



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 12:50 PM UTC

PDB ID : 8EBF / pdb_00008ebf
Title : C-terminal (TPR) domain of LIC11990 from *Leptospira interrogans*
Authors : Larrieux, N.; Buschiazzo, A.
Deposited on : 2022-08-31
Resolution : 2.50 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

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
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (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

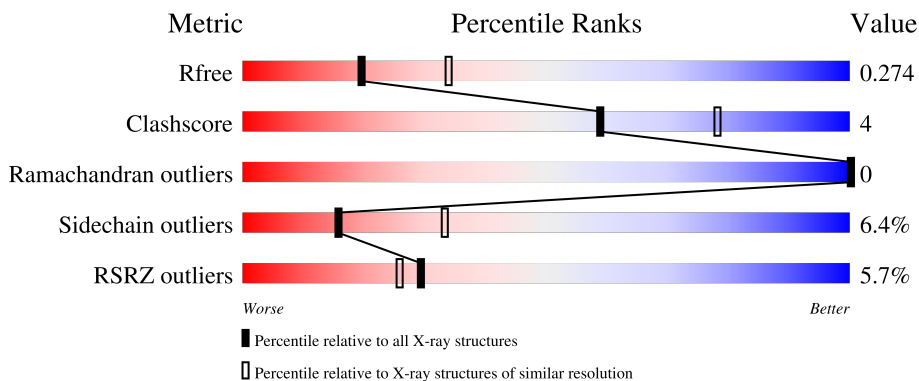
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	718	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 5377 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.

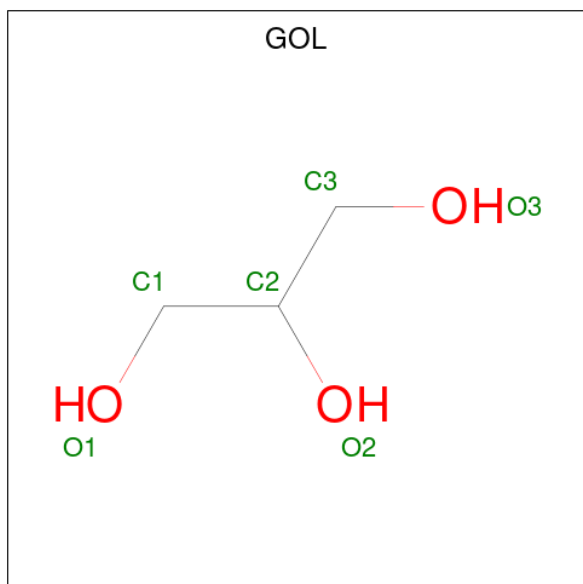
- Molecule 1 is a protein called Cytoplasmic membrane protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	667	5325	3377	904	1030	14	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

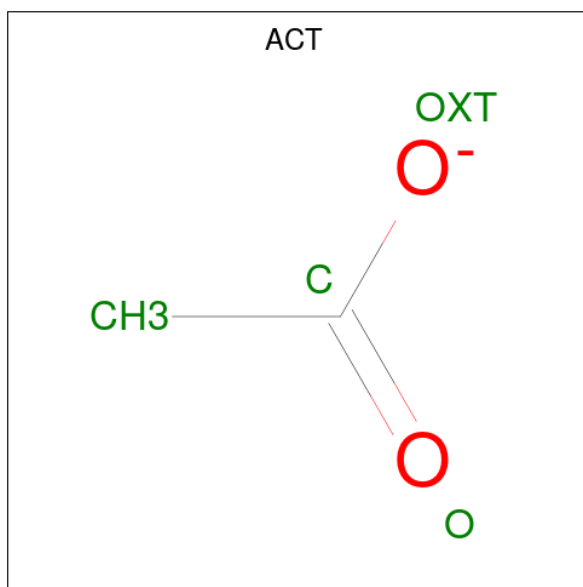
Chain	Residue	Modelled	Actual	Comment	Reference
A	482	HIS	-	expression tag	UNP Q72QW8
A	483	HIS	-	expression tag	UNP Q72QW8
A	484	HIS	-	expression tag	UNP Q72QW8
A	485	HIS	-	expression tag	UNP Q72QW8
A	486	HIS	-	expression tag	UNP Q72QW8
A	487	HIS	-	expression tag	UNP Q72QW8

- Molecule 2 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



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

- Molecule 3 is ACETATE ION (CCD ID: ACT) (formula: $C_2H_3O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		
3	A	1	Total	C	O	0	0
			4	2	2		

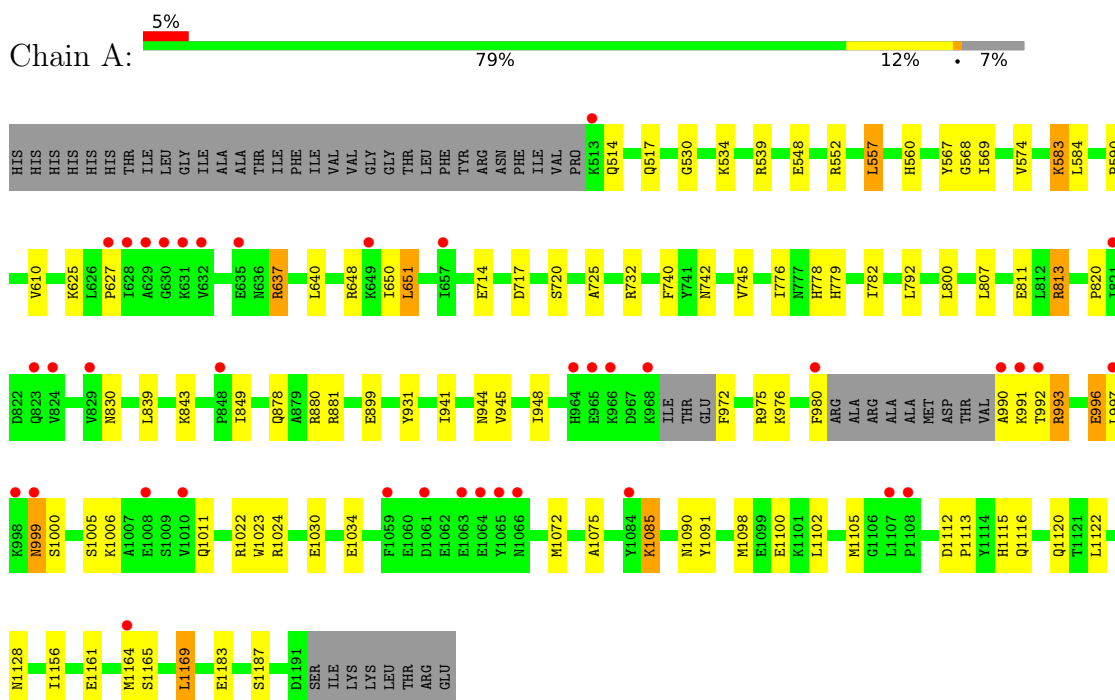
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	28	Total	O	0	0
			28	28		

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: Cytoplasmic membrane protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	50.66Å 100.09Å 170.21Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.68 – 2.50 43.68 – 2.50	Depositor EDS
% Data completeness (in resolution range)	96.5 (43.68-2.50) 96.6 (43.68-2.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.49 (at 2.51Å)	Xtrriage
Refinement program	BUSTER 2.10.4 (8-JUN-2022)	Depositor
R, R_{free}	0.235 , 0.278 0.231 , 0.274	Depositor DCC
R_{free} test set	1465 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å ²)	65.1	Xtrriage
Anisotropy	0.661	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 55.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5377	wwPDB-VP
Average B, all atoms (Å ²)	85.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.48% 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](#)

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

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	0.68	1/5444 (0.0%)	1.10	2/7352 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	637	ARG	CA-C	7.42	1.57	1.53

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	999	ASN	CA-CB-CG	5.48	118.08	112.60
1	A	1183	GLU	N-CA-C	-5.16	98.28	107.98

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	5325	0	5082	46	0
2	A	12	0	16	0	0
3	A	12	0	9	0	0
4	A	28	0	0	0	0
All	All	5377	0	5107	46	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 4.

All (46) 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:980:PHE:HB3	1:A:990:ALA:HA	1.31	1.08
1:A:557:LEU:HD22	1:A:560:HIS:CD2	2.04	0.91
1:A:557:LEU:HD22	1:A:560:HIS:HD2	1.39	0.86
1:A:778:HIS:CE1	1:A:782:ILE:HD11	2.27	0.69
1:A:569:ILE:HD13	1:A:849:ILE:HG22	1.77	0.67
1:A:1075:ALA:HB2	1:A:1090:ASN:HB2	1.77	0.66
1:A:1098:MET:HB2	1:A:1122:LEU:HD13	1.78	0.65
1:A:980:PHE:HE1	1:A:993:ARG:NH1	1.98	0.61
1:A:530:GLY:HA2	1:A:574:VAL:CG2	2.30	0.60
1:A:1116:GLN:O	1:A:1120:GLN:HB2	2.02	0.60
1:A:548:GLU:O	1:A:552:ARG:HG2	2.02	0.60
1:A:539:ARG:NH2	1:A:574:VAL:O	2.38	0.56
1:A:944:ASN:HD21	1:A:1011:GLN:HG2	1.71	0.55
1:A:980:PHE:HB3	1:A:990:ALA:CA	2.21	0.55
1:A:996:GLU:O	1:A:999:ASN:OD1	2.26	0.54
1:A:530:GLY:HA2	1:A:574:VAL:HG23	1.92	0.52
1:A:779:HIS:CD2	1:A:800:LEU:HD21	2.45	0.52
1:A:534:LYS:HA	1:A:539:ARG:HD3	1.92	0.51
1:A:1091:TYR:CZ	1:A:1128:ASN:HB3	2.45	0.51
1:A:567:TYR:HB2	1:A:583:LYS:HG2	1.93	0.51
1:A:980:PHE:HE1	1:A:993:ARG:HH11	1.59	0.51
1:A:568:GLY:HA3	1:A:584:LEU:HG	1.94	0.49
1:A:640:LEU:HB3	1:A:650:ILE:HD11	1.93	0.49
1:A:792:LEU:O	1:A:843:LYS:HE2	2.15	0.47
1:A:627:PRO:HG3	1:A:651:LEU:HD12	1.96	0.46
1:A:590:PRO:O	1:A:648:ARG:HD3	2.17	0.45
1:A:1165:SER:O	1:A:1169:LEU:HB2	2.15	0.45
1:A:742:ASN:HA	1:A:745:VAL:HG22	1.98	0.45
1:A:996:GLU:H	1:A:996:GLU:HG2	1.66	0.44
1:A:1022:ARG:HG3	1:A:1023:TRP:CD1	2.52	0.44
1:A:714:GLU:HG3	1:A:717:ASP:HB2	2.00	0.44
1:A:1085:LYS:H	1:A:1085:LYS:CD	2.30	0.44
1:A:813:ARG:HG2	1:A:820:PRO:HD3	1.99	0.43
1:A:1112:ASP:OD2	1:A:1115:HIS:HD2	2.02	0.43
1:A:1112:ASP:HA	1:A:1113:PRO:HD3	1.92	0.43
1:A:776:ILE:HD11	1:A:807:LEU:HD21	2.01	0.43
1:A:625:LYS:O	1:A:637:ARG:HB3	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:725:ALA:HB2	1:A:740:PHE:HB2	2.02	0.42
1:A:931:TYR:HB3	1:A:941:ILE:HG12	2.01	0.42
1:A:945:VAL:HG23	1:A:948:ILE:HD12	2.01	0.41
1:A:997:LEU:O	1:A:1000:SER:OG	2.36	0.41
1:A:972:PHE:HE1	1:A:975:ARG:HH21	1.68	0.41
1:A:567:TYR:CB	1:A:583:LYS:HG2	2.51	0.41
1:A:1085:LYS:H	1:A:1085:LYS:HD3	1.86	0.41
1:A:732:ARG:NH1	1:A:1023:TRP:CE3	2.89	0.40
1:A:980:PHE:CE1	1:A:993:ARG:NH1	2.84	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	661/718 (92%)	640 (97%)	21 (3%)	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	548/613 (89%)	513 (94%)	35 (6%)	16 33

All (35) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	514	GLN
1	A	517	GLN
1	A	557	LEU
1	A	583	LYS
1	A	610	VAL
1	A	651	LEU
1	A	720	SER
1	A	811	GLU
1	A	813	ARG
1	A	830	ASN
1	A	839	LEU
1	A	878	GLN
1	A	880	ARG
1	A	881	ARG
1	A	899	GLU
1	A	976	LYS
1	A	991	LYS
1	A	992	THR
1	A	993	ARG
1	A	996	GLU
1	A	1005	SER
1	A	1006	LYS
1	A	1024	ARG
1	A	1030	GLU
1	A	1034	GLU
1	A	1072	MET
1	A	1085	LYS
1	A	1100	GLU
1	A	1102	LEU
1	A	1105	MET
1	A	1156	ILE
1	A	1161	GLU
1	A	1164	MET
1	A	1169	LEU
1	A	1187	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	560	HIS
1	A	602	ASN

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Mol	Chain	Res	Type
1	A	742	ASN
1	A	795	HIS
1	A	878	GLN
1	A	918	ASN
1	A	944	ASN
1	A	1116	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](#)

5 ligands 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	$\# Z > 2$
2	GOL	A	1201	-	5,5,5	0.12	0	5,5,5	0.40	0
3	ACT	A	1202	-	3,3,3	0.97	0	3,3,3	1.57	0
2	GOL	A	1203	-	5,5,5	0.09	0	5,5,5	0.36	0
3	ACT	A	1205	-	3,3,3	1.01	0	3,3,3	1.64	1 (33%)
3	ACT	A	1204	-	3,3,3	0.90	0	3,3,3	1.59	1 (33%)

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	1201	-	-	1/4/4/4	-
2	GOL	A	1203	-	-	0/4/4/4	-

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1205	ACT	OXT-C-O	2.25	130.38	122.03
3	A	1204	ACT	OXT-C-O	2.12	129.90	122.03

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1201	GOL	O2-C2-C3-O3

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, 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	667/718 (92%)	0.37	38 (5%) 29 26	59, 83, 121, 185	0

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	628	ILE	5.1
1	A	629	ALA	4.8
1	A	990	ALA	4.6
1	A	1107	LEU	3.9
1	A	632	VAL	3.5
1	A	631	LYS	3.5
1	A	627	PRO	3.4
1	A	1164	MET	3.2
1	A	1061	ASP	3.1
1	A	824	VAL	3.1
1	A	1065	TYR	2.9
1	A	968	LYS	2.9
1	A	1059	PHE	2.8
1	A	998	LYS	2.8
1	A	997	LEU	2.7
1	A	966	LYS	2.7
1	A	1064	GLU	2.6
1	A	635	GLU	2.6
1	A	991	LYS	2.5
1	A	1108	PRO	2.5
1	A	1010	VAL	2.4
1	A	1066	ASN	2.4
1	A	823	GLN	2.3
1	A	1063	GLU	2.3
1	A	513	LYS	2.3
1	A	965	GLU	2.2
1	A	630	GLY	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	999	ASN	2.2
1	A	1008	GLU	2.2
1	A	992	THR	2.1
1	A	980	PHE	2.1
1	A	829	VAL	2.1
1	A	848	PRO	2.1
1	A	821	ILE	2.0
1	A	964	HIS	2.0
1	A	649	LYS	2.0
1	A	657	ILE	2.0
1	A	1084	TYR	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 oligosaccharides in this entry.

6.4 Ligands [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, 95th 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(\AA^2)	Q<0.9
3	ACT	A	1205	4/4	0.60	0.19	96,96,96,96	0
2	GOL	A	1203	6/6	0.74	0.18	104,104,104,104	0
2	GOL	A	1201	6/6	0.76	0.14	98,99,99,99	0
3	ACT	A	1202	4/4	0.79	0.17	73,73,73,74	0
3	ACT	A	1204	4/4	0.83	0.13	88,88,88,88	0

6.5 Other polymers [i](#)

There are no such residues in this entry.