wwPDB NMR Structure Validation Summary Report (i)

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PDB ID	:	2MRD
BMRB ID	:	25069
Title	:	Solution structure of human Ca2+-loaded S100A4 cys-free mutant
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Deposited on	:	2014-07-03

This is a wwPDB NMR Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/NMRValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (i)) were used in the production of this report:

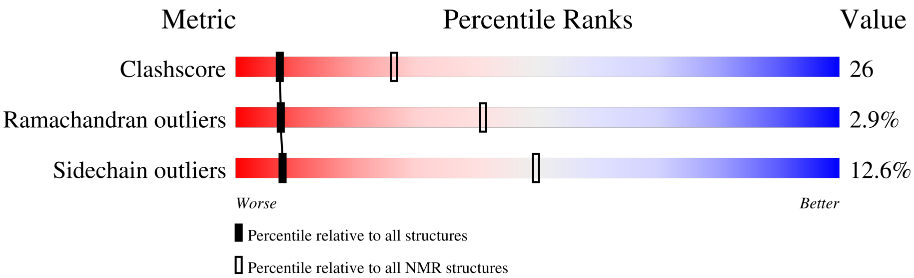
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
BMRB Restraints Analysis	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.33

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
SOLUTION NMR

The overall completeness of chemical shifts assignment is 41%.

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 <=5%

Mol	Chain	Length	Quality of chain
1	A	101	44% 44% 6% 7%
1	B	101	43% 45% 6% 7%

2 Ensemble composition and analysis (i)

This entry contains 20 models. Model 16 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:3-A:96, B:3-B:96 (188)	0.57	16

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

The models can be grouped into 3 clusters and 6 single-model clusters were found.

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

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 3264 atoms, of which 1626 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Protein S100-A4.

Mol	Chain	Residues	Atoms						Trace
1	A	101	Total	C	H	N	O	S	0
			1632	519	813	135	160	5	
1	B	101	Total	C	H	N	O	S	0
			1632	519	813	135	160	5	

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	3	SER	CYS	engineered mutation	UNP P26447
A	76	SER	CYS	engineered mutation	UNP P26447
A	81	SER	CYS	engineered mutation	UNP P26447
A	86	SER	CYS	engineered mutation	UNP P26447
B	3	SER	CYS	engineered mutation	UNP P26447
B	76	SER	CYS	engineered mutation	UNP P26447
B	81	SER	CYS	engineered mutation	UNP P26447
B	86	SER	CYS	engineered mutation	UNP P26447

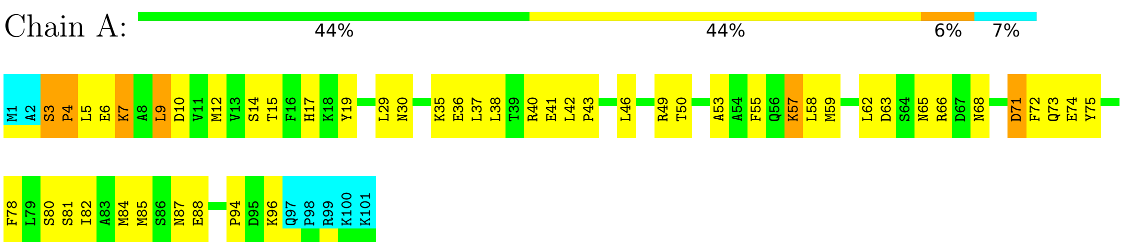
4 Residue-property plots (i)

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.

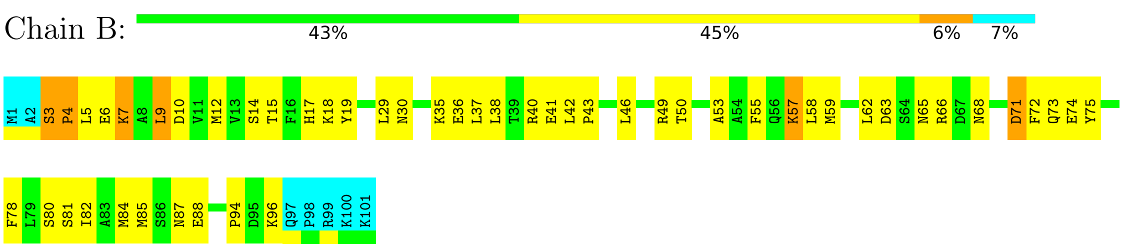
- Molecule 1: Protein S100-A4

Chain A:



- Molecule 1: Protein S100-A4

Chain B:

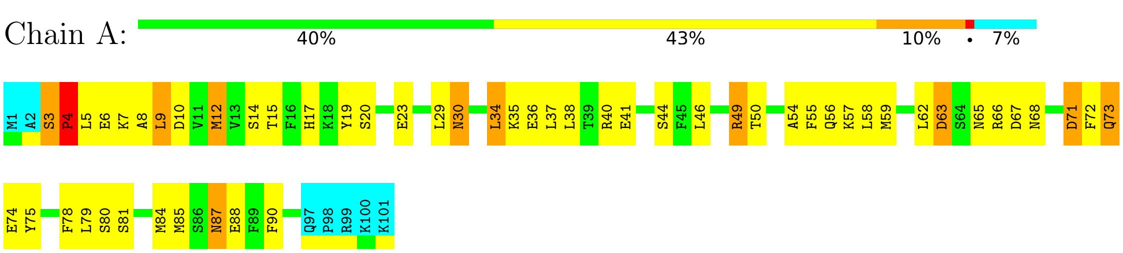


4.2 Residue scores for the representative (medoid) model from the NMR ensemble

The representative model is number 16. Colouring as in section 4.1 above.

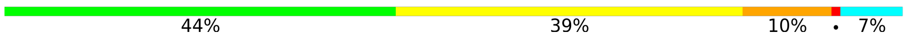
- Molecule 1: Protein S100-A4

Chain A:



- Molecule 1: Protein S100-A4

Chain B:


44%
39%
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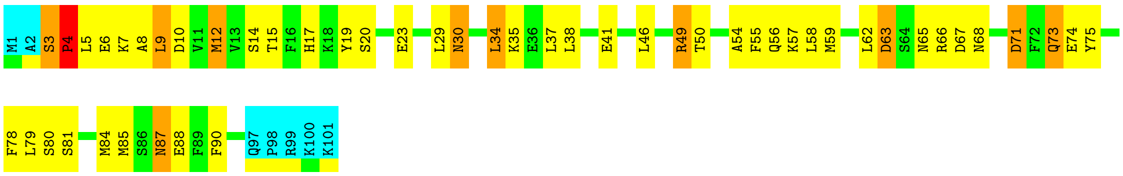
7%


M1 A2 S3 P4 L5 E6 K7 A8 L9 D10 V11 M12 V13 S14 T15 F16 H17 K18 Y19 S20 E23 L29 N30 L34 K35 E36 L37 L38 E41 L46 R49 T50 A54 F55 Q56 K57 L58 M59 L62 D63 S64 N65 R66 D67 N68 D71 F72 Q73 E74 Y75
F78 L79 S80 S81 M84 M85 S86 N87 E88 F89 F90 Q97 P98 R99 K100 K101

5 Refinement protocol and experimental data overview (i)

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

Of the 200 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
ARIA	structure solution	
ARIA	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	1137
Number of shifts mapped to atoms	1137
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	41%

6 Model quality (i)

6.1 Standard geometry (i)

There are no covalent bond-length or bond-angle outliers.

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
1	B	0.0±0.0	0.1±0.3
All	All	0	4

There are no bond-length outliers.

There are no bond-angle outliers.

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	3	SER	Peptide	2
1	B	3	SER	Peptide	2

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	760	743	742	42±5
1	B	760	743	742	42±5
All	All	30400	29720	29680	1589

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 26.

5 of 460 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:B:52:GLU:HA	1:B:55:PHE:CE2	0.83	2.09	13	5
1:A:52:GLU:HA	1:A:55:PHE:CE2	0.82	2.08	13	5
1:A:41:GLU:O	1:A:42:LEU:HG	0.80	1.77	7	1
1:B:41:GLU:O	1:B:42:LEU:HG	0.80	1.77	7	1
1:B:36:GLU:O	1:B:40:ARG:HG2	0.78	1.79	20	1

6.3 Torsion angles (i)

6.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all NMR entries. The Analysed column shows the number of residues for which the backbone conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	94/101 (93%)	85±2 (91±2%)	6±2 (6±2%)	3±1 (3±1%)	7	41
1	B	94/101 (93%)	85±2 (91±2%)	6±2 (6±2%)	3±1 (3±1%)	7	41
All	All	3760/4040 (93%)	3416 (91%)	234 (6%)	110 (3%)	7	41

5 of 8 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	4	PRO	20
1	B	4	PRO	20
1	A	3	SER	19
1	B	3	SER	19
1	A	63	ASP	10

6.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all NMR entries. The Analysed column shows the number of residues for which the sidechain conformation was analysed and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	86/92 (93%)	75±2 (87±3%)	11±2 (13±3%)	8	49
1	B	86/92 (93%)	75±2 (87±3%)	11±2 (13±3%)	8	50

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
All	All	3440/3680 (93%)	3005 (87%)	435 (13%)	8	50

5 of 70 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	57	LYS	20
1	A	73	GLN	20
1	B	57	LYS	20
1	B	73	GLN	20
1	A	9	LEU	18

6.3.3 RNA (i)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains (i)

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

6.5 Carbohydrates (i)

There are no monosaccharides in this entry.

6.6 Ligand geometry (i)

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 (i)

The completeness of assignment taking into account all chemical shift lists is 41% for the well-defined parts and 41% 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 (i)

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	1137
Number of shifts mapped to atoms	1137
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 (i)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	100	-0.23 ± 0.15	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	96	0.25 ± 0.10	None needed (< 0.5 ppm)
$^{13}C'$	100	-0.06 ± 0.16	None needed (< 0.5 ppm)
^{15}N	95	0.82 ± 0.31	Should be applied

7.1.3 Completeness of resonance assignments (i)

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 41%, i.e. 1059 atoms were assigned a chemical shift out of a possible 2574. 0 out of 30 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	464/936 (50%)	185/378 (49%)	188/376 (50%)	91/182 (50%)
Sidechain	595/1406 (42%)	402/902 (45%)	186/452 (41%)	7/52 (13%)

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	Total	^{1}H	^{13}C	^{15}N
Aromatic	0/232 (0%)	0/114 (0%)	0/114 (0%)	0/4 (0%)
Overall	1059/2574 (41%)	587/1394 (42%)	374/942 (40%)	98/238 (41%)

7.1.4 Statistically unusual chemical shifts (i)

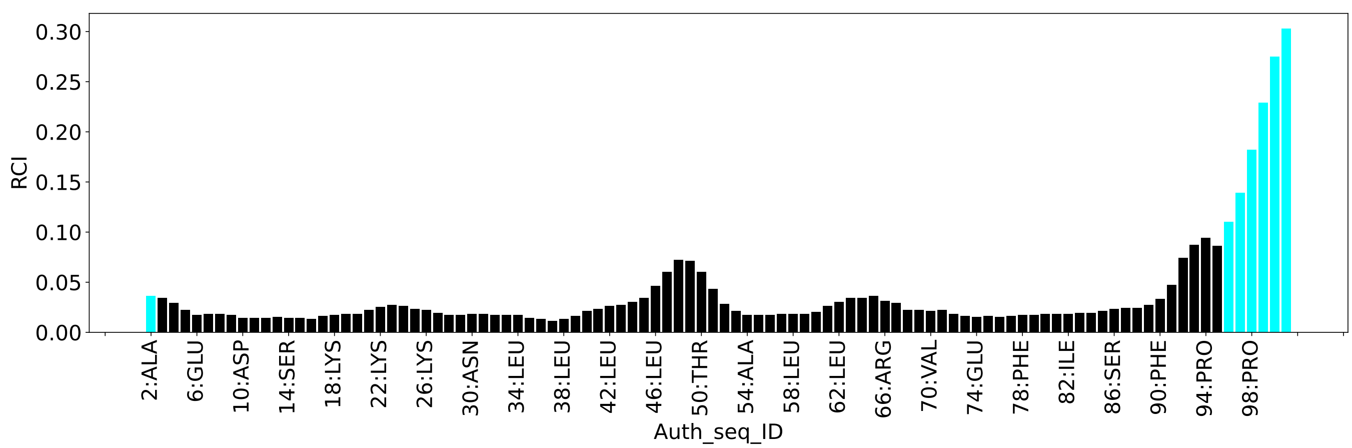
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, *ppm*	Expected range, *ppm*	Z-score
1	A	20	SER	HB2	2.05	2.61 – 5.13	-7.2
1	A	28	LYS	CE	35.87	37.57 – 46.21	-7.0

7.1.5 Random Coil Index (RCI) plots (i)

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition.If well-defined core and ill-defined regions are not identified then it is shown as gray bars.

Random coil index (RCI) for chain A:



8 NMR restraints analysis (i)

8.1 Conformationally restricting restraints (i)

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	5118
Intra-residue (|i-j|=0)	1404
Sequential (|i-j|=1)	1032
Medium range (|i-j|>1 and |i-j|<5)	1316
Long range (|i-j|≥5)	918
Inter-chain	264
Hydrogen bond restraints	184
Disulfide bond restraints	0
Total dihedral-angle restraints	320
Number of unmapped restraints	0
Number of restraints per residue	26.9
Number of long range restraints per residue[1]	4.6

[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 (i)

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 (i)

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)	142.5	0.2
0.2-0.5 (Medium)	91.1	0.5
>0.5 (Large)	116.0	3.53

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

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)	16.1	10.0
10.0-20.0 (Medium)	1.3	18.6
>20.0 (Large)	None	None

9 Distance violation analysis (i)

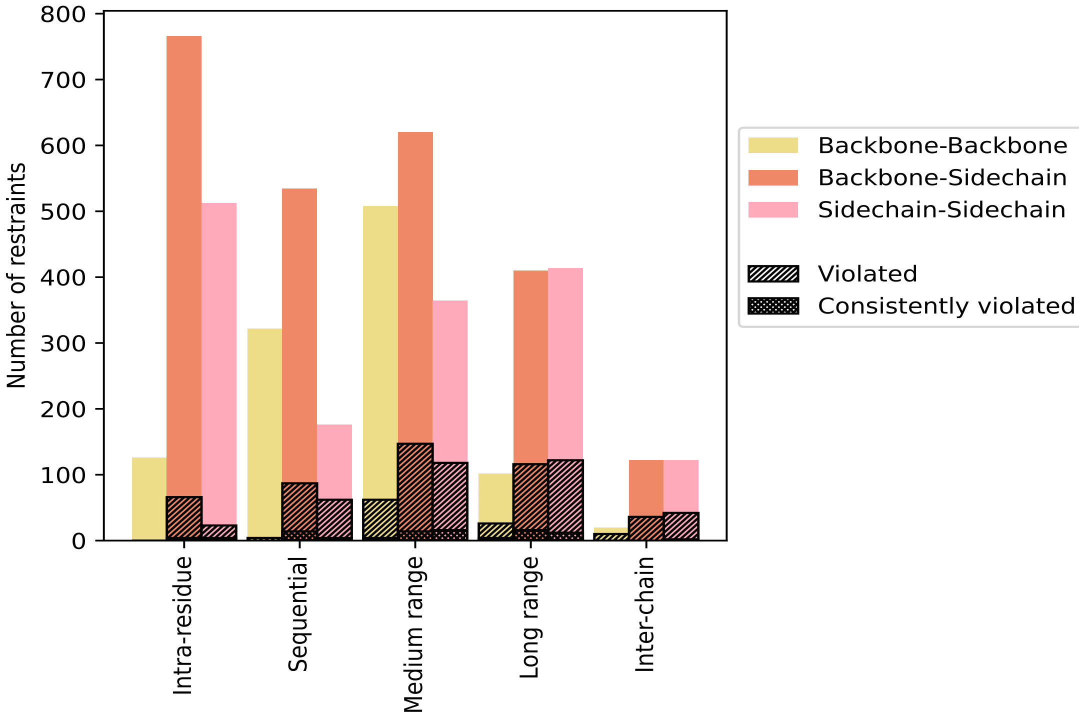
9.1 Summary of distance violations (i)

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)	1404	27.4	89	6.3	1.7	8	0.6	0.2
Backbone-Backbone	126	2.5	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	766	15.0	66	8.6	1.3	4	0.5	0.1
Sidechain-Sidechain	512	10.0	23	4.5	0.4	4	0.8	0.1
Sequential (|i-j|=1)	1032	20.2	153	14.8	3.0	18	1.7	0.4
Backbone-Backbone	322	6.3	4	1.2	0.1	0	0.0	0.0
Backbone-Sidechain	534	10.4	87	16.3	1.7	14	2.6	0.3
Sidechain-Sidechain	176	3.4	62	35.2	1.2	4	2.3	0.1
Medium range (|i-j|>1 & |i-j|<5)	1316	25.7	295	22.4	5.8	32	2.4	0.6
Backbone-Backbone	332	6.5	30	9.0	0.6	2	0.6	0.0
Backbone-Sidechain	620	12.1	147	23.7	2.9	14	2.3	0.3
Sidechain-Sidechain	364	7.1	118	32.4	2.3	16	4.4	0.3
Long range (|i-j|≥5)	918	17.9	260	28.3	5.1	32	3.5	0.6
Backbone-Backbone	94	1.8	22	23.4	0.4	4	4.3	0.1
Backbone-Sidechain	410	8.0	116	28.3	2.3	16	3.9	0.3
Sidechain-Sidechain	414	8.1	122	29.5	2.4	12	2.9	0.2
Inter-chain	264	5.2	88	33.3	1.7	2	0.8	0.0
Backbone-Backbone	20	0.4	10	50.0	0.2	0	0.0	0.0
Backbone-Sidechain	122	2.4	36	29.5	0.7	0	0.0	0.0
Sidechain-Sidechain	122	2.4	42	34.4	0.8	2	1.6	0.0
Hydrogen bond	184	3.6	36	19.6	0.7	2	1.1	0.0
Disulfide bond	0	0.0	0	0.0	0.0	0	0.0	0.0
Total	5118	100.0	921	18.0	18.0	94	1.8	1.8
Backbone-Backbone	1078	21.1	102	9.5	2.0	8	0.7	0.2
Backbone-Sidechain	2452	47.9	452	18.4	8.8	48	2.0	0.9
Sidechain-Sidechain	1588	31.0	367	23.1	7.2	38	2.4	0.7

[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	25	59	118	102	28	332	0.47	3.53	0.47	0.25
2	24	58	141	97	16	336	0.46	2.8	0.45	0.23
3	34	52	126	114	26	352	0.46	3.5	0.46	0.24
4	34	49	126	101	21	331	0.46	2.45	0.42	0.27
5	26	54	133	112	30	355	0.44	3.3	0.43	0.25
6	28	69	135	94	30	356	0.45	3.36	0.42	0.26
7	30	70	130	104	30	364	0.46	3.52	0.46	0.28
8	36	52	123	101	23	335	0.5	3.36	0.47	0.33
9	32	60	124	114	23	353	0.47	3.3	0.45	0.25
10	36	62	126	129	30	383	0.49	3.38	0.47	0.29
11	28	64	119	102	20	333	0.5	3.22	0.48	0.32

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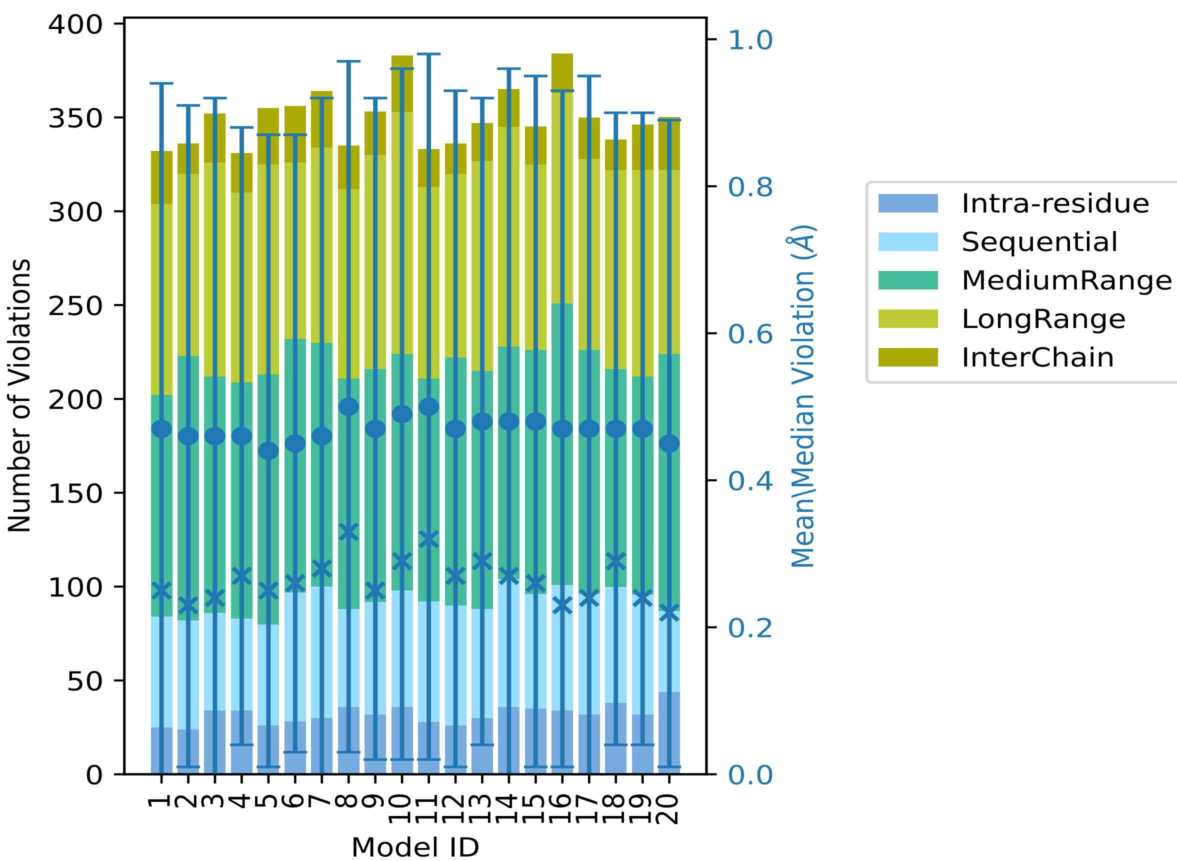
Model ID	Number of violations						Mean (Å)	Max (Å)	SD[6] (Å)	Median (Å)
	IR[1]	SQ[2]	MR[3]	LR[4]	IC[5]	Total				
12	26	64	132	98	16	336	0.47	3.28	0.46	0.27
13	30	58	127	112	20	347	0.48	3.46	0.44	0.29
14	36	68	124	117	20	365	0.48	3.46	0.48	0.27
15	35	61	130	99	20	345	0.48	3.16	0.47	0.26
16	34	67	150	112	21	384	0.47	2.86	0.46	0.23
17	32	64	130	102	22	350	0.47	3.27	0.48	0.24
18	38	62	116	106	16	338	0.47	3.04	0.43	0.29
19	32	64	116	110	24	346	0.47	2.52	0.43	0.24
20	44	43	137	98	28	350	0.45	2.99	0.44	0.22

[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 (i)



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

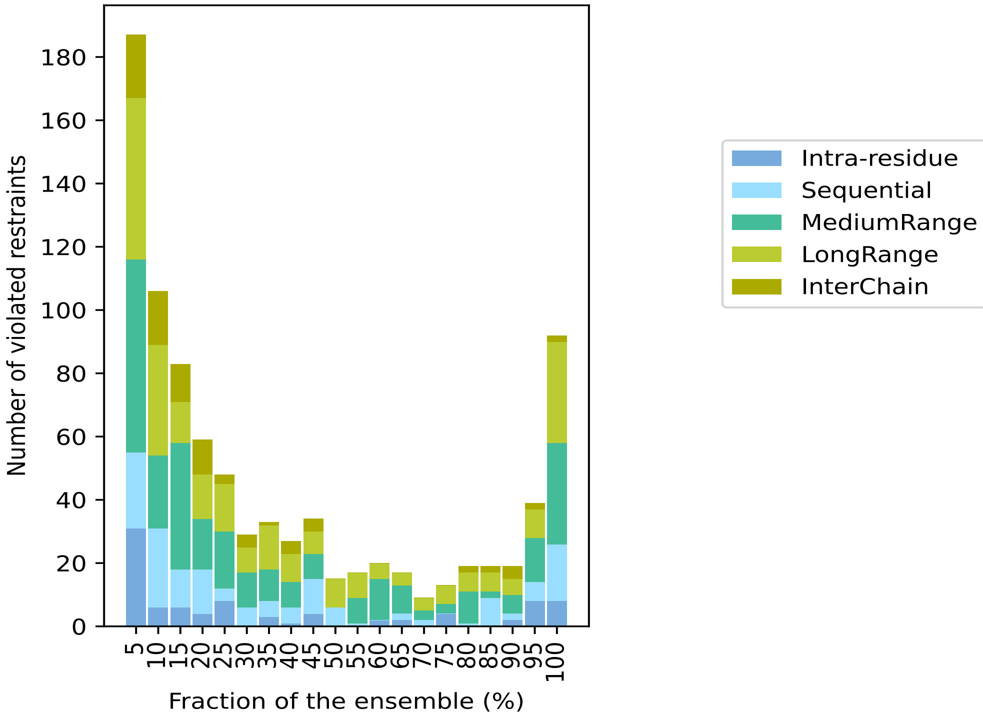
9.3 Distance violation statistics for the ensemble (i)

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, 4049(IR:1315, SQ:879, MR:1021, LR:658, IC:176) 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]	%
31	24	61	51	20	187	1	5.0
6	25	23	35	17	106	2	10.0
6	12	40	13	12	83	3	15.0
4	14	16	14	11	59	4	20.0
8	4	18	15	3	48	5	25.0
0	6	11	8	4	29	6	30.0
3	5	10	14	1	33	7	35.0
1	5	8	9	4	27	8	40.0
4	11	8	7	4	34	9	45.0
0	6	0	9	0	15	10	50.0
0	1	8	8	0	17	11	55.0
2	0	13	5	0	20	12	60.0
2	2	9	4	0	17	13	65.0
0	2	3	4	0	9	14	70.0
4	0	3	6	0	13	15	75.0
0	1	10	6	2	19	16	80.0
0	9	2	6	2	19	17	85.0
2	2	6	5	4	19	18	90.0
8	6	14	9	2	39	19	95.0
8	18	32	32	2	92	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

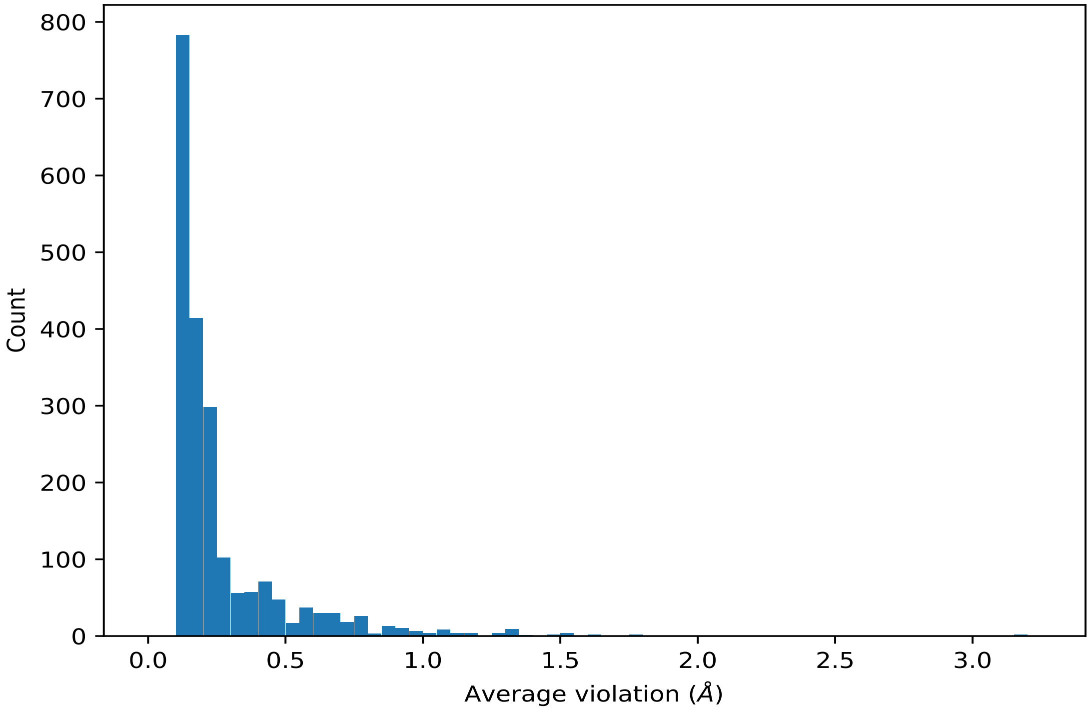
9.3.1 Bar graph : Distance violation statistics for the ensemble (i)



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 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.

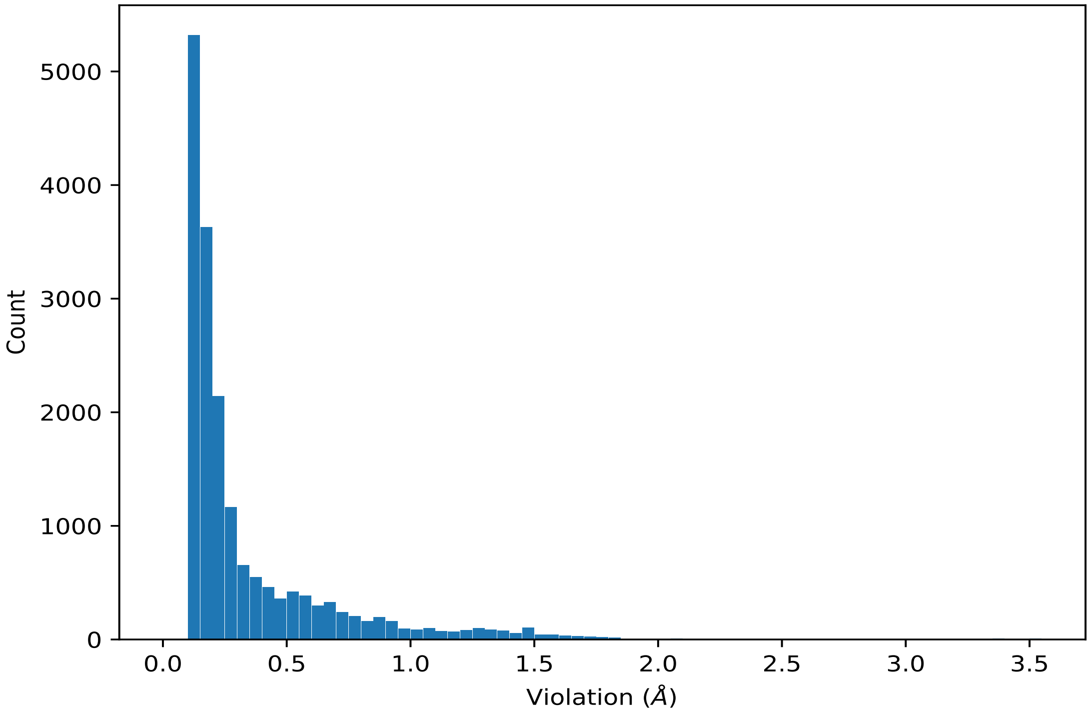
Key	Atom-1	Atom-2	Models[1]	Mean (Å)	SD[1] (Å)	Median (Å)
(1,1307)	1:A:9:LEU:HB2	1:B:9:LEU:HB2	20	3.19	0.31	3.29
(1,1308)	1:B:9:LEU:HB2	1:A:9:LEU:HB2	20	3.19	0.31	3.29
(2,240)	1:B:89:PHE:H	1:B:94:PRO:HB2	20	1.75	0.06	1.78
(2,239)	1:A:89:PHE:H	1:A:94:PRO:HB2	20	1.75	0.06	1.77
(1,785)	1:A:38:LEU:H	1:A:41:GLU:HB3	20	1.53	0.11	1.54
(1,786)	1:B:38:LEU:H	1:B:41:GLU:HB3	20	1.53	0.11	1.54
(2,18)	1:B:66:ARG:HB2	1:B:63:ASP:HB2	20	1.46	0.13	1.46
(2,17)	1:A:66:ARG:HB2	1:A:63:ASP:HB2	20	1.46	0.13	1.45
(2,94)	1:B:61:ASN:HA	1:B:63:ASP:HB2	20	1.35	0.08	1.37
(2,93)	1:A:61:ASN:HA	1:A:63:ASP:HB2	20	1.34	0.08	1.37

[1]Number of violated models, [2]Standard 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 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)
(1,1308)	1:B:9:LEU:HB2	1:A:9:LEU:HB2	1	3.53
(1,1307)	1:A:9:LEU:HB2	1:B:9:LEU:HB2	1	3.53
(1,1308)	1:B:9:LEU:HB2	1:A:9:LEU:HB2	7	3.52
(1,1307)	1:A:9:LEU:HB2	1:B:9:LEU:HB2	7	3.52
(1,1308)	1:B:9:LEU:HB2	1:A:9:LEU:HB2	3	3.5
(1,1307)	1:A:9:LEU:HB2	1:B:9:LEU:HB2	3	3.5
(1,1308)	1:B:9:LEU:HB2	1:A:9:LEU:HB2	13	3.46
(1,1308)	1:B:9:LEU:HB2	1:A:9:LEU:HB2	14	3.46
(1,1307)	1:A:9:LEU:HB2	1:B:9:LEU:HB2	13	3.46
(1,1307)	1:A:9:LEU:HB2	1:B:9:LEU:HB2	14	3.46

10 Dihedral-angle violation analysis (i)

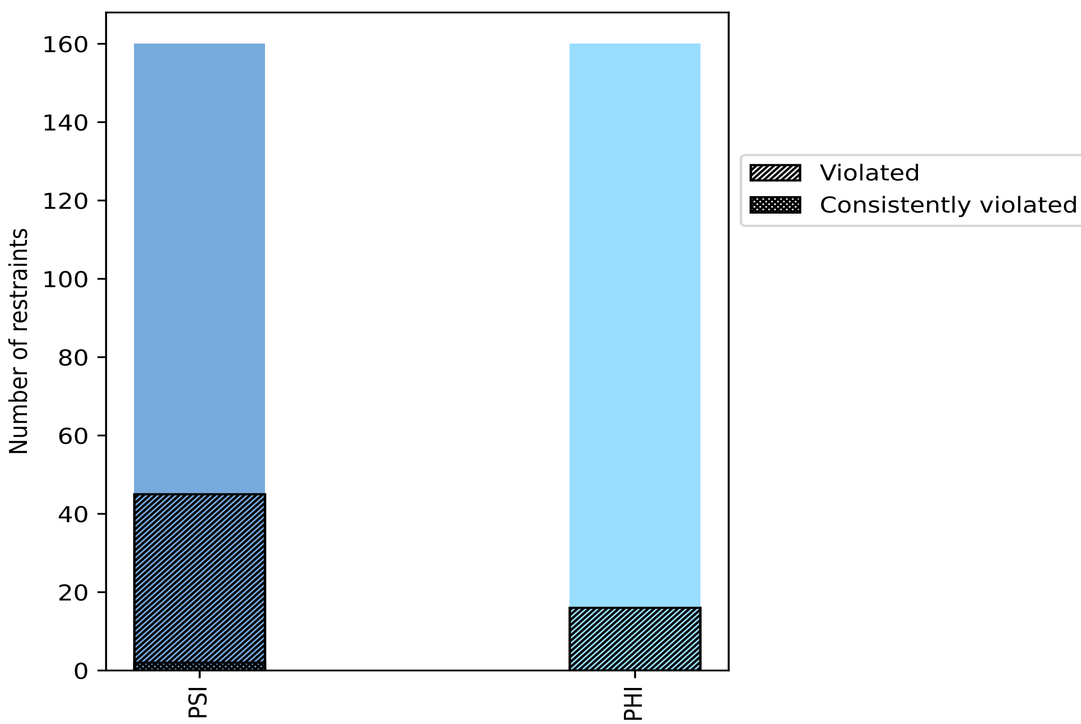
10.1 Summary of dihedral-angle violations (i)

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	160	50.0	45	28.1	14.1	2	1.2	0.6
PHI	160	50.0	16	10.0	5.0	0	0.0	0.0
Total	320	100.0	61	19.1	19.1	2	0.6	0.6

[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 (i)



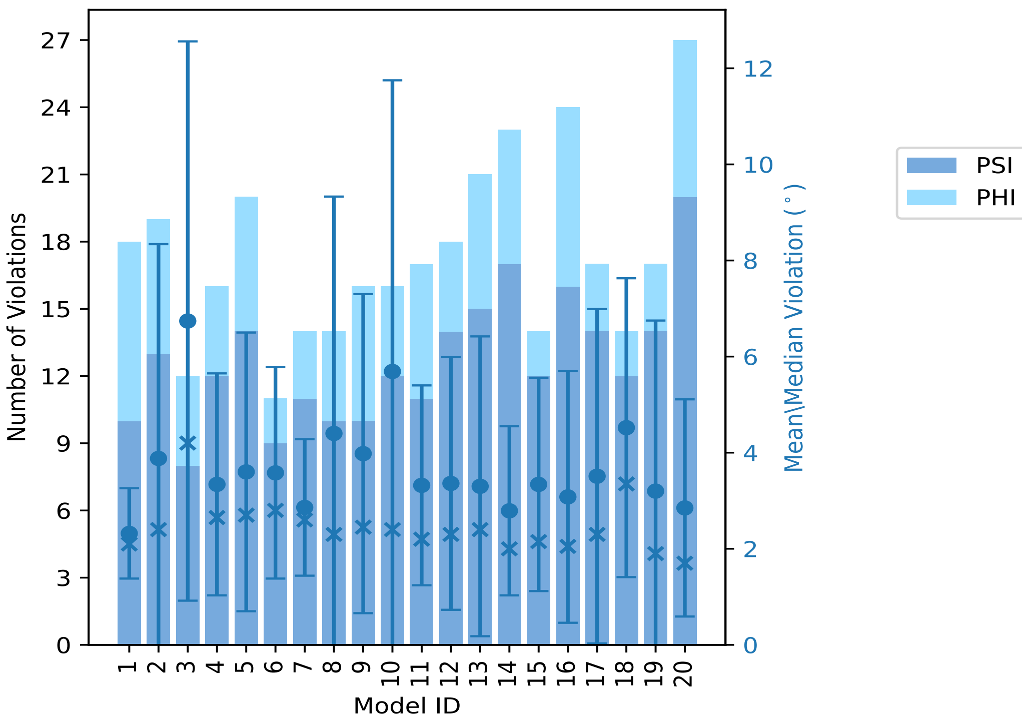
Violated and consistently violated restraints are shown using different hatch patterns in their respective categories

10.2 Dihedral-angle violation statistics for each model (i)

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	10	8	18	2.32	4.7	0.94	2.1
2	13	6	19	3.88	16.5	4.46	2.4
3	8	4	12	6.74	17.3	5.82	4.2
4	12	4	16	3.34	8.8	2.31	2.65
5	14	6	20	3.6	11.9	2.9	2.7
6	9	2	11	3.58	6.9	2.2	2.8
7	11	3	14	2.86	5.2	1.42	2.6
8	10	4	14	4.4	16.4	4.93	2.3
9	10	6	16	3.98	12.3	3.32	2.45
10	12	4	16	5.69	18.6	6.06	2.4
11	11	6	17	3.32	7.8	2.08	2.2
12	14	4	18	3.36	10.1	2.63	2.3
13	15	6	21	3.3	12.3	3.12	2.4
14	17	6	23	2.79	6.4	1.76	2.0
15	12	2	14	3.34	8.0	2.22	2.15
16	16	8	24	3.08	10.1	2.62	2.05
17	14	3	17	3.51	12.8	3.48	2.3
18	12	2	14	4.52	10.7	3.11	3.35
19	14	3	17	3.2	12.9	3.55	1.9
20	20	7	27	2.85	9.3	2.26	1.7

10.2.1 Bar graph : Dihedral 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

10.3 Dihedral-angle violation statistics for the ensemble (i)

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]	%
18	5	23	1	5.0
6	1	7	2	10.0
2	4	6	3	15.0
3	0	3	4	20.0
3	0	3	5	25.0
1	0	1	6	30.0
0	0	0	7	35.0
2	0	2	8	40.0
0	0	0	9	45.0
0	2	2	10	50.0
2	0	2	11	55.0

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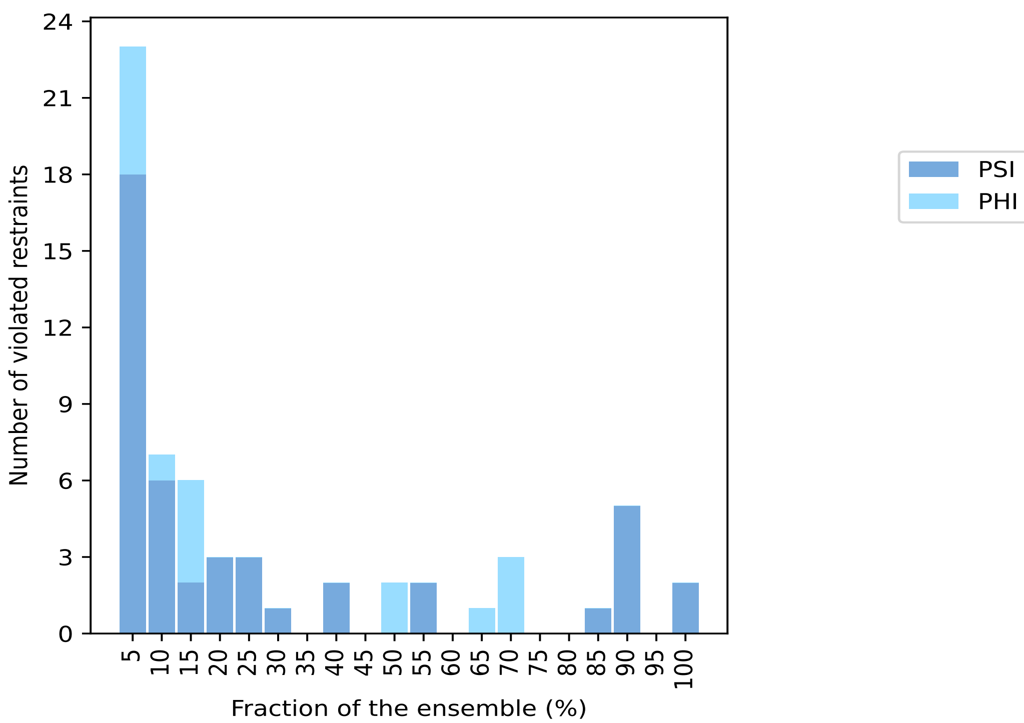
Number of violated restraints			Fraction of the ensemble	
PSI	PHI	Total	Count[1]	%
0	0	0	12	60.0
0	1	1	13	65.0
0	3	3	14	70.0
0	0	0	15	75.0
0	0	0	16	80.0
1	0	1	17	85.0
5	0	5	18	90.0
0	0	0	19	95.0
2	0	2	20	100.0

[1] Number of models with violations

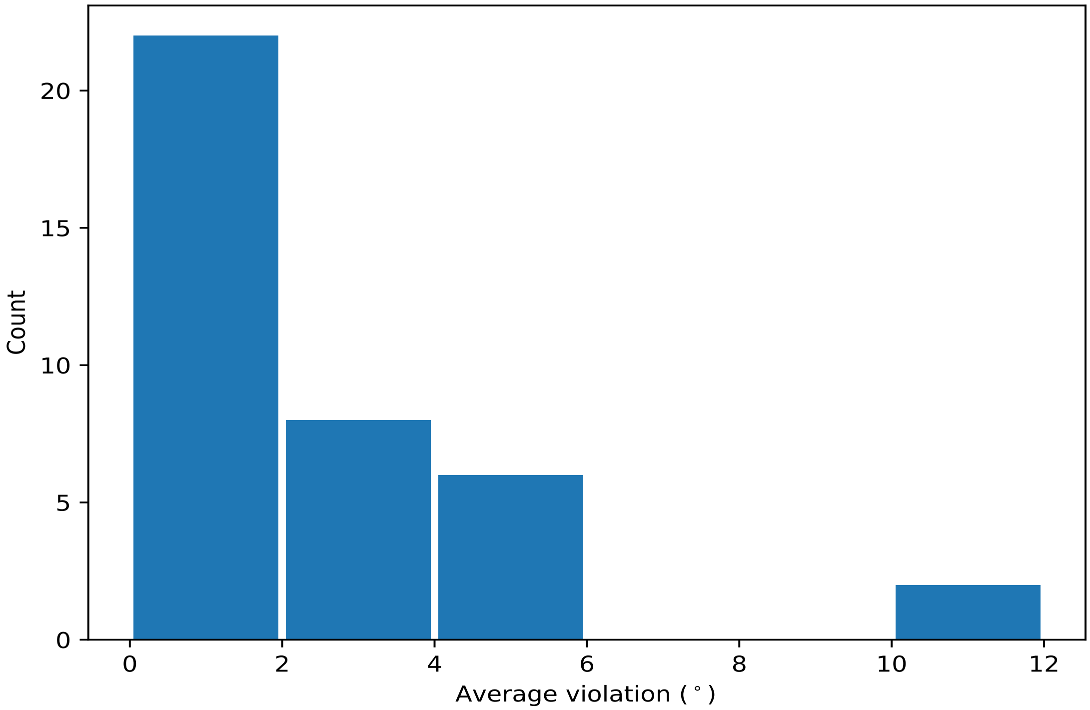
10.3.1 Bar graph : Dihedral-angle Violation statistics for the ensemble ⓘ



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 (i)

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.

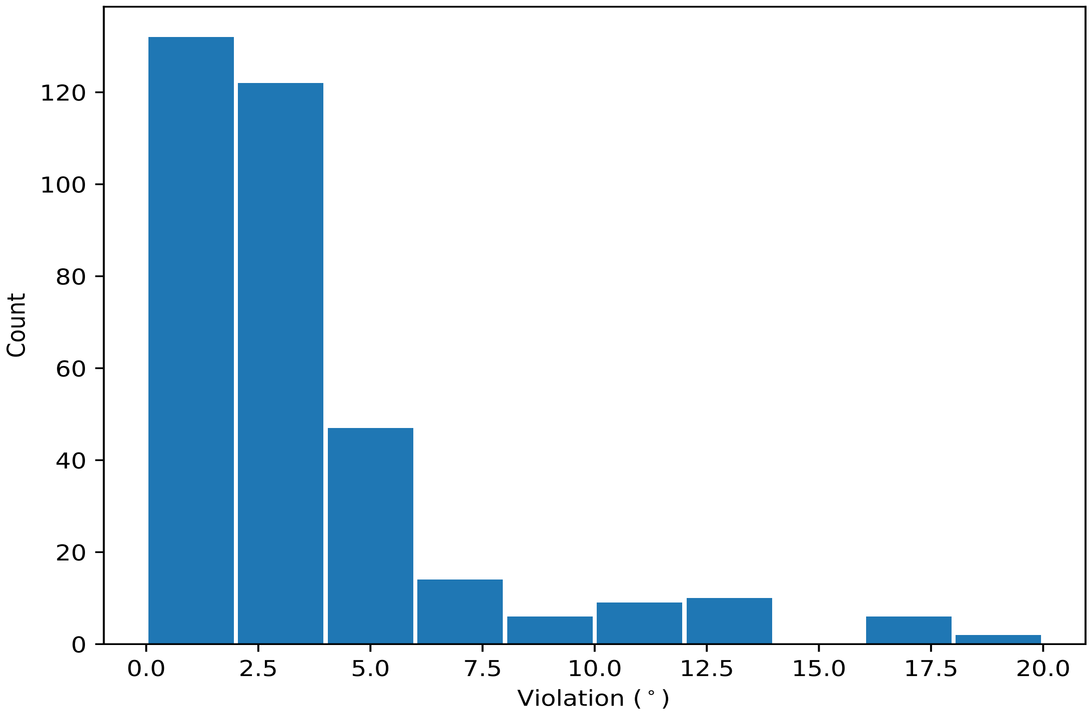
Key	Atom-1	Atom-2	Atom-3	Atom-4	Models[1]	Mean	SD[2]	Median
(1,10)	1:A:7:LYS:N	1:A:7:LYS:CA	1:A:7:LYS:C	1:A:8:ALA:N	20	4.4	1.35	4.35
(1,170)	1:B:7:LYS:N	1:B:7:LYS:CA	1:B:7:LYS:C	1:B:8:ALA:N	20	4.39	1.37	4.35
(1,162)	1:B:3:SER:N	1:B:3:SER:CA	1:B:3:SER:C	1:B:4:PRO:N	18	10.11	3.37	10.05
(1,2)	1:A:3:SER:N	1:A:3:SER:CA	1:A:3:SER:C	1:A:4:PRO:N	18	10.09	3.36	10.0
(1,4)	1:A:4:PRO:N	1:A:4:PRO:CA	1:A:4:PRO:C	1:A:5:LEU:N	18	5.06	2.72	4.7
(1,164)	1:B:4:PRO:N	1:B:4:PRO:CA	1:B:4:PRO:C	1:B:5:LEU:N	18	5.04	2.79	4.6
(1,208)	1:B:29:LEU:N	1:B:29:LEU:CA	1:B:29:LEU:C	1:B:30:ASN:N	18	2.36	0.94	2.3
(1,48)	1:A:29:LEU:N	1:A:29:LEU:CA	1:A:29:LEU:C	1:A:30:ASN:N	17	2.42	0.91	2.4
(1,163)	1:B:3:SER:C	1:B:4:PRO:N	1:B:4:PRO:CA	1:B:4:PRO:C	14	4.29	5.59	2.2
(1,79)	1:A:45:PHE:C	1:A:46:LEU:N	1:A:46:LEU:CA	1:A:46:LEU:C	14	2.0	0.5	2.1

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

10.5 All violated dihedral-angle restraints (i)

10.5.1 Histogram : Distribution of violations (i)

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 (i)

The following table provides the list of violationsfor 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 (°)
(1,3)	1:A:3:SER:C	1:A:4:PRO:N	1:A:4:PRO:CA	1:A:4:PRO:C	10	18.6
(1,163)	1:B:3:SER:C	1:B:4:PRO:N	1:B:4:PRO:CA	1:B:4:PRO:C	10	18.6
(1,3)	1:A:3:SER:C	1:A:4:PRO:N	1:A:4:PRO:CA	1:A:4:PRO:C	3	17.3
(1,163)	1:B:3:SER:C	1:B:4:PRO:N	1:B:4:PRO:CA	1:B:4:PRO:C	3	17.2
(1,162)	1:B:3:SER:N	1:B:3:SER:CA	1:B:3:SER:C	1:B:4:PRO:N	2	16.5
(1,2)	1:A:3:SER:N	1:A:3:SER:CA	1:A:3:SER:C	1:A:4:PRO:N	2	16.4
(1,2)	1:A:3:SER:N	1:A:3:SER:CA	1:A:3:SER:C	1:A:4:PRO:N	8	16.4
(1,162)	1:B:3:SER:N	1:B:3:SER:CA	1:B:3:SER:C	1:B:4:PRO:N	8	16.4
(1,162)	1:B:3:SER:N	1:B:3:SER:CA	1:B:3:SER:C	1:B:4:PRO:N	19	12.9
(1,2)	1:A:3:SER:N	1:A:3:SER:CA	1:A:3:SER:C	1:A:4:PRO:N	17	12.8