



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 13, 2017 – 11:29 pm GMT

PDB ID : 2YSU  
Title : Structure of the complex between BtuB and Colicin E2 receptor binding domain  
Authors : Cramer, W.A.; Sharma, O.; Yamashita, E.  
Deposited on : 2007-04-04  
Resolution : 3.50 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  
Xtriage (Phenix) : 1.9-1692  
EDS : trunk28620  
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)  
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) : recalc28949

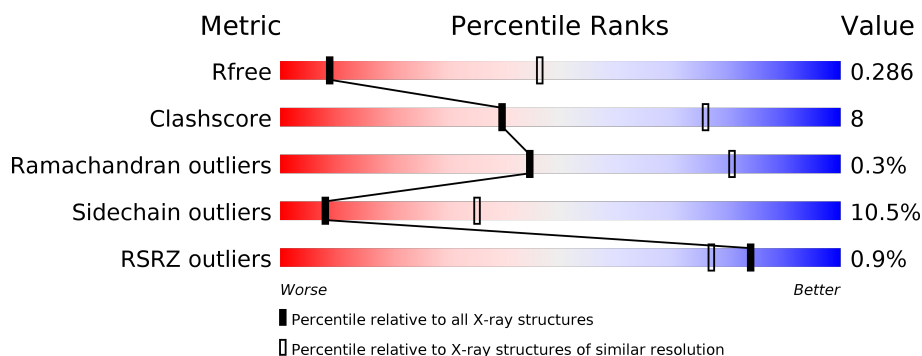
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.50 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))
$R_{free}$	100719	1195 (3.60-3.40)
Clashscore	112137	1322 (3.60-3.40)
Ramachandran outliers	110173	1283 (3.60-3.40)
Sidechain outliers	110143	1284 (3.60-3.40)
RSRZ outliers	101464	1226 (3.60-3.40)

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	594	
2	B	135	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5537 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 Vitamin B12 transporter btuB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	576	Total	C	N	O	S	0	0	0
			4567	2877	781	907	2			

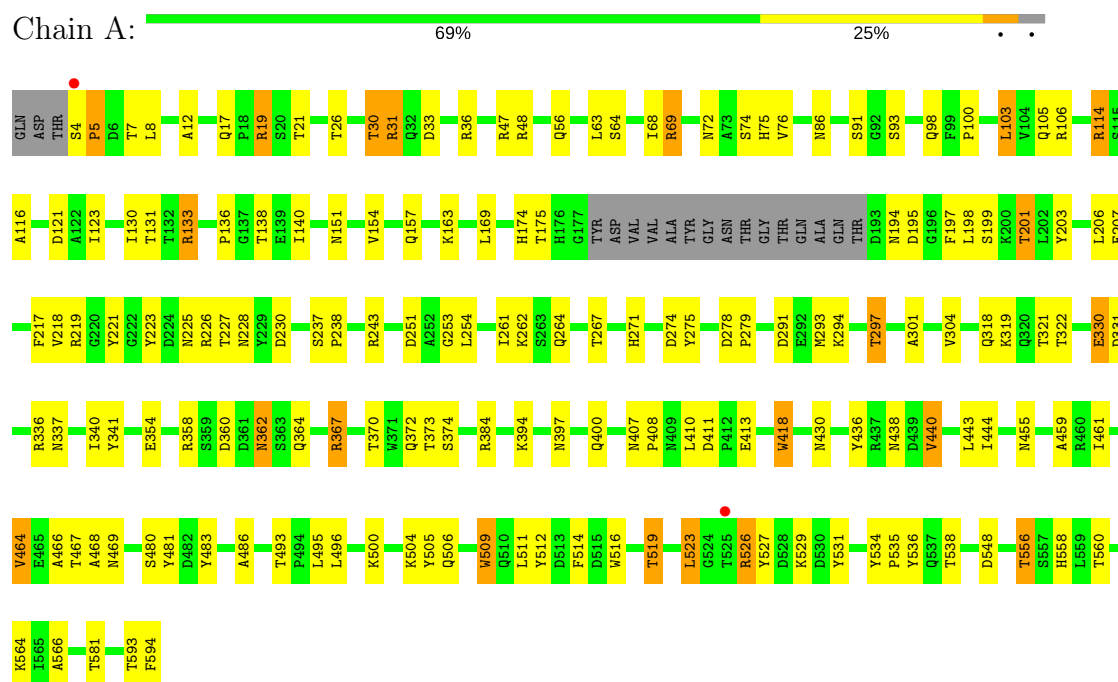
- Molecule 2 is a protein called Colicin-E2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	123	Total	C	N	O	S	0	0	0
			970	582	195	190	3			

