



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 19, 2024 – 04:13 PM EST

PDB ID : 9DL5
Title : Structure of proline utilization A complexed with 5-chloro-1-indanone
Authors : Tanner, J.J.; Meeks, K.R.
Deposited on : 2024-09-10
Resolution : 1.77 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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 1.21
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

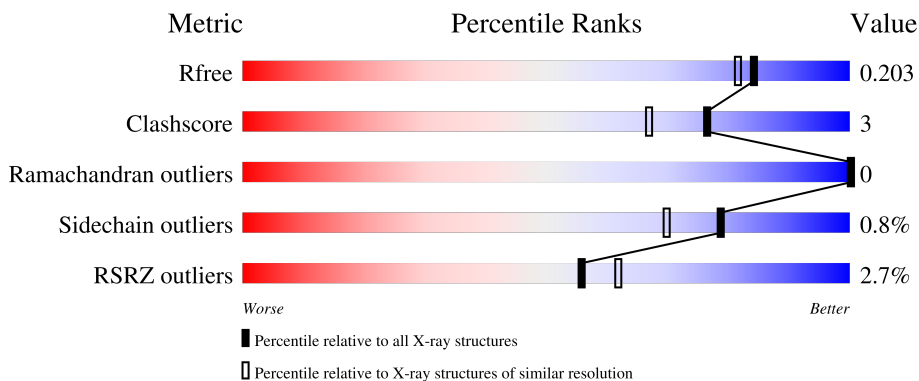
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.77 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}	164625	1191 (1.78-1.78)
Clashscore	180529	1282 (1.78-1.78)
Ramachandran outliers	177936	1270 (1.78-1.78)
Sidechain outliers	177891	1270 (1.78-1.78)
RSRZ outliers	164620	1191 (1.78-1.78)

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	 2% 91% 5%
1	B	1235	 3% 89% 8%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
8	SO4	A	2014	-	-	X	-
8	SO4	B	2018	-	-	X	-

2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 19627 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.

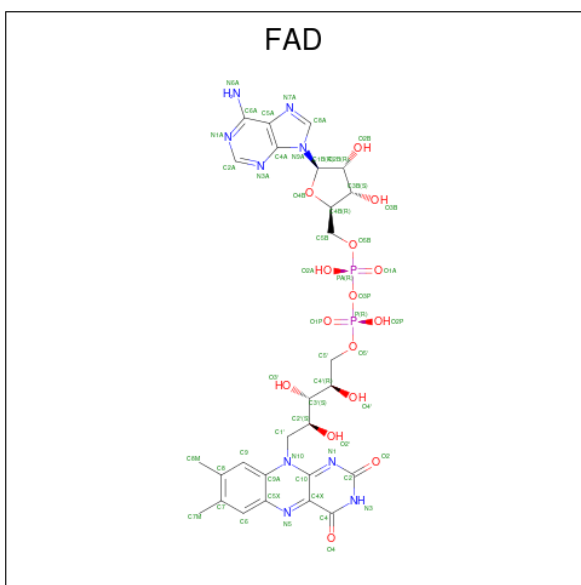
- Molecule 1 is a protein called Bifunctional protein PutA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	1193	Total 8767	C 5525	N 1558	O 1649	S 35	0	10	0
1	B	1201	Total 8746	C 5512	N 1559	O 1642	S 33	0	7	0

There are 4 discrepancies between the modelled and reference sequences:

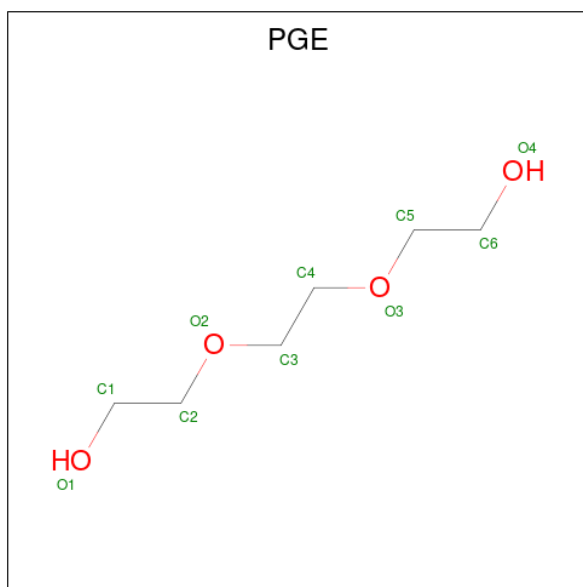
Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	SER	-	expression tag	UNP F7X6I3
A	0	MET	-	expression tag	UNP F7X6I3
B	-1	SER	-	expression tag	UNP F7X6I3
B	0	MET	-	expression tag	UNP F7X6I3

- Molecule 2 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$) (labeled as "Ligand of Interest" by depositor).



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

- Molecule 3 is TRIETHYLENE GLYCOL (three-letter code: PGE) (formula: C₆H₁₄O₄).



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

- Molecule 4 is FORMIC ACID (three-letter code: FMT) (formula: CH₂O₂).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 3 1 2	0	0
4	A	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0
4	B	1	Total C O 3 1 2	0	0

- Molecule 5 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C₄H₁₀O₃).



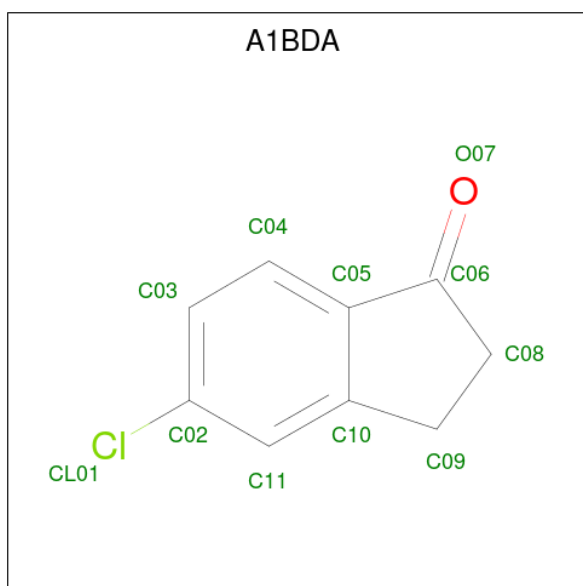
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 7 4 3	0	0
5	A	1	Total C O 7 4 3	0	0
5	A	1	Total C O 7 4 3	0	0
5	B	1	Total C O 7 4 3	0	0
5	B	1	Total C O 7 4 3	0	0
5	B	1	Total C O 7 4 3	0	0
5	B	1	Total C O 7 4 3	0	0
5	B	1	Total C O 7 4 3	0	0

- Molecule 6 is TETRAETHYLENE GLYCOL (three-letter code: PG4) (formula: C₈H₁₈O₅).



