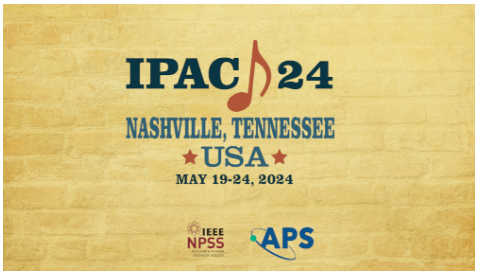

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Passively stable pulsed optical timing distribution at 1030-nm wavelength using hollow core optical fibers

Wednesday 22 May 2024 16:00 (2 hours)

New generation X-ray free electron lasers require reliable and precise synchronization of pulsed laser sources across various locations. This demands stable timing distribution to preserve ultra-low timing jitter, ultrashort pulse duration, and high peak power. *Fiber optic delivery, compared to free-space optics, offers advantages in flexibility, laser safety, ease of deployment and superior output beam quality. However, standard fibers with silica glass core face challenges like high dispersion, nonlinear pulse shaping and environmental sensitivity, causing excess timing jitter. Emerging anti-resonant hollow core fibers that guide light though a central hole have significantly lower environmental sensitivity, high nonlinearity threshold and low dispersion, while achieving attenuation similar to glass-core fibers**. This makes them an improved medium for low-noise transmission of fs pulses with high peak powers. Here, we experimentally demonstrate passively stable timing distribution of femtosecond pulses at 1030-nm center wavelength using sealed hollow core fibers with-out vacuum components. We have achieved a timing precision of 0.3 fs RMS from 1 Hz to 1 MHz and < 250 fs peak-to-peak for 12 hours with a hollow core fiber length of 72 m without requiring any transmission delay stabilization.

Footnotes

- M. Xin, K. Şafak, and F. X. Kärtner, Optica, vol. 5, no. 12, pp. 1564-1578, 2018. ** G. T. Jasion et al., 2022 Optical Fiber Communications Conference and Exhibition (OFC), San Diego, CA, USA, pp. 1-3, 2022.

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