Full wwPDB X-ray Structure Validation Report ⓘ

Oct 7, 2024 – 09:05 PM EDT

PDB ID	:	3P01
Title	:	Crystal structure of two-component response regulator from Nostoc sp. PCC 7120
Authors	:	Chang, C.; Mack, J.; Feldman, B.; Joachimiak, A.; Midwest Center for Structural Genomics (MCSG)
Deposited on	:	2010-09-27
Resolution	:	2.65 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:

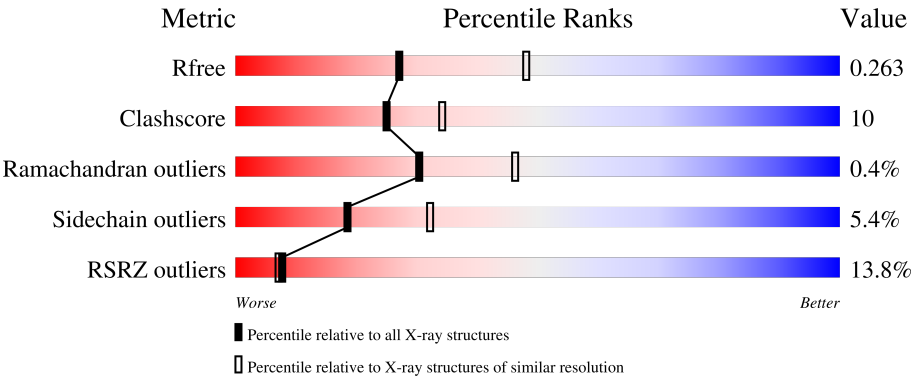
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 2.65 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}	164625	1003 (2.66-2.66)
Clashscore	180529	1063 (2.66-2.66)
Ramachandran outliers	177936	1052 (2.66-2.66)
Sidechain outliers	177891	1052 (2.66-2.66)
RSRZ outliers	164620	1003 (2.66-2.66)

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	184	4% 88% 9% ·
1	B	184	30% 65% 27% · 5%
1	C	184	4% 67% 23% · 8%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 3934 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 Two-component response regulator.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	178	Total	C	N	O	S	Se	0	0	0
			1322	828	231	258	2	3			
1	B	175	Total	C	N	O	S	Se	0	0	0
			1303	822	228	248	2	3			
1	C	169	Total	C	N	O	S	Se	0	0	0
			1267	796	219	247	2	3			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	132	SER	-	expression tag	UNP Q8YLP5
A	133	ASN	-	expression tag	UNP Q8YLP5
B	132	SER	-	expression tag	UNP Q8YLP5
B	133	ASN	-	expression tag	UNP Q8YLP5
C	132	SER	-	expression tag	UNP Q8YLP5
C	133	ASN	-	expression tag	UNP Q8YLP5

- Molecule 2 is water.

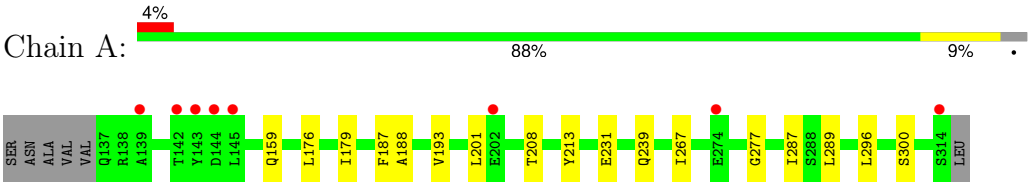
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	19	Total	O	0	0
			19	19		
2	B	7	Total	O	0	0
			7	7		
2	C	16	Total	O	0	0
			16	16		

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.

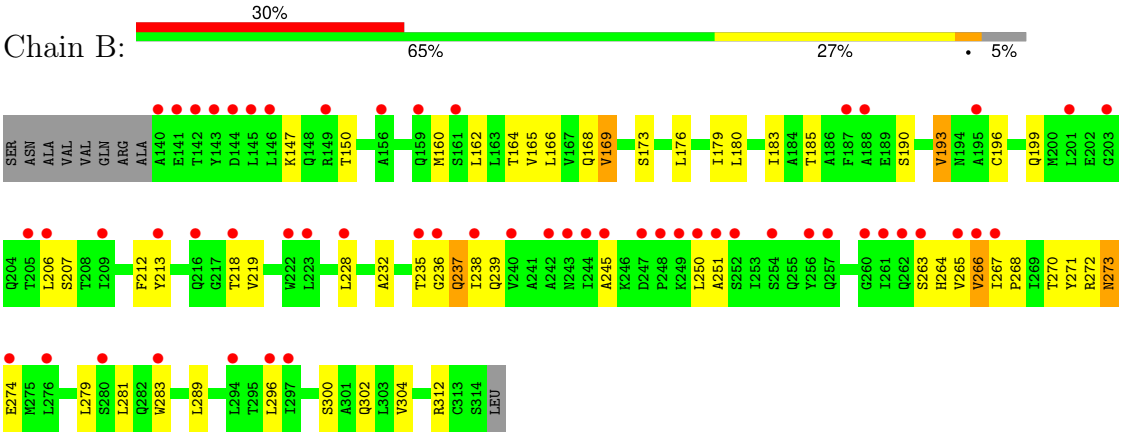
• Molecule 1: Two-component response regulator

