Full wwPDB X-ray Structure Validation Report (i)

Jul 26, 2023 – 02:32 AM EDT

PDB ID	:	1A50
Title	:	CRYSTAL STRUCTURE OF WILD-TYPE TRYPTOPHAN SYNTHASE COMPLEXED WITH 5-FLUOROINDOLE PROPANOL PHOSPHATE
Authors	:	Schneider, T.R.; Gerhardt, E.; Lee, M.; Liang, P.-H.; Anderson, K.S.; Schlichting, I.
Deposited on	:	1998-02-18
Resolution	:	2.30 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 (i) 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 (1)) were used in the production of this report:

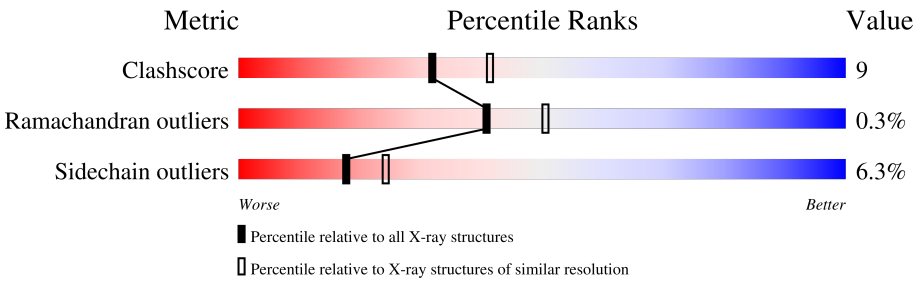
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.34

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)

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 <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	268	77% 17% • •
2	B	396	78% 19% • •

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 5191 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.

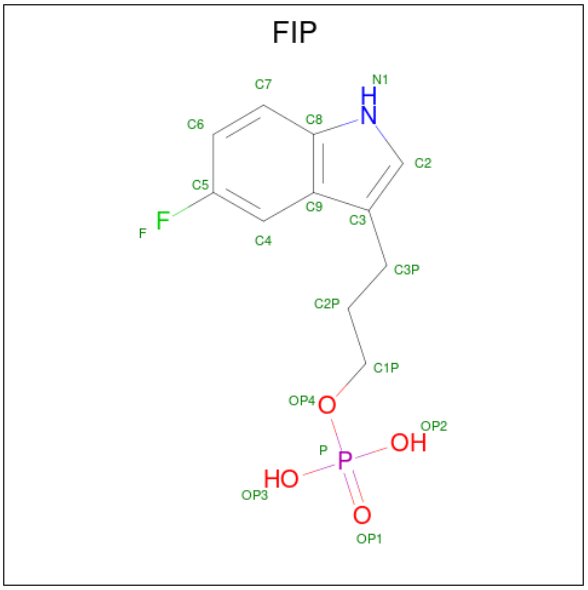
- Molecule 1 is a protein called TRYPTOPHAN SYNTHASE (ALPHA CHAIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	260	1962	1245	341	369	7	0	0	0

- Molecule 2 is a protein called TRYPTOPHAN SYNTHASE (BETA CHAIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	390	2957	1859	519	560	19	0	0	0

- Molecule 3 is 5-FLUOROINDOLE PROPANOL PHOSPHATE (three-letter code: FIP) (formula: $C_{11}H_{13}FNO_4P$).

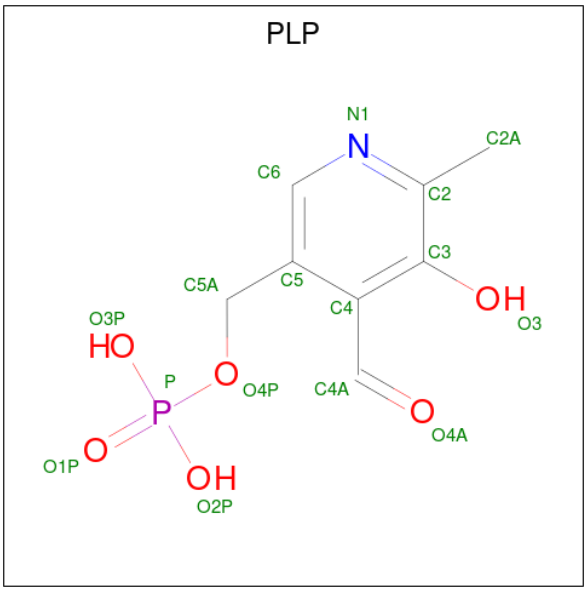


Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	F	N	O	P		
3	A	1	18	11	1	1	4	1	0	0

