Full wwPDB X-ray Structure Validation Report (i)

Jul 31, 2023 – 02:42 AM EDT

PDB ID	:	2AY4
Title	:	AROMATIC AMINO ACID AMINOTRANSFERASE WITH 3-(P-TOLYL)PROPIONIC ACID
Authors	:	Okamoto, A.; Hirotsu, K.; Kagamiyama, H.
Deposited on	:	1998-08-06
Resolution	:	2.20 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 (i)) were used in the production of this report:

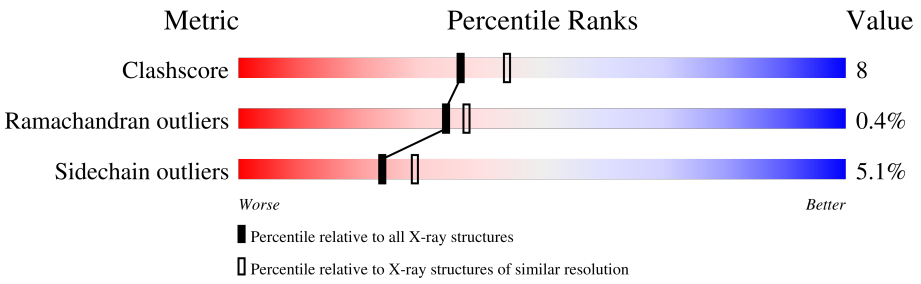
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (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 2.20 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	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)

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	394	83% 15% •
1	B	394	75% 21% • •

2 Entry composition (i)

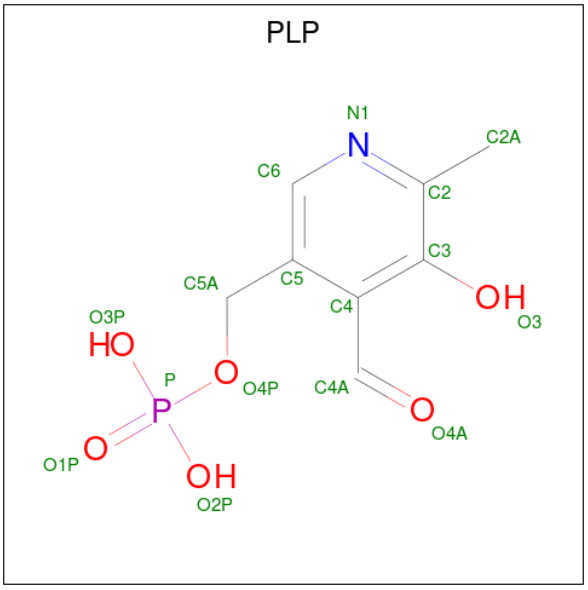
There are 4 unique types of molecules in this entry. The entry contains 6270 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 AROMATIC AMINO ACID AMINOTRANSFERASE.

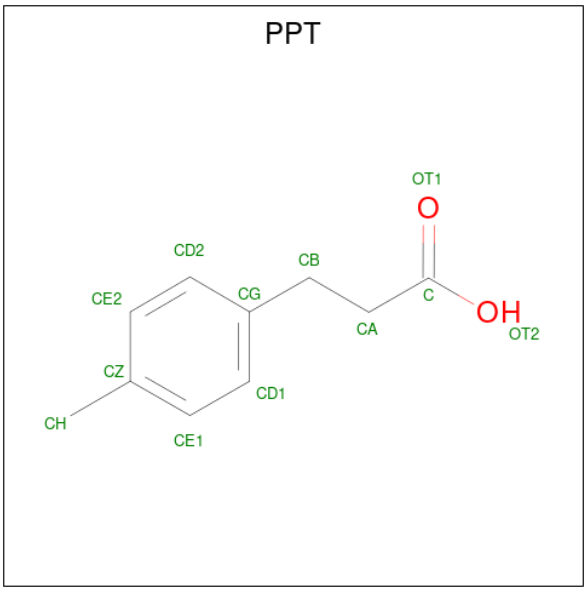
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	394	2996	1884	527	565	20	0	0	0
1	B	388	2945	1855	514	556	20	0	0	0

- Molecule 2 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		
2	A	1	15	8	1	5	1	0	0
2	B	1	15	8	1	5	1	0	0

- Molecule 3 is 3-(P-TOLYL)PROPIONIC ACID (three-letter code: PPT) (formula: $C_{10}H_{12}O_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total C O 12 10 2	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	157	Total O 157 157	0	0
4	B	130	Total O 130 130	0	0

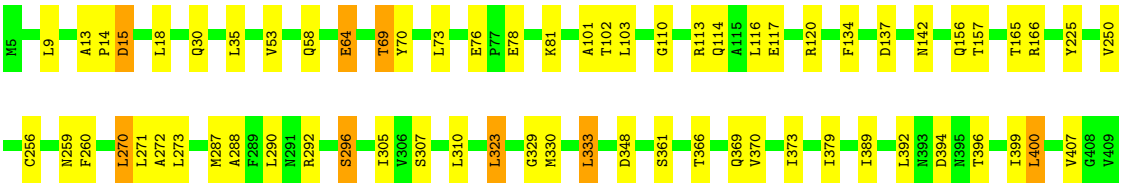
3 Residue-property plots (i)

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.

