User Experience

NHERI Lehigh Researcher Workshop

December 9, 2021

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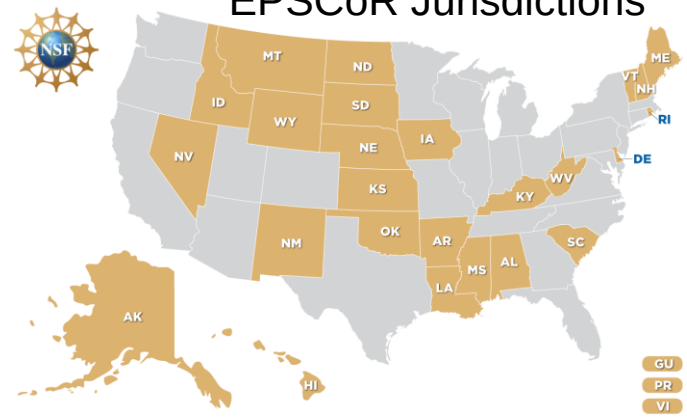
GALLOGLY COLLEGE OF ENGINEERING
SCHOOL OF CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE
The UNIVERSITY of OKLAHOMA

PROPOSAL WRITING & PLANNING

Proposal Timeline



Nov. 2015
Met Dr. Ricles at NSF-sponsored workshop in Japan

Dec. 5-6, 2016
Attended NHERI Lehigh Research Workshop

Jan. 2018
Submitted internal proposal; *selected!*

Dec. 2019
Project Funded!

2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021

Nov. 2016
Internal (OU) competition for NSF EPSCoR Track-4 program announced; contacted Dr. Ricles

Dec. 2016
Submitted internal proposal; not selected

March 2018
Submitted proposal to NSF w/ input from Drs. Ricles and Kusko; proposal not funded

March 2019
Re-competed internally, selected, and submitted revised proposal with feedback

Award Period
10/2022 – 9/2021

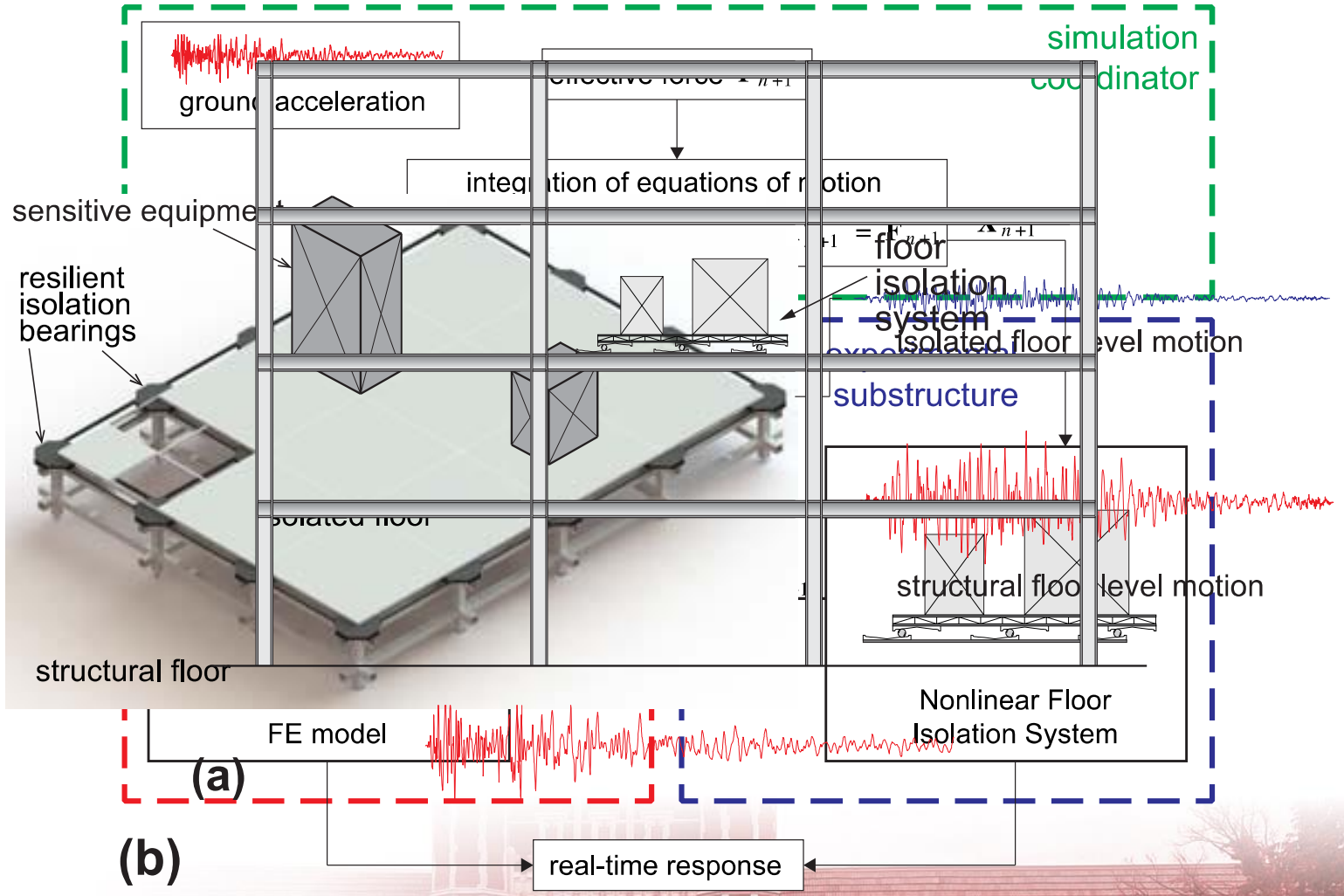
RII Track-4: Quantifying Seismic Resilience of Multi-Functional Floor Isolation Systems through Cyber-Physical Testing [OIA-1929151]

Overview

- Investigate the *multi-directional* nonlinear dynamics of floor isolation systems (FISs) used to reduce seismic force demand and protect vital building contents.
- Rigorously evaluate a design methodology for multi-functional FISs incorporating building-FIS interactions.

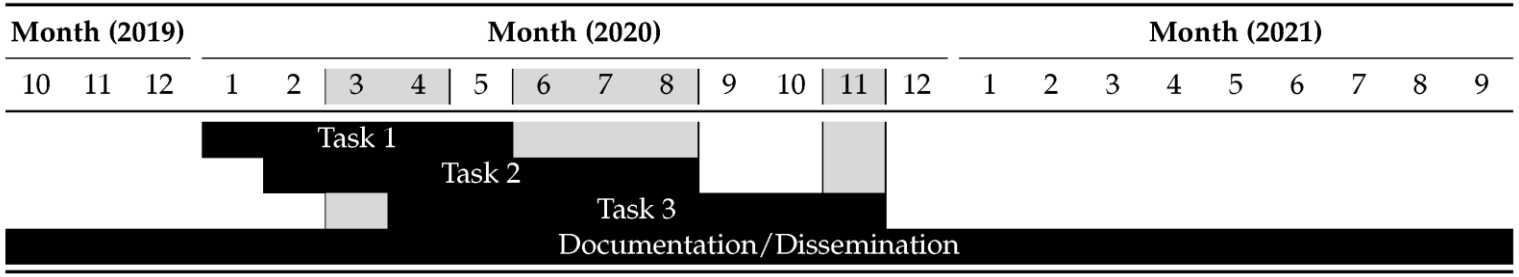
Scope

- Perform large-scale FIS characterization tests to experimentally validate physics-based mathematical models.
- Perform large-scale real-time hybrid simulations to quantify the performance of FISs which incorporate multi-scale building-FIS interactions.
- Use of the Real-time Cyber-Physical Structural Systems Laboratory (CPSSL)



RII Track-4: Quantifying Seismic Resilience of Multi-Functional Floor Isolation Systems through Cyber-Physical Testing [OIA-1929151]

Table 1: Overview of project timeline. Host site visits are indicated by gray shading.



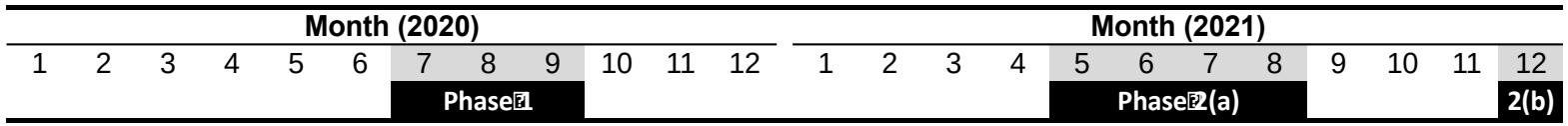
Covid-19 lockdown!

Table 2: Project timeline. Host site visits are indicated by gray shading.

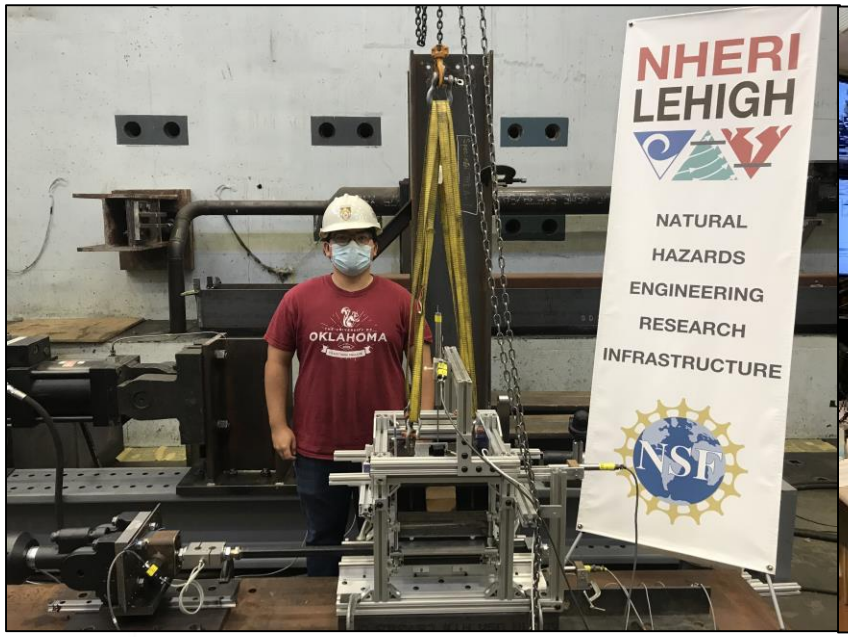
Activity	Month (2020)											
	1	2	3	4	5	6	7	8	9	10	11	12
RTHS Primer	1(a)											
RTHS Hands-on Training			1(b)			1(b)						
FIS Testbed Design/Fabrication		2(a)			2(a)							
Assembly and Characterization Testing			2(b)									
RTHS FIS Experimental Trials						2(c)						
Data Processing / Manuscript Preparation				3(a)					3(a)			
Debriefing and Proposal Planning											3(b)	

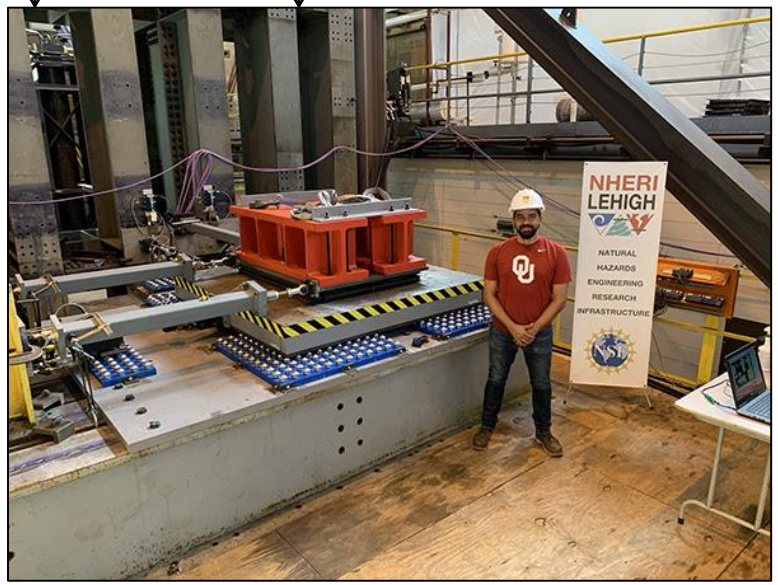
https://beta.nsf.gov/funding/opportunities/epscor-research-infrastructure-improvement-track-4-epscor-research-fellows

RII Track-4: Quantifying Seismic Resilience of Multi-Functional Floor Isolation Systems through Cyber-Physical Testing [OIA-1929151]

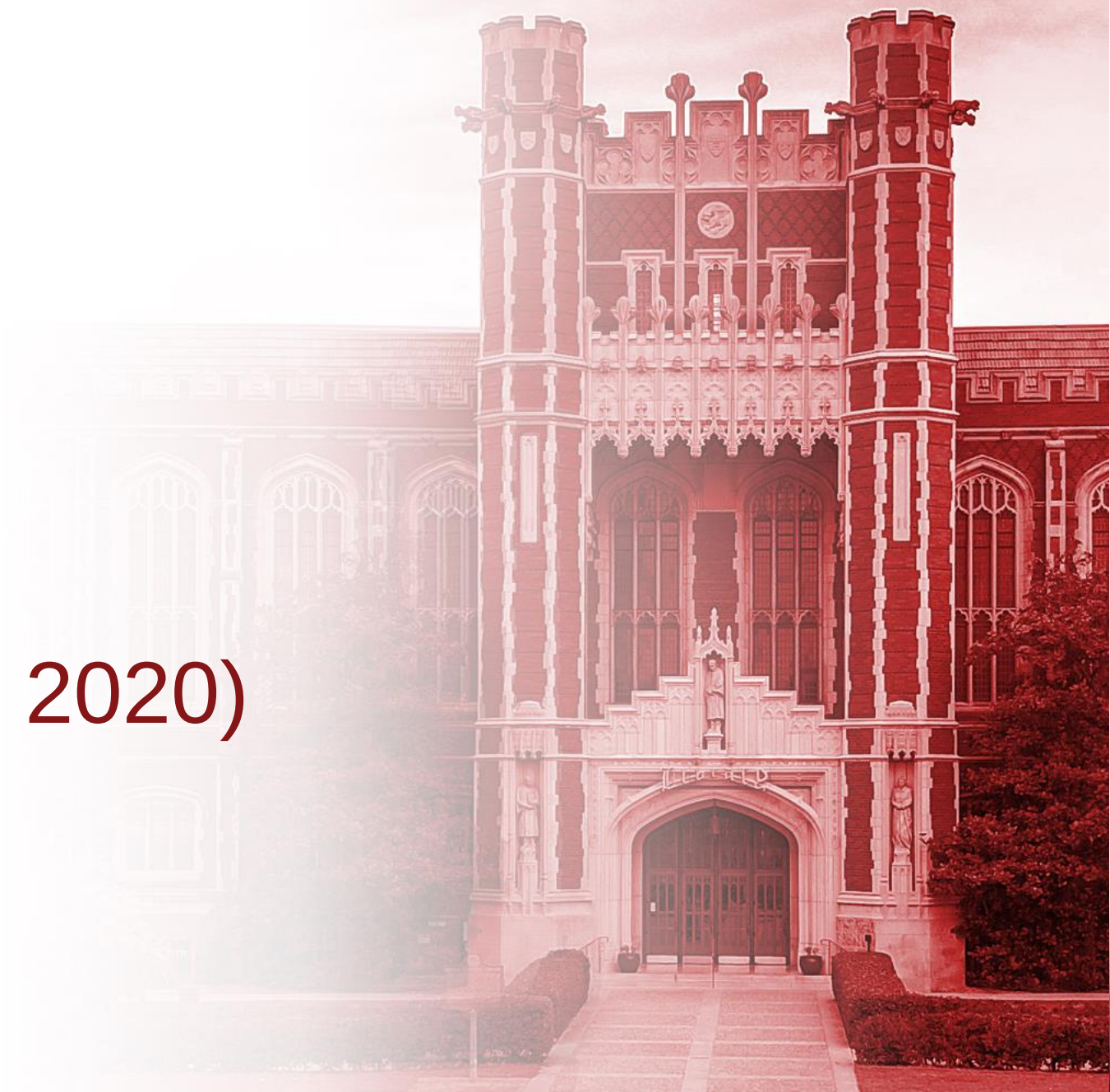


zoom

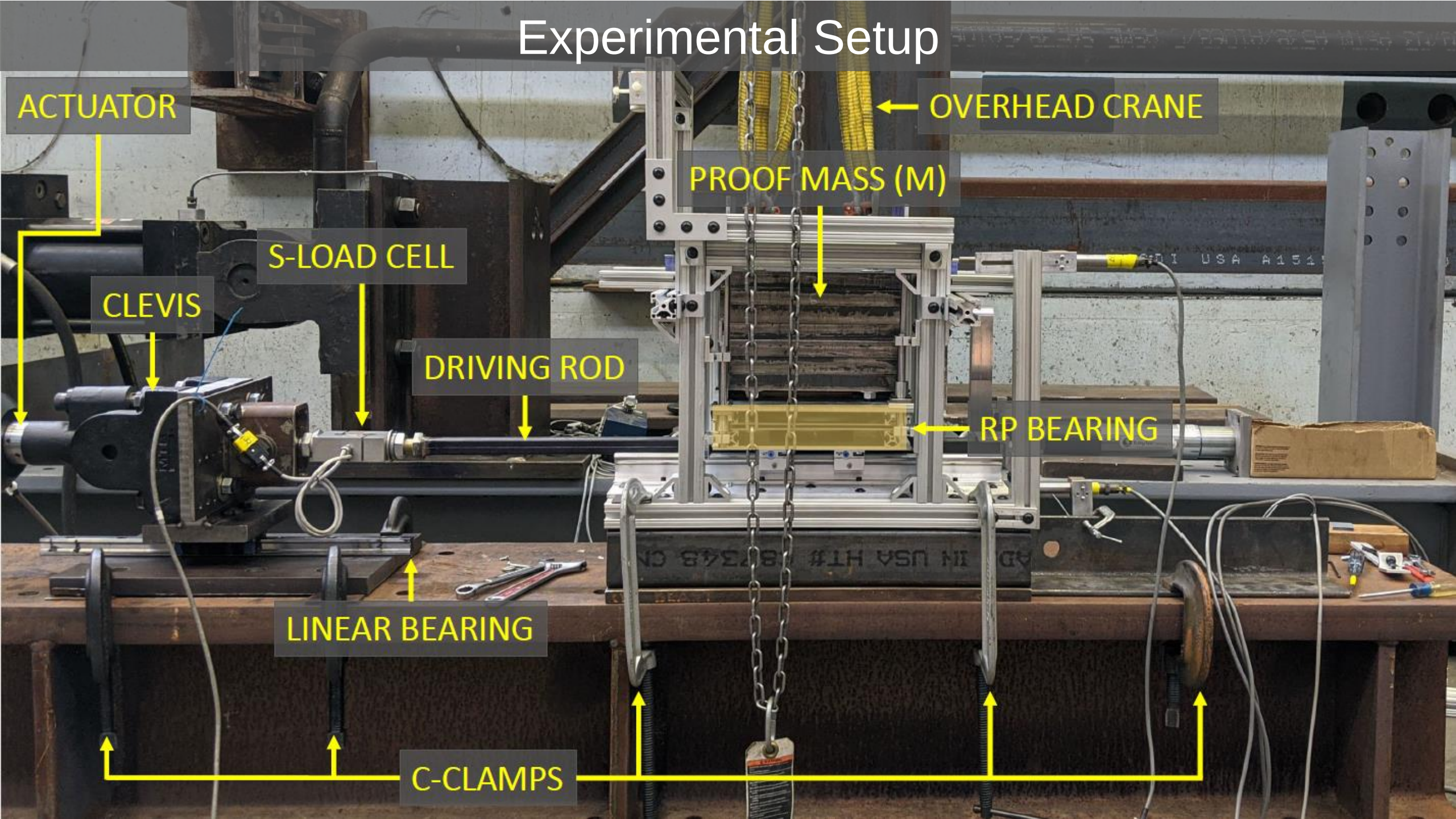




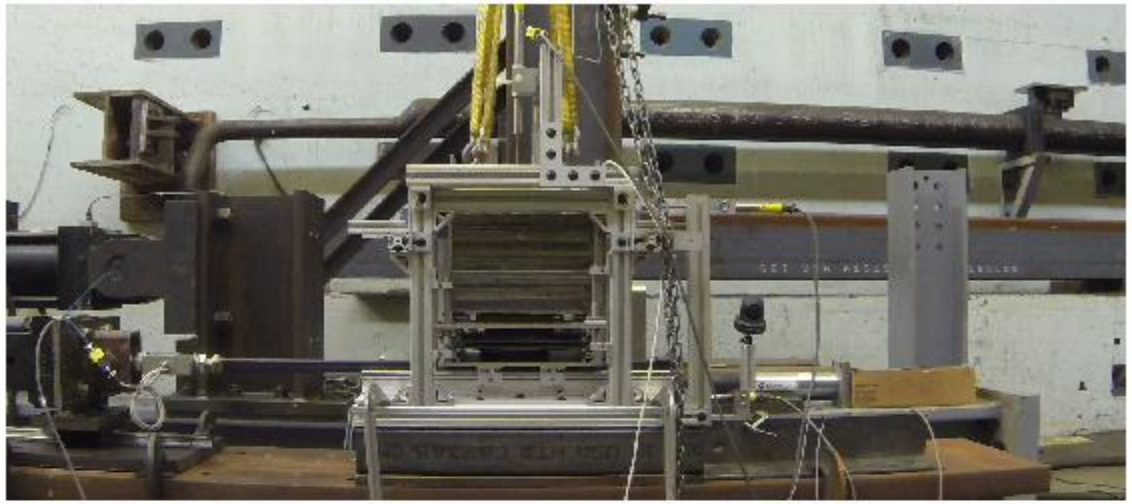
PHASE 1 (SUMMER 2020)

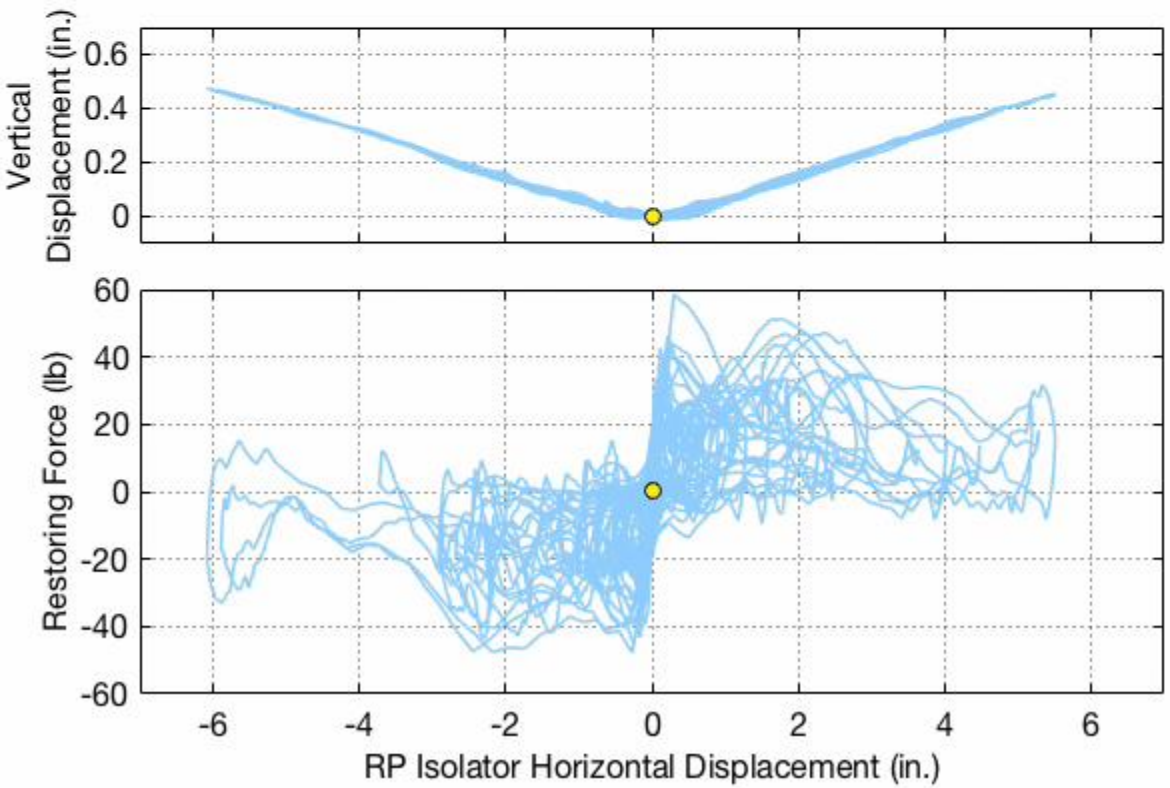


Experimental Setup

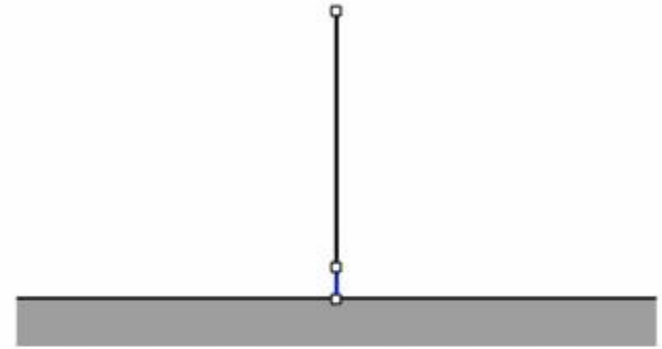


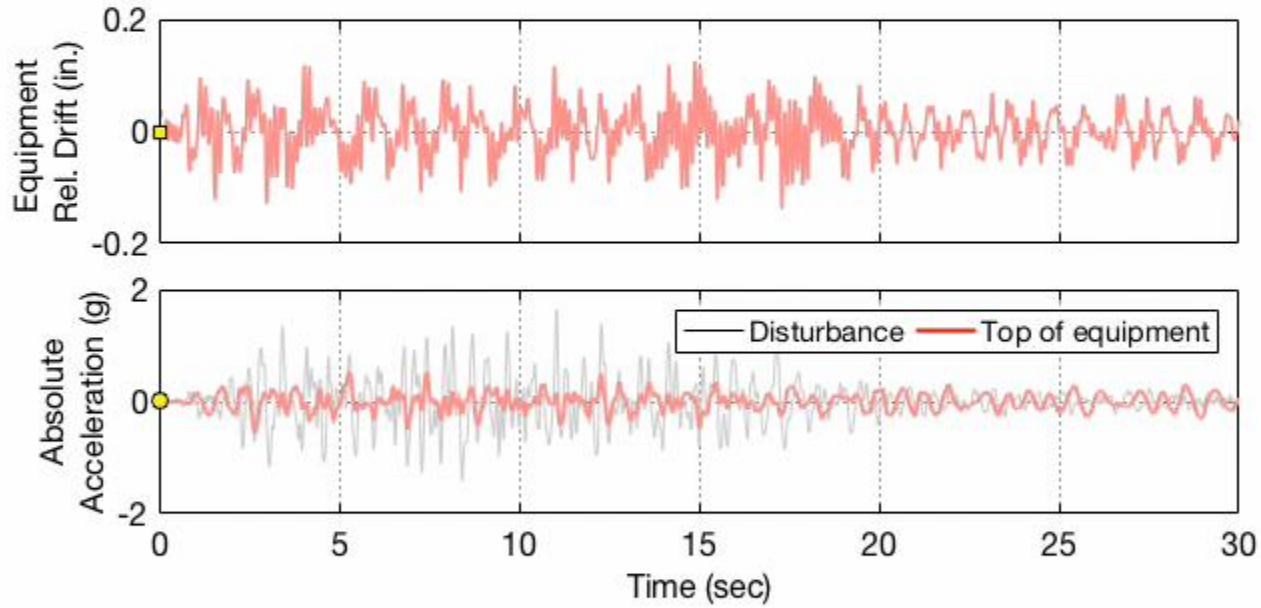
Experimental Substructure





Numerical Substructure (5x Deformation Scale)





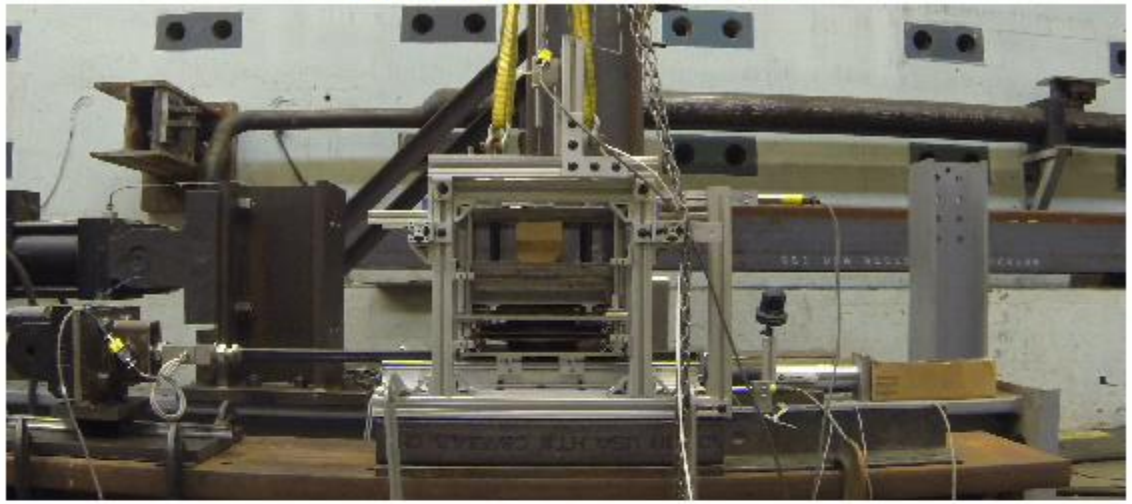
Real-Time Hybrid Simulation of Flexible Equipment Isolated via a Rolling Pendulum (RP)-based Isolation System

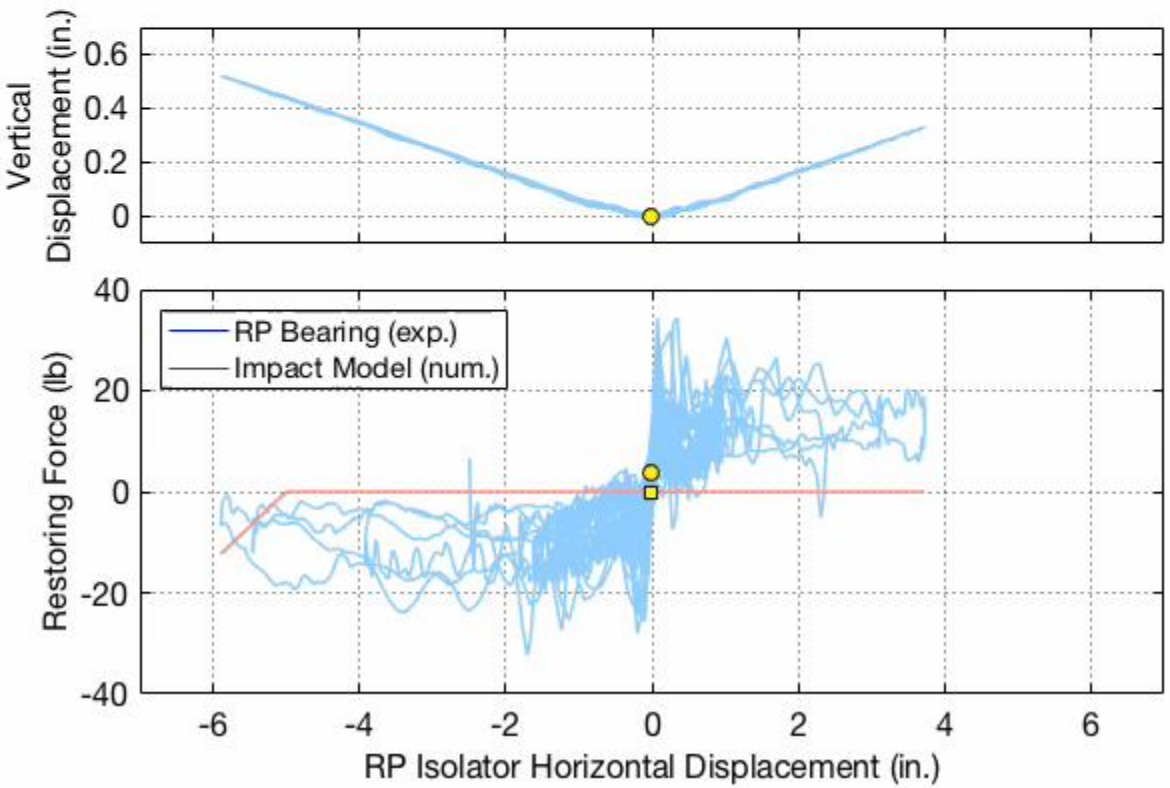
Nominal QuakeCoat Treatement w/ 240-lb proof mass
78.7-in.-Tall Flexible Equipment (5 Hz, 2% damped)
0.75x VERTEQII per GR-63-CORE

Supported by NSF Award No. OIA-1929151

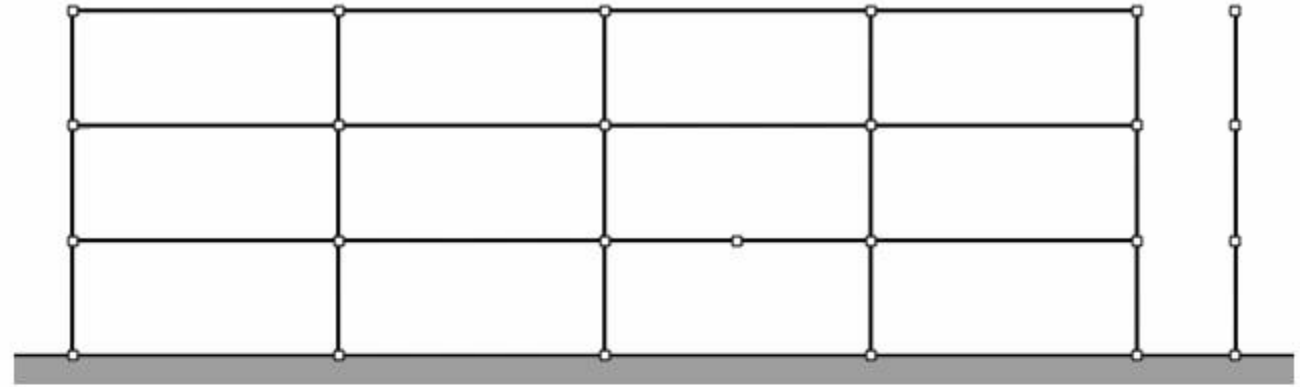
LEHIGH NHERI
Real-Time Multi-Directional Testing Facility

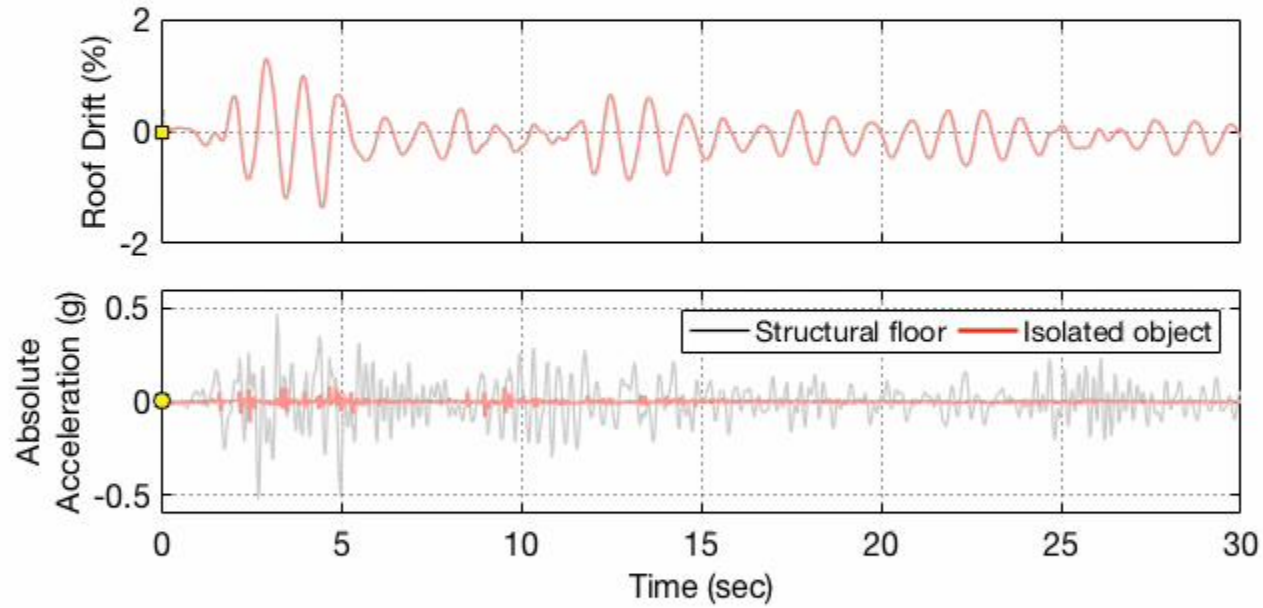
Experimental Substructure





Numerical Substructure (5x Deformation Scale)





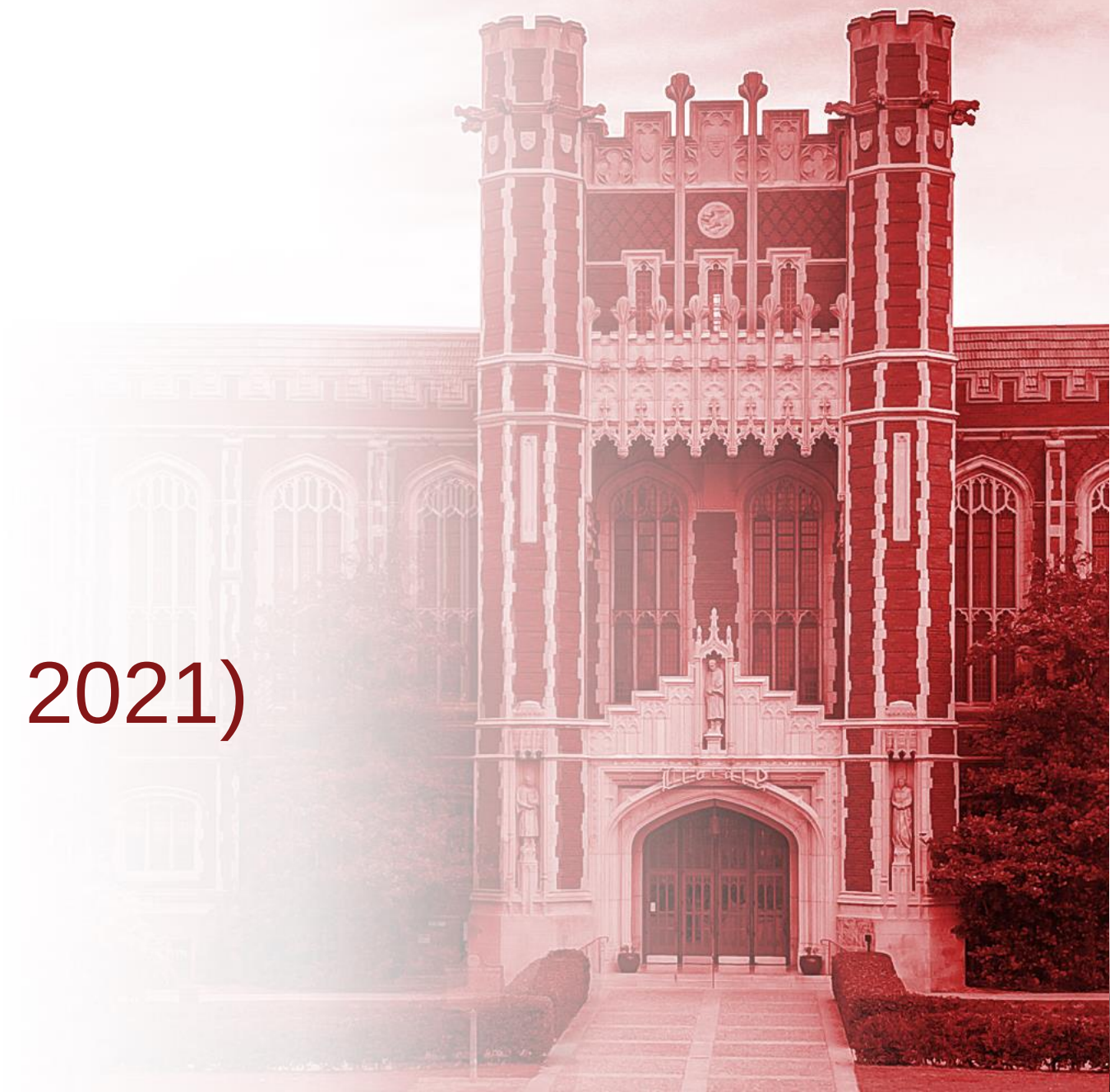
Real-Time Hybrid Simulation of a 3-Story Steel MRF Building with a Rolling Pendulum (RP)-based 50-kip Floor Isolation System (FIS) on the First Floor

2-Layer QuakeCoat Treatement w/ 143-lb proof mass
Impact Model w/ 5-in. gap (13.75 lb/in.)
1x El Centro, Imperial Valley Irrigation District substation, 1940

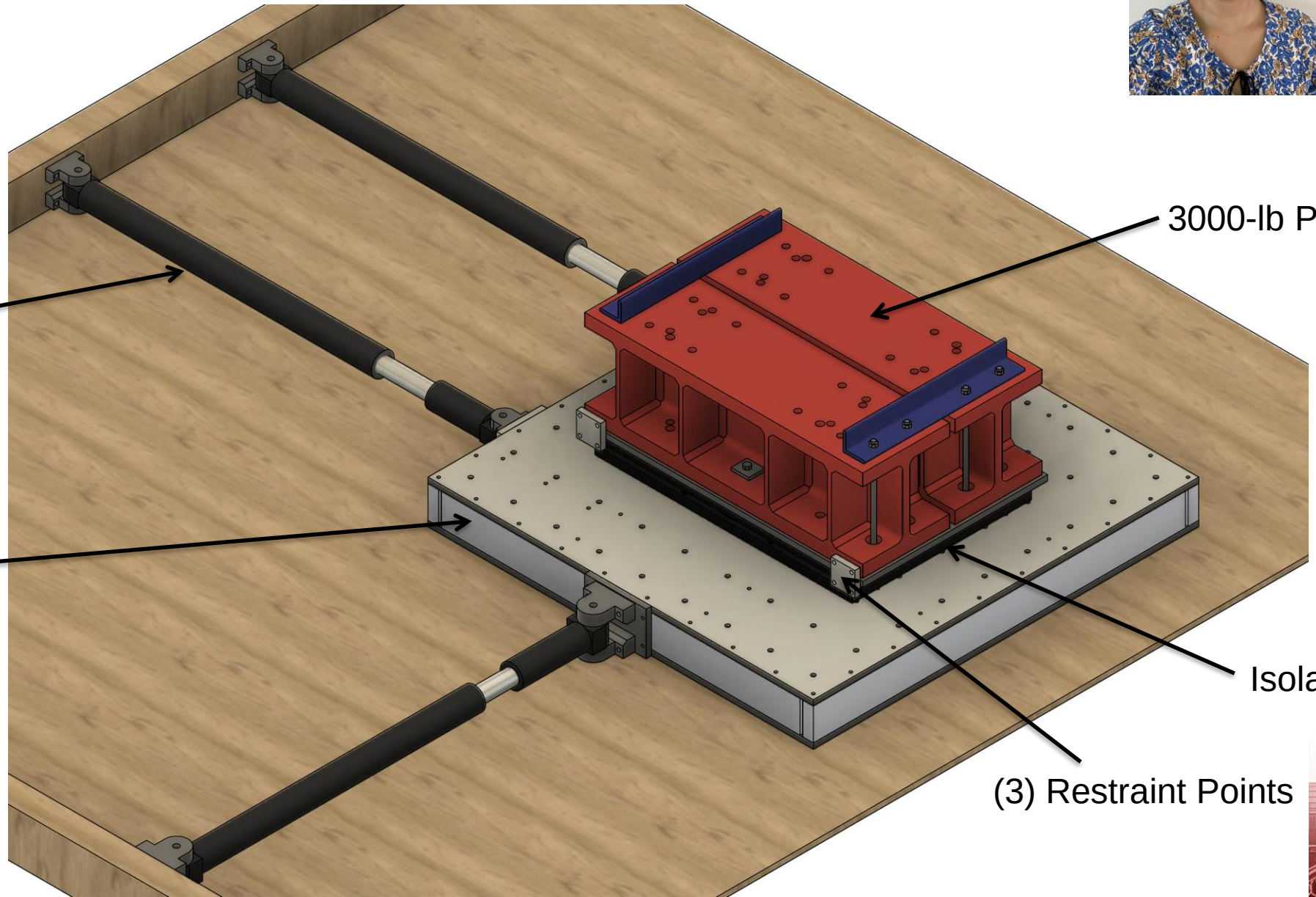
Supported by NSF Award No. OIA-1929151

LEHIGH NHERI
Real-Time Multi-Directional Testing Facility

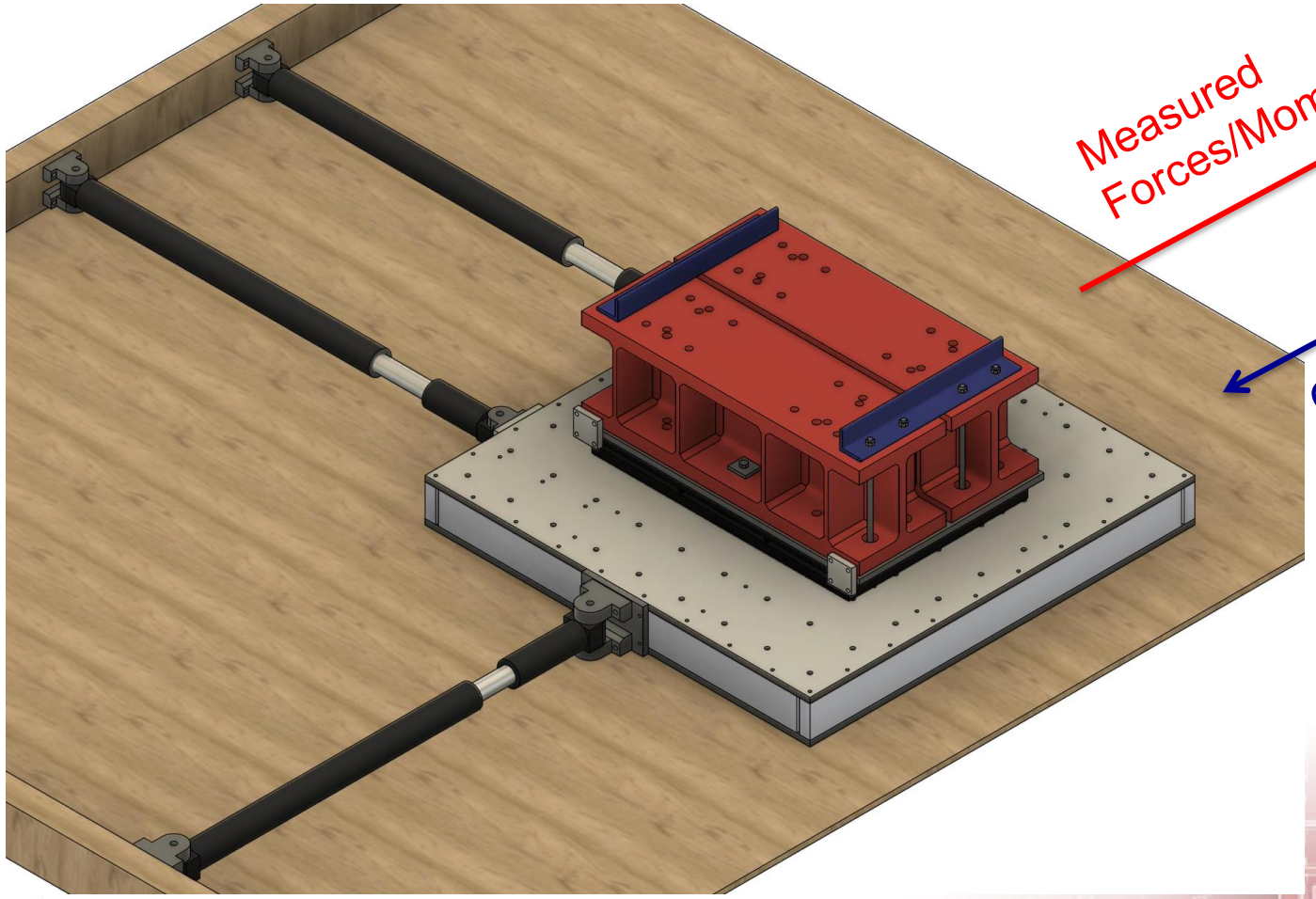
PHASE 2 (SUMMER 2021)



Multi-Directional RTHS Testing

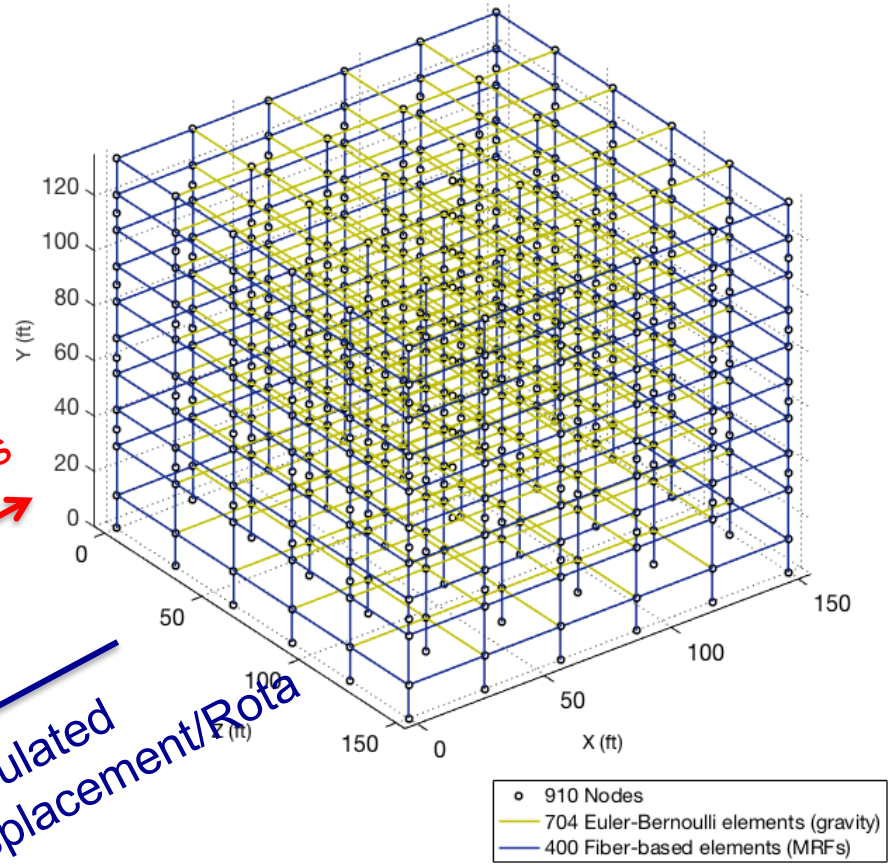


Multi-Directional RTHS Testing

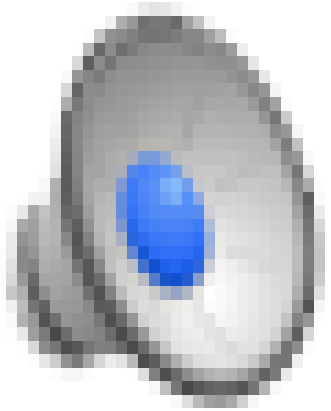


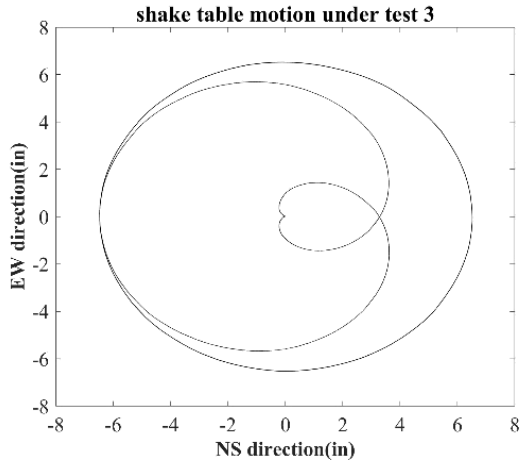
Measured Forces/Moments

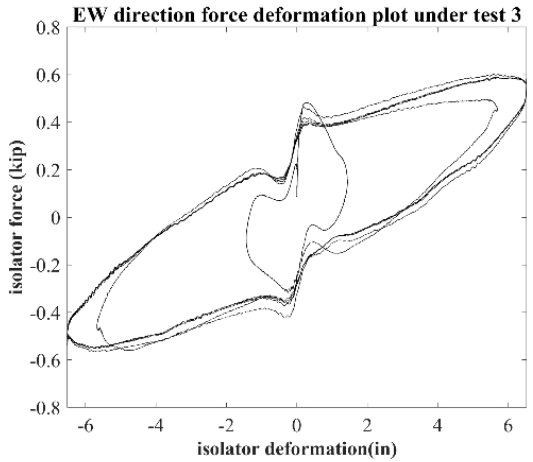
Calculated Displacement/Rotation

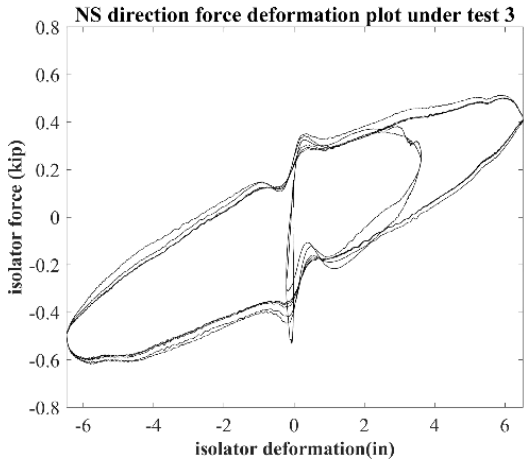


Multi-Directional RTHS Testing









Acknowledgements

- This material is based upon work supported by the **National Science Foundation** under Award Nos. CMMI-1663376, OIA-1929151, and CMMI-1943917. This support is greatly appreciated.
- Thanks to **WorkSafe Technologies** for providing the isolation systems used for this research.
- Thanks to **NHERI Lehigh EF** for the use of their laboratories and technical expertise.

Thank You! Questions?

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