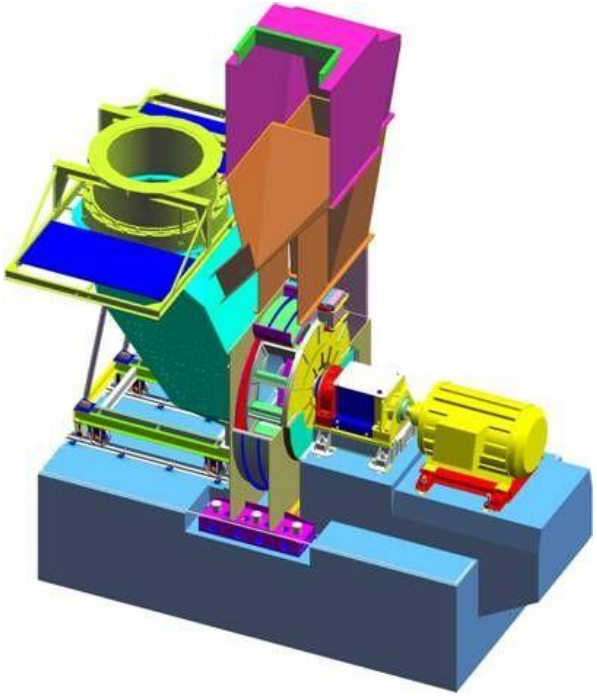
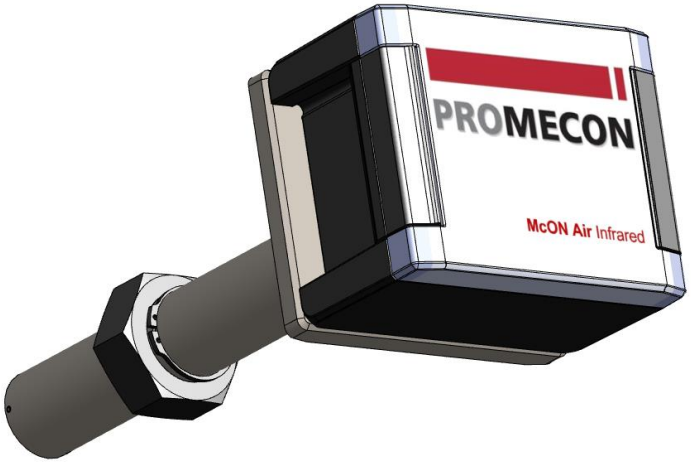
PROMECON
we focus on your process



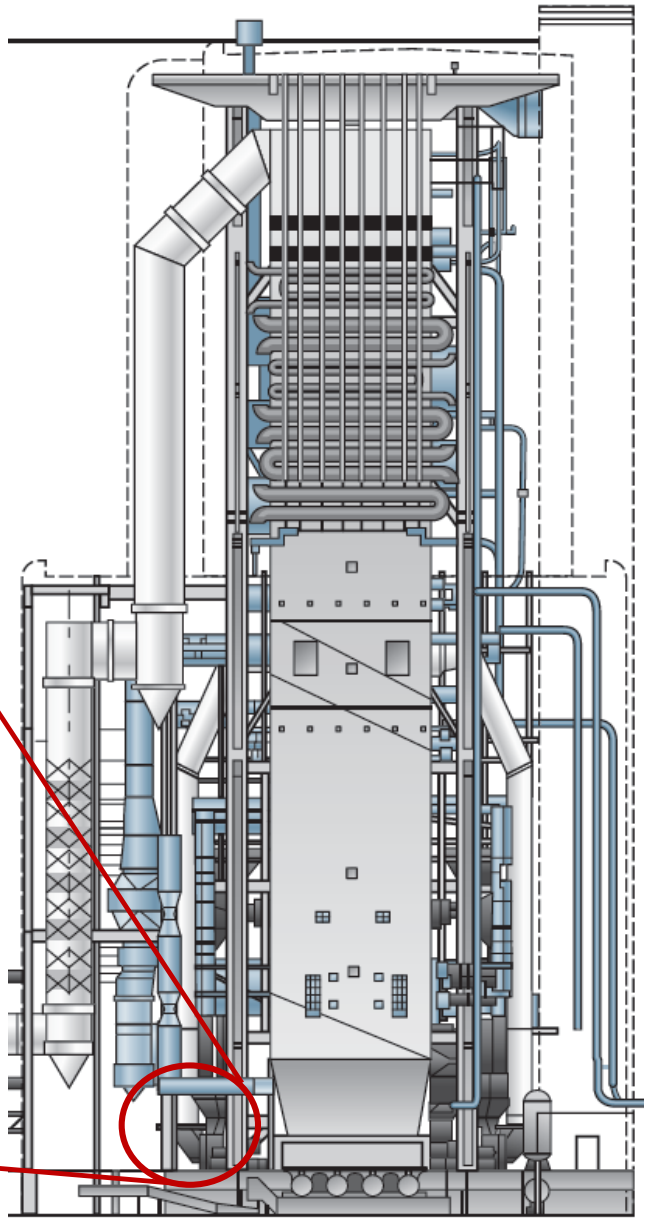


Novel measurements for Beater Wheel Mill Controls

Dipl.-Ing. Hans Georg Conrads
Dipl.-Ing. Frank Schulze (VPC)

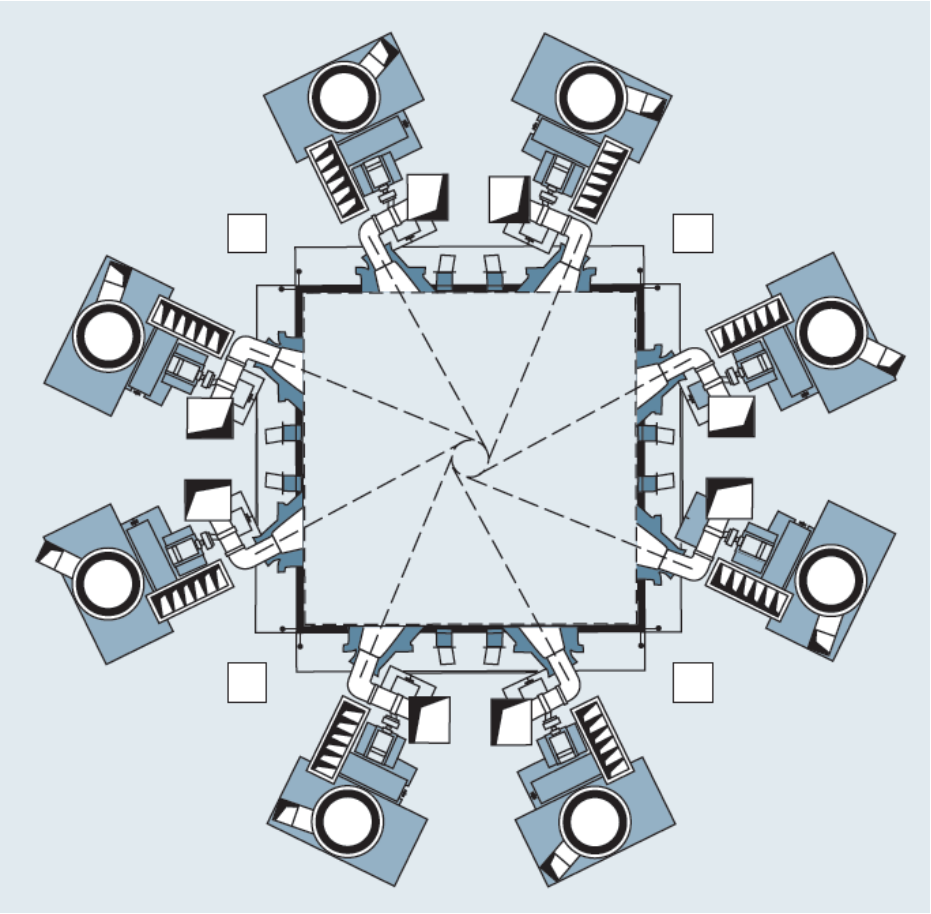
You can control what you can measure properly

- Beater Wheel Mill in typical lignite station

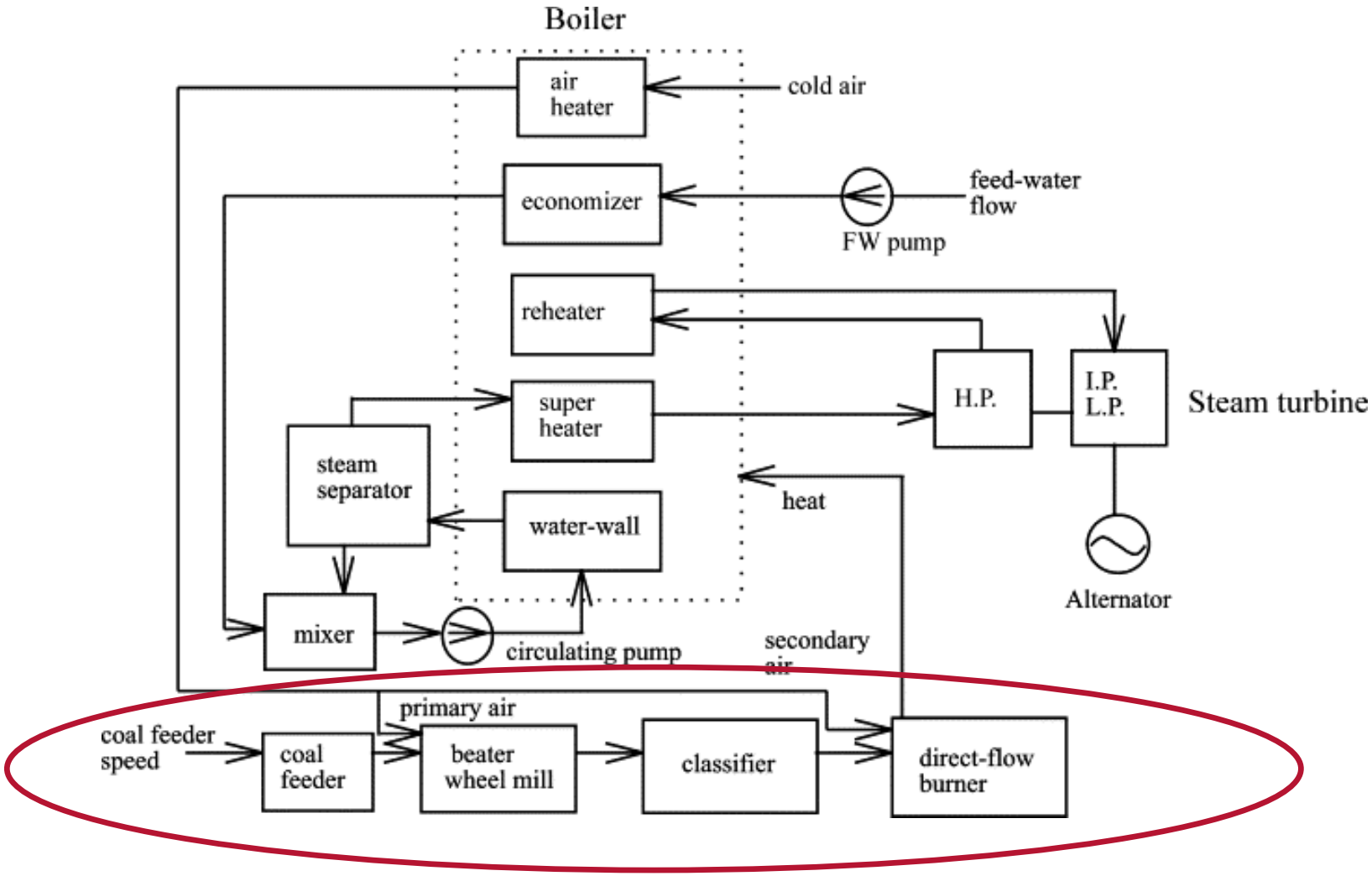


Mill Arrangement in a Lignite Boiler

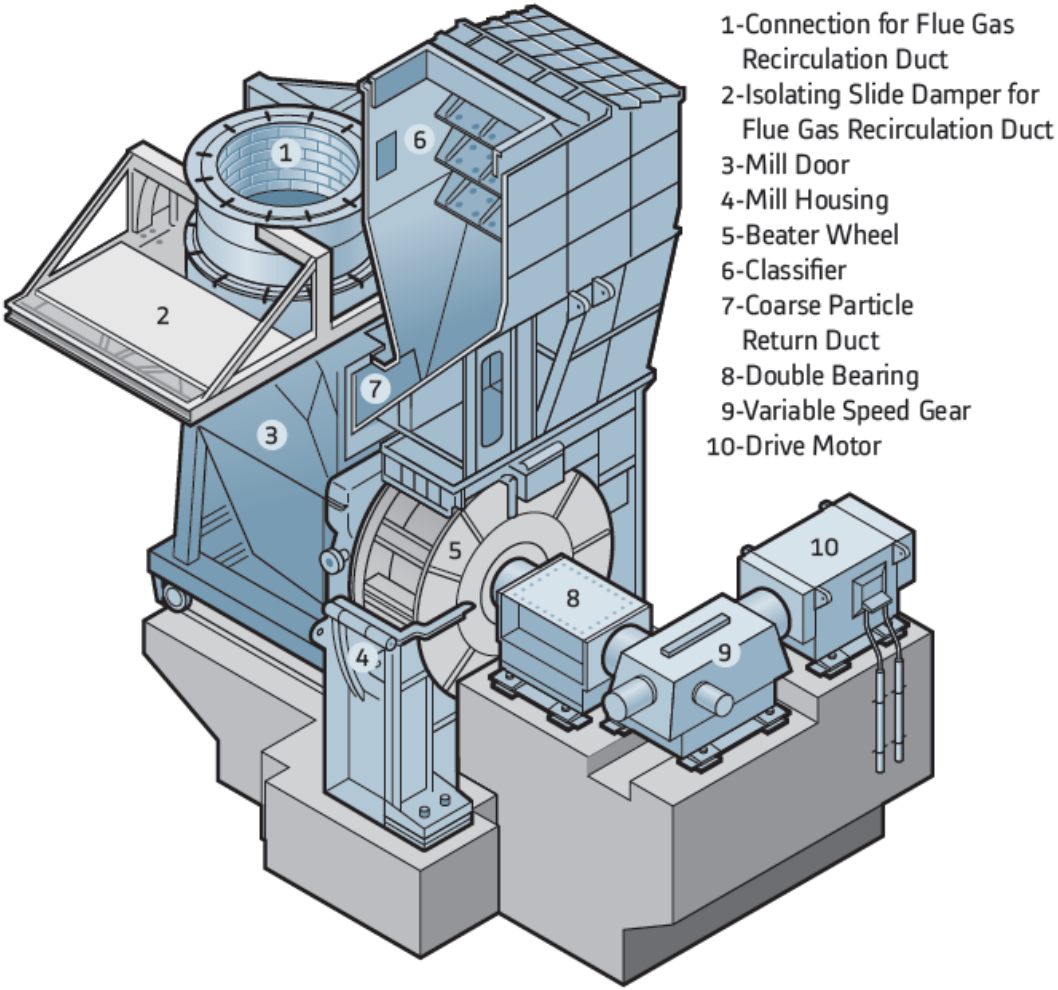
- Beater Wheel Mill in typical lignite station
- Mills out of service for maintenance all the time
- Full load with n-1 or even n-2 mills possible
- Different firing patterns depending on mill outage



The mill in the overall plant configuration

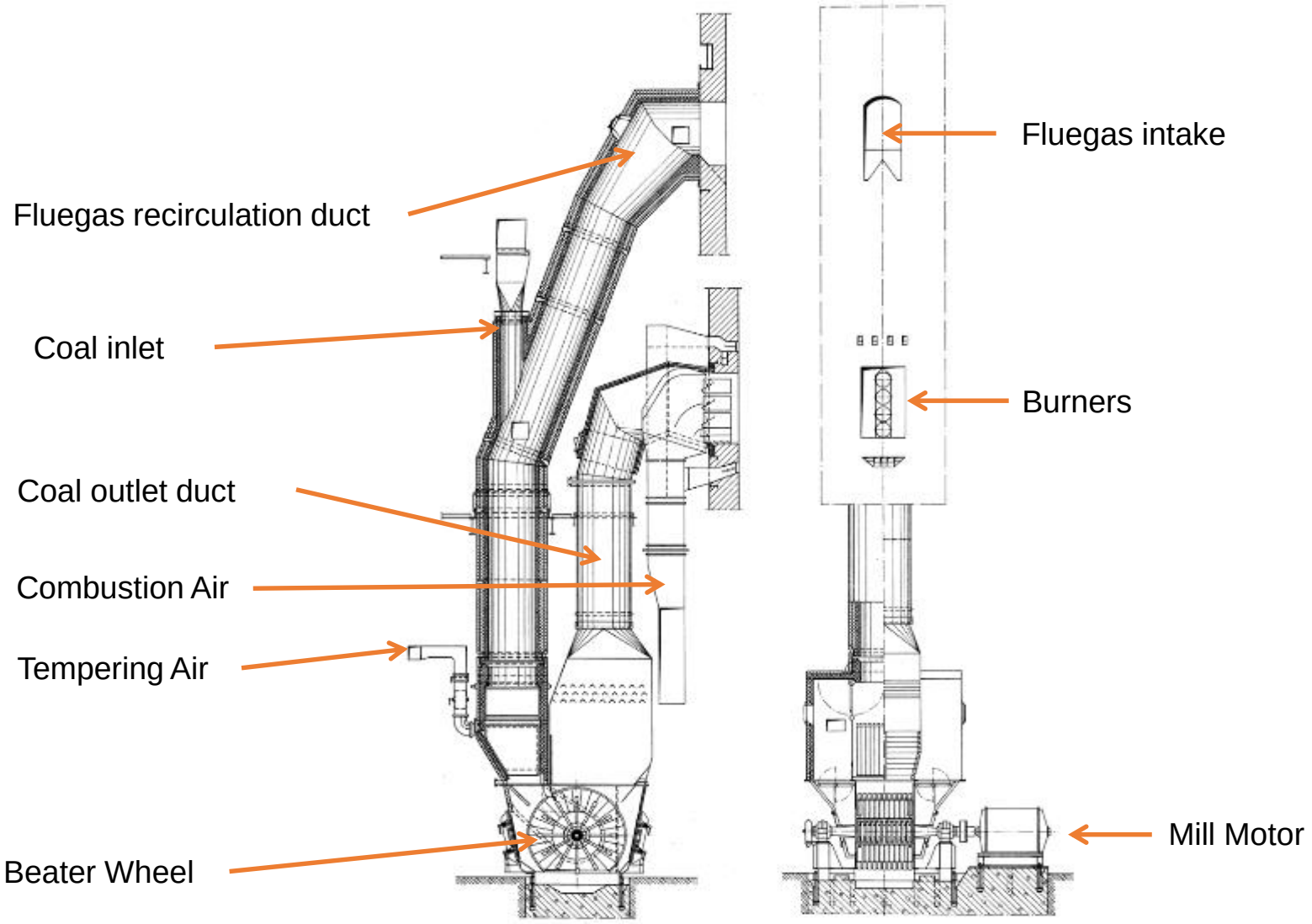


Beater Wheel Mill for lignite preparation

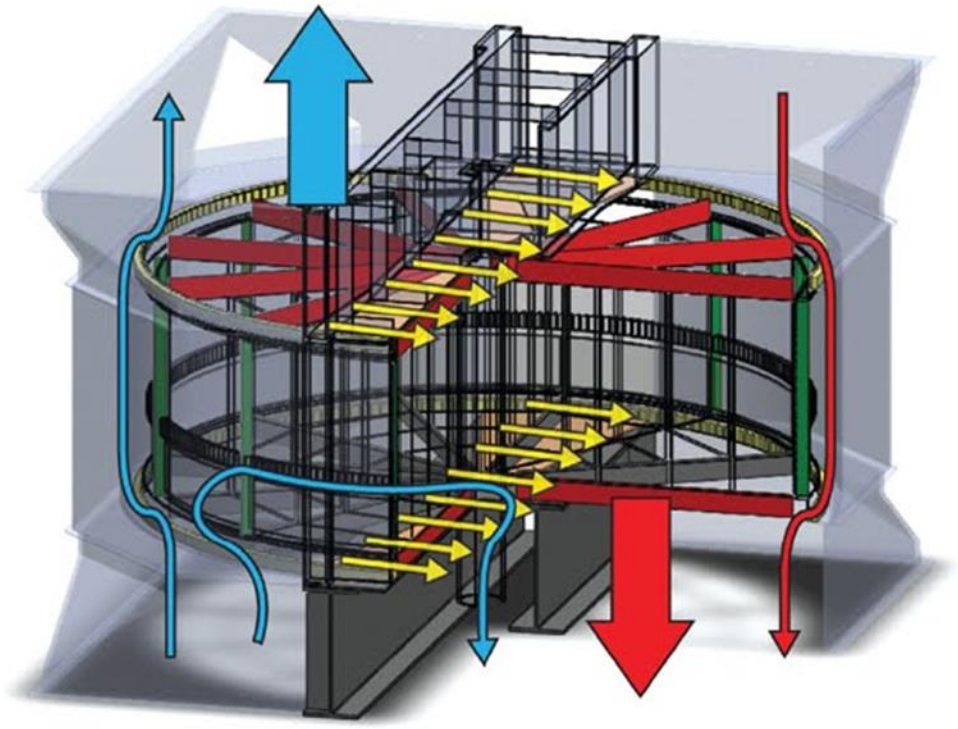


1-Connection for Flue Gas Recirculation Duct
2-Isolating Slide Damper for Flue Gas Recirculation Duct
3-Mill Door
4-Mill Housing
5-Beater Wheel
6-Classifier
7-Coarse Particle Return Duct
8-Double Bearing
9-Variable Speed Gear
10-Drive Motor

Main Elements



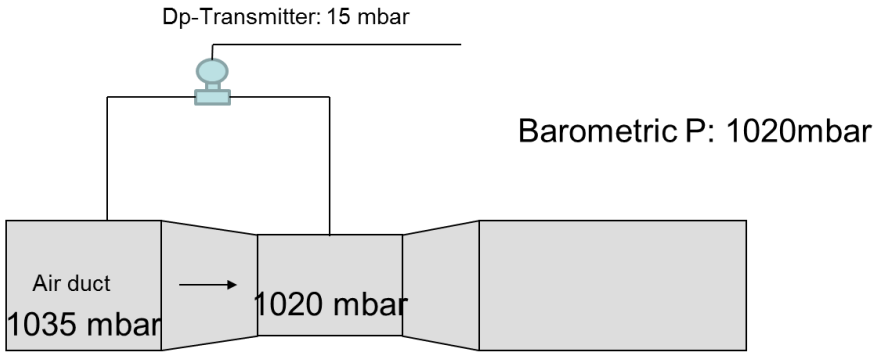
Problem of air heater leakage



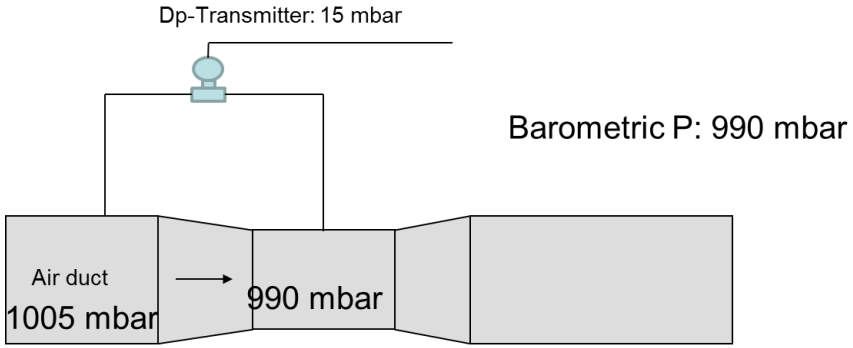
Due to rotating hoods or heat exchangers there is a considerable air leakage from the air side to the gas side of the AH

It is hard to measure as the dimensions of the AH are quite large.

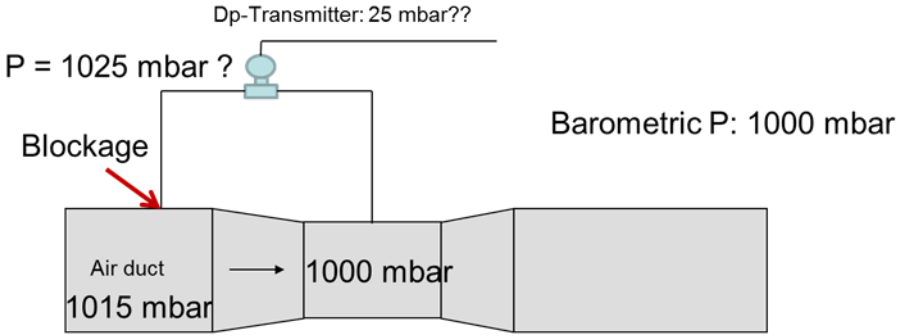
What happens with a blocked impulse line?



Ok, no problem



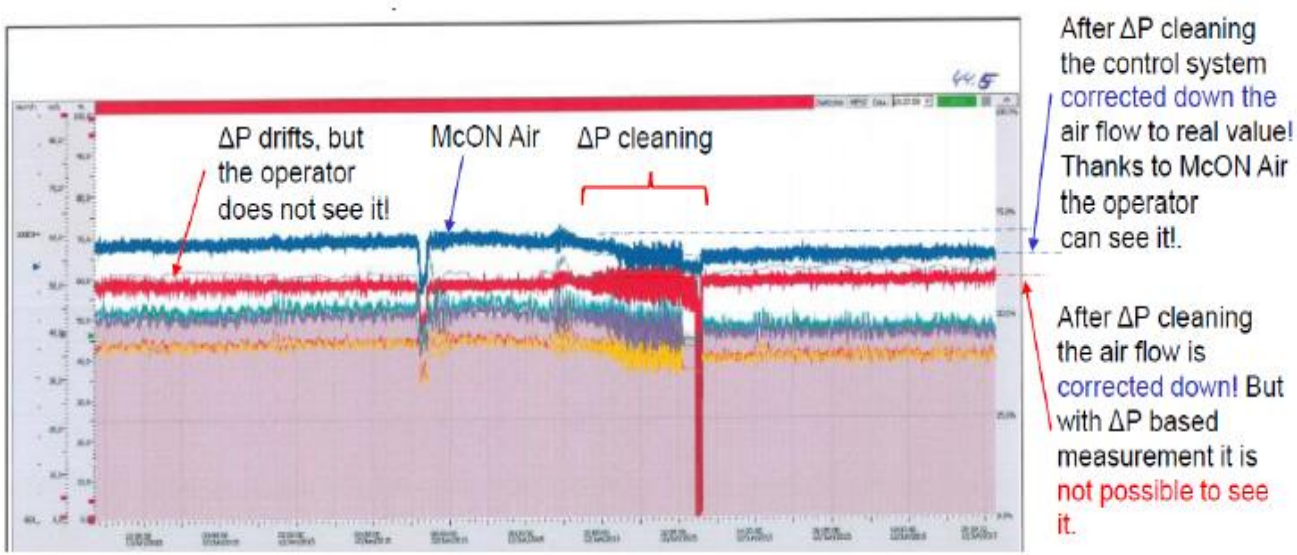
Ok, no problem



Undefined drift of value

Differential pressure measurement

- Congestion of ports and openings cause drift and wrong operation of combution air
- Operators have cannot identify drift until failure of the measurement
- Dp probes inside burners can be used during commissioning phase before plugging
- Dp probes inside burners cannot determine true axial mass flow in variable swirls



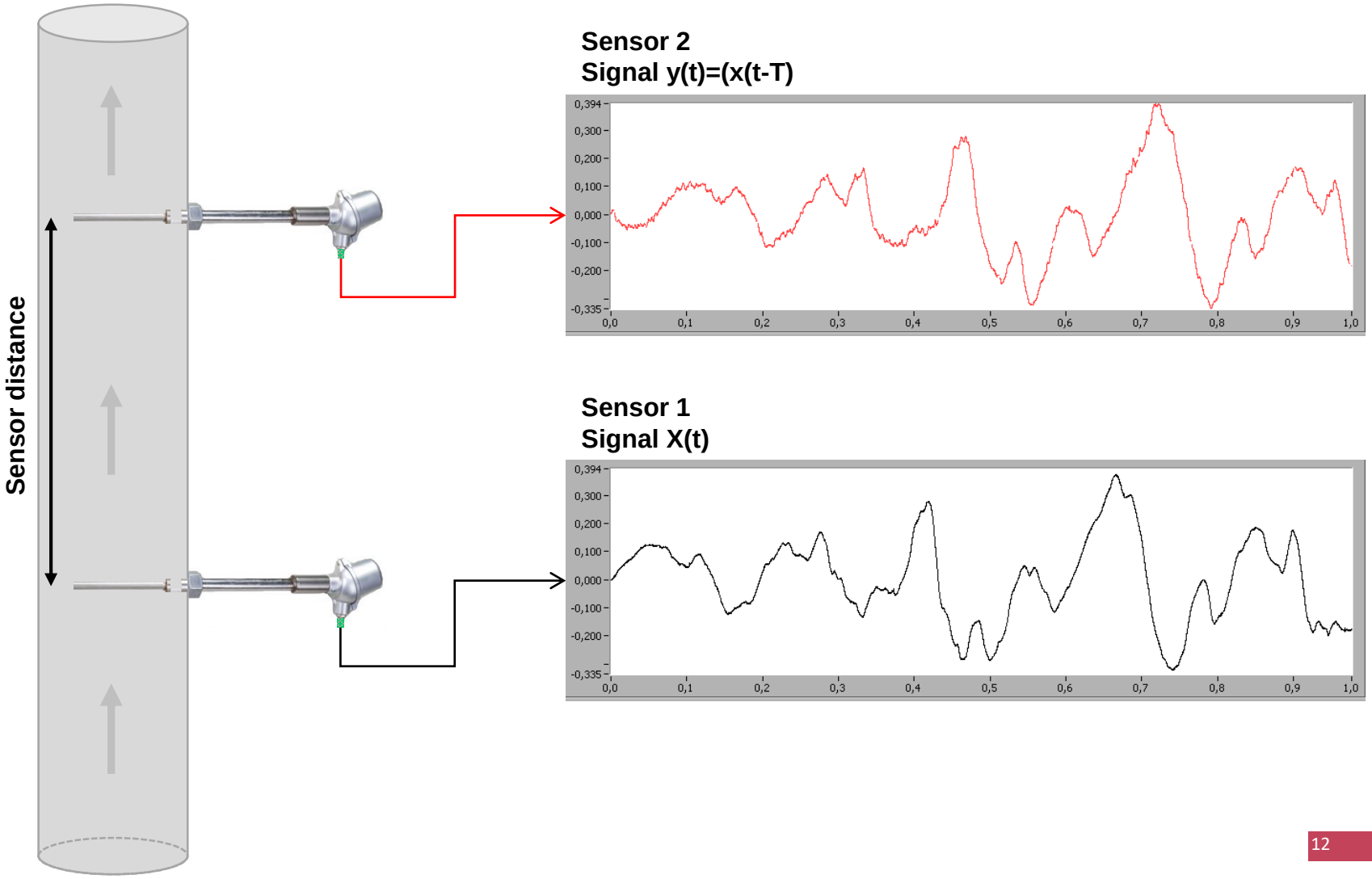
Trace comparison between delta P measurement and PROMECON McON air measurement at 800 MW T-fired Unit , commissioned 2012

McON Air compact

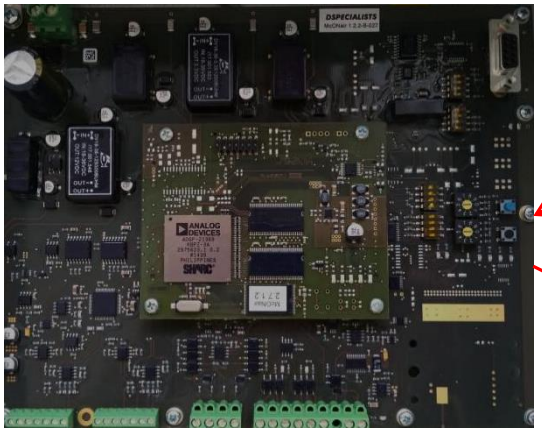
Measurement principle

- measurement of the transport velocity of particles or ionized air (e.g. dust particles from the air preheater)
- therefore two sensors with antennas installed in the duct
- while passing an antenna the particles or ionized air provide an electrical signal
- signals are recorded in cycles (1 second per cycle)
- recorded data of 1 cycle is used in correlation function to determine time of flight

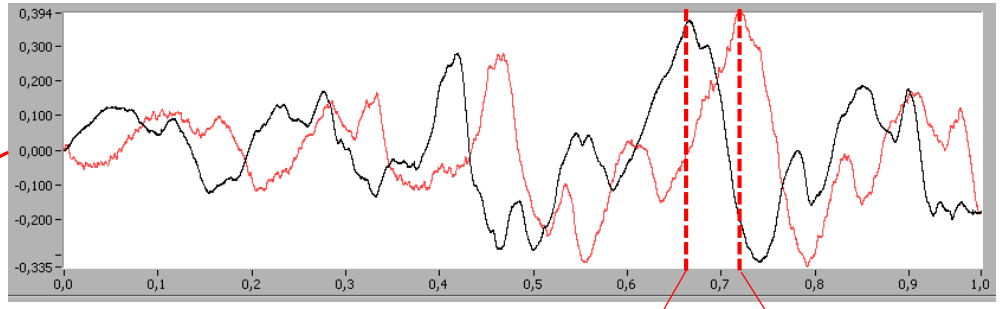
Measurement Principle - Raw Signal



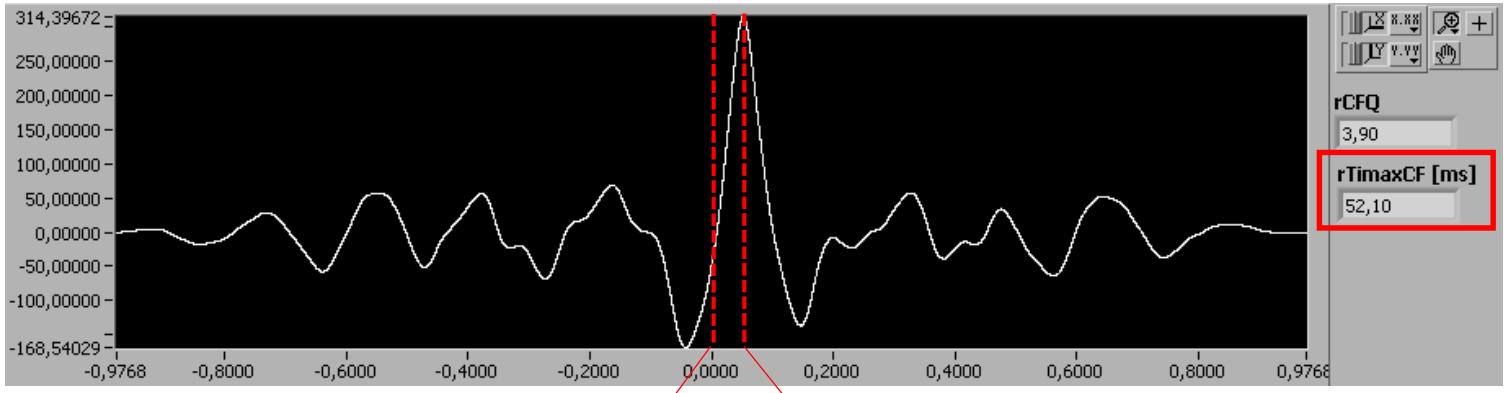
Measurement Principle – Raw Signal



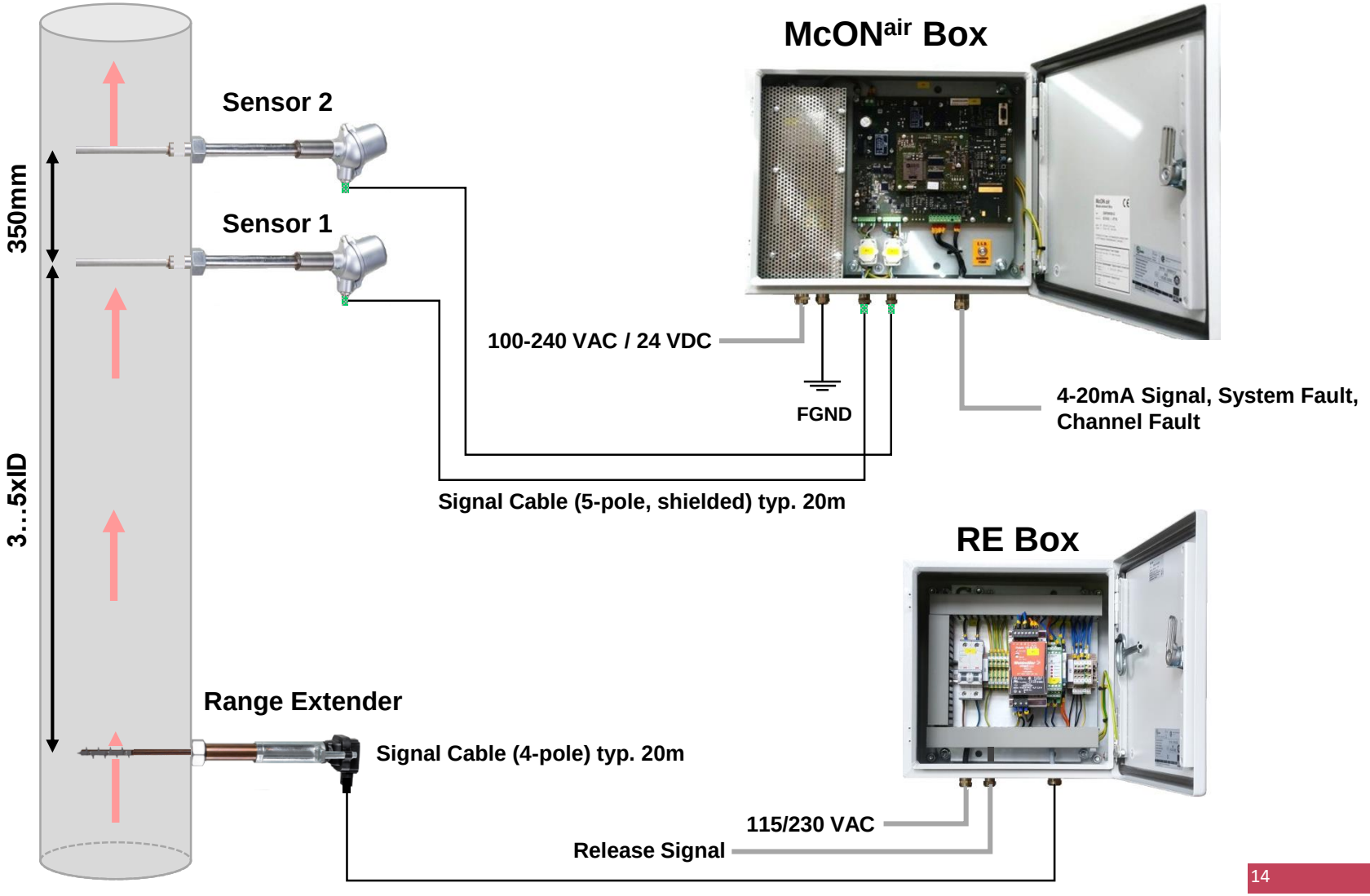
Sensorsignals



Correlation Function



System Setup with Emitter



Technology 2: Individual air flow measurement

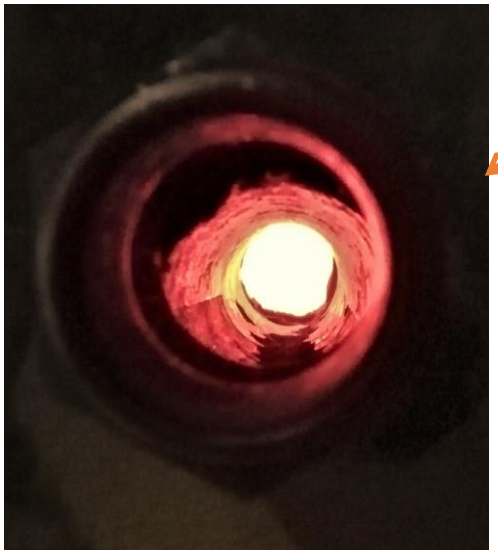
Technical Data McON Air

- Measurement principle: cross correlation
- Typical accuracy: better +/- 2%
- Repeatability: better 0,05%
- Drift: 0%
- Maintenance/cleaning: none
- Linearity: 100%
- Hysteresis: none
- Calibration: none
- Gas temperature: 10- 900 °C (50 - 1800 °F)
- Dust load range: 0mg – 2000 g/m3
- Safety standards: SIL 2 according EN 61508 on demand
- No venturies necessary

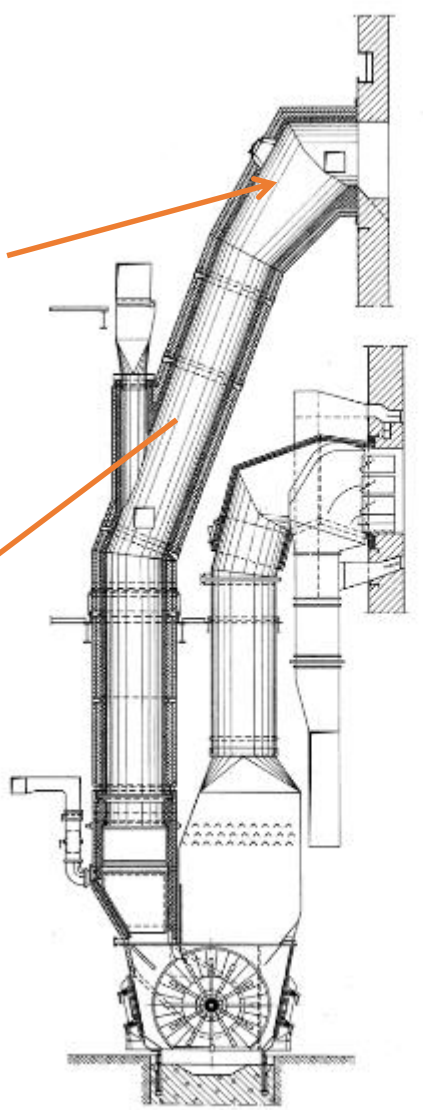
How to measure 900c° hot recirculation gas?

- Fluegas recirculation duct

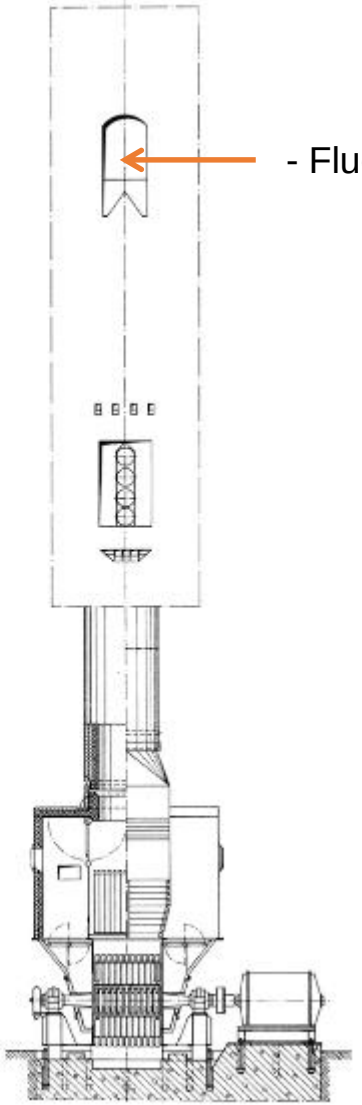
- Fluegas intake



View into the duct

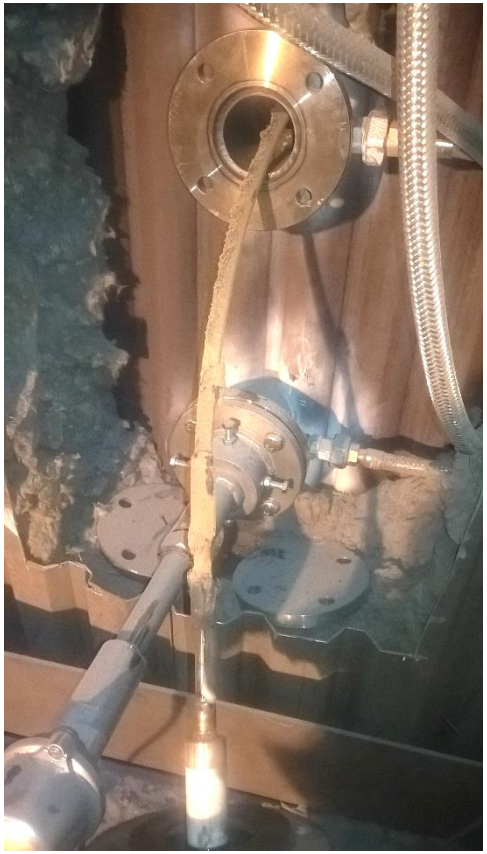


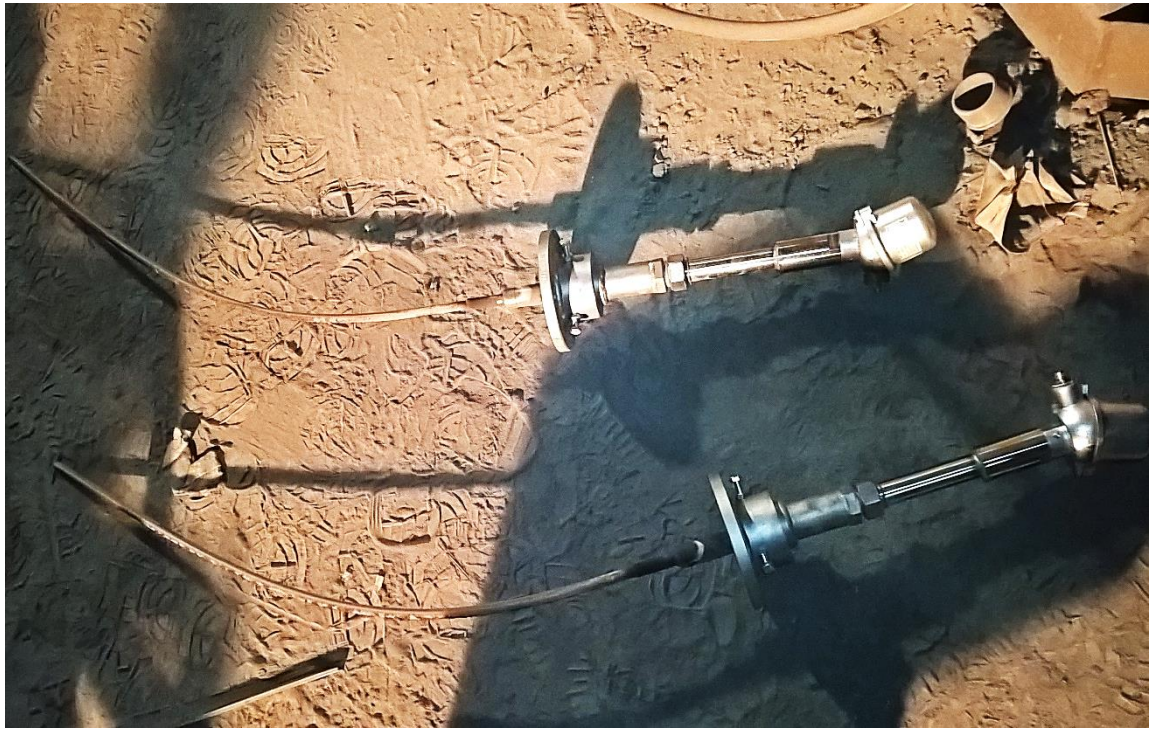
side view



front view

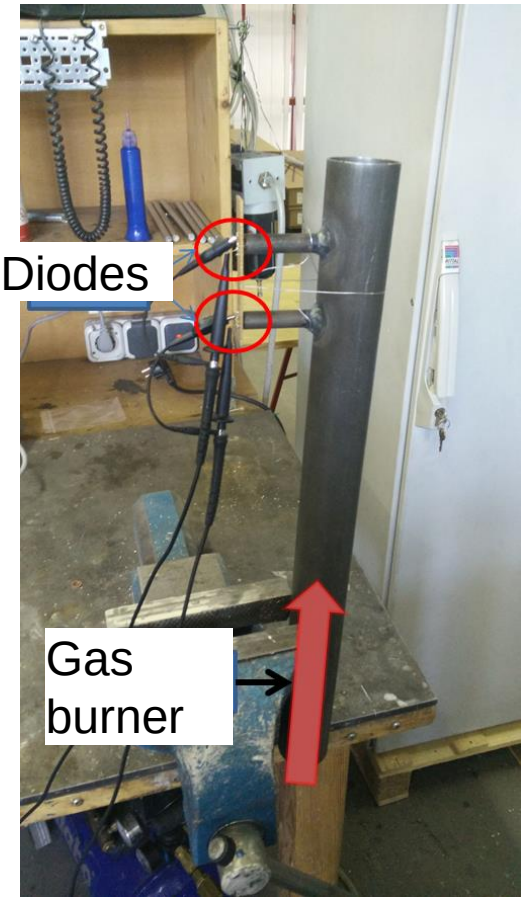
Temperature Failure of Sensors

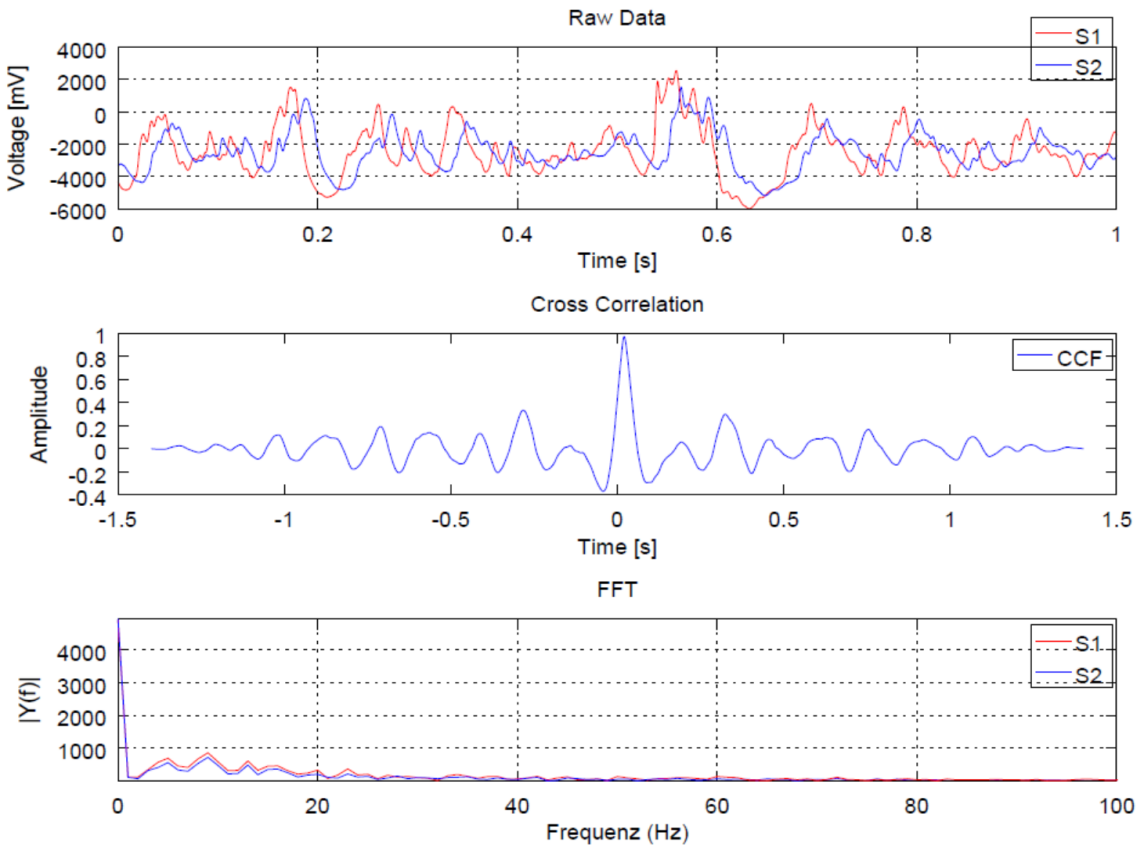




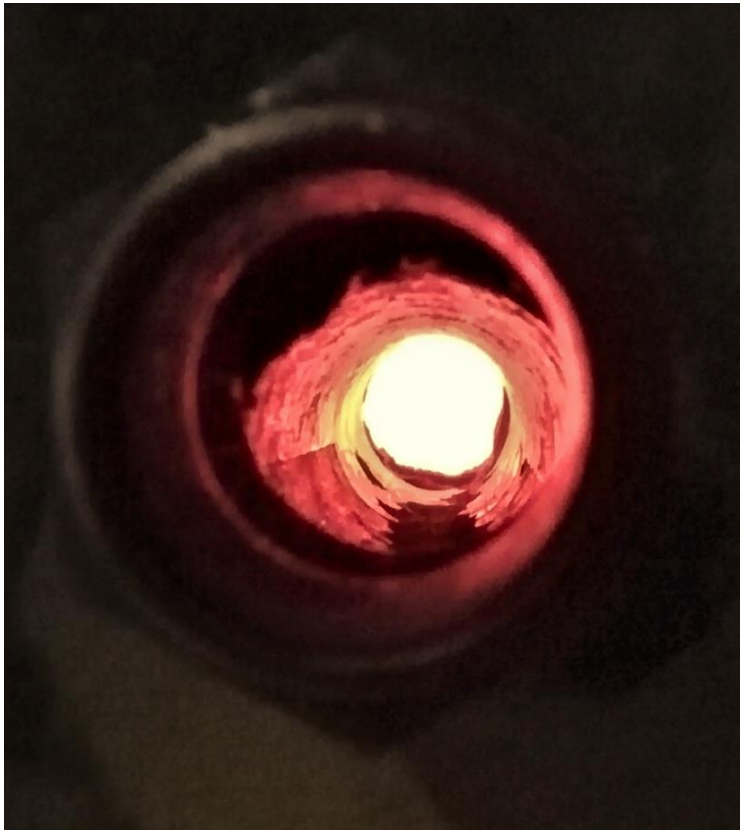
