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Optical and laser systems for the AWAKE run 2C experiment

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In the AWAKE Run 2c experiment, two electron beams are injected into two separate rubidium (Rb) vapour sources. The first electron beam initiates the self-modulation of a proton bunch in the first vapour source, while the second electron beam serves as a witness beam for plasma wakefield acceleration with low energy spread in the second vapour source. This setup requires the precise spatio-temporal delivery of four laser beams: two deep UV beams that generate the electron beams with a relative timing jitter well below 100 fs, and two near-IR beams that ionize efficiently the Rb vapour sources. The UV pulses are generated by an established Yb laser system, capable of producing 400 uJ, 0.2-10 ps pulses at 257 nm with high reliability (<0.1% RMS energy fluctuation), and enables emittance optimization via spatial beam shaping. The same system is used for both electron sources, utilizing a partial reflector to split the beam and account for differing photocathode yields. For the Rb ionizing pulses, which are directed into the vapour sources in a counter-propagating geometry, the pulses from the AWAKE Ti:Sapphire laser system are transported using a series of vacuum relay telescopes.

Footnotes

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Author: GRANADOS, Eduardo (European Organization for Nuclear Research)

Co-authors: LATINA, Andrea (European Organization for Nuclear Research); EAGER, Anton (European Organization for Nuclear Research); GROUSSIN, Baptiste (European Organization for Nuclear Research); WOOLLEY, Benjamin (European Organization for Nuclear Research); GSCHWENDTNER, Edda (European Organization for Nuclear Research); MARTINEZ-CALDERON, Miguel (European Organization for Nuclear Research); CHRITIN, Nicolas (European Organization for Nuclear Research); MAZZONI, Stefano (European Organization for Nuclear Research); DOEBERT, Steffen (European Organization for Nuclear Research); FEDOSSEEV, Valentin (European Organization for Nuclear Research); MUSAT, Vlad (European Organization for Nuclear Research)

Presenter: GRANADOS, Eduardo (European Organization for Nuclear Research)

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