WCTE Beamline Status

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July 21, 2022

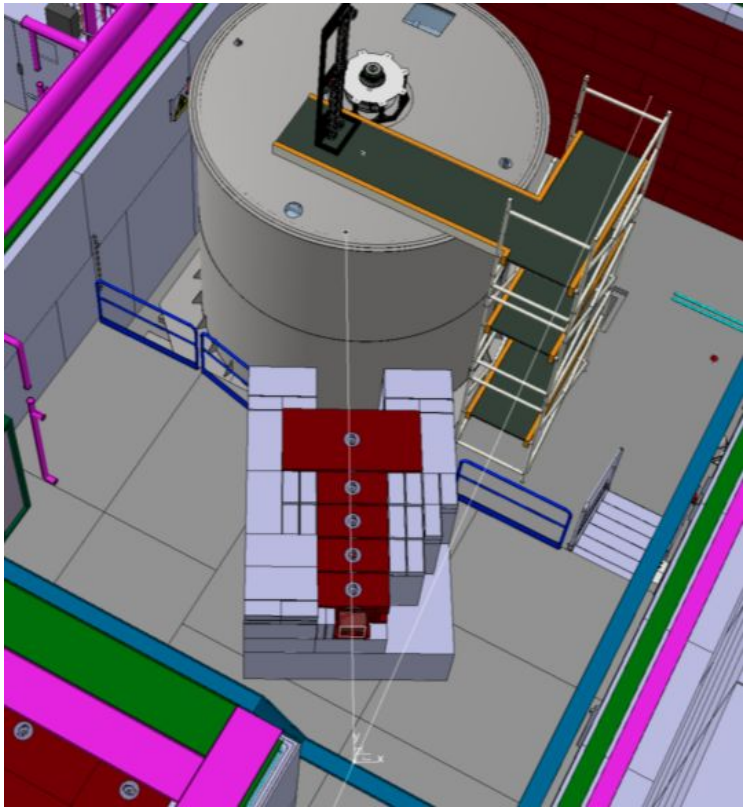
Outline

Beam session:

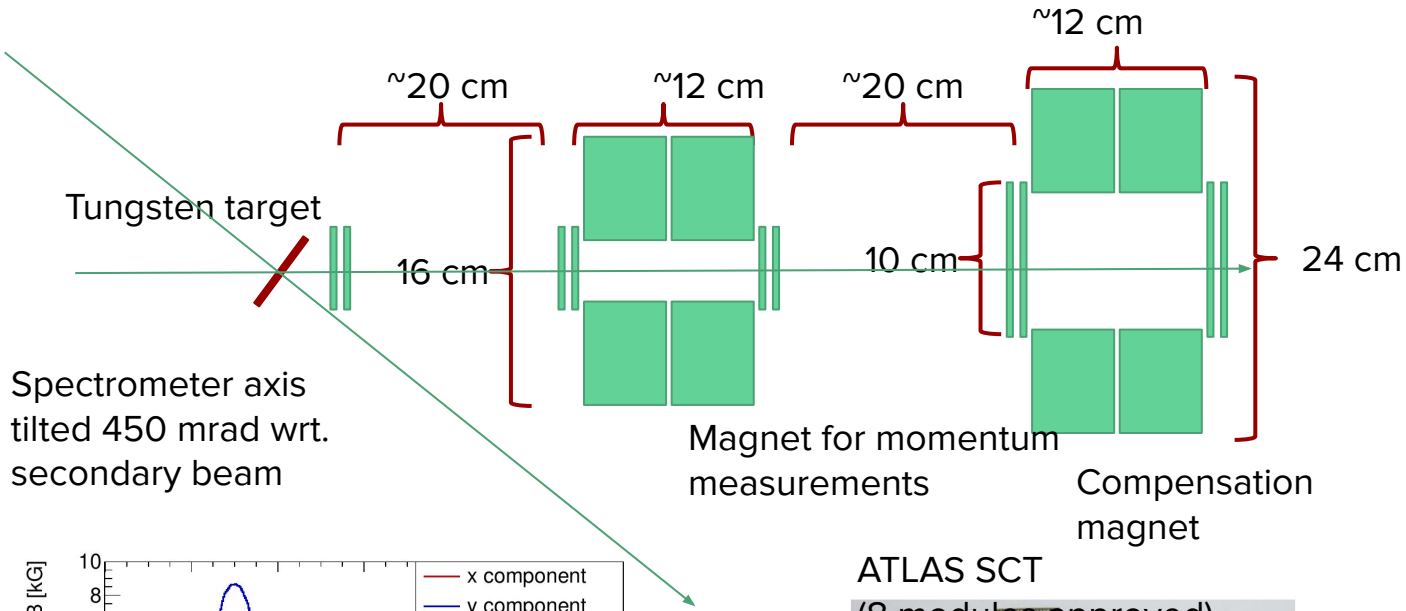
- Beam summary (M. Pavin)
- Secondary beamline simulation (A. Fiorentini)
- T9 beam test (L. Koerich)

