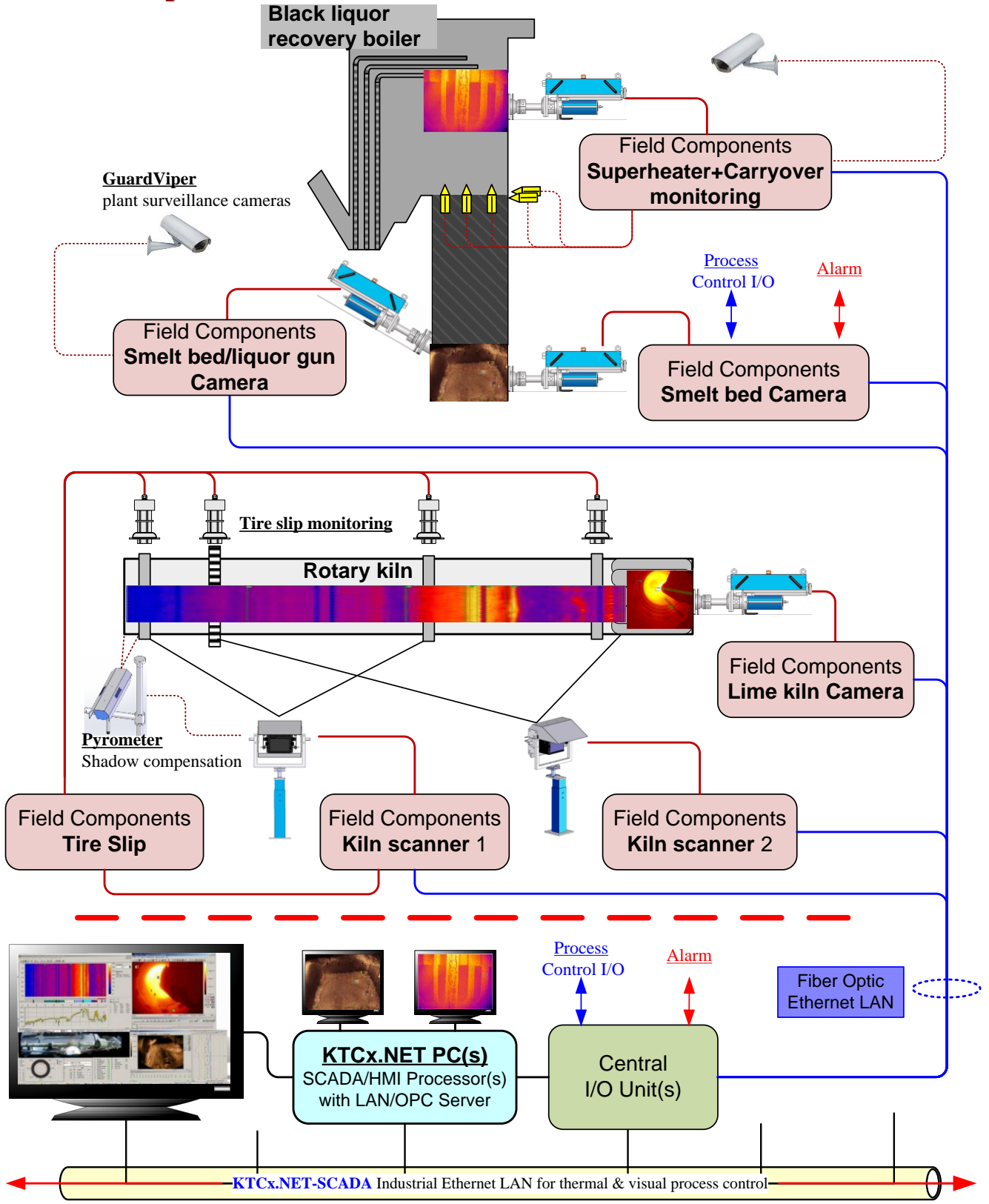


BTCx.NET Boiler+Kiln Temperature Control in Paper Mills:

Unique Integrated-System Concept for Process Monitoring & Plant Supervision with smart Thermal & Visual Instrumentation



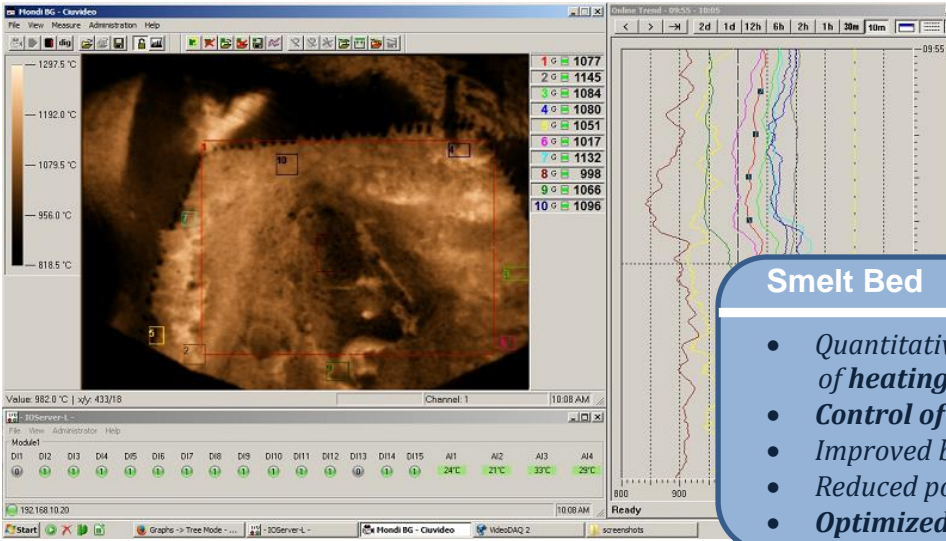
(SCADA sub-system for industrial Ethernet based Automation)
 Uplink to the Field-, Control-, or Operations- Level of a Plant Automation System via industrial Ethernet communication

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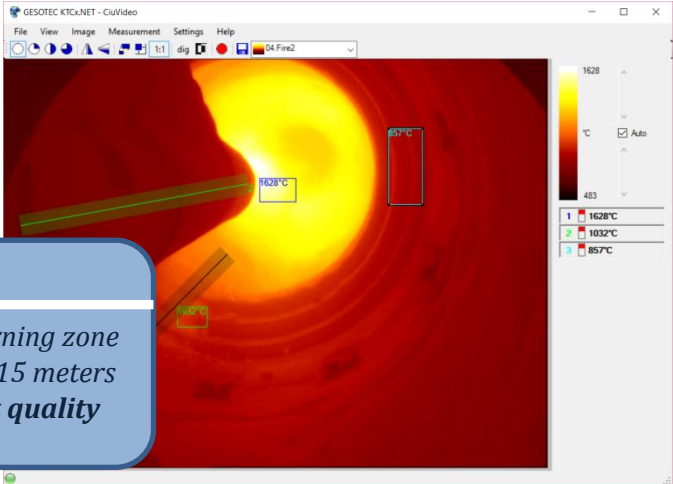
GESOTEC®
 Imaging Pyrometry
 Industrial Thermography
 Process- Monitoring & Control
 Infrared- & Video- Signal Processing

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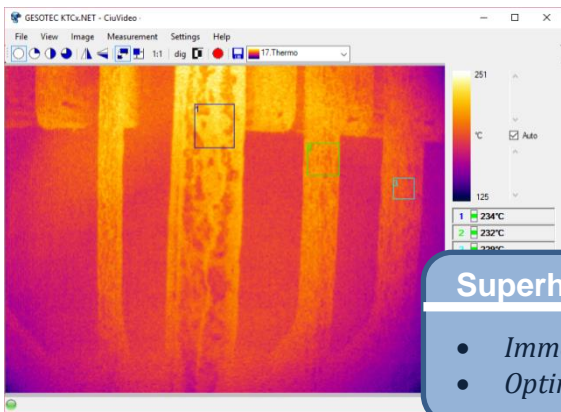
Advantages of PyroViper™ furnace probe cameras in a Paper Mill:



- Smelt Bed**
- *Quantitative observation & control of heating uniformity and combustion quality.*
 - *Control of smelt bed size & shape.*
 - *Improved boiler performance.*
 - *Reduced pollution.*
 - *Optimized fuel consumption.*



- Lime Kiln**
- *Live monitoring of combustion conditions in the burning zone*
 - *Accurate temperature of lime and refractory up to 15 meters*
 - *Process control for efficient fuel usage and product quality*



- Superheater Tubes**
- *Immediate identification of material deposits between the tubes*
 - *Optimization of heat distribution*

PyroViper™: Subsystem of KTCx.NET integrated system

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Feature highlights of PyroViper video-processing software

Free life-time remote support

- Remote access via Ethernet LAN
- Screen-sharing & web streaming

Manual & auto history recording

- Standard data formats & quick-review replay
- Temperature-calibrated images
- Freely configurable

Direct-print & Easy-share

- For image, window or desktop

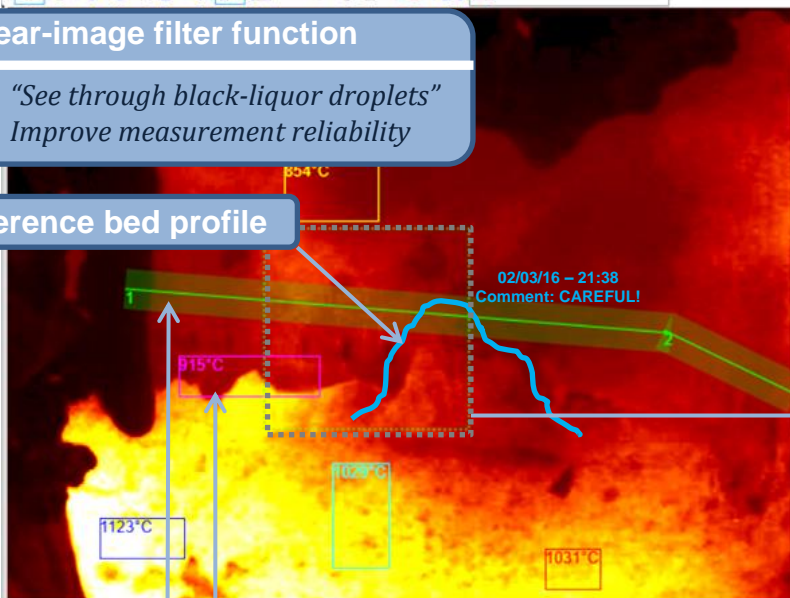
>15 calibrated color palettes

- Fixed or automatic scale

Clear-image filter function

- "See through black-liquor droplets"
- Improve measurement reliability

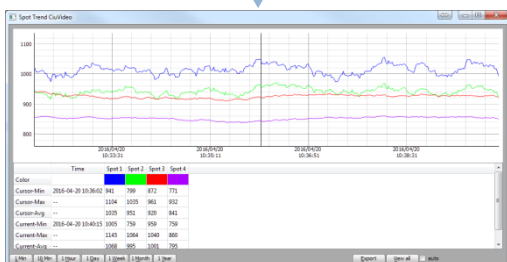
Reference bed profile



Zoom window

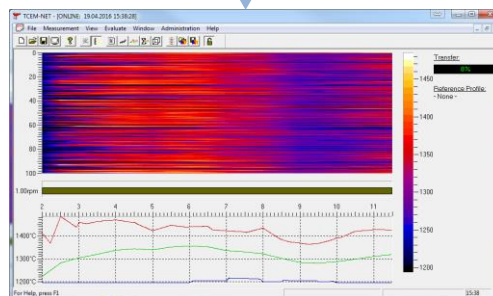
Drag&Drop overlappable measurement spots and lines

- Trend, historical database, Min/Max/Average, low/high alarms
- More than 48 spot evaluation for live and playback media
- Output via 4-20mA, OPC, file exchange...



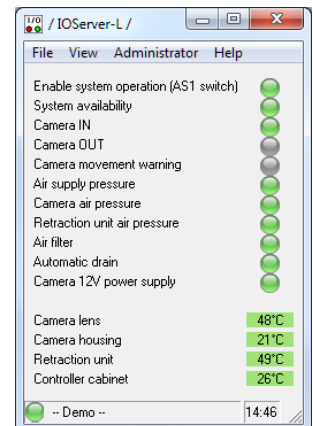
Measurement spots

- Long and short-time trends



Line profile trend

- E.g. bed level alarm

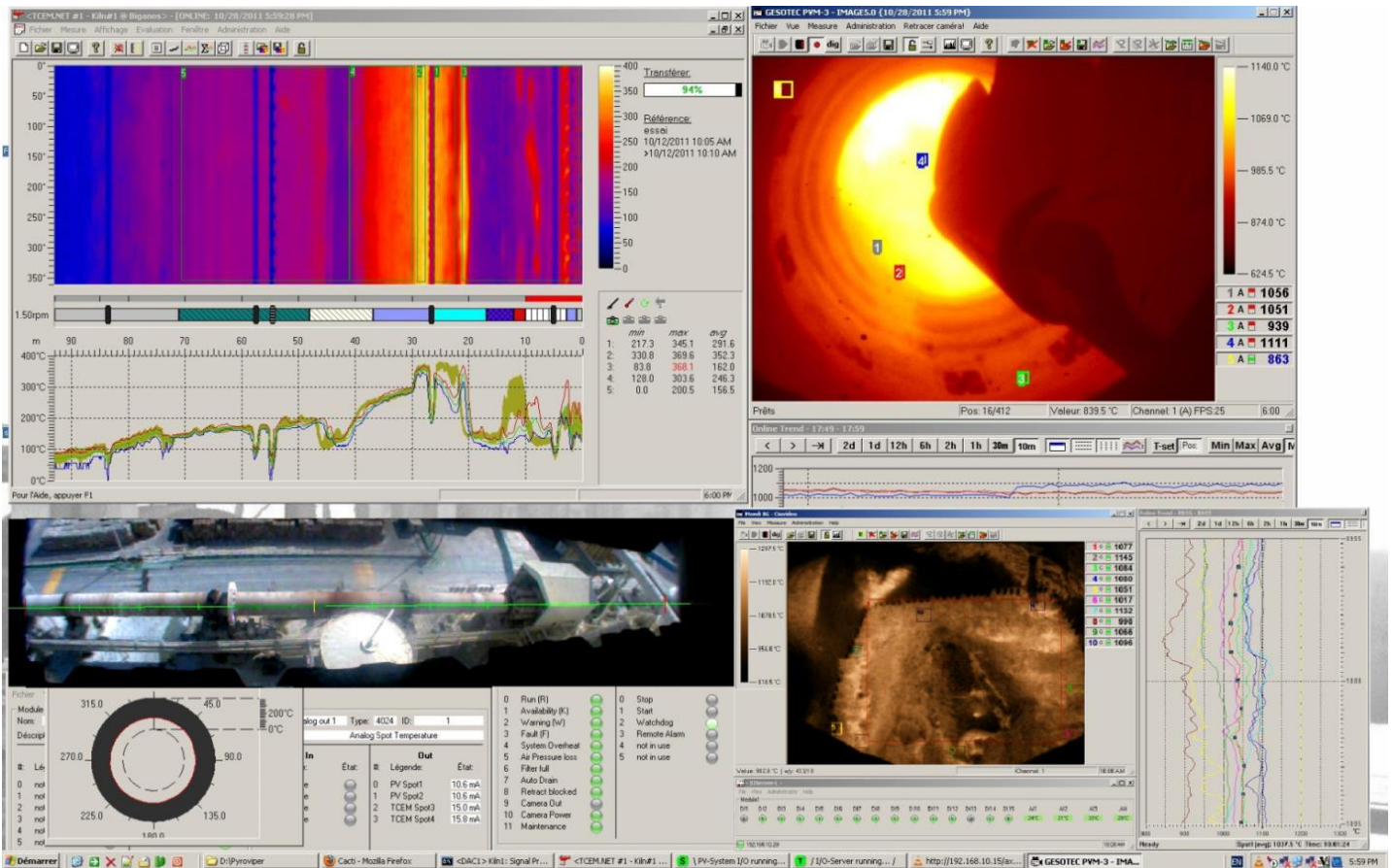


Remote I/O

- Detailed system status
- Camera adjustment
- System retraction/insertion

In-house design: flexible tailored solutions available right away

Typical operator view for integrated KTCx.NET in a Paper Mill



Main design advantages

State-of-the-art infrared imaging for lime kiln, smelt bed and superheaters

- *“Two-dimensional-pyrometry”*. through computer-optimized probe optics
- *Great visual details of the process conditions for the operator*
- *Accurate **temperature measurement** of any object or region on the screen*

Simple handling, cleaning and troubleshooting

- ***Minimum maintenance** cycles and efforts*
- ***Adjustable** optical zoom, focus, image centering*
- ***Lightweight**: easy to dismount and transport*
- ***Exchangeable** probe optics*

Usable lengths from 202 to 1142mm

- *Custom lengths also available*

In-house design and production of mechanics, optics, control electronics, software

- ***Flexible tailored solutions available right away***

Ethernet LAN-based signal transmission

- *For status, image, temperature*
- *Web interfaces, streaming*

Air-cooled wall-box mounting

- ***No water cooling** required*
- ***Automatic safety retraction***

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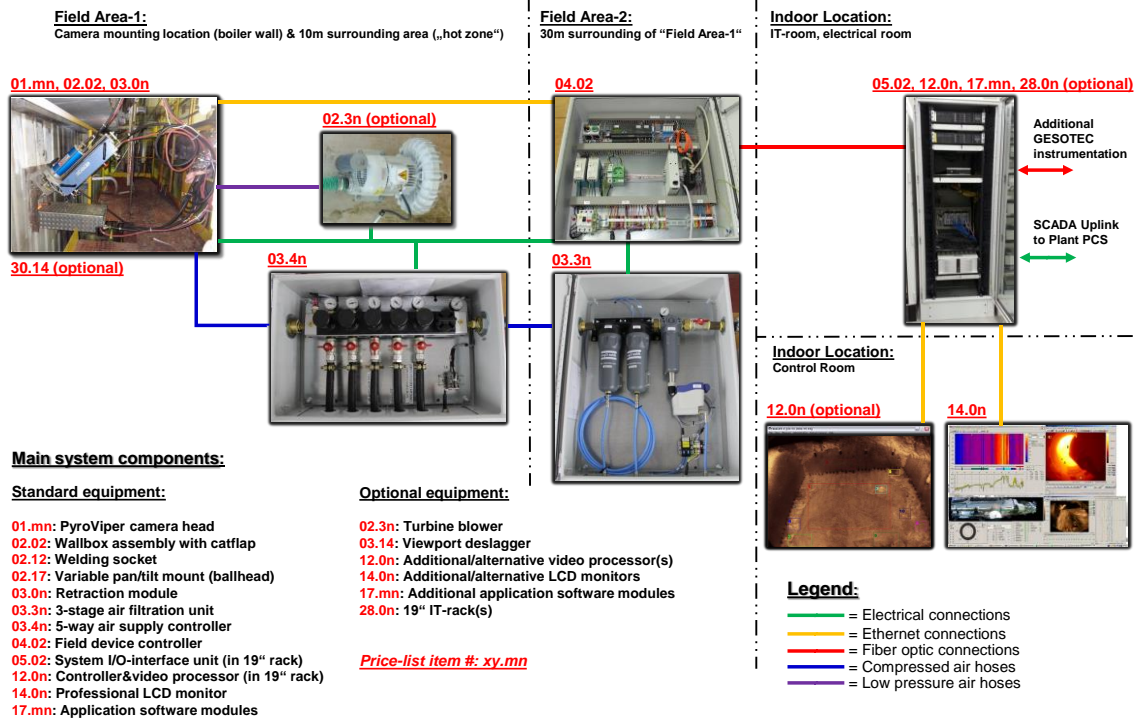
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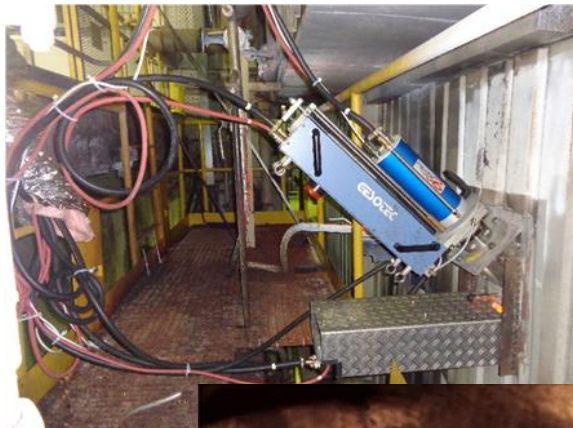
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Layout drawing of a typical PyroViper Camera System for Paper Mill Process Monitoring

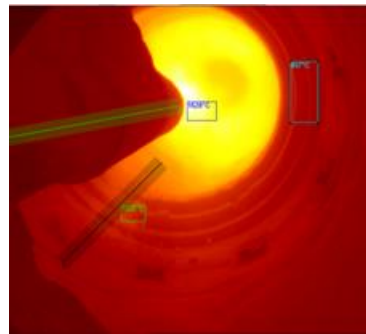


A typical PyroViper™ system configuration consists of the following basic components

Industrial camera assembly with an integrated infrared imager for accurate temperature measurement.
 Air cooled industrial IP66 camera housing with “quick change” furnace probe optics and air supply connectors.
 Stainless steel furnace optics, i.e. rugged lens assembly with patented “Wide angle, Bright Image Optical System”.
 Furnace wall-box with auto-shutter, automatic-retract assembly, high performance air filtration system with regulator assembly.
 Smart sensor data acquisition controller with industrial Ethernet-LAN connectivity & dual video output for UXGA color monitors.



Example 1:
Recovery Boiler
(smelt bed)

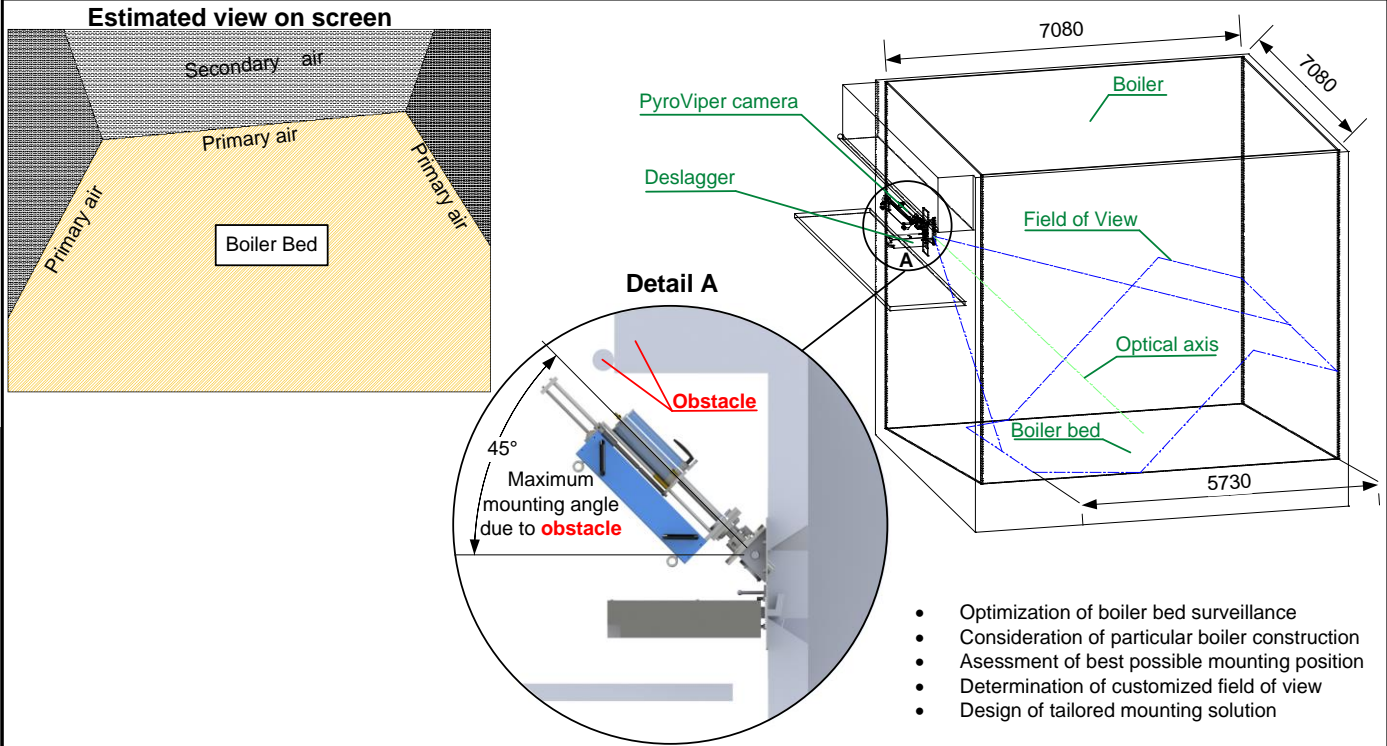


Example 2:
Lime Kiln
(burn zone)



PyroViper™ application note: Black liquor recovery boiler

Project engineering



Actual implementation

picture on screen

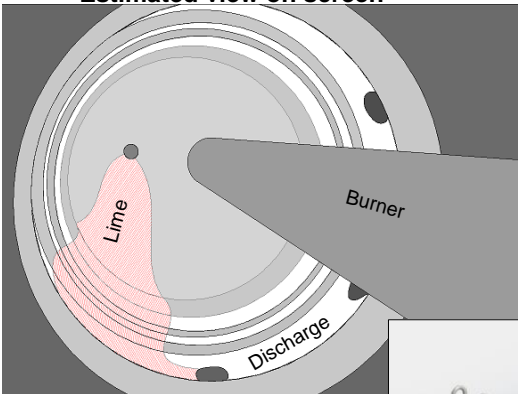
1	1077
2	1145
3	1084
4	1080
5	1051
6	1017
7	1132
8	998
9	1066
10	1096

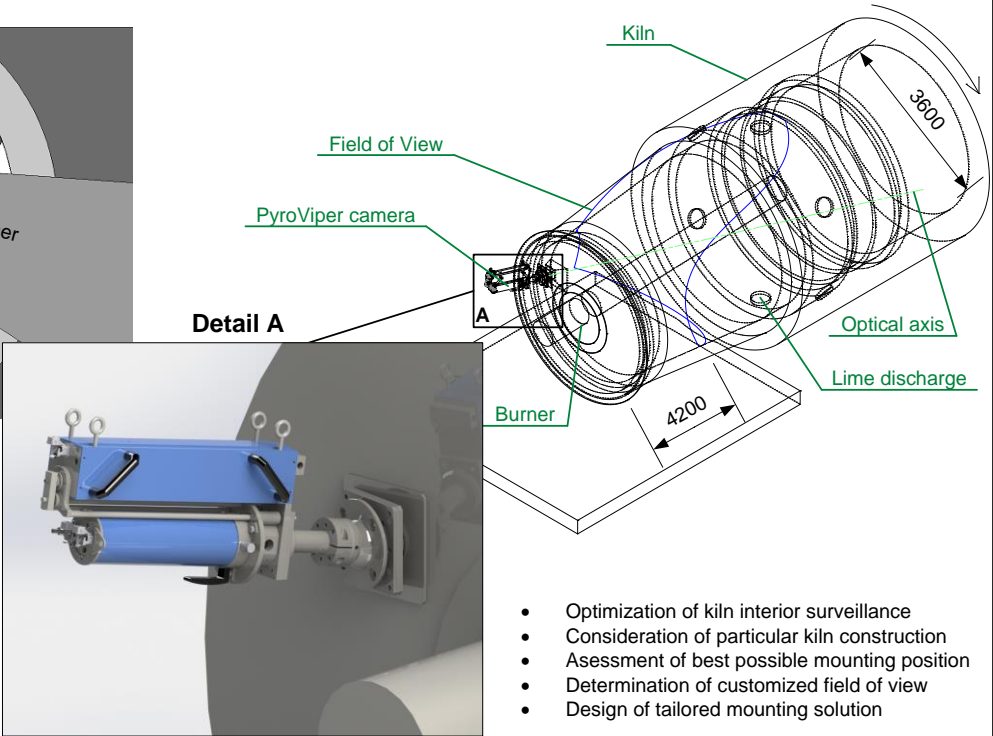
Installation on boiler wall

PyroViper™ application note: Lime kiln

Project engineering

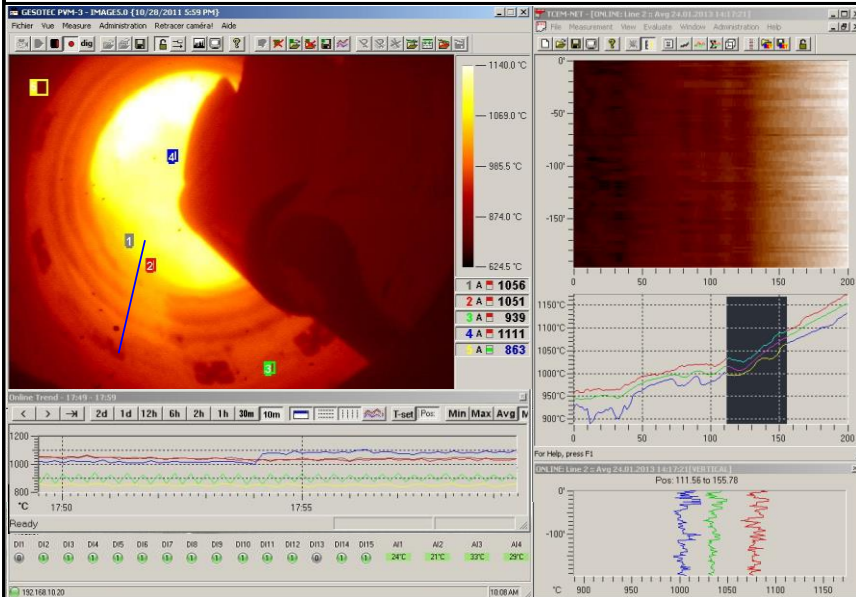
Estimated view on screen






- Optimization of kiln interior surveillance
- Consideration of particular kiln construction
- Assessment of best possible mounting position
- Determination of customized field of view
- Design of tailored mounting solution

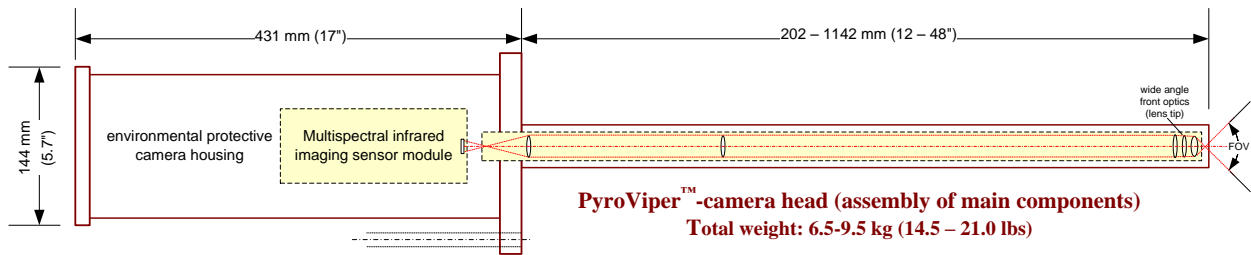
Actual implementation



picture on screen



Installation on kiln hood wall



PyroViper™- temperature measuring industrial furnace probe camera sensor

Sensor types:	Digital high performance industrial solid state FPAs (analog optionally) from 0.4 to 14.0µm
Sensor video signal output:	Digital modules: Ethernet IP-Video, CameraLink, Gigabit Ethernet (“GigE”). Analog options: (1V p-p, 75 Ohms): PAL/NTSC, RS-170/CCIR.
Sensor “imaging resolution”:	Digital modules: from 320 x 240 up to 1920 x 1200 effective pixels. Analog options: NTSC/PAL signal with up to 640H x 460V “imaging pixels”.
Sensor frame/field rate:	Digital modules: between 5Hz and 100Hz (depending on sensor type & resolution). Analog options: 25/50Hz (PAL/CCIR), 30/60Hz (NTSC/RS-170).
Sensor SNR (signal to noise ratio):	Depending on model: 50-73 dB
Typical calibrated temperature ranges: (available customized ranges from 100°C)	R1-Smelt Bed: 800-1200°C, R2 - Lime Kiln: 600-1600°C, R3-Superheaters: 200-800°C, Rx: Custom
Typical spectral filters:	F1x - NIR Filter: NBP/LP range 0.6µm to 1.2µm (Lime Kiln) F2x - SWIR Filter: NBP at 1.3µm/1.7µm/2.3µm/2.6µm (Lime Kiln, Boiler) F3x - MWIR Filter: NBP at 3.4µm/3.9µm/4.2µm, LP at 4.5µm (Lime Kiln, Boiler) F4x - LWIR Filter: BP/NBP between 8.5µm and 12.5µm (Lime Kiln, Boiler) Fx - Custom - Optical filters optimized for the application (e.g. see through dust/vapor)
Measurement accuracy, repeatability:	<±1.0% (full scale), <±0.5% (full scale).
Temperature resolution / NETD:	<2°C / 1,5°C @ 1000°C
Typical Spot size 90/50% SRF (FOV=90°D):	Infrared FPA imaging sensor with 320x240 pixel: <10/<5mrad Infrared FPA imaging sensor with 640x480 pixel: <5/<2mrad CCD/CMOS HD sensors: <3/<1mrad.
Multiple spot measurement cycle:	<40 ms (continuous measurement) or actual frame rate.
Power requirements:	12VDC or 24VDC +/-10% max. 15.0W.

PyroViper™- high temperature furnace probe lens assembly (standard furnace probe lens models)

Overall length	273mm, 451mm, 629mm, 921mm, 1213 mm (12”, 18”, 24”, 36”, 48”).
Usable length / Shroud diameter:	202mm, 380mm, 558mm, 850mm, 1142 mm (8”, 15”, 22”, 34”, 45”) / 42.4 mm (1.67”).
Shroud diameter:	41.3mm (1.625”) or 60.0mm (2.362”)
Field of view (FOV):	Typical 72°H x 54°V x 90°D (custom FOVs between 45°D & 110°D are available).
Angle of view (AOV):	Standard AOV is “straight ahead”. Optional: “right AOV” or “obtuse AOV”.
Environment: (lens view-port in furnace wall)	Continuous lens operating temperature is up to 1800°C (3272°F) if protected with an additional, open-cycle air cooled wall box shroud made of stainless steel or ceramics. Option: Additional closed-cycle water cooled wall box shroud made of stainless steel.
Lens air purging & cooling:	Instrument-quality air: 34-72Nm ³ /h at 0.1-0.7MPa
Sensor housing air purging & cooling:	Instrument-quality air: 3.4-7.2Nm ³ /h at 0.01-0.07MPa Requirement: maximum pressure air temperature 40°C, else vortex cooler recommended
Optional Wall box shroud cooling:	Pre-filtered ambient air: 12-24Nm ³ /h at 0.02-0.1MPa Water cooling option: 5-15 liters per minute at dT≤50°C.

PyroViper™- environmental protective camera housing (sensor module enclosure)

Material:	High temperature synthetic and/or stainless steel/aluminum.
Environment with standard air cooling:	Furnace surrounding ambient air temperature up to 80°C Option: Vortex cooler for ambient air temperature up to 150°C or pressure air temperature up to 70°C. Outer furnace wall temperature up to 500°C with air cooled wall box shroud.
Environmental protection rating:	IP66 (NEMA 4X).
Wall box mounting interface:	Slide track block or slide track flange.

PyroViper™- accessories and options

Customized optics/filters & digital CCD/CMOS/infrared FPA imaging sensors adapted to the application for optimized image quality.
High performance air filtration/distribution system, automatic retract assembly, automatic port de-slagger.
Heavy-duty furnace wall-box with auto-shutter & air-cooled lens protection shroud, water cooled welding socket, ball-head mount, etc.
R etract- and S ensor C ontrol U nit “RESC-U”: Sensor power supply, automatic retraction control, video & control signal conditioning.
S ignal processor I/O unit: Video & control signal conditioning, status & alarm signal I/O, interface to process control systems (PCS).
Isolated video & control signal transmission via fiber-optic cable up to 2km (video transmission via CAT7 <100m / coax cable <30m).