



Piccolo Micromegas for ADS project

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on behalf of
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Outline



Goal:

Measurement of neutron spectra in ADS project

- characterisation of the ADS spallation target
- Flux measurement in TRIGA reactor with external neutron source

Unfortunately the neutron spectra can not be obtained using only one type of detector.

To cover the complete energy range of the produced neutrons, a new neutron detector concept based on Micromegas technology is developed.

Why Micromegas ?



Micromegas advantage for neutrons detection

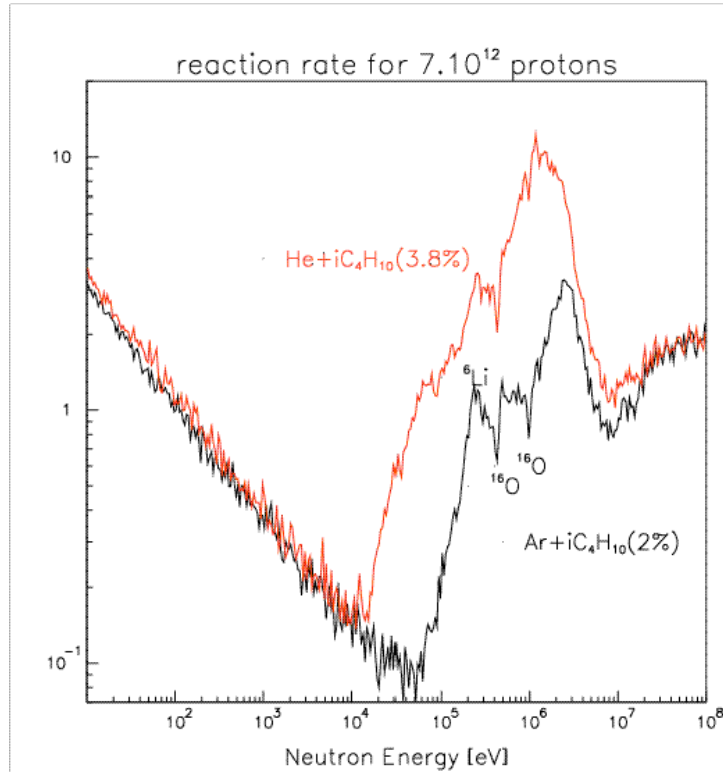
- High radiation resistance $\gg 24 \text{ mC/mm}^2$
- Low sensitivity to gamma background
- Large dynamic range
- Micromegas already tested and used for neutron detection on different applications

New for Piccolo-Micromegas

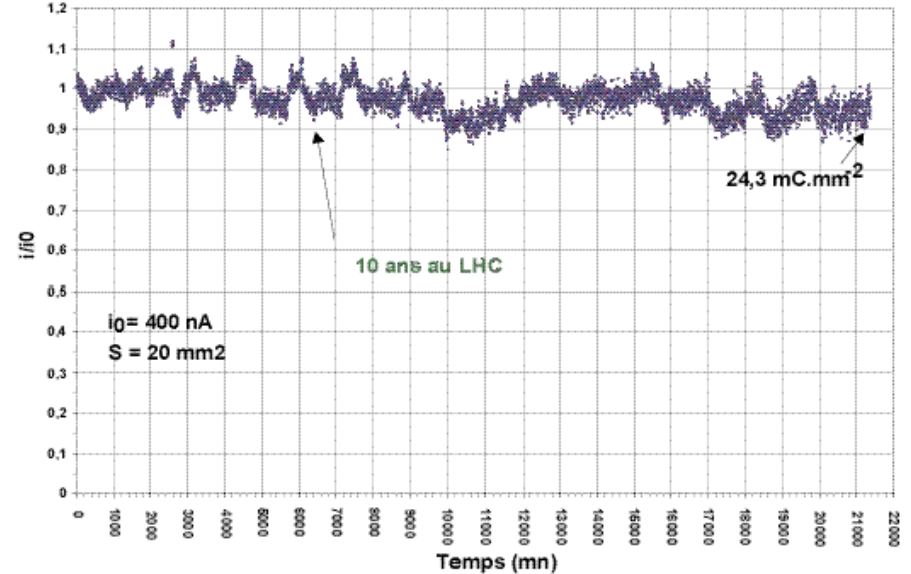
- Temperature effect on the various material and on the operation of the detector
- Resistant pillard structure (glass, quartz,...)
- Connection to electronics
- Sealed detector

