

EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS



WP12 Key technologies for compact accelerators

Antoine Courjaud - AMPLITUDE



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101079773

Liquid cooling of multidisks is the **key enabling technology** for high rep rate PW lasers

Pump development



2016

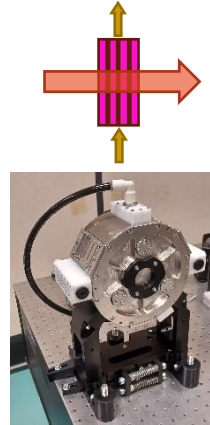


2019

50J
10Hz



2022



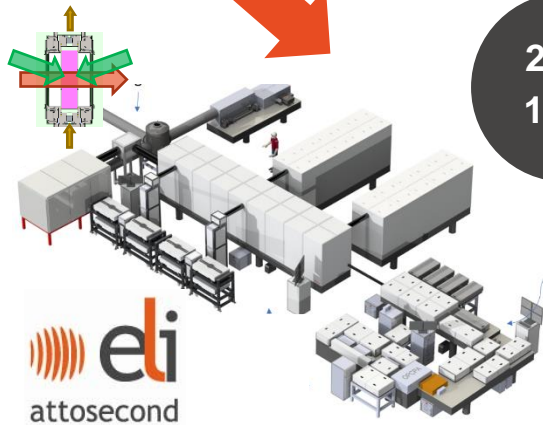
2025

3-10J
100Hz

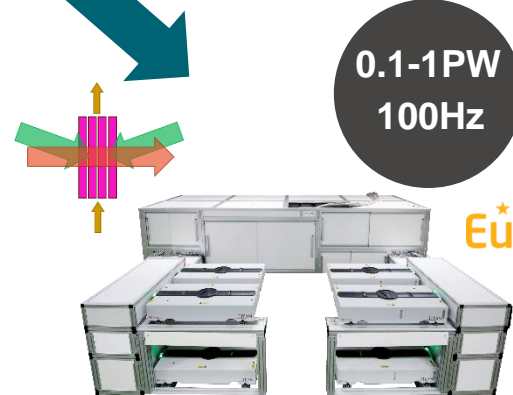
2028

2031

Laser driver development



2PW
10Hz



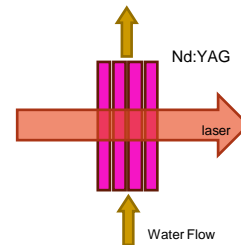
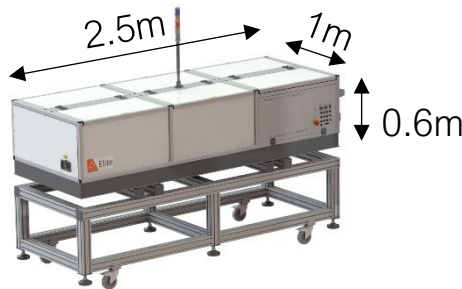
0.1-1PW
100Hz

Requirement : pump for 0.1 to 1PW 100Hz lasers

- > Multi-Joule (>5J)
- > Simple and robust
- > Compact
- > Efficient

Pump development

- > 3-10J 100Hz @532nm (upgradable 200-500Hz)
- > Multidisc **Nd:YAG diode-pumped** heads
- > Longitudinal liquid cooling
- > **Modular** architecture
- > Compatible with OPCPA pumping

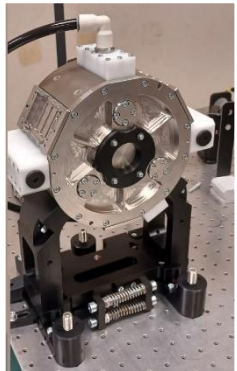


Current status : Laser head validation

- > Consistent gain & gain homogeneity
- > Cooling efficiency
- > Low wavefront distortion

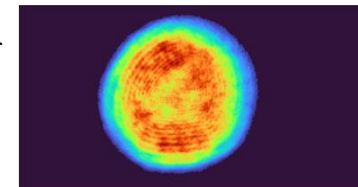
Next steps

- > 10J laser assembly and commissioning
- > Operation planned 2026

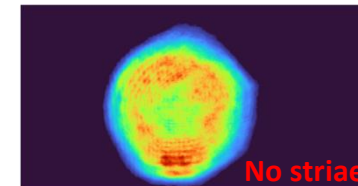


unpumped amplifier

5m seeder propagation

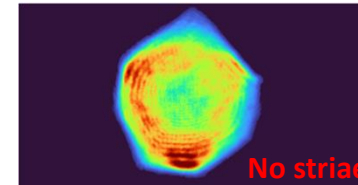


100Hz operation

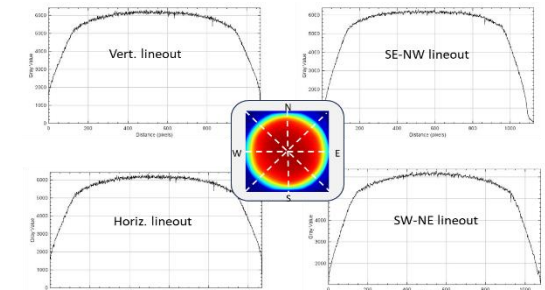


No striaes !

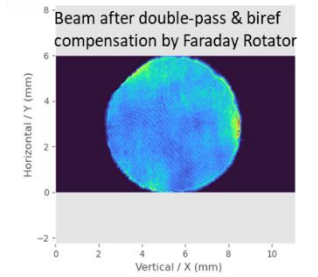
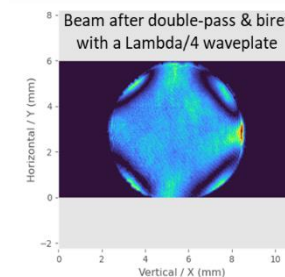
200Hz operation



No striaes !



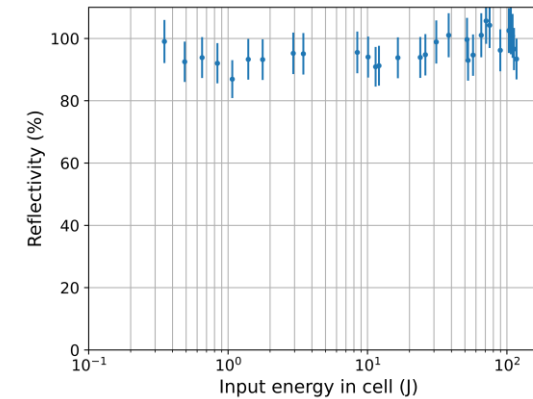
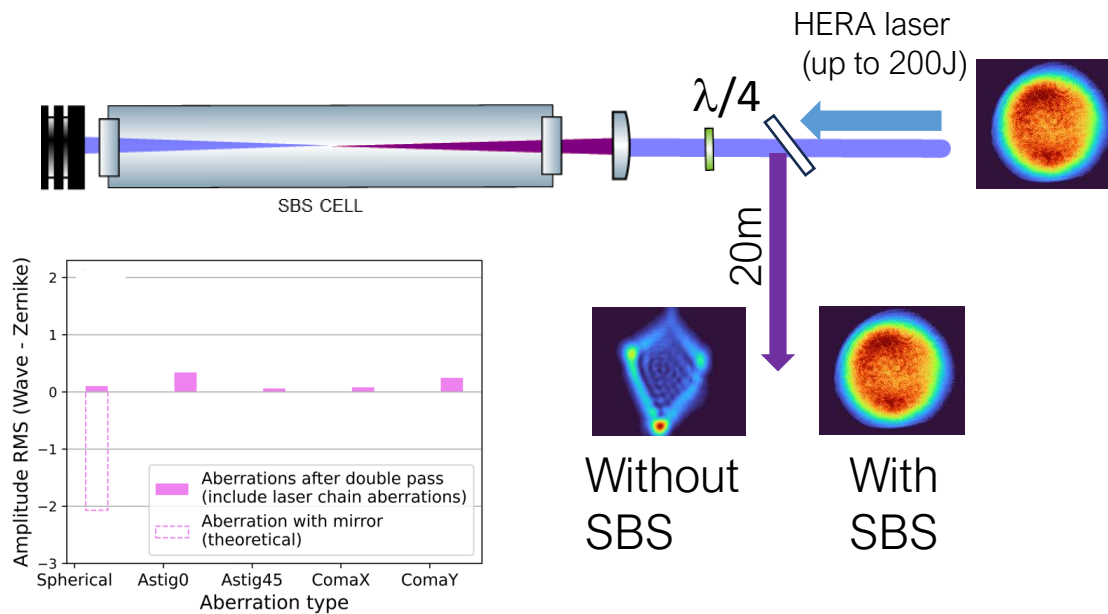
Double-pass amplification & birefringence



Collaboration with



- > **Passive** wavefront compensation using SBS mirror
- > 95% reflection measured up to 120J input energy
- > Ideal solution to be integrated in 100Hz pump laser



- > 100Hz PW ultrafast amplifier
 - > Water cooling - Longitudinal heat extraction
 - > multidisk **Ti:Sa**
 - > Modular architecture : 4 to 40J

- > 100Hz PW compressor
 - > **Retex from 10 years** TiSa laser 250mJ 100Hz (LP3-France)
 - > Design based on **MLD gratings**
 - > Capitalize our experience with **kW Yb** lasers

- > Control-command
 - > Diagnostics & metrology
 - > **Active stabilization** of critical stages

