Full wwPDB X-ray Structure Validation Report (i)

Nov 13, 2023 – 01:04 PM JST

PDB ID	:	5X7M
Title	:	Crystal structure of meso-diaminopimelate decarboxylase (DAPDC) from Corynebacterium glutamicum
Authors	:	Son, H.-F.; Kim, K.-J.
Deposited on	:	2017-02-27
Resolution	:	2.40 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:

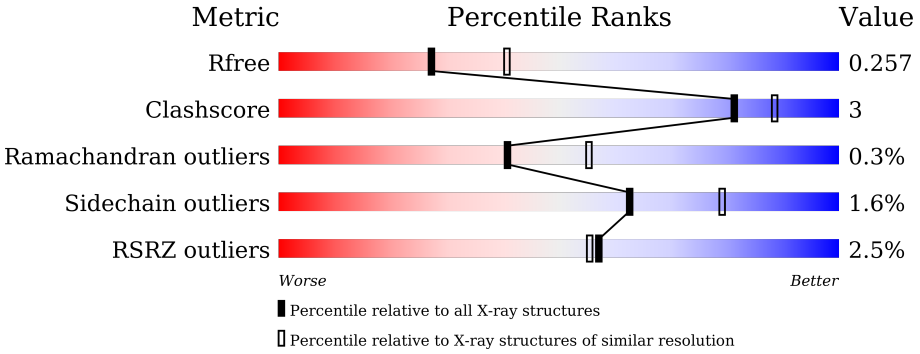
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.40 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}	130704	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

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% 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	453	2% 89% 9% •
1	B	453	3% 89% 9% •

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 6813 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.

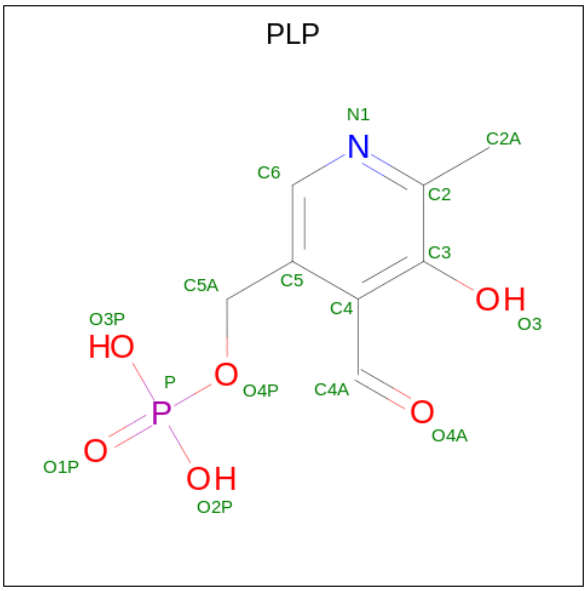
- Molecule 1 is a protein called Diaminopimelate decarboxylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	443	3326	2087	572	658	9	0	0	0
1	B	443	3326	2087	572	658	9	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	446	LEU	-	expression tag	UNP P09890
A	447	GLU	-	expression tag	UNP P09890
A	448	HIS	-	expression tag	UNP P09890
A	449	HIS	-	expression tag	UNP P09890
A	450	HIS	-	expression tag	UNP P09890
A	451	HIS	-	expression tag	UNP P09890
A	452	HIS	-	expression tag	UNP P09890
A	453	HIS	-	expression tag	UNP P09890
B	446	LEU	-	expression tag	UNP P09890
B	447	GLU	-	expression tag	UNP P09890
B	448	HIS	-	expression tag	UNP P09890
B	449	HIS	-	expression tag	UNP P09890
B	450	HIS	-	expression tag	UNP P09890
B	451	HIS	-	expression tag	UNP P09890
B	452	HIS	-	expression tag	UNP P09890
B	453	HIS	-	expression tag	UNP P09890

- Molecule 2 is PYRIDOXAL-5'-PHOSPHATE (three-letter code: PLP) (formula: $C_8H_{10}NO_6P$).



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

- Molecule 3 is water.

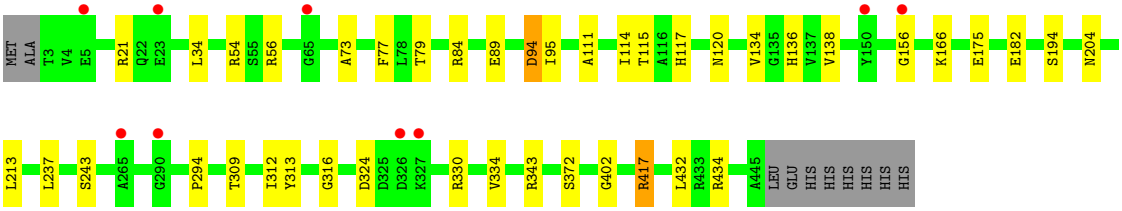
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	68	Total	O	0	0
			68	68		
3	B	63	Total	O	0	0
			63	63		

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.

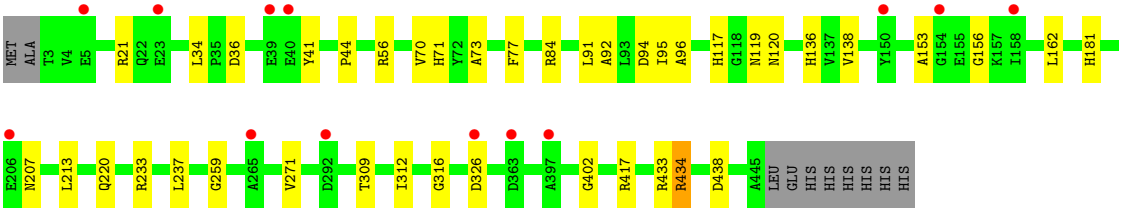
• Molecule 1: Diaminopimelate decarboxylase

Chain A:



• Molecule 1: Diaminopimelate decarboxylase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	114.65Å 92.01Å 94.75Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	23.71 – 2.40 23.71 – 2.40	Depositor EDS
% Data completeness (in resolution range)	95.5 (23.71-2.40) 95.6 (23.71-2.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	5.65 (at 2.41Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.186 , 0.253 0.192 , 0.257	Depositor DCC
R_{free} test set	1898 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å^2)	32.2	Xtriage
Anisotropy	0.130	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.43 , 39.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.46$, $< L^2 > = 0.29$	Xtriage
Estimated twinning fraction	0.030 for -h,l,k	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	6813	wwPDB-VP
Average B, all atoms (Å^2)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 74.04 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.6443e-06. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: 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	0.72	0/3388	0.90	9/4609 (0.2%)
1	B	0.71	0/3388	0.90	10/4609 (0.2%)
All	All	0.71	0/6776	0.90	19/9218 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	1
All	All	0	2

There are no bond length outliers.

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	434	ARG	NE-CZ-NH2	8.38	124.49	120.30
1	A	434	ARG	NE-CZ-NH1	-7.76	116.42	120.30
1	A	330	ARG	NE-CZ-NH1	7.67	124.13	120.30
1	B	233	ARG	NE-CZ-NH1	7.61	124.10	120.30
1	B	56	ARG	NE-CZ-NH1	-7.42	116.59	120.30
1	A	417	ARG	NE-CZ-NH2	-6.92	116.84	120.30
1	B	434	ARG	NE-CZ-NH1	-6.76	116.92	120.30
1	A	434	ARG	NE-CZ-NH2	6.64	123.62	120.30
1	A	343	ARG	NE-CZ-NH2	-6.29	117.16	120.30
1	B	233	ARG	NE-CZ-NH2	-6.27	117.17	120.30
1	A	21	ARG	NE-CZ-NH1	-6.14	117.23	120.30
1	A	417	ARG	NE-CZ-NH1	6.09	123.34	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	343	ARG	NE-CZ-NH1	6.01	123.30	120.30
1	B	56	ARG	NE-CZ-NH2	5.56	123.08	120.30
1	B	36	ASP	CB-CG-OD1	5.51	123.25	118.30
1	B	84	ARG	NE-CZ-NH2	5.16	122.88	120.30
1	A	56	ARG	NE-CZ-NH2	-5.14	117.73	120.30
1	B	433	ARG	NE-CZ-NH1	5.13	122.86	120.30
1	B	21	ARG	NE-CZ-NH1	-5.12	117.74	120.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	156	GLY	Peptide
1	B	156	GLY	Peptide

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	3326	0	3237	19	0
1	B	3326	0	3236	20	0
2	A	15	0	7	0	0
2	B	15	0	7	0	0
3	A	68	0	0	0	0
3	B	63	0	0	0	0
All	All	6813	0	6487	34	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 3.

All (34) 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:44:PRO:O	1:B:434:ARG:NH1	2.11	0.83
1:A:34:LEU:HD22	1:A:312:ILE:HD11	1.84	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:213:LEU:CD1	1:B:237:LEU:HD23	2.35	0.57
1:A:117:HIS:CE1	1:A:138:VAL:HG21	2.40	0.56
1:A:54:ARG:NH2	1:A:89:GLU:OE2	2.39	0.53
1:B:73:ALA:HA	1:B:94:ASP:HB2	1.90	0.53
1:B:162:LEU:N	1:B:162:LEU:HD12	2.24	0.53
1:B:96:ALA:HA	1:B:117:HIS:O	2.09	0.53
1:B:136:HIS:CD2	1:B:162:LEU:HD11	2.44	0.52
1:A:115:THR:HG23	1:A:136:HIS:HB2	1.91	0.52
1:A:213:LEU:CD1	1:A:237:LEU:HD23	2.40	0.51
1:B:117:HIS:CE1	1:B:138:VAL:HG21	2.46	0.51
1:B:34:LEU:HD22	1:B:312:ILE:HD11	1.93	0.51
1:A:316:GLY:HA3	1:B:120:ASN:HD21	1.78	0.48
1:A:120:ASN:HD21	1:B:316:GLY:HA3	1.79	0.48
1:A:166:LYS:HD2	1:A:182:GLU:HB2	1.96	0.48
1:A:111:ALA:O	1:A:134:VAL:HA	2.14	0.47
1:B:309:THR:HB	1:B:402:GLY:CA	2.45	0.47
1:A:309:THR:HB	1:A:402:GLY:CA	2.45	0.46
1:A:213:LEU:HD13	1:A:237:LEU:HD23	1.98	0.46
1:A:417:ARG:HH22	1:B:417:ARG:NH2	2.15	0.45
1:B:153:ALA:HB2	1:B:207:ASN:ND2	2.32	0.45
1:A:73:ALA:HA	1:A:94:ASP:OD1	2.19	0.43
1:B:309:THR:HB	1:B:402:GLY:HA3	2.00	0.43
1:A:79:THR:CG2	1:A:432:LEU:HD11	2.48	0.43
1:B:41:TYR:O	1:B:434:ARG:NH2	2.52	0.42
1:A:111:ALA:HA	1:A:114:ILE:HD12	2.02	0.42
1:A:79:THR:HG22	1:A:432:LEU:HD11	2.02	0.42
1:B:71:HIS:CD2	1:B:92:ALA:HB3	2.55	0.42
1:B:70:VAL:HB	1:B:91:LEU:HD22	2.02	0.41
1:A:313:TYR:HB3	1:A:334:VAL:HB	2.02	0.41
1:A:324:ASP:HA	1:B:181:HIS:CD2	2.56	0.40
1:A:372:SER:HA	1:B:119:ASN:HD21	1.86	0.40
1:B:220:GLN:OE1	1:B:259:GLY:HA2	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	441/453 (97%)	425 (96%)	14 (3%)	2 (0%)	29	41
1	B	441/453 (97%)	428 (97%)	12 (3%)	1 (0%)	47	62
All	All	882/906 (97%)	853 (97%)	26 (3%)	3 (0%)	41	55

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	204	ASN
1	B	77	PHE
1	A	77	PHE

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	345/354 (98%)	338 (98%)	7 (2%)	55	74
1	B	345/354 (98%)	341 (99%)	4 (1%)	71	85
All	All	690/708 (98%)	679 (98%)	11 (2%)	62	79

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	84	ARG
1	A	94	ASP
1	A	95	ILE
1	A	175	GLU
1	A	194	SER
1	A	243	SER
1	A	294	PRO
1	B	95	ILE
1	B	271	VAL

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Mol	Chain	Res	Type
1	B	326	ASP
1	B	438	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	71	HIS
1	A	99	ASN
1	A	117	HIS
1	A	120	ASN
1	A	143	GLN
1	B	22	GLN
1	B	71	HIS
1	B	99	ASN
1	B	119	ASN
1	B	120	ASN
1	B	136	HIS
1	B	143	GLN
1	B	181	HIS
1	B	207	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)

2 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	PLP	A	501	1	15,15,16	4.06	5 (33%)	20,22,23	2.08	3 (15%)
2	PLP	B	501	1	15,15,16	4.20	4 (26%)	20,22,23	2.11	7 (35%)

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	PLP	A	501	1	-	4/6/6/8	0/1/1/1
2	PLP	B	501	1	-	2/6/6/8	0/1/1/1

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	501	PLP	C5-C4	12.39	1.54	1.40
2	A	501	PLP	C5-C4	11.86	1.53	1.40
2	A	501	PLP	C3-C2	7.98	1.48	1.40
2	B	501	PLP	C3-C2	7.93	1.48	1.40
2	B	501	PLP	C3-C4	5.92	1.52	1.40
2	A	501	PLP	C3-C4	5.37	1.51	1.40
2	B	501	PLP	C6-C5	2.12	1.42	1.37
2	A	501	PLP	C6-C5	2.07	1.42	1.37
2	A	501	PLP	C5A-C5	2.02	1.56	1.50

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	501	PLP	O4P-C5A-C5	7.35	123.35	109.35
2	B	501	PLP	O4P-C5A-C5	6.31	121.38	109.35
2	B	501	PLP	C4A-C4-C5	2.83	123.85	120.94
2	B	501	PLP	C6-N1-C2	2.62	124.02	119.17
2	A	501	PLP	C6-C5-C4	-2.52	116.17	118.16
2	B	501	PLP	O3P-P-O4P	-2.43	100.27	106.73
2	B	501	PLP	O3-C3-C4	2.22	123.95	118.10

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	501	PLP	C4A-C4-C5	2.07	123.07	120.94
2	B	501	PLP	C5A-C5-C6	-2.07	115.97	119.37
2	B	501	PLP	C4-C3-C2	-2.06	117.03	120.07

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	501	PLP	C4-C5-C5A-O4P
2	A	501	PLP	C6-C5-C5A-O4P
2	A	501	PLP	C5A-O4P-P-O1P
2	A	501	PLP	C5A-O4P-P-O2P
2	B	501	PLP	C4-C5-C5A-O4P
2	B	501	PLP	C6-C5-C5A-O4P

There are no ring outliers.

No monomer is involved in short contacts.

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)

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	443/453 (97%)	-0.22	9 (2%)	65	63	21, 33, 53, 79	0
1	B	443/453 (97%)	-0.21	13 (2%)	51	50	22, 35, 56, 72	0
All	All	886/906 (97%)	-0.22	22 (2%)	57	55	21, 34, 55, 79	0

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	23	GLU	3.5
1	A	23	GLU	3.0
1	B	292	ASP	2.9
1	A	150	TYR	2.9
1	A	326	ASP	2.8
1	A	156	GLY	2.8
1	A	65	GLY	2.8
1	B	40	GLU	2.7
1	B	206	GLU	2.7
1	B	150	TYR	2.6
1	B	326	ASP	2.5
1	B	5	GLU	2.5
1	A	5	GLU	2.4
1	B	154	GLY	2.3
1	B	265	ALA	2.3
1	A	290	GLY	2.3
1	B	158	ILE	2.2
1	B	39	GLU	2.2
1	B	363	ASP	2.1
1	B	397	ALA	2.1
1	A	327	LYS	2.1
1	A	265	ALA	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
2	PLP	A	501	15/16	0.95	0.16	24,56,67,67	0
2	PLP	B	501	15/16	0.95	0.16	24,57,71,72	0

6.5 Other polymers (i)

There are no such residues in this entry.