



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 10:58 AM UTC

PDB ID : 7MY9 / pdb_00007my9
Title : Structure of proline utilization A with 1,3-dithiolane-2-carboxylate bound in the proline dehydrogenase active site
Authors : Tanner, J.J.; Campbell, A.C.
Deposited on : 2021-05-20
Resolution : 1.63 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

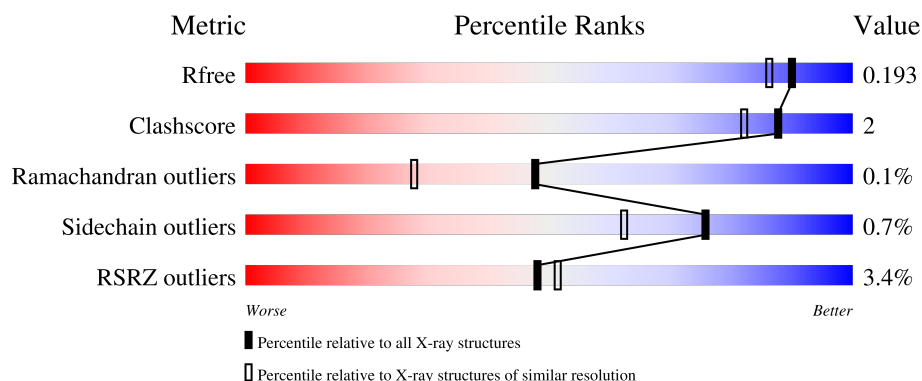
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.63 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	6728 (1.64-1.60)
Clashscore	190562	7023 (1.64-1.60)
Ramachandran outliers	187476	6898 (1.64-1.60)
Sidechain outliers	187428	6896 (1.64-1.60)
RSRZ outliers	180081	6727 (1.64-1.60)

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	1235	4% 94% 5%
1	B	1235	3% 94% 5%

2 Entry composition [i](#)

There are 10 unique types of molecules in this entry. The entry contains 20512 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.

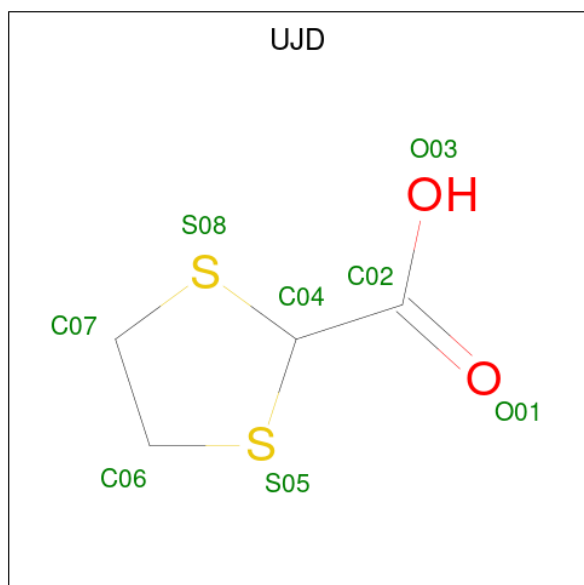
- Molecule 1 is a protein called Bifunctional protein PutA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	1216	Total	C	N	O	S	0	8	0
			9056	5696	1629	1697	34			
1	B	1216	Total	C	N	O	S	0	18	0
			9115	5738	1637	1706	34			

There are 4 discrepancies between the modelled and reference sequences:

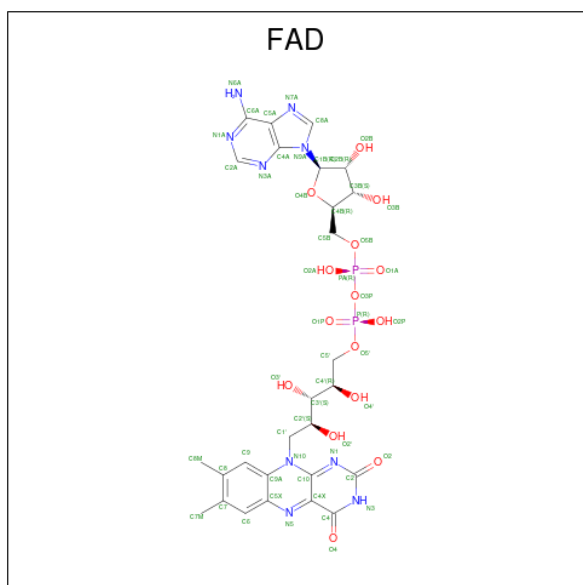
Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	SER	-	expression tag	UNP F7X6I3
A	0	MET	-	expression tag	UNP F7X6I3
B	-1	SER	-	expression tag	UNP F7X6I3
B	0	MET	-	expression tag	UNP F7X6I3

- Molecule 2 is 1,3-dithiolane-2-carboxylic acid (CCD ID: UJD) (formula: C₄H₆O₂S₂) (labeled as "Ligand of Interest" by depositor).



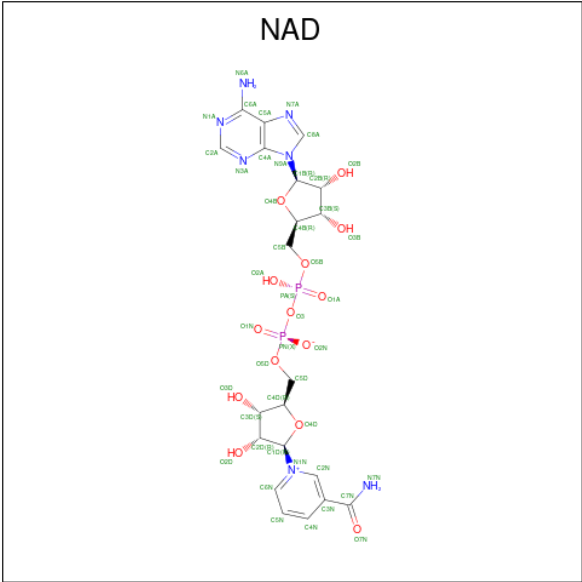
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total 8	C 4	O 2	S 2	0	0
2	B	1	Total 8	C 4	O 2	S 2	0	0

- Molecule 3 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$) (labeled as "Ligand of Interest" by depositor).



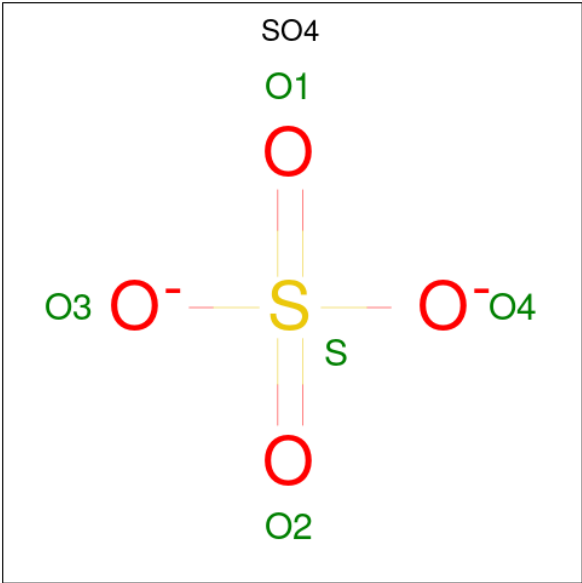
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total 53	C 27	N 9	O 15	P 2	0	0
3	B	1	Total 53	C 27	N 9	O 15	P 2	0	0

- Molecule 4 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (CCD ID: NAD) (formula: $\text{C}_{21}\text{H}_{27}\text{N}_7\text{O}_{14}\text{P}_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
4	B	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 5 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	O	S	0	0
			5	4	1		
5	A	1	Total	O	S	0	0
			5	4	1		

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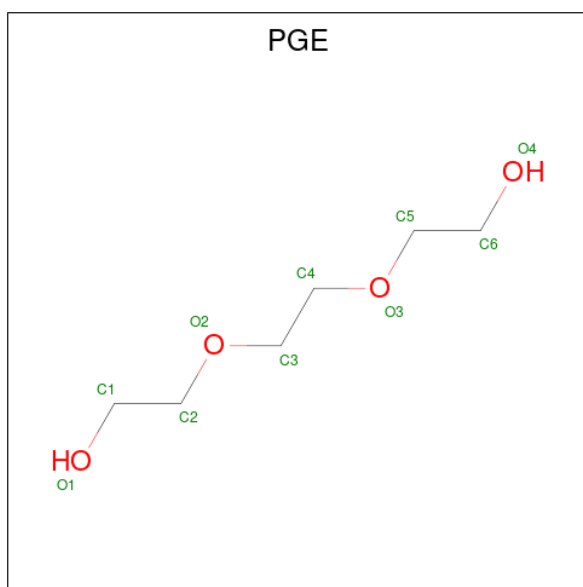
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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	O	S	0	0
			5	4	1		
5	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 6 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

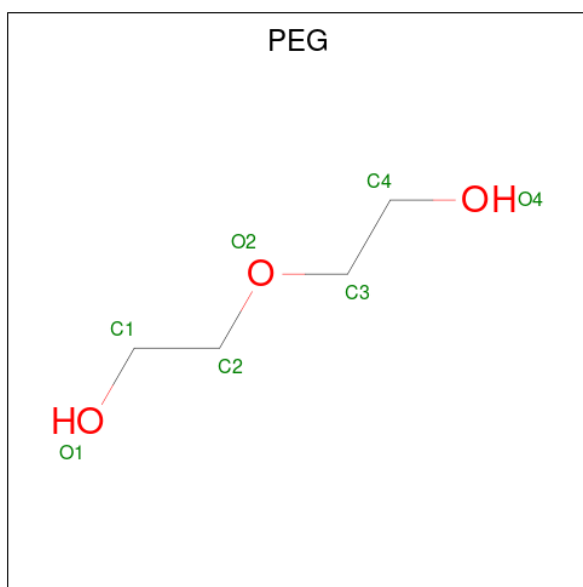
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total	Mg	0	0
			1	1		
6	B	1	Total	Mg	0	0
			1	1		

- Molecule 7 is TRIETHYLENE GLYCOL (CCD ID: PGE) (formula: C₆H₁₄O₄).



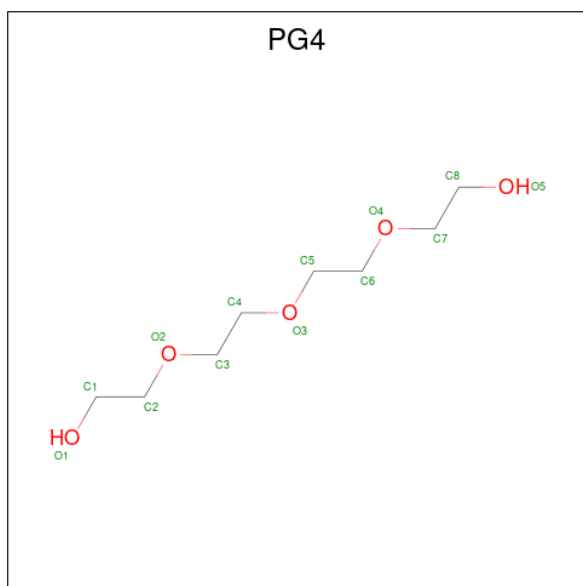
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total	C	O	0	0
			10	6	4		
7	B	1	Total	C	O	0	0
			10	6	4		
7	B	1	Total	C	O	0	0
			10	6	4		

- Molecule 8 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: C₄H₁₀O₃).



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

- Molecule 9 is TETRAETHYLENE GLYCOL (CCD ID: PG4) (formula: $C_8H_{18}O_5$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	B	1	Total	C	O	0	0
			13	8	5		

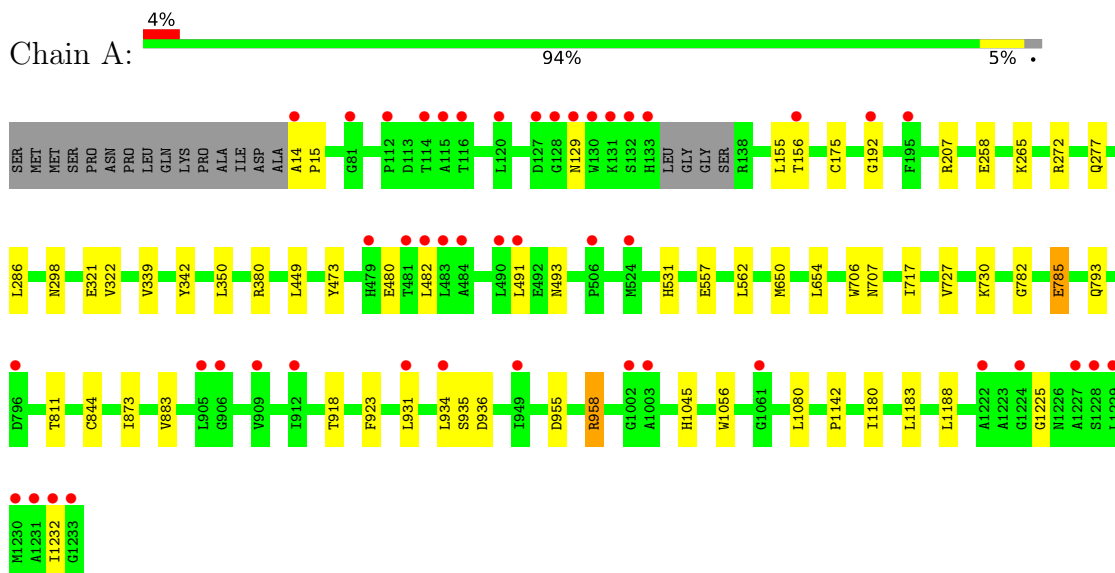
- Molecule 10 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	963	Total 963	O 963	0	0
10	B	1096	Total 1096	O 1096	0	0

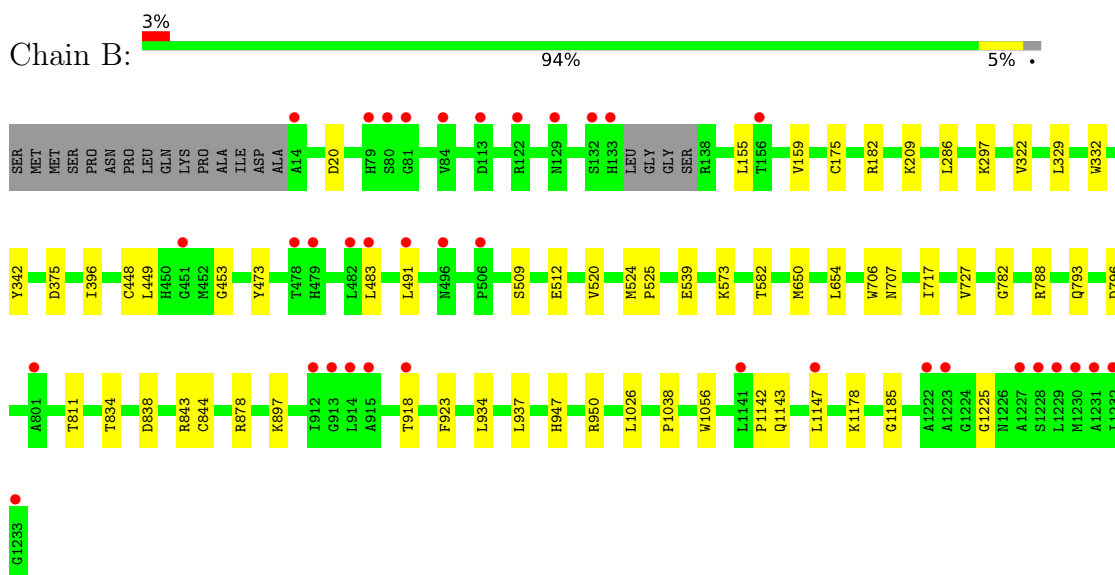
3 Residue-property plots [i](#)

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

• Molecule 1: Bifunctional protein PutA



• Molecule 1: Bifunctional protein PutA



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	101.93Å 103.09Å 126.91Å 90.00° 106.50° 90.00°	Depositor
Resolution (Å)	121.68 – 1.63 121.68 – 1.63	Depositor EDS
% Data completeness (in resolution range)	98.4 (121.68-1.63) 98.4 (121.68-1.63)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.37 (at 1.63Å)	Xtriage
Refinement program	PHENIX 1.14	Depositor
R, R_{free}	0.162 , 0.192 0.164 , 0.193	Depositor DCC
R_{free} test set	15405 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	23.6	Xtriage
Anisotropy	0.070	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 39.2	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	0.97	EDS
Total number of atoms	20512	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.06% 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: UJD, FAD, SO4, PGE, NAD, PEG, MG, PG4

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	0.26	0/9240	0.46	0/12571
1	B	0.28	0/9336	0.49	0/12703
All	All	0.27	0/18576	0.47	0/25274

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	9056	0	9091	34	0
1	B	9115	0	9176	38	0
2	A	8	0	0	0	0
2	B	8	0	0	0	0
3	A	53	0	31	0	0
3	B	53	0	31	0	0
4	A	44	0	26	1	0
4	B	44	0	26	2	0
5	A	15	0	0	0	0
5	B	5	0	0	0	0
6	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	1	0	0	0	0
7	A	10	0	14	0	0
7	B	20	0	28	1	0
8	B	7	0	10	0	0
9	B	13	0	18	1	0
10	A	963	0	0	10	0
10	B	1096	0	0	8	0
All	All	20512	0	18451	72	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 2.

All (72) 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:491:LEU:HD11	1:A:1225:GLY:HA3	1.57	0.85
1:B:838[B]:ASP:HB3	1:B:843[B]:ARG:HH12	1.43	0.82
1:B:539:GLU:OE1	10:B:1401:HOH:O	2.02	0.75
1:B:175:CYS:SG	10:B:2356:HOH:O	2.49	0.70
1:B:844:CYS:SG	4:B:1304:NAD:C4N	2.79	0.69
1:B:491:LEU:HD11	1:B:1225:GLY:HA3	1.74	0.69
1:A:155:LEU:HD22	1:A:491:LEU:HD21	1.75	0.69
1:A:1183:LEU:O	10:A:1401:HOH:O	2.12	0.67
1:B:582:THR:HA	7:B:1308:PGE:H5	1.76	0.66
1:B:793:GLN:OE1	10:B:1402:HOH:O	2.14	0.66
1:B:524[A]:MET:HE3	1:B:525:PRO:HD2	1.77	0.66
1:B:788[A]:ARG:NH2	1:B:1185:GLY:O	2.29	0.66
1:A:286:LEU:HD21	1:A:322:VAL:HG11	1.77	0.65
1:A:175:CYS:SG	10:A:2267:HOH:O	2.54	0.64
1:B:897:LYS:HZ3	9:B:1309:PG4:H32	1.67	0.59
1:B:297:LYS:HD2	1:B:329:LEU:HA	1.85	0.59
1:B:155:LEU:HD22	1:B:491:LEU:HD21	1.86	0.58
1:A:844:CYS:SG	4:A:1303:NAD:C4N	2.92	0.57
1:A:873:ILE:HG13	1:A:883:VAL:HB	1.86	0.57
1:B:788[B]:ARG:NH1	1:B:1185:GLY:O	2.33	0.57
1:A:1045[B]:HIS:ND1	10:A:1408:HOH:O	2.32	0.55
1:A:955:ASP:HB3	1:A:958:ARG:HH11	1.73	0.54
1:B:650:MET:O	1:B:654:LEU:HG	2.07	0.53
1:B:573:LYS:NZ	10:B:1412:HOH:O	2.40	0.53
1:A:298:ASN:ND2	10:A:1406:HOH:O	2.28	0.53
1:B:449:LEU:HD23	1:B:473:TYR:HB3	1.91	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:339:VAL:HG21	1:A:350:LEU:HD21	1.92	0.51
1:B:209:LYS:NZ	10:B:1417:HOH:O	2.43	0.51
1:A:793:GLN:OE1	10:A:1402:HOH:O	2.20	0.50
1:B:1056:TRP:CD1	1:B:1142:PRO:HD3	2.46	0.50
1:A:650:MET:O	1:A:654:LEU:HG	2.13	0.48
1:B:834:THR:O	1:B:838[B]:ASP:HB2	2.13	0.47
1:A:785:GLU:CD	1:A:785:GLU:H	2.23	0.47
1:A:1180:ILE:HG23	1:A:1188:LEU:HD12	1.96	0.47
1:A:931:LEU:HD13	1:A:936:ASP:HB2	1.97	0.46
1:B:706:TRP:CE3	1:B:707:ASN:HA	2.51	0.46
1:B:937:LEU:HD21	1:B:947:HIS:CD2	2.50	0.46
1:A:557:GLU:OE2	10:A:1403:HOH:O	2.21	0.46
1:B:20:ASP:OD2	1:B:878:ARG:NH1	2.48	0.46
1:A:491:LEU:CD1	1:A:1225:GLY:HA3	2.38	0.46
1:A:192:GLY:O	1:A:207:ARG:NH1	2.49	0.45
1:A:706:TRP:CE3	1:A:707:ASN:HA	2.51	0.45
1:B:844:CYS:SG	4:B:1304:NAD:C3N	3.05	0.45
1:A:265:LYS:HE3	10:A:1746:HOH:O	2.16	0.45
1:B:297:LYS:HG3	1:B:332:TRP:HB2	1.99	0.45
1:B:286:LEU:HD21	1:B:322:VAL:HG11	2.00	0.44
1:A:918:THR:HB	1:A:923:PHE:CD1	2.51	0.44
1:B:782:GLY:O	1:B:811:THR:HA	2.17	0.44
1:A:1056:TRP:CD1	1:A:1142:PRO:HD3	2.54	0.43
1:B:509:SER:OG	1:B:512:GLU:HG3	2.18	0.43
1:B:396:ILE:HD11	1:B:520:VAL:HB	2.00	0.43
1:A:272:ARG:HB3	1:A:277:GLN:HG3	2.01	0.43
1:A:531:HIS:NE2	1:A:1232:ILE:HG23	2.34	0.43
1:A:14:ALA:HA	1:A:15:PRO:HD3	1.90	0.42
1:A:717:ILE:HG12	1:A:727:VAL:HG11	2.02	0.42
1:B:717:ILE:HG12	1:B:727:VAL:HG11	2.02	0.42
1:B:796:ASP:HA	1:B:1178:LYS:HE2	2.02	0.42
1:B:1026:LEU:HD23	1:B:1038:PRO:HG2	2.02	0.42
1:A:562:LEU:HD11	1:A:654:LEU:HD12	2.02	0.42
1:B:1143:GLN:O	1:B:1147:LEU:HG	2.20	0.42
1:B:182:ARG:NH1	10:B:1414:HOH:O	2.41	0.41
1:A:380[A]:ARG:NH2	10:A:1438:HOH:O	2.53	0.41
1:A:480:GLU:C	1:A:482:LEU:H	2.28	0.41
1:B:838[B]:ASP:HB3	1:B:843[B]:ARG:NH1	2.22	0.41
1:A:449:LEU:HD23	1:A:473:TYR:HB3	2.02	0.41
1:A:156:THR:HB	10:A:2001:HOH:O	2.20	0.41
1:A:1080:LEU:HD12	10:A:1988:HOH:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:448:CYS:HB2	1:B:453:GLY:HA3	2.02	0.40
1:B:918:THR:HB	1:B:923:PHE:CD1	2.56	0.40
1:B:950:ARG:NH1	10:B:1405:HOH:O	2.30	0.40
1:B:375[A]:ASP:OD1	10:B:1403:HOH:O	2.22	0.40
1:A:782:GLY:O	1:A:811:THR:HA	2.22	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	1220/1235 (99%)	1196 (98%)	23 (2%)	1 (0%)	48	28
1	B	1232/1235 (100%)	1208 (98%)	23 (2%)	1 (0%)	48	28
All	All	2452/2470 (99%)	2404 (98%)	46 (2%)	2 (0%)	48	28

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	483	LEU
1	A	129	ASN

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	912/951 (96%)	903 (99%)	9 (1%)	68	50
1	B	924/951 (97%)	921 (100%)	3 (0%)	86	79
All	All	1836/1902 (96%)	1824 (99%)	12 (1%)	76	62

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	258	GLU
1	A	321	GLU
1	A	342	TYR
1	A	493	ASN
1	A	730	LYS
1	A	785	GLU
1	A	934	LEU
1	A	935	SER
1	A	958	ARG
1	B	159	VAL
1	B	342	TYR
1	B	934	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	96	GLN
1	A	340	GLN
1	A	440	HIS
1	A	501	HIS
1	A	685	GLN
1	B	28	GLN
1	B	340	GLN
1	B	501	HIS
1	B	685	GLN
1	B	793	GLN

5.3.3 RNA ⓘ

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 17 ligands modelled in this entry, 2 are monoatomic - leaving 15 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	$\# Z > 2$
5	SO4	A	1306	-	4,4,4	0.24	0	6,6,6	0.10	0
5	SO4	B	1305	-	4,4,4	0.23	0	6,6,6	0.17	0
2	UJD	B	1301	-	7,8,8	0.82	0	6,10,10	0.90	0
9	PG4	B	1309	-	12,12,12	0.53	0	11,11,11	0.17	0
3	FAD	B	1303	-	58,58,58	2.00	13 (22%)	85,89,89	1.66	16 (18%)
3	FAD	A	1302	-	58,58,58	2.17	15 (25%)	85,89,89	1.76	17 (20%)
5	SO4	A	1305	-	4,4,4	0.25	0	6,6,6	0.12	0
2	UJD	A	1301	-	7,8,8	0.87	0	6,10,10	0.69	0
7	PGE	A	1308	-	9,9,9	0.32	0	8,8,8	0.29	0
7	PGE	B	1308	-	9,9,9	0.30	0	8,8,8	0.33	0
5	SO4	A	1304	-	4,4,4	0.14	0	6,6,6	0.25	0
4	NAD	A	1303	6	46,48,48	3.77	19 (41%)	64,73,73	2.01	11 (17%)
8	PEG	B	1302	-	6,6,6	0.30	0	5,5,5	0.33	0
4	NAD	B	1304	6	46,48,48	3.38	15 (32%)	64,73,73	1.98	13 (20%)
7	PGE	B	1307	-	9,9,9	0.34	0	8,8,8	0.24	0

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	UJD	B	1301	-	-	0/2/11/11	0/1/1/1
9	PG4	B	1309	-	-	5/10/10/10	-
3	FAD	B	1303	-	-	5/34/50/50	0/6/6/6
3	FAD	A	1302	-	-	3/34/50/50	0/6/6/6
2	UJD	A	1301	-	-	0/2/11/11	0/1/1/1
7	PGE	A	1308	-	-	2/7/7/7	-
7	PGE	B	1308	-	-	3/7/7/7	-
4	NAD	A	1303	6	-	4/30/62/62	0/5/5/5
8	PEG	B	1302	-	-	1/4/4/4	-
4	NAD	B	1304	6	-	4/30/62/62	0/5/5/5
7	PGE	B	1307	-	-	2/7/7/7	-

All (62) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	1303	NAD	PN-O3	9.10	1.69	1.59
4	A	1303	NAD	O4D-C1D	-9.09	1.29	1.40
4	A	1303	NAD	C3B-C4B	-8.41	1.31	1.53
3	A	1302	FAD	PA-O3P	-8.25	1.50	1.59
4	B	1304	NAD	O4D-C1D	-8.24	1.30	1.40
4	A	1303	NAD	C7N-N7N	8.17	1.48	1.33
4	B	1304	NAD	C7N-N7N	7.77	1.47	1.33
4	B	1304	NAD	C3B-C4B	-7.73	1.33	1.53
4	A	1303	NAD	C3D-C4D	-7.52	1.33	1.53
4	A	1303	NAD	O4B-C4B	7.49	1.61	1.45
4	A	1303	NAD	O4D-C4D	7.09	1.60	1.45
3	A	1302	FAD	O4-C4	6.92	1.36	1.23
3	B	1303	FAD	PA-O3P	-6.83	1.52	1.59
4	B	1304	NAD	O4B-C4B	6.81	1.60	1.45
3	B	1303	FAD	O4-C4	6.80	1.36	1.23
4	B	1304	NAD	C3D-C4D	-6.77	1.35	1.53
4	B	1304	NAD	O4D-C4D	6.72	1.59	1.45
4	B	1304	NAD	PN-O3	6.70	1.66	1.59
4	A	1303	NAD	C6A-N6A	5.96	1.49	1.34
4	B	1304	NAD	C6A-N6A	5.82	1.49	1.34
4	A	1303	NAD	PA-O3	4.92	1.64	1.59
4	B	1304	NAD	C2N-N1N	4.59	1.40	1.35
3	A	1302	FAD	C4X-N5	4.46	1.40	1.30
4	A	1303	NAD	C3N-C7N	4.32	1.57	1.50
3	B	1303	FAD	C6A-N6A	4.20	1.44	1.34
3	B	1303	FAD	O2-C2	4.16	1.32	1.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	1304	NAD	C3N-C7N	4.11	1.56	1.50
3	A	1302	FAD	C6A-N6A	4.11	1.44	1.34
4	A	1303	NAD	O3D-C3D	3.99	1.52	1.43
3	A	1302	FAD	O2-C2	3.99	1.32	1.24
3	B	1303	FAD	C4X-N5	3.85	1.39	1.30
4	B	1304	NAD	O3D-C3D	3.71	1.52	1.43
4	A	1303	NAD	O4B-C1B	-3.50	1.33	1.42
4	A	1303	NAD	C2N-N1N	3.36	1.38	1.35
3	B	1303	FAD	P-O3P	3.28	1.63	1.59
3	A	1302	FAD	P-O3P	3.23	1.63	1.59
4	A	1303	NAD	O3B-C3B	3.15	1.50	1.43
4	B	1304	NAD	O4B-C1B	-3.13	1.34	1.42
3	A	1302	FAD	C2-N1	2.88	1.43	1.36
4	B	1304	NAD	O3B-C3B	2.83	1.50	1.43
3	B	1303	FAD	C2-N1	2.75	1.42	1.36
3	A	1302	FAD	O2'-C2'	-2.69	1.37	1.43
4	A	1303	NAD	C2A-N1A	2.67	1.38	1.33
3	A	1302	FAD	C10-N1	2.63	1.38	1.33
3	A	1302	FAD	O4'-C4'	-2.60	1.37	1.43
4	A	1303	NAD	C5A-C4A	-2.56	1.34	1.39
4	A	1303	NAD	C8A-N9A	-2.53	1.33	1.37
3	B	1303	FAD	O2'-C2'	-2.51	1.38	1.43
4	B	1304	NAD	C2A-N1A	2.49	1.38	1.33
3	A	1302	FAD	O4B-C4B	-2.47	1.39	1.45
3	B	1303	FAD	C5A-C4A	2.33	1.43	1.39
3	A	1302	FAD	PA-O5B	-2.33	1.50	1.59
3	B	1303	FAD	O4B-C4B	-2.27	1.39	1.45
3	A	1302	FAD	P-O1P	2.19	1.58	1.50
4	A	1303	NAD	O2B-C2B	-2.18	1.37	1.43
3	A	1302	FAD	PA-O2A	-2.15	1.45	1.55
3	B	1303	FAD	PA-O2A	-2.07	1.45	1.55
3	B	1303	FAD	C10-N1	2.05	1.37	1.33
3	A	1302	FAD	O3'-C3'	-2.03	1.37	1.43
4	A	1303	NAD	C5A-N7A	-2.02	1.35	1.39
4	B	1304	NAD	C5A-C4A	-2.02	1.35	1.39
3	B	1303	FAD	O4'-C4'	-2.00	1.39	1.43

All (57) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	1304	NAD	N3A-C2A-N1A	-5.91	119.63	128.58
4	A	1303	NAD	N3A-C2A-N1A	-5.88	119.67	128.58

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1302	FAD	N3A-C2A-N1A	-5.70	119.95	128.58
4	B	1304	NAD	C5A-C4A-N3A	-5.58	119.04	126.72
4	A	1303	NAD	C4A-N9A-C1B	-5.56	113.64	126.63
3	A	1302	FAD	C5A-C4A-N3A	-5.10	119.70	126.72
4	A	1303	NAD	N9A-C8A-N7A	-5.07	106.74	113.94
4	B	1304	NAD	N9A-C8A-N7A	-4.96	106.90	113.94
3	B	1303	FAD	N3A-C2A-N1A	-4.80	121.32	128.58
4	A	1303	NAD	C5A-C4A-N3A	-4.78	120.14	126.72
3	B	1303	FAD	C5A-C4A-N3A	-4.67	120.28	126.72
4	B	1304	NAD	C4A-N9A-C1B	-4.53	116.04	126.63
4	A	1303	NAD	C4D-O4D-C1D	-4.51	105.80	109.92
4	B	1304	NAD	N3A-C4A-N9A	4.48	134.79	127.17
4	A	1303	NAD	C4A-N9A-C8A	4.14	110.09	105.74
4	A	1303	NAD	C1B-N9A-C8A	4.12	136.25	127.09
4	B	1304	NAD	C4D-O4D-C1D	-4.12	106.15	109.92
3	A	1302	FAD	N3A-C4A-N9A	4.10	134.13	127.17
4	A	1303	NAD	N3A-C4A-N9A	3.90	133.80	127.17
4	B	1304	NAD	C4A-N9A-C8A	3.88	109.81	105.74
4	B	1304	NAD	C2A-N3A-C4A	3.88	121.30	111.83
3	A	1302	FAD	C5A-N7A-C8A	3.87	109.53	103.45
3	A	1302	FAD	C4-C4X-N5	3.77	123.41	118.21
3	A	1302	FAD	C2A-N3A-C4A	3.62	120.68	111.83
3	B	1303	FAD	O2P-P-O3P	-3.62	97.49	107.27
3	B	1303	FAD	N3A-C4A-N9A	3.61	133.31	127.17
3	A	1302	FAD	O2P-P-O3P	-3.38	98.14	107.27
3	B	1303	FAD	C5A-N7A-C8A	3.37	108.75	103.45
4	A	1303	NAD	C5A-N7A-C8A	3.34	108.70	103.45
4	A	1303	NAD	C2A-N3A-C4A	3.27	119.83	111.83
4	B	1304	NAD	C5A-N7A-C8A	3.23	108.52	103.45
3	B	1303	FAD	C4-C4X-N5	3.21	122.64	118.21
4	B	1304	NAD	C1B-N9A-C8A	3.17	134.14	127.09
3	B	1303	FAD	O2-C2-N1	-3.15	116.58	121.80
3	A	1302	FAD	N9A-C8A-N7A	-3.14	109.48	113.94
3	A	1302	FAD	C4X-C4-N3	3.12	121.19	113.25
3	B	1303	FAD	C2A-N3A-C4A	3.05	119.28	111.83
3	A	1302	FAD	C4A-C5A-N7A	-3.04	107.11	110.58
3	B	1303	FAD	C4-N3-C2	-3.02	120.27	125.64
3	A	1302	FAD	C4-N3-C2	-3.00	120.32	125.64
3	B	1303	FAD	C4A-C5A-N7A	-2.93	107.23	110.58
3	B	1303	FAD	O3P-P-O1P	2.75	118.97	110.70
3	A	1302	FAD	C5X-C9A-N10	2.70	120.41	117.97
3	B	1303	FAD	C4X-C10-N10	2.64	120.26	116.48

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1303	FAD	C4X-C4-N3	2.59	119.84	113.25
3	B	1303	FAD	O4-C4-C4X	-2.53	119.86	126.53
3	B	1303	FAD	N9A-C8A-N7A	-2.47	110.43	113.94
3	A	1302	FAD	C9-C9A-N10	-2.38	118.65	121.85
3	B	1303	FAD	C10-C4X-N5	-2.30	120.11	124.81
3	A	1302	FAD	O2A-PA-O3P	-2.28	101.11	107.27
3	A	1302	FAD	O3P-P-O1P	2.25	117.48	110.70
4	A	1303	NAD	O2N-PN-O3	2.18	113.16	107.27
4	B	1304	NAD	C2B-C1B-N9A	-2.17	107.90	113.30
3	A	1302	FAD	C10-C4X-N5	-2.14	120.44	124.81
3	A	1302	FAD	O4-C4-C4X	-2.04	121.14	126.53
4	B	1304	NAD	C2B-C3B-C4B	2.04	106.55	102.61
4	B	1304	NAD	C2N-C3N-C4N	2.01	120.59	118.26

There are no chirality outliers.

All (29) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1302	FAD	P-O3P-PA-O5B
3	A	1302	FAD	N10-C1'-C2'-O2'
3	A	1302	FAD	N10-C1'-C2'-C3'
3	B	1303	FAD	P-O3P-PA-O5B
3	B	1303	FAD	N10-C1'-C2'-O2'
3	B	1303	FAD	N10-C1'-C2'-C3'
3	B	1303	FAD	C1'-C2'-C3'-C4'
9	B	1309	PG4	O2-C3-C4-O3
7	A	1308	PGE	O1-C1-C2-O2
7	B	1307	PGE	O3-C5-C6-O4
7	B	1308	PGE	O1-C1-C2-O2
9	B	1309	PG4	O1-C1-C2-O2
9	B	1309	PG4	C5-C6-O4-C7
9	B	1309	PG4	C3-C4-O3-C5
7	B	1307	PGE	C3-C4-O3-C5
4	A	1303	NAD	C2B-C1B-N9A-C8A
4	B	1304	NAD	C2B-C1B-N9A-C8A
4	A	1303	NAD	C4D-C5D-O5D-PN
4	A	1303	NAD	C5B-O5B-PA-O1A
4	B	1304	NAD	C5B-O5B-PA-O1A
4	B	1304	NAD	C4D-C5D-O5D-PN
7	A	1308	PGE	C4-C3-O2-C2
3	B	1303	FAD	C3B-C4B-C5B-O5B
9	B	1309	PG4	C1-C2-O2-C3

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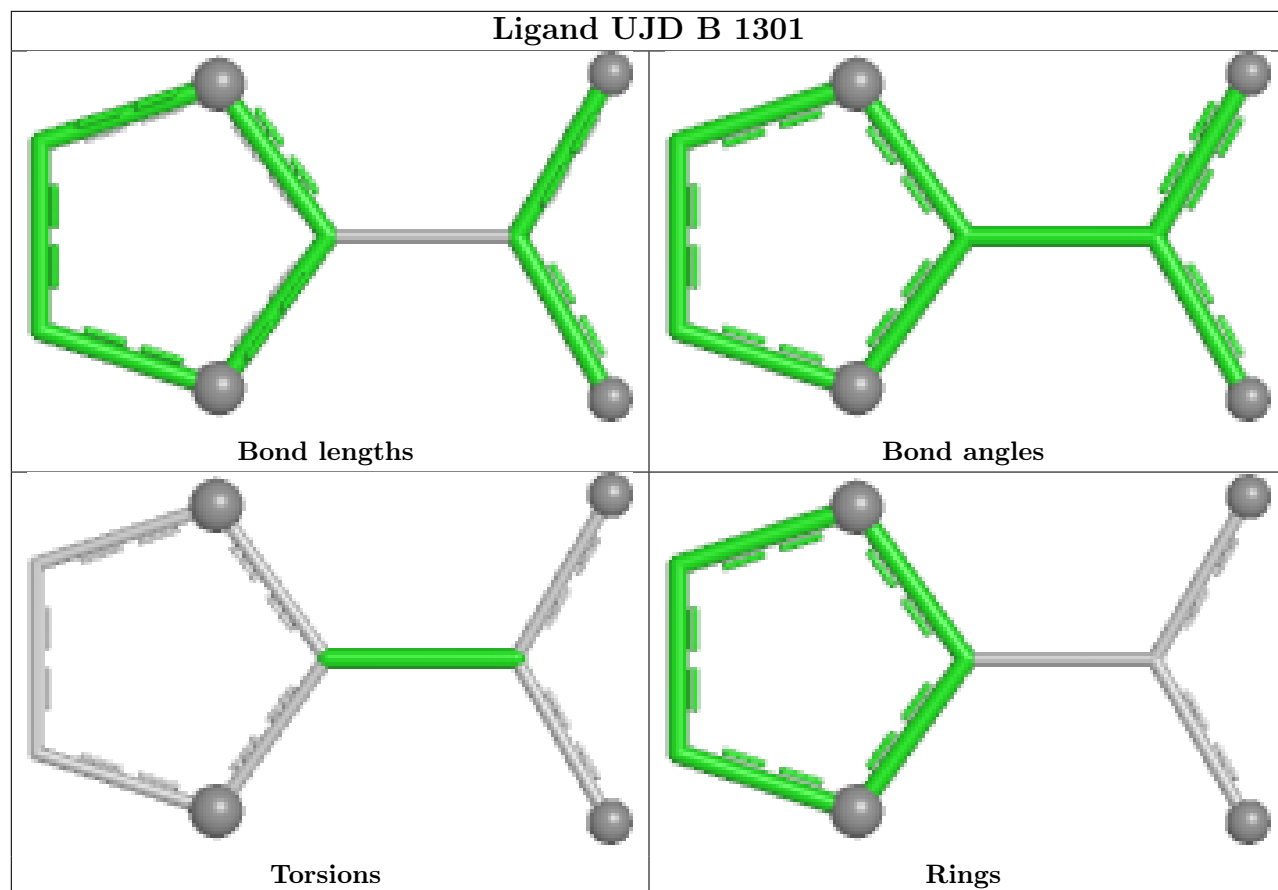
Mol	Chain	Res	Type	Atoms
8	B	1302	PEG	C1-C2-O2-C3
7	B	1308	PGE	O3-C5-C6-O4
7	B	1308	PGE	C6-C5-O3-C4
4	A	1303	NAD	C2B-C1B-N9A-C4A
4	B	1304	NAD	C2B-C1B-N9A-C4A

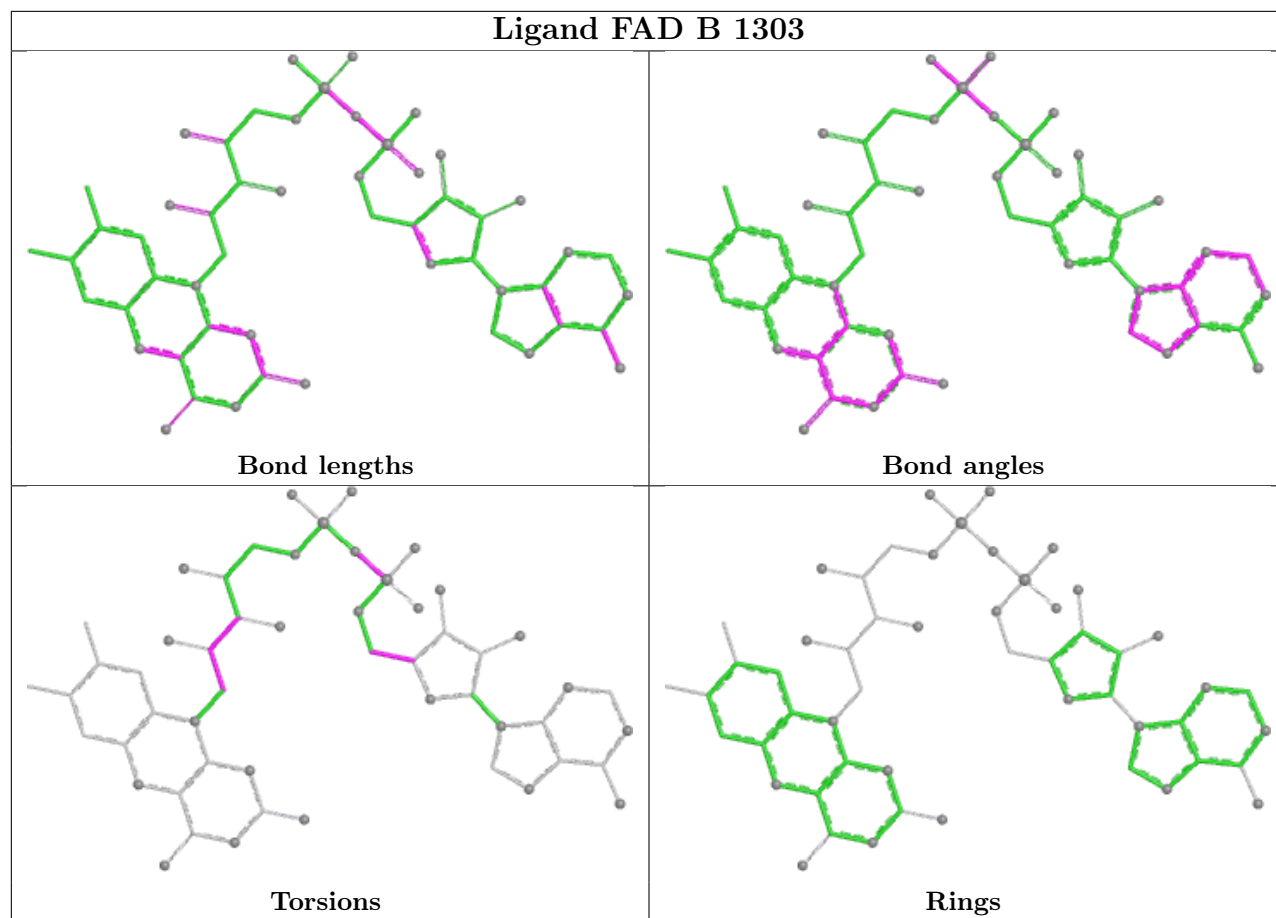
There are no ring outliers.

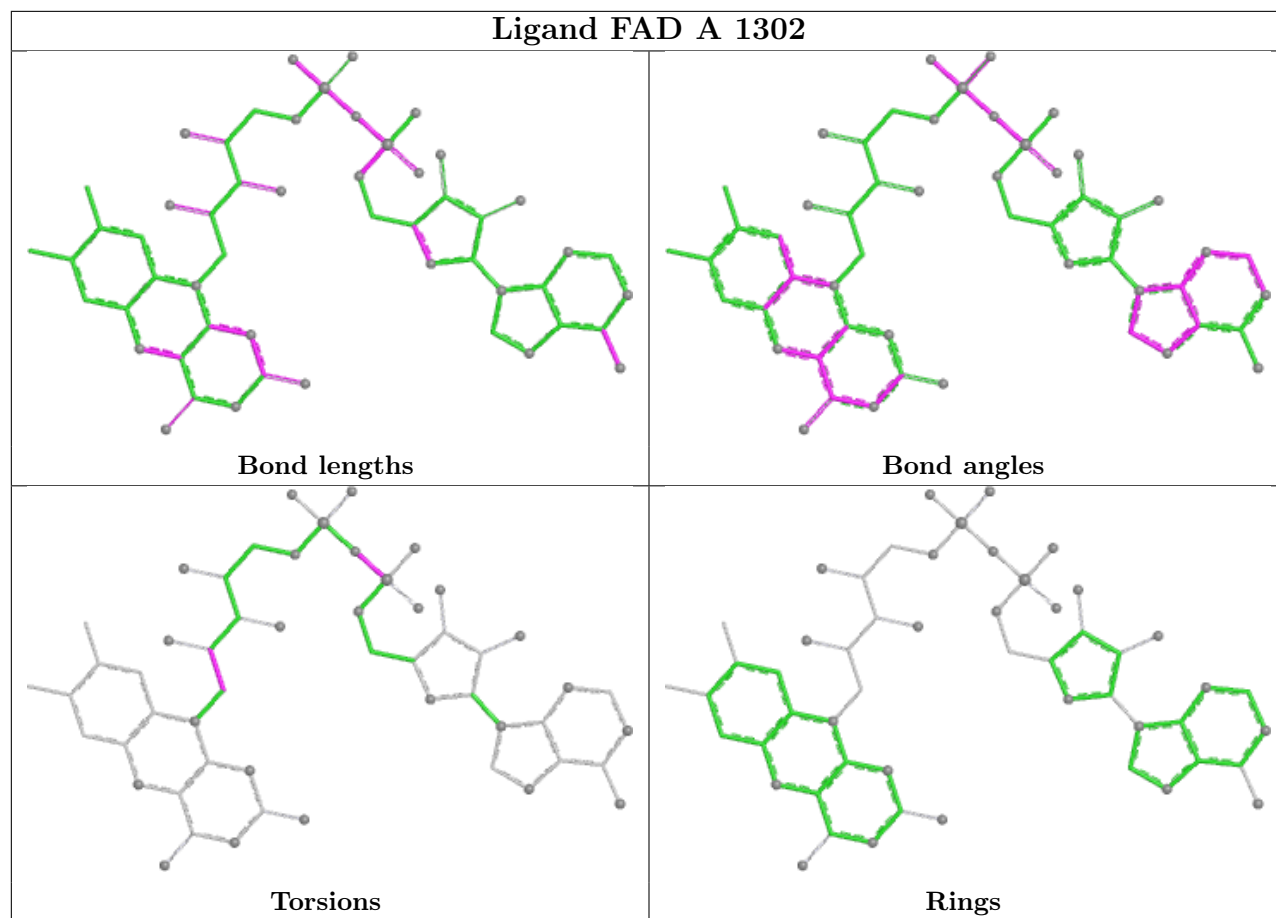
4 monomers are involved in 5 short contacts:

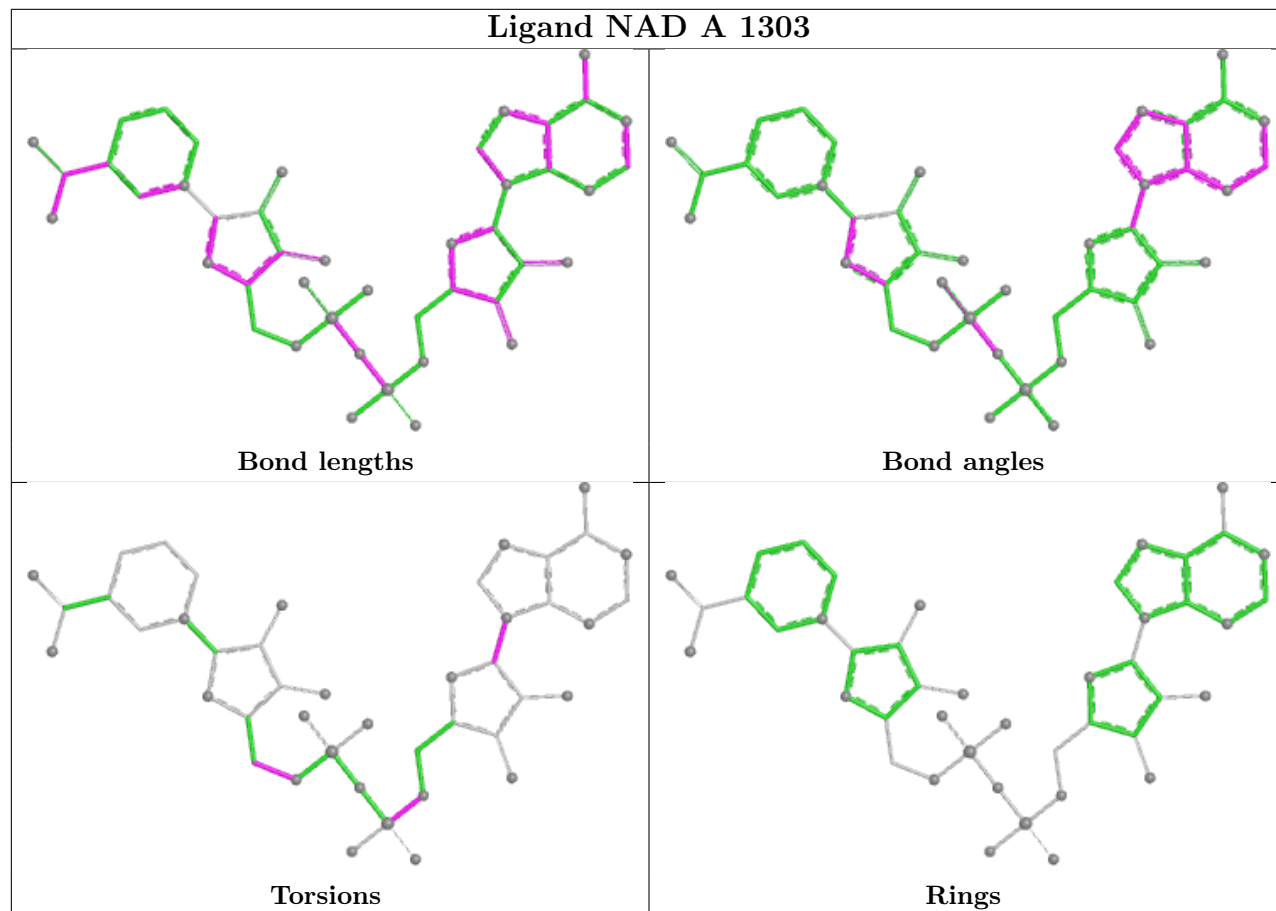
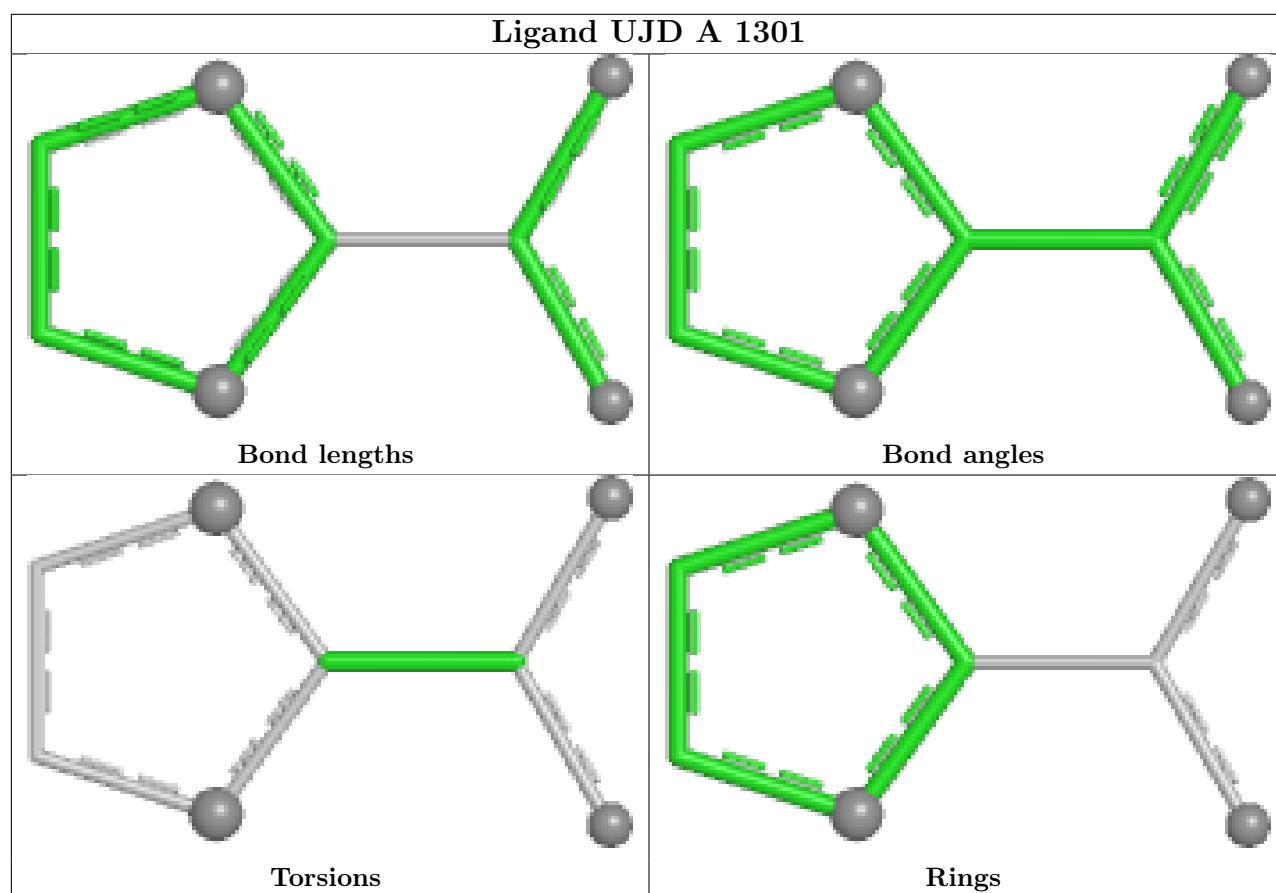
Mol	Chain	Res	Type	Clashes	Symm-Clashes
9	B	1309	PG4	1	0
7	B	1308	PGE	1	0
4	A	1303	NAD	1	0
4	B	1304	NAD	2	0

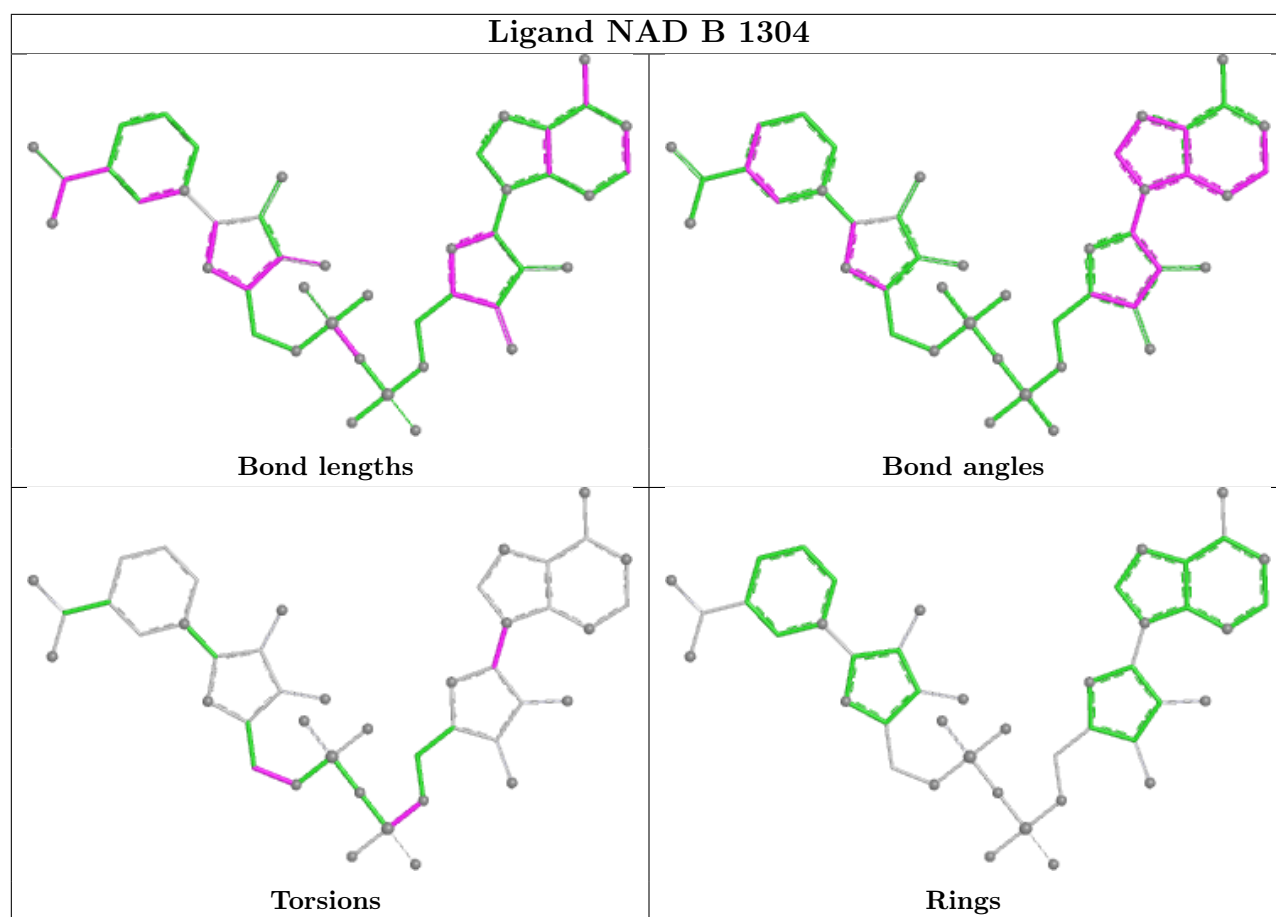
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.











5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ > 2		OWAB(Å ²)	Q < 0.9
1	A	1216/1235 (98%)	0.12	46 (3%)	44 47	12, 27, 51, 89	8 (0%)
1	B	1216/1235 (98%)	-0.04	36 (2%)	52 56	10, 24, 48, 88	18 (1%)
All	All	2432/2470 (98%)	0.04	82 (3%)	48 51	10, 26, 49, 89	26 (1%)

All (82) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	912	ILE	5.8
1	A	1232	ILE	5.1
1	A	1230	MET	4.9
1	B	915	ALA	4.8
1	B	1232	ILE	4.7
1	A	1224	GLY	4.3
1	A	1231	ALA	4.0
1	B	129	ASN	3.9
1	B	913	GLY	3.9
1	A	1227	ALA	3.8
1	A	483	LEU	3.7
1	B	1230	MET	3.7
1	B	132	SER	3.6
1	B	156	THR	3.5
1	B	1231	ALA	3.4
1	A	129	ASN	3.4
1	A	132	SER	3.4
1	A	1002	GLY	3.3
1	A	905	LEU	3.2
1	B	14	ALA	3.2
1	B	1229	LEU	3.2
1	B	918	THR	3.2
1	A	912	ILE	3.1
1	B	1227	ALA	3.1

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Mol	Chain	Res	Type	RSRZ
1	B	133	HIS	3.1
1	A	14	ALA	3.1
1	A	81	GLY	3.1
1	A	1233	GLY	3.0
1	A	491	LEU	3.0
1	B	479	HIS	3.0
1	A	490	LEU	2.9
1	B	914	LEU	2.9
1	B	1233	GLY	2.8
1	A	796	ASP	2.8
1	A	484	ALA	2.7
1	B	482	LEU	2.7
1	B	79	HIS	2.6
1	A	1229	LEU	2.6
1	A	479	HIS	2.6
1	B	1222	ALA	2.6
1	A	114	THR	2.6
1	A	481	THR	2.6
1	A	482	LEU	2.6
1	A	120	LEU	2.5
1	A	115	ALA	2.5
1	A	195	PHE	2.5
1	A	133	HIS	2.5
1	A	112	PRO	2.5
1	A	506	PRO	2.5
1	A	156	THR	2.5
1	A	524	MET	2.5
1	B	1141	LEU	2.4
1	B	81	GLY	2.4
1	A	128	GLY	2.4
1	A	192	GLY	2.4
1	B	483	LEU	2.4
1	A	949	ILE	2.4
1	B	1147	LEU	2.3
1	A	1228	SER	2.3
1	B	122	ARG	2.2
1	B	80	SER	2.2
1	B	451	GLY	2.2
1	A	909	VAL	2.2
1	A	1003	ALA	2.2
1	B	113	ASP	2.2
1	A	116	THR	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	1061	GLY	2.2
1	B	1223	ALA	2.1
1	A	931	LEU	2.1
1	B	491	LEU	2.1
1	B	478	THR	2.1
1	A	1222	ALA	2.1
1	B	801	ALA	2.1
1	B	496	ASN	2.1
1	A	934	LEU	2.1
1	B	84	VAL	2.0
1	B	1228	SER	2.0
1	A	131	LYS	2.0
1	B	506	PRO	2.0
1	A	906	GLY	2.0
1	A	130	TRP	2.0
1	A	127	ASP	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.

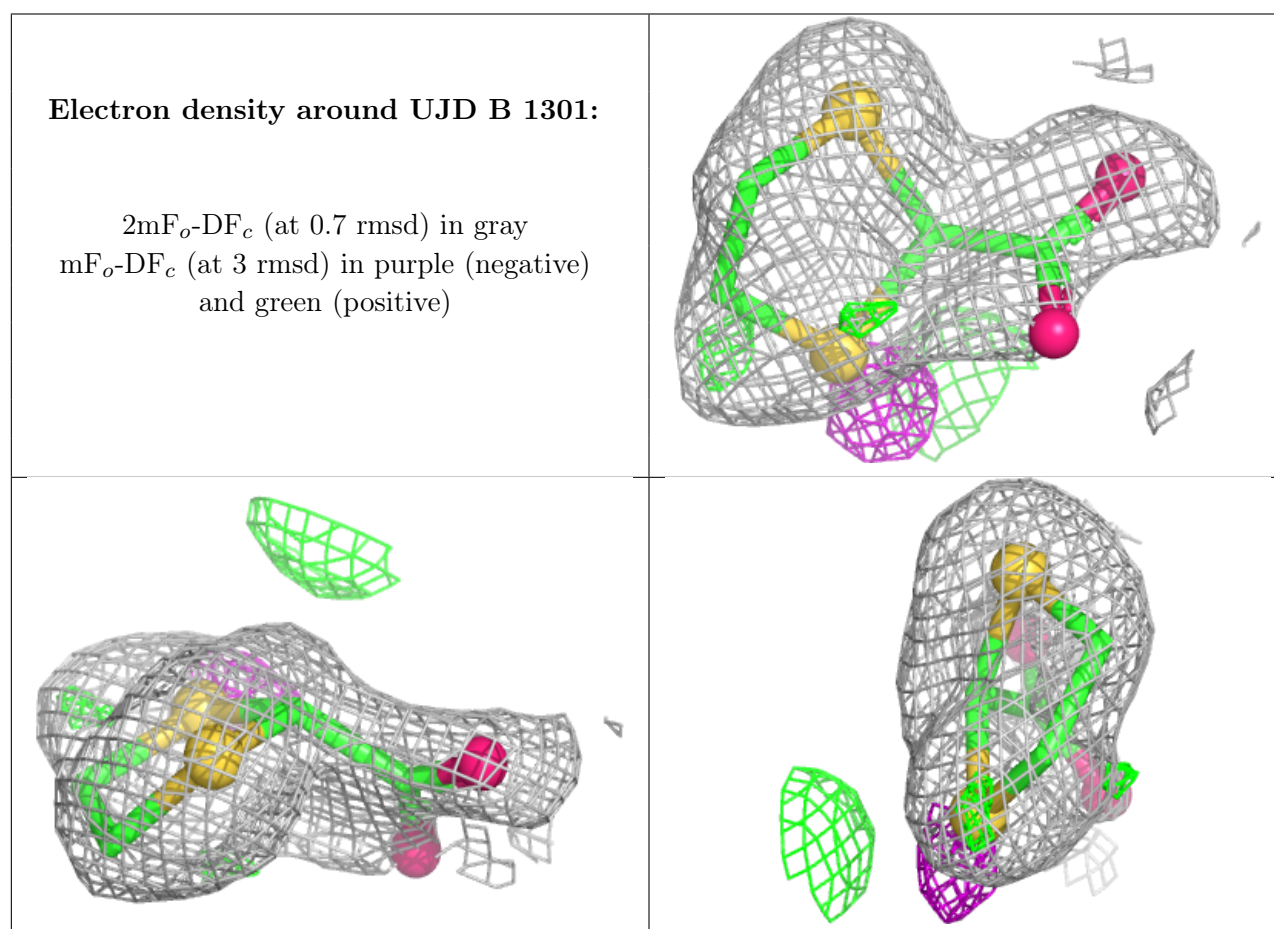
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	SO4	A	1305	5/5	0.70	0.17	70,78,82,83	0
9	PG4	B	1309	13/13	0.76	0.20	43,66,83,83	0
5	SO4	A	1306	5/5	0.80	0.11	85,88,89,92	0
8	PEG	B	1302	7/7	0.82	0.17	33,48,51,51	0
7	PGE	A	1308	10/10	0.83	0.17	41,53,62,64	0
7	PGE	B	1307	10/10	0.86	0.15	46,56,57,58	0
7	PGE	B	1308	10/10	0.87	0.16	52,63,68,68	0

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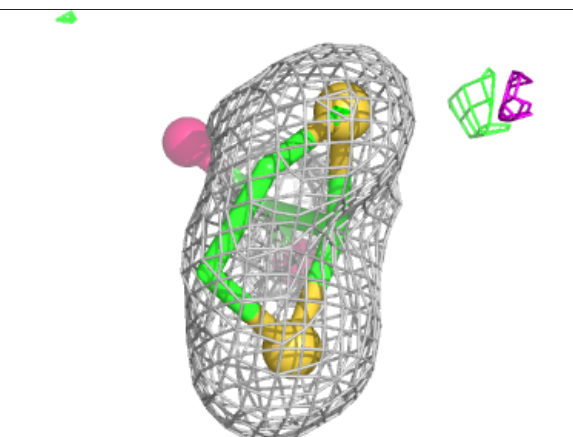
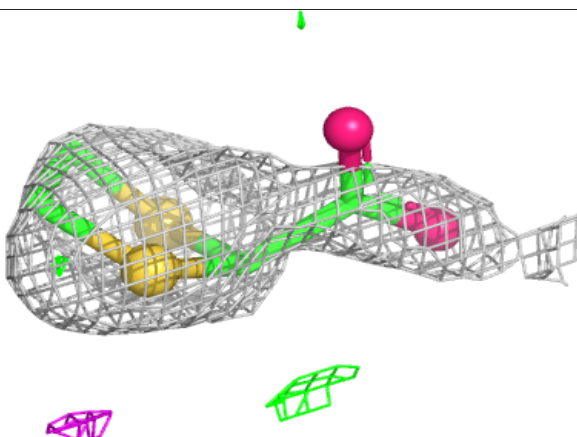
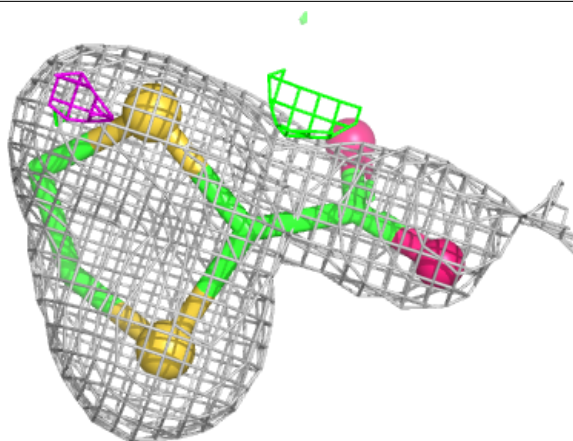
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	UJD	B	1301	8/8	0.90	0.15	38,52,59,65	8
2	UJD	A	1301	8/8	0.90	0.16	39,53,62,68	8
4	NAD	A	1303	44/44	0.95	0.08	22,27,30,32	0
3	FAD	A	1302	53/53	0.95	0.07	18,25,30,32	0
3	FAD	B	1303	53/53	0.96	0.07	19,24,28,30	0
4	NAD	B	1304	44/44	0.97	0.06	16,18,24,31	0
6	MG	B	1306	1/1	0.98	0.07	28,28,28,28	0
6	MG	A	1307	1/1	0.98	0.06	32,32,32,32	0
5	SO4	B	1305	5/5	0.99	0.04	20,23,28,30	0
5	SO4	A	1304	5/5	0.99	0.05	21,22,25,26	0

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

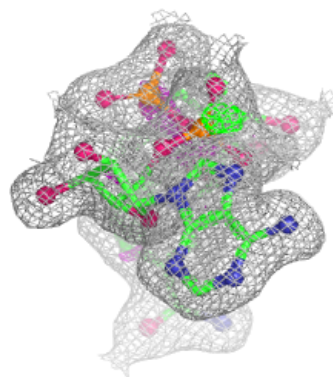
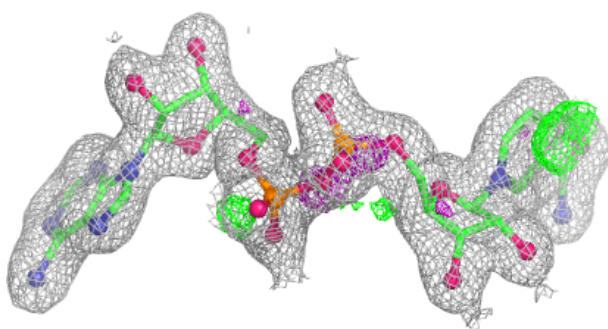
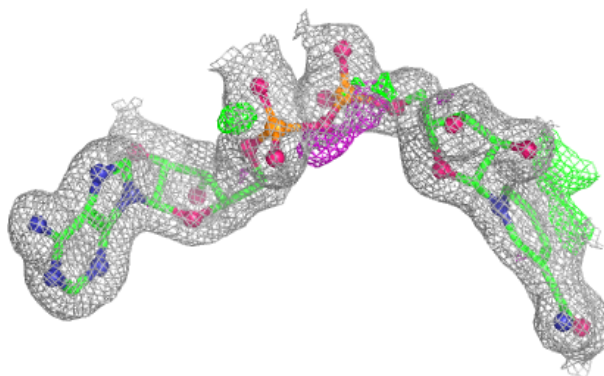


Electron density around UJD A 1301:

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

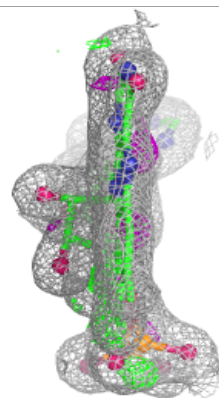
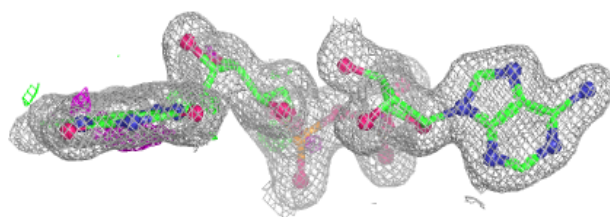
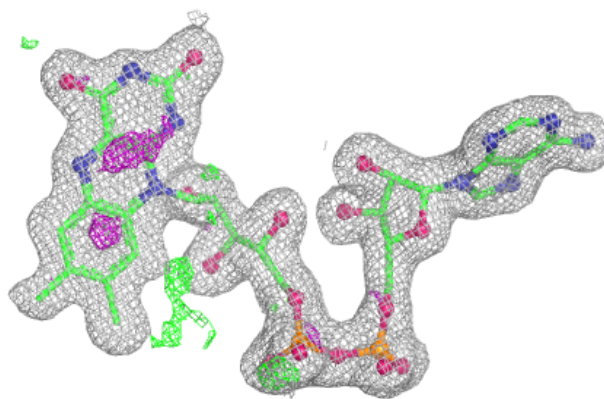
**Electron density around NAD A 1303:**

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

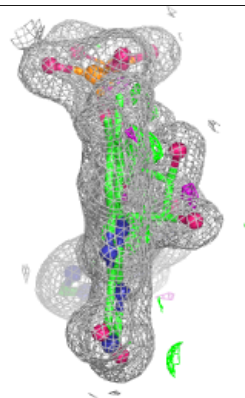
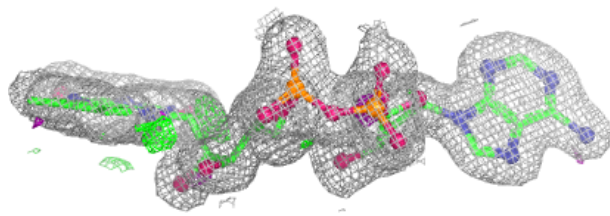
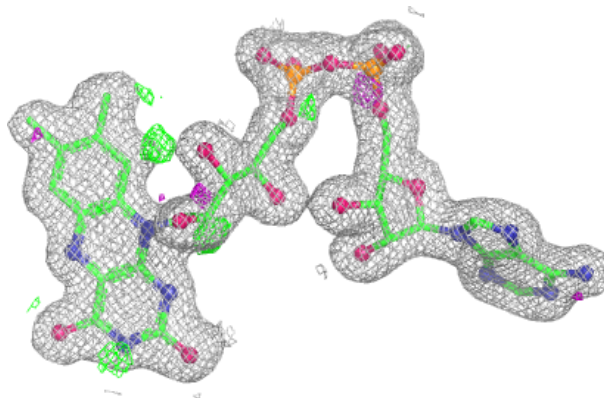


Electron density around FAD A 1302:

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

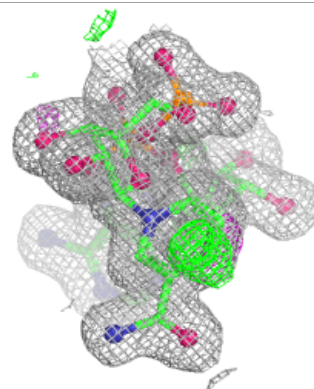
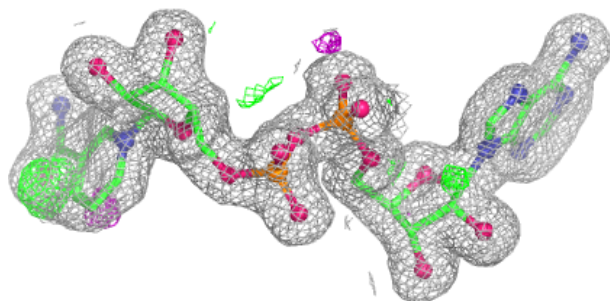
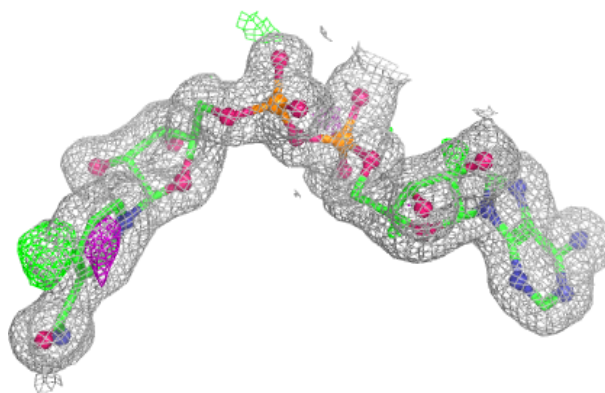
**Electron density around FAD B 1303:**

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



Electron density around NAD B 1304:

$2mF_o-DF_c$ (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.