

New SPAD detector package for SLR and laser time transfer

Ivan Prochazka¹, Tereza Flekova¹, Jan Kodet^{1,2}, Josef Blazej¹

¹Czech Technical University in Prague, Brehova 7, 115 19 Prague 1, Czech Republic

²Technische Universität München, Forschungseinrichtung Satellitengeodäsie, München, Germany

We are presenting a new SPAD detector package developed and optimized for satellite laser ranging and laser time transfer applications. The new detector package is based on standard K14 series SPAD detection chips having an active area diameter of 100 μm . The chip is cooled by a single stage thermoelectric cooler. The new active gating and active quenching circuit with fully passive compensation of temperature induced effect was developed and applied. The entire detector package was optimized for its detection timing performance. The temperature compensation circuit design is an analogy of the space version developed for the ELT+ space mission. The device timing resolution is typically 18 ps rms, its temperature dependence of detection delay is within ± 250 fs/K. The effective dark count rate is well below 50 kHz for gate rates up to 10 kHz. The detection timing stability expressed as Time Deviation TDEV is better than 50 fs over hours of operation. This makes this device exceptionally attractive for laser time transfer applications. The detector package and the control electronics is built in a standard housing with front collecting optics, which consists of a single aspheric lens and accepts collimated beam 12 mm in diameter. All the detector and control electronic biases, chip thermoelectric cooling power and control are provided by a compact power supply. The detector package gate input (TTL) and signal output (NIM) are standard electrical signals identical to previous SPAD detector versions. That is why the various versions of SPAD detectors are 1:1 replaceable.