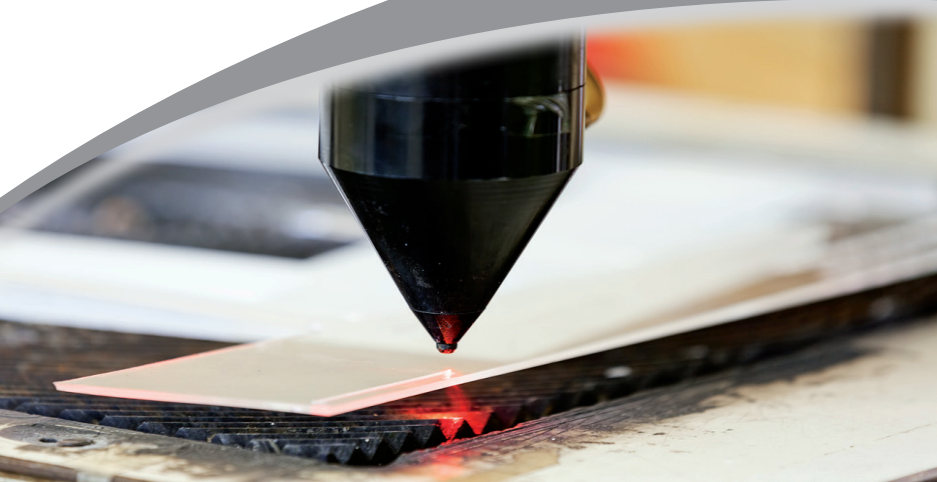


Imagine the invisible



High resolution  
uncooled thermal GigE Vision camera

## Haas Laser Technologies partners with Xenics

High power CO<sub>2</sub> lasers produce a beam of infrared light with wavelengths centering typically at 9.3 or 10.6 μm. Because of the high power available CO<sub>2</sub> lasers are often used in industrial welding and cutting applications. However, CO<sub>2</sub> lasers are also commonly used in medical applications: soft-tissue surgery and skin-resurfacing (facelifts) with 10.6 μm lasers and 9.3 μm lasers for dental hard tissue removal [FAN].

### Passive laser beam analyser for CO<sub>2</sub> lasers

Haas Laser Technologies, Inc. has developed a compact, all passive optical design laser beam analyser for focused laser beams from a CO<sub>2</sub> laser with wavelength range from 9.3 to 10.6 μm. The Haas laser beam analyser provides real time M<sup>2</sup> (M-Squared or beam propagation factor [VAN]), spot size, astigmatism, beam divergence, Rayleigh length and focal position values.

#### Instrument setup

The laser beam analyser system consists of a Haas Beam Waist Analyser Camera (BWA-CAM) that utilizes a special Fabry-Perot resonator [SCA] together with a Gobi-640-GigE microbolometer camera from Xenics. The Gobi camera, inside the BWA-CAM, provides a complete beam waist caustic in real time. Haas provides the BWA-CAM including all necessary software for laser beam measurement and analysis, for continuous-wave (CW) as well as pulsed lasers.

The Fabry-Perot resonator concept is based upon two patent pending optical designs (USPTO 12/756,476 and 13/534,174) that simultaneously image multiple slices of the spatial profile through the Rayleigh length of the beam waist onto the microbolometer camera. The all passive optical design contains no moving parts and has the ability to measure the laser's M<sup>2</sup> value in real time, at about 7 frames per second. The variable spacing of the Fabry-Perot optics also allows to accommodate varying Rayleigh length optical systems.

#### Microbolometer camera from Xenics

The Gobi-640-GigE is a LWIR (Long-Wave Infrared) uncooled microbolometer camera with an array of 640x480 pixels where each pixel is 17 μm x 17 μm. The microbolometer array is sensitive in the wavelength range from 8 to 14 μm, i.e., well-suited for the CO<sub>2</sub> laser wavelength at 9.3 and 10.6 μm. The versatile Gobi camera allows for fine adjustment of the sensitivity of the sensor. Therefore, it is ideally suited for laser beam analysers and varying laser output powers, without the need for additional neutral density filters.

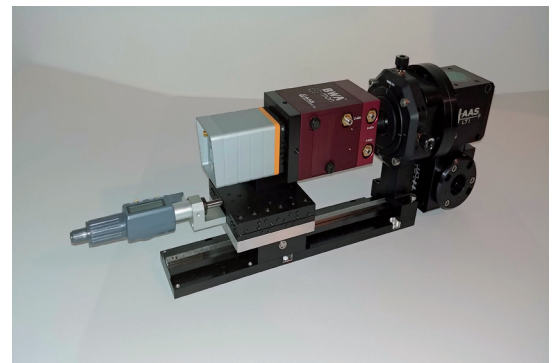


Figure 1: The setup of the Beam Waist Analyser Camera (BWA-CAM) laser beam analyser system, including the Gobi-640-GigE camera from Xenics.

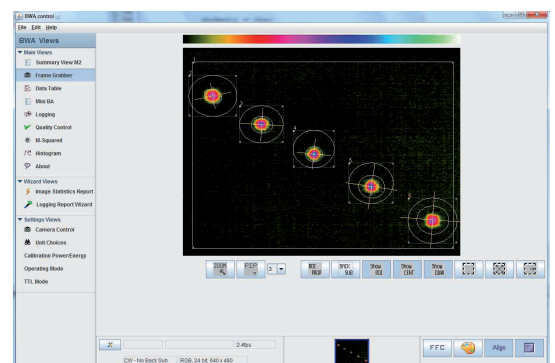
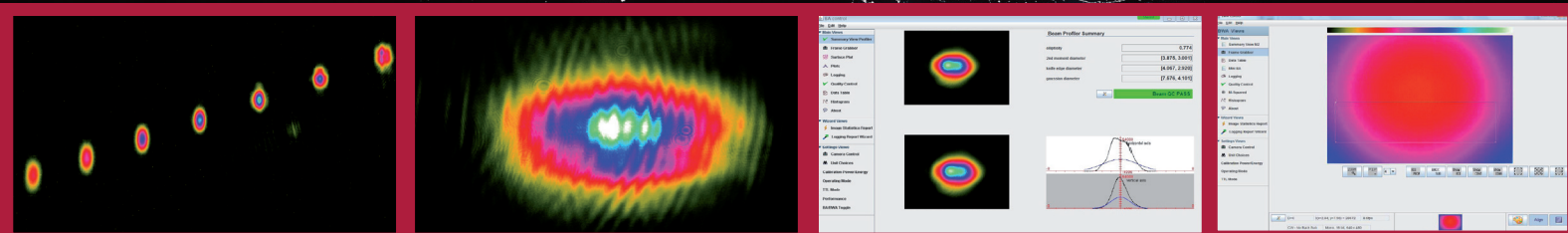


Figure 2: A screenshot of the beam analyser software showing spatial time slices of a focused CO<sub>2</sub> laser beam in real time.

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GigE Vision camera	Gobi-640-GigE
Array type	Uncooled microbolometer (a-Si)
Spectral band	8 $\mu\text{m}$ to 14 $\mu\text{m}$
Resolution	640 x 480
Pixel pitch	17 $\mu\text{m}$
Frame rate (full frame)	50 Hz
Interface	GigE Vision
Trigger	Trigger in or out (configurable)
On-board image processing	Non-Uniformity Correction (NUC), Auto-offset and Auto-gain

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[FAN] Scientific Review – The 9.3- $\mu\text{m}$  CO<sub>2</sub> Dental Laser: Technical Development and Early Clinical Experiences; D. Fantarella and L. Kotlow; J Laser Dent 2014; 22(1): 10-27

[HAA] Haas Laser Technologies, Inc. www.haaslti.com

[SCA] All passive optical design laser beam analyser for high power CO<sub>2</sub> lasers, M. Scaggs, G. Haas

[VAN] Xenics white paper: Laser Beam Profiling and Infrared Cameras; R. Vandersmissen

[www.xenics.com](http://www.xenics.com)  
[www.sinfrared.com](http://www.sinfrared.com)



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