



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 7, 2023 – 04:29 PM EDT

PDB ID : 4Q1T  
Title : Crystal structure of a glutamate 5-kinase from Burkholderia thailandensis  
Authors : Seattle Structural Genomics Center for Infectious Disease (SSGCID)  
Deposited on : 2014-04-04  
Resolution : 2.15 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

<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>.

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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  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
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) : 2.35.1

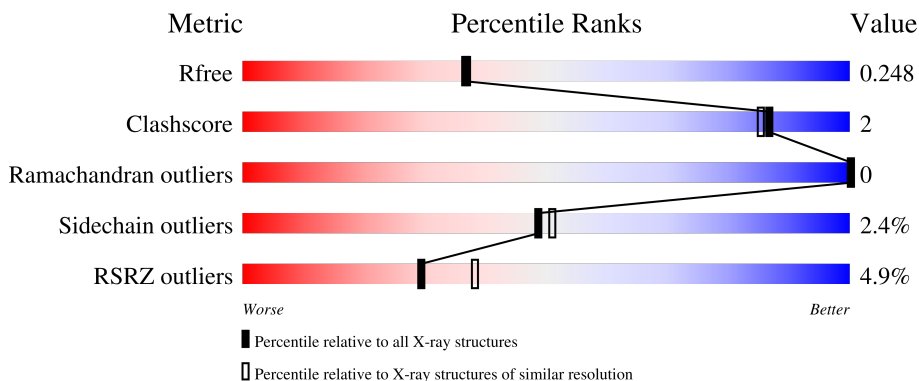
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.15 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	1479 (2.16-2.16)
Clashscore	141614	1585 (2.16-2.16)
Ramachandran outliers	138981	1560 (2.16-2.16)
Sidechain outliers	138945	1559 (2.16-2.16)
RSRZ outliers	127900	1456 (2.16-2.16)

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	376	 4% 84% 5% 10%
1	B	376	 7% 89% 6%
1	C	376	 % 88% 5% 7%
1	D	376	 5% 83% 5% 12%

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 10188 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 Glutamate 5-kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	340	Total 2449	C 1527	N 449	O 467	S 6	0	2	0
1	B	353	Total 2514	C 1567	N 449	O 490	S 8	0	1	0
1	C	351	Total 2560	C 1597	N 469	O 486	S 8	0	1	0
1	D	331	Total 2386	C 1488	N 441	O 450	S 7	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	expression tag	UNP Q2SZF9
A	-2	PRO	-	expression tag	UNP Q2SZF9
A	-1	GLY	-	expression tag	UNP Q2SZF9
A	0	SER	-	expression tag	UNP Q2SZF9
B	-3	GLY	-	expression tag	UNP Q2SZF9
B	-2	PRO	-	expression tag	UNP Q2SZF9
B	-1	GLY	-	expression tag	UNP Q2SZF9
B	0	SER	-	expression tag	UNP Q2SZF9
C	-3	GLY	-	expression tag	UNP Q2SZF9
C	-2	PRO	-	expression tag	UNP Q2SZF9
C	-1	GLY	-	expression tag	UNP Q2SZF9
C	0	SER	-	expression tag	UNP Q2SZF9
D	-3	GLY	-	expression tag	UNP Q2SZF9
D	-2	PRO	-	expression tag	UNP Q2SZF9
D	-1	GLY	-	expression tag	UNP Q2SZF9
D	0	SER	-	expression tag	UNP Q2SZF9

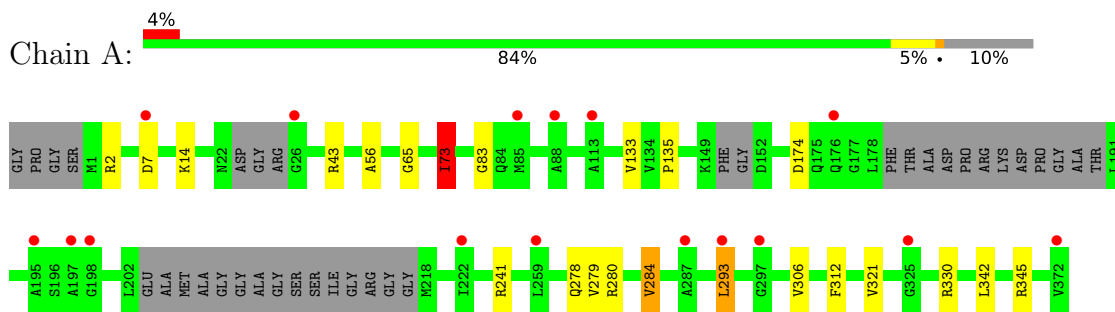
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	70	Total O 70 70	0	0
2	B	72	Total O 72 72	0	0
2	C	76	Total O 76 76	0	0
2	D	61	Total O 61 61	0	0

