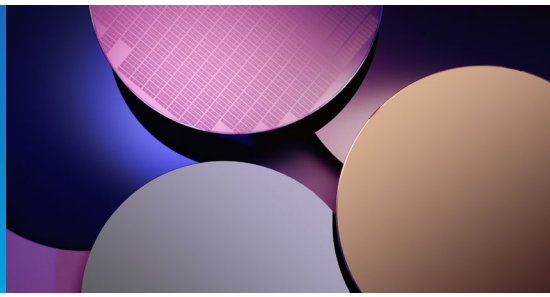
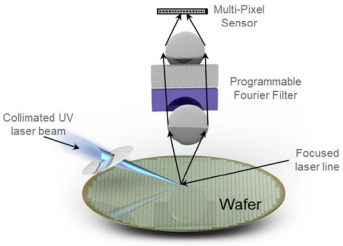
Puma™ 91XX

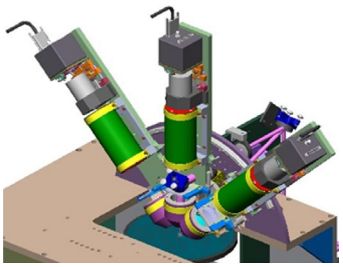
Laser Imaging Patterned Wafer Inspection System



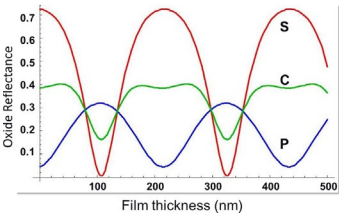
The Puma 9130 and 9150 Laser Imaging Inspectors combine UV illumination optics with multiple high speed imaging sensors to offer a range of optical modes for critical defect detection inline on patterned, production wafers. The 91XX delivers high sampling rates, high throughput and high sensitivity enabling more effective capture and control of yield-impacting defects on critical front-end-of-line (FEOL) and back-end-of-line (BEOL) layers. The 91XX complements the KLA 2367 full-spectrum UV/visible brightfield inspector for a mix-and-match patterned wafer inspection strategy.

Technologies





Flexibility



Streak™ Technology and 3 Independent Collection Channels

KLA's patented darkfield imaging technology used in the 91XX starts with a UV laser as the illumination source. A collimated UV laser beam is focused into a line on the wafer surface which is then imaged in three independent, linear multi-pixel sensors. These high resolution, CCD-based imaging sensors are capable of high data rates (>1Gpps) which enables large parallel data collection. The optical elements of this darkfield imaging tool are unique to the industry and are critical enabling technologies to achieve high resolution inspection at throughputs associated with traditional darkfield scanning tools.

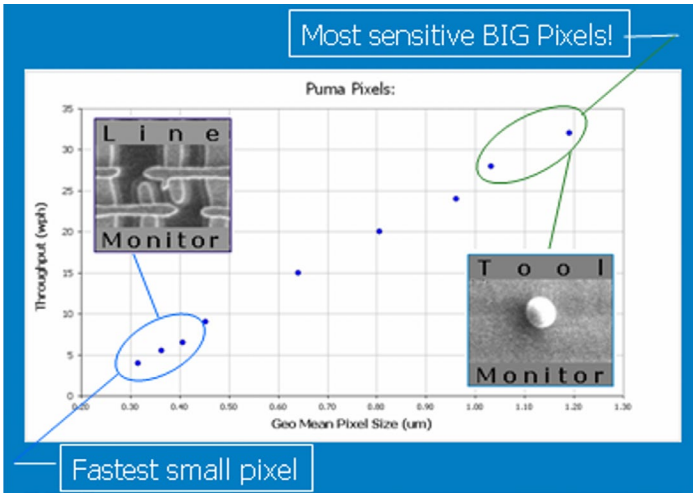
Laser Imaging Advantage

The Puma 9130 provides oblique UV illumination while the 9150 also offers an additional, normal illumination mode. Both tools provide three illumination polarizations (S, P, C) and independently configured collection polarization filters (S, P, None) for each of the three channels. User friendly Optics Selector software aids the user to quickly and accurately determine the best polarization optics combination to best inspect all critical layers with maximum sensitivity and throughput.

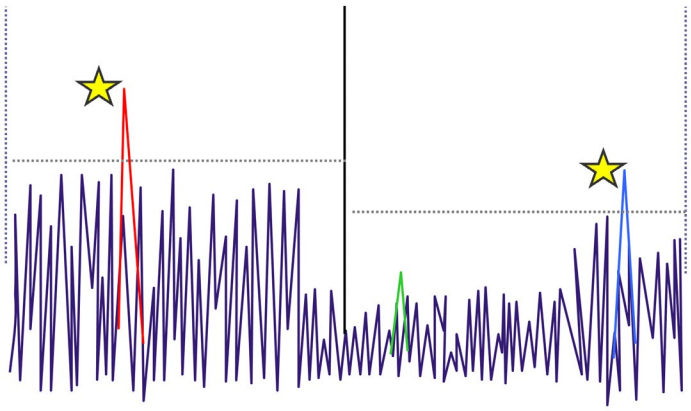
Low Cost of Ownership

The Puma features a new image computer, Laser Streak technology using UV laser line, and linear multi-pixel sensors to enable both fast throughput and high sensitivity. Enabling increased sampling of work in progress, Puma helps chipmakers achieve tighter process line monitor control for a reduced cost of ownership.

Key Technologies



Flexible Configuration provides the performance/cost/sampling optimization for manufacturing. Smallest pixel/highest sensitivity can be used on the most critical line monitoring levels; Large pixel/high throughput modes can be leveraged for less critical layers for process tool monitoring.



Multiple Defect Detection Algorithms

Hierarchical Local Adaptive Threshold (HLAT) is an advanced detection algorithm where most parameters adapt to pattern characteristics such as noise, gradient, and color. Local flexes most parameters to defect patches or inspection regions rather than to detection channels.

Fast Adaptable Single Threshold (FAST) is simple to use and provides good sensitivity quickly by removing the need for algorithm expertise and is highly adopted for foundry use.

Channel Fusion and **Array Mode** algorithms are available for improved detection on critical layers.

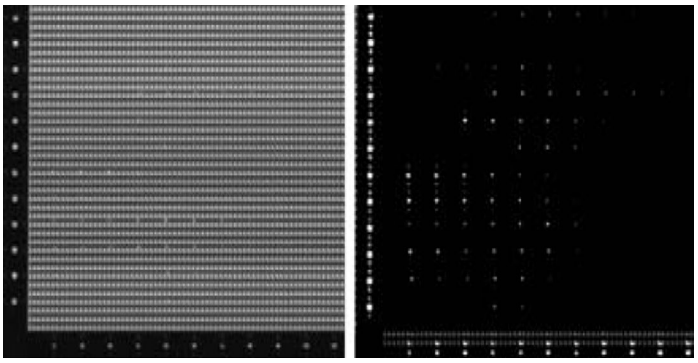
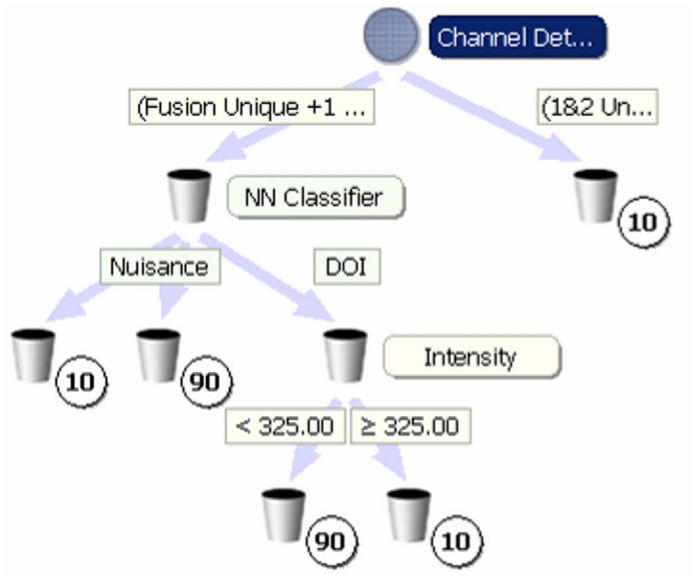


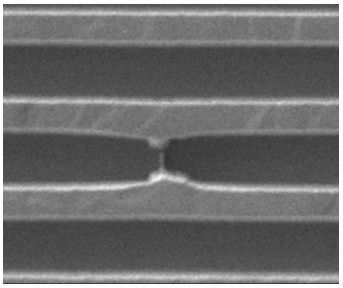
Image without FF | Image with FF

Fourier Filtering (FF): The Puma 91XX includes programmable, flexible Fourier filters. These are not fixed filters or pre-set masks, but rather, truly programmable based upon the unique scattering characteristics of each device. The Fourier filters automatically learn the exact location of the diffraction lines in the Fourier plane and then apply a filter to each individual diffraction line. This methodology effectively filters the repetitive pattern noise while minimizing the amount of detection area lost to filtering. Thus, defect signal is maximized while pattern noise is minimized, providing increased sensitivity in array areas.

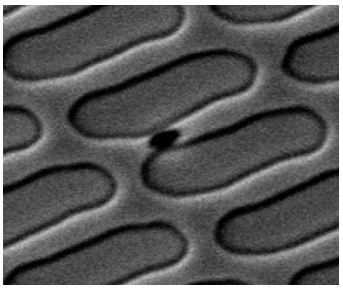


Inline Defect Organizer (iDO) uses feature vectors and defect attributes to classify defects. This classification engine happens in real time while running an inspection without loss in system throughput. When the inspection is completed, defects are automatically sorted and tagged into their respective groups (or bins), enabling more efficient SEM review for final classification.

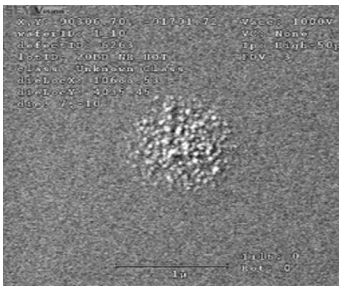
Defect Examples



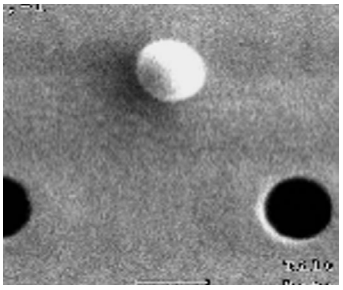
Bridge



Voids



Residue



Particle

Benefits

- The Puma 91XX series combines UV illumination optics with multiple, independent high speed imaging sensors to offer a range of optical modes for critical defect detection.
- Flexible pixel options produce the highest range of production throughputs in a single tool resulting in a cost-effective solution for comprehensive inspection applications.
- The Puma 9150 offers an additional normal illumination mode, enhanced data rates and new optical modes for an extended capabilities, performance and throughput.
- The Puma 91xx series share a common code base with other KLA inspectors, providing the same "look and feel" as the 23xx, 28xx and e-beam tools allowing for rapid integration and yield learning into the production environment.

Applications

Pattern Layer (FEOL and BEOL) Line Monitoring and Process Tool Monitoring

With its high sensitivity, high throughput and noise suppression capabilities, the Puma 91XX meets the cost and performance requirements for inline production defect monitoring and control on a broad range of device manufacturing layers at 65nm and beyond. New optical modes increase sensitivity to bridging, shorts, and other defects in the patterning process and improve capture of residue and other critical defects at cleans and CMP which can complement more sensitive broadband brightfield (BBP) inspections.

Films

The unique optical features of the Puma 91XX maximize surface selectivity and noise suppression, delivering highly effective defect detection on all films – including those with rough, grainy surfaces.

FEOL Memory Defect Monitoring

The 91XX has become a low-cost defect monitor for FEOL memory devices with adoption for baseline inspection and excursion monitoring of HAR structures and STI CMP void detection. Puma can capture a significant subset of defects detected by traditional BBP inspection, at much higher throughput and is less susceptible to previous layer noise.

BEOL Logic Defect Monitoring

The Puma 91XX is also widely adopted for BEOL logic defect monitoring. The Puma 91XX's superior back-end noise suppression capabilities due to low angle oblique illumination, selectable incident and collection polarizations, and iDO filtering make it capable defect monitor with a superior Cost of Ownership.

Photo Cell Monitoring (PCM) and After Develop Inspect (ADI)

With high resolution darkfield imaging and extended optical modes, the Puma 9150 captures critical photo defects at high throughputs while effectively suppressing prior-level defects. Puma complements higher sensitivity BBP inspections by providing an increased sampling option for photo-cell monitoring and after-develop inspection, improving the opportunity to rework and thereby reducing product at risk.

KLA SUPPORT

Maintaining system productivity is an integral part of KLA's yield optimization solution. Efforts in this area include system maintenance, global supply chain management, cost reduction and obsolescence mitigation, system relocation, performance and productivity enhancements, and certified tool resale.

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