BRIEF DESCRIPTION OF THE NA 10 EXPERIMENT

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ABSTRACT

The most recent dimuon experiment, NA 10, at CERN is briefly described. It studies inclusive dimuon production at high incident flux and high mass resolution. NA 10 is a collaboration of CERN, ECOLE POLYTECHNIQUE PALAISEAU, CRN and University Louis PASTEUR STRASBOURG and ETH ZURICH.

The NA 10 experiment is installed in the North Area High Intensity Facility (NAHIF) of the CERN SPS.

The NAHIF H10 beam line can transport primary protons (later antiprotons) and negative secondary particles with momenta up to 450 GeV/c and positive secondary particles with momenta up to 300 GeV/c. The secondary beam has a large acceptance (±10% momentum bite) and a small spot size at the focus (r.m.s. radius = 2.5 mm). An intensity of 5×10^{12} protons/burst on the production target yields 4×10^8 π^-/burst at 280 GeV/c and 2.5×10^9 π^-/burst at 200 GeV/c. The beam line is rather short (190 m) and is equipped with magnetic spoilers to fight the important muon halo.

Figure 1 shows the layout of the NA 10 spectrometer. At a distance of 0.4 m downstream of the target a 4.8 m long hadron absorber is installed. In the centre it consists of a W/U core which begins 1.2 m downstream of the centre of the target. This core is surrounded by high-density graphite (ρ = 1.9 g/cm^3, i.e. 8 absorption lengths) in a cone defined by the acceptance of the magnet, and embedded in iron and concrete blocks.

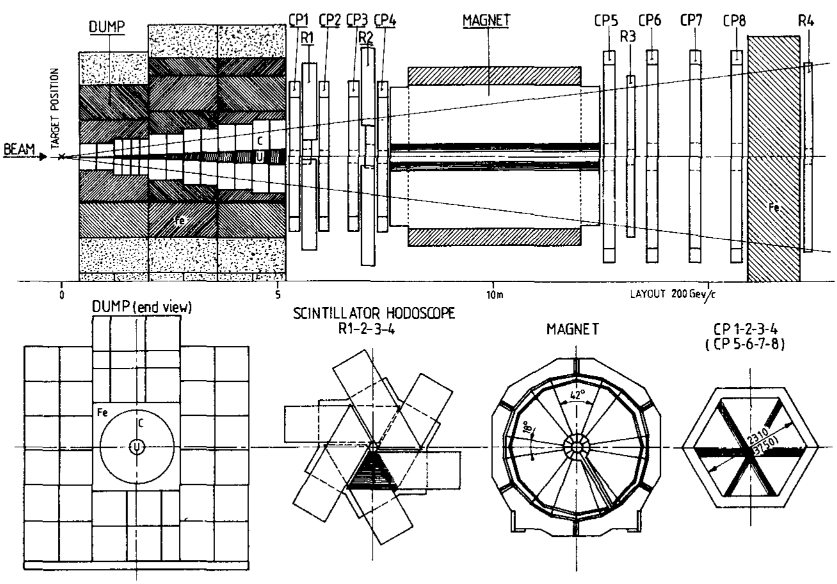

Fig. 1 NA 10 experimental set-up

The magnet of the spectrometer is a toroid. It has six 42° air gaps which are defined by wedge-shaped iron pole pieces. In pulsed operation the field integral is 3 T•m at the mean radius of 0.75 m.

Upstream and downstream of the magnet there are two scintillator hodoscopes R_i and four multiwire proportional chambers PC_K. The last hodoscope R_4 is placed behind a 1.2 m long iron filter. All detectors have the same sextant structure as the magnet. The whole apparatus can be expanded longitudinally in order to preserve scaling (and resolution) when changing the incident energy.

Figure 2 shows diagrammatically the trigger principle. Elements of the front hodoscopes R_1 and R_2 select trajectories which come from the target and reject those originating in the W/U core of the absorber. To suppress accidental triggers from high-multiplicity hadronic showers only events with less than 6 counter hits per sextant are accepted. A fast matrix logic selects for each $R_1 \cdot R_2$ coincidence elements in the allowed range of the back hodoscopes R_3 and R_4 corresponding to a given $p_\perp$ range. A two-particle trigger is obtained by forming the coincidence of two such single-particle triggers in non-adjacent sextants. Adding the two $p_\perp$'s permits a rough on-line dimuon mass selection ($m_{\mu\mu} \simeq p_{\perp 1} + p_{\perp 2}$). Events in the J/ψ region are prescaled.

