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PULSE REPETITION RATE OPTMIZATION IN SLR STATIONS TO PROVIDE MINIMUM SYSTEMATIC ERROR OF RANGING

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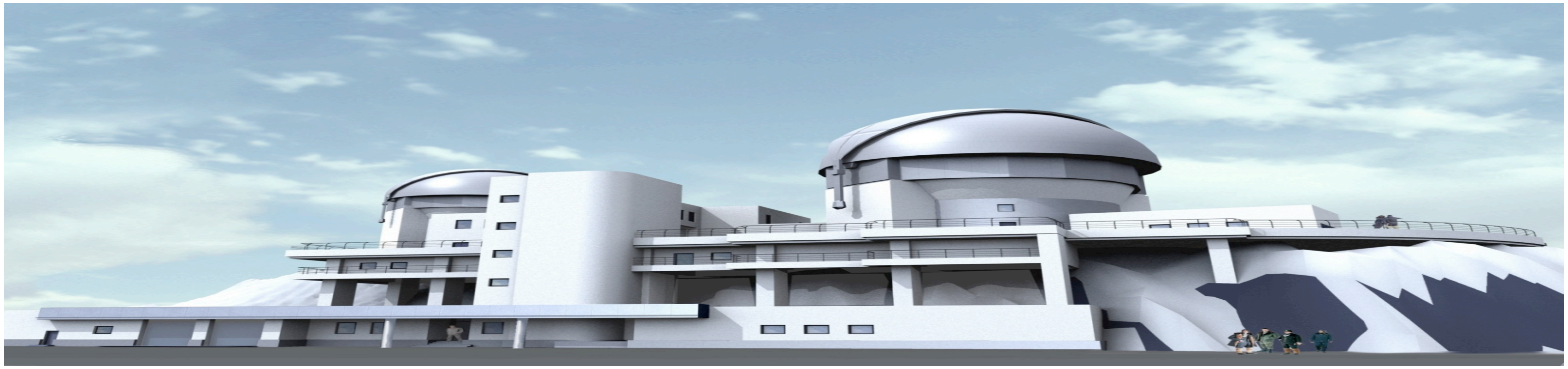
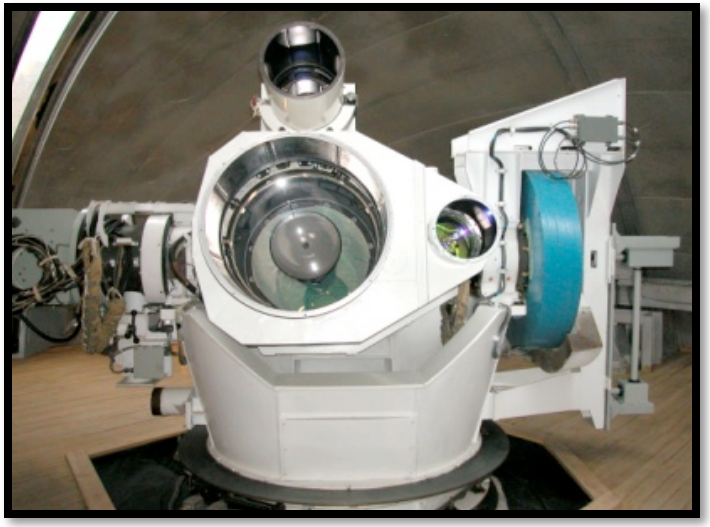


Active 300 Hz SLR stations. What next ?



INITIAL THESES

1. In single-photon SLR, the random and systematic errors of return signal arrival time depend on the number of photoelectrons in the return signal pulse n_{se}.

2. With $n_{se}>1$, the one-shot precision increases, but simultaneously the systematic error of measurement also increases; the error is caused by variations of the moment of detection of the first photoelectron in the return pulse, as well as by variations of the signal transit time in the avalanche photodiode.

3. To eliminate the systematic error, it is necessary to provide $n_{se}<<1$ in combination with a high repetition rate of radiated laser pulses.

4. Using a simple analytical model of detection of return pulses with a fluctuating number of photoelectrons, it is possible to estimate the n_{se} value and corresponding repetition rate F required for a given (sufficiently low) systematic error level.

ANALYSIS RESULTS AND CONCLUSIONS

1. The effect of signal intensity fluctuations on the systematic error of range measurements decreases with reduced average number of photoelectrons in the return signal pulse. With n_{se}<0.05, the intensity fluctuations actually do not affect the measurement accuracy.

2. With n_{se}<0.02, the systematic error of range measurements does not exceed 0.3 mm, with return signal pulsewidth less than 400 ps.

3. With n_{se}<0.05, the systematic error of range measurements does not exceed 0.6 mm, with return signal pulsewidth less than 400 ps.

4. To eliminate the systematic error, the laser pulse repetition rate should meet the requirement $F>f_{se}/n_{se}$, where f_{se} is the mean value of return signal photoelectron generation frequency in the SLR station receiver.

5. To obtain f_{se} values typical for state-of-the-art SLR stations, the laser pulse repetition frequency should be in the tens of kHz range.