

# Quality-tuned production equals efficiency

**Automated optical inspection:** Vitronic's Head of PV Sales Richard Moreth sets out how advanced automatic optical inspection (AOI) systems can deliver cost reductions.

Advanced Automatic Optical Inspection (AOI) systems can deliver increased efficiency, yield rates, and ultimately cost reductions.

As the global PV market and industry continues to mature, quality standards in PV manufacturing continue to increase. But there is still a lot to be done.

In some PV markets, quality control is currently applied only at the very end of production lines by inspection in cell tester and sorter.

Most commonly, automated optical inspection (AOI) systems are installed besides the I-V tester (flasher) in order to additionally sort cells into different color classes.

Some AOI systems can also sort cells into different optical quality levels, and some can even inspect the rear side of cells. Often though, these systems are not really capable or properly parameterized to do a decent job. Sorting levels are just set to halfway satisfy module producer requirements.

Vitronic supplies its VINSPEC SOLAR state-of-the-art AOI systems, which can already bring about significant improvements during the production stage. The systems are applied for sorting into color

classes as well as detecting corner and edge breakages, surface defects, and carrying out a proper inspection with high pixel resolution. These sophisticated systems have two major advantages.

First, these modern solutions offer human-like color classification. Second, high performance inspection helps to reject cells that could cause performance degradation further down the line – for example cells that have been badly fired, suffered poor metallization, print interruptions, uneven coating, improper laser openings, missing rear side print, as well as residues from chemicals, to mention but a few.

### Produced quality, not sorted

Powerful quality inspection in a cell tester and sorter is essential. But in order to achieve the highest cell efficiencies, and to guarantee future quality requirements, high performance optical in-line inspection directly after each surface and metallization process is required to identify and prevent defects.

Optical inspection along the entire cell production line enables stable processes and high cell quality in a narrow tolerance range.



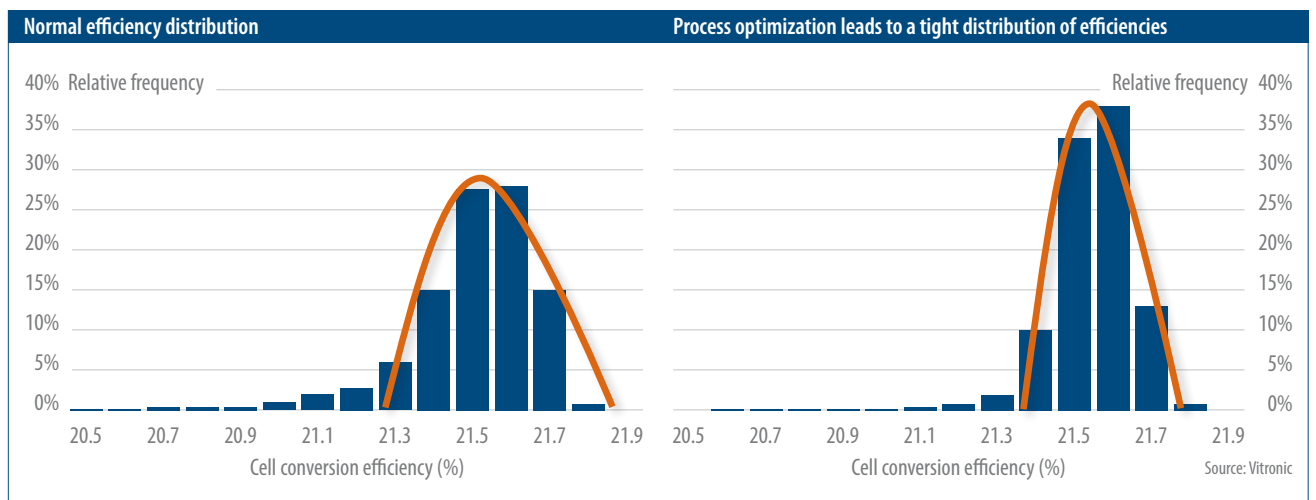
Photos: Vitronic

The early detection of errors by implemented trend analyses and evaluations from heat maps helps manufacturers minimize quality deviations.

Industry 4.0 features like data correlation within and between production equipment enable an ongoing optimization of the production process.

This not only avoids errors but also increases productivity. This is especially true when short feedback loops are installed. ♦

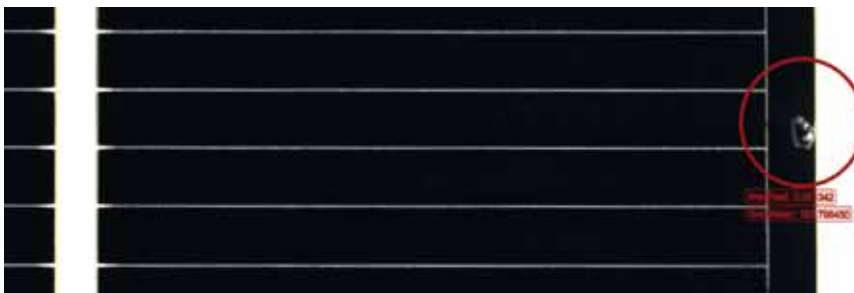
Richard Moreth



Graphic: pv magazine/Harald Schütt

## New post print inspection

Vitronic's post print inspection can be used as an example. Early detection of screen wear with VINSPEC SOLAR extends screen life time (3,000 to 8,000 additional prints) and reduces downtime by up to 10%, because corrective action can be taken immediately due to the fast feedback.



Examples of Vitronic's new post print inspection method.

### **i** NEW POST-PRINT INSPECTION AT A GLANCE

- High 20  $\mu\text{m}$  resolution
- Gross errors on print, outline, and surface
- Immediate stop of printer can be triggered
- Edge inspection for defects
- Surface inspection for stains
- Print inspection for:
  - Print position
  - Finger width (average and peaks)
  - Interruptions and bulges
  - Finger spacing
  - Screen deformation
- Allows reliable inspection at finger width of down to  $<30 \mu\text{m}$  fingers in wet print, smaller than after firing
- No extra space/footprint for AOI
- On-the-fly image acquisition at up to 700 mm/s
- Same small system for front and rear side print
- Retrofit: much lower impact on facilities, on cost, and installation time
- Closed loop communication – optimized predictive maintenance
- Already suited for additional requirements (e.g. PERC, PERT, ..., laser openings, Bifacial)
- Optimization of process parameters
- Benefits that pay off the investment in AOI:
  - Reduction of silver consumption (by minimizing finger width)
  - Elongation of screen life time (by optimizing e.g. paste viscosity, screen height position, pressure, etc.)
  - Reduction of line downtime (by preventing printer stops)
  - Clipping/squeezing of quality distribution (by keeping up optimal printer parameters)

