

# Integrative Structure Validation Report

March 19, 2026 - 09:53 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	9AAN   pdb_00009aan
Structure Title	Integrated Structure of pRN1 DNA Primase in Complex with the First Base Pair
Structure Authors	Wu, P.; Allain, F.H.-T.
Deposited on	2025-07-22

*This is a PDB-IHM Structure Validation Report.*

*We welcome your comments at [helpdesk@pdb-ihm.org](mailto:helpdesk@pdb-ihm.org)*

*A user guide is available at [https://pdb-ihm.org/validation\\_help.html](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

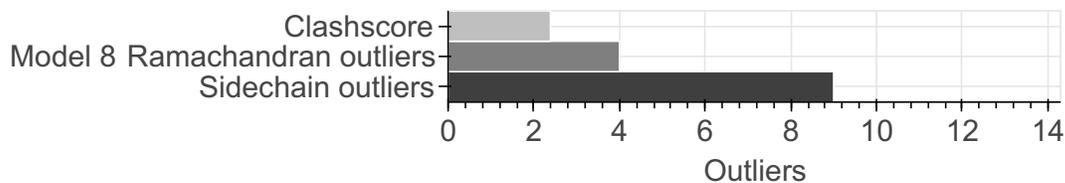
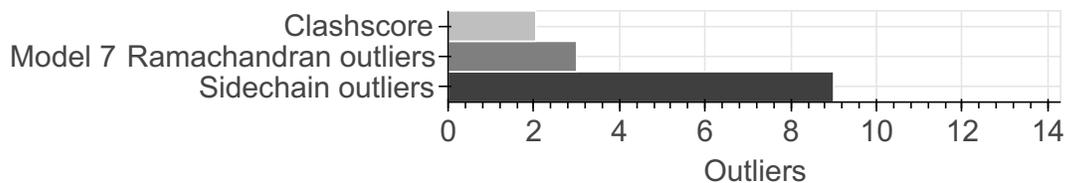
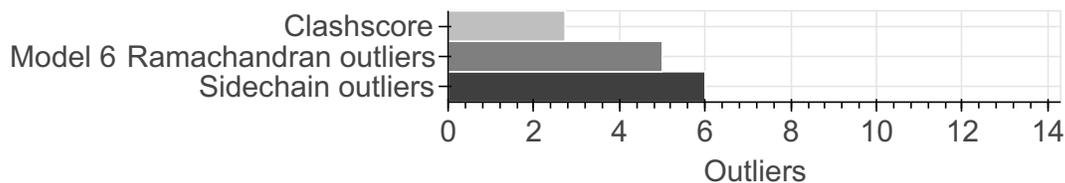
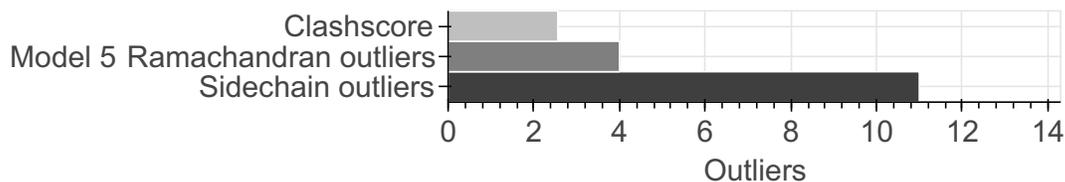
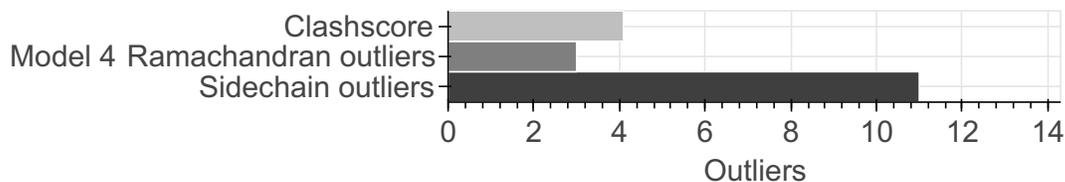
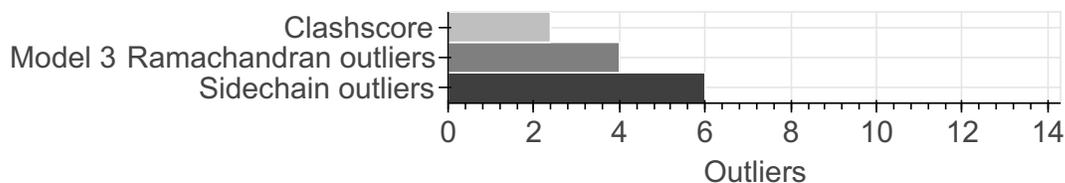
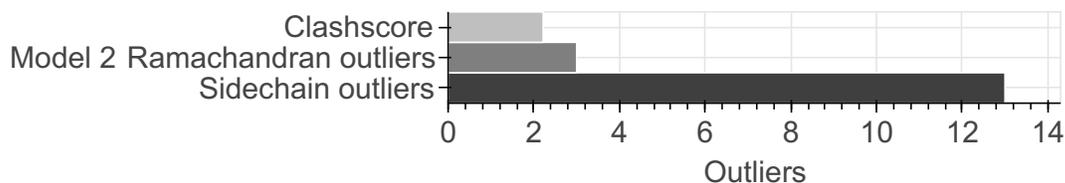
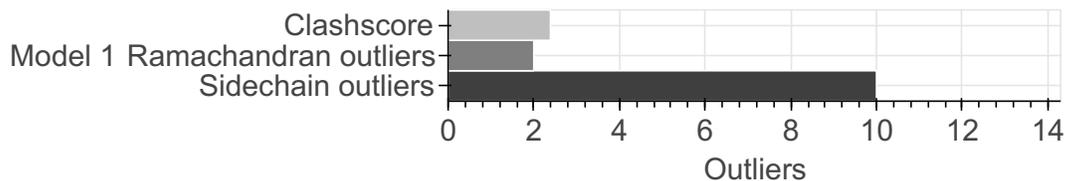
*This entry consists of 20 model(s). A total of 5 dataset(s) were used to build this entry.*

