PRELIMINARY RESULTS OF OUR CHARM SEARCH

presented by M.M. Nussbaum

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ABSTRACT

As part of our experiment we measure the electron to pion ratio at 30° from pp collisions at the ISR (26 GeV on 26 GeV). Preliminary results are presented.

We began an experiment, last november, at the ISR, designed to study the production and decays of charmed particles. The scheme is to trigger on electrons at 30^{o} and to look for correlations with oppositely charged muons and/or strange particles, including the possibility of hadronic decays of charmed particles.

Fig. 1 shows the set-up briefly, arm 2 is used to signal either an inclusive or a diffractive event. Arm 1 is used for detection of muons and/or hadrons. The electron arm is designed to detect electrons with a rejection power for hadrons of approximately 10^{5}.

The preliminary results, I will report today, will be concerned exclusively with our findings from the electron arm. Therefore, I will describe it in more detail.

Fig. 2 is an enlarged view of the electron arm. Each of the scintillation counters shown, is in fact, subdivided into two vertical sections (i,e, four dE/dx counters near the interaction region and two in front of a block of fifteen lead glass counters). The positions of the six X and six Y planes of drift chambers are as shown. The magnet has a 0.6 tesla-meter field, and houses a one meter atmospheric pressure CO_2 Cerenkov counter. The lead glass blocks are twelve radiation lengths long and are arranged in a 5 x 3 matrix that covers the geometrical acceptance of the magnet.

The trigger conditions were: (1) a signal in arm 2, (2) at least two particles in spectrometer arm 1, (3) in the electron arm counts in both front and back scintillation counters, greater than one half photoelectron pulse from the gas Cerenkov counter, and more than 0.4 GeV energy deposition in the lead glass. Pulse heights from all counters in the electron arm were recorded.

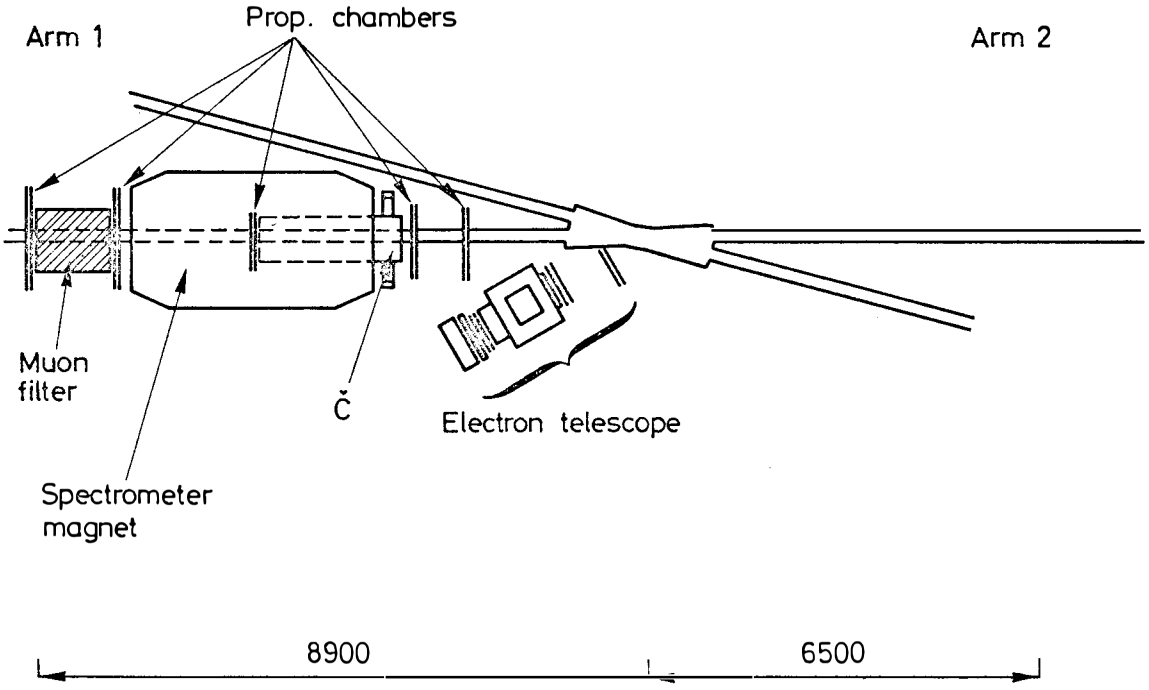
In eighty hours of running we recorded approximately five million events. In addition, about 10% of the time was devoted to various calibration runs. The data analysis, so far, has been directed to extracting a clean electron signal. In order to guard against conversion pairs, we require that only one particle enters the electron arm. This is accomplished

by requiring: (1) that the pulse heights in each of the front counters be compatible with minimum ionization, (2) that the counters hit have an appropriate pattern, (3) that there be evidence of only one track in the drift chambers and (4) that there be only one hit cluster in the lead glass. From these we extract our electron candidates by requiring that the gas Cerenkov has a signal greater than two photoelectrons.

A subsample (first 20% of the total) is displayed in fig. 3. Here we plot, for the residual events, the momentum of the candidate (vertical scale) as measured by the magnetic bending, versus the energy deposited in the lead glass (horizontal scale). The dense population along the line of unit scope is a clear indication of our electron signal. An e/π ratio is obtained by relating these results to runs where no Cerenkov nor lead glass signals were required in the trigger. In order to extract the ratio of "prumpt" electrons to pions two main sources of background must be subtracted. First, there are Dalitz pairs which contribute only one electron to our detector. This background is calculated by a "Monte Carlo" method, and contributed $(1. \pm .5) \times 10^{-4}$ to above ratio. Second, there are electron pairs (produced mainly in the vacuum chamber wall, from π^o gammas) which are not rejected by our pulse height cut, where subsequently one of the pair is swept out by the magnet. This background was measured by using variable absorbers inserted between the vacuum tank and the electron arm, as well as the variable thickness of the vacuum tank by extrapolating to zero thickness of material. After these corrections, we tentatively conclude that our integrated electron to pion ratios above 0.4 GeV are $e^-/\pi^- = e^+/\ ^+ = (7. \pm 2.) \times 10^{-4}$.

In order to have a better empirical determination of our corrections we have now installed numerous "guard" counters, designed to capture both larger angle Dalitz pairs, as well as electrons swept out by the magnet. In addition, we have inserted a third dE/dx counter at the front of electron arm.

In conclusion, let me stress again that these are very preliminary results. We shall be running for the rest of this year, and I hope, before long, we will have a lot more to say on this subject, including the report of our findings in the main spectrometer arm.


Arm 1
Prop. chambers
Arm 2
Muon filter
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Electron telescope
Spectrometer magnet
8900
6500

