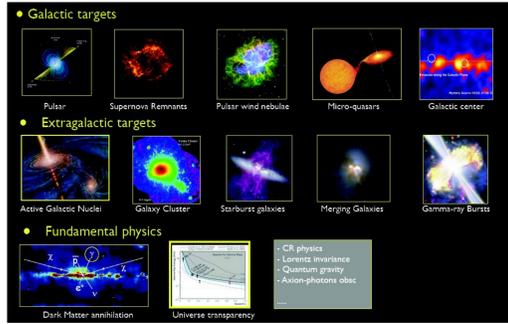




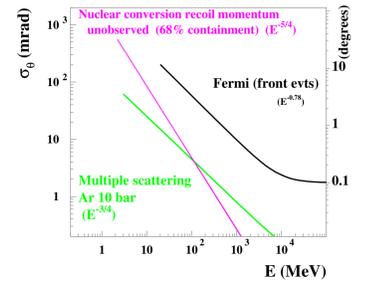
D. Bernard, Ph. Bruel, M. Frotin, Y. Geerebaert, B. Giebels, Ph. Gros, D. Horan, M. Louzir, P. Poilleux, I. Semeniouk, S. Wang
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 JASRI/Spring8, Japan

A Gaseous detector for gamma-ray detection, need and performance

- Rich physics in gamma astronomy
 - Understanding acceleration processes
 - Potential for new physics (Dark Matter, Lorentz Invariance Violation, ...)
- Polarimetry powerful at lower energies
 - never measured above 1MeV



- Sensitivity gap around 1-100MeV
 - Too high for Compton scattering, too low for pair conversion
 - limited by angular resolution
 - Pair tracking limited by scattering in converter
- Gas detector necessary below 100MeV
 - Up to 10x better resolution than FERMI
 - limited by nucleus recoil at low energy

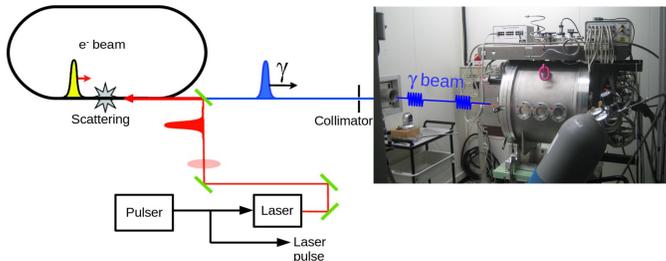


D. Bernard, NIM A 701 (2013) 225

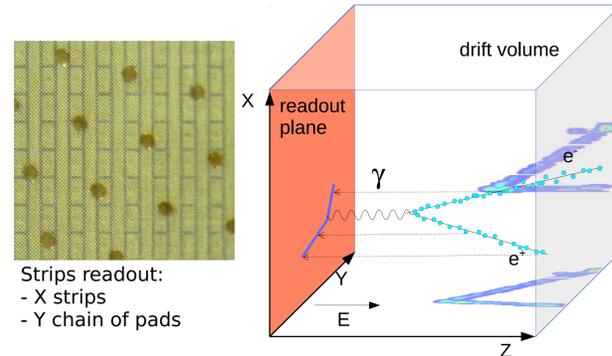
The NewSUBARU beam



- NewSUBARU, U. Hyogō, LASTI, Japan
 - Associated to the SPring8 facility
 - 0.6 to 1.5 GeV electron storage ring
- Polarised γ
 - Multiple scattering, overlapping tracks, ...



Event Geometry in the TPC



- Pair conversion of γ in the gas

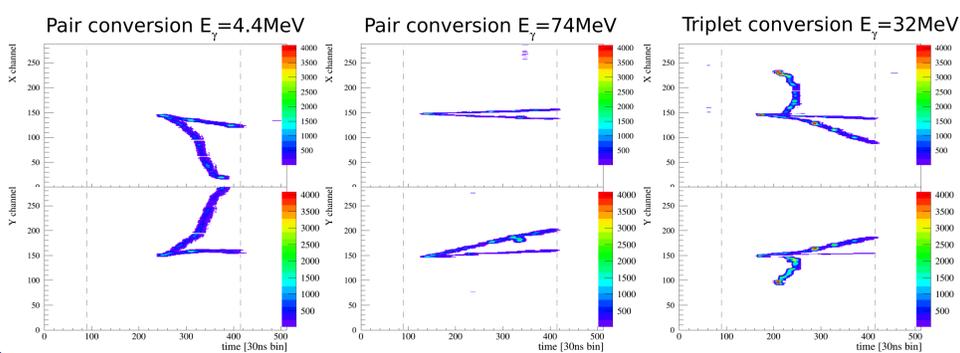
$$\gamma A \rightarrow e^+ e^- A$$
- e^+ , e^- tracking
- γ beam aligned with drift field
- Strip readout \Rightarrow projections X-time and Y-time

Measurement goals

- Angular resolution for γ beam
- Polarimetry from azimuthal angle of conversion plane

RAW Event examples

Selection of events. The two projection X-Time and Y-Time are shown. The dashed lines represent the limits of the 30x30x30cm³ TPC



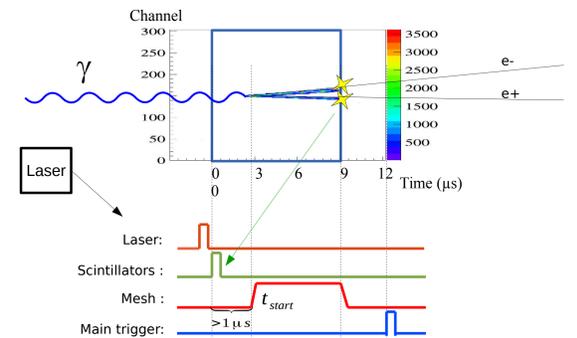
Trigger system

A trigger was built using

- 6 surrounding scintillators
- signal from the laser
- timing of the micromegas mesh direct signal

The main goal of the trigger is to

- reject tracks from interactions of the beam with upstream material (>99% of events)
- Keep as many conversion in the gas volume as possible
- Extra trigger lines for efficiency studies

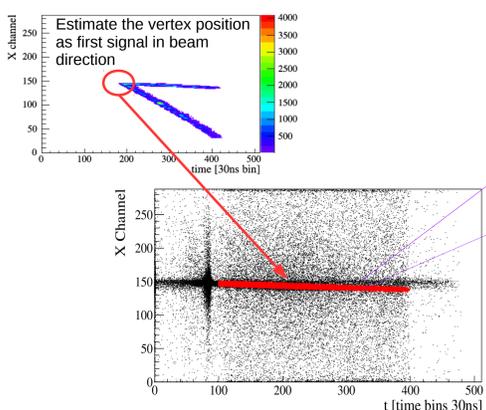


Signal constituting the trigger:

- laser starting pulse defines t_0 (when available)
- downstream scintillators (define t_0 if no laser)
- veto on upstream scintillator
- veto on mesh signal less than 1 μ s after t_0

First Analysis Results

Beam-gas event rate and trigger efficiency



The vertices are located on a region corresponding to the 4mm circular beam collimator

- Before any event reconstruction, we can estimate with good accuracy the amount of recorded event that correspond to interactions of the photons with the gas (pair conversions or Compton scattering)
- Validation of the trigger performance
 - Rejection of >99% of background
 - Selection of >50% of good events
- \Rightarrow ~100Hz acquisition, >50Hz are signal

Ongoing developments

- Advanced reconstruction
 - Track reconstruction with multiple scattering
 - Robust X-Y maps matching for 3D event reconstruction
- Geant4 simulations
 - Test of reconstruction performance

Perspectives

- Development of a self triggered TPC
 - Radiation hardened AGET electronics
 - Multiple HARPO size modules
 - balloon flight module with gas volume >1m³
- Studies towards a space mission