PMU Application in Power System Dynamic Monitoring and Control

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Outline

- PMU Application in Dynamic **Monitoring**
  – Low frequency oscillation monitoring
  – Fast fault positioning
  – Generator primary frequency regulation assessment
- PMU Application in Dynamic **Control**
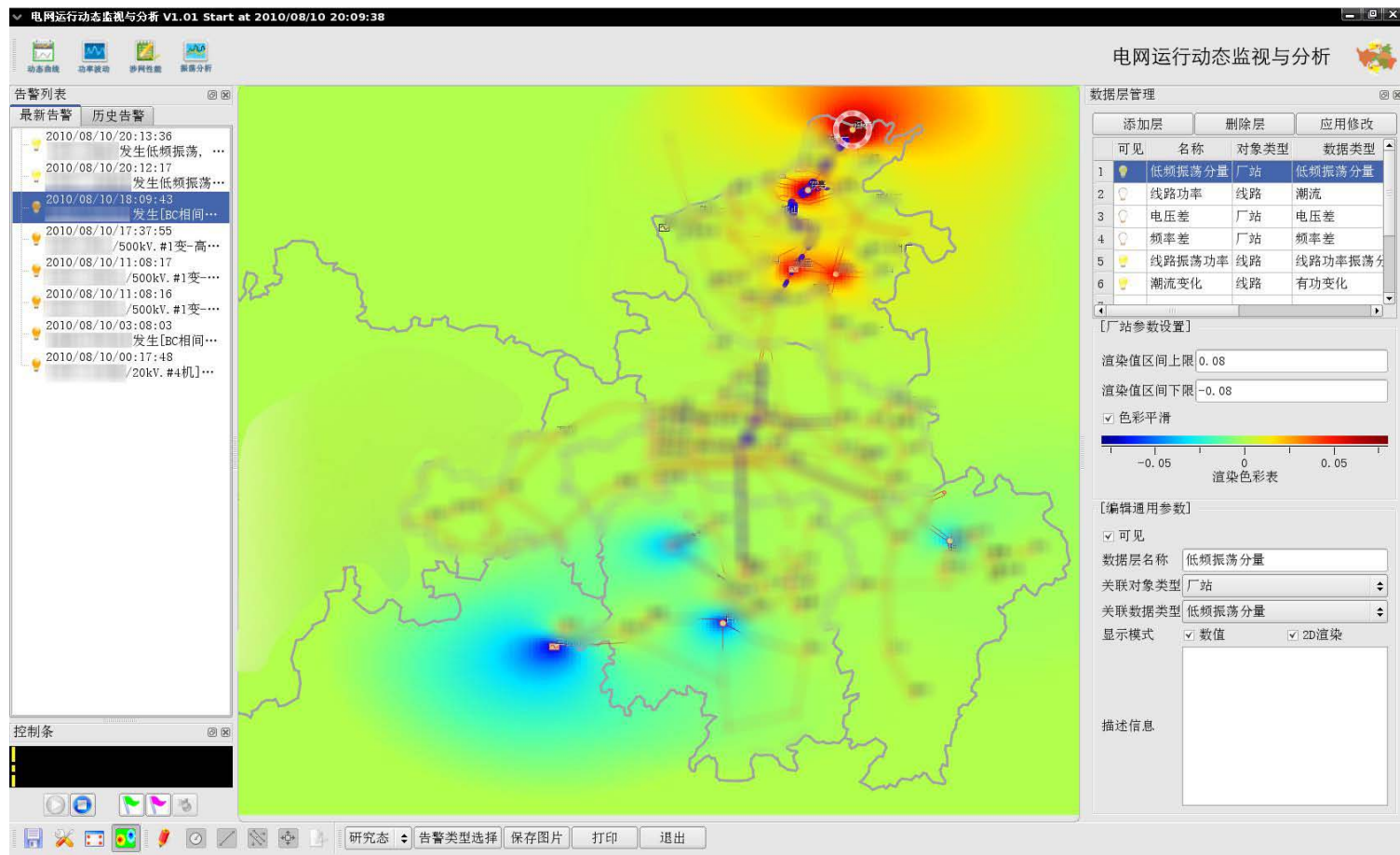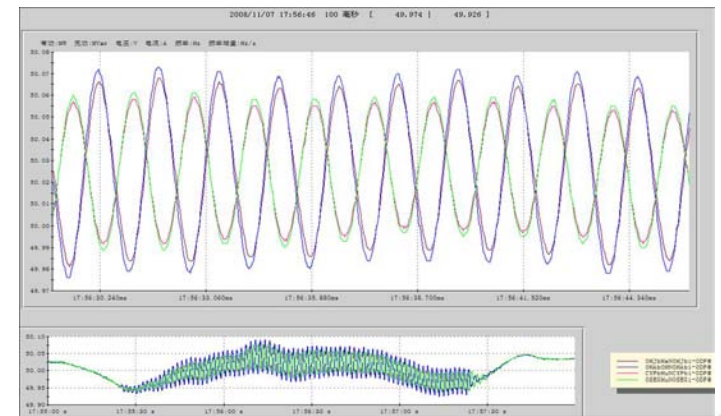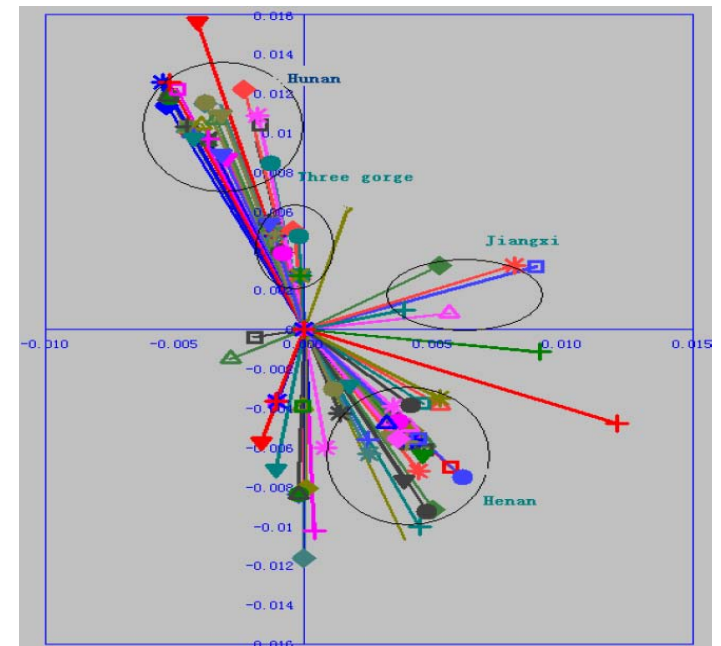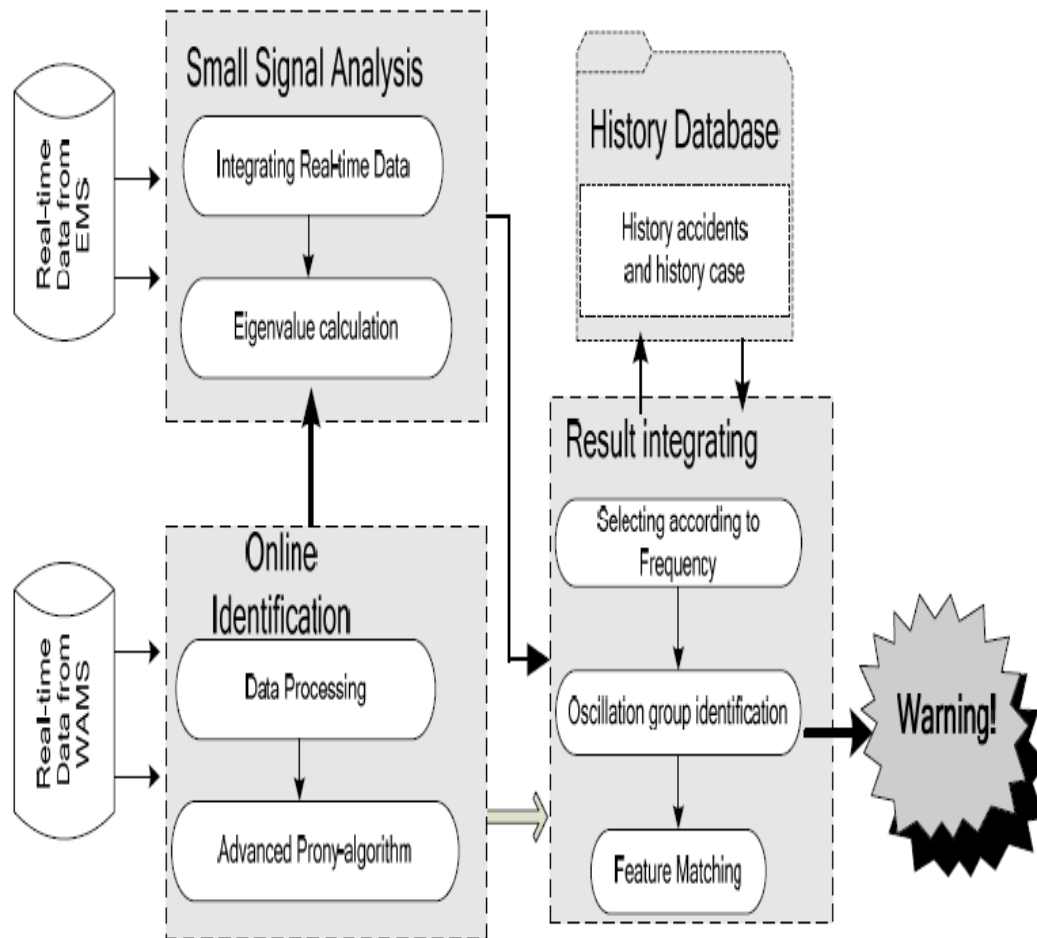 – Wide area low frequency damping control

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Low frequency oscillation monitoring

- **Visualizing the different swing groups**
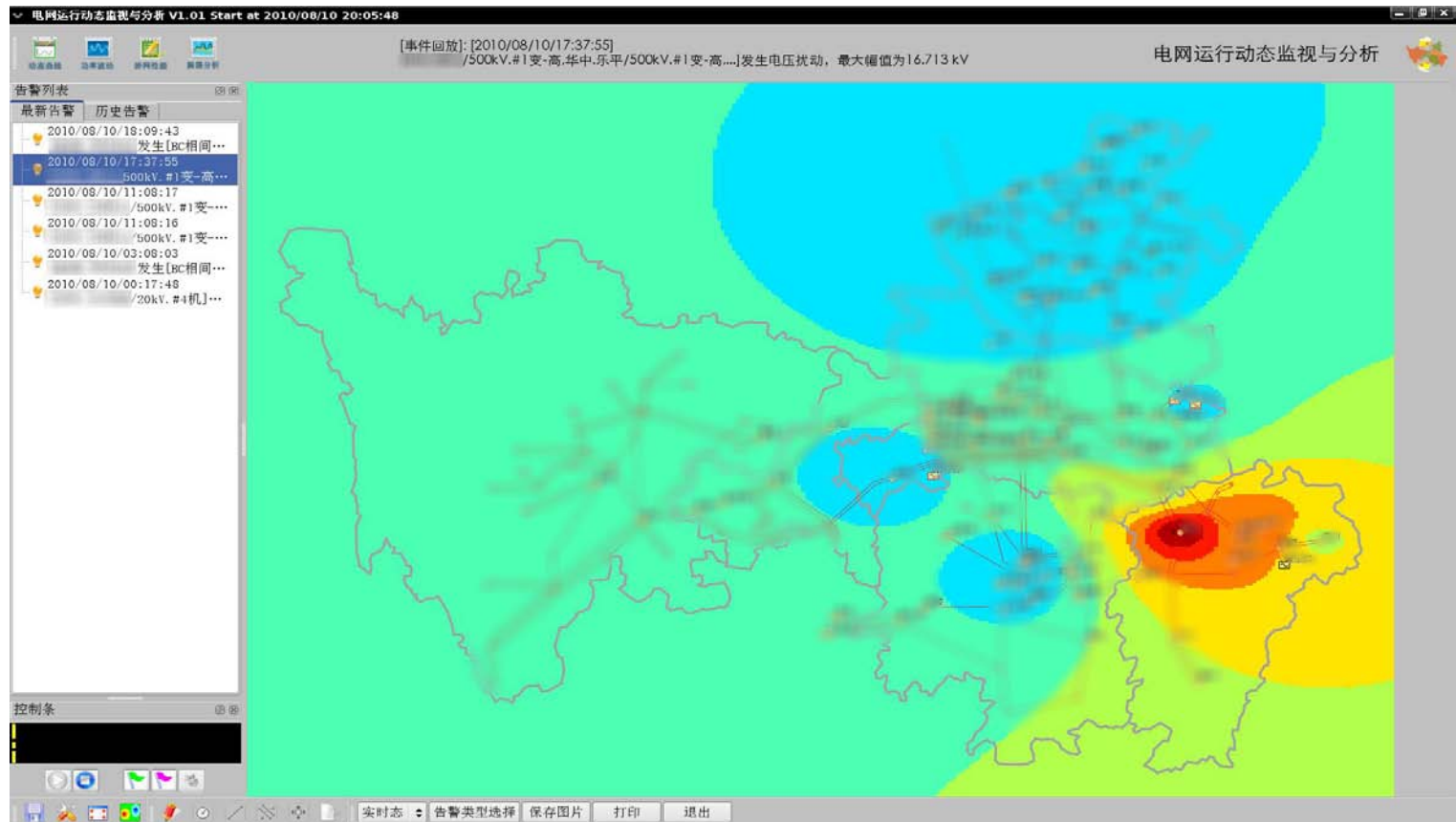- **Locating the first starting oscillation area**

# Combined use of SSA result and Identification result

Fast fault positioning

- Some fault information, such as short circuit fault on 220 kV or lower level can be obtained quickly for system monitoring;
- By employing the visualization techniques, some diagnosis can help dispatchers quickly locate the fault area.

