

Cameras under the spotlight



PCO AG was founded in 1987 with the objective of developing and producing specialised fast and sensitive video camera systems, mainly for scientific applications. Nowadays the product range of PCO cameras covers digital camera systems with high dynamic range, high resolution, high speed and low noise, which are in the scientific and industrial markets all over the world. PES spoke to Dr Gerhard Holst, Head of Science and Research at the company...

PES: Welcome to PES, can you explain a little about your company and how you serve the solar industry?

Dr Gerhard Holst: PCO AG develops and manufactures scientific-grade CCD and sCMOS cameras optimised for Electroluminescence (EL) or Photoluminescence (PL) measurements on solar cells and panels. EL and PL radiation is typically a weak emission with its maximum around 1,100 nm in the near infrared (NIR) region of the radiation spectrum. To detect this NIR radiation, one either uses exotic cameras with special detectors or one can use silicon image sensors that are optimised for visible light applications and under certain conditions can also be used quite effectively. Since the relevant radiation happens just above the natural detection limit of these silicon image sensors, the cameras which are optimised for this application, require sophisticated readout electronics to reduce the noise and therefore the detection limit to the absolute minimum.

PES: How much of your overall business is dedicated to the PV sector and is this sector growing?

GH: Right now cameras for solar cell quality control contribute about three per cent of our turnover, and the sector is growing.

PES: What's your on-the-ground analysis of the European market at present?

GH: The market for testing and quality control instrumentation is still growing since it is the key to reduce costs by increasing efficiency and production yield. However, EL and PL measurements represent a relatively new option, still the development of a better understanding and interpretation of the results is ongoing. Therefore the interest is very high, but the appropriate action still has to come. We're still at the early stages of the learning curve for using the cameras effectively.

PES: It's said that equipment is only as good as the operators who use it. What training do you provide to clients?

GH: In the rare case that a customer is looking for training, we offer customers either in-house training or training on the spot. This enables the best possible performance of our cameras by understanding and adjusting the relevant acquisition parameters. In 2009 we presented a webinar called: Solar cell and panel quality control with cameras, which found a big audience and led to a lot of follow up contacts and consulting activities. We also created a specific application note on the same topic which was last updated recently to include latest camera models and imaging technologies.

PES: Compatibility with proprietary systems must be a huge issue for you. Do you collaborate with other manufacturers to ensure compatibility in advance?

GH: It is not as large an issue as one might expect, since we produce cameras that follow in terms of data interfaces and trigger signals the usual conditions in machine vision. In terms of image quality and usability we try to achieve the best that is technically possible. Many of our customers are not the end-users but rather the system integrators in this market area. Before we start our development process for a new camera product, we try to get in touch with them to learn about their applications and requirements. The new camera system will reflect their input e.g. in terms of feature sets, mechanical properties, physical and electrical interfaces and of course compatibilities with existing systems.

PES: We've been fascinated by the high-speed videos you have on your website. Have you found that they broaden your company's recognition in the wider community?

GH: The high-speed videos were taken with a different camera system using extremely high frame rates, different than the cameras used for EL and PL measurements. We are convinced that

they show the image quality, which the corresponding camera system is able to deliver, and they are also a nice and entertaining eye-catcher. Since we also placed a few of these video-clips on www.youtube.com, yes, we know that this broadens our recognition. But for solar applications they are not relevant.

PES: Can you explain a little about the evolution of your products - are you inspired by feedback that you receive from your clients?

GH: New camera products are usually the result of a proven mixture of factors. On first hand it is the valuable feedback of our customers from the different fields. The general research directions have an influence, since we also join or start research projects in various areas together with partners from science and industry. Finally we try to combine cutting edge technical developments with the market feedback that we get to create new camera systems, which might be applied in many different areas, which often includes to push the physical limits a bit further.

PES: The company is over 20 years old but retains a cutting-edge outlook. Are you able to tell us about any new developments/products that you're working on?

GH: Right now there is definitively the new scientific CMOS (sCMOS) technology, which we developed together with two partners, Fairchild Imaging and Andor Technology, within the last two years. This is the most exciting image sensor technology for us, since this sCMOS sensor combines features that were only possible in different types of image sensors before. It offers an exceptional low readout noise of 1.4 e-rms, it has a high resolution of 5.5 megapixel, a dynamic range of 24000:1 and enables at maximum 100 frames per second image rate with a scientific grade CCD-like quantum efficiency. It's important to note that unlike previous sensors, these features occur simultaneously in the sCMOS sensor. This sCMOS sensor within its first camera model pco.edge will also have a great impact on our solar technology business, since it has a very good sensitivity in the NIR, which, in combination with low noise and high resolution, offers not only cell inspection at high speed but also panel inspection at high speed. Further we'll have a new proprietary CMOS sensor, which can be directly modulated to do fluorescence lifetime measurements for a variety of applications. Finally the high-speed camera with our own high-speed CMOS sensor has now reached an unmatched image quality. Hence, there are quite a few new developments on-

going also with three research grants that we received.

PES: We're hearing more and more about collaboration within the industry - to share costs or knowledge, mainly - is this a way of working that your company embraces?

GH: As I mentioned above, for the development of the new sCMOS technology we teamed up with two partners: Fairchild Imaging and Andor Technology to realise the new sensor technology. However, as camera manufacturers we are still competitors. Therefore for some issues such as new technology or new data interfaces it is helpful to combine forces, but generally we prefer to keep our know-how in-house, except maybe for research projects. But in these cases we collaborate more with application-oriented partners, since we are a camera manufacturer and not a system supplier.

PES: Can you tell us about the after-sales service you offer to your clients?

GH: We offer free software and firmware updates on a regular basis, fast and efficient repair service with the possibility of getting a replacement system to cover repair time. Our support engineers have direct access to our development resources which provides fast problem solutions if it goes into bits and bytes. Furthermore, we regularly talk to our customers to figure out new directions or requirements and keep them updated with new developments.

PES: R&D obviously presents a significant investment for PCO. Does this reap rewards?

GH: Absolutely. We are a manufacturer of high-performance CCD, CMOS and sCMOS camera systems, which are applied world-wide as measuring instruments. To preserve and guarantee that level of performance a high-quality R&D is a prerequisite. You know, today to

build a camera that records digital images is, due to all the specially-designed units and semiconductor devices, not such a big issue. But to really get to the limits and offer the best possible performance, a profound experience, a deep understanding and know-how is required, and that's our R&D.

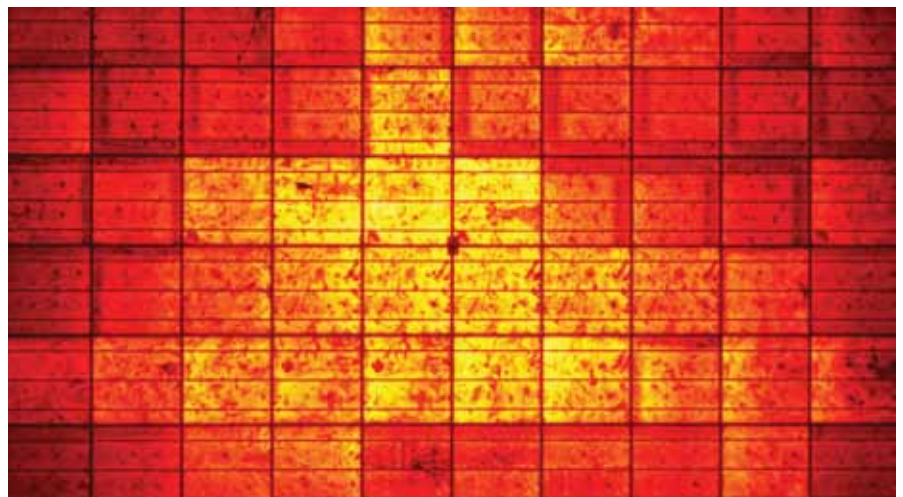
PES: The quest for grid parity is driving the entire industry. Do you find that you are being pressured to lower your prices to help achieve this?

GH: As we are a component manufacturer, this quest has an influence on the expectations of the system integrator, who wants to integrate EL imaging into his portfolio of quality control systems for solar cell or solar panel manufacturing. As in our case, it is more about the application of cutting edge technology, and then the performance comes before the price. However, the cameras we offer have an excellent price/performance ratio.

PES: Finally, if you could look into your crystal ball, how would you say that your sector of the solar/PV industry is going to develop over the next few years?

GH: Right now the interest in photovoltaics is increasing. Therefore the interest in quality control during manufacturing as well as quality control after purchase is increasing. In case of the EL imaging there will be still some delay, due to the fact that evaluation of all the visible effects is not finished yet. Nevertheless, we believe that the EL test cameras, which we offer, will gain a great deal of interest, such that the contribution to our sales will increase within the next years. Definitively the new sCMOS technology promises to become a major impact in that field. ■

For more information, please visit: www.pco.de



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