

New RGG development for bistatic LLR system based on cRIO controller

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Based on the specific requirements of the currently under-construction bistatic Lunar Laser Ranging (LLR) system, a new generation of Range Gate Generator (RGG) has been developed for integrated control of dual laser triggering and multi-detector range gating in the LLR system, and it is also applicable to high-repetition-rate Satellite Laser Ranging (SLR) systems. The new RGG is developed based on the NI cRIO controller, fully utilizing its integrated Linux RT real-time system, FPGA resources, as well as flexible I/O multi-channel expansion capabilities, which can meet the high time resolution, high real-time performance, and high reliability requirements of RGG control. The developed RGG has the capability to output gating signals for a total of four SPAD detectors with two wavelengths of 532nm and 1064nm at both the emission side(also has small-aperture detectability) and detection side(large-aperture detectability). Additionally, the output delay parameters of the gating signals and the system delay parameters of both sides can be independently configured. The RGG features laser emission time latching capability, which reduces the impact of laser emission time jitter on the calculation accuracy of range gating time. It also possesses backscattering avoidance capability to ensure continuous acquisition of effective echo signals. Furthermore, utilizing the Time-Sensitive Networking (TSN) characteristics of the cRIO controller, the RGG can maintain automatic synchronization with UTC time through the Precision Time Protocol (PTP), making it particularly suitable for highly automated laser ranging systems.