

Dark Count Rate Reduction of the SPAD Detection Package for SLR

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We are presenting recent achievements in development of the Single Photon Avalanche Detector (SPAD) packages optimized for satellite laser ranging purposes at high laser repetition rates. The commonly used SPAD detector packages are based on 200 μm diameter SPAD chips cooled down to -60°C to lower the effective dark count rate. The detection chips are operated in and active gating and quenching mode. The effective dark count rate of the entire SPAD package is typically 4 kHz for gate rate of 10 Hz. However for modern SLR systems operating typically at 1 kHz rates this effective dark count rate is increasing to 100 kHz and more. This increase is caused by the effect called afterpulsing, which is pronounced by lowered detection chip temperatures. Modifying the SPAD control circuit we succeeded to reduce the afterpulsing influence significantly. As a result the effective dark count rate of the new version of the SPAD detection package is kept well below 10 kHz for the gate rate of 1 kHz. The new SPAD control circuit maintains the reduction of effective dark count rates at higher gate rates by factor of 5 to 20. All the other detection and timing performance of the SPAD detector package remained unchanged in comparison to the previous version.