

Optics, Coatings, and Thin Films

Glass

Advanced Materials Research / Academia

Technology

## SEE THE CLEAR DIFFERENCE IN YOUR SAMPLING

Optical labs must have the capability to deal with a wide variety of sample types and measurement techniques – and the LAMBDA 1050 has the flexibility to keep up with your lab's ever-changing requirements.

Home

### Click on each photo for more information on optics, coatings, and thin-films solutions.

Measuring High-Performance Coatings and Thin Films Measuring Absorbance and Refractive Index of Thin Films

### **Enhanced Specular Reflector (ESR) Characteristics**

Solar

Enhanced specular reflectors (ESRs) are ultrahigh-reflectivity mirrorlike films used for high-efficiency brightness enhancement in light recycling LCDs, flat-screen TVs, phone screens, and monitors. They're also used to manage and optimize light for architectural and automotive uses, and for solar applications such as tubular daylight devices, or TDDs. The LAMBDA 1050 and the Universal Reflectance Accessory, with its absolute variable angle specular capabilities, enables accurate reflectance measurement of thin, flexible ESR films, which would be impossible to accomplish with accessories designed for rigid filters and glass only.



To read more, download our Field Application Report: <u>Measurement of Enhanced</u> <u>Specular Reflector (ESR) Films</u> <u>Using a LAMBDA 1050 UV/ Vis/NIR Spectrometer and</u> <u>URA Accessory</u>

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Enhanced Specular Reflector (ESR) Characteristics Measuring Absorbance and Refractive Index of Thin Films

### Measuring High-Performance Coatings and Thin Films

Many long-pass optical films, or "visible mirror films," consist of hundreds of layers of transparent polymers that work together to reflect and transmit parts of the solar spectrum for applications such as lowering emissivity of window glass. The LAMBDA 1050 system delivers exceptional capabilities for analysis of coatings and research into thin film manufacturing. And with enhanced performance in the NIR range, it's perfect for material characterization, including high-performance optics.

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Enhanced Specular Reflector (ESR) Characteristics Measuring High-Performance Coatings and Thin Films

### Measuring Absorbance and Refractive Index of Thin Films

Optics can combine films and coatings, layered to create interference effects that enhance transmission or reflection properties of optical systems — and their performance depends on the number and thickness of individual layers and the differences in refractive index at the layer interface. The researchgrade, high-performance LAMBDA 1050 system, fitted with the 150-mm InGaAs Integrating Sphere and Universal Reflectance Accessory, is the ideal tool for the determination of optical thin-film characterization.



To read more, download our Application Note: Measuring Absorptance (k) and Refractive Index (n) of Thin Films with the PerkinElmer Lambda 950/1050 High Performance UV-Vis/NIR Spectrometers

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# THIS IS UV/Vis/NIR THAT LIGHTS THE WAY

Our high-performance LAMBDA UV/Vis/NIR spectrophotometer delivers near-perfect transmission and reflectance measurements, optimizing the characterization of architectural, high-absorbing, and specialty glass. It sets the standard for high performance, flexibility, and convenience for analysis of finished glass and glass components in both research and manufacturing.

### Click on each photo for more information on glass.

Characterization of Architectural Glass

Characterization of Scientific Glass

### **Characterization of Architectural Glass**

Glass in architectural applications comes in a variety of forms: "float" glass, which describes the process of floating molten glass on a surface, giving it a uniform thickness; low-emissivity, or "low-E," glass for high thermal insulation; solar control glass; and self-cleaning, fire-resistant, and toughened security glass. For these applications and more, you need to measure transmittance and reflectance at variable angles. The LAMBDA 1050 system, equipped with its 150-mm Integrating Sphere, is the perfect solution for measurements at the widest possible number of angles — and to exacting ISO 9050, EN410, and JIS 3106 standards.

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### **Characterization of Scientific Glass**

Many glass manufacturers branch out into the scientific glass arena, providing glass and quartz for optics, radiological protection (both X-ray and nuclear), aerospace, optical disks for data storage, fiber optics, even protective eyewear. When obtaining transmittance measurements on samples such as lenses, which are both thick and curved, the beam can deviate, diverge, or converge. The LAMBDA 1050 system with its 150-mm Integrating Sphere ensures that the complete sample beam is collected - regardless of its path.

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### IT'S A BRAND NEW DAY FOR SOLAR ENERGY

Cheap, clean, and renewable: Solar power has the potential to deliver energy solutions to millions of people around the world with limited or no access to other sources – while solving some the world's most intractable environmental challenges.

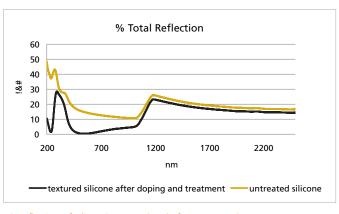
### Click on each photo for more information on solar.

Optical Characterization of Glass and Reflectors

Characterization of Aging Behavior Characterization of Nanomaterials

### Measurements for Silicon Wafers and Cells

Solar cell efficiency depends on the properties of the materials used in the manufacturing process. So it's essential to optimize the potential of surface textures and their reflective and antireflection coatings to obtain the types of properties that ensure efficient performance. Our LAMBDA 1050 system, fitted with accessories such as our Integrating Sphere and Universal Reflectance Accessory, enables you to measure the reflectance, transmission, and absorption properties of raw materials and photovoltaic cells at various stages of manufacture.



% Reflection of silicon (untreated and after treatment)

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Measurements for Silicon Wafers and Cells

Characterization of Aging Behavior

Characterization of Nanomaterials

### Optical Characterization of Glass and Reflectors

To ensure the efficiency and quality of solar panels, it's critical that you're able to verify the performance of the glass and reflectors used in their manufacture, as well as the mirrors employed in solar concentrators. Our unique Universal Reflectance Accessory provides automated reflectance measurement at a variety of angles, for better characterization of samples. Plus, by switching to the 150-mm Integrating Sphere module, total solar reflectance (TSR) can easily be determined.

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Characterization of Nanomaterials

### Characterization of Aging Behavior

Quality assurance and control (QA/QC) of incoming raw materials, including glass and other supplies used in the production of solar panels, improve the manufacturing process through the reduction of PV cell defects and optimization of throughput, improving the bottom line for solar manufacturers worldwide. Our high-performance LAMBDA 1050 system, with its full suite of accessories and analysis software, delivers a complete solution for optical characterization of glass and cell properties' efficiency and quality.

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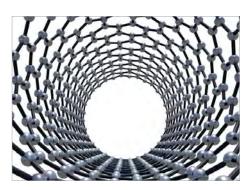
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Measurements for Silicon Wafers and Cells Optical Characterization of Glass and Reflectors

Characterization of Aging Behavior



### **Characterization of Nanomaterials**

Widely used in the construction of polymer-based PV cells, nanomaterials aid the charge transfer from the light-sensitive organic material to the solar cell's conducting layer. A material's charge-transfer efficiency is determined by the "band gap" of the material — the ease in which semiconductor material transfers electrons to its conducting band — and is important for determining the quality of semiconducting elements used in thin-film PV cell production. The LAMBDA 1050 system provides accurate measurement of key research parameters such as band gap.

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# NATURE AND ADVANCED MATERIALS COMING INTO BALANCE

Man-made chemicals and advanced materials can go a long way toward addressing the most vexing issues of our day. So we're helping manufacturers build products that are lighter, stronger, more resilient — in a word, better. This enables chemical manufacturers to create compounds that make our lives richer, while helping them to be good stewards of our natural resources.

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### Click on each photo for more information on advanced materials.

Analysis of Advanced Polymers

Characterization of Advanced Light Sources

### Characterization of Nanomaterials in Solar

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Characterization of Nanomaterials in Solar

Characterization of Advanced Light Sources

### **Analysis of Advanced Polymers**

Wearable technology – smart eyewear, smart watches, fitness wristbands, virtual-reality headgear – depends on polymer advancements in plastics. Researchers use diffuse reflectance capabilities in the LAMBDA 1050 system to characterize plastics used in advanced lighting applications, and for analyzing these high-performance polymers for clarity, helping to mitigate the "rainbow effect" they can produce. The system can also play a role in the development of lighter, stronger, and more impact-resistant products – and even help ensure that the advanced plastics in these wearable technologies don't interact negatively with other products customers wear, such as sunscreens or lotions.

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Characterization of Nanomaterials in Solar

Analysis of Advanced Polymers

### Characterization of Advanced Light Sources

Today's advanced lighting takes many forms — and absolute specular reflection and diffuse reflectance are helping manufacturers move that industry in innovative directions. For example, lasers are being utilized in applications as varied as eye surgery, cosmetic surgery and tattoo removal, and soft-tissue surgery. LEDs are finding their way into many of our personal devices, such as cameras and mobile phones. They're in our streetlights, architectural lighting, even aviation lighting. And because they give off less heat, LEDs are even being used to illuminate surgical theaters, so they need less air conditioning. Our LAMBDA 1050 systems are helping usher in a brighter future for lighting manufacturers.

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## ENABLING THE NEXT BIG SCIENTIFIC BREAKTHROUGH – AND THE NEXT

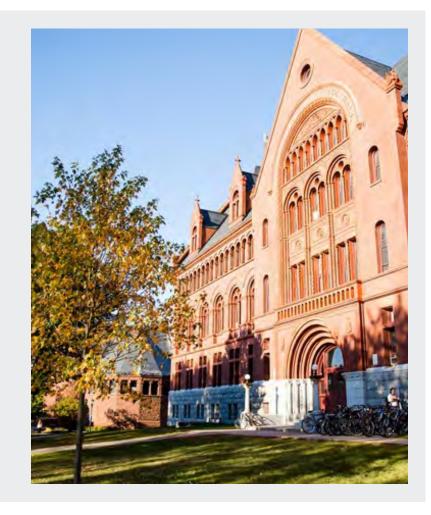
Not only do we sell our solutions into academic settings, but these research institutions collaborate with and share their knowledge with us, with other research institutions and scientific and commercial enterprises, as well as nonprofits, contract laboratories, and more – forming a web of experience and innovation that serves to moves our science forward.

### Collaboration with Research Universities

Research universities across the globe invest in PerkinElmer solutions to meet a variety of scientific requirements, and we help them develop world-class solutions to some of our thorniest scientific problems. These solutions can be shared with other institutions, both commercial and scientific, resulting in a whole host of fruitful collaborations. These alliances have produced results in such areas as:

- Angular and polarization dependence of new optical, nanomaterial-based coatings
- Combined optical and electrical performance of devices: for example, when laminated into a photovoltaic module, spectral mirror films reflect visible wavelengths while transmitting the most efficient NIR wavelengths for the solar cell
- Nanocenters that focus on advancements in nanoparticle research

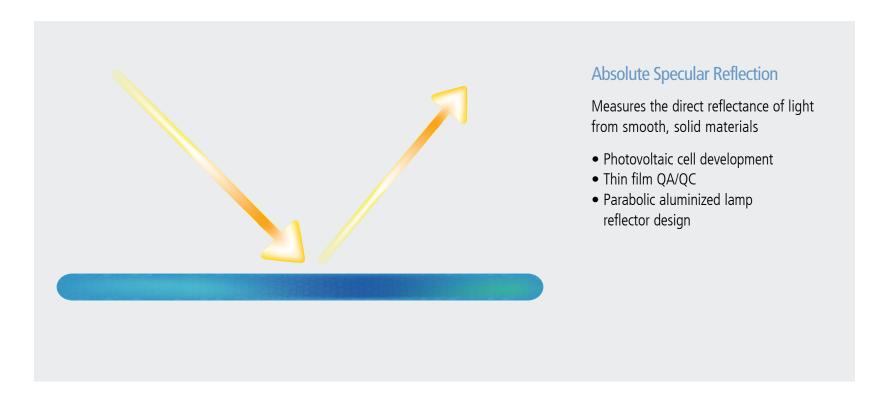
Through it all, we're benefitting from both the invaluable feedback our customers provide and their PerkinElmer evangelism with their customers, which helps improve our products and solutions.



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Whatever your sampling challenge – everything from powders to polymers, rough solids to thin film – we support the sampling technique that works best for your specific testing methods and the markets you serve.

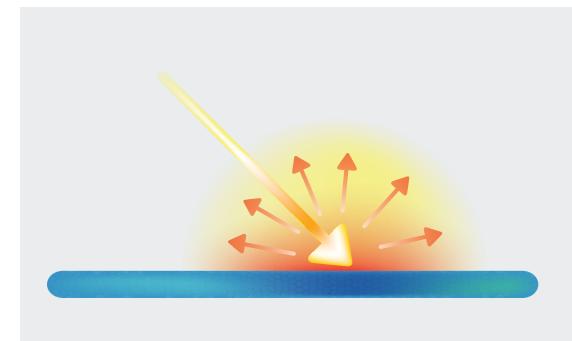


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### **Diffuse Scattering**

The reflection of light, waves, or particles from a surface at a variety of angles

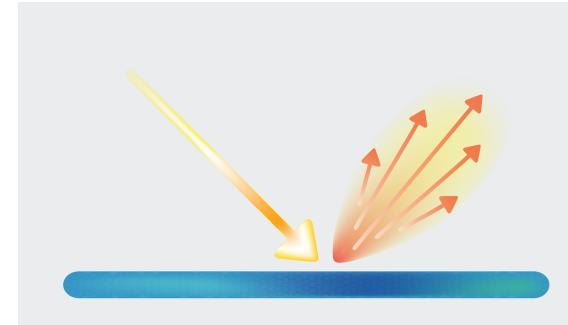
- Analysis of surface texture of thin films
- Characterization of surfaces made from nonabsorbing powder such as plaster

Click on each icon for more information on sampling techniques.

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### **Glossy Scattering**

Measure of contrast-gloss ratio and a finished surface texture of commercially available coatings

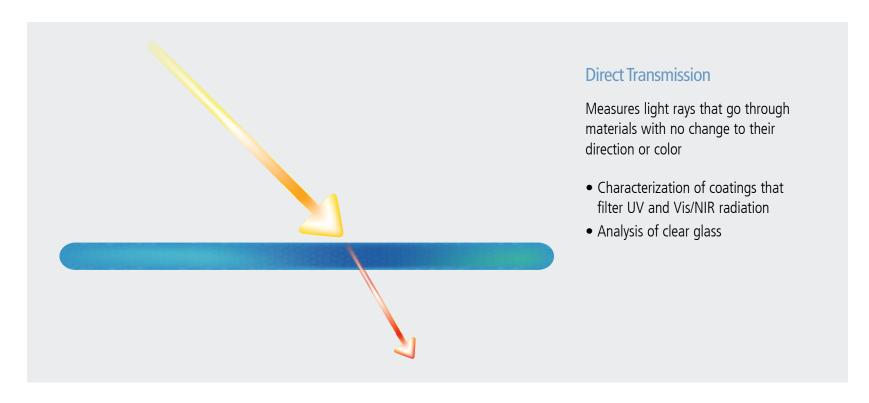
- Analysis of automotive paints
- Characterization of glossy or coated paper surfaces

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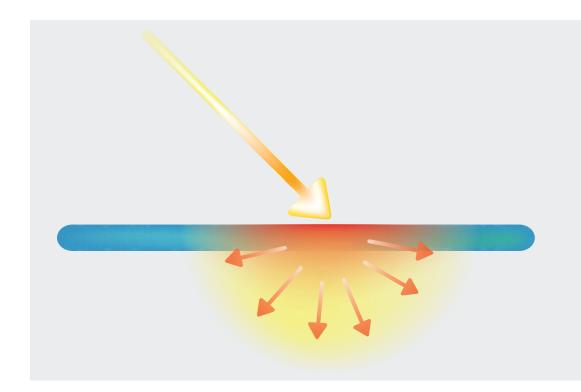


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### **Scattered Transmission**

Measurement of light that goes through a transparent or semi-transparent material with texture

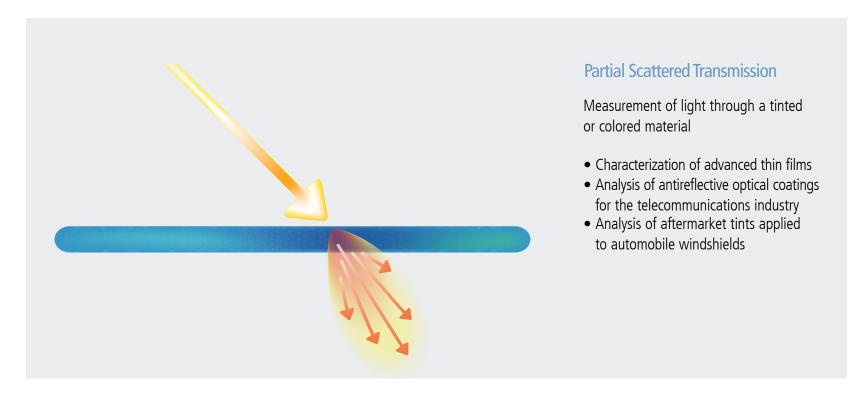
- Characterization of stained or frosted glass
- Analysis of thin films

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### ACCESSORIES COMPLETE THE SOLUTION

When accuracy and precisions are critical, you need accessories that allow you the flexibility to get the job done right. The LAMBDA 1050 high-performance spectrophotometer is designed with two oversized sampling bays to accommodate an array of snap-in accessories that make the most of the instrument's capabilities and help ensure the quality and reliability of your data.



### Click on each image for more information on the accessories.

### Total Absolute Measurement System (TAMS)

The most flexible platform of its kind, the Total Absolute Measurement System (TAMS) unit allows you to choose the right detector for angular-dependent measurements of optical properties of thin and thick samples, using a concentric rotation stage for sample and detector. Paired with either InGaAs or PbS detector, it maintains the highest accuracy with the widest wavelength range for angle-dependent measurement. Commonly used in the analysis of glazing found on architectural and automotive glass as well as photovoltaic cells in the solar industry, TAMS is a useful addition to any production lab tasked with the measurement of transmission and absolute reflectance at variable angles. Two detector types are available:

Direct detectors (standard) are the most sensitive and the best choice for scattering and BRDF/BTDF measurements.

**Sphere detectors** are the least prone to misalignment and other systematic errors and offer the highest transmittance and reflectance accuracy.

### **KEY APPLICATIONS**

- Analysis of glazing found on architectural and automotive glass.
- Characterization of photovoltaic cells.

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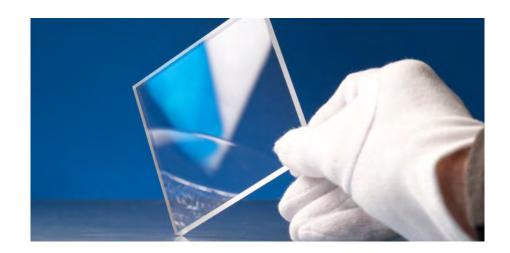
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### **Integrating Spheres**

Overall transmission (direct transmission plus diffuse transmission, including beam deviation) is best measured by an integrating sphere. These detectors measure light at a broad angle, and because samples are placed at the sphere's transmission port, all light that's scattered or refracted can be accurately measured. Two sizes of snap-in spheres are available:

The **100-mm Sphere**, in either PMT/PbS or PMT/InGaAS configuration, uses two measurement ports (reflectance and transmission) and a dedicated reference beam entrance port.

The **150-mm Sphere** is a complete system for measuring diffuse and relative-specular reflectance and diffuse transmission of solids and liquids, with space for optional variable-angle sample mounts and spot kits and polarizers.

### **KEY APPLICATIONS:**

- Characterization of solar cells
- Analysis of security ink

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Determination of food constituents

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### Universal Reflectance Accessory (URA)

The multiangle, high-sensitivity Universal Reflectance Accessory (URA) automatically changes the angle with no adjustments to sample or optics, reducing costs and producing faster results. Samples lie flat on a measuring plate, where internal optics direct a beam to a measurement port — ideal for difficult-to-measure thin films. The URA has its own kinematic detector module and pathlength compensator, which helps maintain identical pathlengths and angles of incidence between background and sample measurement. The URA's adjustable beam spot size enables small, difficult samples to be easily accommodated.

### **KEY APPLICATIONS**

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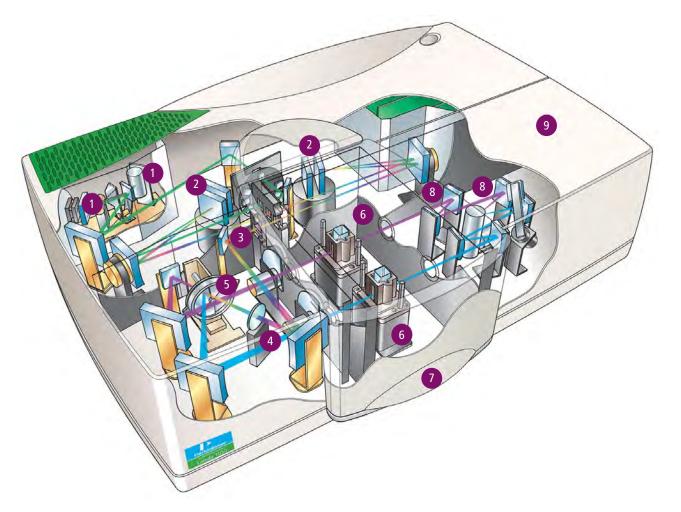
- Characterization of thin films
- Analysis of flat-panel displays

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## WHAT'S INSIDE IS CLEARLY ILLUMINATING



### 1. Deuterium/Tungsten Halogen Light Sources

Prealigned and prefocused for quick replacement and maximum uptime. Features doubling mirror for ultrahigh sensitivity.

### 2. Double Holograph Grating Monochromators

For ultralow stray-light performance.

### 3. Common Beam Mask

Allows precise adjustment of beam height to match samples of different dimensions.

### 4. Common Beam Depolarizer

Corrects for inherent instrument polarization to allow accurate measurements of birefringent samples.

### 5. Chopper

Switches between sample and reference beam; four-segment design provides individual blank readings for sample and reference, increasing measurement accuracy.

### 6. Sampler and Reference Beam Attenuators

For extremely sensitive and accurate measurements on higly absorbing samples.

### 7. Industry's Largest Sample Compartment

Allows easy access to a wide variety of sampling accessories and sampling types.

### 8. High-Sensitivity Photomultiplier, Peltier-Controlled InGaAs, and PbS Detectors.

Provides full-range UV/Vis/NIR coverage from 175 nm to 3300 nm.

### 9. Second Sampling Area

The instrument accommodates a range of snap-in sampling modules, including the Total Absolute Measurement System (TAMS), 100- and 150-mm Integrating Spheres, and the Universal Reflectance Accessory (URA) for high-precision absolute reflectance measurements.

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# WE HAVE LABORATORY SERVICES DOWN TO A SCIENCE

In today's complex laboratory environments, every function has to work in sync toward the common goal: lab efficiency in the service of scientific discovery and progress. And that's the overarching goal of OneSource® Laboratory Services, too. We deliver solutions that cover all aspects of scientific lab operations and can be customized for the scientific workflows — and business outcomes — you're driving toward.

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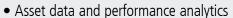
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Beyond Break-and-Fix

**Maximize Your Investment** 

### The Path to Lab Efficiency Starts Here

OneSource Laboratory Services provides customized solutions that turn asset data into actionable, automated, predictive, and scalable insights.



- Instrument and asset operations and information technology (OT/IT)
- Laboratory efficiency consulting and noncore resources

Compliance services

• End-to-end laboratory relocation project management

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From everyday instrument repair and service to compliance and validation, from laboratory IT service to consulting and scientific staffing, OneSource Laboratory Services can help streamline your lab routines and get your scientists back to their main order of business — science.

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Maximize Your Investment

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### **Beyond Break-and-Fix**

Instrument Service and Repair

OneSource service plans are the best way to maximize your instrument investment with solutions designed for optimized performance while ensuring accurate, reproducible results — all while enabling you to adhere to your most stringent regulatory compliance standards. What's more, our plans guarantee a rapid response from our dedicated world-class engineers who are recertified on an ongoing basis.



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The Path to Lab Efficiency Starts Here

Beyond Break-and-Fix

### **Maximize Your Investment**

Training and Educational Services

Get the most from your PerkinElmer instrument platform by learning from the experts. We offer basic and advanced training at your facility, as well as classroom training to broaden your knowledge, share with fellow researchers, and learn from field application scientists.

- Basic Onsite Training: Hands-on instrument training at your location that covers the basics
- Advanced Onsite Training: In-depth training at your location to enable peak instrument performance for your specific lab requirements
- Classroom Training: Offered at PerkinElmer Centers of Excellence located throughout the Americas, Europe, and Asia

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