Full wwPDB NMR Structure Validation Report (i)

Apr 26, 2016 – 04:10 PM BST

PDB ID	:	1OQP
Title	:	STRUCTURE OF THE CA2+/C-TERMINAL DOMAIN OF CALTRACTIN IN COMPLEX WITH THE CDC31P-BINDING DOMAIN FROM KAR1P
Authors	:	Hu, H.T.; Chazin, W.J.
Deposited on	:	2003-03-10

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 (i) symbol.

The following versions of software and data (see references (i)) were used in the production of this report:

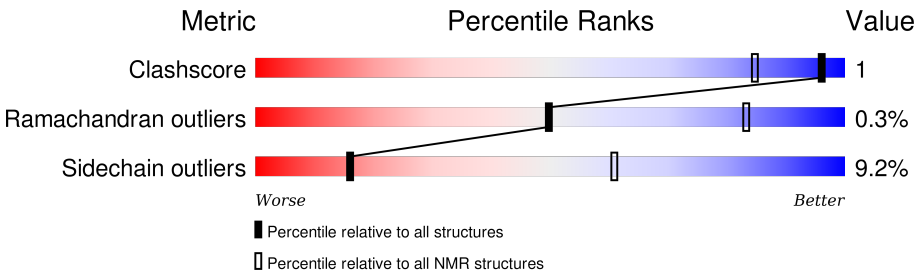
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Mogul	:	unknown
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	rb-20027457
Ideal 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 (i)

The following experimental techniques were used to determine the structure:
SOLUTION NMR

The overall completeness of chemical shifts assignment is 82%.

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	77	81% 5% • 13%
2	B	19	47% 5% 47%

2 Ensemble composition and analysis (i)

This entry contains 20 models. Model 19 is the overall representative, medoid model (most similar to other models).

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:99-A:147, A:152-A:169, B:244-B:253 (77)	0.25	19

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. No single-model clusters were found.

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

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 1601 atoms, of which 796 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Caltractin.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	77	1233	381	605	108	137	2	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	93	GLY	-	EXPRESSION TAG	UNP P05434
A	94	SER	-	EXPRESSION TAG	UNP P05434

- Molecule 2 is a protein called Cell division control protein KAR1.

Mol	Chain	Residues	Atoms					Trace
			Total	C	H	N	O	
2	B	19	368	115	191	35	27	0

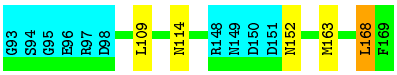
4 Residue-property plots (i)

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.

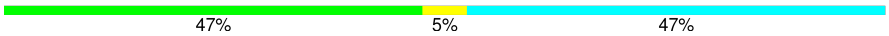
- Molecule 1: Caltractin

Chain A:



- Molecule 2: Cell division control protein KAR1

Chain B:



4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

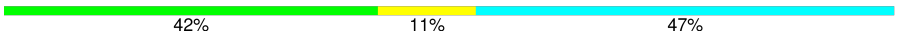
4.2.1 Score per residue for model 1

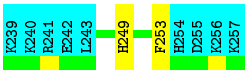
- Molecule 1: Caltractin

Chain A:

- Molecule 2: Cell division control protein KAR1

Chain B:

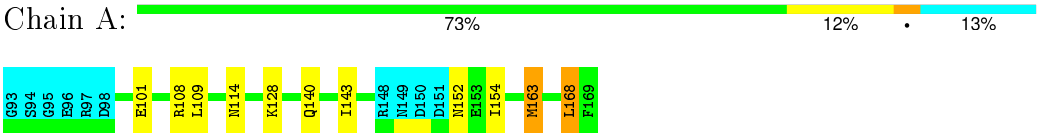




4.2.2 Score per residue for model 2

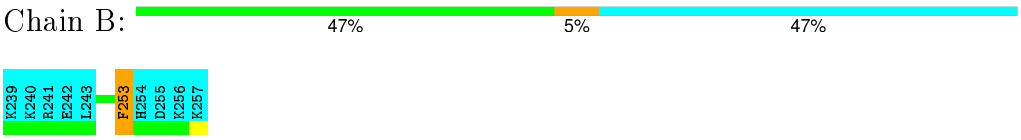
- Molecule 1: Caltractin

Chain A:



- Molecule 2: Cell division control protein KAR1

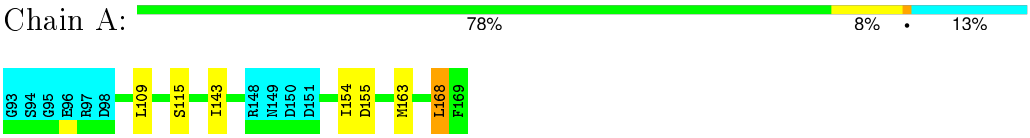
Chain B:



4.2.3 Score per residue for model 3

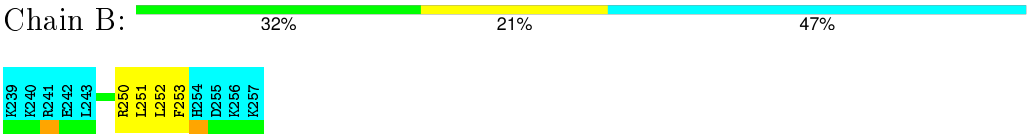
- Molecule 1: Caltractin

Chain A:



- Molecule 2: Cell division control protein KAR1

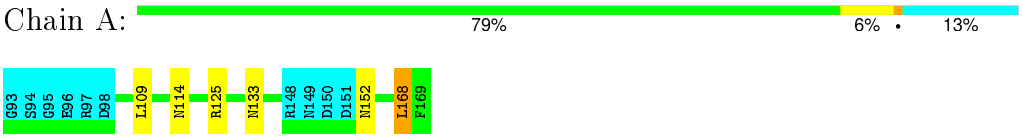
Chain B:



4.2.4 Score per residue for model 4

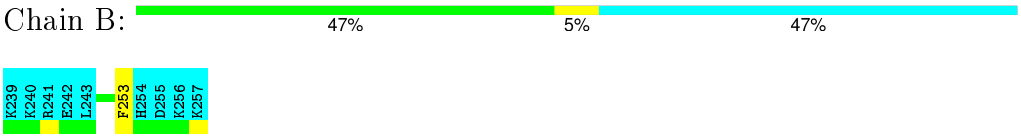
- Molecule 1: Caltractin

Chain A:



- Molecule 2: Cell division control protein KAR1

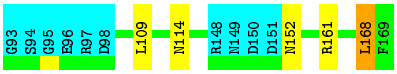
Chain B:



4.2.5 Score per residue for model 5

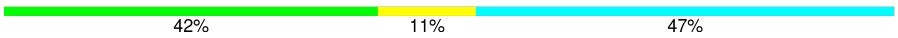
- Molecule 1: Caltractin

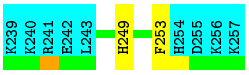
Chain A:



- Molecule 2: Cell division control protein KAR1

Chain B:

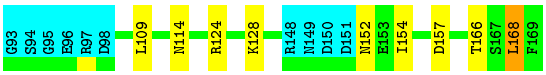




4.2.6 Score per residue for model 6

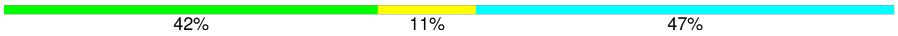
- Molecule 1: Caltractin

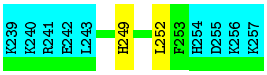
Chain A:



- Molecule 2: Cell division control protein KAR1

Chain B:

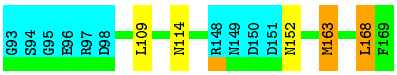




4.2.7 Score per residue for model 7

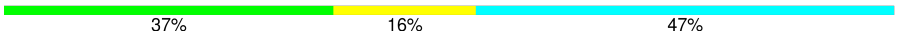
- Molecule 1: Caltractin

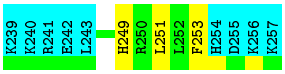
Chain A:



- Molecule 2: Cell division control protein KAR1

Chain B:

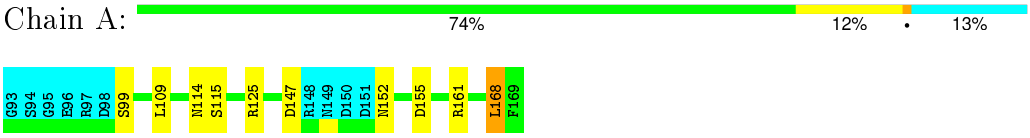




4.2.8 Score per residue for model 8

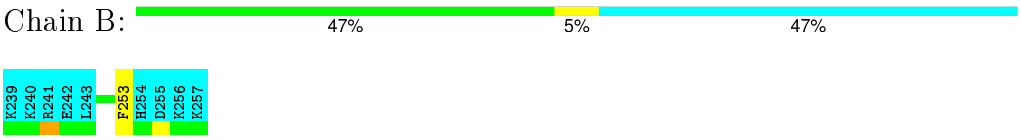
- Molecule 1: Caltractin

Chain A:



- Molecule 2: Cell division control protein KAR1

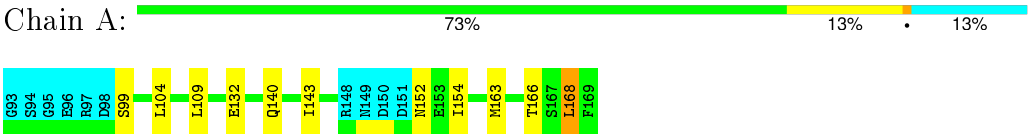
Chain B:



4.2.9 Score per residue for model 9

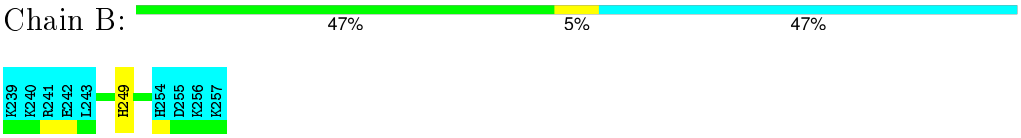
- Molecule 1: Caltractin

Chain A:



- Molecule 2: Cell division control protein KAR1

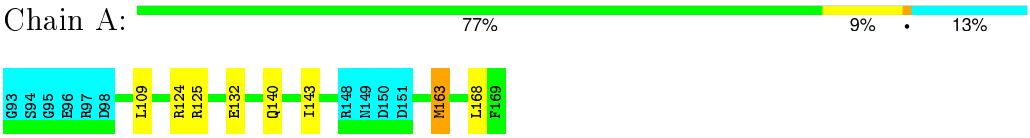
Chain B:



4.2.10 Score per residue for model 10

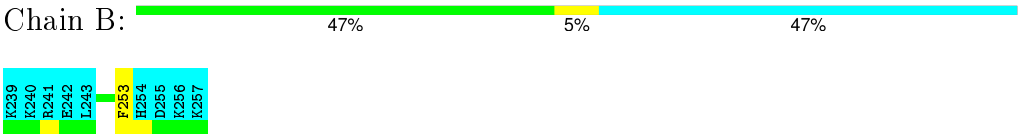
- Molecule 1: Caltractin

Chain A:



- Molecule 2: Cell division control protein KAR1

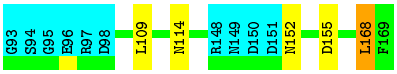
Chain B:



4.2.11 Score per residue for model 11

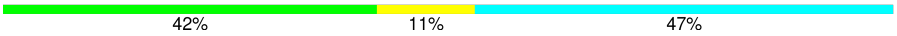
- Molecule 1: Caltractin

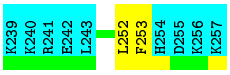
Chain A:



- Molecule 2: Cell division control protein KAR1

Chain B:

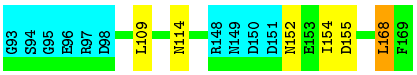




4.2.12 Score per residue for model 12

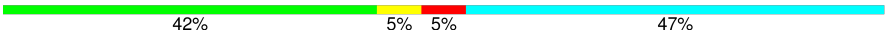
- Molecule 1: Caltractin

Chain A:



- Molecule 2: Cell division control protein KAR1

Chain B:



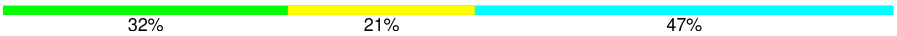
4.2.13 Score per residue for model 13

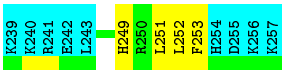
- Molecule 1: Caltractin

Chain A:

- Molecule 2: Cell division control protein KAR1

Chain B:





4.2.14 Score per residue for model 14

- Molecule 1: Caltractin

Chain A: 83% • • 13%

G93 S94 G95 E96 R97 D98 L109 R148 N149 D150 D151 N152 L168 F169

- Molecule 2: Cell division control protein KAR1

Chain B: 42% 11% 47%

K239 K240 R241 E242 L243 K247 F253 H254 D255 K256 K257

4.2.15 Score per residue for model 15

- Molecule 1: Caltractin

Chain A: 77% 10% 13%

G93 S94 G95 E96 R97 D98 L109 S115 Q140 I143 R148 N149 D150 D151 N152 R161 I162 M163 L168 F169

- Molecule 2: Cell division control protein KAR1

Chain B: 37% 16% 47%

K239 K240 R241 E242 L243 H249 L252 F253 H254 D255 K256 K257

4.2.16 Score per residue for model 16

- Molecule 1: Caltractin

Chain A: 79% 6% • 13%

G93 S94 G95 E96 R97 D98 L109 D112 I143 R148 N149 D150 D151 I154 M163 L168 F169

- Molecule 2: Cell division control protein KAR1

Chain B: 42% 11% 47%

K239 K240 R241 E242 L243 H249 F253 H254 D255 K256 K257

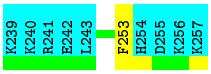
4.2.17 Score per residue for model 17

- Molecule 1: Caltractin

Chain A: 77% 9% • 13%

- Molecule 2: Cell division control protein KAR1

Chain B: 47% 5% 47%



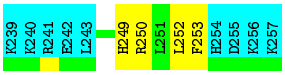
4.2.18 Score per residue for model 18

- Molecule 1: Caltractin

Chain A: 77% 9% • 13%

- Molecule 2: Cell division control protein KAR1

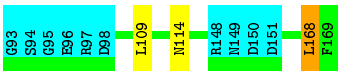
Chain B: 32% 21% 47%



4.2.19 Score per residue for model 19 (medoid)

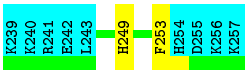
- Molecule 1: Caltractin

Chain A: 83% • • 13%



- Molecule 2: Cell division control protein KAR1

Chain B: 42% 11% 47%



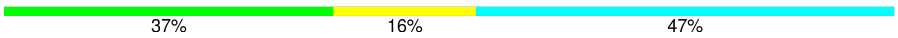
4.2.20 Score per residue for model 20

- Molecule 1: Caltractin

Chain A:

- Molecule 2: Cell division control protein KAR1

Chain B:



5 Refinement protocol and experimental data overview (i)

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

Of the 60 calculated structures, 20 were deposited, based on the following criterion: *structures with the least restraint violations,structures with the lowest energy*.

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

Software name	Classification	Version
DYANA	structure solution	1.5
AMBER	refinement	7.0

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 5722
Number of chemical shift lists	2
Total number of shifts	1082
Number of shifts mapped to atoms	1082
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	82%

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	0.51±0.00	0±0/554 (0.0±0.0%)	0.83±0.02	0±0/738 (0.0±0.0%)
2	B	0.67±0.01	0±0/98 (0.0±0.0%)	1.01±0.09	0±0/132 (0.0±0.2%)
All	All	0.53	0/13040 (0.0%)	0.86	1/17400 (0.0%)

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	0.3±0.5
2	B	0.0±0.0	0.3±0.5
All	All	0	13

There are no bond-length outliers.

