Full wwPDB X-ray Structure Validation Report (i)

Oct 8, 2023 – 01:30 PM EDT

PDB ID	:	4RF6
Title	:	Crystal structure of double-domain arginine kinase from Anthopleura japonicas
Authors	:	Wang, Z.; Qiao, Z.; Ye, S.; Zhang, R.
Deposited on	:	2014-09-25
Resolution	:	1.95 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 (1)) were used in the production of this report:

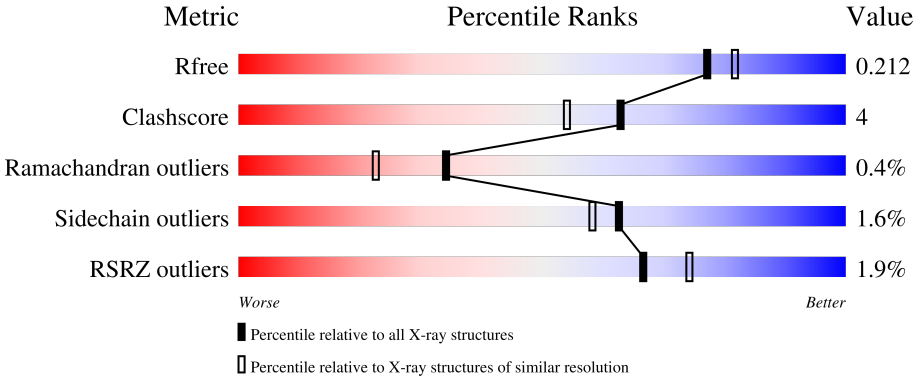
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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	2580 (1.96-1.96)
Clashscore	141614	2705 (1.96-1.96)
Ramachandran outliers	138981	2678 (1.96-1.96)
Sidechain outliers	138945	2678 (1.96-1.96)
RSRZ outliers	127900	2539 (1.96-1.96)

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	718	.% 86% 10% • •
1	B	718	2% 87% 9% • •

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 12598 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 Arginine kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	696	5519	3484	973	1036	26	0	5	0
1	B	698	5541	3495	979	1042	25	0	5	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	expression tag	UNP O15992
A	-1	PRO	-	expression tag	UNP O15992
A	0	HIS	-	expression tag	UNP O15992
B	-2	GLY	-	expression tag	UNP O15992
B	-1	PRO	-	expression tag	UNP O15992
B	0	HIS	-	expression tag	UNP O15992

- Molecule 2 is water.

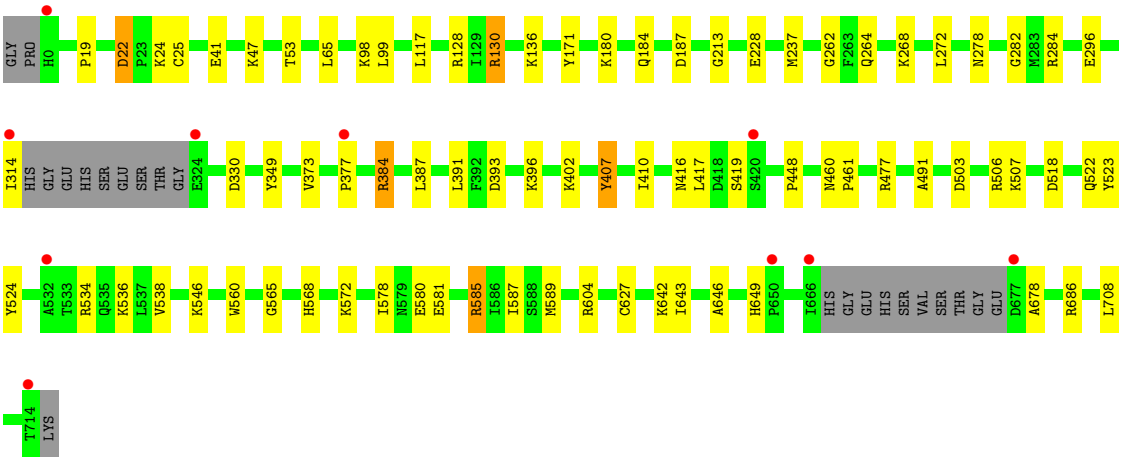
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	699	699	699	0	0
2	B	839	839	839	0	0

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.

