



Full wwPDB NMR Structure Validation Report ⓘ

Jun 24, 2024 – 10:04 AM EDT

PDB ID : 6Y3H
BMRB ID : 27965
Title : NMR solution structure of the hazelnut allergen Cor a 1.0401
Authors : Fuehrer, S.; Kamenik, A.S.; Zeindl, R.; Nothegger, B.; Hofer, F.; Reider, N.;
Liedl, K.R.; Tollinger, M.
Deposited on : 2020-02-18

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 ⓘ 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 ⓘ](#)) 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) : 2.37.1

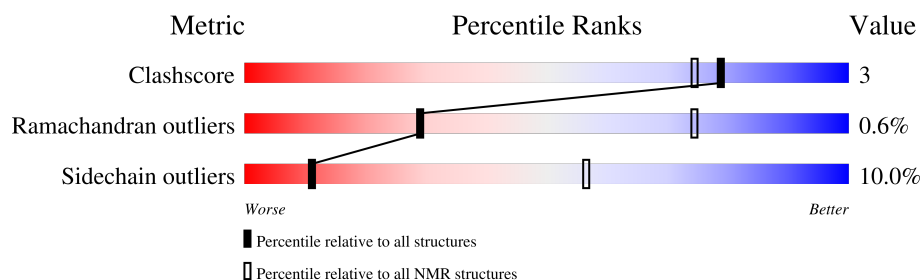
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 90%.

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	160	 81% 13% . .

2 Ensemble composition and analysis

This entry contains 20 models. Model 7 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:2-A:59, A:66-A:160 (153)	0.46	7

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 2 clusters and 5 single-model clusters were found.

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

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 2446 atoms, of which 1215 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Major allergen Cor a 1.0401.

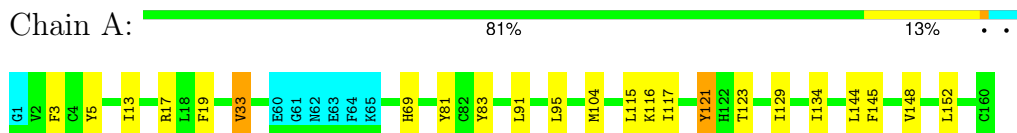
Mol	Chain	Residues	Atoms						Trace
1	A	160	Total	C	H	N	O	S	0
			2446	790	1215	202	234	5	

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: Major allergen Cor a 1.0401

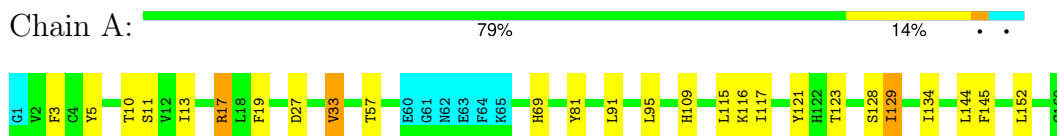


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

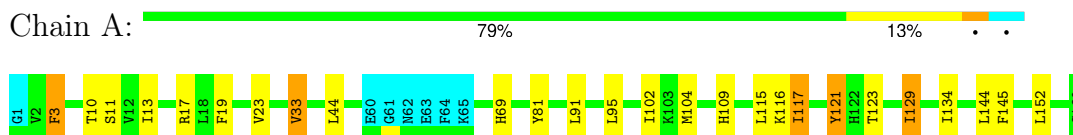
4.2.1 Score per residue for model 1

- Molecule 1: Major allergen Cor a 1.0401



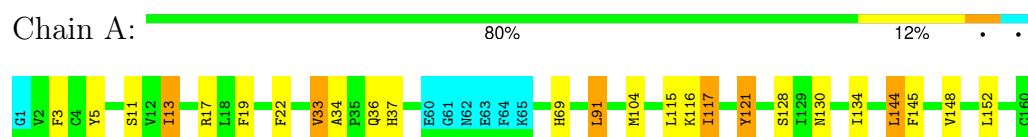
4.2.2 Score per residue for model 2

- Molecule 1: Major allergen Cor a 1.0401



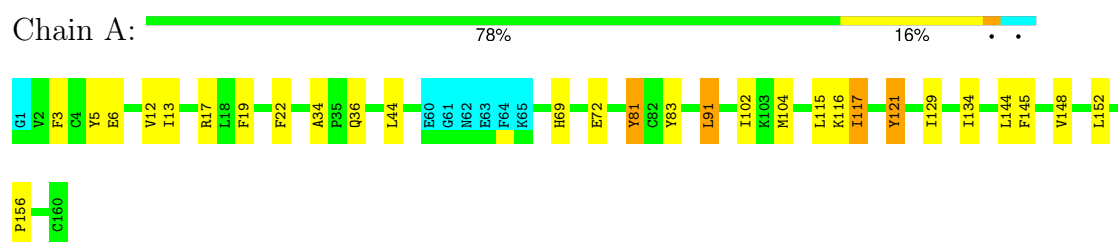
4.2.3 Score per residue for model 3

- Molecule 1: Major allergen Cor a 1.0401



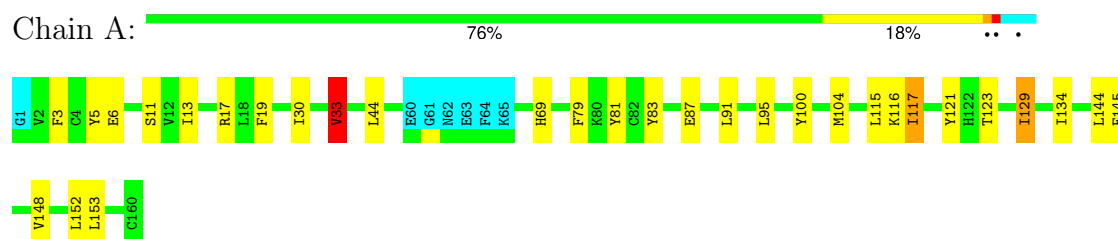
4.2.4 Score per residue for model 4

- Molecule 1: Major allergen Cor a 1.0401



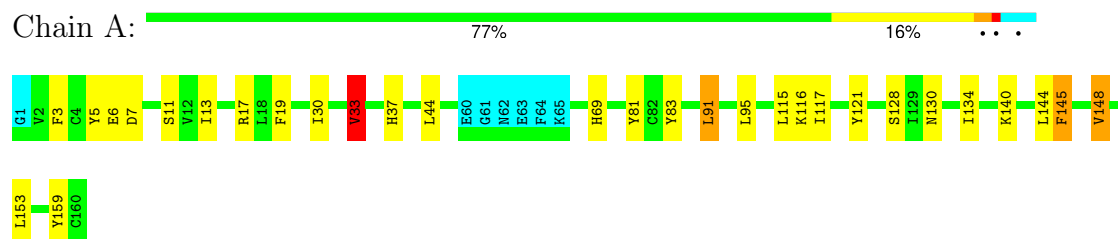
4.2.5 Score per residue for model 5

- Molecule 1: Major allergen Cor a 1.0401



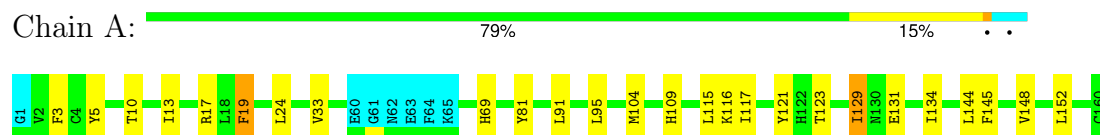
4.2.6 Score per residue for model 6

- Molecule 1: Major allergen Cor a 1.0401



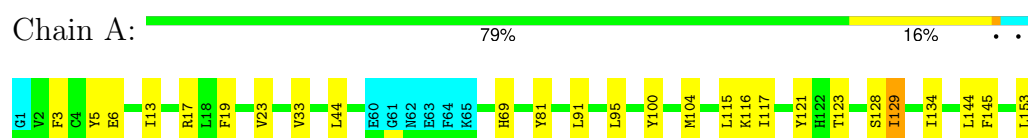
4.2.7 Score per residue for model 7 (medoid)

- Molecule 1: Major allergen Cor a 1.0401



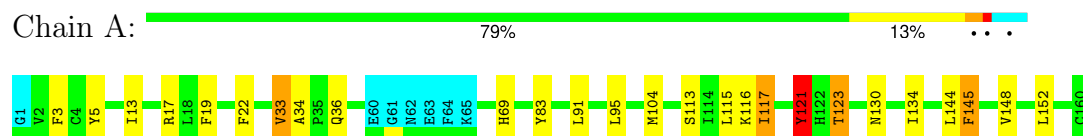
4.2.8 Score per residue for model 8

- Molecule 1: Major allergen Cor a 1.0401



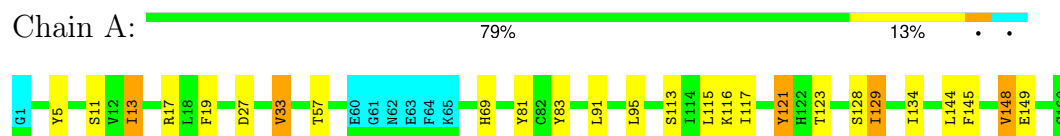
4.2.9 Score per residue for model 9

- Molecule 1: Major allergen Cor a 1.0401



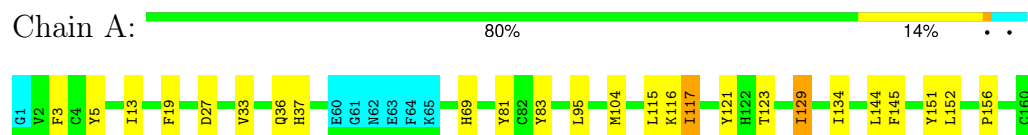
4.2.10 Score per residue for model 10

- Molecule 1: Major allergen Cor a 1.0401



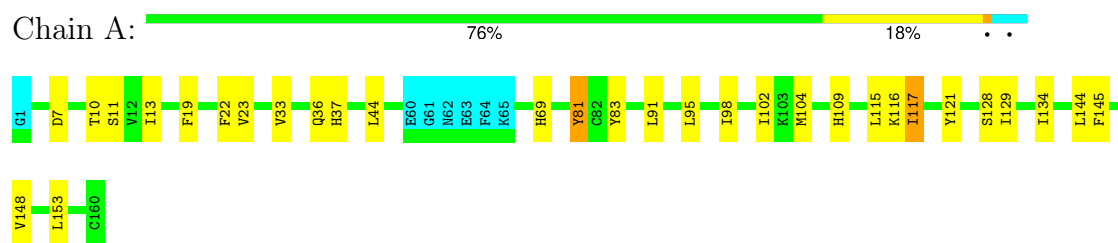
4.2.11 Score per residue for model 11

- Molecule 1: Major allergen Cor a 1.0401



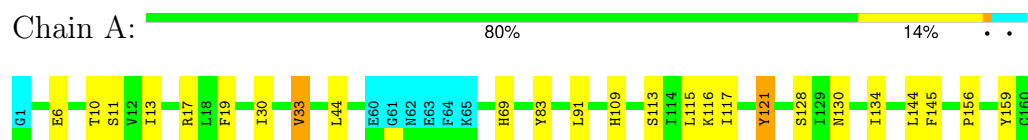
4.2.12 Score per residue for model 12

- Molecule 1: Major allergen Cor a 1.0401



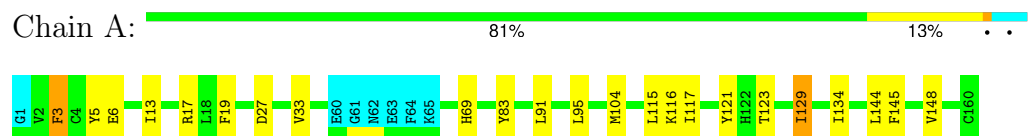
4.2.13 Score per residue for model 13

- Molecule 1: Major allergen Cor a 1.0401



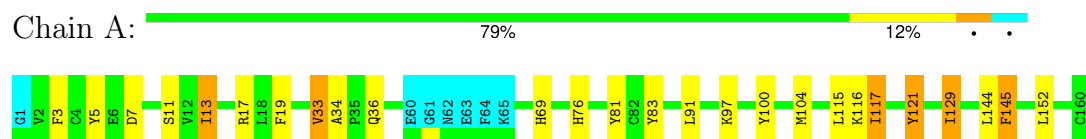
4.2.14 Score per residue for model 14

- Molecule 1: Major allergen Cor a 1.0401



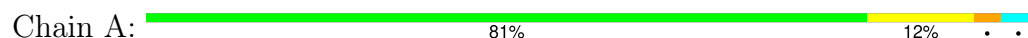
4.2.15 Score per residue for model 15

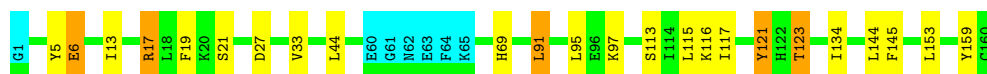
- Molecule 1: Major allergen Cor a 1.0401



4.2.16 Score per residue for model 16

- Molecule 1: Major allergen Cor a 1.0401





4.2.17 Score per residue for model 17

- Molecule 1: Major allergen Cor a 1.0401

Chain A: 82% 13% •



4.2.18 Score per residue for model 18

- Molecule 1: Major allergen Cor a 1.0401

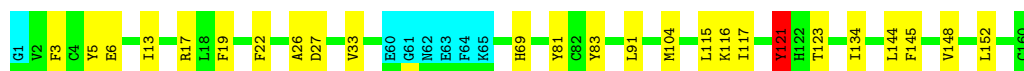
Chain A: 79% 14% • •



4.2.19 Score per residue for model 19

- Molecule 1: Major allergen Cor a 1.0401

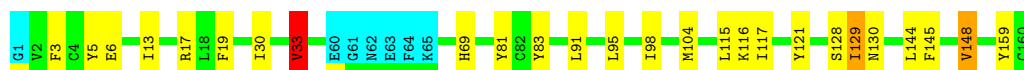
Chain A: 80% 15% • •



4.2.20 Score per residue for model 20

- Molecule 1: Major allergen Cor a 1.0401

Chain A: 79% 14% • •



5 Refinement protocol and experimental data overview

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

Of the 40 calculated structures, 20 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
X-PLOR NIH	structure calculation	
Amber	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	1854
Number of shifts mapped to atoms	1854
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	90%

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	0.68±0.01	0±0/1206 (0.0± 0.0%)	1.16±0.01	3±1/1627 (0.2± 0.1%)
All	All	0.68	0/24120 (0.0%)	1.16	61/32540 (0.2%)

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	6.3±1.8
All	All	0	127

There are no bond-length outliers.

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	17	ARG	NE-CZ-NH1	7.99	124.30	120.30	4	17
1	A	148	VAL	CA-CB-CG1	6.80	121.09	110.90	4	11
1	A	104	MET	CB-CA-C	6.46	123.31	110.40	9	14
1	A	33	VAL	CA-CB-CG1	5.86	119.69	110.90	18	6
1	A	148	VAL	CG1-CB-CG2	-5.66	101.84	110.90	4	5
1	A	23	VAL	CA-CB-CG2	5.54	119.22	110.90	12	3
1	A	115	LEU	CB-CG-CD2	5.25	119.93	111.00	17	1
1	A	130	ASN	CB-CA-C	5.12	120.63	110.40	18	1
1	A	33	VAL	CG1-CB-CG2	-5.08	102.77	110.90	18	2
1	A	148	VAL	CA-CB-CG2	-5.04	103.34	110.90	3	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)
1	A	116	LYS	Peptide	20
1	A	91	LEU	Peptide	19
1	A	115	LEU	Peptide	19
1	A	81	TYR	Sidechain	14
1	A	83	TYR	Sidechain	14
1	A	6	GLU	Peptide	9
1	A	128	SER	Peptide	7
1	A	121	TYR	Sidechain	5
1	A	100	TYR	Sidechain	4
1	A	159	TYR	Sidechain	4
1	A	33	VAL	Peptide	3
1	A	113	SER	Peptide	3
1	A	129	ILE	Peptide	2
1	A	57	THR	Peptide	1
1	A	72	GLU	Peptide	1
1	A	117	ILE	Peptide	1
1	A	97	LYS	Peptide	1

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	1177	1167	1167	7±3
All	All	23540	23340	23340	133

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 3.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:95:LEU:CD2	1:A:123:THR:HG22	0.76	2.10	11	9
1:A:117:ILE:HD13	1:A:117:ILE:H	0.59	1.57	9	8
1:A:121:TYR:CD2	1:A:134:ILE:HD12	0.58	2.32	16	9
1:A:13:ILE:HD13	1:A:13:ILE:H	0.58	1.57	10	2
1:A:123:THR:HG21	1:A:129:ILE:N	0.58	2.14	1	9
1:A:3:PHE:CD2	1:A:129:ILE:HD13	0.57	2.35	15	2
1:A:129:ILE:H	1:A:129:ILE:HD12	0.56	1.60	7	11

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:34:ALA:HB1	1:A:36:GLN:HE22	0.56	1.61	18	6
1:A:10:THR:HG21	1:A:109:HIS:CE1	0.55	2.36	12	5
1:A:121:TYR:CG	1:A:134:ILE:HD12	0.54	2.38	7	9
1:A:95:LEU:HD11	1:A:134:ILE:HD11	0.52	1.82	5	10
1:A:95:LEU:HD23	1:A:123:THR:HA	0.52	1.82	14	10
1:A:36:GLN:HE21	1:A:37:HIS:CD2	0.52	2.24	11	1
1:A:30:ILE:HA	1:A:33:VAL:HG12	0.50	1.83	5	4
1:A:129:ILE:H	1:A:129:ILE:CD1	0.49	2.21	7	6
1:A:34:ALA:HB3	1:A:144:LEU:CD1	0.47	2.39	3	1
1:A:33:VAL:HG11	1:A:148:VAL:HG23	0.46	1.87	20	4
1:A:95:LEU:HD13	1:A:98:ILE:HD11	0.46	1.86	20	2
1:A:13:ILE:H	1:A:13:ILE:CD1	0.46	2.24	10	2
1:A:95:LEU:HD21	1:A:123:THR:HG22	0.46	1.83	11	1
1:A:3:PHE:CG	1:A:129:ILE:HG12	0.45	2.47	18	3
1:A:36:GLN:HE21	1:A:37:HIS:CG	0.44	2.31	3	1
1:A:91:LEU:HD11	1:A:97:LYS:HA	0.43	1.87	16	1
1:A:36:GLN:HE21	1:A:37:HIS:CE1	0.43	2.31	12	1
1:A:22:PHE:O	1:A:26:ALA:HB2	0.43	2.14	19	1
1:A:81:TYR:H	1:A:102:ILE:HB	0.43	1.74	4	3
1:A:37:HIS:CE1	1:A:140:LYS:HE3	0.42	2.50	6	1
1:A:95:LEU:CD1	1:A:134:ILE:HD11	0.42	2.45	2	1
1:A:145:PHE:C	1:A:145:PHE:CD1	0.42	2.93	9	1
1:A:13:ILE:HD12	1:A:152:LEU:HB3	0.42	1.92	3	1
1:A:123:THR:HG21	1:A:129:ILE:HA	0.41	1.92	11	1
1:A:145:PHE:CD1	1:A:145:PHE:C	0.41	2.94	6	2
1:A:123:THR:HG21	1:A:129:ILE:CA	0.41	2.45	11	1
1:A:123:THR:HG21	1:A:128:SER:C	0.41	2.37	8	1
1:A:21:SER:HB3	1:A:159:TYR:CD2	0.41	2.51	16	1
1:A:19:PHE:CE2	1:A:24:LEU:HD11	0.40	2.52	7	1
1:A:129:ILE:HD12	1:A:129:ILE:N	0.40	2.32	15	1

