



Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 11:01 PM BST

PDB ID : 2KDV
Title : Solution structure of RNA Pyrophosphohydrolase RppH from Escherichia coli
Authors : Bi, Y.; Li, H.; Jin, C.
Deposited on : 2009-01-19

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
Mogul : unknown
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
ShiftChecker : rb-20027457
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20027457

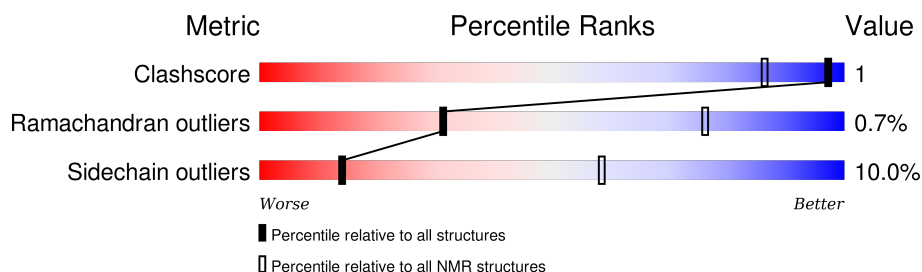
1 Overall quality at a glance

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	114402	11133
Ramachandran outliers	111179	9975
Sidechain outliers	111093	9958

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	164	 87% 10% •

2 Ensemble composition and analysis

This entry contains 21 models. Model 1 is the overall representative, medoid model (most similar to other models).

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:2-A:160 (159)	0.32	1

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 2 clusters and 3 single-model clusters were found.

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

3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 2722 atoms, of which 1353 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called RNA pyrophosphohydrolase.

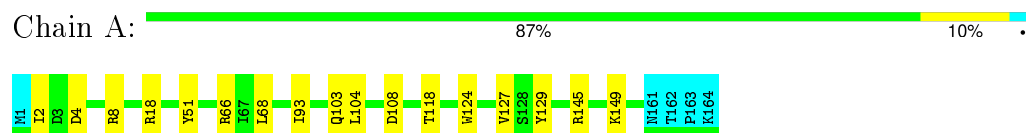
Mol	Chain	Residues	Atoms						Trace
1	A	164	Total	C	H	N	O	S	0
			2722	873	1353	249	239	8	

4 Residue-property plots

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: RNA pyrophosphohydrolase

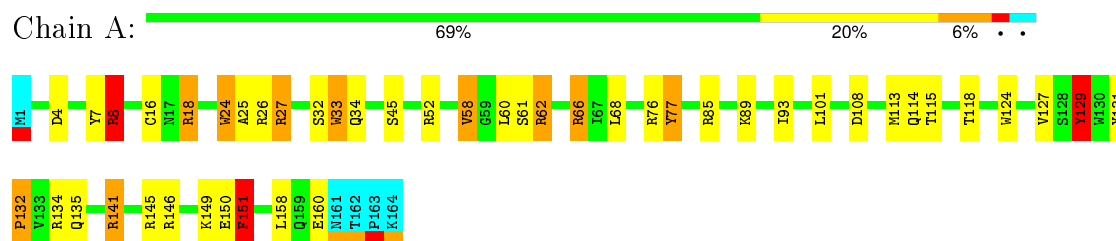


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

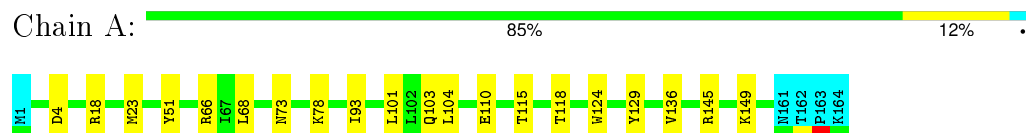
4.2.1 Score per residue for model 1 (medoid)

