Full wwPDB NMR Structure Validation Report (i)

Apr 20, 2024 – 04:21 PM EDT

PDB ID	:	2NAR
BMRB ID	:	25944
Title	:	Solution structure of AVR3a_60-147 from Phytophthora infestans
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Deposited on	:	2016-01-08

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
https://www.wwpdb.org/validation/2017/NMRValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

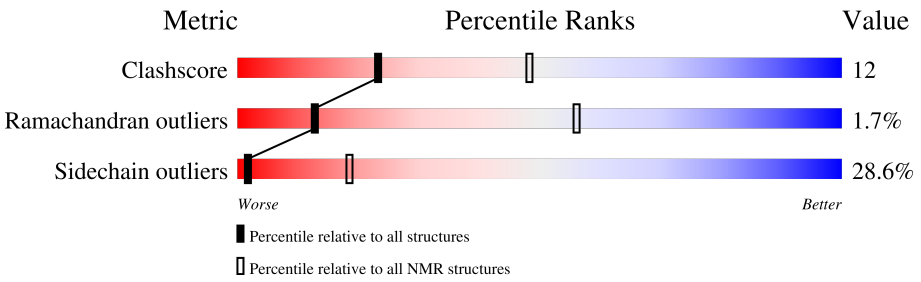
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 83%.

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	102	44% 19% 5% 32%

2 Ensemble composition and analysis (i)

This entry contains 10 models. Model 8 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:10-A:62, A:68-A:83 (69)	0.25	8

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. No single-model clusters were found.

Cluster number	Models
1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1612 atoms, of which 804 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Effector protein Avr3a.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	102	1612	512	804	140	152	4	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	7	SER	ASN	variant	UNP E2DWQ7
A	88	GLU	-	linker	UNP E2DWQ7
A	89	PRO	-	linker	UNP E2DWQ7
A	90	ASN	-	linker	UNP E2DWQ7
A	91	SER	-	linker	UNP E2DWQ7
A	92	SER	-	linker	UNP E2DWQ7
A	93	SER	-	linker	UNP E2DWQ7
A	94	VAL	-	linker	UNP E2DWQ7
A	95	ASP	-	linker	UNP E2DWQ7
A	96	LYS	-	linker	UNP E2DWQ7
A	97	LEU	-	linker	UNP E2DWQ7
A	98	ALA	-	linker	UNP E2DWQ7
A	99	ALA	-	linker	UNP E2DWQ7
A	100	ALA	-	linker	UNP E2DWQ7
A	101	LEU	-	linker	UNP E2DWQ7
A	102	GLU	-	linker	UNP E2DWQ7

4 Residue-property plots (i)

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA, DNA and oligosaccharide 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: Effector protein Avr3a

Chain A: 44% 19% 5% 32%

P1 N2 F3 N4 L5 A6 S7 L8 N9 F13 L18 T19 K20 A24 K25 K26 L27 A28 L31 K36 L37 A38 Y42 I43 W44 W45 N48 R49 V50 I55 F58 L59 K60 L61 A62 S63 R64 K65 T66 Q67 G68 Y71 I74 Y75 L84 T85 G86 Y87

E88 P89 N90 S91 S92 S93 V94 D95 K96 L97 A98 A99 A100 L101 E102

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: Effector protein Avr3a

Chain A: 40% 23% 5% 32%

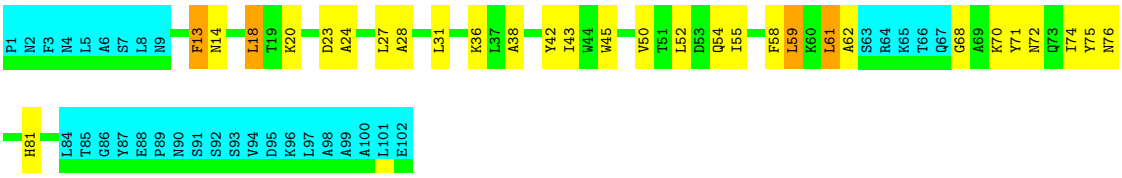
P1 N2 F3 N4 L5 A6 S7 L8 N9 M12 F13 N14 L18 T19 K20 D23 A24 L27 A28 L31 K36 A41 Y42 I43 W44 W45 R49 V50 I55 F58 L59 K60 L61 A62 S63 R64 K65 T66 Q67 G68 Y71 I74 Y75 N76 H81 L84

T85 G86 Y87 E88 P89 N90 S91 S92 S93 V94 D95 K96 L97 A98 A99 A100 L101 E102

4.2.2 Score per residue for model 2

• Molecule 1: Effector protein Avr3a

Chain A: 38% 25% • 32%



4.2.3 Score per residue for model 3

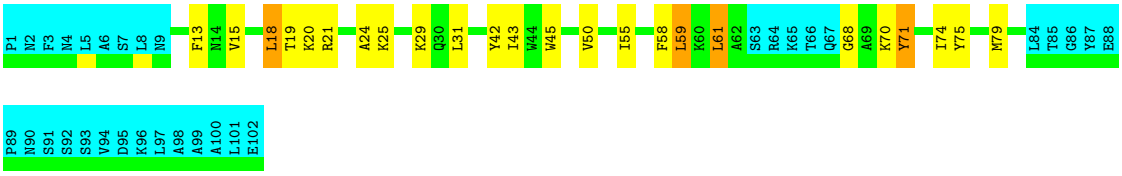
- Molecule 1: Effector protein Avr3a

Chain A: 39% 24% 5% 32%

4.2.4 Score per residue for model 4

- Molecule 1: Effector protein Avr3a

Chain A: 44% 20% • 32%



4.2.5 Score per residue for model 5

- Molecule 1: Effector protein Avr3a

Chain A: 40% 23% 5% 32%

4.2.6 Score per residue for model 6

- Molecule 1: Effector protein Avr3a

Chain A: 40% 25% • 32%

P1 N2 F3 N4 L5 A6 S7 L8 N9 F13 N14 V15 L18 T19 K20 D23 A24 K25 A28 L31 K36 L37 A38 Y42 I43 W44 W45 V50 I55 F58 L59 K60 L61 A62 S63 R64 K65 T66 Q67 G68 A69 K70 Y71 N72 Q73 I74 Y75 H81

L84 T85 G86 Y87 E88 P89 N90 S91 S92 S93 V94 D95 K96 L97 A98 A99 A100 L101 E102

4.2.7 Score per residue for model 7

- Molecule 1: Effector protein Avr3a

Chain A: 43% 21% • 32%

P1 N2 F3 N4 L5 A6 S7 L8 N9 F13 N14 V15 L18 T19 K20 A24 K25 K26 L27 A28 L31 K36 L37 A38 Y42 I43 W44 W45 N48 R49 V50 I55 F58 L59 K60 L61 A62 S63 R64 K65 T66 Q67 G68 Y71 I74 Y75 L84 T85

G86 Y87 E88 P89 N90 S91 S92 S93 V94 D95 K96 L97 A98 A99 A100 L101 E102

4.2.8 Score per residue for model 8 (medoid)

- Molecule 1: Effector protein Avr3a

Chain A: 37% 25% 5% 32%

P1 N2 F3 N4 L5 A6 S7 L8 N9 F13 N14 L18 A24 K25 K26 L27 A28 L31 K36 L37 A38 Y42 I43 W44 W45 Q46 H47 N48 R49 V50 D53 Q54 I55 D56 T57 F58 L59 K60 L61 A62 S63 R64 K65 T66 Q67 G68 Y71 N72 Q73 I74 Y75 N76

L84 T85 G86 Y87 E88 P89 N90 S91 S92 S93 V94 D95 K96 L97 A98 A99 A100 L101 E102

4.2.9 Score per residue for model 9

- Molecule 1: Effector protein Avr3a

Chain A: 40% 23% 5% 32%

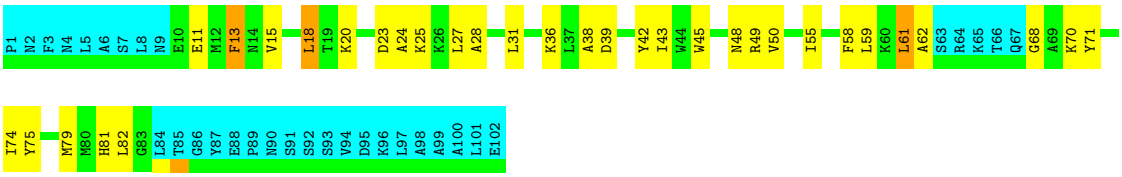
P1 N2 F3 N4 L5 A6 S7 L8 N9 F13 N14 A17 L18 A24 K25 A28 K29 Q30 L31 K36 L37 A38 A41 Y42 I43 W44 W45 Q46 H47 N48 R49 V50 T51 L52 I55 F58 L59 K60 L61 A62 S63 R64 K65 T66 Q67 G68 Y71 I74 Y75

L84 T85 G86 Y87 E88 P89 N90 S91 S92 S93 V94 D95 K96 L97 A98 A99 A100 L101 E102

4.2.10 Score per residue for model 10

- Molecule 1: Effector protein Avr3a

Chain A: 35% 29% • 32%



5 Refinement protocol and experimental data overview (i)

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

Of the 100 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
CYANA	refinement	
YASARA	refinement	

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)	working_cs.cif
Number of chemical shift lists	1
Total number of shifts	1125
Number of shifts mapped to atoms	1125
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	83%

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	560	559	559	14±2
All	All	5600	5590	5590	138

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:18:LEU:HD22	1:A:27:LEU:HD13	0.80	1.54	8	7
1:A:15:VAL:HG21	1:A:55:ILE:HD13	0.73	1.60	6	3
1:A:55:ILE:CG2	1:A:59:LEU:HD12	0.63	2.23	10	10
1:A:55:ILE:HG21	1:A:75:TYR:CE1	0.61	2.31	7	10
1:A:58:PHE:HA	1:A:61:LEU:HD23	0.61	1.73	10	10
1:A:24:ALA:CB	1:A:61:LEU:HD21	0.60	2.26	3	9
1:A:24:ALA:HB1	1:A:61:LEU:HD21	0.60	1.72	10	8
1:A:55:ILE:HG22	1:A:59:LEU:HD12	0.60	1.74	1	8
1:A:31:LEU:HD13	1:A:45:TRP:CH2	0.59	2.32	8	10
1:A:28:ALA:HB2	1:A:58:PHE:CZ	0.57	2.34	7	8
1:A:24:ALA:HB3	1:A:61:LEU:HD11	0.57	1.76	7	1
1:A:28:ALA:HB3	1:A:62:ALA:HB2	0.57	1.75	10	4
1:A:18:LEU:HD12	1:A:19:THR:N	0.57	2.15	4	1
1:A:15:VAL:HG21	1:A:55:ILE:CD1	0.56	2.31	7	3

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:53:ASP:O	1:A:57:THR:HG23	0.53	2.03	8	1
1:A:31:LEU:O	1:A:38:ALA:HB2	0.53	2.04	10	7
1:A:14:ASN:HB2	1:A:17:ALA:HB3	0.52	1.81	5	2
1:A:28:ALA:HB3	1:A:62:ALA:CB	0.51	2.35	7	7
1:A:13:PHE:O	1:A:18:LEU:HD23	0.50	2.07	2	7
1:A:50:VAL:HG21	1:A:55:ILE:HD11	0.50	1.83	8	5
1:A:20:LYS:O	1:A:24:ALA:HB3	0.45	2.11	2	1
1:A:25:LYS:HA	1:A:62:ALA:HB2	0.45	1.88	9	1
1:A:18:LEU:HD11	1:A:24:ALA:HB2	0.43	1.90	4	1
1:A:59:LEU:HD13	1:A:71:TYR:CD1	0.43	2.49	4	1
1:A:31:LEU:HD22	1:A:41:ALA:CB	0.43	2.43	1	1
1:A:59:LEU:HD13	1:A:71:TYR:HD1	0.42	1.75	4	1
1:A:31:LEU:HD13	1:A:45:TRP:HH2	0.42	1.74	10	4
1:A:15:VAL:HA	1:A:18:LEU:HD23	0.41	1.91	4	1
1:A:13:PHE:CE2	1:A:41:ALA:HB2	0.41	2.50	5	2
1:A:28:ALA:HB2	1:A:58:PHE:CE2	0.41	2.50	2	1
1:A:59:LEU:O	1:A:62:ALA:HB3	0.41	2.16	10	1
1:A:55:ILE:HG21	1:A:75:TYR:CD1	0.40	2.52	7	1
1:A:21:ARG:HA	1:A:61:LEU:HD13	0.40	1.94	4	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	69/102 (68%)	61±1 (88±1%)	7±1 (10±2%)	1±0 (2±1%)	13	56
All	All	690/1020 (68%)	607 (88%)	71 (10%)	12 (2%)	13	56

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	68	GLY	10
1	A	20	LYS	2

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	56/84 (67%)	40±2 (71±4%)	16±2 (29±4%)	2 18
All	All	560/840 (67%)	400 (71%)	160 (29%)	2 18

All 33 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	13	PHE	10
1	A	18	LEU	10
1	A	42	TYR	10
1	A	43	ILE	10
1	A	50	VAL	10
1	A	61	LEU	10
1	A	71	TYR	10
1	A	74	ILE	10
1	A	36	LYS	8
1	A	59	LEU	7
1	A	25	LYS	7
1	A	20	LYS	6
1	A	48	ASN	6
1	A	23	ASP	5
1	A	81	HIS	4
1	A	70	LYS	4
1	A	14	ASN	3
1	A	76	ASN	3
1	A	52	LEU	3
1	A	54	GLN	3
1	A	29	LYS	3
1	A	46	GLN	3
1	A	49	ARG	2
1	A	72	ASN	2
1	A	60	LYS	2
1	A	73	GLN	2
1	A	12	MET	1
1	A	26	LYS	1
1	A	47	HIS	1

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Mol	Chain	Res	Type	Models (Total)
1	A	79	MET	1
1	A	56	ASP	1
1	A	11	GLU	1
1	A	39	ASP	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 monosaccharides 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 83% for the well-defined parts and 81% for the entire structure.

7.1 Chemical shift list 1

File name: working_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	1125
Number of shifts mapped to atoms	1125
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	8

7.1.2 Chemical shift referencing (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	99	-0.58 ± 0.21	Should be checked
$^{13}C_{\beta}$	92	0.51 ± 0.16	Should be checked
$^{13}C'$	99	-0.53 ± 0.21	Should be applied
^{15}N	97	0.32 ± 0.33	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 83%, i.e. 805 atoms were assigned a chemical shift out of a possible 972. 0 out of 10 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	346/348 (99%)	139/141 (99%)	138/138 (100%)	69/69 (100%)
Sidechain	413/530 (78%)	291/345 (84%)	120/163 (74%)	2/22 (9%)

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	Total	^{1}H	^{13}C	^{15}N
Aromatic	46/94 (49%)	36/46 (78%)	8/44 (18%)	2/4 (50%)
Overall	805/972 (83%)	466/532 (88%)	266/345 (77%)	73/95 (77%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 81%, i.e. 1125 atoms were assigned a chemical shift out of a possible 1395. 0 out of 16 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	492/510 (96%)	197/206 (96%)	198/204 (97%)	97/100 (97%)
Sidechain	578/772 (75%)	407/502 (81%)	168/238 (71%)	3/32 (9%)
Aromatic	55/113 (49%)	45/55 (82%)	8/54 (15%)	2/4 (50%)
Overall	1125/1395 (81%)	649/763 (85%)	374/496 (75%)	102/136 (75%)

7.1.4 Statistically unusual chemical shifts (i)

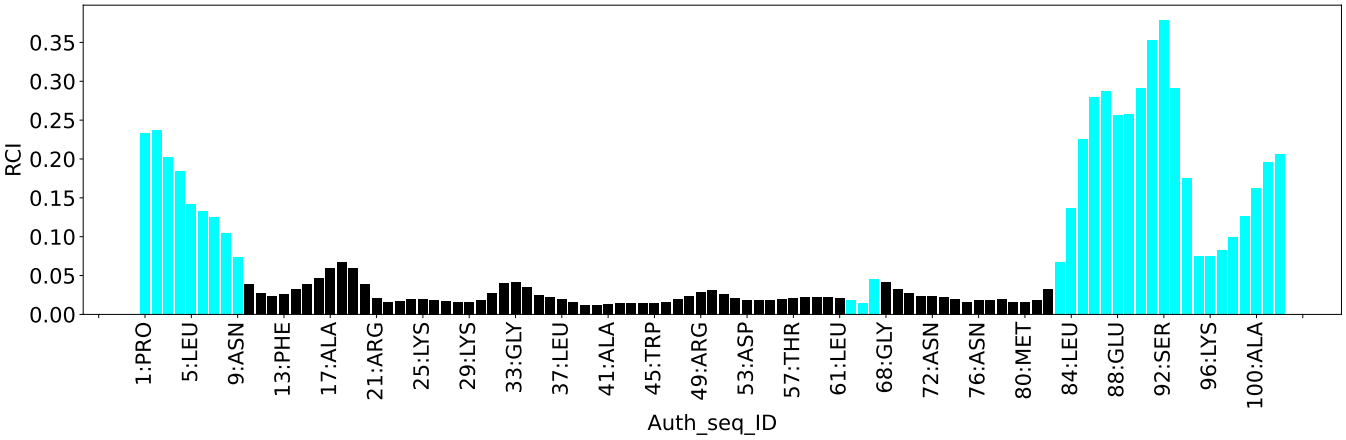
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, *ppm*	Expected range, *ppm*	Z-score
1	A	67	GLN	CD	33.50	173.59 – 185.85	-119.3
1	A	41	ALA	HB1	-0.33	0.14 – 2.58	-6.9
1	A	41	ALA	HB2	-0.33	0.14 – 2.58	-6.9
1	A	41	ALA	HB3	-0.33	0.14 – 2.58	-6.9
1	A	55	ILE	HD11	-1.04	-0.72 – 2.09	-6.1
1	A	55	ILE	HD12	-1.04	-0.72 – 2.09	-6.1
1	A	55	ILE	HD13	-1.04	-0.72 – 2.09	-6.1
1	A	41	ALA	HA	1.92	2.13 – 6.34	-5.5

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.If well-defined core and ill-defined regions are not identified then it is shown as gray bars.

Random coil index (RCI) for chain A:


RCI
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1:PRO
5:LEU
9:ASN
13:PHE
17:ALA
21:ARG
25:LYS
29:LYS
33:GLY
37:LEU
41:ALA
45:TRP
49:ARG
53:ASP
57:THR
61:LEU
68:GLY
72:ASN
76:ASN
80:MET
84:LEU
88:GLU
92:SER
96:LYS
100:ALA
Auth_seq_ID