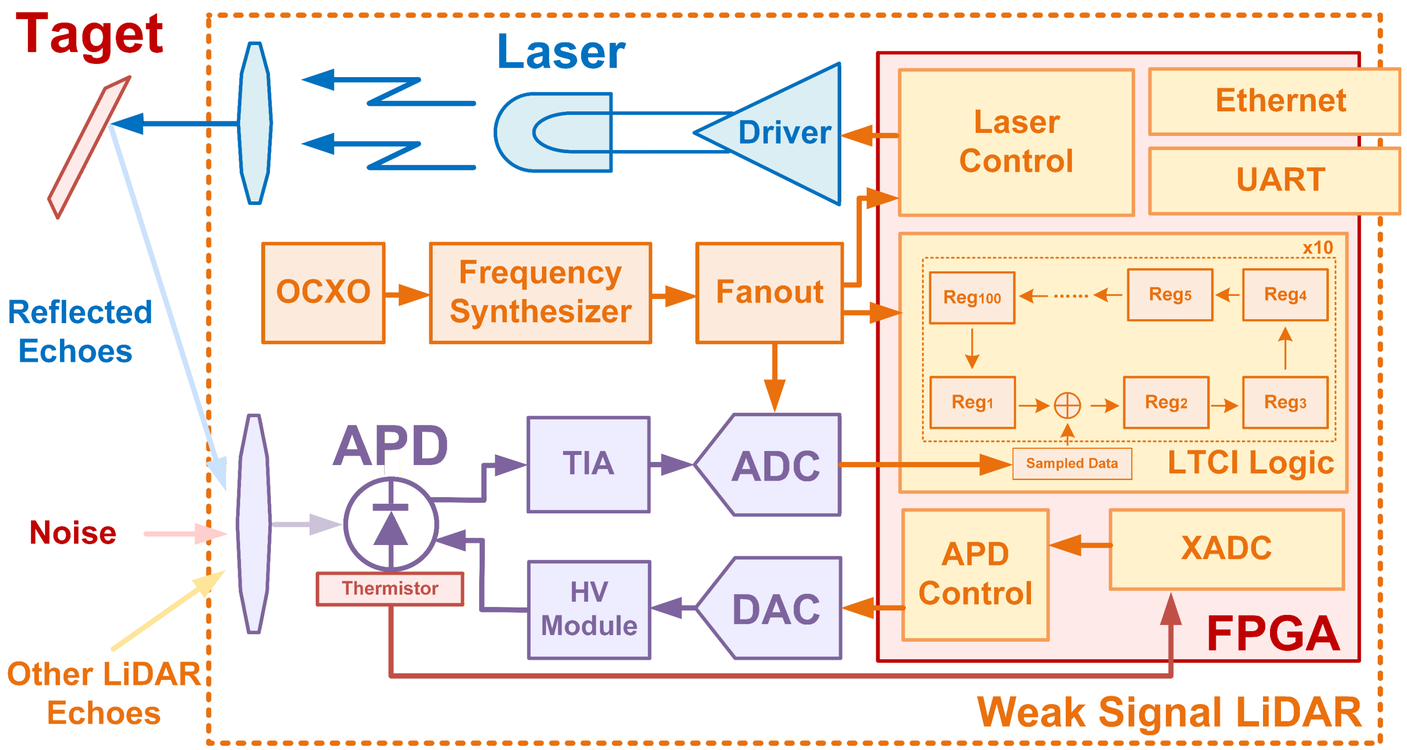
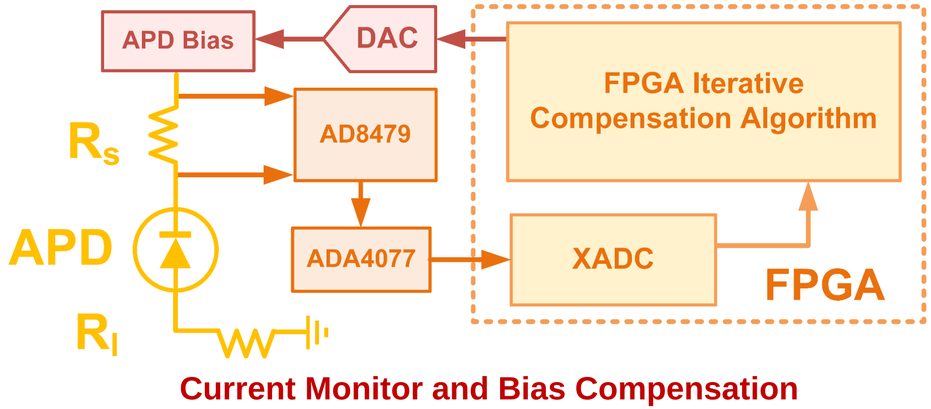
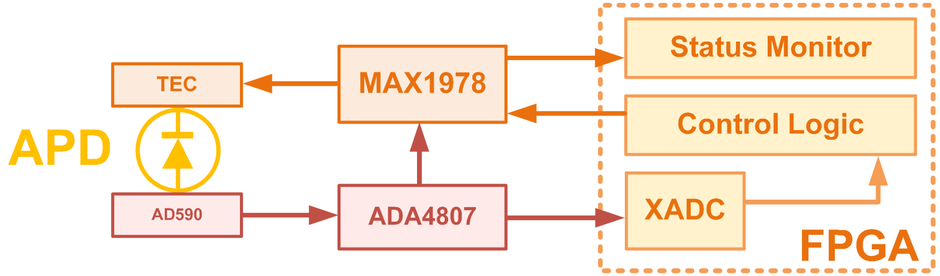
FPGA-Based Weak-Signal LiDAR Architecture





Current Monitor and Bias Compensation



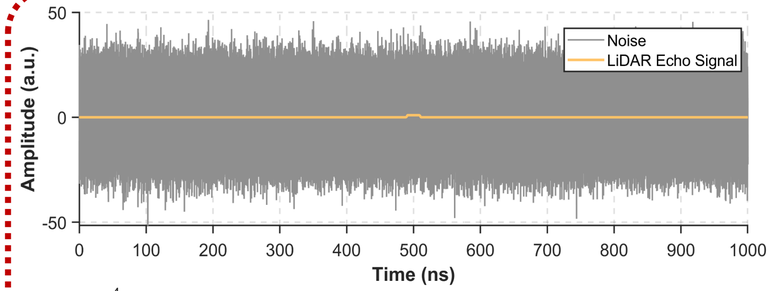
APD Temperature Control

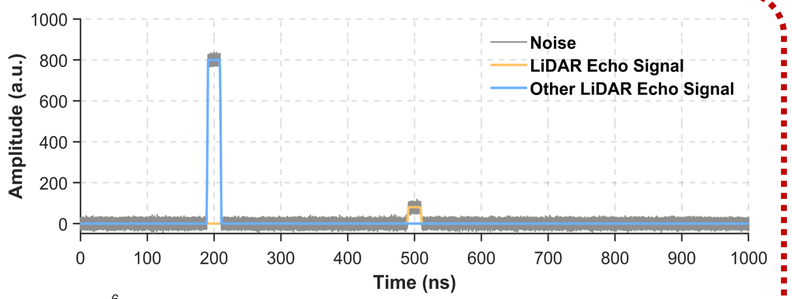
An APD-based pulsed LiDAR system is developed for lunar rover ranging under **low-SNR conditions**. The system combines laser transmission, APD echo detection, synchronized high-speed ADC sampling, and **FPGA-based backend** processing to achieve **low-power weak-signal detection**.

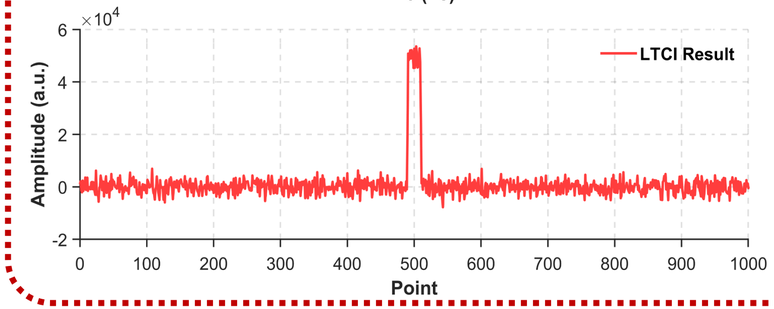
Abstract ID #39 "Long-Time Coherent Integration for High Precision Weak Signal LiDAR on Lunar Rover"
Author: **Wenhao Duan**, Zhongtao Shen*, Yeyu Liu, Lang Liu, Changqing Feng, Shubin Liu

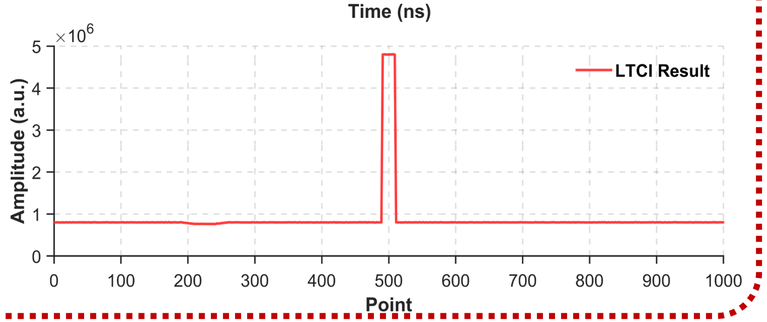
Coherent Integration for Weak-Echo Recovery

Frequency-Selective Coherent Integration Simulation

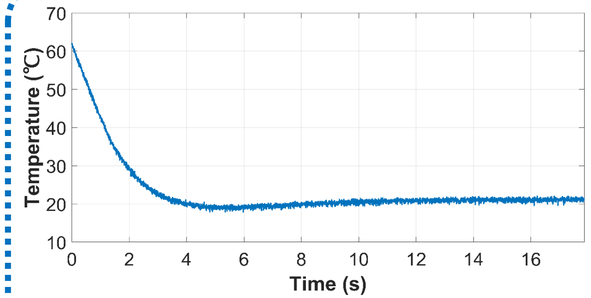


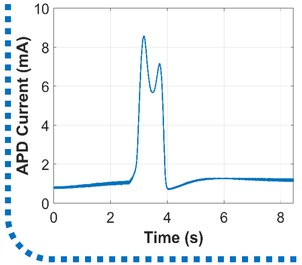


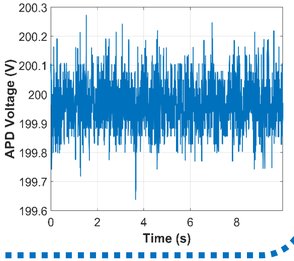




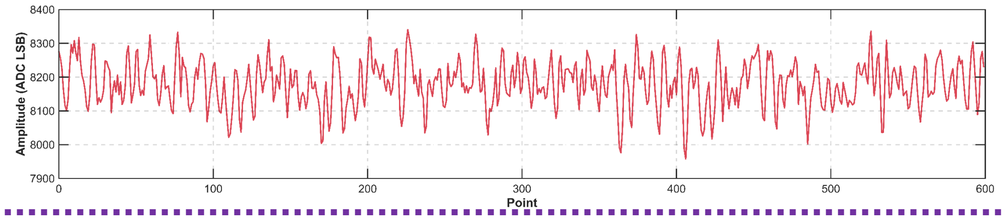
Temperature and Bias Control

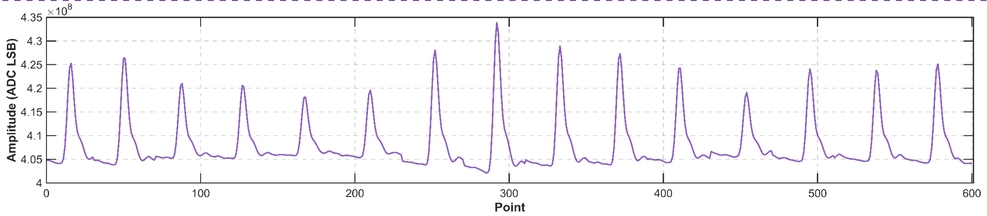






1km Outdoor Test





The FPGA performs **coherent integration** matched to the laser repetition frequency, enhancing weak target echoes while **suppressing noise and off-frequency crosstalk**. Simulation and outdoor measurements verify that clear echo signals can be recovered from signals buried in noise.

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