



Full wwPDB NMR Structure Validation Report ⓘ

Mar 8, 2026 – 07:32 AM UTC

PDB ID : 2B1U / pdb_00002b1u
Title : Solution structure of Calmodulin-like Skin Protein C terminal domain
Authors : Babini, E.; Bertini, I.; Capozzi, F.; Chirivino, E.; Luchinat, C.; Structural Proteomics in Europe (SPINE)
Deposited on : 2005-09-16

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	:	4-5-2 with Phenix2.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
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)	:	2.49

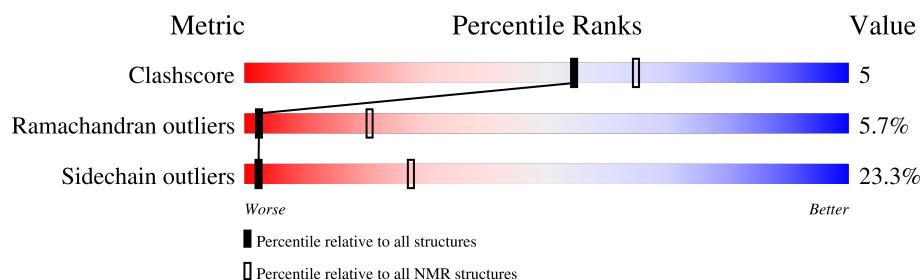
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

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	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

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	71	

2 Ensemble composition and analysis

This entry contains 20 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: *fewest violations*.

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:78-A:91, A:96-A:144 (63)	0.86	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 4 clusters and 1 single-model cluster was found.

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

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 1083 atoms, of which 525 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Calmodulin-like protein 5.

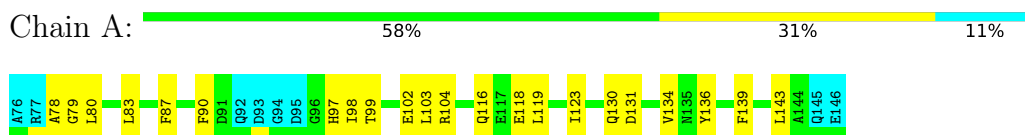
Mol	Chain	Residues	Atoms						Trace
1	A	71	Total	C	H	N	O	S	0
			1083	339	525	101	115	3	

