



Full wwPDB NMR Structure Validation Report ⓘ

Mar 24, 2022 – 06:21 pm GMT

PDB ID : 6SZC
Title : NMR structure of repeat domain 13 of the fibrillar adhesin CshA from *Streptococcus gordonii*.
Authors : Higman, V.A.; Back, C.; Crump, M.P.; Race, P.
Deposited on : 2019-10-02

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

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

MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.27
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.27

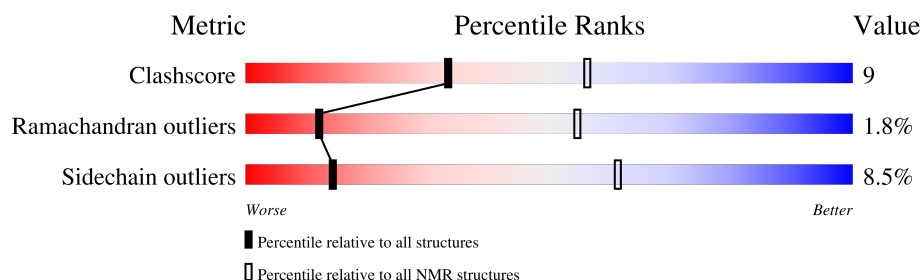
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 86%.

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	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

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	118	

2 Ensemble composition and analysis

This entry contains 15 models. Model 15 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:2056-A:2125 (70)	0.51	15

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 2 clusters and 7 single-model clusters were found.

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

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1171 atoms, of which 580 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Surface-associated protein CshA.

Mol	Chain	Residues	Atoms					Trace
1	A	78	Total	C	H	N	O	0
			1171	375	580	92	124	

There are 18 discrepancies between the modelled and reference sequences:

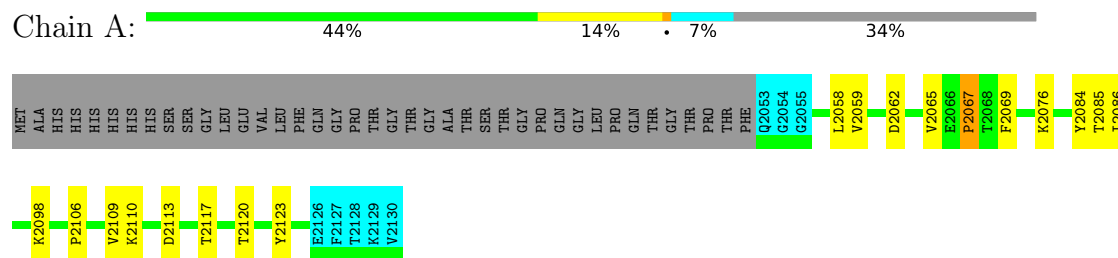
Chain	Residue	Modelled	Actual	Comment	Reference
A	2013	MET	-	initiating methionine	UNP A8AWJ3
A	2014	ALA	-	expression tag	UNP A8AWJ3
A	2015	HIS	-	expression tag	UNP A8AWJ3
A	2016	HIS	-	expression tag	UNP A8AWJ3
A	2017	HIS	-	expression tag	UNP A8AWJ3
A	2018	HIS	-	expression tag	UNP A8AWJ3
A	2019	HIS	-	expression tag	UNP A8AWJ3
A	2020	HIS	-	expression tag	UNP A8AWJ3
A	2021	SER	-	expression tag	UNP A8AWJ3
A	2022	SER	-	expression tag	UNP A8AWJ3
A	2023	GLY	-	expression tag	UNP A8AWJ3
A	2024	LEU	-	expression tag	UNP A8AWJ3
A	2025	GLU	-	expression tag	UNP A8AWJ3
A	2026	VAL	-	expression tag	UNP A8AWJ3
A	2027	LEU	-	expression tag	UNP A8AWJ3
A	2028	PHE	-	expression tag	UNP A8AWJ3
A	2029	GLN	-	expression tag	UNP A8AWJ3
A	2030	GLY	-	expression tag	UNP A8AWJ3

4 Residue-property plots [i](#)

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: Surface-associated protein CshA

