VUV SENSITIVE GASEOUS PHOTOMULTIPLIER WITH POSITION CAPABILITY BASED ON THICK MULTIPLIERS

T. Lopes, A.L.M. Silva, L.F.N.D. Carramate, C.D.R. Azevedo, J.F.C.A. Veloso

I3N, Physics Department, University of Aveiro, 3810-193 Aveiro, Portugal

Abstract

A new VUV single-photon gaseous photomultiplier (GPM) with position capability is presented. It is based on a triple cascade configuration of two THGEM followed by a 2D-THCOBRA with a CsI photocathode deposited on the top electrode of the first structure.

To allow high gains at low applied voltages a mixture of Ne/CH4 at atmospheric pressure was used. The gas mixture allows excellent photoeletron extraction from the CsI photocatothe as well as full electron collection efficiency.

The photomultiplier uses a spectrosil B window allowing the detection of photons in the VUV range (> 165 nm). For the experimental studies a Hg(Ar) lamp to generate the single VUV photons was used.

Gains above 10^6 were achieved at stable operation. The 2D-THCOBRA intrinsic image capability allows to "see" the shape of the first structure of the cascade from where the photoelectrons are emitted and focused into the holes. This indicate that position resolutions bellow 300 μm (FWHM) (σ = 128 μm) for single photons can be achieved with the proposed photomultiplier.

Conclusion

- Good GPM performance - Gain of 10^6 and Position resolution <300μm (FWHM) (σ = 128μm)
- IBF values of about 20 %;
- Count rates higher than 100kHz were measured with no sparks
- 2D-THCOBRA shows to be adequate to obtain image

acquisition setup & operation principle

Detector setup

ThCOBRA structure

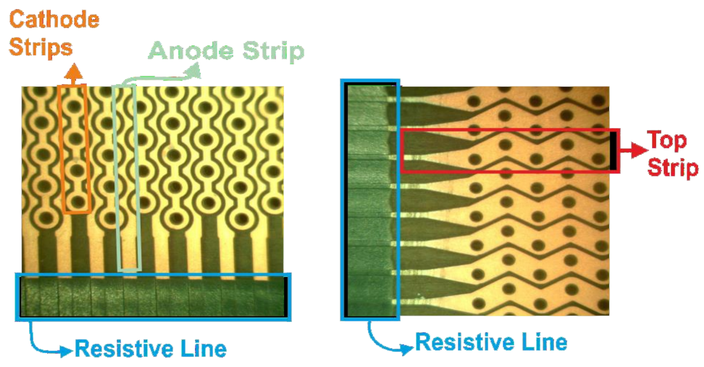
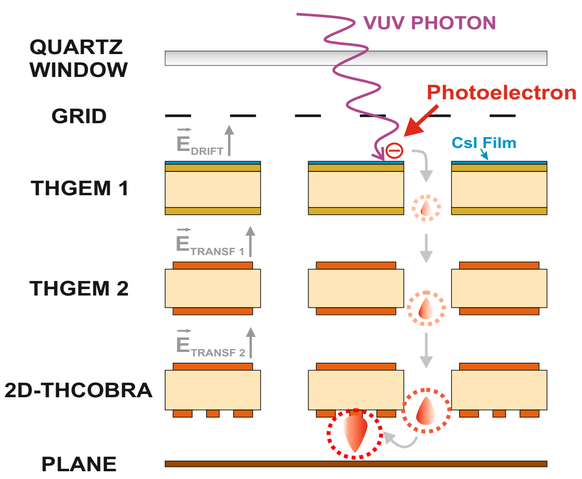


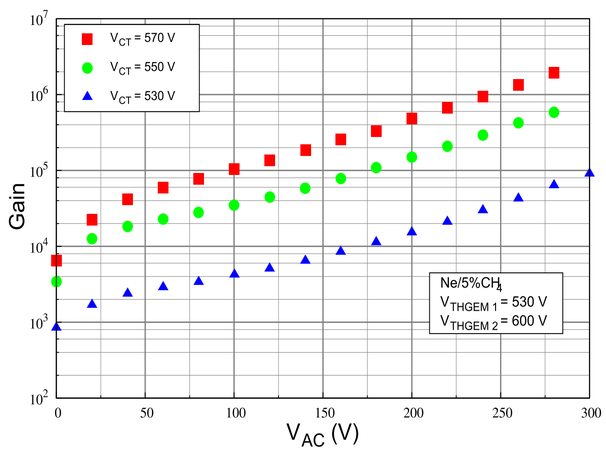
Photo of the 28x28 mm² 2D-THCOBRA. Detailed view of the top and bottom side of the micro-hole structure.

Operation principle

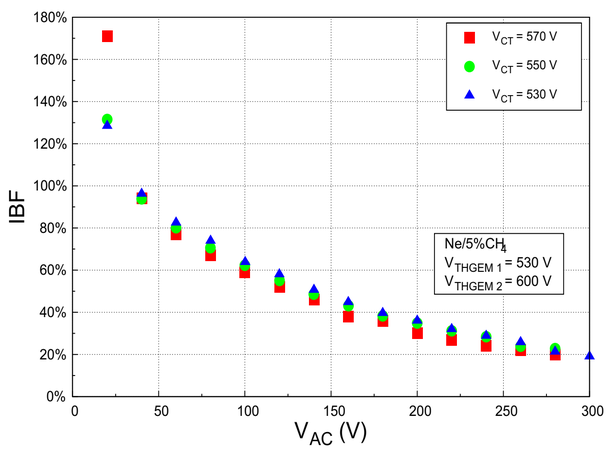


Gain and Ion Back Flow (IBF)

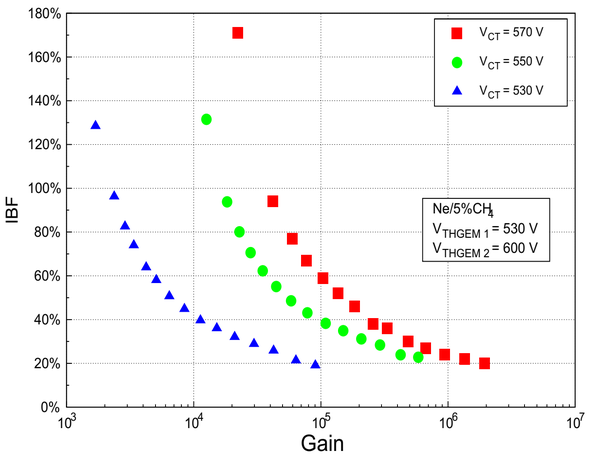
Gain as a function of the V_{AC} for different V_{CT}



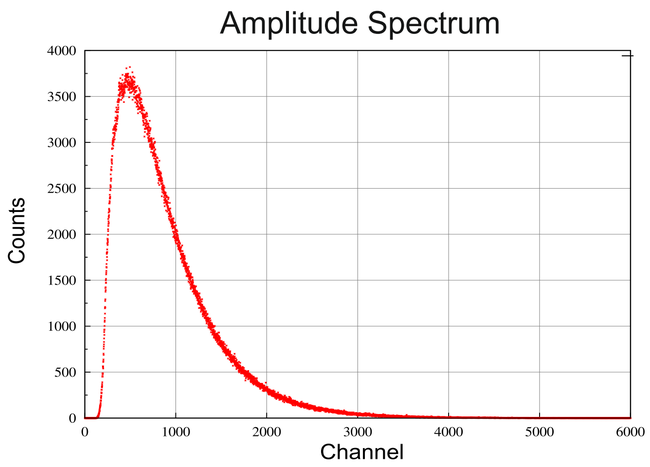
IBF as a function of the V_{AC} for different V_{CT}

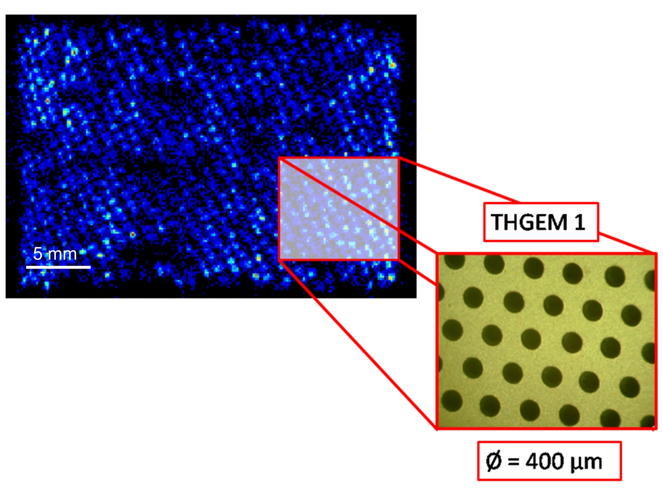


IBF as a function of the Gain

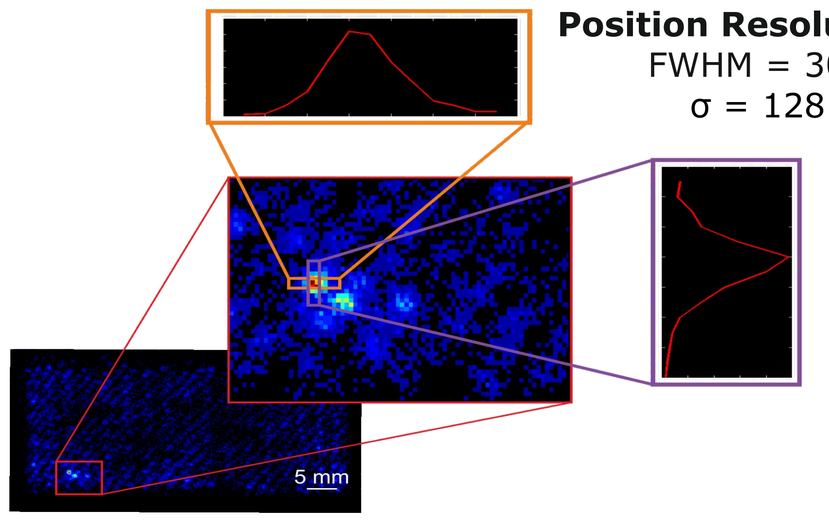


2D Imaging



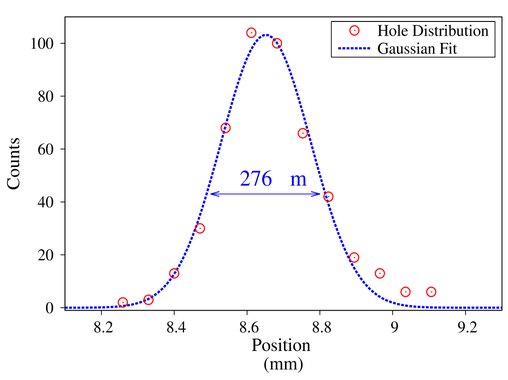


spatial resolution

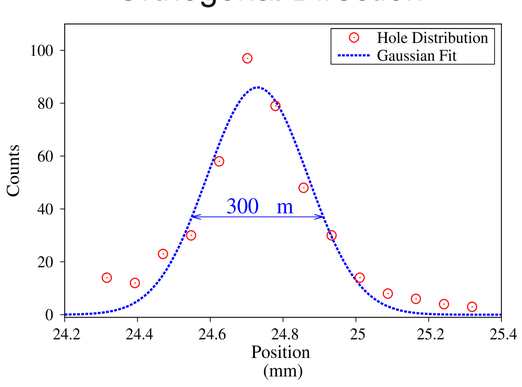


Position Resolution X&Y:
FWHM = 300 μm
σ = 128 μm

Parallel Direction



Orthogonal Direction



future Work

- Use higher granularity structures in order to minimize the effect of the structure geometry, like a GEM or a MHSP;
- Decrease of the IBF by using an R-THCOBRA as a second structure.
- Consider a 10x10 cm^2 detection area

acknowledgements

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references

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