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: Calmodulin-like protein 5

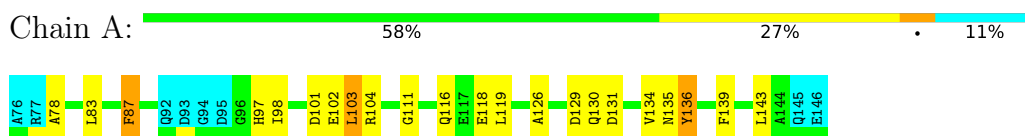


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

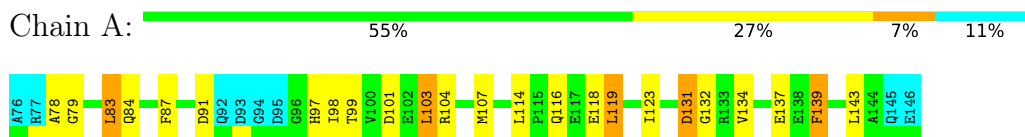
4.2.1 Score per residue for model 1

- Molecule 1: Calmodulin-like protein 5



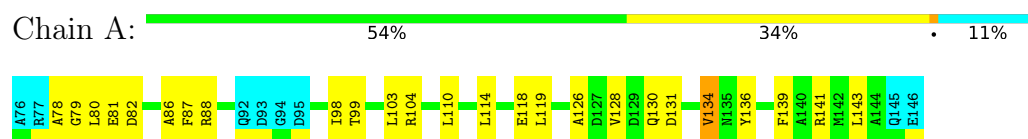
4.2.2 Score per residue for model 2

- Molecule 1: Calmodulin-like protein 5



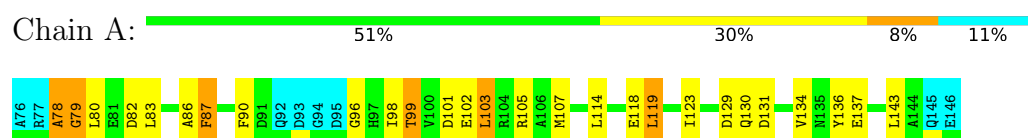
4.2.3 Score per residue for model 3

- Molecule 1: Calmodulin-like protein 5



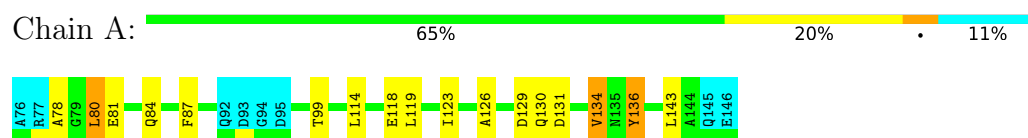
4.2.4 Score per residue for model 4

- Molecule 1: Calmodulin-like protein 5



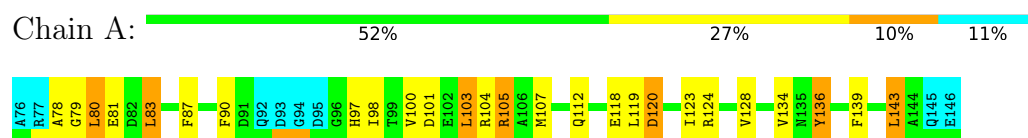
4.2.5 Score per residue for model 5

- Molecule 1: Calmodulin-like protein 5



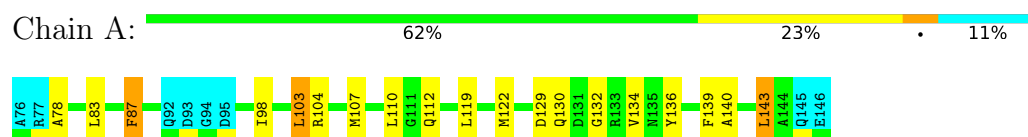
4.2.6 Score per residue for model 6

- Molecule 1: Calmodulin-like protein 5



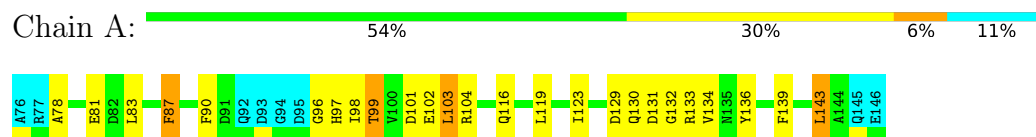
4.2.7 Score per residue for model 7

- Molecule 1: Calmodulin-like protein 5



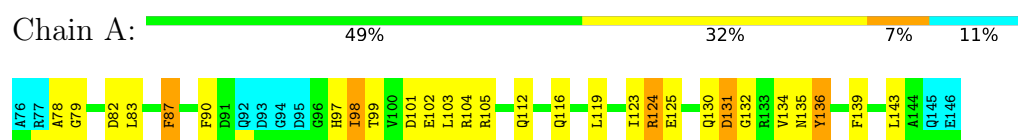
4.2.8 Score per residue for model 8 (medoid)

