



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 12:25 PM UTC

PDB ID : 5W1L / pdb_00005w1l
Title : Echinococcus granulosus thioredoxin glutathione reductas (egTGR) with Gold
Authors : Gao, W.; Wang, Y.; Dai, S.
Deposited on : 2017-06-03
Resolution : 2.88 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

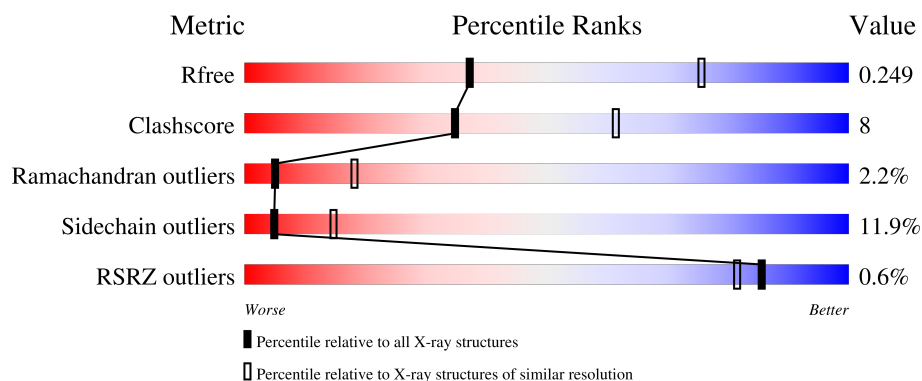
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.88 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	3557 (2.90-2.86)
Clashscore	190562	3801 (2.90-2.86)
Ramachandran outliers	187476	3699 (2.90-2.86)
Sidechain outliers	187428	3702 (2.90-2.86)
RSRZ outliers	180081	3558 (2.90-2.86)

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 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	586	72% 24% . .
2	B	584	71% 23% 5% .

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 9123 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 Thioredoxin glutathione reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	584	4518	2858	766	865	29	0	1	0

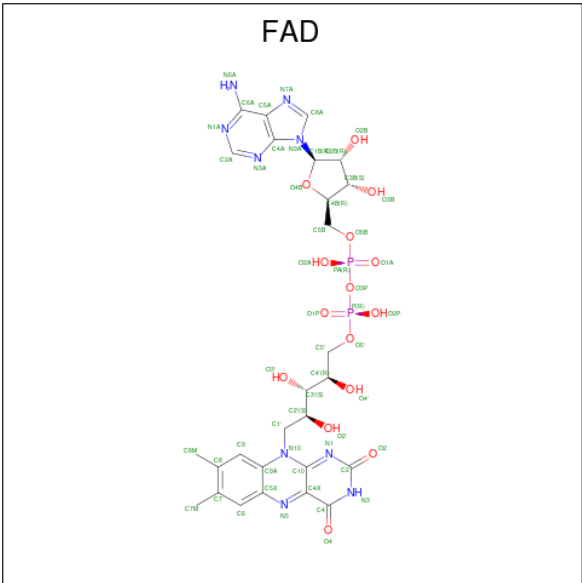
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	2	ALA	-	expression tag	UNP Q869D7
A	3	SEC	-	expression tag	UNP Q869D7

- Molecule 2 is a protein called Thioredoxin glutathione reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	584	4497	2844	762	862	29	0	0	0

- Molecule 3 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂).



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

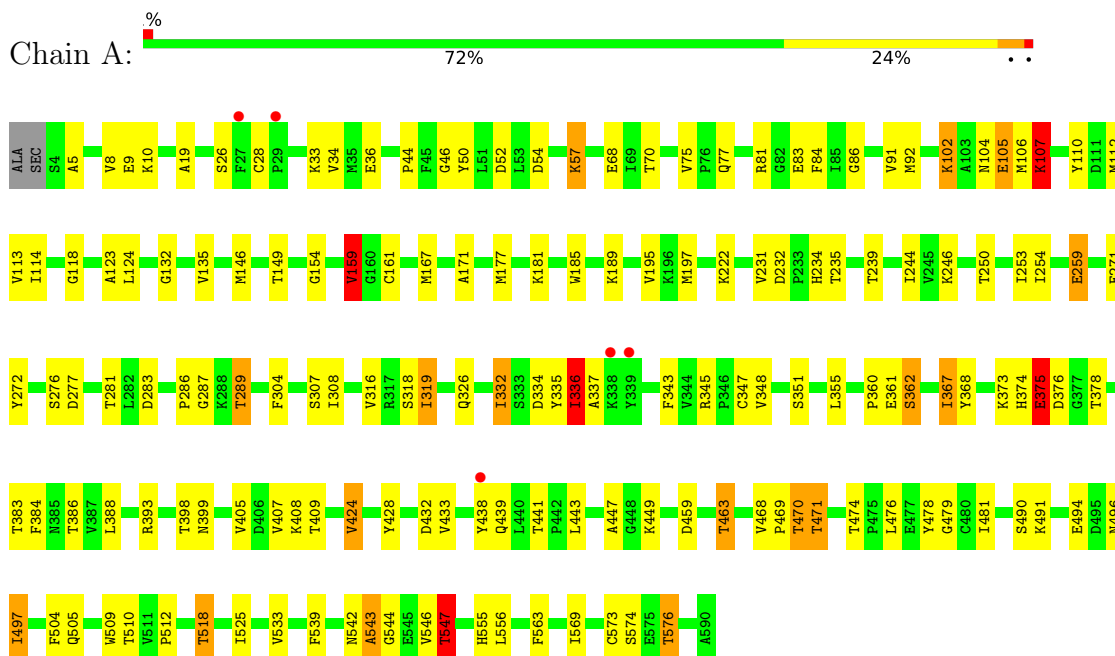
- Molecule 4 is GOLD ION (CCD ID: AU) (formula: Au).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Au	0	0
			1	1		
4	B	1	Total	Au	0	0
			1	1		

