

Sub-picosecond event timing - New techniques and first results

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We are presenting the novel time interval measurement device, which is based on a surface acoustic wave (SAW) filter as a time interpolator. The operating principle is based on the fact that a transversal SAW filter excited by a short pulse can generate a finite signal with highly suppressed spectra outside a narrow frequency band. If the responses to two excitations are sampled at clock ticks, they can be precisely reconstructed from a finite number of samples and then compared so as to determine the time interval between the two excitations. We have designed and constructed a two-channel event timing device base on this principle. The device has been constructed using commercially available components. We have assessed the single-shot time interval measurement precision of 1.3 ps rms what corresponds to the time of arrival precision of 0.9 ps rms in each channel. The temperature drift of the measured time interval on temperature is lower than 0.5 ps/K and the long-term stability is better than +/- 0.2 ps per hour. These are, to our knowledge, the best values reported for the time interval measurement device. The first SLR results based on this timing will be presented.