



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 22, 2024 – 01:56 PM EDT

PDB ID : 6K5S  
Title : Crystal structure of the Helical domain of *S. pombe* Tbf1  
Authors : Zhou, Y.Z.; Wang, N.N.; Zhao, Y.C.; Zeng, Z.X.  
Deposited on : 2019-05-31  
Resolution : 1.90 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) : 1.20.1  
EDS : 2.37.1  
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) : 2.37.1

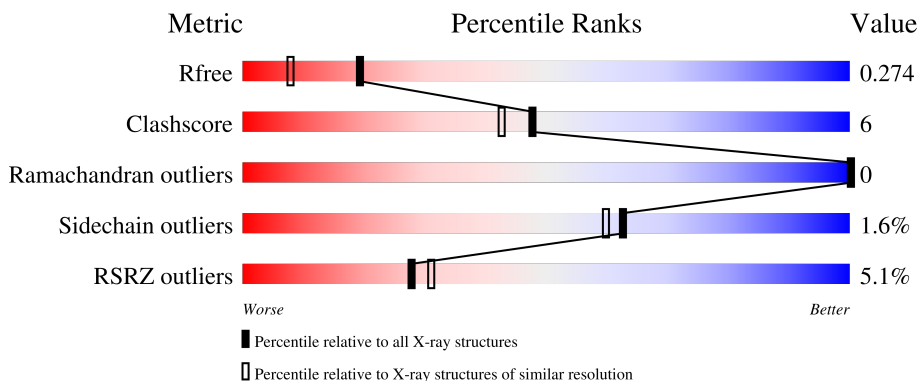
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.90 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	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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	227	 86% 10% 5%
1	B	227	 85% 10% 5%
1	C	227	 12% 82% 14% 5%
1	D	227	 6% 80% 14% 5%

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7380 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 Telomeric DNA-binding factor trf1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	220	1740	1110	296	323	11	0	0	0
1	B	216	1712	1092	292	317	11	0	0	0
1	C	219	1731	1105	295	320	11	0	0	0
1	D	215	1707	1091	290	315	11	0	0	0

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	93	GLY	-	expression tag	UNP Q6E434
A	94	PRO	-	expression tag	UNP Q6E434
A	95	LEU	-	expression tag	UNP Q6E434
A	96	GLY	-	expression tag	UNP Q6E434
A	97	SER	-	expression tag	UNP Q6E434
B	93	GLY	-	expression tag	UNP Q6E434
B	94	PRO	-	expression tag	UNP Q6E434
B	95	LEU	-	expression tag	UNP Q6E434
B	96	GLY	-	expression tag	UNP Q6E434
B	97	SER	-	expression tag	UNP Q6E434
C	93	GLY	-	expression tag	UNP Q6E434
C	94	PRO	-	expression tag	UNP Q6E434
C	95	LEU	-	expression tag	UNP Q6E434
C	96	GLY	-	expression tag	UNP Q6E434
C	97	SER	-	expression tag	UNP Q6E434
D	93	GLY	-	expression tag	UNP Q6E434
D	94	PRO	-	expression tag	UNP Q6E434
D	95	LEU	-	expression tag	UNP Q6E434
D	96	GLY	-	expression tag	UNP Q6E434
D	97	SER	-	expression tag	UNP Q6E434

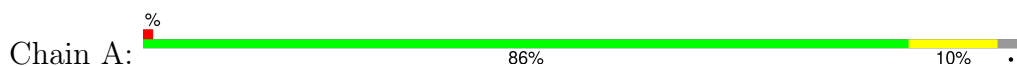
- Molecule 2 is water.

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
2	A	153	Total 153	O 153	0	0
2	B	174	Total 174	O 174	0	0
2	C	72	Total 72	O 72	0	0
2	D	91	Total 91	O 91	0	0

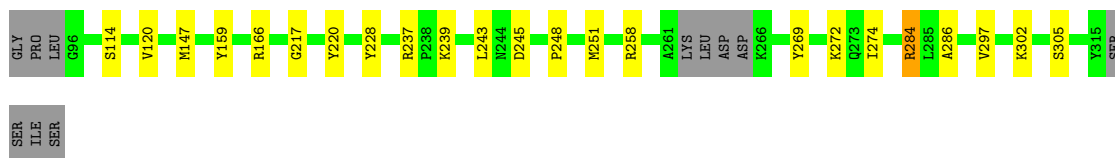
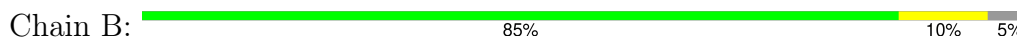
### 3 Residue-property plots [i](#)

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.

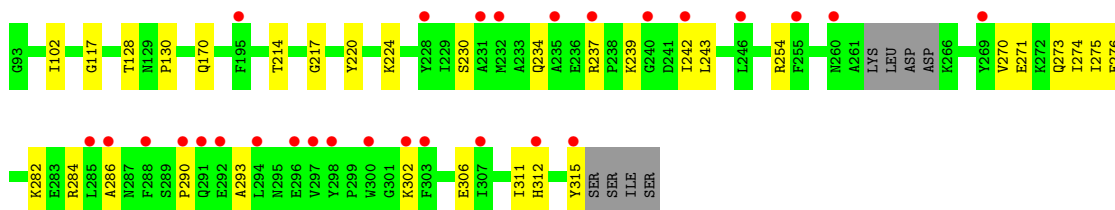
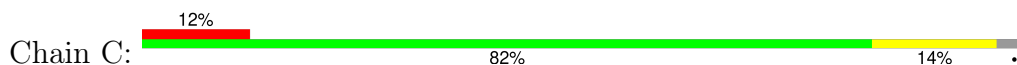
- Molecule 1: Telomeric DNA-binding factor trf1



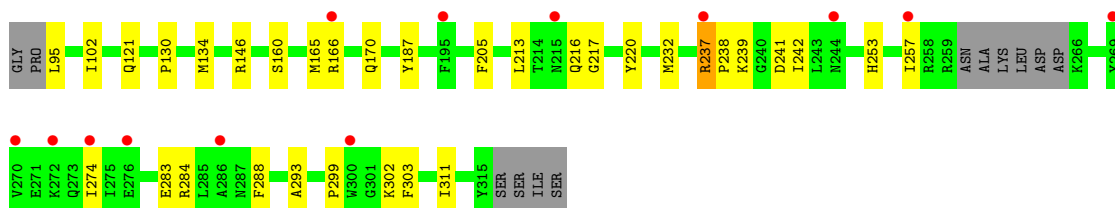
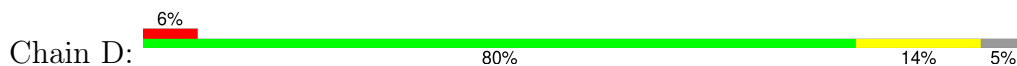
- Molecule 1: Telomeric DNA-binding factor trf1



- Molecule 1: Telomeric DNA-binding factor trf1



- Molecule 1: Telomeric DNA-binding factor trf1



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	38.50Å 80.64Å 77.37Å 111.45° 94.64° 92.05°	Depositor
Resolution (Å)	38.30 – 1.90 38.30 – 1.90	Depositor EDS
% Data completeness (in resolution range)	92.1 (38.30-1.90) 92.2 (38.30-1.90)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.57 (at 1.91Å)	Xtrriage
Refinement program	PHENIX 1.13_2998	Depositor
R, $R_{free}$	0.221 , 0.275 0.222 , 0.274	Depositor DCC
$R_{free}$ test set	3070 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	18.7	Xtrriage
Anisotropy	0.064	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 49.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	7380	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	26.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 79.73 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 5.2300e-07. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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	0.40	0/1773	0.57	1/2395 (0.0%)
1	B	0.42	0/1745	0.55	0/2357
1	C	0.35	0/1765	0.49	0/2385
1	D	0.36	0/1740	0.47	0/2350
All	All	0.38	0/7023	0.52	1/9487 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	232	MET	CG-SD-CE	5.46	108.94	100.20

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	1740	0	1750	20	0
1	B	1712	0	1718	14	0
1	C	1731	0	1739	20	0
1	D	1707	0	1718	36	0
2	A	153	0	0	3	1
2	B	174	0	0	5	0
2	C	72	0	0	1	1
2	D	91	0	0	6	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	7380	0	6925	84	1

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 6.