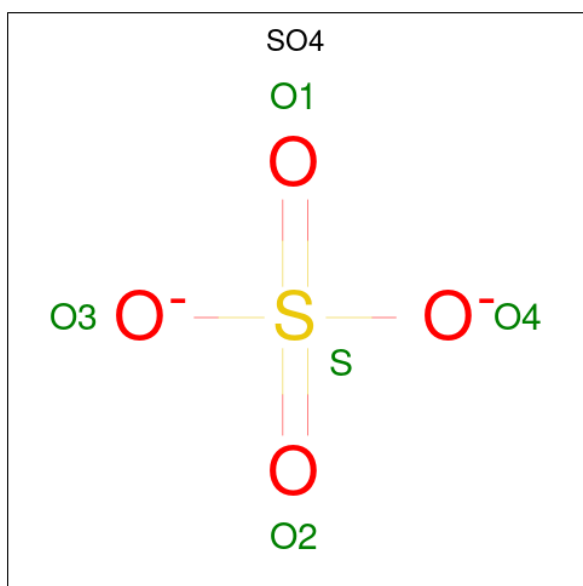
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			13	8	5		
6	B	1	Total	C	O	0	0
			13	8	5		

- Molecule 7 is 5-chloro-2,3-dihydro-1H-inden-1-one (three-letter code: A1BDA) (formula: C₉H₇ClO) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	A	1	Total	C	Cl	O	0	0
			11	9	1	1		

- Molecule 8 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



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

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

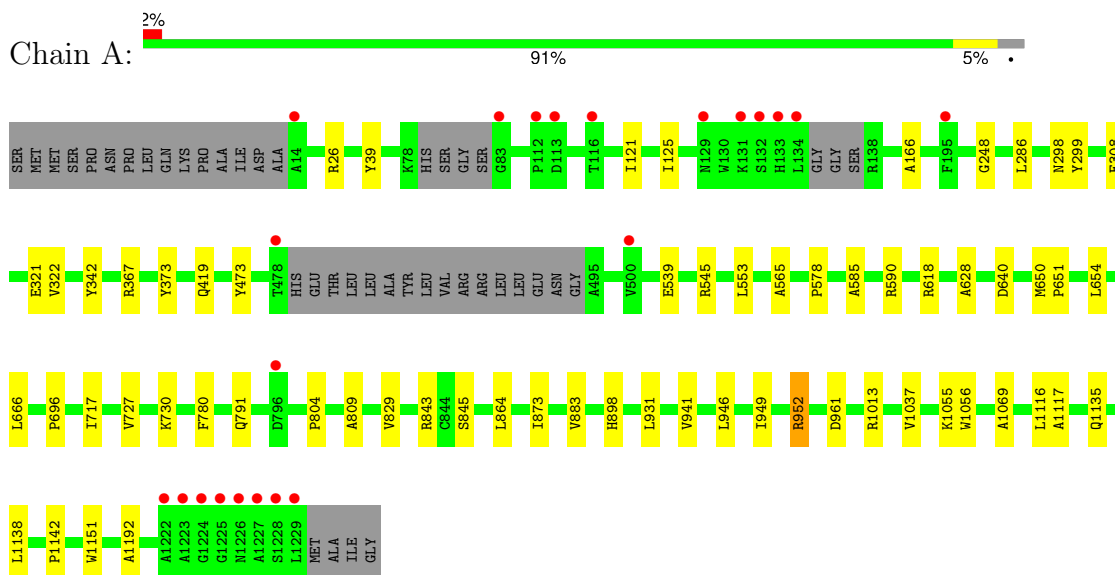
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	925	Total	O	0	0
			925	925		
9	B	847	Total	O	0	0
			847	847		

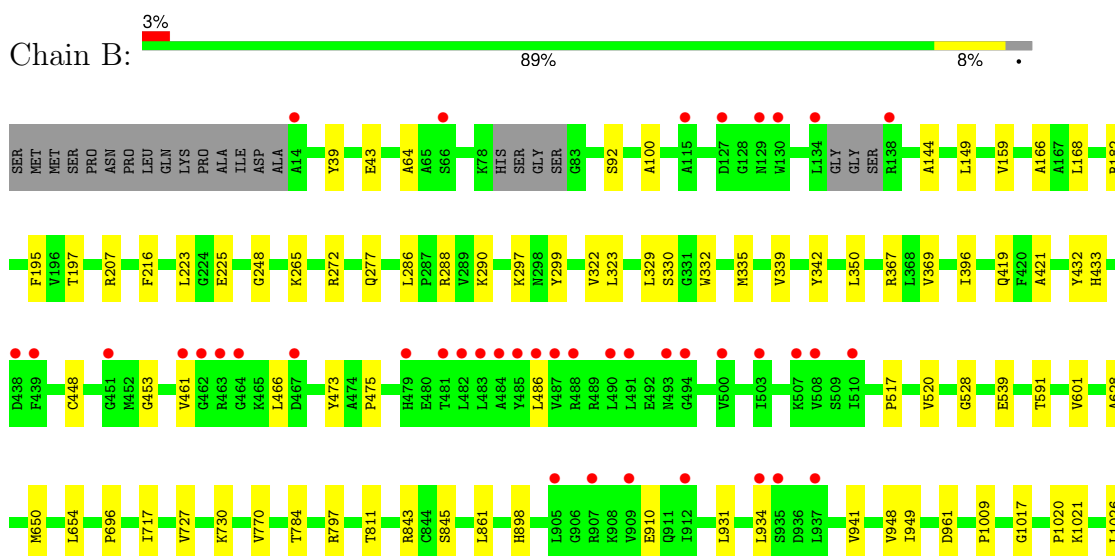
3 Residue-property plots [i](#)

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	100.54Å 101.08Å 125.76Å 90.00° 106.31° 90.00°	Depositor
Resolution (Å)	46.62 – 1.77 46.62 – 1.77	Depositor EDS
% Data completeness (in resolution range)	94.1 (46.62-1.77) 99.2 (46.62-1.77)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.78 (at 1.77Å)	Xtrriage
Refinement program	PHENIX 1.21rc1_5156	Depositor
R, R_{free}	0.173 , 0.206 0.170 , 0.203	Depositor DCC
R_{free} test set	11691 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	23.2	Xtrriage
Anisotropy	0.183	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 41.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	19627	wwPDB-VP
Average B, all atoms (Å ²)	26.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.43% 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: PGE, A1BDA, PEG, PG4, FMT, SO4, FAD

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.34	0/8952	0.58	0/12202
1	B	0.33	0/8925	0.58	0/12178
All	All	0.34	0/17877	0.58	0/24380

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

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	8767	0	8694	41	0
1	B	8746	0	8611	56	0
2	A	53	0	30	2	0
2	B	53	0	31	2	0
3	A	20	0	28	2	0
3	B	10	0	14	1	0
4	A	6	0	2	0	0
4	B	12	0	4	0	0
5	A	21	0	30	3	0
5	B	35	0	50	5	0
6	A	13	0	18	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	13	0	18	0	0
7	A	11	0	0	0	0
8	A	45	0	0	2	0
8	B	50	0	0	2	0
9	A	925	0	0	6	1
9	B	847	0	0	8	1
All	All	19627	0	17530	99	1

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 3.

