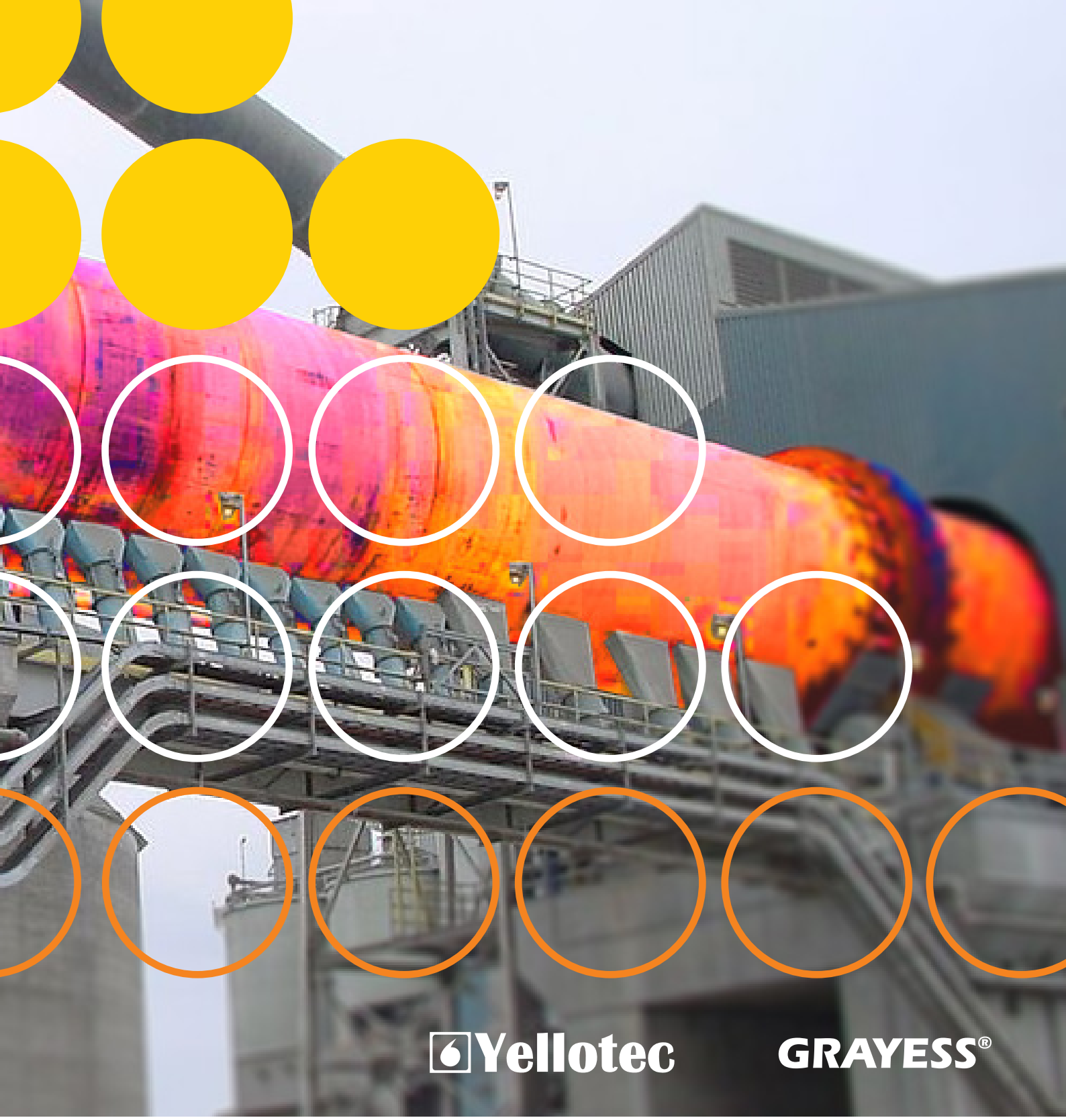


Kiln Monitoring System

The World's first Kiln Shell Monitoring System based on State of The Art Microbolometer Infrared Camera Technology.

Kiln Monitoring System Partnership

Yellotec

Condition Monitoring Specialists

Yellotec is a solution oriented company focused in applying the following technologies:

- Vibration Analysis
- Laser Alignment
- Infrared Thermography
- Ultrasound
- Oil Analysis
- Training
- Field Services

GRAYESS®

Infrared Thermography Software Specialists

Our software is:

- clearly structured
- easy to use
- highly sophisticated
- high compatibility
- ease of data exchange

More than 3000 installations worldwide!

Yellotec + GRAYESS®

IRT KilnMonitor®

The World's first Kiln Shell Monitoring System based on State of The Art Microbolometer Infrared Camera Technology.

IRT KilnMonitor® is a full featured computer system that allows you to monitor, process and trace data from rotary cement kilns.

Unlike existing solutions it is based on standard microbolometer radiometric infrared cameras, as used in a variety of different applications.

IRT KilnMonitor can integrate several cameras per kiln as well as allowing several kilns to be observed at once.

Yellotec + GRAYESS®

IRT KilnMonitor® by Grayess

IRT KilnMonitor® is the industry leading environment for real time kiln data acquisition, analysis and control.

It consists of:

- Camera (Scanner) control module for realtime temperature acquisition;
- Input/output control module;
- Kiln visualization module (2D and 3D);
- Thermographic analysis module;
- Historical storage module.

The Principle

A radiometric infrared camera is mounted in appropriate distance (according to the user selectable FOV and desired geometrical resolution) to the kiln and delivers usual 2d radiometric infrared images in real-time to the control PC.

In the Configuration Module the user defines, beside other kiln parameters a profile line on the image delivered by the camera, which will be used as "scan line" for the 3D kiln observation.

The Advantages

Huge Savings In Installation Expenses

- The weight of conventional IR Line Scanner modules including environmental protection easily sums up to a total of approx. 30kg. Because of this, quite severe and expensive precau tions like heavy duty platforms and stands or even Scanner Houses have to be erected.
- A modern IR Camera including environmental protection weighs approx. 3kg or 10% of the above. The saving potential is obvious!

Solves The Problem With Interrupted Line Of Sight

- Quite rarely a non obstructed view on the entire kiln is possible. Pillars or other obstacles are blocking the line of sight of the wide viewing angle of a single scanner. In addition external rings and the drive shaft are forming shadow areas. Also line scanner certainly have a relatively high geometrical resolution, the above mentioned effects are limiting the advantage.
- Using several cameras instead helps to overcome that limitation, deliver a better resolution, and help to avoid shadow zones and areas in total.

Observe The Surroundings Of The Kiln

- Use the life image of the properly positioned cameras not only to monitor the kiln, but also to get immediate information about abnormal phenomena's in the surrounding of the kiln.

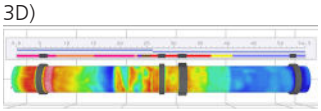
No Moving Parts In The Scanner

Easy Adoptable To Your Specific Needs By Standard Accessories

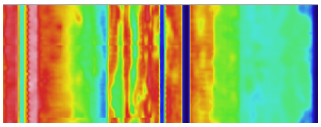
Kiln Monitoring Software

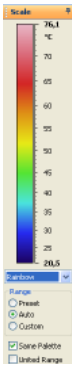
Yellotec + GRAYESS®

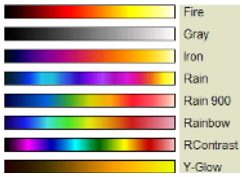
Three-dimensional view of the whole kiln in motion (Virtual Kiln 3D)

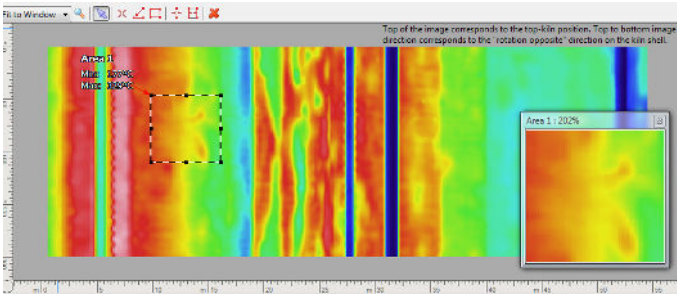


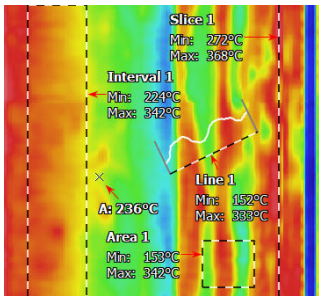
Two-dimensional infrared view (Temperature Map 2D)







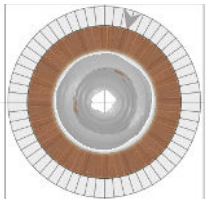




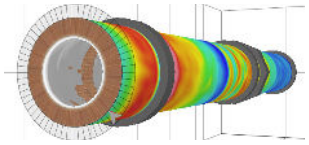
Kiln View Models

In IRT KilnMonitor the kiln can be observed in different ways. GRAYESS Inc. has designed several view modes. There are four basic views of the kiln:

Three-dimensional view of the kiln interior (Kiln Section 3D)



Three-dimensional view from the kiln end (Kiln End-view)



2D Infrared Image Display

- Selectable color palette;
- Selectable temperature range: preset, auto or custom;
- Rulers in the real kiln coordinates;
- Flying spot reader: temperature at the spot, position of the spot, brick thickness, coating thickness;
- Maximum kiln shell temperature is displayed;
- Areas zoom in a separate window, unlimited number or zoomed areas.

Analysis Objects on the 2D Image

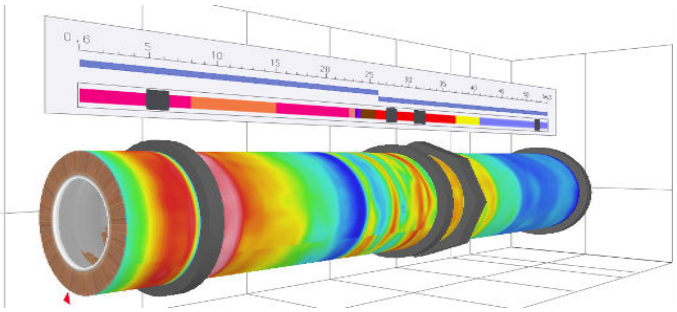
Spots: temperature, position, brick thickness, coating thickness, averaging. Unlimited number of spot objects.

Slices (kiln sections): min, max, average temperature, brick thickness, coating thickness, averaging. Unlimited number of slice objects.

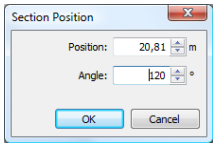
Intervals: min, max, average temperature, brick thickness, coating thickness, averaging. Unlimited number of interval objects.

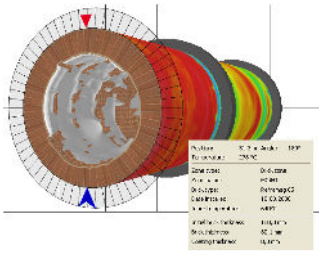
Lines: min, max, average temperature, averaging. Unlimited number of line objects.

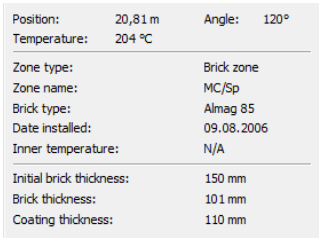
Areas: min, max, average temperature, averaging. Unlimited number of area objects.

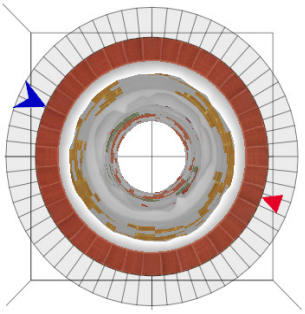


Changing Section Position and Angle









Virtual 3D Kiln Display

- Kiln "pipe" with infrared image on the surface. Kiln is rotating with the real speed.
- Rings and other shadow zones.
- Position of the top-kiln.
- Real coordinates ruler with the kiln refractory and shadow zones structure.
- Brick refractory with calculated thickness.
- Coating with calculated thickness.
- Possibility to view from different angles and look inside the kiln.
- Section view with detailed kiln information at the section.
- Split by refractory zones view (also works in section and end views).
- Colorized refractory zones.

The 3D virtual kiln model consist of the following parts:

- The kiln shell with infrared image on it;
- refractory bricks;
- clinker;
- live rings and gear ring;
- top-kiln position marker (red triangle);
- refractory zones ruler with scanner field of view (blue line).

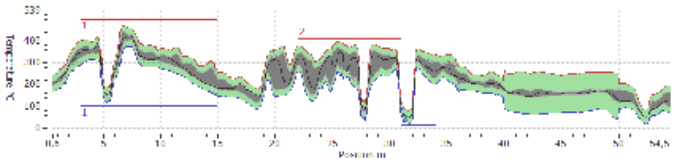
Kiln Section 3D View

Kiln Section 3D View virtually cuts the kiln at some position. So it shows more the kiln interior (bricks and coating).

Change section position by dragging the cursor at the kiln design view or at the 2D infrared image view. Set the exact section position and value of the angle marker manually

Kiln End-View

Kiln End view is a special case of the Kiln Section 3D view: scene angle is fixed at 90°.



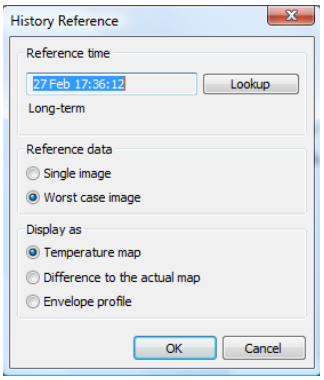
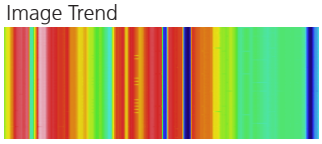
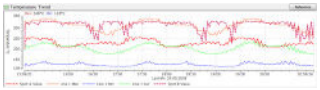


Image Trend



Temperature Trend



Kiln Envelope Profile

Permissible envelope profile with the possibility to define individual limits for different kiln zones. (Green);
Actual envelope profile. (Gray; parts outside permissible range - Red);
Alarm zones;
Last scanned line;
Envelope profile is leveled with the 2D image and is with a cursor to easily see image to profile correspondence.

Kiln-History

Kiln state (scanned infrared image, bricks and coating thickness, alarm state) is continuously recorded in a database.

Three types of history: short-term with recording every 5 minutes, middle-term with recording every 1 hour and long-term with user-defined intervals of recording.

Possibility to load any saved kiln state by date/time to see and analyze it with all available views (2D and 3D). Player controls: first, last, next, previous (2D and 3D). Fast playback with selectable speed (only 2D).

History Reference

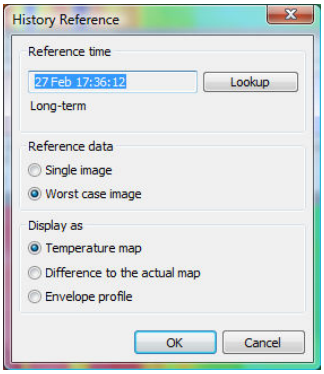
Possibility to recall any kiln state from the history and display it on the screen for reference: as kiln shell image, as envelope profile or as a difference map between the current and the history image.

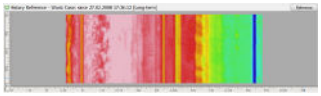
Temperature Trend

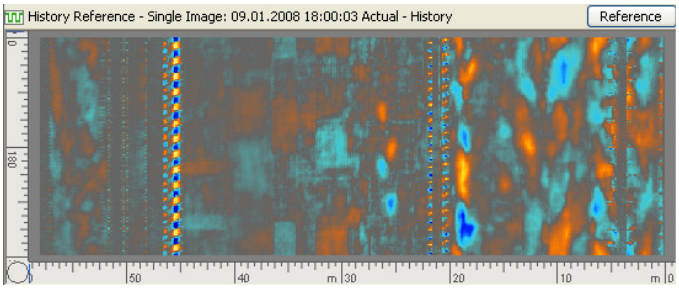
Trending for spots, lines or areas of the kiln shell (spot temperature value, line and area minimum, maximum and average temperature). For the real-time data and for the historical data.

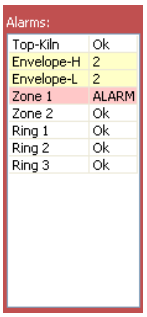
Image Trend

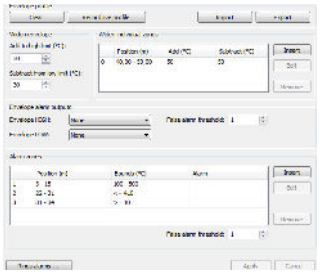
History forms one image where every line represents one record in the history.











Worst Case Image

Worst case image is an infrared image which is composed from many infrared images taken from the kiln history. Every point shows the maximum temperature measured at this point since the indicated time.

Difference Display

History Reference image (single and the worst case) can be displayed as the difference map . In this mode the reference image is subtracted from the actual image. The result is displayed using the special palette:

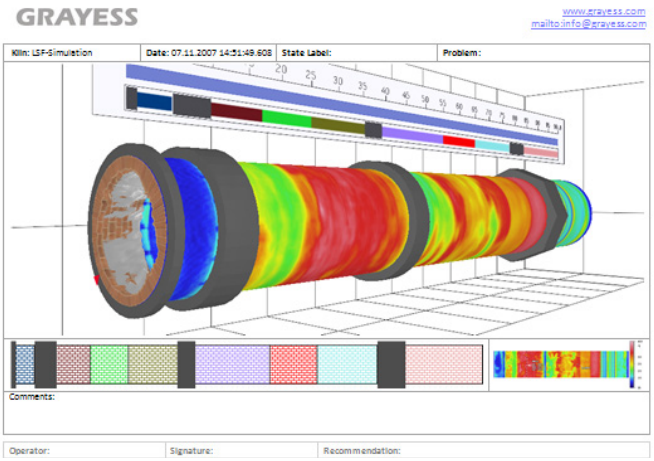
places where the actual data has higher temperature than the history data are orange;
places where the actual data is lower than the history data are blue; gray color means that the difference is not big.

Alarms

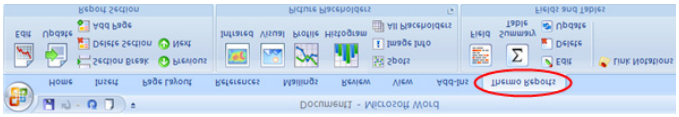
On-screen display, beeper, external hardware alarms and OPC alarms;
Alarms on exceeding reference envelope profile limits – upper and lower bounds;
Alarm zones: upper bound, lower bound, range. Zone number is not limited;
False alarm thresh old.

Alarm Types
Top kiln alarm
Envelope alarms
Zone alarms
Rings alarms

Alarm Indicator shows all monitored alarm conditions.



Server is the computer collecting data from the scanners. Client is any computer in the local network (or as an option – in the Internet).
Kiln information can be visualized in the same way (in 2D and 3D) on the server and on any client computer in the network.
Client-server model is implemented using OPC.



Client-Server Model

OPC

OPC Alarms and Events protocol. Alarms are published for any OPC client.

OPC Data Access protocol. Current kiln state is published for any OPC client: infrared image, kiln temperature min and max, bricks thickness minimum, coating thickness maximum, envelope profile and other information.

Logging

Event-log: monitoring started, monitoring stopped, kiln configuration changed, scanner communication.

Alarm-log: alarm condition changed, alarm condition reset by the operator.

Creating Reports

IRT KilnMonitor generates reports in Microsoft Word format. To be able to create reports you need Microsoft Word 2000 or higher installed on your computer.

Report are created by predefined layouts (also custom-made).
Reports can be generated for any data source online, history or remotely accessed (OPC).

Infrared Automation Cameras By FLIR

World leader in the design, manufacturing and marketing of thermal imaging systems for a wide variety of commercial, industrial and government applications.

A615

- 1 Gb Ethernet
- 16-bit 640 x 480 images @ 50 Hz.
- Windowing mode: 640 × 240 @ 100 Hz or 640 × 120 @ 200 Hz
- GigE Vision/ GenICam compliance
- Image flow control using Digital In

A315

- 1 Gb Ethernet
- 16-bit 320× 240 images @ 60 Hz
- GigE Vision/ GenICam compliance
- 16-bit Temperature linear output
- Image flow control using Digital In
- Large set of Accessory lenses

AX5

- 1 Gb Ethernet
- Price
- Size
- GigE Vision and GenICam compliance
- GigE Vision lockable connector
- Multiple pixel resolutions
- PoE
- 8-/14-bit image streams.
- Master/ Slave sync. between cameras
- High frame rates (60 Hz)
- General purpose Output/ Input

Large selection of accessory lenses:

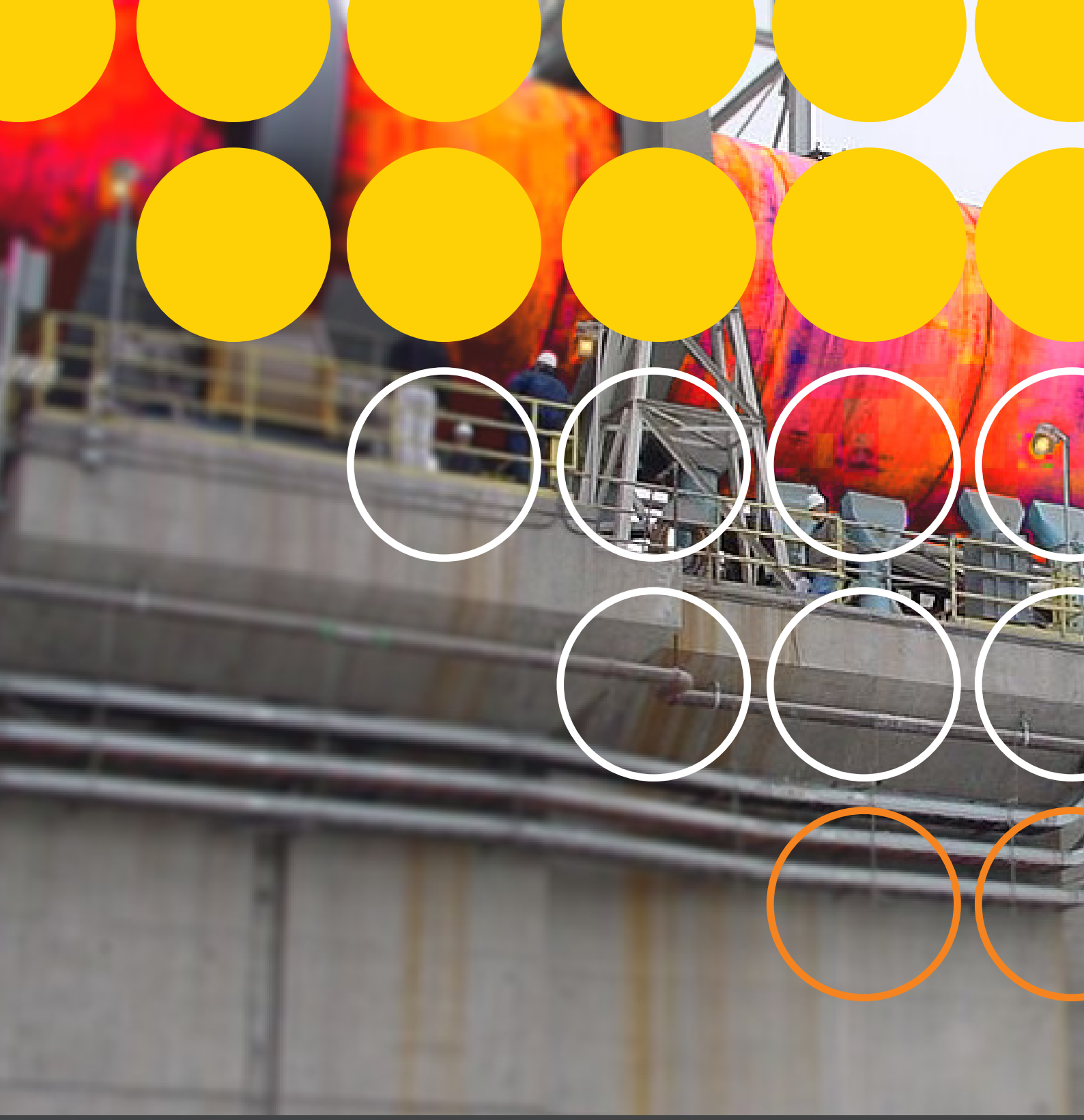
90° lens

45° lens

Environmental Housing:

FLIR Infrared Technology

Yellotec + GRAYESS®



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