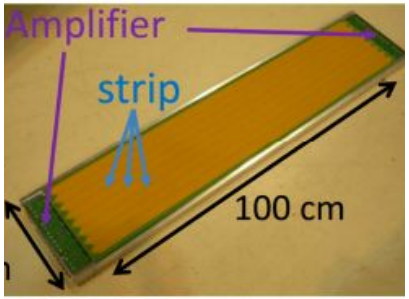
WCTE Beam

- WCTE data-taking will happen in the T9 experimental area at East Hall
- WCTE will require $e^{\pm}$, $\mu^{\pm}$, $\pi^{\pm}$, and p beams between 0.2 and 1.2 GeV/c
- We proposed a compact tertiary beam placed in the T9 experimental area to achieve high hadron rates at low momenta ➜ secondary beam is still required for electrons and muons



WCTE Tertiary Beam Spectrometer



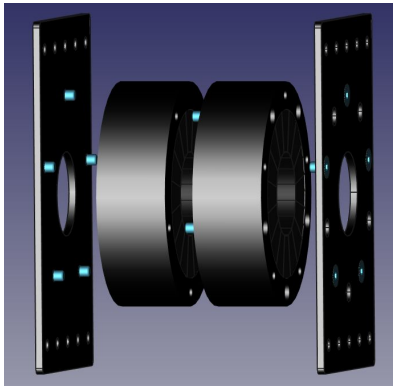


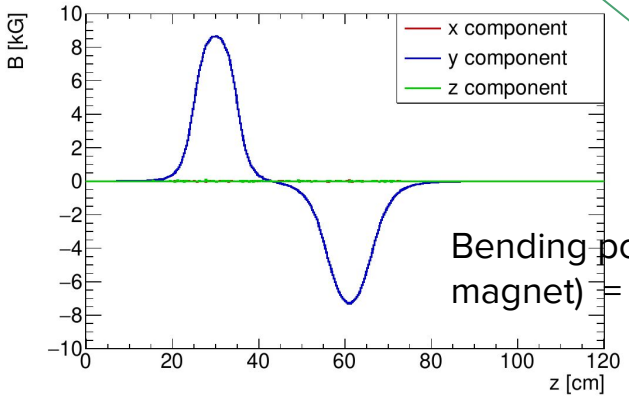
Spectrometer axis tilted 450 mrad wrt. secondary beam

Magnet for momentum measurements

Compensation magnet

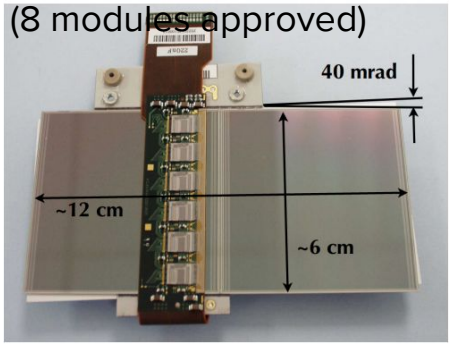
Halbach array





Bending power (first magnet) = 0.075 Tm

ATLAS SCT
(8 modules approved)

