



Full wwPDB NMR Structure Validation Report ⓘ

Feb 12, 2017 – 08:06 pm GMT

PDB ID : 1U5L
Title : Solution Structure of the turtle prion protein fragment (121-226)
Authors : Lysek, D.A.; Calzolari, L.; Guntert, P.; Wuthrich, K.
Deposited on : 2004-07-28

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
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)
RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
ShiftChecker : trunk28760
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : recalc28949

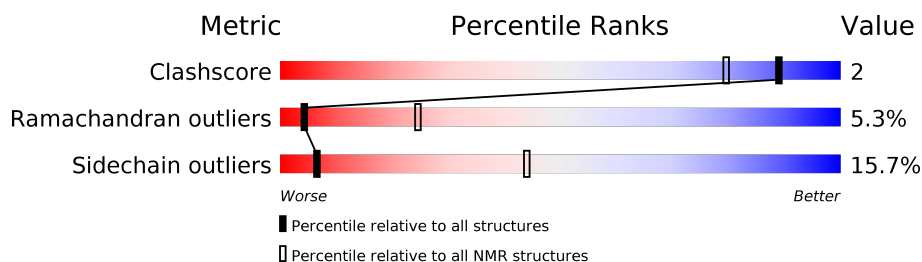
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 75%.

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	125131	11601
Ramachandran outliers	121729	10391
Sidechain outliers	121581	10367

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	108	

2 Ensemble composition and analysis

This entry contains 20 models. Model 7 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *fewest violations*.

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:126-A:225 (100)	0.65	7

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 3 single-model clusters were found.

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

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1702 atoms, of which 825 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called prion protein.

Mol	Chain	Residues	Atoms						Trace
1	A	107	Total	C	H	N	O	S	0
			1702	541	825	157	171	8	

There are 4 discrepancies between the modelled and reference sequences:

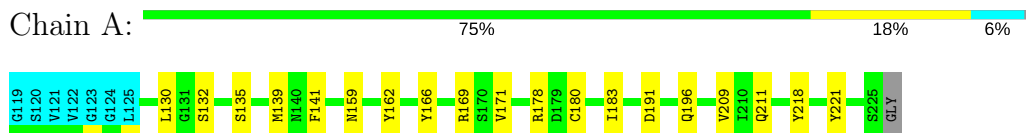
Chain	Residue	Modelled	Actual	Comment	Reference
A	119	GLY	-	CLONING ARTIFACT	UNP Q9I9C0
A	120	SER	-	CLONING ARTIFACT	UNP Q9I9C0
A	181	VAL	LEU	SEE REMARK 999	UNP Q9I9C0
A	183	ILE	ASN	SEE REMARK 999	UNP Q9I9C0

4 Residue-property plots

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA 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: prion protein

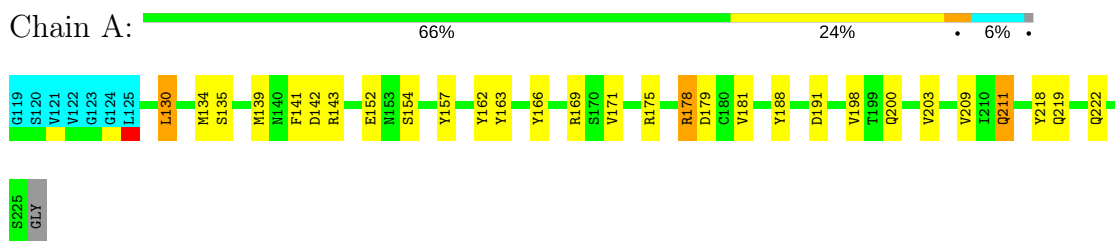


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

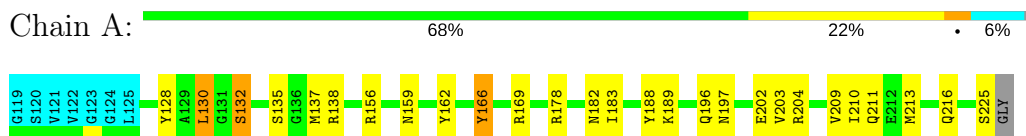
4.2.1 Score per residue for model 1

- Molecule 1: prion protein



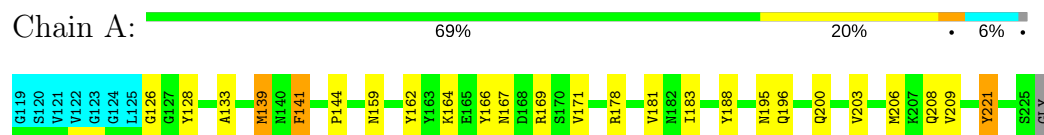
4.2.2 Score per residue for model 2

- Molecule 1: prion protein



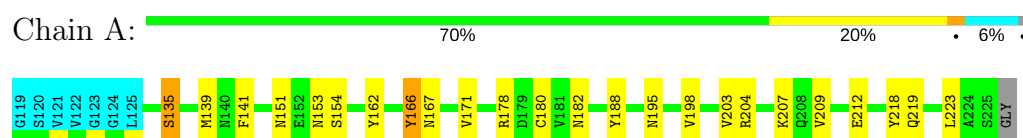
4.2.3 Score per residue for model 3

- Molecule 1: prion protein



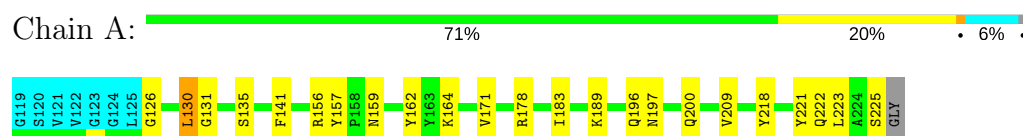
4.2.4 Score per residue for model 4

- Molecule 1: prion protein



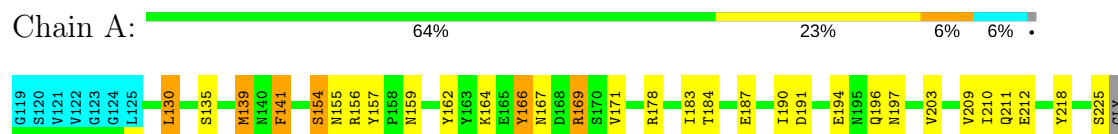
4.2.5 Score per residue for model 5

- Molecule 1: prion protein



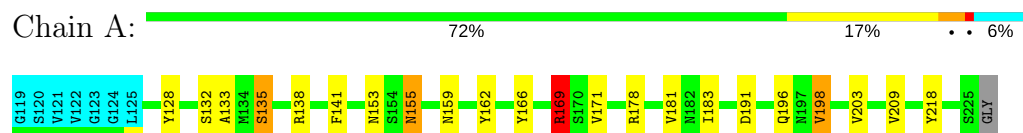
4.2.6 Score per residue for model 6

- Molecule 1: prion protein



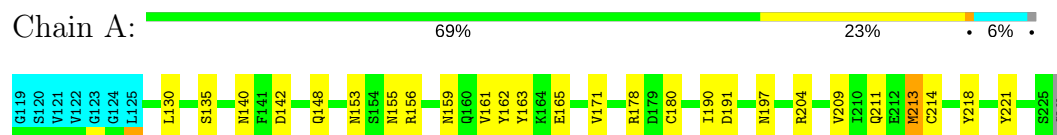
4.2.7 Score per residue for model 7 (medoid)

