



Full wwPDB NMR Structure Validation Report ⓘ

Feb 13, 2017 – 01:44 am GMT

PDB ID : 2N7E
Title : Solution structure of the UBL domain of yeast Ddi1
Authors : Siva, M.; Grantz Saskova, K.; Veverka, V.
Deposited on : 2015-09-09

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

<http://wwpdb.org/validation/2016/NMRValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

Cyrange : Kirchner and Güntert (2011)
NmrClust : Kelley et al. (1996)
MolProbity : 4.02b-467
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)
RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
ShiftChecker : trunk28760
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : recalc28949

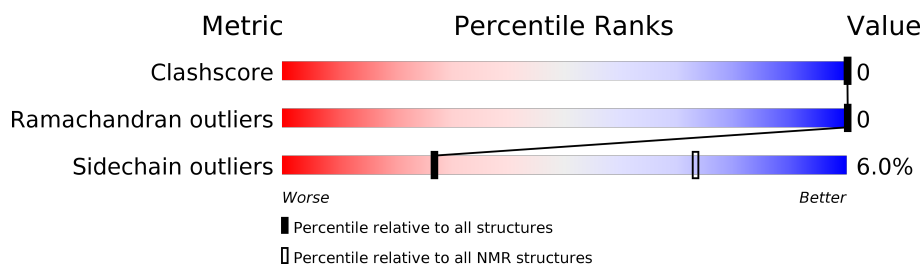
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 91%.

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	125131	11601
Ramachandran outliers	121729	10391
Sidechain outliers	121581	10367

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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	86	

2 Ensemble composition and analysis

This entry contains 43 models. Model 8 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:100-A:175 (76)	0.20	8

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 8 clusters and 7 single-model clusters were found.

Cluster number	Models
1	2, 6, 8, 15, 17, 19, 20, 24, 30, 33, 34, 38
2	11, 18, 22, 28, 39, 40
3	5, 7, 12, 13
4	1, 9, 14, 32
5	4, 37, 42
6	26, 27, 29
7	16, 23
8	3, 41
Single-model clusters	10; 21; 25; 31; 35; 36; 43

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1350 atoms, of which 673 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called DNA damage-inducible protein 1.

Mol	Chain	Residues	Atoms						Trace
1	A	86	Total	C	H	N	O	S	0
			1350	421	673	112	140	4	

There are 6 discrepancies between the modelled and reference sequences:

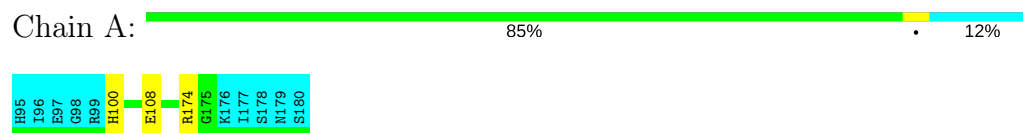
Chain	Residue	Modelled	Actual	Comment	Reference
A	95	HIS	-	EXPRESSION TAG	UNP P40087
A	96	ILE	-	EXPRESSION TAG	UNP P40087
A	97	GLU	-	EXPRESSION TAG	UNP P40087
A	98	GLY	-	EXPRESSION TAG	UNP P40087
A	99	ARG	-	EXPRESSION TAG	UNP P40087
A	100	HIS	-	EXPRESSION TAG	UNP P40087

4 Residue-property plots [i](#)

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA 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: DNA damage-inducible protein 1

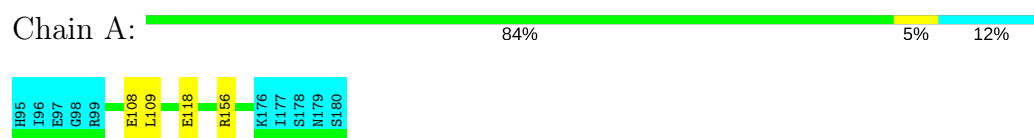


4.2 Scores per residue for each member of the ensemble

Colouring as in section [4.1](#) above.

