Integrative Structure Validation Report

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

IHMValidation Version 3.0
Python-IHM Version 2.5
MolProbity Version 4.5.2

PDB ID	9A9M | pdb_00009a9m
Structure Title	Complex of the apo (no nucleotide-bound) closed conformation of P. furiosus Mre11-Rad50
Structure Authors	Canny, M.D.; Beikzadeh, M.; Kaur, N.; Pendse, R.; Latham, M.P.
Deposited on	2025-03-10

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

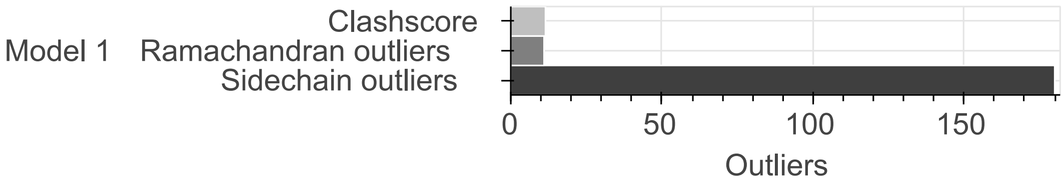
This entry consists of 1 model(s). A total of 7 dataset(s) were used to build this entry.

Name	Type	Count
Ensemble FRET data	Experimental data	1
Predicted contacts	Experimental data	1
Experimental model	Starting model	5

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	1	DNA double-strand break repair Rad50 ATPase	A	199	-	1-199	100.00 / 100.00	Atomic
				D					
		2	DNA double-strand break repair Rad50 ATPase	B	179	-	1-179	100.00 / 100.00	Atomic
				E					
		3	DNA double-strand break repair protein Mre11	C	32	-	1-32	100.00 / 100.00	Atomic
				F					
		4	DNA double-strand break repair protein Mre11	G	333	-	1-333	100.00 / 100.00	Atomic
				H					

2.3. Datasets used for modeling

There are 7 unique datasets used to build the models in this entry.

ID	Dataset type	Database name	Data access code
1	Ensemble FRET data	Zenodo	10.5281/zenodo.14990529
2	Experimental model	PDB	pdb_00003qkr
3	Experimental model	PDB	pdb_00003dsc
4	Predicted contacts	Not available	Not available
5	Experimental model	PDB	pdb_00003av0

ID	Dataset type	Database name	Data access code
6	Experimental model	PDB	pdb_00006s6v
7	Experimental model	PDB	pdb_00003qg5

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	Not available	Not available	Molecular docking of the MRNBD complex was done in the GURU interface on the HADDOCK 2.4 Webserver using experimental luminescence resonance energy transfer (LRET) data as distance restraints. The PDB inputs were 3DSC (Pf Mre11 dimer) and two monomers of 3QKR (Pf Rad50NBD). Except for increasing the number of structures for rigid body docking (it0) to 3000, all settings used were default. The three linkers attaching the Pf Mre11 capping domain to the nuclease domain were allowed to be fully flexible. C2 symmetry was enforced between the two Rad50NBD monomers and between the two monomers of the Mre11 dimer. HADDOCK Mre11 to Rad50 active ambiguous interaction restraints (AIRs) were based on M. jannaschii (3AV0) and E. coli (6S6V) ATP-gamma-S- bound MR structures. Passive AIRs were automatically defined by HADDOCK based on these active AIRs. Two extra passive AIRs were included on the 'back side' of the Mre11 capping domain to allow for the extended structure seen in ATP- free T. maritima MR (PDB: 3QG5). HADDOCK runs had 50% random exclusion of AIRs in each structure calculation. The experimentally measured LRET distances were input as unambiguous restraints and defined as the Cbeta-Cbeta distance between the LRET-labeled residues, -/+5 A, or, for distance restraints greater than 75 A, -/+ 7 A.	Not available	False	False

There is 1 software package reported in this entry.

ID	Software name	Software version	Software classification	Software location
1	HADDOCK	2.40	model building	https://rascar.science.uu.nl/haddock2.4/

3. Data quality

3.4. Predicted contacts

Validation for this section is under development.

3.4. Ensemble FRET

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 no bond angle outliers.

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	11.47	282

There are 282 clashes. The table below contains the detailed list of all clashes based on a MolProbity analysis. Bad clashes are >= 0.4 Angstrom. The output is limited to 100 rows.

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
D:154:GLU:HG2	E:73:VAL:HG23	0.86	1	1
A:154:GLU:HG2	B:73:VAL:HG23	0.85	1	1
B:87:THR:HB	G:332:ARG:HB2	0.80	1	1
B:165:ARG:HB2	B:176:GLU:HB3	0.80	1	1
B:141:LEU:HD13	B:147:VAL:HG11	0.79	1	1
D:86:ARG:HE	D:98:HIS:HB3	0.78	1	1
E:141:LEU:HD13	E:147:VAL:HG11	0.77	1	1
A:7:THR:HB	A:72:ASP:HB3	0.77	1	1
D:7:THR:HB	D:72:ASP:HB3	0.74	1	1
H:177:ARG:CZ	H:191:GLY:HA3	0.72	1	1
A:9:LYS:HB2	A:70:TYR:HB3	0.72	1	1
H:180:SER:HB3	H:185:GLU:HB3	0.71	1	1
G:2:LYS:HE2	G:39:GLU:HG3	0.71	1	1
H:2:LYS:HE2	H:39:GLU:HG3	0.70	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
H:306:ILE:HB	H:330:THR:HG22	0.70	1	1
D:36:LYS:HB3	E:166:ILE:HG21	0.69	1	1
H:7:ALA:HB2	H:47:ALA:HB3	0.69	1	1
G:315:THR:HA	G:318:LYS:NZ	0.68	1	1
E:165:ARG:HB2	E:176:GLU:HB3	0.68	1	1
A:40:LEU:H	A:40:LEU:HD13	0.68	1	1
B:77:VAL:HG21	B:89:LEU:HD21	0.68	1	1
D:40:LEU:H	D:40:LEU:HD13	0.68	1	1
E:121:PRO:HD3	E:149:LEU:HD11	0.67	1	1
G:84:ASN:HA	G:87:ARG:HG2	0.67	1	1
G:180:SER:HB3	G:185:GLU:HB3	0.67	1	1
G:277:LYS:HD2	G:305:ASN:HB3	0.66	1	1
D:139:ARG:HD2	E:119:ASP:OD2	0.65	1	1
A:101:LYS:HD3	A:108:TRP:HB3	0.65	1	1
H:269:LYS:HA	H:269:LYS:HE3	0.65	1	1
G:7:ALA:HB2	G:47:ALA:HB3	0.65	1	1
D:150:ASP:OD2	E:74:ARG:HD3	0.64	1	1
F:22:ASP:OD2	F:25:TYR:HB3	0.64	1	1
H:268:ILE:HG13	H:269:LYS:H	0.63	1	1
B:39:GLU:CD	B:39:GLU:H	0.63	1	1
D:9:LYS:HB2	D:70:TYR:HB3	0.63	1	1
A:139:ARG:HD2	B:119:ASP:OD2	0.63	1	1
C:22:ASP:OD2	C:25:TYR:HB3	0.62	1	1
E:39:GLU:CD	E:39:GLU:H	0.62	1	1
G:276:VAL:HG21	G:292:LEU:HD21	0.62	1	1
H:207:ILE:HG22	H:209:LYS:H	0.62	1	1
A:36:LYS:HB3	B:166:ILE:HG21	0.61	1	1
G:18:LYS:NZ	G:324:GLU:OE1	0.61	1	1
B:95:ILE:HD13	B:129:ARG:HG2	0.60	1	1
F:4:PHE:HB3	F:8:GLU:HB3	0.60	1	1
D:76:GLU:HG3	D:81:LYS:HG2	0.59	1	1
H:63:LYS:O	H:67:LEU:HG	0.58	1	1
D:101:LYS:HD3	D:108:TRP:HB3	0.58	1	1
G:48:GLY:HA2	G:81:ILE:O	0.58	1	1
G:63:LYS:O	G:67:LEU:HG	0.58	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
H:228:ARG:HD2	H:235:GLU:OE2	0.57	1	1
A:7:THR:HG23	A:18:VAL:HG22	0.57	1	1
C:4:PHE:HB3	C:8:GLU:HB3	0.57	1	1
G:45:LEU:HD23	G:79:PHE:HB2	0.57	1	1
B:138:GLU:O	B:142:LYS:HG2	0.57	1	1
E:120:GLU:HB2	E:121:PRO:HA	0.56	1	1
H:48:GLY:HA2	H:81:ILE:O	0.56	1	1
H:15:GLN:HB3	H:21:ARG:HG2	0.56	1	1
G:135:TYR:CZ	G:136:LYS:HE2	0.56	1	1
E:139:ARG:HH22	H:186:ASP:HB2	0.56	1	1
A:180:ILE:HD12	B:20:LYS:HA	0.55	1	1
E:149:LEU:HD21	E:156:LEU:HD13	0.55	1	1
B:137:MET:HG2	B:141:LEU:HD12	0.55	1	1
D:150:ASP:HA	D:153:ARG:NH2	0.55	1	1
G:43:PHE:HB3	G:77:PRO:HG2	0.55	1	1
H:45:LEU:HD23	H:79:PHE:HB2	0.55	1	1
D:47:LEU:HD23	D:84:ILE:HD12	0.55	1	1
E:95:ILE:HD13	E:129:ARG:HG2	0.55	1	1
A:150:ASP:OD1	B:74:ARG:HA	0.55	1	1
D:65:GLY:O	D:90:LYS:HD3	0.55	1	1
D:187:TYR:HB3	E:13:ILE:HD11	0.55	1	1
H:237:ARG:HG3	H:248:ARG:HB3	0.55	1	1
H:315:THR:HA	H:318:LYS:NZ	0.55	1	1
D:140:GLN:HG2	E:119:ASP:OD2	0.54	1	1
H:23:GLU:CD	H:63:LYS:HZ1	0.54	1	1
G:202:TYR:HB2	G:220:VAL:HA	0.54	1	1
D:6:VAL:HG12	D:21:PHE:HE2	0.54	1	1
C:28:LYS:HG2	C:32:GLU:OE2	0.53	1	1
D:96:GLU:HB3	D:98:HIS:CE1	0.53	1	1
A:6:VAL:HG12	A:21:PHE:HE2	0.53	1	1
D:194:THR:HB	E:6:ARG:HD2	0.53	1	1
G:83:GLY:O	G:145:TYR:HB3	0.52	1	1
A:54:LYS:HE2	A:55:ASP:OD2	0.52	1	1
A:140:GLN:HG2	B:119:ASP:OD2	0.52	1	1
H:43:PHE:HB3	H:77:PRO:HG2	0.52	1	1

Atom 1	Atom 2	Clash(Å)	Model ID (Worst)	Models (Total)
F:28:LYS:HG2	F:32:GLU:OE2	0.52	1	1
G:2:LYS:HG2	G:41:VAL:HG12	0.52	1	1
G:207:ILE:HG22	G:209:LYS:H	0.52	1	1
B:121:PRO:HD3	B:149:LEU:HD11	0.52	1	1
D:86:ARG:NE	D:98:HIS:HB3	0.52	1	1
H:202:TYR:HB2	H:220:VAL:HA	0.52	1	1
F:5:THR:OG1	F:8:GLU:HB2	0.51	1	1
G:65:ILE:HD13	H:101:PHE:HZ	0.51	1	1
H:135:TYR:CZ	H:136:LYS:HE2	0.51	1	1
E:158:ASP:OD1	H:147:SER:HB3	0.51	1	1
B:15:ASP:HA	B:18:LYS:HD2	0.50	1	1
G:113:LYS:HE2	G:115:GLU:CD	0.50	1	1
B:166:ILE:HD11	B:173:SER:HB3	0.50	1	1
G:277:LYS:HD2	G:305:ASN:CB	0.50	1	1
G:82:GLU:HG2	G:144:LYS:HB2	0.50	1	1
H:176:VAL:HA	H:190:ILE:O	0.50	1	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	1470	1391	68	11

There are 11 unique backbone outliers. Detailed list of outliers are tabulated below.

Chain	Res	Type	Models (Total)
A	50	PRO	1
B	62	SER	1
B	120	GLU	1
D	12	ARG	1
D	50	PRO	1
E	120	GLU	1
G	56	PRO	1
G	136	LYS	1
G	206	HIS	1
H	136	LYS	1
H	206	HIS	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	1308	935	193	180

There are 180 unique sidechain outliers. Detailed list of outliers are tabulated below. The output is limited to 100 rows.

Chain	Res	Type	Models (Total)
A	2	LYS	1
A	15	SER	1
A	37	SER	1
A	38	SER	1
A	40	LEU	1
A	51	LEU	1
A	54	LYS	1
A	55	ASP	1
A	57	LYS	1
A	59	ASP	1
A	62	THR	1
A	76	GLU	1
A	94	SER	1
A	104	VAL	1
A	112	THR	1
A	113	GLU	1
A	116	SER	1
A	120	SER	1
A	127	ILE	1
A	130	ASN	1
A	133	LEU	1
A	140	GLN	1
A	154	GLU	1
A	167	GLU	1
A	174	SER	1
A	180	ILE	1
A	185	LYS	1
A	191	LEU	1

Chain	Res	Type	Models (Total)
B	8	ARG	1
B	12	GLU	1
B	13	ILE	1
B	16	LEU	1
B	18	LYS	1
B	26	LEU	1
B	34	LYS	1
B	36	LEU	1
B	39	GLU	1
B	44	LYS	1
B	67	ARG	1
B	69	GLU	1
B	87	THR	1
B	90	SER	1
B	107	LEU	1
B	112	GLU	1
B	119	ASP	1
B	122	THR	1
B	125	LEU	1
B	127	GLU	1
B	130	ARG	1
B	135	THR	1
B	136	ILE	1
B	139	ARG	1
B	158	ASP	1
B	167	SER	1
B	172	SER	1
B	179	SER	1
C	1	SER	1
C	9	LEU	1
C	13	ASP	1
C	19	ASP	1
C	24	ASP	1
C	26	ILE	1
D	7	THR	1

Chain	Res	Type	Models (Total)
D	16	ASP	1
D	26	ASN	1
D	37	SER	1
D	38	SER	1
D	40	LEU	1
D	51	LEU	1
D	54	LYS	1
D	55	ASP	1
D	57	LYS	1
D	59	ASP	1
D	62	THR	1
D	67	ARG	1
D	69	THR	1
D	76	GLU	1
D	86	ARG	1
D	94	SER	1
D	98	HIS	1
D	104	VAL	1
D	112	THR	1
D	113	GLU	1
D	119	ILE	1
D	120	SER	1
D	127	ILE	1
D	130	ASN	1
D	133	LEU	1
D	140	GLN	1
D	154	GLU	1
D	174	SER	1
D	180	ILE	1
D	185	LYS	1
D	191	LEU	1
D	195	GLU	1
E	8	ARG	1
E	12	GLU	1
E	13	ILE	1

Chain	Res	Type	Models (Total)
E	16	LEU	1
E	18	LYS	1

5. Fit to Data Used for Modeling Assessment

5.4. Predicted contacts

Validation for this section is under development.

5.4. Ensemble FRET

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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