Status of the MHSPs performance: recent technological developments and future goals

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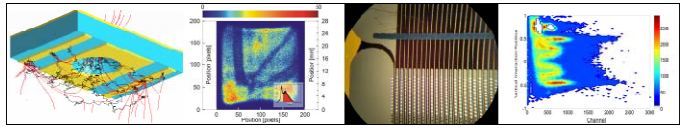
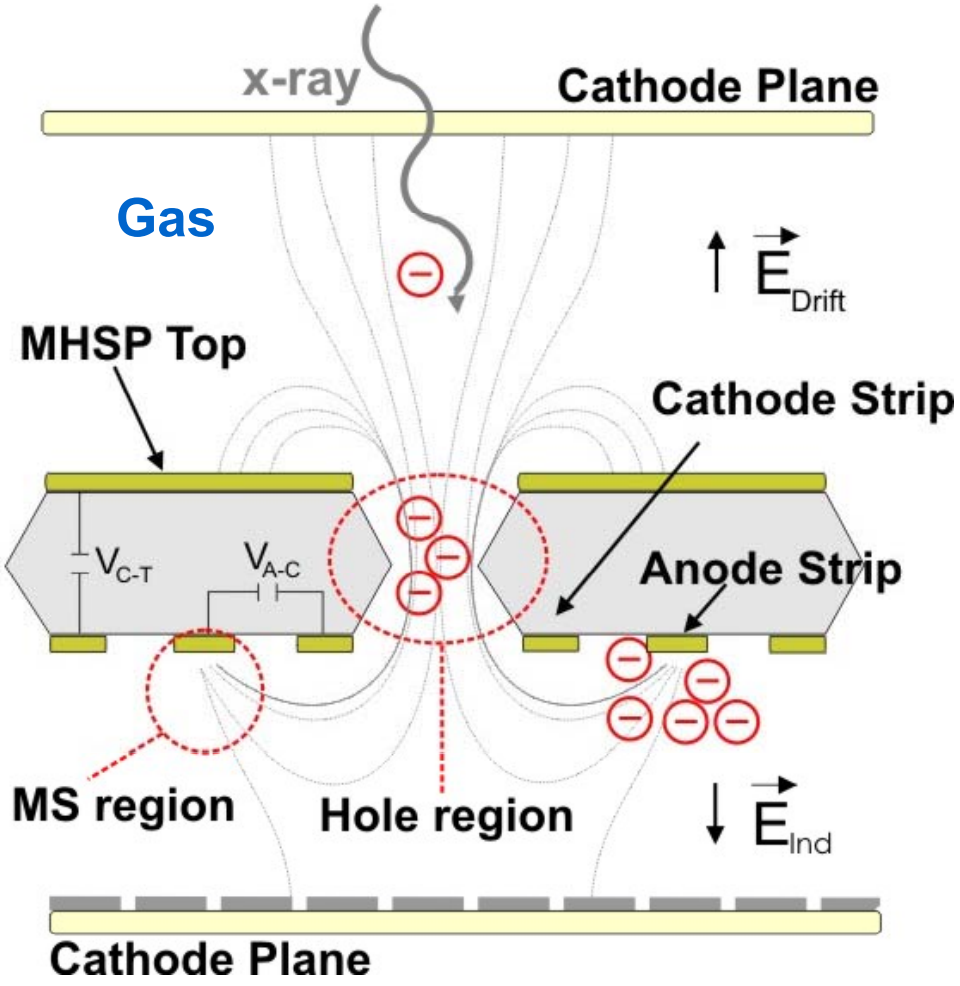
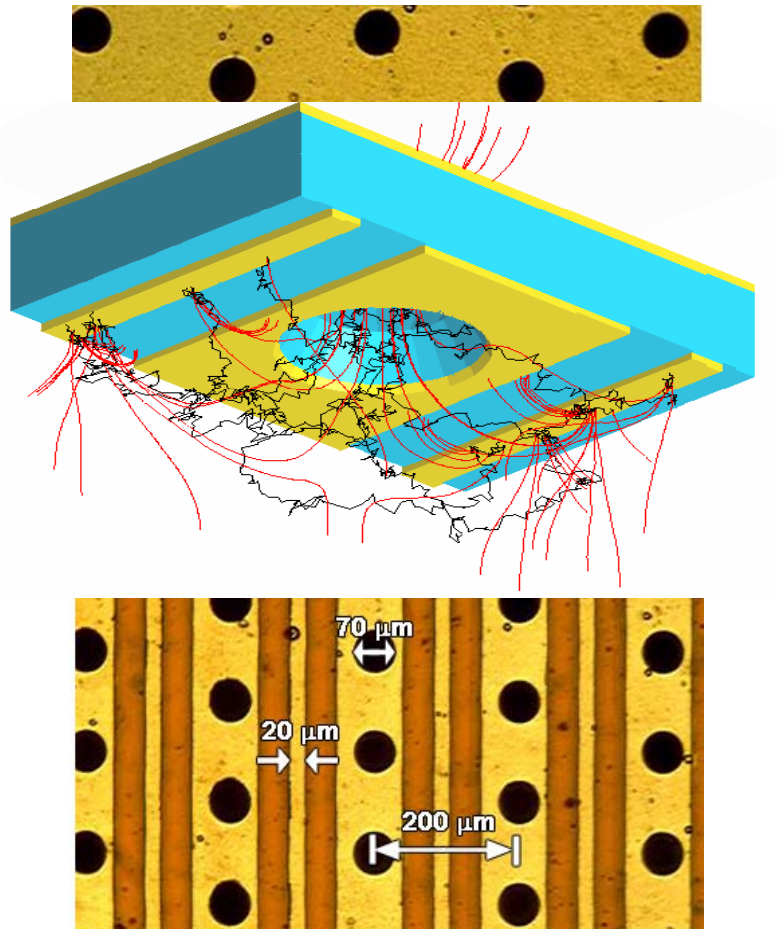


MicroHole & Strip Plate (MHSP)

- Operation Principle



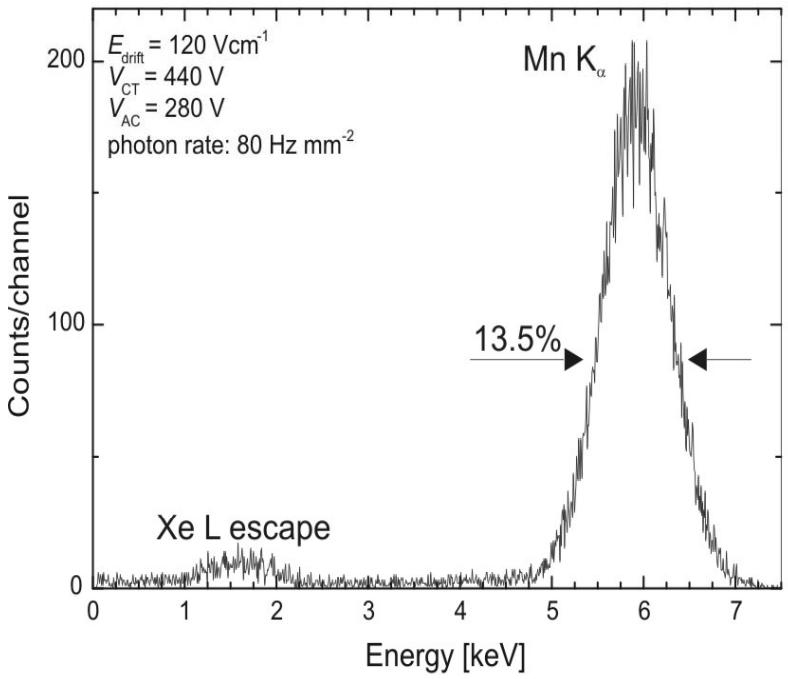


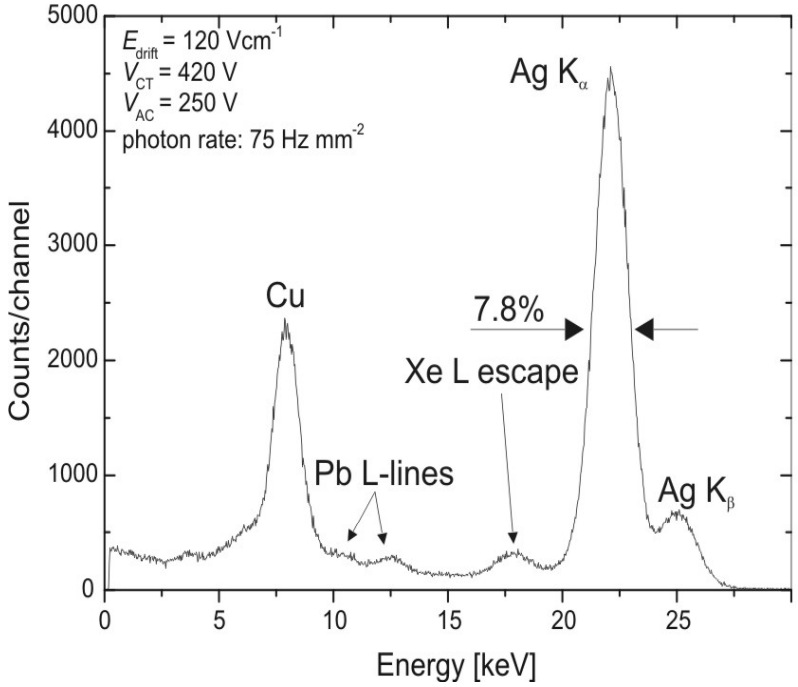
JFCA Veloso et al., RSI 71(2000)2371

MicroHole & Strip Plate (MHSP)

- Present Performance:
  - High gains – ~ 10^4-10^5
  - Fast charge collection – 10 ns
  - Excellent energy resolution – 13.5% @ 5.9keV x-rays - Xe
  - High rate capability – > 0.5 MHz/mm^2
  - High pressure operation capability
  - High ion blocking capability
  - 2-D intrinsic capability – σ~125μm (with resistive line)

Energy Resolution

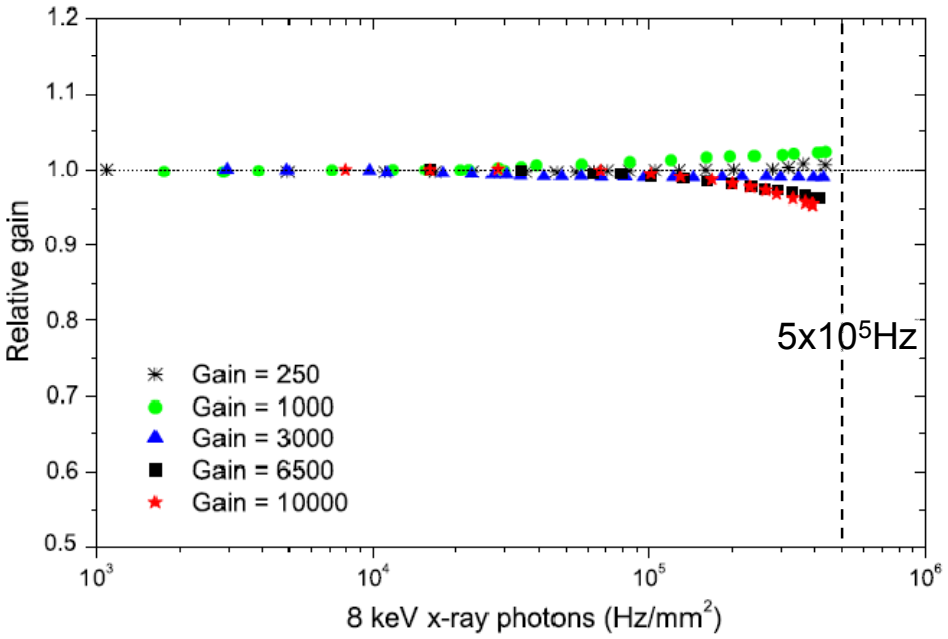


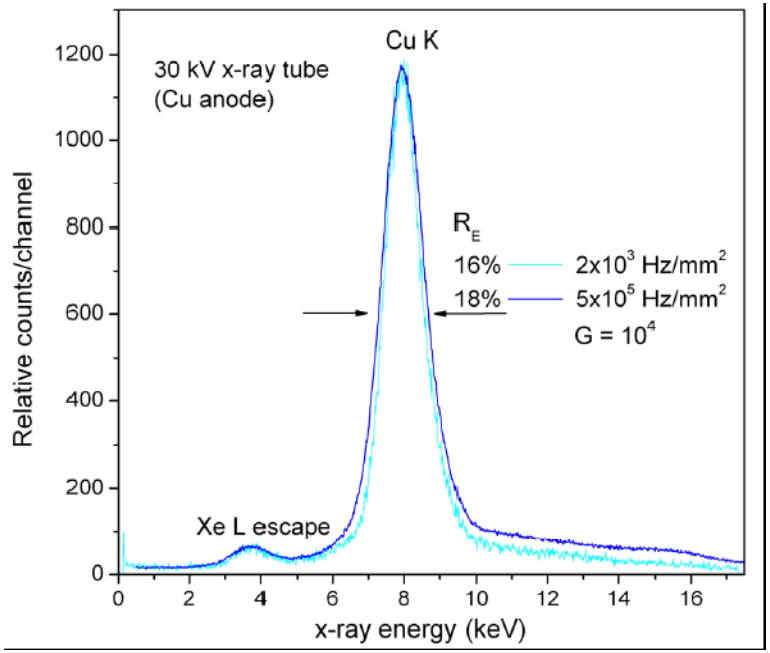


@ G > 10^4
noise < 50 eV

H. Natal da Luz et al., NIM A552 (2005)259

Count rate capability



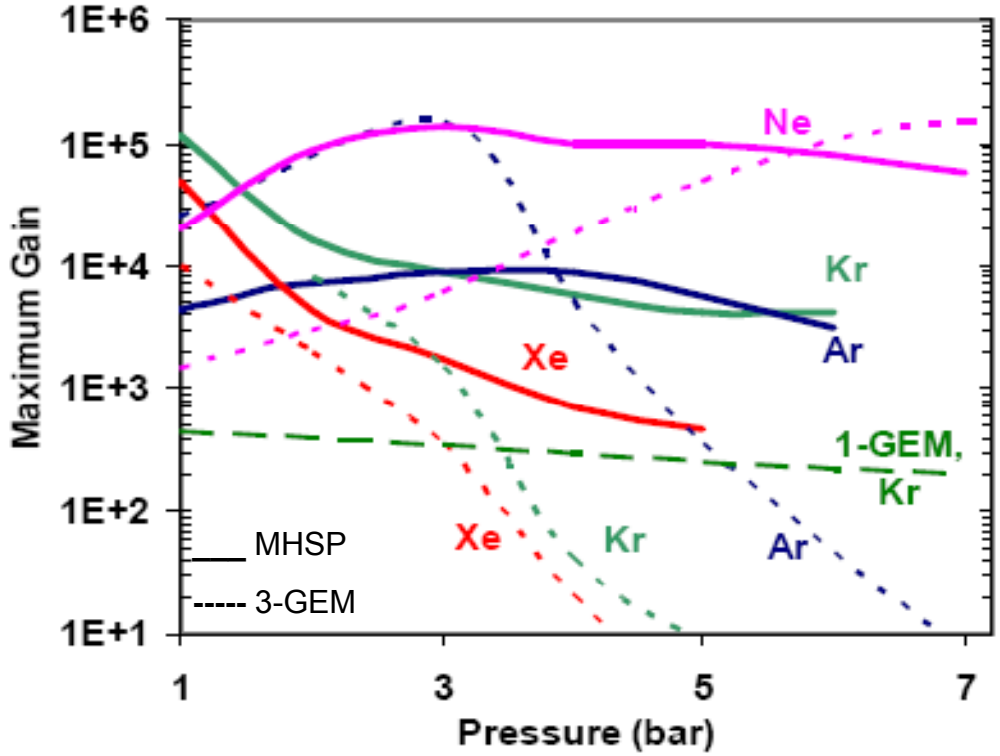


less than 5% variation @ G = 10^4
No visible variation @ G = 3000

JFCA Veloso et al., NIM A580 (2007)362-365

Operation in pure noble gases

Good performance at high pressure:



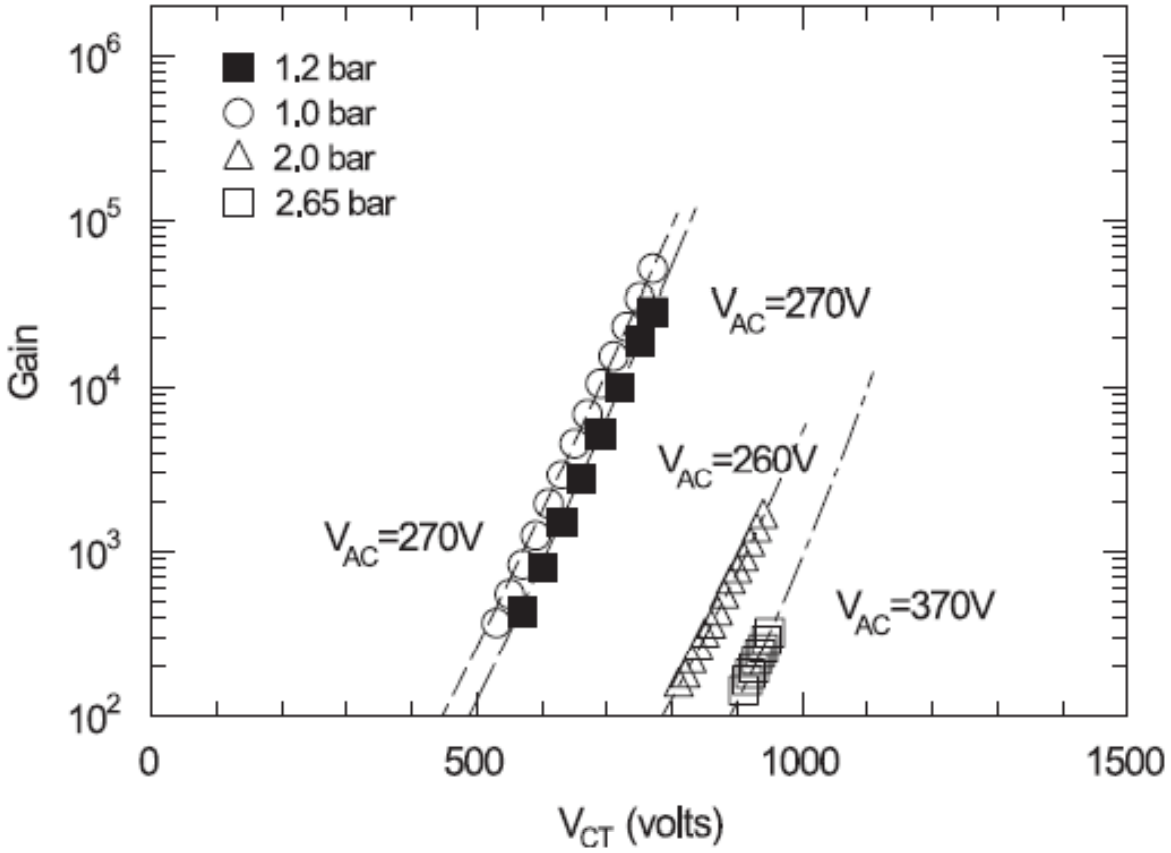
- High gain even for pure xenon
  - 1 bar => G = 5×10^4
  - 5 bar => G = 5×10^2

dual phase

hard x-ray ^ γ-ray

FD Amaro et al., JINST (2006) 1 P04003;
A. Buzulutskov, NIMA 494 (2002) 148

Operation in pure CF_4: from 1-2.65 bar



– High gain for pure CF_4

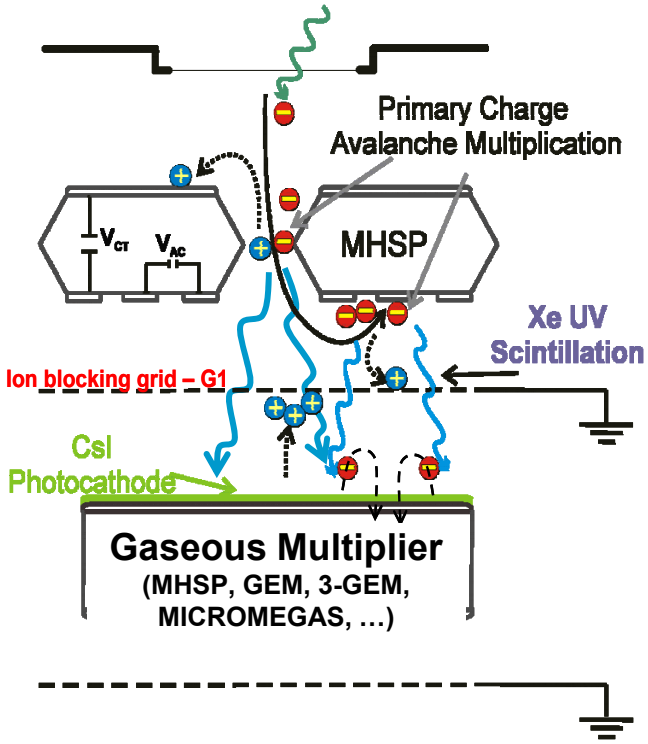
- 1 bar => G = 5×10^4
- 2.65 bar => G = 4×10^2

Neutron detection

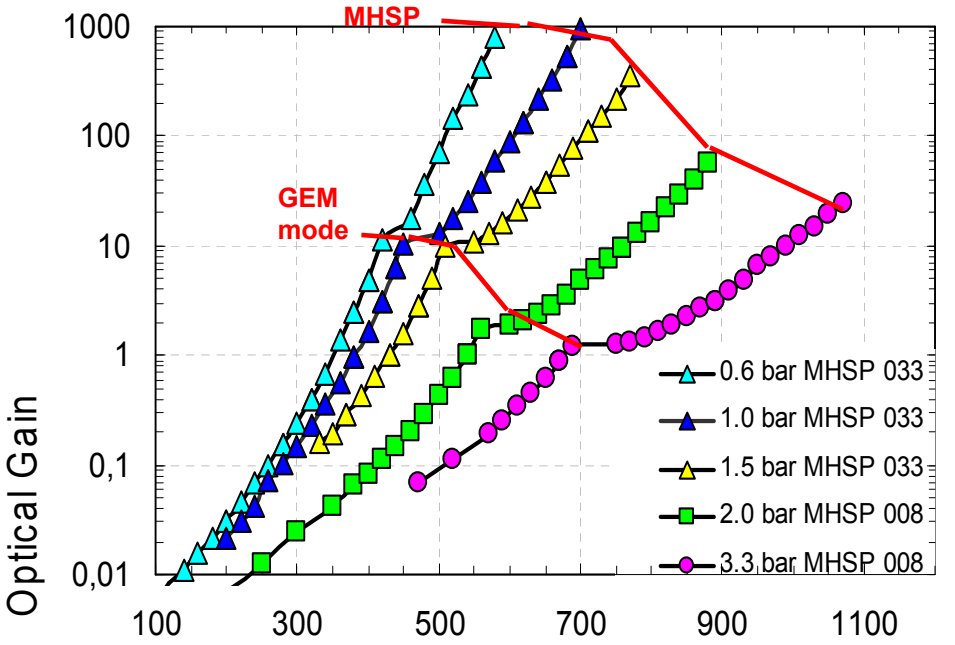
H. Natal da Luz et al., NIMA A580 (2007)286-288

PACEM concept

Operation principle



uses scintillation gases (noble, CF_4, …)



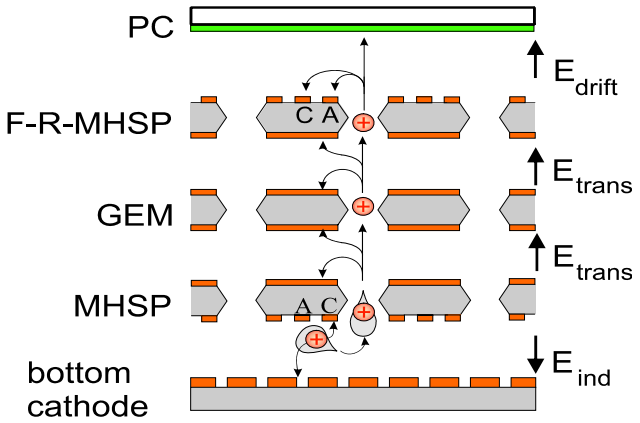
- **Optical Gains of ≈ 10^3**
- **2 orders of magnitude higher than for GEM**

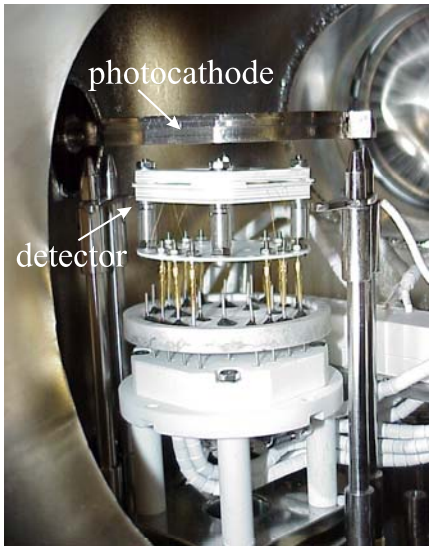
PACEM with THGEM is also under study

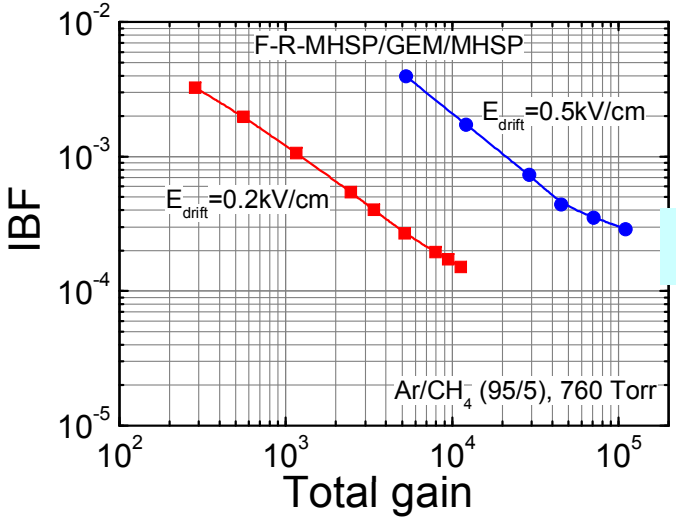
see talk: J. dos Santos

JFCA Veloso et al., JINST (2006) 1 P08003

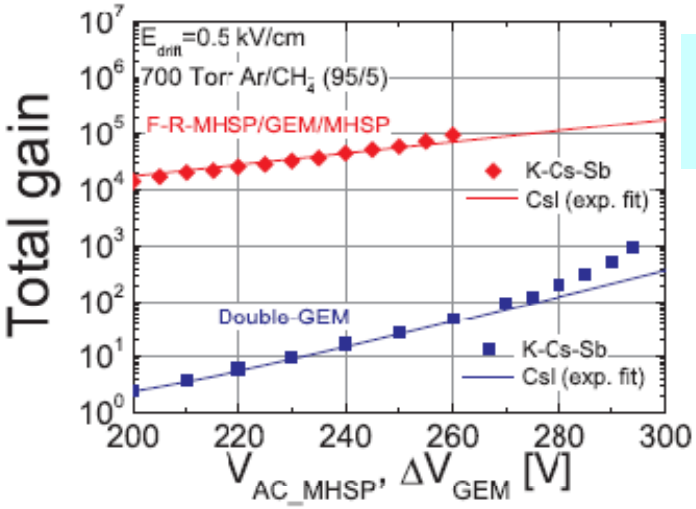
First demonstration of a GPM operation in visible range







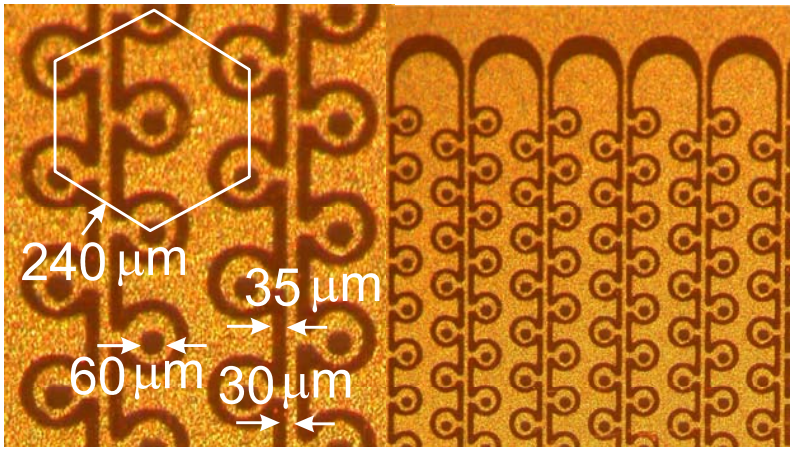
0.03%

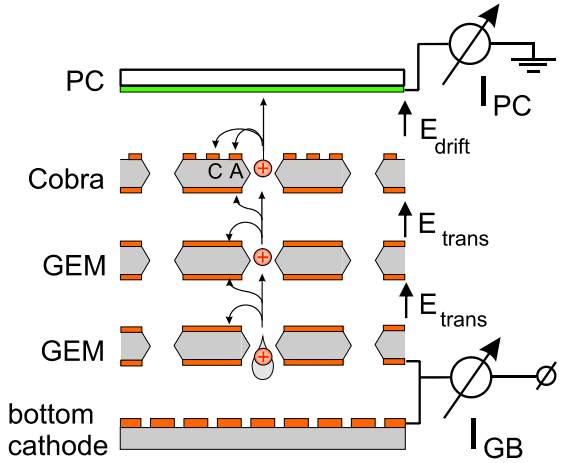


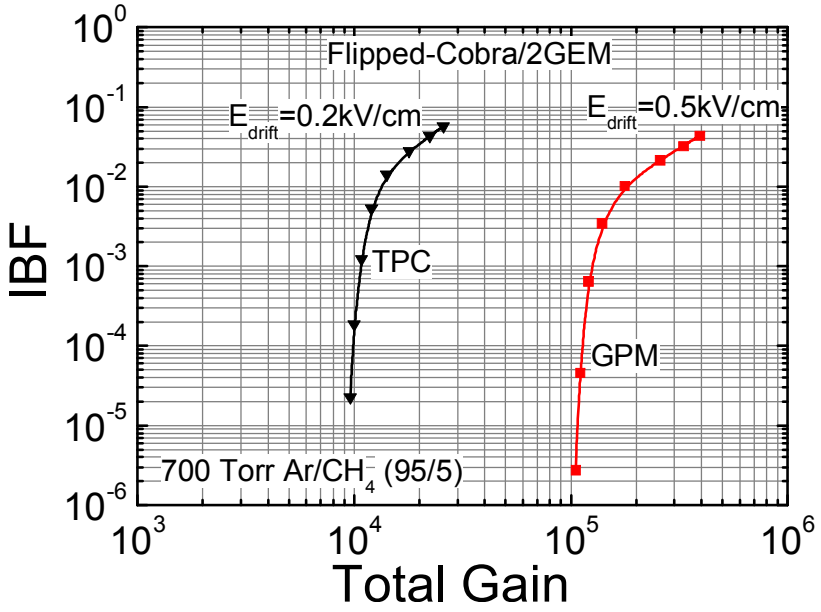
No visible feedback

A. Lyashenko et al., NIMA (2008), http://arxiv.org/abs/0808.1556v2

COBRA – a new hole-type structure for ion blocking





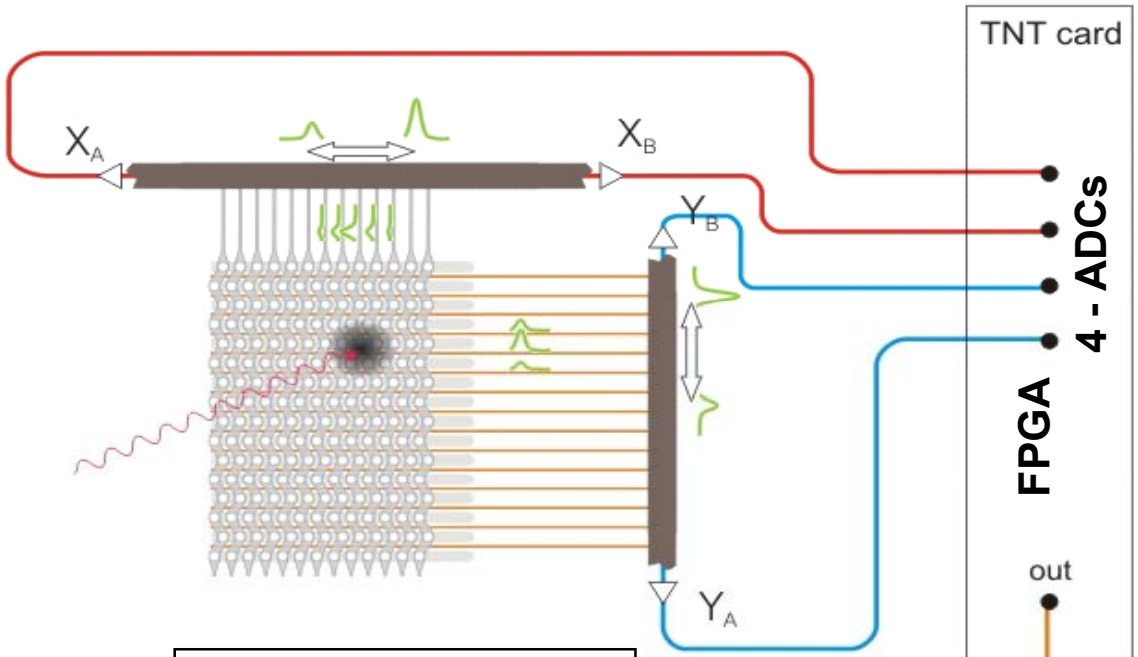


- **IBF 1000 x lower than with GEMs**
- **At the expense of e⁻ collection efficiency (20%)**

Optimization is under investigation

A. Lyashenko et al., NIMA (2008), http://xxx.lanl.gov/abs/0804.4396

2D-Imaging – using resistive lines



COMPUTER

-Set time window

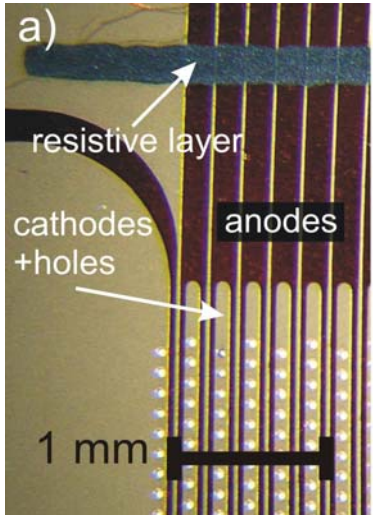
$$- x = k \times \frac{x_A}{x_A + x_B}$$

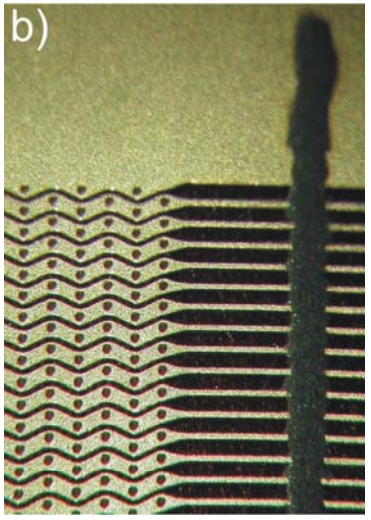
$$- y = k \times \frac{y_A}{y_A + y_B}$$

$$- Energy = l \times (y_A + y_B)$$

Image reconstruction

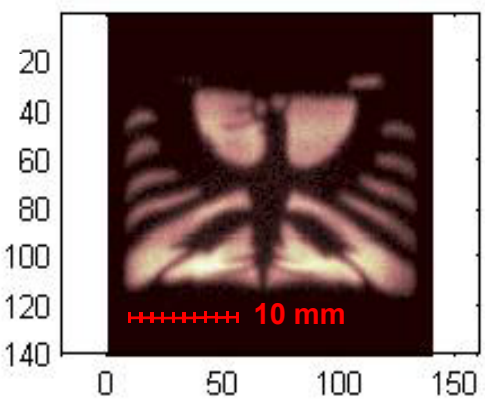
to computer through USB

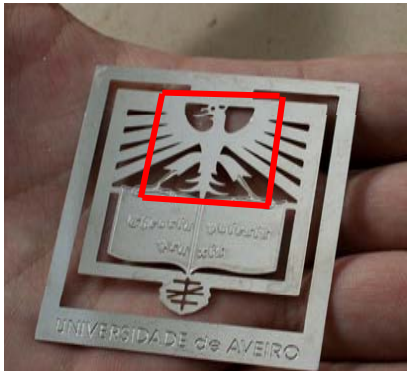




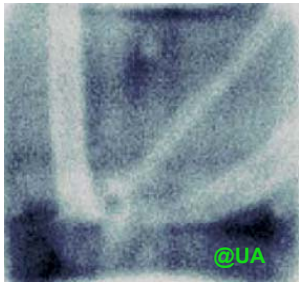
2D-Imaging – examples (active area = 25 x 25 mm²)

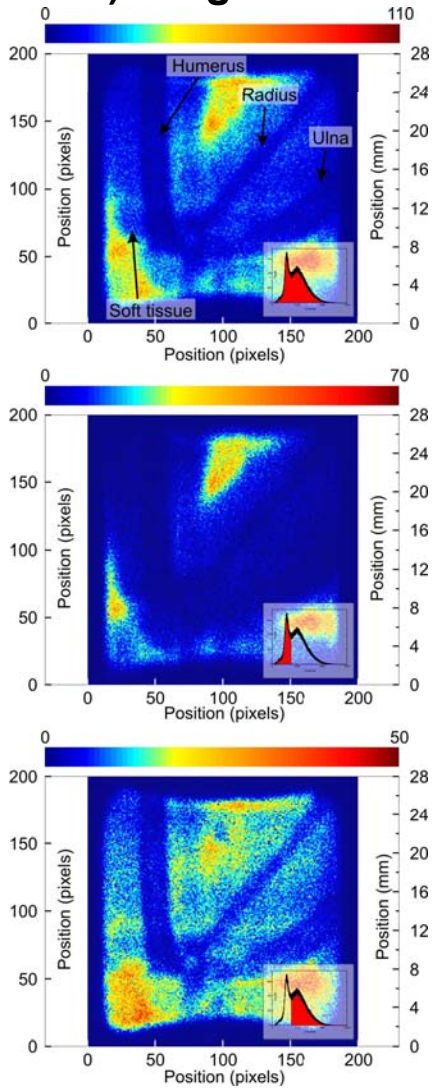
Stainless steel clip from UA



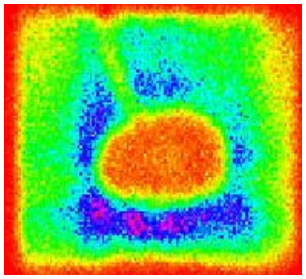


common quail (*coturnix*) wing





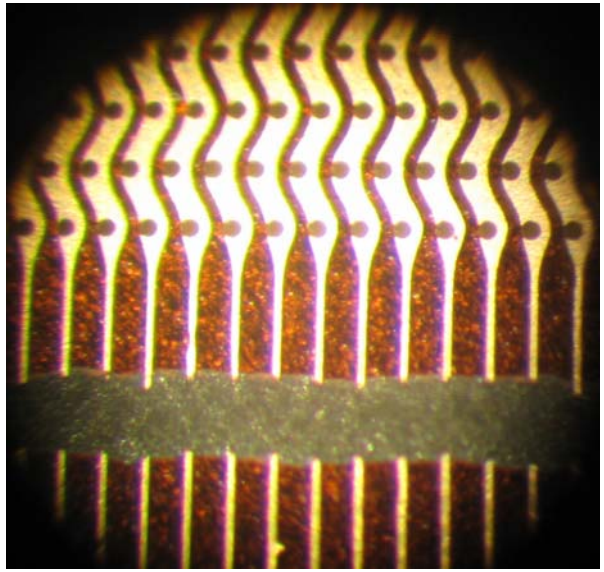
fresh cherry



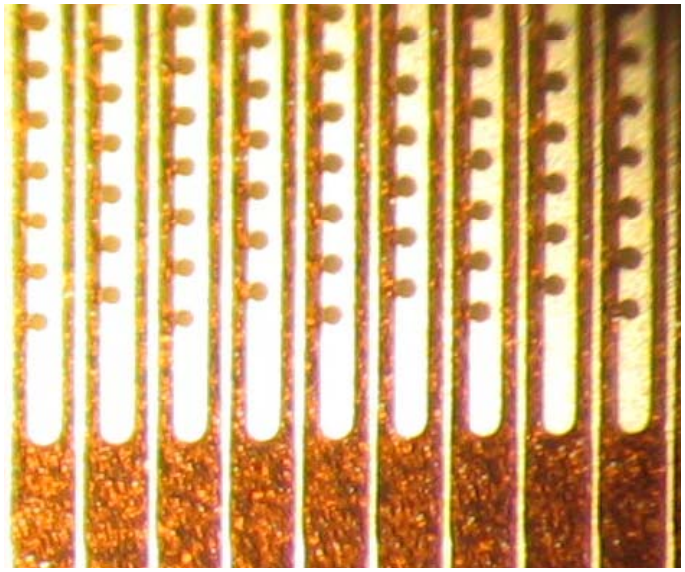
2D-Rp **< 125 µm (σ)** – full area

H. Natal da Luz et al.,IEEE-TNS (2008),in press

Misalignments difficult large area production



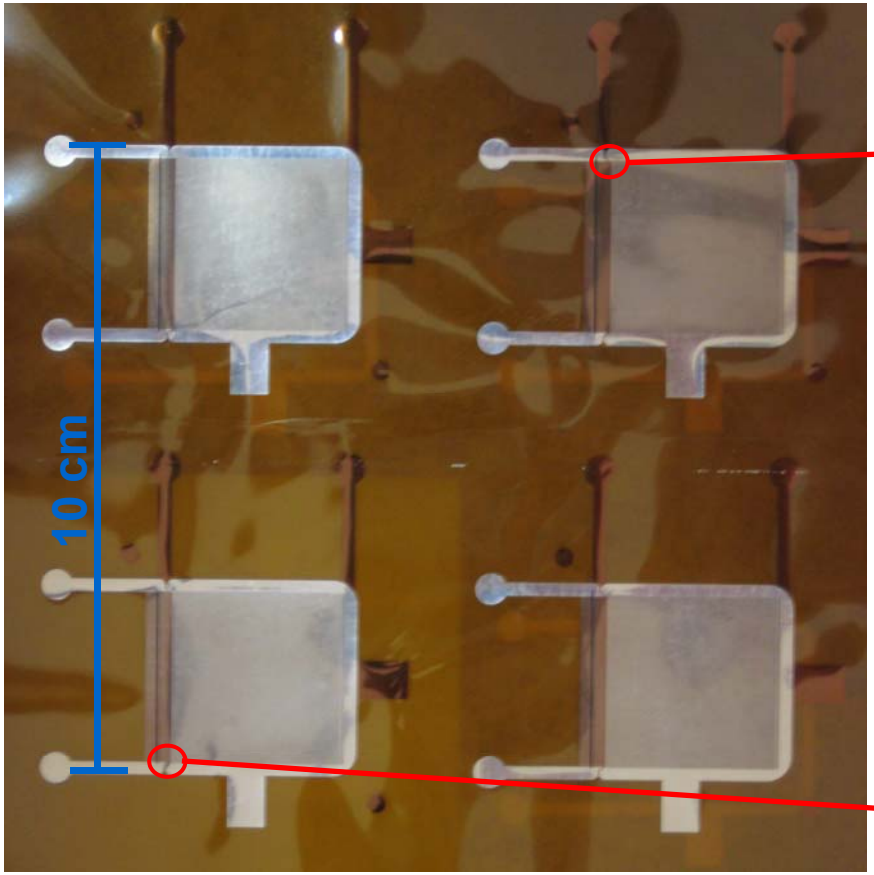
Top side

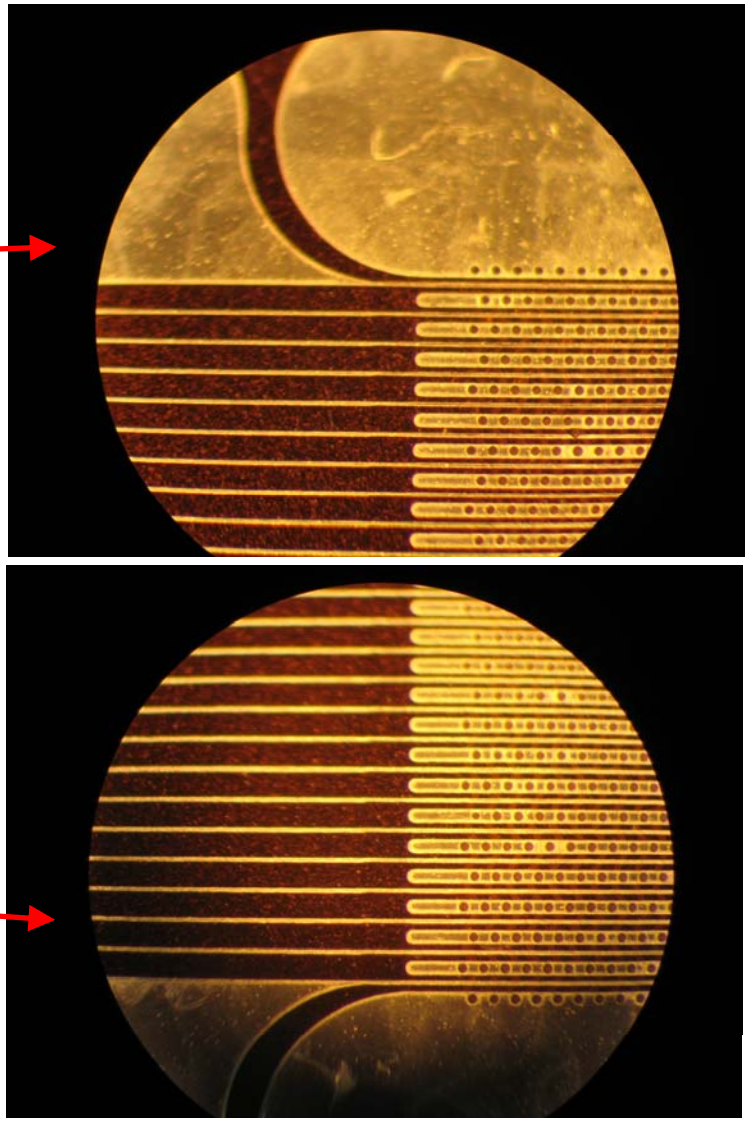


bottom side

New productions indicates - larger MHSPs are possible

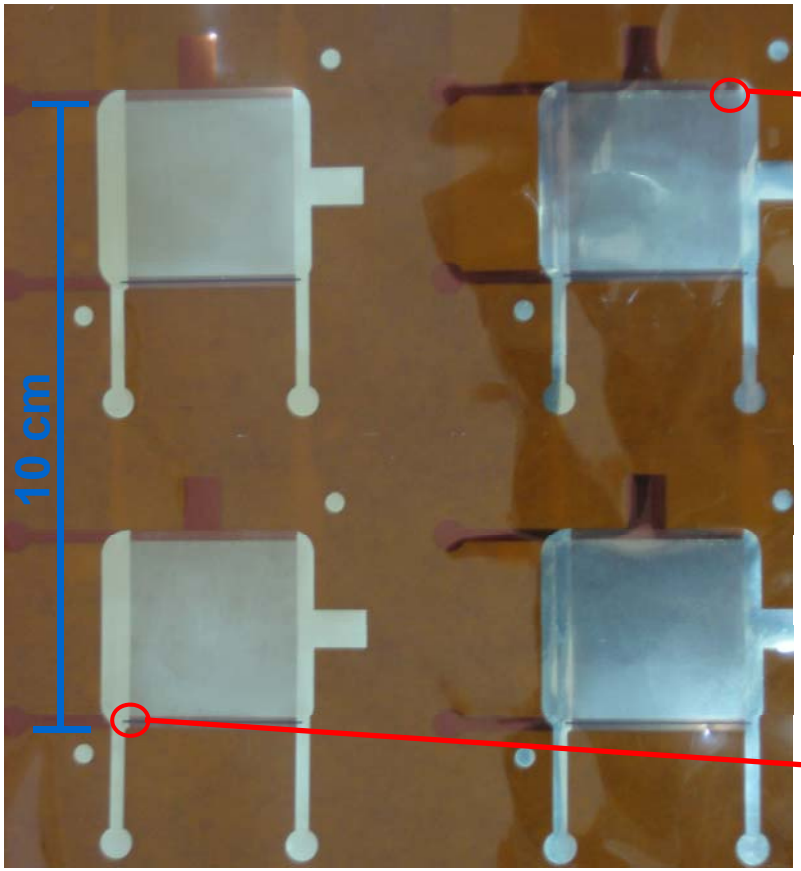
Bottom side

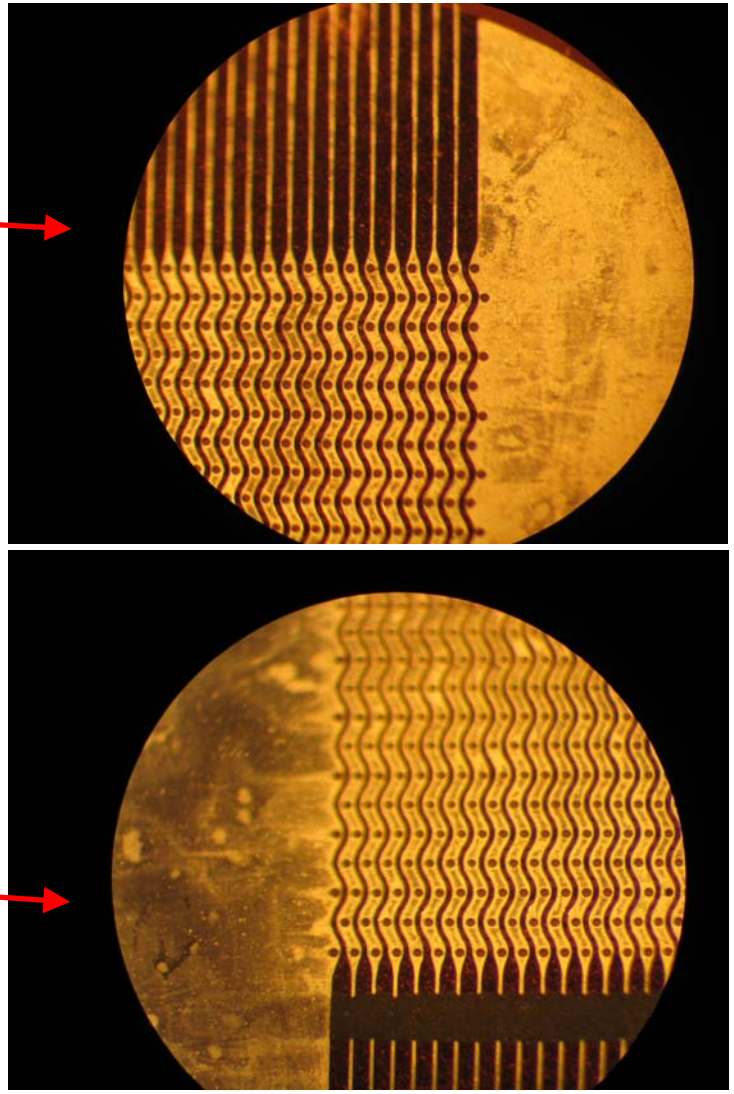




Larger areas - same production method

Top side





Larger areas - same production method

Conclusions & future work

- High quality structures have allowed performance improvement in:
  - High pressure operation
  - Energy resolution (13.5% @ 5.9 keV-Xe)
  - Position resolution (σ=125μm, resistive line)
  - Efficient ion blocking
  - Reliability
- Future improvements and work
  - MHSP areas of **5x5cm^2** and **10x10 cm^2** are under development.
  - Large area single photon counting visible sensitive GPM.
  - Study and optimization of the COBRA structure.
  - Production of more robust resistive lines for 2D

Thanks for your attention