Full wwPDB X-ray Structure Validation Report (i)

Jun 17, 2024 – 07:20 AM EDT

PDB ID	:	5OEZ
Title	:	Crystal structure of Leishmania major fructose-1,6-bisphosphatase in apo form.
Authors	:	Yuan, M.; Vasquez-Valdivieso, M.G.; McNae, I.W.; Michels, P.A.M.; Fothergill-Gilmore, L.A.; Walkinshaw, M.D.
Deposited on	:	2017-07-10
Resolution	:	2.41 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 (i) 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 (1)) were used in the production of this report:

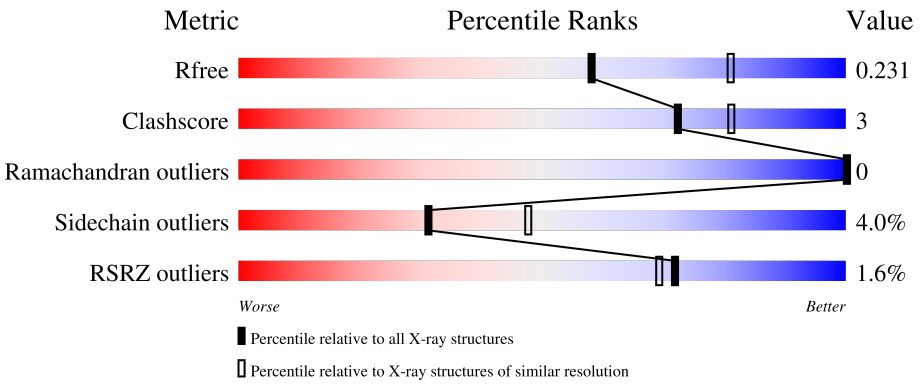
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.41 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	4647 (2.44-2.40)
Clashscore	141614	5161 (2.44-2.40)
Ramachandran outliers	138981	5073 (2.44-2.40)
Sidechain outliers	138945	5074 (2.44-2.40)
RSRZ outliers	127900	4543 (2.44-2.40)

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 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 <=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	351	82% 6% • 11%
1	B	351	2% 81% 7% • 11%
1	C	351	82% 7% 11%
1	D	351	3% 77% 9% • 11%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 9880 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 FBP protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	311	2433	1544	419	456	14	0	0	0
1	B	311	2441	1549	422	456	14	0	1	0
1	C	313	2448	1553	422	459	14	0	0	0
1	D	311	2433	1544	419	456	14	0	0	0

- Molecule 2 is water.

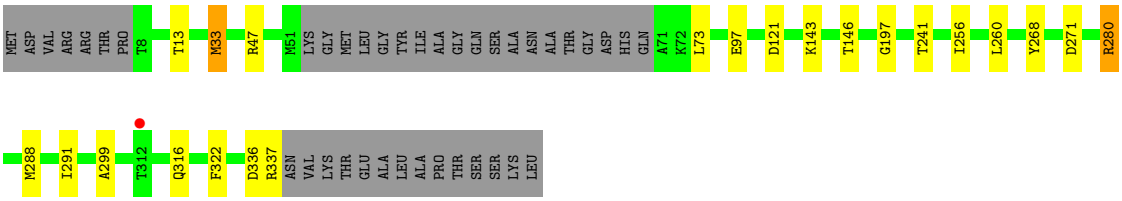
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	36	36	36	0	0
2	B	37	37	37	0	0
2	C	37	37	37	0	0
2	D	15	15	15	0	0

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.

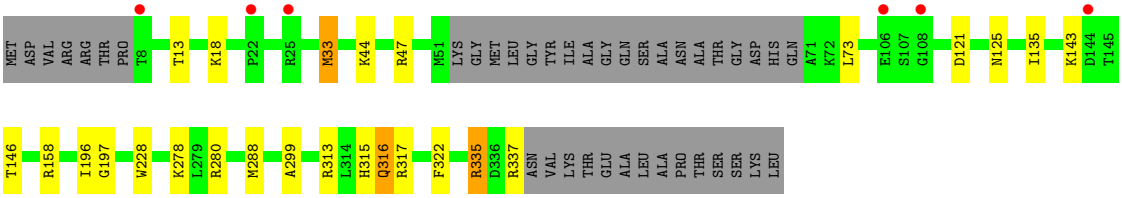
• Molecule 1: FBP protein

Chain A:



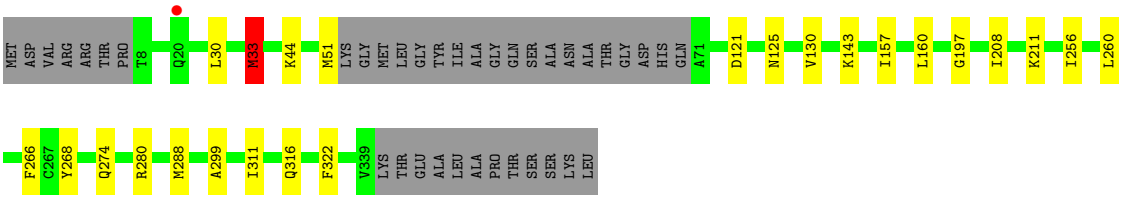
• Molecule 1: FBP protein

Chain B:



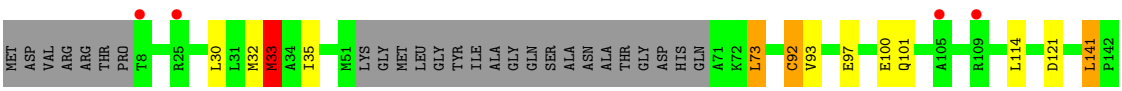
• Molecule 1: FBP protein

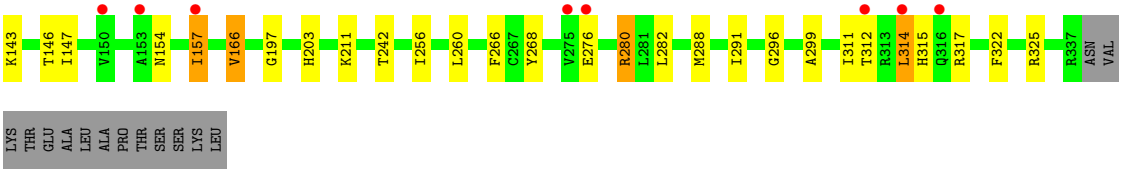
Chain C:



• Molecule 1: FBP protein

Chain D:




K143
T146
I147
V150
A153
N154
I157
V166
G197
H203
K211
T242
I256
L260
F266
C267
Y268
V275
E276
R280
L281
L282
M288
I291
G296
A299
I311
T312
R313
L314
H315
Q316
R317
F322
R325
R337
ASN
VAL
LYS
THR
GLU
ALA
LEU
ALA
PRO
THR
SER
SER
LYS
LEU

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	55.26Å 162.56Å 170.13Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	58.77 – 2.41 58.77 – 2.41	Depositor EDS
% Data completeness (in resolution range)	99.2 (58.77-2.41) 99.2 (58.77-2.41)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.03 (at 2.42Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.187 , 0.225 0.194 , 0.231	Depositor DCC
R_{free} test set	3019 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	50.2	Xtriage
Anisotropy	0.583	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 41.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.016 for -h,l,k	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	9880	wwPDB-VP
Average B, all atoms (Å^2)	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.25% 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, 0.333 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	0.51	0/2482	0.78	1/3356 (0.0%)
1	B	0.53	0/2493	0.78	2/3370 (0.1%)
1	C	0.51	0/2497	0.78	1/3377 (0.0%)
1	D	0.50	0/2482	0.78	3/3356 (0.1%)
All	All	0.51	0/9954	0.78	7/13459 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	47	ARG	NE-CZ-NH1	6.35	123.47	120.30
1	C	33	MET	CG-SD-CE	5.92	109.68	100.20
1	D	33	MET	CG-SD-CE	5.66	109.26	100.20
1	D	73	LEU	CB-CG-CD2	5.28	119.97	111.00
1	B	158	ARG	NE-CZ-NH1	5.12	122.86	120.30
1	B	335	ARG	NE-CZ-NH2	-5.03	117.78	120.30
1	D	166	VAL	CA-CB-CG2	5.01	118.41	110.90

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	2433	0	2433	13	0
1	B	2441	0	2446	20	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	2448	0	2448	15	0
1	D	2433	0	2433	27	0
2	A	36	0	0	0	0
2	B	37	0	0	1	0
2	C	37	0	0	0	0
2	D	15	0	0	0	0
All	All	9880	0	9760	66	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 (66) 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:B:47[B]:ARG:HH11	1:B:47[B]:ARG:HG3	1.05	1.13
1:B:47[B]:ARG:HG3	1:B:47[B]:ARG:NH1	1.74	0.95
1:B:228:TRP:CE2	1:B:335:ARG:HG3	2.03	0.92
1:B:47[B]:ARG:HH11	1:B:47[B]:ARG:CG	1.91	0.74
1:B:33:MET:SD	1:C:33:MET:SD	2.94	0.65
1:A:336:ASP:O	1:A:337:ARG:HG2	1.97	0.64
1:D:296:GLY:O	1:D:325:ARG:NH1	2.31	0.64
1:D:92:CYS:SG	1:D:141:LEU:HD23	2.38	0.63
1:B:196:ILE:HG23	1:C:44:LYS:HE2	1.82	0.61
1:D:30:LEU:HD23	1:D:33:MET:HE2	1.83	0.61
1:D:114:LEU:HD11	1:D:141:LEU:HD22	1.83	0.60
1:C:30:LEU:HD23	1:C:33:MET:HE2	1.84	0.59
1:C:157:ILE:HD13	1:C:160:LEU:HD12	1.84	0.59
1:D:30:LEU:HD23	1:D:33:MET:CE	2.32	0.58
1:C:30:LEU:HD23	1:C:33:MET:CE	2.33	0.58
1:B:47[B]:ARG:NH1	1:B:47[B]:ARG:CG	2.54	0.58
1:B:197:GLY:HA3	1:C:197:GLY:HA3	1.86	0.56
1:B:280:ARG:NH1	1:B:315:HIS:HB3	2.20	0.56
1:B:135:ILE:HG12	1:B:288:MET:HE1	1.89	0.55
1:D:256:ILE:HG21	1:D:288:MET:CE	2.37	0.55
1:A:256:ILE:HG21	1:A:288:MET:CE	2.36	0.55
1:B:44:LYS:O	1:B:47[B]:ARG:HG2	2.07	0.54
1:D:93:VAL:HG12	1:D:114:LEU:HG	1.88	0.54
1:C:256:ILE:HG21	1:C:288:MET:CE	2.37	0.54
1:B:33:MET:SD	1:C:33:MET:HE1	2.49	0.53
1:A:33:MET:SD	1:D:33:MET:SD	3.07	0.53
1:C:125:ASN:HB3	1:C:130:VAL:HG12	1.91	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:33:MET:SD	1:C:33:MET:CE	2.98	0.52
1:D:141:LEU:HD21	1:D:147:ILE:HD12	1.93	0.50
1:A:197:GLY:HA3	1:D:197:GLY:HA3	1.93	0.50
1:B:228:TRP:CD2	1:B:335:ARG:HG3	2.47	0.50
1:A:13:THR:HG23	1:A:33:MET:HE1	1.94	0.48
1:D:154:ASN:HA	1:D:157:ILE:CD1	2.43	0.48
1:D:154:ASN:O	1:D:157:ILE:HD13	2.13	0.47
1:A:33:MET:SD	1:D:33:MET:HE1	2.54	0.47
1:B:280:ARG:NH1	2:B:401:HOH:O	2.48	0.47
1:B:13:THR:HG23	1:B:33:MET:HE1	1.95	0.47
1:D:100:GLU:HG2	1:D:101:GLN:HG3	1.96	0.46
1:D:314:LEU:HD21	1:D:315:HIS:ND1	2.31	0.46
1:D:282:LEU:HD13	1:D:311:ILE:HG12	1.99	0.45
1:D:314:LEU:HD21	1:D:315:HIS:CE1	2.52	0.45
1:C:266:PHE:HZ	1:C:268:TYR:CE2	2.35	0.45
1:A:33:MET:SD	1:D:33:MET:CE	3.05	0.44
1:D:256:ILE:HG21	1:D:288:MET:HE2	2.00	0.44
1:D:266:PHE:HZ	1:D:268:TYR:CE2	2.36	0.44
1:D:97:GLU:OE2	1:D:280:ARG:HD3	2.18	0.44
1:C:256:ILE:HG21	1:C:288:MET:HE2	1.99	0.44
1:C:208:ILE:HG12	1:C:260:LEU:HA	2.00	0.43
1:A:97:GLU:OE2	1:A:280:ARG:HD3	2.18	0.43
1:B:278:LYS:HB3	1:B:317:ARG:HB3	2.01	0.42
1:A:299:ALA:HB1	1:A:322:PHE:CE1	2.54	0.42
1:B:299:ALA:HB1	1:B:322:PHE:CE1	2.54	0.42
1:D:280:ARG:HH21	1:D:317:ARG:NH2	2.17	0.42
1:A:336:ASP:O	1:A:337:ARG:CG	2.66	0.42
1:C:299:ALA:HB1	1:C:322:PHE:CE1	2.55	0.42
1:A:256:ILE:HG21	1:A:288:MET:HE2	2.00	0.42
1:C:157:ILE:CG2	1:C:311:ILE:HG21	2.48	0.42
1:B:228:TRP:CZ2	1:B:335:ARG:HG3	2.50	0.41
1:D:276:GLU:HG2	1:D:317:ARG:HB2	2.03	0.41
1:D:260:LEU:HD21	1:D:291:ILE:HG22	2.02	0.41
1:A:260:LEU:HD21	1:A:291:ILE:HG22	2.02	0.41
1:B:313:ARG:HG3	1:B:316:GLN:HB3	2.02	0.41
1:D:30:LEU:HA	1:D:33:MET:HE2	2.03	0.40
1:D:32:MET:CE	1:D:35:ILE:HD12	2.51	0.40
1:D:299:ALA:HB1	1:D:322:PHE:CE1	2.57	0.40
1:A:256:ILE:HG21	1:A:288:MET:HE1	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	307/351 (88%)	299 (97%)	8 (3%)	0	100	100
1	B	308/351 (88%)	301 (98%)	7 (2%)	0	100	100
1	C	309/351 (88%)	302 (98%)	7 (2%)	0	100	100
1	D	307/351 (88%)	300 (98%)	7 (2%)	0	100	100
All	All	1231/1404 (88%)	1202 (98%)	29 (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	264/295 (90%)	254 (96%)	10 (4%)	33	50
1	B	265/295 (90%)	256 (97%)	9 (3%)	37	54
1	C	266/295 (90%)	258 (97%)	8 (3%)	41	59
1	D	264/295 (90%)	249 (94%)	15 (6%)	20	32
All	All	1059/1180 (90%)	1017 (96%)	42 (4%)	31	48

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	33	MET
1	A	73	LEU

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Mol	Chain	Res	Type
1	A	121	ASP
1	A	143	LYS
1	A	146	THR
1	A	241	THR
1	A	268	TYR
1	A	271	ASP
1	A	280	ARG
1	A	316	GLN
1	B	18	LYS
1	B	33	MET
1	B	73	LEU
1	B	121	ASP
1	B	125	ASN
1	B	143	LYS
1	B	146	THR
1	B	316	GLN
1	B	337	ARG
1	C	33	MET
1	C	51	MET
1	C	121	ASP
1	C	143	LYS
1	C	211	LYS
1	C	274	GLN
1	C	280	ARG
1	C	316	GLN
1	D	33	MET
1	D	73	LEU
1	D	92	CYS
1	D	121	ASP
1	D	141	LEU
1	D	143	LYS
1	D	146	THR
1	D	157	ILE
1	D	166	VAL
1	D	203	HIS
1	D	211	LYS
1	D	242	THR
1	D	280	ARG
1	D	312	THR
1	D	314	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	274	GLN
1	A	315	HIS
1	B	125	ASN
1	C	273	ASN

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 (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	311/351 (88%)	-0.21	1 (0%)	94	93	35, 55, 101, 130	0
1	B	311/351 (88%)	-0.26	6 (1%)	66	64	35, 53, 102, 155	0
1	C	313/351 (89%)	-0.17	1 (0%)	94	93	31, 56, 104, 151	0
1	D	311/351 (88%)	0.04	12 (3%)	39	37	47, 73, 125, 169	0
All	All	1246/1404 (88%)	-0.15	20 (1%)	72	69	31, 60, 111, 169	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	276	GLU	5.1
1	B	22	PRO	4.5
1	D	314	LEU	3.7
1	D	105	ALA	3.7
1	D	8	THR	3.1
1	A	312	THR	2.8
1	D	109	ARG	2.7
1	D	316	GLN	2.7
1	D	157	ILE	2.7
1	B	25	ARG	2.7
1	D	312	THR	2.5
1	B	108	GLY	2.5
1	B	8	THR	2.5
1	D	153	ALA	2.5
1	D	150	VAL	2.3
1	B	144	ASP	2.3
1	D	25	ARG	2.3
1	B	106	GLU	2.2
1	D	275	VAL	2.1
1	C	20	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 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.