CONTRAST ENHANCEMENTS TO THE CPA BEAMLINES OF THE ORION LASER FACILITY


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High peak power, high temporal contrast, laser pulses are the only way to generate the conditions required for a range of plasma physics experiments. Any light that reaches target before the main laser pulse can pre-heat the target reducing its density or even destroy it.

The two Orion chirped pulse amplification beamlines1 consist of a common mode locked oscillator, stretcher, optical parametric amplifier (OPA), Nd:Glass rod and disc amplifiers, compressor and focusing optics each generating 500 J in 0.5 ps. The original beamline design had a nanojoule pulse from the oscillator stretched to ~6ns then amplified in the OPA. Parametric fluorescence from the OPA propagated along the system causing the main laser pulse to be preceded by a pre-pulse/pedestal of ~3 ns duration at ~10^7-8 of its intensity.

In order to reduce the energy within this pedestal we have installed a short pulse (picosecond) optical parametric amplifier (SPOPA) between the modelocked oscillator and nanosecond stretcher. The SPOPA2 is designed as a modular unit which stretches the seed pulse to ~5ps and amplifies it to 30uJ using an OPA with a pump seeded form the same source. This allows the gain of the nanosecond OPA to be decreased thereby reducing the parametric fluorescence proportionately and enhancing the nanosecond contrast to ~10^{12}.

It is also possible to run the SPOPA in conjunction with the frequency doubling system which we have previously reported3. By running these systems together we realize an estimated contrast of 10^{18} which is well beyond our current measurement capabilities.