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wwPDB NMR Structure Validation Summary Report (i)

Jul 28, 2025 – 03:07 PM EDT

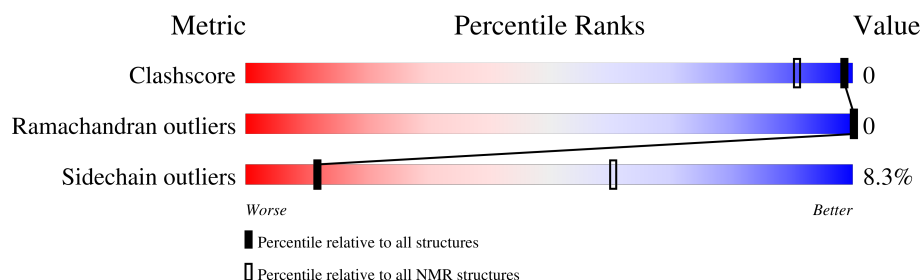|		
PDB ID	:	9NGX / pdb_00009ngx
BMRB ID	:	31231
Title	:	Structure of the 5'SL-bound La Domain of the Human La-related Protein 6
Authors	:	Gordon, B.H.; Silvers, R.
Deposited on	:	2025-02-22

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 92%.

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	Percentile Ranks	Value
Clashscore		0
Ramachandran outliers		0
Sidechain outliers		8.3%

Worse   *Better*

▮ Percentile relative to all structures

▯ Percentile relative to all NMR structures

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	106	78% · 18%

2 Ensemble composition and analysis ⓘ

This entry contains 20 models. Model 14 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *target function*.

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:85-A:171 (87)	0.22	14

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 4 single-model clusters were found.

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

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1801 atoms, of which 907 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called La-related protein 6.

Mol	Chain	Residues	Atoms					Trace
			Total	C	H	N	O	
1	A	106	1801	574	907	156	164	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	78	GLY	-	expression tag	UNP Q9BRS8

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.
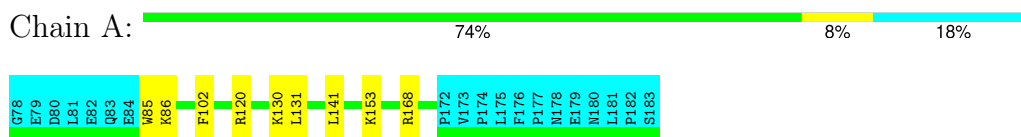
• Molecule 1: La-related protein 6

Chain A:
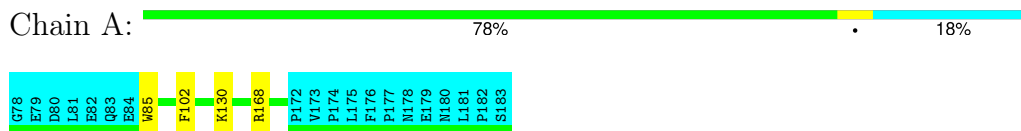
4.2 Residue scores for the representative (medoid) model from the NMR ensemble

The representative model is number 14. Colouring as in section 4.1 above.

• Molecule 1: La-related protein 6

Chain A:

5 Refinement protocol and experimental data overview ⓘ

The models were refined using the following method: *torsion angle dynamics, molecular dynamics.*

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
TALOS-N	geometry optimization	4.12
CYANA	structure calculation	3.98.15
Amber	refinement	22

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	1448
Number of shifts mapped to atoms	1448
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	92%

6   Model quality ⓘ

6.1   Standard geometry ⓘ

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	0.87±0.01	0±0/761 (0.0± 0.0%)	1.45±0.02	0±1/1026 (0.0± 0.1%)
All	All	0.87	0/15220 (0.0%)	1.45	9/20520 (0.0%)

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	0.2±0.4
All	All	0	4

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(^{o})	Ideal(^{o})	Models	
								Worst	Total
1	A	161	ASN	CA-CB-CG	6.04	118.64	112.60	6	3
1	A	106	ASP	CA-CB-CG	5.66	118.26	112.60	5	4
1	A	87	PRO	CA-C-N	5.08	125.09	120.21	7	1
1	A	87	PRO	C-N-CA	5.08	125.09	120.21	7	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	120	ARG	Sidechain	3
1	A	146	ARG	Sidechain	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	744	770	770	0±0
All	All	14880	15400	15400	2

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 0.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models Worst	Total
1:A:91:GLU:HA	1:A:94:LYS:HE2	0.43	1.89	11	1
1:A:130:LYS:HE3	1:A:145:TRP:CD1	0.41	2.49	10	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	87/106 (82%)	84±1 (97±1%)	2±1 (3±1%)	0±0 (0±0%)	100	100
All	All	1740/2120 (82%)	1690 (97%)	50 (3%)	0 (0%)	100	100

There are no Ramachandran outliers.

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	83/101 (82%)	76±1 (92±1%)	7±1 (8±1%)	12	60
All	All	1660/2020 (82%)	1522 (92%)	138 (8%)	12	60

5 of 23 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	85	TRP	20
1	A	102	PHE	20
1	A	168	ARG	20
1	A	130	LYS	10
1	A	153	LYS	8

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 92% for the well-defined parts and 93% for the entire structure.

7.1 Chemical shift list 1

File name: working_cs.cif

Chemical shift list name: *chemical_shift_list*

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	1448
Number of shifts mapped to atoms	1448
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	6

7.1.2 Chemical shift referencing ⓘ

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_\alpha$	105	-0.11 ± 0.14	None needed (< 0.5 ppm)
$^{13}C_\beta$	104	0.25 ± 0.18	None needed (< 0.5 ppm)
$^{13}C'$	103	-0.06 ± 0.12	None needed (< 0.5 ppm)
^{15}N	97	0.54 ± 0.42	None needed (imprecise)

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 92%, i.e. 1216 atoms were assigned a chemical shift out of a possible 1316. 0 out of 20 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	428/432 (99%)	172/173 (99%)	172/174 (99%)	84/85 (99%)
Sidechain	684/765 (89%)	464/492 (94%)	209/236 (89%)	11/37 (30%)

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	Total	^{1}H	^{13}C	^{15}N
Aromatic	104/119 (87%)	52/60 (87%)	50/53 (94%)	2/6 (33%)
Overall	1216/1316 (92%)	688/725 (95%)	431/463 (93%)	97/128 (76%)

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	146	ARG	HG3	-0.15	$0.15 - 2.94$	-6.1
1	A	146	ARG	HG2	0.06	$0.26 - 2.87$	-5.8
1	A	131	LEU	HB2	-0.24	$-0.07 - 3.30$	-5.5
1	A	168	ARG	HD2	1.91	$1.97 - 4.26$	-5.3
1	A	146	ARG	HB3	0.37	$0.43 - 3.11$	-5.2
1	A	142	THR	C	183.38	$166.08 - 183.07$	5.2

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:
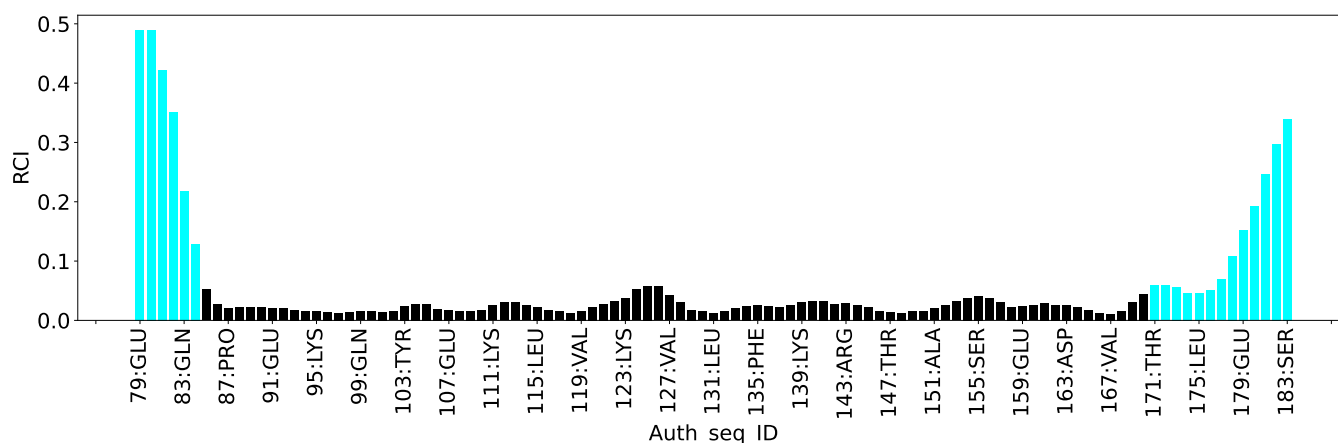
8 NMR restraints analysis ⓘ

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	4116
Intra-residue ($|i\text{-}j|$=0)	520
Sequential ($|i\text{-}j|$=1)	949
Medium range ($|i\text{-}j|$>1 and $|i\text{-}j|$<5)	1219
Long range ($|i\text{-}j|\geq$5)	1428
Inter-chain	0
Hydrogen bond restraints	0
Disulfide bond restraints	0
Total dihedral-angle restraints	154
Number of unmapped restraints	0
Number of restraints per residue	40.3
Number of long range restraints per residue[1]	13.5

[1]Long 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)	18.1	0.2
0.2-0.5 (Medium)	1.1	0.28
>0.5 (Large)	None	None

8.2.2 Average number of dihedral-angle violations per model ⓘ

Dihedral-angle violations less than 1° are not included in the calculation.

Bins (°)	Average number of violations per model	Max (°)
1.0-10.0 (Small)	0.5	8.96
10.0-20.0 (Medium)	0.1	14.55
>20.0 (Large)	None	None

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.

Restraints type	Count	%[1]	Violated[3]			Consistently Violated[4]		
			Count	%[2]	%[1]	Count	%[2]	%[1]
Intra-residue (|i-j|=0)	520	12.6	14	2.7	0.3	1	0.2	0.0
Backbone-Backbone	0	0.0	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	411	10.0	14	3.4	0.3	1	0.2	0.0
Sidechain-Sidechain	109	2.6	0	0.0	0.0	0	0.0	0.0
Sequential (|i-j|=1)	949	23.1	28	3.0	0.7	0	0.0	0.0
Backbone-Backbone	144	3.5	3	2.1	0.1	0	0.0	0.0
Backbone-Sidechain	584	14.2	20	3.4	0.5	0	0.0	0.0
Sidechain-Sidechain	221	5.4	5	2.3	0.1	0	0.0	0.0
Medium range (|i-j|>1 & |i-j|<5)	1219	29.6	28	2.3	0.7	1	0.1	0.0
Backbone-Backbone	275	6.7	9	3.3	0.2	0	0.0	0.0
Backbone-Sidechain	603	14.7	14	2.3	0.3	1	0.2	0.0
Sidechain-Sidechain	341	8.3	5	1.5	0.1	0	0.0	0.0
Long range (|i-j|≥5)	1428	34.7	17	1.2	0.4	2	0.1	0.0
Backbone-Backbone	103	2.5	2	1.9	0.0	0	0.0	0.0
Backbone-Sidechain	622	15.1	7	1.1	0.2	1	0.2	0.0
Sidechain-Sidechain	703	17.1	8	1.1	0.2	1	0.1	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	4116	100.0	87	2.1	2.1	4	0.1	0.1
Backbone-Backbone	522	12.7	14	2.7	0.3	0	0.0	0.0
Backbone-Sidechain	2220	53.9	55	2.5	1.3	3	0.1	0.1
Sidechain-Sidechain	1374	33.4	18	1.3	0.4	1	0.1	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 ⓘ
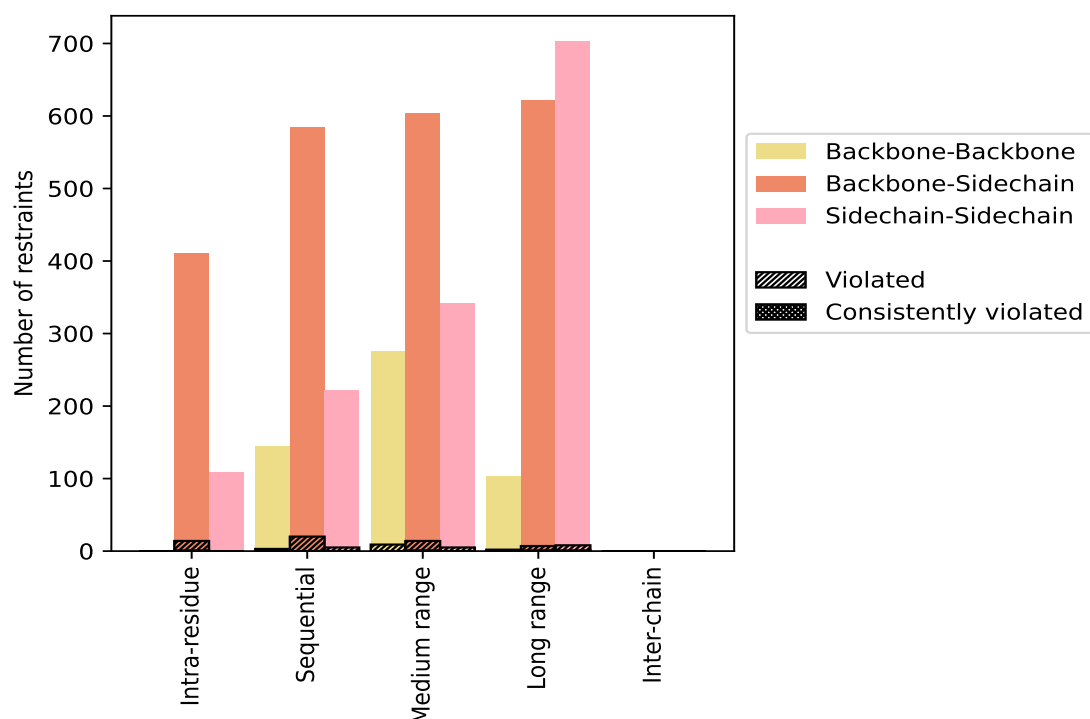
Violated and consistently violated restraints are shown using different hatch patterns in their respective categories. The hydrogen bonds and disulfied bonds are counted in their appropriate category on the x-axis

9.2 Distance violation statistics for each model ⓘ

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	1	4	5	7	0	17	0.13	0.24	0.03	0.12
2	2	5	7	7	0	21	0.13	0.24	0.03	0.12
3	4	8	7	6	0	25	0.13	0.22	0.03	0.12
4	2	3	9	7	0	21	0.12	0.17	0.02	0.12
5	2	9	7	9	0	27	0.15	0.28	0.05	0.13
6	1	8	7	6	0	22	0.13	0.24	0.04	0.12
7	2	3	7	5	0	17	0.13	0.23	0.03	0.12
8	1	7	6	7	0	21	0.14	0.25	0.03	0.13
9	4	5	6	4	0	19	0.13	0.18	0.02	0.12
10	2	7	7	5	0	21	0.15	0.28	0.05	0.13

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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	3	9	9	6	0	27	0.13	0.23	0.03	0.12
12	1	7	2	5	0	15	0.12	0.15	0.01	0.12
13	1	5	8	10	0	24	0.13	0.25	0.03	0.12
14	2	7	5	9	0	23	0.13	0.23	0.03	0.12
15	1	6	5	7	0	19	0.14	0.25	0.04	0.12
16	3	4	9	8	0	24	0.13	0.18	0.02	0.12
17	5	7	8	7	0	27	0.13	0.26	0.04	0.12
18	2	9	12	9	0	32	0.13	0.23	0.03	0.12
19	1	5	5	9	0	20	0.13	0.19	0.03	0.12
20	1	6	7	8	0	22	0.12	0.22	0.03	0.11

[1]Intra-residue restraints, [2]Sequential restraints, [3]Medium range restraints, [4]Long range restraints, [5]Inter-chain restraints, [6]Standard deviation

9.2.1　Bar graph : Distance Violation statistics for each model ⓘ
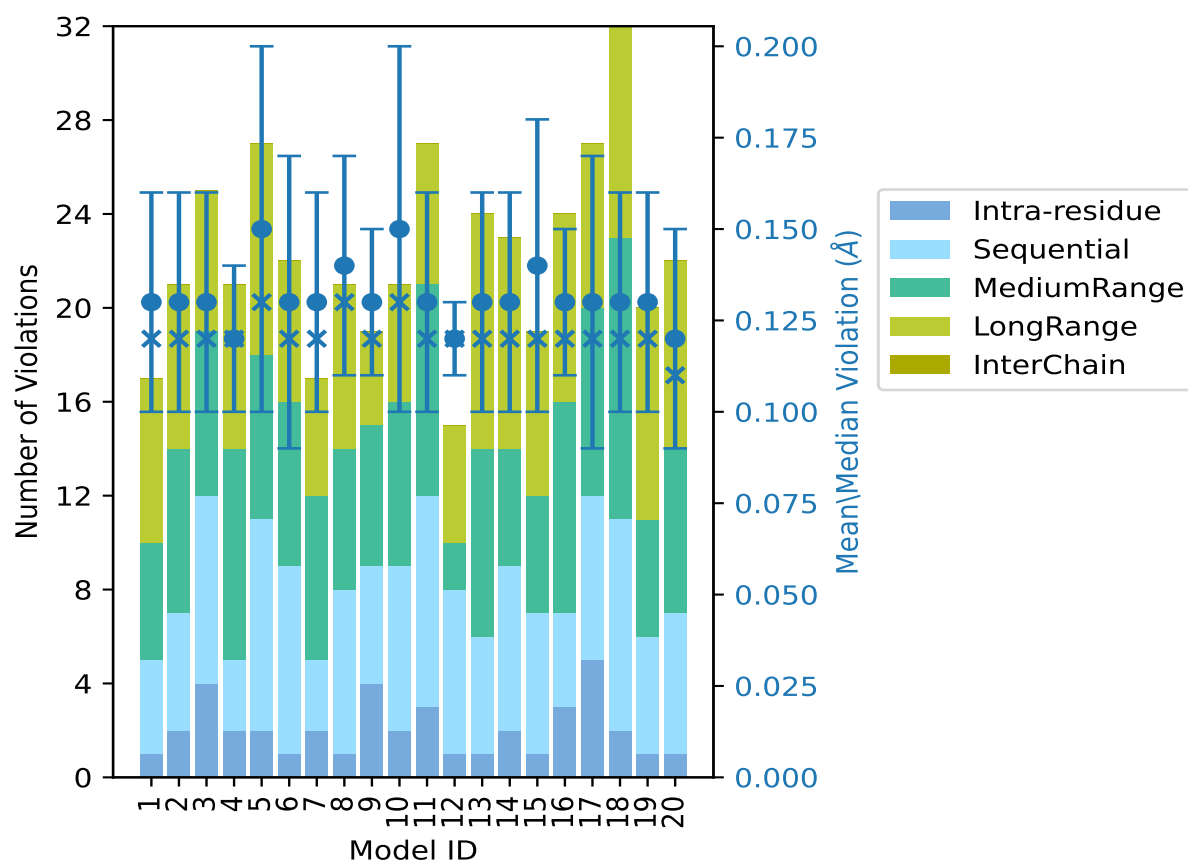
The mean(dot),median(x) and the standard deviation are shown in blue with respect to the y axis on the right

## 9.3 Distance violation statistics for the ensemble ⓘ

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, 4029(IR:506, SQ:921, MR:1191, LR:1411, 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]	%
8	7	9	2	0	26	1	5.0
2	3	3	3	0	11	2	10.0
3	5	4	0	0	12	3	15.0
0	5	5	1	0	11	4	20.0
0	2	1	0	0	3	5	25.0
0	1	0	2	0	3	6	30.0
0	0	0	3	0	3	7	35.0
0	0	0	0	0	0	8	40.0
0	3	2	1	0	6	9	45.0
0	0	0	0	0	0	10	50.0
0	0	0	0	0	0	11	55.0
0	0	0	0	0	0	12	60.0
0	0	1	0	0	1	13	65.0
0	0	0	1	0	1	14	70.0
0	0	0	0	0	0	15	75.0
0	1	1	1	0	3	16	80.0
0	1	0	1	0	2	17	85.0
0	0	0	0	0	0	18	90.0
0	0	1	0	0	1	19	95.0
1	0	1	2	0	4	20	100.0

[1]Intra-residue restraints, [2]Sequential restraints, [3]Medium range restraints, [4]Long range restraints, [5]Inter-chain restraints, [6] Number of models with violations

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9.3.1 Bar graph : Distance violation statistics for the ensemble ⓘ
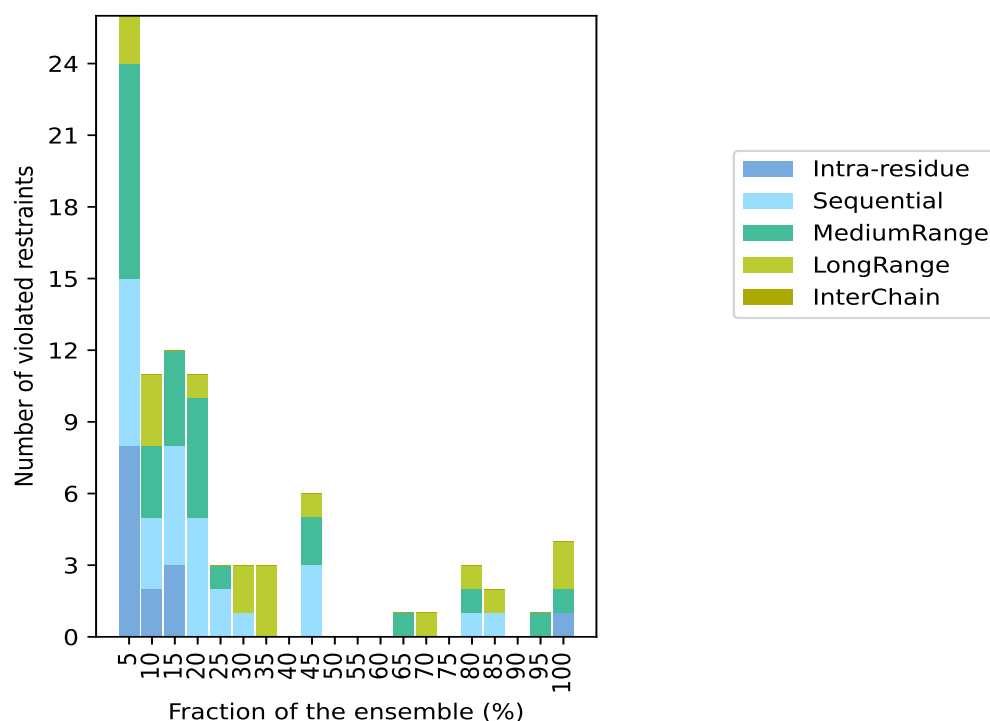
9.4 Most violated distance restraints in the ensemble ⓘ

9.4.1 Histogram : Distribution of mean distance violations ⓘ

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
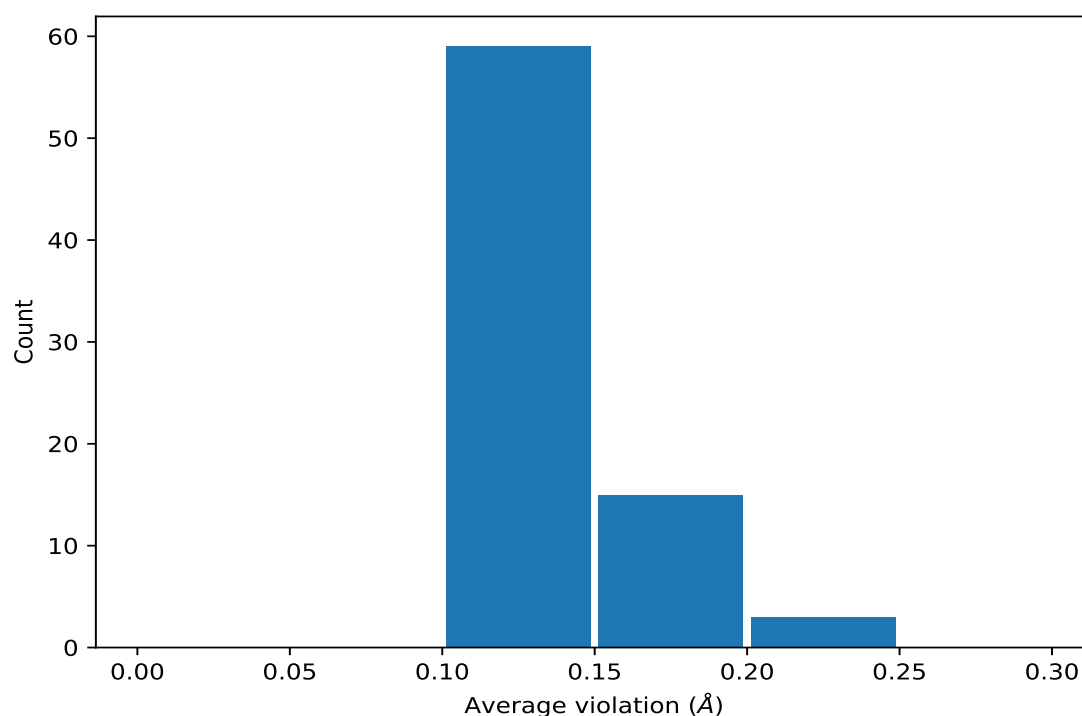
9.4.2 Table: Most violated distance restraints ⓘ

The following table provides the mean and the standard deviation of the violations for the 10 worst performing restraints, sorted by number of violated models and the mean violation 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)
(1,755)	1:135:A:PHE:H	1:139:A:LYS:HG2	20	0.16	0.02	0.16
(1,3341)	1:87:A:PRO:HG2	1:154:A:TYR:HE2	20	0.15	0.02	0.16
(1,3341)	1:87:A:PRO:HG3	1:154:A:TYR:HE2	20	0.15	0.02	0.16
(1,1679)	1:130:A:LYS:HB2	1:144:A:ASP:HA	20	0.13	0.02	0.13
(1,2655)	1:168:A:ARG:HA	1:168:A:ARG:HD2	20	0.13	0.01	0.13
(1,977)	1:95:A:LYS:H	1:98:A:ASP:HA	19	0.12	0.01	0.12
(1,875)	1:122:A:ASN:HD21	1:123:A:LYS:H	17	0.2	0.06	0.23
(1,3118)	1:130:A:LYS:HE2	1:147:A:THR:H	17	0.11	0.01	0.11
(1,1477)	1:152:A:LEU:HA	1:153:A:LYS:HG2	16	0.12	0.01	0.12
(1,2316)	1:131:A:LEU:HA	1:143:A:ARG:HA	16	0.12	0.01	0.12
(1,1211)	1:101:A:GLU:H	1:103:A:TYR:HB2	16	0.11	0.01	0.11

[1]Number of violated models, [2]Standard deviation

9.5 All violated distance restraints ⓘ

9.5.1 Histogram : Distribution of distance violations ⓘ

The following histogram shows the distribution of the absolute value of the violation for all violated restraints in the ensemble.
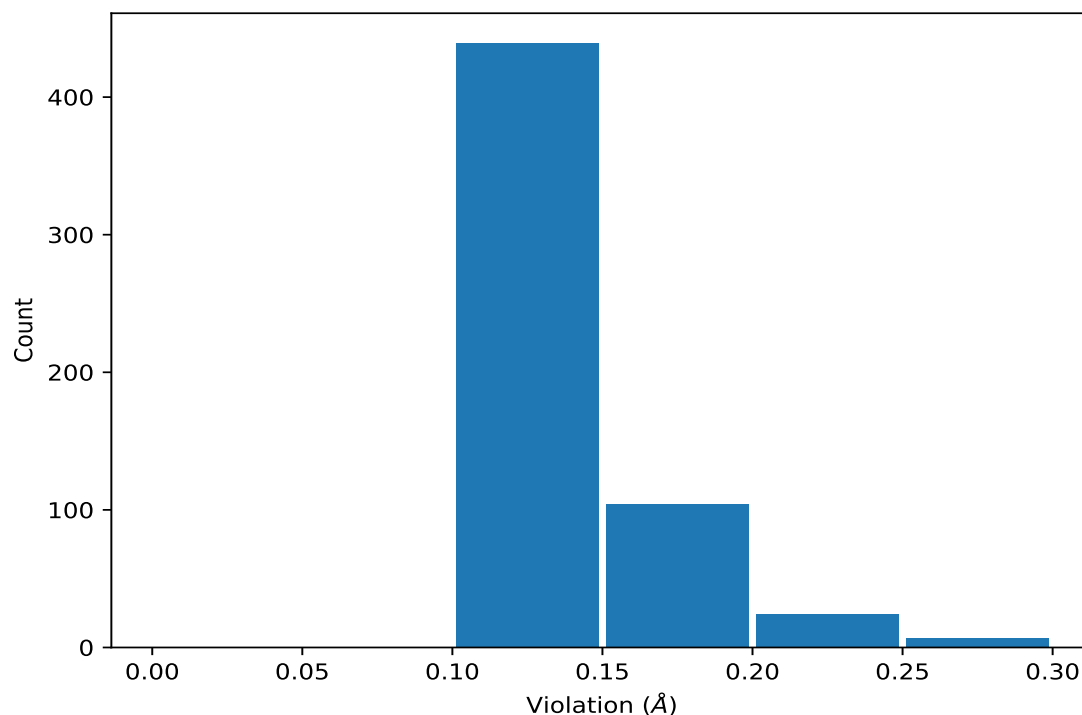
9.5.2 Table : All distance violations ⓘ

The following table provides the 10 worst performing restraints, sorted by the violation 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)
(1,1036)	1:83:A:GLN:HA	1:84:A:GLU:H	5	0.28
(1,875)	1:122:A:ASN:HD21	1:123:A:LYS:H	10	0.28
(1,875)	1:122:A:ASN:HD21	1:123:A:LYS:H	17	0.26
(1,1036)	1:83:A:GLN:HA	1:84:A:GLU:H	10	0.25
(1,875)	1:122:A:ASN:HD21	1:123:A:LYS:H	8	0.25
(1,875)	1:122:A:ASN:HD21	1:123:A:LYS:H	13	0.25
(1,875)	1:122:A:ASN:HD21	1:123:A:LYS:H	15	0.25
(1,1036)	1:83:A:GLN:HA	1:84:A:GLU:H	2	0.24
(1,875)	1:122:A:ASN:HD21	1:123:A:LYS:H	1	0.24
(1,875)	1:122:A:ASN:HD21	1:123:A:LYS:H	5	0.24

10 Dihedral-angle violation analysis ⓘ

10.1 Summary of dihedral-angle violations ⓘ

The following table provides the summary of dihedral-angle violations in different dihedral-angle types. Violations less than 1° are not included in the calculation.

Angle type	Count	$\%^1$	Violated[3]			Consistently Violated[4]		
			Count	$\%^2$	$\%^1$	Count	$\%^2$	$\%^1$
PSI	77	50.0	3	3.9	1.9	0	0.0	0.0
PHI	77	50.0	2	2.6	1.3	0	0.0	0.0
Total	154	100.0	5	3.2	3.2	0	0.0	0.0

[1] percentage calculated with respect to total number of dihedral-angle restraints, [2] percentage calculated with respect to number of restraints in a particular dihedral-angle type, [3] violated in at least one model, [4] violated in all the models

10.1.1 Bar chart : Distribution of dihedral-angles and violations ⓘ
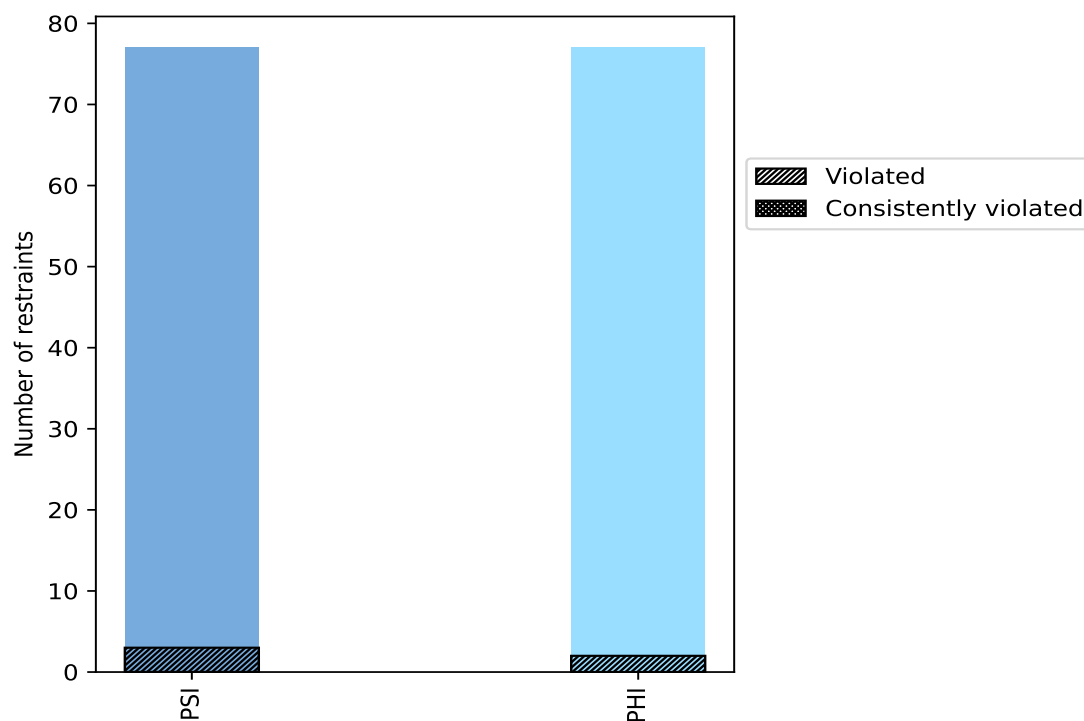

Violated and consistently violated restraints are shown using different hatch patterns in their respective categories

10.2 Dihedral-angle violation statistics for each model ⓘ

The following table provides the dihedral-angle violation statistics for each model in the ensemble.
Violations less than 1° are not included in the statistics.

Model ID	Number of violations			Mean (°)	Max (°)	SD (°)	Median (°)
	PSI	PHI	Total				
1	0	0	0	0.0	0.0	0.0	0.0
2	0	0	0	0.0	0.0	0.0	0.0
3	0	0	0	0.0	0.0	0.0	0.0
4	1	0	1	14.55	14.55	0.0	14.55
5	1	0	1	3.64	3.64	0.0	3.64
6	0	0	0	0.0	0.0	0.0	0.0
7	1	0	1	3.25	3.25	0.0	3.25
8	0	0	0	0.0	0.0	0.0	0.0
9	0	0	0	0.0	0.0	0.0	0.0
10	0	1	1	8.96	8.96	0.0	8.96
11	2	0	2	5.88	10.69	4.81	5.88
12	1	1	2	1.98	2.21	0.24	1.98
13	0	0	0	0.0	0.0	0.0	0.0
14	0	0	0	0.0	0.0	0.0	0.0
15	0	0	0	0.0	0.0	0.0	0.0
16	0	0	0	0.0	0.0	0.0	0.0
17	0	0	0	0.0	0.0	0.0	0.0
18	1	1	2	1.09	1.17	0.08	1.09
19	1	0	1	6.74	6.74	0.0	6.74
20	0	0	0	0.0	0.0	0.0	0.0

10.2.1   Bar graph : Dihedral violation statistics for each model ⓘ
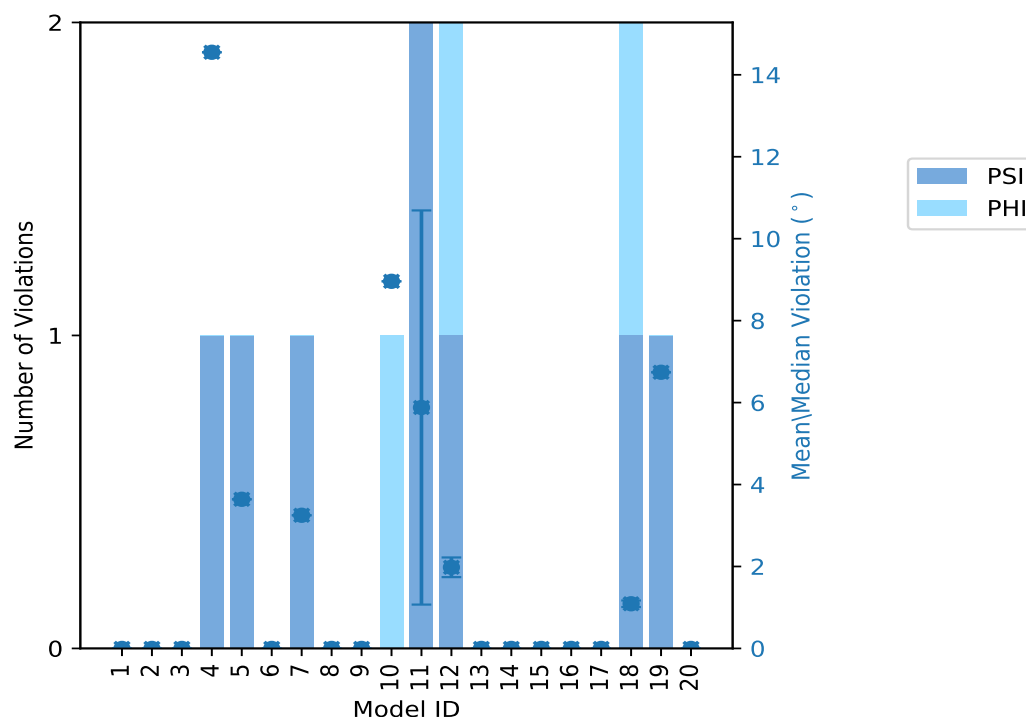
The mean(dot),median(x) and the standard deviation are shown in blue with respect to the y axis on the right

10.3   Dihedral-angle violation statistics for the ensemble ⓘ

Violation analysis may find that some restraints are violated in very 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 ensemble.

| Number of violated restraints			Fraction of the ensemble	
PSI	PHI	Total	Count[1]	%
1	1	2	1	5.0
1	1	2	2	10.0
0	0	0	3	15.0
0	0	0	4	20.0
1	0	1	5	25.0
0	0	0	6	30.0
0	0	0	7	35.0
0	0	0	8	40.0
0	0	0	9	45.0
0	0	0	10	50.0
0	0	0	11	55.0

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Number of violated restraints			Fraction of the ensemble	
PSI	PHI	Total	Count[1]	%
0	0	0	12	60.0
0	0	0	13	65.0
0	0	0	14	70.0
0	0	0	15	75.0
0	0	0	16	80.0
0	0	0	17	85.0
0	0	0	18	90.0
0	0	0	19	95.0
0	0	0	20	100.0

[1] Number of models with violations

10.3.1 Bar graph : Dihedral-angle Violation statistics for the ensemble ⓘ
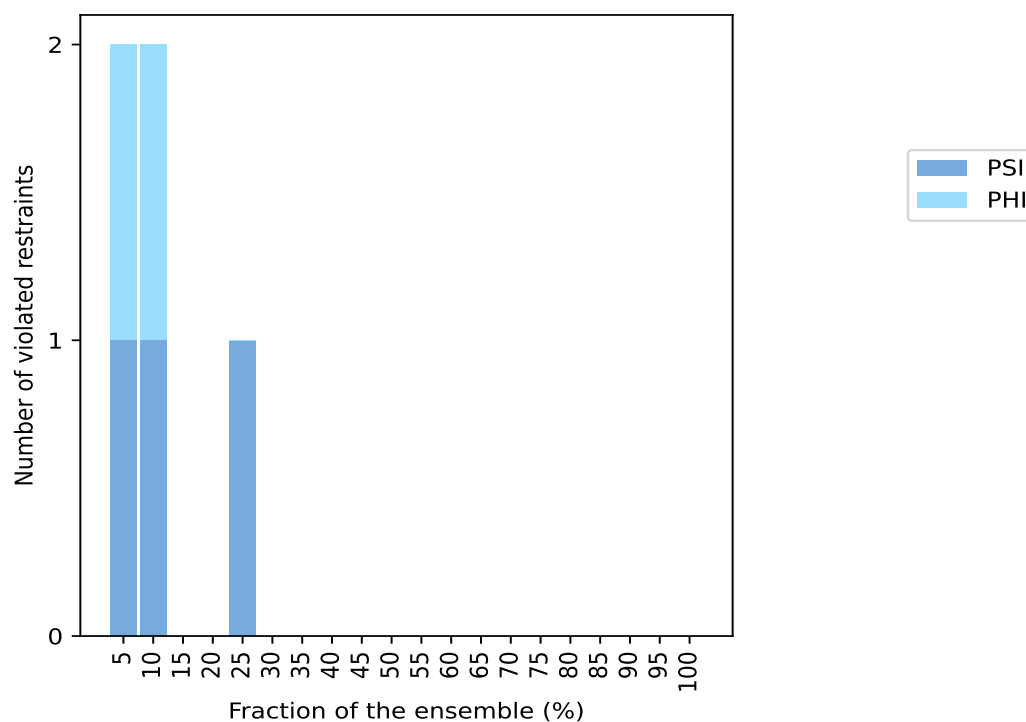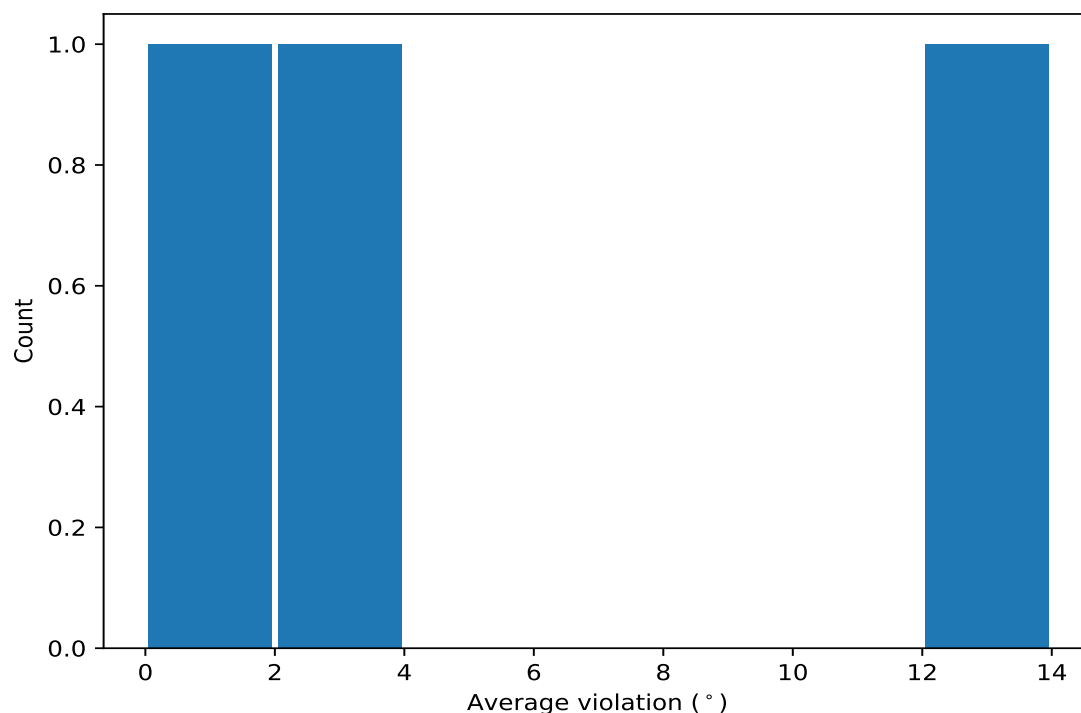

10.4 Most violated dihedral-angle restraints in the ensemble ⓘ

10.4.1 Histogram : Distribution of mean dihedral-angle violations ⓘ

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

10.4.2 Table: Most violated dihedral-angle restraints ⓘ

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.

Key	Atom-1	Atom-2	Atom-3	Atom-4	Models[1]	Mean	SD[2]	Median
(1,48)	1:111:A:LYS:N	1:111:A:LYS:CA	1:111:A:LYS:C	1:112:A:ASP:N	5	3.38	1.9	3.25
(1,16)	1:95:A:LYS:N	1:95:A:LYS:CA	1:95:A:LYS:C	1:96:A:LEU:N	2	12.62	1.93	12.62
(1,1)	1:85:A:TRP:C	1:86:A:LYS:N	1:86:A:LYS:CA	1:86:A:LYS:C	2	1.38	0.36	1.38

[1] Number of violated models, [2]Standard deviation, All angle values are in degree (°)

10.5 All violated dihedral-angle restraints ⓘ

10.5.1 Histogram : Distribution of violations ⓘ

The following histogram shows the distribution of the absolute value of the violation for all violated restraints in the ensemble.
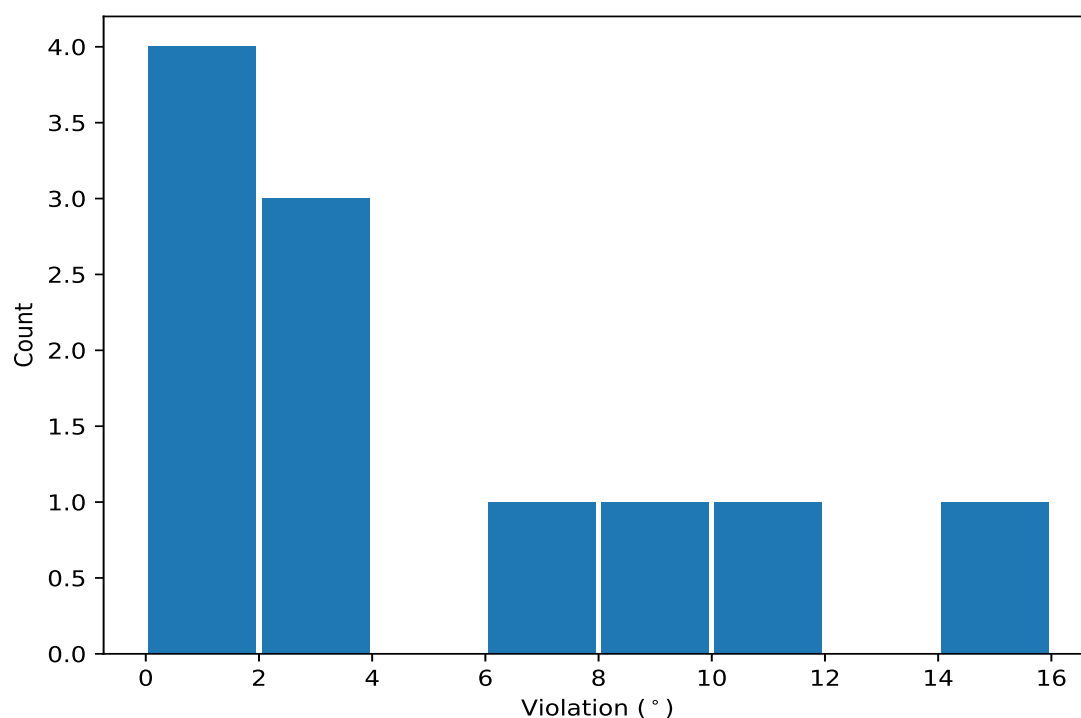
10.5.2   Table: All violated dihedral-angle restraints ⓘ

The following table provides the list of violations for the 10 worst performing restraints, sorted by the violation value. The Key (restraint list ID, restraint ID) is the unique identifier for a given restraint.

Key	Atom-1	Atom-2	Atom-3	Atom-4	Model ID	Violation (°)
(1,16)	1:95:A:LYS:N	1:95:A:LYS:CA	1:95:A:LYS:C	1:96:A:LEU:N	4	14.55
(1,16)	1:95:A:LYS:N	1:95:A:LYS:CA	1:95:A:LYS:C	1:96:A:LEU:N	11	10.69
(1,65)	1:119:A:VAL:C	1:120:A:ARG:N	1:120:A:ARG:CA	1:120:A:ARG:C	10	8.96
(1,48)	1:111:A:LYS:N	1:111:A:LYS:CA	1:111:A:LYS:C	1:112:A:ASP:N	19	6.74
(1,48)	1:111:A:LYS:N	1:111:A:LYS:CA	1:111:A:LYS:C	1:112:A:ASP:N	5	3.64
(1,48)	1:111:A:LYS:N	1:111:A:LYS:CA	1:111:A:LYS:C	1:112:A:ASP:N	7	3.25
(1,48)	1:111:A:LYS:N	1:111:A:LYS:CA	1:111:A:LYS:C	1:112:A:ASP:N	12	2.21
(1,1)	1:85:A:TRP:C	1:86:A:LYS:N	1:86:A:LYS:CA	1:86:A:LYS:C	12	1.74
(1,72)	1:124:A:LEU:N	1:124:A:LEU:CA	1:124:A:LEU:C	1:125:A:GLY:N	18	1.17
(1,48)	1:111:A:LYS:N	1:111:A:LYS:CA	1:111:A:LYS:C	1:112:A:ASP:N	11	1.07