Recent LEM & Anode Developments

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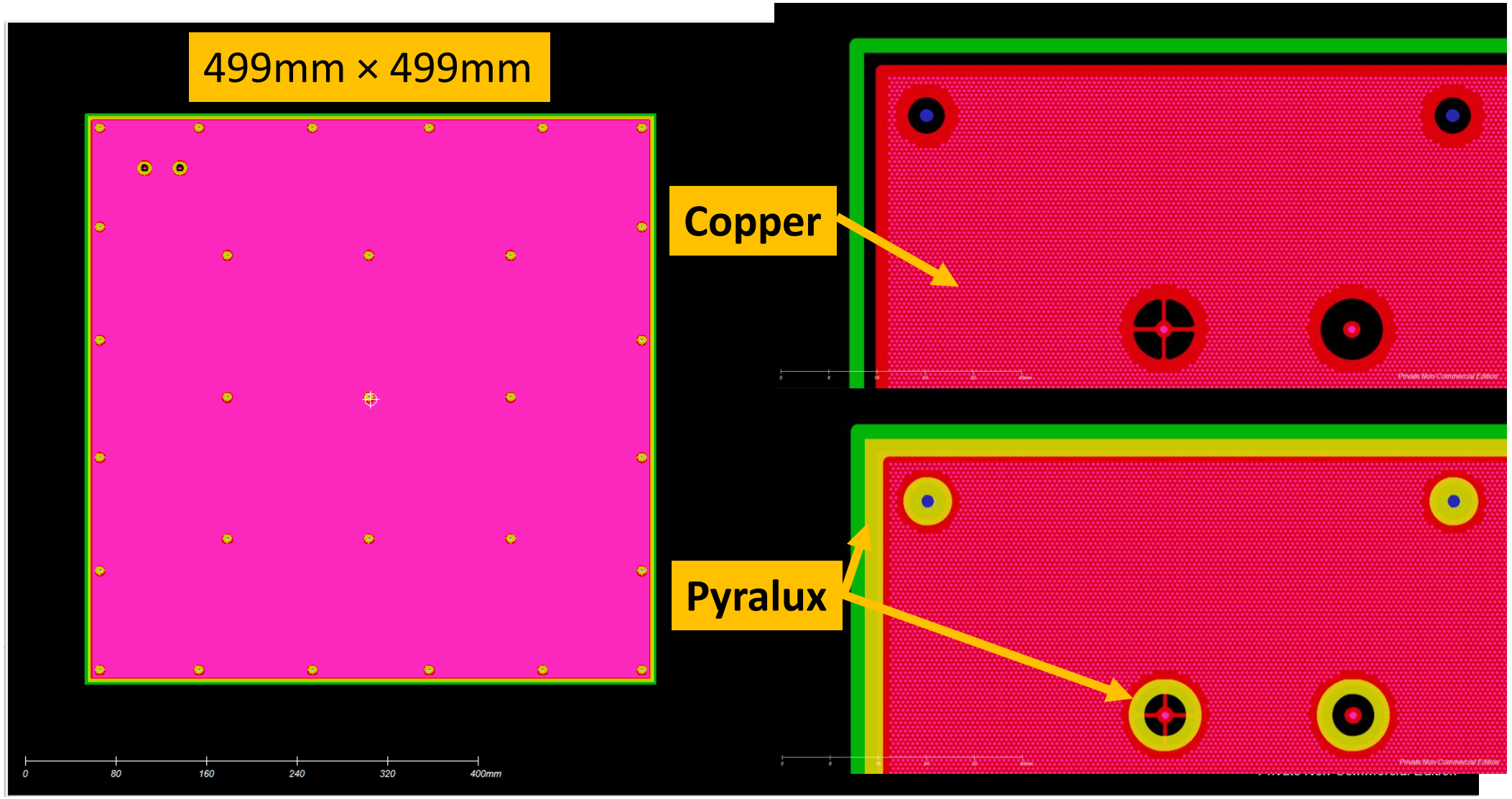
Recent developments and work in progress

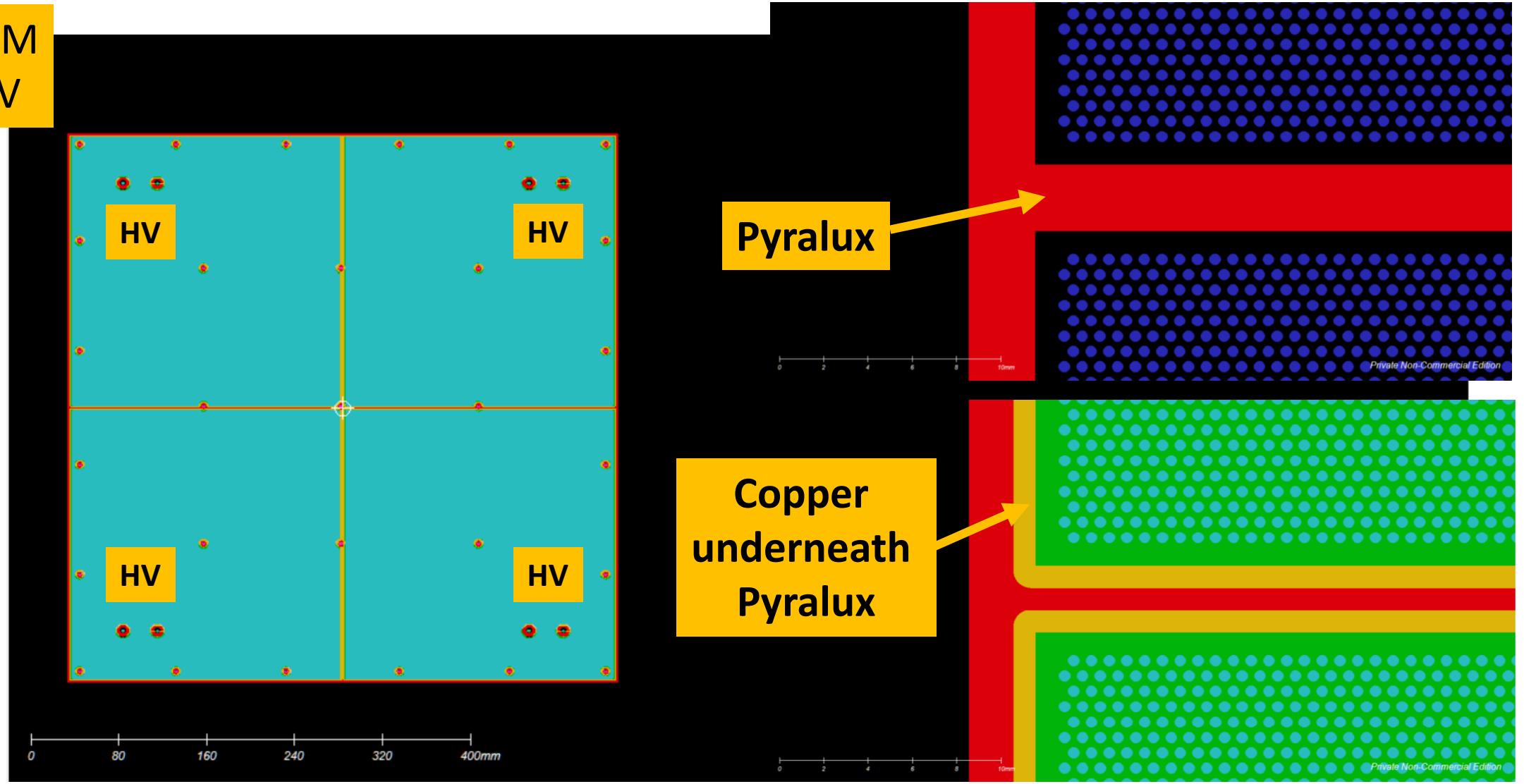
- LEM designs with 95% active area and a 2×2 segmentation completed
- Anode designs with guard ring and for a segmented LEM completed
- Tests with small 10×10 LEM prototypes built by CERN (R. de Oliveira et al.) ongoing (charging up, gain and HV stability) :
  - 2 LEMs with 40µm rims
  - 2 LEMs with 40µm rims covered with a soldermask
  - 2 LEMs with 80µm rims
- Production of 50×50 LEMs started (drilling) at CERN (3 non-segmented, 3 segmented)
- Production of a resistive 10×10 LEM with 40µm rims on both sides (copper and DLC)
- Upgrade of the HP vessel with a gas purification system

LEM design with 95% active area

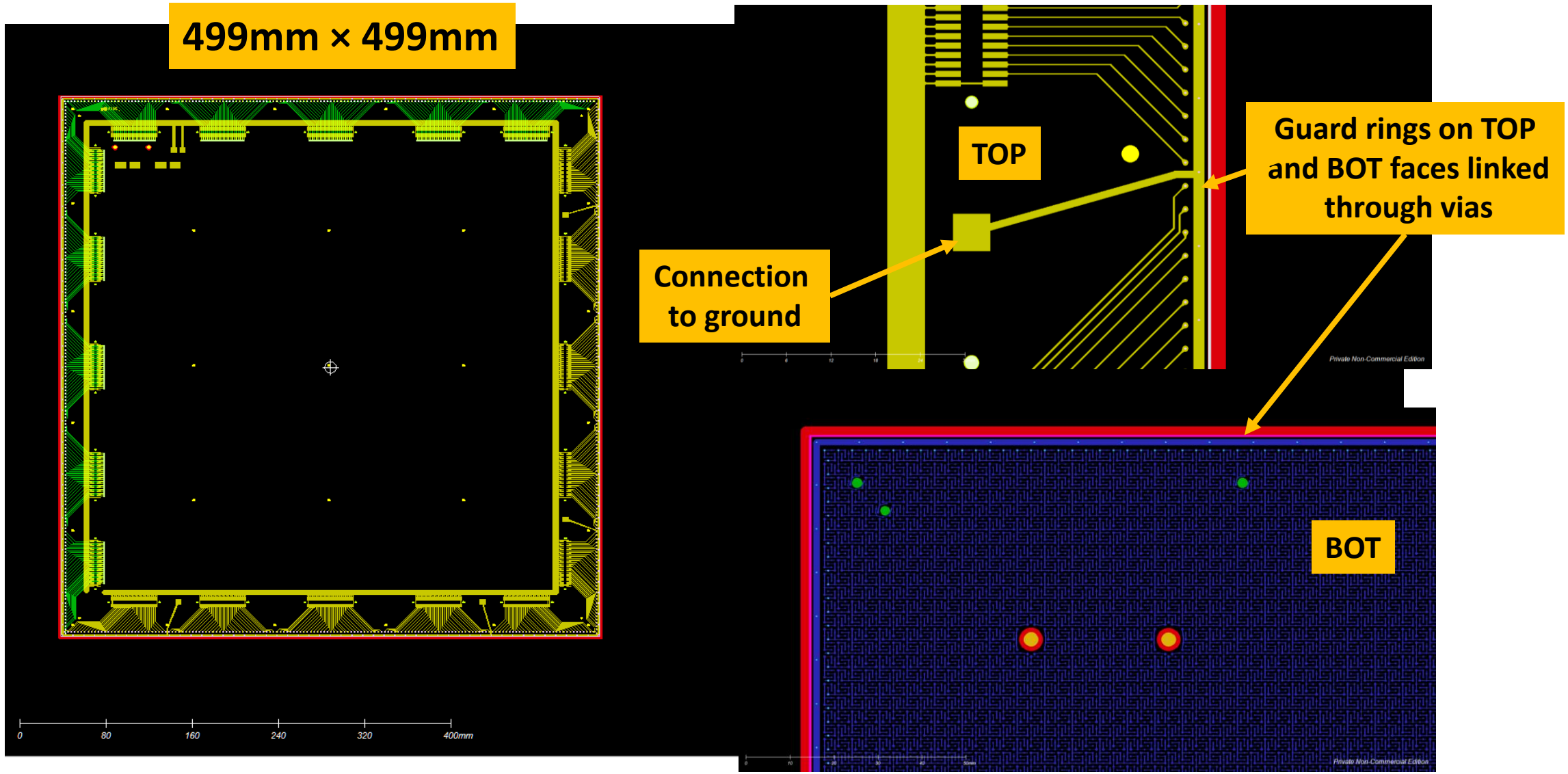


Segmented LEM design (93% active area)

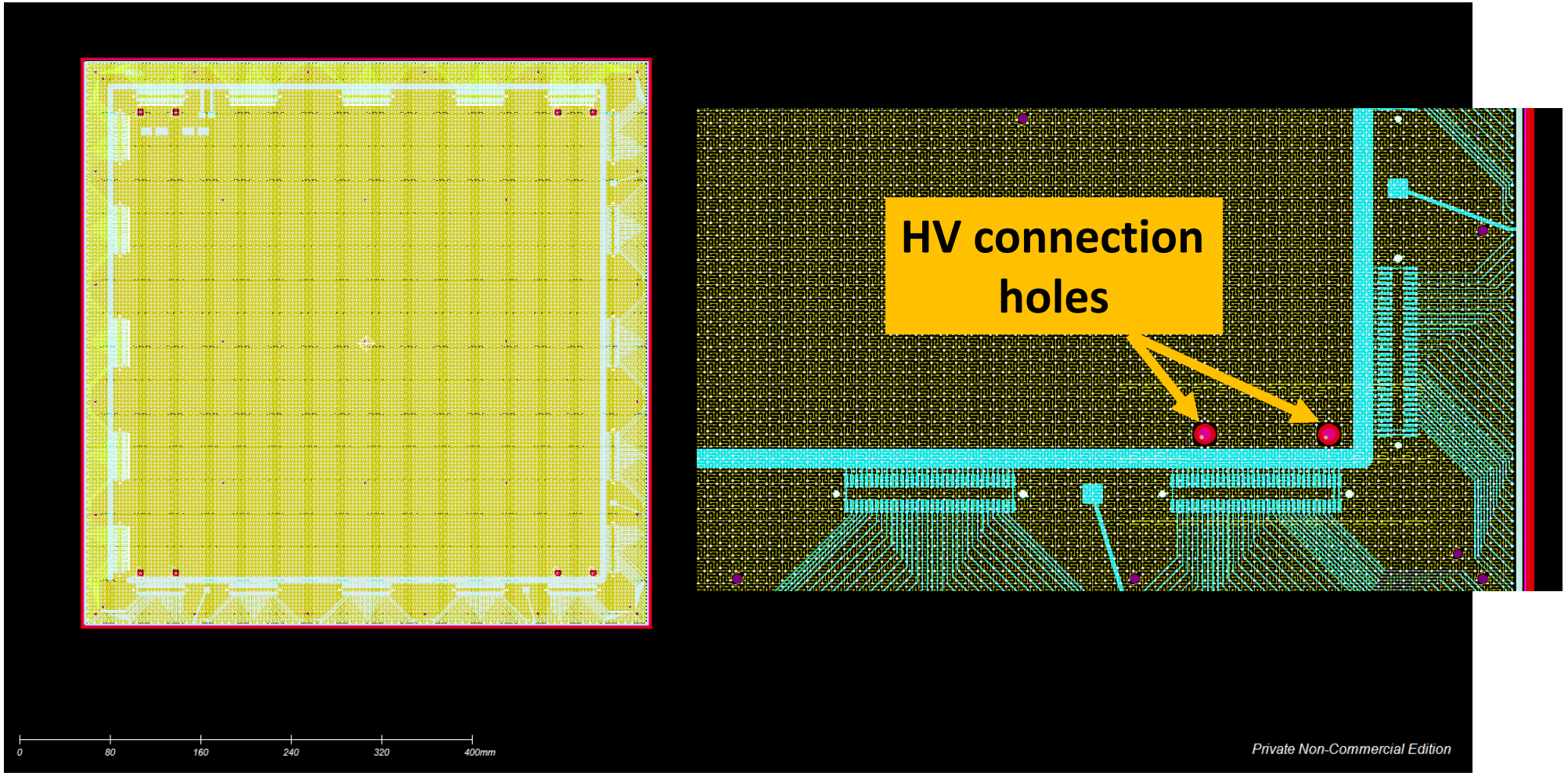
2×2 LEM
4×2 HV

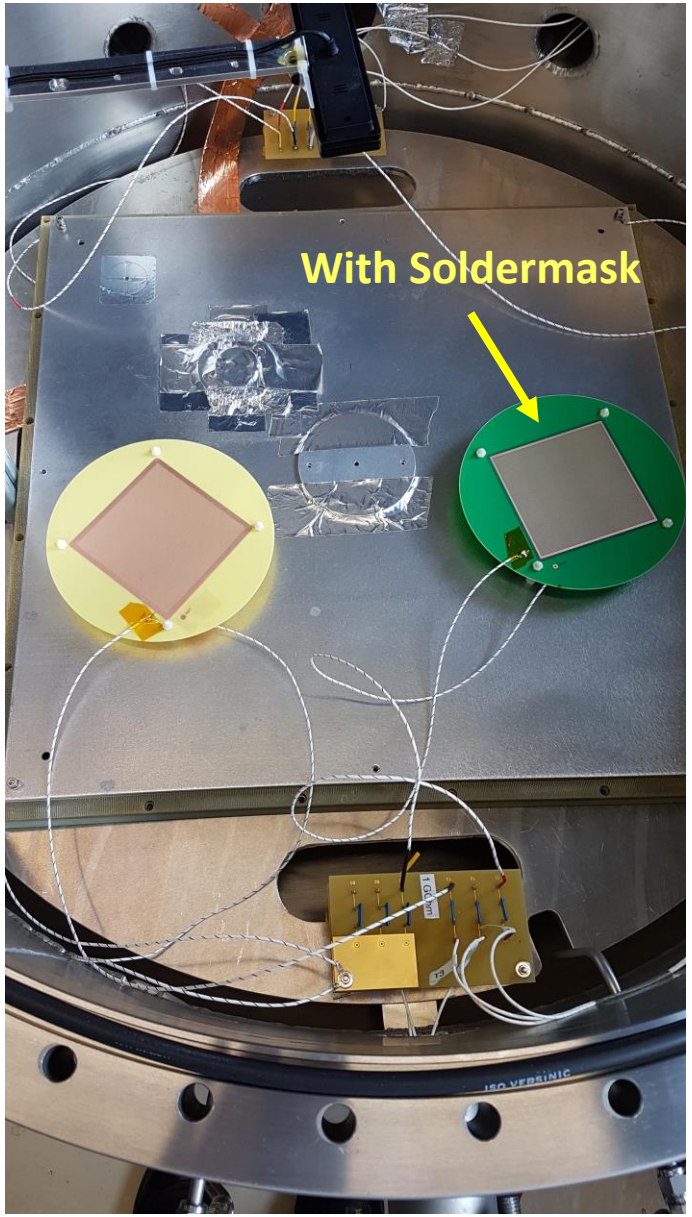


Anode design with guard ring

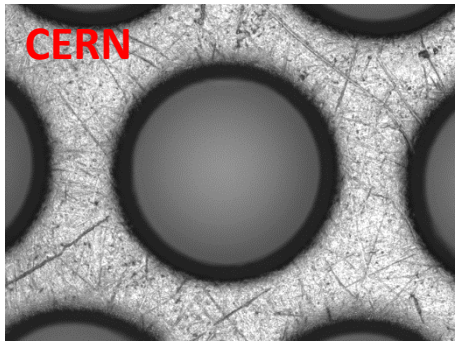


Anode design for a segmented LEM



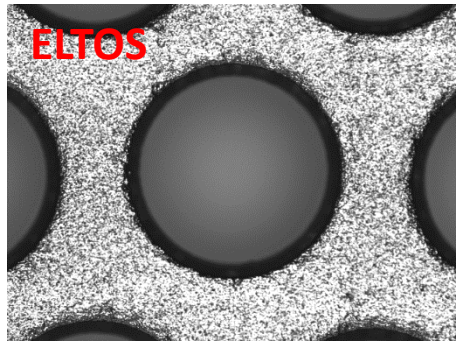


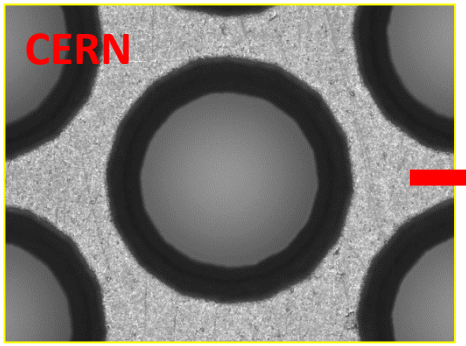
Test of 10×10 LEM prototypes

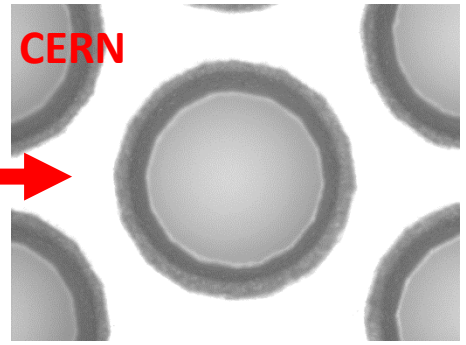


LEMs with 40µm RIMs

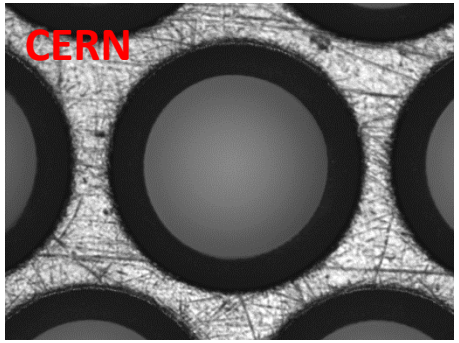
CERN : ~ 50µm
ELTOS : ~ 43µm





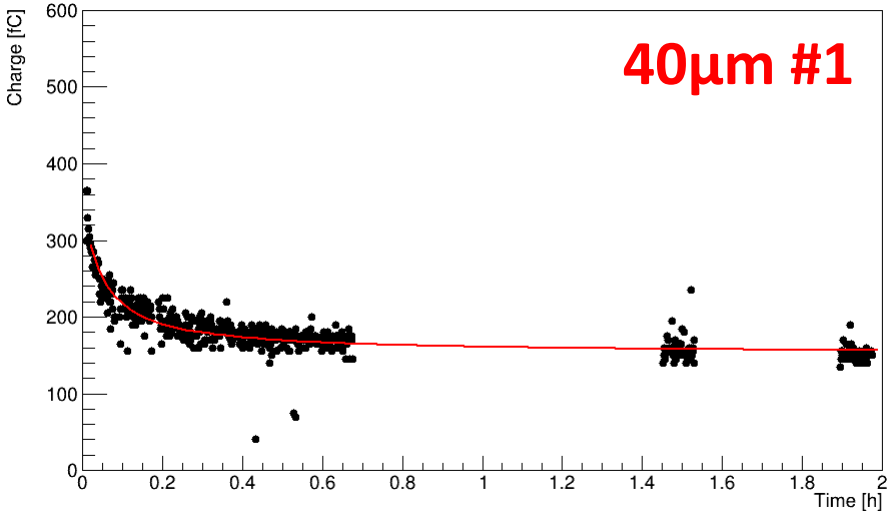


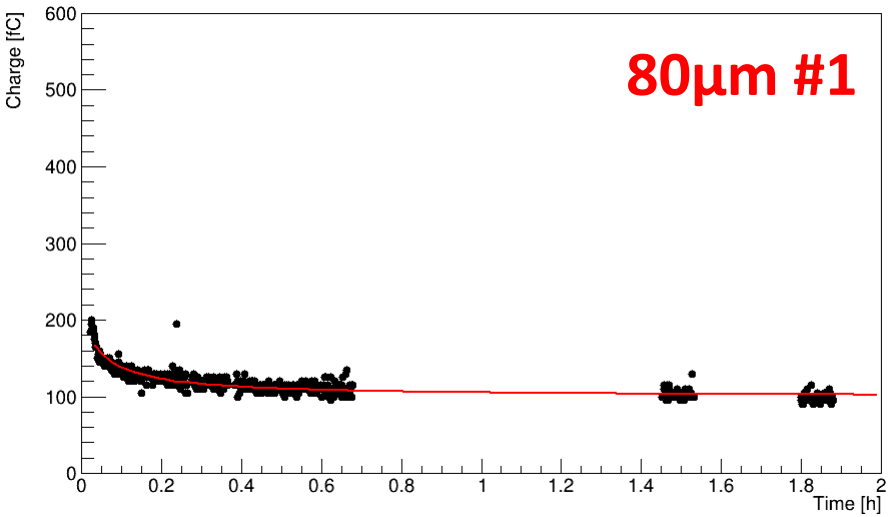
LEM with 40µm RIMs
+
Soldermask (~ 90µm)



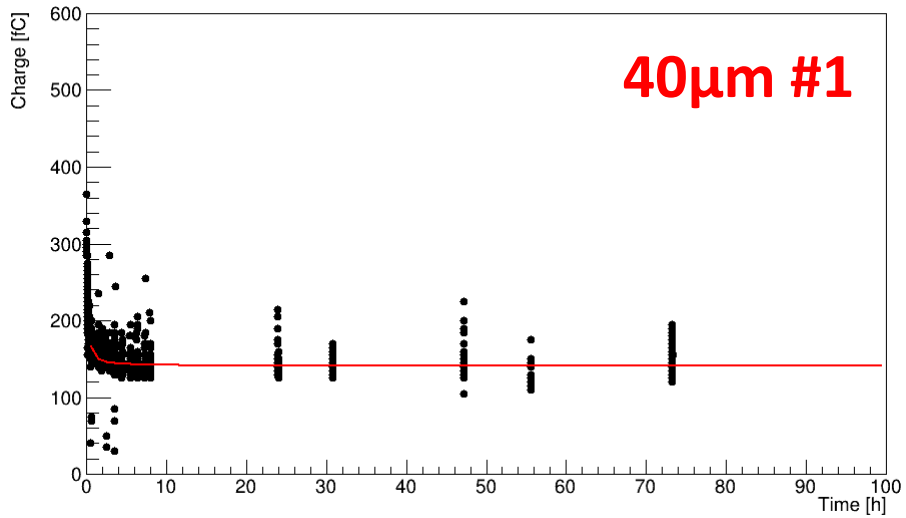
LEM with 80µm RIMs (~ 100µm)

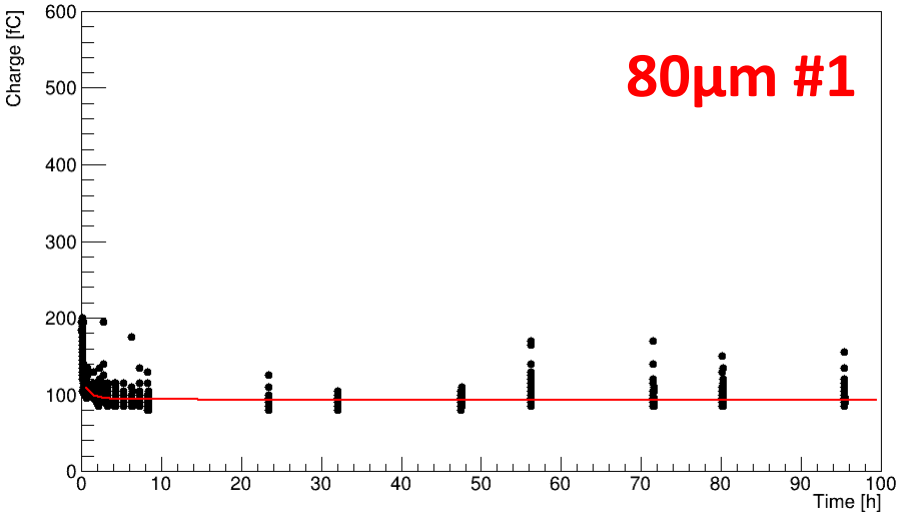
Charging up : standard 40µm and 80µm rims





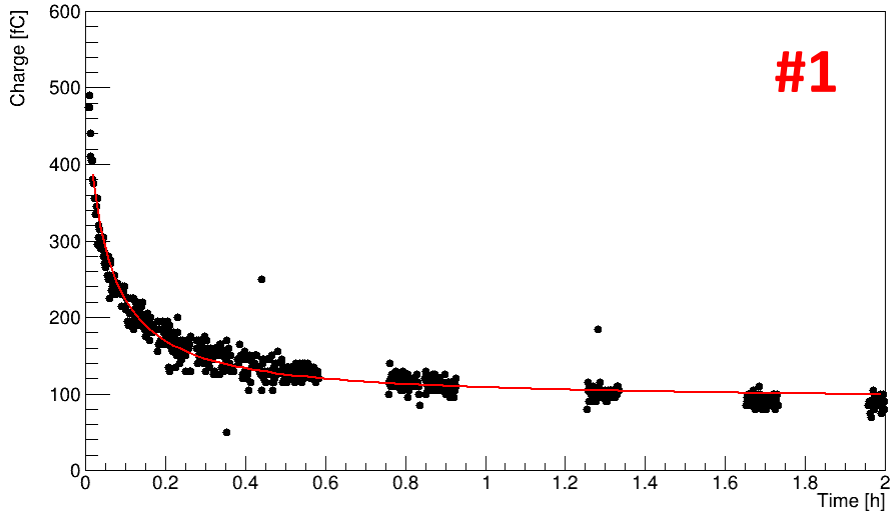
5.5 MeV alphas

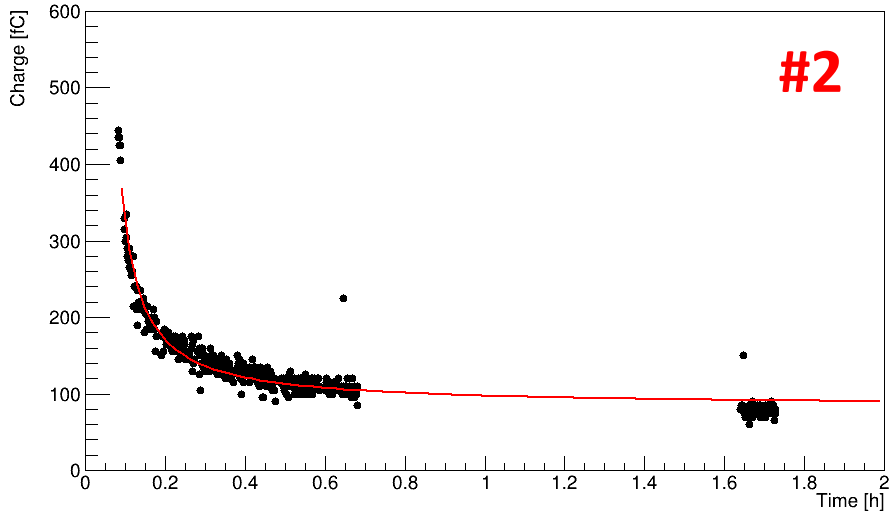


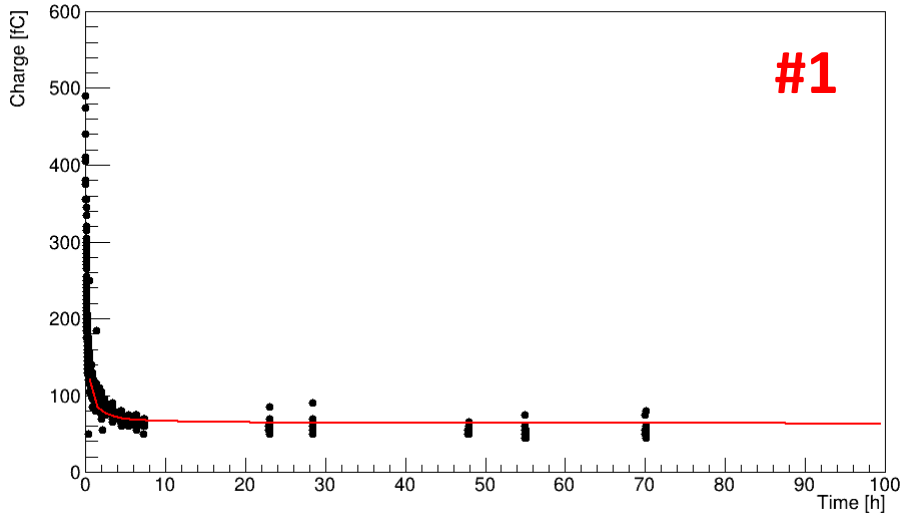


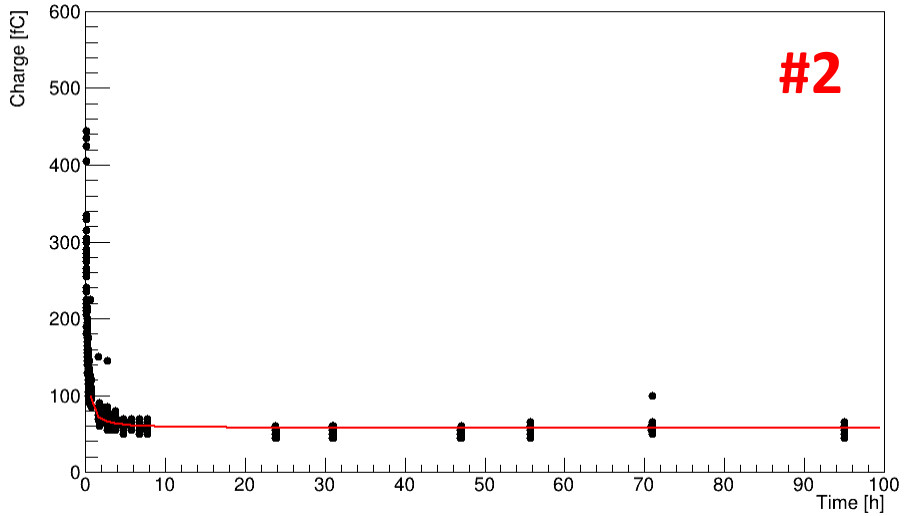
E_{LEM} = 30kV/cm
E_I = 5kV/cm
E_d = 0.5kV/cm

Charging up : 40µm rims with soldermask





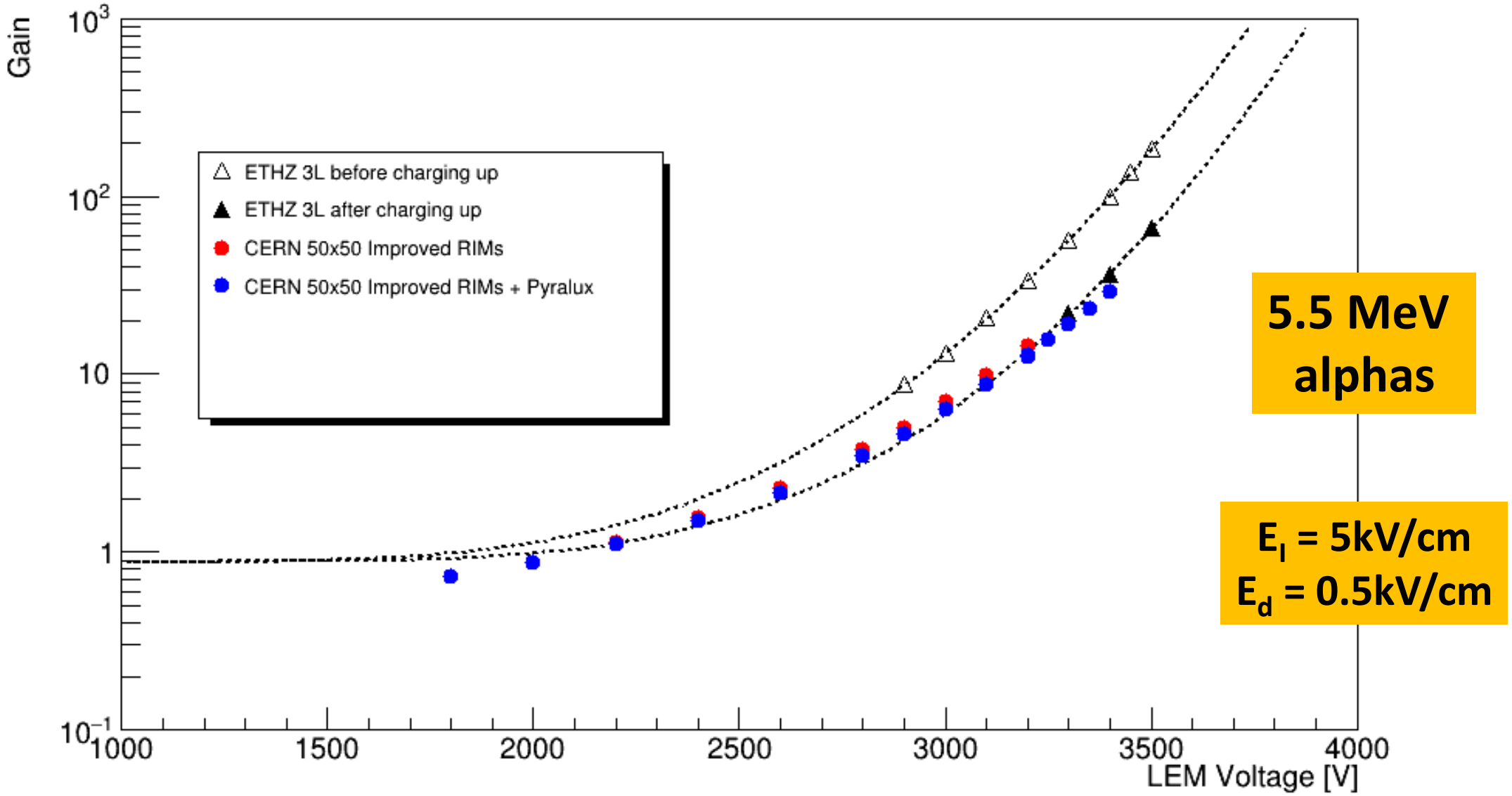




Charging up : summary

LEM type	Q_0 [fC]	Q_∞ [fC]	Q_0 / Q_∞
Standard 40µm rim	370	125	~3
Standard 80µm rim	200	85	~2.4
Soldermask 40µm rim	450 – 500	45-50	~10

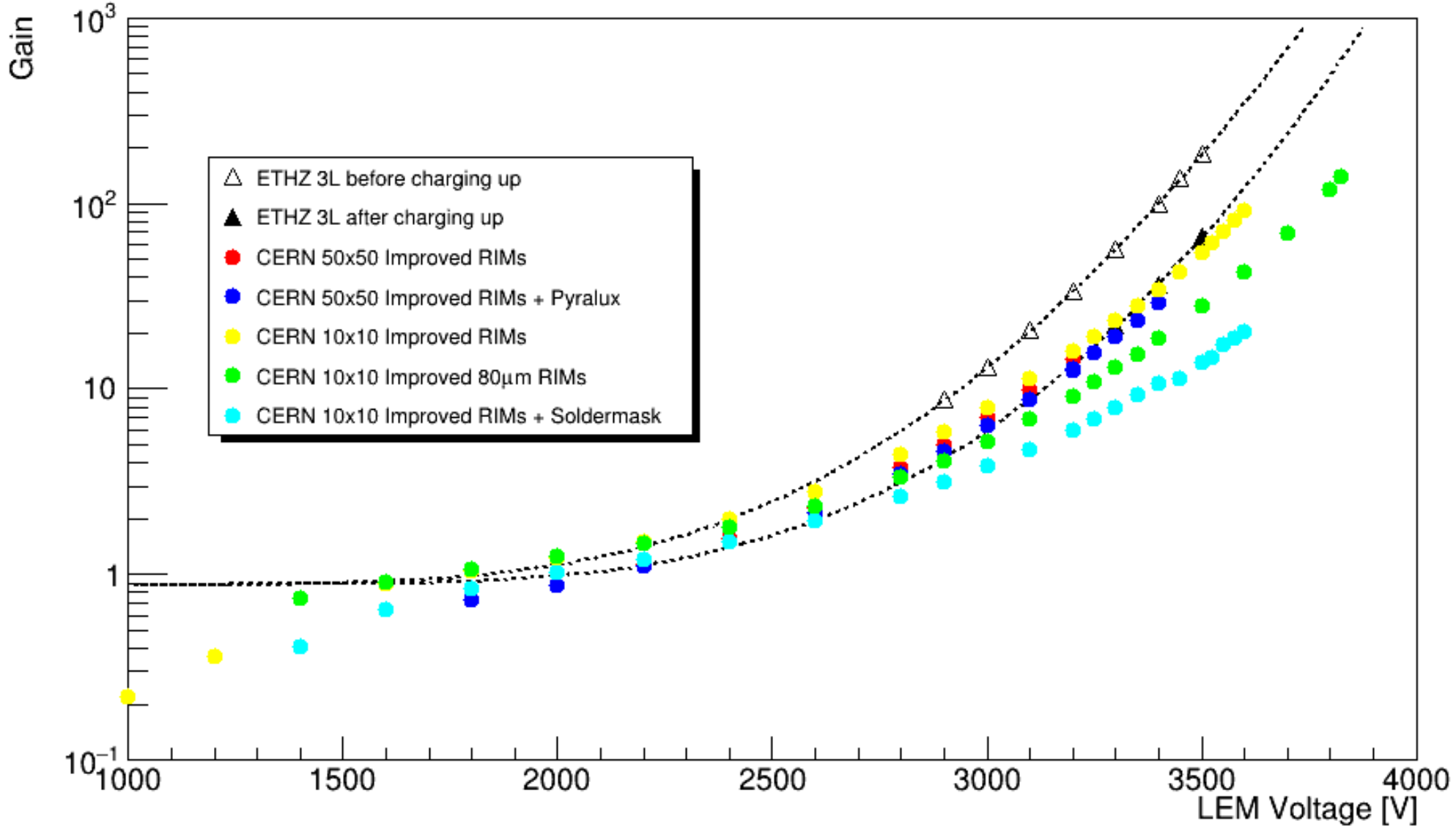
LEM Gain



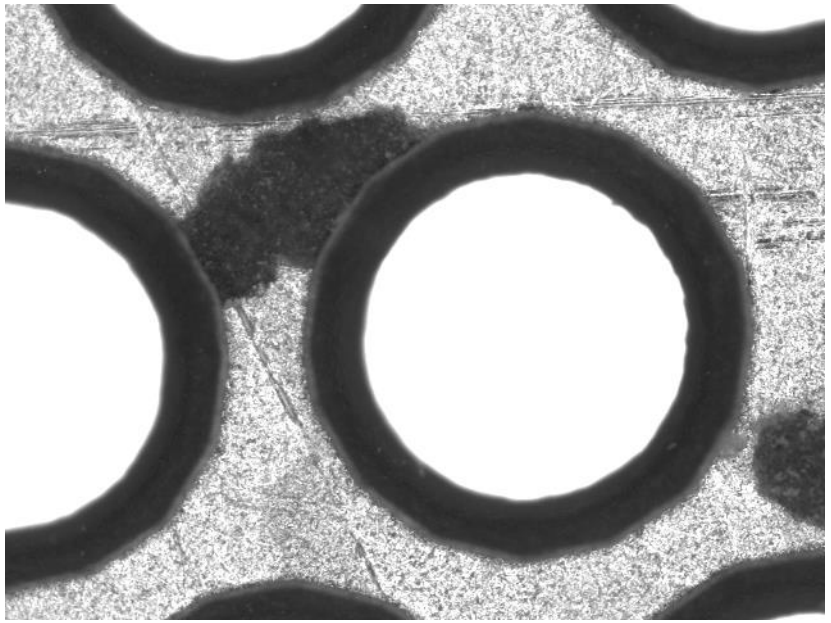
5.5 MeV alphas

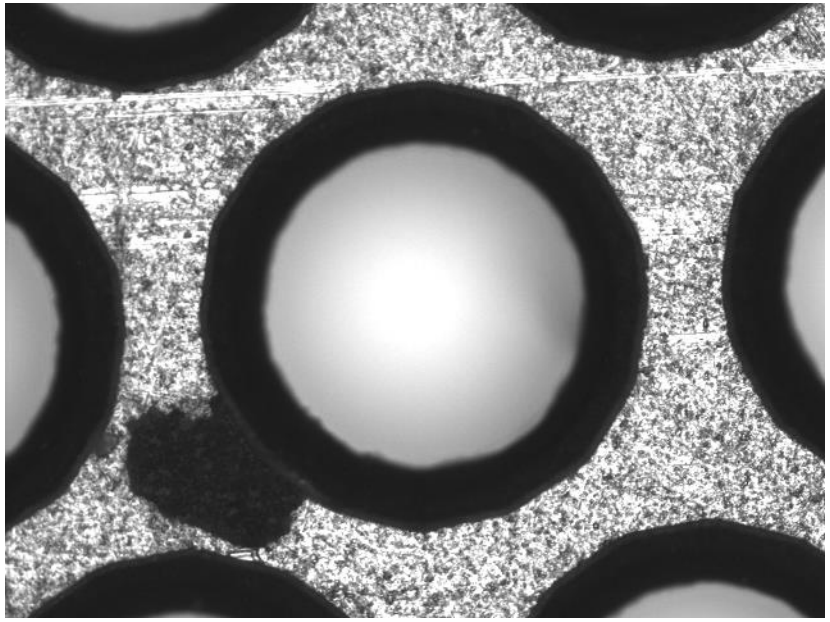
E_I = 5kV/cm
E_d = 0.5kV/cm

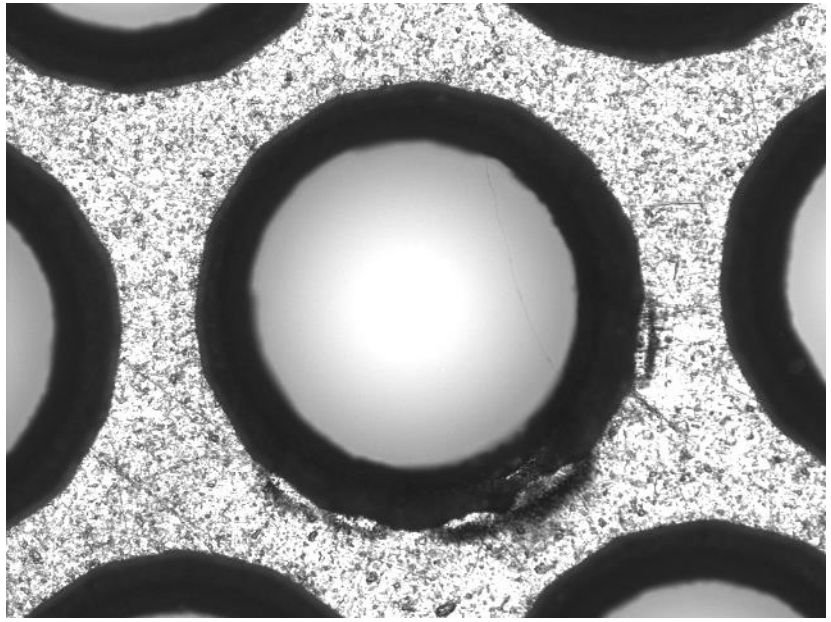
LEM Gain


Gain
10^3
10^2
10
1
10^{-1}
1000
1500
2000
2500
3000
3500
4000
LEM Voltage [V]
ETHZ 3L before charging up
ETHZ 3L after charging up
CERN 50x50 Improved RIMs
CERN 50x50 Improved RIMs + Pyralux
CERN 10x10 Improved RIMs
CERN 10x10 Improved 80µm RIMs
CERN 10x10 Improved RIMs + Soldermask

Soldermask damaged by sparks?



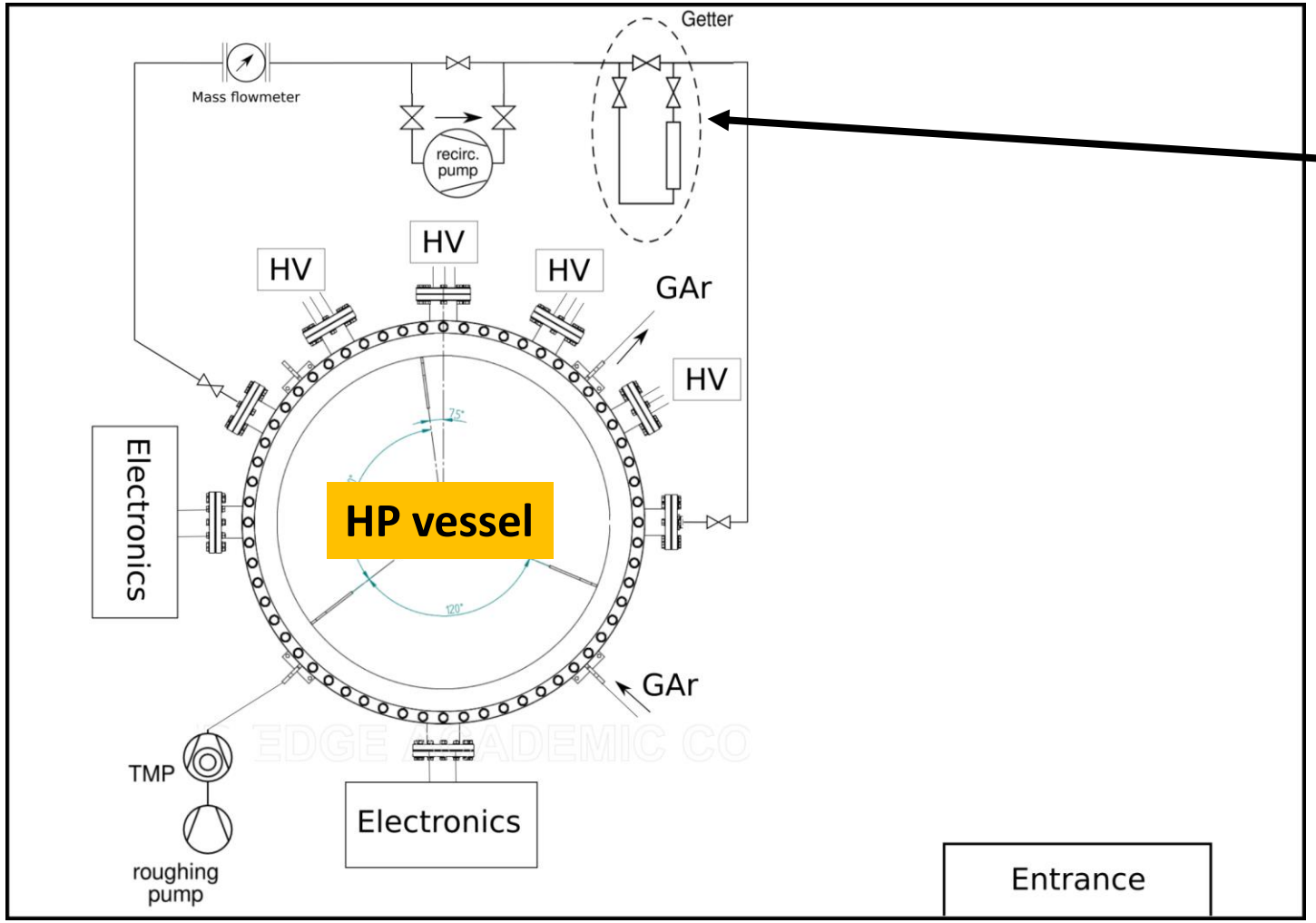




Next …

- HV stability tests of 10×10 LEM prototypes (40µm, 80µm and 40µm + soldermask) have started.
- Based on results above decide on LEM types for the six 50×50 LEMs produced at CERN. Expect first prototypes at Saclay by end of August.
- Procurement of 4 anodes (2 for segmented LEMs) initiated soon.
- Continue R&D with resistive LEMs.
- GAr purification system with the use of a getter to reach < 100ppb.

GAr purification system



Entegris PS3-MT3-R/N