- Molecule 1: RNA pyrophosphohydrolase



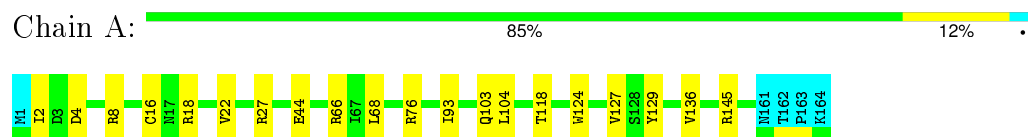
4.2.2 Score per residue for model 2

- Molecule 1: RNA pyrophosphohydrolase



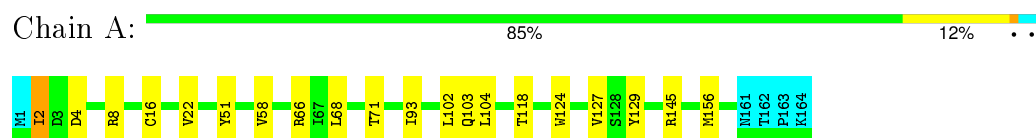
4.2.3 Score per residue for model 3

- Molecule 1: RNA pyrophosphohydrolase



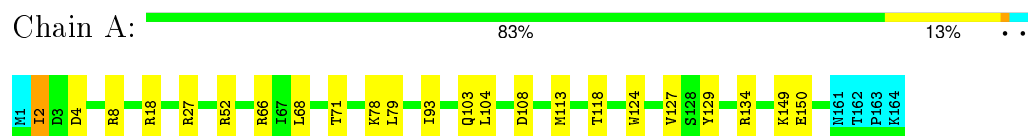
4.2.4 Score per residue for model 4

- Molecule 1: RNA pyrophosphohydrolase



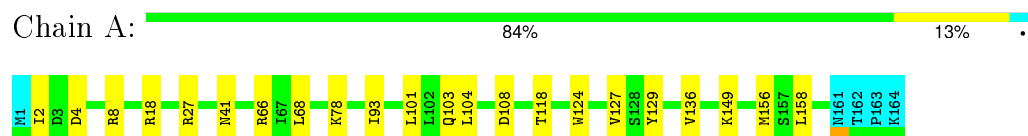
4.2.5 Score per residue for model 5

- Molecule 1: RNA pyrophosphohydrolase



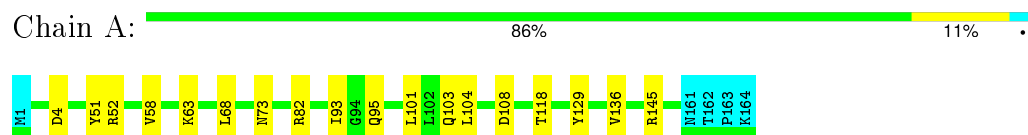
4.2.6 Score per residue for model 6

- Molecule 1: RNA pyrophosphohydrolase



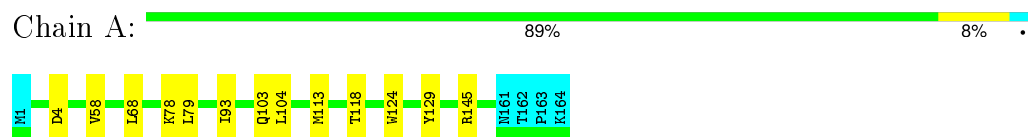
4.2.7 Score per residue for model 7

- Molecule 1: RNA pyrophosphohydrolase



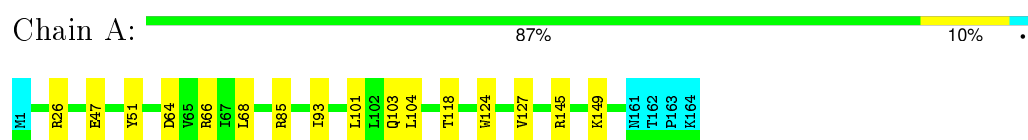
4.2.8 Score per residue for model 8

- Molecule 1: RNA pyrophosphohydrolase



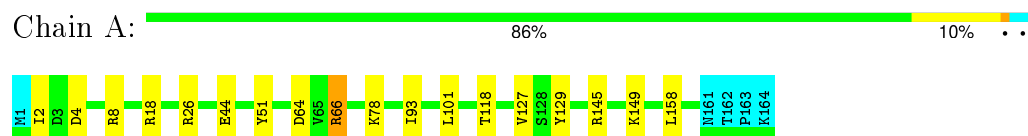
4.2.9 Score per residue for model 9

- Molecule 1: RNA pyrophosphohydrolase



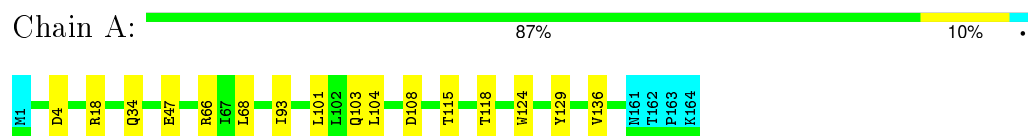
4.2.10 Score per residue for model 10

- Molecule 1: RNA pyrophosphohydrolase



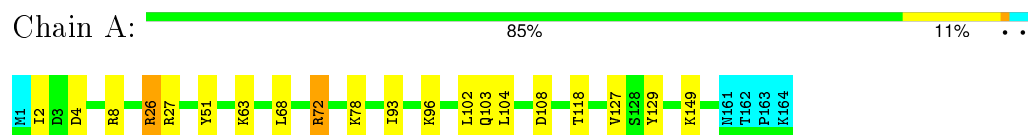
4.2.11 Score per residue for model 11

- Molecule 1: RNA pyrophosphohydrolase



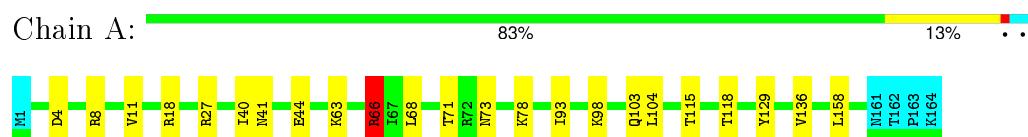
4.2.12 Score per residue for model 12

- Molecule 1: RNA pyrophosphohydrolase



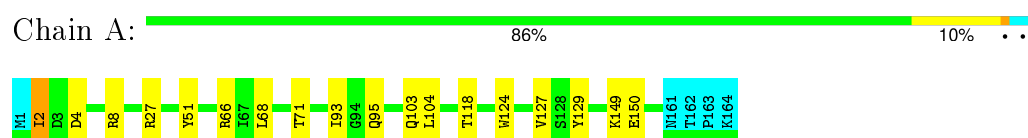
4.2.13 Score per residue for model 13

- Molecule 1: RNA pyrophosphohydrolase



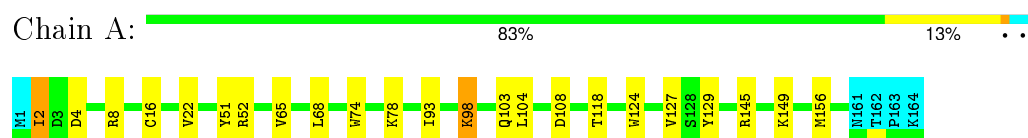
4.2.14 Score per residue for model 14

- Molecule 1: RNA pyrophosphohydrolase



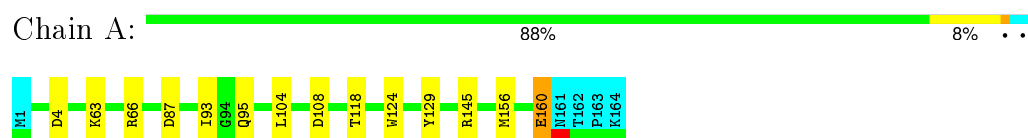
4.2.15 Score per residue for model 15

- Molecule 1: RNA pyrophosphohydrolase



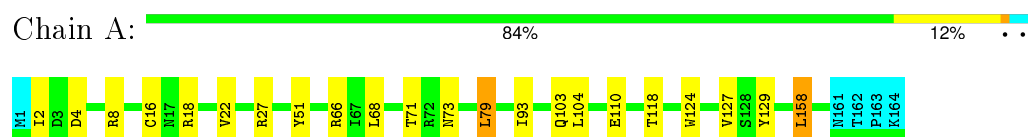
4.2.16 Score per residue for model 16

- Molecule 1: RNA pyrophosphohydrolase



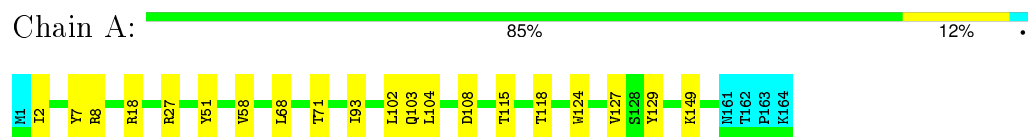
4.2.17 Score per residue for model 17

- Molecule 1: RNA pyrophosphohydrolase



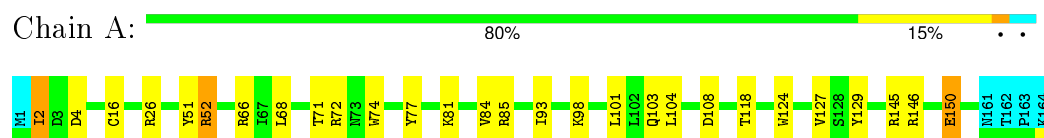
4.2.18 Score per residue for model 18

- Molecule 1: RNA pyrophosphohydrolase



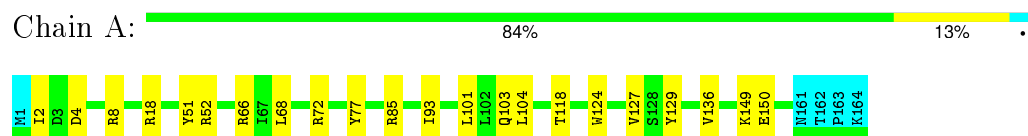
4.2.19 Score per residue for model 19

- Molecule 1: RNA pyrophosphohydrolase



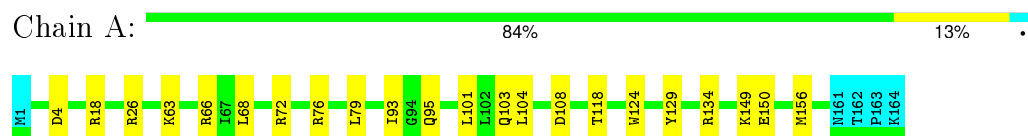
4.2.20 Score per residue for model 20

- Molecule 1: RNA pyrophosphohydrolase



4.2.21 Score per residue for model 21

- Molecule 1: RNA pyrophosphohydrolase



5 Refinement protocol and experimental data overview

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

Of the 100 calculated structures, 21 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
AMBER	refinement	
CYANA	structure solution	

No chemical shift data was provided. 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	0.67±0.02	0±0/1366 (0.0±0.0%)	1.09±0.19	3±10/1848 (0.2±0.5%)
All	All	0.68	2/28686 (0.0%)	1.11	72/38808 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	Chirality	Planarity
1	A	0.0±0.0	1.5±1.5
All	All	0	32

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
1	A	24	TRP	NE1-CE2	-5.93	1.29	1.37	1	1
1	A	24	TRP	CD2-CE3	-5.86	1.31	1.40	1	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(°)	Ideal(°)	Models	
								Worst	Total
1	A	8	ARG	NE-CZ-NH2	-18.13	111.24	120.30	1	1
1	A	24	TRP	CZ3-CH2-CZ2	-14.94	103.67	121.60	1	1
1	A	18	ARG	NE-CZ-NH1	14.14	127.37	120.30	1	1
1	A	27	ARG	NE-CZ-NH2	-13.89	113.35	120.30	1	2
1	A	18	ARG	NE-CZ-NH2	-13.15	113.73	120.30	1	2
1	A	145	ARG	NE-CZ-NH2	-13.05	113.77	120.30	1	11
1	A	8	ARG	NE-CZ-NH1	12.96	126.78	120.30	1	1
1	A	33	TRP	CA-CB-CG	11.61	135.75	113.70	1	1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	24	TRP	CH2-CZ2-CE2	-11.54	105.86	117.40	1	1
1	A	26	ARG	NE-CZ-NH2	-10.81	114.90	120.30	1	5
1	A	24	TRP	NE1-CE2-CD2	-10.68	96.62	107.30	1	1
1	A	151	PHE	CD1-CG-CD2	-10.60	104.52	118.30	1	1
1	A	24	TRP	CE2-CD2-CE3	-10.14	106.54	118.70	1	1
1	A	134	ARG	NE-CZ-NH2	-9.87	115.36	120.30	1	1
1	A	24	TRP	CD1-CG-CD2	-9.68	98.56	106.30	1	1
1	A	8	ARG	CD-NE-CZ	8.99	136.19	123.60	1	1
1	A	27	ARG	NE-CZ-NH1	8.91	124.76	120.30	1	2
1	A	24	TRP	CB-CG-CD2	8.82	138.07	126.60	1	1
1	A	76	ARG	NE-CZ-NH2	-8.70	115.95	120.30	1	1
1	A	66	ARG	NE-CZ-NH2	-8.65	115.97	120.30	1	3
1	A	24	TRP	CD1-NE1-CE2	8.51	116.66	109.00	1	1
1	A	129	TYR	CB-CG-CD2	-8.42	115.95	121.00	1	1
1	A	62	ARG	NE-CZ-NH2	-8.23	116.18	120.30	1	1
1	A	151	PHE	CG-CD1-CE1	-8.19	111.79	120.80	1	1
1	A	131	TYR	CB-CG-CD1	-8.00	116.20	121.00	1	1
1	A	52	ARG	NE-CZ-NH2	-7.73	116.44	120.30	1	3
1	A	77	TYR	CB-CG-CD1	-7.57	116.45	121.00	1	1
1	A	7	TYR	CB-CG-CD2	-7.55	116.47	121.00	1	1
1	A	24	TRP	CE2-CD2-CG	7.38	113.20	107.30	1	1
1	A	141	ARG	NE-CZ-NH2	-7.33	116.64	120.30	1	1
1	A	145	ARG	NE-CZ-NH1	7.23	123.91	120.30	1	1
1	A	58	VAL	CG1-CB-CG2	-6.91	99.85	110.90	1	1
1	A	18	ARG	CD-NE-CZ	6.42	132.59	123.60	1	1
1	A	141	ARG	CD-NE-CZ	-6.36	114.70	123.60	1	1
1	A	66	ARG	NE-CZ-NH1	6.13	123.36	120.30	1	1
1	A	132	PRO	CA-CB-CG	6.12	116.42	104.80	1	1
1	A	58	VAL	CA-CB-CG2	6.10	120.06	110.90	1	1
1	A	141	ARG	CB-CG-CD	5.94	127.05	111.60	1	1
1	A	160	GLU	C-N-CA	5.82	136.26	121.70	16	1
1	A	145	ARG	CD-NE-CZ	5.60	131.44	123.60	1	1
1	A	33	TRP	N-CA-CB	-5.49	100.71	110.60	1	1
1	A	146	ARG	NE-CZ-NH2	-5.40	117.60	120.30	1	1
1	A	62	ARG	CB-CG-CD	-5.39	97.58	111.60	1	1
1	A	60	LEU	CB-CG-CD2	-5.36	101.90	111.00	1	1
1	A	72	ARG	NE-CZ-NH2	-5.30	117.65	120.30	12	1
1	A	141	ARG	CG-CD-NE	5.21	122.74	111.80	1	1
1	A	115	THR	CA-CB-CG2	-5.17	105.17	112.40	1	1
1	A	89	LYS	CG-CD-CE	-5.13	96.52	111.90	1	1
1	A	8	ARG	CG-CD-NE	-5.12	101.05	111.80	1	1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	79	LEU	CB-CA-C	5.06	119.81	110.20	17	2

There are no chirality outliers.

All unique planar outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Group	Models (Total)
1	A	51	TYR	Sidechain	12
1	A	27	ARG	Sidechain	7
1	A	77	TYR	Sidechain	3
1	A	66	ARG	Sidechain	1
1	A	18	ARG	Sidechain	1
1	A	52	ARG	Sidechain	1
1	A	62	ARG	Sidechain	1
1	A	151	PHE	Sidechain	1
1	A	8	ARG	Sidechain	1
1	A	129	TYR	Sidechain	1
1	A	146	ARG	Sidechain	1
1	A	141	ARG	Sidechain	1
1	A	26	ARG	Sidechain	1

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	1329	1309	1309	2±3
All	All	27909	27489	27489	52

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:24:TRP:HE1	1:A:33:TRP:HB3	1.04	1.11	1	1
1:A:24:TRP:NE1	1:A:33:TRP:HB3	0.94	1.77	1	1

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:24:TRP:CE3	1:A:132:PRO:HB3	0.89	2.02	1	1
1:A:16:CYS:SG	1:A:101:LEU:HD11	0.80	2.17	1	2
1:A:24:TRP:HE3	1:A:132:PRO:HB3	0.80	1.32	1	1
1:A:24:TRP:CE3	1:A:132:PRO:CB	0.64	2.81	1	1
1:A:24:TRP:CZ3	1:A:132:PRO:CB	0.61	2.83	1	1
1:A:68:LEU:HD11	1:A:103:GLN:HB2	0.61	1.72	13	18
1:A:101:LEU:HB2	1:A:151:PHE:HD2	0.61	1.54	1	1
1:A:24:TRP:CE2	1:A:33:TRP:HB3	0.58	2.32	1	1
1:A:68:LEU:HB2	1:A:101:LEU:HD23	0.51	1.82	1	1
1:A:150:GLU:HB3	1:A:151:PHE:CE1	0.51	2.41	1	1
1:A:16:CYS:SG	1:A:22:VAL:HG12	0.49	2.48	17	4
1:A:68:LEU:HD11	1:A:103:GLN:CB	0.49	2.38	17	4
1:A:74:TRP:CE2	1:A:98:LYS:HE3	0.46	2.45	15	2
1:A:24:TRP:CD1	1:A:24:TRP:C	0.45	2.89	1	1
1:A:24:TRP:HD1	1:A:25:ALA:N	0.45	2.10	1	1
1:A:74:TRP:CD2	1:A:98:LYS:HE3	0.44	2.48	15	1
1:A:71:THR:HG22	1:A:150:GLU:HG3	0.44	1.89	5	2
1:A:11:VAL:HG13	1:A:40:ILE:HD11	0.44	1.90	13	1
1:A:24:TRP:CD1	1:A:25:ALA:N	0.44	2.85	1	1
1:A:71:THR:HG22	1:A:150:GLU:HG2	0.43	1.90	14	1
1:A:68:LEU:HD13	1:A:158:LEU:HG	0.42	1.90	17	2
1:A:81:LYS:HA	1:A:84:VAL:HG23	0.41	1.92	19	1
1:A:24:TRP:HE1	1:A:33:TRP:CB	0.40	2.04	1	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	159/164 (97%)	153±1 (96±1%)	5±1 (3±1%)	1±0 (1±0%)	31	76
All	All	3339/3444 (97%)	3214 (96%)	100 (3%)	25 (1%)	31	76

All 3 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	4	ASP	19
1	A	2	ILE	5
1	A	7	TYR	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	142/147 (97%)	128±3 (90±2%)	14±3 (10±2%)	14	58
All	All	2982/3087 (97%)	2685 (90%)	297 (10%)	14	58

All 51 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	118	THR	21
1	A	93	ILE	21
1	A	129	TYR	20
1	A	104	LEU	19
1	A	124	TRP	17
1	A	66	ARG	16
1	A	127	VAL	14
1	A	8	ARG	13
1	A	2	ILE	12
1	A	149	LYS	12
1	A	108	ASP	11
1	A	18	ARG	10
1	A	101	LEU	8
1	A	78	LYS	8
1	A	136	VAL	7
1	A	63	LYS	5
1	A	58	VAL	5
1	A	156	MET	5
1	A	85	ARG	4
1	A	72	ARG	4
1	A	95	GLN	4
1	A	73	ASN	4
1	A	115	THR	4

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Models (Total)
1	A	71	THR	4
1	A	150	GLU	3
1	A	44	GLU	3
1	A	158	LEU	3
1	A	113	MET	3
1	A	102	LEU	3
1	A	52	ARG	3
1	A	79	LEU	3
1	A	134	ARG	2
1	A	41	ASN	2
1	A	64	ASP	2
1	A	110	GLU	2
1	A	34	GLN	2
1	A	98	LYS	2
1	A	47	GLU	2
1	A	76	ARG	2
1	A	151	PHE	1
1	A	87	ASP	1
1	A	114	GLN	1
1	A	61	SER	1
1	A	45	SER	1
1	A	65	VAL	1
1	A	26	ARG	1
1	A	82	ARG	1
1	A	32	SER	1
1	A	135	GLN	1
1	A	23	MET	1
1	A	96	LYS	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

No chemical shift data were provided