# Full wwPDB NMR Structure Validation Report (i)

Nov 2, 2024 – 10:55 PM EDT

| | | |
|---|---|---|
| PDB ID | : | 2N2K |
| BMRB ID | : | 25601 |
| Title | : | Ensemble structure of the closed state of Lys63-linked diubiquitin in the absence of a ligand |
| Authors | : | Liu, Z.; Gong, Z.; Tang, C. |
| Deposited on | : | 2015-05-10 |

This is a Full wwPDB NMR Structure Validation 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.

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

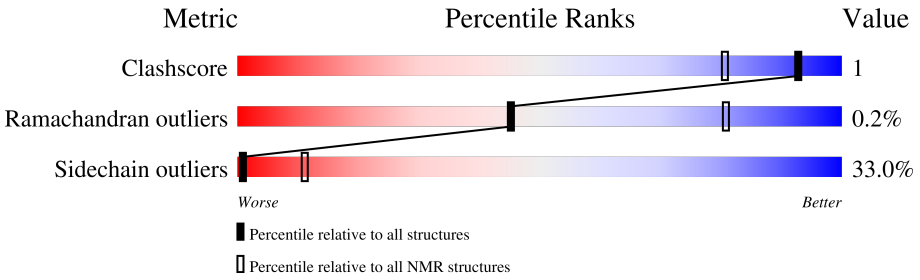
| | | |
|---|---|---|
| MolProbity | : | 4.02b-467 |
| Mogul | : | 2022.3.0, CSD as543be (2022) |
| buster-report | : | 1.1.7 (2018) |
| Percentile statistics | : | 20231227.v01 (using entries in the PDB archive December 27th 2023) |
| wwPDB-RCI | : | v_1n_11_5_13_A (Berjanski et al., 2005) |
| PANAV | : | Wang et al. (2010) |
| wwPDB-ShiftChecker | : | v1.2 |
| Ideal geometry (proteins) | : | Engh & Huber (2001) |
| Ideal geometry (DNA, RNA) | : | Parkinson et al. (1996) |
| Validation Pipeline (wwPDB-VP) | : | 2.39 |

# 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 13%.

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 | 210492 | 14027 |
| Ramachandran outliers | 207382 | 12486 |
| Sidechain outliers | 206894 | 12463 |

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and a grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5%

| Mol | Chain | Length | Quality of chain |
|---|---|---|---|
| 1 | A | 76 | 91% . 5% |
| 2 | B | 71 | 99% . |

## 2 Ensemble composition and analysis (i)

This entry contains 70 models. Model 2 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:1-A:72 (72) | 0.15 | 2 |
| 2 | B:1-B:71 (71) | 1.93 | 26 |

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 7 clusters and 7 single-model clusters were found.

| Cluster number | Models |
|---|---|
| 1 | 2, 3, 4, 5, 8, 10, 11, 13, 14, 20, 21, 22, 30, 33, 35, 39, 43, 44, 48, 49, 50, 52, 55 |
| 2 | 1, 7, 9, 17, 18, 25, 28, 29, 31, 34, 36, 53, 59, 60, 63, 64 |
| 3 | 6, 19, 23, 24, 26, 27, 37, 47, 51, 62, 67, 70 |
| 4 | 16, 32, 42, 54, 56 |
| 5 | 40, 45, 66 |
| 6 | 12, 58 |
| 7 | 41, 57 |
| Single-model clusters | 15; 38; 46; 61; 65; 68; 69 |

# 3 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2045 atoms, of which 445 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called ubiquitin.

| Mol | Chain | Residues | Atoms | | | | | | Trace |
|---|---|---|---|---|---|---|---|---|---|
| | | | Total | C | H | N | O | S | |
| 1 | A | 76 | 459 | 184 | 87 | 91 | 91 | 6 | 0 |

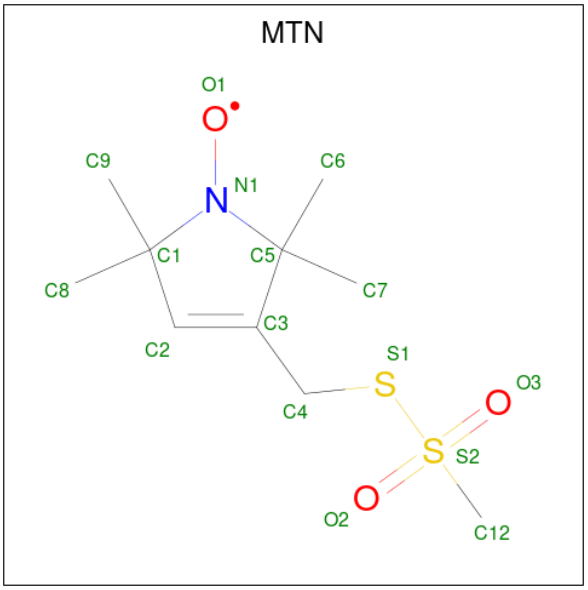
There are 2 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|---|---|---|---|---|---|
| A | 25 | CYS | ASN | engineered mutation | UNP P0CG48 |
| A | 48 | CYS | LYS | engineered mutation | UNP P0CG48 |

- Molecule 2 is a protein called ubiquitin.

| Mol | Chain | Residues | Atoms | | | | | Trace |
|---|---|---|---|---|---|---|---|---|
| | | | Total | C | H | N | O | |
| 2 | B | 71 | 1424 | 584 | 268 | 288 | 284 | 0 |

- Molecule 3 is S-[(1-oxyl-2,2,5,5-tetramethyl-2,5-dihydro-1H-pyrrol-3-yl)methyl] methanesulfonothioate (three-letter code: MTN) (formula: $C_{10}H_{18}NO_3S_2$).




| Mol | Chain | Residues | Atoms | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | C | H | N | O | S |
| 3 | A | 1 | 81 | 27 | 45 | 3 | 3 | 3 |

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| Mol | Chain | Residues | Atoms | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | C | H | N | O | S |
| 3 | A | 1 | 81 | 27 | 45 | 3 | 3 | 3 |

# 4 Residue-property plots

## 4.1 Average score per residue in the NMR ensemble

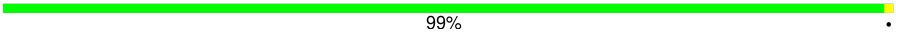
These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-coded according to the number of geometric quality criteria for 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: ubiquitin

Chain A: 



• Molecule 2: ubiquitin

Chain B: 



## 4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

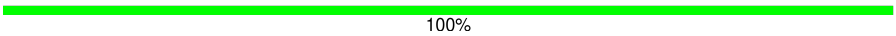
### 4.2.1 Score per residue for model 1

• Molecule 1: ubiquitin

Chain A: 



• Molecule 2: ubiquitin

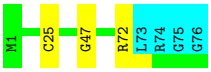
Chain B: 


There are no outlier residues in this chain.

### 4.2.2 Score per residue for model 2 (medoid)

• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

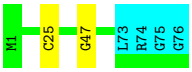
Chain B:


There are no outlier residues in this chain.

### 4.2.3 Score per residue for model 3

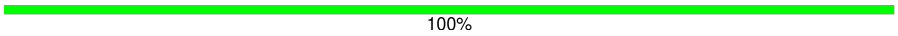
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

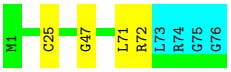



There are no outlier residues in this chain.

### 4.2.4 Score per residue for model 4

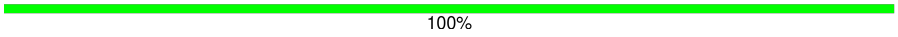
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

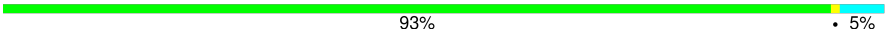


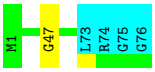

There are no outlier residues in this chain.

### 4.2.5 Score per residue for model 5

• Molecule 1: ubiquitin

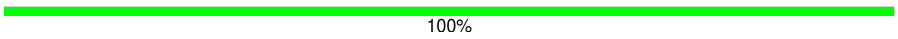
Chain A:




• Molecule 2: ubiquitin

Chain B:




There are no outlier residues in this chain.

### 4.2.6 Score per residue for model 6

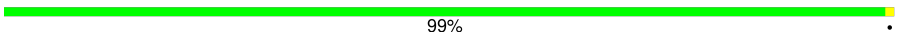
• Molecule 1: ubiquitin

Chain A:



• Molecule 2: ubiquitin

Chain B:

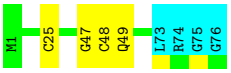




### 4.2.7 Score per residue for model 7

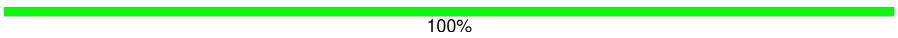
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

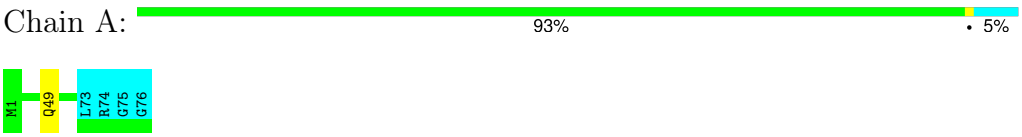



There are no outlier residues in this chain.

### 4.2.8 Score per residue for model 8

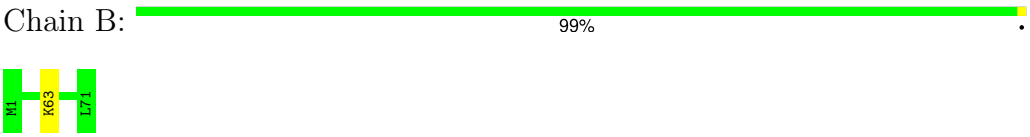
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

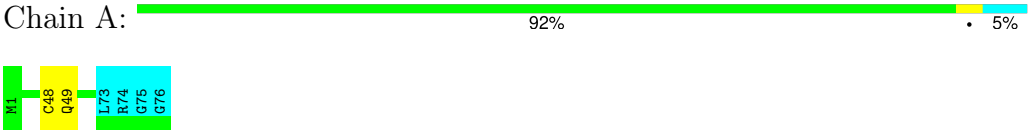
Chain B:




### 4.2.9 Score per residue for model 9

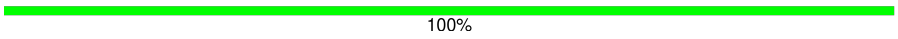
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

Chain B:

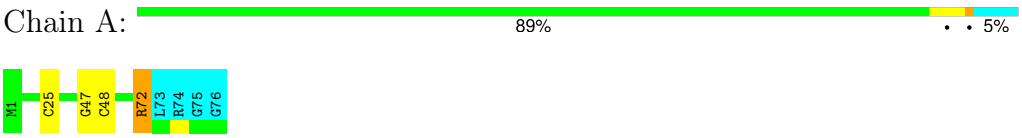



There are no outlier residues in this chain.

### 4.2.10 Score per residue for model 10

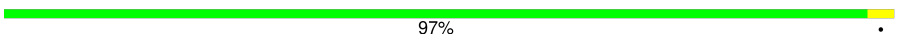
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

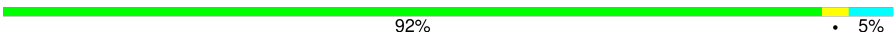
Chain B:



### 4.2.11 Score per residue for model 11

• Molecule 1: ubiquitin

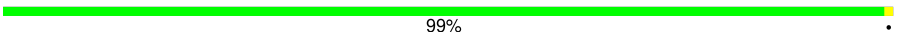
Chain A:





• Molecule 2: ubiquitin

Chain B:

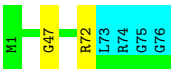




### 4.2.12 Score per residue for model 12

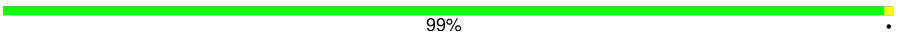
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

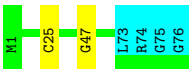




### 4.2.13 Score per residue for model 13

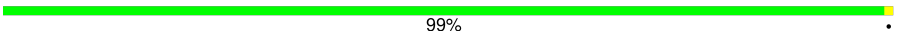
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

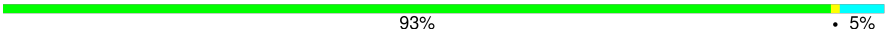
Chain B:

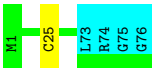



### 4.2.14 Score per residue for model 14

• Molecule 1: ubiquitin

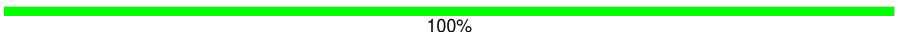
Chain A:




• Molecule 2: ubiquitin

Chain B:

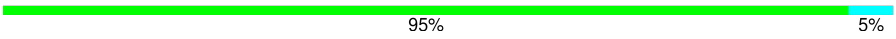


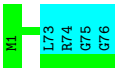

There are no outlier residues in this chain.

### 4.2.15 Score per residue for model 15

• Molecule 1: ubiquitin

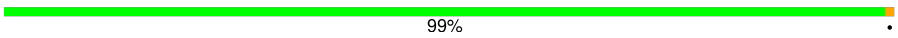
Chain A:




• Molecule 2: ubiquitin

Chain B:

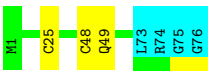




### 4.2.16 Score per residue for model 16

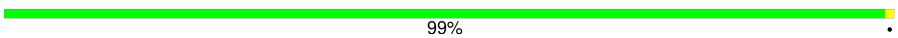
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

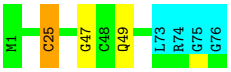
Chain B:




### 4.2.17 Score per residue for model 17

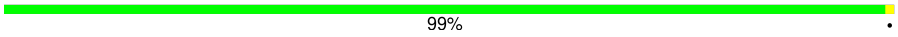
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

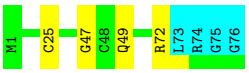




### 4.2.18 Score per residue for model 18

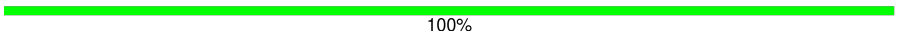
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

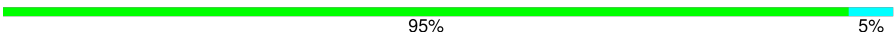


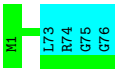

There are no outlier residues in this chain.

### 4.2.19 Score per residue for model 19

• Molecule 1: ubiquitin

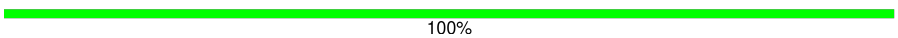
Chain A:




• Molecule 2: ubiquitin

Chain B:

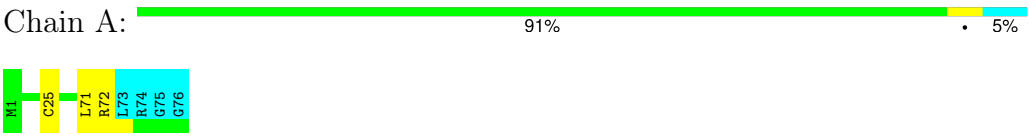



There are no outlier residues in this chain.

### 4.2.20 Score per residue for model 20

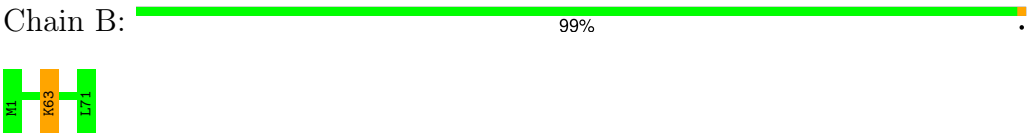
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

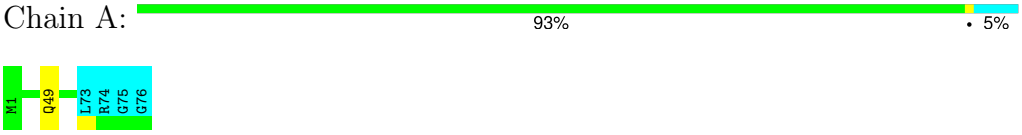
Chain B:




### 4.2.21 Score per residue for model 21

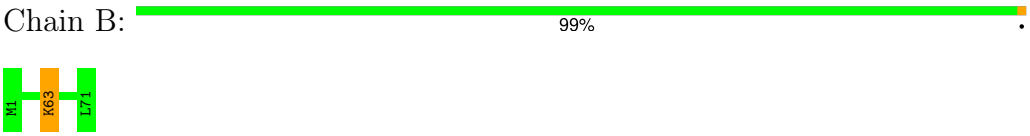
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

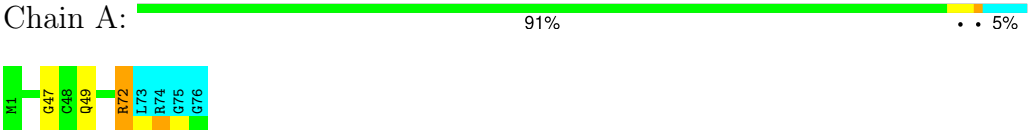
Chain B:




### 4.2.22 Score per residue for model 22

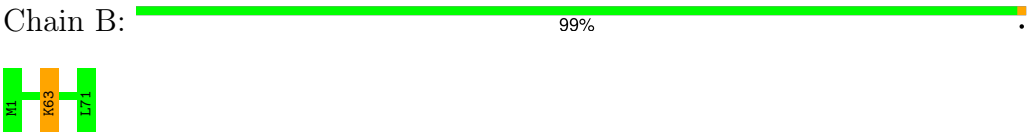
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

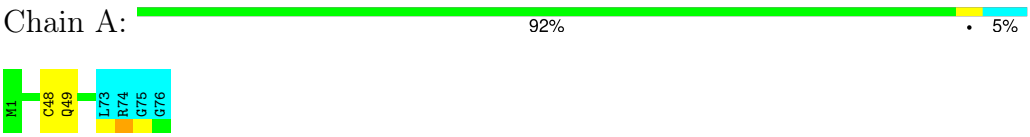
Chain B:



### 4.2.23 Score per residue for model 23

• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

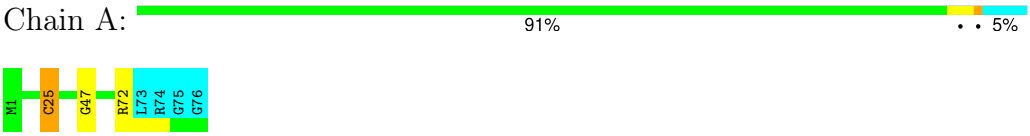
Chain B:


There are no outlier residues in this chain.

### 4.2.24 Score per residue for model 24

• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

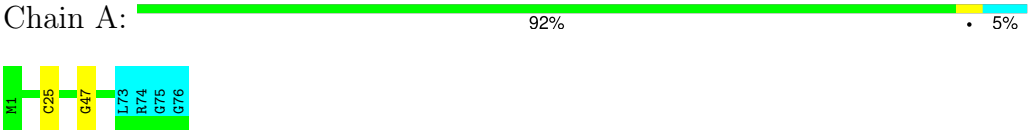
Chain B:


There are no outlier residues in this chain.

### 4.2.25 Score per residue for model 25

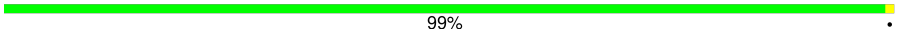
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

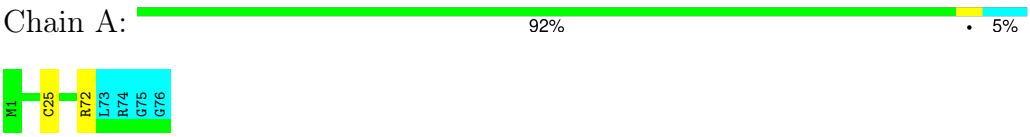
Chain B:




### 4.2.26 Score per residue for model 26

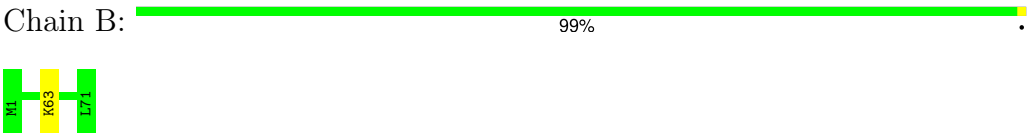
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

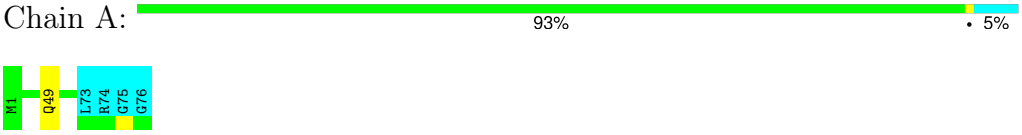
Chain B:




### 4.2.27 Score per residue for model 27

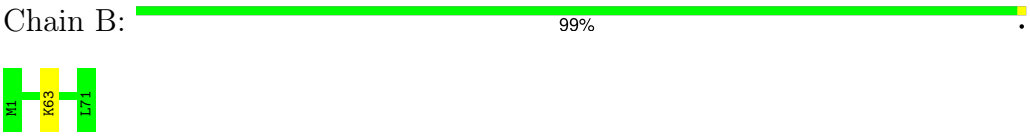
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

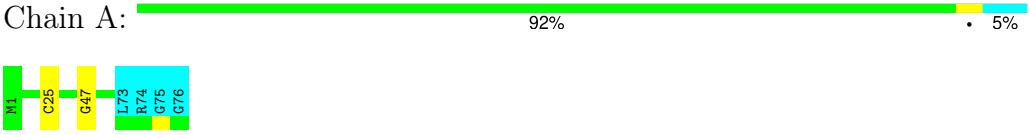
Chain B:




### 4.2.28 Score per residue for model 28

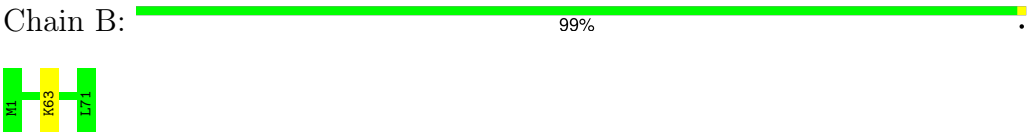
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

Chain B:



### 4.2.29 Score per residue for model 29

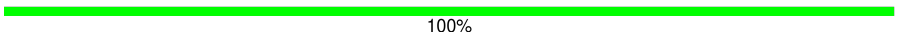
• Molecule 1: ubiquitin

Chain A:



• Molecule 2: ubiquitin

Chain B:

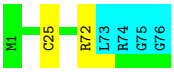



There are no outlier residues in this chain.

### 4.2.30 Score per residue for model 30

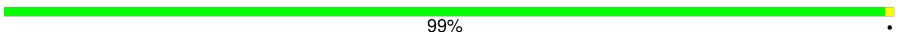
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

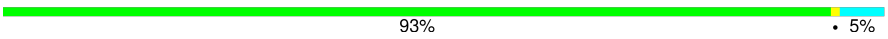


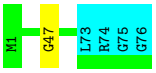


### 4.2.31 Score per residue for model 31

• Molecule 1: ubiquitin

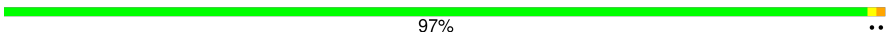
Chain A:

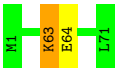



• Molecule 2: ubiquitin

Chain B:

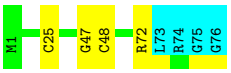


### 4.2.32 Score per residue for model 32

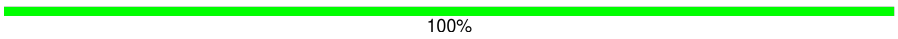
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

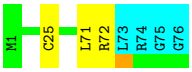



There are no outlier residues in this chain.

### 4.2.33 Score per residue for model 33

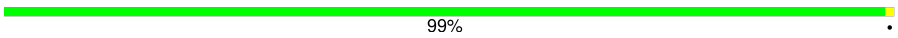
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

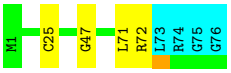




### 4.2.34 Score per residue for model 34

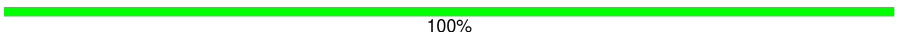
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:




There are no outlier residues in this chain.

### 4.2.35 Score per residue for model 35

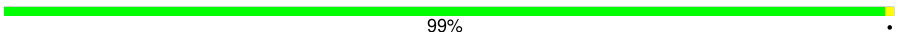
• Molecule 1: ubiquitin

Chain A:



• Molecule 2: ubiquitin

Chain B:

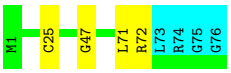




### 4.2.36 Score per residue for model 36

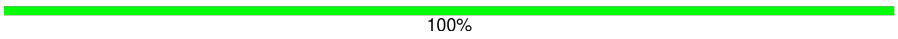
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:




There are no outlier residues in this chain.

### 4.2.37 Score per residue for model 37

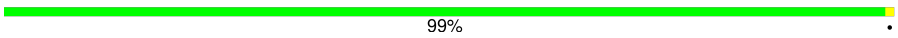
• Molecule 1: ubiquitin

Chain A:



• Molecule 2: ubiquitin

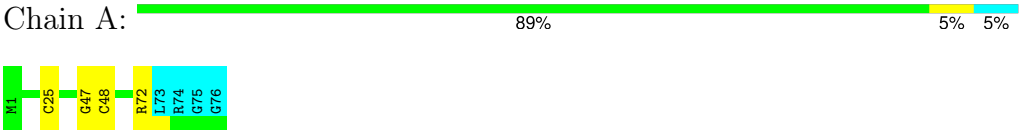
Chain B:




### 4.2.38 Score per residue for model 38

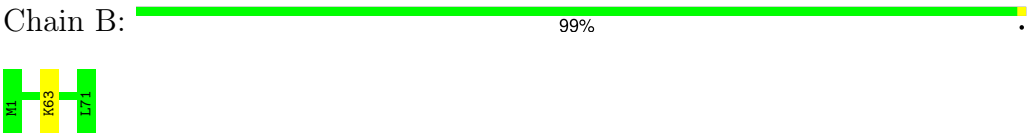
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

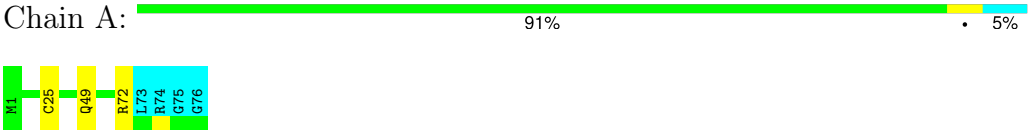
Chain B:




### 4.2.39 Score per residue for model 39

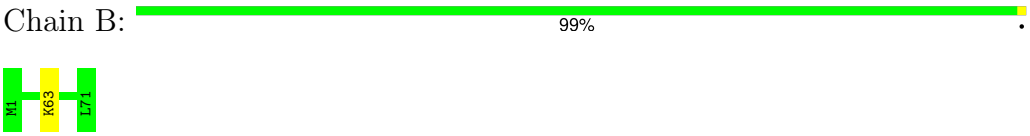
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

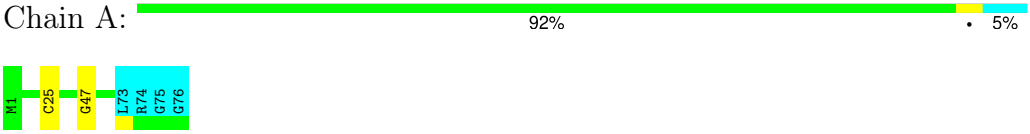
Chain B:




### 4.2.40 Score per residue for model 40

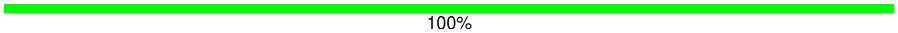
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

Chain B:

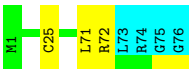



There are no outlier residues in this chain.

### 4.2.41 Score per residue for model 41

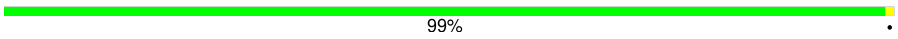
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

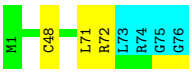




### 4.2.42 Score per residue for model 42

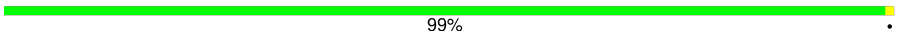
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

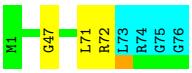




### 4.2.43 Score per residue for model 43

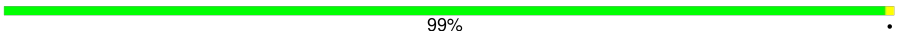
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

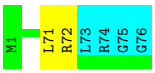
Chain B:




### 4.2.44 Score per residue for model 44

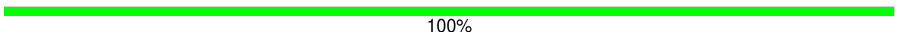
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

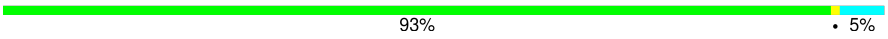


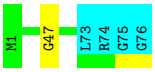

There are no outlier residues in this chain.

### 4.2.45 Score per residue for model 45

• Molecule 1: ubiquitin

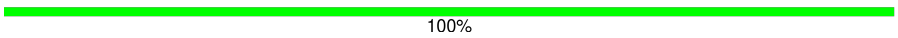
Chain A:




• Molecule 2: ubiquitin

Chain B:

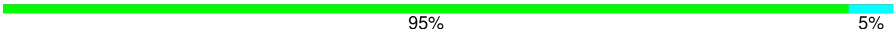


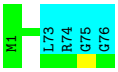

There are no outlier residues in this chain.

### 4.2.46 Score per residue for model 46

• Molecule 1: ubiquitin

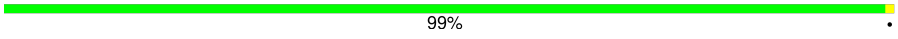
Chain A:




• Molecule 2: ubiquitin

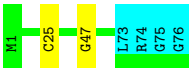
Chain B:




### 4.2.47 Score per residue for model 47

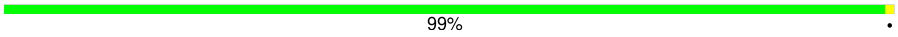
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

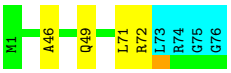




### 4.2.48 Score per residue for model 48

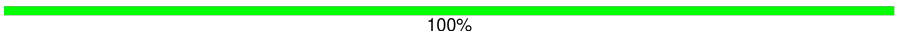
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

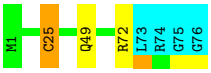



There are no outlier residues in this chain.

### 4.2.49 Score per residue for model 49

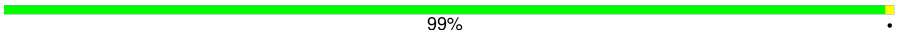
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

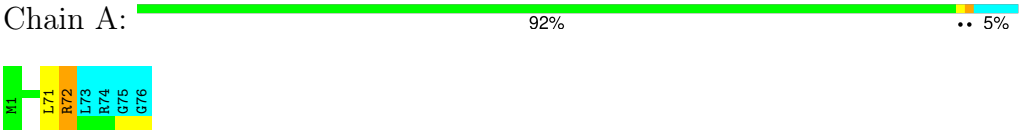
Chain B:




### 4.2.50 Score per residue for model 50

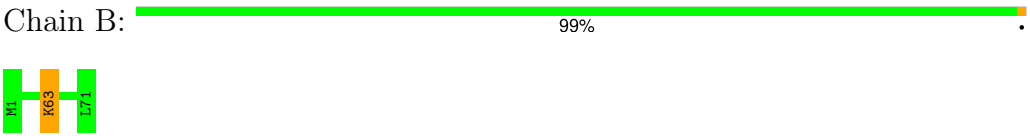
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

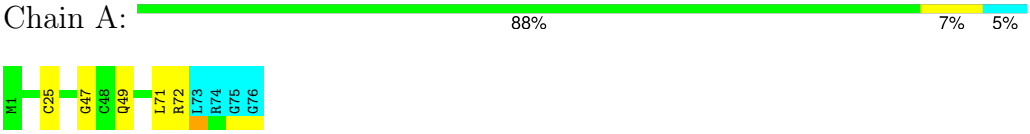
Chain B:




### 4.2.51 Score per residue for model 51

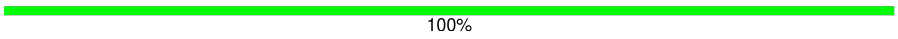
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

Chain B:

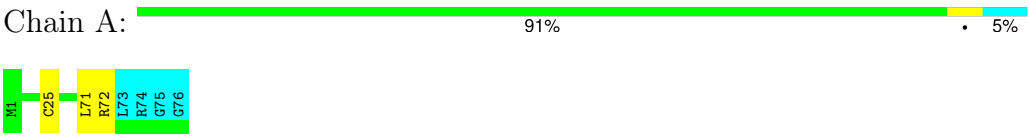



There are no outlier residues in this chain.

### 4.2.52 Score per residue for model 52

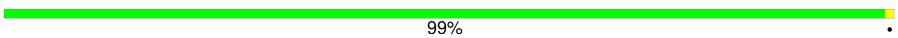
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

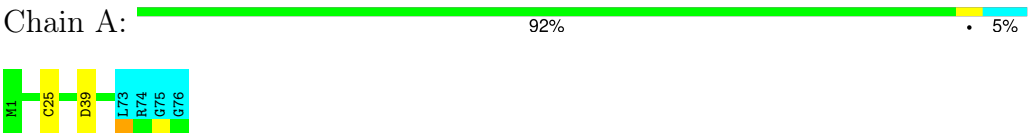
Chain B:



### 4.2.53 Score per residue for model 53

• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

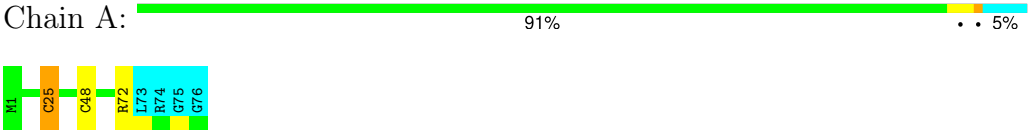
Chain B:


There are no outlier residues in this chain.

### 4.2.54 Score per residue for model 54

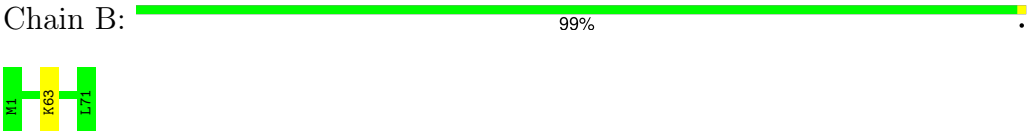
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

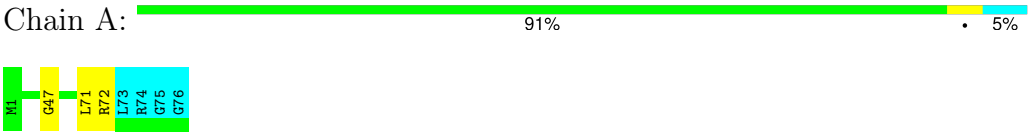
Chain B:




### 4.2.55 Score per residue for model 55

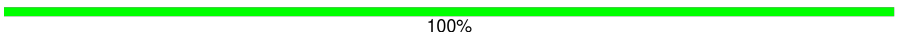
• Molecule 1: ubiquitin

Chain A:




• Molecule 2: ubiquitin

Chain B:




There are no outlier residues in this chain.

### 4.2.56 Score per residue for model 56

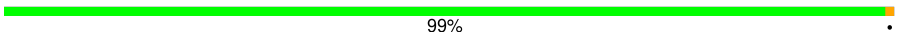
• Molecule 1: ubiquitin

Chain A:



• Molecule 2: ubiquitin

Chain B:





### 4.2.57 Score per residue for model 57

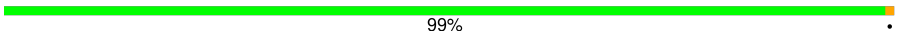
• Molecule 1: ubiquitin

Chain A:



• Molecule 2: ubiquitin

Chain B:

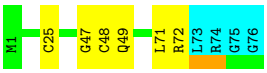




### 4.2.58 Score per residue for model 58

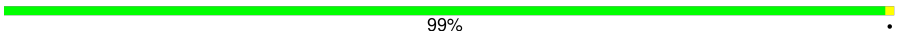
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

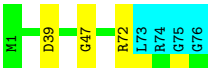
Chain B:




### 4.2.59 Score per residue for model 59

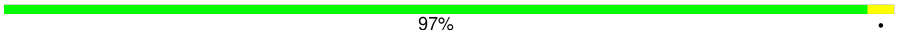
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

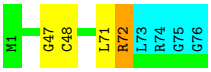




### 4.2.60 Score per residue for model 60

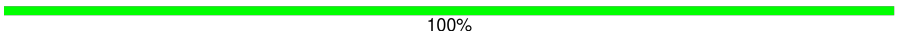
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

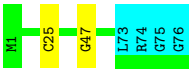



There are no outlier residues in this chain.

### 4.2.61 Score per residue for model 61

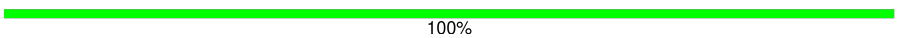
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

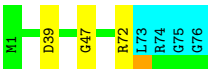



There are no outlier residues in this chain.

### 4.2.62 Score per residue for model 62

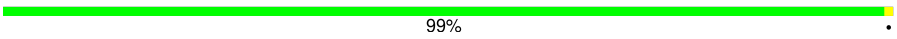
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

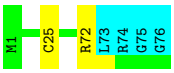




### 4.2.63 Score per residue for model 63

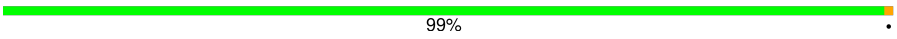
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

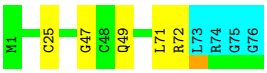




### 4.2.64 Score per residue for model 64

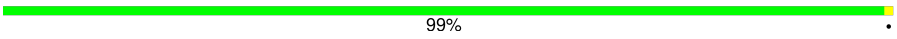
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

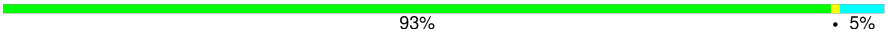
Chain B:

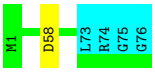



### 4.2.65 Score per residue for model 65

• Molecule 1: ubiquitin

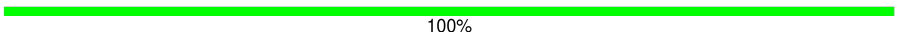
Chain A:




• Molecule 2: ubiquitin

Chain B:

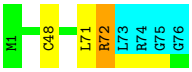



There are no outlier residues in this chain.

### 4.2.66 Score per residue for model 66

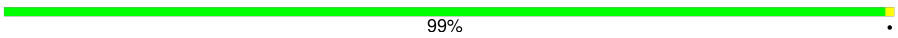
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

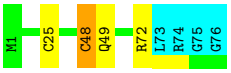




### 4.2.67 Score per residue for model 67

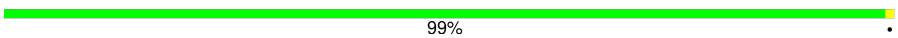
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

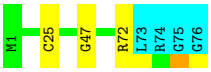
Chain B:




### 4.2.68 Score per residue for model 68

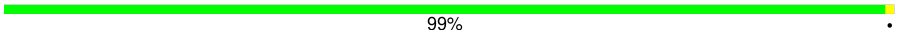
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

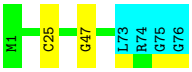




### 4.2.69 Score per residue for model 69

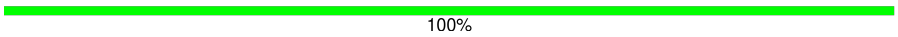
• Molecule 1: ubiquitin

Chain A:


• Molecule 2: ubiquitin

Chain B:

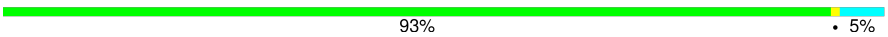


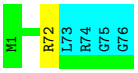

There are no outlier residues in this chain.

### 4.2.70 Score per residue for model 70

• Molecule 1: ubiquitin

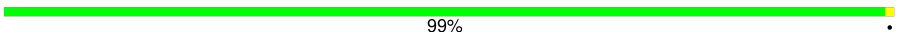
Chain A:




• Molecule 2: ubiquitin

Chain B:




# 5 Refinement protocol and experimental data overview

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

Of the 80 calculated structures, 70 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 |
|---|---|---|
| X-PLOR NIH | structure solution | |
| X-PLOR NIH | 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 | 270 |
| Number of shifts mapped to atoms | 270 |
| Number of unparsed shifts | 0 |
| Number of shifts with mapping errors | 0 |
| Number of shifts with mapping warnings | 0 |
| Assignment completeness (well-defined parts) | 13% |

# 6 Model quality

## 6.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MTN

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

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 | 116 | 23 | 92 | 2±1 |
| 2 | B | 1156 | 268 | 349 | 1±1 |
| 3 | A | 72 | 90 | 90 | 2±1 |
| All | All | 94080 | 26670 | 37226 | 166 |

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 1.

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

| Atom-1 | Atom-2 | Clash(Å) | Distance(Å) | Models | |
|---|---|---|---|---|---|
| | | | | Worst | Total |
| 1:A:47:GLY:O | 3:A:102[X]:MTN:H73 | 0.65 | 1.91 | 37 | 3 |
| 1:A:47:GLY:O | 3:A:102[Y]:MTN:H62 | 0.65 | 1.92 | 11 | 1 |
| 1:A:71:LEU:O | 1:A:72[A]:ARG:O | 0.64 | 2.16 | 66 | 3 |
| 1:A:47:GLY:O | 3:A:102[Z]:MTN:H62 | 0.63 | 1.93 | 7 | 3 |
| 1:A:47:GLY:O | 3:A:102[Y]:MTN:H93 | 0.60 | 1.96 | 10 | 1 |
| 1:A:71:LEU:O | 1:A:72[C]:ARG:C | 0.59 | 2.39 | 33 | 8 |
| 1:A:71:LEU:O | 1:A:72[A]:ARG:C | 0.59 | 2.39 | 43 | 3 |
| 2:B:63[D]:LYS:NZ | 2:B:63[D]:LYS:O | 0.57 | 2.37 | 50 | 2 |
| 1:A:47:GLY:O | 3:A:102[Y]:MTN:H61 | 0.56 | 2.01 | 34 | 1 |
| 1:A:49:GLN:N | 3:A:102[Y]:MTN:S1 | 0.56 | 2.78 | 35 | 8 |

*Continued on next page...*

*Continued from previous page...*

| Atom-1 | Atom-2 | Clash(Å) | Distance(Å) | Models | |
|---|---|---|---|---|---|
| | | | | Worst | Total |
| 1:A:25[Y]:CYS:SG | 3:A:101[Y]:MTN:H2 | 0.54 | 2.42 | 17 | 6 |
| 1:A:48[Z]:CYS:SG | 3:A:102[Z]:MTN:H2 | 0.53 | 2.43 | 67 | 1 |
| 3:A:101[X]:MTN:S1 | 3:A:101[X]:MTN:H71 | 0.51 | 2.46 | 61 | 1 |
| 1:A:47:GLY:O | 3:A:102[X]:MTN:H62 | 0.51 | 2.06 | 59 | 3 |
| 1:A:71:LEU:O | 1:A:72[C]:ARG:O | 0.51 | 2.29 | 33 | 5 |
| 1:A:47:GLY:O | 3:A:102[Z]:MTN:H73 | 0.50 | 2.06 | 13 | 5 |
| 1:A:47:GLY:O | 3:A:102[Z]:MTN:H61 | 0.50 | 2.06 | 47 | 1 |
| 3:A:101[X]:MTN:S1 | 3:A:101[X]:MTN:H61 | 0.50 | 2.47 | 61 | 1 |
| 3:A:102[X]:MTN:S1 | 3:A:102[X]:MTN:H71 | 0.50 | 2.47 | 25 | 1 |
| 1:A:46:ALA:O | 3:A:102[Z]:MTN:S1 | 0.50 | 2.70 | 48 | 1 |
| 2:B:63[D]:LYS:O | 2:B:63[D]:LYS:CE | 0.49 | 2.60 | 66 | 2 |
| 3:A:102[X]:MTN:S1 | 3:A:102[X]:MTN:H61 | 0.49 | 2.47 | 25 | 1 |
| 1:A:47:GLY:O | 3:A:102[X]:MTN:H61 | 0.49 | 2.07 | 32 | 1 |
| 1:A:58:ASP:O | 3:A:102[Y]:MTN:H81 | 0.49 | 2.07 | 65 | 1 |
| 1:A:47:GLY:O | 3:A:102[Y]:MTN:S1 | 0.49 | 2.70 | 69 | 10 |
| 1:A:49:GLN:O | 3:A:102[Y]:MTN:S1 | 0.48 | 2.72 | 35 | 1 |
| 1:A:71:LEU:C | 1:A:72[C]:ARG:O | 0.48 | 2.52 | 44 | 3 |
| 1:A:47:GLY:O | 3:A:102[Z]:MTN:H71 | 0.48 | 2.08 | 47 | 1 |
| 1:A:47:GLY:O | 3:A:102[X]:MTN:H71 | 0.48 | 2.08 | 32 | 1 |
| 1:A:47:GLY:O | 3:A:102[Z]:MTN:H82 | 0.47 | 2.09 | 36 | 1 |
| 1:A:47:GLY:C | 3:A:102[Y]:MTN:S1 | 0.47 | 2.93 | 24 | 13 |
| 2:B:63[B]:LYS:N | 2:B:63[B]:LYS:CD | 0.47 | 2.78 | 46 | 7 |
| 1:A:49:GLN:N | 3:A:102[X]:MTN:S1 | 0.46 | 2.89 | 58 | 6 |
| 1:A:47:GLY:C | 3:A:102[X]:MTN:S1 | 0.46 | 2.95 | 64 | 4 |
| 1:A:49:GLN:N | 3:A:102[Z]:MTN:S1 | 0.46 | 2.89 | 22 | 5 |
| 1:A:47:GLY:C | 3:A:102[Z]:MTN:S1 | 0.45 | 2.95 | 6 | 8 |
| 1:A:47:GLY:O | 3:A:102[Y]:MTN:H73 | 0.45 | 2.11 | 22 | 1 |
| 2:B:63[C]:LYS:N | 2:B:63[C]:LYS:CD | 0.45 | 2.80 | 58 | 2 |
| 1:A:47:GLY:O | 3:A:102[X]:MTN:S1 | 0.45 | 2.74 | 5 | 2 |
| 2:B:63[D]:LYS:N | 2:B:63[D]:LYS:CD | 0.45 | 2.80 | 22 | 15 |
| 1:A:47:GLY:O | 3:A:102[Z]:MTN:S1 | 0.45 | 2.74 | 61 | 5 |
| 2:B:63[A]:LYS:N | 2:B:63[A]:LYS:CD | 0.44 | 2.80 | 57 | 2 |
| 2:B:63[B]:LYS:CD | 2:B:63[B]:LYS:H | 0.43 | 2.26 | 46 | 2 |
| 1:A:71:LEU:O | 1:A:72[D]:ARG:C | 0.43 | 2.56 | 20 | 1 |
| 1:A:47:GLY:O | 3:A:102[X]:MTN:H82 | 0.43 | 2.14 | 51 | 1 |
| 1:A:71:LEU:C | 1:A:72[A]:ARG:O | 0.43 | 2.57 | 36 | 1 |
| 2:B:63[C]:LYS:HG2 | 2:B:64[C]:GLU:N | 0.42 | 2.29 | 59 | 2 |
| 2:B:63[A]:LYS:HD3 | 2:B:63[A]:LYS:H | 0.42 | 1.75 | 20 | 1 |
| 2:B:63[C]:LYS:H | 2:B:63[C]:LYS:HD3 | 0.41 | 1.76 | 67 | 1 |
| 2:B:63[A]:LYS:HG2 | 2:B:64[A]:GLU:N | 0.40 | 2.32 | 31 | 1 |
| 1:A:47:GLY:O | 3:A:102[Y]:MTN:H81 | 0.40 | 2.16 | 57 | 1 |

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| Atom-1 | Atom-2 | Clash(Å) | Distance(Å) | Models | |
|---|---|---|---|---|---|
| | | | | Worst | Total |
| 1:A:47:GLY:O | 3:A:102[Z]:MTN:H93 | 0.40 | 2.16 | 28 | 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 | 78/76 (103%) | 76±2 (98±3%) | 1±2 (1±2%) | 1±2 (1±2%) | 16 65 |
| 2 | B | 276/71 (389%) | 276±0 (100±0%) | 0±0 (0±0%) | 0±0 (0±0%) | 100 100 |
| All | All | 24780/10290 (241%) | 24660 (100%) | 64 (0%) | 56 (0%) | 45 81 |

All 4 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 | 72[A] | ARG | 14 |
| 1 | A | 72[B] | ARG | 14 |
| 1 | A | 72[C] | ARG | 14 |
| 1 | A | 72[D] | ARG | 14 |

### 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 | 6/68 (9%) | 4±2 (62±32%) | 2±2 (38±32%) | 0 6 |
| 2 | B | 4/65 (6%) | 3±2 (74±44%) | 1±2 (26±44%) | 2 22 |
| All | All | 700/9310 (8%) | 469 (67%) | 231 (33%) | 1 11 |

All 10 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 | 25[X] | CYS | 37 |
| 1 | A | 25[Y] | CYS | 37 |
| 1 | A | 25[Z] | CYS | 37 |
| 2 | B | 63[A] | LYS | 18 |
| 2 | B | 63[B] | LYS | 18 |
| 2 | B | 63[C] | LYS | 18 |
| 2 | B | 63[D] | LYS | 18 |
| 1 | A | 48[X] | CYS | 16 |
| 1 | A | 48[Y] | CYS | 16 |
| 1 | A | 48[Z] | CYS | 16 |

### 6.3.3 RNA

There are no RNA molecules in this entry.

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

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

## 6.5 Carbohydrates

There are no oligosaccharides in this entry.

## 6.6 Ligand geometry

6 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds for which Mogul statistics could be retrieved, the number of bonds that are observed in the model and the number of bonds that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length is the number of standard deviations the observed value is removed from the expected value. A bond length with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond lengths.

| Mol | Type | Chain | Res | Link | Bond lengths | | |
|---|---|---|---|---|---|---|---|
| | | | | | Counts | RMSZ | #Z>2 |
| 3 | MTN | A | 101[Y] | 1 | 9,12,16 | 1.49±0.01 | 1±0 (11±1%) |
| 3 | MTN | A | 101[Z] | 1 | 9,12,16 | 1.46±0.01 | 1±0 (11±0%) |

| Mol | Type | Chain | Res | Link | Bond lengths | | |
|---|---|---|---|---|---|---|---|
| | | | | | Counts | RMSZ | #Z>2 |
| 3 | MTN | A | 102[X] | 1 | 9,12,16 | 1.50±0.01 | 1±0 (11±0%) |
| 3 | MTN | A | 101[X] | 1 | 9,12,16 | 1.51±0.01 | 2±0 (16±5%) |
| 3 | MTN | A | 102[Y] | 1 | 9,12,16 | 1.46±0.01 | 1±0 (11±0%) |
| 3 | MTN | A | 102[Z] | 1 | 9,12,16 | 1.49±0.01 | 1±0 (11±0%) |

In the following table, the Counts columns list the number of angles for which Mogul statistics could be retrieved, the number of angles that are observed in the model and the number of angles that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond angle is the number of standard deviations the observed value is removed from the expected value. A bond angle with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond angles.

| Mol | Type | Chain | Res | Link | Bond angles | | |
|---|---|---|---|---|---|---|---|
| | | | | | Counts | RMSZ | #Z>2 |
| 3 | MTN | A | 101[Y] | 1 | 11,20,27 | 1.44±0.01 | 1±0 (9±0%) |
| 3 | MTN | A | 101[Z] | 1 | 11,20,27 | 1.40±0.01 | 1±0 (9±0%) |
| 3 | MTN | A | 102[X] | 1 | 11,20,27 | 1.41±0.01 | 1±0 (9±0%) |
| 3 | MTN | A | 101[X] | 1 | 11,20,27 | 1.47±0.01 | 1±0 (9±0%) |
| 3 | MTN | A | 102[Y] | 1 | 11,20,27 | 1.42±0.01 | 1±0 (9±0%) |
| 3 | MTN | A | 102[Z] | 1 | 11,20,27 | 1.42±0.01 | 1±0 (9±0%) |

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

| Mol | Type | Chain | Res | Link | Chirals | Torsions | Rings |
|---|---|---|---|---|---|---|---|
| 3 | MTN | A | 101[Y] | 1 | - | 0±0,0,25,29 | 0±0,1,1,1 |
| 3 | MTN | A | 101[Z] | 1 | - | 0±0,0,25,29 | 0±0,1,1,1 |
| 3 | MTN | A | 102[Z] | 1 | - | 0±0,0,25,29 | 0±0,1,1,1 |
| 3 | MTN | A | 101[X] | 1 | - | 0±0,0,25,29 | 0±0,1,1,1 |
| 3 | MTN | A | 102[Y] | 1 | - | 0±0,0,25,29 | 0±0,1,1,1 |
| 3 | MTN | A | 102[X] | 1 | - | 0±0,0,25,29 | 0±0,1,1,1 |

All unique bond outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

| Mol | Chain | Res | Type | Atoms | Z | Observed(Å) | Ideal(Å) | Models | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Worst | Total |
| 3 | A | 101[X] | MTN | O1-N1 | 3.70 | 1.23 | 1.43 | 22 | 70 |
| 3 | A | 102[Z] | MTN | O1-N1 | 3.69 | 1.23 | 1.43 | 36 | 70 |
| 3 | A | 102[X] | MTN | O1-N1 | 3.69 | 1.23 | 1.43 | 56 | 70 |
| 3 | A | 101[Z] | MTN | O1-N1 | 3.69 | 1.23 | 1.43 | 59 | 70 |
| 3 | A | 102[Y] | MTN | O1-N1 | 3.68 | 1.23 | 1.43 | 54 | 70 |
| 3 | A | 101[Y] | MTN | O1-N1 | 3.68 | 1.23 | 1.43 | 14 | 70 |
| 3 | A | 101[X] | MTN | C5-N1 | 2.12 | 1.52 | 1.50 | 35 | 36 |
| 3 | A | 101[Y] | MTN | C5-N1 | 2.01 | 1.52 | 1.50 | 12 | 1 |

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

| Mol | Chain | Res | Type | Atoms | Z | Observed($^o$) | Ideal($^o$) | Models | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Worst | Total |
| 3 | A | 101[X] | MTN | C2-C1-N1 | 3.53 | 101.86 | 99.43 | 5 | 70 |
| 3 | A | 101[Y] | MTN | C2-C1-N1 | 3.45 | 101.81 | 99.43 | 3 | 70 |
| 3 | A | 102[Z] | MTN | C2-C1-N1 | 3.42 | 101.79 | 99.43 | 58 | 70 |
| 3 | A | 102[X] | MTN | C2-C1-N1 | 3.33 | 101.72 | 99.43 | 25 | 70 |
| 3 | A | 101[Z] | MTN | C2-C1-N1 | 3.32 | 101.71 | 99.43 | 66 | 70 |
| 3 | A | 102[Y] | MTN | C2-C1-N1 | 3.30 | 101.70 | 99.43 | 19 | 70 |

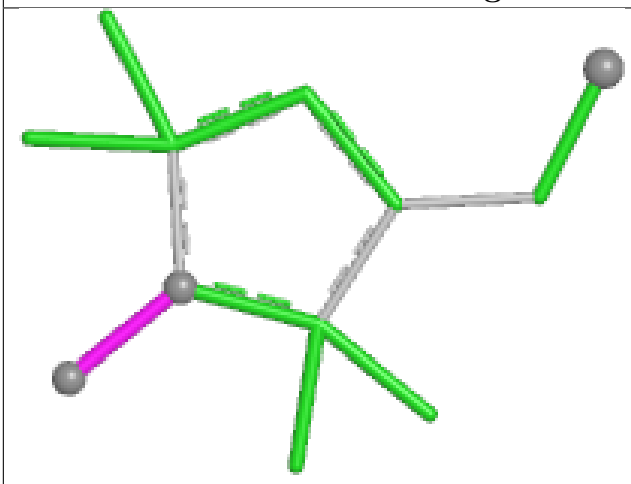
There are no chirality outliers.

There are no torsion outliers.

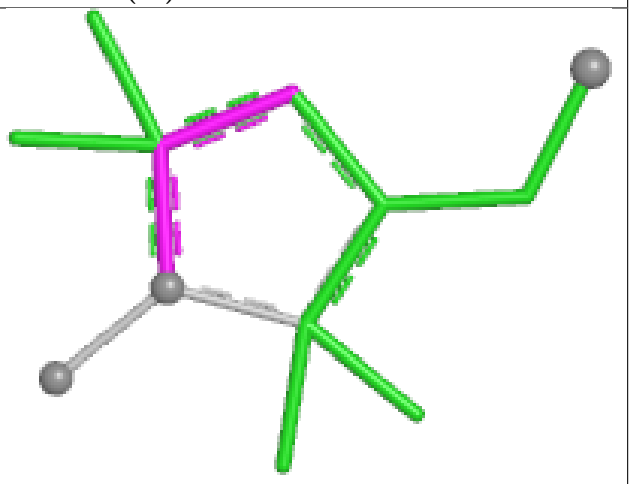
There are no ring outliers.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

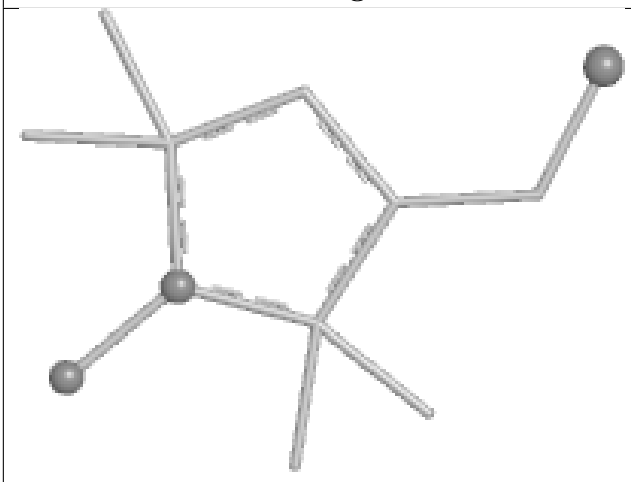
**Ligand MTN A 101 (Y)**



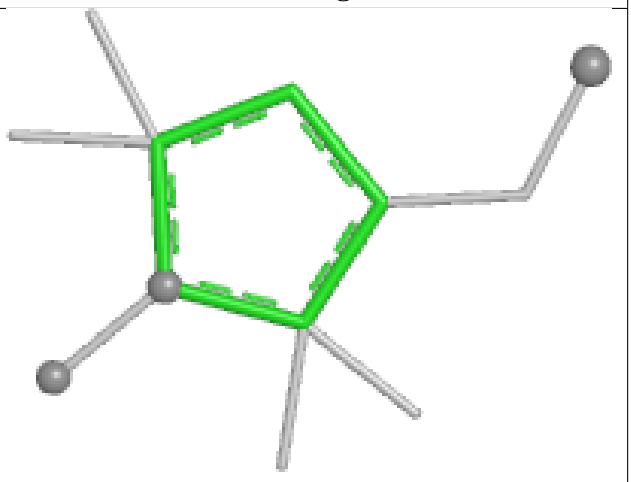
**Bond lengths**



**Bond angles**

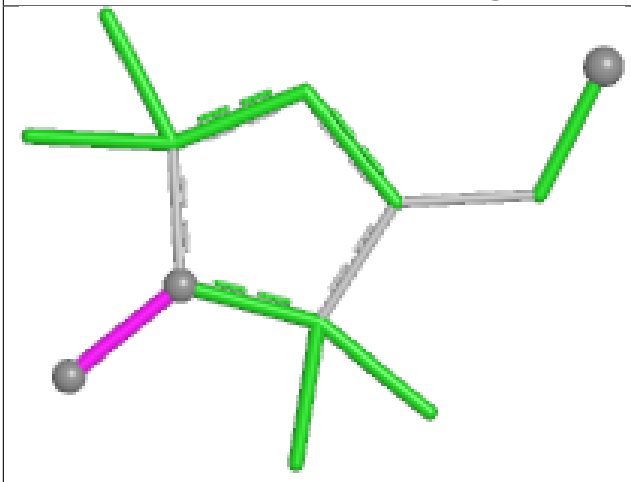


**Torsions**

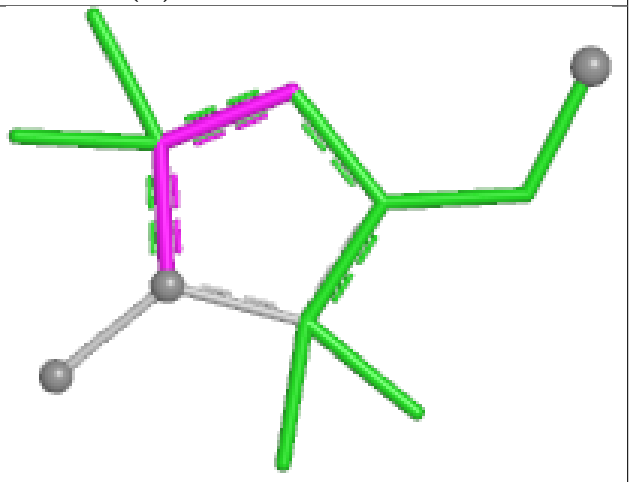


**Rings**

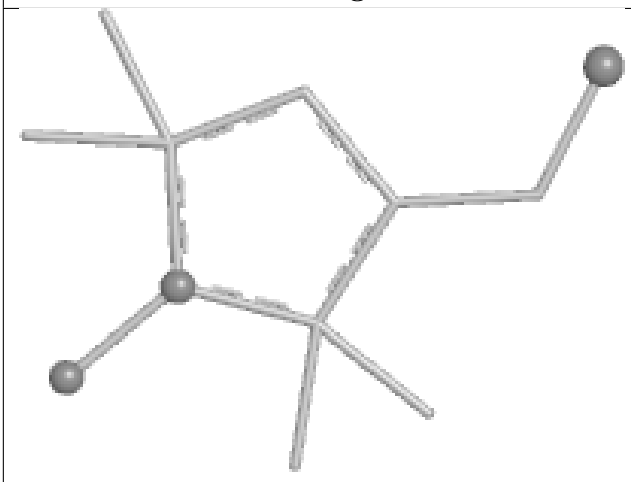
**Ligand MTN A 101 (Z)**



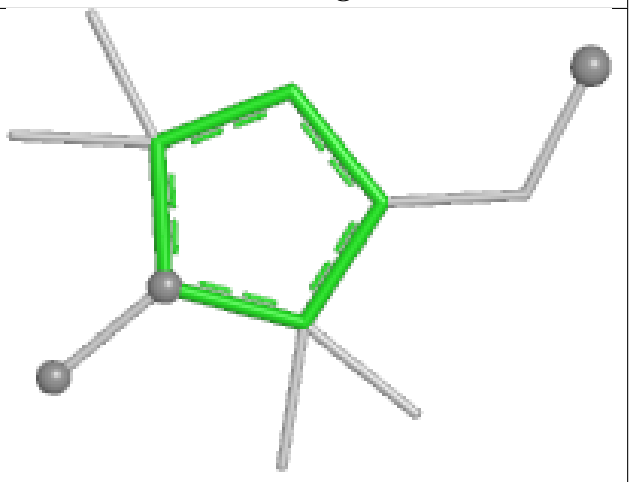
**Bond lengths**



**Bond angles**

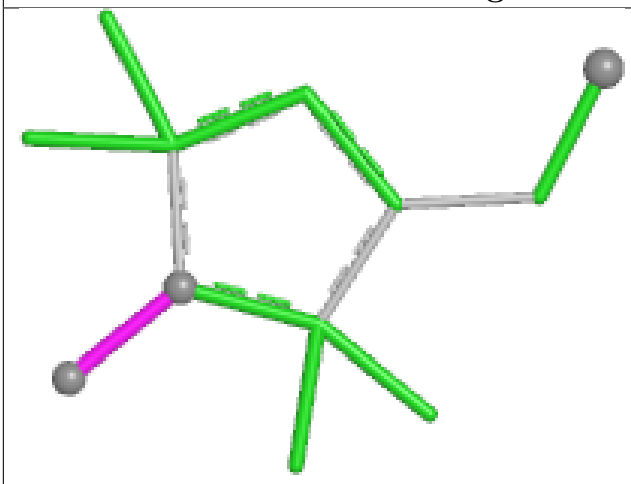


**Torsions**

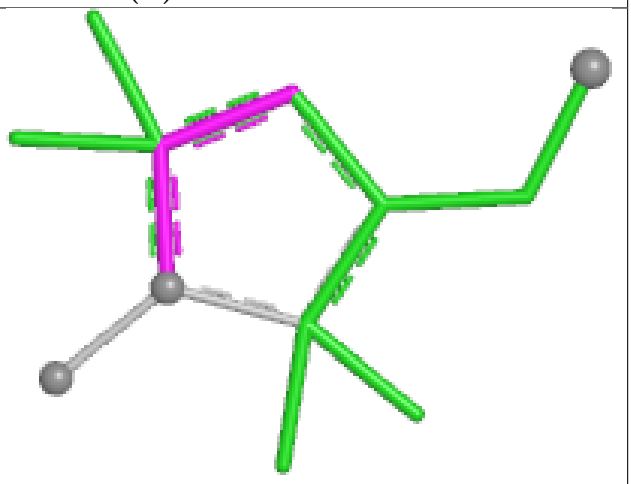


**Rings**

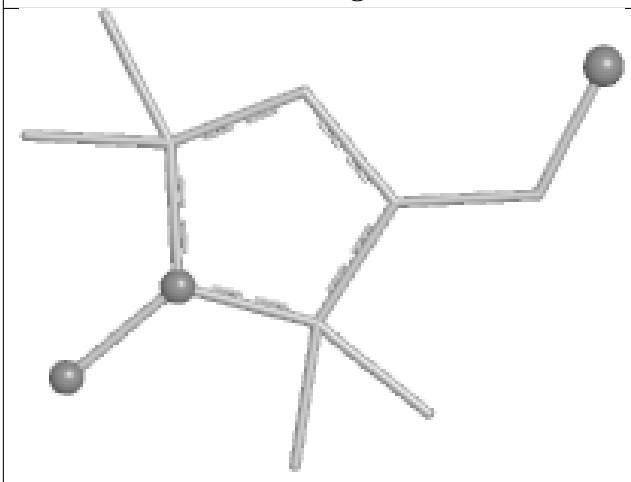
**Ligand MTN A 102 (Z)**



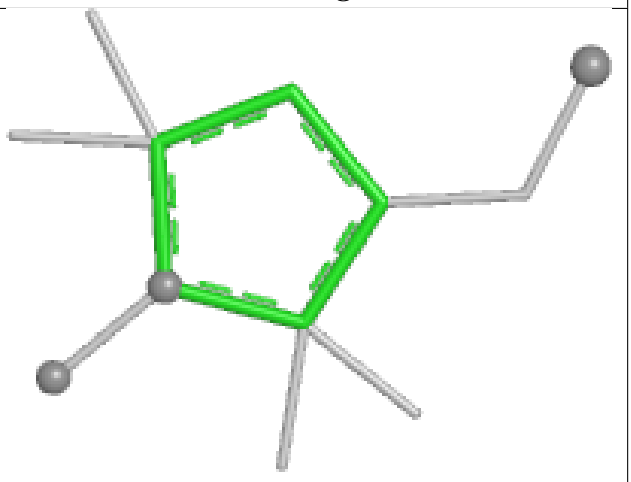
**Bond lengths**



**Bond angles**

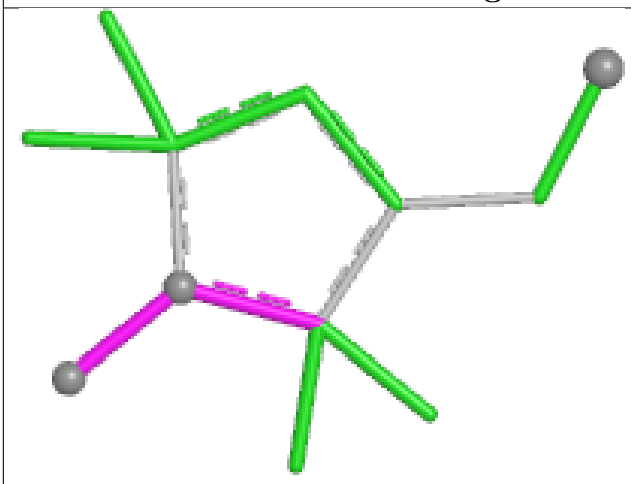


**Torsions**

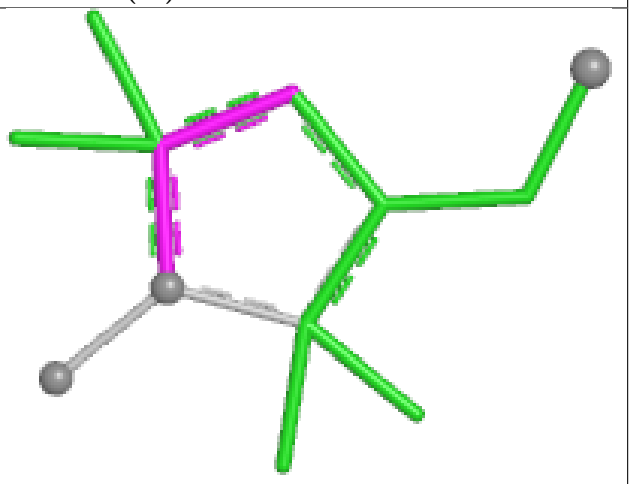


**Rings**

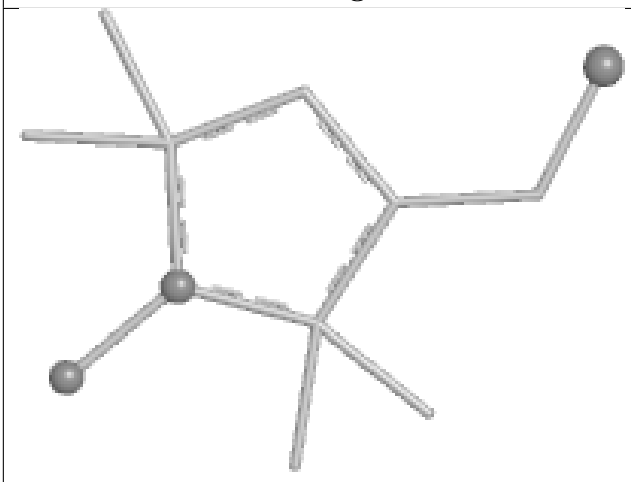
**Ligand MTN A 101 (X)**



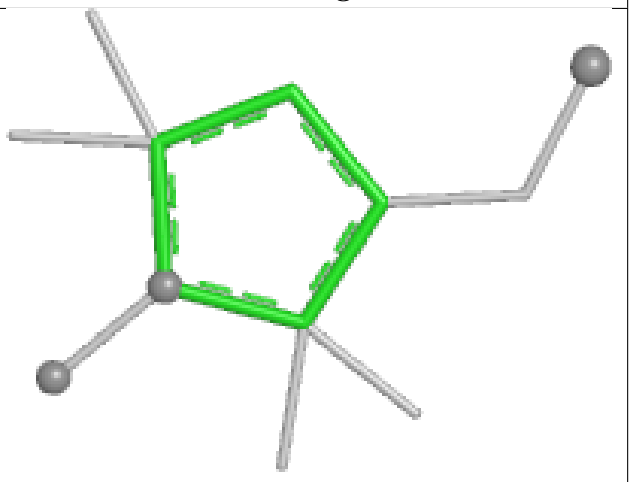
**Bond lengths**



**Bond angles**

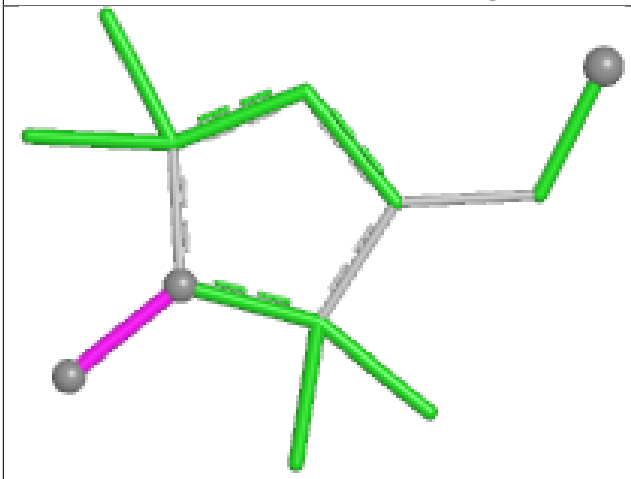


**Torsions**

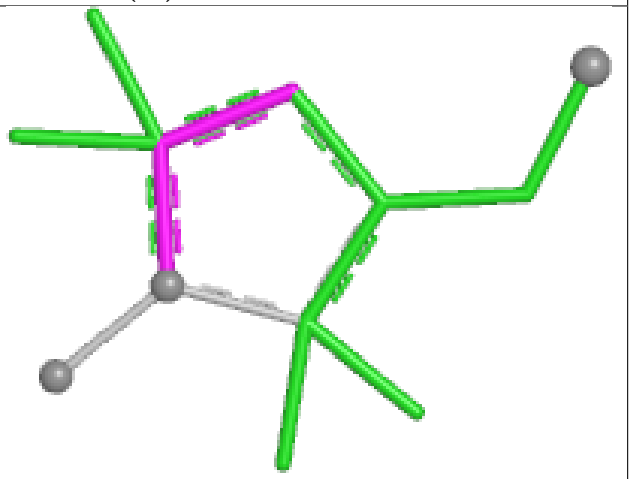


**Rings**

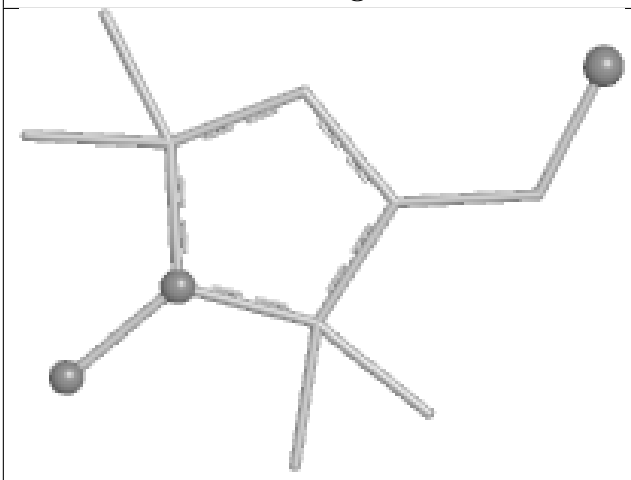
**Ligand MTN A 102 (Y)**



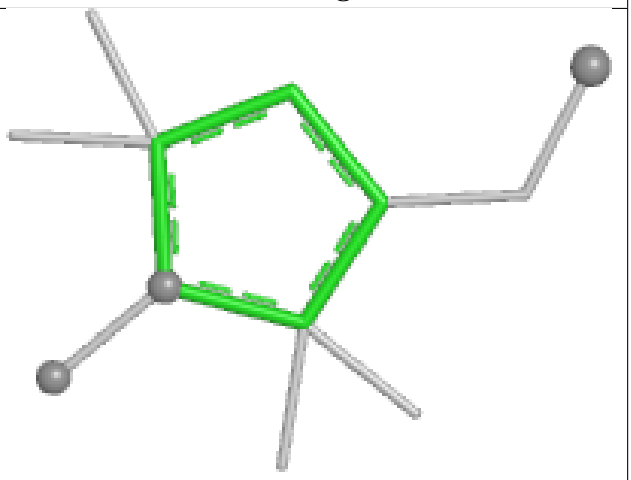
**Bond lengths**



**Bond angles**

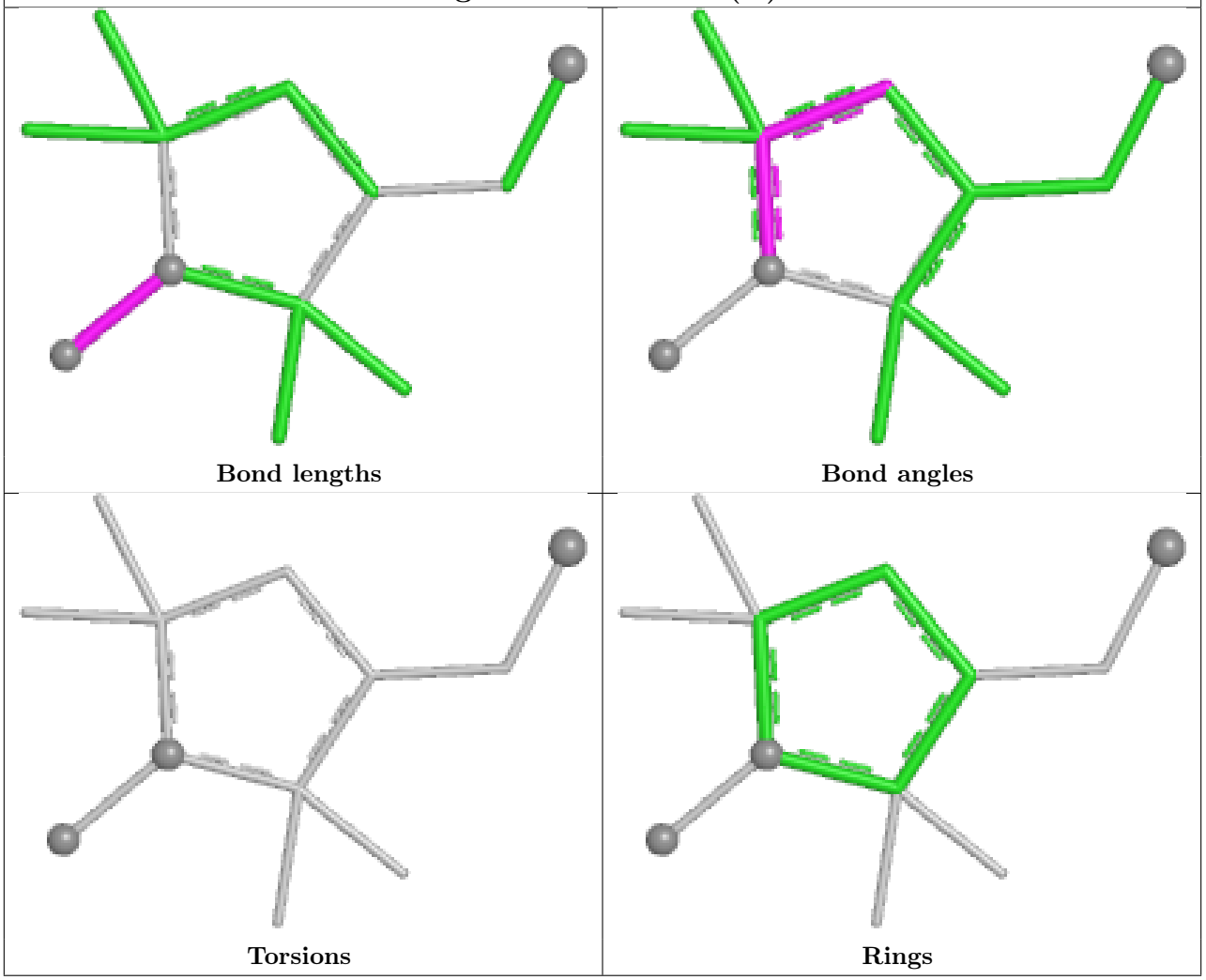


**Torsions**



**Rings**

**Ligand MTN A 102 (X)**




## 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

The completeness of assignment taking into account all chemical shift lists is 13% for the well-defined parts and 13% 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 | 270 |
| Number of shifts mapped to atoms | 270 |
| Number of unparsed shifts | 0 |
| Number of shifts with mapping errors | 0 |
| Number of shifts with mapping warnings | 0 |
| Number of shift outliers (ShiftChecker) | 0 |

### 7.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

| Nucleus | # values | Correction ± precision, *ppm* | Suggested action |
|---|---|---|---|
| $^{13}C_{\alpha}$ | 0 | — | None (insufficient data) |
| $^{13}C_{\beta}$ | 0 | — | None (insufficient data) |
| $^{13}C'$ | 0 | — | None (insufficient data) |
| $^{15}N$ | 135 | 0.54 ± 0.71 | None needed (imprecise) |

### 7.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 13%, i.e. 262 atoms were assigned a chemical shift out of a possible 1997. 0 out of 24 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

| | Total | $^{1}H$ | $^{13}C$ | $^{15}N$ |
|---|---|---|---|---|
| Backbone | 262/711 (37%) | 131/288 (45%) | 0/286 (0%) | 131/137 (96%) |
| Sidechain | 0/1216 (0%) | 0/787 (0%) | 0/386 (0%) | 0/43 (0%) |

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| | Total | $^{1}$H | $^{13}$C | $^{15}$N |
|---|---|---|---|---|
| Aromatic | 0/70 (0%) | 0/36 (0%) | 0/34 (0%) | 0/0 (—%) |
| Overall | 262/1997 (13%) | 131/1111 (12%) | 0/706 (0%) | 131/180 (73%) |

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 13%, i.e. 270 atoms were assigned a chemical shift out of a possible 2050. 0 out of 25 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

| | Total | $^{1}$H | $^{13}$C | $^{15}$N |
|---|---|---|---|---|
| Backbone | 270/733 (37%) | 135/298 (45%) | 0/294 (0%) | 135/141 (96%) |
| Sidechain | 0/1247 (0%) | 0/807 (0%) | 0/394 (0%) | 0/46 (0%) |
| Aromatic | 0/70 (0%) | 0/36 (0%) | 0/34 (0%) | 0/0 (—%) |
| Overall | 270/2050 (13%) | 135/1141 (12%) | 0/722 (0%) | 135/187 (72%) |

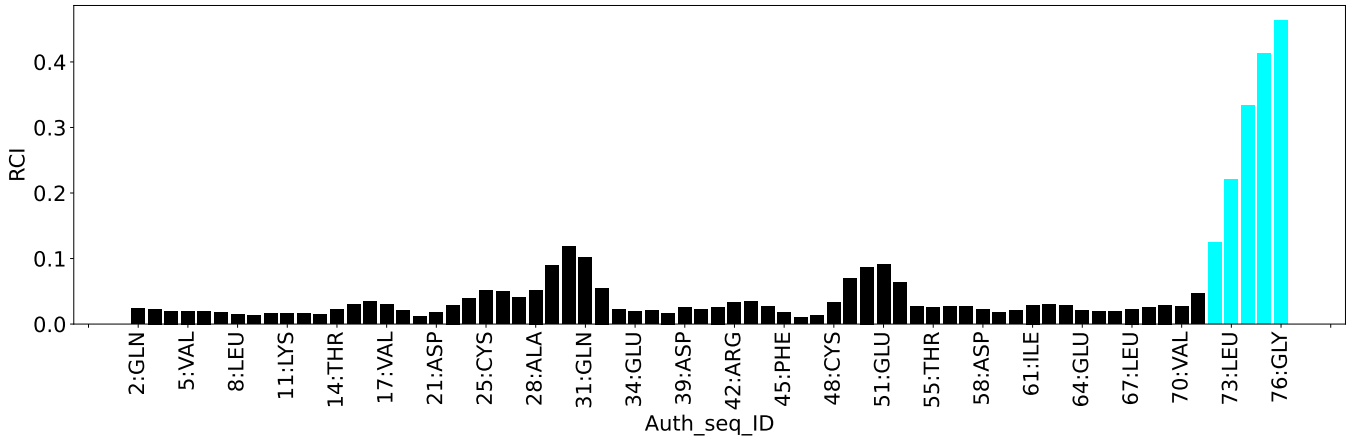
### 7.1.4 Statistically unusual chemical shifts (i)

There are no statistically unusual chemical shifts.

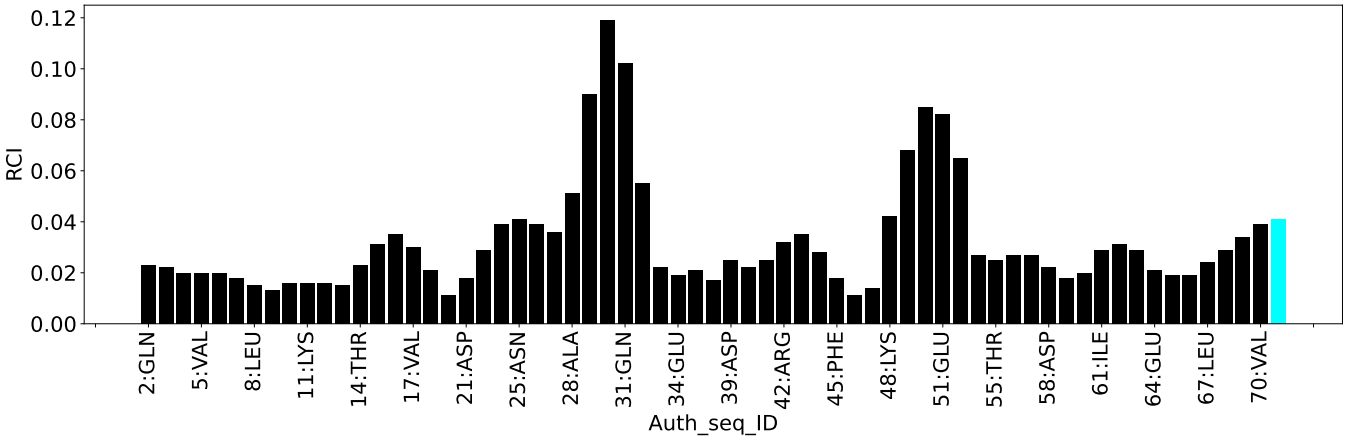
### 7.1.5 Random Coil Index (RCI) plots (i)

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:




Random coil index (RCI) for chain B:


RCI
0.12
0.10
0.08
0.06
0.04
0.02
0.00
2:GLN
5:VAL
8:LEU
11:LYS
14:THR
17:VAL
21:ASP
25:ASN
28:ALA
31:GLN
34:GLU
39:ASP
42:ARG
45:PHE
48:LYS
51:GLU
55:THR
58:ASP
61:ILE
64:GLU
67:LEU
70:VAL
Auth_seq_ID