
## ePulse: Laser Measurement News
**February 2021**

Welcome to **ePulse: Laser Measurement News**, a review of new developments in laser beam measurements, beam diagnostics, and beam profiling. Each issue contains industry news, product information, and technical tips to help you solve challenging laser measurement and spectral analysis requirements. Please forward to interested colleagues or have them subscribe.

## Photonics West

**See What's New at Photonics West 2021**
Stop by this year's virtual Photonics West to see what's new in laser beam profiling, power/energy measurement, and IR optics, March 8-10, 2021. New products include:

- Ariel, ultra-compact laser power meter for measuring high power industrial lasers up to 8kW, such as in additive manufacturing.
- PD300RM-UVA, UV LED irradiance and dosage sensor with flat spectral response, small aperture, and cosine corrected response.
- Helios Plus, an expanded version of the Helios industrial laser power meter for measuring blue, green, and infrared wavelengths.
- Wide Beam Imager (WB-I), compact, calibrated optical system for measuring the size and power distribution of large and divergent beams of VCSELs, LEDs, edge emitting lasers, and fiber lasers.
- Long Range Zoom Lenses designed for 10µm MWIR F/4 HD/ SXGA detectors in security and surveillance applications.

Visit the MKS Virtual Booth during Photonics West. Explore our latest products and solutions, chat with one of our experts, view product demo videos, and more. Watch a quick preview.

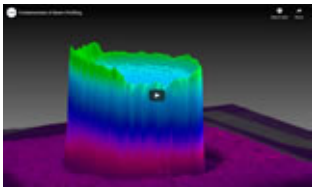
## Features

**Comparison of 1µm Optical Materials for High Power Laser Processing**
*By Adam Argondizzo, Gregg Davis, Madeleine Anderson, Scott Schnur, Tyler Graham, Fred Knopf, Alan Hedges, II-VI Inc., and Stan Ream, EWI*

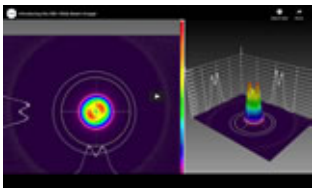
A major concern in transmissive systems is the amount of focal shift induced by the optics at higher powers. These focal shifts can lead to poor cutting performance and decreased efficiency. This study uses the BeamWatch non-contact beam profiling system to compare the focal shift of lenses made from three 1.064µm wavelength materials: fused silica, ZnS (multi-spectral), and sapphire, at laser powers up to 20 kW. Focal Shift.

## Videos of the Month

**Fundamentals of Beam Profiling**
Learn how to measure your laser beam. Find out which different beam profile or spatial energy distribution shapes are required for different laser applications, such as welding and cutting. Check out the impact that laser beam diameter has on laser power density. Video: Beam Profiling.



**Introducting the Wide Beam Imager**
The Wide Beam Imager accessory is a compact, calibrated optical system for measuring the size and power distribution of large and divergent beams of VCSELs, LEDs, edge emitting lasers, and fiber lasers. It lets you analyze beams that are too large or too divergent for a conventional beam profiler alone. Video: WB-I.



**Measuring High Power Using Short Exposures**
Treating a short exposure as a pulse and measuring its energy allows the use of low-moderate power sensors to measure much higher powers by measuring the energy of the pulse and dividing by the pulse width. You can make it easier by having the Centauri power meter do the math in "pulsed power" mode. Video: Centauri.

**Premium Energy Sensors (even for UV)**

Pulsed lasers are as popular as continuous wave (CW) lasers. While pulsed lasers exist in many wavelengths from UV to IR, UV lasers have some unique applications in material processing and medicine, due to the high absorption of UV in many materials and the high photon energy at short wavelengths. This can present special challenges that require absorber coatings to prevent damage or diffusers that spread the beam and reduce the energy density on the absorber. Energy Sensors.

## Applications

**Measuring Broadband UVA and Violet LED Light Sources in Industrial and Medical Applications**

*By Assaf Halevy, Efi Rotem, and Simon Rankel, Ophir*

UV LEDs are being put to work in various industrial processes, medical applications, and -- increasingly, due to COVID-19 -- to develop solutions for disinfection purposes. Efficient utilization of the UV spectrum requires good measurement tools. However, accurate measurement in this range presents challenges, such as how to accurately measure the irradiance of the wavelength if the light source is unknown. Here's how to solve that problem. Measuring UVA.

**How to Avoid Damage to Your Thermal Sensors**

*By Christian Dini, Director, Global Business Development, Ophir*

Thermal sensors can be used over many years without the need for repairs if they are used in a correct laser optical setup. However, experienced service technicians from Ophir's European Calibration Laboratory repeatedly see sensors from around the globe where incorrect usage leads to early wear. The experts discuss the four most common causes that significantly influence the measurement accuracy of thermal sensors -- contamination, overheating, real vs cosmetic damage, and water quality -- and preventive measures. Thermal Sensors.

## Webinar

**Reflective Optics for Multispectral Systems**

When it comes to long-range, multispectral optical systems, large mirrors play an integral role. They take many shapes - spherical, aspheric, parabolic, or freeform - and are used for a wide spectrum of light, including visible, UV, and IR. As an example, large mirrors may be integrated into the optical systems of large unmanned aerial vehicles (UAVs) in long-distance aerial monitoring of agricultural field temperature using IR. In this on-demand webinar, we discuss challenges in the optical design and manufacturing of refractive optics and present relevant case studies. PhotonicsNEXT Summit webinar.

## Research News

**OAM Light Propagation Through Tissue**

A major challenge in use of the optical spectrum for communication and imaging applications is the scattering of light as it passes through diffuse media. Recent studies indicate that light beams with orbital angular momentum (OAM) can penetrate deeper through diffuse media than simple Gaussian beams. This paper describes, for the first time, an experiment examining transmission of OAM beams through biological tissue with thickness of up to a few centimeters, and for OAM modes reaching up to 20. Power was measured using an Ophir PD300-UV sensor connected to an Ophir Centauri dual channel meter. Light Propagation.

**Virtual Tour of IR Optics Production**

Join us for a virtual tour of our Jerusalem production site to learn how we provide a one-stop-shop solution, from design to manufacture, assembly and QA, for optical components and assemblies in IR thermal imaging and high-power laser applications. Video: IR-Optics.

## Laser Puzzle

Try your hand at this month's Laser Puzzle. This month we're challenging your ability to handle 3D measurements. We're giving you just enough information to answer this drilling question, but no more. Let's see how you do.

All submissions will receive an 8GB USB pen drive. The grand prize winner will receive a 16GB iPad. E-mail answers to sales.ophir.usa@mksinst.com. Need a hint? E-mail john@enigmaturge.com.

Here's the answer to last issue's puzzle. Congratulations to the winner of last issue's puzzle - **Carson Mok, OZ Optics Ltd.** "We use Ophir's NanoScans to quickly and accurately measure output beam profiles every day for hundreds of items we produce. They have proven to be so easy-to-use and robust that they quickly became the go-to profiler for our technicians! Being able to measure beams ranging from 10um to 5mm with the same consistent system greatly reduces setup time. We also use the BeamSquared 2.0 to measure propagation characteristics of the beams with ease and speed to ensure that our end users have a well behaved beam in a quality product." - *Carson Mok*

## Social Media: Blog

**Can a Laser Wavelength Be Converted and Do We Even Want To?**

Not all wavelengths can be generated from lasers with the required parameters needed for

**Terahertz Coherent Edge Radiation**
A coupling device was developed which can extract coherent edge radiation (CER) from an optical cavity for a free-electron laser (FEL) without damaging the FEL due to diffraction loss. This study demonstrates that the CER is an excellent tool to reveal the overall effect of FEL interaction on electron distribution in a bunch. The FEL was measured using an Ophir PE25BB power sensor; the CER beam was measured using an Ophir 3A-P-THz sensor. THz Edge Radiation.

## What's New

**2021 PRISM Award Finalist: LBS-300HP-NIR Attenuator**

We are honored that our Beam Splitter for High Power NIR Lasers, the Ophir LBS-300HP-NIR Attenuator, is among the 2021 PRISM Award finalists. The beam splitter allows measurement of NIR (1000-1100 nm) focused or collimated laser beams profiles up to 5kW or 15MW/cm$^2$. Less than 0.0001% (1/10$^6$) of the beam is reflected towards the beam profiler camera, enabling analysis of beam shape, focal spot, beam waist, and M$^2$ of high-power lasers. LBS-300HP-NIR.

**UV LED Irradiance and Dosage Sensor**

Measuring LED irradiance and dosage parameters with traditional photodiode radiometers, which are calibrated to a single wavelength (e.g. 365nm), can lead to significant errors. The Ophir PD300RM-UVA LED and laser radiometer is a UV-enhanced silicon photodetector that is calibrated over the entire spectral range, not just a single wavelength. It provides a flat spectral response over the 350-450nm range that is forgiving of inexact LED wavelengths, wide bandwidths, and wavelength shifts (e.g. due to heating). PD300RM-UVA.

## Technical Tips

Any precision measurement is normally associated with a tolerance. You may be wondering how a user of laser measurement instruments, say a laser power meter, quantifies the tolerance in the measurements obtained with the instrument. Read the Tech Tip.

## FAQs

**Beam Profiling**
Do Ophir beam profilers work on the Linux operating systems? Read the FAQ.

My NanoScan equipment is producing a dip in the beam profile in the same spot when I move the beam across the aperture. Have I damaged the NanoScan? Read the FAQ.

**Power Meters**
I need to place a power sensor (thermal) in a closed, sealed chamber and connect it to a meter outside that chamber. How do I do that? Read the FAQ.

a given application, such as power or energy. When other laser wavelengths are needed, some type of wavelength conversion is typically used. Here we present situations in which converting the wavelength of laser light is advantageous for specific applications, and outline processes that enable such wavelength conversion. Wavelength Conversion.

**Measuring Diffuse Reflectance**
Most objects scatter light in all directions. How can we catch it all? It is fairly easy to measure the specular component because we know in what direction to look for it. However, to accurately measure the diffuse reflectance we must capture the light going in all directions. This is usually accomplished by use of an integrating sphere. Integrating Sphere.

## New Catalogs: Power Meters, Beam Profiling, IR Optics

The 2021 Ophir Laser Measurement Catalogs include tutorials and product specifications for laser power meters and beam profiling systems.

The 2021 Ophir IR Optics Thermal Imaging Lenses Catalog covers IR components and complex lens assemblies with fixed or motorized focus and zoom lenses.

## MKS Newsletters

TECHinnovations Newsletter for the latest on vacuum, power solutions, gas delivery and analysis, plasma generation, and ozone solutions for semiconductor and advanced markets from MKS Instruments.

Focus on Photonics Newsletter for innovations in lasers, opto-mechanical components, vibration and motion control, and laser characterization from Newport Corp.

## Trade Shows

Photonics West
March 6-11, 2021
Digital Forum

## Follow Us Online

**Social Media**

I know the "SH to BNC Adapter" can be used to get a raw analog signal from power sensors. Can I use it to get a raw analog signal from an "RM9" radiometer sensor? Read the FAQ.

What is the damage threshold (maximum power density and maximum energy density) of the Ariel? It doesn't seem to be stated in the specifications. Read the FAQ.

**Optics**
What is the Narcissus Effect and what causes these unwanted effects of thermal imaging? Read the FAQ.

What are multispectral optical systems and what role do large mirrors play in them? Read the FAQ.

**Blog**
The Ophir Laser Measurement Group

**Web**
www.ophiropt.com/photonics

## About Ophir

Ophir is a brand within the MKS Instruments Light & Motion division. The Ophir product portfolio consists of laser and LED measurement products, including laser power and energy meters, laser beam profilers measuring femto-watt to hundred-kilowatt lasers, high-performance IR and visible optical elements, IR thermal imaging lenses and zoom lenses for defense and commercial applications, and OEM and replacement high-quality optics and sub-assemblies for $CO_2$ and high-power fiber laser material processing applications. Dedicated to continuous innovation in laser measurement, the product portfolio includes the **R&D 100** award-winning **BeamTrack** power/position/size meters and Spiricon **Ultracal™**, the baseline correction algorithm that helped establish the ISO 11146-3 standard for beam measurement accuracy. The company is **ISO/IEC 17025:2005** accredited for calibration of laser measurement instruments. The company's modular, customizable solutions serve semiconductor, industrial, life and health sciences, research, and defense industries throughout the world. An ISO 9001:2008 Registered Company.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