Chain A:



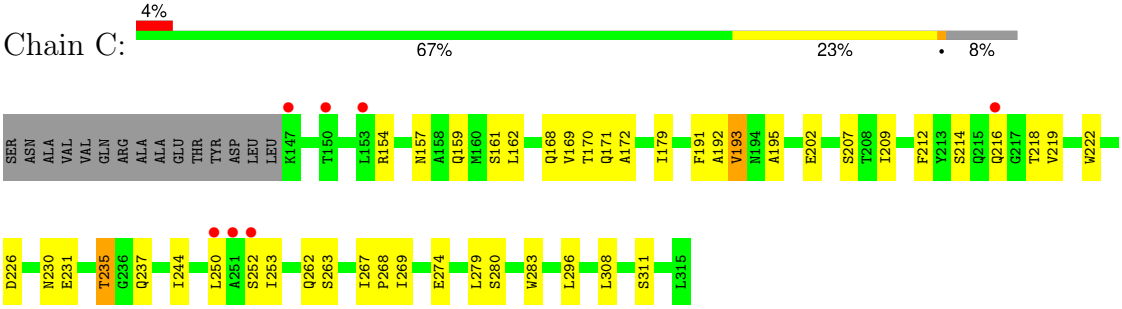
• Molecule 1: Two-component response regulator

Chain B:



• Molecule 1: Two-component response regulator

Chain C:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α, β, γ	111.88Å 111.88Å 112.84Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 2.65 50.00 – 2.65	Depositor EDS
% Data completeness (in resolution range)	98.2 (50.00-2.65) 98.1 (50.00-2.65)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.67 (at 2.65Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.228 , 0.268 0.227 , 0.263	Depositor DCC
R_{free} test set	1206 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å^2)	60.4	Xtriage
Anisotropy	0.489	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 50.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.032 for -h,-k,l	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	3934	wwPDB-VP
Average B, all atoms (Å^2)	80.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.26% 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

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	0.63	0/1335	0.71	0/1821
1	B	0.55	0/1316	0.65	0/1793
1	C	0.63	0/1280	0.73	0/1746
All	All	0.60	0/3931	0.70	0/5360

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	1322	0	1294	8	0
1	B	1303	0	1293	33	0
1	C	1267	0	1251	34	0
2	A	19	0	0	0	0
2	B	7	0	0	1	0
2	C	16	0	0	1	0
All	All	3934	0	3838	74	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 10.

