



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 12, 2017 – 11:10 pm GMT

PDB ID : 4F1M  
Title : Crystal Structure of the G1179S Roco4 Kinase Domain bound to AppCp from *D. discoideum*.  
Authors : Gilsbach, B.K.; Vetter, I.R.; Wittinghofer, A.; Kortholt, A.  
Deposited on : 2012-05-07  
Resolution : 2.04 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](mailto:validation@mail.wwpdb.org)

A user guide is available at

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.7.2 (RC1), CSD as538be (2017)  
Xtriage (Phenix) : 1.9-1692  
EDS : trunk28620  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : recalc28949

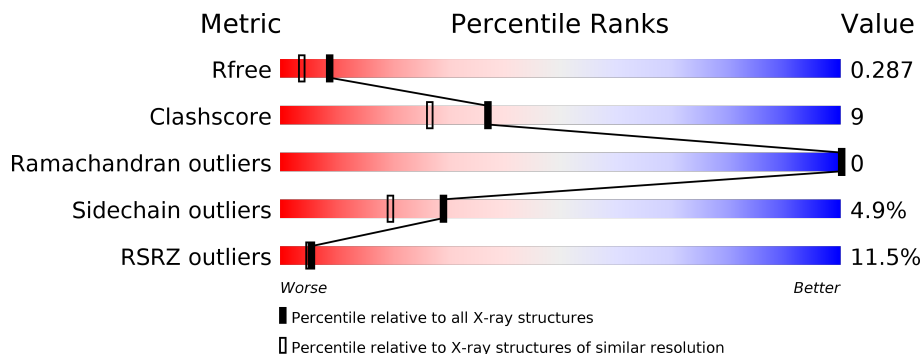
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.04 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))
$R_{free}$	100719	1316 (2.04-2.04)
Clashscore	112137	1394 (2.04-2.04)
Ramachandran outliers	110173	1383 (2.04-2.04)
Sidechain outliers	110143	1383 (2.04-2.04)
RSRZ outliers	101464	1319 (2.04-2.04)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	287	

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
3	BTB	A	1302	-	-	X	-

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 2366 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.

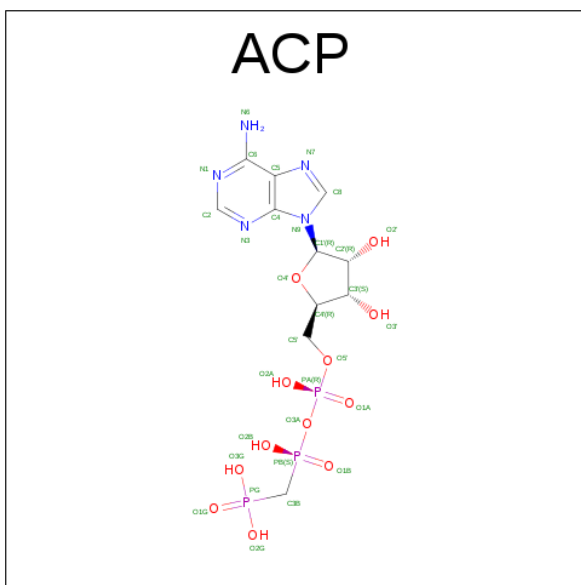
- Molecule 1 is a protein called Serine/threonine-protein kinase roco4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	278	Total	C	N	O	S	0	1	0
			2224	1425	373	412	14			

There are 14 discrepancies between the modelled and reference sequences:

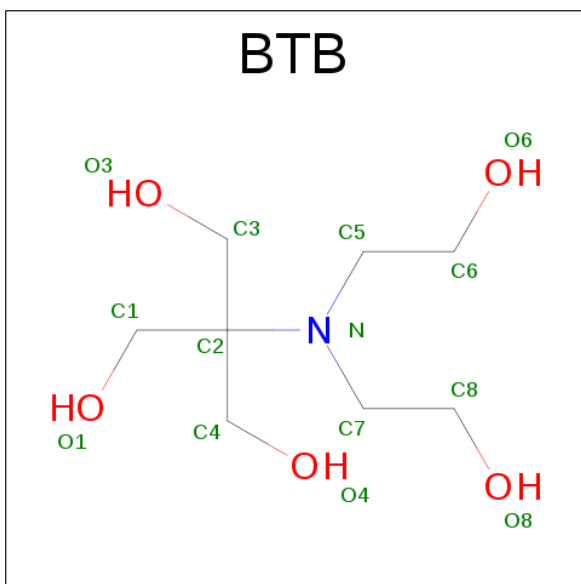
Chain	Residue	Modelled	Actual	Comment	Reference
A	1006	GLY	-	EXPRESSION TAG	UNP Q6XHB2
A	1007	ALA	-	EXPRESSION TAG	UNP Q6XHB2
A	1008	MET	-	EXPRESSION TAG	UNP Q6XHB2
A	1009	GLY	-	EXPRESSION TAG	UNP Q6XHB2
A	1010	GLY	-	EXPRESSION TAG	UNP Q6XHB2
A	1011	SER	-	EXPRESSION TAG	UNP Q6XHB2
A	1012	GLU	-	EXPRESSION TAG	UNP Q6XHB2
A	1013	PHE	-	EXPRESSION TAG	UNP Q6XHB2
A	1014	PRO	-	EXPRESSION TAG	UNP Q6XHB2
A	1015	LYS	-	EXPRESSION TAG	UNP Q6XHB2
A	1016	SER	-	EXPRESSION TAG	UNP Q6XHB2
A	1017	ARG	-	EXPRESSION TAG	UNP Q6XHB2
A	1018	LEU	-	EXPRESSION TAG	UNP Q6XHB2
A	1179	SER	GLY	ENGINEERED MUTATION	UNP Q6XHB2

- Molecule 2 is PHOSPHOMETHYLPHOSPHONIC ACID ADENYLATE ESTER (three-letter code: ACP) (formula:  $C_{11}H_{18}N_5O_{12}P_3$ ).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			31	11	5	12	3		

- Molecule 3 is 2-[BIS-(2-HYDROXY-ETHYL)-AMINO]-2-HYDROXYMETHYL-PROPAN E-1,3-DIOL (three-letter code: BTB) (formula:  $C_8H_{19}NO_5$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Mg	0	0
			1	1		

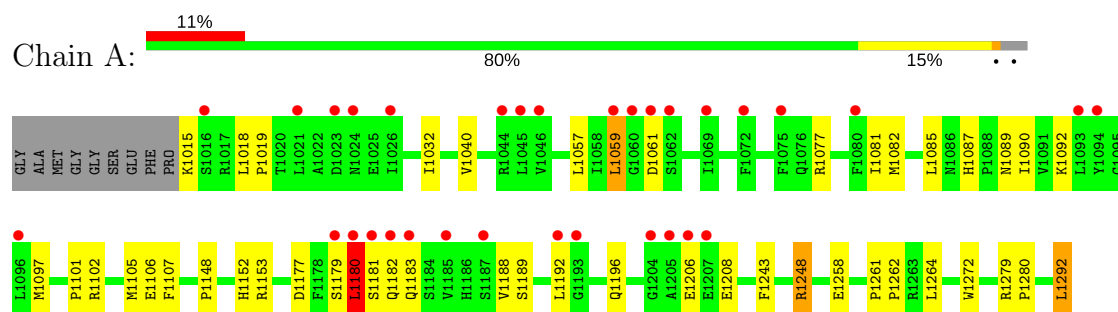
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	96	Total	O	0	0
			96	96		

### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Serine/threonine-protein kinase roco4