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Na		
4	B	1	1	1	0	0

- Molecule 5 is PYRIDOXAL-5'-PHOSPHATE (three-letter code: PLP) (formula: $C_8H_{10}NO_6P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
5	B	1	15	8	1	5	1	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
6	A	79	79	79	0	0
6	B	159	159	159	0	0

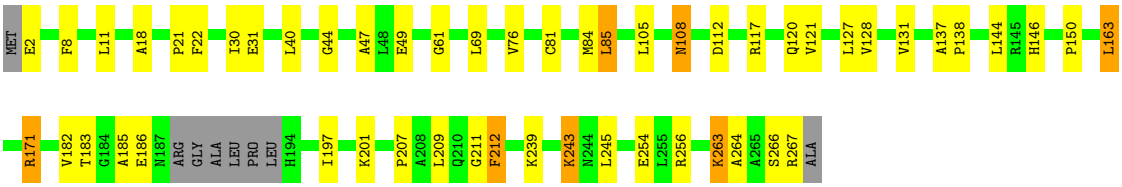
3 Residue-property plots (i)

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. 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. 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.

Note EDS was not executed.

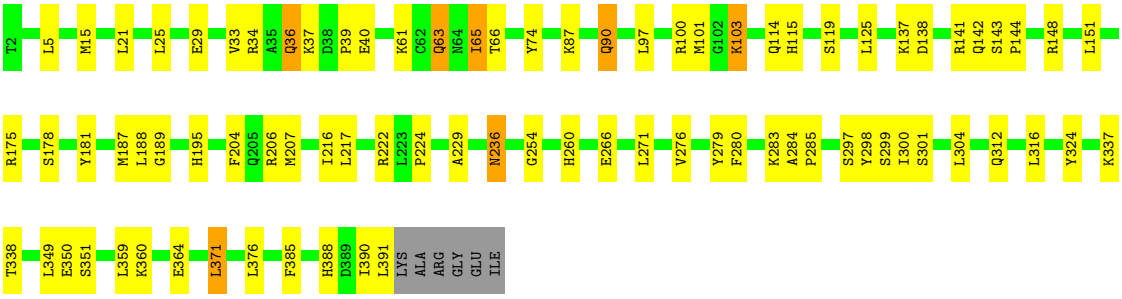
• Molecule 1: TRYPTOPHAN SYNTHASE (ALPHA CHAIN)

Chain A:



• Molecule 2: TRYPTOPHAN SYNTHASE (BETA CHAIN)

Chain B:



4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	182.70Å 60.70Å 67.50Å 90.00° 94.50° 90.00°	Depositor
Resolution (Å)	10.00 – 2.30	Depositor
% Data completeness (in resolution range)	93.8 (10.00-2.30)	Depositor
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.177 , 0.247	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	5191	wwPDB-VP
Average B, all atoms (Å^2)	19.0	wwPDB-VP

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: NA, FIP, PLP

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	0.32	0/2000	0.59	0/2716
2	B	0.35	0/3015	0.63	0/4074
All	All	0.33	0/5015	0.61	0/6790

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	1962	0	1960	39	0
2	B	2957	0	2931	50	0
3	A	18	0	11	0	0
4	B	1	0	0	0	0
5	B	15	0	7	0	0
6	A	79	0	0	3	0
6	B	159	0	0	1	1
All	All	5191	0	4909	88	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 9.

