Light. Measurement. Excellence.

BENTHAM

Optical Metrology Systems Guide

2019

www.bentham.co.uk

Bentham are global leaders in the development and manufacture of high performance scientific instrumentation used in the UV-vis-IR optical characterisation of sources, detectors and materials.

Established in 1975, we have developed a comprehensive product range spanning optical metrology instrument components, turnkey measurement solutions, a bespoke product design capability and a traceable calibration service.

Light is our passion

Our aim is to drive science and industry to a brighter future, delivering market leading optical metrology components and systems to accelerate research, development, quality and certification.

Our Approach

We are passionate about working with our clients so that together we can find the best solution to your optical metrology problem.

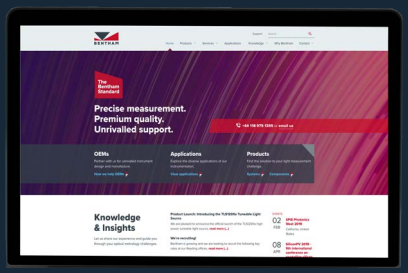
Wide Reaching

We supply instrumentation to a global market in a broad range of applications and industries, serving clients in national laboratories, research institutes, educational establishments, test houses and product manufacturers.

Quality & Technology

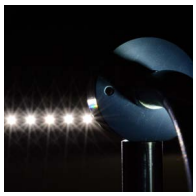
All our products are designed and built in our headquarters in the UK by our dedicated team of optical, mechanical, electronic and software engineers and technicians. Designed for performance. Built to last.

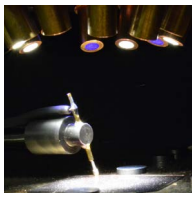
We take pride in the high standards we uphold and the exceptional level of service we provide.



- Components
- Systems
- Services
- Applications

Discover More at bentham.co.uk





We are pleased to introduce to you our portfolio of application-ready optical metrology systems. Used in a wide range of source, detector and material characterisation applications, our products are designed to be easy to use, reliable and configurable to meet your specific requirements.

For further information or to discuss your application with one of our specialists, please contact us through our website or call us on +44 118 975 1355.

Source Characterisation

Detector Evaluation

Material Optical Properties

Source Characterisation

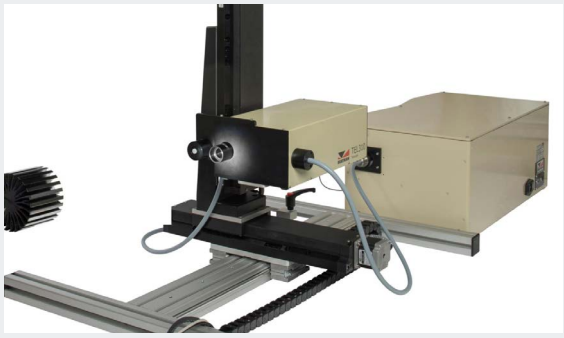
Application-ready solutions designed for precise UV-vis-IR characterisation of source emission.

IDR300-PSL

Photobiological Safety Spectroradiometer

Test and certification companies and lamp and luminaire manufacturers can now evaluate the photobiological safety of lamps and lamp systems easier, faster and with greater accuracy than ever before.

- Assess all product types, from UV through to IR
- Includes full measurement guidance, calculation and report generation
- Quality of measurements assured via NMI calibration standards traceable to PTB
- Fully compliant to instrumentation recommendation of international standards



Standards

IEC/EN 62471 | IEC/EN 60825-1 | IEC/EN 62471-5 | IEC 62115 | IS 16108 | ISO 15004-2 | JIS C 7550 | IEC/EN 60598-1 | IEC/EN 61167 | IEC TR 62778 | ANSI RP 27

Measurements

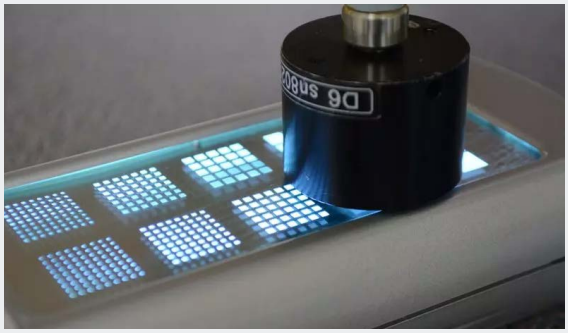
Spectral irradiance | Spectral radiance | Source subtense | Modulation

PTCal150

Enabling Precision Dosimetry in Phototherapy & PDT

Safe and effective phototherapy and photodynamic therapy (PDT) treatment relies on accurate dosimetry. In hospitals and in clinical research, the PTCal150 sets the benchmark for the precise spectral irradiance measurement of all phototherapy and PDT light sources.

- High-accuracy spectroradiometry in just a few steps
- Superlative stray light performance of double monochromator
- Choice of UV or UV-vis configurations tailored to your phototherapy facilities
- Alignment-free calibration standards ensure your link to national metrology standards



Measurements

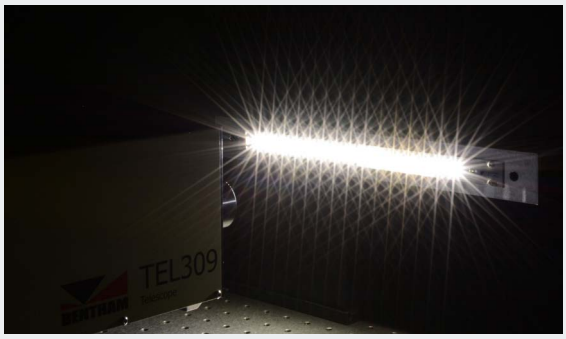
Spectral irradiance

ISR300-PSL

Luminaire Blue Light Hazard Spectroradiometer

The ISR300-PSL is a key tool in the accurate evaluation of blue light hazard across all classes of lighting products. Design your products for compliance and provide accurate safety information to your clients.

- Direct approach to blue light hazard testing
- Assess all classes of lighting product
- No dark room or knowledge of standards required
- Avoid negative perception of hazard over-estimation



Standards

IEC/EN 60598-1 | IEC TR 62778

Measurements

Spectral radiance

Standards

IEC/EN 60335-2-27 | IEC/EN 61228 | 21 CFR 1040.20

Measurements

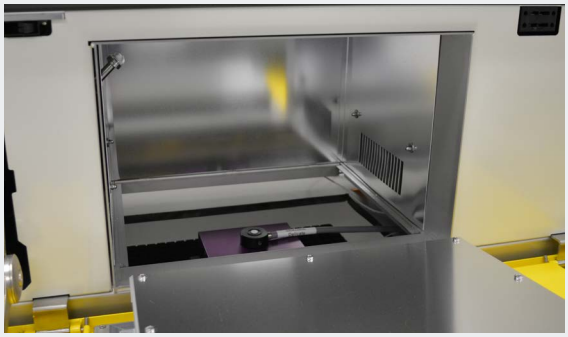
Spectral irradiance | Spectral transmittance

TanTest150

Complete Type-Testing of UV Tanning Appliances

An accurate and reliable solution for manufacturers to type-test the UV emission of tanning appliances and lamps. Benefit from a high-performance measurement solution that ensures compliance with national and international standards.

- High accuracy spectral irradiance measurements you can rely on
- Precision cosine diffuser (f_2<1%)
- Portable double monochromator spectroradiometer
- Adaptable to measurement of UV, blue and red light sources or protective eye-wear



Standards

ISO 24443 | ISO 24444 | ISO 105-B02 | ISO 105-B04 | OECD 316

Measurements

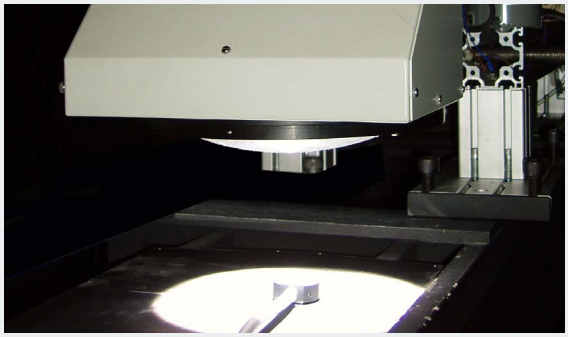
Spectral irradiance

SolarSim150

UV-Vis Spectral Testing of Solar Simulators

The correct setting of your solar simulator is key to the success of your study. A precision cosine diffuser and a double monochromator spectroadiometer ensures the highest quality UV-vis spectral irradiance data on your solar simulator.

- High-accuracy spectroradiometry in just a few steps
- Side view entrance optic ensures reaching correct measurement plane
- Choice of UV or UV-vis configurations tailored to your application
- Alignment-free calibration standards ensure your link to national metrology standards



Standards

IEC/EN 60904-9 | ASTM E927 | MIL-STD-810G

Measurements

Spectral irradiance

SolarSim300

Vis-IR Spectral Testing of Solar Simulators

Measure your solar simulator in confidence over a wide spectral range. Designed with research-grade optics and a double monochromator spectroadiometer, the SolarSim300 delivers the highest quality vis-IR spectral irradiance data.

- High-accuracy spectroradiometry in just a few steps
- Choice of configurations tailored to your solar simulator application
- Cover a wide spectral range in a single scan
- Alignment-free calibration standards ensure your link to national metrology standards

AutoSpec150

Accurate Spectral Testing of Automotive lighting

The AutoSpec150 enables the quick and accurate spectral distribution testing of LED, HID and filament lamps used in automotive lighting across the full UV and visible spectral range.

- Accurate assessment of spectral distribution and colour as required by standards
- Easily integrated into existing automotive lighting goniophotometric setups
- Direct report of ratios and colourimetric values
- Calibration traceable to PTB, Germany

Standards

ECE 19 | ECE 37 | ECE 99 | ECE 112 | ECE 113 | ECE 123 | IEC/EN 60810

Measurements

Spectral irradiance

Enviro150

UV Solar Spectroradiometer

The Enviro150 UV Solar Irradiance System comprises a double monochromator spectroradiometer in a thermally controlled, environmentally sealed enclosure to deliver reliable, high-accuracy solar UV measurements independent of its situation.

- Have confidence in reliable UV irradiance data
- Laboratory performance in the field
- Ruggedised enclosure permits optimal operation regardless of environment
- Automatic solar irradiance measurement at user-defined intervals

Standards

GAW report 125

Measurements

Global spectral irradiance | Diffuse spectral irradiance | Direct normal spectral irradiance

Enviro300

UV-vis-IR Solar Spectroradiometer

Comprising a double-spectroradiometer housed within a thermally controlled, environmentally sealed enclosure, the Enviro300 delivers reliable, high-accuracy measurements over a wide spectral range, independent of location or environment.

- Have confidence in reliable irradiance data throughout the UV-vis-IR
- Laboratory performance in the field
- Ruggedised enclosure permits optimal operation regardless of environment
- Automatic solar irradiance measurement at user-defined intervals

Standards

GAW report 125

Measurements

Global spectral irradiance | Diffuse spectral irradiance | Direct normal spectral irradiance

Standards

MIL STD 3009 | SAE ARP 5825 | STANAG 1445

Measurements

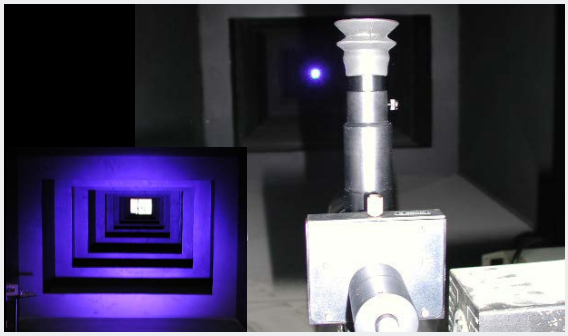
Spectral radiance | Spectral transmittance

NVC150

Night Vision Compatibility Testing

Assess the night vision apparatus compatibility of interior and exterior lighting products with confidence. The requirements of this challenging measurement are exceeded with the high performance NVC150.

- High performance double monochromator based spectroradiometer
- Choice of telescope lens according to luminous area
- Assess all types of lighting product (interior & exterior)
- Optional configuration to enable measurement of filters



Standards

FAA Eng. Brief No. 67 | IEC TS 61828 | STANAG 3316

SAE ARP 5825

Measurements

Spectral radiant intensity

SP150

Photometry of Visual and Covert Signals

Obtain the highest accuracy spectral radiant intensity data on your signal products. Quickly access luminous intensity and colourimetric data for visible signals. Characterise the radiant intensity, NVIS intensity and wavelength of covert signals.

- Ultimate accuracy in spectral radiant intensity testing
- Measure visible and covert sources
- Ease of setting up measurement with direct view telescope
- Directly access photometric and radiometric data

Measurements

Spectral radiance

DVC150

Visual Characterisation of Displays

Take your display measurements to the next level with the DVC150 spectroradiometer. The superlative stray light performance of the DVC150 offers high dynamic range display characterisation and ultimate measurement accuracy.

- Highest accuracy display measurements
- Ease of measurement with direct-view telescope
- Over six decades of dynamic range
- Accurate assessment of colour and luminance

BGS400

Moving Luminaire Goniophotometer

Accelerate your luminaire product development with the BGS400 moving lamp and luminaire goniophotometer, an economical, turnkey solution for the evaluation of source luminous intensity profile.

- Fully automated two-axis moving lamp and luminaire goniophotometer
- Customisable sample mounting using optical breadboard and lamp mounting accessories
- Precision photometer with NMI traceable calibration
- Data export in Eulumdat (*.ldt) and IES (*.IES) file formats

Standards

IEC/EN 13032-1 | EU 1194/2012

Measurements

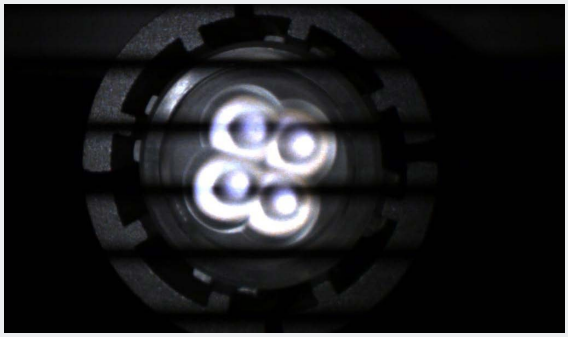
Luminous intensity distribution

Flicker400

Light Source Modulation Characterisation

The Flicker400 offers lamp and luminaire manufacturers deeper insight into the flicker characteristics of their products. Ensure visual comfort of space occupants and compatibility with recording equipment for successful adoption of your luminaires.

- Simple establishment of all key flicker metrics
- Stay ahead of the legislative curve
- Easy integration into existing photometric testing facilities
- Quickly gain insight into source performance



Standards

ENERGY STAR | IEEE 1789 | UEFA Lighting Guide

Measurements

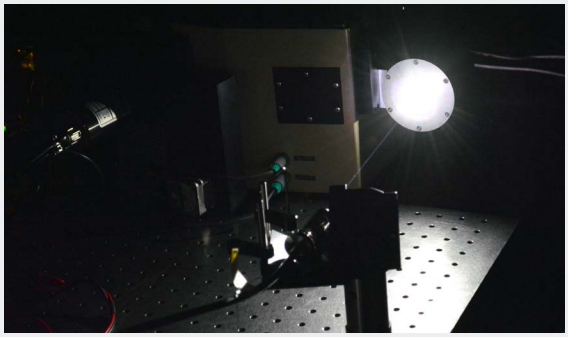
Flicker percent | Flicker index

SCL300

UV-vis-IR Supercontinuum Laser Spectroradiometer

Characterise the wide spectral range emission of supercontinuum laser sources with ease with the SCL300. Obtain accurate spectral radiant power data over the full emission range of your source throughout.

- Perform measurements over wide spectral range in one scan
- High damage threshold integrating sphere entrance optic
- Configurable over the UV-vis-IR
- Fully automated spectroradiometer



Standards

IEC/EN 60825-1 | IEC/EN 62471

Measurements

Spectral radiant power

Detector Evaluation

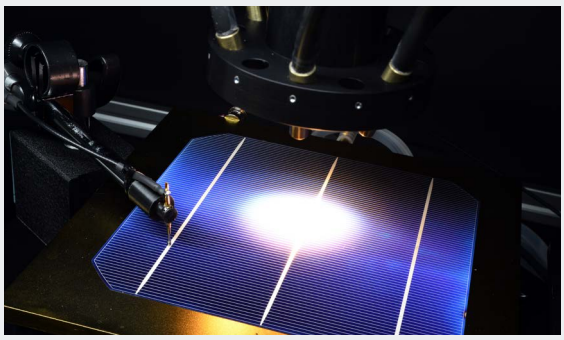
Precise opto-electronic testing of photodetectors, image sensors and radiometers.

PVE300

Photovoltaic EQE (IPCE) and IQE solution

The PVE300 photovoltaic QE system is an essential tool in PV research and production line quality processes, employed in the accurate determination of solar cell spectral response/ EQE (IPCE) and IQE.

- Measure all types of materials and device architectures including multiple junction
- Full EQE and IQE characterisation on device and material level
- Superior quality optical components ensure consistent system performance
- Enables your PV research



Standards

IEC 60904-8 | IEC 60904-8-1 | ASTM E1021 | ASTM E2236

Measurements

Spectral responsivity | Total reflectance | Total transmittance | Predicted Jsc | EQE | IQE

SensorQE300

Image Sensor QE Characterisation

A key tool in the development and quality assurance of image sensors. Highly configurable to the spectral range of your sensor, the SensorQE300 features an integrating sphere to ensure uniform sensor illumination.

- Obtain high quality QE data on your sensors
- On-sphere detector allows real-time determination of spectral irradiance
- Easily integrated to camera measurement system
- Calibration traceable to PTB, Germany

Standards

EMVA1288

Measurements

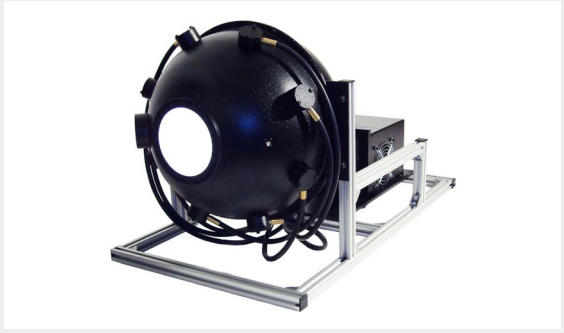
Spectral responsivity | Quantum efficiency

ULS300

Variable, Constant CCT Luminance Source

Achieving high quality images with sensors and cameras requires accurate uniformity analysis at the pixel level, particularly where wide-angle lenses are used. Let the unparalleled spatial uniformity of the ULS300 underpin your imaging system characterisation.

- Exceptional uniformity over 100mm diameter aperture, independent of luminance setting
- High temporal stability
- Delivers continuously variable luminance
- Optional on-board luminance monitor



Standards

EMVA 1288

Measurements

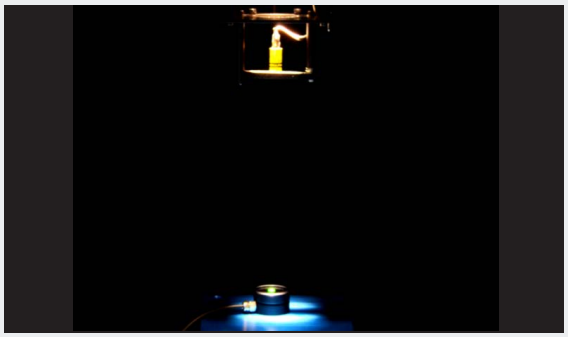
Spectral responsivity | Quantum efficiency

PD300

Photodetector Quantum Efficiency Evaluation

The PD300 comprises a range of configurations for the accurate characterisation of photodiode quantum efficiency over a wide spectral range and under customised measurement conditions including light and voltage bias.

- Measure all types of material systems
- Configurations covering full UV-vis-IR
- Customisable beam delivery
- NMI traceable calibration



Standards

ISO/CIE 19476

Measurements

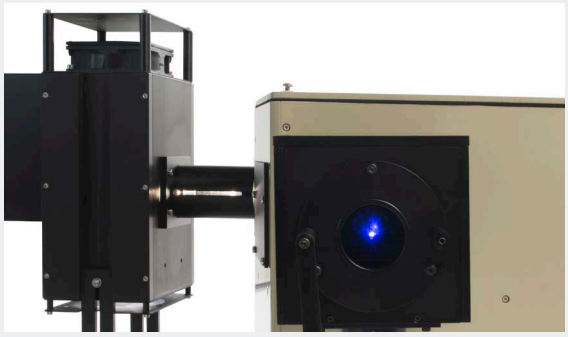
Illuminance responsivity | Luminance responsivity

LuxCal250

Lux and Luminance Meter Calibration

Provides accurate luxmeter calibration over an exceptionally wide dynamic range. Comprising a light-tight enclosure housing standards of illuminance, the LuxCal250 obviates requirements typical of traditional, distance-based calibration.

- Calibrate luxmeters and luminance meters with ease
- No darkroom or optical bench required to achieve wide dynamic range
- Calibration traceable to PTB, Germany
- Optional UKAS accredited reference luxmeter and luminance meters



Standards

ISO/CIE 19476

Measurements

Spectral responsivity | Spectral transmittance

PCS300

Photometer Characterisation Solution

The PCS300 provides accurate characterisation of key parameters relating to the performance of luxmeters, luminance meters and components.

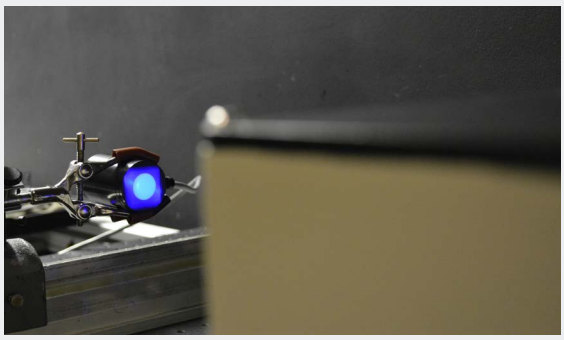
- Characterise spectral (f_1') and angular response (f_2) of photometers
- Easy to use and interface devices under test
- No darkroom or optical bench required (except for directional response measurement)
- Calibration traceable to PTB, Germany

UVR300

UV Radiometer Spectral Sensitivity Testing

Combining a UV-optimised tuneable light source and micro-lens array optics, the UVCS300 ensures the most accurate spectral response characterisation of UV radiometers used in a wide range of applications.

- Characterise key parameters of UV radiometers in accordance with CIE 220
- High beam uniformity
- Easy to use and interface devices under test
- Calibration traceable to PTB, Germany



Measurements

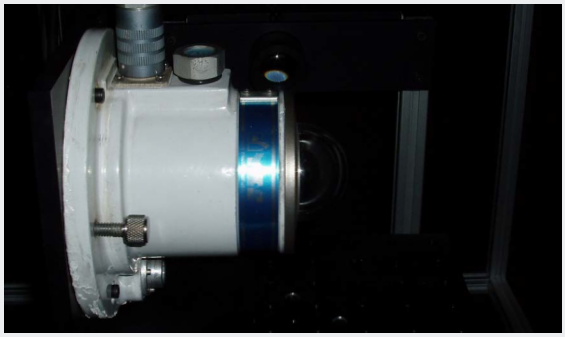
Spectral responsivity

UVCS300

UV Radiometer Characterisation Solution

Fully characterise the key performance parameters of UV radiometers with spectral, angular and absolute irradiance sensitivity testing in one measurement solution.

- Double monochromator tuneable light source spectral testing
- Single axis goniometer
- Stable halogen irradiance sensitivity calibrator
- All three measurement reunited around one measurement solution



Measurements

Spectral responsivity | Directional response | Irradiance sensitivity

OICS300

Optical Instrumentation Characterisation Solution

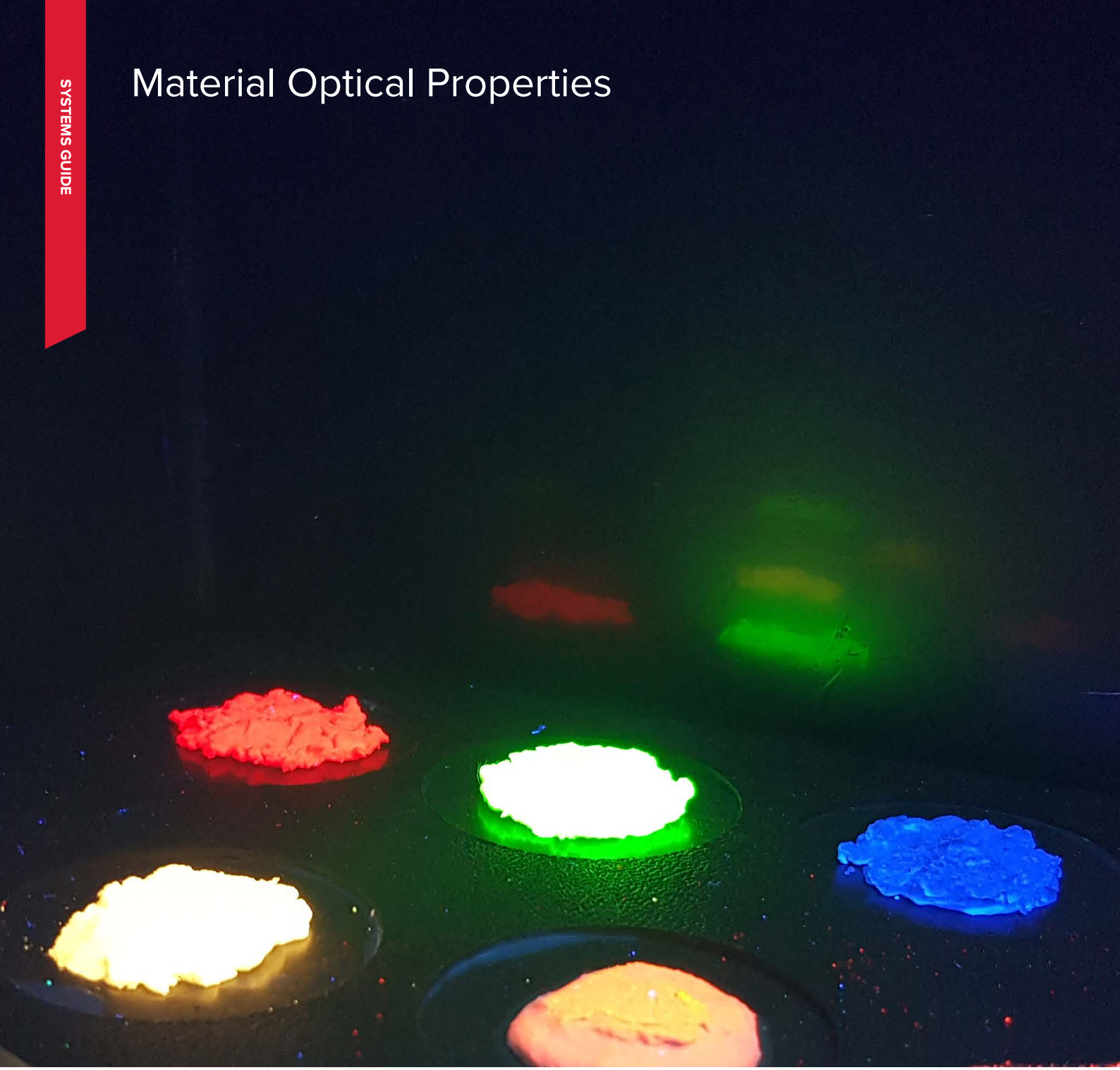
Comprising a wavelength agile tuneable light source based on a double monochromator, characterise the spectral response properties of a wide range of optical instruments with confidence.

- Tuneable light source configured to spectral range of interest
- Double monochromator ensures superlative stray light performance
- Range of optics to control illumination of DUT
- Includes reference detectors with calibration traceable to PTB, Germany

Measurements

Spectral responsivity | Stray light | Linearity | Transfer function

Material Optical Properties



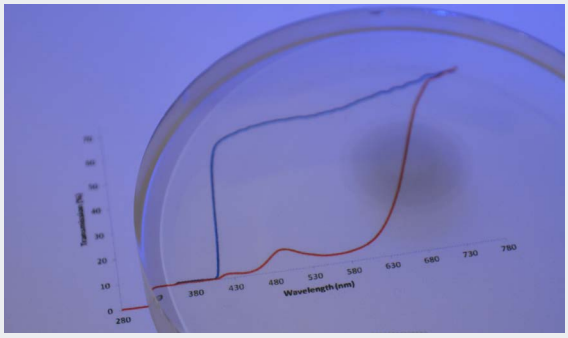
Research grade solutions to probe a wide range of products and materials throughout the UV-vis-NIR.

BPC300

Photochromic Lens Spectrophotometer

The BPC300 spectrophotometer offers accurate characterisation of photochromic lens transmission in the faded and AM2 conditioned states.

- Accurate transmission testing of photochromic lenses
- Explore lens performance in range of conditions
- Monitor rates of darkening and fading
- Easy and highly repeatable process



Standards

ISO/EN 8980-3 | ISO/EN 12312-1 | ANSI Z80.3 | AS/ NZS 1067

Measurements

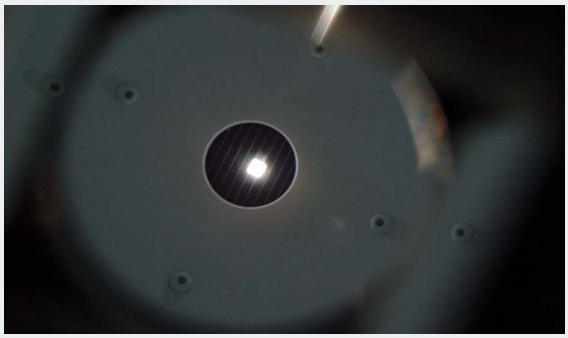
Spectral transmittance

UMS300

Universal Measurement Spectrophotometer

Based on a tuneable monochromatic light source configured for your spectral range of interest, the UMS300 accommodates a range of accessories including goniometer and integrating sphere to permit the high-accuracy measurement of material optical properties.

- High power optical probe relayed to easy access measurement plane
- Configurable throughout UV-vis-IR
- Easily migrate between measurement types
- Broad range of transmittance and reflectance measurements



Measurements

Spectral total transmittance | Spectral total reflectance

Spectral direct transmittance | Spectral specular reflectance

Spectral diffuse transmittance | Spectral diffuse reflectance

Fluoro300

High Performance Fluorometer

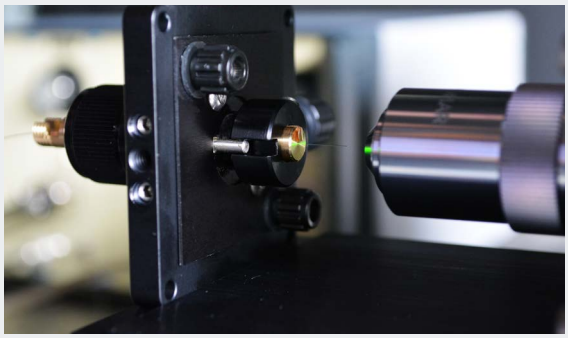
A highly configurable fluorometer utilised in the high-accuracy assessment of solid and liquid samples, in either a high throughput relative measurement or absolute quantum yield configuration.

- Excitation source optimised to maximise probe power
- Highly configurable, ideal for research use
- Easily execute excitation and emission measurements
- Accurate and repeatable measurement procedure

Measurements

Excitation spectrum | Emission spectrum

Quantum yield



Standards

IEC/EN 60793-1-40 | IEC/EN 60793-1-44

Measurements

Spectral attenuation | Cut-off wavelength

FSL300

Fibre Spectral Attenuation Spectrometer

Including precise launch of a monochromatic probe into fibre and a range of fibre-coupled detectors, the FSL300 provides accurate assessment of fibre spectral loss, wavelength cut-off and characterisation of WDM components.

- Superior stability of launch optics
- Spectral range beyond that of traditional OSA solutions
- Modular design and high configurational flexibility
- Fully automated measurement and calculation of relevant parameters

Standards

ISO 24443 | AS/NZS 2604 | FDA 2011

Measurements

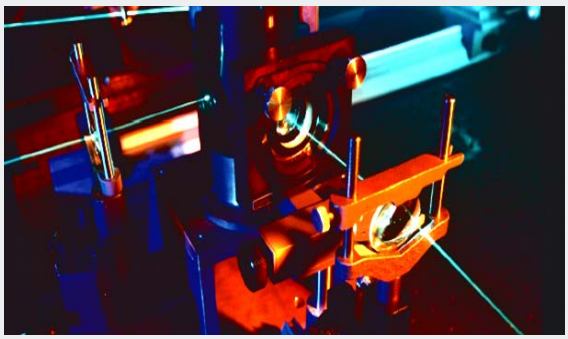
Spectral total transmittance

SSUV300

In Vitro Sunscreen Spectrophotometer

Combining the superior stray light and dynamic range performance of a double monochromator with precise collection of diffusely transmitted light, the SSUV300 exceeds requirements of standards for the in vitro testing of sunscreen products.

- Measure absorbance down to 6 OD
- Avoid incorrect results due to fluorescence
- Easy to use
- Accurate and repeatable measurements



Measurements

PL emission

PL300

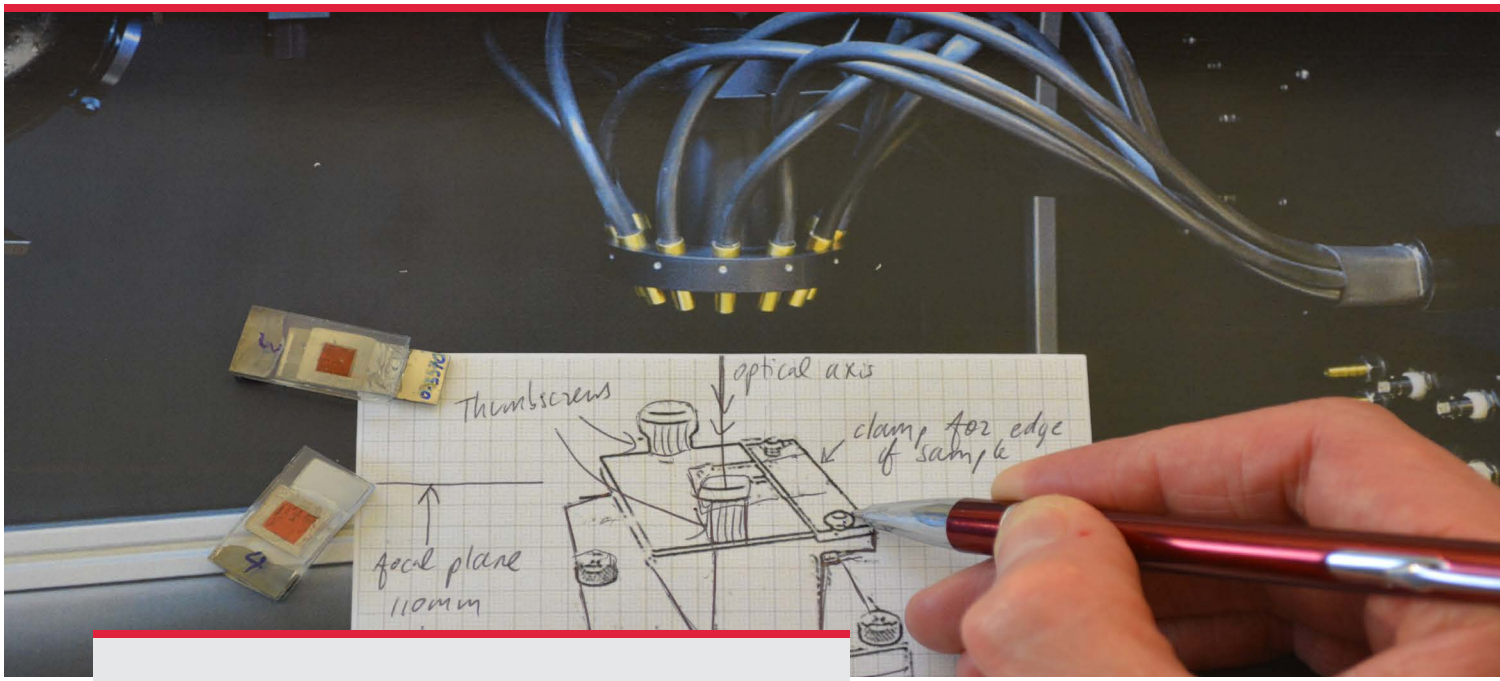
Spectrometers for Photoluminescence Applications

The PL300 spectrometer range includes high performance single and double monochromators optimised for the collection of photoluminescence in the presence of the excitation source. Configurable throughout the UV-vis-NIR, customise the PL300 to your material system under study.

- Range of spectrometers configurable to your spectral range of interest
- Double monochromator for ultimate stray light suppression
- Easily integrated into existing optical set-ups
- Spectral calibration traceable to NMI

Bentham Bespoke Metrology

Tailored Instrumentation for Your Application

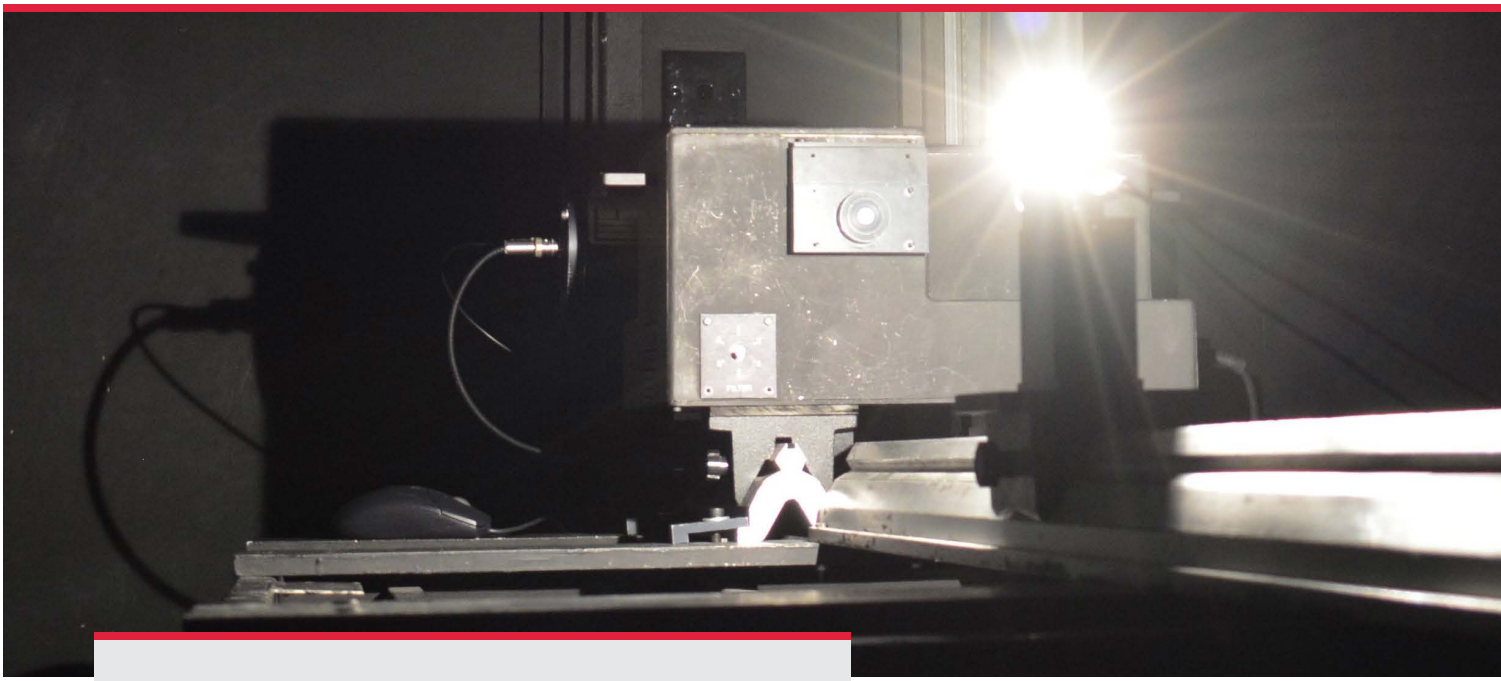


- Measurement solution designed to your requirements
- Customisation from sample mount to full measurement solution
- Team of optical, mechanical and electronic design engineers offer customisation on every level
- Software development to facilitate measurements, calculations and results reporting

Discover more online

www.bentham.co.uk/bespoke

Traceable Calibration Services
Your link to National Standards



- Have confidence in your measurements with National Metrology Institute traceable calibrations
- Range of optical source and detector calibrations on offer
- From receipt to return we track and take care of your artefact
- Fast turn-around guaranteed
- Calibrations traceable to PTB, Germany / NPL, UK.
- Annual re-calibration reminder program helps keep your calibrations up to date

Discover more online
www.bentham.co.uk/calibration

Optical Design

A team of optical experts offer high-proficiency in both imaging and non-imaging optical design, with extensive use of Zemax modelling software together with proprietary in-house optical design optimisation software.

Mechanical Design

Our team of mechanical designers offer extensive practical experience in the design and specification for manufacture, calibration and alignment of optical components and systems for use from ultraviolet through to infrared.

Electronic Design

We offer leading expertise in both digital and analogue electronic circuit design and PCB layout, with extensive use of OrCAD for schematic capture and PCB layout, and PSpice for circuit simulation and characterisation.

Software Development

Our team of software developers create software with the user at the forefront. Our full software suite, easily integrated into your software development stream, can be broken down into three core platforms: EmBen, BenHW and BenWin+.

Optical Component Manufacture

We can offer specialist insight in precision optical alignment and calibration techniques, automated life time testing and product characterisation procedures and a dedicated production streams for OEM products.

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