All (99) 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:473:TYR:HB2	2:A:2001:FAD:HM72	1.65	0.77
1:B:473:TYR:HB2	2:B:2001:FAD:HM72	1.68	0.76
1:A:286:LEU:HD21	1:A:322:VAL:HG11	1.71	0.71
1:A:651:PRO:HG2	5:A:2010:PEG:H31	1.72	0.70
1:A:298[A]:ASN:OD1	9:A:2101:HOH:O	2.11	0.68
1:B:286:LEU:HD21	1:B:322:VAL:HG11	1.76	0.67
1:A:539:GLU:OE1	9:A:2102:HOH:O	2.12	0.67
1:B:1196:GLY:HA3	5:B:2011:PEG:H22	1.77	0.66
1:B:539:GLU:OE1	9:B:2101:HOH:O	2.13	0.65
1:A:565:ALA:HB2	5:A:2010:PEG:H42	1.80	0.64
1:A:961:ASP:OD2	1:B:1055:LYS:NZ	2.26	0.64
1:B:225:GLU:HB3	1:B:265:LYS:HD2	1.80	0.63
1:B:1212:GLU:OE1	9:B:2102:HOH:O	2.16	0.63
1:A:829:VAL:HG13	1:A:864[B]:LEU:HD23	1.81	0.62
1:B:339:VAL:HG21	1:B:350:LEU:HD21	1.81	0.62
1:B:297:LYS:HG3	1:B:332:TRP:HB2	1.84	0.59
1:B:650:MET:O	1:B:654:LEU:HG	2.03	0.57
1:A:473:TYR:CB	2:A:2001:FAD:HM72	2.35	0.56
1:B:195:PHE:O	1:B:486:LEU:HD21	2.05	0.56
1:A:618:ARG:NH2	9:A:2112:HOH:O	2.39	0.55
1:B:770:VAL:O	1:B:797:ARG:NH2	2.40	0.55
1:A:1055:LYS:NZ	1:B:961:ASP:OD2	2.35	0.53
1:A:845:SER:OG	8:A:2014:SO4:O2	2.24	0.53
1:A:650:MET:O	1:A:654:LEU:HG	2.10	0.52
1:B:845:SER:OG	8:B:2018:SO4:O3	2.26	0.52
1:B:448:CYS:HB2	1:B:453:GLY:HA3	1.92	0.52
1:B:1026:LEU:HD23	1:B:1038:PRO:HG2	1.91	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:553:LEU:HD12	1:A:666:LEU:HG	1.93	0.51
1:B:323:LEU:HD13	1:B:335:MET:HE3	1.93	0.51
1:B:297:LYS:HD2	1:B:329:LEU:HA	1.93	0.50
1:B:288[A]:ARG:HE	5:B:2005:PEG:H11	1.78	0.49
1:B:1187:LEU:HD13	9:B:2328:HOH:O	2.11	0.49
1:B:861:LEU:HD21	1:B:948:VAL:HG11	1.95	0.49
1:A:578:PRO:HB2	1:A:585:ALA:HB3	1.95	0.49
1:A:804:PRO:HD3	1:A:1192:ALA:HB3	1.95	0.49
1:A:640:ASP:HB3	3:A:2005:PGE:H32	1.95	0.49
1:B:64:ALA:HA	1:B:433:HIS:CD2	2.47	0.48
5:B:2008:PEG:H11	9:B:2831:HOH:O	2.13	0.48
1:A:873:ILE:HG13	1:A:883:VAL:HB	1.95	0.48
3:B:2003:PGE:H22	9:B:2568:HOH:O	2.13	0.48
1:B:396:ILE:HD11	1:B:517:PRO:HA	1.95	0.48
1:B:717:ILE:HG12	1:B:727:VAL:HG11	1.96	0.47
3:A:2005:PGE:H3	3:A:2005:PGE:H52	1.50	0.47
1:B:473:TYR:CB	2:B:2001:FAD:HM72	2.40	0.47
1:B:628:ALA:HB2	1:B:696:PRO:HG3	1.96	0.47
1:B:144:ALA:HB3	1:B:159:VAL:HG11	1.97	0.47
1:B:1056:TRP:CD1	1:B:1142:PRO:HD3	2.50	0.47
1:A:545:ARG:HA	6:A:2006:PG4:H21	1.95	0.47
1:B:931:LEU:HB2	1:B:949:ILE:HG22	1.96	0.46
1:B:1058:ASP:OD2	1:B:1070[B]:ARG:NH1	2.31	0.46
1:A:843:ARG:HD3	8:A:2014:SO4:O2	2.16	0.46
1:A:1056:TRP:CD1	1:A:1142:PRO:HD3	2.51	0.46
1:A:26:ARG:HH22	1:A:322:VAL:HG23	1.80	0.45
1:A:952:ARG:HA	1:A:952:ARG:HD2	1.74	0.45
1:B:43:GLU:HB3	1:B:528:GLY:O	2.17	0.45
1:B:432:TYR:CZ	1:B:466:LEU:HD22	2.51	0.45
1:B:591[A]:THR:HG23	1:B:601:VAL:HG13	1.98	0.45
1:B:1009:PRO:HB2	1:B:1021:LYS:HD3	1.99	0.45
1:B:272:ARG:HB3	1:B:277:GLN:HG3	1.98	0.45
1:A:367:ARG:HA	1:A:419:GLN:HB2	2.00	0.44
1:B:369:VAL:HG12	1:B:421:ALA:HB3	1.98	0.44
1:B:1017:GLY:HA2	9:B:2328:HOH:O	2.16	0.44
1:B:396:ILE:HD11	1:B:520:VAL:HB	1.98	0.44
1:A:717:ILE:HG12	1:A:727:VAL:HG11	2.00	0.44
1:A:1135:GLN:HA	1:A:1151:TRP:CZ2	2.53	0.44
1:B:100:ALA:HB1	1:B:168:LEU:HB2	1.99	0.44
1:B:223:LEU:HD21	1:B:475:PRO:HB3	2.00	0.44
1:B:367:ARG:HA	1:B:419:GLN:HB2	1.99	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:843:ARG:HD3	8:B:2018:SO4:O3	2.18	0.43
1:A:1116[B]:LEU:HD11	1:A:1138:LEU:HD11	2.01	0.43
5:A:2004:PEG:H42	9:A:2104:HOH:O	2.19	0.43
5:B:2008:PEG:H41	5:B:2008:PEG:H22	1.71	0.43
1:A:590:ARG:NH2	9:A:2115:HOH:O	2.40	0.43
1:B:898:HIS:CG	1:B:941:VAL:HG21	2.54	0.43
1:B:1067:GLU:OE1	1:B:1070[A]:ARG:NH2	2.41	0.43
1:A:931:LEU:HB2	1:A:949:ILE:HG22	2.01	0.42
1:B:784:THR:HG22	1:B:811:THR:HB	2.01	0.42
5:B:2011:PEG:H11	5:B:2011:PEG:H32	1.69	0.42
1:B:248:GLY:HA3	1:B:299:TYR:CG	2.54	0.42
1:B:628:ALA:CB	1:B:696:PRO:HG3	2.50	0.42
1:A:166:ALA:HB1	1:B:1037:VAL:HG11	2.02	0.42
1:A:628:ALA:HB2	1:A:696:PRO:HG3	2.01	0.42
1:A:1037:VAL:HG11	1:B:166:ALA:HB1	2.01	0.42
1:B:216:PHE:CE1	1:B:461:VAL:HG21	2.55	0.42
1:B:1020:PRO:HG2	1:B:1027:TYR:HA	2.02	0.41
1:A:308:GLU:HA	1:A:373:TYR:CE1	2.56	0.41
1:A:898:HIS:CG	1:A:941:VAL:HG21	2.54	0.41
6:A:2006:PG4:H71	1:B:92:SER:HB3	2.01	0.41
1:A:248:GLY:HA3	1:A:299:TYR:CG	2.54	0.41
1:A:1069:ALA:HA	1:A:1117:ALA:HB1	2.03	0.41
1:A:864[A]:LEU:HD21	1:A:946:LEU:HD23	2.03	0.41
1:B:197:THR:O	1:B:207:ARG:HD2	2.19	0.41
1:B:1167:GLU:HA	1:B:1193:ALA:O	2.21	0.41
1:A:121:ILE:HA	1:A:125:ILE:HB	2.03	0.41
1:A:780:PHE:O	1:A:809:ALA:HA	2.21	0.41
1:A:791:GLN:HG3	9:A:2960:HOH:O	2.21	0.40
1:A:898:HIS:CD2	1:A:941:VAL:HG21	2.57	0.40
1:B:910:GLU:HB2	9:B:2402:HOH:O	2.21	0.40
1:B:182:ARG:HG2	9:B:2584:HOH:O	2.20	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
9:A:2111:HOH:O	9:B:2769:HOH:O[2_556]	2.17	0.03

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	1195/1235 (97%)	1172 (98%)	23 (2%)	0	100	100
1	B	1203/1235 (97%)	1177 (98%)	26 (2%)	0	100	100
All	All	2398/2470 (97%)	2349 (98%)	49 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	868/951 (91%)	861 (99%)	7 (1%)	79	70
1	B	853/951 (90%)	846 (99%)	7 (1%)	79	70
All	All	1721/1902 (90%)	1707 (99%)	14 (1%)	79	70

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	39	TYR
1	A	321[A]	GLU
1	A	321[B]	GLU
1	A	342	TYR
1	A	730	LYS
1	A	952	ARG
1	A	1013	ARG
1	B	39	TYR

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Mol	Chain	Res	Type
1	B	149	LEU
1	B	290	LYS
1	B	330	SER
1	B	342	TYR
1	B	730	LYS
1	B	934	LEU

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

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](#)

41 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	FAD	B	2001	-	54,58,58	2.20	16 (29%)	71,89,89	1.64	11 (15%)
8	SO4	A	2017	-	4,4,4	0.64	0	6,6,6	0.16	0
8	SO4	B	2013	-	4,4,4	0.69	0	6,6,6	0.16	0
8	SO4	A	2013	-	4,4,4	0.66	0	6,6,6	0.48	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	FMT	A	2009	-	2,2,2	0.60	0	1,1,1	0.19	0
5	PEG	B	2004	-	6,6,6	0.26	0	5,5,5	0.31	0
3	PGE	A	2005	-	9,9,9	0.34	0	8,8,8	0.53	0
4	FMT	B	2012	-	2,2,2	0.60	0	1,1,1	0.15	0
8	SO4	B	2019	-	4,4,4	0.66	0	6,6,6	0.19	0
5	PEG	A	2010	-	6,6,6	0.22	0	5,5,5	0.35	0
2	FAD	A	2001	-	54,58,58	2.17	13 (24%)	71,89,89	1.79	16 (22%)
8	SO4	B	2018	-	4,4,4	0.69	0	6,6,6	0.19	0
8	SO4	B	2016	-	4,4,4	0.69	0	6,6,6	0.12	0
8	SO4	B	2015	-	4,4,4	0.66	0	6,6,6	0.14	0
4	FMT	B	2010	-	2,2,2	0.54	0	1,1,1	0.12	0
4	FMT	B	2009	-	2,2,2	0.63	0	1,1,1	0.16	0
5	PEG	B	2005	-	6,6,6	0.26	0	5,5,5	0.19	0
3	PGE	A	2002	-	9,9,9	0.33	0	8,8,8	0.48	0
5	PEG	B	2011	-	6,6,6	0.26	0	5,5,5	0.19	0
8	SO4	B	2022	-	4,4,4	0.71	0	6,6,6	0.25	0
5	PEG	A	2004	-	6,6,6	0.23	0	5,5,5	0.17	0
7	A1BDA	A	2008	-	12,12,12	1.93	3 (25%)	16,17,17	1.65	2 (12%)
8	SO4	A	2015	-	4,4,4	0.72	0	6,6,6	0.26	0
8	SO4	A	2018	-	4,4,4	0.68	0	6,6,6	0.19	0
4	FMT	A	2003	-	2,2,2	0.61	0	1,1,1	0.15	0
5	PEG	A	2007	-	6,6,6	0.25	0	5,5,5	0.26	0
8	SO4	A	2016	-	4,4,4	0.59	0	6,6,6	0.27	0
8	SO4	A	2019	-	4,4,4	0.59	0	6,6,6	0.18	0
8	SO4	A	2014	-	4,4,4	0.58	0	6,6,6	0.23	0
8	SO4	B	2017	-	4,4,4	0.63	0	6,6,6	0.34	0
4	FMT	B	2007	-	2,2,2	0.59	0	1,1,1	0.18	0
8	SO4	B	2020	-	4,4,4	0.69	0	6,6,6	0.10	0
5	PEG	B	2002	-	6,6,6	0.25	0	5,5,5	0.28	0
5	PEG	B	2008	-	6,6,6	0.27	0	5,5,5	0.23	0
8	SO4	B	2021	-	4,4,4	0.65	0	6,6,6	0.17	0
8	SO4	A	2012	-	4,4,4	0.51	0	6,6,6	0.28	0
3	PGE	B	2003	-	9,9,9	0.33	0	8,8,8	0.50	0
6	PG4	A	2006	-	12,12,12	0.30	0	11,11,11	0.18	0
8	SO4	A	2011	-	4,4,4	0.69	0	6,6,6	0.19	0
6	PG4	B	2006	-	12,12,12	0.31	0	11,11,11	0.30	0
8	SO4	B	2014	-	4,4,4	0.56	0	6,6,6	0.28	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	FAD	B	2001	-	-	5/30/50/50	0/6/6/6
7	A1BDA	A	2008	-	-	-	0/2/2/2
5	PEG	B	2011	-	-	2/4/4/4	-
3	PGE	B	2003	-	-	4/7/7/7	-
6	PG4	A	2006	-	-	4/10/10/10	-
5	PEG	A	2007	-	-	1/4/4/4	-
5	PEG	B	2004	-	-	2/4/4/4	-
5	PEG	B	2005	-	-	2/4/4/4	-
3	PGE	A	2002	-	-	3/7/7/7	-
3	PGE	A	2005	-	-	6/7/7/7	-
5	PEG	B	2008	-	-	3/4/4/4	-
6	PG4	B	2006	-	-	3/10/10/10	-
5	PEG	B	2002	-	-	2/4/4/4	-
5	PEG	A	2010	-	-	3/4/4/4	-
2	FAD	A	2001	-	-	3/30/50/50	0/6/6/6
5	PEG	A	2004	-	-	2/4/4/4	-

All (32) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	2001	FAD	PA-O3P	-8.95	1.49	1.59
2	B	2001	FAD	PA-O3P	-8.07	1.50	1.59
2	B	2001	FAD	O4-C4	7.00	1.36	1.23
2	A	2001	FAD	O4-C4	6.32	1.35	1.23
2	B	2001	FAD	O2-C2	5.37	1.35	1.24
7	A	2008	A1BDA	C05-C06	4.99	1.53	1.47
2	A	2001	FAD	O2-C2	4.28	1.32	1.24
2	A	2001	FAD	C4X-N5	4.03	1.39	1.30
2	B	2001	FAD	C4X-N5	3.66	1.38	1.30
2	A	2001	FAD	O2'-C2'	-3.13	1.36	1.43
2	B	2001	FAD	O2'-C2'	-2.99	1.37	1.43
2	B	2001	FAD	C6A-N6A	2.90	1.44	1.34
2	A	2001	FAD	C6A-N6A	2.82	1.44	1.34
2	B	2001	FAD	C2-N1	2.81	1.43	1.36
2	B	2001	FAD	P-O3P	2.81	1.62	1.59
2	A	2001	FAD	PA-O5B	-2.78	1.48	1.59
2	A	2001	FAD	C1B-N9A	-2.58	1.43	1.49
2	B	2001	FAD	C2A-N3A	2.56	1.36	1.32
2	A	2001	FAD	C2-N1	2.50	1.42	1.36
2	A	2001	FAD	O4'-C4'	-2.45	1.38	1.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2001	FAD	PA-O5B	-2.41	1.49	1.59
2	A	2001	FAD	PA-O2A	-2.39	1.44	1.55
2	B	2001	FAD	C10-N1	2.37	1.38	1.33
2	B	2001	FAD	O4B-C4B	-2.35	1.39	1.45
2	A	2001	FAD	O4B-C4B	-2.31	1.39	1.45
2	B	2001	FAD	C1B-N9A	-2.30	1.44	1.49
7	A	2008	A1BDA	O07-C06	-2.18	1.18	1.22
2	B	2001	FAD	PA-O2A	-2.18	1.45	1.55
2	A	2001	FAD	C2A-N3A	2.13	1.35	1.32
2	B	2001	FAD	O4'-C4'	-2.12	1.38	1.43
2	B	2001	FAD	P-O1P	2.03	1.57	1.50
7	A	2008	A1BDA	C02-CL01	2.00	1.79	1.74

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2001	FAD	N3A-C2A-N1A	-7.07	119.08	128.67
2	A	2001	FAD	N3A-C2A-N1A	-6.91	119.29	128.67
2	B	2001	FAD	O2P-P-O3P	-4.38	95.43	107.27
7	A	2008	A1BDA	C08-C09-C10	4.29	107.46	104.30
2	A	2001	FAD	C4-C4X-N5	4.24	124.07	118.21
2	A	2001	FAD	C4-N3-C2	-3.84	118.81	125.64
2	A	2001	FAD	O2P-P-O3P	-3.38	98.14	107.27
2	A	2001	FAD	C4X-C4-N3	3.35	121.78	113.25
7	A	2008	A1BDA	C09-C10-C05	-3.24	109.12	111.16
2	A	2001	FAD	C4B-O4B-C1B	-3.07	107.11	109.92
2	B	2001	FAD	C4-N3-C2	-2.94	120.42	125.64
2	B	2001	FAD	O3P-P-O1P	2.90	119.43	110.70
2	B	2001	FAD	C4X-C4-N3	2.70	120.13	113.25
2	B	2001	FAD	O4-C4-C4X	-2.60	119.66	126.53
2	A	2001	FAD	O2-C2-N1	-2.57	117.54	121.80
2	A	2001	FAD	C5X-C9A-N10	2.55	120.28	117.97
2	A	2001	FAD	O3'-C3'-C4'	-2.48	103.29	108.93
2	B	2001	FAD	C5X-C9A-N10	2.47	120.20	117.97
2	A	2001	FAD	O4-C4-C4X	-2.46	120.05	126.53
2	A	2001	FAD	C9-C9A-N10	-2.44	118.57	121.85
2	B	2001	FAD	C4-C4X-N5	2.41	121.53	118.21
2	B	2001	FAD	C9-C9A-N10	-2.38	118.65	121.85
2	A	2001	FAD	C10-C4X-N5	-2.35	120.01	124.81
2	A	2001	FAD	O3P-P-O1P	2.30	117.62	110.70
2	A	2001	FAD	C4X-C10-N10	2.24	119.69	116.48
2	B	2001	FAD	O2A-PA-O5B	-2.20	97.59	107.57

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	2001	FAD	C2'-C1'-N10	2.16	120.39	110.20
2	B	2001	FAD	O5'-P-O1P	2.06	117.08	108.94
2	A	2001	FAD	O5'-P-O1P	2.02	116.93	108.94

There are no chirality outliers.

All (45) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	2001	FAD	N10-C1'-C2'-O2'
2	A	2001	FAD	N10-C1'-C2'-C3'
2	B	2001	FAD	P-O3P-PA-O5B
2	B	2001	FAD	N10-C1'-C2'-O2'
2	B	2001	FAD	N10-C1'-C2'-C3'
3	A	2005	PGE	C4-C3-O2-C2
3	A	2005	PGE	C3-C4-O3-C5
5	B	2008	PEG	C4-C3-O2-C2
3	A	2002	PGE	O1-C1-C2-O2
5	B	2008	PEG	O1-C1-C2-O2
6	B	2006	PG4	O1-C1-C2-O2
6	A	2006	PG4	O2-C3-C4-O3
3	A	2005	PGE	O1-C1-C2-O2
3	B	2003	PGE	O3-C5-C6-O4
5	A	2010	PEG	O1-C1-C2-O2
5	A	2004	PEG	O1-C1-C2-O2
6	A	2006	PG4	O1-C1-C2-O2
5	A	2010	PEG	O2-C3-C4-O4
5	B	2011	PEG	C1-C2-O2-C3
2	A	2001	FAD	P-O3P-PA-O5B
5	A	2010	PEG	C4-C3-O2-C2
2	B	2001	FAD	C1'-C2'-C3'-C4'
5	B	2005	PEG	C4-C3-O2-C2
3	A	2005	PGE	O3-C5-C6-O4
5	B	2004	PEG	O2-C3-C4-O4
6	B	2006	PG4	O4-C7-C8-O5
5	B	2011	PEG	C4-C3-O2-C2
5	B	2002	PEG	C1-C2-O2-C3
6	A	2006	PG4	C4-C3-O2-C2
5	B	2004	PEG	C1-C2-O2-C3
5	A	2004	PEG	C4-C3-O2-C2
5	B	2008	PEG	C1-C2-O2-C3
3	A	2005	PGE	C6-C5-O3-C4
3	B	2003	PGE	C3-C4-O3-C5

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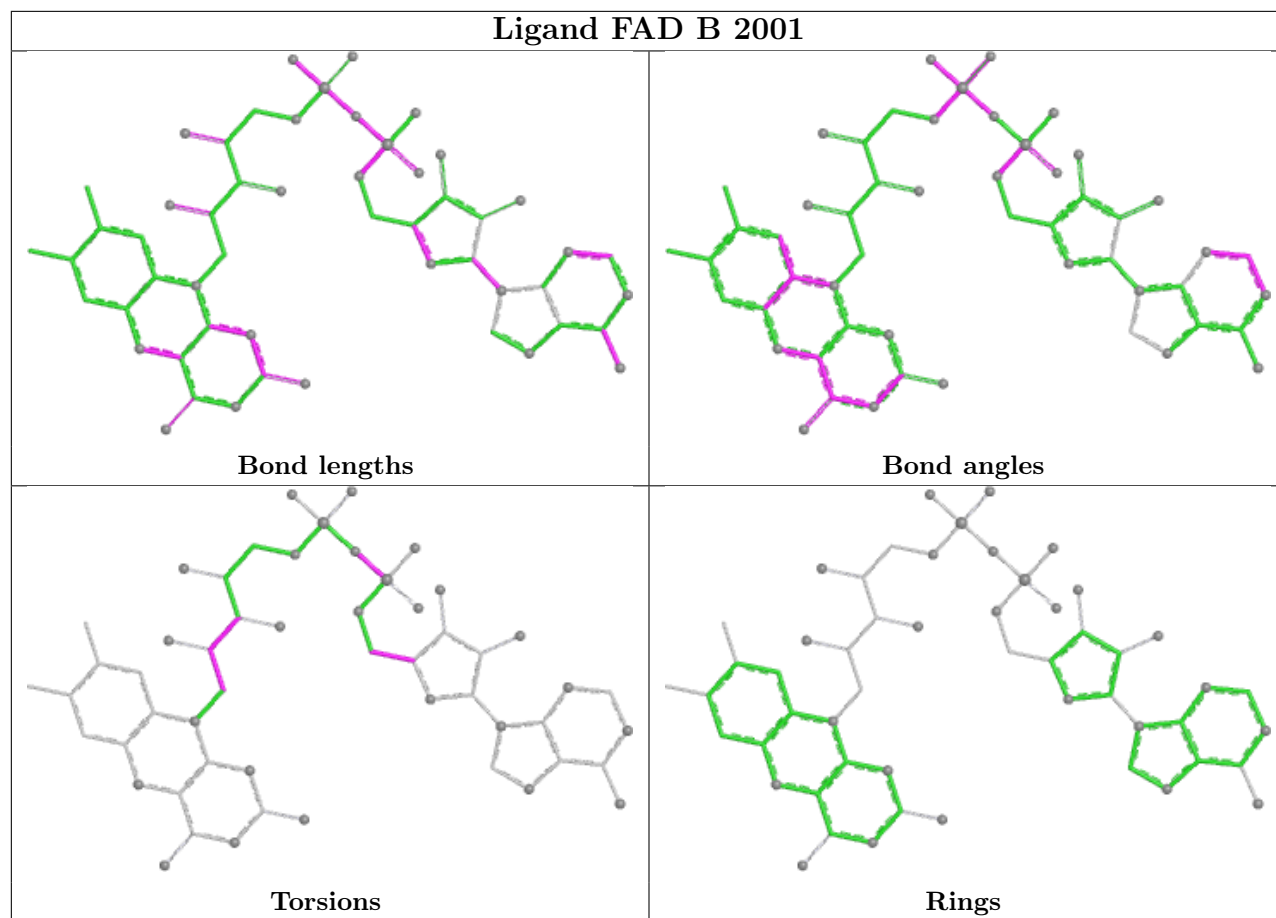
Mol	Chain	Res	Type	Atoms
3	A	2002	PGE	C6-C5-O3-C4
3	A	2005	PGE	O2-C3-C4-O3
5	B	2002	PEG	O1-C1-C2-O2
5	B	2005	PEG	C1-C2-O2-C3
3	B	2003	PGE	C1-C2-O2-C3
6	A	2006	PG4	C5-C6-O4-C7
5	A	2007	PEG	O2-C3-C4-O4
2	B	2001	FAD	C3B-C4B-C5B-O5B
6	B	2006	PG4	C4-C3-O2-C2
3	B	2003	PGE	O1-C1-C2-O2
3	A	2002	PGE	O2-C3-C4-O3

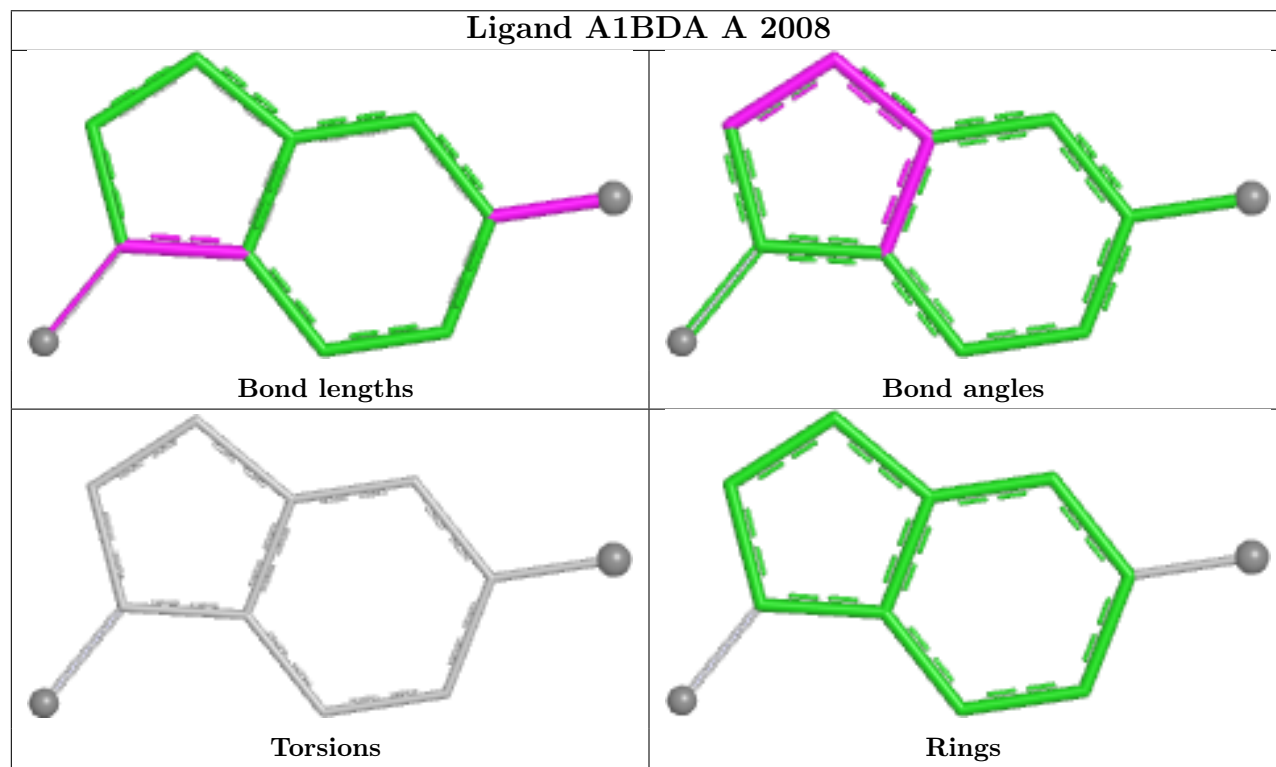
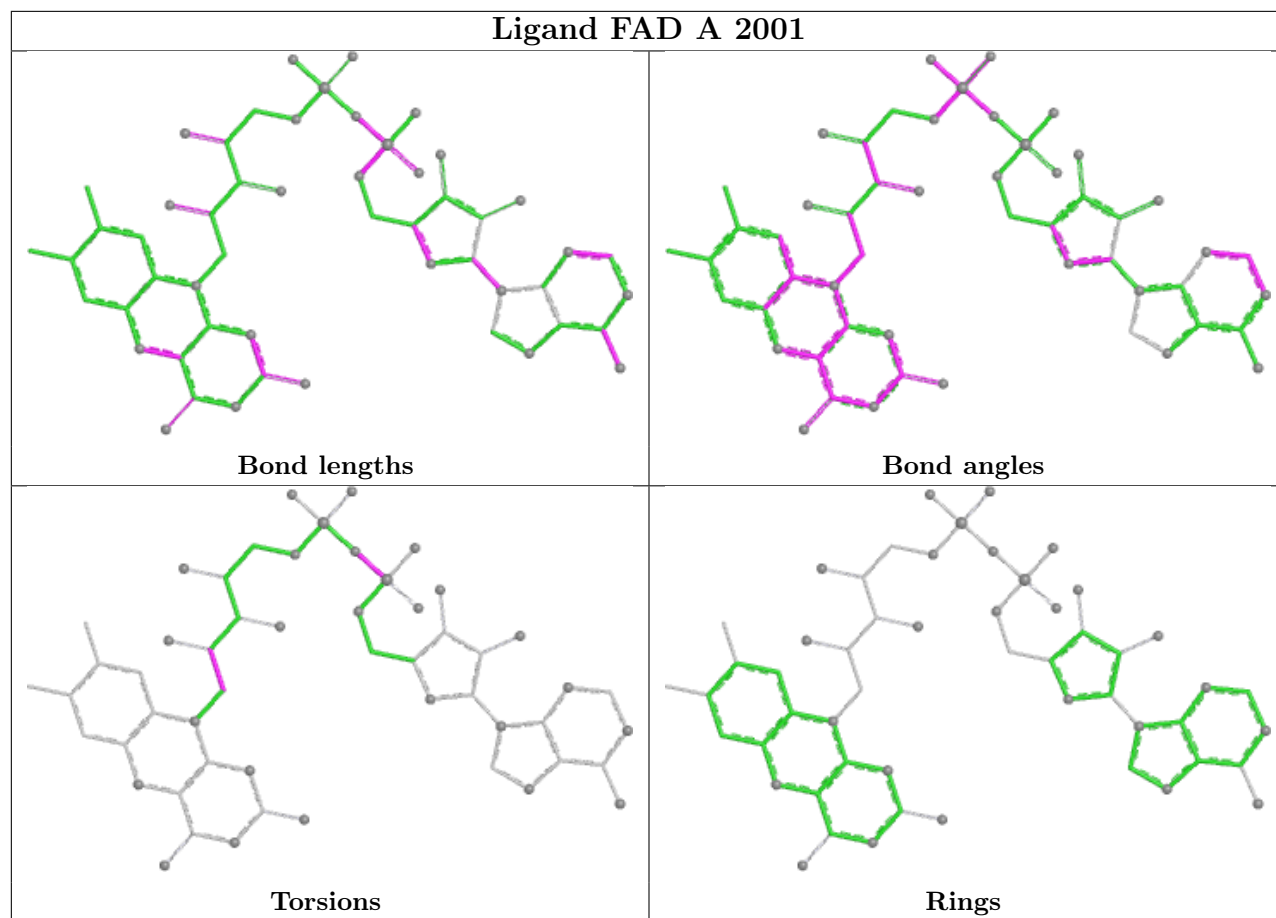
There are no ring outliers.

12 monomers are involved in 21 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	2001	FAD	2	0
3	A	2005	PGE	2	0
5	A	2010	PEG	2	0
2	A	2001	FAD	2	0
8	B	2018	SO4	2	0
5	B	2005	PEG	1	0
5	B	2011	PEG	2	0
5	A	2004	PEG	1	0
8	A	2014	SO4	2	0
5	B	2008	PEG	2	0
3	B	2003	PGE	1	0
6	A	2006	PG4	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	1193/1235 (96%)	-0.20	22 (1%) 67 74	11, 23, 40, 73	10 (0%)
1	B	1201/1235 (97%)	-0.04	42 (3%) 47 54	11, 25, 46, 63	7 (0%)
All	All	2394/2470 (96%)	-0.12	64 (2%) 56 62	11, 24, 44, 73	17 (0%)

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	482	LEU	5.0
1	A	1223	ALA	4.9
1	A	1227	ALA	4.3
1	A	1226	ASN	3.8
1	A	14	ALA	3.8
1	B	500	VAL	3.6
1	B	486	LEU	3.6
1	B	491	LEU	3.6
1	B	935	SER	3.2
1	A	1228	SER	3.2
1	B	438	ASP	3.2
1	B	464	GLY	3.1
1	B	487	VAL	3.0
1	A	1222	ALA	3.0
1	A	83	GLY	3.0
1	B	494	GLY	3.0
1	A	1229	LEU	3.0
1	B	483	LEU	3.0
1	B	937	LEU	3.0
1	B	14	ALA	3.0
1	B	462	GLY	3.0
1	B	481	THR	3.0
1	B	129	ASN	3.0
1	B	490	LEU	2.9

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Mol	Chain	Res	Type	RSRZ
1	B	909	VAL	2.9
1	B	488	ARG	2.9
1	A	134	LEU	2.9
1	B	485	TYR	2.9
1	B	439	PHE	2.9
1	A	133	HIS	2.8
1	A	1224	GLY	2.8
1	A	132	SER	2.8
1	B	907	ARG	2.8
1	B	510	ILE	2.8
1	B	127	ASP	2.7
1	B	134	LEU	2.6
1	A	500	VAL	2.6
1	B	66	SER	2.6
1	B	138	ARG	2.5
1	B	484	ALA	2.4
1	B	905	LEU	2.4
1	B	479	HIS	2.3
1	B	934	LEU	2.3
1	A	1225	GLY	2.3
1	B	912	ILE	2.3
1	A	116	THR	2.3
1	A	113	ASP	2.2
1	A	129	ASN	2.2
1	B	493	ASN	2.2
1	B	115	ALA	2.2
1	A	478	THR	2.2
1	B	461	VAL	2.2
1	B	503	ILE	2.2
1	B	507	LYS	2.2
1	A	796	ASP	2.2
1	B	451	GLY	2.2
1	A	131	LYS	2.1
1	B	1221	ALA	2.1
1	B	467	ASP	2.1
1	A	195	PHE	2.1
1	B	130	TRP	2.1
1	B	508	VAL	2.1
1	B	463	ARG	2.0
1	A	112	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 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.

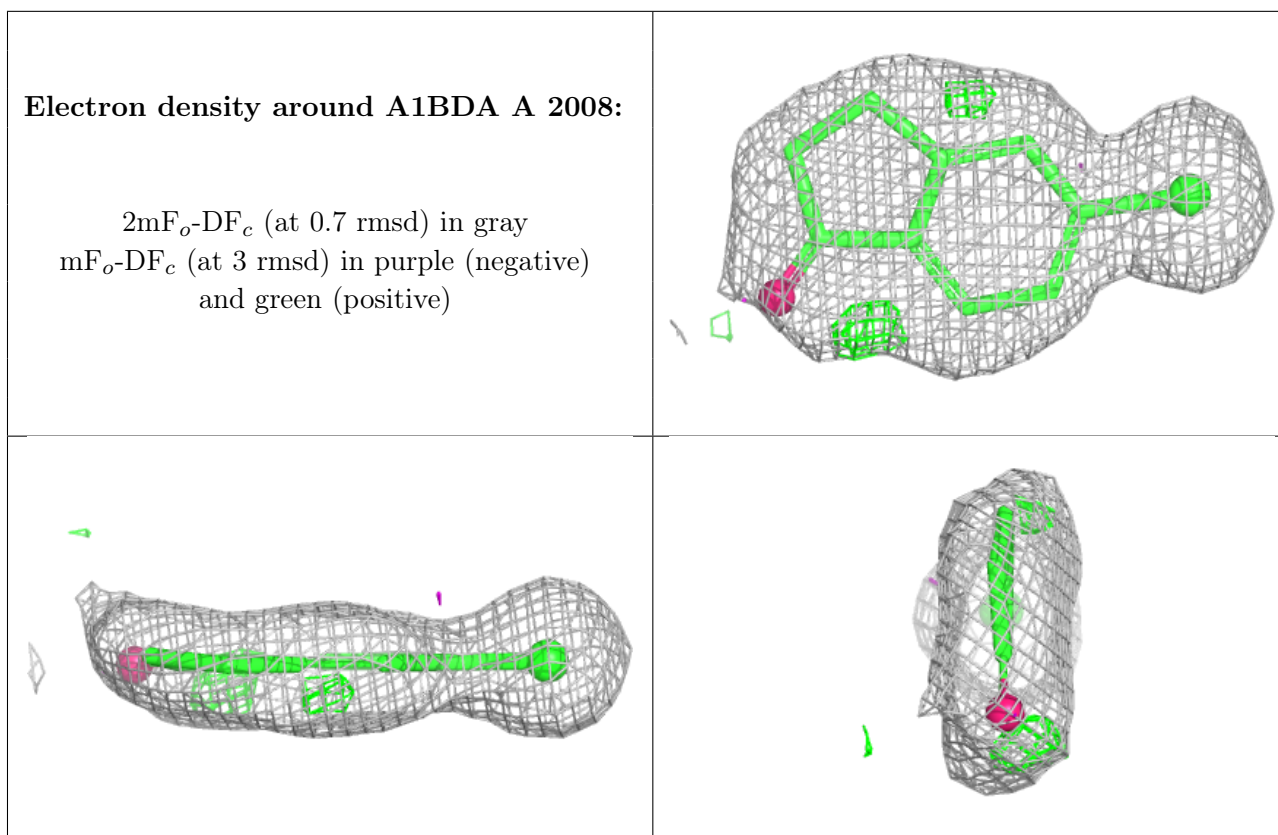
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
8	SO4	B	2022	5/5	0.64	0.16	48,51,56,59	5
4	FMT	B	2007	3/3	0.74	0.13	43,43,47,47	0
5	PEG	A	2007	7/7	0.77	0.16	42,44,50,52	0
5	PEG	A	2010	7/7	0.78	0.14	31,37,41,45	0
8	SO4	B	2019	5/5	0.82	0.19	24,28,31,32	5
5	PEG	B	2005	7/7	0.82	0.13	40,41,50,51	0
5	PEG	B	2004	7/7	0.84	0.14	41,44,48,48	0
6	PG4	B	2006	13/13	0.84	0.13	27,34,39,43	0
4	FMT	B	2012	3/3	0.85	0.13	41,41,43,45	0
5	PEG	B	2008	7/7	0.85	0.11	30,36,40,42	0
6	PG4	A	2006	13/13	0.85	0.12	32,37,45,46	0
5	PEG	B	2011	7/7	0.86	0.11	38,43,49,51	0
8	SO4	A	2018	5/5	0.86	0.12	40,42,43,53	5
8	SO4	B	2020	5/5	0.87	0.10	45,54,54,55	5
8	SO4	B	2021	5/5	0.87	0.12	27,29,36,38	5
3	PGE	A	2005	10/10	0.87	0.12	37,41,43,51	0
3	PGE	B	2003	10/10	0.88	0.13	28,37,42,42	0
8	SO4	A	2019	5/5	0.88	0.15	23,24,29,29	5
4	FMT	B	2010	3/3	0.89	0.15	25,25,31,32	0
5	PEG	A	2004	7/7	0.89	0.11	29,33,37,41	0
4	FMT	A	2003	3/3	0.90	0.09	33,33,34,39	0
8	SO4	B	2015	5/5	0.91	0.09	46,46,50,50	5
8	SO4	B	2018	5/5	0.91	0.14	24,26,29,35	5
7	A1BDA	A	2008	11/11	0.91	0.12	28,34,39,47	0
3	PGE	A	2002	10/10	0.92	0.09	25,33,43,44	0
8	SO4	A	2013	5/5	0.92	0.12	21,22,30,39	5
8	SO4	B	2016	5/5	0.92	0.09	35,36,40,41	5

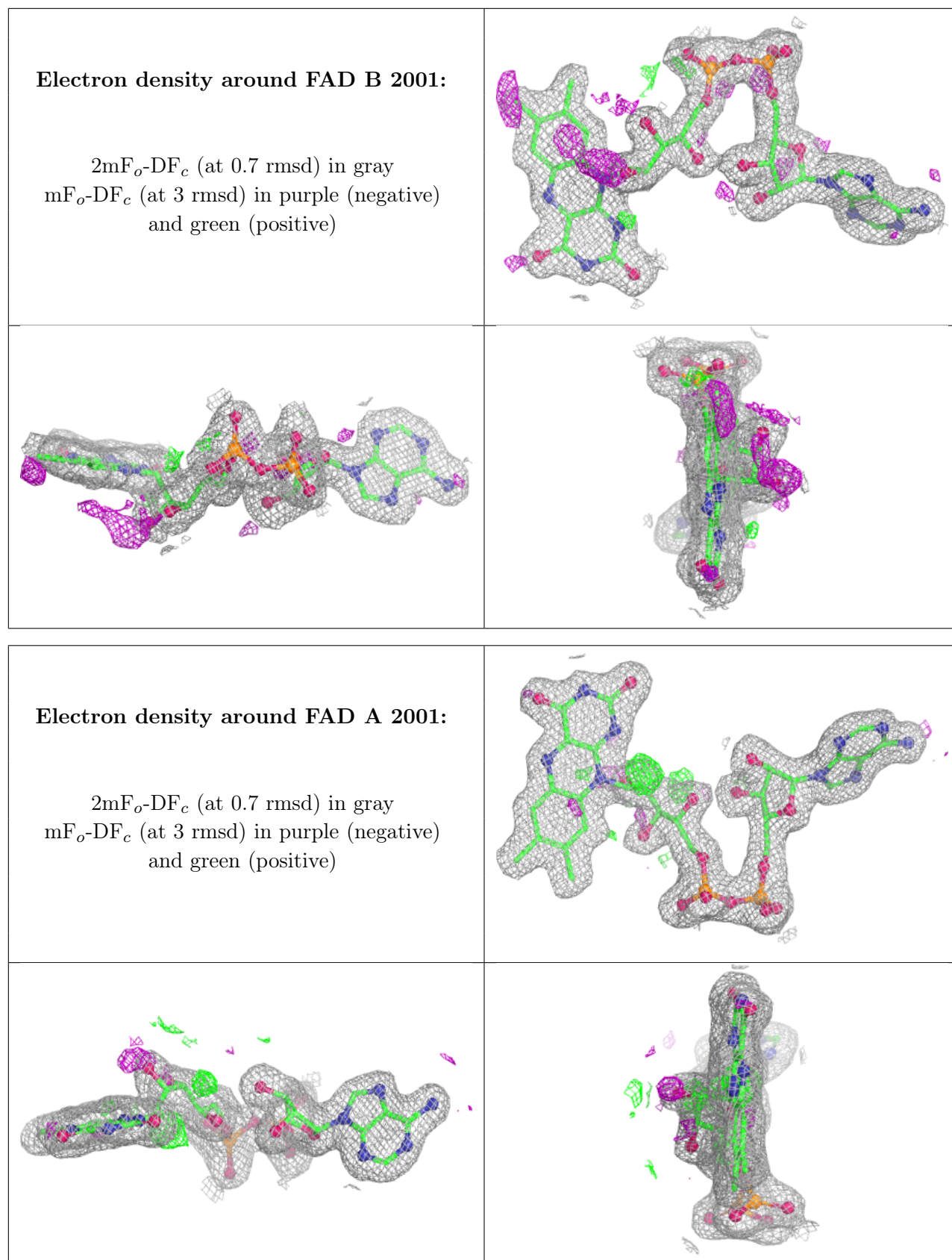
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	FMT	A	2009	3/3	0.92	0.10	40,40,41,43	0
4	FMT	B	2009	3/3	0.93	0.09	35,35,37,44	0
8	SO4	A	2014	5/5	0.93	0.12	22,26,32,33	5
8	SO4	A	2015	5/5	0.93	0.09	34,37,40,49	5
8	SO4	A	2016	5/5	0.93	0.13	21,27,33,35	5
8	SO4	B	2017	5/5	0.93	0.15	21,23,34,36	5
5	PEG	B	2002	7/7	0.94	0.07	29,31,36,40	0
8	SO4	A	2017	5/5	0.94	0.09	32,34,36,42	5
8	SO4	B	2013	5/5	0.95	0.08	29,29,33,37	5
8	SO4	A	2011	5/5	0.95	0.08	26,30,34,35	5
2	FAD	B	2001	53/53	0.95	0.07	18,21,27,29	0
2	FAD	A	2001	53/53	0.96	0.06	16,21,26,29	0
8	SO4	A	2012	5/5	0.99	0.05	20,22,22,23	0
8	SO4	B	2014	5/5	0.99	0.04	18,20,23,24	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

There are no such residues in this entry.