PHOTON COUNTING VERSUS ANALOG DETECTION SYSTEMS IN LASER RADAR STUDIES OF THE ATMOSPHERE

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ABSTRACT

Raman scatter monitors of low concentration pollutants naturally make use of photon counting in the visible whereas Rayleigh/Mie scatter monitors of nitrogen/aerosols in the lower atmosphere naturally make use of analog current detection. The details of a 200 MHz, dual channel, sixteen bin, variable bin width, 22 accumulation bit per bin, photon counting system in use at NASA Langley Research Center is exposited with respect to its use for SO_2, H_2O, and other gas monitoring. The application of this photon counting system to backscatter differential absorption experiments is discussed with the result of a unique choice for the mode of operation of the laser transmitter. The details of a dual channel analog LIDAR is then exposited for the same differential absorption experiment. The advantages of both systems are discussed in their respective regimes, and the region of overlap is critically appraised. Verification of the analysis is presented based on laboratory simulation of the laser return pulse using a pulsed light emitting diode. The use of photon counting techniques to characterize such a light pulse and tips to achieve photon counting at high rates are also presented.

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Work supported by NASA Grant NGR-47-003-087.