Beam profile measurements with the GEM detector at the n_TOF EAR1 Beam Dump

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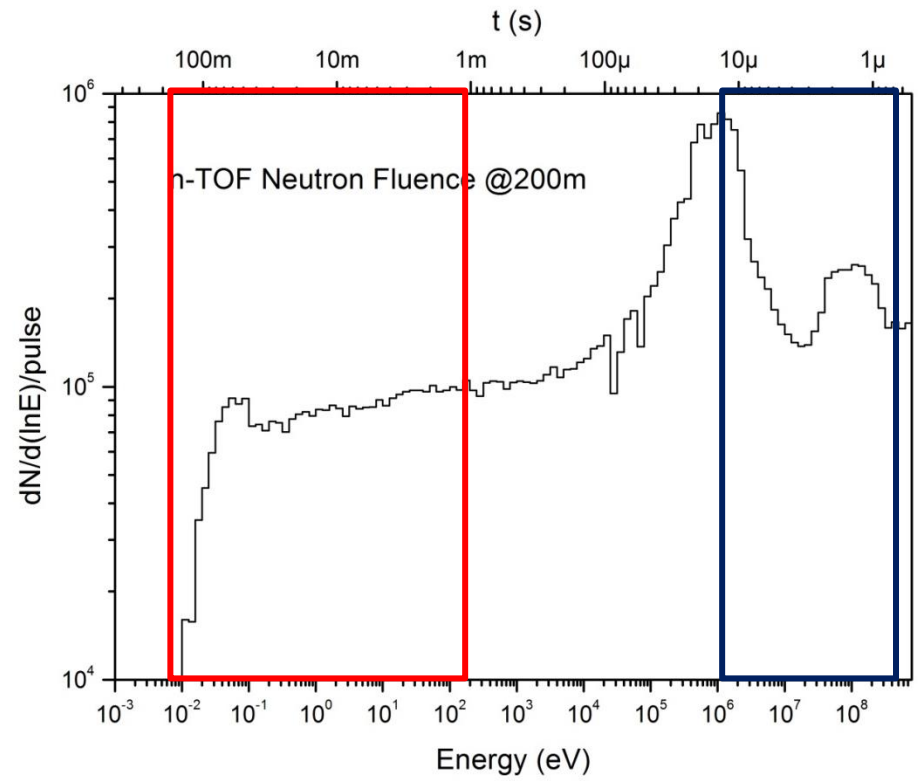
n_TOF Collaboration Meeting
07.10.14

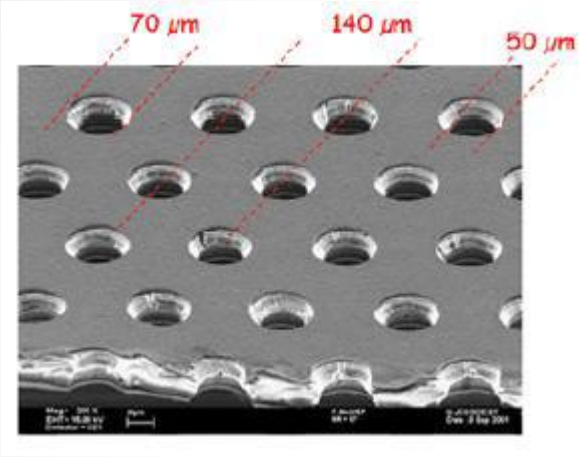
Experimental set-up @200m



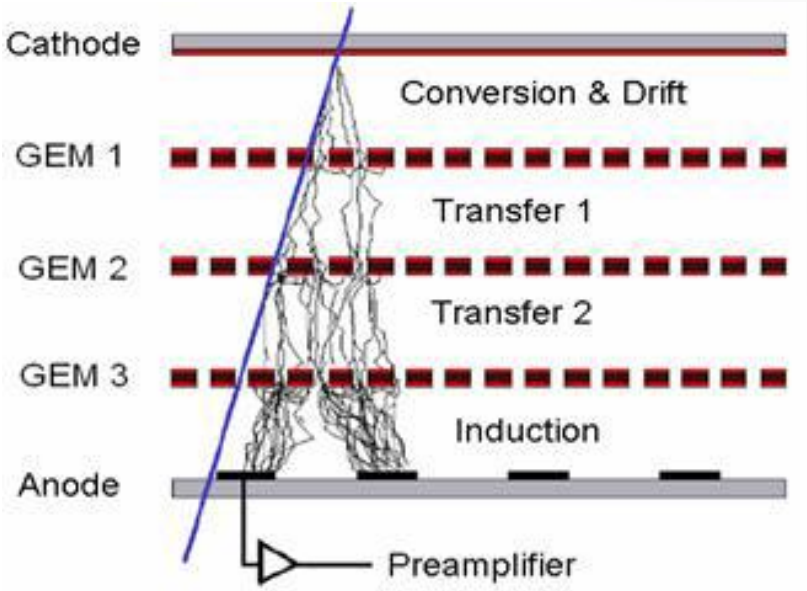
Slow neutrons
5 meV- 200 eV

Fast neutrons
1- 500 MeV

The triple GEM detector



Kapton foil (50 μm), clad with copper (5 μm)

