



Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 11:08 PM BST

PDB ID : 2K7P
Title : Filamin A Ig-like domains 16-17
Authors : Heikkinen, O.K.; Kilpelainen, I.; Koskela, H.; Permi, P.; Heikkinen, S.; Ylanne, J.
Deposited on : 2008-08-19

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

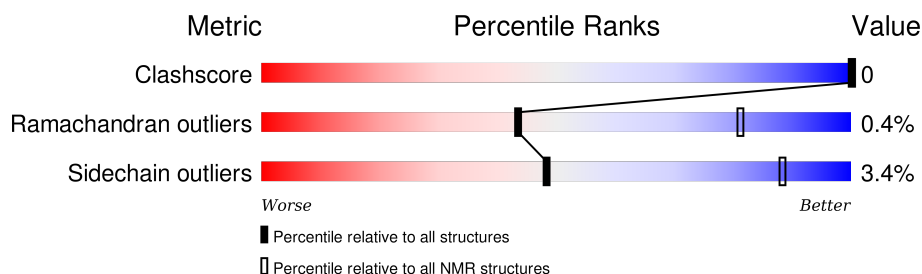
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 84%.

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	188	 86% • 11%

2 Ensemble composition and analysis

This entry contains 40 models. Model 2 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:1788-A:1955 (168)	0.34	2

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	1, 2, 3, 5, 6, 7, 8, 10, 13, 14, 17, 18, 20, 21, 23, 27, 30, 33, 36
2	4, 12, 15, 16, 24, 26, 29, 31, 35, 37
3	11, 25, 32, 34, 40
4	9, 22, 39
Single-model clusters	19; 28; 38

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 2777 atoms, of which 1372 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Filamin-A.

Mol	Chain	Residues	Atoms						Trace
1	A	188	Total	C	H	N	O	S	0
			2777	882	1372	236	280	7	

There are 3 discrepancies between the modelled and reference sequences:

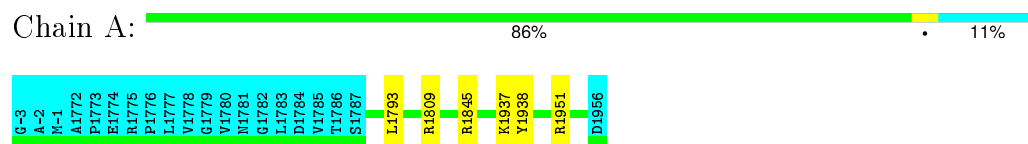
Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	EXPRESSION TAG	UNP P21333
A	-2	ALA	-	EXPRESSION TAG	UNP P21333
A	-1	MET	-	EXPRESSION TAG	UNP P21333

4 Residue-property plots [i](#)

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: Filamin-A

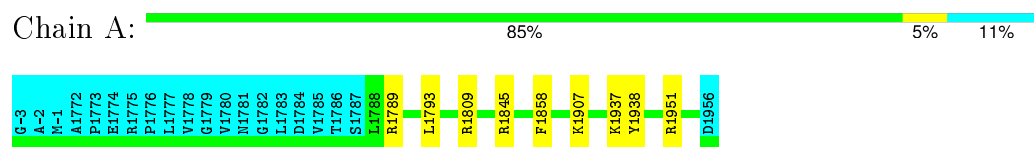


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

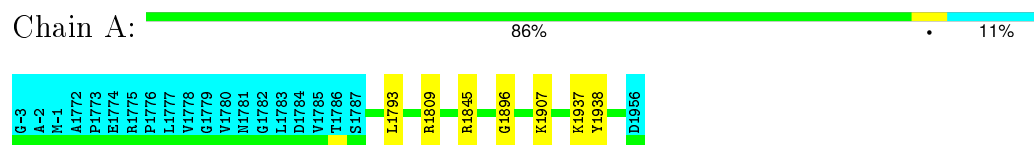
4.2.1 Score per residue for model 1

- Molecule 1: Filamin-A



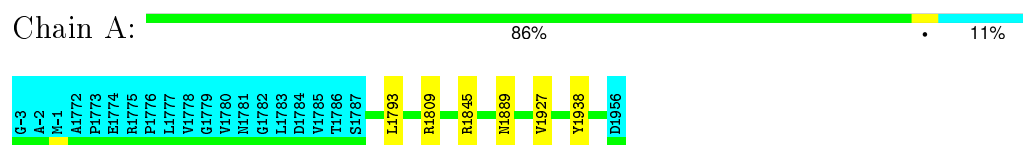
4.2.2 Score per residue for model 2 (medoid)

- Molecule 1: Filamin-A



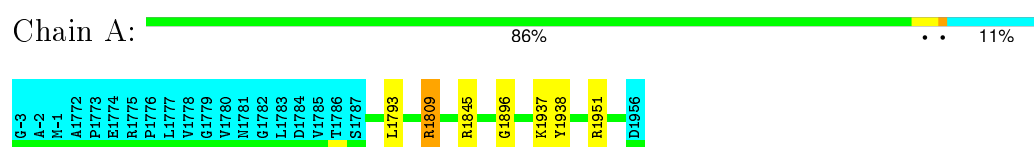
4.2.3 Score per residue for model 3

- Molecule 1: Filamin-A



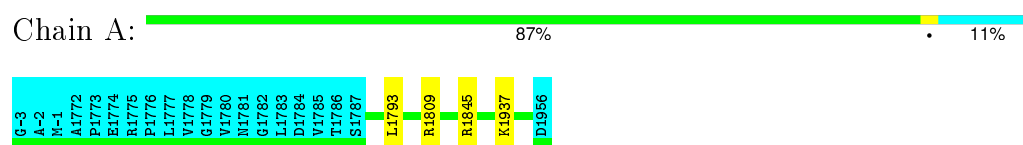
4.2.4 Score per residue for model 4

- Molecule 1: Filamin-A



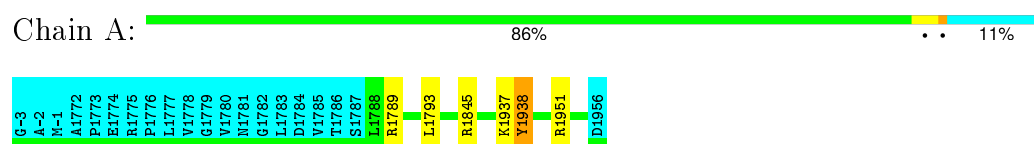
4.2.5 Score per residue for model 5

- Molecule 1: Filamin-A



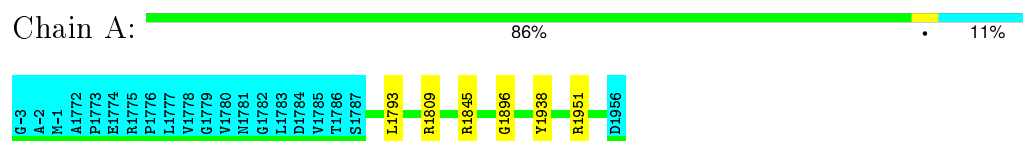
4.2.6 Score per residue for model 6

- Molecule 1: Filamin-A



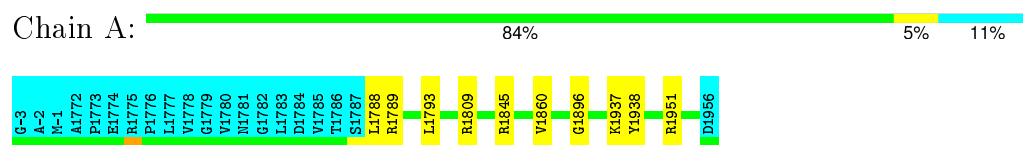
4.2.7 Score per residue for model 7

- Molecule 1: Filamin-A



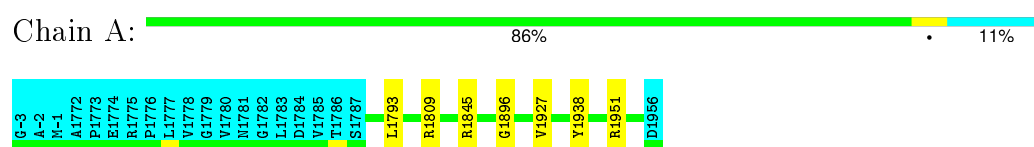
4.2.8 Score per residue for model 8

- Molecule 1: Filamin-A



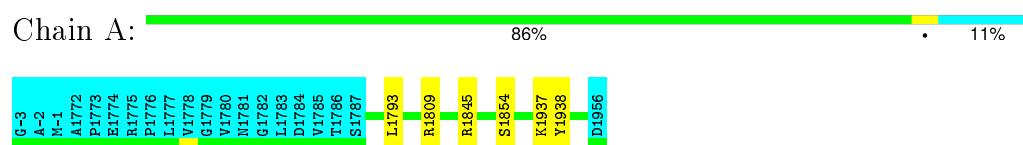
4.2.9 Score per residue for model 9

- Molecule 1: Filamin-A



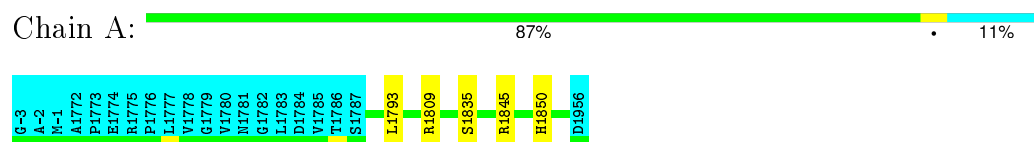
4.2.10 Score per residue for model 10

- Molecule 1: Filamin-A



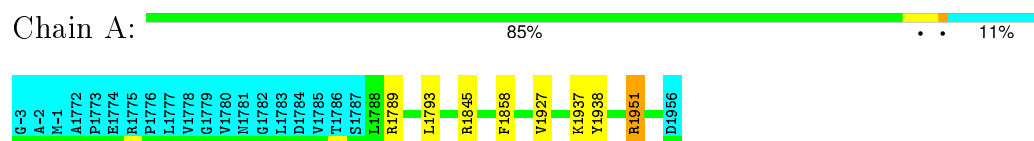
4.2.11 Score per residue for model 11

- Molecule 1: Filamin-A



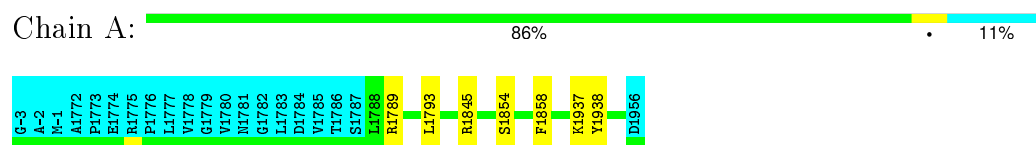
4.2.12 Score per residue for model 12

- Molecule 1: Filamin-A



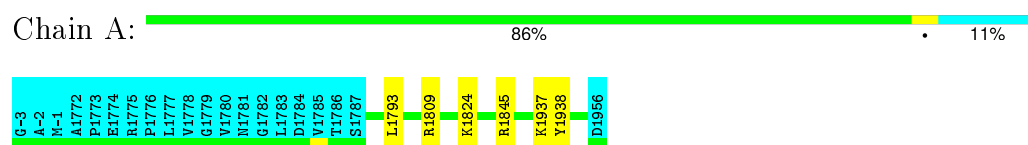
4.2.13 Score per residue for model 13

- Molecule 1: Filamin-A



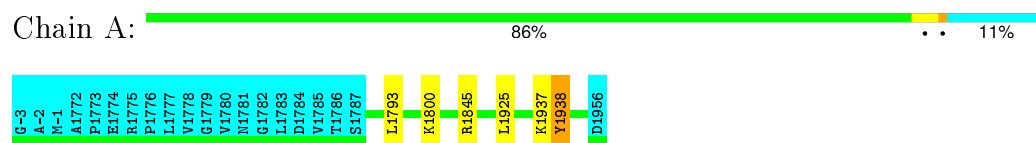
4.2.14 Score per residue for model 14

- Molecule 1: Filamin-A



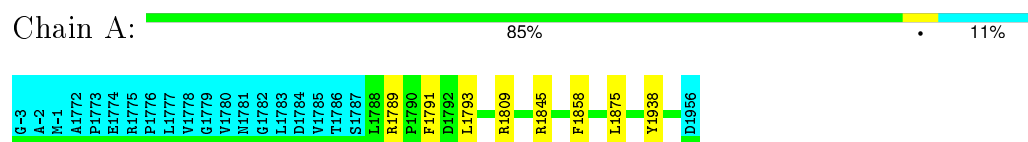
4.2.15 Score per residue for model 15

- Molecule 1: Filamin-A



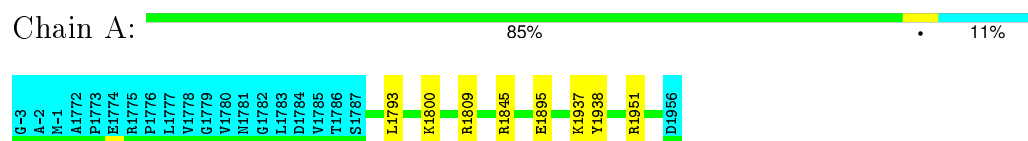
4.2.16 Score per residue for model 16

- Molecule 1: Filamin-A



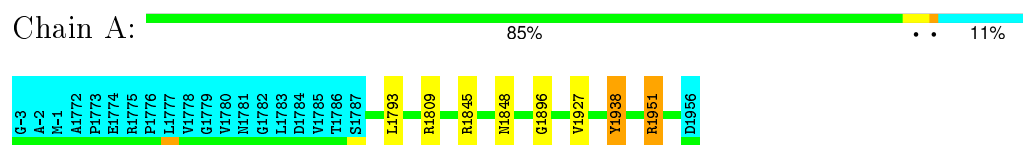
4.2.17 Score per residue for model 17

