WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB NMR Structure Validation Summary Report (i)

Jun 4, 2023 – 03:16 AM EDT

PDB ID	:	2KVB
BMRB ID	:	16773
Title	:	Solution structure of CI-MPR domain 5 bound to N-acetylglucosaminyl 6-phosphomethylmannoside
Authors	:	Olson, L.J.; Peterson, F.C.; Volkman, B.F.; Dahms, N.M.
Deposited on	:	2010-03-10

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

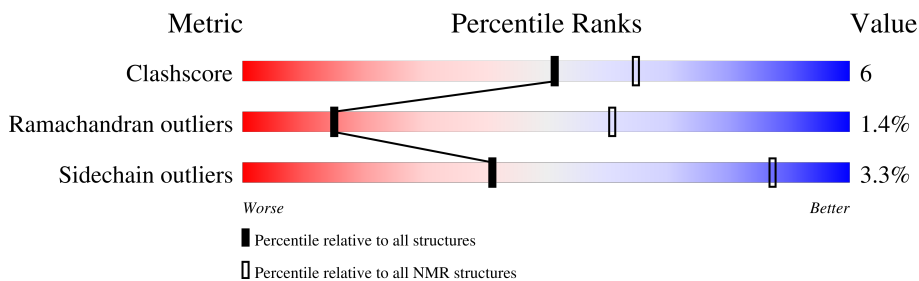|		
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
wwPDB-RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
wwPDB-ShiftChecker	:	v1.2
BMRB Restraints Analysis	:	v1.2
Ideal geometry (proteins)	:	Engh & Huber (2001)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

1 Overall quality at a glance ⓘ

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

The overall completeness of chemical shifts assignment is 88%.

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		6
Ramachandran outliers		1.4%
Sidechain outliers		3.3%

Worse   *Better*

■ Percentile relative to all structures

▯ Percentile relative to all NMR structures

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	148	77% 11% 12%

2 Ensemble composition and analysis ⓘ

This entry contains 20 models. Model 3 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:587-A:679, A:685-A:695, A:700-A:725 (130)	0.59	3

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 5 clusters and 1 single-model cluster was found.

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

3 Entry composition ⓘ

There is only 1 type of molecule in this entry. The entry contains 2134 atoms, of which 956 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Cation-independent mannose-6-phosphate receptor.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	148	2134	734	956	198	239	7	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	578	GLU	-	expression tag	UNP P08169
A	579	ALA	-	expression tag	UNP P08169
A	580	GLU	-	expression tag	UNP P08169
A	581	ALA	-	expression tag	UNP P08169
A	582	GLU	-	expression tag	UNP P08169
A	583	PHE	-	expression tag	UNP P08169

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.
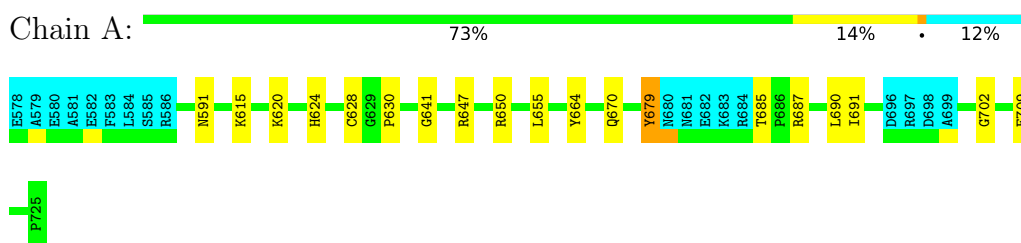
• Molecule 1: Cation-independent mannose-6-phosphate receptor
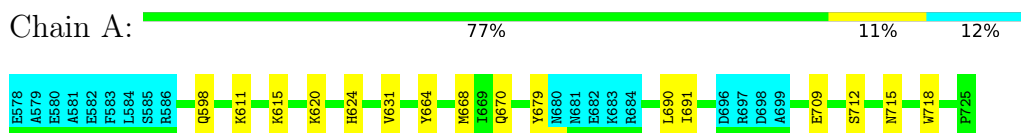
4.2   Residue scores for the representative (medoid) model from the NMR ensemble

The representative model is number 3. Colouring as in section 4.1 above.

• Molecule 1: Cation-independent mannose-6-phosphate receptor

5 Refinement protocol and experimental data overview ⓘ

The models were refined using the following method: *AUTOMATED METHODS WERE USED FOR BACKBONE CHEMICAL SHIFT ASSIGNMENT AND ITERATIVE NOE REFINEMENT. FINAL STRUCTURES WERE OBTAINED BY MOLECULAR DYNAMICS IN EXPLICIT SOLVENT.*

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
Xplor-NIH	refinement	2.9.3

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	1620
Number of shifts mapped to atoms	1510
Number of unparsed shifts	0
Number of shifts with mapping errors	110
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	88%

6 Model quality ⓘ

6.1 Standard geometry ⓘ

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
All	All	0	2

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

All unique planar outliers are listed below.

Mol	Chain	Res	Type	Group	Models (Total)
1	A	687	ARG	Sidechain	2

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	1028	830	946	12±3
All	All	20560	16600	18920	230

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 6.

5 of 85 unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models Worst	Total
1:A:596:ASP:OD1	1:A:598:GLN:HG2	0.66	1.89	5	6
1:A:654:ASN:HB3	1:A:677:THR:OG1	0.61	1.95	20	2

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:587:THR:HG21	1:A:596:ASP:HA	0.61	1.73	8	2
1:A:596:ASP:OD2	1:A:598:GLN:HG3	0.60	1.96	17	2
1:A:657:ARG:HG2	1:A:674:ARG:HB2	0.60	1.73	13	2

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	129/148 (87%)	116±2 (90±2%)	11±2 (9±2%)	2±1 (1±1%)	15	61
All	All	2580/2960 (87%)	2317 (90%)	227 (9%)	36 (1%)	15	61

5 of 7 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	679	TYR	14
1	A	710	ASP	7
1	A	628	CYS	7
1	A	591	ASN	2
1	A	708	GLU	2

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	113/128 (88%)	109±1 (97±1%)	4±1 (3±1%)	41	87
All	All	2260/2560 (88%)	2185 (97%)	75 (3%)	41	87

5 of 19 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	709	GLU	14
1	A	624	HIS	12
1	A	664	TYR	11
1	A	668	MET	8
1	A	650	ARG	5

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 88% for the well-defined parts and 84% 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	1620
Number of shifts mapped to atoms	1510
Number of unparsed shifts	0
Number of shifts with mapping errors	110
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	5

The following assigned chemical shifts were not mapped to the molecules present in the coordinate file.

- No matching atom found in the structure. First 5 (of 110) occurrences are reported below.

List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	A	584	LEU	HD11	0.897	0.010	2
1	A	584	LEU	HD12	0.897	0.010	2
1	A	584	LEU	HD22	0.866	0.010	2
1	A	584	LEU	HD23	0.866	0.010	2
1	A	587	THR	HG22	1.433	0.020	1
1	A	587	THR	HG23	1.433	0.020	1
1	A	591	ASN	HD22	6.556	0.020	2
1	A	593	THR	HG22	1.236	0.008	1
1	A	593	THR	HG23	1.236	0.008	1
1	A	594	VAL	HG11	0.982	0.007	2
1	A	594	VAL	HG12	0.982	0.007	2
1	A	594	VAL	HG22	0.875	0.020	2
1	A	594	VAL	HG23	0.875	0.020	2
1	A	598	GLN	HE22	6.845	0.020	2

Continued on next page...

Continued from previous page...

List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	A	605	LEU	HD11	-0.106	0.020	2
1	A	605	LEU	HD12	-0.106	0.020	2
1	A	605	LEU	HD22	-0.149	0.020	2
1	A	605	LEU	HD23	-0.149	0.020	2
1	A	606	THR	HG22	1.388	0.020	1
1	A	606	THR	HG23	1.388	0.020	1
1	A	608	LEU	HD11	0.552	0.020	2
1	A	608	LEU	HD12	0.552	0.020	2
1	A	608	LEU	HD22	0.324	0.020	2
1	A	608	LEU	HD23	0.324	0.020	2
1	A	609	THR	HG22	1.255	0.020	1
1	A	609	THR	HG23	1.255	0.020	1
1	A	616	VAL	HG11	1.26	0.020	2
1	A	616	VAL	HG12	1.26	0.020	2
1	A	616	VAL	HG22	0.948	0.020	2
1	A	616	VAL	HG23	0.948	0.020	2
1	A	618	THR	HG22	1.433	0.020	1
1	A	618	THR	HG23	1.433	0.020	1
1	A	625	ILE	HD12	-0.029	0.020	1
1	A	625	ILE	HD13	-0.029	0.020	1
1	A	625	ILE	HG13	0.804	0.020	2
1	A	625	ILE	HG21	0.616	0.020	1
1	A	625	ILE	HG22	0.616	0.020	1
1	A	626	ASN	HD22	7.189	0.020	2
1	A	627	VAL	HG11	0.624	0.020	2
1	A	627	VAL	HG12	0.624	0.020	2
1	A	627	VAL	HG22	0.617	0.020	2
1	A	627	VAL	HG23	0.617	0.020	2
1	A	631	VAL	HG11	0.856	0.007	2
1	A	631	VAL	HG12	0.856	0.007	2
1	A	631	VAL	HG22	0.877	0.007	2
1	A	631	VAL	HG23	0.877	0.007	2
1	A	633	VAL	HG11	0.427	0.020	2
1	A	633	VAL	HG12	0.427	0.020	2
1	A	633	VAL	HG22	0.528	0.007	2
1	A	633	VAL	HG23	0.528	0.007	2
1	A	645	VAL	HG11	0.876	0.020	2
1	A	645	VAL	HG12	0.876	0.020	2
1	A	645	VAL	HG22	0.842	0.020	2
1	A	645	VAL	HG23	0.842	0.020	2
1	A	654	ASN	HD22	6.287	0.020	2

Continued on next page...

Continued from previous page...

List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	A	655	LEU	HD11	0.071	0.020	2
1	A	655	LEU	HD12	0.071	0.020	2
1	A	655	LEU	HD22	0.542	0.020	2
1	A	655	LEU	HD23	0.542	0.020	2
1	A	659	ASN	HD22	6.733	0.020	2
1	A	662	LEU	HD11	0.641	0.020	2
1	A	662	LEU	HD12	0.641	0.020	2
1	A	662	LEU	HD22	0.528	0.009	2
1	A	662	LEU	HD23	0.528	0.009	2
1	A	669	ILE	HD12	0.048	0.020	1
1	A	669	ILE	HD13	0.048	0.020	1
1	A	669	ILE	HG13	0.588	0.020	2
1	A	669	ILE	HG21	0.789	0.020	1
1	A	669	ILE	HG22	0.789	0.020	1
1	A	670	GLN	HE22	6.818	0.020	2
1	A	671	LEU	HD11	1.055	0.020	2
1	A	671	LEU	HD12	1.055	0.020	2
1	A	671	LEU	HD22	1.04	0.020	2
1	A	671	LEU	HD23	1.04	0.020	2
1	A	672	THR	HG22	1.152	0.020	1
1	A	672	THR	HG23	1.152	0.020	1
1	A	677	THR	HG22	1.748	0.020	1
1	A	677	THR	HG23	1.748	0.020	1
1	A	680	ASN	HD22	6.992	0.020	2
1	A	681	ASN	HD22	6.912	0.020	2
1	A	685	THR	HG22	1.467	0.020	1
1	A	685	THR	HG23	1.467	0.020	1
1	A	689	THR	HG22	1.18	0.020	1
1	A	689	THR	HG23	1.18	0.020	1
1	A	690	LEU	HD11	0.804	0.020	2
1	A	690	LEU	HD12	0.804	0.020	2
1	A	690	LEU	HD22	0.802	0.020	2
1	A	690	LEU	HD23	0.802	0.020	2
1	A	691	ILE	HD12	0.592	0.020	1
1	A	691	ILE	HD13	0.592	0.020	1
1	A	691	ILE	HG13	1.398	0.020	2
1	A	691	ILE	HG21	-0.012	0.010	1
1	A	691	ILE	HG22	-0.012	0.010	1
1	A	692	THR	HG22	1.119	0.020	1
1	A	692	THR	HG23	1.119	0.020	1
1	A	694	LEU	HD11	0.838	0.020	2

Continued on next page...

Continued from previous page...

List ID	Chain	Res	Type	Atom	Shift Data		
					Value	Uncertainty	Ambiguity
1	A	694	LEU	HD12	0.838	0.020	2
1	A	694	LEU	HD22	0.487	0.020	2
1	A	694	LEU	HD23	0.487	0.020	2
1	A	701	VAL	HG11	1.587	0.020	2
1	A	701	VAL	HG12	1.587	0.020	2
1	A	701	VAL	HG22	1.429	0.020	2
1	A	701	VAL	HG23	1.429	0.020	2
1	A	707	GLN	HE22	6.663	0.020	2
1	A	711	ASN	HD22	6.556	0.020	2
1	A	713	THR	HG22	1.116	0.020	1
1	A	713	THR	HG23	1.116	0.020	1
1	A	715	ASN	HD22	6.888	0.020	2
1	A	720	THR	HG22	1.159	0.020	1
1	A	720	THR	HG23	1.159	0.020	1

7.1.2   Chemical shift referencing ⓘ

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_\alpha$	141	-0.50 ± 0.13	Should be applied
$^{13}C_\beta$	131	-0.55 ± 0.14	Should be applied
$^{13}C'$	131	0.09 ± 0.27	None needed (< 0.5 ppm)
^{15}N	137	-0.25 ± 0.46	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 88%, i.e. 1475 atoms were assigned a chemical shift out of a possible 1679. 0 out of 14 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	630/644 (98%)	261/262 (100%)	247/260 (95%)	122/122 (100%)
Sidechain	718/843 (85%)	478/543 (88%)	228/266 (86%)	12/34 (35%)
Aromatic	127/192 (66%)	79/91 (87%)	46/97 (47%)	2/4 (50%)
Overall	1475/1679 (88%)	818/896 (91%)	521/623 (84%)	136/160 (85%)

### 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	717	ARG	NE	117.07	76.53 − 92.65	20.1
1	A	687	ARG	NE	115.53	76.53 − 92.65	19.2
1	A	591	ASN	ND2	131.64	101.55 − 123.95	8.4
1	A	704	PRO	HD3	0.84	1.76 − 5.48	-7.5
1	A	709	GLU	HG3	0.93	1.20 − 3.30	-6.3

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:
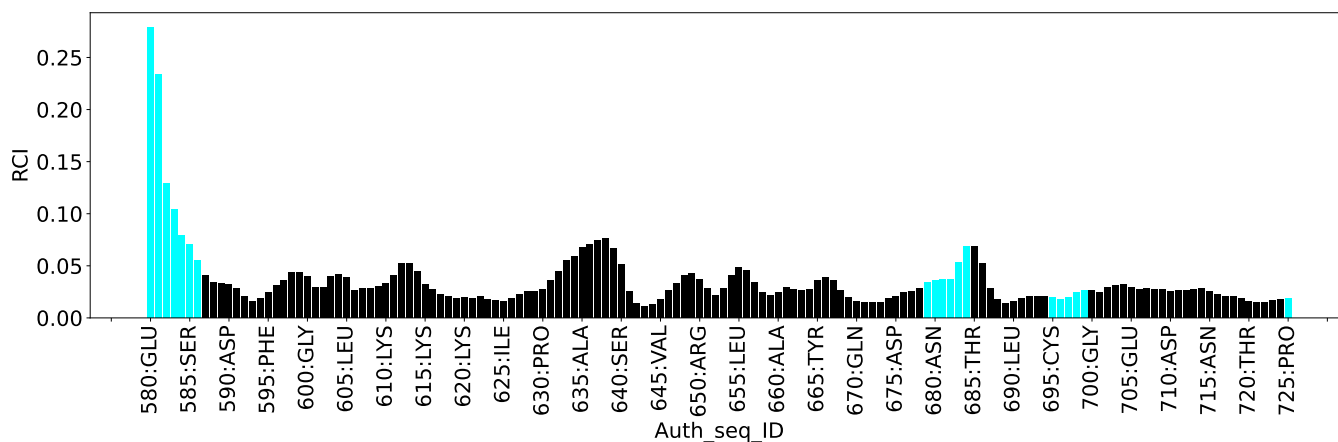
8 NMR restraints analysis ⓘ

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	2060
Intra-residue ($|i\text{-}j|$=0)	328
Sequential ($|i\text{-}j|$=1)	510
Medium range ($|i\text{-}j|$>1 and $|i\text{-}j|$<5)	260
Long range ($|i\text{-}j|$≥5)	953
Inter-chain	0
Hydrogen bond restraints	0
Disulfide bond restraints	9
Total dihedral-angle restraints	0
Number of unmapped restraints	651
Number of restraints per residue	13.9
Number of long range restraints per residue[1]	6.5

[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)	40.6	0.2
0.2-0.5 (Medium)	61.9	0.5
>0.5 (Large)	125.4	3.68

WORLDWIDE
wwPDB
PROTEIN DATA BANK

8.2.2   Average number of dihedral-angle violations per model ⓘ

Dihedral-angle violations less than 1° are not included in the calculation.There are no dihedral-angle violations
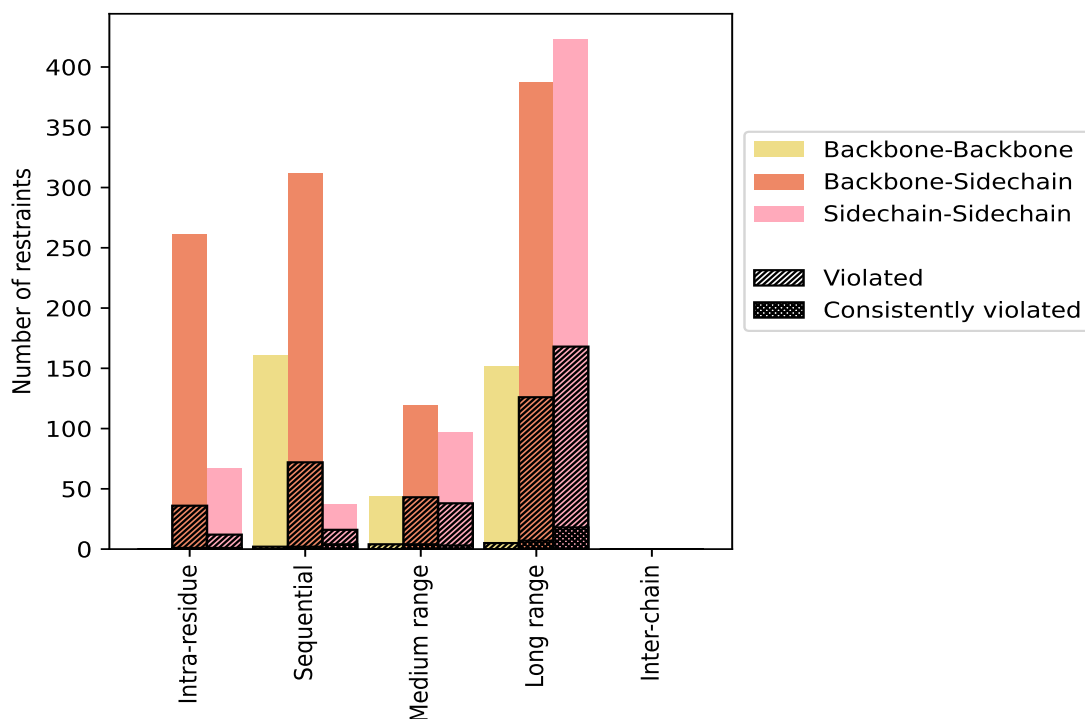
9 Distance violation analysis ⓘ

9.1 Summary of distance violations ⓘ

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

Restraints type	Count	%[1]	Violated[3]			Consistently Violated[4]		
			Count	%[2]	%[1]	Count	%[2]	%[1]
Intra-residue (|i-j|=0)	328	15.9	48	14.6	2.3	2	0.6	0.1
Backbone-Backbone	0	0.0	0	0.0	0.0	0	0.0	0.0
Backbone-Sidechain	261	12.7	36	13.8	1.7	1	0.4	0.0
Sidechain-Sidechain	67	3.3	12	17.9	0.6	1	1.5	0.0
Sequential (|i-j|=1)	510	24.8	90	17.6	4.4	6	1.2	0.3
Backbone-Backbone	161	7.8	2	1.2	0.1	0	0.0	0.0
Backbone-Sidechain	312	15.1	72	23.1	3.5	2	0.6	0.1
Sidechain-Sidechain	37	1.8	16	43.2	0.8	4	10.8	0.2
Medium range (|i-j|>1 & |i-j|<5)	260	12.6	85	32.7	4.1	7	2.7	0.3
Backbone-Backbone	44	2.1	4	9.1	0.2	0	0.0	0.0
Backbone-Sidechain	119	5.8	43	36.1	2.1	4	3.4	0.2
Sidechain-Sidechain	97	4.7	38	39.2	1.8	3	3.1	0.1
Long range (|i-j|≥5)	953	46.3	299	31.4	14.5	25	2.6	1.2
Backbone-Backbone	152	7.4	5	3.3	0.2	0	0.0	0.0
Backbone-Sidechain	387	18.8	126	32.6	6.1	7	1.8	0.3
Sidechain-Sidechain	414	20.1	168	40.6	8.2	18	4.3	0.9
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	9	0.4	0	0.0	0.0	0	0.0	0.0
Total	2060	100.0	522	25.3	25.3	40	1.9	1.9
Backbone-Backbone	357	17.3	11	3.1	0.5	0	0.0	0.0
Backbone-Sidechain	1079	52.4	277	25.7	13.4	14	1.3	0.7
Sidechain-Sidechain	624	30.3	234	37.5	11.4	26	4.2	1.3

[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	17	40	35	139	0	231	0.74	3.57	0.58	0.62
2	20	39	43	134	0	236	0.73	3.35	0.58	0.57
3	18	45	36	124	0	223	0.73	2.96	0.56	0.58
4	18	38	48	113	0	217	0.75	3.36	0.59	0.64
5	18	38	41	126	0	223	0.75	3.22	0.58	0.62
6	22	35	37	132	0	226	0.76	3.38	0.63	0.59
7	22	40	34	138	0	234	0.71	3.17	0.58	0.51
8	18	37	30	138	0	223	0.71	2.95	0.55	0.56
9	20	42	39	131	0	232	0.7	2.52	0.54	0.55
10	17	40	30	133	0	220	0.73	3.68	0.56	0.64
11	12	42	43	138	0	235	0.69	3.18	0.56	0.55

Continued on next page...

Continued from previous page...

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	19	35	35	128	0	217	0.73	3.13	0.57	0.55
13	23	45	38	136	0	242	0.73	2.89	0.56	0.57
14	22	33	41	130	0	226	0.7	3.65	0.59	0.51
15	17	33	38	145	0	233	0.73	2.25	0.53	0.6
16	19	37	31	129	0	216	0.65	3.57	0.53	0.52
17	18	43	39	137	0	237	0.69	3.61	0.58	0.51
18	20	39	43	137	0	239	0.79	3.22	0.6	0.63
19	17	39	35	133	0	224	0.73	3.37	0.58	0.6
20	19	34	34	138	0	225	0.71	3.49	0.6	0.55

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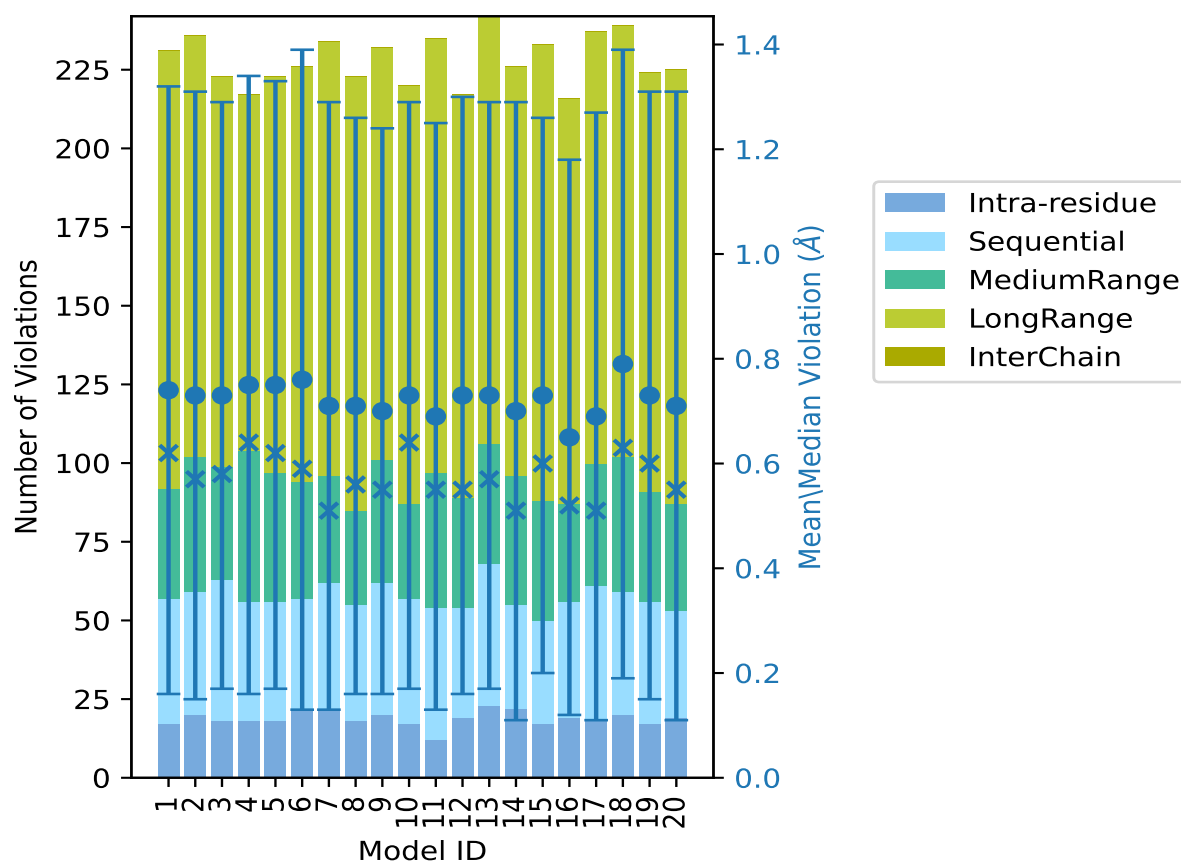
The mean(dot),median(x) and the standard deviation are shown in blue with respect to the y axis on the right

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, 1529(IR:280, SQ:420, MR:175, LR:654, 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]	%
6	8	11	32	0	57	1	5.0
4	11	11	19	0	45	2	10.0
7	10	6	31	0	54	3	15.0
1	7	3	19	0	30	4	20.0
3	3	4	15	0	25	5	25.0
2	4	4	11	0	21	6	30.0
5	2	3	18	0	28	7	35.0
2	0	2	15	0	19	8	40.0
1	4	3	16	0	24	9	45.0
2	6	2	16	0	26	10	50.0
0	4	2	15	0	21	11	55.0
1	5	7	8	0	21	12	60.0
5	4	5	7	0	21	13	65.0
1	1	1	8	0	11	14	70.0
1	5	2	8	0	16	15	75.0
3	2	5	4	0	14	16	80.0
0	5	2	10	0	17	17	85.0
2	2	5	7	0	16	18	90.0
0	1	0	15	0	16	19	95.0
2	6	7	25	0	40	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 ⓘ
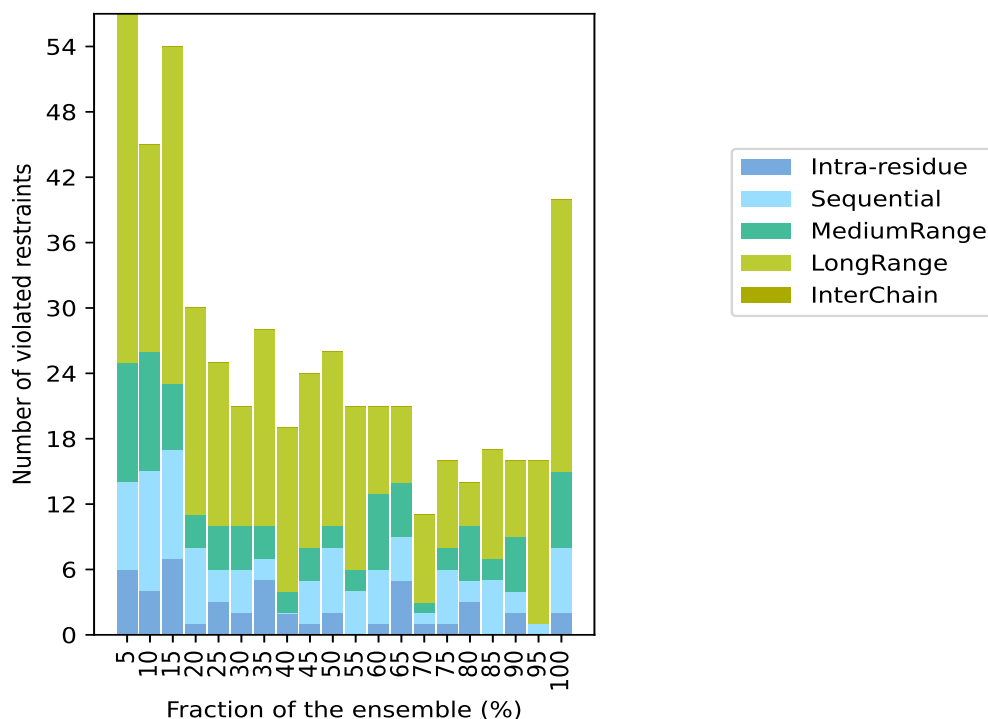
9.4 Most violated distance restraints in the ensemble ⓘ

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
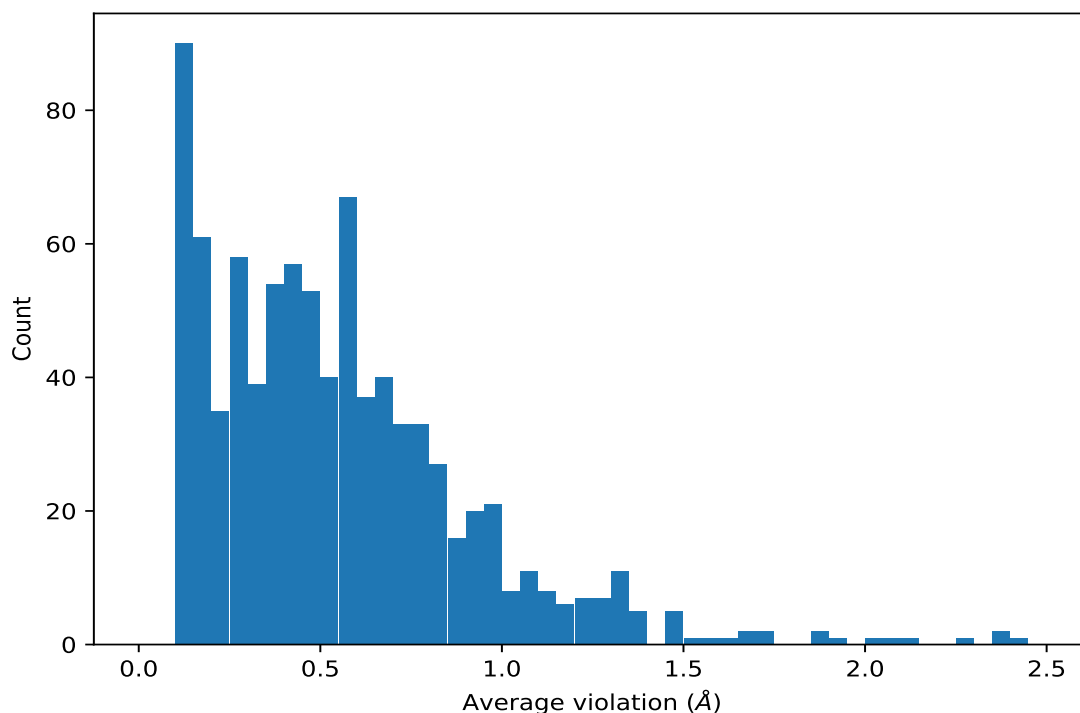
9.4.2 Table: Most violated distance restraints (i)

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)
(1,1709)	1:A:691:ILE:HG23	1:A:692:THR:HG21	20	2.44	0.82	2.74
(1,766)	1:A:625:ILE:HG23	1:A:631:VAL:HG13	20	2.36	0.8	2.36
(1,766)	1:A:625:ILE:HG23	1:A:631:VAL:HG21	20	2.36	0.8	2.36
(1,117)	1:A:594:VAL:HG21	1:A:669:ILE:HD11	20	2.27	0.57	2.46
(1,1409)	1:A:671:LEU:HD21	1:A:691:ILE:HG23	20	2.01	0.65	2.12
(1,364)	1:A:609:THR:HG21	1:A:627:VAL:HG13	20	1.88	0.63	2.04
(1,364)	1:A:609:THR:HG21	1:A:627:VAL:HG21	20	1.88	0.63	2.04
(1,551)	1:A:616:VAL:HG13	1:A:625:ILE:HG23	20	1.71	0.94	1.72
(1,551)	1:A:616:VAL:HG21	1:A:625:ILE:HG23	20	1.71	0.94	1.72
(1,1235)	1:A:659:ASN:HD21	1:A:673:TYR:HB2	20	1.67	0.14	1.72
(1,593)	1:A:618:THR:HG21	1:A:622:GLU:H	20	1.65	0.73	2.19
(1,69)	1:A:592:CYS:H	1:A:627:VAL:HG13	20	1.48	0.52	1.76
(1,69)	1:A:592:CYS:H	1:A:627:VAL:HG21	20	1.48	0.52	1.76
(1,2030)	1:A:720:THR:HG21	1:A:724:CYS:H	20	1.48	0.62	1.78

[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.
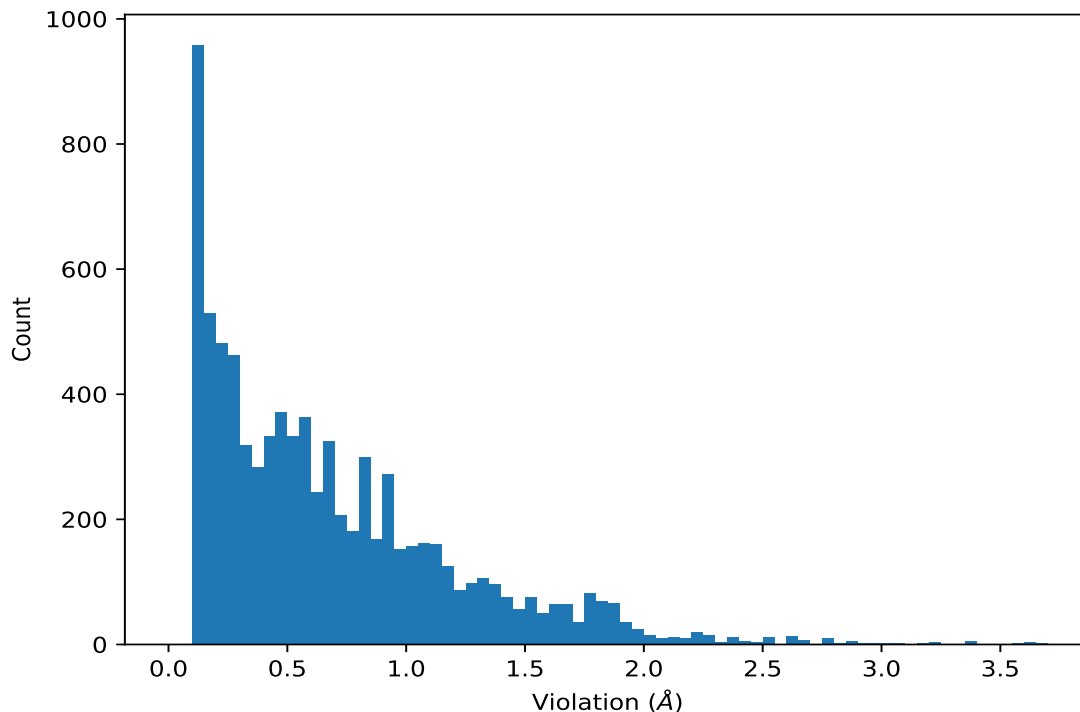
9.5.2 Table : All distance violations ⓘ

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)
(1,766)	1:A:625:ILE:HG23	1:A:631:VAL:HG13	10	3.68
(1,766)	1:A:625:ILE:HG23	1:A:631:VAL:HG21	10	3.68
(1,551)	1:A:616:VAL:HG13	1:A:625:ILE:HG23	14	3.65
(1,551)	1:A:616:VAL:HG21	1:A:625:ILE:HG23	14	3.65
(1,766)	1:A:625:ILE:HG23	1:A:631:VAL:HG13	17	3.61
(1,766)	1:A:625:ILE:HG23	1:A:631:VAL:HG21	17	3.61
(1,766)	1:A:625:ILE:HG23	1:A:631:VAL:HG13	16	3.57
(1,766)	1:A:625:ILE:HG23	1:A:631:VAL:HG21	16	3.57
(1,1709)	1:A:691:ILE:HG23	1:A:692:THR:HG21	1	3.57
(1,1709)	1:A:691:ILE:HG23	1:A:692:THR:HG21	20	3.49
(1,1341)	1:A:669:ILE:HD11	1:A:720:THR:HG21	6	3.38

Continued on next page...

Continued from previous page...

Key	Atom-1	Atom-2	Model ID	Violation (Å)
(1,318)	1:A:608:LEU:HD13	1:A:720:THR:HG21	19	3.37
(1,551)	1:A:616:VAL:HG13	1:A:625:ILE:HG23	4	3.36
(1,551)	1:A:616:VAL:HG21	1:A:625:ILE:HG23	4	3.36
(1,318)	1:A:608:LEU:HD13	1:A:720:THR:HG21	4	3.36

10 Dihedral-angle violation analysis ⓘ

Dihedral angle analysis failed due to data error in the dihedral angle restraints, possibly missing target value