



Full wwPDB NMR Structure Validation Report ⓘ

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PDB ID : 7X9U / pdb_00007x9u
BMRB ID : 36478
Title : Type-II KH motif of human mitochondrial RbfA
Authors : Kuwasako, K.; Suzuki, S.; Furue, M.; Takizawa, M.; Takahashi, M.; Tsuda, K.; Nagata, T.; Watanabe, S.; Tanaka, A.; Kobayashi, N.; Kigawa, T.; Guntert, P.; Shirouzu, M.; Yokoyama, S.; Muto, Y.; RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on : 2022-03-16

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<https://www.wwpdb.org/validation/2017/NMRValidationReportHelp>

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
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
wwPDB-RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
wwPDB-ShiftChecker : v1.2
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

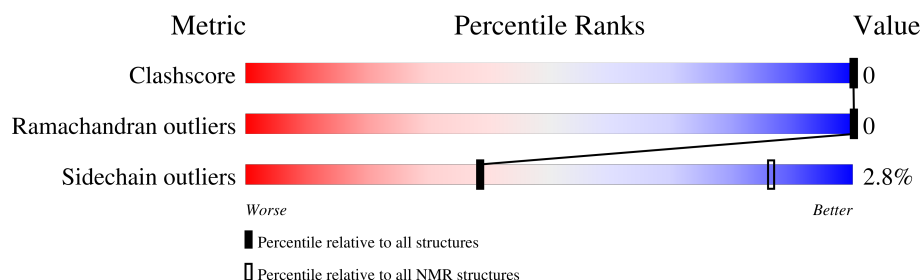
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 92%.

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	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

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	129	

2 Ensemble composition and analysis

This entry contains 20 models. Model 9 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *lowest energy*.

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	Residue range (total)	Backbone RMSD (Å)	Medoid model
1	A:16-A:90, A:98-A:105 (83)	0.33	9

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 4 clusters and 4 single-model clusters were found.

Cluster number	Models
1	1, 3, 8, 9, 11, 15
2	5, 6, 10, 14, 20
3	2, 7, 13
4	12, 16
Single-model clusters	4; 17; 18; 19

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1961 atoms, of which 980 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Putative ribosome-binding factor A, mitochondrial.

Mol	Chain	Residues	Atoms						Trace
1	A	129	Total	C	H	N	O	S	0
			1961	607	980	176	193	5	

There are 13 discrepancies between the modelled and reference sequences:

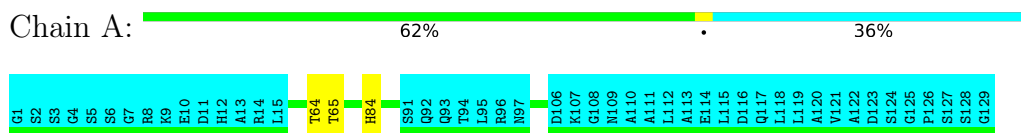
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP Q8N0V3
A	2	SER	-	expression tag	UNP Q8N0V3
A	3	SER	-	expression tag	UNP Q8N0V3
A	4	GLY	-	expression tag	UNP Q8N0V3
A	5	SER	-	expression tag	UNP Q8N0V3
A	6	SER	-	expression tag	UNP Q8N0V3
A	7	GLY	-	expression tag	UNP Q8N0V3
A	124	SER	-	expression tag	UNP Q8N0V3
A	125	GLY	-	expression tag	UNP Q8N0V3
A	126	PRO	-	expression tag	UNP Q8N0V3
A	127	SER	-	expression tag	UNP Q8N0V3
A	128	SER	-	expression tag	UNP Q8N0V3
A	129	GLY	-	expression tag	UNP Q8N0V3

4 Residue-property plots

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

- Molecule 1: Putative ribosome-binding factor A, mitochondrial

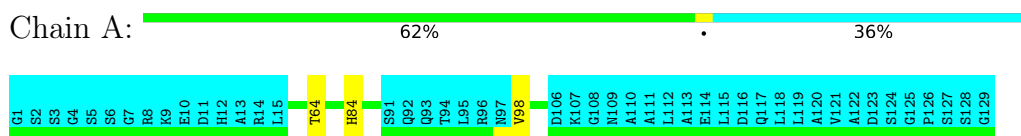


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

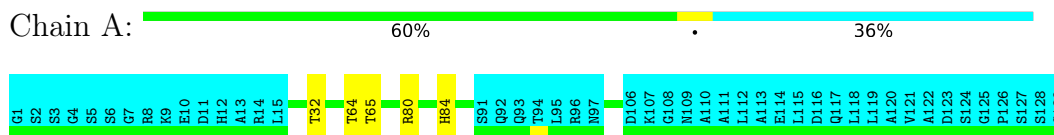
4.2.1 Score per residue for model 1

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



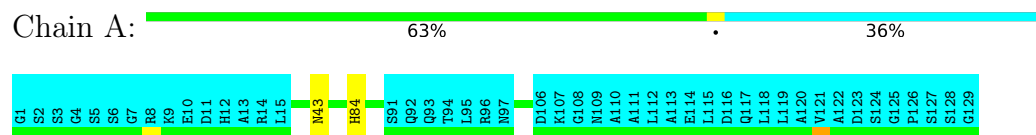
4.2.2 Score per residue for model 2

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



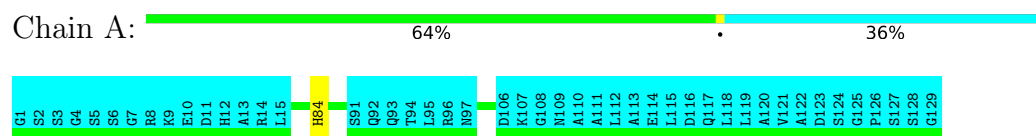
4.2.3 Score per residue for model 3

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



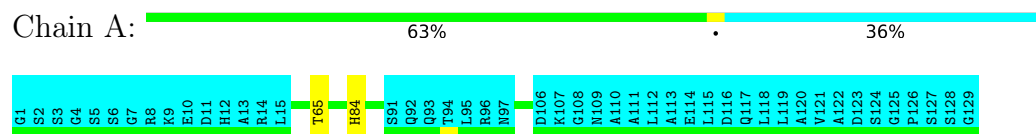
4.2.4 Score per residue for model 4

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



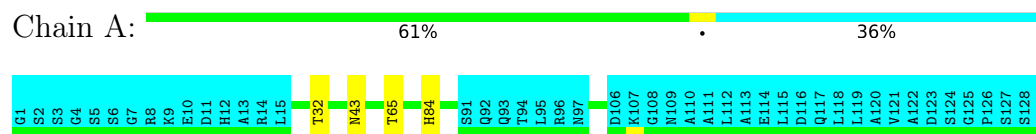
4.2.5 Score per residue for model 5

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



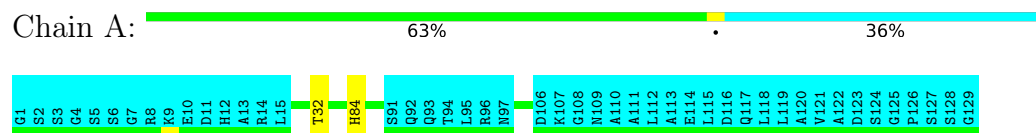
4.2.6 Score per residue for model 6

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



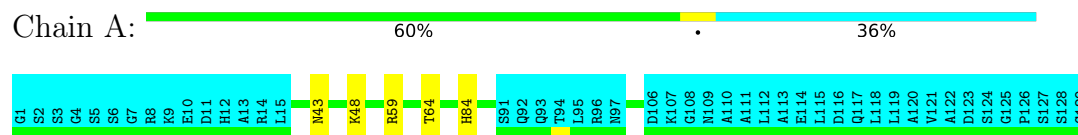
4.2.7 Score per residue for model 7

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



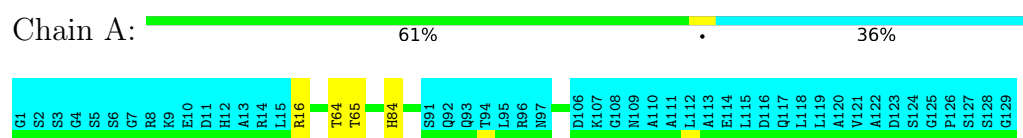
4.2.8 Score per residue for model 8

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



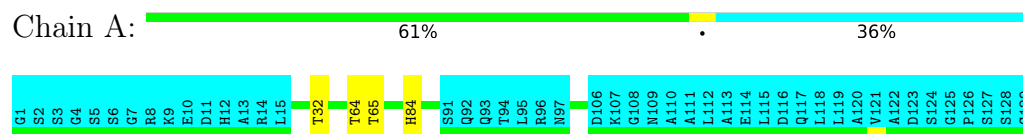
4.2.9 Score per residue for model 9 (medoid)

