



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 09:54 AM GMT

PDB ID : 3K4E  
Title : Puf3 RNA binding domain bound to Cox17 RNA 3' UTR recognition sequence site A  
Authors : Zhu,D.; Stumpf, C.R.; Krahn, J.M.; Wickens, M.; Hall, T.M.T  
Deposited on : 2009-10-05  
Resolution : 3.20 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 (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

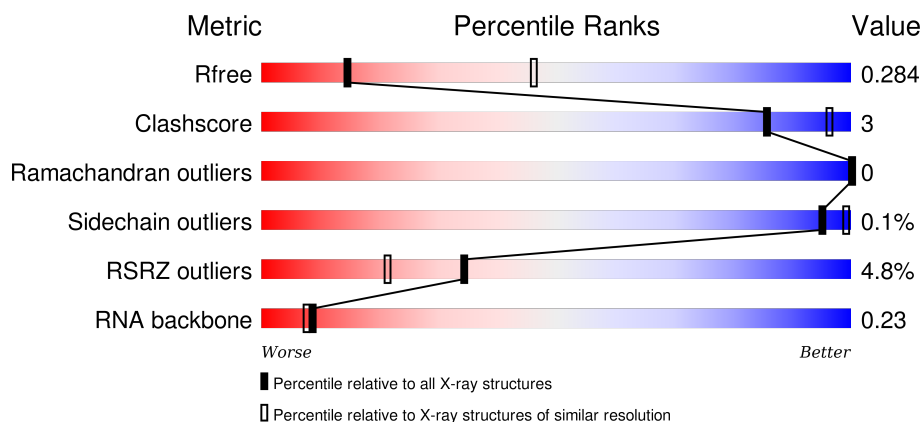
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 3.20 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	1124 (3.24-3.16)
Clashscore	102246	1024 (3.22-3.18)
Ramachandran outliers	100387	1004 (3.22-3.18)
Sidechain outliers	100360	1003 (3.22-3.18)
RSRZ outliers	91569	1129 (3.24-3.16)
RNA backbone	2183	1079 (3.70-2.70)

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	369	<div> <div>4%</div> <div>85% 8% 7%</div> </div>
1	C	369	<div> <div>6%</div> <div>86% 7% 7%</div> </div>
1	E	369	<div> <div>4%</div> <div>86% 7% 7%</div> </div>
2	B	10	<div> <div>10%</div> <div>70% 20% 10%</div> </div>

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Mol	Chain	Length	Quality of chain
2	D	10	 80% 10% 10%
2	F	10	 60% 30% 10%

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 9036 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 mRNA-binding protein PUF3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	343	Total	C	N	O	S	0	0	0
			2771	1767	463	531	10			
1	C	343	Total	C	N	O	S	0	0	0
			2771	1767	463	531	10			
1	E	343	Total	C	N	O	S	0	0	0
			2771	1767	463	531	10			

- Molecule 2 is a RNA chain called RNA (5'-R(P\*CP\*UP\*UP\*GP\*UP\*AP\*UP\*AP\*UP\*A)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	10	Total	C	N	O	P	0	0	0
			210	94	33	73	10			
2	D	10	Total	C	N	O	P	0	0	0
			210	94	33	73	10			
2	F	10	Total	C	N	O	P	0	0	0
			210	94	33	73	10			

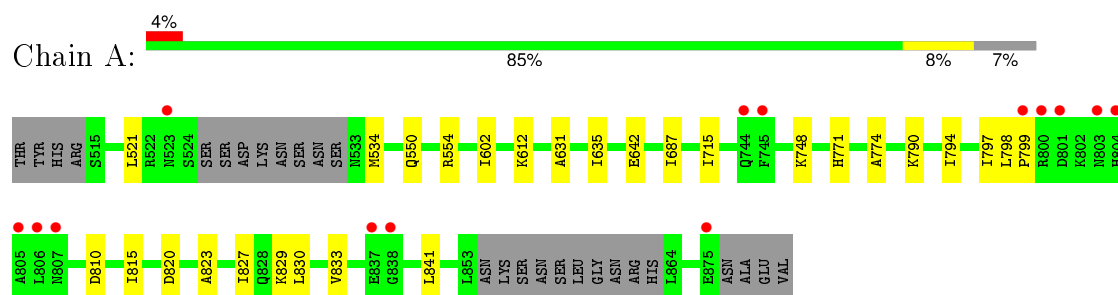
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	38	Total	O	0	0
			38	38		
3	B	1	Total	O	0	0
			1	1		
3	C	22	Total	O	0	0
			22	22		
3	D	3	Total	O	0	0
			3	3		
3	E	25	Total	O	0	0
			25	25		
3	F	4	Total	O	0	0
			4	4		

