T10 - beam test

Solangel Rojas Torres
Czech Technical University in Prague

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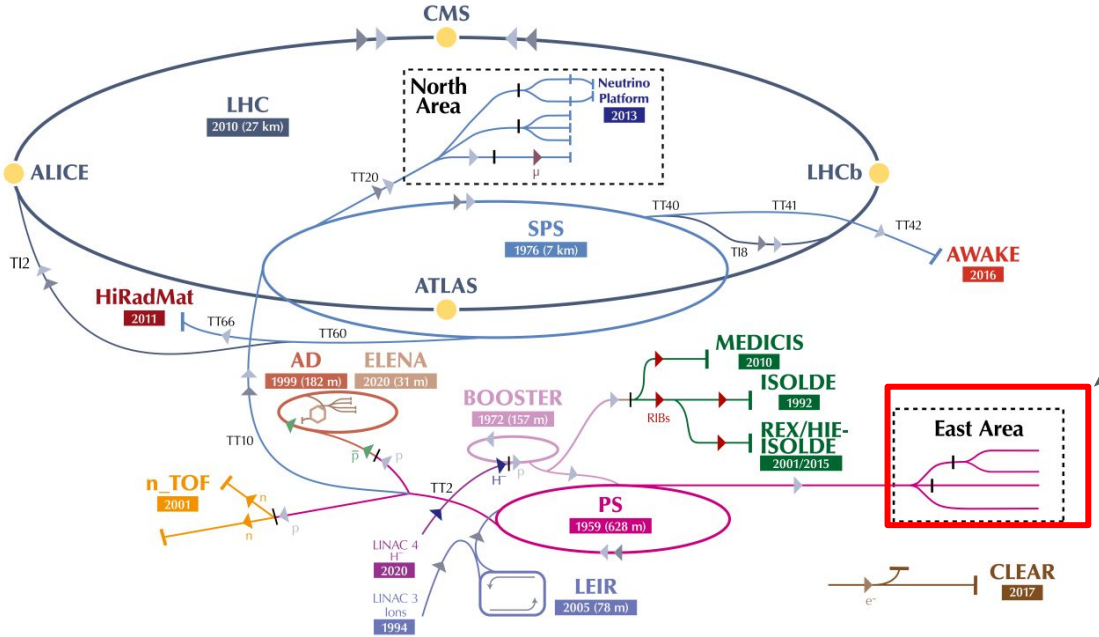
The CERN accelerator complex
Complexe des accélérateurs du CERN