FIG. 1

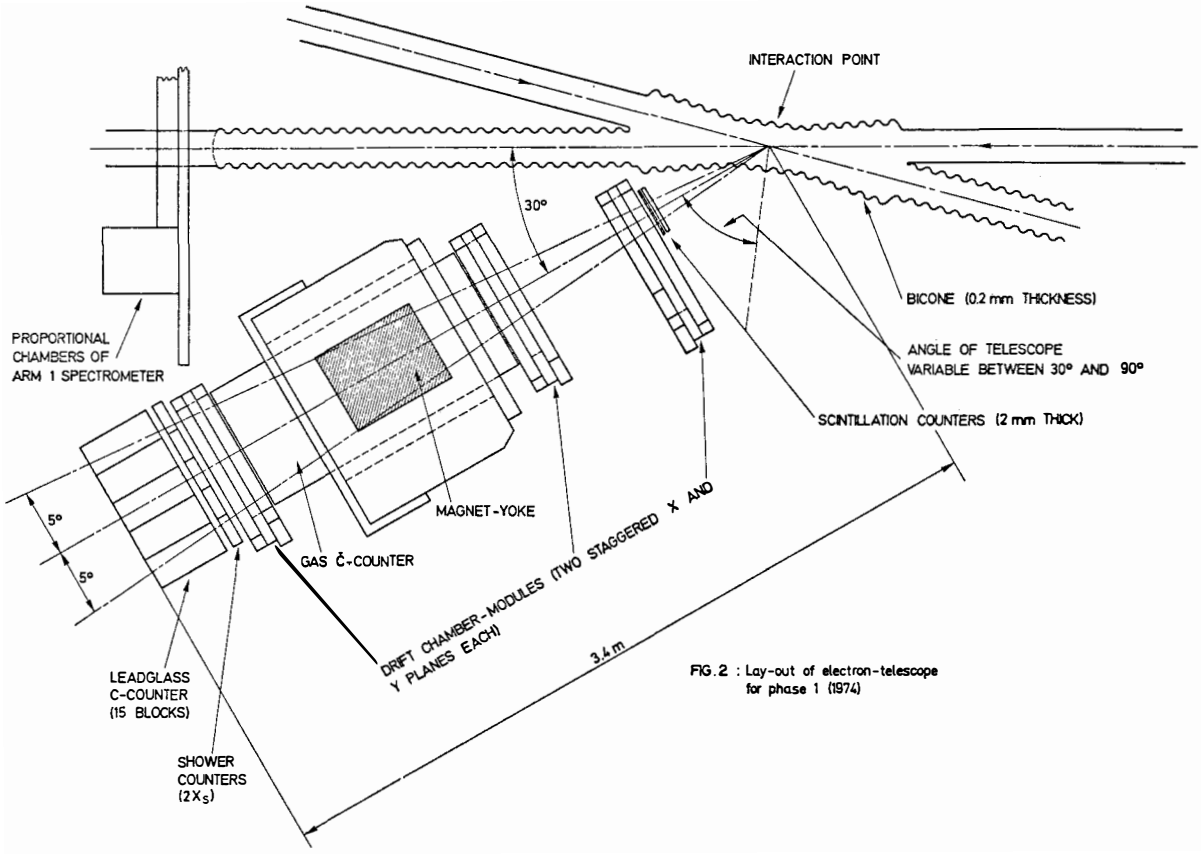

FIG. 2 : Lay-out of electron-telescope for phase 1 (1974)

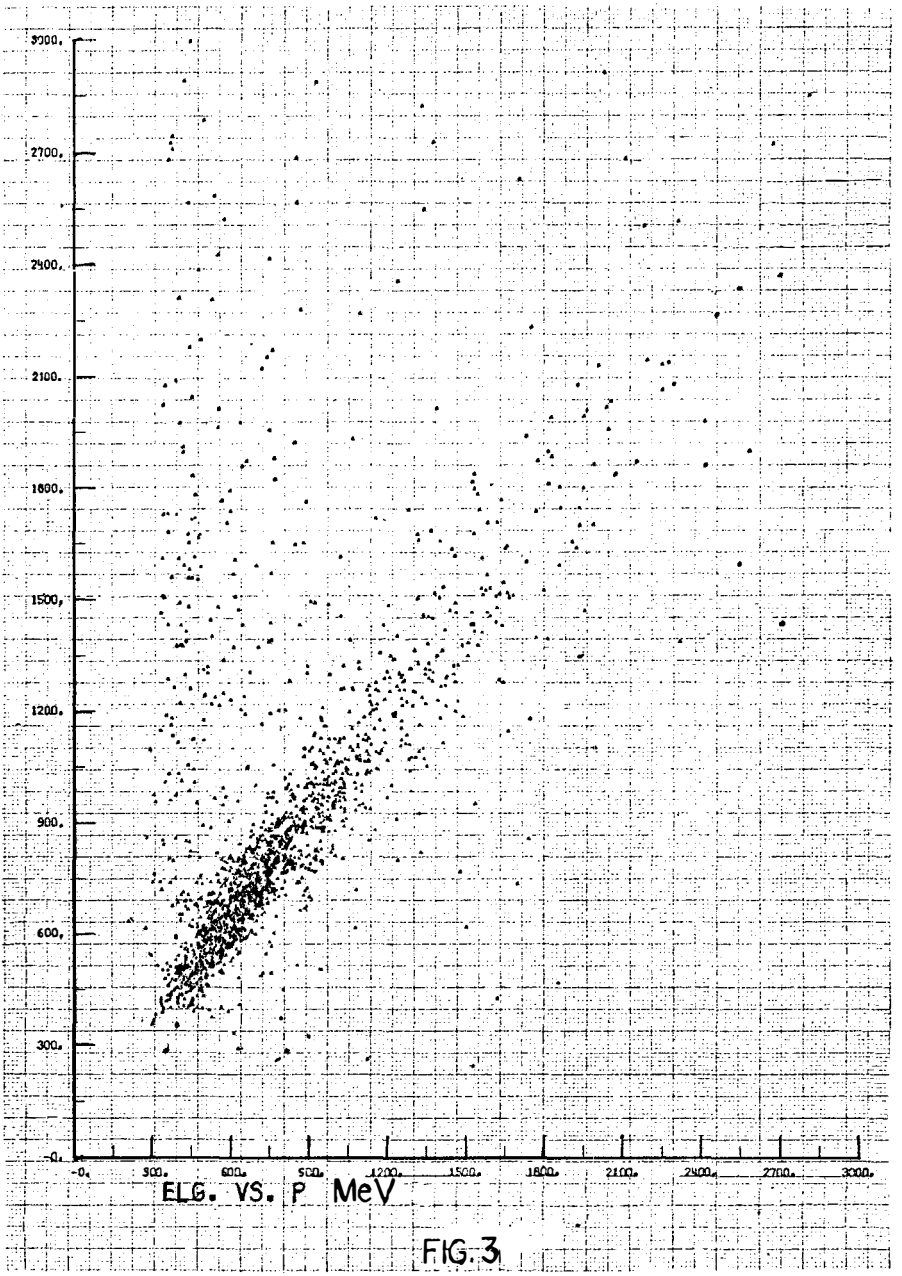
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FIG. 3