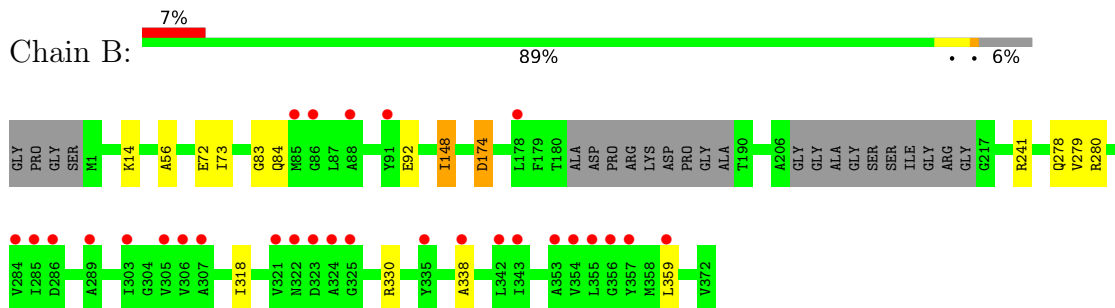
### 3 Residue-property plots [i](#)

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 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.

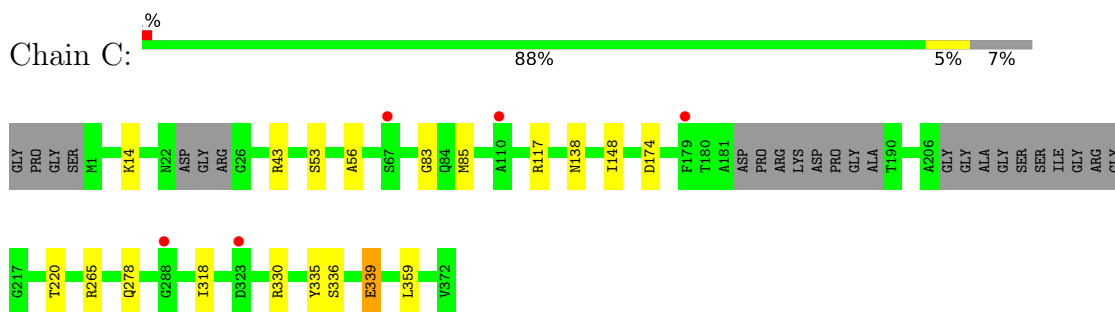
- Molecule 1: Glutamate 5-kinase



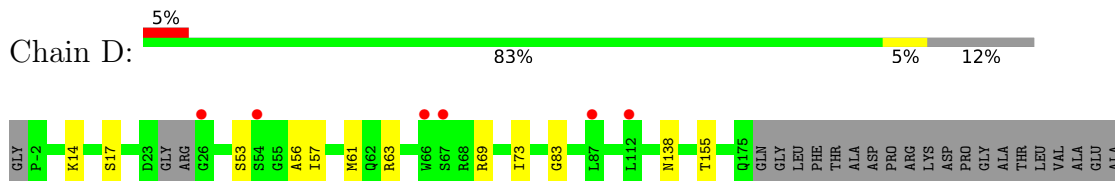
- Molecule 1: Glutamate 5-kinase

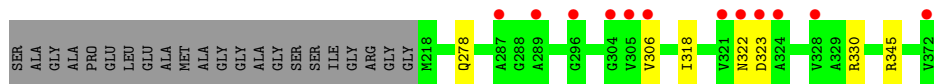


- Molecule 1: Glutamate 5-kinase



- Molecule 1: Glutamate 5-kinase





## 4 Data and refinement statistics i

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	151.85Å 69.15Å 141.68Å 90.00° 119.51° 90.00°	Depositor
Resolution (Å)	50.00 – 2.15 49.04 – 2.15	Depositor EDS
% Data completeness (in resolution range)	99.8 (50.00-2.15) 99.8 (49.04-2.15)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.95 (at 2.16Å)	Xtrriage
Refinement program	REFMAC 5.8.0069	Depositor
R, $R_{free}$	0.219 , 0.243 0.224 , 0.248	Depositor DCC
$R_{free}$ test set	3519 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	33.6	Xtrriage
Anisotropy	0.150	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 35.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.013 for h,-k,-h-l	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	10188	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	42.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 18.06% 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](#)

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	0.53	0/2475	0.74	3/3357 (0.1%)
1	B	0.49	0/2540	0.65	0/3452
1	C	0.51	0/2585	0.70	2/3503 (0.1%)
1	D	0.51	0/2408	0.70	1/3267 (0.0%)
All	All	0.51	0/10008	0.70	6/13579 (0.0%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	293	LEU	CA-CB-CG	7.16	131.76	115.30
1	D	330	ARG	N-CA-CB	-5.97	99.86	110.60
1	C	339	GLU	CB-CA-C	5.94	122.28	110.40
1	C	117	ARG	NE-CZ-NH1	5.87	123.24	120.30
1	A	73	ILE	CB-CA-C	-5.48	100.65	111.60
1	A	73	ILE	N-CA-CB	5.06	122.45	110.80

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	2449	0	2441	15	0
1	B	2514	0	2476	11	0
1	C	2560	0	2595	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	2386	0	2394	16	0
2	A	70	0	0	1	0
2	B	72	0	0	0	0
2	C	76	0	0	0	0
2	D	61	0	0	0	0
All	All	10188	0	9906	41	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 2.

All (41) 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:57:ILE:HG22	1:D:61:MET:CE	2.04	0.88
1:D:61:MET:HE1	1:D:69:ARG:HG3	1.56	0.88
1:A:342:LEU:CD1	1:B:338:ALA:HB1	2.08	0.83
1:A:342:LEU:HD12	1:B:338:ALA:HB1	1.60	0.82
1:D:57:ILE:HG22	1:D:61:MET:HE3	1.63	0.81
1:D:57:ILE:CG2	1:D:61:MET:HE2	2.14	0.77
1:D:57:ILE:CG2	1:D:61:MET:CE	2.67	0.73
1:A:65:GLY:O	2:A:441:HOH:O	2.07	0.72
1:D:57:ILE:HG22	1:D:61:MET:HE2	1.73	0.71
1:A:73:ILE:HG13	1:C:359:LEU:HA	1.75	0.68
1:D:322:ASN:OD1	1:D:323:ASP:N	2.26	0.68
1:A:2:ARG:NH1	1:A:7:ASP:OD2	2.32	0.62
1:B:174:ASP:OD1	1:B:241:ARG:NH1	2.33	0.61
1:B:279:VAL:HG11	1:C:220:THR:HG22	1.85	0.59
1:A:73:ILE:CG1	1:C:359:LEU:HA	2.33	0.59
1:D:53:SER:O	1:D:138:ASN:ND2	2.37	0.56
1:C:336:SER:OG	1:C:339:GLU:HG2	2.06	0.56
1:B:92:GLU:OE1	1:D:63:ARG:NH1	2.38	0.56
1:C:53:SER:O	1:C:138[B]:ASN:ND2	2.39	0.54
1:A:279:VAL:HG23	1:D:155:THR:HG22	1.90	0.53
1:A:56:ALA:O	1:A:83:GLY:HA3	2.09	0.52
1:D:56:ALA:O	1:D:83:GLY:HA3	2.09	0.52
1:C:56:ALA:O	1:C:83:GLY:HA3	2.10	0.51
1:B:359:LEU:HA	1:D:73:ILE:HB	1.92	0.51
1:C:335:TYR:HB3	1:C:339:GLU:HG3	1.91	0.51
1:D:61:MET:CE	1:D:69:ARG:HG3	2.34	0.51
1:D:278:GLN:NE2	1:D:318:ILE:HG22	2.26	0.51
1:B:56:ALA:O	1:B:83:GLY:HA3	2.10	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:342:LEU:HD11	1:B:338:ALA:O	2.13	0.48
1:B:278:GLN:NE2	1:B:318:ILE:HG22	2.29	0.48
1:C:278:GLN:NE2	1:C:318:ILE:HG22	2.29	0.48
1:A:284:VAL:HG22	1:A:306:VAL:HB	2.00	0.44
1:D:306:VAL:HG22	1:D:345:ARG:NH1	2.32	0.44
1:A:278:GLN:OE1	1:A:280:ARG:N	2.52	0.42
1:A:278:GLN:NE2	1:A:312:PHE:HB3	2.35	0.42
1:D:57:ILE:HG23	1:D:61:MET:HE2	1.97	0.42
1:A:306:VAL:HG22	1:A:345:ARG:NH1	2.35	0.41
1:A:284:VAL:HA	1:A:321:VAL:O	2.21	0.41
1:B:278:GLN:OE1	1:B:280:ARG:N	2.54	0.41
1:A:133:VAL:O	1:A:135:PRO:HD3	2.22	0.40
1:B:73:ILE:HD11	1:B:148:ILE:HG21	2.03	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	332/376 (88%)	331 (100%)	1 (0%)	0	100	100
1	B	348/376 (93%)	345 (99%)	3 (1%)	0	100	100
1	C	344/376 (92%)	343 (100%)	1 (0%)	0	100	100
1	D	325/376 (86%)	324 (100%)	1 (0%)	0	100	100
All	All	1349/1504 (90%)	1343 (100%)	6 (0%)	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	235/281 (84%)	226 (96%)	9 (4%)	33	31
1	B	241/281 (86%)	235 (98%)	6 (2%)	47	49
1	C	252/281 (90%)	245 (97%)	7 (3%)	43	44
1	D	231/281 (82%)	229 (99%)	2 (1%)	78	83
All	All	959/1124 (85%)	935 (98%)	24 (2%)	49	49

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	LYS
1	A	43[A]	ARG
1	A	43[B]	ARG
1	A	73	ILE
1	A	174	ASP
1	A	241	ARG
1	A	284	VAL
1	A	293	LEU
1	A	330	ARG
1	B	14	LYS
1	B	72	GLU
1	B	84	GLN
1	B	148	ILE
1	B	174	ASP
1	B	330	ARG
1	C	14	LYS
1	C	43	ARG
1	C	85	MET
1	C	148	ILE
1	C	174	ASP
1	C	265	ARG
1	C	330	ARG
1	D	14	LYS
1	D	17	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	344	GLN
1	C	344	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 monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

### 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	340/376 (90%)	0.19	16 (4%) 31 41	22, 40, 70, 88	0
1	B	353/376 (93%)	0.31	28 (7%) 12 17	23, 43, 71, 108	0
1	C	351/376 (93%)	-0.05	5 (1%) 75 80	19, 38, 61, 76	0
1	D	331/376 (88%)	0.20	18 (5%) 25 34	19, 42, 71, 92	0
All	All	1375/1504 (91%)	0.16	67 (4%) 29 38	19, 40, 69, 108	0

All (67) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	306	VAL	6.5
1	B	285	ILE	6.1
1	B	305	VAL	5.6
1	B	353	ALA	4.9
1	B	357	TYR	4.8
1	B	323	ASP	4.8
1	A	198	GLY	4.5
1	B	289	ALA	4.1
1	A	88	ALA	4.0
1	A	293	LEU	4.0
1	A	372	VAL	3.9
1	D	54	SER	3.8
1	B	338	ALA	3.6
1	B	321	VAL	3.5
1	B	88	ALA	3.3
1	D	323	ASP	3.2
1	B	307	ALA	3.2
1	B	284	VAL	3.2
1	B	86	GLY	3.2
1	A	287	ALA	3.1
1	D	321	VAL	3.1

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	D	328	VAL	3.1
1	B	356	GLY	3.1
1	B	325	GLY	3.0
1	D	287	ALA	2.9
1	C	323	ASP	2.9
1	B	85	MET	2.9
1	D	67	SER	2.7
1	D	306	VAL	2.7
1	D	322	ASN	2.6
1	B	342	LEU	2.6
1	D	296	GLY	2.6
1	B	355	LEU	2.6
1	A	197	ALA	2.6
1	C	288	GLY	2.5
1	D	26	GLY	2.5
1	D	372	VAL	2.5
1	A	85	MET	2.5
1	D	289	ALA	2.5
1	C	179	PHE	2.4
1	A	195	ALA	2.4
1	D	87	LEU	2.4
1	B	335	TYR	2.4
1	B	303	ILE	2.3
1	C	67	SER	2.3
1	B	178	LEU	2.2
1	D	324	ALA	2.2
1	A	7	ASP	2.2
1	D	305	VAL	2.2
1	B	354	VAL	2.2
1	A	26	GLY	2.2
1	B	91	TYR	2.2
1	A	222	ILE	2.2
1	B	322	ASN	2.2
1	B	359	LEU	2.1
1	A	325	GLY	2.1
1	B	286	ASP	2.1
1	A	113	ALA	2.1
1	B	324	ALA	2.1
1	C	110	ALA	2.1
1	A	297	GLY	2.1
1	B	343	ILE	2.0
1	D	112	LEU	2.0

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Mol	Chain	Res	Type	RSRZ
1	A	176	GLN	2.0
1	D	66	TRP	2.0
1	A	259	LEU	2.0
1	D	304	GLY	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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.