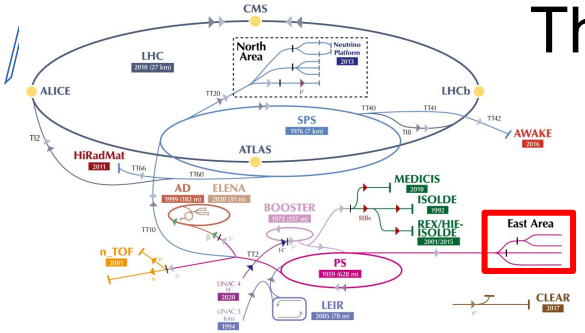


T10 beam line

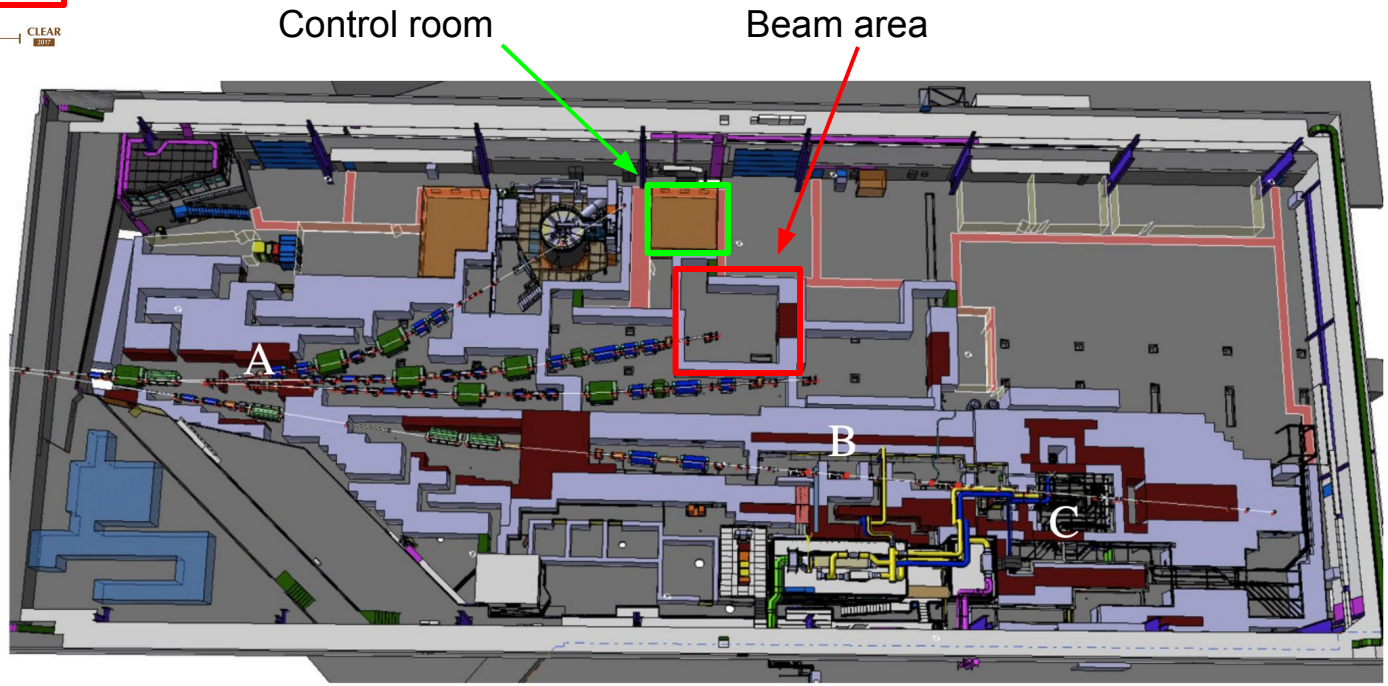
H⁻ (hydrogen anions) · p (protons) · ions · RIBs (Radioactive Ion Beams) · n (neutrons) · $\bar{p}$ (antiprotons) · e^- (electrons) · μ (muons)

LHC - Large Hadron Collider // SPS - Super Proton Synchrotron // PS - Proton Synchrotron // AD - Antiproton Decelerator // CLEAR - CERN Linear Electron Accelerator for Research // AWAKE - Advanced WAKefield Experiment // ISOLDE - Isotope Separator OnLine // REX/HIE-ISOLDE - Radioactive EXperiment/High Intensity and Energy ISOLDE // MEDICIS // LEIR - Low Energy Ion Ring // LINAC - LINear ACcelerator // n_TOF - Neutrons Time Of Flight // HiRadMat - High-Radiation to Materials // Neutrino Platform

The T10 beam line at the East Area



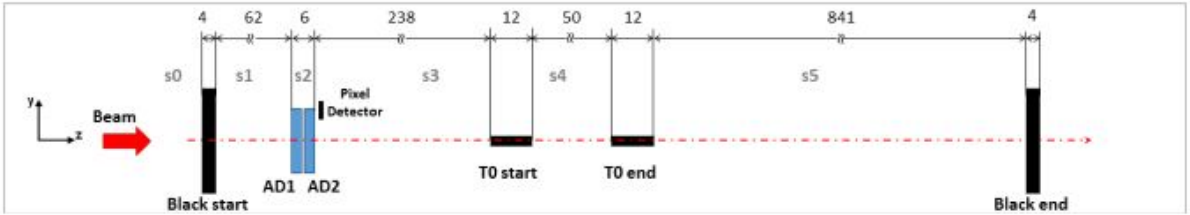
- Secondary particles: mainly pions
- Up to 6 GeV/c



Experience with AD beam test

T10 beam line setup

- Were used two kind of detectors for trigger:
  1) Scintillator hodoscopes: **Black-Left** and **Black-Right**
  2) Cherenkov radiators: **T0-end** and **T0-start**