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	42.28Å 42.28Å 332.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	41.95 – 2.04 41.95 – 2.04	Depositor EDS
% Data completeness (in resolution range)	100.0 (41.95-2.04) 100.0 (41.95-2.04)	Depositor EDS
$R_{merge}$	0.14	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.06 (at 2.05Å)	Xtriage
Refinement program	REFMAC 5.6.0093	Depositor
R, $R_{free}$	0.261 , 0.294 0.259 , 0.287	Depositor DCC
$R_{free}$ test set	1033 reflections (5.27%)	DCC
Wilson B-factor (Å <sup>2</sup> )	30.5	Xtriage
Anisotropy	0.165	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 30.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.41$ , $\langle L^2 \rangle = 0.24$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	2366	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.39% of the height of the origin peak. No significant pseudotranslation is detected.*

<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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MG, ACP, BTB

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	0/2280	0.54	2/3084 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1180	LEU	CB-CA-C	-6.39	98.06	110.20
1	A	1059	LEU	CA-CB-CG	5.30	127.48	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	2224	0	2207	29	0
2	A	31	0	14	1	0
3	A	14	0	19	12	0
4	A	1	0	0	0	0
5	A	96	0	0	1	0
All	All	2366	0	2240	40	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 9.



All (40) 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:1179:SER:O	1:A:1180:LEU:HB2	1.46	1.11
1:A:1179:SER:O	5:A:1481:HOH:O	1.82	0.97
3:A:1302:BTB:C8	3:A:1302:BTB:C3	2.52	0.86
3:A:1302:BTB:H32	3:A:1302:BTB:C8	2.08	0.77
3:A:1302:BTB:H32	3:A:1302:BTB:O8	1.88	0.73
1:A:1179:SER:O	1:A:1180:LEU:CB	2.30	0.70
1:A:1097:MET:HB2	1:A:1102:ARG:HB2	1.73	0.69
3:A:1302:BTB:C3	3:A:1302:BTB:O8	2.45	0.64
1:A:1179:SER:OG	1:A:1180:LEU:N	2.30	0.62
1:A:1188:VAL:HG22	1:A:1189:SER:H	1.66	0.60
1:A:1082:MET:HA	1:A:1085:LEU:HD12	1.83	0.60
3:A:1302:BTB:H31	3:A:1302:BTB:C8	2.36	0.56
1:A:1208:GLU:OE1	1:A:1248:ARG:NH2	2.40	0.55
1:A:1153:ARG:HD3	1:A:1180:LEU:O	2.09	0.52
1:A:1179:SER:C	1:A:1181:SER:H	2.08	0.52
1:A:1182:GLN:HG3	1:A:1188:VAL:HG21	1.92	0.52
1:A:1148:PRO:HG2	1:A:1183:GLN:HG2	1.91	0.51
1:A:1264:LEU:HB2	1:A:1292:LEU:HD21	1.93	0.50
1:A:1087:HIS:HD2	1:A:1089:ASN:H	1.59	0.49
3:A:1302:BTB:H81	3:A:1302:BTB:C3	2.40	0.48
1:A:1040:VAL:HG21	2:A:1301:ACP:H5'1	1.94	0.48
1:A:1015:LYS:N	3:A:1302:BTB:HO3	2.12	0.48
1:A:1057:LEU:HB3	1:A:1101:PRO:HG2	1.96	0.48
1:A:1153:ARG:HE	1:A:1192:LEU:HD21	1.78	0.47
1:A:1087:HIS:CD2	1:A:1089:ASN:H	2.32	0.47
3:A:1302:BTB:H42	3:A:1302:BTB:H52	1.63	0.47
1:A:1179:SER:C	1:A:1181:SER:N	2.64	0.47
1:A:1077:ARG:O	1:A:1081:ILE:HG12	2.15	0.46
1:A:1092:LYS:H	1:A:1106:GLU:HG2	1.81	0.45
1:A:1261:PRO:HA	1:A:1262:PRO:HD2	1.85	0.44
1:A:1077:ARG:HH21	1:A:1180:LEU:H	1.64	0.44
3:A:1302:BTB:H72	3:A:1302:BTB:H32	1.46	0.42
1:A:1032:ILE:HD13	1:A:1107:PHE:HE1	1.84	0.42
3:A:1302:BTB:H31	3:A:1302:BTB:H81	2.02	0.42
1:A:1085:LEU:HD22	1:A:1090:ILE:HD13	2.02	0.41
1:A:1018:LEU:HA	1:A:1019:PRO:HD3	1.93	0.41
1:A:1279:ARG:HA	1:A:1280:PRO:HD3	1.84	0.41
3:A:1302:BTB:O3	3:A:1302:BTB:O1	2.39	0.41
1:A:1152:HIS:O	1:A:1153:ARG:HB2	2.21	0.40
3:A:1302:BTB:H31	3:A:1302:BTB:O8	2.19	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 5.3.1 Protein backbone