- Molecule 1: Calmodulin-like protein 5



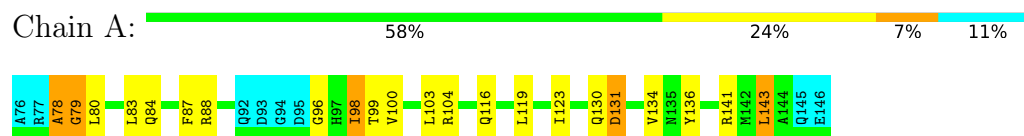
4.2.9 Score per residue for model 9

- Molecule 1: Calmodulin-like protein 5



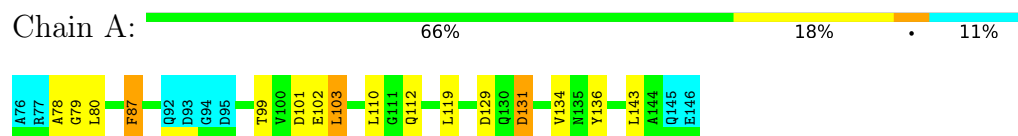
4.2.10 Score per residue for model 10

- Molecule 1: Calmodulin-like protein 5



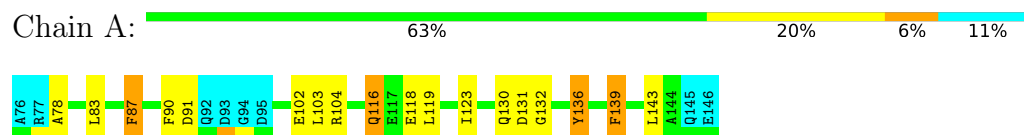
4.2.11 Score per residue for model 11

- Molecule 1: Calmodulin-like protein 5



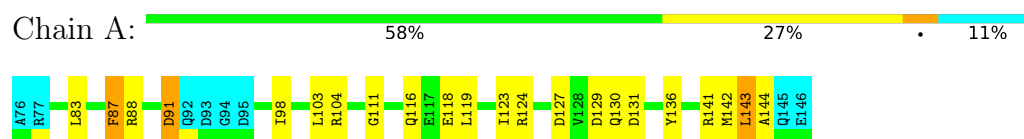
4.2.12 Score per residue for model 12

- Molecule 1: Calmodulin-like protein 5



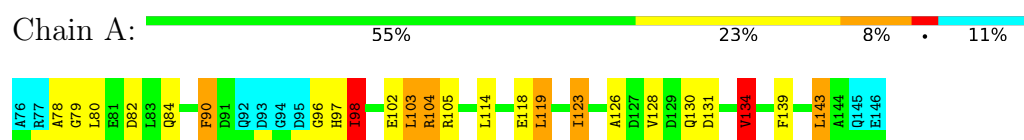
4.2.13 Score per residue for model 13

- Molecule 1: Calmodulin-like protein 5



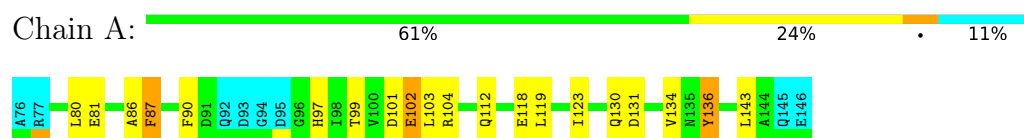
4.2.14 Score per residue for model 14

- Molecule 1: Calmodulin-like protein 5



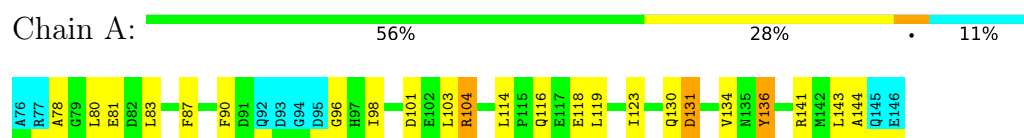
4.2.15 Score per residue for model 15

- Molecule 1: Calmodulin-like protein 5



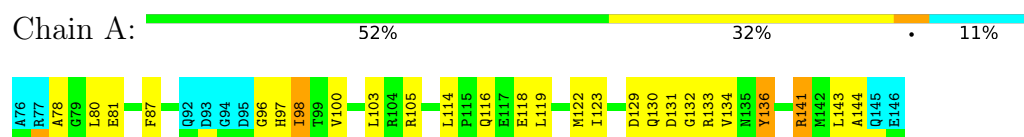
4.2.16 Score per residue for model 16

- Molecule 1: Calmodulin-like protein 5



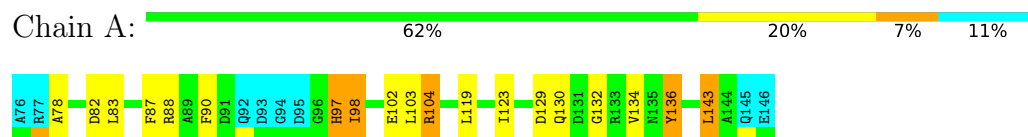
4.2.17 Score per residue for model 17

- Molecule 1: Calmodulin-like protein 5



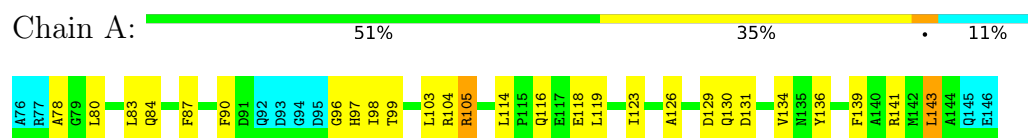
4.2.18 Score per residue for model 18

- Molecule 1: Calmodulin-like protein 5



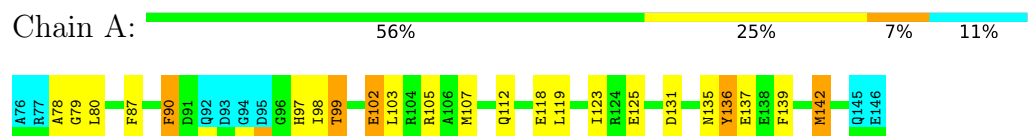
4.2.19 Score per residue for model 19

- Molecule 1: Calmodulin-like protein 5



4.2.20 Score per residue for model 20

- Molecule 1: Calmodulin-like protein 5



5 Refinement protocol and experimental data overview

The models were refined using the following method: *torsion angle dynamics, coupled with simulated annealing, followed by restrained energy minimization.*

Of the 400 calculated structures, 20 were deposited, based on the following criterion: *target function.*

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

Software name	Classification	Version