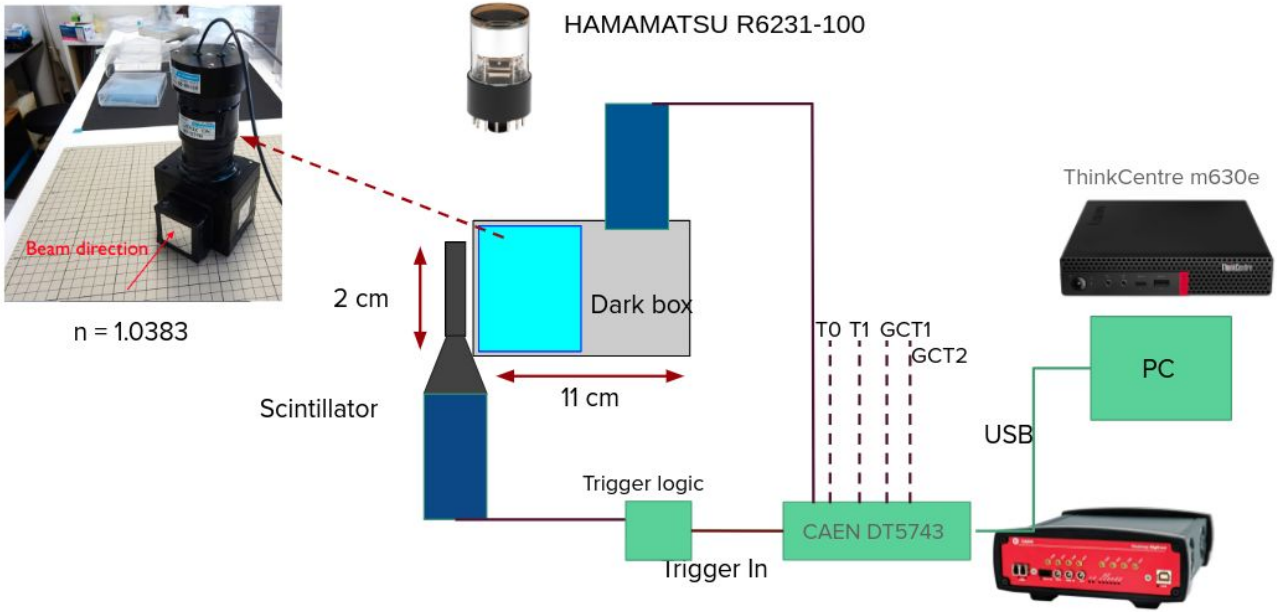


Secondary vs. tertiary beamline

- Advantages of using only secondary beam
  - No spectrometer and collimator
  - WCTE water tank will be stationary ➔ simplified mechanical design
  - Only a single smaller beam window
- Disadvantages of using only secondary beam
  - Lower beam rates (pions mostly decay before hitting the water tank
- East Hall was recently renovated ➔ T9 beamline can go below 0.4 GeV/c

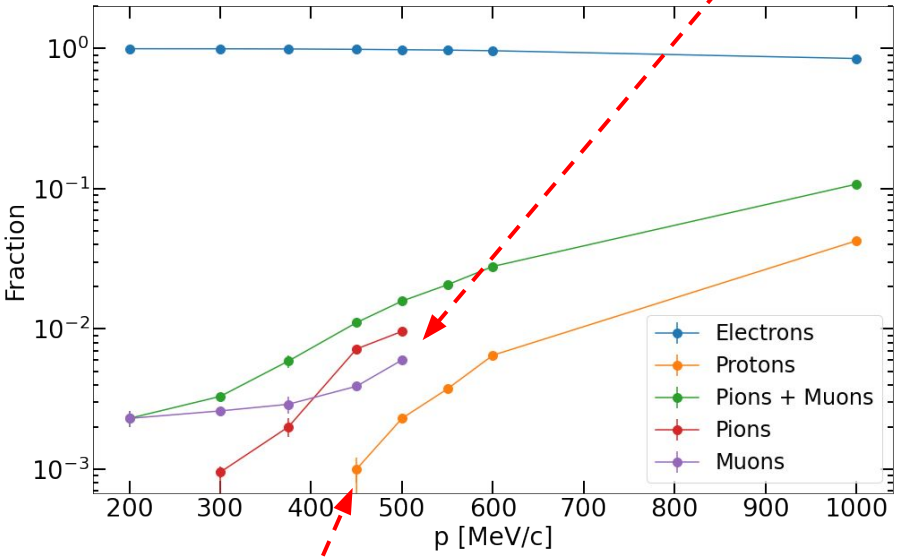
T9 beam commissioning

- Beam test in March 2022 (during T9 beam commissioning)
  - Measurement of the beam composition (0.2 - 1.2 GeV/c)
  - Test of the pion/muon separation using aerogel threshold Cherenkov detectors
- T9 beamline was operated in the high momentum mode

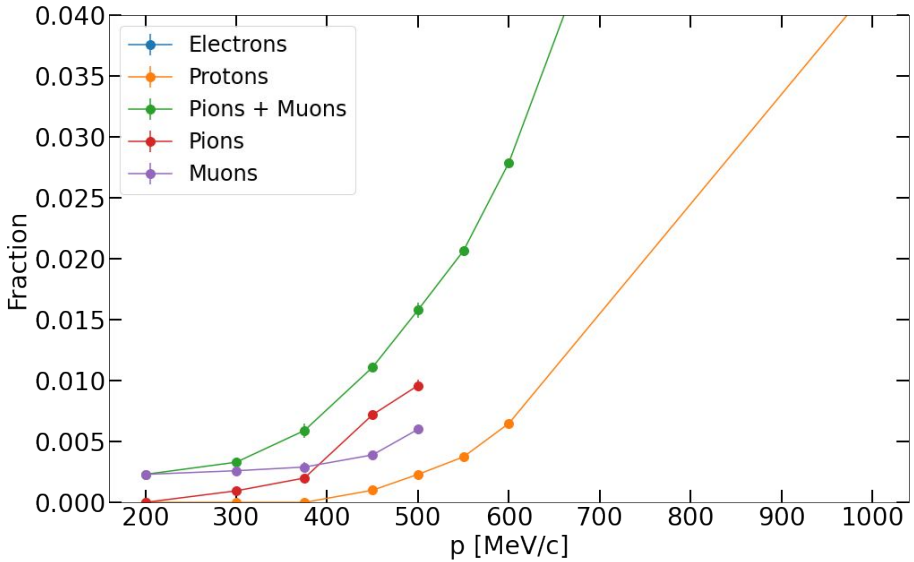


Beam composition (March 2022)