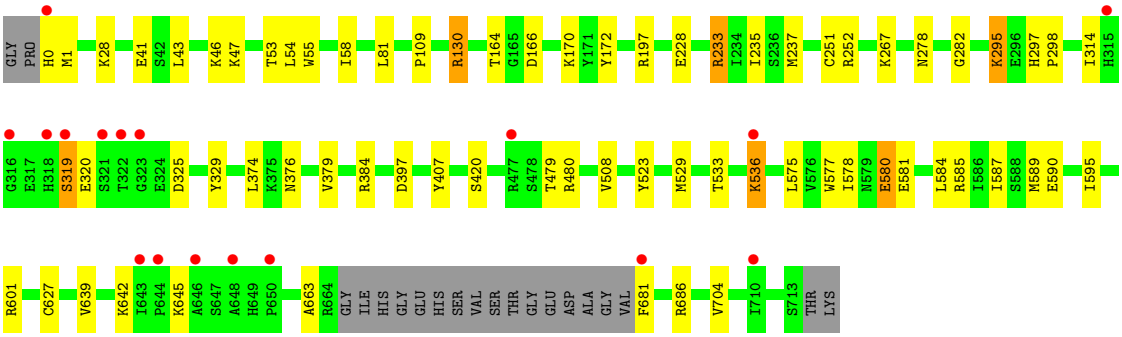
- Molecule 1: Arginine kinase

Chain A:



- Molecule 1: Arginine kinase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	77.44Å 58.91Å 162.13Å 90.00° 90.96° 90.00°	Depositor
Resolution (Å)	47.66 – 1.95 47.65 – 1.95	Depositor EDS
% Data completeness (in resolution range)	87.0 (47.66-1.95) 83.9 (47.65-1.95)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.37 (at 1.95Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.2_1309)	Depositor
R, R_{free}	0.172 , 0.212 0.172 , 0.212	Depositor DCC
R_{free} test set	4687 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	18.2	Xtriage
Anisotropy	0.035	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 54.7	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.025 for h,-k,-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	12598	wwPDB-VP
Average B, all atoms (Å^2)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.60% of the height of the origin peak. No significant pseudotranslation is detected.*

[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)

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	0.29	0/5644	0.46	0/7610
1	B	0.30	0/5672	0.46	0/7648
All	All	0.30	0/11316	0.46	0/15258

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 (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	5519	0	5519	48	0
1	B	5541	0	5530	46	0
2	A	699	0	0	13	2
2	B	839	0	0	14	3
All	All	12598	0	11049	94	3

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 4.

All (94) 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:41:GLU:OE1	2:A:1335:HOH:O	1.86	0.93

