



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 10:41 AM UTC

PDB ID : 4XOH / pdb_00004xoh
Title : Mechanistic insights into anchorage of the contractile ring from yeast to humans
Authors : Chen, Z.; Wu, J.-Q.; Wang, J.; Guan, R.; Sun, L.; Lee, I.-J.; Liu, Y.; Chen, M.
Deposited on : 2015-01-16
Resolution : 2.80 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

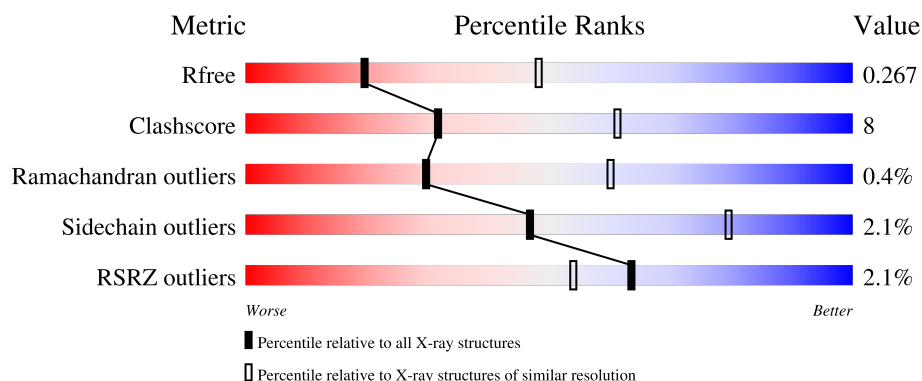
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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}	180053	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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 $\leq 5\%$. 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	325	 2% 62% 18% 18%
1	B	325	 % 64% 18% 18%
1	C	325	 2% 64% 18% 18%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 6483 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 Division mal foutue 1 protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	268	Total	C	N	O	S	0	1	0
			2171	1398	377	386	10			
1	A	266	Total	C	N	O	S	0	0	0
			2147	1379	367	392	9			
1	B	268	Total	C	N	O	S	0	0	0
			2165	1390	372	394	9			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	1	GLY	-	expression tag	UNP P78953
C	2	HIS	-	expression tag	UNP P78953
C	3	MET	-	expression tag	UNP P78953
C	106	GLY	-	linker	UNP P78953
C	107	GLY	-	linker	UNP P78953
C	108	SER	-	linker	UNP P78953
C	109	THR	-	linker	UNP P78953
C	110	GLY	-	linker	UNP P78953
C	111	SER	-	linker	UNP P78953
C	112	SER	-	linker	UNP P78953
C	113	GLY	-	linker	UNP P78953
C	114	GLY	-	linker	UNP P78953
A	1	GLY	-	expression tag	UNP P78953
A	2	HIS	-	expression tag	UNP P78953
A	3	MET	-	expression tag	UNP P78953
A	106	GLY	-	linker	UNP P78953
A	107	GLY	-	linker	UNP P78953
A	108	SER	-	linker	UNP P78953
A	109	THR	-	linker	UNP P78953
A	110	GLY	-	linker	UNP P78953
A	111	SER	-	linker	UNP P78953
A	112	SER	-	linker	UNP P78953
A	113	GLY	-	linker	UNP P78953

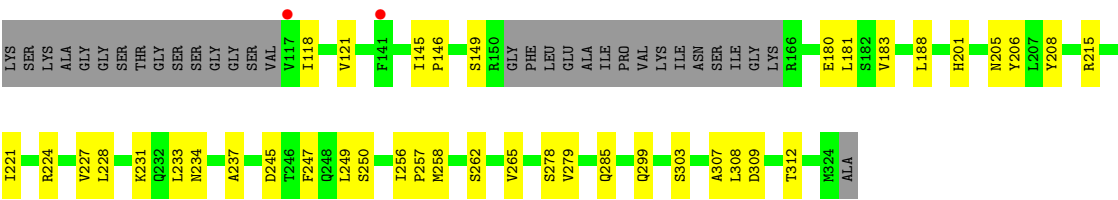
Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
A	114	GLY	-	linker	UNP P78953
B	1	GLY	-	expression tag	UNP P78953
B	2	HIS	-	expression tag	UNP P78953
B	3	MET	-	expression tag	UNP P78953
B	106	GLY	-	linker	UNP P78953
B	107	GLY	-	linker	UNP P78953
B	108	SER	-	linker	UNP P78953
B	109	THR	-	linker	UNP P78953
B	110	GLY	-	linker	UNP P78953
B	111	SER	-	linker	UNP P78953
B	112	SER	-	linker	UNP P78953
B	113	GLY	-	linker	UNP P78953
B	114	GLY	-	linker	UNP P78953

