



# THE TECHNOLOGY LEADER IN PV INSPECTION EQUIPMENT

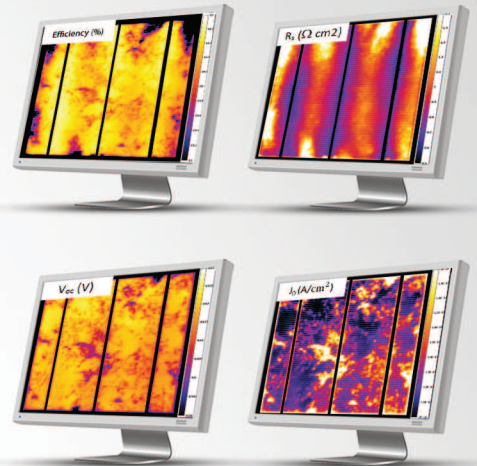
ALL NEW  
PRODUCT RANGE

## **PL IMAGING OF SILICON**

FIRST INVENTED at the University of NSW  
in 2005 by the founders of BT Imaging.  
PROTECTED BY MULTIPLE PATENTS



## Quantitative PL imaging Examples



PL on wafer



Processing issues



High mag image

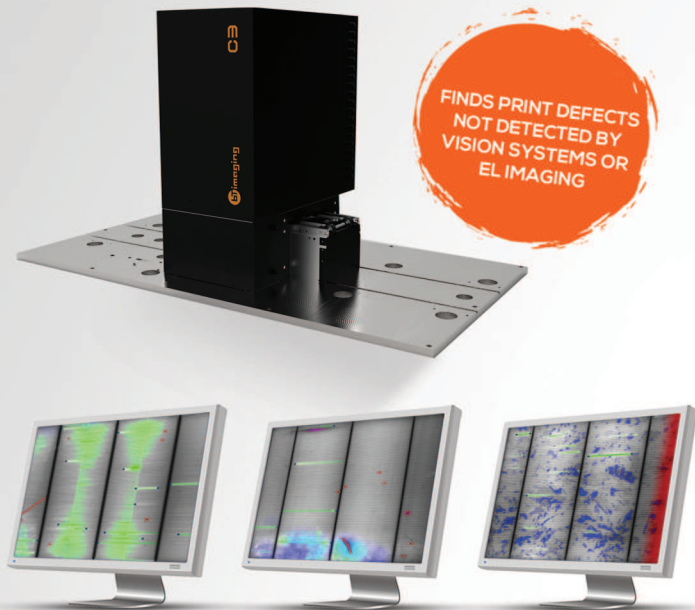


**LIS-R2 Plus & LIS-R3** – The premier laboratory tools for silicon bricks, ingots, wafers, cells and mini-modules. A summary of measurement applications:

	Bricks & Ingots	As-Cut Wafers	In-Process Solar Cells	Completed Solar Cells	Mini-Modules
Photoluminescence Imaging	> LIS-R2-Plus (Option) > LIS-R3 (Option)	> LIS-R2-Plus > LIS-R3	> LIS-R2-Plus > LIS-R3	> LIS-R2-Plus > LIS-R3	> LIS-R2-Plus (Option) > LIS-R3 (Option)
Electroluminescence Imaging				> LIS-R2-Plus (Option) > LIS-R3 (Option)	> LIS-R2-Plus (Option) > LIS-R3 (Option)
Electrically Biased PL Imaging				> LIS-R2-Plus (Option) > LIS-R3 (Option)	> LIS-R2-Plus (Option) > LIS-R3 (Option)
Injection Level Dependent Lifetime (QSS-Photo-conductance)		> LIS-R2-Plus (Option) > LIS-R3 (Option)	> LIS-R2-Plus (Option) > LIS-R3 (Option)		
Calibrated Lifetime Imaging		> LIS-R2-Plus (Option) > LIS-R3 (Option)	> LIS-R2-Plus (Option) > LIS-R3 (Option)		
Series Resistance Imaging				> LIS-R2-Plus (Option) > LIS-R3 (Option)	> LIS-R2-Plus (Option) > LIS-R3 (Option)
Dark & Light IV, Suns-Voc Curves				> LIS-R3 (Option)	
J <sub>sc</sub> , Voc, J <sub>mp</sub> , J <sub>o</sub> and Efficiency Imaging				> LIS-R3 (Option)	
Front and Bulk Analysis				> LIS-R3 (Option)	
Multi-crystalline Silicon Defects & Impurities	> LIS-R3 (Option)	> LIS-R3 (Option)	> LIS-R3 (Option)	> LIS-R3 (Option)	
Mono-crystalline Silicon Defects & Impurities	> LIS-R3 (Option)	> LIS-R3 (Option)	> LIS-R3 (Option)	> LIS-R3 (Option)	

# THE iLS-C3 & iLS-W3

## iLS-C3 Non-Contact & Non-Stop Inline Scanning PL Imaging Inspection of Solar Cells



## Data reported by iLS-C3

Type of Sample	Multi-Crystalline Solar Cells	Mono-Crystalline Solar Cells
Stage of Sampling	> After the diffusion step through to completed cells	> After the diffusion step through to completed cells
Wafer Defects Reported	> Impurities > Dislocations	> Dark Spots > Dark Corners > Dark Middles > Dark Areas
Other Efficiency Limiting Defects Reported	N/A	> Cracks > Dark PL Features
Series Resistance Defects Reported	> Broken Fingers > Bright Areas	> Broken Fingers > Bright Areas
PL Counts Reported	> Images, Histograms and Statistical Data	> Images, Histograms and Statistical Data
Statistical Data	> Based on all PL Data	> Based on all PL Data
Persistence Measurement	> Available for all Overlay Defects	> Available for all Overlay Defects
Real Time Export of Metrics	> Yes	> Yes

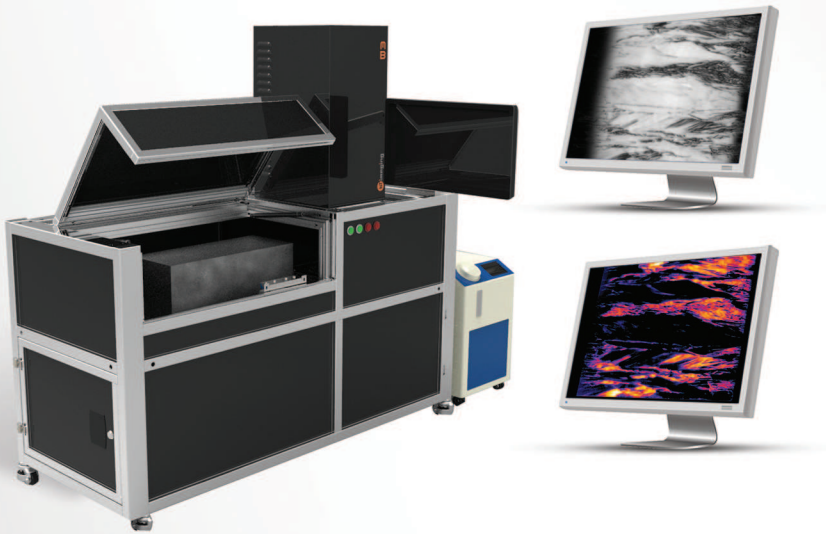
## iLS-W3 Non-Contact & Non-Stop Inline Scanning PL Imaging Inspection of Solar Wafers



## Data reported by iLS-W3

Type of Sample	Multi-Crystalline As-Cut Wafers	Mono-Crystalline As-Cut Wafers
Wafer Defects Reported	> Impure Edges > Impure Corners > Impure Middles > Dislocations > Wafer Type	> Dark Spots > Dark Corners > Dark Middles > Dark Areas > Ring Defect Strength
Other Efficiency Limiting Defects Reported	N/A	> Cracks
PL Counts Reported	> Images, Histograms and Statistical Data	> Images, Histograms and Statistical Data
Statistical Data	> Based on all PL Data	> Based on all PL Data
Persistence Measurement	> Available for all Overlay Defects	> Available for all Overlay Defects
Real Time Export of Metrics	> Yes	> Yes

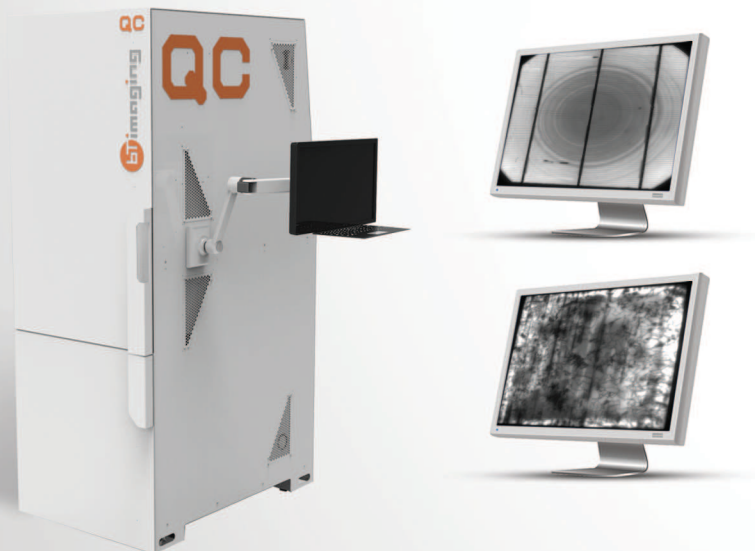
**LIS-B3** is a PL Imaging inspection tool designed for quality control and process improvements in silicon bricks and ingot factories



**LIS-B3** Applications, Automation Options and Reported Metrics

Sample type	Multi-Brick & Mono-Ingot
Application	<ul style="list-style-type: none"> <li>&gt; Wafer specifications based on bulk lifetime &amp; defects</li> <li>&gt; QA &amp; QC in silicon casting</li> <li>&gt; Process debug in casting</li> <li>&gt; Process and product improvement in casting</li> <li>&gt; Cutting guide for silicon bricks to remove low quality material with lowest loss of good quality material</li> <li>&gt; R&amp;D in casting and wafering</li> <li>&gt; Option for wafer and cell defect inspection</li> </ul>
Automation	<ul style="list-style-type: none"> <li>&gt; Manual or Factory Robot Load</li> <li>&gt; Manual or Factory Robot Rotation</li> <li>&gt; InkJet marking of Cutting Guides</li> </ul>
Data	<ul style="list-style-type: none"> <li>&gt; Bulk Lifetime image resolution in <math>\mu\text{S}</math> measured at 1024 micron resolution in both x and y</li> <li>&gt; PL Imaging Silicon Defects – PL images</li> <li>&gt; PL Imaging Silicon Defects – proprietary metrics and overlays for (a) multi – dislocations &amp; impure regions, (b) mono - dark line features and slip lines</li> <li>&gt; Cutting Guide is based on pre-set Bulk Lifetime and defect values and reports distance from the end in mm</li> </ul>

**LIS-QC** is an affordable PL Imaging tool designed for quality control in solar cell factories



**LIS-QC** measures and analyses PL images and reports quantitative metrics

Sample type	Wafer	In-Process Solar Cells	Solar Cells
Multi wafer	<ul style="list-style-type: none"> <li>&gt; Dislocations</li> <li>&gt; Impure regions</li> <li>&gt; PL count</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Dislocations</li> <li>&gt; Impure regions</li> <li>&gt; PL count</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Dislocations</li> <li>&gt; Impure regions</li> <li>&gt; PL count</li> </ul>
Mono wafer	<ul style="list-style-type: none"> <li>&gt; Cracks</li> <li>&gt; Ring defects</li> <li>&gt; Corner defects</li> <li>&gt; Non-uniform metrics</li> <li>&gt; PL count</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Cracks</li> <li>&gt; Ring defects</li> <li>&gt; Corner defects</li> <li>&gt; Non-uniform metrics</li> <li>&gt; PL count</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Cracks</li> <li>&gt; Ring defects</li> <li>&gt; Corner defects</li> <li>&gt; Non-uniform metrics</li> <li>&gt; PL count</li> </ul>
Other	<ul style="list-style-type: none"> <li>&gt; Other unexpected light and dark regions</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Other unexpected light and dark regions</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Other unexpected light and dark regions</li> </ul>