

# Disturbance Monitoring at ISO-NE

*A NASPI Success Story Presentation*

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# Outline

- History of disturbance monitoring in New England
- History of Enhancements
- What We Have Learned
- Future Enhancements

# History of Disturbance Monitoring in NE

- Original Objective:
  - Collect data to benchmark stability simulations
  - 7 strategically selected sites
- First recorder installed in 1989
  - others added in 2003
- Continuous enhancements

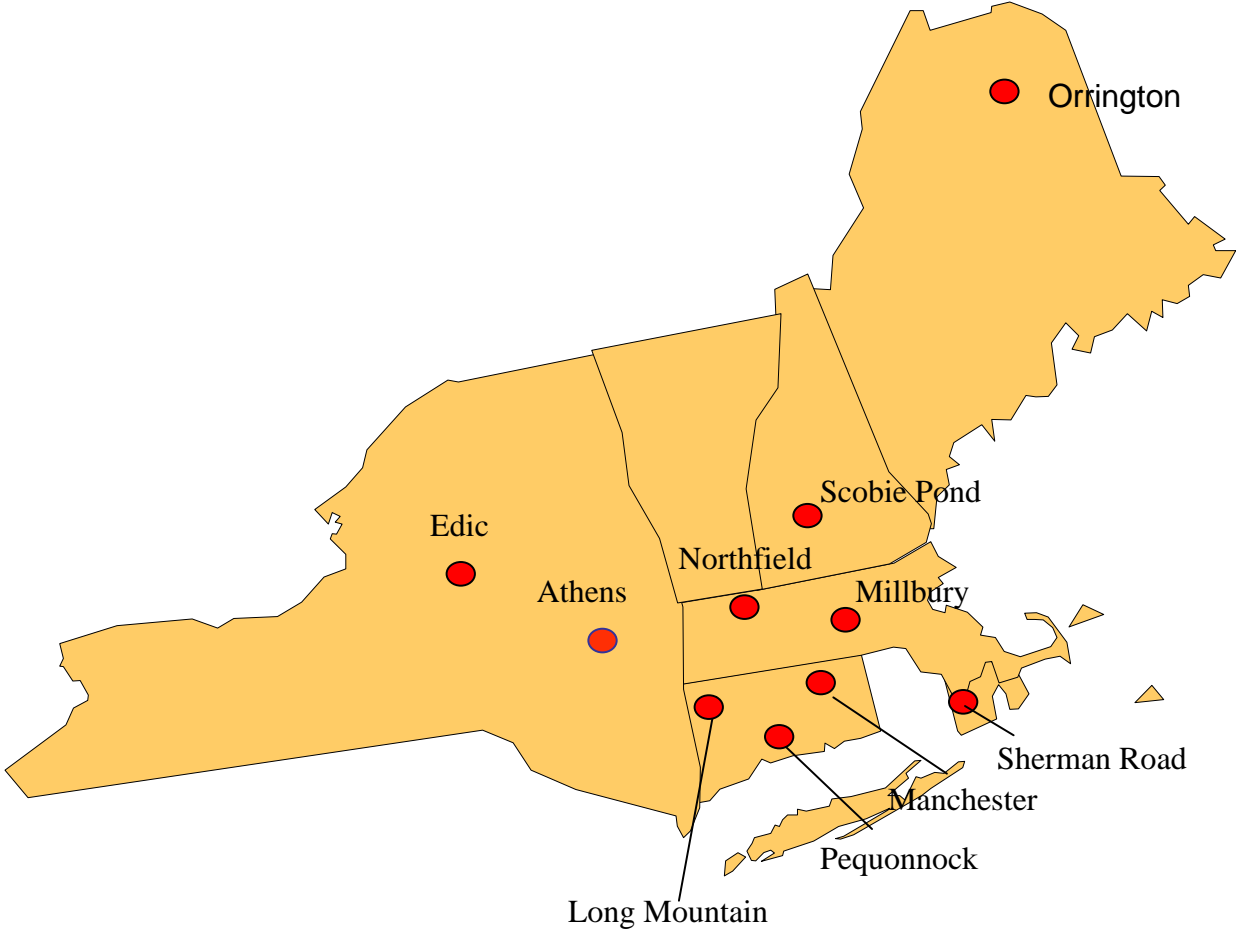
# History of Enhancements (continued)

- Pre-1989 - *Trigger-initiated recording*
  - Simulations and experience suggested frequency based trigger
  - Field verification confirmed that this trigger would detect important disturbances.
- 1990's
  - *Additional triggers (voltage, power, etc.)*
  - Data conversion to PSS/E format for easy comparison with stability simulation

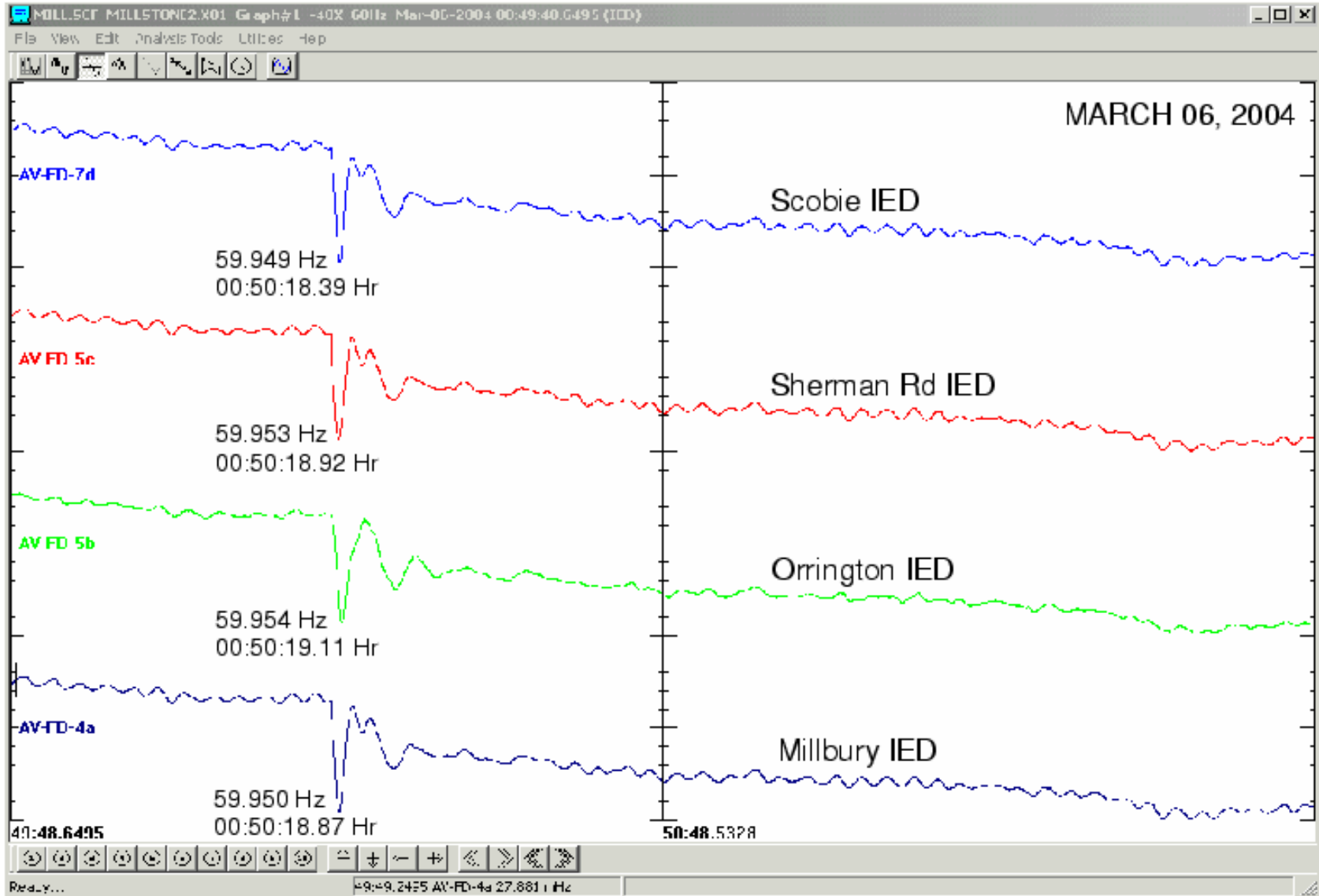
# History of Enhancements (continued)

- Post-2000 Enhancements
  - Finally added recorders to all sites in NE (and NY)
    - *Wide Area Measurements*
  - Oscillation detection (ISO-NE R&D-driven capability)
  - Continuous recording (NERC's DDR function)
  - Two types of local recordings:
    1. High sample rate (2880 per second) - NERC/NPCC DFR and SER function
    2. 720 per second - ISO-NE R&D-driven
  - Data streaming to TVA (NASPI-PMU function)

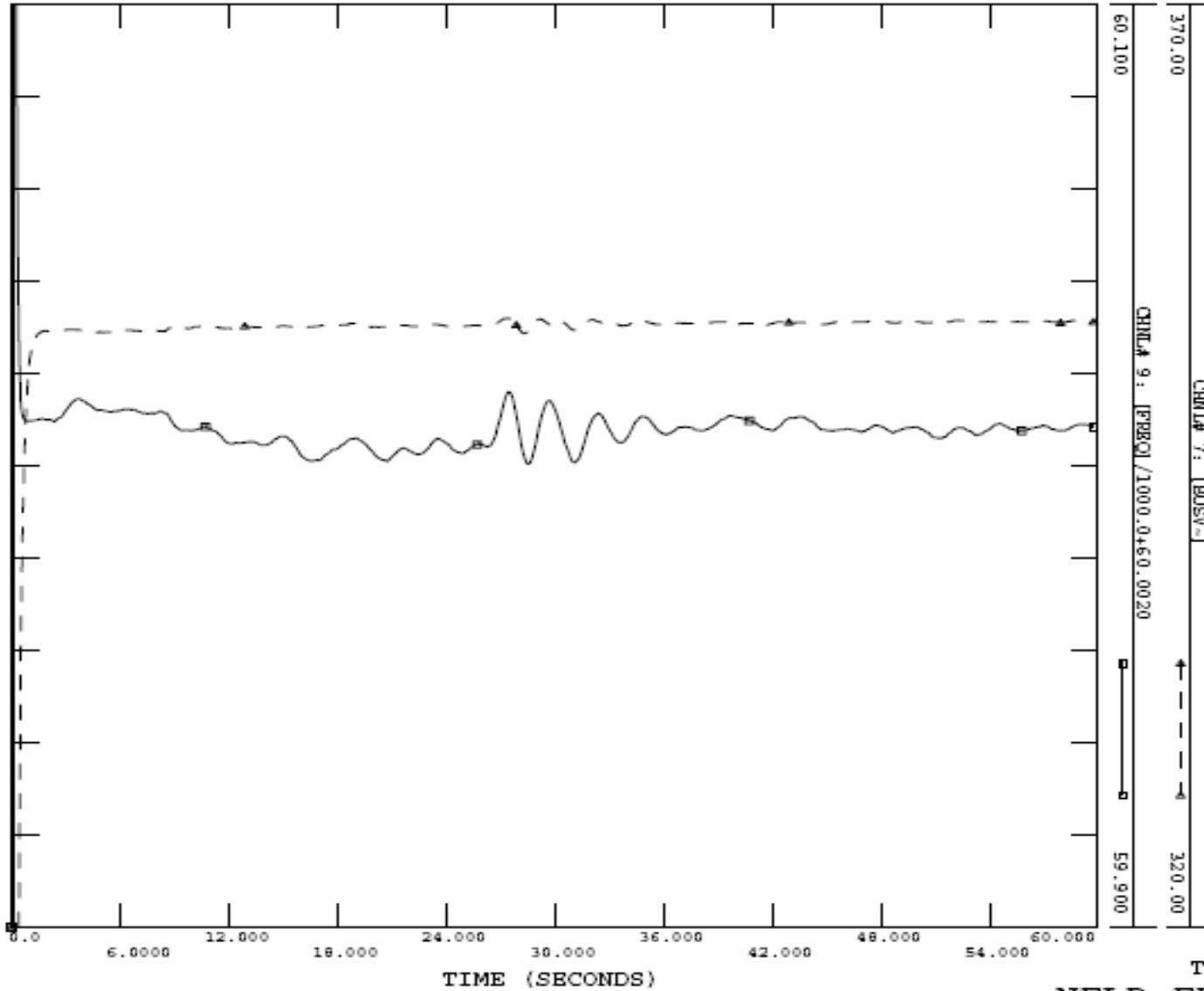
# Disturbance Monitoring Sites



# Wide Area Measurements



# Oscillation Data (1 min.)



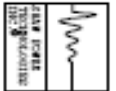
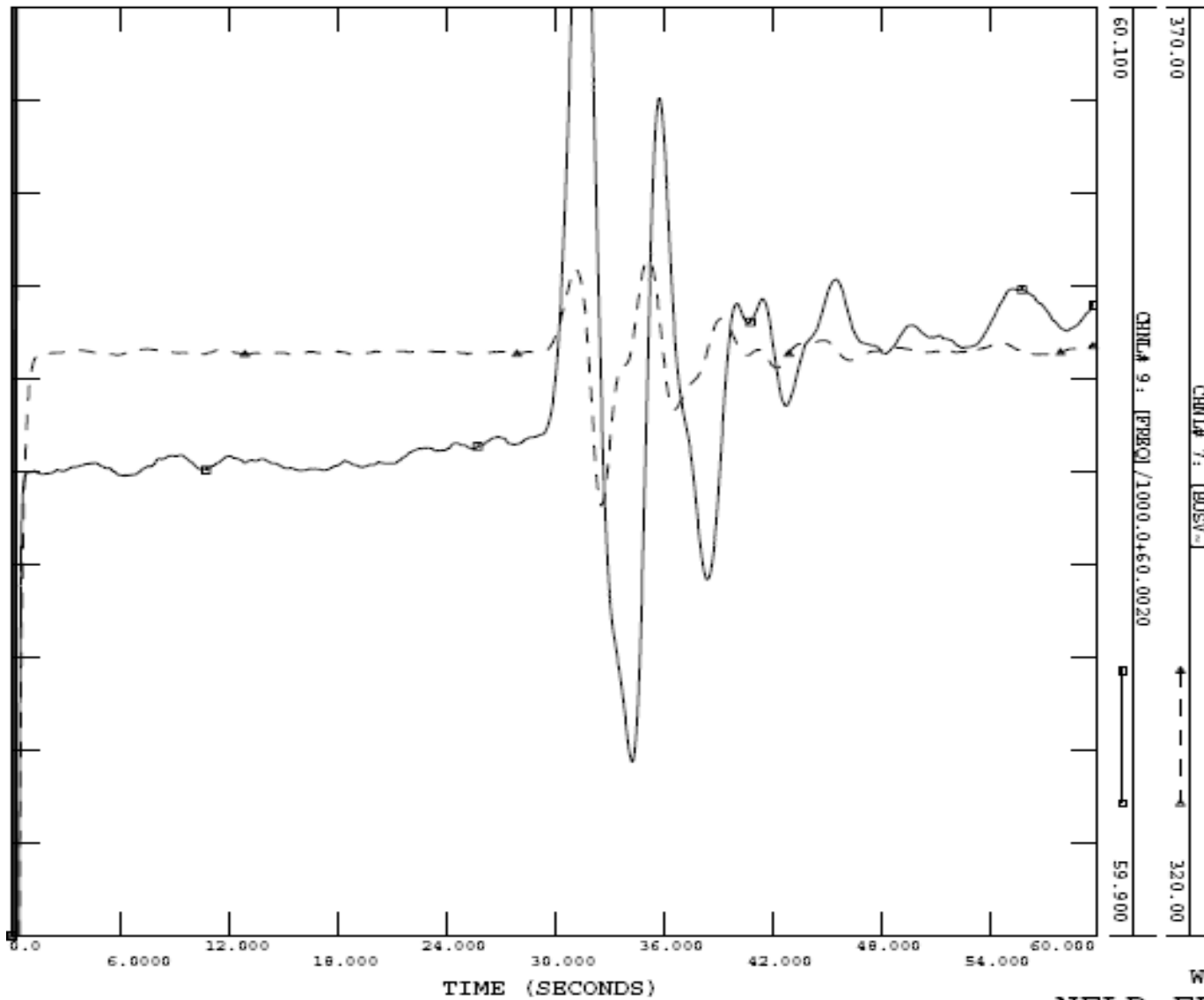
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COLLAPSE = 4, W0 = 60.00208 HZ

FILE: .\Output\NIUT0946.out

TUE, FEB 19 2008 16:11  
NFLD FREQ AND VOLTAGE



# February 26, 2008 Event – Triggered Data (1 min.)

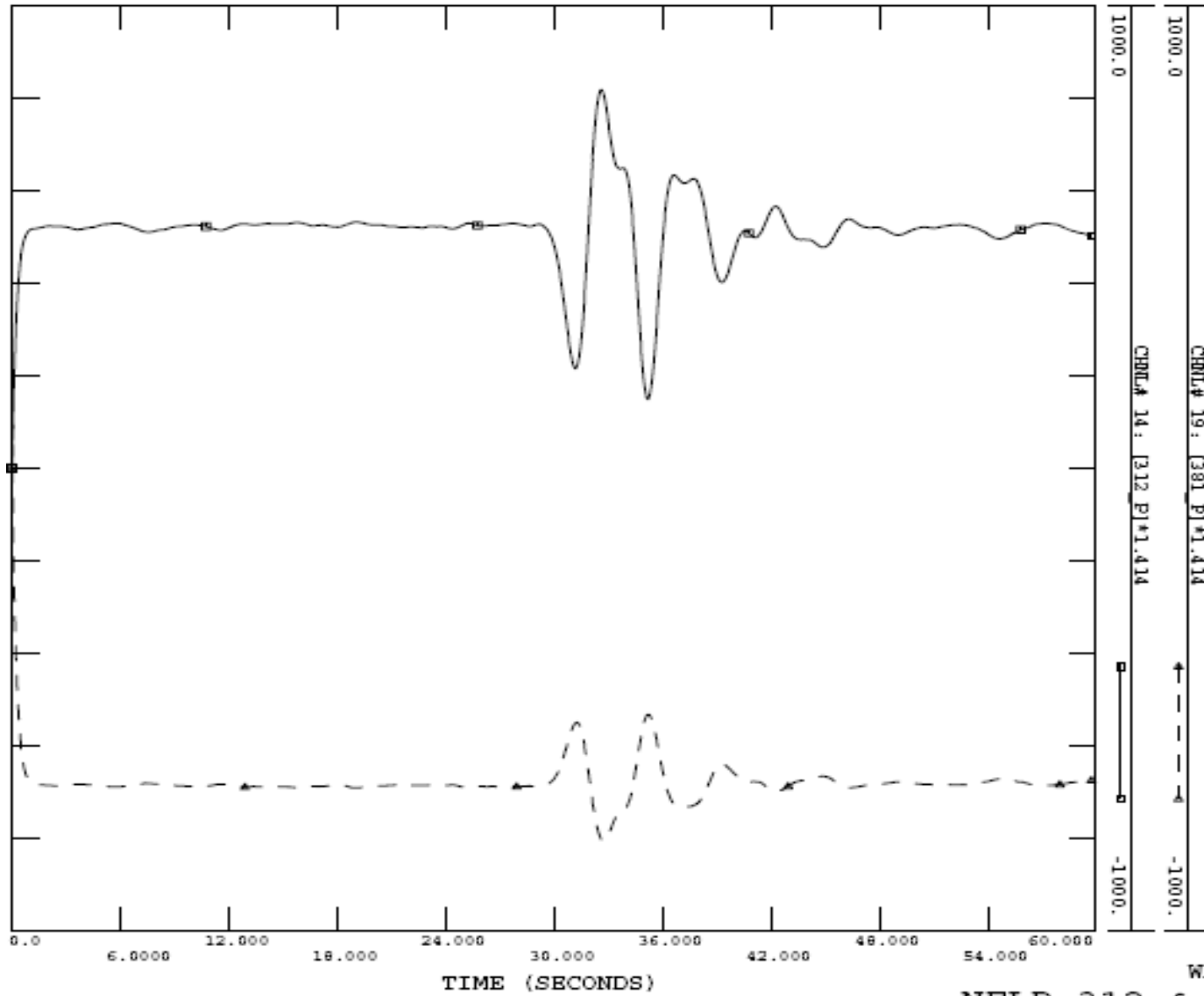


NIUT094C.XXX @ 2880 = 057:13:08:40.1728.  
COLLAPSE = 4, W0 = 60.00208 HZ

FILE: .\Output\NIUT094C.out

WED, FEB 27 2008 8:53  
NFLD FREQ AND VOLTAGE

# February 26, 2008 Event – Triggered Data (1 min.)



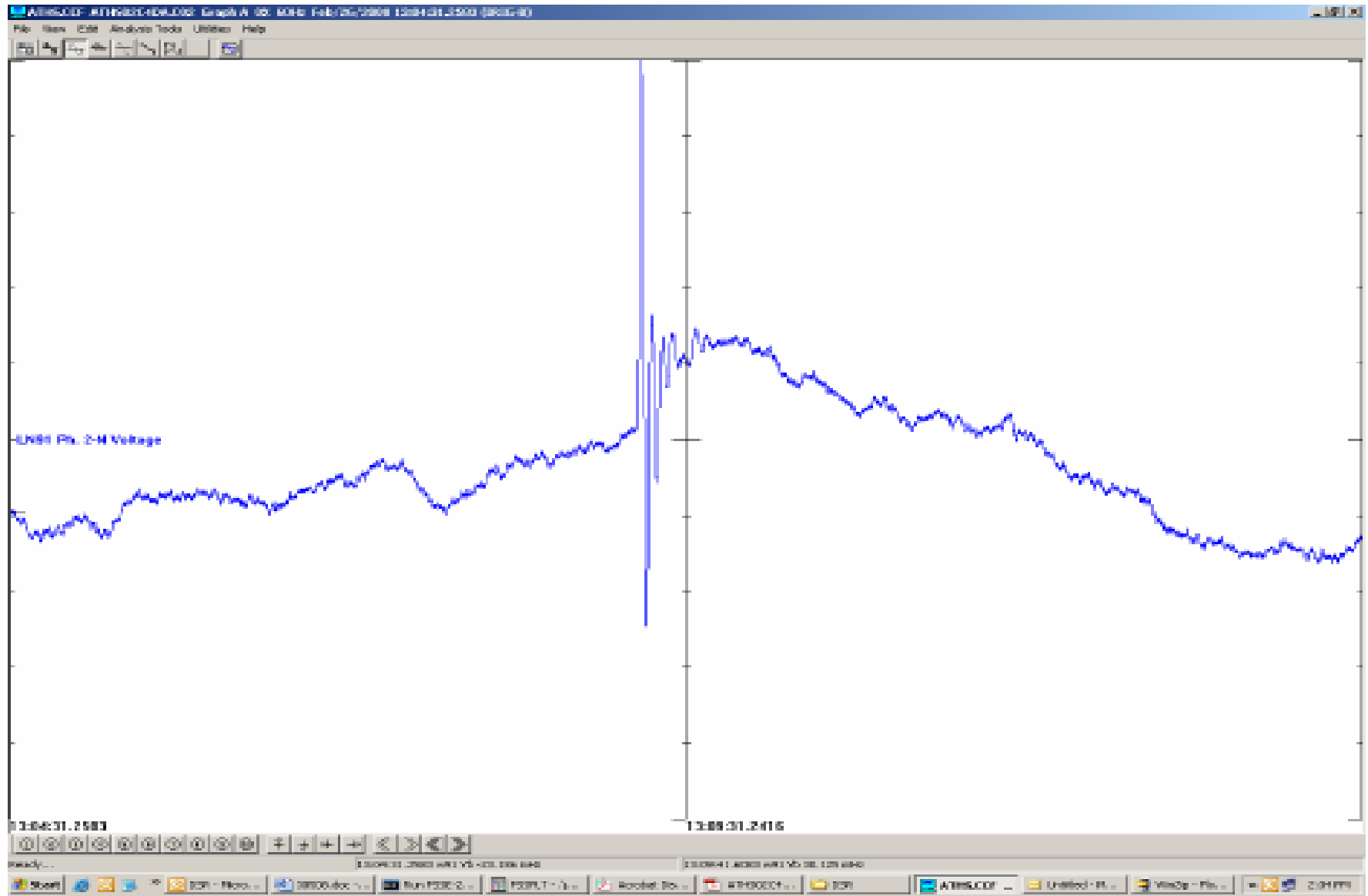
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FILE: .\Output\NIUT094C.out

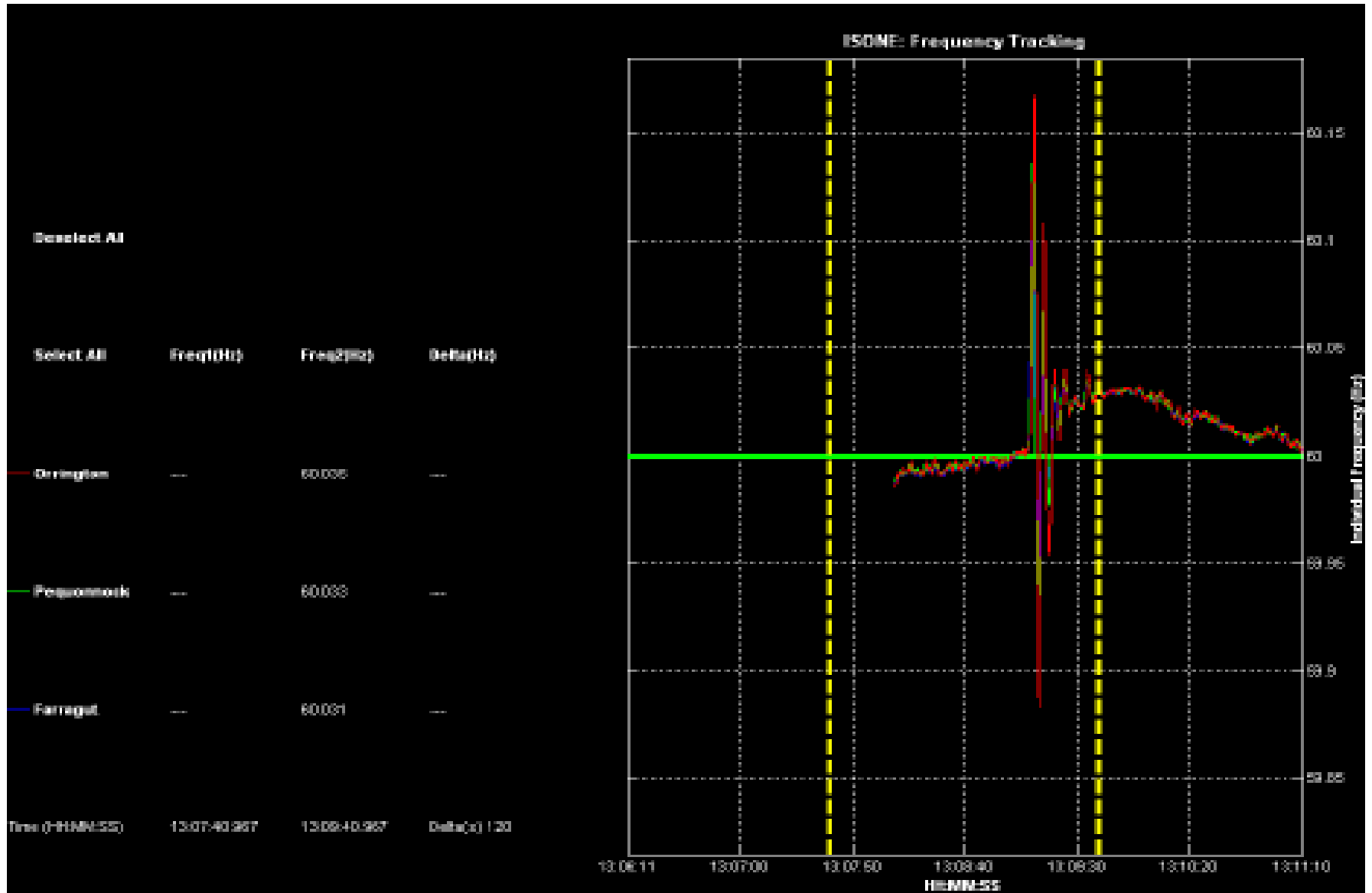
WED, FEB 27 2008 8:53

NFLD 312 & 381 LINE MW FL

# February 26, 2008 Event – Continuous Data<sub>(10 min.)</sub>



# February 26, 2008 Event – Streaming Data (5 min.)



# What We Have Learned

- Triggered recording
  - Frequency based triggers detect almost all events that other triggers might detect
    - *Sufficient to capture data for events of interest.*
  - Oscillation based trigger sometimes captures events that frequency based trigger does not
  - Oscillations usually have minor impact on the bulk power system
  - Data recorded at speeds higher than once per cycle provide additional useful information for event reconstruction and model verification.
  - Knowledgeable user can visually identify events that are of concern

# What We Have Learned (continued)

- **Continuous Recording**

- Augments trigger based recording
  - Provide ability to see long term trends
  - Assures availability of data for all time periods
  - Enables wide area visualization of events that trigger based recording might miss.
  - Supports real-time, near-real-time and off-line applications
- Multi-stream capability enhances event reconstruction

# Further Research & Development

- **Establish Phasor Data Concentrator at ISO-NE**
  - Relieve TVA of responsibility for New England data
- **Advanced analysis within New England**
  - Improved real-time security margins
- **Impact of external disturbances on New England**
  - NE power system is at a corner of the Eastern Interconnection (end of a swing phenomenon).
  - Phasor measurements may allow assessment of how large external disturbances propagate into NE.
  - Is there a set of paths of least reactance in Eastern Interconnection that is most “accommodating” to disturbances
    - *Disturbance super highway?*