- Molecule 1: prion protein



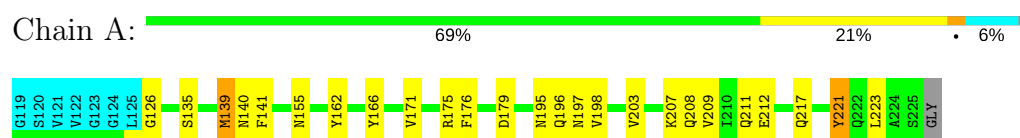
4.2.8 Score per residue for model 8

- Molecule 1: prion protein



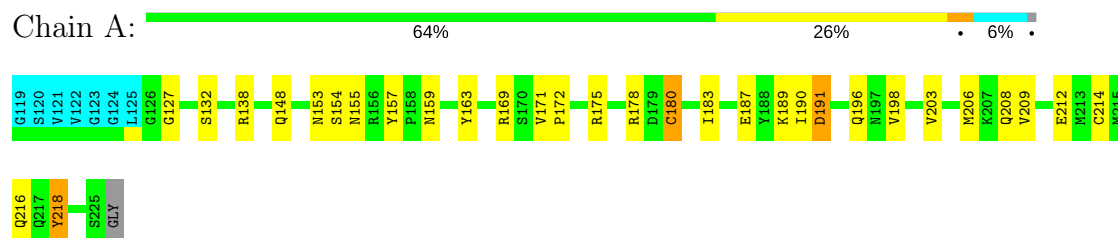
4.2.9 Score per residue for model 9

- Molecule 1: prion protein



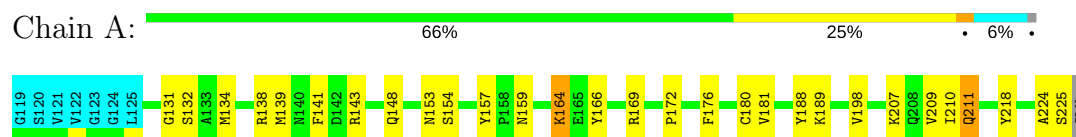
4.2.10 Score per residue for model 10

- Molecule 1: prion protein



4.2.11 Score per residue for model 11

- Molecule 1: prion protein



4.2.12 Score per residue for model 12

- Molecule 1: prion protein





4.2.13 Score per residue for model 13

- Molecule 1: prion protein

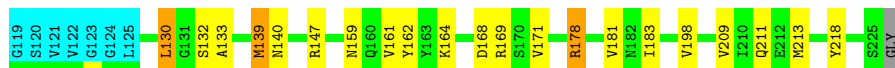
Chain A: 67% 25% 6%



4.2.14 Score per residue for model 14

- Molecule 1: prion protein

Chain A: 73% 17% 6%



4.2.15 Score per residue for model 15

- Molecule 1: prion protein

Chain A: 74% 17% 6%



4.2.16 Score per residue for model 16

- Molecule 1: prion protein

Chain A: 69% 19% 6%



4.2.17 Score per residue for model 17

- Molecule 1: prion protein

Chain A:  71% 18% 6% •



4.2.18 Score per residue for model 18

- Molecule 1: prion protein

Chain A:  69% 23% 6% •



4.2.19 Score per residue for model 19

- Molecule 1: prion protein

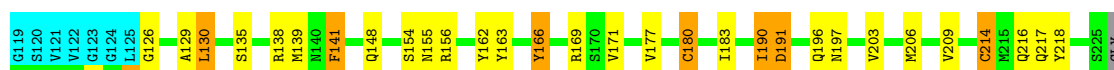
Chain A:  69% 19% 5% 6% •



4.2.20 Score per residue for model 20

- Molecule 1: prion protein

Chain A:  65% 21% 6% 6% •



5 Refinement protocol and experimental data overview

The models were refined using the following method: *torsion angle dynamics*.

Of the 100 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
DYANA	structure solution	6.0
DYANA	refinement	6.0

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 6282
Number of chemical shift lists	1
Total number of shifts	1134
Number of shifts mapped to atoms	1134
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	75%

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

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	0.65±0.01	0±0/854 (0.0±0.0%)	1.13±0.03	2±1/1153 (0.2±0.1%)
All	All	0.65	0/17080 (0.0%)	1.13	44/23060 (0.2%)

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	0.0±0.0	2.0±1.1
All	All	0	41

There are no bond-length outliers.

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	166	TYR	CB-CG-CD2	-7.07	116.76	121.00	15	6
1	A	188	TYR	CB-CG-CD2	-6.83	116.90	121.00	19	8
1	A	181	VAL	CA-CB-CG2	6.62	120.83	110.90	3	5
1	A	203	VAL	CA-CB-CG2	6.50	120.65	110.90	7	8
1	A	143	ARG	NE-CZ-NH2	-6.00	117.30	120.30	1	2
1	A	178	ARG	NE-CZ-NH2	-5.96	117.32	120.30	3	2
1	A	169	ARG	NE-CZ-NH2	-5.61	117.50	120.30	7	1
1	A	138	ARG	NE-CZ-NH2	-5.59	117.50	120.30	10	1
1	A	153	ASN	C-N-CA	5.54	135.55	121.70	4	1
1	A	169	ARG	CD-NE-CZ	5.54	131.36	123.60	11	1
1	A	156	ARG	NE-CZ-NH2	-5.42	117.59	120.30	2	1
1	A	139	MET	CG-SD-CE	-5.34	91.65	100.20	14	2
1	A	171	VAL	CA-CB-CG1	5.25	118.78	110.90	20	1
1	A	188	TYR	CB-CG-CD1	5.22	124.13	121.00	19	1
1	A	143	ARG	NE-CZ-NH1	5.17	122.88	120.30	1	1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	221	TYR	CB-CG-CD2	-5.06	117.97	121.00	3	1
1	A	133	ALA	CB-CA-C	5.04	117.67	110.10	14	1
1	A	213	MET	CA-CB-CG	5.00	121.81	113.30	19	1

There are no chirality outliers.

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

Mol	Chain	Res	Type	Group	Models (Total)
1	A	218	TYR	Sidechain	6
1	A	221	TYR	Sidechain	5
1	A	166	TYR	Sidechain	4
1	A	163	TYR	Sidechain	4
1	A	147	ARG	Sidechain	4
1	A	128	TYR	Sidechain	3
1	A	169	ARG	Sidechain	3
1	A	178	ARG	Sidechain	2
1	A	143	ARG	Sidechain	1
1	A	171	VAL	Peptide	1
1	A	156	ARG	Sidechain	1
1	A	164	LYS	Peptide	1
1	A	162	TYR	Sidechain	1
1	A	224	ALA	Peptide	1
1	A	204	ARG	Sidechain	1
1	A	188	TYR	Sidechain	1
1	A	157	TYR	Sidechain	1
1	A	136	GLY	Peptide	1

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
1	A	837	782	784	3±2
All	All	16740	15640	15680	68

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 2.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:130:LEU:HD12	1:A:162:TYR:CD1	0.62	2.29	5	5
1:A:177:VAL:HA	1:A:180:CYS:SG	0.56	2.40	17	2
1:A:181:VAL:HG11	1:A:211:GLN:HG3	0.55	1.78	1	2
1:A:139:MET:SD	1:A:141:PHE:CZ	0.55	3.00	6	4
1:A:171:VAL:HG12	1:A:175:ARG:HD3	0.54	1.80	15	1
1:A:130:LEU:HD12	1:A:162:TYR:CG	0.53	2.38	14	2
1:A:161:VAL:HG13	1:A:213:MET:SD	0.53	2.43	8	1
1:A:130:LEU:N	1:A:130:LEU:HD13	0.52	2.19	17	3
1:A:180:CYS:SG	1:A:214:CYS:SG	0.52	3.07	17	5
1:A:130:LEU:HD12	1:A:162:TYR:CB	0.52	2.35	14	2
1:A:171:VAL:HG21	1:A:176:PHE:HB2	0.51	1.81	9	1
1:A:128:TYR:CE1	1:A:183:ILE:HG12	0.51	2.40	7	3
1:A:157:TYR:CD2	1:A:206:MET:SD	0.51	3.03	10	1
1:A:130:LEU:HD12	1:A:162:TYR:HB3	0.49	1.83	14	1
1:A:139:MET:HG2	1:A:141:PHE:CE1	0.49	2.43	1	2
1:A:130:LEU:HD23	1:A:162:TYR:CD1	0.48	2.43	6	1
1:A:161:VAL:CG1	1:A:213:MET:HG3	0.48	2.39	14	3
1:A:171:VAL:HG12	1:A:175:ARG:CD	0.47	2.39	10	1
1:A:161:VAL:HG21	1:A:214:CYS:HA	0.47	1.85	8	1
1:A:130:LEU:HD13	1:A:130:LEU:N	0.47	2.24	13	2
1:A:180:CYS:HG	1:A:214:CYS:CB	0.47	2.23	19	2
1:A:188:TYR:HD2	1:A:190:ILE:HD11	0.46	1.71	16	1
1:A:164:LYS:HG3	1:A:166:TYR:CD1	0.46	2.44	6	1
1:A:181:VAL:HG12	1:A:210:ILE:HG22	0.46	1.86	11	1
1:A:139:MET:HB3	1:A:141:PHE:CE2	0.46	2.46	3	2
1:A:157:TYR:CD1	1:A:188:TYR:CD2	0.46	3.04	16	1
1:A:130:LEU:CD1	1:A:162:TYR:CD1	0.45	3.00	5	1
1:A:184:THR:HG22	1:A:210:ILE:HD13	0.45	1.89	6	1
1:A:130:LEU:HG	1:A:162:TYR:CD1	0.45	2.47	14	1
1:A:130:LEU:HD23	1:A:162:TYR:CD2	0.44	2.47	8	1
1:A:188:TYR:CD2	1:A:190:ILE:HD11	0.44	2.48	16	1
1:A:200:GLN:HA	1:A:203:VAL:HG22	0.44	1.88	1	2
1:A:139:MET:SD	1:A:141:PHE:CE1	0.42	3.12	4	2
1:A:129:ALA:C	1:A:130:LEU:HD13	0.42	2.34	20	1
1:A:164:LYS:HE2	1:A:166:TYR:CD1	0.42	2.49	12	1
1:A:210:ILE:HA	1:A:213:MET:HG2	0.42	1.92	2	1
1:A:190:ILE:HG22	1:A:191:ASP:H	0.41	1.74	20	1
1:A:128:TYR:CE1	1:A:183:ILE:HG23	0.41	2.50	2	1
1:A:164:LYS:CG	1:A:166:TYR:CE1	0.40	3.04	6	1

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:139:MET:CB	1:A:141:PHE:CE1	0.40	3.04	20	1
1:A:164:LYS:HG3	1:A:166:TYR:CE1	0.40	2.51	11	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	99/108 (92%)	80±3 (81±3%)	14±3 (14±3%)	5±3 (5±3%)	4	24
All	All	1980/2160 (92%)	1600 (81%)	276 (14%)	104 (5%)	4	24

All 25 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	135	SER	14
1	A	196	GLN	10
1	A	141	PHE	8
1	A	132	SER	8
1	A	154	SER	7
1	A	191	ASP	7
1	A	169	ARG	6
1	A	197	ASN	6
1	A	155	ASN	6
1	A	126	GLY	4
1	A	133	ALA	4
1	A	131	GLY	4
1	A	172	PRO	2
1	A	190	ILE	2
1	A	198	VAL	2
1	A	189	LYS	2
1	A	166	TYR	2
1	A	173	GLU	2
1	A	157	TYR	2
1	A	137	MET	1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Models (Total)
1	A	176	PHE	1
1	A	153	ASN	1
1	A	134	MET	1
1	A	127	GLY	1
1	A	167	ASN	1

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	92/96 (96%)	78±2 (84±2%)	14±2 (16±2%)	6	44
All	All	1840/1920 (96%)	1552 (84%)	288 (16%)	6	44

