Full wwPDB NMR Structure Validation Report (i)

Oct 17, 2021 – 09:27 AM EDT

PDB ID	:	1M9O
Title	:	NMR structure of the first Zinc Binding domain of Nup475/TTP/TIS11
Authors	:	Amann, B.T.; Worthington, M.T.; Berg, J.M.
Deposited on	:	2002-07-29

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

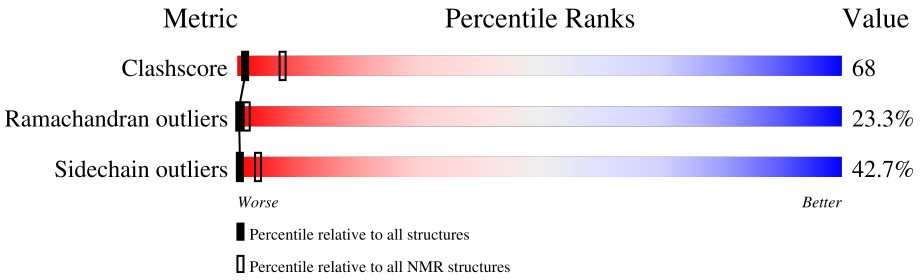
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.23.2
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 was not calculated.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	NMR archive (#Entries)
Clashscore	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

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

Mol	Chain	Length	Quality of chain
1	A	77	. 25% 6% . 17% 48%

2 Ensemble composition and analysis (i)

This entry contains 23 models. Model 10 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *closest to the average*.

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:11-A:37 (27)	0.22	10

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

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

The models can be grouped into 3 clusters and 2 single-model clusters were found.

Cluster number	Models
1	1, 2, 3, 4, 7, 8, 9, 10, 12, 13, 14, 18, 19, 20, 22
2	6, 11, 15, 21
3	5, 17
Single-model clusters	16; 23

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 620 atoms, of which 303 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Tristetraproline.

Mol	Chain	Residues	Atoms						Trace
1	A	40	Total	C	H	N	O	S	0
			619	190	303	62	60	4	

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	cloning artifact	UNP P22893
A	2	SER	-	cloning artifact	UNP P22893
A	3	HIS	-	cloning artifact	UNP P22893
A	4	MET	-	cloning artifact	UNP P22893
A	57	LYS	TYR	engineered mutation	UNP P22893

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	
2	A	1	Total	Zn
			1	1

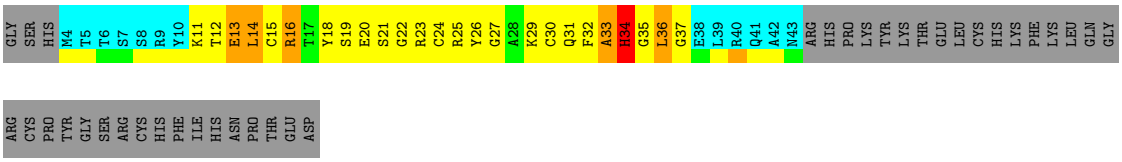
4 Residue-property plots

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: Tristetraproline

Chain A: 



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

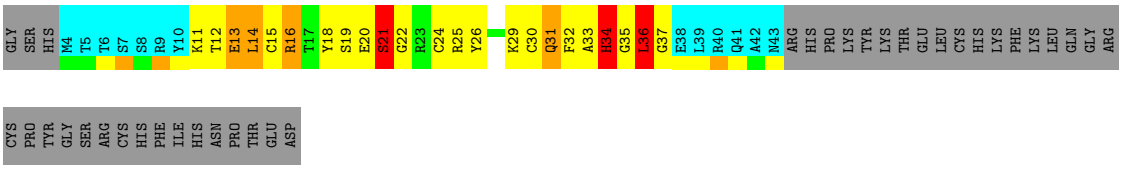
• Molecule 1: Tristetraproline

Chain A: 

4.2.2 Score per residue for model 2

• Molecule 1: Tristetraproline

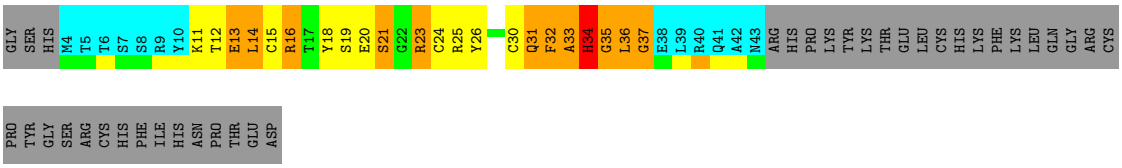
Chain A: 



