wwPDB NMR Structure Validation Summary Report (i)

Nov 21, 2016 – 06:22 PM EST

PDB ID	:	2N84
Title	:	Solution structure of the FHA domain of TbPar42
Authors	:	Rehic, E.; Bayer, P.
Deposited on	:	2015-10-04

This is a wwPDB NMR Structure Validation Summary 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:

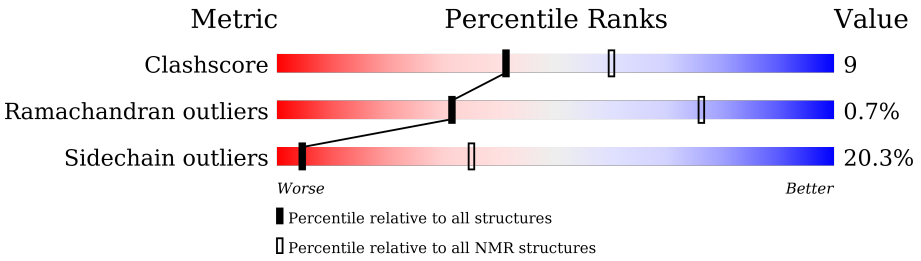
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Mogul	:	unknown
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	rb-20028320
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20028320

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 87%.

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	179	41% 21% • 36%

2 Ensemble composition and analysis (i)

This entry contains 10 models. Model 9 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:58-A:172 (115)	0.23	9

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 3 clusters and 3 single-model clusters were found.

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

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 2744 atoms, of which 1388 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Uncharacterized protein.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	179	2744	871	1388	240	238	7	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	EXPRESSION TAG	UNP Q57XM6
A	0	PRO	-	EXPRESSION TAG	UNP Q57XM6

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: Uncharacterized protein

Chain A: 41% 21% • 36%

G-1 P0 M1 V2 T3 S4 T5 G6 L7 L8 S9 R10 V11 A12 A13 V14 E15 K16 A17 A18 E19 I20 A21 K22 P23 P24 P25 P26 K27 V28 V29 E30 L31 T32 E33 A34 A35 K36 Q37 L38 P39 Q40 H41 I42 I43 G44 V45 T46 D47 P48 T49 K50 L51 N52 A53 Q54 V55 S56 Y57 F58

P61 A64 A65 S68 L73 Q74 R89 F90 P91 F92 Y93 L94 R97 S98 K99 V100 C101 L105 E106 H107 S112 V113 H114 L117 V118 F119 Q123 R124 C125 F126 L131 V137 K138 L139 N140 G141 N142 R143 I144 E145 K146 R147 R148 P149 L150 S156

Q159 S163 S164 R165 P173 P174 S175 S176 S177

4.2 Residue scores for the representative (medoid) model from the NMR ensemble

The representative model is number 9. Colouring as in section 4.1 above.

- Molecule 1: Uncharacterized protein

Chain A: 45% 17% • 36%

G-1 P0 M1 V2 T3 S4 T5 G6 L7 L8 S9 R10 V11 A12 A13 V14 E15 K16 A17 A18 E19 I20 A21 K22 P23 P24 P25 P26 K27 V28 V29 E30 L31 T32 E33 A34 A35 K36 Q37 L38 P39 Q40 H41 I42 I43 G44 V45 T46 D47 P48 T49 K50 L51 N52 A53 Q54 V55 S56 Y57 F58

Q59 C60 P61 P62 W63 A64 L73 Q74 F92 Y93 L94 R97 S98 K99 V100 C101 L105 E106 H107 V113 L117 V118 F119 R124 C125 F126 L131 G132 S133 T134 L139 N140 I144 E145 K146 R147 R148 P149 L150 S156 Q159 Q170 P173 P174 S175 S176

S177

5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *torsion angle dynamics, simulated annealing, molecular dynamics.*

Of the 60 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
CYANA	structure solution	2.1
Talos	structure solution	
CYANA	refinement	2.1

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)	2n84_cs.cif
Number of chemical shift lists	1
Total number of shifts	2069
Number of shifts mapped to atoms	2069
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	87%

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)

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

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

6.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in each chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	892	899	899	16±2
All	All	8920	8990	8990	162

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 9.