- Molecule 1: Filamin-A



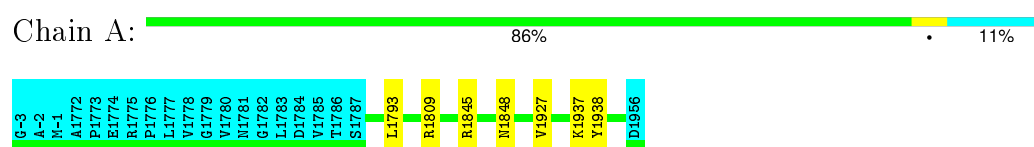
4.2.18 Score per residue for model 18

- Molecule 1: Filamin-A



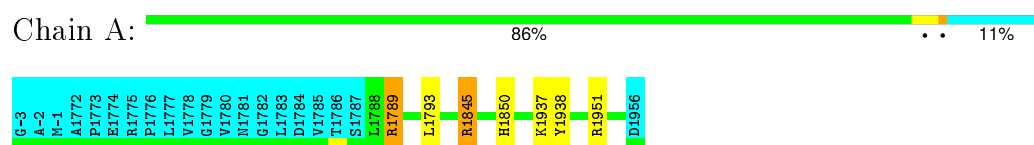
4.2.19 Score per residue for model 19

- Molecule 1: Filamin-A



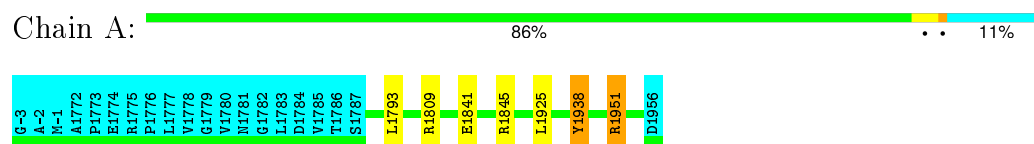
4.2.20 Score per residue for model 20

- Molecule 1: Filamin-A



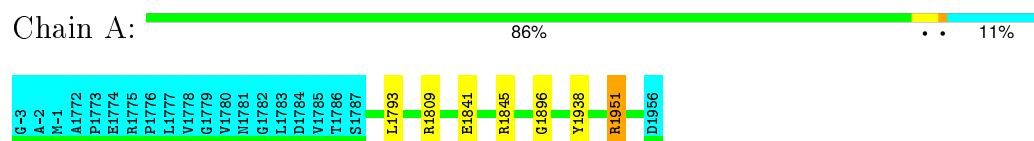
4.2.21 Score per residue for model 21

- Molecule 1: Filamin-A



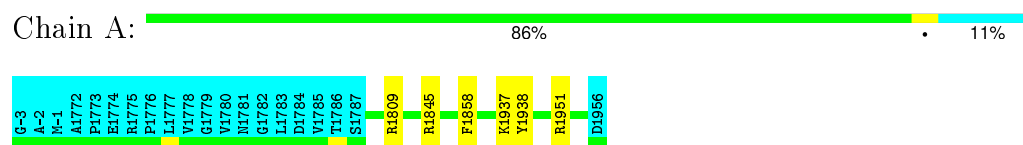
4.2.22 Score per residue for model 22

- Molecule 1: Filamin-A



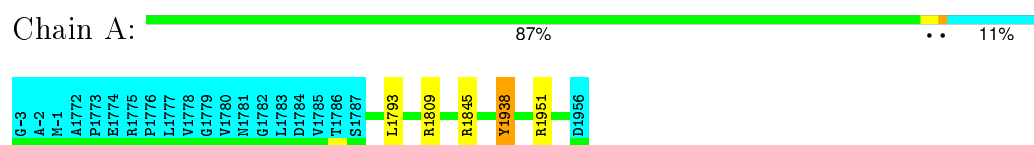
4.2.23 Score per residue for model 23

- Molecule 1: Filamin-A



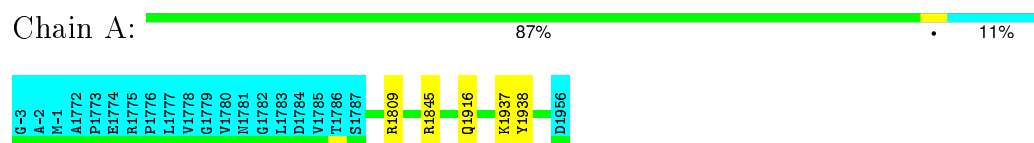
4.2.24 Score per residue for model 24

- Molecule 1: Filamin-A



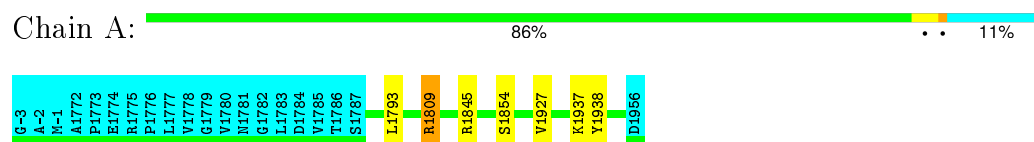
4.2.25 Score per residue for model 25

- Molecule 1: Filamin-A



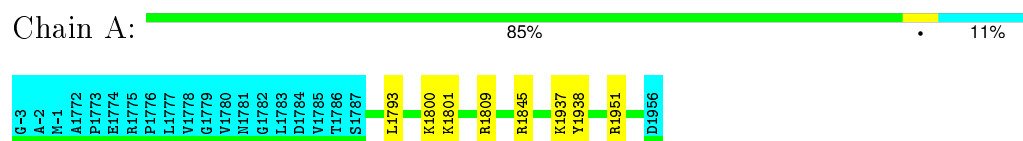
4.2.26 Score per residue for model 26

- Molecule 1: Filamin-A



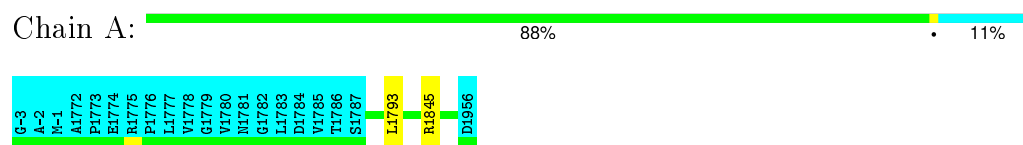
4.2.27 Score per residue for model 27

- Molecule 1: Filamin-A



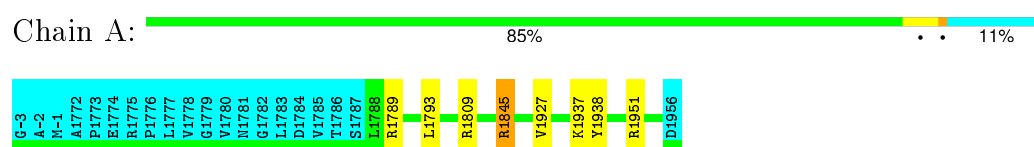
4.2.28 Score per residue for model 28

- Molecule 1: Filamin-A



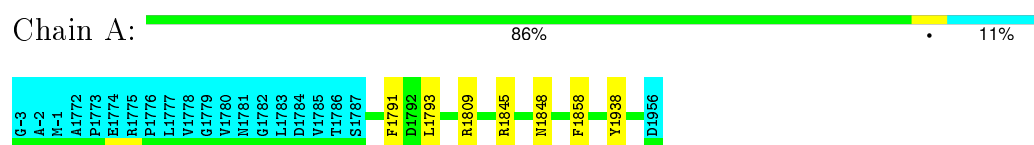
4.2.29 Score per residue for model 29

- Molecule 1: Filamin-A



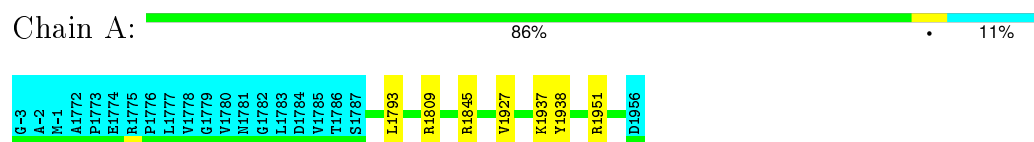
4.2.30 Score per residue for model 30

- Molecule 1: Filamin-A



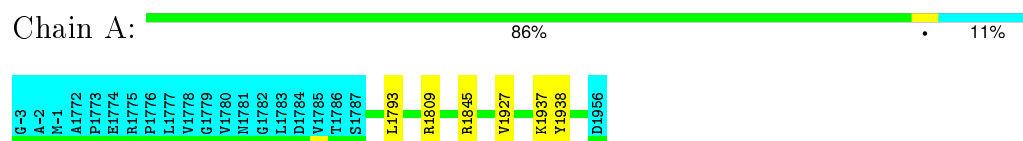
4.2.31 Score per residue for model 31

- Molecule 1: Filamin-A



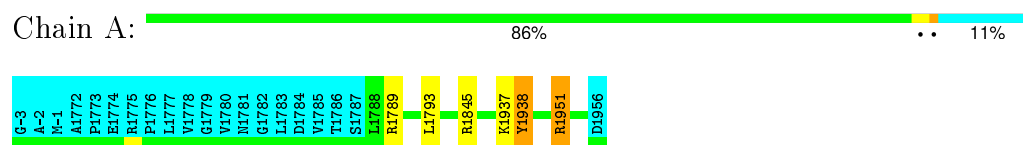
4.2.32 Score per residue for model 32

- Molecule 1: Filamin-A



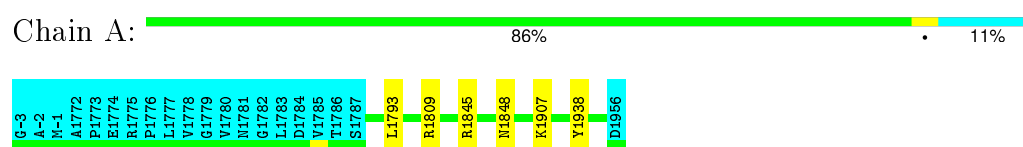
4.2.33 Score per residue for model 33

- Molecule 1: Filamin-A



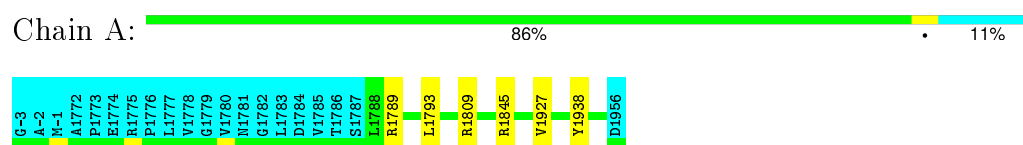
4.2.34 Score per residue for model 34

- Molecule 1: Filamin-A



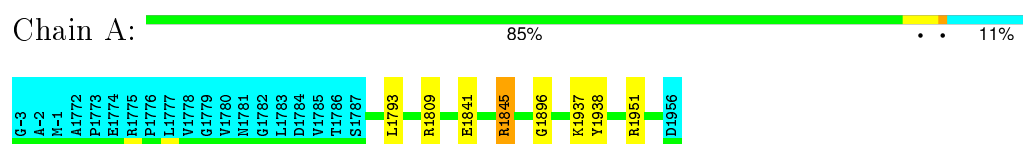
4.2.35 Score per residue for model 35

- Molecule 1: Filamin-A



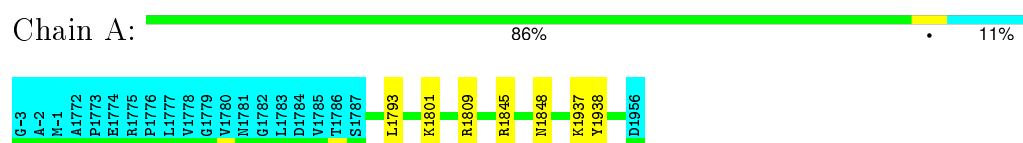
4.2.36 Score per residue for model 36

- Molecule 1: Filamin-A



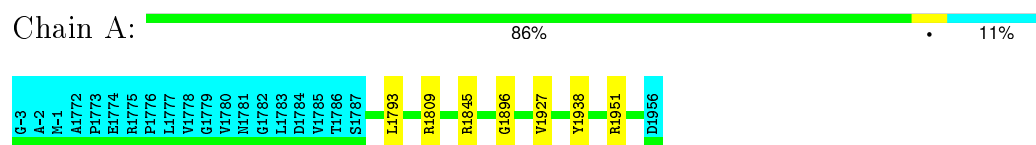
4.2.37 Score per residue for model 37

- Molecule 1: Filamin-A



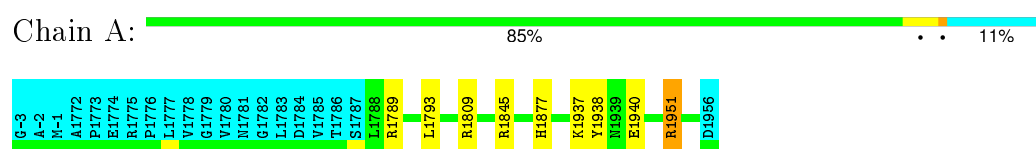
4.2.38 Score per residue for model 38

- Molecule 1: Filamin-A



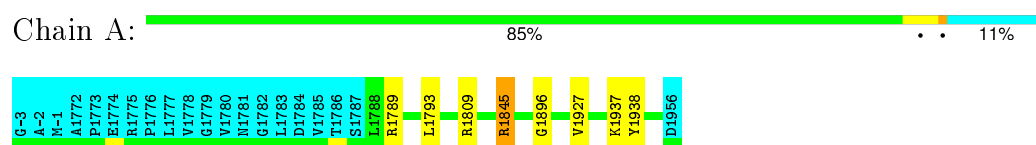
4.2.39 Score per residue for model 39

- Molecule 1: Filamin-A



4.2.40 Score per residue for model 40

- Molecule 1: Filamin-A



5 Refinement protocol and experimental data overview

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

Of the 400 calculated structures, 40 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
TALOS	geometry optimization	
CYANA	structure solution	2.1
AMBER	refinement	8.0

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 15924
Number of chemical shift lists	1
Total number of shifts	2036
Number of shifts mapped to atoms	2036
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	84%

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

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	0.70±0.00	0±0/1298 (0.0±0.0%)	0.91±0.01	2±1/1773 (0.1±0.1%)
All	All	0.70	0/51920 (0.0%)	0.91	77/70920 (0.1%)

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	0.1±0.2
All	All	0	2

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	1809	ARG	NE-CZ-NH1	7.87	124.23	120.30	17	32
1	A	1845	ARG	NE-CZ-NH1	7.39	123.99	120.30	36	4
1	A	1789	ARG	NE-CZ-NH1	6.77	123.69	120.30	1	10
1	A	1809	ARG	NE-CZ-NH2	-6.55	117.03	120.30	5	10
1	A	1951	ARG	NE-CZ-NH1	6.49	123.54	120.30	21	14
1	A	1789	ARG	NE-CZ-NH2	-6.11	117.25	120.30	1	1
1	A	1938	TYR	CB-CG-CD2	-5.30	117.82	121.00	18	6

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	1809	ARG	Sidechain	1

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Mol	Chain	Res	Type	Group	Models (Total)
1	A	1951	ARG	Sidechain	1

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	1266	1234	1234	0±0
All	All	50640	49360	49360	2

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 0.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:1788:LEU:HD11	1:A:1860:VAL:HG12	0.43	1.89	8	1
1:A:1877:HIS:CE1	1:A:1951:ARG:HH22	0.41	2.33	39	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	168/188 (89%)	162±1 (96±1%)	6±1 (3±1%)	1±1 (0±0%)	43	81
All	All	6720/7520 (89%)	6473 (96%)	222 (3%)	25 (0%)	43	81

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	1927	VAL	12

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Mol	Chain	Res	Type	Models (Total)
1	A	1896	GLY	10
1	A	1801	LYS	2
1	A	1835	SER	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	141/156 (90%)	136±1 (97±1%)	5±1 (3±1%)	48	88
All	All	5640/6240 (90%)	5448 (97%)	192 (3%)	48	88

All 22 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	1845	ARG	40
1	A	1793	LEU	38
1	A	1938	TYR	37
1	A	1937	LYS	26
1	A	1951	ARG	11
1	A	1858	PHE	6
1	A	1848	ASN	5
1	A	1789	ARG	3
1	A	1800	LYS	3
1	A	1841	GLU	3
1	A	1907	LYS	3
1	A	1854	SER	3
1	A	1791	PHE	2
1	A	1925	LEU	2
1	A	1809	ARG	2
1	A	1850	HIS	2
1	A	1889	ASN	1
1	A	1940	GLU	1
1	A	1916	GLN	1
1	A	1824	LYS	1
1	A	1875	LEU	1
1	A	1895	GLU	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 84% for the well-defined parts and 84% for the entire structure.

7.1 Chemical shift list 1

File name: BMRB entry 15924

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	2036
Number of shifts mapped to atoms	2036
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	5

7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	188	0.02 ± 0.11	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	167	-0.20 ± 0.08	None needed (< 0.5 ppm)
$^{13}\text{C}'$	0	—	—
^{15}N	167	-1.66 ± 0.30	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 84%, i.e. 1617 atoms were assigned a chemical shift out of a possible 1927. 3 out of 26 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	638/812 (79%)	319/322 (99%)	168/336 (50%)	151/154 (98%)
Sidechain	849/971 (87%)	520/568 (92%)	315/369 (85%)	14/34 (41%)

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	Total	¹ H	¹³ C	¹⁵ N
Aromatic	130/144 (90%)	67/77 (87%)	62/62 (100%)	1/5 (20%)
Overall	1617/1927 (84%)	906/967 (94%)	545/767 (71%)	166/193 (86%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 84%, i.e. 1787 atoms were assigned a chemical shift out of a possible 2136. 3 out of 31 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	710/908 (78%)	355/360 (99%)	188/376 (50%)	167/172 (97%)
Sidechain	947/1084 (87%)	579/633 (91%)	353/413 (85%)	15/38 (39%)
Aromatic	130/144 (90%)	67/77 (87%)	62/62 (100%)	1/5 (20%)
Overall	1787/2136 (84%)	1001/1070 (94%)	603/851 (71%)	183/215 (85%)

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	1875	LEU	HD23	-0.96	2.14 – -0.66	-6.1
1	A	1875	LEU	HD22	-0.96	2.14 – -0.66	-6.1
1	A	1875	LEU	HD21	-0.96	2.14 – -0.66	-6.1
1	A	1922	VAL	HB	0.06	3.59 – 0.39	-6.0
1	A	1840	HIS	HB3	0.98	5.00 – 1.10	-5.3

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:

