

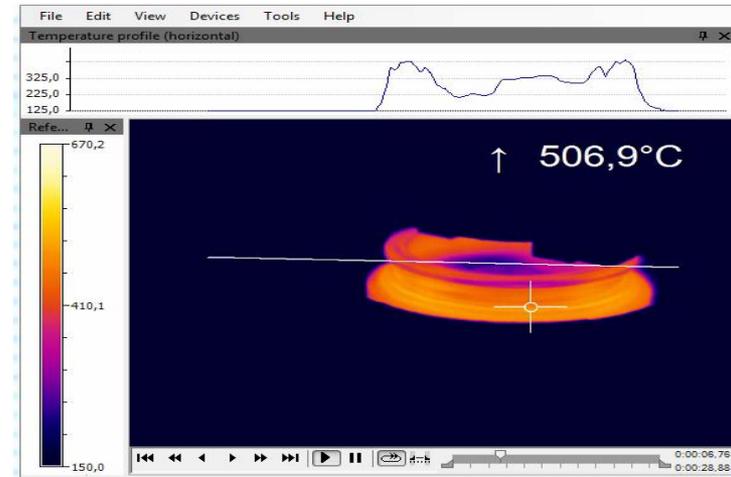
optris PI 05M

innovative infrared technology

Raw metal

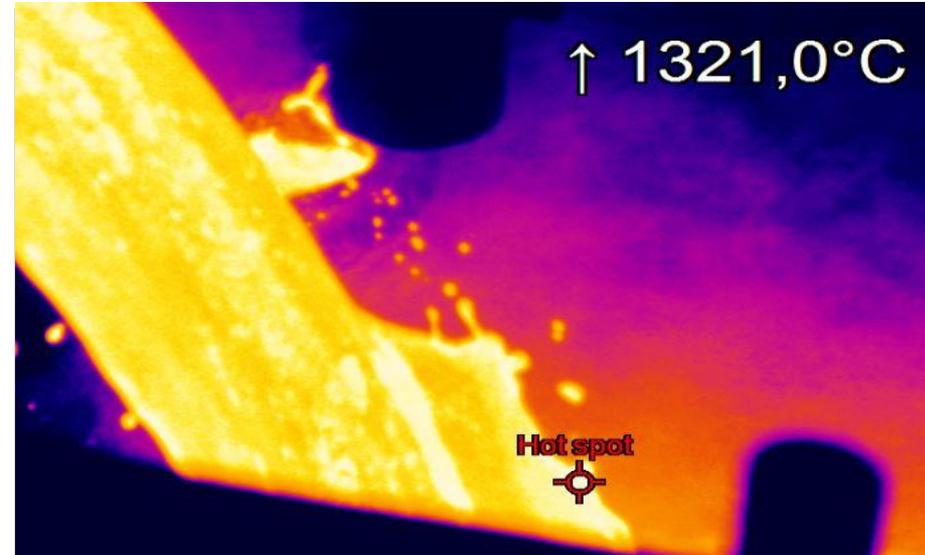


Metal processing



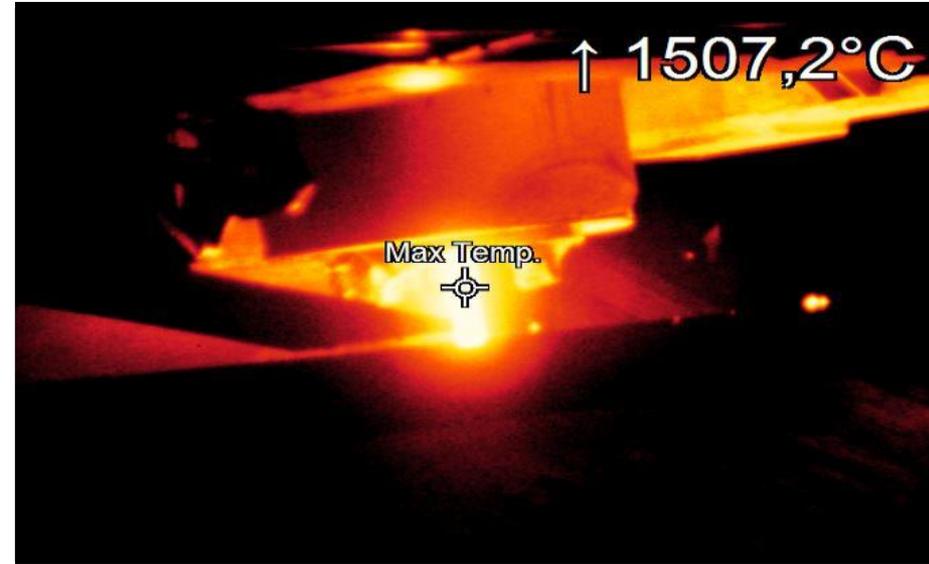
- PI 05M and PI 1M cameras covering a range of **450...2000 °C**
- High optical resolution up to 764 x 480 pixels
- CoolingJacket Advanced for use in harsh environment up to ambient temperatures of **315 °C**

NEW: optris PI 05M



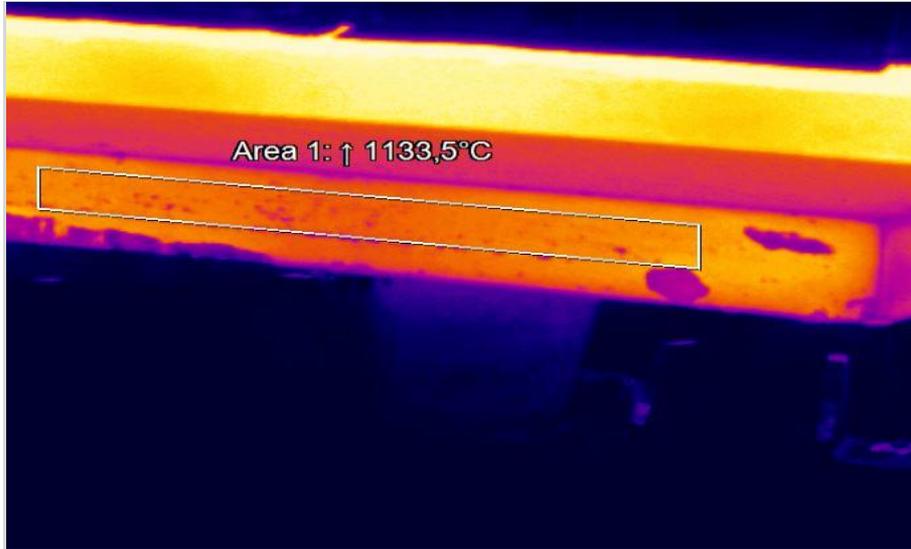
- optris PI 05M with high dynamic CMOS detector
- Temperature range **900 ... 2000 °C** without sub-ranges
- All features of the PI family: PI Connect, Process interfaces
USB or GigE connectivity, SDKs for Windows and Linux
- List price: 3.700 €

NEW: optris PI 05M



- Special wavelength range of 500-540 nm minimizes errors due to uncertainty of emissivity
- Ideally suited to all applications with molten metals
- Dedicated to all laser processing applications through excellent blocking of radiation above 540 nm

NEW: optris PI 05M



- 46 x 56 x 90 mm³ small NEMA 4/ IP67 rated, rugged camera
- Up to 1 kHz frame rate (72 x 56 px)
- 1 kHz linescanning (764 x 8 px)
- Real-time analog output of 8x8 pixels with **1 ms** response time (free arrangement in the IR image)

- Spectral response 500...540 nm
- Geometrical resolution (switchable) 764 x 480 px @ 32 Hz
382 x 288 px @ 80 Hz / 27 Hz
72 x 56 px @ 1 kHz
- Linescanner 764 x 8 px @ 1 kHz
- Temperature ranges 900...2000 °C (27 Hz mode)
950...2000 °C (80 Hz/ 32 Hz mode)
1100...2000 °C (1 kHz mode)
- Accuracy +/- 1.5 % of reading
- Optics OF25 (f=25mm)
26° x 16° (764x480 px)/
13° x 10° (382x288 px)



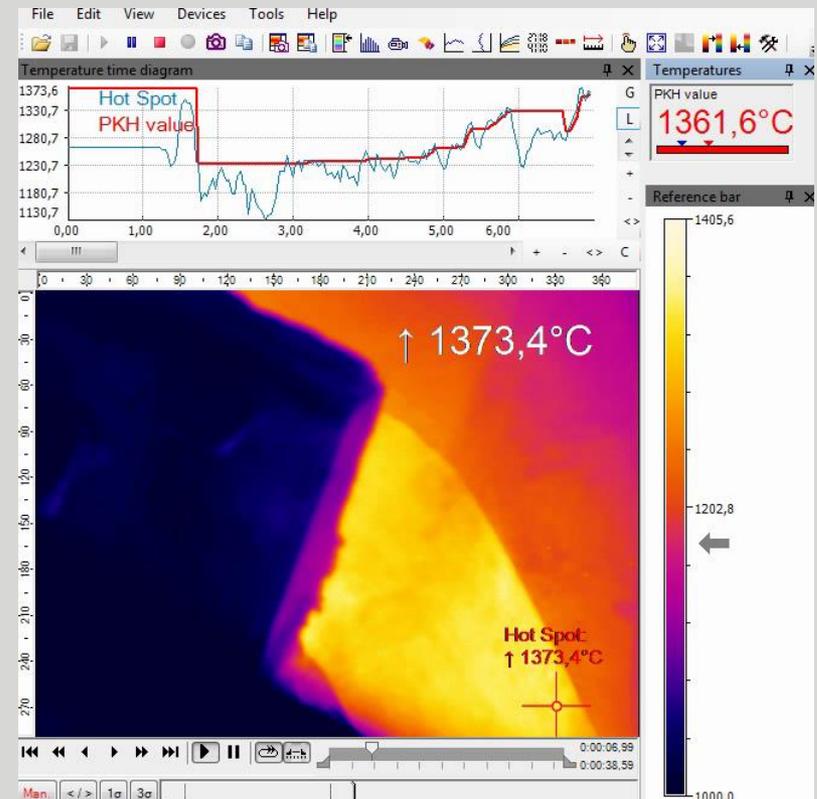
- High speed analog out 8x8 px, position free definable within the FOV
- Operating temperature 5-50 °C
- Environmental rating IP67
- Weight 320 g (incl. lens)
- Power supply USB powered



optris PI 05M – Application example

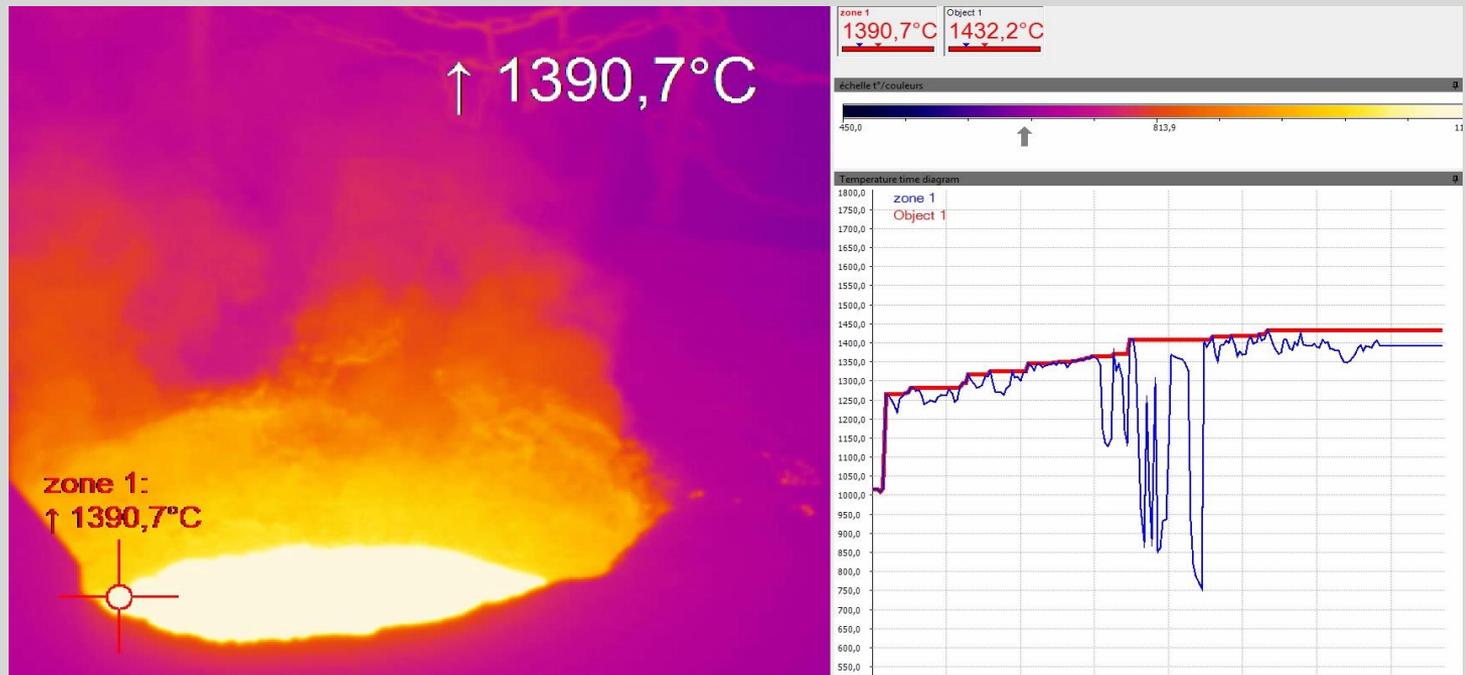


- Iron sand casting of truck axles and automotive parts
- Varying alloys – different emissivities
- Hot spot function + Peak hold

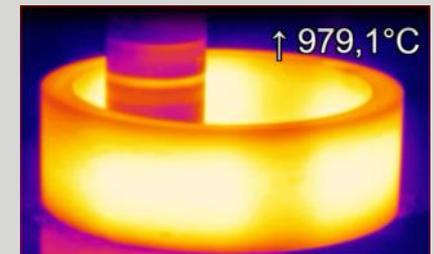
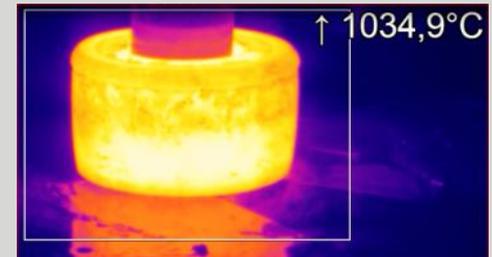
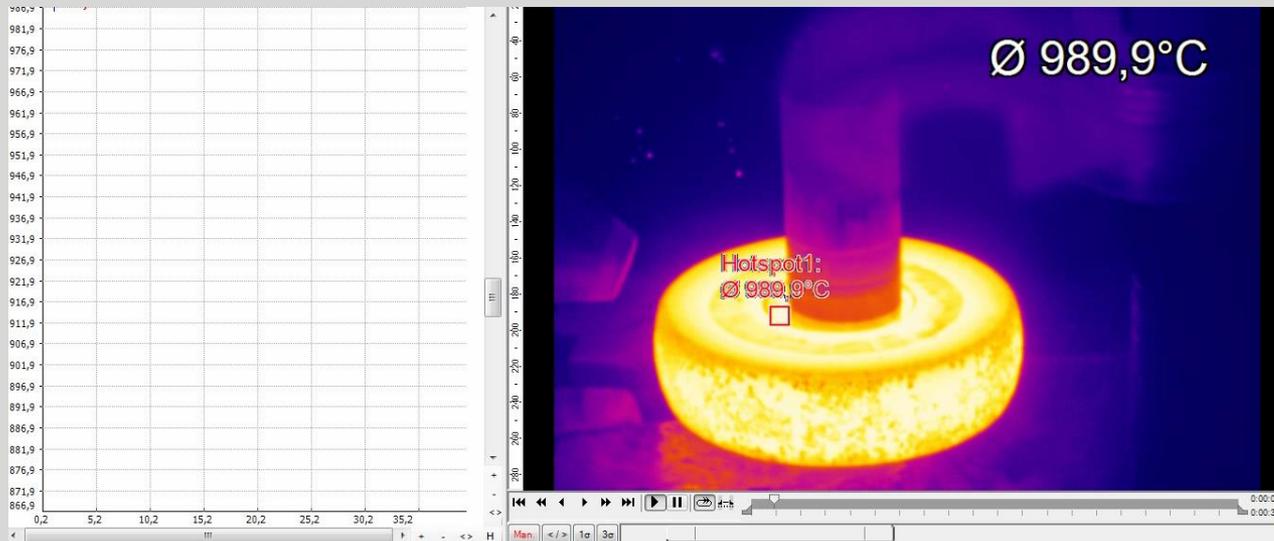




- Melting furnace
- Hot spot function + Peak hold

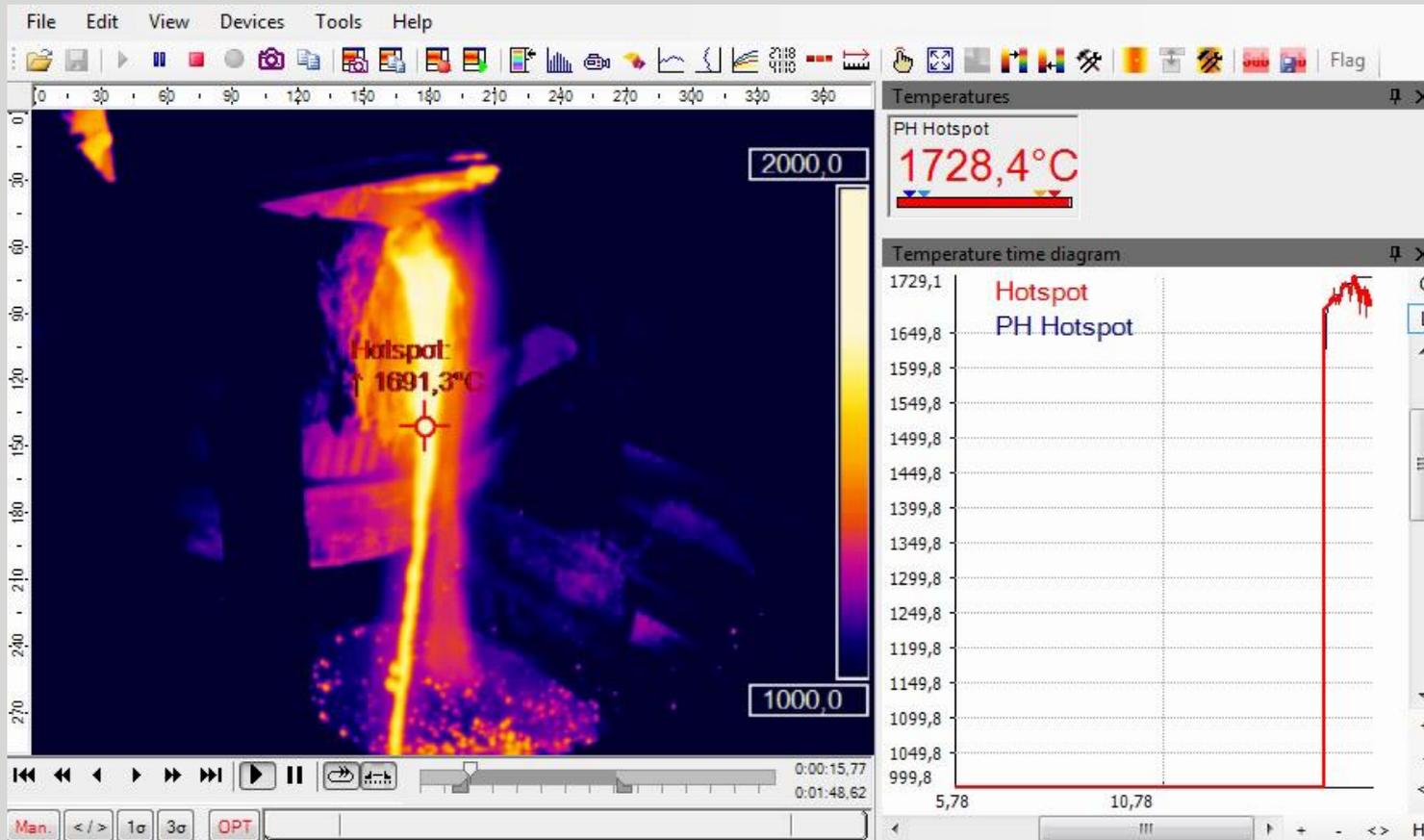


- Ring rolling

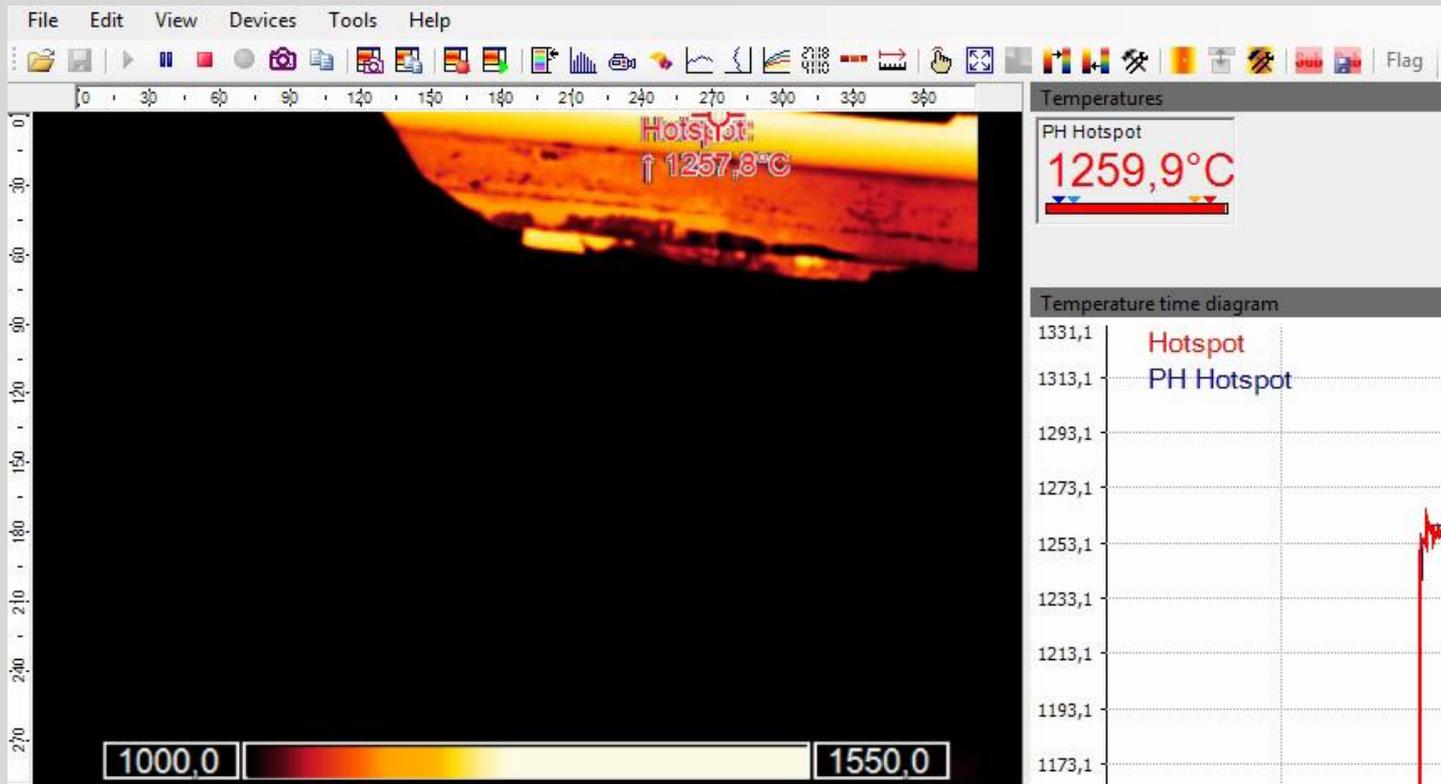


- Averaging + Peak hold
- Replacement of ratio pyrometers

■ Steel tapping



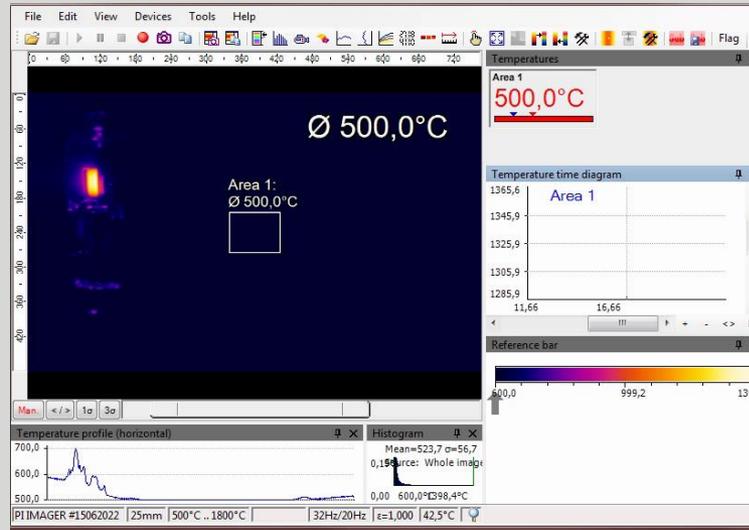
- Steel slabs coming out of a furnace



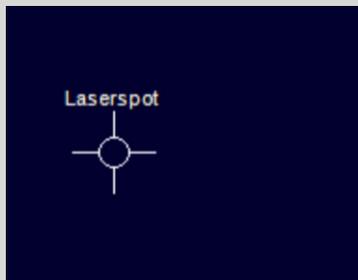
- PI 05M is dedicated to all laser processing applications through excellent blocking of radiation above 540 nm:
 - all diode lasers in the range of 900-1030 nm
 - solid state lasers like Nd:YAG at 1064 nm
 - gas lasers like CO₂ working at 10.6 μm
- no additional filters necessary
- 1 kHz mode (72 x 56 px) + 1 ms direct real time analog out



- Easy graphic adjustment of the 1 kHz sub-frame area (72x56 px):



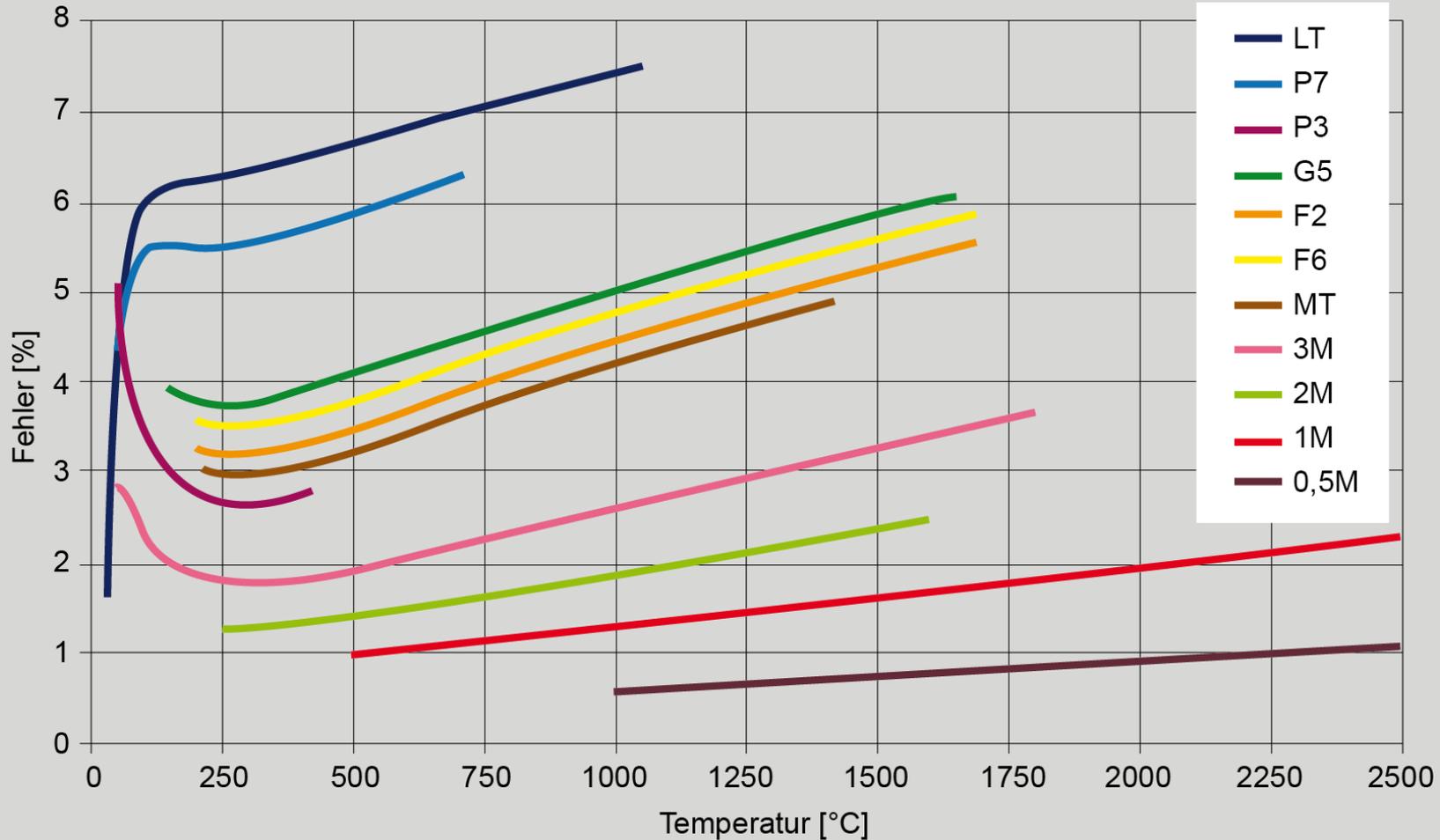
- quality inspection in laser welding:
bad good



material
heat up:

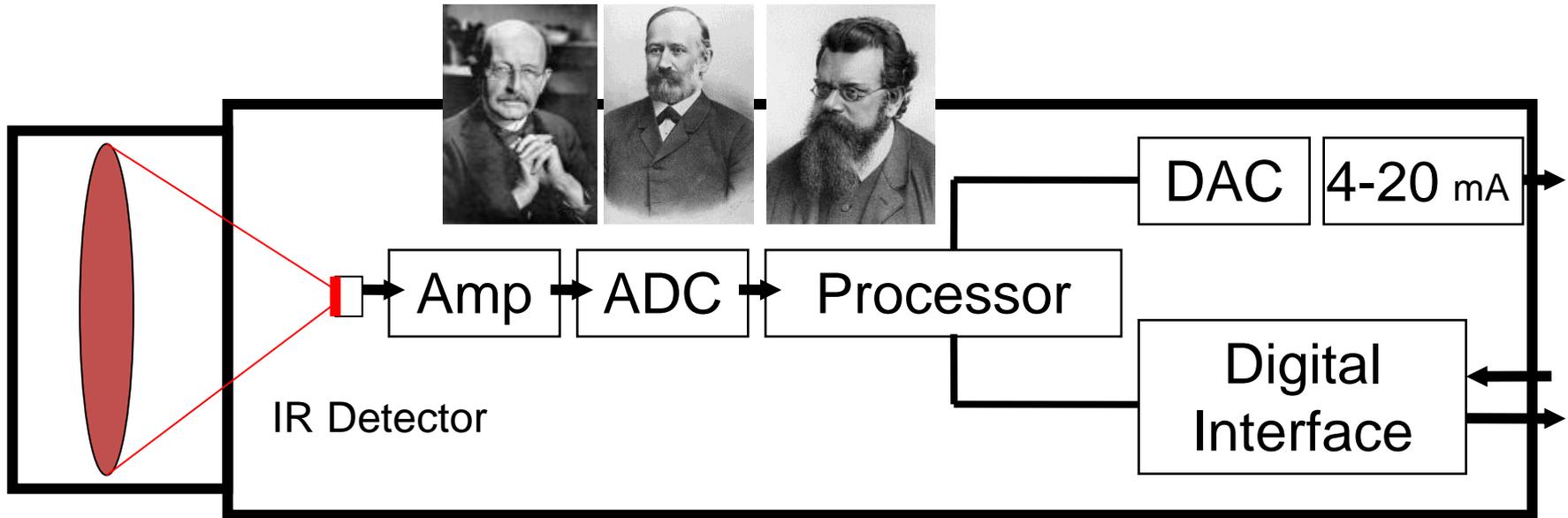


Shorter wavelength – why



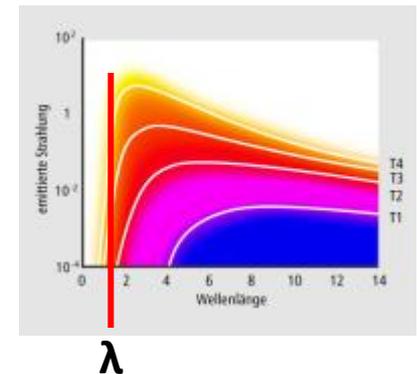
Error of reading (T) - Assuming 10% error in emissivity setting

Shorter wavelength – why



$$U = \epsilon T^4 \text{ (Stefan-Boltzmann Law)}$$

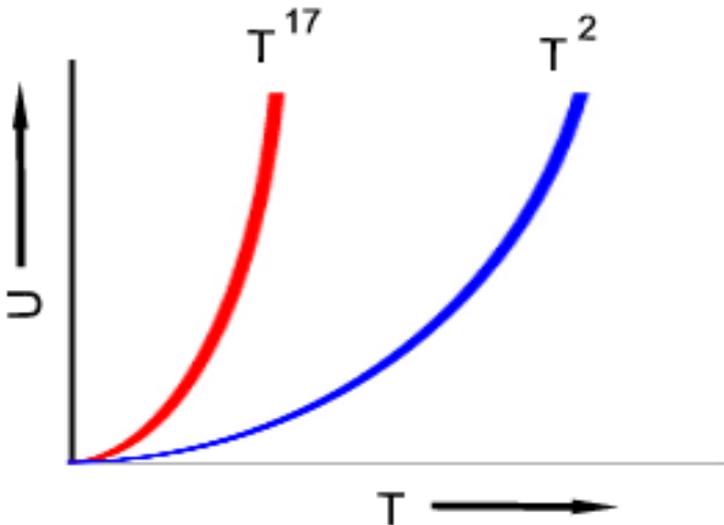
ϵ is influencing U strongly



Shorter wavelength – why

$$U = \varepsilon T^n \quad n = f(\lambda)$$

$$T = \sqrt[n]{U/\varepsilon} = (U/\varepsilon)^{\frac{1}{n}}$$



for $n=17$

$$\frac{\Delta T}{T} = \frac{\Delta \varepsilon}{\varepsilon} \frac{1}{17}$$

for $n=2$

$$\frac{\Delta T}{T} = \frac{\Delta \varepsilon}{\varepsilon} \frac{1}{2}$$

