Instrumentation used to perform continuous Fuel / Air trim on coal fired Power Boilers, and the benefits of an Online Extractive CO/O2 Grid.
Continuous Combustion Management (CCM) is measurement and control of parameters previously ignored that are critical to efficiency and emissions reduction.
Accurate, Continuous, Real Time Coal Flow and Velocity Measurement

![Diagram showing coal flow and velocity measurement setup]

- **Amplitude**
  - Frequency Shift
  - Mid Amplitude

- **Frequency**
  - Sensor Distance: 40 - 60 cm

- **Diagram Components**
  - Transmitter
  - Receiver
  - Signal 1: \( x(t) \)
  - Signal 2: \( y(t) = x(t-T) \)
  - Cross Correlation Method

- **Coal Flow**

- **Formulas**
  - Coal Flow Velocity: \( \frac{\text{Distance}}{\Delta t} \)
Adjustable Diffusing Coal Valves for Control to the Burners
Coal Flow Balancing

Coal Mass Flow
Adjustable Valves for Riffles
IBAM
Individual Burner Airflow Measurement
Secondary Air Measurement

- Wind Tunnel Testing at Air Monitor HQ

**Equation 2:** Inner Vane Position - 15° Open, Outer Vane Position - 55° Open

Coefficient = 0.0000335938X^4 - 0.0013321146X^3 + 0.0179408814X^2
- 0.0886535541X + 0.8467944546

**Equation 3:** Inner Vane Position - 15° Open, Outer Vane Position - 60° Open

Coefficient = 0.0000718750X^4 - 0.0025442917X^3 + 0.0314481881X^2
- 0.1504645772X + 0.9413919352
Optimize Combustion Using CO

Combustion Parameters

- CO
- Slagging
- Fireside Corrosion
- Tube Leaks

Air Flow

- Boiler Efficiency
- NOx
- O2
- LOI

Optimum Zone

Comfort Zone
Combined CO and O2 Measurement
Why Delta CO?

DMCC — CO Monitor Is Designed for Power Plants

Continuously, automatically zeroes the non-dispersive infrared analyzer.

Multiple (3) stages of moisture and water vapor separation

Resistant to latent ash
- Probe purge purges the probe and flushes sample line
- Sintered filter at probe head
Probe Features

Patented “Extractive Venturi“ Designed to keep ash out, Sintered Hastelloy filtration makes it last.
PROBE - Venturi Design, and Slip Stream (Inertia) effect, reduces ash contact with sintered filter.
Separate Sample and Purge Lines, ensures lines and sintered filter are kept clean.
Multi-Points in Common Enclosure

“4-Pack” Model
Reduce O2

- LOI benefits
- Nox benefits
- Efficiency benefits

![Unit 4 O2 Curve](image_url)
CCM Tuning

CR4 Load > 700 MW

CCM Tuning

O2

North & South CO
CO / O2 Grid on a T-Fired Unit
Locate WHERE CO is being produced
CCM Benefits

- Reduced emissions
- Improved Efficiency
- Reduced (SCR) Ammonia Consumption
- Reduced LOI
- Reduced pulverizer wear
- Reduced wear on Coal Yard equipment.
- Reduced boiler tube & non-pressure part erosion due to lower flue gas velocities. Less Fan required.
- Improved ESP performance due to lower flue gas velocities.
- Reduced potential for slagging and fouling events
- Improved Pressure part life due to improved temperature profile
- Reduced ash disposal costs
- Reduced boiler tube failures due to reducing atmospheres