Begner Agenturer

iba

Time-synchronous recording and analysis of videos and process data

ibaCapture

ibaCapture
Measure, view and understand

ibaVision
Industrial image processing in real time

Measurement Systems for Industry and Energy
www.iba-ag.com

Record videos and process data time-synchronously

ibaCapture - Measure, view and understand

The video recording system ibaCapture records video and HMI images time-synchronously to process data in conjunction with ibaPDA - either continuously or triggered by events. Important events can be automatically stored as still images. The exact relation and simultaneous display of recorded process data and visual information with ibaAnalyzer offers a completely new quality of process analysis.

See everything

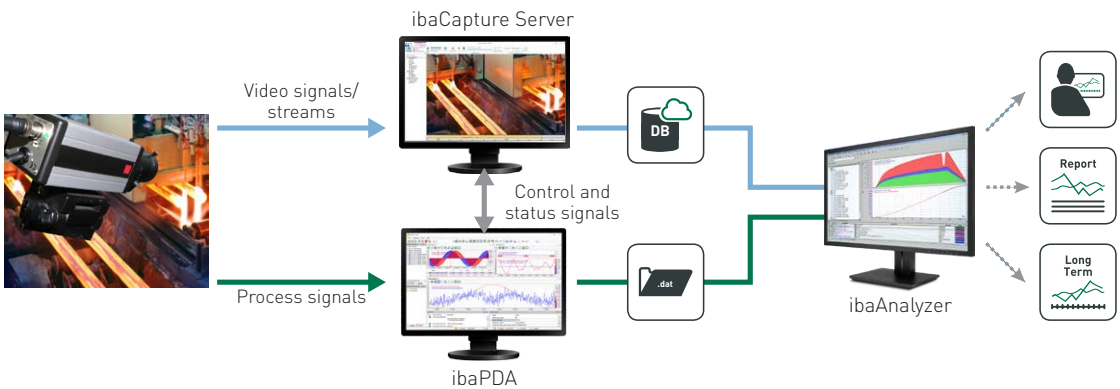
ibaCapture can be used to capture and record video from cameras and HMI systems synchronized to process data in ibaPDA. Unlike conventional video systems, ibaCapture not only records videos but links acquired data from the process synchronously with the visual information.

Images and process data can be viewed in a time-synchronized way with accuracy down to individual samples. As a result, causalities that are often not identifiable at first glance can be better understood. At last, failures can be detected more quickly which allows better identification of root-causes.

At a glance

- Synchronous recording of video images and process data with ibaPDA
- Continuous and event-triggered recording
- Integration of HMI images and images from ibaVision as virtual cameras
- Protected storage areas for important sequences
- Capturing of up to 64 cameras (analog, IP, GigE or virtual)
- View and analyze video sequences and process data with ibaAnalyzer
- Live image display as replacement for a CCTV system
- Event-triggered switching of display-layouts (Scenario Player)

The use of cameras improves process monitoring wherever operations are difficult to measure or process steps cannot be reliably detected with sensors. These can be, for example, material feeders of machine tools or material handling systems where excessive steam, dust or heat is generated, such as in steel and rolling mills.



Configurable full-screen layouts can be used as a substitute for CCTV systems

Synchronous data recording with ibaPDA

ibaCapture Server records video and provides synchronization data over a network connection for use in ibaPDA.

Together with acquiring process data, ibaPDA continuously receives this synchronization data and stores it into the measurement files. This way a temporal relation between signal values and video data can be ensured.

For analyzing and viewing recorded video in ibaAnalyzer, network access to the ibaCapture Server is required.

Topology

Multiple ibaCapture Servers can be installed in a network. It is possible to access an ibaCapture Server from multiple ibaPDA systems, but also multiple ibaCapture Servers can be synchronized to one ibaPDA system.

Up to 64 cameras can be configured on one ibaCapture Server.

Continuous and triggered recording

In addition to continuous video recording, process sequences of particular interest can be recorded when triggered by an event. The desired process signals from ibaPDA can be used as "video triggers" in order to record the event with a defined start and stop. All steps in this process period can therefore be recorded and analyzed from the beginning to the end. In addition, still images can be saved in different file formats for documentation with the help of "image triggers".

Easy configuration

The connected cameras are configured with ibaCapture Manager. The suitable video parameters can be adjusted for each camera, such as bit rate, frame rate and resolution.

The cameras whose image data are to be linked with the process data are then selected in ibaPDA. Up to 10 video triggers can be added for each camera. During video trigger configuration, all signals available in the ibaPDA configuration can be used as trigger signals.

Live image display and replay

The video images can be viewed live and as a replay with adjustable speed in ibaPDA Client, ibaQPanel or in ibaCapture Manager.

Through a "dockable view" design, the display can be quickly and easily adapted to your needs. A client can display up to 32 cameras. In full-screen mode, the display can be used as a CCTV system to monitor an entire plant system live. Brightness, contrast, hue and saturation can be optimally adjusted for each camera to suit different lighting conditions.

RTSP-Server

The integrated RTSP server allows video to be streamed from the ibaCapture Server to third-party video players. This way you can watch live video as well as saved recordings, for example with the VLC Media Player.

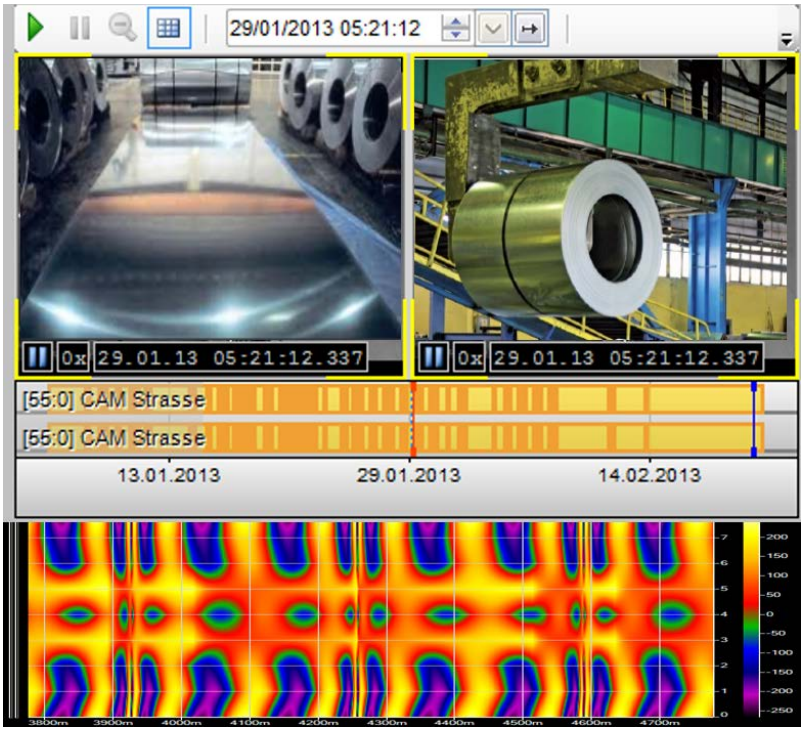
Scenario Player in ibaQPanel

It is easy to lose track when monitoring multiple displays. With the Scenario Player feature in ibaQPanel it is therefore possible to set up signal based triggers. This allows selecting predefined camera layouts based on the current state of the process.

For example, if an emergency stop is triggered in a certain area of the plant, the display of this section is moved to the foreground and the operator immediately gets an insight into the area at risk. This enables not only the live image to be viewed but also the image playback to be started with a pre-trigger time of the event in order to detect the cause that triggered the emergency stop.

Capture and data storage

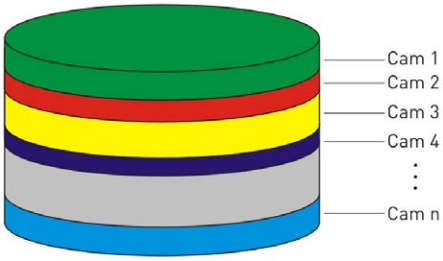
The compressed video streams from all configured cameras are captured by ibaCapture Server and stored on the hard disk.



Scenario Player allows signal-triggered switching to predefined camera views.

A separate target directory is created for each camera. Periods in which a "video trigger" occurs are marked as "protected".

Video data is overwritten cyclically using the ring buffer principle. An automatic clean-up procedure optionally removes stored video data after a defined period of time.



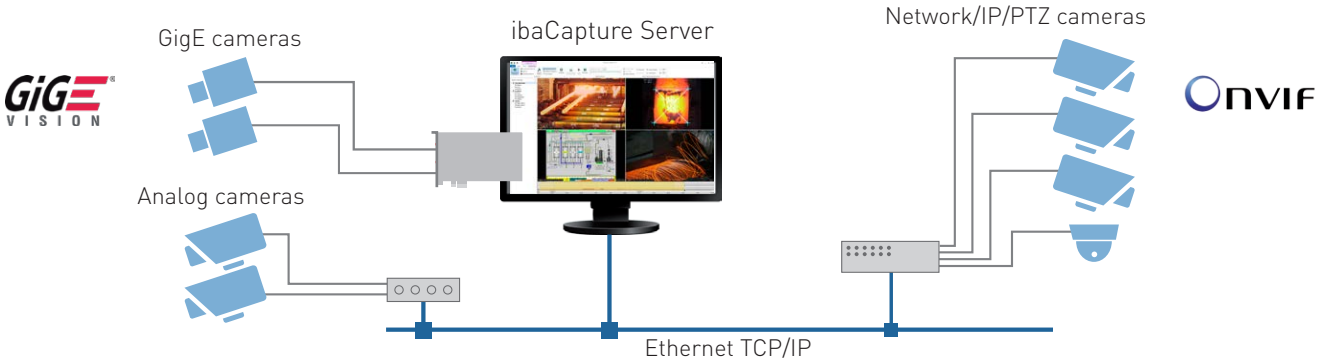
A separate area is set up on the hard disk for each camera. The areas can vary in size and contain protected areas.

How much disk space is required for video data?

The required storage capacity varies due to many factors including resolution, frame rate and how much activity is present in the image.

The figures (in GB) in the table on the right therefore only represent an estimate of the required storage capacity. The estimate is based on a bit rate of 2 Mbit/s for continuous recording. The actual bit rate for every camera will only be visible after recording has been started.

	1 h	24 h	7 d
1 camera	1 GB	21 GB	144 GB
4 cameras	3 GB	82 GB	577 GB
16 cameras	14 GB	330 GB	2307 GB
32 cameras	27 GB	659 GB	4614 GB



Up to 64 different cameras can be operated per ibaCapture Server

User management

ibaCapture provides a user management system to flexibly set access rights to video. Integration with Active Directory is also possible. This integration provides the possibility to centrally manage user accounts and passwords. Domain policies can easily be enforced. In ibaCapture, different privileges can be granted to users such as the right to view videos, especially protected or blocked videos, but also rights to perform actions such as exporting and locking videos or controlling PTZ functions.

Complying with privacy guidelines

ibaCapture offers different possibilities to comply with data privacy guidelines for video recordings. The assignment of user rights is a method to protect videos from unauthorized access. Overlay images can be used to cover sensitive areas in the image in accordance with privacy guidelines. This function can also be used to display orientation information in the image.

Supported cameras

ibaCapture supports analog cameras, IP cameras as well as cameras compatible with GigE Vision®. One ibaCapture Server allows up to 64 cameras of different types to be connected, which can all be operated simultaneously.

ibaCapture supports different IP camera types: AXIS IP cameras, ONVIF-compatible devices and RTSP sources. In addition, ibaCapture is compatible with the video codecs MPEG-4, H.264 and H.265.

For connecting analog cameras, a converter has to be used. IP cameras are connected via the network. GigE cameras must be connected directly to a network card in the ibaCapture Server for optimal performance.

It is also possible to control PTZ cameras with ibaCapture. This applies to ONVIF-compatible PTZ cameras as well as AXIS IP-cameras. PTZ cameras can pan, tilt or zoom the picture using a mouse, joystick or via ibaPDA. It is possible to access predefined positions - either through the menu or controlled by ibaPDA signals - and focus on specific views.

Specific features for GigE Vision cameras

When it comes to capturing very fast movements in high quality, GigE Vision compatible cameras (GigE cameras) offer special possibilities. With specially selected components, processes that are usually invisible to the human eye can be visualized.

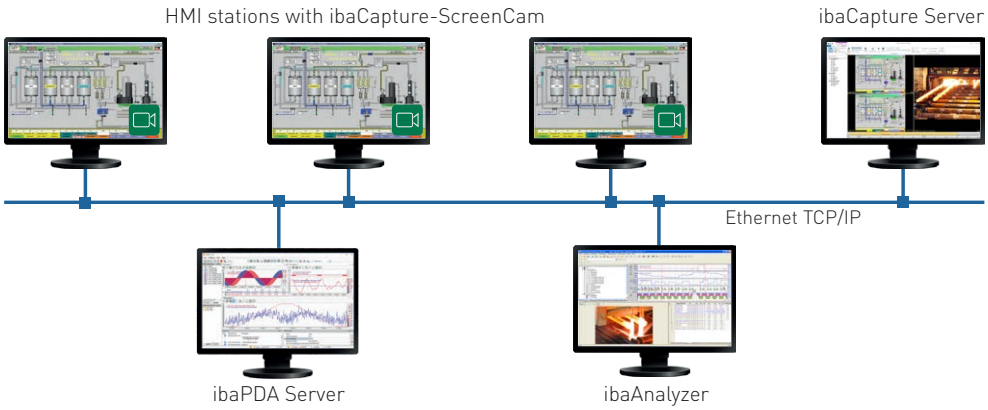
Image acquisition with GigE cameras can precisely be controlled by using external trigger signals.

Moreover, the exposure settings of GigE cameras can be adjusted to the given lighting conditions in order to achieve optimal results.

To establish connections to GigE cameras, ibaCapture uses the eBUS SDK from Pleora. The corresponding runtime license can be provided by iba.

High-speed hardware for GigE cameras

For optimal performance in video acquisition, ibaCapture Servers require a dedicated network card for GigE cameras with sufficient bandwidth. When using appropriate hardware, multiple GigE cameras can be recorded simultaneously.



The required performance for video encoding can be ensured by using a suitable graphic card. Currently, video encoding is supported with Intel HD Graphics or NVIDIA graphic cards.

iba offers powerful industrial computers for video recording and processing applications.

10GigE support

In current versions ibaCapture also supports cameras with GenICam protocol, which provide a 10GigE interface. By increasing the bandwidth by a factor of 10, high-resolution images with increased frame rate can now also be transmitted. An example configuration is a resolution of 4096 x 3000 pixels at 60 fps.

If a high-performance graphic card is available, one of these cameras can be recorded per ibaCapture Server.

Virtual cameras

The screen contents of HMI stations as well as the output streams of ibaVision programs can be recorded as virtual cameras.

Virtual cameras are configured in ibaCapture Manager similar to other camera types. The image source, screen section, and frame rate, amongst other things, are adjusted there.

Discover relations between operation and process

Visual information of the HMI operator stations, including operating procedures, are recorded synchronously with process data from ibaPDA with the help of virtual cameras. This way, the relations between process control and process data can easily be identified.

This way tasks like trouble-shooting and process analysis, commissioning and documentation of operating processes are supported.

All computer monitors that work with a Windows operating system can be captured. For this purpose, an agent program (ibaCapture-ScreenCam) with TCP/IP connectivity to the ibaCapture Server needs to be installed on the PC to monitor.

Automatically extract information from image processing

ibaVision processes image data recorded with ibaCapture and extracts information or processed images with added visual information. The images processed by ibaVision can be captured again in ibaCapture and recorded using a virtual camera.

The information extracted from the images can be sent to ibaPDA. There, the information is handled like other sensor signals, which can be trended, monitored and stored for further analysis.

In ibaAnalyzer, video playback simultaneously moves the marker in the trend graph and the movement of the marker along the graph always shows the matching image.

With triggered recordings video sequences can be opened by clicking on the trigger signal.

Offline analysis of video images and process data

Process data and video sequences can be viewed and evaluated in ibaAnalyzer. Recorded video from each camera can be displayed in a window alongside trend graphs with measured signals. By moving the marker along the time axis, video from all displayed cameras is synchronously displayed. Video recordings can be embedded in the data file and also exported in a standard format (MP4). The process for embedding videos into data files and storing on a separate drive can be automated with ibaDatCoordinator. This provides a convenient way of archiving video together with process data.

Furthermore it is possible to include still images from ibaCapture into reports.

Length-based synchronization

If ibaQDR is used to record length-based product data, ibaCapture can also be synchronized in the length-based mode. For this purpose, cameras can be added to measurement locations. When displaying ibaQDR data and video in ibaAnalyzer, images from different camera positions in the plant can be displayed synchronized with the product length.

Language variety for international use

ibaCapture supports several languages. By default the languages German, English and French are included.

Other languages are optionally available on request, for example Chinese, Russian and Spanish. Please contact your local iba subsidiary or the local iba sales partner.

Keep an eye on the entire plant with process specific camera monitoring

The synchronized recording of camera and process data allows a comprehensive root cause analysis in case of process issues. By interpreting process signals and image information, errors can be detected more easily.

Improvement of product quality

Enhanced productivity through more efficient processes

The project

In general, not all critical components and aggregates are freely visible from the control panel of a rolling mill. This is why camera systems are used in the field of process monitoring.

Thus, disturbances in the process can be identified from the control panel and appropriate countermeasures can be taken. For preventing disturbances in the process that have occurred once and should be prevented in the future, the causes of these disturbances have to be identified. Recording the camera signals simultaneously to the process signals is a proven method for identifying the causes.

The project comprised the installation of ibaCapture and ibaPDA in a rod mill.

The technology

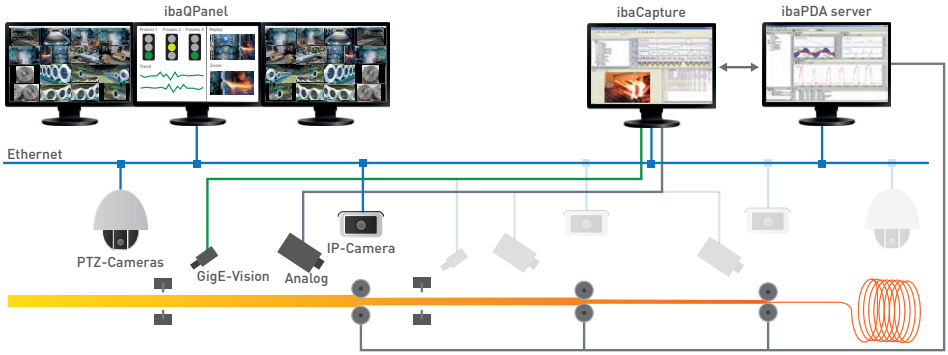
ibaPDA and ibaCapture record process and video signals time-synchronously. For this purpose, ibaCapture sends synchronization signals to ibaPDA that are recorded simultaneously to the process data. In addition to the common analog and IP cameras, GigE cameras with a frame rate of up to 300 fps were used to record the rapid processes in a rod mill.

Online visualization

Camera and process signals can be displayed online with ibaPDA and ibaQPanel. Process signals can be used for controlling the camera display. Using the scenario player, e.g. functions like the automatic and process controlled switching of the camera sequence or displaying critical process sections in slow motion can be implemented.

Offline analysis

With the analysis tool ibaAnalyzer, process and video images can be analyzed together. Recorded video sequences can be played in variable speeds. A marker moves time-synchronously over the displayed process signals. The corresponding video image is displayed for the selected marker position. A frame-by-frame view of recorded video is also possible. The signal marker then jumps to the corresponding position on the time axis.



Automatically extract information from image data

ibaVision

ibaVision integrates professional, industrial image processing into the iba system and enables visual monitoring and analysis of processes. Quality checks can be automated during the production and allow early intervention in the process before major errors occur.

At a glance

- Seamless integration of automated image processing with ibaCapture and ibaPDA
- New plug-in architecture: HALCON and Python plug-ins are included, user-specific plug-ins can be loaded
- Use of ibaCapture as image source and storage for processed images
- Acquire and visualize image processing results as signals in ibaPDA
- Use process signals from ibaPDA in ibaVision
- Automated quality control and process monitoring

ibaVision serves as a link between the iba system and project-specific image processing solutions. With version 3, ibaVision introduces a new plug-in architecture that allows building solutions for an even wider array of projects.

Independent of the used plug-in, the main feature of ibaVision consists of processing image data automatically. Results are presented either as data (numeric/text) or as new images.

All these results can be processed, visualized and analyzed with the familiar iba tools in the usual way.

In general, automatic inspection images can provide information that is hidden to conventional sensors. Thus, ibaVision provides ways to enhance previously unavailable process information thus offering new possibilities for analysis and automated monitoring.

Intelligent image processing

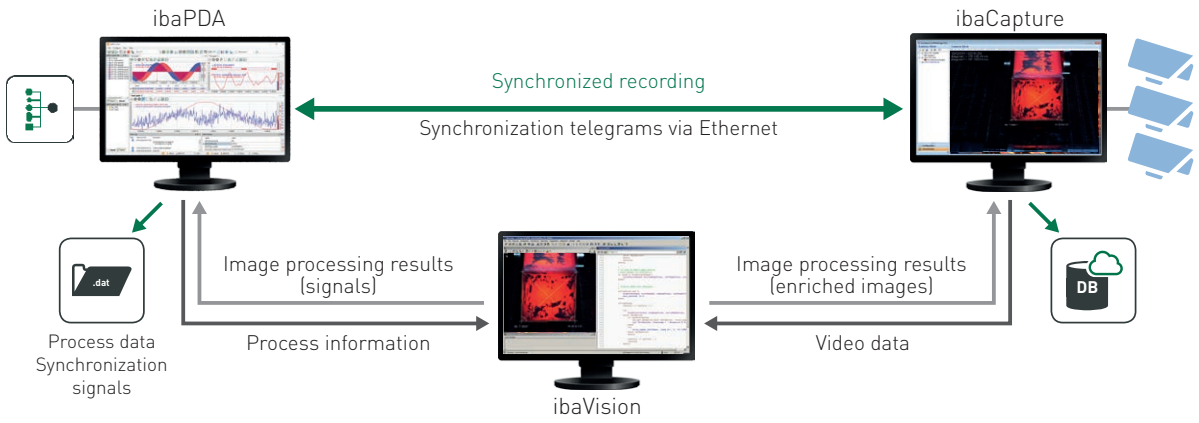
ibaVision plug-in programs convert visual process information into numerical or logical values. In this way, for example, the spacing, geometry or position of products can be determined and used for quality testing or identification of parts during the ongoing process. In addition, identification features, such as bar codes, numbers or other machine-readable symbols can be captured.

Numeric or textual values are recorded online in ibaPDA and can, like other process signals, be visualized and displayed as trends. The user can display process data side-by-side with static images or live video streams and can recognize emerging trends, process deviations or failures.

In addition, optical warning messages can be integrated into HMI system displays. In case tolerances for a quality feature are exceeded, this can immediately be displayed, for example, using a signal light.

Integration of ibaVision

All data and image interfaces that are defined in ibaVision plug-in programs are automatically listed and can be flexibly linked to signals in the iba system. Both signal and image information can be used bidirectionally. The resulting values are recorded in ibaPDA. If necessary, pro-



cess signals which are already available in ibaPDA, can be sent to ibaVision in order to adapt the running image analysis.

Cameras that are configured in ibaCapture can be used as image sources. Finally, resulting images from the image analysis which may contain markers or other additional visual information, can be encoded into a video stream. With ibaCapture such streams can again be recorded using the virtual camera video source.

Image information plus process signal

Since the image information is synchronized with other process signals, causal relationships can be examined in a later analysis and finally the root-causes of malfunctions can be easily identified. In ibaAnalyzer, signals extracted by image processing, process signals and the images from all cameras are time-synchronized and replayed accurate to the sample. Processed images provide additional information and facilitate the identification of certain image content based on markers. With the help of comprehensive information, users are able to conduct in-depth analyses.

On the other hand, process information can also be used for image processing. For example, ibaVision plug-in programs can be adapted based on data from automation systems to optimize image processing by adjusting camera settings to pre-defined setpoints.

Flexible choice of processing tools

The introduction of ibaVision v3.0 allows a new plug-in concept to choose the right tool for every job.

Initially, ibaVision will be delivered with two plug-ins that work out-of-the-box. The first plug-in provides the HALCON integration, which has already been available in all previous versions of ibaVision.

The second plug-in executes Python scripts. This allows using the extensive selection of libraries that are available for the Python programming language for solving image processing tasks.

Beyond the included plug-ins, it is also possible to program plug-ins that execute custom applications within ibaVision. This offers unlimited possibilities for image processing applications in the iba-system.

HALCON

HALCON by MVTec is a widely-used product that specialists all over the world use to create image processing applications. Commercial programming libraries such as HALCON offer the advantage of constant development of functions in new releases. In addition, technical support and training can be obtained.

In order to create HALCON applications, a license for using HDevelop is required. To run the ibaVision program, a HALCON runtime license is required (included with ibaVision or purchased separately depending on the order option).

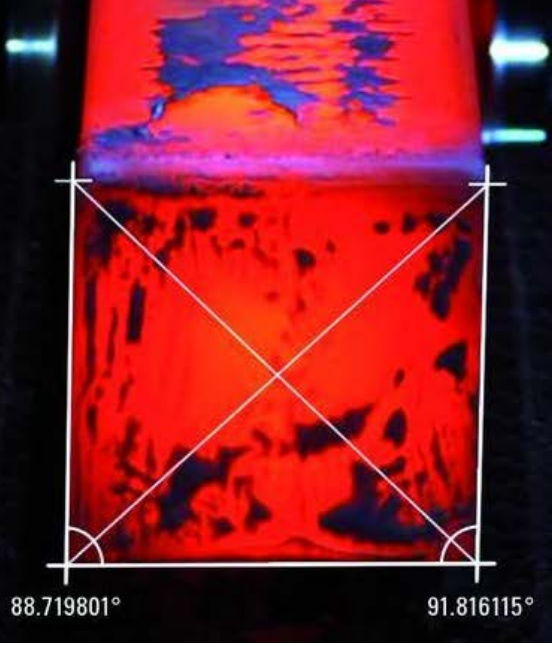
The HALCON library provides a large set of functions and is a reliable tool for a wide range of image processing requirements.

Python

Due to the extensive number of available libraries, Python can also be used to create image processing applications. Python itself and most of the available libraries do not require purchasing licenses. This allows using Python immediately with every purchased ibaVision license.

One available library for Python is OpenCV, which is an open-source image processing toolkit. Enthusiasts around the world use the available functionalities to build solutions. The OpenCV website is the starting point for documentation and help from other users.

Increasing product quality by automatic inspection of image data



Camera and image processing detect information in the video image and enable thorough and continuous testing. The state of the process is monitored reliably, continuously and 24/7 as a trend. Process efficiency and product quality are sustainably increased.

Improvement of product quality

Enhanced productivity through more efficient processes

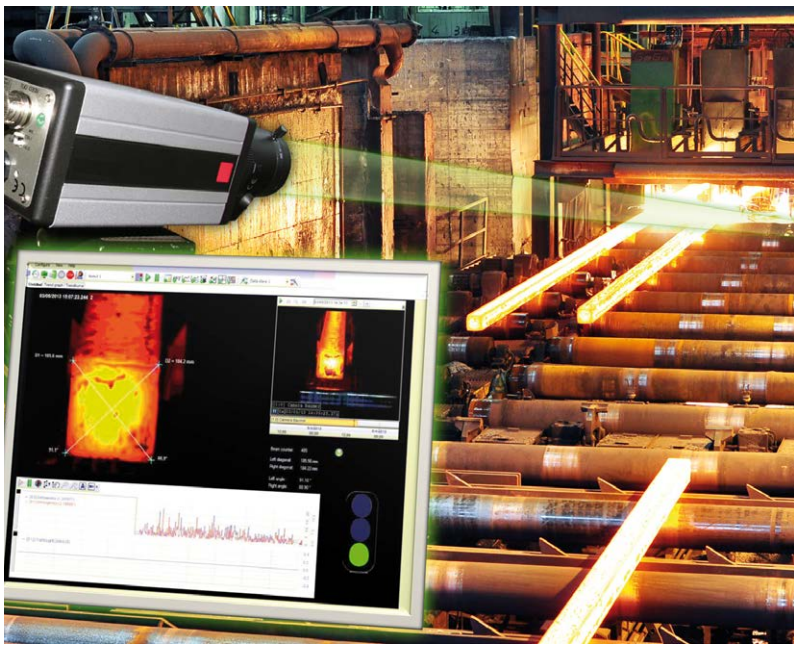
The project

The task is to detect rhomboidity during a continuous casting process. This needs to be done to allow timely process adjustments and consequently avoid problems in the downstream rolling mill.

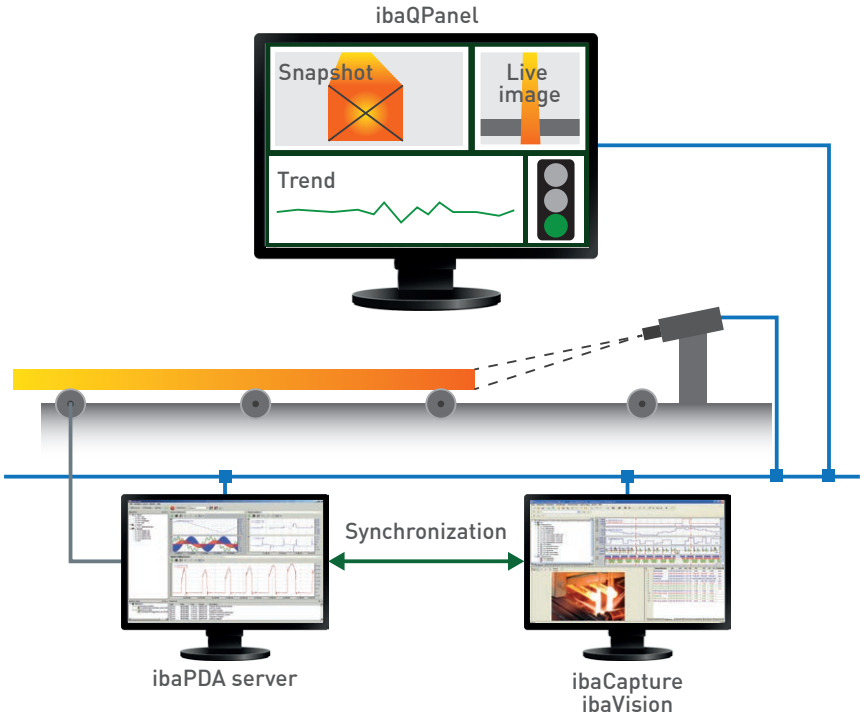
Continuous casting is a semi-continuous procedure for manufacturing steel blocks. The molten liquid metal is poured in the mold and pre-cooled, so that the strand has a solid shell of a few centimeters and a large part of the cross section still is in a liquid state. The strand is guided by the machines over strand guide rolls and is afterwards cooled. After it has solidified, the strand is cut on the out conveyor to the desired length by means of a cutting torch.

Without real-time monitoring, the geometry of the cast billets can only be measured on a random basis after cooling. Rhomboidity as a result of deviations in the casting process could then only be detected much later in the process.

This is prevented by continuously monitoring the production plant with an image processing system. The process efficiency and also the product quality are increased with a lasting effect.



Easier identification of error causes: Image processing results and process signals are recorded time-synchronously for in-depth process analysis.



The video images of an existing ibaCapture Server can be used easily for ibaVision applications.

The technology

A camera that is installed behind the cutting torch records the front sides of the billets and provides ibaCapture with the video data.

ibaVision processes the video sequences and first of all determines the corner points of the front side of the billet and calculates - using these data - the length and the difference of the diagonal. These values are fed in the ibaPDA process data acquisition system as other sensor signals. ibaPDA then creates a long-term trend of these characteristic values.

In this way, ibaVision can determine numerical values where no sensors are available. In case of a significant trend, indicated by a diagonal-difference above a pre-defined threshold, the operator is being alarmed by means of a virtual traffic light on the user interface. The defective billet can then be eliminated. Simultaneously, the settings of the plant are adapted.

iba products

Process data can be visualized online by means of the data recorded with ibaCapture and ibaPDA. The data determined in real time with ibaVision are available like all other process data.

A control panel has been designed using ibaQPanel. Here, the functions of online measurement display are combined with HMI elements. In addition to the live video image of the camera, the snapshot with the diagonal calculation, the current trend of the information automatically extracted from the images and the process quality is displayed by means of a traffic light.

The offline analysis of the process data, the visual data and the time-synchronously recorded video images can be done with ibaAnalyzer for the purpose of cause analysis.

Order information

License policy

Various licenses are available for ibaCapture servers. Each license specifies an upper limit of frames per second (fps) transmitted by the cameras to the ibaCapture Server in total.

Licenses are also required for cameras. A distinction is made between licenses for recording cameras, display-only, virtual and GigE cameras. Virtual cameras are required to record HMI images or output images of ibaVision.

An additional license is required for the operation of the RTSP server.

Starting with ibaCapture v5 WIBU CodeMeter licenses are supported (USB dongle or soft license).

ibaCapture requirements

- Operating system: Windows 10, Windows Server 2012 (R2), Windows Server 2016
- .NET framework 4.5.2

Hardware requirements

- PC, Intel® Core™ 2Quad CPU, 2 GB RAM
- Sufficient hard disk space for storing video data

For use with GigE cameras

- PC, Intel Core-CPU 2nd Generation or newer (from Intel Core i7-2x00K CPU)
- Intel HD graphics 3000 or newer on CPU or supported NVIDIA graphic card
- 4 GB RAM
- GigE network card Intel Ethernet I350 T4 V2 SVR (recommended)
- License for one of the supported SDKs (eBUS, CVB or MIL)

Due to the unique technical properties, we strongly recommend to clarify the technical feasibility of the planned GigE configuration with your local iba support.

ibaVision requirements

- Operating system: Windows 10, Windows Server 2012/2012 R2/2016

HALCON plug-in

- HALCON v20.11 steady (Support is also available for v18.11, v13 and v12. Functionality may be limited)

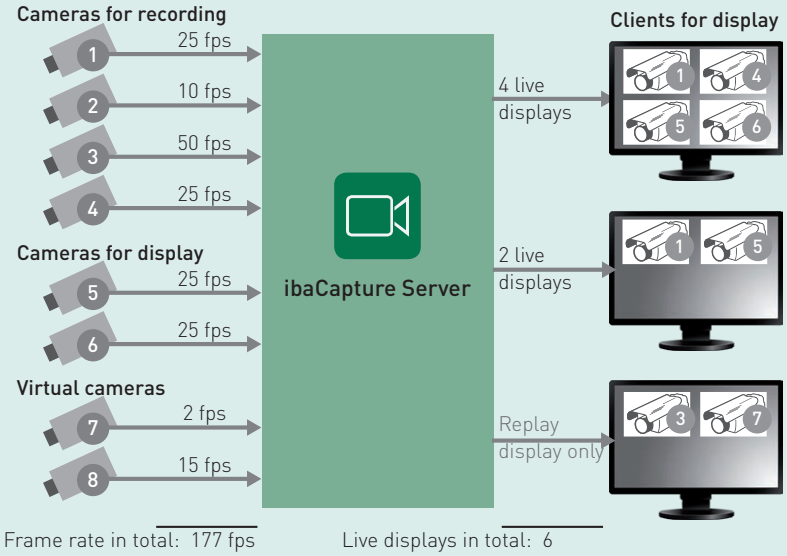
Python plug-in

- Python v3.8 (for working with image data, NumPy library needs to be installed)

Example configuration

In the example configuration 8 cameras are operated which together transmit 177 images per second to the ibaCapture Server. An ibaCapture-Server-180fps license or higher is required for this.
The server license with 180 fps includes 16 live displays from different cameras. In the example, only 6 live displays are used, another 10 could still be used.
The following camera licenses are required:

- 4x ibaCapture-1CAM-REC (recording)
- 2x ibaCapture-1CAM-DISP (display only)
- 2x ibaCapture-1CAM-VIRT (virtual cameras)



ibaCapture

Order No.	Name	Description
38.000001	ibaCapture-Server-60fps	Video recording for up to 60 fps, 8 client live-streams included
38.000002	ibaCapture-Server-180fps	Video recording for up to 180 fps, 16 client live-streams included
38.000003	ibaCapture-Server-480fps	Video recording for up to 480 fps, 48 client live-streams included
38.000004	ibaCapture-Server-960fps	Video recording for up to 960 fps, 96 client live-streams included
38.000005	ibaCapture-Server-1440fps	Video recording for up to 1440 fps, 144 client live-streams included
38.000030	ibaCapture-1CAM-REC	1 camera for recording and display
38.000031	ibaCapture-1CAM-DISP	1 camera only for display
38.000032	ibaCapture-1CAM-VIRT	1 virtual camera for recording and display of HMI or ibaVision images
38.000033	ibaCapture-1CAM-GigE	1 GigE camera for recording and display
38.000041	ibaCapture-Live-Stream Add-On	8 additional live streams for display
38.000042	ibaCapture-AddOn-RTSP-Server	Add-on for receiving RTSP streams on third-party hardware/software
38.000043	Pleora eBUS Runtime	Runtime licese for GigE-Vision SDK

Hardware

40.005021	ibaRackline-PC CAM, XEON E, Win10	ibaRackline for mass data recording
43.001001	Upgrade ibaRackline-PC HD/CAM with Graphic Card	Graphic Card Upgrade
43.001002	Upgrade ibaRackline-PC CAM with NVME-SSD	NVME-SSD for OS installation
43.001003	Upgrade ibaRackline-PC CAM with NVME-SSD 512GB	NVME-SSD 512GB for OS installation
43.001020	Upgrade HD 5x4TB to 5x8TB SAS	Harddisc Extension for ibaRackline-PC CAM or HD
43.001021	Upgrade HD 5x4TB to 5x12TB SAS	Harddisc Extension for ibaRackline-PC CAM or HD
19.001005	Analog-to-IP Video Encoder 4Channel	4 channel video encoder
19.001010	Analog-to-IP-Converter 16 Channel	16 channel video encoder
19.116011	GigE network card for PCI Express	Intel Ethernet I350 T4 V2 SVR

Language packages

38.000050	ibaCapture-Lang-CN	Language package Chinese
38.000052	ibaCapture-Lang-RU	Language package Russian
38.000053	ibaCapture-Lang-ES	Language package Spanish

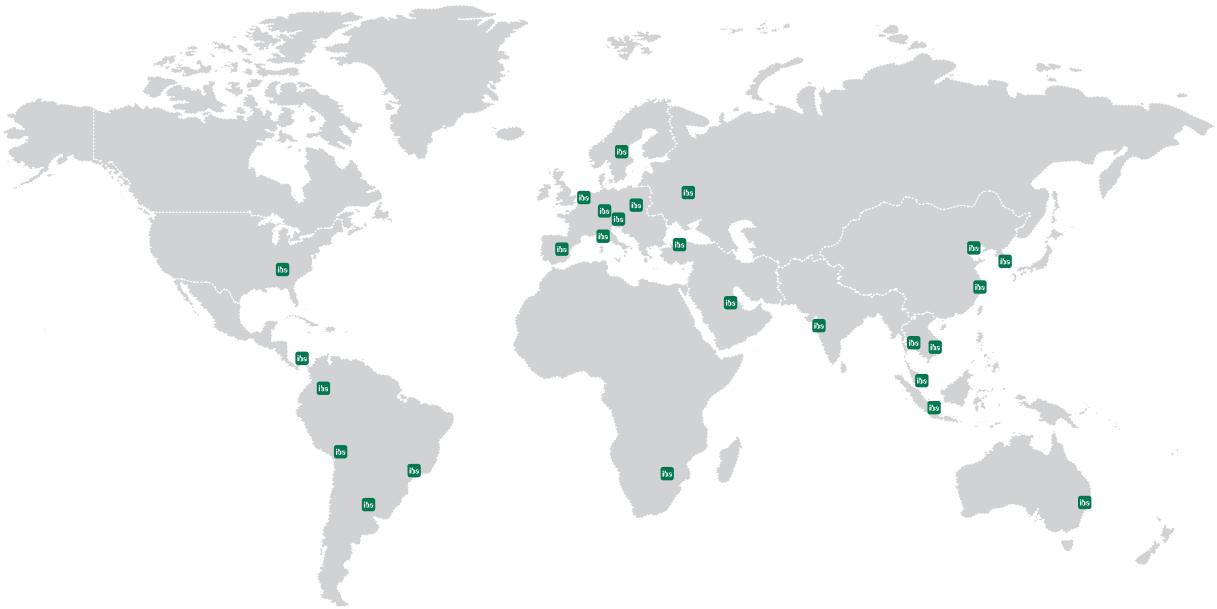
The language packages are available on request from local iba subsidiaries and iba sales partners.

ibaVision

38.100000	ibaVision	Application for image recognition tasks
38.100001	ibaVision with HALCON Runtime License	Application for image recognition tasks including HALCON runtime license
38.100002	ibaVision 2-Program-Add-On	Extension license for 2 additional HALCON applications
38.100003	ibaVision-128-Signal-Add-On	License extension to transfer 128 more output signals to ibaPDA

Training

61.000500	Synchronous recording of video images and measured data with ibaCapture	2-day advanced course



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Technical changes and errors excepted.

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