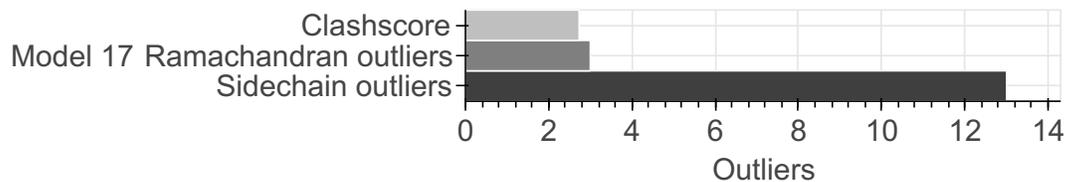
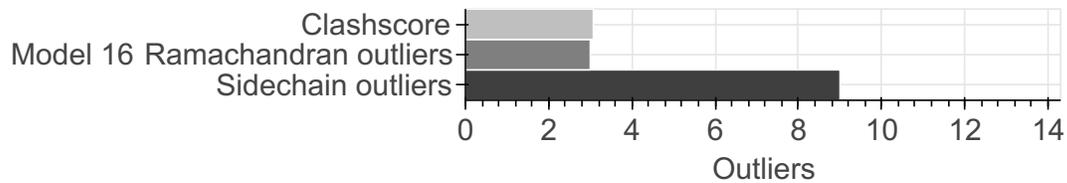
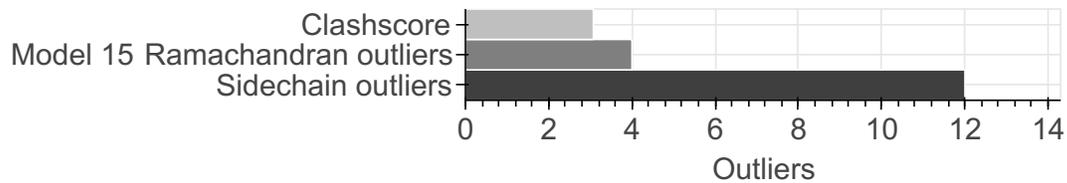
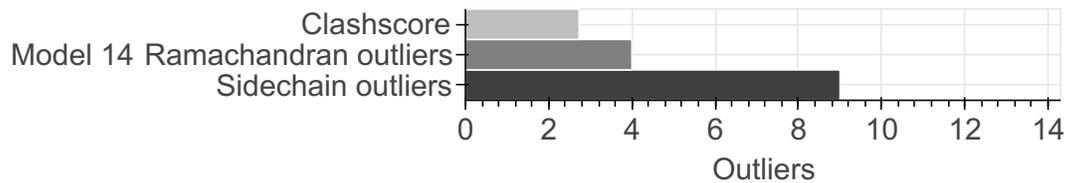
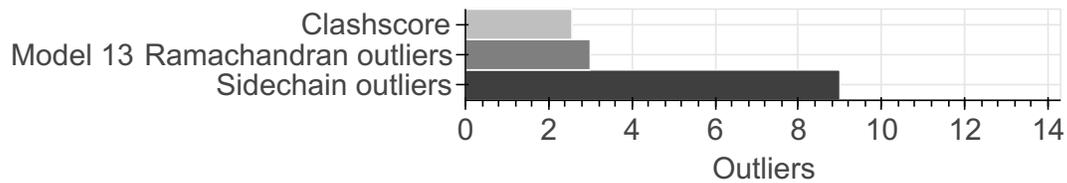
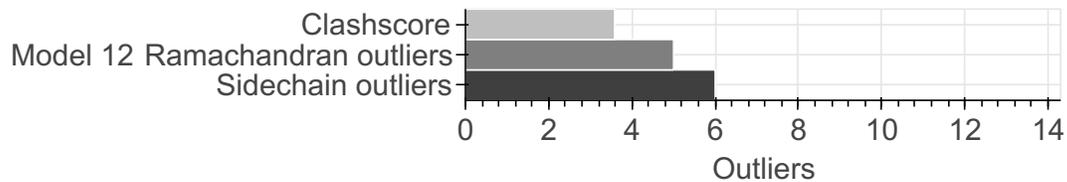
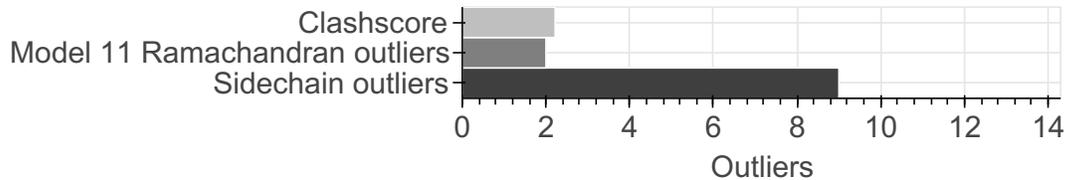
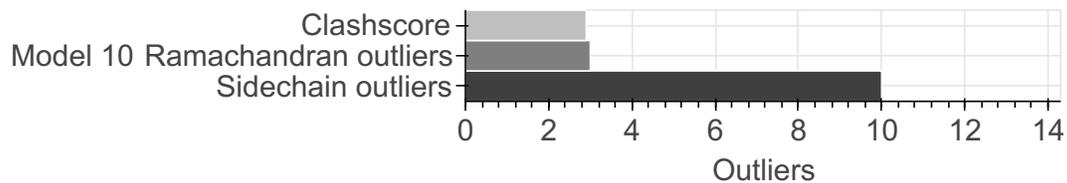
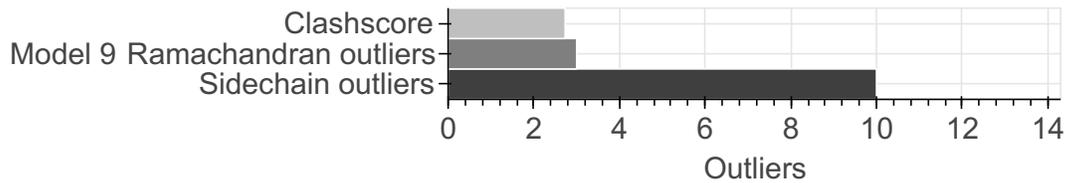
Name	Type	Count
NMR data	Experimental data	2
Experimental model	Starting model	3

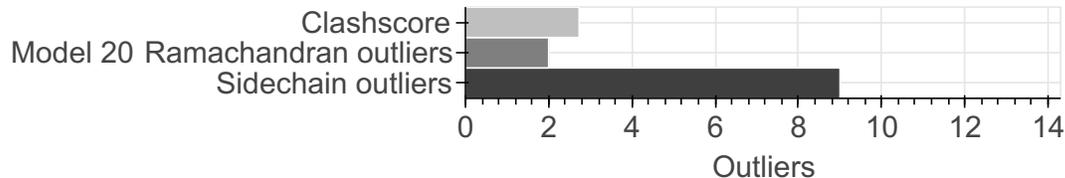
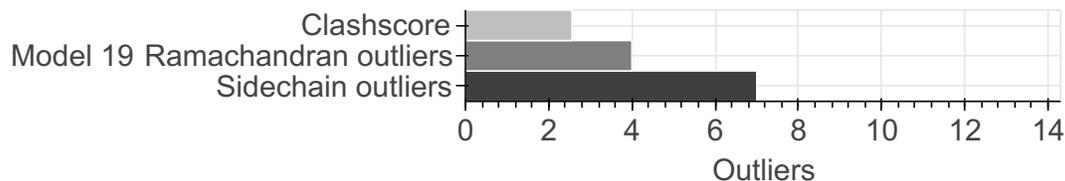
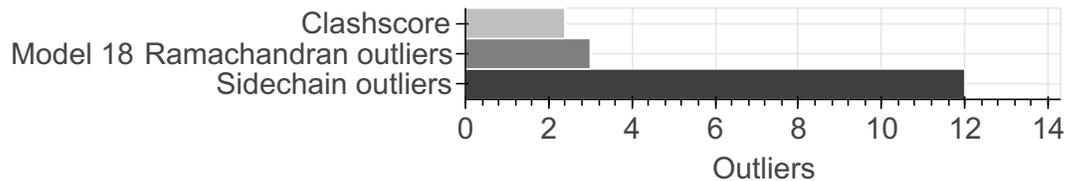
### 1.2. Overall quality

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 ?







## 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	2'-DEOXYGUANOSINE-5'-TRIPHOSPHATE	C	Non-polymeric	-	-	Not available / Not available	Atomic
		4	ADENOSINE-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] F [C] G [C]	Non-polymeric	-	-	Not available / Not available	Atomic
		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	<a href="#">53262</a>
2	Experimental model	PDB	<a href="#">pdb_00003m1m</a>
3	Experimental model	PDB	<a href="#">pdb_00007qaz</a>
4	Experimental model	PDB	<a href="#">pdb_00009rtj</a>
5	NMR data	BMRbig	<a href="#">Bmrbig142</a>

### 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	<a href="#">CYANA</a>	3.98	model building	<a href="https://www.las.jp/english/cyana.html">https://www.las.jp/english/cyana.html</a>
2	<a href="#">AMBER</a>	20	refinement	<a href="https://ambermd.org/">https://ambermd.org/</a>

### 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-particle 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 135 bond angle outliers in this entry (0.16% of 82564 assessed bonds). A summary is provided below.

Chain	Res	Type	Atoms	Z	Observed (Å)	Ideal (Å)	Model ID (Worst)	Models (Total)
D	1	ATP	PB-O3B-PG	11.11	128.76	139.87	9	20
D	1	ATP	PA-O3A-PB	7.36	129.47	136.83	14	14
A	132	ASP	CA-CB-CG	6.79	119.39	112.60	14	12
D	1	ATP	O1G-PG-O3B	5.03	102.20	110.47	9	20
B	9	DC	C5'-C4'-C3'	4.98	107.44	114.90	13	4
A	149	HIS	CB-CG-CD2	4.95	124.77	131.20	14	20
A	117	HIS	CB-CG-CD2	4.58	125.25	131.20	5	20
A	102	HIS	CB-CG-CD2	4.24	125.69	131.20	10	2
A	106	HIS	CB-CG-CD2	4.18	125.77	131.20	16	15
A	276	HIS	CB-CG-CD2	4.11	125.86	131.20	18	6
A	38	HIS	CB-CG-CD2	4.03	125.96	131.20	20	1
A	14	HIS	CB-CG-CD2	4.02	125.97	131.20	9	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	2.39	14
2	2.22	13
3	2.39	14

Model ID	Clash score	Number of clashes
4	4.10	24
5	2.56	15
6	2.73	16
7	2.05	12
8	2.39	14
9	2.73	16
10	2.90	17
11	2.22	13
12	3.58	21
13	2.56	15
14	2.73	16
15	3.07	18
16	3.07	18
17	2.73	16
18	2.39	14
19	2.56	15
20	2.73	16

There are 317 clashes. The table below contains the detailed list of all clashes based on a MolProbity analysis. Bad clashes are  $\geq 0.4$  Angstrom.

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
B:2:DC:C6	B:2:DC:H5'	0.71	14	11
A:306:GLU:CD	A:306:GLU:H	0.62	2	2
A:226:LYS:HA	A:226:LYS:HE2	0.58	19	5
A:31:LYS:HA	A:31:LYS:HE3	0.57	17	9
A:291:LYS:HE3	A:291:LYS:N	0.55	17	19
A:34:GLN:CD	A:34:GLN:H	0.55	2	13
A:118:LYS:HE2	B:5:DT:H5'	0.54	12	1
A:7:TYR:CD2	A:143:LEU:HB3	0.52	3	16
A:18:ILE:HD11	A:49:PHE:HB3	0.52	2	1
A:30:LEU:HD11	A:49:PHE:CZ	0.52	6	18
A:291:LYS:HA	A:291:LYS:HE2	0.52	20	1
B:3:DT:H4'	B:4:DG:H5"	0.51	7	4
A:276:HIS:CE1	B:7:DC:H5"	0.51	17	11
A:221:PHE:CZ	A:315:VAL:HG22	0.51	15	8

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
A:156:LYS:HE3	A:156:LYS:N	0.50	2	1
A:217:THR:C	A:219:VAL:H	0.50	16	8
B:2:DC:C5'	B:2:DC:C6	0.50	14	1
B:9:DC:H3'	B:10:DA:H5'	0.50	20	1
A:27:LYS:HE3	B:2:DC:H5"	0.49	5	3
A:305:ASN:H	D:1:ATP:PG	0.49	7	2
A:73:PHE:CD1	A:131:ILE:HD12	0.49	13	1
A:120:ASN:CB	A:121:PRO:CD	0.49	12	1
A:120:ASN:H	B:5:DT:H4'	0.49	12	1
A:301:LYS:HG3	A:313:TYR:CZ	0.49	10	1
A:118:LYS:HZ2	A:138:SER:HB2	0.48	18	2
A:221:PHE:CE2	A:315:VAL:HG22	0.47	4	7
A:252:LEU:C	A:252:LEU:HD13	0.47	17	20
A:27:LYS:HE3	B:2:DC:C5'	0.47	5	3
B:9:DC:H3'	B:10:DA:H5"	0.47	5	1
A:35:LYS:HE2	A:36:TYR:CE2	0.47	9	2
B:6:DG:C8	B:6:DG:O5'	0.47	10	19
A:301:LYS:HB3	A:313:TYR:CZ	0.47	14	12
A:5:ILE:N	A:5:ILE:HD12	0.47	4	2
A:143:LEU:H	A:143:LEU:HD22	0.46	4	9
A:85:GLU:CD	A:85:GLU:H	0.45	4	7
A:221:PHE:CG	A:315:VAL:HG21	0.45	1	1
A:218:VAL:O	A:218:VAL:HG12	0.44	19	5
A:120:ASN:O	A:132:ASP:HA	0.44	12	1
A:219:VAL:HG21	A:315:VAL:HG12	0.44	20	6
A:73:PHE:CD2	A:131:ILE:CD1	0.44	17	2
B:8:DT:H4'	B:9:DC:H5'	0.44	14	1
A:27:LYS:HE3	B:2:DC:O5'	0.43	5	2
A:98:THR:HG21	A:143:LEU:HD21	0.43	1	3
A:118:LYS:HE3	A:138:SER:HB2	0.43	17	4
A:224:LEU:HD22	A:319:SER:HA	0.43	6	2
A:141:LEU:HB2	A:168:TYR:CZ	0.43	12	3
A:156:LYS:H	A:156:LYS:HD2	0.43	5	1
A:226:LYS:CA	A:226:LYS:HE2	0.43	19	5
A:313:TYR:C	A:313:TYR:CD1	0.43	14	7

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
A:320:LYS:HE2	B:6:DG:N7	0.43	20	2
A:307:LYS:HA	A:307:LYS:HE3	0.43	10	1
A:269:ASP:HB3	A:272:ARG:H	0.42	11	2
A:101:VAL:HG13	A:168:TYR:CE1	0.42	15	2
A:73:PHE:CD2	A:131:ILE:HD11	0.42	17	1
A:122:LEU:HD11	A:133:LEU:HB2	0.42	9	3
A:149:HIS:HA	A:152:CYS:SG	0.42	15	6
A:154:THR:HA	A:307:LYS:HE2	0.42	17	1
A:300:SER:C	A:302:ALA:H	0.42	10	1
A:235:LYS:HE3	A:235:LYS:N	0.42	13	1
A:118:LYS:NZ	A:138:SER:HB3	0.41	17	3
A:157:CYS:HA	A:158:PRO:HD3	0.41	4	1
A:217:THR:C	A:219:VAL:N	0.41	10	1
A:322:TRP:HA	A:325:VAL:HG12	0.41	11	3
A:308:TRP:CZ2	A:312:LYS:HB3	0.41	14	1
A:308:TRP:CE2	A:312:LYS:HB3	0.41	6	1
A:65:GLN:HE22	A:66:LYS:HE2	0.41	12	1
B:4:DG:H2'	B:5:DT:H71	0.41	10	1
A:183:LYS:HE3	A:207:TRP:CH2	0.41	19	2
A:183:LYS:HE3	A:207:TRP:CZ2	0.41	19	1
A:35:LYS:HE2	A:36:TYR:CE1	0.41	5	1
A:143:LEU:CD1	A:143:LEU:N	0.41	13	1
A:143:LEU:N	A:143:LEU:HD22	0.41	17	1
A:291:LYS:CA	A:291:LYS:HE3	0.40	14	4
A:98:THR:HG21	A:143:LEU:HD11	0.40	9	1
A:263:TYR:HA	A:266:VAL:HG22	0.40	16	2
A:247:LYS:HZ1	A:284:HIS:CD2	0.40	18	1
A:118:LYS:HE3	A:138:SER:CB	0.40	6	1
A:263:TYR:CE1	A:273:GLY:HA3	0.40	7	1
A:98:THR:CG2	A:143:LEU:HD11	0.40	10	1
A:27:LYS:C	A:27:LYS:HD2	0.40	15	1
A:16:PHE:CE1	A:66:LYS:CE	0.40	13	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	314	13	2
2	329	312	14	3
3	329	313	12	4
4	329	315	11	3
5	329	314	11	4
6	329	314	10	5
7	329	315	11	3
8	329	315	10	4
9	329	313	13	3
10	329	315	11	3
11	329	315	12	2
12	329	311	13	5
13	329	316	10	3
14	329	315	10	4
15	329	316	9	4
16	329	310	16	3
17	329	313	13	3
18	329	313	13	3
19	329	315	10	4
20	329	316	11	2

There are 8 unique backbone outliers. Detailed list of outliers are tabulated below.

Chain	Res	Type	Models (Total)
A	305	ASN	19
A	218	VAL	15
A	121	PRO	14
A	219	VAL	14
A	217	THR	2
A	120	ASN	1
A	212	LYS	1
A	215	GLU	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	276	17	10
2	303	277	13	13
3	303	282	15	6
4	303	277	15	11
5	303	278	14	11
6	303	281	16	6
7	303	278	16	9
8	303	278	16	9
9	303	278	15	10
10	303	278	15	10
11	303	281	13	9
12	303	282	15	6
13	303	282	12	9
14	303	278	16	9
15	303	278	13	12
16	303	280	14	9
17	303	276	14	13
18	303	276	15	12
19	303	281	15	7
20	303	284	10	9

There are 31 unique sidechain outliers. Detailed list of outliers are tabulated below.

Chain	Res	Type	Models (Total)
A	50	LEU	20
A	140	VAL	20
A	132	ASP	19
A	291	LYS	19
A	118	LYS	17
A	27	LYS	14
A	31	LYS	10
A	34	GLN	7
A	138	SER	7
A	310	THR	6
A	65	GLN	5
A	6	ARG	4

Chain	Res	Type	Models (Total)
A	74	GLU	4
A	272	ARG	4
A	307	LYS	4
A	152	CYS	3
A	156	LYS	3
A	212	LYS	3
A	48	ARG	2
A	72	ASP	2
A	131	ILE	2
A	219	VAL	2
A	235	LYS	2
A	267	ASN	2
A	269	ASP	2
A	306	GLU	2
A	32	GLU	1
A	93	ARG	1
A	211	LYS	1
A	241	LYS	1
A	298	ARG	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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*Members of the [wwPDB Integrative/Hybrid Methods Task Force](#) provided recommendations and community support for the project.*