Integrative Structure Validation Report

March 19, 2026 - 09:43 AM PDT

The following software was used in the production of this report:

IHMValidation Version 3.1
Python-IHM Version 2.9
MolProbity Version 4.5.2

PDB ID	9AAM | pdb_00009aam
Structure Title	Integrated Structure of pRN1 DNA Primase in Complex with the First Two Base Pairs
Structure Authors	Wu, P.; Allain, F.H.-T.
Deposited on	2025-06-30

This is a PDB-IHM Structure Validation Report.

We welcome your comments at helpdesk@pdb-ihm.org

A user guide is available at https://pdb-ihm.org/validation_help.html with specific help available everywhere you see the ? symbol.

List of references used to build this report is available here.

1. Overview

1.1. Summary

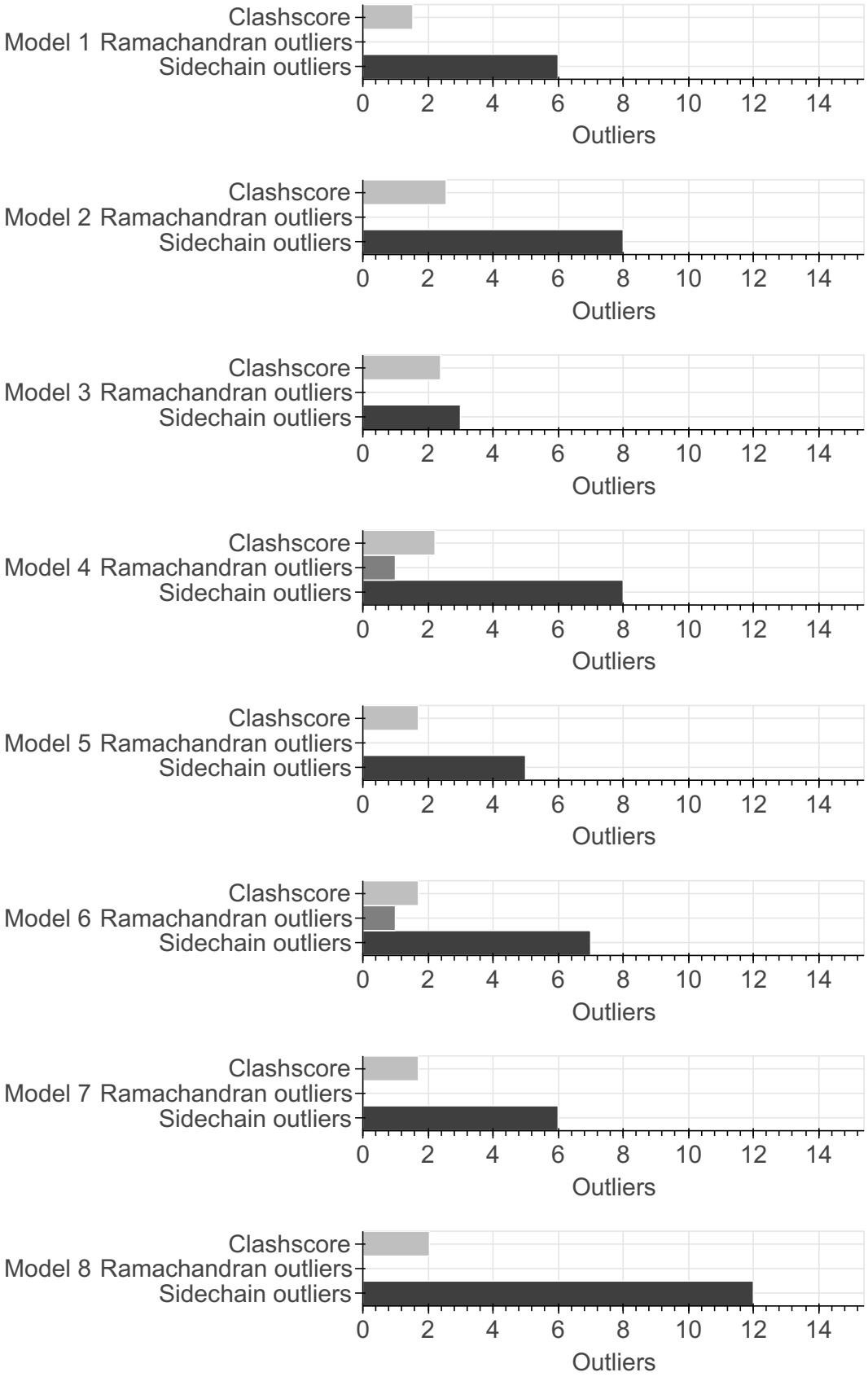
This entry consists of 20 model(s). A total of 5 dataset(s) were used to build this entry.