4.2.3 Score per residue for model 3

- Molecule 1: Tristetraproline

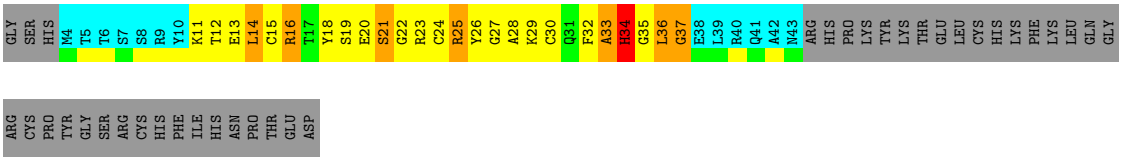
Chain A: 6% 13% 14% 17% 48%



4.2.4 Score per residue for model 4

- Molecule 1: Tristetraproline

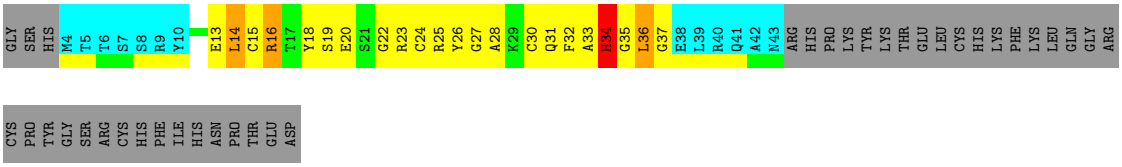
Chain A: 22% 9% 17% 48%



4.2.5 Score per residue for model 5

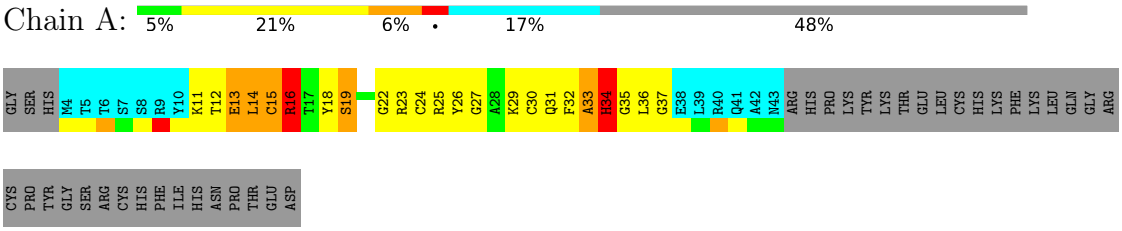
- Molecule 1: Tristetraproline

Chain A: 6% 23% 17% 48%



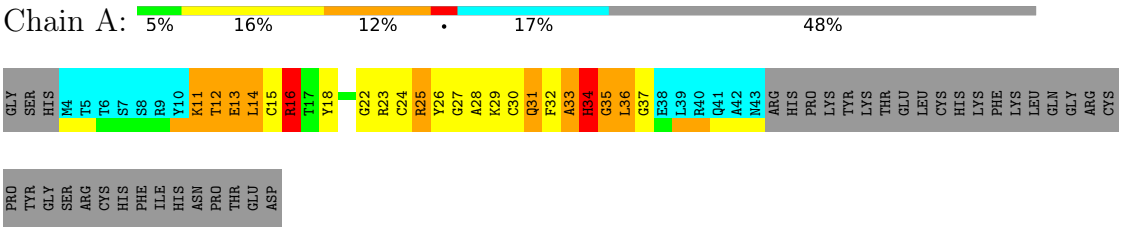
4.2.6 Score per residue for model 6

- Molecule 1: Tristetraproline



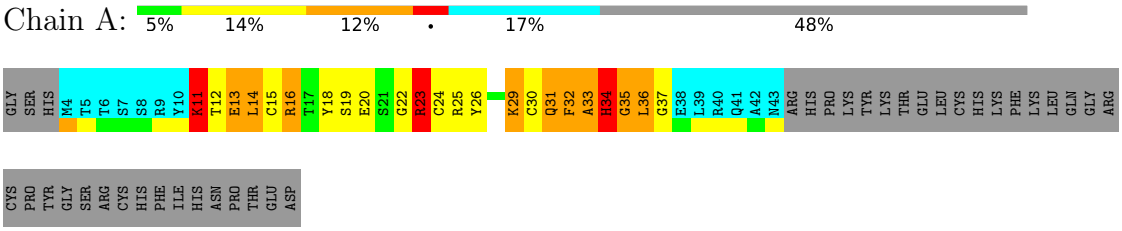
4.2.7 Score per residue for model 7

- Molecule 1: Tristetraproline



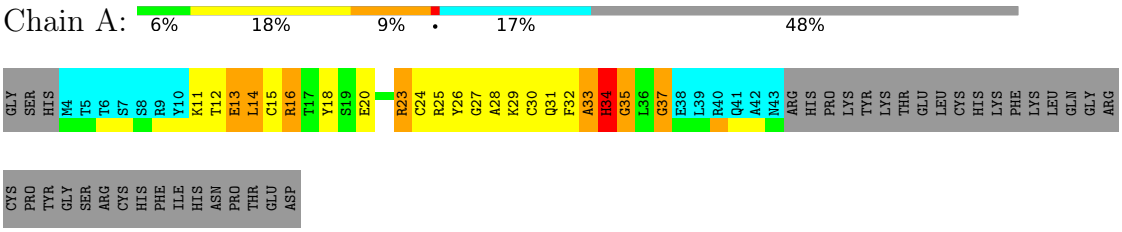
4.2.8 Score per residue for model 8

- Molecule 1: Tristetraproline



4.2.9 Score per residue for model 9

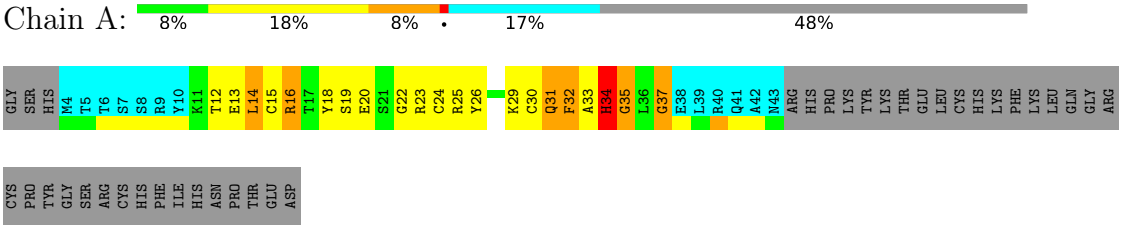
- Molecule 1: Tristetraproline



4.2.10 Score per residue for model 10 (medoid)

• Molecule 1: Tristetraproline

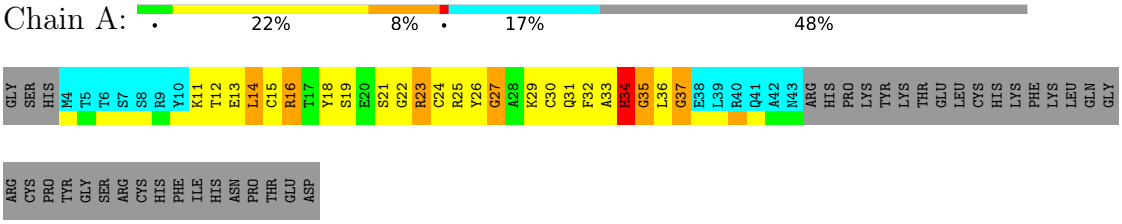
Chain A:



4.2.11 Score per residue for model 11

• Molecule 1: Tristetraproline

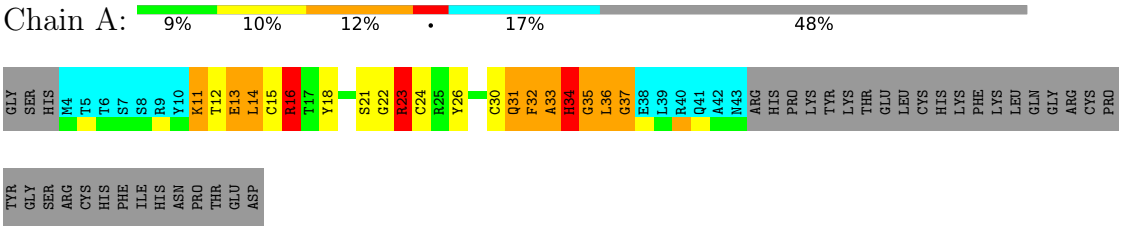
Chain A:



4.2.12 Score per residue for model 12

• Molecule 1: Tristetraproline

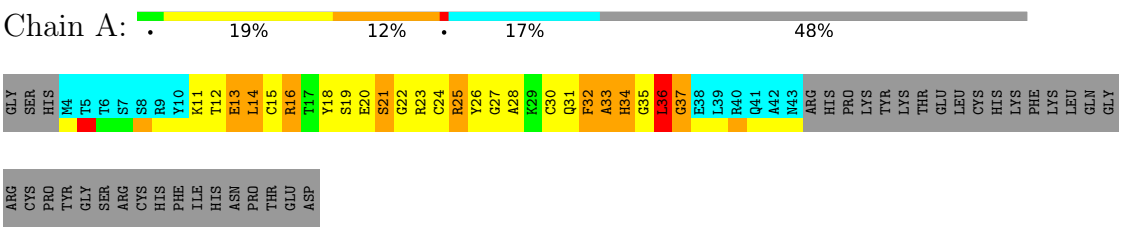
Chain A:



4.2.13 Score per residue for model 13

• Molecule 1: Tristetraproline

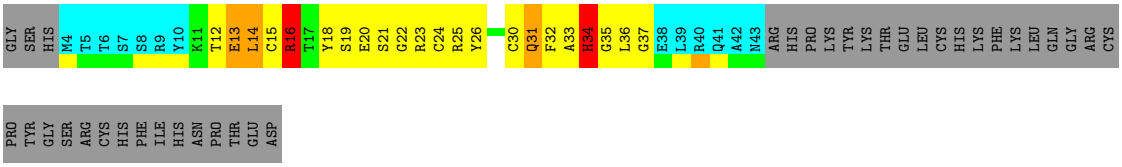
Chain A:



4.2.14 Score per residue for model 14

• Molecule 1: Tristetraproline

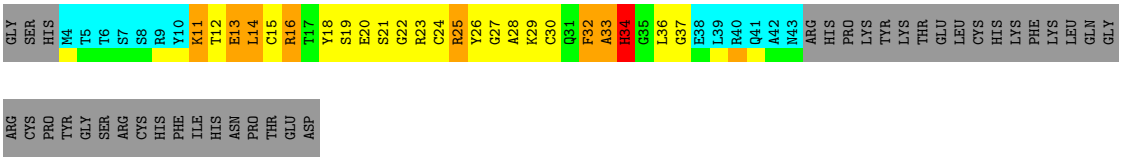
Chain A: 6% 22% 17% 48%



4.2.15 Score per residue for model 15

• Molecule 1: Tristetraproline

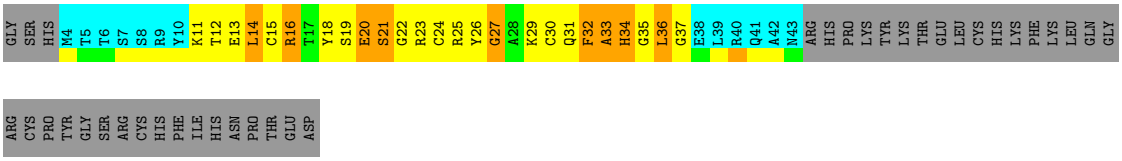
Chain A: 21% 9% 17% 48%



4.2.16 Score per residue for model 16

• Molecule 1: Tristetraproline

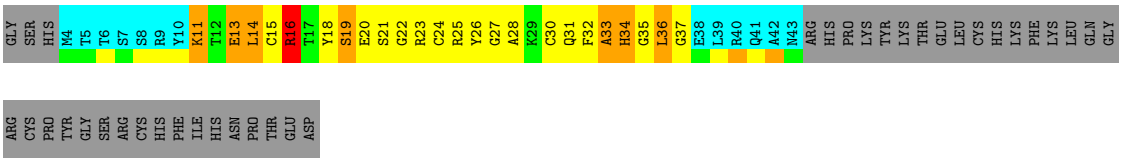
Chain A: 21% 12% 17% 48%



4.2.17 Score per residue for model 17

• Molecule 1: Tristetraproline

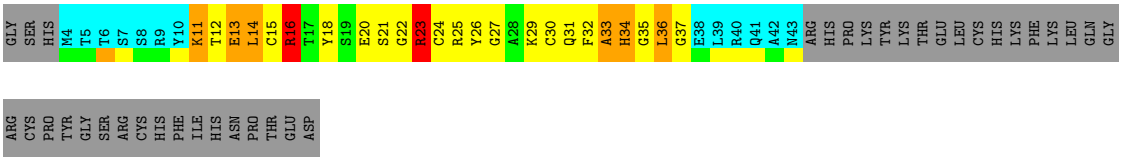
Chain A: 21% 9% 17% 48%



4.2.18 Score per residue for model 18

• Molecule 1: Tristetraproline

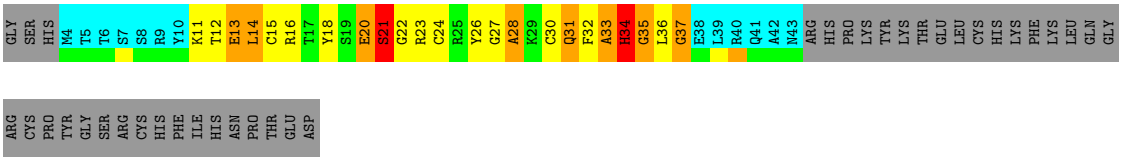
Chain A: 21% 8% 17% 48%



4.2.19 Score per residue for model 19

• Molecule 1: Tristetraproline

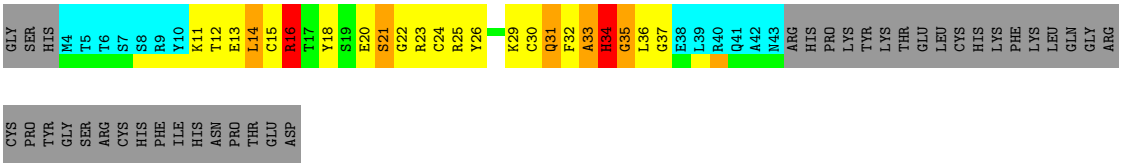
Chain A: 5% 17% 10% 17% 48%



4.2.20 Score per residue for model 20

• Molecule 1: Tristetraproline

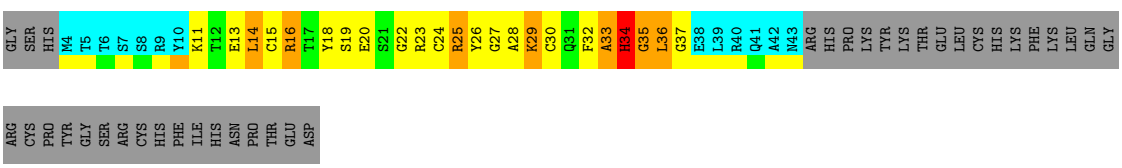
Chain A: 5% 21% 6% 17% 48%



4.2.21 Score per residue for model 21

• Molecule 1: Tristetraproline

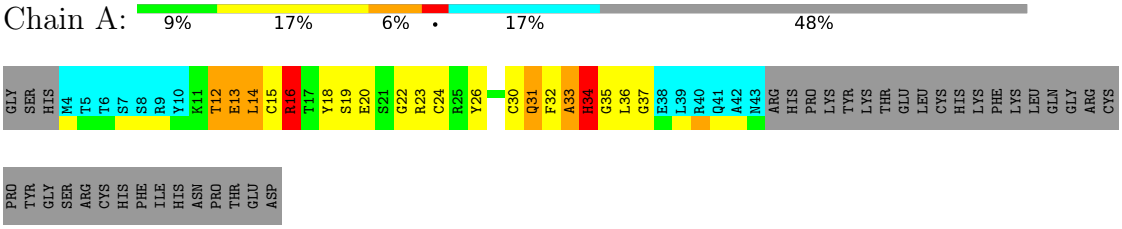
Chain A: 5% 19% 9% 17% 48%



4.2.22 Score per residue for model 22

• Molecule 1: Tristetraproline

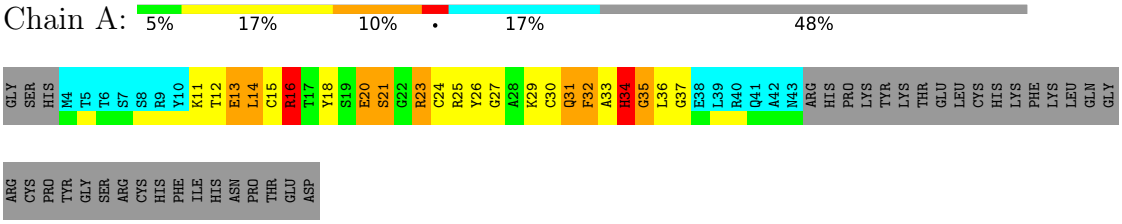
Chain A:



4.2.23 Score per residue for model 23

• Molecule 1: Tristetraproline

Chain A:



5 Refinement protocol and experimental data overview

The models were refined using the following method: *CNS, dynamical annealing protocal with molecular dynamic scheme of torsion,torsion,cartesian. Initially only distance restraints from the three Cys to the zinc were restrained. Eventually the His was also restrained and angle restraints added to make the site tetrahedral.*.

Of the 30 calculated structures, 23 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
CNS	structure solution	1.0
CNS	refinement	1.0

No chemical shift data was provided.

6 Model quality

6.1 Standard geometry

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

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	209	199	199	28±4
All	All	4830	4577	4577	643

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 68.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:26:TYR:CE2	1:A:33:ALA:HB3	0.80	2.10	3	16
1:A:36:LEU:HD23	1:A:37:GLY:N	0.78	1.93	16	3
1:A:13:GLU:C	1:A:14:LEU:HD13	0.76	2.01	23	16
1:A:18:TYR:CD2	1:A:34:HIS:CG	0.71	2.78	19	23
1:A:33:ALA:O	1:A:34:HIS:ND1	0.70	2.25	10	20
1:A:15:CYS:HA	1:A:34:HIS:CD2	0.69	2.23	16	23
1:A:14:LEU:HD22	1:A:14:LEU:N	0.68	2.04	7	18
1:A:24:CYS:HA	1:A:34:HIS:CE1	0.67	2.25	19	23
1:A:14:LEU:HD23	1:A:16:ARG:HG3	0.67	1.65	23	10
1:A:14:LEU:N	1:A:14:LEU:HD13	0.67	2.05	16	2
1:A:14:LEU:HD23	1:A:16:ARG:HG2	0.67	1.64	18	10
1:A:14:LEU:HD23	1:A:16:ARG:HD3	0.66	1.66	6	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:18:TYR:CE2	1:A:34:HIS:HA	0.65	2.25	15	7
1:A:13:GLU:HA	1:A:37:GLY:HA3	0.65	1.67	3	19
1:A:14:LEU:HD23	1:A:16:ARG:CG	0.64	2.22	18	1
1:A:24:CYS:HA	1:A:34:HIS:NE2	0.63	2.09	18	23
1:A:24:CYS:HB3	1:A:27:GLY:HA2	0.63	1.71	6	4
1:A:26:TYR:HB2	1:A:30:CYS:CA	0.60	2.26	6	10
1:A:16:ARG:CD	1:A:36:LEU:HD11	0.60	2.26	3	1
1:A:14:LEU:HD11	1:A:37:GLY:HA2	0.60	1.73	16	7
1:A:33:ALA:O	1:A:34:HIS:HB2	0.60	1.95	2	3
1:A:36:LEU:HD23	1:A:37:GLY:H	0.60	1.55	21	3
1:A:20:GLU:O	1:A:21:SER:CB	0.59	2.50	23	8
1:A:14:LEU:HD22	1:A:14:LEU:O	0.59	1.97	16	2
1:A:26:TYR:HB2	1:A:30:CYS:HA	0.58	1.75	3	16
1:A:13:GLU:O	1:A:32:PHE:HD2	0.58	1.80	22	5
1:A:14:LEU:HD13	1:A:14:LEU:N	0.58	2.12	17	3
1:A:18:TYR:CD2	1:A:34:HIS:CD2	0.58	2.91	5	23
1:A:26:TYR:O	1:A:30:CYS:N	0.57	2.37	18	23
1:A:14:LEU:HD21	1:A:37:GLY:HA2	0.57	1.76	15	3
1:A:13:GLU:HA	1:A:37:GLY:CA	0.57	2.29	14	9
1:A:14:LEU:CD2	1:A:16:ARG:HG2	0.57	2.30	16	1
1:A:18:TYR:CB	1:A:34:HIS:CD2	0.56	2.88	23	23
1:A:13:GLU:CG	1:A:37:GLY:HA3	0.56	2.30	2	6
1:A:18:TYR:CE1	1:A:35:GLY:N	0.56	2.74	8	18
1:A:18:TYR:CE1	1:A:35:GLY:CA	0.56	2.89	18	16
1:A:13:GLU:OE1	1:A:34:HIS:N	0.56	2.38	4	1
1:A:14:LEU:CD2	1:A:16:ARG:HG3	0.56	2.29	23	3
1:A:18:TYR:CZ	1:A:35:GLY:N	0.55	2.74	17	9
1:A:13:GLU:O	1:A:32:PHE:CD2	0.54	2.59	8	10
1:A:14:LEU:HD21	1:A:36:LEU:O	0.54	2.03	6	2
1:A:36:LEU:HD12	1:A:37:GLY:H	0.53	1.63	3	1
1:A:13:GLU:HB3	1:A:33:ALA:N	0.52	2.19	2	3
1:A:18:TYR:CZ	1:A:34:HIS:C	0.52	2.83	4	6
1:A:27:GLY:O	1:A:28:ALA:HB3	0.52	2.04	19	10
1:A:13:GLU:HB3	1:A:33:ALA:O	0.52	2.04	2	2
1:A:25:ARG:HB3	1:A:33:ALA:O	0.51	2.05	6	13
1:A:31:GLN:OE1	1:A:32:PHE:N	0.51	2.44	2	3
1:A:30:CYS:CB	1:A:34:HIS:CE1	0.51	2.94	6	20
1:A:35:GLY:O	1:A:36:LEU:O	0.50	2.29	16	2
1:A:14:LEU:CD1	1:A:37:GLY:HA2	0.50	2.36	13	5
1:A:13:GLU:CB	1:A:33:ALA:N	0.50	2.75	2	3
1:A:22:GLY:O	1:A:23:ARG:HB2	0.50	2.06	12	3

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:20:GLU:O	1:A:21:SER:HB2	0.49	2.07	20	3
1:A:15:CYS:SG	1:A:19:SER:HB3	0.48	2.48	13	1
1:A:18:TYR:CE1	1:A:35:GLY:HA2	0.48	2.44	12	2
1:A:14:LEU:N	1:A:14:LEU:CD1	0.48	2.77	16	1
1:A:11:LYS:HB2	1:A:32:PHE:CB	0.48	2.39	17	2
1:A:14:LEU:HD13	1:A:37:GLY:HA2	0.48	1.85	20	1
1:A:26:TYR:O	1:A:29:LYS:N	0.47	2.46	1	3
1:A:14:LEU:HD23	1:A:16:ARG:CD	0.47	2.38	6	1
1:A:14:LEU:N	1:A:14:LEU:CD2	0.47	2.76	7	2
1:A:25:ARG:HG2	1:A:33:ALA:HB1	0.47	1.86	15	1
1:A:14:LEU:O	1:A:14:LEU:CD2	0.47	2.62	5	2
1:A:18:TYR:CD2	1:A:34:HIS:CB	0.47	2.97	15	6
1:A:32:PHE:O	1:A:33:ALA:C	0.46	2.53	13	1
1:A:24:CYS:CA	1:A:34:HIS:CE1	0.46	2.98	14	18
1:A:24:CYS:HB3	1:A:27:GLY:CA	0.46	2.41	11	5
1:A:31:GLN:O	1:A:32:PHE:CD1	0.46	2.69	12	5
1:A:13:GLU:OE1	1:A:33:ALA:HA	0.46	2.10	8	5
1:A:25:ARG:N	1:A:34:HIS:CE1	0.46	2.84	16	9
1:A:30:CYS:HB3	1:A:34:HIS:CE1	0.46	2.45	12	5
1:A:32:PHE:O	1:A:33:ALA:O	0.46	2.34	20	4
1:A:13:GLU:HB2	1:A:33:ALA:H	0.45	1.70	20	1
1:A:31:GLN:C	1:A:32:PHE:CD1	0.45	2.90	12	2
1:A:14:LEU:CD2	1:A:14:LEU:O	0.45	2.65	18	2
1:A:14:LEU:O	1:A:14:LEU:HD22	0.45	2.12	18	1
1:A:15:CYS:HA	1:A:34:HIS:HD2	0.44	1.72	14	14
1:A:14:LEU:CD2	1:A:37:GLY:HA2	0.44	2.42	23	5
1:A:16:ARG:HD2	1:A:36:LEU:HD11	0.44	1.88	3	1
1:A:13:GLU:HB3	1:A:32:PHE:O	0.44	2.13	6	2
1:A:15:CYS:SG	1:A:34:HIS:CD2	0.44	3.11	16	9
1:A:12:THR:O	1:A:37:GLY:O	0.44	2.36	18	3
1:A:34:HIS:O	1:A:35:GLY:O	0.43	2.37	10	4
1:A:16:ARG:HD3	1:A:36:LEU:HD11	0.43	1.90	3	1
1:A:23:ARG:NE	1:A:25:ARG:HA	0.43	2.29	11	2
1:A:14:LEU:HD11	1:A:37:GLY:CA	0.43	2.44	15	1
1:A:27:GLY:O	1:A:28:ALA:CB	0.42	2.67	19	1
1:A:11:LYS:O	1:A:32:PHE:CE2	0.42	2.73	15	1
1:A:18:TYR:HB2	1:A:34:HIS:CD2	0.42	2.49	16	1
1:A:31:GLN:O	1:A:32:PHE:CG	0.42	2.73	7	5
1:A:36:LEU:C	1:A:36:LEU:HD23	0.42	2.35	15	1
1:A:18:TYR:CD2	1:A:24:CYS:N	0.42	2.85	2	3
1:A:13:GLU:OE2	1:A:33:ALA:HA	0.42	2.14	18	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:18:TYR:CE2	1:A:34:HIS:CA	0.41	3.01	2	2
1:A:14:LEU:HD22	1:A:14:LEU:H	0.41	1.73	6	1
1:A:25:ARG:O	1:A:26:TYR:CD1	0.41	2.73	11	1
1:A:13:GLU:CG	1:A:36:LEU:O	0.41	2.68	8	1
1:A:20:GLU:O	1:A:21:SER:HB3	0.41	2.14	16	1
1:A:32:PHE:O	1:A:34:HIS:HB2	0.41	2.15	13	1
1:A:35:GLY:O	1:A:37:GLY:N	0.40	2.54	18	1
1:A:25:ARG:HB3	1:A:34:HIS:HD1	0.40	1.77	16	1
1:A:26:TYR:HB2	1:A:30:CYS:CB	0.40	2.46	6	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	27/77 (35%)	11±1 (41±4%)	10±2 (36±6%)	6±1 (23±5%)	0	1
All	All	621/1771 (35%)	253 (41%)	223 (36%)	145 (23%)	0	1

All 15 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	16	ARG	23
1	A	34	HIS	18
1	A	22	GLY	17
1	A	33	ALA	17
1	A	35	GLY	14
1	A	32	PHE	9
1	A	37	GLY	9
1	A	21	SER	8
1	A	36	LEU	8
1	A	11	LYS	8
1	A	23	ARG	6
1	A	19	SER	4
1	A	27	GLY	2

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Mol	Chain	Res	Type	Models (Total)
1	A	15	CYS	1
1	A	28	ALA	1

6.3.2 Protein sidechains (i)

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	21/67 (31%)	12±1 (57±6%)	9±1 (43±6%)	0 3
All	All	483/1541 (31%)	277 (57%)	206 (43%)	0 3

All 14 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	14	LEU	23
1	A	34	HIS	23
1	A	23	ARG	22
1	A	31	GLN	20
1	A	13	GLU	16
1	A	36	LEU	16
1	A	11	LYS	15
1	A	29	LYS	15
1	A	20	GLU	14
1	A	19	SER	13
1	A	16	ARG	10
1	A	21	SER	9
1	A	25	ARG	6
1	A	12	THR	4

6.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

6.5 Carbohydrates (i)

There are no monosaccharides in this entry.

6.6 Ligand geometry (i)

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

6.7 Other polymers (i)

There are no such molecules in this entry.

6.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

7 Chemical shift validation (i)

No chemical shift data were provided