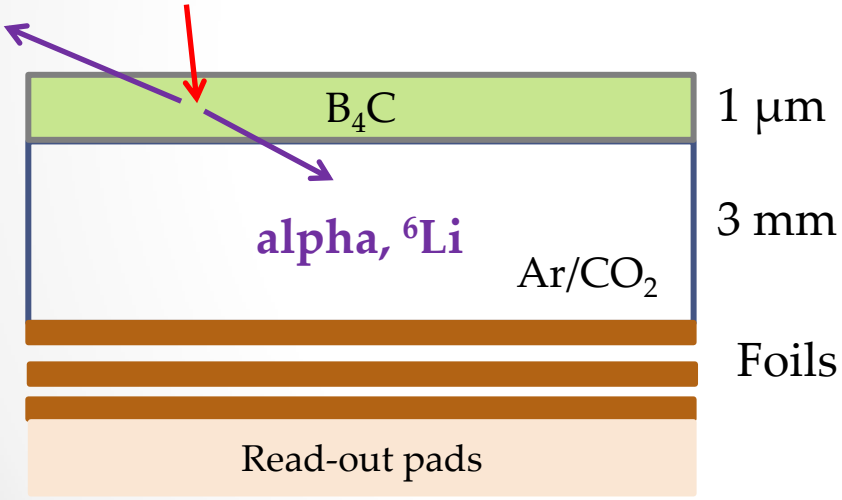


- Particle conversion, charge amplification and signal induction zones are physically separated
- Padded anode, measures in x-y directions
- Dynamic range: **from 1 to 10^8 particles/cm^2/s**
- Time resolution: **5-10 ns** for Ar-CO_2
- Effective gain proportional to the sum of applied voltage to the foils

Low energy neutrons

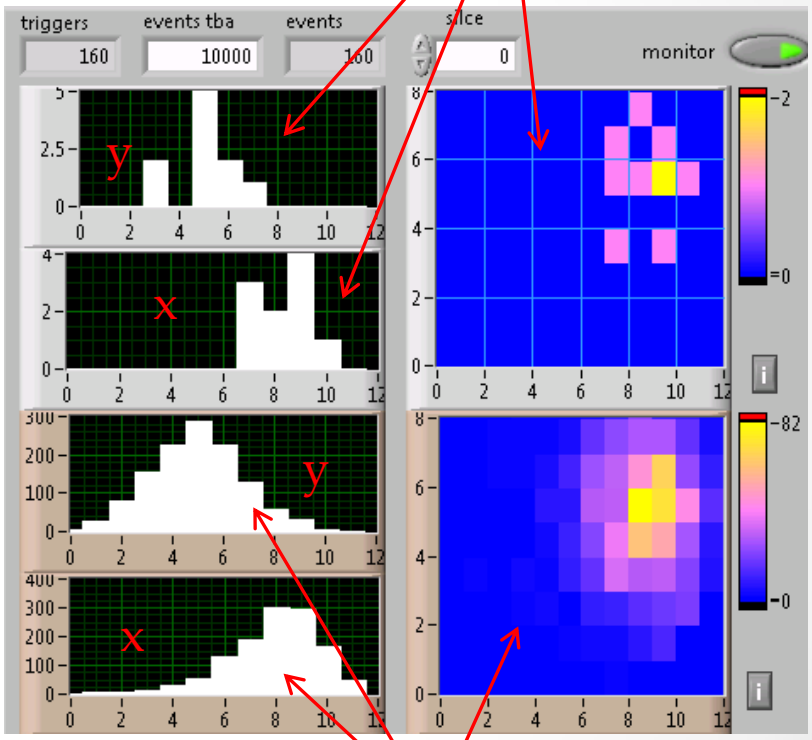
Active area: 10x10 cm^2
Time step : 1 ms (150 total)
Spatial resolution: 128 pads, 8x8 mm^2 each

Low energy neutrons



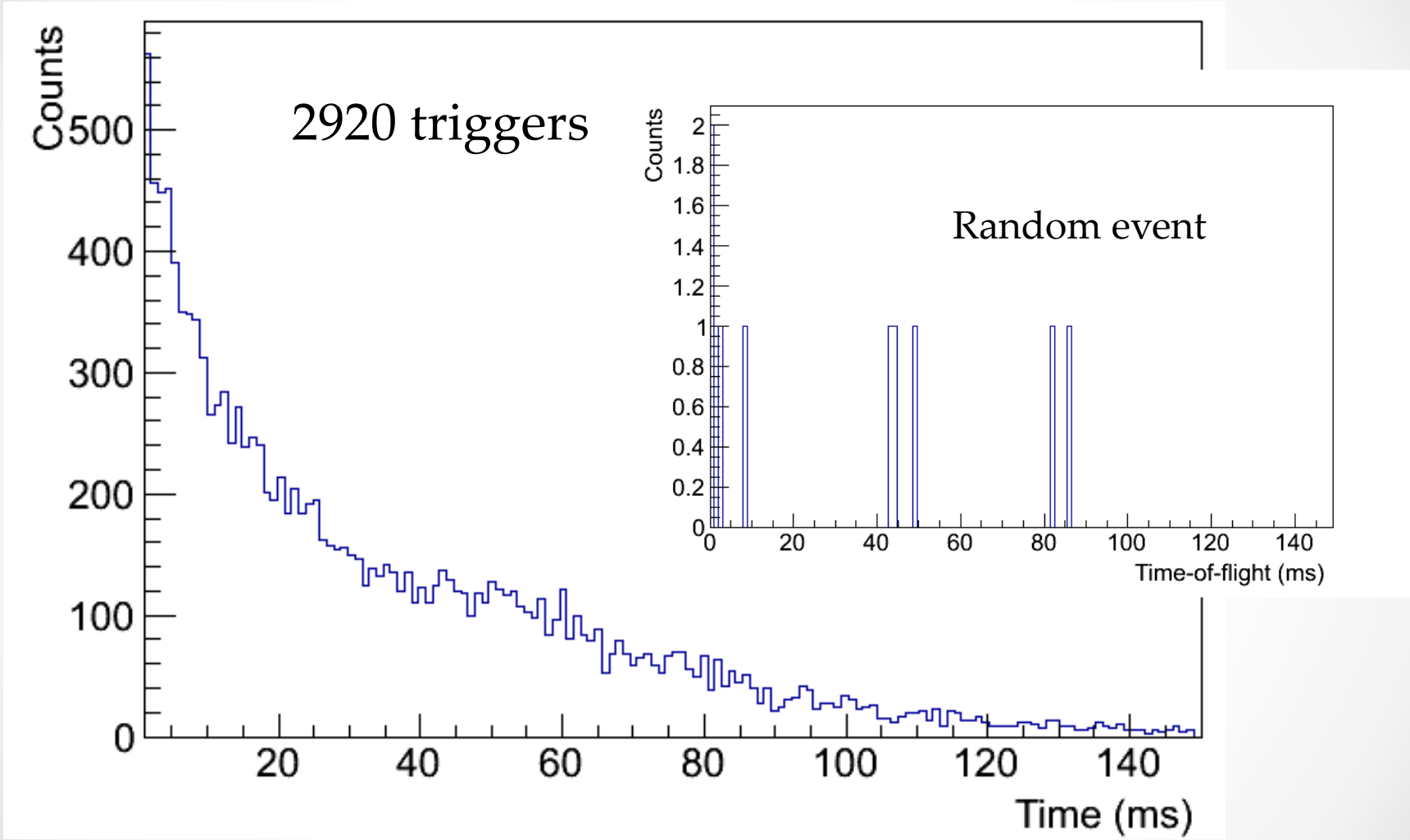
Online beam profile

Instantaneous counts



Accumulated counts

Time distribution of counts



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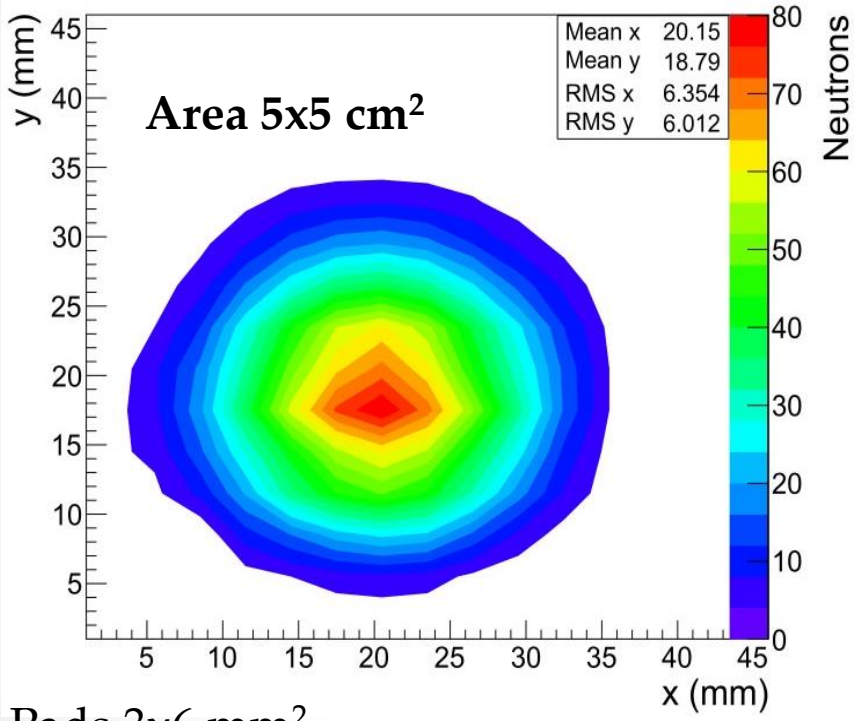
Beam image for low energy neutrons

@185 m

Measurements in July 2012 with another GEM

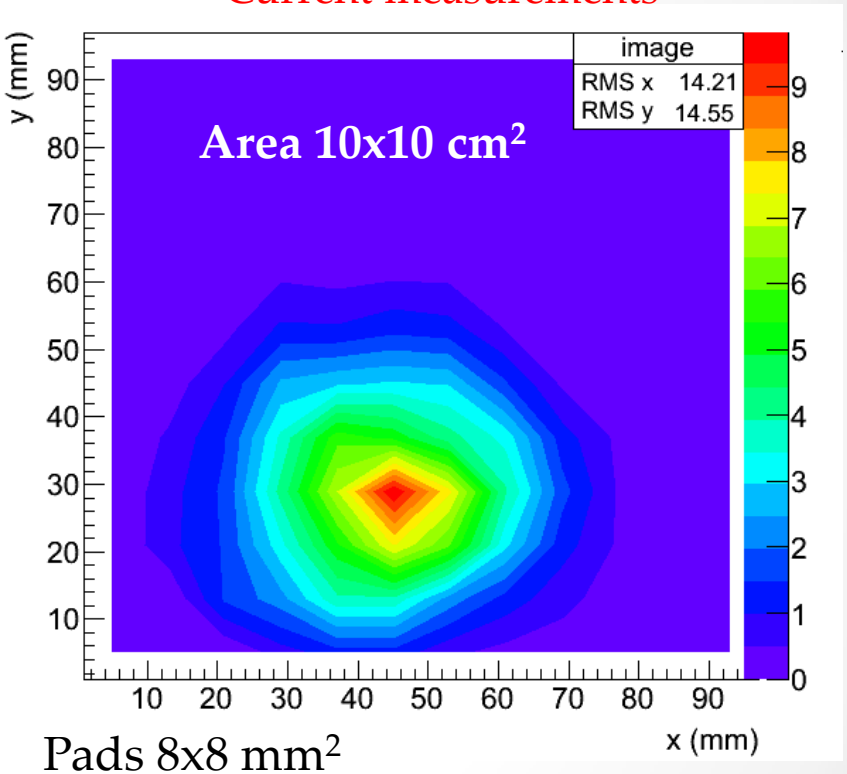


Pads 3x6 mm²

RMSx= 6.4
RMSy= 6.0

@200 m

Current measurements

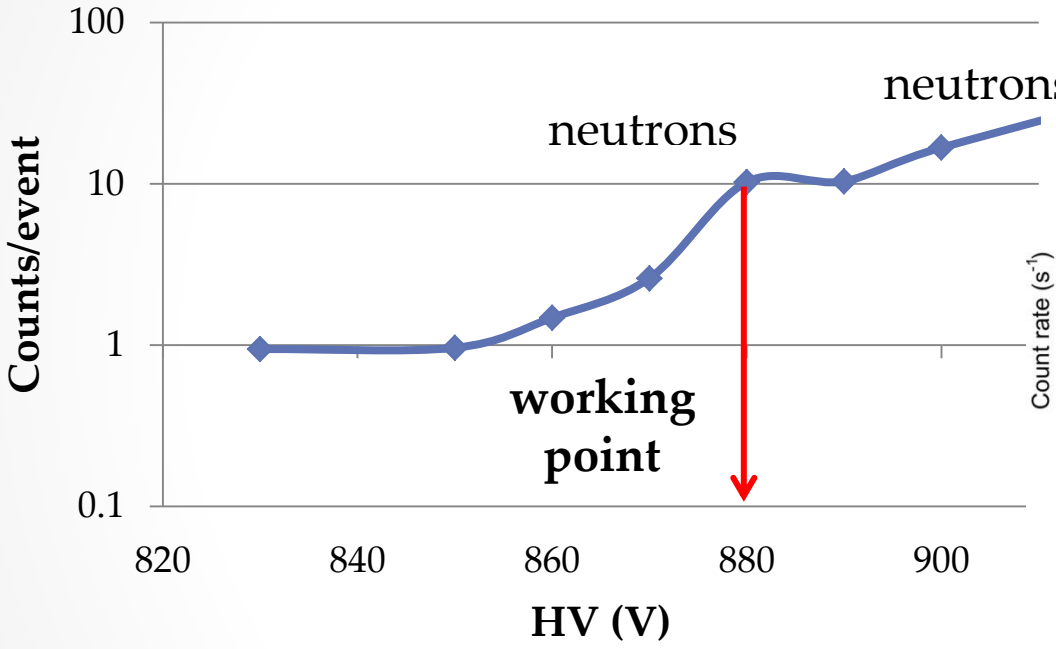


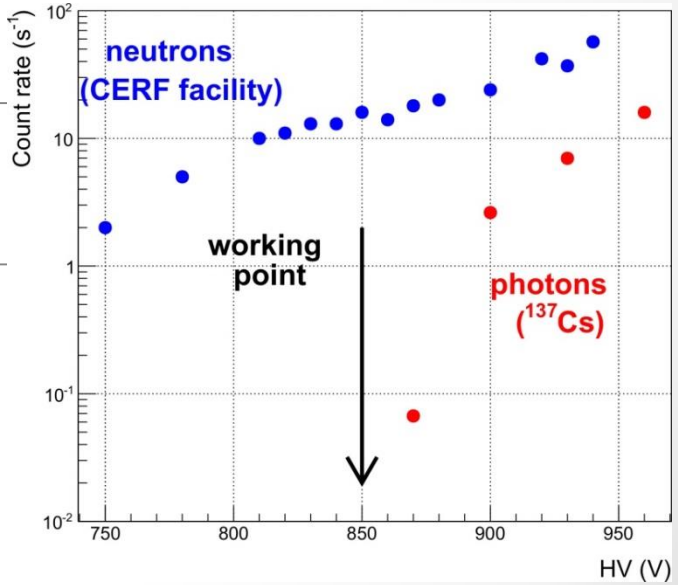
Pads 8x8 mm²

RMSx= 14.2
RMSy= 14.6

Photon rejection

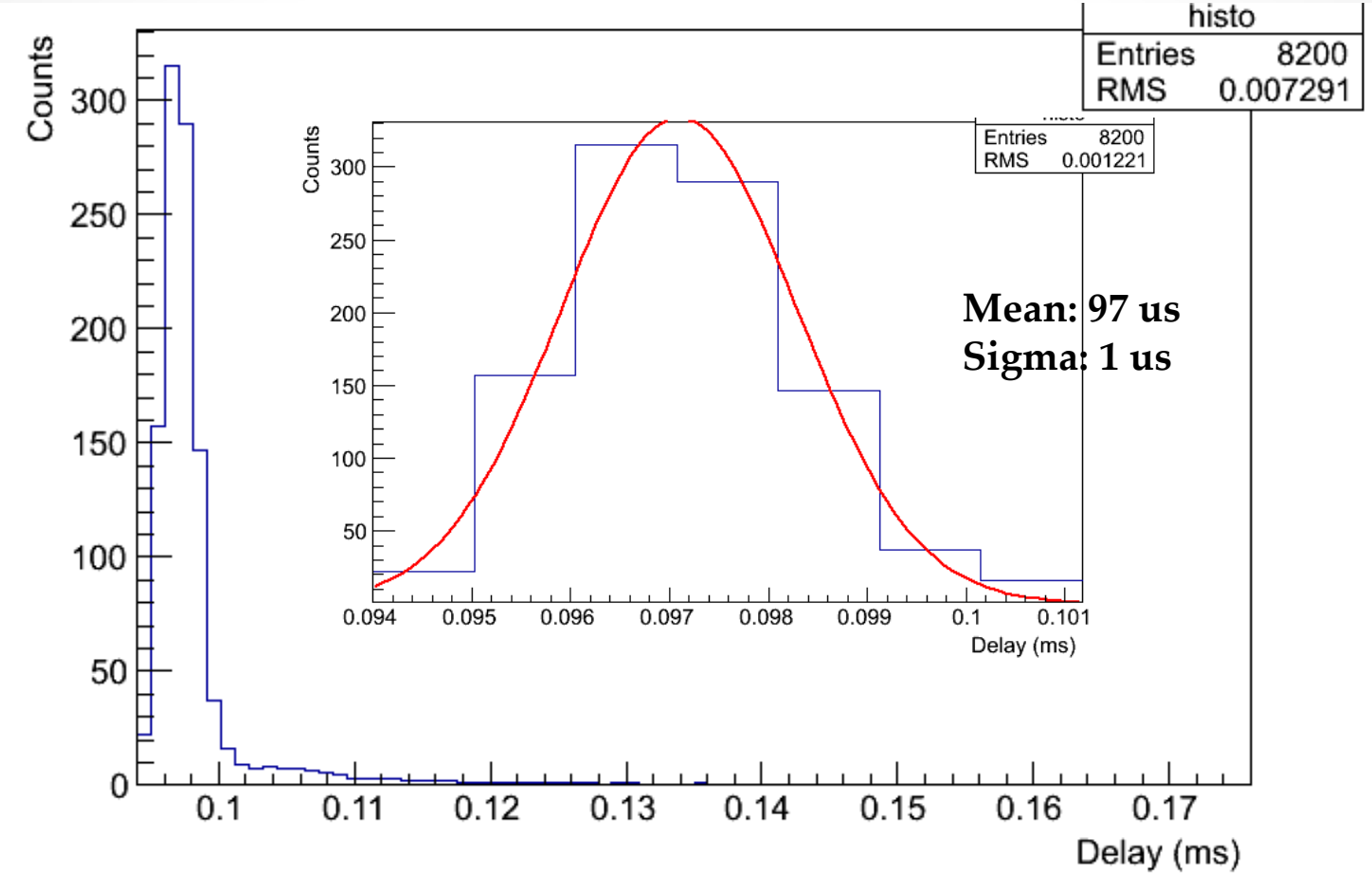
Rejection of photon signal by varying the total HV applied





From past measurements

Prompt Photons (@1050 V)

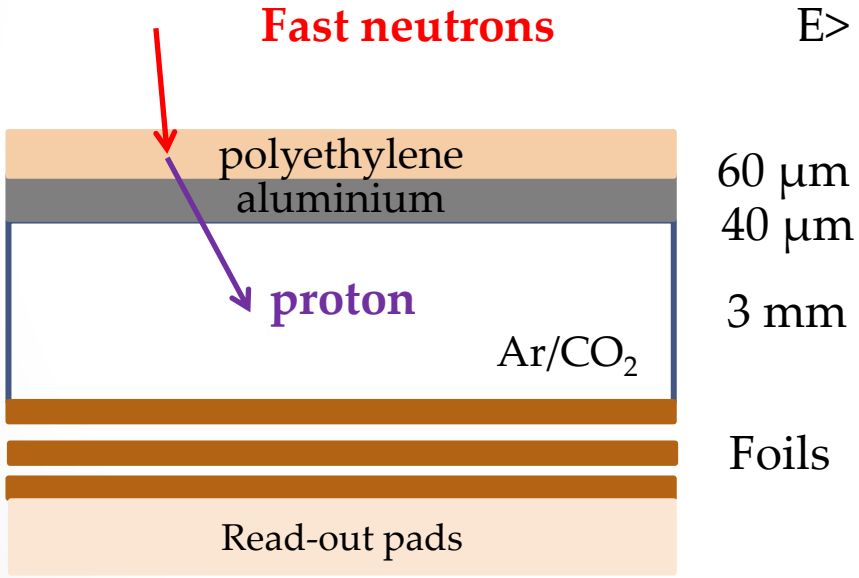


Trigger jitter of 2 us from the PS?

Fast neutrons

Active area: 10x10 cm^2
Time step : 50 ns (280 total)
Spatial resolution: 128 pads, 8x8 mm^2 each

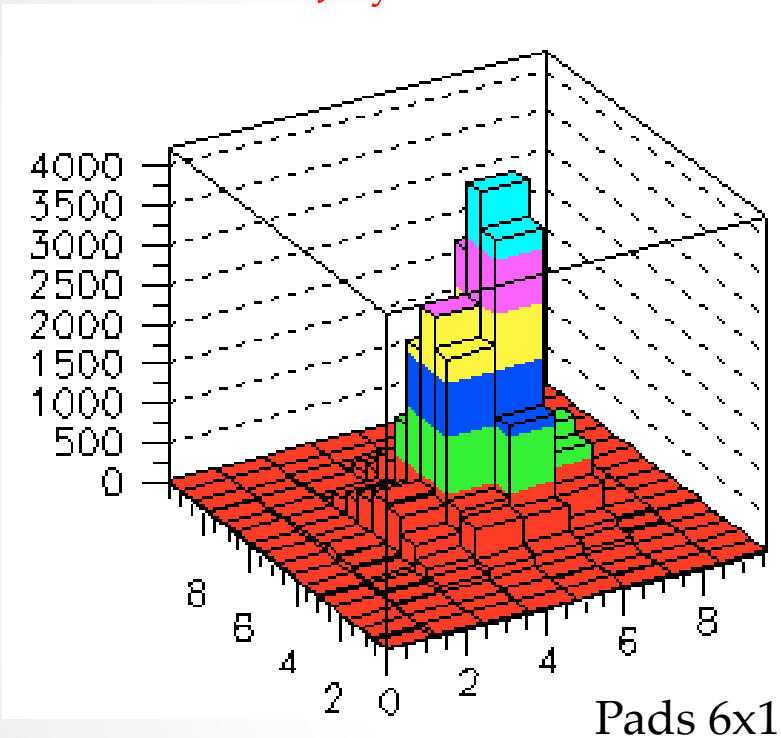
E< 20 MeV: (n,p)
E> 20 MeV: (n,p), (n,d), (n,a)..



Beam image for fast neutrons

@200 m

Measurements in July 2012 with another GEM

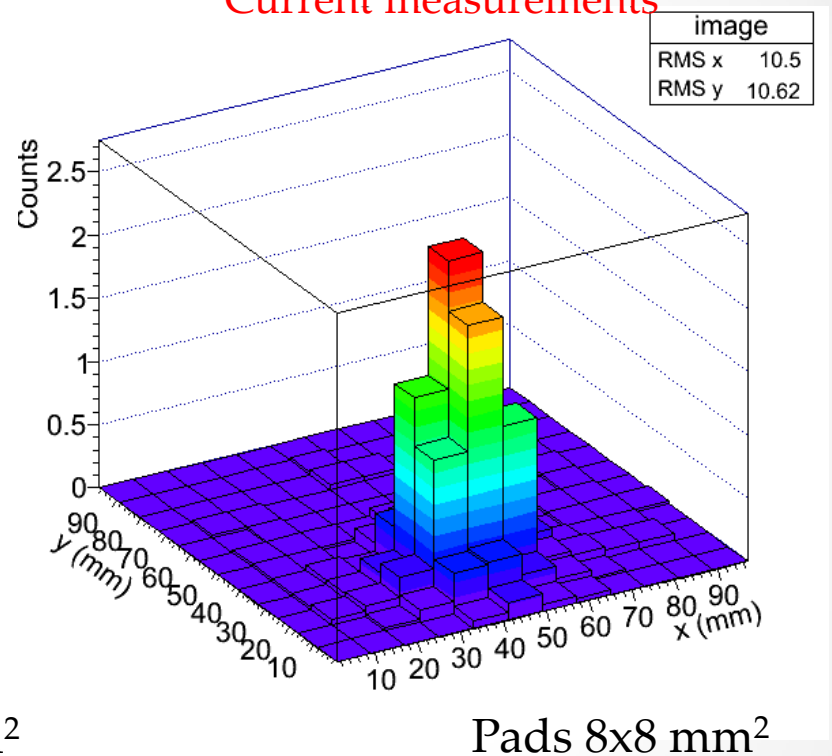


Pads 6x12 mm^2

RMSx= 10.5
RMSy= 10.5

@200 m

Current measurements

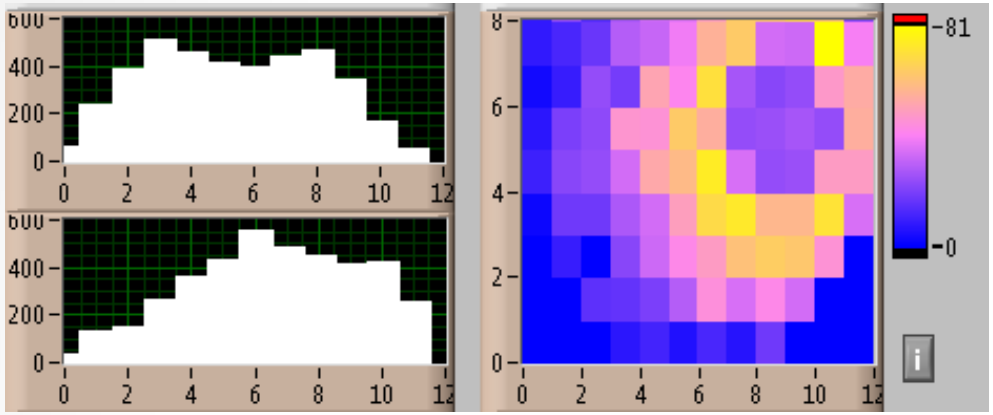


Pads 8x8 mm^2

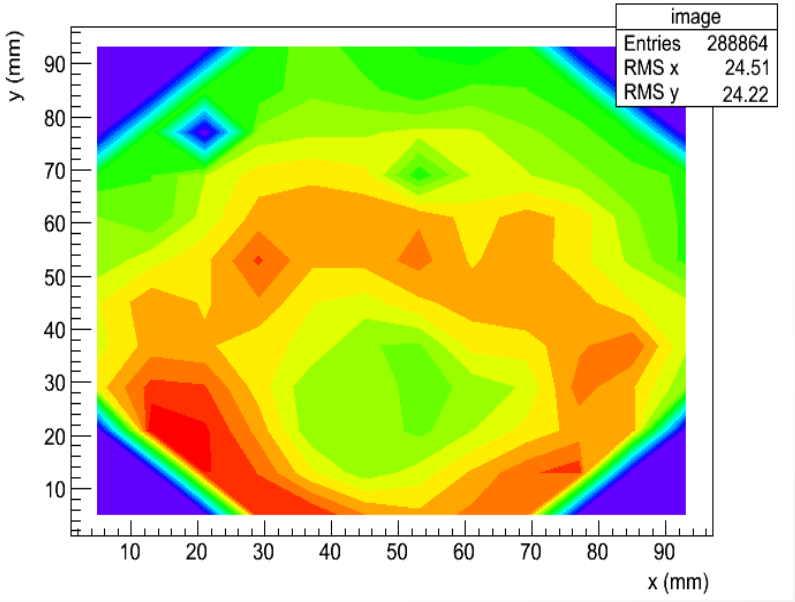
RMSx= 10.5
RMSy= 10.6

Photon & high energy neutron image at 1050 V

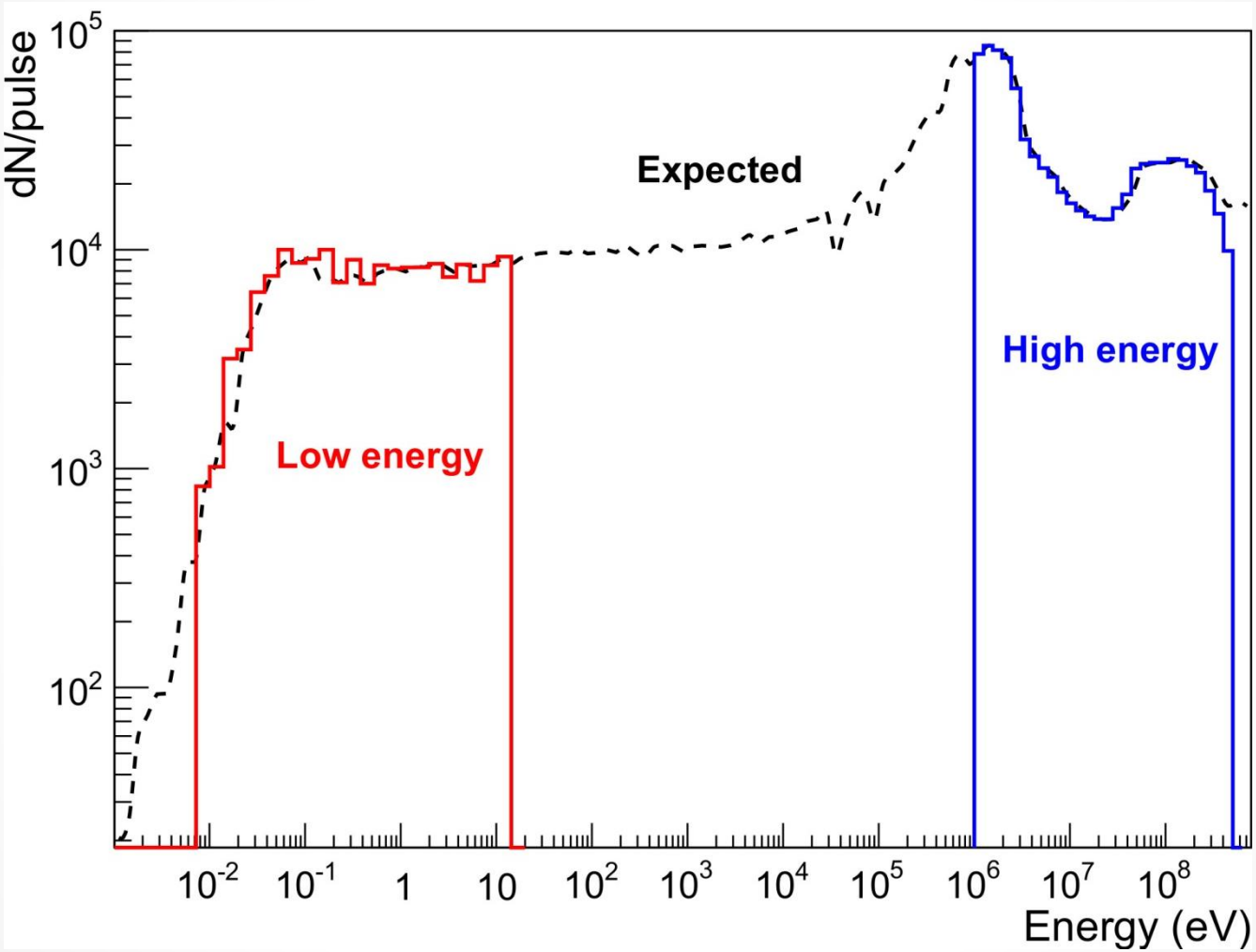
The "Volcano" distribution



Preliminary



Measured neutron spectrum



Conclusions

- 2D Beam image in 10x10 cm^2 area both for slow and fast neutrons
- Neutron distribution inside the beam without photons within 50 triggers for slow and 250 triggers for fast neutrons
- In the dump area the neutron beam dimensions were measured:
  - **Slow:** RMSx =14.2 mm, RMSy = 14.6 mm
  - **Fast:** RMSx = 10.5 mm, RMSy= 10.6 mm
- Volcano distribution present at high voltage; it needs to be checked with Medipix
- More detectors will be tested and characterized in the beam dump area with view to the design of a novel neutron spectrometer

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