



Full wwPDB NMR Structure Validation Report ⓘ

Mar 5, 2026 – 07:00 PM UTC

PDB ID : 2K2E / pdb_00002k2e
Title : Solution NMR structure of Bordetella pertussis protein BP2786, a Mth938-like domain. Northeast Structural Genomics Consortium target BeR31
Authors : Cort, J.R.; Ho, C.K.; Nwosu, C.; Maglaqui, M.; Xiao, R.; Liu, J.; Baran, M.C.; Swapna, G.; Acton, T.B.; Rost, B.; Montelione, G.T.; Kennedy, M.A.; Northeast Structural Genomics Consortium (NESG)
Deposited on : 2008-04-01

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<https://www.wwpdb.org/validation/2017/NMRValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity	:	4-5-2 with Phenix2.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
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)	:	2.49

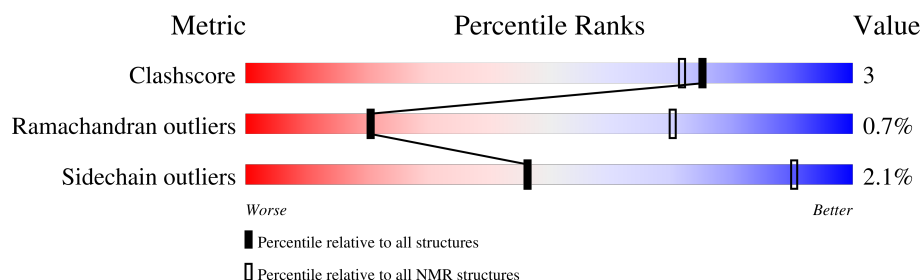
1 Overall quality at a glance

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	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

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	158	70% . 29%

2 Ensemble composition and analysis

This entry contains 20 models. Model 11 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:63, A:88-A:146 (112)	0.94	11

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

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

The models can be grouped into 4 clusters. No single-model clusters were found.

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

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 2367 atoms, of which 1179 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Uncharacterized protein BP2786.

Mol	Chain	Residues	Atoms						Trace
1	A	158	Total	C	H	N	O	S	0
			2367	744	1179	219	221	4	

There are 8 discrepancies between the modelled and reference sequences:

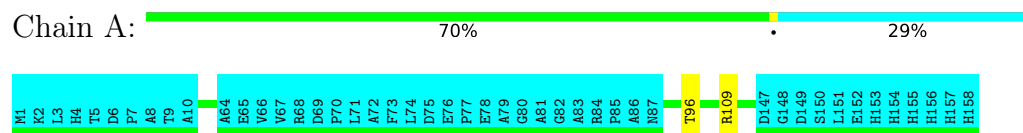
Chain	Residue	Modelled	Actual	Comment	Reference
A	151	LEU	-	expression tag	UNP Q7VV99
A	152	GLU	-	expression tag	UNP Q7VV99
A	153	HIS	-	expression tag	UNP Q7VV99
A	154	HIS	-	expression tag	UNP Q7VV99
A	155	HIS	-	expression tag	UNP Q7VV99
A	156	HIS	-	expression tag	UNP Q7VV99
A	157	HIS	-	expression tag	UNP Q7VV99
A	158	HIS	-	expression tag	UNP Q7VV99

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: Uncharacterized protein BP2786

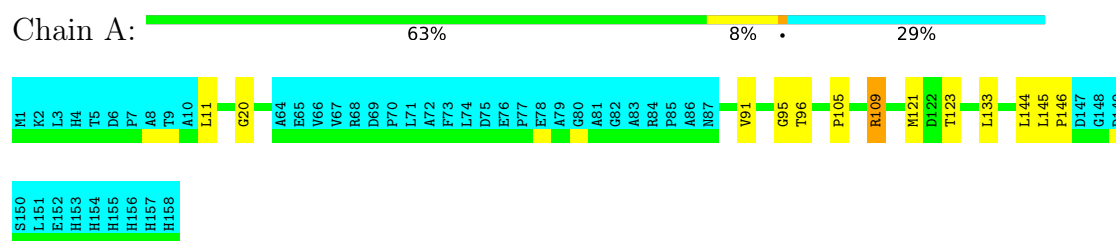


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

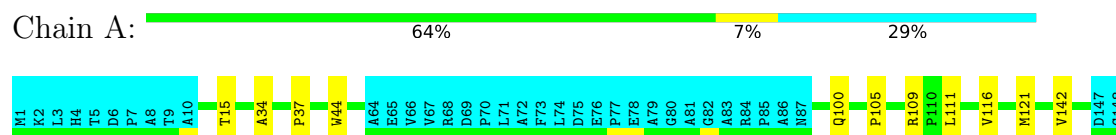
4.2.1 Score per residue for model 1

- Molecule 1: Uncharacterized protein BP2786



4.2.2 Score per residue for model 2

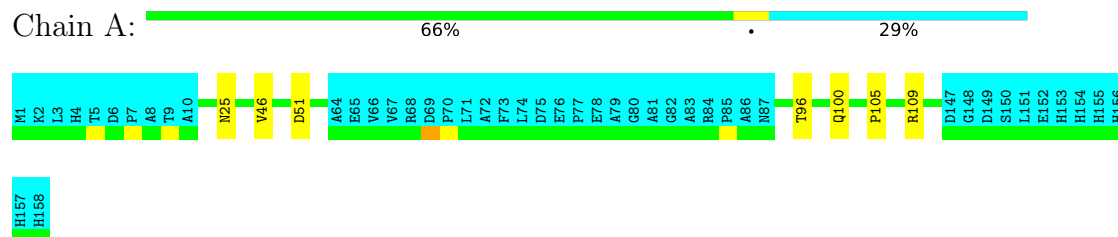
- Molecule 1: Uncharacterized protein BP2786



D149
S150
L151
E152
H153
H154
H155
H156
H157
H158

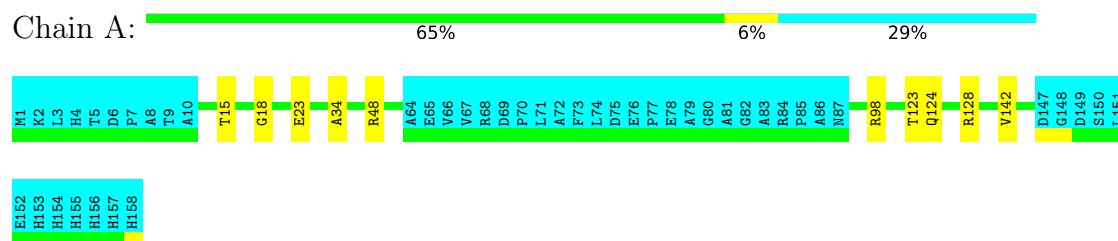
4.2.3 Score per residue for model 3

- Molecule 1: Uncharacterized protein BP2786



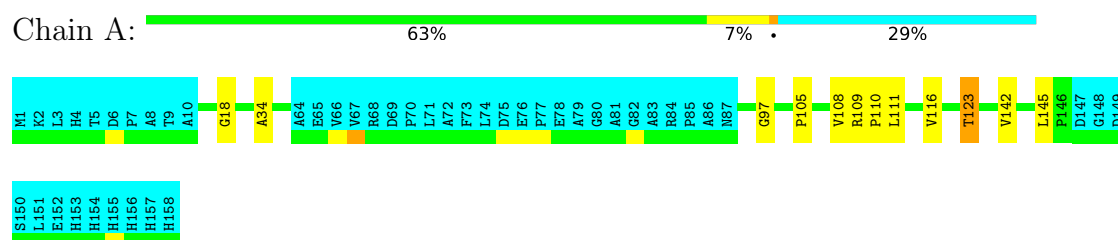
4.2.4 Score per residue for model 4

- Molecule 1: Uncharacterized protein BP2786



4.2.5 Score per residue for model 5

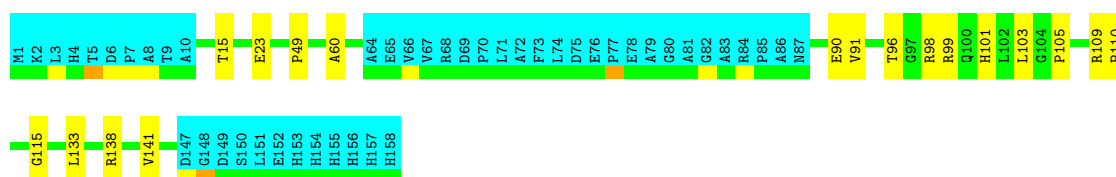
- Molecule 1: Uncharacterized protein BP2786



4.2.6 Score per residue for model 6

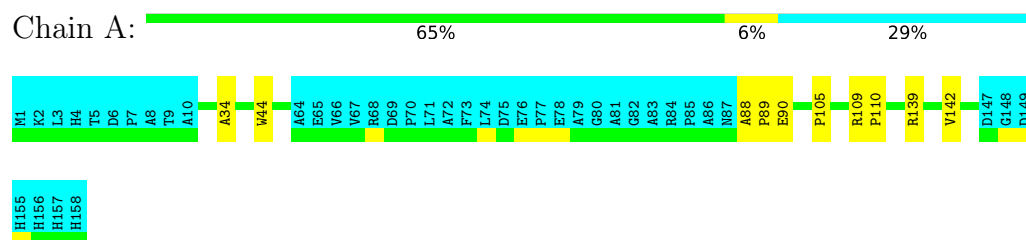
- Molecule 1: Uncharacterized protein BP2786





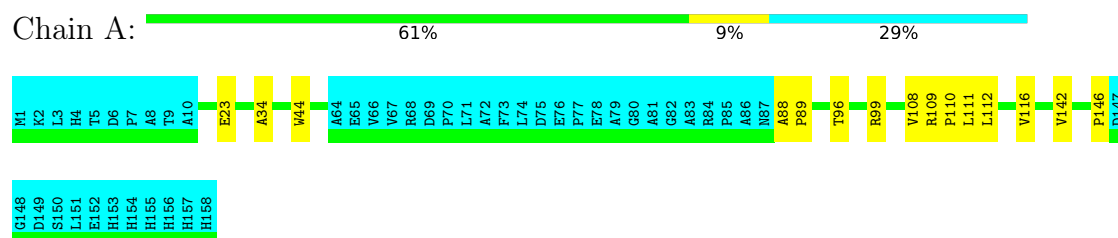
4.2.7 Score per residue for model 7

- Molecule 1: Uncharacterized protein BP2786



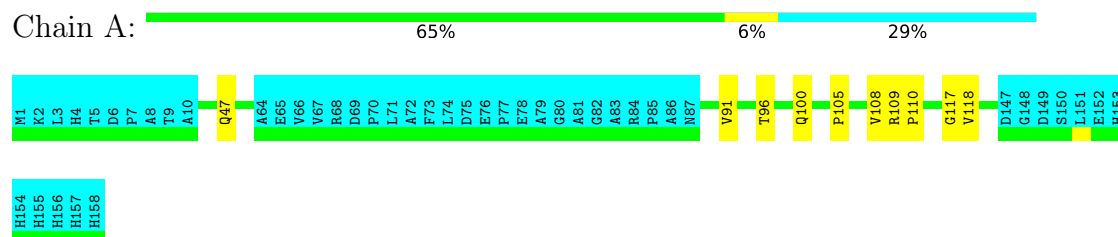
4.2.8 Score per residue for model 8

- Molecule 1: Uncharacterized protein BP2786



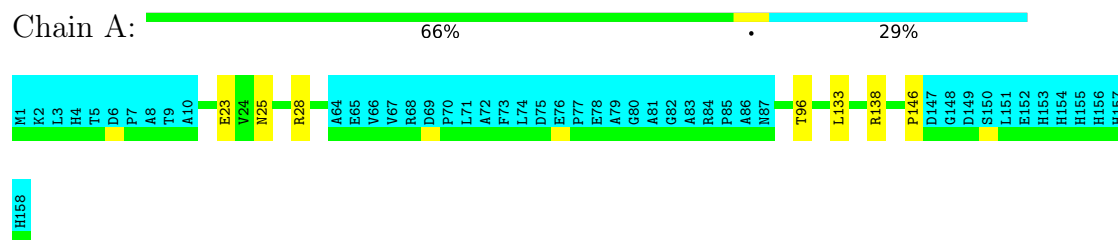
4.2.9 Score per residue for model 9

- Molecule 1: Uncharacterized protein BP2786



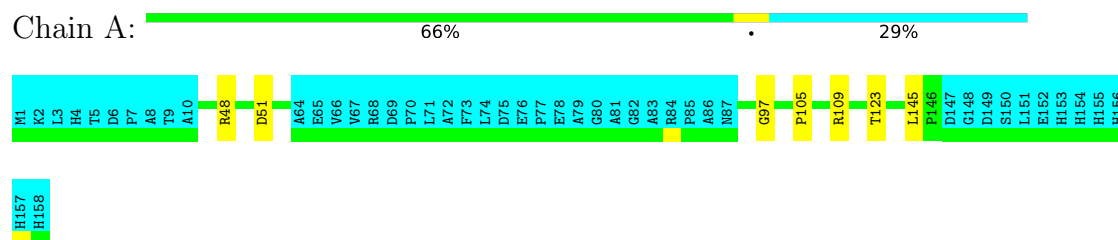
4.2.10 Score per residue for model 10

- Molecule 1: Uncharacterized protein BP2786



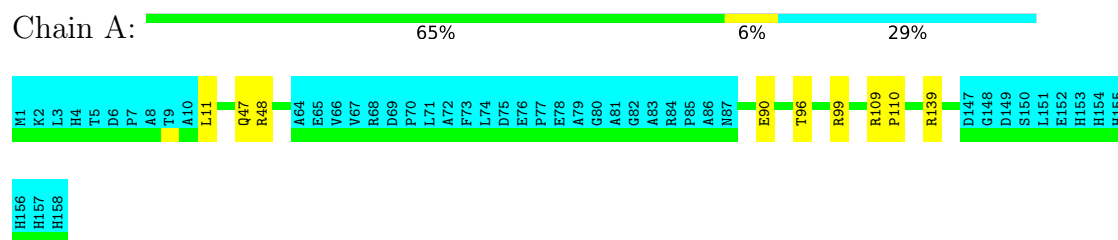
4.2.11 Score per residue for model 11 (medoid)

- Molecule 1: Uncharacterized protein BP2786



4.2.12 Score per residue for model 12

- Molecule 1: Uncharacterized protein BP2786



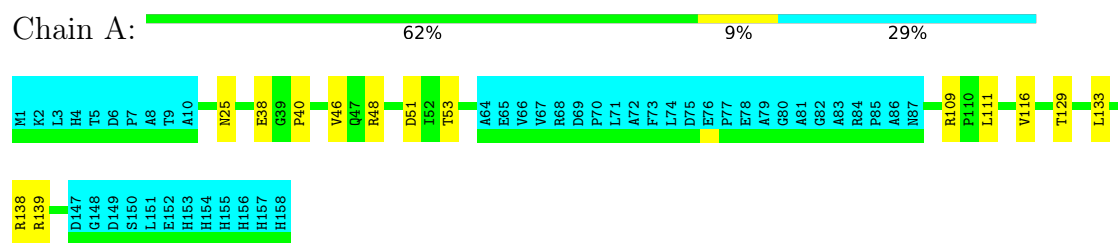
4.2.13 Score per residue for model 13

- Molecule 1: Uncharacterized protein BP2786



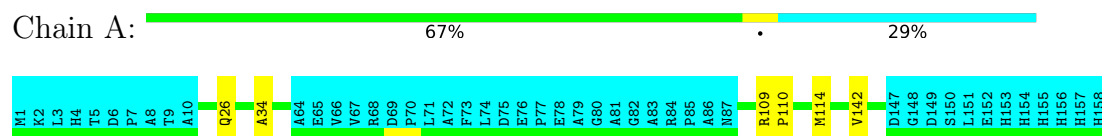
4.2.14 Score per residue for model 14

- Molecule 1: Uncharacterized protein BP2786



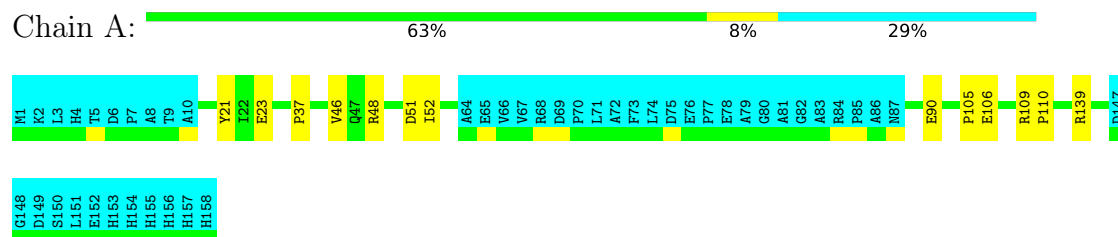
4.2.15 Score per residue for model 15

- Molecule 1: Uncharacterized protein BP2786



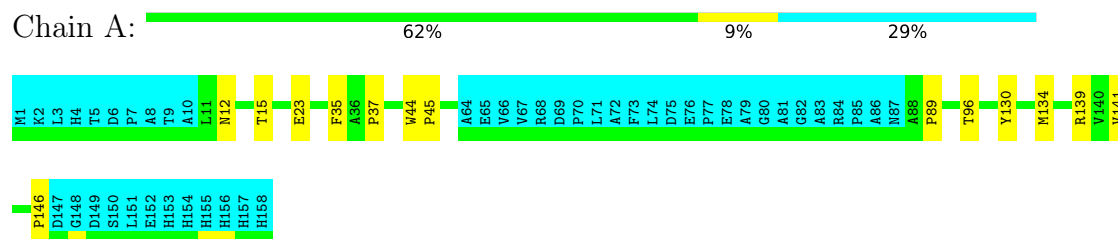
4.2.16 Score per residue for model 16

- Molecule 1: Uncharacterized protein BP2786



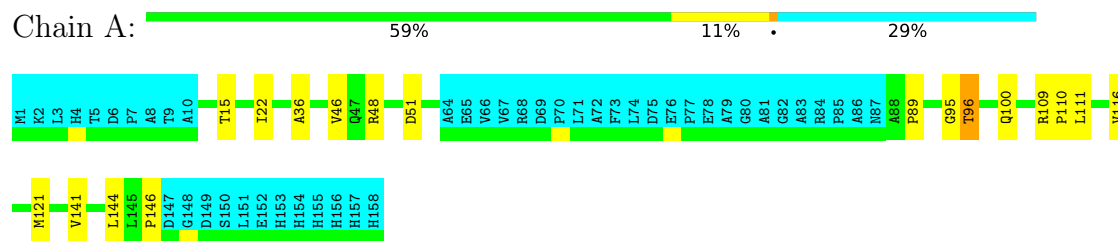
4.2.17 Score per residue for model 17

- Molecule 1: Uncharacterized protein BP2786



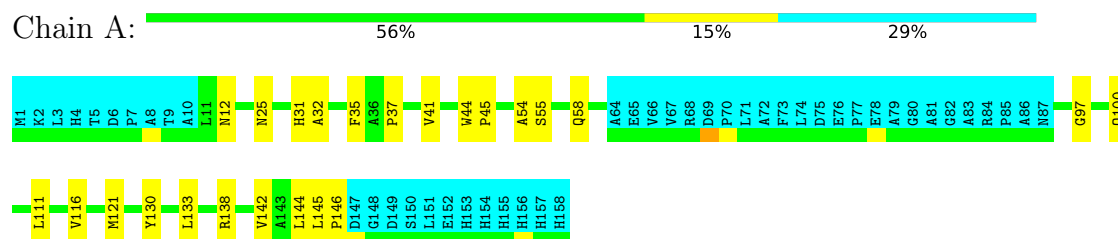
4.2.18 Score per residue for model 18

- Molecule 1: Uncharacterized protein BP2786



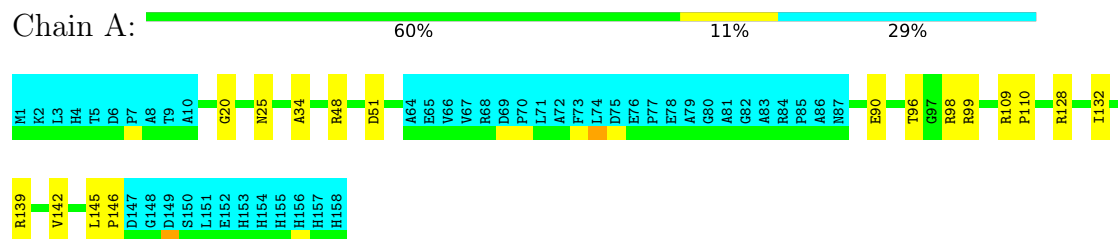
4.2.19 Score per residue for model 19

- Molecule 1: Uncharacterized protein BP2786



4.2.20 Score per residue for model 20

- Molecule 1: Uncharacterized protein BP2786



5 Refinement protocol and experimental data overview

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

Of the 20 calculated structures, 20 were deposited, based on the following criterion: *all calculated structures submitted*.

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

Software name	Classification	Version
AutoStructure	refinement	
AutoStructure	structure solution	
PSVS	refinement	
CNS	refinement	
CNS	structure solution	
X-PLOR NIH	refinement	
X-PLOR NIH	structure solution	

No chemical shift data was provided.

6 Model quality

6.1 Standard geometry

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	837	856	854	5±2
All	All	16740	17120	17080	105

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 3.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:48:ARG:HB2	1:A:51:ASP:HB2	0.84	1.48	11	1
1:A:21:TYR:HE1	1:A:23:GLU:HB2	0.73	1.43	16	1
1:A:100:GLN:HG3	1:A:121:MET:HA	0.67	1.64	2	2
1:A:91:VAL:HG11	1:A:133:LEU:HD21	0.64	1.68	6	1
1:A:105:PRO:O	1:A:109:ARG:HB2	0.62	1.94	6	3
1:A:21:TYR:CE1	1:A:23:GLU:HB2	0.61	2.30	16	1
1:A:105:PRO:O	1:A:109:ARG:HG3	0.56	2.01	2	5
1:A:109:ARG:HB3	1:A:110:PRO:HD3	0.56	1.78	8	5
1:A:97:GLY:HA3	1:A:123:THR:HG22	0.55	1.77	11	1
1:A:111:LEU:HB3	1:A:116:VAL:HB	0.55	1.78	8	6
1:A:34:ALA:HA	1:A:142:VAL:O	0.54	2.01	7	7
1:A:90:GLU:HG3	1:A:139:ARG:HB2	0.53	1.81	20	3
1:A:32:ALA:HA	1:A:144:LEU:O	0.53	2.04	19	1
1:A:37:PRO:HB3	1:A:134:MET:HG3	0.52	1.80	17	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:133:LEU:HD22	1:A:138:ARG:HD2	0.51	1.83	10	2
1:A:91:VAL:HG11	1:A:133:LEU:HD13	0.51	1.83	1	2
1:A:47:GLN:HG3	1:A:48:ARG:HG3	0.51	1.83	12	1
1:A:97:GLY:HA2	1:A:123:THR:OG1	0.51	2.04	5	1
1:A:96:THR:OG1	1:A:100:GLN:HA	0.51	2.06	9	3
1:A:48:ARG:HB2	1:A:51:ASP:OD1	0.50	2.07	16	1
1:A:101:HIS:HD2	1:A:103:LEU:HD23	0.50	1.67	6	1
1:A:38:GLU:OE2	1:A:139:ARG:HD2	0.49	2.06	13	1
1:A:109:ARG:HB2	1:A:110:PRO:HD3	0.49	1.84	15	3
1:A:96:THR:HB	1:A:99:ARG:O	0.49	2.08	8	2
1:A:108:VAL:HB	1:A:118:VAL:HG11	0.49	1.83	9	1
1:A:109:ARG:N	1:A:110:PRO:HD2	0.48	2.22	20	2
1:A:98:ARG:C	1:A:99:ARG:HD2	0.48	2.34	6	1
1:A:44:TRP:CD1	1:A:45:PRO:HD2	0.48	2.43	19	2
1:A:90:GLU:HG3	1:A:139:ARG:HB3	0.48	1.86	7	1
1:A:46:VAL:HG13	1:A:51:ASP:HB2	0.47	1.87	3	3
1:A:105:PRO:HA	1:A:108:VAL:HG22	0.46	1.88	5	1
1:A:88:ALA:HB1	1:A:89:PRO:HD2	0.45	1.87	7	2
1:A:128:ARG:O	1:A:132:ILE:HG12	0.45	2.12	20	1
1:A:97:GLY:HA3	1:A:145:LEU:O	0.45	2.12	5	1
1:A:46:VAL:HG11	1:A:52:ILE:HG12	0.44	1.88	16	1
1:A:60:ALA:O	1:A:141:VAL:HG11	0.44	2.13	6	1
1:A:12:ASN:HB2	1:A:37:PRO:HA	0.44	1.88	19	1
1:A:97:GLY:HA2	1:A:145:LEU:O	0.44	2.12	19	1
1:A:35:PHE:HB3	1:A:41:VAL:HG13	0.44	1.90	19	1
1:A:22:ILE:HG12	1:A:144:LEU:HD13	0.44	1.88	18	1
1:A:130:TYR:CD1	1:A:142:VAL:HB	0.43	2.47	19	1
1:A:95:GLY:HA2	1:A:121:MET:O	0.43	2.13	1	2
1:A:89:PRO:HB3	1:A:141:VAL:CG2	0.43	2.44	18	1
1:A:110:PRO:O	1:A:114:MET:HG3	0.43	2.14	15	1
1:A:108:VAL:O	1:A:112:LEU:HG	0.43	2.14	8	1
1:A:38:GLU:C	1:A:40:PRO:HD2	0.43	2.38	14	1
1:A:124:GLN:O	1:A:128:ARG:HG3	0.42	2.13	4	1
1:A:37:PRO:HD3	1:A:130:TYR:HE1	0.42	1.73	17	1
1:A:36:ALA:HB2	1:A:141:VAL:HG22	0.42	1.90	18	1
1:A:105:PRO:O	1:A:109:ARG:HG2	0.42	2.13	16	1
1:A:106:GLU:HA	1:A:109:ARG:HG2	0.42	1.91	16	1
1:A:129:THR:O	1:A:133:LEU:HG	0.42	2.14	14	1
1:A:139:ARG:HD2	1:A:139:ARG:H	0.42	1.73	17	1
1:A:91:VAL:CG1	1:A:133:LEU:HD21	0.42	2.40	6	1
1:A:48:ARG:HB3	1:A:51:ASP:OD2	0.41	2.15	20	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:145:LEU:HD23	1:A:146:PRO:HD2	0.41	1.92	1	1
1:A:48:ARG:HH11	1:A:48:ARG:HG2	0.41	1.76	4	1
1:A:91:VAL:HA	1:A:117:GLY:O	0.41	2.16	9	1
1:A:37:PRO:HD3	1:A:130:TYR:CE1	0.41	2.50	17	1
1:A:54:ALA:O	1:A:58:GLN:HG3	0.40	2.17	19	1
1:A:49:PRO:HB3	1:A:96:THR:HB	0.40	1.92	6	1
1:A:12:ASN:HD21	1:A:35:PHE:HB2	0.40	1.77	17	1
1:A:123:THR:HG23	1:A:144:LEU:HD22	0.40	1.92	1	1
1:A:89:PRO:HB3	1:A:141:VAL:HG23	0.40	1.92	17	1
1:A:32:ALA:N	1:A:146:PRO:HD2	0.40	2.32	19	1
1:A:90:GLU:OE2	1:A:138:ARG:HD2	0.40	2.15	6	1
1:A:23:GLU:HA	1:A:28:ARG:HA	0.40	1.92	10	1
1:A:18:GLY:HA3	1:A:21:TYR:CE1	0.40	2.52	13	1

6.3 Torsion angles ⓘ

6.3.1 Protein backbone ⓘ

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	112/158 (71%)	104±2 (92±2%)	8±2 (7±2%)	1±1 (1±1%)	20	70
All	All	2240/3160 (71%)	2071 (92%)	153 (7%)	16 (1%)	20	70

All 6 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	25	ASN	6
1	A	146	PRO	5
1	A	18	GLY	2
1	A	26	GLN	1
1	A	138	ARG	1
1	A	98	ARG	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	85/120 (71%)	83±1 (98±2%)	2±1 (2±2%)	46	90
All	All	1700/2400 (71%)	1665 (98%)	35 (2%)	46	90

All 15 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	15	THR	6
1	A	96	THR	5
1	A	23	GLU	5
1	A	44	TRP	4
1	A	109	ARG	2
1	A	123	THR	2
1	A	145	LEU	2
1	A	48	ARG	2
1	A	38	GLU	1
1	A	43	SER	1
1	A	53	THR	1
1	A	139	ARG	1
1	A	55	SER	1
1	A	133	LEU	1
1	A	99	ARG	1

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 oligosaccharides 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

No chemical shift data were provided