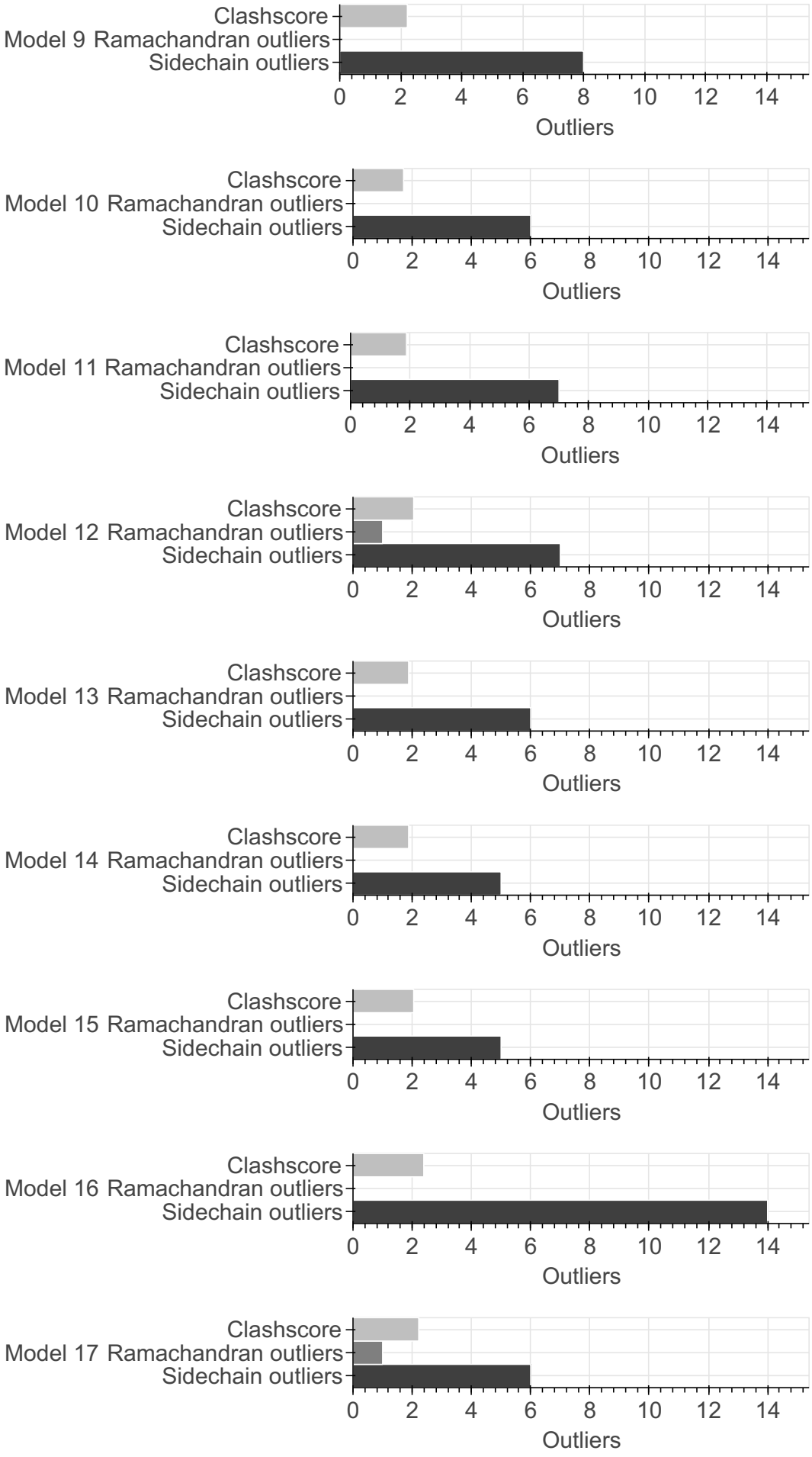
Name	Type	Count
NMR data	Experimental data	2
Experimental model	Starting model	3

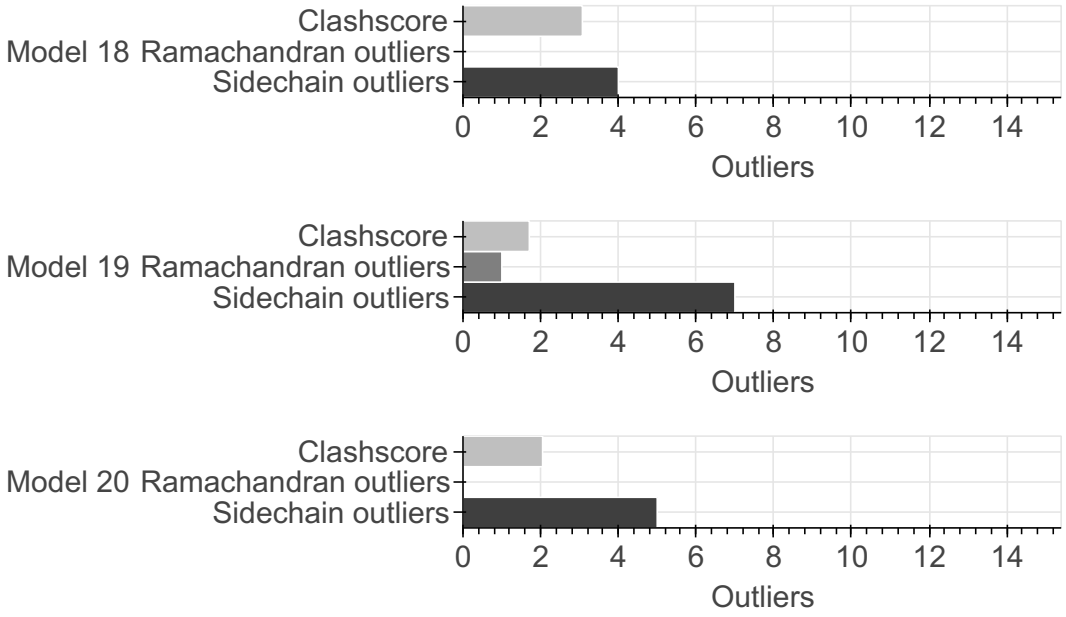
1.2. Overall quality

This validation report contains model quality assessments for all structures, data quality and fit to model assessments for SAS and crosslinking-MS datasets. Data quality and fit to model assessments for other datasets and model uncertainty are under development. Number of plots is limited to 256.

Model Quality: MolProbity Analysis




Clashscore
Model 9 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers
Clashscore
Model 10 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers
Clashscore
Model 11 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers
Clashscore
Model 12 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers
Clashscore
Model 13 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers
Clashscore
Model 14 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers
Clashscore
Model 15 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers
Clashscore
Model 16 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers
Clashscore
Model 17 Ramachandran outliers
Sidechain outliers
0 2 4 6 8 10 12 14
Outliers



2. Model Details

2.1. Ensemble information

This entry consists of 0 distinct ensemble(s).

2.2. Representation

This entry has 1 representation(s).

