



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 6, 2026 – 09:44 PM UTC

PDB ID : 2ZP7 / pdb_00002zp7
Title : Crystal structure of LysN, alpha-aminoacidate aminotransferase (Leucine complex), from *Thermus thermophilus* HB27
Authors : Tomita, T.; Miyazaki, T.; Miyagawa, T.; Fushinobu, S.; Kuzuyama, T.; Nishiyama, M.
Deposited on : 2008-06-30
Resolution : 2.26 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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
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

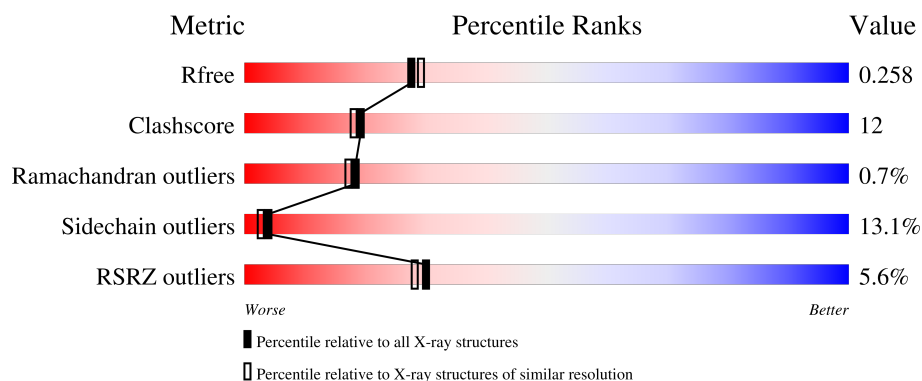
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.26 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	1898 (2.26-2.26)
Clashscore	190562	2005 (2.26-2.26)
Ramachandran outliers	187476	1965 (2.26-2.26)
Sidechain outliers	187428	1966 (2.26-2.26)
RSRZ outliers	180081	1898 (2.26-2.26)

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	397	3% 69% 26% • •
1	B	397	4% 72% 22% 5% •
1	C	397	7% 69% 26% • •
1	D	397	6% 71% 22% 5% •
1	E	397	9% 71% 24% • •

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Mol	Chain	Length	Quality of chain
1	F	397	

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
2	PLP	D	600	-	-	X	-

2 Entry composition [i](#)

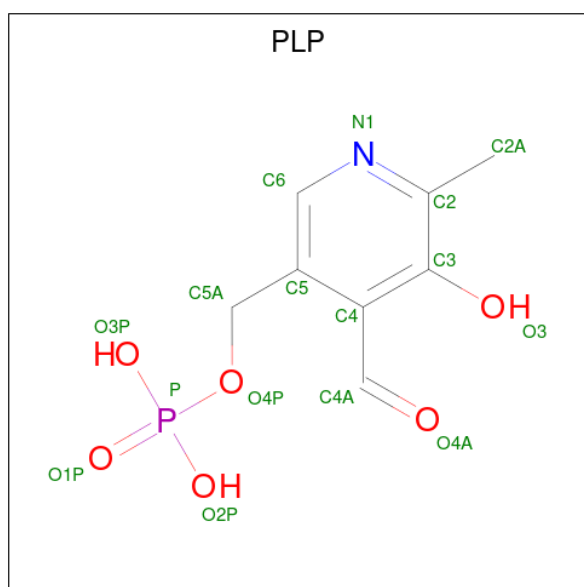
There are 4 unique types of molecules in this entry. The entry contains 18870 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Alpha-aminodipate aminotransferase.

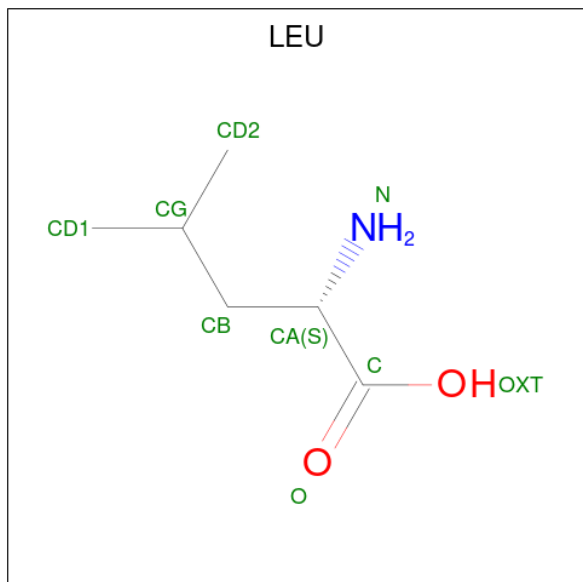
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	391	Total	C	N	O	S	0	0	0
			3033	1946	535	544	8			
1	B	391	Total	C	N	O	S	0	0	0
			3033	1946	535	544	8			
1	C	391	Total	C	N	O	S	0	0	0
			3033	1946	535	544	8			
1	D	391	Total	C	N	O	S	0	0	0
			3033	1946	535	544	8			
1	E	391	Total	C	N	O	S	0	0	0
			3033	1946	535	544	8			
1	F	391	Total	C	N	O	S	0	0	0
			3033	1946	535	544	8			

- Molecule 2 is PYRIDOXAL-5'-PHOSPHATE (CCD ID: 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		
2	C	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
2	D	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
2	E	1	Total	C	N	O	P	0	0
			15	8	1	5	1		
2	F	1	Total	C	N	O	P	0	0
			15	8	1	5	1		

- Molecule 3 is LEUCINE (CCD ID: LEU) (formula: C₆H₁₃NO₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			9	6	1	2		
3	B	1	Total	C	N	O	0	0
			9	6	1	2		
3	E	1	Total	C	N	O	0	0
			9	6	1	2		

- Molecule 4 is water.

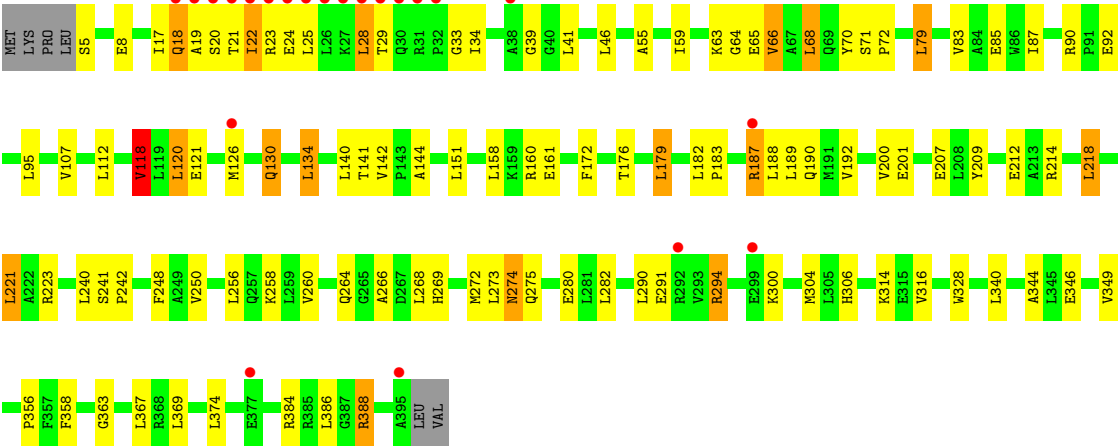
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	97	Total	O	0	0
			97	97		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	95	Total 95	O 95	0	0
4	C	97	Total 97	O 97	0	0
4	D	112	Total 112	O 112	0	0
4	E	76	Total 76	O 76	0	0
4	F	78	Total 78	O 78	0	0





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	55.95Å 167.64Å 119.36Å 90.00° 97.87° 90.00°	Depositor
Resolution (Å)	41.92 – 2.26 41.92 – 2.26	Depositor EDS
% Data completeness (in resolution range)	99.1 (41.92-2.26) 99.1 (41.92-2.26)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.72 (at 2.27Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.205 , 0.263 0.202 , 0.258	Depositor DCC
R_{free} test set	5030 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	29.9	Xtriage
Anisotropy	0.025	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 38.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	18870	wwPDB-VP
Average B, all atoms (Å ²)	31.0	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 23.57 % 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 4.5456e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: 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	0.75	0/3099	1.02	5/4191 (0.1%)
1	B	0.74	0/3099	1.01	2/4191 (0.0%)
1	C	0.75	1/3099 (0.0%)	0.99	2/4191 (0.0%)
1	D	0.72	0/3099	0.99	3/4191 (0.1%)
1	E	0.74	0/3099	0.98	3/4191 (0.1%)
1	F	0.71	0/3099	1.00	2/4191 (0.0%)
All	All	0.74	1/18594 (0.0%)	1.00	17/25146 (0.1%)

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	C	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	246	VAL	CA-CB	7.11	1.63	1.54

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	355	GLY	CA-C-N	6.70	126.40	119.56
1	B	355	GLY	C-N-CA	6.70	126.40	119.56
1	F	118	VAL	CB-CA-C	-6.26	101.18	110.82
1	C	118	VAL	CB-CA-C	-5.87	101.78	110.82
1	D	142	VAL	CA-C-N	-5.79	114.00	119.85

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	31	ARG	Peptide

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	3033	0	3081	81	0
1	B	3033	0	3082	76	0
1	C	3033	0	3081	81	0
1	D	3033	0	3084	84	0
1	E	3033	0	3082	76	0
1	F	3033	0	3082	63	0
2	A	15	0	7	1	0
2	B	15	0	6	1	0
2	C	15	0	7	0	0
2	D	15	0	7	7	0
2	E	15	0	7	2	0
2	F	15	0	6	0	0
3	A	9	0	10	2	0
3	B	9	0	10	3	0
3	E	9	0	10	1	0
4	A	97	0	0	10	0
4	B	95	0	0	11	0
4	C	97	0	0	9	0
4	D	112	0	0	13	0
4	E	76	0	0	8	0
4	F	78	0	0	10	0
All	All	18870	0	18562	429	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 12.

The worst 5 of 429 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:D:238:LYS:HZ1	2:D:600:PLP:C4A	1.27	1.38
1:D:110:VAL:HB	4:D:698:HOH:O	1.12	1.27
1:E:118:VAL:HB	4:E:786:HOH:O	1.19	1.26
1:C:375:ASP:HB3	4:C:864:HOH:O	1.36	1.25
1:A:118:VAL:HB	4:A:789:HOH:O	1.45	1.11

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	389/397 (98%)	369 (95%)	18 (5%)	2 (0%)	24	24
1	B	389/397 (98%)	371 (95%)	13 (3%)	5 (1%)	9	6
1	C	389/397 (98%)	370 (95%)	16 (4%)	3 (1%)	16	14
1	D	389/397 (98%)	370 (95%)	18 (5%)	1 (0%)	36	40
1	E	389/397 (98%)	373 (96%)	12 (3%)	4 (1%)	12	10
1	F	389/397 (98%)	376 (97%)	11 (3%)	2 (0%)	24	24
All	All	2334/2382 (98%)	2229 (96%)	88 (4%)	17 (1%)	18	17

5 of 17 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	30	GLN
1	B	28	LEU
1	B	39	GLY
1	E	32	PRO
1	A	33	GLY

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	307/316 (97%)	263 (86%)	44 (14%)	3	1
1	B	307/316 (97%)	266 (87%)	41 (13%)	4	2
1	C	307/316 (97%)	270 (88%)	37 (12%)	5	3
1	D	307/316 (97%)	269 (88%)	38 (12%)	4	3
1	E	307/316 (97%)	272 (89%)	35 (11%)	5	3
1	F	307/316 (97%)	264 (86%)	43 (14%)	3	2
All	All	1842/1896 (97%)	1604 (87%)	238 (13%)	4	3

5 of 238 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	316	VAL
1	F	212	GLU
1	D	273	LEU
1	F	188	LEU
1	F	386	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 50 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	257	GLN
1	E	135	GLN
1	F	360	ASN
1	D	261	GLN
1	D	274	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

9 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	E	600	1	15,15,16	2.72	3 (20%)	21,22,23	1.49	5 (23%)
2	PLP	F	600	1	15,15,16	2.55	7 (46%)	21,22,23	2.33	7 (33%)
2	PLP	C	600	1	15,15,16	1.67	3 (20%)	21,22,23	1.79	6 (28%)
3	LEU	E	700	-	6,8,8	1.03	1 (16%)	5,10,10	1.34	1 (20%)
3	LEU	B	700	-	6,8,8	1.23	1 (16%)	5,10,10	1.64	1 (20%)
2	PLP	B	600	1	15,15,16	1.39	2 (13%)	21,22,23	1.59	5 (23%)
3	LEU	A	700	-	6,8,8	1.09	1 (16%)	5,10,10	1.57	1 (20%)
2	PLP	D	600	1	15,15,16	1.25	2 (13%)	21,22,23	1.91	5 (23%)
2	PLP	A	600	1	15,15,16	1.02	2 (13%)	21,22,23	1.65	5 (23%)

