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Basic Commissioning of the ELIMED Line: challenges in the selection and extraction of a laser-driven beam

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ELIMED is the ion transport and dosimetry section of the ELIMAIA laser-plasma accelerator [1].
In this contribution, we present the main characteristics and capabilities of the ELIMED ion beam transport system. We also describe the initial phases of the experimental testing, highlighting key results, challenges encountered, and the solutions adopted.
In particular, we report on the successful extraction of a selected ion beam with a central energy of 20 MeV with a 30% energy spread at FWHM, i.e. a spread ranging from 17 to 23 MeV, conresponding to a 7nsec bunch length at the sample location (7.5m downstream the interaction point). The achieved peak dose was of about 40mGy per laser shot which, with a 7nsec long bunch delivered to the irradiation point and successfully used for irradiation experiments of biological samples [2], both cells and embryos, as part of the ELI User Program. These preliminary steps were crucial for enhancing the beam diagnostics along the line, improving control over beam transport, energy selection, and final beam shaping, with the goal to offer a more reliable machine to the users from different communities.

[1] The ELIMAIA Laser–Plasma Ion Accelerator: Technological Commissioning and Perspectives, F. Schillaci et al., Quantum Beam Sci. 2022, 6(4), 30; https://doi.org/10.3390/qubs6040030

[2] ELIMAIA-ELIMED: A new user platform for radiobiological research utilizing laser-driven protons, P. Blaha et al., Front. Phys. Sec. Accelerator Physics Volume 13 –2025, doi: 10.3389/fphy.2025.1567622

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