



# wwPDB NMR Structure Validation Summary Report ⓘ

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PDB ID : 4A1M  
BMRB ID : 17953  
Title : NMR Structure of protoporphyrin-IX bound murine p22HBP  
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<https://www.wwpdb.org/validation/2017/NMRValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) 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

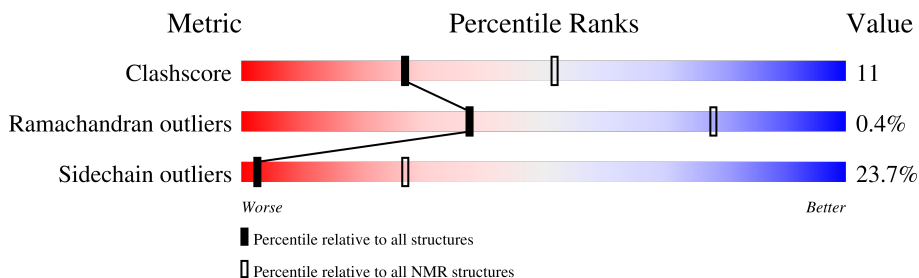
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*SOLUTION NMR*

The overall completeness of chemical shifts assignment is 84%.

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and a grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	195	

## 2 Ensemble composition and analysis

This entry contains 20 models. Model 1 is the overall representative, medoid model (most similar to other models).

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:18-A:73, A:78-A:172, A:181-A:190 (161)	0.73	1

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 2 single-model clusters were found.

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

### 3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 2814 atoms, of which 1381 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called HEME-BINDING PROTEIN 1.

Mol	Chain	Residues	Atoms					Trace	
			Total	C	H	N	O		S
1	A	184	2814	911	1381	236	279	7	0

There are 11 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	MET	-	expression tag	UNP Q9R257
A	-3	LYS	-	expression tag	UNP Q9R257
A	-2	ASN	-	expression tag	UNP Q9R257
A	-1	SER	-	expression tag	UNP Q9R257
A	0	THR	-	expression tag	UNP Q9R257
A	1	HIS	-	expression tag	UNP Q9R257
A	2	HIS	-	expression tag	UNP Q9R257
A	3	HIS	-	expression tag	UNP Q9R257
A	4	HIS	-	expression tag	UNP Q9R257
A	5	HIS	-	expression tag	UNP Q9R257
A	6	HIS	-	expression tag	UNP Q9R257



## 5 Refinement protocol and experimental data overview

Of the 100 calculated structures, 20 were deposited, based on the following criterion: *target function*.

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

Software name	Classification	Version
CYANA	refinement	
CYANA	structure solution	2.1

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	1903
Number of shifts mapped to atoms	1903
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	84%

## 6 Model quality [i](#)

### 6.1 Standard geometry [i](#)

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

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 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	1261	1220	1220	27±5
All	All	25220	24400	24400	542

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 11.

5 of 163 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:151:LEU:HD23	1:A:187:LEU:HD12	0.98	1.30	2	7
1:A:51:VAL:HG13	1:A:98:LEU:HD13	0.78	1.55	17	11
1:A:44:VAL:HG22	1:A:100:VAL:HB	0.69	1.63	1	3
1:A:85:ALA:HB2	1:A:168:TYR:CZ	0.68	2.23	14	3
1:A:98:LEU:HD13	1:A:99:LYS:N	0.66	2.05	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	160/195 (82%)	152±1 (95±1%)	7±1 (4±1%)	1±1 (0±0%)	38	78
All	All	3200/3900 (82%)	3043 (95%)	144 (4%)	13 (0%)	38	78

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	96	LYS	12
1	A	136	GLY	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	133/163 (82%)	102±4 (76±3%)	32±4 (24±3%)	2	27
All	All	2660/3260 (82%)	2030 (76%)	630 (24%)	2	27

5 of 94 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	78	MET	19
1	A	40	LYS	18
1	A	80	VAL	18
1	A	143	ASP	18
1	A	116	SER	17

### 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 84% for the well-defined parts and 79% for the entire structure.

