

# HIGH DYNAMIC RANGE MULTI-CHANNEL CROSS-CORRELATOR FOR SINGLE SHOT TEMPORAL CONTRAST MEASUREMENT

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Temporal contrast of an ultra-high intensity laser is a crucial parameter for laser plasma interaction experiments, such as fast ignition <sup>1</sup> and particle acceleration <sup>2</sup> because of the influence of the pre-formed plasma. The measurements of the contrast ratio with a high dynamic range and wide temporal range, is required for Peta-watt class or next generation laser system. Moreover, because the repetition rate of the ultra-high intensity laser systems is generally low, or the intensity fluctuations due to random of process such as amplified spontaneous emission (ASE), parametric fluorescence, and phase noise, etc., shot to shot measurement of the contrast is also required <sup>3</sup>.

We have developed a multi-channel cross-correlator (MCCC) for single-shot measurement of temporal contrast of the high-power lasers system. The MCCC is based on a third order cross-correlator with a reference arm to be normalized by a peak intensity <sup>4</sup>, and has a three independent optical delay. The advantage of MCCC is that it can set up the optional time period to measure the pre-pulse which likely is amplified and break up a target with a high dynamic range.

We have experimentally demonstrated that the MCCC system achieves the high dynamic range of  $>10^{10}$  and large temporal window of  $\sim 1$  ns. In the experiment with short pulse laser, the shot to shot fluctuation of a pedestal intensity at sub-ns was measured. The fluctuation is mainly due to the random process of ASE. The precise information on temporal contrast shot to shot will be crucial in assessing the particle acceleration in relativistic laser-mater interaction studies. We will discuss the experimental detail and result.

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