Pulsed fiber lasers and amplifiers generating tens of kW peak power have been attracted by various applications in medicine, sensing and material processing. A function can change pulse durations and repetition rates into independence is strongly desired in many of today’s demanding applications.

Fiber based amplifier systems have a great potential for such production in using seed sources which have the function. Here, we report on a linearly polarized monolithic fiber amplifier system with a novel master oscillator, which consists of a laser diode and electro optical (EO)-modulator.

The experimental arrangement is shown in Figure 1. This laser employs a master oscillator (Seed source) power amplifier (MOPA) architecture. The seed pulses generated in the master oscillator are amplified by a three-stage amplifier system based on polarization maintaining (PM) Yb-doped fibers. The system consists of two-stage single mode fiber amplifiers and a large mode area (LMA) fiber amplifier which has the core diameter of 25 µm and the core NA of 0.07. PM fiber isolators are used in between amplifier stages. 976nm-wavelength laser diodes are used to pump the Yb-doped fiber in each amplifier stage through pump beam combiners.

Detail of the seed source is shown in Figure 2. The 1064nm-wavelength CW output power of the laser diode is modulated by a waveguide EO amplitude modulator (a Mach-Zehnder interferometer). To stabilize the phase fluctuation of the MZ interferometer the feedback bias control system is applied to the modulator. The modulator has a modulation bandwidth of >10GHz. Therefore, the achievable shortest pulse should be <100ps. We demonstrate tunable 0.15ns-2ns pulse duration, a tunable 200kHz-3MHz pulse repetition rate in this paper.

We also demonstrate the pulsed fiber laser with >70-kW peak power and 30-W average power operating at 1064 nm. The output beam quality \( M_x^2 \) and \( M_y^2 \) values have obtained 1.1 and 1.2, respectively.Two bulk LBO crystals were used for second and third harmonic conversion. The UV output at 355nm represents 35% conversion efficiency from the fundamental output.