



Distribution Data for FIDVR & Load Modeling

Kyle Thomas
ET Operations Engineering
Dominion Virginia Power



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— **NERC TPL-001**

- Addition of dynamic load model requirement in planning studies expected/planned

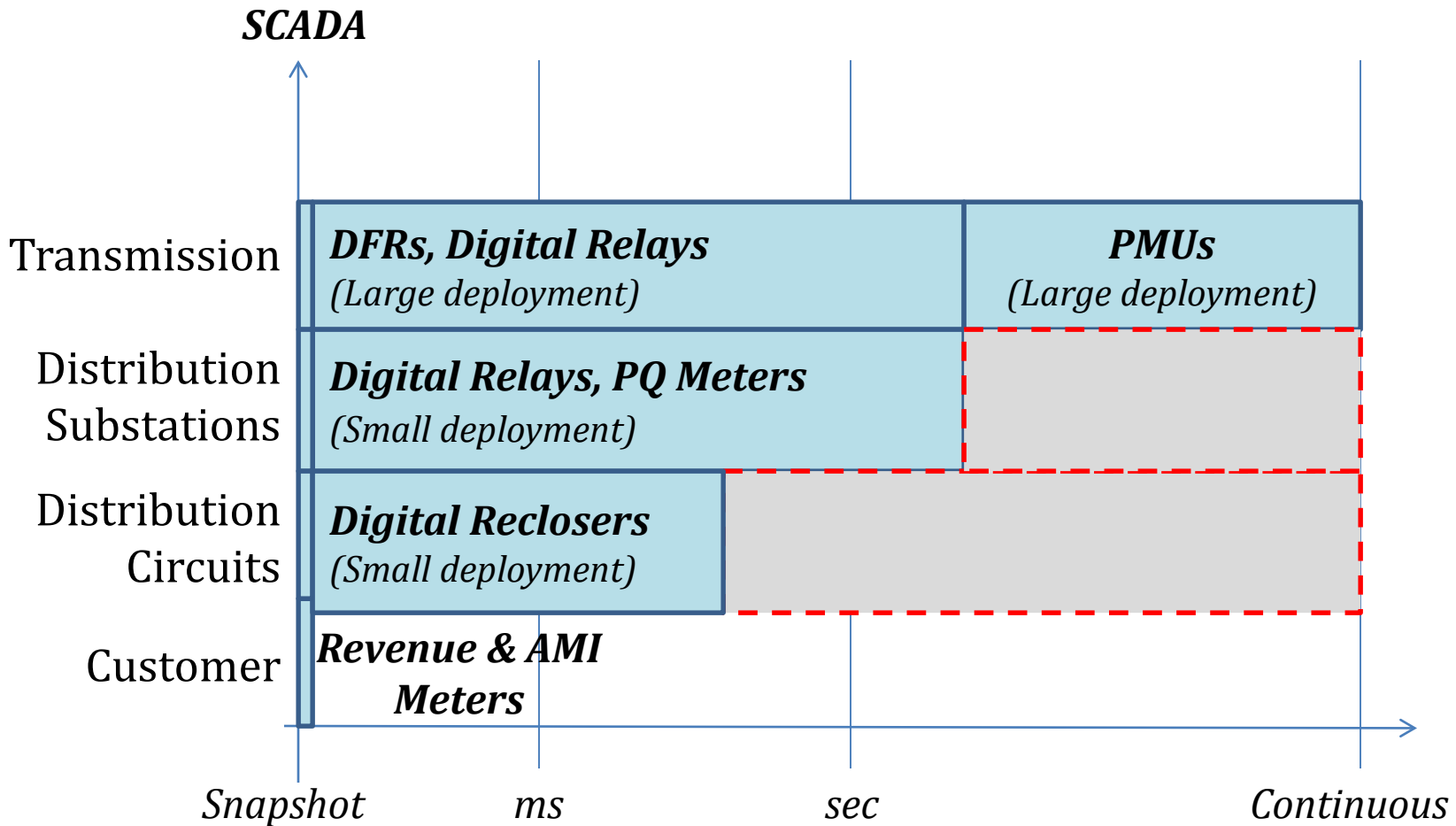
— **Initial Simulation Observations**

- Simulations using composite load model with best guess load composition parameters show widespread FIDVR on Transmission system
- Actual Transmission level monitoring shows little to no widespread FIDVR

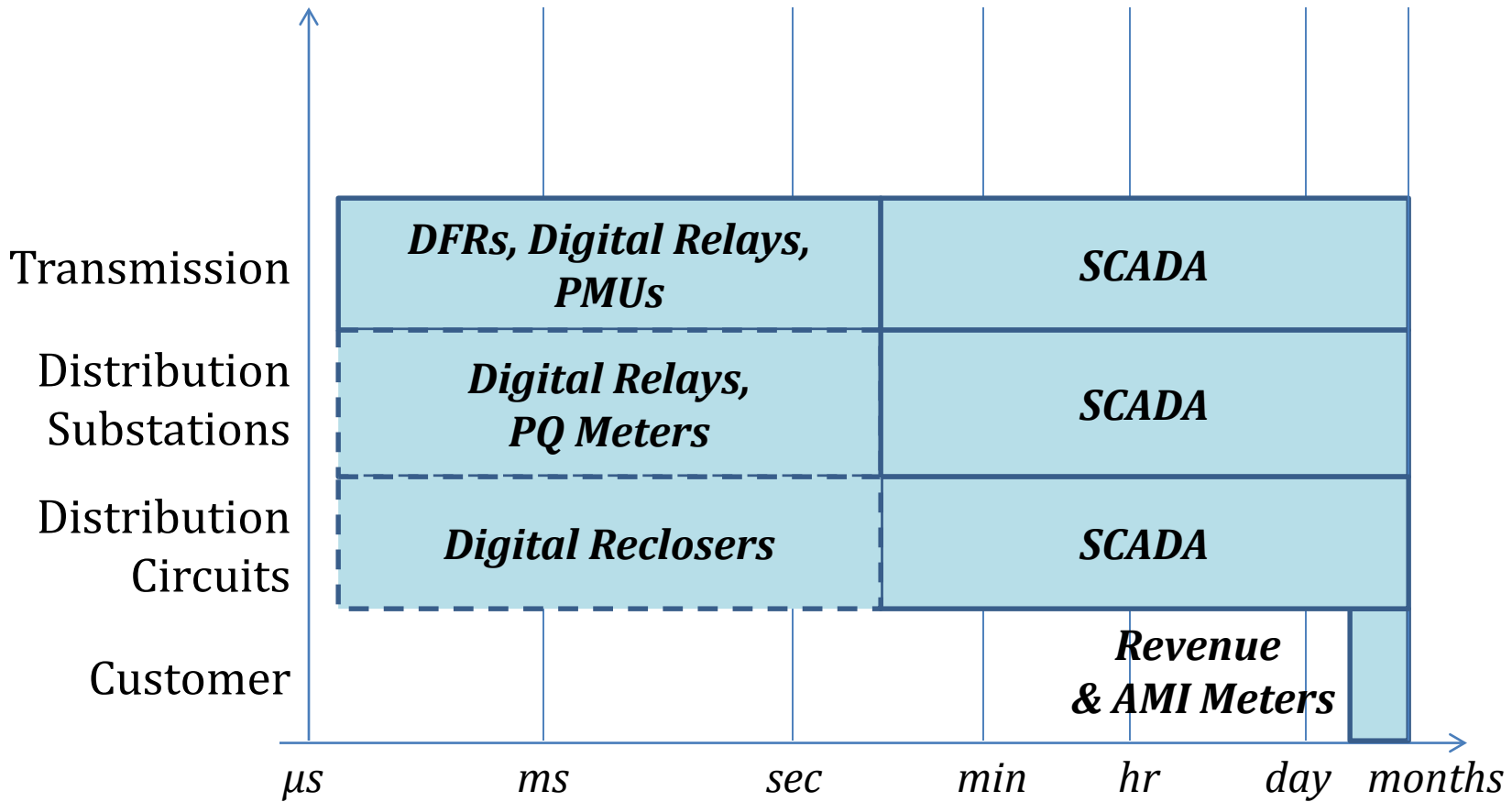
— **Goal:**

- Improve distribution level monitoring capability
- Use captured data to understand phenomena & model parameters
- Use improved model parameters to perform better informed studies

Distribution Data Gap – Capture Duration



Distribution Data Gap – Monitoring Resolution



— Portable Digital Fault Recorders (DFRs)

- 3 Portable DFRs purchased
- Placed in distribution substations throughout our system
- Can monitor 3-phase voltages and 3-phase currents at two distribution feeders
- High resolution oscillography
- Continuous RMS
- Synchrophasors
- Local storage and communications



Initial Field Installations

2012-2014



Initial Field Installations

2012-2014



- **High quality data captured over 3 summers**
 - Moved the Portable DFRs around every summer
- **Devices never failed**
- **Communications had high uptime, local storage a perfect backup**

- **Excellent service to customers**
 - No significant events captured!
 - Very few events occurred at all
 - The couple of events occurred at very end of the circuits

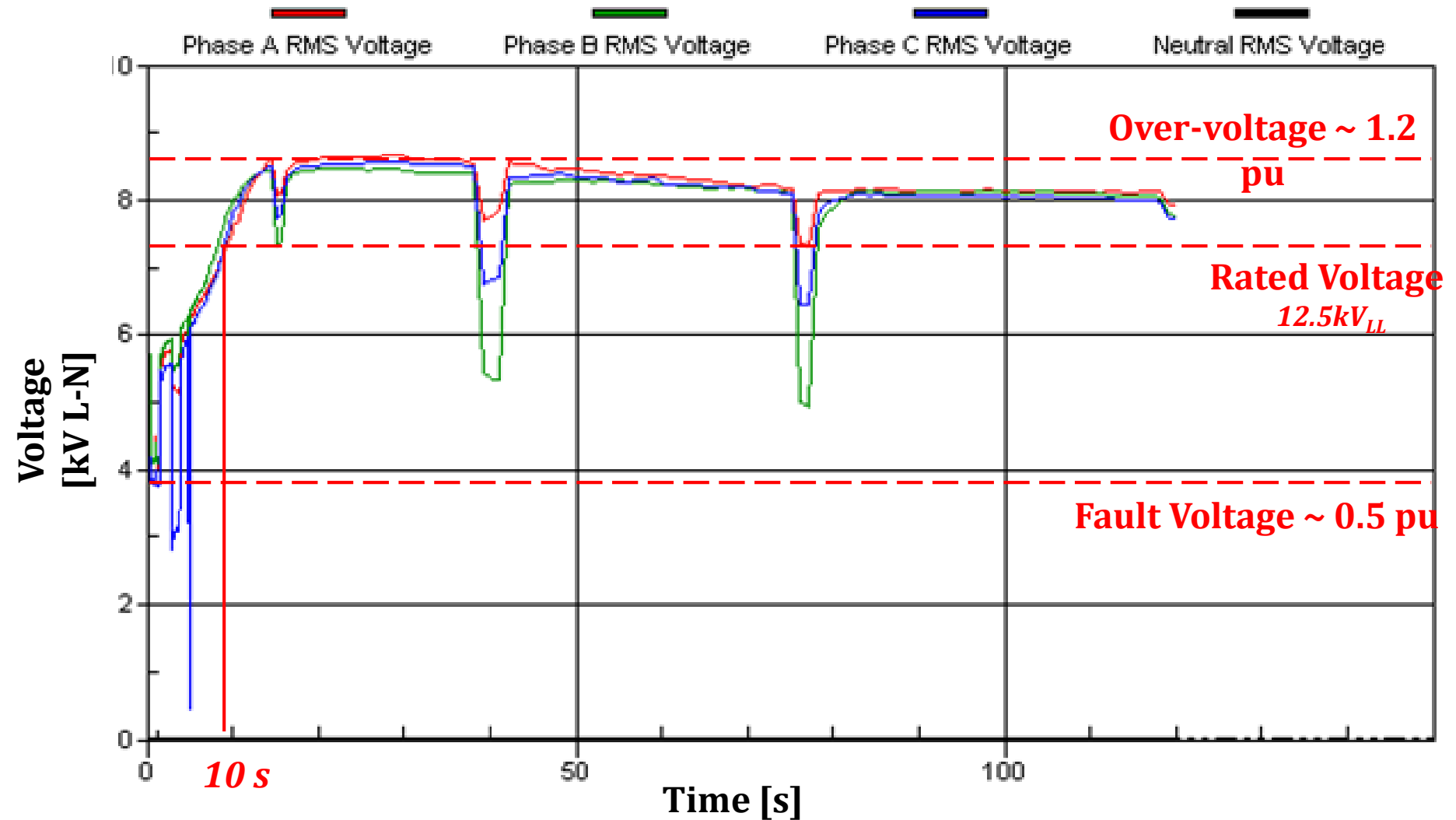
Distribution PQ Meter Data

2013 and on

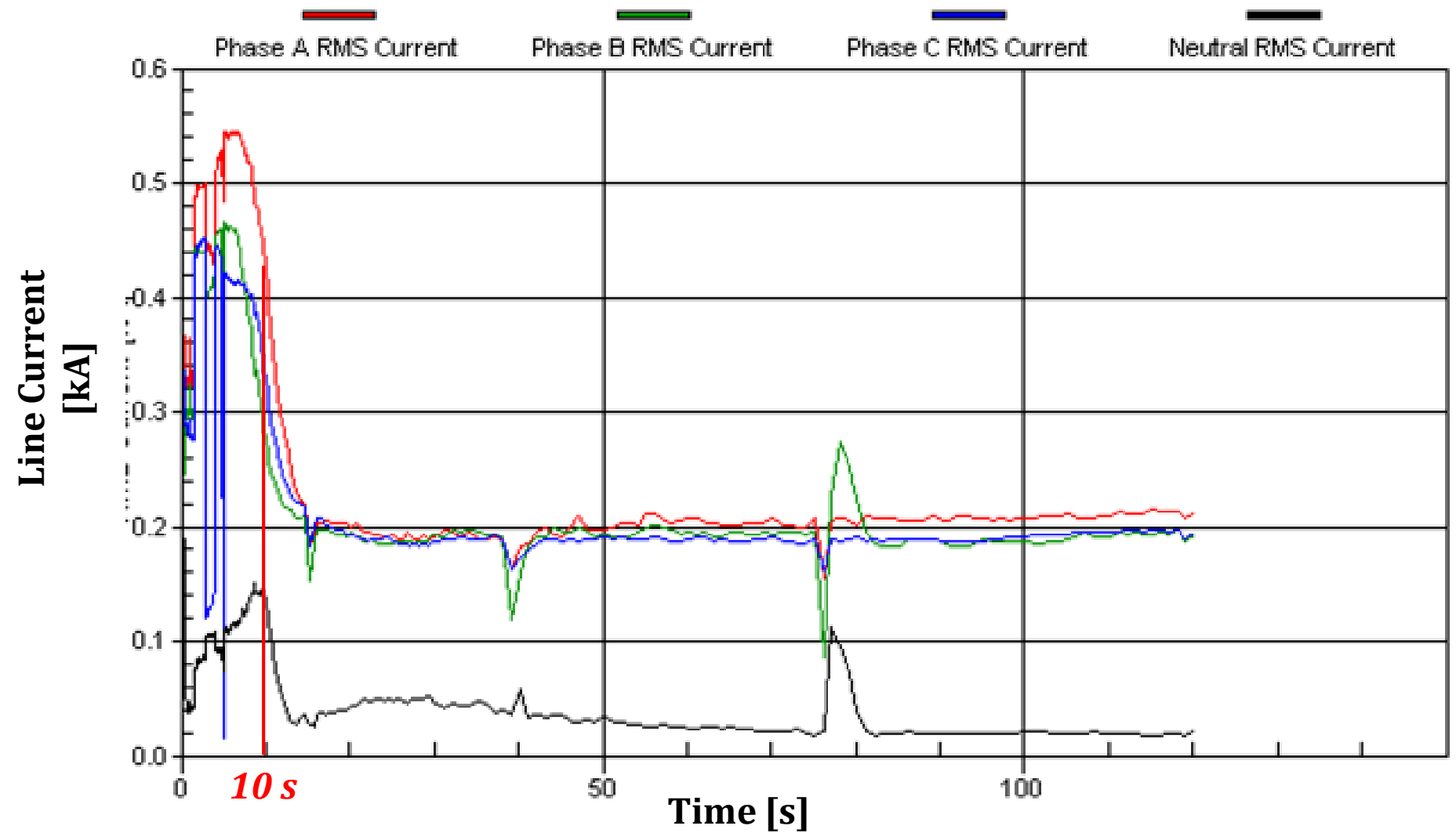


- **Power Quality meters installed on low-side of Distribution Transformers**
 - Primary purpose for helping with customer service issues
- **PQ data automatically collected via network and dial-up**
- **Historical data going back to 2005**

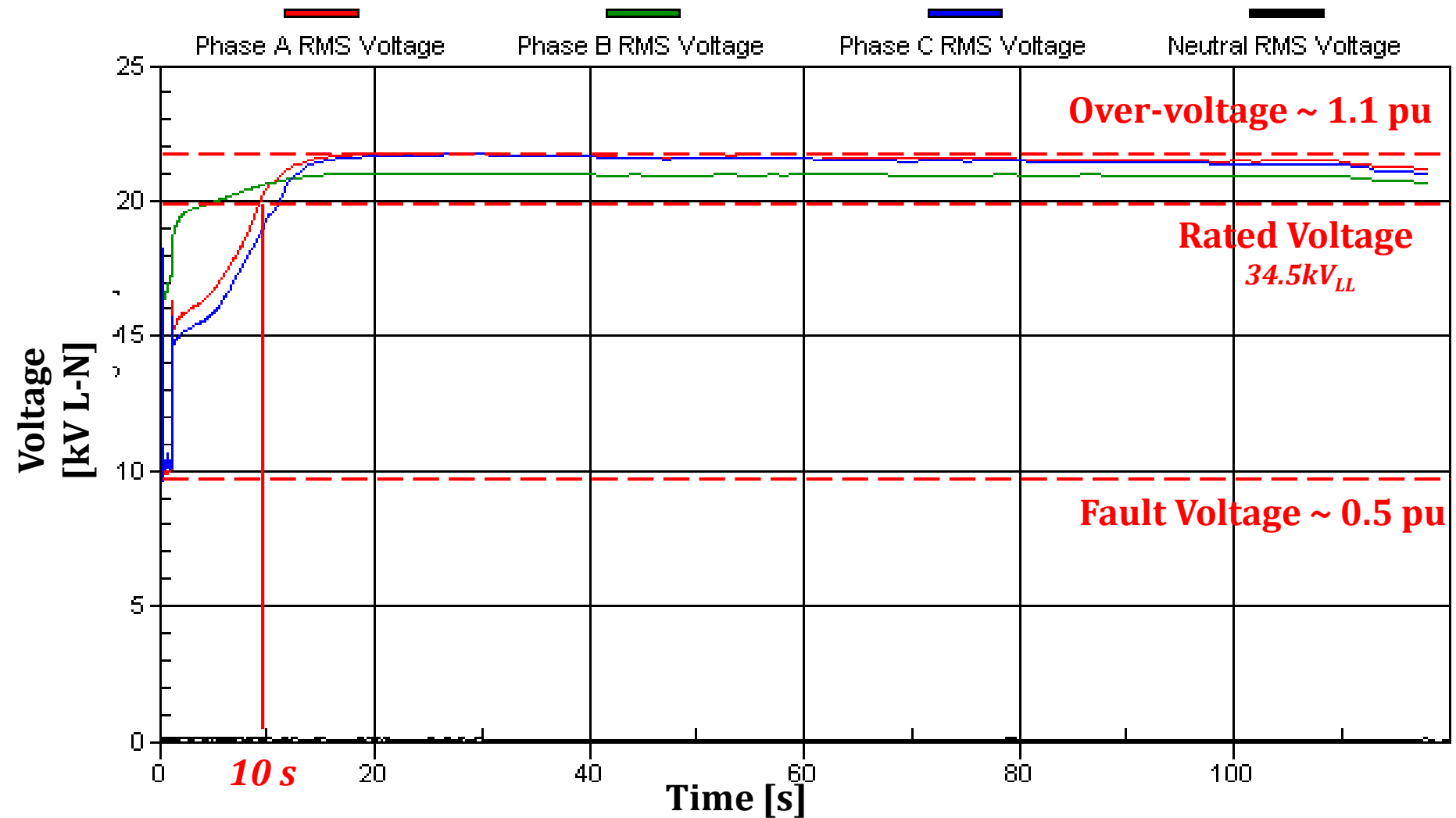
Example 1 - July 2006 4pm



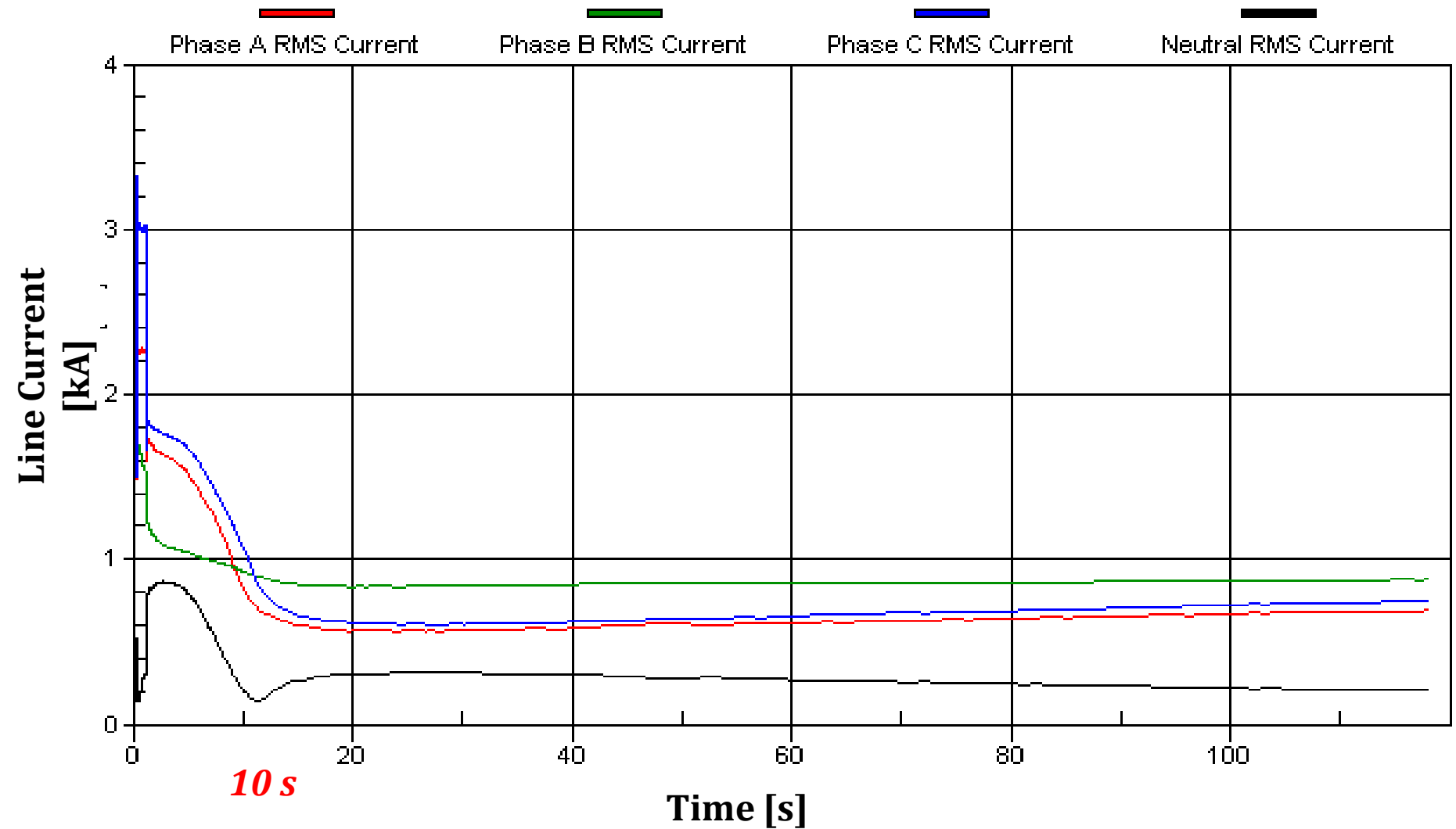
Example 1 - July 2006 4pm



Example 2 - August 2006 6pm



Example 2 - August 2006 6pm

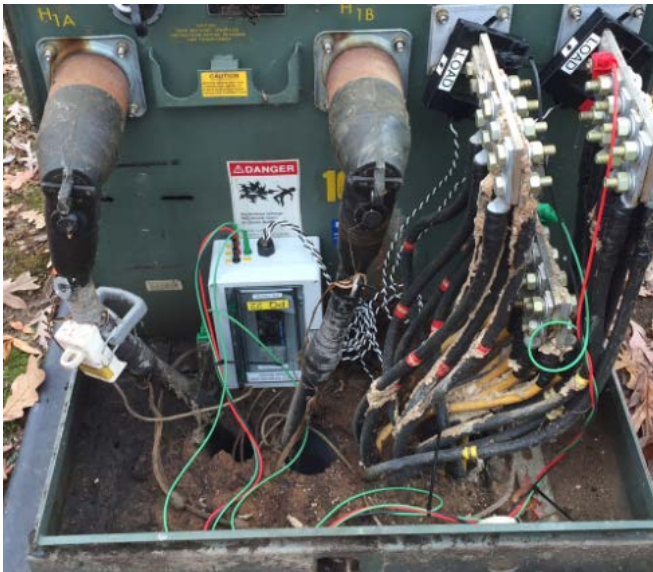


- **Did not find any FIDVR events in the PQ meter network since the 2006-2008 timeframe**
 - Problem solved?
- **Past: Magnitude trigger with duration setting**
 - Can capture longer term dynamics following faults
- **Current: Trigger on $V < 0.9$ pu, stop capture upon recovery back to 0.9 pu**
 - Very useful for fault analysis, but not for longer dynamics such as A/C motor stalling

Latest Field Installations

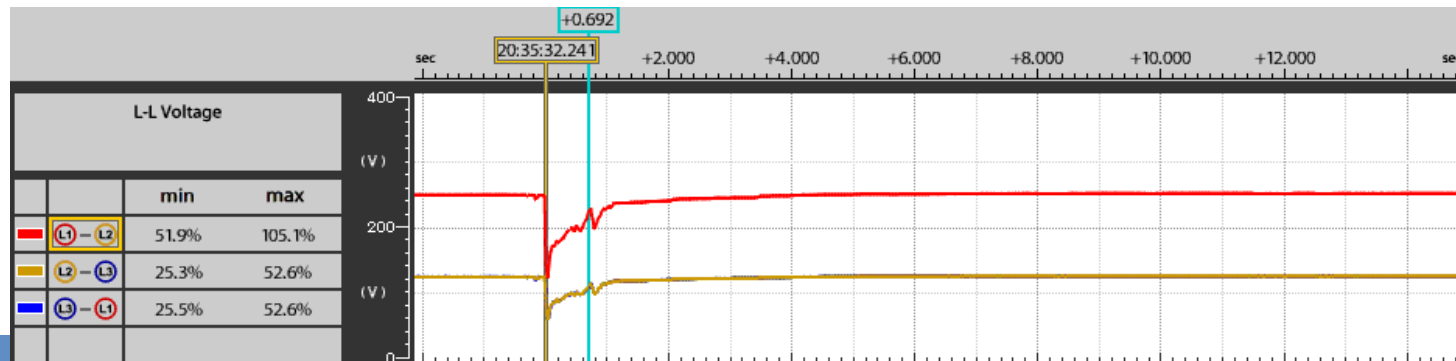
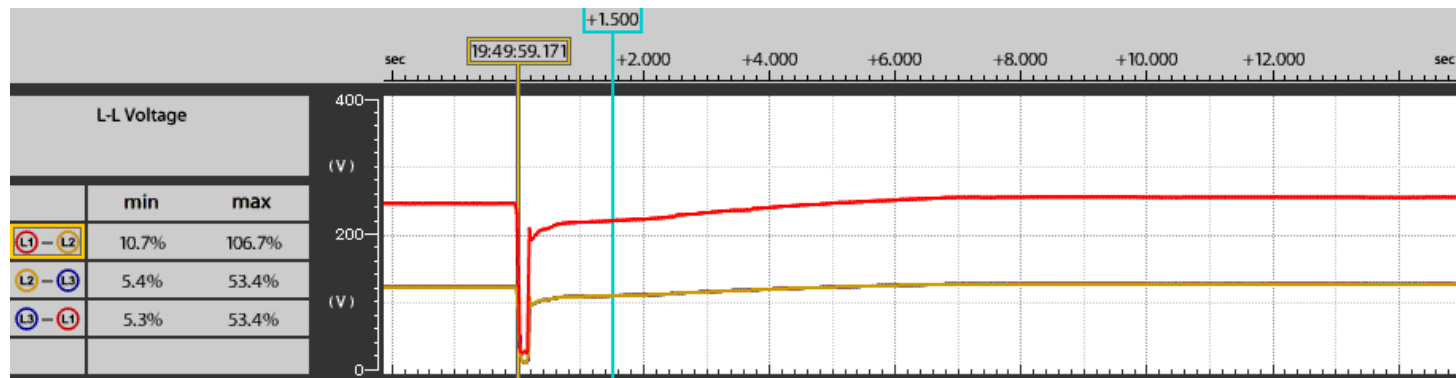
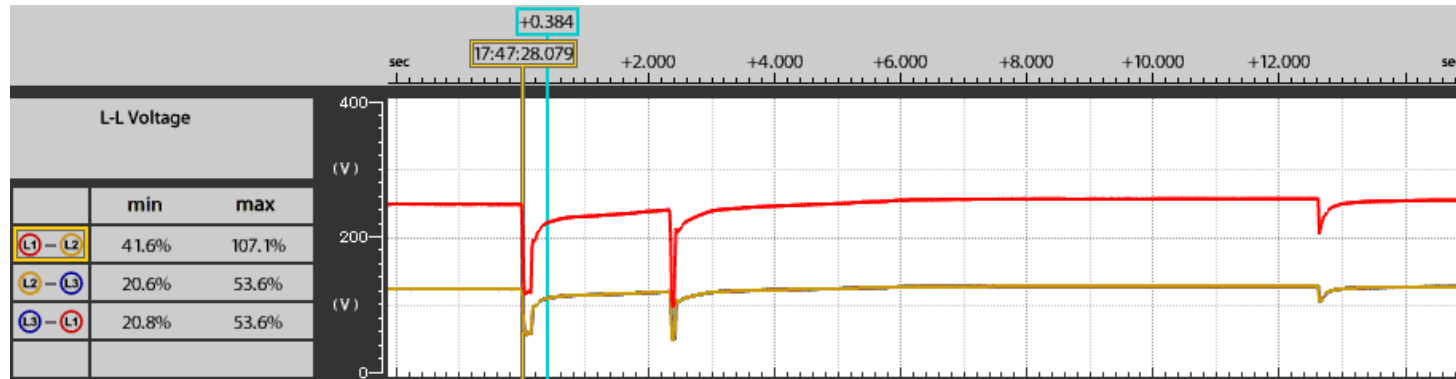
Summer 2015

- 10 PQube devices from Joe Eto & Richard Bravo
- Installed on pad mount transformers around our territory
- Selected circuits with portable DFRs and/or digital relays on distribution feeder
- Data being collected at this time



Latest Field Installations

Summer 2015



Going Forward



Standardization = Proliferation

- **Transmission PMUs as % of Total Capital Expenditure =< 0.1%**
 - \$1M/yr expected on PDC infrastructure & architecture
- **Distribution Substation Hurdles**
 - Use 300-series SEL relays (387/351) w/o PMU capability
 - Use Power Quality meters (SEL 734/735) w/o PMU capability
 - Adding PMU functionality to these devices will proliferate PMU technology into Distribution
- **Fix/standardize meter and relay settings**
- **Automate data/file collection**
- **Distributed Generation increasing need/push for high resolution data on distribution (ex: PMUs)**



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