BEAM MONITOR & BEAM TIME AT THE **PROTONTHERAPY CENTER** (Trento, July)

- the BM is a drift chamber of 11cm x 11cm x 20cm

- 12 layers with 3 drift cells per layer

- rectangular cell shape (16mm x 10mm)



Purpose in FOOT

Measure the direction of the incident beam and reject the events in which the primary ion has fragmentated before the target (mostly in the start counter scintillator and in the beam monitor material)

Plan of the experiment

1) Measurement of the efficency of each detector cell

 > As a function of the HV : from 1.7 kV to 2.1 kV (0.5 kV step)
 -> As a function of the incident particle energy : from 70 MeV to
 200 MeV

We want to evaluate the BM performance after many years from FIRST (aging effect) 2) Calibration of space-time relations New calibration with the use of an external tracking detector (not done in FIRST)

3) Evaluation of the spatial resolution of the BM thanks to the new space-time relations

We will test the spatial resolution at 70, 120, 160, 200 MeV for at least 4 different angles







Start Counter

 $250\,\mu\text{m}$ plastic scintillator, circular shape of 4.6 cm in diameter

It measures the incoming beam rate and it works as trigger for data acquisition

Two planes of microstrip silicon detector (MSD) -Perugia-

One at the front and one at the end of the beam trajectory

They reconstruct the primary proton track with high spatial resolution and that track will be a benchmark of the BM space-time relations

Beam Monitor

Mixture Ar/CO2 -> 80/20 %

It will operate at atmospheric pressure

No need for flux system inside the irradiation room the gas mixture will flow throughout the detector for a few hours (outside the irradiation room) to clean the drift volume and eject gas impurities

The filling and cleanup procedure will be performed every day before data acquisition

DAQ system -Bologna-

The new DAQ setup designed for FOOT will be tested for the first time



Preliminary schedule of the

<u>experiment</u>

- DAY 1 Mounting, cabling, daq setup, first cosmic data taking and first proton beam exposure
 - Measurement of the efficiency of the detector cells as a function of the HV -> minimum value of 1.7 kV to a maximum value of 2.1 kV with a step of 0.5 kV (9 different HV measurements)
 - For each HV point we need to check the efficiency for each BM cell (54 different measurements)
 - Measurement of the efficiency as a function of the incident particle energy -> proton projectile energies from 70 MeV to 200 MeV
- DAY 2 Space-time relations calibration -> since the proton beam at 200 MeV has a FWHM of ~ 8 mm, in order to cover all the area of one cell exhaustively, we need to move all the detectors through the experimental room movable table 2 times for each cell
- DAY 3 Once the BM is calibrated, we need to check the BM performances with a beam impinging with different angles on the detector and with different protons energies -> protons at 70, 120, 160 and 200 MeV, varying the incident angles for at least 4 angle values, for a total of 16 measurements. Because the beam direction is fixed, we also will need to rotate all the detectors.