



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 18, 2025 – 01:47 PM EDT

PDB ID : 1FC4  
Title : 2-AMINO-3-KETOBUTYRATE COA LIGASE  
Authors : Schmidt, A.; Matte, A.; Li, Y.; Sivaraman, J.; Larocque, R.; Schrag, J.D.;  
Smith, C.; Sauve, V.; Cygler, M.; Montreal-Kingston Bacterial Structural Ge-  
nomics Initiative (BSGI)  
Deposited on : 2000-07-17  
Resolution : 2.00 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](mailto: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
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.004 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.41.4

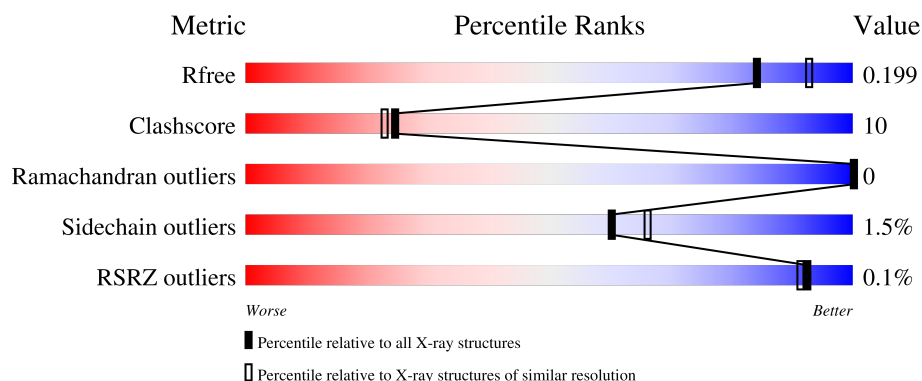
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.00 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	9409 (2.00-2.00)
Clashscore	180529	10737 (2.00-2.00)
Ramachandran outliers	177936	10628 (2.00-2.00)
Sidechain outliers	177891	10627 (2.00-2.00)
RSRZ outliers	164620	9409 (2.00-2.00)

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  $\geq 3$ , 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	401	 83% 17%
1	B	401	 84% 16%

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	AKB	A	1200	-	-	X	-
2	AKB	B	1202	-	-	X	-

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 7238 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 2-AMINO-3-KETOBUTYRATE CONENZYME A LIGASE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	401	Total	C	N	O	S	Se	0	0	0
			3043	1903	544	578	6	12			
1	B	401	Total	C	N	O	S	Se	0	0	0
			3046	1905	545	578	6	12			

There are 30 discrepancies between the modelled and reference sequences:

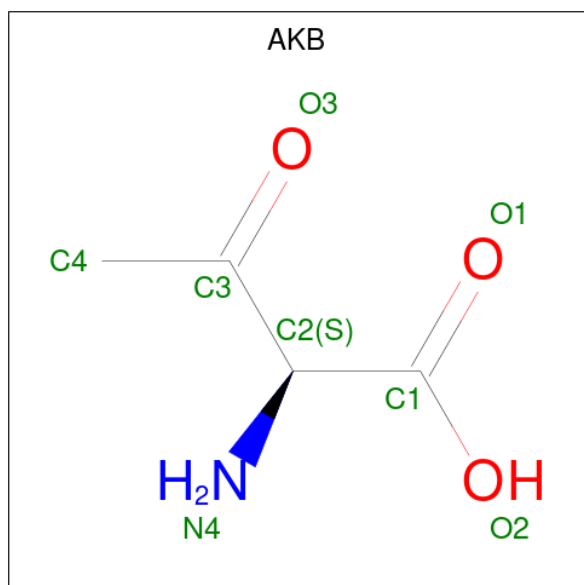
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	cloning artifact	UNP P07912
A	-1	SER	-	cloning artifact	UNP P07912
A	0	HIS	-	cloning artifact	UNP P07912
A	1	MSE	MET	modified residue	UNP P07912
A	69	MSE	MET	modified residue	UNP P07912
A	76	MSE	MET	modified residue	UNP P07912
A	102	MSE	MET	modified residue	UNP P07912
A	158	MSE	MET	modified residue	UNP P07912
A	186	MSE	MET	modified residue	UNP P07912
A	208	MSE	MET	modified residue	UNP P07912
A	232	MSE	MET	modified residue	UNP P07912
A	291	MSE	MET	modified residue	UNP P07912
A	313	MSE	MET	modified residue	UNP P07912
A	331	MSE	MET	modified residue	UNP P07912
A	371	MSE	MET	modified residue	UNP P07912
B	-2	GLY	-	cloning artifact	UNP P07912
B	-1	SER	-	cloning artifact	UNP P07912
B	0	HIS	-	cloning artifact	UNP P07912
B	1	MSE	MET	modified residue	UNP P07912
B	69	MSE	MET	modified residue	UNP P07912
B	76	MSE	MET	modified residue	UNP P07912
B	102	MSE	MET	modified residue	UNP P07912
B	158	MSE	MET	modified residue	UNP P07912
B	186	MSE	MET	modified residue	UNP P07912
B	208	MSE	MET	modified residue	UNP P07912

*Continued on next page...*

Continued from previous page...

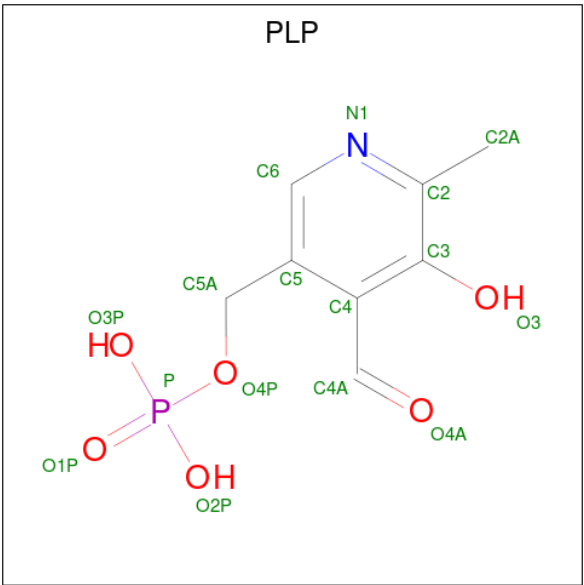
Chain	Residue	Modelled	Actual	Comment	Reference
B	232	MSE	MET	modified residue	UNP P07912
B	291	MSE	MET	modified residue	UNP P07912
B	313	MSE	MET	modified residue	UNP P07912
B	331	MSE	MET	modified residue	UNP P07912
B	371	MSE	MET	modified residue	UNP P07912

- Molecule 2 is 2-AMINO-3-KETOBUTYRIC ACID (three-letter code: AKB) (formula:  $C_4H_7NO_3$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			8	4	1	3		
2	B	1	Total	C	N	O	0	0
			8	4	1	3		

- Molecule 3 is PYRIDOXAL-5'-PHOSPHATE (three-letter code: PLP) (formula:  $C_8H_{10}NO_6P$ ).



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

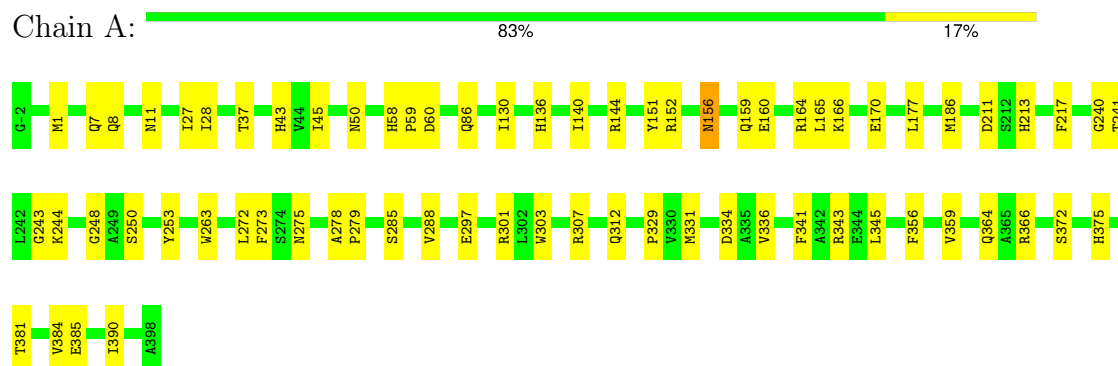
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	535	Total	O	0	0
			535	535		
4	B	568	Total	O	0	0
			568	568		

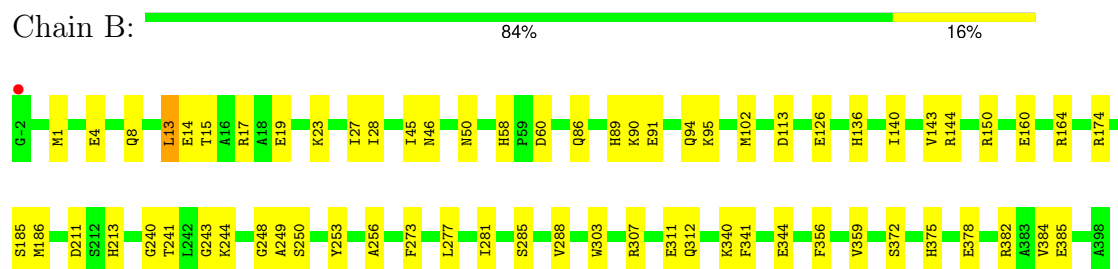
### 3 Residue-property plots

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: 2-AMINO-3-KETOBUTYRATE CONENZYME A LIGASE



#### • Molecule 1: 2-AMINO-3-KETOBUTYRATE CONENZYME A LIGASE



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	63.94Å 98.66Å 118.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	12.00 – 2.00 12.00 – 2.00	Depositor EDS
% Data completeness (in resolution range)	100.0 (12.00-2.00) 98.4 (12.00-2.00)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	10.13 (at 2.00Å)	Xtriage
Refinement program		Depositor
R, $R_{free}$	0.151 , 0.212 0.158 , 0.199	Depositor DCC
$R_{free}$ test set	5098 reflections (10.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	13.9	Xtriage
Anisotropy	0.285	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40 , 68.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	7238	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	16.0	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 25.07 % 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 3.3976e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: AKB, 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	0.41	0/3080	0.59	0/4133
1	B	0.41	0/3083	0.58	0/4137
All	All	0.41	0/6163	0.59	0/8270

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	3043	0	3004	61	0
1	B	3046	0	3007	64	0
2	A	8	0	5	7	0
2	B	8	0	5	8	0
3	A	15	0	7	0	0
3	B	15	0	7	0	0
4	A	535	0	0	7	0
4	B	568	0	0	7	0
All	All	7238	0	6035	118	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 10.

The worst 5 of 118 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)
2:A:1200:AKB:H41	4:B:1254:HOH:O	1.68	0.92
1:B:126:GLU:HB2	1:B:174:ARG:HH12	1.32	0.90
4:A:1212:HOH:O	2:B:1202:AKB:H41	1.73	0.88
1:B:126:GLU:HB2	1:B:174:ARG:NH1	1.89	0.87
1:B:58:HIS:HD2	1:B:60:ASP:H	1.24	0.86

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	399/401 (100%)	380 (95%)	19 (5%)	0	100	100
1	B	399/401 (100%)	381 (96%)	18 (4%)	0	100	100
All	All	798/802 (100%)	761 (95%)	37 (5%)	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	306/295 (104%)	303 (99%)	3 (1%)	73	78

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	306/295 (104%)	300 (98%)	6 (2%)	50	55
All	All	612/590 (104%)	603 (98%)	9 (2%)	60	66

5 of 9 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	211	ASP
1	B	341	PHE
1	B	13	LEU
1	B	17	ARG
1	B	113	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	58	HIS
1	B	312	GLN
1	B	375	HIS
1	B	370	GLN
1	A	221	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](#)

4 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	AKB	A	1200	3	5,7,7	2.02	3 (60%)	2,9,9	1.03	0
3	PLP	A	1201	2	15,15,16	3.18	7 (46%)	21,22,23	1.57	5 (23%)
3	PLP	B	1203	2	15,15,16	3.22	8 (53%)	21,22,23	1.57	4 (19%)
2	AKB	B	1202	3	5,7,7	1.94	3 (60%)	2,9,9	1.07	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	AKB	A	1200	3	-	0/6/8/8	-
3	PLP	A	1201	2	-	3/6/6/8	0/1/1/1
3	PLP	B	1203	2	-	5/6/6/8	0/1/1/1
2	AKB	B	1202	3	-	0/6/8/8	-

The worst 5 of 21 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1201	PLP	C5-C4	7.30	1.48	1.40
3	B	1203	PLP	C5-C4	7.26	1.48	1.40
3	A	1201	PLP	C2-N1	5.58	1.43	1.33
3	B	1203	PLP	C2-N1	5.53	1.43	1.33
3	B	1203	PLP	C3-C4	4.93	1.49	1.40

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1203	PLP	C5-C6-N1	-3.08	118.82	123.83
3	A	1201	PLP	C5-C6-N1	-3.04	118.88	123.83
3	B	1203	PLP	O4P-C5A-C5	3.03	115.04	109.36
3	A	1201	PLP	O4P-C5A-C5	2.86	114.72	109.36
3	B	1203	PLP	C6-C5-C4	2.67	120.28	118.10

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1201	PLP	C5A-O4P-P-O3P
3	B	1203	PLP	C4-C5-C5A-O4P
3	B	1203	PLP	C5A-O4P-P-O2P
3	B	1203	PLP	C5A-O4P-P-O3P
3	A	1201	PLP	C5A-O4P-P-O1P

There are no ring outliers.

2 monomers are involved in 15 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1200	AKB	7	0
2	B	1202	AKB	8	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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	389/401 (97%)	-0.65	0	100	100	6, 12, 25, 36	0
1	B	389/401 (97%)	-0.66	1 (0%)	90	89	6, 12, 25, 34	1 (0%)
All	All	778/802 (97%)	-0.65	1 (0%)	92	91	6, 12, 25, 36	1 (0%)

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	-2	GLY	2.5

### 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
2	AKB	A	1200	8/8	0.71	0.22	23,29,31,36	0
2	AKB	B	1202	8/8	0.71	0.18	23,29,31,36	0
3	PLP	A	1201	15/16	0.94	0.14	7,23,27,27	0
3	PLP	B	1203	15/16	0.95	0.12	7,23,27,27	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.