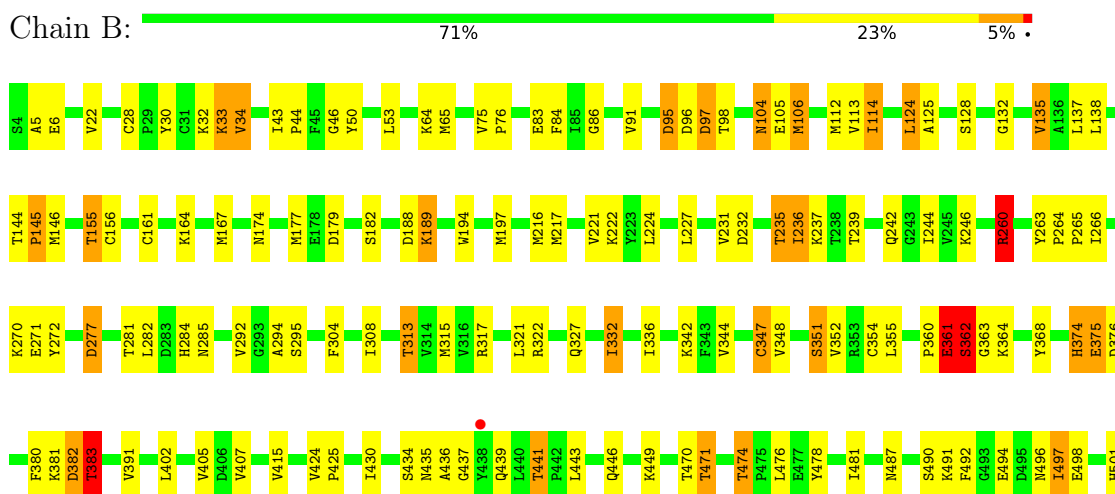
3 Residue-property plots

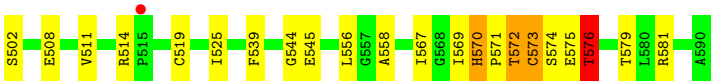
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Thioredoxin glutathione reductase



• Molecule 2: Thioredoxin glutathione reductase





4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	109.35Å 109.35Å 258.71Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	100.72 – 2.88 100.72 – 2.88	Depositor EDS
% Data completeness (in resolution range)	99.0 (100.72-2.88) 99.0 (100.72-2.88)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.75 (at 2.86Å)	Xtriage
Refinement program	REFMAC 5.8.0158	Depositor
R, R_{free}	0.185 , 0.249 0.188 , 0.249	Depositor DCC
R_{free} test set	1804 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	70.9	Xtriage
Anisotropy	0.467	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 38.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	9123	wwPDB-VP
Average B, all atoms (Å ²)	77.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.19% 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

5.1 Standard geometry

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

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	1.32	14/4613 (0.3%)	1.33	21/6255 (0.3%)
2	B	1.25	7/4592 (0.2%)	1.33	24/6231 (0.4%)
All	All	1.29	21/9205 (0.2%)	1.33	45/12486 (0.4%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
2	B	0	5
All	All	0	6

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	573	CYS	CA-C	6.29	1.60	1.52
1	A	468	VAL	N-CA	-6.26	1.41	1.46
1	A	481	ILE	C-O	-6.24	1.17	1.24
2	B	519	CYS	CA-C	6.22	1.60	1.52
2	B	579	THR	C-O	-5.88	1.17	1.24
1	A	469	PRO	N-CA	-5.87	1.40	1.46
1	A	504	PHE	C-O	5.82	1.30	1.23
2	B	545	GLU	C-O	5.68	1.30	1.24
2	B	511	VAL	CA-CB	5.62	1.56	1.54
1	A	123	ALA	CA-C	-5.58	1.45	1.53
1	A	542	ASN	CA-C	-5.58	1.45	1.53
2	B	294	ALA	C-O	-5.48	1.19	1.24
1	A	449	LYS	C-O	-5.47	1.17	1.24
1	A	555	HIS	C-O	-5.43	1.17	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	525	ILE	C-O	-5.37	1.18	1.24
2	B	478	TYR	C-O	-5.23	1.18	1.24
1	A	234	HIS	CA-C	-5.16	1.46	1.52
1	A	384	PHE	N-CA	5.14	1.52	1.45
1	A	336	ILE	CA-C	5.08	1.59	1.52
1	A	459	ASP	N-CA	5.08	1.52	1.45
1	A	28	CYS	CA-C	5.04	1.58	1.52

All (45) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	295	SER	N-CA-C	-9.08	97.03	110.46
1	A	398	THR	N-CA-C	-8.87	98.58	110.55
2	B	382	ASP	N-CA-C	8.78	129.50	110.80
2	B	332	ILE	CB-CA-C	-8.43	100.76	112.14
2	B	266	ILE	N-CA-C	8.40	116.08	109.19
1	A	574	SER	N-CA-C	8.35	121.32	111.71
1	A	438	TYR	N-CA-C	-7.43	99.49	110.48
1	A	424	VAL	CB-CA-C	7.30	119.25	110.85
2	B	260	ARG	CB-CG-CD	7.15	127.74	111.30
1	A	433	VAL	CB-CA-C	-6.96	101.89	112.05
2	B	424	VAL	CA-C-N	6.86	126.56	119.56
2	B	424	VAL	C-N-CA	6.86	126.56	119.56
1	A	332	ILE	CB-CA-C	-6.78	103.14	112.02
1	A	348	VAL	CA-C-N	-6.71	113.74	120.31
1	A	348	VAL	C-N-CA	-6.71	113.74	120.31
1	A	319	ILE	CB-CG1-CD1	6.56	127.58	113.80
1	A	337	ALA	N-CA-C	6.56	118.08	111.07
2	B	425	PRO	N-CA-C	6.29	122.02	113.84
1	A	399	ASN	N-CA-C	6.23	120.47	112.86
2	B	114	ILE	CB-CA-C	-6.20	102.41	110.84
2	B	487	ASN	N-CA-C	6.04	117.94	111.36
1	A	518	THR	N-CA-C	-5.97	104.74	112.68
2	B	570	HIS	C-N-CD	-5.96	107.48	120.60
2	B	574	SER	N-CA-C	5.93	119.61	112.38
2	B	364	LYS	N-CA-C	-5.92	99.63	109.46
2	B	28	CYS	CA-C-N	5.75	125.11	118.85
2	B	28	CYS	C-N-CA	5.75	125.11	118.85
2	B	496	ASN	N-CA-C	5.74	120.34	113.23
2	B	282	LEU	N-CA-C	5.50	118.32	110.24
2	B	281	THR	N-CA-C	-5.49	107.59	114.56
1	A	432	ASP	N-CA-C	5.38	117.14	111.28

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	546	VAL	O-C-N	5.36	127.16	121.91
2	B	65	MET	N-CA-C	5.36	117.20	111.36
1	A	543	ALA	CA-C-O	-5.33	114.91	120.55
1	A	491	LYS	N-CA-C	5.32	116.76	111.07
2	B	576	THR	N-CA-CB	5.29	118.48	110.28
1	A	547	THR	N-CA-C	5.21	118.80	112.23
2	B	501	HIS	N-CA-C	5.20	116.20	108.60
2	B	519	CYS	CB-CA-C	5.20	118.31	109.84
2	B	155	THR	CB-CA-C	-5.18	102.20	110.79
1	A	543	ALA	N-CA-C	-5.13	105.69	111.28
1	A	361	GLU	N-CA-C	-5.04	100.06	110.80
1	A	375	GLU	N-CA-C	5.04	121.53	110.80
1	A	490	SER	CB-CA-C	5.01	119.37	110.85
2	B	481	ILE	CB-CA-C	-5.01	102.05	110.71

There are no chirality outliers.