All (88) 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:211:GLY:O	1:A:212:PHE:HB2	1.74	0.84
1:A:137:ALA:HB3	1:A:138:PRO:HD3	1.61	0.82
2:B:283:LYS:HE3	6:B:1186:HOH:O	1.83	0.79
1:A:185:ALA:HB3	1:A:239:LYS:HZ1	1.48	0.79
2:B:300:ILE:HD11	2:B:390:ILE:HD11	1.66	0.77
2:B:21:LEU:HD21	2:B:178:SER:HA	1.69	0.72
2:B:138:ASP:OD1	2:B:141:ARG:NH2	2.23	0.71
1:A:108:ASN:HA	6:A:1203:HOH:O	1.91	0.71
2:B:137:LYS:O	2:B:141:ARG:HG3	1.91	0.70
1:A:256:ARG:HB3	1:A:256:ARG:HH11	1.57	0.70
1:A:31:GLU:HG2	6:A:1291:HOH:O	1.92	0.68
1:A:183:THR:HG22	1:A:212:PHE:CE1	2.29	0.67
1:A:256:ARG:HB3	1:A:256:ARG:NH1	2.10	0.67
1:A:185:ALA:HB3	1:A:239:LYS:NZ	2.10	0.65
2:B:34:ARG:HE	2:B:100:ARG:HE	1.44	0.65
2:B:260:HIS:HD2	2:B:266:GLU:OE1	1.80	0.64
1:A:112:ASP:OD2	1:A:146:HIS:HE1	1.83	0.62
1:A:2:GLU:N	6:A:1307:HOH:O	2.35	0.60
1:A:137:ALA:HB3	1:A:138:PRO:CD	2.32	0.59
2:B:65:ILE:HG22	2:B:66:THR:HG23	1.85	0.58
2:B:36:GLN:HE21	2:B:36:GLN:HA	1.70	0.57
2:B:34:ARG:NE	2:B:100:ARG:HE	2.03	0.57
1:A:11:LEU:CD1	1:A:18:ALA:HB2	2.35	0.56
1:A:30:ILE:HD11	1:A:76:VAL:HG22	1.86	0.56
2:B:34:ARG:HD2	2:B:100:ARG:HH21	1.70	0.56
2:B:216:ILE:HG21	2:B:224:PRO:HD3	1.87	0.56
2:B:385:PHE:O	2:B:388:HIS:HB3	2.07	0.55
1:A:112:ASP:OD2	1:A:146:HIS:CE1	2.60	0.55
2:B:87:LYS:HD2	2:B:114:GLN:HG3	1.87	0.55
2:B:222:ARG:NH2	2:B:371:LEU:HB2	2.23	0.54
1:A:243:LYS:HE3	1:A:254:GLU:OE1	2.08	0.54
2:B:37:LYS:O	2:B:39:PRO:HD3	2.07	0.53
2:B:34:ARG:HE	2:B:100:ARG:NE	2.07	0.53
1:A:128:VAL:CG1	1:A:131:VAL:HG23	2.39	0.53
1:A:264:ALA:HA	1:A:267:ARG:HH11	1.74	0.53
2:B:142:GLN:NE2	2:B:142:GLN:HA	2.23	0.53
1:A:197:ILE:O	1:A:201:LYS:HG3	2.09	0.52
2:B:101:MET:HB2	2:B:103:LYS:HD3	1.92	0.52
1:A:117:ARG:NH1	1:A:120:GLN:HE21	2.07	0.52
2:B:143:SER:HB3	2:B:144:PRO:HD3	1.92	0.52

