Associate Corporate Member

Cement Alliance
A European Expert Pool for the Cement Industry

Application Collection:

Solutions for the Cement Industry

Felix Bartknecht & Siegfried Andräß

Industry Management Building Materials

SICK AG

Solutions for the Cement Industry

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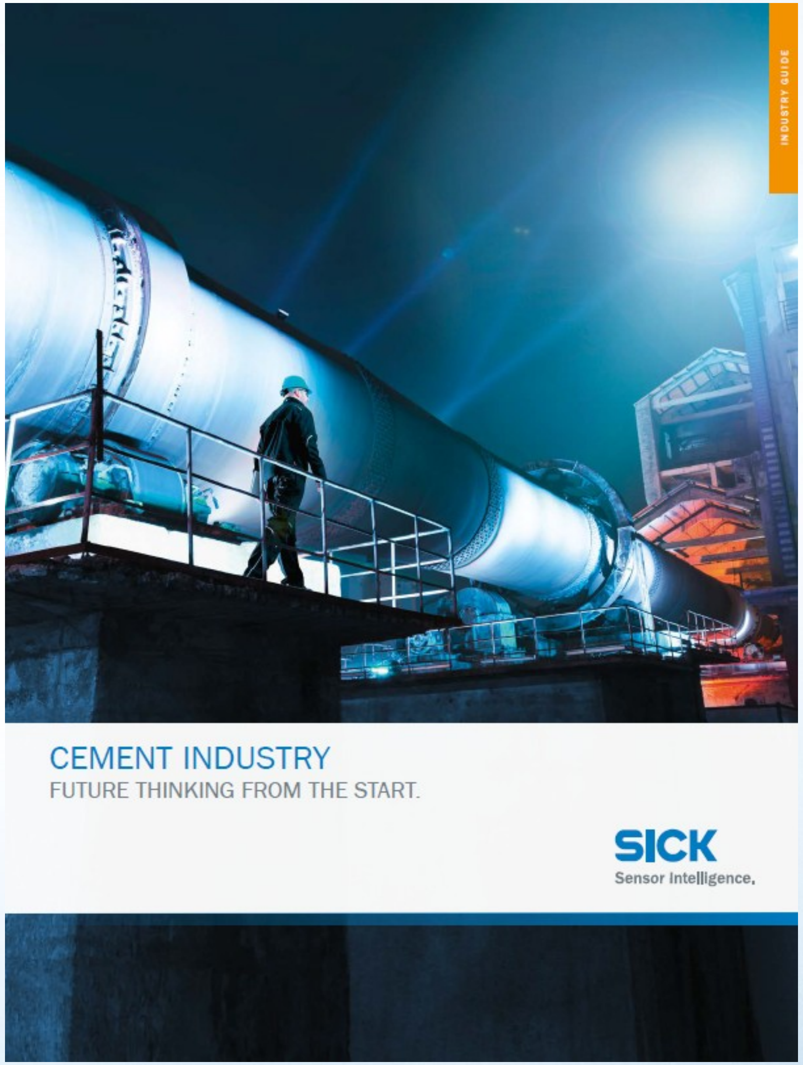

INDUSTRY GUIDE
CEMENT INDUSTRY
FUTURE THINKING FROM THE START.
SICK
Sensor Intelligence.

SICK AG

Fiscal year 2021

11,022
EMPLOYEES

1,964
SALES
(IN EUR MILLION)

202
EBIT
(IN EUR MILLION)

2,321
ORDERS RECEIVED
(IN EUR MILLION)

40,000
PRODUCT SOLUTIONS

1,406
EMPLOYEES IN R&D

3,749
PATENTS

210
R&D EXPENDITURE
(IN EUR MILLION)

SICK – worldwide one of the leading manufacturers of sensors and sensor solutions for industrial applications

Industry Characteristics

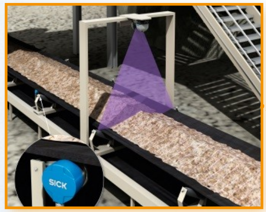
Sensor Intelligence – at a glance

- Analyzer solutions
- Automation light grids
- Detection and ranging solutions
- Distance sensors
- Dust measuring devices
- Encoders and inclination sensors
- Fluid sensors
- Gas analyzers
- Identification solutions
- Magnetic cylinder sensors
- Motor feedback systems
- Opto-electronic protective devices
- Photoelectric sensors
- Proximity sensors
- Registration sensors
- Software products
- Safety switches
- sens:Control – safe control solutions
- System solutions
- Traffic sensors
- Ultrasonic gas flow measuring devices
- Vision

Process Overview

Efficient Solutions for the Cement Industry

Collision Awareness

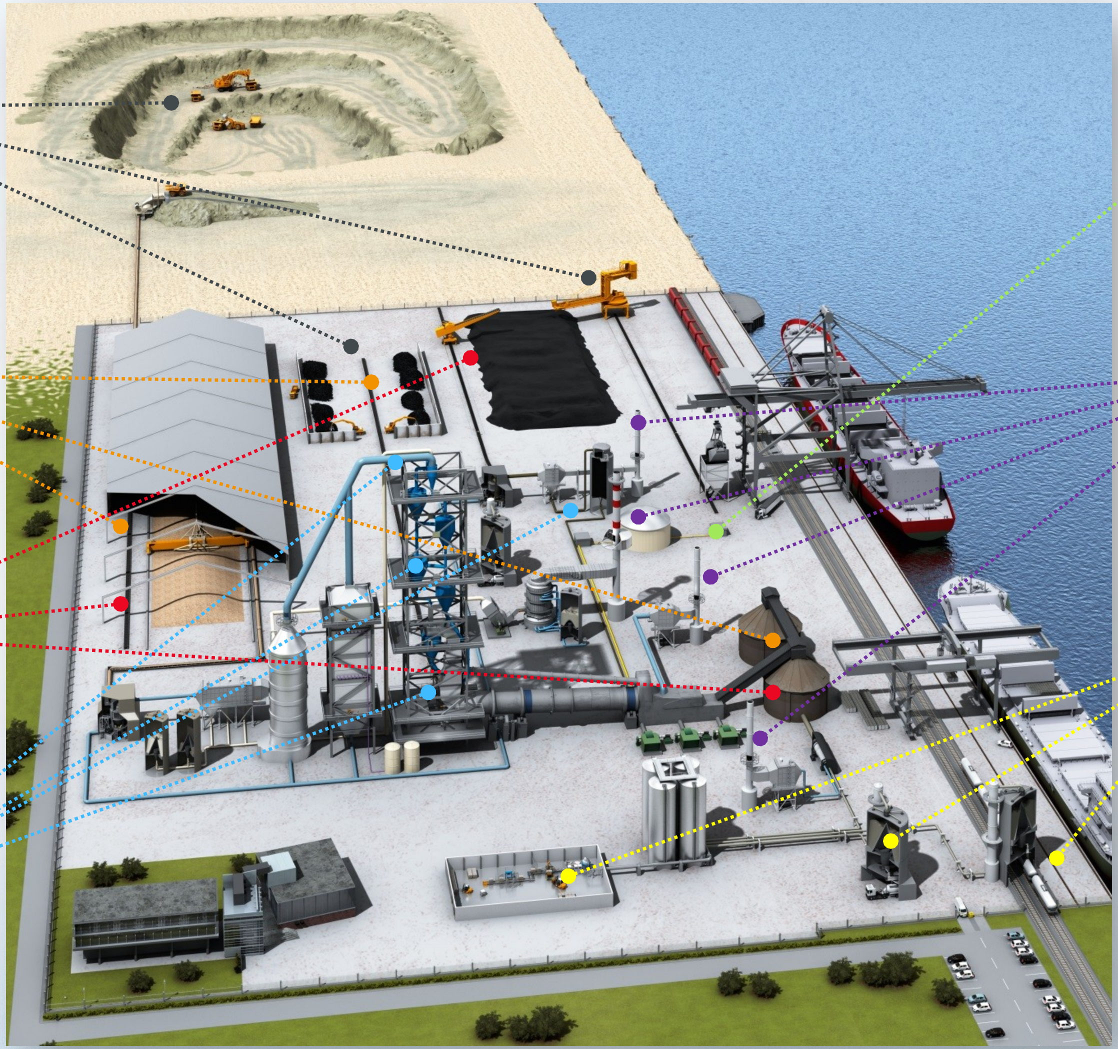


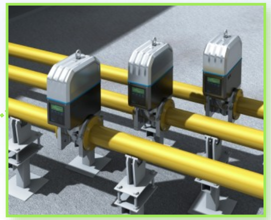
Conveyor Control

Stacker/Reclaimer

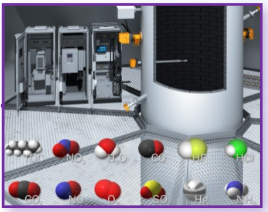
CO
SO2
NO
HCl
NO2
H2O
O2
CH4

Process Gas Analysis





Gas Metering



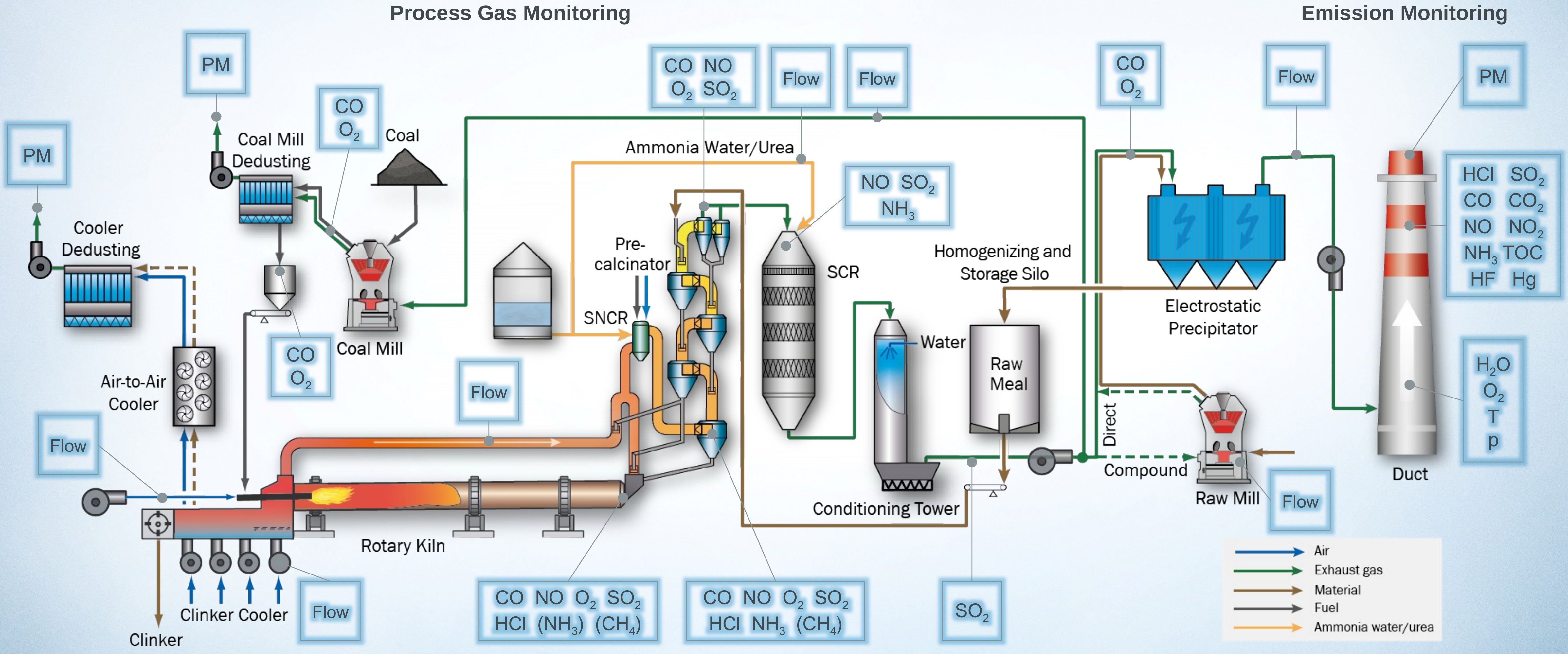
Emission Monitoring

End of line & Logistics

and many more…!

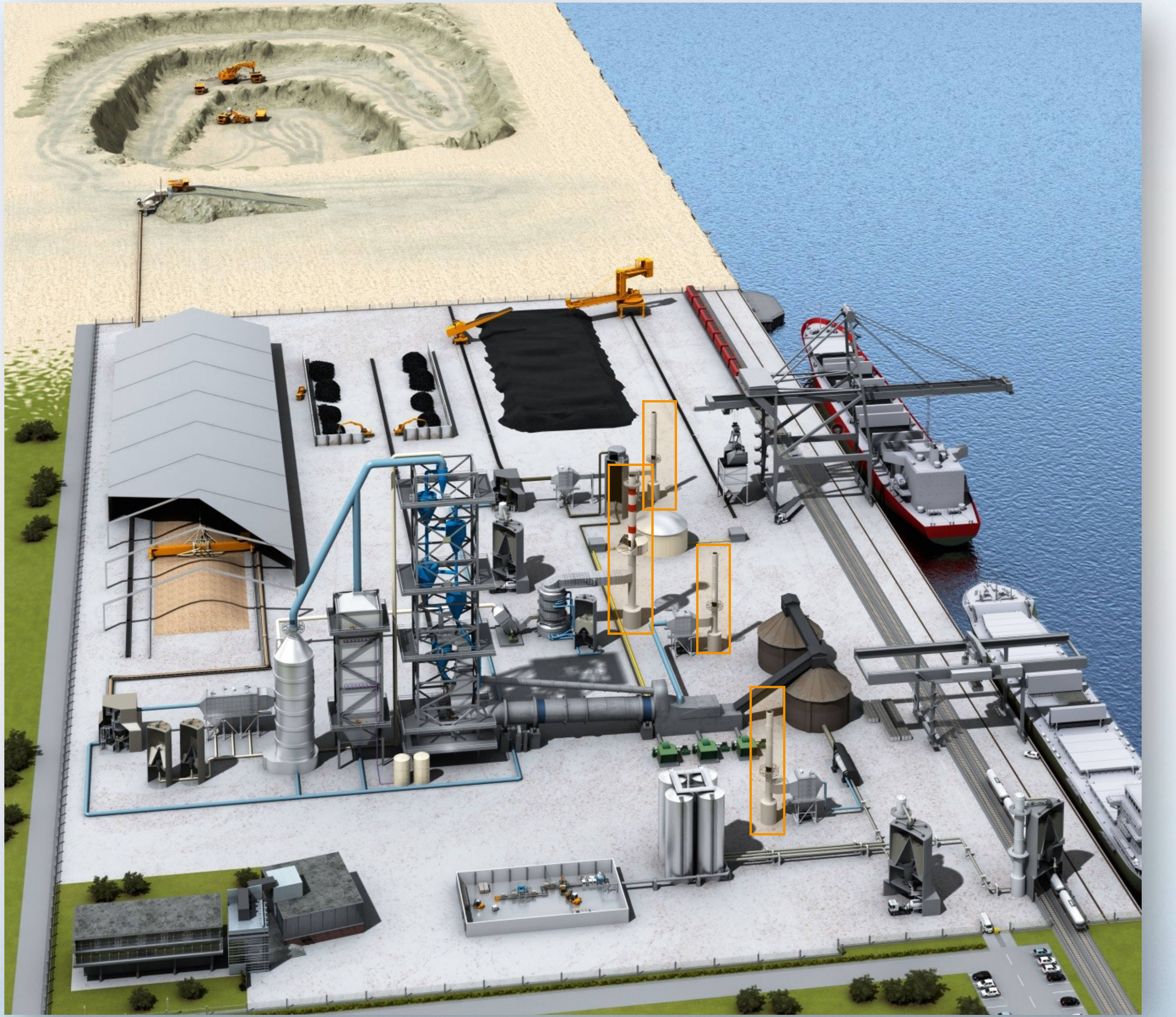
Process Overview

CEMS & Process Gas Monitoring


Process Gas Monitoring
Emission Monitoring
PM
PM
CO O_2
Coal Mill Dedusting
Coal
CO NO O_2 SO_2
Flow
Flow
CO O_2
Flow
PM
Cooler Dedusting
Ammonia Water/Urea
NO SO_2 NH_3
HCl SO_2 CO CO_2 NO NO_2 NH_3 TOC HF Hg
Pre-calcinator
SNCR
SCR
Homogenizing and Storage Silo
Electrostatic Precipitator
CO O_2
Coal Mill
Water
Raw Meal
Air-to-Air Cooler
Flow
Flow
H_2O O_2 T p
Direct
Compound
Duct
Conditioning Tower
Raw Mill
Flow
Rotary Kiln
Clinker Cooler
Clinker
Flow
CO NO O_2 SO_2 HCl (NH_3) (CH_4)
CO NO O_2 SO_2 HCl NH_3 (CH_4)
SO_2
Air
Exhaust gas
Material
Fuel
Ammonia water/urea

Solutions & Field Installations

CEMS



Solutions & Field Installations

CEMS

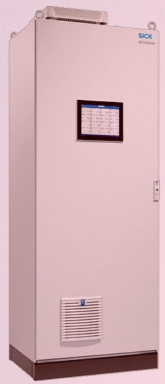
- **Measuring components**
  - Depending on local regulations (CEMS)!
  - Affected by fuels/materials used, prod. capacity, thermal power, exceptional permissions
  - Gases measured: CO, NO, NO_2 , SO_2 , HCl, NH_3, CO_2, VOC, H_2O, HF, Hg, O_2
  - In addition:
    - Dust concentration (particulate matter)
    - Gas velocity (flow)
    - Temperature & Pressure
    - Data Acquisition System used (sometimes direct data transfer to local authorities)

Solutions & Field Installations

CEMS

Hot/Wet

Gas



MCS200HW

SO_2, CO, NH_3, HCl, VOC, NOx, (NO_2), CO_2, H_2O, O_2

Gas

MCS100FT

SO_2, CO, NH_3, HCl, HF, VOC, NO, (NO_2), CO_2, H_2O, O_2,

MERCEM300Z

Hg

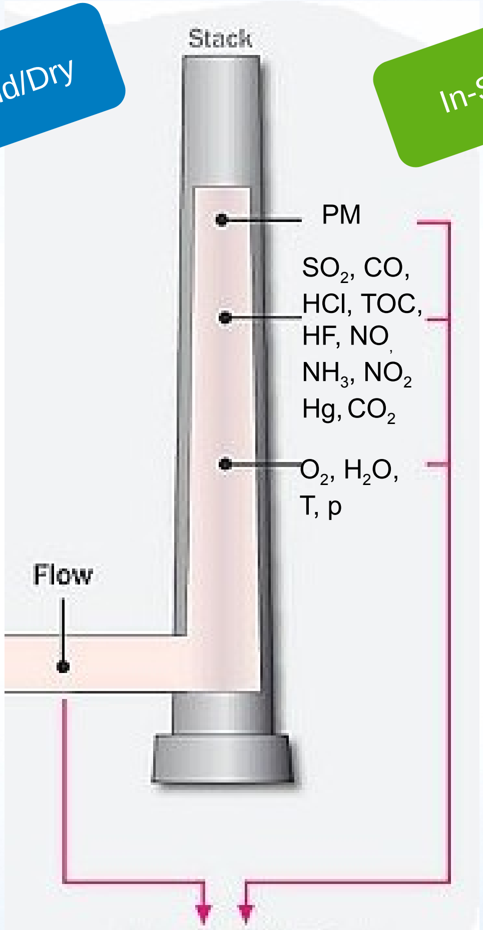
Cold/Dry

Gas

MKAS

SO_2, CO, NO, O_2

Gas



Stack

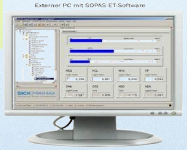
PM

SO_2, CO, HCl, TOC, HF, NO, NH_3, NO_2 Hg, CO_2

O_2, H_2O, T, p

Flow

Data Acquisition system MEAC300



In-Situ

Gas

GM32

GM35

ZIRKOR200

SO_2, H_2O, CO_2, CO, NO, O_2

Gas

TDLS

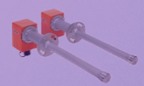
GM700

NH_3, HCl, HF, H_2O

Dust

DUST-HUNTER

Flow



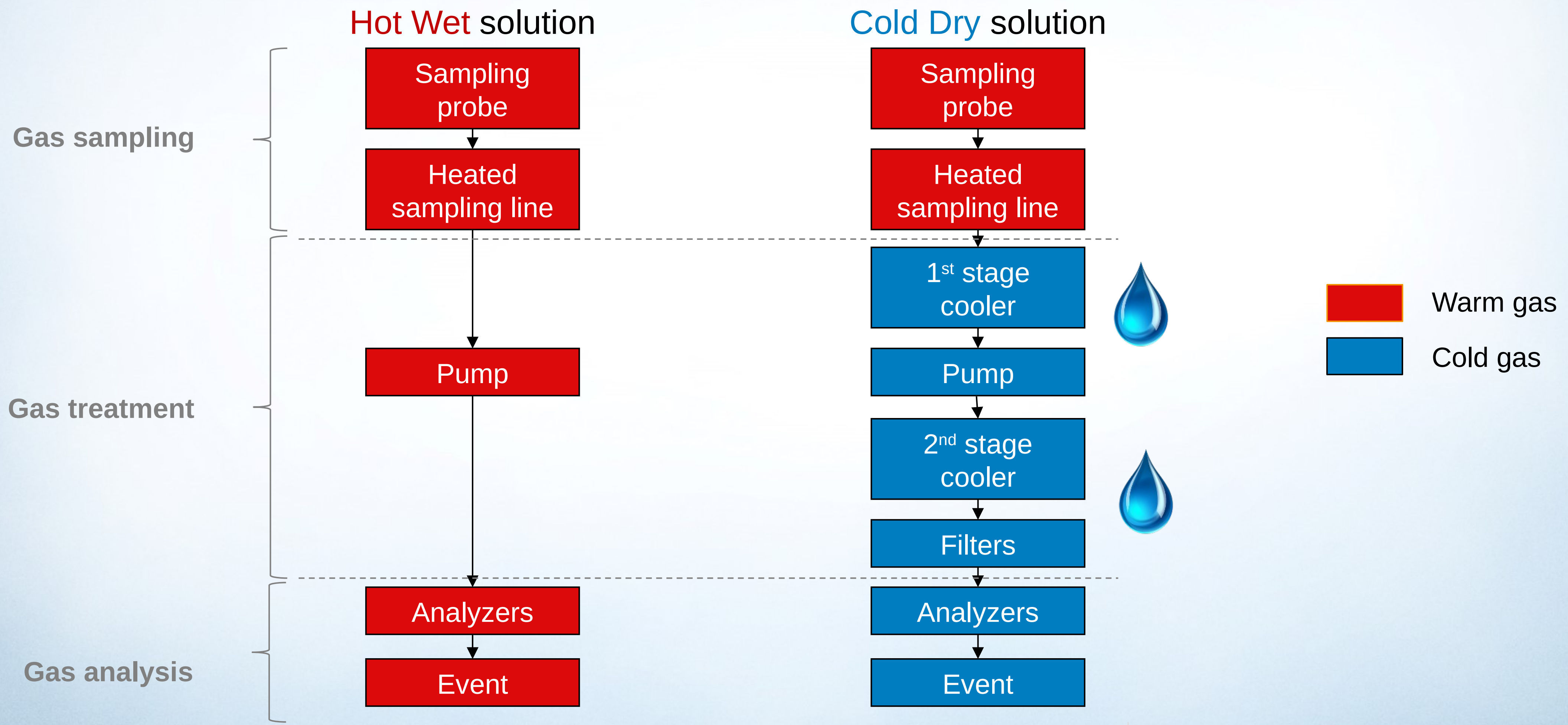
Ultra Sound

FLOWSIC 100

Solutions & Field Installations

CEMS - Extractive

- **Extractive technology** - differentiation Hot/Wet & Cold/Dry



Hot Wet solution

Sampling probe → Heated sampling line → Pump → Analyzers → Event

Cold Dry solution

Sampling probe → Heated sampling line → 1st stage cooler → Pump → 2nd stage cooler → Filters → Analyzers → Event

Gas sampling

Gas treatment

Gas analysis

🟥 Warm gas

🟦 Cold gas

Solutions & Field Installations

CEMS - Extractive

- **Extractive technology** - differentiation Hot/Wet & Cold/Dry

Hot Wet solution

Cold Dry solution

Water soluble components:

Yes: HCl, NH3, HF

No

Single component:

costly

price attractive

Multiple components (>6):

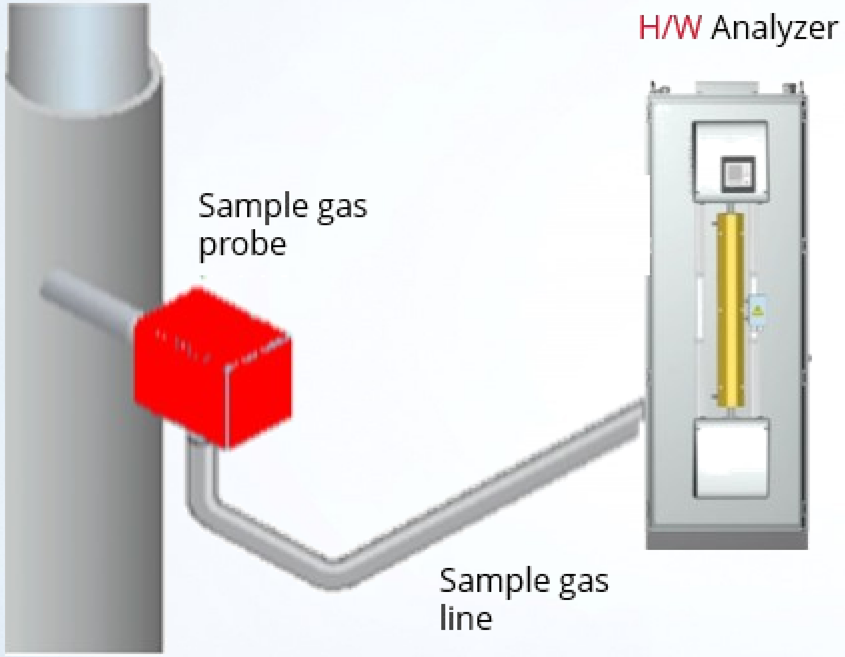
price attractive

costly

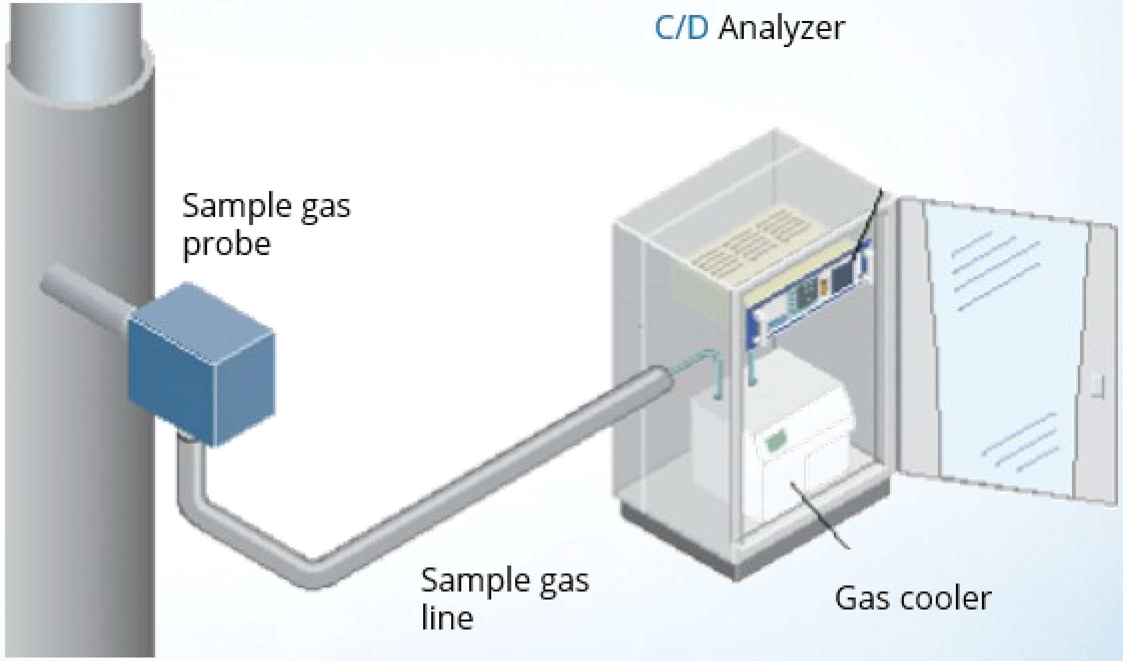
Solutions & Field Installations

CEMS - Extractive

- **Extractive technology** - differentiation Hot/Wet & Cold/Dry


H/W Analyzer
Sample gas probe
Sample gas line

Extractive Technology Hot Wet


C/D Analyzer
Sample gas probe
Sample gas line
Gas cooler

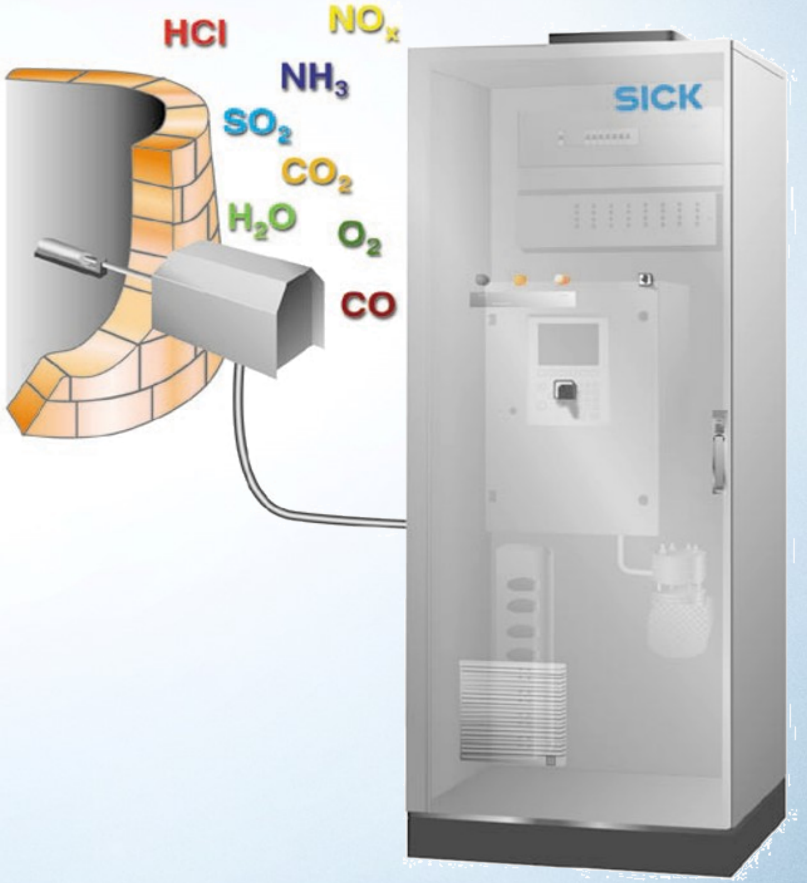
Extractive Technology Cold Dry

  - Both technologies are offered by SICK
  - Technology depending on main fuel & gas components to be measured

Solutions & Field Installations

CEMS - Extractive

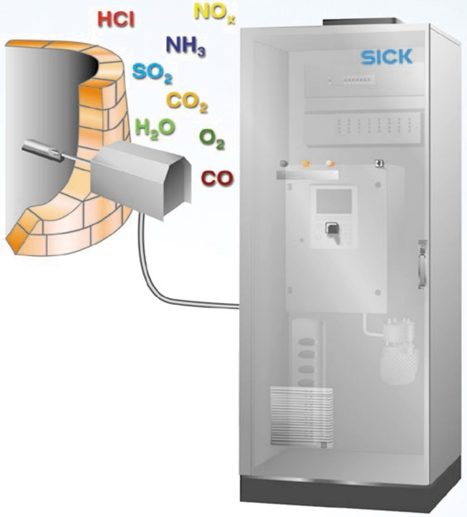
- **Extractive Hot/Wet Measurement (Overview)**
  - Independent from sampling point
  - High sample gas temperatures (185-220°C)
  - Easy maintenance and validation
  - Uninterrupted heating from the sampling probe to the sample gas cell
    - No cold intersections between the modules
    - No water condensation
    - Accurate and interference-free measurement results for water-soluble components such as HCl, NH_3, HF …

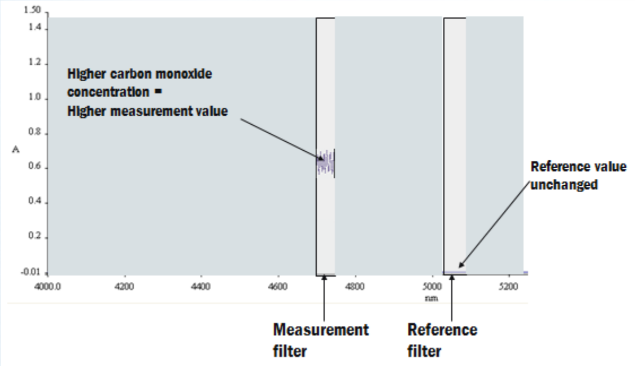


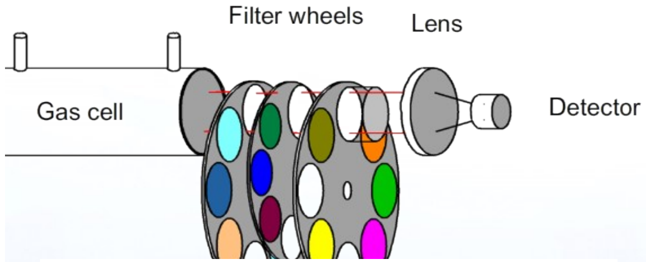
Solutions & Field Installations

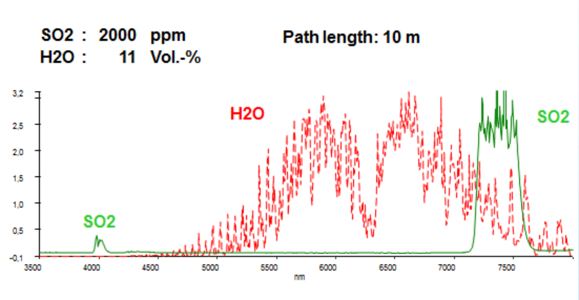
CEMS - Extractive

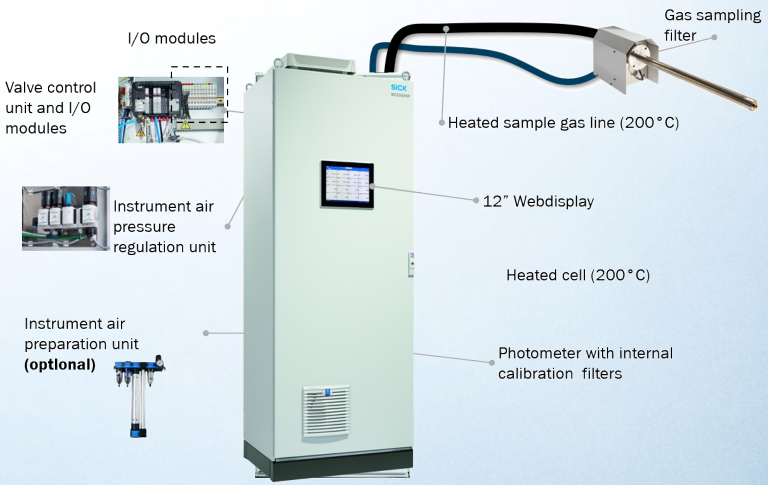
- **MCS200HW – multi component analyzer**
  - Measurement of up to 10 infra red- active gas compounds + O_2 & VOC
  - Single beam photometer:
    - Gas-filter-correlation (GFC)
    - Interference-filter-correlation (IFC)


HCl
NOx
NH3
SO2
CO2
H2O
O2
CO
SICK




Filter wheels
Lens
Gas cell
Detector

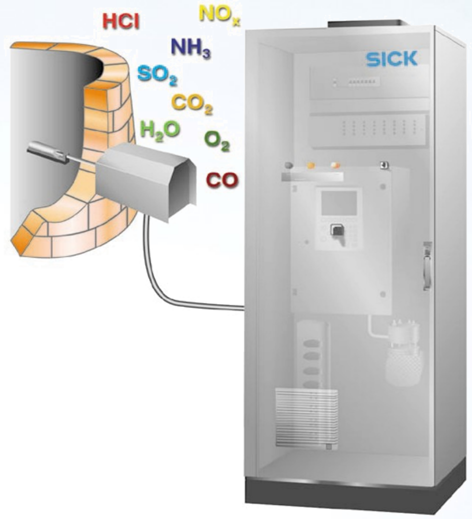


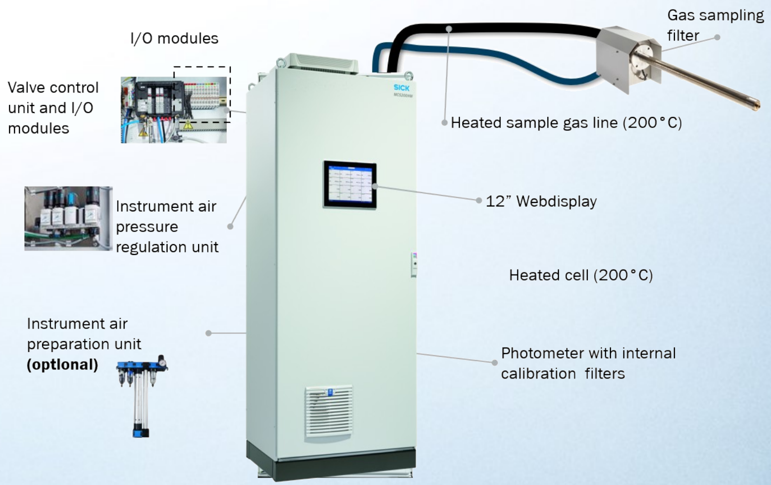

Gas sampling filter
I/O modules
Valve control unit and I/O modules
Heated sample gas line (200°C)
12" Webdisplay
Instrument air pressure regulation unit
Heated cell (200°C)
Instrument air preparation unit
(optional)
Photometer with internal calibration filters

Solutions & Field Installations

CEMS - Extractive

- **MCS200HW – multi component analyzer**
  - Measurement of up to 10 infra red- active gas compounds + O_2 & VOC
  - Heated sample probe and sample line extract flue gas (above dew point)
  - Test gas supply at the gas sampling probe or at the analyzer
  - Back-purging of gas sampling probe for cleaning of filters
  - Fast sample gas exchange for minimizing adsorption and desorption effects
  - Automated sample point switching
  - QAL3 drift test according to EN 14181 with internal calibration filter wheel – no test gas required

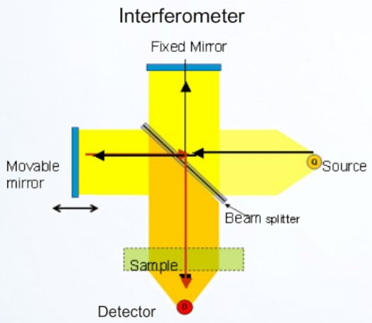

HCl
NO_x
NH_3
SO_2
CO_2
H_2O
O_2
CO
SICK

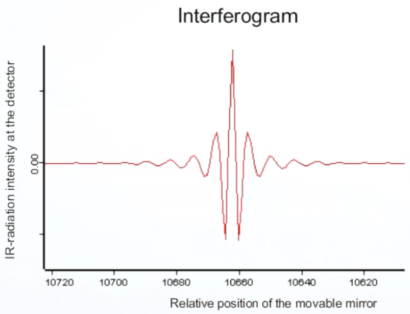

I/O modules
Valve control unit and I/O modules
Instrument air pressure regulation unit
Instrument air preparation unit **(optional)**
Gas sampling filter
Heated sample gas line (200°C)
12” Webdisplay
Heated cell (200°C)
Photometer with internal calibration filters

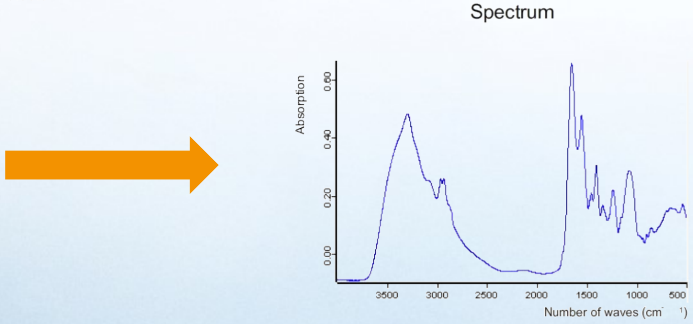
Solutions & Field Installations

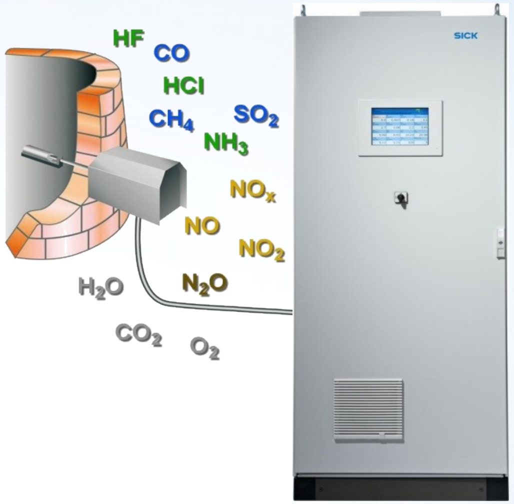
CEMS - Extractive

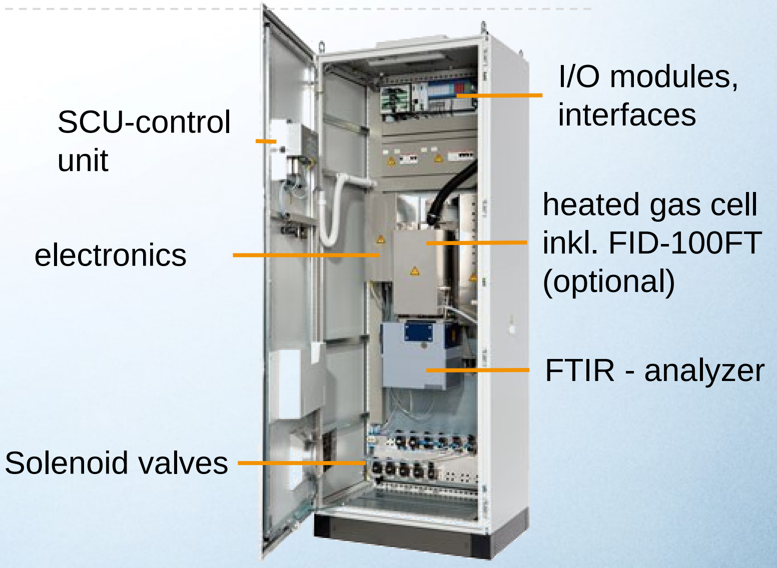
- **MCS100 FT - multi component analyzer**
  - Measurement of more than 12 measuring components simultaneously
  - Infrared spectroscopy according to the Fourier transformation (FTIR) principle ensures high measurement accuracy


Interferometer
Fixed Mirror
Movable mirror
Source
Beam splitter
Sample
Detector






HF
CO
HCl
CH_4
SO_2
NH_3
NO_x
NO
NO_2
H_2O
N_2O
CO_2
O_2
SICK



I/O modules, interfaces

SCU-control unit

heated gas cell inkl. FID-100FT (optional)

electronics

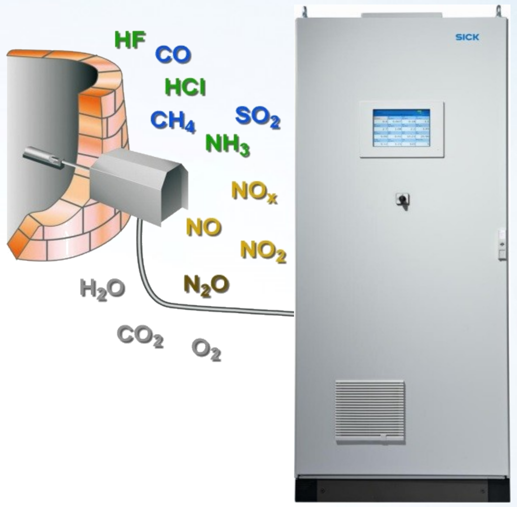
FTIR - analyzer

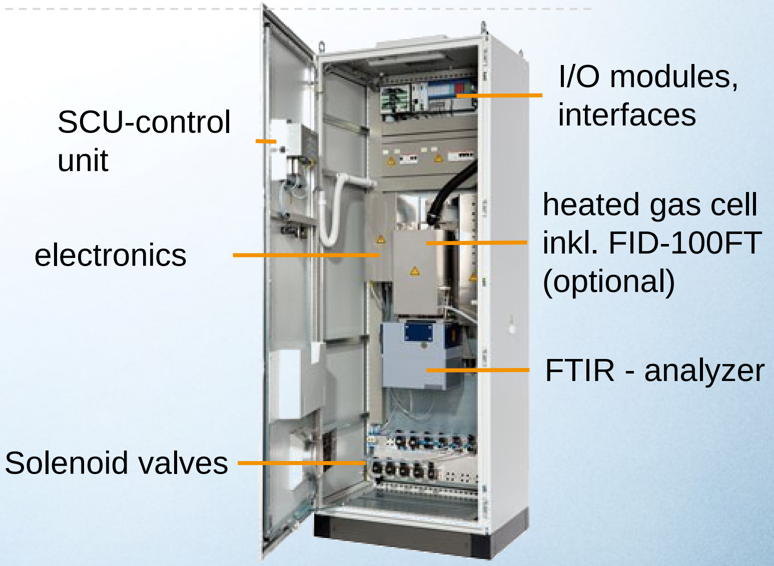
Solenoid valves

Solutions & Field Installations

CEMS - Extractive

- **MCS100 FT - multi component analyzer**
  - Measurement of more than 12 measuring components simultaneously
  - Infrared spectroscopy according to the Fourier transformation (FTIR) principle ensures high measurement accuracy
  - Lowest approved measuring range for HF
  - Remote control and diagnosis via software SOPAS ET
  - Automatic adjustment of analyzer
  - Automatic back flushing and filter cleaning of sampling unit
  - Sample gas transport by an ejector without moving parts
  - Operation via touchscreen


HF
CO
HCl
CH_4
SO_2
NH_3
NO_x
NO
NO_2
N_2O
H_2O
CO_2
O_2
SICK


SCU-control unit
electronics
Solenoid valves
I/O modules, interfaces
heated gas cell inkl. FID-100FT (optional)
FTIR - analyzer

Solutions & Field Installations

CEMS - Extractive

MCS200HW

- Less complex technology
- Need of additional instrument to measure more components
- No need for high qualified personal for adjustment & regular maintenance

MCS100 FT

- Requires more calibration effort (chemometric modelling)
- Can detect more components e.g. HF
- Simplified upgrade on side for additional components
- Less maintenance (ejector pump)

- Both technologies…

  …offer drift control w/o span gas use for QAL-3 function

  …can be equipped with remote control via ethernet for diagnosis & operation

  …can be upgraded with system integrated O_2 & FID measurement

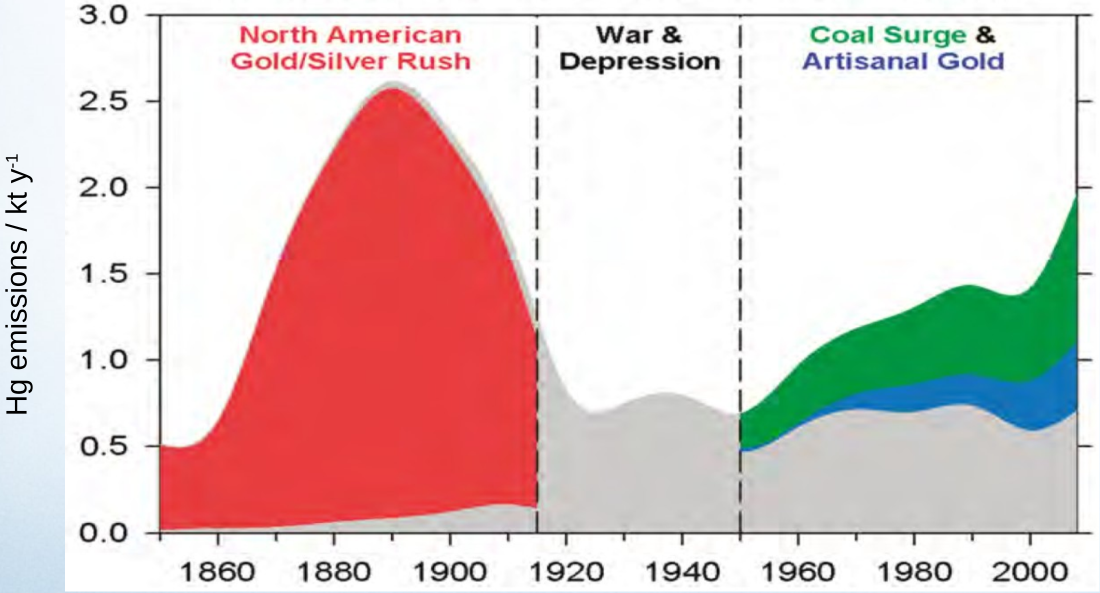
Solutions & Field Installations

CEMS - Extractive

- **Mercury & its organic compounds are extremely toxic & can cause health problems**
- Mercury can enter food chain (esp. fish & shellfish)
- Cement industry → appr. **10%** of all anthropogenic Hg emissions (190 t/y)
  → worldwide average emission factor **= 35mg/t$_{\mathbf{cement}}$**

Source: wbcsd

The three phases of historical mercury emissions



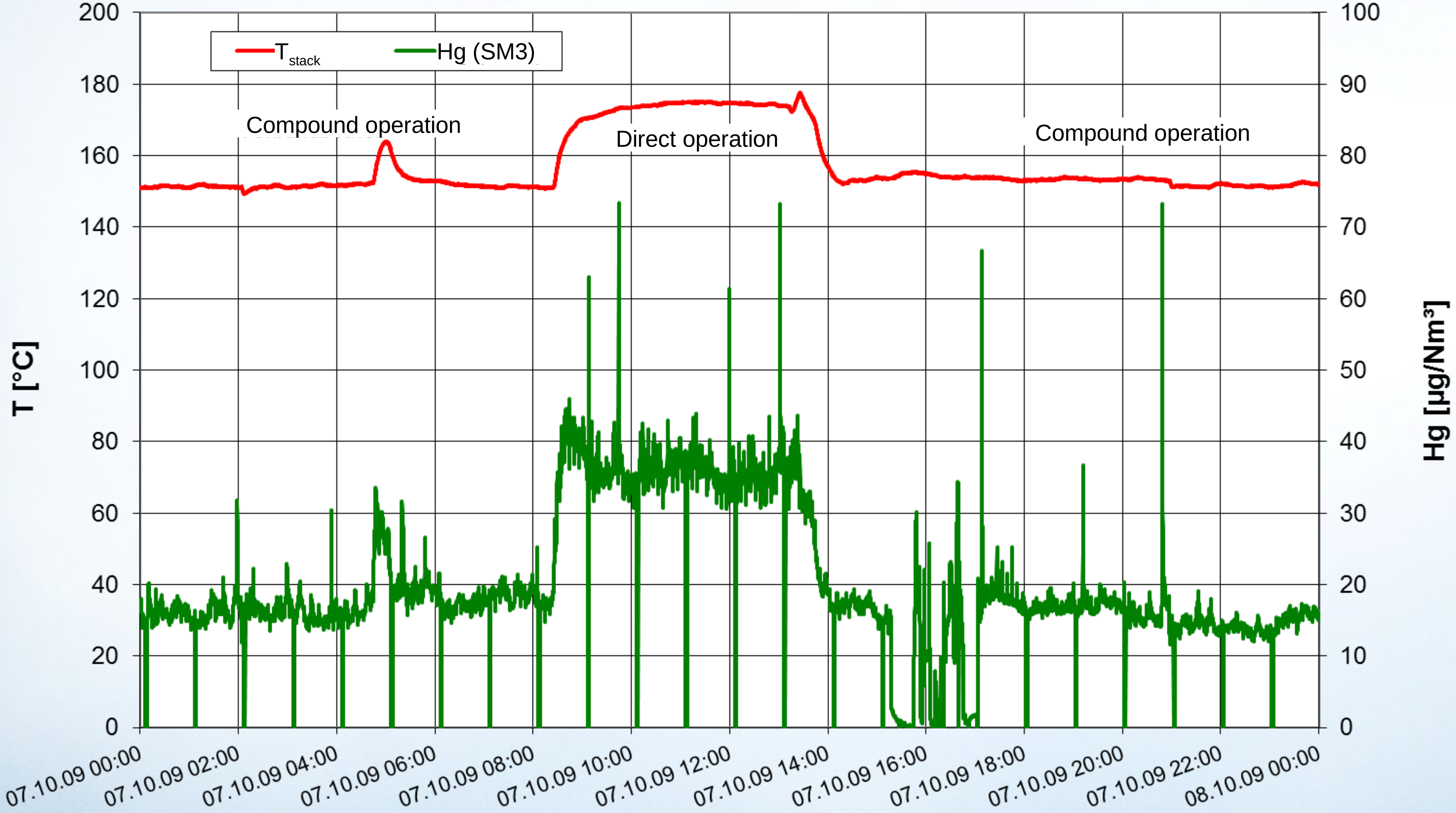
Source: Streets (2011)

UN environment
MINIMATA CONVENTION ON MERCURY
80
Hg
Mercury
200.59(2)
2
8
18
32
18
2

Solutions & Field Installations

CEMS - Extractive

› Mercury emissions – compound & direct operation

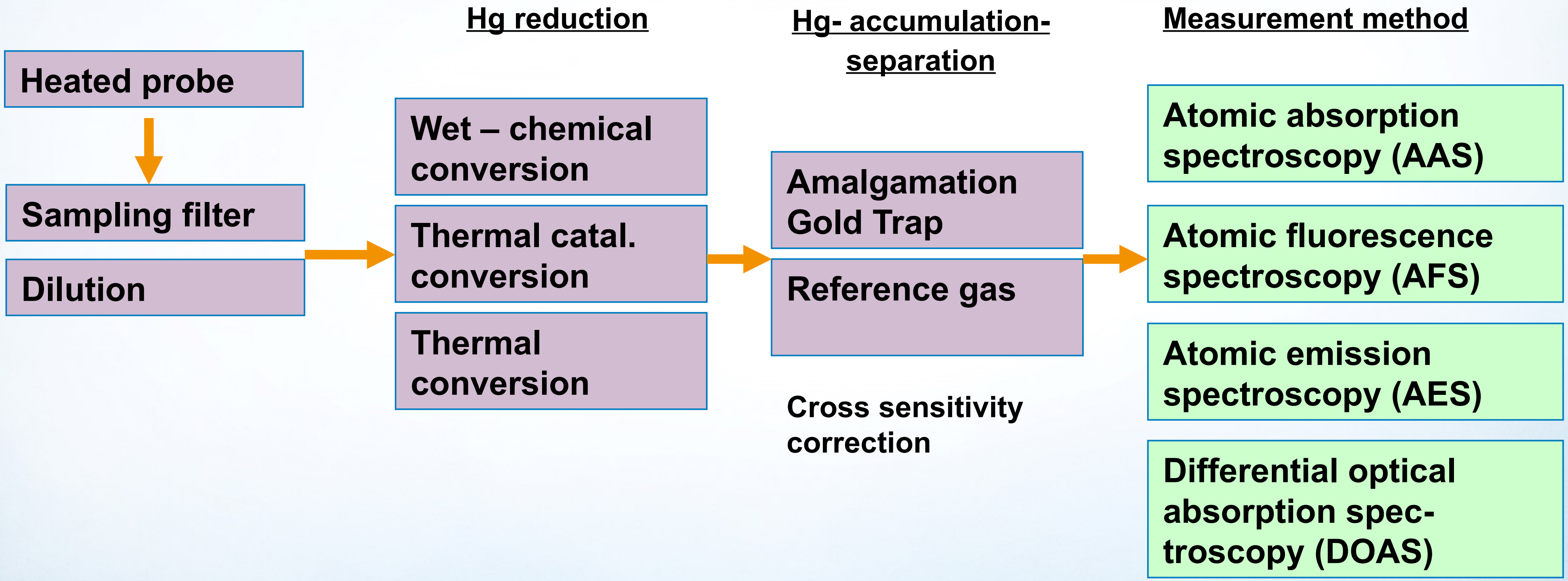


Solutions & Field Installations

CEMS - Extractive

SICK
Sensor Intelligence.