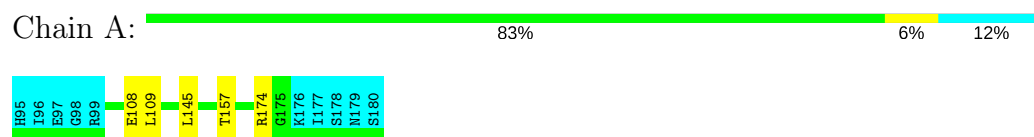
4.2.1 Score per residue for model 1

- Molecule 1: DNA damage-inducible protein 1



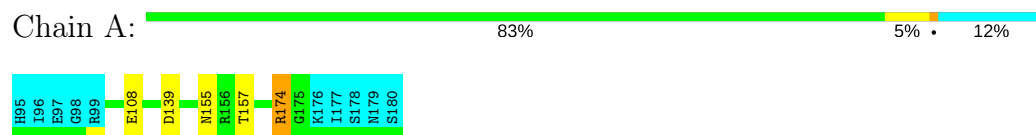
4.2.2 Score per residue for model 2

- Molecule 1: DNA damage-inducible protein 1



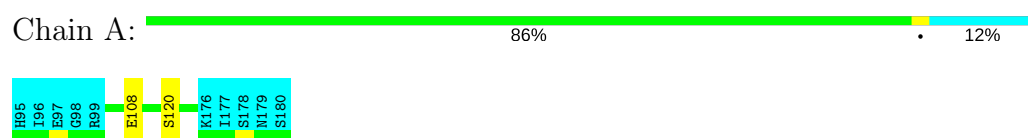
4.2.3 Score per residue for model 3

- Molecule 1: DNA damage-inducible protein 1



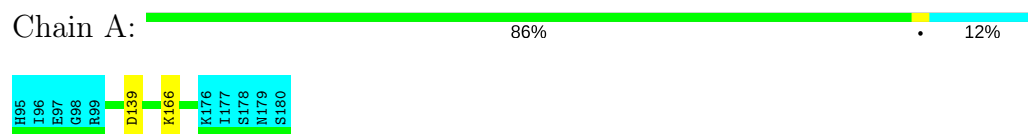
4.2.4 Score per residue for model 4

- Molecule 1: DNA damage-inducible protein 1



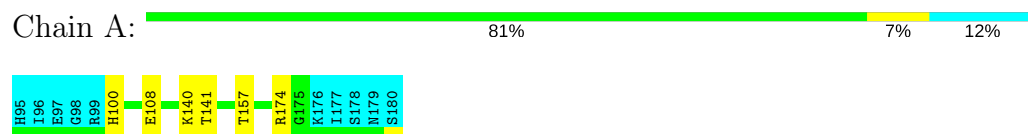
4.2.5 Score per residue for model 5

- Molecule 1: DNA damage-inducible protein 1



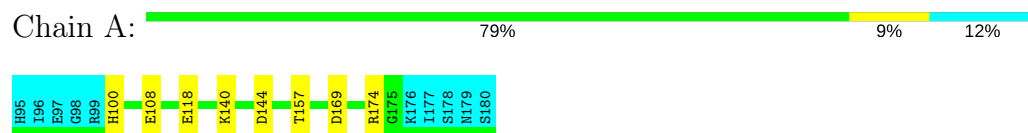
4.2.6 Score per residue for model 6

- Molecule 1: DNA damage-inducible protein 1



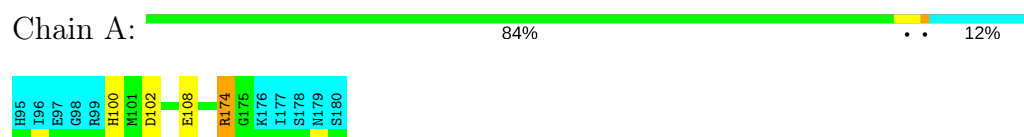
4.2.7 Score per residue for model 7

- Molecule 1: DNA damage-inducible protein 1



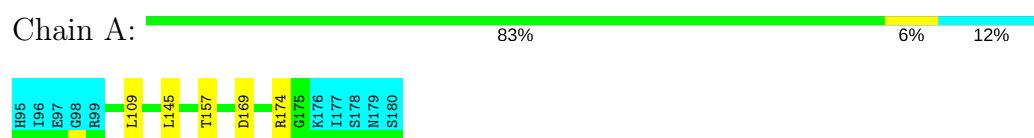
4.2.8 Score per residue for model 8 (medoid)

- Molecule 1: DNA damage-inducible protein 1



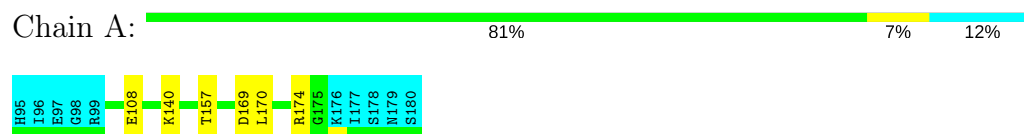
4.2.9 Score per residue for model 9

- Molecule 1: DNA damage-inducible protein 1



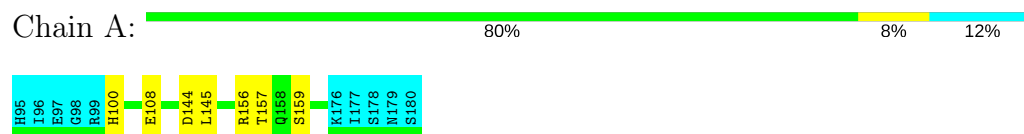
4.2.10 Score per residue for model 10

- Molecule 1: DNA damage-inducible protein 1



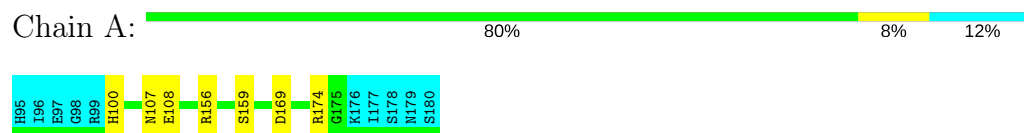
4.2.11 Score per residue for model 11

- Molecule 1: DNA damage-inducible protein 1



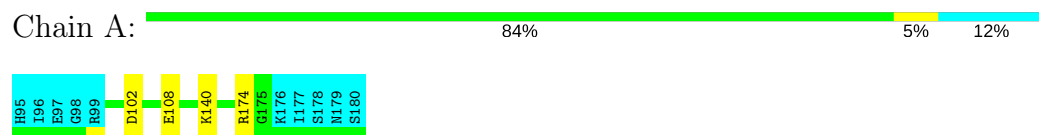
4.2.12 Score per residue for model 12

- Molecule 1: DNA damage-inducible protein 1



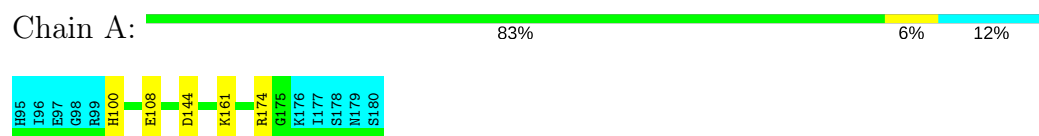
4.2.13 Score per residue for model 13

- Molecule 1: DNA damage-inducible protein 1



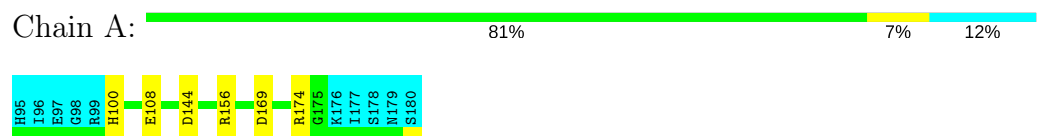
4.2.14 Score per residue for model 14

- Molecule 1: DNA damage-inducible protein 1



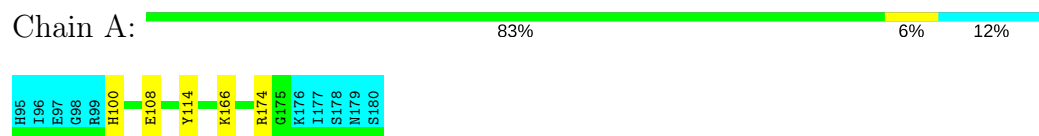
4.2.15 Score per residue for model 15

- Molecule 1: DNA damage-inducible protein 1



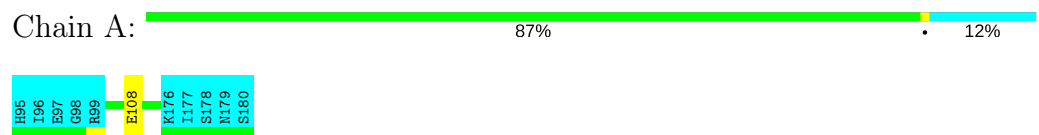
4.2.16 Score per residue for model 16

- Molecule 1: DNA damage-inducible protein 1



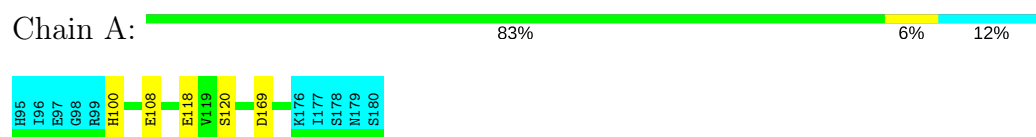
4.2.17 Score per residue for model 17

- Molecule 1: DNA damage-inducible protein 1



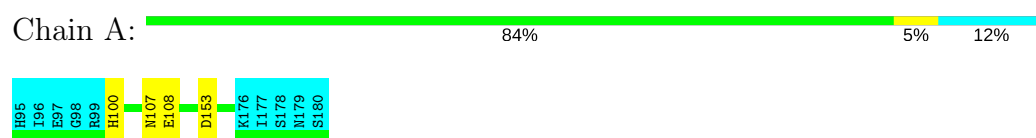
4.2.18 Score per residue for model 18

- Molecule 1: DNA damage-inducible protein 1



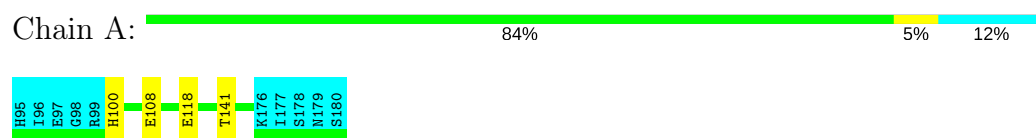
4.2.19 Score per residue for model 19

- Molecule 1: DNA damage-inducible protein 1



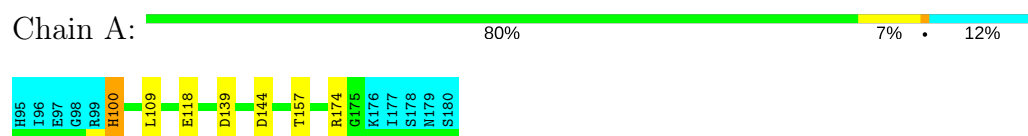
4.2.20 Score per residue for model 20

- Molecule 1: DNA damage-inducible protein 1



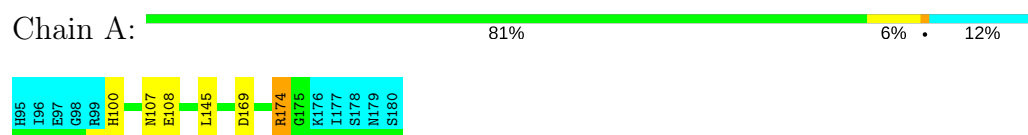
4.2.21 Score per residue for model 21

- Molecule 1: DNA damage-inducible protein 1



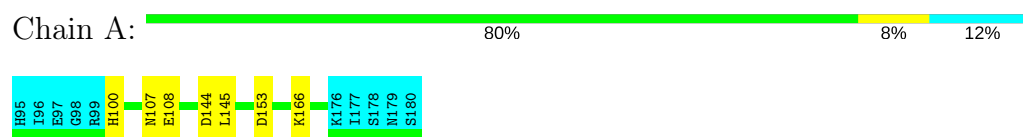
4.2.22 Score per residue for model 22

- Molecule 1: DNA damage-inducible protein 1



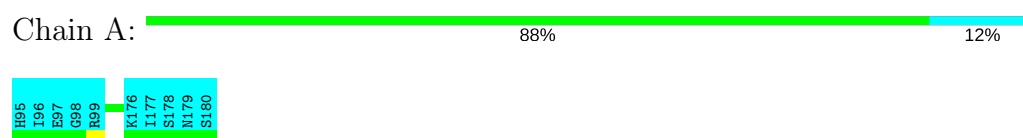
4.2.23 Score per residue for model 23

- Molecule 1: DNA damage-inducible protein 1



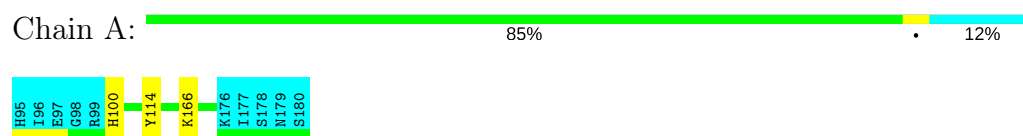
4.2.24 Score per residue for model 24

- Molecule 1: DNA damage-inducible protein 1



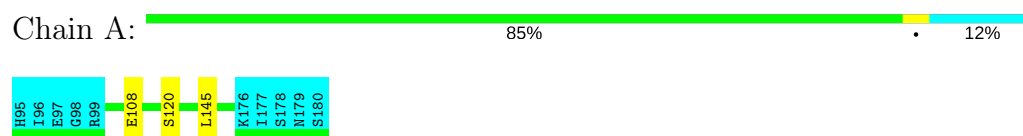
4.2.25 Score per residue for model 25

- Molecule 1: DNA damage-inducible protein 1



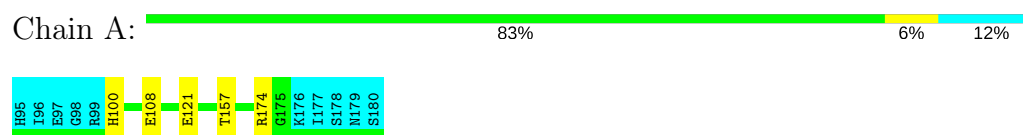
4.2.26 Score per residue for model 26

- Molecule 1: DNA damage-inducible protein 1



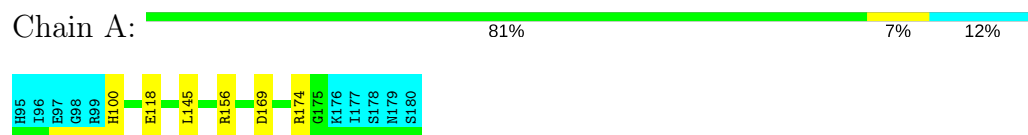
4.2.27 Score per residue for model 27

- Molecule 1: DNA damage-inducible protein 1



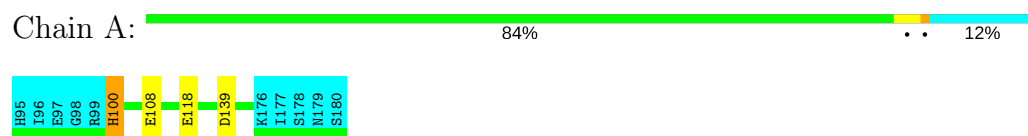
4.2.28 Score per residue for model 28

- Molecule 1: DNA damage-inducible protein 1



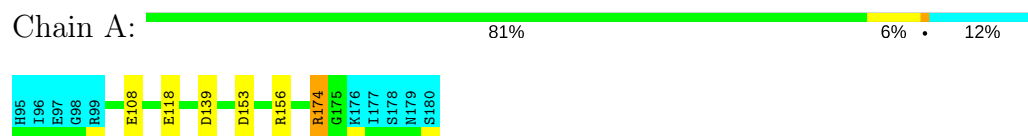
4.2.29 Score per residue for model 29

- Molecule 1: DNA damage-inducible protein 1



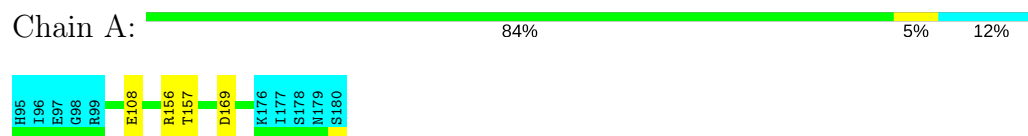
4.2.30 Score per residue for model 30

- Molecule 1: DNA damage-inducible protein 1



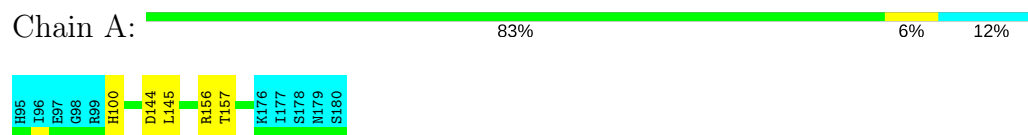
4.2.31 Score per residue for model 31

- Molecule 1: DNA damage-inducible protein 1



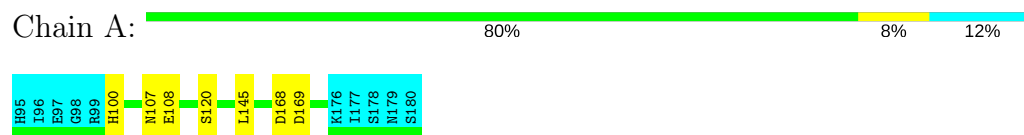
4.2.32 Score per residue for model 32

- Molecule 1: DNA damage-inducible protein 1



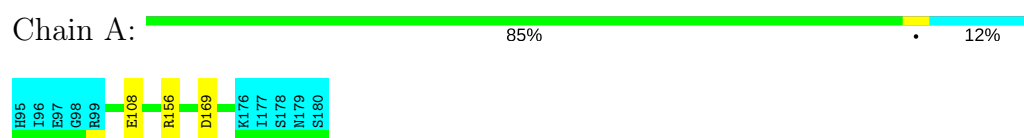
4.2.33 Score per residue for model 33

- Molecule 1: DNA damage-inducible protein 1



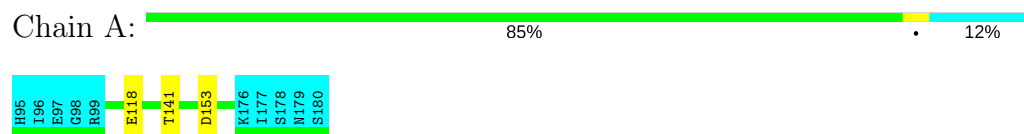
4.2.34 Score per residue for model 34

- Molecule 1: DNA damage-inducible protein 1



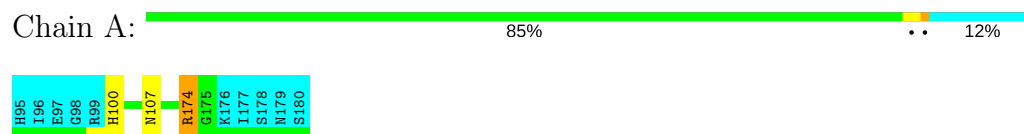
4.2.35 Score per residue for model 35

- Molecule 1: DNA damage-inducible protein 1



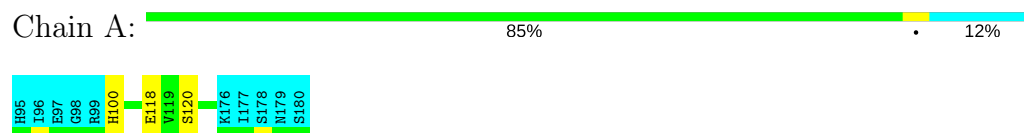
4.2.36 Score per residue for model 36

- Molecule 1: DNA damage-inducible protein 1



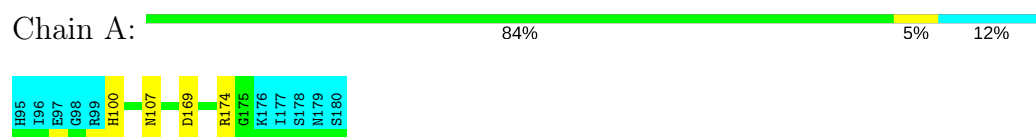
4.2.37 Score per residue for model 37

- Molecule 1: DNA damage-inducible protein 1



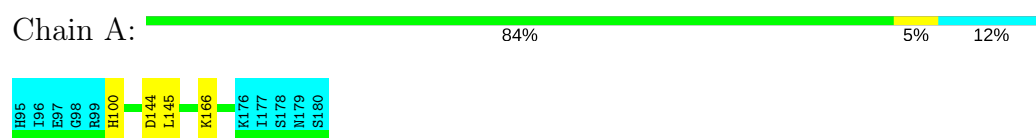
4.2.38 Score per residue for model 38

- Molecule 1: DNA damage-inducible protein 1



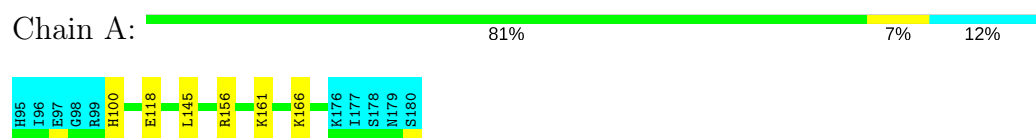
4.2.39 Score per residue for model 39

- Molecule 1: DNA damage-inducible protein 1



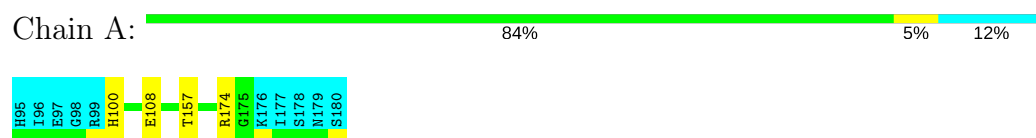
4.2.40 Score per residue for model 40

- Molecule 1: DNA damage-inducible protein 1



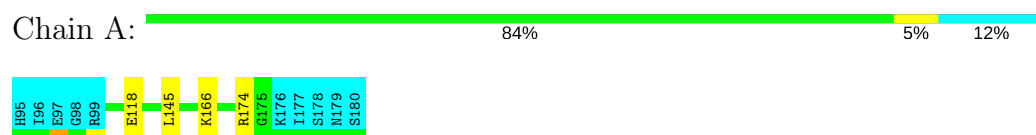
4.2.41 Score per residue for model 41

- Molecule 1: DNA damage-inducible protein 1




4.2.42 Score per residue for model 42

- Molecule 1: DNA damage-inducible protein 1



4.2.43 Score per residue for model 43

- Molecule 1: DNA damage-inducible protein 1

Chain A:  85% • 12%



5 Refinement protocol and experimental data overview

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

Of the 100 calculated structures, 43 were deposited, based on the following criterion: *structures with the least restraint violations*.

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

Software name	Classification	Version
CYANA	structure solution	
YASARA	refinement	
CYANA	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)	2n7e_cs.str
Number of chemical shift lists	1
Total number of shifts	1063
Number of shifts mapped to atoms	1063
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	91%

No validations of the models with respect to experimental NMR restraints is performed at this time.

6 Model quality [i](#)

6.1 Standard geometry [i](#)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the (average) root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#Z>5	RMSZ	#Z>5
1	A	0.58±0.03	0±0/604 (0.0±0.0%)	0.72±0.02	1±1/817 (0.1±0.1%)
All	All	0.58	0/25972 (0.0%)	0.72	24/35131 (0.1%)

There are no bond-length outliers.

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(°)	Ideal(°)	Models	
								Worst	Total
1	A	174	ARG	NE-CZ-NH1	7.22	123.91	120.30	27	13
1	A	156	ARG	NE-CZ-NH1	6.10	123.35	120.30	31	10
1	A	174	ARG	NE-CZ-NH2	-5.29	117.65	120.30	27	1

There are no chirality outliers.

There are no planarity outliers.

6.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in each chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	597	592	592	0±0
All	All	25671	25456	25456	2

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 0.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:100:HIS:CE1	1:A:118:GLU:HB3	0.42	2.50	29	2

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	76/86 (88%)	75±1 (99±1%)	1±1 (1±1%)	0±0 (0±0%)	100	100
All	All	3268/3698 (88%)	3239 (99%)	29 (1%)	0 (0%)	100	100

There are no Ramachandran outliers.

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	68/77 (88%)	64±2 (94±2%)	4±2 (6±2%)	27	73
All	All	2924/3311 (88%)	2749 (94%)	175 (6%)	27	73

All 24 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	108	GLU	28
1	A	100	HIS	27
1	A	169	ASP	13
1	A	174	ARG	13
1	A	157	THR	12
1	A	145	LEU	12
1	A	118	GLU	10
1	A	144	ASP	8

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Mol	Chain	Res	Type	Models (Total)
1	A	166	LYS	7
1	A	107	ASN	7
1	A	120	SER	5
1	A	139	ASP	5
1	A	109	LEU	4
1	A	153	ASP	4
1	A	140	LYS	4
1	A	159	SER	3
1	A	141	THR	3
1	A	161	LYS	2
1	A	102	ASP	2
1	A	114	TYR	2
1	A	170	LEU	1
1	A	168	ASP	1
1	A	155	ASN	1
1	A	121	GLU	1

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 carbohydrates in this entry.

6.6 Ligand geometry ⓘ

There are no ligands in this entry.

6.7 Other polymers ⓘ

There are no such molecules in this entry.

6.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

7 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 91% for the well-defined parts and 89% for the entire structure.

7.1 Chemical shift list 1

File name: 2n7e_cs.str

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	1063
Number of shifts mapped to atoms	1063
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 \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	85	2.59 ± 0.22	Should be applied
$^{13}\text{C}_\beta$	79	2.59 ± 0.18	Should be applied
$^{13}\text{C}'$	85	2.75 ± 0.17	Should be applied
^{15}N	84	0.13 ± 0.48	None needed (< 0.5 ppm)

7.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 91%, i.e. 826 atoms were assigned a chemical shift out of a possible 911. 1 out of 15 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	378/378 (100%)	151/151 (100%)	152/152 (100%)	75/75 (100%)
Sidechain	431/486 (89%)	262/279 (94%)	164/192 (85%)	5/15 (33%)

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	Total	¹ H	¹³ C	¹⁵ N
Aromatic	17/47 (36%)	17/25 (68%)	0/20 (0%)	0/2 (0%)
Overall	826/911 (91%)	430/455 (95%)	316/364 (87%)	80/92 (87%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 89%, i.e. 928 atoms were assigned a chemical shift out of a possible 1040. 1 out of 15 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	424/428 (99%)	170/171 (99%)	170/172 (99%)	84/85 (99%)
Sidechain	487/558 (87%)	298/322 (93%)	184/216 (85%)	5/20 (25%)
Aromatic	17/54 (31%)	17/29 (59%)	0/22 (0%)	0/3 (0%)
Overall	928/1040 (89%)	485/522 (93%)	354/410 (86%)	89/108 (82%)

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.

Random coil index (RCI) for chain A:

