

# SynchroPhasor Update

## Success story



David Hawkins - CAISO

**NASPI Meeting – June 2008**



California ISO  
Your Link to Power

# Phasor Workstation in CAISO Control Room



# Application Highlights

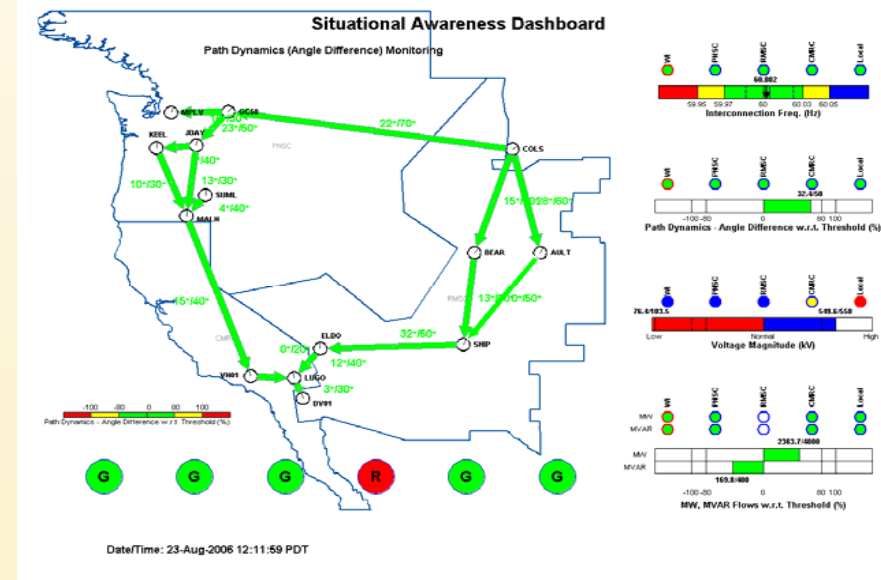
## Real Time Dynamics Monitoring System (RTDMS)

New release of the RTDMS software is now being installed and tested at the CAISO.

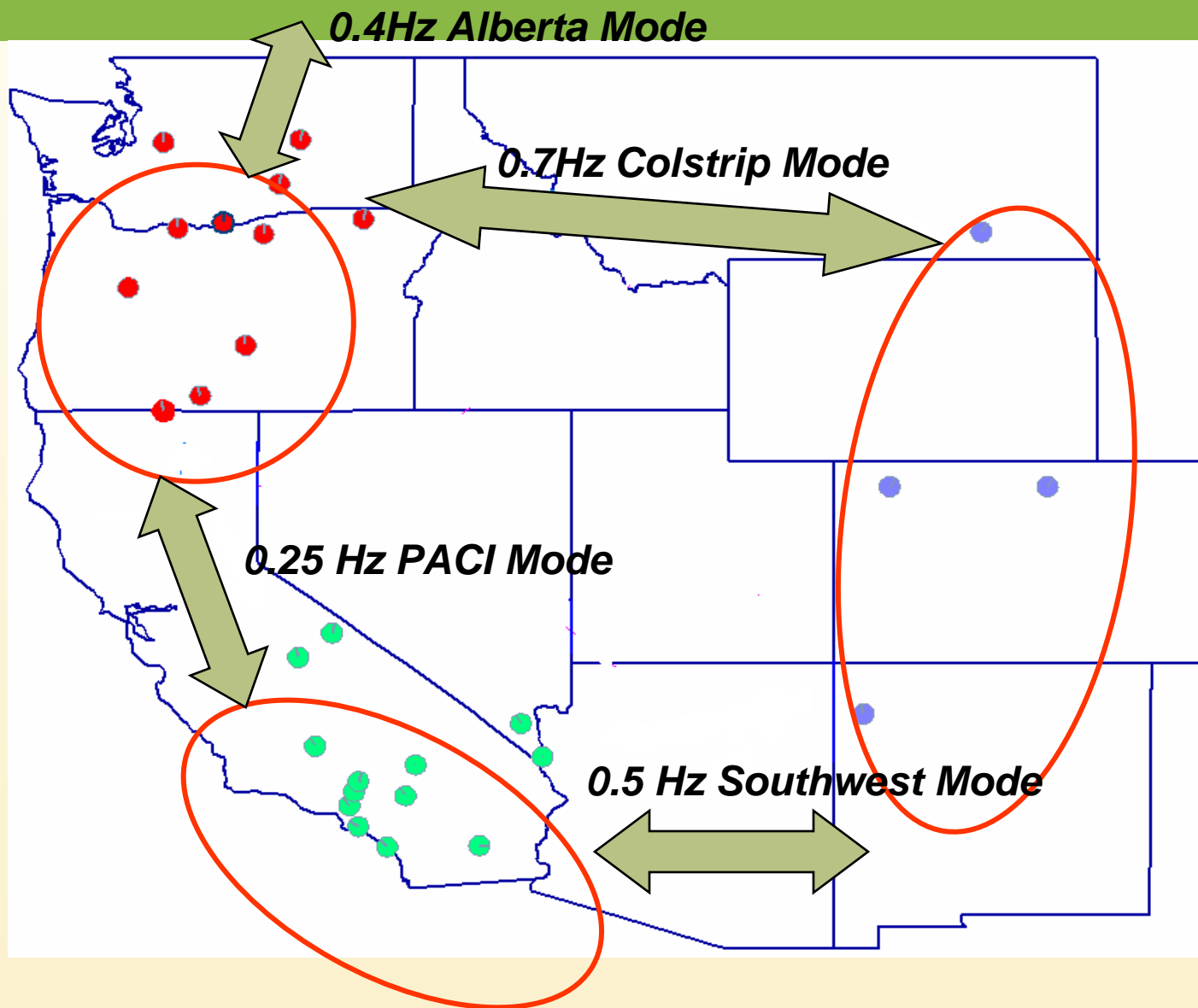
Includes new voltage trend analysis

Small Signal Analysis, oscillation modes, and grid damping analysis now imbedding in the RTDMS application

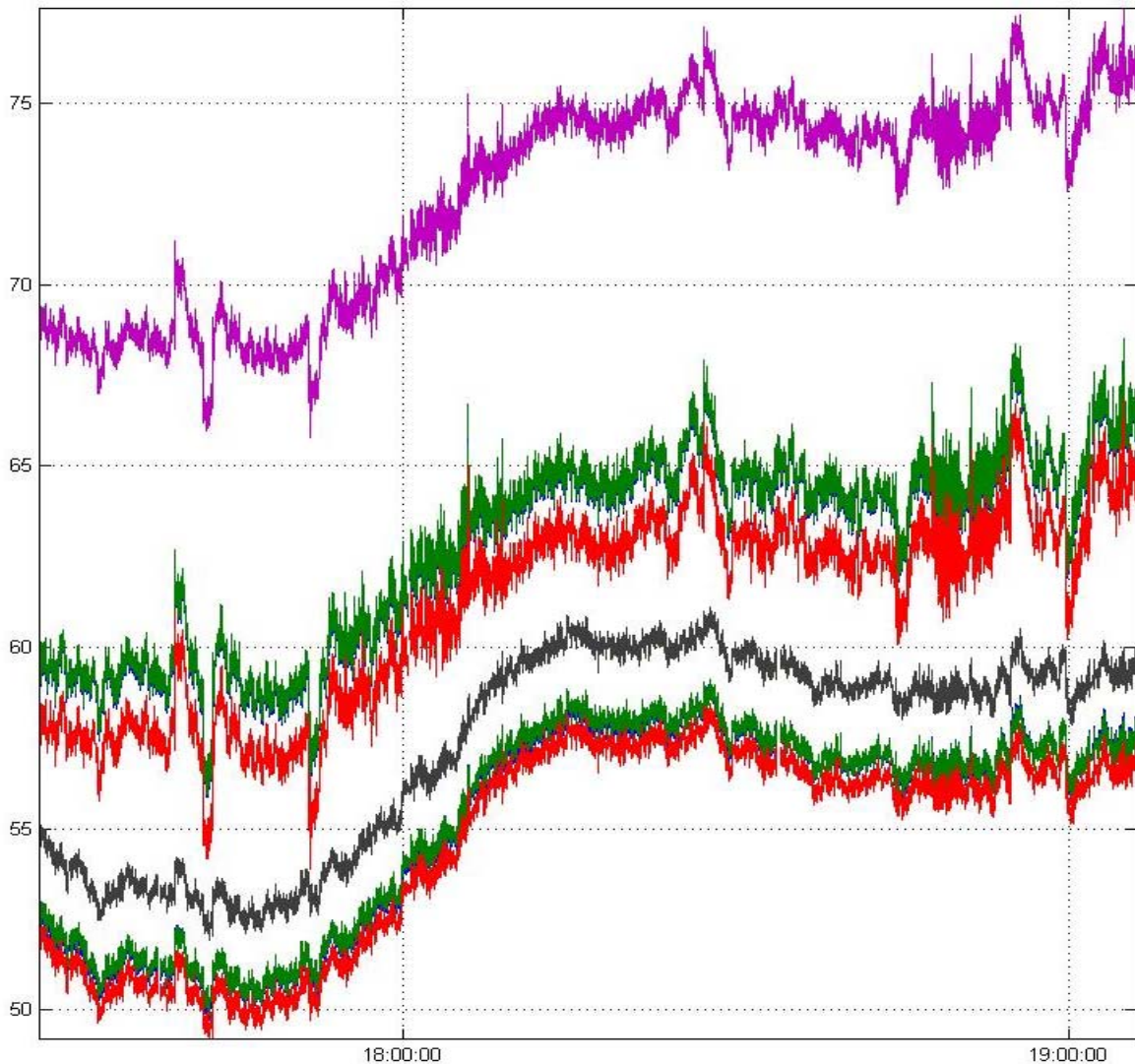
Phasor data was used to analyze the January PCDI Oscillation problem



# MODE CLUSTERS & OBSERVABILITY (MODE SHAPE ANALYSIS)



# Angle Clusters & Long-term Angle Trends (West)

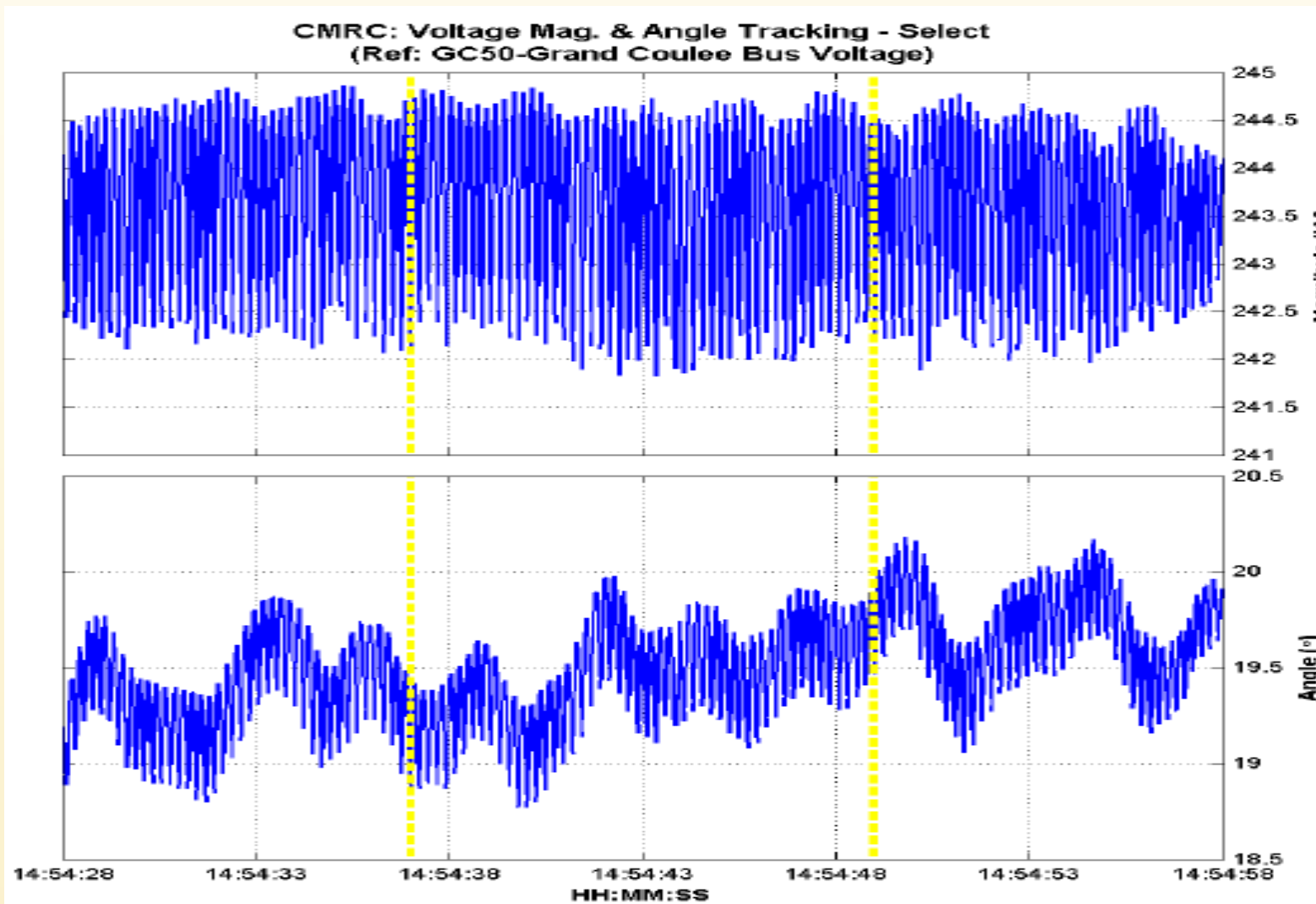


- AULT.VA.Ault 345 kV Voltage (Craig)
- AULT.VA.Ault 345 kV Voltage (LRS)
- AULT.VA.230 kV Bus Voltage (StVrain)
- BEAR.VA.Bears Ears 345 kV Bus Voltage (Craig)
- BEAR.VA.Bears Ears 345 kV Bus Voltage (Bonanza)
- SHIP.VA.Shiprock 345 kV Voltage (San Juan Line)
- SHIP.VA.Shiprock 345 kV Voltage (4 Corners Line)
- SHIP.VA.Shiprock 230 kV Voltage (Lost Canyon Line)
- SHIP.VA.Shiprock 230 kV Voltage (230 Main Bus)
- SHIP.VA.Shiprock 115 kV Voltage (115 Main Bus)

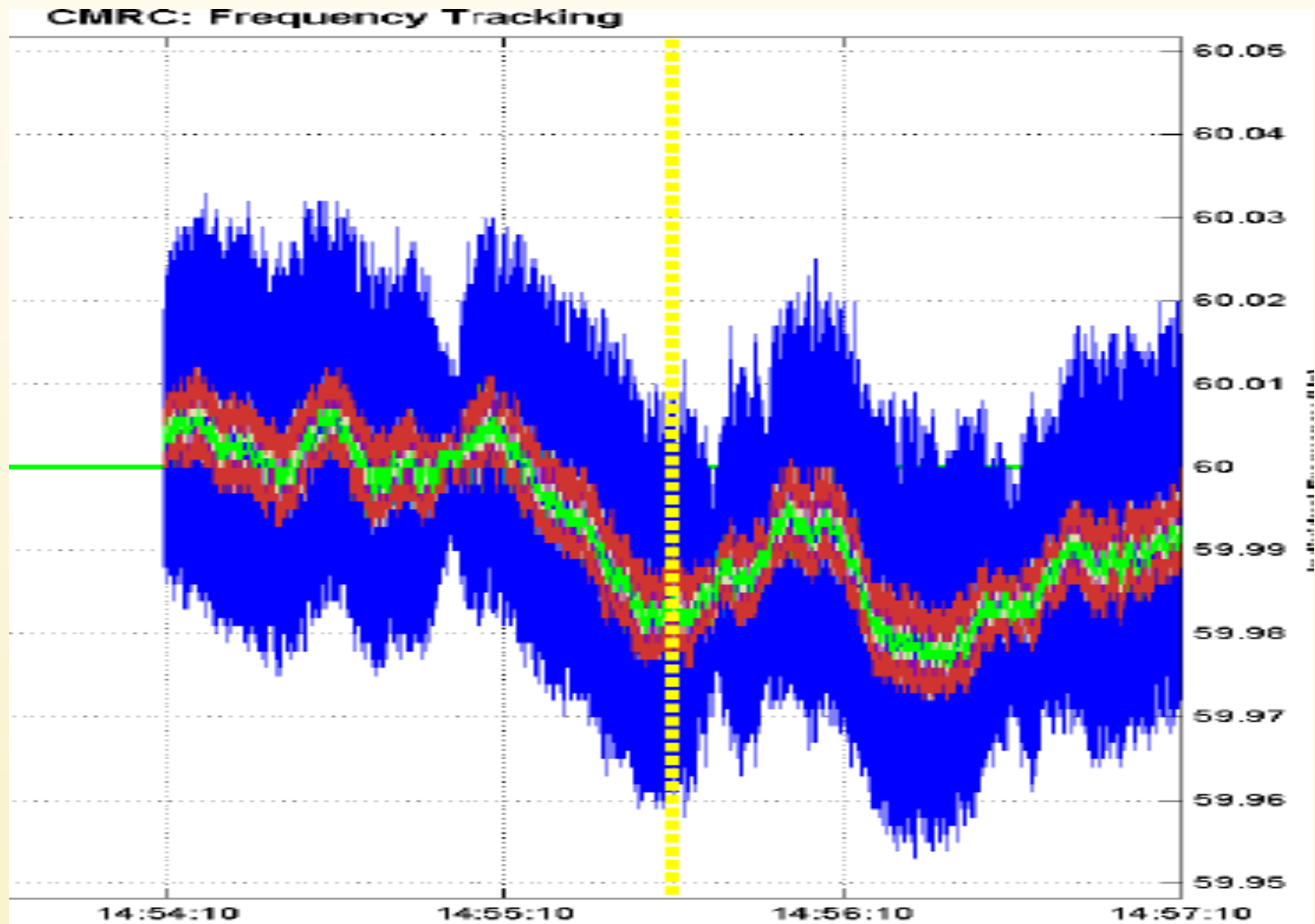
## 2008-1-26 Pacific DC Line event

- ❶ PCDI – Path 65 operating at 1700 MW - South to North flow
- ❷ Short circuit at Big Eddie substation resulted in loss of transformers between 500Kv and 230kV
- ❸ The loss of the Big Eddy 500/230 kV ties affected the PDCI controls and an oscillation occurred with the DC current fluctuating approximately +/- 150 amps.
- ❹ The SCE operator noticed the oscillations on the analog recorder but the oscillations were not visible on SCADA
- ❺ Oscillations continued for an extended period of time and were finally observed by the CMRC on the phasor monitoring system.
- ❻ PCDI link was then shut down.

# 2008-1-26 PDCI event – Sylmar voltage oscillation

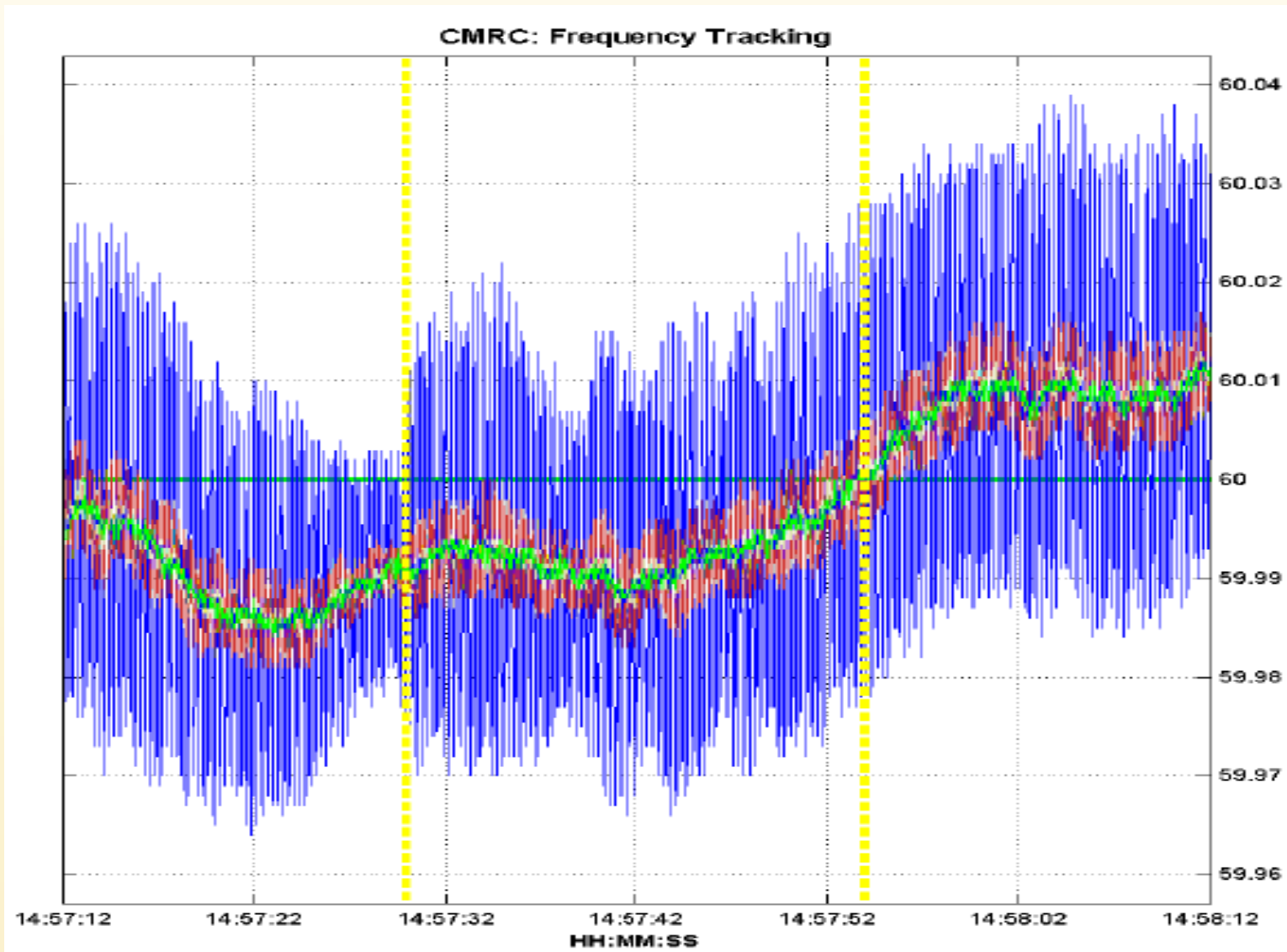


# 2008-1-26 PDCI Frequency Oscillation



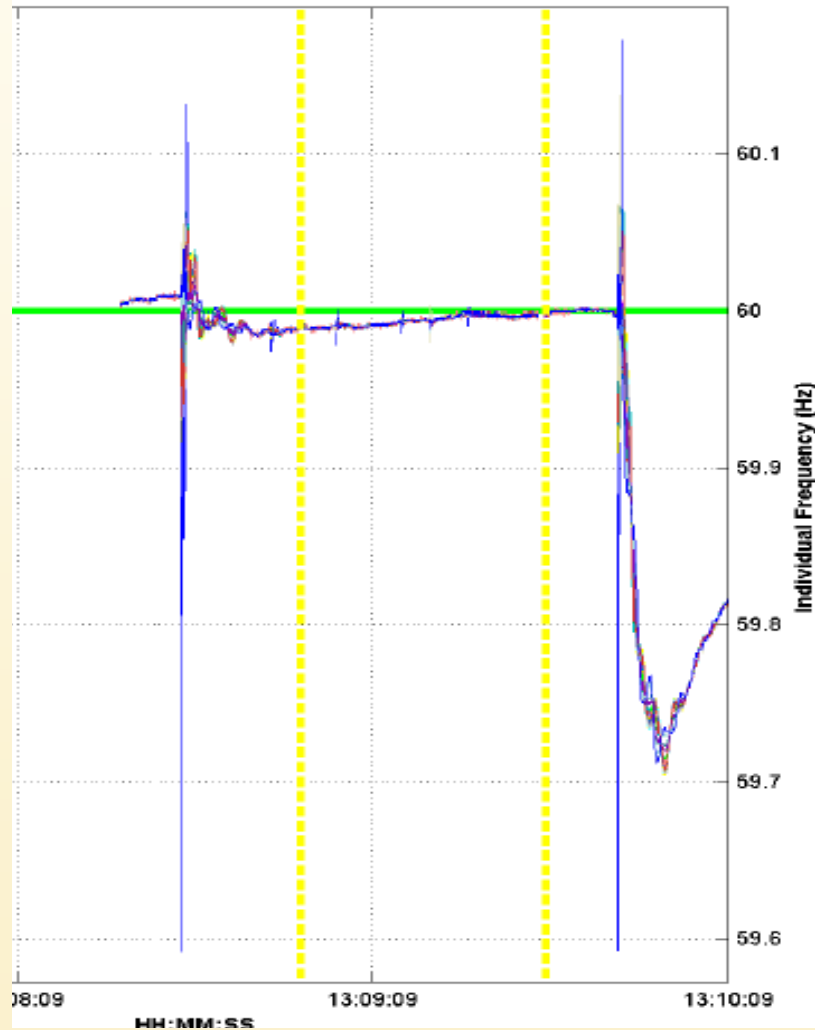


# 2008-1-26 PDCI event - Frequency

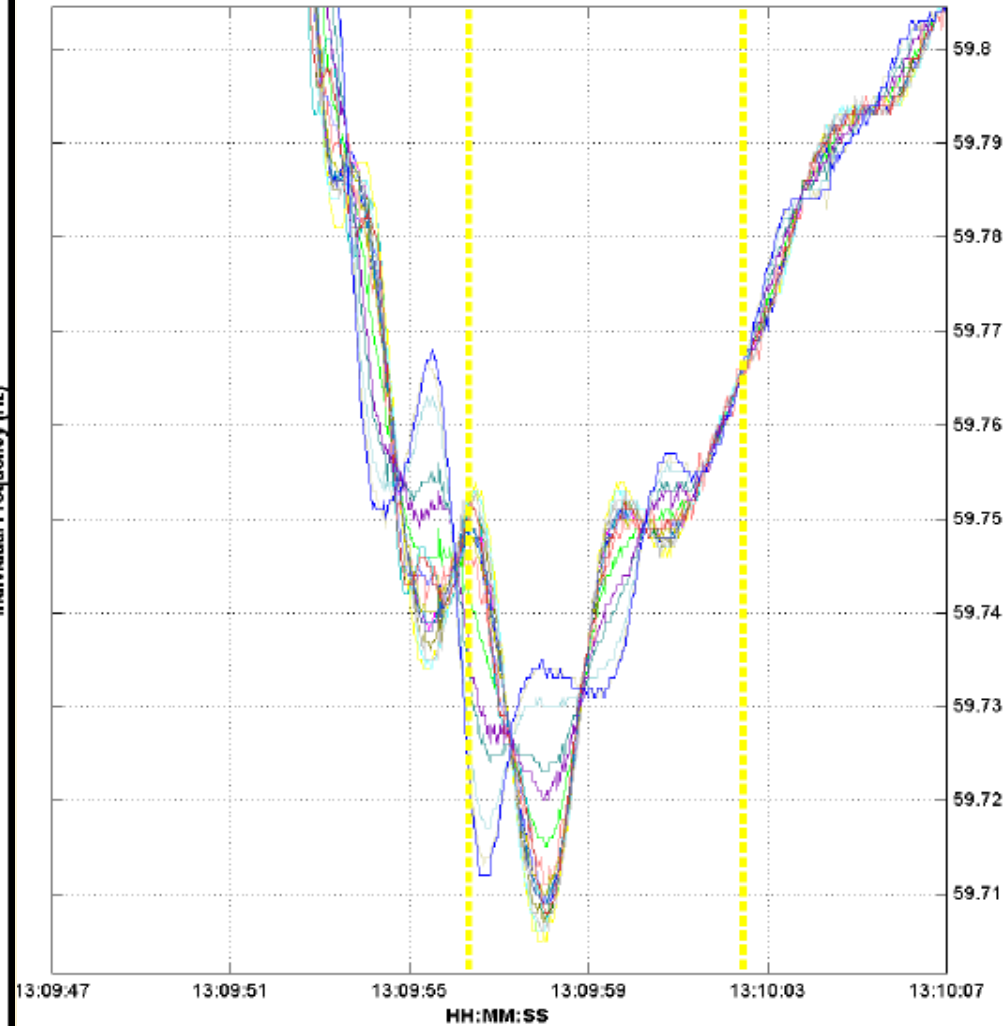


# 2008-5-20 PDCI multiple events-BPA gen. trip

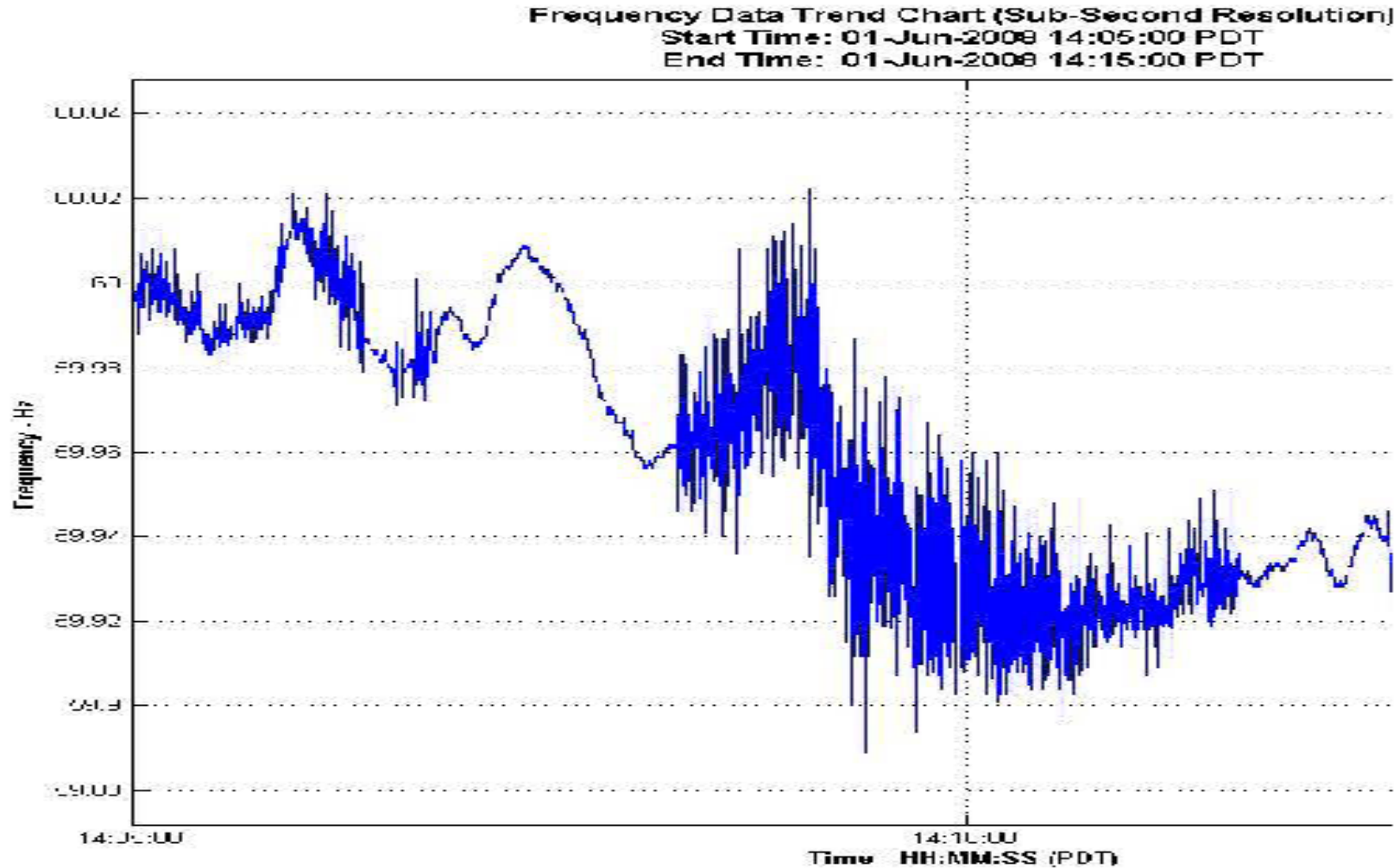
CMRC: Frequency Tracking



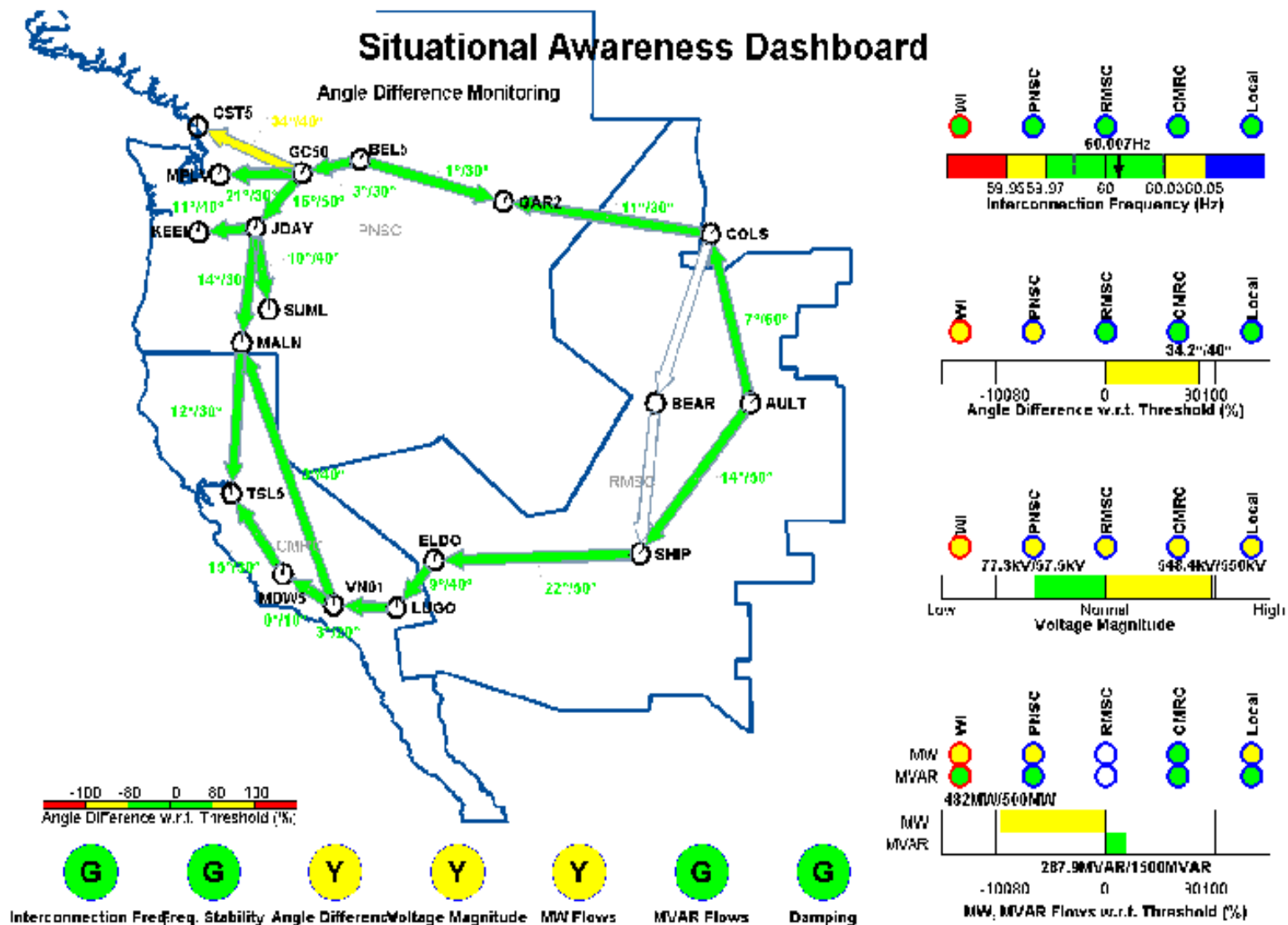
CMRC: Frequency Tracking



# June 1 – Pacific DC Interconnection Oscillation

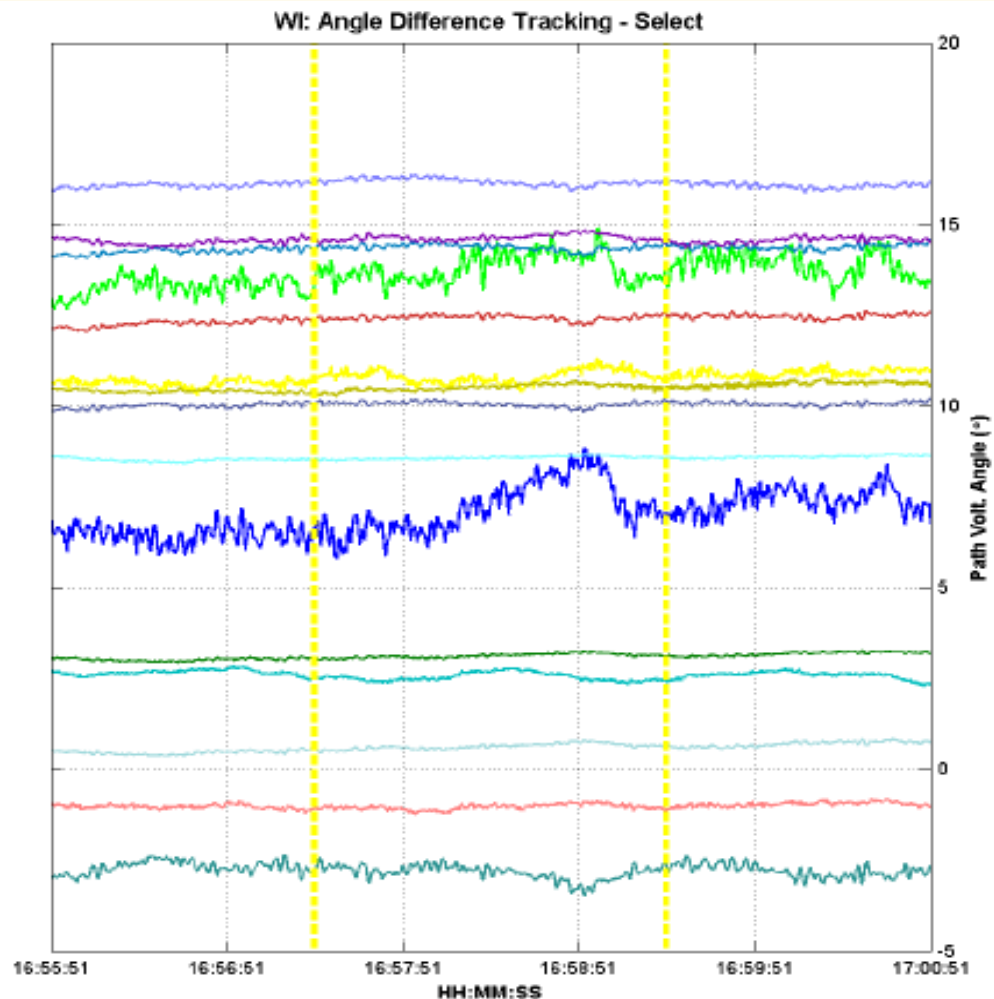


# RTDMS Dashboard

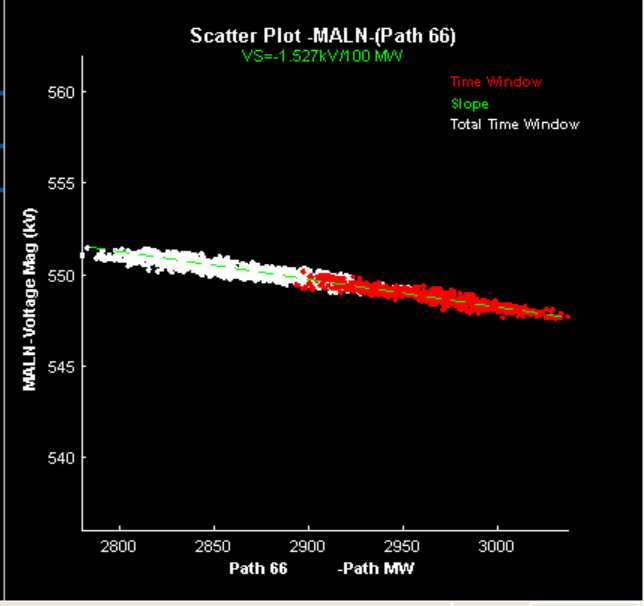
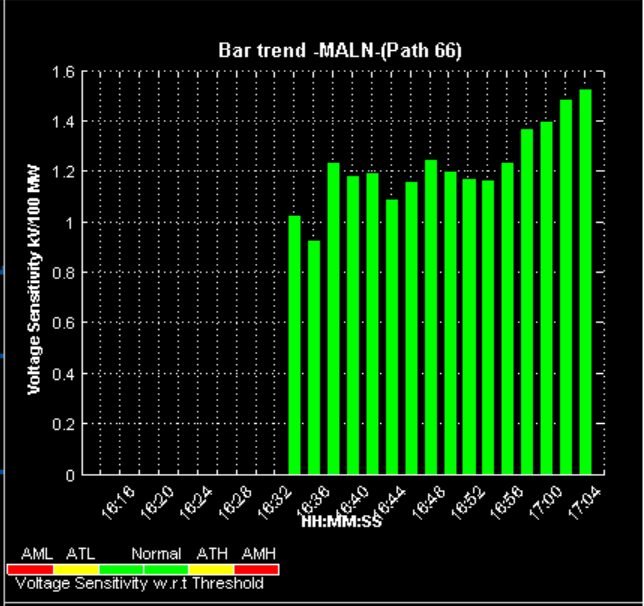
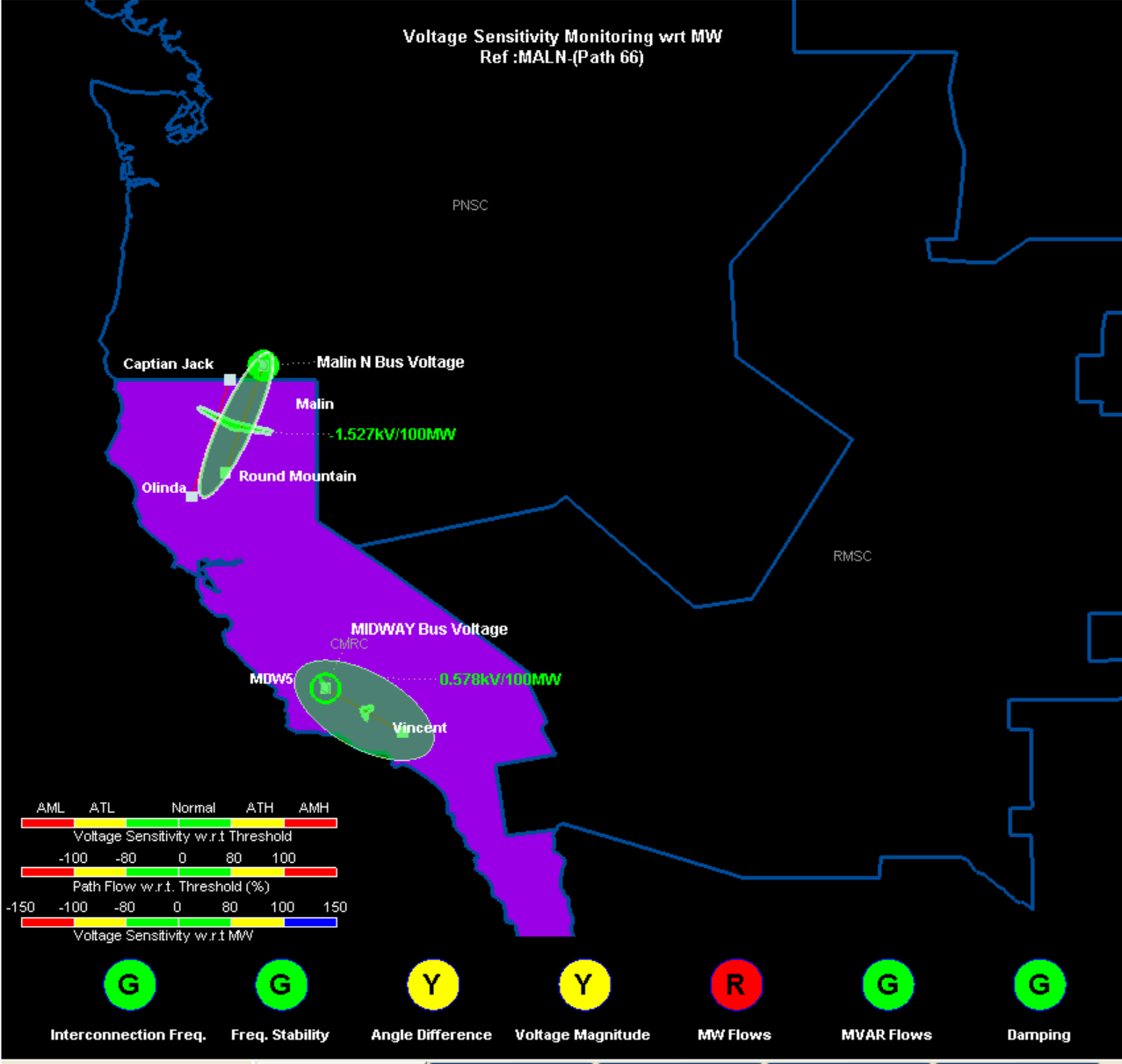


# Angle Difference Tracking

Deselect All			
Select All	AngDiff(°)	AngDiff(°)	Delta(°)
VN01-MDW5	0.56	0.63	0.07
SHIP-ELDO			
MDW5-TSL5	14.64	14.54	-0.1
MALN-VN01	-2.84	-2.66	0.18
MALN-TSL5	12.36	12.51	0.15
LUGO-VN01	3.08	3.12	0.04
JDAY-SUML	10.07	10.15	0.08
JDAY-MALN	14.34	14.46	0.12
JDAY-KEEL	10.38	10.54	0.16
GC50-MALN			
GC50-JDAY	16.13	16.21	0.08
GC50-C875			
GAR2-BEL5	-1.04	-1.12	-0.08
ELDO-LUGO	8.54	8.57	0.03
COLS-GAR2	10.85	10.65	-0.2
COLS-BEAR	---	---	---
BEL5-GC50	2.49	2.43	-0.06
BEAR-SHIP	---	---	---
AULT-SHIP	13.33	13.45	0.12
AULT-COLS	6.55	7	0.45
Time (HH:MM:SS)	16:57:21.967	16:59:21.967	Delta(s) 120



Date/Time: 29-May-2008 17:00:51 PDT



Date/Time: 29-May-2008 17:08:00 PDT

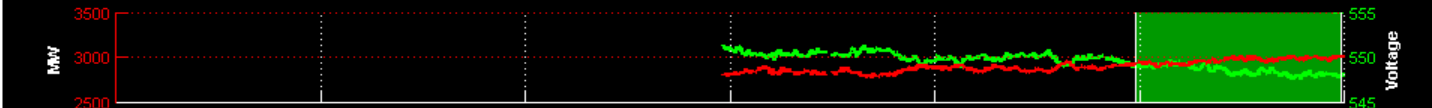
Scrolling Chart Panel 1 Data Panel 2 Data Panel 3 Data Panel 4 Data

Auto Refresh

VS Flows (MW)

Connected (Refresh Rate: 3 Second)

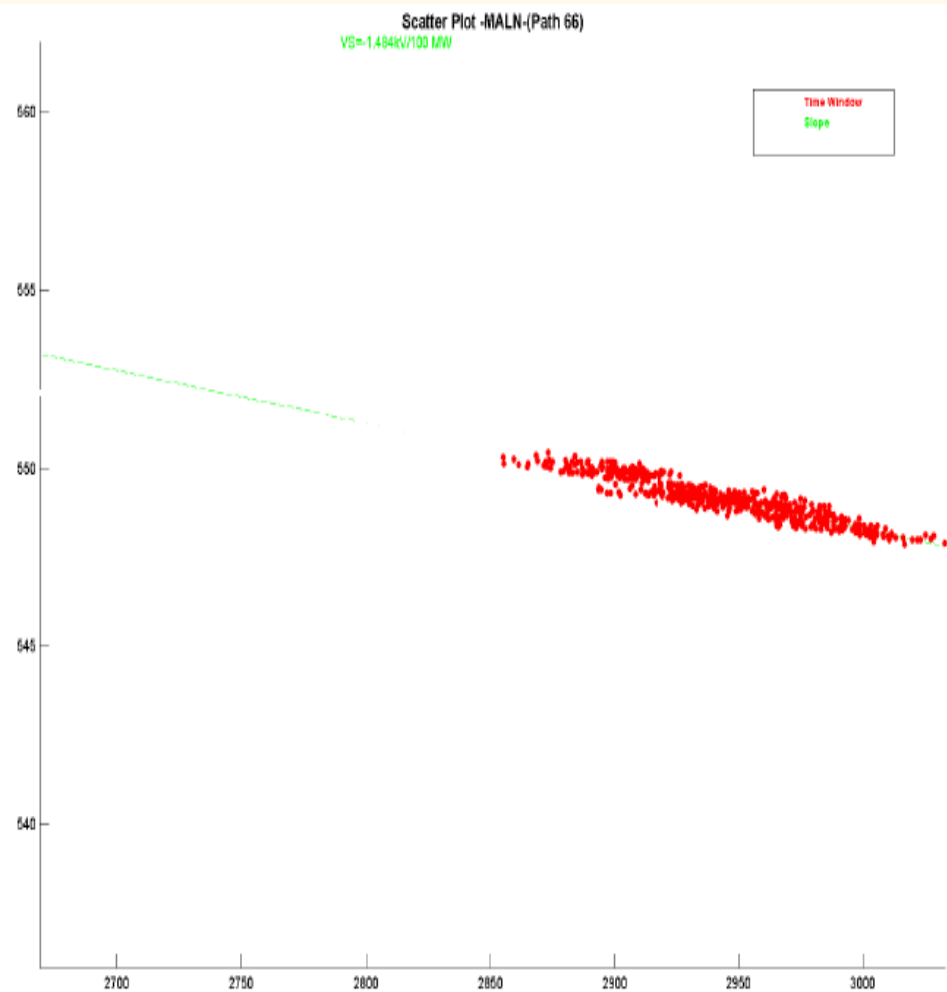
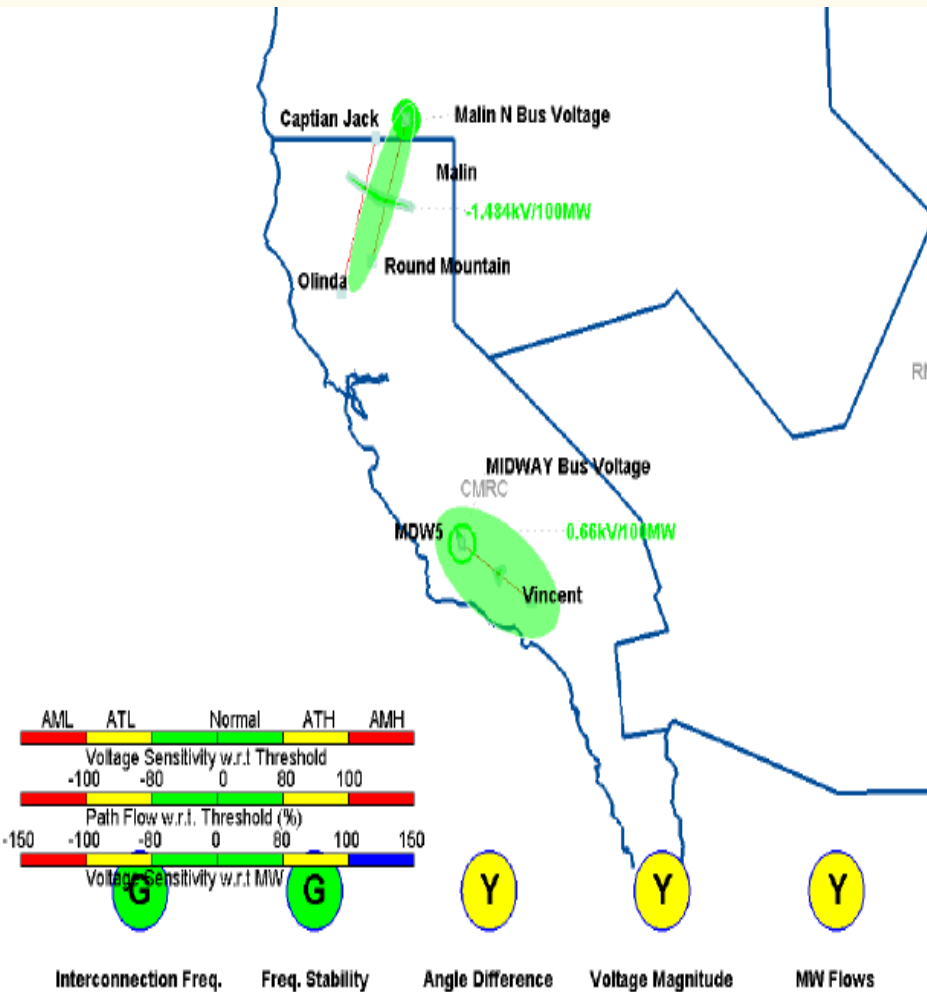
EPG CPID: 208 U.S. Dist: 7 333 843



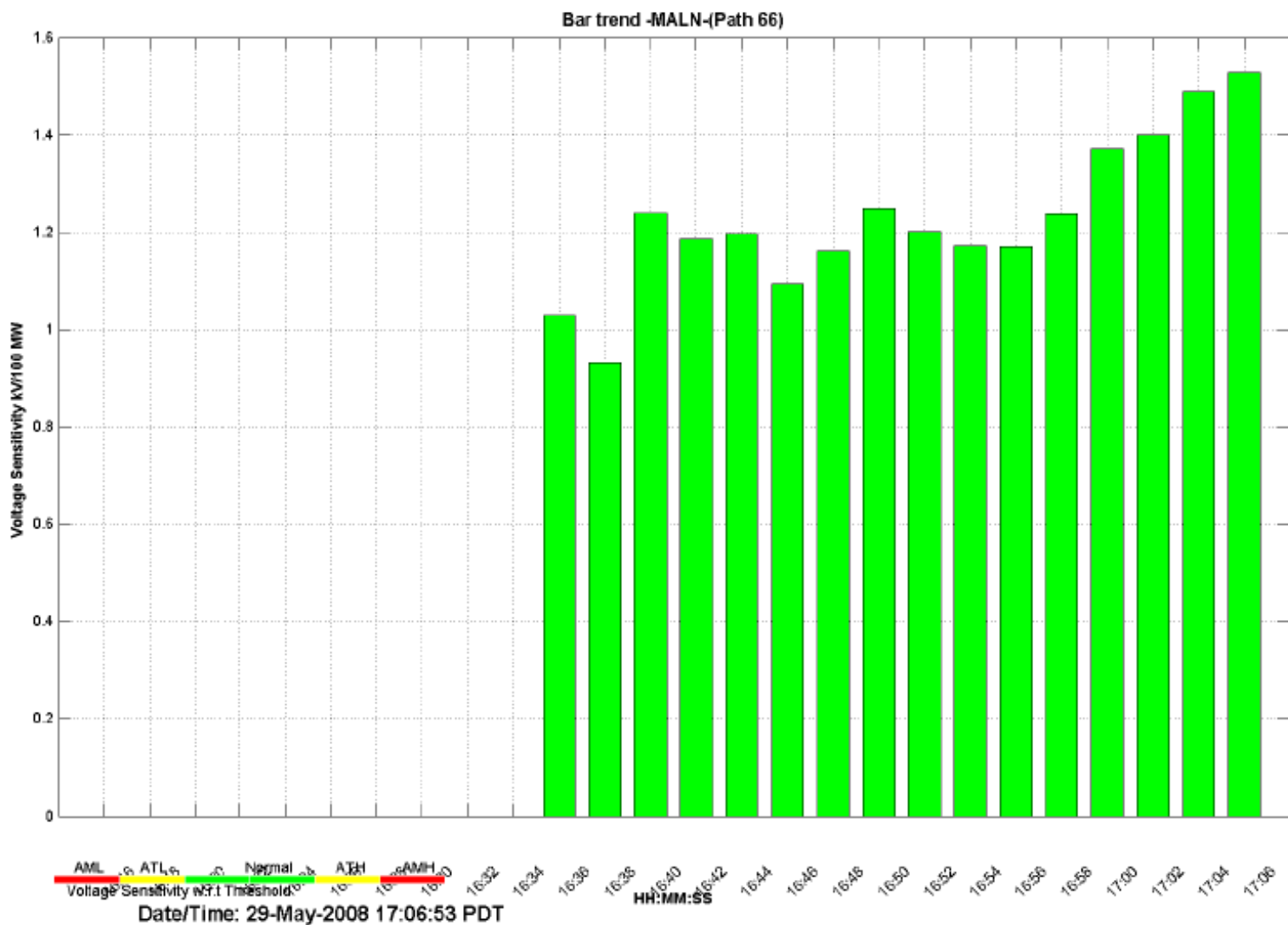
Replay

Frame: Normal

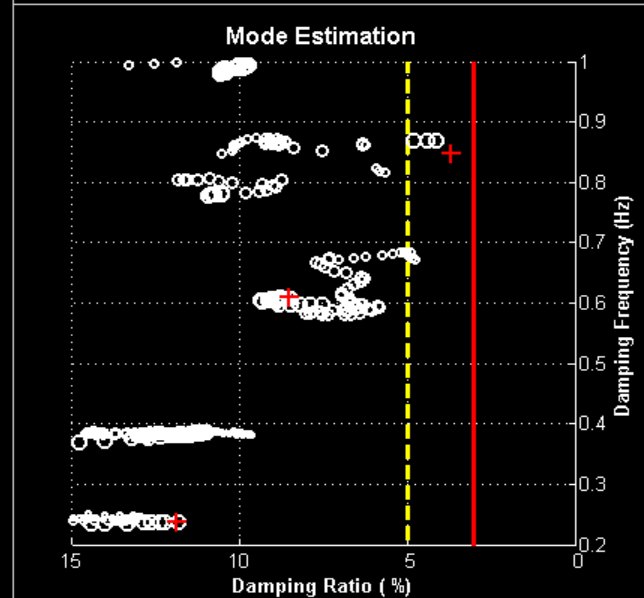
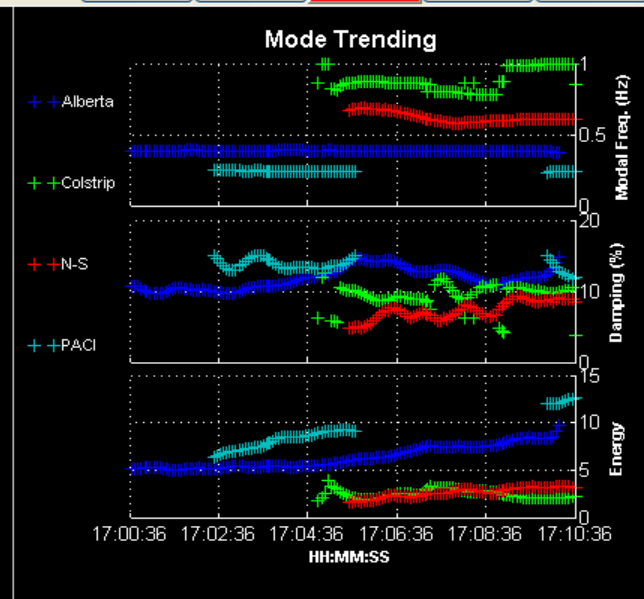
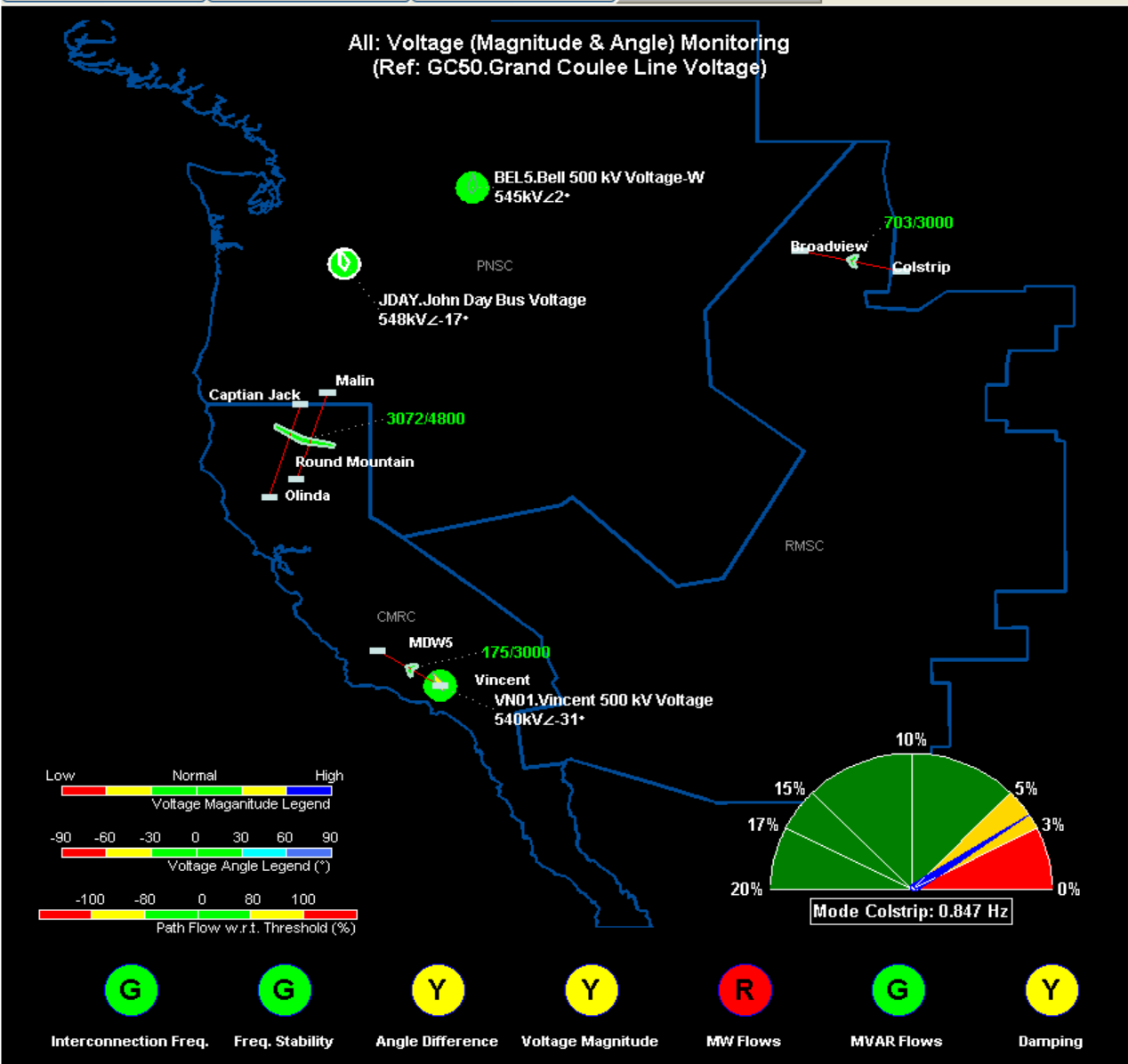
# Voltage Sensitive Plots



# Voltage Sensitive





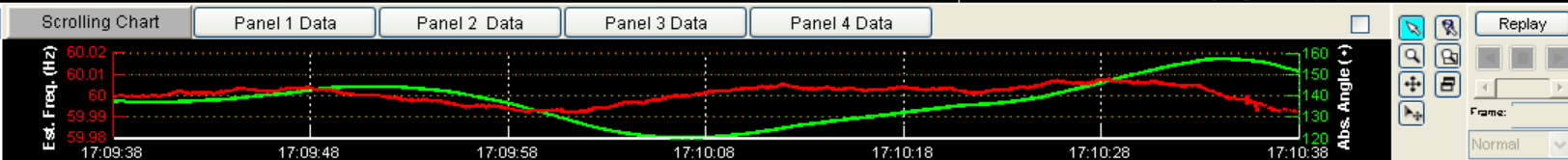


Date/Time: 29-May-2008 17:10:38 PDT

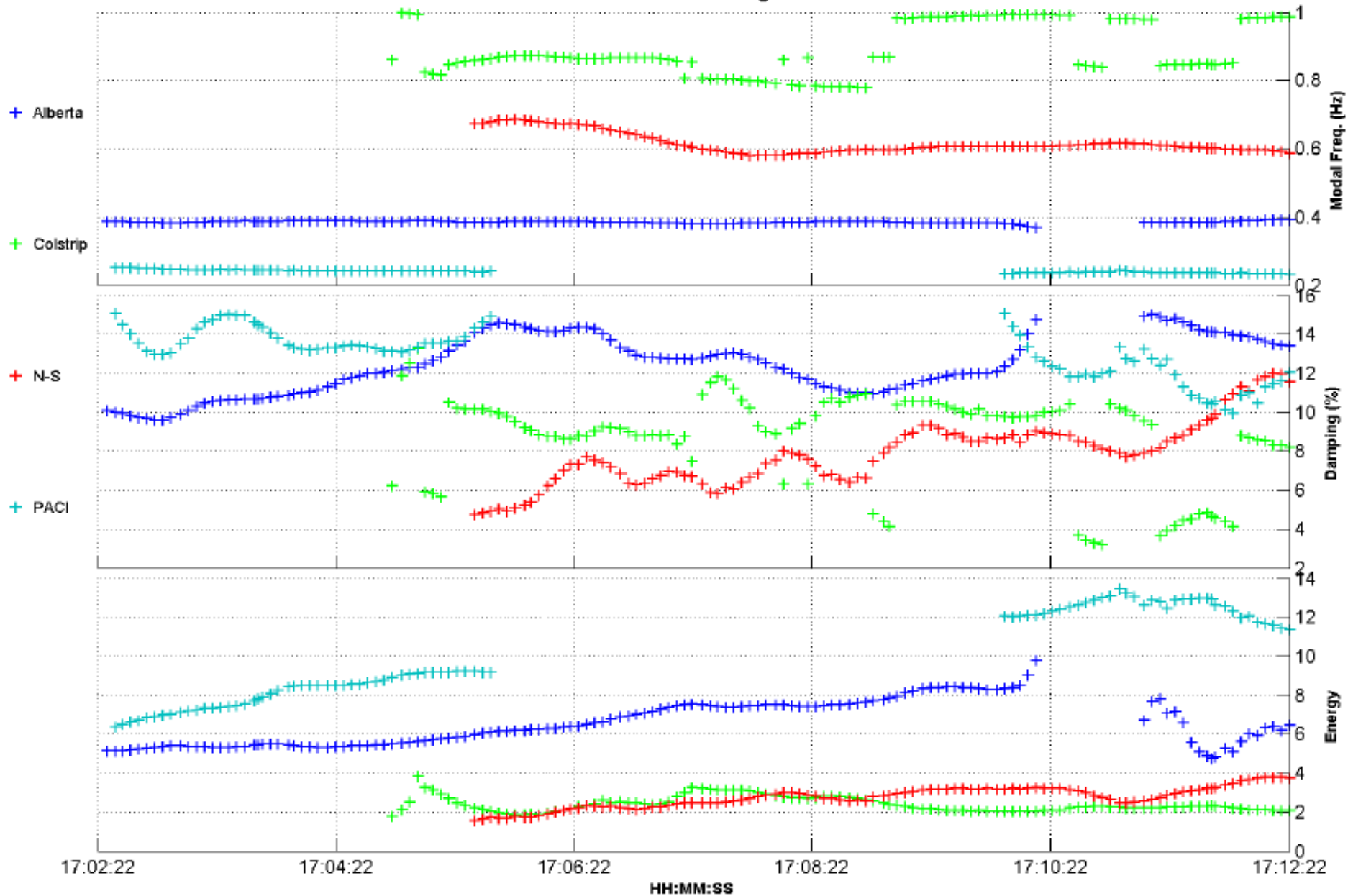
Auto Refresh

Voltage Angle  
Connected (Refresh Rate: 3 Second)

EPG GRID-3P®, U.S. Patent 7,233,843



# Mode Trending



Date/Time: 29-May-2008 17:12:23 PDT

# WECC Wide Area Measurement Task Force Update

## **2008 Goals:**

**Sign data sharing agreement**

**Rebroadcast real-time SynchroPhasor Data to participating transmission operators**

- SCE, BPA, PG&E, WALC
- Provide secure web portal for access to key files

**Add new TO participants (BC Hydro, others?)**

**Improve real-time displays for operators**

**Improve off-line tools for analysis of events**

**New training materials of users of the system**

# WECC Wide Area Measurement Task Force Update

## **Status:**

**Data Sharing agreement -**

**Ready to review draft with Transmission Operator participants**

**Rebroadcast real-time SynchroPhasor Data –**

**Ready to test final software implementation.**

**Provide secure web portal for access to key files –**

**Design complete and ready for participant testing**

**Add new TO participants (BC Hydro, others?) - pending**

**Improve real-time displays for operators – new software installed**

**Improve off-line tools for analysis of events – new tool ready**

**New training materials for users of the system – done**

**Create WECC Project Plan - started**