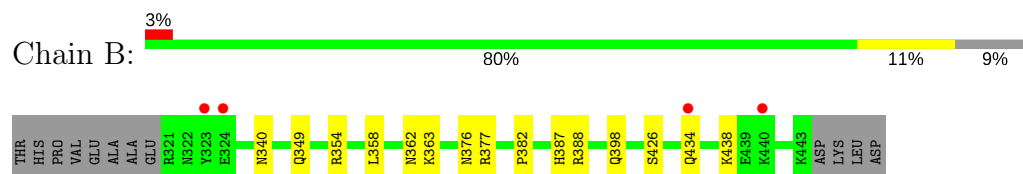
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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: Vitamin B12 transporter btuB



#### • Molecule 2: Colicin-E2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	76.23Å 80.69Å 235.92Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.61 – 3.50 47.61 – 3.50	Depositor EDS
% Data completeness (in resolution range)	99.2 (47.61-3.50) 99.0 (47.61-3.50)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.57 (at 3.48Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.250 , 0.315 0.239 , 0.286	Depositor DCC
$R_{free}$ test set	969 reflections (5.40%)	DCC
Wilson B-factor (Å <sup>2</sup> )	80.6	Xtriage
Anisotropy	0.524	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.28 , 59.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.89	EDS
Total number of atoms	5537	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	77.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.11% 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

### 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	0.39	0/4684	0.55	0/6377
2	B	0.37	0/979	0.45	0/1307
All	All	0.39	0/5663	0.54	0/7684

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

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	4567	0	4288	87	0
2	B	970	0	949	4	0
All	All	5537	0	5237	90	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 8.

All (90) 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:121:ASP:HB3	1:A:394:LYS:HD3	1.52	0.89
1:A:4:SER:N	1:A:5:PRO:HD2	1.91	0.85

