Improved-Bandwidth Transimpedance Amplifier
NASA's Jet Propulsion Laboratory, Pasadena, California

The widest available operational amplifier, with the best voltage and current noise characteristics, is considered for transimpedance amplifier (TIA) applications where wide bandwidth is required to handle fast rising input signals (as for time-of-flight measurement cases). The added amplifier inside the TIA feedback loop can be configured to have slightly lower voltage gain than the bandwidth reduction factor (the ratio of the input capacitance plus the feedback capacitance to the feed capacitance). This innovation enables the optimization of design based on suitable space-approved operational amplifiers and provides better, stronger performance under radiation and wide temperature variations. In many cases, this approach can eliminate the need to qualify new amplifiers.

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Inter-Symbol Guard Time for Synchronizing Optical PPM
This method would involve less computation than does the pilot-symbol method.
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An inter-symbol guard time has been proposed as a means of synchronizing the symbol and slot clocks of an optical pulse-position modulation (PPM) receiver with the symbol and slot periods of an incoming optical PPM signal. (Such synchronization is necessary for correct identification of received symbols.) The proposal is applicable to the low-flux case in which the receiver photodetector operates in a photon-counting mode and the count can include contributions from incidental light sources and dark current. The use of the inter-symbol guard time would be an alternative to a prior synchronization method based on the periodic transmission of a fixed pilot symbol.

The proposal involves a modification of conventional M-ary optical PPM, in which each successive symbol period is divided into M time slots (0, 1, 2, ..., M-1), each slot being of duration T_s. Each time slot represents a different symbol in an alphabet of up to M symbols. At the transmitter, during each time slot, a laser either transmits a pulse or no pulse, depending on which symbol is to be sent. Synchronization of the receiver symbol and slot clocks is necessary because the task of the receiver is to determine which of the M possible symbols has been received by observing the photon counts accumulated during each of the M time slots of a symbol period.

In both the prior method and the method now proposed, the basic idea is to estimate the symbol and slot timing boundaries of the received signal by correlating the received-signal counts with a known component of the transmitted signal while taking account of the fact that the received-signal counts are related to the received-signal intensity through a Poisson distribution. In the prior method, the known component of