The installation of the experiment was finished by April 1980. After a short period of running-in we took some data with 280 GeV/c π^- at 4×10^8 π^-/burst before the $p\bar{p}$ shutdown in June 1980. We used four different targets: 12 cm W, 6 cm W, 9.1 cm Cu, and 30 cm C, the last three targets having approximately the same ratio of target length/absorption length. Targets were interchanged on a regular basis and the magnet polarity was periodically reversed.

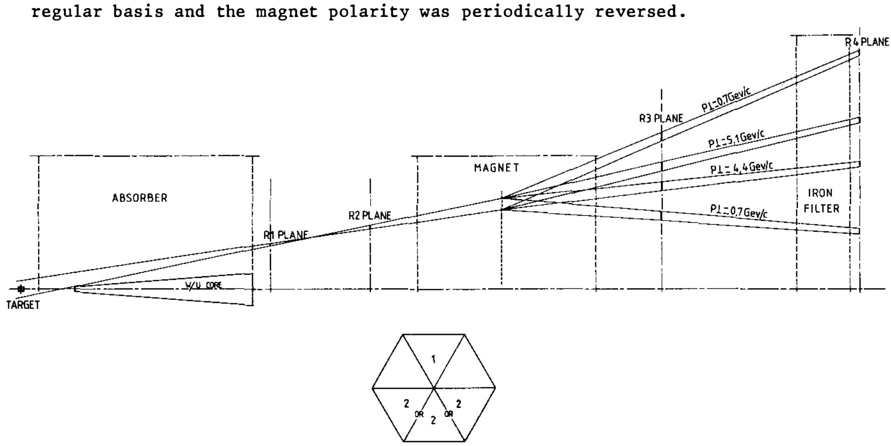

Fig. 2 Trigger principle. Single-particle trajectories for four $p_\perp$ values are shown (at p_{π^-} = 280 GeV/c).

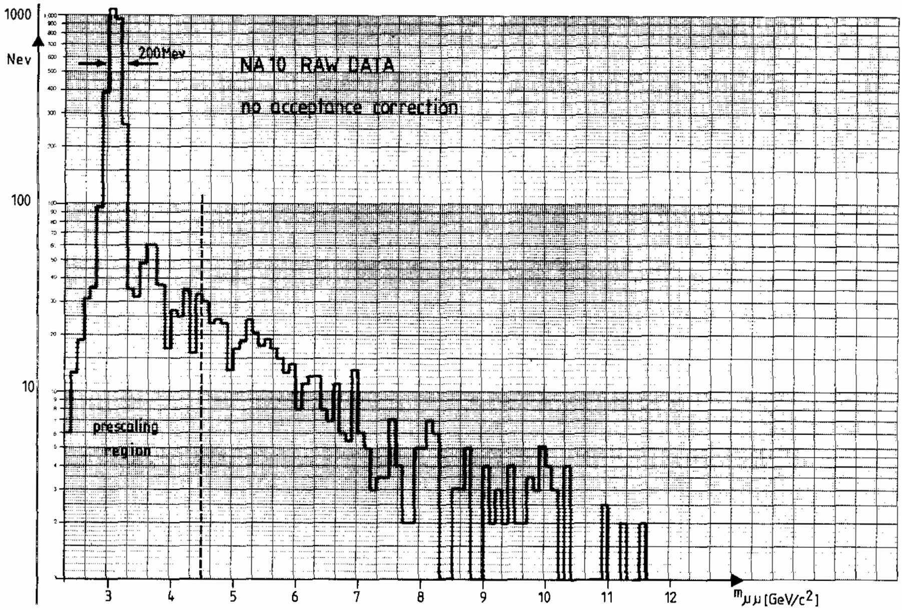

Fig. 3 Raw $\mu^+\mu^-$ mass spectrum for π^-Cu interactions at 280 GeV/c

Figure 3 shows the raw dimuon mass spectrum from the Cu target for events having both tracks going through air sectors of the magnet. The resolution at the J/ψ peak is 3%. This agrees with the predicted resolution and extrapolates to 2% at the upsilon. The data are not corrected for acceptance and for the trigger prescaling in the J/ψ mass region. One sixth of the events in Fig. 3 come from a run without prescaling.

Such data will allow the determination of the A dependence of dimuon production as a function of mass, $p_\perp$, etc.