

PEPITES : Status & Plans

PEPITES = **Profileur à Electrons secondaires Pour Ions Thérapeutiques**

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For PEPITES Team

Overview



- PEPITES in a nutshell
- PEPITES status
- PEPITES plans @ CNAO

PEPITES in a nutshell

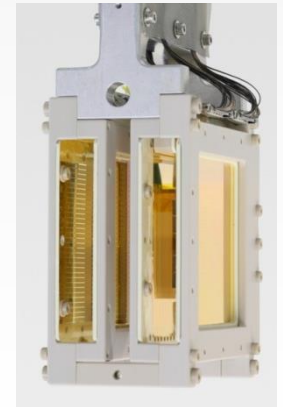
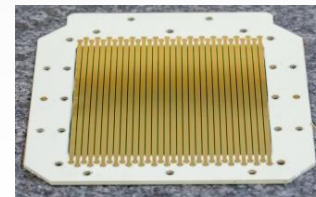
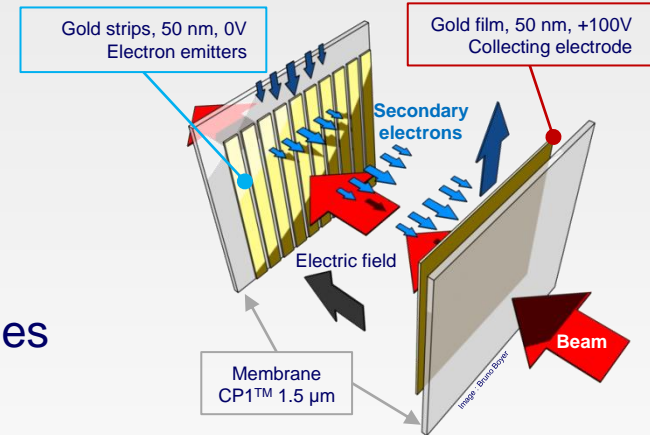


- **Ultra-thin Secondary Electron Emission (SEE) beam profiler**

- SEE used for signal because:
 - Tiny amount of material needed (~10 nm)
 - Very linear (at least up to O(A) beams)
 - BTW : suitable for FLASH !
- Sensitive Area build using « Thin Film » techniques
- Operates in vacuum

- **Current version:**

- 10 μm WET
- Low noise & high range read-out electronic
 - For continuous current beams
 - Designed by our CEA partner
- 2 x 32 channels (X & Y beam sampling)



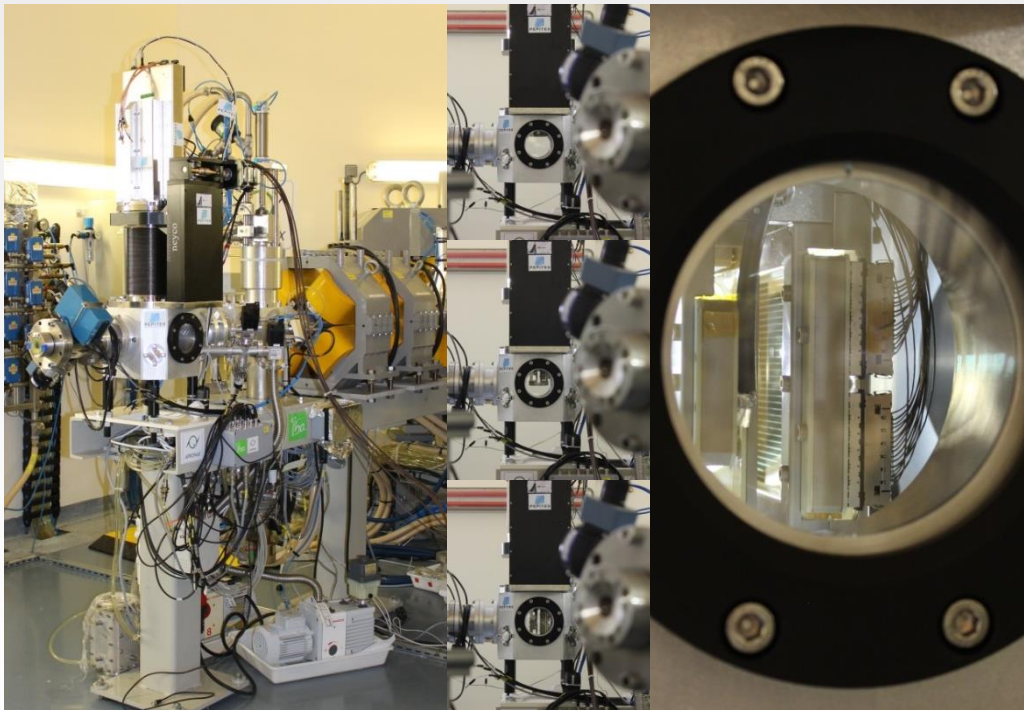


PEPITES STATUS

PEPITES @ ARRONAX



- Installed in May 2022



68 MeV proton beam

Continuous, 17 pA

Peak signal : 400 fA

Continuous, ~20 nA

Peak signal : 6 nA

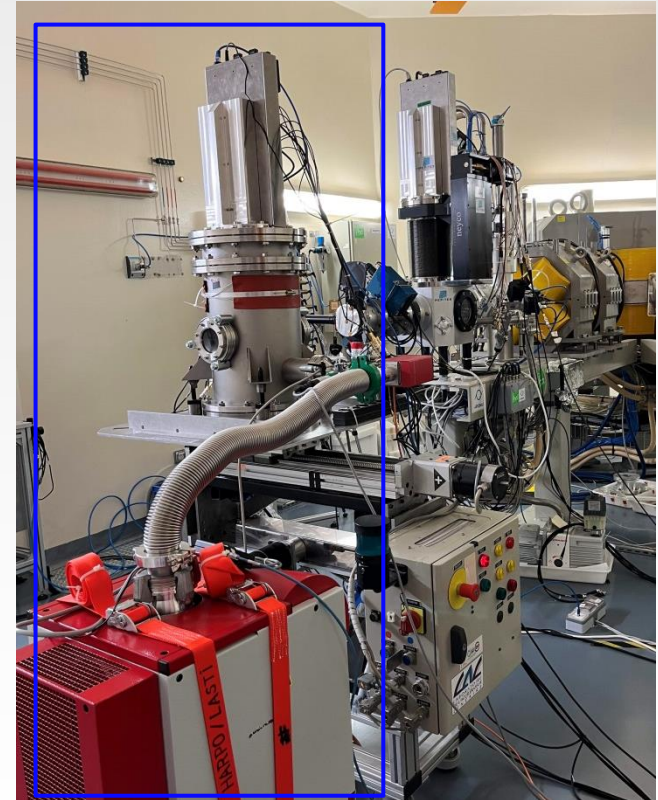
FLASH, ~1 μ A, 10 ms

Peak signal : 400 nA

PEPITES NOMAD



- Copy of the PEPITES installed @ ARRONAX
 - Here shown tested @ ARRONAX, in June 2023
 - Some differences in responses between the two systems to be understood still
- **It is the system we will start with @ CNAO**
 - **For the test beam of 19th & 20th of November**
- Comes with:
 - Vacuum chamber + PEPITES inside
 - With 230 μm Kapon entrance & exit windows
 - Readout electronic & acq.
 - Vacuum Pump
 - Translation table (if needed)



Other PEPITES activities



▪ SPLIF :

- = **SimPL**e moniteur pour Intensités Flash
- FLASH therapy research very active now !
- **Comparing FLASH and conventional irradiations** is almost systematic these days
 - **A portable apparatus able to monitor intensities in both cases is very welcome !**
- SPLIF is a simplified PEPITES
 - Takes advantage of the high linearity of SEE

▪ PEPITES-UltraFlash :

- PEPITES can measure FLASH beams
- Is SEE signal able to withstand **laser-plasma accelerated ultra-short beams** ?
- French “MITI” funding started this year
 - Joint LLR + LOA project
 - **30 fs (!) e⁻** beam pulses, O(100) MeV, O(nC)
 - 1st test beam in October :
 - Just faced **aggressive** EM environment...
 - Next attempt in February



Money & Manpower



- CNRS – CNAO agreement supposed to come with some funding
 - But limited
 - **Finding other sources is unavoidable**
- **Manpower:**
 - **“Chronic lack of manpower at LLR”** has been the realistic statement for a while
 - Physicists are one several topics, engineers and technicians too
 - Lost our main electronic engineer end 2022, while critical work have to be done here !
 - **Improving now:**
 - **New and experienced electronic engineer joined LLR in October : 100% on PEPITES !**
 - Great help for several left over things !
 - In particular : will start **calibration/verification of electronic readout through signal current injection**
 - **SPLIF**, even though independent on paper, **hired an engineer for one year** in September – mechanics background, but multi-competences- and quite overlap between projects
 - Hoping this position will be extended !
 - **2 years researcher position offered to PEPITES group**
 - One very good candidate found, **now in hiring process**, hoping process will go smooth...
 - For both PEPITES-UltraFlash & PEPITES @ CNAO
 - **Manpower situation is greatly improving : we should not be sub-critical anymore !**



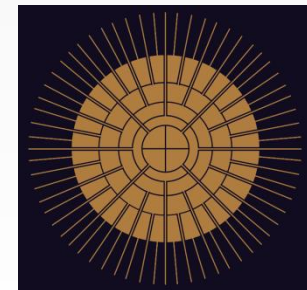
PEPITES PLANS @ CNAO

PEPITES @ CNAO : plans [1/2]



- **First TB @ CNAO, 19th & 20th of November**
 - With PEPITES-NOMAD
 - Will operate with C & p beams, at various intensities & energies
 - State then on “what’s next”
- **What’s next options:**
 - We stop...
 - **We continue together:**
 - **Main anticipated R&D topic : reduction of material budget**
 - PEPITES material budget is to sustain a sub-millimeter disturbance of the beam at the patient level for a monitor placed 2 – 3 meters upstream, in the beam line
 - At CNAO : 2 – 3 meters → 6.5 meters !
 - **Current 10 μm WET can be reduced:**
 - **WET gross-estimates:**

Geometry	CP1™ (1.5 μm) membranes Cost : moderate	LuxFilm™ (0.1 μm) membranes Cost : +++
2 strip planes + 2 anodes planes	~10 μm	~2.5 μm
2 strip planes + 2 off axis anodes	~5 μm	~1.25 μm
2D pattern + off axis anode	~2.5 μm	~0.63 μm



2D pattern

PEPITES @ CNAO : plans [2/2]



- What's next options (con't):
 - We continue together (con't)
 - Each of these options will have to be discussed and studied
 - They **can be prototyped in a non-invasive way wrt CNAO**, “à la nomade”
 - And ported to the line later on, if satisfactory
 - We hence have a **rich potential program of R&D !**
- **One aspect to bare in mind:**
 - **The partnership with CEA –electronic designer– will have to be clarified**
 - Not a problem now, in the R&D phase
 - But will have to be considered **if converging to a system used in clinic @ CNAO**



Thank you !