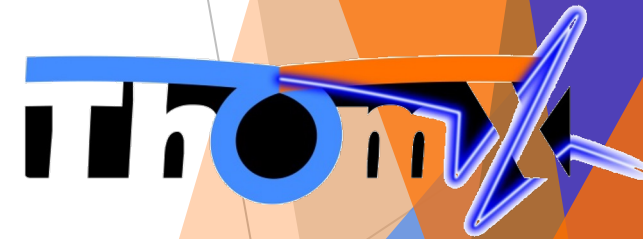


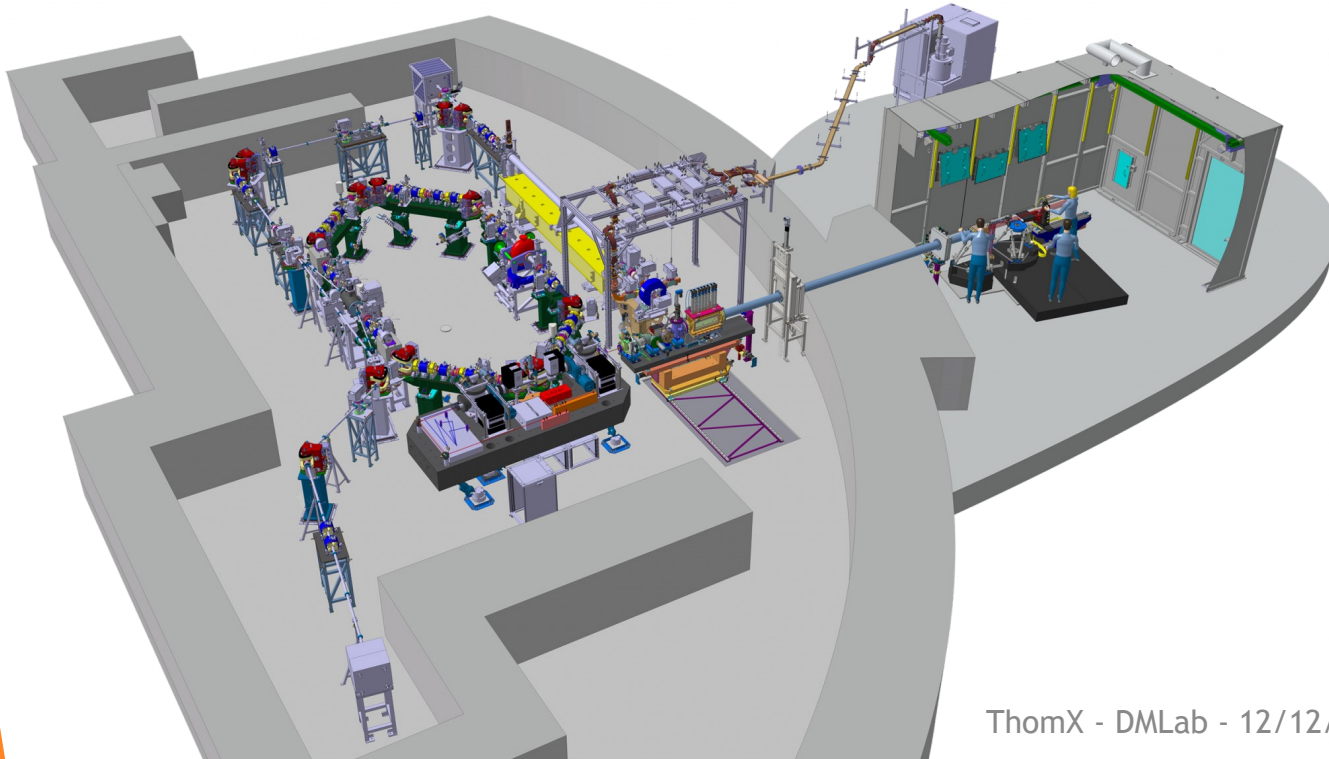
# ThomX: Building a Compact Compton Light source

Nicolas Delerue, IJCLab  
+ the ThomX collaboration

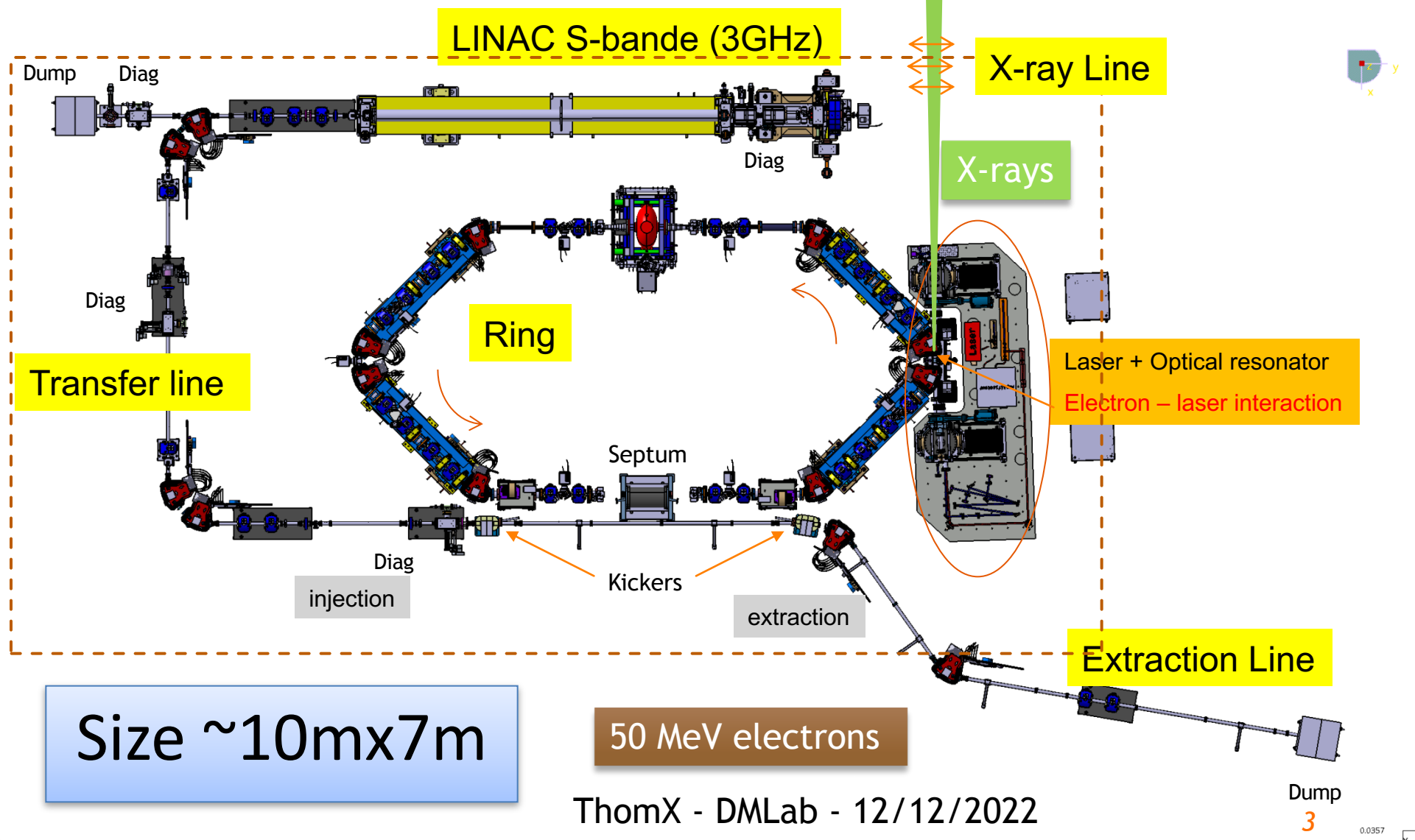


# Overview

- ▶ ThomX is a compact light source based on Compton scattering being built at IJCLab
- ▶ Small Footprint ~ 200m<sup>2</sup>
- ▶ Being commissioned (subject to Nuclear Safety Authority clearance):  
Linac started in 2021  
Ring + transfer lines started in August 2022

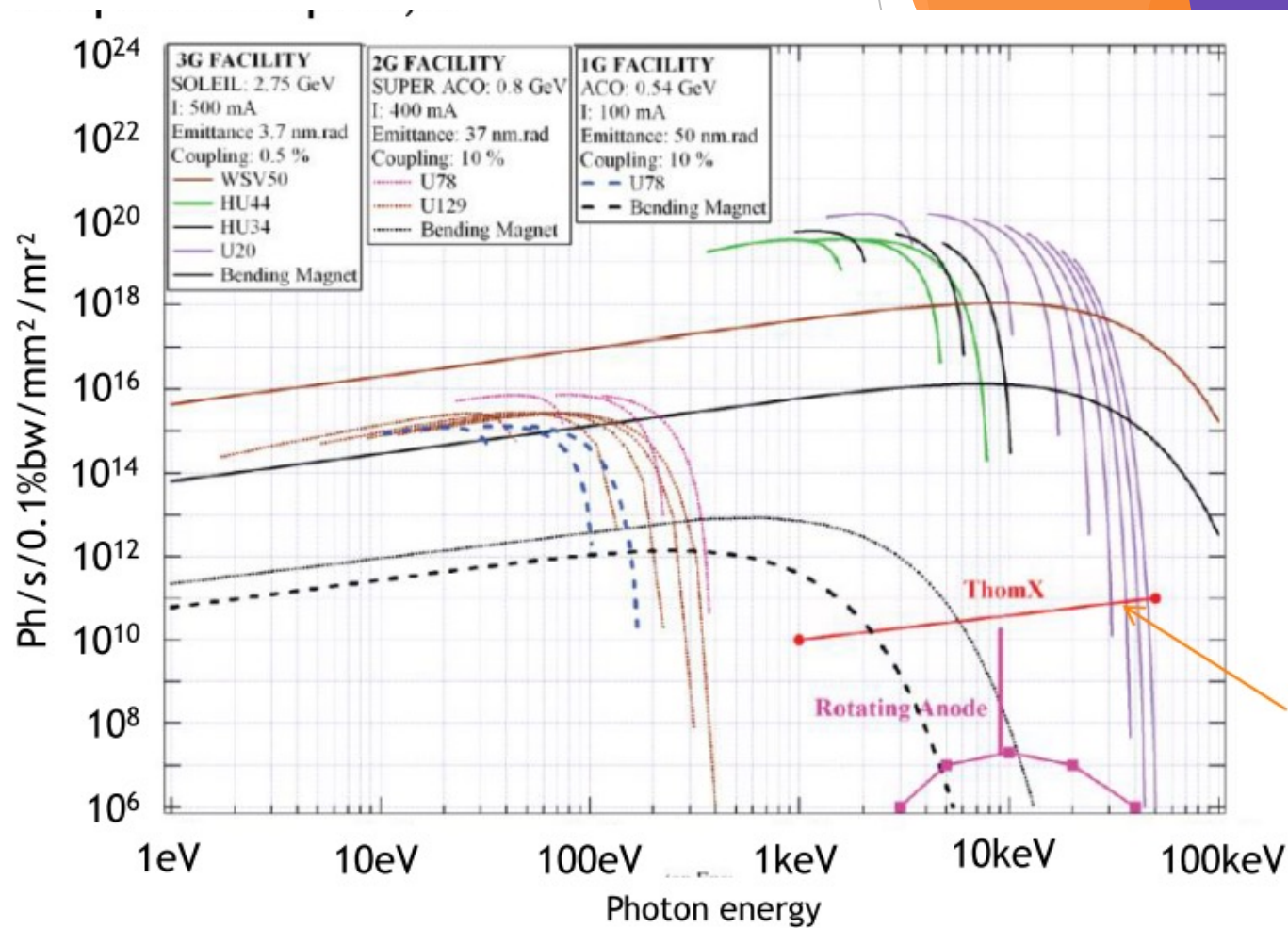


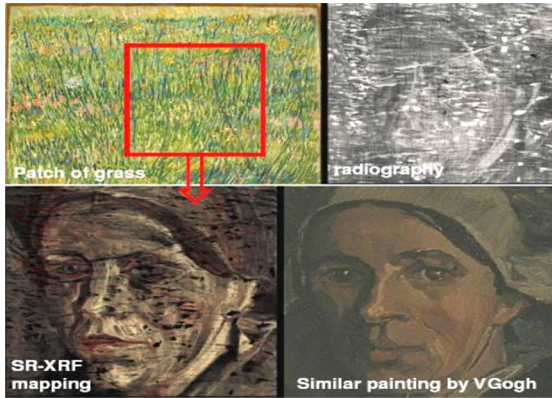
# The machine



# Applications:

- ▶ The X-ray yield of ThomX is lower than that of 3<sup>rd</sup> generation synchrotron radiation facility.
- ▶ However it is also much more compact => can fit in smaller space such as those that can be found in museums or hospitals.
- ▶ Possible applications:
  - Heritage studies
  - Artwork
  - Medical
  - Quasi-Monochromatic X-rays applications
- ▶ Several workshop have taken place to define the first experiments.

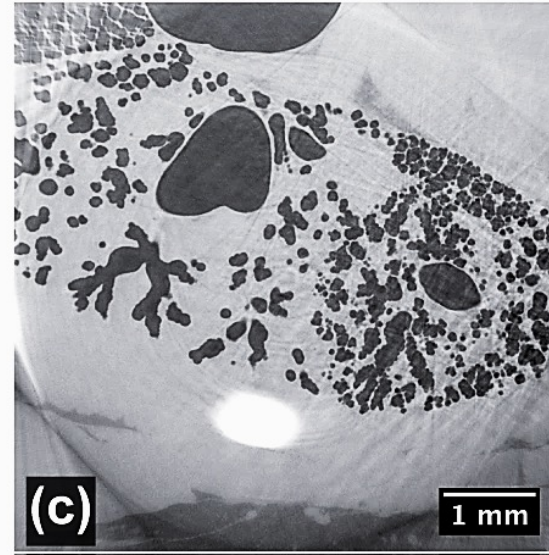
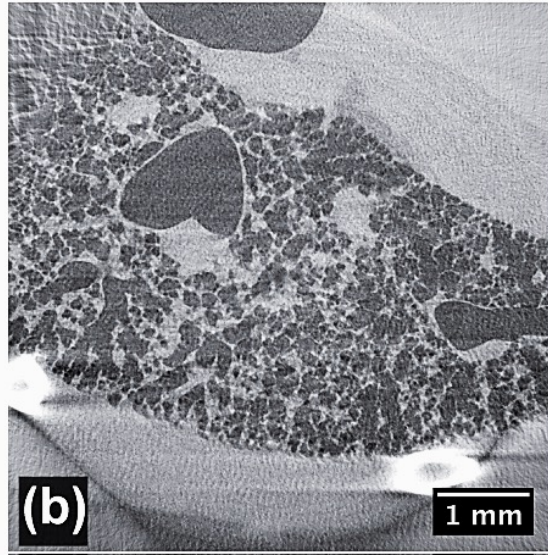
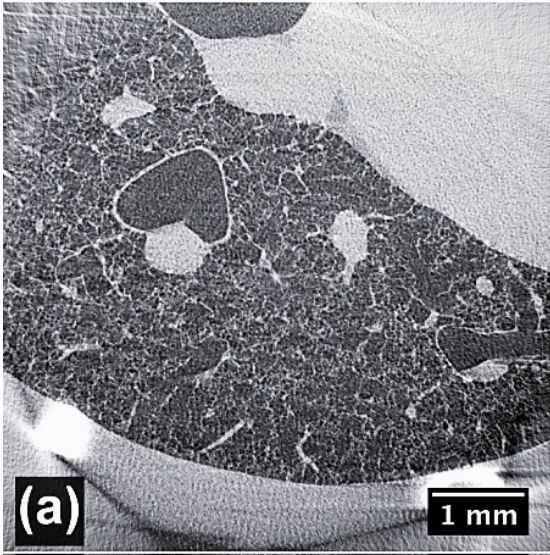




## Applications: Studies of historical artefact

- ▶ ThomX will allow to perform similar studies on art work as those done on one synchrotron radiation sources
  - Identification of some atomic compound of the paint
  - Identifying hidden drawing on the canvas
- ▶ Pioneering studies made at DESY on Van Gogh paintings (see image)
- ▶ Possibility to have the accelerator near the museum in a dedicated facility
- ▶ There is already an accelerator used for heritage studies at the Louvres museum but it is an ion accelerator => complementary machines

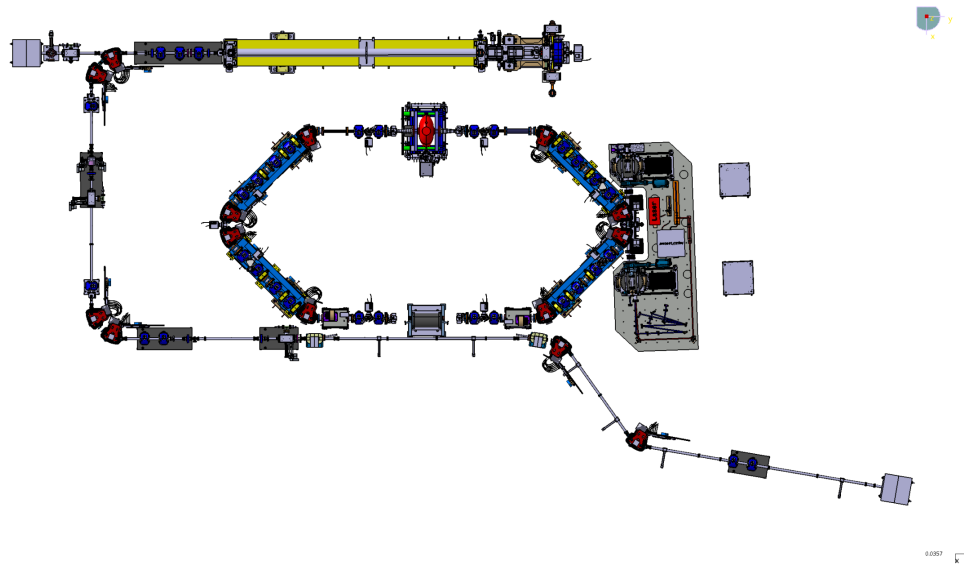
# Applications: Phase contrast microscopy



- ▶ Phase contrast microscopy will be possible with the ThomX beam
- ▶ Allows to see very thin structures such as lung membranes.

# ThomX status

- ▶ Like all accelerators in France, conditioned by clearance from the French Nuclear Safety Authority (ASN)
- ▶ Initial authorization (Spring 2021) was for the linac only.
- ▶ Additional authorization in August 2022 to bring the beam to the extraction dump and the ring.
- ▶ A new authorization will be required to extract the X-rays and increase the rep rate (50Hz instead of 10Hz at the moment).



# Linac commissioning (October 2021)

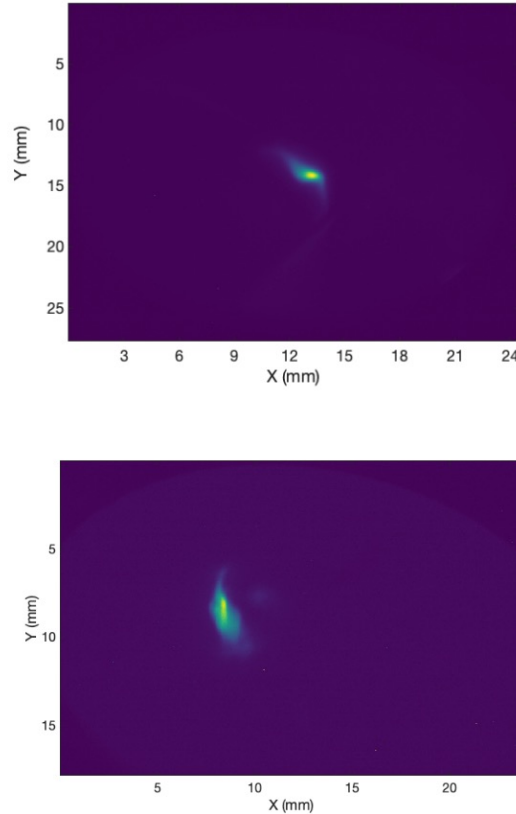


Figure 1: Image retrieved from the YAG:Ce screen light emission from the electron beam at the exit of the RF gun (Top) and at the linac exit (Bottom) the 6th of October 2021.

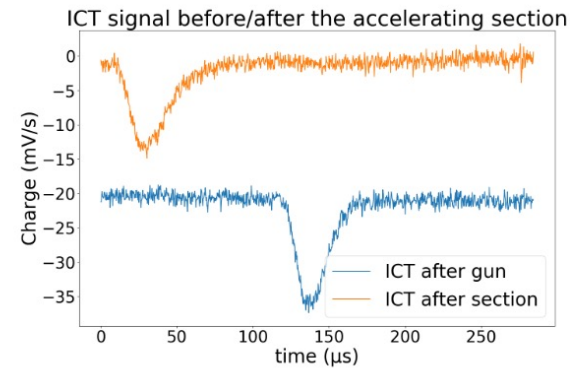


Figure 2: Raw ICT signal versus time at the gun exit (blue) and at the linac exit (red) taken the 6th of October 2021.

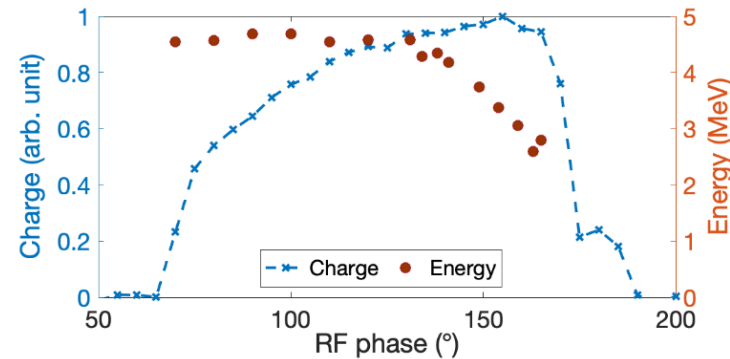
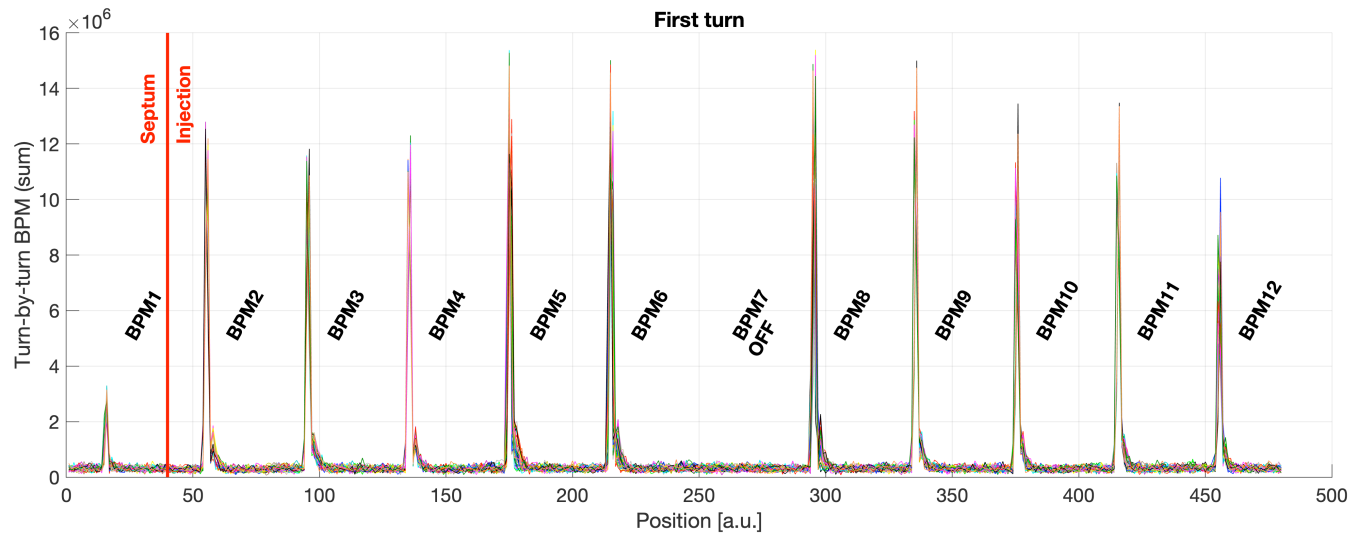


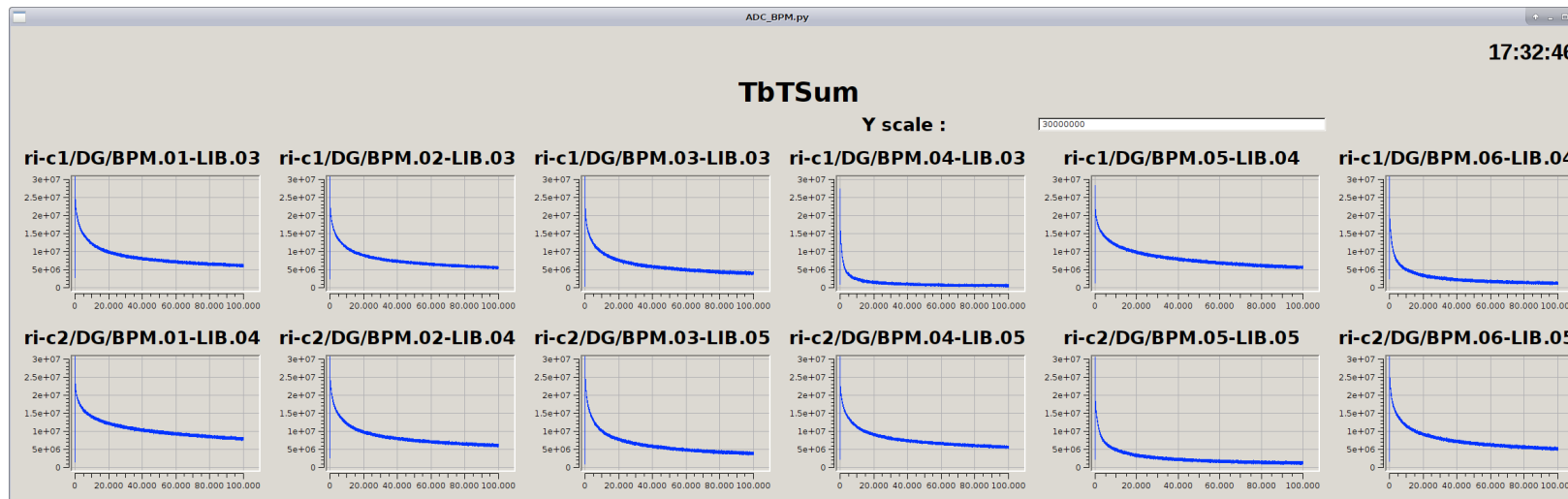
Figure 3: Charge and kinetic energy measured at the exit of the RF gun versus its RF phase the 30th of May 2022. The energy measurements were provided by a steerer and a screen spaced by 0.77 m.

# Ring commissioning (Autumn 2022)

First turn:



Full storage:



# Outlook

- ▶ ThomX is designed as a compact light source that could fit in space where a synchrotron radiation source is not suitable.
- ▶ Commissioning is going well:
  - beam storage in the ring achieved in December 2022.
  - Progress limited by what the Nuclear Safety Authorization allows us to do.
- ▶ Next step: laser resonator commissioning
- ▶ Hopefully after summer 2023: X-rays outside the bunker
- ▶ Collaboration are welcome to optimize the machine.