Trial with standard sensors: MARD-1000/1150-D12-VZ2-S

McON Air IR – new patented infrared correlation measurment of gas velocities



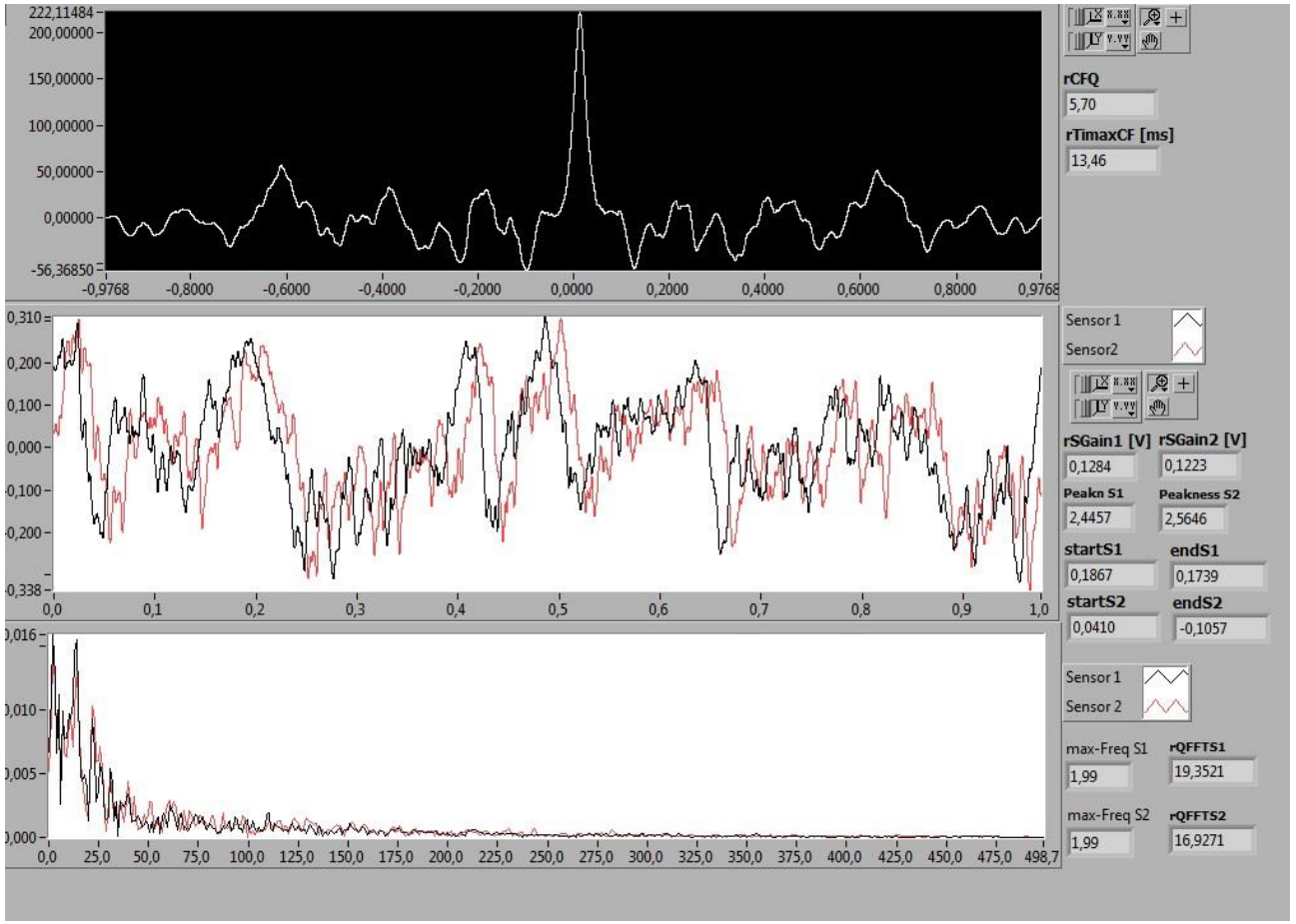


Accurate measurement by cross correlation McON AIR IR

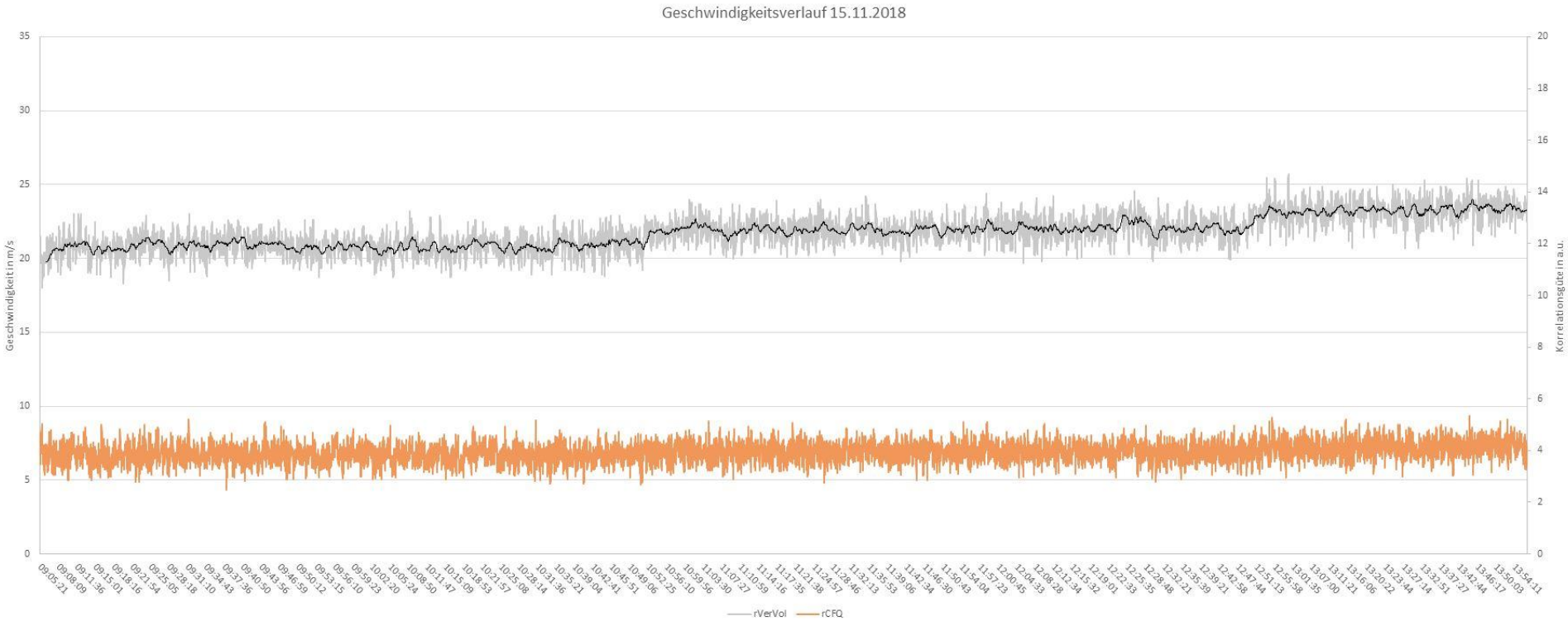


McON Air IR - results

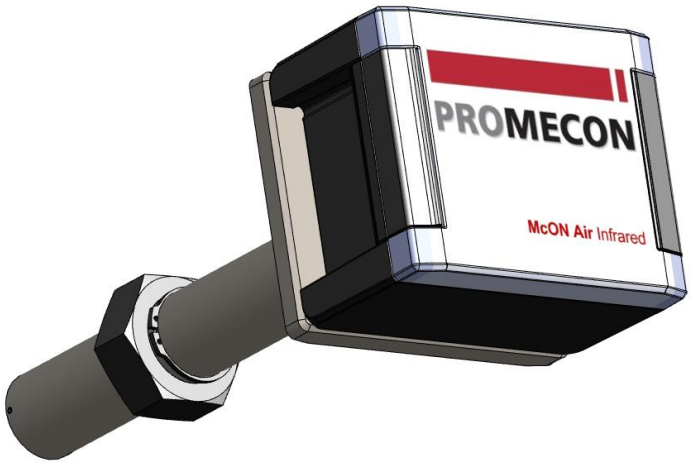
- Measurement data out of 1000°C gas flow



Log Data out of a 800MW lignite plant in Germany

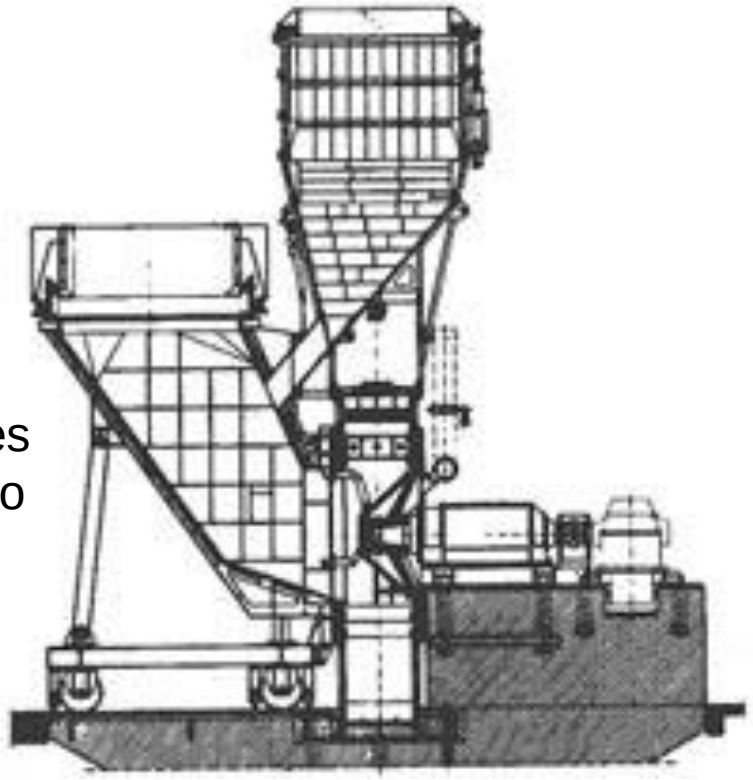


New IR Sensors with well proven air flow technology



Targets of mill operation

- safe operation
- stable operation
- handling wide range of coal moistures
- consistent in fuel flow as compared to the other mills of the firing system



Targets of Beater Wheel Mill operation

Control strategy:

a) Constant volume flow through the mill at O_2 < 11%
b) Target coal mass flow through the mill for firing system

How can constant volume flow through the mill at different densities and loadings be achieved?

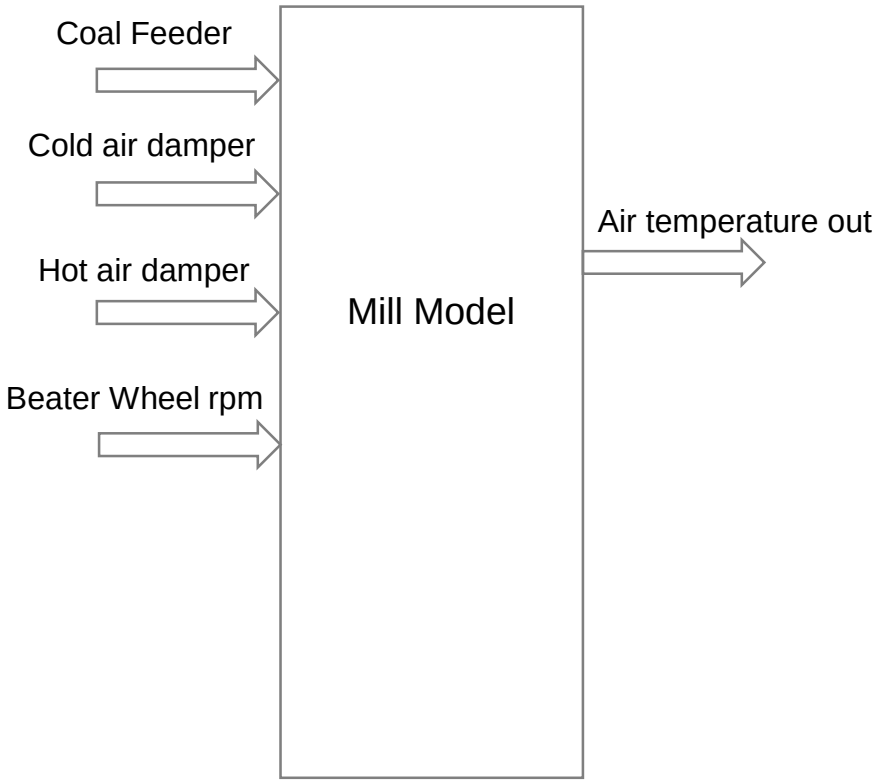
Necessary:

- accurate total air flow control into the mill
- Online mass energy balance (drying process, vapour generation in the mill)
- Control of Max O_2 point and hence max tempering air flow

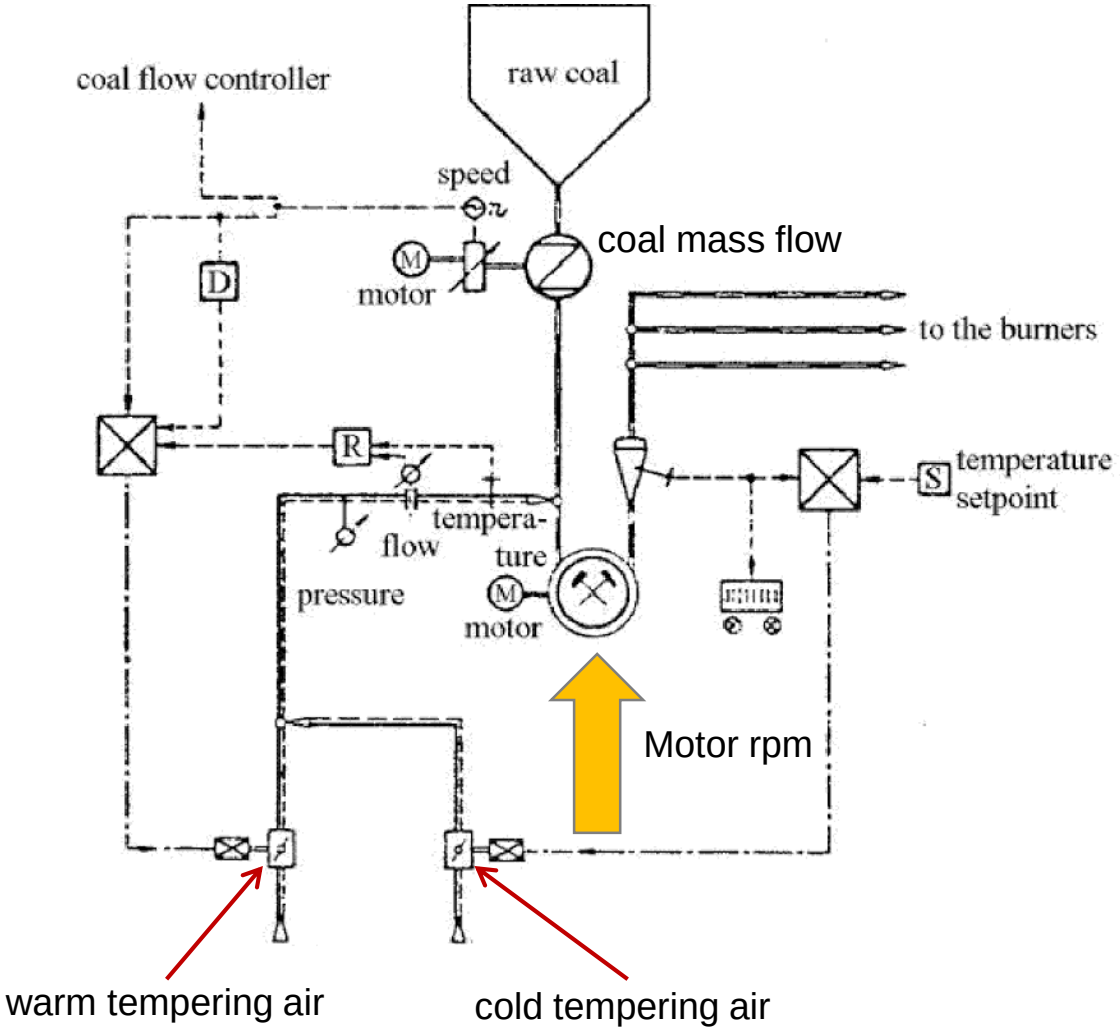
Control parameters:

- Warm tempering air
- Cold tempering air
- Feeder
- Beater Wheel rpm

Classic Mill Model



Main Control Inputs to the coal mill

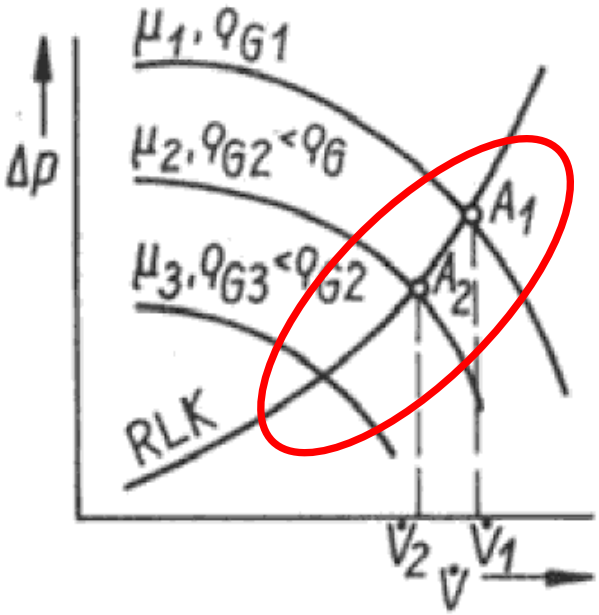


Fan characteristics of the Beater Wheel

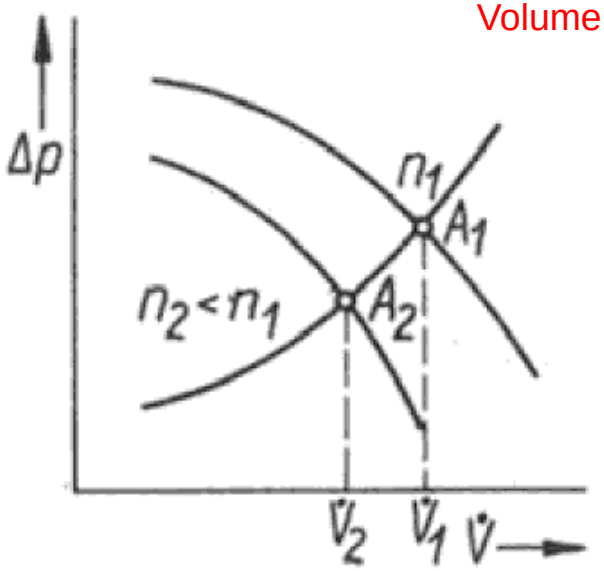
Beater Wheel Mills are also called ventilation mills

Below: characteristic fan curves of the beater wheel

Changes in H_2O loading or air mixing temperature will change the operating point of the beater wheel!
Volume flow will change



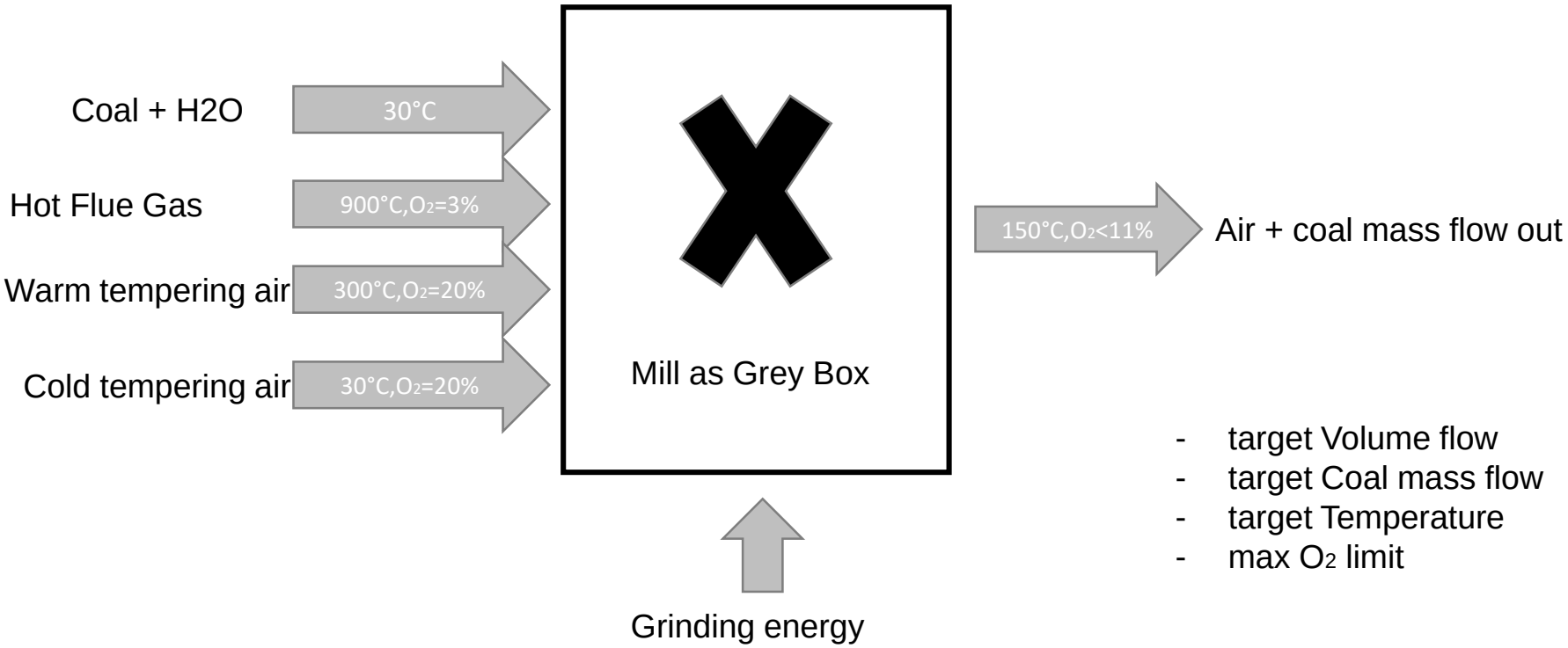
Different densities and loadings



Different beater wheel speeds

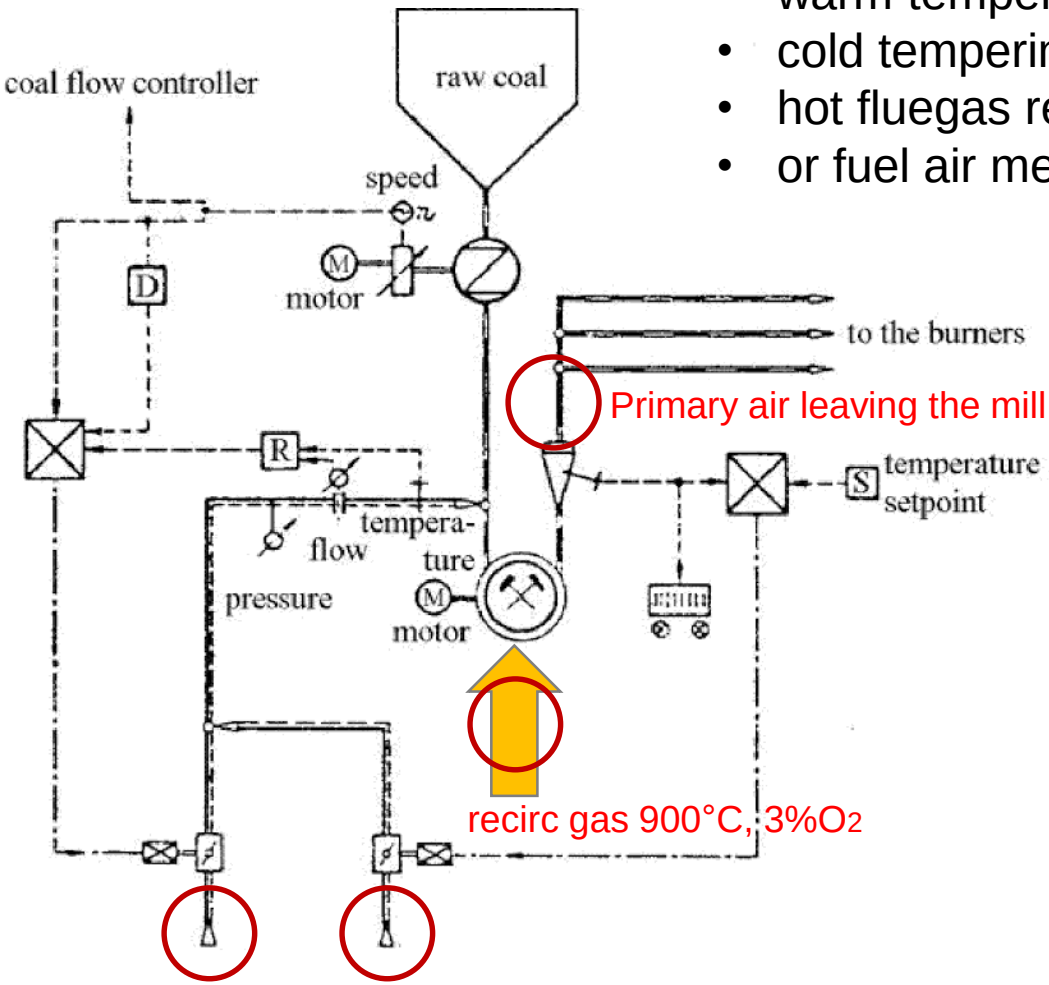
Pv / Pg = 1.35 – 1.4

Typical mass energy balance



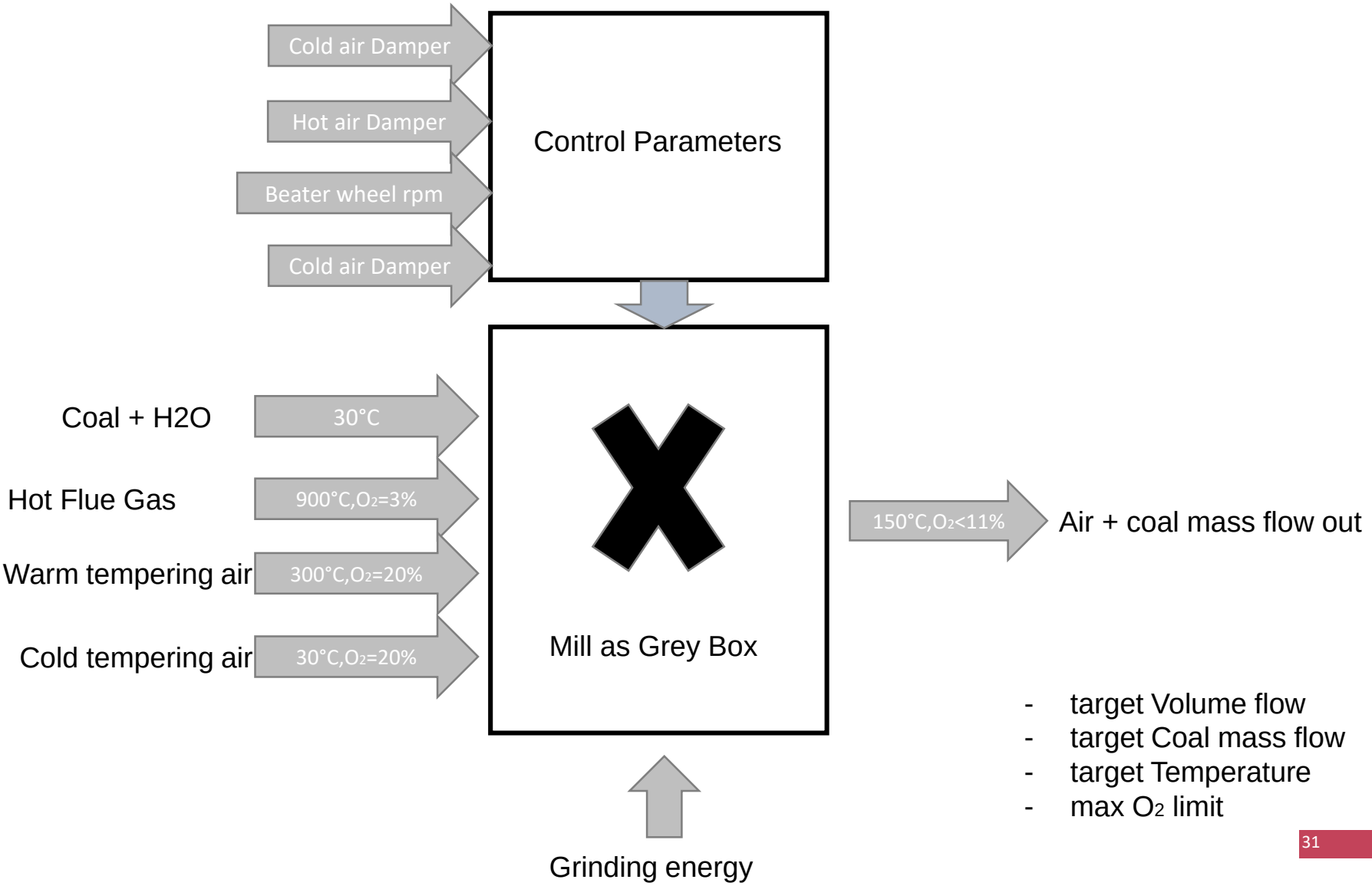
- target Volume flow
- target Coal mass flow
- target Temperature
- max O_2 limit

Recommended Measurements



- warm tempering air measurement
- cold tempering air measurement
- hot fluegas recirculation measurment
- or fuel air measurement

Typical mass energy balance



- target Volume flow
- target Coal mass flow
- target Temperature
- max O_2 limit

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