



Full wwPDB NMR Structure Validation Report ⓘ

Mar 26, 2026 – 07:07 AM UTC

PDB ID : 5LG0 / pdb_00005lg0
BMRB ID : 25249
Title : Solution NMR structure of Tryptophan to Alanine mutant of Arkadia RING domain.
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Deposited on : 2016-07-05

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
BMRB Restraints Analysis	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

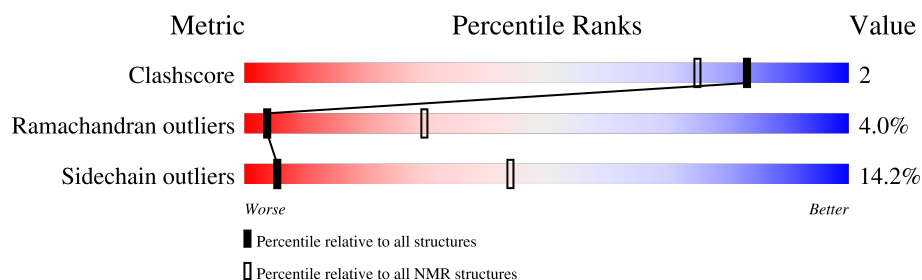
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 50%.

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	69	55% 14% 30%

2 Ensemble composition and analysis

This entry contains 31 models. Model 18 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *minimized average structure*.

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:15-A:62 (48)	0.55	18

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 6 clusters and 2 single-model clusters were found.

Cluster number	Models
1	1, 2, 3, 4, 11, 16, 17, 18, 23, 31
2	5, 13, 20, 21, 22
3	9, 15, 24, 25
4	8, 12, 19, 27
5	6, 7, 26, 30
6	14, 28
Single-model clusters	10; 29

3 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 1065 atoms, of which 522 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called E3 ubiquitin-protein ligase Arkadia.

Mol	Chain	Residues	Atoms						Trace
1	A	69	Total	C	H	N	O	S	0
			1063	328	522	91	114	8	

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP Q6ZNA4
A	47	ALA	TRP	engineered mutation	UNP Q6ZNA4

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

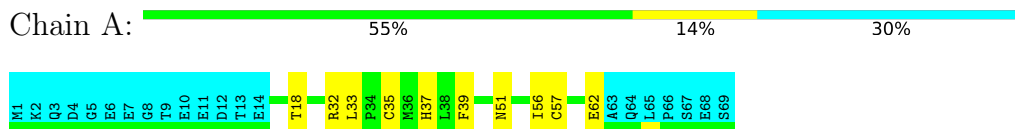
Mol	Chain	Residues	Atoms	
2	A	2	Total	Zn
			2	2

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: E3 ubiquitin-protein ligase Arkadia