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



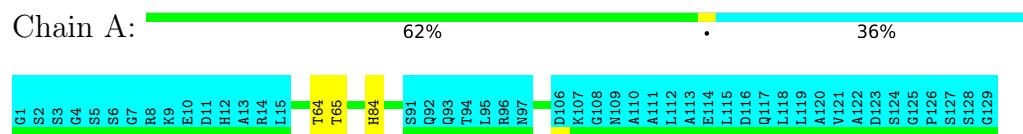
4.2.10 Score per residue for model 10

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



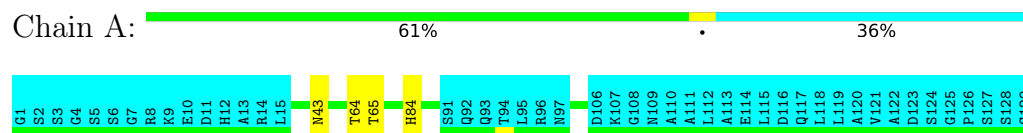
4.2.11 Score per residue for model 11

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



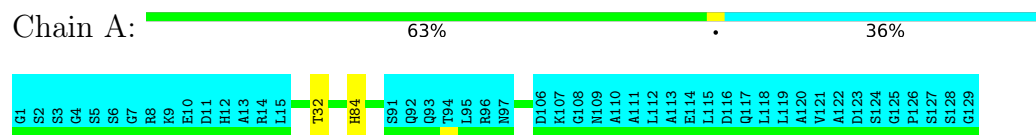
4.2.12 Score per residue for model 12

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



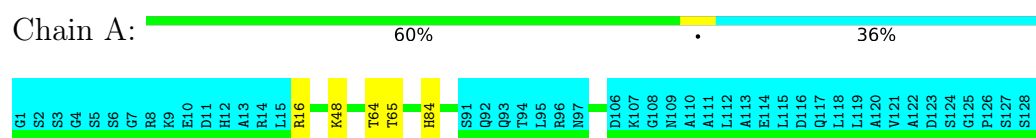
4.2.13 Score per residue for model 13

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



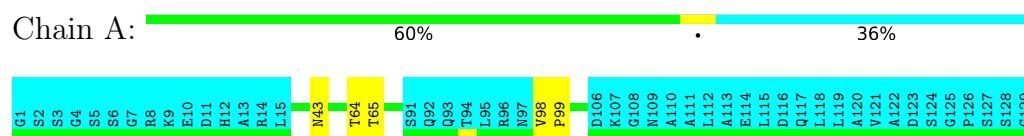
4.2.14 Score per residue for model 14

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



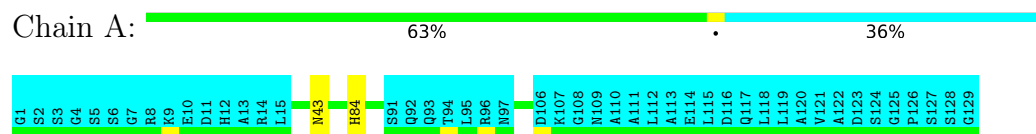
4.2.15 Score per residue for model 15

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



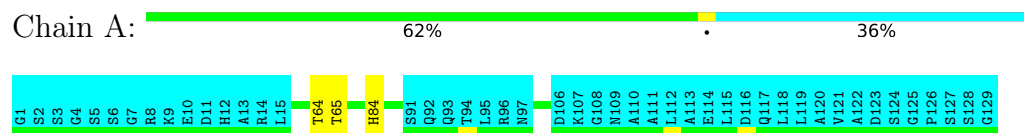
4.2.16 Score per residue for model 16

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



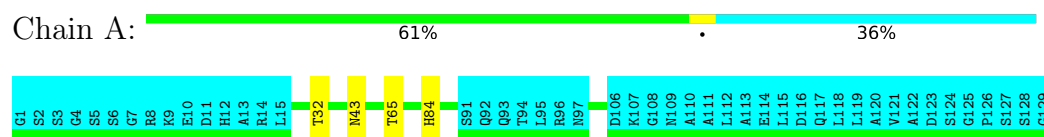
4.2.17 Score per residue for model 17

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



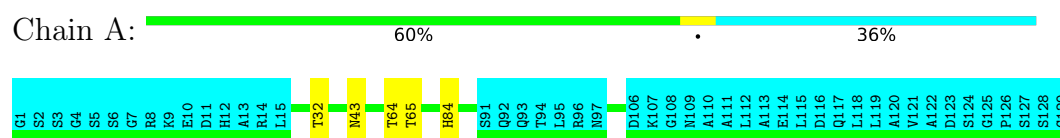
4.2.18 Score per residue for model 18

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



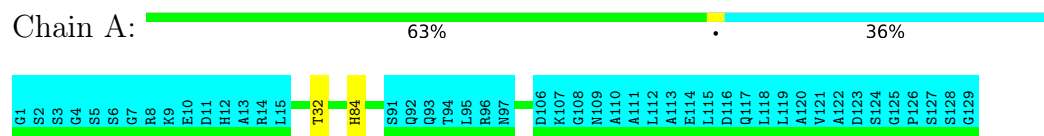
4.2.19 Score per residue for model 19

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



4.2.20 Score per residue for model 20

- Molecule 1: Putative ribosome-binding factor A, mitochondrial



5 Refinement protocol and experimental data overview

The models were refined using the following method: *simulated annealing*.

Of the 200 calculated structures, 20 were deposited, based on the following criterion: *structures with the least restraint violations*.

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

Software name	Classification	Version
Amber	refinement	12
CYANA	structure calculation	2-1
TALOS	geometry optimization	2007

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)	working_cs.cif
Number of chemical shift lists	1
Total number of shifts	1499
Number of shifts mapped to atoms	1499
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	92%

6 Model quality

6.1 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 (average) 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	0.82±0.01	0±0/669 (0.0± 0.0%)	1.46±0.02	1±1/912 (0.2± 0.1%)
All	All	0.82	1/13380 (0.0%)	1.46	28/18240 (0.2%)

All unique bond outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	99	PRO	CA-C	5.17	1.54	1.51	15	1

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	80	ARG	NE-CZ-NH2	5.74	124.36	119.20	2	1
1	A	43	ASN	CA-CB-CG	5.74	118.33	112.60	19	3
1	A	84	HIS	CB-CG-CD2	-5.41	124.17	131.20	11	19
1	A	99	PRO	N-CA-CB	5.29	106.15	103.19	15	1
1	A	98	VAL	CA-C-N	5.14	123.41	119.66	15	2
1	A	98	VAL	C-N-CA	5.14	123.41	119.66	15	2

There are no chirality outliers.

There are no planarity outliers.

6.2 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 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
All	All	13100	13300	13300	-

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 -.

There are no clashes.

6.3 Torsion angles [i](#)

6.3.1 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 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	83/129 (64%)	83±0 (100±0%)	0±0 (0±0%)	0±0 (0±0%)	100	100
All	All	1660/2580 (64%)	1657 (100%)	3 (0%)	0 (0%)	100	100

There are no Ramachandran outliers.

6.3.2 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 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	73/107 (68%)	71±1 (97±2%)	2±1 (3±2%)	38	86
All	All	1460/2140 (68%)	1419 (97%)	41 (3%)	38	86

All 7 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	65	THR	12
1	A	64	THR	11
1	A	32	THR	8
1	A	43	ASN	5

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Mol	Chain	Res	Type	Models (Total)
1	A	48	LYS	2
1	A	16	ARG	2
1	A	59	ARG	1

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 oligosaccharides 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 92% for the well-defined parts and 88% for the entire structure.

7.1 Chemical shift list 1

File name: working_cs.cif

Chemical shift list name: *mtRbfA*

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	1499
Number of shifts mapped to atoms	1499
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	3

7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction $\pm$ precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	124	-0.46 ± 0.12	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	119	0.20 ± 0.07	None needed (< 0.5 ppm)
$^{13}\text{C}'$	115	-0.19 ± 0.11	None needed (< 0.5 ppm)
^{15}N	118	-0.06 ± 0.24	None needed (< 0.5 ppm)

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 92%, i.e. 1067 atoms were assigned a chemical shift out of a possible 1155. 0 out of 21 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	401/408 (98%)	163/163 (100%)	159/166 (96%)	79/79 (100%)
Sidechain	602/667 (90%)	411/440 (93%)	184/205 (90%)	7/22 (32%)

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	Total	¹H	¹³C	¹⁵N
Aromatic	64/80 (80%)	32/40 (80%)	31/36 (86%)	1/4 (25%)
Overall	1067/1155 (92%)	606/643 (94%)	374/407 (92%)	87/105 (83%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 88%, i.e. 1499 atoms were assigned a chemical shift out of a possible 1704. 0 out of 28 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹H	¹³C	¹⁵N
Backbone	601/642 (94%)	244/260 (94%)	239/258 (93%)	118/124 (95%)
Sidechain	830/975 (85%)	561/638 (88%)	258/299 (86%)	11/38 (29%)
Aromatic	68/87 (78%)	34/44 (77%)	33/38 (87%)	1/5 (20%)
Overall	1499/1704 (88%)	839/942 (89%)	530/595 (89%)	130/167 (78%)

7.1.4 Statistically unusual chemical shifts ⓘ

The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	78	LEU	HD21	-0.87	-0.65 – 2.13	-5.8
1	A	78	LEU	HD22	-0.87	-0.65 – 2.13	-5.8
1	A	78	LEU	HD23	-0.87	-0.65 – 2.13	-5.8

7.1.5 Random Coil Index (RCI) plots ⓘ

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. If well-defined core and ill-defined regions are not identified then it is shown as gray bars.

Random coil index (RCI) for chain A:

