wwPDB NMR Structure Validation Summary Report

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PDB ID	:	7JYN
BMRB ID	:	30790
Title	:	Solution NMR structure of human Brd3 ET complexed with NSD3(148-184) peptide
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Deposited on	:	2020-08-31

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 (1)) were used in the production of this report:

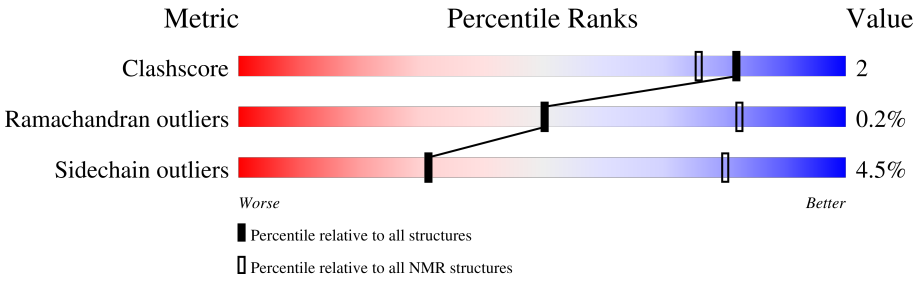
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
BMRB Restraints Analysis	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal 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 79%.

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	96	70% . 29%
2	B	39	28% 72%

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: *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:26-A:93, B:153-B:159, B:168-B:171 (79)	0.75	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 2 clusters and 6 single-model clusters were found.

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

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 2167 atoms, of which 1075 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Bromodomain-containing protein 3.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	96	1562	484	773	146	156	3	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	HIS	-	expression tag	UNP Q15059
A	2	HIS	-	expression tag	UNP Q15059
A	3	HIS	-	expression tag	UNP Q15059
A	4	HIS	-	expression tag	UNP Q15059
A	5	HIS	-	expression tag	UNP Q15059
A	6	HIS	-	expression tag	UNP Q15059
A	7	SER	-	expression tag	UNP Q15059
A	8	HIS	-	expression tag	UNP Q15059
A	9	MET	-	expression tag	UNP Q15059

- Molecule 2 is a protein called Histone-lysine N-methyltransferase NSD3.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
2	B	39	605	188	302	49	65	1	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	146	GLU	-	expression tag	UNP Q9BZ95
B	147	PHE	-	expression tag	UNP Q9BZ95

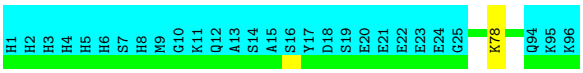
4 Residue-property plots

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.

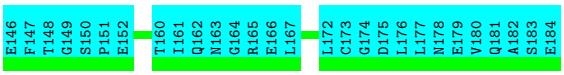
• Molecule 1: Bromodomain-containing protein 3

Chain A:



• Molecule 2: Histone-lysine N-methyltransferase NSD3

Chain B:

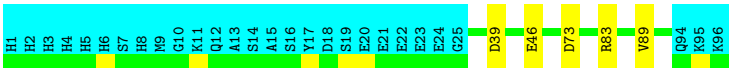


4.2 Residue scores for the representative (medoid) model from the NMR ensemble

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

• Molecule 1: Bromodomain-containing protein 3

Chain A:



• Molecule 2: Histone-lysine N-methyltransferase NSD3

Chain B:

5 Refinement protocol and experimental data overview

The models were refined using the following method: *distance geometry*.

Of the 100 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
ASDP	geometry optimization	2.3
CYANA	structure calculation	3.98.13
CNS	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	1368
Number of shifts mapped to atoms	1368
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	79%

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±0.03	0±0/568 (0.0± 0.0%)	0.63±0.02	0±0/767 (0.0± 0.0%)
2	B	0.78±0.04	0±0/91 (0.0± 0.0%)	0.63±0.05	0±0/120 (0.0± 0.0%)
All	All	0.85	0/13180 (0.0%)	0.63	1/17740 (0.0%)

There are no bond-length outliers.

All unique angle outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})	Models	
								Worst	Total
1	A	83	ARG	NE-CZ-NH1	5.67	123.13	120.30	14	1

There are no chirality outliers.

There are no planarity outliers.

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	559	572	571	3±2
2	B	90	104	104	1±1
All	All	12980	13520	13500	65

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.

5 of 49 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:33:LYS:HG2	1:A:75:GLU:HA	0.60	1.74	1	1
2:B:159:LYS:HA	2:B:168:PHE:HB3	0.56	1.75	6	2
1:A:33:LYS:HE2	1:A:82:LEU:HD11	0.54	1.79	10	1
1:A:62:LEU:HD13	1:A:71:GLU:HB2	0.54	1.78	4	1
1:A:39:ASP:HB3	1:A:89:VAL:HG11	0.54	1.79	14	3

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	68/96 (71%)	64±1 (94±2%)	4±2 (6±2%)	0±0 (0±1%)	50	82
2	B	11/39 (28%)	10±1 (86±8%)	2±1 (14±8%)	0±0 (0±0%)	100	100
All	All	1580/2700 (59%)	1463 (93%)	114 (7%)	3 (0%)	50	82

All 2 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	27	PRO	2
1	A	65	SER	1

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	66/90 (73%)	63±2 (96±2%)	3±2 (4±2%)	34	82
2	B	11/35 (31%)	10±1 (93±7%)	1±1 (7±7%)	19	68
All	All	1540/2500 (62%)	1471 (96%)	69 (4%)	31	80

5 of 24 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	87	ARG	8
1	A	78	LYS	7
1	A	46	GLU	5
2	B	154	LYS	5
1	A	58	ARG	4

6.3.3 RNA

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains

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

6.5 Carbohydrates

There are no monosaccharides in this entry.

6.6 Ligand geometry

There are no ligands in this entry.

6.7 Other polymers

There are no such molecules in this entry.

6.8 Polymer linkage issues

There are no chain breaks in this entry.

7 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 79% for the well-defined parts and 73% 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	1368
Number of shifts mapped to atoms	1368
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	1

7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	127	-0.37 ± 0.09	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	120	0.06 ± 0.08	None needed (< 0.5 ppm)
$^{13}C'$	0	—	None (insufficient data)
^{15}N	114	-0.17 ± 0.19	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 79%, i.e. 915 atoms were assigned a chemical shift out of a possible 1152. 0 out of 14 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	308/387 (80%)	155/155 (100%)	79/158 (50%)	74/74 (100%)
Sidechain	571/719 (79%)	388/463 (84%)	179/224 (80%)	4/32 (12%)

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	Total	^{1}H	^{13}C	^{15}N
Aromatic	36/46 (78%)	18/22 (82%)	18/22 (82%)	0/2 (0%)
Overall	915/1152 (79%)	561/640 (88%)	276/404 (68%)	78/108 (72%)

7.1.4 Statistically unusual chemical shifts

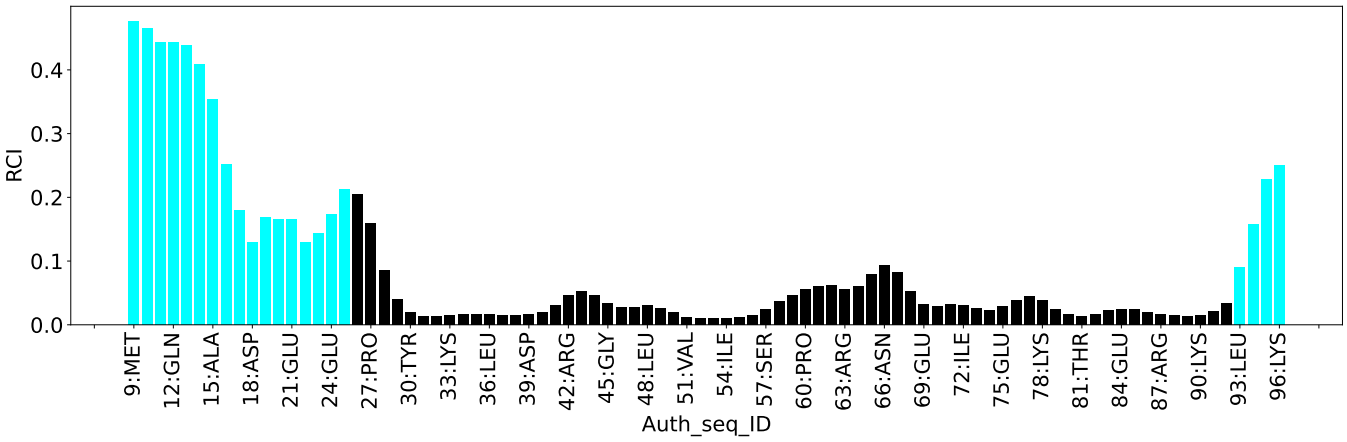
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, *ppm*	Expected range, *ppm*	Z-score
1	B	159	LYS	HD3	0.52	0.54 – 2.65	-5.1

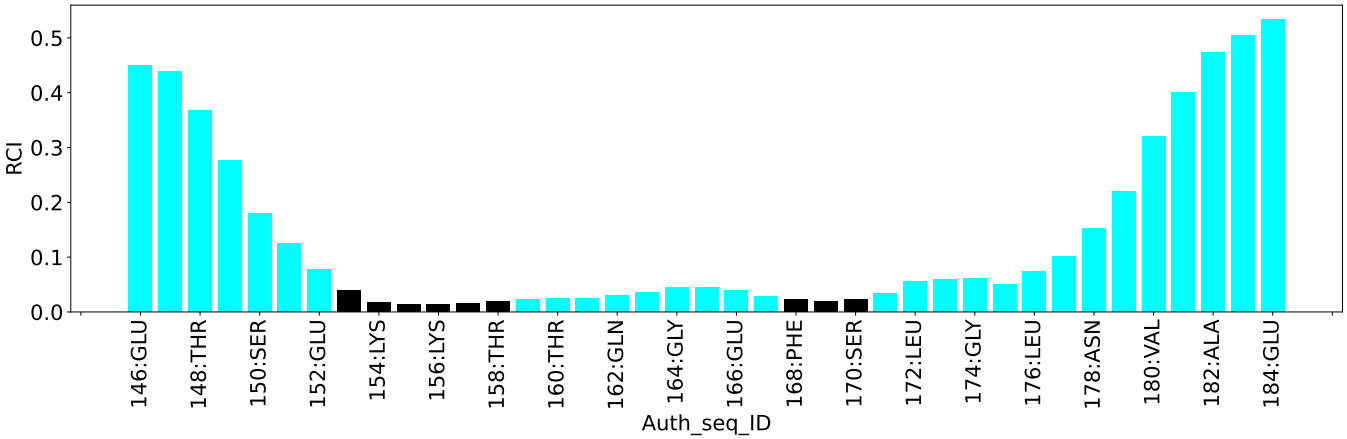
7.1.5 Random Coil Index (RCI) plots

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:



Random coil index (RCI) for chain B:


RCI
0.0
0.1
0.2
0.3
0.4
0.5
146:GLU
148:THR
150:SER
152:GLU
154:LYS
156:LYS
158:THR
160:THR
162:GLN
164:GLY
166:GLU
168:PHE
170:SER
172:LEU
174:GLY
176:LEU
178:ASN
180:VAL
182:ALA
184:GLU
Auth_seq_ID

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	1754
Intra-residue (|i-j|=0)	456
Sequential (|i-j|=1)	573
Medium range (|i-j|>1 and |i-j|<5)	366
Long range (|i-j|≥5)	222
Inter-chain	87
Hydrogen bond restraints	50
Disulfide bond restraints	0
Total dihedral-angle restraints	138
Number of unmapped restraints	0
Number of restraints per residue	14.0
Number of long range restraints per residue[1]	1.6

[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

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)	12.3	0.2
0.2-0.5 (Medium)	4.9	0.44
>0.5 (Large)	0.1	0.57

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)	4.7	5.8
10.0-20.0 (Medium)	None	None
>20.0 (Large)	None	None

9 Distance violation analysis (i)

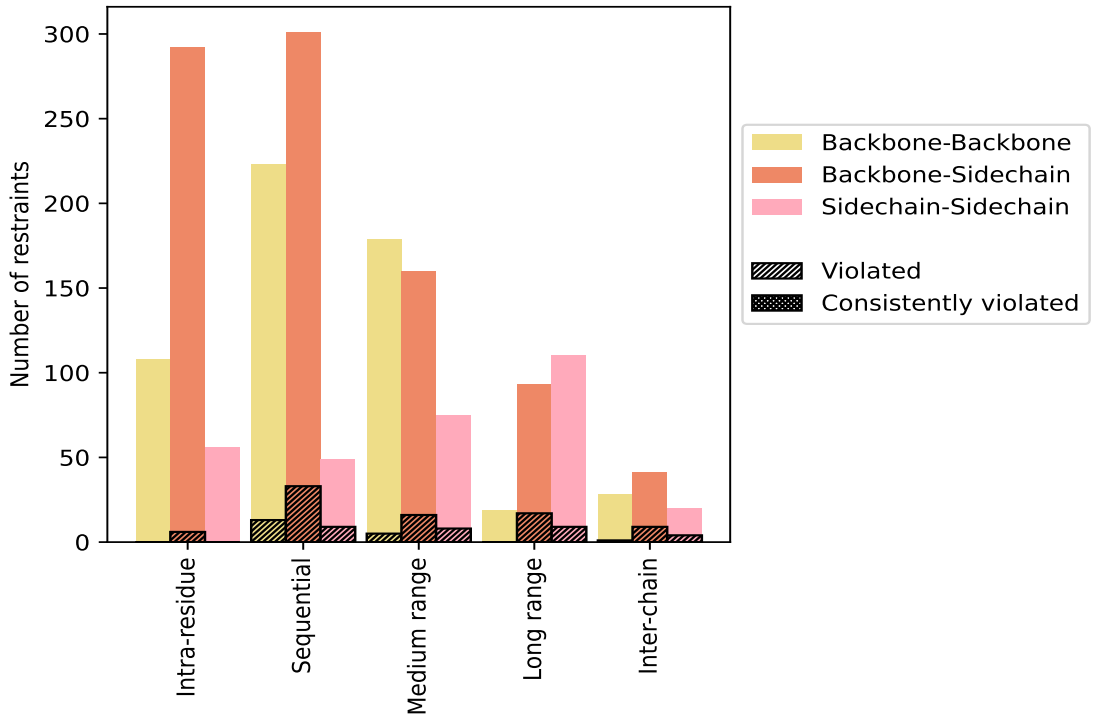
9.1 Summary of distance violations (i)

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)	456	26.0	6	1.3	0.3	0	0.0	0.0
Backbone-Backbone	108	6.2	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	292	16.6	6	2.1	0.3	0	0.0	0.0
Sidechain-Sidechain	56	3.2	0	0.0	0.0	0	0.0	0.0
Sequential (|i-j|=1)	573	32.7	55	9.6	3.1	0	0.0	0.0
Backbone-Backbone	223	12.7	13	5.8	0.7	0	0.0	0.0
Backbone-Sidechain	301	17.2	33	11.0	1.9	0	0.0	0.0
Sidechain-Sidechain	49	2.8	9	18.4	0.5	0	0.0	0.0
Medium range (|i-j|>1 & |i-j|<5)	366	20.9	26	7.1	1.5	0	0.0	0.0
Backbone-Backbone	131	7.5	2	1.5	0.1	0	0.0	0.0
Backbone-Sidechain	160	9.1	16	10.0	0.9	0	0.0	0.0
Sidechain-Sidechain	75	4.3	8	10.7	0.5	0	0.0	0.0
Long range (|i-j|≥5)	222	12.7	26	11.7	1.5	0	0.0	0.0
Backbone-Backbone	19	1.1	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	93	5.3	17	18.3	1.0	0	0.0	0.0
Sidechain-Sidechain	110	6.3	9	8.2	0.5	0	0.0	0.0
Inter-chain	87	5.0	14	16.1	0.8	0	0.0	0.0
Backbone-Backbone	26	1.5	1	3.8	0.1	0	0.0	0.0
Backbone-Sidechain	41	2.3	9	22.0	0.5	0	0.0	0.0
Sidechain-Sidechain	20	1.1	4	20.0	0.2	0	0.0	0.0
Hydrogen bond	50	2.9	3	6.0	0.2	0	0.0	0.0
Disulfide bond	0	0.0	0	0.0	0.0	0	0.0	0.0
Total	1754	100.0	130	7.4	7.4	0	0.0	0.0
Backbone-Backbone	557	31.8	19	3.4	1.1	0	0.0	0.0
Backbone-Sidechain	887	50.6	81	9.1	4.6	0	0.0	0.0
Sidechain-Sidechain	310	17.7	30	9.7	1.7	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



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	0	4	4	2	1	11	0.18	0.26	0.06	0.16
2	0	7	5	3	2	17	0.16	0.27	0.05	0.15
3	1	6	2	3	2	14	0.17	0.28	0.05	0.17
4	0	6	3	4	2	15	0.17	0.27	0.06	0.14
5	1	8	5	3	2	19	0.18	0.36	0.06	0.17
6	0	7	6	3	2	18	0.18	0.3	0.05	0.18
7	0	9	3	3	4	19	0.19	0.34	0.06	0.18
8	0	9	3	3	2	17	0.16	0.27	0.05	0.14
9	0	7	4	5	2	18	0.17	0.28	0.04	0.16
10	1	12	3	4	4	24	0.22	0.57	0.13	0.17
11	1	5	3	0	4	13	0.15	0.22	0.04	0.14

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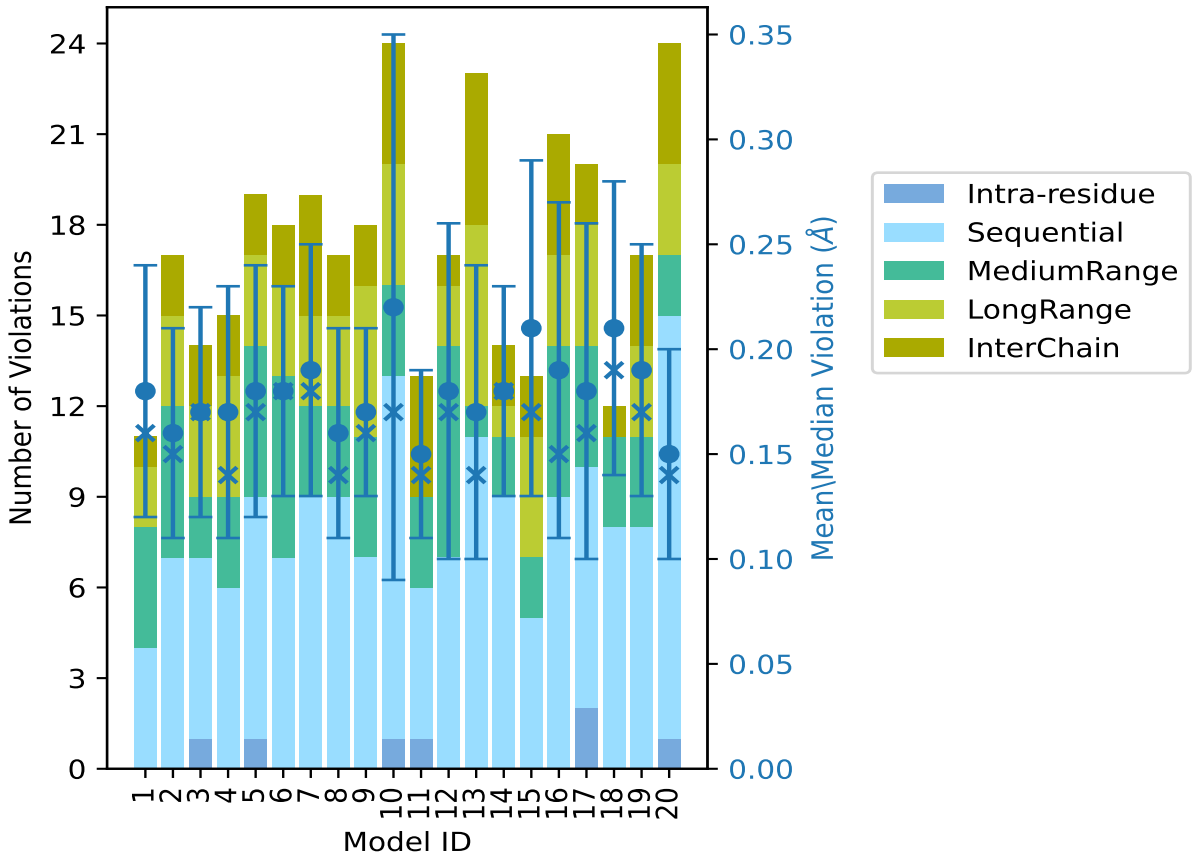
Model ID	Number of violations						Mean (Å)	Max (Å)	SD[6] (Å)	Median (Å)
	IR[1]	SQ[2]	MR[3]	LR[4]	IC[5]	Total				
12	0	7	7	2	1	17	0.18	0.4	0.08	0.17
13	0	11	1	6	5	23	0.17	0.4	0.07	0.14
14	0	9	2	1	2	14	0.18	0.27	0.05	0.18
15	0	5	2	4	2	13	0.21	0.37	0.08	0.17
16	0	9	5	3	4	21	0.19	0.37	0.08	0.15
17	2	8	4	4	2	20	0.18	0.44	0.08	0.16
18	0	8	3	0	1	12	0.21	0.35	0.07	0.19
19	0	8	3	3	3	17	0.19	0.29	0.06	0.17
20	1	14	2	3	4	24	0.15	0.32	0.05	0.14

[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

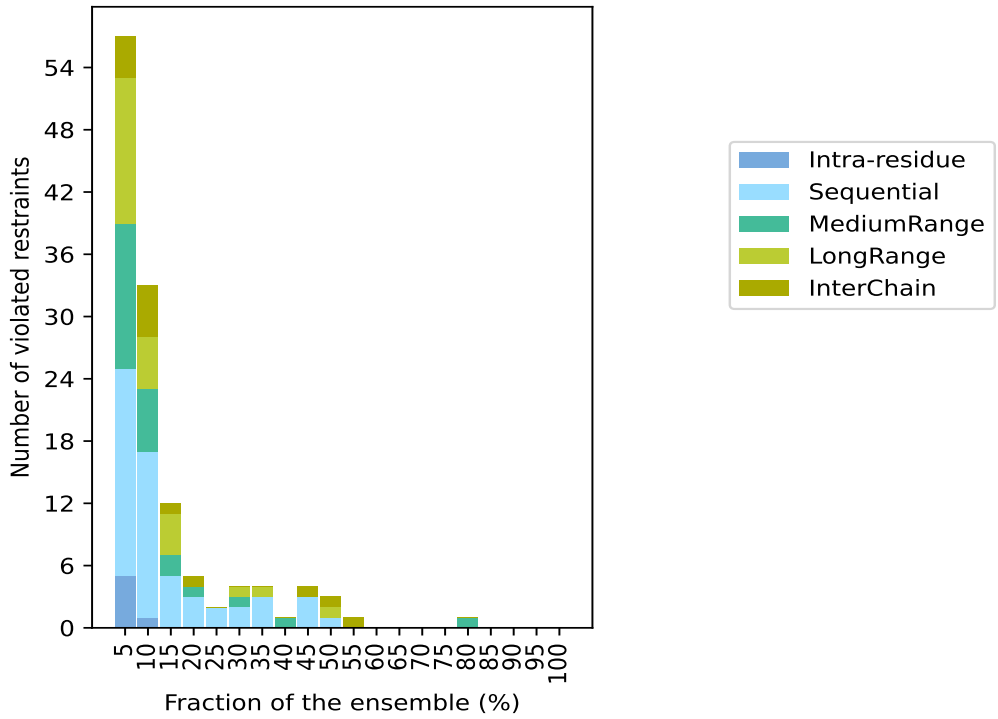
9.3 Distance violation statistics for the ensemble (i)

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, 1577(IR:450, SQ:518, MR:340, LR:196, IC:73) 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]	%
5	20	14	14	4	57	1	5.0
1	16	6	5	5	33	2	10.0
0	5	2	4	1	12	3	15.0
0	3	1	0	1	5	4	20.0
0	2	0	0	0	2	5	25.0
0	2	1	1	0	4	6	30.0
0	3	0	1	0	4	7	35.0
0	0	1	0	0	1	8	40.0
0	3	0	0	1	4	9	45.0
0	1	0	1	1	3	10	50.0
0	0	0	0	1	1	11	55.0
0	0	0	0	0	0	12	60.0
0	0	0	0	0	0	13	65.0
0	0	0	0	0	0	14	70.0
0	0	0	0	0	0	15	75.0
0	0	1	0	0	1	16	80.0
0	0	0	0	0	0	17	85.0
0	0	0	0	0	0	18	90.0
0	0	0	0	0	0	19	95.0
0	0	0	0	0	0	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

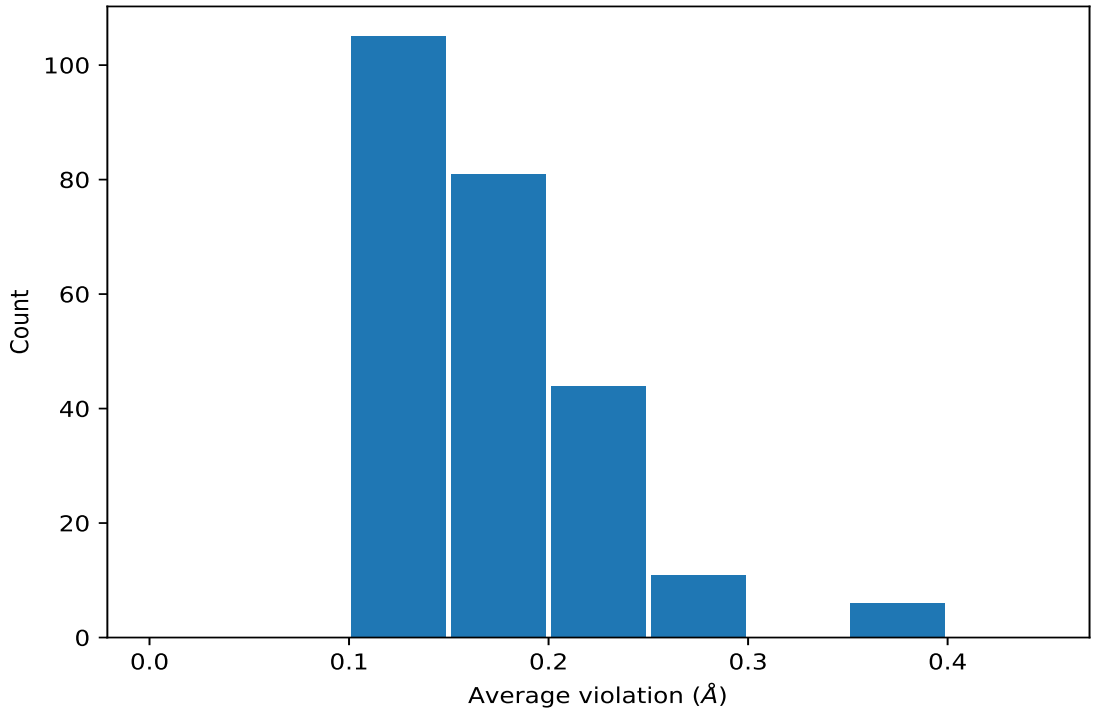
9.3.1 Bar graph : Distance violation statistics for the ensemble



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)
(1,1256)	1:A:80:THR:HG21	1:A:82:LEU:H	16	0.2	0.04	0.2
(1,1256)	1:A:80:THR:HG22	1:A:82:LEU:H	16	0.2	0.04	0.2
(1,1256)	1:A:80:THR:HG23	1:A:82:LEU:H	16	0.2	0.04	0.2
(1,651)	1:A:52:VAL:H	2:B:168:PHE:HZ	11	0.26	0.09	0.27
(1,1596)	2:B:166:GLU:HB2	2:B:167:LEU:H	10	0.21	0.08	0.2
(1,1596)	2:B:166:GLU:HB3	2:B:167:LEU:H	10	0.21	0.08	0.2
(1,1013)	1:A:70:ILE:H	2:B:158:THR:HG21	10	0.18	0.05	0.18
(1,1013)	1:A:70:ILE:H	2:B:158:THR:HG22	10	0.18	0.05	0.18
(1,1013)	1:A:70:ILE:H	2:B:158:THR:HG23	10	0.18	0.05	0.18
(1,809)	1:A:56:GLN:HA	1:A:70:ILE:HD11	10	0.16	0.04	0.17
(1,809)	1:A:56:GLN:HA	1:A:70:ILE:HD12	10	0.16	0.04	0.17
(1,809)	1:A:56:GLN:HA	1:A:70:ILE:HD13	10	0.16	0.04	0.17
(1,91)	1:A:21:GLU:HB2	1:A:22:GLU:H	9	0.21	0.07	0.2
(1,91)	1:A:21:GLU:HB3	1:A:22:GLU:H	9	0.21	0.07	0.2
(1,1034)	1:A:70:ILE:HD11	2:B:157:ILE:HD11	9	0.18	0.08	0.15
(1,1034)	1:A:70:ILE:HD11	2:B:157:ILE:HD12	9	0.18	0.08	0.15

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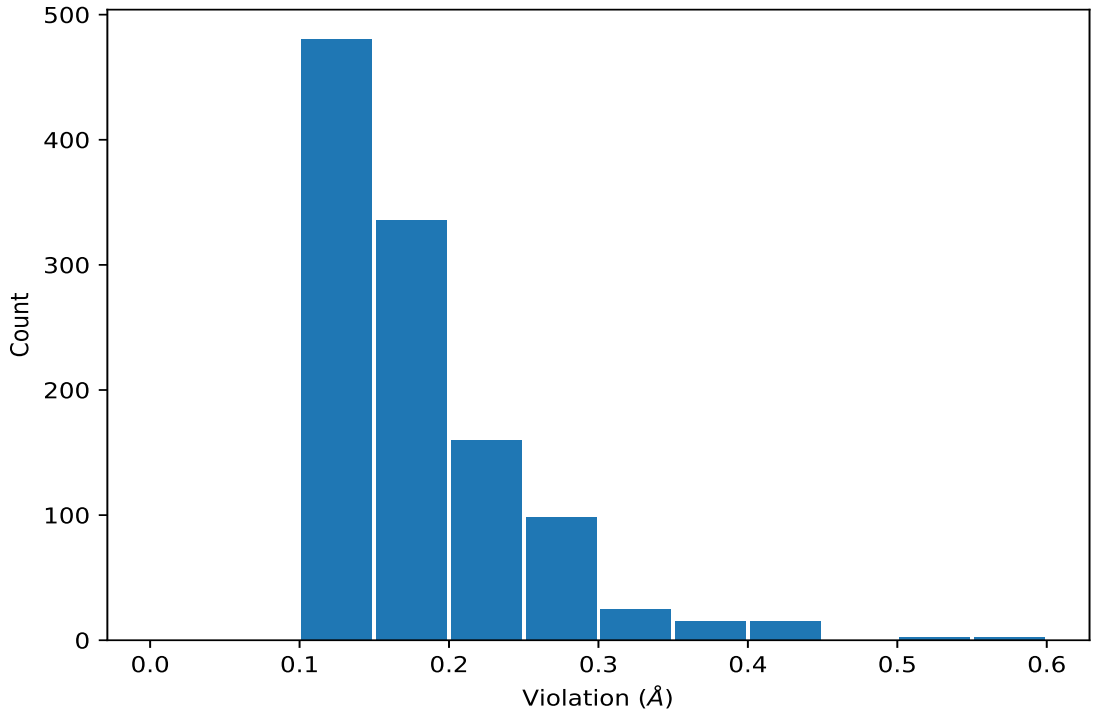
Key	Atom-1	Atom-2	Models[1]	Mean (Å)	SD[1] (Å)	Median (Å)
(1,1034)	1:A:70:ILE:HD11	2:B:157:ILE:HD13	9	0.18	0.08	0.15
(1,1034)	1:A:70:ILE:HD12	2:B:157:ILE:HD11	9	0.18	0.08	0.15
(1,1034)	1:A:70:ILE:HD12	2:B:157:ILE:HD12	9	0.18	0.08	0.15
(1,1034)	1:A:70:ILE:HD12	2:B:157:ILE:HD13	9	0.18	0.08	0.15
(1,1034)	1:A:70:ILE:HD13	2:B:157:ILE:HD11	9	0.18	0.08	0.15
(1,1034)	1:A:70:ILE:HD13	2:B:157:ILE:HD12	9	0.18	0.08	0.15
(1,1034)	1:A:70:ILE:HD13	2:B:157:ILE:HD13	9	0.18	0.08	0.15
(1,387)	1:A:38:LEU:HG	1:A:39:ASP:H	9	0.17	0.04	0.16
(1,109)	1:A:24:GLU:HA	1:A:25:GLY:H	9	0.13	0.02	0.12
(1,223)	1:A:30:TYR:HD1	1:A:34:ARG:H	8	0.13	0.01	0.13

[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 (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)
(1,1641)	2:B:175:ASP:HB2	2:B:176:LEU:H	10	0.57
(1,1641)	2:B:175:ASP:HB3	2:B:176:LEU:H	10	0.57
(1,328)	1:A:36:LEU:HA	1:A:39:ASP:HB2	10	0.52
(1,328)	1:A:36:LEU:HA	1:A:39:ASP:HB3	10	0.52
(1,1568)	2:B:160:THR:H	2:B:167:LEU:HD11	17	0.44
(1,1568)	2:B:160:THR:H	2:B:167:LEU:HD12	17	0.44
(1,1568)	2:B:160:THR:H	2:B:167:LEU:HD13	17	0.44
(1,1568)	2:B:160:THR:H	2:B:167:LEU:HD21	17	0.44
(1,1568)	2:B:160:THR:H	2:B:167:LEU:HD22	17	0.44
(1,1568)	2:B:160:THR:H	2:B:167:LEU:HD23	17	0.44
(1,651)	1:A:52:VAL:H	2:B:168:PHE:HZ	10	0.43
(1,1446)	1:A:93:LEU:HB2	1:A:94:GLN:HG2	12	0.4
(1,1446)	1:A:93:LEU:HB2	1:A:94:GLN:HG3	12	0.4
(1,1446)	1:A:93:LEU:HB3	1:A:94:GLN:HG2	12	0.4
(1,1446)	1:A:93:LEU:HB3	1:A:94:GLN:HG3	12	0.4
(1,1398)	1:A:89:VAL:HB	1:A:90:LYS:HG2	10	0.4
(1,1398)	1:A:89:VAL:HB	1:A:90:LYS:HG3	10	0.4
(1,102)	1:A:23:GLU:HB2	1:A:24:GLU:H	13	0.4
(1,102)	1:A:23:GLU:HB3	1:A:24:GLU:H	13	0.4
(1,651)	1:A:52:VAL:H	2:B:168:PHE:HZ	16	0.37
(1,1596)	2:B:166:GLU:HB2	2:B:167:LEU:H	15	0.37
(1,1596)	2:B:166:GLU:HB3	2:B:167:LEU:H	15	0.37
(1,91)	1:A:21:GLU:HB2	1:A:22:GLU:H	16	0.36

10 Dihedral-angle violation analysis

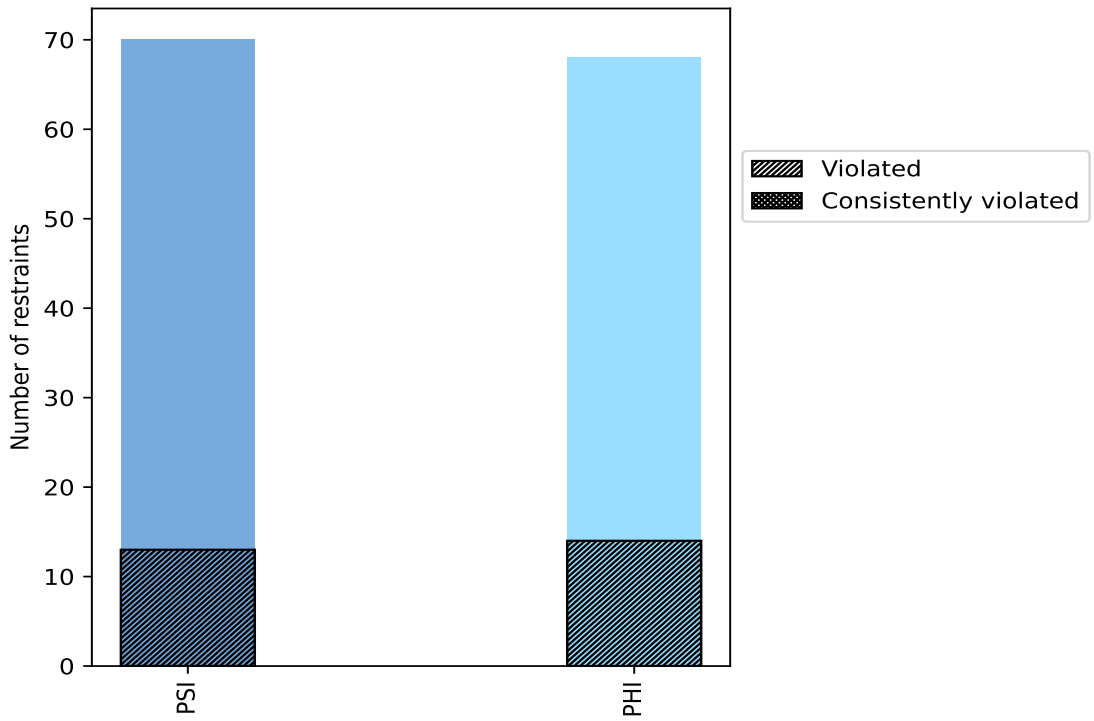
10.1 Summary of dihedral-angle violations

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	70	50.7	13	18.6	9.4	0	0.0	0.0
PHI	68	49.3	14	20.6	10.1	0	0.0	0.0
Total	138	100.0	27	19.6	19.6	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



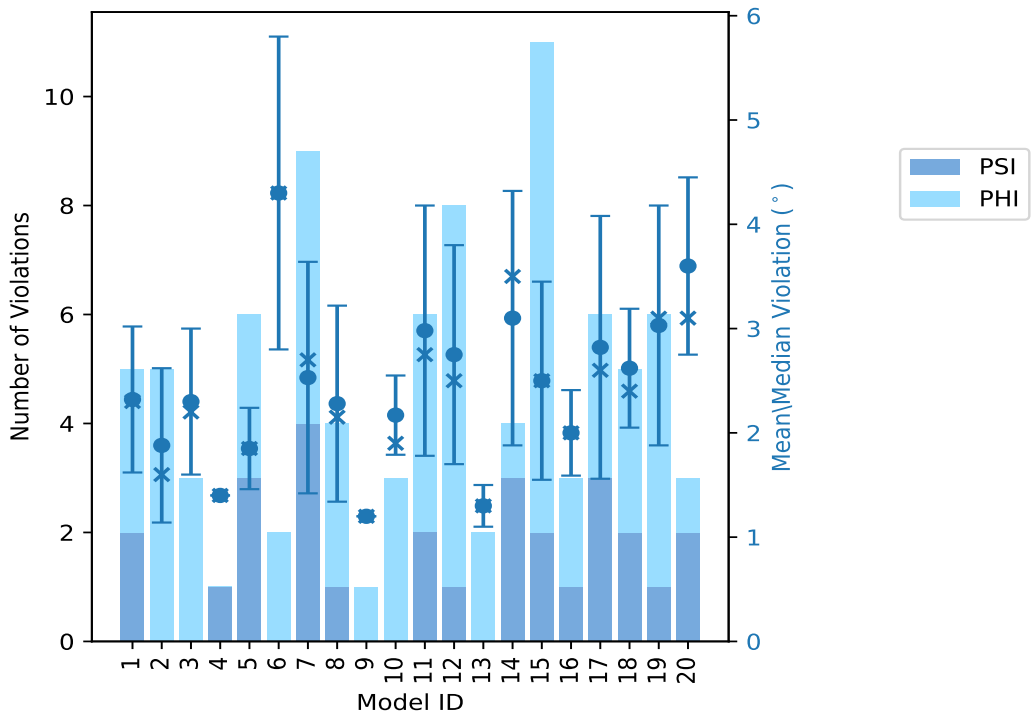
Violated and consistently violated restraints are shown using different hatch patterns in their respective categories

10.2 Dihedral-angle violation statistics for each model (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	2	3	5	2.32	3.0	0.7	2.3
2	0	5	5	1.88	3.3	0.74	1.6
3	0	3	3	2.3	3.2	0.7	2.2
4	1	0	1	1.4	1.4	0.0	1.4
5	3	3	6	1.85	2.6	0.39	1.85
6	0	2	2	4.3	5.8	1.5	4.3
7	4	5	9	2.53	5.1	1.11	2.7
8	1	3	4	2.28	3.7	0.94	2.15
9	0	1	1	1.2	1.2	0.0	1.2
10	0	3	3	2.17	2.7	0.38	1.9
11	2	4	6	2.98	5.2	1.2	2.75
12	1	7	8	2.75	4.4	1.05	2.5
13	0	2	2	1.3	1.5	0.2	1.3
14	3	1	4	3.1	4.3	1.22	3.5
15	2	9	11	2.5	4.3	0.95	2.5
16	1	2	3	2.0	2.5	0.41	2.0
17	3	3	6	2.82	4.7	1.26	2.6
18	2	3	5	2.62	3.6	0.57	2.4
19	1	5	6	3.03	4.4	1.15	3.1
20	2	1	3	3.6	4.8	0.85	3.1

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]	%
4	3	7	1	5.0
3	2	5	2	10.0
6	2	8	3	15.0
0	1	1	4	20.0
0	3	3	5	25.0
0	0	0	6	30.0
0	0	0	7	35.0
0	2	2	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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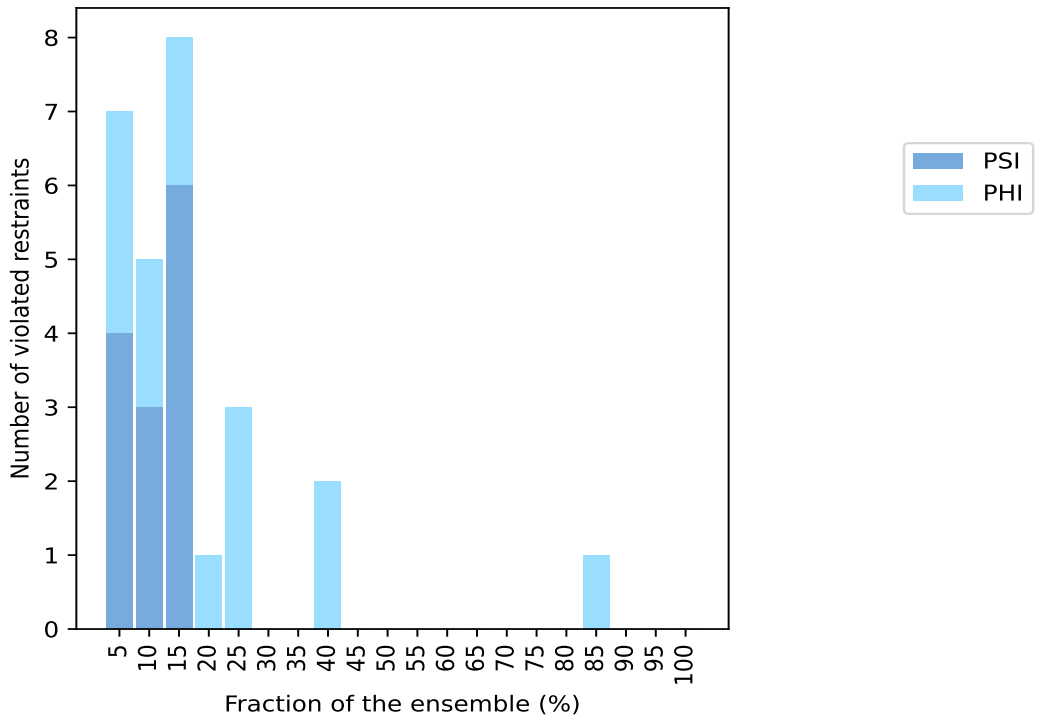
Number of violated restraints			Fraction of the ensemble	
PSI	PHI	Total	Count[1]	%
0	0	0	12	60.0
0	0	0	13	65.0
0	0	0	14	70.0
0	0	0	15	75.0
0	0	0	16	80.0
0	1	1	17	85.0
0	0	0	18	90.0
0	0	0	19	95.0
0	0	0	20	100.0

[1] Number of models with violations

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

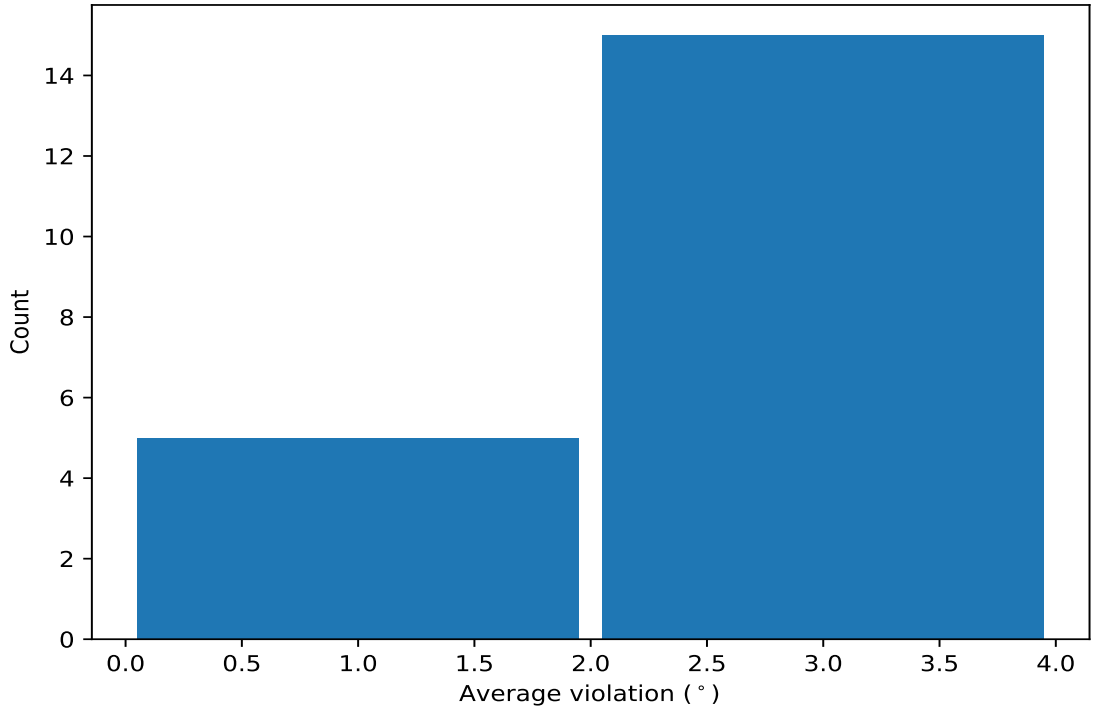


10.4 Most violated dihedral-angle restraints in the ensemble

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 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.

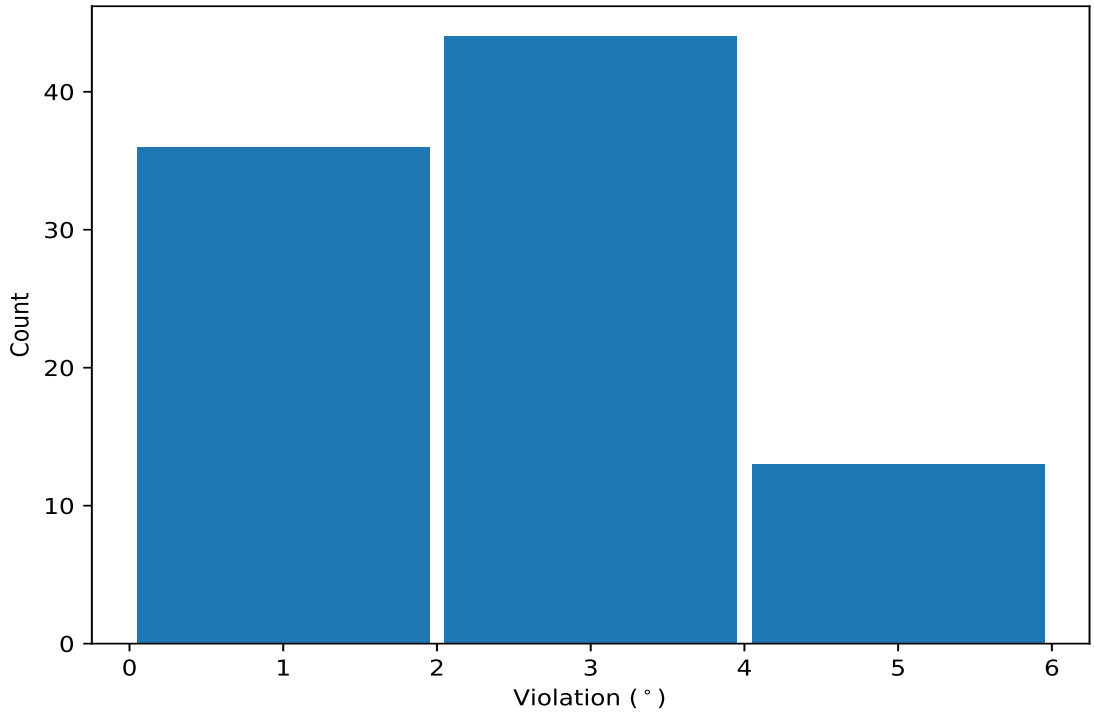
Key	Atom-1	Atom-2	Atom-3	Atom-4	Models[1]	Mean	SD[2]	Median
(2,5)	1:A:27:PRO:C	1:A:28:MET:N	1:A:28:MET:CA	1:A:28:MET:C	17	3.23	1.19	3.2
(2,62)	1:A:65:SER:C	1:A:66:ASN:N	1:A:66:ASN:CA	1:A:66:ASN:C	8	2.35	1.45	1.6
(2,135)	2:B:169:GLU:C	2:B:170:SER:N	2:B:170:SER:CA	2:B:170:SER:C	8	1.92	0.69	1.8
(2,123)	2:B:160:THR:C	2:B:161:ILE:N	2:B:161:ILE:CA	2:B:161:ILE:C	5	3.0	0.59	3.0
(2,113)	2:B:155:LEU:C	2:B:156:LYS:N	2:B:156:LYS:CA	2:B:156:LYS:C	5	2.64	0.45	2.7
(2,115)	2:B:156:LYS:C	2:B:157:ILE:N	2:B:157:ILE:CA	2:B:157:ILE:C	5	1.7	0.28	1.8
(2,119)	2:B:158:THR:C	2:B:159:LYS:N	2:B:159:LYS:CA	2:B:159:LYS:C	4	2.55	0.85	2.55
(2,126)	2:B:162:GLN:N	2:B:162:GLN:CA	2:B:162:GLN:C	2:B:163:ASN:N	3	3.67	0.98	3.8
(2,66)	1:A:69:GLU:C	1:A:70:ILE:N	1:A:70:ILE:CA	1:A:70:ILE:C	3	3.13	1.02	3.1
(2,117)	2:B:157:ILE:C	2:B:158:THR:N	2:B:158:THR:CA	2:B:158:THR:C	3	2.47	1.58	1.5

[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 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 (°)
(2,5)	1:A:27:PRO:C	1:A:28:MET:N	1:A:28:MET:CA	1:A:28:MET:C	6	5.8
(2,62)	1:A:65:SER:C	1:A:66:ASN:N	1:A:66:ASN:CA	1:A:66:ASN:C	11	5.2
(2,5)	1:A:27:PRO:C	1:A:28:MET:N	1:A:28:MET:CA	1:A:28:MET:C	7	5.1
(2,126)	2:B:162:GLN:N	2:B:162:GLN:CA	2:B:162:GLN:C	2:B:163:ASN:N	20	4.8
(2,117)	2:B:157:ILE:C	2:B:158:THR:N	2:B:158:THR:CA	2:B:158:THR:C	17	4.7
(2,66)	1:A:69:GLU:C	1:A:70:ILE:N	1:A:70:ILE:CA	1:A:70:ILE:C	12	4.4
(2,62)	1:A:65:SER:C	1:A:66:ASN:N	1:A:66:ASN:CA	1:A:66:ASN:C	19	4.4
(2,5)	1:A:27:PRO:C	1:A:28:MET:N	1:A:28:MET:CA	1:A:28:MET:C	12	4.4
(2,5)	1:A:27:PRO:C	1:A:28:MET:N	1:A:28:MET:CA	1:A:28:MET:C	15	4.3
(2,124)	2:B:161:ILE:N	2:B:161:ILE:CA	2:B:161:ILE:C	2:B:162:GLN:N	14	4.3