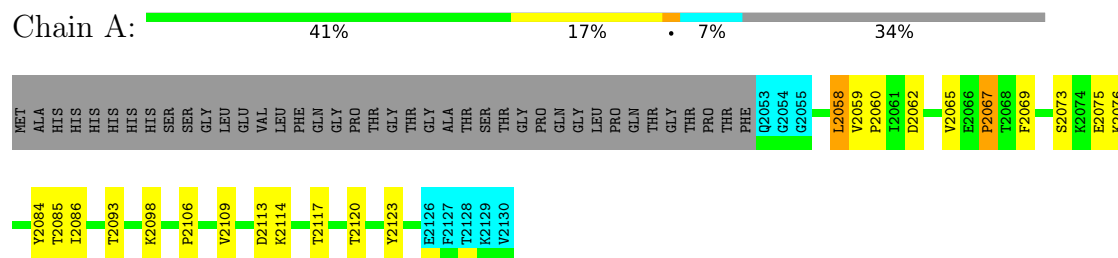


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

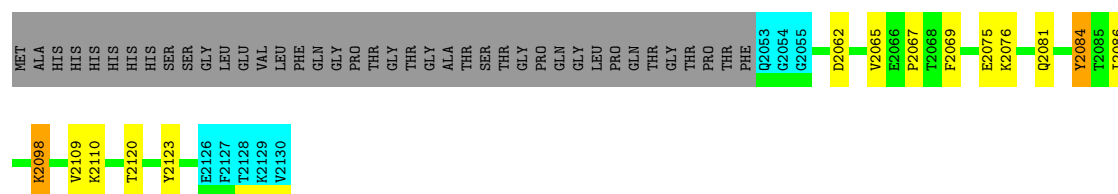
- Molecule 1: Surface-associated protein CshA



4.2.2 Score per residue for model 2

- Molecule 1: Surface-associated protein CshA

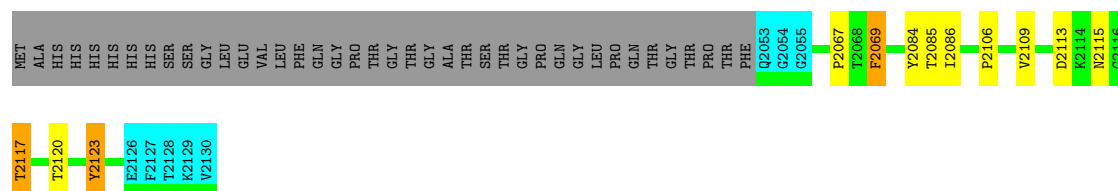




4.2.3 Score per residue for model 3

- Molecule 1: Surface-associated protein CshA

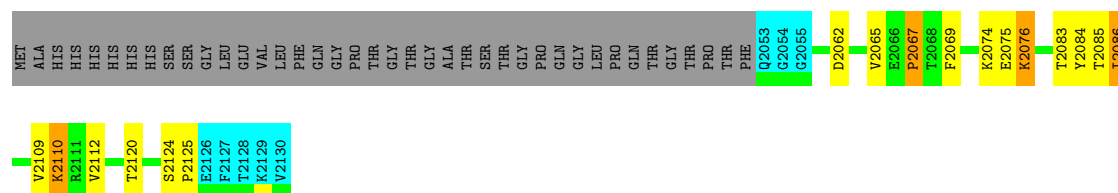
Chain A: 49% 8% 7% 34%



4.2.4 Score per residue for model 4

- Molecule 1: Surface-associated protein CshA

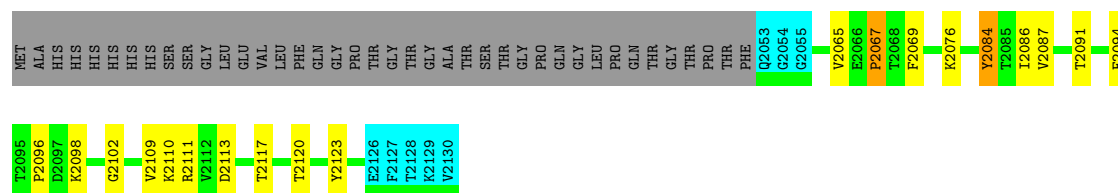
Chain A: 45% 11% 7% 34%



4.2.5 Score per residue for model 5

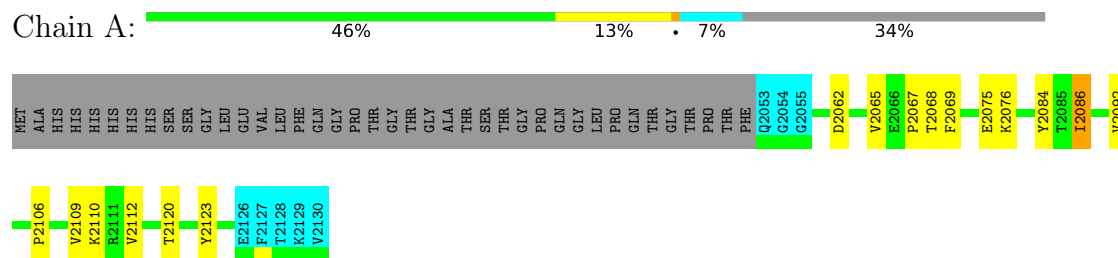
- Molecule 1: Surface-associated protein CshA

Chain A: 43% 14% 7% 34%



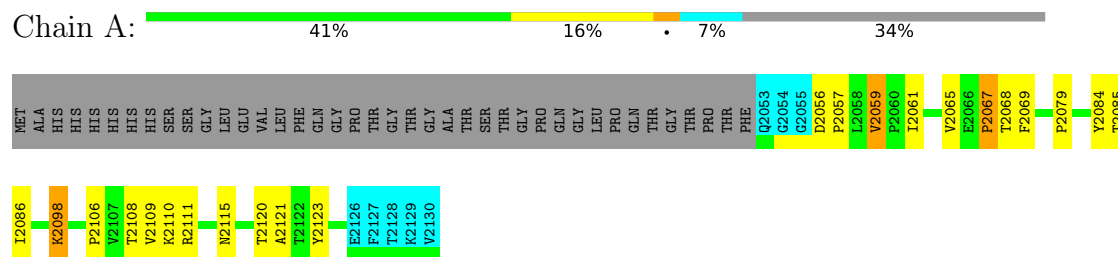
4.2.6 Score per residue for model 6

- Molecule 1: Surface-associated protein CshA



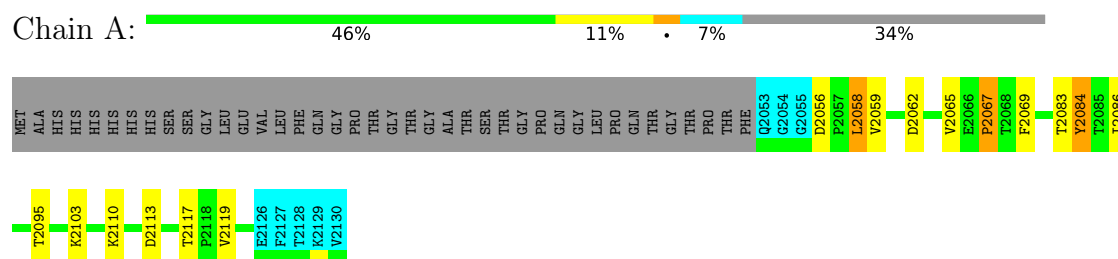
4.2.7 Score per residue for model 7

- Molecule 1: Surface-associated protein CshA



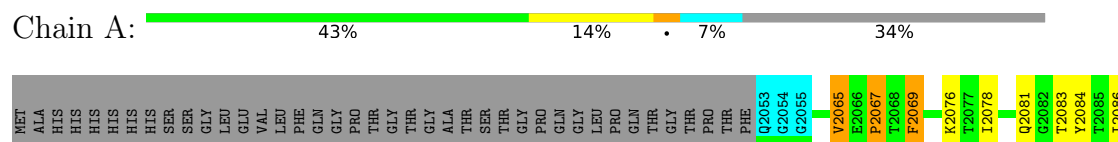
4.2.8 Score per residue for model 8

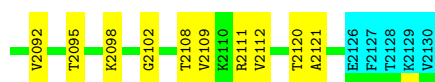
- Molecule 1: Surface-associated protein CshA



4.2.9 Score per residue for model 9

- Molecule 1: Surface-associated protein CshA

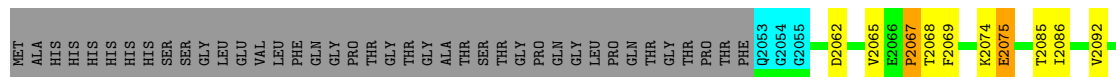




4.2.10 Score per residue for model 10

- Molecule 1: Surface-associated protein CshA

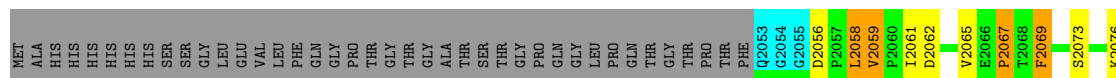
Chain A: 43% 14% 7% 34%



4.2.11 Score per residue for model 11

- Molecule 1: Surface-associated protein CshA

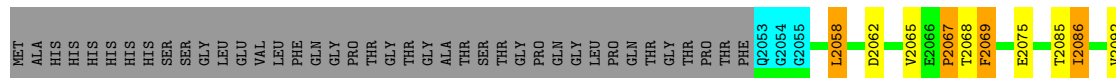
Chain A: 41% 15% 7% 34%



4.2.12 Score per residue for model 12

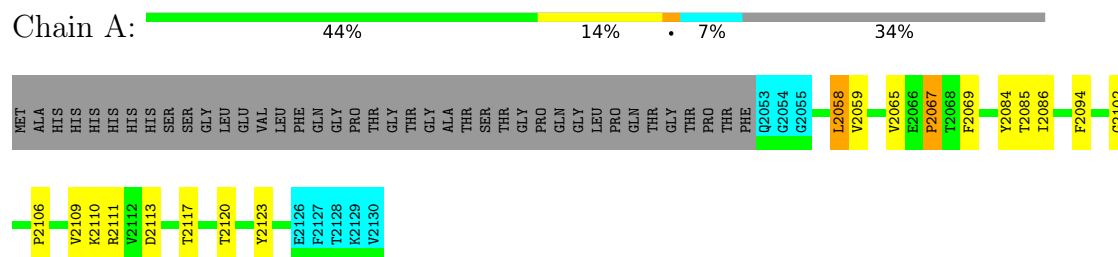
- Molecule 1: Surface-associated protein CshA

Chain A: 45% 11% 7% 34%



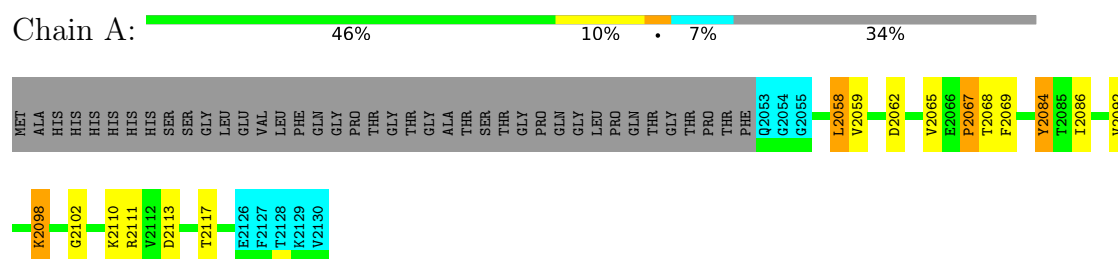
4.2.13 Score per residue for model 13

- Molecule 1: Surface-associated protein CshA



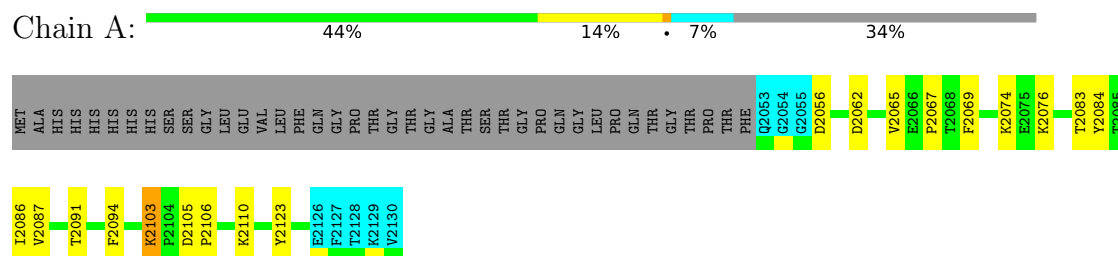
4.2.14 Score per residue for model 14

- Molecule 1: Surface-associated protein CshA



4.2.15 Score per residue for model 15 (medoid)

- Molecule 1: Surface-associated protein CshA



5 Refinement protocol and experimental data overview

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

Of the 200 calculated structures, 15 were deposited, based on the following criterion: *structures with the lowest energy*.

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

Software name	Classification	Version
ARIA	structure calculation	

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	853
Number of shifts mapped to atoms	853
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	86%

6 Model quality [i](#)

6.1 Standard geometry [i](#)

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

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	530	522	522	10±2
All	All	7950	7830	7830	143

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 9.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:2058:LEU:HD13	1:A:2059:VAL:HG23	0.62	1.70	8	5
1:A:2075:GLU:HG2	1:A:2085:THR:HG22	0.61	1.72	10	2
1:A:2065:VAL:O	1:A:2067:PRO:HD3	0.59	1.96	9	13
1:A:2075:GLU:HG3	1:A:2085:THR:HG22	0.59	1.73	4	1
1:A:2069:PHE:CZ	1:A:2084:TYR:HB2	0.58	2.34	2	8
1:A:2113:ASP:OD2	1:A:2117:THR:HB	0.57	2.00	10	5
1:A:2113:ASP:OD1	1:A:2117:THR:HB	0.56	1.99	14	3
1:A:2094:PHE:CE2	1:A:2109:VAL:HG11	0.56	2.35	5	2
1:A:2109:VAL:O	1:A:2120:THR:HA	0.55	2.01	13	10
1:A:2106:PRO:HA	1:A:2123:TYR:O	0.54	2.02	1	9
1:A:2094:PHE:CZ	1:A:2109:VAL:HG11	0.54	2.38	5	1
1:A:2075:GLU:CG	1:A:2085:THR:HG22	0.53	2.33	12	1
1:A:2061:ILE:HG13	1:A:2111:ARG:NE	0.52	2.19	7	2
1:A:2058:LEU:HD12	1:A:2058:LEU:H	0.52	1.65	11	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:2092:VAL:HB	1:A:2111:ARG:NH1	0.52	2.20	14	2
1:A:2075:GLU:HA	1:A:2084:TYR:O	0.52	2.05	2	3
1:A:2069:PHE:CD2	1:A:2069:PHE:N	0.51	2.79	2	7
1:A:2069:PHE:CD1	1:A:2069:PHE:N	0.50	2.79	12	3
1:A:2086:ILE:HA	1:A:2091:THR:O	0.50	2.06	15	1
1:A:2058:LEU:N	1:A:2058:LEU:HD12	0.50	2.21	12	3
1:A:2108:THR:HA	1:A:2121:ALA:O	0.50	2.06	9	4
1:A:2124:SER:OG	1:A:2125:PRO:HD2	0.50	2.06	4	1
1:A:2062:ASP:O	1:A:2065:VAL:HG22	0.50	2.06	15	10
1:A:2074:LYS:O	1:A:2086:ILE:HG22	0.49	2.08	4	1
1:A:2110:LYS:HD2	1:A:2110:LYS:C	0.49	2.27	4	1
1:A:2092:VAL:HG13	1:A:2111:ARG:NH1	0.49	2.22	9	1
1:A:2069:PHE:CD2	1:A:2109:VAL:HG13	0.49	2.42	1	2
1:A:2087:VAL:HG22	1:A:2091:THR:OG1	0.48	2.07	5	2
1:A:2086:ILE:HD13	1:A:2092:VAL:HG22	0.47	1.86	6	1
1:A:2081:GLN:CD	1:A:2104:PRO:HA	0.47	2.30	11	1
1:A:2069:PHE:CE2	1:A:2084:TYR:HB2	0.47	2.45	13	3
1:A:2098:LYS:HD3	1:A:2098:LYS:H	0.46	1.69	14	1
1:A:2065:VAL:HG11	1:A:2112:VAL:O	0.46	2.10	9	1
1:A:2110:LYS:HG2	1:A:2111:ARG:N	0.46	2.26	14	1
1:A:2094:PHE:O	1:A:2096:PRO:HD3	0.45	2.11	5	1
1:A:2078:ILE:HB	1:A:2081:GLN:HB3	0.45	1.88	9	1
1:A:2076:LYS:O	1:A:2083:THR:HA	0.44	2.12	4	2
1:A:2098:LYS:H	1:A:2098:LYS:HD2	0.44	1.72	7	1
1:A:2069:PHE:N	1:A:2069:PHE:HD2	0.44	2.10	9	3
1:A:2058:LEU:HD12	1:A:2058:LEU:N	0.44	2.28	11	1
1:A:2067:PRO:HA	1:A:2111:ARG:CB	0.43	2.42	5	2
1:A:2083:THR:O	1:A:2095:THR:HB	0.43	2.13	8	2
1:A:2058:LEU:H	1:A:2058:LEU:CD1	0.43	2.27	1	2
1:A:2056:ASP:HB2	1:A:2059:VAL:O	0.43	2.13	7	1
1:A:2065:VAL:HG21	1:A:2112:VAL:O	0.42	2.14	6	2
1:A:2068:THR:O	1:A:2110:LYS:HB3	0.42	2.14	6	4
1:A:2058:LEU:CD1	1:A:2059:VAL:HG23	0.42	2.44	11	1
1:A:2058:LEU:HD13	1:A:2059:VAL:CG2	0.42	2.45	11	1
1:A:2069:PHE:N	1:A:2069:PHE:HD1	0.41	2.11	12	2
1:A:2086:ILE:CG1	1:A:2092:VAL:HG22	0.41	2.45	12	1
1:A:2060:PRO:O	1:A:2114:LYS:HG3	0.41	2.16	1	1
1:A:2069:PHE:N	1:A:2069:PHE:CD2	0.41	2.89	15	1
1:A:2068:THR:HG22	1:A:2074:LYS:HE2	0.40	1.94	10	1
1:A:2103:LYS:HB3	1:A:2103:LYS:NZ	0.40	2.32	15	1