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	277/287 (96%)	266 (96%)	11 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains

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	246/254 (97%)	234 (95%)	12 (5%)	29	20

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1059	LEU
1	A	1061	ASP
1	A	1105	MET
1	A	1177	ASP
1	A	1180	LEU
1	A	1196	GLN
1	A	1206	GLU
1	A	1243	PHE
1	A	1248	ARG
1	A	1258	GLU

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Mol	Chain	Res	Type
1	A	1272	TRP
1	A	1292	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1076	GLN
1	A	1087	HIS
1	A	1196	GLN

### 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 carbohydrates 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	$\# Z  > 2$
2	ACP	A	1301	-	27,33,33	1.53	5 (18%)	30,52,52	1.87	3 (10%)
3	BTB	A	1302	-	13,13,13	0.41	0	9,16,16	0.78	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	ACP	A	1301	-	-	0/15/38/38	0/3/3/3
3	BTB	A	1302	-	-	0/21/21/21	0/0/0/0

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1301	ACP	PB-O2B	-3.29	1.48	1.56
2	A	1301	ACP	PB-O3A	2.36	1.61	1.58
2	A	1301	ACP	PG-O2G	3.22	1.62	1.54
2	A	1301	ACP	PG-O3G	3.29	1.62	1.54
2	A	1301	ACP	O4'-C1'	3.67	1.46	1.41

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1301	ACP	N3-C2-N1	-8.27	121.66	128.86
2	A	1301	ACP	PA-O3A-PB	-3.61	120.76	132.39
2	A	1301	ACP	O2B-PB-O1B	2.86	119.65	110.09

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1301	ACP	1	0
3	A	1302	BTB	12	0

## 5.7 Other polymers

There are no such residues in this entry.

## 5.8 Polymer linkage issues

There are no chain breaks in this entry.

## 6 Fit of model and data ⓘ

### 6.1 Protein, DNA and RNA chains ⓘ

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	278/287 (96%)	0.73	32 (11%) 5 5	21, 31, 64, 72	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1205	ALA	6.8
1	A	1016	SER	5.6
1	A	1185	VAL	5.6
1	A	1046	VAL	4.7
1	A	1072	PHE	4.1
1	A	1059	LEU	3.7
1	A	1060	GLY	3.5
1	A	1206	GLU	3.4
1	A	1024	ASN	3.3
1	A	1045	LEU	3.1
1	A	1193	GLY	3.0
1	A	1026	ILE	2.9
1	A	1192	LEU	2.8
1	A	1183	GLN	2.7
1	A	1061	ASP	2.7
1	A	1044	ARG	2.7
1	A	1096	LEU	2.6
1	A	1179	SER	2.5
1	A	1023	ASP	2.5
1	A	1075	PHE	2.5
1	A	1182	GLN	2.5
1	A	1181	SER	2.5
1	A	1069	ILE	2.4
1	A	1207	GLU	2.4
1	A	1080	PHE	2.3
1	A	1180	LEU	2.3
1	A	1204	GLY	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	1094	TYR	2.2
1	A	1093	LEU	2.2
1	A	1187	SER	2.2
1	A	1062	SER	2.2
1	A	1021	LEU	2.2

## 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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
2	ACP	A	1301	31/31	0.80	0.16	0.14	37,46,64,64	0
3	BTB	A	1302	14/14	0.57	0.30	-	44,45,46,46	14
4	MG	A	1303	1/1	0.91	0.23	-	30,30,30,30	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.