Real time Situational Awareness of WAMS at San Diego Gas and Electric

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San Diego Gas & Electric

San Diego Gas and Electric

- Subsidiary of Sempra Energy

- Regulated public utility

- Provide safe and reliable energy service to 3.4 million consumers
  - 1.4 million electric meters
  - 800,000 natural gas meters

- 4,100 square mile service territory in San Diego and southern Orange Counties (25 cities)

- 1,800 miles of electric transmission lines and 21,600 miles of electric distribution lines
- Two compressor stations, 160 miles of natural gas transmission pipelines, 8,100 miles of distribution pipelines and 6,200 miles of service lines
- 4,500 employees

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SDG&E

GAS SYSTEM

PIPELINE

GAS T&D

GAS STORAGE

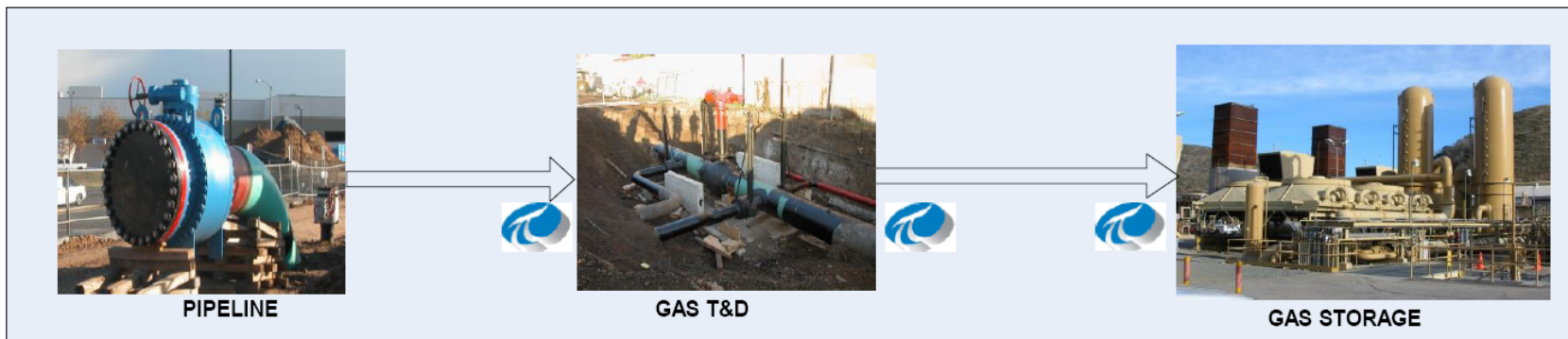**ELECTRICAL SYSTEM**

GENERATION

SUBSTATIONS

T&D OPERATIONS

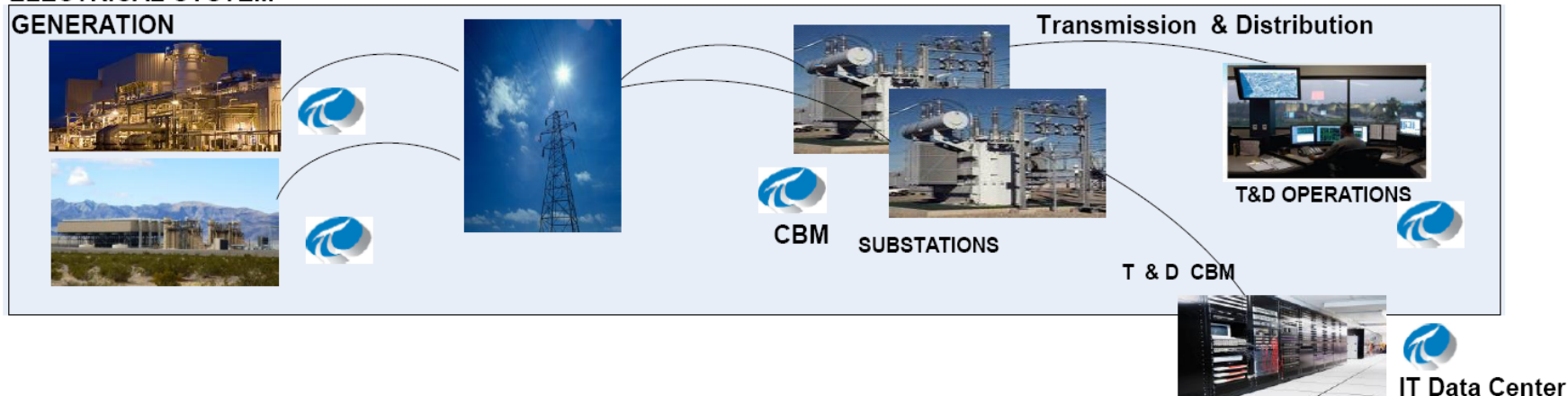T & D CBM

IT Data Center

San Diego Gas & Electric

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Wide Area Measurement System

- Goals
  - Provide improved situational awareness to operators
  - Compute critical angle differences in real time
  - Compute and display grid oscillations
  - Determine data storage requirements for future expansions
  - Evaluate new event detection and system modeling technology

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System Architecture
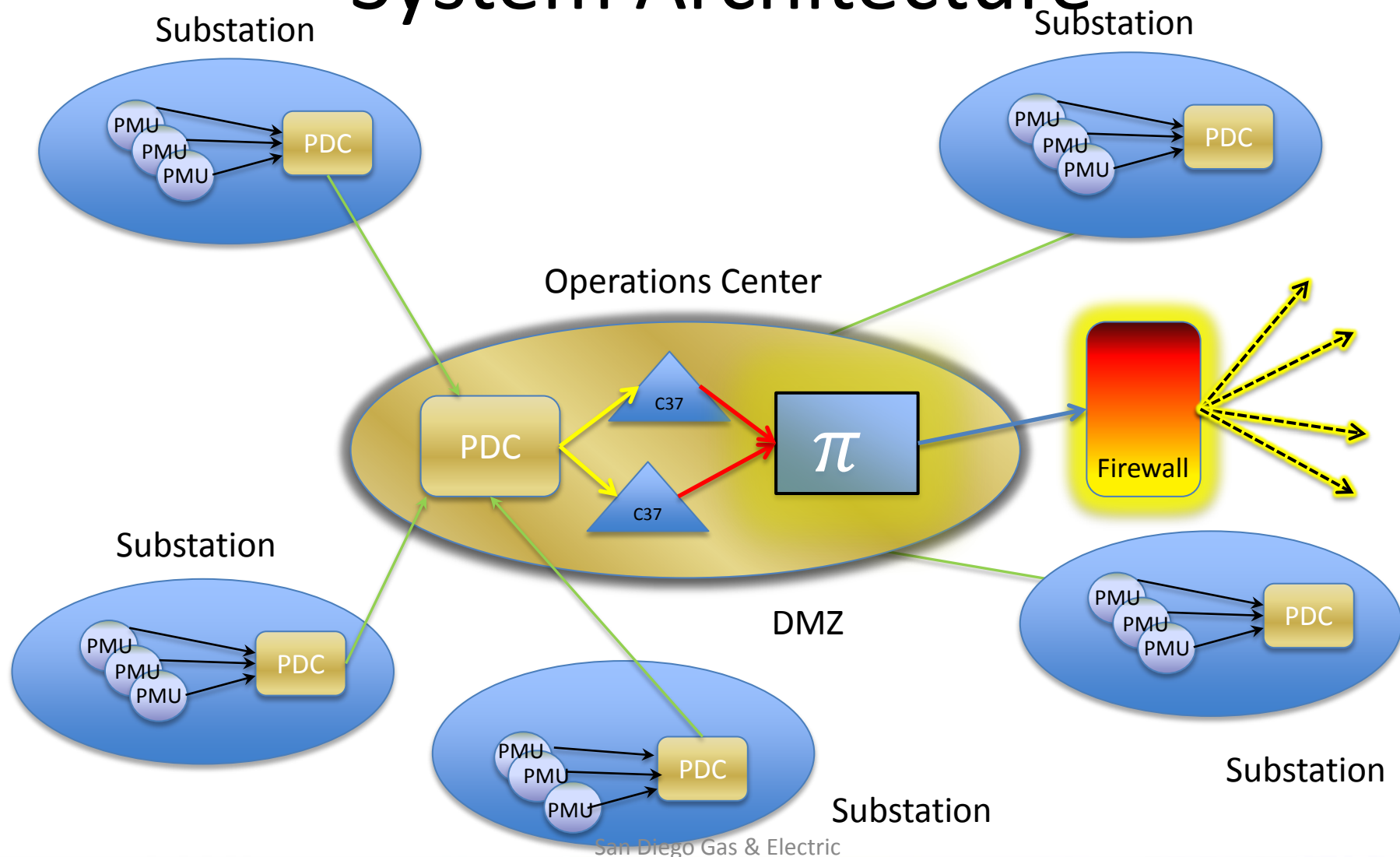
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Data volume

- ## 90 PMUs (Approaching 100 by end of 2014)
    - Each with 25 measured variables
    - 2250 measured values each 30 times per second
    - 67,500 events per second to the PI system
    - Average compression 20 percent of volume
    - Raw data = 31 GB per day
    - Compressed data = 31*0.2= 6.2 GB /day
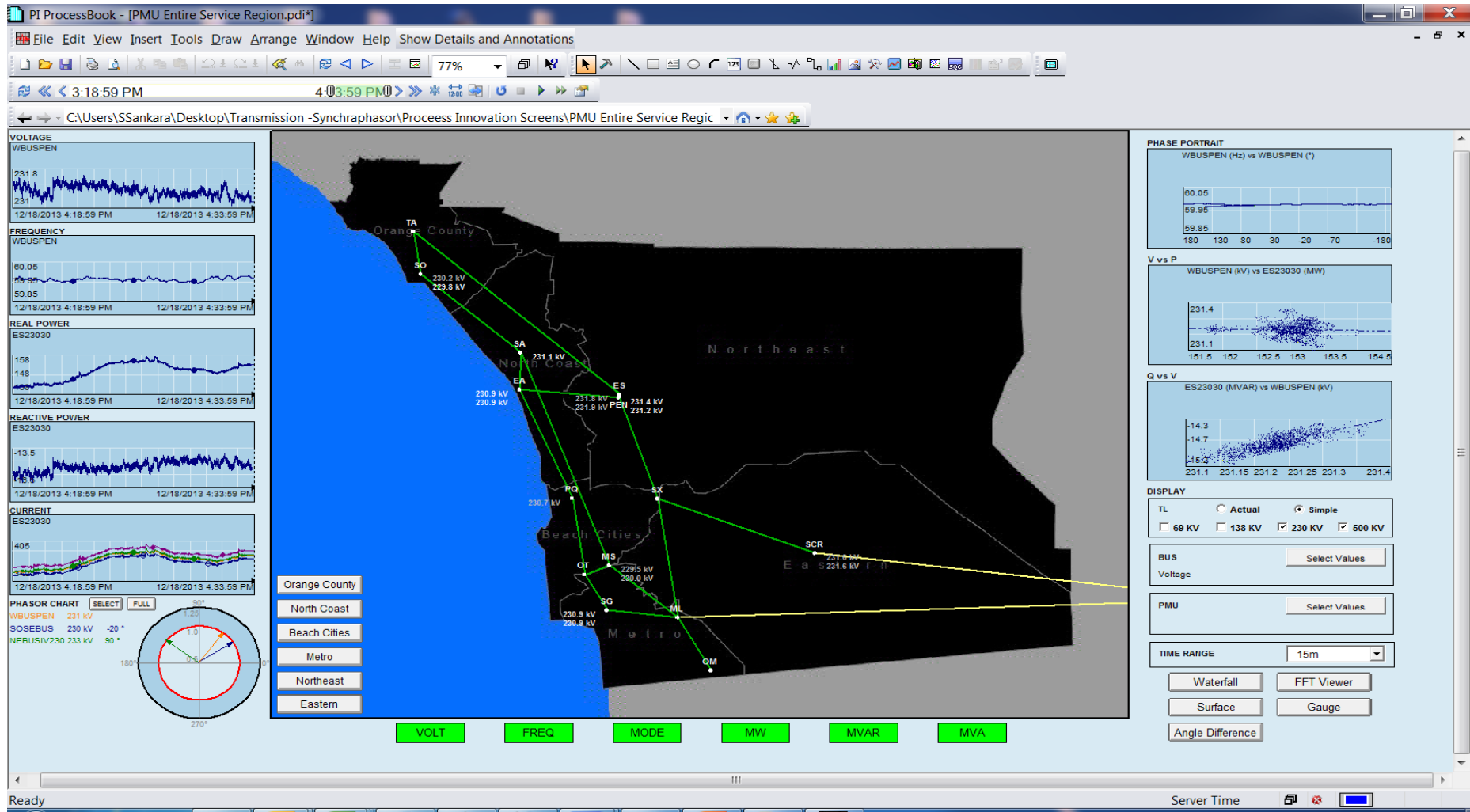
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Applications

- Overview Graphics (zoom with interactions)
- Voltage and frequency alarms
- Real and Reactive power alarms
- Island detection
- Phase angle chart
- Phase angle difference
- FFTs for oscillation
- PQ and PV charts for stability
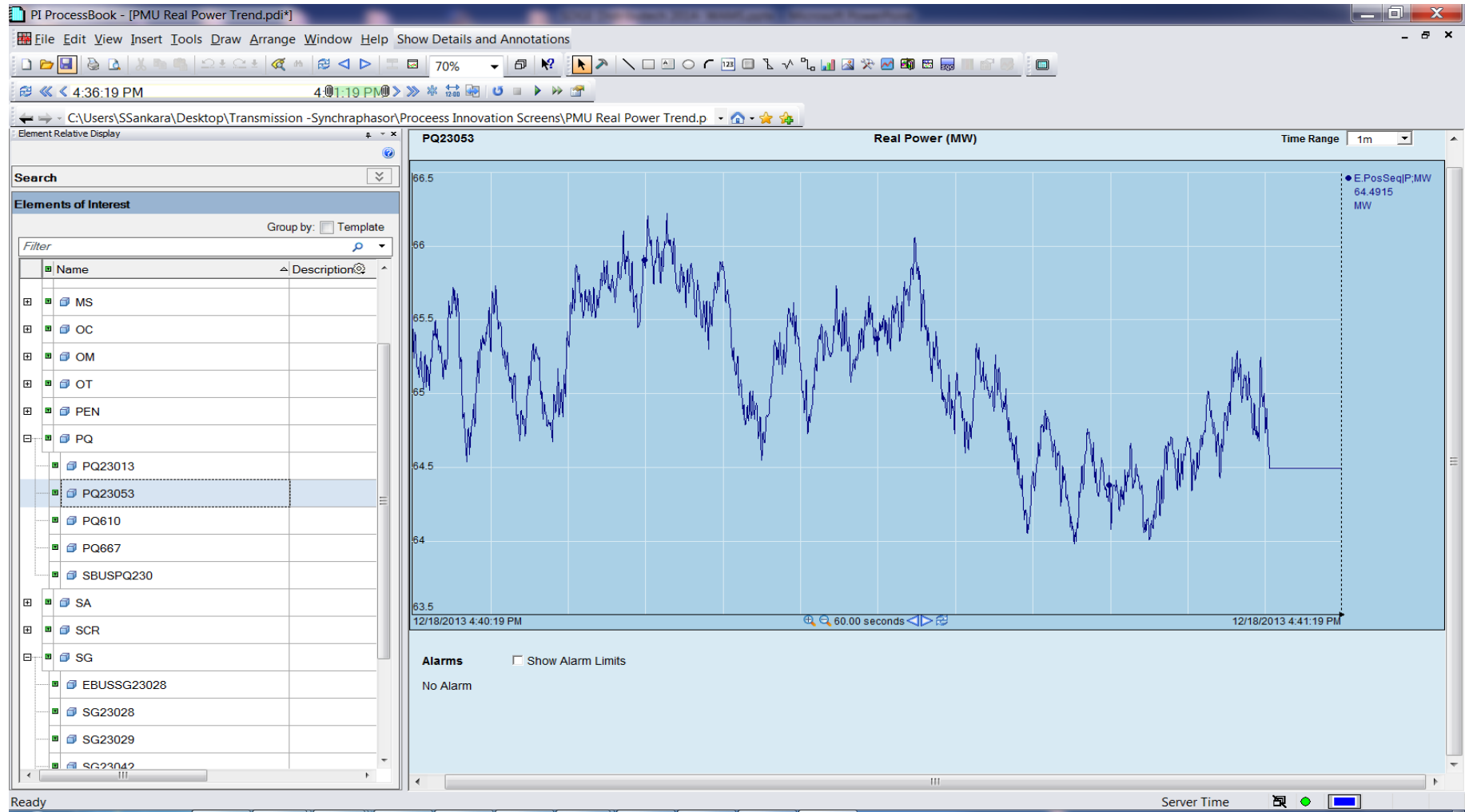
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Basic Graphics

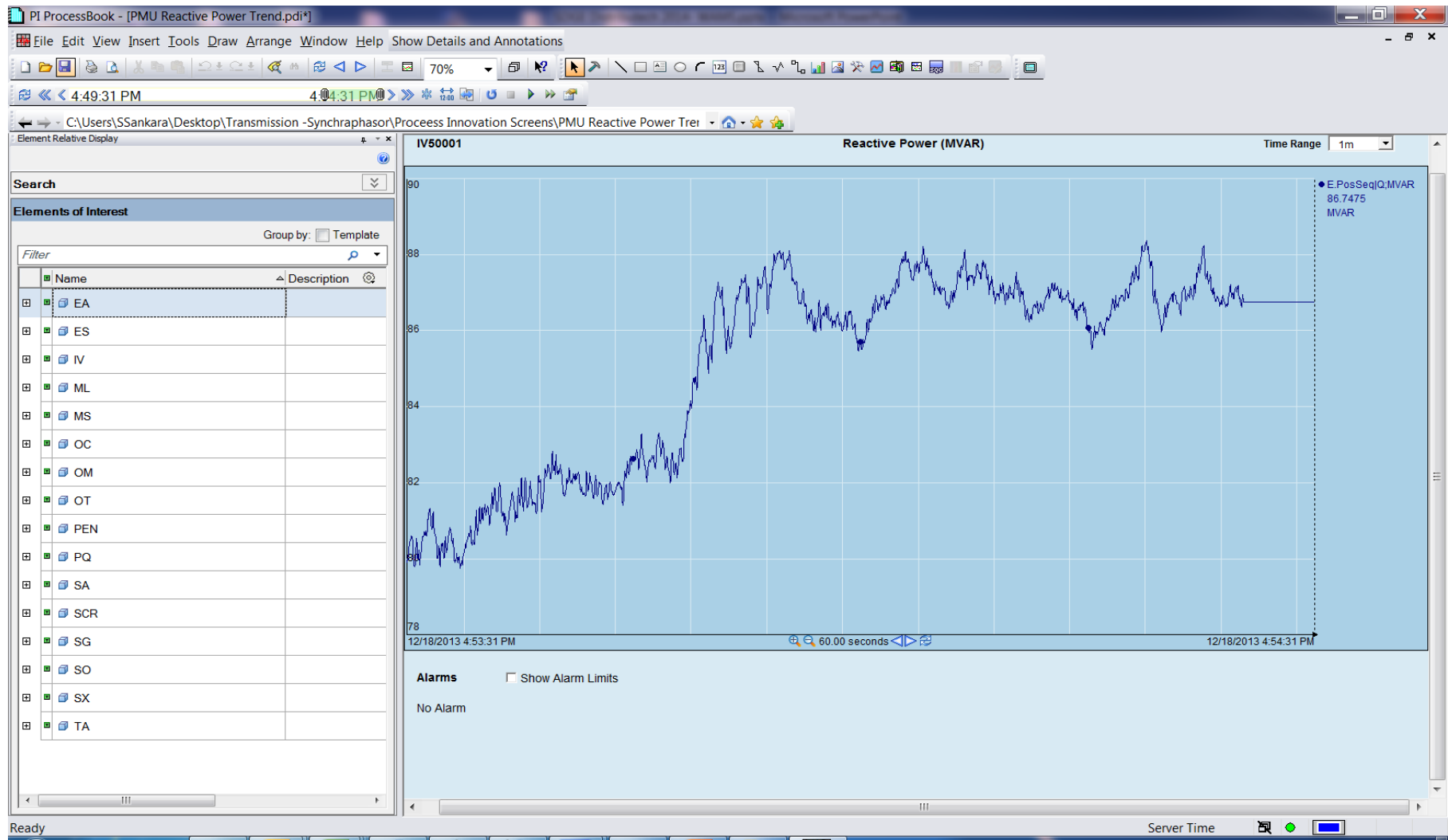San Diego Gas & Electric

Voltage and Frequency Alarms
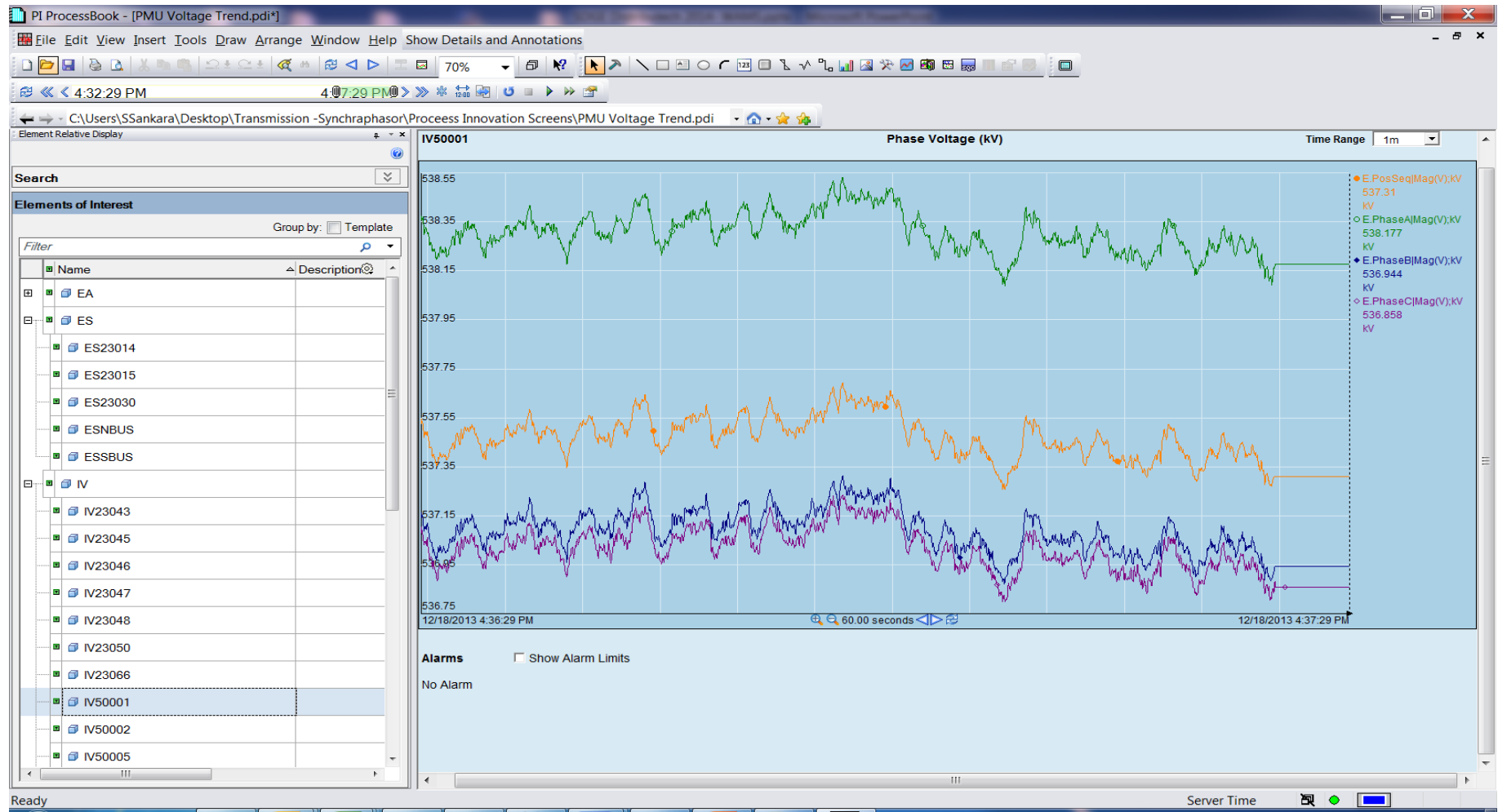
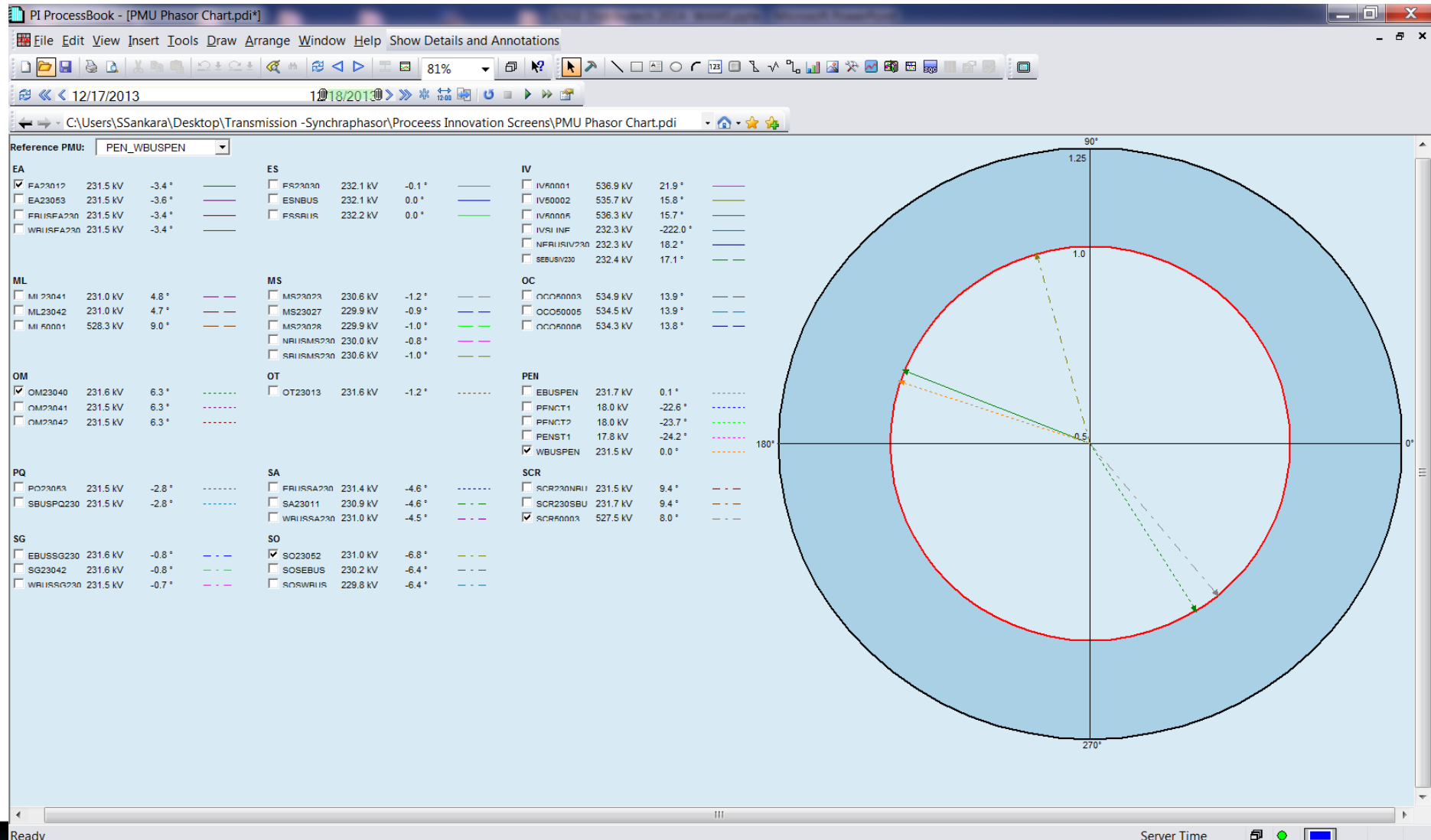San Diego Gas & Electric

Real and Reactive Power Alarms
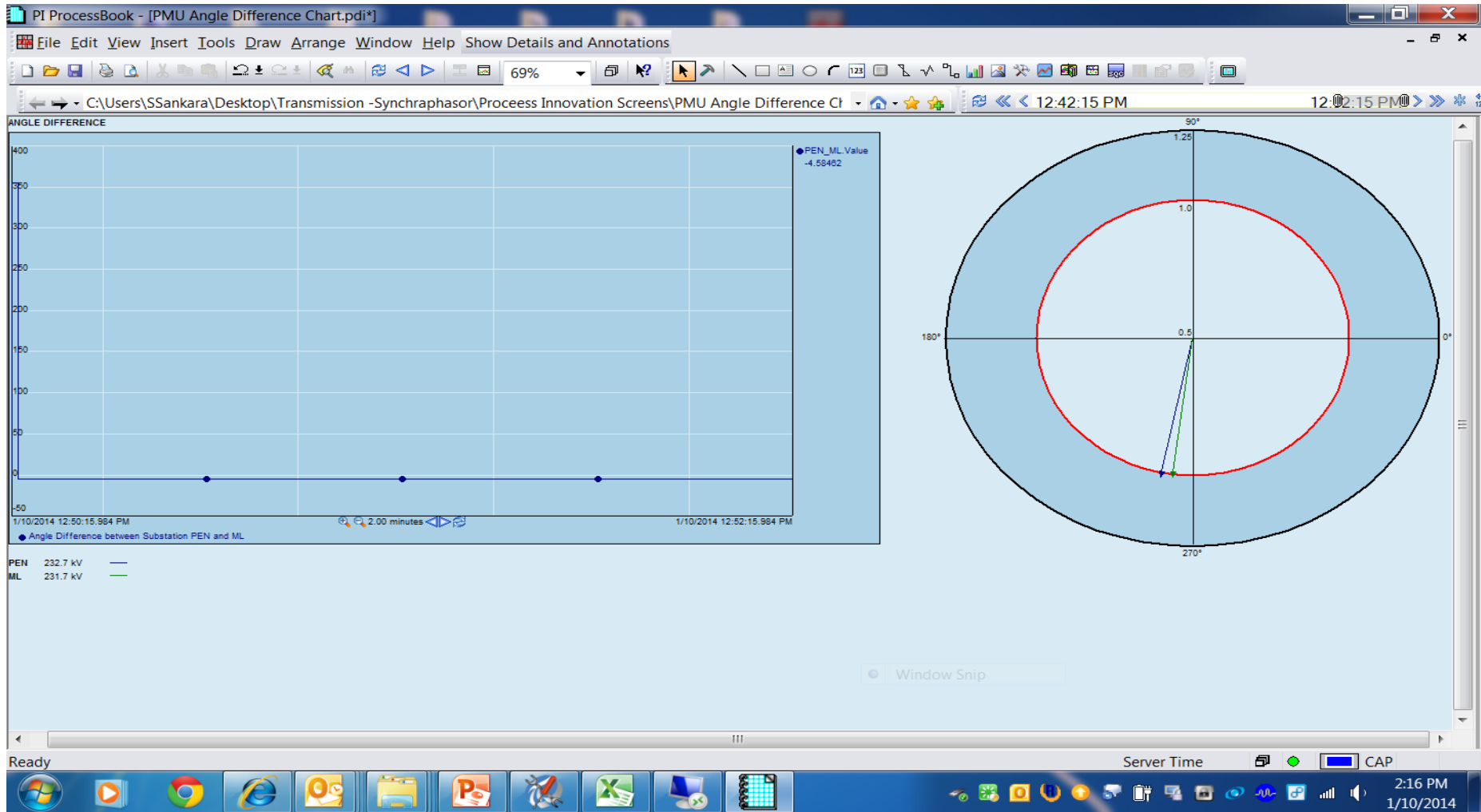

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Real and Reactive Power Alarms
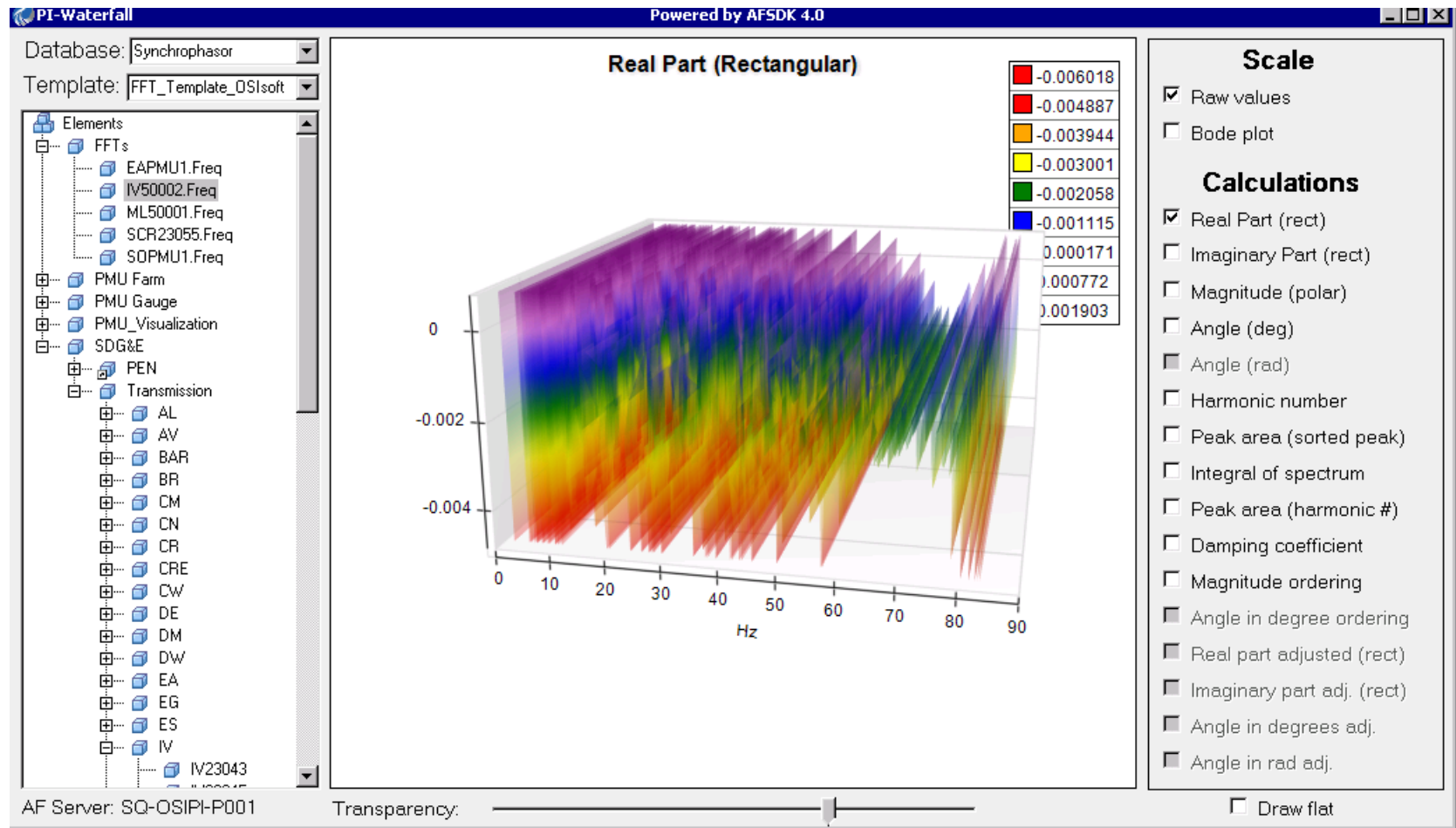

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Phase angle chart
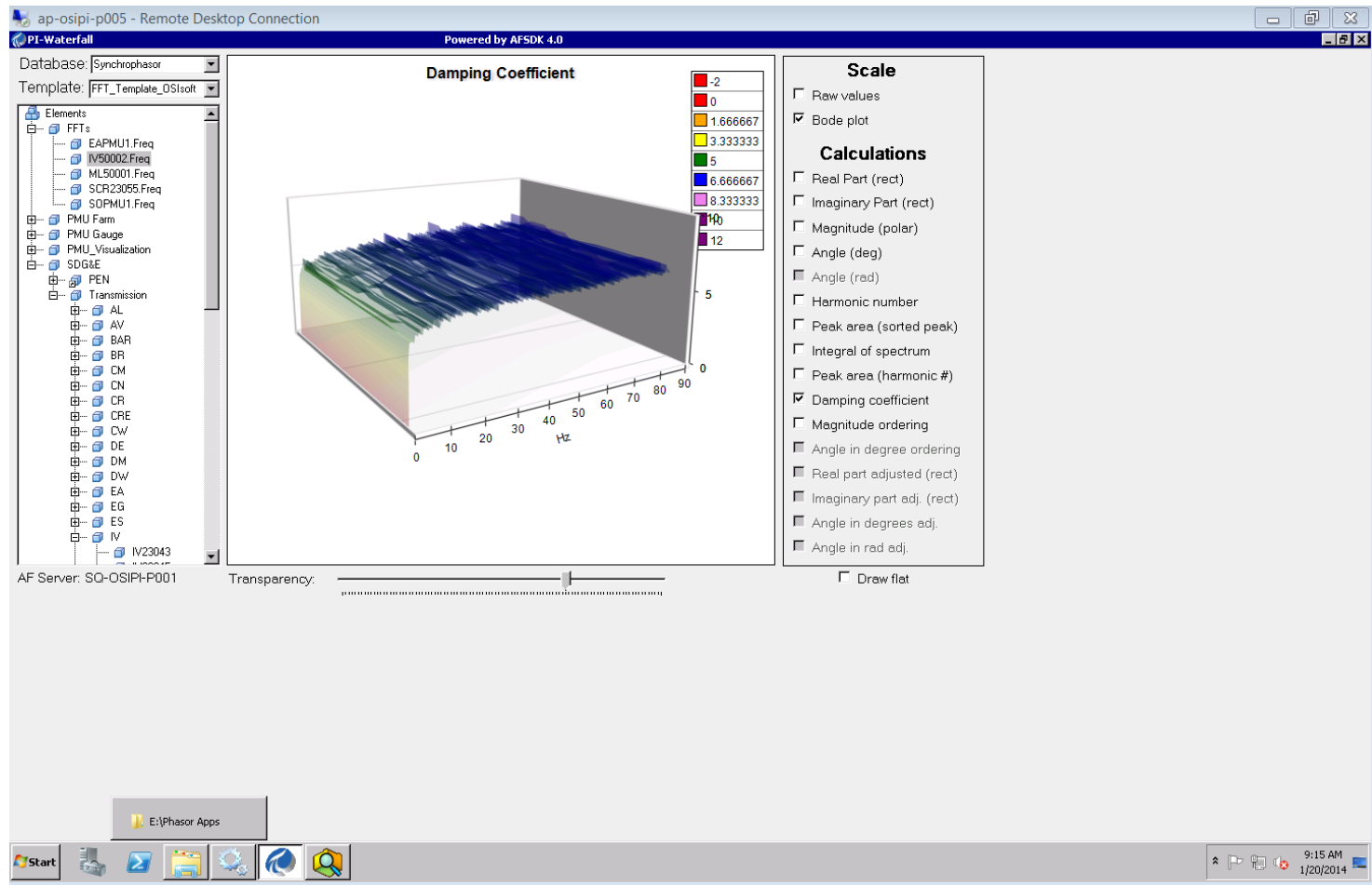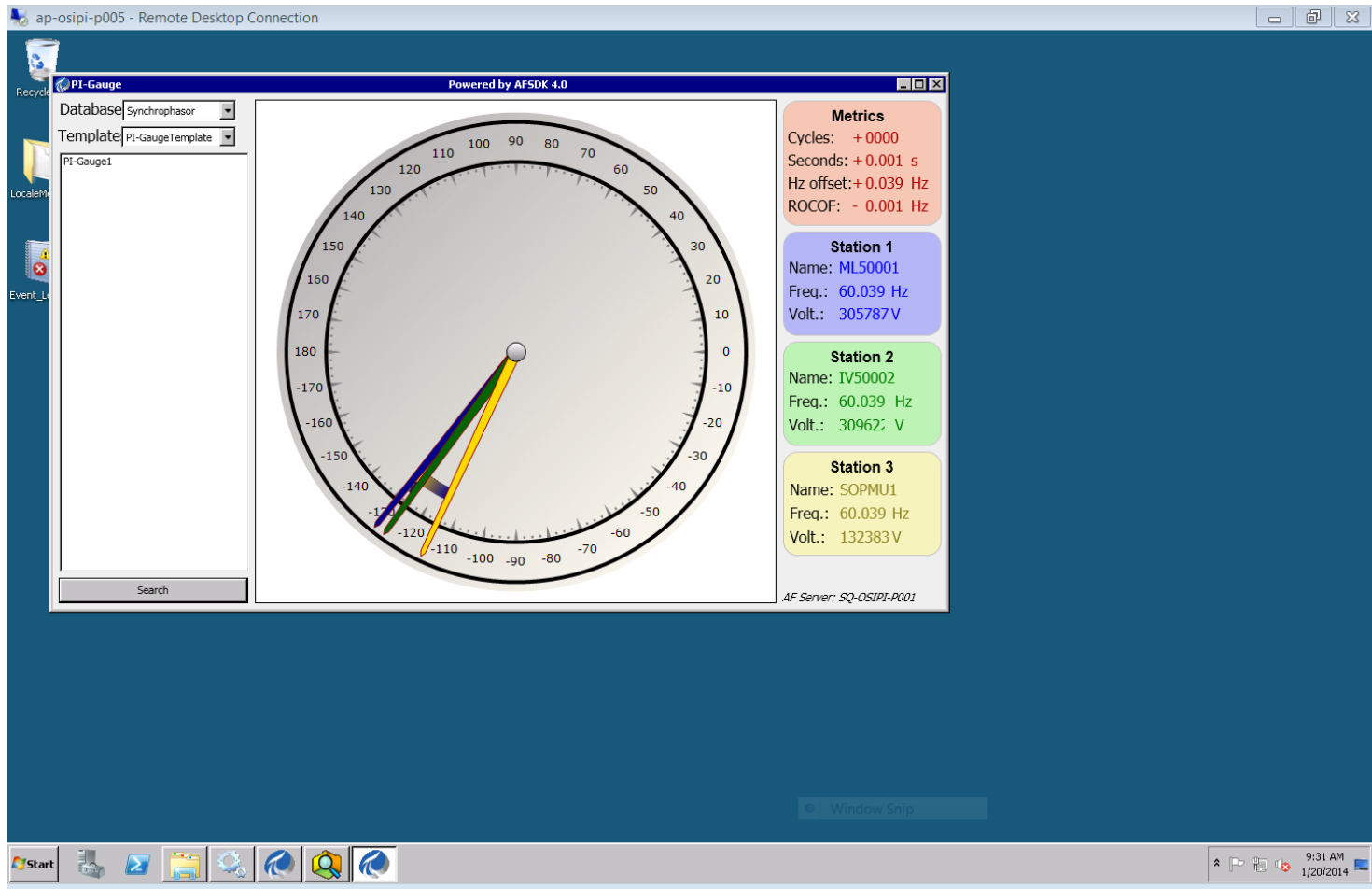
Phase angle differences

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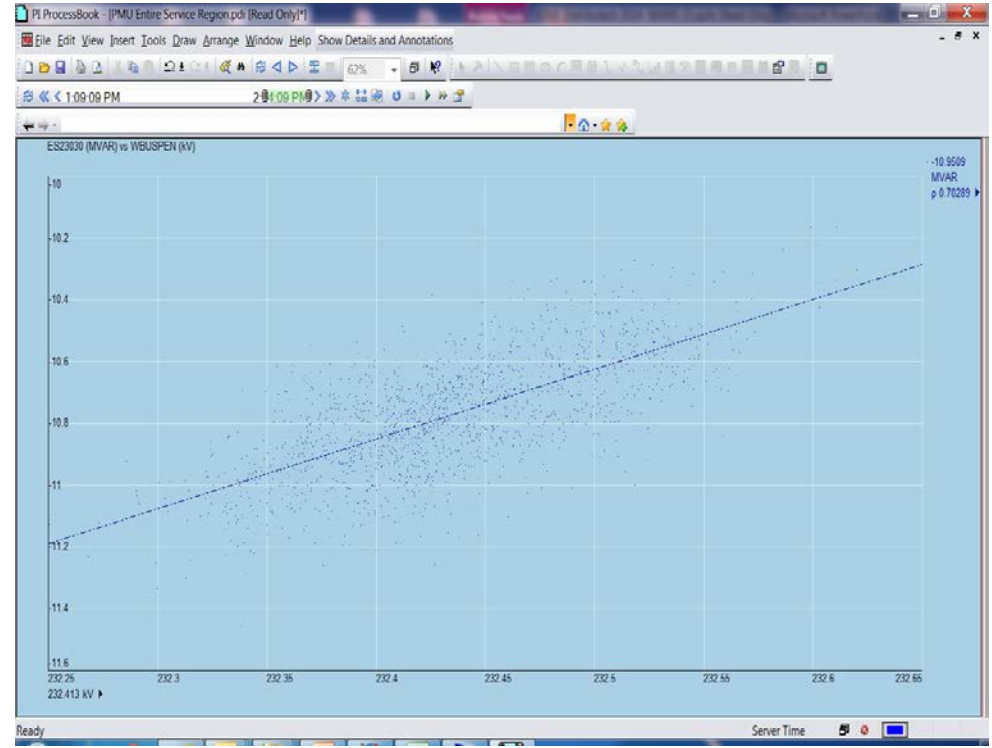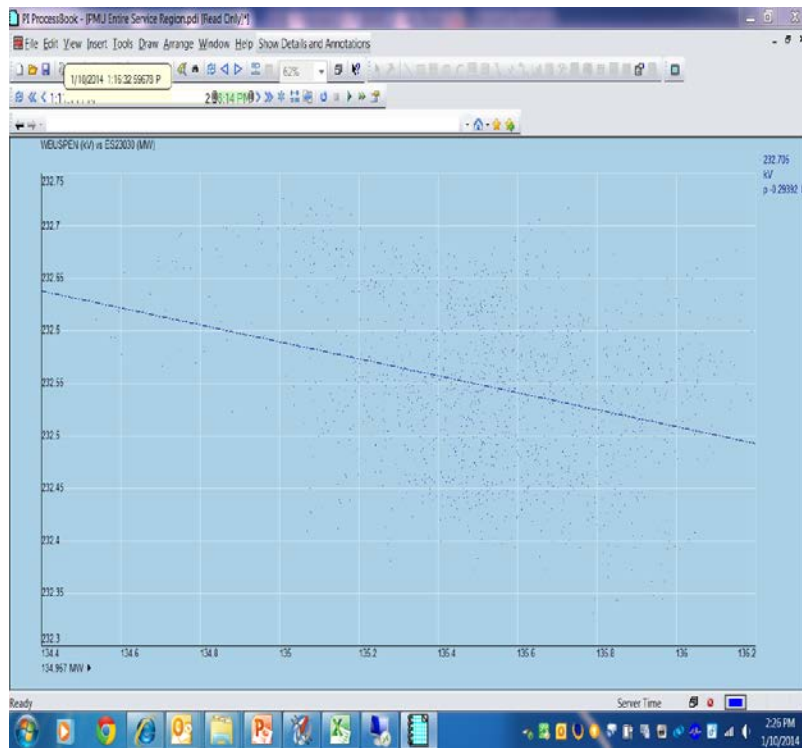
FFT for Oscillation detection

Damping surface

Phase angle chart

PQ & PV Charts

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Status

- Phase I complete
- Phase II commenced (October 2013)
- Includes:
  - Enhanced graphics
  - Automatic event detection
  - Automatic dynamic modeling (realization).

- Thank you for attending this presentation

- Questions?