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/IcH10 95/5 up to 5bar
- 2x288 strips readout (X&Y), ~0.5mm wide
- Readout electronics based on AFTER chips (511 time bins up to 100 MHz)
- Trigger: 6 scintillators in coincidence

TPC (Time Projection Chamber) in space

- γ are converted in the gas and produced e- which drift along the E field and are amplified and measured on the x-y readout plane
- The time gives a measure of the z coordinate

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!

Reconstruction and track matching

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

Gain studies

- Cosmic data:
  - Compatible with test box
  - Help to find optimal operation configuration
- Test box: three peaks are visible:
  - Two ionization peak (main peak and escape peak) amplified through one GEM and one Micromegas
  - The main ionization peak with Micromegas amplified only

Characterization with cosmic-rays

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