All unique angle outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})	Models	
								Worst	Total
2	B	253	PHE	CB-CG-CD2	-5.53	116.93	120.80	2	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)
2	B	249	HIS	Sidechain	4
1	A	124	ARG	Sidechain	4
1	A	125	ARG	Sidechain	3
2	B	253	PHE	Sidechain	1
2	B	250	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	551	542	542	2±1
2	B	94	96	96	1±0
All	All	12900	12760	12760	32

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 1.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:168:LEU:HD23	2:B:253:PHE:CE1	0.76	2.14	10	18
1:A:166:THR:HB	1:A:168:LEU:HD12	0.60	1.73	6	3
1:A:143:ILE:HA	1:A:154:ILE:HD11	0.45	1.87	16	1
1:A:163:MET:CE	1:A:168:LEU:HD13	0.45	2.41	9	7
1:A:168:LEU:HD23	2:B:253:PHE:CZ	0.43	2.48	15	1
1:A:127:ALA:HB1	1:A:132:GLU:O	0.42	2.14	20	1
1:A:168:LEU:HD22	2:B:252:LEU:HD13	0.41	1.92	6	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	66/77 (86%)	62±2 (94±3%)	4±2 (6±3%)	0±0 (0±1%)	43	81
2	B	10/19 (53%)	9±1 (86±11%)	1±1 (14±11%)	0±0 (0±0%)	100	100
All	All	1520/1920 (79%)	1410 (93%)	105 (7%)	5 (0%)	50	83

All 3 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	132	GLU	2
1	A	152	ASN	2
1	A	99	SER	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	61/69 (88%)	55±2 (91±3%)	6±2 (9±3%)	16	61
2	B	10/19 (53%)	9±1 (90±10%)	1±1 (10±10%)	14	58
All	All	1420/1760 (81%)	1289 (91%)	131 (9%)	16	61

All 27 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	109	LEU	20
1	A	168	LEU	18
1	A	114	ASN	12
1	A	152	ASN	12
2	B	249	HIS	6
1	A	155	ASP	6
1	A	163	MET	6
1	A	154	ILE	6
1	A	143	ILE	5
2	B	252	LEU	5
1	A	115	SER	4
1	A	140	GLN	4
1	A	99	SER	3
1	A	161	ARG	3
2	B	247	LYS	3
1	A	104	LEU	3
2	B	251	LEU	3
1	A	128	LYS	2
2	B	250	ARG	2
1	A	125	ARG	1
1	A	147	ASP	1
1	A	112	ASP	1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Models (Total)
1	A	101	GLU	1
1	A	157	ASP	1
2	B	253	PHE	1
1	A	133	ASN	1
1	A	108	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 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 (i)

The completeness of assignment taking into account all chemical shift lists is 82% for the well-defined parts and 77% for the entire structure.

7.1 Chemical shift list 1

File name: BMRB entry 5722

Chemical shift list name: *assigned_ chem_ shift_ list_ 1*

7.1.1 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	930
Number of shifts mapped to atoms	930
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 (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	76	-0.22 ± 0.08	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	73	0.06 ± 0.15	None needed (< 0.5 ppm)
$^{13}C'$	73	-0.44 ± 0.15	None needed (< 0.5 ppm)
^{15}N	74	-0.10 ± 0.25	None needed (< 0.5 ppm)

7.1.3 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 75%, i.e. 759 atoms were assigned a chemical shift out of a possible 1017. 8 out of 10 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	329/385 (85%)	133/154 (86%)	130/154 (84%)	66/77 (86%)
Sidechain	410/568 (72%)	255/330 (77%)	151/210 (72%)	4/28 (14%)

Continued on next page...

Continued from previous page...

	Total	^{1}H	^{13}C	^{15}N
Aromatic	20/64 (31%)	20/35 (57%)	0/27 (0%)	0/2 (0%)
Overall	759/1017 (75%)	408/519 (79%)	281/391 (72%)	70/107 (65%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 66%, i.e. 846 atoms were assigned a chemical shift out of a possible 1277. 8 out of 11 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	374/480 (78%)	151/192 (79%)	149/192 (78%)	74/96 (77%)
Sidechain	452/726 (62%)	283/424 (67%)	164/260 (63%)	5/42 (12%)
Aromatic	20/71 (28%)	20/39 (51%)	0/29 (0%)	0/3 (0%)
Overall	846/1277 (66%)	454/655 (69%)	313/481 (65%)	79/141 (56%)

