



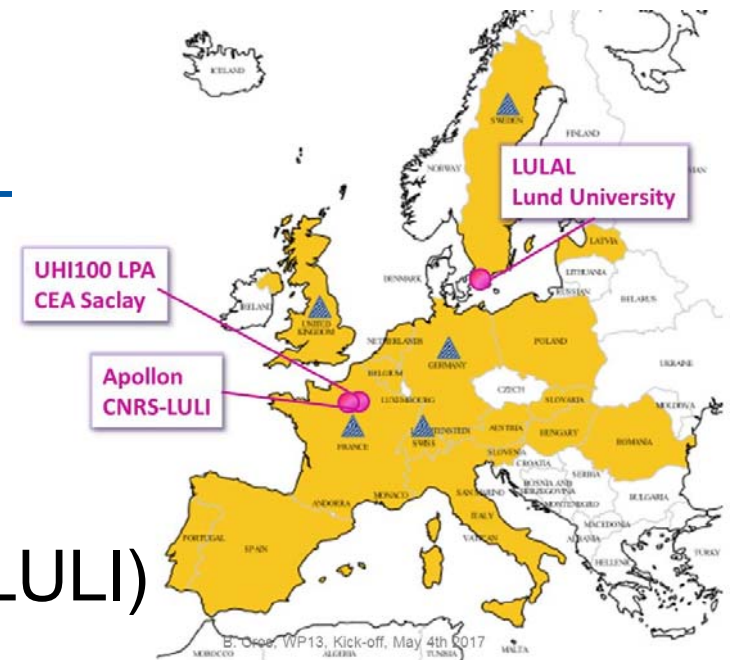
WP13: Access to Plasma Beam testing facilities

Budapest / April 10th, 2019/ 2nd Yearly meeting

Brigitte CROS / CNRS - LPGP

Overview

- 3 facilities offering TA in WP13:
 - LULAL (Lund University)
 - UHI100 LPA (CEA LIDYL)
 - APOLLON MUST-LPA (CNRS LULI)



- Status of WP13 access
 - Continuous submission for UHI100 LPA and LULAL
 - 2 projects performed at UHI100 LPA
 - 2 projects accepted for LULAL
 - Proposals welcome for APOLLON

UHI100 Facility : electron bunch acceleration and transport

- **CEA LIDYL**
- 2 projects performed (2018,2019)
- For ARIES users, access to
 - **UHI100 experimental area** devoted to electron acceleration
 - Laser plasma **electron beamline** equipped with state-of-the-art instrumentation
 - **Electron bunches** (50-200 MeV)
- Opportunity to test concepts or equipment before experiments with APOLLON facility
- Scientific contact: Sandrine Dobosz-Dufrénoy,
sandrine.dobosz@cea.fr

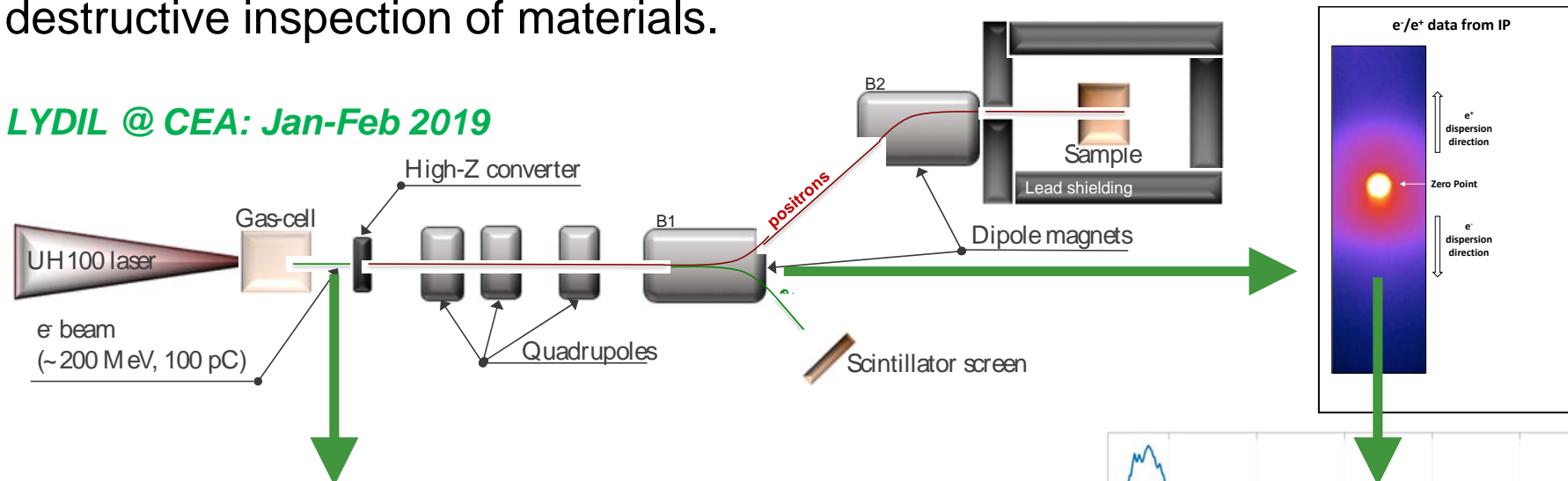




Low-energy positrons for high-resolution non-disruptive inspection of materials

RATIONALE: generation and characterisation of dense populations of low-energy (sub-MeV) and ultra-short duration (\sim ps) positrons to be used for advanced non-destructive inspection of materials.

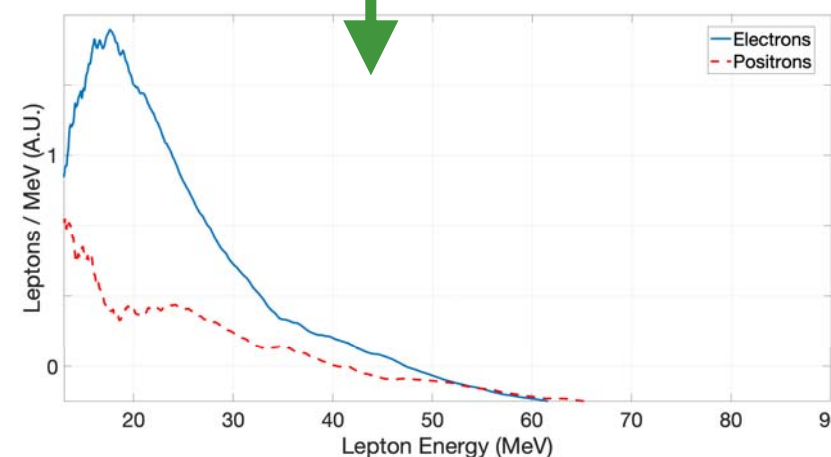
LYDIL @ CEA: Jan-Feb 2019



Typical electrons from the plasma accelerator

Electron beam divergence $\sim (1.9 \pm 0.2)$ mrad

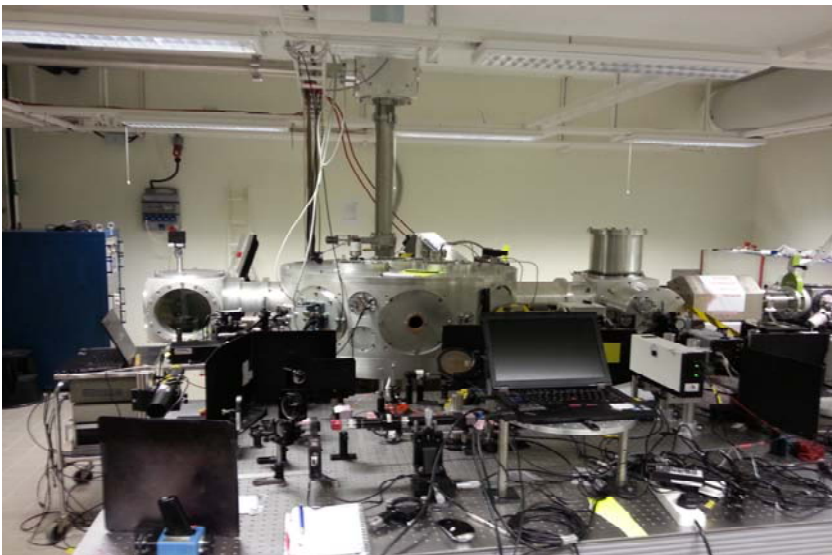
Electron overall charge ~ 50 pC



N.B. data currently being analysed to extract the characteristics of the positron beam

LULAL access and status

- Facility in operation: 2017-2021
 - Recent upgrade of laser energy (2J BComp now available)
 - Electron transport funded, implementation in progress
- 2 experiment campaigns accepted for 2019
 - Scientific collaboration with the hosting research team
 - Scientific contact: Olle Lundh, olle.lundh@fysik.lth.se
- Multistage Laser and Beam Driven Plasma Accelerator,
 - PI : G. Raciukaitis (FTMC), Vilnius, Lithuania
- Testing plasma accelerator source for EuPRAXIA,
 - PI: M. Streeter (ICL), London , UK



Multistage Laser and Beam Driven Plasma Accelerator

*Testing of femtosecond laser micro-machined supersonic gas jets for
LWFA and X-ray emission*

Performed Feb 2019 (120 hours, 3 weeks)

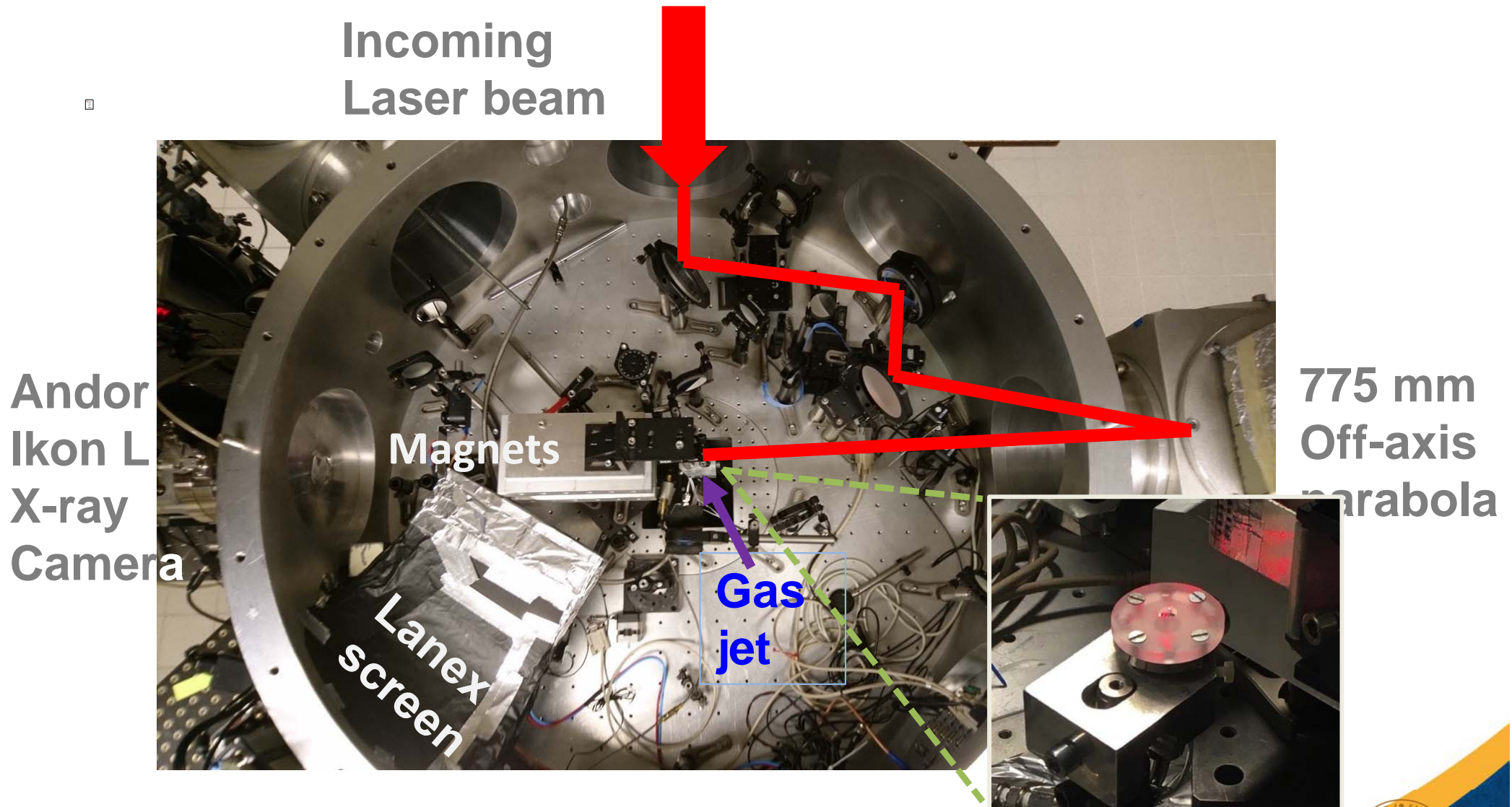
User team: V. Tomkus¹, V. Girdauskas², G. Raciukaitis¹ (PI), V. Stankevic¹, J. Dudutis¹

¹Center For Physical Sciences and Technology (FTMC), Vilnius,

²Lithuanian University of Educational Sciences (VDU), Vilnius, Lithuania

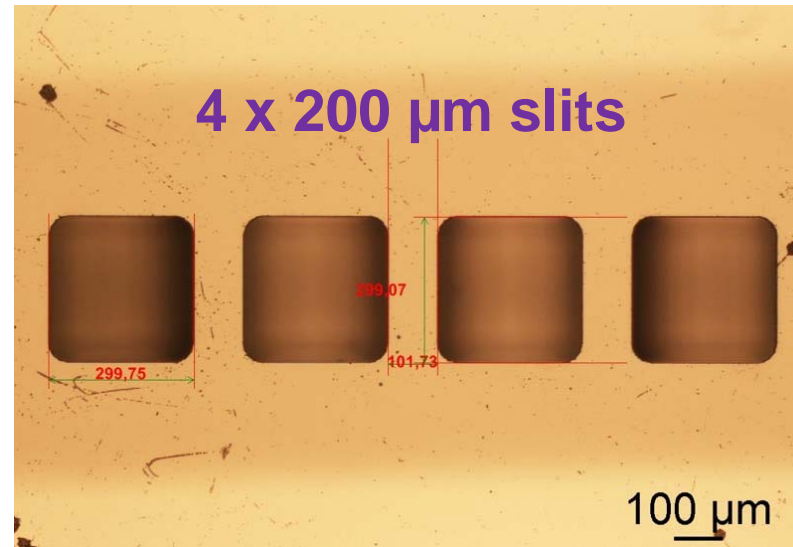
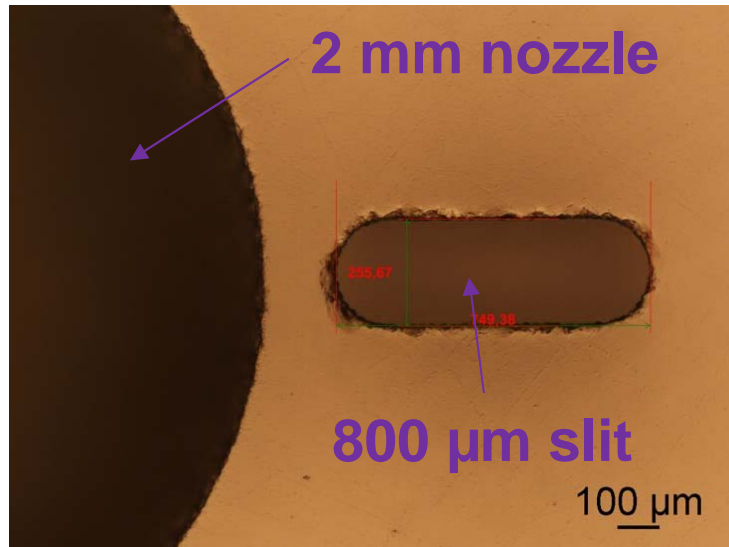
Local team: I. Gallardo González, D. Guénot, J. B. Svensson, A. Persson and O. Lundh

Experimental Setup

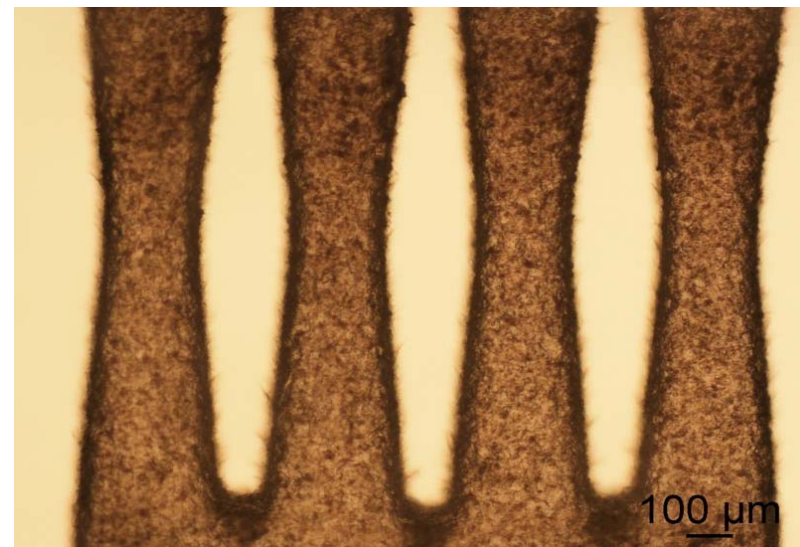
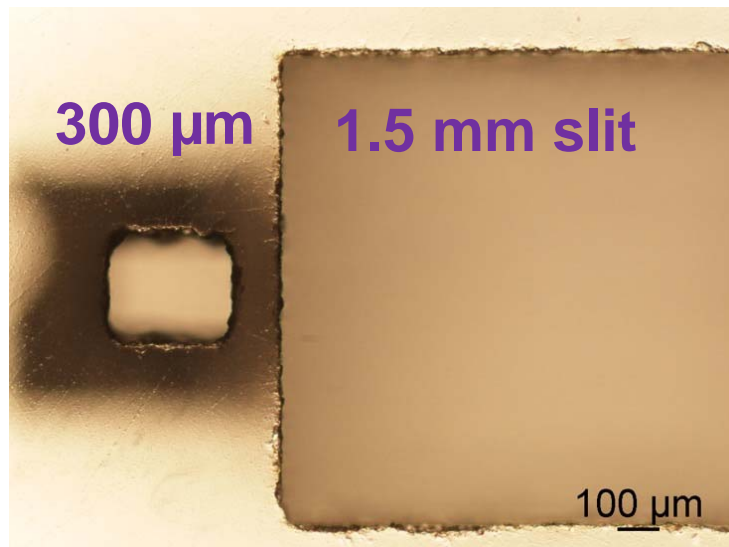


800 nm, 900 mJ, 30 fs, FWHM = 13 μm / 8 μm

Laser-machined micro-nozzle arrays



1 x 800 μm
4 x 200 μm



1 x 300 μm
□ 1.5 mm
4 x 200 μm

De Laval nozzle shapes

EuPRAXIA ARIES Project

Testing plasma accelerator source for EuPRAXIA

Full simultaneous characterization e-beam and laser parameters

Planned Nov 2019 (160 hours, 4 weeks)

User team

M. Streeter¹ (PI), B. Cros², F. Filippi³, S. Dobosz⁴, A. Kim⁵, N. Lopes⁶,
C. Murphy⁷, Z. Najmudin¹, R. Pattathil⁸, G. Maynard², S. Hooker⁹

