



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 2, 2021 – 05:20 AM EDT

PDB ID : 1KNR
Title : L-aspartate oxidase: R386L mutant
Authors : Bossi, R.T.; Mattevi, A.
Deposited on : 2001-12-19
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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.23.2
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) : 2.23.2

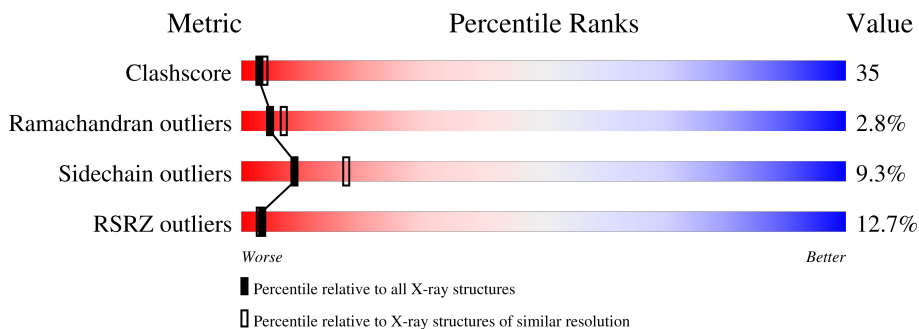
1 Overall quality at a glance

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))
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (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	540	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4228 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 L-aspartate oxidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	529	4150	2607	749	773	21	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	386	LEU	ARG	engineered mutation	UNP P10902

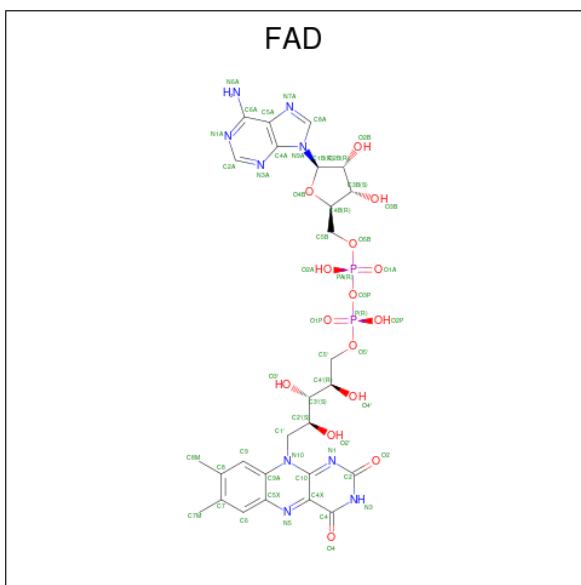
- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Cl	0	0
			1	1		

- Molecule 3 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Na	0	0
			1	1		

- Molecule 4 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: C₂₇H₃₃N₉O₁₅P₂).



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

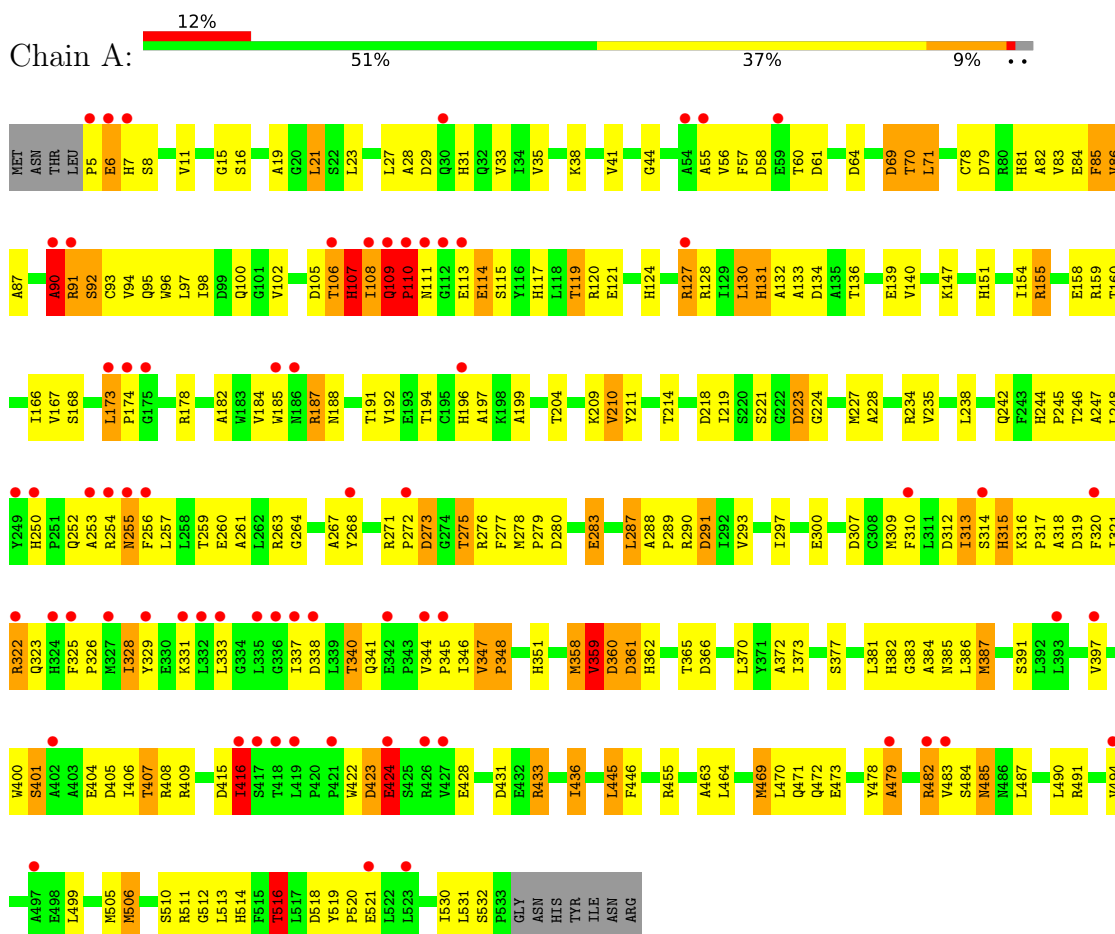
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	23	Total	O	0	0
			23	23		

3 Residue-property plots i

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: L-aspartate oxidase



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	73.28Å 73.28Å 313.93Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 2.50 39.24 – 2.50	Depositor EDS
% Data completeness (in resolution range)	95.6 (40.00-2.50) 95.6 (39.24-2.50)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	0.11	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.60 (at 2.51Å)	Xtrriage
Refinement program	REFMAC 5.0	Depositor
R, R_{free}	0.250 , 0.295 0.246 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	47.5	Xtrriage
Anisotropy	0.098	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 98.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	4228	wwPDB-VP
Average B, all atoms (Å ²)	86.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.53% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality i

5.1 Standard geometry i

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

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	1.01	1/4244 (0.0%)	1.32	41/5767 (0.7%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	358	MET	SD-CE	-5.21	1.48	1.77

All (41) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	499	LEU	CB-CG-CD1	-10.06	93.89	111.00
1	A	280	ASP	CB-CG-OD2	9.19	126.57	118.30
1	A	238	LEU	CB-CG-CD1	-7.74	97.84	111.00
1	A	499	LEU	CB-CG-CD2	-7.66	97.98	111.00
1	A	90	ALA	CA-C-N	-7.43	100.86	117.20
1	A	90	ALA	O-C-N	6.83	133.63	122.70
1	A	218	ASP	CB-CG-OD2	6.68	124.31	118.30
1	A	64	ASP	CB-CG-OD2	6.67	124.31	118.30
1	A	307	ASP	CB-CG-OD2	6.54	124.19	118.30
1	A	387	MET	CG-SD-CE	-6.53	89.75	100.20
1	A	210	VAL	CB-CA-C	-6.50	99.06	111.40
1	A	291	ASP	CB-CG-OD2	6.49	124.14	118.30
1	A	360	ASP	CB-CG-OD2	6.34	124.00	118.30
1	A	130	LEU	CA-CB-CG	6.33	129.87	115.30
1	A	86	VAL	CG1-CB-CG2	-6.26	100.88	110.90
1	A	431	ASP	CB-CG-OD2	6.26	123.94	118.30
1	A	469	MET	CG-SD-CE	6.06	109.90	100.20
1	A	312	ASP	CB-CG-OD2	6.04	123.73	118.30
1	A	69	ASP	CB-CG-OD2	6.03	123.73	118.30
1	A	110	PRO	N-CA-C	-5.87	96.84	112.10

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	71	LEU	CB-CG-CD2	-5.77	101.19	111.00
1	A	235	VAL	CB-CA-C	-5.77	100.43	111.40
1	A	223	ASP	CB-CG-OD2	5.74	123.47	118.30
1	A	273	ASP	CB-CG-OD2	5.57	123.31	118.30
1	A	111	ASN	CB-CA-C	5.50	121.39	110.40
1	A	29	ASP	CB-CG-OD2	5.42	123.18	118.30
1	A	105	ASP	CB-CG-OD2	5.37	123.13	118.30
1	A	361	ASP	CB-CG-OD2	5.32	123.09	118.30
1	A	516	THR	OG1-CB-CG2	-5.31	97.78	110.00
1	A	348	PRO	N-CD-CG	-5.27	95.30	103.20
1	A	44	GLY	N-CA-C	-5.23	100.01	113.10
1	A	70	THR	OG1-CB-CG2	-5.23	97.98	110.00
1	A	518	ASP	CB-CG-OD2	5.21	122.99	118.30
1	A	377	SER	CB-CA-C	-5.19	100.24	110.10
1	A	127	ARG	CG-CD-NE	5.14	122.61	111.80
1	A	109	GLN	N-CA-C	5.13	124.86	111.00
1	A	347	VAL	CB-CA-C	-5.12	101.66	111.40
1	A	114	GLU	N-CA-C	5.09	124.73	111.00
1	A	506	MET	CB-CA-C	-5.08	100.24	110.40
1	A	359	VAL	CG1-CB-CG2	5.03	118.95	110.90
1	A	78	CYS	CB-CA-C	-5.02	100.37	110.40

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	4150	0	4061	286	0
2	A	1	0	0	0	0
3	A	1	0	0	0	0
4	A	53	0	31	3	0
5	A	23	0	0	6	0
All	All	4228	0	4092	287	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 35.

All (287) 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:155:ARG:HH21	1:A:155:ARG:CB	1.15	1.55
1:A:505:MET:SD	1:A:505:MET:CE	2.05	1.42
1:A:155:ARG:HB3	1:A:155:ARG:NH2	1.04	1.34
1:A:313:ILE:H	1:A:313:ILE:CD1	1.32	1.31
1:A:340:THR:HG22	1:A:341:GLN:OE1	1.16	1.28
1:A:313:ILE:HD12	1:A:313:ILE:N	1.20	1.28
1:A:90:ALA:O	1:A:93:CYS:N	1.72	1.20
1:A:340:THR:CG2	1:A:341:GLN:OE1	1.94	1.14
1:A:109:GLN:O	1:A:109:GLN:HG2	1.34	1.10
1:A:91:ARG:HA	1:A:94:VAL:HB	1.29	1.10
1:A:416:ILE:HD12	1:A:416:ILE:H	1.03	1.08
1:A:109:GLN:O	1:A:109:GLN:CG	2.05	1.05
1:A:416:ILE:H	1:A:416:ILE:CD1	1.65	1.02
1:A:160:THR:HG22	1:A:184:VAL:CG1	1.90	1.01
1:A:408:ARG:HG3	1:A:408:ARG:HH11	1.25	1.00
1:A:259:THR:HG23	1:A:261:ALA:N	1.77	1.00
1:A:260:GLU:HG3	1:A:263:ARG:NH2	1.77	1.00
1:A:234:ARG:HB3	1:A:358:MET:HE3	1.45	0.99
1:A:155:ARG:HH21	1:A:155:ARG:CG	1.74	0.99
1:A:100:GLN:O	1:A:147:LYS:HE3	1.63	0.98
1:A:109:GLN:C	1:A:110:PRO:O	1.97	0.97
1:A:250:HIS:CD2	1:A:252:GLN:H	1.83	0.95
1:A:234:ARG:HG2	1:A:532:SER:HB3	1.48	0.95
1:A:244:HIS:CE1	1:A:257:LEU:HD11	2.01	0.95
1:A:23:LEU:HD12	1:A:23:LEU:O	1.66	0.95
1:A:58:ASP:OD1	1:A:60:THR:HB	1.67	0.95
1:A:424:GLU:CD	1:A:424:GLU:N	2.22	0.93
1:A:416:ILE:HD12	1:A:416:ILE:N	1.82	0.93
1:A:160:THR:HG22	1:A:184:VAL:HG11	1.49	0.92
1:A:513:LEU:CD2	5:A:817:HOH:O	2.18	0.91
1:A:259:THR:HG23	1:A:261:ALA:H	1.36	0.91
1:A:107:HIS:N	1:A:115:SER:O	2.04	0.90
1:A:404:GLU:O	1:A:408:ARG:NH1	2.04	0.90
1:A:159:ARG:HH21	1:A:187:ARG:HH11	1.18	0.89
1:A:250:HIS:HD2	1:A:252:GLN:H	0.91	0.88
1:A:90:ALA:C	1:A:94:VAL:H	1.76	0.88
1:A:155:ARG:CB	1:A:155:ARG:NH2	1.91	0.87
1:A:244:HIS:NE2	1:A:257:LEU:HD11	1.89	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:110:PRO:HD2	1:A:113:GLU:O	1.76	0.86
1:A:314:SER:C	1:A:316:LYS:H	1.81	0.83
1:A:250:HIS:HD2	1:A:252:GLN:N	1.75	0.83
1:A:91:ARG:CA	1:A:94:VAL:HB	2.08	0.82
1:A:69:ASP:HB3	1:A:387:MET:HE1	1.61	0.81
1:A:108:ILE:HG13	1:A:109:GLN:CB	2.12	0.80
1:A:90:ALA:O	1:A:93:CYS:CA	2.30	0.79
1:A:90:ALA:O	1:A:94:VAL:N	2.16	0.79
1:A:234:ARG:CG	1:A:532:SER:HB3	2.13	0.78
1:A:57:PHE:CE1	1:A:91:ARG:HB2	2.18	0.78
1:A:408:ARG:HG3	1:A:408:ARG:NH1	1.97	0.78
1:A:96:TRP:O	1:A:100:GLN:HG2	1.84	0.78
1:A:7:HIS:O	1:A:196:HIS:HD2	1.67	0.77
1:A:362:HIS:HA	1:A:401:SER:OG	1.85	0.77
1:A:109:GLN:O	1:A:110:PRO:O	2.03	0.76
1:A:297:ILE:HG23	1:A:309:MET:HG3	1.67	0.75
1:A:267:ALA:HB2	1:A:313:ILE:HG23	1.69	0.74
1:A:107:HIS:CD2	1:A:117:HIS:HD2	2.06	0.74
1:A:445:LEU:C	1:A:445:LEU:HD12	2.08	0.73
1:A:16:SER:HB3	1:A:35:VAL:CG1	2.19	0.73
1:A:405:ASP:O	1:A:409:ARG:HG3	1.89	0.73
1:A:155:ARG:HB3	1:A:155:ARG:CZ	2.11	0.73
1:A:57:PHE:CZ	1:A:91:ARG:HB2	2.24	0.72
1:A:33:VAL:HG11	1:A:154:ILE:HG12	1.70	0.72
1:A:33:VAL:CG1	1:A:154:ILE:HG12	2.20	0.72
1:A:160:THR:CG2	1:A:184:VAL:HG11	2.21	0.71
1:A:69:ASP:OD2	1:A:128:ARG:NH2	2.24	0.71
1:A:214:THR:O	1:A:255:ASN:HB3	1.91	0.70
1:A:314:SER:C	1:A:316:LYS:N	2.42	0.70
1:A:358:MET:CE	1:A:530:ILE:HG23	2.22	0.70
1:A:108:ILE:HG13	1:A:109:GLN:HB2	1.73	0.70
1:A:173:LEU:HD23	1:A:174:PRO:CD	2.22	0.69
1:A:109:GLN:O	1:A:110:PRO:C	2.29	0.69
1:A:259:THR:HG21	1:A:261:ALA:HB3	1.75	0.69
1:A:313:ILE:CD1	1:A:313:ILE:N	2.02	0.67
1:A:314:SER:O	1:A:316:LYS:N	2.29	0.66
1:A:155:ARG:HB3	1:A:155:ARG:HH22	1.49	0.66
1:A:81:HIS:O	1:A:85:PHE:HB2	1.97	0.65
1:A:173:LEU:HD23	1:A:174:PRO:HD3	1.77	0.65
1:A:445:LEU:HD12	1:A:445:LEU:O	1.97	0.65
1:A:506:MET:CE	1:A:531:LEU:HD23	2.27	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:11:VAL:HG22	1:A:199:ALA:HB3	1.78	0.64
1:A:455:ARG:HH11	1:A:514:HIS:HD2	1.45	0.64
1:A:83:VAL:O	1:A:87:ALA:N	2.21	0.64
1:A:166:ILE:HG13	1:A:182:ALA:HA	1.79	0.64
1:A:90:ALA:HB1	1:A:94:VAL:HG23	1.80	0.63
1:A:234:ARG:HB2	1:A:366:ASP:OD2	1.97	0.63
1:A:242:GLN:HA	1:A:513:LEU:HD22	1.80	0.63
1:A:267:ALA:CB	1:A:313:ILE:HG23	2.29	0.62
1:A:423:ASP:C	1:A:424:GLU:OE2	2.38	0.62
1:A:192:VAL:HG21	1:A:422:TRP:CD1	2.34	0.62
1:A:424:GLU:OE2	1:A:424:GLU:O	2.18	0.61
1:A:244:HIS:CD2	1:A:257:LEU:HD11	2.34	0.61
1:A:38:LYS:HE2	1:A:223:ASP:OD2	2.00	0.61
1:A:365:THR:HG23	1:A:370:LEU:O	2.00	0.61
1:A:7:HIS:O	1:A:196:HIS:CD2	2.51	0.60
1:A:82:ALA:O	1:A:86:VAL:HB	2.01	0.60
1:A:79:ASP:OD1	1:A:79:ASP:C	2.40	0.60
1:A:131:HIS:ND1	1:A:133:ALA:O	2.30	0.60
1:A:244:HIS:CE1	1:A:257:LEU:CD1	2.82	0.60
1:A:16:SER:HB3	1:A:35:VAL:HG11	1.83	0.60
1:A:106:THR:HG22	1:A:107:HIS:O	2.02	0.60
1:A:219:ILE:O	1:A:221:SER:N	2.33	0.60
1:A:267:ALA:CA	1:A:313:ILE:HG23	2.31	0.59
1:A:340:THR:HG22	1:A:341:GLN:CD	2.13	0.59
1:A:428:GLU:OE2	1:A:482:ARG:HD3	2.02	0.59
1:A:69:ASP:HB3	1:A:387:MET:CE	2.33	0.59
1:A:106:THR:CG2	1:A:107:HIS:O	2.51	0.58
1:A:28:ALA:HB1	1:A:151:HIS:CE1	2.38	0.58
1:A:520:PRO:HD2	5:A:814:HOH:O	2.03	0.58
1:A:159:ARG:NH1	1:A:188:ASN:OD1	2.36	0.58
1:A:108:ILE:HG13	1:A:109:GLN:N	2.15	0.58
1:A:90:ALA:O	1:A:92:SER:C	2.41	0.57
1:A:423:ASP:C	1:A:424:GLU:CD	2.63	0.57
1:A:271:ARG:HB3	1:A:272:PRO:HD2	1.87	0.56
1:A:85:PHE:CD2	1:A:86:VAL:N	2.74	0.56
1:A:277:PHE:CD2	1:A:277:PHE:N	2.73	0.55
1:A:485:ASN:ND2	5:A:810:HOH:O	2.39	0.55
1:A:160:THR:CG2	1:A:184:VAL:CG1	2.74	0.55
1:A:505:MET:CE	1:A:505:MET:CB	2.84	0.55
1:A:313:ILE:H	1:A:313:ILE:HD12	0.47	0.55
1:A:322:ARG:HE	1:A:323:GLN:HG2	1.71	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:173:LEU:HD23	1:A:174:PRO:HD2	1.88	0.55
1:A:506:MET:CE	1:A:531:LEU:CD2	2.85	0.54
1:A:85:PHE:CG	1:A:86:VAL:N	2.71	0.54
1:A:325:PHE:N	1:A:326:PRO:CD	2.69	0.54
1:A:58:ASP:OD1	1:A:60:THR:CB	2.47	0.54
1:A:260:GLU:HG3	1:A:263:ARG:HH22	1.67	0.54
1:A:55:ALA:O	1:A:128:ARG:HB2	2.08	0.54
1:A:155:ARG:NH2	1:A:155:ARG:CG	2.45	0.54
1:A:159:ARG:NH2	1:A:187:ARG:HH11	1.96	0.54
1:A:511:ARG:O	1:A:512:GLY:C	2.46	0.54
1:A:358:MET:HE2	1:A:530:ILE:HG23	1.90	0.53
1:A:360:ASP:OD1	1:A:360:ASP:C	2.47	0.53
1:A:424:GLU:O	1:A:424:GLU:CG	2.55	0.53
1:A:359:VAL:HG21	1:A:372:ALA:HB3	1.88	0.53
1:A:506:MET:HE1	1:A:531:LEU:HD23	1.90	0.53
1:A:134:ASP:HB3	1:A:325:PHE:HD2	1.73	0.53
1:A:361:ASP:O	1:A:401:SER:OG	2.18	0.53
1:A:19:ALA:HB1	1:A:373:ILE:HG13	1.89	0.53
1:A:260:GLU:CG	1:A:263:ARG:NH2	2.62	0.53
1:A:185:TRP:CE3	1:A:187:ARG:HG2	2.43	0.52
1:A:248:LEU:HD23	1:A:253:ALA:HB2	1.91	0.52
1:A:90:ALA:C	1:A:92:SER:N	2.62	0.52
1:A:423:ASP:O	1:A:424:GLU:C	2.47	0.52
1:A:244:HIS:CD2	1:A:257:LEU:CD1	2.93	0.52
1:A:408:ARG:NH1	1:A:408:ARG:CG	2.66	0.52
1:A:33:VAL:HG13	1:A:154:ILE:HA	1.91	0.51
1:A:90:ALA:O	1:A:93:CYS:CB	2.58	0.51
1:A:248:LEU:HD12	1:A:345:PRO:O	2.11	0.51
1:A:513:LEU:HD23	5:A:817:HOH:O	1.95	0.51
1:A:55:ALA:O	1:A:128:ARG:HD2	2.10	0.51
1:A:90:ALA:O	1:A:92:SER:N	2.44	0.51
1:A:291:ASP:OD1	1:A:291:ASP:N	2.43	0.51
1:A:107:HIS:CD2	1:A:117:HIS:CD2	2.93	0.51
1:A:107:HIS:NE2	1:A:117:HIS:HD2	2.08	0.51
1:A:268:TYR:CE2	1:A:315:HIS:CD2	2.99	0.51
1:A:358:MET:HE1	1:A:530:ILE:CG2	2.41	0.50
1:A:91:ARG:N	1:A:94:VAL:H	2.09	0.50
1:A:23:LEU:HD12	1:A:23:LEU:C	2.22	0.50
1:A:132:ALA:O	1:A:133:ALA:C	2.50	0.50
1:A:487:LEU:HD21	1:A:491:ARG:NH2	2.26	0.50
1:A:516:THR:O	1:A:516:THR:HG23	2.10	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:23:LEU:O	1:A:23:LEU:CD1	2.52	0.49
1:A:33:VAL:CG1	1:A:154:ILE:HA	2.42	0.49
1:A:288:ALA:HB1	1:A:289:PRO:HD2	1.94	0.49
1:A:436:ILE:HD11	1:A:487:LEU:HD13	1.92	0.49
1:A:16:SER:HB2	1:A:21:LEU:CD1	2.42	0.49
1:A:185:TRP:CZ3	1:A:187:ARG:HG2	2.47	0.49
1:A:160:THR:HG22	1:A:184:VAL:HG12	1.90	0.49
1:A:167:VAL:O	1:A:168:SER:C	2.49	0.49
1:A:325:PHE:N	1:A:326:PRO:HD3	2.28	0.49
1:A:82:ALA:O	1:A:85:PHE:HB3	2.11	0.49
1:A:397:VAL:O	1:A:400:TRP:HB3	2.13	0.49
1:A:313:ILE:O	1:A:321:ILE:HD11	2.13	0.49
1:A:259:THR:CG2	1:A:261:ALA:HB3	2.42	0.49
1:A:483:VAL:CG1	1:A:484:SER:N	2.76	0.49
1:A:6:GLU:HB3	1:A:194:THR:O	2.13	0.48
1:A:41:VAL:HG12	1:A:158:GLU:OE1	2.13	0.48
1:A:406:ILE:O	1:A:409:ARG:N	2.45	0.48
1:A:505:MET:CE	1:A:505:MET:HB2	2.44	0.48
1:A:382:HIS:O	1:A:383:GLY:C	2.52	0.48
1:A:358:MET:HE1	1:A:530:ILE:HG23	1.96	0.48
1:A:86:VAL:HG12	1:A:87:ALA:N	2.28	0.48
1:A:267:ALA:HA	1:A:313:ILE:HG23	1.95	0.48
1:A:58:ASP:OD1	1:A:60:THR:N	2.42	0.48
1:A:278:MET:N	1:A:279:PRO:CD	2.77	0.48
1:A:487:LEU:HG	1:A:487:LEU:O	2.14	0.48
1:A:487:LEU:O	1:A:491:ARG:HG3	2.14	0.48
1:A:272:PRO:HA	1:A:310:PHE:CE2	2.49	0.48
1:A:406:ILE:O	1:A:407:THR:C	2.52	0.47
1:A:483:VAL:HG12	1:A:484:SER:N	2.29	0.47
1:A:490:LEU:O	1:A:494:VAL:HG23	2.14	0.47
1:A:134:ASP:OD2	1:A:328:ILE:HD12	2.15	0.47
1:A:209:LYS:HG3	1:A:209:LYS:O	2.15	0.47
1:A:268:TYR:HB3	1:A:276:ARG:HD2	1.95	0.47
1:A:505:MET:CE	1:A:505:MET:CG	2.91	0.47
1:A:83:VAL:HG22	1:A:381:LEU:HD12	1.97	0.47
1:A:158:GLU:O	1:A:159:ARG:C	2.53	0.47
1:A:92:SER:O	1:A:96:TRP:N	2.37	0.47
1:A:106:THR:HG22	1:A:106:THR:O	2.14	0.46
1:A:119:THR:HG22	1:A:120:ARG:H	1.80	0.46
1:A:158:GLU:O	1:A:160:THR:OG1	2.22	0.46
1:A:69:ASP:OD2	1:A:124:HIS:HA	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:244:HIS:HB2	1:A:351:HIS:HB2	1.97	0.46
1:A:70:THR:O	1:A:71:LEU:C	2.54	0.46
1:A:283:GLU:H	1:A:283:GLU:HG3	1.47	0.46
1:A:433:ARG:NH2	1:A:482:ARG:O	2.49	0.46
1:A:136:THR:O	1:A:140:VAL:HG23	2.16	0.45
1:A:196:HIS:O	1:A:197:ALA:HB2	2.15	0.45
1:A:288:ALA:HB1	1:A:289:PRO:CD	2.46	0.45
1:A:487:LEU:HD21	1:A:491:ARG:HH21	1.82	0.45
1:A:90:ALA:O	1:A:93:CYS:C	2.55	0.45
1:A:436:ILE:CD1	1:A:487:LEU:HD13	2.47	0.45
1:A:320:PHE:O	1:A:321:ILE:C	2.54	0.45
1:A:384:ALA:O	1:A:385:ASN:HB2	2.16	0.45
1:A:273:ASP:C	1:A:273:ASP:OD2	2.55	0.45
1:A:132:ALA:HB3	1:A:136:THR:HA	1.98	0.45
1:A:90:ALA:O	1:A:93:CYS:HB2	2.17	0.44
1:A:110:PRO:CD	1:A:113:GLU:O	2.57	0.44
1:A:204:THR:OG1	1:A:224:GLY:HA3	2.18	0.44
1:A:113:GLU:CG	1:A:114:GLU:H	2.30	0.44
1:A:60:THR:O	1:A:60:THR:CG2	2.65	0.44
1:A:173:LEU:CD2	1:A:174:PRO:HD2	2.48	0.44
1:A:273:ASP:OD2	1:A:275:THR:OG1	2.28	0.44
1:A:358:MET:CE	1:A:530:ILE:CG2	2.94	0.44
1:A:340:THR:CG2	1:A:340:THR:O	2.59	0.44
1:A:316:LYS:HB3	1:A:317:PRO:HD2	1.99	0.43
1:A:478:TYR:O	1:A:479:ALA:C	2.56	0.43
1:A:424:GLU:O	1:A:424:GLU:HG2	2.18	0.43
1:A:433:ARG:NH1	1:A:433:ARG:CG	2.80	0.43
1:A:81:HIS:O	1:A:85:PHE:CB	2.65	0.43
1:A:253:ALA:O	1:A:254:ARG:C	2.56	0.43
1:A:271:ARG:HB3	1:A:272:PRO:CD	2.48	0.43
1:A:108:ILE:HG13	1:A:109:GLN:HB3	1.97	0.43
1:A:245:PRO:CB	1:A:293:VAL:HG12	2.48	0.43
1:A:256:PHE:N	5:A:803:HOH:O	2.41	0.43
1:A:27:LEU:O	1:A:31:HIS:HD2	2.01	0.43
1:A:424:GLU:N	1:A:424:GLU:OE1	2.50	0.43
1:A:86:VAL:O	1:A:87:ALA:C	2.56	0.43
1:A:259:THR:CG2	1:A:261:ALA:H	2.20	0.43
1:A:97:LEU:HG	1:A:102:VAL:HG21	2.01	0.43
1:A:131:HIS:H	1:A:131:HIS:CD2	2.37	0.43
1:A:247:ALA:O	1:A:346:ILE:HA	2.19	0.43
1:A:16:SER:HB2	1:A:21:LEU:HD13	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:433:ARG:CG	1:A:433:ARG:HH11	2.32	0.42
1:A:455:ARG:HH11	1:A:514:HIS:CD2	2.32	0.42
1:A:347:VAL:HB	1:A:348:PRO:CD	2.50	0.42
1:A:391:SER:HG	4:A:800:FAD:C2	2.30	0.42
1:A:5:PRO:O	1:A:6:GLU:O	2.36	0.42
1:A:159:ARG:HH21	1:A:187:ARG:HD2	1.83	0.42
1:A:55:ALA:O	1:A:128:ARG:CD	2.68	0.42
1:A:464:LEU:HA	1:A:464:LEU:HD12	1.74	0.42
1:A:60:THR:O	1:A:60:THR:HG22	2.16	0.42
1:A:244:HIS:ND1	1:A:245:PRO:HD2	2.35	0.42
1:A:90:ALA:C	1:A:94:VAL:N	2.58	0.42
1:A:337:ILE:HG21	1:A:344:VAL:HG13	2.00	0.42
1:A:246:THR:O	1:A:246:THR:OG1	2.32	0.41
1:A:264:GLY:HA2	1:A:287:LEU:HD11	2.02	0.41
4:A:800:FAD:C2'	4:A:800:FAD:N1	2.76	0.41
1:A:33:VAL:HG13	1:A:33:VAL:O	2.20	0.41
1:A:244:HIS:CG	1:A:257:LEU:CD1	3.03	0.41
1:A:290:ARG:O	1:A:291:ASP:C	2.55	0.41
1:A:463:ALA:O	1:A:464:LEU:C	2.57	0.41
1:A:469:MET:O	1:A:473:GLU:HB2	2.20	0.41
1:A:84:GLU:O	1:A:85:PHE:C	2.59	0.41
1:A:95:GLN:HA	1:A:98:ILE:HD12	2.02	0.41
1:A:131:HIS:CD2	1:A:131:HIS:N	2.88	0.41
1:A:91:ARG:C	1:A:94:VAL:N	2.74	0.41
1:A:27:LEU:O	1:A:31:HIS:CD2	2.74	0.41
1:A:56:VAL:HG13	1:A:61:ASP:HB3	2.03	0.41
1:A:90:ALA:HB3	1:A:91:ARG:H	1.15	0.41
1:A:185:TRP:HH2	5:A:811:HOH:O	2.04	0.41
1:A:242:GLN:HA	1:A:513:LEU:CD2	2.50	0.41
1:A:271:ARG:NH2	1:A:300:GLU:OE2	2.52	0.41
1:A:470:LEU:HD23	1:A:470:LEU:HA	1.86	0.41
1:A:174:PRO:CD	1:A:174:PRO:O	2.68	0.41
1:A:210:VAL:HG23	1:A:211:TYR:CD2	2.56	0.41
1:A:516:THR:HG23	1:A:519:TYR:H	1.85	0.41
1:A:21:LEU:HD12	1:A:21:LEU:HA	1.92	0.40
1:A:106:THR:HG23	1:A:107:HIS:O	2.21	0.40
1:A:331:LYS:O	1:A:331:LYS:HG3	2.20	0.40
1:A:329:TYR:HE1	1:A:338:ASP:OD1	2.04	0.40
1:A:471:GLN:O	1:A:472:GLN:C	2.58	0.40
1:A:15:GLY:HA2	4:A:800:FAD:H1B	2.03	0.40
1:A:98:ILE:C	1:A:100:GLN:N	2.74	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:227:MET:O	1:A:228:ALA:C	2.58	0.40
1:A:121:GLU:HB3	1:A:260:GLU:HB3	2.03	0.40
1:A:134:ASP:HB3	1:A:325:PHE:CD2	2.55	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	527/540 (98%)	463 (88%)	49 (9%)	15 (3%)	5 7

All (15) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	90	ALA
1	A	91	ARG
1	A	110	PRO
1	A	85	PHE
1	A	108	ILE
1	A	315	HIS
1	A	407	THR
1	A	6	GLU
1	A	92	SER
1	A	424	GLU
1	A	479	ALA
1	A	107	HIS
1	A	109	GLN
1	A	318	ALA
1	A	416	ILE

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	441/452 (98%)	400 (91%)	41 (9%)	9 17

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	SER
1	A	21	LEU
1	A	106	THR
1	A	107	HIS
1	A	109	GLN
1	A	119	THR
1	A	127	ARG
1	A	130	LEU
1	A	131	HIS
1	A	139	GLU
1	A	155	ARG
1	A	173	LEU
1	A	178	ARG
1	A	187	ARG
1	A	191	THR
1	A	255	ASN
1	A	275	THR
1	A	283	GLU
1	A	287	LEU
1	A	313	ILE
1	A	319	ASP
1	A	322	ARG
1	A	328	ILE
1	A	333	LEU
1	A	340	THR
1	A	359	VAL
1	A	386	LEU
1	A	401	SER
1	A	415	ASP
1	A	416	ILE

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Mol	Chain	Res	Type
1	A	423	ASP
1	A	424	GLU
1	A	433	ARG
1	A	436	ILE
1	A	445	LEU
1	A	446	PHE
1	A	482	ARG
1	A	485	ASN
1	A	510	SER
1	A	516	THR
1	A	521	GLU

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	31	HIS
1	A	107	HIS
1	A	117	HIS
1	A	196	HIS
1	A	250	HIS
1	A	315	HIS
1	A	414	HIS
1	A	514	HIS

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 2 are monoatomic - leaving 1 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
4	FAD	A	800	-	51,58,58	1.42	7 (13%)	60,89,89	2.97	19 (31%)

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
4	FAD	A	800	-	-	6/30/50/50	0/6/6/6

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	800	FAD	C2A-N3A	3.82	1.38	1.32
4	A	800	FAD	C4X-N5	3.26	1.38	1.33
4	A	800	FAD	C2A-N1A	2.96	1.39	1.33
4	A	800	FAD	C2B-C1B	-2.85	1.49	1.53
4	A	800	FAD	O2'-C2'	-2.27	1.38	1.43
4	A	800	FAD	C4-N3	2.20	1.36	1.33
4	A	800	FAD	C1'-N10	2.03	1.50	1.48

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	800	FAD	C1'-N10-C9A	13.53	128.94	118.29
4	A	800	FAD	C4-N3-C2	9.91	123.51	115.14
4	A	800	FAD	C1'-N10-C10	-7.03	112.11	118.41
4	A	800	FAD	C5X-C9A-N10	4.78	121.18	117.72
4	A	800	FAD	O4B-C1B-C2B	-4.42	100.47	106.93
4	A	800	FAD	C4-C4X-C10	-4.40	117.04	119.95
4	A	800	FAD	O2'-C2'-C1'	-3.84	100.34	109.59
4	A	800	FAD	N3A-C2A-N1A	-3.65	122.97	128.68
4	A	800	FAD	C4X-C4-N3	-3.61	118.50	123.43
4	A	800	FAD	C6-C5X-C9A	3.00	122.99	119.05

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	800	FAD	O3B-C3B-C2B	-2.91	102.40	111.82
4	A	800	FAD	C9A-N10-C10	-2.81	118.22	121.91
4	A	800	FAD	O2'-C2'-C3'	-2.66	102.62	109.10
4	A	800	FAD	C7-C6-C5X	-2.63	117.50	121.22
4	A	800	FAD	C4-C4X-N5	2.40	121.34	118.60
4	A	800	FAD	C9A-C5X-N5	-2.34	118.69	122.36
4	A	800	FAD	C7M-C7-C8	-2.08	116.46	120.74
4	A	800	FAD	C1'-C2'-C3'	2.05	115.51	109.79
4	A	800	FAD	C8M-C8-C7	-2.01	116.61	120.74

There are no chirality outliers.

All (6) torsion outliers are listed below:

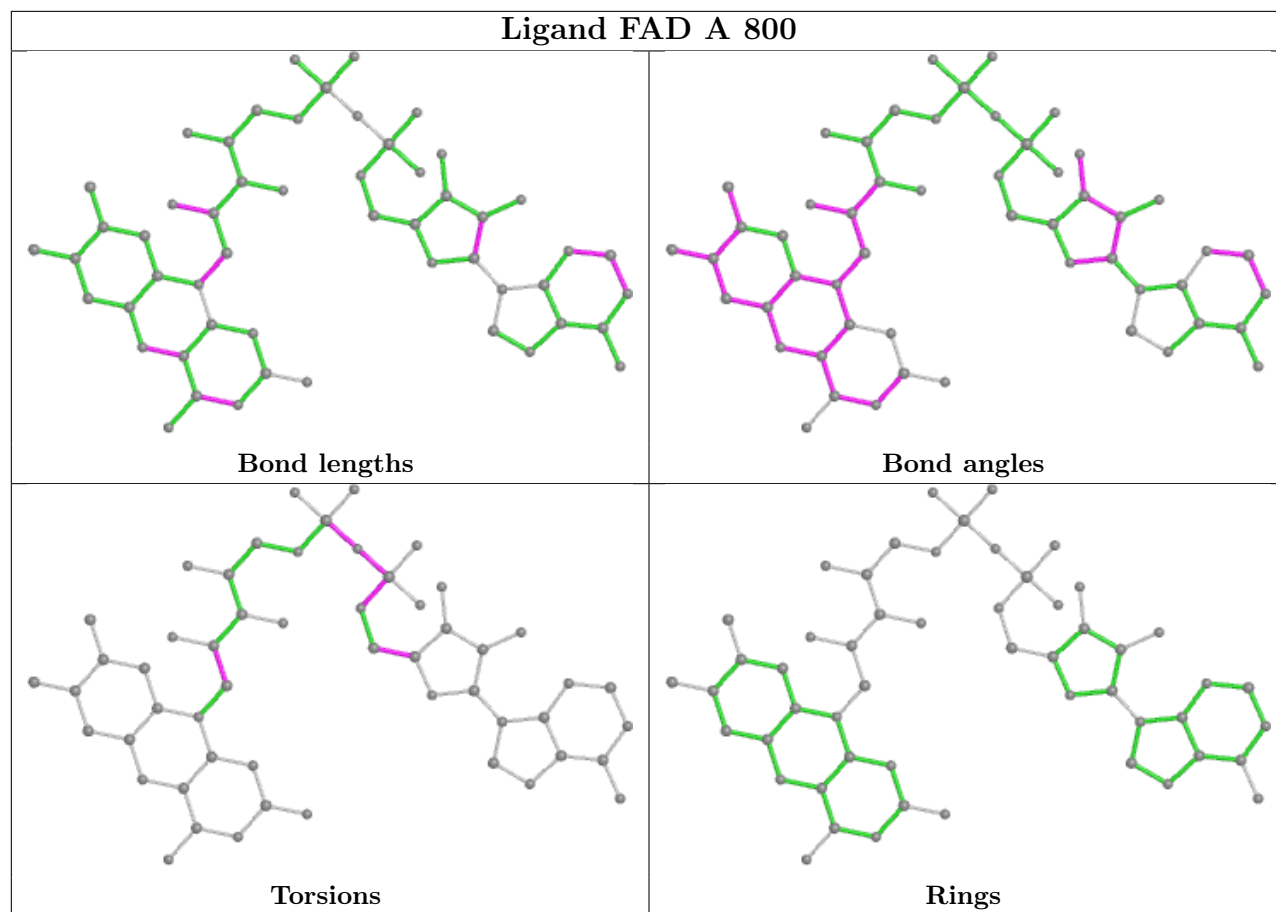
Mol	Chain	Res	Type	Atoms
4	A	800	FAD	N10-C1'-C2'-C3'
4	A	800	FAD	PA-O3P-P-O5'
4	A	800	FAD	P-O3P-PA-O1A
4	A	800	FAD	P-O3P-PA-O2A
4	A	800	FAD	C5B-O5B-PA-O1A
4	A	800	FAD	O4B-C4B-C5B-O5B

There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	800	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](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	529/540 (97%)	0.91	67 (12%) 3 3	55, 87, 100, 100	0

All (67) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	254	ARG	7.4
1	A	108	ILE	5.8
1	A	479	ALA	5.6
1	A	110	PRO	5.1
1	A	5	PRO	4.9
1	A	320	PHE	4.7
1	A	333	LEU	4.6
1	A	90	ALA	4.5
1	A	344	VAL	4.3
1	A	55	ALA	4.3
1	A	426	ARG	4.3
1	A	111	ASN	4.2
1	A	113	GLU	4.1
1	A	6	GLU	4.1
1	A	174	PRO	3.9
1	A	109	GLN	3.7
1	A	255	ASN	3.6
1	A	424	GLU	3.6
1	A	59	GLU	3.5
1	A	337	ILE	3.5
1	A	419	LEU	3.4
1	A	175	GLY	3.3
1	A	335	LEU	3.3
1	A	127	ARG	3.2
1	A	91	ARG	3.1
1	A	521	GLU	3.0
1	A	336	GLY	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	329	TYR	2.9
1	A	427	VAL	2.9
1	A	253	ALA	2.8
1	A	325	PHE	2.8
1	A	249	TYR	2.7
1	A	250	HIS	2.7
1	A	324	HIS	2.6
1	A	417	SER	2.6
1	A	418	THR	2.6
1	A	332	LEU	2.6
1	A	310	PHE	2.6
1	A	106	THR	2.6
1	A	272	PRO	2.6
1	A	345	PRO	2.5
1	A	416	ILE	2.5
1	A	523	LEU	2.5
1	A	497	ALA	2.5
1	A	54	ALA	2.5
1	A	421	PRO	2.4
1	A	494	VAL	2.3
1	A	7	HIS	2.3
1	A	327	MET	2.3
1	A	268	TYR	2.3
1	A	322	ARG	2.3
1	A	397	VAL	2.3
1	A	256	PHE	2.2
1	A	30	GLN	2.2
1	A	331	LYS	2.2
1	A	342	GLU	2.2
1	A	482	ARG	2.1
1	A	112	GLY	2.1
1	A	173	LEU	2.1
1	A	483	VAL	2.1
1	A	314	SER	2.1
1	A	185	TRP	2.1
1	A	338	ASP	2.1
1	A	196	HIS	2.1
1	A	393	LEU	2.1
1	A	402	ALA	2.0
1	A	186	ASN	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](#)

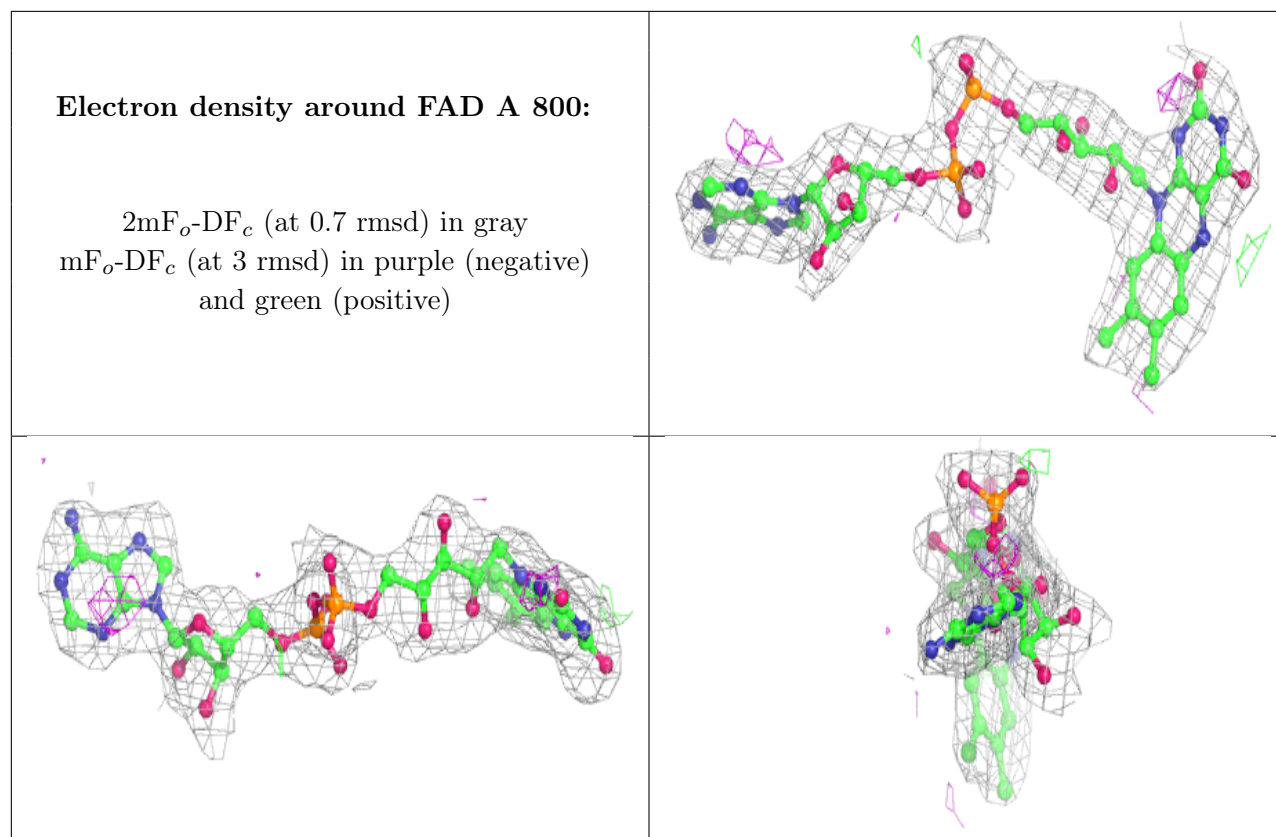
There are no monosaccharides in this entry.

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
3	NA	A	542	1/1	0.82	0.17	71,71,71,71	0
4	FAD	A	800	53/53	0.93	0.21	68,79,85,87	0
2	CL	A	541	1/1	0.94	0.46	77,77,77,77	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.