All (74) 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:235:THR:HG22	1:C:237:GLN:H	1.31	0.94
1:B:300:SER:O	1:B:304:VAL:HG23	1.79	0.83
1:C:231:GLU:O	1:C:235:THR:HB	1.84	0.77
1:B:263:SER:HB2	1:B:283:TRP:HB2	1.65	0.77
1:C:269:ILE:HD11	1:C:279:LEU:HB2	1.64	0.77
1:C:235:THR:HG22	1:C:237:GLN:N	2.00	0.76
1:B:199:GLN:NE2	1:B:207:SER:O	2.21	0.74
1:B:238:ILE:HD13	1:B:267:ILE:HD13	1.70	0.72
1:C:179:ILE:HD11	1:C:308:LEU:HD23	1.73	0.71
1:B:237:GLN:O	1:B:239:GLN:NE2	2.24	0.71
1:B:302:GLN:NE2	2:B:10:HOH:O	2.23	0.70
1:C:244:ILE:CG2	1:C:244:ILE:O	2.46	0.64
1:B:235:THR:HG22	1:B:237:GLN:H	1.64	0.62
1:B:265:VAL:HG21	1:B:289:LEU:HD11	1.82	0.61
1:B:267:ILE:HG23	1:B:279:LEU:HB3	1.80	0.61
1:B:165:VAL:O	1:B:169:VAL:HB	2.02	0.59
1:B:160:MSE:HE3	1:C:159:GLN:HB3	1.84	0.59
1:B:228:LEU:HD13	1:B:250:LEU:HD11	1.85	0.59
1:C:154:ARG:O	1:C:157:ASN:HB2	2.04	0.58
1:B:267:ILE:HD12	1:B:268:PRO:HD2	1.86	0.56
1:B:179:ILE:O	1:B:183:ILE:HG13	2.05	0.55
1:B:232:ALA:HA	1:B:239:GLN:HE21	1.71	0.55
1:B:218:THR:HG22	1:B:219:VAL:H	1.71	0.55
1:C:235:THR:HG23	1:C:237:GLN:HG2	1.89	0.54
1:B:264:HIS:HD2	1:B:281:LEU:O	1.90	0.54
1:C:263:SER:HB3	1:C:283:TRP:HB2	1.91	0.53
1:C:250:LEU:C	1:C:252:SER:H	2.11	0.53
1:A:201:LEU:HG	1:A:277:GLY:HA2	1.91	0.52
1:A:188:ALA:HA	1:A:193:VAL:HG22	1.91	0.51
1:C:235:THR:CG2	1:C:237:GLN:HG2	2.40	0.51
1:A:176:LEU:O	1:A:179:ILE:HG22	2.12	0.50
1:B:236:GLY:O	1:B:268:PRO:HG2	2.12	0.50
1:A:159:GLN:HG2	1:A:296:LEU:HD22	1.93	0.49
1:B:264:HIS:CE1	1:B:266:VAL:HG22	2.48	0.49
1:C:159:GLN:HG2	1:C:296:LEU:HD13	1.93	0.49
1:C:170:THR:C	1:C:171:GLN:O	2.46	0.48
1:C:212:PHE:CZ	1:C:219:VAL:HG22	2.48	0.48
1:B:164:THR:O	1:B:168:GLN:HG3	2.14	0.47
1:B:212:PHE:HB2	1:B:219:VAL:HG11	1.95	0.47
1:B:162:LEU:O	1:B:166:LEU:HG	2.13	0.47
1:B:218:THR:HG22	1:B:219:VAL:N	2.30	0.47
1:B:193:VAL:HG11	1:B:196:CYS:HB2	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:176:LEU:O	1:B:180:LEU:HG	2.14	0.47
1:C:168:GLN:CD	2:C:25:HOH:O	2.53	0.47
1:A:187:PHE:CZ	1:A:300:SER:HB3	2.49	0.47
1:C:250:LEU:C	1:C:252:SER:N	2.69	0.46
1:C:244:ILE:O	1:C:244:ILE:HG23	2.15	0.46
1:C:171:GLN:O	1:C:172:ALA:HB3	2.16	0.46
1:C:267:ILE:HG13	1:C:268:PRO:HD2	1.96	0.46
1:B:147:LYS:O	1:B:150:THR:HG22	2.16	0.46
1:B:185:THR:HG23	1:B:213:TYR:CD1	2.51	0.46
1:B:162:LEU:HD23	1:B:296:LEU:HD11	1.97	0.45
1:C:169:VAL:C	1:C:171:GLN:O	2.55	0.45
1:C:214:SER:OG	1:C:219:VAL:HG13	2.17	0.45
1:B:245:ALA:HA	1:B:251:ALA:HB2	1.98	0.44
1:A:213:TYR:CD2	1:A:213:TYR:C	2.91	0.44
1:C:159:GLN:CG	1:C:296:LEU:HD13	2.48	0.44
1:C:222:TRP:CZ3	1:C:226:ASP:HB2	2.53	0.44
1:C:244:ILE:O	1:C:244:ILE:HG22	2.18	0.43
1:C:169:VAL:O	1:C:171:GLN:O	2.35	0.43
1:A:287:ILE:HD12	1:A:289:LEU:HG	2.00	0.43
1:B:270:THR:CG2	1:B:273:ASN:HA	2.49	0.43
1:C:202:GLU:HG3	1:C:207:SER:HB3	2.00	0.42
1:C:191:PHE:O	1:C:192:ALA:C	2.58	0.42
1:C:202:GLU:OE1	1:C:207:SER:HB2	2.19	0.42
1:C:269:ILE:CD1	1:C:279:LEU:HB2	2.42	0.42
1:B:271:TYR:O	1:B:273:ASN:N	2.52	0.42
1:C:235:THR:CG2	1:C:237:GLN:HB2	2.50	0.41
1:A:231:GLU:HG2	1:A:239:GLN:CD	2.40	0.41
1:B:185:THR:HG23	1:B:213:TYR:CE1	2.55	0.41
1:C:161:SER:O	1:C:162:LEU:C	2.58	0.41
1:B:238:ILE:HD11	1:B:265:VAL:CG1	2.51	0.41
1:C:214:SER:HG	1:C:219:VAL:HG13	1.87	0.40
1:C:193:VAL:HG13	1:C:195:ALA:N	2.36	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	176/184 (96%)	172 (98%)	4 (2%)	0	100 100
1	B	173/184 (94%)	157 (91%)	15 (9%)	1 (1%)	22 35
1	C	167/184 (91%)	154 (92%)	12 (7%)	1 (1%)	22 35
All	All	516/552 (94%)	483 (94%)	31 (6%)	2 (0%)	30 46

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	273	ASN
1	C	253	ILE

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	137/154 (89%)	135 (98%)	2 (2%)	60 77
1	B	135/154 (88%)	125 (93%)	10 (7%)	11 19
1	C	135/154 (88%)	125 (93%)	10 (7%)	11 19
All	All	407/462 (88%)	385 (95%)	22 (5%)	18 32

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	208	THR
1	A	267	ILE
1	B	169	VAL
1	B	173	SER
1	B	190	SER
1	B	193	VAL
1	B	206	LEU

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Mol	Chain	Res	Type
1	B	237	GLN
1	B	266	VAL
1	B	272	ARG
1	B	274	GLU
1	B	312	ARG
1	C	193	VAL
1	C	209	ILE
1	C	216	GLN
1	C	218	THR
1	C	230	ASN
1	C	235	THR
1	C	262	GLN
1	C	274	GLU
1	C	280	SER
1	C	311	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	239	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

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	175/184 (95%)	-0.15	8 (4%) 38 35	32, 56, 110, 151	0
1	B	172/184 (93%)	1.58	56 (32%) 1 1	55, 109, 177, 228	0
1	C	166/184 (90%)	0.12	7 (4%) 41 38	40, 64, 113, 135	0
All	All	513/552 (92%)	0.52	71 (13%) 8 7	32, 70, 147, 228	0

All (71) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	140	ALA	5.3
1	A	145	LEU	5.3
1	B	254	SER	5.3
1	C	147	LYS	5.3
1	A	143	TYR	5.2
1	B	146	LEU	5.0
1	B	256	TYR	5.0
1	B	240	VAL	4.1
1	B	244	ILE	4.1
1	B	245	ALA	4.1
1	B	142	THR	4.0
1	B	265	VAL	3.9
1	B	252	SER	3.8
1	B	296	LEU	3.8
1	B	250	LEU	3.8
1	B	238	ILE	3.8
1	B	156	ALA	3.7
1	B	203	GLY	3.7
1	B	149	ARG	3.6
1	C	251	ALA	3.6
1	B	247	ASP	3.5
1	B	205	THR	3.3
1	B	143	TYR	3.2

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Mol	Chain	Res	Type	RSRZ
1	B	283	TRP	3.2
1	B	144	ASP	3.2
1	B	235	THR	3.1
1	B	251	ALA	3.1
1	B	262	GLN	3.1
1	B	248	PRO	3.1
1	B	141	GLU	3.0
1	B	145	LEU	3.0
1	B	206	LEU	2.9
1	A	144	ASP	2.9
1	B	187	PHE	2.9
1	B	261	ILE	2.9
1	B	195	ALA	2.9
1	B	294	LEU	2.9
1	B	222	TRP	2.8
1	B	266	VAL	2.8
1	B	263	SER	2.8
1	B	228	LEU	2.8
1	B	249	LYS	2.8
1	B	223	LEU	2.8
1	B	216	GLN	2.7
1	C	216	GLN	2.7
1	C	153	LEU	2.7
1	B	243	ASN	2.7
1	B	280	SER	2.7
1	C	250	LEU	2.6
1	A	314	SER	2.6
1	B	188	ALA	2.6
1	A	139	ALA	2.5
1	C	252	SER	2.5
1	B	242	ALA	2.4
1	B	218	THR	2.4
1	B	267	ILE	2.4
1	A	202	GLU	2.3
1	A	274	GLU	2.3
1	B	276	LEU	2.3
1	B	159	GLN	2.3
1	B	257	GLN	2.3
1	C	150	THR	2.3
1	B	209	ILE	2.2
1	B	260	GLY	2.2
1	A	142	THR	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	201	LEU	2.1
1	B	236	GLY	2.1
1	B	274	GLU	2.1
1	B	161	SER	2.1
1	B	297	ILE	2.1
1	B	213	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 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.