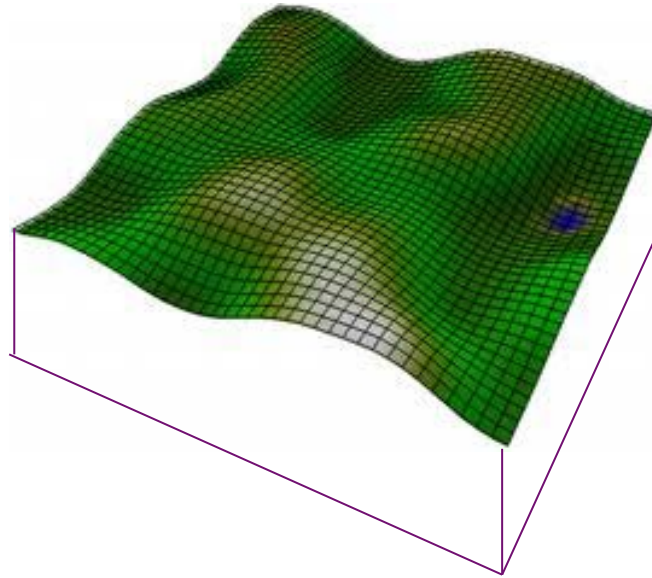
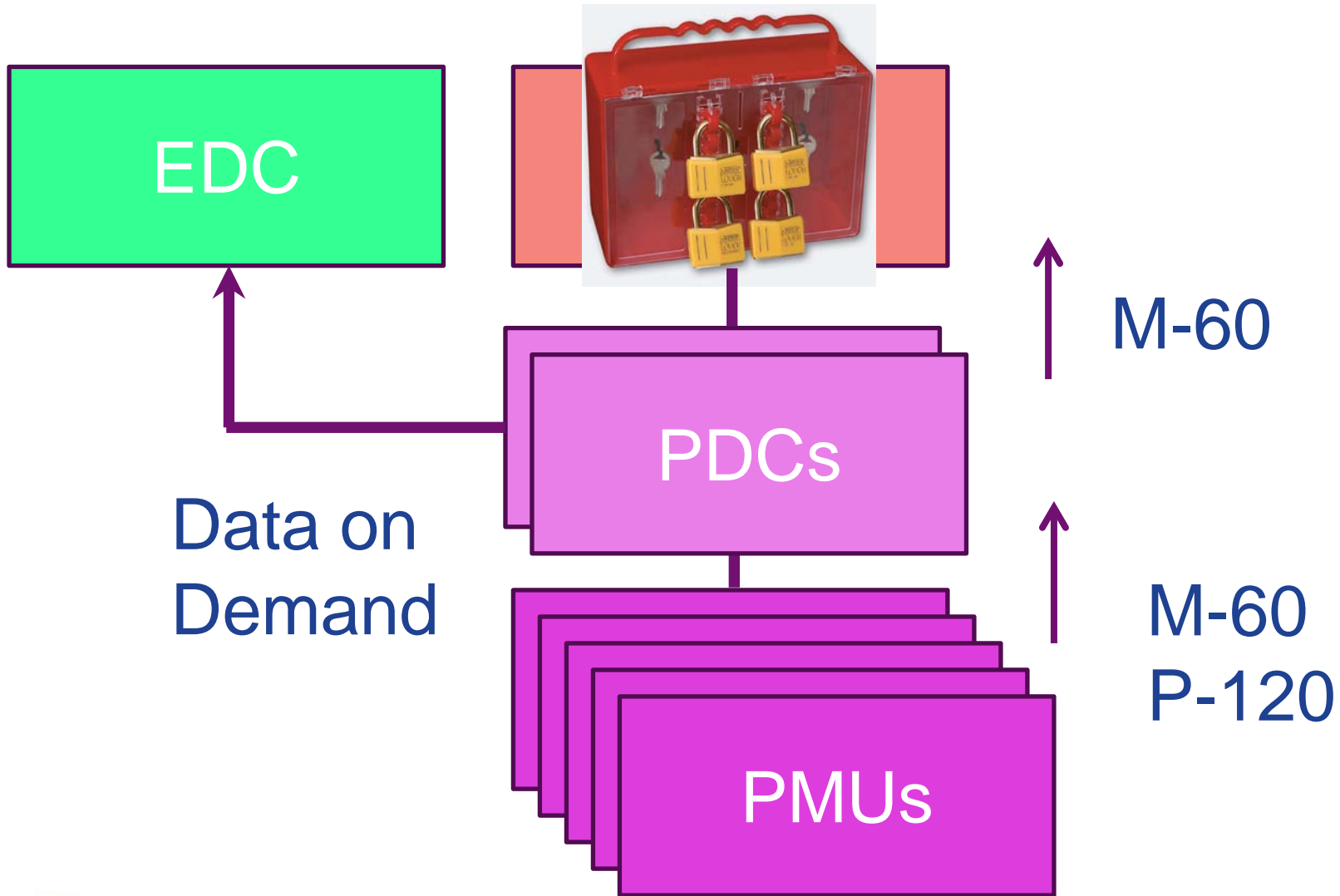


Engineering Data Concentrator (EDC) for Synchrophasors The Engineer's Sandbox



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Typical Synchrophasor Data Path



EDC Functions

- Auto collection of Evented Data
- Hi-resolution Data retrieval (e.g. – 120 measurements/sec)
- User-defined Data requests
- Real-time data
- Analytic execution

Evented Data (Per Synchrophasor Std.)

- Over/Under Voltage
- Over/Under Frequency
- Over Current
- Over-Power
- User Defined Triggers (e.g. – Line Out)

Implements NERC PRC-002 for
Disturbance Monitoring and Reporting

Event Data Capture Selection

Data Transfer Configuration

WIN-2008-01

Data Transfers

- MTN3.044

Station / PMU

Station ID / PMU Code

Station ID: MTN3

PMU ID Code: 044

Trigger Window


Pre-Trigger (sec.): 2

Post-Trigger (sec.): 3

Data Tags

Select Data Tags

- \\R2_PCM\MTN3.1005.FNOM
- \\R2_PCM\MTN3.1005.S1-IA.AI

Delete! **New!** 

Data Transfer Report

Data Transfer Detail WIN-2008-01


Transfer Details

Transfer ID	41360.5132869213	Type	Manual
Event ID	PDC 2 Min 1 Tag	Agent ID	1136
Transfer Start Date	3/27/2013 12:19:07.357	Transfer End Date	3/27/2013 12:19:10.357
Data Start Time	03/06/2013 21:04:38.000	Data End Time	03/06/2013 21:06:38.000
Pre-Trigger	0	Post-Trigger	0

Data Export

File Export Format

- CSV
- CSV Time Aligned
- COMTRADE 2013 (ASCII)
- COMTRADE 2013 (Binary)



Tags

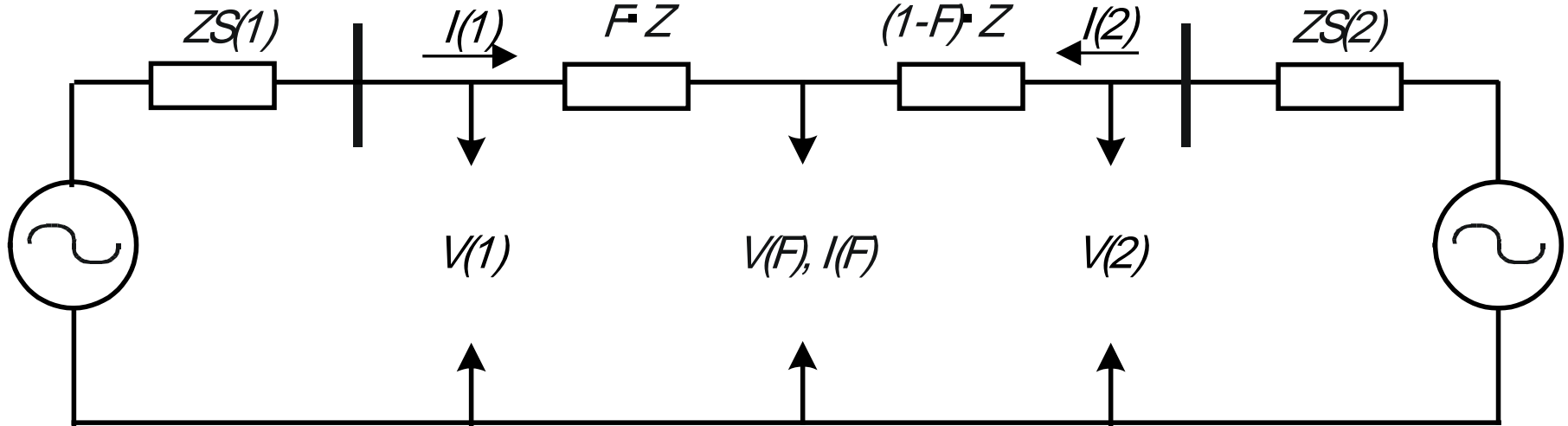
- R2_PCM
 - V5PMU09_2_1
 - 519
 - PHASOR_CH_2_VB.VM

Focused Captures:

- Event & Line Out:
 - Capture Synchrophasors from both ends of the line for Fault Calculation – X seconds before the trigger and Y seconds after the trigger

Synchrophasor-Enabled Double Ended Fault Location

Location



The composite signal is created using Clarke transform in such a way that regardless of the fault type, there is a disturbance in the composite signals.

$$V = \frac{2 \cdot V_A - V_B - V_C}{3}$$



New Double-Ended Fault Location Algorithm

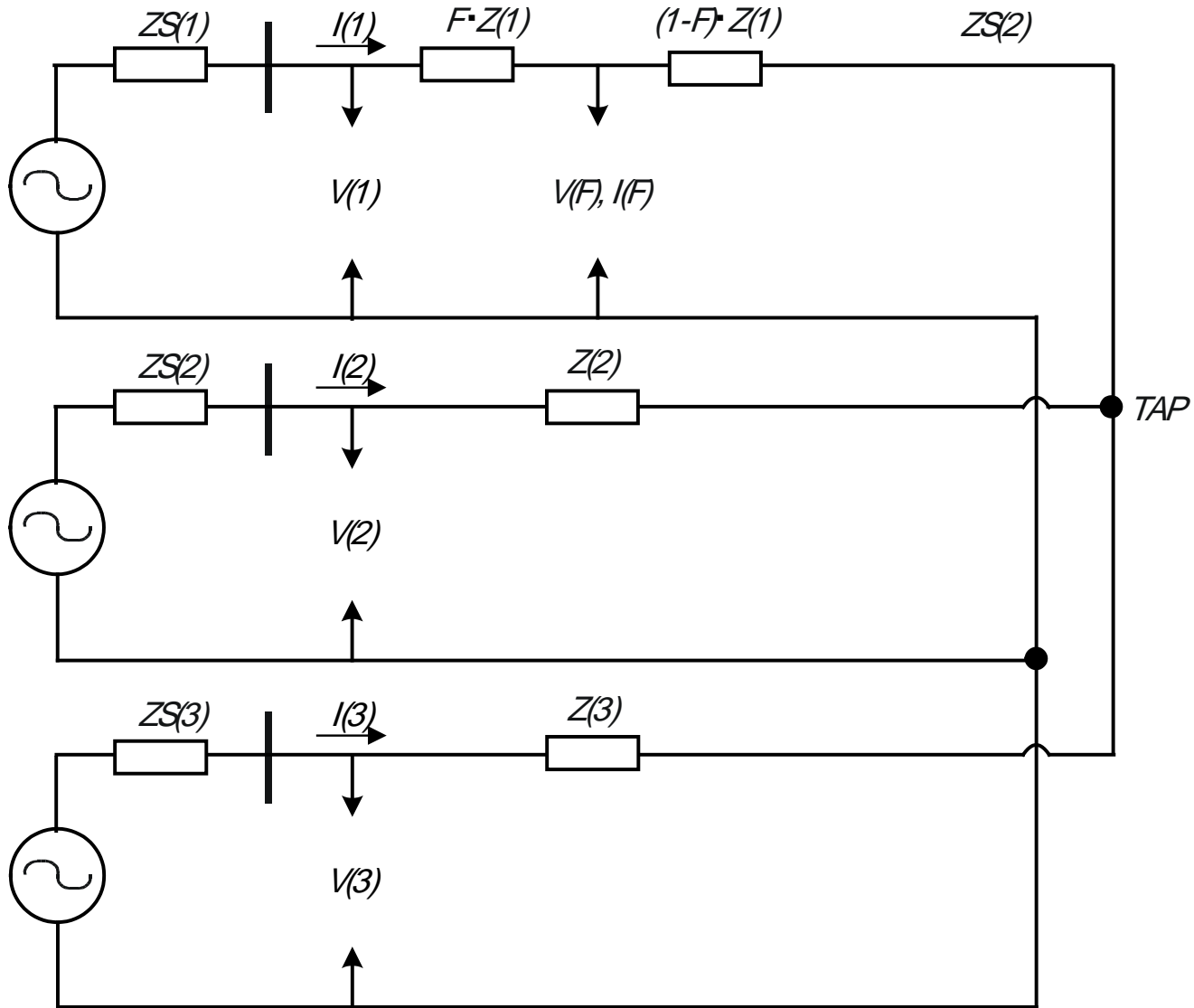
The fractional fault location is given by:

$$F = \text{Real} \left[\frac{\frac{V(1) - V(2)}{Z} + I(2)}{I(1) + I(2)} \right]$$

- Takes advantage of redundancy in the data.
 - more equations than unknowns
 - least mean squares fit is used
 - Calculation is independent of:
 - faulted phase
 - fault type
 - fault resistance
 - zero-sequence (ground current) coupling



Three Terminal Fault Location



imagination at work

Distance from Terminal To Tap Computed

Line Fault Parameter Configuration

Line Fault Configuration WIN-2008-01

Lines

- 00001
- 00002

Line

Name: Index:

Differential Threshold: Length Unit:

Application

Two Terminal Three Terminal

T1

Station ID / PMU Code	Station ID	PMU ID Code
<input type="text" value="V5PMU01_1_1"/>	<input type="text" value="V5PMU01_1_1"/>	<input type="text" value="511"/>

Line Out:

T2

Station ID / PMU Code	Station ID	PMU ID Code
<input type="text" value="V5PMU19_3_3"/>	<input type="text" value="V5PMU19_3_3"/>	<input type="text" value="529"/>

Line Out:

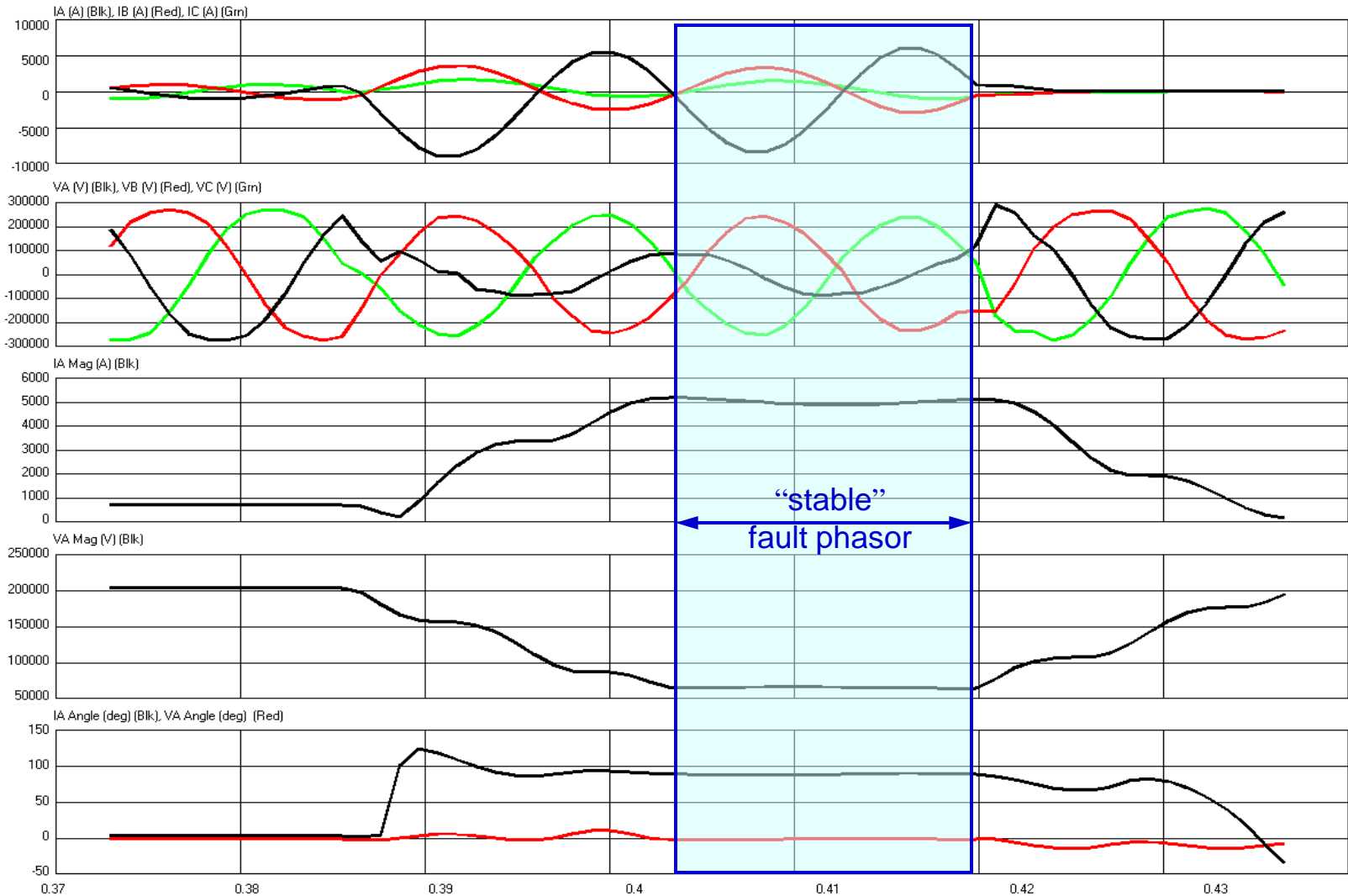
Parameters

Line Length:

Pos. Imped. Mag.: Zero Imped. Mag.:

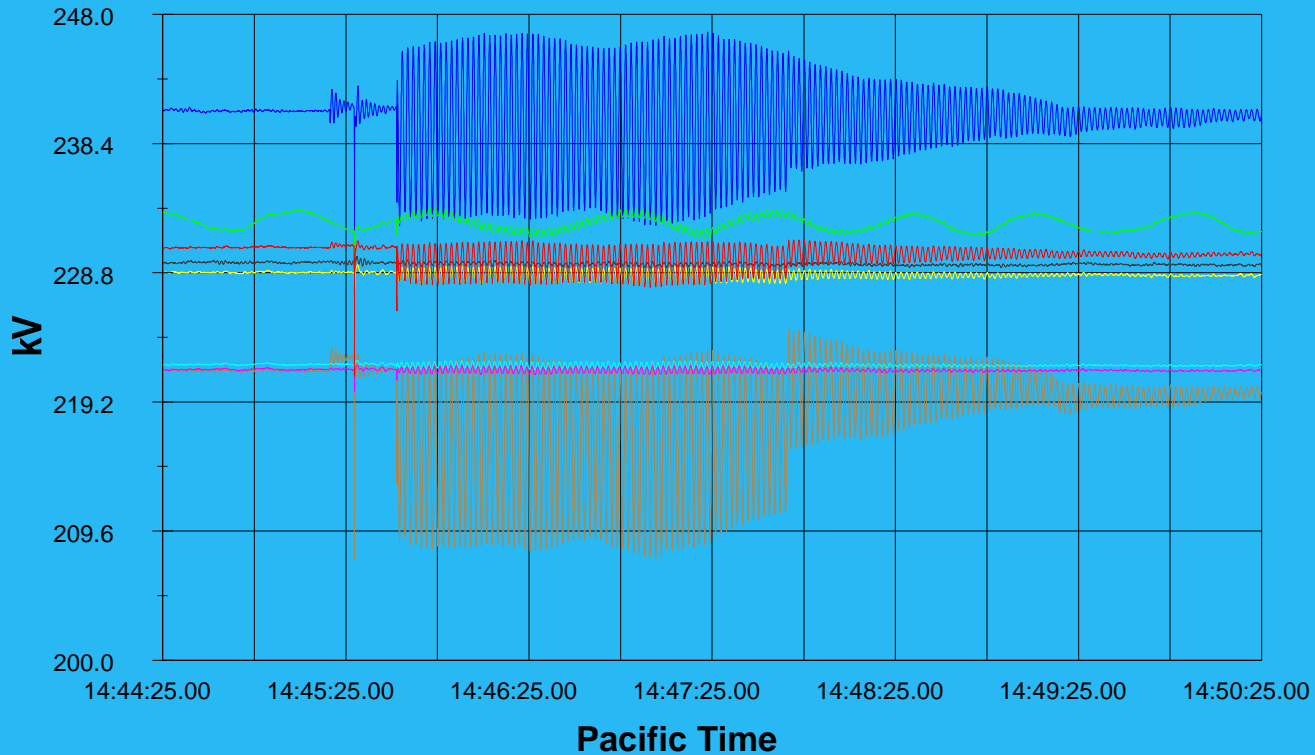
Pos. Imped. Angle: Zero Imped. Angle:

Real-life fault: stable fault phasor time

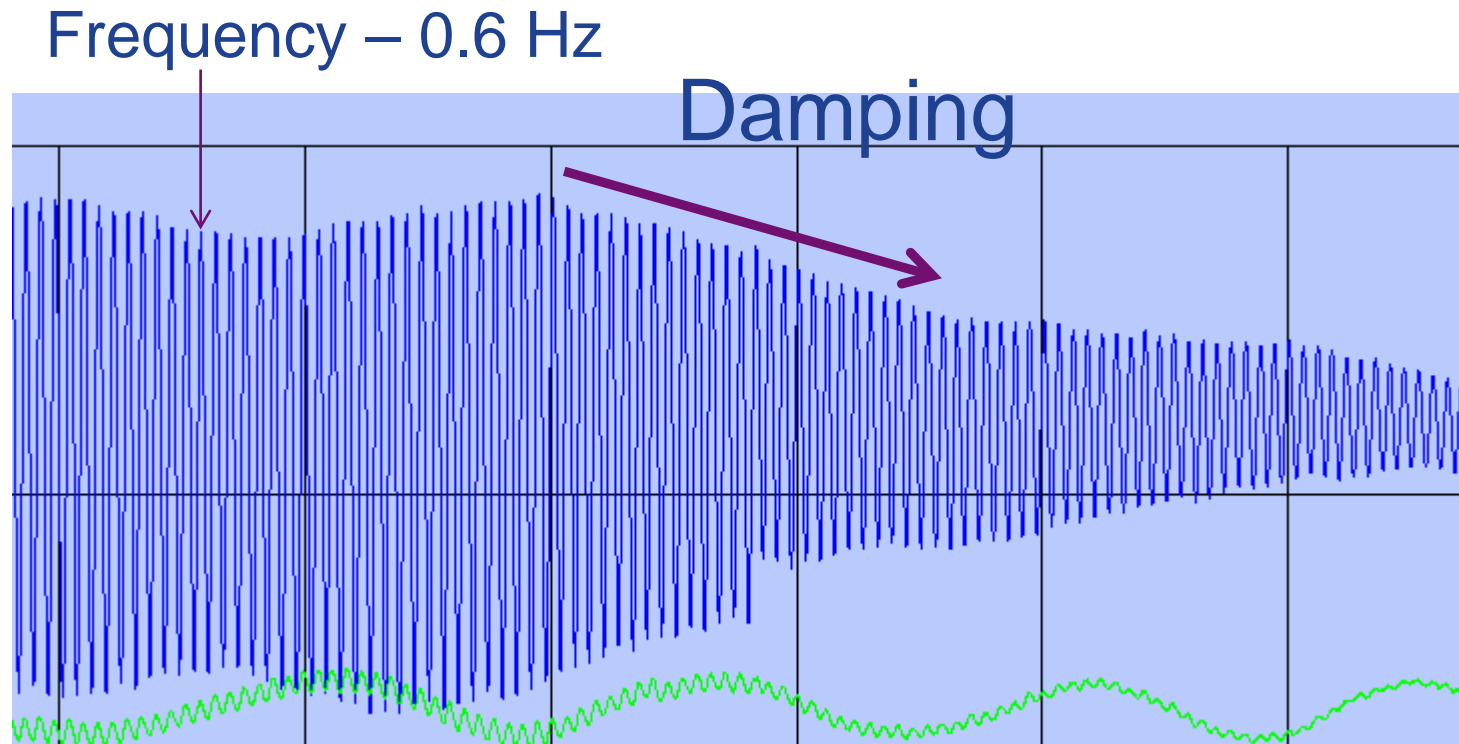


Small Signal Oscillation Detection and Analysis

09/13/00 Event at 14:44 Pacific Time (09/13/00 at 21:44 GMT)



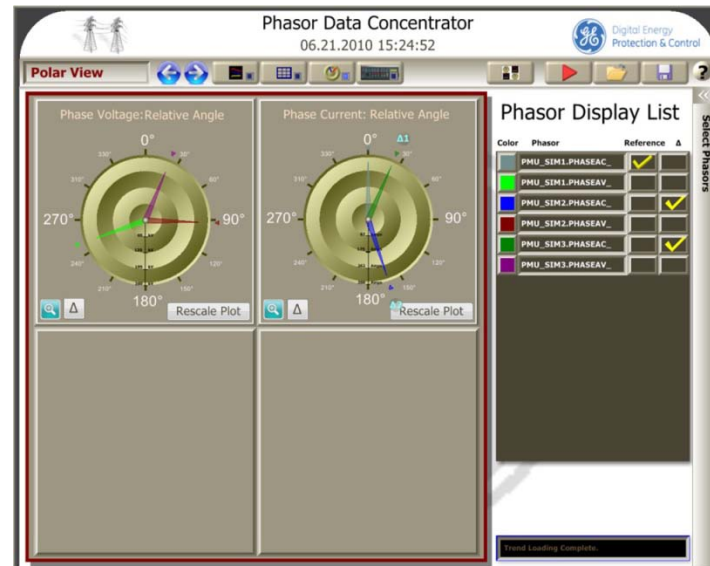
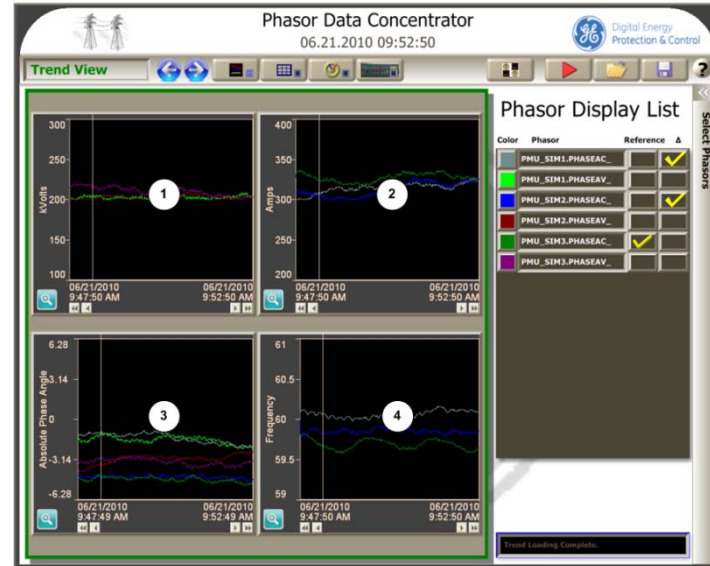
SSOD Measured Quantities: Frequency, Phase, and Damping



Live Data ON DEMAND – Client Controlled

Select:

- PDC
- PMU
- Data Item
- View Mode
 - Strip Chart
 - Polar Plot



Summary

- A need has been identified for hosting and testing ancillary applications with Synchrophasors
- An Engineering Data Concentrator has been developed to provide a “sandbox” for hosting existing and future engineering applications