All-fiber 1.15 mJ pulsed eye-safe optical source

V. Philippov, J. K. Sahu, C. Codemard, W. A. Clarkson, J.-N. Jang, and J. Nilsson,
Optoelectronics Research Centre, University of Southampton, Southampton SO17 1BJ, UK,
phone +44 23 8059 4532, fax +44 23 8059 3142, email vap@orc.soton.ac.uk

G. N. Pearson
QinetiQ, Malvern, UK
Tel: 44 (0) 1684 895729
Fax: 44 (0) 1684 896270
gnpearson@qinetiq.com

High power pulsed fiber lasers and amplifiers based on Er or Er-Yb fibers have received much attention in recent years due to advantages such as compactness, efficiency, relative eye safety, high brightness, and compatibility with telecom components at 1550 nm. Applications such as lidar also benefit from a low weight. A seed source, followed by a cascade of erbium-doped fiber amplifiers, are an attractive means to this end, providing for a compact, reliable, and versatile system. So far, however, pulse energies achieved with such amplifier cascades have been significantly less than 1 mJ.

Here, we report a MOPA (master oscillator –power amplifier) optical fiber source with a record pulse energy of 1.15 mJ at low repetition rates in a high-brightness beam ($M^2 = 1.6$). Maximum average output power was 2.2 W. The wavelength of operation was 1562 nm and the repetition rate was 0.8 – 10 kHz. The pulse duration varied between 50 and 500 ns. Our fiber MOPA source consisted of an actively Q-switched erbium-ytterbium codoped fiber ring laser spliced to a high-power cladding-pumped multimode Er-Yb co-doped fiber amplifier. High-brightness operation (with suppression of unwanted modes) was obtained through spatial mode-selection. Additional results with different seed sources and at higher powers will be presented at the conference.