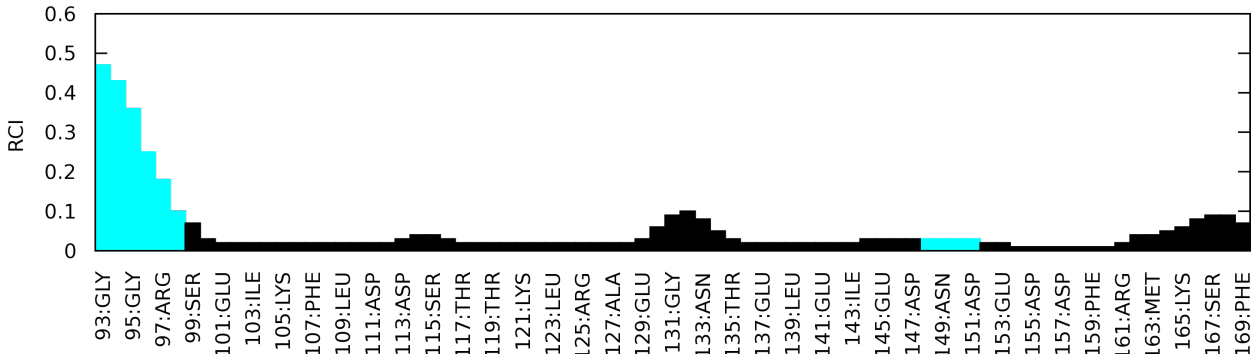
7.1.4 Statistically unusual chemical shifts (i)

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:



7.2 Chemical shift list 2

File name: BMRB entry 5722

Chemical shift list name: *assigned_chem_shift_list_2*

7.2.1 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	152
Number of shifts mapped to atoms	152
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

7.2.2 Chemical shift referencing (i)

No chemical shift referencing corrections were calculated (not enough data).

7.2.3 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 7%, i.e. 70 atoms were assigned a chemical shift out of a possible 1017. 0 out of 10 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}**H**	^{13}**C**	^{15}**N**
Backbone	19/385 (5%)	19/154 (12%)	0/154 (0%)	0/77 (0%)
Sidechain	39/568 (7%)	39/330 (12%)	0/210 (0%)	0/28 (0%)
Aromatic	12/64 (19%)	12/35 (34%)	0/27 (0%)	0/2 (0%)
Overall	70/1017 (7%)	70/519 (13%)	0/391 (0%)	0/107 (0%)

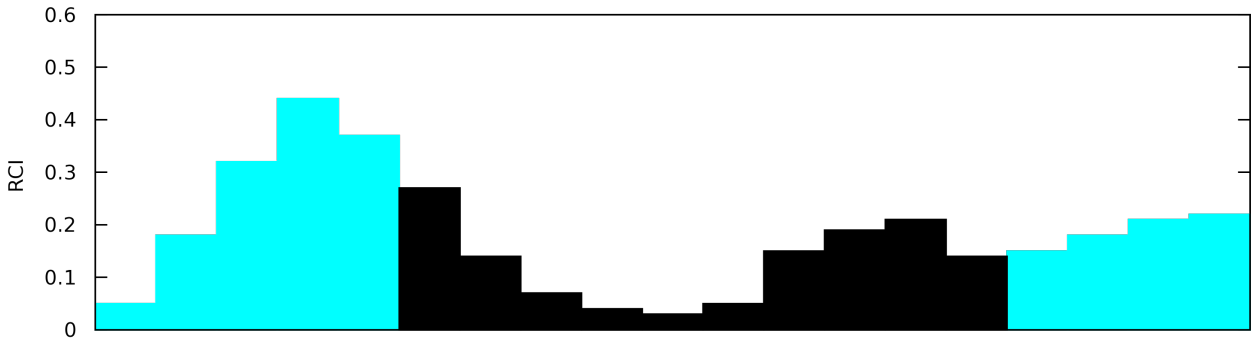
The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 11%, i.e. 138 atoms were assigned a chemical shift out of a possible 1277. 0 out of 11 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}**H**	^{13}**C**	^{15}**N**
Backbone	35/480 (7%)	35/192 (18%)	0/192 (0%)	0/96 (0%)
Sidechain	90/726 (12%)	90/424 (21%)	0/260 (0%)	0/42 (0%)
Aromatic	13/71 (18%)	13/39 (33%)	0/29 (0%)	0/3 (0%)
Overall	138/1277 (11%)	138/655 (21%)	0/481 (0%)	0/141 (0%)

7.2.4 Statistically unusual chemical shifts (i)

There are no statistically unusual chemical shifts.

7.2.5 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 B: