

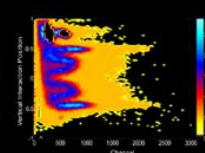
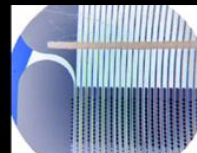
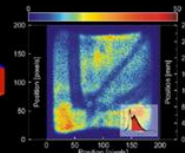
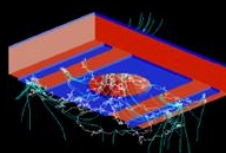
THCOBRA for Ion Back Flow Reduction in THGEM based photosensors

Fabio Pereira¹, C.A.Santos¹, C.D.R.Azevedo¹, A. Breskin², J.F.C.A. Veloso¹

¹I3N, Universidade de Aveiro

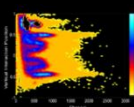
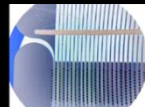
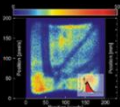
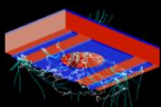
²Weizmann Institute of Science

7th RD51 Collaboration Meeting, CERN, 13-15 April 2011

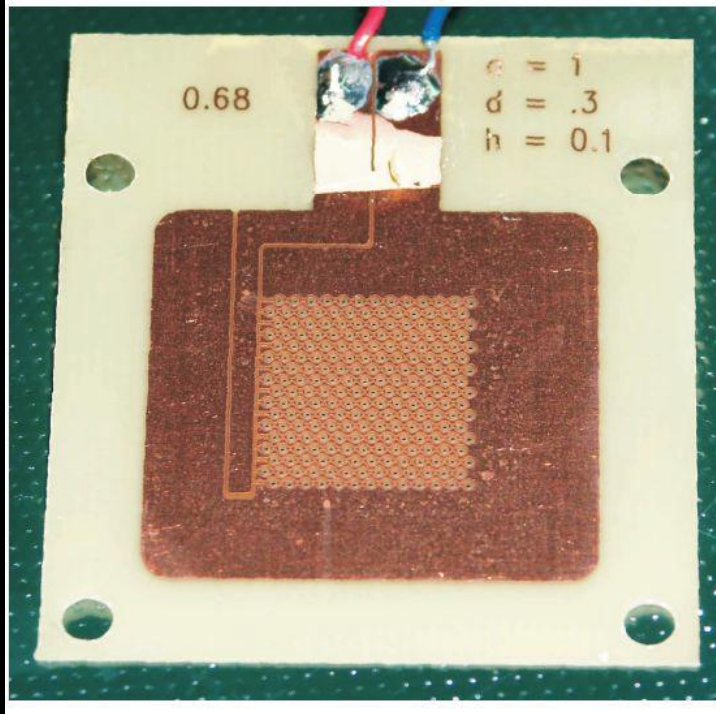


Motivation – Gaseous Photomultipliers

- High Gain Devices
 - RICH
 - Visible range detection
- High Gain \Rightarrow Increase in number of Ions flowing back
- High Ion Back Flow (IBF)
 - Feedback pulses
 - Electric field distortions
 - Photocathode (PC) aging



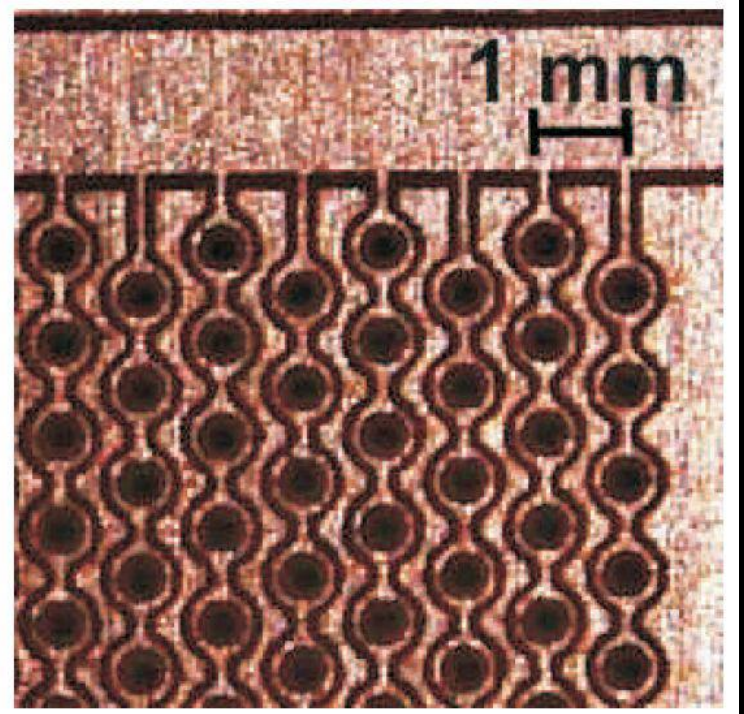
ThickCOBRA



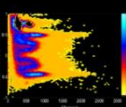
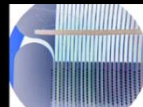
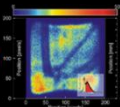
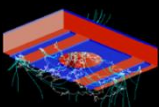
Hole diameter
- 0,3 mm

Rim
- 0,1 mm

Thickness
- 0,4 mm

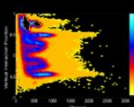
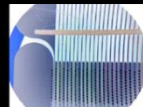
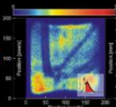
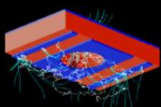
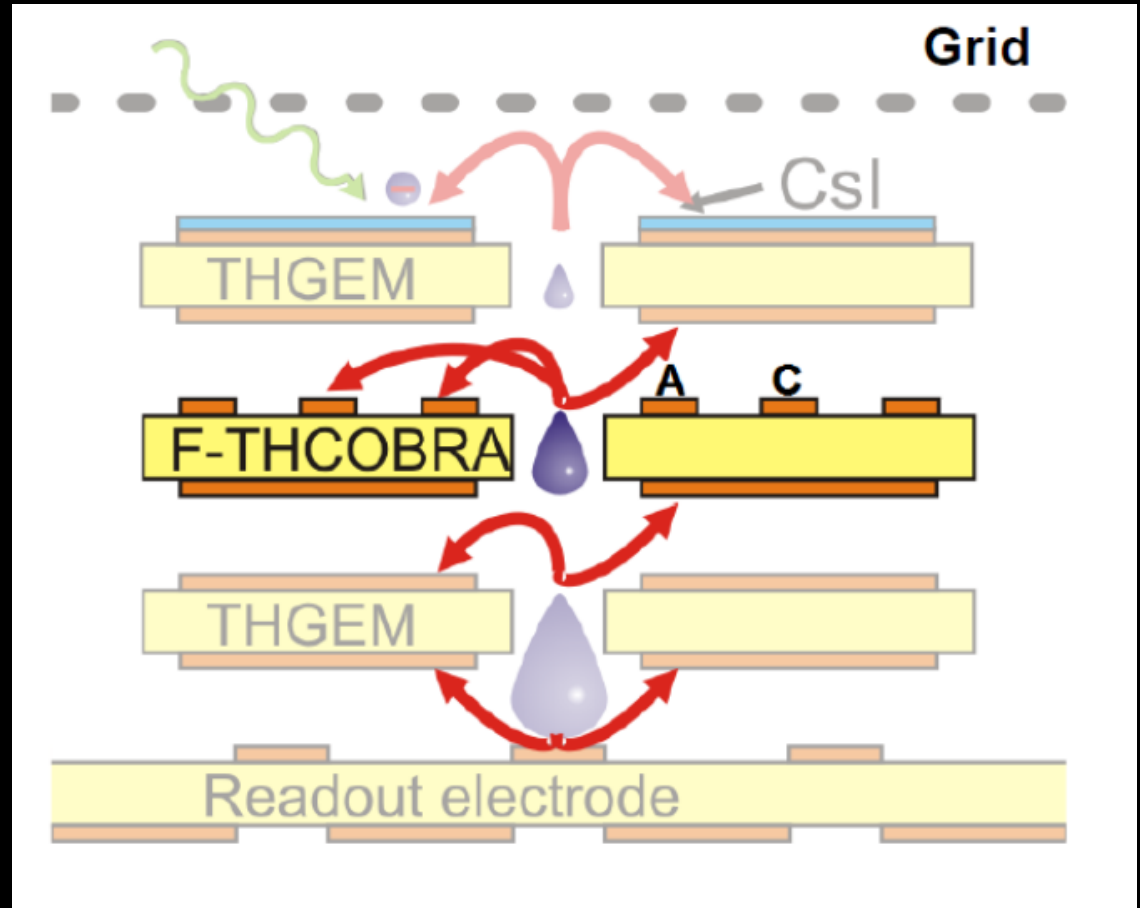


- THGEM-like structure
- Additional electrode allows ion draining

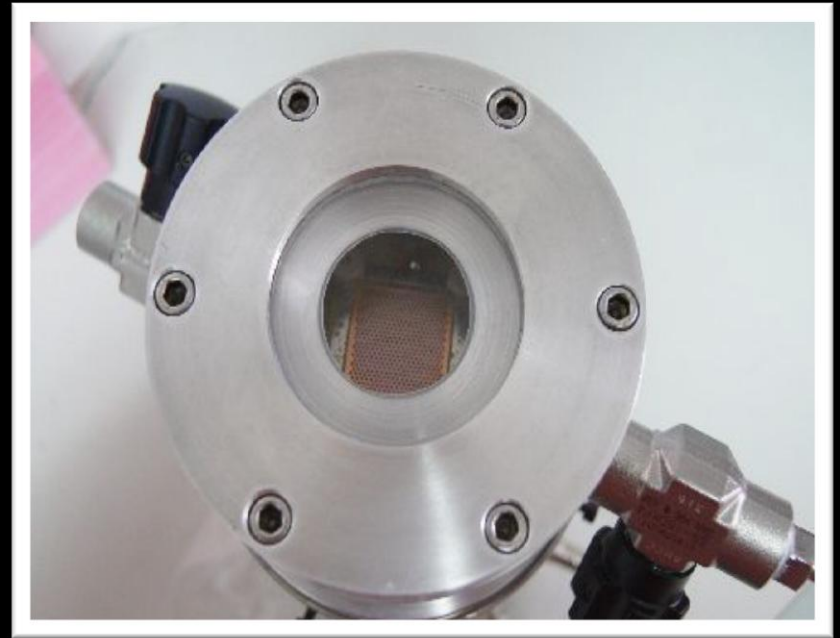
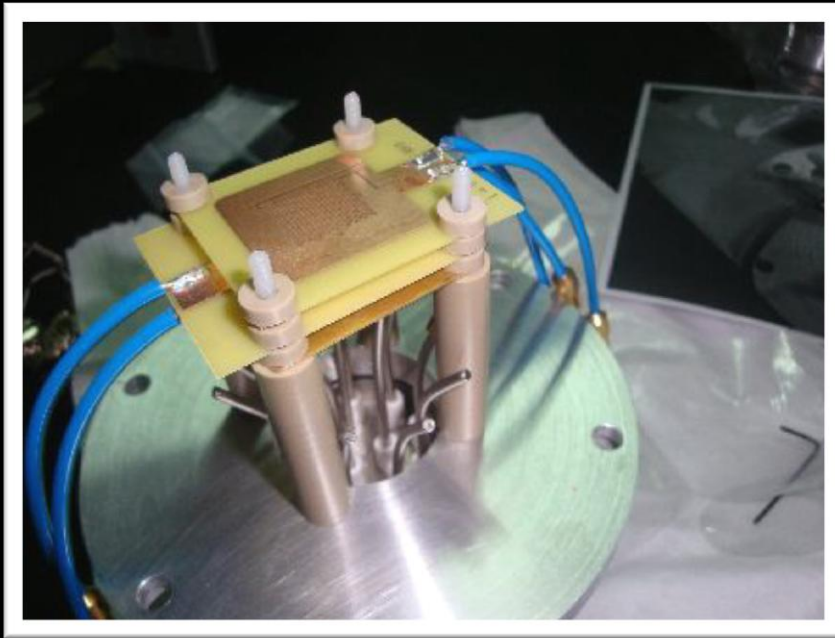


Detector configuration

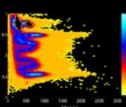
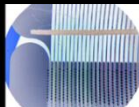
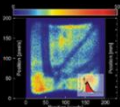
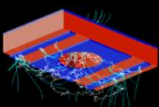
- Voltage between A and C to trap ions (Vac)
- Electron transparency is not a limited factor for total collection efficiency



The Detector

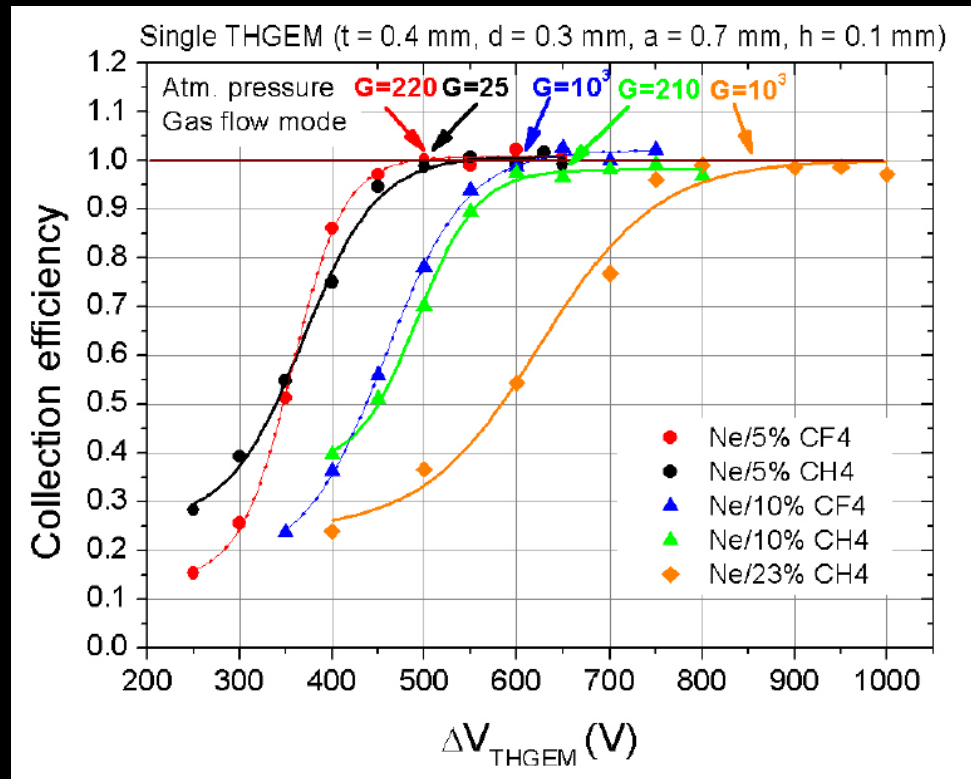


- 95% Ne / 5% CH₄

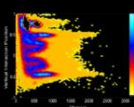
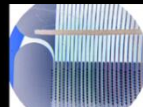
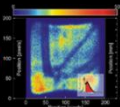
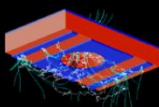


Efficiency

- First THGEM's with enough voltage to ensure electron collection efficiency (> 500V)

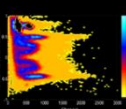
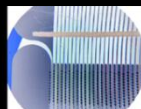
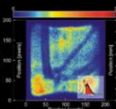
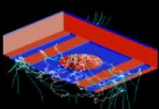
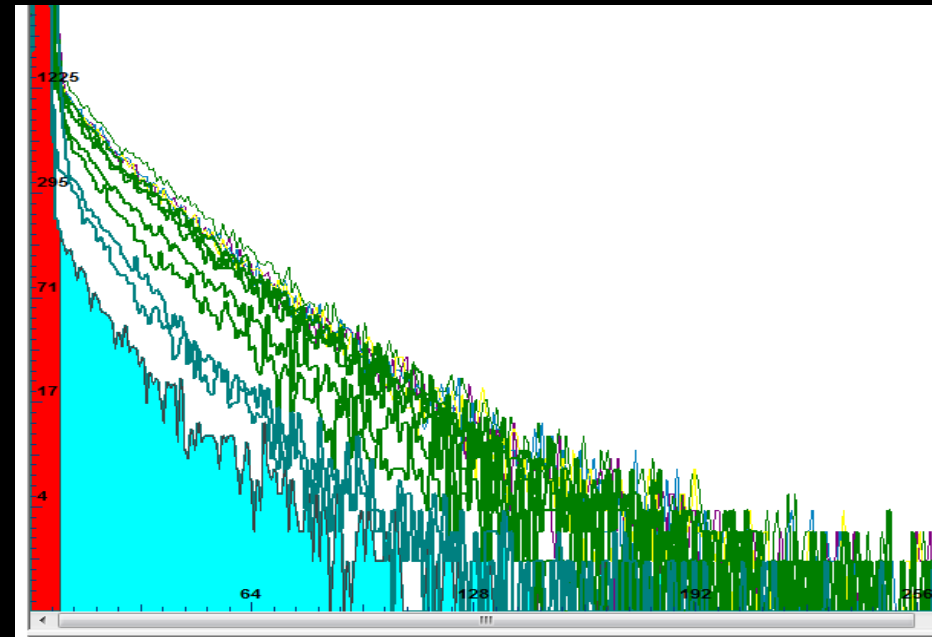
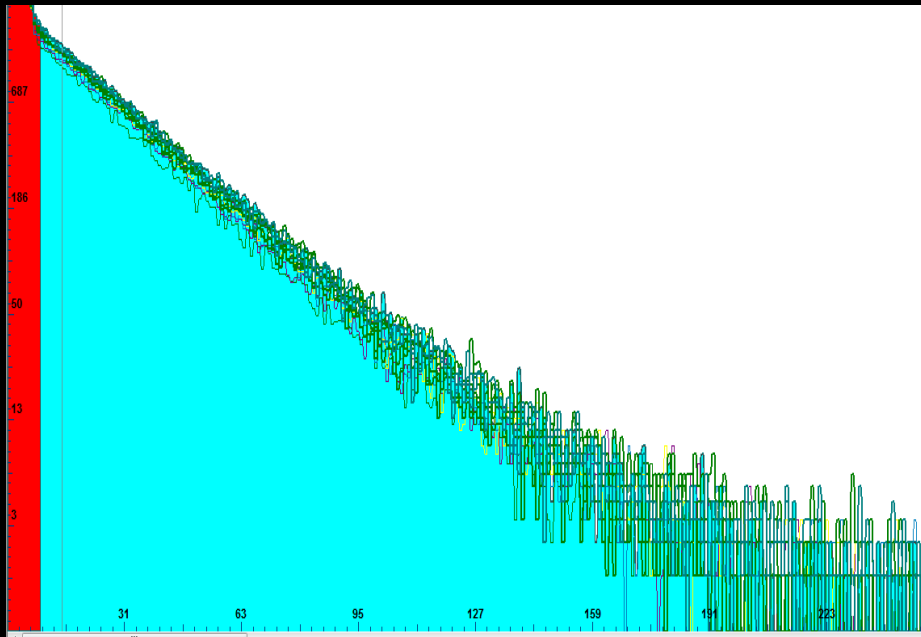


