



HARPO: a TPC concept for gamma ray polarimetry with high angular resolution in the MeV-GeV range



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The HARPO (Hermetic Argon Polarimeter) project

- The TPC technology is used as a high angular resolution polarimeter telescope in the MeV-GeV range
- A prototype has been built to demonstrate the concept

The HARPO Detector Prototype

- 30 cm cubic TPC
- Amplification made by Micromegas+2GEM
- Gas: Ar/iC₄H10 95/5 up to 5bar
- 2x288 strips readout (X&Y), ~0.5mm wide
- Readout electronics based on AFTER chips



- **TPC (Time Projection Chamber) in space** γ are converted in the gas and produced ewhich drift along the E field and are amplified
 - The time gives a measure of the z coordinate

and measured on the x-y readout plane

Expected performance

- Angular resolution:
 - limited by multiple scattering above 100MeV
 - limited by the unknown recoil nucleus momentum below 100MeV
 - only multiple scattering for triplet conversion, but very low efficiency
- Up to 1 order of magnitude better than Fermi!

(511 time bins up to 100 MHz)

• Trigger: 6 scintillators in coincidence



GEM

(Gas Electron Multiplier)



Reconstruction and track matching

- Cosmic-ray event leaving a lower energy electron (δ -ray)



Gain studies

- <u>Cosmics data</u>:
 - Compatible with test box
 - Help to find optimal operation configuration



 $V_{mesh} E^{b}_{trans} V^{b}_{GEM}$

400 250 270

- <u>Test box</u>: three peaks are visible :
 - Two ionization peak (main peak and escape peak) amplified through one GEM and one Micromegas

∞̃10⁴

- The main ionization peak with Micromegas ampplified only







- the track
- Drift velocity (drift time)
- Gain (total charge)



New Developments In Photodetecti

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