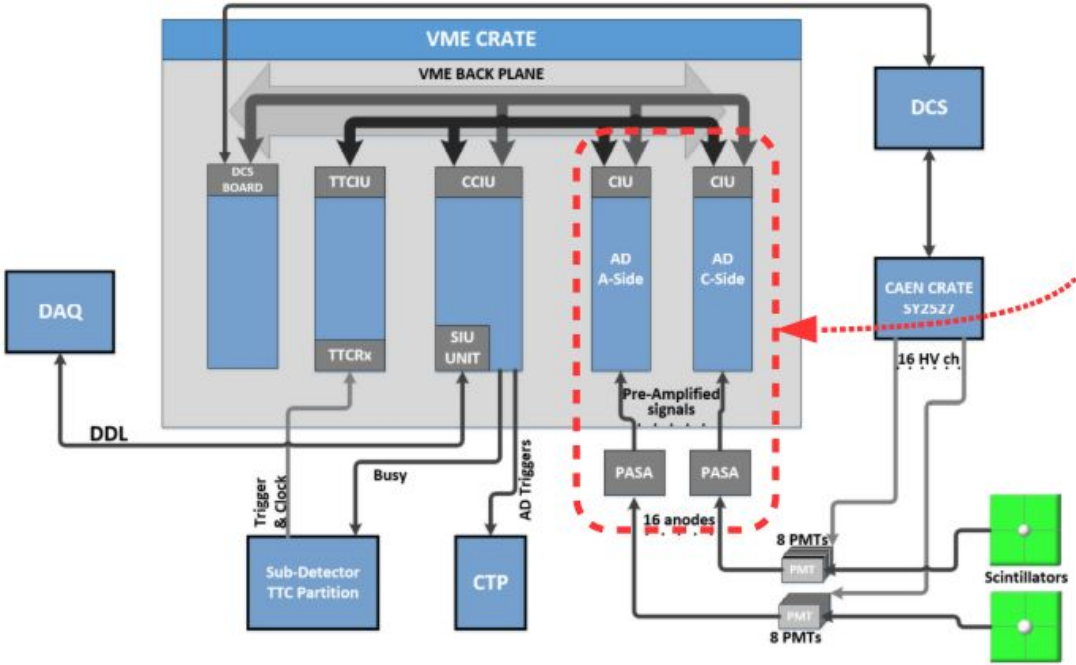
- Run with the pixel detector: **1.5 GeV/c**.
- The momentum for the general scans: **1 GeV/c.**
- Extra runs: **1.5**, **2** and **6 GeV/c**.
- Were used an ADA and ADC spare modules, labeled as AD1 and AD2 respectively.

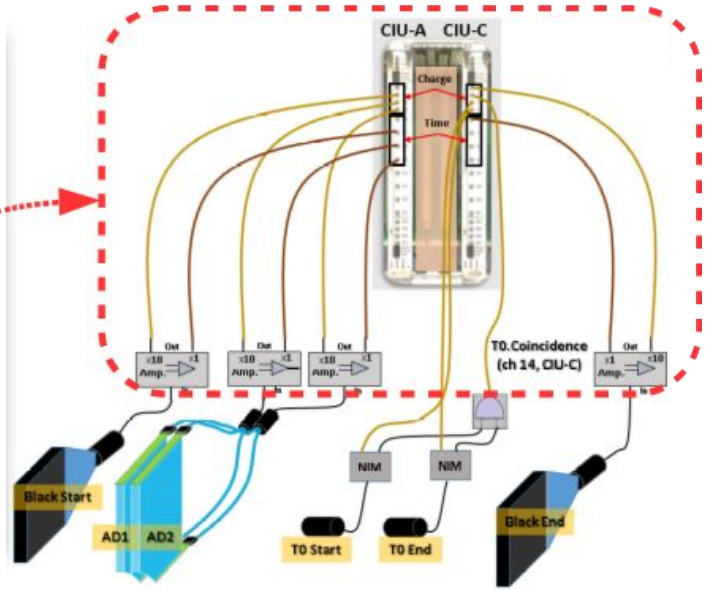
Frontal view

Back view

AD beam test: readout

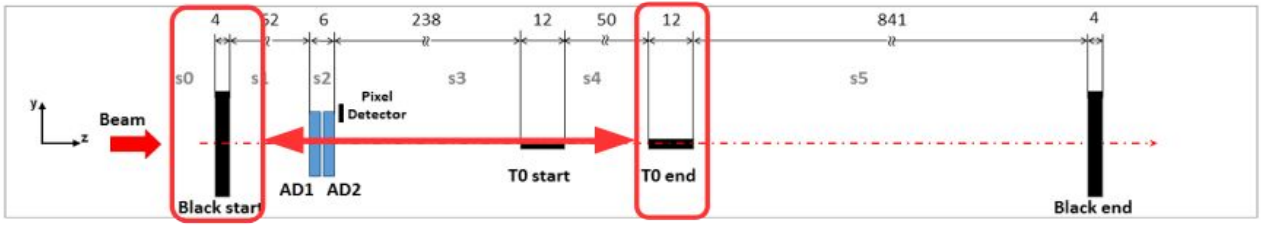
Replica of the AD electronics integrated to ALICE (including DCS, DAQ and FEE)

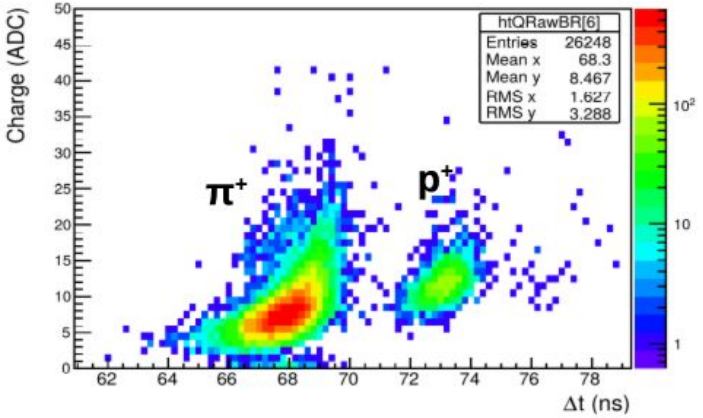


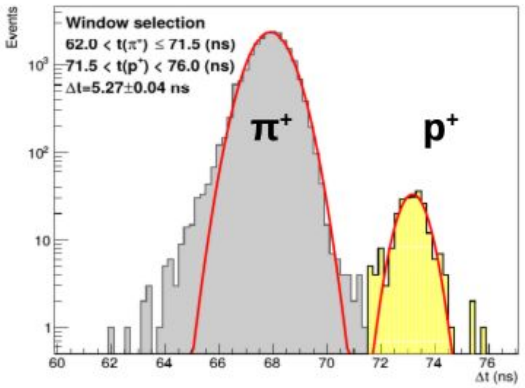


Particle selection at T10

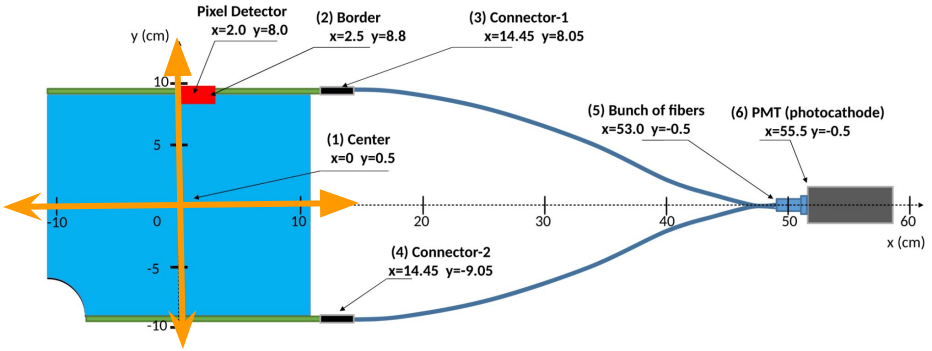
The **particle selection** was made using **Black-start** and **T0-end** time difference.

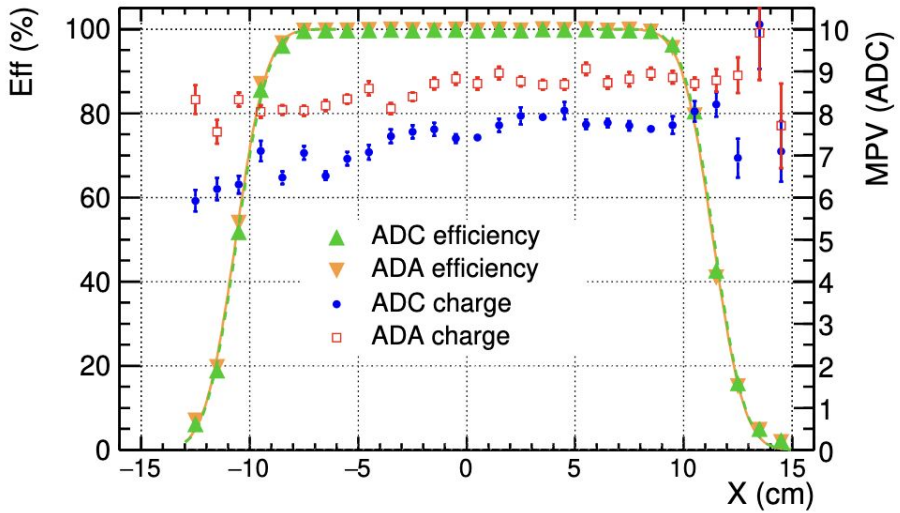


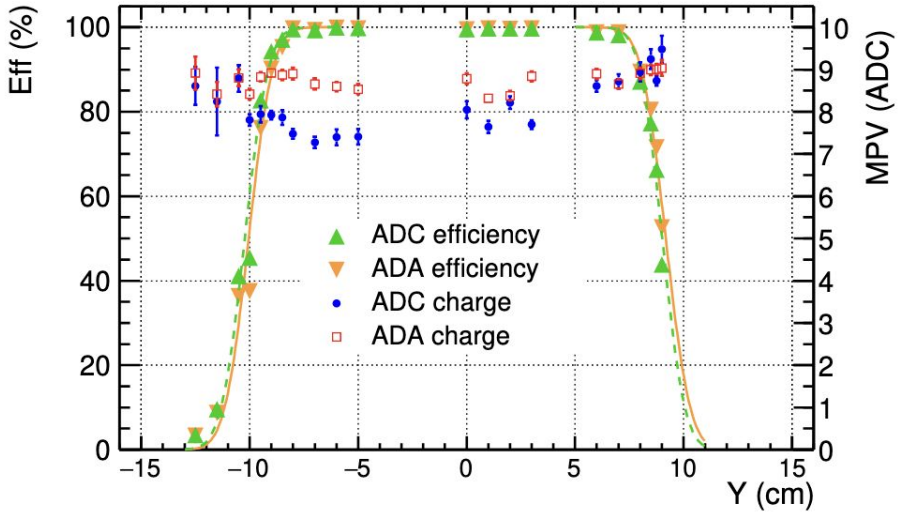




Scan test

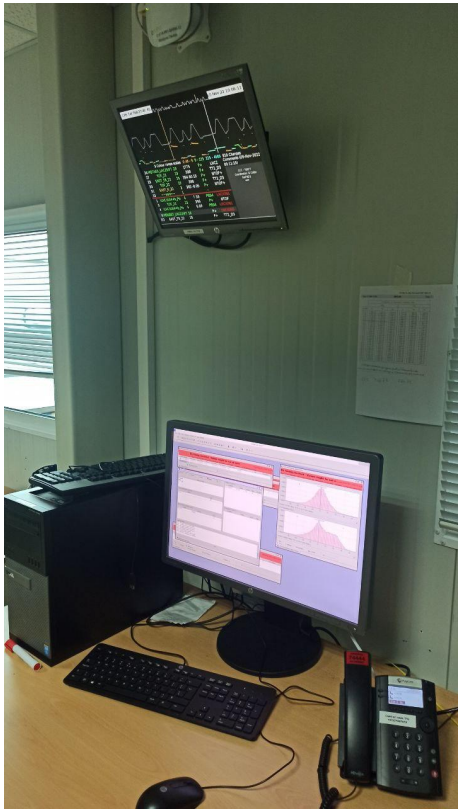

Pixel Detector
x=2.0 y=8.0
(2) Border
x=2.5 y=8.8
(3) Connector-1
x=14.45 y=8.05
(5) Bunch of fibers
x=53.0 y=-0.5
(6) PMT (photocathode)
x=55.5 y=-0.5
(1) Center
x=0 y=0.5
(4) Connector-2
x=14.45 y=-9.05
y (cm)
x (cm)


Eff (%)
MPV (ADC)
ADC efficiency
ADA efficiency
ADC charge
ADA charge
X (cm)


Eff (%)
MPV (ADC)
ADC efficiency
ADA efficiency
ADC charge
ADA charge
Y (cm)