All (84) 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:219:LEU:HD21	1:A:307:ILE:HD12	1.31	1.11
1:A:234:GLN:HE22	1:D:166:ARG:NH2	1.79	0.80
1:B:166:ARG:NH2	2:B:402:HOH:O	2.13	0.79
1:A:219:LEU:HD21	1:A:307:ILE:CD1	2.12	0.78
1:C:214:THR:HG21	1:D:130:PRO:HG2	1.67	0.77
1:A:318:ILE:O	2:A:401:HOH:O	2.04	0.73
1:A:232:MET:HE3	1:A:242:ILE:HD12	1.72	0.71
1:D:205:PHE:CE2	1:D:311:ILE:HD11	2.26	0.70
1:D:237:ARG:HG3	1:D:242:ILE:HD11	1.74	0.70
1:D:288:PHE:HE2	1:D:293:ALA:HB3	1.58	0.68
1:D:146:ARG:NH1	2:D:404:HOH:O	2.27	0.68
1:D:237:ARG:HD3	1:D:241:ASP:CB	2.26	0.66
1:B:159:TYR:OH	2:B:401:HOH:O	2.12	0.66
1:C:290:PRO:HG2	1:C:293:ALA:HB2	1.77	0.65
1:C:117:GLY:HA2	1:C:312:HIS:NE2	2.13	0.64
1:D:237:ARG:HD3	1:D:241:ASP:HB2	1.79	0.64
1:B:147:MET:HG2	2:D:471:HOH:O	1.97	0.64
1:D:237:ARG:HD2	1:D:242:ILE:HG13	1.80	0.63
1:A:219:LEU:CD2	1:A:307:ILE:HD12	2.19	0.62
1:C:117:GLY:HA2	1:C:312:HIS:CE1	2.35	0.62
1:C:273:GLN:HE22	1:D:130:PRO:HG3	1.66	0.61
1:A:214:THR:HG23	1:A:270:VAL:HG22	1.82	0.60
1:D:121:GLN:NE2	2:D:405:HOH:O	2.35	0.59
1:C:239:LYS:HE3	1:C:286:ALA:HA	1.84	0.59
1:A:302:LYS:O	1:A:306:GLU:HG2	2.04	0.58
1:D:299:PRO:HG2	1:D:302:LYS:HG3	1.85	0.57
1:D:232:MET:HE3	1:D:242:ILE:HD13	1.87	0.56
1:D:160:SER:HB2	1:D:165:MET:HB2	1.87	0.56
1:D:213:LEU:HB2	1:D:216:GLN:HG3	1.88	0.56
1:D:217:GLY:HA3	1:D:274:ILE:HG12	1.87	0.56
1:D:237:ARG:HG3	1:D:242:ILE:CD1	2.37	0.54
1:C:217:GLY:HA3	1:C:274:ILE:HD13	1.90	0.53
1:A:215:ASN:ND2	2:A:409:HOH:O	2.41	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:284:ARG:HH12	1:B:297:VAL:HG11	1.74	0.52
1:C:270:VAL:HA	1:C:273:GLN:HE21	1.74	0.52
1:D:205:PHE:CZ	1:D:311:ILE:HD11	2.45	0.52
1:D:237:ARG:HD3	1:D:241:ASP:HB3	1.92	0.52
1:C:220:TYR:CE1	1:C:224:LYS:HE2	2.44	0.52
1:A:232:MET:CE	1:A:242:ILE:HD12	2.38	0.51
1:B:120:VAL:HG21	1:B:305:SER:OG	2.10	0.51
1:A:95:LEU:HD23	1:A:98:ARG:H	1.76	0.51
1:D:165:MET:HB3	1:D:170:GLN:HB3	1.93	0.50
1:D:232:MET:SD	1:D:239:LYS:HG2	2.52	0.50
1:D:102:ILE:HG13	1:D:170:GLN:HG2	1.93	0.50
1:D:232:MET:CE	1:D:242:ILE:HD13	2.41	0.50
1:D:187:TYR:OH	2:D:401:HOH:O	2.15	0.49
1:C:311:ILE:O	1:C:315:TYR:HD2	1.96	0.49
1:A:317:SER:O	1:A:318:ILE:HB	2.13	0.48
1:B:302:LYS:HE3	2:B:552:HOH:O	2.13	0.48
1:A:232:MET:HA	1:A:232:MET:HE2	1.97	0.47
1:A:235:ALA:HB1	1:D:95:LEU:HD13	1.95	0.47
1:B:114:SER:OG	1:D:95:LEU:HD11	2.15	0.47
1:C:243:LEU:HD22	1:C:282:LYS:HG3	1.96	0.47
1:D:238:PRO:O	1:D:242:ILE:HD12	2.15	0.47
1:A:218:THR:OG1	1:A:277:LYS:NZ	2.48	0.47
1:B:239:LYS:NZ	1:B:286:ALA:O	2.48	0.47
1:B:228:TYR:CE1	1:B:243:LEU:HG	2.50	0.46
1:C:230:SER:O	1:C:234:GLN:HG3	2.15	0.46
1:C:302:LYS:HG2	1:C:306:GLU:OE1	2.15	0.46
1:D:205:PHE:CE2	1:D:311:ILE:CD1	2.98	0.46
1:B:248:PRO:HD2	1:B:251:MET:HG3	1.97	0.45
1:D:253:HIS:O	1:D:257:ILE:HG13	2.16	0.45
1:C:224:LYS:NZ	2:C:411:HOH:O	2.48	0.45
1:A:171:ARG:NE	2:A:406:HOH:O	2.38	0.45
1:D:239:LYS:HE2	1:D:239:LYS:HB2	1.82	0.45
1:C:237:ARG:NH2	1:C:242:ILE:HA	2.31	0.44
1:D:303:PHE:HB2	2:D:445:HOH:O	2.18	0.44
1:A:234:GLN:NE2	1:D:166:ARG:NH2	2.58	0.44
1:B:269:TYR:HA	1:B:272:LYS:NZ	2.33	0.44
1:C:273:GLN:O	1:C:276:GLU:HG3	2.18	0.44
1:C:128:THR:O	1:C:130:PRO:HD3	2.17	0.44
1:C:273:GLN:HA	1:C:276:GLU:HG2	2.00	0.44
1:D:253:HIS:CD2	1:D:257:ILE:HD11	2.52	0.44
1:B:217:GLY:HA3	1:B:274:ILE:HG12	1.99	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:271:GLU:O	1:C:275:ILE:HG13	2.18	0.43
1:C:102:ILE:HG13	1:C:170:GLN:HG2	2.02	0.42
1:B:245:ASP:HB3	2:B:546:HOH:O	2.19	0.42
1:D:283:GLU:OE1	2:D:403:HOH:O	2.22	0.42
1:A:95:LEU:HD22	1:A:98:ARG:HG3	2.01	0.42
1:B:237:ARG:HD2	2:B:474:HOH:O	2.19	0.42
1:A:267:LEU:HD23	1:A:272:LYS:HG2	2.02	0.41
1:A:313:ASN:OD1	1:A:313:ASN:N	2.54	0.41
1:D:95:LEU:HD12	1:D:95:LEU:HA	1.90	0.41
1:D:237:ARG:HB2	1:D:238:PRO:HD2	2.03	0.40

All (1) 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:530:HOH:O	2:C:471:HOH:O[1_665]	2.18	0.02

## 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	216/227 (95%)	212 (98%)	4 (2%)	0	100	100
1	B	212/227 (93%)	210 (99%)	2 (1%)	0	100	100
1	C	215/227 (95%)	211 (98%)	4 (2%)	0	100	100
1	D	211/227 (93%)	208 (99%)	3 (1%)	0	100	100
All	All	854/908 (94%)	841 (98%)	13 (2%)	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	189/195 (97%)	186 (98%)	3 (2%)	62	60
1	B	185/195 (95%)	182 (98%)	3 (2%)	62	60
1	C	187/195 (96%)	185 (99%)	2 (1%)	73	73
1	D	185/195 (95%)	181 (98%)	4 (2%)	52	47
All	All	746/780 (96%)	734 (98%)	12 (2%)	62	60

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

Mol	Chain	Res	Type
1	A	220	TYR
1	A	258	ARG
1	A	305	SER
1	B	220	TYR
1	B	258	ARG
1	B	284	ARG
1	C	254	ARG
1	C	284	ARG
1	D	134	MET
1	D	220	TYR
1	D	237	ARG
1	D	284	ARG

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

Mol	Chain	Res	Type
1	C	273	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

### 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	220/227 (96%)	0.00	3 (1%) 75 77	7, 20, 35, 47	0
1	B	216/227 (95%)	-0.11	0 100 100	7, 19, 31, 37	0
1	C	219/227 (96%)	0.76	28 (12%) 3 4	9, 33, 56, 60	0
1	D	215/227 (94%)	0.49	13 (6%) 21 24	8, 30, 52, 58	0
All	All	870/908 (95%)	0.29	44 (5%) 28 31	7, 24, 50, 60	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	269	TYR	5.4
1	C	240	GLY	5.1
1	D	269	TYR	4.5
1	D	272	LYS	4.1
1	C	315	TYR	4.0
1	C	242	ILE	4.0
1	C	288	PHE	3.9
1	C	246	LEU	3.3
1	D	195	PHE	3.3
1	C	232	MET	3.3
1	C	290	PRO	3.1
1	C	291	GLN	3.0
1	D	276	GLU	2.9
1	C	298	TYR	2.9
1	C	286	ALA	2.9
1	A	313	ASN	2.8
1	C	297	VAL	2.8
1	D	215	ASN	2.8
1	C	285	LEU	2.8
1	D	257	ILE	2.8
1	D	270	VAL	2.7

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Mol	Chain	Res	Type	RSRZ
1	D	274	ILE	2.7
1	C	260	ASN	2.7
1	D	237	ARG	2.7
1	C	231	ALA	2.6
1	C	302	LYS	2.6
1	C	296	GLU	2.6
1	D	286	ALA	2.6
1	C	195	PHE	2.6
1	C	303	PHE	2.6
1	C	235	ALA	2.4
1	C	255	PHE	2.4
1	C	300	TRP	2.4
1	C	228	TYR	2.4
1	C	237	ARG	2.3
1	A	318	ILE	2.3
1	D	166	ARG	2.2
1	C	292	GLU	2.2
1	D	300	TRP	2.1
1	C	307	ILE	2.1
1	C	294	LEU	2.1
1	A	312	HIS	2.0
1	C	312	HIS	2.0
1	D	244	ASN	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.