All 67 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	209	VAL	20
1	A	159	ASN	14
1	A	218	TYR	12
1	A	178	ARG	11
1	A	171	VAL	11
1	A	130	LEU	9
1	A	211	GLN	9
1	A	153	ASN	8
1	A	180	CYS	8
1	A	198	VAL	8
1	A	183	ILE	7
1	A	169	ARG	6
1	A	212	GLU	6
1	A	162	TYR	6
1	A	164	LYS	6
1	A	138	ARG	6
1	A	223	LEU	5
1	A	139	MET	5
1	A	216	GLN	5
1	A	217	GLN	5

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Models (Total)
1	A	179	ASP	5
1	A	204	ARG	5
1	A	148	GLN	4
1	A	195	ASN	4
1	A	219	GLN	4
1	A	189	LYS	4
1	A	207	LYS	4
1	A	142	ASP	4
1	A	190	ILE	4
1	A	225	SER	4
1	A	206	MET	4
1	A	208	GLN	4
1	A	221	TYR	4
1	A	147	ARG	3
1	A	140	ASN	3
1	A	182	ASN	3
1	A	132	SER	3
1	A	168	ASP	3
1	A	154	SER	3
1	A	191	ASP	3
1	A	201	VAL	3
1	A	222	GLN	3
1	A	156	ARG	3
1	A	137	MET	2
1	A	214	CYS	2
1	A	146	GLU	2
1	A	175	ARG	2
1	A	197	ASN	2
1	A	155	ASN	2
1	A	187	GLU	2
1	A	167	ASN	2
1	A	152	GLU	2
1	A	135	SER	2
1	A	200	GLN	2
1	A	151	ASN	2
1	A	173	GLU	2
1	A	163	TYR	1
1	A	213	MET	1
1	A	194	GLU	1
1	A	144	PRO	1
1	A	202	GLU	1
1	A	134	MET	1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Models (Total)
1	A	145	GLU	1
1	A	196	GLN	1
1	A	193	ASN	1
1	A	165	GLU	1
1	A	157	TYR	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 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 75% for the well-defined parts and 75% for the entire structure.

7.1 Chemical shift list 1

File name: BMRB entry 6282

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	1134
Number of shifts mapped to atoms	1134
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	2

7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	107	0.35 ± 0.17	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	98	0.62 ± 0.17	Should be applied
$^{13}\text{C}'$	0	—	None (insufficient data)
^{15}N	102	0.66 ± 0.32	Should be applied

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 75%, i.e. 984 atoms were assigned a chemical shift out of a possible 1304. 11 out of 12 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	392/492 (80%)	196/196 (100%)	100/200 (50%)	96/96 (100%)
Sidechain	536/706 (76%)	343/418 (82%)	184/240 (77%)	9/48 (19%)

Continued on next page...

Continued from previous page...

	Total	¹H	¹³C	¹⁵N
Aromatic	56/106 (53%)	54/54 (100%)	0/50 (0%)	2/2 (100%)
Overall	984/1304 (75%)	593/668 (89%)	284/490 (58%)	107/146 (73%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 75%, i.e. 1029 atoms were assigned a chemical shift out of a possible 1363. 12 out of 15 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹H	¹³C	¹⁵N
Backbone	418/527 (79%)	209/210 (100%)	107/214 (50%)	102/103 (99%)
Sidechain	555/730 (76%)	354/431 (82%)	192/251 (76%)	9/48 (19%)
Aromatic	56/106 (53%)	54/54 (100%)	0/50 (0%)	2/2 (100%)
Overall	1029/1363 (75%)	617/695 (89%)	299/515 (58%)	113/153 (74%)

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.

Mol	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	153	ASN	HB3	0.32	4.41 – 1.11	-7.4
1	A	199	THR	CB	60.30	78.10 – 61.30	-5.6

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.

Random coil index (RCI) for chain A:

