

SourceLAB

High Rep Rate Particle Source for Advanced Material Inspection

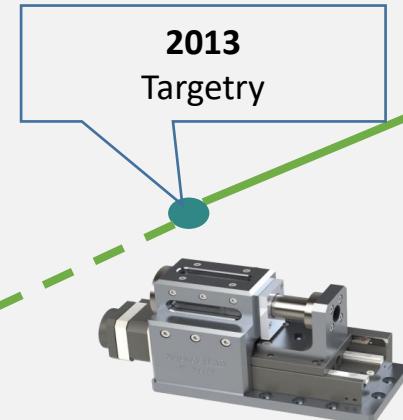
François Sylla, PhD

JuSPARC Workshop - March 2019

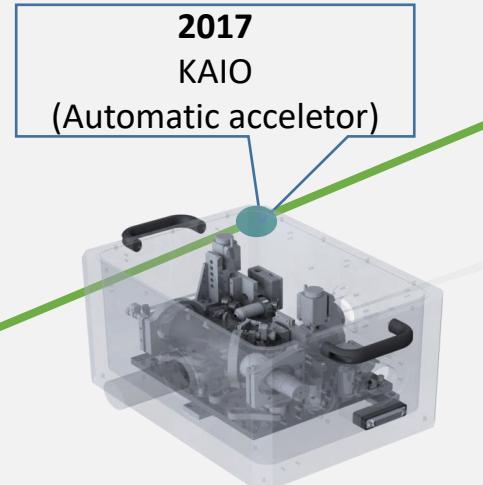
SourceLAB – founded in 2013

LOA spinoff, at Ecole Polytechnique (Paris – France)

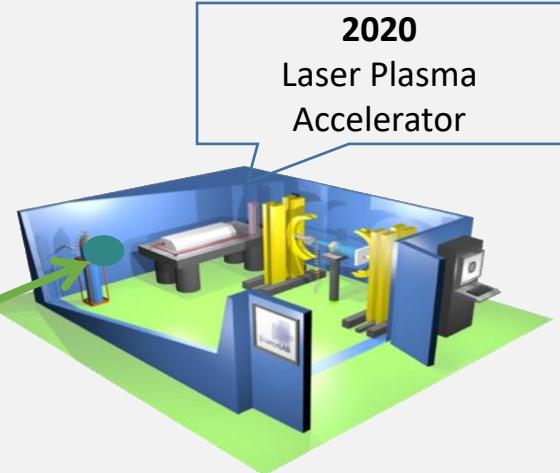
2



Components



Integration



Full system

Particle accelerators support every year 500 bn\$-value markets

3

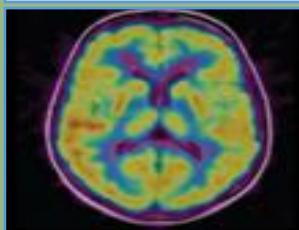
Health & Medicine

Industry & Environment

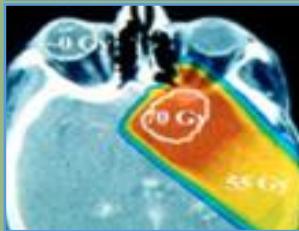
Security & Defense

Research & Cultural Heritage

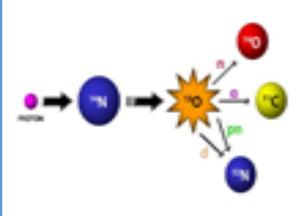
Imaging



Therapy



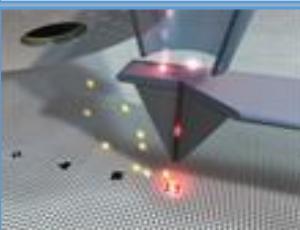
Radioisotope production



Non Destructive Testing (NDT)



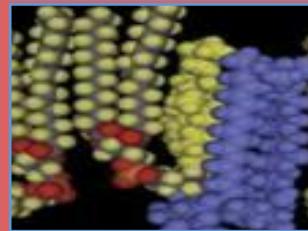
Ion implantation



Cargo scanning



Material characterization



Food sterilization



Emission reduction



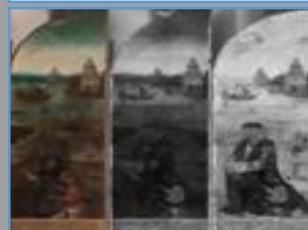
Radiation hardening



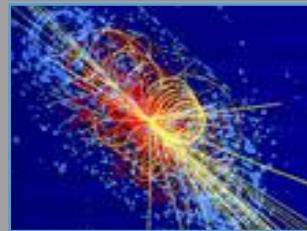
Plasma physics



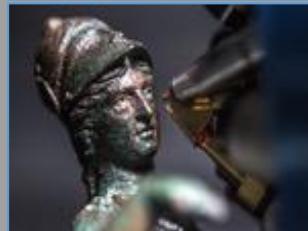
Imaging



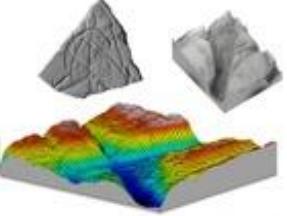
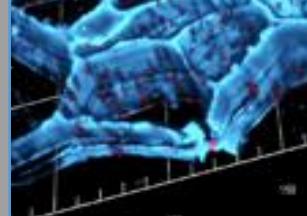
High energy physics



Layer inspection



2D/3D microscopy



Industrial Non Destructive Testing: The market

4



3000 installed sources:

- ~ +100 new each year
- ~ 100 M€ market for sources

Covered by 3 technologies:

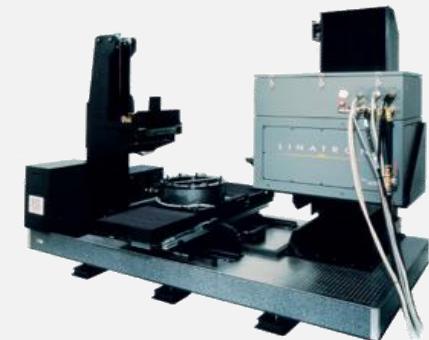
Gammagraphs:



X-ray tubes:

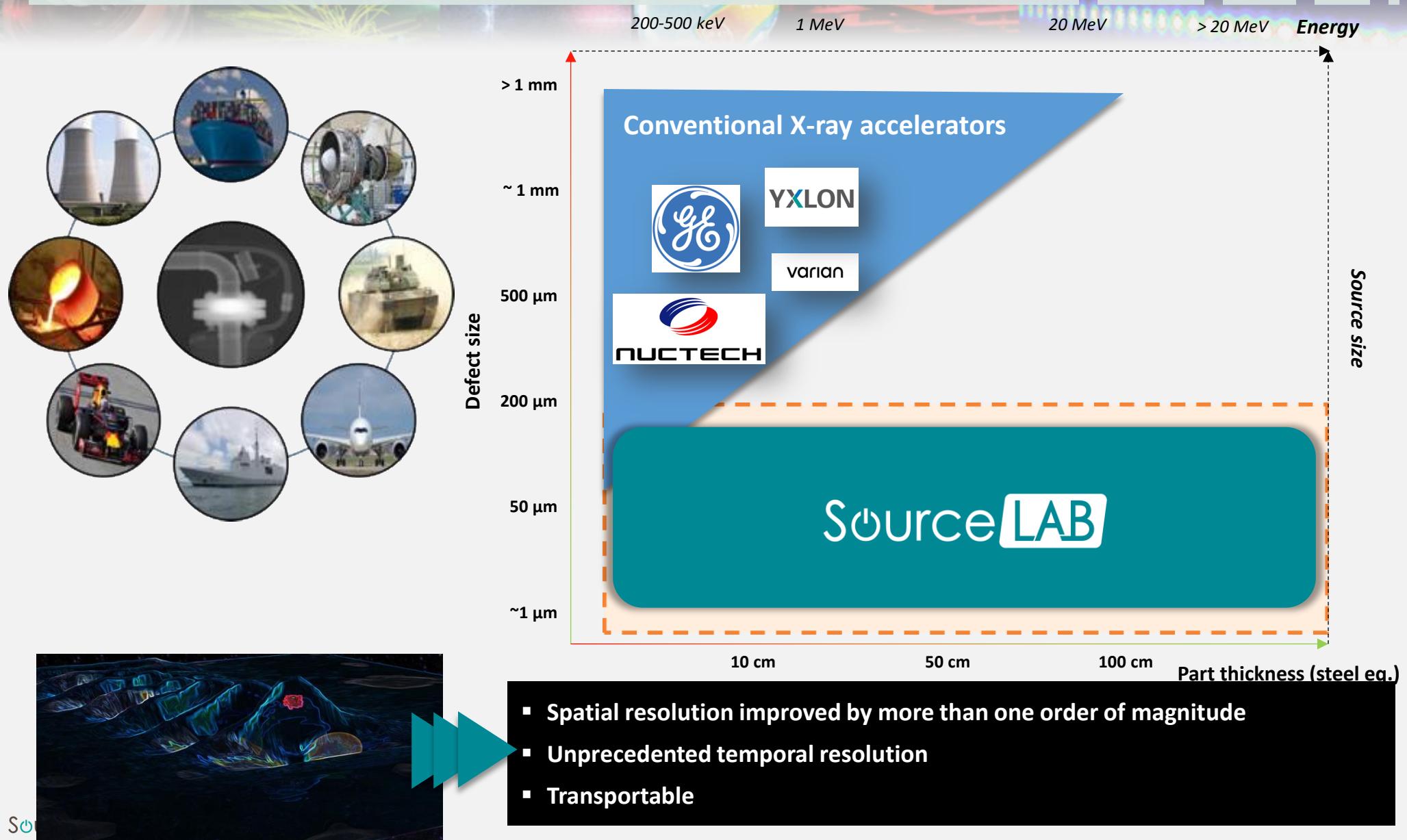


Linear accelerators:



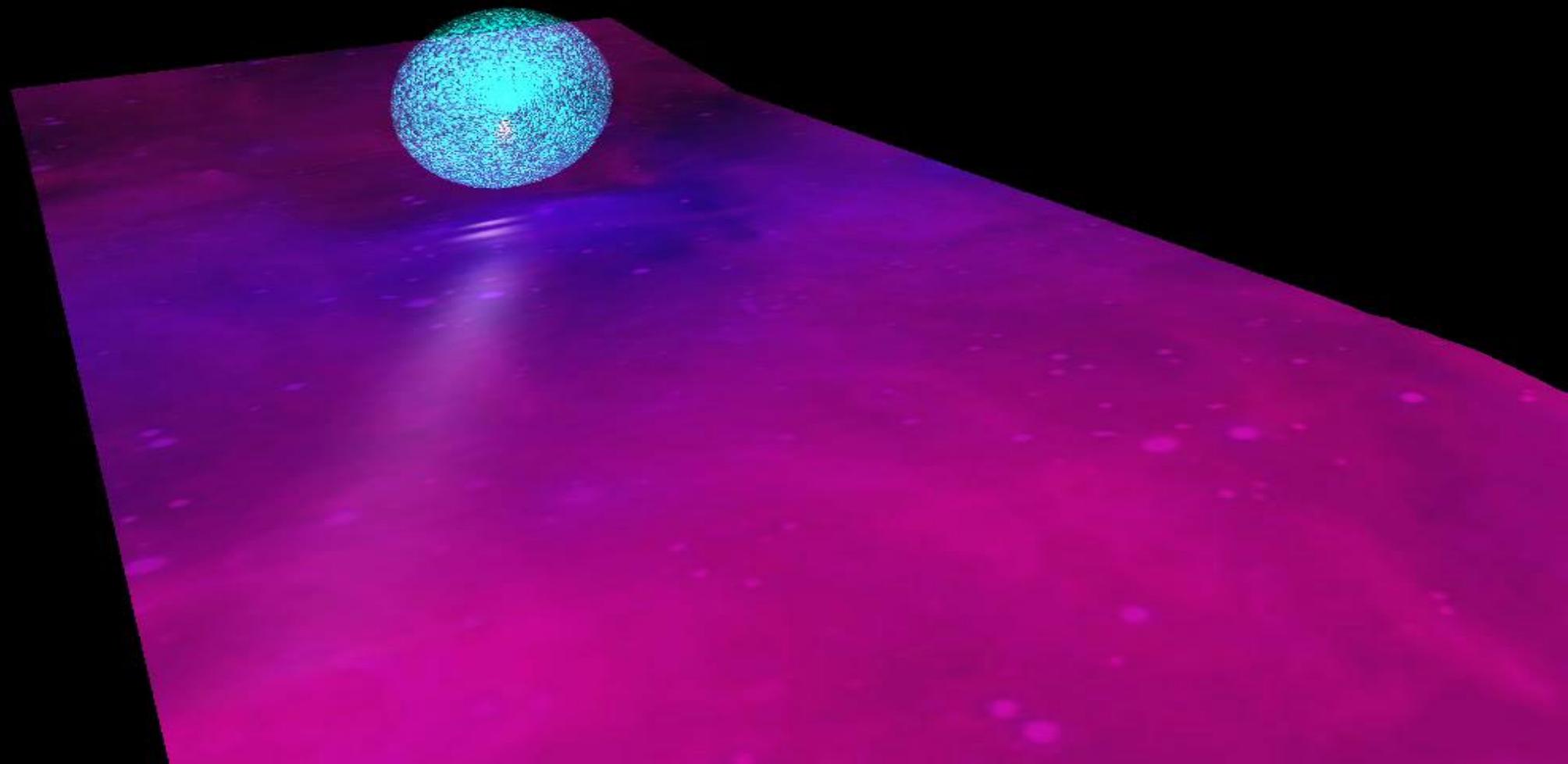
Our high-added value positioning in NDT market

5



Malka et al., *Science*, 298, 1596 (2002)

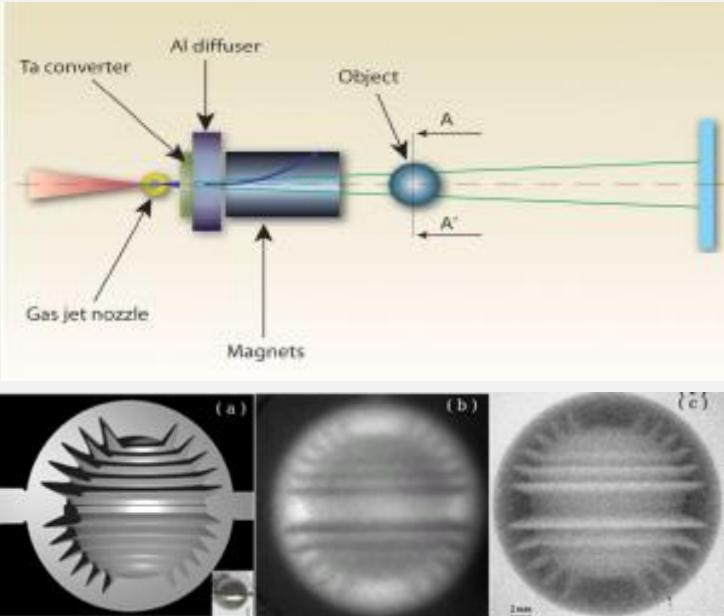
Faure et al., *Nature*, 431, 541 (2004)



NDT X-ray sources with a laser plasma accelerator

7

High energy source with Bremsstrahlung effect



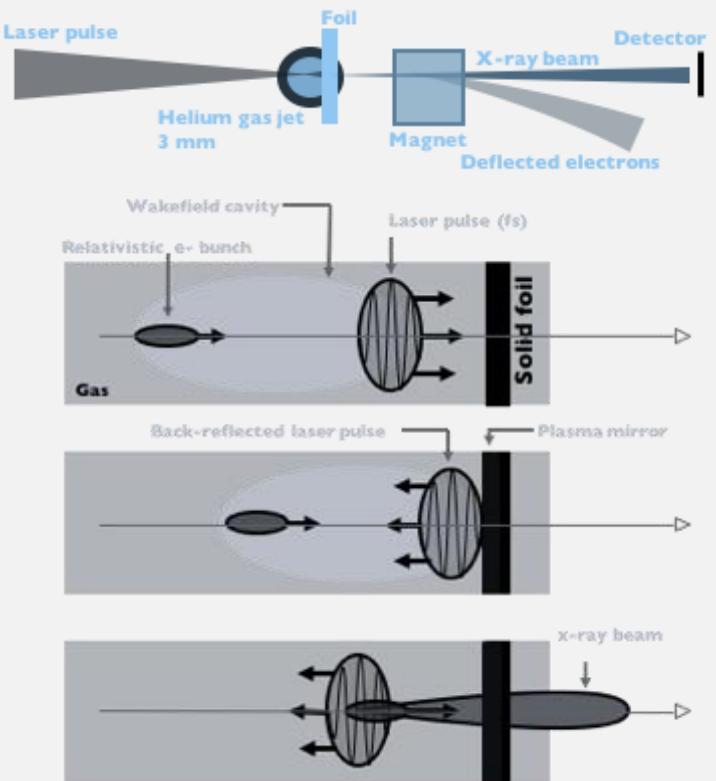
Energy: 1-100 MeV tunable

Resolution: ~50 μm

Flow: 1-10 Gy/min/m

- Glinec et al, Phys. Rev. Lett., 94, 025003 (2005)
- Ben-Ismael et al, Appl. Phys. Lett., 98, 264101 (2011)
- Guillaume et al, PRSTAB, 18, 061301 (2015)
- Döpp et al, NIMA, 830 (2016)

Micro focus source with Compton effect



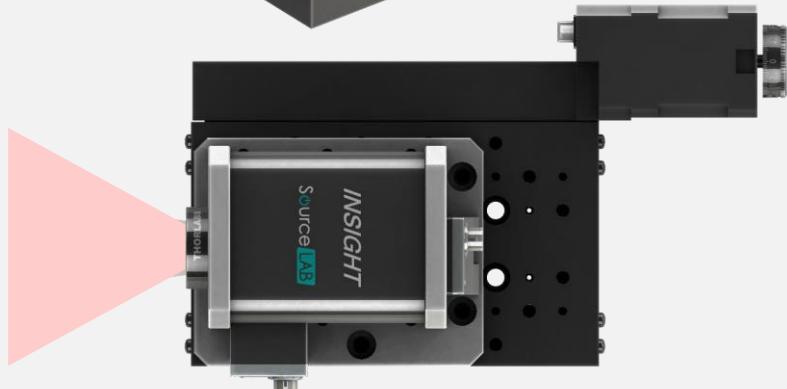
Energy: >100 keV

Resolution: 1 μm

- Ta Phuoc et al. Nature Photonics 6, 308-311 (2012)
- Corde et al, Rev. Mod. Phys., 85, 1 (2013).

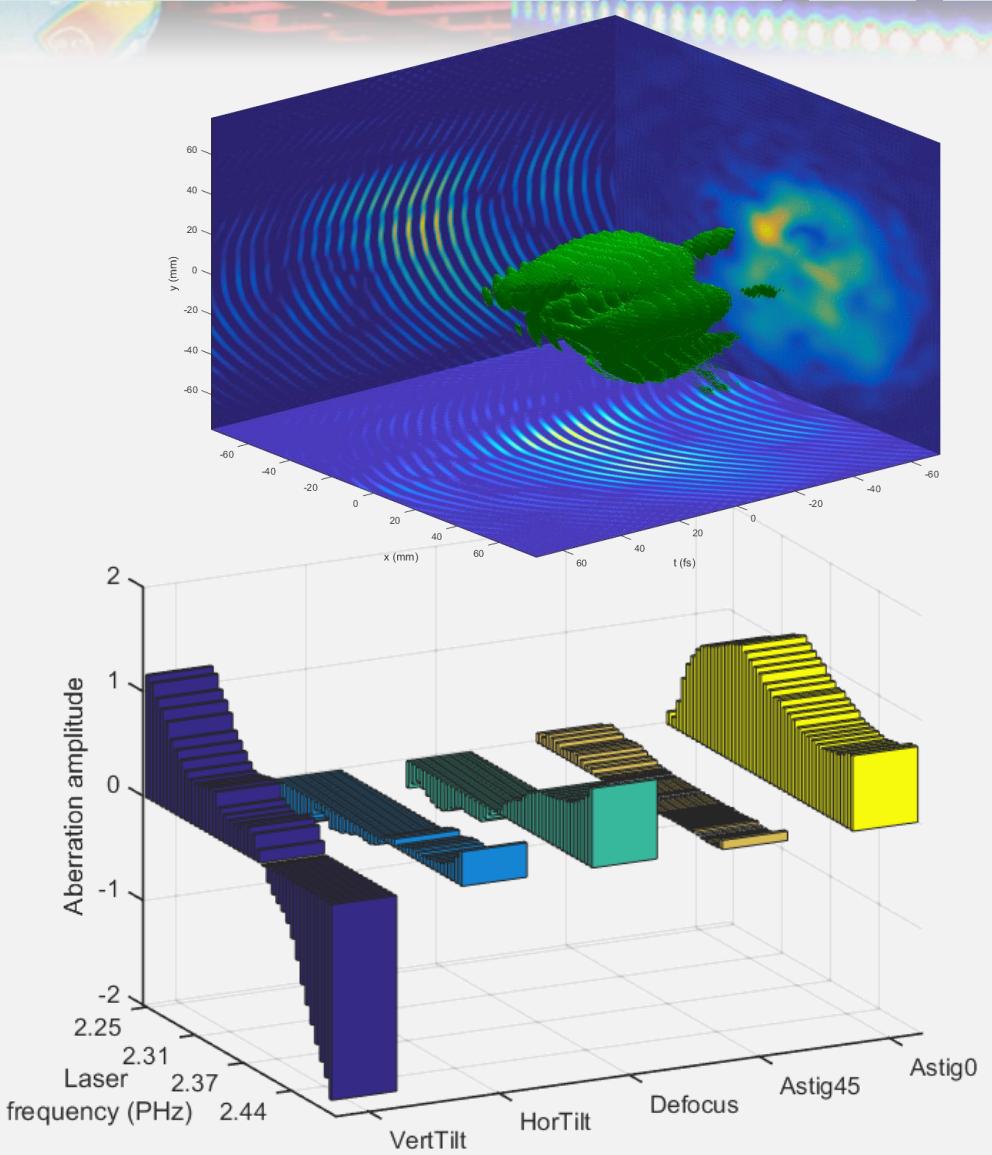
SL- Insight : Spatio-spectral 2D mapping at the focus

8



1 Hz: ~15min
10Hz : ~3min

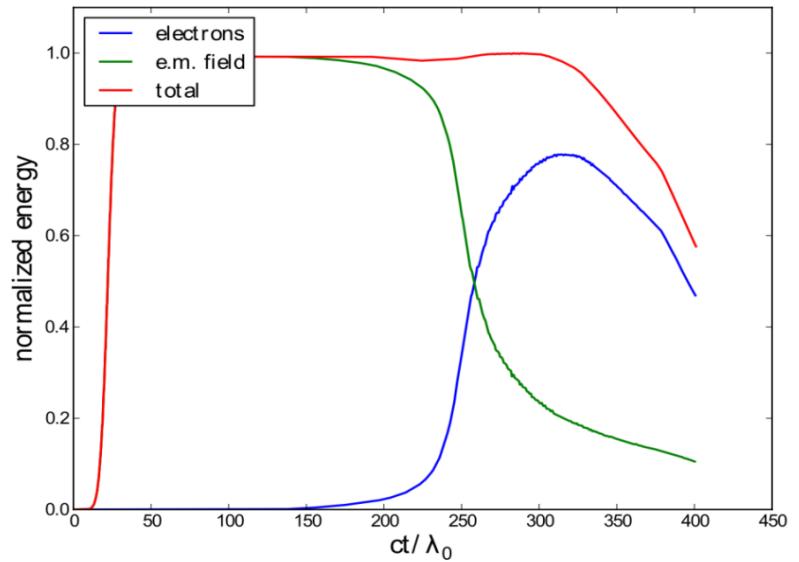
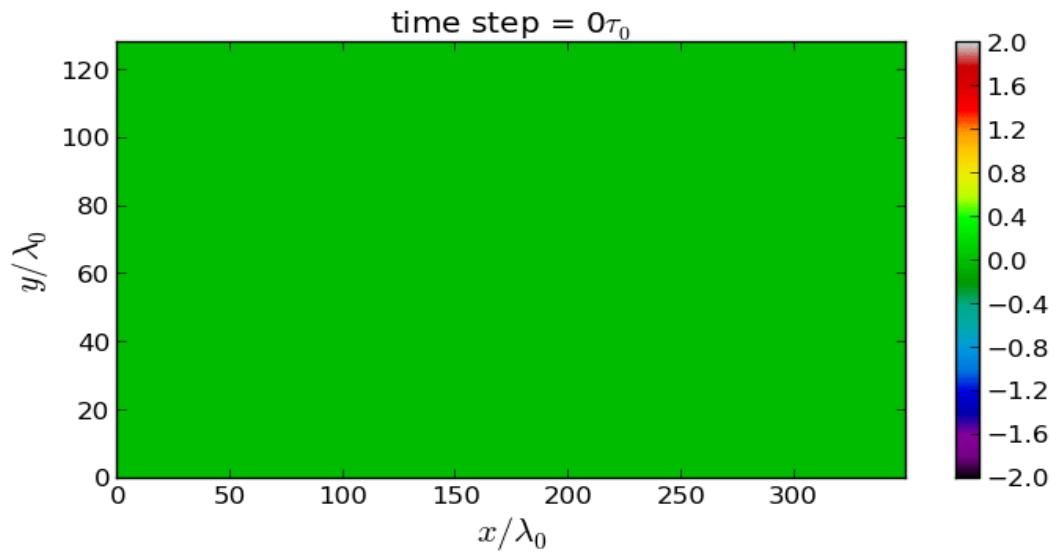
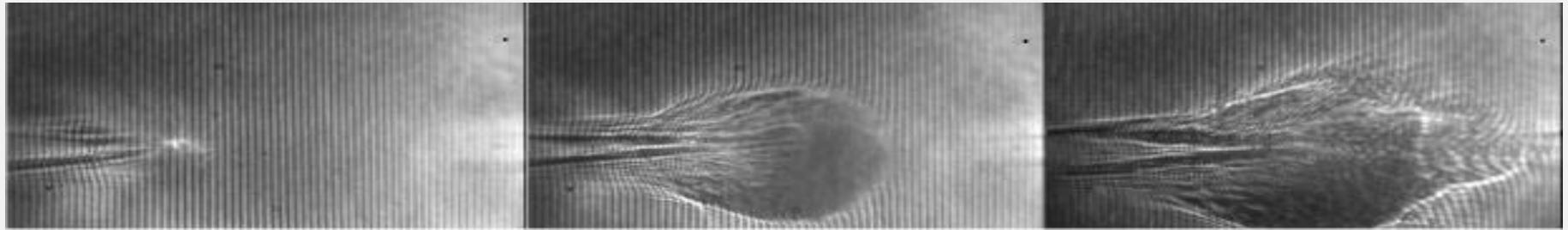
Borot & Quéré, Opt. Exp., 26, 26444 (2018)



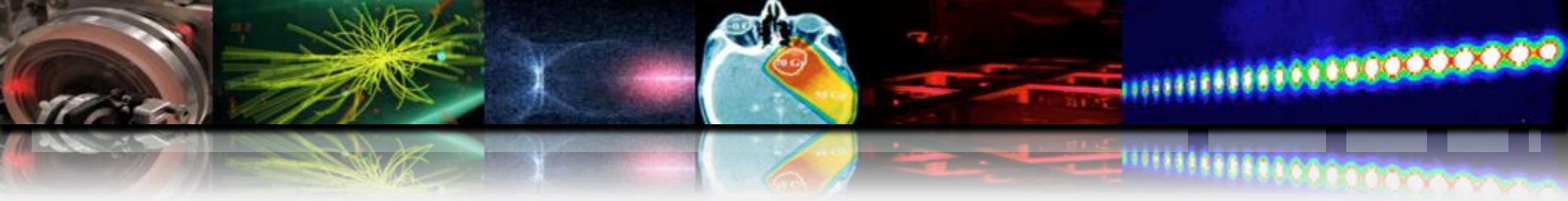
SL-GT-10 : High density gas jet

9

Laser collapse



Sylla et al, PRL, 110, 085001 (2013)



Laser Plasma Technologies

www.sourcelab-plasma.com