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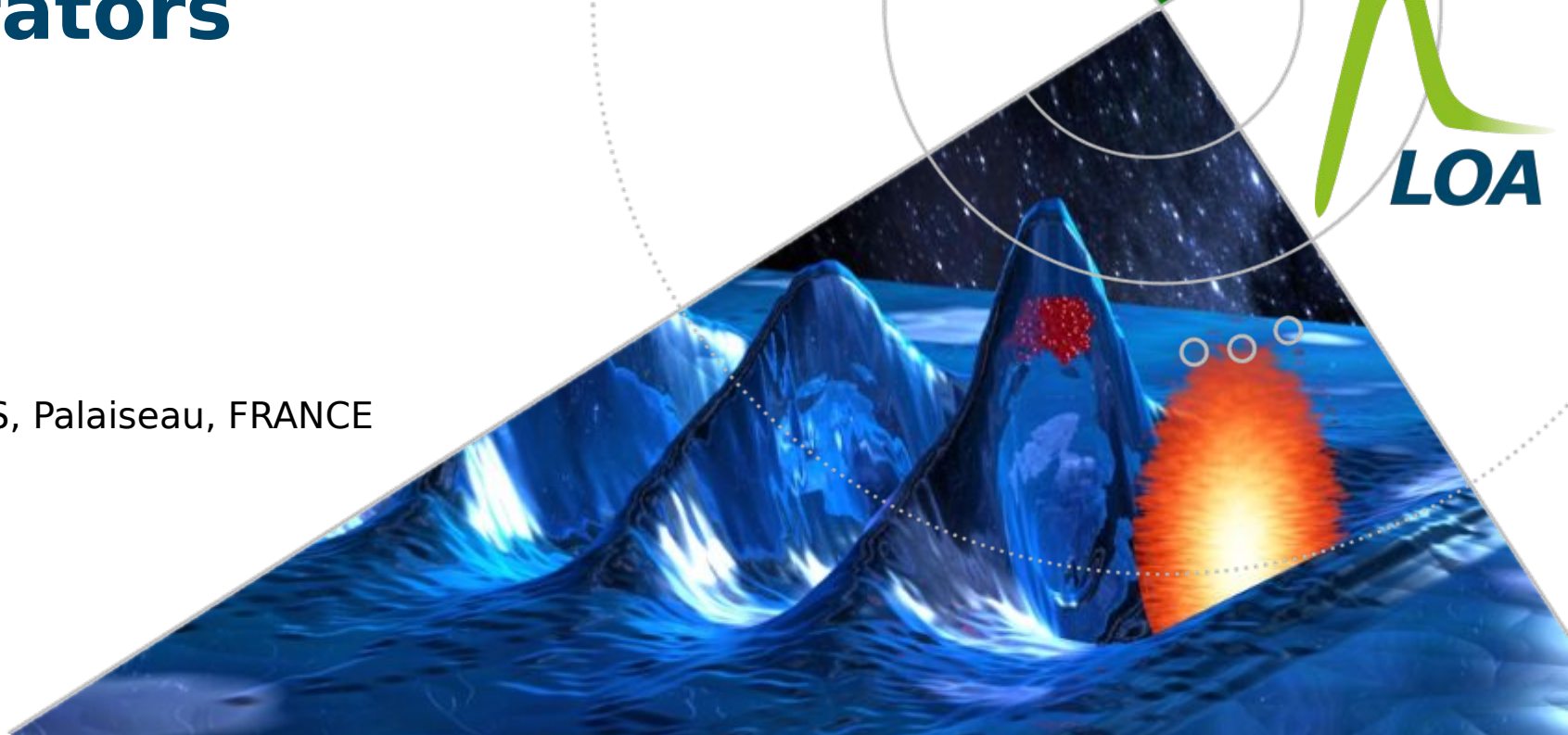


Task 6.3 - Multi-scale innovative targets for laser- plasma accelerators

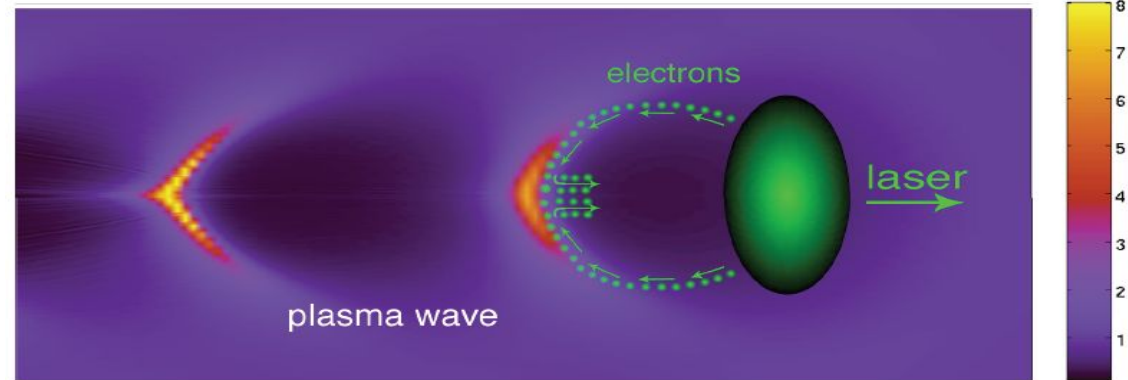
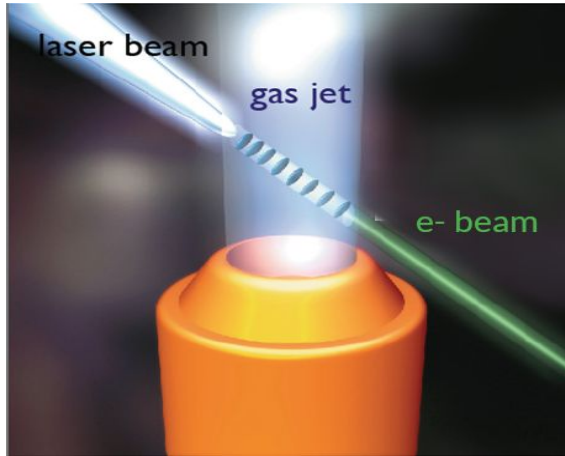
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Laser Plasma Acceleration



- An intense laser pulse ($I > 10^{18} \text{ Wcm}^{-2}$) turns a light gas into a plasma.
- The ponderomotive force expels electron from the optical axis.
- A relativistic ion cavity is generated in the laser wake.

Plasma = ionized medium



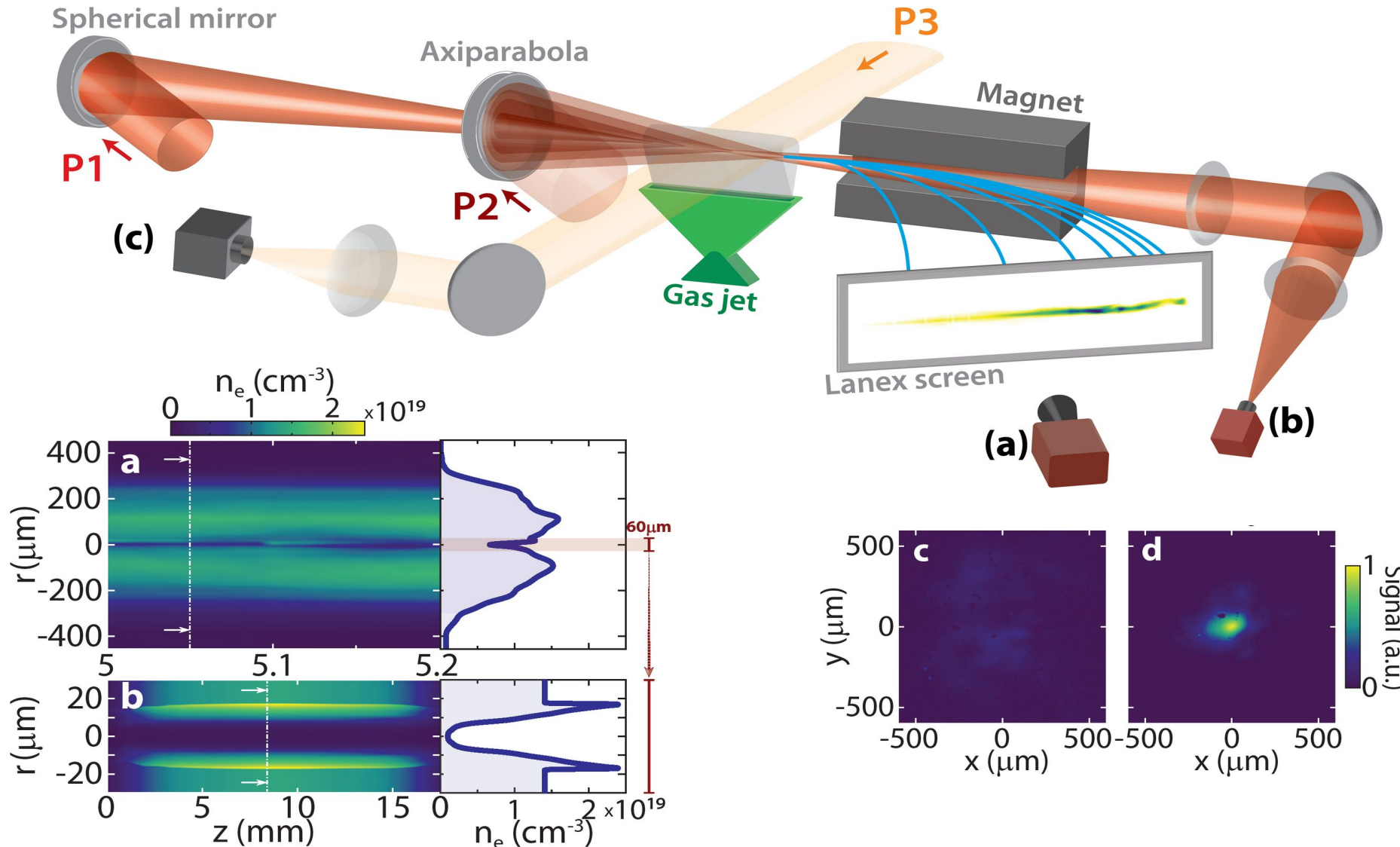
Can sustain electric fields of extremely high amplitude (up to 4 orders of magnitude larger than RF acc.)

Task 6.3 aims to develop and test targets of superior quality for extending the beam energy and improving its reliability

D 6.3 Electron acceleration experiments with new targets

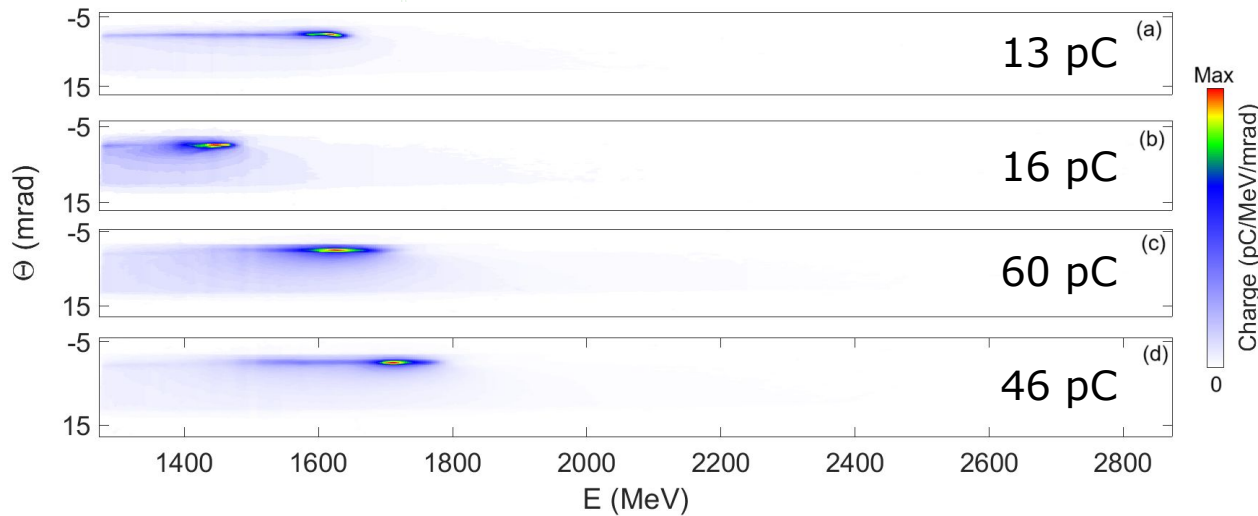
- Delivered the 30/04/2023.
- **Dielectric shocked nozzles** demonstrated improved reliability
 - reproducible results during $> 50 \times 10^6$ shots
 - day-to-day variation ($\sim 10\%$ in charge, $\sim 5\%$ in energy) are due variations in laser energy ($\sim 5\%$).
- Laser **Carrier-Envelope-Phase must be stabilized** to 50 mrad RMS to keep the electron beam pointing variations under 1 mrad.
- **Optically generated laser-plasma waveguide**
 - controlled injection in a plasma waveguide.
 - energy spread $< 4\%$ FWHM at the GeV level.
 - conversion efficiency from the laser $> 1\%$.

Acceleration in a Laser-Generated Waveguide

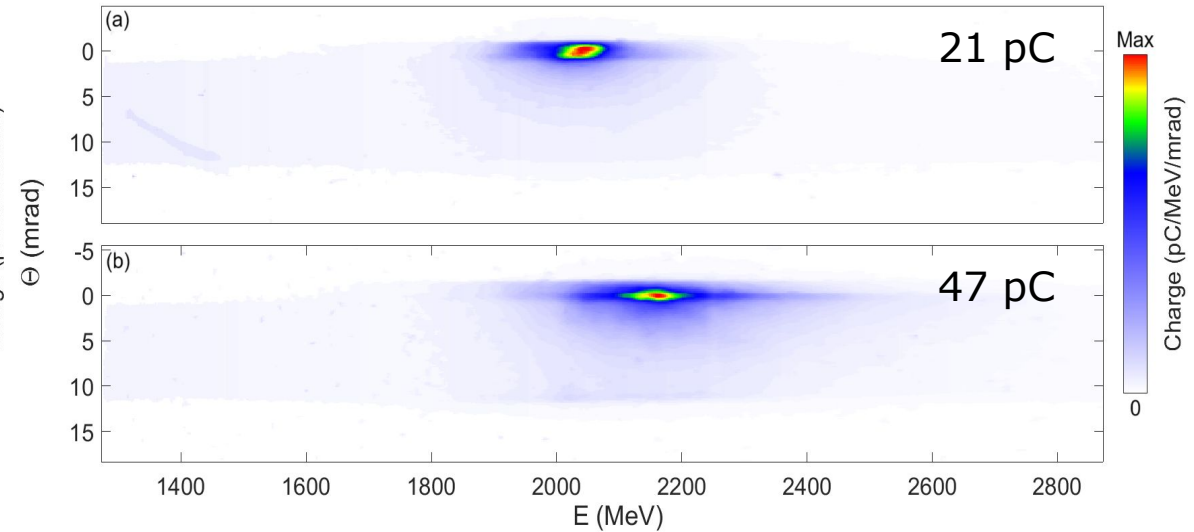


Improved-quality, high-energy beams with a PW-class laser

Blade



Blade + guiding



- 6 cm long target
- 2.2 GeV
- 1% conversion efficiency
- 10% energy spread