- Molecule 1: Division mal foutue 1 protein





4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	80.94Å 80.94Å 314.44Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	68.40 – 2.80 68.40 – 2.80	Depositor EDS
% Data completeness (in resolution range)	86.7 (68.40-2.80) 86.8 (68.40-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.84 (at 2.81Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7.3_928)	Depositor
R, R_{free}	0.235 , 0.269 0.236 , 0.267	Depositor DCC
R_{free} test set	1319 reflections (4.32%)	wwPDB-VP
Wilson B-factor (Å ²)	74.4	Xtriage
Anisotropy	0.616	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 88.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	0.047 for -h,-k,l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	6483	wwPDB-VP
Average B, all atoms (Å ²)	125.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.82% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	0.29	0/2192	0.70	2/2968 (0.1%)
1	B	0.27	0/2210	0.69	1/2992 (0.0%)
1	C	0.30	0/2220	0.70	2/3002 (0.1%)
All	All	0.29	0/6622	0.70	5/8962 (0.1%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	50	GLY	N-CA-C	-5.92	107.65	114.69
1	C	28	SER	CA-C-N	5.42	126.62	119.84
1	C	28	SER	C-N-CA	5.42	126.62	119.84
1	A	218	ASP	CB-CA-C	-5.20	110.59	116.63
1	A	50	GLY	N-CA-C	-5.04	108.29	115.30

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	2147	0	2156	37	0
1	B	2165	0	2178	37	0
1	C	2171	0	2195	40	0
All	All	6483	0	6529	105	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 (105) 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:C:213:LEU:HD21	1:C:286:LEU:HB3	1.59	0.83
1:A:39:GLN:HG2	1:B:61:HIS:H	1.51	0.76
1:C:53:ARG:NH1	1:C:54:LEU:O	2.20	0.74
1:C:274:ILE:HB	1:C:286:LEU:HB2	1.70	0.72
1:C:215:ARG:O	1:C:221:ILE:N	2.23	0.71
1:A:57:ASP:HB2	1:B:42:GLN:HB2	1.75	0.68
1:A:220:SER:OG	1:A:222:ARG:NH1	2.27	0.67
1:C:144:GLU:HB2	1:A:19:LEU:HD13	1.78	0.66
1:C:215:ARG:HH22	1:C:224:ARG:HB2	1.61	0.66
1:B:228:LEU:HD13	1:B:233:LEU:HD13	1.76	0.65
1:C:10[A]:ARG:NH1	1:C:180:GLU:OE2	2.31	0.62
1:B:249:LEU:HA	1:B:278:SER:HA	1.82	0.61
1:B:221:ILE:HD11	1:B:265:VAL:HG12	1.81	0.61
1:A:198:ASP:HB3	1:A:317:LEU:HD11	1.84	0.60
1:B:250:SER:HA	1:B:279:VAL:HG22	1.83	0.60
1:C:233:LEU:HD11	1:C:247:PHE:HB3	1.84	0.59
1:B:8:LEU:HB2	1:B:180:GLU:HG3	1.84	0.58
1:A:183:VAL:HG13	1:A:188:LEU:HD11	1.84	0.58
1:A:30:ILE:O	1:A:45:TRP:N	2.32	0.57
1:C:229:ARG:HB3	1:A:27:HIS:CD2	2.39	0.57
1:B:54:LEU:HB3	1:B:56:HIS:HD2	1.72	0.55
1:B:145:ILE:HD12	1:B:146:PRO:HD2	1.89	0.55
1:C:145:ILE:HD12	1:C:146:PRO:HD2	1.88	0.54
1:A:72:PHE:HB3	1:A:75:ILE:HD11	1.89	0.54
1:B:299:GLN:O	1:B:303:SER:OG	2.23	0.54
1:B:43:LEU:HD12	1:B:44:PRO:HD2	1.90	0.54
1:A:42:GLN:HB2	1:B:57:ASP:HB2	1.88	0.54
1:A:79:ASP:H	1:A:118:ILE:HD12	1.72	0.54
1:C:232:GLN:NE2	1:C:234:ASN:HD21	2.05	0.54
1:C:8:LEU:HB2	1:C:180:GLU:HG3	1.89	0.53
1:A:216:LEU:HD13	1:A:221:ILE:HG12	1.91	0.52
1:B:205:ASN:HD21	1:B:307:ALA:HB2	1.74	0.52
1:C:228:LEU:HD12	1:C:233:LEU:HB3	1.92	0.52
1:C:309:ASP:OD2	1:B:26:VAL:HG13	2.09	0.51
1:B:224:ARG:HH11	1:B:237:ALA:HB2	1.76	0.51
1:C:200:ARG:NH1	1:B:29:PRO:HG3	2.25	0.51
1:C:19:LEU:HD13	1:A:144:GLU:HB2	1.91	0.51

