

Title: Low light sensing with Silicon Photomultipliers

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SensL has developed a novel silicon based photon counting sensor which provides both high performance and flexibility for applications ranging from cell imaging, bio-analytical instrumentation, nuclear medicine, high energy physics, laser range finding, to 3d cameras. SensL's core technology is a silicon photon counting diode which is capable of operating as a single photon counter providing a digital signal output in response to single photons or as a Silicon Photomultiplier (SPM) which outputs an analogue signal in relation to the number of photons which strike the detector. This allows a silicon replacement of the ubiquitous vacuum tube based photomultiplier tube (PMT) in many applications. The SPM is a unique detector in that it contains thousands of individual photon counting sensors each with its own quenching circuit built into the pixel structure. The photon counting capable sensors in the array each respond to individual photons and output a fixed quantity of charge onto the output node in response to the incident photons. Key to the successful operation of a SPM is carefully controlled manufacturing processes which ensure uniformity across the detector array and from batch to batch of silicon wafers. Combined with design practices which design in the performance characteristics of the detector, it is possible with a SPM to have a very uniform response to optical signals across detector batches, something which is not possible with a PMT. Other advantages of SensL SPM detectors are low operating voltages, high quantum efficiency and signal to noise ratio, robustness, ability to resolve the single photo-electron spectrum, and magnetic field immunity. SensL will present the latest state of the art in SPM detector technology and show the fundamental device operation of many of the SPM operating characteristics as compared with photon counting sensors and PMT detectors. Novel methods which SensL is undertaking to package and make the detector suitable for a wide range of applications will be shown with the latest in performance results. The SPM will be shown to be an ideal detector for replacement of the PMT tube in many applications and an enabler for next generation low light detection systems.

SensL manufactures a broad range of silicon based detectors and low light detection solutions ranging from photon counting modules such as the PCDMicro, PCDMini and PCMPPlus to fully integrated USB high resolution timing systems such as the PCSTime and the HRMTime with 66ps of timing resolution. In SPM technology, SensL produces the SPMMicro and SPMMini silicon photomultiplier in a range of detector sizes and varying integrated electronics to simplify signal acquisition. By combining high performance silicon processing techniques with the latest in electronics, SensL has developed a full range of low light sensing detector solutions ideal for many existing and emerging applications.