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Noise and Dynamic Range in Multiplexed Photonic Doppler Velocimetry EDWARD DAYKIN, CHAN JUNG, EDWARD MILLER, MICHAEL PENA, CARLOS PEREZ, OLIVER STRAND, Natl Security Technologies LLC — We have designed and built the Multiplexed Photonic Doppler Velocimeter (MPDV) for use on any class of shock physics experiments that requires a large number of spatial points to be measured. The MPDV uses the heterodyne method to either multiplex or up-shift data channels in the frequency domain, and also employs fiber-optic delays to multiplex additional data channels in the time domain. MPDV differs in architecture from the Photonic Doppler Velocimeter (PDV) in that the MPDV employs an Erbium Doped Fiber Amplifier (EDFA) for small signal optical pre-amplification prior to photo detection. Optical amplification allows for two aspects of MPDV operation that differ from PDV: 1) use of low power (eye-safe) lasers, and 2) ability to time multiplex with minimal degradation to the signal-to-noise ratio (SNR). However, use of EDFA optical amplification within PDV or MPDV architecture also contributes noise to the spectrogram. EDFA optical noise will impact the SNR of MPDV data, and is dependent on amplifier performance, laser power, as well as optical signal attenuation due to fiber-optic delays and components. We will review this dependence and the trade-offs that exist between SNR and multiplexing architectures.

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