



EvenFlow™ Coal Flow Control System

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Product Development Engineer

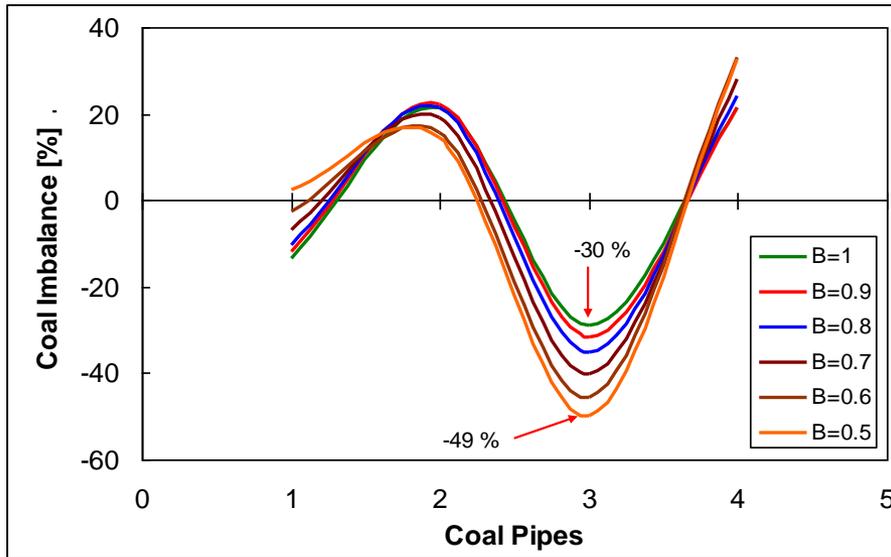
Air/Fuel Distribution

- B&W recognizes the importance of air/fuel distribution
 - Good distribution key to good performance
 - Dynamic control needed to maintain performance over operating range
- B&W has conducted air/fuel distribution R&D for decades
 - Lab-scale flow loops
 - CFD modeling
 - Field testing
- B&W has also monitored available technologies
 - Coal distribution control (adjustable orifices)
 - Coal flow measuring (microwave devices)

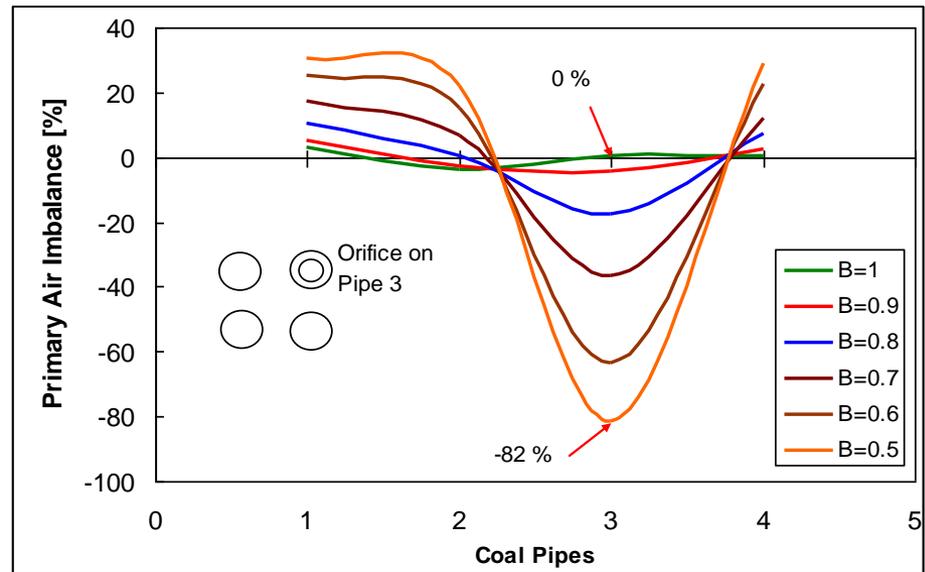
EvenFlow™ Coal Flow Control Technology

- Extends patented Lehigh University technology for non-pressurized mills
- Incorporates B&W's R&D experience and design expertise
- B&W sponsored R&D at Lehigh University
 - CFD modeling to down-select designs
 - Laboratory-scale testing to confirm performance
- Lehigh testing revealed:
 - Coal distribution controlled with minimal impact on PA distribution
 - Performance impacted by location and design of control devices