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:262:SER:HB3	1:A:265:VAL:HG13	1.91	0.51
1:A:232:GLN:NE2	1:A:246:THR:OG1	2.38	0.51
1:C:72:PHE:HB3	1:C:75:ILE:HD11	1.94	0.50
1:B:262:SER:HB3	1:B:265:VAL:HG13	1.93	0.50
1:A:26:VAL:HG12	1:A:27:HIS:HD2	1.78	0.49
1:A:66:PHE:CZ	1:A:68:VAL:HB	2.47	0.49
1:C:298:LEU:HA	1:C:301:MET:HG2	1.95	0.49
1:B:215:ARG:NH2	1:B:245:ASP:OD1	2.32	0.48
1:A:323:PHE:HD2	1:A:324:MET:HE2	1.77	0.48
1:C:15:LEU:HD12	1:C:56:HIS:HB2	1.96	0.48
1:A:310:ARG:HA	1:A:311:GLY:HA2	1.59	0.48
1:C:208:TYR:HE1	1:C:227:VAL:HG13	1.79	0.48
1:A:145:ILE:HD12	1:A:146:PRO:HD2	1.95	0.48
1:C:312:THR:HG22	1:C:314:LYS:HB2	1.95	0.47
1:C:234:ASN:HB3	1:C:243:TYR:HD1	1.80	0.47
1:C:231:LYS:HE3	1:C:305:SER:HB3	1.96	0.47
1:A:26:VAL:CG1	1:A:27:HIS:HD2	2.27	0.47
1:A:125:ALA:HB2	1:A:147:ILE:HG12	1.95	0.47
1:B:231:LYS:NZ	1:B:303:SER:O	2.47	0.46
1:C:35:ASN:HB3	1:C:69:SER:HB3	1.97	0.46
1:A:11:PHE:CE1	1:A:175:CYS:HB2	2.51	0.46
1:A:10:ARG:HH22	1:A:185:GLU:HG2	1.81	0.46
1:A:207:LEU:HD21	1:A:303:SER:HB2	1.97	0.46
1:A:118:ILE:HG22	1:A:119:LYS:HG3	1.98	0.45
1:C:265:VAL:HB	1:C:270:LEU:HD12	1.98	0.45
1:C:37:PRO:O	1:C:38:THR:OG1	2.28	0.45
1:A:10:ARG:NH1	1:A:188:LEU:HD22	2.31	0.45
1:B:181:LEU:HB2	1:B:183:VAL:HG12	1.99	0.45
1:A:201:HIS:HB3	1:A:312:THR:HG21	1.99	0.45
1:B:183:VAL:HG13	1:B:188:LEU:HD11	1.99	0.44
1:B:201:HIS:HB3	1:B:312:THR:HG22	1.99	0.44
1:C:66:PHE:CE2	1:C:68:VAL:HB	2.52	0.44
1:C:210:GLU:HB2	1:C:225:PHE:CE2	2.52	0.44
1:C:274:ILE:HG23	1:C:298:LEU:HD21	2.00	0.44
1:B:62:VAL:HG23	1:B:66:PHE:CD1	2.53	0.43
1:C:270:LEU:HA	1:C:289:ASP:HA	2.00	0.43
1:C:308:LEU:HD11	1:C:317:LEU:HB3	2.00	0.43
1:C:234:ASN:HB3	1:C:243:TYR:CD1	2.54	0.43
1:B:206:TYR:CE2	1:B:208:TYR:HB3	2.53	0.43
1:B:8:LEU:HA	1:B:63:ASP:HA	2.01	0.42
1:B:26:VAL:HG21	1:B:118:ILE:HD11	2.01	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:187:GLU:N	1:A:187:GLU:OE1	2.53	0.42
1:C:245:ASP:OD1	1:C:246:THR:N	2.53	0.42
1:A:6:LEU:HA	1:A:7:PRO:HD3	1.90	0.42
1:C:16:ASN:O	1:C:53:ARG:HD2	2.20	0.42
1:C:198:ASP:HB3	1:C:317:LEU:HD11	2.02	0.42
1:C:274:ILE:N	1:C:286:LEU:O	2.38	0.42
1:A:25:GLU:H	1:A:25:GLU:CD	2.27	0.42
1:B:256:ILE:HD12	1:B:257:PRO:HD2	2.02	0.42
1:B:62:VAL:HG22	1:B:63:ASP:O	2.21	0.41
1:B:308:LEU:HG	1:B:312:THR:HG21	2.02	0.41
1:C:235:PHE:CD1	1:C:245:ASP:HB3	2.55	0.41
1:B:309:ASP:O	1:B:312:THR:HG23	2.20	0.41
1:B:6:LEU:HA	1:B:7:PRO:HD3	1.86	0.41
1:B:233:LEU:HD12	1:B:233:LEU:HA	1.87	0.41
1:C:233:LEU:CD1	1:C:247:PHE:HB3	2.48	0.41
1:A:243:TYR:OH	1:A:246:THR:HB	2.20	0.41
1:B:28:SER:HB3	1:B:76:PRO:HG3	2.01	0.41
1:B:227:VAL:HG12	1:B:234:ASN:HB2	2.02	0.41
1:B:247:PHE:CZ	1:B:278:SER:HB3	2.56	0.41
1:A:274:ILE:HG23	1:A:298:LEU:HD21	2.03	0.41
1:C:225:PHE:HB2	1:C:239:LYS:HA	2.02	0.41
1:A:9:GLY:C	1:A:62:VAL:HG12	2.47	0.40
1:A:36:THR:HB	1:A:66:PHE:HE1	1.87	0.40
1:B:258:MET:HE1	1:B:285:GLN:HB3	2.03	0.40
1:C:232:GLN:OE1	1:A:26:VAL:HB	2.22	0.40
1:A:263:GLU:O	1:A:267:ASN:HB2	2.21	0.40
1:B:33:ILE:HG23	1:B:42:GLN:HG2	2.03	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	260/325 (80%)	241 (93%)	18 (7%)	1 (0%)	30	60
1	B	262/325 (81%)	246 (94%)	15 (6%)	1 (0%)	30	60
1	C	261/325 (80%)	245 (94%)	15 (6%)	1 (0%)	30	60
All	All	783/975 (80%)	732 (94%)	48 (6%)	3 (0%)	30	60

