



Full wwPDB NMR Structure Validation Report ⓘ

May 28, 2020 – 10:40 pm BST

PDB ID : 2KSP
Title : Mechanism for the selective interaction of C-terminal EH-domain proteins with specific NPF-containing partners
Authors : Kieken, F.; Sharma, M.; Jovic, M.; Giridharan, S.S.; Naslavsky, N.; Caplan, S.; Sorgen, P.L.
Deposited on : 2010-01-11

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.

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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:

Cyrange : Kirchner and Güntert (2011)
NmrClust : Kelley et al. (1996)
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 : 2.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

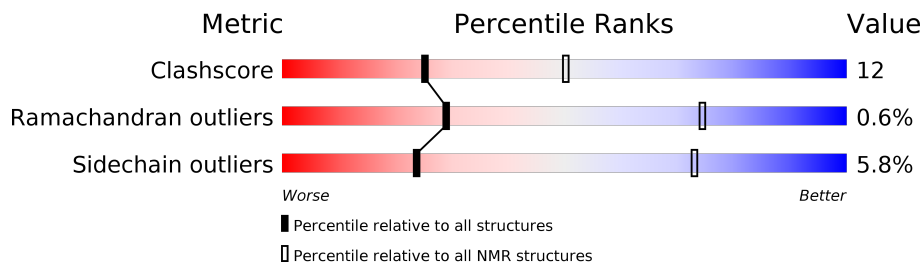
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 85%.

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	105	
2	B	15	

2 Ensemble composition and analysis i

This entry contains 10 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:44-A:131, B:148-B:152 (93)	0.36	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 1 clusters and 1 single-model cluster was found.

Cluster number	Models
1	1, 2, 3, 4, 5, 6, 7, 8, 10
Single-model clusters	9

3 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 1902 atoms, of which 948 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called EH domain-containing protein 1.

Mol	Chain	Residues	Atoms					Trace	
			Total	C	H	N	O		S
1	A	105	1661	527	839	138	156	1	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	35	GLY	-	expression tag	UNP Q9H4M9
A	36	PRO	-	expression tag	UNP Q9H4M9
A	37	LEU	-	expression tag	UNP Q9H4M9
A	38	GLY	-	expression tag	UNP Q9H4M9
A	39	SER	-	expression tag	UNP Q9H4M9

- Molecule 2 is a protein called MICAL L1 like peptide.

Mol	Chain	Residues	Atoms					Trace
			Total	C	H	N	O	
2	B	15	240	81	109	17	33	0

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

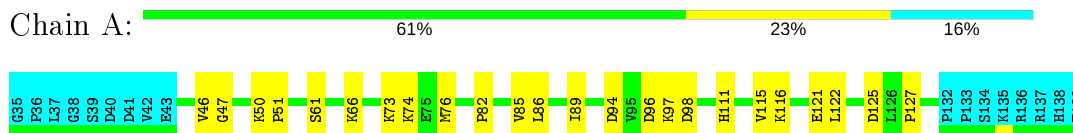
Mol	Chain	Residues	Atoms	
			Total	Ca
3	A	1	1	1

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: EH domain-containing protein 1



- Molecule 2: MICAL L1 like peptide

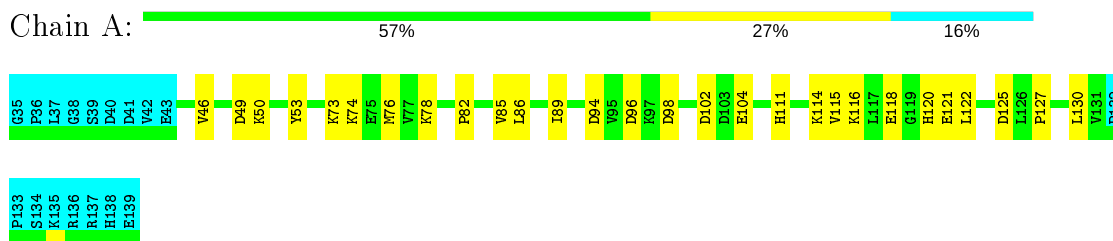


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

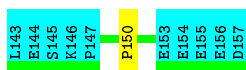
4.2.1 Score per residue for model 1

- Molecule 1: EH domain-containing protein 1



- Molecule 2: MICAL L1 like peptide





4.2.2 Score per residue for model 2 (medoid)

- Molecule 1: EH domain-containing protein 1



- Molecule 2: MICAL L1 like peptide



4.2.3 Score per residue for model 3

- Molecule 1: EH domain-containing protein 1



- Molecule 2: MICAL L1 like peptide



4.2.4 Score per residue for model 4

- Molecule 1: EH domain-containing protein 1



- Molecule 2: MICAL L1 like peptide

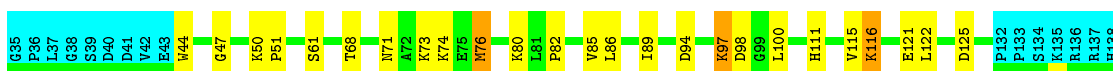
Chain B: 



4.2.5 Score per residue for model 5

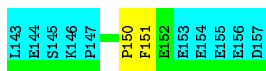
- Molecule 1: EH domain-containing protein 1

Chain A: 



- Molecule 2: MICAL L1 like peptide

Chain B: 



4.2.6 Score per residue for model 6

- Molecule 1: EH domain-containing protein 1

Chain A: 



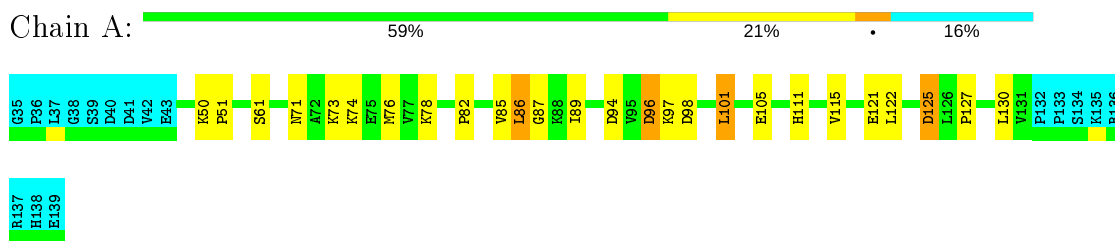
- Molecule 2: MICAL L1 like peptide

Chain B: 



4.2.7 Score per residue for model 7

- Molecule 1: EH domain-containing protein 1

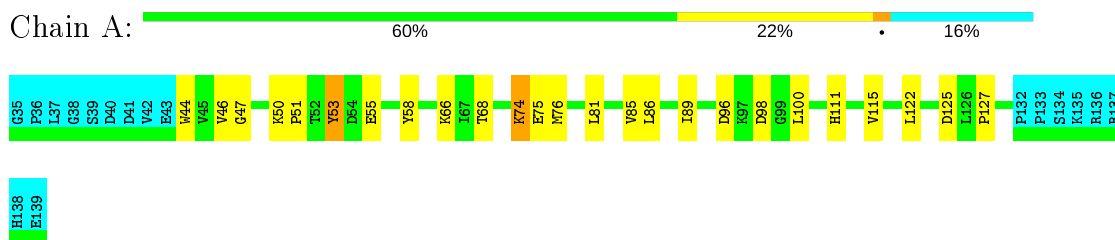


- Molecule 2: MICAL L1 like peptide



4.2.8 Score per residue for model 8

- Molecule 1: EH domain-containing protein 1

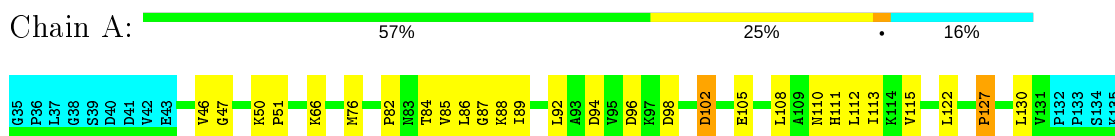


- Molecule 2: MICAL L1 like peptide



4.2.9 Score per residue for model 9

- Molecule 1: EH domain-containing protein 1



R136
R137
H138
E139

- Molecule 2: MICAL L1 like peptide

Chain B:  20% 13% 67%

L143
E144
S145
K146
P147
Y148
N149
E152
E153
E154
E155
E156
D157

4.2.10 Score per residue for model 10


- Molecule 1: EH domain-containing protein 1

Chain A:  50% 31% 16%

635
F36
L37
638
S39
D40
D41
V42
E43
G47
K50
F51
T52
I56
S61
R66
I67
T68
N71
A72
K73
K74
E75
E76
V77
K78
P82
V85
L86
G87
R88
I89
D94
V95
D96
R97
D98
G99
L100
E105
H111
L112
I113
K114
V115
K116
L117
E118
G119

H120
E121
L122
L126
V131
P132
P133
S134
K135
R136
R137
H138
E139

- Molecule 2: MICAL L1 like peptide

Chain B:  13% 20% 67%

L143
E144
S145
K146
P147
Y148
N149
F151
E152
E153
E154
E155
E156
D157

5 Refinement protocol and experimental data overview (i)

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

Of the 30 calculated structures, 10 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	refinement	1.2

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 6 of this report.

