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Efficient laser proton acceleration in the near critical density regime

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Improved control of high intensity laser beam parameters on target recently enabled proton energies beyond 100 MeV, dose-controlled sample irradiation experiments, and the demonstration of seeded FEL light.

This presentation focuses on the chain of developments at the Petawatt laser DRACO that enabled systematic studies in the regime of relativistic target transparency for thin foil as well as cryogenic hydrogen targets. While both targets concepts yielded highest proton energies, the second was further improved to support 1 Hz repetition rate operation at 100TW class laser power. Here, flat jet geometries recently showed very promising energy and efficiency scaling for future applications.

References:

- [1] F. Kroll, et al., Nature Physics 18, 316 (2022)
- [2] M. Rehwald, et al., Nature Commun. 14, 4009 (2023)
- [3] T. Ziegler, et al., Nature Physics 20, 1211 (2024)

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