LULI2000 front-ends update: multi-temporal-shaping capabilities for plasma physics

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Since its first shot in 2003, LULI2000 is used by worldwide plasma scientists and brings an important contribution to laser plasma physics and ICF studies. Composed of high-energy multi-beams Nd:Glass chains (1μm), it is capable of combining two independent kJ nanosecond beams (North and South) with high-energy sub-picosecond one (PICO2000, 100J) with frequency doubling ability (0.5 μm), and two probe beams (Blue, ns/100J and COLOC ps/10 J).

We present a major upgrade of the LULI2000 front-ends. We demonstrate, for the first time, new high performance nanosecond synthesized fiber-based front-ends using Arbitrary Waveform Generators to seed kJ laser chains with precise control of the temporal pulse shape. These front-ends exhibit excellent temporal stability (1 % rms) and duration flexibility (25 ps to 20 ns). The temporal profiling is fully arbitrary (ramp, bi-pulses, exponential) up to 1 kJ. Those systems have proven an ultra low jitter and synchronization between nanosecond and picosecond beams.

We also present the commissioning of a new short pulse (1 -50 ps) CPA probe at 1 μm (COLOC) in operation since end 2016. The energy is up to 10 J for an intensity on target of 10^{18} W/cm^2. This new probe as proven to be a good candidate for X-ray radiography.

These new front-ends integrated in the current facility allow LULI2000 to operate with more shot-to-shot stability. This major front-ends upgrade is an important step towards LULI2000 facility modernizing.

References

[1] L.Meignien, Fiber based modulator systems at 1053 nm for 'shaped' long pulse on LULI2000, ICUIL2012, Romania
[2] L.Meignien, Fiber based modulator systems at 1053 nm for "Shaped long pulse on LULI2000", CLEO/IQUEC 2013, Munich, Germany
[3] L.Meignien, LULI2000 front-ends update: multi-temporal-shaping capabilities with sub-picosecond jitter for plasma physics and OPCPA pumping, ICUIL2016, Canada