Chemical shift file(s)	input_cs.cif
Number of chemical shift lists	1
Total number of shifts	1280
Number of shifts mapped to atoms	1280
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	85%

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

COVALENT-GEOMETRY INFOmissingINFO

5.1 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	690	713	710	16±4
2	B	47	37	37	3±2
3	A	1	0	0	2±1
All	All	7380	7500	7470	171

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 12.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:49:ASP:HB3	1:A:53:TYR:CE2	0.80	2.11	1	1
1:A:47:GLY:HA2	1:A:50:LYS:HG2	0.78	1.56	8	6
1:A:76:MET:HB3	1:A:86:LEU:HG	0.76	1.56	7	3
1:A:105:GLU:OE1	3:A:141:CA:CA	0.67	1.72	4	1
1:A:94:ASP:OD1	3:A:141:CA:CA	0.66	1.73	2	9
1:A:76:MET:HB3	1:A:86:LEU:HD22	0.66	1.67	3	2
1:A:98:ASP:OD1	3:A:141:CA:CA	0.65	1.74	8	6
1:A:98:ASP:OD2	3:A:141:CA:CA	0.65	1.73	6	1
1:A:96:ASP:OD1	3:A:141:CA:CA	0.65	1.74	6	6
1:A:102:ASP:OD1	1:A:104:GLU:HG2	0.63	1.93	1	1
1:A:94:ASP:HA	1:A:105:GLU:OE2	0.63	1.93	7	3
1:A:87:GLY:HA2	2:B:149:ASN:ND2	0.62	2.09	6	1
1:A:71:ASN:O	1:A:74:LYS:HG2	0.61	1.96	2	2
1:A:76:MET:SD	1:A:113:ILE:HD11	0.60	2.36	9	1
1:A:87:GLY:HA2	2:B:149:ASN:HD21	0.59	1.58	6	4
1:A:74:LYS:O	1:A:78:LYS:HG3	0.59	1.98	1	3
1:A:94:ASP:OD2	1:A:97:LYS:HA	0.59	1.98	7	3
1:A:76:MET:HG2	1:A:86:LEU:HG	0.59	1.73	4	1
1:A:125:ASP:O	1:A:127:PRO:HD3	0.58	1.97	7	3
1:A:68:THR:HA	1:A:100:LEU:HD22	0.58	1.75	10	3
1:A:73:LYS:HA	2:B:151:PHE:HZ	0.58	1.59	6	1
1:A:66:LYS:HE3	1:A:100:LEU:HB2	0.58	1.75	8	1
1:A:76:MET:HG3	2:B:151:PHE:CZ	0.58	2.34	3	2
1:A:88:LYS:HD3	1:A:122:LEU:HB2	0.57	1.77	9	1
1:A:50:LYS:N	1:A:51:PRO:HD2	0.57	2.14	3	9
1:A:127:PRO:HD2	1:A:130:LEU:HB2	0.56	1.76	9	3
1:A:74:LYS:HD3	1:A:75:GLU:N	0.56	2.16	8	1
1:A:73:LYS:HA	2:B:151:PHE:CZ	0.55	2.36	6	3
1:A:82:PRO:O	1:A:86:LEU:HD13	0.55	2.00	5	6
1:A:114:LYS:O	1:A:118:GLU:HG2	0.55	2.00	1	3
1:A:112:LEU:HD13	1:A:122:LEU:HD13	0.54	1.79	10	1
1:A:49:ASP:HB3	1:A:53:TYR:HE2	0.54	1.57	1	1
1:A:111:HIS:O	1:A:115:VAL:HG23	0.54	2.02	4	10
2:B:149:ASN:HB3	2:B:152:GLU:HB3	0.54	1.80	3	6