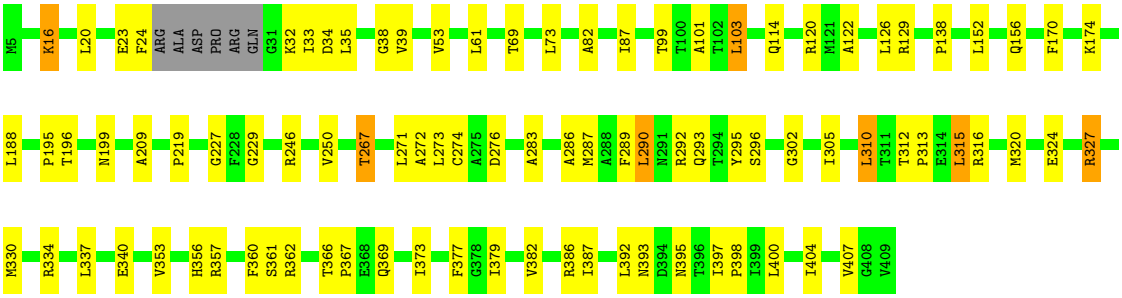
• Molecule 1: AROMATIC AMINO ACID AMINOTRANSFERASE

Chain A:



• Molecule 1: AROMATIC AMINO ACID AMINOTRANSFERASE

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	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	124.20Å 121.79Å 55.17Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	6.00 – 2.20	Depositor
% Data completeness (in resolution range)	70.9 (6.00-2.20)	Depositor
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.181 , 0.230	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	6270	wwPDB-VP
Average B, all atoms (Å^2)	28.0	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: PPT, 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	0.33	0/3048	0.59	0/4119
1	B	0.33	0/2995	0.58	1/4046 (0.0%)
All	All	0.33	0/6043	0.59	1/8165 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	188	LEU	CA-CB-CG	5.09	127.00	115.30

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	2996	0	3004	42	0
1	B	2945	0	2953	59	0
2	A	15	0	7	1	0
2	B	15	0	6	0	0
3	B	12	0	11	0	0
4	A	157	0	0	4	0
4	B	130	0	0	1	0
All	All	6270	0	5981	95	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 8.

All (95) 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:B:209:ALA:HB1	1:B:246:ARG:HD2	1.62	0.81
1:B:324:GLU:HA	1:B:327:ARG:HE	1.47	0.79
1:A:69:THR:HG23	1:B:39:VAL:HG11	1.70	0.73
1:B:120:ARG:HD3	1:B:152:LEU:HD11	1.74	0.69
1:A:18:LEU:HB2	4:A:563:HOH:O	1.92	0.69
1:B:33:ILE:HB	1:B:379:ILE:HG22	1.74	0.69
1:B:267:THR:HG21	1:B:302:GLY:HA3	1.74	0.69
1:B:373:ILE:HG12	1:B:407:VAL:HG21	1.78	0.66
1:B:369:GLN:O	1:B:373:ILE:HG13	1.98	0.64
1:B:16:LYS:H	1:B:16:LYS:HZ2	1.46	0.63
1:A:101:ALA:HB3	1:A:272:ALA:HB3	1.82	0.62
1:B:129:ARG:HD3	1:B:156:GLN:HE21	1.64	0.61
1:B:103:LEU:HG	1:B:287:MET:HB3	1.83	0.61
1:A:110:GLY:O	1:A:114:GLN:HG2	2.01	0.60
1:A:137:ASP:HB2	1:A:157:THR:CG2	2.31	0.60
1:A:392:LEU:HD11	1:A:400:LEU:HD12	1.83	0.59
1:B:334:ARG:HH21	1:B:356:HIS:HB2	1.68	0.59
1:A:9:LEU:CD1	1:B:122:ALA:HB2	2.33	0.58
1:A:256:CYS:O	1:A:260:PHE:HB2	2.04	0.57
1:B:99:THR:HB	1:B:274:CYS:O	2.04	0.57
1:B:209:ALA:CB	1:B:246:ARG:HD2	2.33	0.56
1:B:20:LEU:HD11	1:B:382:VAL:HA	1.89	0.55
1:B:24:PHE:CE1	1:B:32:LYS:HB3	2.41	0.55
1:B:33:ILE:HG22	1:B:35:LEU:HD13	1.88	0.54
1:A:64:GLU:HG2	4:B:523:HOH:O	2.07	0.54
1:B:229:GLY:HA2	1:B:357:ARG:HG3	1.90	0.54
1:B:337:LEU:HD12	1:B:353:VAL:HG11	1.89	0.54
1:B:82:ALA:HB1	1:B:310:LEU:HD23	1.89	0.54
1:A:78:GLU:HG2	1:A:307:SER:HB2	1.90	0.53
1:A:137:ASP:HB2	1:A:157:THR:HG23	1.91	0.53
1:A:102:THR:HG23	1:A:271:LEU:HD23	1.91	0.52
1:B:196:THR:HA	1:B:362:ARG:HG3	1.91	0.52
1:A:250:VAL:HB	1:A:273:LEU:HD22	1.92	0.52
1:B:101:ALA:HB3	1:B:272:ALA:HB3	1.92	0.52
1:A:114:GLN:HE21	1:A:114:GLN:HA	1.76	0.51
1:B:377:PHE:HE2	1:B:407:VAL:HG23	1.74	0.51
1:A:120:ARG:HD2	4:A:479:HOH:O	2.09	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:392:LEU:HD11	1:B:400:LEU:HD22	1.93	0.51
1:A:292:ARG:HA	1:A:296:SER:HA	1.93	0.50
1:B:250:VAL:HB	1:B:273:LEU:HD12	1.94	0.50
1:A:330:MET:HA	1:A:333:LEU:HD22	1.93	0.49
1:B:400:LEU:O	1:B:404:ILE:HG13	2.12	0.49
1:A:329:GLY:O	1:A:333:LEU:HD13	2.13	0.48
1:B:373:ILE:O	1:B:377:PHE:HB2	2.13	0.48
1:B:286:ALA:O	1:B:290:LEU:HD22	2.14	0.48
1:A:369:GLN:O	1:A:373:ILE:HG13	2.12	0.47
1:B:53:VAL:HG13	1:B:305:ILE:HG21	1.95	0.47
1:B:337:LEU:HD23	1:B:397:ILE:HG23	1.95	0.47
1:A:142:ASN:HB3	4:A:473:HOH:O	2.14	0.47
1:A:103:LEU:HD22	1:A:287:MET:HB3	1.96	0.47
1:B:289:PHE:O	1:B:293:GLN:HG2	2.15	0.47
1:A:407:VAL:HG12	1:A:407:VAL:O	2.14	0.47
1:B:219:PRO:HG2	1:B:250:VAL:HG13	1.97	0.46
1:A:53:VAL:HG13	1:A:305:ILE:HG21	1.97	0.46
1:B:129:ARG:HH11	1:B:156:GLN:NE2	2.14	0.45
1:B:87:ILE:HD12	1:B:271:LEU:HD11	1.98	0.45
1:A:389:ILE:HA	1:A:392:LEU:HD23	1.99	0.45
1:B:377:PHE:CE2	1:B:407:VAL:HG23	2.52	0.45
1:B:227:GLY:O	1:B:327:ARG:NH1	2.50	0.45
1:A:30:GLN:NE2	1:A:30:GLN:H	2.16	0.44
1:B:366:THR:HB	1:B:367:PRO:HD2	1.99	0.44
1:A:9:LEU:HD23	1:B:283:ALA:HA	1.99	0.44
1:A:366:THR:O	1:A:370:VAL:HG23	2.18	0.44
1:A:9:LEU:HD11	1:B:122:ALA:HB2	1.98	0.43
1:A:259:ASN:HB2	1:A:323:LEU:HD11	2.00	0.43
1:B:170:PHE:CE2	1:B:174:LYS:HD3	2.53	0.43
1:B:316:ARG:O	1:B:320:MET:HG3	2.18	0.43
1:B:382:VAL:HB	1:B:386:ARG:HB3	2.00	0.43
1:A:73:LEU:HD23	1:A:288:ALA:HB1	2.00	0.43
1:B:23:GLU:O	1:B:23:GLU:HG2	2.18	0.43
1:A:13:ALA:HA	1:A:14:PRO:HD3	1.92	0.43
1:A:69:THR:HG22	1:A:70:TYR:H	1.84	0.43
1:A:379:ILE:HD11	1:A:399:ILE:HG22	2.01	0.43
1:B:267:THR:CG2	1:B:302:GLY:HA3	2.47	0.43
1:B:373:ILE:HG22	1:B:379:ILE:HG12	2.00	0.43
1:A:225:TYR:HE2	2:A:413:PLP:HO3	1.62	0.43
1:B:73:LEU:HD21	1:B:292:ARG:HB2	2.00	0.42
1:A:270:LEU:HD13	1:A:287:MET:CE	2.49	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:340:GLU:HG2	1:B:398:PRO:HA	2.01	0.42
1:B:199:ASN:ND2	1:B:357:ARG:HB3	2.35	0.42
1:A:396:THR:HG21	4:A:533:HOH:O	2.19	0.42
1:B:138:PRO:HG3	1:B:362:ARG:NH1	2.34	0.42
1:A:58:GLN:HA	1:B:61:LEU:HD21	2.02	0.41
1:A:114:GLN:HA	1:A:114:GLN:NE2	2.35	0.41
1:B:24:PHE:CZ	1:B:34:ASP:HB2	2.55	0.41
1:A:15:ASP:OD2	1:B:73:LEU:HD22	2.21	0.41
1:B:38:GLY:HA3	1:B:360:PHE:HZ	1.85	0.41
1:A:134:PHE:HA	1:A:156:GLN:O	2.21	0.41
1:B:387:ILE:O	1:B:387:ILE:HG13	2.21	0.41
1:B:330:MET:O	1:B:334:ARG:HG3	2.21	0.41
1:B:393:ASN:O	1:B:397:ILE:HG13	2.21	0.41
1:A:165:THR:O	1:A:166:ARG:HB2	2.21	0.40
1:A:113:ARG:O	1:A:117:GLU:HG2	2.22	0.40
1:B:334:ARG:NH2	1:B:356:HIS:HB2	2.35	0.40
1:B:312:THR:HB	1:B:315:LEU:HB2	2.04	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	392/394 (100%)	375 (96%)	16 (4%)	1 (0%)	41	46
1	B	384/394 (98%)	360 (94%)	22 (6%)	2 (0%)	29	31
All	All	776/788 (98%)	735 (95%)	38 (5%)	3 (0%)	34	37

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	296	SER

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Mol	Chain	Res	Type
1	B	295	TYR
1	B	296	SER

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	308/308 (100%)	292 (95%)	16 (5%)	23	28
1	B	303/308 (98%)	288 (95%)	15 (5%)	24	30
All	All	611/616 (99%)	580 (95%)	31 (5%)	24	29

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	ASP
1	A	35	LEU
1	A	64	GLU
1	A	69	THR
1	A	76	GLU
1	A	81	LYS
1	A	116	LEU
1	A	270	LEU
1	A	290	LEU
1	A	310	LEU
1	A	323	LEU
1	A	333	LEU
1	A	348	ASP
1	A	361	SER
1	A	394	ASP
1	A	400	LEU
1	B	16	LYS
1	B	69	THR
1	B	103	LEU
1	B	114	GLN
1	B	126	LEU

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Mol	Chain	Res	Type
1	B	195	PRO
1	B	267	THR
1	B	276	ASP
1	B	290	LEU
1	B	310	LEU
1	B	313	PRO
1	B	315	LEU
1	B	327	ARG
1	B	361	SER
1	B	395	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	30	GLN
1	A	58	GLN
1	A	114	GLN
1	A	395	ASN
1	B	156	GLN
1	B	395	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)

3 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	$\#\|Z\| > 2$
3	PPT	B	414	-	12,12,12	0.59	0	15,15,15	0.63	0
2	PLP	B	413	1	15,15,16	2.28	2 (13%)	20,22,23	1.65	4 (20%)
2	PLP	A	413	1	15,15,16	2.16	2 (13%)	20,22,23	2.45	3 (15%)

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	PPT	B	414	-	-	2/5/5/5	0/1/1/1
2	PLP	B	413	1	-	2/6/6/8	0/1/1/1
2	PLP	A	413	1	-	5/6/6/8	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	413	PLP	C4A-C4	-5.87	1.39	1.51
2	B	413	PLP	C3-C2	-5.74	1.35	1.40
2	B	413	PLP	C4A-C4	-5.59	1.40	1.51
2	A	413	PLP	C3-C2	-4.76	1.36	1.40

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	413	PLP	O4P-C5A-C5	8.66	125.84	109.35
2	B	413	PLP	O4P-C5A-C5	4.74	118.39	109.35
2	A	413	PLP	O2P-P-O4P	-4.15	95.70	106.73
2	A	413	PLP	O3P-P-O4P	2.69	113.89	106.73
2	B	413	PLP	C6-C5-C4	2.52	120.14	118.16
2	B	413	PLP	C5-C6-N1	-2.08	120.36	123.82
2	B	413	PLP	O2P-P-O4P	-2.06	101.24	106.73

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	413	PLP	C4-C5-C5A-O4P
2	A	413	PLP	C6-C5-C5A-O4P
2	A	413	PLP	C5A-O4P-P-O2P
2	B	413	PLP	C4-C5-C5A-O4P
2	B	413	PLP	C6-C5-C5A-O4P
2	A	413	PLP	C5A-O4P-P-O1P
2	A	413	PLP	C5A-O4P-P-O3P
3	B	414	PPT	OT1-C-CA-CB
3	B	414	PPT	OT2-C-CA-CB

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	413	PLP	1	0

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.