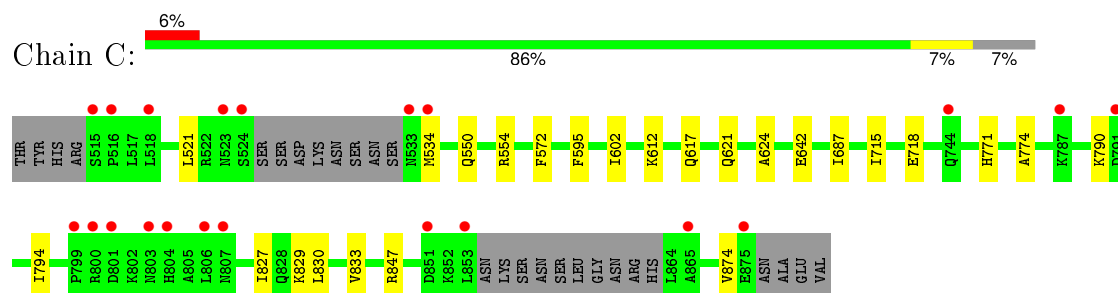
### 3 Residue-property plots [i](#)

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.

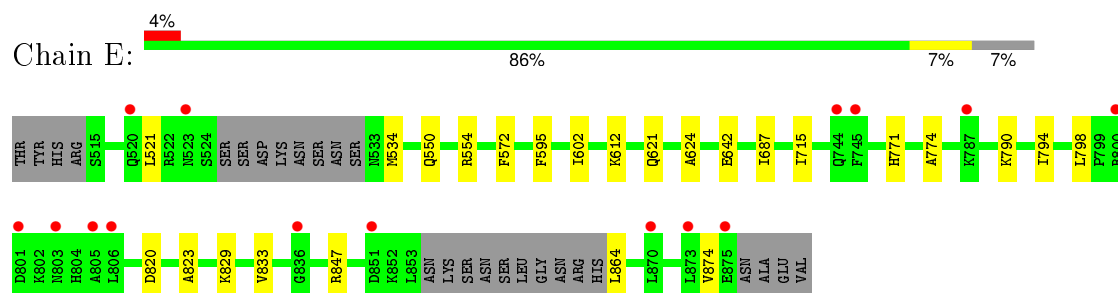
- Molecule 1: mRNA-binding protein PUF3



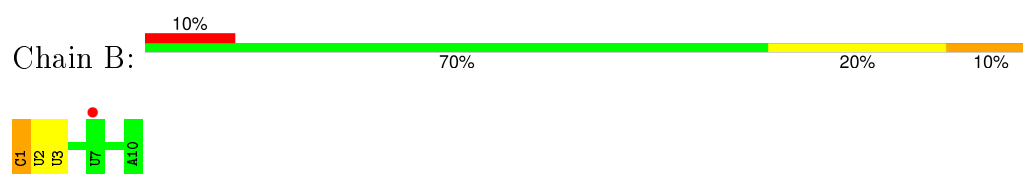
- Molecule 1: mRNA-binding protein PUF3




- Molecule 1: mRNA-binding protein PUF3



- Molecule 2: RNA (5'-R(P\*CP\*UP\*UP\*GP\*UP\*AP\*UP\*AP\*UP\*A)-3')



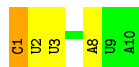
- Molecule 2: RNA (5'-R(P\*CP\*UP\*UP\*GP\*UP\*AP\*UP\*AP\*UP\*A)-3')

Chain D:  80% 10% 10%



- Molecule 2: RNA (5'-R(P\*CP\*UP\*UP\*GP\*UP\*AP\*UP\*AP\*UP\*A)-3')

