Full wwPDB X-ray Structure Validation Report (i)

Feb 1, 2016 – 01:24 AM GMT

PDB ID	:	2CW5
Title	:	Crystal structure of a conserved hypothetical protein from Thermus thermophilus HB8
Authors	:	Ebihara, A.; Yokoyama, S.; Kuramitsu, S.; RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on	:	2005-06-16
Resolution	:	1.94 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

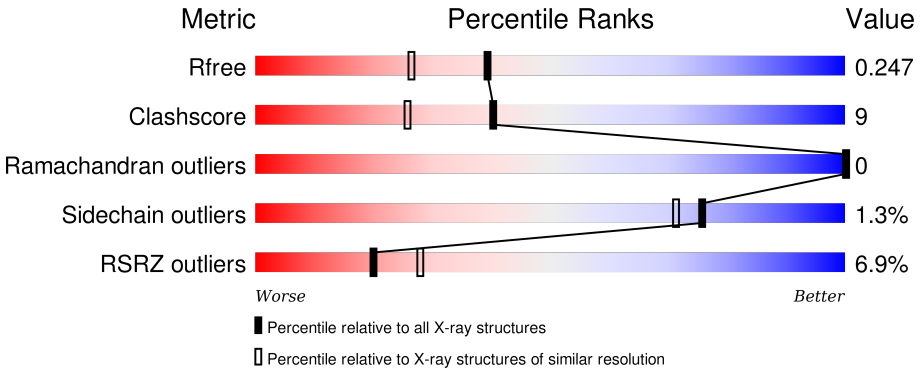
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

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 1.94 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}	91344	2910 (1.96-1.92)
Clashscore	102246	3095 (1.96-1.92)
Ramachandran outliers	100387	3062 (1.96-1.92)
Sidechain outliers	100360	3062 (1.96-1.92)
RSRZ outliers	91569	2915 (1.96-1.92)

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 >=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 <=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	255	5% 77% 15% 8%
1	B	255	4% 77% 11% 12%
1	C	255	9% 73% 19% • 7%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5460 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 Bacterial fluorinating enzyme homolog.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	235	Total	C	N	O	Se	0	0	0
			1753	1137	304	310	2			
1	B	224	Total	C	N	O	Se	0	0	0
			1686	1094	296	294	2			
1	C	238	Total	C	N	O	Se	0	0	0
			1794	1167	314	311	2			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MSE	MET	MODIFIED RESIDUE	UNP Q5SLF5
A	250	MSE	MET	MODIFIED RESIDUE	UNP Q5SLF5
B	1	MSE	MET	MODIFIED RESIDUE	UNP Q5SLF5
B	250	MSE	MET	MODIFIED RESIDUE	UNP Q5SLF5
C	1	MSE	MET	MODIFIED RESIDUE	UNP Q5SLF5
C	250	MSE	MET	MODIFIED RESIDUE	UNP Q5SLF5

- Molecule 2 is water.

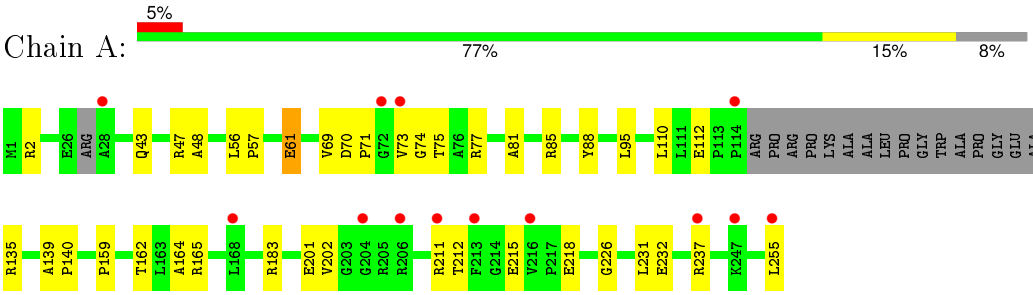
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	77	Total	O	0	0
			77	77		
2	B	92	Total	O	0	0
			92	92		
2	C	58	Total	O	0	0
			58	58		

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 errors 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.