n_TOF neutron spectrum (relative) and ageing of Micromegas

CERN n_TOF flux viewed by Micromegas versus neutron energy



Gain versus irradiation time for Ar_Isobutane (6%) mixture

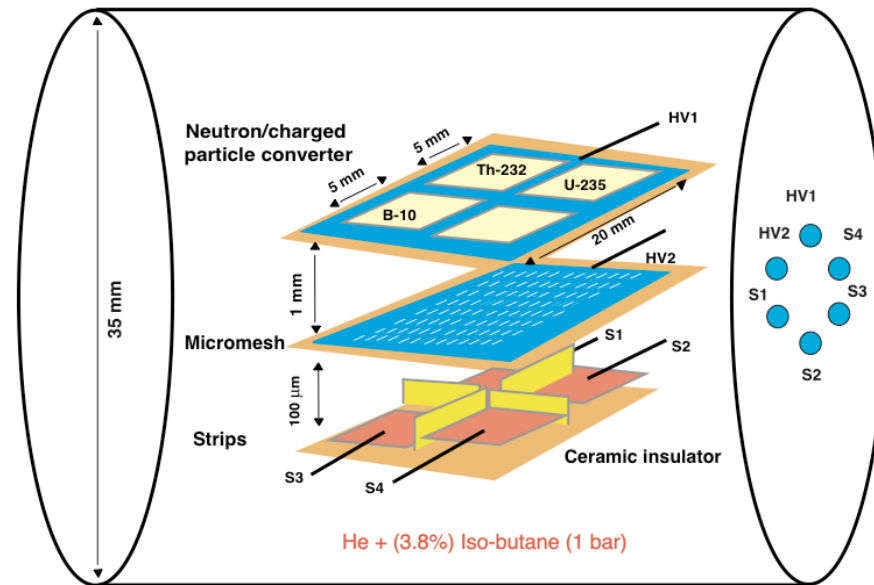
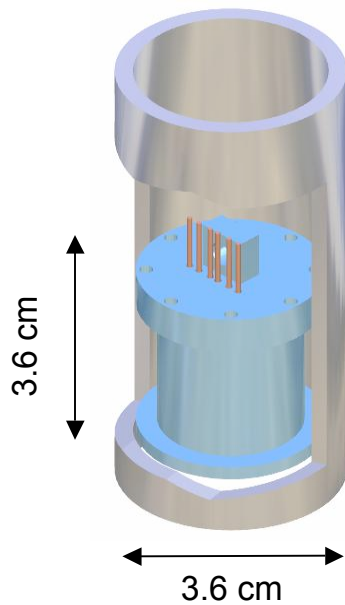


Piccolo Micromegas for ADS project

Combination of two Technologies: fission micro-chamber and Micromegas



Schematic view of the Piccolo-Micromegas detector (sealed) for neutron flux measurement.

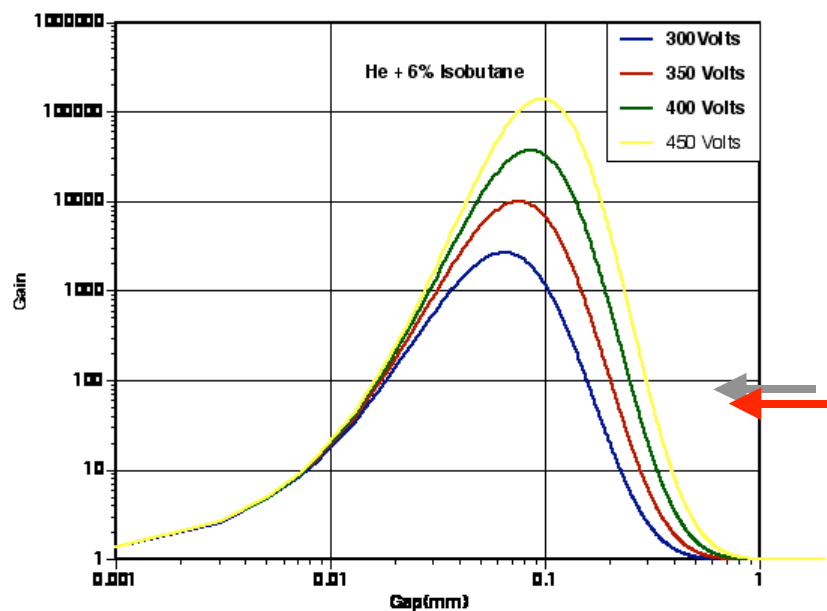


View of the detector Piccolo-Micromegas placed inside the empty rod of TRIGA reactor

Piccolo-Micromegas for core neutron flux measurements



Gain versus gap (theoretical curve)



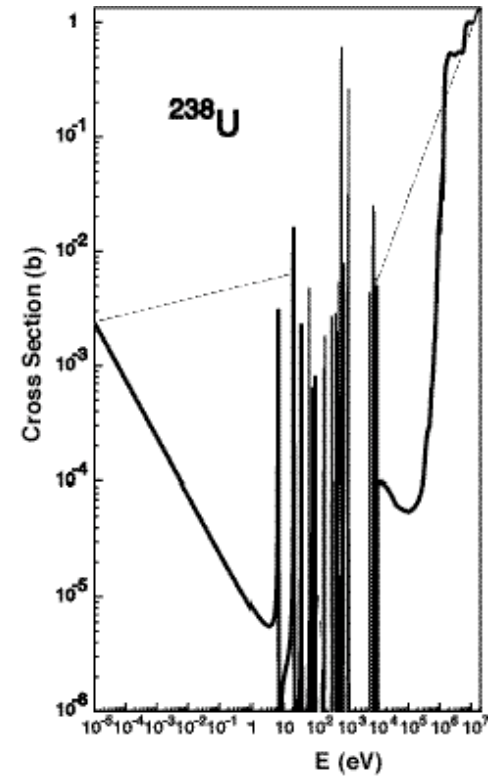
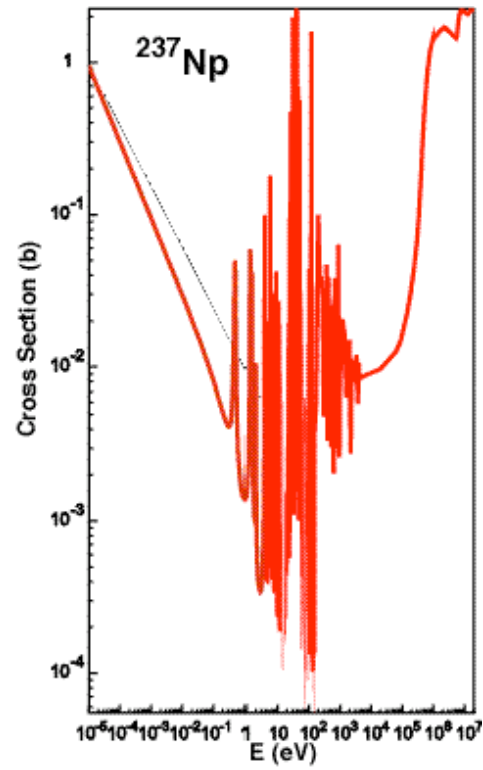
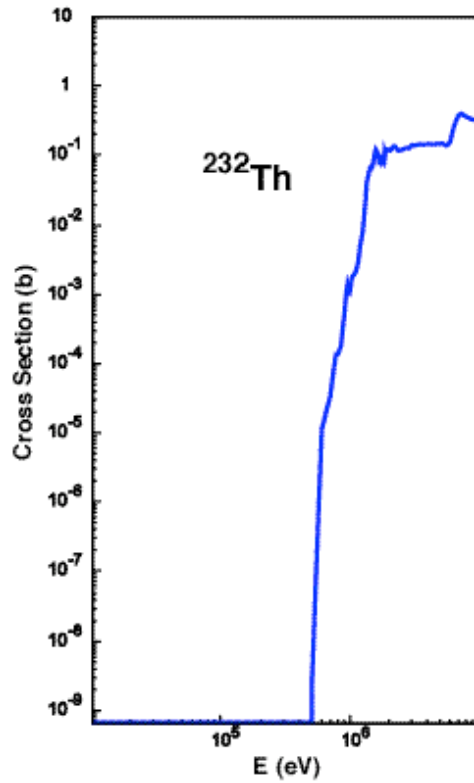
Optimum gap : 30 - 100 microns

Y. Giomataris, NIM A419, p239 (1998)

Main characteristics:

- **Very small Micromegas detector** (Max 30 mm) for instrumented rod of nuclear reactor
- **Fissile elements for converter**
 - ^{235}U : for monitoring
 - ^{232}Th (700 keV) ou ^{238}U (800 keV) or ^{237}Np (500 keV) flux for $E_n \geq$ fission shreshold
- ^{10}B or ^6Li : flux $\leq 1\text{MeV}$
- **Empty**: flux for high energy neutron from H^+ & ^4He recoil nucleus
- **Different amplification gap** in each compartment in order the dynamic range of the collected charge
- **Specific material** for:
 - high temperature environment
 - low activation
 - small perturbation of the neutron flux
- **Sealed**
- Able to measure:- **very high** flux (current preamp) and **very low** flux (charge preamp)

Fission cross sections

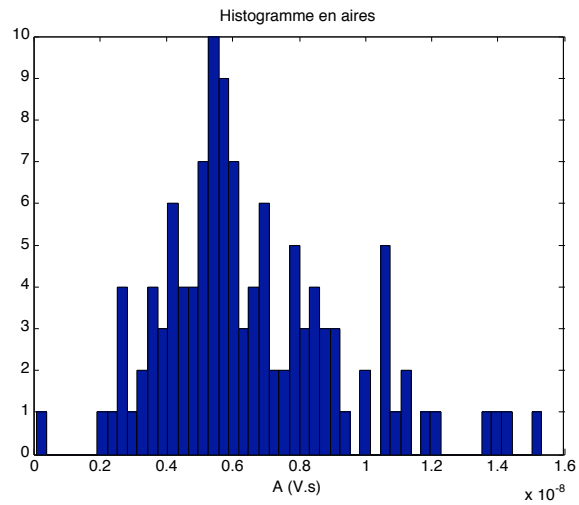
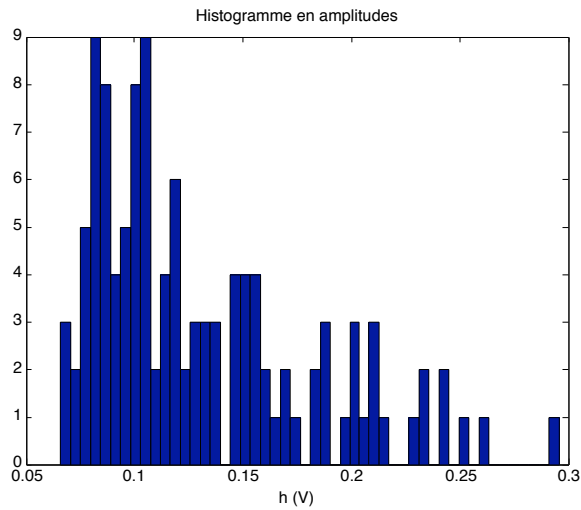


Neutron flux for $E_n \geq$ fission threshold

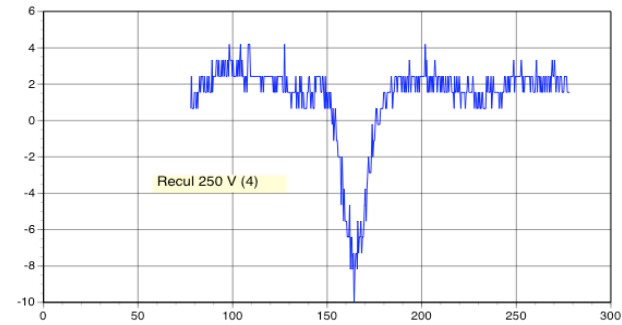
First results



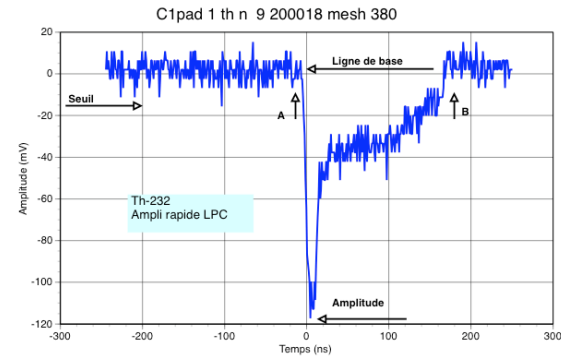
Fission fragments from ^{232}Th



Pulse from $\text{H}(n,n')\text{H}$ on $n + i\text{C}_4\text{H}_{10}$ (2%)



Pulse from $^{232}\text{Th}(n,ff)$ on $\text{Ar} + 10\%\text{CO}_2$



Pulse for X-Mode acquisition