Towards THGEM UV-photon detectors for RICH: on single-photon detection efficiency in Ne/CH₄ and Ne/CF₄, C.D.R. Azevedo et al., JINST 5 P01002, 2010



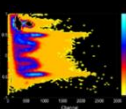
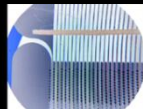
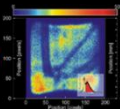
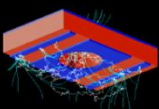
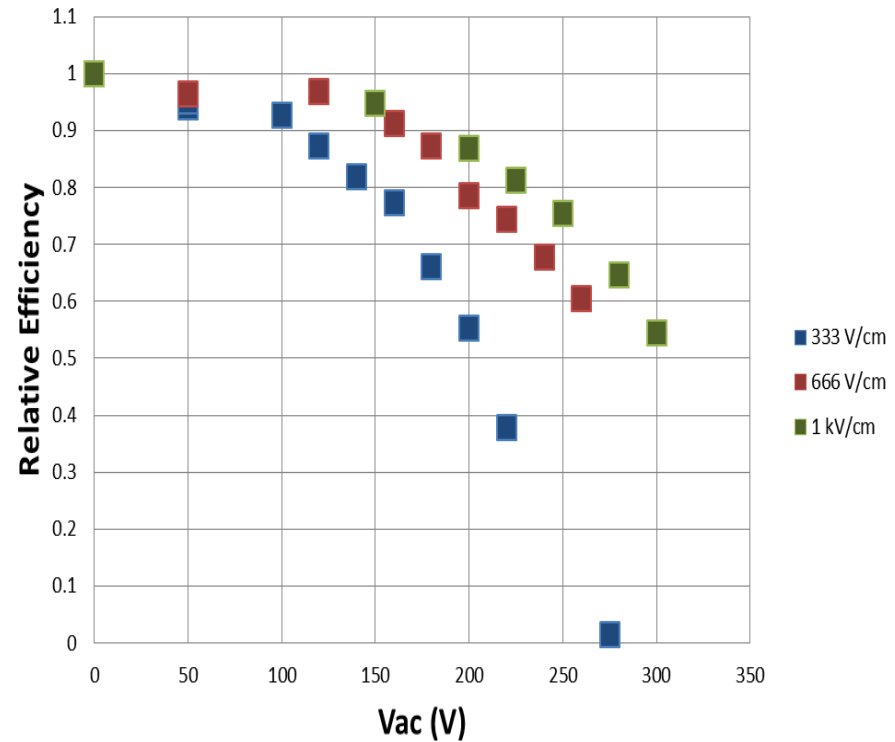
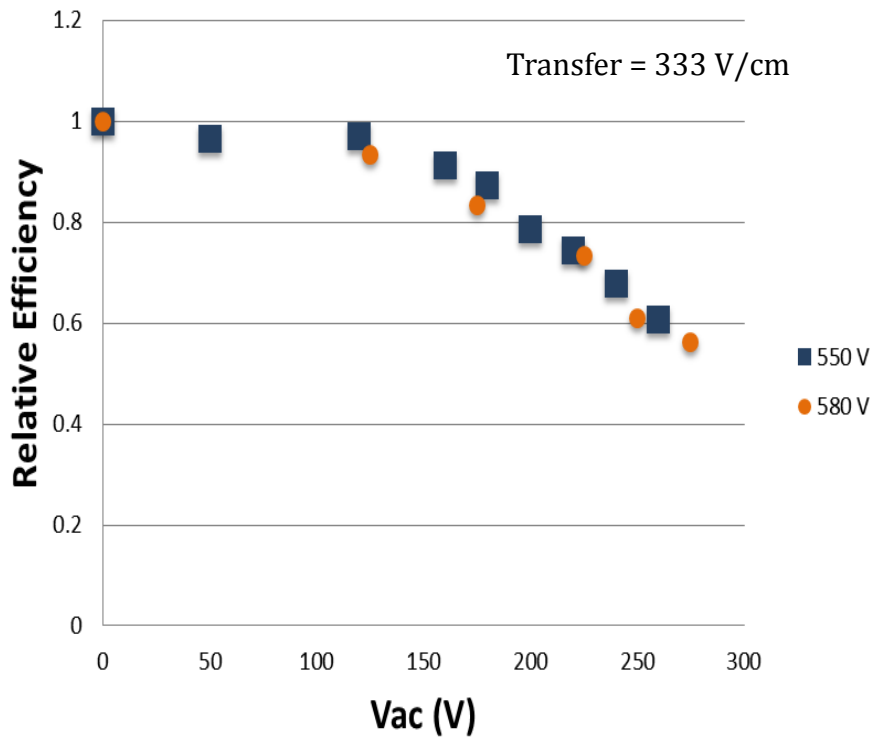
Efficiency

- Variation of collection efficiency as a function of Vac in THCOBRA
- Pulse mode
 - Keeping a constant gain, difference in number of events must be from efficiency loss

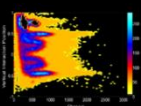
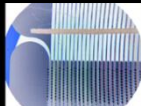
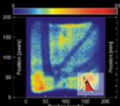
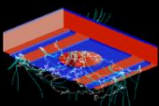
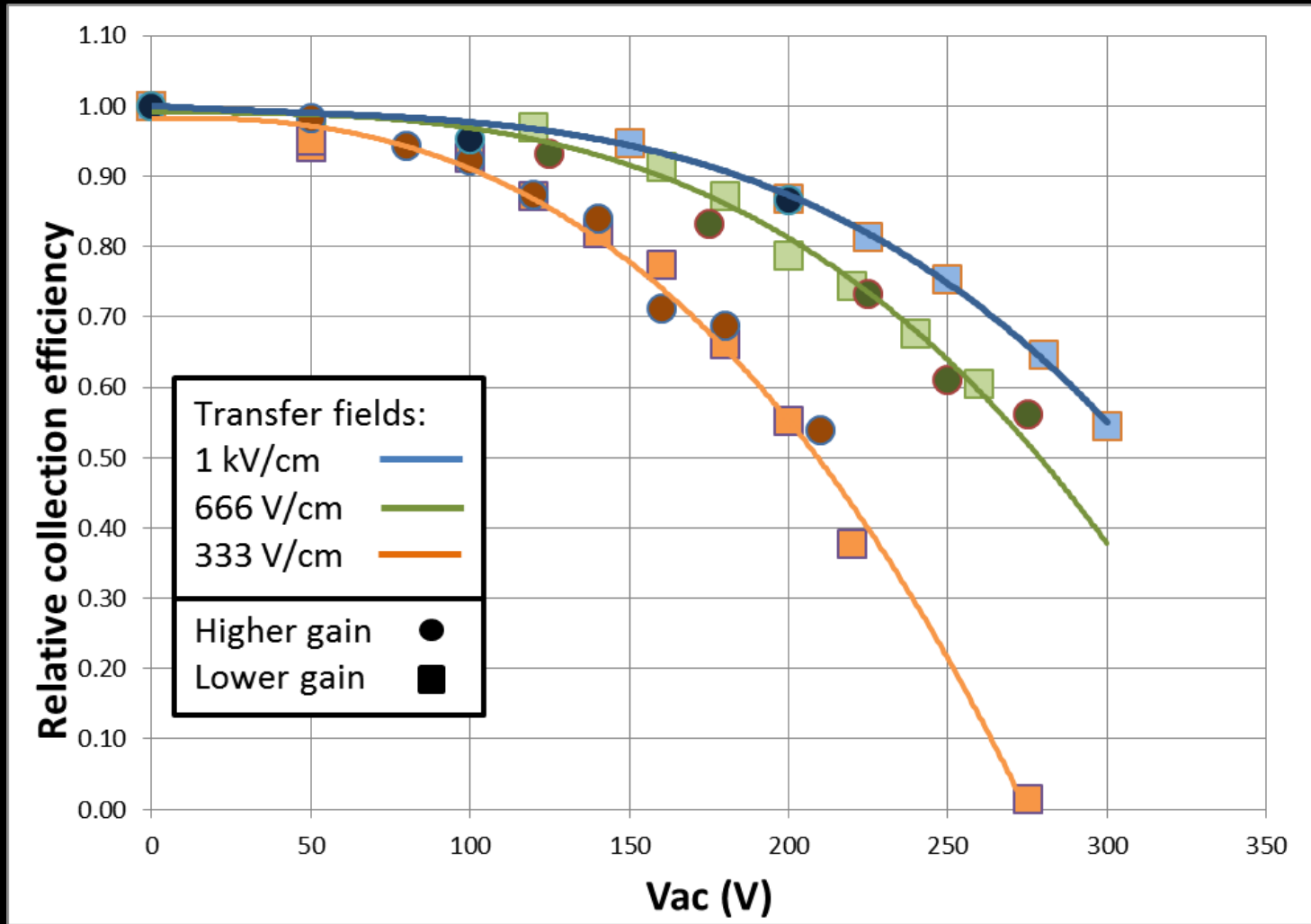


Efficiency

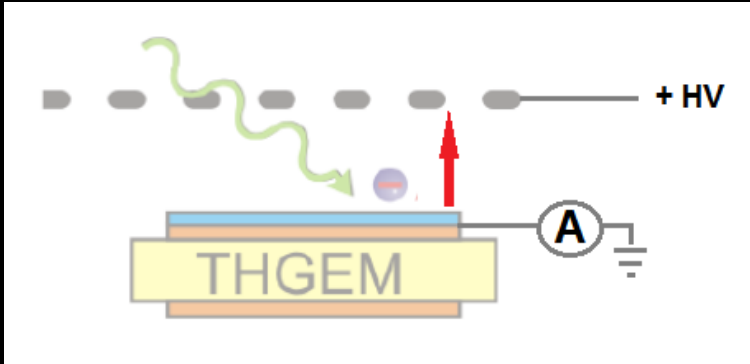
- Variation of efficiency with transfer field
- Absence of variation with gain



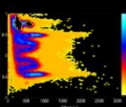
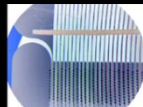
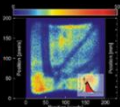
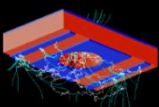
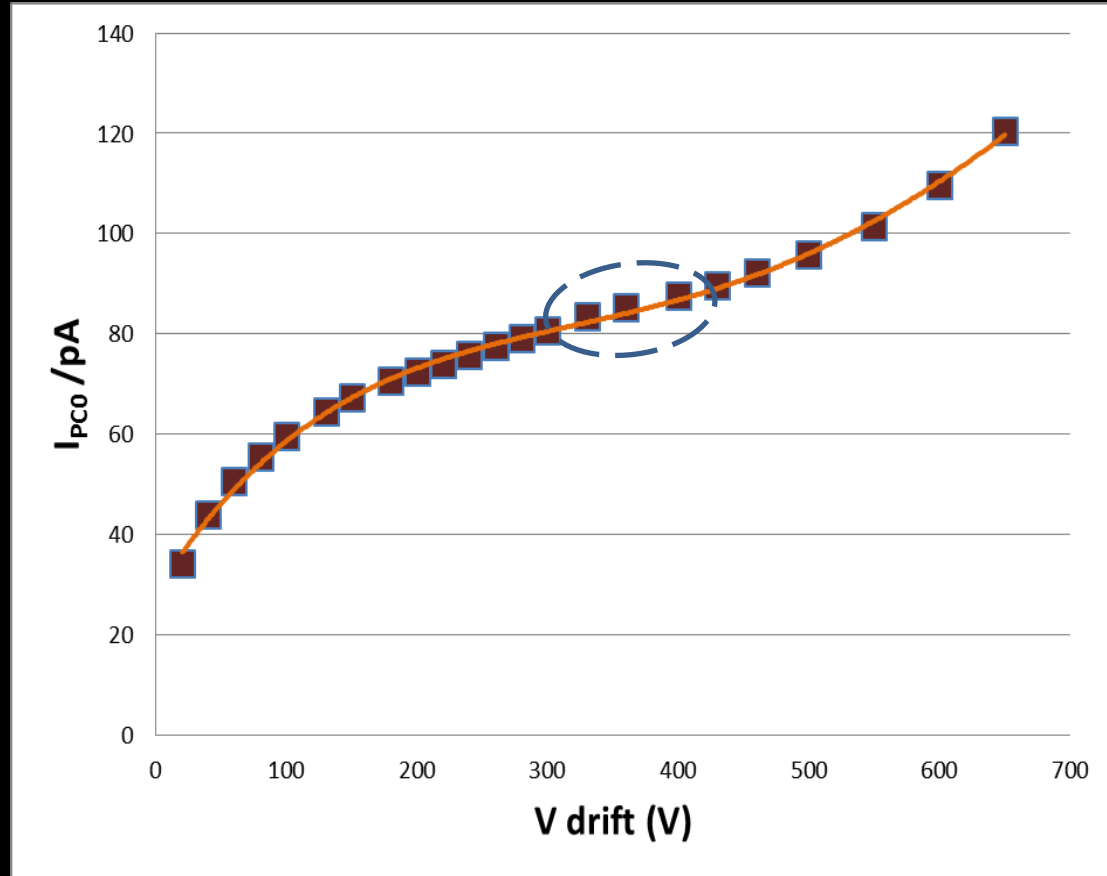
Efficiency



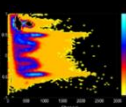
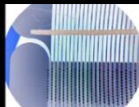
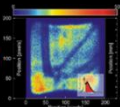
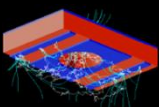
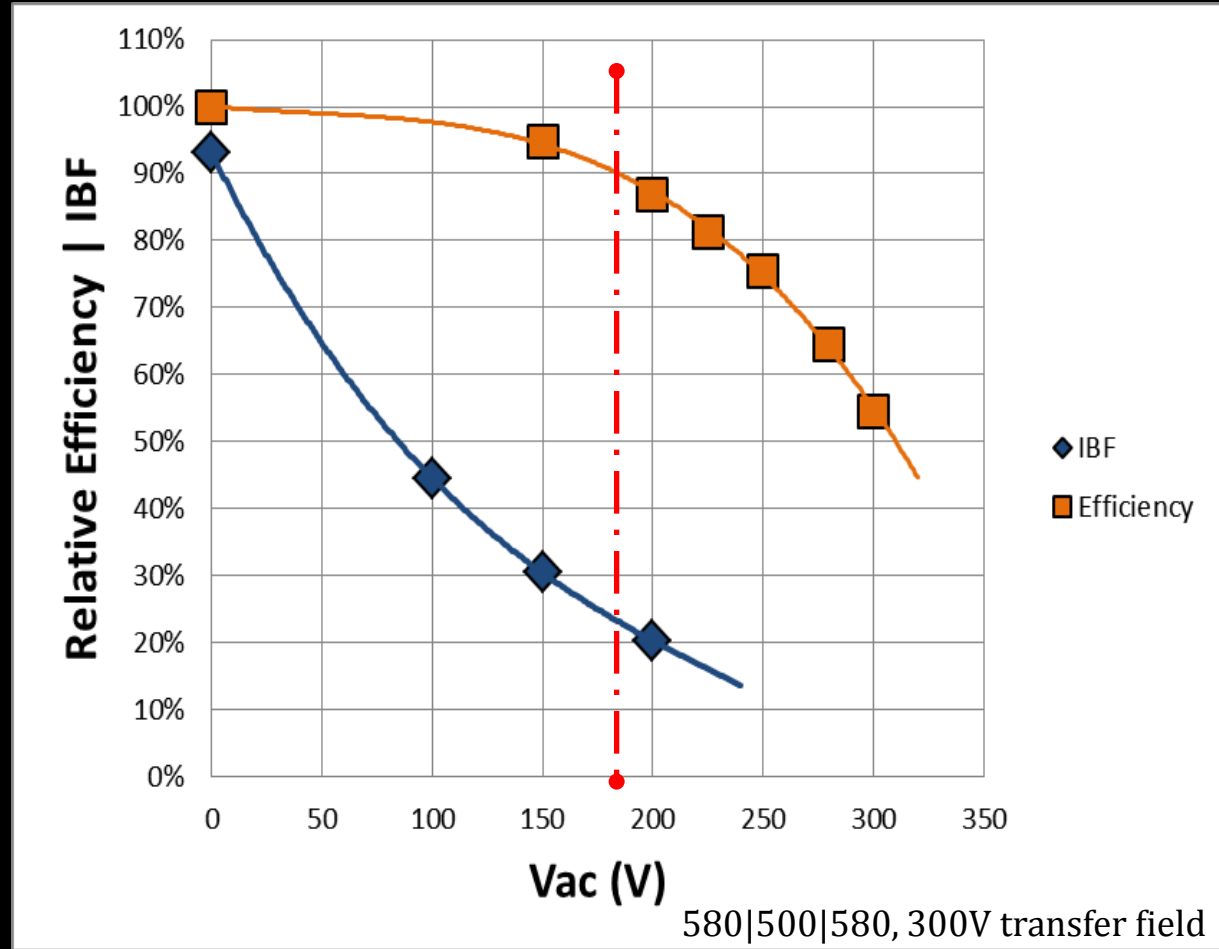
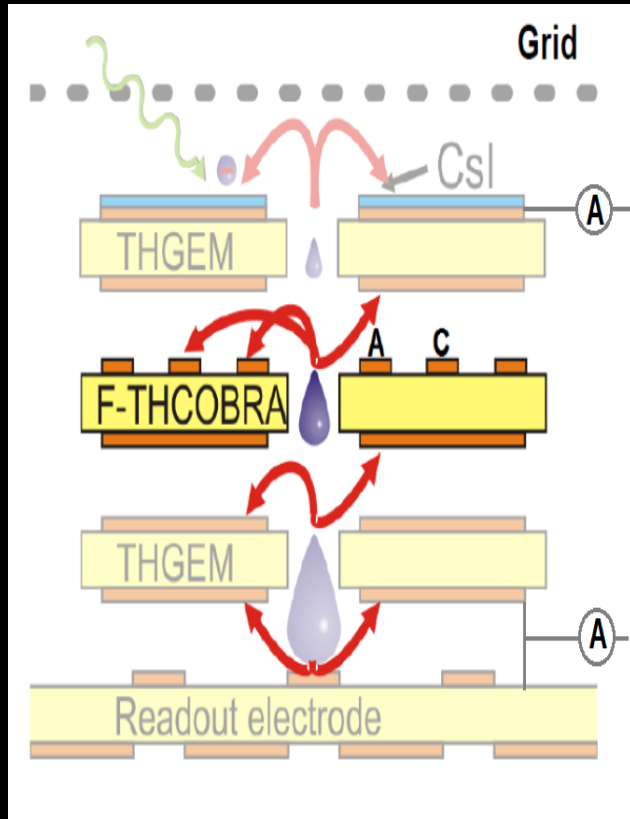
IBF



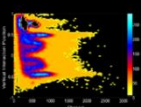
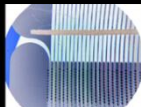
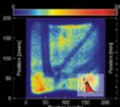
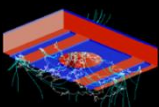
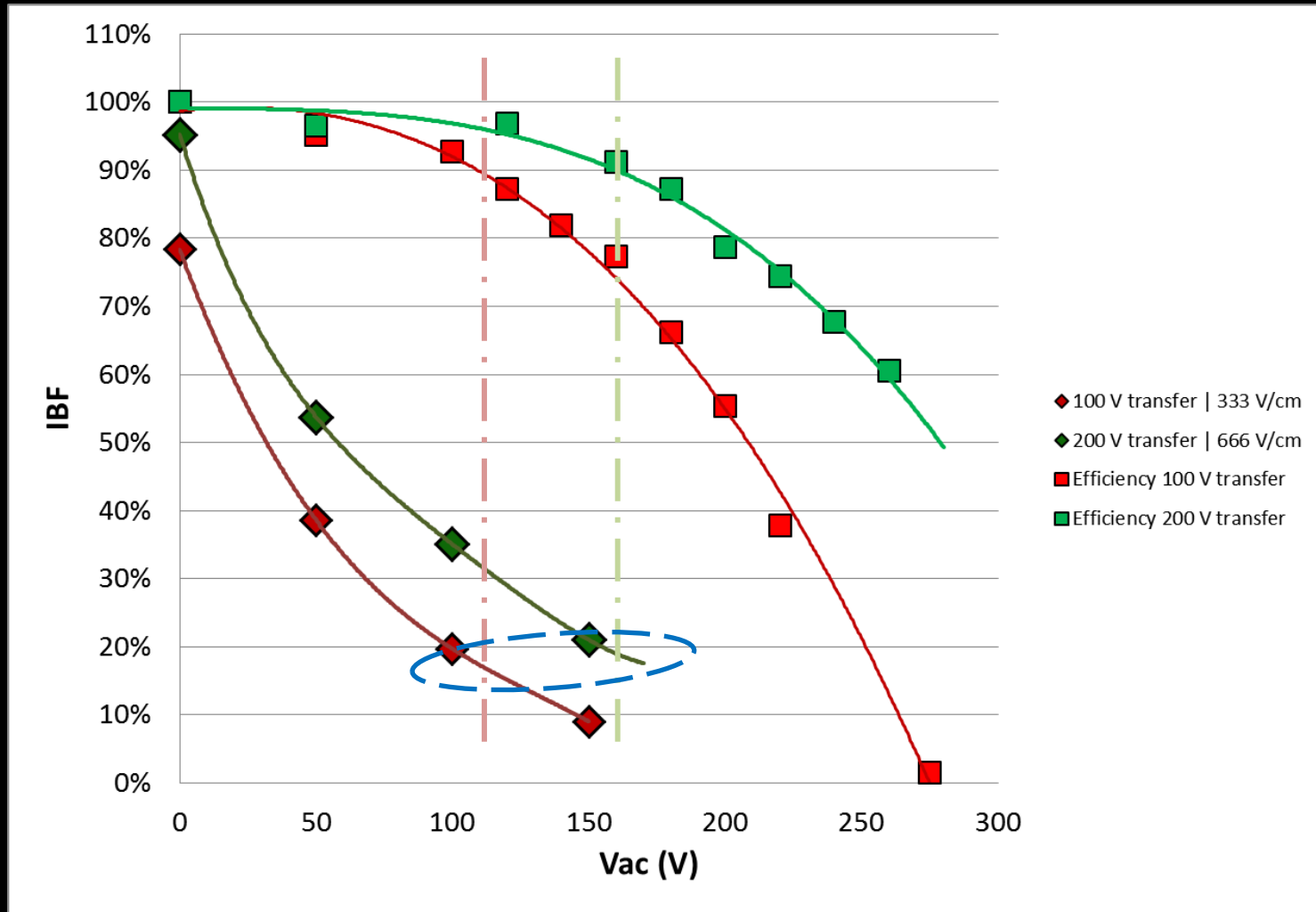
- Limit of electron extraction from CsI PC