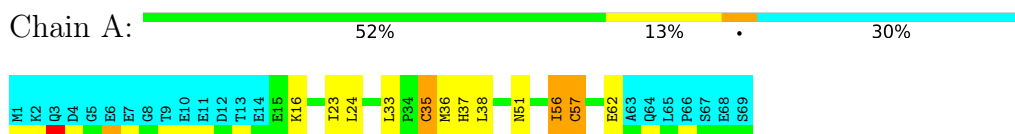


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

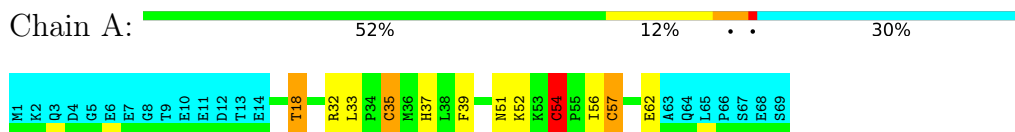
4.2.1 Score per residue for model 1

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



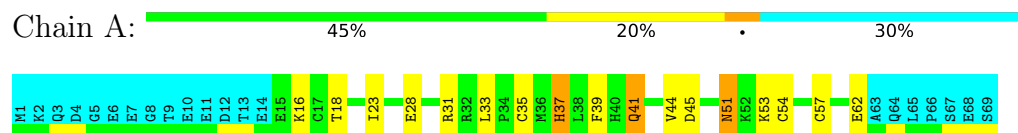
4.2.2 Score per residue for model 2

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



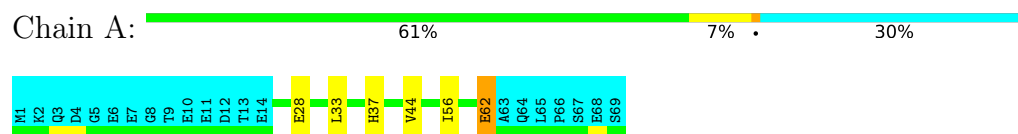
4.2.3 Score per residue for model 3

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



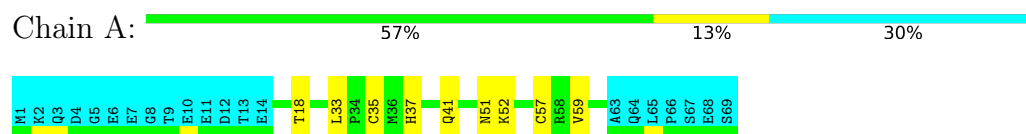
4.2.4 Score per residue for model 4

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



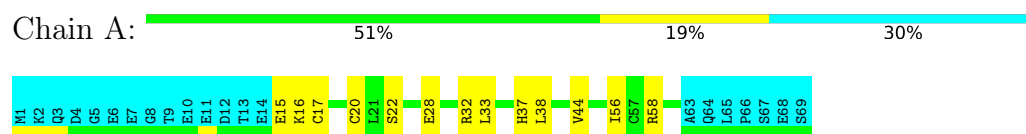
4.2.5 Score per residue for model 5

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



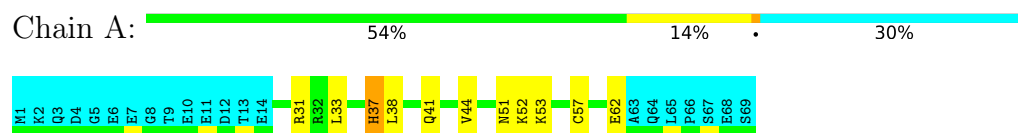
4.2.6 Score per residue for model 6

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



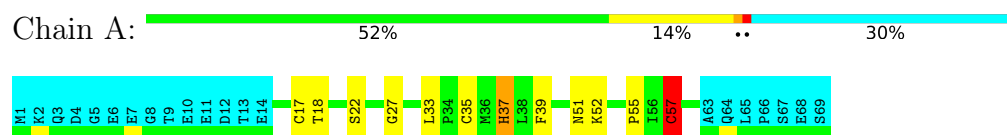
4.2.7 Score per residue for model 7

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



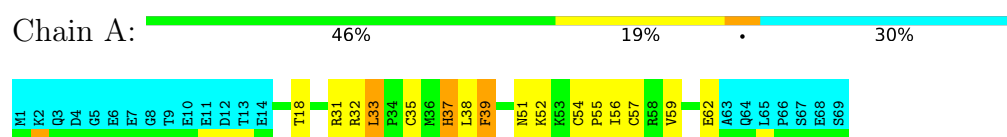
4.2.8 Score per residue for model 8

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



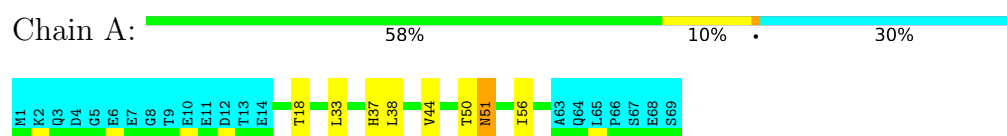
4.2.9 Score per residue for model 9

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



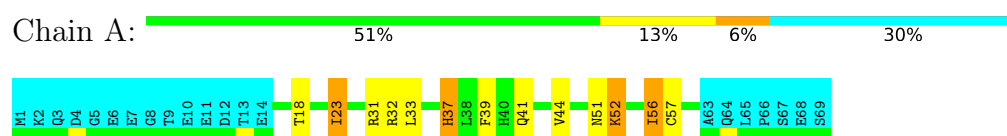
4.2.10 Score per residue for model 10

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



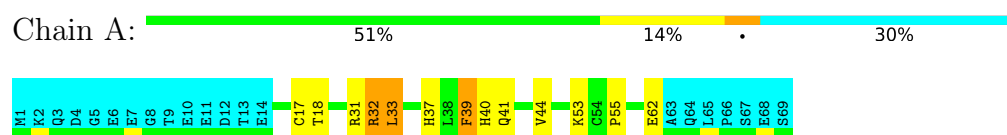
4.2.11 Score per residue for model 11

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



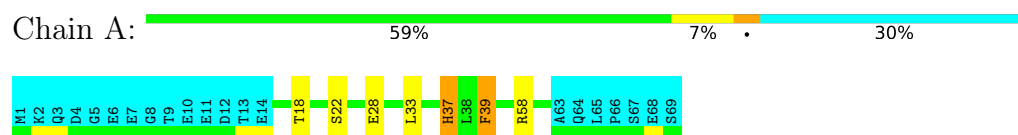
4.2.12 Score per residue for model 12

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



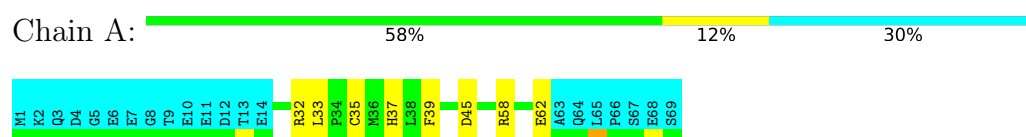
4.2.13 Score per residue for model 13

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



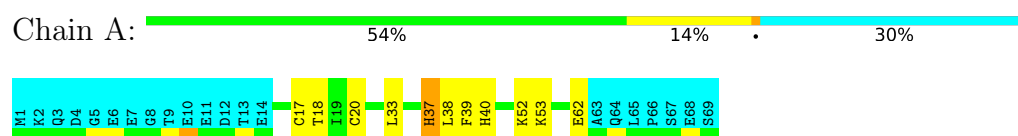
4.2.14 Score per residue for model 14

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



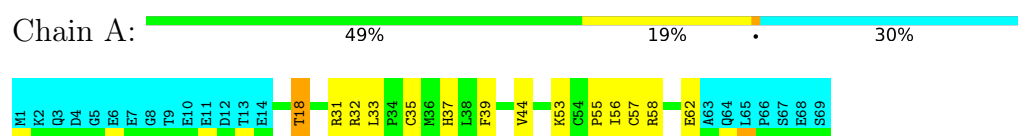
4.2.15 Score per residue for model 15

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



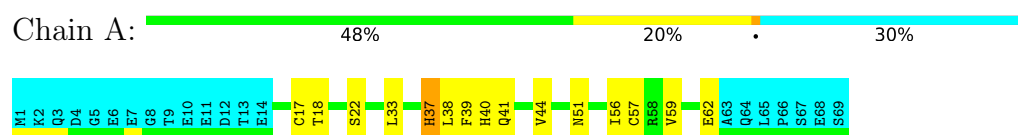
4.2.16 Score per residue for model 16

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



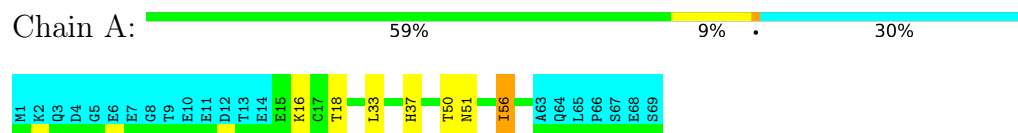
4.2.17 Score per residue for model 17

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



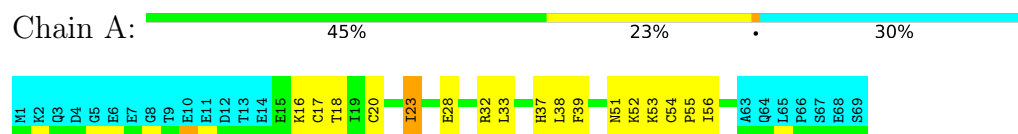
4.2.18 Score per residue for model 18 (medoid)

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



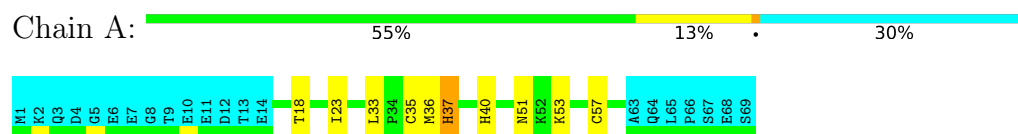
4.2.19 Score per residue for model 19

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



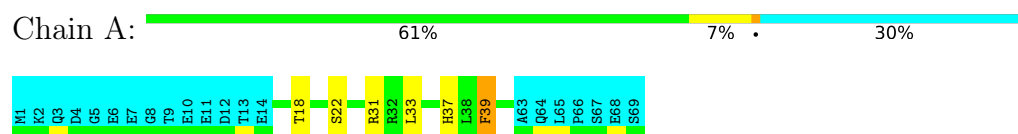
4.2.20 Score per residue for model 20

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



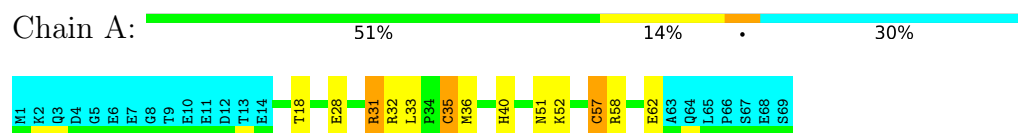
4.2.21 Score per residue for model 21

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



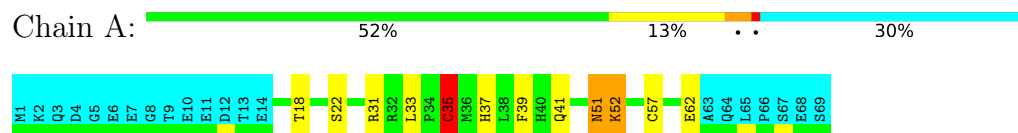
4.2.22 Score per residue for model 22

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



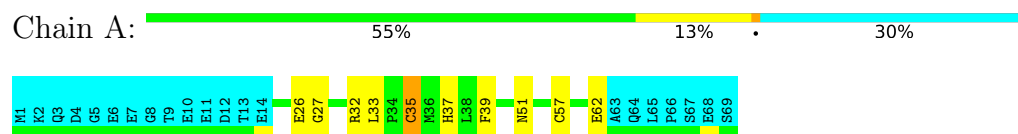
4.2.23 Score per residue for model 23

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



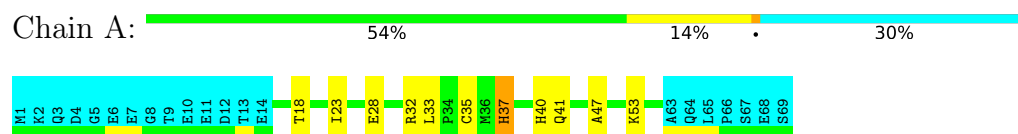
4.2.24 Score per residue for model 24

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



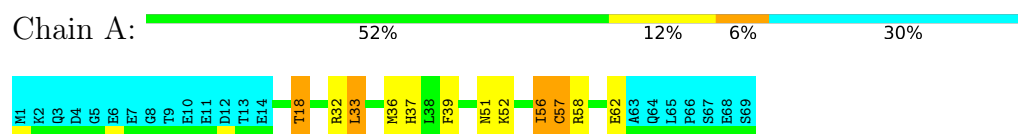
4.2.25 Score per residue for model 25

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



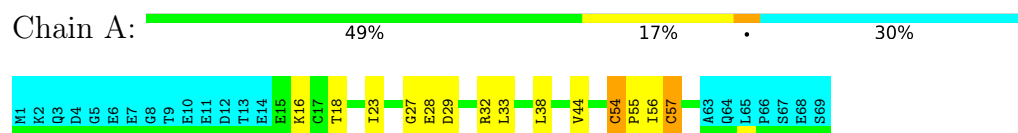
4.2.26 Score per residue for model 26

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



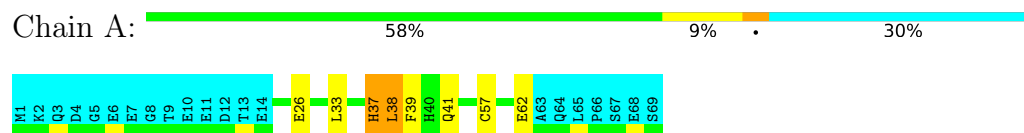
4.2.27 Score per residue for model 27

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



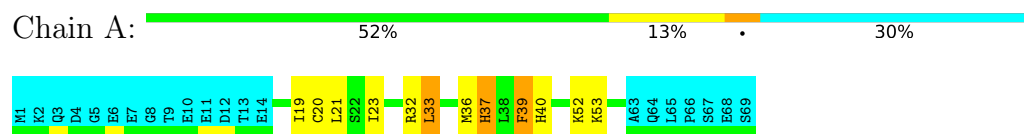
4.2.28 Score per residue for model 28

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



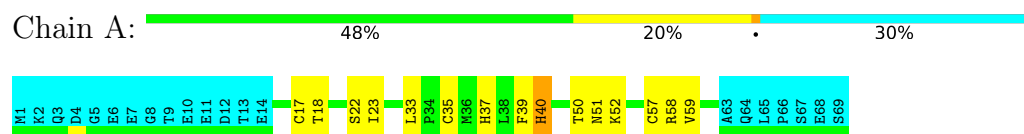
4.2.29 Score per residue for model 29

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



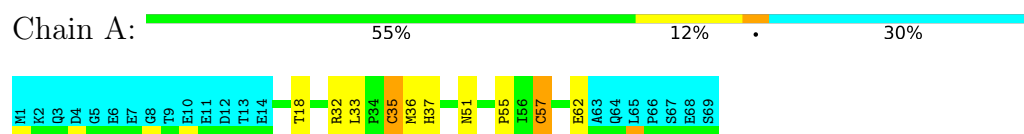
4.2.30 Score per residue for model 30

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



4.2.31 Score per residue for model 31

- Molecule 1: E3 ubiquitin-protein ligase Arkadia



5 Refinement protocol and experimental data overview

The models were refined using the following method: *molecular mechanics*.

Of the 31 calculated structures, 31 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
UNIO	structure calculation	10
Amber	refinement	5.0

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	421
Number of shifts mapped to atoms	421
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	50%

6 Model quality [i](#)

6.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN

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	0.63±0.02	0±0/386 (0.0± 0.0%)	1.30±0.05	2±1/521 (0.4± 0.2%)
All	All	0.63	1/11966 (0.0%)	1.30	65/16151 (0.4%)

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	0.1±0.3
All	All	0	3

All unique bond outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	37	HIS	CG-ND1	5.02	1.43	1.38	3	1

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	56	ILE	CB-CG1-CD1	11.41	137.76	113.80	1	1
1	A	37	HIS	CB-CG-CD2	-7.76	121.12	131.20	3	25
1	A	56	ILE	CA-C-N	7.06	135.03	121.54	17	2
1	A	56	ILE	C-N-CA	7.06	135.03	121.54	17	2
1	A	35	CYS	CA-C-N	6.92	134.76	121.54	31	6
1	A	35	CYS	C-N-CA	6.92	134.76	121.54	31	6
1	A	29	ASP	CA-CB-CG	6.84	119.44	112.60	27	1
1	A	51	ASN	CA-CB-CG	6.70	119.30	112.60	3	3

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	39	PHE	CA-CB-CG	6.57	120.37	113.80	14	8
1	A	40	HIS	CB-CG-CD2	-5.98	123.42	131.20	29	3
1	A	40	HIS	CA-CB-CG	5.81	119.61	113.80	30	1
1	A	37	HIS	CB-CG-ND1	5.75	131.32	122.70	3	1
1	A	47	ALA	CA-C-N	5.25	127.57	120.38	25	1
1	A	47	ALA	C-N-CA	5.25	127.57	120.38	25	1
1	A	54	CYS	CB-CA-C	5.19	116.33	108.86	2	1
1	A	16	LYS	CA-C-N	5.12	128.04	120.82	6	1
1	A	16	LYS	C-N-CA	5.12	128.04	120.82	6	1
1	A	56	ILE	CB-CA-C	5.04	117.55	110.99	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	31	ARG	Sidechain	1
1	A	35	CYS	Peptide	1
1	A	56	ILE	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	381	385	385	2±1
All	All	11873	11935	11935	56

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 2.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:35:CYS:SG	1:A:57:CYS:CB	0.65	2.83	31	6
1:A:35:CYS:SG	1:A:54:CYS:CB	0.63	2.85	2	1
1:A:35:CYS:HB2	1:A:59:VAL:HG21	0.57	1.76	30	2

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:52:LYS:HE3	1:A:62:GLU:OE2	0.51	2.06	15	4
1:A:33:LEU:HD22	1:A:39:PHE:CD1	0.49	2.43	26	1
1:A:18:THR:HG22	1:A:39:PHE:CE2	0.48	2.44	17	5
1:A:38:LEU:HD23	1:A:38:LEU:O	0.48	2.07	28	1
1:A:38:LEU:C	1:A:38:LEU:HD23	0.48	2.34	7	1
1:A:18:THR:HG22	1:A:39:PHE:CE1	0.48	2.44	15	5
1:A:18:THR:HG21	1:A:56:ILE:HD11	0.47	1.87	18	1
1:A:54:CYS:CB	1:A:57:CYS:SG	0.46	3.04	27	1
1:A:23:ILE:HG22	1:A:24:LEU:O	0.46	2.10	1	1
1:A:23:ILE:HD12	1:A:23:ILE:N	0.46	2.26	20	1
1:A:18:THR:HG22	1:A:39:PHE:CZ	0.45	2.45	12	4
1:A:16:LYS:HB3	1:A:23:ILE:HD13	0.45	1.88	27	1
1:A:33:LEU:HD23	1:A:33:LEU:N	0.45	2.26	12	1
1:A:23:ILE:N	1:A:23:ILE:CD1	0.45	2.80	11	6
1:A:57:CYS:HB2	1:A:59:VAL:HG22	0.44	1.90	5	1
1:A:33:LEU:HD11	1:A:37:HIS:HB2	0.44	1.89	29	1
1:A:52:LYS:CE	1:A:62:GLU:OE2	0.44	2.65	7	1
1:A:32:ARG:C	1:A:33:LEU:HD23	0.43	2.39	12	1
1:A:18:THR:CG2	1:A:39:PHE:CZ	0.43	3.02	16	1
1:A:35:CYS:SG	1:A:54:CYS:HB3	0.42	2.52	2	1
1:A:17:CYS:CB	1:A:20:CYS:SG	0.42	3.06	19	2
1:A:19:ILE:HD11	1:A:39:PHE:CD1	0.42	2.50	29	1
1:A:52:LYS:HE3	1:A:62:GLU:OE1	0.42	2.15	26	1
1:A:35:CYS:CB	1:A:54:CYS:SG	0.40	3.09	3	1
1:A:33:LEU:HD11	1:A:39:PHE:CE2	0.40	2.51	9	1
1:A:35:CYS:HB3	1:A:59:VAL:CG2	0.40	2.46	9	1
1:A:51:ASN:OD1	1:A:53:LYS:HE2	0.40	2.17	19	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	48/69 (70%)	39±2 (81±4%)	7±2 (15±4%)	2±1 (4±2%)	4	30
All	All	1488/2139 (70%)	1209 (81%)	220 (15%)	59 (4%)	4	30

All 13 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	57	CYS	10
1	A	56	ILE	9
1	A	62	GLU	7
1	A	55	PRO	7
1	A	36	MET	5
1	A	58	ARG	5
1	A	17	CYS	5
1	A	35	CYS	4
1	A	27	GLY	3
1	A	41	GLN	1
1	A	15	GLU	1
1	A	52	LYS	1
1	A	21	LEU	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	46/64 (72%)	39±2 (86±4%)	7±2 (14±4%)	5	44
All	All	1426/1984 (72%)	1223 (86%)	203 (14%)	5	44

All 27 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	33	LEU	31
1	A	51	ASN	18
1	A	32	ARG	15
1	A	37	HIS	15
1	A	18	THR	11
1	A	44	VAL	10
1	A	38	LEU	9
1	A	57	CYS	9
1	A	31	ARG	9
1	A	41	GLN	9
1	A	28	GLU	8

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Mol	Chain	Res	Type	Models (Total)
1	A	53	LYS	8
1	A	52	LYS	8
1	A	22	SER	7
1	A	62	GLU	5
1	A	40	HIS	5
1	A	16	LYS	4
1	A	54	CYS	4
1	A	56	ILE	3
1	A	50	THR	3
1	A	45	ASP	2
1	A	23	ILE	2
1	A	20	CYS	2
1	A	58	ARG	2
1	A	26	GLU	2
1	A	59	VAL	1
1	A	36	MET	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 ⓘ

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

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 50% for the well-defined parts and 46% 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	421
Number of shifts mapped to atoms	421
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

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction $\pm$ precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	64	-0.10 ± 0.14	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	57	0.06 ± 0.17	None needed (< 0.5 ppm)
$^{13}\text{C}'$	0	—	None (insufficient data)
^{15}N	61	0.11 ± 0.22	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 50%, i.e. 333 atoms were assigned a chemical shift out of a possible 672. 0 out of 9 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	133/237 (56%)	45/95 (47%)	45/96 (47%)	43/46 (93%)
Sidechain	200/411 (49%)	112/267 (42%)	86/129 (67%)	2/15 (13%)

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	Total	¹ H	¹³ C	¹⁵ N
Aromatic	0/24 (0%)	0/13 (0%)	0/9 (0%)	0/2 (0%)
Overall	333/672 (50%)	157/375 (42%)	131/234 (56%)	45/63 (71%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 46%, i.e. 421 atoms were assigned a chemical shift out of a possible 914. 0 out of 10 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	188/342 (55%)	63/138 (46%)	64/138 (46%)	61/66 (92%)
Sidechain	233/548 (43%)	130/352 (37%)	101/178 (57%)	2/18 (11%)
Aromatic	0/24 (0%)	0/13 (0%)	0/9 (0%)	0/2 (0%)
Overall	421/914 (46%)	193/503 (38%)	165/325 (51%)	63/86 (73%)

7.1.4 Statistically unusual chemical shifts ⓘ

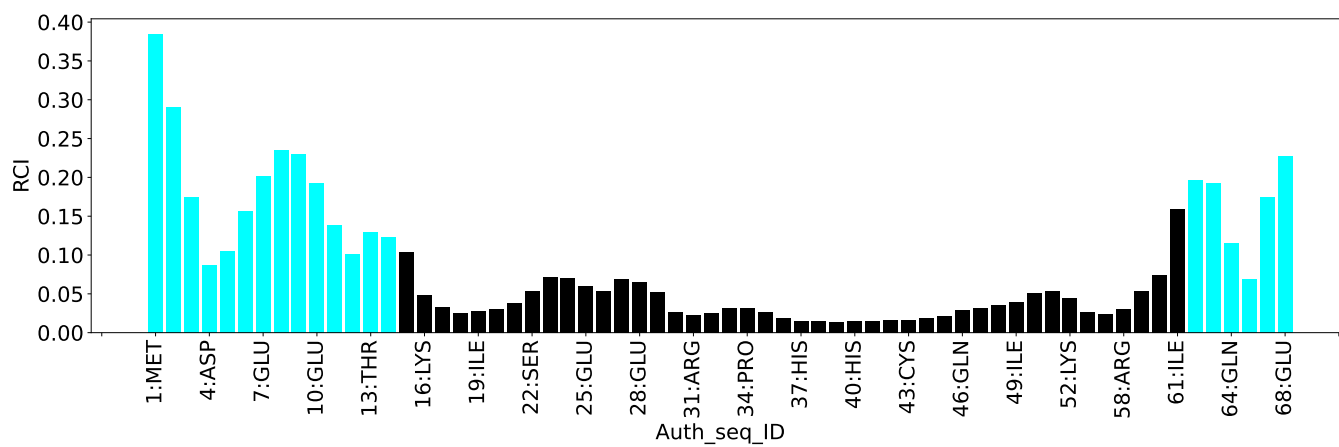
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	31	ARG	CG	20.32	21.24 – 33.19	-5.8
1	A	58	ARG	HG3	3.06	0.15 – 2.94	5.4

7.1.5 Random Coil Index (RCI) plots ⓘ

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:



8 NMR restraints analysis

8.1 Conformationally restricting restraints

The following table provides the summary of experimentally observed NMR restraints in different categories. Restraints are classified into different categories based on the sequence separation of the atoms involved.

Description	Value
Total distance restraints	647
Intra-residue ($ i-j =0$)	111
Sequential ($ i-j =1$)	241
Medium range ($ i-j >1$ and $ i-j <5$)	104
Long range ($ i-j \geq 5$)	191
Inter-chain	0
Hydrogen bond restraints	0
Disulfide bond restraints	0
Total dihedral-angle restraints	0
Number of unmapped restraints	0
Number of restraints per residue	9.1
Number of long range restraints per residue ¹	2.7

¹Long range hydrogen bonds and disulfide bonds are counted as long range restraints while calculating the number of long range restraints per residue

8.2 Residual restraint violations

This section provides the overview of the restraint violations analysis. The violations are binned as small, medium and large violations based on its absolute value. Average number of violations per model is calculated by dividing the total number of violations in each bin by the size of the ensemble.

8.2.1 Average number of distance violations per model

Distance violations less than 0.1 Å are not included in the calculation.

Bins (Å)	Average number of violations per model	Max (Å)
0.1-0.2 (Small)	1.5	0.2
0.2-0.5 (Medium)	None	None
>0.5 (Large)	None	None

8.2.2 Average number of dihedral-angle violations per model [i](#)

Dihedral-angle violations less than 1° are not included in the calculation. There are no dihedral-angle violations

9 Distance violation analysis ⓘ

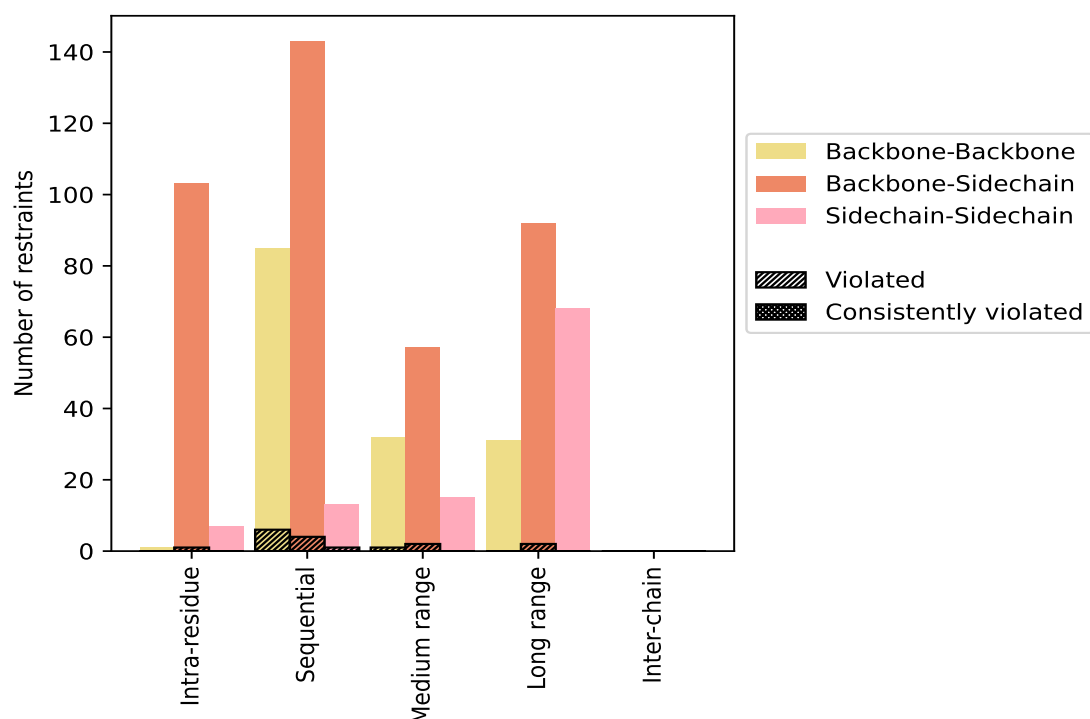
9.1 Summary of distance violations ⓘ

The following table shows the summary of distance violations in different restraint categories based on the sequence separation of the atoms involved. Each category is further sub-divided into three sub-categories based on the atoms involved. Violations less than 0.1 Å are not included in the statistics.

Restrains type	Count	% ¹	Violated ³			Consistently Violated ⁴		
			Count	% ²	% ¹	Count	% ²	% ¹
Intra-residue ($i-j =0$)	111	17.2	1	0.9	0.2	0	0.0	0.0
Backbone-Backbone	1	0.2	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	103	15.9	1	1.0	0.2	0	0.0	0.0
Sidechain-Sidechain	7	1.1	0	0.0	0.0	0	0.0	0.0
Sequential ($i-j =1$)	241	37.2	11	4.6	1.7	0	0.0	0.0
Backbone-Backbone	85	13.1	6	7.1	0.9	0	0.0	0.0
Backbone-Sidechain	143	22.1	4	2.8	0.6	0	0.0	0.0
Sidechain-Sidechain	13	2.0	1	7.7	0.2	0	0.0	0.0
Medium range ($i-j >1$ & $i-j <5$)	104	16.1	3	2.9	0.5	0	0.0	0.0
Backbone-Backbone	32	4.9	1	3.1	0.2	0	0.0	0.0
Backbone-Sidechain	57	8.8	2	3.5	0.3	0	0.0	0.0
Sidechain-Sidechain	15	2.3	0	0.0	0.0	0	0.0	0.0
Long range ($i-j \geq 5$)	191	29.5	2	1.0	0.3	0	0.0	0.0
Backbone-Backbone	31	4.8	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	92	14.2	2	2.2	0.3	0	0.0	0.0
Sidechain-Sidechain	68	10.5	0	0.0	0.0	0	0.0	0.0
Inter-chain	0	0.0	0	0.0	0.0	0	0.0	0.0
Backbone-Backbone	0	0.0	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	0	0.0	0	0.0	0.0	0	0.0	0.0
Sidechain-Sidechain	0	0.0	0	0.0	0.0	0	0.0	0.0
Hydrogen bond	0	0.0	0	0.0	0.0	0	0.0	0.0
Disulfide bond	0	0.0	0	0.0	0.0	0	0.0	0.0
Total	647	100.0	17	2.6	2.6	0	0.0	0.0
Backbone-Backbone	149	23.0	7	4.7	1.1	0	0.0	0.0
Backbone-Sidechain	395	61.1	9	2.3	1.4	0	0.0	0.0
Sidechain-Sidechain	103	15.9	1	1.0	0.2	0	0.0	0.0

¹ percentage calculated with respect to the total number of distance restraints, ² percentage calculated with respect to the number of restraints in a particular restraint category, ³ violated in at least one model, ⁴ violated in all the models

9.1.1 Bar chart : Distribution of distance restraints and violations [i](#)



Violated and consistently violated restraints are shown using different hatch patterns in their respective categories. The hydrogen bonds and disulfied bonds are counted in their appropriate category on the x-axis

9.2 Distance violation statistics for each model [i](#)

The following table provides the distance violation statistics for each model in the ensemble. Violations less than 0.1 Å are not included in the statistics.

Model ID	Number of violations						Mean (Å)	Max (Å)	SD ⁶ (Å)	Median (Å)
	IR ¹	SQ ²	MR ³	LR ⁴	IC ⁵	Total				
1	0	3	2	1	0	6	0.13	0.2	0.03	0.12
2	0	2	1	0	0	3	0.12	0.13	0.01	0.12
3	0	1	0	0	0	1	0.14	0.14	0.0	0.14
4	0	1	1	0	0	2	0.12	0.13	0.01	0.12
5	0	0	1	0	0	1	0.1	0.1	0.0	0.1
6	0	1	1	1	0	3	0.11	0.11	0.0	0.11
7	1	0	0	0	0	1	0.1	0.1	0.0	0.1
8	0	1	0	0	0	1	0.11	0.11	0.0	0.11
9	0	0	0	1	0	1	0.11	0.11	0.0	0.11
10	0	0	1	0	0	1	0.11	0.11	0.0	0.11

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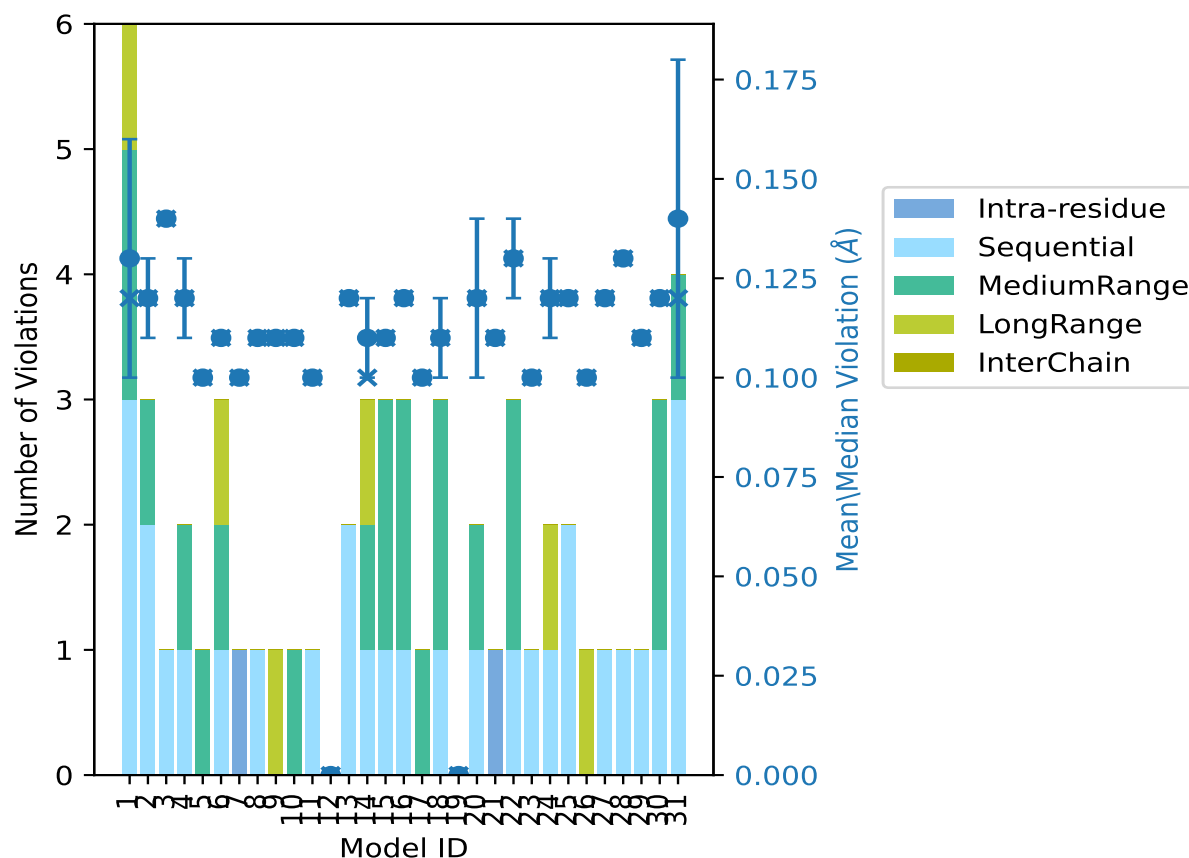
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Model ID	Number of violations						Mean (Å)	Max (Å)	SD ⁶ (Å)	Median (Å)
	IR ¹	SQ ²	MR ³	LR ⁴	IC ⁵	Total				
11	0	1	0	0	0	1	0.1	0.1	0.0	0.1
12	0	0	0	0	0	0	0.0	0.0	0.0	0.0
13	0	2	0	0	0	2	0.12	0.12	0.0	0.12
14	0	1	1	1	0	3	0.11	0.12	0.01	0.1
15	0	1	2	0	0	3	0.11	0.11	0.0	0.11
16	0	1	2	0	0	3	0.12	0.12	0.0	0.12
17	0	0	1	0	0	1	0.1	0.1	0.0	0.1
18	0	1	2	0	0	3	0.11	0.12	0.01	0.11
19	0	0	0	0	0	0	0.0	0.0	0.0	0.0
20	0	1	1	0	0	2	0.12	0.14	0.02	0.12
21	1	0	0	0	0	1	0.11	0.11	0.0	0.11
22	0	1	2	0	0	3	0.13	0.14	0.01	0.13
23	0	1	0	0	0	1	0.1	0.1	0.0	0.1
24	0	1	0	1	0	2	0.12	0.13	0.01	0.12
25	0	2	0	0	0	2	0.12	0.12	0.0	0.12
26	0	0	0	1	0	1	0.1	0.1	0.0	0.1
27	0	1	0	0	0	1	0.12	0.12	0.0	0.12
28	0	1	0	0	0	1	0.13	0.13	0.0	0.13
29	0	1	0	0	0	1	0.11	0.11	0.0	0.11
30	0	1	2	0	0	3	0.12	0.13	0.0	0.12
31	0	3	1	0	0	4	0.14	0.2	0.04	0.12

¹Intra-residue restraints, ²Sequential restraints, ³Medium range restraints, ⁴Long range restraints,

⁵Inter-chain restraints, ⁶Standard deviation

9.2.1 Bar graph : Distance Violation statistics for each model [i](#)



The mean(dot),median(x) and the standard deviation are shown in blue with respect to the y axis on the right

9.3 Distance violation statistics for the ensemble [i](#)

Violation analysis may find that some restraints are violated in few models and some are violated in most of models. The following table provides this information as number of violated restraints for a given fraction of the ensemble. In total, 630(IR:110, SQ:230, MR:101, LR:189, IC:0) restraints are not violated in the ensemble.

Number of violated restraints						Fraction of the ensemble	
IR ¹	SQ ²	MR ³	LR ⁴	IC ⁵	Total	Count ⁶	%
0	4	0	1	0	5	1	3.2
1	2	0	0	0	3	2	6.5
0	1	1	0	0	2	3	9.7
0	3	0	0	0	3	4	12.9
0	0	1	1	0	2	5	16.1
0	1	0	0	0	1	6	19.4

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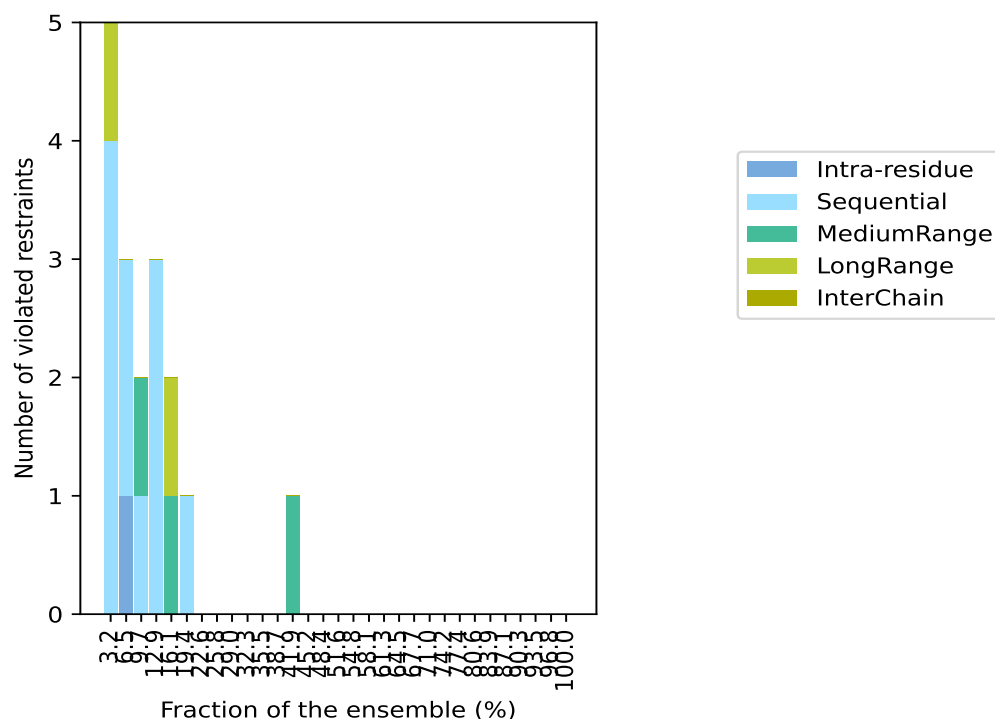
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Number of violated restraints						Fraction of the ensemble	
IR ¹	SQ ²	MR ³	LR ⁴	IC ⁵	Total	Count ⁶	%
0	0	0	0	0	0	7	22.6
0	0	0	0	0	0	8	25.8
0	0	0	0	0	0	9	29.0
0	0	0	0	0	0	10	32.3
0	0	0	0	0	0	11	35.5
0	0	0	0	0	0	12	38.7
0	0	1	0	0	1	13	41.9
0	0	0	0	0	0	14	45.2
0	0	0	0	0	0	15	48.4
0	0	0	0	0	0	16	51.6
0	0	0	0	0	0	17	54.8
0	0	0	0	0	0	18	58.1
0	0	0	0	0	0	19	61.3
0	0	0	0	0	0	20	64.5
0	0	0	0	0	0	21	67.7
0	0	0	0	0	0	22	71.0
0	0	0	0	0	0	23	74.2
0	0	0	0	0	0	24	77.4
0	0	0	0	0	0	25	80.6
0	0	0	0	0	0	26	83.9
0	0	0	0	0	0	27	87.1
0	0	0	0	0	0	28	90.3
0	0	0	0	0	0	29	93.5
0	0	0	0	0	0	30	96.8
0	0	0	0	0	0	31	100.0

¹Intra-residue restraints, ²Sequential restraints, ³Medium range restraints, ⁴Long range restraints,

⁵Inter-chain restraints, ⁶ Number of models with violations

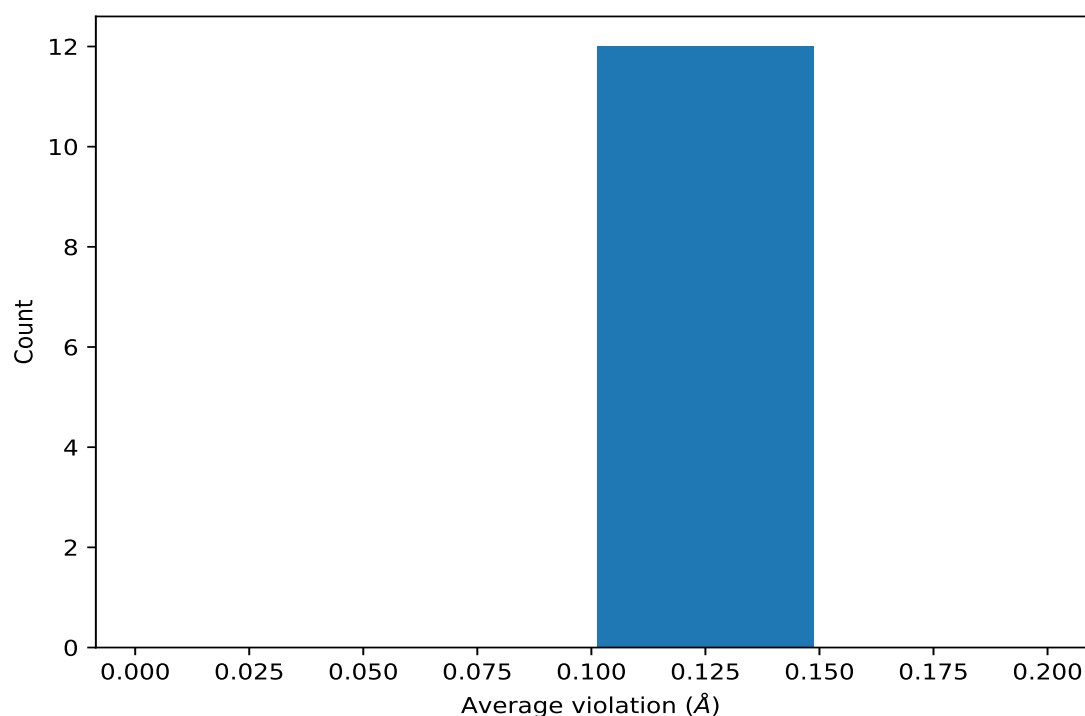
9.3.1 Bar graph : Distance violation statistics for the ensemble [i](#)



9.4 Most violated distance restraints in the ensemble [i](#)

9.4.1 Histogram : Distribution of mean distance violations [i](#)

The following histogram shows the distribution of the average value of the violation. The average is calculated for each restraint that is violated in more than one model over all the violated models in the ensemble



9.4.2 Table: Most violated distance restraints [i](#)

The following table provides the mean and the standard deviation of the violation for each restraint sorted by number of violated models and the mean value. The Key (restraint list ID, restraint ID) is the unique identifier for a given restraint. Rows with same key represent combinatorial or ambiguous restraints and are counted as a single restraint.

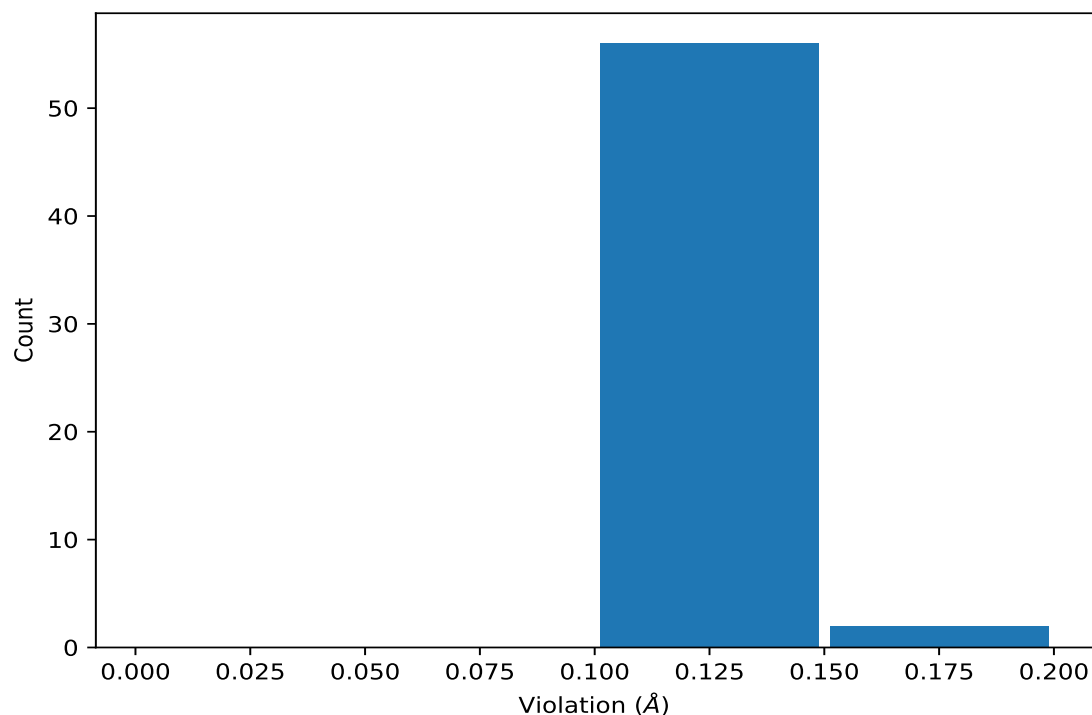
Key	Atom-1	Atom-2	Models ¹	Mean (Å)	SD ¹ (Å)	Median (Å)
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	13	0.12	0.01	0.11
(1,249)	1:30:A:VAL:H	1:31:A:ARG:HA	6	0.11	0.0	0.11
(1,311)	1:33:A:LEU:HA	1:36:A:MET:H	5	0.12	0.01	0.12
(1,79)	1:16:A:LYS:HG3	1:23:A:ILE:HA	5	0.11	0.01	0.11
(1,34)	1:13:A:THR:HB	1:14:A:GLU:H	4	0.14	0.03	0.12
(1,240)	1:29:A:ASP:HB2	1:30:A:VAL:H	4	0.12	0.01	0.11
(1,298)	1:32:A:ARG:HD2	1:33:A:LEU:HG	4	0.11	0.01	0.11
(1,11)	1:7:A:GLU:H	1:8:A:GLY:H	3	0.13	0.01	0.13
(1,97)	1:17:A:CYS:HB2	1:21:A:LEU:H	3	0.11	0.01	0.11
(1,13)	1:7:A:GLU:HA	1:8:A:GLY:H	2	0.11	0.01	0.11
(1,351)	1:36:A:MET:H	1:37:A:HIS:HA	2	0.11	0.0	0.11
(1,535)	1:61:A:ILE:H	1:61:A:ILE:HB	2	0.11	0.0	0.11

¹Number of violated models, ²Standard deviation

9.5 All violated distance restraints [i](#)

9.5.1 Histogram : Distribution of distance violations [i](#)

The following histogram shows the distribution of the absolute value of the violation for all violated restraints in the ensemble.



9.5.2 Table : All distance violations [i](#)

The following table lists the absolute value of the violation for each restraint in the ensemble sorted by its value. The Key (restraint list ID, restraint ID) is the unique identifier for a given restraint. Rows with same key represent combinatorial or ambiguous restraints and are counted as a single restraint.

Key	Atom-1	Atom-2	Model ID	Violation (Å)
(1,34)	1:13:A:THR:HB	1:14:A:GLU:H	31	0.2
(1,20)	1:9:A:THR:HA	1:10:A:GLU:H	1	0.2
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	20	0.14
(1,311)	1:33:A:LEU:HA	1:36:A:MET:H	22	0.14
(1,11)	1:7:A:GLU:H	1:8:A:GLY:H	3	0.14
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	2	0.13
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	4	0.13
(1,311)	1:33:A:LEU:HA	1:36:A:MET:H	31	0.13
(1,240)	1:29:A:ASP:HB2	1:30:A:VAL:H	28	0.13
(1,97)	1:17:A:CYS:HB2	1:21:A:LEU:H	30	0.13

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Key	Atom-1	Atom-2	Model ID	Violation (Å)
(1,34)	1:13:A:THR:HB	1:14:A:GLU:H	22	0.13
(1,11)	1:7:A:GLU:H	1:8:A:GLY:H	24	0.13
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	14	0.12
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	22	0.12
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	30	0.12
(1,311)	1:33:A:LEU:HA	1:36:A:MET:H	16	0.12
(1,311)	1:33:A:LEU:HA	1:36:A:MET:H	18	0.12
(1,298)	1:32:A:ARG:HD2	1:33:A:LEU:HG	27	0.12
(1,249)	1:30:A:VAL:H	1:31:A:ARG:HA	2	0.12
(1,249)	1:30:A:VAL:H	1:31:A:ARG:HA	25	0.12
(1,79)	1:16:A:LYS:HG3	1:23:A:ILE:HA	1	0.12
(1,34)	1:13:A:THR:HB	1:14:A:GLU:H	1	0.12
(1,34)	1:13:A:THR:HB	1:14:A:GLU:H	16	0.12
(1,33)	1:13:A:THR:HA	1:14:A:GLU:H	13	0.12
(1,13)	1:7:A:GLU:HA	1:8:A:GLY:H	30	0.12
(1,535)	1:61:A:ILE:H	1:61:A:ILE:HB	21	0.11
(1,504)	1:54:A:CYS:H	1:59:A:VAL:HB	9	0.11
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	1	0.11
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	10	0.11
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	15	0.11
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	16	0.11
(1,351)	1:36:A:MET:H	1:37:A:HIS:HA	1	0.11
(1,311)	1:33:A:LEU:HA	1:36:A:MET:H	1	0.11
(1,298)	1:32:A:ARG:HD2	1:33:A:LEU:HG	2	0.11
(1,298)	1:32:A:ARG:HD2	1:33:A:LEU:HG	29	0.11
(1,293)	1:32:A:ARG:HA	1:33:A:LEU:HG	6	0.11
(1,249)	1:30:A:VAL:H	1:31:A:ARG:HA	8	0.11
(1,249)	1:30:A:VAL:H	1:31:A:ARG:HA	13	0.11
(1,249)	1:30:A:VAL:H	1:31:A:ARG:HA	18	0.11
(1,249)	1:30:A:VAL:H	1:31:A:ARG:HA	31	0.11
(1,240)	1:29:A:ASP:HB2	1:30:A:VAL:H	4	0.11
(1,240)	1:29:A:ASP:HB2	1:30:A:VAL:H	15	0.11
(1,240)	1:29:A:ASP:HB2	1:30:A:VAL:H	25	0.11
(1,97)	1:17:A:CYS:HB2	1:21:A:LEU:H	15	0.11
(1,79)	1:16:A:LYS:HG3	1:23:A:ILE:HA	6	0.11
(1,79)	1:16:A:LYS:HG3	1:23:A:ILE:HA	24	0.11
(1,11)	1:7:A:GLU:H	1:8:A:GLY:H	20	0.11
(1,535)	1:61:A:ILE:H	1:61:A:ILE:HB	7	0.1
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	5	0.1
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	6	0.1
(1,445)	1:46:A:GLN:HA	1:49:A:ILE:HB	18	0.1
(1,351)	1:36:A:MET:H	1:37:A:HIS:HA	31	0.1

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Key	Atom-1	Atom-2	Model ID	Violation (Å)
(1,298)	1:32:A:ARG:HD2	1:33:A:LEU:HG	14	0.1
(1,97)	1:17:A:CYS:HB2	1:21:A:LEU:H	17	0.1
(1,79)	1:16:A:LYS:HG3	1:23:A:ILE:HA	14	0.1
(1,79)	1:16:A:LYS:HG3	1:23:A:ILE:HA	26	0.1
(1,70)	1:16:A:LYS:HB2	1:17:A:CYS:H	23	0.1
(1,13)	1:7:A:GLU:HA	1:8:A:GLY:H	11	0.1

10 Dihedral-angle violation analysis ⓘ

No dihedral-angle restraints found