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	E	600	1	-	4/6/6/8	0/1/1/1
2	PLP	F	600	1	-	3/6/6/8	0/1/1/1
2	PLP	C	600	1	-	4/6/6/8	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	LEU	E	700	-	-	4/8/8/8	-
3	LEU	B	700	-	-	4/8/8/8	-
2	PLP	B	600	1	-	0/6/6/8	0/1/1/1
3	LEU	A	700	-	-	5/8/8/8	-
2	PLP	D	600	1	-	2/6/6/8	0/1/1/1
2	PLP	A	600	1	-	3/6/6/8	0/1/1/1

The worst 5 of 22 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	600	PLP	C4A-C4	-9.56	1.32	1.51
2	F	600	PLP	C4A-C4	-5.55	1.40	1.51
2	C	600	PLP	C4A-C4	4.81	1.61	1.51
2	F	600	PLP	O3-C3	-3.78	1.28	1.36
2	F	600	PLP	P-O3P	-3.57	1.41	1.54

The worst 5 of 36 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	F	600	PLP	C4A-C4-C5	-6.06	114.69	120.94
2	C	600	PLP	C4A-C4-C5	-4.56	116.24	120.94
2	D	600	PLP	C5A-C5-C6	-4.41	112.17	119.36
2	F	600	PLP	C5A-C5-C6	-4.34	112.29	119.36
2	D	600	PLP	C4A-C4-C5	-4.27	116.54	120.94

There are no chirality outliers.

5 of 29 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	600	PLP	C5A-O4P-P-O1P
2	A	600	PLP	C5A-O4P-P-O2P
2	A	600	PLP	C5A-O4P-P-O3P
2	C	600	PLP	C5A-O4P-P-O2P
2	C	600	PLP	C5A-O4P-P-O3P

There are no ring outliers.

7 monomers are involved in 16 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	600	PLP	2	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	E	700	LEU	1	0
3	B	700	LEU	3	0
2	B	600	PLP	1	0
3	A	700	LEU	2	0
2	D	600	PLP	7	0
2	A	600	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](#)

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	391/397 (98%)	0.03	12 (3%)	51 51	14, 25, 46, 66	0
1	B	391/397 (98%)	0.13	15 (3%)	44 44	15, 27, 46, 60	0
1	C	391/397 (98%)	0.23	26 (6%)	24 23	14, 27, 54, 77	0
1	D	391/397 (98%)	0.23	22 (5%)	30 28	15, 29, 49, 84	0
1	E	391/397 (98%)	0.45	34 (8%)	16 15	17, 31, 70, 90	0
1	F	391/397 (98%)	0.35	22 (5%)	30 28	18, 32, 45, 81	0
All	All	2346/2382 (98%)	0.24	131 (5%)	30 28	14, 29, 54, 90	0

The worst 5 of 131 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	25	LEU	7.5
1	F	28	LEU	7.0
1	E	26	LEU	6.7
1	D	26	LEU	6.0
1	F	21	THR	5.9

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(Å ²)	Q<0.9
3	LEU	E	700	9/9	0.77	0.20	62,62,63,63	0
3	LEU	B	700	9/9	0.80	0.18	34,36,38,39	0
3	LEU	A	700	9/9	0.87	0.11	33,34,35,35	0
2	PLP	F	600	15/16	0.93	0.09	22,30,32,34	0
2	PLP	A	600	15/16	0.95	0.09	18,27,30,32	0
2	PLP	D	600	15/16	0.95	0.09	20,27,31,34	0
2	PLP	E	600	15/16	0.96	0.07	18,31,36,36	0
2	PLP	B	600	15/16	0.97	0.09	21,35,38,38	0
2	PLP	C	600	15/16	0.97	0.06	16,27,29,30	0

6.5 Other polymers [i](#)

There are no such residues in this entry.