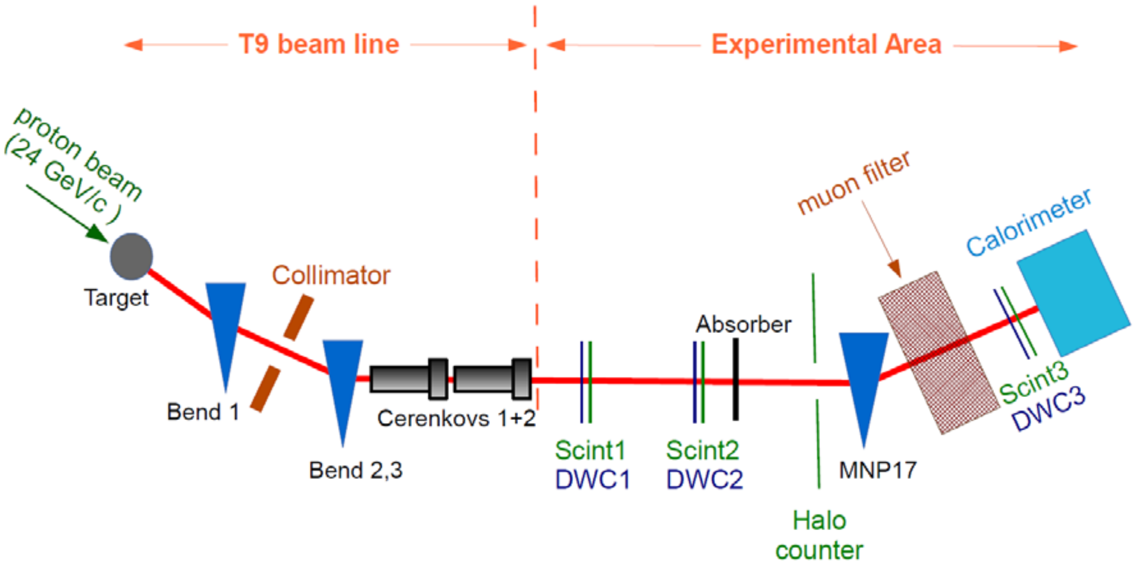
An example experimental setup at the T9 beam line

Purpose

To measure by different techniques the particle composition of the beam line at various beam momenta.

Experimental setup



The incoming 24 GeV/c primary proton beam from the PS impinges on a **target**. The collisions of the protons with the target nuclei provide a variety of particles. The T9 secondary beam line is set up to select the particles of various momenta, between 0.5 and 10 GeV/c. This selection is based on the deflection in the **bending magnets** (Bends 1-3) and the collimator, and is further refined by **quadrupole lenses**.

All particles arriving in the experimental area are counted by two **scintillators,** SCINT 1 and 2, and their directions are measured with two **delay wire chambers** DWC1 and 2.

Two **cherenkov counters**, installed at the beam entrance into the experimental area allow a first particle identification, as they only give a light signal in case the particle velocity is above a certain adjustable threshold, i.e. if the particle mass is below a set value.

A second information can be obtained using a **lead absorber**, that is inserted into the beam. Electrons will loose a large amount of their energy in the lead whereas most of the hadrons cross the absorber essentially unobstructed. The particles that have interacted or undergone hard scattering in the absorber are flagged with a **halo counter.**

A **magnetic spectrometer** is installed inside the T9 experimental zone and it consists of the large aperture MNP17 dipole magnet, another delay wire chamber DWC 3 and the scintillator SCINT 3. With this equipment one can analyze the momentum of the particles emerging from the absorber and count the ones that still have the initial momentum (i.e. the hadrons).

Another redundant measurement is provided with an electromagnetic **calorimeter**. This allows measuring the energy correctly for electrons, but gives a much lower response for the other particles in the beam. This detector thus allows measuring the electron content in the beam when the absorber is removed.

Finally, a **muon filter** in the form of a massive iron block can be installed on the beam line, just downstream of the MNP17 magnet. All particles except the muons in the beam are absorbed in the Iron. The count rate in Scint3 will thus be a measurement of the muon content of the beam.

Other possible experiments at the T9 beam line

Particle accelerators are used in modern cancer treatment to destroy the tumour with a beam of protons or anti-protons. The energy of these beams has to be adjusted to the location of the tumour, so as little healthy tissue as possible is damaged. Use the beam line to compare the energy flow of different particles in varying thicknesses of water!

or

Find out how many hadrons and electrons survive different materials! Some particles travel through matter and loose only little of their energy and speed, while others are absorbed completely.

or

Design your own time of flight system and try to find anti-protons! The different types of particles in a beam can be discriminated by a time-of-flight-detector using their varying masses. The detector measures the time it takes each particle to travel between two scintillators. The rest is simple math.

or

Design your own detector and calibrate it with a beam at CERN!