

# Industrial Compact Free Electron Lasers and Laser-driven Accelerators

Thursday, 21 September 2023 17:45 (20 minutes)

Ultrahigh-intensity lasers and laser-driven particle accelerators made rapid progress towards becoming commercial tools. Tau Systems Inc. is working to bring laser-plasma acceleration into the commercial sphere by leveraging expertise in laser physics, laser-driven plasma, conventional accelerators, and data science. Major challenges facing future LWFA-based commercial systems are stability and repeatability, low repetition rates, technical expertise required for operation. To address such challenges, we construct a fully-integrated high average power laser-accelerator facility at TAU Labs (San Diego, CA). The phase I system is driven by a 100 Hz, 1J, 25fs Ti:Sapphire laser accelerating electrons to >100 MeV and will be outfitted with electron, neutron, and X-ray target stations. Diagnostics, control systems, etc. are developed from the ground up to operate at 100+ Hz and be fully integrated. Furthermore, TAU partners with UT Austin and the Berkeley Laser Laboratory Accelerator (BELLA) Center. At UT we upgraded the UT3 Ti:Sapphire laser with a second beamline and dedicated LWFA setup with stable performance at 10Hz, 35fs, 1J on-target. At BELLA we jointly operate the Bella-HTU (100 TW Undulator) to demonstrate laser-driven FEL. We present first results, progress of the 100Hz TAU Labs system and technology considerations for reaching into the multi-kHz regime.

**Primary authors:** HEGELICH, B.M. (TAU Systems Inc., University of Texas at Austin); ALTAMIRANO, a (University of Texas at Austin); ANICULAESEI, C. (University of Texas at Austin); BARBER, S. (Lawrence Berkeley National Laboratory); BORGER, T. (TAU Systems Inc.); BROOKS, J. (University of Texas at Austin); CONNOLY, M. (TAU Systems Inc.); DONOVAN, M. (TAU Systems Inc.); DOWNER, M. (University of Texas at Austin); FRANKE, P. (TAU Systems Inc.); GRACIA, M. (TAU Systems Inc.); HA, T. (TAU Systems Inc., University of Texas at Austin); MCCARY, E. (TAU Systems Inc., University of Texas at Austin); LABUN, L. (TAU Systems Inc.); METZGER, K. (TAU Systems Inc.); MILTON, S. (TAU Systems Inc.); ORTMANN, A. (TAU Systems Inc.); PHAN, D. (University of Texas at Austin); PLATEAU, G. (TAU Systems Inc.); VAN MOURIK, R. (TAU Systems Inc.); VAN TILBOERG, J. (Lawrence Berkeley National Laboratory); WALTER, P. (TAU Systems Inc.); ZGADZAJ, R. (University of Texas at Austin); ZHANG-LABUN, O. (TAU Systems Inc., University of Texas at Austin)

**Presenter:** NEACSU, Catalin (Tau Systems)

**Session Classification:** WG2: Laser technology (WP6 - Task2)

**Track Classification:** WG2: Laser technology