CYANA	structure solution	1.2
Amber	refinement	5.0

No chemical shift data was provided.

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	0.67±0.01	0±0/501 (0.0± 0.0%)	1.40±0.04	2±2/676 (0.3± 0.2%)
All	All	0.67	0/10020 (0.0%)	1.40	41/13520 (0.3%)

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	3.8±1.6
All	All	0	76

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	79	GLY	N-CA-C	-9.22	101.82	110.21	6	2
1	A	116	GLN	CA-C-N	6.89	129.81	120.44	16	2
1	A	116	GLN	C-N-CA	6.89	129.81	120.44	16	2
1	A	131	ASP	CA-CB-CG	6.86	119.45	112.60	11	1
1	A	98	ILE	CA-C-N	6.40	132.19	123.11	13	4
1	A	98	ILE	C-N-CA	6.40	132.19	123.11	13	4
1	A	90	PHE	CA-CB-CG	-6.37	107.43	113.80	4	3
1	A	99	THR	CB-CA-C	6.29	120.38	110.19	8	4
1	A	80	LEU	N-CA-C	6.10	117.60	111.07	19	2
1	A	101	ASP	CA-CB-CG	-5.94	106.66	112.60	6	2
1	A	114	LEU	CB-CA-C	5.65	115.21	111.20	5	1
1	A	129	ASP	CA-CB-CG	5.43	118.03	112.60	18	1
1	A	83	LEU	N-CA-CB	-5.37	102.28	110.07	2	1
1	A	118	GLU	N-CA-C	-5.31	105.41	111.14	14	2
1	A	97	HIS	CB-CG-CD2	-5.27	124.35	131.20	9	3

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	98	ILE	CA-CB-CG1	5.21	119.25	110.40	10	1
1	A	99	THR	N-CA-CB	-5.17	102.45	110.87	9	1
1	A	86	ALA	CA-C-N	5.11	128.49	120.82	15	1
1	A	86	ALA	C-N-CA	5.11	128.49	120.82	15	1
1	A	98	ILE	CA-CB-CG2	5.08	119.14	110.50	14	1
1	A	129	ASP	CA-C-N	5.01	131.11	121.54	17	1
1	A	129	ASP	C-N-CA	5.01	131.11	121.54	17	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	87	PHE	Sidechain	17
1	A	104	ARG	Sidechain	14
1	A	136	TYR	Sidechain	13
1	A	78	ALA	Peptide	9
1	A	90	PHE	Sidechain	5
1	A	105	ARG	Sidechain	4
1	A	139	PHE	Sidechain	3
1	A	133	ARG	Sidechain	2
1	A	98	ILE	Peptide	2
1	A	124	ARG	Sidechain	1
1	A	88	ARG	Sidechain	1
1	A	96	GLY	Peptide	1
1	A	97	HIS	Peptide	1
1	A	141	ARG	Sidechain	1
1	A	79	GLY	Peptide	1
1	A	142	MET	Peptide	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	494	472	472	5±3
All	All	9880	9440	9440	99

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 5.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:98:ILE:HD13	1:A:103:LEU:HD12	0.73	1.58	7	2
1:A:98:ILE:HG22	1:A:136:TYR:CE2	0.72	2.19	4	2
1:A:83:LEU:HD11	1:A:143:LEU:HD13	0.69	1.62	19	2
1:A:143:LEU:C	1:A:143:LEU:HD12	0.69	2.13	14	3
1:A:87:PHE:CE1	1:A:103:LEU:HD21	0.65	2.27	15	8
1:A:103:LEU:HD11	1:A:139:PHE:CE2	0.62	2.29	7	1
1:A:83:LEU:HD11	1:A:143:LEU:CD1	0.59	2.28	19	1
1:A:98:ILE:CD1	1:A:103:LEU:HD12	0.56	2.31	7	3
1:A:79:GLY:O	1:A:83:LEU:HD12	0.54	2.03	9	1
1:A:87:PHE:CD1	1:A:98:ILE:HG21	0.54	2.37	1	1
1:A:87:PHE:CZ	1:A:103:LEU:HD21	0.53	2.39	4	2
1:A:83:LEU:HD22	1:A:143:LEU:HB3	0.52	1.81	6	1
1:A:83:LEU:HD11	1:A:87:PHE:CE2	0.52	2.40	2	1
1:A:83:LEU:CD1	1:A:87:PHE:CZ	0.51	2.93	2	1
1:A:80:LEU:HA	1:A:143:LEU:HD21	0.51	1.81	14	1
1:A:80:LEU:HD23	1:A:81:GLU:N	0.51	2.21	6	6
1:A:83:LEU:HD11	1:A:87:PHE:CZ	0.50	2.40	2	1
1:A:107:MET:SD	1:A:119:LEU:HD23	0.50	2.46	2	1
1:A:98:ILE:HD13	1:A:103:LEU:CD1	0.50	2.34	14	1
1:A:80:LEU:HD23	1:A:80:LEU:C	0.50	2.32	4	3
1:A:126:ALA:HB1	1:A:134:VAL:CG2	0.49	2.37	1	3
1:A:119:LEU:HD12	1:A:123:ILE:CD1	0.48	2.38	14	1
1:A:83:LEU:HD13	1:A:143:LEU:HD12	0.48	1.85	2	1
1:A:143:LEU:C	1:A:143:LEU:CD1	0.47	2.86	13	2
1:A:79:GLY:O	1:A:83:LEU:HD23	0.47	2.10	4	1
1:A:83:LEU:HD12	1:A:87:PHE:CE1	0.47	2.45	6	1
1:A:90:PHE:CB	1:A:102:GLU:HB3	0.46	2.40	14	2
1:A:83:LEU:HD12	1:A:143:LEU:HD13	0.46	1.85	8	1
1:A:80:LEU:HA	1:A:83:LEU:HD23	0.46	1.88	6	1
1:A:139:PHE:C	1:A:139:PHE:CD1	0.45	2.94	1	7
1:A:78:ALA:HB1	1:A:82:ASP:CG	0.45	2.35	4	1
1:A:140:ALA:HA	1:A:143:LEU:HD23	0.45	1.86	7	1
1:A:107:MET:HE3	1:A:119:LEU:CD2	0.45	2.41	4	1
1:A:90:PHE:CG	1:A:102:GLU:HB3	0.45	2.47	8	2
1:A:78:ALA:O	1:A:79:GLY:C	0.44	2.61	4	2
1:A:126:ALA:HB1	1:A:134:VAL:HG12	0.44	1.90	14	1
1:A:126:ALA:HB1	1:A:134:VAL:HG21	0.44	1.89	19	2
1:A:143:LEU:O	1:A:143:LEU:HD23	0.44	2.12	3	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:83:LEU:HD13	1:A:107:MET:CE	0.44	2.43	7	1
1:A:83:LEU:CB	1:A:143:LEU:HD22	0.44	2.43	7	1
1:A:141:ARG:O	1:A:144:ALA:HB3	0.43	2.13	16	2
1:A:87:PHE:HB3	1:A:136:TYR:CE2	0.43	2.48	15	1
1:A:87:PHE:CZ	1:A:139:PHE:CD1	0.43	3.05	9	2
1:A:120:ASP:HA	1:A:123:ILE:HD12	0.43	1.91	6	1
1:A:83:LEU:O	1:A:86:ALA:HB3	0.43	2.14	4	1
1:A:82:ASP:OD2	1:A:110:LEU:HD13	0.43	2.14	3	1
1:A:86:ALA:HB2	1:A:110:LEU:HD11	0.43	1.91	3	1
1:A:98:ILE:CG1	1:A:134:VAL:CG2	0.43	2.97	4	1
1:A:83:LEU:CD1	1:A:87:PHE:CE1	0.42	3.02	6	1
1:A:83:LEU:O	1:A:87:PHE:CD1	0.42	2.72	13	1
1:A:87:PHE:CZ	1:A:139:PHE:CG	0.42	3.08	12	1
1:A:87:PHE:CD1	1:A:103:LEU:HD21	0.42	2.50	13	1
1:A:90:PHE:HB3	1:A:102:GLU:HB3	0.42	1.91	18	1
1:A:134:VAL:HG11	1:A:139:PHE:CD2	0.41	2.51	2	1
1:A:104:ARG:HG2	1:A:114:LEU:HD23	0.41	1.92	16	1
1:A:80:LEU:HB2	1:A:144:ALA:HB2	0.41	1.91	16	1
1:A:83:LEU:CB	1:A:143:LEU:HD13	0.41	2.45	18	1
1:A:102:GLU:HG2	1:A:103:LEU:N	0.41	2.31	15	1
1:A:126:ALA:CB	1:A:134:VAL:HG12	0.41	2.46	14	1
1:A:98:ILE:HG22	1:A:136:TYR:CD2	0.40	2.49	4	1
1:A:91:ASP:HB2	1:A:136:TYR:CD2	0.40	2.51	13	1
1:A:126:ALA:CB	1:A:134:VAL:CG1	0.40	2.99	14	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	63/71 (89%)	49±2 (78±3%)	10±2 (16±3%)	4±1 (6±2%)	2	21
All	All	1260/1420 (89%)	981 (78%)	207 (16%)	72 (6%)	2	21

