Full wwPDB X-ray Structure Validation Report (i)

Mar 19, 2026 – 10:11 AM JST

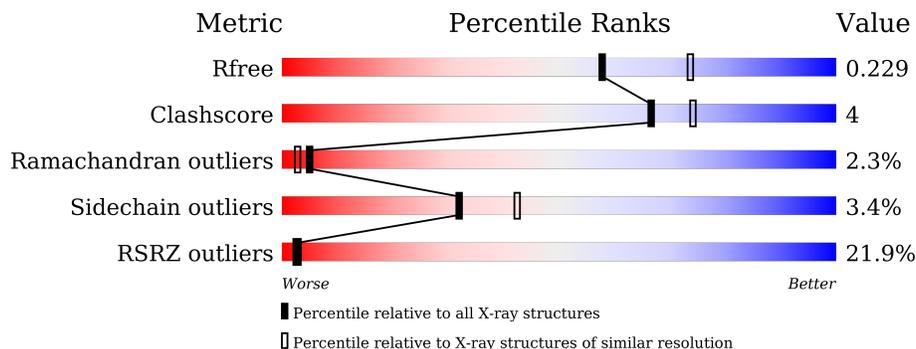|		
PDB ID	:	24QI / pdb_000024qi
Title	:	Crystal structure of a tailspike depolymerase (Belisarius_gp86) from Acinetobacter phage Belisarius
Authors	:	Matyuta, I.O.; Shneider, M.M.; Timoshina, O.Y.; Boyko, K.M.
Deposited on	:	2026-03-16
Resolution	:	2.20 Å(reported)

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 2.20 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	Percentile Ranks	Value
Rfree		0.229
Clashscore		4
Ramachandran outliers		2.3%
Sidechain outliers		3.4%
RSRZ outliers		21.9%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	5791 (2.20-2.20)
Clashscore	180529	6634 (2.20-2.20)
Ramachandran outliers	177936	6560 (2.20-2.20)
Sidechain outliers	177891	6561 (2.20-2.20)
RSRZ outliers	164620	5791 (2.20-2.20)

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	599	21% / 81% / 14%

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 4614 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 Tailspike depolymerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	575	Total 4409	C 2789	N 740	O 867	S 13	0	4	0

- Molecule 2 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).
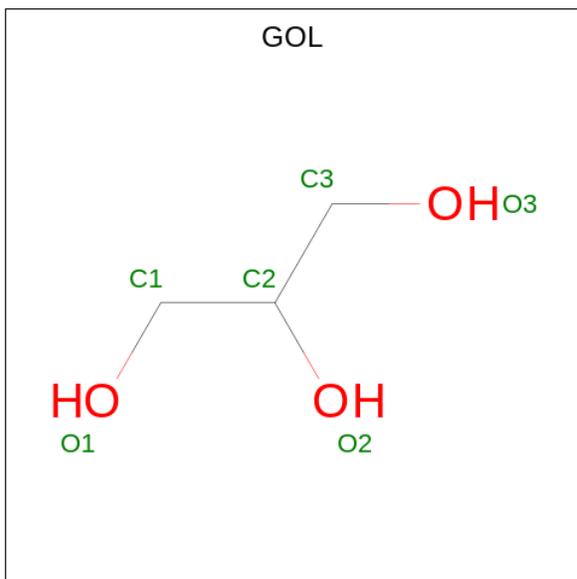
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 6	C 3	O 3	0	0
2	A	1	Total 6	C 3	O 3	0	0

- Molecule 3 is TRIETHYLENE GLYCOL (CCD ID: PGE) (formula: $C_6H_{14}O_4$).

PGE
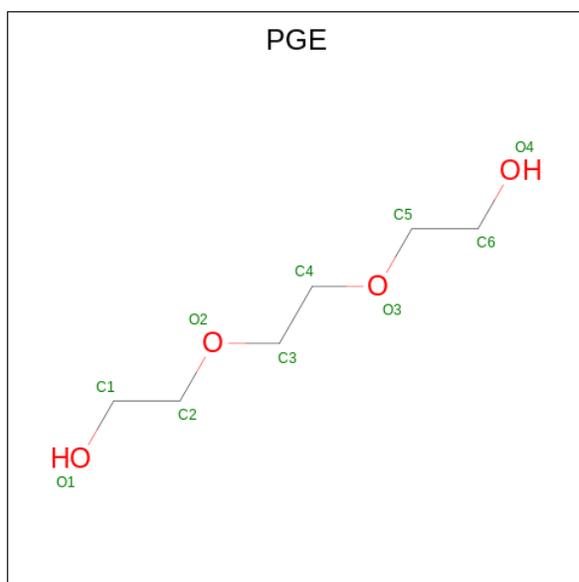
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 10	C 6	O 4	0	0
3	A	1	Total 10	C 6	O 4	0	0

• Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	173	Total 173	O 173	0	0

3 Residue-property plots ⓘ

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: Tailspike depolymerase
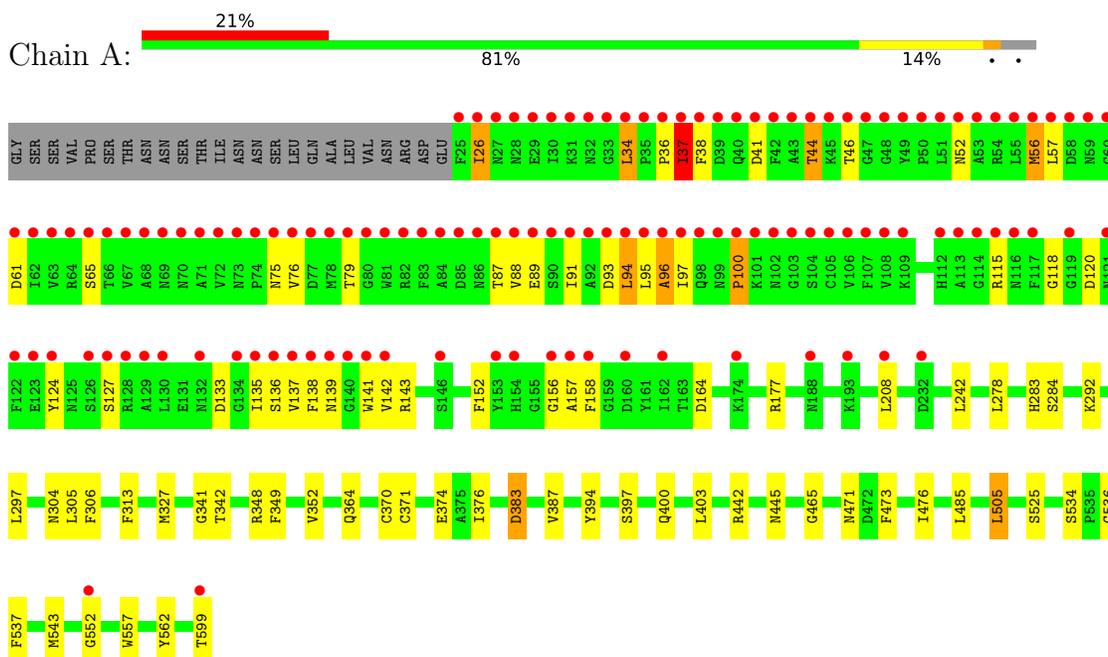
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α, β, γ	100.97Å 100.97Å 784.52Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	49.67 – 2.20 49.67 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.6 (49.67-2.20) 99.6 (49.67-2.20)	Depositor EDS
R_{merge}	0.30	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.77 (at 2.20Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.210 , 0.226 0.216 , 0.229	Depositor DCC
R_{free} test set	3996 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	39.9	Xtriage
Anisotropy	0.236	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 40.8	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	4614	wwPDB-VP
Average B, all atoms (Å^2)	54.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.37% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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, PGE

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	1.29	6/4520 (0.1%)	1.47	24/6146 (0.4%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	5

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	465	GLY	C-O	7.92	1.30	1.23
1	A	397	SER	C-O	6.78	1.32	1.23
1	A	278	LEU	C-O	5.81	1.31	1.24
1	A	525	SER	C-O	5.42	1.31	1.24
1	A	376	ILE	C-O	5.40	1.30	1.24
1	A	371	CYS	C-O	5.38	1.30	1.24

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	599	THR	CA-C-O	-6.38	109.95	120.80
1	A	177	ARG	CB-CA-C	-6.14	100.41	110.85
1	A	37	ILE	CB-CA-C	6.12	121.32	111.29
1	A	473	PHE	CA-CB-CG	6.08	119.88	113.80
1	A	94	LEU	N-CA-C	-5.90	102.88	110.19
1	A	157	ALA	CA-C-N	5.88	132.77	121.54
1	A	157	ALA	C-N-CA	5.88	132.77	121.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	177	ARG	N-CA-CB	5.79	118.74	110.16
1	A	292	LYS	CB-CA-C	5.62	120.00	109.71
1	A	61	ASP	CA-CB-CG	5.52	118.12	112.60
1	A	41	ASP	CA-C-N	5.46	128.35	120.38
1	A	41	ASP	C-N-CA	5.46	128.35	120.38
1	A	56	MET	CA-C-N	5.37	131.79	121.54
1	A	56	MET	C-N-CA	5.37	131.79	121.54
1	A	348	ARG	NE-CZ-NH2	5.35	124.02	119.20
1	A	152	PHE	CA-C-N	5.32	127.41	120.28
1	A	152	PHE	C-N-CA	5.32	127.41	120.28
1	A	44	THR	CA-C-N	5.21	127.53	120.65
1	A	44	THR	C-N-CA	5.21	127.53	120.65
1	A	177	ARG	CG-CD-NE	-5.16	100.64	112.00
1	A	100	PRO	N-CA-CB	-5.13	97.87	103.25
1	A	476	ILE	CB-CA-C	5.11	117.79	110.33
1	A	536	GLY	CA-C-O	-5.08	118.66	122.37
1	A	94	LEU	CA-C-O	-5.05	116.70	122.01

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	156	GLY	Peptide
1	A	26	ILE	Peptide
1	A	552	GLY	Peptide
1	A	87	THR	Peptide
1	A	96	ALA	Peptide

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	4409	0	4167	30	0
2	A	12	0	16	0	0
3	A	20	0	28	3	0
4	A	173	0	0	0	0
All	All	4614	0	4211	31	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 (31) 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:485:LEU:HD23	1:A:505:LEU:HD13	1.61	0.81
1:A:118:GLY:O	1:A:143:ARG:NH2	2.20	0.74
1:A:342:THR:HG23	3:A:604:PGE:H12	1.80	0.62
1:A:387:VAL:HG21	1:A:403:LEU:HD22	1.82	0.61
1:A:95:LEU:HD21	1:A:138:PHE:HB3	1.84	0.59
1:A:284:SER:HA	1:A:306:PHE:O	2.11	0.51
1:A:95:LEU:HD12	1:A:139:ASN:HD22	1.75	0.50
1:A:124:TYR:HB2	1:A:141:TRP:CZ2	2.49	0.48
1:A:543:MET:HA	1:A:557[B]:TRP:CE3	2.50	0.47
1:A:537:PHE:HA	1:A:562:TYR:O	2.15	0.47
1:A:124:TYR:HB2	1:A:141:TRP:CE2	2.50	0.47
1:A:94:LEU:C	1:A:96:ALA:H	2.23	0.46
1:A:133:ASP:OD2	1:A:136:SER:OG	2.30	0.46
1:A:137:VAL:HA	1:A:141:TRP:O	2.16	0.46
1:A:297:LEU:HB3	1:A:327:MET:HE2	1.98	0.46
1:A:313:PHE:O	1:A:349:PHE:HA	2.15	0.45
1:A:283:HIS:O	1:A:305:LEU:HA	2.17	0.45
1:A:445:ASN:HD22	1:A:471:ASN:HB2	1.80	0.44
1:A:305:LEU:O	1:A:341:GLY:HA3	2.18	0.44
1:A:89:GLU:HB2	1:A:93:ASP:OD2	2.18	0.43
1:A:364:GLN:HA	1:A:394:TYR:O	2.19	0.43
1:A:383:ASP:OD1	1:A:442[A]:ARG:NH2	2.52	0.43
1:A:124:TYR:HD2	1:A:141:TRP:CD1	2.38	0.42
1:A:370:CYS:HA	1:A:400:GLN:O	2.20	0.42
3:A:603:PGE:H2	3:A:603:PGE:H6	2.00	0.42
1:A:352:VAL:HA	1:A:374:GLU:O	2.20	0.41
1:A:137:VAL:HG23	1:A:142:VAL:HG22	2.02	0.41
1:A:403:LEU:C	1:A:403:LEU:HD12	2.45	0.41
1:A:304:ASN:OD1	3:A:604:PGE:H2	2.21	0.41
1:A:37:ILE:HG13	1:A:38:PHE:N	2.36	0.41
1:A:306:PHE:HA	1:A:342:THR:O	2.21	0.41

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	577/599 (96%)	520 (90%)	44 (8%)	13 (2%)	5	3

All (13) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	26	ILE
1	A	36	PRO
1	A	52	ASN
1	A	56	MET
1	A	120	ASP
1	A	127	SER
1	A	164	ASP
1	A	57	LEU
1	A	75	ASN
1	A	158	PHE
1	A	100	PRO
1	A	34	LEU
1	A	135	ILE

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	469/508 (92%)	453 (97%)	16 (3%)	32	42

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	LEU
1	A	37	ILE
1	A	44	THR
1	A	46	THR
1	A	65	SER
1	A	76	VAL
1	A	79	THR
1	A	88	VAL
1	A	91	ILE
1	A	97	ILE
1	A	115	ARG
1	A	208	LEU
1	A	242	LEU
1	A	383	ASP
1	A	505	LEU
1	A	534	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	A	112	HIS
1	A	139	ASN
1	A	217	ASN
1	A	255	ASN
1	A	324	ASN
1	A	356	GLN
1	A	430	GLN
1	A	445	ASN
1	A	471	ASN
1	A	548	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

4 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	$\#|Z| > 2$
3	PGE	A	604	-	9,9,9	0.98	0	8,8,8	0.76	0
2	GOL	A	601	-	5,5,5	0.25	0	5,5,5	0.41	0
3	PGE	A	603	-	9,9,9	0.59	0	8,8,8	0.42	0
2	GOL	A	602	-	5,5,5	0.88	0	5,5,5	1.15	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
3	PGE	A	604	-	-	2/7/7/7	-
2	GOL	A	601	-	-	2/4/4/4	-
3	PGE	A	603	-	-	2/7/7/7	-
2	GOL	A	602	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	601	GOL	C1-C2-C3-O3
3	A	604	PGE	O3-C5-C6-O4

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Mol	Chain	Res	Type	Atoms
2	A	602	GOL	O1-C1-C2-C3
3	A	603	PGE	O3-C5-C6-O4
2	A	601	GOL	O2-C2-C3-O3
2	A	602	GOL	O1-C1-C2-O2
3	A	604	PGE	C6-C5-O3-C4
3	A	603	PGE	C1-C2-O2-C3

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	604	PGE	2	0
3	A	603	PGE	1	0

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	575/599 (95%)	1.02	126 (21%)	3	2	13, 42, 123, 177	4 (0%)

All (126) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	39	ASP	11.4
1	A	68	ALA	10.1
1	A	58	ASP	9.1
1	A	71	ALA	9.1
1	A	41	ASP	9.0
1	A	26	ILE	8.9
1	A	30	ILE	8.8
1	A	38	PHE	8.7
1	A	29	GLU	8.4
1	A	56	MET	7.9
1	A	67	VAL	7.7
1	A	27	ASN	7.5
1	A	25	PHE	7.5
1	A	117	PHE	7.4
1	A	48	GLY	7.4
1	A	28	ASN	7.1
1	A	40	GLN	7.0
1	A	54	ARG	6.9
1	A	72	VAL	6.8
1	A	70	ASN	6.8
1	A	55	LEU	6.8
1	A	31	LYS	6.7
1	A	50	PRO	6.7
1	A	42	PHE	6.7
1	A	35	PRO	6.6
1	A	99	ASN	6.5
1	A	69	ASN	6.4

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Mol	Chain	Res	Type	RSRZ
1	A	97	ILE	6.4
1	A	81	TRP	6.4
1	A	95	LEU	6.4
1	A	49	TYR	6.0
1	A	34	LEU	5.9
1	A	76	VAL	5.9
1	A	98	GLN	5.8
1	A	44	THR	5.8
1	A	75	ASN	5.6
1	A	93	ASP	5.6
1	A	37	ILE	5.5
1	A	62	ILE	5.3
1	A	87	THR	5.3
1	A	33	GLY	5.3
1	A	100	PRO	5.3
1	A	43	ALA	5.2
1	A	130	LEU	5.1
1	A	45	LYS	5.0
1	A	61	ASP	4.9
1	A	86	ASN	4.9
1	A	32	ASN	4.6
1	A	46	THR	4.6
1	A	83	PHE	4.5
1	A	51	LEU	4.4
1	A	127	SER	4.4
1	A	84	ALA	4.4
1	A	36	PRO	4.3
1	A	101	LYS	4.3
1	A	157	ALA	4.3
1	A	106	VAL	4.3
1	A	59	ASN	4.2
1	A	96	ALA	4.1
1	A	158	PHE	4.1
1	A	82	ARG	4.0
1	A	47	GLY	3.9
1	A	552	GLY	3.9
1	A	53	ALA	3.9
1	A	90	SER	3.9
1	A	141	TRP	3.9
1	A	126	SER	3.7
1	A	60	GLY	3.7
1	A	107	PHE	3.6

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Mol	Chain	Res	Type	RSRZ
1	A	52	ASN	3.5
1	A	66	THR	3.5
1	A	138	PHE	3.5
1	A	114	GLY	3.4
1	A	115	ARG	3.4
1	A	124	TYR	3.3
1	A	105	CYS	3.3
1	A	63	VAL	3.3
1	A	139	ASN	3.2
1	A	79	THR	3.2
1	A	94	LEU	3.2
1	A	142	VAL	3.1
1	A	57	LEU	3.1
1	A	137	VAL	3.0
1	A	113	ALA	3.0
1	A	121	ASN	3.0
1	A	116	ASN	2.9
1	A	122	PHE	2.9
1	A	92	ALA	2.9
1	A	135	ILE	2.9
1	A	65	SER	2.9
1	A	162	ILE	2.8
1	A	74	PRO	2.8
1	A	78	MET	2.8
1	A	103	GLY	2.8
1	A	140	GLY	2.7
1	A	88	VAL	2.7
1	A	89	GLU	2.7
1	A	73	ASN	2.6
1	A	156	GLY	2.6
1	A	85	ASP	2.6
1	A	128	ARG	2.6
1	A	123	GLU	2.5
1	A	80	GLY	2.5
1	A	232	ASP	2.5
1	A	91	ILE	2.5
1	A	174	LYS	2.5
1	A	129	ALA	2.5
1	A	599	THR	2.5
1	A	64	ARG	2.4
1	A	109	LYS	2.3
1	A	108	VAL	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	193	LYS	2.3
1	A	102	ASN	2.3
1	A	208	LEU	2.3
1	A	112	HIS	2.3
1	A	153	TYR	2.2
1	A	188	ASN	2.2
1	A	146	SER	2.2
1	A	134	GLY	2.2
1	A	136	SER	2.1
1	A	160	ASP	2.1
1	A	154	HIS	2.1
1	A	77	ASP	2.1
1	A	119	GLY	2.1
1	A	132	ASN	2.1
1	A	104	SER	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no oligosaccharides 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, 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(Å^2)	Q<0.9
2	GOL	A	601	6/6	0.74	0.31	59,70,90,93	0
3	PGE	A	603	10/10	0.78	0.36	47,77,111,115	0
2	GOL	A	602	6/6	0.83	0.21	37,40,44,61	0
3	PGE	A	604	10/10	0.86	0.25	39,68,86,88	0

6.5 Other polymers ⓘ

There are no such residues in this entry.