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Single Photon Counting Electronics Usage Extended to MPPC (SiPMT) - Detectors

Scope

Internally developed single photon counting electronics from Volpi is specially designed to perform from an ultra-low signal level regime with a very high dynamic range (from 20 photons per second up to $1x10^8$ photons per second).

These single photon counting electronics was combined with specialized PMTs and tested successfully.

PMTs are suitable to detect low photon quantities but they are relatively costly when considered for applications requiring very low instrument costs.

Photodiodes, on the other hand, are cost-effective solutions for the detection of photons, but they are limited in the ability to detect small photon fluxes within a short time.

MPPCs are potential alternative sensor elements with much higher photon sensitivity than PDs. They can bridge the application gaps between ultra-sensitive PMTs and low cost PDs, and they are able to extend the measurement range with the internally applied gain, combined with higher dark signal levels than PMTs.

In order to extend the usability of MPPCs, the combination of specially developed single photon counting electronics with theses sensors has been tested and optimized at Volpi.

SCAN ME

Results

The MPPCs could be coupled to the read-out circuit designed for the PMT. The signal shape is conserved well, but the resulting signal amplitude is relatively low for further processing at the comparator stage.

Therefore, the electronics had to be modified in order to form a two-stage amplification using the same components, but in a stacked design. That led to the required amplitude increase as expected, and conserves signal integrity very well.

Conclusion

Volpi's sensor electronics architecture provides an excellent solution to analyze event counts from MPPC dark count rates (typically 10'000 events per second per square millimeter) up to 1x108 events per second.

That enables a cost-effective extension of PD based photo current signal acquisition architectures, which lend themselves well to applications demanding low instruments costs, such as Point-of-Care testing.

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