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:136:PRO:HA	1:A:157:GLN:HG2	1.57	0.84
1:A:100:PRO:HG2	1:A:103:LEU:CD2	2.09	0.82
1:A:519:THR:HG23	1:A:548:ASP:HB2	1.64	0.80
1:A:271:HIS:CE1	1:A:294:LYS:HE2	2.23	0.73
1:A:440:VAL:HG23	1:A:459:ALA:HB3	1.74	0.70
1:A:174:HIS:HB2	1:A:198:LEU:HD23	1.74	0.69
1:A:464:VAL:HG12	1:A:483:TYR:HB3	1.76	0.67
1:A:261:ILE:HG22	1:A:304:VAL:HG22	1.78	0.65
1:A:264:GLN:HB2	1:A:301:ALA:HB3	1.81	0.62
1:A:199:SER:HA	1:A:225:ASN:HD22	1.64	0.61
1:A:100:PRO:HG2	1:A:103:LEU:HD23	1.82	0.60
1:A:5:PRO:HA	1:A:19:ARG:HD2	1.82	0.60
1:A:556:THR:C	1:A:558:HIS:H	2.07	0.58
1:A:30:THR:H	1:A:33:ASP:HB2	1.67	0.57
1:A:98:GLN:HE22	1:A:225:ASN:CB	2.18	0.56
1:A:354:GLU:HG2	1:A:374:SER:HB2	1.88	0.56
1:A:195:ASP:HB3	1:A:228:ASN:HD22	1.70	0.56
1:A:293:MET:HG2	1:A:322:THR:HG22	1.88	0.56
1:A:75:HIS:CD2	1:A:123:ILE:HD12	2.41	0.56
1:A:48:ARG:HA	1:A:504:LYS:HD3	1.88	0.55
1:A:12:ALA:HA	1:A:114:ARG:HH12	1.72	0.54
1:A:511:LEU:O	1:A:514:PHE:HB2	2.07	0.54
1:A:201:THR:HG23	1:A:223:TYR:HB3	1.90	0.53
1:A:136:PRO:HA	1:A:157:GLN:CG	2.36	0.53
1:A:195:ASP:HB3	1:A:228:ASN:ND2	2.24	0.52
1:A:438:ASN:HB3	1:A:461:ILE:HB	1.90	0.52
1:A:509:TRP:O	1:A:516:TRP:HB2	2.10	0.52
1:A:91:SER:OG	1:A:93:SER:HB3	2.11	0.51
1:A:506:GLN:NE2	1:A:519:THR:HB	2.26	0.50
1:A:207:GLU:HG3	1:A:217:PHE:HB3	1.93	0.50
1:A:12:ALA:HB3	1:A:17:GLN:NE2	2.27	0.50
1:A:330:GLU:HB2	2:B:398:GLN:NE2	2.26	0.49
1:A:531:TYR:HA	1:A:536:TYR:CD2	2.47	0.49
1:A:511:LEU:HG	1:A:512:TYR:HD1	1.78	0.48
1:A:217:PHE:CE2	1:A:253:GLY:HA3	2.49	0.48
1:A:558:HIS:HD2	1:A:593:THR:O	1.97	0.47
1:A:4:SER:N	1:A:5:PRO:CD	2.69	0.47
1:A:466:ALA:HB3	1:A:481:TYR:HB3	1.96	0.47
1:A:418:TRP:C	1:A:418:TRP:CD1	2.88	0.47
1:A:430:ASN:O	1:A:468:ALA:HA	2.15	0.47
1:A:243:ARG:HA	1:A:275:TYR:O	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:558:HIS:CD2	1:A:593:THR:O	2.69	0.46
1:A:199:SER:HA	1:A:225:ASN:ND2	2.29	0.45
1:A:360:ASP:O	1:A:367:ARG:HA	2.16	0.45
1:A:72:ASN:HB2	1:A:75:HIS:ND1	2.31	0.45
1:A:174:HIS:HD2	1:A:198:LEU:HB2	1.81	0.45
1:A:100:PRO:HG2	1:A:103:LEU:HD22	1.94	0.45
1:A:411:ASP:HB2	1:A:455:ASN:HD21	1.82	0.45
1:A:116:ALA:HA	1:A:358:ARG:HB3	1.99	0.45
1:A:140:ILE:HG13	1:A:154:VAL:HG13	1.99	0.45
1:A:74:SER:HB3	1:A:394:LYS:HE2	1.99	0.45
1:A:523:LEU:HD13	1:A:526:ARG:HH12	1.82	0.45
1:A:106:ARG:HB3	1:A:130:ILE:HB	1.98	0.45
1:A:267:THR:HA	1:A:297:THR:O	2.17	0.44
1:A:509:TRP:CG	1:A:509:TRP:O	2.70	0.44
1:A:105:GLN:HB3	1:A:133:ARG:HG2	1.97	0.44
1:A:413:GLU:HG2	1:A:443:LEU:HA	1.98	0.44
1:A:56:GLN:HG3	1:A:64:SER:HB3	1.99	0.44
1:A:341:TYR:HB3	1:A:358:ARG:HD3	1.98	0.44
1:A:203:TYR:CD2	1:A:221:TYR:HB3	2.53	0.43
1:A:496:LEU:HB2	1:A:527:TYR:O	2.18	0.43
2:B:382:PRO:HA	2:B:387:HIS:CD2	2.54	0.43
1:A:31:ARG:HG3	1:A:105:GLN:OE1	2.18	0.43
1:A:98:GLN:HE22	1:A:225:ASN:HB2	1.82	0.43
1:A:197:PHE:HD2	1:A:227:THR:HB	1.82	0.43
1:A:7:THR:O	1:A:19:ARG:N	2.48	0.43
1:A:397:ASN:OD1	1:A:400:GLN:HG2	2.19	0.43
1:A:36:ARG:NH1	1:A:36:ARG:HB3	2.33	0.42
1:A:410:LEU:HD13	1:A:444:ILE:HD13	2.01	0.42
1:A:534:TYR:HA	1:A:535:PRO:C	2.40	0.42
1:A:407:ASN:HD22	1:A:408:PRO:HD2	1.84	0.41
1:A:529:LYS:HA	1:A:538:THR:HA	2.01	0.41
2:B:434:GLN:O	2:B:438:LYS:HG2	2.20	0.41
1:A:219:ARG:NE	1:A:251:ASP:OD1	2.53	0.41
1:A:278:ASP:HA	1:A:279:PRO:HD2	1.81	0.41
2:B:358:LEU:O	2:B:362:ASN:HB2	2.20	0.41
1:A:103:LEU:O	1:A:131:THR:HA	2.20	0.41
1:A:69:ARG:HG2	1:A:436:TYR:CZ	2.54	0.41
1:A:486:ALA:HB1	1:A:495:LEU:HD12	2.02	0.41
1:A:68:ILE:HD13	1:A:76:VAL:HG21	2.02	0.41
1:A:274:ASP:HB3	1:A:291:ASP:HB2	2.02	0.41
1:A:467:THR:HG22	1:A:480:SER:HB2	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:337:ASN:HD22	1:A:362:ASN:HA	1.86	0.41
1:A:237:SER:HA	1:A:238:PRO:HD3	1.88	0.40
1:A:319:LYS:HG3	1:A:336:ARG:HG2	2.04	0.40
1:A:564:LYS:HD3	1:A:566:ALA:HB2	2.02	0.40
1:A:69:ARG:CG	1:A:436:TYR:CZ	3.05	0.40
1:A:140:ILE:HD12	1:A:594:PHE:HE1	1.86	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	572/594 (96%)	533 (93%)	38 (7%)	1 (0%)	51	85
2	B	121/135 (90%)	117 (97%)	3 (2%)	1 (1%)	22	65
All	All	693/729 (95%)	650 (94%)	41 (6%)	2 (0%)	44	80

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	5	PRO
2	B	376	ASN

### 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	481/495 (97%)	428 (89%)	53 (11%)	7	33
2	B	93/103 (90%)	86 (92%)	7 (8%)	16	51
All	All	574/598 (96%)	514 (90%)	60 (10%)	8	35

All (60) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	LEU
1	A	19	ARG
1	A	21	THR
1	A	26	THR
1	A	30	THR
1	A	31	ARG
1	A	47	ARG
1	A	63	LEU
1	A	69	ARG
1	A	86	ASN
1	A	103	LEU
1	A	114	ARG
1	A	133	ARG
1	A	138	THR
1	A	151	ASN
1	A	163	LYS
1	A	169	LEU
1	A	175	THR
1	A	194	ASN
1	A	201	THR
1	A	206	LEU
1	A	218	VAL
1	A	226	ARG
1	A	230	ASP
1	A	254	LEU
1	A	262	LYS
1	A	297	THR
1	A	318	GLN
1	A	321	THR
1	A	330	GLU
1	A	331	ASP
1	A	340	ILE
1	A	362	ASN
1	A	364	GLN
1	A	367	ARG

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Mol	Chain	Res	Type
1	A	370	THR
1	A	372	GLN
1	A	373	THR
1	A	384	ARG
1	A	418	TRP
1	A	440	VAL
1	A	464	VAL
1	A	469	ASN
1	A	493	THR
1	A	500	LYS
1	A	505	TYR
1	A	509	TRP
1	A	519	THR
1	A	523	LEU
1	A	526	ARG
1	A	556	THR
1	A	560	THR
1	A	581	THR
2	B	340	ASN
2	B	349	GLN
2	B	354	ARG
2	B	363	LYS
2	B	377	ARG
2	B	388	ARG
2	B	426	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (28) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	17	GLN
1	A	57	ASN
1	A	86	ASN
1	A	98	GLN
1	A	174	HIS
1	A	225	ASN
1	A	228	ASN
1	A	271	HIS
1	A	295	GLN
1	A	302	ASN
1	A	303	ASN
1	A	318	GLN
1	A	320	GLN

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Mol	Chain	Res	Type
1	A	335	GLN
1	A	337	ASN
1	A	347	GLN
1	A	362	ASN
1	A	372	GLN
1	A	400	GLN
1	A	407	ASN
1	A	506	GLN
1	A	521	GLN
1	A	558	HIS
2	B	341	GLN
2	B	387	HIS
2	B	391	GLN
2	B	405	ASN
2	B	429	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 carbohydrates 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	576/594 (96%)	-0.35	2 (0%) 93 90	64, 74, 85, 105	0
2	B	123/135 (91%)	-0.01	4 (3%) 47 39	74, 84, 99, 105	0
All	All	699/729 (95%)	-0.29	6 (0%) 84 77	64, 76, 92, 105	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	323	TYR	3.7
2	B	440	LYS	2.8
1	A	525	THR	2.2
1	A	4	SER	2.2
2	B	324	GLU	2.1
2	B	434	GLN	2.1

### 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.