ID	Model(s)	Entity ID	Molecule name	Chain(s) [auth]	Total residues	Rigid segments	Flexible segments	Model coverage/ Starting model coverage (%)	Scale
1	1-20	1	SF3 helicase domain-containing protein	A [B]	331	-	1-331	100.00 / 100.00	Atomic
		2	DNA (5'-D(*AP*CP*TP*GP*TP*GP*CP*TP*CP*A)-3')	B [A]	10	-	1-10	100.00 / 100.00	Atomic
		3	ADENOSINE-5'-TRIPHOSPHATE	C	Non-polymeric	-	-	Not available / Not available	Atomic
		4	2'-DEOXYGUANOSINE-5'-TRIPHOSPHATE	D [C]	Non-polymeric	-	-	Not available / Not available	Atomic

ID	Model(s)	Entity ID	Molecule name	Chain(s) [auth]	Total residues	Rigid segments	Flexible segments	Model coverage/ Starting model coverage (%)	Scale
		5	MAGNESIUM ION	E [C]	Non-polymeric	-	-	Not available / Not available	Atomic
				F [C]					
				G [C]					
		6	ZINC ION	H [C]	Non-polymeric	-	-	Not available / Not available	Atomic

2.3. Datasets used for modeling

There are 5 unique datasets used to build the models in this entry.

ID	Dataset type	Database name	Data access code
1	NMR data	BMRB	53266
2	Experimental model	PDB	pdb_00003m1m
3	Experimental model	PDB	pdb_00007qaz
4	Experimental model	PDB	pdb_00009rtj
5	NMR data	BMRbig	Bmrbig143

2.4. Methodology and software

This entry is a result of 1 distinct protocol(s).

Step number	Protocol ID	Method name	Method type	Method description	Number of computed models	Multi state modeling	Multi scale modeling
1	1	CYANA regularization	pseudo-distance restraints	Not available	1	False	False
2	1	CYANA calculation	torsion angle dynamics combined with simulated annealing	Not available	50	False	False
3	1	AMBER refinement	Energy minimization	Not available	20	False	False

There are 2 software packages reported in this entry.

ID	Software name	Software version	Software classification	Software location
1	CYANA	3.98	model building	https://www.las.jp/english/cyana.html
2	AMBER	20	refinement	https://ambermd.org/

3. Data quality

3.4. NMR

Validation for this section is under development.

4. Model quality

For models with atomic structures, MolProbity analysis is performed. For models with coarse-grained or multi-scale structures, excluded volume analysis is performed.

4.1b. MolProbity Analysis

Excluded volume satisfaction for the models in the entry are listed below. The Analysed column shows the number of particle-partice or particle-atom pairs for which excluded volume was analysed.

Standard geometry: bond outliers

There are no bond length outliers.

Standard geometry: angle outliers

There are 123 bond angle outliers in this entry (0.15% of 82561 assessed bonds). A summary is provided below.

Chain	Res	Type	Atoms	|Z|	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
C	1	ATP	PB-O3B-PG	10.20	129.67	139.87	2	19
C	1	ATP	PA-O3A-PB	5.76	131.07	136.83	12	4
B	5	DT	C5'-C4'-C3'	5.33	106.90	114.90	1	6
B	9	DC	C5'-C4'-C3'	5.13	107.20	114.90	10	5
A	149	HIS	CB-CG-CD2	4.74	125.03	131.20	17	20
C	1	ATP	O1G-PG-O3B	4.48	103.10	110.47	12	20
A	132	ASP	CA-CB-CG	4.43	117.03	112.60	12	1
A	117	HIS	CB-CG-CD2	4.43	125.44	131.20	20	20
B	7	DC	C5'-C4'-C3'	4.31	108.44	114.90	1	1
A	102	HIS	CB-CG-CD2	4.20	125.74	131.20	13	5
B	10	DA	C5'-C4'-C3'	4.18	108.63	114.90	17	2
B	5	DT	C7-C5-C6	4.17	117.74	124.00	20	1
A	284	HIS	CB-CG-CD2	4.14	125.82	131.20	10	4
A	14	HIS	CB-CG-CD2	4.10	125.87	131.20	4	4
B	2	DC	C5'-C4'-C3'	4.10	108.75	114.90	15	4
A	106	HIS	CB-CG-CD2	4.09	125.89	131.20	4	1
A	269	ASP	CA-CB-CG	4.09	116.69	112.60	13	1
A	276	HIS	CB-CG-CD2	4.07	125.91	131.20	16	4
A	151	HIS	CB-CG-CD2	4.04	125.95	131.20	2	1

Too-close contacts

The following all-atom clashscore is based on a MolProbity analysis. All-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The table below contains clashscores for all atomic models in this entry.

Model ID	Clash score	Number of clashes
1	1.54	9
2	2.56	15
3	2.39	14
4	2.22	13
5	1.71	10
6	1.71	10
7	1.71	10
8	2.05	12
9	2.22	13
10	1.71	10
11	1.88	11
12	2.05	12
13	1.88	11
14	1.88	11
15	2.05	12
16	2.39	14
17	2.22	13
18	3.07	18
19	1.71	10
20	2.05	12

There are 240 clashes. The table below contains the detailed list of all clashes based on a MolProbity analysis. Bad clashes are >= 0.4 Angstrom.

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
A:308:TRP:CD1	B:3:DT:H73	0.63	7	16
A:308:TRP:CG	B:3:DT:H72	0.58	12	4
A:118:LYS:HE3	A:138:SER:HB2	0.56	4	6
A:308:TRP:CD1	B:3:DT:H72	0.56	4	4
A:291:LYS:HA	A:291:LYS:HE2	0.55	8	5
A:291:LYS:HE3	A:291:LYS:N	0.54	14	15
A:31:LYS:HA	A:31:LYS:HE3	0.53	3	2
A:118:LYS:HE3	A:138:SER:CB	0.51	4	5
A:276:HIS:CE1	B:7:DC:H5"	0.51	12	16

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
A:101:VAL:HG13	A:168:TYR:CE1	0.51	14	16
B:2:DC:C6	B:3:DT:H72	0.50	3	15
B:9:DC:H3'	B:10:DA:H5''	0.49	1	1
A:118:LYS:HE2	B:5:DT:H5'	0.49	5	4
A:252:LEU:C	A:252:LEU:HD13	0.48	1	19
A:73:PHE:CE2	A:131:ILE:HD12	0.48	14	11
B:10:DA:C8	B:10:DA:H5'	0.48	9	1
A:26:LYS:HE3	A:141:LEU:HD22	0.47	16	8
A:91:LEU:C	A:91:LEU:HD13	0.47	4	1
A:202:LYS:HA	A:202:LYS:HE3	0.47	8	1
A:34:GLN:CD	A:34:GLN:H	0.47	15	4
A:306:GLU:CD	A:306:GLU:H	0.47	2	1
A:5:ILE:N	A:5:ILE:HD12	0.46	7	5
A:85:GLU:CD	A:85:GLU:H	0.46	16	6
B:9:DC:C6	B:9:DC:H5'	0.46	9	1
B:9:DC:H1'	B:10:DA:N7	0.45	16	1
B:6:DG:C8	B:6:DG:O5'	0.45	4	17
A:7:TYR:CG	A:143:LEU:HD23	0.45	17	1
A:320:LYS:HE2	B:6:DG:N7	0.45	18	2
A:120:ASN:HB3	A:121:PRO:HD3	0.45	6	7
B:8:DT:C5'	B:9:DC:C5	0.44	18	1
A:120:ASN:HB3	A:121:PRO:CD	0.44	6	3
A:118:LYS:HD3	A:138:SER:CB	0.44	13	1
A:73:PHE:CZ	A:131:ILE:HD12	0.43	1	1
A:115:PRO:HA	A:116:PRO:HD3	0.43	11	1
A:183:LYS:HE3	A:207:TRP:CZ2	0.43	20	1
A:322:TRP:HA	A:325:VAL:HG12	0.42	18	2
A:154:THR:HB	A:156:LYS:HE3	0.42	10	1
A:183:LYS:HE3	A:207:TRP:CH2	0.42	17	3
A:123:PHE:CZ	A:200:LEU:HD21	0.42	14	1
A:149:HIS:HA	A:152:CYS:SG	0.42	19	6
B:8:DT:H5'	B:9:DC:C5	0.42	18	1
A:141:LEU:HD23	A:168:TYR:CE1	0.42	14	1
A:118:LYS:CE	A:138:SER:HB2	0.42	17	1
A:263:TYR:HA	A:266:VAL:HG22	0.41	19	4

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
A:74:GLU:HA	A:74:GLU:OE1	0.41	1	4
A:237:VAL:HG12	A:241:LYS:HE3	0.41	18	2
A:235:LYS:HE3	A:235:LYS:N	0.41	8	1
D:1:DGT:H8	D:1:DGT:O5'	0.41	17	1
B:9:DC:C2'	B:10:DA:C8	0.41	18	1
A:291:LYS:CA	A:291:LYS:HE3	0.41	9	2
A:122:LEU:HA	A:122:LEU:HD23	0.41	15	1
A:275:TRP:CD1	B:7:DC:H5'	0.40	14	2
B:5:DT:H2'	B:6:DG:C5	0.40	20	1
A:35:LYS:HE3	A:36:TYR:CE2	0.40	3	1
A:120:ASN:O	A:132:ASP:HA	0.40	2	1

Torsion angles: Protein backbone

In the following table, Ramachandran outliers are listed. The Analysed column shows the number of residues for which the backbone conformation was analysed.

Model ID	Analysed	Favored	Allowed	Outliers
1	329	317	12	0
2	329	316	13	0
3	329	319	10	0
4	329	315	13	1
5	329	316	13	0
6	329	313	15	1
7	329	316	13	0
8	329	316	13	0
9	329	317	12	0
10	329	317	12	0
11	329	318	11	0
12	329	314	14	1
13	329	318	11	0
14	329	318	11	0
15	329	320	9	0
16	329	316	13	0
17	329	315	13	1
18	329	317	12	0
19	329	315	13	1
20	329	318	11	0

There are 2 unique backbone outliers. Detailed list of outliers are tabulated below.

Chain	Res	Type	Models (Total)
A	305	ASN	4
A	212	LYS	1

Torsion angles : Protein sidechains

In the following table, sidechain rotameric outliers are listed. The Analysed column shows the number of residues for which the sidechain conformation was analysed.

Model ID	Analysed	Favored	Allowed	Outliers
1	303	285	12	6
2	303	285	10	8
3	303	287	13	3
4	303	277	18	8
5	303	284	14	5
6	303	282	14	7
7	303	278	19	6
8	303	275	16	12
9	303	284	11	8
10	303	277	20	6
11	303	282	14	7
12	303	284	12	7
13	303	279	18	6
14	303	284	14	5
15	303	283	15	5
16	303	279	10	14
17	303	284	13	6
18	303	282	17	4
19	303	280	16	7
20	303	282	16	5

There are 35 unique sidechain outliers. Detailed list of outliers are tabulated below.

Chain	Res	Type	Models (Total)
A	50	LEU	20
A	138	SER	19
A	291	LYS	15
A	137	ASN	14
A	132	ASP	8

Chain	Res	Type	Models (Total)
A	308	TRP	6
A	318	LEU	5
A	34	GLN	4
A	32	GLU	3
A	118	LYS	3
A	240	ILE	3
A	241	LYS	3
A	27	LYS	2
A	31	LYS	2
A	122	LEU	2
A	131	ILE	2
A	139	TYR	2
A	152	CYS	2
A	156	LYS	2
A	212	LYS	2
A	269	ASP	2
A	19	ILE	1
A	48	ARG	1
A	65	GLN	1
A	76	LYS	1
A	94	LYS	1
A	124	GLU	1
A	128	LYS	1
A	134	GLN	1
A	172	ASN	1
A	202	LYS	1
A	225	ARG	1
A	235	LYS	1
A	283	LYS	1
A	306	GLU	1

5. Fit to Data Used for Modeling Assessment

5.4. NMR

Validation for this section is under development.

6. Fit to Data Used for Validation Assessment

Validation for this section is under development.

Acknowledgments

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