› Available continuous mercury emission monitoring systems

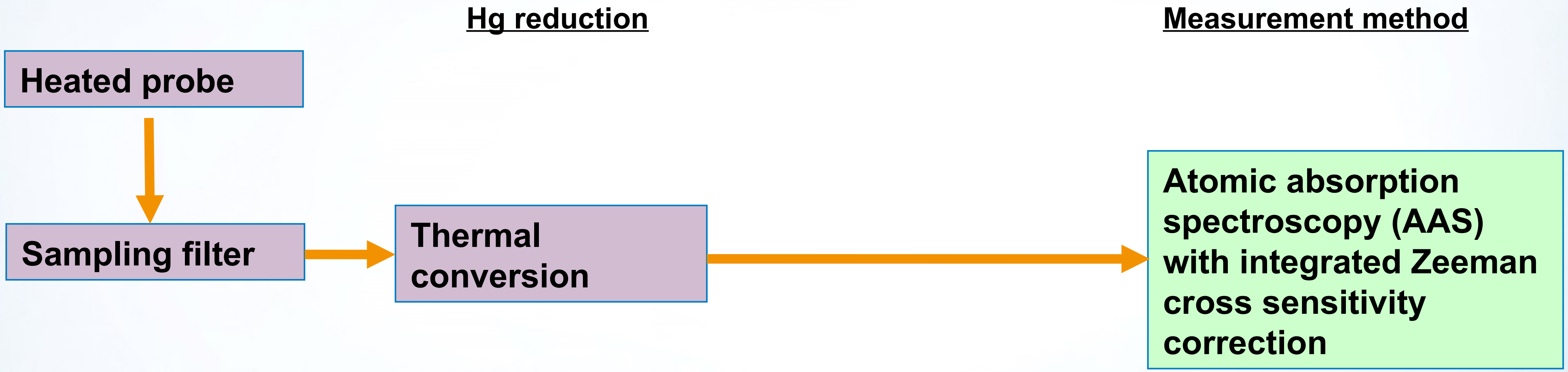


Heated probe
Sampling filter
Dilution
Hg reduction
Wet – chemical conversion
Thermal catal. conversion
Thermal conversion
Hg- accumulation-separation
Amalgamation Gold Trap
Reference gas
Cross sensitivity correction
Measurement method
Atomic absorption spectroscopy (AAS)
Atomic fluorescence spectroscopy (AFS)
Atomic emission spectroscopy (AES)
Differential optical absorption spec-troscopy (DOAS)

Solutions & Field Installations

CEMS - Extractive

› Optimized approach (SICK technology)



Hg reduction

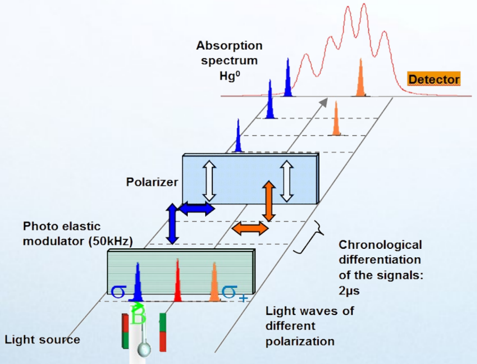
Measurement method

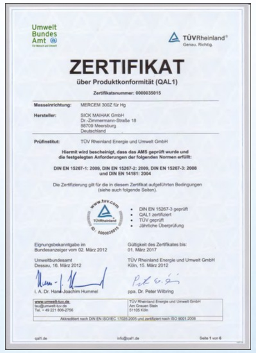
Heated probe

Sampling filter

Thermal conversion

Atomic absorption spectroscopy (AAS) with integrated Zeeman cross sensitivity correction


Absorption spectrum Hg^0
Detector
Polarizer
Photo elastic modulator (50kHz)
Chronological differentiation of the signals: 2µs
σ
σ_+
B
Light source
Light waves of different polarization



Umwelt Bundes Amt

TÜVRheinland®
Genau. Richtig.

ZERTIFIKAT
über Produktkonformität (QAL1)

Zertifikatsnummer: 0000035015

Messeinrichtung: MERCEM 300Z für Hg

Hersteller: SICK MAIHAK GmbH
Dr.-Zimmermann-Straße 18
88709 Meersburg
Deutschland

Prüfinstitut: TÜV Rheinland Energie und Umwelt GmbH

Hiermit wird bescheinigt, dass das AMS geprüft wurde und die festgelegten Anforderungen der folgenden Normen erfüllt:

DIN EN 15267-1: 2009, DIN EN 15267-2: 2009, DIN EN 15267-3: 2008 und DIN EN 14181: 2004

Die Zertifizierung gilt für die in diesem Zertifikat aufgeführten Bedingungen (siehe auch folgende Seiten).

www.tuv.com TÜVRheinland ID: 0000035015

- DIN EN 15267-3 geprüft
- QAL1 zertifiziert
- TÜV geprüft
- Jährliche Überprüfung

Eignungsbekanntgabe im Bundesanzeiger vom 02. März 2012

Gültigkeit des Zertifikates bis: 01. März 2017

Umweltbundesamt
Dessau, 16. März 2012

i. A. Dr. Hans-Joachim Hummel

TÜV Rheinland Energie und Umwelt GmbH
Köln, 15. März 2012

ppa. Dr. Peter Wilbring

www.umwelt-tuv.de
teu@umwelt-tuv.de
Tel. + 49 221 806-2756

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Köln

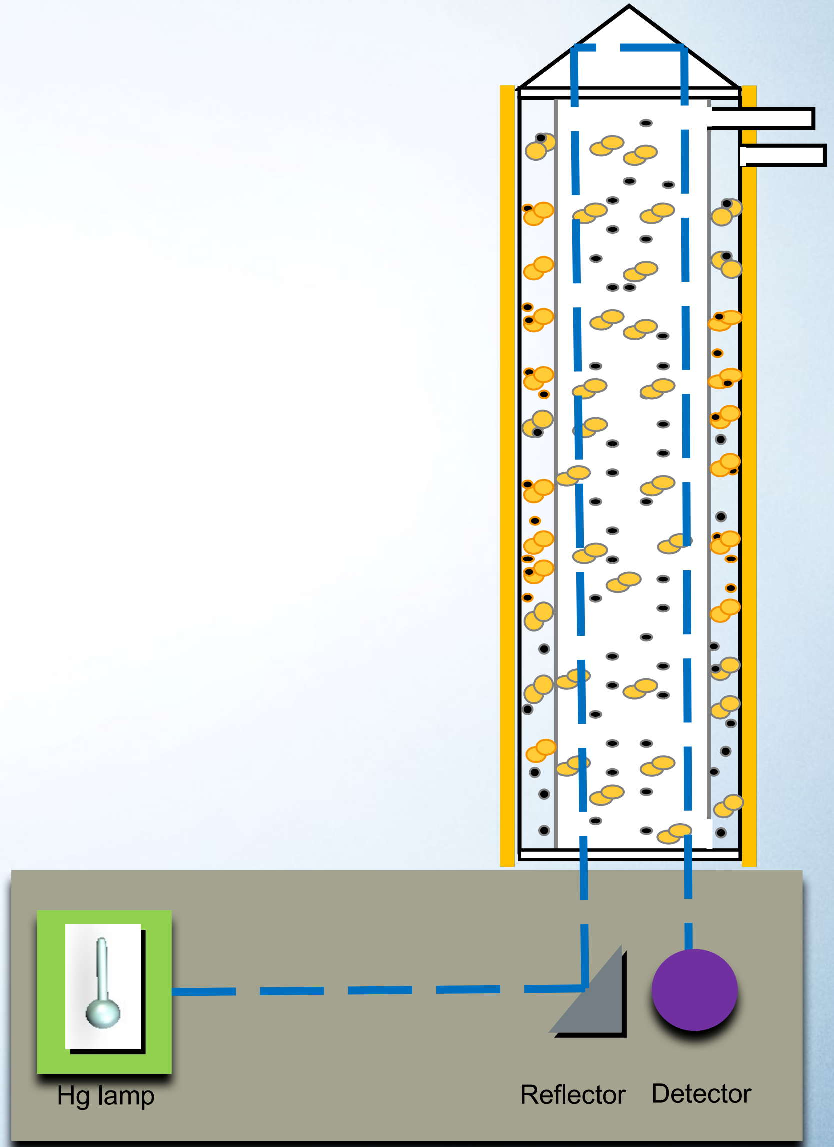
Akkreditiert nach DIN EN ISO/IEC 17025:2005 und zertifiziert nach ISO 9001:2008

qal1.de info@qal1.de Seite 1 von 6

Solutions & Field Installations

CEMS - Extractive

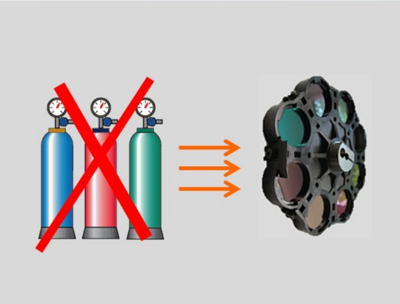
- **Patented direct measurement**
  - Zeeman atomic absorption spectroscopy within high temperature cell
- **Advantages**
  - No moving parts
  - No Hg recombination
  - No memory effects
  - Continuous monitoring of total Hg
  - Best possible cross sensitivity correction
- **Benefits**
  - Reliable measuring results at any time for all target industries: waste incinerators, power plants and cement plants!
  - One system setup for emission and process gas monitoring



Solutions & Field Installations

CEMS - Extractive

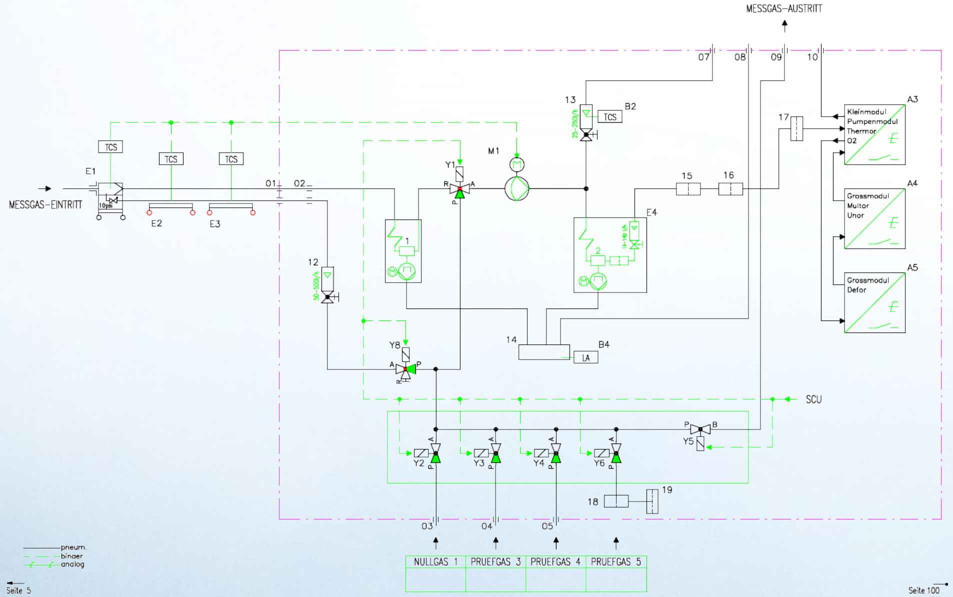
- **MERCEM300z – Mercury gas analyzer**
  - Continuous mercury emission monitoring of total mercury (Hgtot) in flue gases
  - Approved measuring ranges: 0-10/45/100/1000 µg/m³
  - One system setup for emission and raw gas monitoring (same parts, same instruction, same knowledge)
  - Direct measurement: Combined advantages of high temperature conversion and Zeemann cross sensitivity correction
  - Less operational costs: Automated check without need for test gases (Integrated adjustment cell)
  - Maintenance interval of 6 months
  - Longest certified measuring gas line of 35m
  - Sample point switching possible



Solutions & Field Installations

CEMS - Extractive

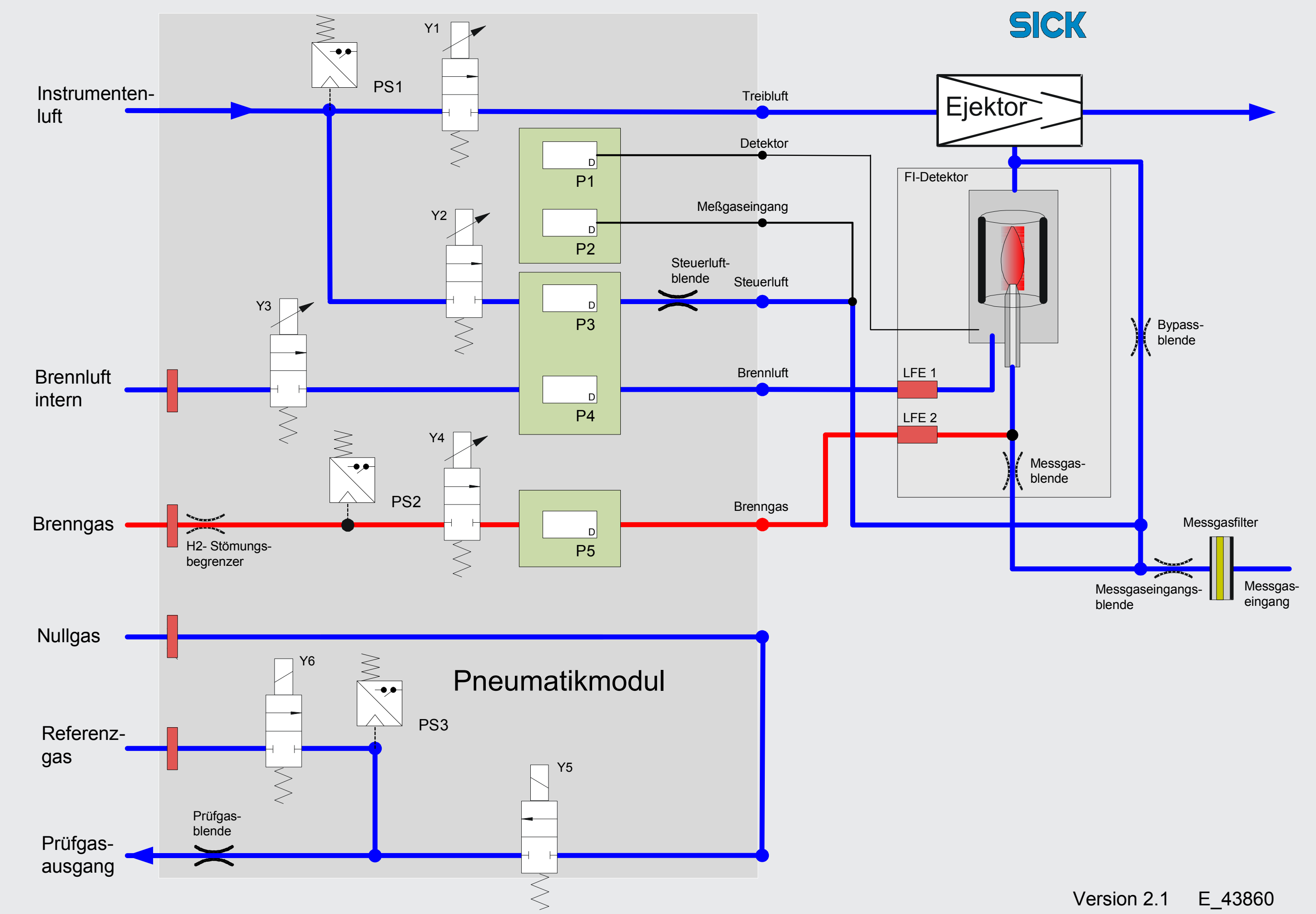
- **PowerCEMS100 (Cold Dry)**
  - Configurable setup
  - Up to three analyzers
    - Three analyzers GMS811 or
    - Two GMS811 + combined with DAE or NOx-Converter
    - One GMS811 + DAE + NOx-Converter


MESSGAS–AUSTRITT
07
08
09
10
A3
Kleinmodul
Pumpenmodul
Thermor
O2
17
13
B2
TCS
25–250l/h
M1
TCS
TCS
TCS
E1
Y1
R
A
P
01
02
15
16
MESSGAS–EINTRITT
10psi
E2
E3
E4
A4
Grossmodul
Multor
Unor
1
2
14–140 l/h
12
50–500l/h
A5
Grossmodul
Defor
14
B4
LA
Y8
A
P
R
SCU
P
B
Y5
Y2
Y3
Y4
Y6
19
18
03
04
05
NULLGAS 1
PRUEFGAS 3
PRUEFGAS 4
PRUEFGAS 5
pneum.
binaer
analog
Seite 5
Seite 100

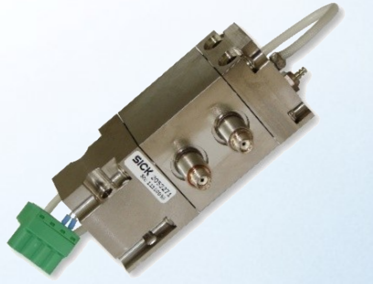
Solutions & Field Installations

CEMS - Extractive

› Flame Ionization Detector → VOC/THC* monitoring


SICK
Y1
PS1
Instrumenten-
luft
Treibluft
Ejektor
Detektor
P1
FI-Detektor
Meßgaseingang
Y2
P2
Steuerluft-
blende
Steuerluft
Y3
P3
Bypass-
blende
Brennluft
intern
Brennluft
LFE 1
P4
LFE 2
Y4
Messgas-
blende
PS2
Brenngas
Brenngas
P5
H2- Stömungs-
begrenzer
Messgasfilter
Messgaseingangs-
blende
Messgas-
eingang
Nullgas
Y6
Pneumatikmodul
Referenz-
gas
PS3
Y5
Prüfgas-
blende
Prüfgas-
ausgang
Version 2.1 E_43860

GMS810-FIDOR



*

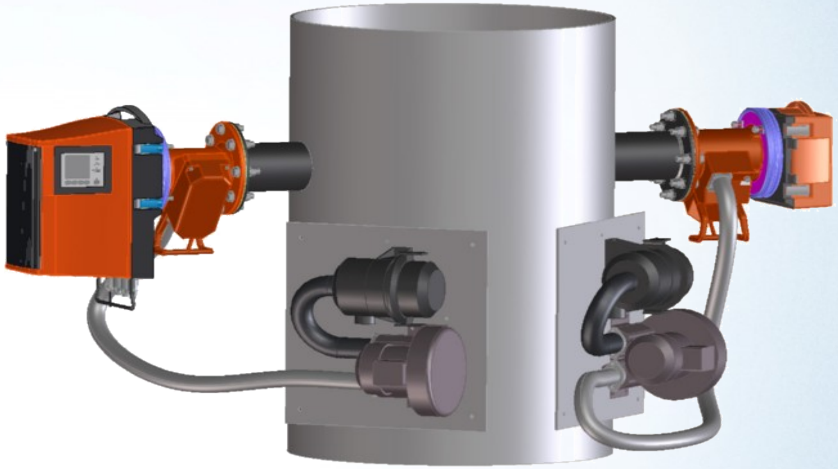
VOC = volatile organic carbons

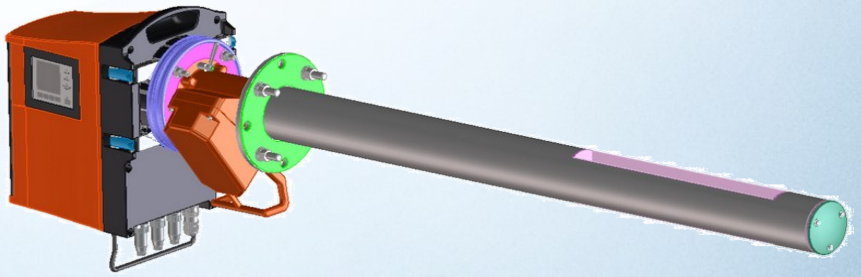
THC = total hydro carbons

Solutions & Field Installations

CEMS – In-Situ

- **In-situ technology**
  - no change of the gas composition (no extraction, no gas conditioning)
  - fast reaction and measurement times
  - direct reflection of operating conditions
  - representative
  - low maintenance
  - extensive analyzer self-tests
  - test gas –free operation
  - Low installation effort (cabinet, air conditioning,..)





Solutions & Field Installations

CEMS – In-Situ

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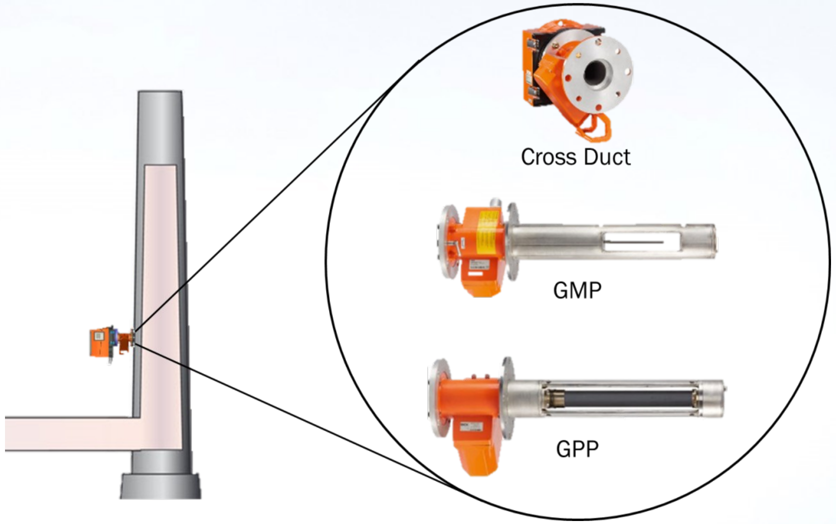
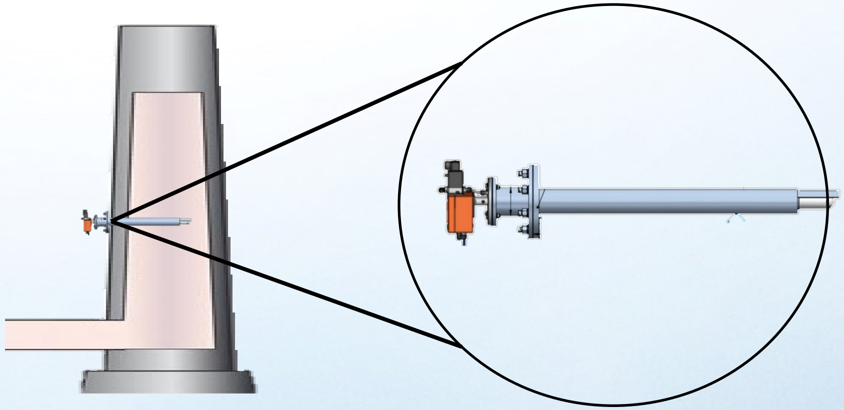


- **GM32**
  SO_2, NO, NO_2, NH_3; TRS (UV)
- **GM35**
  CO, CO_2, H_2O, N_2O (IR)
- **GM700**
  NH_3, HCl, HF, H_2O (Laser)
- **GM901**
  CO (IR)z

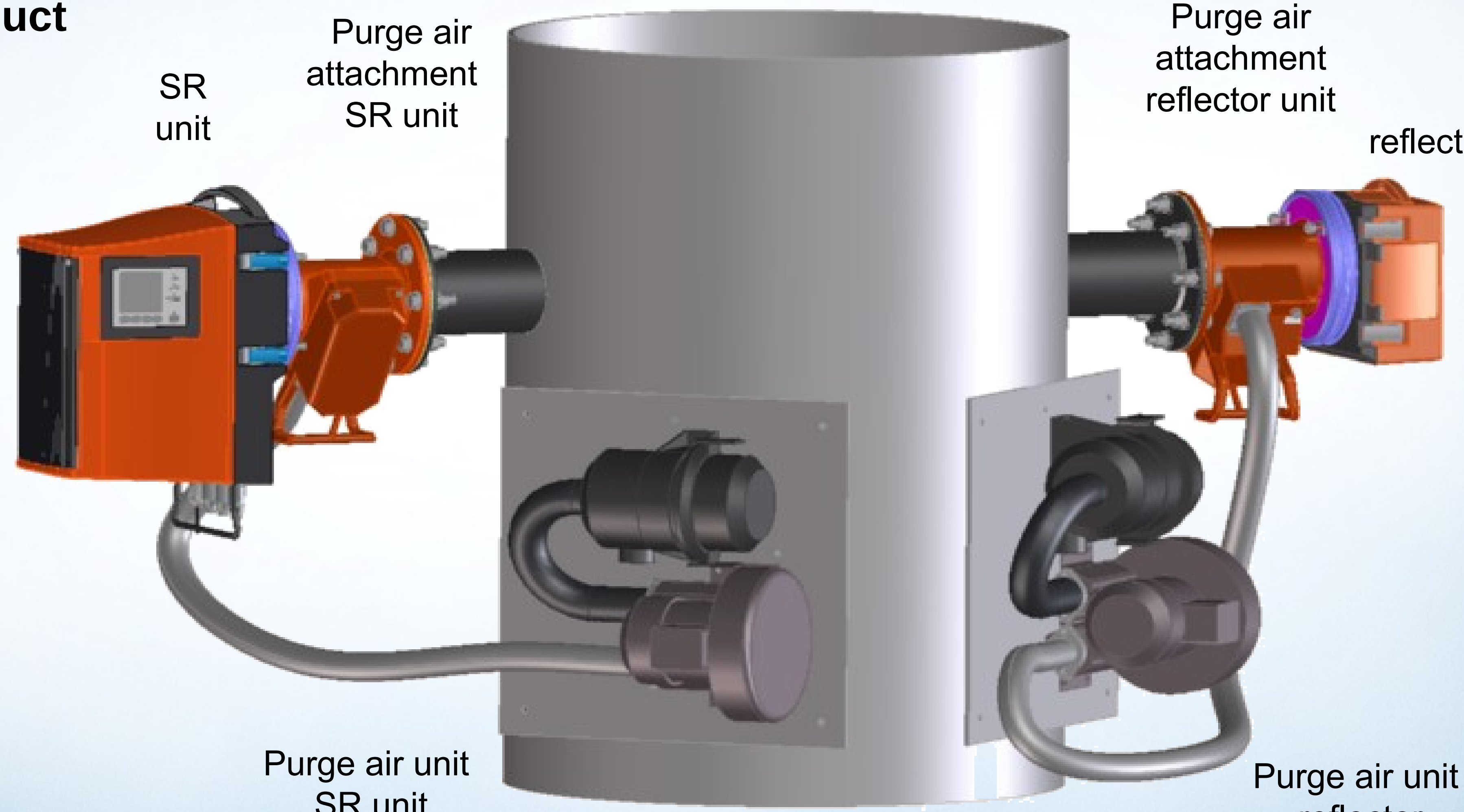


- **ZIRKOR200**
  O_2 (ZrO_2)

Solutions & Field Installations

CEMS – In-Situ

› Cross duct

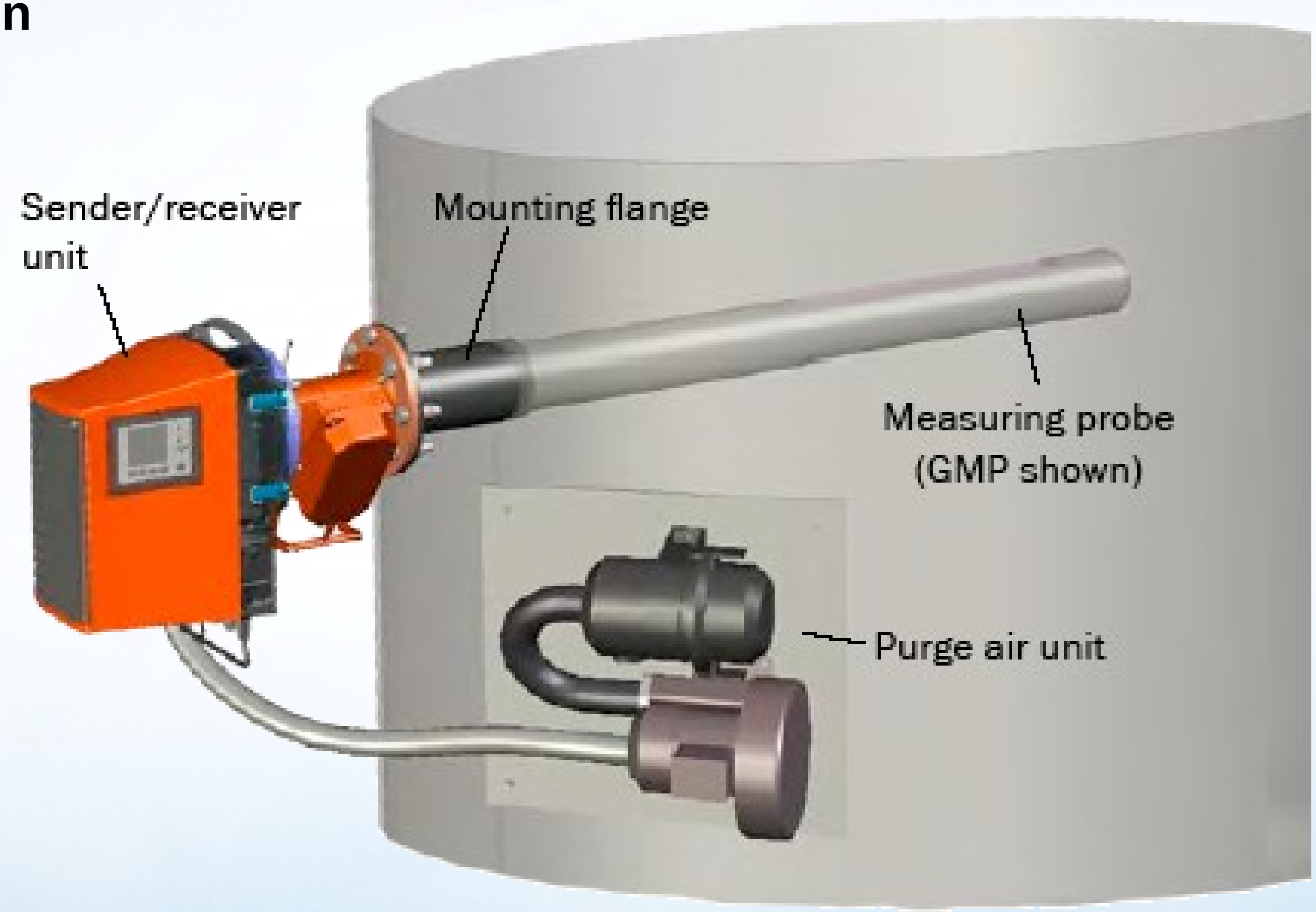


SR unit
Purge air attachment SR unit
Purge air attachment reflector unit
reflector
Purge air unit SR unit
Purge air unit reflector

Solutions & Field Installations

CEMS – In-Situ

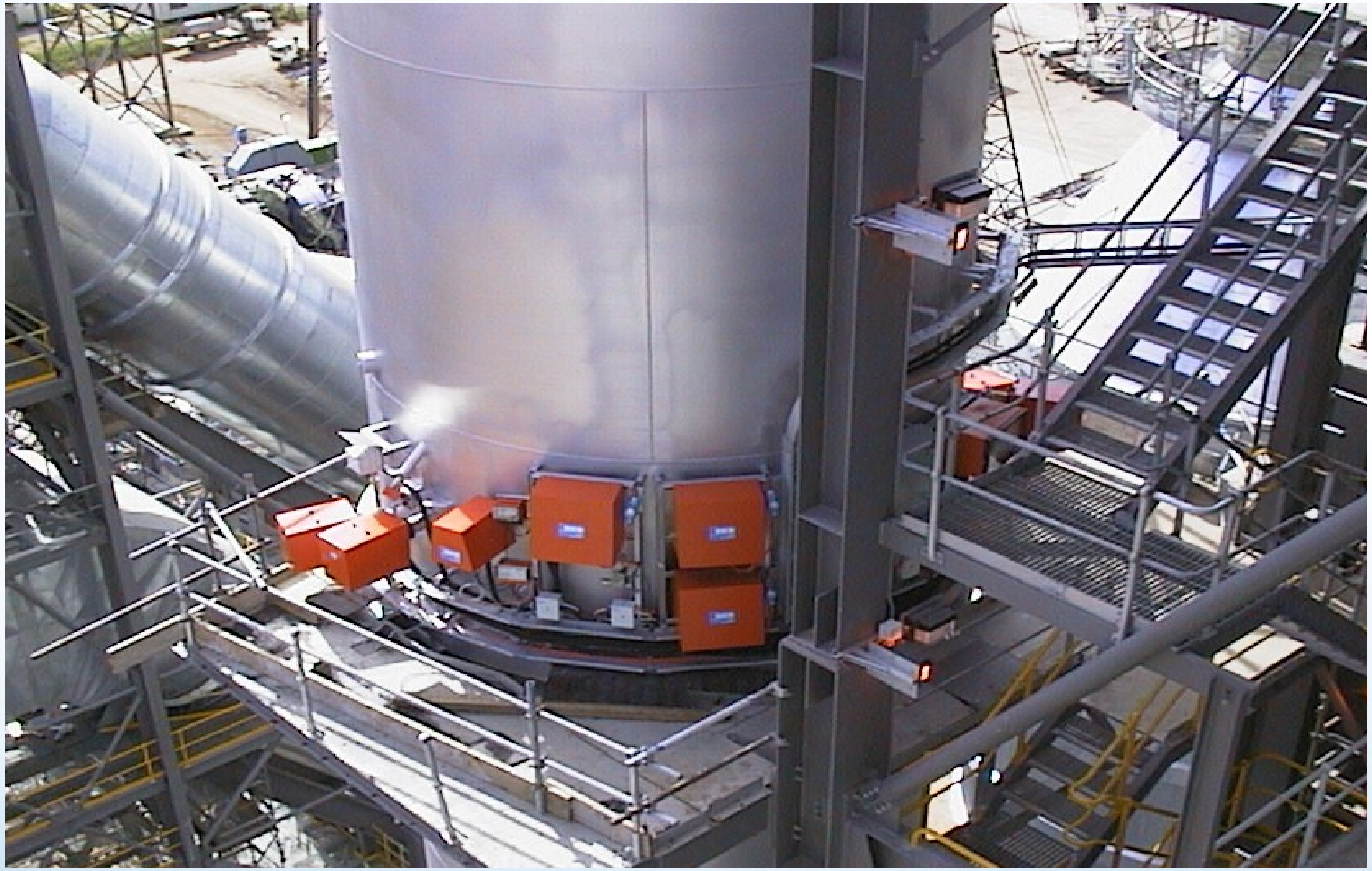
- **Probe version**


Sender/receiver unit
Mounting flange
Measuring probe (GMP shown)
Purge air unit

Solutions & Field Installations

CEMS – In-Situ

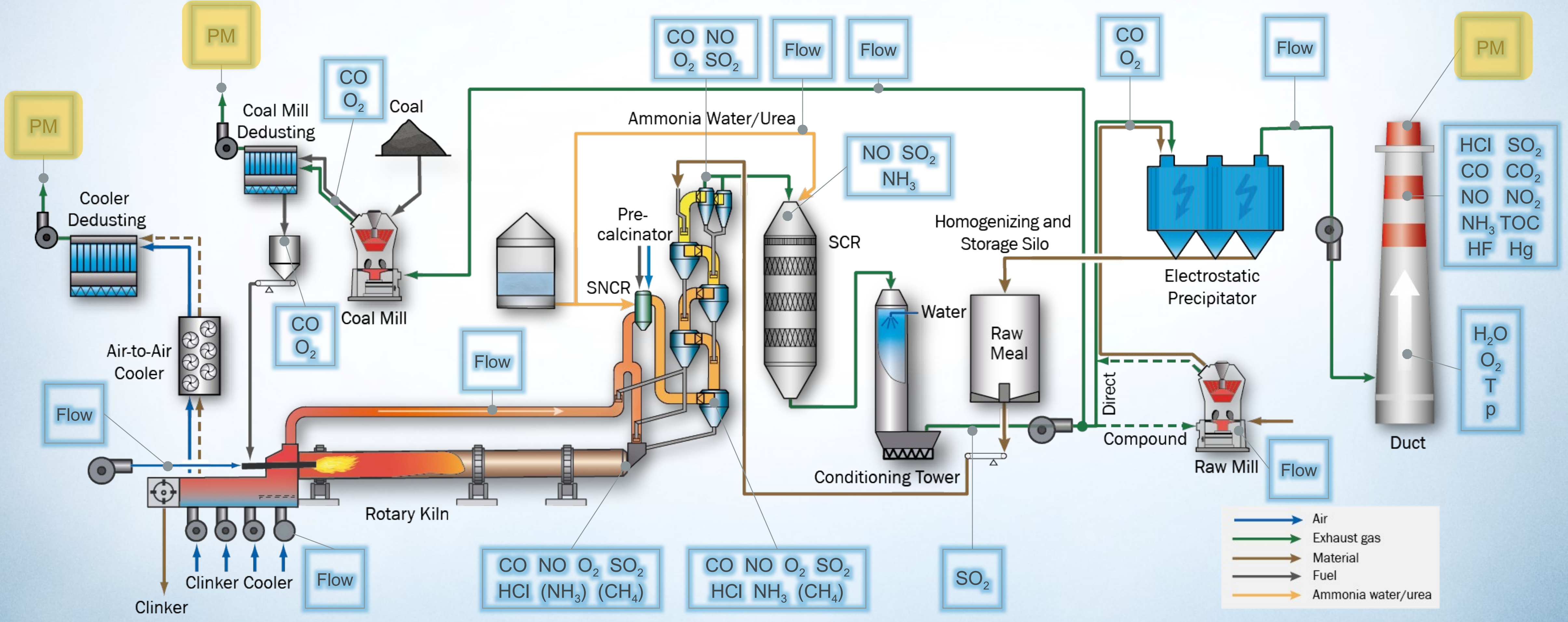
- **Cross duct & probe version**



Solutions & Field Installations

CEMS – Dust

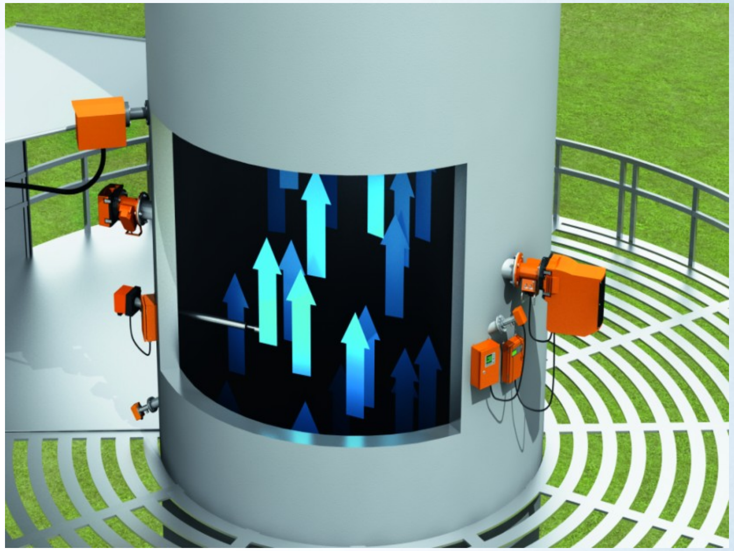
› Dust measurement – Emission Monitoring

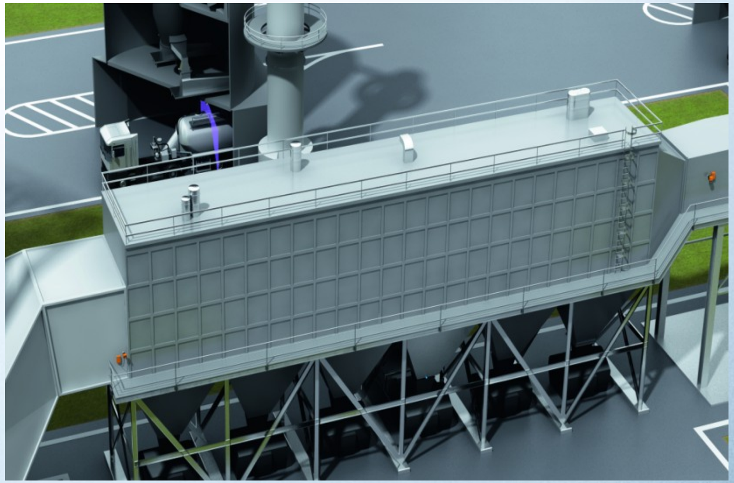

PM
PM
PM
CO O_2
Coal Mill Dedusting
Coal
Cooler Dedusting
CO NO O_2 SO_2
Flow
Flow
Ammonia Water/Urea
CO O_2
Flow
NO SO_2 NH_3
Pre-calcinator
SNCR
SCR
Homogenizing and Storage Silo
Electrostatic Precipitator
HCl SO_2 CO CO_2 NO NO_2 NH_3 TOC HF Hg
H_2O O_2 T p
Air-to-Air Cooler
CO O_2
Coal Mill
Flow
Water
Raw Meal
Direct
Compound
Raw Mill
Flow
Duct
Flow
Conditioning Tower
Rotary Kiln
Clinker Cooler
Clinker
Flow
CO NO O_2 SO_2 HCl (NH_3) (CH_4)
CO NO O_2 SO_2 HCl NH_3 (CH_4)
SO_2
Air
Exhaust gas
Material
Fuel
Ammonia water/urea

Solutions & Field Installations

CEMS – Dust

- **Continuous** dust measuring technologies
  - Transmission
  - Scattered light
- **Tribo-Electric**
- **Semi-continuous dust measuring technologies**
  - **Beta-Radiation**
- **Discontinuous** dust measuring technologies
  - Gravimetric measurement
- For CEMS according to local regulation
- Bag filter/electrostatic precipitator efficiency meas.

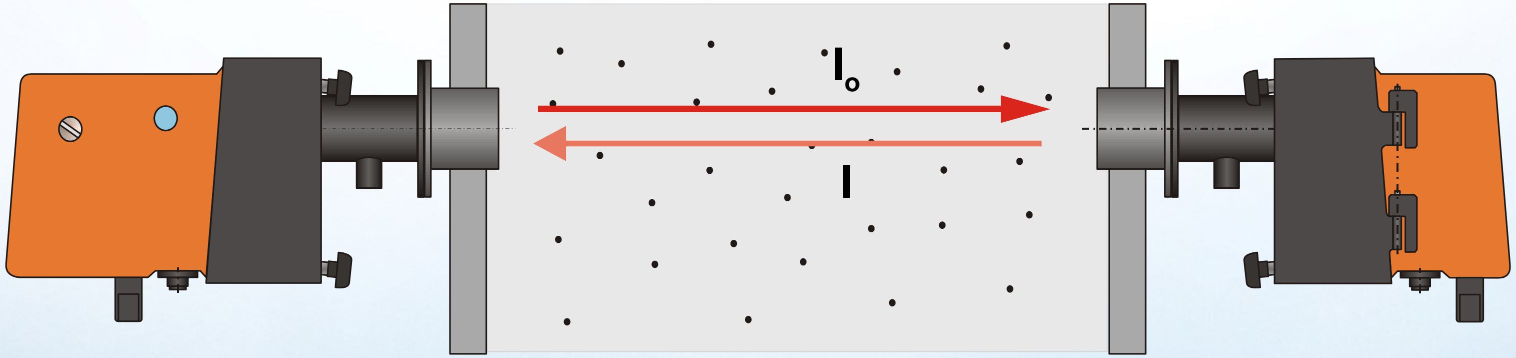




Solutions & Field Installations

CEMS – Dust

- **Transmission principle**
  - Measuring of the amount of light received as a fraction of the amount of light emitted in an optical cross stack monitoring.
  - Opacity is the %-age of light lost
  - Transmission is the %-age of light received
  - Calculation of the dust concentration (for high dust concentrations)
  - In-situ measurement



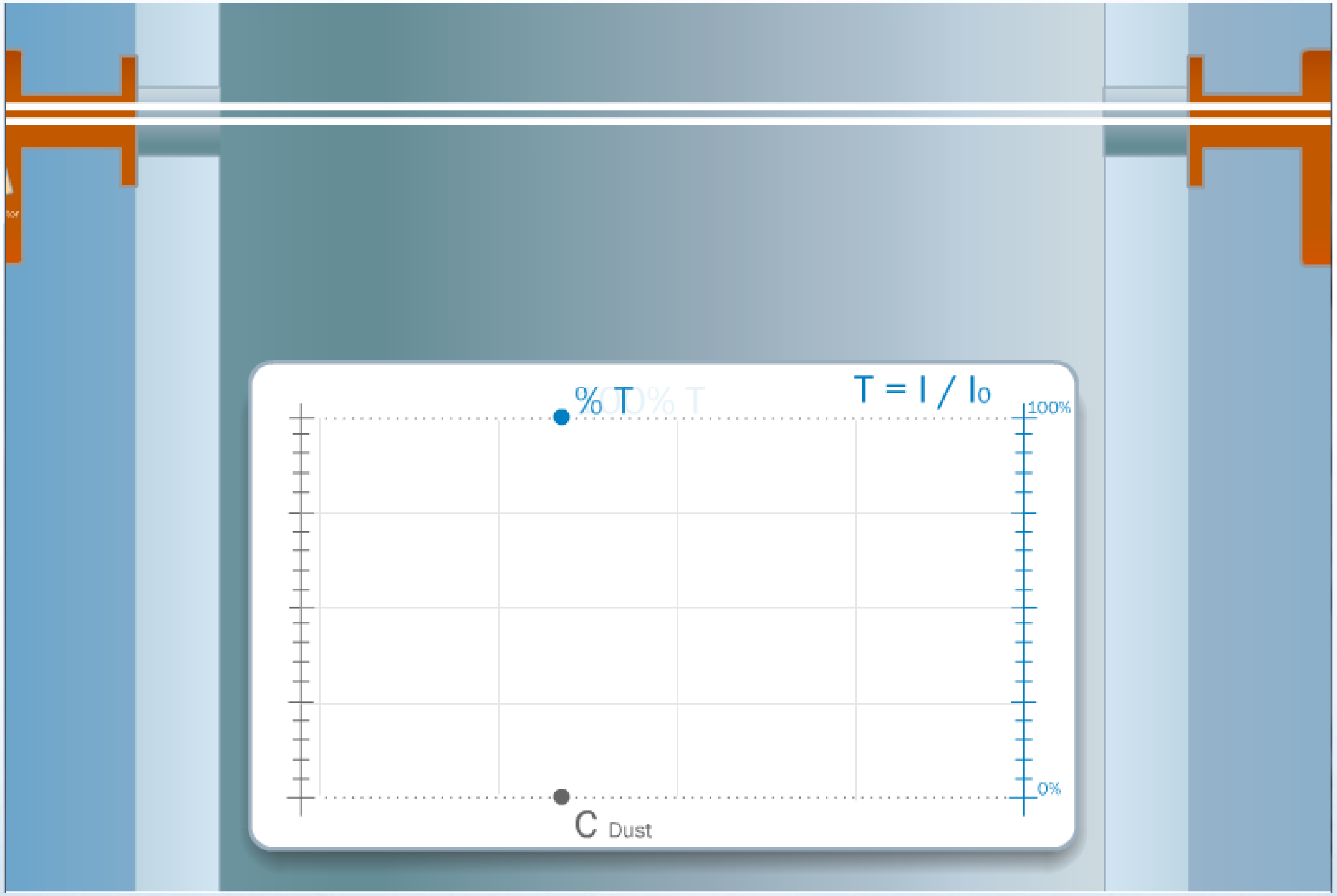
Sender/Receiver

Reflector

Solutions & Field Installations

CEMS – Dust

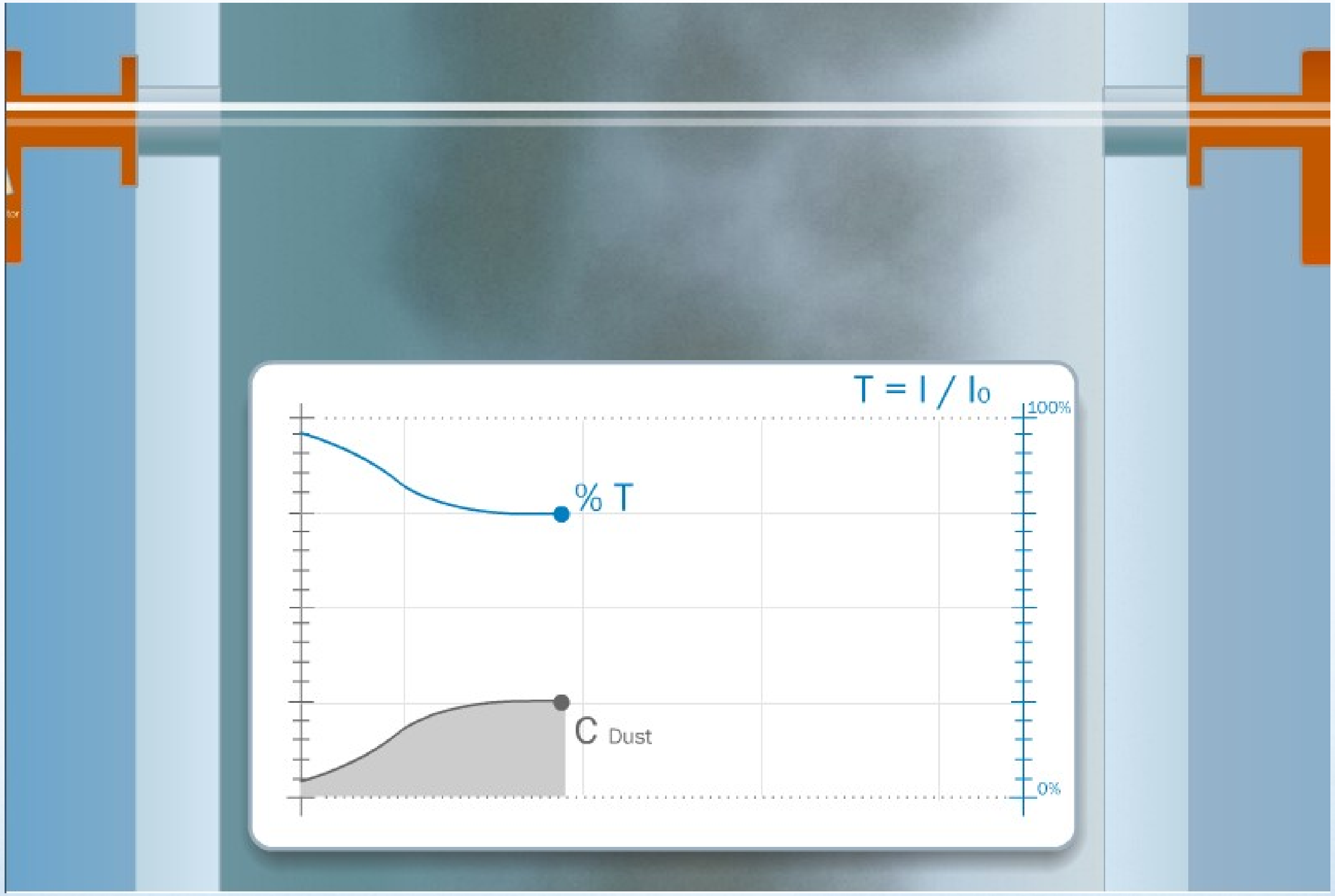
- **Transmission principle**



Solutions & Field Installations

CEMS – Dust

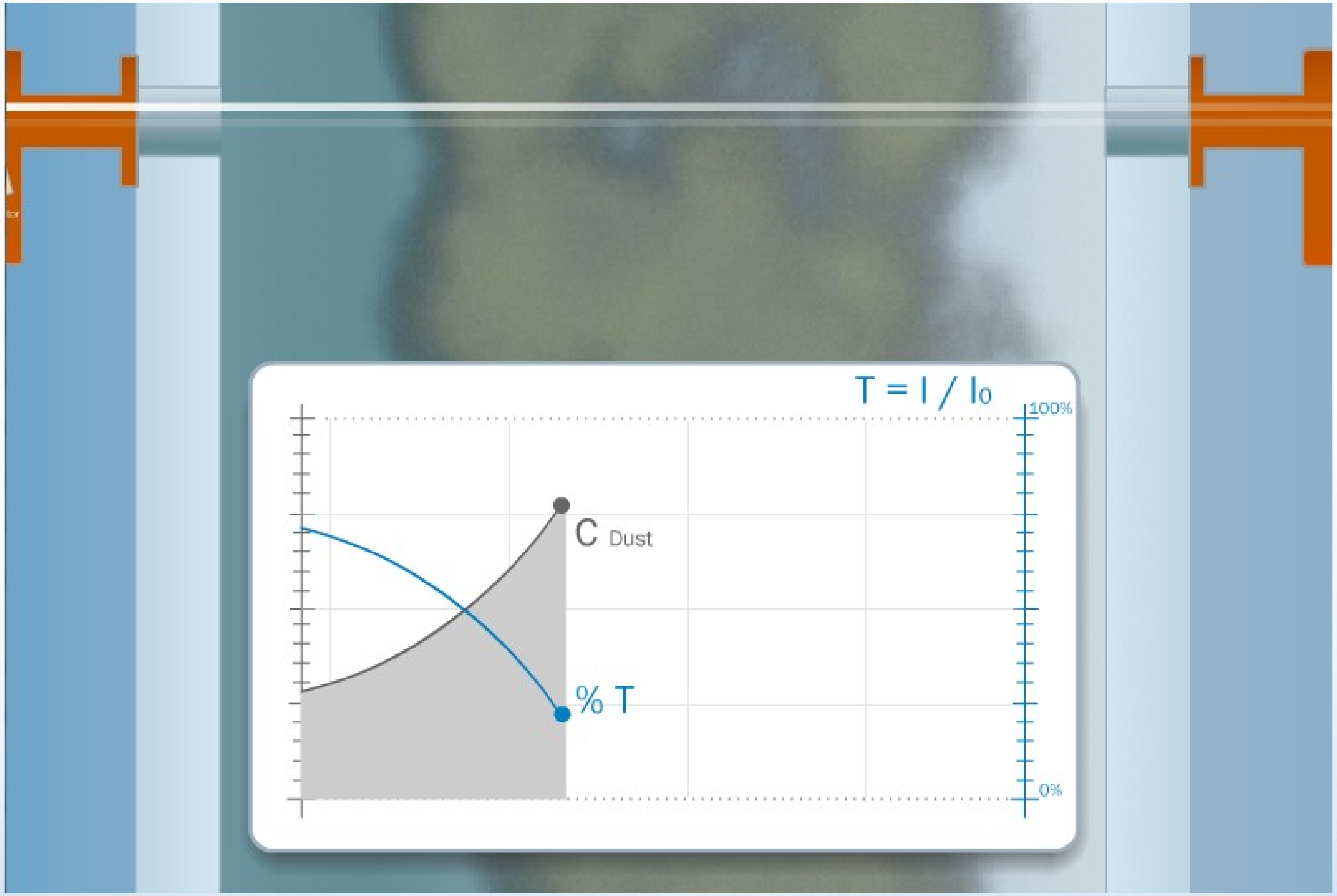
- **Transmission principle**



Solutions & Field Installations

CEMS – Dust

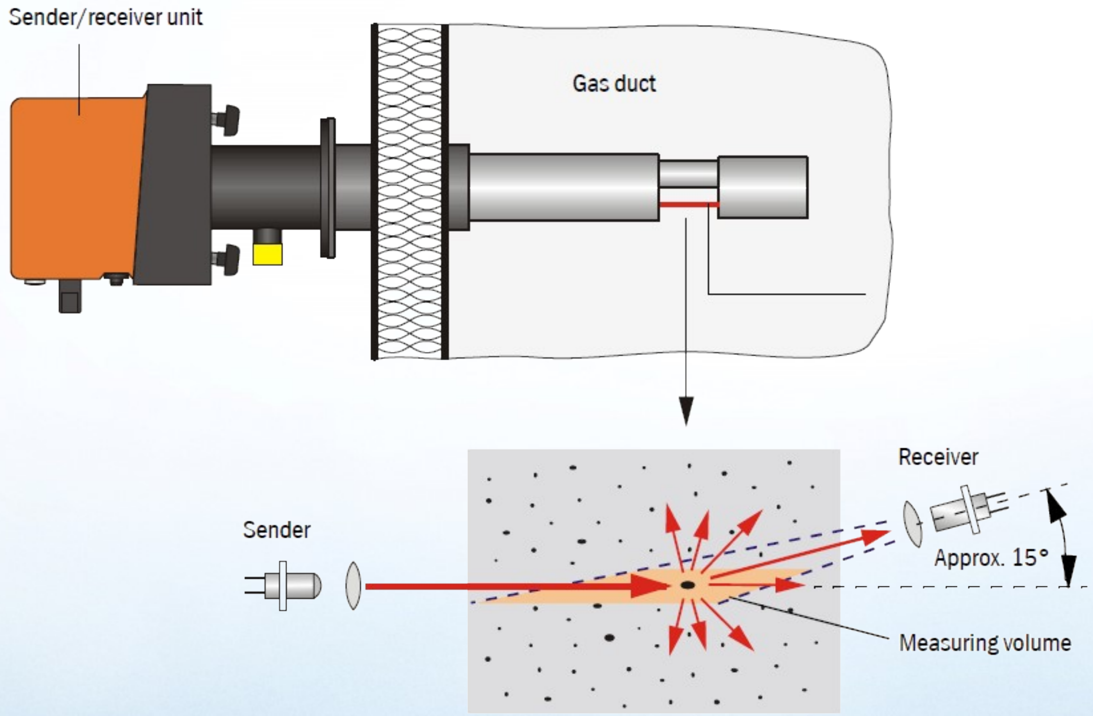
- **Transmission principle**



Solutions & Field Installations

CEMS – Dust

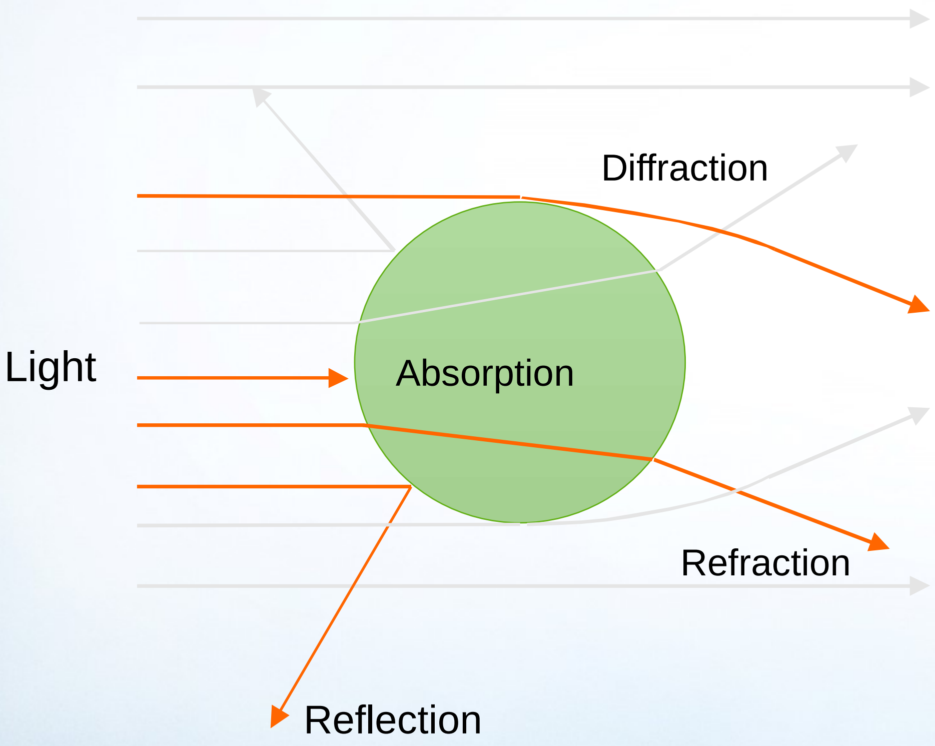
- **Scattered light (forward)**
  - Radiation of the dust loaded measuring volume with visible laser light (wavelength approx. 655 nm);
  - Receiver is on the transmitter side (for low to medium dust concentrations)

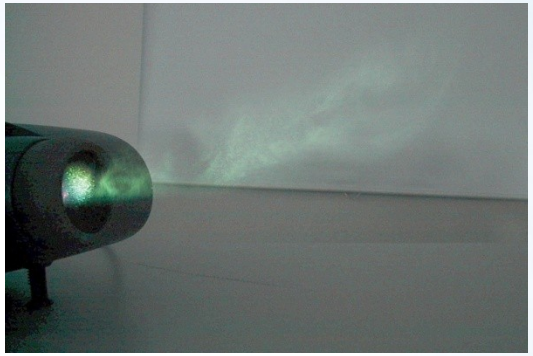

Sender/receiver unit
Gas duct
Sender
Receiver
Approx. 15°
Measuring volume

Solutions & Field Installations

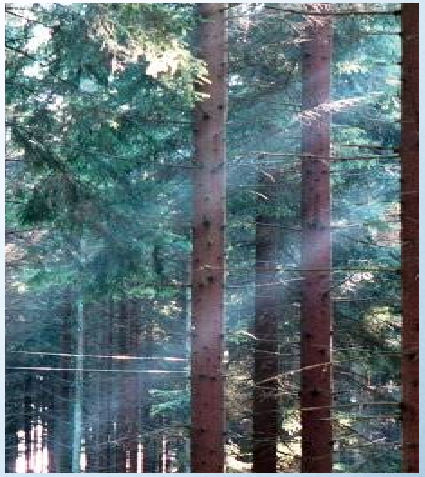
CEMS – Dust

› Scattered light (forward)


Diffraction
Light
Absorption
Refraction
Reflection



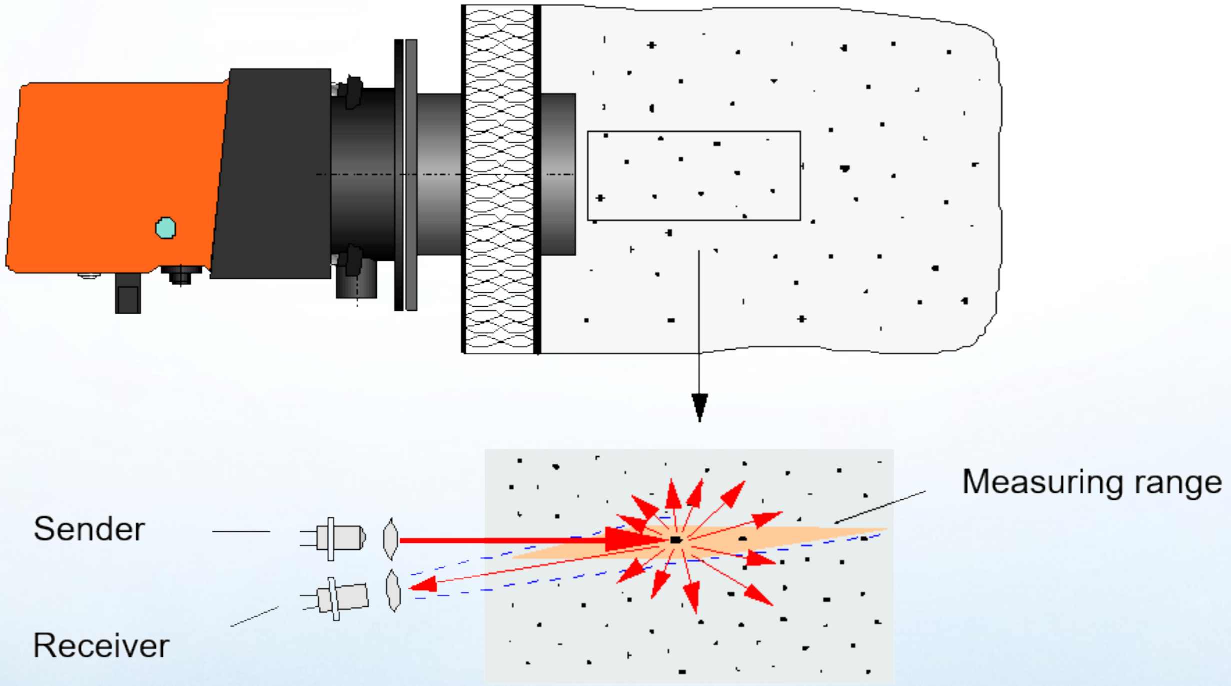
Everyday situations



Solutions & Field Installations

CEMS – Dust

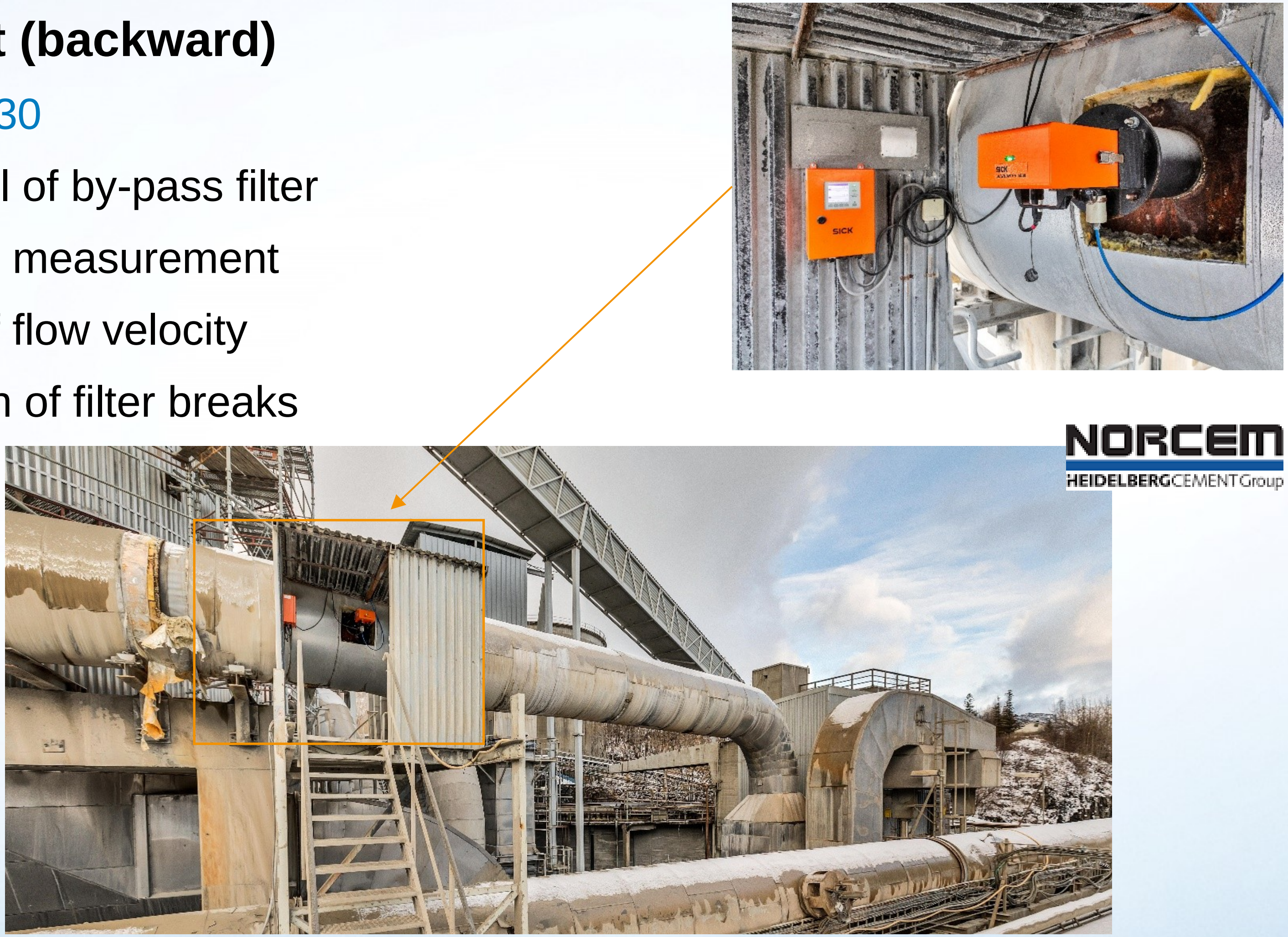
- **Scattered light (backward)**
  - Radiation of the dust loaded measuring volume with visible laser light (wavelength approx. 655 nm);
  - Sender/Receiver unit (for low to medium dust concentrations)



Solutions & Field Installations

CEMS – Dust

- **Scattered light (backward)**
  - Dusthunter SB30
  - Process control of by-pass filter
  - Continous dust measurement
  - Independent of flow velocity
  - Rapid detection of filter breaks

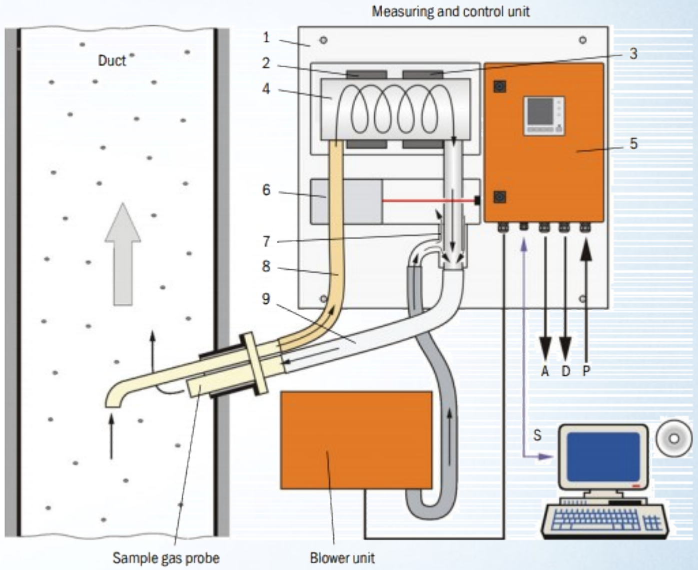


NORCEM
HEIDELBERGCEMENT Group

Solutions & Field Installations

CEMS – Dust

- **Scattered light (wet dust)**
  - Measuring dust emissions downstream of flue-gas desulfurization plants and wet purifiers
  - Monitoring dust concentrations in the wet exhaust gas of industrial processes
  - Gas is extracted via a gas sampling probe and heated above the dew point.
  - Droplets in the gas are vaporized, making it impossible for them to falsify the measurement results
  - Very low maintenance since no moving parts come into contact with the aggressive gas
  - For very low to medium dust concentrations
  - Gas sampling and return combined in one probe



1	Base plate
2	Heating band 1
3	Heating band 2
4	Thermo cyclone
5	Control unit
6	Measuring sensor with measuring cell
7	Ejector
8	Extraction line
9	Return line
S	SOPAS ET operating software
P	Power supply 115 / 230 V AC
A	Output signal 0 ... 20 mA
D	Status signals

Solutions & Field Installations

CEMS – Dust

- **Scattered light (wet dust)**
  - SICK FWE200DH + Seawater FGD
  - Fully comply with regulations (CEMS)
  - Customized probe geometry
  - “We haven't had a single problem since we installed it” NORCEM HEIDELBERGCEMENT Group

Solutions & Field Installations

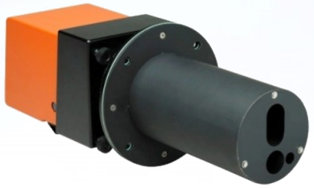
CEMS – Dust

DUSTHUNTER SP

Scattered light forward
(probe)

DUSTHUNTER SB

Scattered light backward



DUSTHUNTER SF

Scattered light forward
(cross-stack)

EN 15267-3

GOST

mCERTS

DUSTHUNTER T

Transmission

DUSTHUNTER C

Transmission +
scattered light forward

FWE200 DH

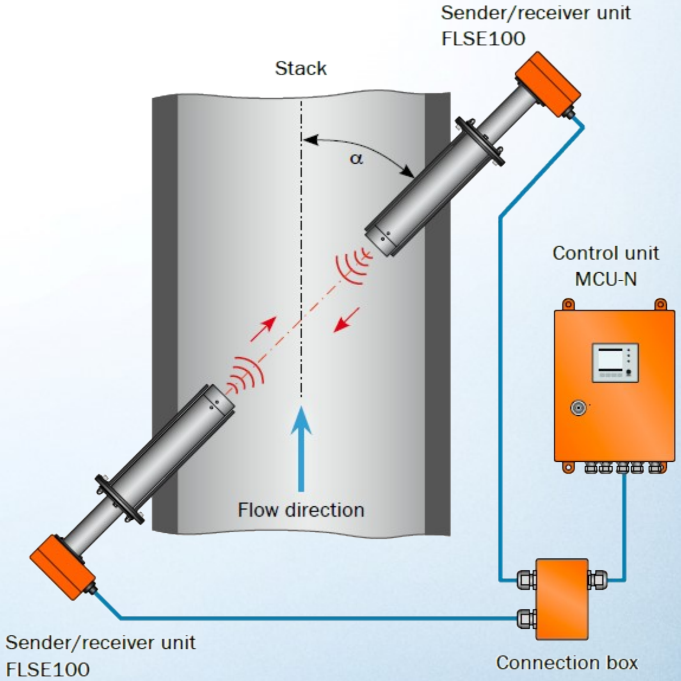
Scattered light forward (extractive)

Solutions & Field Installations

CEMS – Gas Flow

- **FLOWSIC100 – Gas Flow Meter**
  - **Ultrasonic** transit time difference measurement (transducer technology)
  - Medium & high power versions available
  - "H" suitable for stacks with **large diameters**
  - "M" suited for stacks with **medium diameter**
  - Internal cooling and air purging available
  - Durable **titanium converters** for long service life
  - Automatic **operational check** with zero and reference point test
  - Accurate measuring results under difficult measuring conditions
  - Measurement **without pressure loss**, therefore no influences on the process

i. .

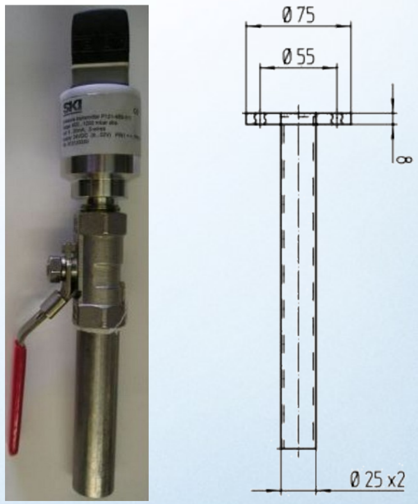

Sender/receiver unit
FLSE100
Stack
α
Control unit
MCU-N
Flow direction
Sender/receiver unit
FLSE100
Connection box

Solutions & Field Installations

CEMS – Temperature & Pressure

- **Pressure measurement**
  - Resistance thermometer PT100
  - Temperature range: 0-600 °C
  - Transmitter with isolated output: 0/4 - 20mA or 0 - 10 V
  - LCD display
  - Blank flange (ST37) for easy installation
- **Temperature measurement**
  - Absolut pressure transducer
  - measuring range: 800 - 1200 mbar abs.
  - output signal: 4-20 mA
  - Stainless steel
  - Blank flange & adapter for easy installation

JUMO
dTRANS T02 LCD
26.79
°C
P
S
Cal

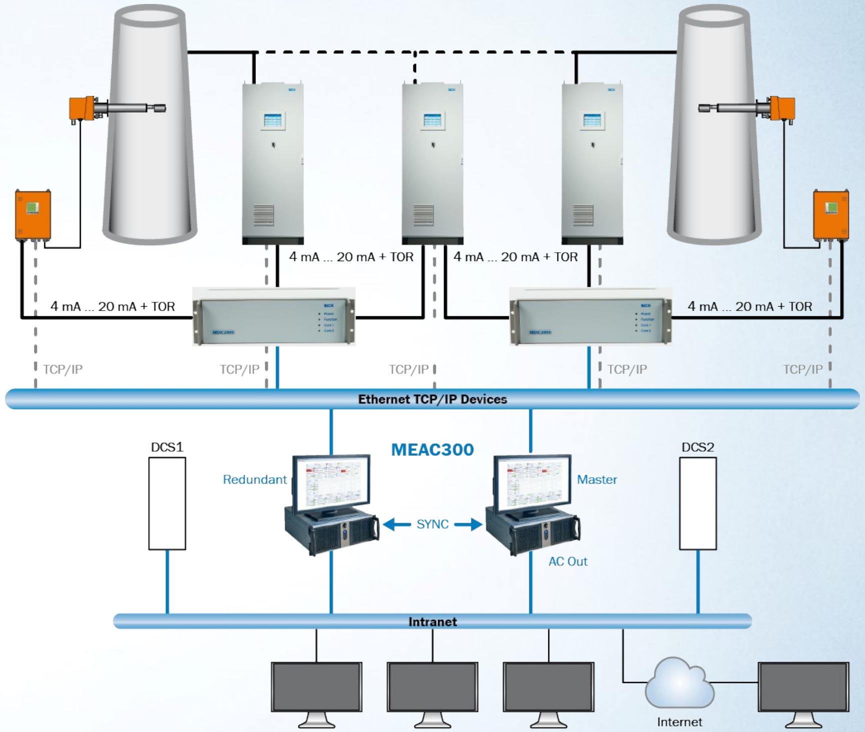


Solutions & Field Installations

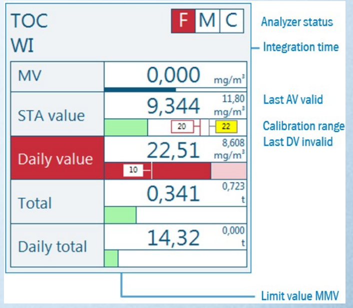
CEMS – Data Aquisition

MEAC300

- **Emission PC**
- Acquisition, evaluation, storage, visualization & transfer of emission data for modern **emission data management**
- Analog and digital **data collection** saved at 5 s/1 min intervals with **auto-backup**
- Distributed **visualization**, operation in the network and automatic e-mail alarms
- Flexible **data presentation** also in process images
- Time savings through **simulation mode** for installation and functions checks
- Parallel calculation of **greenhouse gas emissions** in the same system
- **Reporting tool**


4 mA ... 20 mA + TOR
4 mA ... 20 mA + TOR
4 mA ... 20 mA + TOR
4 mA ... 20 mA + TOR
TCP/IP
TCP/IP
TCP/IP
TCP/IP
TCP/IP
Ethernet TCP/IP Devices
DCS1
MEAC300
DCS2
Redundant
Master
SYNC
AC Out
Intranet
Internet

MEAC300
Messwertrechner
SICK


TOC
WI
F M C

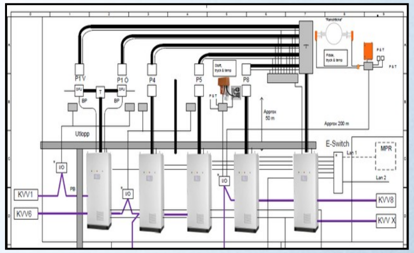
MV	0,000	mg/m³
STA value	9,344	11,80 mg/m³
Daily value	22,51	8,608 mg/m³
Total	0,341	0,723 t
Daily total	14,32	0,000 t

20
22
10
Analyzer status
Integration time
Last AV valid
Calibration range
Last DV invalid
Limit value MMV

Solutions & Field Installations

CEMS – Shelters & Systems

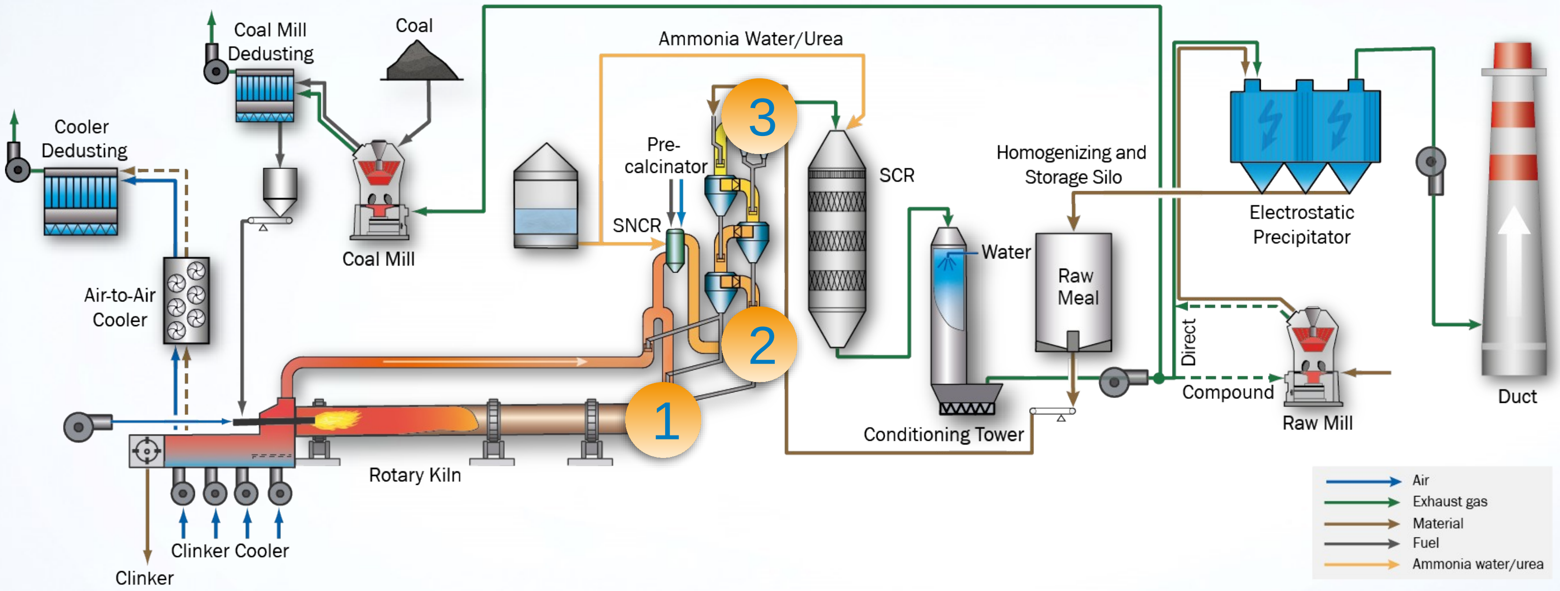
- **Shelters & Systems**
  - Heating/Cooling/Ventilation (redundant on req.)
  - Standard shelter, 10 to 40 feet
  - Insulation and high-quality paint (C5)
  - Fire alarm and fire extinguishers available
  - CSC certificate for standard dimensions
  - Suitable for ATEX zones
  - Earthquake-safe and fireproof types available (F30, F60)
  - Special constructions



Solutions & Field Installations

Combustion Control (pyro process)

› Process Gas Analysis


Coal Mill
Dedusting
Coal
Ammonia Water/Urea
Cooler
Dedusting
Pre-
calcinator
3
SCR
Homogenizing and
Storage Silo
Electrostatic
Precipitator
SNCR
Coal Mill
Water
Raw
Meal
Air-to-Air
Cooler
2
Direct
Compound
Raw Mill
Duct
1
Conditioning Tower
Rotary Kiln
Clinker Cooler
Clinker
Air
Exhaust gas
Material
Fuel
Ammonia water/urea

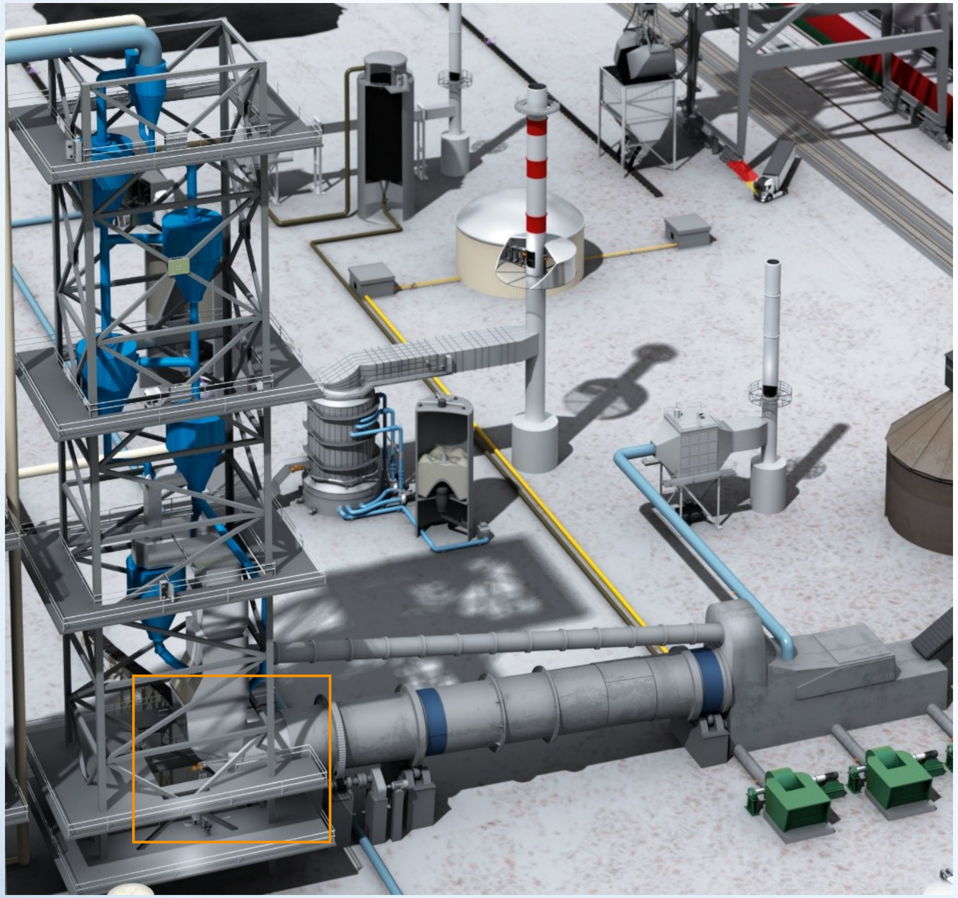
– Measurement at:

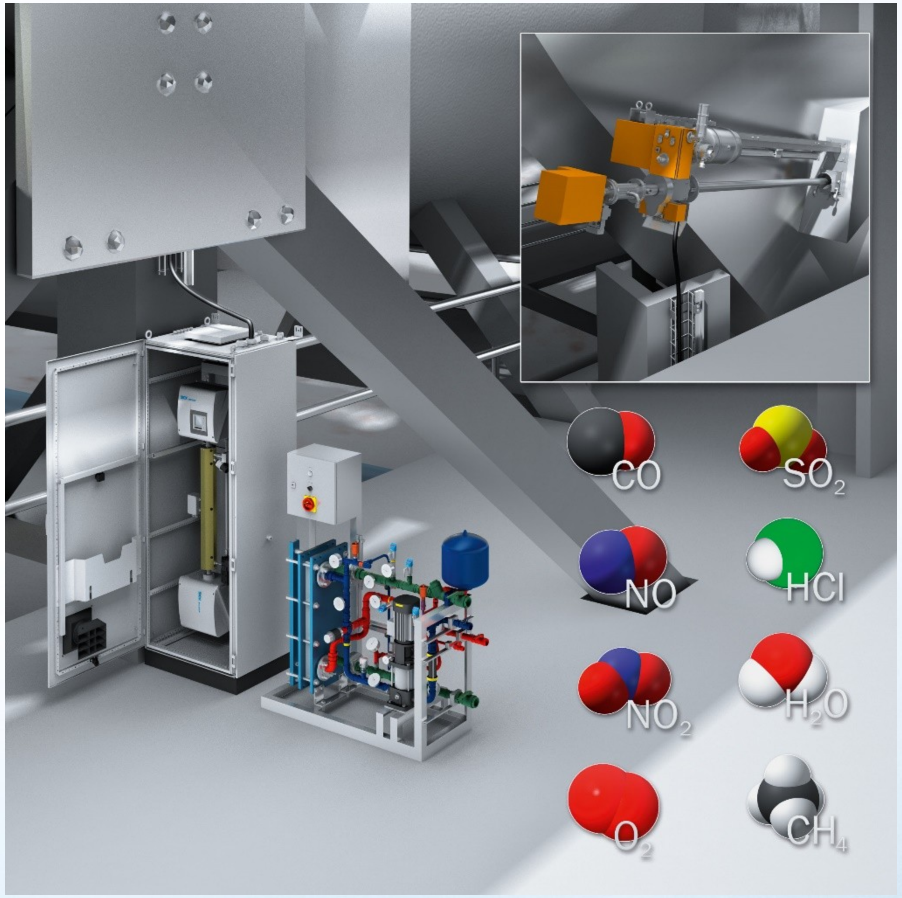
- Kiln Inlet / Kiln Back End ① (e.g. CO, O_2, NO, NO_2, SO_2, HCl, CH_4, H_2O)
- Calciner outlet ② (e.g. CO, O_2, NO, NO_2, SO_2, NH_3, HCl, CH_4, H_2O)
- Preheater outlet ③ (e.g. CO, O_2, NO, NO_2, SO_2, CH_4)

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› Process Gas Analysis – Kiln Inlet




CO
SO_2
NO
HCl
NO_2
H_2O
O_2
CH_4

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

Typical Requested Measurement Ranges

CO	0 … 3 Vol.%	
NO	0 … 3000 ppm	
O2	0 … 21 Vol.%	
SO_2	0 … 1 Vol.%	
HCl	0 … 5000 ppm	(if waste fuels are used)
CH_4	0 … 5 Vol.%	(if natural gas is used)
NH_3	0 … ?	(for special raw materials)
CO_2	0 … 25 Vol.%	(due to CS correction)
H_2O	0 … 30 Vol.%	(due to CS correction)

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

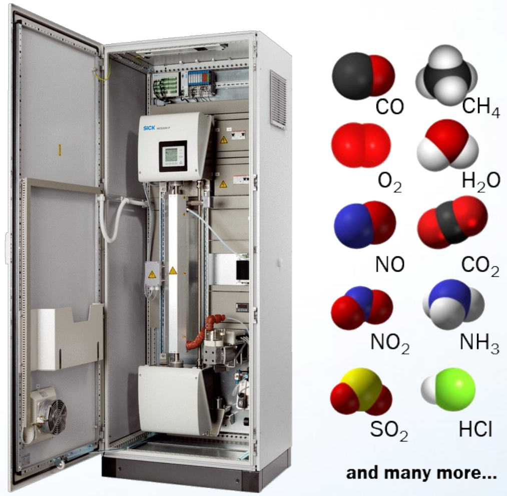
› Process Gas Analysis – Kiln Inlet

Gas extraction probe + auxiliary equipment

Hot/Wet

Gas Analyzer

+



and many more...

SICK SCP3000

SICK MCS300P

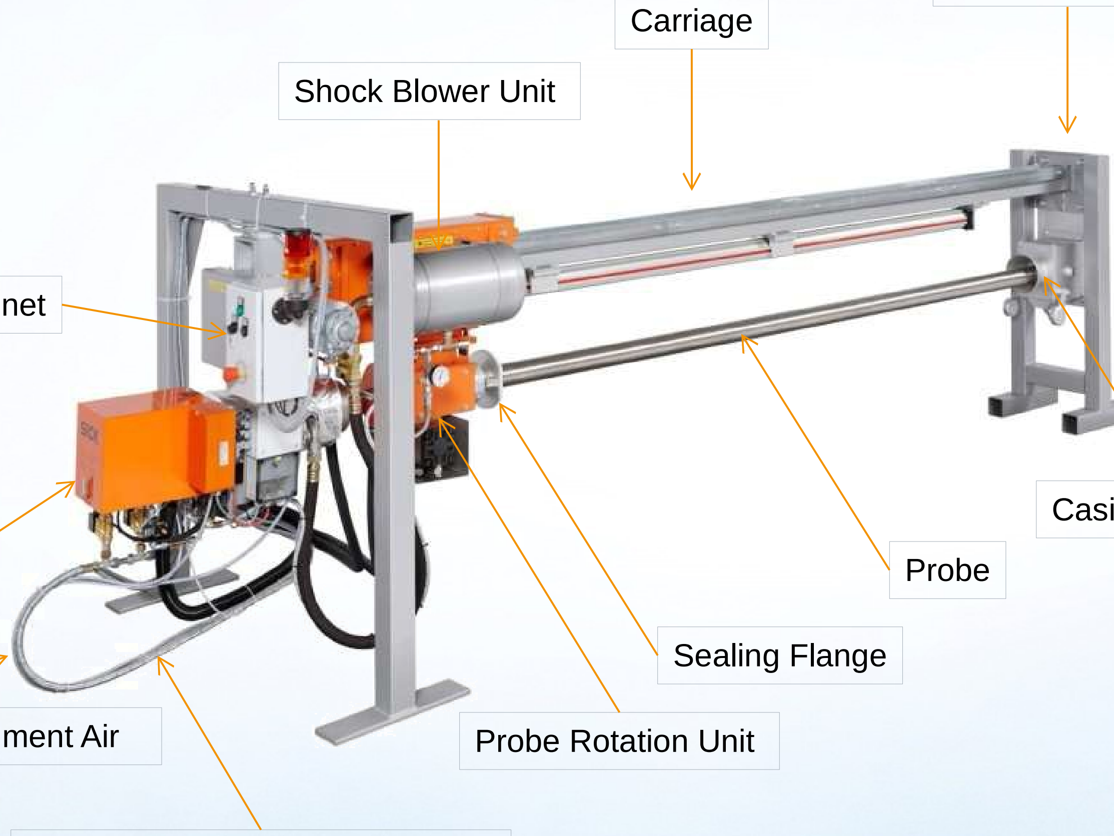
SICK Cement Probe System 3300

SCPS 3300

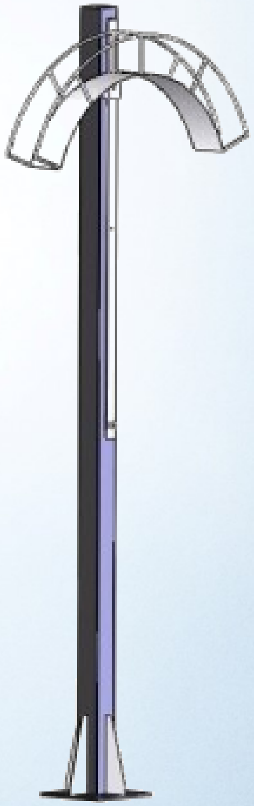
Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› **SCP3000** – Gas extraction probe


Mounting Flange
Carriage
Shock Blower Unit
Local Control Cabinet
Casing with Flap
Filter Unit
Probe
Sealing Flange
Connection Hose for Instrument Air
Probe Rotation Unit
Connection Hose for Pneumatics

Compressed Air
Supply Unit



Bracket for Pipe Clamps
& Exhaust Valve

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› **SCP3000** – Gas extraction probe

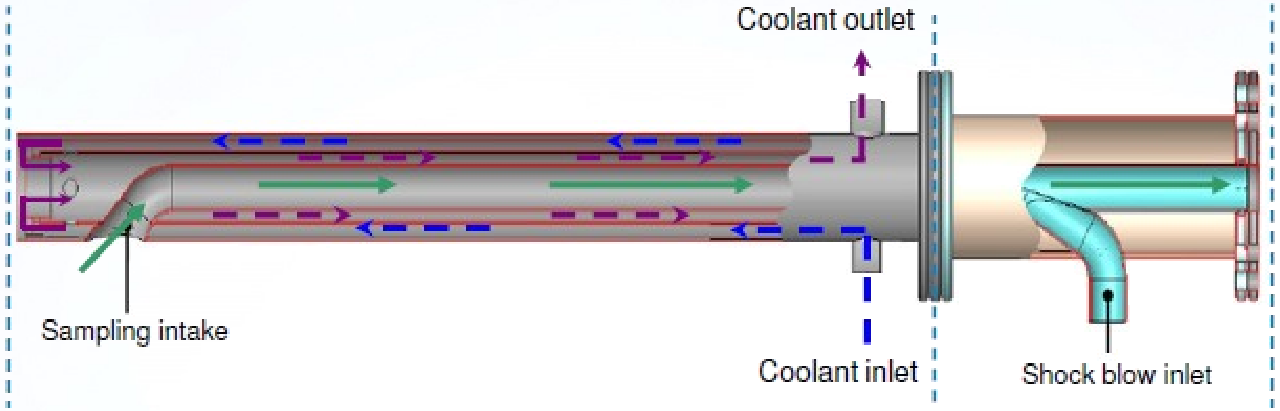
- System design
  - Highly corrosive-resistant probe material (1.4841)
  - 2500/3000/3500/4000mm probe length available
  - 2 µm metal mash filter (heated with regulation)
  - Heated shut-off valves for sample line and back flushing
  - No thermal bridges and no mechanical movements
  - Retraction and Rotation unit to prevent backing of deposits

→ Prevent corrosion, condensation & blocking

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› **SCP3000** – Gas extraction probe



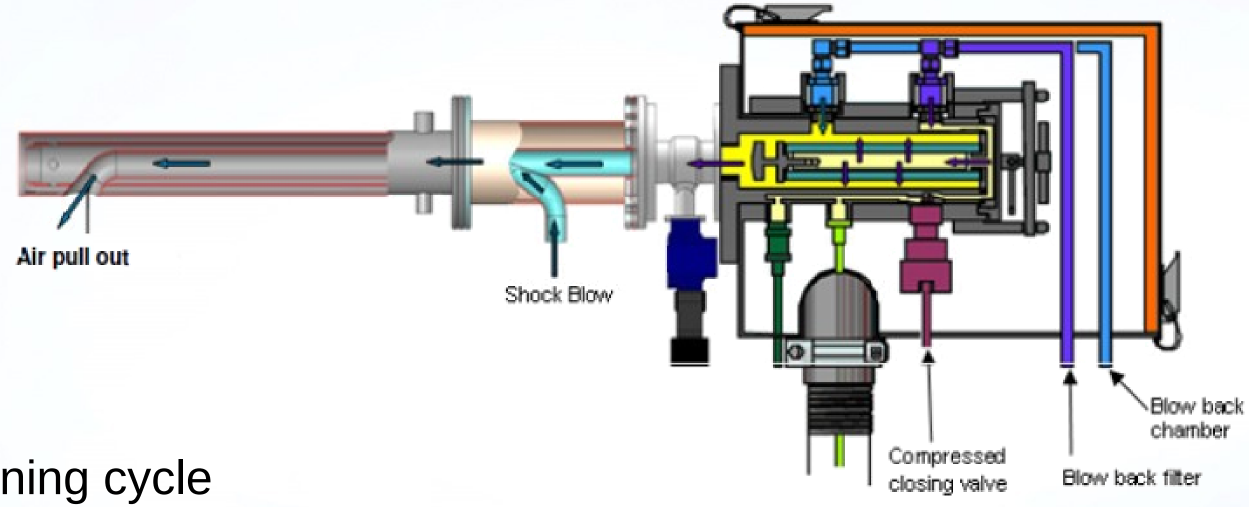
Coolant outlet
Sampling intake
Coolant inlet
Shock blow inlet

- Optimized probe geometry
  - sampling intake open to the bottom → Limited dust entrance
  - Flow optimized & reinforced sampling intake → Limited attack surface against abrasion & caking
  - Large collection volume → Not effected by thermal stress & blockages
  - Coolant flow to the tip along probe’s external & back flow along probe’s internal diameter → Prevent condensation effects

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› **SCP3000** – Gas extraction probe


Air pull out
Shock Blow
Compressed closing valve
Blow back chamber
Blow back filter

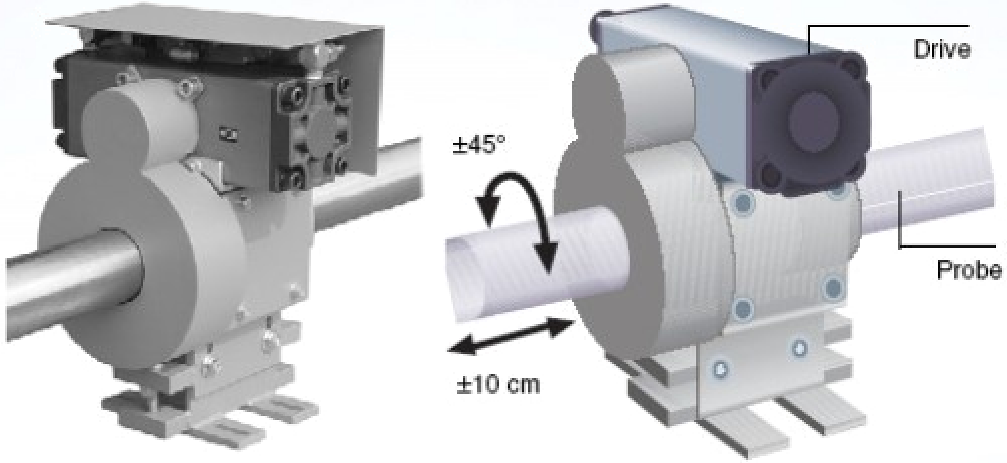
- Effective probe cleaning cycle
  - Probe back purge (high pressure shock blow)
  - Filter blow back
  - Filter chamber blow back
  - Filter, filter chamber & probe blow back

→ Prevention of blockages / high availability

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› **SCP3000** – Gas extraction probe



- Rotation module
  - Double probe movement: backward/forward 10cm and rotation 45° (and reverse)
  - Pneumatic piston drive
  - Heavy duty piston, bearings & valves

→ Prevent caking of dust on the probe & flange

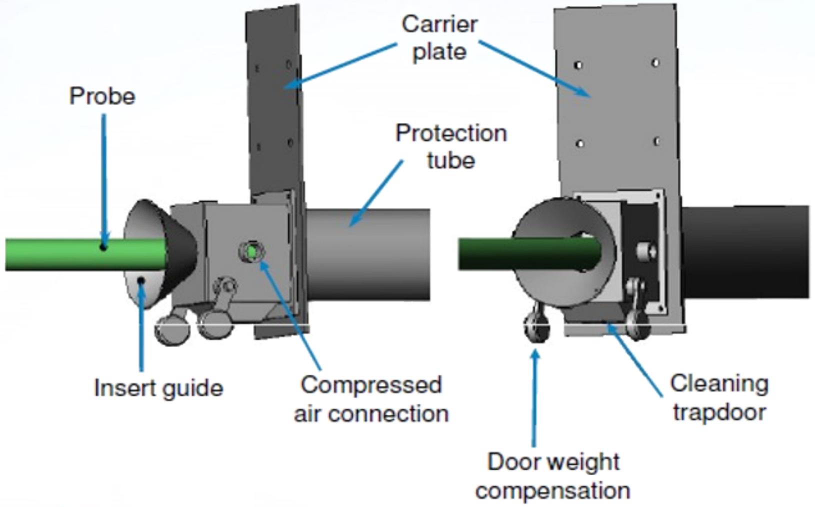
→ High availability

→ Full day operation / probe does not leave kiln

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› SCP3000 – Gas extraction probe


Carrier plate
Probe
Protection tube
Insert guide
Compressed air connection
Cleaning trapdoor
Door weight compensation

- Sealing box
  - Designed to protect external area from row material flow out from the kiln
  - Mechanical solution for a higher reliability in harsh conditions
  - Possibility to connect instrument air for protection tube cleaning
  - Directly fixed on the flange for an easy installation

→ high availability

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

SCP3000 – Water/water cooler

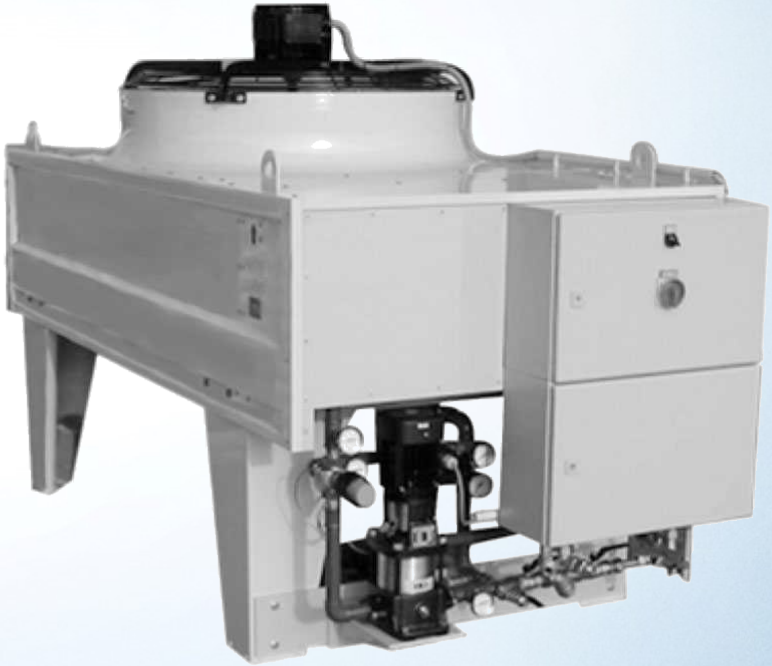
- The principle is a plate and frame heat exchanger
- Water flow consumption: 3m³/h with max. 30°C
- Cooling capacity: 70 kW with cooling delta of 40°C
- Temperature + Pressure + Flow are always under control for primary and secondary circuit.
- Mixture valve manage the liquid regulation autonomous
- Dimensions L x W x H: 1200 x 1600 x 600 mm

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

SCP3000 – Air/water cooler

- The principle is a plate and frame heat exchanger
- Heat exchanger surface 174 m²
- Cooling capacity: 72 kW at 40°C ambient temperature and 60°C coolant temperature
- Air flow16,7 m³/h, 0,86 kW, 420 rpm, 75 db.
- Dimensions (L x W x H) 2300 x 1170 x 1480 mm



Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

SICK
Sensor Intelligence.

› **SCP3000** – Air/water cooler

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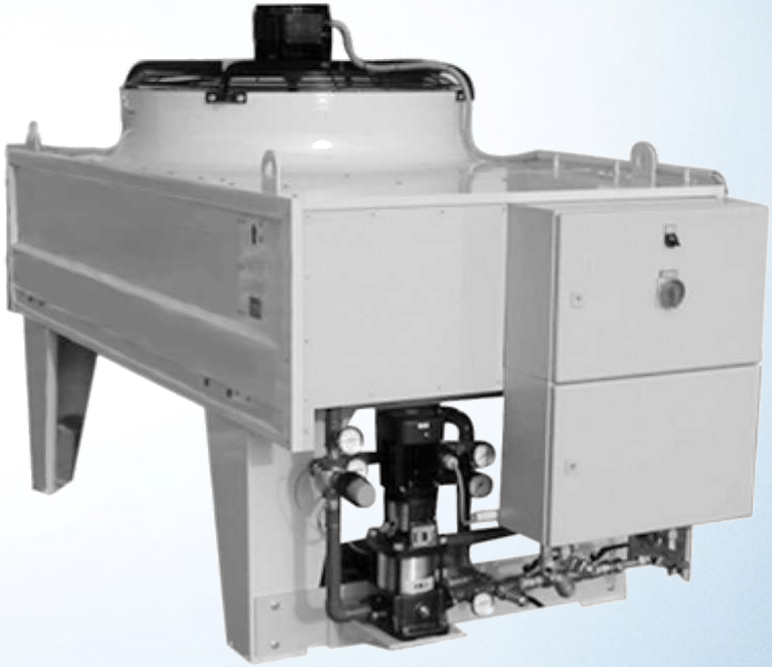


Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

- **SCP3000 – PLC**
  - Control Unit
    - Touch screen panel in standard :
    - easy interface with the system
    - easy to use
  - Standard Plc
    - Siemens S7-300
    - ALLEN – BRADLEY MicroLogix 1400

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

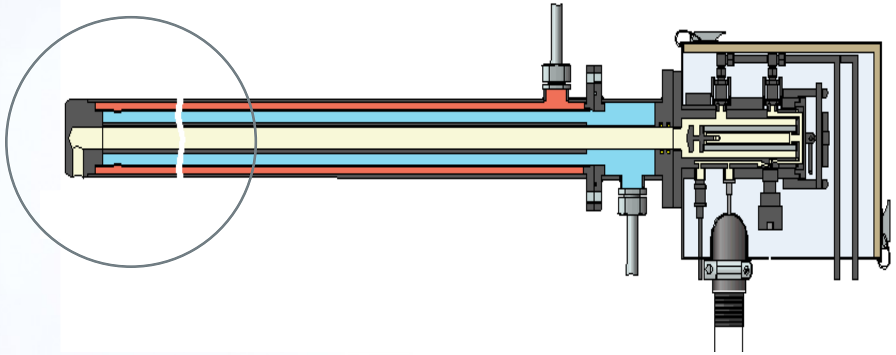
- **SCP3000 – PLC**
  - Local operating panel
    - Control of the probe (forward, backward)
    - Manual starting of a back flushing cycle
    - Emergency control of the probe to prevent from damages
  - Signal lamps:
    - Red flashlight signal → Failure
    - Orange light → System ready
    - Orange light blinking → Probe in movement
    - White light → Normal operation in automatic mode

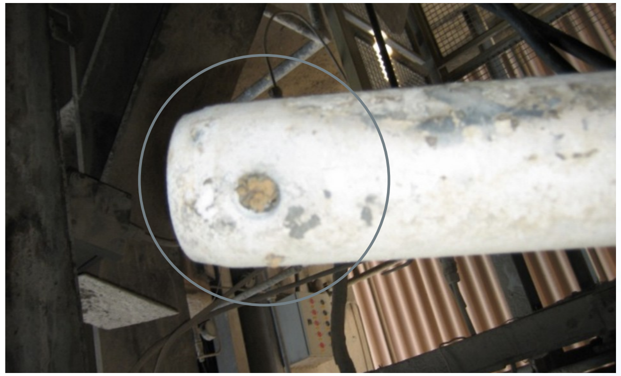
vor Ort
Freigabe
Sonde
zurück/vor
Blasen
manuell
NOT
AUS

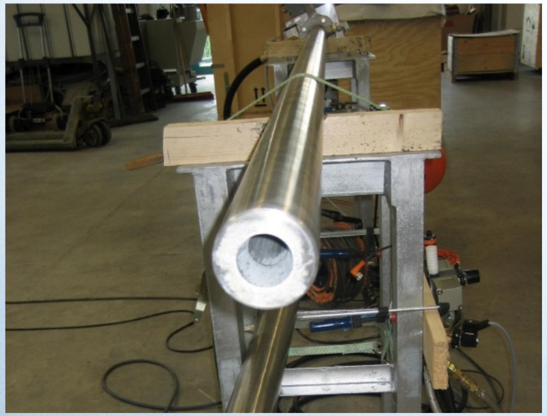
Solutions & Field Installations

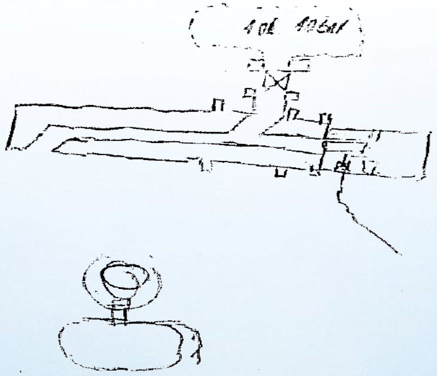
Combustion Control (pyro process) – Kiln Inlet

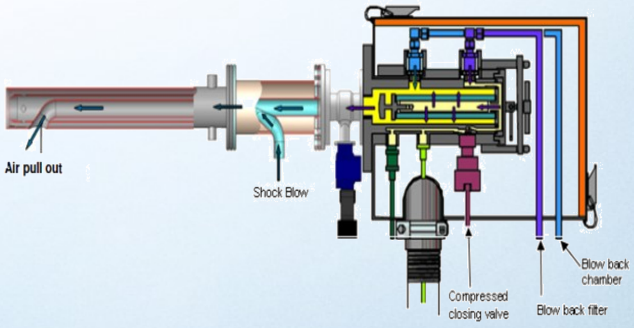
- **SCP3000** – **What we have learned from "dirty" fuels / our development process**
  - E.g. use of petcoke & alternative fuels










Air pull out
Shock Blow
Blow back chamber
Compressed closing valve
Blow back filter

Solutions & Field Installations

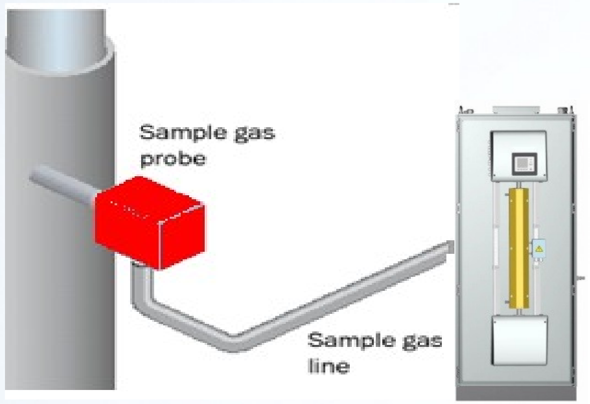
Combustion Control (pyro process) – Kiln Inlet

- **SCP3000 – What we have learned from “dirty” fuels / our development process**
  - E.g. use of petcoke & alternative fuels

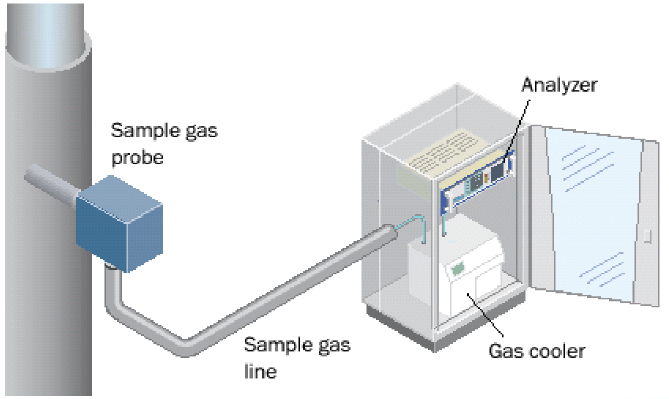
Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› SICK Gas Analyzers – Best choice for alternative fuel combustion


Sample gas probe
Sample gas line

Extractive Technology Hot Wet


Analyzer
Sample gas probe
Sample gas line
Gas cooler

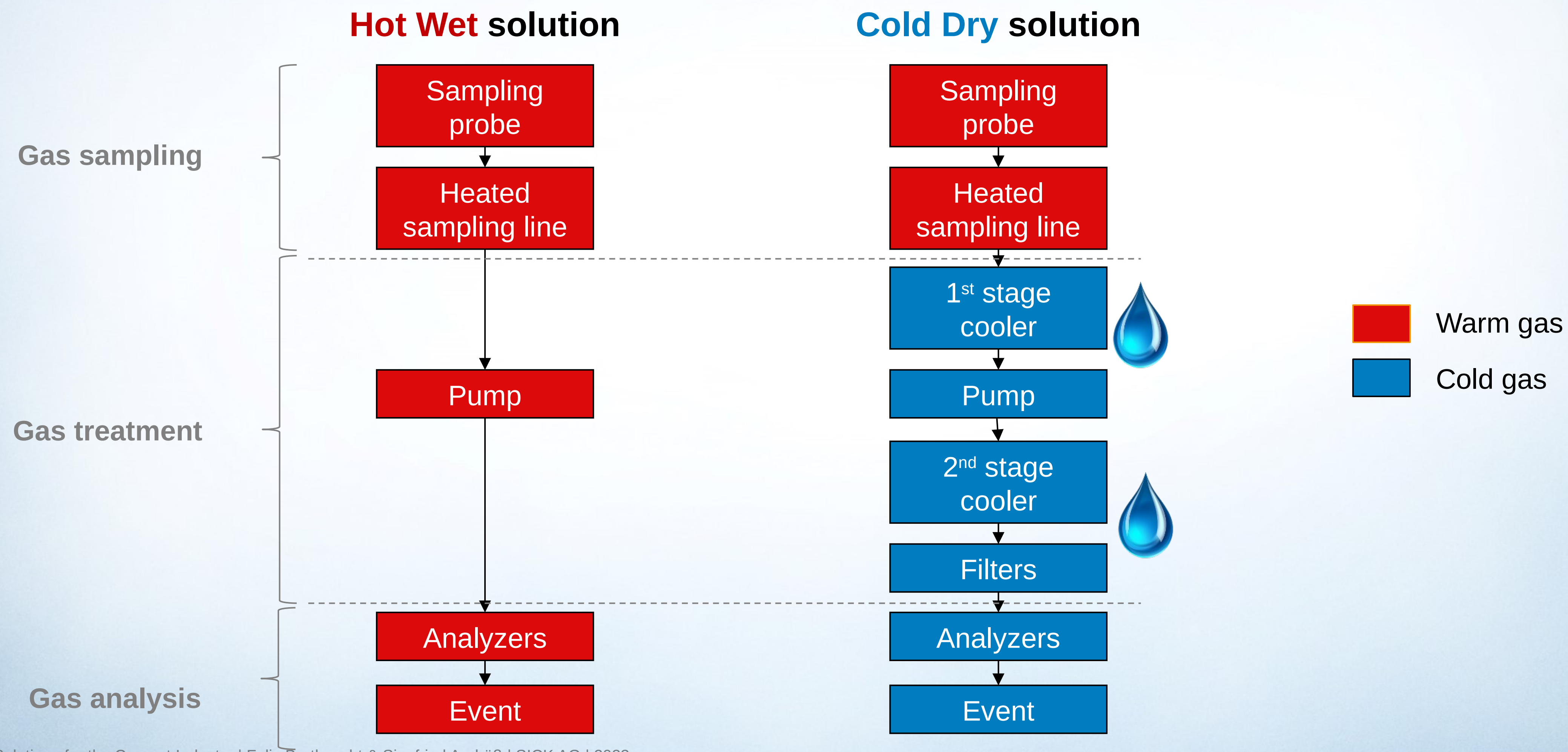
Extractive Technology Cold Dry

- Both technologies are offered by Sick
- Technology depending on main fuel & gas components
- For alternative fuel usage SICK recommends the Extractive Hot Wet technology

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› SICK Gas Analyzers – Best choice for alternative fuel combustion



Hot Wet solution

Cold Dry solution

Gas sampling

Gas treatment

Gas analysis

Hot Wet solution: Sampling probe → Heated sampling line → Pump → Analyzers → Event

Cold Dry solution: Sampling probe → Heated sampling line → 1^{st} stage cooler → Pump → 2^{nd} stage cooler → Filters → Analyzers → Event

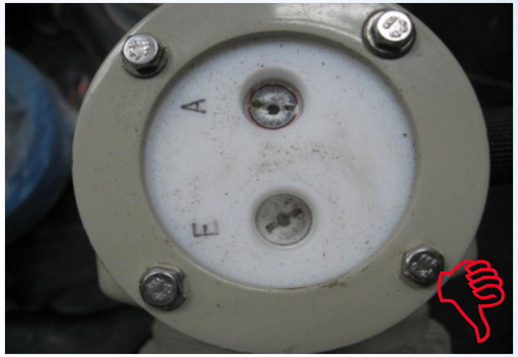
🟥 Warm gas

🟦 Cold gas

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

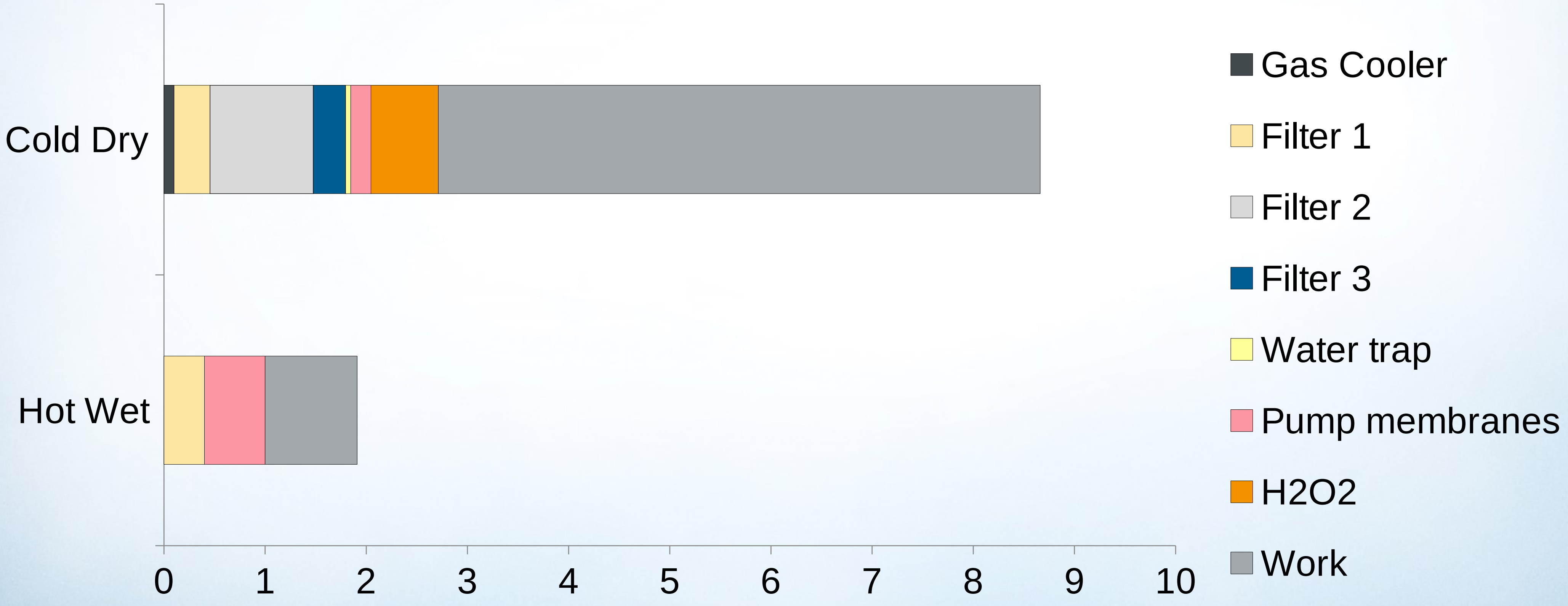
- **SICK Gas Analyzers – Best choice for alternative fuel combustion**
  - Why the Cold Dry - system is not recommended with e.g. (high) SO_2 concentrations?
    - At high SO_2-concentrations, (esp.in cement flue gases):
      - → Creation of sulphuric acid aerosols and droplets
      - → Causing corrosion in measuring cells of the analyzers
    - Removal of aggressive acids needed to protect analyzer (e.g. hydrogen peroxide, H_2O_2)
    - Higher costs for maintenance and spares to achieve the same reliability as a Hot Wet -system.



Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

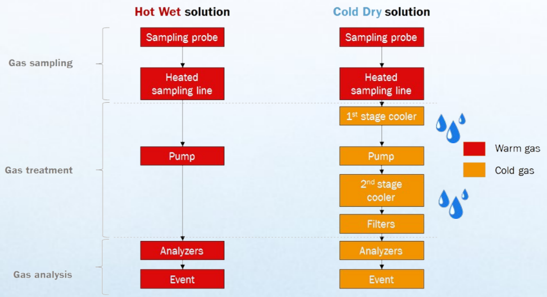
- **MCS300P hot wet process gas analyzer**
  - OPEX comparison (kiln inlet analyzers) / kEur/a



Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

- **Hot Wet measurement technology**
  - Completely heated measuring path (200°C)
    - Sampling, treatment, analysis (above dew point)
    - No gas cooler required
    - No problems associated with condensates
    - “Real”, fast and accurate measurement of water-soluble components e.g. NH_3, HCl, SO_2
    - Less maintenance & consumables/span gases


Hot Wet solution
Cold Dry solution
Gas sampling
Gas treatment
Gas analysis
Sampling probe
Heated sampling line
Pump
Analyzers
Event
Sampling probe
Heated sampling line
1st stage cooler
Pump
2nd stage cooler
Filters
Analyzers
Event
Warm gas
Cold gas

SICK SCP3000

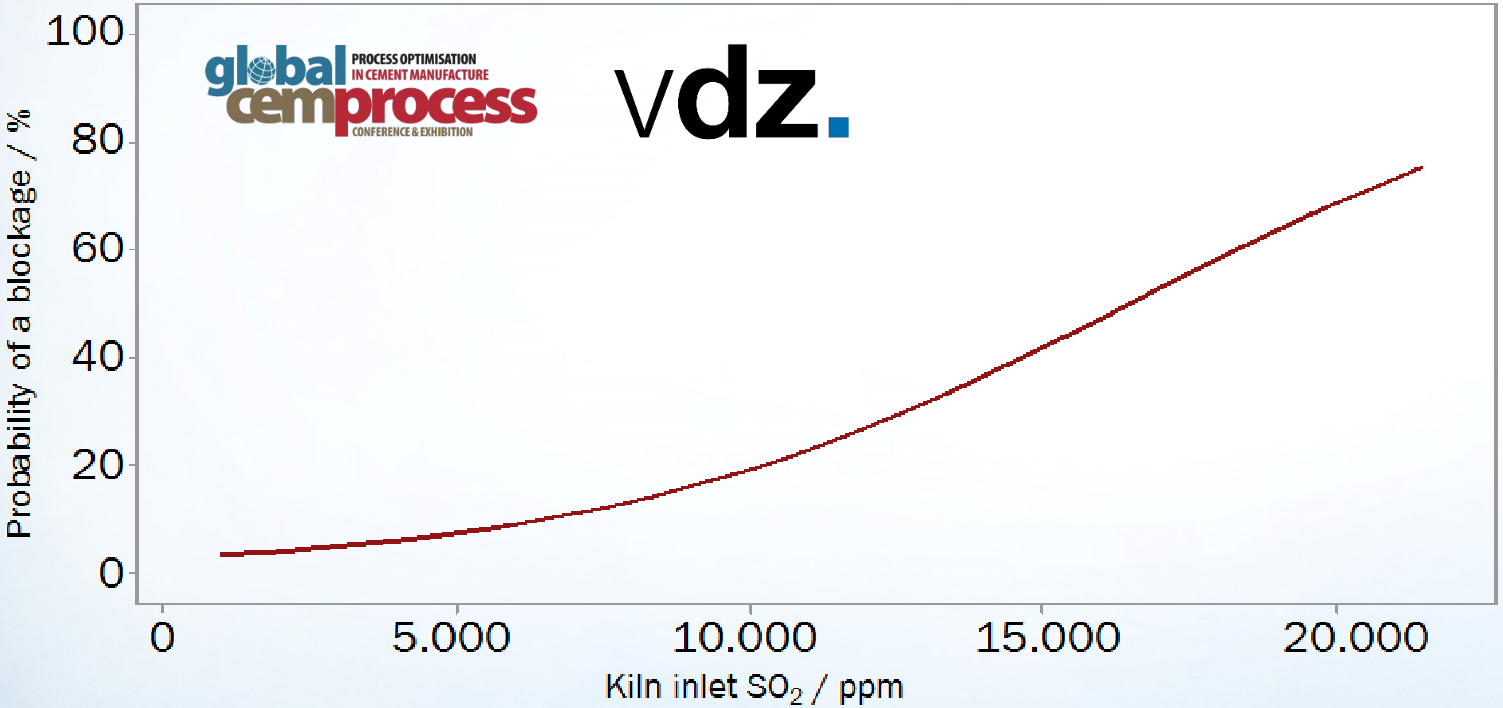
CO
CH_4
O_2
H_2O
NO
CO_2
NO_2
NH_3
SO_2
HCl
and many more...

SICK MCS300P

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

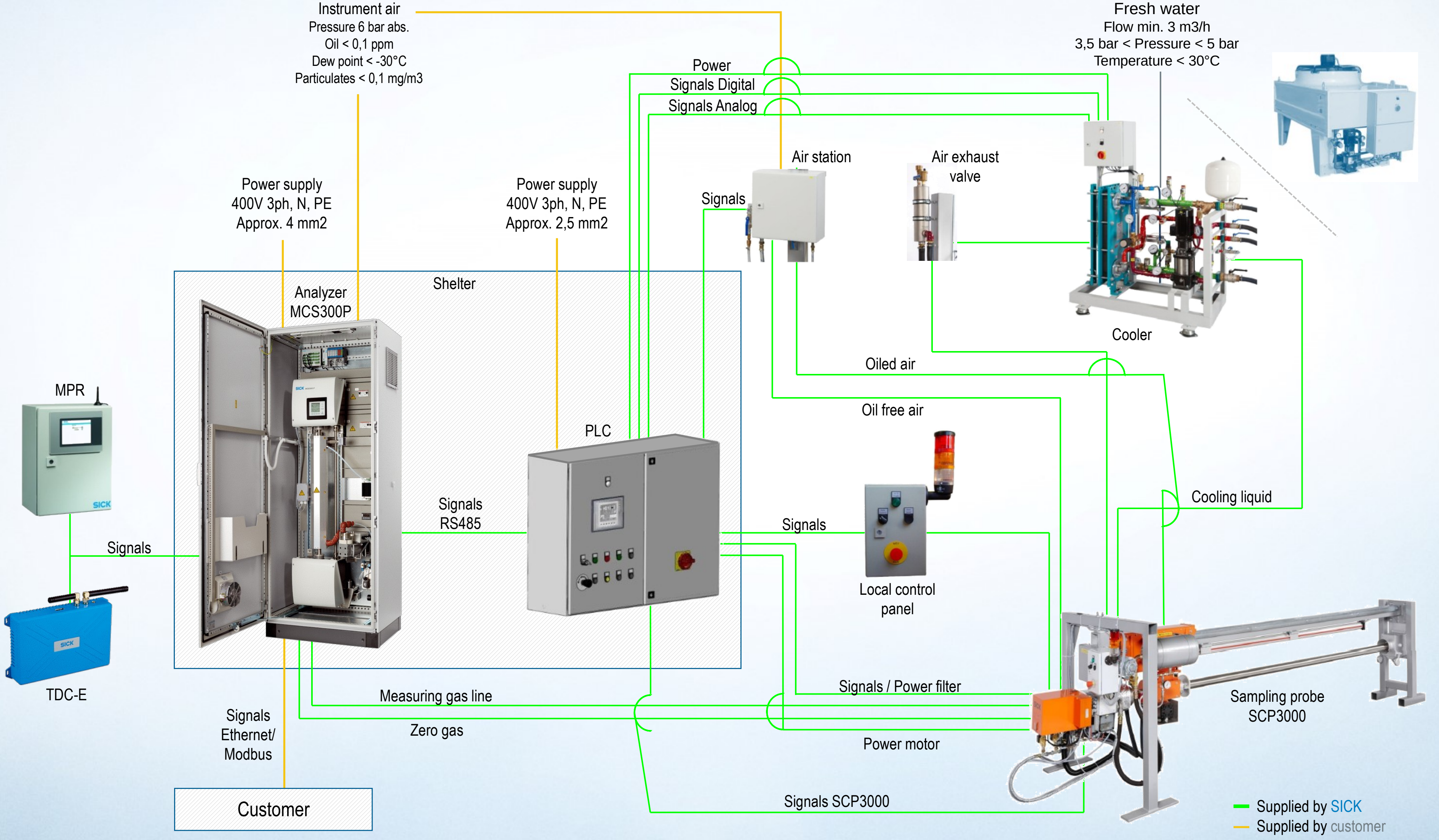
- **ÇİMSA Cimento, Turkey**
  - Cyclone blockage study using SCP3000/MCS300P kiln inlet monitoring system



  - if SO_2 amount increases above 15.000 ppm in the kiln inlet, cyclone blockage possibility can reach up to 80%!

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet


Instrument air
Pressure 6 bar abs.
Oil < 0,1 ppm
Dew point < -30°C
Particulates < 0,1 mg/m3
Fresh water
Flow min. 3 m3/h
3,5 bar < Pressure < 5 bar
Temperature < 30°C
Power
Signals Digital
Signals Analog
Air station
Air exhaust valve
Signals
Power supply
400V 3ph, N, PE
Approx. 4 mm2
Power supply
400V 3ph, N, PE
Approx. 2,5 mm2
Cooler
Shelter
Analyzer
MCS300P
Oiled air
Oil free air
MPR
PLC
Signals
RS485
Cooling liquid
Signals
Signals
Local control panel
TDC-E
Signals / Power filter
Measuring gas line
Sampling probe
SCP3000
Signals
Ethernet/
Modbus
Zero gas
Power motor
Signals SCP3000
Customer
Supplied by SICK
Supplied by customer

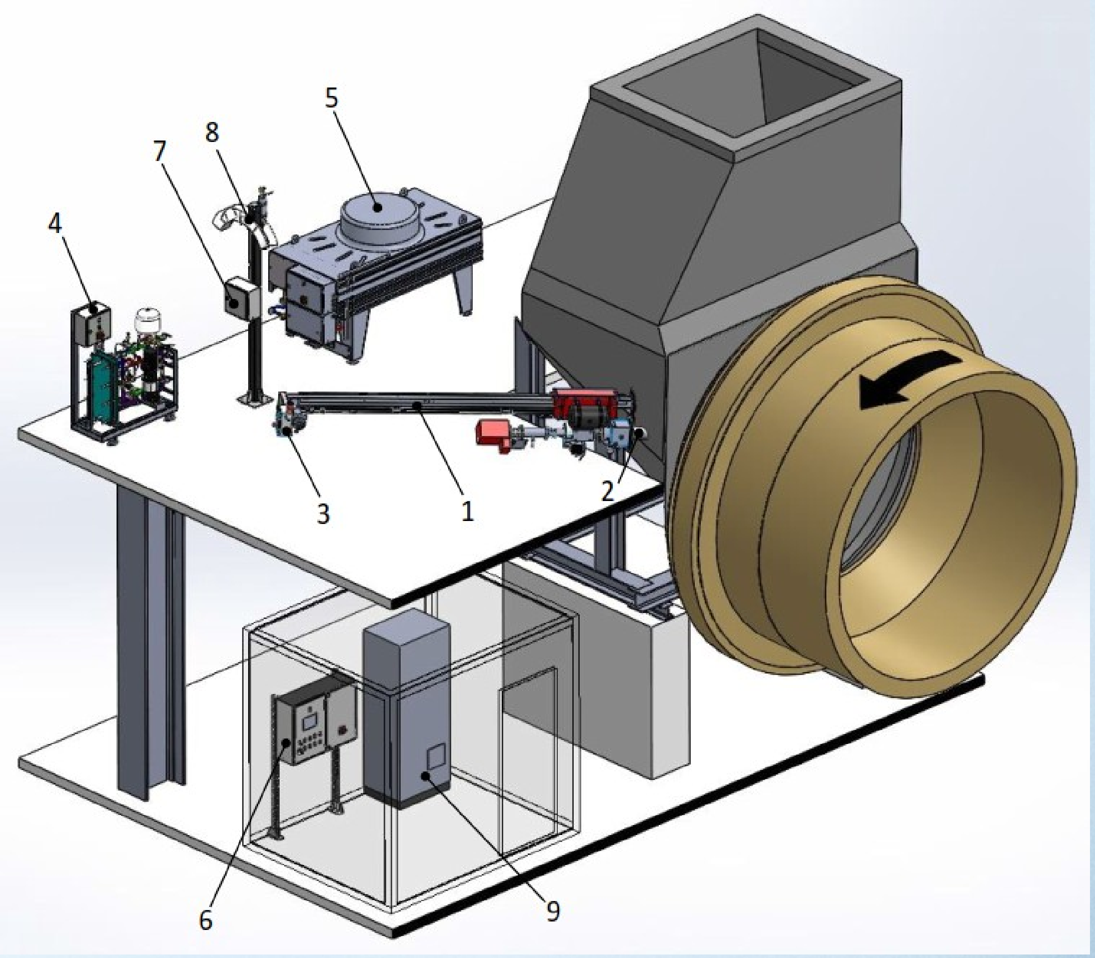
Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

SICK
Sensor Intelligence.

› SCPS3300 - System Design

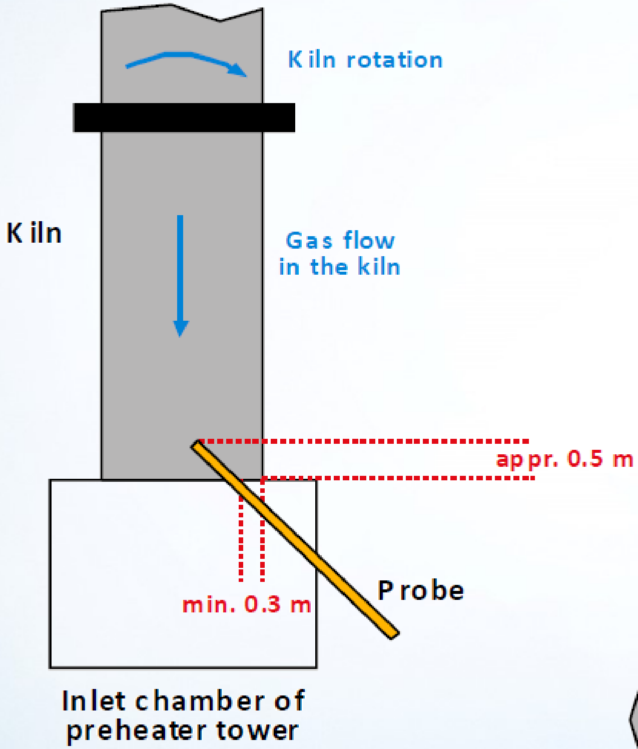
Nr.	Description	Dimension (mm)
1.1	Retraction unit with carriage length 2.500mm/probe 3.000mm	3608x795x820 (wxdxh)
1.2	Retraction unit with carriage length 3.000mm/probe 3.500mm	4108x795x820 (wxdxh)
1.3	Retraction unit with carriage length 3.500mm/probe 4.000mm	4608x795x820 (wxdxh)
2	Mounting flange plate with protection tube; length: 2.000mm	2000x300x670x140(wxdxhxø)
3	Local control cabinet	305x205x460 (wxdxh)
4	Water/Water cooler	1368x603x1554 (wxdxh)
5	Air/Water cooler	2560x1180x1460 (wxdxh)
6	PLC cabinet	1000x370x1860 (wxdxh)
7	Instrument air pressure cabinet	380x380x210(wxdxh)
8	Cable and tube support stand	940x410x2698(wxdxh)
9	MCS300P	800x600x2100 (wxdxh)

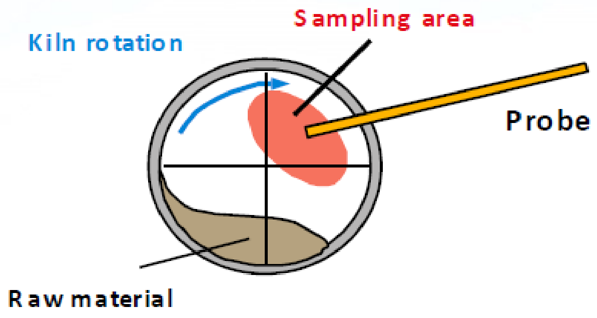


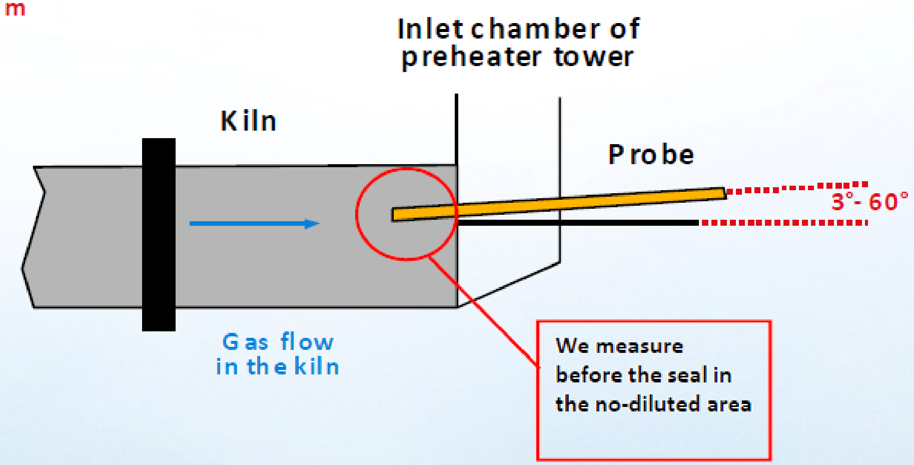
Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› SCPS3300 Installation (probe positioning)


Kiln rotation
Kiln
Gas flow in the kiln
appr. 0.5 m
min. 0.3 m
Probe
Inlet chamber of preheater tower

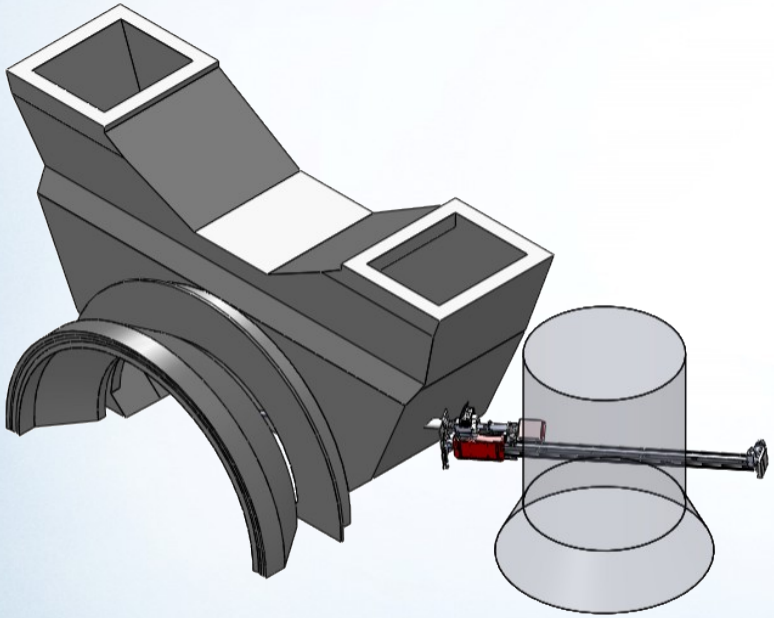

Sampling area
Kiln rotation
Probe
Raw material


Inlet chamber of preheater tower
Kiln
Probe
3°- 60°
Gas flow in the kiln
We measure before the seal in the no-diluted area

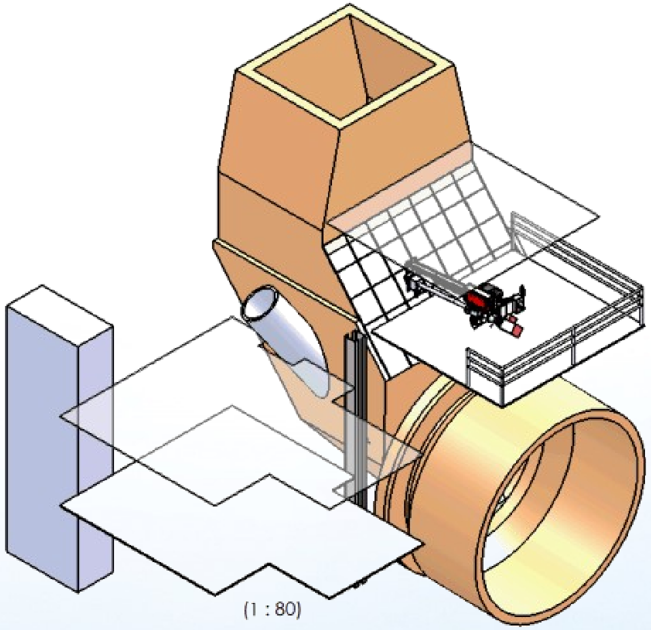
Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

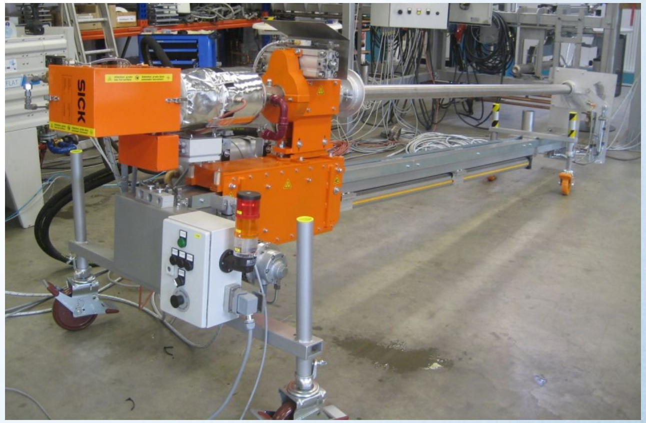
› **SCPS3300** Installation (customization examples)



„Back Pack“ Version



„Riser Duct“ Version

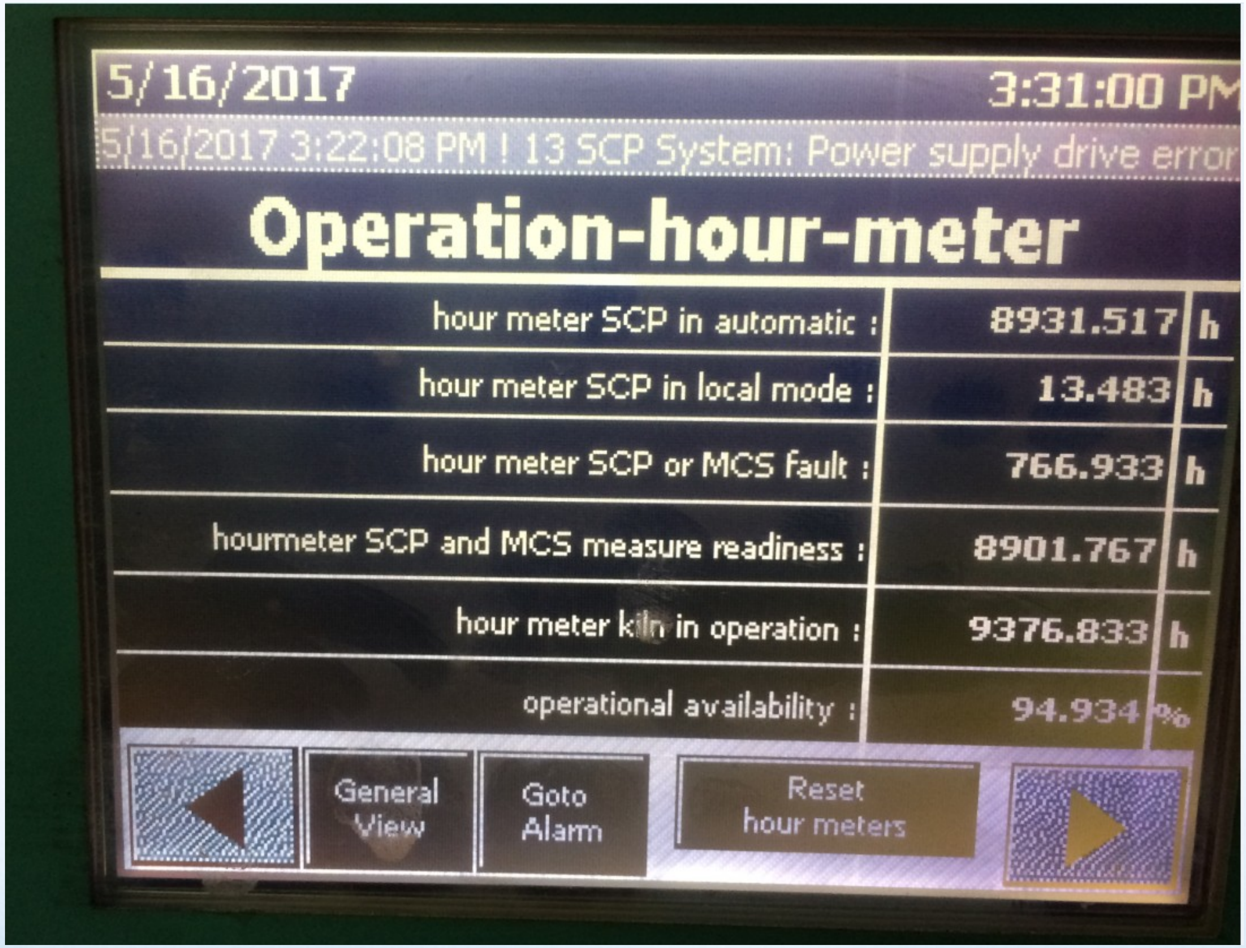


„Mobile“ Version

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

- **SCPS3300 availability**



5/16/2017 3:31:00 PM

5/16/2017 3:22:08 PM ! 13 SCP System: Power supply drive error

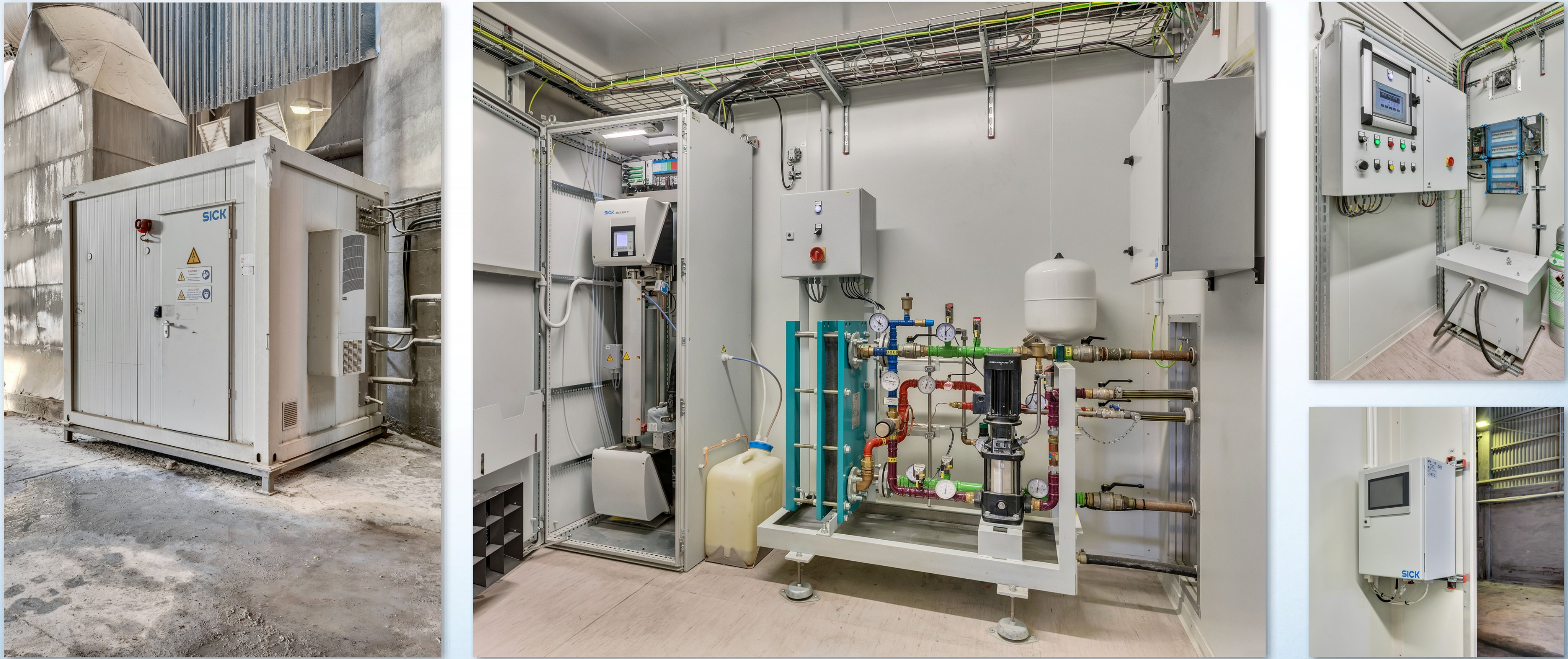
Operation-hour-meter

hour meter SCP in automatic :	8931.517	h
hour meter SCP in local mode :	13.483	h
hour meter SCP or MCS fault :	766.933	h
hourmeter SCP and MCS measure readiness :	8901.767	h
hour meter kiln in operation :	9376.833	h
operational availability :	94.934	%

Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› **SCPS3300** system integration

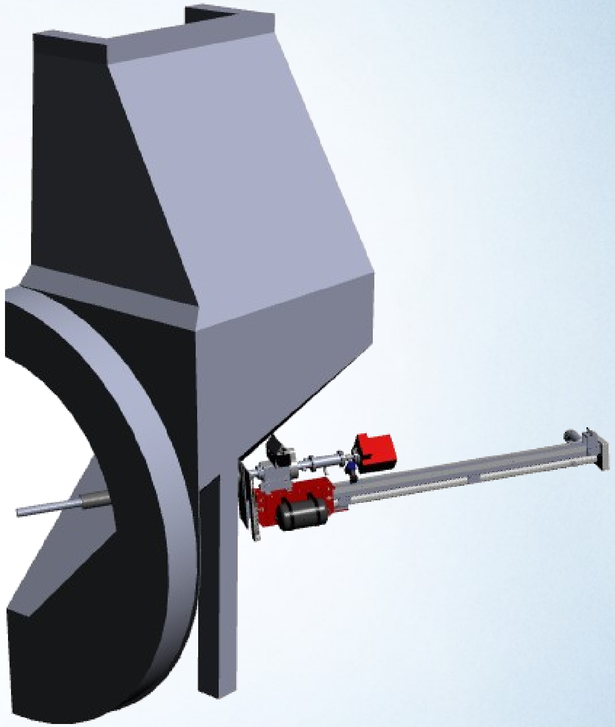


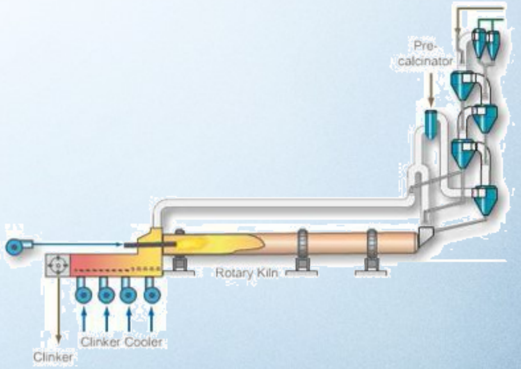
Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

› **SCPS3300** – Overview

- Optimized for use with high share of alternative fuels
- Increased availability (+95%) while measuring continuously
- Working in combination with hot wet (preferred) & cold dry analyzer technology (both offered by SICK)
- Easy adaption to changes in operation procedure (add measurement components)
- Probe & Analyzer from one supplier
- Control burner & process efficiency
- Turn key solutions
- Wide experience (big installed base)

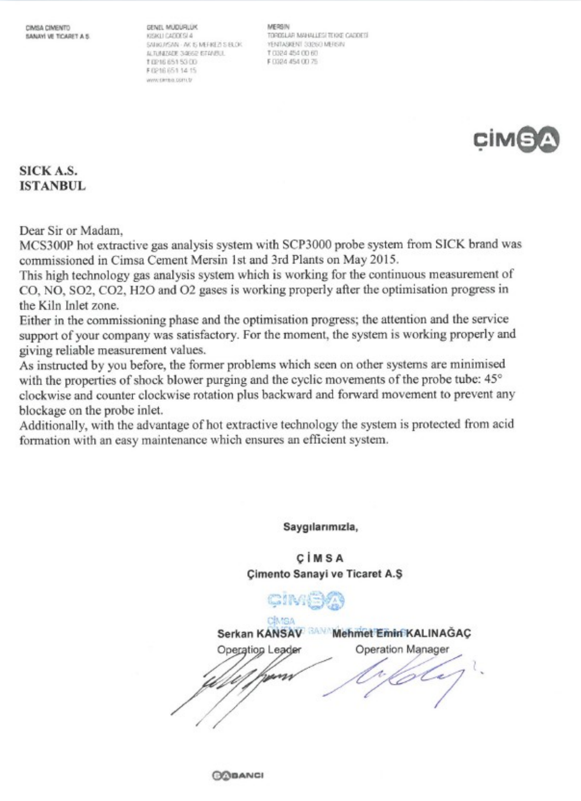




Solutions & Field Installations

Combustion Control (pyro process) – Kiln Inlet

- **SCPS3300 – References**
  - Over 150 kiln inlet systems (SCP3000/1000) installed worldwide



CIMSA CIMENTO
SANAYI VE TICARET A.S

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ALTUNIZADE 34662 ISTANBUL
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F 0216 651 14 15
www.cimsa.com.tr

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YENITASKENT 33260 MERSIN
T 0324 454 00 60
F 0324 454 00 75

SICK A.S.
ISTANBUL

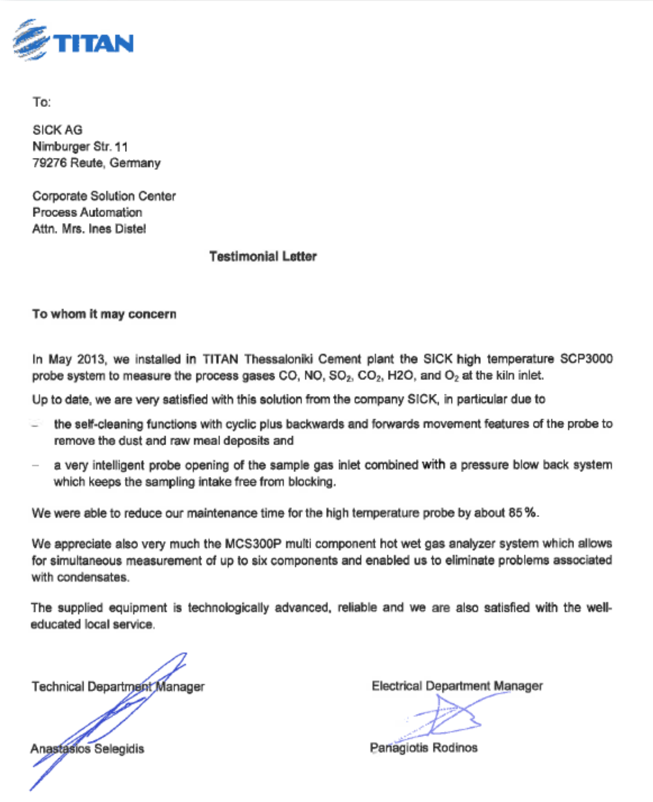
Dear Sir or Madam,
MCS300P hot extractive gas analysis system with SCP3000 probe system from SICK brand was commissioned in Cimsa Cement Mersin 1st and 3rd Plants on May 2015.
This high technology gas analysis system which is working for the continuous measurement of CO, NO, SO2, CO2, H2O and O2 gases is working properly after the optimisation progress in the Kiln Inlet zone.
Either in the commissioning phase and the optimisation progress; the attention and the service support of your company was satisfactory. For the moment, the system is working properly and giving reliable measurement values.
As instructed by you before, the former problems which seen on other systems are minimised with the properties of shock blower purging and the cyclic movements of the probe tube: 45° clockwise and counter clockwise rotation plus backward and forward movement to prevent any blockage on the probe inlet.
Additionally, with the advantage of hot extractive technology the system is protected from acid formation with an easy maintenance which ensures an efficient system.

Saygılarımızla,

Ç İ M S A
Çimento Sanayi ve Ticaret A.Ş

Serkan KANSAV **Mehmet Emin KALINAĞAÇ**
Operation Leader Operation Manager

SABANCI



TITAN

To:

SICK AG
Nimburger Str. 11
79276 Reute, Germany

Corporate Solution Center
Process Automation
Attn. Mrs. Ines Distel

Testimonial Letter

To whom it may concern

In May 2013, we installed in TITAN Thessaloniki Cement plant the SICK high temperature SCP3000 probe system to measure the process gases CO, NO, SO_2, CO_2, H2O, and O_2 at the kiln inlet.

Up to date, we are very satisfied with this solution from the company SICK, in particular due to

- the self-cleaning functions with cyclic plus backwards and forwards movement features of the probe to remove the dust and raw meal deposits and
- a very intelligent probe opening of the sample gas inlet combined with a pressure blow back system which keeps the sampling intake free from blocking.

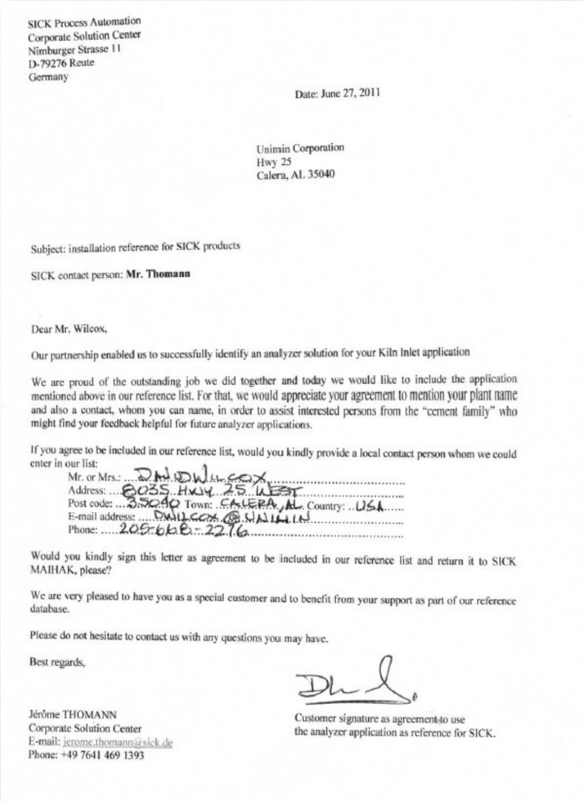
We were able to reduce our maintenance time for the high temperature probe by about 85 %.

We appreciate also very much the MCS300P multi component hot wet gas analyzer system which allows for simultaneous measurement of up to six components and enabled us to eliminate problems associated with condensates.

The supplied equipment is technologically advanced, reliable and we are also satisfied with the well-educated local service.

Technical Department Manager
Anastasios Selegidis

Electrical Department Manager
Panagiotis Rodinos



SICK Process Automation
Corporate Solution Center
Nimburger Strasse 11
D-79276 Reute
Germany

Date: June 27, 2011

Unimin Corporation
Hwy 25
Calera, AL 35040

Subject: installation reference for SICK products

SICK contact person: **Mr. Thomann**

Dear Mr. Wilcox,

Our partnership enabled us to successfully identify an analyzer solution for your Kiln Inlet application

We are proud of the outstanding job we did together and today we would like to include the application mentioned above in our reference list. For that, we would appreciate your agreement to mention your plant name and also a contact, whom you can name, in order to assist interested persons from the "cement family" who might find your feedback helpful for future analyzer applications.

If you agree to be included in our reference list, would you kindly provide a local contact person whom we could enter in our list:
Mr. or Mrs.: DM DWILCOX
Address: 8035 HWY 25 WEST
Post code: 35040 Town: CALERA, AL Country: USA
E-mail address: DWILCOX@UNIMIN
Phone: 205-668-2276

Would you kindly sign this letter as agreement to be included in our reference list and return it to SICK MAIHAK, please?

We are very pleased to have you as a special customer and to benefit from your support as part of our reference database.

Please do not hesitate to contact us with any questions you may have.

Best regards,

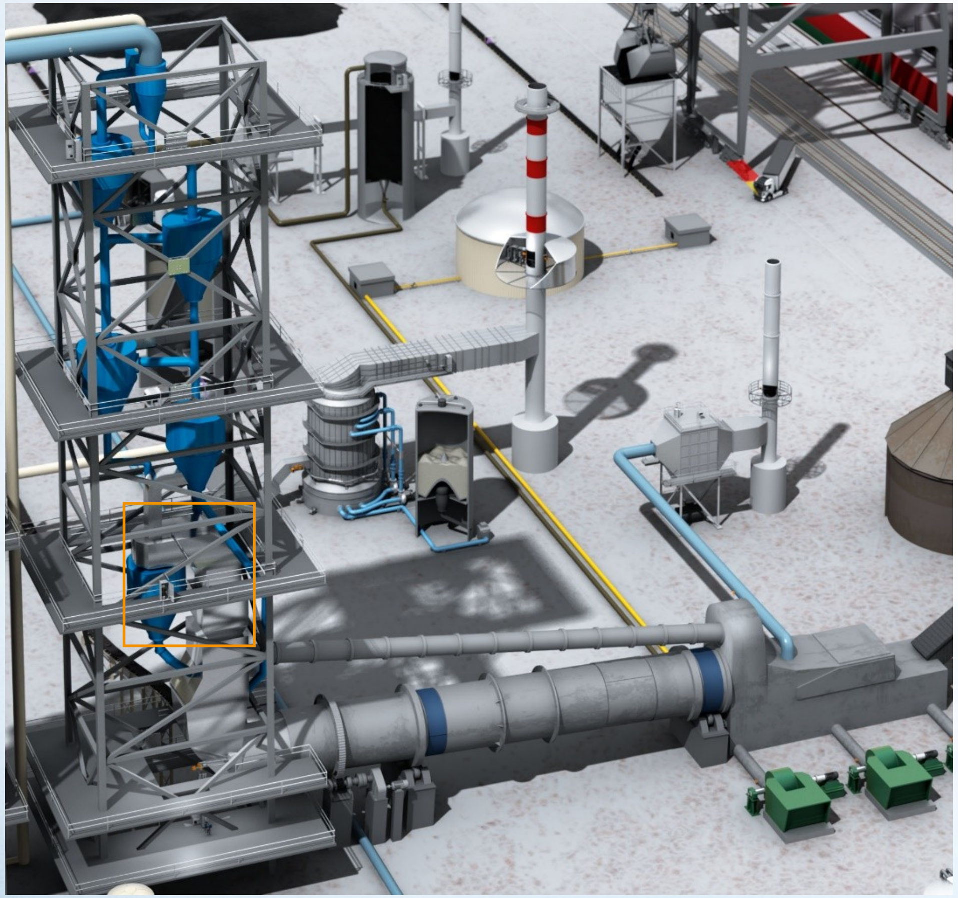
Jérôme THOMANN
Corporate Solution Center
E-mail: jerome.thomann@sick.de
Phone: +49 7641 469 1393

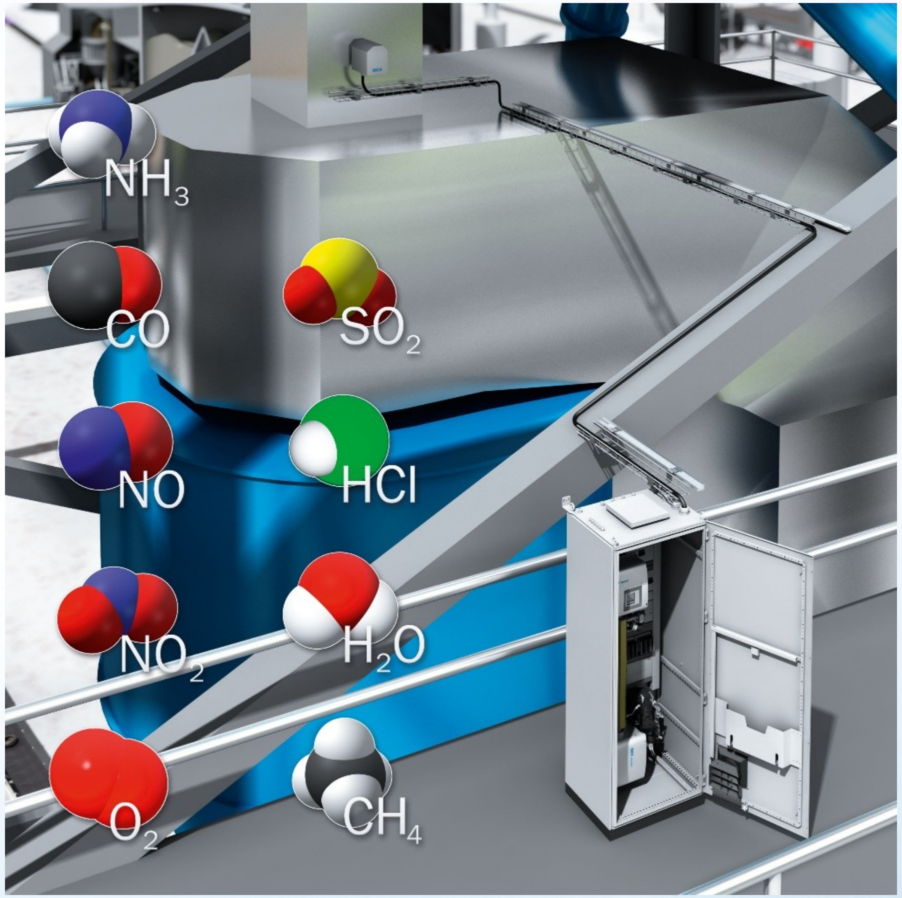
Customer signature as agreement to use
the analyzer application as reference for SICK.

Solutions & Field Installations

Combustion Control (pyro process) – Calciner

› Process Gas Analysis – Calciner



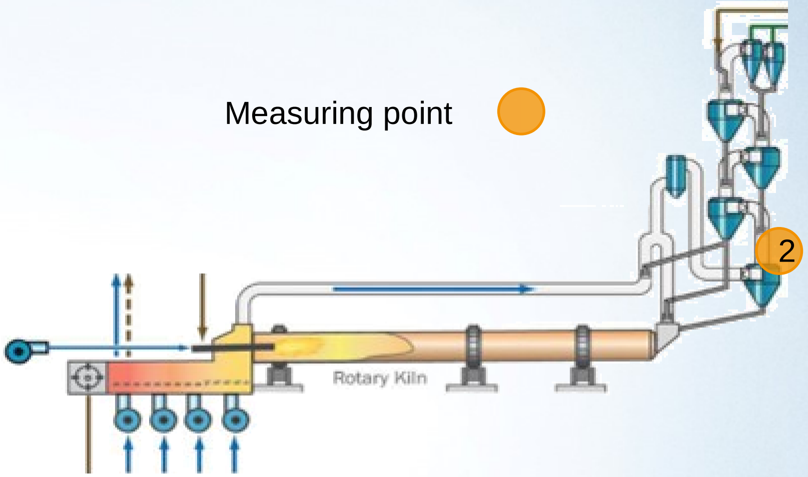

NH_3
CO
SO_2
NO
HCl
NO_2
H_2O
O_2
CH_4

Solutions & Field Installations

Combustion Control (pyro process) – Calciner

Calciner – SICK Solution

- **SP2000 / MCS300P**
  - Gas extraction probe
  - Hot-wet gas analyzer
- Combustion control (secondary burner)
- Clinker quality control (material output)
- Supervision of thermal conditions
- Monitoring of volatile elements
- Hot-wet process gas analyzer
- Measurement of water-soluble components (NH3, HCL, SO2)
- Automatic control cycle (Equivalent Qal3 w/o span gas)
- System field-tested under harsh process conditions / reduced maintenance / high operational availability



Solutions & Field Installations

Combustion Control (pyro process) – Calciner

Typical Requested Measurement Ranges

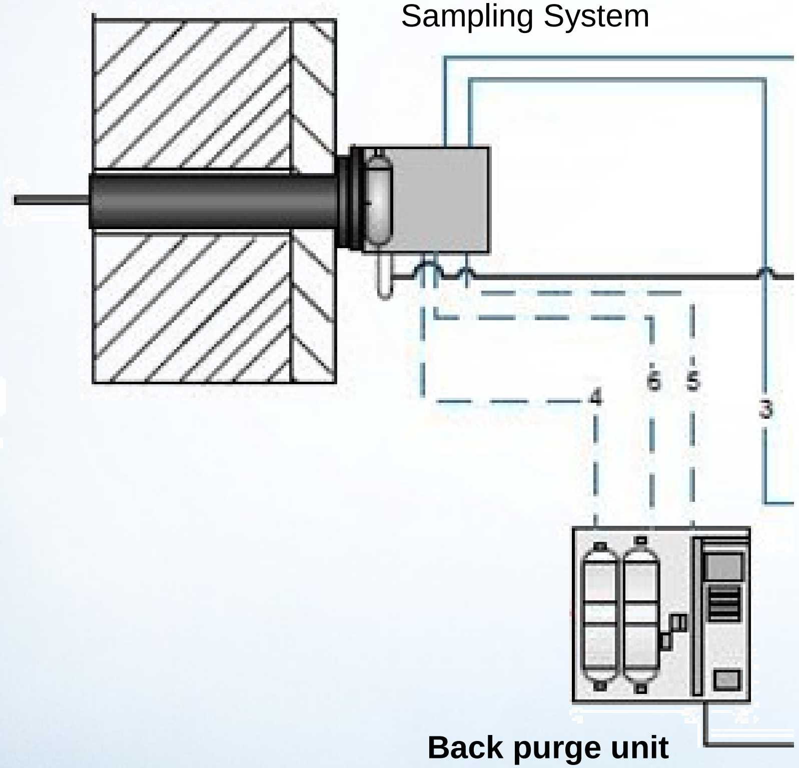
CO	0 … 3 Vol.%	
NO	0 … 3000 ppm	
O_2	0 … 21 Vol.%	
SO_2	0 … 1 Vol.%	
HCl	0 … 5000 ppm	(if waste fuels are used)
CH_4	0 … 5 Vol.%	(if natural gas is used)
NH_3	0 … ?	(for special raw materials)
CO_2	0 … 25 Vol.%	(due to CS correction)
H_2O	0 … 30 Vol.%	(due to CS correction)

Solutions & Field Installations

Combustion Control (pyro process) – Calciner

› System Overview

SP2000/KA & SCP3000-F
Sampling System



Back purge unit

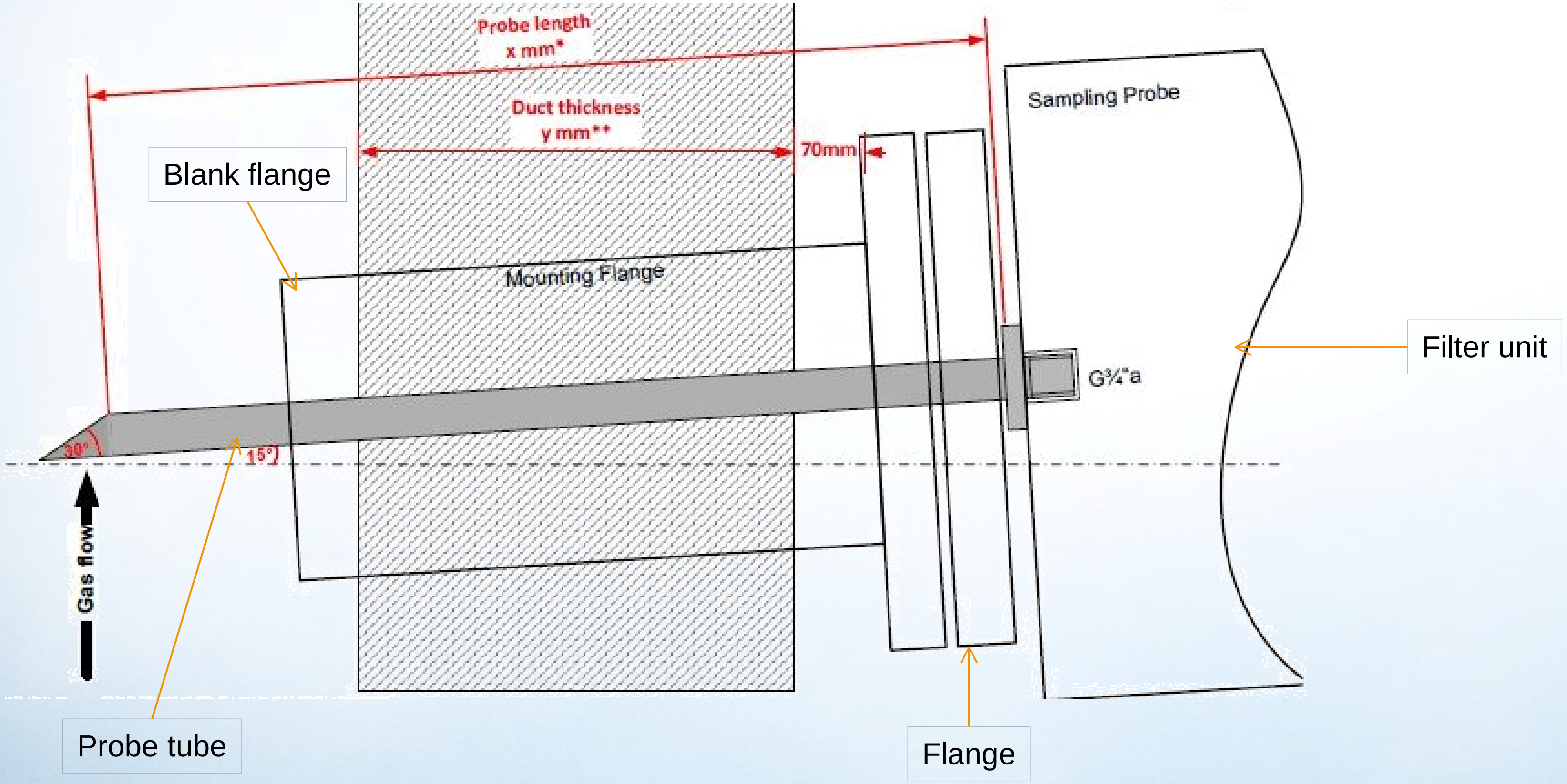
MCS300P
Multicomponent gas analyzer

MPR

Solutions & Field Installations

Combustion Control (pyro process) – Calciner

- **SP2000/KA & SCP3000-F - gas sampling system**
  - With angled probe shape to reduce the entrained dust level entering the sample probe (adjusted on site)


Probe length
x mm*
Duct thickness
y mm**
70mm
Sampling Probe
Mounting Flange
G¾"a
30°
15°
Gas flow

Blank flange

Filter unit

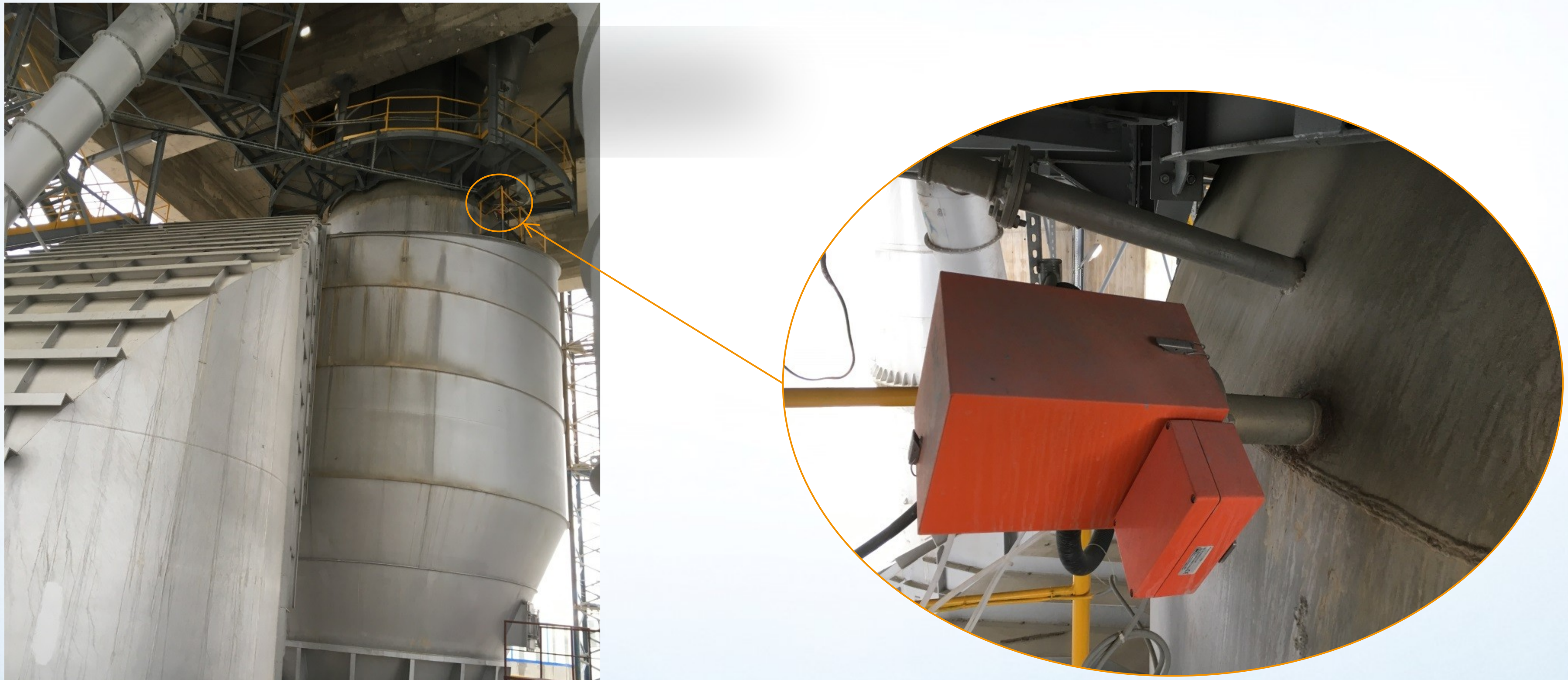
Probe tube

Flange

Solutions & Field Installations

Combustion Control (pyro process) – Calciner

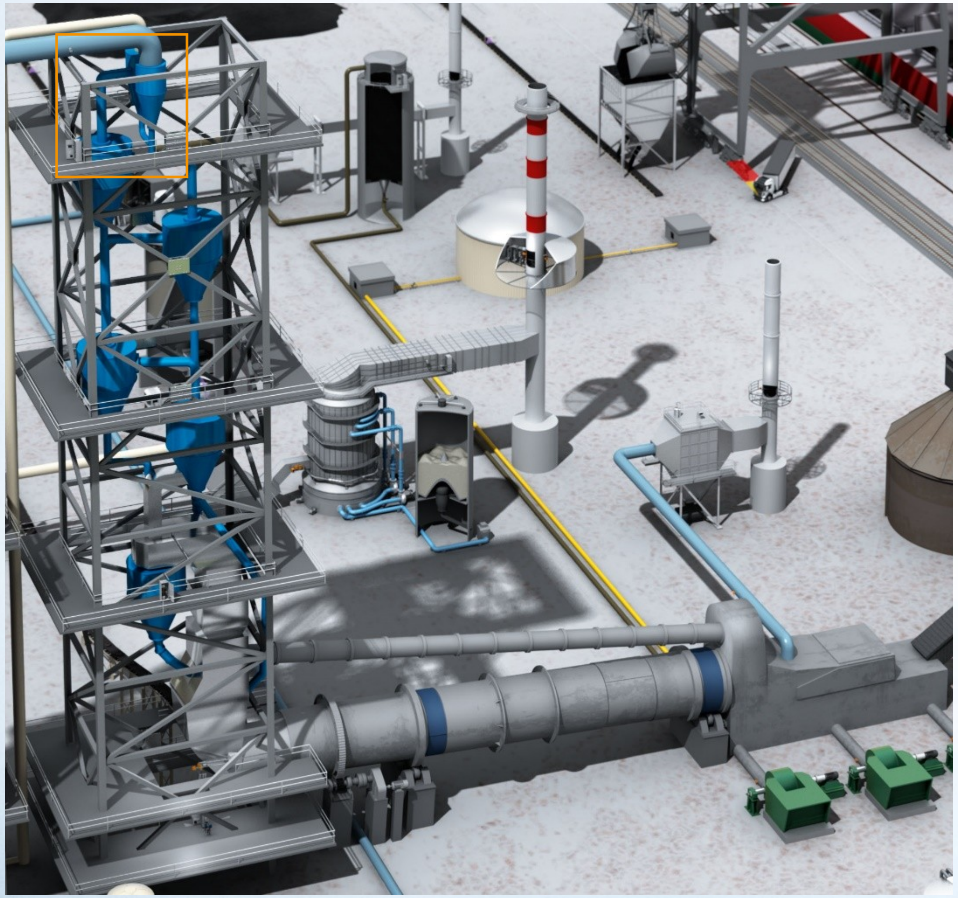
- **SP2000/KA & SCP3000-F - gas sampling system**

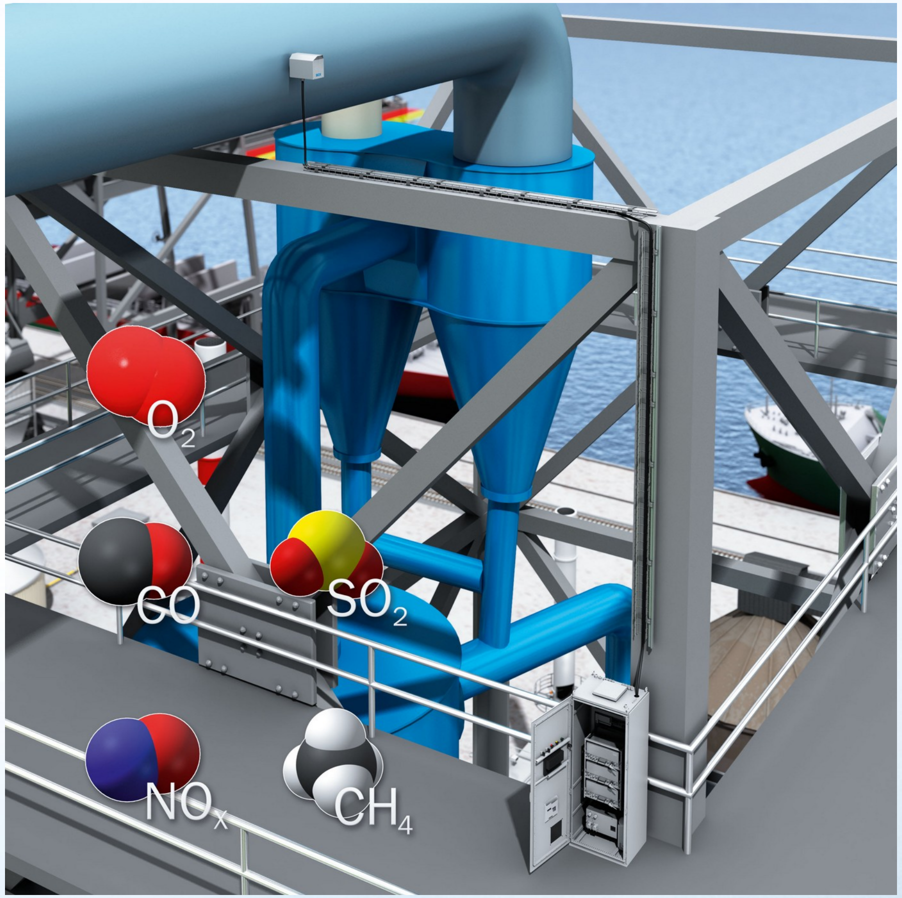


Solutions & Field Installations

Combustion Control (pyro process) – Preheater / ID-Fan

› Process Gas Analysis – Preheater / ID-Fan



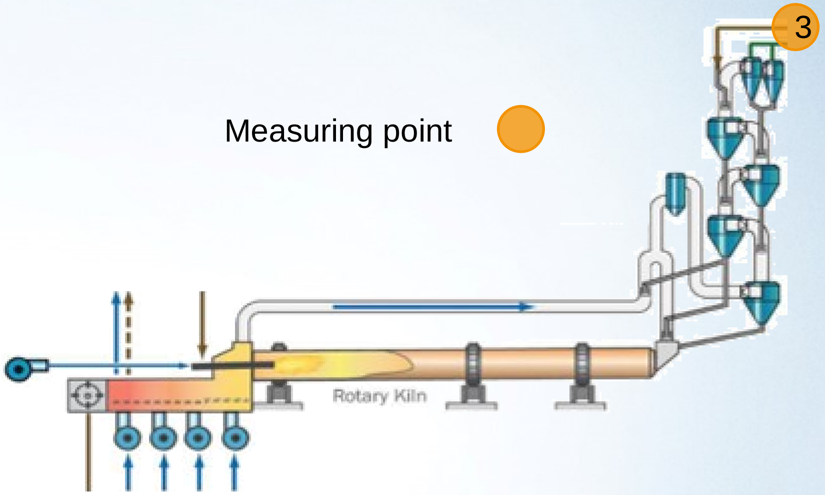


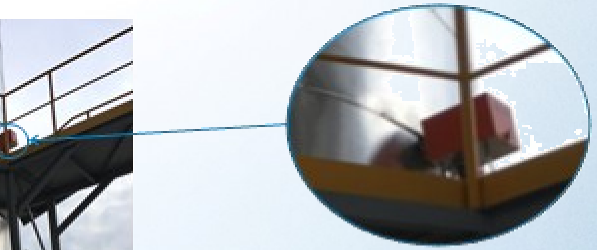
Solutions & Field Installations

Combustion Control (pyro process) – Preheater / ID-Fan

› Preheater – SICK Solution

- **SP2000 / MKAS**
  ↳ Gas extraction probe ↳cold-dry gas analyzer
- Combustion control (secondary burner)
- Flue gas treatment control
- ESP protection
- Fan control (energy efficiency)
- Supervision of thermal conditions
- Cold-dry process gas analyzer
- Cost efficient solution for moderate process conditions
- System field-tested under harsh process conditions / high operational availability





Solutions & Field Installations

Combustion Control (pyro process) – Preheater / ID-Fan

Typical Requested Measurement Ranges

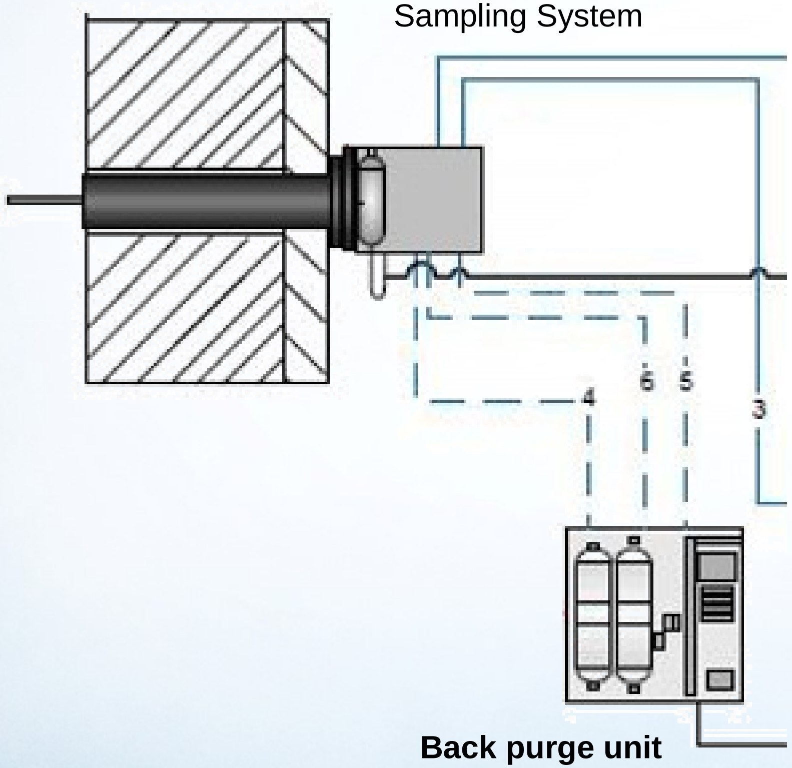
CO	0 … 2 Vol.%
NO	0 … 2000 ppm
O_2	0 … 10 Vol.%
SO_2	0 … 2000 ppm

Solutions & Field Installations

Combustion Control (pyro process) – Preheater / ID-Fan

› System Overview

SP2000/KA & SCP3000-F
Sampling System



Back purge unit

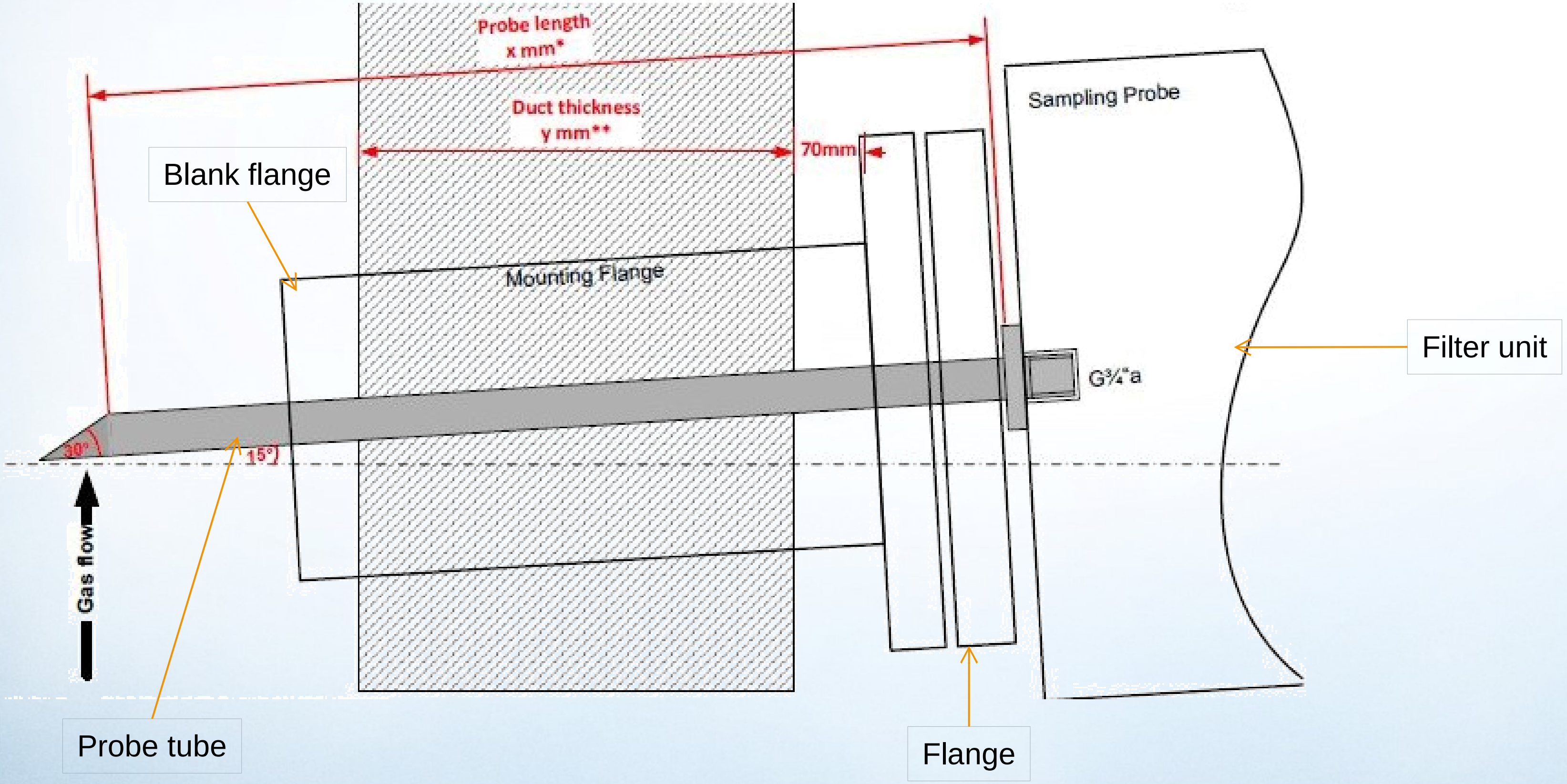
MKAS-Comfort
Multicomponent gas analyzer

MPR

Solutions & Field Installations

Combustion Control (pyro process) – Preheater / ID-Fan

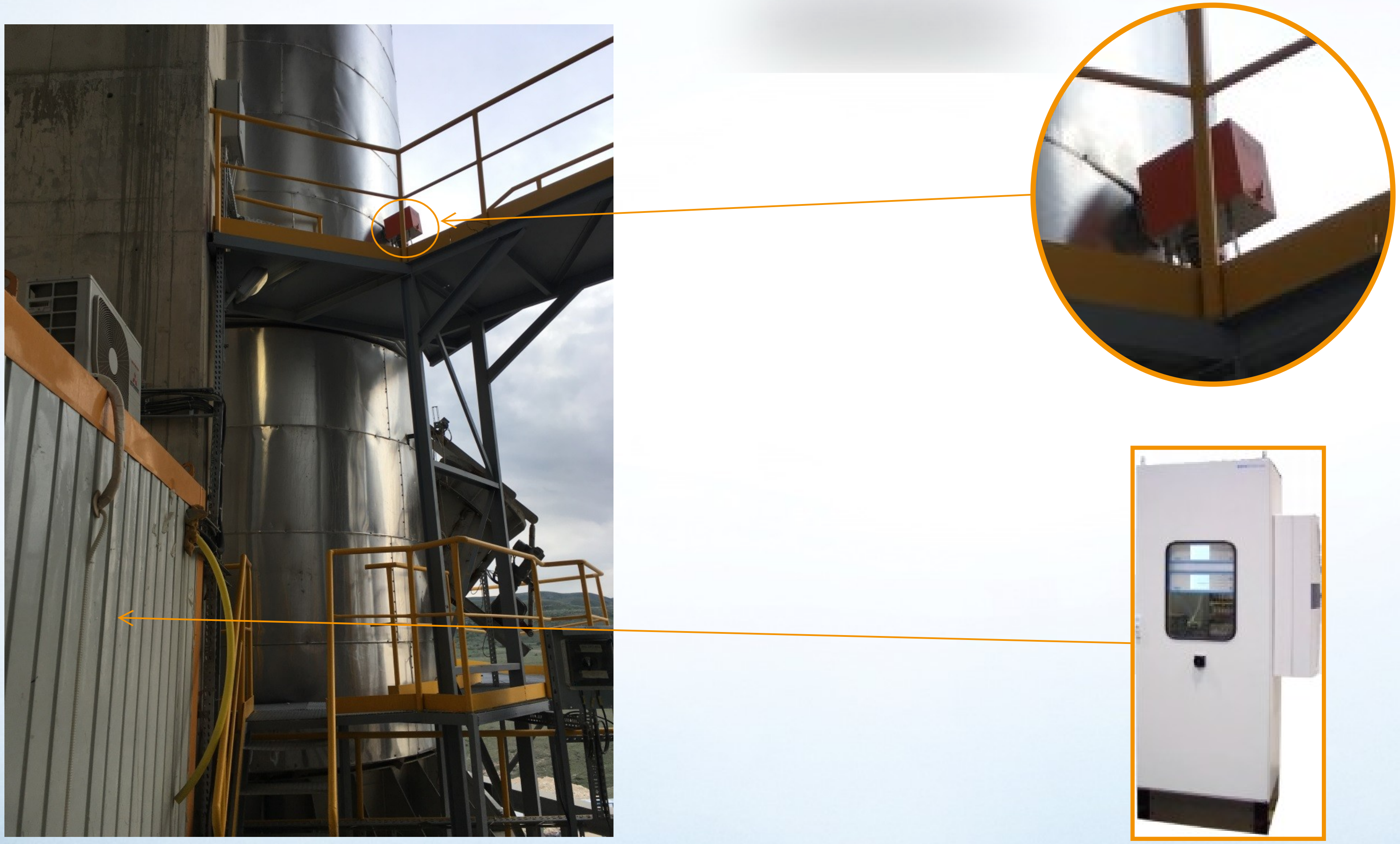
- **SP2000/KA & SCP3000-F - gas sampling system**
  - With angled probe shape to reduce the entrained dust level entering the sample probe (adjusted on site)


Probe length
x mm*
Duct thickness
y mm**
70mm
Sampling Probe
Blank flange
Mounting Flange
Filter unit
G¾"a
30°
15°
Gas flow
Probe tube
Flange

Solutions & Field Installations

Combustion Control (pyro process) – Preheater / ID-Fan

- **SP2000/KA & SCP3000-F - gas sampling system**



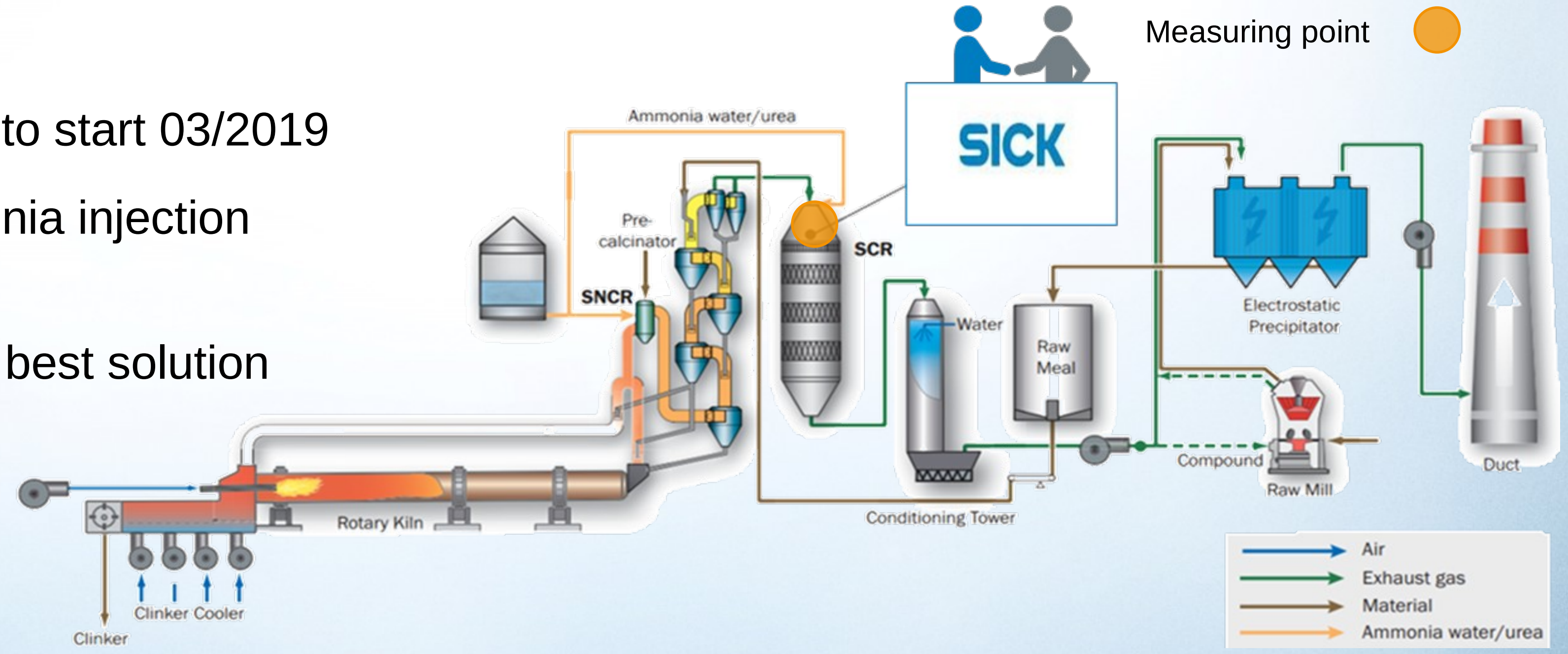
Solutions & Field Installations

DeNOx Control

DENOX / S(N)CR – GM32

- HeidelbergCement Geseke used a SNCR only till 2019
- New emission limits due to revision of 17. BImSchV from 01.01.2019
- NO: 200 mg/m3
- NH3: 30 mg/m3
- New SCR unit was planned to start 03/2019
- Measuring point after ammonia injection before catalyst.
- HC contact SICK to find the best solution

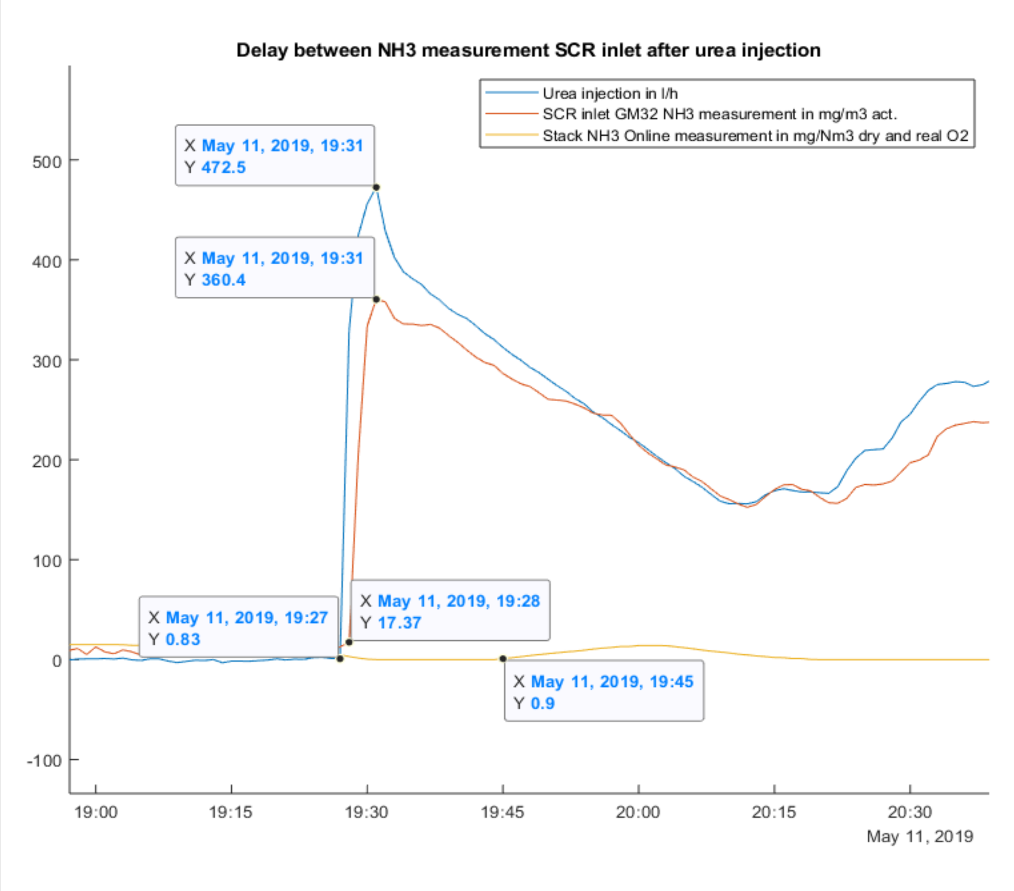
→ **GM32**


Measuring point ●
SICK
Ammonia water/urea
Pre-calcinator
SNCR
SCR
Water
Raw Meal
Electrostatic Precipitator
Compound
Raw Mill
Duct
Conditioning Tower
Rotary Kiln
Clinker Cooler
Clinker
Air
Exhaust gas
Material
Ammonia water/urea

Solutions & Field Installations

DeNOx Control

- **DENOX / S(N)CR – GM32**
  - Findings after 12 month field trail
    - CEMS measurement have a delay of 2 - 17 minutes depending on the component.
    - A real SCR control is with a CEMS system only not possible.

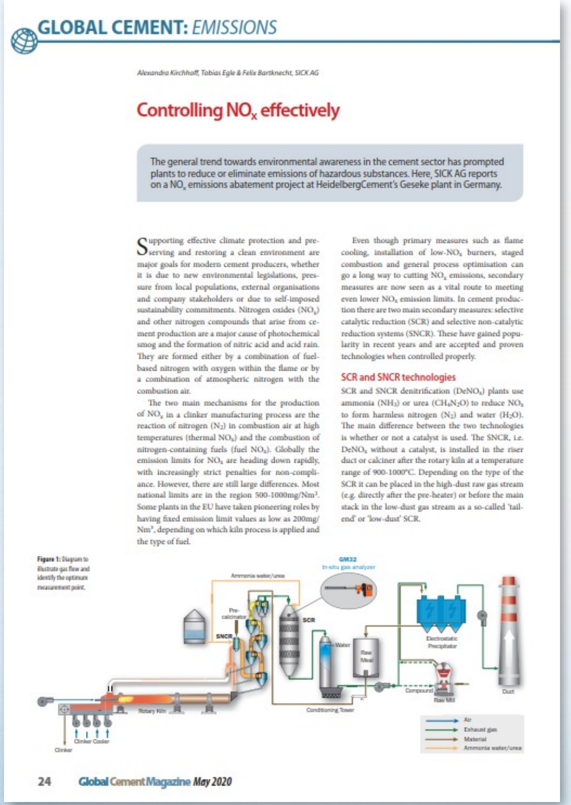


Solutions & Field Installations

DeNOx Control

› DENOX / S(N)CR – GM32

Global Cement Magazine May 2020



Alexandra Kirchhoff, Tobias Egle & Felix Bartknecht, SICK AG

Controlling NO_x effectively

The general trend towards environmental awareness in the cement sector has prompted plants to reduce or eliminate emissions of hazardous substances. Here, SICK AG reports on a NO_x emissions abatement project at HeidelbergCement's Geseke plant in Germany.

Supporting effective climate protection and preserving and restoring a clean environment are major goals for modern cement producers, whether it is due to new environmental legislations, pressure from local populations, external organisations and company stakeholders or due to self-imposed sustainability commitments. Nitrogen oxides (NO_x) and other nitrogen compounds that arise from cement production are a major cause of photochemical smog and the formation of nitric acid and acid rain. They are formed either by a combination of fuel-based nitrogen with oxygen within the flame or by a combination of atmospheric nitrogen with the combustion air.

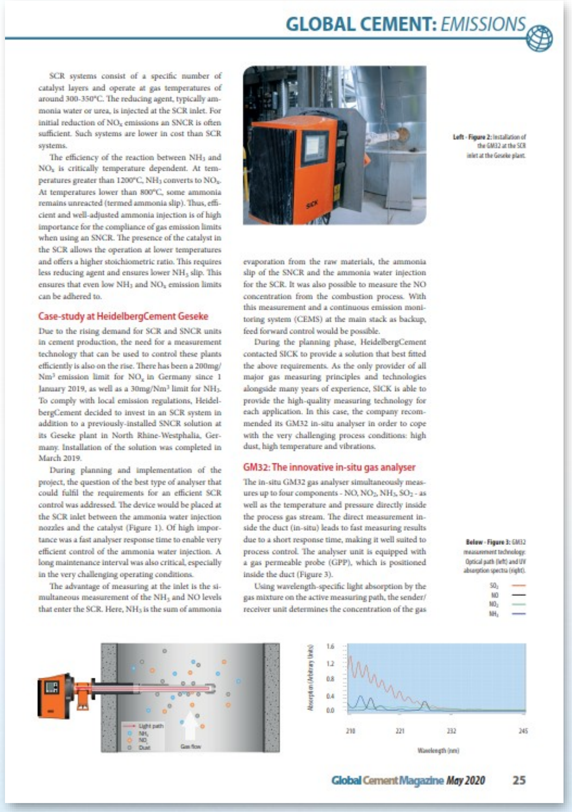
The two main mechanisms for the production of NO_x in a clinker manufacturing process are the reaction of nitrogen (N_2) in combustion air at high temperatures (thermal NO_x) and the combustion of nitrogen-containing fuels (fuel NO_x). Globally the emission limits for NO_x are heading down rapidly, with increasingly strict penalties for non-compliance. However, there are still large differences. Most national limits are in the region 500-1000mg/Nm³. Some plants in the EU have taken pioneering roles by having fixed emission limit values as low as 200mg/Nm³, depending on which kiln process is applied and the type of fuel.

Even though primary measures such as flame cooling, installation of low-NO_x burners, staged combustion and general process optimisation can go a long way to cutting NO_x emissions, secondary measures are now seen as a vital route to meeting even lower NO_x emission limits. In cement production there are two main secondary measures: selective catalytic reduction (SCR) and selective non-catalytic reduction systems (SNCR). These have gained popularity in recent years and are accepted and proven technologies when controlled properly.

SCR and SNCR technologies

SCR and SNCR denitrification ($DeNO_x$) plants use ammonia (NH_3) or urea (CH_4N_2O) to reduce NO_x to form harmless nitrogen (N_2) and water (H_2O). The main difference between the two technologies is whether or not a catalyst is used. The SNCR, i.e. $DeNO_x$ without a catalyst, is installed in the riser duct or calciner after the rotary kiln at a temperature range of 900-1000°C. Depending on the type of the SCR it can be placed in the high-dust raw gas stream (e.g. directly after the pre-heater) or before the main stack in the low-dust gas stream as a so-called 'tail-end' or 'low-dust' SCR.

Figure 1: Diagram to illustrate gas flow and identify the optimum measurement point.



SCR systems consist of a specific number of catalyst layers and operate at gas temperatures of around 300-350°C. The reducing agent, typically ammonia water or urea, is injected at the SCR inlet. For initial reduction of NO_x emissions an SNCR is often sufficient. Such systems are lower in cost than SCR systems.

The efficiency of the reaction between NH_3 and NO_x is critically temperature dependent. At temperatures greater than 1200°C, NH_3 converts to NO_x. At temperatures lower than 800°C, some ammonia remains unreacted (termed ammonia slip). Thus, efficient and well-adjusted ammonia injection is of high importance for the compliance of gas emission limits when using an SNCR. The presence of the catalyst in the SCR allows the operation at lower temperatures and offers a higher stoichiometric ratio. This requires less reducing agent and ensures lower NH_3 slip. This ensures that even low NH_3 and NO_x emission limits can be adhered to.

Case-study at HeidelbergCement Geseke

Due to the rising demand for SCR and SNCR units in cement production, the need for a measurement technology that can be used to control these plants efficiently is also on the rise. There has been a 200mg/Nm³ emission limit for NO_x in Germany since 1 January 2019, as well as a 30mg/Nm³ limit for NH_3. To comply with local emission regulations, HeidelbergCement decided to invest in an SCR system in addition to a previously-installed SNCR solution at its Geseke plant in North Rhine-Westphalia, Germany. Installation of the solution was completed in March 2019.

During planning and implementation of the project, the question of the best type of analyser that could fulfil the requirements for an efficient SCR control was addressed. The device would be placed at the SCR inlet between the ammonia water injection nozzles and the catalyst (Figure 1). Of high importance was a fast analyser response time to enable very efficient control of the ammonia water injection. A long maintenance interval was also critical, especially in the very challenging operating conditions.

The advantage of measuring at the inlet is the simultaneous measurement of the NH_3 and NO levels that enter the SCR. Here, NH_3 is the sum of ammonia evaporation from the raw materials, the ammonia slip of the SNCR and the ammonia water injection for the SCR. It was also possible to measure the NO concentration from the combustion process. With this measurement and a continuous emission monitoring system (CEMS) at the main stack as backup, feed forward control would be possible.

During the planning phase, HeidelbergCement contacted SICK to provide a solution that best fitted the above requirements. As the only provider of all major gas measuring principles and technologies alongside many years of experience, SICK is able to provide the high-quality measuring technology for each application. In this case, the company recommended its GM32 in-situ analyser in order to cope with the very challenging process conditions: high dust, high temperature and vibrations.

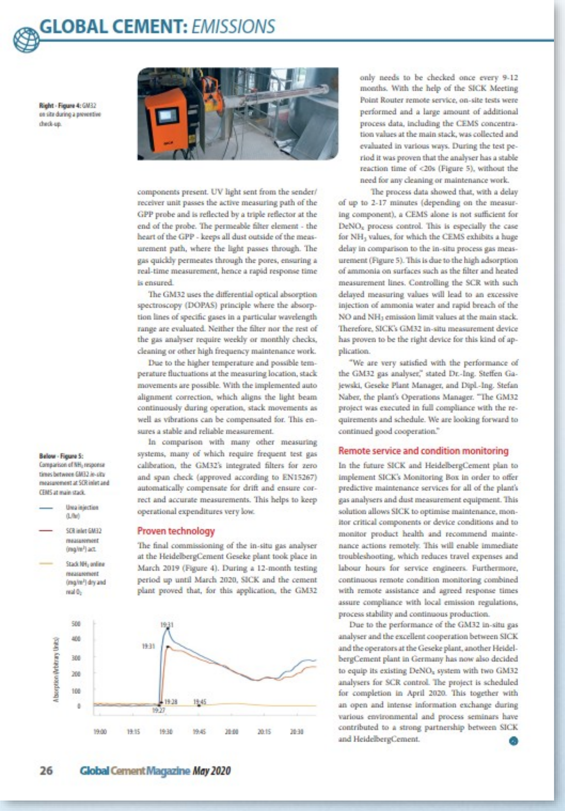
GM32: The innovative in-situ gas analyser

The in-situ GM32 gas analyser simultaneously measures up to four components - NO, NO_2, NH_3, SO_2 - as well as the temperature and pressure directly inside the process gas stream. The direct measurement inside the duct (in-situ) leads to fast measuring results due to a short response time, making it well suited to process control. The analyser unit is equipped with a gas permeable probe (GPP), which is positioned inside the duct (Figure 3).

Using wavelength-specific light absorption by the gas mixture on the active measuring path, the sender/receiver unit determines the concentration of the gas

Left - Figure 2: Installation of the GM32 at the SCR inlet at the Geseke plant.

Below - Figure 3: GM32 measurement technology: Optical path (left) and UV absorption spectra (right).



Right - Figure 4: GM32 on-site during a preventive check-up.

components present. UV light sent from the sender/receiver unit passes the active measuring path of the GPP probe and is reflected by a triple reflector at the end of the probe. The permeable filter element - the heart of the GPP - keeps all dust outside of the measurement path, where the light passes through. The gas quickly permeates through the pores, ensuring a real-time measurement, hence a rapid response time is ensured.

The GM32 uses the differential optical absorption spectroscopy (DOPAS) principle where the absorption lines of specific gases in a particular wavelength range are evaluated. Neither the filter nor the rest of the gas analyser require weekly or monthly checks, cleaning or other high frequency maintenance work.

Due to the higher temperature and possible temperature fluctuations at the measuring location, stack movements are possible. With the implemented auto alignment correction, which aligns the light beam continuously during operation, stack movements as well as vibrations can be compensated for. This ensures a stable and reliable measurement.

In comparison with many other measuring systems, many of which require frequent test gas calibration, the GM32's integrated filters for zero and span check (approved according to EN15267) automatically compensate for drift and ensure correct and accurate measurements. This helps to keep operational expenditures very low.

Proven technology

The final commissioning of the in-situ gas analyser at the HeidelbergCement Geseke plant took place in March 2019 (Figure 4). During a 12-month testing period up until March 2020, SICK and the cement plant proved that, for this application, the GM32 only needs to be checked once every 9-12 months. With the help of the SICK Meeting Point Router remote service, on-site tests were performed and a large amount of additional process data, including the CEMS concentration values at the main stack, was collected and evaluated in various ways. During the test period it was proven that the analyser has a stable reaction time of <20s (Figure 5), without the need for any cleaning or maintenance work.

The process data showed that, with a delay of up to 2-17 minutes (depending on the measuring component), a CEMS alone is not sufficient for $DeNO_x$ process control. This is especially the case for NH_3 values, for which the CEMS exhibits a huge delay in comparison to the in-situ process gas measurement (Figure 5). This is due to the high adsorption of ammonia on surfaces such as the filter and heated measurement lines. Controlling the SCR with such delayed measuring values will lead to an excessive injection of ammonia water and rapid breach of the NO and NH_3 emission limit values at the main stack. Therefore, SICK's GM32 in-situ measurement device has proven to be the right device for this kind of application.

"We are very satisfied with the performance of the GM32 gas analyser," stated Dr.-Ing. Steffen Gajewski, Geseke Plant Manager, and Dipl.-Ing. Stefan Naber, the plant's Operations Manager. "The GM32 project was executed in full compliance with the requirements and schedule. We are looking forward to continued good cooperation."

Remote service and condition monitoring

In the future SICK and HeidelbergCement plan to implement SICK's Monitoring Box in order to offer predictive maintenance services for all of the plant's gas analysers and dust measurement equipment. This solution allows SICK to optimise maintenance, monitor critical components or device conditions and to monitor product health and recommend maintenance actions remotely. This will enable immediate troubleshooting, which reduces travel expenses and labour hours for service engineers. Furthermore, continuous remote condition monitoring combined with remote assistance and agreed response times assure compliance with local emission regulations, process stability and continuous production.

Due to the performance of the GM32 in-situ gas analyser and the excellent cooperation between SICK and the operators at the Geseke plant, another HeidelbergCement plant in Germany has now also decided to equip its existing $DeNO_x$ system with two GM32 analysers for SCR control. The project is scheduled for completion in April 2020. This together with an open and intense information exchange during various environmental and process seminars have contributed to a strong partnership between SICK and HeidelbergCement.

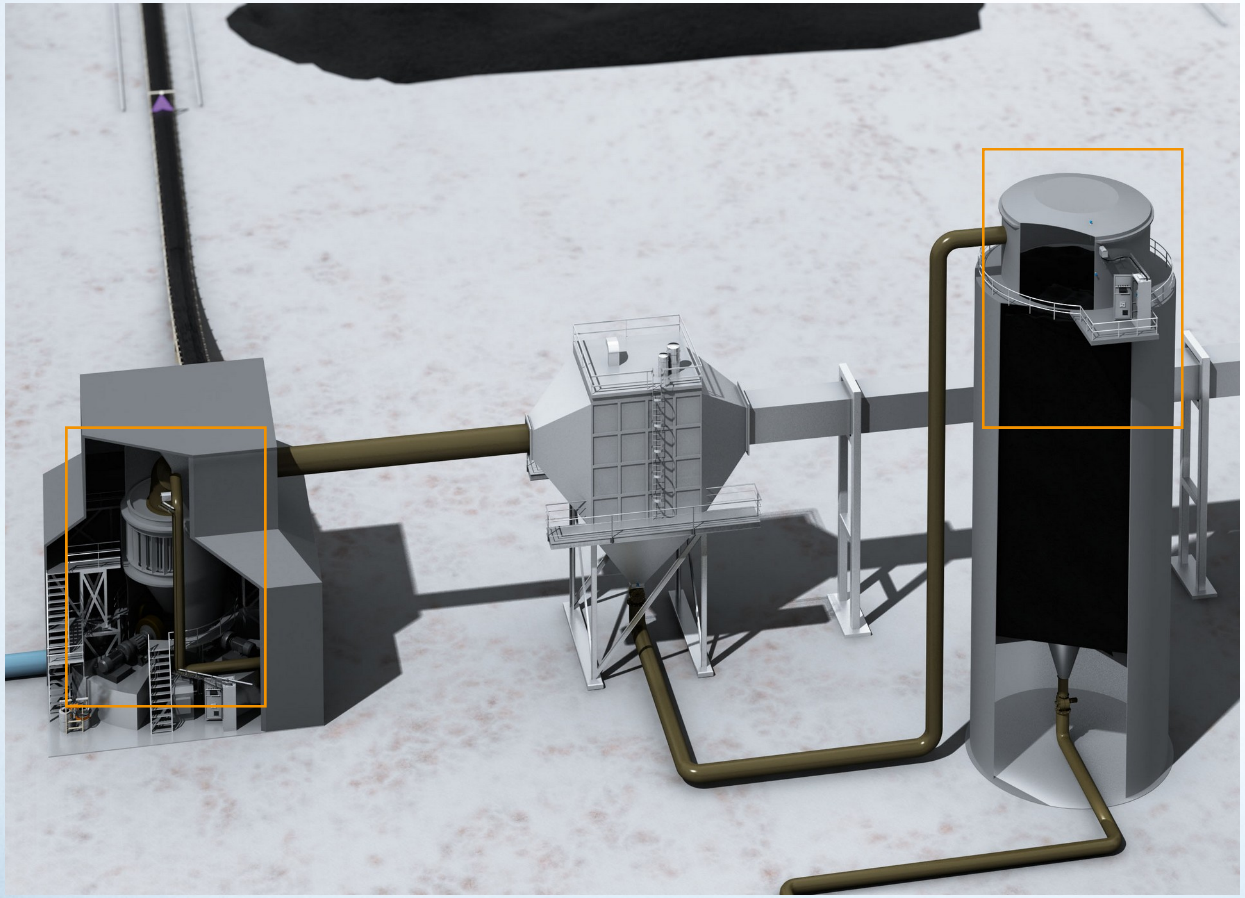
Below - Figure 5: Comparison of NH_3 response times between GM32 in-situ measurement at SCR inlet and CEMS at main stack.

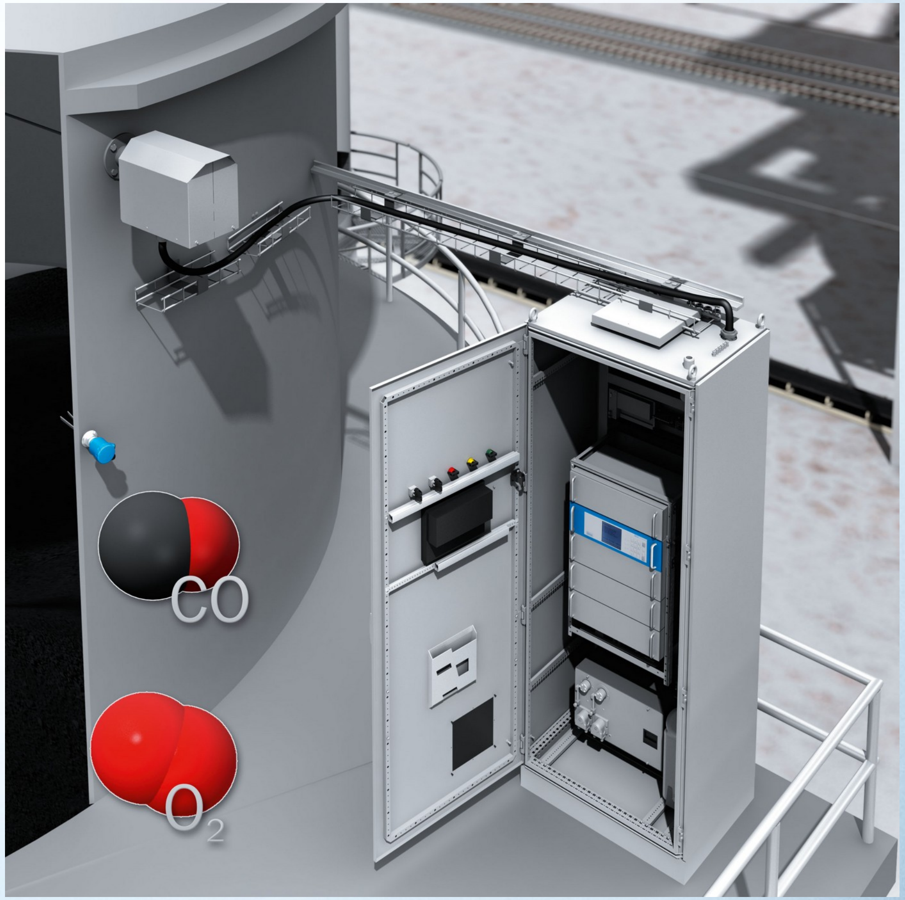
Urea injection (L/hr)
SCR inlet GM32 measurement (mg/m³) act.
Stack NH_3 online measurement (mg/m³) dry and real O_2
Absorption (Arbitrary Units)
500
400
300
200
100
0
19:31
19:31
19:28
19:45
19:27
19:00
19:15
19:30
19:45
20:00
20:15
20:30

Solutions & Field Installations

Coal Mill / Coal Silo

› Coal Handling





Solutions & Field Installations

Coal Mill / Coal Silo

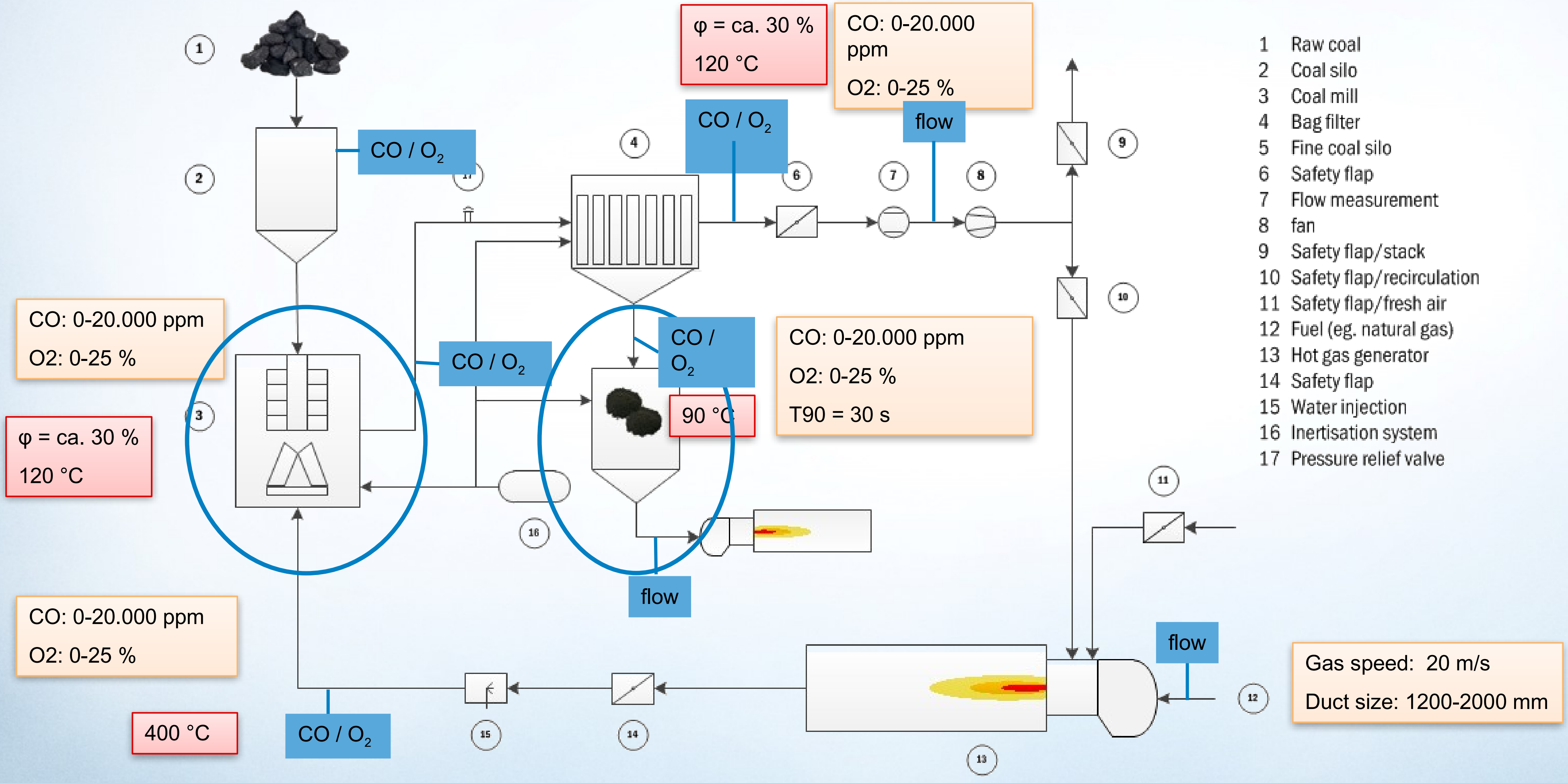
Typical Requested Measurement Ranges

CO	0 … 10.000 ppm
(O_2	0 … 21 %)

Solutions & Field Installations

Coal Mill / Coal Silo

› Exemplary Coal Handling Process



φ = ca. 30 %

120 °C

CO: 0-20.000 ppm

O2: 0-25 %

CO / O_2

flow

CO / O_2

CO: 0-20.000 ppm

O2: 0-25 %

φ = ca. 30 %

120 °C

CO / O_2

CO / O_2

90 °C

CO: 0-20.000 ppm

O2: 0-25 %

T90 = 30 s

flow

CO: 0-20.000 ppm

O2: 0-25 %

400 °C

CO / O_2

flow

Gas speed: 20 m/s

Duct size: 1200-2000 mm

1 Raw coal
2 Coal silo
3 Coal mill
4 Bag filter
5 Fine coal silo
6 Safety flap
7 Flow measurement
8 fan
9 Safety flap/stack
10 Safety flap/recirculation
11 Safety flap/fresh air
12 Fuel (eg. natural gas)
13 Hot gas generator
14 Safety flap
15 Water injection
16 Inertisation system
17 Pressure relief valve

Solutions & Field Installations

Coal Mill / Coal Silo

› System Overview

Gas sample probe
Ex or non-Ex
With back purge unit

Heated sample line
Ex or non-Ex

SIDOR
Gas Analyzer

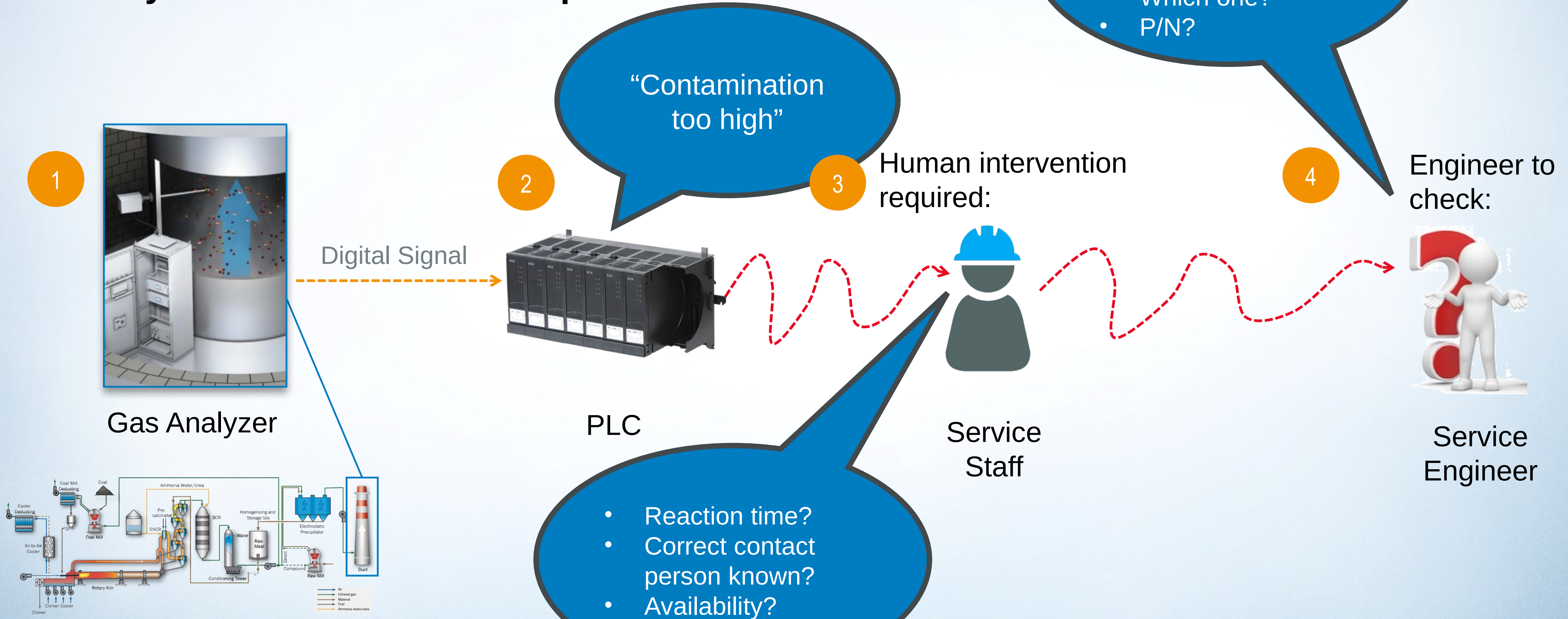
MKAS
Analyzing System

CO Safety Sensor

Solutions & Field Installations

Condition Monitoring

› Analyzer Maintenance in the past



1
Gas Analyzer
Digital Signal
2
PLC
3
4
Coal Mill Dedusting
Coal
Cooler Dedusting
Ammonia Water/Urea
Pre-calcinator
SNCR
SCR
Homogenizing and Storage Silo
Electrostatic Precipitator
Water
Raw Meal
Coal Mill
Air-to-Air Cooler
Direct
Compound
Raw Mill
Duct
Conditioning Tower
Rotary Kiln
Clinker Cooler
Clinker
Air
Exhaust gas
Material
Fuel
Ammonia water/urea

"Contamination too high"

Human intervention required:

- Reaction time?
- Correct contact person known?
- Availability?

Service Staff

Engineer to check:

- Why is this error message?
- Clean optics?
- Replace Filter?
- Which one?
- P/N?

Service Engineer

Solutions & Field Installations

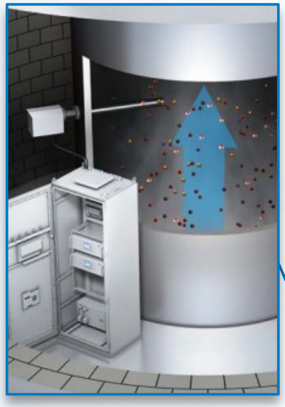
Condition Monitoring

- **Analyzer Maintenance today**

Condition Based /
Predictive Maintenance

“ I am Gas Analyzer MCS100FT S/N 15128032. The filter in my purge gas inlet will need to be replaced in the next 2 weeks, P/N 5306108.”

1



Gas Analyzer

Digital Signal/
Ethernet

2

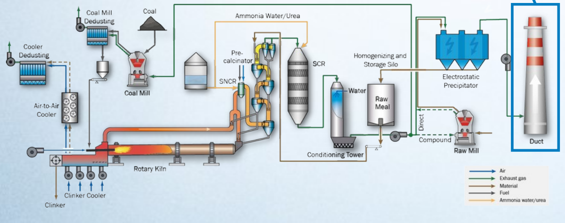
Monitoring
Gateway

https

4

Monitoring
Box

Service


Coal Mill
Dedusting
Coal
Cooler
Dedusting
Ammonia Water/Urea
Pre-
calcinator
SCR
Homogenizing and
Storage Silo
Electrostatic
Precipitator
SNCR
Coal Mill
Water
Raw
Meal
Air-to-Air
Cooler
Direct
Compound
Raw Mill
Duct
Conditioning Tower
Rotary Kiln
Clinker Cooler
Clinker
Air
Exhaust gas
Material
Fuel
Ammonia water/urea

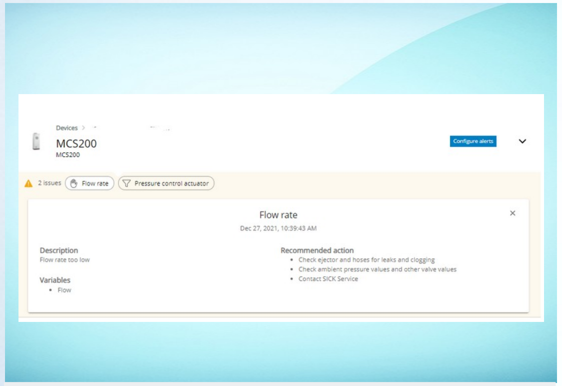
Preventive Maintenance

“I am dust measurement device DUSTHUNTER SB100, S/N 13258025: When you do service to stack 123 anyway, please also do my half-year maintenance.

Solutions & Field Installations

Condition Monitoring

› The 4 components of the online dashboard used by the cement plant



MCS200
MCS200

2 issues · Flow rate · Pressure control actuator

Flow rate
Dec 27, 2021, 10:39:43 AM

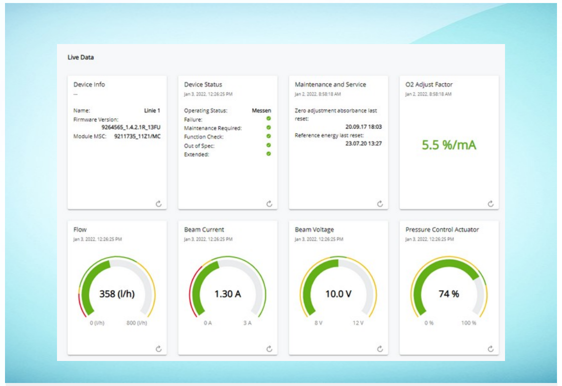
Description
Flow rate too low

Variables
- Flow

Recommended action
- Check ejector and hoses for leaks and clogging
- Check ambient pressure values and other valve values
- Contact SICK Service

Overview

- › Overview of the status, name and location
- › Including job recommendations


Live Data

Device Info
—
Name: Linie 1
Firmware Version: 9264565_1.4.2.1R_13FU
Module MSC: 9211735_11Z1/MC

Device Status
Jan 3, 2022, 12:26:25 PM
Operating Status: Messen
Failure: ✓
Maintenance Required: ✓
Function Check: ✓
Out of Spec: ✓
Extended: ✓

Maintenance and Service
Jan 2, 2022, 8:58:18 AM
Zero adjustment absorbance last reset: 20.09.17 18:03
Reference energy last reset: 23.07.20 13:27

O2 Adjust Factor
Jan 2, 2022, 8:58:18 AM
5.5 %/mA

Flow
Jan 3, 2022, 12:26:25 PM
358 (l/h)

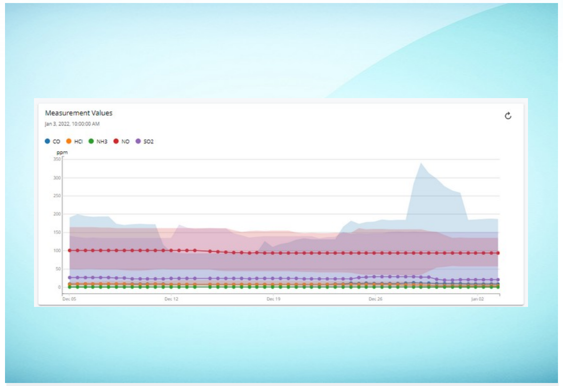
Beam Current
Jan 3, 2022, 12:26:25 PM
1.30 A

Beam Voltage
Jan 3, 2022, 12:26:25 PM
10.0 V

Pressure Control Actuator
Jan 3, 2022, 12:26:25 PM
74 %

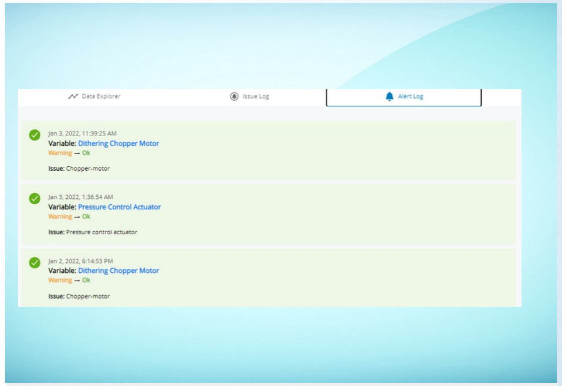
Live status data

- › Live view of internal temperatures, pressures etc.


Measurement Values
Jan 3, 2022, 10:00:00 AM

Historical data

- › Data within chronological context



Jan 3, 2022, 11:39:25 AM
Variable: Dithering Chopper Motor
Warning → Ok
Issue: Chopper-motor

Jan 3, 2022, 1:36:54 AM
Variable: Pressure Control Actuator
Warning → Ok
Issue: Pressure control actuator

Jan 2, 2022, 6:14:53 PM
Variable: Dithering Chopper Motor
Warning → Ok
Issue: Chopper-motor

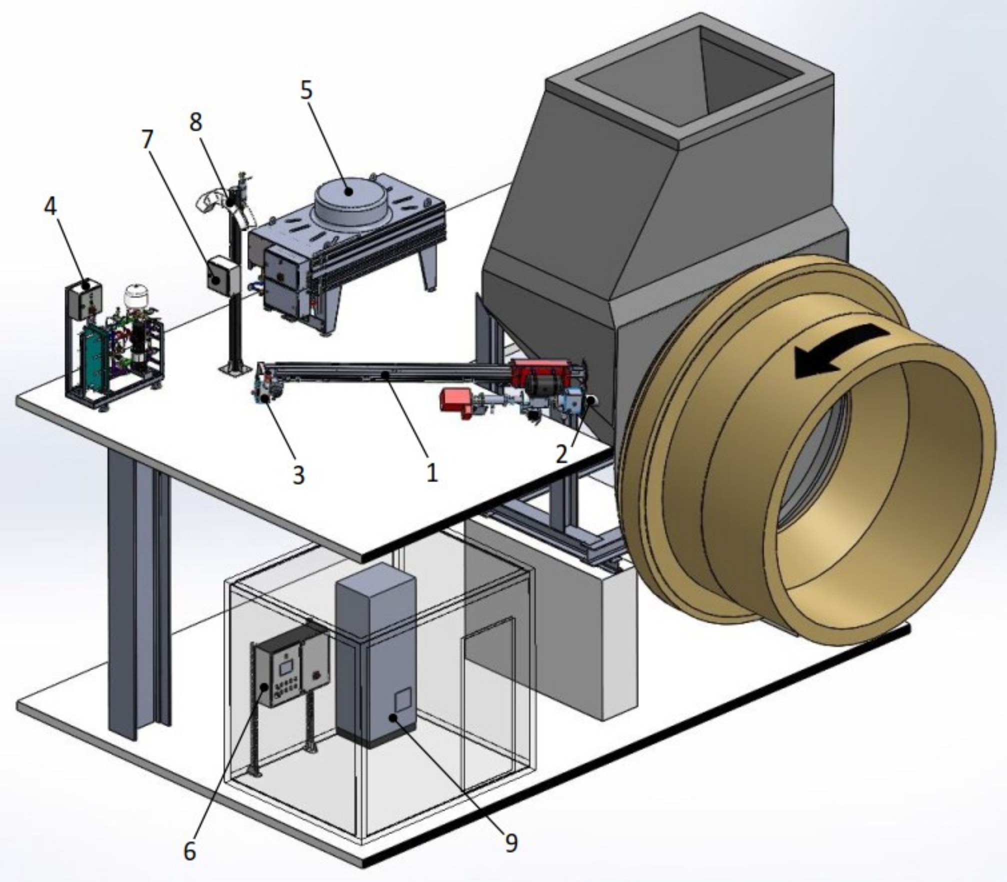
Issue and alert log

- › All issues and alerts will be logged

Solutions & Field Installations

Condition Monitoring

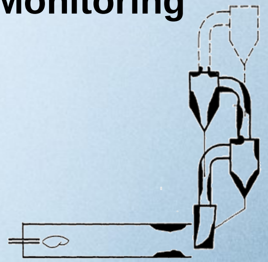
› Use Case – SCPS3300 (process gas monitoring)



1. Retraction unit with carriage; 2. Mounting flange plate with protection tube; 3. Local control cabinet; 4. Water/water cooler; 5. Air/water cooler; 6. PLC cabinet; 7. Instrument air pressure cabinet; 8. Cable & tube support stand; 9. MCS300P HW gas analyser

Data Usage	
Past	**Today**
CO, NO, O_2, SO_2, CO_2, H_2O, HCl	CO, NO, O_2, SO_2, CO_2, H_2O, HCl
	Temperatures
	Flows
	Currents
	Frequencies
	Voltages
	Pressure
	Vibration
	Positions
	Signal strength
	And many more…

Vital Sensor Data used for Condition Monitoring



Solutions & Field Installations

Condition Monitoring

Use Case – SCPS3300 (process gas monitoring)

Situation

- Project : Kiln inlet, Calciner & Preheater Process Gas Measurement

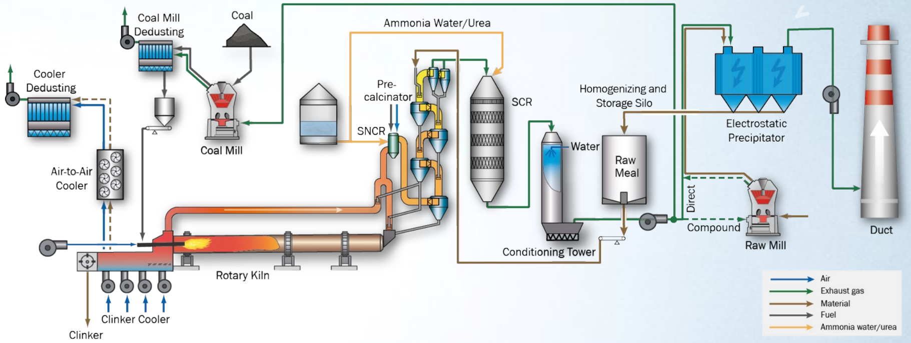
Most important points for plant

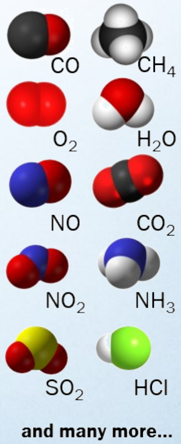
- Increase share of alternative fuels
- Measurement Availability > 90%
- Local Service reactivity
- Future RTO investment (flue gas treatment)
- Price

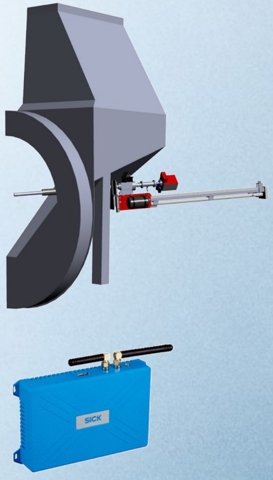
SICK Proposal

- Hardware (Probe & Analyzers) + Service Package incl. Cond. Mon.
- Optimization of predictive maintenance in 1st year
- 90% availability guaranteed (if not => SICK pays for trouble shootings)
- On-site service within 48h

→ **Higher availaibility without any major cost addings**


Coal Mill Dedusting
Coal
Ammonia Water/Urea
Cooler Dedusting
Pre-calcinator
SCR
Homogenizing and Storage Silo
Electrostatic Precipitator
SNCR
Water
Raw Meal
Coal Mill
Air-to-Air Cooler
Direct
Compound
Duct
Raw Mill
Conditioning Tower
Rotary Kiln
Clinker Cooler
Clinker
Air
Exhaust gas
Material
Fuel
Ammonia water/urea


CO
CH_4
O_2
H_2O
NO
CO_2
NO_2
NH_3
SO_2
HCl
and many more...

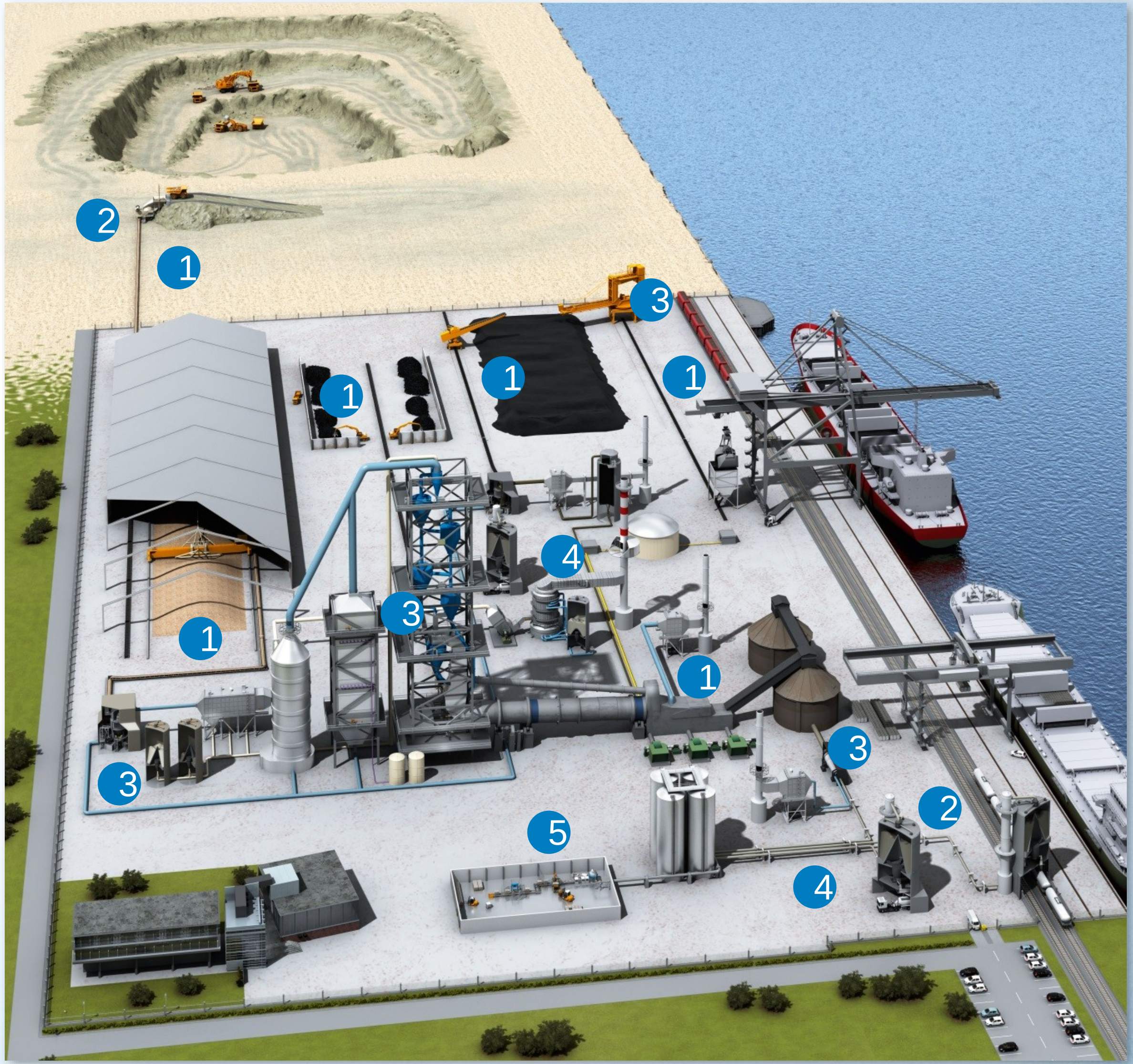


Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

- **Transportation of:**
  - Raw material & additives
  - Coal, petcoke & alternative fuels
  - Clinker
  - Cement
  - Cement bags
  - Pallets

① Belt conveyors
② Vibrating conveyors
③ Bucket conveyors
④ Pneumatic conveyors
⑤ Roller conveyors



Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

- **Non-contact volume flow measurement**
  - Infrared Class 1 Laser Scanner (safe under all conditions)
  - For all open conveyor types
  - Real time volume flow (13 ms)
  - Density & mass flow calculator; $\rho = \dot{m}/\dot{V}$
  - High operating range (0.5…20m)
  - Wide aperture angle (190°)
  - 5 echo-pulse technology

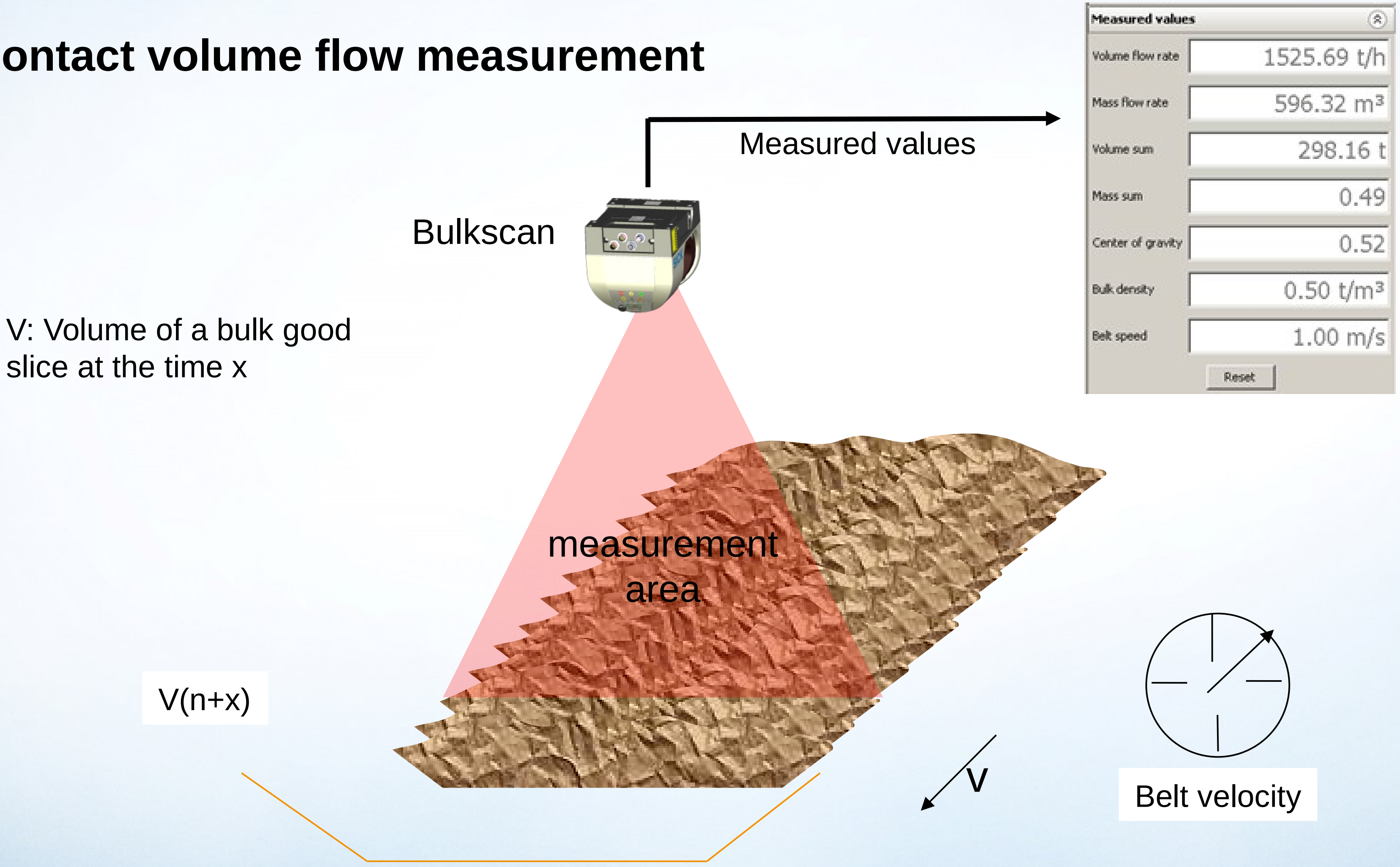
SICK
STOP
Q1
Q2
OK
CLASS 1 LASER PRODUCT

Bulkscan LMS511

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

› Non-contact volume flow measurement



Measured values

Bulkscan

V: Volume of a bulk good slice at the time x

measurement area

V(n+x)

V

Belt velocity

Measured values

Volume flow rate	1525.69 t/h
Mass flow rate	596.32 m³
Volume sum	298.16 t
Mass sum	0.49
Center of gravity	0.52
Bulk density	0.50 t/m³
Belt speed	1.00 m/s

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

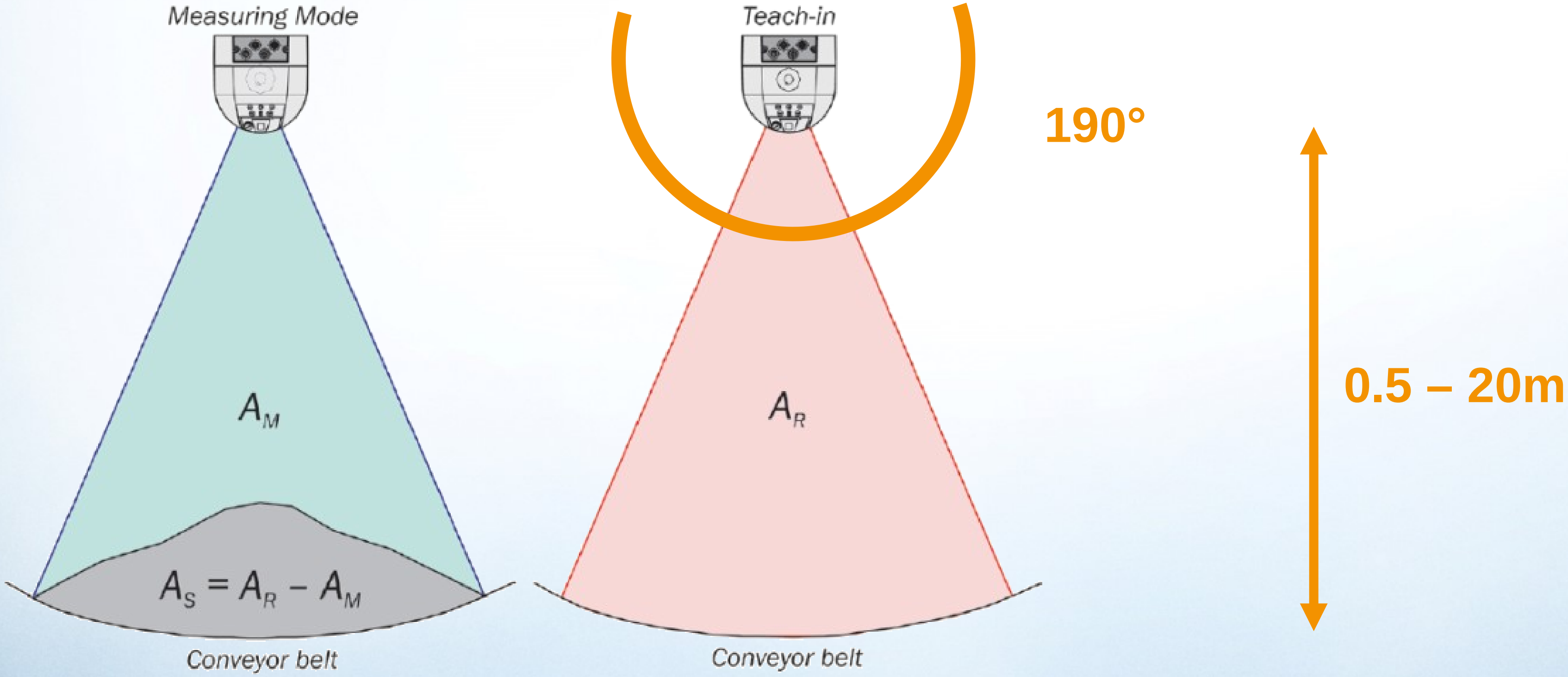
- **Non-contact volume flow measurement**
  - Light source: Infrared (905 nm)
  - Max. scan frequenzy: 35 Hz, 50 Hz, 75 Hz
  - Scanangle: 190°
  - Angle resolution: 0,5°
  - Response time: 13 ms, 20 ms, 30 ms
  - Laser class: 1, IEC 60825-1 (2007-6), eye-safe
  - Heating system yes
  - Ambient temperature: -30 ... +50°C
  - Degree of protection: IP67

Bulkscan LMS511

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

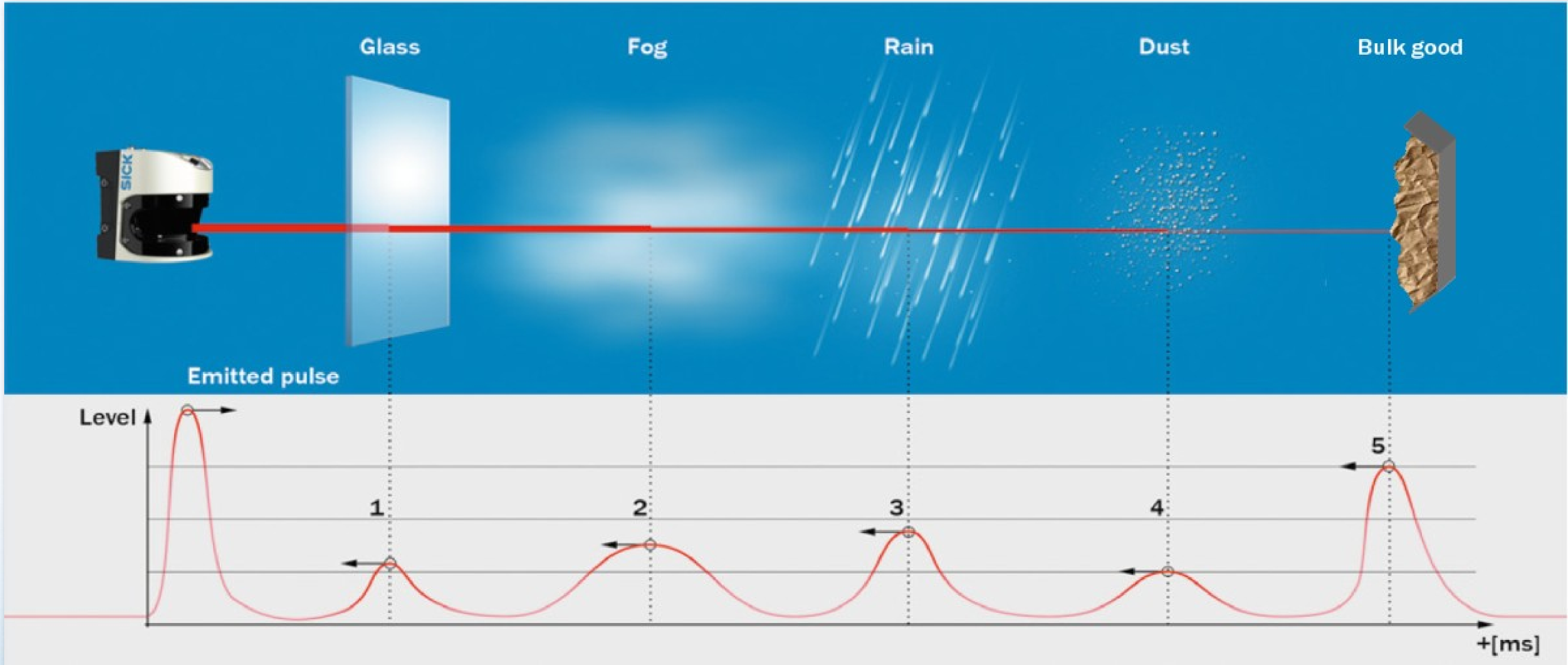
- **Non-contact volume flow measurement – Bulkscan LMS511**
  - High operating range (0.5…20m)
  - Wide aperture angle (190°)


Measuring Mode
Teach-in
190°
A_M
A_R
0.5 – 20m
$A_S = A_R - A_M$
Conveyor belt
Conveyor belt

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

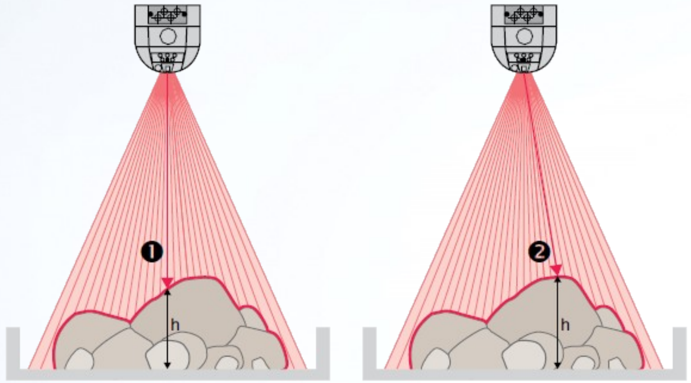
- **Non-contact volume flow measurement – Bulkscan LMS511**
  - 5 echo-pulse technology


Glass
Fog
Rain
Dust
Bulk good
Emitted pulse
Level
1
2
3
4
5
+[ms]

Solutions & Field Installations

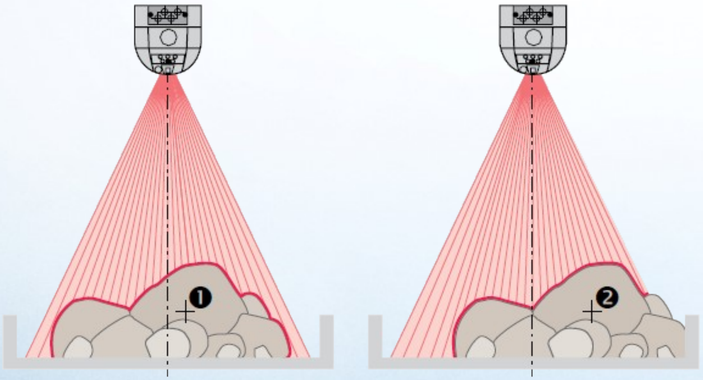
Conveyor Operation – Bulkscan LMS511

› Non-contact volume flow measurement – Bulkscan LMS511



Bulk height

Bulk edge & Conveyor edge



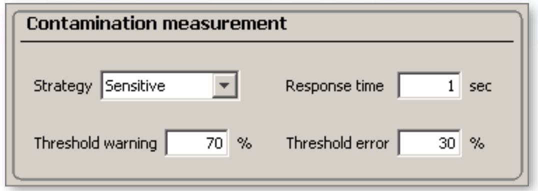
Center of gravity

- Increased belt life (loading alert)
- Minimum maintenance
- Non contact measurement
- Unaffected by environment
- High resolution

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

- **Non-contact volume flow measurement – Bulkscan LMS511**
  - Contamination Measurement
    - Information / Warning output
    - Diagnostics on the device
  - Bulk Height Measurement
    - Information / Warning output
    - Diagnostics on the device



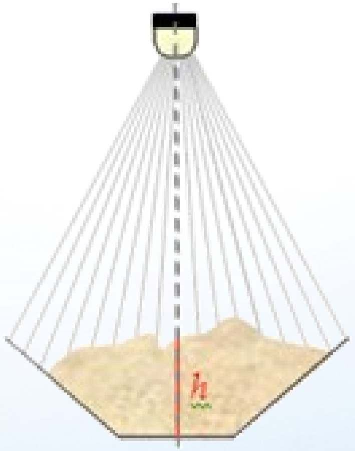
Contamination measurement

Strategy: Sensitive

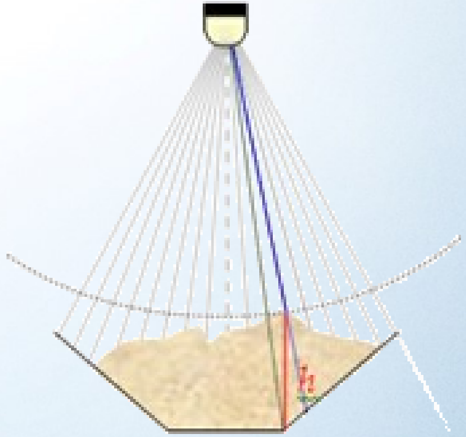
Response time: 1 sec

Threshold warning: 70 %

Threshold error: 30 %



Perpendicular point strategy

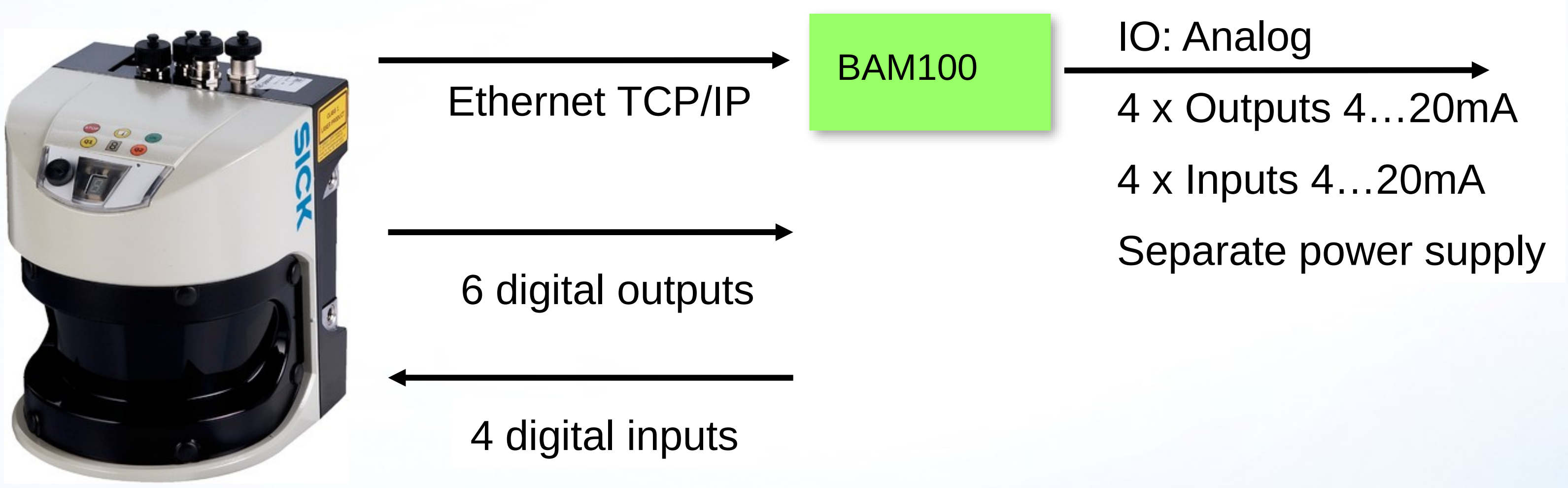


Highest point strategy

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

- **Non-contact volume flow measurement – Bulkscan LMS511**
  - Signals



Ethernet TCP/IP

BAM100

IO: Analog

4 x Outputs 4…20mA

4 x Inputs 4…20mA

Separate power supply

6 digital outputs

4 digital inputs

Profinet, Ethernet/IP

(function blocks for Siemens PLCs,

Rockwell PLCs, Beckhoff PLCs)

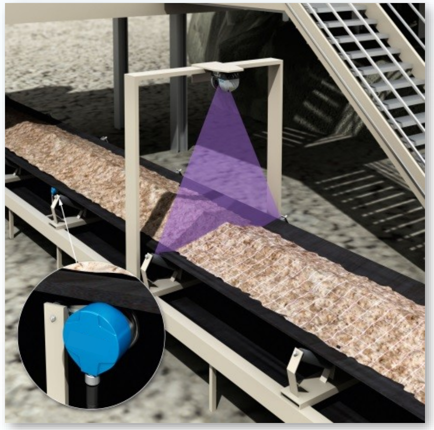
Others if required ?

Solutions & Field Installations

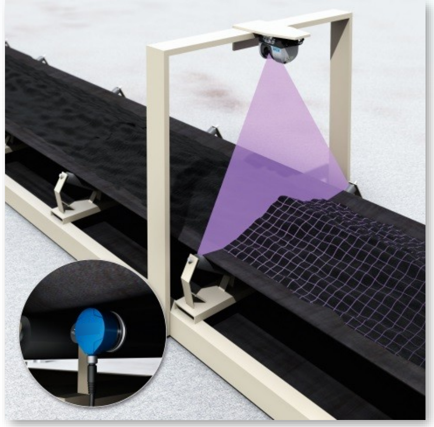
Conveyor Operation – Bulkscan LMS511

- **Non-contact volume flow measurement – Bulkscan LMS511**

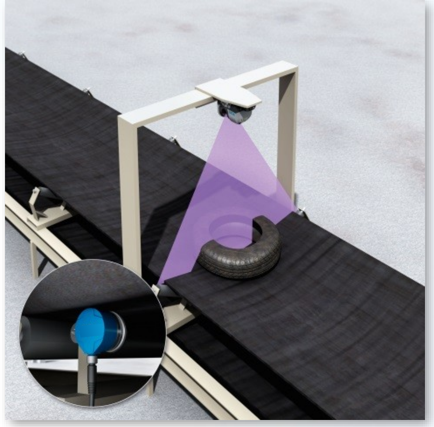
Crusher monitoring



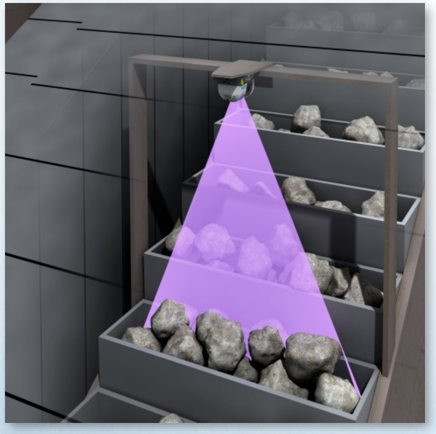
Raw material monitoring



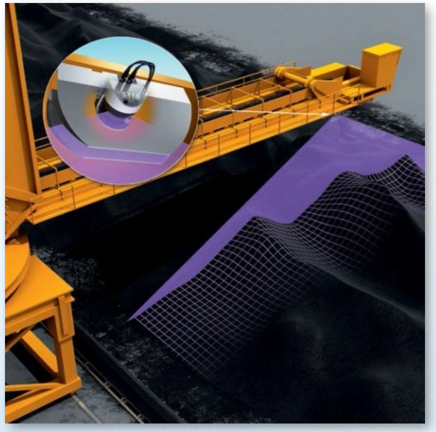
Coal / bulk fuel monitoring



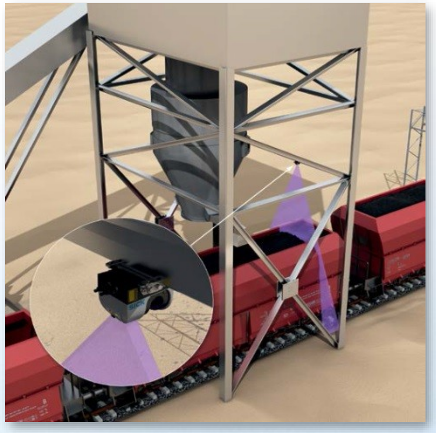
Alternative fuel monitoring



Clinker belt monitoring



Stock pile measurement



Truck / train filling

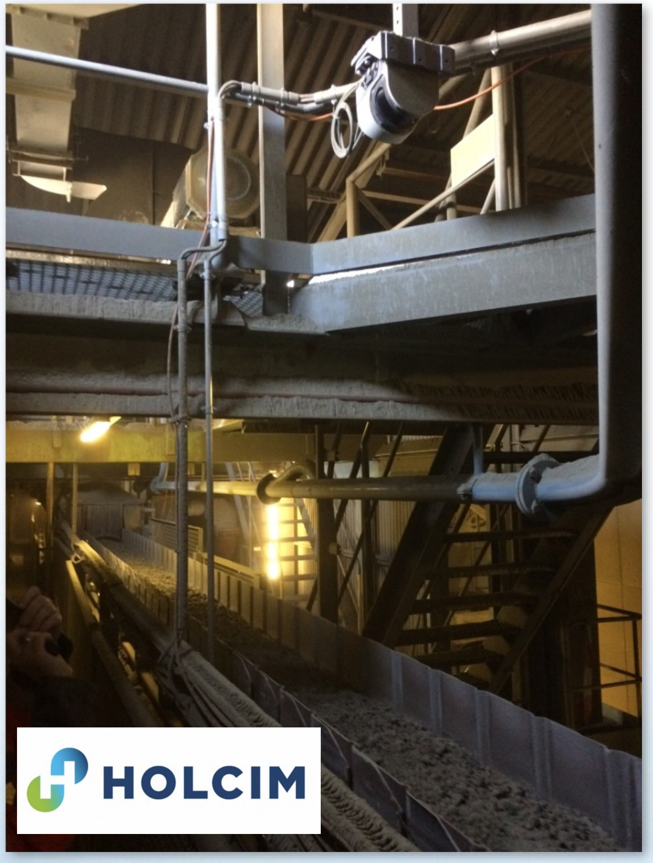
and many more…!

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

› Non-contact volume flow measurement – Bulkscan LMS511

- Installation on clinker cooler belt



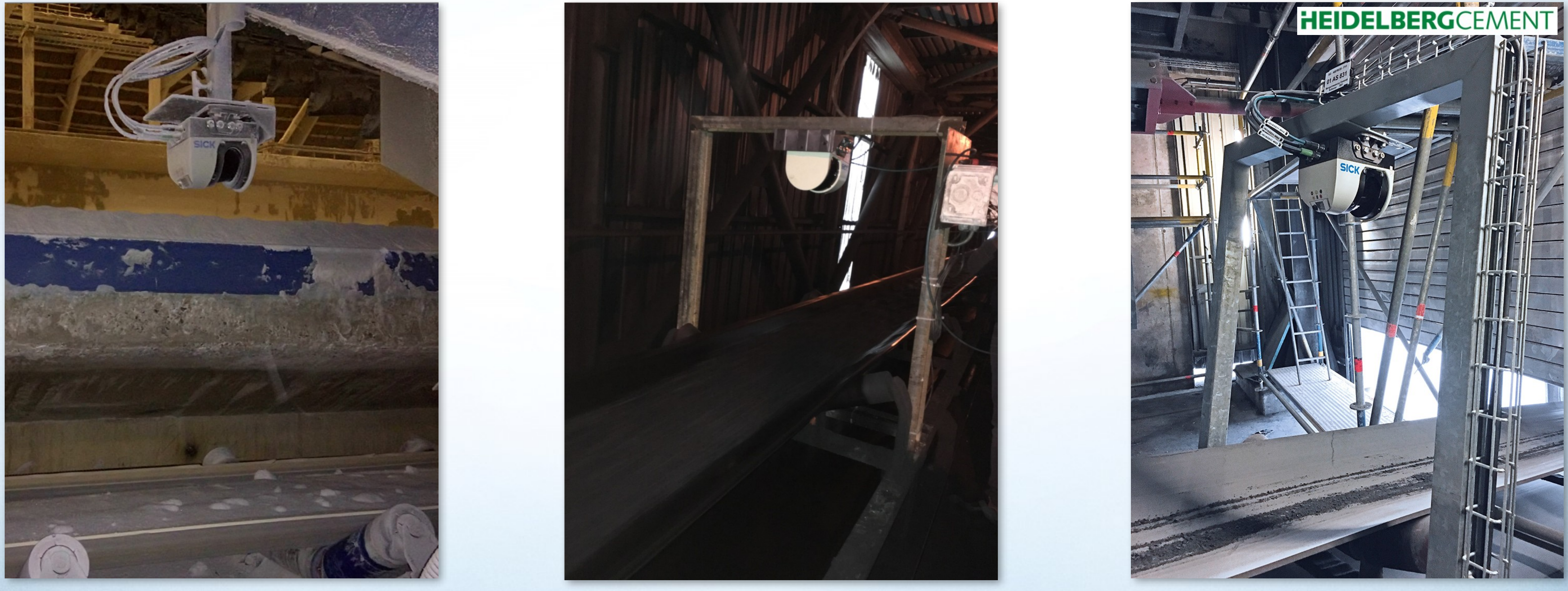
According to customer:

- Measuring accuracy of ± 2 %
- Device is working since 2 years without any maintenance demand

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

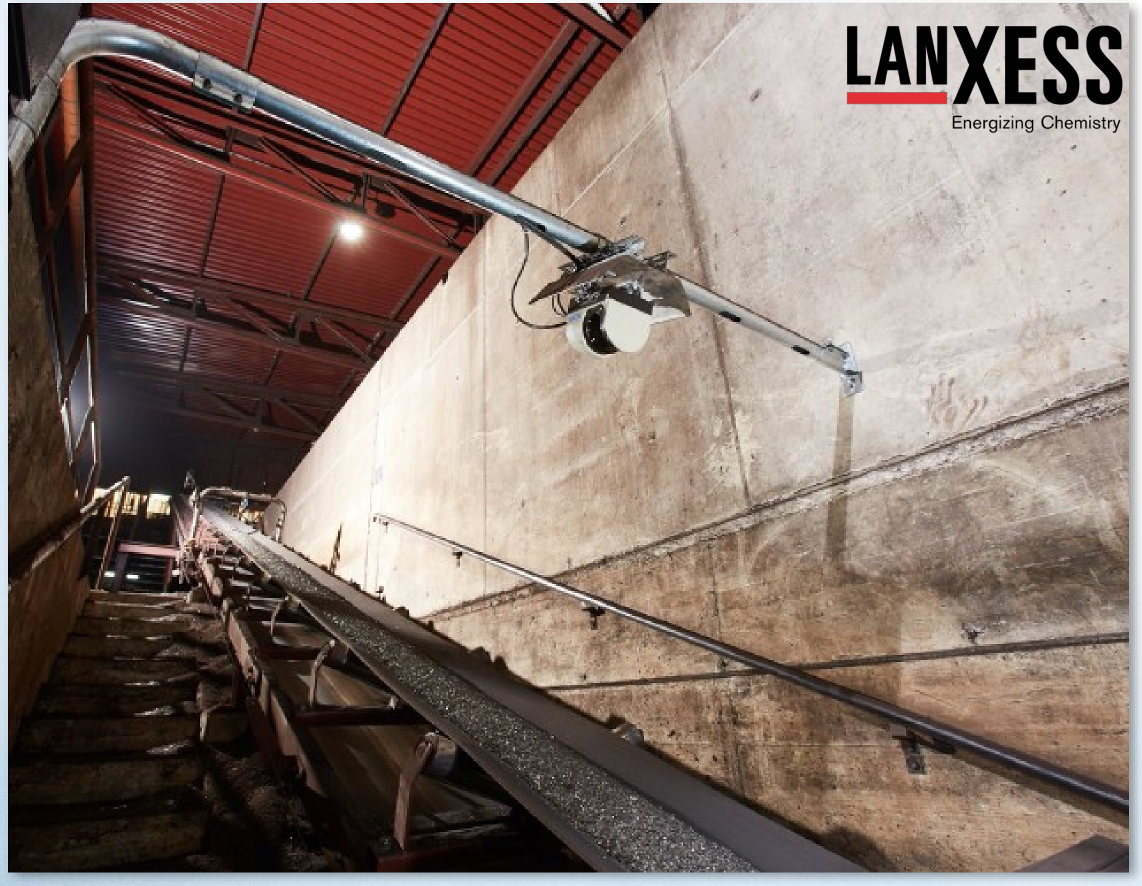
- **Non-contact volume flow measurement – Bulkscan LMS511**
  - Installation on raw material & coal & secondary raw material belt

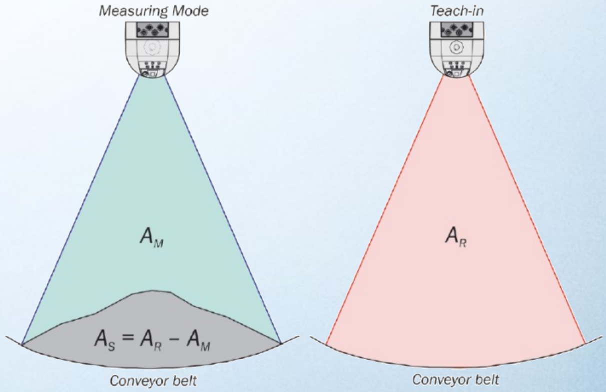


Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

- **Non-contact volume flow measurement** **– Bulkscan LMS511**
  - Installation on metal recycling belt


LANXESS
Energizing Chemistry


Measuring Mode
A_M
$A_S = A_R - A_M$
Conveyor belt
Teach-in
A_R
Conveyor belt

Solutions & Field Installations

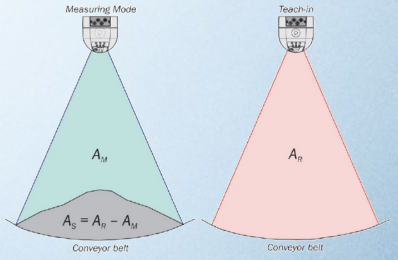
Conveyor Operation – Bulkscan LMS511

- **Non-contact volume flow measurement – Bulkscan LMS511**
  - And many more….

Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

VOTORANTIM
cimentos

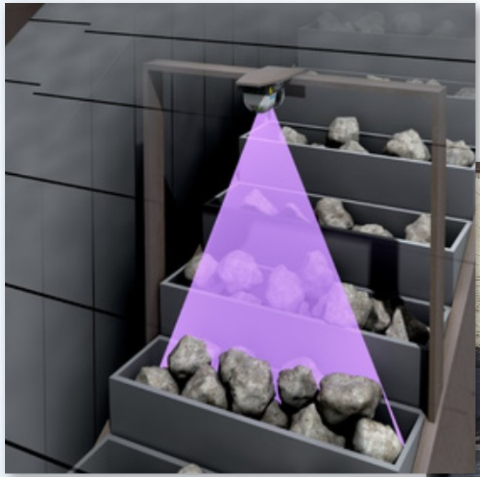

Measuring Mode
Teach-in
A_M
A_R
$A_S = A_R - A_M$
Conveyor belt
Conveyor belt

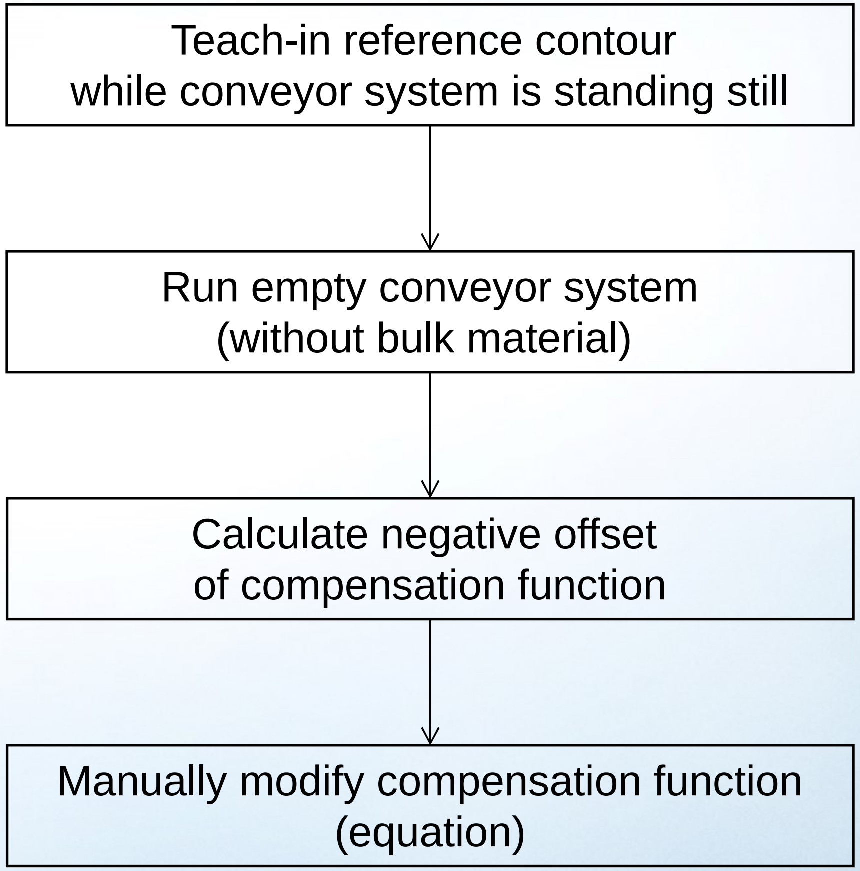
Solutions & Field Installations

Conveyor Operation – Bulkscan LMS511

Non-contact volume flow measurement – Bulkscan LMS511

- Sequence of bucket conveyor calibration





Teach-in reference contour
while conveyor system is standing still

Run empty conveyor system
(without bulk material)

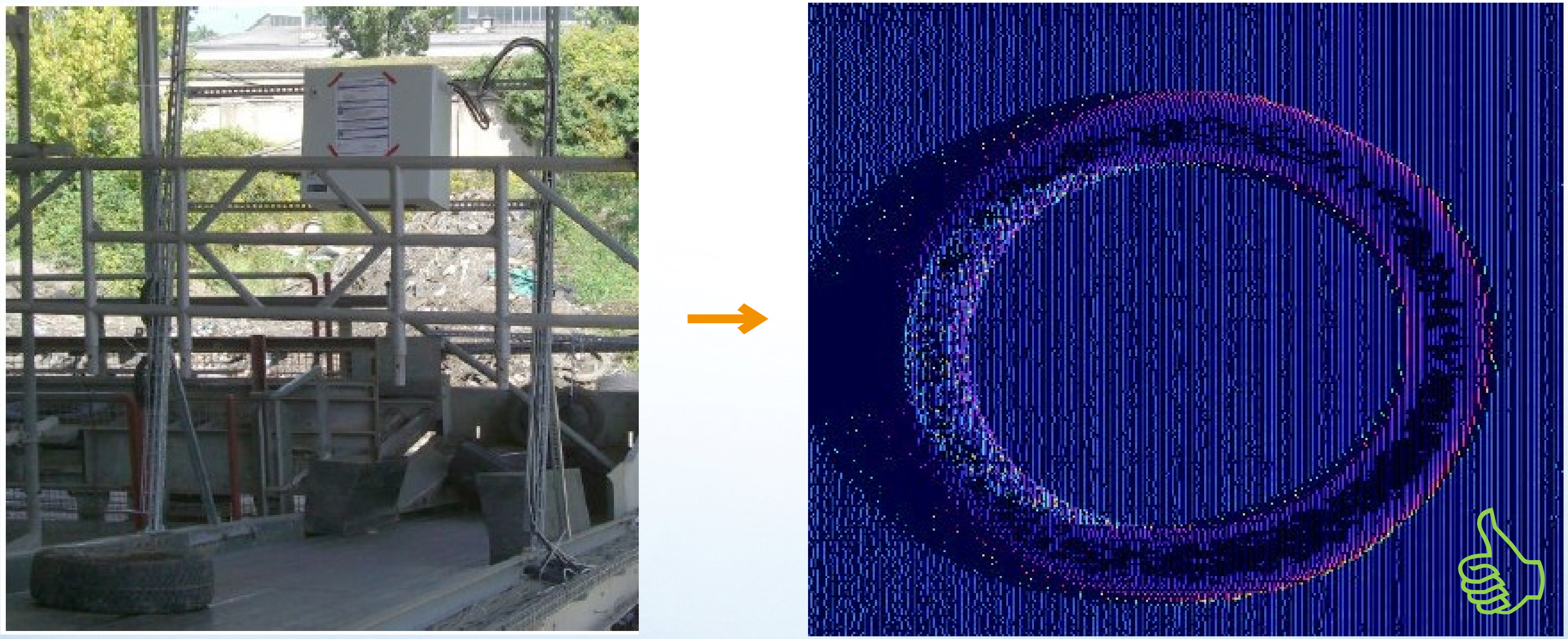
Calculate negative offset
of compensation function

Manually modify compensation function
(equation)

Solutions & Field Installations

Conveyor Operation – Tire/Rim Detection

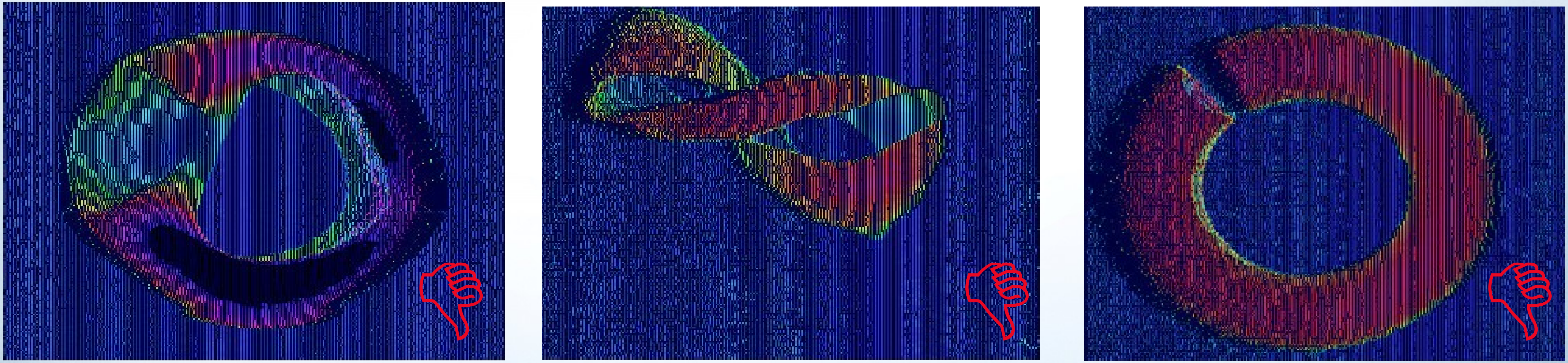
- **Non-contact 2D LiDAR Sensor + Encoder**
  - Tire / rim detection system for separation unit
  - Sorting out of broken tires and rims



Solutions & Field Installations

Conveyor Operation – Tire/Rim Detection

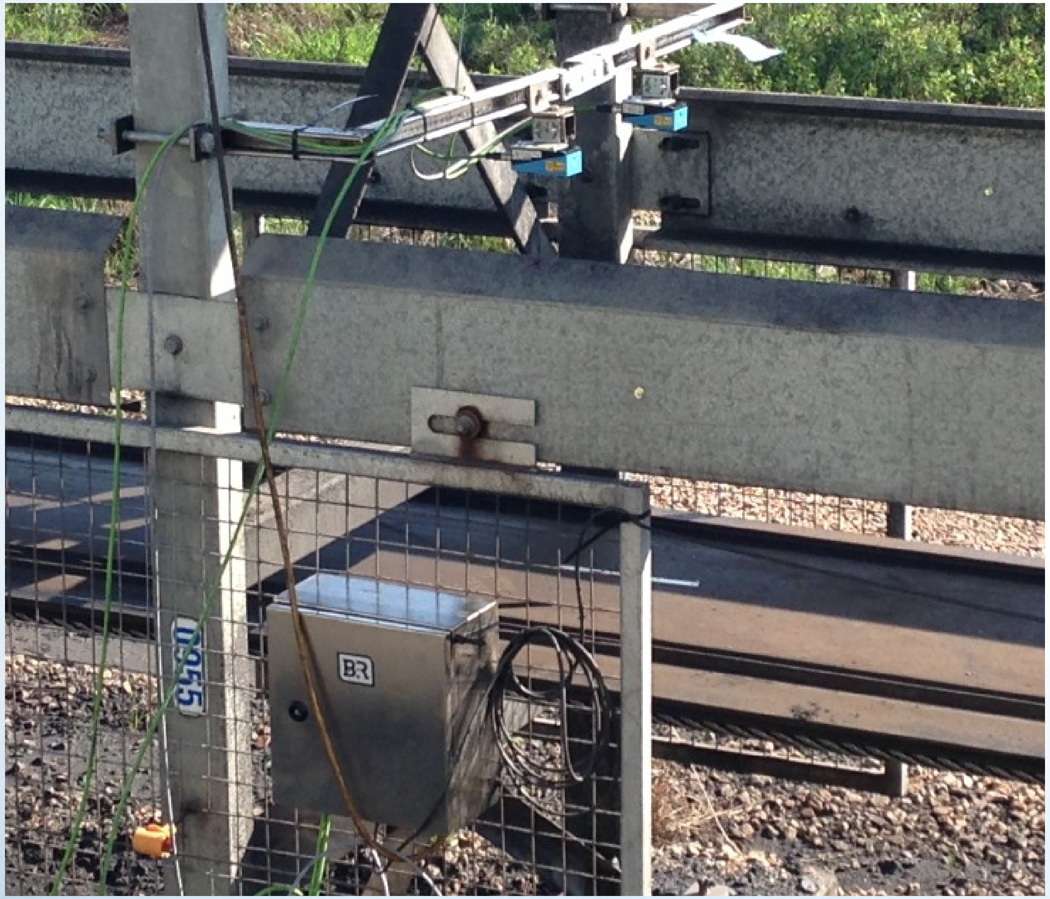
- **Non-contact 2D LiDAR Sensor + Encoder**
  - Tire / rim detection system for separation unit → Guarantee of continuous fuel flow

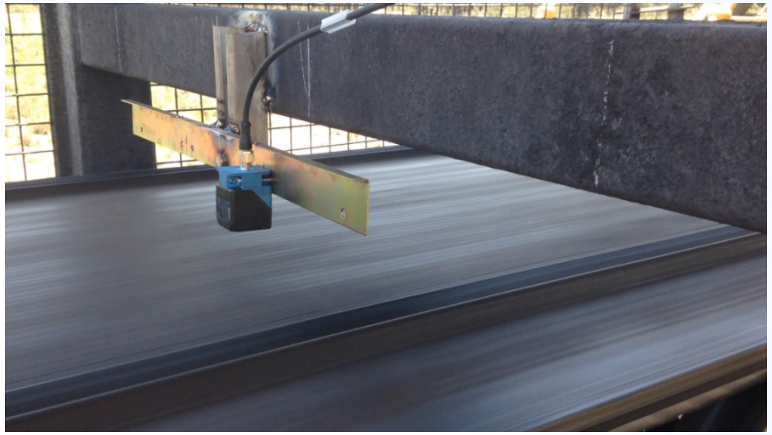


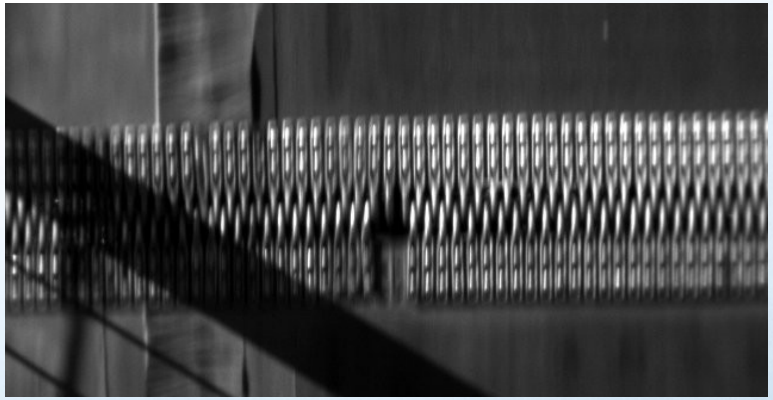
Solutions & Field Installations

Conveyor Operation – Belt Drift & Staple Wear Detection

› Wear detection on conveyor staples


Camera mounted to capture belt staple

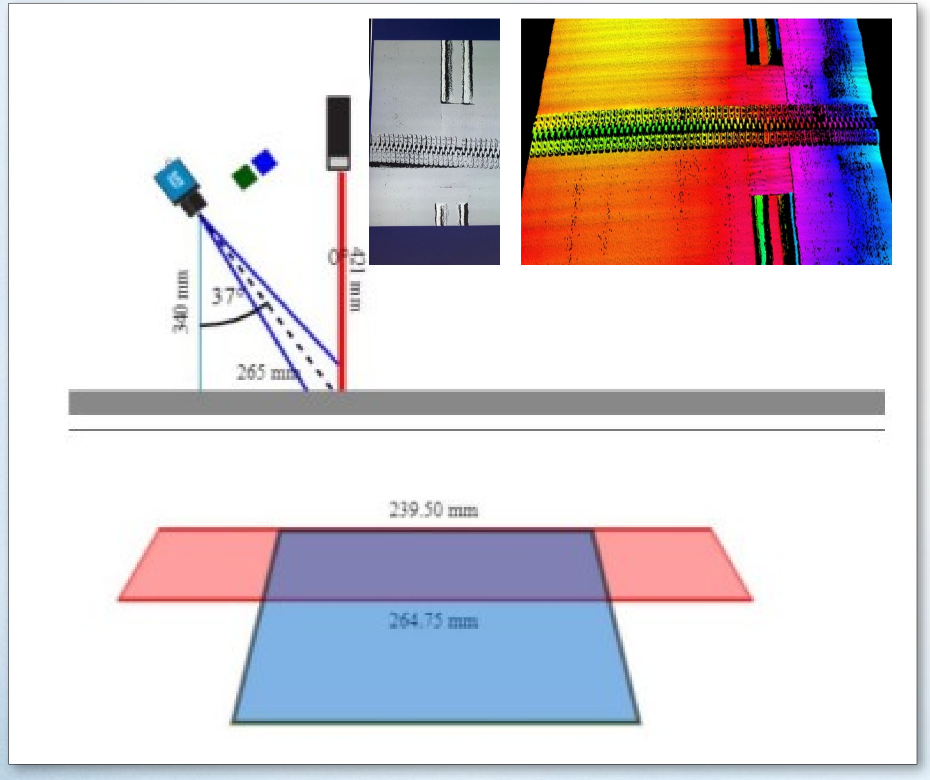

Inductive sensor triggering from staples


Belt Splice captured (belt running at 6 m/s)

Solutions & Field Installations

Conveyor Operation – Belt Drift & Staple Wear Detection

- **Belt Rip and Broken Splice Detection**
  - 3D Streaming Camera + Encoder + RFID + Software

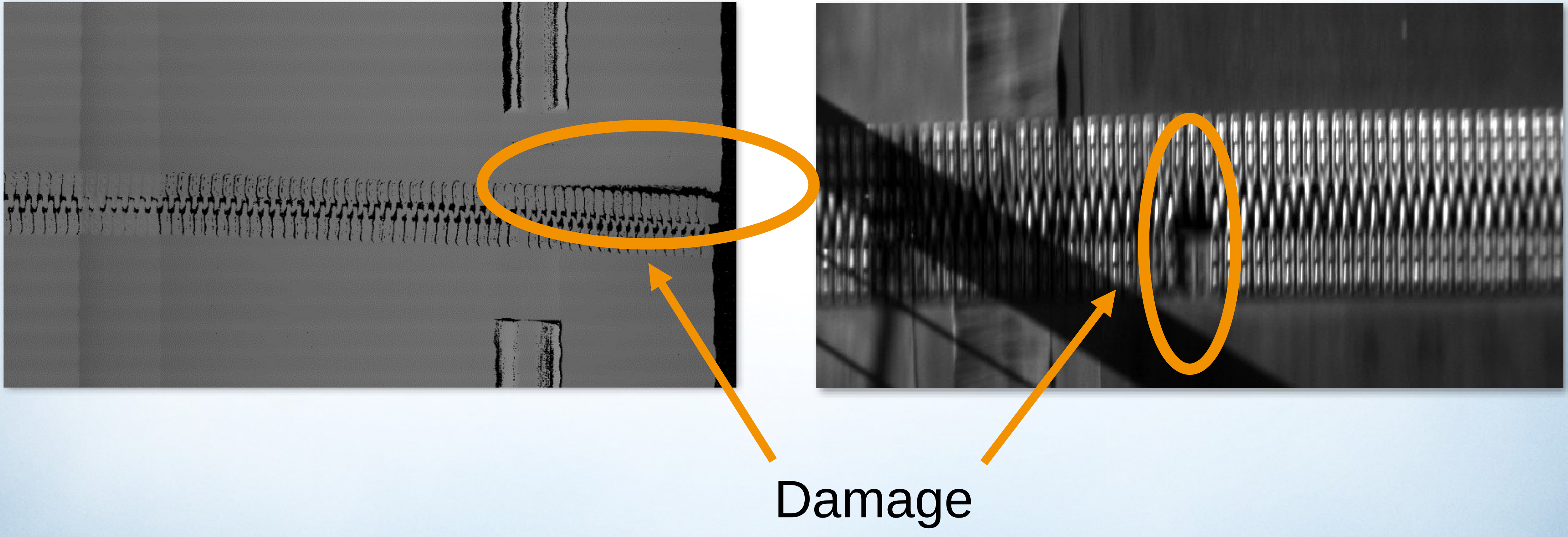

340 mm
37°
265 mm
0°
421 mm
239.50 mm
264.75 mm

SICK
Ranger3

Solutions & Field Installations

Conveyor Operation – Belt Drift & Staple Wear Detection

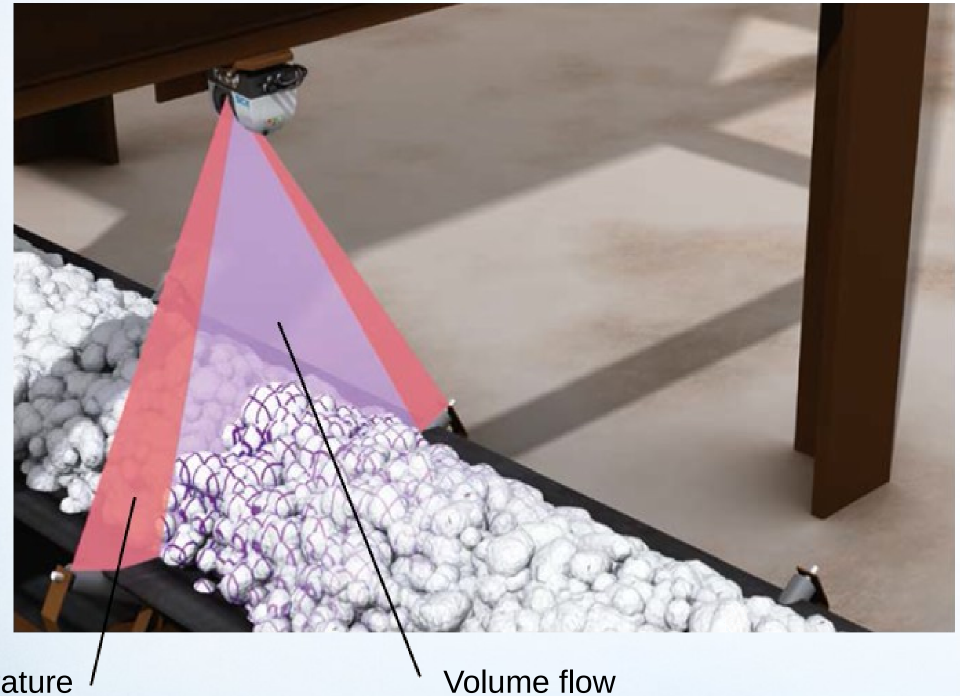
- **Belt Rip and Broken Splice Detection**
  - 3D Streaming Camera + Encoder + RFID + Software


Damage

Solutions & Field Installations

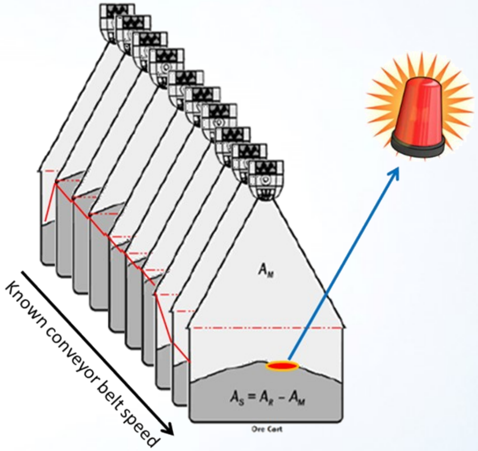
Conveyor Operation – Conveyor Hot Spot Detection (CHD) System

- **Early fire detection / prevention of silo fires – CHD System**
  - Stop of conveyor belt in case temperature exceeds limit value



Temperature Measurement (e.g. IR camera)

Volume flow Measurement (by Bulkscan LMS511)

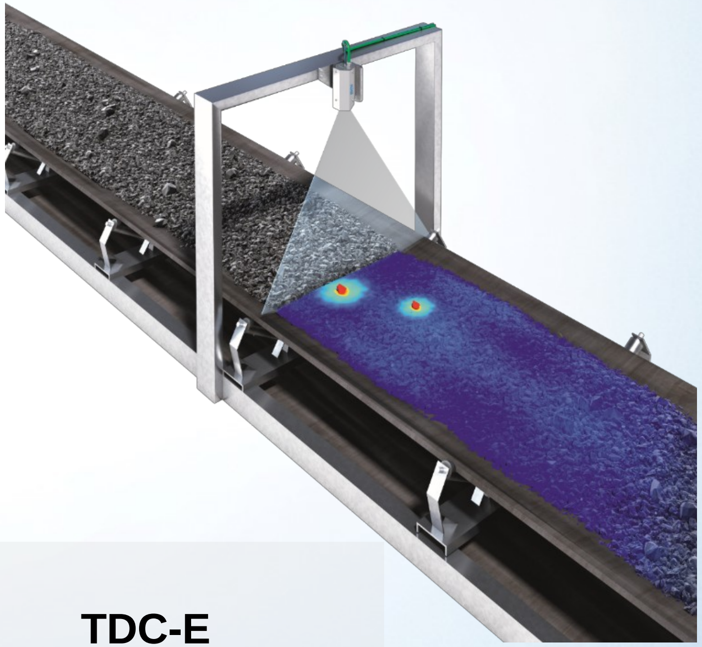

Known conveyor belt speed
A_M
$A_S = A_R - A_M$
Ore Cart

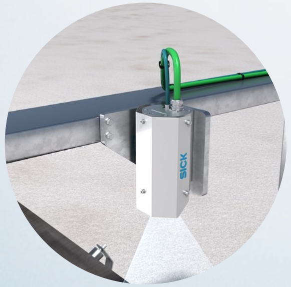
Solutions & Field Installations

Conveyor Operation – Conveyor Hot Spot Detection (CHD) System

› Early fire detection / prevention of silo fires – CHD System

- The Conveyor Hotspot Detection System deploys thermal imaging cameras to detect fire hazards at an early stage.
- The system continuously and fully automatically measures the temperature of the transported material.
- As soon as a hotspot above the defined limit is detected an alarm is sent out.





Thermal Camera

Thermal imaging camera for measuring and visualizing the temperature of the material passing by.

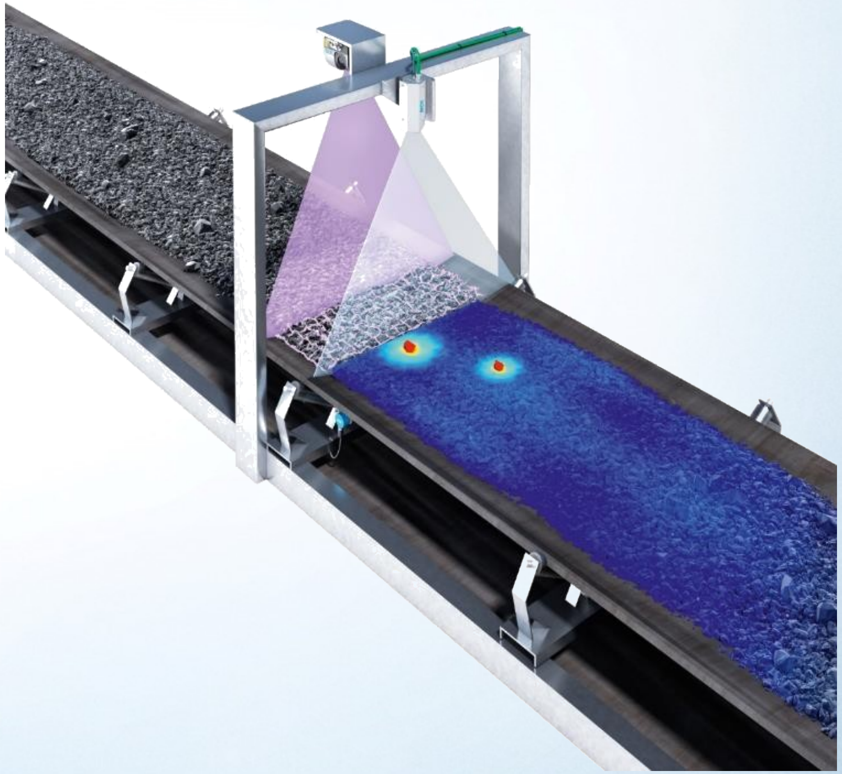
TDC-E

The TDC-E as Controller for process, visualize and pass on the measurement data.

Solutions & Field Installations

Conveyor Operation – Conveyor Hot Spot Detection (CHD) System

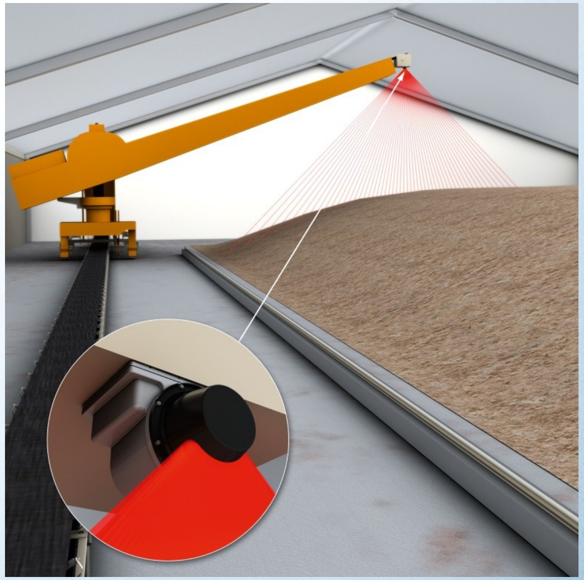
- **Conveyor hotspot detection combined with SICK Bulkscan®**
  - Non-contact time-of-flight technology to measure the volume flow of bulk materials on conveyor belts.
  - Reliable volume flow signal irrespective of weather conditions thanks to multi-echo technology.
  - Additional features:
    - Level measuring
    - Center of gravity
    - Belt monitoring



Solutions & Field Installations

Stock Pile & Silo Level Monitoring

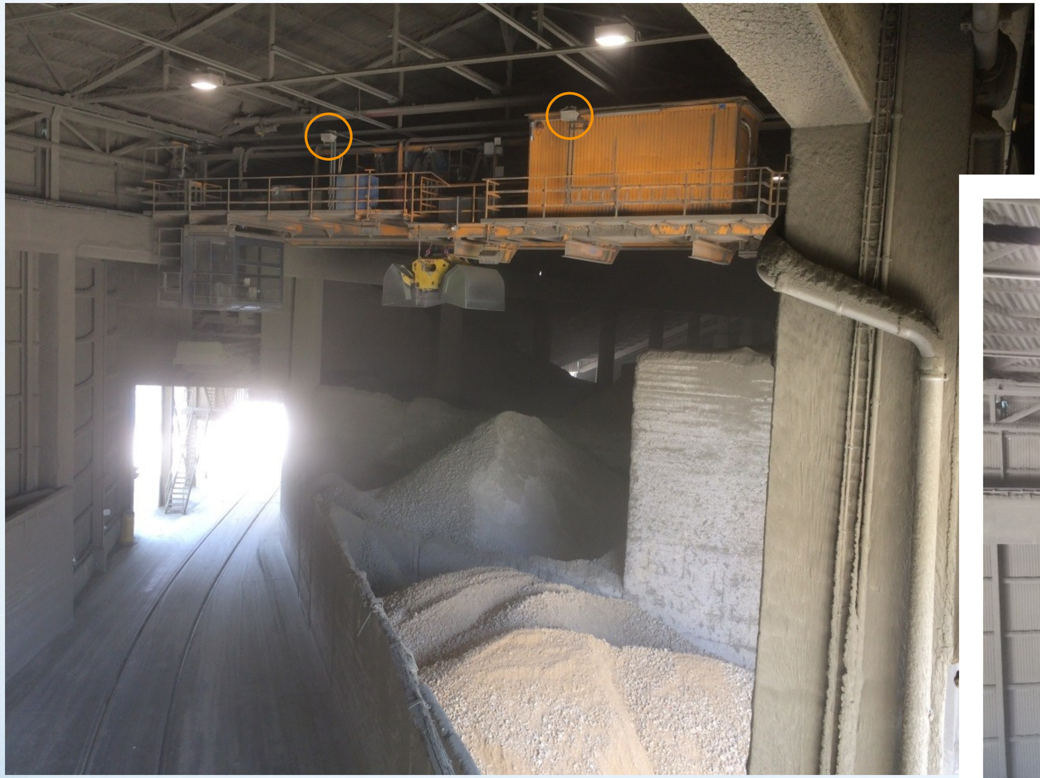
- **Stock pile measurement**
  - e.g. for raw material & bulky/alternative fuels
  - Contour, volume, distance measurement using 2D LiDAR sensors
  - Preventing dust formation & collisions
  - Optimized material handling & machine positioning



Solutions & Field Installations

Stockpile & Silo Level Monitoring

- **Stockpile measurement**
  - Crane automation

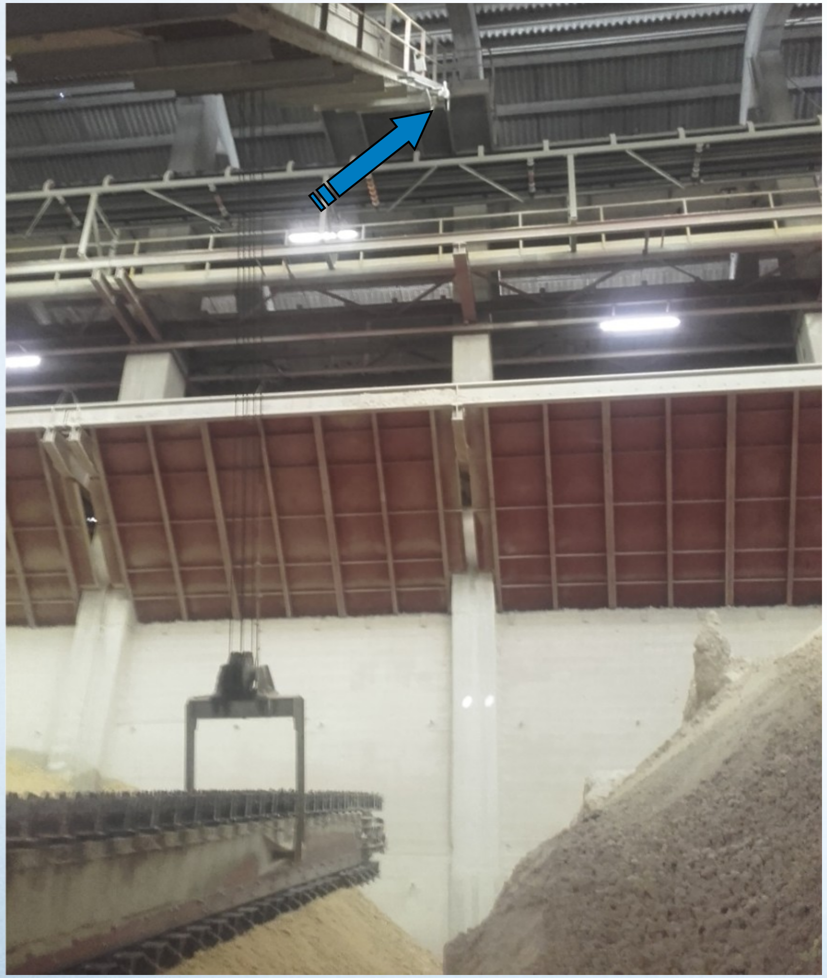


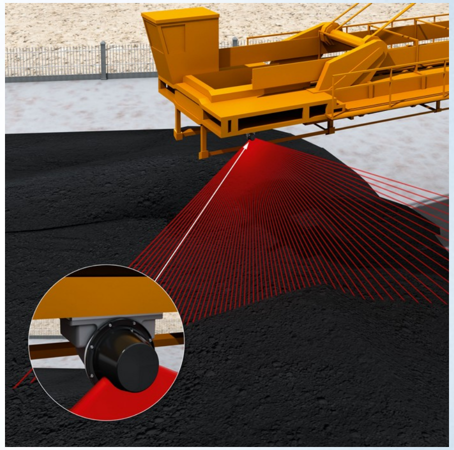
LD-LRS

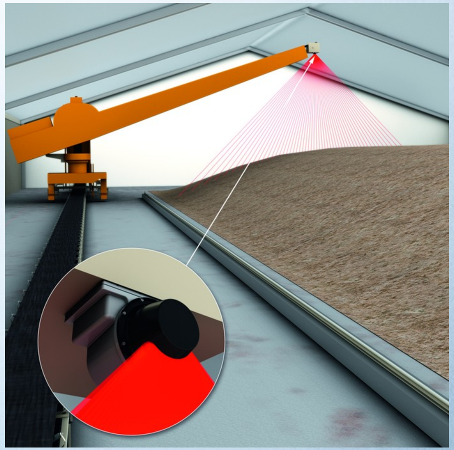
Solutions & Field Installations

Stockpile & Silo Level Monitoring

- **Reclaimer control / level measurement using LMS111**



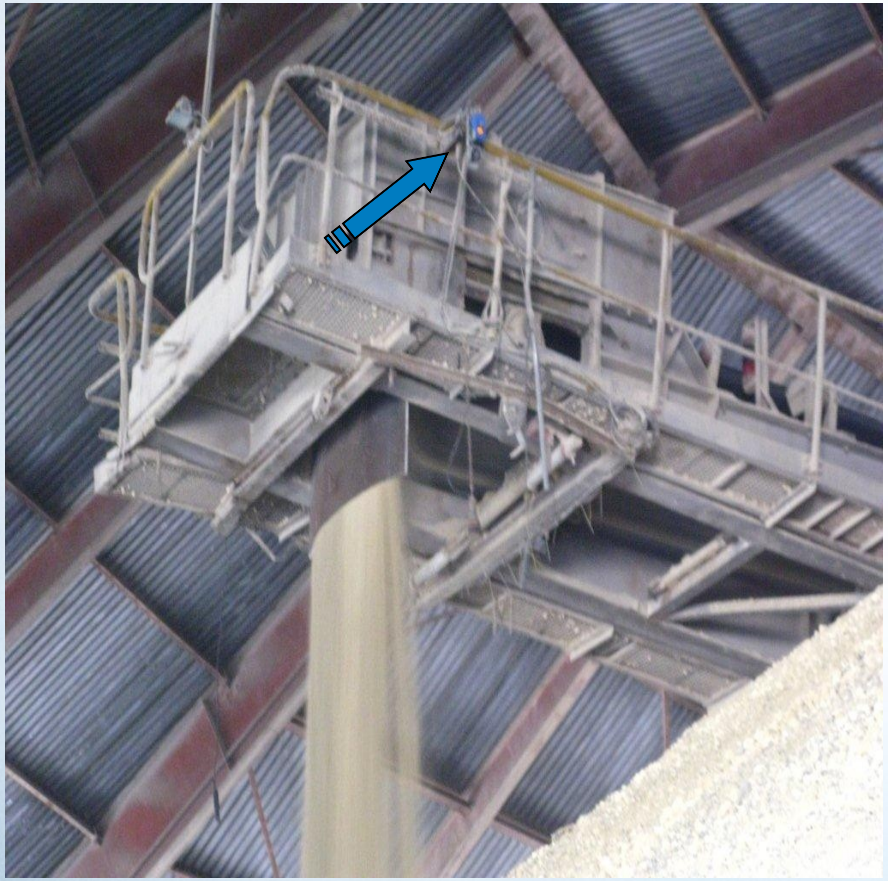


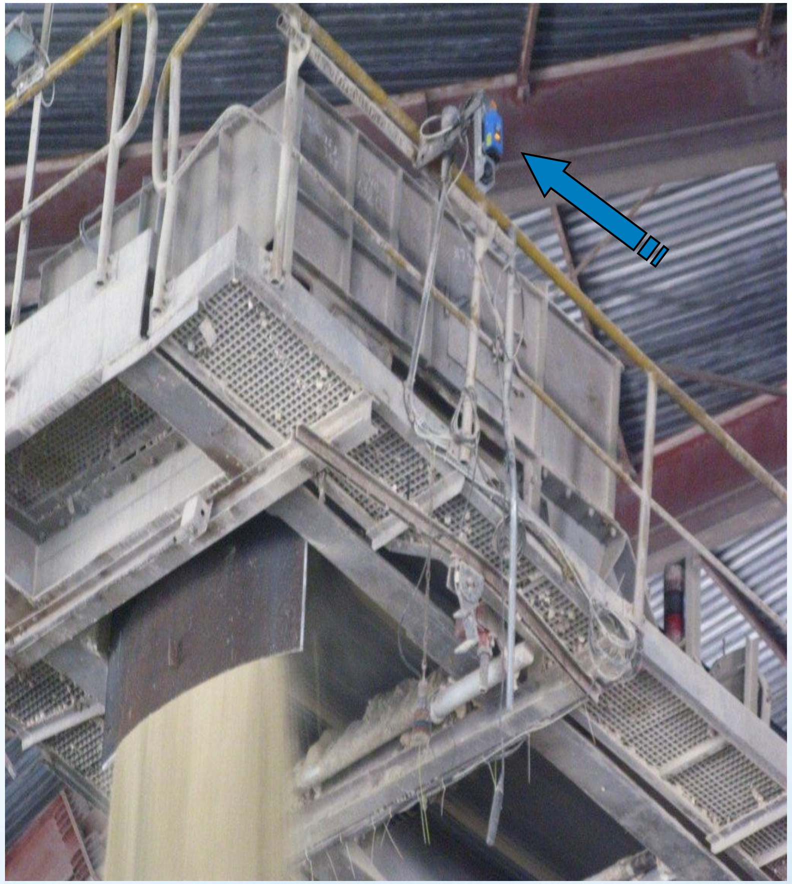


Solutions & Field Installations

Stockpile & Silo Level Monitoring

- **Stacker control / level measurement using DT500**

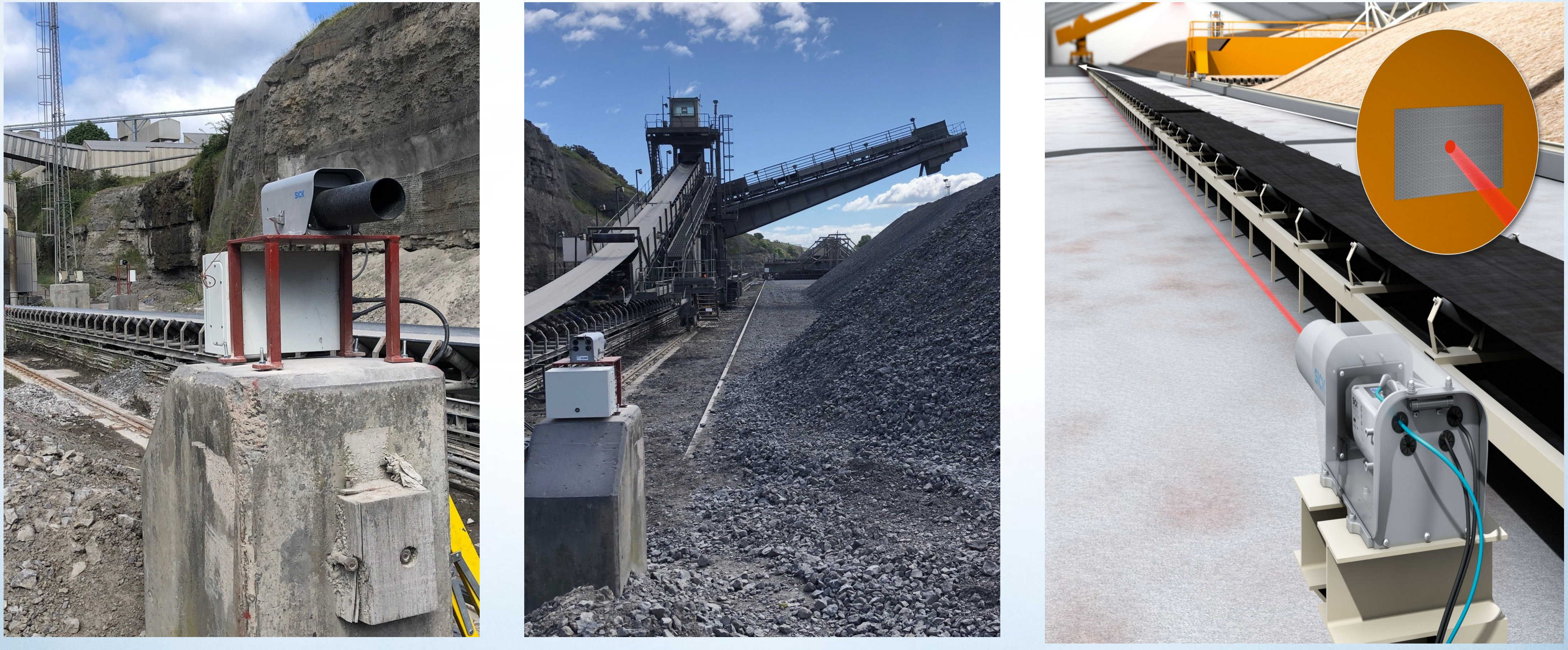




Solutions & Field Installations

Stockpile & Silo Level Monitoring

- **Stacker control / distance measurement using Dx1000**

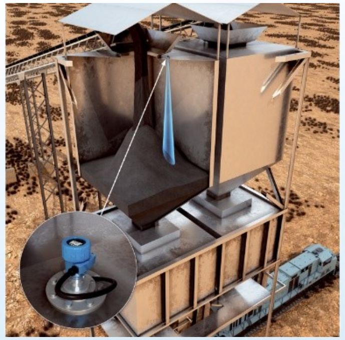


Solutions & Field Installations

Stockpile & Silo Level Monitoring

Silo Level Measurment – SicWave LBR

- Free Space radar sensor
  - 80 GHz free space non-contact radar level sensor for bulk solids
  - Flexible measuring range up to 120 m
  - Process temperature range -40°C … +200°C
  - Process pressure -1 … 20 bar
  - Plastic or aluminum housing
  - Enclosure rating IP66/IP67 and IP66/IP68
  - Ex-approvals
  - 4…20 mA (2-wire) with HART communication
  - Bluetooth incl. level-app

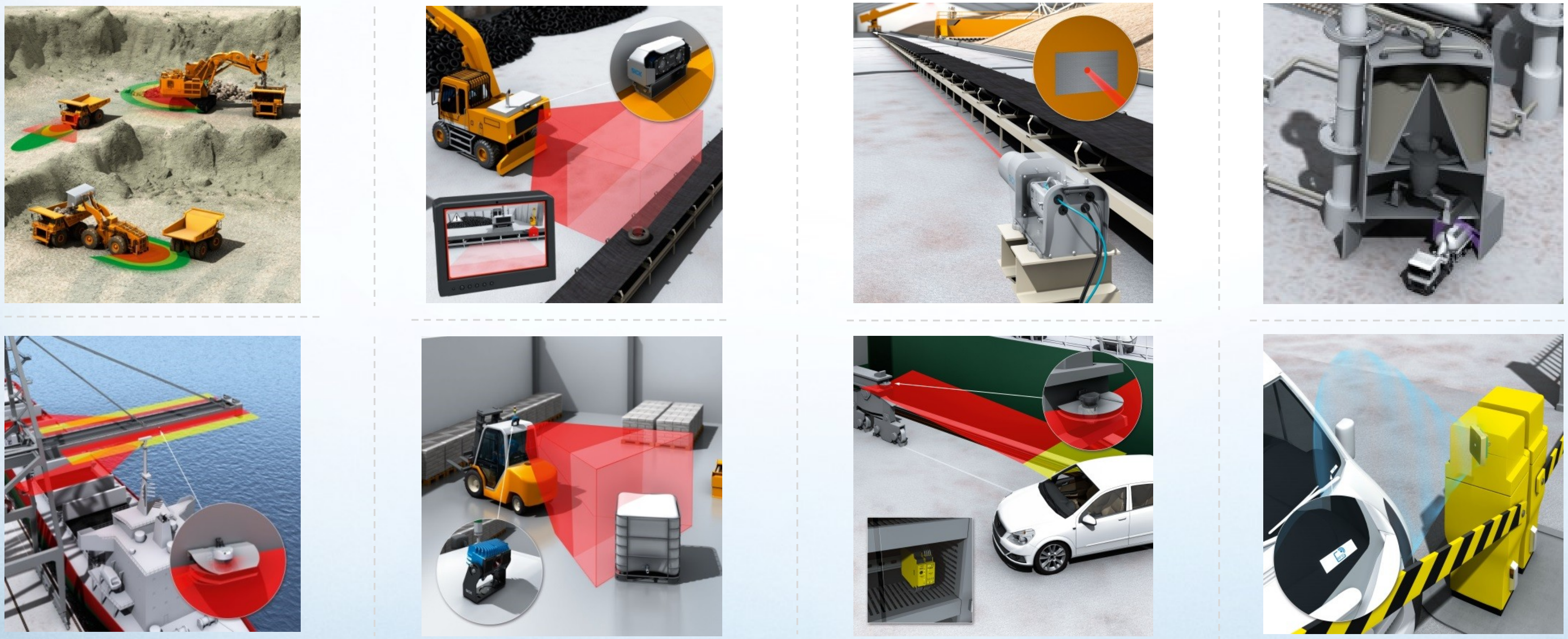


Solutions & Field Installations

Driver Assistance

Collision Awareness Systems

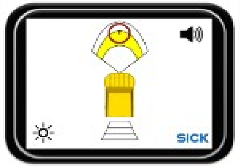
- Infrastructure, area & distance monitoring
- Guiding systems for production optimization
- Operator warning to prevent collisions & downtime



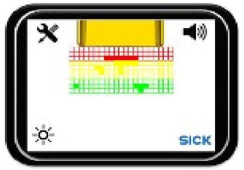
Solutions & Field Installations

Driver Assistance

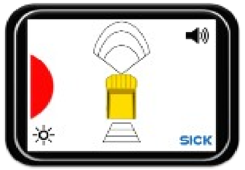
- **Collision awareness systems - MINESIC100 TPS/EPS/WPS**
  - Front/End Collision Warning



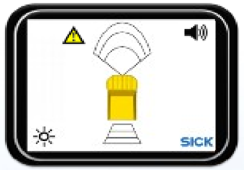
  - Reverse Assist



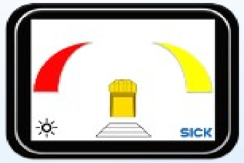
  - Road Departure Warning

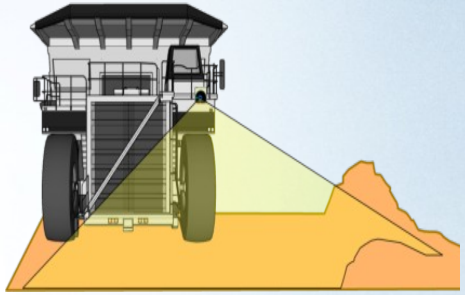


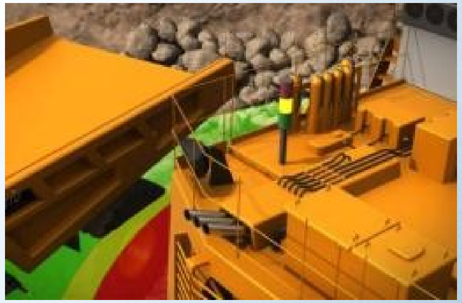
  - Black Spot Warning



  - Underground Tunnel Collision Warning







Solutions & Field Installations

Driver Assistance

› Collision Warning - MINESIC100 TPS/EPS/WPS

MINESIC100TPS

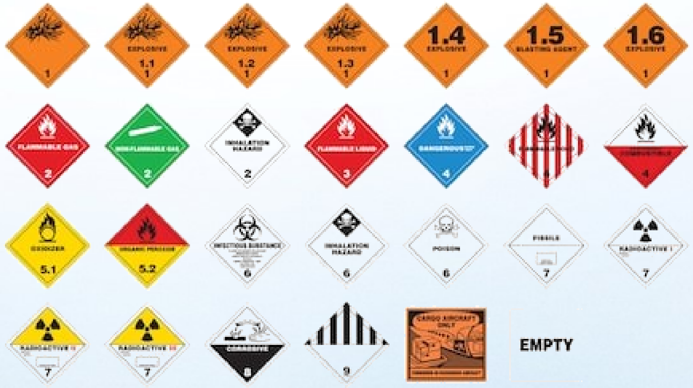
MINESIC100WPS

MINESIC100EPS

Solutions & Field Installations

Driver Assistance

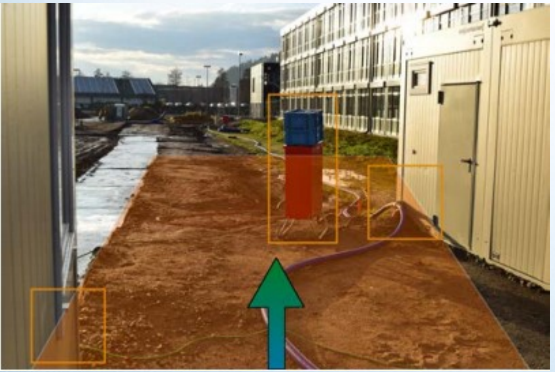
- Truck profiling, loading control, parking control, license & hazardous goods plate recognition, fleet & fuel management

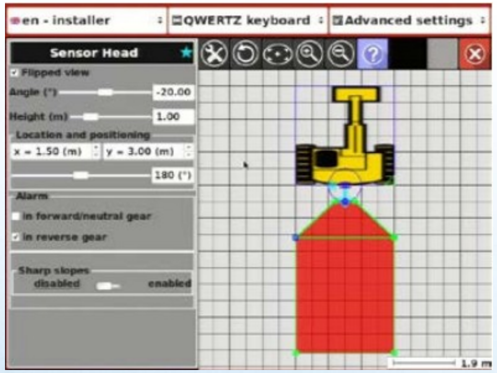


Solutions & Field Installations

Driver Assistance

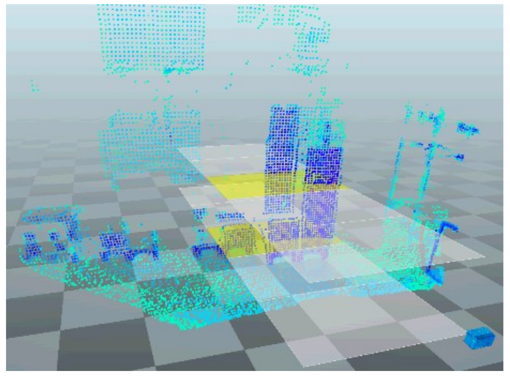
- **3D assistant systems - Visionary-B/-T**
  - Visionary-B
  - Visionary-T

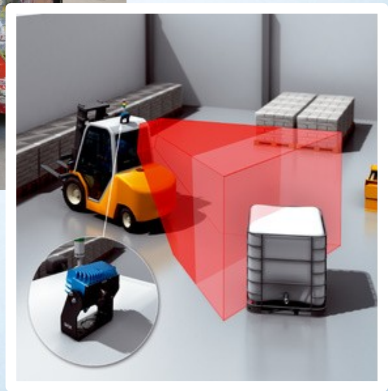



en - installer
QWERTZ keyboard
Advanced settings
Sensor Head

☑ Flipped view
Angle (°) -20.00
Height (m) 1.00
Location and positioning
x = 1.50 (m) y = 3.00 (m)
180 (°)
Alarm
☐ in forward/neutral gear
☑ in reverse gear
Sharp slopes
disabled enabled

1.9 m

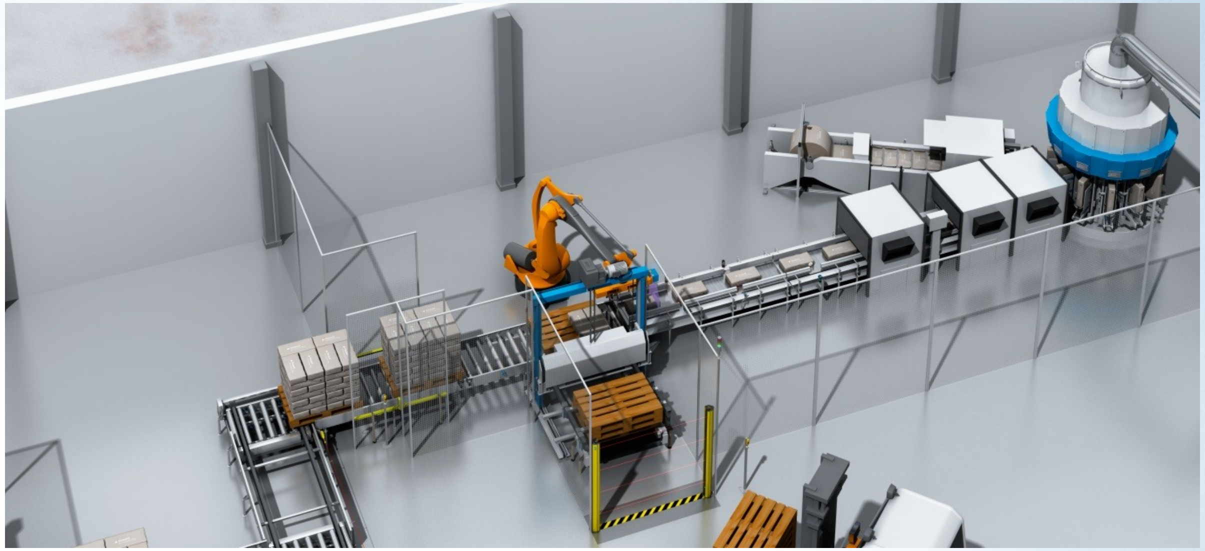




Solutions & Field Installations

Packaging & Palletizing

- Distance sensors
- Photoelectric sensors
- Code readers
- Contrast sensors
- 2D laser scanners (LiDAR)
- Absolute encoders

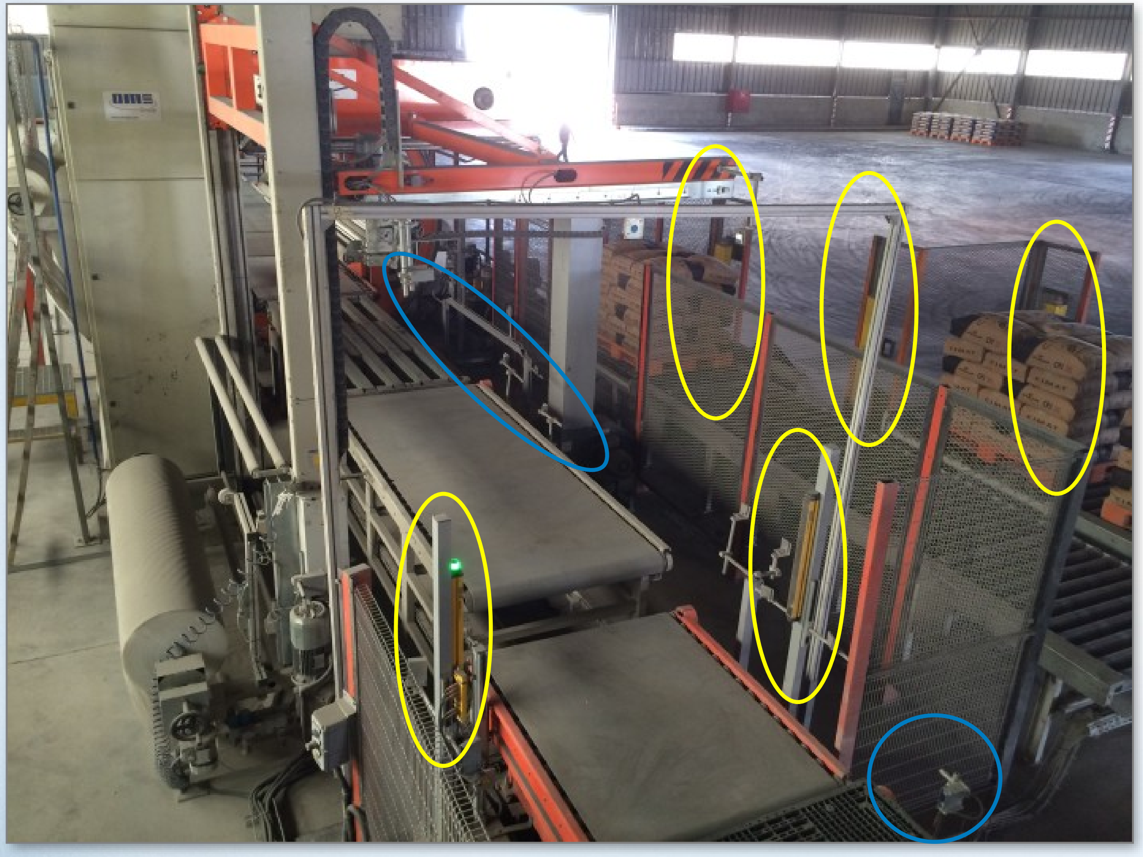


- Proximity sensors
- Safety light grids
- Safety locks
- Safety command devices
- 3D Camera
- …

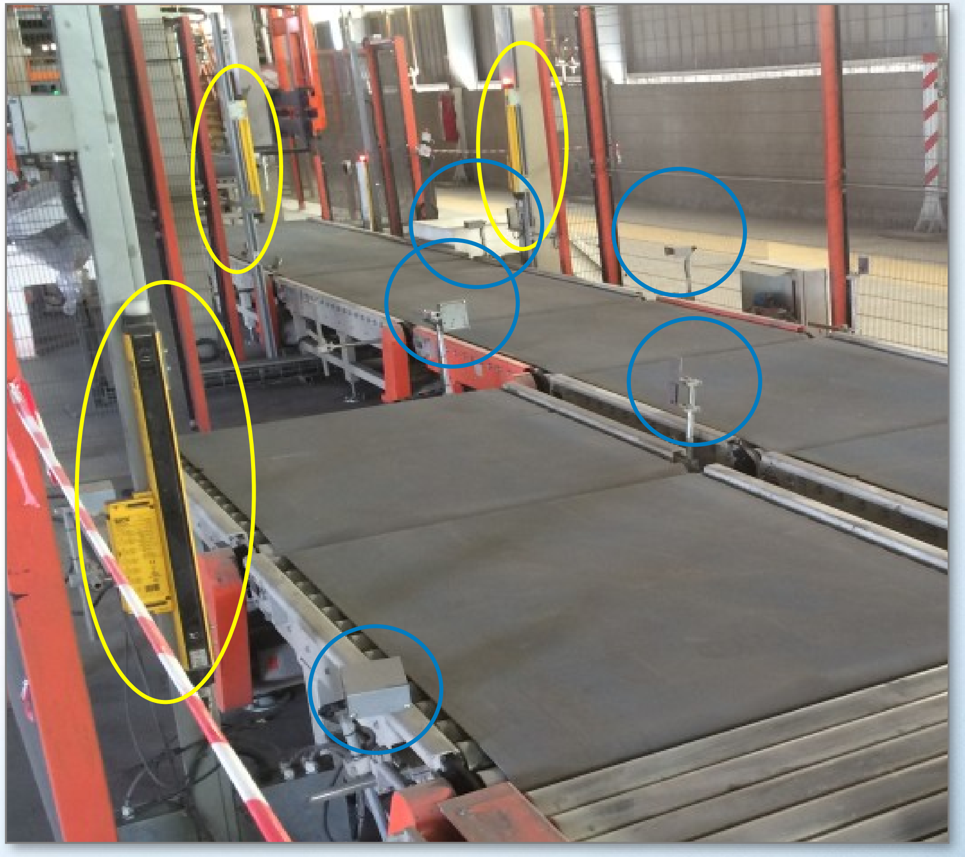
Solutions & Field Installations

Packaging & Palletizing

ASMENT TEMARA
أسمنت تمارة



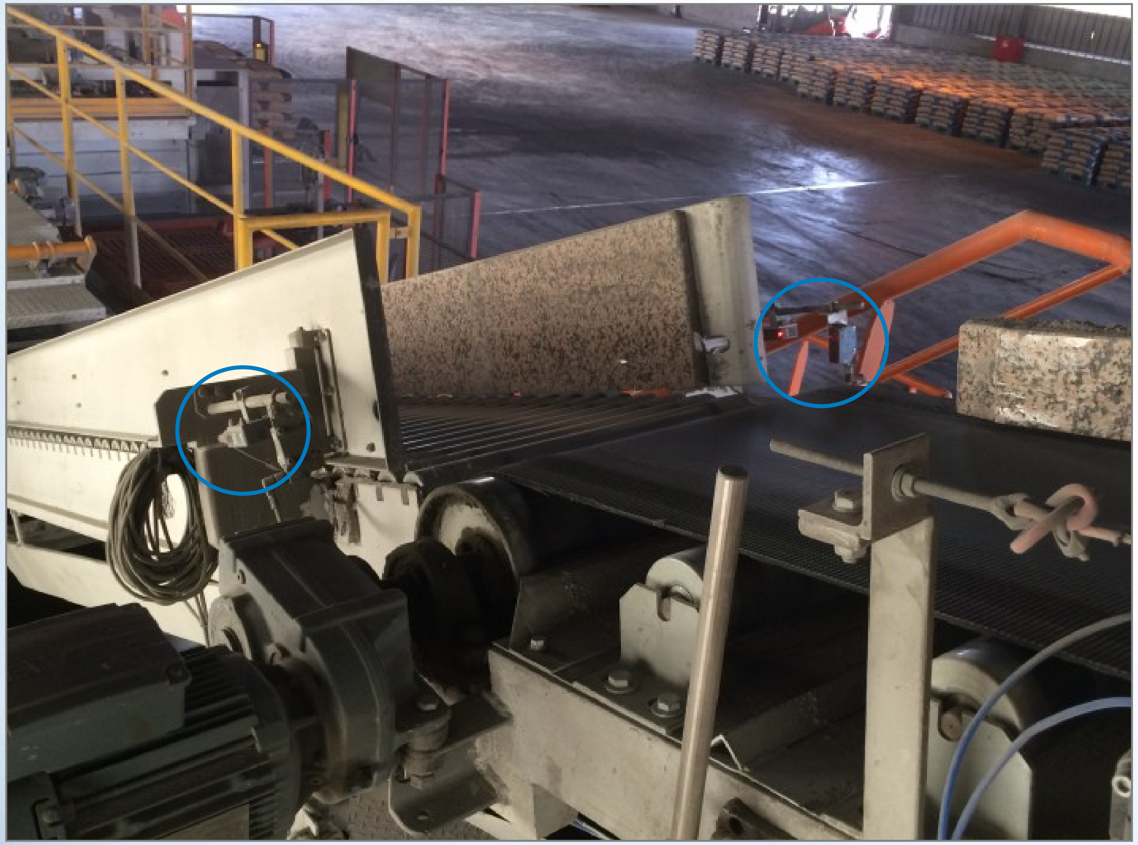
Safe guarding palletizer; M4000



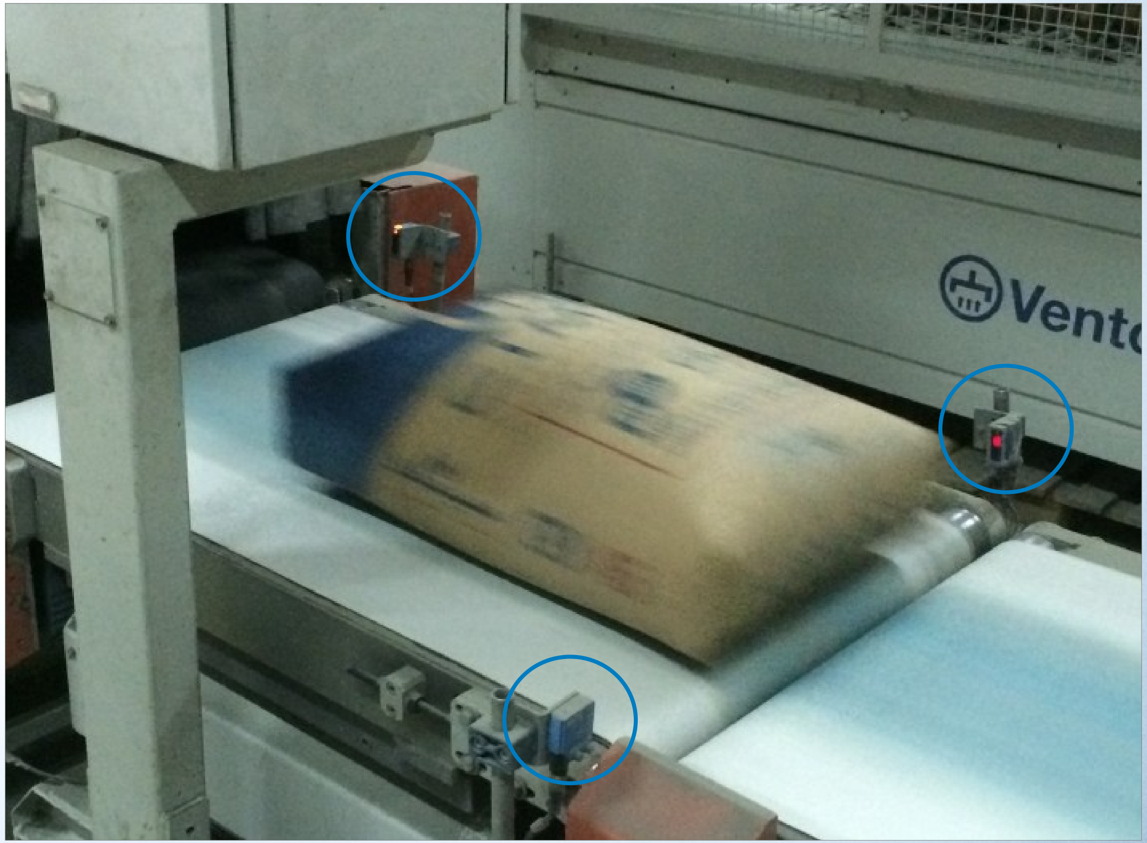
Safe guarding stretch wrapper; M4000

Solutions & Field Installations

Packaging & Palletizing



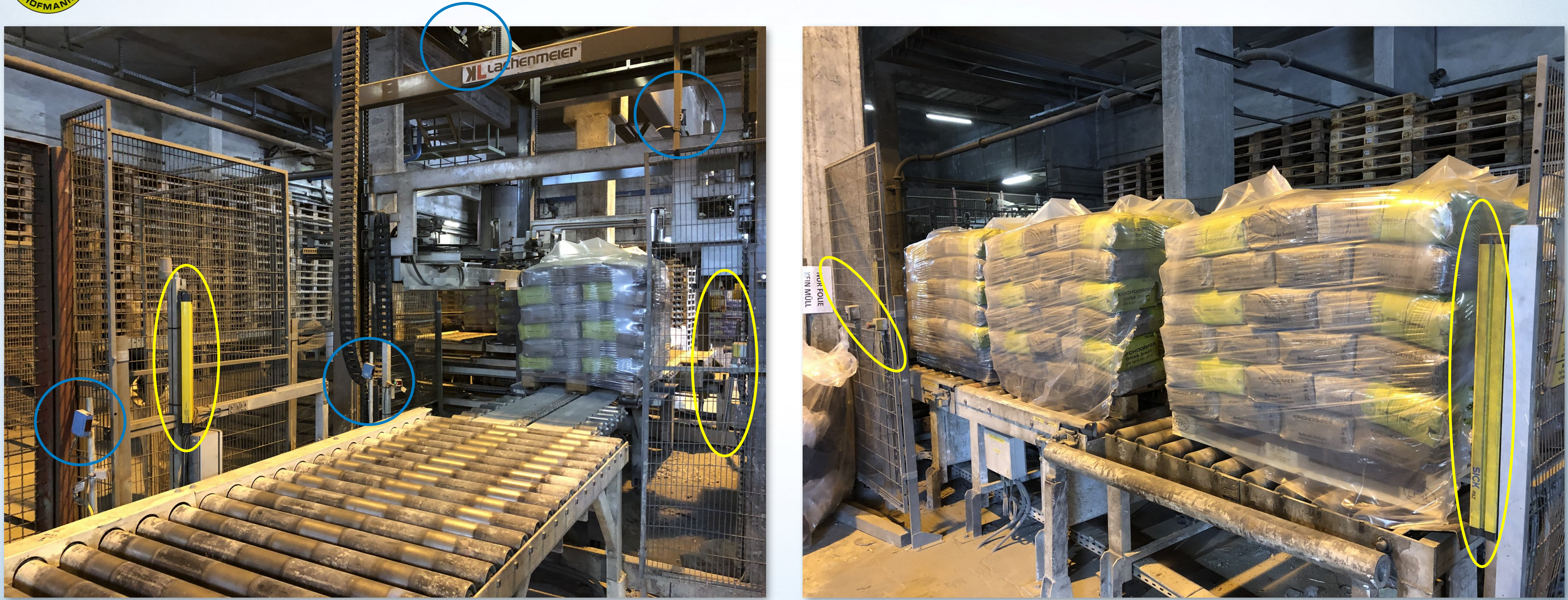
Counting cement bags; W12



Triggering belt scale; W260

Solutions & Field Installations

Packaging & Palletizing


KL Lachenmeier
NUR FOLIE
KEIN MÜLL
SICK

Solutions & Field Installations

Other Sensor Applications…

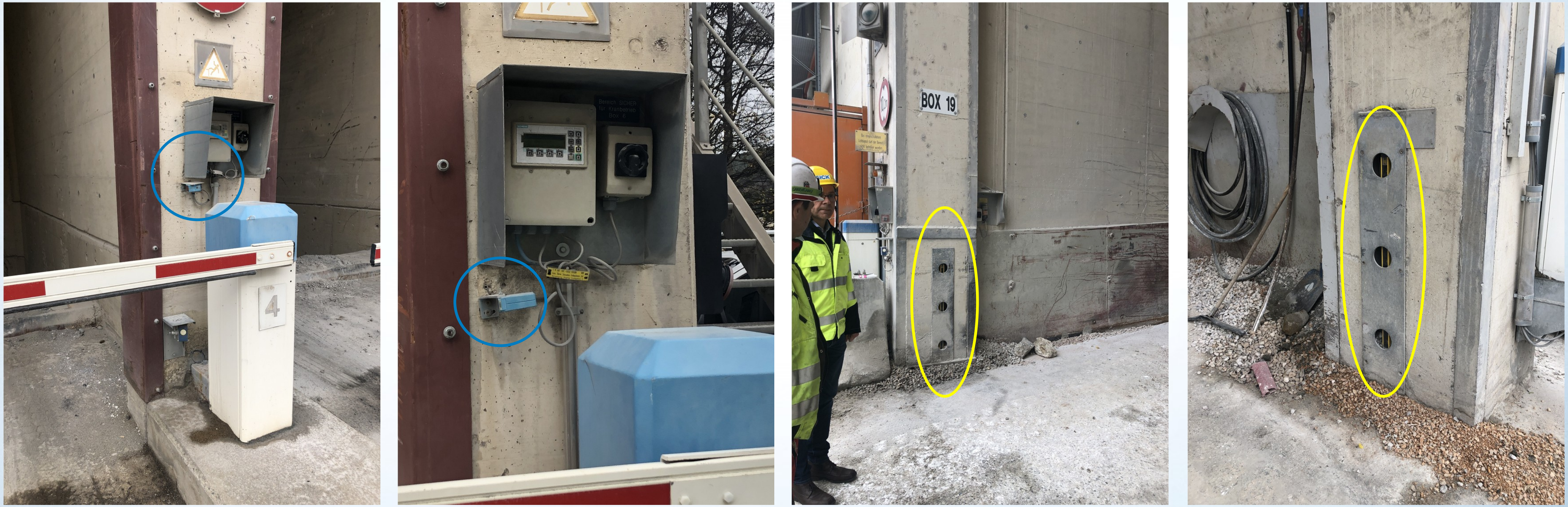
- **Safeguarding rolling gate for alternative fuel storage**

SICK
01 SF 271

Solutions & Field Installations

Other Sensor Applications…

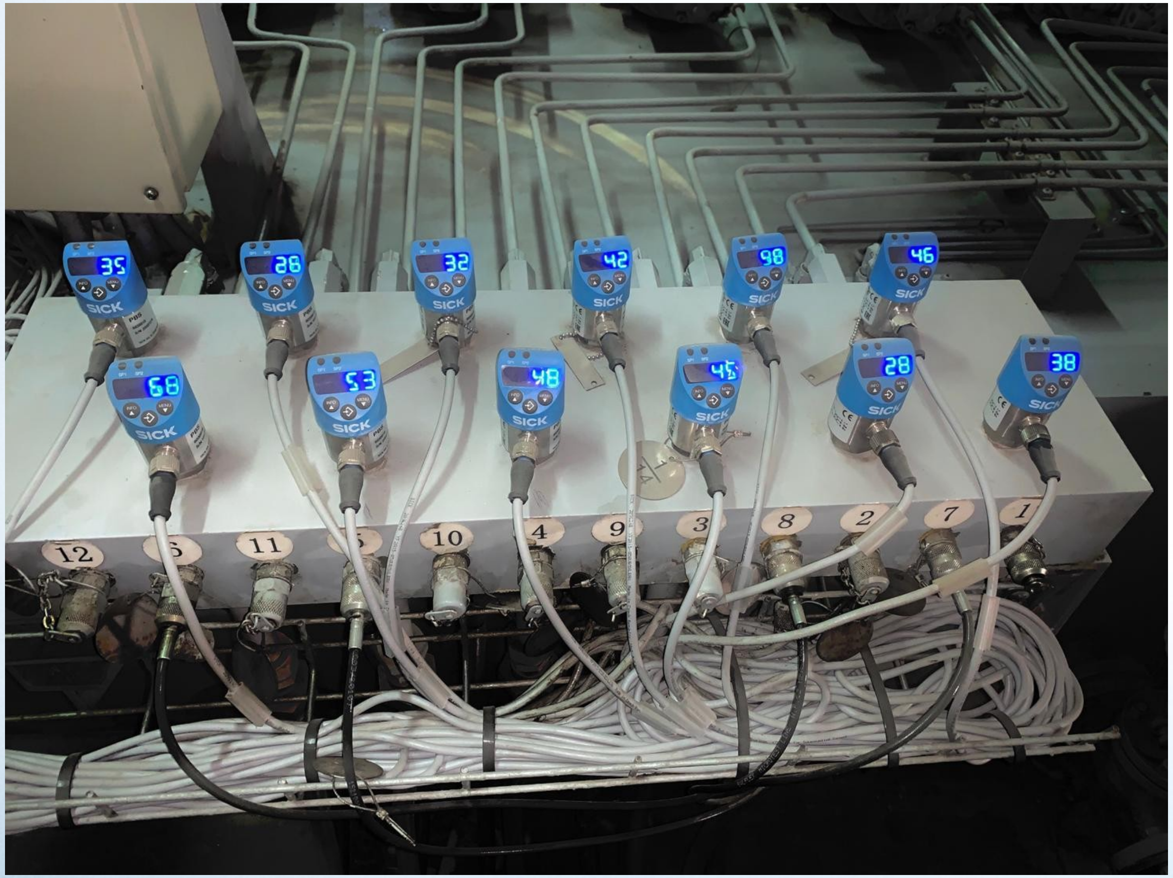
- **Safeguarding rolling gate for alternative fuel storage**



Solutions & Field Installations

Other Sensor Applications…

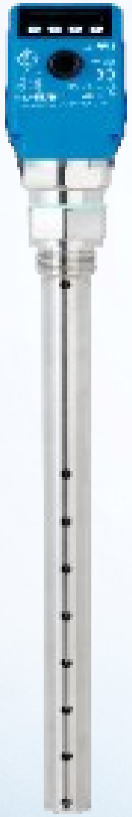
- **Hydraulic oil pressure measurement - PBS**

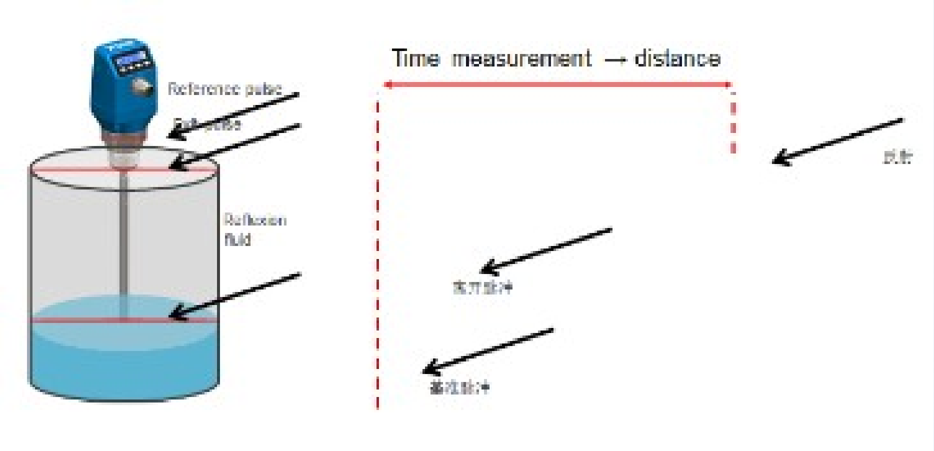


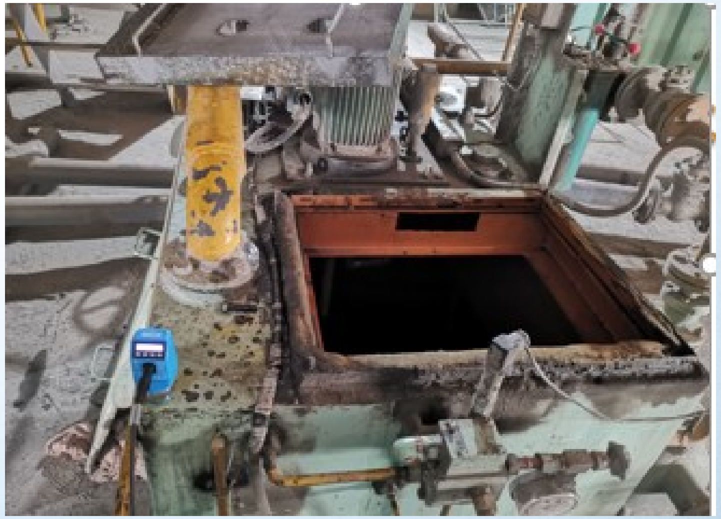
Solutions & Field Installations

Other Sensor Applications…

- **Hydraulic oil level measurement - LFP**



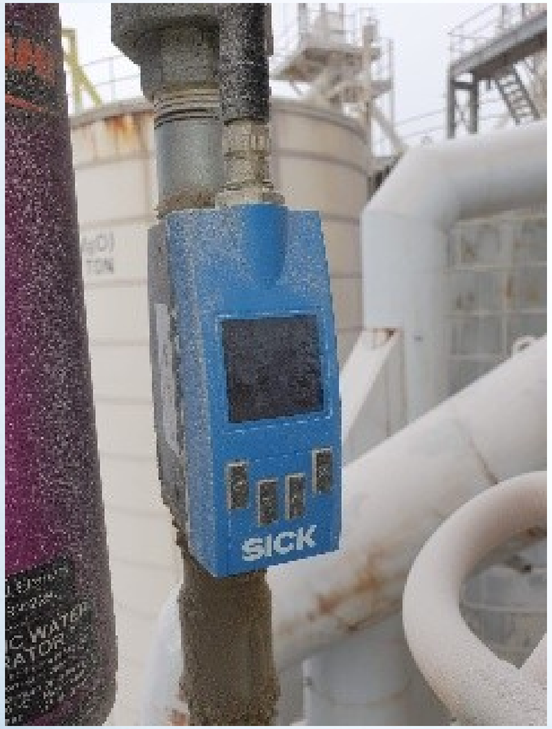

Reference pulse
Reflexion fluid
Time measurement → distance
反射
基准脉冲

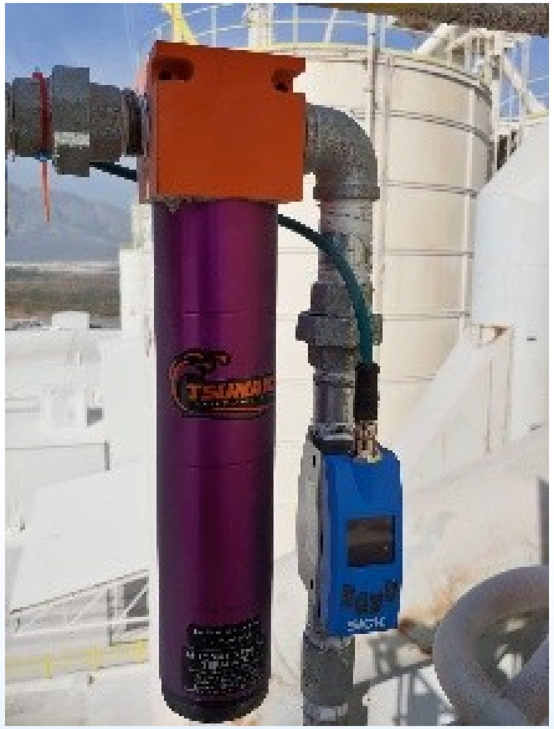


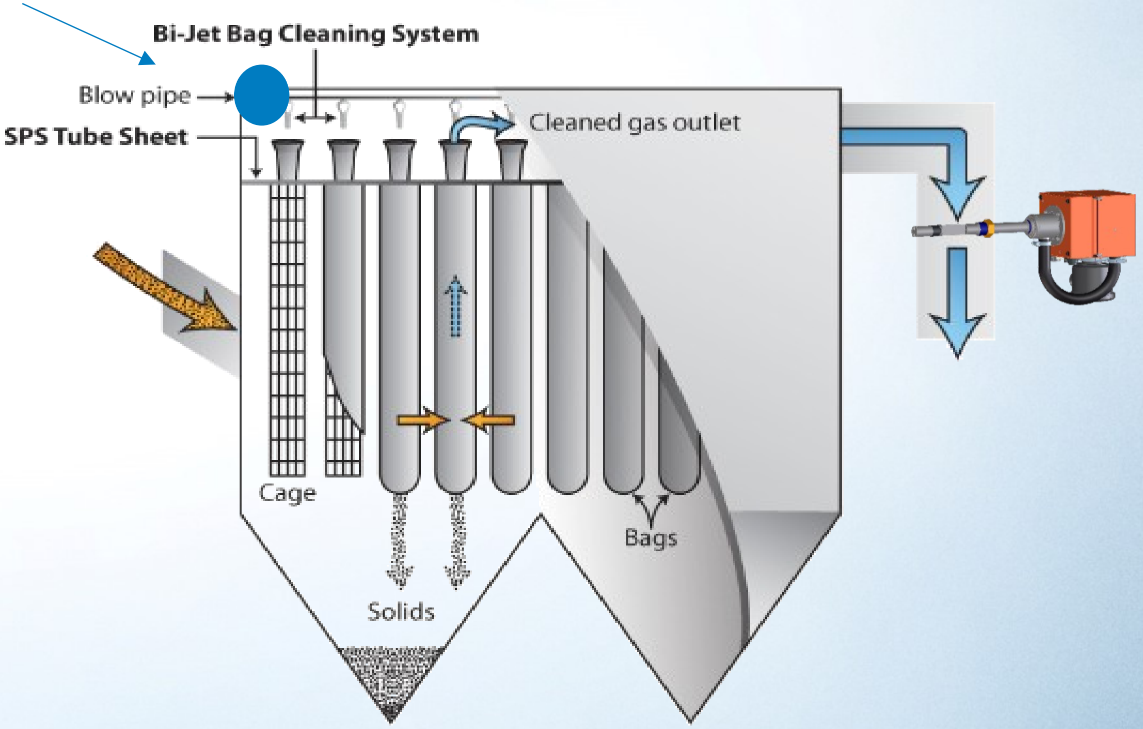
Solutions & Field Installations

Other Sensor Applications…

› Compressed Air Flow Measurement on dust filter bags using FTMg



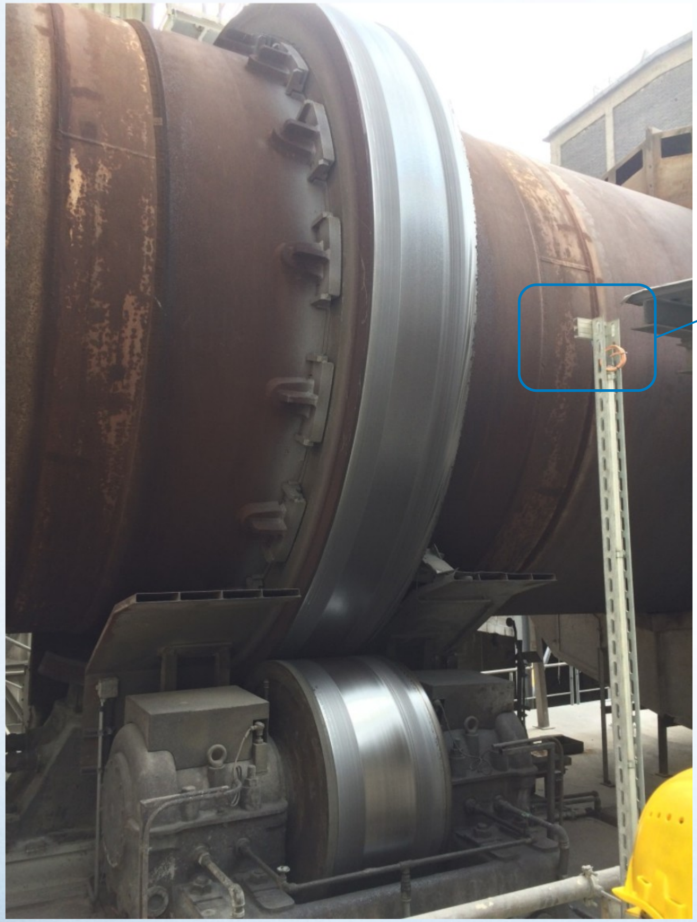



Bi-Jet Bag Cleaning System
Blow pipe
SPS Tube Sheet
Cleaned gas outlet
Cage
Bags
Solids

Solutions & Field Installations

Other Sensor Applications…

- **Checking kiln alignment/slack/torsion using WTT12L**



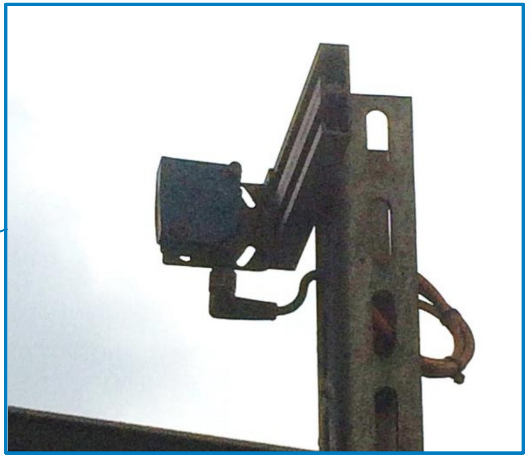
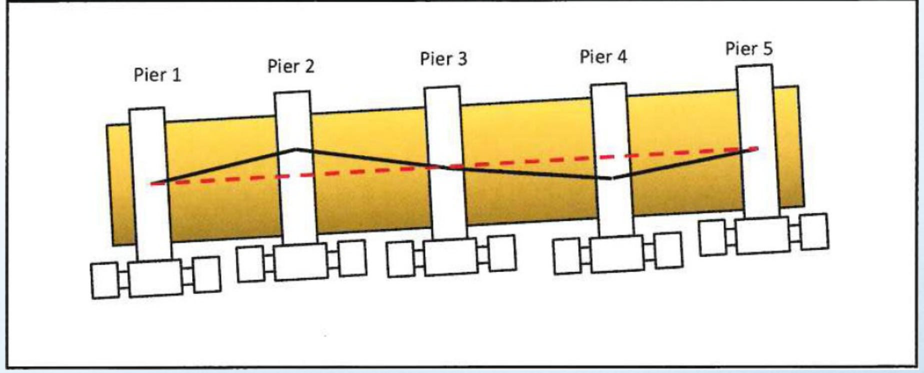


Figure 1: vertical misalignment of the kiln: Pier 2 is high while Pier 4 is low



Solutions & Field Installations

Other Sensor Applications…

› People tracking - Tag-LOC System:

Basculeur 3

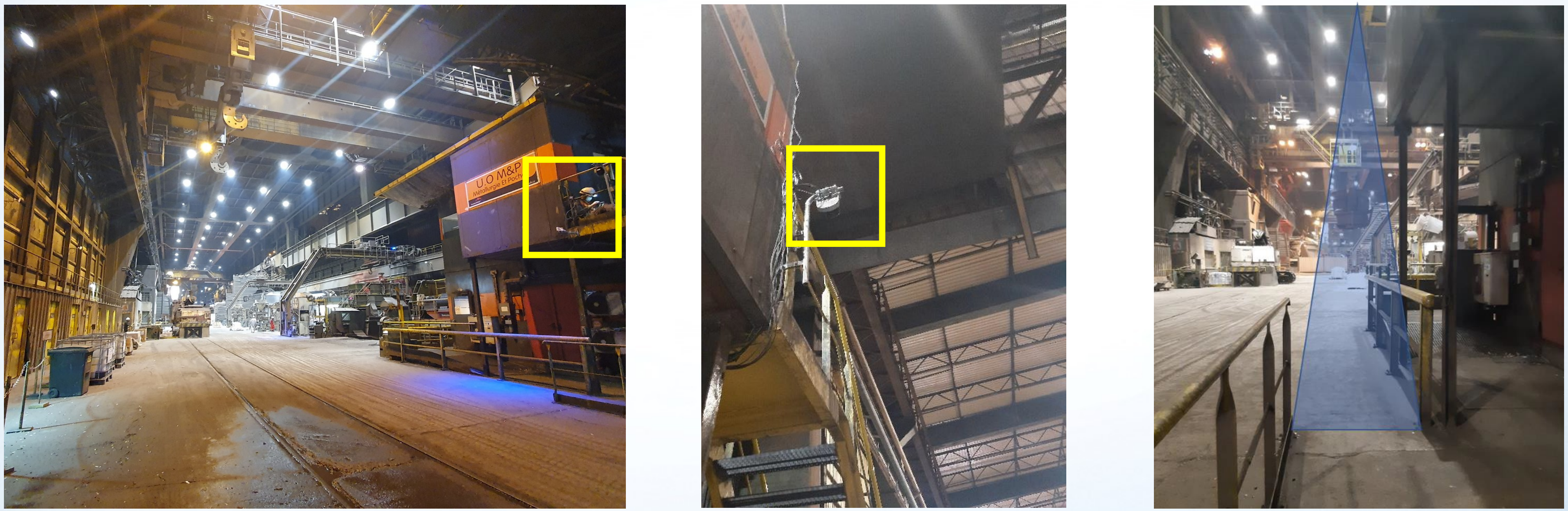
LOCAL TPM
Equipe 1

Operateur 2
SICK

Solutions & Field Installations

Other Sensor Applications…

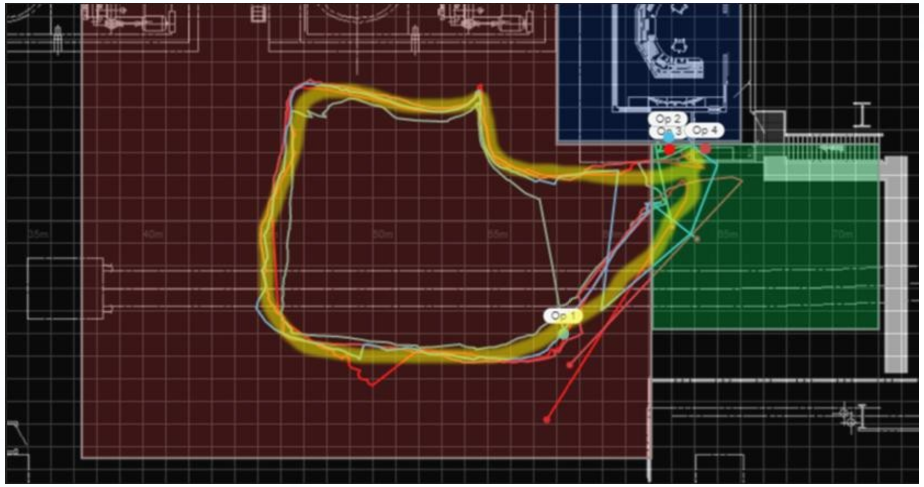
- **People tracking - MRS – “People Counter”**

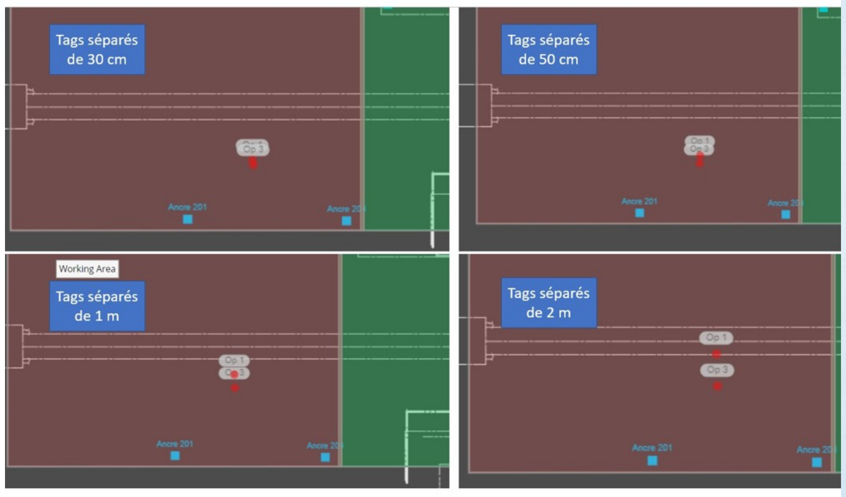


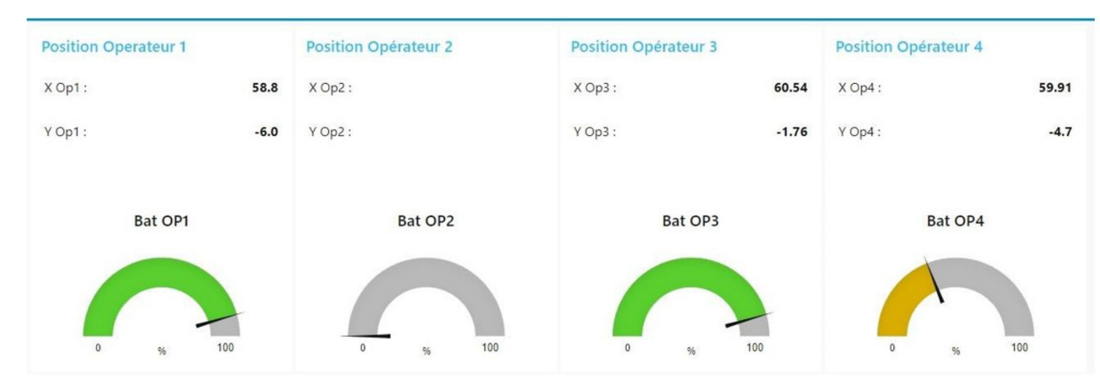
Solutions & Field Installations

Other Sensor Applications…

› **People tracking -** MRS – “People Counter”


Op 2
Op 3
Op 4
Op 1


Tags séparés de 30 cm
Op 3
Ancre 201
Tags séparés de 50 cm
Op 1
Op 3
Ancre 201
Working Area
Tags séparés de 1 m
Op 1
Op 3
Ancre 201
Tags séparés de 2 m
Op 1
Op 3
Ancre 201



Position Operateur 1

X Op1 : 58.8

Y Op1 : -6.0

Position Opérateur 2

X Op2 :

Y Op2 :

Position Opérateur 3

X Op3 : 60.54

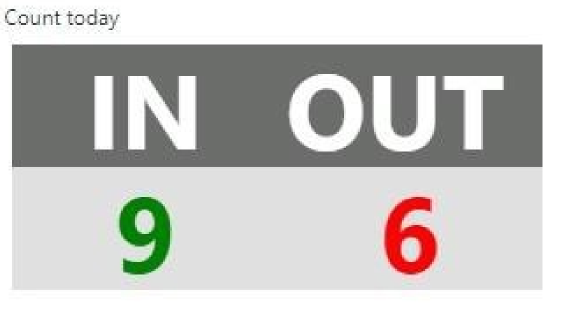
Y Op3 : -1.76

Position Opérateur 4

X Op4 : 59.91

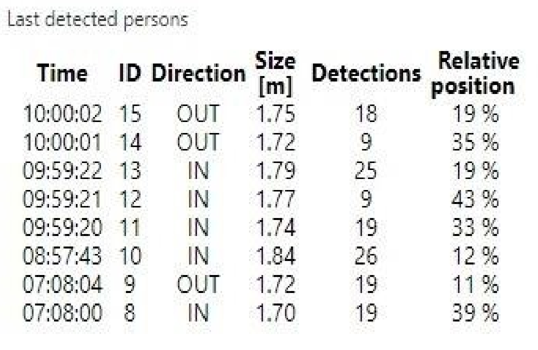
Y Op4 : -4.7

Bat OP1
0
%
100
Bat OP2
0
%
100
Bat OP3
0
%
100
Bat OP4
0
%
100



Count today

IN	OUT
9	6



Last detected persons

Time	ID	Direction	Size [m]	Detections	Relative position
10:00:02	15	OUT	1.75	18	19 %
10:00:01	14	OUT	1.72	9	35 %
09:59:22	13	IN	1.79	25	19 %
09:59:21	12	IN	1.77	9	43 %
09:59:20	11	IN	1.74	19	33 %
08:57:43	10	IN	1.84	26	12 %
07:08:04	9	OUT	1.72	19	11 %
07:08:00	8	IN	1.70	19	39 %

Solutions & Field Installations

Other Sensor Applications…

Photoelectric sensors

Proximity sensors

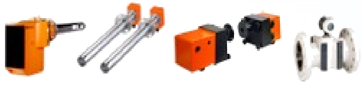
Magnetic cylinder sensors

Identification solutions

Detection and ranging solutions

Fluid sensors

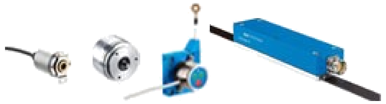
System solutions



Analyzers and systems

Gas flow measurement

Motor feedback system



Encoders

Vision

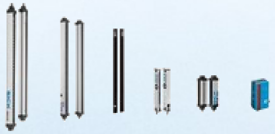
Opto-electronic protective devices

Safety switches

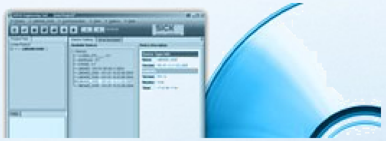
sens:Control – safe control solutions

Registration sensors

Distance sensors



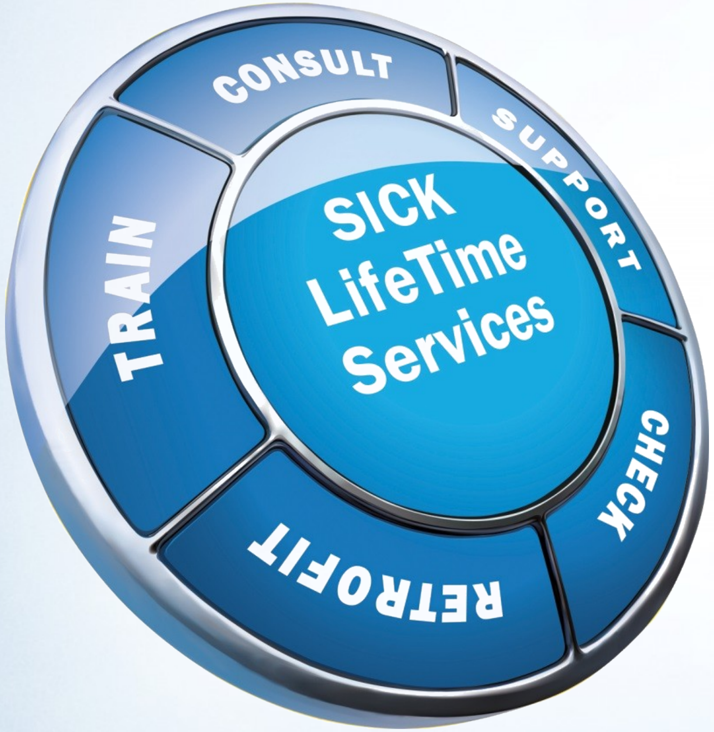
Automation light grids



Software

Service & Support

SICK Lifetime services


CONSULT
SUPPORT
CHECK
RETROFIT
TRAIN
SICK LifeTime Services

Consulting and design
Safe and professional

Product and system support
Reliable, fast and on-site

Verification and optimization
Safe and regularly inspected

Upgrade and retrofits
Easy, safe and economical

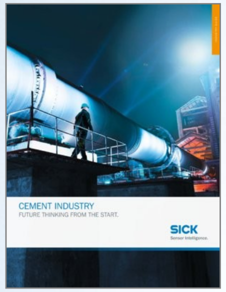
Training and education
Practical, focused and professional

Service & Support

Publications

SICK
Sensor Intelligence.

INDUSTRY GUIDE


CEMENT INDUSTRY
FUTURE THINKING FROM THE START.
SICK

Order No. 8014937

INDUSTRY
EMISSION MEASUREMENT

EMISSION MEASUREMENT TECHNOLOGY
SINGLE-SOURCE TECHNOLOGIES AND SOLUTIONS
SICK

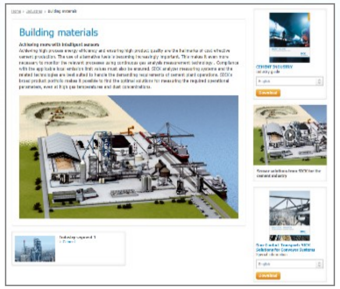
Order No. 8014933

SICKINSIGHT
CLEAN PROCESSES

SICKinsight
SAUBERE PROZESSE
RESSOURCENEFFIZIENT PRODUZIEREN

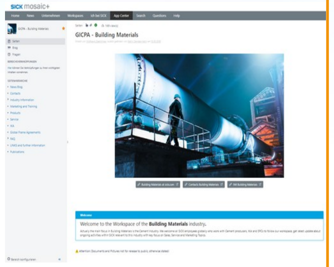
Order No. 8018376

INDUSTRY WEBSITE


Building materials

www.sick.com/cement

INDUSTRY WORKSPACE


SICK mosaic+
GICPA - Building Materials

https://mosaicplus.sickcn.net/display/WSGICPACement/GICPA+-+Building+Materials

SPECIAL INFORMATION

NON-CONTACT TRANSPORT
SICK SOLUTIONS FOR CONVEYOR SYSTEMS
SICK

www.sick.com/conveyor

Measuring bulk flows
FROM QUARRY
TO DISPATCH

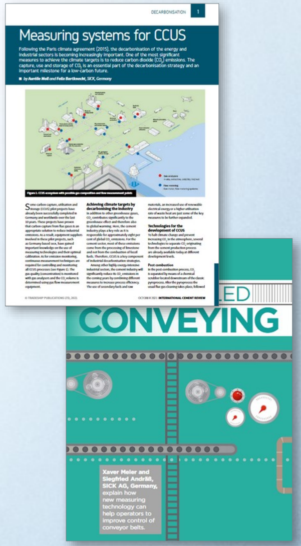
AF SPECIAL ISSUE: CASE-STUDIES
Fluctuating flows
MONITORING
MERCURY

Finding the missing link
10 STEP GUIDE
TO CHOOSING A
CEM SOLUTION
SICK

New radar sensors from SICK

GLOBAL CEMENT: EMISSIONS
Controlling NOx effectively

A DUSTY
BUSINESS
THE
MEASURE
OF THINGS


Measuring systems for CCUS
CONVEYING

SICK

Sensor Intelligence.