

Double Beta Decay Searches

Motivation: from the experiments of oscillations we know that neutrinos have finite mass. But there are open questions:

- Neutrino mass scale.
 - Their nature, Dirac or Majorana.
- $\beta\beta 0\nu$ can answer both questions at the same time.

NEXT EXPERIMENT

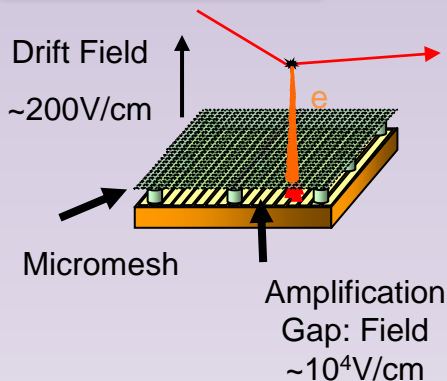
(for more details see D. Lorca's talk)

- A high-pressure, 100 kg gaseous Xe TPC to look for the $0\nu\beta\beta$ decay of $^{136}\text{Xe} \rightarrow Q_{\beta\beta}$ at 2.46 MeV
- **Baseline:** an EL TPC, energy measured by PMTs and tracking with SiPM.

R & D studies

Microbulk Micromegas with pixelized anode to study gas mixtures and tracking.

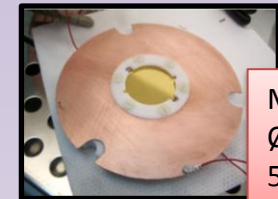
MicroMegas



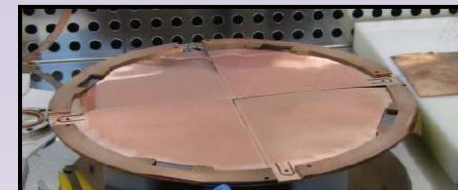
MicroMesh Gaseous Structure

Metallic micromesh suspended over an anode plane by insulator pillars

- amplification gap 50-100 μm
- e- drifted go through the mesh
- avalanche
- detectable signals in mesh and pixels



Microbulk
 $\varnothing = 35 \text{ mm}$
50 μm gap



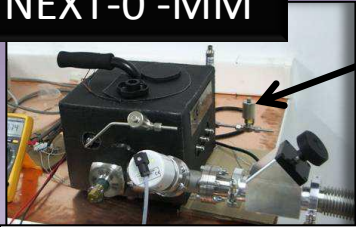
Largest area with μbulk technology
Each sector radius = 14 cm
1252 pixels independently read
0.8 cm pixel, 50 μm gap

Setup & Results

Two prototypes of TPC have been built in order to test MicroMegas (NEXT0-MM, NEXT-MM).

- ✓ Different types of MMs technologies have been tested
- ✓ Tested up to 10 bar (NEXT-0)
- ✓ Measurements with different gases and mixture gases: Ar- $i\text{C}_4\text{H}_{10}$, Ar, Xe, Ne-Xe, TMA-Xe

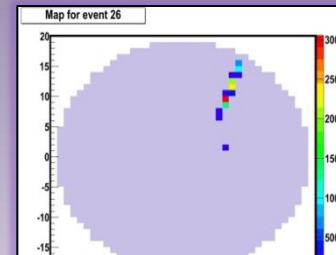
NEXT-0 -MM



HP TPC: 2 l, 6 cm drfit

- Low outgassing materials, 10^{-6} mbar x l/s
- Recirculation and heating up system possibility

NEXT-MM

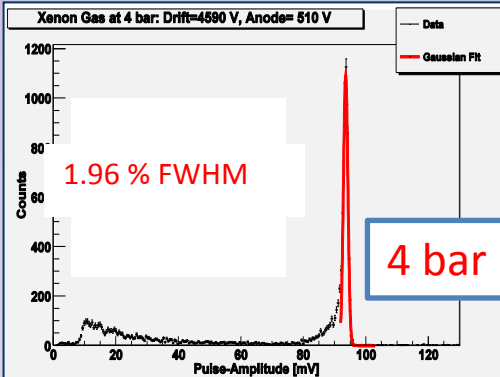


Alpha track from Rn-222 source



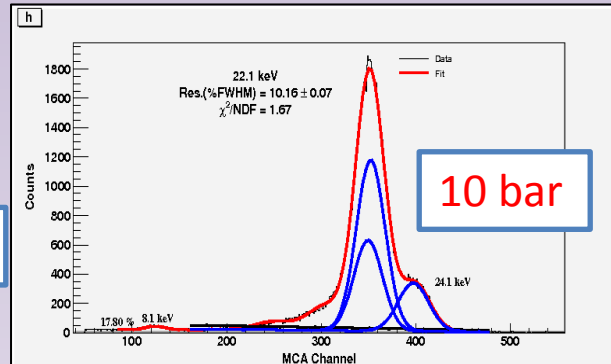
HP TPC: 74 l, 35 cm drfit

■ Pure Xe



Am-241 source, 5.5 MeV
 $\Delta E = 1.96\%$ FWHM
 @ 4 bar

■ Xe-TMA (Penning Mixture)



Cd-109 source 22.1 keV
 $\Delta E = 10.16\%$ FWHM @ 10 bar
 $\rightarrow \Delta E = 1.02\%$ FWHM @ $Q_{\beta\beta}$

Conclusions - Outlook

- ☐ Micromegas have shown excellent performance for rare event searches:
 - ✓ very good energy resolution achieved and radiopurity.
 - ✓ Tracking capabilities are being explored.