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### **Advances in laser ranging technology at CTU in Prague and new SLR applications**

The laser time transfer ground to space and space to ground is a fast emerging application putting new challenging requirements on a ground stations. Along with low timing jitter and high stability the key parameter is the system timing performance characterized by time deviation. We optimized our Start detector, NPET epoch timing system and SPAD photon counter to provide extremely high stability and low time deviation. We demonstrated laser time transfer in ground experiment, which provided time deviations better than 0.3ps for averaging times longer than 200s. It was based on a standard Graz SLR hardware and a photon counting receiver developed for European Laser Timing project. In addition we did develop new SPAD photon counting receiver for future laser time transfer mission. In a first experiments it demonstrated the single shot jitter well below 20ps / 3mm rms and the time deviation as low as 80fs for averaging times of 2000s. Even lower single shot jitter for single photon signals is expected to be achieved in a near future. This SPAD receiver might be attractive for future Lunar laser ranging as well. For applications in space debris tracking, one way ranging and similar experiments, the one-way delays of existing SLR systems must be determined. We have developed the calibration hardware and measurements procedures to determine these delays with accuracy reaching  $\pm 20$  ps.