1:A:76:MET:CG	1:A:86:LEU:HG	0.54	2.33	9	2
1:A:47:GLY:HA2	1:A:50:LYS:CG	0.53	2.31	8	1
1:A:66:LYS:HE3	1:A:102:ASP:N	0.52	2.19	9	1
1:A:46:VAL:O	1:A:50:LYS:HG2	0.52	2.04	1	2
1:A:85:VAL:O	1:A:89:ILE:HG12	0.52	2.05	10	7
2:B:152:GLU:O	2:B:152:GLU:HG2	0.50	2.06	3	1
1:A:55:GLU:HA	1:A:58:TYR:CE2	0.49	2.41	8	1
1:A:116:LYS:HA	1:A:116:LYS:NZ	0.49	2.22	5	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:82:PRO:O	1:A:86:LEU:HG	0.49	2.08	6	3
1:A:116:LYS:HA	1:A:120:HIS:O	0.49	2.08	1	2
1:A:73:LYS:HA	2:B:151:PHE:CE1	0.48	2.44	5	1
1:A:89:ILE:HG23	1:A:112:LEU:HB2	0.48	1.84	9	1
2:B:149:ASN:HB3	2:B:152:GLU:CB	0.48	2.38	9	1
1:A:89:ILE:HD13	1:A:113:ILE:HG12	0.48	1.86	6	1
1:A:90:TRP:HB3	2:B:149:ASN:ND2	0.47	2.25	6	1
1:A:52:THR:O	1:A:56:ILE:HG13	0.47	2.09	10	2
1:A:87:GLY:O	1:A:91:LYS:HB2	0.47	2.10	6	1
1:A:81:LEU:HB2	1:A:86:LEU:HD21	0.47	1.86	2	3
1:A:47:GLY:CA	1:A:50:LYS:HG2	0.46	2.36	8	1
1:A:97:LYS:NZ	1:A:97:LYS:HB2	0.46	2.24	5	1
1:A:72:ALA:O	1:A:76:MET:HG2	0.46	2.10	3	3
1:A:96:ASP:HB2	1:A:98:ASP:OD1	0.46	2.11	1	1
1:A:126:LEU:HB3	1:A:131:VAL:HB	0.46	1.88	10	1
1:A:73:LYS:HG3	2:B:151:PHE:CE1	0.45	2.46	6	3
1:A:66:LYS:HB2	1:A:101:LEU:O	0.45	2.11	6	1
1:A:73:LYS:HE2	2:B:150:PRO:O	0.45	2.12	5	1
1:A:73:LYS:HD3	2:B:150:PRO:HB2	0.43	1.90	1	1
1:A:92:LEU:HD12	1:A:122:LEU:HD12	0.43	1.89	2	1
1:A:66:LYS:CB	1:A:102:ASP:HA	0.43	2.43	6	1
1:A:101:LEU:HD13	1:A:105:GLU:HG2	0.43	1.90	7	1
1:A:98:ASP:OD2	1:A:100:LEU:HB2	0.43	2.14	3	2
1:A:127:PRO:HD2	1:A:130:LEU:HD12	0.43	1.91	3	1
1:A:46:VAL:HB	1:A:53:TYR:HE2	0.43	1.74	8	1
1:A:85:VAL:O	1:A:89:ILE:HG13	0.43	2.14	9	1
1:A:108:LEU:O	1:A:112:LEU:HD23	0.42	2.14	9	1
1:A:66:LYS:HB2	1:A:66:LYS:NZ	0.42	2.28	10	1
1:A:46:VAL:HG21	1:A:108:LEU:HD23	0.42	1.90	9	1
1:A:46:VAL:HG12	1:A:111:HIS:HB2	0.42	1.92	3	1
1:A:45:VAL:O	1:A:48:LYS:HG2	0.42	2.15	3	1
1:A:66:LYS:HG2	1:A:100:LEU:HB2	0.41	1.92	10	1
1:A:82:PRO:HG2	1:A:85:VAL:CG2	0.41	2.46	4	1
1:A:88:LYS:CD	1:A:122:LEU:HB2	0.41	2.45	9	1
1:A:50:LYS:HZ1	1:A:103:ASP:CG	0.40	2.19	6	1
1:A:52:THR:HA	1:A:55:GLU:OE2	0.40	2.16	6	1