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:536:LYS:NZ	2:A:1346:HOH:O	2.08	0.85
1:A:377:PRO:HA	1:A:384:ARG:HH22	1.44	0.81
1:A:627[A]:CYS:SG	2:A:932:HOH:O	2.39	0.81
1:A:518:ASP:OD1	1:A:604:ARG:NH2	2.13	0.81
1:B:529:MET:SD	2:B:1435:HOH:O	2.38	0.80
1:A:686:ARG:NH2	2:A:1139:HOH:O	2.15	0.80
1:A:187:ASP:OD2	2:A:1336:HOH:O	2.00	0.79
1:A:128:ARG:NH2	2:A:837:HOH:O	2.13	0.75
1:B:397:ASP:OD2	2:B:1263:HOH:O	2.05	0.75
1:B:374:LEU:O	1:B:384:ARG:NH1	2.21	0.72
1:B:627[A]:CYS:SG	2:B:1380:HOH:O	2.47	0.71
1:B:590:GLU:HG3	1:B:601:ARG:HH22	1.57	0.70
1:B:41:GLU:OE1	2:B:1396:HOH:O	2.08	0.70
1:B:686:ARG:NH2	2:B:1348:HOH:O	2.25	0.69
1:B:166:ASP:OD1	1:B:252:ARG:NH2	2.25	0.69
1:B:420:SER:OG	2:B:893:HOH:O	2.11	0.68
1:A:387:LEU:O	2:A:984:HOH:O	2.13	0.66
1:A:47:LYS:NZ	2:A:1174:HOH:O	2.31	0.63
1:B:533:THR:HA	1:B:536:LYS:HD2	1.84	0.59
1:A:416:ASN:O	1:A:419:SER:OG	2.19	0.58
1:A:506:ARG:NH2	2:A:1265:HOH:O	2.34	0.57
1:A:477:ARG:HD2	1:A:642:LYS:HE3	1.87	0.56
1:A:47:LYS:HG2	1:A:53:THR:HG22	1.90	0.54
1:B:233:ARG:HD3	1:B:235:ILE:HD11	1.90	0.53
1:B:319:SER:HB3	1:B:329:TYR:CZ	2.45	0.52
1:A:643:ILE:CG2	1:A:646:ALA:HB3	2.40	0.52
1:B:480:ARG:NH1	2:B:864:HOH:O	2.21	0.51
1:A:136:LYS:HD2	1:A:262:GLY:HA3	1.93	0.51
1:A:646:ALA:HA	1:A:649:HIS:HB2	1.94	0.50
1:A:568:HIS:CE1	1:A:572:LYS:HE3	2.47	0.50
1:A:523:TYR:CE1	1:A:578:ILE:HD12	2.47	0.50
1:A:128:ARG:HH22	1:A:130[A]:ARG:NH1	2.09	0.50
1:A:296:GLU:OE2	2:A:1372:HOH:O	2.19	0.50
1:B:575:LEU:HD23	1:B:587:ILE:HD12	1.93	0.49
1:A:373:VAL:HB	1:A:417:LEU:HD21	1.94	0.49
1:B:663:ALA:HB1	1:B:681:PHE:CD1	2.47	0.49
1:B:267:LYS:NZ	2:B:1528:HOH:O	2.45	0.49
1:B:627[A]:CYS:SG	2:B:910:HOH:O	2.26	0.49
1:B:376:ASN:HB3	1:B:379:VAL:HG23	1.95	0.48
1:A:534:ARG:NH1	2:A:1177:HOH:O	2.44	0.48
1:B:28:LYS:NZ	2:B:1468:HOH:O	2.32	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:47:LYS:HG2	1:B:53:THR:HG22	1.95	0.48
1:B:314:ILE:HD11	1:B:325:ASP:HB3	1.96	0.48
1:B:297:HIS:CG	1:B:298:PRO:HD2	2.49	0.47
1:A:284:ARG:NH1	1:A:330:ASP:OD2	2.47	0.47
1:B:314:ILE:HG12	2:B:1353:HOH:O	2.14	0.47
1:A:534:ARG:O	1:A:538:VAL:HG23	2.14	0.47
1:A:387:LEU:HD12	1:A:391:LEU:HD22	1.97	0.46
1:A:546:LYS:HG3	1:A:560:TRP:CG	2.49	0.46
1:B:43:LEU:HB2	1:B:54:LEU:HD22	1.98	0.46
1:A:581:GLU:OE1	2:A:1192:HOH:O	2.20	0.46
1:B:580:GLU:OE2	1:B:581:GLU:HG3	2.16	0.46
1:A:708:LEU:HD23	1:A:708:LEU:HA	1.77	0.46
1:A:585:ARG:HD3	1:A:587:ILE:HD11	1.98	0.45
1:B:508:VAL:HG11	1:B:584:LEU:HD21	1.99	0.45
1:B:577:TRP:HB2	1:B:585:ARG:HB3	1.98	0.45
1:B:320:GLU:N	1:B:320:GLU:OE2	2.50	0.45
1:B:164:THR:O	2:B:1591:HOH:O	2.21	0.45
1:A:448:PRO:O	2:A:1037:HOH:O	2.20	0.44
1:B:170:LYS:HE3	1:B:172:TYR:CE2	2.52	0.44
1:B:639:VAL:HG21	1:B:704:VAL:HG21	1.99	0.44
1:B:55:TRP:HA	1:B:58:ILE:HG12	1.99	0.44
1:B:109:PRO:HG3	1:B:251:CYS:HB2	2.00	0.44
1:B:663:ALA:HB1	1:B:681:PHE:HD1	1.83	0.44
1:A:264:GLN:HB3	1:A:272:LEU:HD12	2.00	0.44
1:A:407:TYR:HA	1:A:410:ILE:HG12	2.00	0.43
1:B:46:LYS:HD3	1:B:81:LEU:HD11	2.00	0.43
1:A:19:PRO:O	1:A:22:ASP:HB2	2.18	0.43
1:A:278:ASN:O	1:A:282:GLY:HA2	2.19	0.43
1:A:180:LYS:O	1:A:184:GLN:HG3	2.20	0.42
1:B:523:TYR:CE1	1:B:578:ILE:HD12	2.54	0.42
1:A:393:ASP:HA	1:A:396:LYS:HD3	2.01	0.42
1:A:99:LEU:O	1:A:268:LYS:HG3	2.20	0.42
1:A:503:ASP:O	1:A:507:LYS:HG3	2.20	0.42
1:A:522:GLN:HG3	1:A:524:TYR:CZ	2.54	0.41
1:B:295:LYS:HG3	1:B:329:TYR:OH	2.18	0.41
1:B:581:GLU:OE2	2:B:1380:HOH:O	2.22	0.41
1:A:25:CYS:HA	1:A:65:LEU:HB3	2.02	0.41
1:A:98:LYS:HA	1:A:98:LYS:HD3	1.84	0.41
1:A:130[A]:ARG:HH11	1:A:284:ARG:HB3	1.85	0.41
1:B:642:LYS:HE2	1:B:642:LYS:HB3	1.92	0.41
1:B:479:THR:HG21	1:B:595:ILE:HA	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1:MET:HB2	1:B:197:ARG:CZ	2.50	0.41
1:A:523:TYR:OH	1:A:565:GLY:HA3	2.19	0.41
1:B:278:ASN:O	1:B:282:GLY:HA2	2.21	0.41
1:B:577:TRP:CE3	1:B:585:ARG:HD2	2.56	0.41
1:A:460:ASN:HA	1:A:461:PRO:HD2	1.98	0.40
1:A:117:LEU:HG	1:A:349:TYR:CE1	2.56	0.40
1:B:41:GLU:HB3	2:B:1396:HOH:O	2.21	0.40
1:A:402:LYS:HD3	1:A:491:ALA:HB2	2.04	0.40
1:B:384:ARG:O	1:B:384:ARG:HG2	2.21	0.40
1:A:171:TYR:OH	1:A:213:GLY:HA3	2.21	0.40