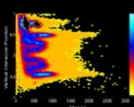
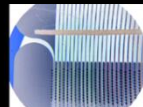
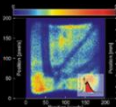
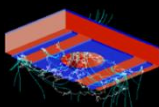
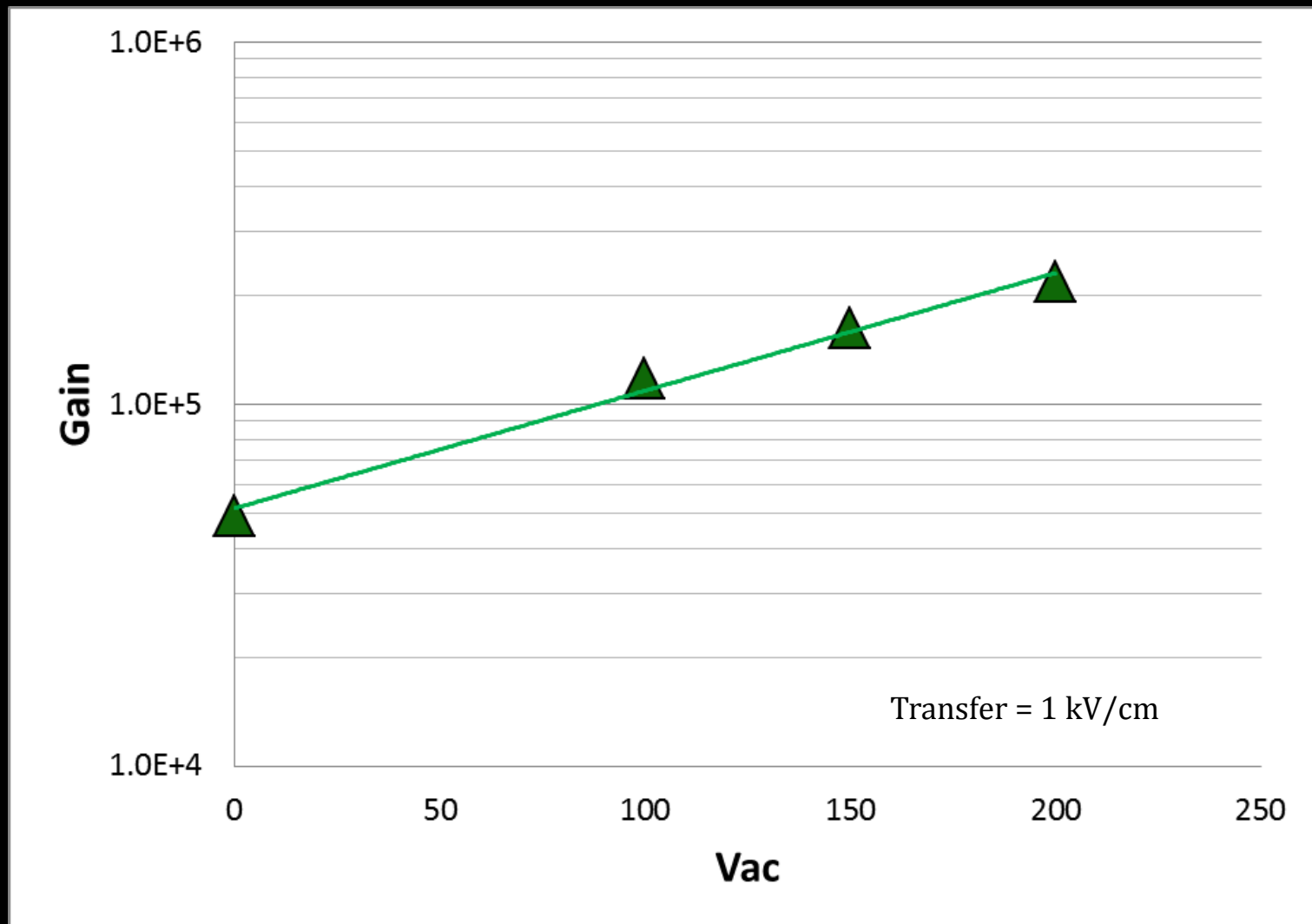
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IBF

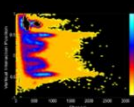
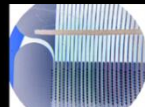
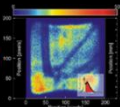
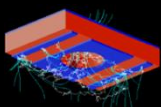


Gain



Discussion / Conclusion

- THCOBRA integrated as the second stage in a triple structure configuration can provide:
 - IBF reduction up to 5 times, close to full detection efficiency
 - Additional gain increase up to 5 times
- Threshold value for efficiency increases with transfer field
 - » Future Work:
 - Variation of detection efficiency for different gains of first stage is under study
 - Study of other gas mixtures
 - Investigation of effect of voltage in the last structure
 - Continuation of the systematic studies



Thank you