5 of 85 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:131:LEU:C	1:A:131:LEU:HD22	0.67	2.10	4	1
1:A:58:PHE:CZ	1:A:116:VAL:HG21	0.65	2.27	3	2
1:A:113:VAL:HG23	1:A:131:LEU:HD13	0.64	1.68	3	3
1:A:61:PRO:HG2	1:A:64:ALA:HB2	0.63	1.70	7	9
1:A:117:LEU:HD12	1:A:126:PHE:CD1	0.63	2.28	2	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	115/179 (64%)	104±1 (90±1%)	11±1 (9±1%)	1±1 (1±1%)	31 76
All	All	1150/1790 (64%)	1037 (90%)	105 (9%)	8 (1%)	31 76

All 2 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	145	GLU	7
1	A	119	PHE	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	98/151 (65%)	78±2 (80±2%)	20±2 (20±2%)	4 35
All	All	980/1510 (65%)	781 (80%)	199 (20%)	4 35

5 of 45 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	74	GLN	10
1	A	159	GLN	10
1	A	107	HIS	10
1	A	119	PHE	10
1	A	105	LEU	10

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 87% for the well-defined parts and 85% for the entire structure.

7.1 Chemical shift list 1

File name: 2n84_cs.cif

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	2069
Number of shifts mapped to atoms	2069
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 (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	171	-0.22 ± 0.11	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	158	-0.01 ± 0.12	None needed (< 0.5 ppm)
$^{13}C'$	147	0.24 ± 0.08	None needed (< 0.5 ppm)
^{15}N	159	-0.55 ± 0.28	None needed (imprecise)

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 87%, i.e. 1235 atoms were assigned a chemical shift out of a possible 1424. 25 out of 25 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	533/555 (96%)	216/220 (98%)	212/230 (92%)	105/105 (100%)
Sidechain	601/726 (83%)	370/433 (85%)	223/257 (87%)	8/36 (22%)

Continued on next page...

Continued from previous page...

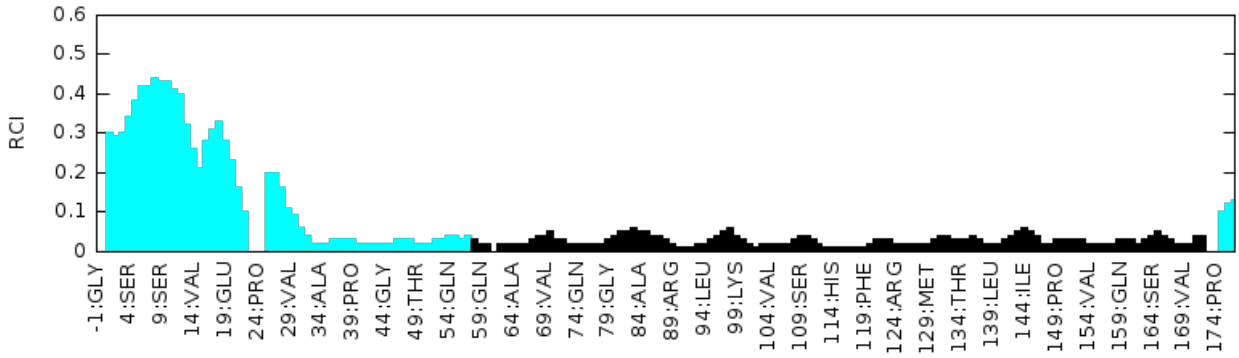
	Total	^{1}H	^{13}C	^{15}N
Aromatic	101/143 (71%)	58/78 (74%)	42/59 (71%)	1/6 (17%)
Overall	1235/1424 (87%)	644/731 (88%)	477/546 (87%)	114/147 (78%)

7.1.4 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	111	SER	H	11.50	11.23 – 5.33	5.5
1	A	170	GLN	HB3	0.62	3.37 – 0.67	-5.2

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: