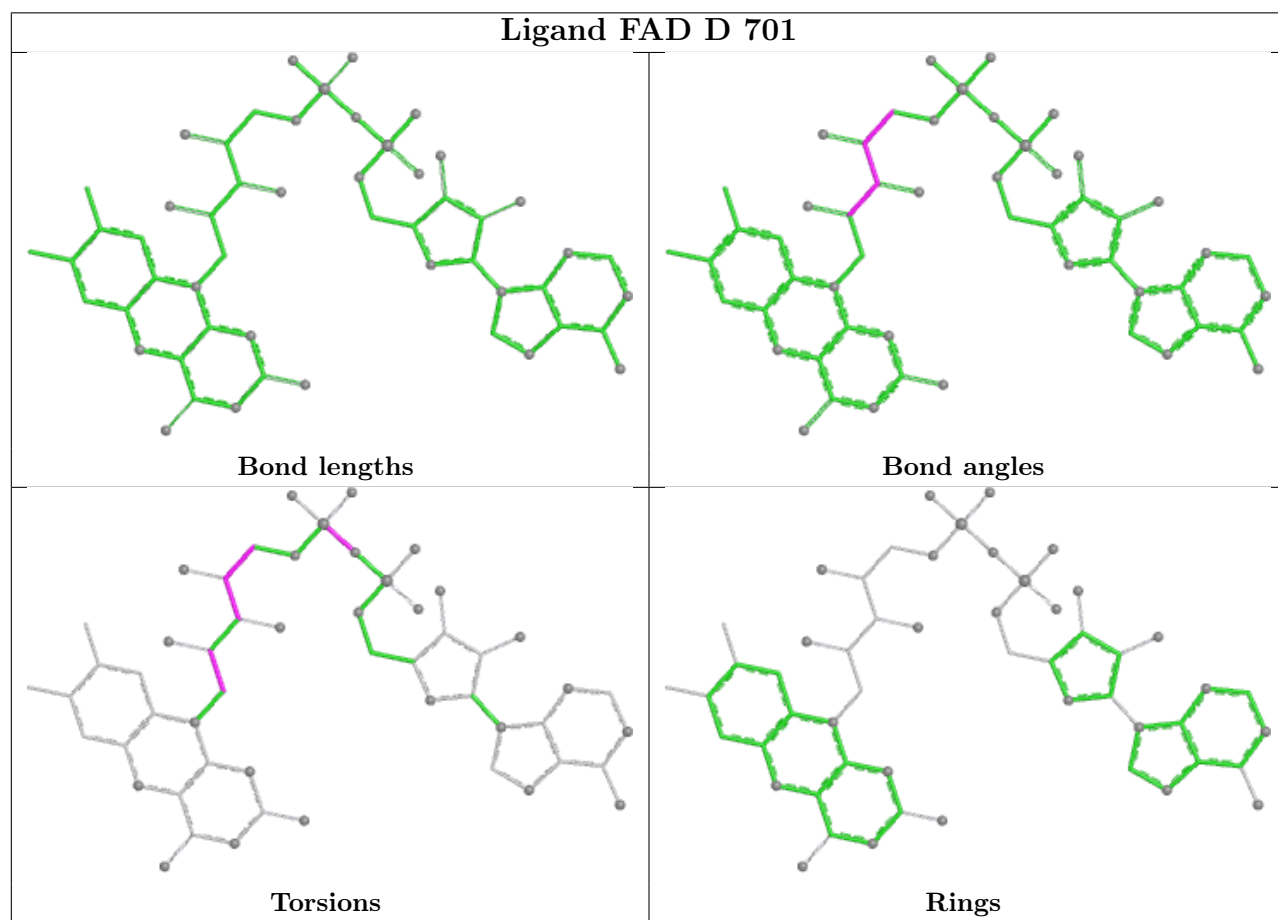
There are no ring outliers.

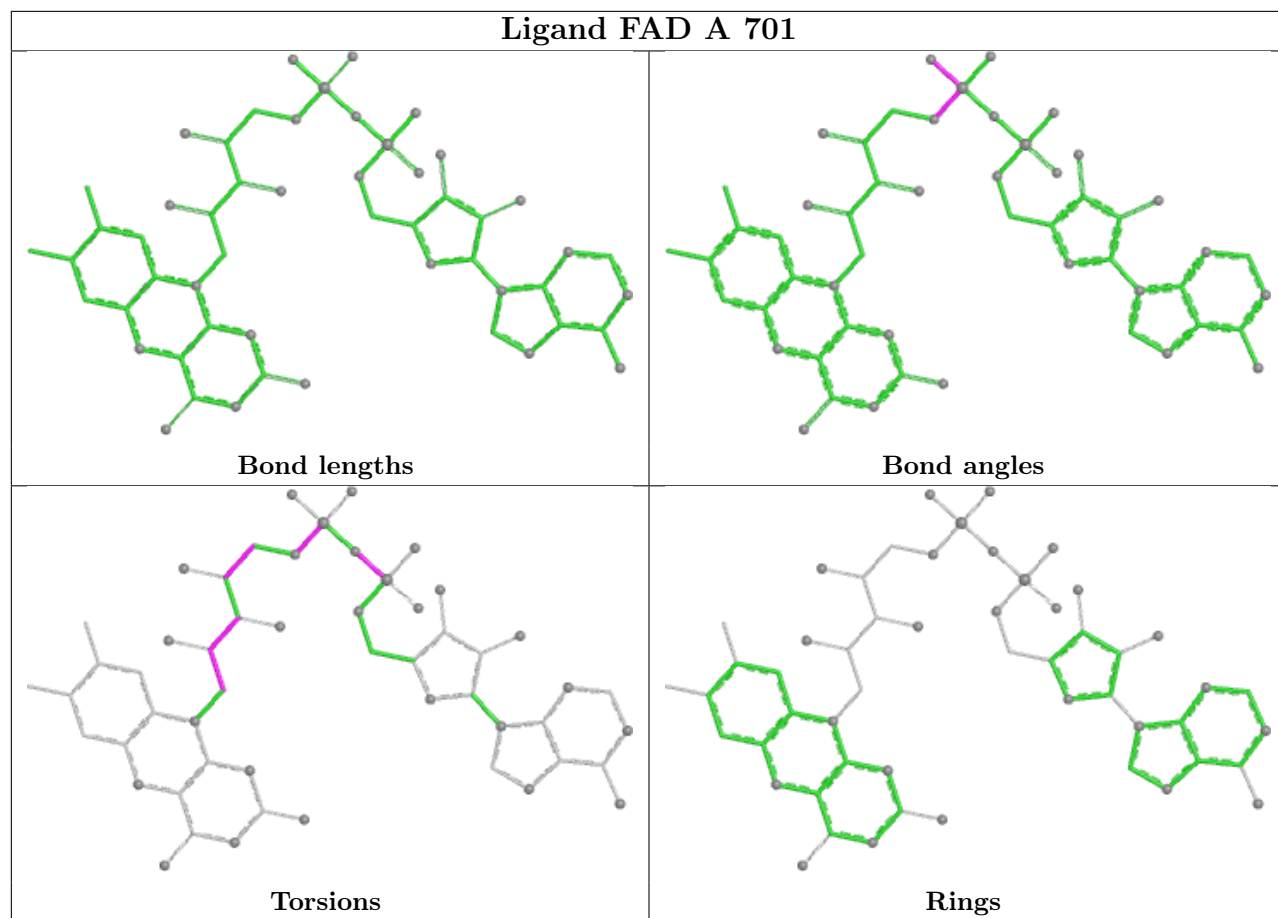
9 monomers are involved in 13 short contacts:

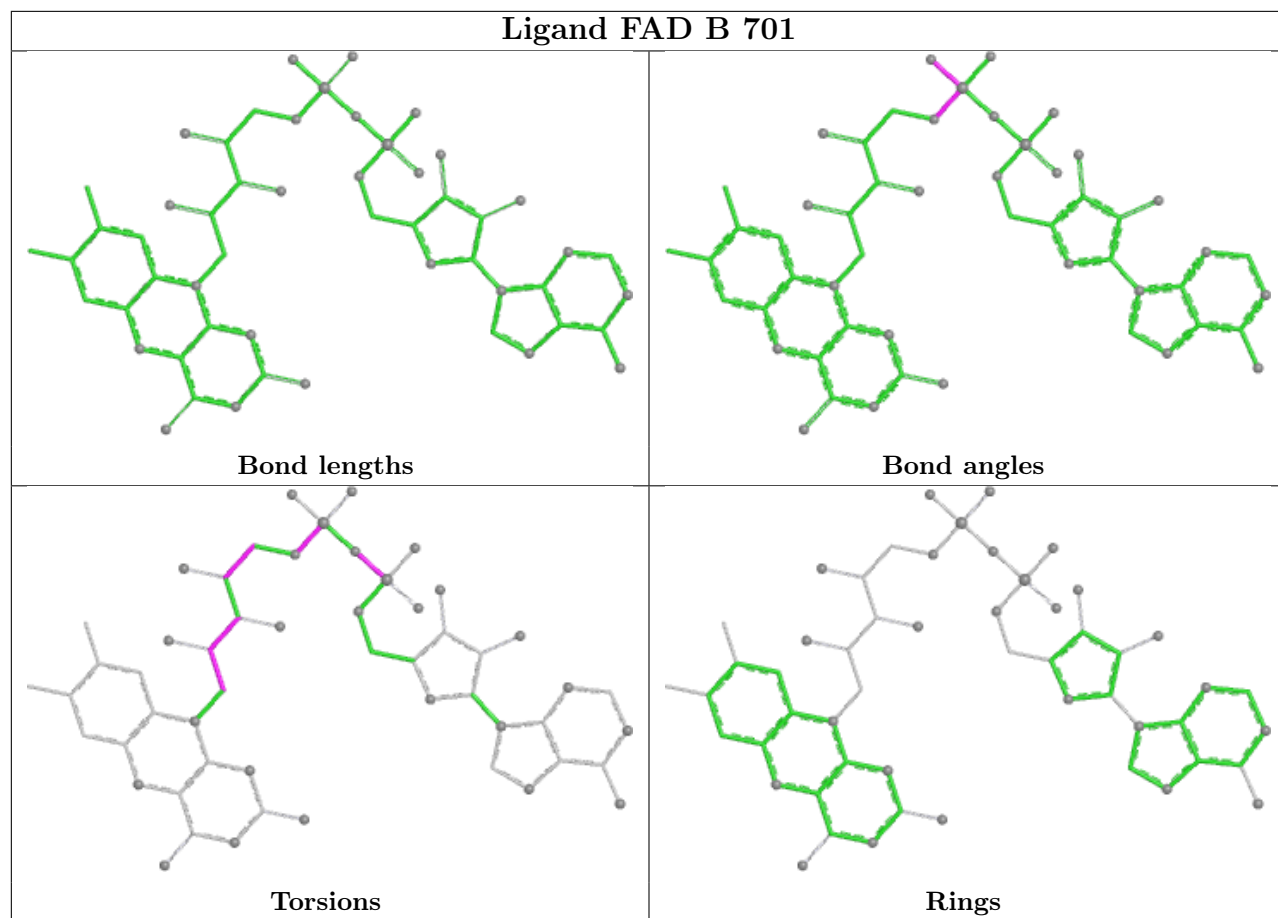
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	701	FAD	2	0
4	B	702	PEG	1	0
4	D	702	PEG	2	0
2	A	701	FAD	2	0
3	C	706	GOL	1	0
2	B	701	FAD	2	0
4	D	703	PEG	1	0
3	B	704	GOL	1	0
2	C	701	FAD	1	0

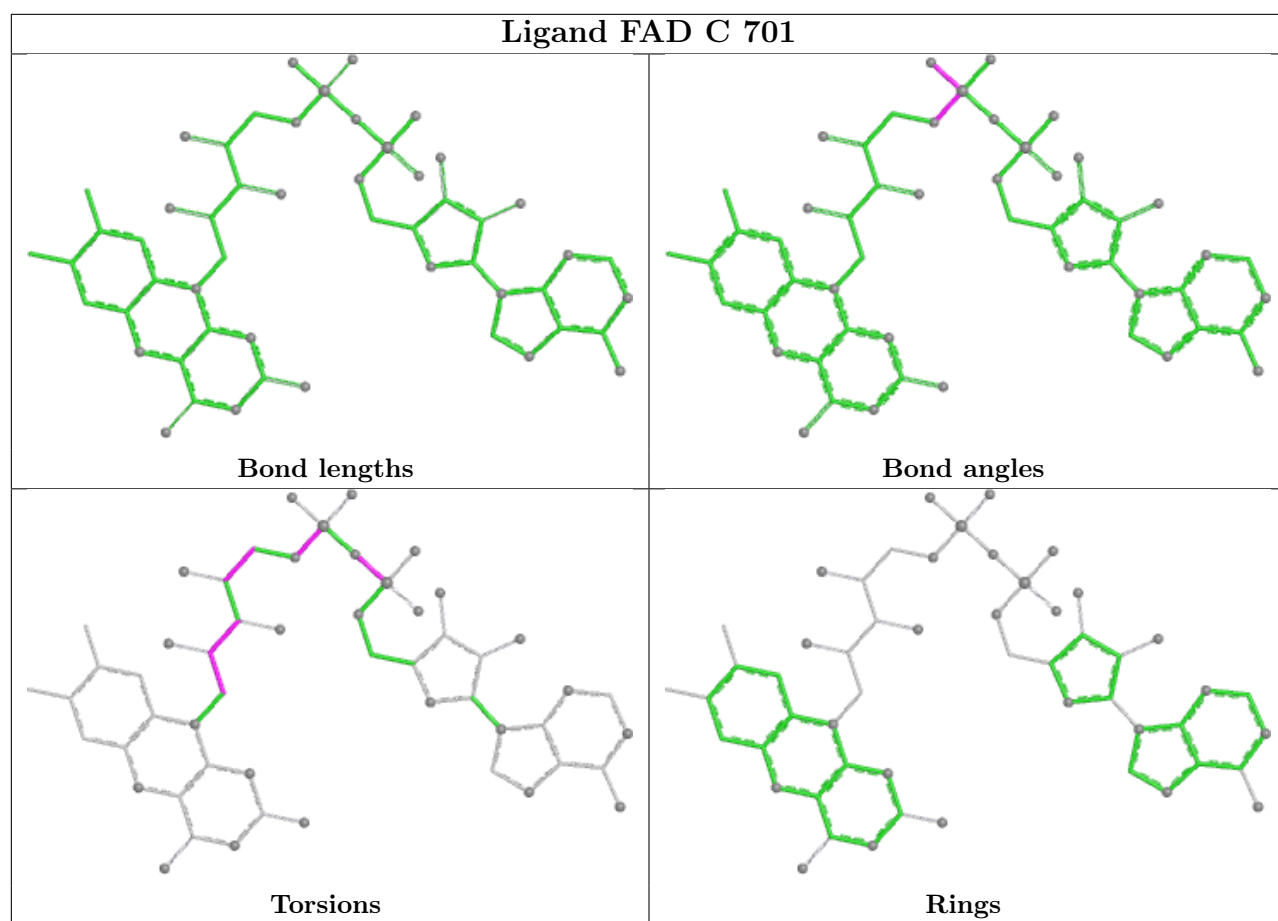
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier.

The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.









5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

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

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	598/618 (96%)	-0.32	3 (0%) 87 85	20, 43, 64, 91	1 (0%)
1	B	589/618 (95%)	-0.33	2 (0%) 90 87	29, 45, 63, 78	0
1	C	591/618 (95%)	-0.32	1 (0%) 91 89	18, 44, 63, 80	1 (0%)
1	D	597/618 (96%)	-0.22	1 (0%) 91 89	18, 44, 71, 88	4 (0%)
All	All	2375/2472 (96%)	-0.30	7 (0%) 90 87	18, 44, 65, 91	6 (0%)

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	7	PRO	2.7
1	A	213	LEU	2.7
1	A	5	SER	2.6
1	B	140	ALA	2.4
1	B	210	TYR	2.4
1	D	509	GLY	2.2
1	C	142	HIS	2.1

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

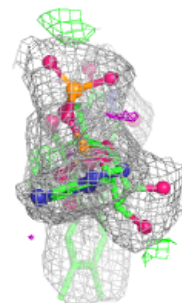
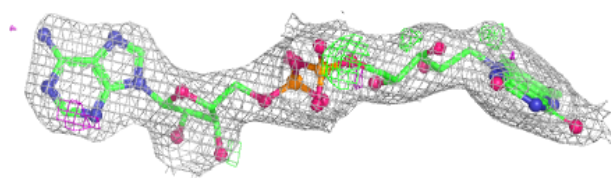
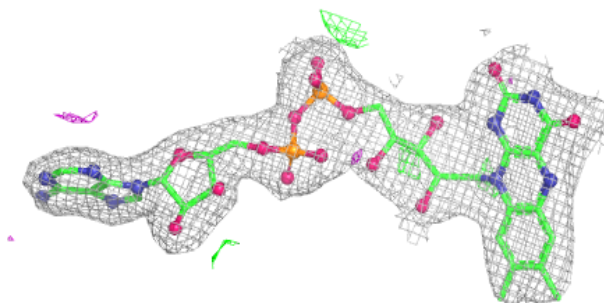
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	PEG	A	705	7/7	0.72	0.17	59,60,76,79	0
4	PEG	C	703	7/7	0.76	0.16	38,45,57,61	0
4	PEG	B	702	7/7	0.78	0.16	46,49,52,55	0
3	GOL	A	704	6/6	0.80	0.18	56,57,62,66	0
3	GOL	C	706	6/6	0.81	0.17	48,49,56,60	0
3	GOL	B	704	6/6	0.84	0.12	46,51,52,57	0
4	PEG	D	703	7/7	0.84	0.21	48,49,53,57	0
3	GOL	C	705	6/6	0.87	0.12	38,46,47,56	0
3	GOL	B	703	6/6	0.88	0.14	50,50,56,57	0
3	GOL	B	706	6/6	0.89	0.11	53,55,58,65	0
4	PEG	D	702	7/7	0.90	0.13	51,55,59,60	0
3	GOL	A	703	6/6	0.91	0.10	46,52,58,60	0
3	GOL	C	702	6/6	0.93	0.12	51,52,60,61	0
3	GOL	B	705	6/6	0.94	0.08	38,45,48,49	0
3	GOL	C	704	6/6	0.94	0.08	50,55,61,65	0
3	GOL	A	702	6/6	0.94	0.08	41,48,49,54	0
2	FAD	C	701	53/53	0.95	0.08	27,41,47,52	0
2	FAD	B	701	53/53	0.96	0.07	32,42,49,55	0
2	FAD	D	701	53/53	0.96	0.08	28,40,54,67	0
2	FAD	A	701	53/53	0.97	0.06	28,38,45,46	0

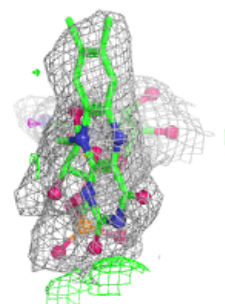
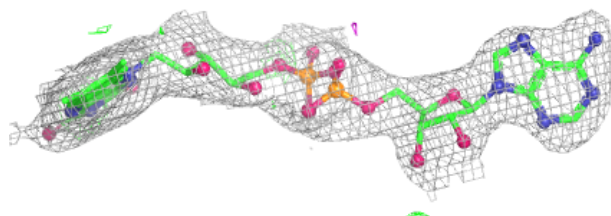
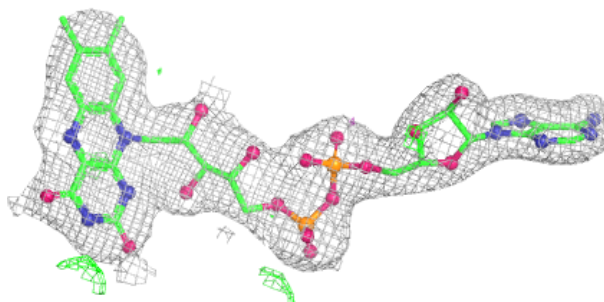
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around FAD C 701:

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

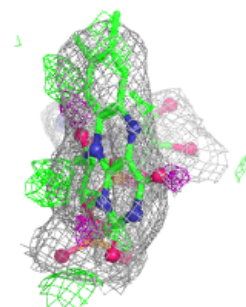
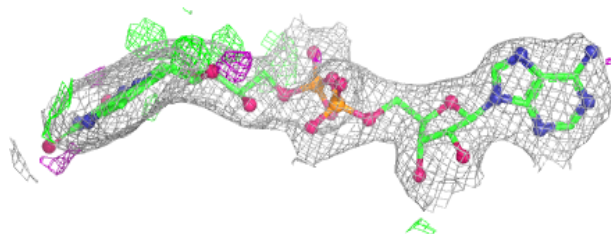
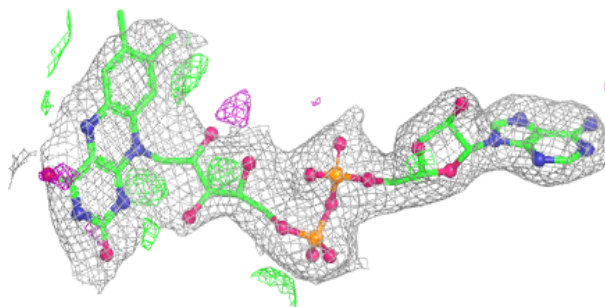
**Electron density around FAD B 701:**

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

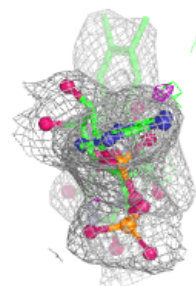
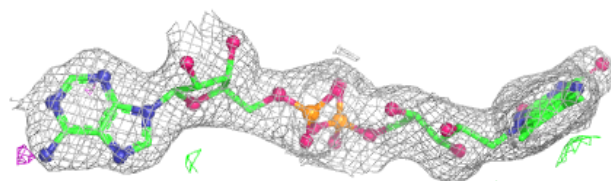
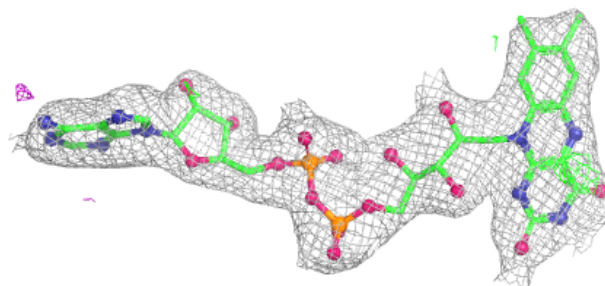


Electron density around FAD D 701:

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

**Electron density around FAD A 701:**

$2mF_o-DF_c$ (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.