Full wwPDB X-ray Structure Validation Report ⓘ

Jun 17, 2024 – 01:02 PM EDT

PDB ID	:	2Y6U
Title	:	Peroxisomal alpha-beta-hydrolase Lpx1 (Yor084w) from Saccharomyces cerevisiae (crystal form II)
Authors	:	Thoms, S.; Niemann, H.H.
Deposited on	:	2011-01-26
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*
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:

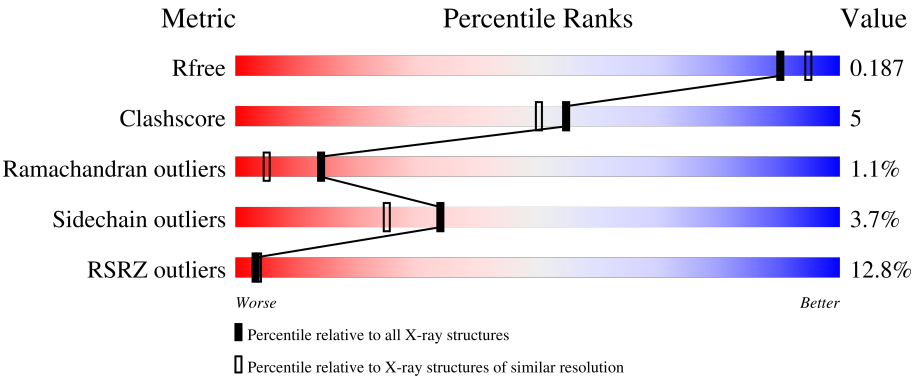
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

1 Overall quality at a glance (i)

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 >=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	398	12% 78% 12% • 7%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 3356 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.

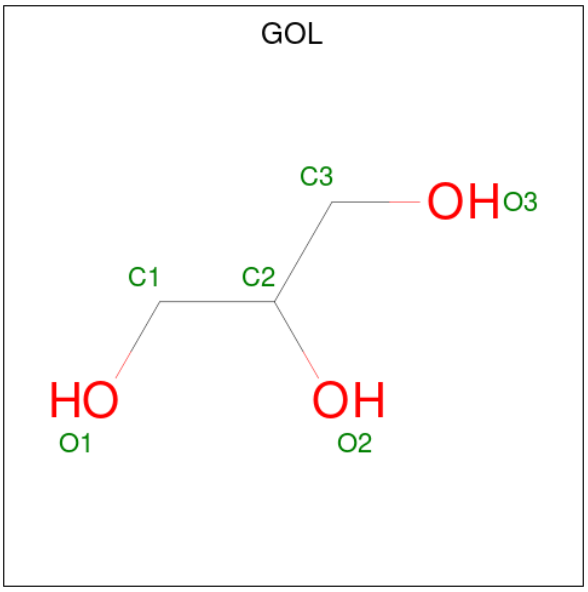
- Molecule 1 is a protein called PEROXISOMAL MEMBRANE PROTEIN LPX1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	371	Total	C	N	O	S	0	21	0
			3070	1947	542	563	18			

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	388	ALA	-	expression tag	UNP Q12405
A	389	ALA	-	expression tag	UNP Q12405
A	390	ALA	-	expression tag	UNP Q12405
A	391	LEU	-	expression tag	UNP Q12405
A	392	GLU	-	expression tag	UNP Q12405
A	393	HIS	-	expression tag	UNP Q12405
A	394	HIS	-	expression tag	UNP Q12405
A	395	HIS	-	expression tag	UNP Q12405
A	396	HIS	-	expression tag	UNP Q12405
A	397	HIS	-	expression tag	UNP Q12405
A	398	HIS	-	expression tag	UNP Q12405

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			6	3	3		

- Molecule 3 is water.

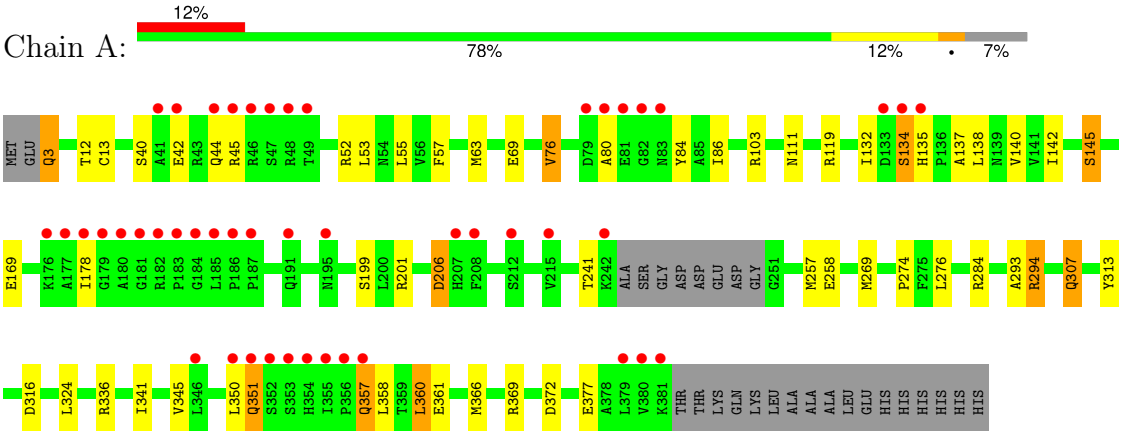
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	280	Total	O	0	0
			280	280		

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: PEROXISOMAL MEMBRANE PROTEIN LPX1

Chain A:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α, β, γ	87.16Å 87.16Å 125.52Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	20.00 – 1.90 43.58 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.9 (20.00-1.90) 99.9 (43.58-1.90)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.56 (at 1.89Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.153 , 0.179 0.163 , 0.187	Depositor DCC
R_{free} test set	2221 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	25.6	Xtriage
Anisotropy	0.069	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 57.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.024 for -h,-k,l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	3356	wwPDB-VP
Average B, all atoms (Å^2)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.74% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, CME, CSO

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	1.23	11/3142 (0.4%)	1.05	16/4249 (0.4%)

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	69	GLU	CG-CD	6.30	1.61	1.51
1	A	119	ARG	CZ-NH1	-6.05	1.25	1.33
1	A	169	GLU	CG-CD	5.99	1.60	1.51
1	A	3	GLN	N-CA	5.99	1.58	1.46
1	A	313	TYR	CD2-CE2	-5.67	1.30	1.39
1	A	307	GLN	CB-CG	-5.46	1.37	1.52
1	A	145	SER	N-CA	5.44	1.57	1.46
1	A	111	ASN	CB-CG	5.37	1.63	1.51
1	A	140	VAL	CB-CG1	5.25	1.63	1.52
1	A	361	GLU	CG-CD	5.22	1.59	1.51
1	A	293	ALA	CA-CB	5.10	1.63	1.52

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	269	MET	CG-SD-CE	10.51	117.01	100.20
1	A	336	ARG	NE-CZ-NH2	-10.02	115.29	120.30
1	A	336	ARG	NE-CZ-NH1	9.03	124.82	120.30
1	A	119	ARG	NE-CZ-NH1	8.48	124.54	120.30
1	A	119	ARG	NE-CZ-NH2	-6.06	117.27	120.30
1	A	360	LEU	CA-CB-CG	5.90	128.88	115.30
1	A	3	GLN	CA-CB-CG	5.71	125.97	113.40
1	A	276	LEU	CB-CG-CD2	5.65	120.61	111.00
1	A	201	ARG	NE-CZ-NH1	5.59	123.10	120.30
1	A	294	ARG	NE-CZ-NH1	5.45	123.02	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	276	LEU	CA-CB-CG	-5.36	102.98	115.30
1	A	103	ARG	NE-CZ-NH2	5.31	122.96	120.30
1	A	119	ARG	CG-CD-NE	-5.18	100.91	111.80
1	A	206[A]	ASP	CB-CG-OD1	-5.11	113.70	118.30
1	A	206[B]	ASP	CB-CG-OD1	-5.11	113.70	118.30
1	A	316	ASP	CB-CG-OD2	-5.04	113.76	118.30

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	3070	0	3096	32	0
2	A	6	0	8	0	0
3	A	280	0	0	7	0
All	All	3356	0	3104	32	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 5.

All (32) 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:372[A]:ASP:OD1	3:A:2278:HOH:O	1.69	1.09
1:A:284:ARG:NH2	3:A:2217:HOH:O	1.91	0.96
1:A:350:LEU:HA	1:A:351:GLN:HB3	1.47	0.95
1:A:12[B]:THR:HG23	3:A:2018:HOH:O	1.69	0.93
1:A:350:LEU:HA	1:A:351:GLN:CB	2.05	0.87
1:A:132:ILE:HD12	1:A:132:ILE:N	1.93	0.81
1:A:132:ILE:HD12	1:A:132:ILE:H	1.54	0.72
1:A:132:ILE:H	1:A:132:ILE:CD1	2.02	0.71
1:A:12[B]:THR:CG2	3:A:2018:HOH:O	2.34	0.68
1:A:350:LEU:CA	1:A:351:GLN:HB3	2.25	0.66
1:A:135:HIS:ND1	3:A:2136:HOH:O	2.29	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:357:GLN:NE2	1:A:357:GLN:H	1.94	0.65
1:A:63:MET:CE	1:A:324:LEU:HD22	2.35	0.56
1:A:53[B]:LEU:HD21	1:A:341:ILE:HG21	1.87	0.55
1:A:134:SER:O	1:A:137:ALA:HB2	2.06	0.54
1:A:350:LEU:CA	1:A:351:GLN:CB	2.83	0.51
1:A:63:MET:HE1	1:A:324:LEU:HD22	1.93	0.49
1:A:294:ARG:HG2	1:A:294:ARG:HH11	1.77	0.49
1:A:53[B]:LEU:HG	1:A:55:LEU:CD1	2.44	0.46
1:A:42[A]:GLU:HG2	1:A:45:ARG:HB2	1.96	0.46
1:A:53[B]:LEU:HB3	1:A:86:ILE:HA	1.98	0.45
1:A:341:ILE:O	1:A:345:VAL:HG23	2.17	0.44
1:A:358:LEU:HD13	1:A:366[A]:MET:SD	2.57	0.44
1:A:350:LEU:HA	1:A:351:GLN:HB2	1.97	0.44
1:A:57:PHE:CZ	1:A:142[B]:ILE:HD12	2.54	0.43
1:A:84:TYR:CD2	1:A:345:VAL:HG11	2.55	0.42
1:A:369:ARG:HD2	3:A:2273:HOH:O	2.20	0.42
1:A:258[B]:GLU:HG2	3:A:2192:HOH:O	2.20	0.41
1:A:53[A]:LEU:HD23	1:A:138:LEU:HB2	2.02	0.41
1:A:206[A]:ASP:OD1	1:A:257:MET:O	2.39	0.41

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	381/398 (96%)	367 (96%)	10 (3%)	4 (1%)	15 6

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	80	ALA
1	A	351	GLN

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Mol	Chain	Res	Type
1	A	134	SER
1	A	76	VAL

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	340/342 (99%)	328 (96%)	12 (4%)	36 27

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

Mol	Chain	Res	Type
1	A	3	GLN
1	A	40	SER
1	A	44	GLN
1	A	76	VAL
1	A	145	SER
1	A	178	ILE
1	A	199	SER
1	A	241	THR
1	A	274	PRO
1	A	307	GLN
1	A	357	GLN
1	A	360	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	351	GLN
1	A	357	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)

7 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
1	CSO	A	26	1	3,6,7	1.04	0	1,6,8	1.01	0
1	CSO	A	205	1	3,6,7	0.58	0	1,6,8	0.22	0
1	CSO	A	298[B]	-	3,6,7	0.62	0	1,6,8	0.21	0
1	CME	A	13	1	8,9,10	1.19	1 (12%)	6,9,11	1.55	1 (16%)
1	CSO	A	127[A]	-	3,6,7	0.75	0	1,6,8	0.35	0
1	CSO	A	298[A]	-	3,6,7	0.60	0	1,6,8	0.17	0
1	CSO	A	127[B]	-	3,6,7	0.72	0	1,6,8	0.96	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	CSO	A	26	1	-	0/1/5/7	-
1	CSO	A	205	1	-	0/1/5/7	-
1	CSO	A	298[B]	-	-	1/1/5/7	-
1	CME	A	13	1	-	1/5/8/10	-
1	CSO	A	127[A]	-	-	0/1/5/7	-
1	CSO	A	298[A]	-	-	0/1/5/7	-
1	CSO	A	127[B]	-	-	0/1/5/7	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	13	CME	CB-SG	-2.83	1.72	1.81

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	13	CME	OH-CZ-CE	-2.40	101.44	110.82

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	298[B]	CSO	N-CA-CB-SG
1	A	13	CME	CA-CB-SG-SD

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	GOL	A	1382	-	5,5,5	0.50	0	5,5,5	0.68	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GOL	A	1382	-	-	0/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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^{th} 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	366/398 (91%)	0.49	47 (12%)	3 4	19, 36, 90, 121	0

All (47) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	180	ALA	14.1
1	A	178	ILE	10.2
1	A	187	PRO	8.7
1	A	181	GLY	8.0
1	A	82	GLY	7.8
1	A	183	PRO	7.7
1	A	81	GLU	7.7
1	A	179	GLY	7.4
1	A	46	ARG	7.3
1	A	182	ARG	6.2
1	A	48	ARG	5.8
1	A	185	LEU	5.7
1	A	184	GLY	5.6
1	A	49	THR	5.5
1	A	352	SER	5.2
1	A	177	ALA	5.1
1	A	133[A]	ASP	4.8
1	A	351	GLN	4.6
1	A	79[A]	ASP	4.3
1	A	242	LYS	4.1
1	A	42[A]	GLU	4.1
1	A	80	ALA	4.0
1	A	350	LEU	4.0
1	A	44	GLN	3.8
1	A	356	PRO	3.6
1	A	134	SER	3.6
1	A	41	ALA	3.6

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Mol	Chain	Res	Type	RSRZ
1	A	45	ARG	3.6
1	A	380	VAL	3.5
1	A	186	PRO	3.5
1	A	135	HIS	3.4
1	A	176	LYS	3.4
1	A	353	SER	3.3
1	A	357	GLN	3.1
1	A	207[A]	HIS	3.0
1	A	83	ASN	2.9
1	A	195[A]	ASN	2.9
1	A	212[A]	SER	2.8
1	A	346	LEU	2.5
1	A	379	LEU	2.5
1	A	47	SER	2.5
1	A	208	PHE	2.5
1	A	355	ILE	2.4
1	A	191	GLN	2.4
1	A	354	HIS	2.4
1	A	381	LYS	2.2
1	A	215	VAL	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (i)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
1	CSO	A	205	7/8	0.92	0.09	42,43,54,58	0
1	CSO	A	298[A]	7/8	0.94	0.10	38,39,41,42	4
1	CSO	A	298[B]	7/8	0.94	0.10	33,39,41,42	4
1	CME	A	13	10/11	0.95	0.09	29,31,45,53	0
1	CSO	A	127[A]	7/8	0.95	0.08	29,31,40,40	4
1	CSO	A	127[B]	7/8	0.95	0.08	29,31,34,37	4
1	CSO	A	26	7/8	0.96	0.07	34,36,44,48	0

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	GOL	A	1382	6/6	0.96	0.16	39,41,45,45	0

6.5 Other polymers

There are no such residues in this entry.