

Real-Time Displays of Aggregate Data in Electric Power Systems



A PowerWorld Retriever Overview
EIPP Work Group Meeting
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Scott R. Dahman, P.E.
1816 South Oak St
Champaign, IL 61820
weber@powerworld.com



PowerWorld
Corporation

(217) 384-6330

<http://www.powerworld.com>

Retriever's History



- PowerWorld Simulator 3.1 released in 1996.
- Development of Simulator's off-line planning tool continues – version 10.0 released in 2004
- Users express interest in applying the visualization of Simulator to the real-time environment
- June, 2000: ComEd and CWLP (Springfield, IL) begin separate projects
 - Interface to PI data source
- January, 2001: TVA
 - Interface to flat-text data source
- Ongoing development with ComEd & TVA
- New projects with ERCOT, PJM, AEP, Entergy, SPP, Southern Company, SCANA

Retriever Benefits



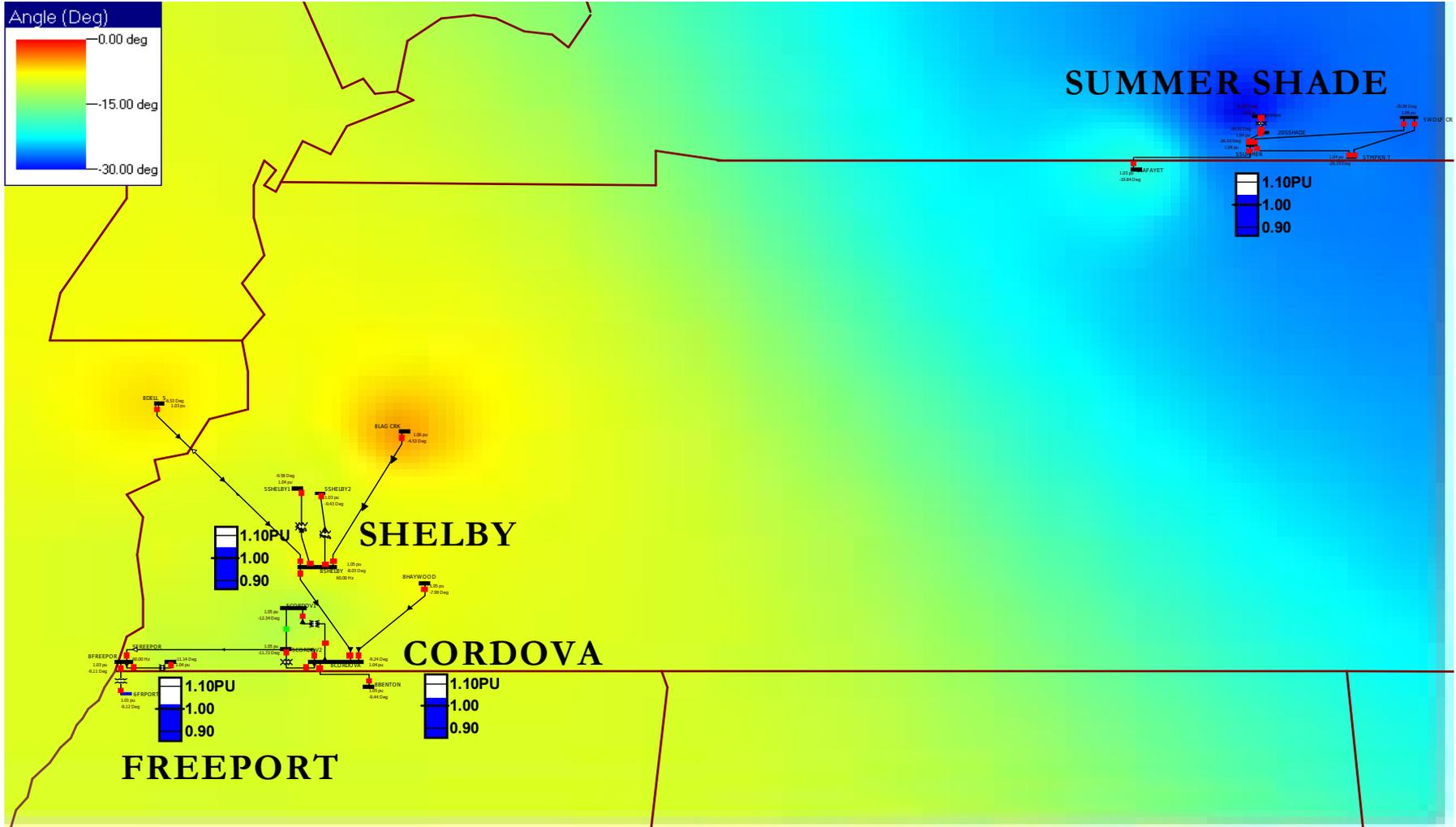
- Real-time visualization
- Provides excellent overview of system health to enhance situational awareness in control room
- Capture a power flow case from real-time data for study, training, or post-mortem analysis
- Independent of EMS platform
- Remote access by FTP

Retriever and the EIPP

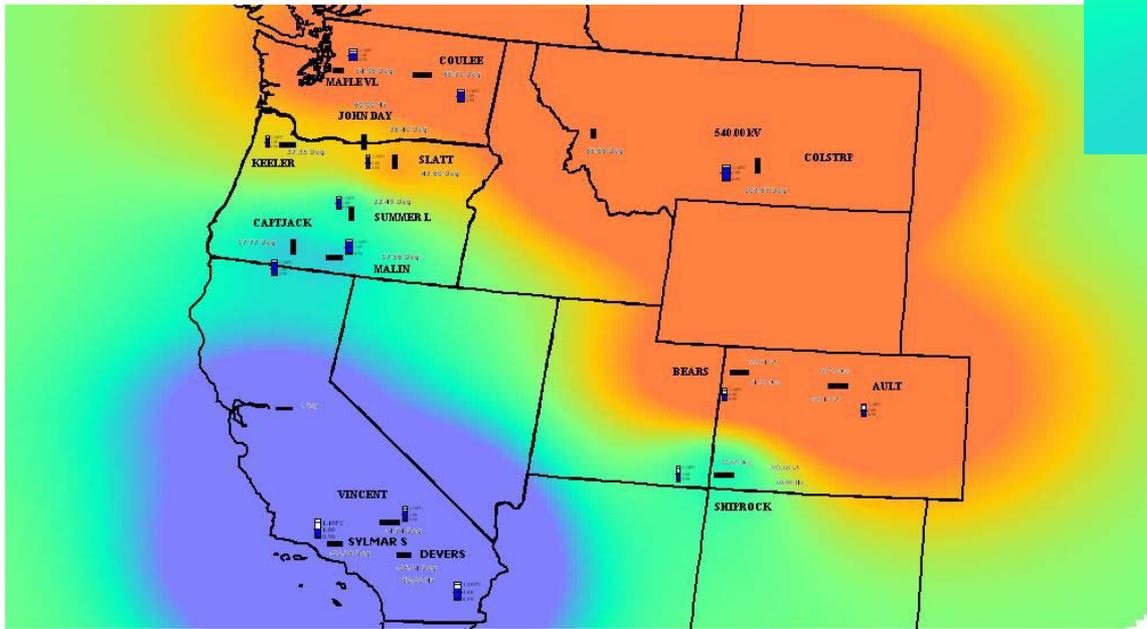
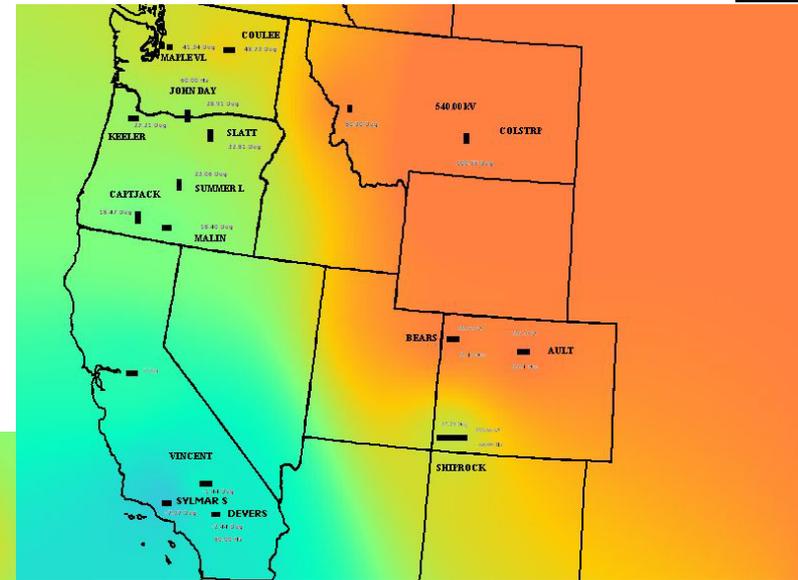


- Summer 2004: Pilot installation of PMU Visualization at TVA
 - ODBC connection to TVA SQL database
 - Phasor data retrieved from PMUs at several stations
 - Cordova
 - Shelby
 - Freeport
 - Volunteer
 - Summer Shade
- Can also communicate with OPC sources through 3rd party software (e.g. Matrikon OPC client)

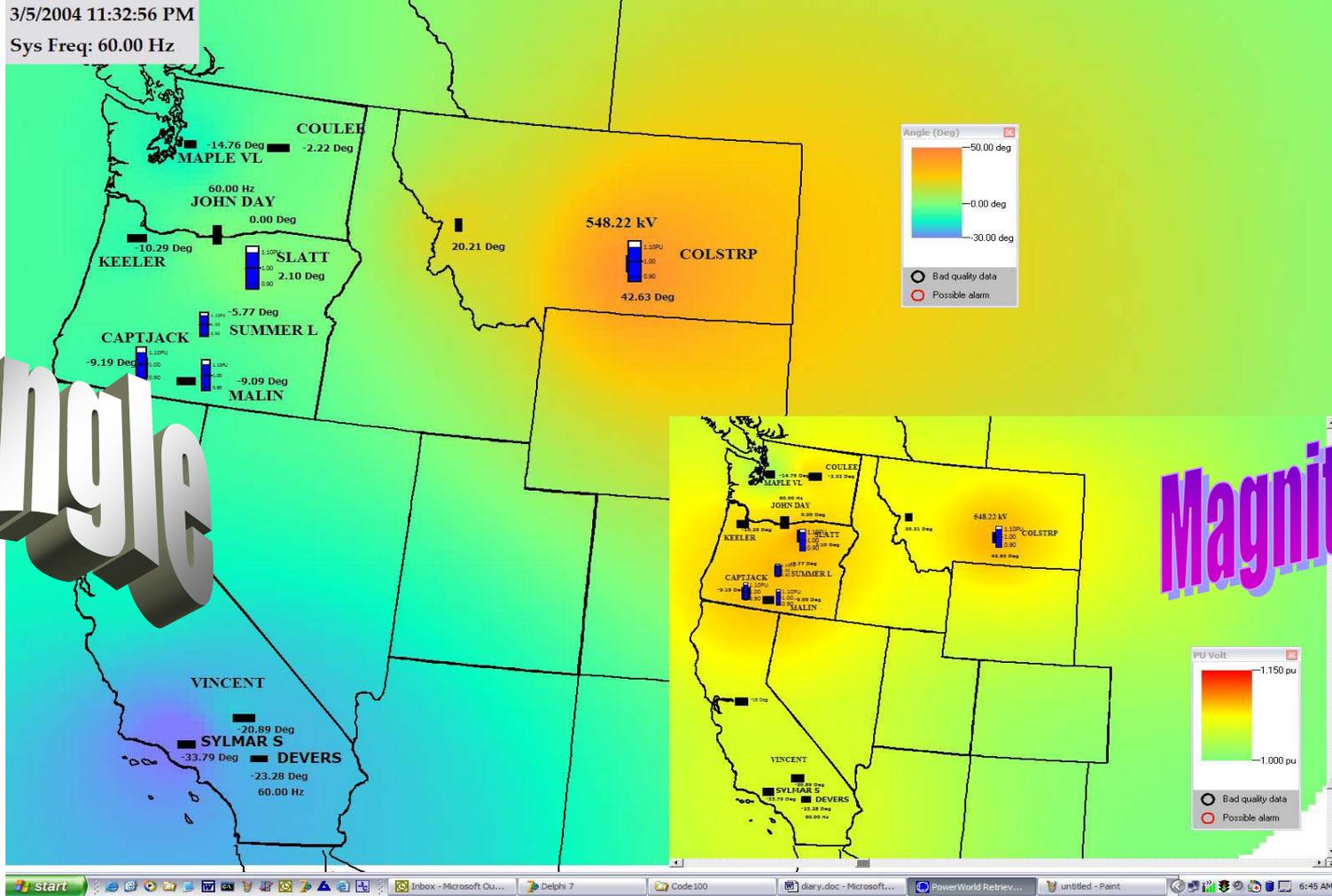
Eastern Interconnect Phasors (TVA)



WECC Angle Displays (BPA)



Phasor Combination Displays (BPA)



Angle

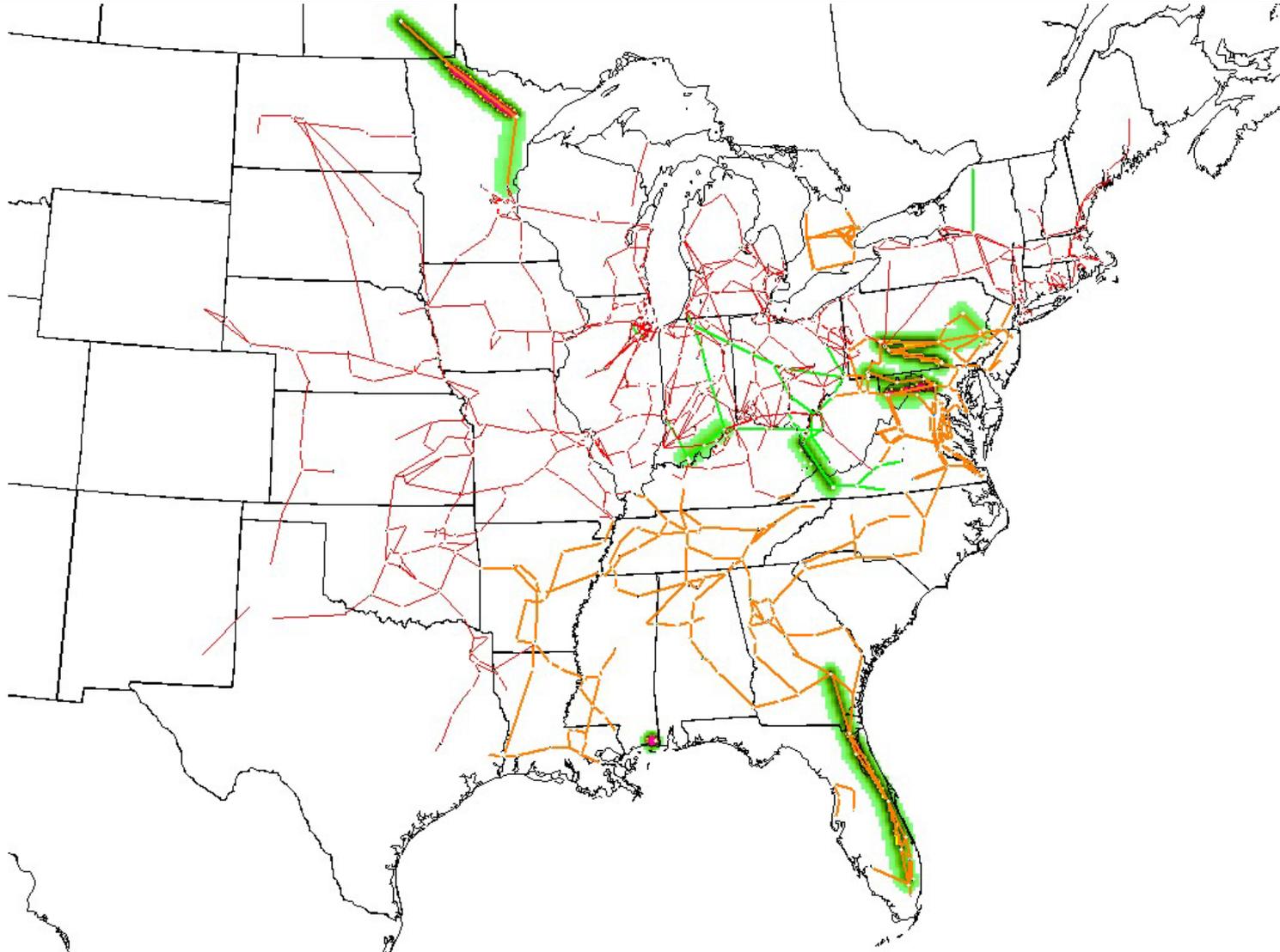
Magnitude

Contouring and 3D Columns

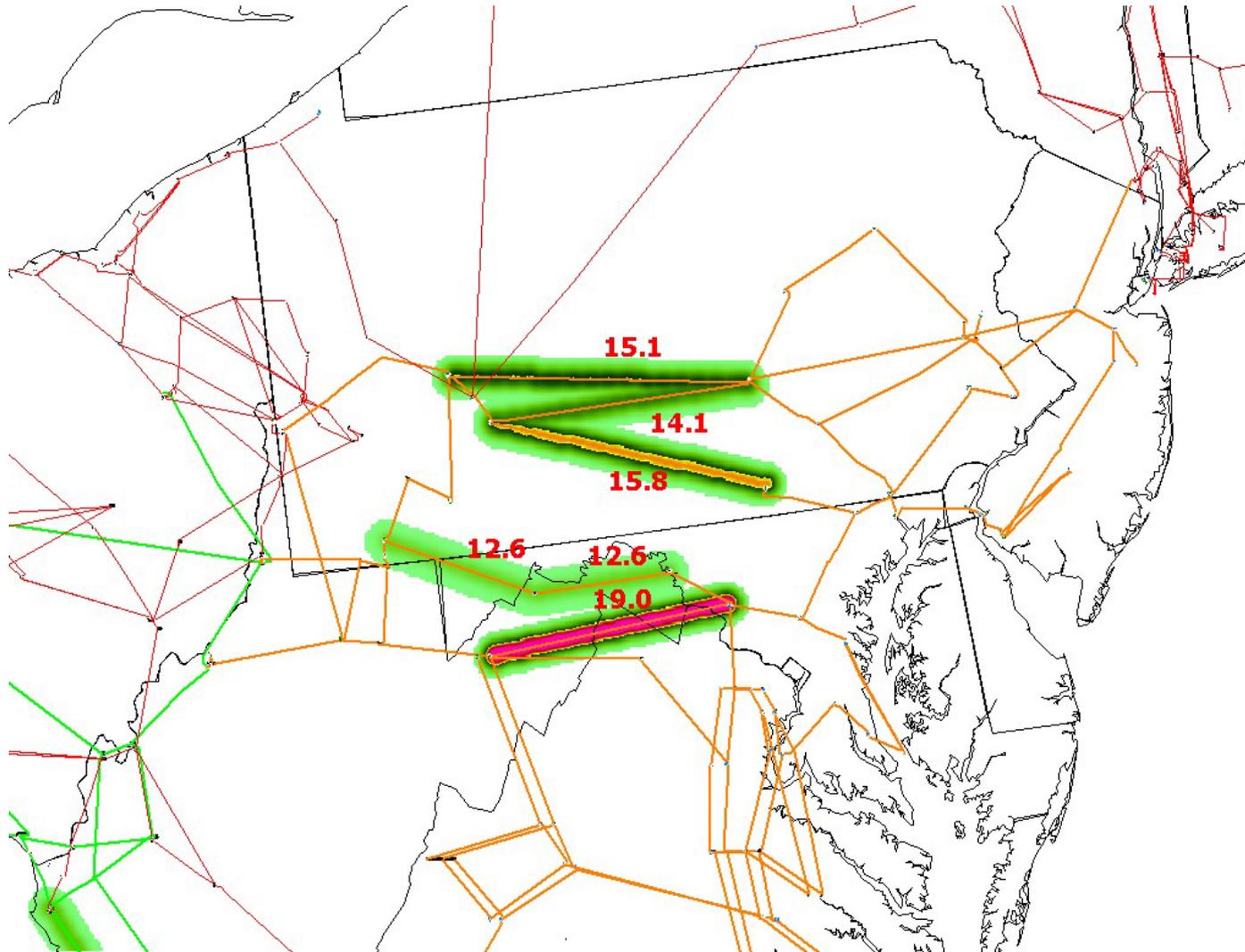


- Color contouring can visualize any numerical data that can be captured in real time
 - Bus per unit voltage or angle
 - Angle difference across transmission line
 - Locational marginal prices
 - Transmission line or transformer loading
- 3D columns can show related quantities
 - Reactive power output and reserves
 - Area real and reactive power load

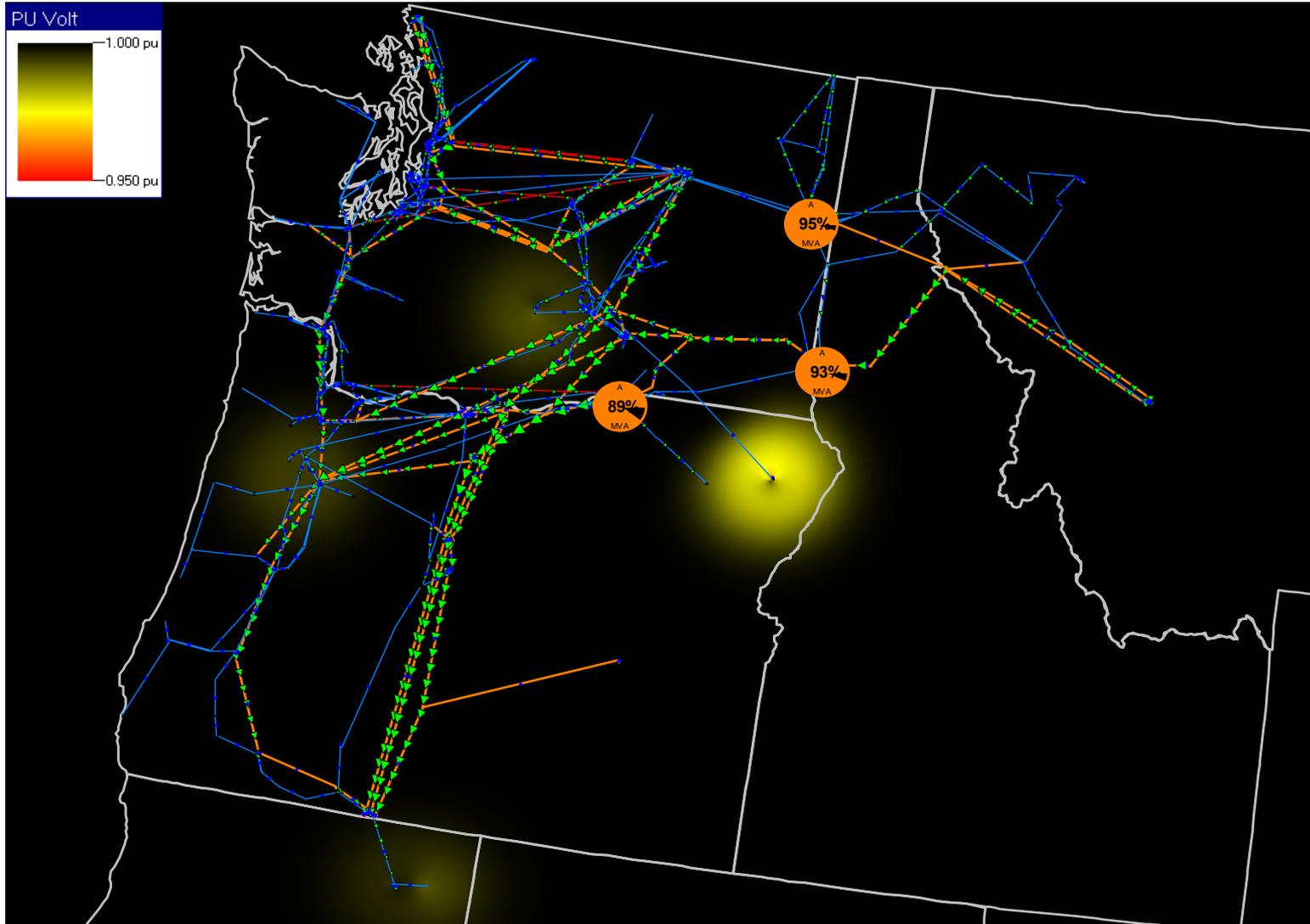
Angle Difference Across Lines



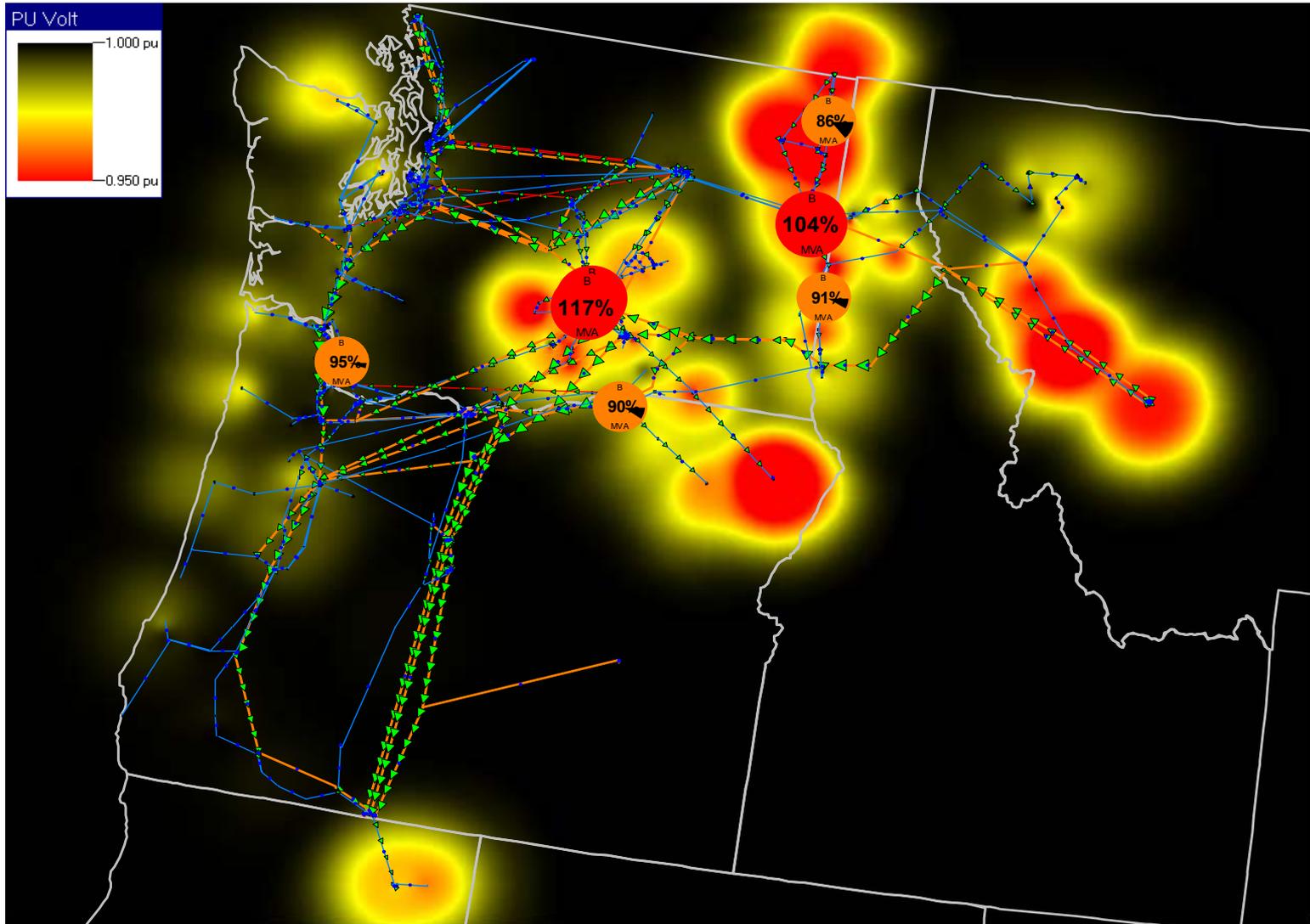
Angle Difference Across Lines



Contingency Visualization: Base Case

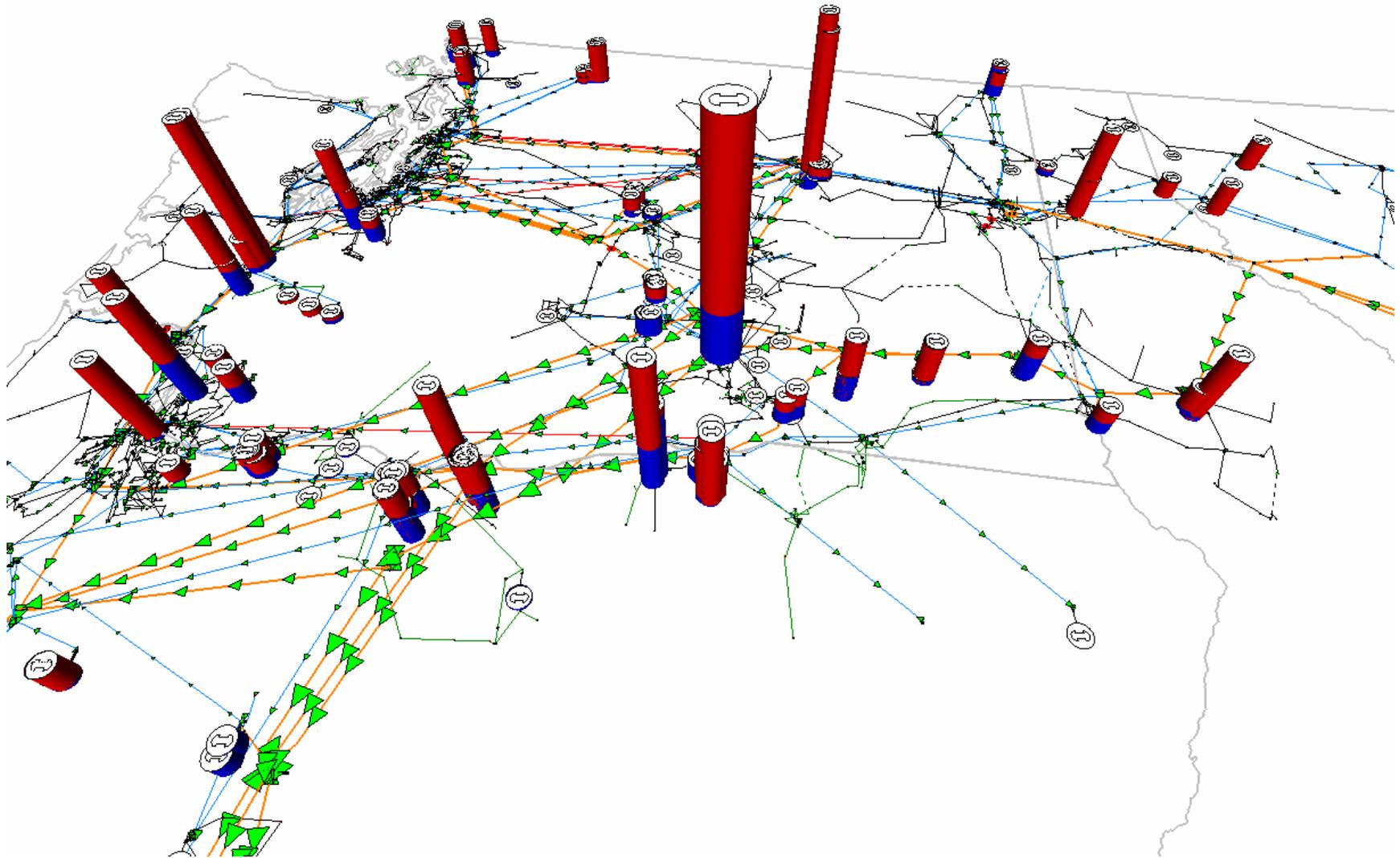


Contingency Visualization: Loss of Coulee-Hanford and Vantage-Hanford



Contouring with 3D Columns:

Base Case Reactive Reserves



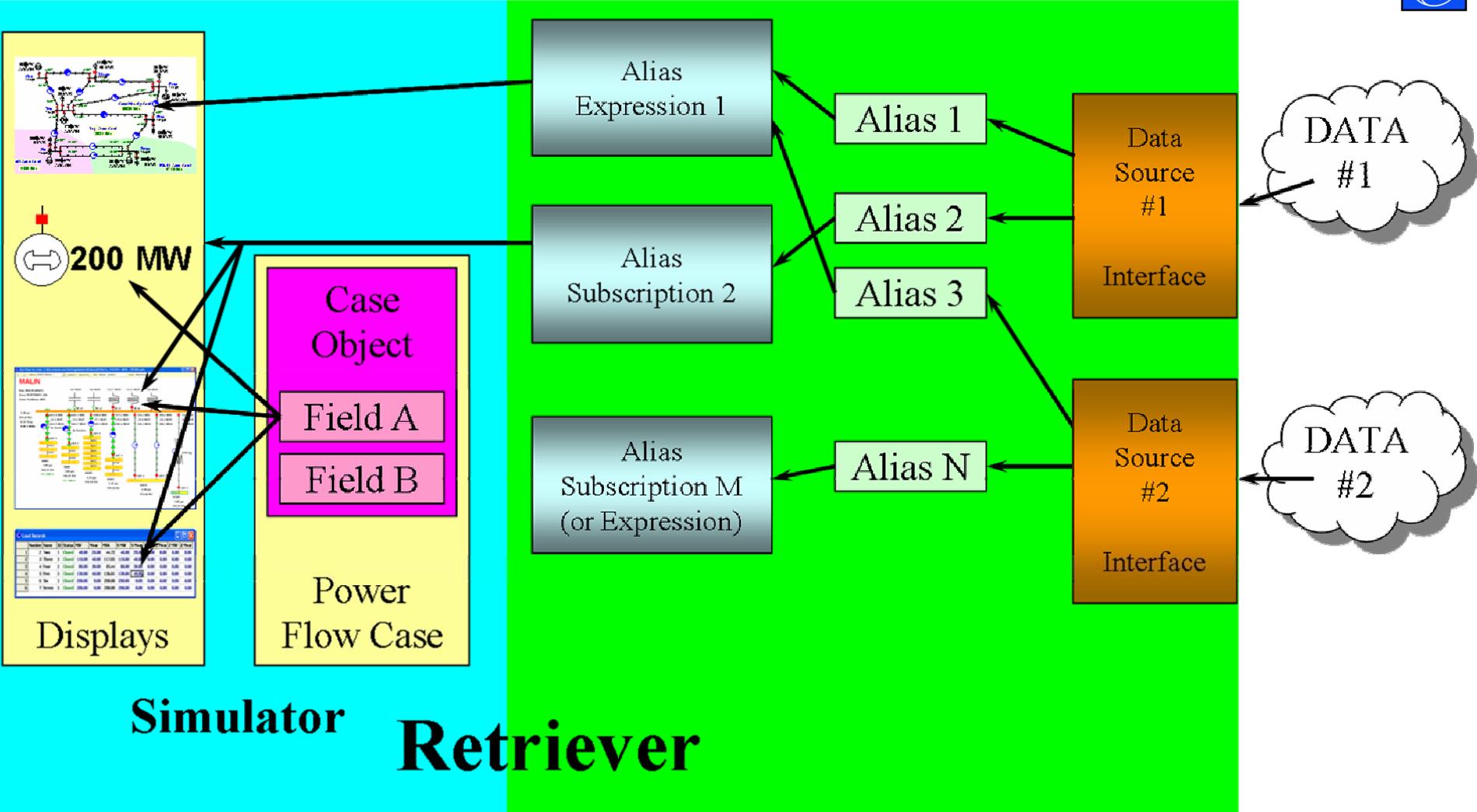
Recent Enhancement:

Study Mode



- Create a power flow case from real-time state estimator data
- Phasor retrieval from state estimator or PMU
- Applications
 - operator training for emergency operation or post-mortem analysis
 - Contingency, ATC, voltage stability analysis based on real system conditions

Retriever Architecture



Summary



- Retriever brings all the visualization techniques of PowerWorld to the on-line environment
- Advantages
 - Flexibility in data and display format
 - Ability to communicate complex data and trends quickly, in a manner that is easily understood by engineers and management
 - Visualization platform developed over several years and guided by hundreds of customers and research

To Probe Further



- Retriever product information and case study available at
<http://www.powerworld.com/products/retriever.html>
- 30-day free software demos available to qualified parties