

## WP10 - Plasma Components & Systems

### French possible contributions

K. Cassou (CNRS/IJClab) on behalf of LOA (C. Thaury, J. Faure), LPGP (B. Cros) and S. Dobosz (CEA/Lydil)



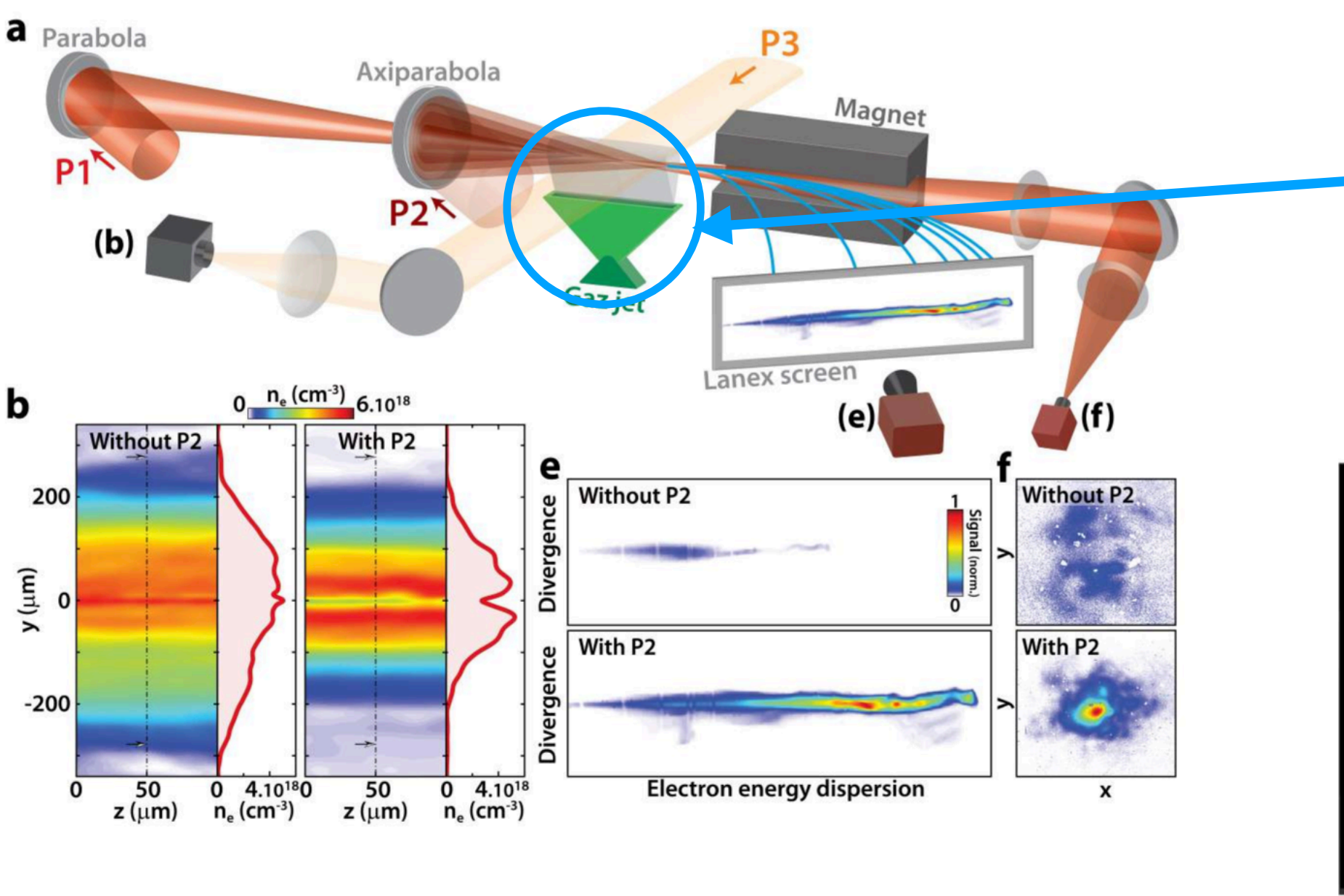
# Multi-scale gas jet target



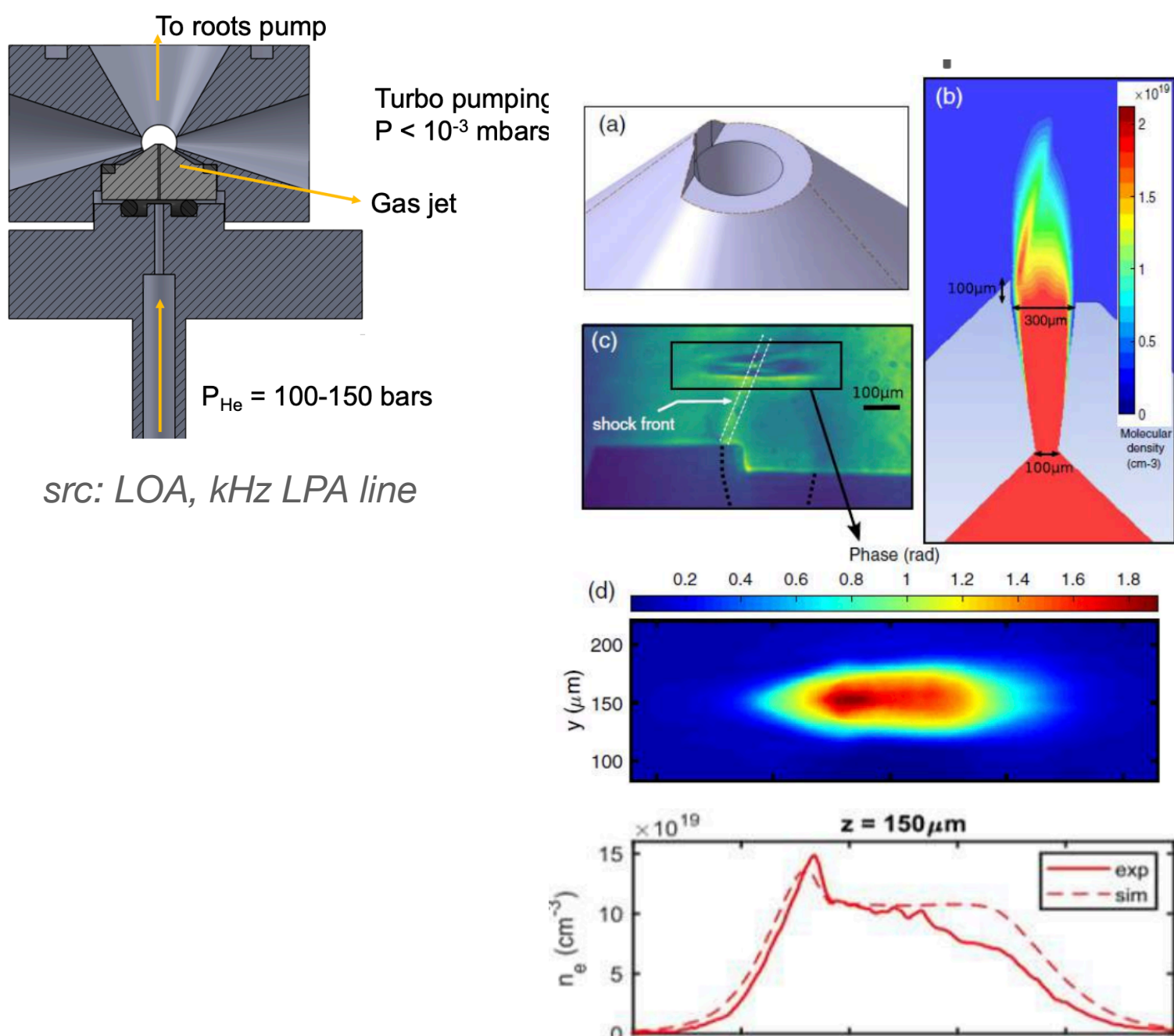
## R&D objectives

- Development of multi-scale gas jet targets: from 100  $\mu\text{m}$  to 10 cm
- Development of techniques for structuring plasma density (shocks, precursors, multi-jets, etc.)
- Development of jets for high rate (continuous or pulsed flow, pumping issues) and high medium power (resistance to laser and plasma and plasma damage)

## Long gas jet, >50 TW laser guiding



## kHz high density micro gas jet



FLSE technique: V. Tomkus et al. Opt. Express **26**, 27965 (2018) L. Rovige et al., RSI **92**, 083302 (2021)

Oubrierie, K., Leblanc, A., Kononenko, O. *et al.* Controlled acceleration of GeV electron beams in an all-optical plasma waveguide. *Light Sci Appl* **11**, 180 (2022). <https://doi.org/10.1038/s41377-022-00862-0>



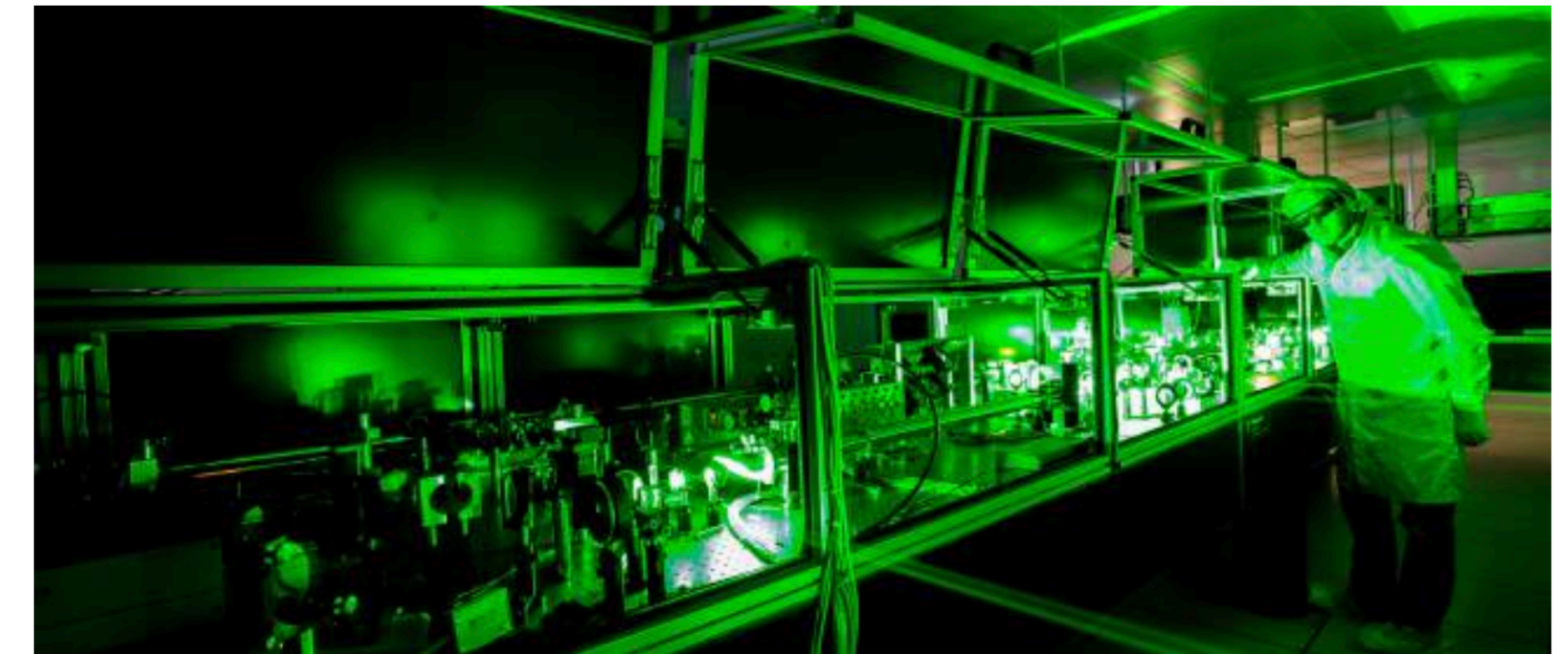
# Multi-scale gas jet target



## Available facilities

**Currently:** laser 80TW Salle Jaune and Apollon laser for centimetric gas jets. Laser Salle Noir for kHz and micro-jet developments

**From 2024:** the LAPLACE-HC platform for high speed / high medium power 100 Hz, 50W



## Beam time :

substantial beam time as development is integrated with current activities

## Resources :

2 research teams ~10 FTE

Collaboration with LTS-FMS Center for physical sciences (Lt)



## Funding :

**IFAST MILPAT** (very modest) and important regional public funding for **LAPLACE** project



# Gas cell target development

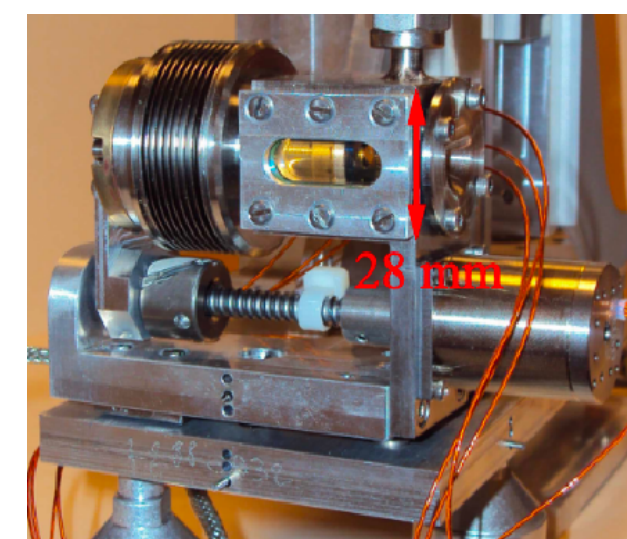
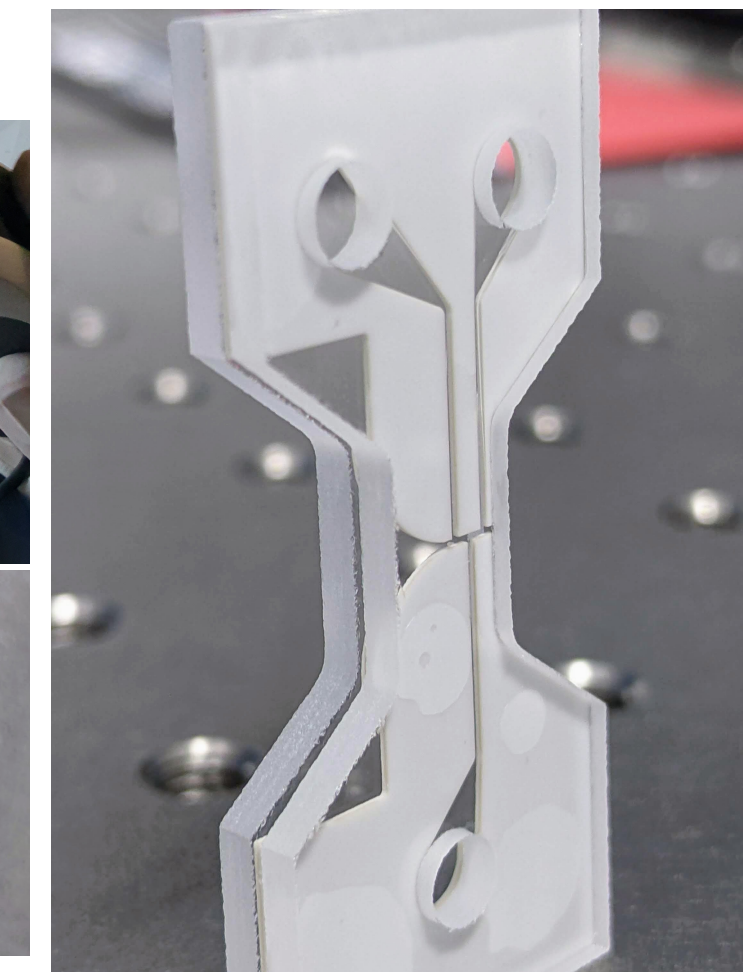
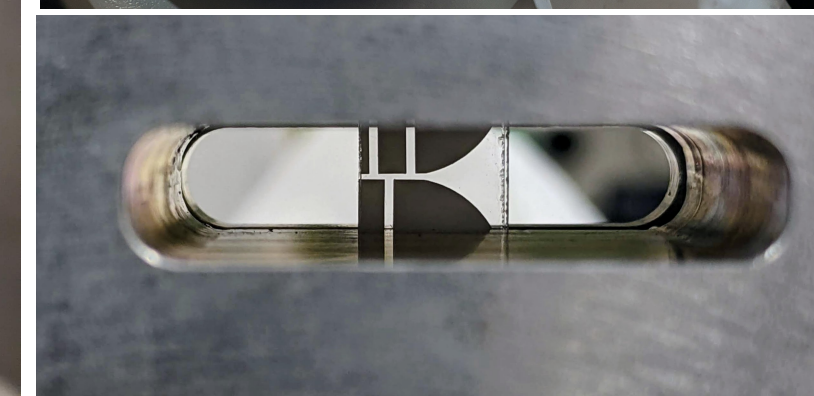
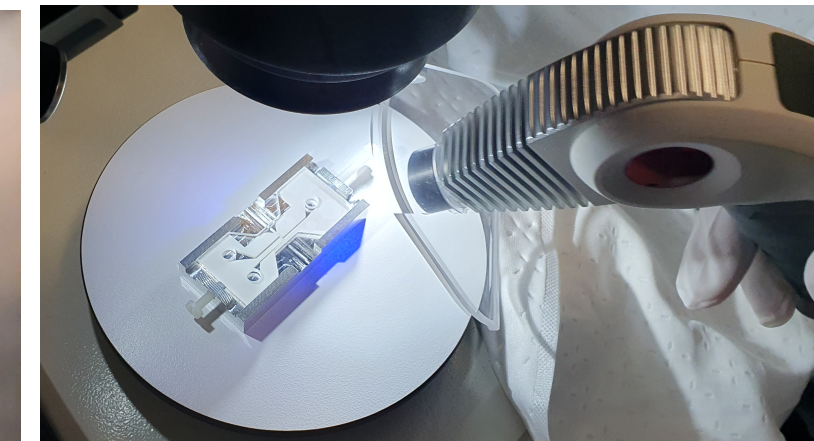
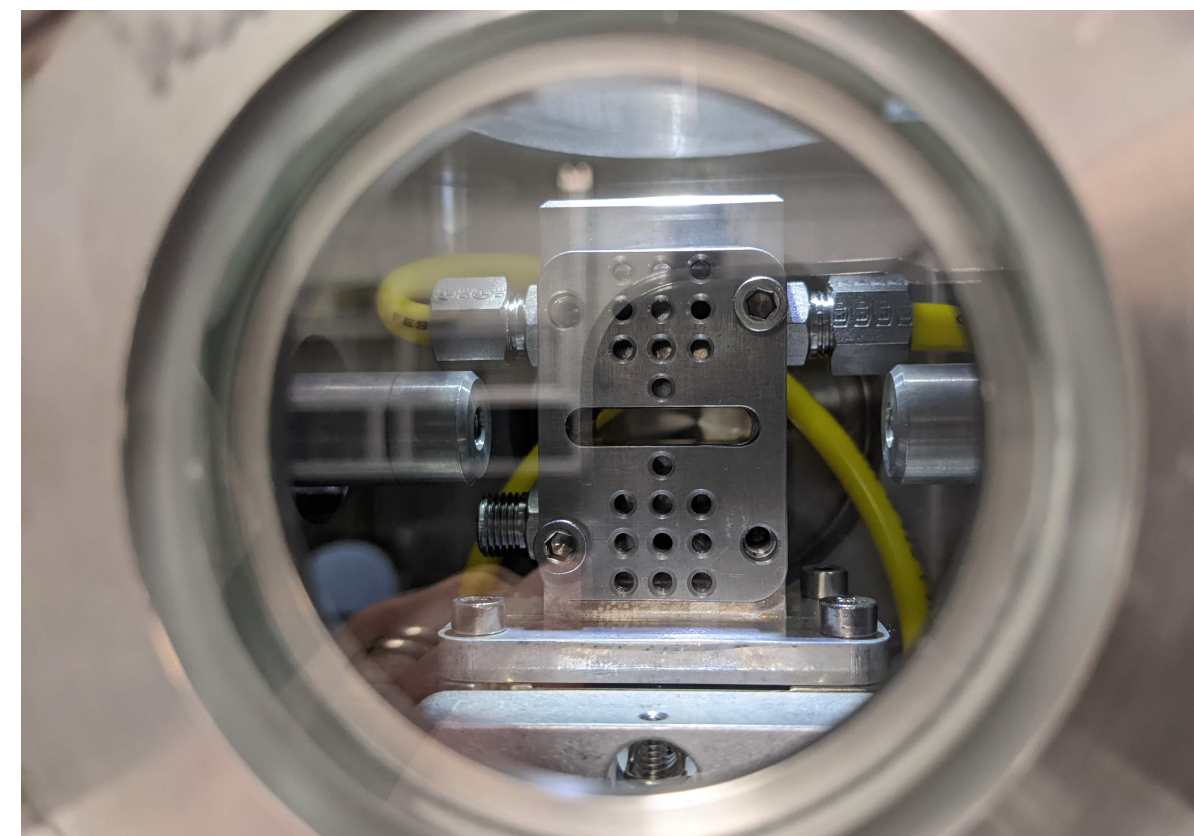
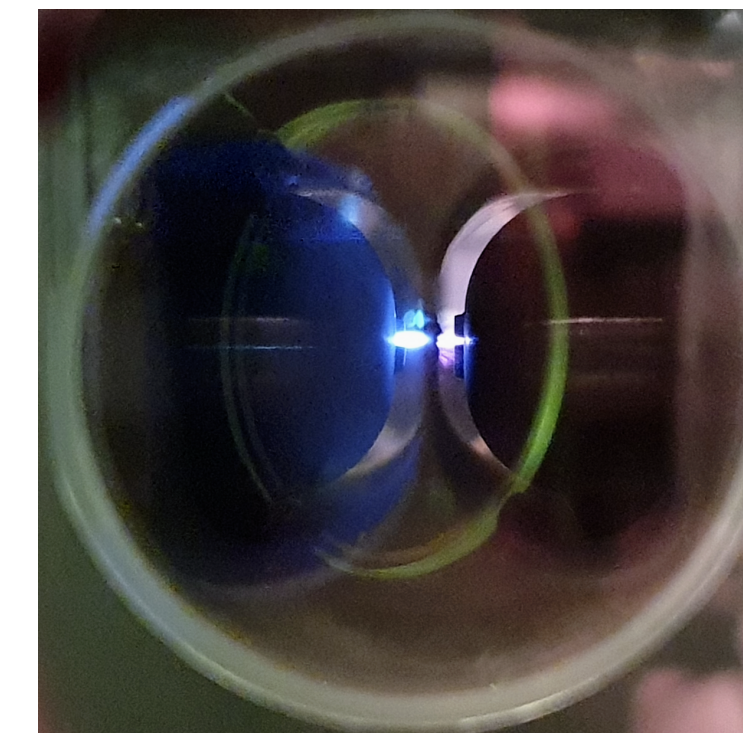
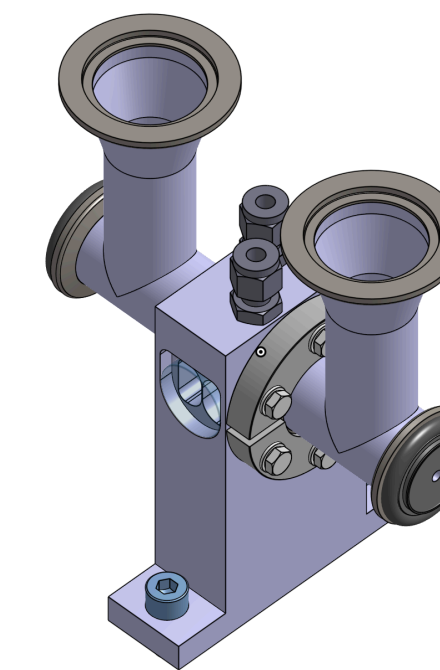
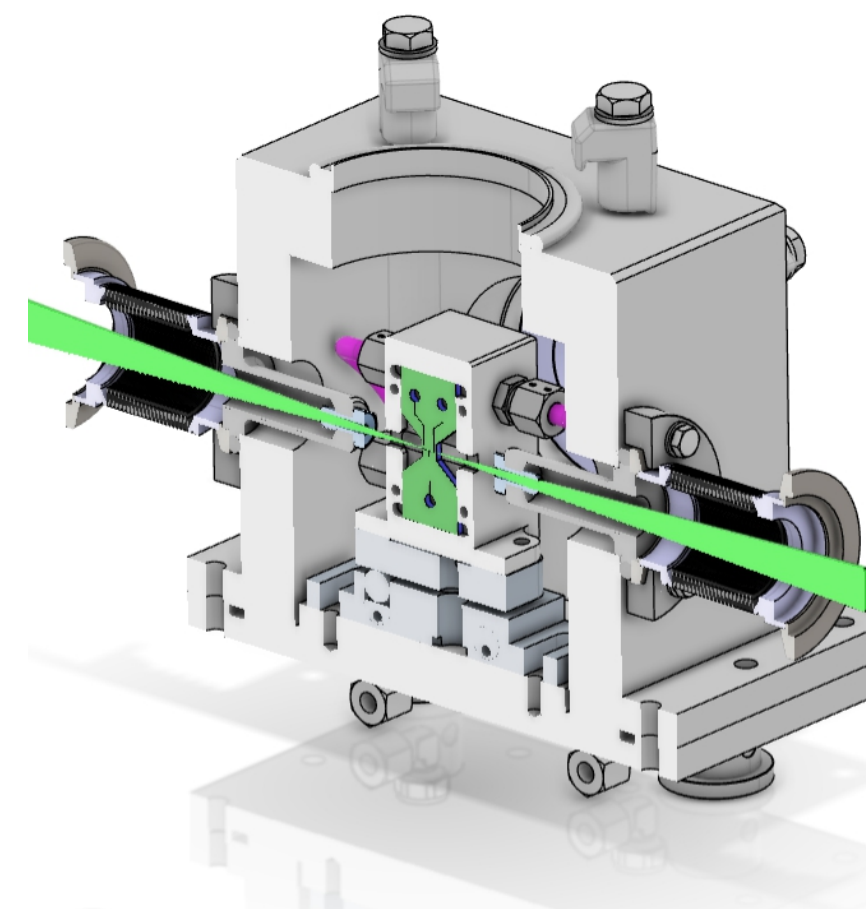


## R&D objectives

- Inline integrated target
- continuous gas flow operation
- Power dissipation
- Density out ramp control
- transverse optical access for diagnostic

## Gas cell type

- Channel type
- Gas slab type
- Variable length cell (ELISA LPGP)
- Waveguide structure (LPGP)





# Gas cell target test bench & test facilities



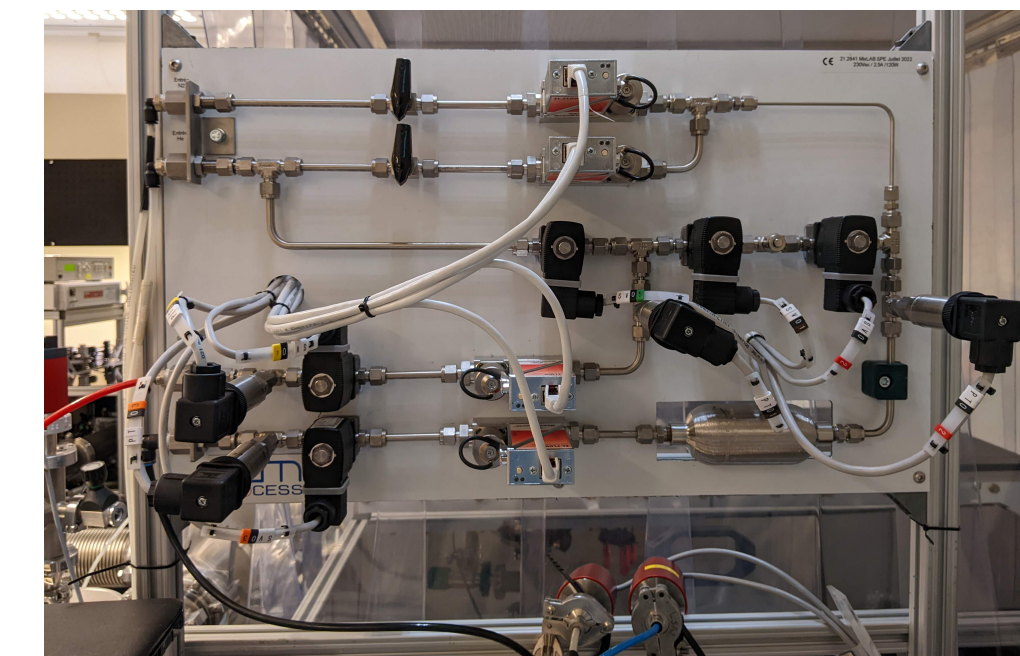
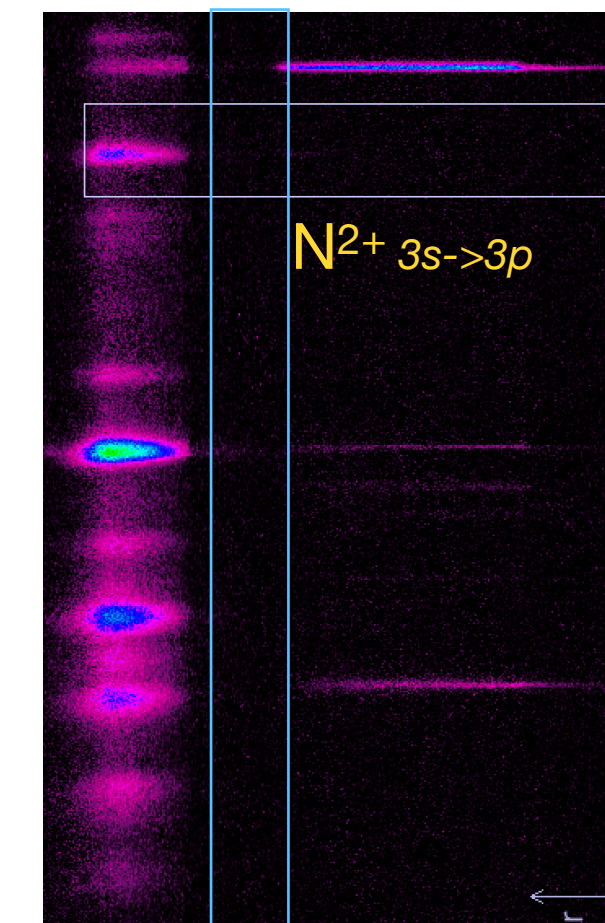
## Currently : dedicated test bench for inline plasma target

2.5 TW 10Hz, 50 fs laser with synchronized probe [- 50 ;+ 150 ps ]

Plasma diags :

- density measurement (SID4-HR),
- visible spectroscopy (2D imaging spectrometer)
- target lifetime diagnostics / aperture imaging

+ national (LOA) and European collaboration in EuPRAXIA framework (LNF)



## By 2024 : PALLAS test facility

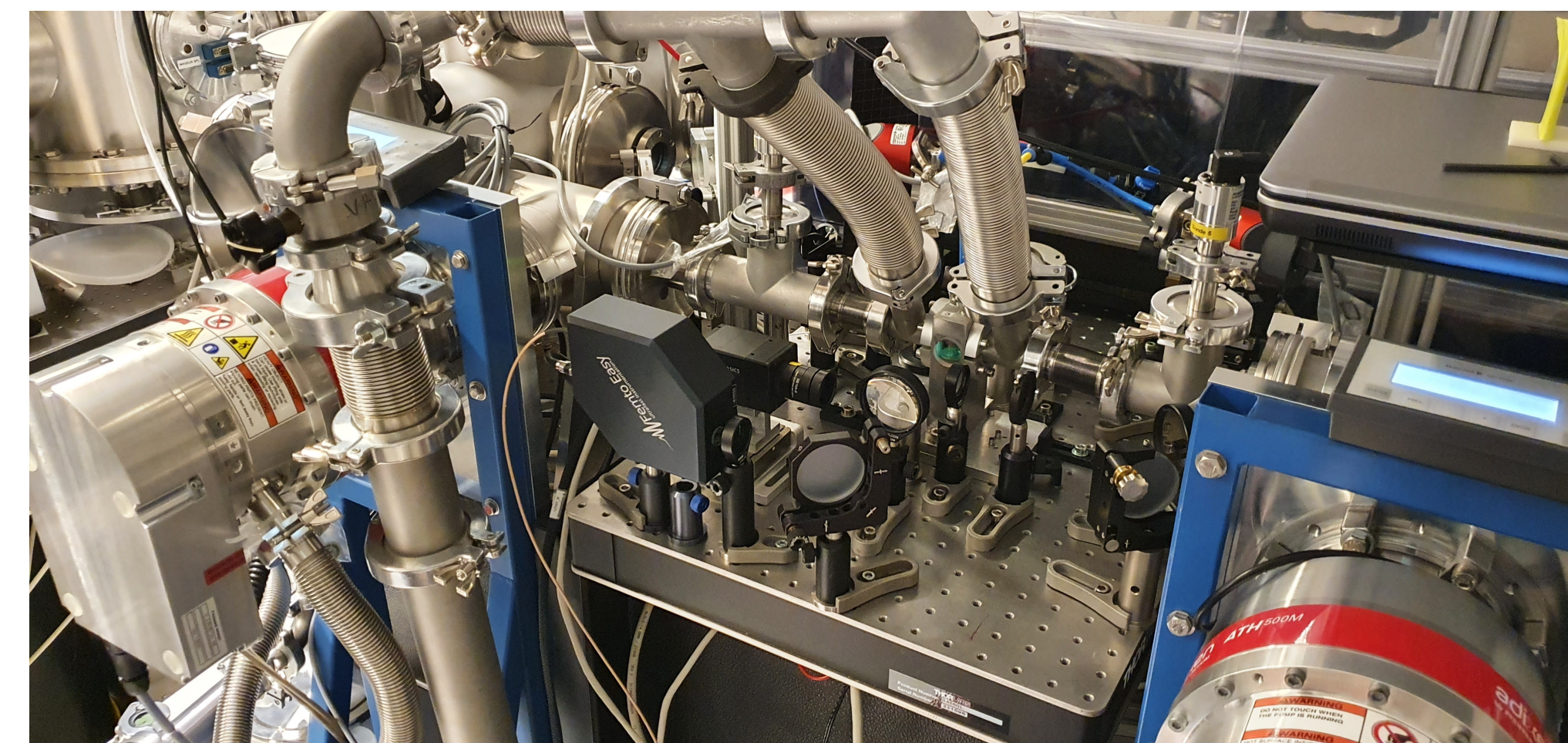
50 TW 10Hz laser driver with advanced control inline target positionner

With complete characterization e- beamline (beam transport focusing, spectra, charge, position, ... ) emittance, collimation studies

**Beam time :** 22 weeks / year + extra on test bench

**Resources :** one team ~ 10 FTE

**Funding :** ANR-PACIFICS, IN2P3-PALLAS



Developing industrial collaboration for target manufacturing



## French groups can address various key development for EuPRAXIA plasma component

- Available facilities and test bench for *laser-driven components*
- Scientific and industrial network
- Current development and expertise on simulation workflow for target design :
  - CFD for target design
  - Fast PIC simulations
  - Multi physics
- Development of micro mechanic of ceramic, gas flow management and heat dissipation optimized components
- Willing to settle coordinated work on plasma target at the national level and with EuPRAXIA European partner
- Limited funds to address more advanced specific EuPRAXIA needs on plasma target
  - Funds for post or engineer of 24 month at least.
  - Funds for 2 PhD