### 7.1 Chemical shift list 1

File name: working\_cs.cif

Chemical shift list name: *deposit2\_1.bmr.b.csh*

#### 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	1903
Number of shifts mapped to atoms	1903
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	13

#### 7.1.2 Chemical shift referencing [i](#)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction $\pm$ precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	167	$-0.37 \pm 0.09$	None needed (< 0.5 ppm)
$^{13}\text{C}_\beta$	151	$-0.31 \pm 0.08$	None needed (< 0.5 ppm)
$^{13}\text{C}'$	145	$0.01 \pm 0.10$	None needed (< 0.5 ppm)
$^{15}\text{N}$	154	$0.43 \pm 0.42$	None needed (< 0.5 ppm)

#### 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 84%, i.e. 1789 atoms were assigned a chemical shift out of a possible 2128. 0 out of 23 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	$^1\text{H}$	$^{13}\text{C}$	$^{15}\text{N}$
Backbone	765/802 (95%)	323/328 (98%)	297/322 (92%)	145/152 (95%)
Sidechain	901/1142 (79%)	619/738 (84%)	273/360 (76%)	9/44 (20%)

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	Total	<sup>1</sup> H	<sup>13</sup> C	<sup>15</sup> N
Aromatic	123/184 (67%)	77/88 (88%)	43/92 (47%)	3/4 (75%)
Overall	1789/2128 (84%)	1019/1154 (88%)	613/774 (79%)	157/200 (78%)

#### 7.1.4 Statistically unusual chemical shifts [i](#)

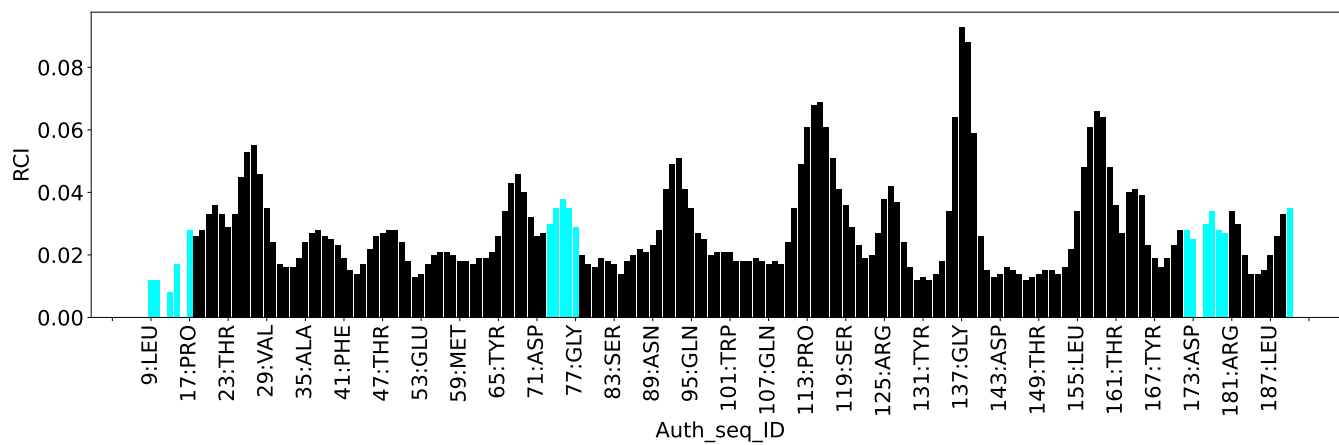
The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

List Id	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	103	ARG	HG2	-0.44	0.26 – 2.87	-7.7
1	A	103	ARG	HG3	-0.52	0.15 – 2.94	-7.4
1	A	103	ARG	HD3	1.22	1.81 – 4.39	-7.3
1	A	183	ASN	HB3	0.58	1.12 – 4.38	-6.7
1	A	43	THR	HG21	0.01	0.08 – 2.19	-5.3
1	A	43	THR	HG22	0.01	0.08 – 2.19	-5.3
1	A	43	THR	HG23	0.01	0.08 – 2.19	-5.3
1	A	130	VAL	HG11	-0.53	-0.48 – 2.12	-5.2
1	A	130	VAL	HG12	-0.53	-0.48 – 2.12	-5.2
1	A	130	VAL	HG13	-0.53	-0.48 – 2.12	-5.2
1	A	81	PRO	HB2	0.31	0.37 – 3.78	-5.2
1	A	103	ARG	HB2	0.47	0.52 – 3.08	-5.2
1	A	176	MET	CG	38.63	25.46 – 38.60	5.0