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	57	LYS	Peptide
2	B	104	ASN	Peptide
2	B	284	HIS	Peptide
2	B	360	PRO	Peptide
2	B	363	GLY	Peptide
2	B	434	SER	Peptide

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	4518	0	4444	69	0
2	B	4497	0	4406	73	0
3	A	53	0	31	0	0
3	B	53	0	31	3	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
All	All	9123	0	8912	136	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 8.

All (136) 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:46:GLY:C	1:A:50:TYR:N	2.14	1.05
2:B:125:ALA:HB3	2:B:216:MET:HE1	1.55	0.87
2:B:46:GLY:C	2:B:50:TYR:N	2.33	0.86
1:A:46:GLY:O	1:A:50:TYR:N	2.09	0.86
2:B:46:GLY:O	2:B:50:TYR:N	2.10	0.85
2:B:216:MET:HE3	2:B:221:VAL:HG11	1.58	0.85
1:A:471:THR:HG21	1:A:544:GLY:HA2	1.62	0.81
2:B:137:LEU:HD22	2:B:216:MET:HE2	1.64	0.79
2:B:167:MET:HE2	2:B:304:PHE:CE1	2.21	0.75
1:A:319:ILE:HG12	1:A:326:GLN:OE1	1.87	0.74
2:B:105:GLU:O	2:B:106:MET:O	2.09	0.70
1:A:476:LEU:HD23	1:A:539:PHE:CZ	2.30	0.67
2:B:125:ALA:CB	2:B:216:MET:HE1	2.25	0.66
2:B:232:ASP:OD1	2:B:235:THR:HG23	1.95	0.66
1:A:289:THR:HB	1:A:386:THR:HB	1.77	0.65
2:B:405:VAL:HG23	2:B:407:VAL:HG23	1.79	0.65
1:A:46:GLY:O	1:A:50:TYR:CA	2.45	0.65
1:A:447:ALA:HA	1:A:463:THR:HG21	1.80	0.64
1:A:573:CYS:O	1:A:576:THR:HG23	1.99	0.63
1:A:113:VAL:HG23	1:A:250:THR:HB	1.79	0.62
2:B:155:THR:OG1	3:B:601:FAD:O1A	2.18	0.62
2:B:138:LEU:HD11	2:B:236:ILE:HD11	1.81	0.61
2:B:347:CYS:HA	2:B:374:HIS:HB3	1.83	0.60
1:A:476:LEU:HD23	1:A:539:PHE:CE2	2.36	0.60
1:A:19:ALA:HA	1:A:81:ARG:HG2	1.84	0.60
1:A:319:ILE:CG1	1:A:326:GLN:OE1	2.50	0.60
1:A:84:PHE:CZ	1:A:86:GLY:HA2	2.38	0.59
1:A:497:ILE:C	1:A:497:ILE:HD12	2.27	0.59
2:B:144:THR:O	2:B:145:PRO:C	2.45	0.59
2:B:382:ASP:CG	2:B:382:ASP:O	2.46	0.58
1:A:83:GLU:OE1	1:A:102:LYS:NZ	2.29	0.58
1:A:44:PRO:HB2	1:A:132:GLY:HA2	1.86	0.58
2:B:34:VAL:HG23	2:B:91:VAL:HG11	1.85	0.58
1:A:46:GLY:O	1:A:50:TYR:HA	2.04	0.58
2:B:315:MET:HE3	2:B:347:CYS:SG	2.44	0.57
2:B:167:MET:HE3	2:B:197:MET:HE1	1.87	0.57
2:B:216:MET:CE	2:B:221:VAL:HG11	2.33	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:441:THR:HG22	3:B:601:FAD:H2'	1.86	0.57
2:B:216:MET:HE3	2:B:221:VAL:CG1	2.34	0.56
1:A:332:ILE:HD11	1:A:478:TYR:HB2	1.88	0.55
1:A:110:TYR:OH	1:A:222:LYS:HE3	2.05	0.55
1:A:505:GLN:NE2	1:A:510:THR:HG22	2.21	0.55
1:A:159:VAL:HG22	1:A:277:ASP:HA	1.89	0.55
1:A:287:GLY:O	1:A:289:THR:HG22	2.08	0.54
1:A:405:VAL:HG23	1:A:407:VAL:HG23	1.90	0.53
1:A:471:THR:HG23	2:B:569:ILE:HG21	1.90	0.53
2:B:138:LEU:HD11	2:B:236:ILE:CD1	2.39	0.53
1:A:113:VAL:HG23	1:A:250:THR:CB	2.39	0.53
2:B:22:VAL:O	2:B:50:TYR:HA	2.09	0.52
1:A:167:MET:HE2	1:A:197:MET:HE3	1.91	0.52
1:A:479:GLY:HA3	1:A:547:THR:HG21	1.92	0.51
1:A:360:PRO:O	1:A:362:SER:HA	2.11	0.51
1:A:443:LEU:HD13	2:B:567:ILE:HG13	1.92	0.51
1:A:355:LEU:HD12	1:A:367:ILE:HD11	1.93	0.51
2:B:137:LEU:CD2	2:B:216:MET:HE2	2.39	0.51
1:A:171:ALA:HB1	1:A:307:SER:HB2	1.94	0.50
1:A:259:GLU:OE2	1:A:393:ARG:HD3	2.11	0.50
1:A:104:ASN:O	1:A:105:GLU:C	2.54	0.50
1:A:543:ALA:O	1:A:547:THR:HG23	2.11	0.50
2:B:313:THR:HA	2:B:342:LYS:O	2.12	0.50
2:B:382:ASP:O	2:B:383:THR:HB	2.10	0.50
1:A:470:THR:O	1:A:471:THR:HG22	2.12	0.49
1:A:509:TRP:C	1:A:512:PRO:HD2	2.37	0.49
2:B:260:ARG:NH1	2:B:277:ASP:OD2	2.35	0.49
1:A:185:TRP:CZ2	2:B:174:ASN:HB2	2.48	0.49
2:B:476:LEU:HD23	2:B:539:PHE:CZ	2.47	0.49
2:B:236:ILE:C	2:B:236:ILE:HD12	2.38	0.49
2:B:113:VAL:HG11	2:B:236:ILE:HG12	1.93	0.49
2:B:44:PRO:HB2	2:B:132:GLY:HA2	1.94	0.48
2:B:135:VAL:HG22	2:B:221:VAL:HG13	1.95	0.48
1:A:232:ASP:OD1	1:A:232:ASP:C	2.56	0.48
2:B:260:ARG:CG	2:B:260:ARG:HH11	2.26	0.48
2:B:441:THR:CG2	3:B:601:FAD:H2'	2.43	0.48
2:B:361:GLU:O	2:B:362:SER:HB2	2.13	0.48
2:B:114:ILE:HD12	2:B:124:LEU:HD13	1.94	0.48
1:A:316:VAL:HG11	1:A:345:ARG:HD2	1.96	0.48
1:A:8:VAL:HG21	1:A:68:GLU:OE2	2.14	0.48
2:B:112:MET:HE1	2:B:128:SER:CB	2.44	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:347:CYS:HA	2:B:374:HIS:CB	2.44	0.48
2:B:260:ARG:HH11	2:B:260:ARG:HG2	1.79	0.47
2:B:471:THR:HG21	2:B:544:GLY:HA2	1.97	0.47
1:A:471:THR:HG21	1:A:544:GLY:CA	2.39	0.47
1:A:569:ILE:HG21	2:B:471:THR:HG23	1.96	0.47
2:B:354:CYS:SG	2:B:355:LEU:N	2.88	0.47
2:B:476:LEU:HD23	2:B:539:PHE:CE2	2.49	0.47
1:A:177:MET:HG2	2:B:177:MET:HG2	1.97	0.47
2:B:491:LYS:HE2	2:B:492:PHE:CZ	2.50	0.46
2:B:375:GLU:N	2:B:375:GLU:OE2	2.49	0.46
2:B:114:ILE:HB	2:B:137:LEU:HD12	1.96	0.46
2:B:30:TYR:O	2:B:34:VAL:HG12	2.16	0.46
2:B:497:ILE:HA	2:B:525:ILE:O	2.16	0.46
1:A:272:TYR:HB3	1:A:368:TYR:CE2	2.51	0.45
1:A:543:ALA:O	1:A:547:THR:CG2	2.64	0.45
1:A:114:ILE:HD12	1:A:124:LEU:HD23	1.97	0.45
1:A:124:LEU:HD21	1:A:254:ILE:HG12	1.98	0.45
2:B:179:ASP:OD2	2:B:514:ARG:NH1	2.50	0.45
2:B:321:LEU:O	2:B:322:ARG:C	2.59	0.45
2:B:573:CYS:O	2:B:576:THR:HG23	2.16	0.45
1:A:91:VAL:HG13	1:A:92:MET:HE2	1.98	0.45
2:B:112:MET:HE1	2:B:128:SER:OG	2.17	0.44
2:B:138:LEU:HD23	2:B:224:LEU:HB2	1.99	0.44
1:A:496:ASN:N	1:A:496:ASN:OD1	2.50	0.44
1:A:335:TYR:O	1:A:336:ILE:C	2.60	0.44
2:B:263:TYR:CE2	2:B:270:LYS:HA	2.53	0.44
2:B:232:ASP:CG	2:B:235:THR:HG23	2.43	0.43
2:B:332:ILE:HG21	2:B:474:THR:HG21	1.99	0.43
1:A:70:THR:HG21	1:A:77:GLN:OE1	2.18	0.43
1:A:106:MET:O	1:A:107:LYS:CB	2.66	0.43
1:A:336:ILE:HG21	1:A:343:PHE:HZ	1.83	0.43
2:B:84:PHE:CZ	2:B:86:GLY:HA2	2.53	0.43
2:B:415:VAL:HA	2:B:435:ASN:HB2	2.00	0.43
1:A:286:PRO:O	1:A:386:THR:OG1	2.33	0.43
2:B:156:CYS:HB2	2:B:441:THR:HG21	1.99	0.43
1:A:34:VAL:HG22	1:A:91:VAL:HG11	2.01	0.43
1:A:304:PHE:O	1:A:308:ILE:HG12	2.20	0.42
2:B:188:ASP:OD1	2:B:189:LYS:N	2.51	0.42
1:A:46:GLY:CA	1:A:50:TYR:N	2.80	0.42
1:A:159:VAL:HG13	1:A:159:VAL:O	2.20	0.42
2:B:572:THR:HG22	2:B:575:GLU:HG2	2.02	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:33:LYS:O	2:B:33:LYS:HG2	2.18	0.42
1:A:254:ILE:HG13	1:A:428:TYR:HB2	2.01	0.41
1:A:556:LEU:HD11	2:B:558:ALA:HB2	2.02	0.41
2:B:264:PRO:HA	2:B:265:PRO:HD3	1.91	0.41
1:A:112:MET:HG3	1:A:254:ILE:HD13	2.02	0.41
1:A:195:VAL:HG22	1:A:283:ASP:O	2.20	0.41
1:A:318:SER:OG	1:A:319:ILE:N	2.52	0.41
1:A:52:ASP:OD1	1:A:54:ASP:HB2	2.20	0.41
2:B:75:VAL:HG22	2:B:76:PRO:HA	2.03	0.41
2:B:95:ASP:OD1	2:B:95:ASP:N	2.51	0.41
2:B:272:TYR:HB3	2:B:368:TYR:CD2	2.55	0.41
1:A:533:VAL:HG21	1:A:563:PHE:CE1	2.56	0.40
2:B:167:MET:HE1	2:B:194:TRP:CH2	2.56	0.40
1:A:118:GLY:HA2	1:A:154:GLY:HA3	2.03	0.40
1:A:253:ILE:C	1:A:254:ILE:HD12	2.47	0.40
2:B:570:HIS:HA	2:B:571:PRO:HA	1.84	0.40
1:A:181:LYS:HA	1:A:185:TRP:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	581/586 (99%)	534 (92%)	39 (7%)	8 (1%)	9	28
2	B	580/584 (99%)	510 (88%)	52 (9%)	18 (3%)	3	12
All	All	1161/1170 (99%)	1044 (90%)	91 (8%)	26 (2%)	5	18

All (26) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	5	ALA

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Mol	Chain	Res	Type
1	A	375	GLU
2	B	5	ALA
2	B	34	VAL
2	B	106	MET
2	B	361	GLU
2	B	362	SER
2	B	374	HIS
2	B	436	ALA
1	A	334	ASP
1	A	336	ILE
2	B	189	LYS
2	B	437	GLY
1	A	26	SER
1	A	189	LYS
2	B	277	ASP
2	B	351	SER
2	B	391	VAL
1	A	107	LYS
2	B	96	ASP
2	B	97	ASP
1	A	159	VAL
2	B	145	PRO
2	B	244	ILE
2	B	383	THR
2	B	285	ASN

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	493/493 (100%)	443 (90%)	50 (10%)	7	22
2	B	489/493 (99%)	422 (86%)	67 (14%)	3	10
All	All	982/986 (100%)	865 (88%)	117 (12%)	5	15

All (117) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	GLU
1	A	10	LYS
1	A	33	LYS
1	A	36	GLU
1	A	57	LYS
1	A	75	VAL
1	A	102	LYS
1	A	105	GLU
1	A	107	LYS
1	A	135	VAL
1	A	146	MET
1	A	149	THR
1	A	159	VAL
1	A	161	CYS
1	A	231	VAL
1	A	235	THR
1	A	239	THR
1	A	244	ILE
1	A	246	LYS
1	A	259	GLU
1	A	271	GLU
1	A	276	SER
1	A	281	THR
1	A	289	THR
1	A	336	ILE
1	A	347	CYS
1	A	351	SER
1	A	362	SER
1	A	367	ILE
1	A	373	LYS
1	A	374	HIS
1	A	375	GLU
1	A	376	ASP
1	A	378	THR
1	A	383	THR
1	A	388	LEU
1	A	408	LYS
1	A	409	THR
1	A	424	VAL
1	A	439	GLN
1	A	441	THR
1	A	463	THR
1	A	470	THR

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Mol	Chain	Res	Type
1	A	471	THR
1	A	474	THR
1	A	494	GLU
1	A	497	ILE
1	A	518	THR
1	A	547	THR
1	A	576	THR
2	B	6	GLU
2	B	32	LYS
2	B	33	LYS
2	B	43	ILE
2	B	53	LEU
2	B	64	LYS
2	B	83	GLU
2	B	95	ASP
2	B	97	ASP
2	B	98	THR
2	B	104	ASN
2	B	124	LEU
2	B	135	VAL
2	B	146	MET
2	B	161	CYS
2	B	164	LYS
2	B	182	SER
2	B	217	MET
2	B	222	LYS
2	B	227	LEU
2	B	231	VAL
2	B	235	THR
2	B	236	ILE
2	B	237	LYS
2	B	239	THR
2	B	242	GLN
2	B	246	LYS
2	B	260	ARG
2	B	271	GLU
2	B	292	VAL
2	B	308	ILE
2	B	313	THR
2	B	317	ARG
2	B	327	GLN
2	B	336	ILE

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Mol	Chain	Res	Type
2	B	344	VAL
2	B	347	CYS
2	B	348	VAL
2	B	351	SER
2	B	352	VAL
2	B	361	GLU
2	B	362	SER
2	B	375	GLU
2	B	376	ASP
2	B	380	PHE
2	B	381	LYS
2	B	383	THR
2	B	402	LEU
2	B	430	ILE
2	B	439	GLN
2	B	441	THR
2	B	443	LEU
2	B	446	GLN
2	B	449	LYS
2	B	470	THR
2	B	471	THR
2	B	474	THR
2	B	490	SER
2	B	494	GLU
2	B	497	ILE
2	B	498	GLU
2	B	502	SER
2	B	508	GLU
2	B	556	LEU
2	B	572	THR
2	B	576	THR
2	B	581	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	218	ASN
1	A	399	ASN
1	A	446	GLN
1	A	505	GLN
1	A	526	ASN
2	B	17	ASN

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Mol	Chain	Res	Type
2	B	204	HIS
2	B	247	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	$\# Z > 2$
3	FAD	B	601	-	58,58,58	1.71	12 (20%)	85,89,89	1.80	19 (22%)
3	FAD	A	601	-	58,58,58	1.71	12 (20%)	85,89,89	1.66	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
3	FAD	B	601	-	-	4/34/50/50	0/6/6/6

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	FAD	A	601	-	-	4/34/50/50	0/6/6/6

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	601	FAD	C9A-C5X	6.11	1.51	1.41
3	A	601	FAD	C5A-C4A	5.18	1.48	1.39
3	B	601	FAD	C5A-C4A	4.41	1.47	1.39
3	B	601	FAD	C4-N3	-4.30	1.30	1.38
3	A	601	FAD	C5X-N5	-4.10	1.31	1.39
3	A	601	FAD	C4-N3	-3.99	1.31	1.38
3	A	601	FAD	C9A-C5X	3.90	1.47	1.41
3	B	601	FAD	P-O3P	3.67	1.63	1.59
3	A	601	FAD	C8A-N7A	3.09	1.37	1.31
3	A	601	FAD	P-O3P	2.99	1.62	1.59
3	A	601	FAD	C5A-N7A	-2.84	1.33	1.39
3	A	601	FAD	C2-N3	-2.76	1.32	1.39
3	B	601	FAD	C5A-N7A	-2.60	1.34	1.39
3	B	601	FAD	C8A-N7A	2.54	1.36	1.31
3	B	601	FAD	C8-C7	2.40	1.46	1.40
3	A	601	FAD	C8-C7	2.29	1.46	1.40
3	B	601	FAD	C6-C7	-2.28	1.36	1.39
3	A	601	FAD	C5A-C6A	2.26	1.47	1.41
3	B	601	FAD	C5X-N5	-2.22	1.35	1.39
3	A	601	FAD	C4A-N9A	-2.20	1.33	1.37
3	A	601	FAD	C2A-N1A	2.18	1.37	1.33
3	B	601	FAD	C5A-C6A	2.09	1.46	1.41
3	B	601	FAD	C2-N3	-2.09	1.34	1.39
3	B	601	FAD	C8A-N9A	-2.03	1.34	1.37

All (38) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	601	FAD	C5A-C4A-N3A	-6.24	118.12	126.72
3	A	601	FAD	C5A-C4A-N3A	-5.50	119.14	126.72
3	B	601	FAD	N3A-C4A-N9A	4.78	135.30	127.17
3	A	601	FAD	N3A-C4A-N9A	4.41	134.66	127.17
3	B	601	FAD	C4A-C5A-N7A	-4.19	105.79	110.58
3	B	601	FAD	N3A-C2A-N1A	-4.07	122.42	128.58
3	B	601	FAD	C2A-N3A-C4A	3.55	120.49	111.83
3	A	601	FAD	C10-N1-C2	3.54	124.51	116.85
3	A	601	FAD	O2A-PA-O3P	3.48	116.68	107.27

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	601	FAD	O4-C4-C4X	-3.35	117.69	126.53
3	B	601	FAD	C4A-N9A-C8A	3.25	109.15	105.74
3	B	601	FAD	C5A-N7A-C8A	3.24	108.54	103.45
3	A	601	FAD	C4-C4X-N5	3.13	122.53	118.21
3	A	601	FAD	C5X-N5-C4X	3.07	123.05	118.09
3	A	601	FAD	C2B-C1B-N9A	2.95	120.63	113.30
3	B	601	FAD	N9A-C8A-N7A	-2.81	109.94	113.94
3	B	601	FAD	C2A-N1A-C6A	2.80	123.33	118.73
3	A	601	FAD	C4X-C10-N10	2.77	120.45	116.48
3	A	601	FAD	C4X-C10-N1	-2.72	117.91	124.59
3	B	601	FAD	C9-C8-C7	2.65	123.57	119.69
3	A	601	FAD	C2A-N3A-C4A	2.51	117.97	111.83
3	B	601	FAD	O4'-C4'-C5'	-2.51	104.46	109.99
3	B	601	FAD	C4X-C10-N1	-2.46	118.56	124.59
3	B	601	FAD	C4X-C4-N3	2.45	119.48	113.25
3	A	601	FAD	C9-C9A-N10	2.41	125.10	121.85
3	B	601	FAD	O2P-P-O3P	-2.40	100.78	107.27
3	A	601	FAD	O4B-C1B-C2B	-2.39	101.50	106.62
3	A	601	FAD	O3P-PA-O1A	2.34	117.76	110.70
3	A	601	FAD	C4A-C5A-N7A	-2.34	107.90	110.58
3	A	601	FAD	N6A-C6A-N1A	2.34	123.60	118.38
3	B	601	FAD	O4B-C1B-C2B	-2.27	101.76	106.62
3	A	601	FAD	O4'-C4'-C5'	-2.26	105.01	109.99
3	A	601	FAD	C4X-C4-N3	2.22	118.91	113.25
3	B	601	FAD	N3-C2-N1	2.20	124.17	119.50
3	A	601	FAD	N3A-C2A-N1A	-2.20	125.26	128.58
3	B	601	FAD	C6A-C5A-N7A	2.14	136.21	132.09
3	B	601	FAD	C4-N3-C2	-2.06	121.99	125.64
3	A	601	FAD	C1'-N10-C9A	2.02	124.55	120.63

There are no chirality outliers.

All (8) torsion outliers are listed below:

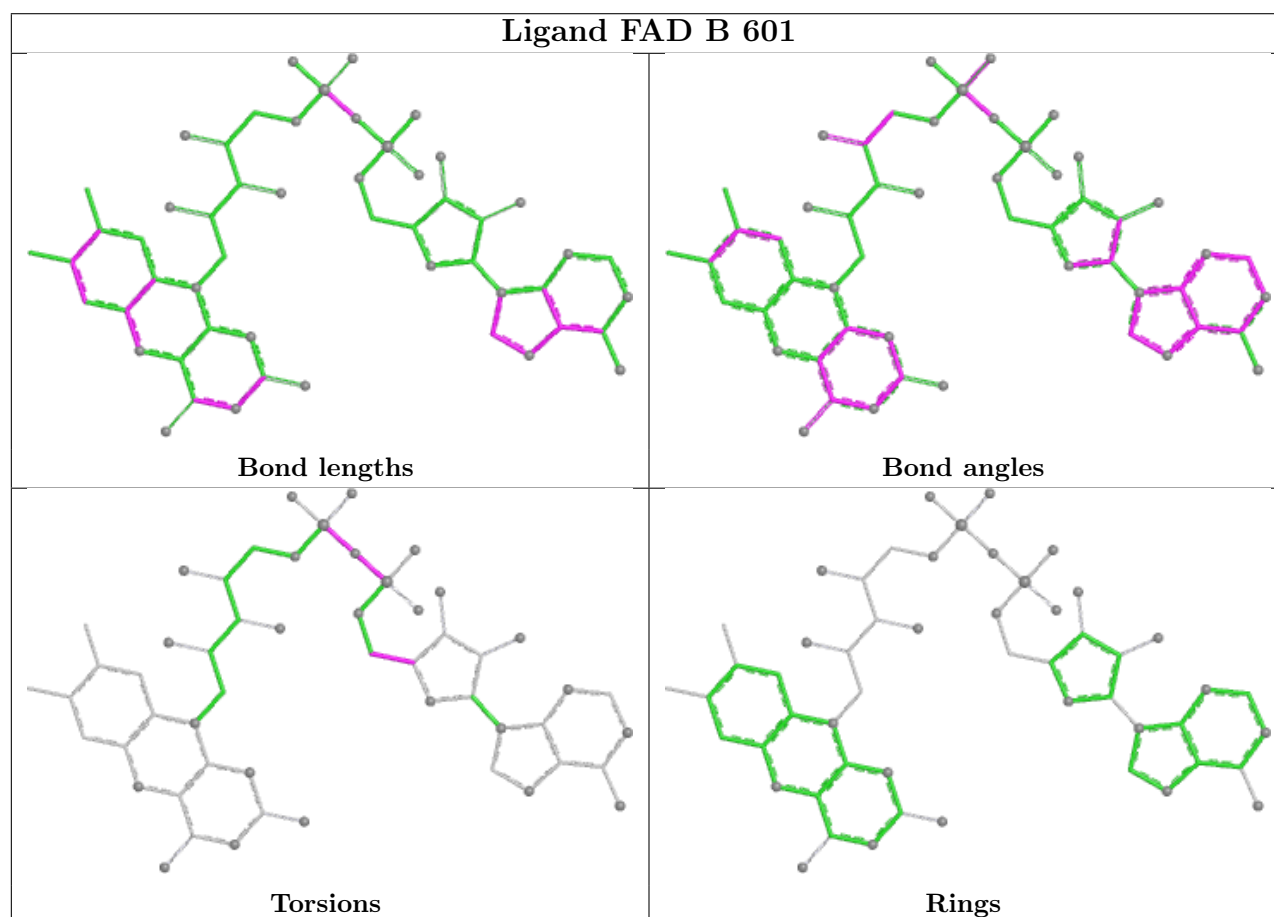
Mol	Chain	Res	Type	Atoms
3	A	601	FAD	C3B-C4B-C5B-O5B
3	A	601	FAD	O4B-C4B-C5B-O5B
3	B	601	FAD	O4B-C4B-C5B-O5B
3	B	601	FAD	C3B-C4B-C5B-O5B
3	B	601	FAD	PA-O3P-P-O5'
3	A	601	FAD	C2B-C1B-N9A-C8A
3	A	601	FAD	C5B-O5B-PA-O2A
3	B	601	FAD	P-O3P-PA-O2A

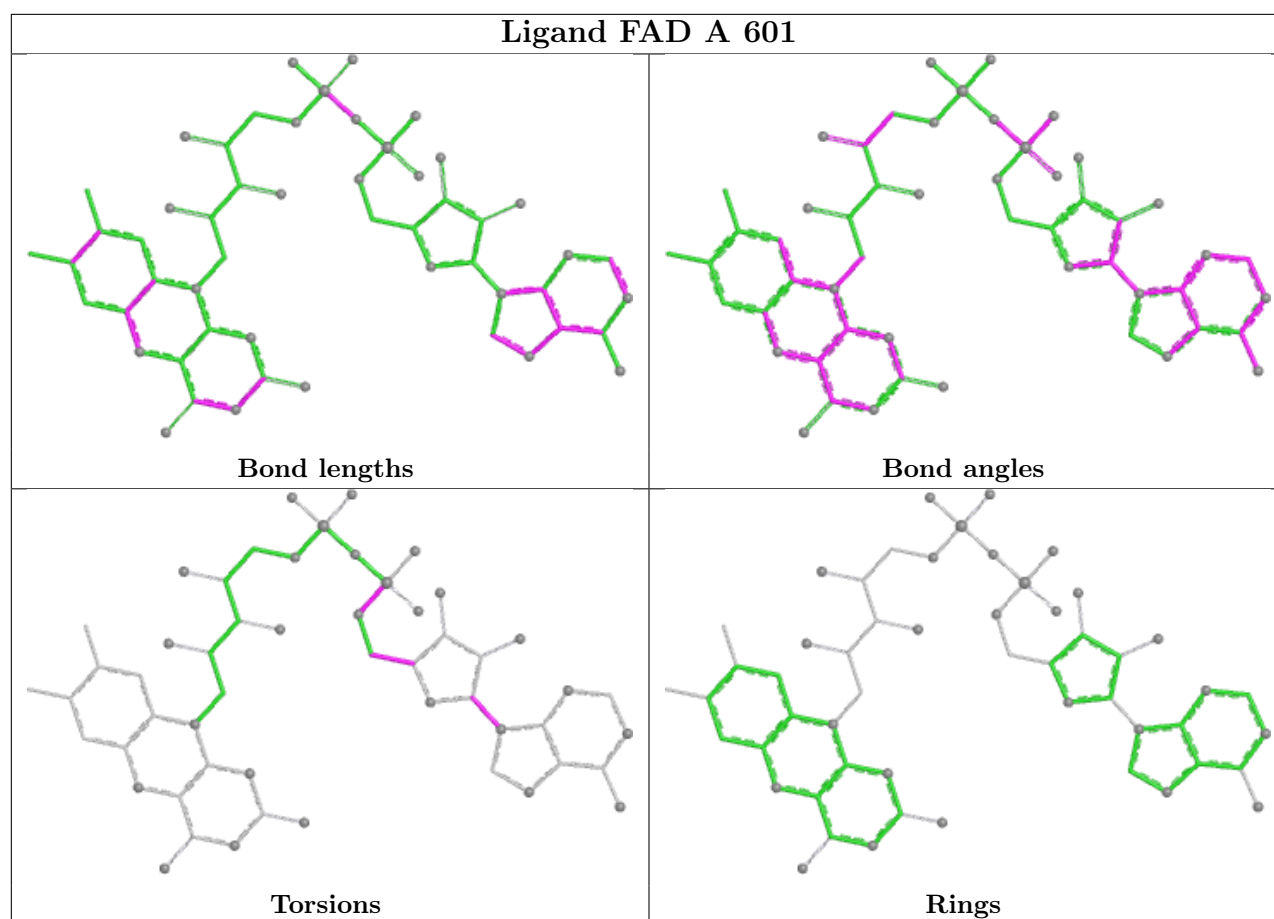
There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	601	FAD	3	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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
2	B	1
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	46:GLY	C	50:TYR	N	2.33
1	A	46:GLY	C	50:TYR	N	2.14

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	584/586 (99%)	-0.39	5 (0%)	81 75	38, 69, 109, 142	1 (0%)
2	B	584/584 (100%)	-0.35	2 (0%)	90 87	47, 78, 123, 150	0
All	All	1168/1170 (99%)	-0.37	7 (0%)	85 81	38, 72, 118, 150	1 (0%)

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	338[A]	LYS	3.6
1	A	27	PHE	2.3
1	A	438	TYR	2.3
1	A	339	TYR	2.2
2	B	438	TYR	2.1
2	B	515	PRO	2.1
1	A	29	PRO	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](#)

