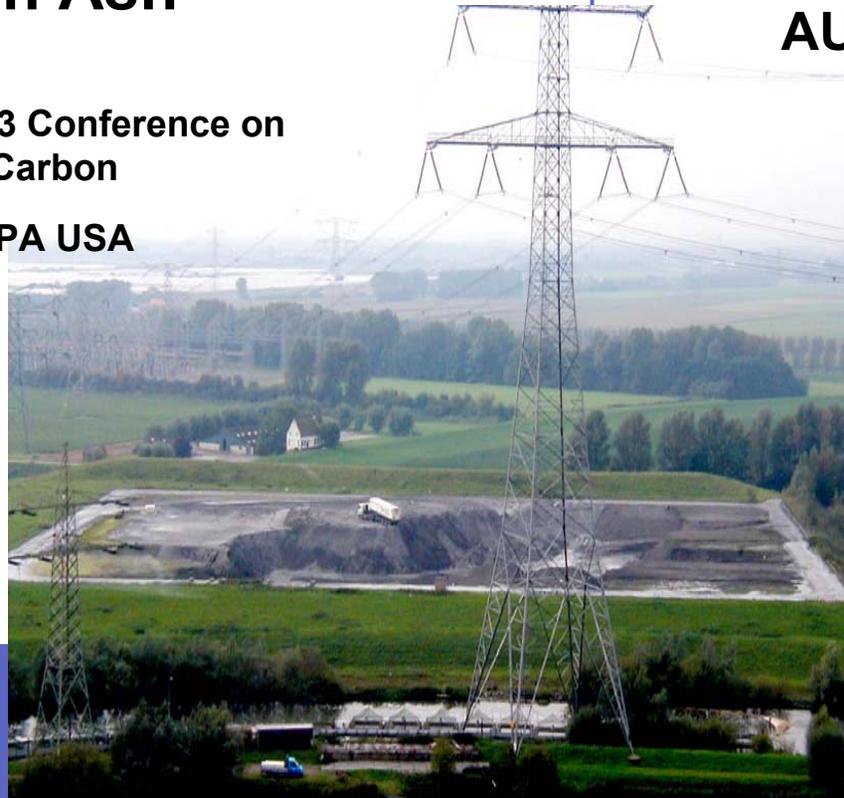


# Active Control of Carbon In Ash

Presented at the 2003 Conference on  
Unburned Carbon

Pittsburgh, PA USA



## ABB UTILITY PLANT AUTOMATION



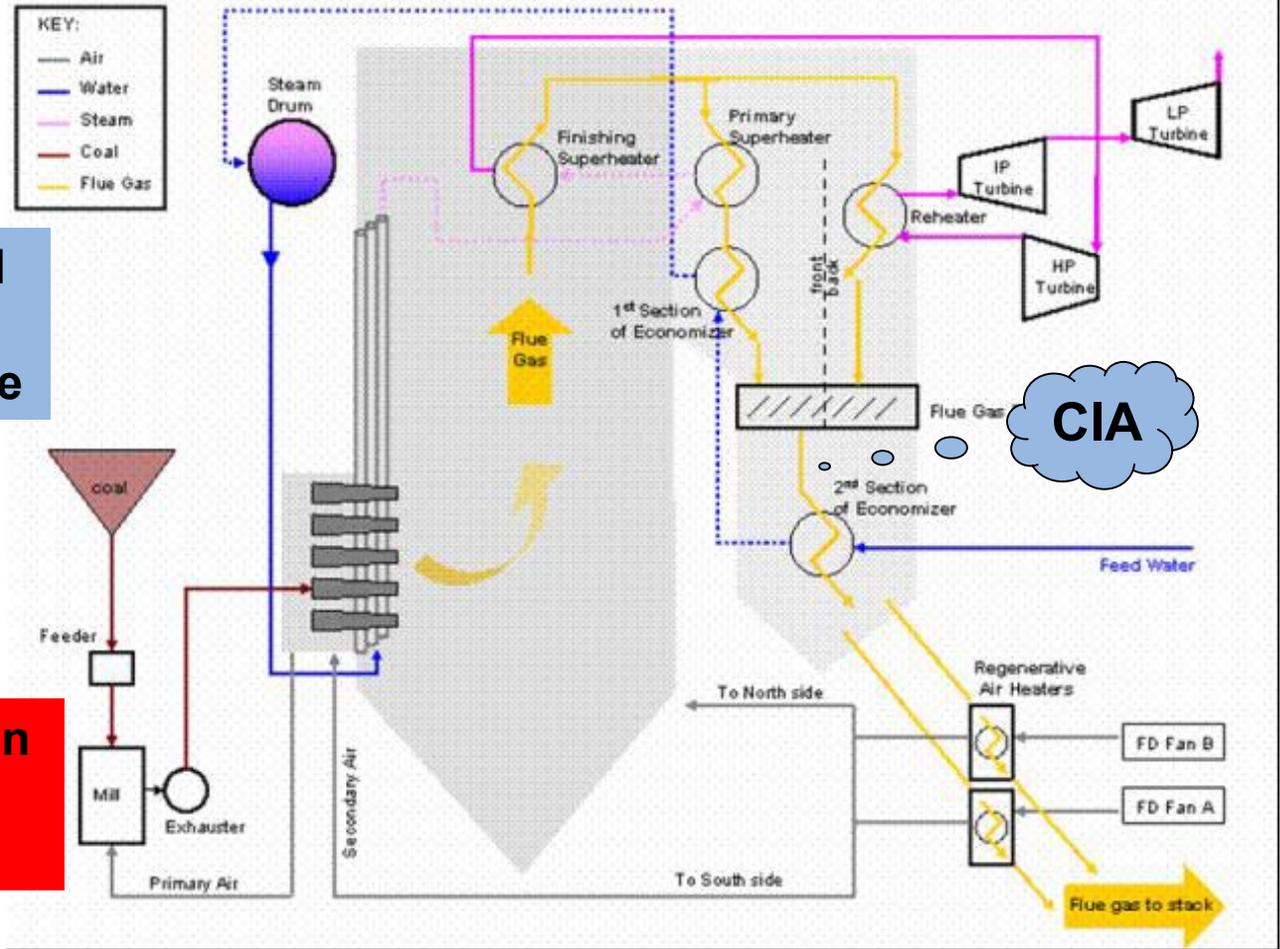
**Paul Thulen**  
**Product Manager**  
**Combustion Management**



# Unit Configuration

**Foster Wheeler Coal  
Fired Boiler  
375MW GE Turbine**

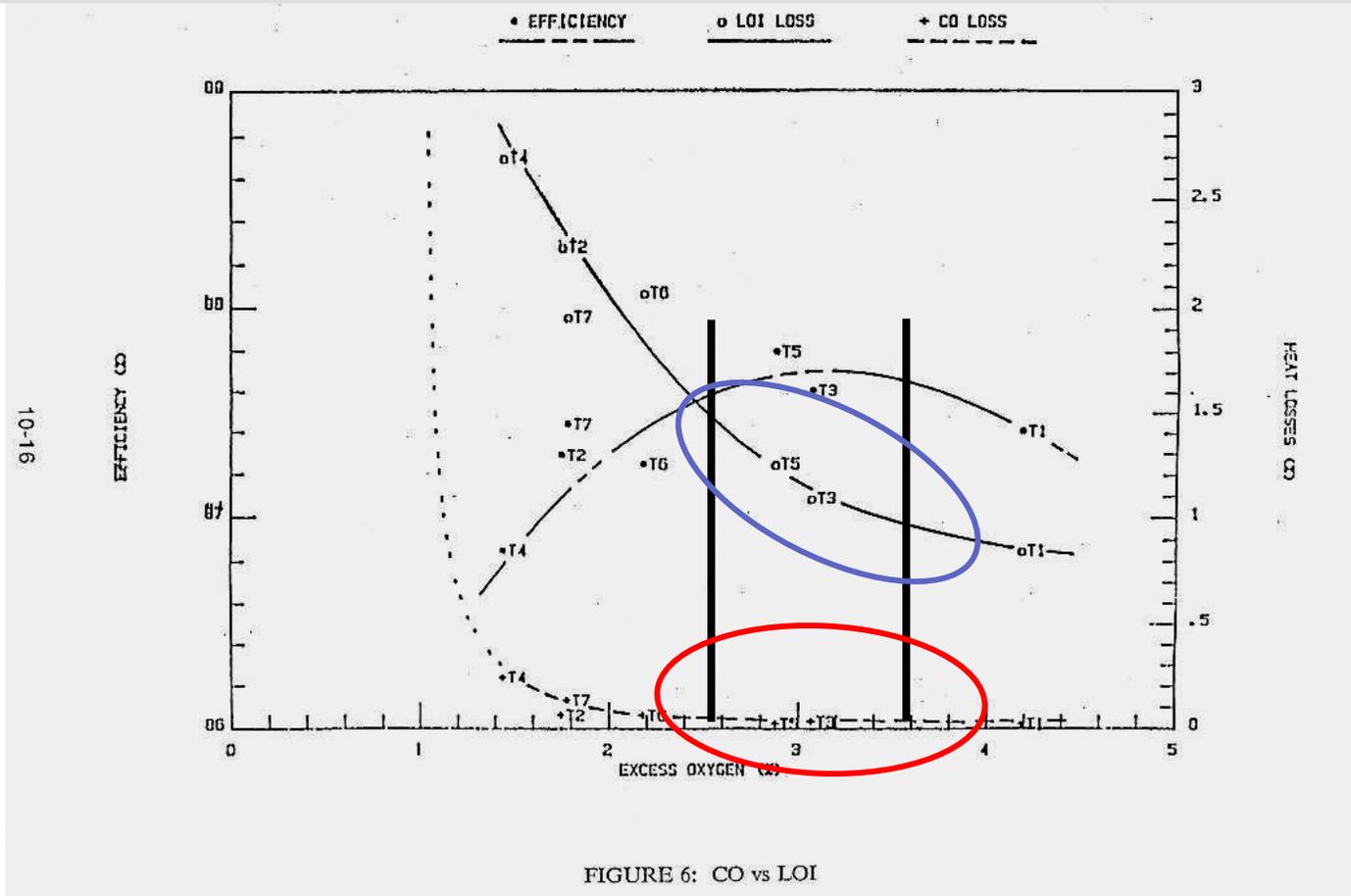
**Burner Configuration  
5 Mills (Rows)  
4 Columns**



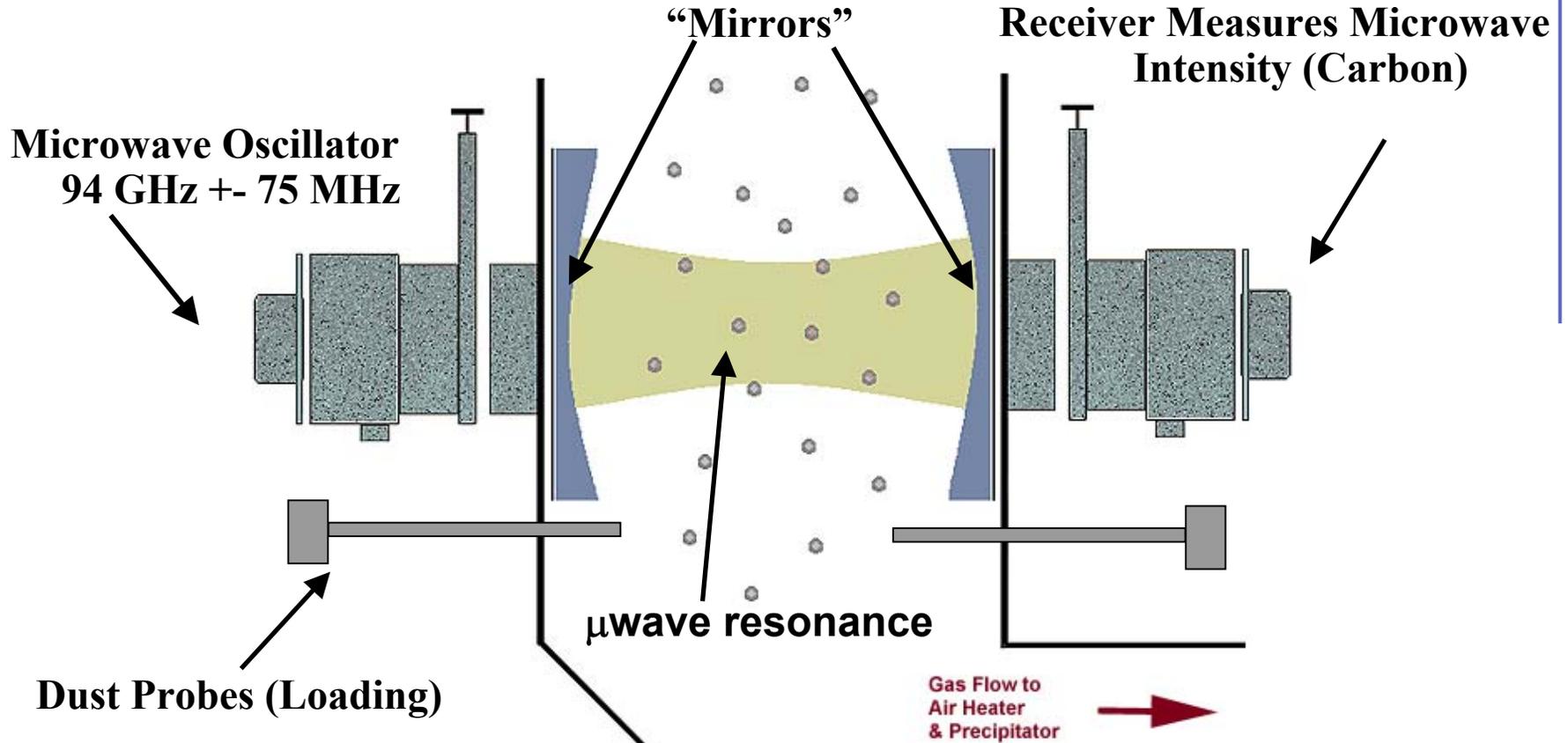


# LOI Excellent Measure of Efficiency

## LOI Measure Makes Optimization With Coal Achievable



# CIA System Configuration



***CIA Output***  
***Carbon/Ash Loading @ %***

***OR***  
***Carbon @ g/m<sup>3</sup>***



# Carbon & Ash Load Instrument

Advanced microwave technology to measure unburned carbon in ash

- Non-extractive monitoring measures carbon across the width of the back-pass.
- Real-time monitoring provides data that enables easy integration into Combustion Optimization systems.
- A simple design, with minimal moving parts, provides fast installation and less maintenance.

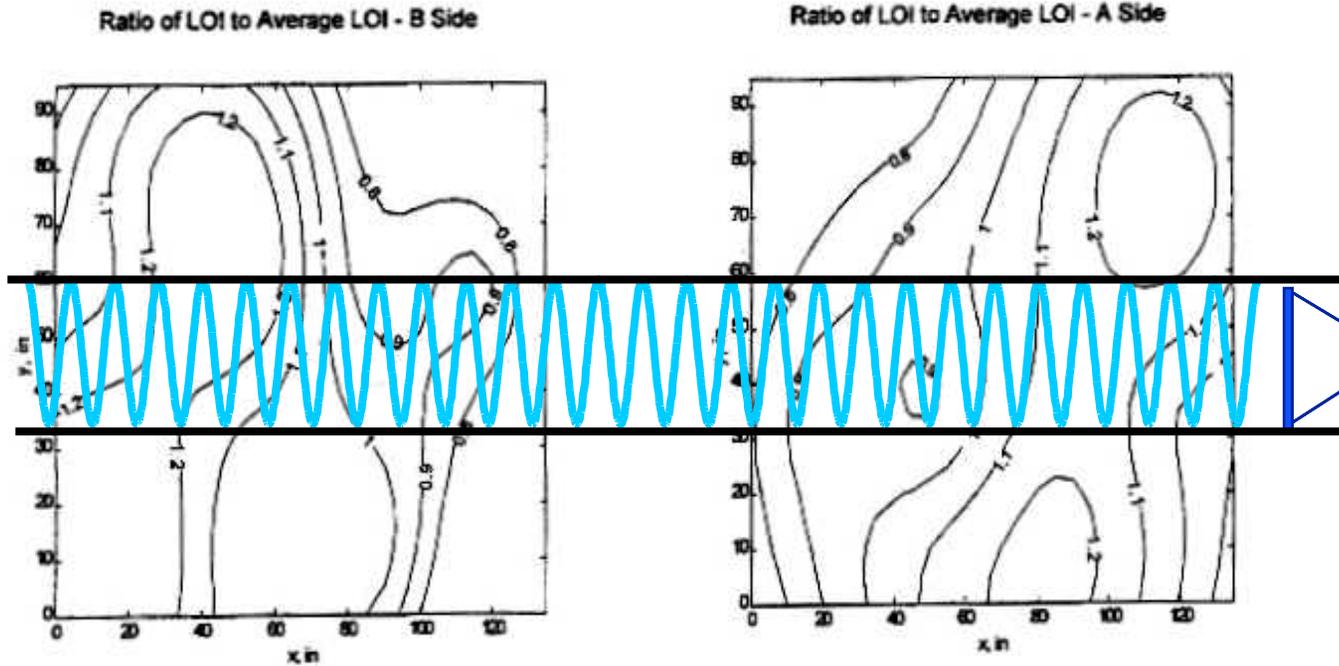


# Features

- Availability
  - Minimal Instrument fouling
  - In-situ Measurement (Not Extractive)
- Accuracy
  - ~ 1% Absolute
  - Average Duct CIA
- Real Time Information
  - 1 minute average values
  - Easily displayed or integration into ABB's Combustion Optimization systems



# Stratification of LOI Compensated



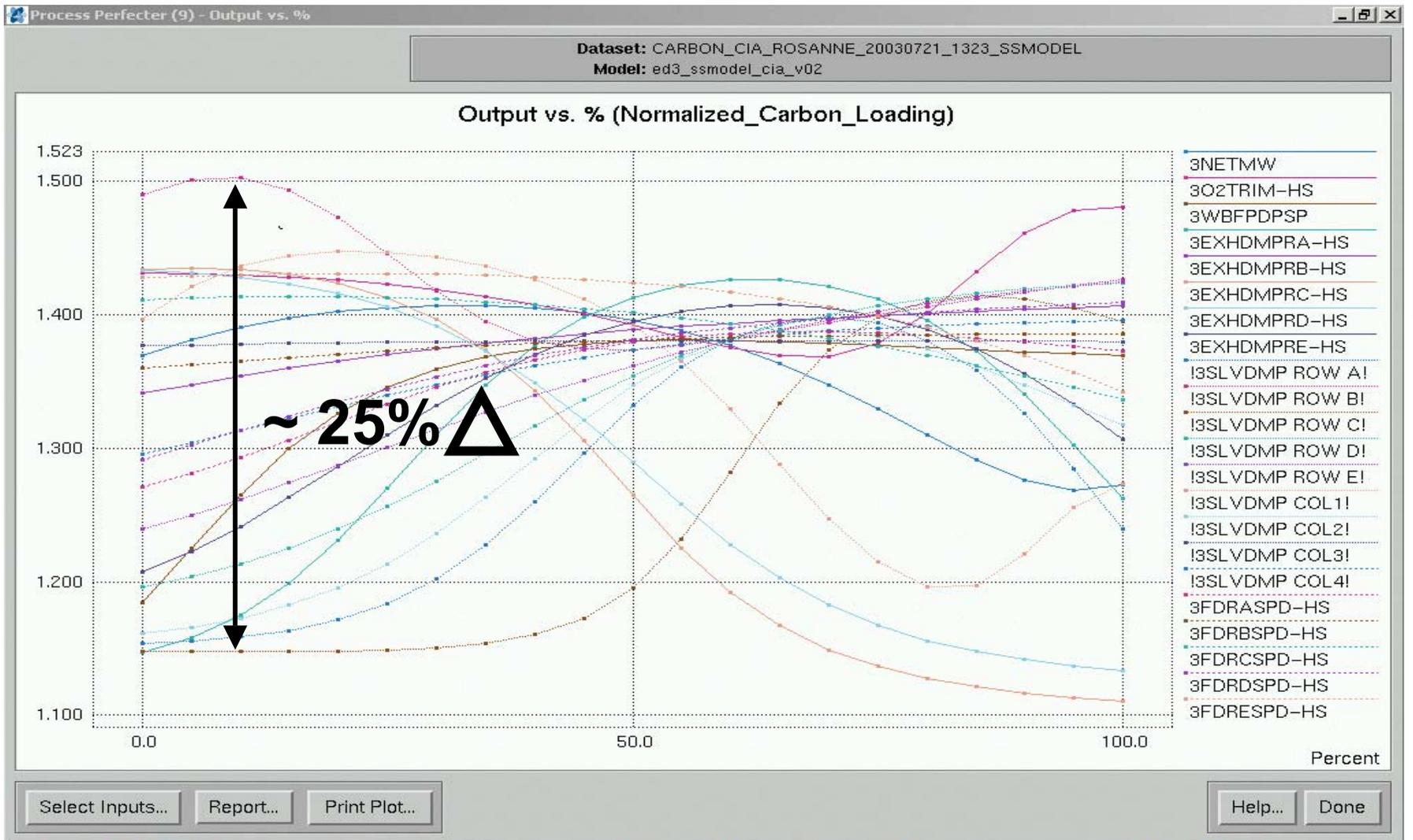
**Duct Gas / LOI Stratification Is Not a Problem When Instrument Is Not Dependent On Point Sampling**

# Benefits

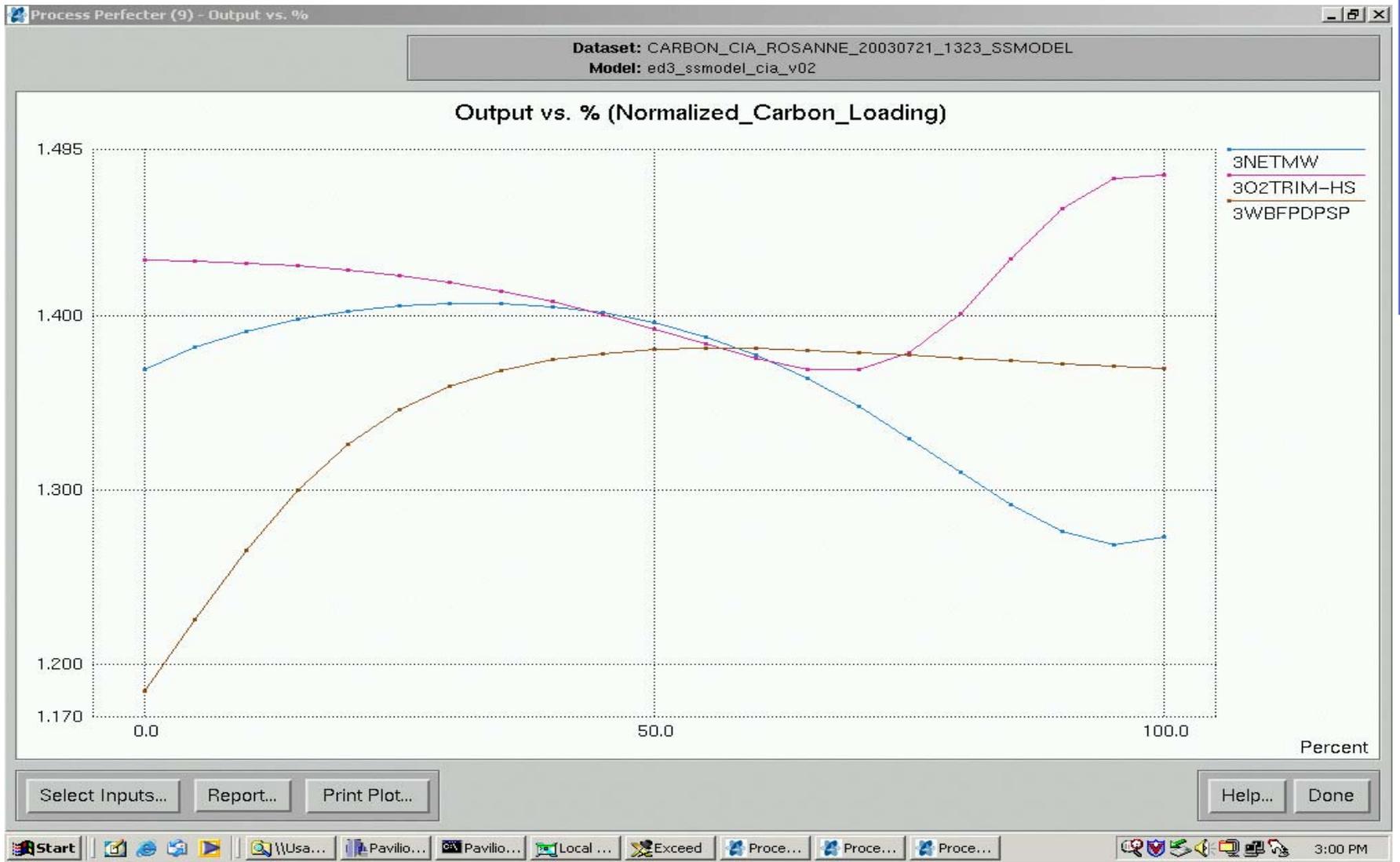
- Fast Return On Investment
  - Get more money for your ash sale
  - Advanced combustion control optimization solutions improve Heat Rate
  - Detect problems / Optimization in firing system
    - Burner Physical Condition
    - Air Distribution Fault
    - Pulverizer Wear or Damage or Coal Fineness



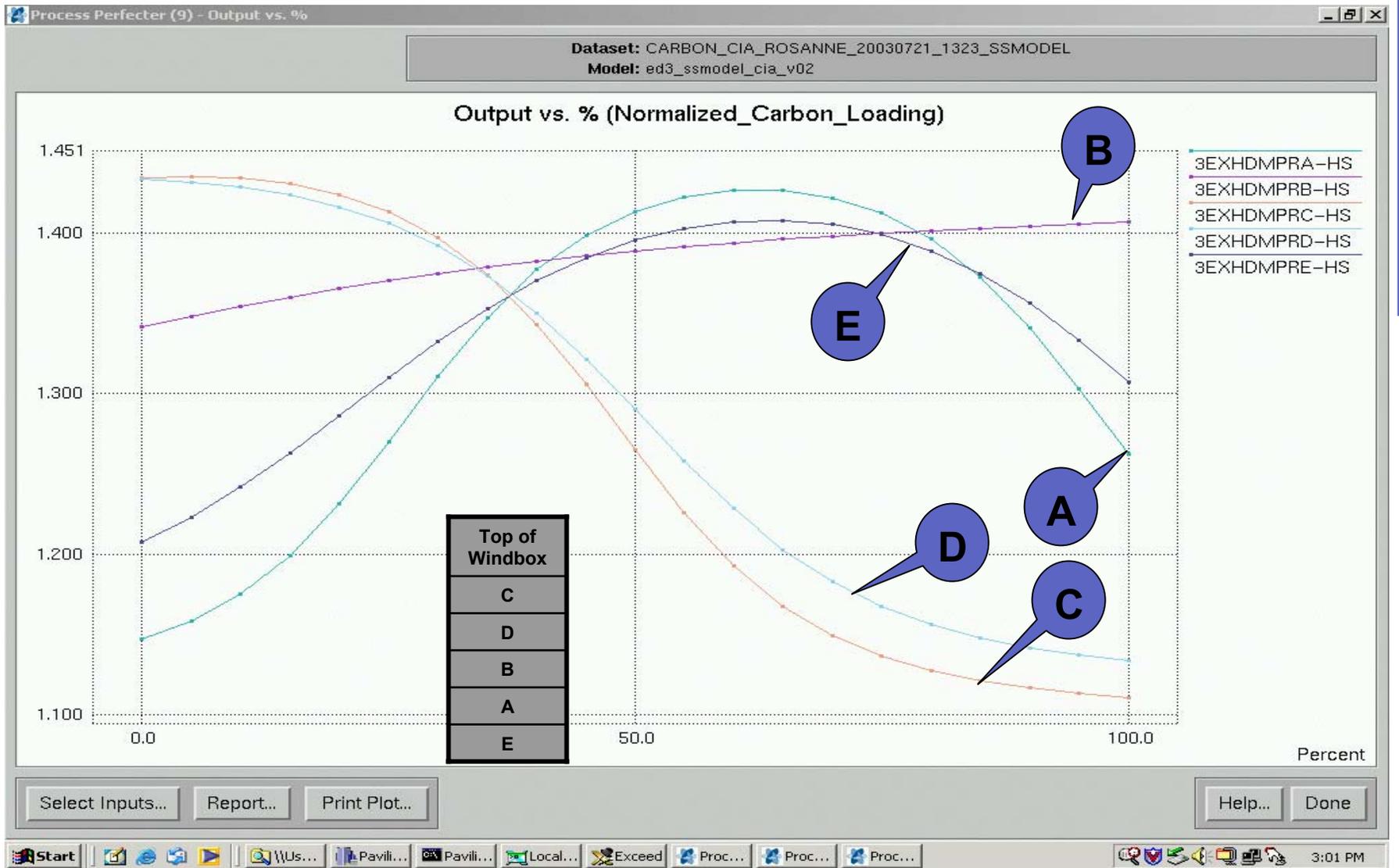
# Non-Linear Response of Key Manipulated Variables



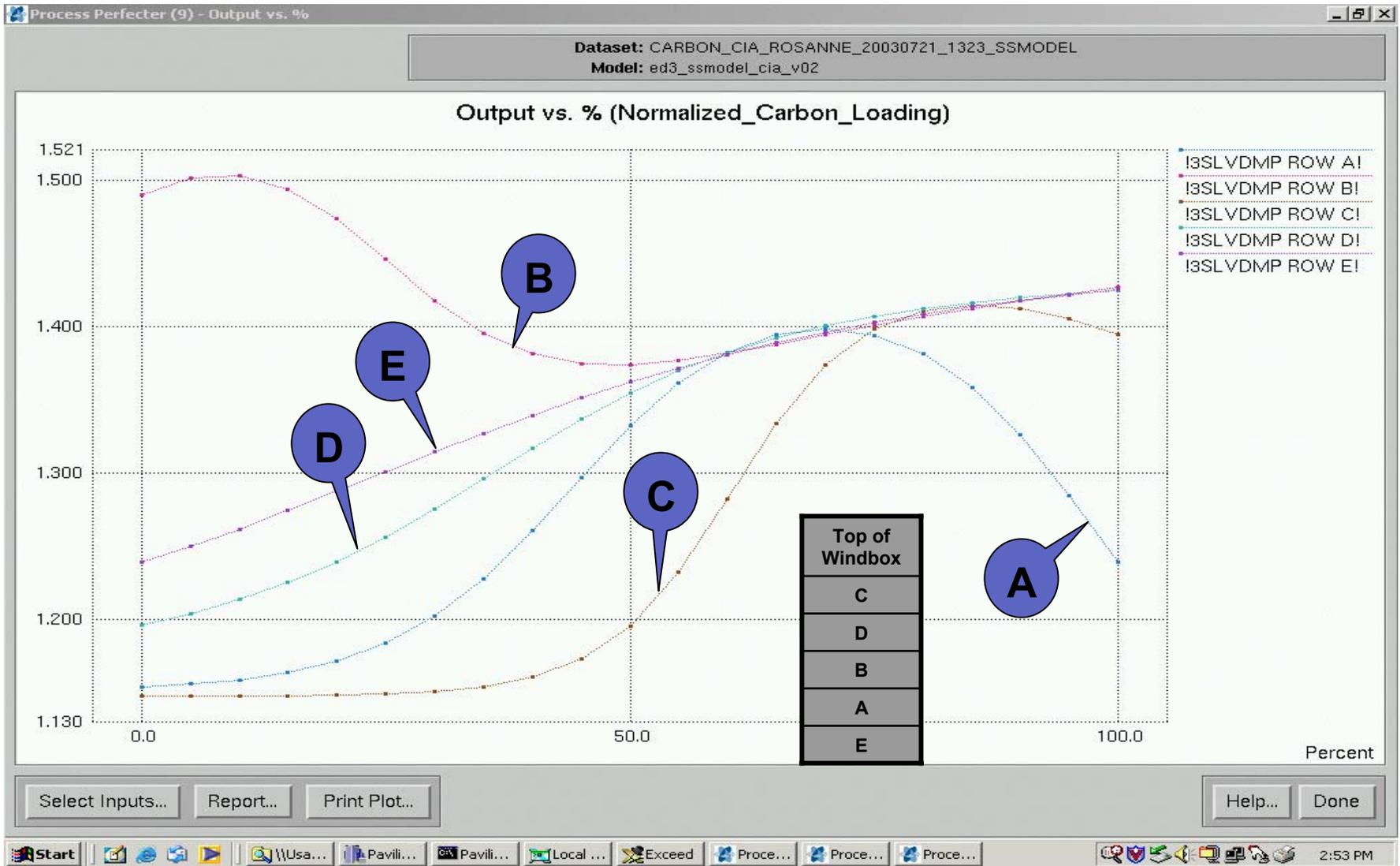
# Global Stoichiometry MV's



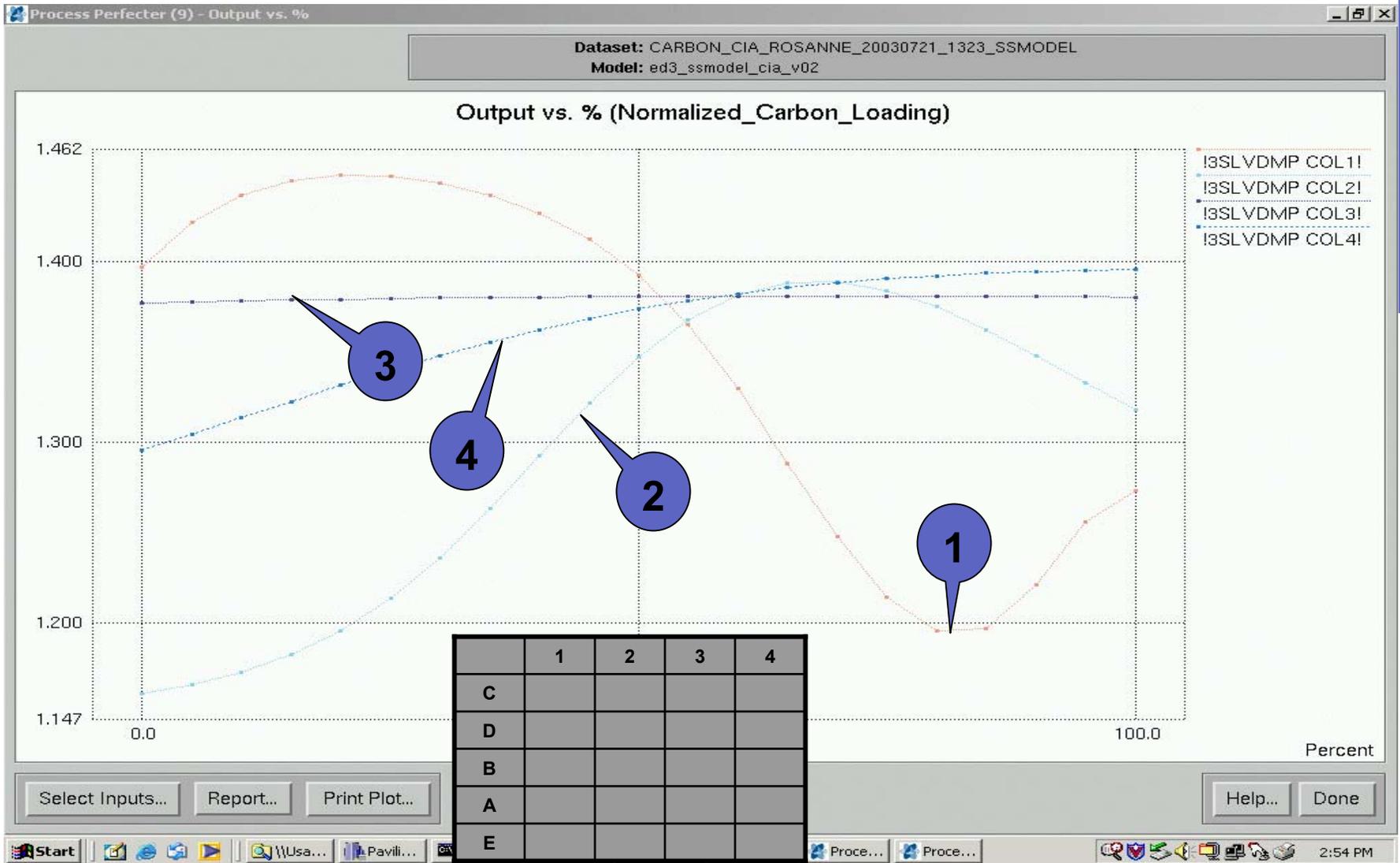
# Exhauster Dampers



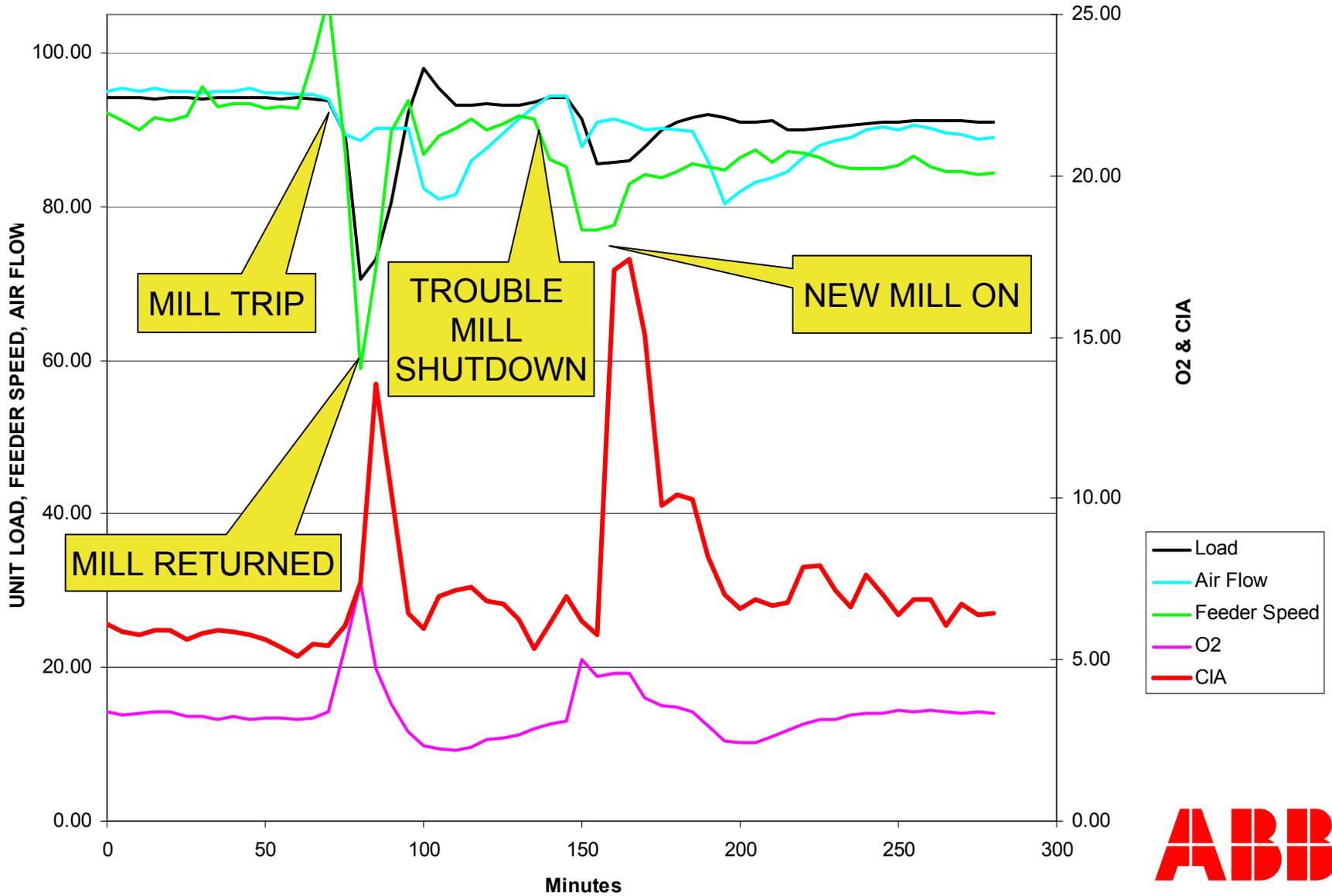
# Burner Sleeve Dampers (Rows)



# Burner Sleeve Dampers (Columns)



# Real Time Data



# Summary

- Low NOx burner modifications driven from the CAA often results in increased levels of CIA
- Higher levels of CIA results in reduced sales potential for “used coal”
- Active control of CIA requires:
  - A live measurement
  - An understanding of combustion (CIA vs. NOx vs. Slag, etc.)
  - A multivariable approach
- Each firing configuration must be evaluated and designed individually

**KNOWLEDGE IS POWER**



**A A B B**