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| **Case Study** | **26.03.2018** |

Characterizing a Beam of Light

 **SWIR laser beams are characterized with Axiom Optics CinCam InGaAs system equipped with Allied Vision Goldeye SWIR cameras**
The applications utilizing lasers are numerous. Some examples would be the welding and cutting of materials, medical applications, spectroscopy and surveying and ranging. Lasers are very useful when functioning optimality. Over time, the extensive use of a laser eventually leads to its degradation and loss of efficiency. At this point, it becomes essential for the user to conduct analysis of the laser characteristics. In the past, users conducted tests by analyzing the burn of various materials, such as paper, wooden blocks, or a slab of drywall. While these tests gave laser users some analytical results, they did not provide enough information to properly assess the “health” of the laser. Furthermore, these tests did not allow for users to assess the laser in real time. This is where a laser beam profiler shines. A laser beam profiler allows users to measure the spatial intensity of a laser beam. The following characteristics are measured:

* Beam profile or 2D power distribution: the 2D intensity plot of a beam with the typical desired result being either a Gaussian or flat-top profile.
* 2D beam size measurements
* Beam divergence: measurement of the beam’s spread with distance
* Beam quality with M2: the focusing ability of the laser
* Pointing stability

There are many types of lasers that cover the electromagnetic spectrum, ranging from ultraviolet to far infrared. Lasers in the SWIR wavelengths are invisible to the human eye, which makes real-time assessment more favorable. For lasers in the short-wave infrared wavelengths (SWIR) ranging from 900 – 1800 nm, a SWIR beam profiler is necessary. Axiom Optics has a solution that accomplishes this task: the CinCam InGaAs SWIR Beam Profiler.

**Axiom Optics + Goldeye = CinCam InGaAs**

The CinCam InGaAs is a turn-key and user-friendly solution for characterizing laser beams in the SWIR wavelengths (0.9 to 1.8 microns). It is a versatile solution that can be used in both a lab and in production settings. The CinCam InGaAs has three models: CinCam InGaAs 320, CinCam InGaAs 640, and the CinCam InGaAs 636. Between all three models, most, if not all, beam sizes can be profiled. Furthermore, the laser beam profiling software, RayCi by Cinogy, can be configured according to the user (e.g., lab technician, engineer, production technician, etc.).

**Goldeye Assists in Laser Beam Profiling**The CinCam InGaAs utilizes Allied Vision’s Goldeye Gigabit Ethernet (GigE) SWIR cameras in all three models. “The Goldeye is the perfect camera line for our system for multiple reasons,” Nick Lechocinski, Sales/3D sensor and camera specialist at Axiom Optics, explained. He continued, “The Goldeye’s three models address our customers’ varying requirements in terms of price and performance. Furthermore, the Goldeye has TEC1 cooling (thermo-electric cooling), which is mandatory for quantitative measurements completed in laser beam profiling.” The three Goldeye SWIR models used in the CinCam InGaAs models are the Goldeye G-008 TEC1 (320 x 256 resolution at 334 fps, Goldeye G-032 TEC1 (0.3 Megapixels at 100 fps), and the Goldeye G-033 (0.3 Megapixels at 301 fps). All three models are equipped with a Gigabit Ethernet (GigE) interface and each Goldeye SWIR model provides an advantage for each CinCam InGaAs model. The Goldeye G-008 TEC1 is used in the CinCam InGaAs 320, Axiom Optics’ “entry level” model in terms of pricing. It provides larger pixels if resolution is not a factor and is perfect for product environments. The Goldeye G-033 TEC1, used in the CinCam InGaAs 640, has the smallest pixel pitch, 15 µm, allowing the profiling of smaller beams and acquisition of additional beam details. The Goldeye G-032 TEC1 provides the largest active area allowing profiling of large beams or multiple beams at once with the CinCam InGaAs 636.

Allied Vision’s Goldeye SWIR cameras are sensitive in the SWIR spectrum of 900 to 1,700 nm using InGaAs sensor technology (Indium Gallium Arsenide). The Goldeye delivers high quality, low noise images using image correction and optimization functionalities, such as advanced image correction algorithms and TEC cooling. The compact and ruggedized housing design of 55 mm x 55 mm x 78 mm provides a form factor that allows the Goldeye to be easily integrated into systems. All Goldeye models are also available with a Camera Link interface.

**Software is Key**The RayCi software is a crucial cog for the CinCam InGaAs system. It supports Windows operating systems (XP, Vista, Windows 7 and 8) and can simultaneously control several beam profiler cameras on a single computer. Its straightforward menu structure design makes it easy for users to quickly access standard settings and begin use. “Incomparable visualization modes, extensive analytical capabilities and new developed correction algorithms ensure the highest accuracy in laser beam analysis,” Lechocinski commented. The RayCi software enables users to complete many laser beam characterizations:

* Beam width techniques (2nd Moment, knife edge, moving slit, plateau and Gauss-fit) can be applied to determine quick and reliable standard beam parameters
* The unique measurement tool enables continuous monitoring of beam parameters, beam position and power density position
* A new beam quality M2 tool enables accurate beam quality analysis
* The unique measurement of time series – a sequence of consecutive measurements with a selectable interval, enabling continuous monitoring and analysis of laser beam parameters and temporal behavior
* Continuous measurement of pointing stability according to ISO 11670 standards calculated by the centroid

These characterizations are captured in detailed illustrations that ensure the optimal visualization of measurement results during profiling. Comparisons between live data and previously stored data is possible with RayCi’s ability to simultaneously analyze both.

**High Quality and Ease of Use**
Allied Vision has over 25 years of expertise in developing machine vision cameras for various applications. This expertise is channeled not only in camera solutions Allied Vision develops, but also in the manner Allied Vision commits to understand each customer’s needs. “The reasons we selected Allied Vision’s Goldeye SWIR cameras are because of their numerous SWIR camera options, the ease of use with our software and their desire to understand our application to provide us with the ideal camera solution,” proclaimed Lechocinski.

**Profile of Allied Vision**

For over 25 years, Allied Vision has been helping people to see the bigger picture. Allied Vision supplies camera technology and image capture solutions for industrial inspection, science, medicine, traffic monitoring and many more application areas in digital imaging. With a deep understanding of customers’ needs, Allied Vision finds individual solutions for every application, a practice which has made Allied Vision one of the leading camera manufacturers worldwide in the machine vision market. The company has eight locations in Germany, Canada, the United States, Singapore and China and is represented by a network of sales partners in over 30 countries. [www.alliedvision.com](http://www.alliedvision.com)

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