5.2 Torsion angles [i](#)

5.2.1 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	88/105 (84%)	85±1 (96±1%)	3±1 (3±1%)	1±0 (1±1%)	26	73
2	B	5/15 (33%)	5±0 (96±8%)	0±0 (4±8%)	0±0 (0±0%)	100	100
All	All	930/1200 (78%)	895 (96%)	29 (3%)	6 (1%)	29	74

All 1 unique Ramachandran outliers are listed below.

Mol	Chain	Res	Type	Models (Total)
1	A	61	SER	6

5.2.2 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	76/91 (84%)	71±1 (94±2%)	5±1 (6±2%)	22	71
2	B	5/15 (33%)	5±0 (100±0%)	0±0 (0±0%)	100	100
All	All	810/1060 (76%)	763 (94%)	47 (6%)	24	73

All 23 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	122	LEU	9
1	A	121	GLU	6
1	A	76	MET	4
1	A	44	TRP	3
1	A	116	LYS	2
1	A	71	ASN	2
1	A	66	LYS	2

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Mol	Chain	Res	Type	Models (Total)
1	A	110	ASN	2
1	A	96	ASP	2
1	A	125	ASP	2
1	A	101	LEU	1
1	A	92	LEU	1
1	A	49	ASP	1
1	A	80	LYS	1
1	A	55	GLU	1
1	A	84	THR	1
1	A	62	PRO	1
1	A	127	PRO	1
1	A	97	LYS	1
1	A	102	ASP	1
1	A	86	LEU	1
1	A	74	LYS	1
1	A	77	VAL	1

5.2.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.4 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.5 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

5.6 Other polymers [i](#)

There are no such molecules in this entry.

5.7 Polymer linkage issues

There are no chain breaks in this entry.

6 Chemical shift validation [i](#)

The completeness of assignment taking into account all chemical shift lists is 85% for the well-defined parts and 78% for the entire structure.

6.1 Chemical shift list 1

File name: input_cs.cif

Chemical shift list name: *assigned_chem_shift_list_1*

6.1.1 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	1280
Number of shifts mapped to atoms	1280
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	6

6.1.2 Chemical shift referencing [i](#)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	99	1.17 ± 0.11	Should be applied
$^{13}\text{C}_\beta$	93	1.56 ± 0.19	Should be applied
$^{13}\text{C}'$	0	—	None (insufficient data)
^{15}N	87	-0.84 ± 0.56	None needed (imprecise)

6.1.3 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 85%, i.e. 978 atoms were assigned a chemical shift out of a possible 1152. 20 out of 20 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	342/451 (76%)	175/179 (98%)	88/186 (47%)	79/86 (92%)
Sidechain	553/602 (92%)	347/351 (99%)	202/234 (86%)	4/17 (24%)

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	Total	¹ H	¹³ C	¹⁵ N
Aromatic	83/99 (84%)	51/51 (100%)	31/40 (78%)	1/8 (12%)
Overall	978/1152 (85%)	573/581 (99%)	321/460 (70%)	84/111 (76%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 78%, i.e. 1149 atoms were assigned a chemical shift out of a possible 1482. 21 out of 23 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	394/578 (68%)	208/229 (91%)	99/240 (41%)	87/109 (80%)
Sidechain	669/797 (84%)	437/468 (93%)	228/304 (75%)	4/25 (16%)
Aromatic	86/107 (80%)	53/55 (96%)	32/42 (76%)	1/10 (10%)
Overall	1149/1482 (78%)	698/752 (93%)	359/586 (61%)	92/144 (64%)

6.1.4 Statistically unusual chemical shifts [i](#)

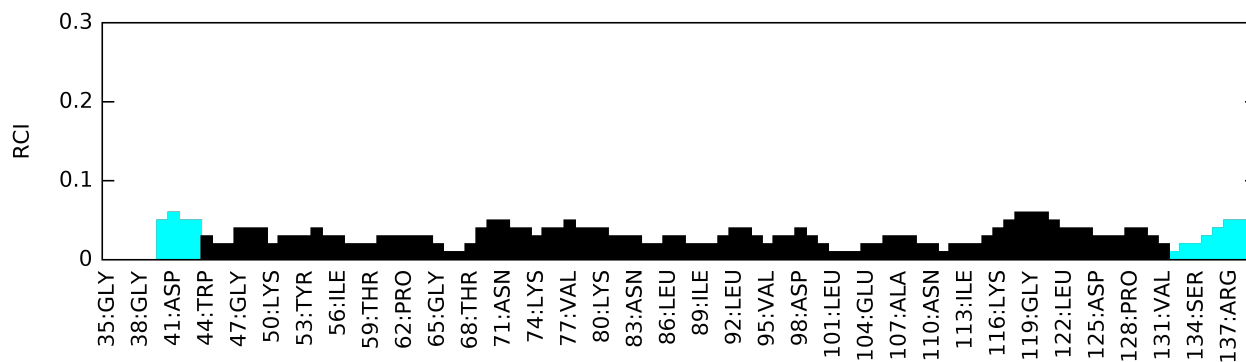
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

Mol	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	46	VAL	HB	-1.24	3.59 – 0.39	-10.1
1	A	110	ASN	HD22	3.96	9.59 – 4.69	-6.5
1	A	103	ASP	HA	2.83	6.15 – 3.05	-5.7
1	A	94	ASP	HB2	1.20	4.07 – 1.37	-5.6
1	A	86	LEU	HB2	-0.21	3.32 – -0.08	-5.4
1	A	132	PRO	HA	2.72	6.05 – 2.75	-5.1

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

The images below report *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:



Random coil index (RCI) for chain B:

