Two-proton radioactivity studies using ACTAR

- two-proton radioactivity
- CENBG TPC
- ACTAR requirements

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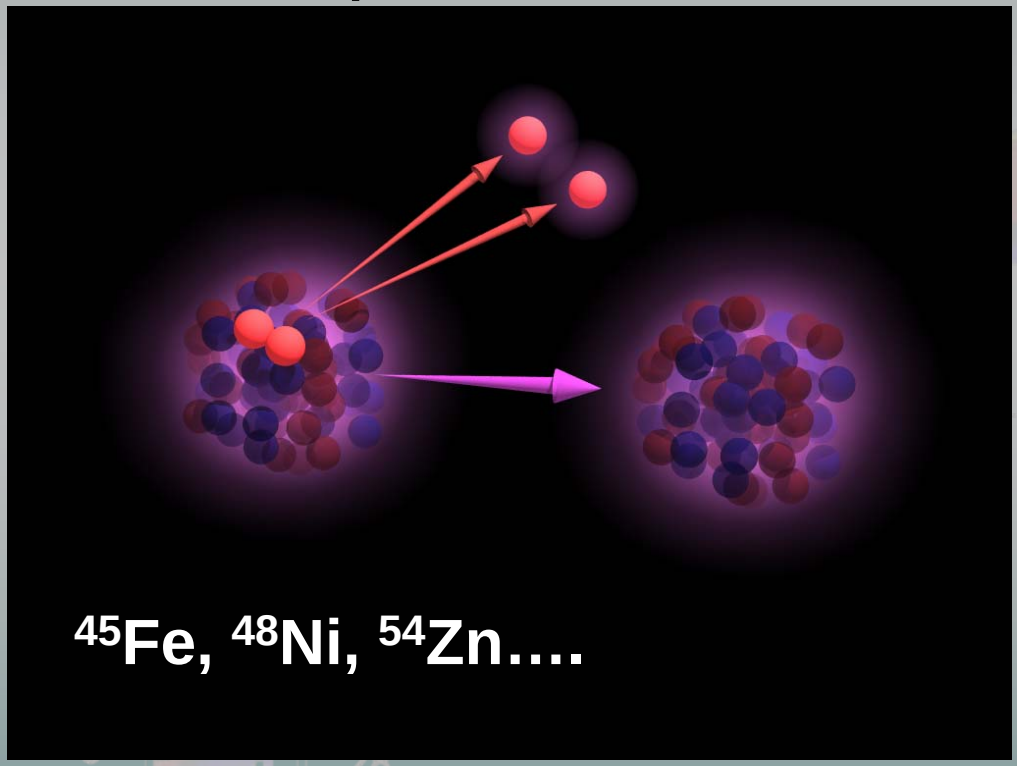
two-proton radioactivity

Two-proton radioactivity

nucleus → two protons + nucleus - 2



to be measured:

- **total decay energy**
- **individual proton energies**
- **angle between protons**

➔➔ 3D traces of protons

➔➔ TPC

CENBG TPC for 2p studies

aim

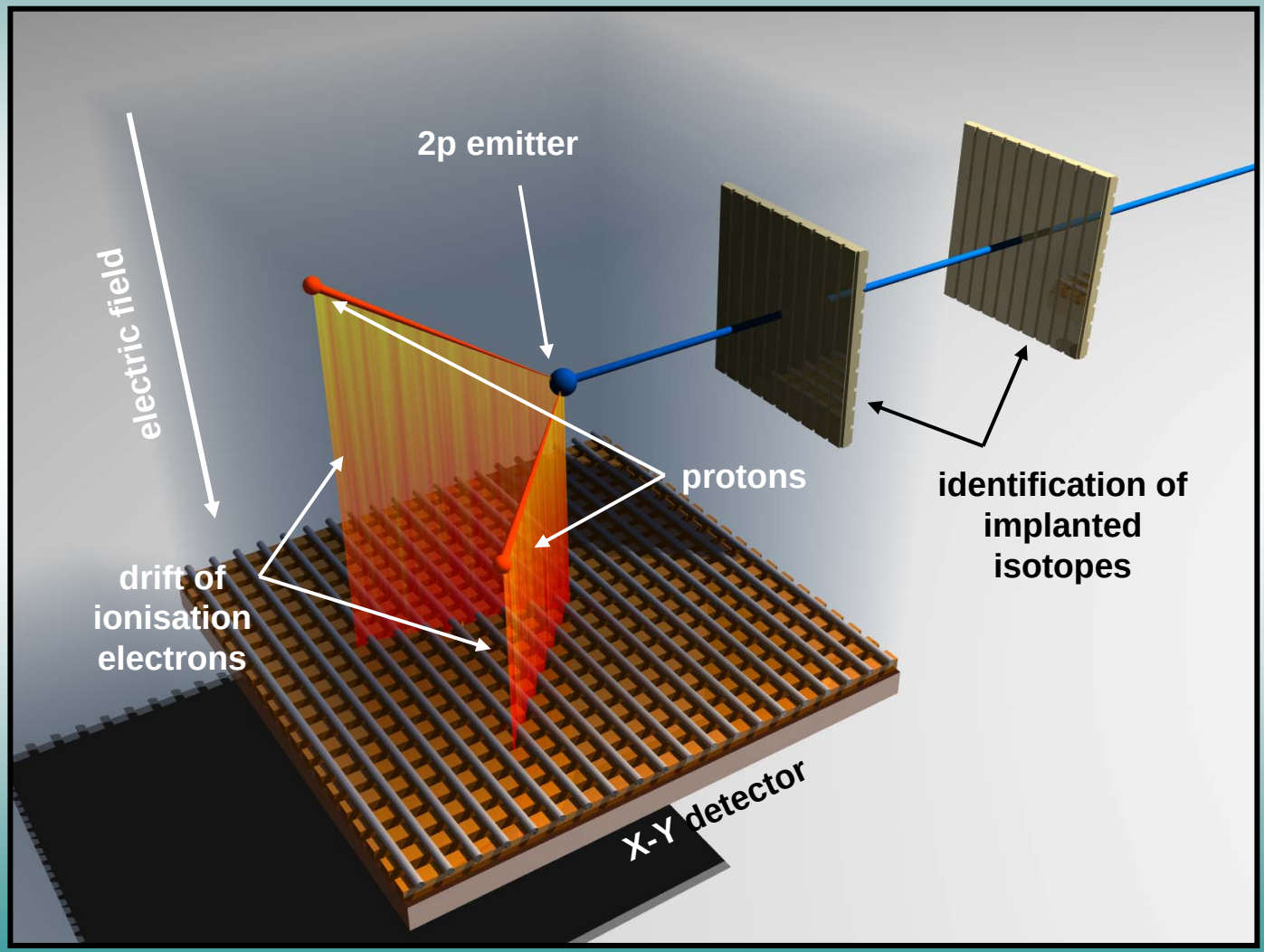
measurement of individual proton energies and proton-proton angle
→ distinction between correlated ^{2}He or uncorrelated 3-body decay

principle of detection

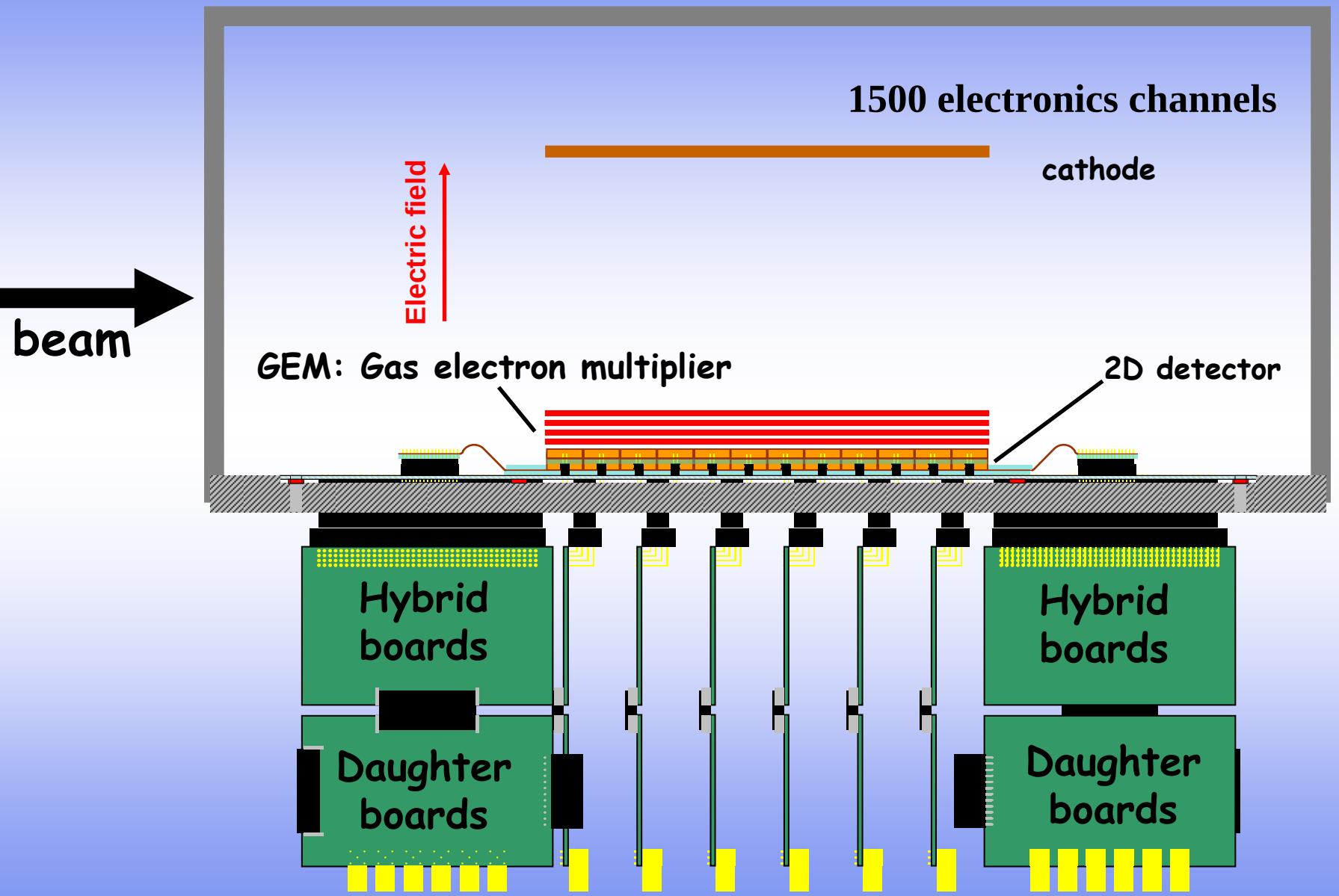
implantation in gas volume

traces in 3D of protons
→ X-Y detector
→ Z from time projection

technology:
Micro-groove detector
+ GEMs
electronics: ASICs

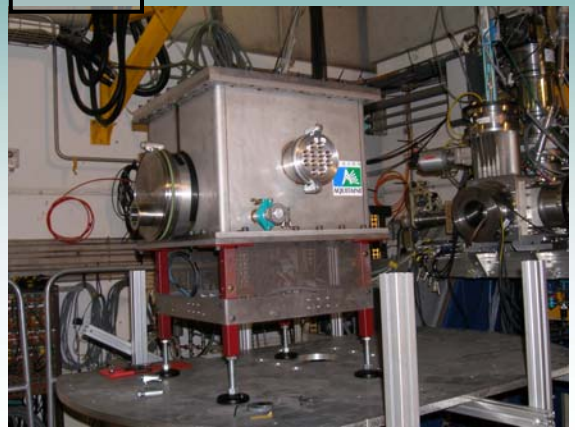


time projection chamber for 2p studies

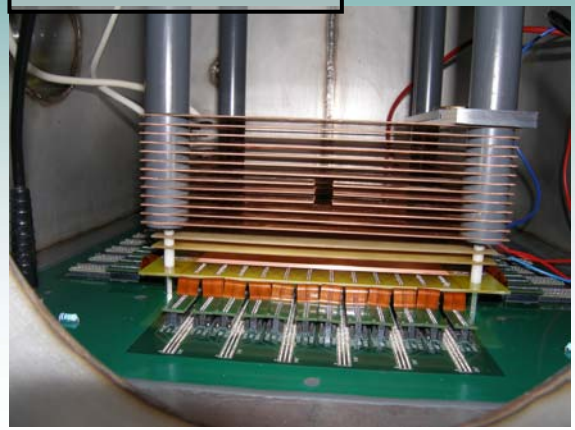


Time projection chamber

TPC

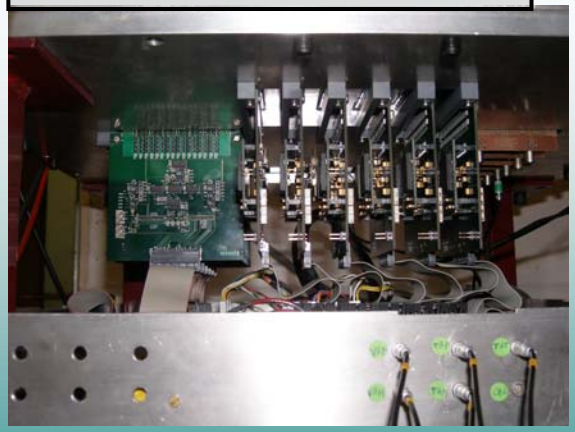


Drift volume

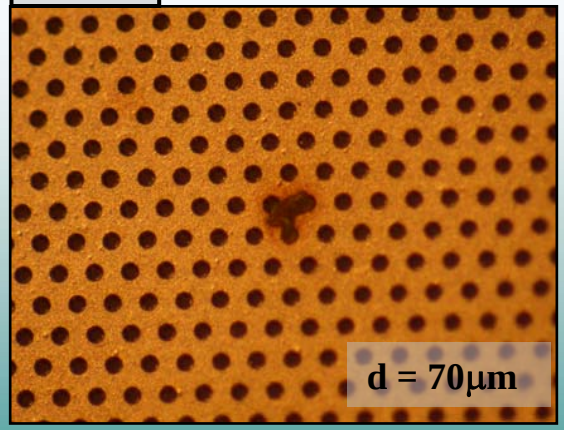


Hybrid card

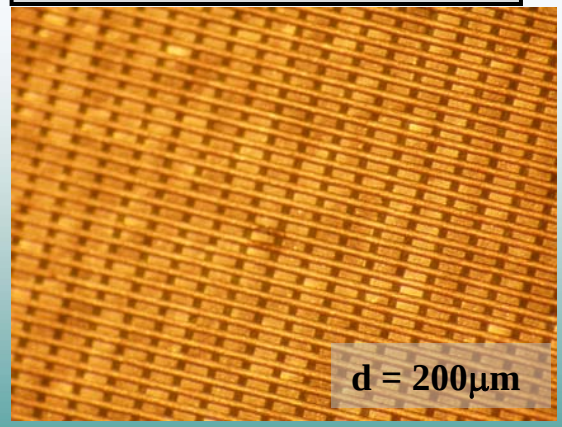
Mount of electronics



GEM

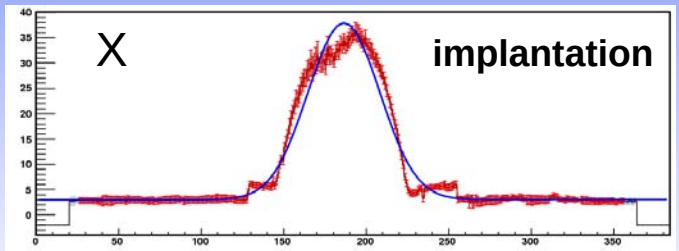


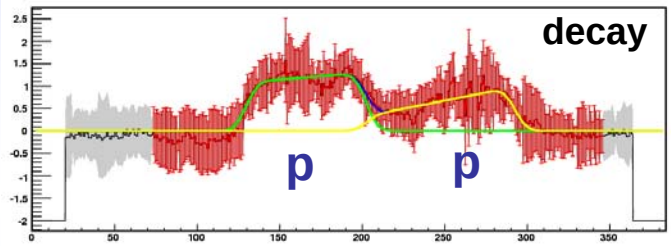
strip-strip detector

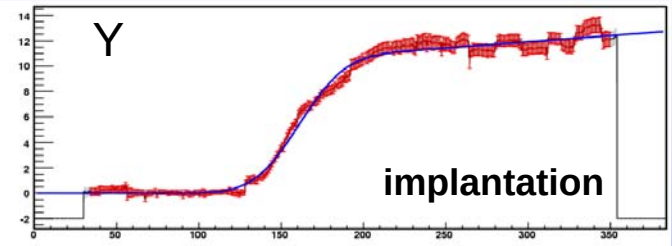


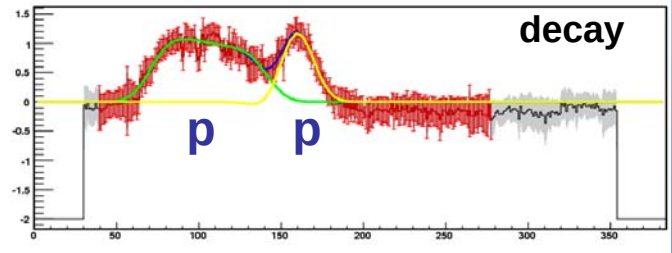
Experiment in september 2006

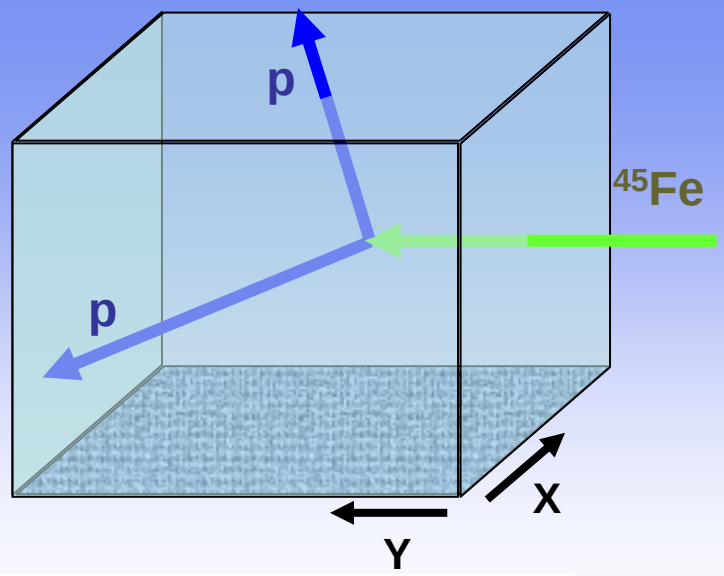
Typical event

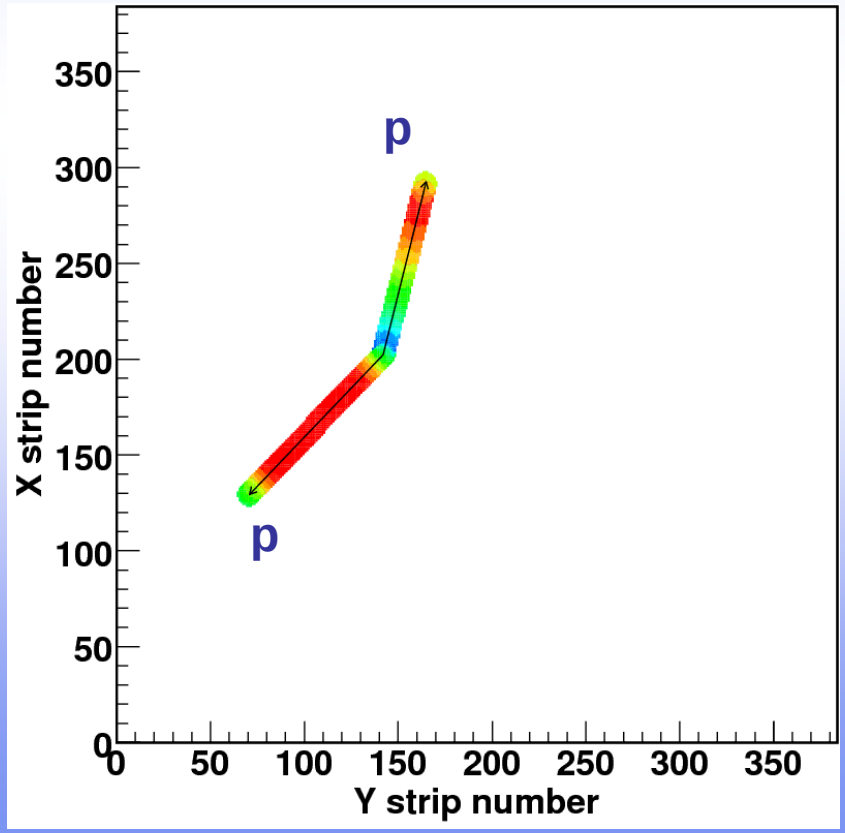












time projection chamber: details

Active detection volume: 15 x 15 x 10 cm^3

Detector gas: P10 at 0.5 - 1atm

4 GEMs: Gas electron multiplier (CERN) (gain: ≈ 20 per GEM)

Detector: double-sided micro-groove detector (CERN)

Strip pitch: 200 μm, ASIC pitch: 400 μm

ASICs: VAT/TAT by IDEAS, Norway

TAC window: 10 μs

channels per chip: 32 time and energy

Electronics and data acquisition: PXI – VME

Energy resolution (GEM or sum of strips): 150 keV

Position width for point source: 4 - 5 mm

Precision on position: 150 – 200 μm

ACTAR requirements

pressure of P10 gas	1 atm	0.5 atm
length in beam direction:	30 cm	60 cm
width:	10 cm	20 cm
height:	20 cm	40 cm
proton trace length:	1 cm	2 cm
number of pixels to fire to define trace:	10	10
pixel density:	1 / mm^2	1 / 4 mm^2
total number of channels:	30000	30000
sampling rate:	10-50 Mhz	10-50 MHz
dynamical range:	1000	1000
event rate:	10-100 / s	10-100 / s

however: two subsequent events in ms range (implantation & decay)