

**Camber and position
measurement
at the hot strip**



- ▶ reduced camber
- ▶ higher operational safety
- ▶ improved strip quality

hotCAM Camber and position measurement

Hot rolling process:

The hot rolling process is typically a combination of a reversing mill (roughing mill) and a multi-stand hot rolling mill (finishing line).

For the process reliability in a hot rolling mill it is extremely important to keep a defined position of the strip between the hot rolling stands. The continuous measurement of the strip position allows an optimized adjustment of the rolling force and gap.

In reversing mills this leads to a reduction of the camber of the strip and thus prevents collisions of the strip with the mechanical strip guiding rail.

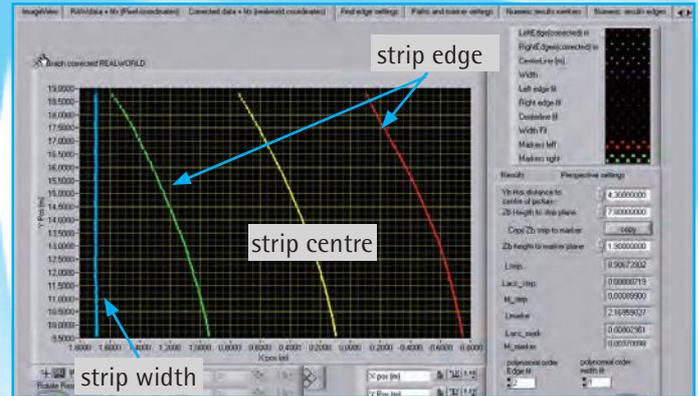
The continuous control of the centre position in a hot rolling mill also reduces cobbles (outbreaks) of the strip, which lead to serious damages and production stops.

With the measured parameters transmitted to the level-2-system, the line operator is able to realize a closed loop system (sensor and mill) for camber reduction and optimized strip positioning in the hot rolling mill.

The EMG solution hotCAM for camber and position measurement helps you to increase your product quality and to avoid damage to your line!

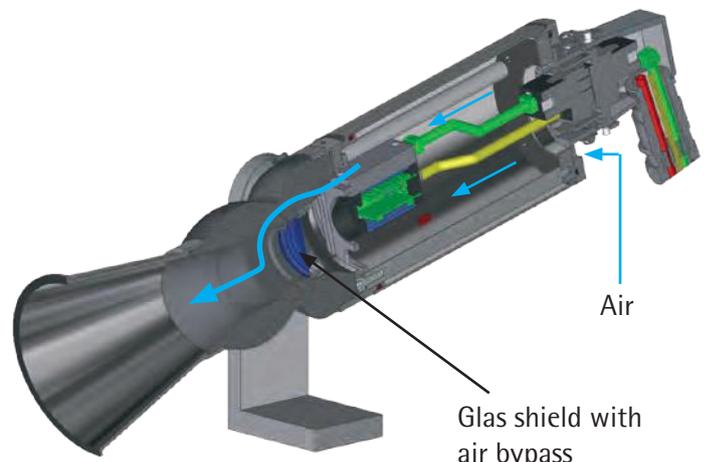


Camera view and region of interest of hotCAM in the hot rolling mill



hotCAM - Visualization of the measuring results

EMG Automation GmbH specialises in the automation of continuous production processes in the metal, paper and plastics industries as well as in the foil and tyre industries. The company, which was established in 1946, is a leading provider of electro hydraulic control systems. Furthermore, EMG provides quality assurance systems for the manufacturing industry. Based on the combination of more than 60 years of experience, the quality of our products and complete solutions as well as our advisory skills, our customer, by his trust, makes us the market leader. In close co-operation with our customers, research facilities and universities, we are permanently searching for innovative solutions to promote our new and further developments and therefore to design and actively form the market as innovation leader.



Housing with air flushing / cooling

- reduced camber

- higher operational safety

Application hotCAM camber measurement:

In a reversing mill the camber of the strip is an important quality criterion. Not only the coil quality is defined by a minimal camber. Exceeding a certain limit the strip may contact the mechanical strip guiding rail and thus cause damages to the strip and/or the line. By measuring the camber of the strip online the adjustment of the rolling force and gap is possible to get a straighter strip at the end and to prevent collisions.

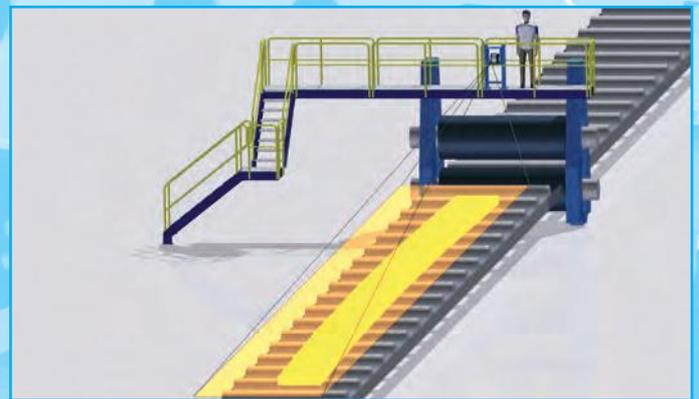
By viewing a strip area of about 4-8 metres the camera records the strip form and delivers an image of the camber over the entire coil.

With special mathematical corrections and algorithms for image processing the optical camber measurement system hotCAM compensates errors of the optic. After this correction it is possible to calculate the camber and the position of the strip exactly.

The strip edge detection is largely independent of rising water steam. Due to a special design of an air flushing the pollution of the optic is prevented.



Reversing mill



Installation and camera view of hotCAM at a reversing mill

Technical data:

hotCAM for camber measurement:

Environmental temperature	up to 100 °C (depends on the cooling air temperature)
Minimum strip temperature	820 °C (lower temperatures on request)
Cooling / Air flushing	compressed air (approx. 500 l/min; > 5 bar)
Accuracy position measurement	up to +/- 2 mm
Interface to PLC	Profibus/Ethernet
Parameter camber	mean centre position; centre deviation; radius; angle of camber and max. camber
Measuring rate	up to each strip metre (depends on the mill speed)
Measuring distance	approx. 4-8 m

• improved strip quality

Application hotCAM position measurement:

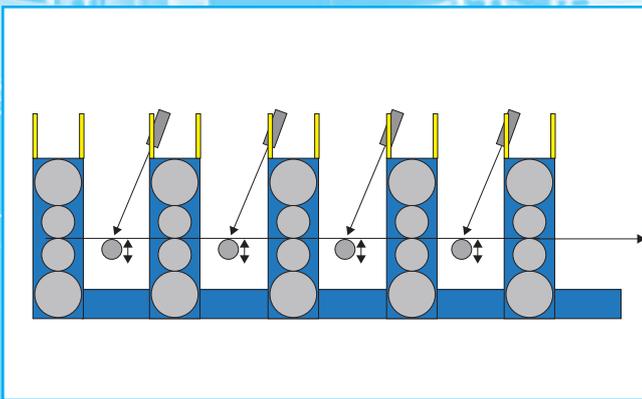
During hot rolling processes in a multi-stand rolling mill, the position of the moving hot strip changes between the rolling stands. By detecting this position, the optimized adjustment of the rolling force and gap is possible, to keep the strip in the middle of the line.

By knowing the strip position at each rolling step, the online control of the slab/strip movement becomes much more effective. Furthermore, it helps to avoid critical movements of the strip, leading in the worst case to cobbles of the hot strip between the rolling stands. hotCAM provides not only the basic data to prevent collision of the strip with the mechanical strip guiding of the line and to improve the

coil quality, but moreover it helps to protect the mill against disaster events.

With special mathematical corrections and algorithms for image processing the optical position measurement system hotCAM compensates errors of the optic. After this correction and considering the height position of the looper as well as the size of the rolling gap (actual values for each) hotCAM calculates the strip position between the rolling stands exactly.

The strip edge detection is largely independent of rising water steam. Due to a special design of an air flushing the pollution of the optic is prevented.



Installation place(s) in a rolling mill



Rolling stands in a finishing line

Technical data:

hotCAM for position measurement:

Environmental temperature	up to 100 °C (depends on the cooling air temperature)
Minimum strip temperature	820 °C (lower temperatures on request)
Cooling / Air flushing	compressed air (approx. 500 l/min; > 5 bar)
Accuracy strip width measurement	up to +/- 1.5 mm
Accuracy position measurement	up to +/- 1.5 mm
Interface to PLC	Profibus/Ethernet
Measuring rate	50 Hz
Scalability (no. of measuring sets)	1-n
Measuring distance	approx. 4-8 m (mounted on top of the roll stand)

Performance features:

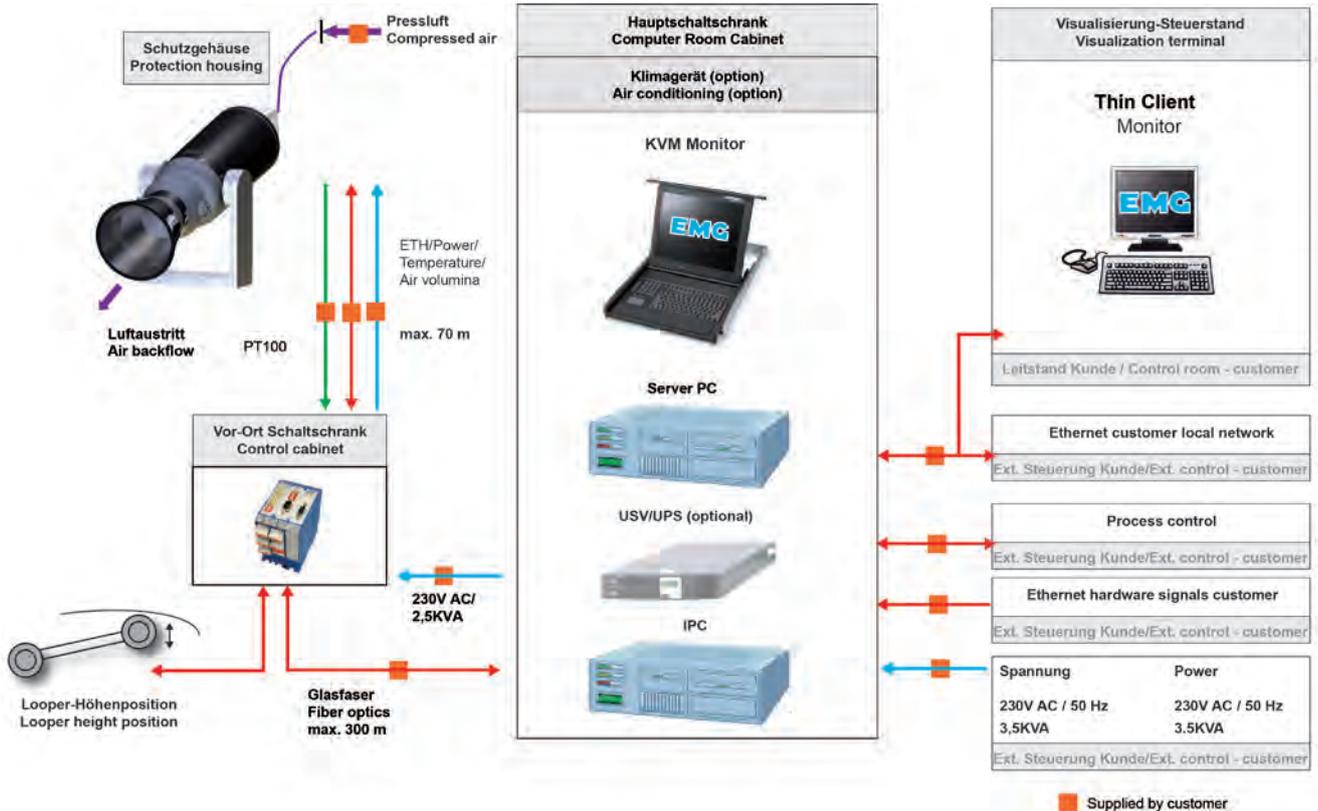
- ▶ a CMOS area scan camera takes near infrared (NIR) pictures of the hot strip; minimum strip temperature 820 °C
- ▶ the strip edges are detected exactly
- ▶ mathematical algorithms compensate errors (such as vapor, dust and steam)
- ▶ the program calculates the position, the width and the camber of the strip accurately
- ▶ the measuring data is transferred to the line PLC
- ▶ the system is scalable for several rolling stands
- ▶ temperature monitoring
- ▶ corrosion-resistant housing
- ▶ optic shutter in case of air pressure drop (optional)
- ▶ air monitoring (optional)
- ▶ air preparation acc. to ISO 8573-1:2010 (optional)

Customer's benefit:

After realizing a closed loop system the line operator benefits among others from the following advantages:

- ▶ controlling the centre position by optimized adjustment of the rolls
- ▶ using the camber information to optimize the strip form
- ▶ reduction of cobbles between the rolling stands
- ▶ prevention of collisions between the strip and the mechanical strip guiding rail
- ▶ prevention of mill and strip damage
- ▶ optimized coil quality

Example of a system configuration:



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