Cannot separate muons and pions above 500 MeV/c



Zoomed in plot (linear scale)

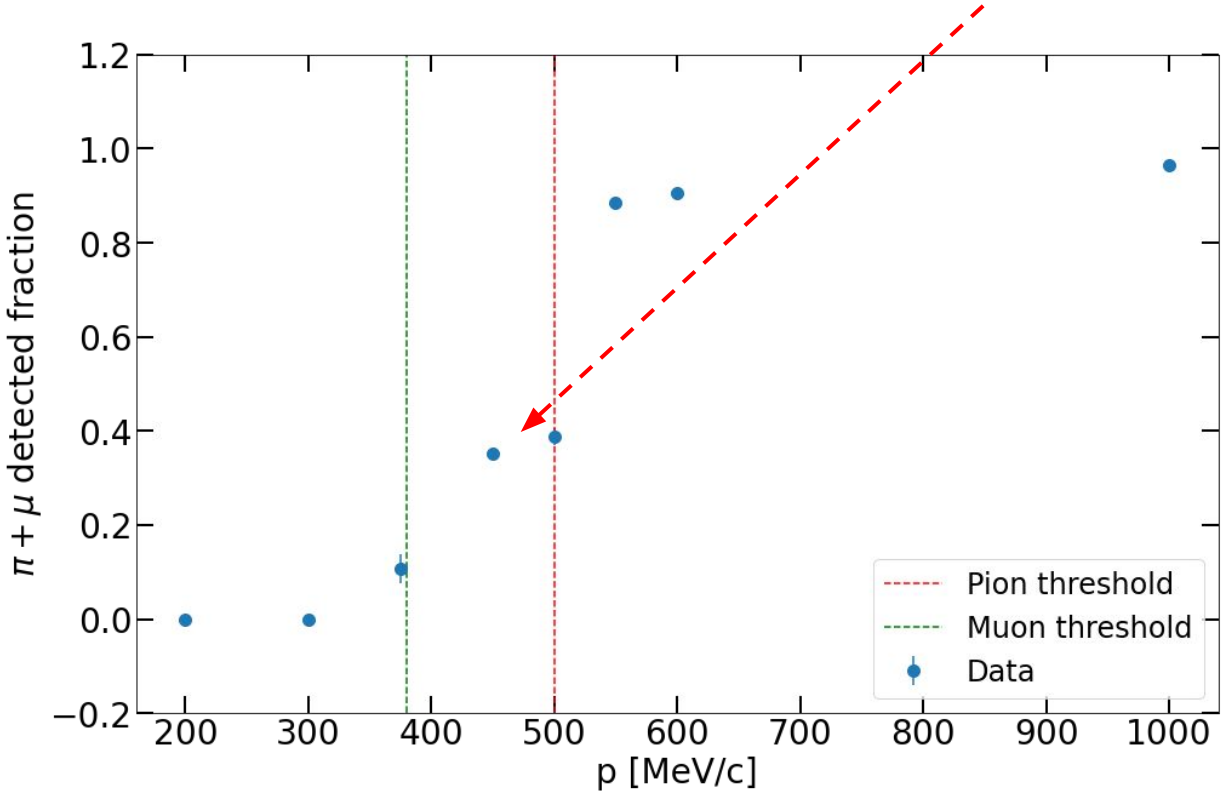


No protons below 350 MeV/c ➔ after running beam simulation we think protons are mostly absorbed by tof scintillators and beam windows

ACT momentum scan

For the given aerogel, we can set the beam momentum between 475 and 500 MeV/c to successfully separate pions and muons

Pion and muon candidates are remaining events after removing positrons with gas Cherenkov detectors and protons with tof measurements



T9 Beam Test (July 2022)

- T9 in low momentum mode (vacuum pipes, scintillators and gas Cherenkovs are taken out)
- Improved TOF detectors and three aerogel threshold Cherenkov detector
  Preliminary results ➜ we see pions at 200 MeV/c (see the talk by L. Koerich)

Tagged photon beam

- There is a possibility of using a tagged photon beam for WCTE ➜ studying electron-gamma separation
- Bremsstrahlung process ➜ electrons are decelerated in the nucleus' field and emit photons
    - Photon energy can be estimated by measuring electron angle and initial electron energy

Summary

- Secondary vs. tertiary beam ➔ using only secondary beam seems feasible
  - Initial results from the T9 beam test
  - Beam rate will be lower (compared to the tertiary beam simulation)
  - Pion/muon separation is possible
- Possibility of using tagged photon beam