

This Issue

REACHING OUT HELPING HANDS Pg 1

CORPORATE NEWS Pg 2
SME 500
New Partner - Quantel

WHAT'S ON Pg 3
Laser World of Photonics

ZUGO MAILBOX (NEW SEGMENT!) Pg 3

PRODUCT SHOWCASE Pg 4
Objective Imaging Turboscan Kit
Minus K Benchtop Vibration Isolation Platform
Nutfield Scan Head
Capacitec Non-Contact Sensors

Quick Bytes Pg 6

APPLICATION HIGHLIGHTS Pg 7

PRODUCT INDEX

www.zugophotonics.com
enquiry@zugophotonics.com

“Great acts are made up of small deeds”



Reaching Out Helping Hands

The season of festivities has passed, and it is now business as usual. This Ox year, as with previous Ox years, symbolises a year of hard work, and many companies have already been relooking at their business models to trim off the excesses and maintain their muscle.

While reducing expenses is a must, it is also imperative for us to remember the needs of the underprivileged. Since 2002, **Zugo Photonics** has been the Sponsor for children's education, Giver of wheelchairs to the needy, Supporter of children suffering from Thalasaemia and Cancer, and also, the Food Provider to hundreds of elderly over the years.

Other than giving back to the society in terms of financial assistance, the management and staff of Zugo Photonics have also been avid fans of events organized by societies like Touch Community Service, Bright Hill Temple, Lifeblood Centre and Singapore Red Cross Society.

Going forward, Zugo Photonics will stand by our principles and continue to serve the community.

Giving is a pleasure, do join us in **Reaching Out** to the needy and providing a **Helping Hand**.

Thank You.

Cheers to 5 times Singapore SME 500 Winner!

The **Singapore SME 500** is an essential reference to the annual audited financial performance of Singapore's most successful small and medium Enterprise (SME) and we are very proud to announce that **Zugo Photonics** has once again been presented the award.

This award is the fifth addition to Zugo's family of **Singapore SME 500** accolades, and we will like to take this opportunity to thank all our customers and suppliers for providing their utmost support for the past 15 years. Zugo Photonics has also been ranked in the **Singapore 1000** for two consecutive years since 2008.



More on Singapore SME 500

The "Singapore SME 500" (SME 500) accesses and ranks the companies by annual financial performance of sales and/or turnover, as well as a separate ranking of SME 500 companies by Net Profit. The rankings also determine the ranked performance of these companies via other financial indicators such as total assets, return on shareholders' funds, etc.

New Partner

Zugo Photonics is proud to announce that we have been appointed by **Quantel** to be its exclusive distributor for its Fiber Laser products in China.

Founded in 1970, **Quantel** has built up a world class reputation for itself in the field of solid-state lasers and has since been the leader in the rapidly advancing field of laser technology for the past 39 years.

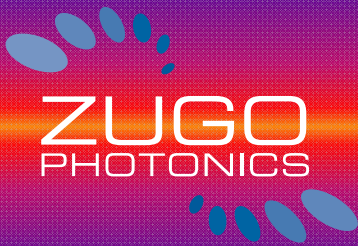
Quantel invests heavily in research and development and this has led to the introduction of numerous successful and innovative new products. Being the pioneer in its field, **Quantel** chose to develop a very promising technology based on fiber laser as an active medium.

Comprising of the world's best specialists in this field for systems design, **Quantel** proposes a new line of innovating products that are low cost and reliable. The applications aimed by these products are **laser marking, coding, engraving micromachining, drilling, cleaning, trimming** and all the applications which require an optimal beam quality and a perfect repeatability.



Leader in Solid State Lasers





What's On?

Calendar of Events



17 – 19 March

Venue: Shanghai New International Expo Centre
2345 Longyang Road, Pudong New Area

Following last year's success, Zugo Photonics will once again take part in this leading tradeshow for the Lasers & Photonics Community and we will like to extend our most sincere invitation to you for this exciting event!

Exhibits Highlights:

Lasers and Optronics, Optics, Sensors, Test and Measurement, Manufacturing Technology for Optics, Laser Systems for Production Engineering, Optical Measurement Systems, Biomedical Optics and Technology and Imaging.

Zugo Product Showcase:

- **Objective Imaging's** Optical Microscope, QICAM Color Camera, MIC Controller and Reflected Light Source for DMLA Microscope.
- **Capacitec's** Gapmaster3.
- **Nutfield's** Open Head Scan Head and 2 Axis Scan Head.
- **Minus K's** Vibration Isolation System.
- **Litron's** Nano S PIV system, Single Head Laser and Energy Meter.



For more information, please visit the event's website at <http://world-of-photonics.net/en/laser-china/start>

Please visit us at Hall E1, Booth 1418

Zugo Mailbox



Dear Readers,

Since the relaunch of **UPDATES** in January, we have been receiving streams of enquiries on our products and services, and as most of these information pertains to you, we have decided to share these insights by setting up a new segment in our bi-monthly newsletter – **Zugo Mailbox.**

Q: This sounds interesting but how do I get my questions to you?

A: You can email your enquiries to huihua.tan@zugophotonics.com and we will reply to you in a private mail as well as publish the answers in the next issue of **UPDATES.**

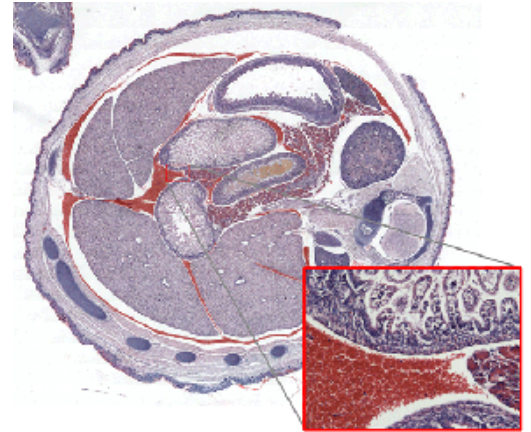
Pro-Series Turboscan Kit

Fast Mosaic Image Acquisition for Image-Pro® Plus



Based on the Oasis-4i controller, the Pro-Series Turboscan Kit provides the ideal solution for **surveying, relocating, printing** and saving mosaic images at a new standard in high-performance automation.

Scan an entire cover slip area of a slide in minutes, and then effortlessly relocate to areas of interest with a simple click. Quickly get the specimen overview to aid in understanding the relationships between microscopic features and overall structure. Save your work for later review, discussion, and publication.



Sample Scan
 Mouse, 10X objective lens, Turboscan mosaic of over 340 images. Digital camera resolution: 1392 x 1040 pixels, Final mosaic resolution: 23,596 x 20,720 pixels, Scanned with predictive focus and shading correction. Total time for scan and mosaic: 42 seconds

Features:

- Scanning and acquisition at camera frame rates
- Support for various analog and digital cameras, including Media Cybernetics' Evolution VF and QImaging's QICAM cameras
- High-quality image tiling
- Frame-rate shading correction
- Fast and accurate relocation
- Continuous focus tracking using predictive focus
- Compatible with most 3rd party motorized stage and focus drives
- Intelligent memory management supports mosaic sizes limited only by available disk space
- Plug-in capture driver for use within Image-Pro® Plus 5.1

Please click [HERE](#) for more information

Bench Top Vibration Isolation Platform

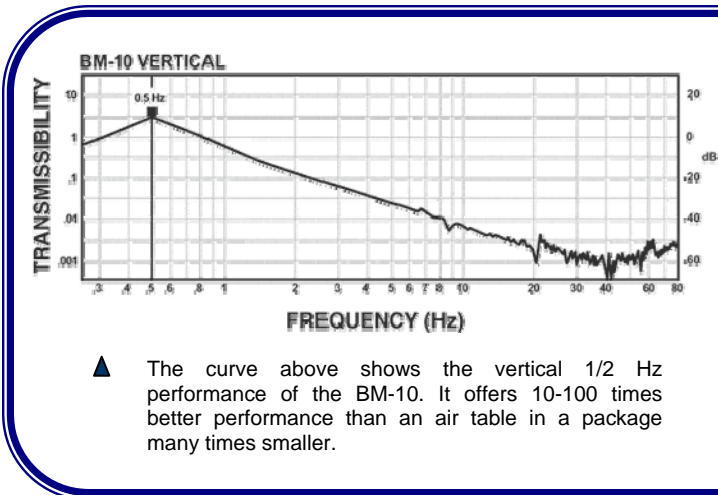
This new vibration isolation platform is extremely easy to use and offers extreme performance. It offers a **1.5Hz** horizontal natural frequency and our signature **0.5Hz** vertical natural frequency. There are only two adjustments.



▲ BM-10 Bench Top Vibration Isolation Platform

The BM-10 is perfect for new generations of small SPM's that require the highest performance in a very compact system.

This is the thinnest, smallest footprint, most portable, and most user-friendly isolator ever offered that is capable of delivering this level of performance.



Nutfield 3XB 3-Axis Scan Head



▲ 3XB 3-Axis Scan Head

Nutfield's 3XB 3-Axis Scan Heads offer laser system designers smaller spot sizes and larger scan field sizes than can be achieved with f-theta lenses. Our integrated design leverages the best of NTI's galvo technology to offer superior bandwidth, accuracy and flexibility in 3-axis technology.

- 3-Axis Scan Head for Large and Variable Field Sizes
- External Adjustment for Field Sizes From 100 - 1000mm
- Exclusive Focus & Variable Field Size Adjustment Design
- Achieves Smaller Spot Sizes and Larger Field Sizes than F-Theta Lenses
- Performs 3 Dimensional Process with Z- offset for Multiple Layers
- Useful for Rapid Prototyping and Laser Sintering Applications

The 3XB is the only 3-Axis Scan Head, which offers different field and spot size combinations by simply turning a knob to adjust the spacing between the translator and objective lens (patent pending). The lens translator houses an expander lens, which accepts a beam from the laser source. The beam expands and then travels through an objective lens, which lies in front of the X/Y scan mirrors in a post objective scanning configuration.



▲ Microinch level positioning sensing system

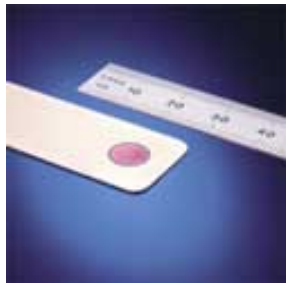
NON-CONTACT CAPACITIVE SENSORS

Non-intrusive alignment

Capacitec's micro-inch level positioning sensing systems assist chip processing and handling equipment manufacturers to sense silicon wafers for **exact** positioning prior to deposition, etching and other processing where generating unwanted particles is preferred.

This is accomplished without coming into contact or damaging their highly sensitive surfaces. Other industries where sensitive surfaces must be measured damage free are printing presses, photocopier rollers, computer hard disc drives and molten materials.

- Silicon Wafer deposition & etching
- Silicon Wafer proximity
- Wafer cutting/processing
- Robot arm control
- Computer hard disc drives
- Printing Press/Photocopiers
- Tooling parallelism/alignment



▲ GAPMAN Thin Gap Measurement (HPD SERIES PROBES)

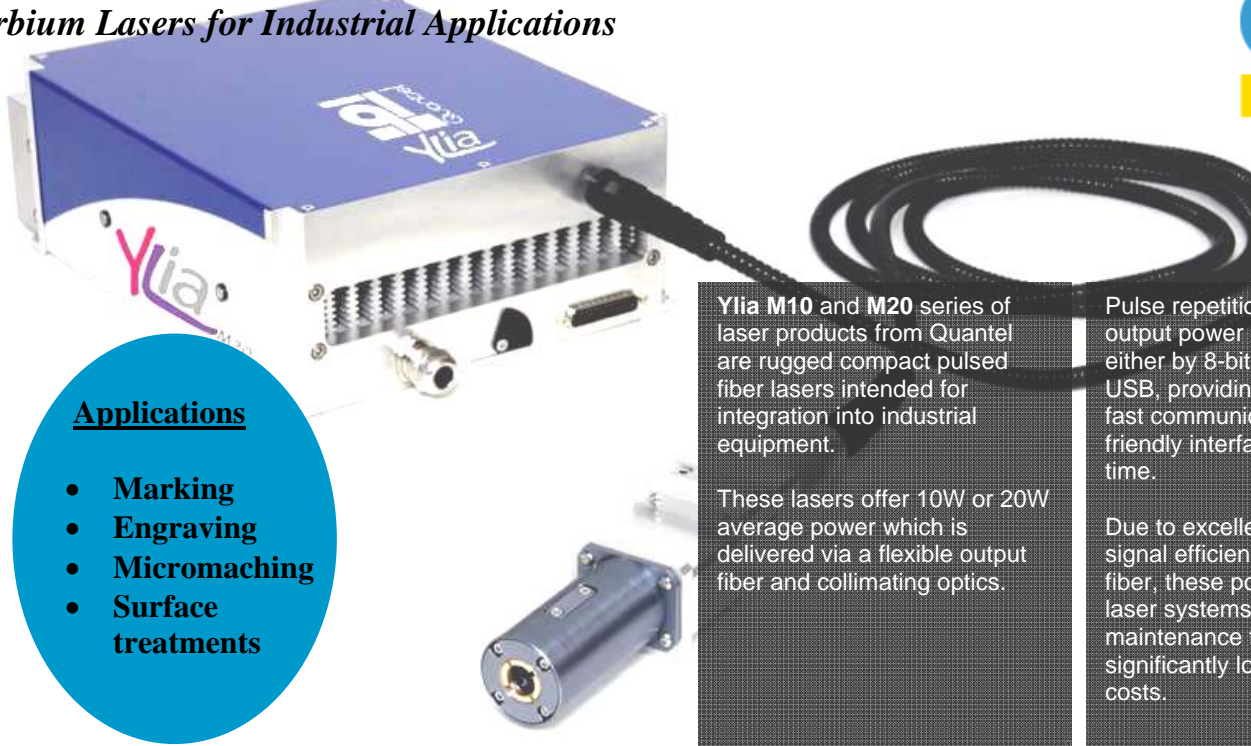
THIN GAP MEASUREMENT

Mechanical contact methods such as feeler gauges, shims and calipers had long been the only available method to measure gaps, even in areas where damage could be caused to polished or sensitive surfaces. **Capacitec** has eliminated the requirement for the operator's "feel" inherent in feeler gauges by developing a broad line of non contact industrial gap sensors as well as a new portable gap measurement tool named GAPMAN®. These modern Capacitec non contact methods now provide engineers with excellent repeatability with the added ease of digitally stored data for use in today's advanced quality control systems.

- Adhesive coatings
- Film manufacturing
- Plastic extrusions
- Automotive & Aircraft assembly
- Packaging materials
- Nuclear fuel rod gaps
- Photocopiers / Printing
- Tooling dimensions

Ylia Fiber Laser

Ytterbium Lasers for Industrial Applications



Applications

- Marking
- Engraving
- Micromaching
- Surface treatments

Ylia M10 and M20 series of laser products from Quantel are rugged compact pulsed fiber lasers intended for integration into industrial equipment.

These lasers offer 10W or 20W average power which is delivered via a flexible output fiber and collimating optics.

Pulse repetition rate and output power can be controlled either by 8-bits TTL signal or USB, providing the user both fast communication and user-friendly interfaces at the same time.

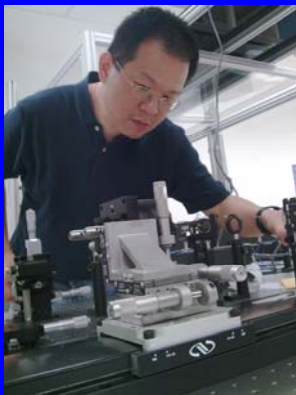
Due to excellent pump to signal efficiency in the optical fiber, these powerful air-cooled laser systems are maintenance free with significantly low operational costs.

Quick Bytes

Stepping into Dr Elbert Chia's laboratory located in NTU School of Physical & Mathematic Sciences, it is not difficult to notice the vast number of Zugo products present in the lab.

From the array of Power Meter, Delay Stages, Optical Mounts, Motion Controller to the Vibration Isolation Optical Table, we can ascertain that these products did serve Dr Chia well in his experiments which kept him as a loyal customer of Zugo Photonics.

Let's take a look at his lab . . .



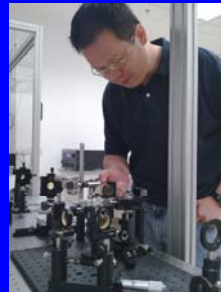
▲ Dr Chia checking on the stages mounted on the optical table

"The stainless steel translation stages are excellent! I mount them onto the delay stage and I use them all the time!"

"The optical table was top of the world. I've been using since my post-doc days in Los Alamos National Lab in the US."

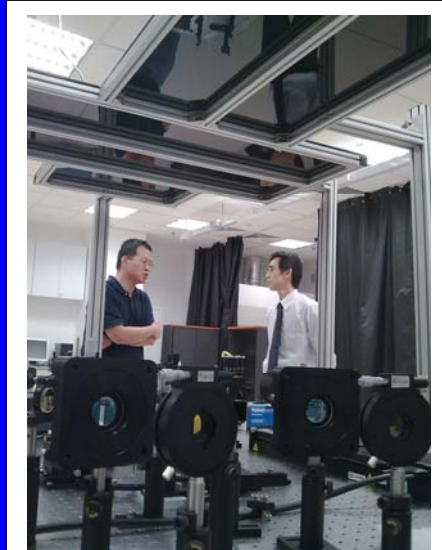


▲ 3 axis motion controller sitting on the top of the rack.



Dr Chia adjusting the optical mounts to ensure their alignments.

"The optical mounts are very good too! They are very smooth, lightweight and the controls are very fluid."



Dr Chia and Dep. Director of Strategic Marketing Oh Kim Eng were engaged in a conversation about their research days as well as sharing their different product experiences.

Photo-Response Mapping of Photovoltaic Cells

The performance of a photovoltaic (PV) cell can be quantified by measuring its spectral response and I-V curve. From these measurements the parameters like external quantum efficiency (EQE%), fill factor, efficiency, and maximum power can be derived.

For example, efficiency of the cell is calculated as

$$\eta = 100 \times \frac{P_m}{AE_o}$$

where **P_m** is the maximum power (W), **A** is the cell area (m²) and **E** is the standard reporting irradiance (W/m²)

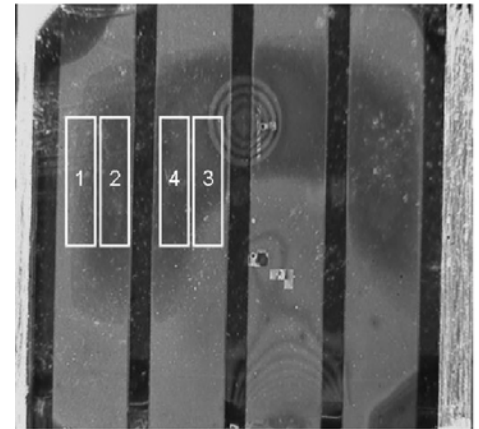
It is evident that accurately calculating the efficiency depends on how accurately the area A of the PV cell is known. In most of the cases the area is measured using visual methods with the assumption that the cell has a uniform response over the entire area. Despite the fact that the cell may look uniform visually, significant non-uniformity of the photoresponse over the cell area is possible. This tends to be the case in the research environment when the manufacturing processes are not worked out, or when degradation of the cell occurs.

For EQE% measurements in general the actual illuminated area of the cell is usually much smaller than the defined area of the cell. Thus, depending on the position of the illuminated area used for EQE% measurements significant differences in results can be expected.

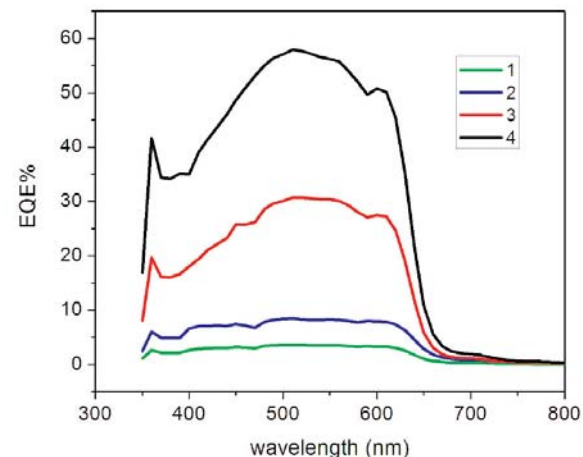
Measurement of EQE% in four different spots (1-4) exhibits an order of magnitude difference as shown in Figure on the right. If one assumes that the entire surface of the cell is uniform and then measures the I-V curve by illuminating the entire surface of the cell with 1 Sun of irradiance (1000 W/m²), an artificially low value of the efficiency will be calculated. Thus, the photoresponse uniformity data can be used to improve manufacturing processes by exposing discontinuities in a cell's photoresponse due to cracks and/or contamination, or degradation in the case of organic PV cells.

The **Photoresponse Mapping Technique** is a simpler version of what has come to be known in the literature as Laser Beam Induced Current or LBIC². In LBIC the laser beam is focused onto the PV cell surface using a microscope objective lens. To avoid challenges due to surface roughness and non-flatness of the sample surface a careful polishing or autofocus were proposed.

In this application highlight we will describe a simple and cost effective device based on standard Newport components that facilitates photocurrent mapping of PV cells or modules with dimensions up to 8"x 8".



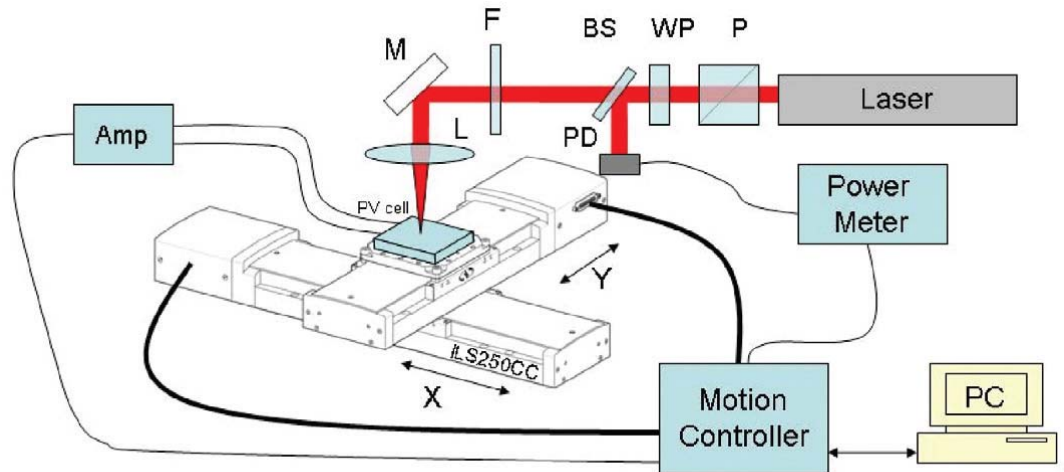
▲ Photo of the organic PV cell with area of the cell used for recording EQE%



▲ EQE% scans corresponding to areas 1-4.

Experimental Setup

- P - Polarizer
- WP - Wave plate
- PD - Photodiode
- F - Filter wheel
- M - Turning mirror
- L - Focusing lens
- BS - Beamsplitter



▲ Schematic diagram of the set-up.

For illumination of the samples, three different lasers with wavelengths 633nm, 532 nm and 375 nm are used. The laser beam is directed to the sample after passing through an isolator made up of polarizer P and a 1/4 wave plate WP.

The focusing lens L is a fused silica plano-convex lens with a focal length of 50 mm. We measured the spot size at the sample to be in the range of 0.1-0.2 mm at the beam waist ($1/e^2$). In general, a shorter focal length lens or microscope objective can be used to achieve higher spatial resolution at the expense of longer scanning time.

For the purpose of having a reasonable scan time of 0.2 min/mm² and be able to map the entire cell in all experiments we limited our resolution to 0.1-0.2 mm. The beam was attenuated using ND filter wheel F to deliver 100 mW/cm² onto the cell. For a reference channel a small portion of the beam is picked-off after the isolator and the average power is recorded using a power meter and a photodiode.

The PV cell was mounted on top of two computer controlled linear stages providing XY positioning of the cell in the XY plane normal to the laser beam with an accuracy of 2.5 microns. The generated photocurrent for each XY position is pre-amplified and converted into voltage using an Oriel® Current Preamplifier. The data is sampled at 10 kHz by one of four analog DAQ inputs through a GPIO port on the back of the XPS.

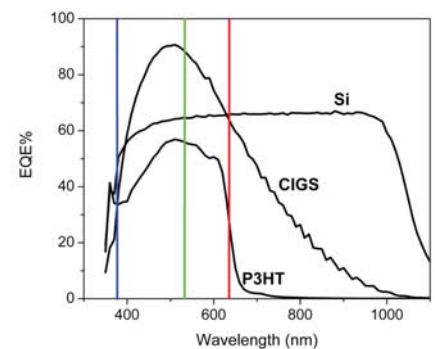
Experimental results

We investigated photoresponse maps of three types of cells: a commercially available monocrystalline silicon cell, an experimental CIGS and an organic P3HT/C60 cell.

First EQE% was recorded using Newport's QE/IPCE Measurement Kit. The results are presented in Figure on the right. It is evident that the photoresponse of each cell exhibits a different dependence on wavelength of the laser.

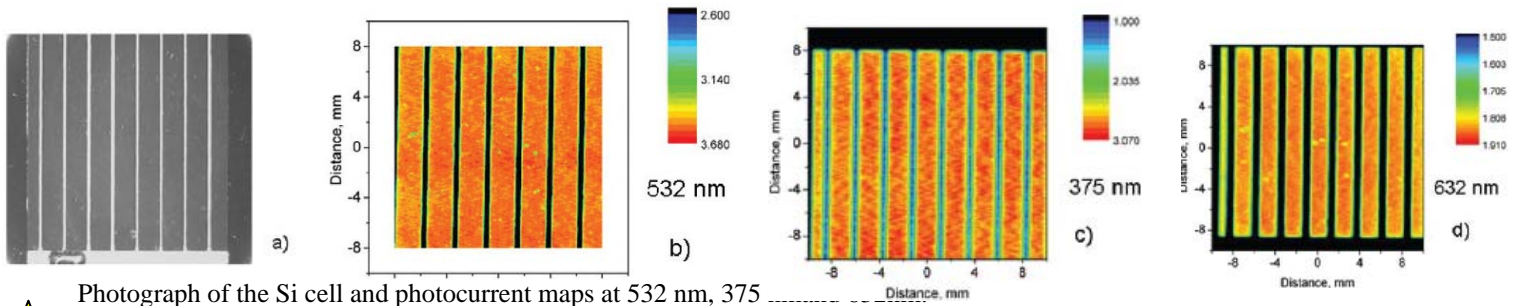
On the other hand, the penetration depth of the laser beam into the cell also depends on wavelength. The colored lines in Figure correspond to wavelengths of the lasers used in the experiments, so that the photoresponse scan can be thought of as an EQE% scan at one wavelength over the entire surface of the cell.

For example, the 375 nm laser beam will be absorbed in the first 10-20 nm of the material, while the 632 nm beam will penetrate much deeper. Thus, despite the fact that Rayleigh length of the laser beam at the focus is about 0.5 mm long, varying the wavelength of the laser allows selective probing of the cell at different depths.



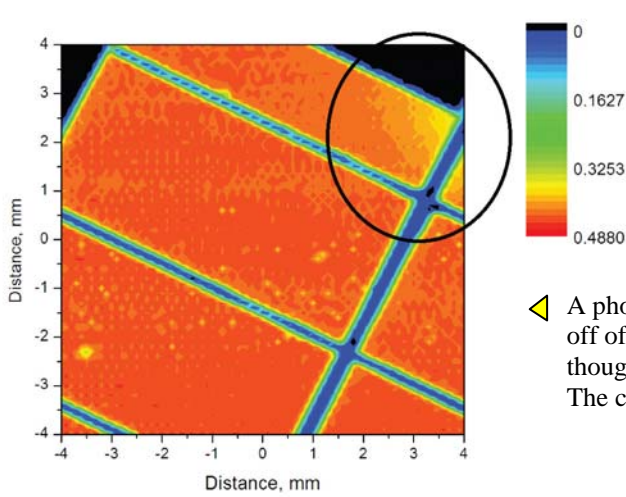
▲ Measured EQE% of the various PV cells. Vertical color lines correspond to wavelengths of the lasers used in the experiment.

The uniformity maps are very similar and the photoresponse is fairly uniform across the entire surface area of the cell, but there are clearly observable spots with reduced or no photoresponse due to inclusions, dust or damage to the cell or to the protective window.



▲ Photograph of the Si cell and photocurrent maps at 532 nm, 375 nm, and 632 nm.

The photocurrent map of a section of the CIGS cell scanned with 632 nm is shown below. A slight fall off of the photoresponse on the right side is observable, and there are multiple spots with reduced photoresponse.

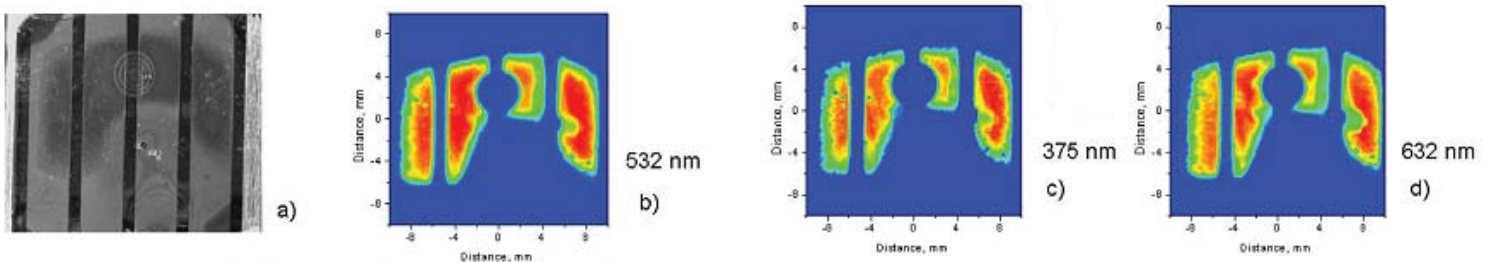


In this case, the non-uniformity of the response will have little effect on efficiency calculations, but the data can be used to reveal imperfections in structure or in the packaging.

▲ A photocurrent scan of the experimental CIGS PV cell. A drop off of the signal is seen in the upper right-hand corner even though upon visual inspection the cell appeared to be uniform. The colors represent photocurrent and are in arbitrary units.

Comparison of the photoresponse maps in Figure a-d. The photoresponse is fairly uniform across the entire surface area of the cell, but there are clearly observable spots with reduced or no photoresponse due to inclusions, dust or damage to the cell or to the protective window.

Good correlation of the discoloration features with the photocurrent map is evident.



UPDATES

Product Index

PHOTONICS

AXSUN TECHNOLOGIES

Spectroscopy
<http://www.axsun.com>

CAPACITEC

Test & Measurement
<http://www.capacitec.com>

DENSELIGHT

SEMICONDUCTORS
Fiber Optics/ Photonics
Components, Light Sources
<http://www.denselight.com>

LASER S.O.S.

Laser Accessories
<http://www.lasersos.com>

LINOS PHOTONICS

Light Source, Motion Control,
Vibration Control, Optics &
Optoelectronics
<http://www.linos.com>

MINUS K TECHNOLOGY

Vibration Control
<http://www.minusk.com>

MMR TECHNOLOGIES

Cryogenic Instruments
<http://www.mmr.com>

NUTFIELD TECHNOLOGY

Optics & Opto-Mechanics
<http://www.nutfieldtech.com/nutfield>

OBJECTIVE IMAGING

Microscopy
<http://www.objectiveimaging.com>

LASERS

AMTRON

Laser Electronics
<http://www.amtron.net>

ILIOS SYSTEMS

Laser Systems
<http://www.ilios-sys.com>

LITRON LASERS

Lasers Nd:YAG
<http://www.litronlasers.com>

QUANTEL

Fiber Lasers
<http://www.quantel-laser.com>

SINGAPORE

55 Kaki Bukit View
Kaki Bukit Techpark II
Singapore 415976
Republic of Singapore
T: (65) 6844 0055
F: (65) 6844 0655

SHANGHAI

N0.555 Nanjing West Road
Unit 226, Shanghai
P.R.China 200 041
T: (86) 021 6256 2268
F: (86) 021 6256 2278

SHENZHEN

Room 3902M Hongchang Square
2001 Shennan East Rd
Luohu District
Shenzhen
T: (86) 0755 82682155
F: (86) 0755 82682156

KUALA LUMPUR

No. 9, Jalan USJ 21/11
47620 Subang Jaya
Selangor Darul Ehsan
Malaysia
T: (603) 8023 6969
F: (603) 8023 6161

BANGKOK

731 PM Tower, 9th Flr.,
Asoke-Dindaeng Rd.,
Dindaeng,
Bangkok 10400
Thailand
T: (662) 640 2955
F: (662) 640 2958

HANOI

158 Quan Nhan Street
Trung Hoa Ward
Cau Giay District
Hanoi,
Vietnam
T: (84) 43 556 8505
F: (84) 43 556 8506

HO CHI MINH

Room 316,
Duy Tan Plaza,
10 Ba Thang Hai,
Street Ward 12, District 10,
Ho Chi Minh, Vietnam
T: (84) 85 404 2748
F: (84) 85 404 2625

For any enquiries or more details on our products & services,
please email: enquiry@zugophotonics.com or visit our website at www.zugophotonics.com.