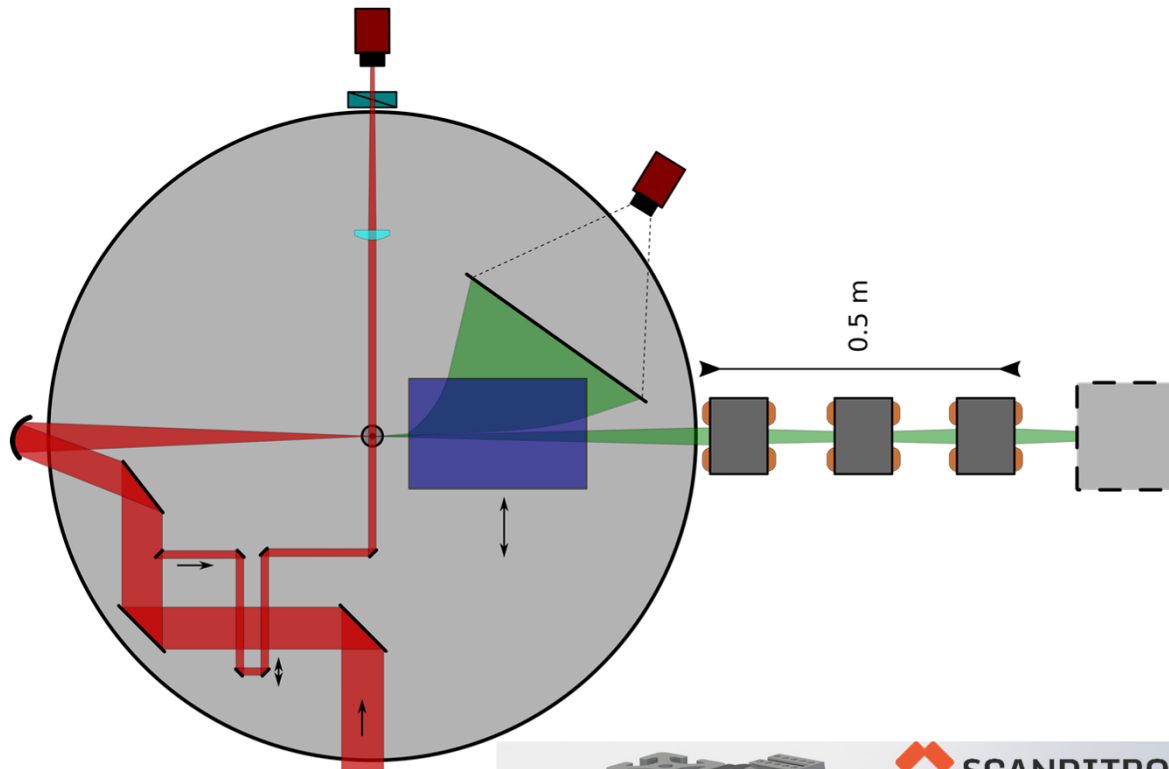
¹Imperial College, UK ²CNRS, France ³INFN, Italy

⁴CEA, France ⁵U Paris Sud, France ⁶IST, Portugal

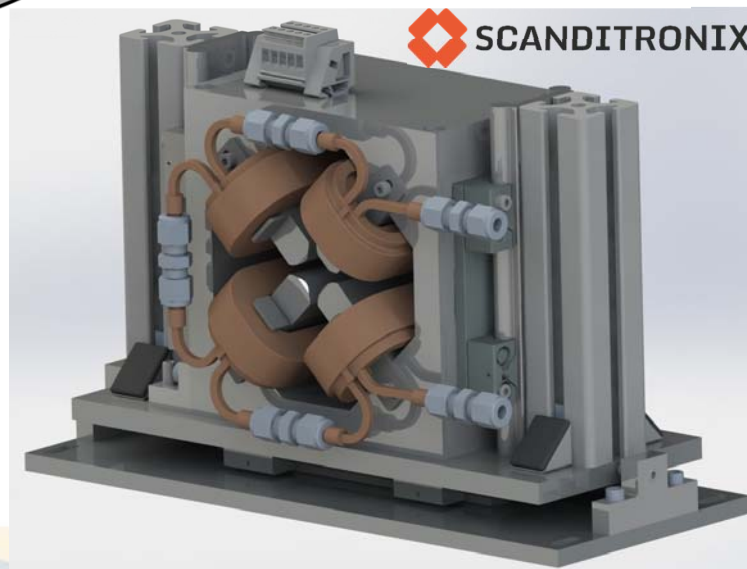
⁷U of York, UK ⁸CLF, UK ⁹Oxford U, UK



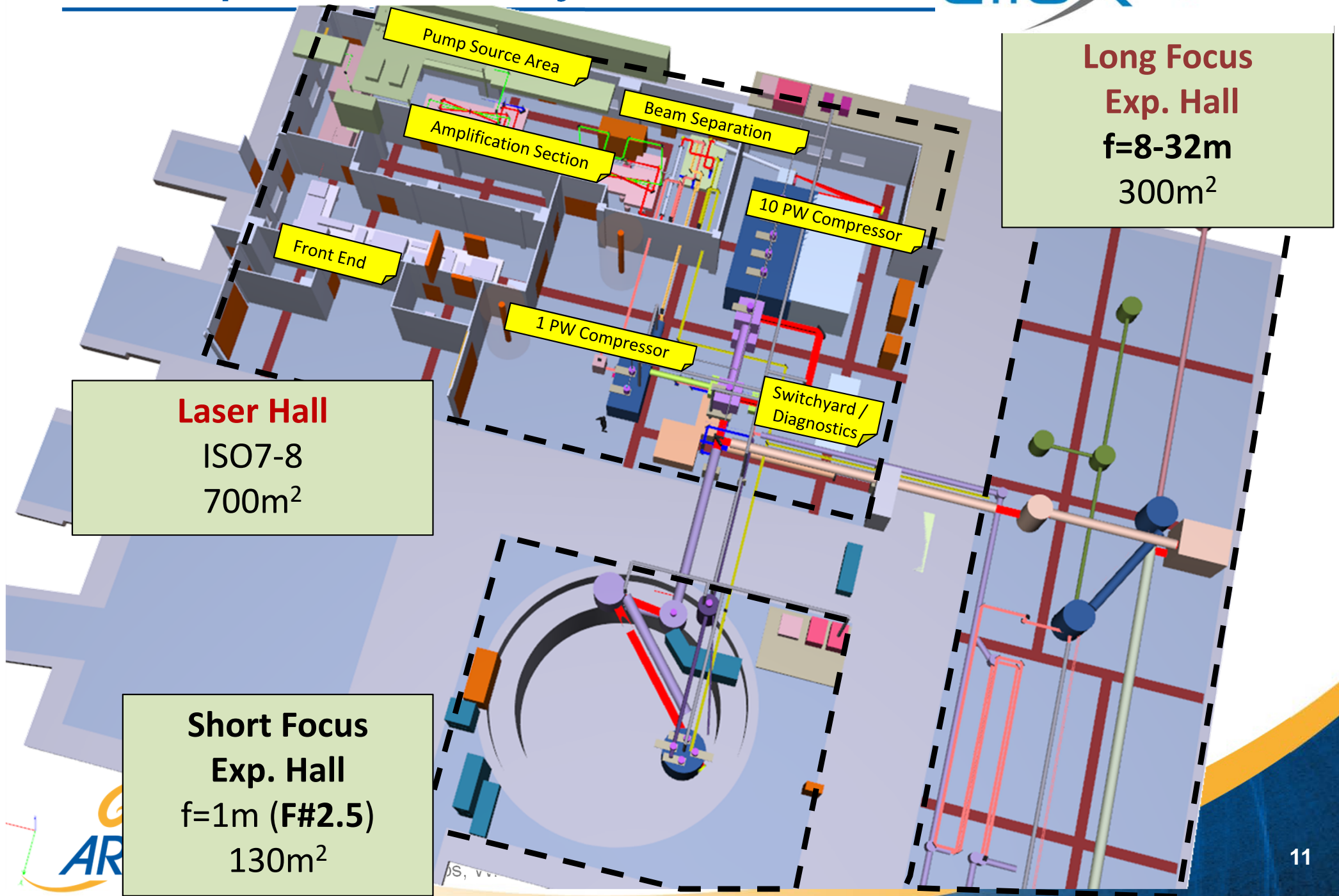
LWFA Beam transport for beam testing



- Will be available for experiments autumn 2019
- Compact re-imaging line
 - $g \lesssim 55 \text{ T/m}$
 - Focus $E \lesssim 260 \text{ MeV}$
- Adaptable for experiments, e.g.
 - VHEE radiotherapy
 - Radiation damage
 - Secondary sources
 - Diagnostics
 - ...



The Apollon Facility



❑ 1.1 PW milestone (at the exit of the compressor) has been reached on December 2018.

❑ Commissioning of the PW beam under way

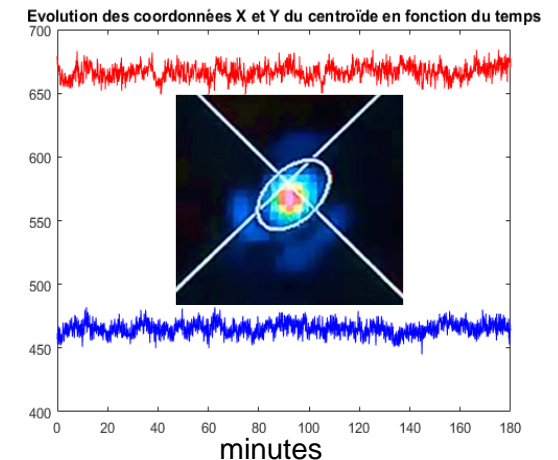
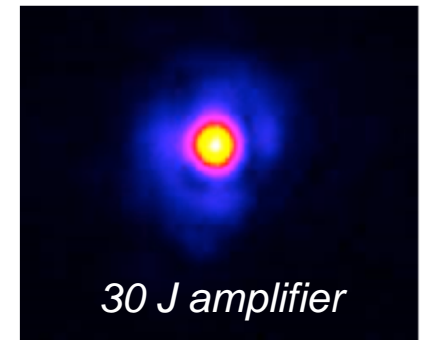
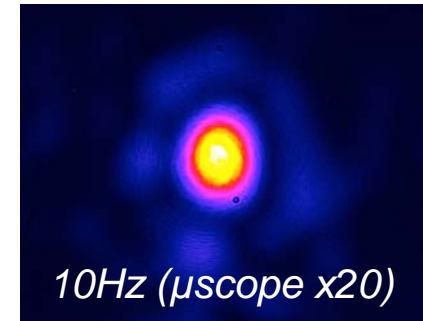
⇒ About 18J available in the experimental hall.

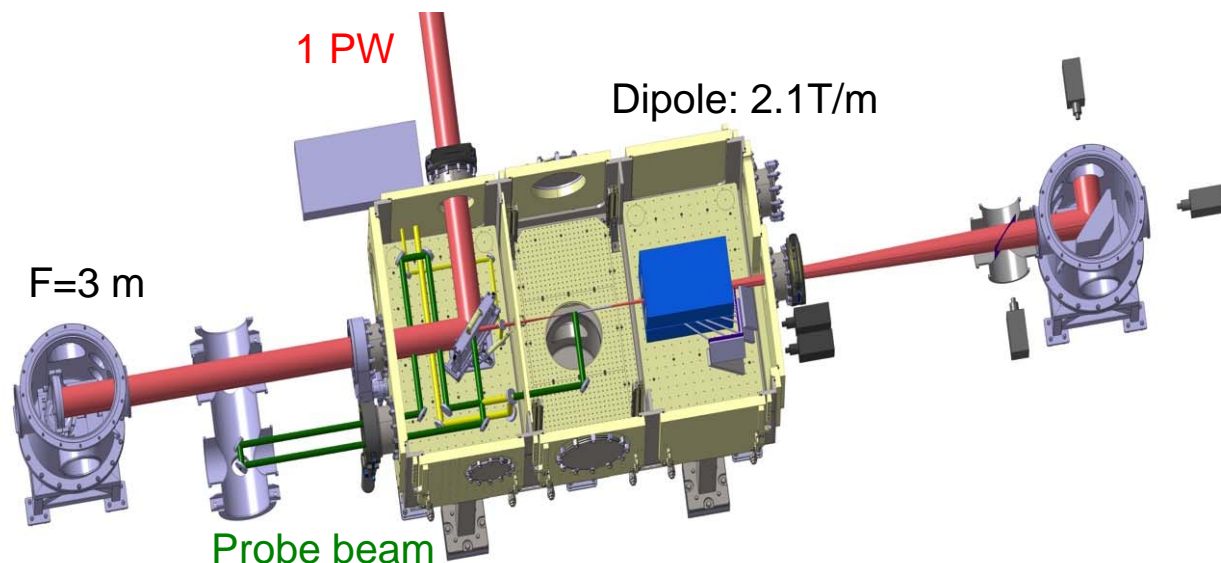
⇒ Pulse duration around 22 fs.

⇒ Strehl ratio of ~ 0.5 measured at the experimental chamber centre using the 10 Hz alignment laser.

⇒ Strehl ratio of ~ 0.6 measured at the end of the last amplifier running at full energy (30J).

⇒ Shot-to-shot stability measured over 3h to be around 15 μrad (real values are expected to be better due to the low dynamic of the camera. Extra measurements under way).





- A collaborative experiment: LLR , LOA, CEA-LIDYL, LAL, LEDA, SOLEIL, LPGP
- Electron beam: Few GeV, few 10's pC expected.
- The experiment is under construction.
- First electrons are expected by end of spring 2019 - early summer 2019.
- **Save the dates:**
 - ⇒ Call for external user experiments by end of year 2019 (experiments starting on September 2020).
 - ⇒ Apollon Users meeting on Fall 2019.

Summary

- Access to electron bunches driven by laser in plasma was provided at UHI100 LPA and LULAL facilities
- Users are invited to contact WP13 coordinator or facility contacts to prepare proposals
- First electrons expected in June 2019 at APOLLON (contact B Cros for access): interested ARIES users are welcome during commissioning for collaborative projects with internal teams



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 730871.



Thank for your attention