6.3 Torsion angles ⓘ

6.3.1 Protein backbone ⓘ

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	152/160 (95%)	145±2 (95±1%)	7±2 (4±1%)	1±1 (1±0%)	29 74
All	All	3040/3200 (95%)	2891 (95%)	131 (4%)	18 (1%)	29 74

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	129	ILE	10
1	A	130	ASN	5
1	A	91	LEU	3

6.3.2 Protein sidechains ⓘ

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	122/127 (96%)	110±2 (90±2%)	12±2 (10±2%)	11 56
All	All	2440/2540 (96%)	2197 (90%)	243 (10%)	11 56

All 31 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	ILE	20
1	A	19	PHE	20
1	A	69	HIS	20
1	A	117	ILE	20
1	A	144	LEU	20
1	A	145	PHE	20
1	A	33	VAL	19
1	A	5	TYR	15
1	A	3	PHE	13
1	A	11	SER	10
1	A	152	LEU	10
1	A	44	LEU	9
1	A	121	TYR	8
1	A	27	ASP	6
1	A	22	PHE	5

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Models (Total)
1	A	153	LEU	5
1	A	156	PRO	3
1	A	7	ASP	3
1	A	123	THR	3
1	A	17	ARG	2
1	A	113	SER	2
1	A	12	VAL	1
1	A	79	PHE	1
1	A	87	GLU	1
1	A	95	LEU	1
1	A	131	GLU	1
1	A	57	THR	1
1	A	149	GLU	1
1	A	151	TYR	1
1	A	76	HIS	1
1	A	6	GLU	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 monosaccharides 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 90% for the well-defined parts and 88% 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	1854
Number of shifts mapped to atoms	1854
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

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	152	-0.20 ± 0.07	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	141	-0.13 ± 0.07	None needed (< 0.5 ppm)
$^{13}\text{C}'$	151	-0.04 ± 0.09	None needed (< 0.5 ppm)
^{15}N	138	0.19 ± 0.43	None needed (< 0.5 ppm)

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 90%, i.e. 1826 atoms were assigned a chemical shift out of a possible 2018. 0 out of 16 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	726/762 (95%)	294/311 (95%)	296/306 (97%)	136/145 (94%)
Sidechain	971/1060 (92%)	652/694 (94%)	311/340 (91%)	8/26 (31%)

Continued on next page...

Continued from previous page...

	Total	¹ H	¹³ C	¹⁵ N
Aromatic	129/196 (66%)	60/95 (63%)	59/89 (66%)	10/12 (83%)
Overall	1826/2018 (90%)	1006/1100 (91%)	666/735 (91%)	154/183 (84%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 88%, i.e. 1854 atoms were assigned a chemical shift out of a possible 2102. 0 out of 16 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	741/799 (93%)	300/327 (92%)	303/320 (95%)	138/152 (91%)
Sidechain	980/1097 (89%)	658/716 (92%)	313/353 (89%)	9/28 (32%)
Aromatic	133/206 (65%)	62/100 (62%)	61/94 (65%)	10/12 (83%)
Overall	1854/2102 (88%)	1020/1143 (89%)	677/767 (88%)	157/192 (82%)

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. 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:

