

PandaX-III Prototype Detector



上海交通大学
SHANGHAI JIAO TONG UNIVERSITY

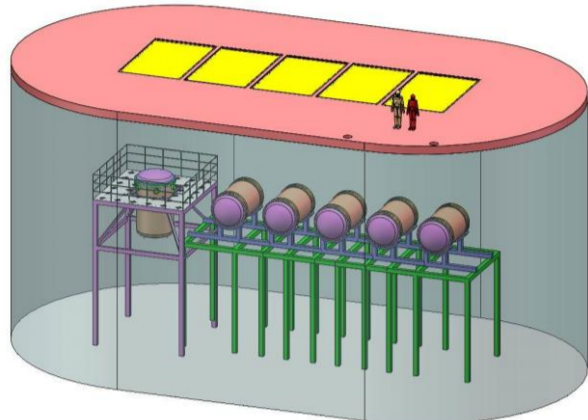
Lin Heng On behalf of the PandaX-III Collaboration
Shanghai Jiao Tong University



PANDA X
PARTICLE AND ASTROPHYSICAL XENON TPC

1. PandaX-III

The PandaX-III experiment, based on a high pressure TPC, searches for neutrinoless double-beta decay of Xe-136 with high energy resolution and sensitivity at the China Jin Ping underground Laboratory II (CJPL-II).



Tank of water shield in CJPL-II

2. Prototype Detector: TPC and Vessel

A prototype is built at SJTU to demonstrate the design concept



Prototype TPC structure

- 78 cm long teflon bars as frames
- 59 copper rings to shape the electric field
- Designed with working field of 1kV/cm

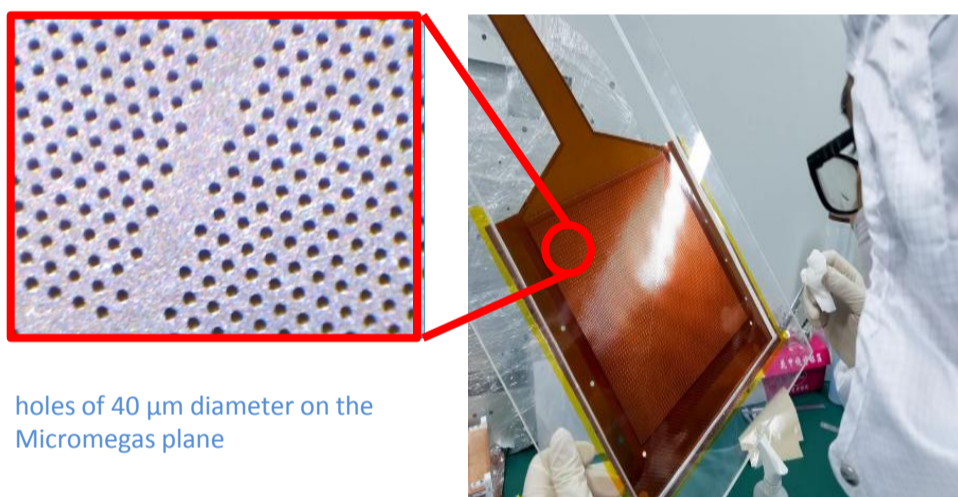


Prototype vessel

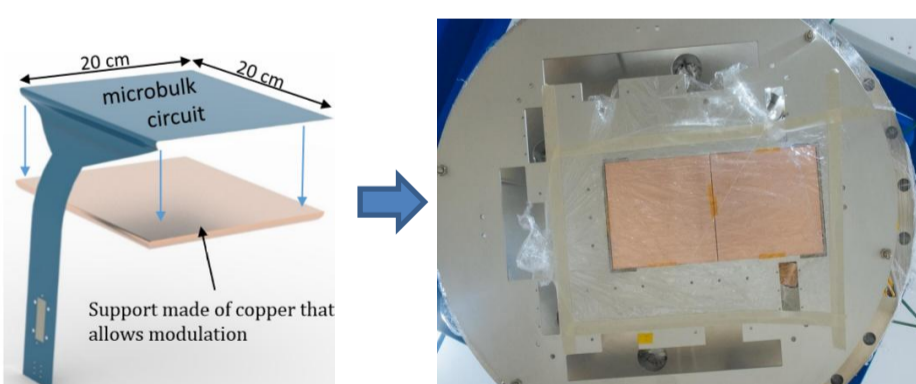
- Volume of 600 L (18kg Xenon at 10 Bar in the active volume)
- Made of 8mm thick stainless steel
- Connected with gas system for gas mixing and circulation

3. Prototype Detector: Micromegas

Microbulk Micromegas is used as a charge amplification and readout system of the prototype in order to reconstruct both the energy and track of the neutrinoless double-beta decay event. The detector is designed with a maximum of 7 Micromegas modules



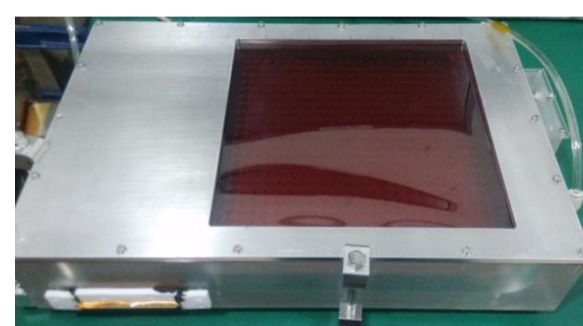
holes of 40 μ m diameter on the Micromegas plane



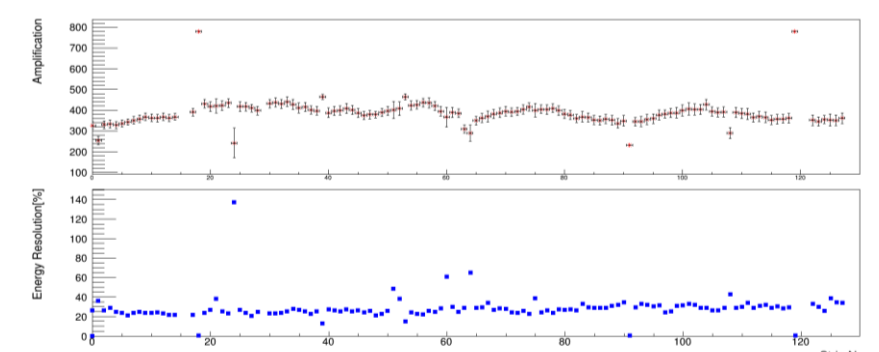
Single Micromegas module (Left) and 2 Micromegas on the detector (Right)

- Made of copper and kapton
- charge amplification through very thin layers of 50 μ m
- 128 channels strip read out for each single module to characterize the position of signals
- Typical amplification \sim 1000

A acrylic box working at 1 Bar is made to test the gain uniformity of the 128 channels of each Micromegas



The test box with one piece of Micromegas inside

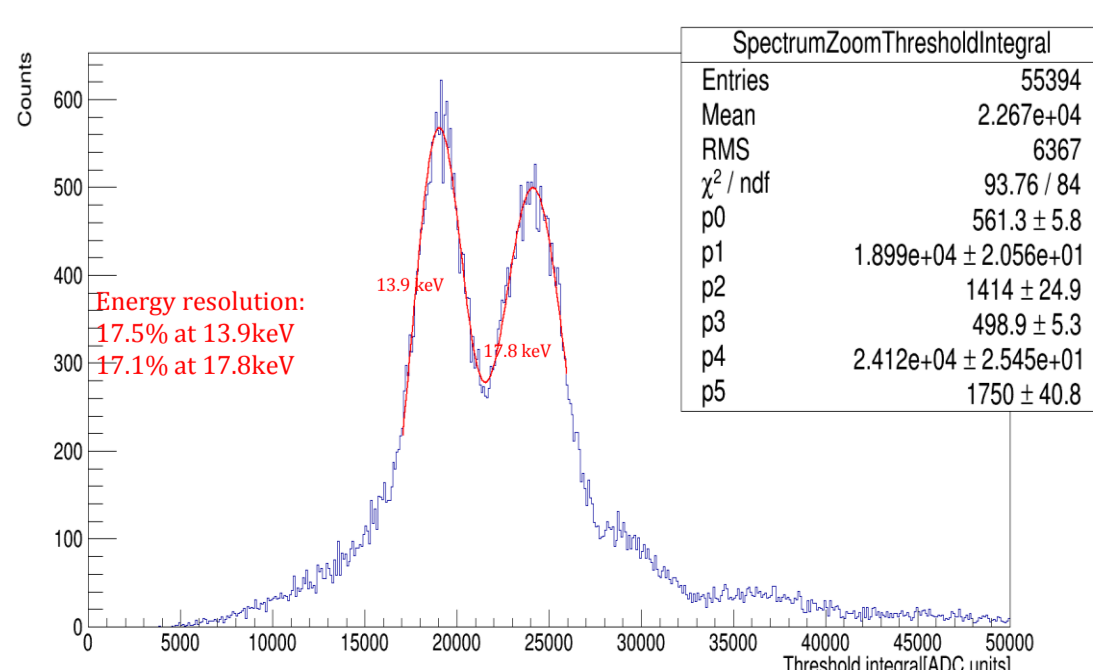


Calibration result for gain of 128 channels

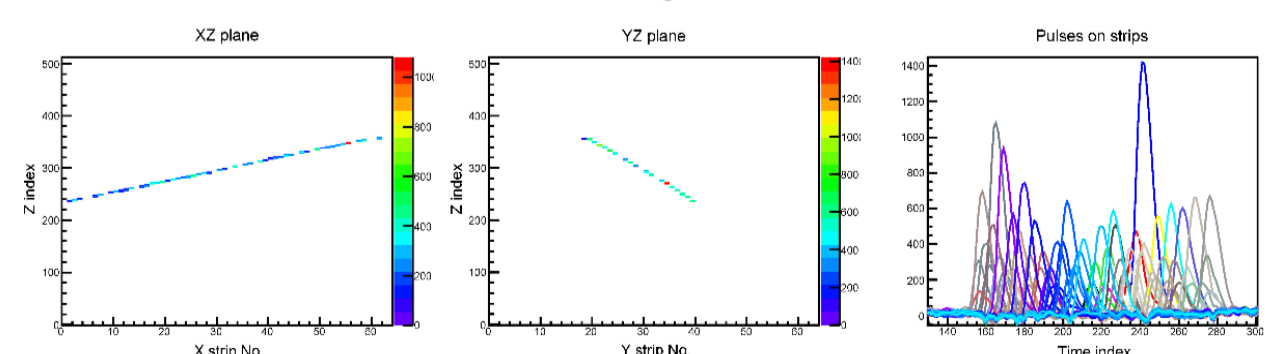
4. Data Taking and Prospect

The prototype detector has been running with mixed gas (Ar-CO₂; Ar-Isobutane; Xe-TMA at different pressure respectively) and radiation source of ²⁴¹Am (gamma and alpha) and ¹³⁷Cs (gamma)

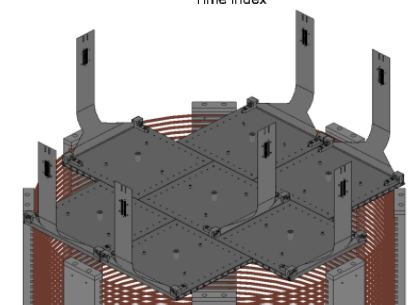
²⁴¹Am energy spectrum at 1bar Ar:Iso(5%) with 1 Micromegas



Muon track at 2 bar Xe:TMA with 1 Micromegas



The prototype TPC is now running with 2 Micromegas inside; It will soon be upgraded to 7 Micromegas with 10 bar gaseous Xenon in the future



Design for geometry of 7 Micromegas