All 12 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	131	ASP	17
1	A	130	GLN	14
1	A	78	ALA	9
1	A	129	ASP	8
1	A	132	GLY	7
1	A	96	GLY	6
1	A	79	GLY	5
1	A	111	GLY	2
1	A	144	ALA	1
1	A	128	VAL	1
1	A	134	VAL	1
1	A	97	HIS	1

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	49/55 (89%)	38±2 (77±5%)	11±2 (23±5%)	2	27
All	All	980/1100 (89%)	752 (77%)	228 (23%)	2	27

All 38 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	119	LEU	20
1	A	103	LEU	17
1	A	143	LEU	17
1	A	123	ILE	15
1	A	134	VAL	13
1	A	118	GLU	12
1	A	136	TYR	10
1	A	99	THR	10
1	A	116	GLN	9
1	A	98	ILE	8
1	A	101	ASP	7
1	A	97	HIS	7
1	A	102	GLU	6
1	A	114	LEU	6

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Mol	Chain	Res	Type	Models (Total)
1	A	112	GLN	6
1	A	84	GLN	5
1	A	105	ARG	5
1	A	83	LEU	4
1	A	131	ASP	4
1	A	141	ARG	4
1	A	135	ASN	3
1	A	91	ASP	3
1	A	137	GLU	3
1	A	88	ARG	3
1	A	80	LEU	3
1	A	100	VAL	3
1	A	124	ARG	3
1	A	82	ASP	3
1	A	104	ARG	3
1	A	128	VAL	2
1	A	107	MET	2
1	A	110	LEU	2
1	A	122	MET	2
1	A	125	GLU	2
1	A	142	MET	2
1	A	130	GLN	2
1	A	120	ASP	1
1	A	127	ASP	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 [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

No chemical shift data were provided