



Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 01:44 PM BST

PDB ID : 1BTA
Title : THREE-DIMENSIONAL SOLUTION STRUCTURE AND ¹³C ASSIGNMENTS OF BARSTAR USING NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY
Authors : Lubinski, M.J.; Bycroft, M.; Freund, S.M.V.; Fersht, A.R.
Deposited on : 1994-05-09

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at
<http://wwpdb.org/validation/2016/NMRValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

Cyrange : Kirchner and Güntert (2011)
NmrClust : Kelley et al. (1996)
MolProbity : 4.02b-467
Mogul : unknown
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
ShiftChecker : rb-20027457
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20027457

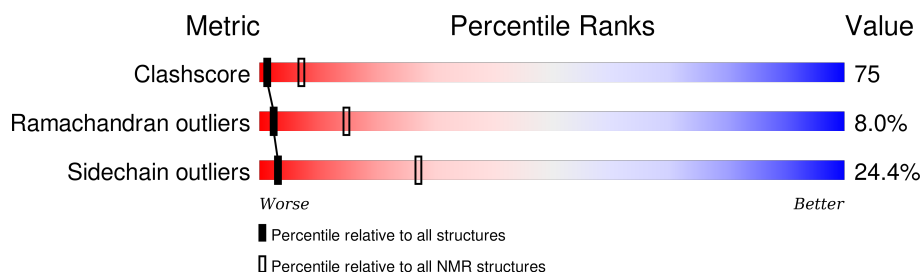
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

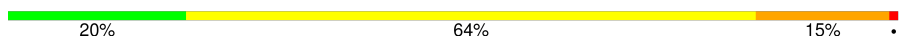
The overall completeness of chemical shifts assignment is 47%.

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)	NMR archive (#Entries)
Clashscore	114402	11133
Ramachandran outliers	111179	9975
Sidechain outliers	111093	9958

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	89	

2 Ensemble composition and analysis ⓘ

This entry contains 1 models. Identification of well-defined residues and clustering analysis are not possible.

3 Entry composition [i](#)

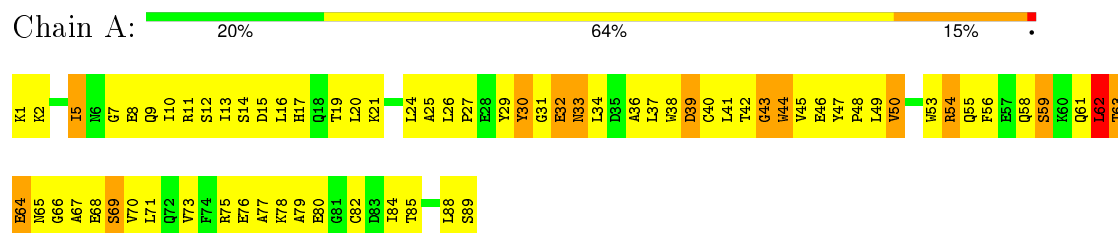
There is only 1 type of molecule in this entry. The entry contains 1434 atoms, of which 714 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called BARSTAR.

Mol	Chain	Residues	Atoms						Trace
1	A	89	Total	C	H	N	O	S	0
			1434	459	714	118	141	2	

i

- Molecule 1: BARSTAR



5 Refinement protocol and experimental data overview

Of the ? calculated structures, 1 were deposited, based on the following criterion: ?.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
X-PLOR	refinement	

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	BMRB entry 5293, BMRB entry 6227
Number of chemical shift lists	2
Total number of shifts	634
Number of shifts mapped to atoms	634
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	47%

No validations of the models with respect to experimental NMR restraints is performed at this time.

6 Model quality [i](#)

6.1 Standard geometry [i](#)

There are no covalent bond-length or bond-angle outliers.

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	Planarity
1	A	0	3
All	All	0	3

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

All planar outliers are listed below.

Mol	Chain	Res	Type	Group
1	A	11	ARG	Sidechain
1	A	54	ARG	Sidechain
1	A	75	ARG	Sidechain

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	720	714	714	108
All	All	720	714	714	108

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 75.

All clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:47:TYR:CE2	1:A:84:ILE:HD11	0.94	1.97

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:20:LEU:CD1	1:A:70:VAL:HG11	0.93	1.94
1:A:5:ILE:HD11	1:A:20:LEU:HD21	0.92	1.41
1:A:20:LEU:O	1:A:24:LEU:HD12	0.86	1.70
1:A:20:LEU:HD11	1:A:70:VAL:HG11	0.80	1.51
1:A:56:PHE:CE2	1:A:71:LEU:HD22	0.80	2.12
1:A:34:LEU:HD11	1:A:69:SER:OG	0.78	1.78
1:A:37:LEU:CD2	1:A:70:VAL:HG13	0.77	2.09
1:A:38:TRP:HE3	1:A:73:VAL:HG13	0.75	1.42
1:A:34:LEU:HD21	1:A:69:SER:HB3	0.73	1.59
1:A:59:SER:CA	1:A:62:LEU:HD11	0.72	2.14
1:A:56:PHE:CD2	1:A:88:LEU:CD2	0.71	2.74
1:A:47:TYR:CE2	1:A:84:ILE:CD1	0.70	2.74
1:A:37:LEU:HD22	1:A:70:VAL:HG13	0.69	1.64
1:A:53:TRP:CZ2	1:A:67:ALA:HB1	0.68	2.24
1:A:47:TYR:CZ	1:A:84:ILE:HD11	0.67	2.25
1:A:59:SER:HA	1:A:62:LEU:HD11	0.67	1.64
1:A:62:LEU:HD12	1:A:62:LEU:N	0.65	2.07
1:A:47:TYR:CD1	1:A:49:LEU:CB	0.64	2.80
1:A:5:ILE:CD1	1:A:20:LEU:HD21	0.64	2.21
1:A:27:PRO:CB	1:A:29:TYR:CZ	0.62	2.82
1:A:56:PHE:CZ	1:A:71:LEU:HD22	0.62	2.30
1:A:47:TYR:CD1	1:A:49:LEU:HB3	0.60	2.31
1:A:59:SER:C	1:A:62:LEU:HD11	0.60	2.15
1:A:47:TYR:CE1	1:A:49:LEU:HB3	0.59	2.31
1:A:38:TRP:CE3	1:A:73:VAL:HG13	0.59	2.30
1:A:20:LEU:C	1:A:24:LEU:HD12	0.59	2.16
1:A:47:TYR:CE1	1:A:49:LEU:CB	0.58	2.86
1:A:17:HIS:CE1	1:A:32:GLU:O	0.58	2.56
1:A:31:GLY:O	1:A:32:GLU:CG	0.57	2.52
1:A:47:TYR:CZ	1:A:84:ILE:CG1	0.57	2.88
1:A:63:THR:O	1:A:64:GLU:C	0.57	2.42
1:A:61:GLN:O	1:A:63:THR:N	0.54	2.41
1:A:13:ILE:HG23	1:A:14:SER:N	0.53	2.17
1:A:13:ILE:CG2	1:A:14:SER:N	0.53	2.71
1:A:63:THR:O	1:A:66:GLY:N	0.53	2.41
1:A:47:TYR:CD2	1:A:82:CYS:HB3	0.53	2.39
1:A:27:PRO:HG2	1:A:29:TYR:CE1	0.53	2.39
1:A:38:TRP:CZ3	1:A:77:ALA:N	0.52	2.76
1:A:76:GLU:O	1:A:79:ALA:HB3	0.52	2.03
1:A:17:HIS:CG	1:A:32:GLU:HB2	0.52	2.38
1:A:17:HIS:HB3	1:A:30:TYR:CE2	0.51	2.40
1:A:20:LEU:O	1:A:24:LEU:CD1	0.51	2.54

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:64:GLU:O	1:A:65:ASN:CB	0.51	2.57
1:A:41:LEU:HD22	1:A:47:TYR:OH	0.51	2.05
1:A:24:LEU:HD22	1:A:45:VAL:HG21	0.51	1.83
1:A:31:GLY:O	1:A:32:GLU:HG3	0.50	2.05
1:A:56:PHE:CD2	1:A:88:LEU:HD22	0.50	2.42
1:A:49:LEU:HD12	1:A:50:VAL:H	0.49	1.67
1:A:34:LEU:HD22	1:A:73:VAL:CG2	0.49	2.38
1:A:47:TYR:CZ	1:A:84:ILE:CD1	0.49	2.94
1:A:29:TYR:O	1:A:30:TYR:C	0.49	2.51
1:A:47:TYR:HB3	1:A:48:PRO:HA	0.49	1.84
1:A:26:LEU:HD12	1:A:30:TYR:CD2	0.49	2.43
1:A:38:TRP:CZ2	1:A:80:GLU:HG3	0.49	2.42
1:A:17:HIS:CD2	1:A:32:GLU:HB2	0.48	2.43
1:A:20:LEU:HD13	1:A:70:VAL:HG11	0.48	1.79
1:A:38:TRP:CZ3	1:A:76:GLU:HB3	0.48	2.44
1:A:13:ILE:HG13	1:A:17:HIS:NE2	0.48	2.23
1:A:62:LEU:CD1	1:A:62:LEU:N	0.48	2.73
1:A:53:TRP:CZ2	1:A:67:ALA:CB	0.48	2.97
1:A:30:TYR:CZ	1:A:32:GLU:HA	0.47	2.43
1:A:27:PRO:HD3	1:A:44:TRP:CE2	0.47	2.44
1:A:47:TYR:HA	1:A:48:PRO:C	0.47	2.30
1:A:56:PHE:CE2	1:A:88:LEU:CD2	0.47	2.98
1:A:10:ILE:CD1	1:A:16:LEU:HA	0.46	2.40
1:A:31:GLY:C	1:A:32:GLU:CG	0.46	2.83
1:A:47:TYR:CD1	1:A:49:LEU:HB2	0.46	2.44
1:A:7:GLY:HA2	1:A:59:SER:OG	0.46	2.11
1:A:31:GLY:C	1:A:32:GLU:HG2	0.46	2.31
1:A:5:ILE:HG21	1:A:53:TRP:CE2	0.46	2.46
1:A:38:TRP:O	1:A:40:CYS:N	0.45	2.50
1:A:13:ILE:HG13	1:A:17:HIS:CD2	0.45	2.47
1:A:16:LEU:CD2	1:A:67:ALA:HA	0.45	2.42
1:A:31:GLY:O	1:A:33:ASN:OD1	0.45	2.34
1:A:31:GLY:O	1:A:33:ASN:N	0.45	2.50
1:A:38:TRP:O	1:A:39:ASP:C	0.45	2.55
1:A:61:GLN:O	1:A:62:LEU:C	0.45	2.54
1:A:36:ALA:O	1:A:37:LEU:C	0.45	2.56
1:A:37:LEU:HD21	1:A:70:VAL:HG13	0.44	1.84
1:A:49:LEU:HD23	1:A:84:ILE:HG12	0.44	1.89
1:A:59:SER:C	1:A:62:LEU:CD1	0.44	2.86
1:A:38:TRP:NE1	1:A:42:THR:HG21	0.43	2.28
1:A:10:ILE:HD12	1:A:16:LEU:N	0.43	2.29
1:A:7:GLY:O	1:A:8:GLU:C	0.43	2.56

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:5:ILE:HD12	1:A:53:TRP:CE2	0.43	2.48
1:A:9:GLN:O	1:A:10:ILE:C	0.43	2.56
1:A:13:ILE:HD13	1:A:66:GLY:CA	0.43	2.43
1:A:49:LEU:HG	1:A:50:VAL:N	0.43	2.29
1:A:49:LEU:CG	1:A:50:VAL:N	0.42	2.83
1:A:5:ILE:HB	1:A:53:TRP:CD1	0.42	2.49
1:A:27:PRO:CB	1:A:29:TYR:CE2	0.42	3.03
1:A:26:LEU:HD13	1:A:30:TYR:CE1	0.42	2.50
1:A:26:LEU:HD12	1:A:30:TYR:CE2	0.42	2.50
1:A:47:TYR:HE2	1:A:84:ILE:HD11	0.41	1.65
1:A:43:GLY:O	1:A:44:TRP:HB2	0.41	2.14
1:A:7:GLY:O	1:A:9:GLN:N	0.41	2.53
1:A:16:LEU:HD21	1:A:67:ALA:HA	0.41	1.91
1:A:20:LEU:O	1:A:24:LEU:HB2	0.41	2.15
1:A:27:PRO:CG	1:A:29:TYR:CZ	0.41	3.04
1:A:34:LEU:HD22	1:A:73:VAL:HG23	0.41	1.91
1:A:47:TYR:CE2	1:A:84:ILE:CG1	0.41	3.04
1:A:24:LEU:CD2	1:A:45:VAL:HG21	0.41	2.46
1:A:27:PRO:CG	1:A:29:TYR:CE1	0.41	3.04
1:A:38:TRP:C	1:A:40:CYS:N	0.41	2.69
1:A:58:GLN:O	1:A:62:LEU:HD11	0.41	2.16
1:A:21:LYS:O	1:A:25:ALA:N	0.41	2.54
1:A:38:TRP:CE2	1:A:42:THR:HG21	0.40	2.51

6.3 Torsion angles

6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	87/89 (98%)	67 (77%)	13 (15%)	7 (8%)	2	15
All	All	87/89 (98%)	67 (77%)	13 (15%)	7 (8%)	2	15

All 7 Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	43	GLY
1	A	30	TYR
1	A	32	GLU
1	A	64	GLU
1	A	62	LEU
1	A	85	THR
1	A	44	TRP

6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	78/78 (100%)	59 (76%)	19 (24%)	3	27
All	All	78/78 (100%)	59 (76%)	19 (24%)	3	27

All 19 residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	89	SER
1	A	19	THR
1	A	78	LYS
1	A	62	LEU
1	A	68	GLU
1	A	63	THR
1	A	69	SER
1	A	39	ASP
1	A	46	GLU
1	A	59	SER
1	A	2	LYS
1	A	5	ILE
1	A	12	SER
1	A	33	ASN
1	A	54	ARG
1	A	1	LYS
1	A	50	VAL
1	A	55	GLN
1	A	15	ASP

6.3.3 RNA [i](#)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

6.6 Ligand geometry [i](#)

There are no ligands in this entry.

6.7 Other polymers [i](#)

There are no such molecules in this entry.

6.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

7 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 47% for the well-defined parts and 47% for the entire structure.

7.1 Chemical shift list 1

File name: BMRB entry 5293

Chemical shift list name: *assigned_chem_shift_list_1*

7.1.1 Bookkeeping

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	199
Number of shifts mapped to atoms	199
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	18	-0.45 ± 0.19	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	13	-1.20 ± 1.14	None needed (imprecise)
$^{13}\text{C}'$	16	-0.34 ± 0.23	None needed (< 0.5 ppm)
^{15}N	21	-2.09 ± 1.47	None needed (imprecise)

7.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 16%, i.e. 177 atoms were assigned a chemical shift out of a possible 1118. 0 out of 17 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	97/441 (22%)	42/176 (24%)	34/178 (19%)	21/87 (24%)
Sidechain	80/592 (14%)	67/344 (19%)	13/224 (6%)	0/24 (0%)

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	Total	¹ H	¹³ C	¹⁵ N
Aromatic	0/85 (0%)	0/44 (0%)	0/37 (0%)	0/4 (0%)
Overall	177/1118 (16%)	109/564 (19%)	47/439 (11%)	21/115 (18%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 16%, i.e. 177 atoms were assigned a chemical shift out of a possible 1118. 0 out of 17 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	97/441 (22%)	42/176 (24%)	34/178 (19%)	21/87 (24%)
Sidechain	80/592 (14%)	67/344 (19%)	13/224 (6%)	0/24 (0%)
Aromatic	0/85 (0%)	0/44 (0%)	0/37 (0%)	0/4 (0%)
Overall	177/1118 (16%)	109/564 (19%)	47/439 (11%)	21/115 (18%)

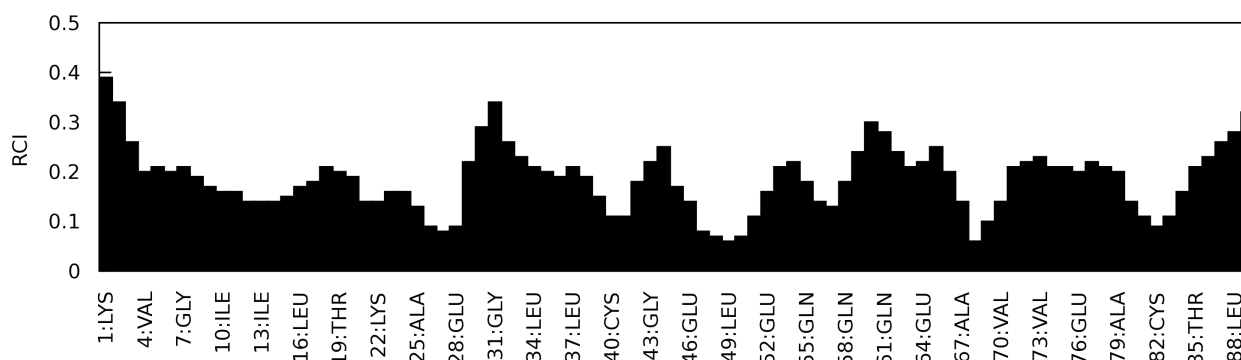
7.1.4 Statistically unusual chemical shifts [i](#)

There are no statistically unusual chemical shifts.

7.1.5 Random Coil Index (RCI) plots [i](#)

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.

Random coil index (RCI) for chain A:



7.2 Chemical shift list 2

File name: BMRB entry 6227

Chemical shift list name: *assigned_chem_shift_list_1*

7.2.1 Bookkeeping [i](#)

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	435
Number of shifts mapped to atoms	435
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

7.2.2 Chemical shift referencing [i](#)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	89	-0.69 ± 0.33	Should be applied
$^{13}\text{C}_\beta$	84	0.88 ± 0.32	Should be applied
$^{13}\text{C}'$	88	-0.61 ± 0.24	Should be applied
^{15}N	87	-1.48 ± 0.50	Should be applied

7.2.3 Completeness of resonance assignments [i](#)

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 39%, i.e. 435 atoms were assigned a chemical shift out of a possible 1118. 0 out of 17 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	351/441 (80%)	87/176 (49%)	177/178 (99%)	87/87 (100%)
Sidechain	84/592 (14%)	0/344 (0%)	84/224 (38%)	0/24 (0%)
Aromatic	0/85 (0%)	0/44 (0%)	0/37 (0%)	0/4 (0%)
Overall	435/1118 (39%)	87/564 (15%)	261/439 (59%)	87/115 (76%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 39%, i.e. 435 atoms were assigned a chemical shift out of a possible 1118. 0 out of 17 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	351/441 (80%)	87/176 (49%)	177/178 (99%)	87/87 (100%)

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	Total	¹ H	¹³ C	¹⁵ N
Sidechain	84/592 (14%)	0/344 (0%)	84/224 (38%)	0/24 (0%)
Aromatic	0/85 (0%)	0/44 (0%)	0/37 (0%)	0/4 (0%)
Overall	435/1118 (39%)	87/564 (15%)	261/439 (59%)	87/115 (76%)

7.2.4 Statistically unusual chemical shifts [i](#)

There are no statistically unusual chemical shifts.

7.2.5 Random Coil Index (RCI) plots [i](#)

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.

Random coil index (RCI) for chain A:

