Full wwPDB NMR Structure Validation Report (i)

Oct 30, 2024 – 06:03 AM EDT

PDB ID	:	2N9Y
BMRB ID	:	25920
Title	:	Structure of the Integrin alphaIIb-beta3(A711P) Transmembrane Complex
Authors	:	Schmidt, T.; Situ, A.J.; Ulmer, T.S.
Deposited on	:	2015-12-14

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:

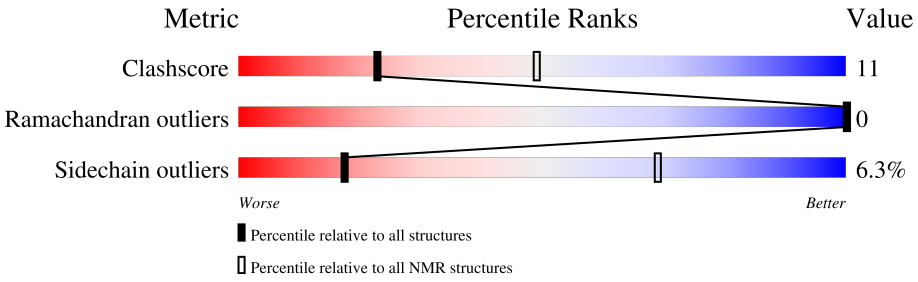
MolProbity	:	4.02b-467
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 39%.

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	210492	14027
Ramachandran outliers	207382	12486
Sidechain outliers	206894	12463

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	42	50% 17% 33%
2	B	43	56% 14% • 28%

2 Ensemble composition and analysis

This entry contains 21 models. Model 1 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:966-A:993, B:692-B:722 (59)	0.28	1

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 6 single-model clusters were found.

Cluster number	Models
1	1, 4, 5, 6, 8, 9, 10, 15
2	2, 3, 11, 14
3	7, 12, 17
Single-model clusters	13; 16; 18; 19; 20; 21

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 1413 atoms, of which 742 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Integrin alpha-IIb.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	42	707	230	369	57	49	2	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	957	GLY	-	expression tag	UNP P08514
A	963	CYS	ALA	engineered mutation	UNP P08514

- Molecule 2 is a protein called Integrin beta-3.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
2	B	43	706	224	373	52	55	2	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	685	GLY	-	expression tag	UNP P05106
B	687	SER	CYS	engineered mutation	UNP P05106
B	690	CYS	GLY	engineered mutation	UNP P05106
B	711	PRO	ALA	engineered mutation	UNP P05106

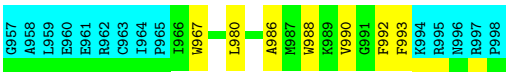
4 Residue-property plots

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.

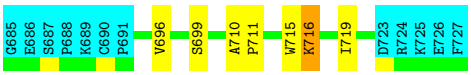
• Molecule 1: Integrin alpha-IIb

Chain A:



• Molecule 2: Integrin beta-3

Chain B:



4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

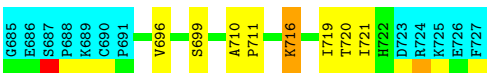
4.2.1 Score per residue for model 1 (medoid)

• Molecule 1: Integrin alpha-IIb

Chain A:

• Molecule 2: Integrin beta-3

Chain B:



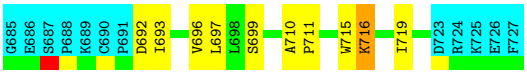
4.2.2 Score per residue for model 2

• Molecule 1: Integrin alpha-IIb

Chain A:

• Molecule 2: Integrin beta-3

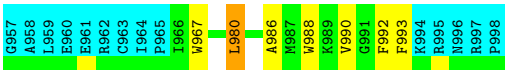
Chain B:



4.2.3 Score per residue for model 3

• Molecule 1: Integrin alpha-IIb

Chain A:



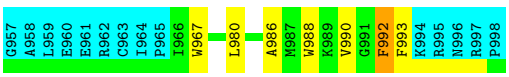
• Molecule 2: Integrin beta-3

Chain B:

4.2.4 Score per residue for model 4

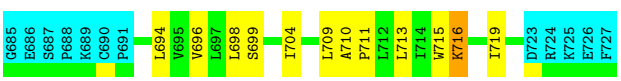
• Molecule 1: Integrin alpha-IIb

Chain A:



• Molecule 2: Integrin beta-3

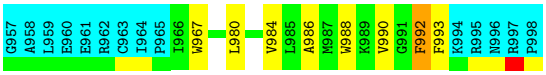
Chain B:



4.2.5 Score per residue for model 5

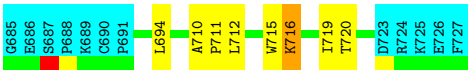
• Molecule 1: Integrin alpha-IIb

Chain A:



• Molecule 2: Integrin beta-3

Chain B:



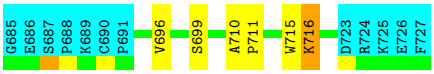
4.2.6 Score per residue for model 6

• Molecule 1: Integrin alpha-IIb

Chain A:

• Molecule 2: Integrin beta-3

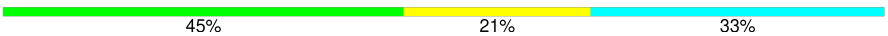
Chain B:

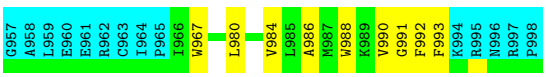


4.2.7 Score per residue for model 7

• Molecule 1: Integrin alpha-IIb

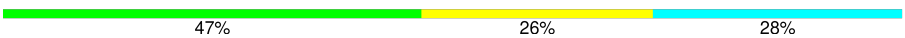
Chain A:

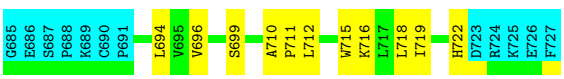




• Molecule 2: Integrin beta-3

Chain B:

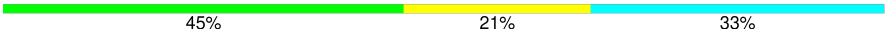


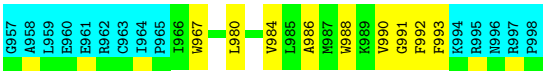


4.2.8 Score per residue for model 8

• Molecule 1: Integrin alpha-IIb

Chain A:





• Molecule 2: Integrin beta-3

Chain B:

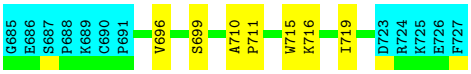
4.2.9 Score per residue for model 9

• Molecule 1: Integrin alpha-IIb

Chain A:

• Molecule 2: Integrin beta-3

Chain B:



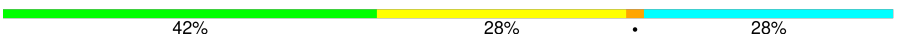
4.2.10 Score per residue for model 10

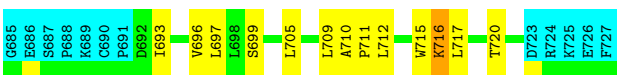
• Molecule 1: Integrin alpha-IIb

Chain A:

• Molecule 2: Integrin beta-3

Chain B:





4.2.11 Score per residue for model 11

• Molecule 1: Integrin alpha-IIb

Chain A:

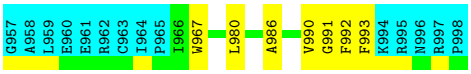
• Molecule 2: Integrin beta-3

Chain B:

4.2.12 Score per residue for model 12

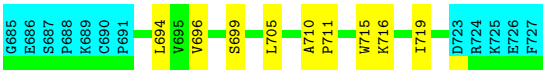
• Molecule 1: Integrin alpha-IIb

Chain A:



• Molecule 2: Integrin beta-3

Chain B:



4.2.13 Score per residue for model 13

• Molecule 1: Integrin alpha-IIb

Chain A:

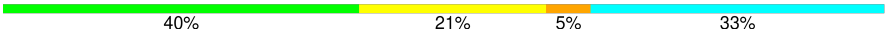
• Molecule 2: Integrin beta-3

Chain B:

4.2.14 Score per residue for model 14

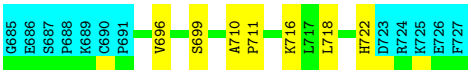
• Molecule 1: Integrin alpha-IIb

Chain A:



• Molecule 2: Integrin beta-3

Chain B:



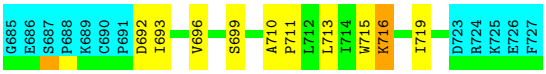
4.2.15 Score per residue for model 15

• Molecule 1: Integrin alpha-IIb

Chain A:

• Molecule 2: Integrin beta-3

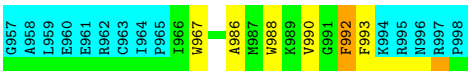
Chain B:



4.2.16 Score per residue for model 16

• Molecule 1: Integrin alpha-IIb

Chain A:



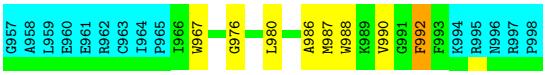
• Molecule 2: Integrin beta-3

Chain B:

4.2.17 Score per residue for model 17

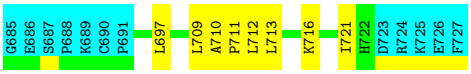
• Molecule 1: Integrin alpha-IIb

Chain A:



• Molecule 2: Integrin beta-3

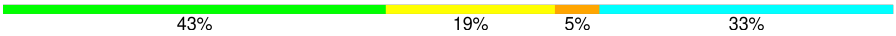
Chain B:



4.2.18 Score per residue for model 18

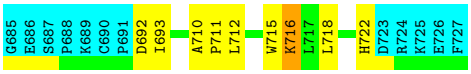
• Molecule 1: Integrin alpha-IIb

Chain A:



• Molecule 2: Integrin beta-3

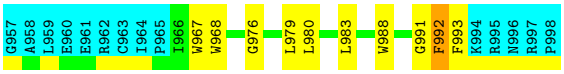
Chain B:



4.2.19 Score per residue for model 19

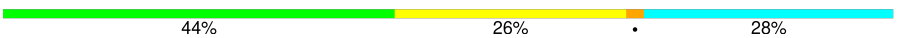
• Molecule 1: Integrin alpha-IIb

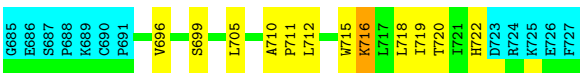
Chain A:



• Molecule 2: Integrin beta-3

Chain B:

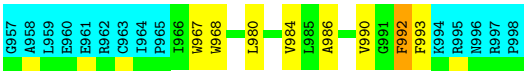




4.2.20 Score per residue for model 20

• Molecule 1: Integrin alpha-IIb

Chain A:



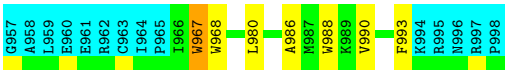
• Molecule 2: Integrin beta-3

Chain B:

4.2.21 Score per residue for model 21

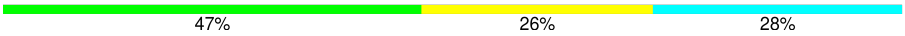
• Molecule 1: Integrin alpha-IIb

Chain A:



• Molecule 2: Integrin beta-3

Chain B:



5 Refinement protocol and experimental data overview

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

Of the 21 calculated structures, 21 were deposited, based on the following criterion: *all calculated structures submitted*.

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

Software name	Classification	Version
X-PLOR NIH	structure solution	
X-PLOR NIH	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	429
Number of shifts mapped to atoms	429
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	39%

6 Model quality

6.1 Standard geometry

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

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	224	249	249	6±2
2	B	236	281	281	7±3
All	All	9660	11130	11130	229

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 11.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
2:B:715:TRP:NE1	2:B:719:ILE:HD11	0.78	1.93	11	8
2:B:715:TRP:HE1	2:B:719:ILE:HD11	0.64	1.51	5	7
1:A:986:ALA:O	1:A:990:VAL:HG23	0.63	1.94	5	18
2:B:697:LEU:HD23	2:B:697:LEU:C	0.62	2.15	13	4
1:A:967:TRP:O	1:A:971:VAL:HG13	0.61	1.96	15	1
1:A:977:LEU:HD13	1:A:977:LEU:O	0.59	1.98	6	1
2:B:705:LEU:O	2:B:709:LEU:HD13	0.57	1.98	10	1
1:A:993:PHE:CD1	2:B:715:TRP:CH2	0.57	2.93	10	11
1:A:980:LEU:HD21	2:B:705:LEU:HD23	0.57	1.77	12	1
2:B:692:ASP:OD1	2:B:693:ILE:N	0.56	2.38	18	3
1:A:968:TRP:CD1	1:A:968:TRP:N	0.56	2.72	19	4
1:A:993:PHE:CZ	2:B:712:LEU:HD22	0.55	2.36	13	4
2:B:716:LYS:O	2:B:720:THR:HG23	0.55	2.00	8	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:968:TRP:NE1	2:B:693:ILE:HD12	0.55	2.16	20	1
1:A:990:VAL:O	1:A:990:VAL:HG12	0.55	2.01	1	19
2:B:710:ALA:HB3	2:B:711:PRO:HD3	0.55	1.79	14	21
1:A:992:PHE:O	2:B:716:LYS:NZ	0.54	2.39	5	10
1:A:968:TRP:CE2	2:B:693:ILE:HD12	0.54	2.37	10	2
1:A:992:PHE:CD1	2:B:716:LYS:NZ	0.53	2.68	16	1
1:A:968:TRP:NE1	2:B:693:ILE:CD1	0.52	2.72	20	1
2:B:718:LEU:O	2:B:722:HIS:ND1	0.52	2.43	7	5
1:A:993:PHE:CD1	2:B:715:TRP:CZ3	0.51	2.98	7	8
1:A:980:LEU:HD21	2:B:705:LEU:HA	0.51	1.82	19	1
1:A:968:TRP:CZ2	2:B:693:ILE:HD12	0.50	2.41	10	1
2:B:694:LEU:O	2:B:698:LEU:HD13	0.49	2.08	4	1
1:A:987:MET:CE	1:A:992:PHE:CD2	0.48	2.96	17	2
1:A:992:PHE:C	2:B:716:LYS:NZ	0.48	2.67	16	2
1:A:980:LEU:O	1:A:984:VAL:HG23	0.48	2.08	14	7
1:A:976:GLY:O	1:A:980:LEU:HD23	0.48	2.09	19	2
2:B:694:LEU:HD12	2:B:694:LEU:N	0.47	2.24	7	3
2:B:694:LEU:CD2	2:B:694:LEU:N	0.47	2.77	21	2
1:A:967:TRP:O	1:A:971:VAL:HG23	0.47	2.10	18	5
1:A:993:PHE:CE1	2:B:715:TRP:CE3	0.46	3.03	7	1
1:A:988:TRP:O	1:A:988:TRP:CD1	0.46	2.69	17	10
1:A:969:VAL:HG13	1:A:970:LEU:N	0.46	2.26	14	1
2:B:722:HIS:CD2	2:B:722:HIS:C	0.46	2.89	20	1
1:A:980:LEU:HD11	2:B:705:LEU:HD12	0.46	1.87	21	1
1:A:988:TRP:CD1	1:A:988:TRP:O	0.45	2.70	15	7
2:B:710:ALA:HB3	2:B:711:PRO:CD	0.45	2.42	15	2
1:A:967:TRP:CD2	1:A:967:TRP:N	0.45	2.84	21	1
2:B:694:LEU:N	2:B:694:LEU:HD22	0.44	2.26	21	2
2:B:696:VAL:O	2:B:699:SER:OG	0.44	2.34	21	15
1:A:980:LEU:HD11	2:B:708:GLY:HA3	0.44	1.89	3	1
2:B:697:LEU:C	2:B:697:LEU:CD2	0.44	2.86	2	2
2:B:712:LEU:HD12	2:B:712:LEU:N	0.43	2.28	17	5
1:A:980:LEU:CD2	2:B:705:LEU:HD23	0.43	2.44	12	1
1:A:984:VAL:HG22	2:B:712:LEU:HD21	0.43	1.88	18	1
1:A:992:PHE:C	2:B:716:LYS:HZ1	0.42	2.18	16	1
1:A:990:VAL:O	1:A:990:VAL:CG1	0.42	2.65	1	1
2:B:715:TRP:CD1	2:B:715:TRP:C	0.42	2.93	21	2
1:A:966:ILE:CG2	1:A:967:TRP:CE3	0.42	3.03	2	1
2:B:709:LEU:O	2:B:713:LEU:N	0.42	2.43	4	2
2:B:717:LEU:O	2:B:720:THR:OG1	0.42	2.36	10	2
2:B:697:LEU:HD23	2:B:697:LEU:O	0.41	2.15	13	2

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
2:B:707:ILE:O	2:B:711:PRO:CD	0.41	2.69	16	2
2:B:709:LEU:O	2:B:713:LEU:HD13	0.41	2.16	17	1
1:A:968:TRP:CE3	2:B:697:LEU:HD22	0.41	2.51	10	1
1:A:988:TRP:CD1	1:A:988:TRP:C	0.40	2.93	15	1
1:A:979:LEU:O	1:A:983:LEU:HD13	0.40	2.17	19	1
2:B:719:ILE:CG2	2:B:720:THR:N	0.40	2.85	19	1
1:A:968:TRP:CZ2	2:B:693:ILE:HD11	0.40	2.52	21	1
1:A:980:LEU:HD11	2:B:704:ILE:HG22	0.40	1.93	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	28/42 (67%)	28±0 (100±1%)	0±0 (0±1%)	0±0 (0±0%)	100	100
2	B	31/43 (72%)	31±0 (100±0%)	0±0 (0±0%)	0±0 (0±0%)	100	100
All	All	1239/1785 (69%)	1237 (100%)	2 (0%)	0 (0%)	100	100

There are no Ramachandran outliers.

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	23/35 (66%)	21±0 (92±2%)	2±0 (8±2%)	11	60
2	B	27/38 (71%)	26±0 (96±1%)	1±0 (4±1%)	26	79
All	All	1050/1533 (68%)	984 (94%)	66 (6%)	17	69

All 7 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	967	TRP	21
2	B	716	LYS	21
1	A	992	PHE	18
2	B	719	ILE	2
2	B	713	LEU	2
1	A	980	LEU	1
1	A	977	LEU	1

6.3.3 RNA

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains

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

6.5 Carbohydrates

There are no oligosaccharides in this entry.

6.6 Ligand geometry

There are no ligands in this entry.

6.7 Other polymers

There are no such molecules in this entry.

6.8 Polymer linkage issues

There are no chain breaks in this entry.

7 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 39% for the well-defined parts and 34% 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

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	429
Number of shifts mapped to atoms	429
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	1

7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	77	-0.23 ± 0.11	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	69	1.30 ± 0.05	Should be checked
$^{13}C'$	69	0.00 ± 0.28	None needed (< 0.5 ppm)
^{15}N	72	0.76 ± 0.34	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 39%, i.e. 348 atoms were assigned a chemical shift out of a possible 899. 0 out of 26 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	240/299 (80%)	68/123 (55%)	114/118 (97%)	58/58 (100%)
Sidechain	91/525 (17%)	41/361 (11%)	50/162 (31%)	0/2 (0%)

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	Total	^{1}H	^{13}C	^{15}N
Aromatic	17/75 (23%)	9/38 (24%)	4/32 (12%)	4/5 (80%)
Overall	348/899 (39%)	118/522 (23%)	168/312 (54%)	62/65 (95%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 34%, i.e. 427 atoms were assigned a chemical shift out of a possible 1261. 0 out of 27 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	300/423 (71%)	82/173 (47%)	146/170 (86%)	72/80 (90%)
Sidechain	110/753 (15%)	41/504 (8%)	69/231 (30%)	0/18 (0%)
Aromatic	17/85 (20%)	9/43 (21%)	4/37 (11%)	4/5 (80%)
Overall	427/1261 (34%)	132/720 (18%)	219/438 (50%)	76/103 (74%)

7.1.4 Statistically unusual chemical shifts (i)

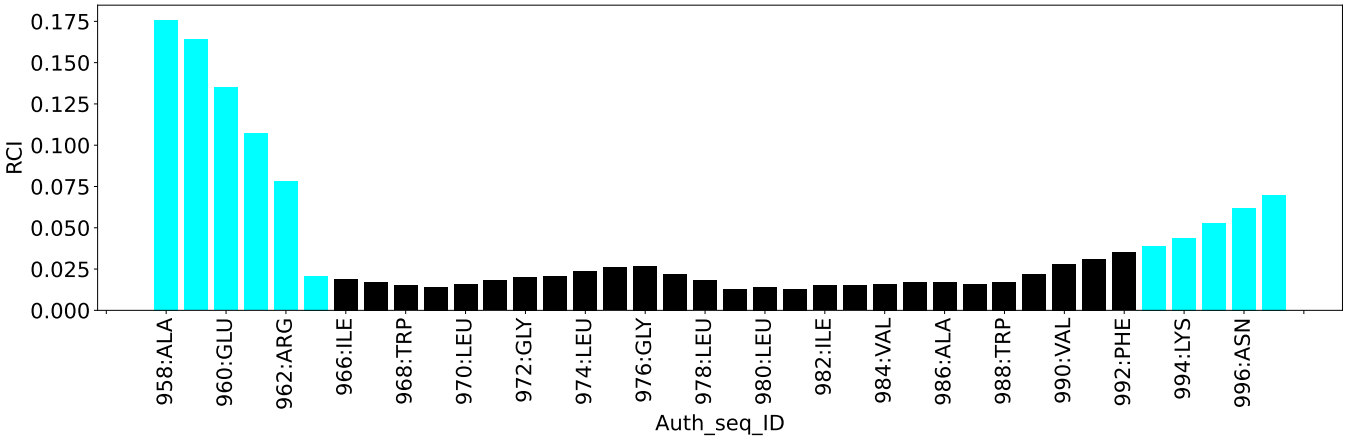
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, *ppm*	Expected range, *ppm*	Z-score
1	A	981	THR	HG1	4.10	0.08 – 2.19	14.0

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:



Random coil index (RCI) for chain B: