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Stable Multi-Day Performance of a Laser Wakefield Accelerator for FEL Applications

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We report on the operation of the DRACO Laser Driven electron source for stable multi-day operation for FEL applications. The nC-class accelerator delivers charge densities around 10 pC/MeV , <1 mrad rms divergence at energies up to 0.5 GeV and peak currents of over 10 kA [1].
Precise characterisation is paramount for controlled operation, including: spectrally resolved charge diagnostic, coherent optical transition radiation (TR) to resolve microbunch beam structures [2] and TR-based multioctave high-dynamic range spectrometry for sub-fs resolved characterisation of the 10 fs rms electron bunches [3]. Achieved stability allows for systematic exploration of demanding applications, resulting in the recent demonstration of the first LWFA based Beam-driven Plasma Wakefield Accelerator [4].
Fulfilling the high demands required for FEL operation, the COXINEL manipulation line developed at Synchotron SOLEIL has recently been installed at our facility. Based on successful beam transport of over 13000 shots within 9 experimental days during commissioning, we were able to demonstrate the very first operation of a seeded FEL driven by a laser plasma accelerator [5].

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Yes

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