Lehigh Research – Traditional Orifices



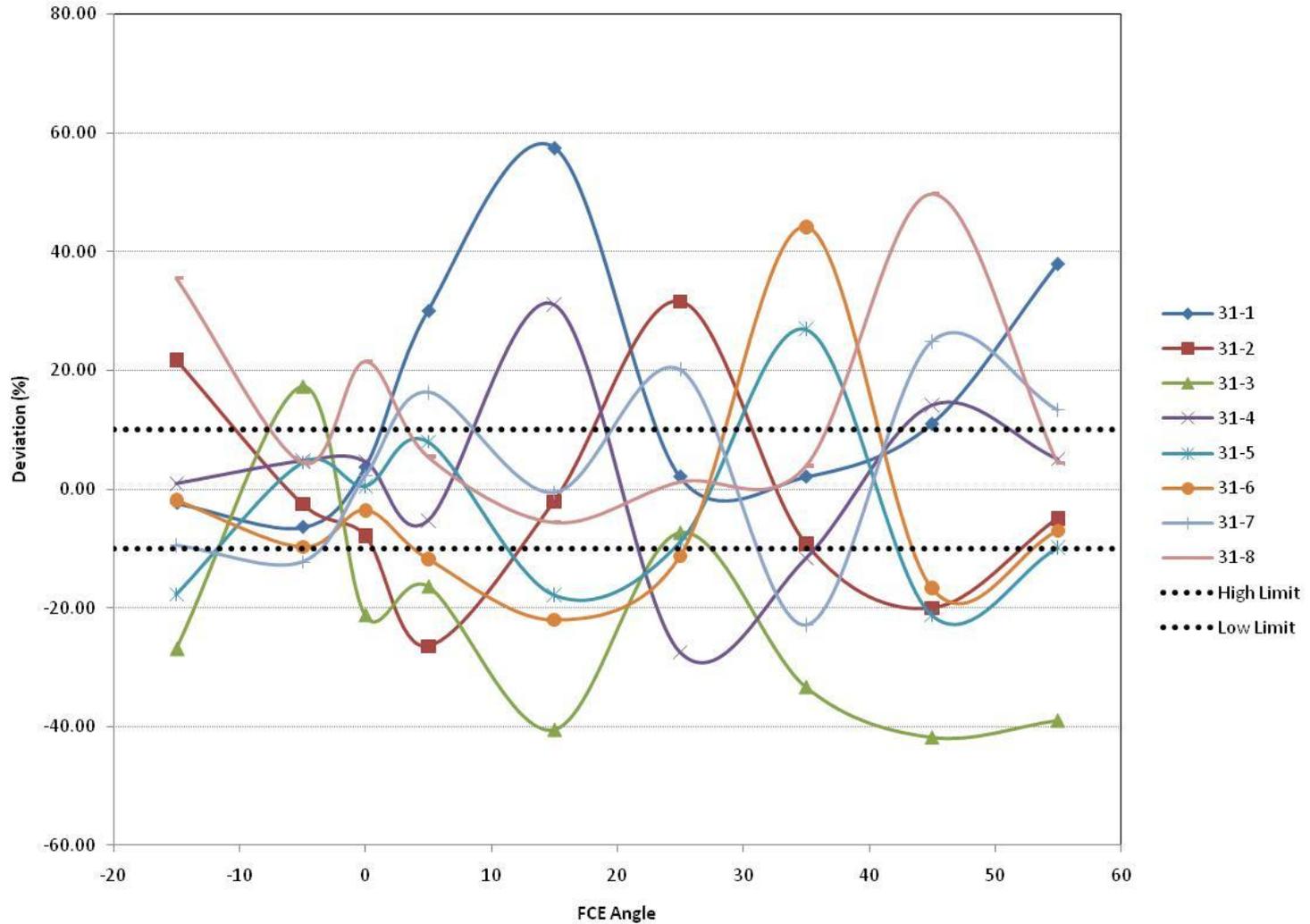
Traditional orifices have a disproportionate impact on primary air flow