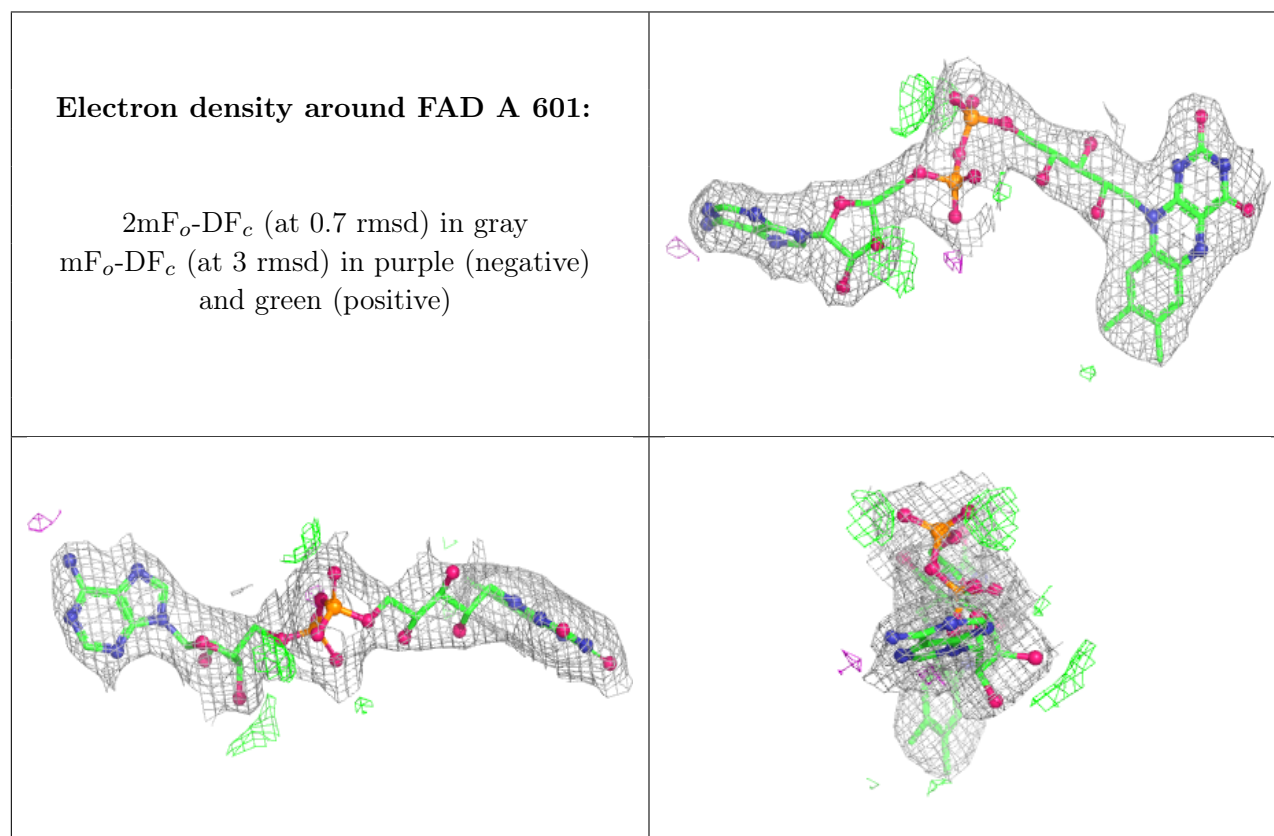
There are no oligosaccharides in this entry.

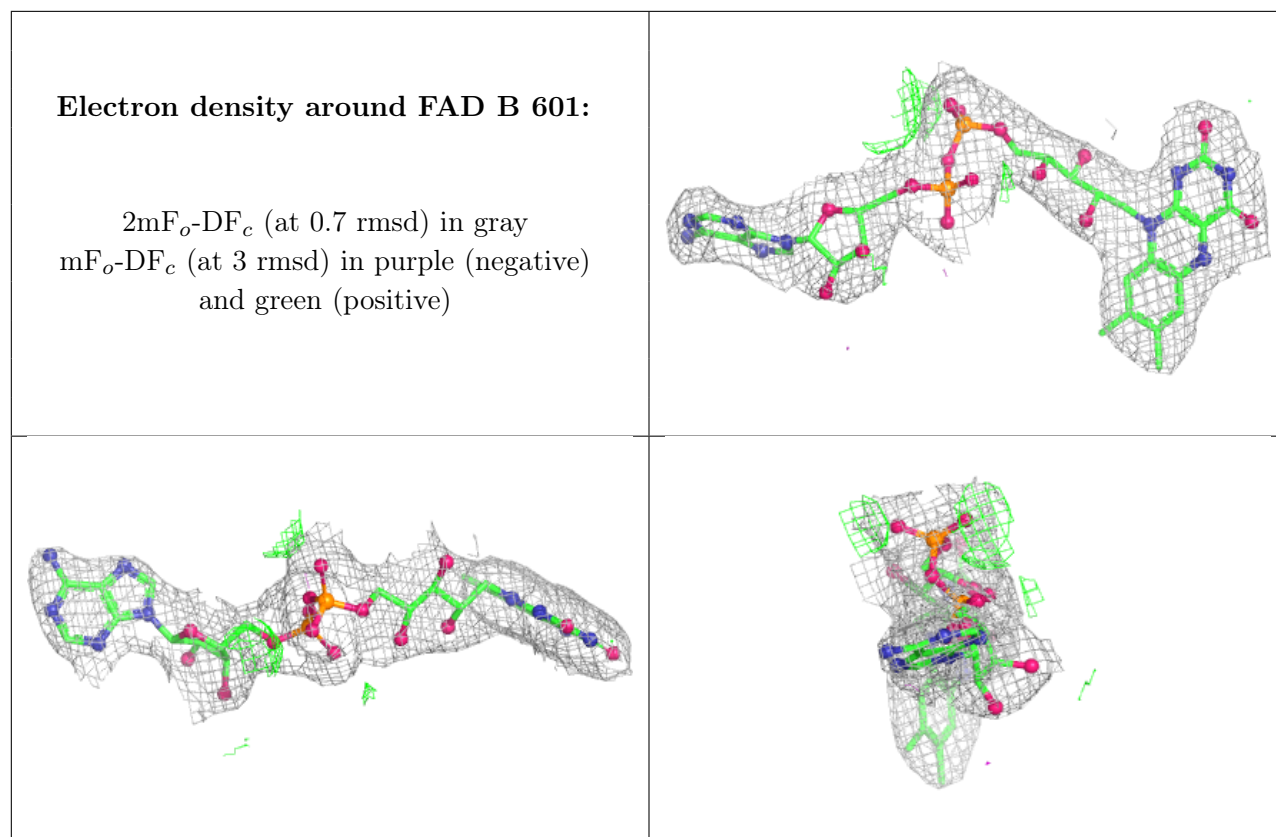
6.4 Ligands [i](#)

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($\text{\AA}^2$)	Q<0.9
4	AU	B	602	1/1	0.95	0.26	126,126,126,126	0
3	FAD	A	601	53/53	0.96	0.07	49,54,59,60	0
4	AU	A	602	1/1	0.97	0.17	116,116,116,116	0
3	FAD	B	601	53/53	0.97	0.06	54,60,69,71	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.





6.5 Other polymers [i](#)

There are no such residues in this entry.