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:119:SER:HA	2:B:187:MET:HE3	1.92	0.52
2:B:21:LEU:CD2	2:B:178:SER:HA	2.39	0.51
1:A:22:PHE:C	1:A:22:PHE:CD1	2.83	0.51
1:A:128:VAL:HG11	1:A:131:VAL:CG2	2.41	0.51
1:A:81:CYS:HA	1:A:84:MET:HE3	1.93	0.51
2:B:103:LYS:NZ	2:B:181:TYR:O	2.44	0.50
1:A:150:PRO:HD2	1:A:171:ARG:HB2	1.95	0.49
1:A:186:GLU:OE1	1:A:239:LYS:NZ	2.44	0.49
1:A:44:GLY:O	1:A:263:LYS:HG3	2.13	0.48
1:A:112:ASP:CG	1:A:146:HIS:HE1	2.17	0.48
1:A:81:CYS:HA	1:A:84:MET:CE	2.44	0.47
2:B:376:LEU:HD12	2:B:376:LEU:HA	1.76	0.47
1:A:264:ALA:HA	1:A:267:ARG:NH1	2.29	0.47
2:B:36:GLN:HE21	2:B:36:GLN:CA	2.28	0.47
1:A:163:LEU:HD12	1:A:163:LEU:HA	1.77	0.46
2:B:254:GLY:O	2:B:324:TYR:HA	2.16	0.46
2:B:337:LYS:HD3	2:B:391:LEU:HD21	1.98	0.46
2:B:29:GLU:O	2:B:33:VAL:HG23	2.17	0.45
1:A:8:PHE:CD2	1:A:207:PRO:HG2	2.52	0.45
2:B:115:HIS:CE1	2:B:189:GLY:HA2	2.51	0.45
1:A:182:VAL:HG11	2:B:175:ARG:HG2	1.98	0.45
1:A:128:VAL:HG12	1:A:131:VAL:HG23	1.99	0.45
2:B:279:TYR:CG	2:B:280:PHE:N	2.85	0.44
1:A:61:GLY:HA3	1:A:183:THR:O	2.17	0.44
1:A:21:PRO:HD2	1:A:47:ALA:O	2.18	0.44
2:B:119:SER:OG	2:B:187:MET:HE3	2.19	0.43
2:B:61:LYS:HB2	2:B:74:TYR:CE1	2.53	0.43
2:B:63:GLN:H	2:B:63:GLN:HG2	1.68	0.43
2:B:15:MET:HG2	2:B:195:HIS:HB3	1.99	0.43
2:B:304:LEU:HG	2:B:350:GLU:HG3	2.00	0.43
2:B:312:GLN:O	2:B:316:LEU:HG	2.18	0.43
2:B:142:GLN:HA	2:B:142:GLN:HE21	1.84	0.43
2:B:97:LEU:HD23	2:B:97:LEU:HA	1.91	0.42
1:A:85:LEU:HB3	1:A:121:VAL:HG11	2.01	0.42
2:B:276:VAL:HA	2:B:285:PRO:HA	2.01	0.42
2:B:65:ILE:HD11	2:B:338:THR:HG22	2.01	0.42
2:B:229:ALA:HB1	2:B:236:ASN:HD21	1.85	0.42
2:B:119:SER:CB	2:B:187:MET:CE	2.97	0.42
2:B:271:LEU:O	2:B:271:LEU:HD23	2.20	0.42
2:B:298:TYR:CG	2:B:299:SER:N	2.87	0.42
1:A:22:PHE:HA	1:A:49:GLU:O	2.19	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:128:VAL:HG11	1:A:131:VAL:HG21	2.02	0.42
1:A:263:LYS:HE3	1:A:266:SER:OG	2.20	0.41
2:B:90:GLN:HA	2:B:204:PHE:HB3	2.02	0.41
2:B:284:ALA:HB1	2:B:285:PRO:HD2	2.02	0.41
2:B:360:LYS:O	2:B:364:GLU:HG3	2.21	0.41
2:B:301:SER:HB3	2:B:349:LEU:HB3	2.03	0.41
2:B:224:PRO:HA	2:B:371:LEU:HD13	2.03	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)
6:B:1174:HOH:O	6:B:1174:HOH:O[2_655]	2.19	0.01

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	256/268 (96%)	247 (96%)	7 (3%)	2 (1%)	19 23
2	B	388/396 (98%)	377 (97%)	11 (3%)	0	100 100
All	All	644/664 (97%)	624 (97%)	18 (3%)	2 (0%)	41 50

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	212	PHE
1	A	108	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	203/208 (98%)	191 (94%)	12 (6%)	19	27
2	B	306/310 (99%)	286 (94%)	20 (6%)	17	23
All	All	509/518 (98%)	477 (94%)	32 (6%)	18	24

All (32) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	40	LEU
1	A	69	LEU
1	A	85	LEU
1	A	105	LEU
1	A	127	LEU
1	A	144	LEU
1	A	163	LEU
1	A	171	ARG
1	A	209	LEU
1	A	243	LYS
1	A	245	LEU
1	A	263	LYS
2	B	5	LEU
2	B	25	LEU
2	B	36	GLN
2	B	40	GLU
2	B	63	GLN
2	B	65	ILE
2	B	90	GLN
2	B	103	LYS
2	B	125	LEU
2	B	148	ARG
2	B	151	LEU
2	B	188	LEU
2	B	206	ARG
2	B	207	MET
2	B	217	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	B	236	ASN
2	B	297	SER
2	B	351	SER
2	B	359	LEU
2	B	371	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	10	GLN
1	A	120	GLN
1	A	146	HIS
2	B	36	GLN
2	B	64	ASN
2	B	142	GLN
2	B	145	ASN
2	B	236	ASN
2	B	260	HIS
2	B	342	HIS
2	B	375	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
3	FIP	A	270	-	18,19,19	1.01	1 (5%)	21,27,27	1.43	5 (23%)
5	PLP	B	901	2	15,15,16	1.83	4 (26%)	20,22,23	1.56	5 (25%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	FIP	A	270	-	-	3/8/8/8	0/2/2/2
5	PLP	B	901	2	-	0/6/6/8	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	901	PLP	C3-C2	-3.59	1.37	1.40
5	B	901	PLP	C2A-C2	2.88	1.55	1.50
5	B	901	PLP	P-O4P	-2.62	1.51	1.60
5	B	901	PLP	C5-C4	-2.18	1.38	1.40
3	A	270	FIP	C6-C5	2.09	1.41	1.37

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	B	901	PLP	O4P-C5A-C5	4.60	118.12	109.35
3	A	270	FIP	C6-C7-C8	-2.66	117.49	120.84
3	A	270	FIP	OP3-P-OP4	-2.60	99.81	106.73
3	A	270	FIP	C7-C6-C5	2.47	121.57	118.74
5	B	901	PLP	O4P-P-O1P	-2.38	99.79	106.47
3	A	270	FIP	OP3-P-OP2	2.26	116.28	107.64
5	B	901	PLP	O3P-P-O2P	2.21	116.09	107.64
3	A	270	FIP	C6-C5-C4	-2.13	120.88	123.23
5	B	901	PLP	C6-C5-C4	2.12	119.83	118.16
5	B	901	PLP	C5-C6-N1	-2.04	120.41	123.82

There are no chirality outliers.

All (3) torsion outliers are listed below:

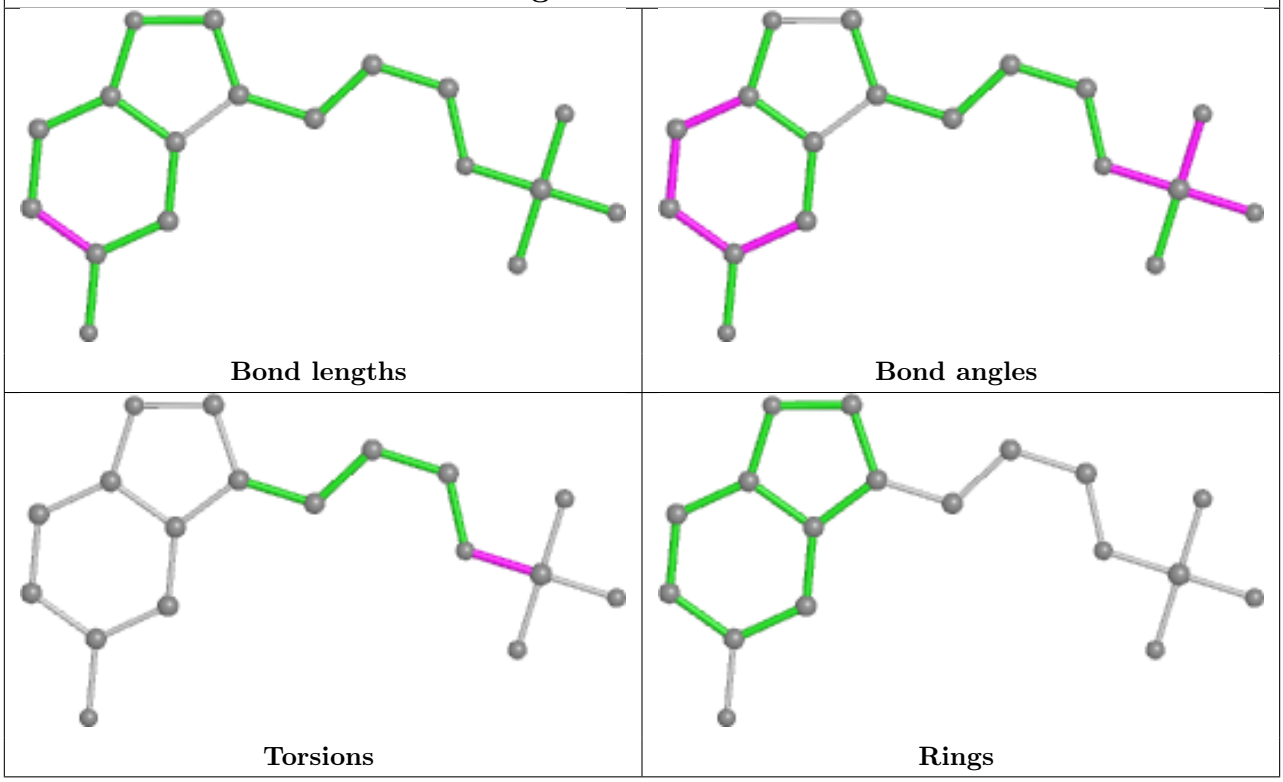
Mol	Chain	Res	Type	Atoms
3	A	270	FIP	C1P-OP4-P-OP2
3	A	270	FIP	C1P-OP4-P-OP3
3	A	270	FIP	C1P-OP4-P-OP1

There are no ring outliers.

No monomer is involved in short contacts.

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 then 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.

Ligand FIP A 270



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.