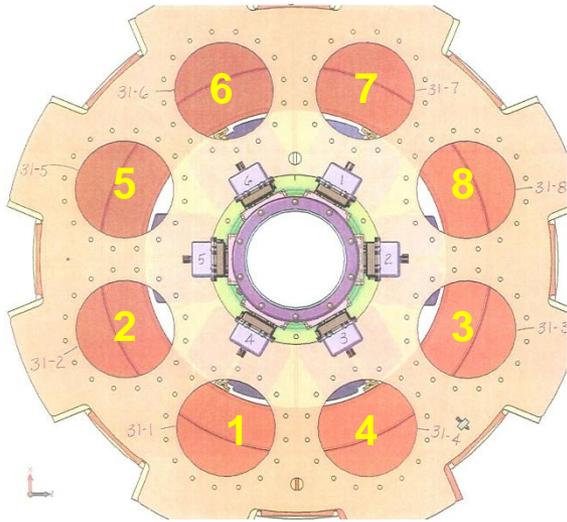
EvenFlow™ Installation



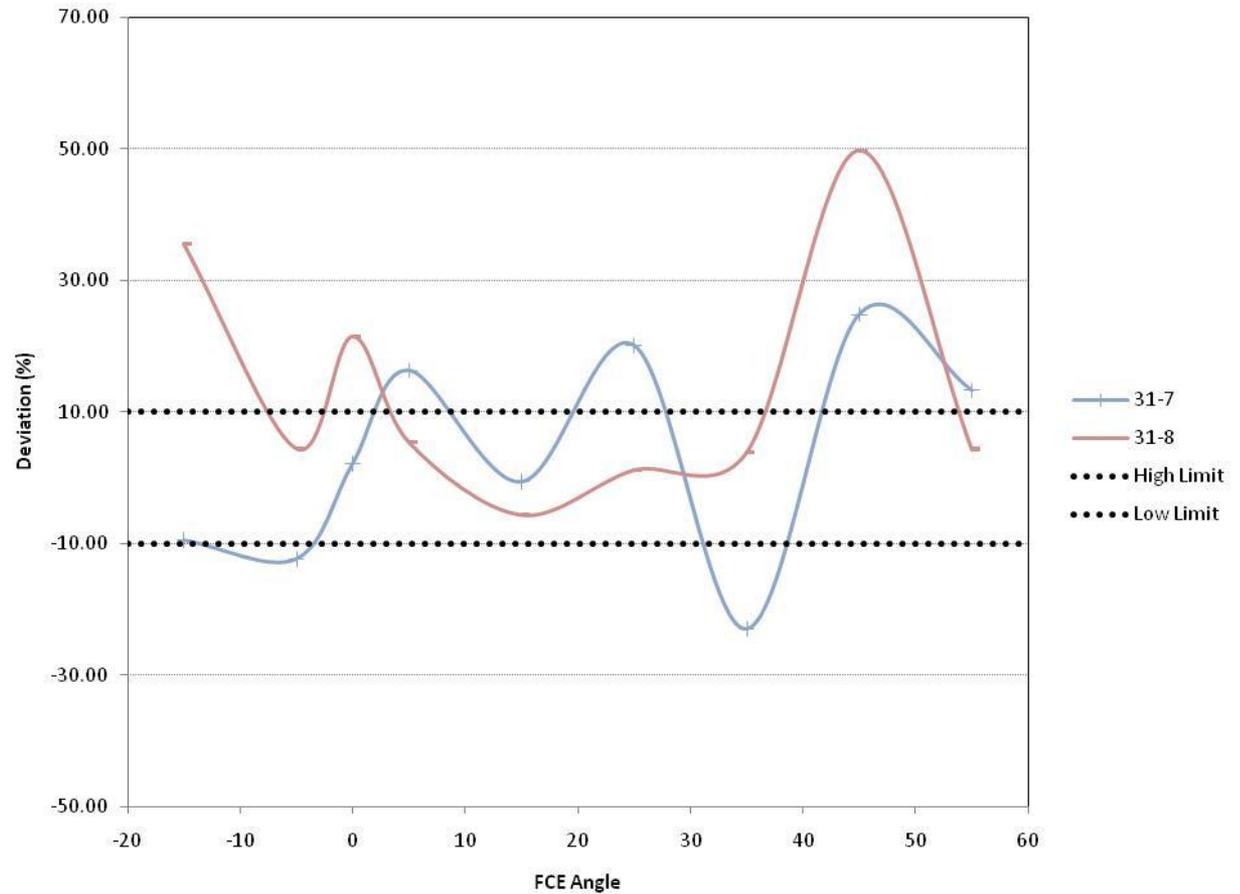
EvenFlow™ Test Results



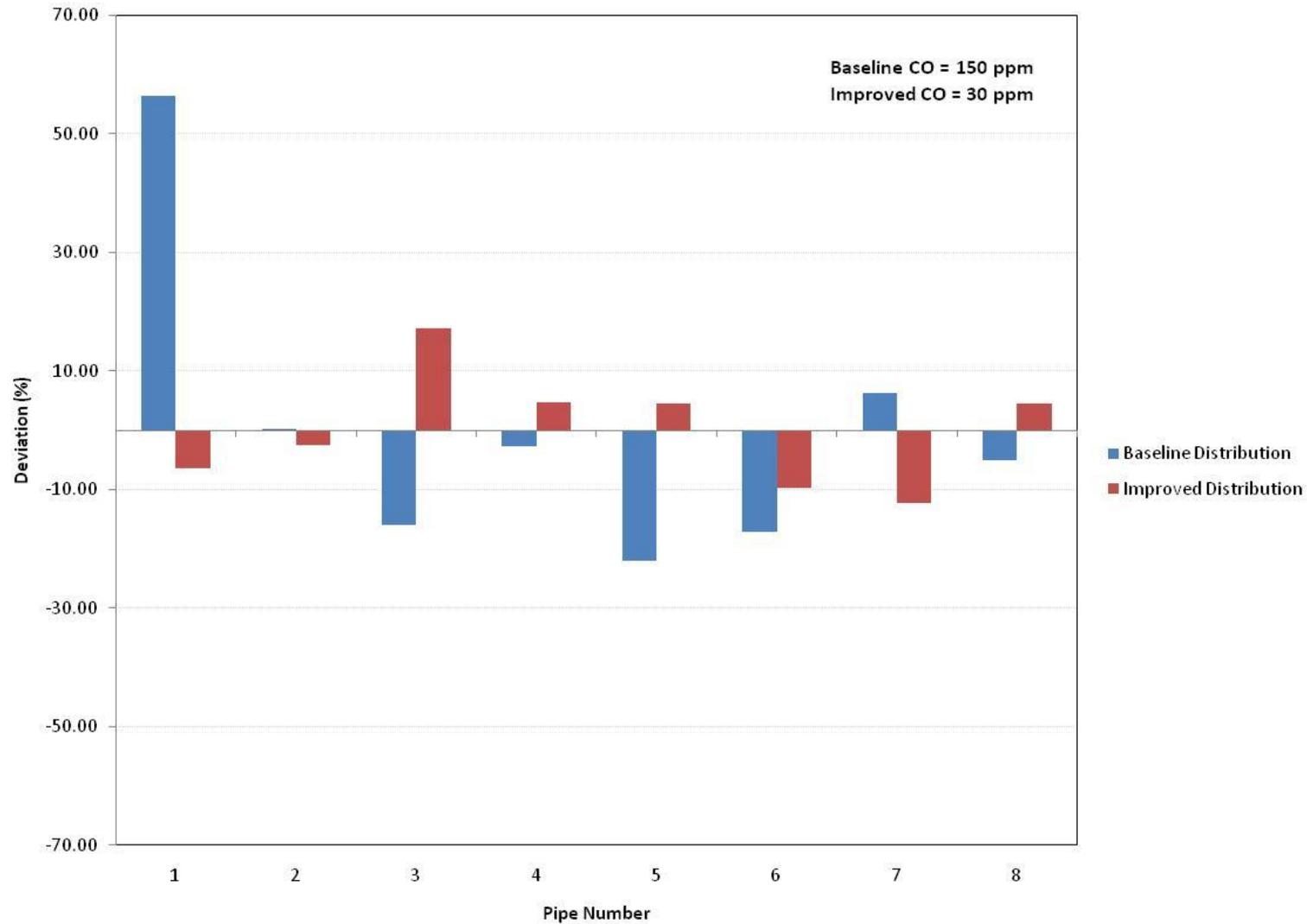
EvenFlow™ Test Results



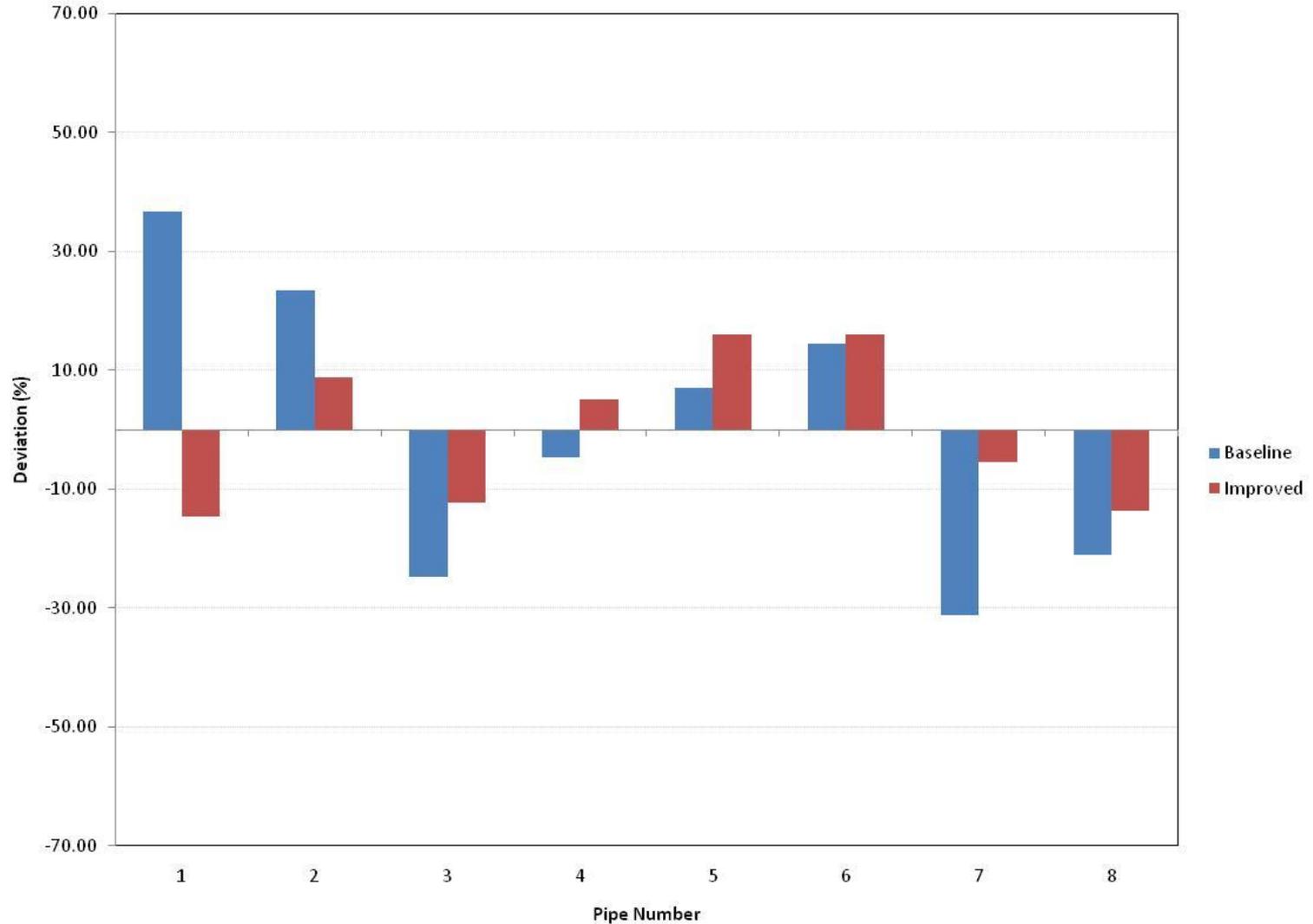
←
Direction of
flow helix



Full Load Test Results



Part Load Balancing Results



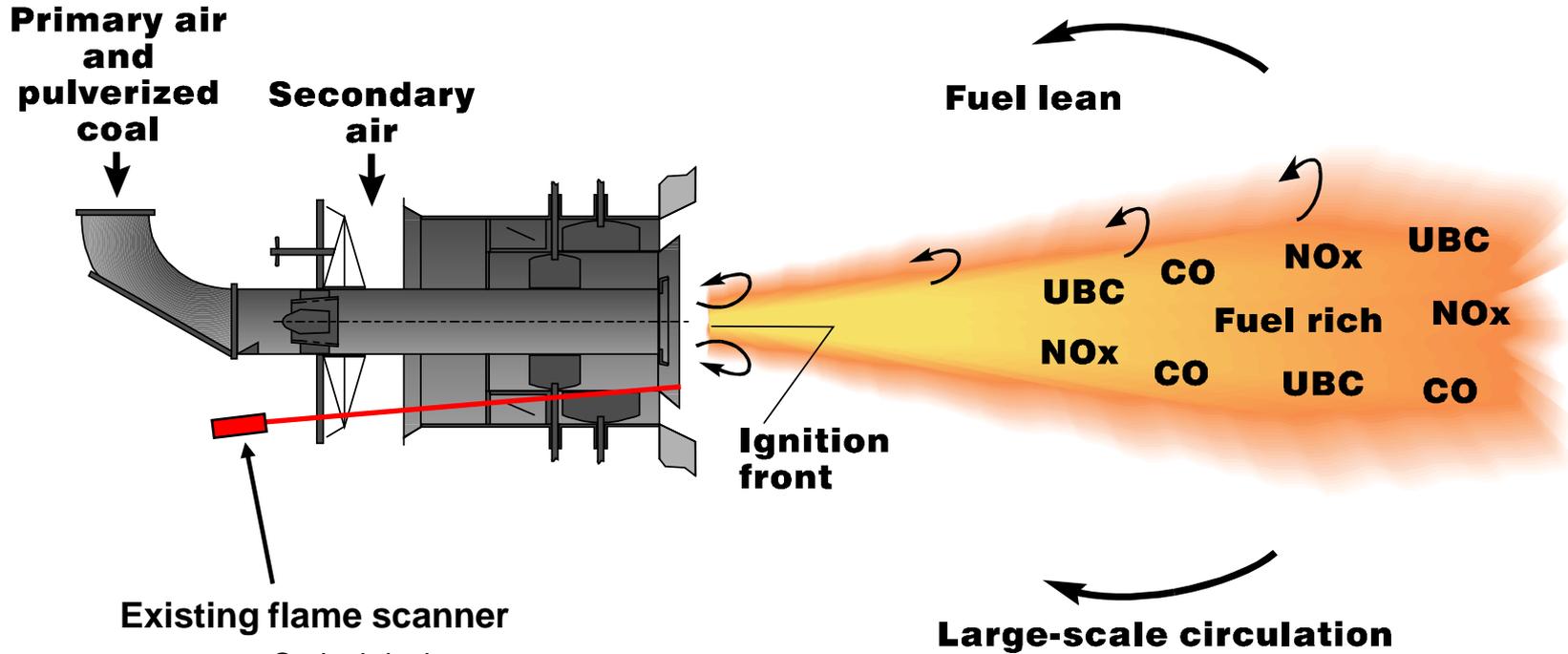
EvenFlow's Benefits

- ▶ Unique design adjusts coal with minimal impact on air
- ▶ Factory assembled – quick installation
- ▶ Wear resistant materials – low maintenance
- ▶ Lower, more consistent emissions performance
 - Lower CO
 - Lower NOx
 - Lower Excess O2
 - Lower, consistent LOI
- ▶ Reduced slagging and fouling due to poor combustion



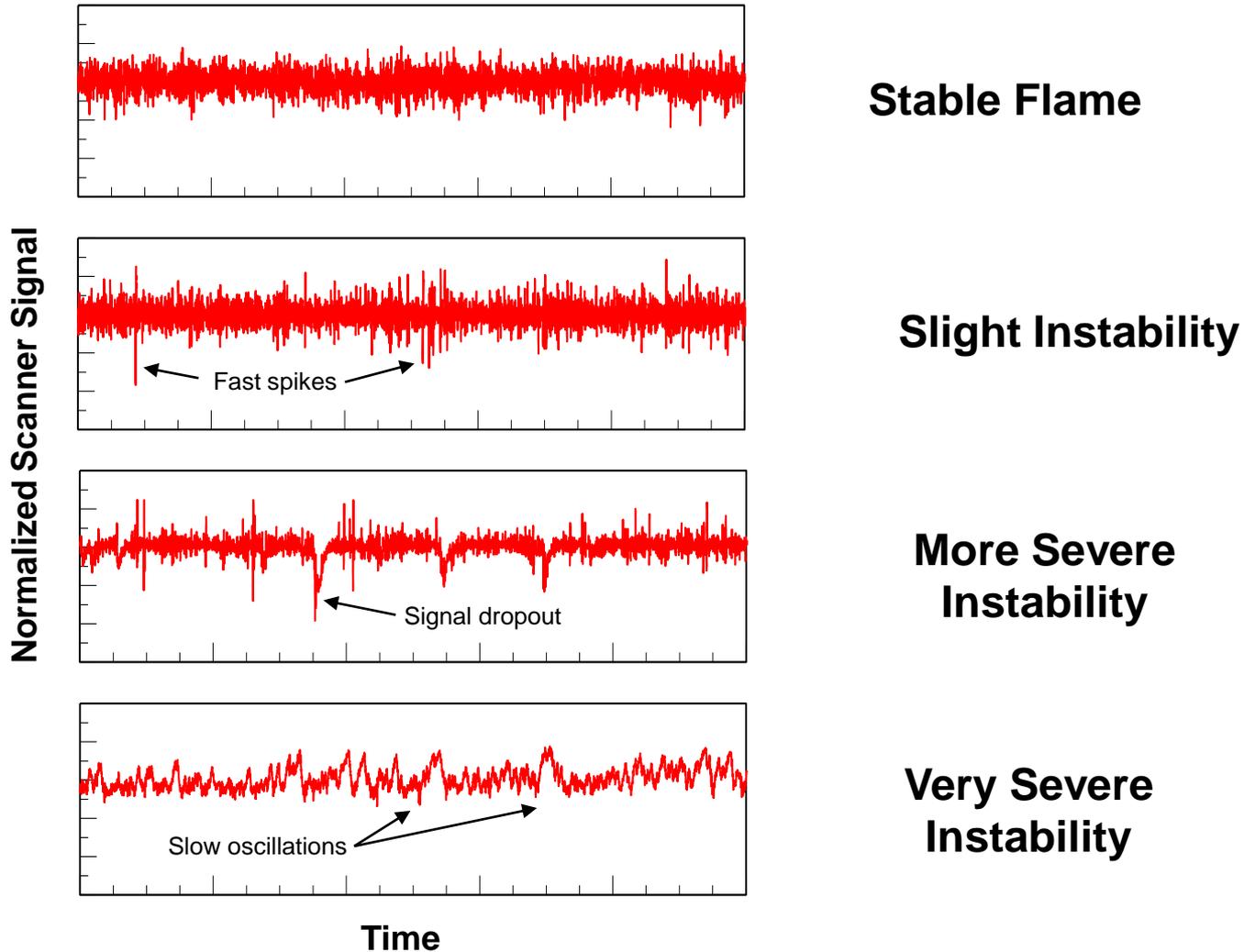
Combustion Diagnostics

How Flame Doctor Measures Combustion



- Existing flame scanner**
- Optical device
 - Converts flame flicker into electrical fluctuations
 - Used for On/Off detection

Scanner Signals Reflect Combustion State



Flame Doctor Software

- Flame Doctor Results

- ▶ Burners

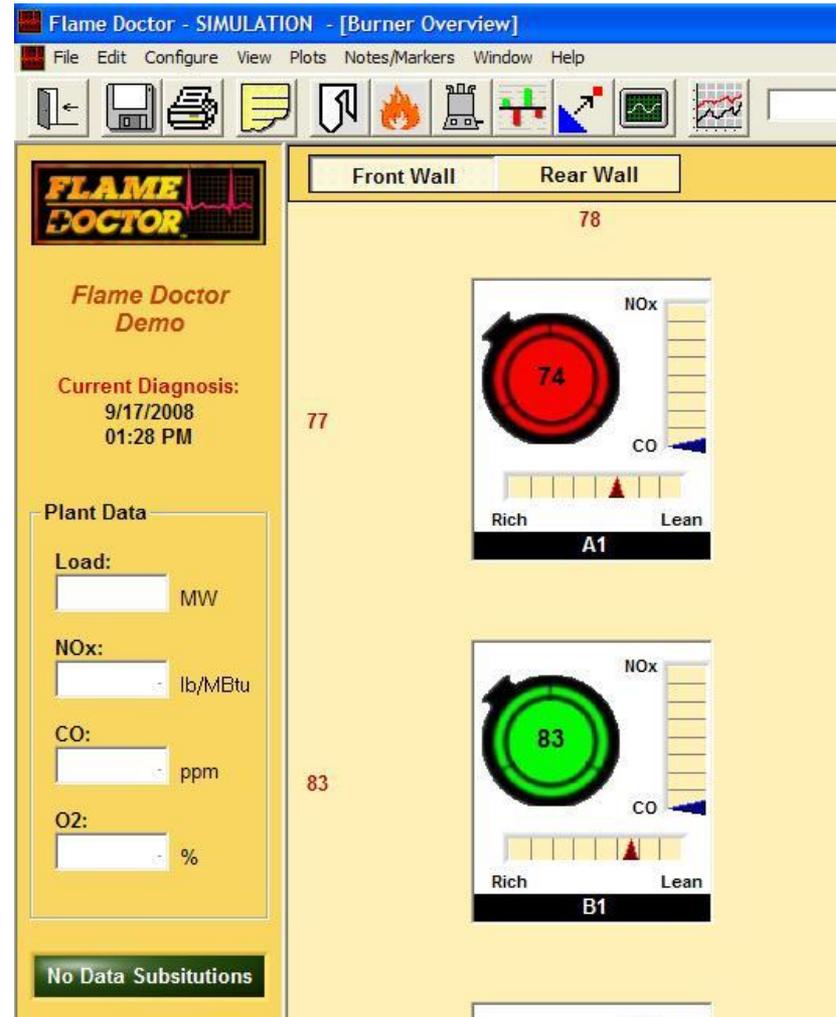
- ▶ Absolute ratings (0-100)
 - ▶ Flame type identification
 - ▶ Operator guidance
 - ▶ Air/fuel index
 - ▶ CO/NO_x potential

- ▶ Mills

- ▶ Absolute ratings (0-100)
 - ▶ Relative rankings
 - ▶ Lean/rich alarming
 - ▶ Line-to-line balance

- Availability

- ▶ Sent to DCS
 - ▶ Sent to optimization system

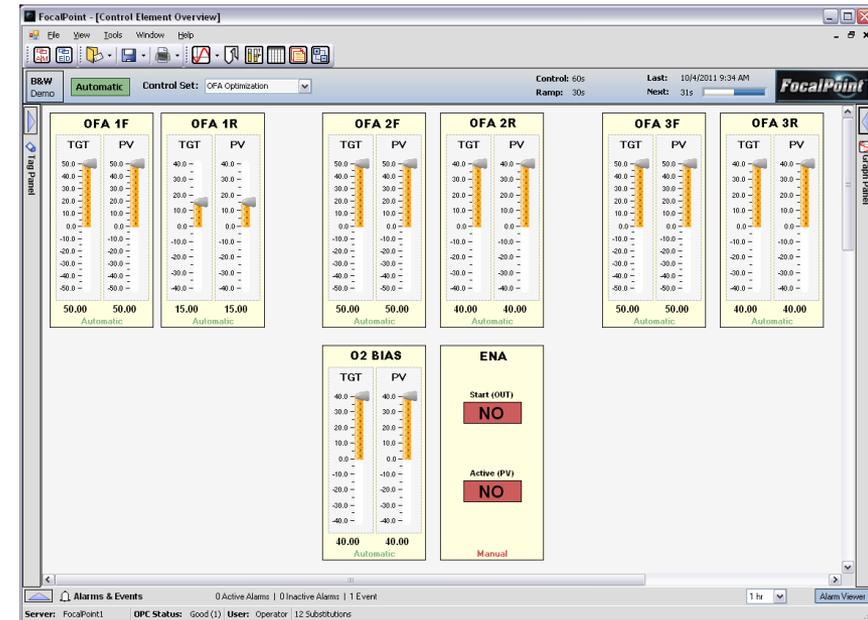




OPTIMIZATION SYSTEM

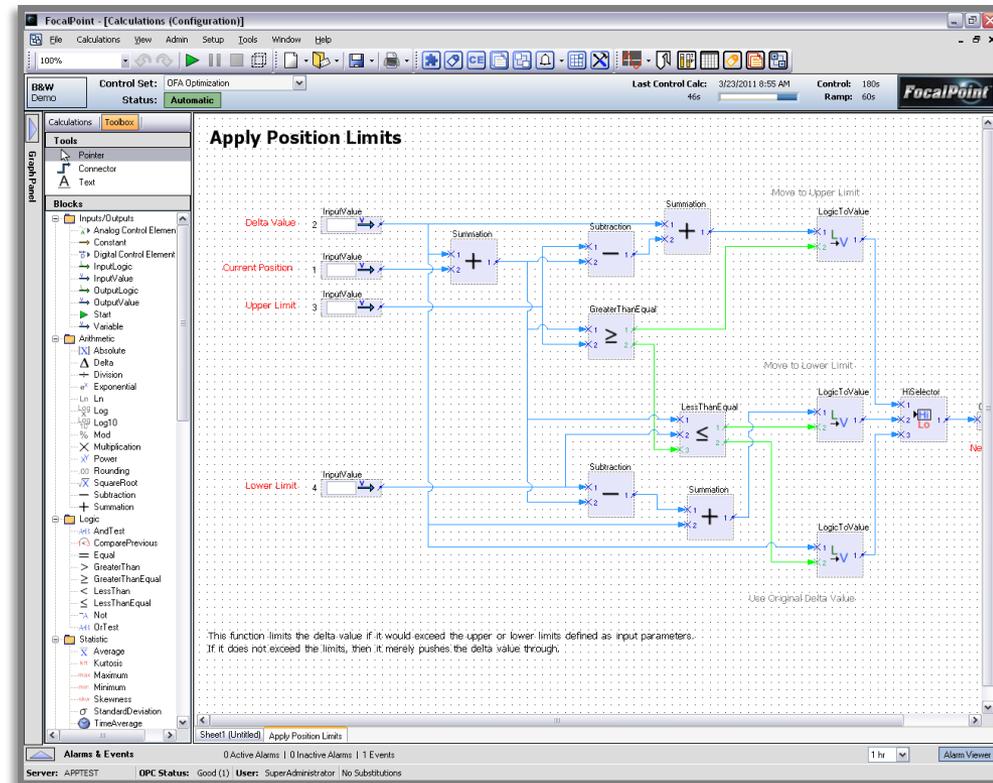
Unique Approach to Optimization

- Open system
 - Not a “Black Box”
 - Users may view and edit optimization strategies
- Supports multiple optimization approaches
 - Does not “force fit” a single solution
 - Strategy tailored to specific application
- Flexible, expandable system
 - Capable of optimizing multiple processes
 - No additional software cost
- Cost-effective solution
 - Low initial price
 - Low annual maintenance fees
- Developed by boiler OEM
 - Built upon B&W’s 140+ years of experience
 - Ongoing support from combustion experts

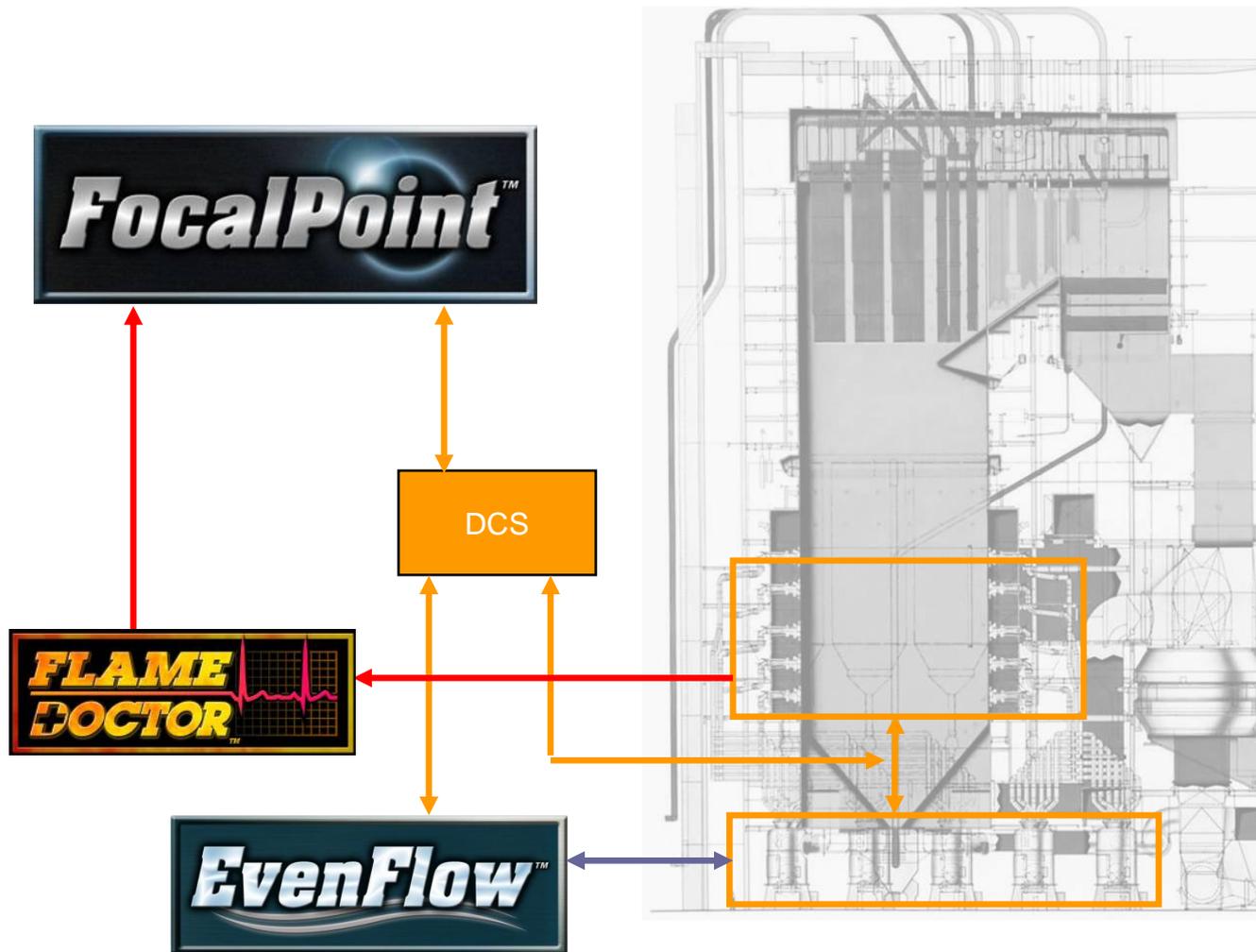


Optimization With FocalPoint

- FocalPoint provides suite of tools to develop optimization strategies
- Optimization strategies created using Calculation Editor
 - Function block approach
 - Intuitive drag-and-drop interface
 - Simple flow chart layout
 - Wide array of algorithms, models, calculations and logic functions
- Strategies can be implemented or modified online



Closed Loop Stoichiometry Control



Automatic control based on FocalPoint analysis and logic

Feedback from Flame Doctor combustion analysis and/or real time coal flow measurement

Control strategy developed from demonstration testing



Questions?