Chain F:  60% 30% 10%



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	150.08 Å   87.13 Å   124.91 Å 90.00°   116.23°   90.00°	Depositor
Resolution (Å)	28.91 – 3.20 28.91 – 3.20	Depositor EDS
% Data completeness (in resolution range)	97.8 (28.91-3.20) 97.8 (28.91-3.20)	Depositor EDS
$R_{merge}$	0.15	Depositor
$R_{sym}$	0.15	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.21 (at 3.18 Å)	Xtriage
Refinement program	PHENIX	Depositor
R, $R_{free}$	0.247 , 0.297 0.236 , 0.284	Depositor DCC
$R_{free}$ test set	1202 reflections (5.13%)	DCC
Wilson B-factor (Å <sup>2</sup> )	46.6	Xtriage
Anisotropy	0.500	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.26 , 28.4	EDS
Estimated twinning fraction	0.088 for $1/2^*h+3/2^*k, 1/2^*h-1/2^*k, -1/2^*h-1/2^*k-l$ 0.065 for $1/2^*h-3/2^*k, -1/2^*h-1/2^*k, -1/2^*h+1/2^*k-l$	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 23454 reflections	Xtriage
$F_o, F_c$ correlation	0.87	EDS
Total number of atoms	9036	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	62.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.97% 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, 0.375 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	0/2811	0.45	0/3783
1	C	0.32	0/2811	0.45	0/3783
1	E	0.32	0/2811	0.45	0/3783
2	B	0.93	1/233 (0.4%)	1.10	1/358 (0.3%)
2	D	0.96	1/233 (0.4%)	1.16	1/358 (0.3%)
2	F	0.95	1/233 (0.4%)	1.15	2/358 (0.6%)
All	All	0.40	3/9132 (0.0%)	0.55	4/12423 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	F	1	C	OP3-P	-10.84	1.48	1.61
2	D	1	C	OP3-P	-10.82	1.48	1.61
2	B	1	C	OP3-P	-10.75	1.48	1.61

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
2	F	1	C	OP1-P-OP2	-8.09	107.47	119.60
2	D	1	C	OP1-P-OP2	-8.07	107.49	119.60
2	B	1	C	OP1-P-OP2	-7.95	107.68	119.60
2	F	8	A	N1-C6-N6	5.12	121.67	118.60

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	2771	0	2807	16	0
1	C	2771	0	2807	14	0
1	E	2771	0	2807	14	0
2	B	210	0	106	2	0
2	D	210	0	106	1	0
2	F	210	0	106	3	0
3	A	38	0	0	1	0
3	B	1	0	0	0	0
3	C	22	0	0	1	0
3	D	3	0	0	0	0
3	E	25	0	0	0	0
3	F	4	0	0	0	0
All	All	9036	0	8739	49	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 3.

All (49) 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:748:LYS:HD2	3:A:58:HOH:O	1.81	0.79
1:C:771:HIS:HB3	1:C:774:ALA:HB3	1.87	0.56
1:A:687:ILE:HD13	1:A:715:ILE:HA	1.87	0.56
1:A:771:HIS:HB3	1:A:774:ALA:HB3	1.89	0.55
1:E:687:ILE:HD13	1:E:715:ILE:HA	1.88	0.55
1:A:550:GLN:O	1:A:554:ARG:HG3	2.06	0.55
1:E:771:HIS:HB3	1:E:774:ALA:HB3	1.90	0.53
1:E:521:LEU:HB2	1:E:534:MET:HE1	1.91	0.52
1:E:550:GLN:O	1:E:554:ARG:HG3	2.10	0.51
1:C:790:LYS:O	1:C:794:ILE:HG13	2.10	0.51
1:A:602:ILE:HD12	1:A:602:ILE:H	1.76	0.51
1:E:790:LYS:O	1:E:794:ILE:HG13	2.10	0.50
1:A:790:LYS:O	1:A:794:ILE:HG13	2.12	0.49
1:A:799:PRO:HG2	1:A:841:LEU:HB3	1.96	0.47
1:E:602:ILE:HD12	1:E:602:ILE:H	1.79	0.47
1:A:794:ILE:HG22	1:A:798:LEU:HG	1.96	0.47
1:A:521:LEU:HB2	1:A:534:MET:HE3	1.97	0.47
1:E:794:ILE:HG22	1:E:798:LEU:HG	1.97	0.46
1:C:521:LEU:HB2	1:C:534:MET:HE3	1.97	0.46
1:E:829:LYS:O	1:E:833:VAL:HG22	2.16	0.45
1:C:612:LYS:HE2	1:C:642:GLU:OE1	2.17	0.45
1:C:602:ILE:H	1:C:602:ILE:HD12	1.81	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:1:C:H1'	2:D:3:U:H1'	1.99	0.45
1:C:829:LYS:O	1:C:833:VAL:HG22	2.17	0.45
1:C:687:ILE:HD13	1:C:715:ILE:HA	1.97	0.45
1:C:687:ILE:HD12	1:C:718:GLU:CD	2.38	0.45
2:F:1:C:H1'	2:F:3:U:H1'	2.00	0.44
1:A:829:LYS:O	1:A:833:VAL:HG22	2.18	0.44
1:E:572:PHE:HB2	1:E:595:PHE:CE2	2.53	0.43
2:F:2:U:H5''	2:F:3:U:H5'	2.00	0.43
2:B:1:C:H1'	2:B:3:U:H1'	2.00	0.43
2:B:2:U:H5''	2:B:3:U:H5'	2.00	0.43
1:A:631:ALA:O	1:A:635:ILE:HG12	2.17	0.43
1:E:864:LEU:HD22	2:F:1:C:H2'	2.02	0.42
1:A:810:ASP:HA	1:A:815:ILE:HG21	2.02	0.41
1:E:612:LYS:HE2	1:E:642:GLU:OE1	2.20	0.41
1:C:572:PHE:HB2	1:C:595:PHE:CE2	2.54	0.41
1:C:617:GLN:HB2	3:C:29:HOH:O	2.19	0.41
1:C:847:ARG:HE	1:C:874:VAL:HG13	1.85	0.41
1:A:820:ASP:HB3	1:A:823:ALA:HB3	2.02	0.41
1:C:550:GLN:O	1:C:554:ARG:HG3	2.20	0.41
1:A:798:LEU:HA	1:A:799:PRO:HD2	1.93	0.41
1:E:847:ARG:HE	1:E:874:VAL:HG13	1.85	0.41
1:A:827:ILE:HA	1:A:830:LEU:HD12	2.03	0.41
1:C:827:ILE:HA	1:C:830:LEU:HD12	2.03	0.41
1:A:612:LYS:HE2	1:A:642:GLU:OE1	2.21	0.41
1:C:621:GLN:HB3	1:C:624:ALA:HB3	2.02	0.41
1:E:621:GLN:HB3	1:E:624:ALA:HB3	2.02	0.40
1:E:820:ASP:HB3	1:E:823:ALA:HB3	2.02	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	337/369 (91%)	330 (98%)	7 (2%)	0	100	100
1	C	337/369 (91%)	330 (98%)	7 (2%)	0	100	100
1	E	337/369 (91%)	331 (98%)	6 (2%)	0	100	100
All	All	1011/1107 (91%)	991 (98%)	20 (2%)	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	315/339 (93%)	314 (100%)	1 (0%)	94	98
1	C	315/339 (93%)	315 (100%)	0	100	100
1	E	315/339 (93%)	315 (100%)	0	100	100
All	All	945/1017 (93%)	944 (100%)	1 (0%)	95	99