Generator Primary Frequency Regulation Assessment

■ Analyzing unit power output and frequency curve measured by PMU to assess the effect of primary frequency regulation.
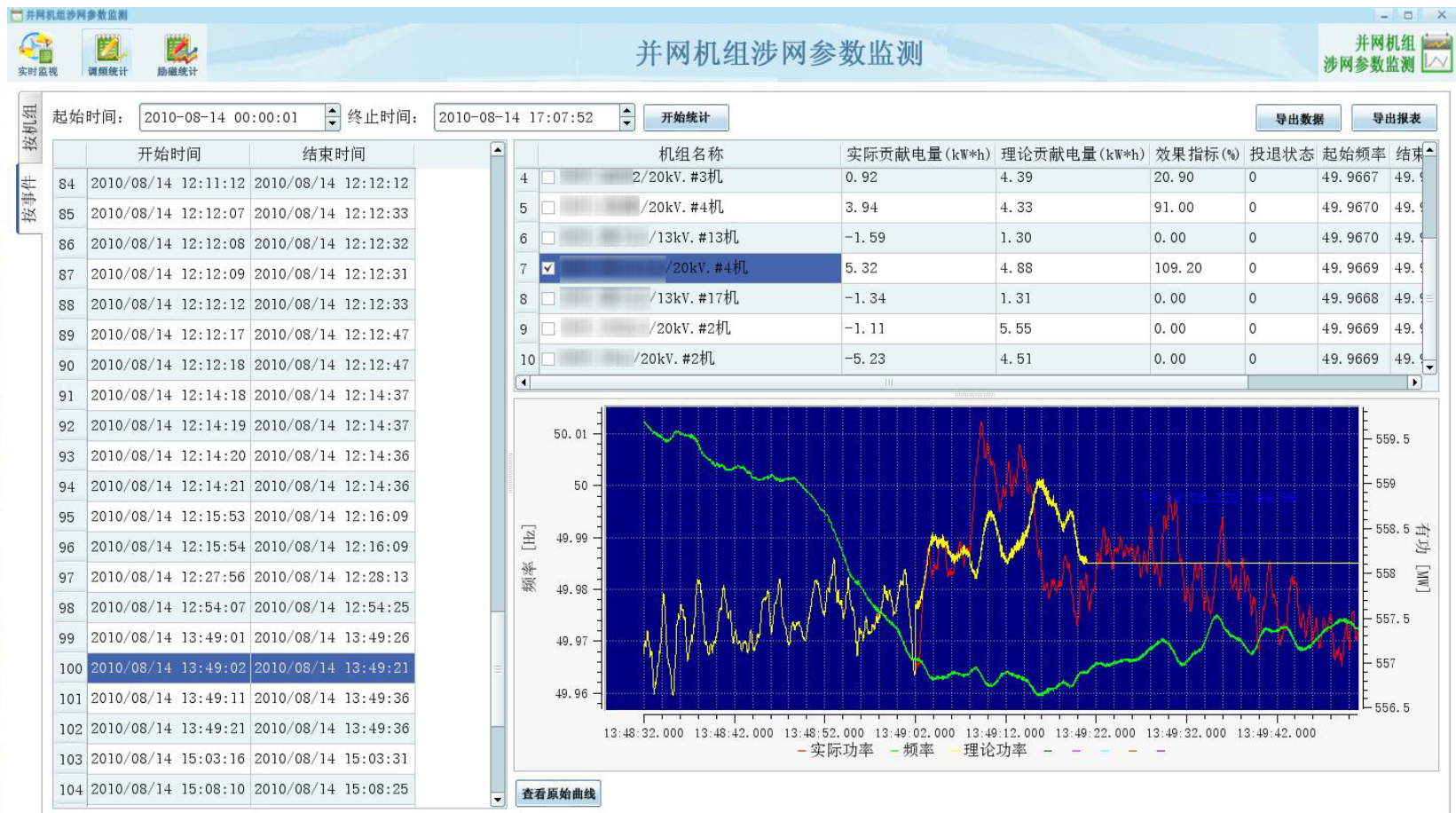
Trend of PMU data application

■ Architecture for PMU application
  – Final goal is to accomplish closed-loop control

Online Analyzing/Identification

Wide Area Measurement
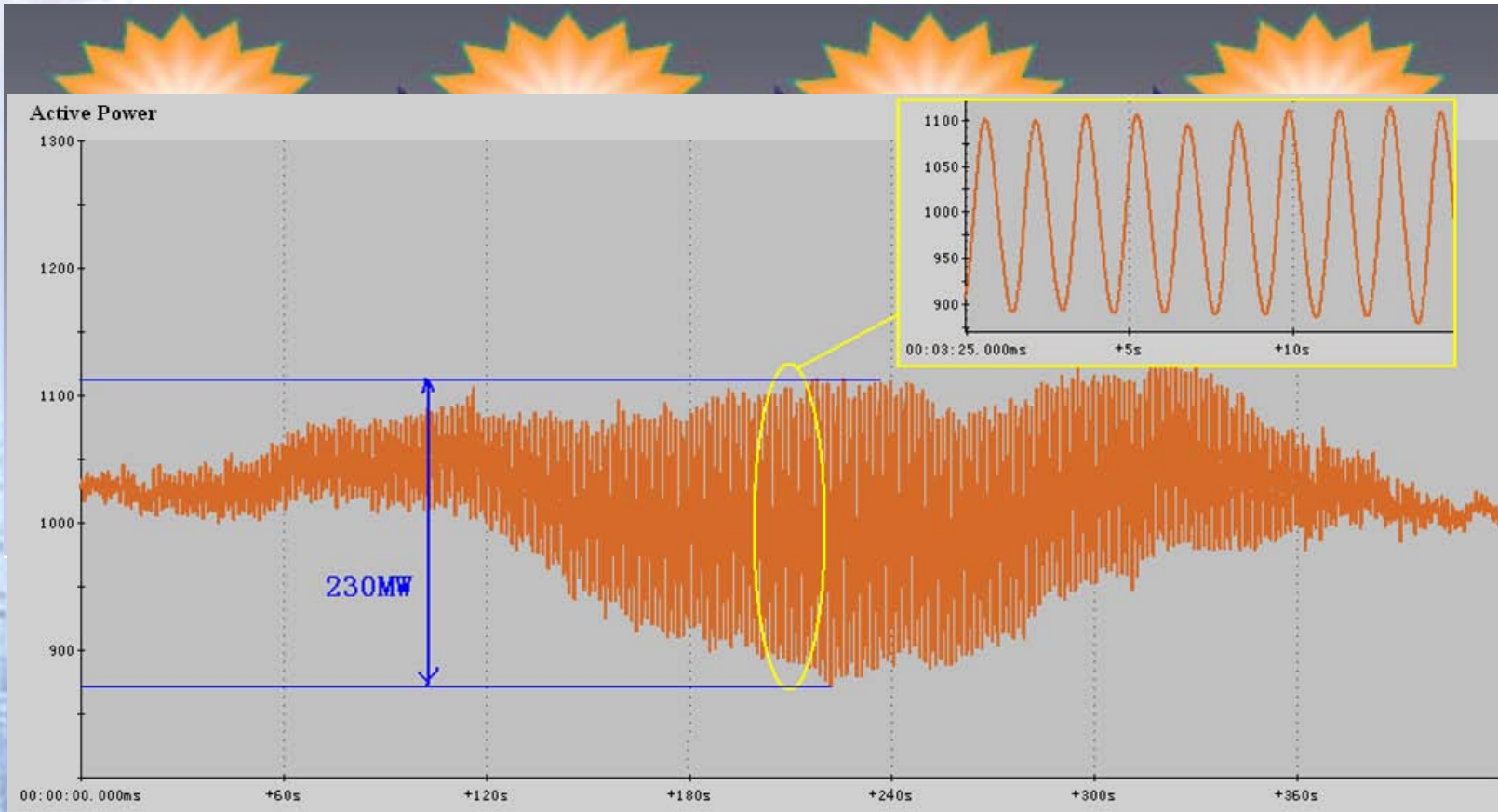
Wide Area Control

Electrical Power System
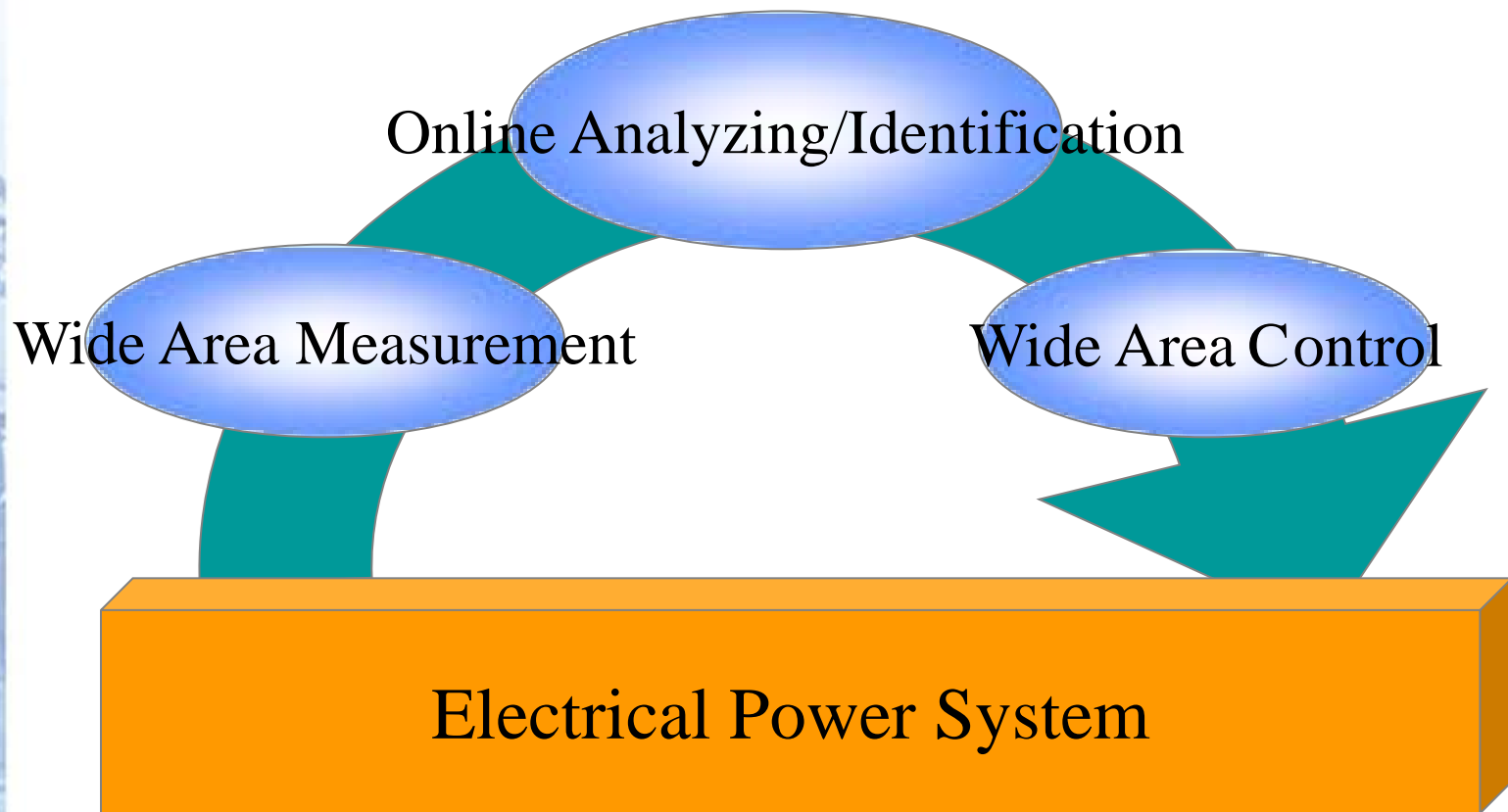
China Southern Power Grid