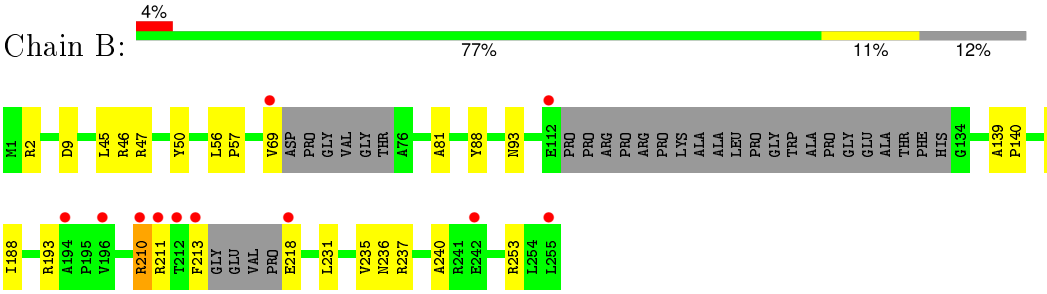
- Molecule 1: Bacterial fluorinating enzyme homolog

Chain A:



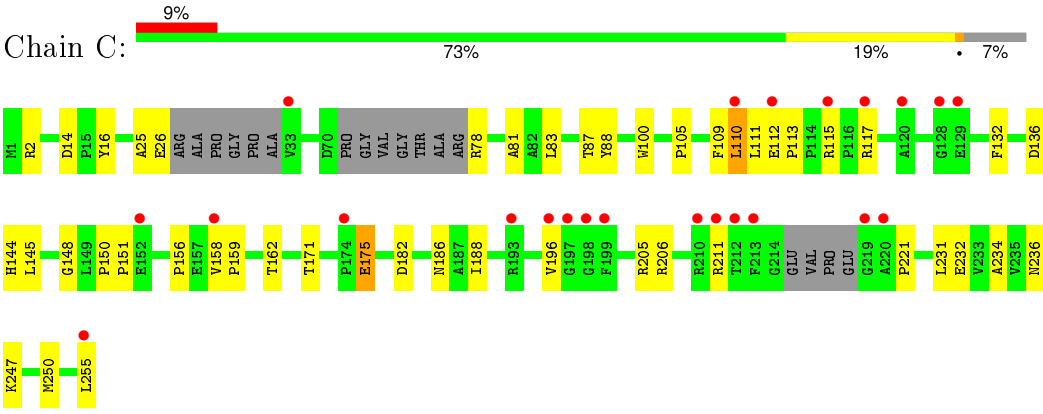
- Molecule 1: Bacterial fluorinating enzyme homolog

Chain B:



- Molecule 1: Bacterial fluorinating enzyme homolog

Chain C:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	74.79Å 78.12Å 120.58Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.40 – 1.94 37.40 – 1.94	Depositor EDS
% Data completeness (in resolution range)	99.5 (37.40-1.94) 99.6 (37.40-1.94)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.96 (at 1.94Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.212 , 0.246 0.212 , 0.247	Depositor DCC
R_{free} test set	5353 reflections (10.14%)	DCC
Wilson B-factor (Å^2)	25.8	Xtriage
Anisotropy	0.316	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 49.8	EDS
Estimated twinning fraction	0.004 for k,h,-l	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Outliers	0 of 52815 reflections	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	5460	wwPDB-VP
Average B, all atoms (Å^2)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.42% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

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	0.32	0/1797	0.62	1/2458 (0.0%)
1	B	0.32	0/1725	0.59	0/2353
1	C	0.32	0/1841	0.58	0/2515
All	All	0.32	0/5363	0.60	1/7326 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	69	VAL	N-CA-C	-5.63	95.79	111.00

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	1753	0	1789	35	0
1	B	1686	0	1729	26	0
1	C	1794	0	1829	36	0
2	A	77	0	0	0	0
2	B	92	0	0	1	0
2	C	58	0	0	1	0
All	All	5460	0	5347	92	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 (92) 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:73:VAL:HG22	1:A:135:ARG:HH22	1.38	0.89
1:A:201:GLU:HB2	1:A:255:LEU:HD11	1.67	0.77
1:C:115:ARG:NH1	1:C:115:ARG:HB3	2.02	0.75
1:C:78:ARG:HD2	1:C:110:LEU:HD21	1.69	0.74
1:A:61:GLU:OE2	1:A:85:ARG:HD3	1.87	0.74
1:C:115:ARG:HB3	1:C:115:ARG:HH11	1.53	0.71
1:A:183:ARG:HH22	1:C:16:TYR:HE2	1.41	0.67
1:A:159:PRO:HB2	1:A:162:THR:HG23	1.79	0.65
1:C:110:LEU:HD23	1:C:158:VAL:HG11	1.79	0.65
1:B:218:GLU:O	1:B:236:ASN:HB3	1.97	0.65
1:A:218:GLU:HG3	1:A:237:ARG:HD3	1.80	0.63
1:A:73:VAL:HG22	1:A:135:ARG:NH2	2.11	0.62
1:B:45:LEU:HD23	1:B:166:LEU:HD21	1.82	0.62
1:A:43:GLN:NE2	1:A:71:PRO:HA	2.15	0.61
1:A:2:ARG:HA	1:A:2:ARG:NE	2.16	0.60
1:B:47:ARG:HD3	1:B:180:THR:OG1	2.01	0.60
1:B:45:LEU:HD21	1:B:93:ASN:O	2.02	0.60
1:B:46:ARG:HG3	2:B:302:HOH:O	2.04	0.58
1:A:139:ALA:HB3	1:A:140:PRO:HD3	1.86	0.58
1:C:206:ARG:NH1	1:C:255:LEU:HD13	2.17	0.58
1:A:110:LEU:C	1:A:110:LEU:HD23	2.25	0.57
1:C:115:ARG:HH22	1:C:117:ARG:NH2	2.03	0.57
1:B:139:ALA:HB3	1:B:140:PRO:HD3	1.86	0.57
1:C:144:HIS:HE1	1:C:150:PRO:O	1.87	0.56
1:A:43:GLN:HB3	1:A:71:PRO:HB3	1.87	0.56
1:C:110:LEU:HD23	1:C:158:VAL:CG1	2.37	0.55
1:A:183:ARG:HH21	1:A:183:ARG:HG2	1.72	0.55
1:C:115:ARG:CB	1:C:115:ARG:HH11	2.19	0.55
1:C:81:ALA:HB2	1:C:111:LEU:HD21	1.89	0.54
1:A:237:ARG:HB3	1:A:237:ARG:NH2	2.22	0.54
1:A:212:THR:CG2	1:A:215:GLU:HG3	2.38	0.54
1:A:47:ARG:NH2	1:C:14:ASP:OD1	2.40	0.53
1:C:87:THR:HG21	1:C:145:LEU:HD13	1.90	0.53
1:C:236:ASN:OD1	1:C:237:ARG:HD3	2.09	0.53
1:C:188:ILE:HD13	1:C:232:GLU:HG2	1.91	0.52
1:B:45:LEU:HG	1:B:166:LEU:HD11	1.90	0.52
1:B:210:ARG:HH11	1:B:210:ARG:HG2	1.74	0.52
1:B:9:ASP:OD2	1:B:69:VAL:HG13	2.09	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:50:TYR:CE2	1:B:188:ILE:HD13	2.46	0.51
1:B:218:GLU:HG2	1:B:236:ASN:ND2	2.25	0.50
1:C:159:PRO:HB2	1:C:162:THR:HG23	1.93	0.50
1:C:115:ARG:HG3	1:C:136:ASP:HB3	1.94	0.49
1:C:83:LEU:HD23	1:C:87:THR:HG23	1.95	0.49
1:C:78:ARG:HG3	1:C:110:LEU:HD11	1.95	0.49
1:A:73:VAL:O	1:A:75:THR:HG23	2.13	0.48
1:B:45:LEU:CD2	1:B:166:LEU:HD21	2.42	0.48
1:B:81:ALA:HA	1:B:88:TYR:O	2.13	0.48
1:A:70:ASP:O	1:A:73:VAL:HG23	2.12	0.48
1:B:50:TYR:CZ	1:B:188:ILE:HD13	2.49	0.48
1:A:110:LEU:HD22	1:A:112:GLU:HG3	1.96	0.47
1:C:182:ASP:OD2	1:C:186:ASN:HB2	2.15	0.47
1:A:211:ARG:HB2	1:A:215:GLU:OE1	2.15	0.47
1:C:110:LEU:HB2	1:C:156:PRO:HG2	1.97	0.46
1:B:236:ASN:O	1:B:237:ARG:HB2	2.14	0.46
1:C:247:LYS:HB2	1:C:250:MSE:HE3	1.97	0.46
1:B:193:ARG:HB2	1:B:193:ARG:HH11	1.80	0.46
1:A:212:THR:HG22	1:A:215:GLU:HG3	1.97	0.46
1:A:218:GLU:CG	1:A:237:ARG:HD3	2.45	0.46
1:A:183:ARG:NH2	1:C:16:TYR:HE2	2.11	0.46
1:A:71:PRO:HB2	1:B:237:ARG:NH1	2.30	0.46
1:C:205:ARG:CD	1:C:244:LEU:HD22	2.46	0.46
1:C:112:GLU:N	1:C:113:PRO:CD	2.79	0.45
1:C:100:TRP:CD1	1:C:105:PRO:HD3	2.51	0.45
1:C:109:PHE:CE2	1:C:151:PRO:HB2	2.52	0.45
1:A:231:LEU:HD23	1:A:231:LEU:C	2.37	0.45
1:C:139:ALA:N	1:C:140:PRO:HD2	2.31	0.44
1:C:231:LEU:HD23	1:C:231:LEU:C	2.38	0.44
1:C:250:MSE:HG2	2:C:280:HOH:O	2.17	0.44
1:A:164:ALA:O	1:A:165:ARG:HD3	2.18	0.44
1:A:81:ALA:HA	1:A:88:TYR:O	2.18	0.43
1:B:2:ARG:HD3	1:B:2:ARG:HA	1.84	0.43
1:B:235:VAL:HG23	1:B:240:ALA:HA	1.99	0.43
1:A:202:VAL:O	1:A:202:VAL:HG13	2.19	0.43
1:A:2:ARG:HA	1:A:2:ARG:HE	1.83	0.43
1:A:226:GLY:HA3	1:A:232:GLU:OE2	2.18	0.43
1:C:25:ALA:O	1:C:26:GLU:C	2.56	0.43
1:A:201:GLU:CB	1:A:255:LEU:HD11	2.44	0.43
1:B:210:ARG:HB3	1:B:211:ARG:H	1.62	0.42
1:C:221:PRO:HA	1:C:234:ALA:O	2.18	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:210:ARG:HG2	1:B:210:ARG:NH1	2.34	0.42
1:B:253:ARG:HH11	1:B:253:ARG:HG2	1.84	0.42
1:C:2:ARG:NH1	1:C:148:GLY:HA2	2.34	0.42
1:C:175:GLU:H	1:C:175:GLU:CD	2.22	0.42
1:B:231:LEU:C	1:B:231:LEU:HD23	2.40	0.42
1:C:81:ALA:HA	1:C:88:TYR:O	2.20	0.42
1:C:196:VAL:HG12	1:C:211:ARG:HE	1.84	0.42
1:B:69:VAL:HG12	1:B:69:VAL:O	2.19	0.42
1:A:183:ARG:HG2	1:A:183:ARG:NH2	2.35	0.41
1:B:56:LEU:HB3	1:B:57:PRO:HD3	2.01	0.41
1:A:56:LEU:HB3	1:A:57:PRO:HD3	2.03	0.41
1:A:74:GLY:HA3	1:B:213:PHE:CD1	2.56	0.40
1:A:48:ALA:HB1	1:A:95:LEU:HD11	2.04	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	229/255 (90%)	225 (98%)	4 (2%)	0	100	100
1	B	216/255 (85%)	210 (97%)	6 (3%)	0	100	100
1	C	230/255 (90%)	220 (96%)	10 (4%)	0	100	100
All	All	675/765 (88%)	655 (97%)	20 (3%)	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	175/187 (94%)	173 (99%)	2 (1%)	80 76
1	B	167/187 (89%)	166 (99%)	1 (1%)	90 89
1	C	178/187 (95%)	174 (98%)	4 (2%)	60 50
All	All	520/561 (93%)	513 (99%)	7 (1%)	76 71

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	61	GLU
1	A	77	ARG
1	B	210	ARG
1	C	110	LEU
1	C	132	PHE
1	C	171	THR
1	C	175	GLU

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

Mol	Chain	Res	Type
1	A	236	ASN
1	C	144	HIS

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

There are no ligands in this entry.

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^{th} 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	233/255 (91%)	0.59	13 (5%)	28	36	16, 25, 50, 58	0
1	B	222/255 (87%)	0.31	11 (4%)	32	42	16, 25, 44, 64	0
1	C	236/255 (92%)	0.65	24 (10%)	9	13	17, 30, 49, 67	0
All	All	691/765 (90%)	0.52	48 (6%)	20	28	16, 26, 48, 67	0

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	73	VAL	6.9
1	C	196	VAL	6.3
1	A	28	ALA	4.9
1	B	196	VAL	4.5
1	C	255	LEU	4.5
1	B	210	ARG	4.4
1	B	213	PHE	4.0
1	C	213	PHE	3.9
1	C	128	GLY	3.7
1	B	255	LEU	3.5
1	B	212	THR	3.5
1	A	211	ARG	3.3
1	C	115	ARG	3.2
1	A	114	PRO	3.2
1	C	212	THR	3.2
1	A	255	LEU	3.2
1	C	120	ALA	3.1
1	C	220	ALA	3.1
1	C	237	ARG	3.1
1	A	237	ARG	3.0
1	C	198	GLY	3.0
1	A	216	VAL	3.0
1	C	219	GLY	3.0

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Mol	Chain	Res	Type	RSRZ
1	C	129	GLU	2.8
1	B	112	GLU	2.7
1	C	199	PHE	2.7
1	C	33	VAL	2.7
1	B	211	ARG	2.6
1	C	211	ARG	2.5
1	B	194	ALA	2.4
1	A	206	ARG	2.4
1	C	197	GLY	2.4
1	C	117	ARG	2.3
1	B	69	VAL	2.3
1	C	152	GLU	2.3
1	B	218	GLU	2.2
1	C	110	LEU	2.2
1	A	213	PHE	2.2
1	B	242	GLU	2.2
1	C	112	GLU	2.2
1	C	174	PRO	2.1
1	A	204	GLY	2.1
1	C	193	ARG	2.1
1	A	72	GLY	2.1
1	C	158	VAL	2.1
1	A	168	LEU	2.1
1	C	210	ARG	2.0
1	A	247	LYS	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 carbohydrates 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.