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	797	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	B	9/10 (90%)	0	0
2	D	9/10 (90%)	0	0
2	F	9/10 (90%)	0	0
All	All	27/30 (90%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

#### 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

#### 5.5 Carbohydrates ⓘ

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<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(Å²)	Q<0.9
1	A	343/369 (92%)	-0.07	14 (4%)	41	27	21, 52, 125, 146	0
1	C	343/369 (92%)	0.05	21 (6%)	25	13	23, 51, 127, 148	0
1	E	343/369 (92%)	-0.03	15 (4%)	38	24	22, 50, 123, 142	0
2	B	10/10 (100%)	0.32	1 (10%)	9	5	58, 77, 104, 111	0
2	D	10/10 (100%)	0.60	0	100	100	59, 78, 104, 110	0
2	F	10/10 (100%)	0.37	0	100	100	59, 77, 103, 109	0
All	All	1059/1137 (93%)	-0.00	51 (4%)	34	21	21, 52, 126, 148	0

All (51) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	744	GLN	5.9
1	C	515	SER	4.7
1	A	803	ASN	4.6
1	C	803	ASN	4.2
1	E	875	GLU	4.2
1	E	523	ASN	4.0
1	C	799	PRO	3.9
1	C	744	GLN	3.9
1	C	806	LEU	3.6
1	C	791	ASP	3.6
1	C	787	LYS	3.6
1	A	523	ASN	3.5
1	A	745	PHE	3.5
1	E	803	ASN	3.4
1	E	744	GLN	3.4
1	E	801	ASP	3.4
1	C	875	GLU	3.3
1	C	518	LEU	3.3
1	A	807	ASN	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	806	LEU	3.0
1	A	804	HIS	3.0
1	A	799	PRO	3.0
1	C	851	ASP	3.0
1	C	523	ASN	3.0
1	E	873	LEU	3.0
1	C	800	ARG	2.8
1	C	865	ALA	2.7
1	A	805	ALA	2.7
1	C	534	MET	2.7
1	C	804	HIS	2.7
1	C	516	PRO	2.6
1	C	801	ASP	2.6
1	E	806	LEU	2.6
1	C	807	ASN	2.5
1	C	853	LEU	2.4
1	C	533	ASN	2.4
1	A	837	GLU	2.4
1	E	800	ARG	2.3
1	A	838	GLY	2.3
1	E	836	GLY	2.3
1	E	851	ASP	2.2
2	B	7	U	2.2
1	A	801	ASP	2.2
1	C	524	SER	2.1
1	E	787	LYS	2.1
1	E	520	GLN	2.1
1	A	800	ARG	2.0
1	E	805	ALA	2.0
1	A	875	GLU	2.0
1	E	745	PHE	2.0
1	E	870	LEU	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.