All (3) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:1214:HOH:O	2:B:1336:HOH:O[1_554]	1.80	0.40
2:B:1624:HOH:O	2:B:1636:HOH:O[2_656]	2.14	0.06
2:A:908:HOH:O	2:B:980:HOH:O[1_554]	2.19	0.01

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	695/718 (97%)	676 (97%)	16 (2%)	3 (0%)	34 22
1	B	699/718 (97%)	682 (98%)	15 (2%)	2 (0%)	41 30
All	All	1394/1436 (97%)	1358 (97%)	31 (2%)	5 (0%)	34 22

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	580	GLU

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Mol	Chain	Res	Type
1	A	678	ALA
1	B	580	GLU
1	A	228	GLU
1	B	228	GLU

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	604/616 (98%)	594 (98%)	10 (2%)	60	55
1	B	607/616 (98%)	596 (98%)	11 (2%)	59	53
All	All	1211/1232 (98%)	1190 (98%)	21 (2%)	62	55

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	22	ASP
1	A	24	LYS
1	A	130[A]	ARG
1	A	130[B]	ARG
1	A	237	MET
1	A	314	ILE
1	A	384	ARG
1	A	407	TYR
1	A	585	ARG
1	A	589	MET
1	B	0	HIS
1	B	130[A]	ARG
1	B	130[B]	ARG
1	B	233	ARG
1	B	237	MET
1	B	295	LYS
1	B	319	SER
1	B	407	TYR
1	B	536	LYS

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Mol	Chain	Res	Type
1	B	589	MET
1	B	645	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	121	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)

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, 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	696/718 (96%)	-0.02	10 (1%)	75	82	12, 28, 52, 88	0
1	B	698/718 (97%)	-0.10	17 (2%)	59	68	12, 23, 48, 70	0
All	All	1394/1436 (97%)	-0.06	27 (1%)	66	74	12, 25, 51, 88	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	318	HIS	5.2
1	B	321	SER	4.2
1	A	714	THR	3.9
1	B	319	SER	3.8
1	B	0	HIS	3.8
1	A	677	ASP	3.5
1	B	644	PRO	3.2
1	B	316	GLY	3.1
1	A	377	PRO	3.0
1	A	314	ILE	3.0
1	A	666	ILE	3.0
1	B	315	HIS	2.9
1	B	477	ARG	2.9
1	A	0	HIS	2.9
1	A	324	GLU	2.9
1	B	681	PHE	2.8
1	B	643	ILE	2.6
1	B	646	ALA	2.5
1	B	710	ILE	2.5
1	B	648	ALA	2.5
1	A	532	ALA	2.4
1	B	322	THR	2.4
1	A	650	PRO	2.3
1	A	420	SER	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	536	LYS	2.1
1	B	650	PRO	2.1
1	B	323	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.