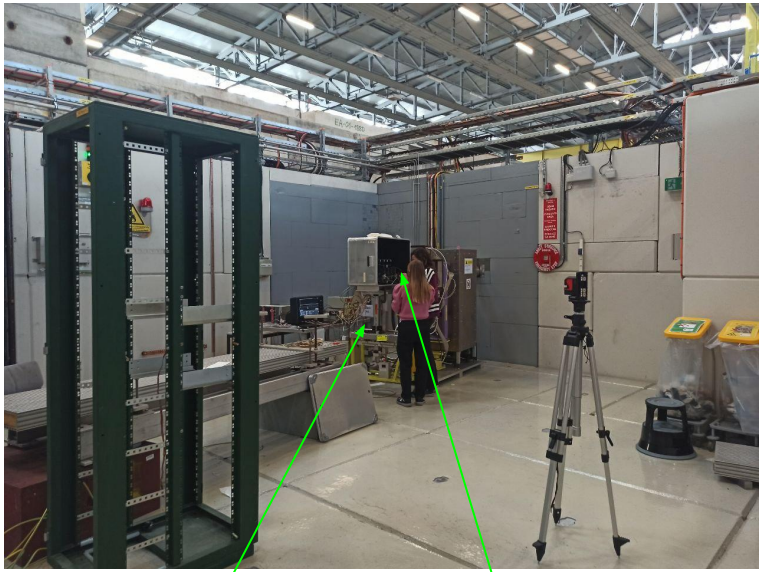
Beam test area

Beam control



Patch panel and controls inside the control room

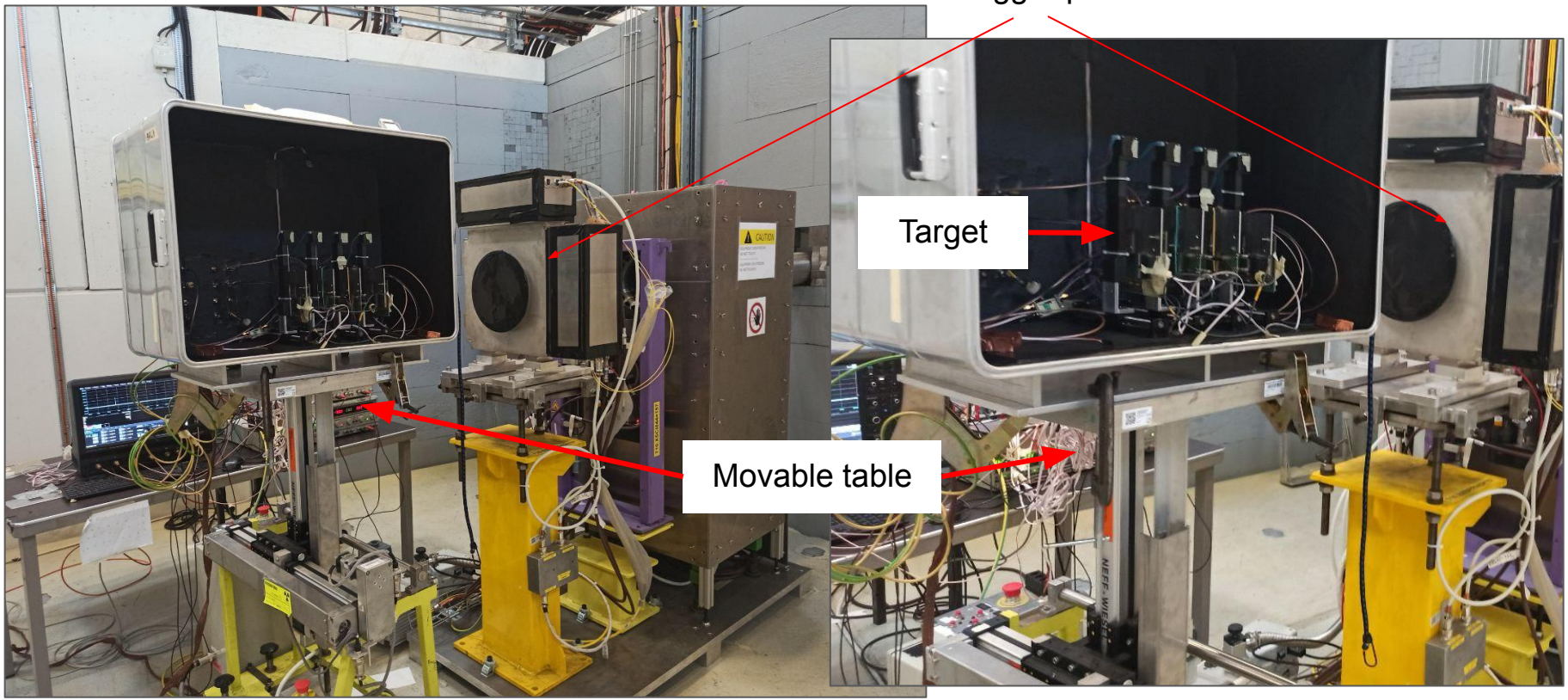
Inside the beam area



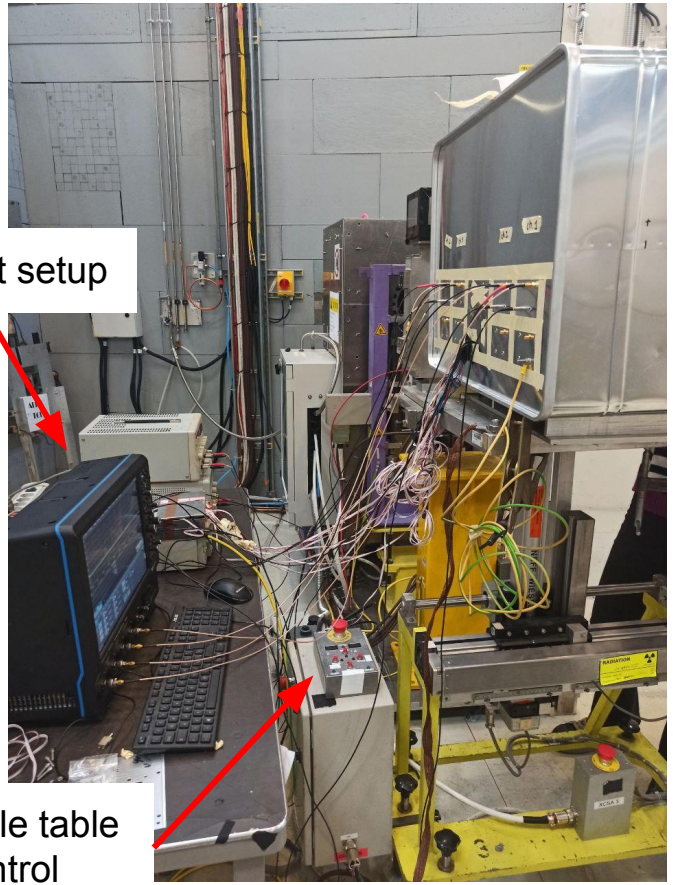
Movable table

Detector target

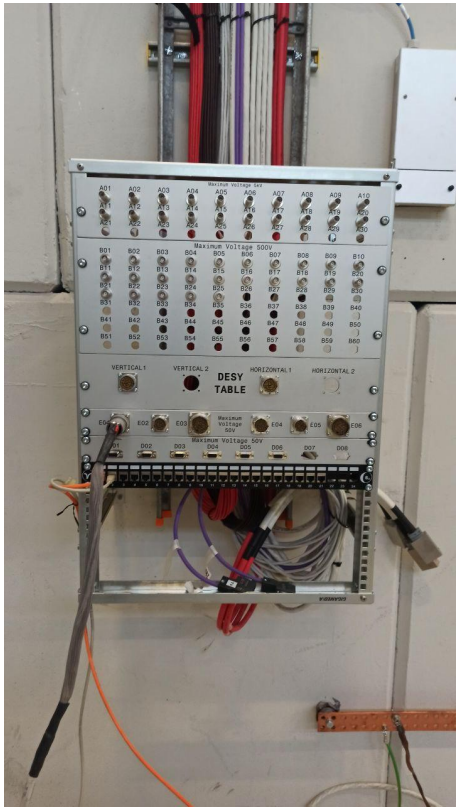
Beam output



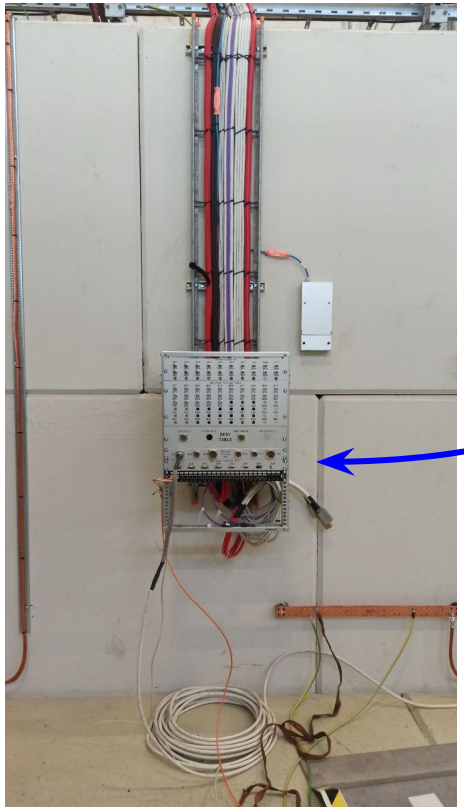
Movable table



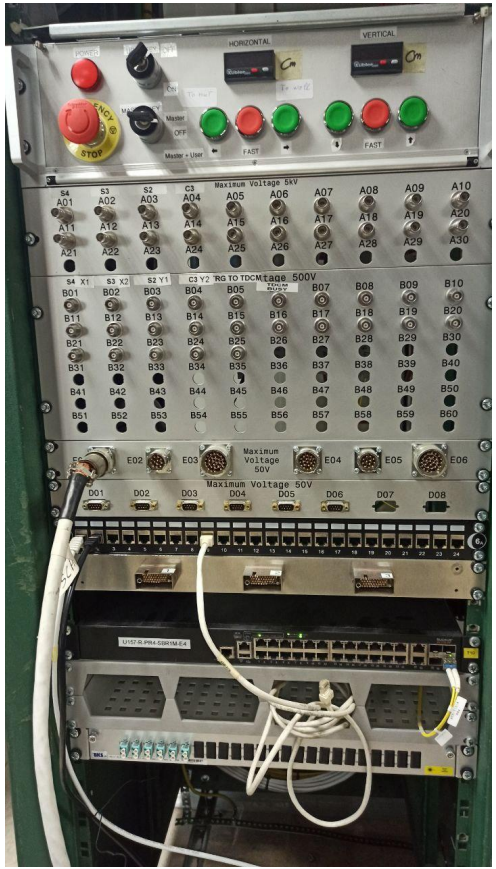
Patch panel - beam area



- High voltage
- Signal
- Low voltage
- Ethernet



Patch panel in control room



Movable table control

- High voltage
- Signal
- Low voltage
- Ethernet

Equipment needed to test the prototypes

DAQ

- Digitizer
- Oscilloscope
- QDC
- TDC
- ALICE/FIT readout?

Software