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	27	HIS
1	A	29	PRO
1	C	29	PRO

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	243/285 (85%)	236 (97%)	7 (3%)	37	73
1	B	245/285 (86%)	241 (98%)	4 (2%)	55	83
1	C	243/285 (85%)	239 (98%)	4 (2%)	55	83
All	All	731/855 (86%)	716 (98%)	15 (2%)	47	79

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	62	VAL
1	C	121	VAL
1	C	228	LEU
1	C	229	ARG
1	A	48	VAL
1	A	143	VAL
1	A	183	VAL
1	A	218	ASP
1	A	254	VAL
1	A	279	VAL

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	312	THR
1	B	57	ASP
1	B	73	LEU
1	B	121	VAL
1	B	149	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	49	ASN
1	C	61	HIS
1	C	234	ASN
1	A	27	HIS
1	A	46	GLN
1	A	56	HIS
1	B	39	GLN
1	B	40	ASN
1	B	142	ASN
1	B	285	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 oligosaccharides 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	266/325 (81%)	0.17	8 (3%)	52 42	78, 112, 162, 204	0
1	B	268/325 (82%)	0.19	3 (1%)	78 70	74, 124, 177, 218	0
1	C	268/325 (82%)	0.18	6 (2%)	62 52	47, 117, 212, 232	1 (0%)
All	All	802/975 (82%)	0.18	17 (2%)	63 54	47, 118, 194, 232	1 (0%)

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	216	LEU	4.4
1	A	28	SER	3.8
1	C	215	ARG	3.2
1	A	48	VAL	3.2
1	C	46	GLN	3.0
1	C	26	VAL	2.7
1	A	26	VAL	2.6
1	A	78	GLU	2.6
1	A	49	ASN	2.6
1	A	206	TYR	2.5
1	B	141	PHE	2.5
1	B	117	VAL	2.5
1	B	26	VAL	2.4
1	C	280	ASP	2.3
1	C	246	THR	2.3
1	A	221	ILE	2.2
1	A	118	ILE	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 oligosaccharides 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.