#### 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

### 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	1573
Intra-residue ( $ i-j =0$ )	281
Sequential ( $ i-j =1$ )	343
Medium range ( $ i-j >1$ and $ i-j <5$ )	248
Long range ( $ i-j \geq 5$ )	701
Inter-chain	0
Hydrogen bond restraints	0
Disulfide bond restraints	0
Total dihedral-angle restraints	0
Number of unmapped restraints	0
Number of restraints per residue	8.1
Number of long range restraints per residue <sup>1</sup>	3.6

<sup>1</sup>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)	8.8	0.2
0.2-0.5 (Medium)	1.8	0.38
>0.5 (Large)	None	None

### 8.2.2 Average number of dihedral-angle violations per model

Dihedral-angle violations less than  $1^\circ$  are not included in the calculation. There are no dihedral-angle violations

## 9 Distance violation analysis [i](#)

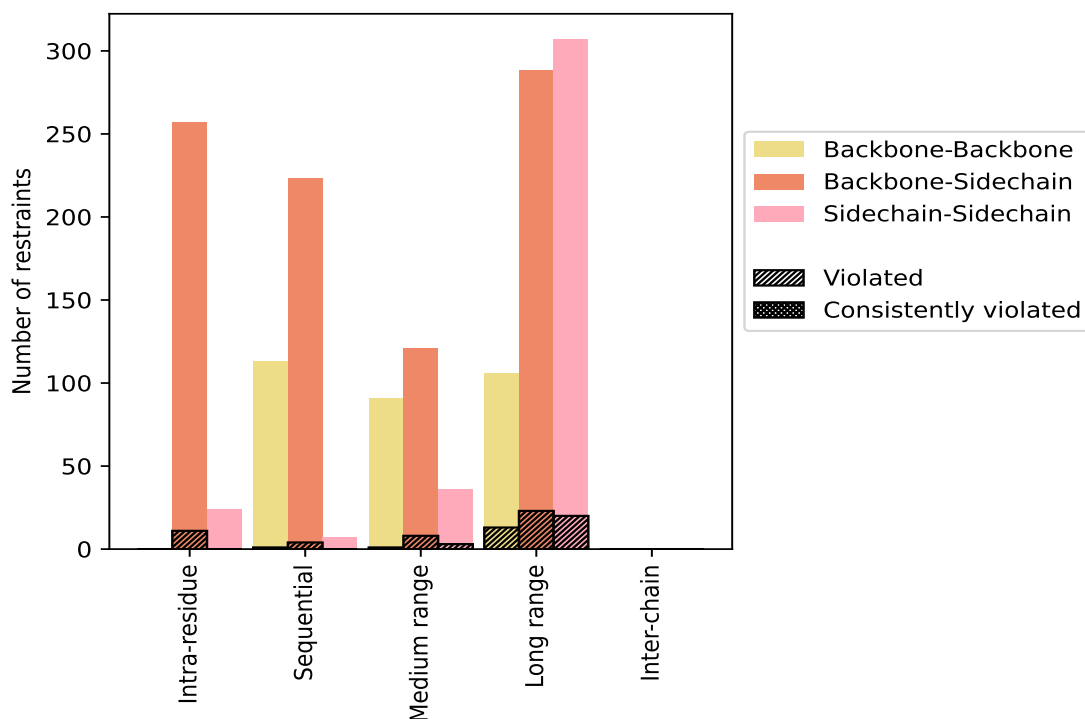
### 9.1 Summary of distance violations [i](#)

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.

Restrains type	Count	% <sup>1</sup>	Violated <sup>3</sup>			Consistently Violated <sup>4</sup>		
			Count	% <sup>2</sup>	% <sup>1</sup>	Count	% <sup>2</sup>	% <sup>1</sup>
<b>Intra-residue (<math> i-j =0</math>)</b>	<b>281</b>	<b>17.9</b>	<b>11</b>	<b>3.9</b>	<b>0.7</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
Backbone-Backbone	0	0.0	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	257	16.3	11	4.3	0.7	0	0.0	0.0
Sidechain-Sidechain	24	1.5	0	0.0	0.0	0	0.0	0.0
<b>Sequential (<math> i-j =1</math>)</b>	<b>343</b>	<b>21.8</b>	<b>5</b>	<b>1.5</b>	<b>0.3</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
Backbone-Backbone	113	7.2	1	0.9	0.1	0	0.0	0.0
Backbone-Sidechain	223	14.2	4	1.8	0.3	0	0.0	0.0
Sidechain-Sidechain	7	0.4	0	0.0	0.0	0	0.0	0.0
<b>Medium range (<math> i-j &gt;1</math> &amp; <math> i-j &lt;5</math>)</b>	<b>248</b>	<b>15.8</b>	<b>12</b>	<b>4.8</b>	<b>0.8</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
Backbone-Backbone	91	5.8	1	1.1	0.1	0	0.0	0.0
Backbone-Sidechain	121	7.7	8	6.6	0.5	0	0.0	0.0
Sidechain-Sidechain	36	2.3	3	8.3	0.2	0	0.0	0.0
<b>Long range (<math> i-j \geq 5</math>)</b>	<b>701</b>	<b>44.6</b>	<b>56</b>	<b>8.0</b>	<b>3.6</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
Backbone-Backbone	106	6.7	13	12.3	0.8	0	0.0	0.0
Backbone-Sidechain	288	18.3	23	8.0	1.5	0	0.0	0.0
Sidechain-Sidechain	307	19.5	20	6.5	1.3	0	0.0	0.0
<b>Inter-chain</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
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
<b>Hydrogen bond</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
<b>Disulfide bond</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
<b>Total</b>	<b>1573</b>	<b>100.0</b>	<b>84</b>	<b>5.3</b>	<b>5.3</b>	<b>0</b>	<b>0.0</b>	<b>0.0</b>
Backbone-Backbone	310	19.7	15	4.8	1.0	0	0.0	0.0
Backbone-Sidechain	889	56.5	46	5.2	2.9	0	0.0	0.0
Sidechain-Sidechain	374	23.8	23	6.1	1.5	0	0.0	0.0

<sup>1</sup> percentage calculated with respect to the total number of distance restraints, <sup>2</sup> percentage calculated with respect to the number of restraints in a particular restraint category, <sup>3</sup> violated in at least one model, <sup>4</sup> 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 disulfid 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 <sup>6</sup> (Å)	Median (Å)
	IR <sup>1</sup>	SQ <sup>2</sup>	MR <sup>3</sup>	LR <sup>4</sup>	IC <sup>5</sup>	Total				
1	2	1	1	7	0	11	0.16	0.31	0.06	0.14
2	2	1	0	6	0	9	0.18	0.32	0.07	0.15
3	3	1	0	6	0	10	0.17	0.31	0.05	0.16
4	2	1	1	5	0	9	0.16	0.32	0.07	0.12
5	1	1	0	4	0	6	0.13	0.14	0.01	0.13
6	2	0	2	5	0	9	0.18	0.3	0.06	0.15
7	1	0	1	3	0	5	0.15	0.23	0.05	0.12
8	2	1	0	9	0	12	0.17	0.32	0.06	0.15
9	2	2	0	7	0	11	0.13	0.22	0.03	0.13
10	1	2	1	7	0	11	0.16	0.31	0.06	0.15
11	0	1	0	8	0	9	0.14	0.23	0.03	0.13

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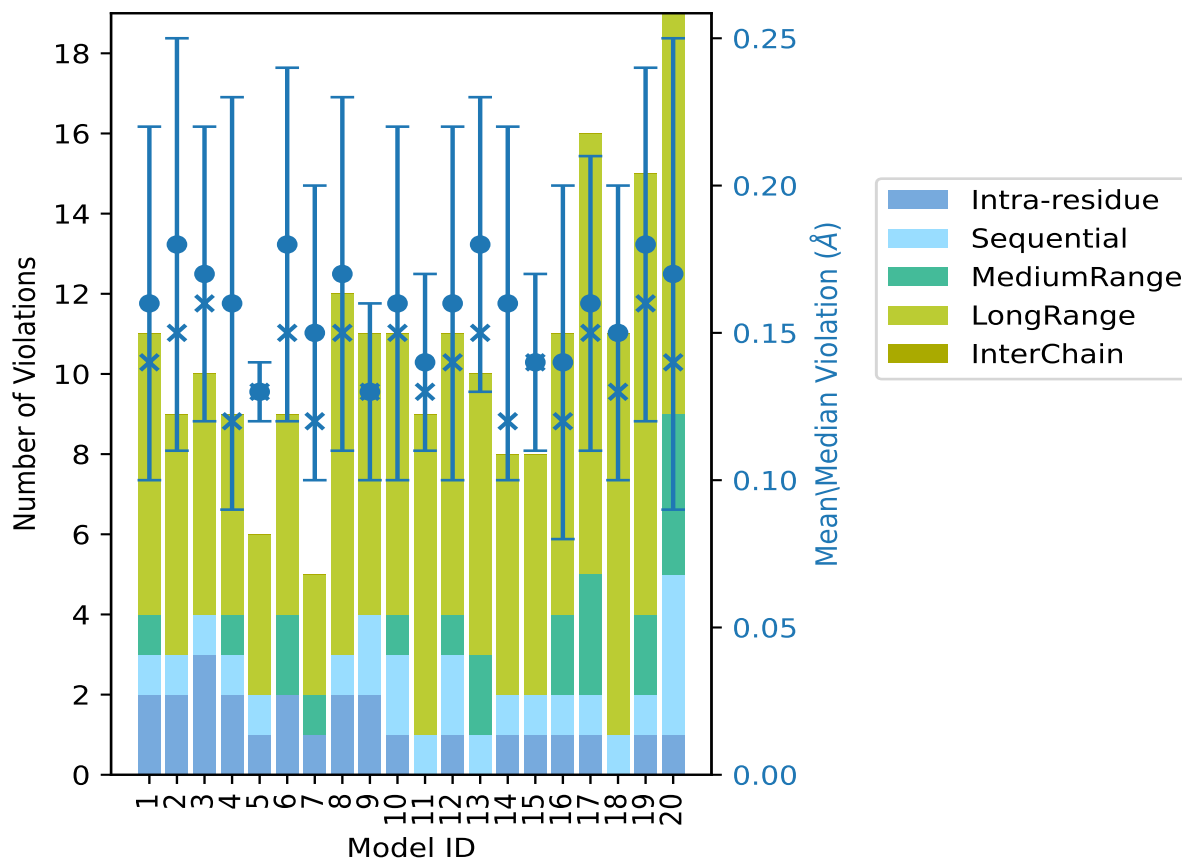


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Model ID	Number of violations						Mean (Å)	Max (Å)	SD <sup>6</sup> (Å)	Median (Å)
	IR <sup>1</sup>	SQ <sup>2</sup>	MR <sup>3</sup>	LR <sup>4</sup>	IC <sup>5</sup>	Total				
12	1	2	1	7	0	11	0.16	0.31	0.06	0.14
13	0	1	2	7	0	10	0.18	0.29	0.05	0.15
14	1	1	0	6	0	8	0.16	0.3	0.06	0.12
15	1	1	0	6	0	8	0.14	0.2	0.03	0.14
16	1	1	2	7	0	11	0.14	0.31	0.06	0.12
17	1	1	3	11	0	16	0.16	0.31	0.05	0.15
18	0	1	0	10	0	11	0.15	0.26	0.05	0.13
19	1	1	2	11	0	15	0.18	0.31	0.06	0.16
20	1	4	4	10	0	19	0.17	0.38	0.08	0.14

<sup>1</sup>Intra-residue restraints, <sup>2</sup>Sequential restraints, <sup>3</sup>Medium range restraints, <sup>4</sup>Long range restraints, <sup>5</sup>Inter-chain restraints, <sup>6</sup>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

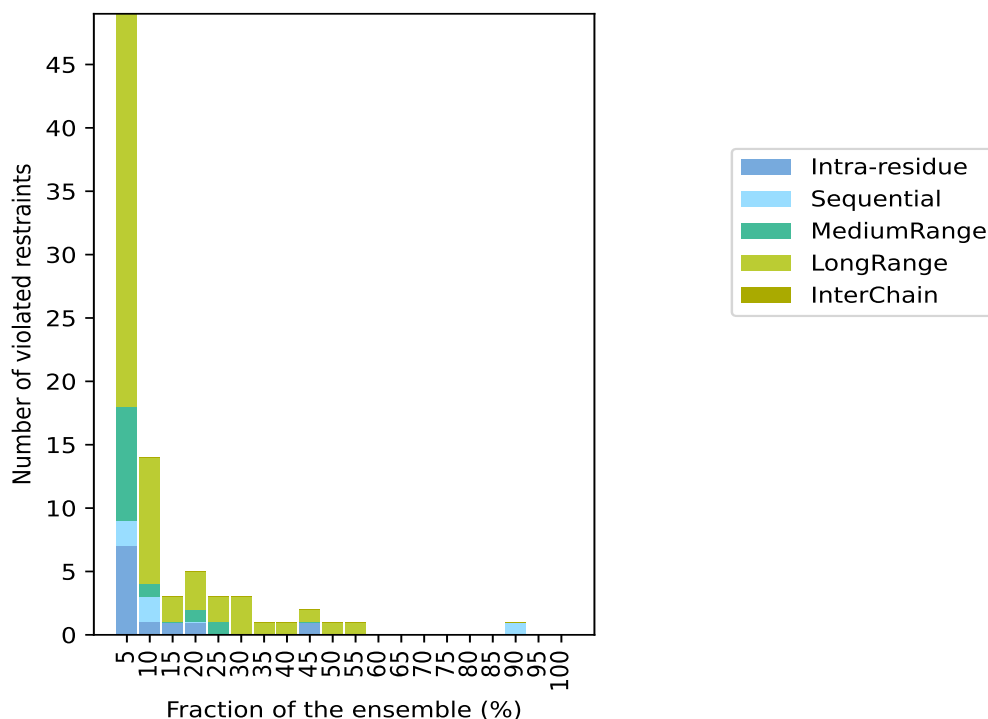
### 9.3 Distance violation statistics for the ensemble

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, 1489(IR:270, SQ:338, MR:236, LR:645, IC:0) restraints are not violated in the ensemble.

Number of violated restraints						Fraction of the ensemble	
IR <sup>1</sup>	SQ <sup>2</sup>	MR <sup>3</sup>	LR <sup>4</sup>	IC <sup>5</sup>	Total	Count <sup>6</sup>	%
7	2	9	31	0	49	1	5.0
1	2	1	10	0	14	2	10.0
1	0	0	2	0	3	3	15.0
1	0	1	3	0	5	4	20.0
0	0	1	2	0	3	5	25.0
0	0	0	3	0	3	6	30.0
0	0	0	1	0	1	7	35.0
0	0	0	1	0	1	8	40.0
1	0	0	1	0	2	9	45.0
0	0	0	1	0	1	10	50.0
0	0	0	1	0	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	0	0	0	0	16	80.0
0	0	0	0	0	0	17	85.0
0	1	0	0	0	1	18	90.0
0	0	0	0	0	0	19	95.0
0	0	0	0	0	0	20	100.0

<sup>1</sup>Intra-residue restraints, <sup>2</sup>Sequential restraints, <sup>3</sup>Medium range restraints, <sup>4</sup>Long range restraints, <sup>5</sup>Inter-chain restraints, <sup>6</sup> Number of models with violations

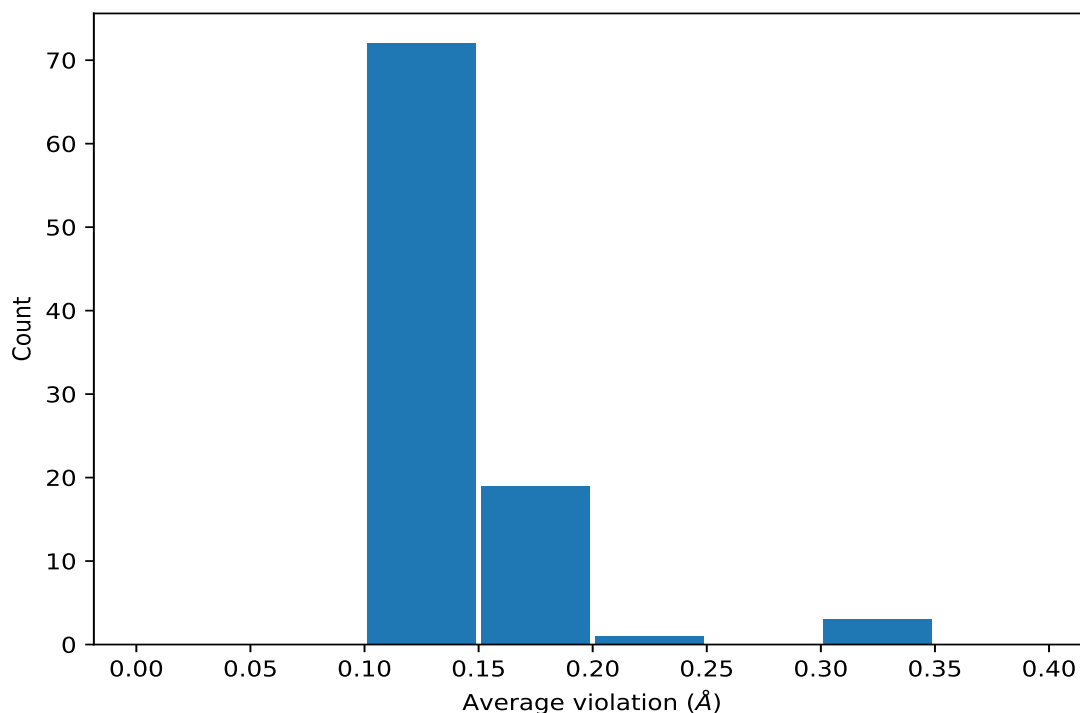
### 9.3.1 Bar graph : Distance violation statistics for the ensemble [i](#)



## 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 <sup>1</sup>	Mean (Å)	SD <sup>1</sup> (Å)	Median (Å)
(1,183)	1:A:37:GLU:HA	1:A:38:GLY:H	18	0.15	0.01	0.15
(1,306)	1:A:44:VAL:HB	1:A:100:VAL:HB	11	0.24	0.04	0.23
(1,1462)	1:A:162:TYR:HB2	1:A:190:ALA:H	10	0.14	0.02	0.13
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG21	9	0.31	0.01	0.31
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG22	9	0.31	0.01	0.31
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG23	9	0.31	0.01	0.31
(1,1010)	1:A:104:ILE:H	1:A:122:ILE:HD11	9	0.13	0.01	0.13
(1,1010)	1:A:104:ILE:H	1:A:122:ILE:HD12	9	0.13	0.01	0.13
(1,1010)	1:A:104:ILE:H	1:A:122:ILE:HD13	9	0.13	0.01	0.13
(1,894)	1:A:88:PRO:HD3	1:A:166:VAL:H	8	0.14	0.04	0.13
(1,1484)	1:A:163:GLN:HE21	1:A:190:ALA:HA	7	0.17	0.07	0.14
(1,1484)	1:A:163:GLN:HE22	1:A:190:ALA:HA	7	0.17	0.07	0.14
(1,1453)	1:A:161:THR:HA	1:A:190:ALA:H	6	0.14	0.03	0.13
(1,86)	1:A:24:GLY:HA2	1:A:31:TYR:HE1	6	0.14	0.02	0.14
(1,86)	1:A:24:GLY:HA2	1:A:31:TYR:HE2	6	0.14	0.02	0.14
(1,86)	1:A:24:GLY:HA3	1:A:31:TYR:HE1	6	0.14	0.02	0.14

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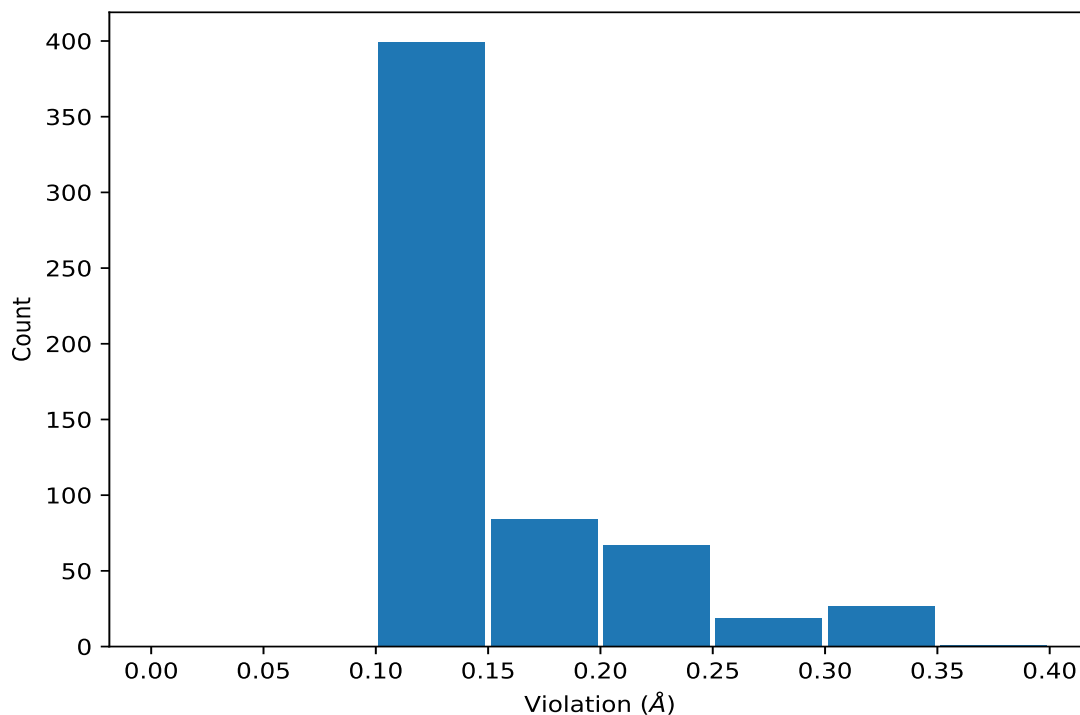
Key	Atom-1	Atom-2	Models <sup>1</sup>	Mean (Å)	SD <sup>1</sup> (Å)	Median (Å)
(1,86)	1:A:24:GLY:HA3	1:A:31:TYR:HE2	6	0.14	0.02	0.14
(1,810)	1:A:84:PHE:HD1	1:A:100:VAL:HA	6	0.13	0.02	0.12

<sup>1</sup>Number of violated models, <sup>2</sup>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)
(1,1327)	1:A:147:HIS:HD1	1:A:148:ALA:H	20	0.38
(1,1294)	1:A:144:TYR:H	1:A:147:HIS:HD1	20	0.35
(1,306)	1:A:44:VAL:HB	1:A:100:VAL:HB	2	0.32

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Key	Atom-1	Atom-2	Model ID	Violation (Å)
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG21	4	0.32
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG22	4	0.32
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG23	4	0.32
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG21	8	0.32
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG22	8	0.32
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG23	8	0.32
(1,449)	1:A:53:GLU:H	1:A:53:GLU:HG2	19	0.31
(1,449)	1:A:53:GLU:H	1:A:53:GLU:HG3	19	0.31
(1,306)	1:A:44:VAL:HB	1:A:100:VAL:HB	10	0.31
(1,1408)	1:A:154:THR:H	1:A:154:THR:HB	16	0.31
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG21	1	0.31
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG22	1	0.31
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG23	1	0.31
(1,1345)	1:A:149:THR:H	1:A:149:THR:HG21	2	0.31

## 10 Dihedral-angle violation analysis

No dihedral-angle restraints found