- Prepare and pre-test the analisis scripts for the DAQ for quick and on-site analysis.

Power sources

- High voltage
- Low voltage

For trigger

- Scint. pallets
- Threshold discriminators
- Coincidence modules

Personal protection equipment

- Helmets
- Shoes
- Dosimeter

Patrol course

Mechanical frame: to fix the prototypes

Gas mixer (for RPCs)

Cables:

- Signal
- High voltage
- Ethernet

Contact person to ask about the use of the T10 beam controls: Maarten VAN DIJK

What to test?

Prototypes

- Comercial scintillators
- Plastic scintillators manufactured in Mexico
- RPC
- MWPC?

Types of tests

- Length scan along vertical and horizontal axis
  - For time, charge and efficiency characterization
- Momentum from 1 to 6 GeV/c
- Prototypes at different angles
- Iron block (as an absorber)

Person power

To test plastic scintillator prototypes:

- UNAM: Antonio Ortiz + 2 students
- CTU: Solangel Rojas + student?
- BUAP: 1 + 2 students
- UAS: Ildefonso Leon + ?
- CINVESTAV: Gerardo Herrera

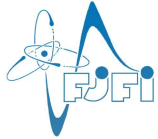
To test RPCs prototypes?

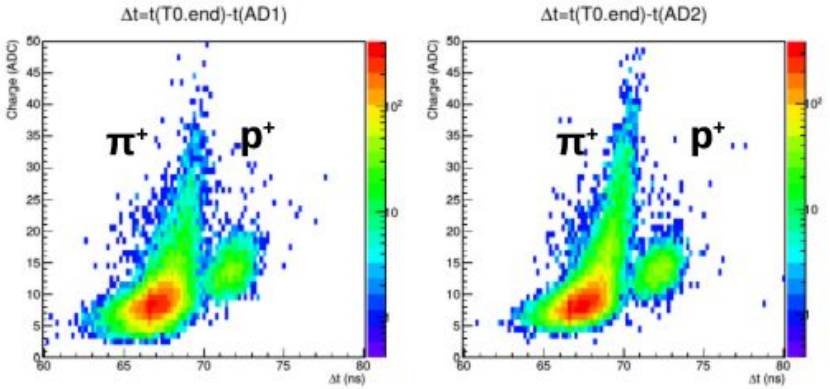
To test MWPC prototypes?

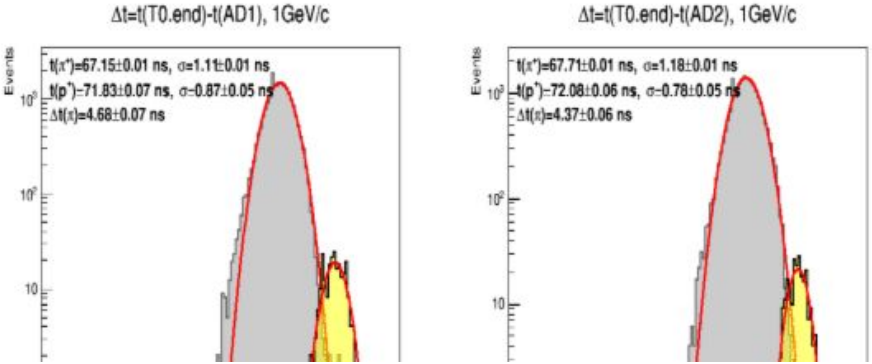
To be discussed in detail

Request already submitted: foreseen in May 2023. Waiting to be approved.

Thank you!







- The time response of the AD modules have been analyzed respect to **T0-end** detector.
- T0-end have a good time resolution of **~50 ps**.
- The beam **momentum** was set at **1 GeV/c**.