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	70/118 (59%)	62±2 (88±2%)	7±1 (10±2%)	1±1 (2±1%)	12	54
All	All	1050/1770 (59%)	928 (88%)	103 (10%)	19 (2%)	12	54

All 4 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	2067	PRO	13
1	A	2102	GLY	4
1	A	2079	PRO	1
1	A	2125	PRO	1

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	63/100 (63%)	58±2 (92±3%)	5±2 (8±3%)	14	61
All	All	945/1500 (63%)	865 (92%)	80 (8%)	14	61

All 24 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	2086	ILE	14
1	A	2076	LYS	7
1	A	2110	LYS	7
1	A	2058	LEU	6
1	A	2098	LYS	6
1	A	2084	TYR	6

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Mol	Chain	Res	Type	Models (Total)
1	A	2085	THR	5
1	A	2069	PHE	4
1	A	2123	TYR	3
1	A	2056	ASP	3
1	A	2073	SER	2
1	A	2115	ASN	2
1	A	2059	VAL	2
1	A	2103	LYS	2
1	A	2119	VAL	2
1	A	2093	THR	1
1	A	2081	GLN	1
1	A	2117	THR	1
1	A	2065	VAL	1
1	A	2075	GLU	1
1	A	2097	ASP	1
1	A	2100	PHE	1
1	A	2074	LYS	1
1	A	2105	ASP	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 monosaccharides 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 ⓘ

There are no chain breaks in this entry.

7 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 86% for the well-defined parts and 82% for the entire structure.

7.1 Chemical shift list 1

File name: working_cs.cif

Chemical shift list name: *assigned_chem_shift_list*

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	853
Number of shifts mapped to atoms	853
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
$^{13}\text{C}_\alpha$	70	-0.88 ± 0.25	Should be applied
$^{13}\text{C}_\beta$	65	-1.11 ± 0.19	Should be applied
$^{13}\text{C}'$	68	0.52 ± 0.19	Should be applied
^{15}N	59	-0.08 ± 0.45	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 86%, i.e. 689 atoms were assigned a chemical shift out of a possible 803. 0 out of 10 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	305/330 (92%)	121/130 (93%)	129/140 (92%)	55/60 (92%)
Sidechain	343/430 (80%)	212/251 (84%)	129/167 (77%)	2/12 (17%)

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	Total	^1H	^{13}C	^{15}N
Aromatic	41/43 (95%)	23/23 (100%)	18/20 (90%)	0/0 (—%)
Overall	689/803 (86%)	356/404 (88%)	276/327 (84%)	57/72 (79%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 82%, i.e. 734 atoms were assigned a chemical shift out of a possible 895. 1 out of 11 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	327/370 (88%)	130/146 (89%)	138/156 (88%)	59/68 (87%)
Sidechain	366/473 (77%)	226/276 (82%)	138/183 (75%)	2/14 (14%)
Aromatic	41/52 (79%)	23/28 (82%)	18/24 (75%)	0/0 (—%)
Overall	734/895 (82%)	379/450 (84%)	294/363 (81%)	61/82 (74%)

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:

