The University of California at Santa Barbara

nees@UCSB

The George E. Brown, Jr. Network for Earthquake Engineering Simulation

Virtual Tour of the NEES@UCSB Permanently Instrumented Field Sites

Your Tour Guide

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UC Santa Barbara

http://nees.ucsb.edu

NEES

- The George E. Brown Jr., Network for Earthquake Engineering Simulation
- NSF Large Facility Program of 14 shared use equipment sites

What is NEES?

- A National Shared Use Resource of 14 experimental earthquake engineering research facilities
- All linked by Cyber-Infrastructure
  - NEEShub, NEEScommIT
- A Collaborative Research Environment
- Open Access to Facilities and Data
- A New Paradigm in Experimental Research
  - Remote Participation and Collaboration Through “Telepresence” and “Teleoperation”.

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Permanently Instrumented Field Sites

Garner Valley Downhole Array near Hemet, CA

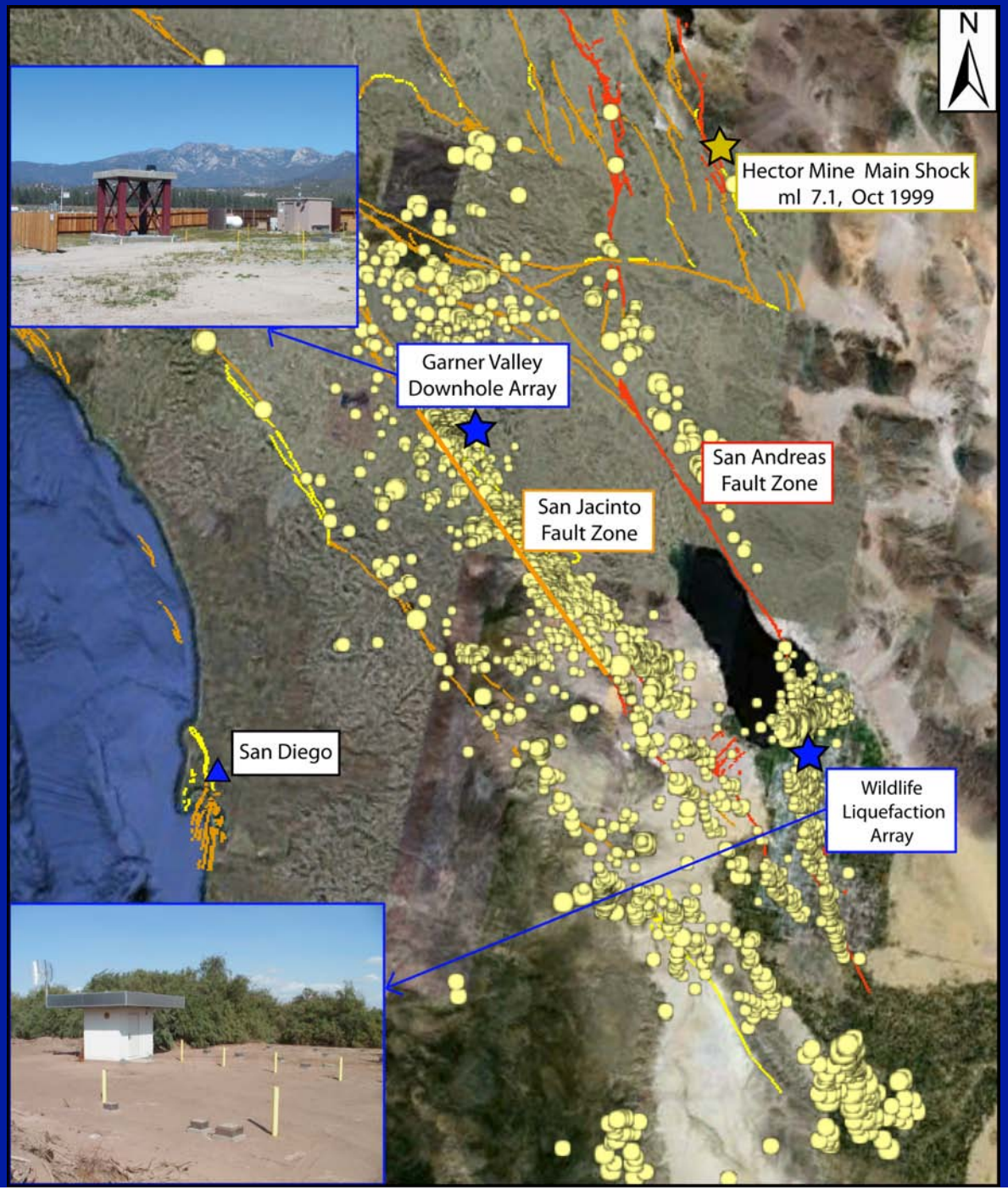
Wildlife Liquefaction Array in the Imperial Valley

nees@UCSB
Permanently
Instrumented
Field Sites

Garner Valley
Downhole Array
GVDA

Wildlife Liquefaction
Array
WLA

Over 9500 Events
recorded from 01/2004
Thru 02/2011



GVDA (top) and WLA (bottom) Field Sites

Today's Tour Schedule

- Introduction & brief background
- Visit the WLA site (via web telepresence)
  - Outside camera – sensors & site layout
  - Inside camera – data acquisition systems & site infrastructure (power, communications)
- Visit the GVDA site (via web telepresence)
  - Outside camera – SFSI, sensors & site layout

Today's Tour Schedule

- Preview of the "Greatest Hits" of the best observations from the permanent field sites
- Research Vision and Future Potential

- Tour the web-based data dissemination tools for access to the observed acceleration and pore pressure time histories from earthquakes

Introduction

- Why permanent field sites in NEES
  - Provide densely instrumented Case Histories
  - Calibration and validation of the many new and sometimes complicated models for estimation of site response and nonlinear dynamic soil behavior
  - Development and validation of models that include pore pressure generation in the formulation
  - Validation of models that include ground failure and permanent deformations

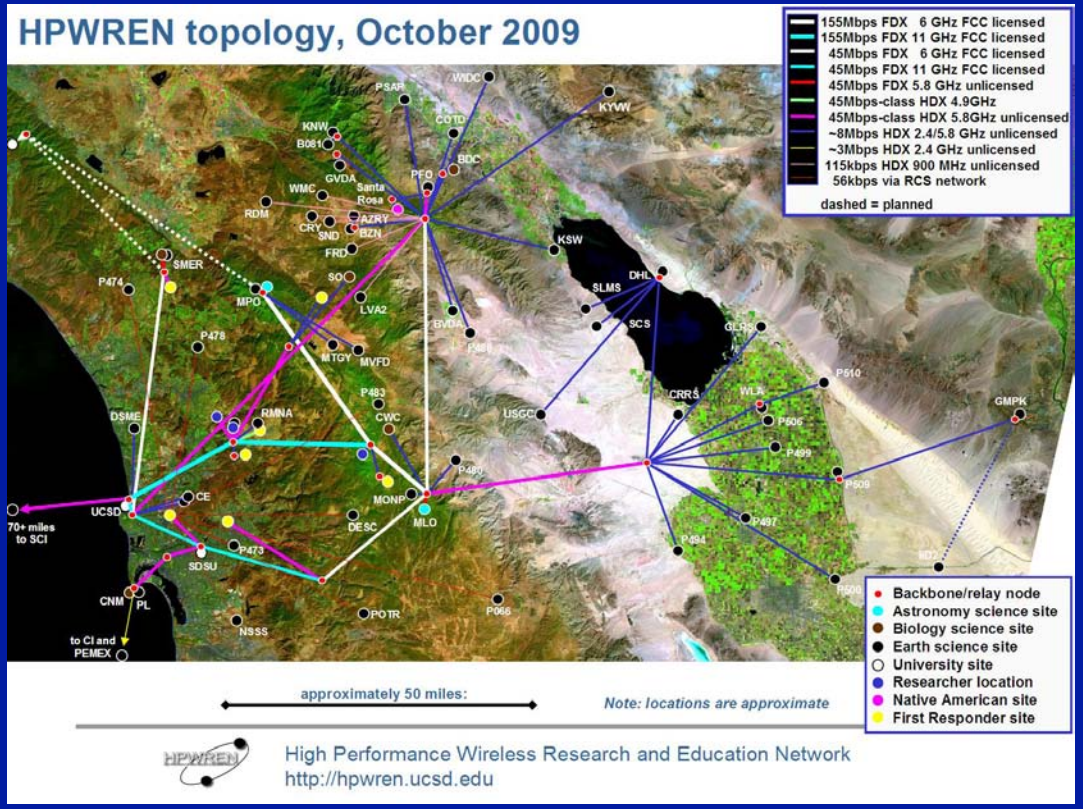
Introduction (cont.)

- Why permanent field sites in NEES
  - Provide a simple, densely instrumented, reconfigurable experimental structure to examine the site/structure interactions
  - Improve our understanding of the physics behind soil-foundation-structure interaction
  - Provide well characterized test sites to conduct active and passive source experiments
  - Provide densely instrumented SFSI Case Histories

Lets tour the WLA field site

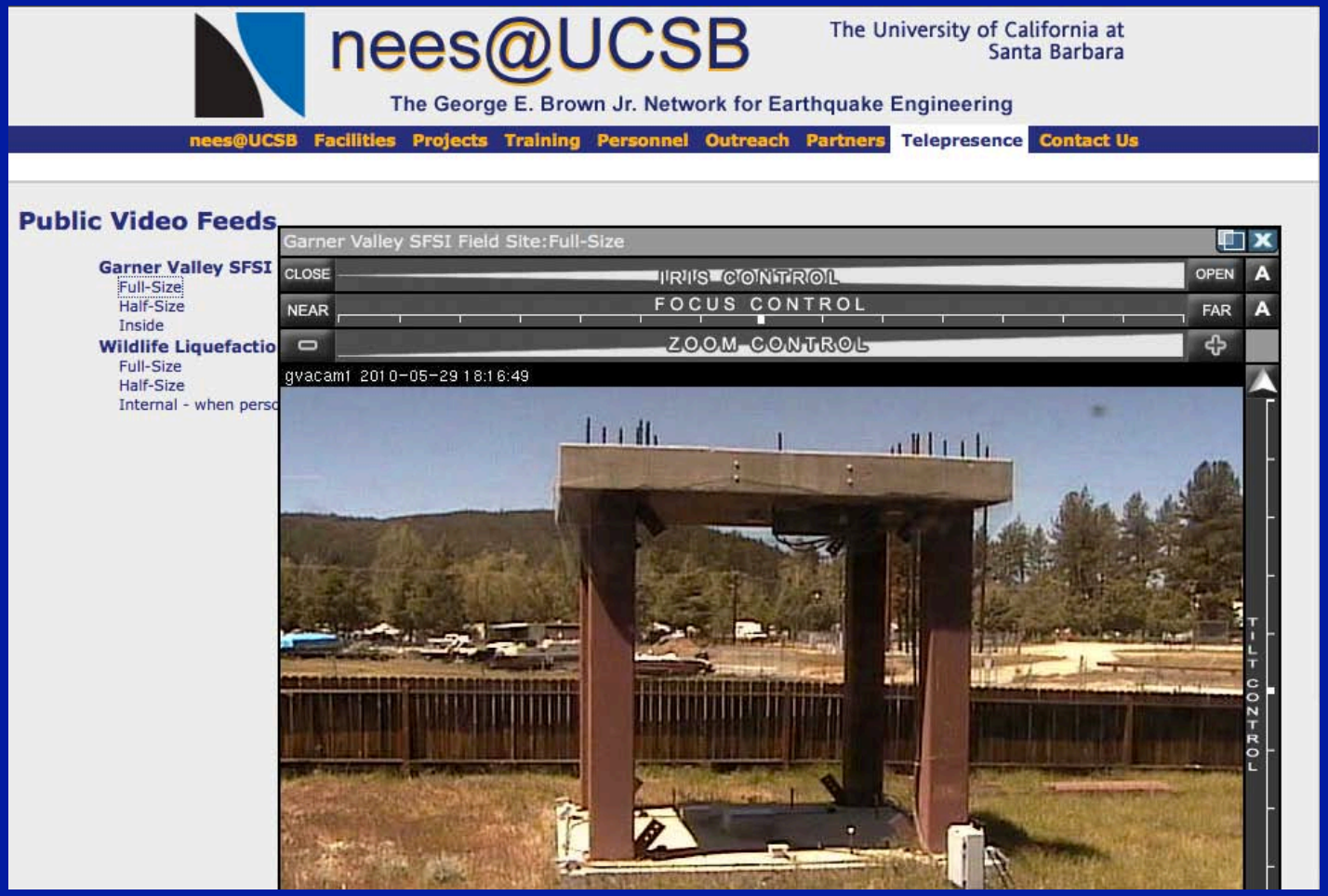
http://nees.ucsb.edu/telepresence

Wireless Video & Data Telemetry
UCSD's NSF Funded HPWREN



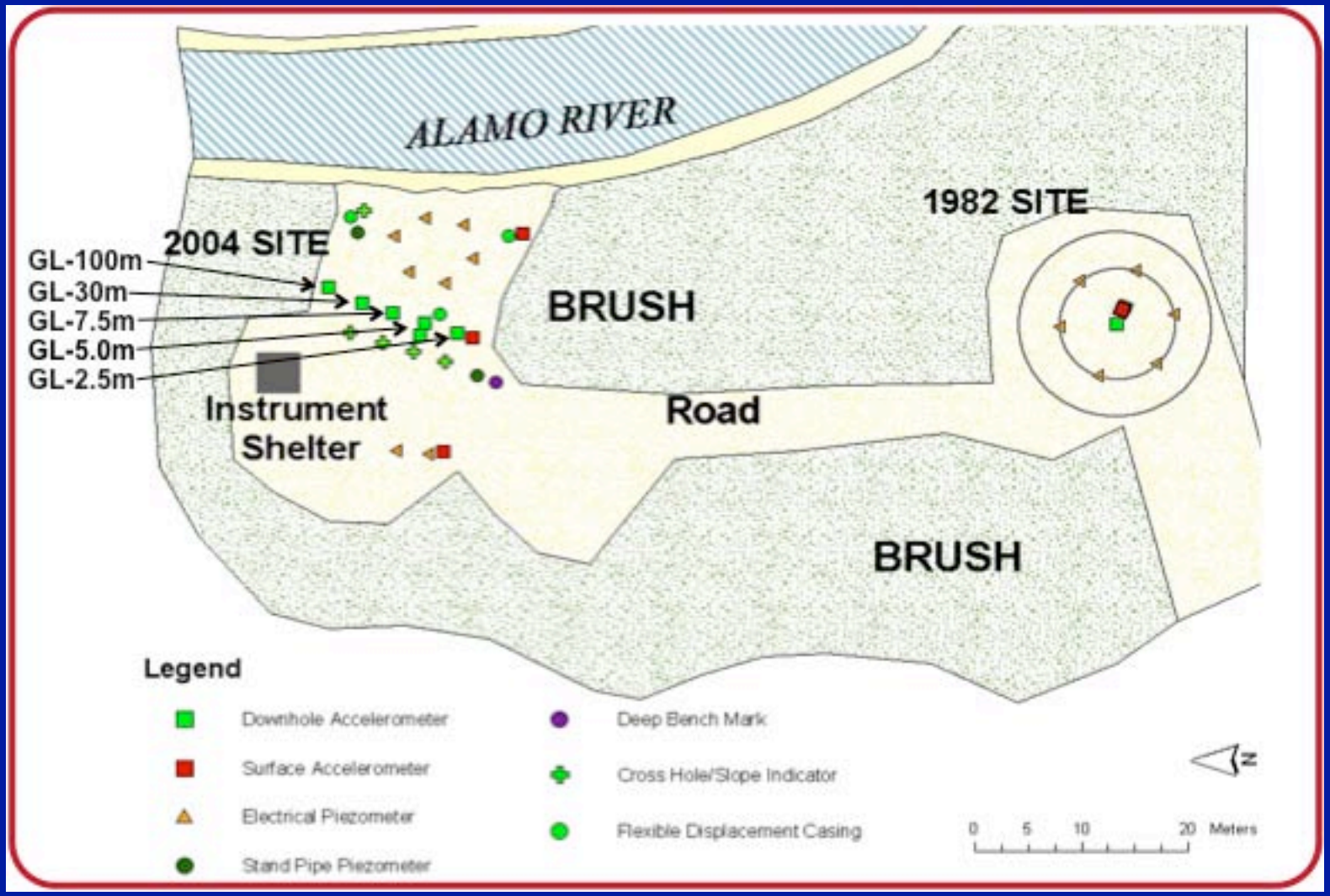
HPWEN Provides Network Connectivity here too!

Quick tour the GVDA field site

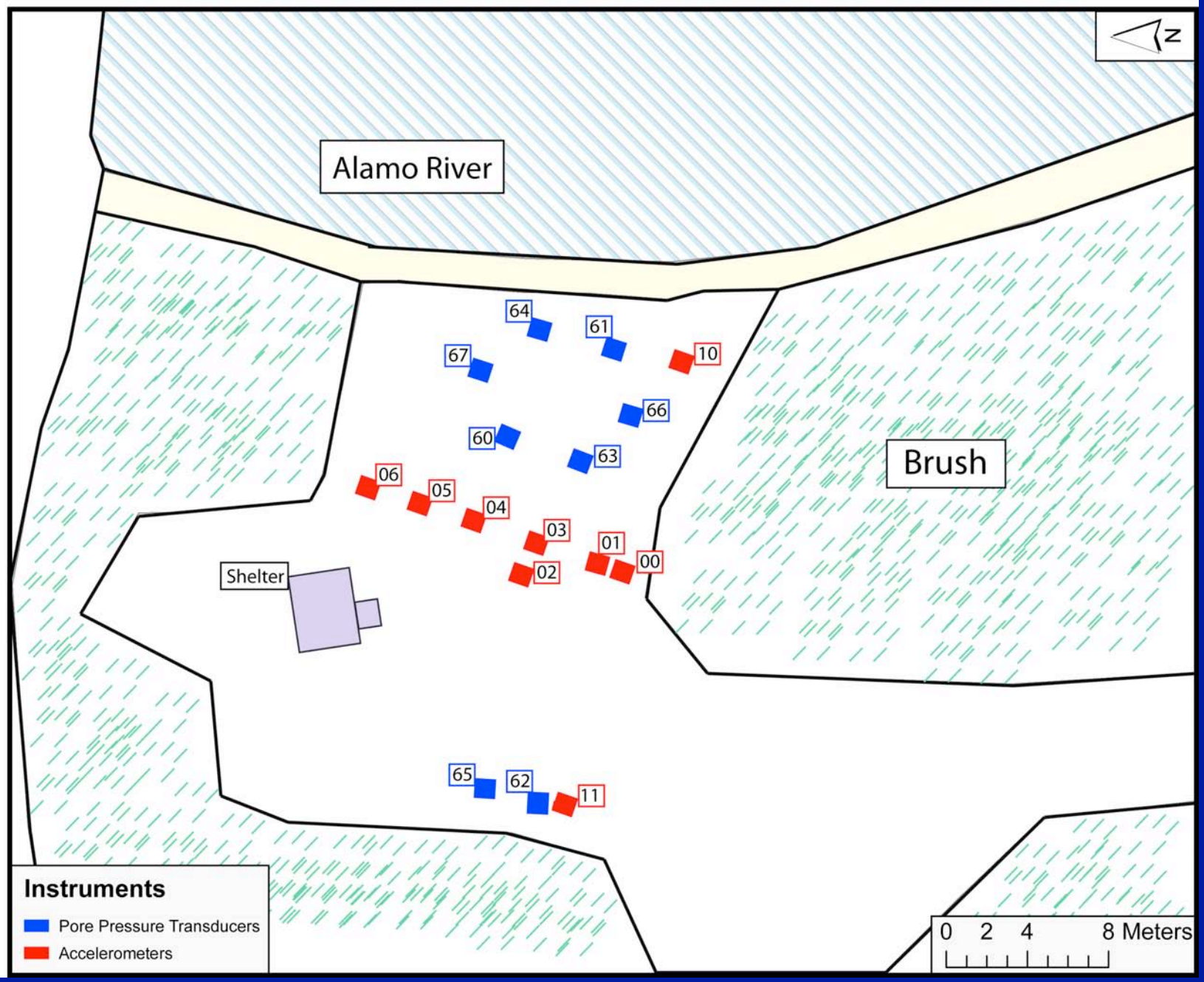


http://nees.ucsb.edu/telepresence

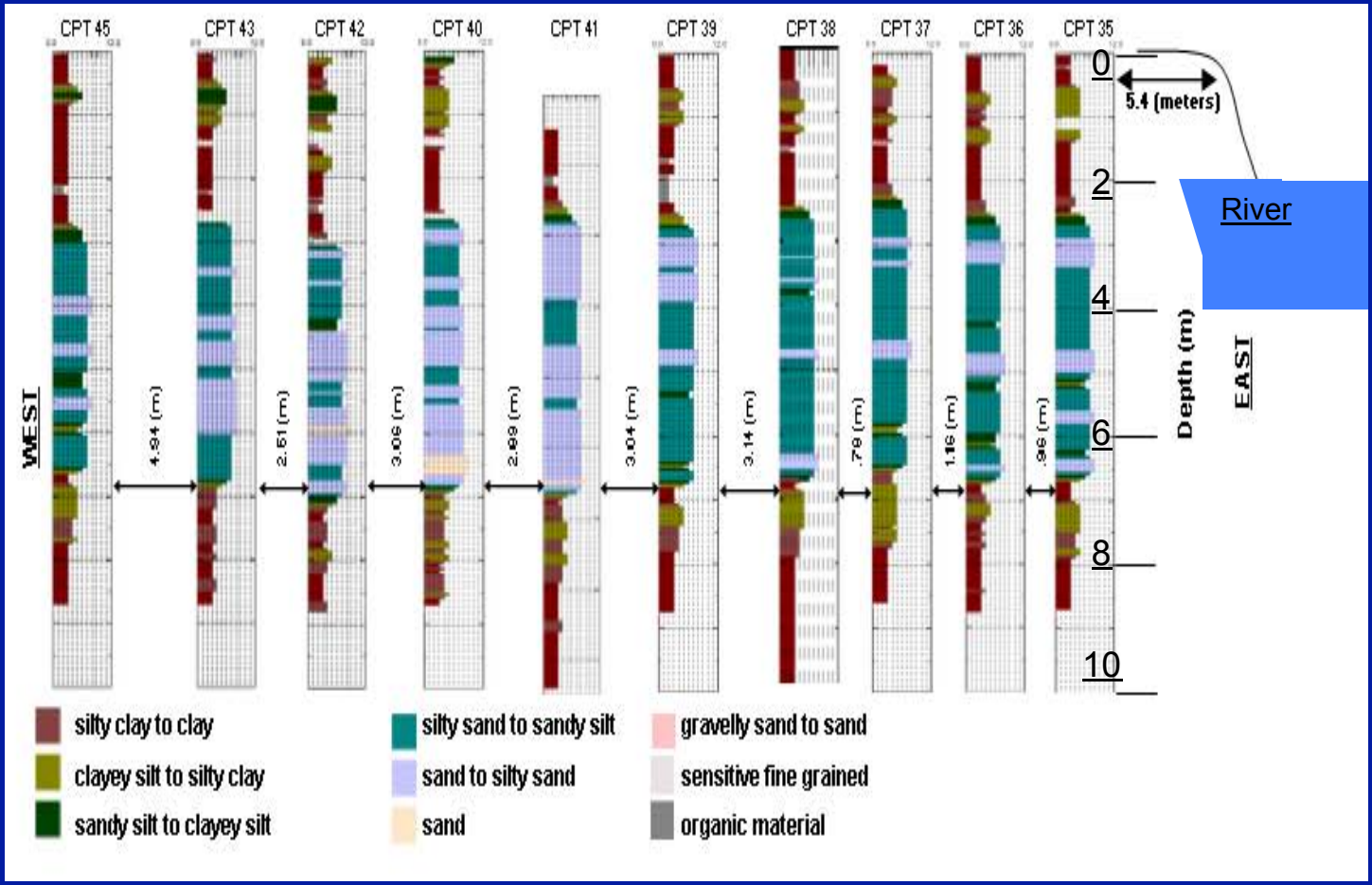
WLA Instrumentation Details



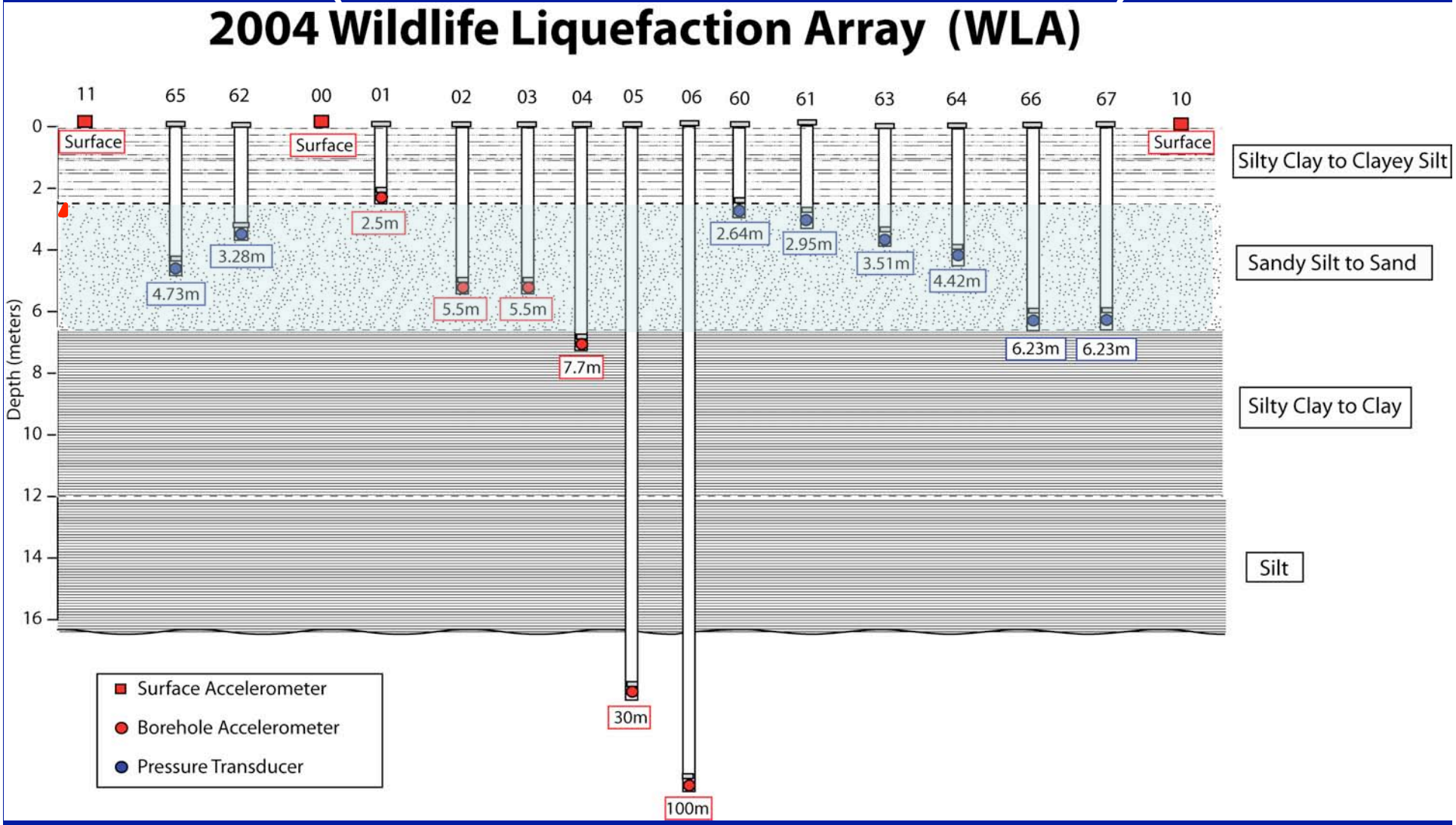
2004 Wildlife Liquefaction Array (WLA)



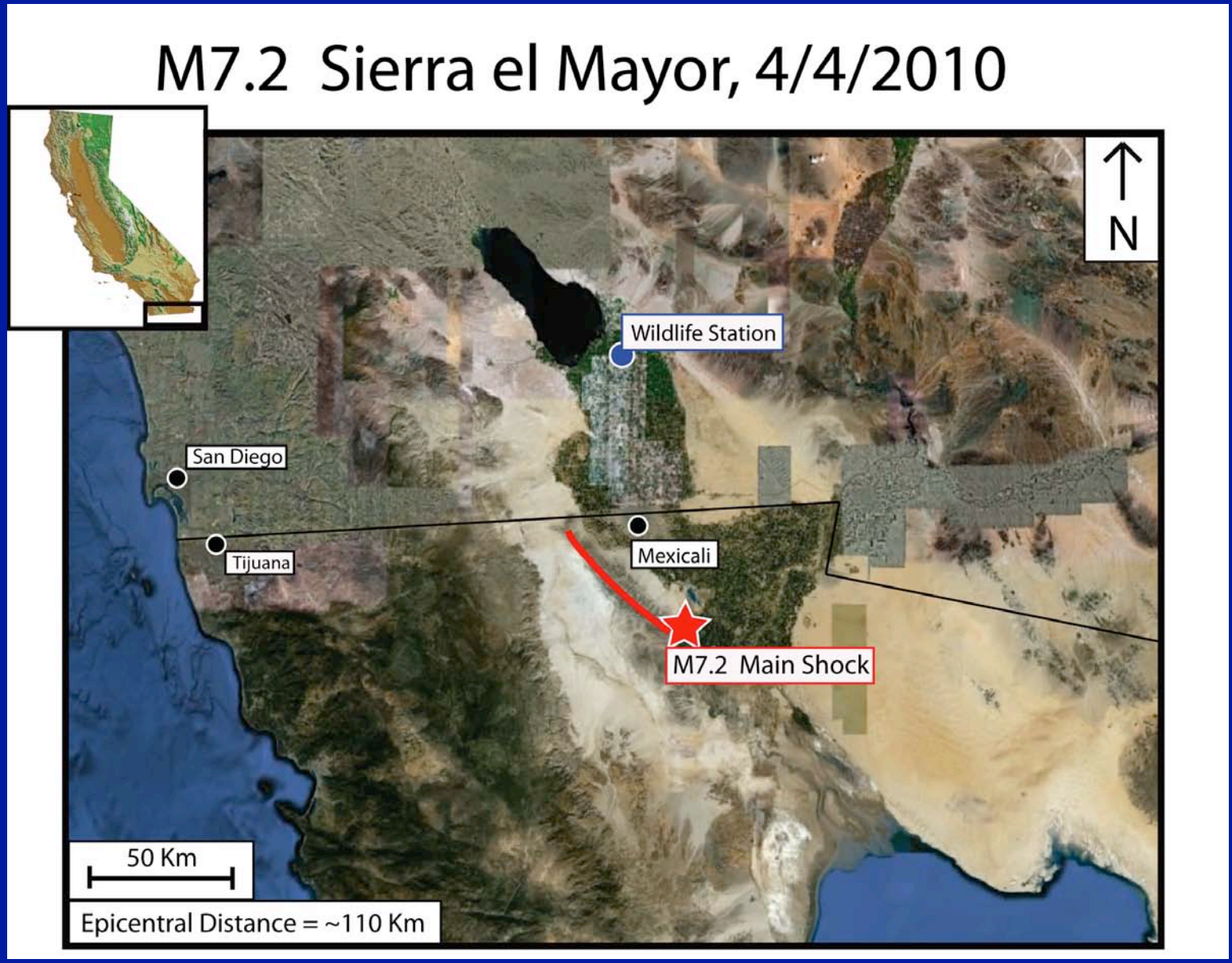
Extensive Site Condition Information at WLA
CPT logs
Saturated Sand Layer 2.5m – 6.8m, Clay Layers Above and Below



Instrumentation Cross-Section (note location codes)



Lets tour the observed “greatest hits”



A Snapshot of Conditions before the Onset of Liquefaction:
r_u ~ 10-20%
Peak Acceleration ~ 10% g

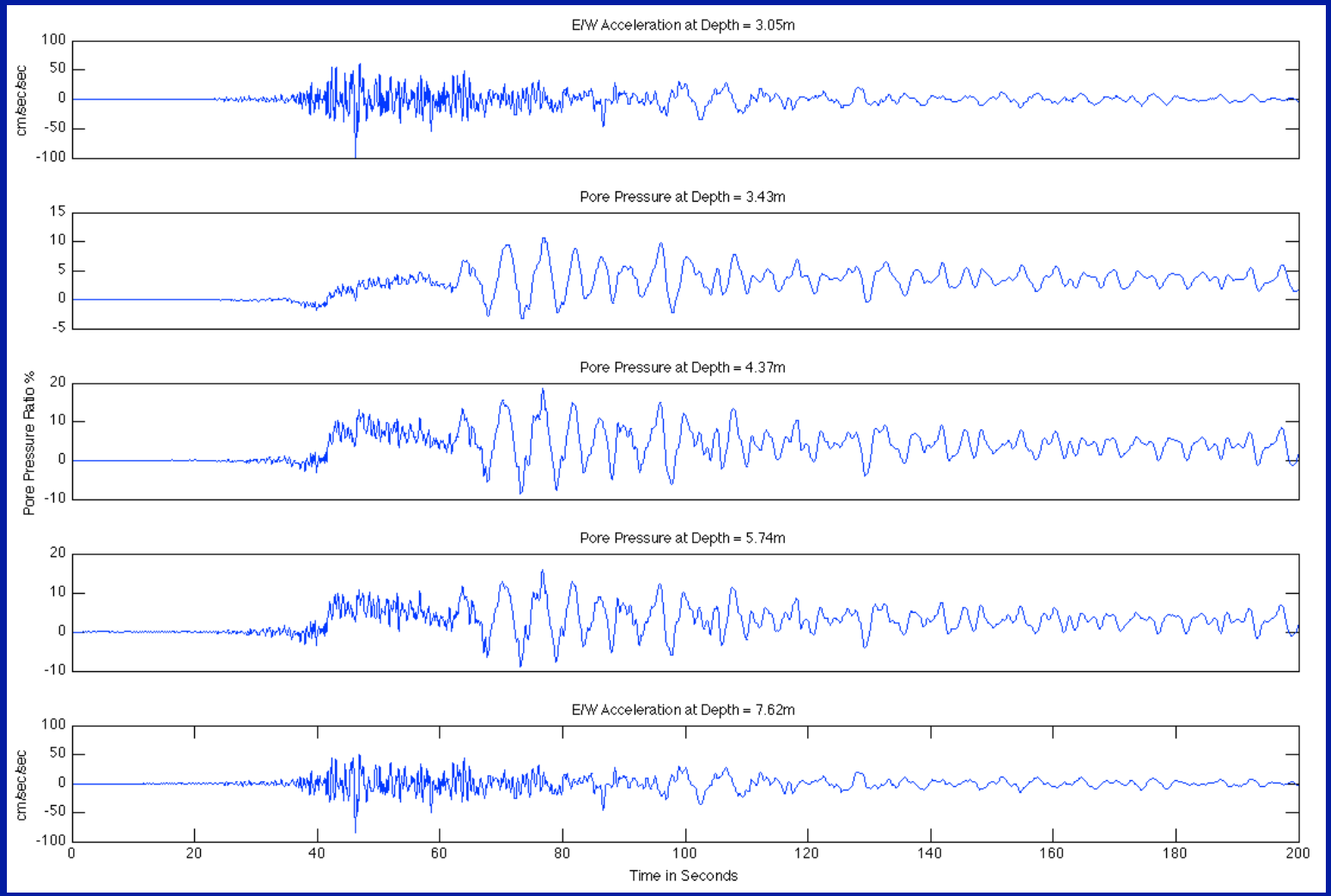
Acceleration Above Sand Layer GL-3.0m

GL-3.4m

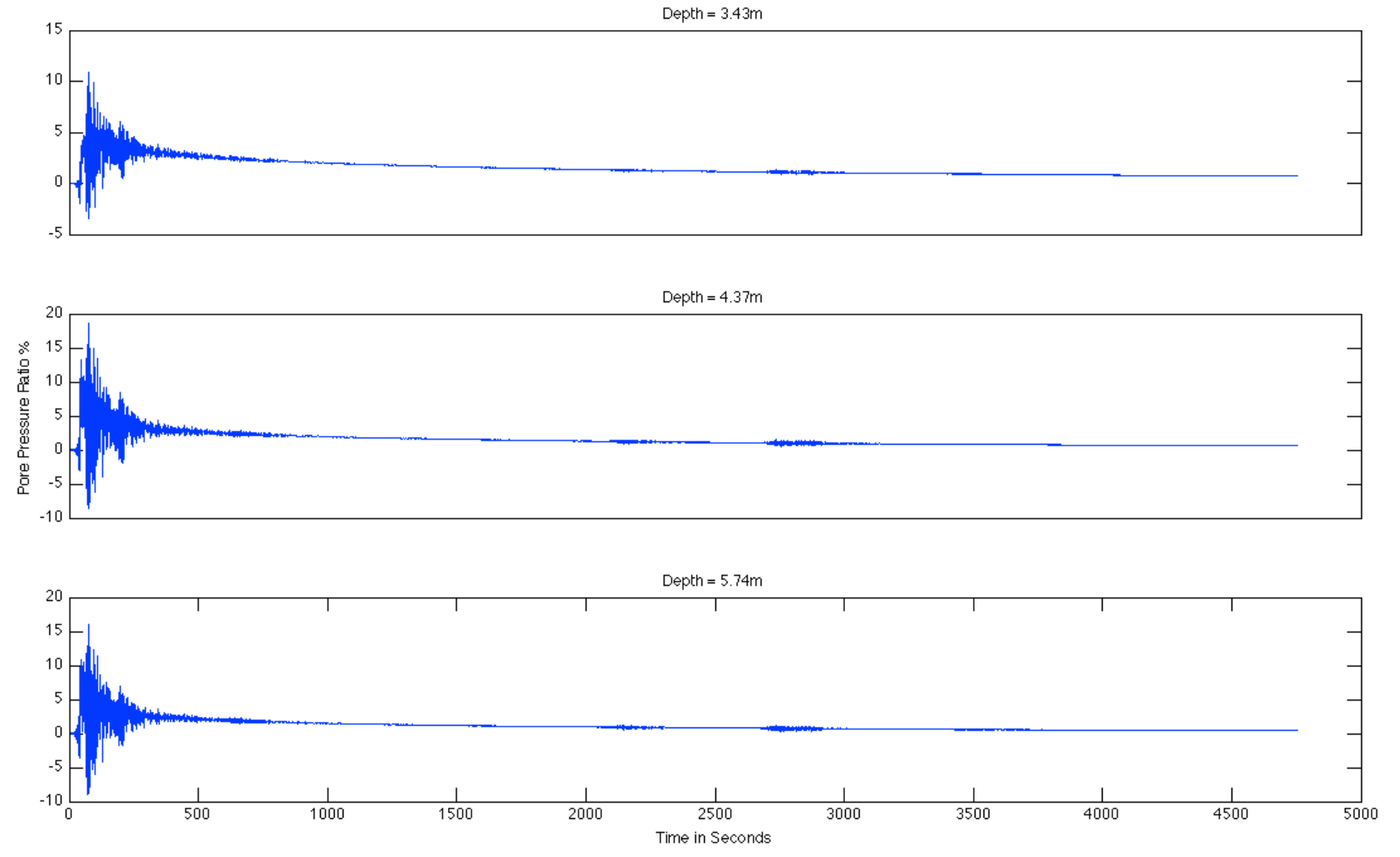
GL-4.4m

GL-5.7m

Acceleration Below Sand Layer GL-7.6m



Pore Pressure Response - Long (1.5 hrs!) Recovery Time

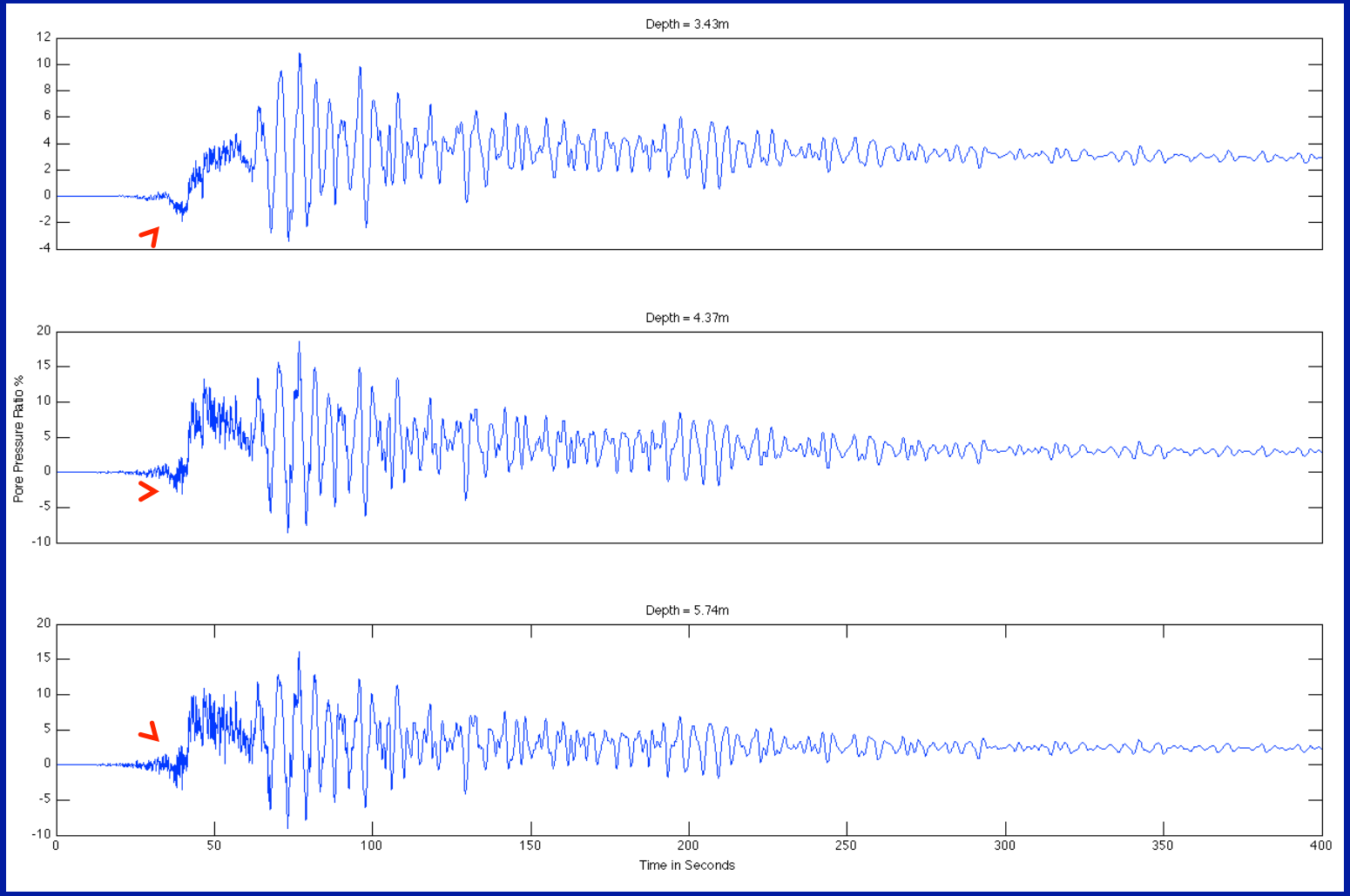


Data is recorded continuously, not triggered, so we can observe these effects

Unique Observations

Pore Pressure Response - Pressure decreases before Increase!

Pore Pressure ***Decreases*** before Increasing

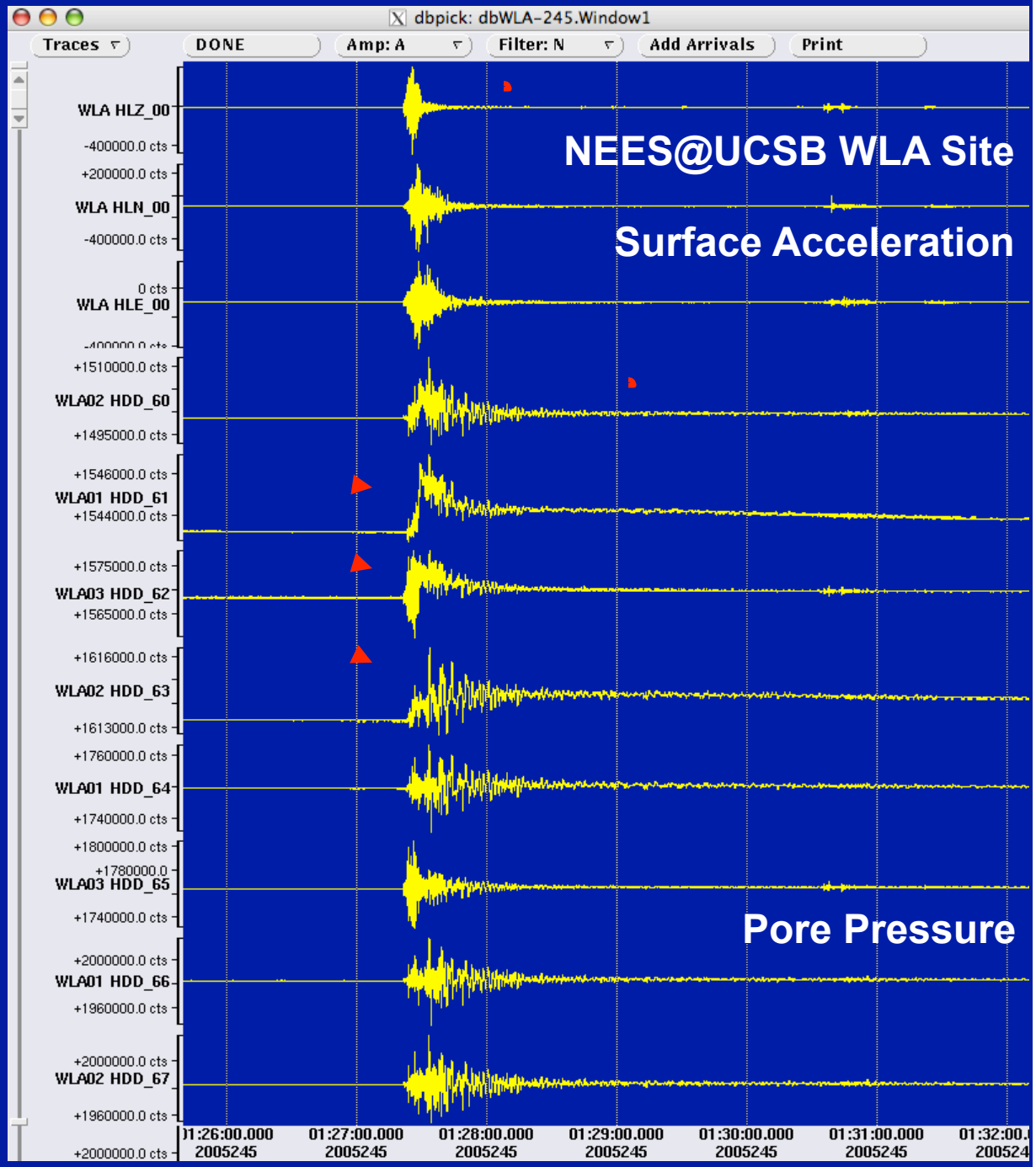


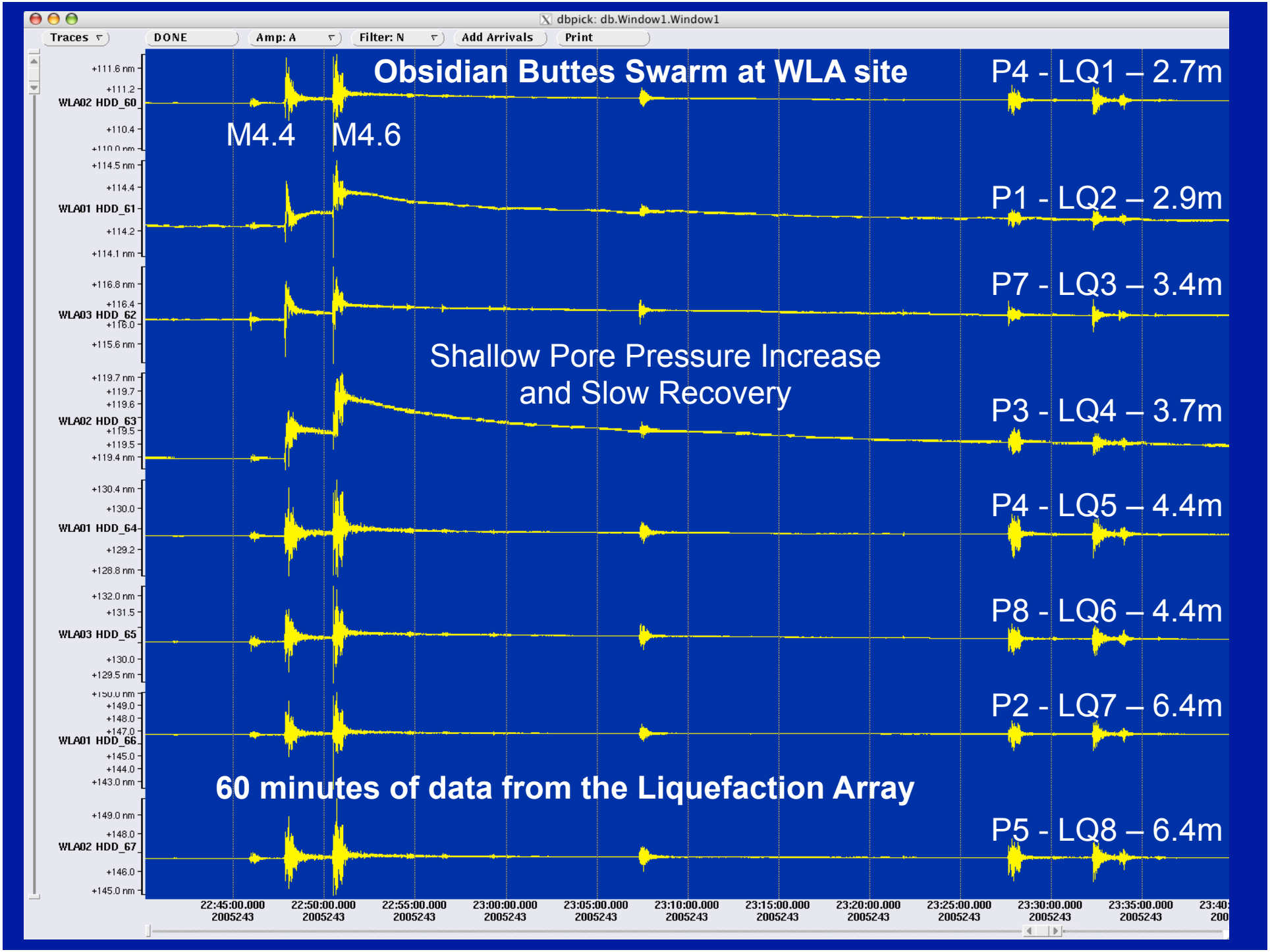
Over 6 minutes of pore pressure ratio shown

Note the effect of Surface Waves in the Imperial Valley

- Pore Pressure Increase
- Slow recovery back to pre-event pore pressure level

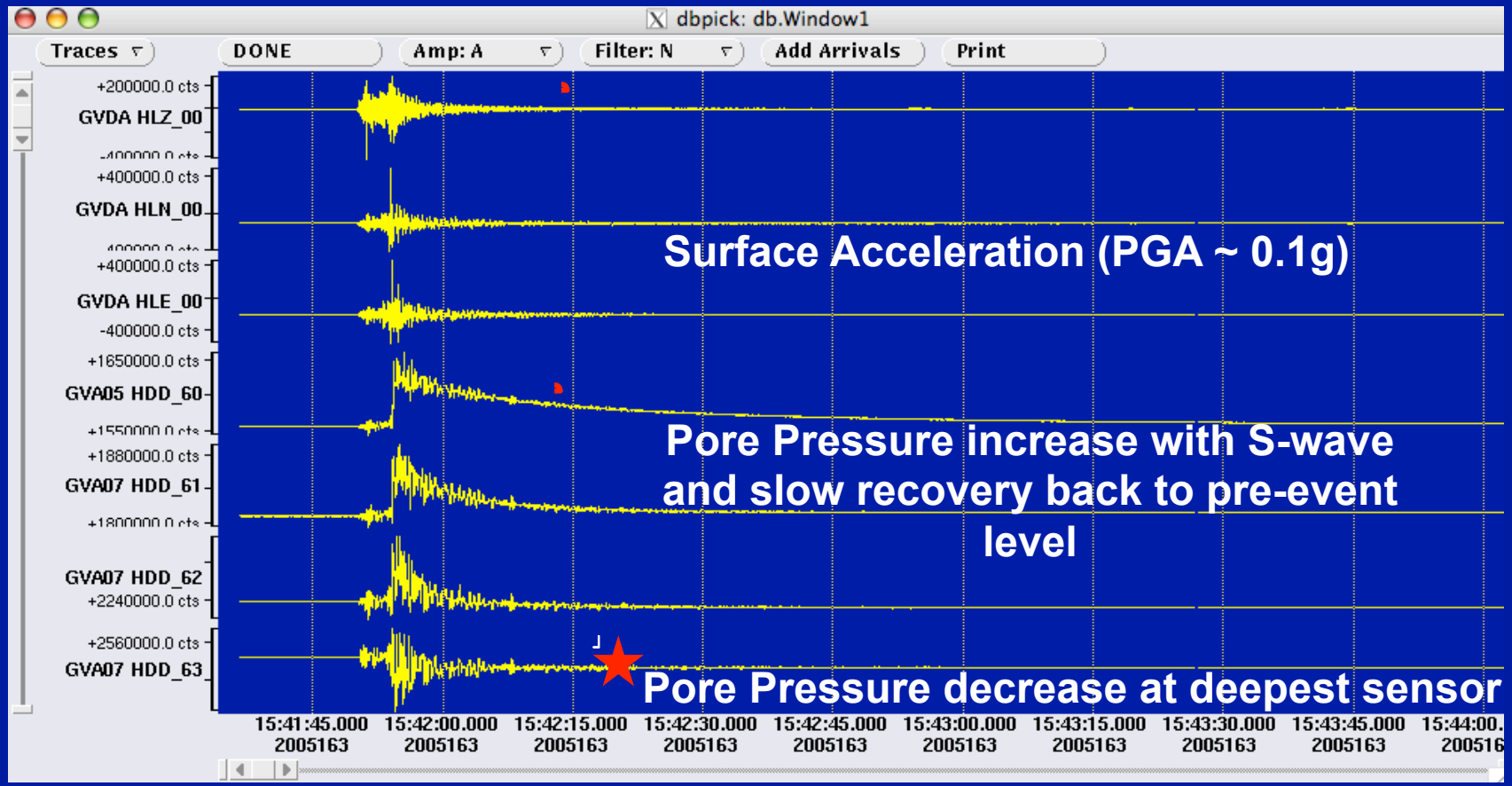
- 2005 M5.1 Obsidian Buttes Mainshock Event
- Imperial Valley, CA




dbpick: db.Window1.Window1
Traces
DONE
Amp: A
Filter: N
Add Arrivals
Print
Obsidian Buttes Swarm at WLA site
M4.4
M4.6
P4 - LQ1 – 2.7m
P1 - LQ2 – 2.9m
P7 - LQ3 – 3.4m
Shallow Pore Pressure Increase
and Slow Recovery
P3 - LQ4 – 3.7m
P4 - LQ5 – 4.4m
P8 - LQ6 – 4.4m
P2 - LQ7 – 6.4m
60 minutes of data from the Liquefaction Array
P5 - LQ8 – 6.4m
WLA02 HDD_60
WLA01 HDD_61
WLA03 HDD_62
WLA02 HDD_63
WLA01 HDD_64
WLA03 HDD_65
WLA01 HDD_66
WLA02 HDD_67
22:45:00.000 2005243
22:50:00.000 2005243
22:55:00.000 2005243
23:00:00.000 2005243
23:05:00.000 2005243
23:10:00.000 2005243
23:15:00.000 2005243
23:20:00.000 2005243
23:25:00.000 2005243
23:30:00.000 2005243
23:35:00.000 2005243

NEES@UCSB Garner Valley

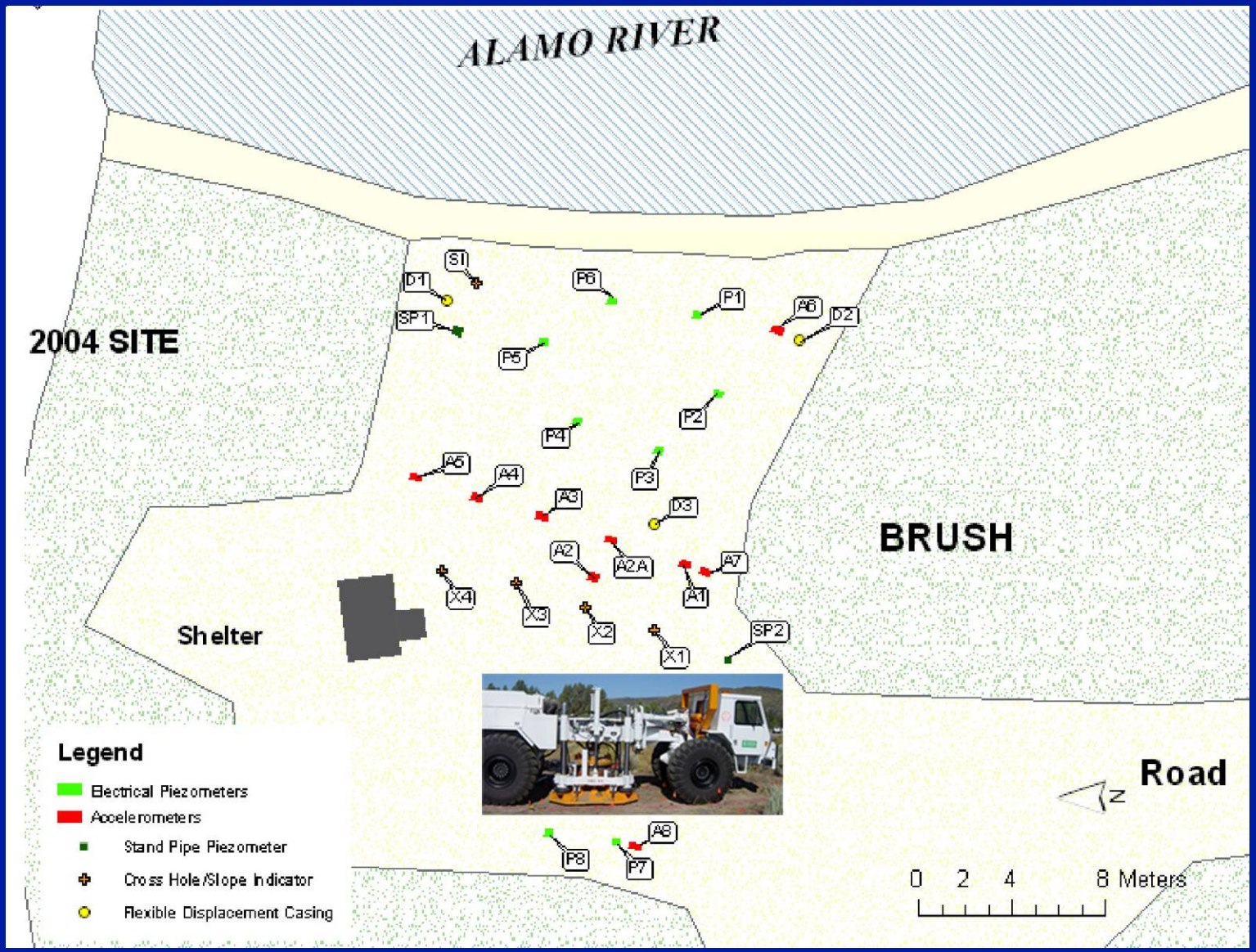
- Pore pressure on GVDA Liquefaction array
- 2005 M5.1 Anza Event



150 Seconds of data

Active Source Generation of Liquefaction
NEES@UTA “T-Rex” Shaker
WLA Site - Imperial Valley, CA

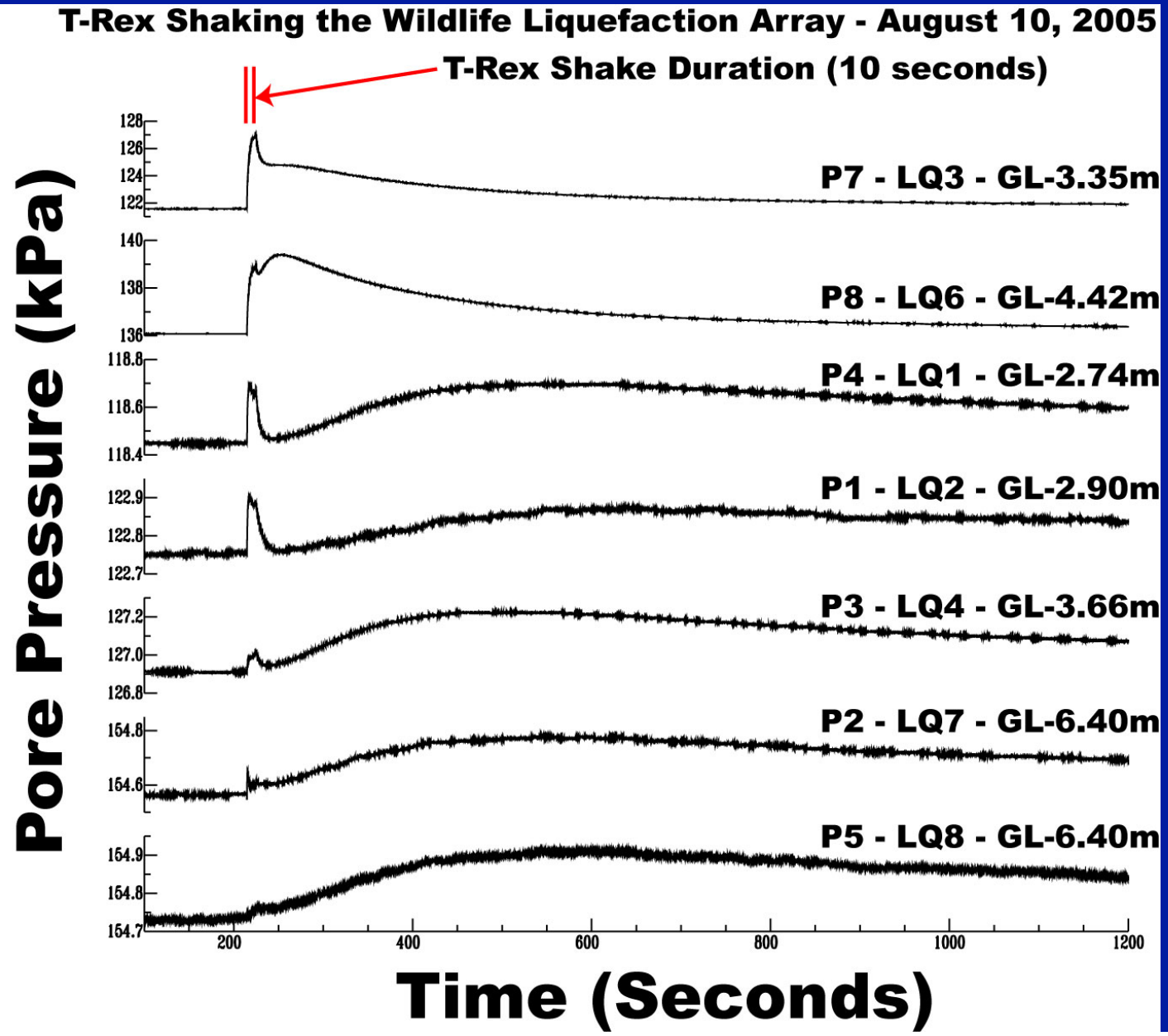
T-Rex shaking relative to permanent array at WLA



T-Rex Shaking at WLA Site

Learning about Liquefaction

"T-Rex" Excites the Liquefaction Array at WLA



10 minutes shown

Use of WLA for SFSI Experiment

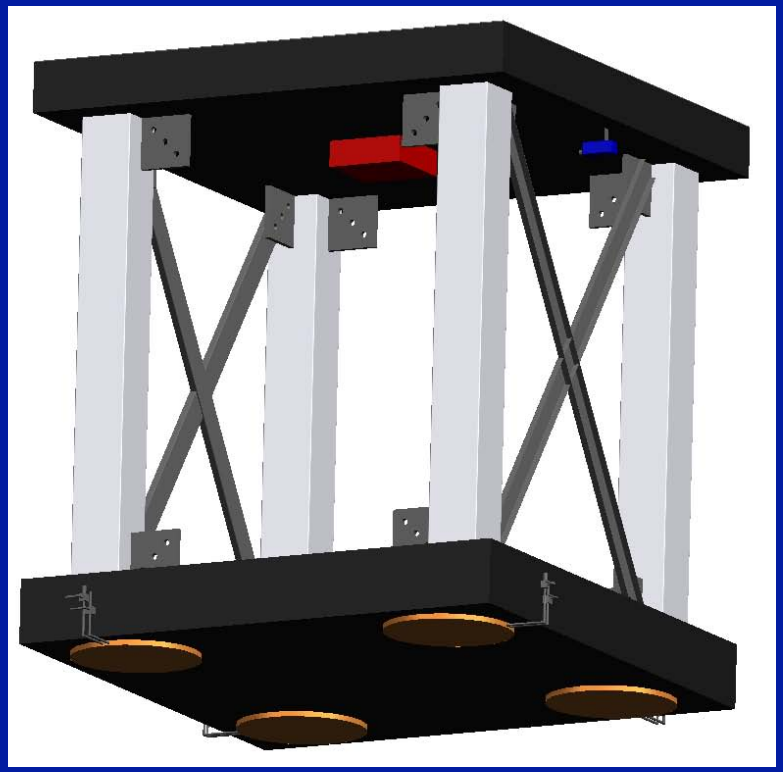
UC Berkeley NEESR Grand Challenge

NEES@UCLA and project co-PI Stewart testing at WLA

NEES@UCLA's "Mighty Mouse" shakes the temporary structure at WLA

Soil-Foundation-Structure Interaction Test Facility at Garner Valley

Design Model

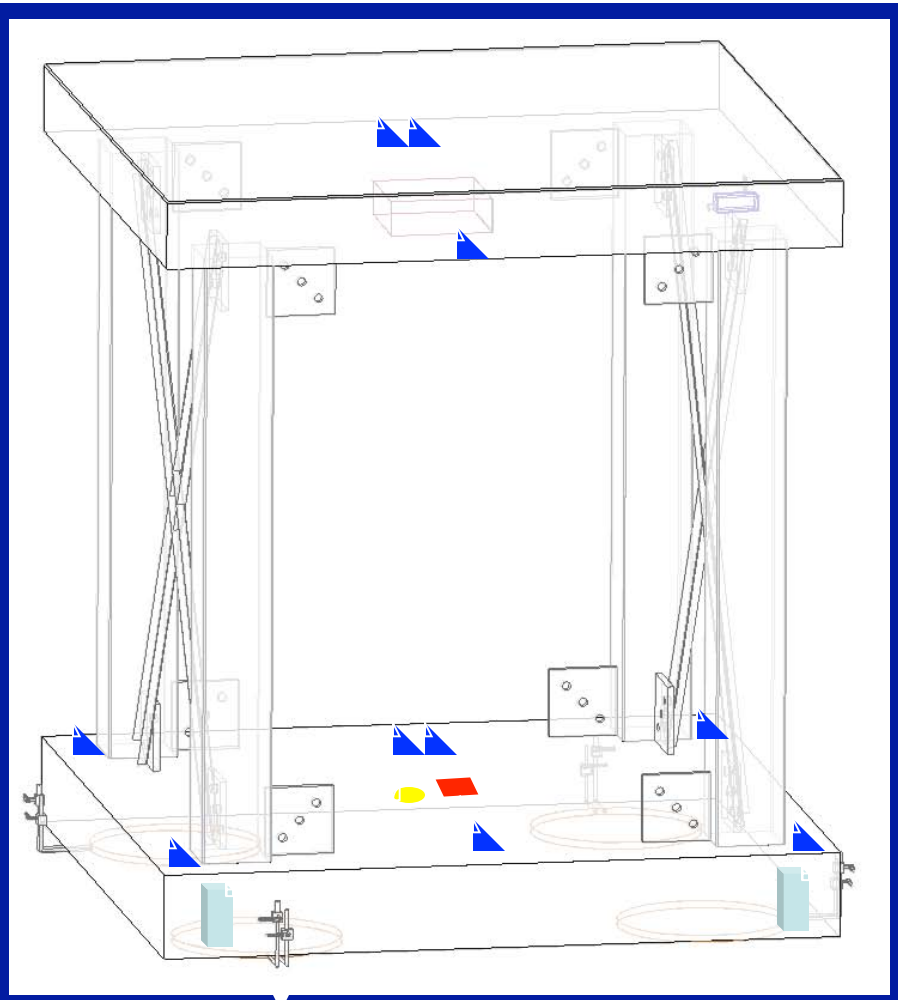


As-Built Test Structure at GVDA

Re-configurable Steel frame structure

Stiffness and Mass can be modified

SFSI Instrumentation

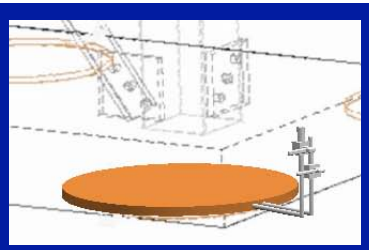


Uni-axial Accelerometer

Tri-axial Accelerometer

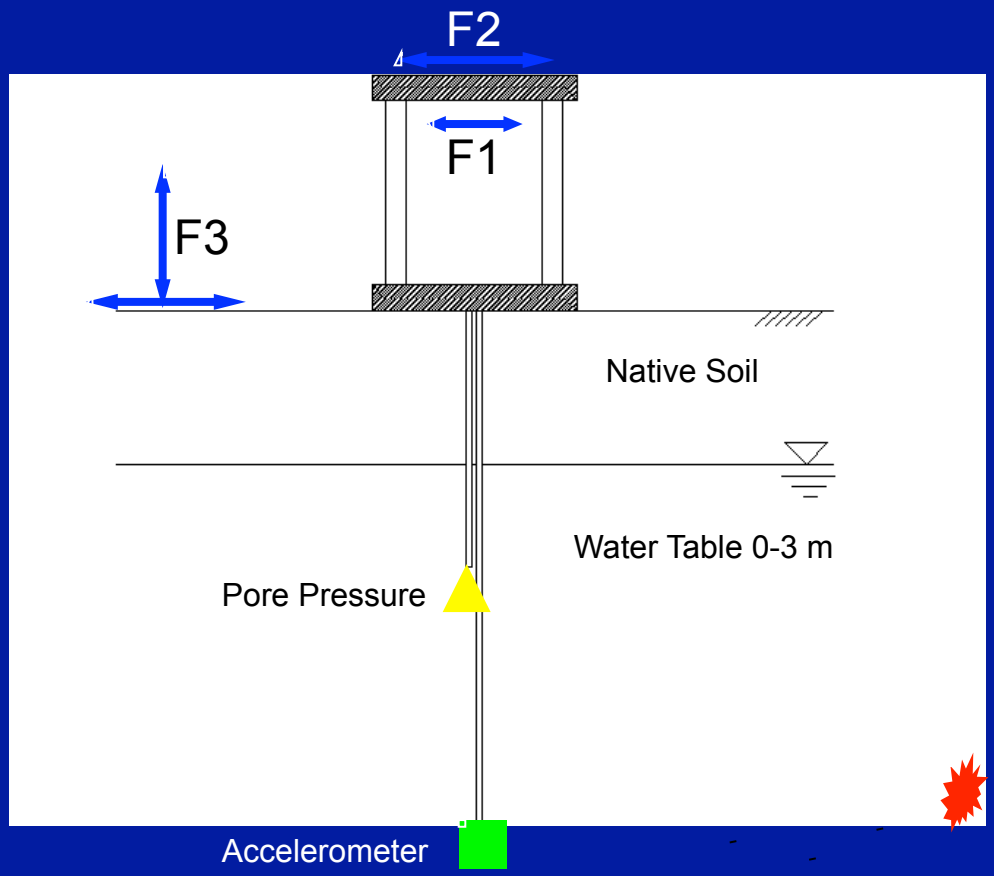
Rotation Sensor

Pressure Cell and Sensor



Displacement Transducer

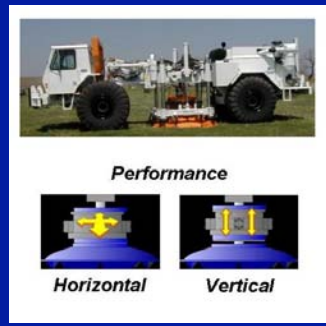
SFSI Monitoring at Garner Valley



F1 : Permanent Shaker

F2 : NEES@UCLA Shaker

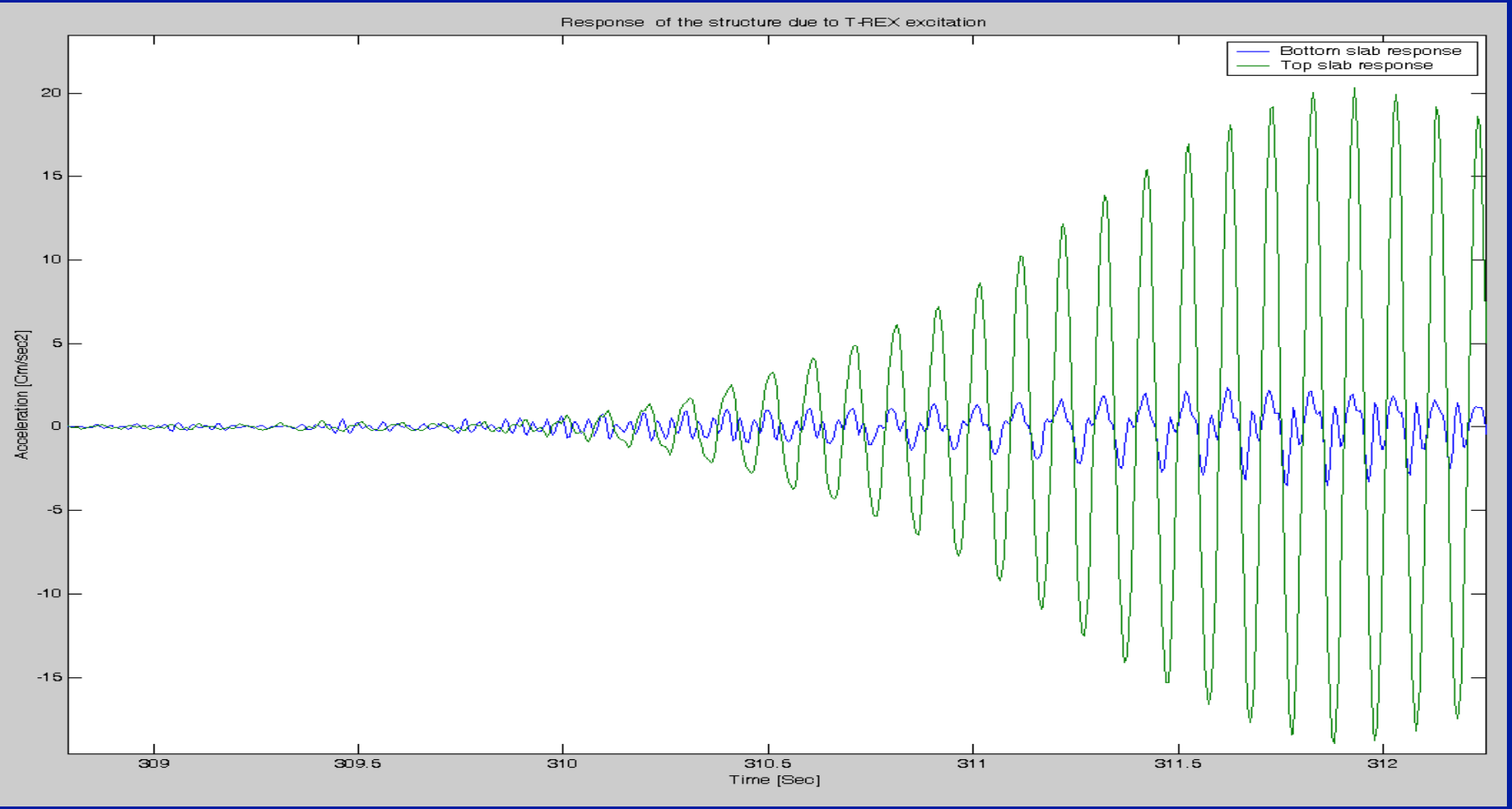
F3 : NEES@UTexas Shaker



F4: Natural Earthquake

Making Waves at GVDA with T-Rex

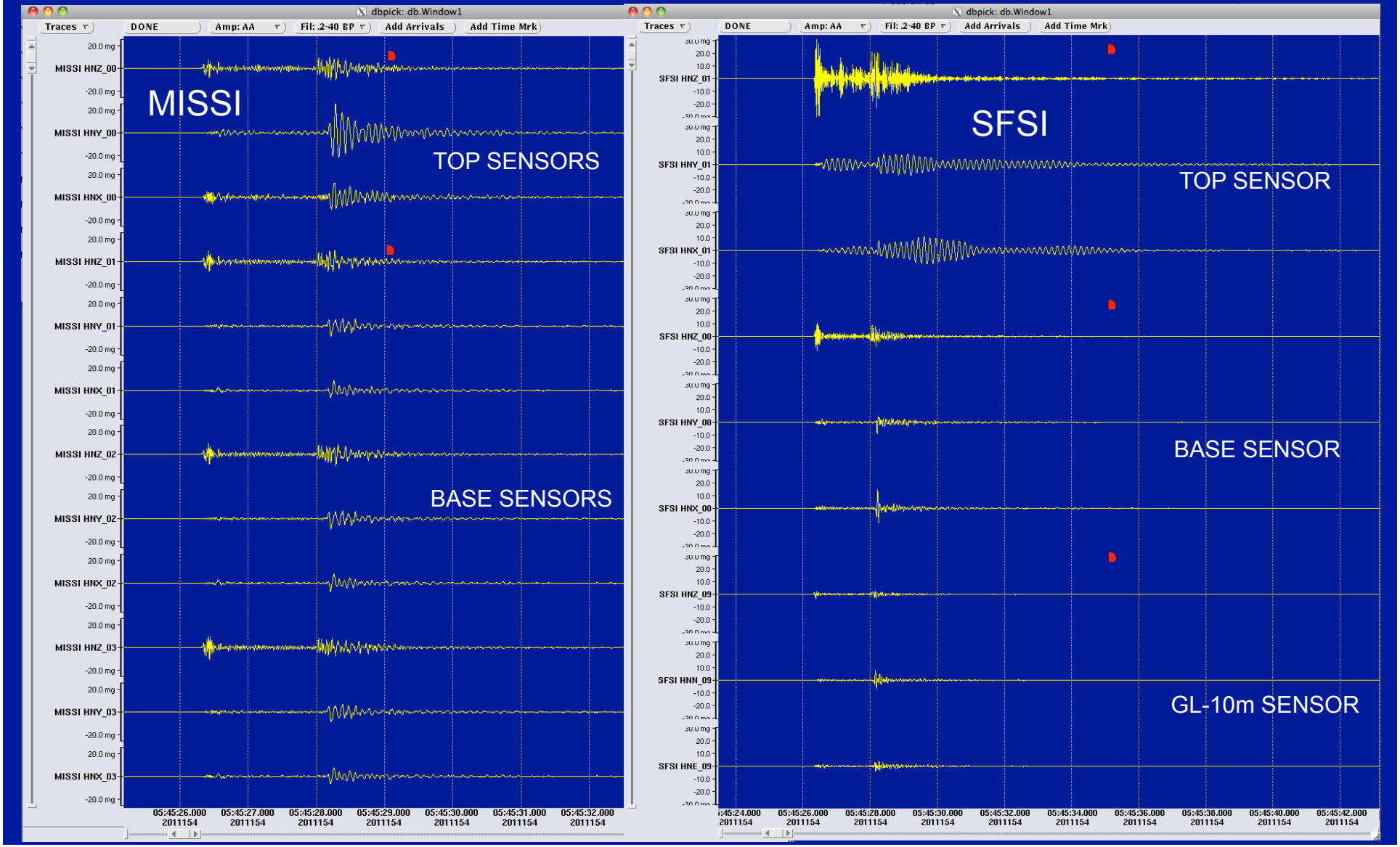
Response of the structure (Top slab and bottom slab)
Excited by T-REX Shaker



SFSI Research @ GVDA

UC Berkeley NEESR Grand Challenge
NEES@UCLA and project co-PI Stewart testing at GVDA

SFSI Research @ GVDA
Braced vs. Unbraced Response



New Projects

- Looking forward to assisting researchers develop proposals to use the nees@UCSB facilities for future testing
- Potential Resources: NSF NEESR and USGS NEHRP solicitations, due yearly in Spring

NSF NEESR Solicitation

Nov. 2, 2011 RFP 11-566

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• Grants.gov Application Guide

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George E. Brown, Jr. Network for Earthquake Engineering Simulation Research (NEESR)

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PROGRAM GUIDELINES

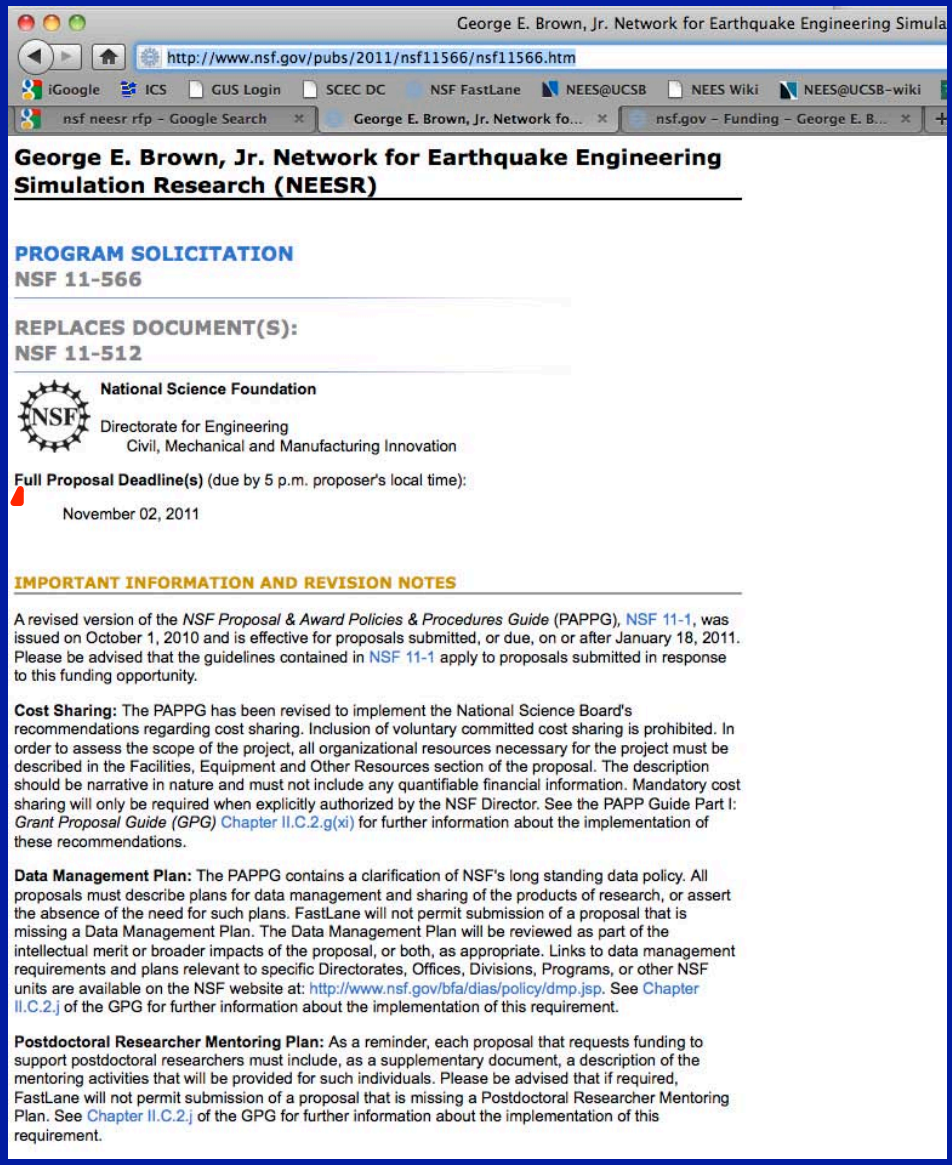
Solicitation 11-566

DUE DATES

Full Proposal Deadline Date: November 2, 2011

SYNOPSIS

The Division of Civil, Mechanical and Manufacturing Innovation (CMMI) in the Directorate for Engineering (ENG) of the National Science Foundation (NSF) invites proposals for research that uses the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) to advance knowledge, discovery, and innovation for (1) earthquake and tsunami loss reduction of our nation's civil infrastructure, and (2) new experimental simulation techniques and instrumentation for NEES. NEES comprises a network of 14 earthquake engineering experimental equipment sites available for experimentation on-site or in the field and through telepresence. NEES equipment sites include shake tables, geotechnical centrifuges, a tsunami wave basin, unique large-scale testing laboratory facilities, and mobile and permanently installed field equipment. The NEEShub cyberinfrastructure connects, via Internet2, the equipment sites as well as provides telepresence; a curated central data repository known as the NEES Project Warehouse; simulation tools; collaborative tools for facilitating on-line planning, execution, and post-processing of experiments; and the NEES Academy for education and outreach. Projects proposed and supported under this solicitation must require significant use of one or more of the NEES equipment sites listed at http://www.nees.org and the related cyberinfrastructure and/or require significant reuse of data curated and archived in the NEES Project Warehouse at http://nees.org/warehouse. Proposals that seek new scientific inquiry through reuse of data curated and archived in the NEES Project Warehouse, either alone or in combination with use of the NEES equipment site(s), will be considered. The data eligible for reuse from the NEES Project Warehouse must be



http://www.nsf.gov/pubs/2011/nsf11566/nsf11566.htm

Please visit us at . . .

http://nees.ucsb.edu/

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