- 8 AC lines and 4 DC lines parallel transmission system
- The transmission distance spans over 1000km
- The total power transmitted from the west to the east over 18,000 MW
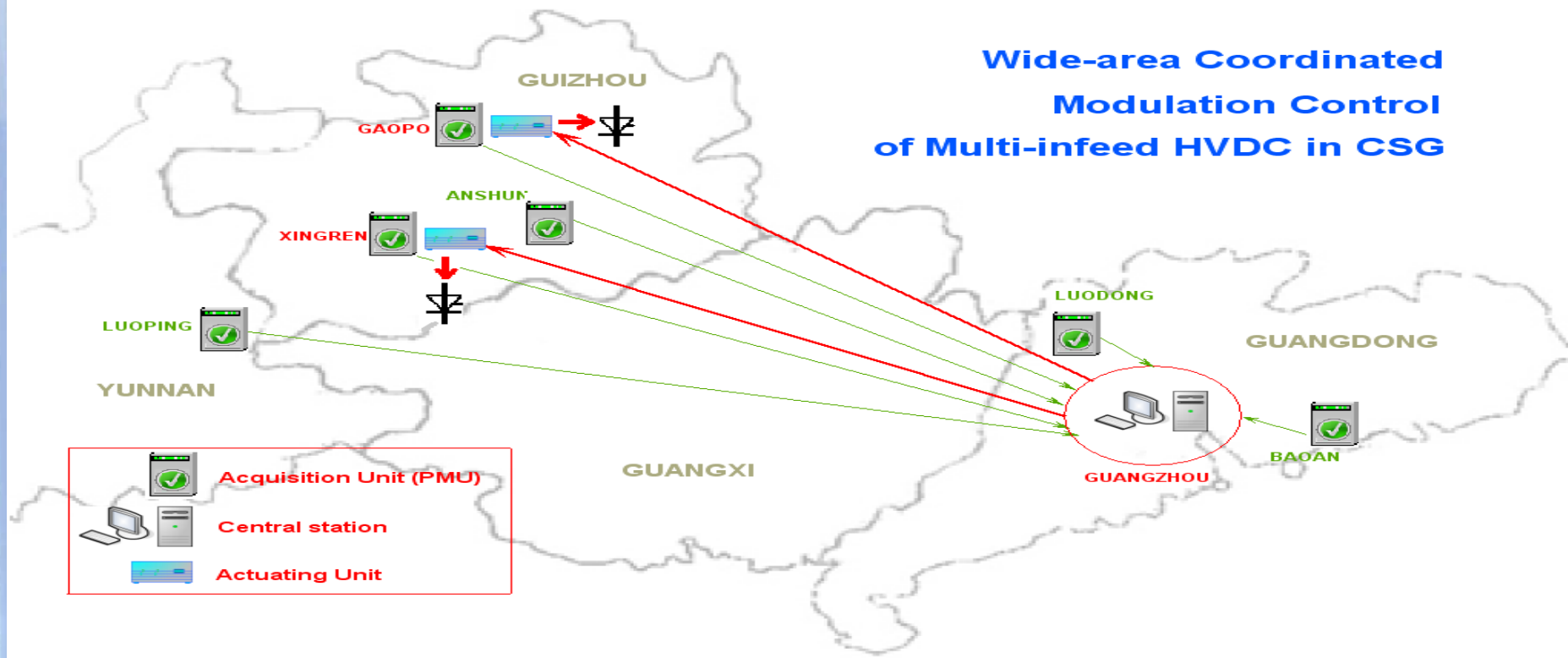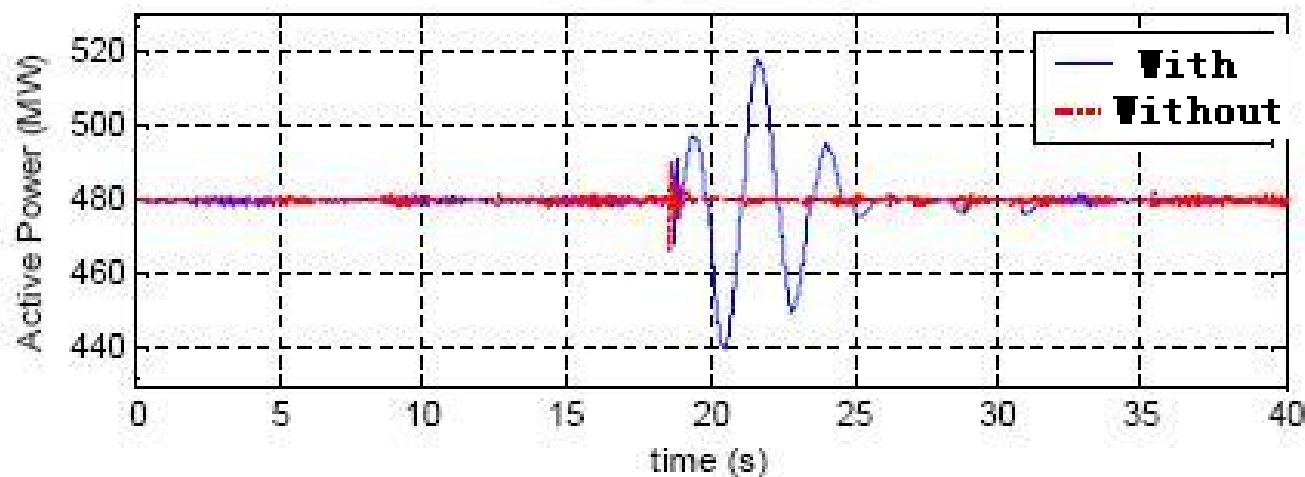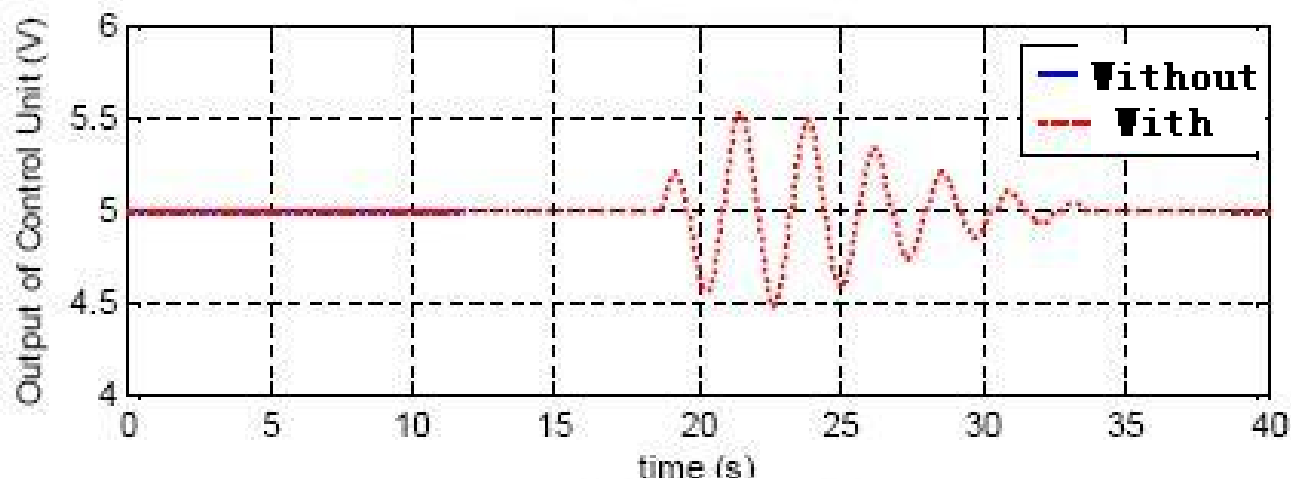
Project Background

- Oscillation continues more than 6 minutes
- Oscillation amplitude larger than 230 MW
- Oscillation frequency is about 0.64 Hz

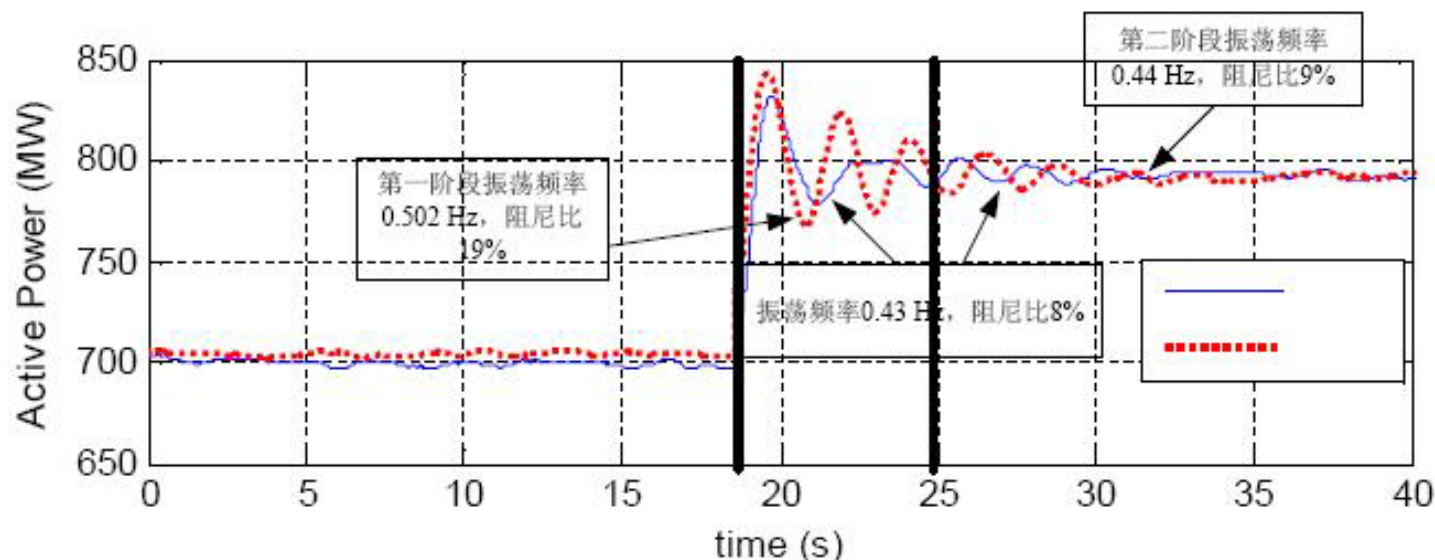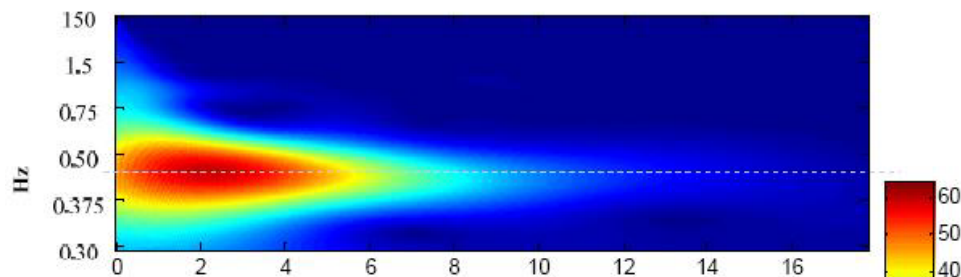# Control Output Test Under Large Disturbance

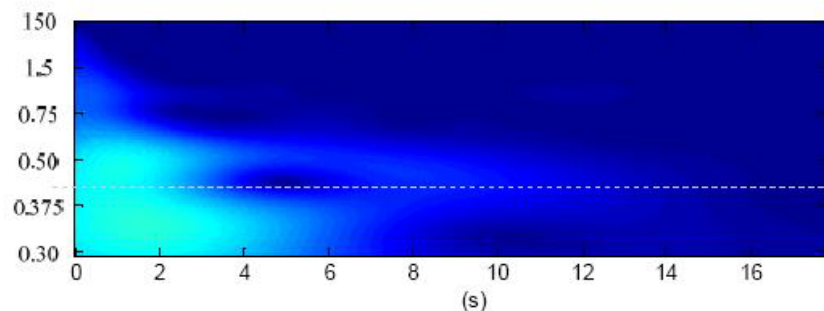- Test 1: Without HVDC modulation
- Test 2: With HVDC modulation

Power Oscillation on Tie Line I

HVDC Modulation Switch Off

HVDC Modulation Switch In

Any Question?

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