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# STUDY OF PARTICLE CORRELATIONS AT LARGE ANGLES AT THE ISR, USING THE SPLIT FIELD MAGNET

Proposed layout for measurements during the first phase of experimentation at the SFM.

MIT-Orsay (IPN)-Scandinavian Collaboration.

## Introduction

The study of particle correlations at wide angles using the SFM detector has been proposed by the Orsay - MIT Collaboration in ISRC 71-37 and by the Scandinavian Collaboration in ISRC 71-38, 38 add. 1.

The common aim is to study the general properties of correlation in the central region between two or more identified particles In our case we can distinguish the short range correlation region, which is mainly goverened by resonance production, and the medium range correlation where the exchange of secondary Regge trajectories predict a correlation length of 1 to 2 in units of rapidity.

Some of the questions we will be able to answer are the following

a. What are the production rates of two-particle combinations which will appear at wide angles, like $\pi\pi$, $\pi K$, $\pi p$, $KK$, $Kp$, $p\bar{p}$, etc , and how do they depend on the quantum numbers and invariant mass of the combination?

b Can resonances be distinguished in the invariant mass-distribution of two-particle correlations, and, if so, is their momentum distribution similar to those for single particle production?

c. How does the momentum distribution of single particles or pairs of particles depend on momentum, direction and multiplicity of other particles detected at large angles?

d How does the momentum distribution and multiplicity at large angles depend on the energy and multiplicity which is observed to go in the backward and forward showers and what are the associated multiplicities? For these questions the full information from the detectors in the SFM will be needed.

e. What are the correlations between a particle at wide angles with a forward going particle (requires collaboration with a group having a forward detector system)?

f. Are there an excess of high transverse momentum particles or jets which would indicate hardcore constituents in the proton? x)

## The experimental layout

### a) Hodoscopes

The proposed studies require particle identification by the means of t.o.f. measurement and momentum determination in a large solid angle. In the first stage pions will be separated from protons up to 1.5 GeV/c using time of flight determination between the hodoscopes. In order to make the best possible use of the solid angle available we must position the first counter hodoscope (15 x 200 x 0.6 $cm^3$) close to the vacuum chamber, i.e. in front of the packed proportional chambers. According to the SFM group this presents no special technical problems. The detailed construction of the counters and the light guides will be settled later.

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x) S.M. Berman, J.D. Bjorken and J.B. Kogut Phys.Rev. D4, 3388 (1971)

At a later stage particle separation above 1.5 GeV/c will be possible by gas Cerenkov counters covering part of the solid angle (as indicated in fig. 1)

The hodoscopes will contain about 100 counter elements, each being timed separately. The experiment will have a HP 2114B 8 k computer available from the beginning of 1973. It will be used during the testing of the equipment and for on-line monitoring of the counters during data taking.

b) Proportional chambers

As emphasized in ISRC 71-37 and again in 72-7 the study of correlations over a large range in rapidity ($\Delta y = 4$) requires a larger angular range than is possible with the 2 m central detector alone, which has since been approved by ISRC, and would only cover a rapidity range $\Delta y = 2$ In principle a larger coverage can be achieved even with this detector if it becomes possible to reconstruct tracks leaving at large angles after traversing the first forward chambers. We believe that this may be possible if the track reconstruction is aided by information from chambers installed outside the magnet, as shown in fig. 1, which provide the final track direction in addition to serving as a handle to detect decays and improve the timing accuracy. The final feasability can only be determined when we have a new reconstruction program which can combine information both from the forward and central detector and from the external chambers. The detector as shown requires twelve SFM-type proportional chambers of dimensions 2 x 1 $m^2$, with a total of 18000 wires. In this application the full resolution is however not required, and the number of amplifiers needed can be reduced to 5000 to 9000 by grouping 2-4 wires on one amplifier.

The chambers will be made so as to be also installable inside the magnet, when it becomes possible to use the larger central detector foreseen in our proposal The chambers will be mounted on rails together with associated hodoscopes

or Cerenkov counters to allow easy changes of the geometry to suit the problems investigated, and for easy access to the SFM magnet.

## Time scale and organisation

We expect to be able to set up the hodoscopes at the SFM during April - June 1973 and to test them during some preliminary runs in July-September 1973 together with some of the external proportional chambers. Data taking could take place soon after the central detector is installed and tested. The Cerenkov counters would be added in the later stage of the experiment during 1974.

Recognizing our similar interests the two collaborations, Orsay-MIT and Scandinavia, are now working as one team. About 15 physicists will participate full time in the experiment. Further physicists will participate on a part time basis during the running of the experiments and on special problems.

| MIT | ORSAY(IPN) | SCANDINAVIA |
|---|---|---|
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Figure caption

Fig. 1 The experimental layout. In addition to the standard SFM detector we plan to install three hodoscopes ($H_1$ - $H_3$) and six proportional chambers ($C_1$ - $C_6$) on each side of the intersection region. Chambers 3 and 4 are mounted on top of chambers 5 and 6 respectively. The external hodoscope-chamber assemblies are mounted on rails and can be moved side-ways. In the version shown one arbitrary position is chosen.

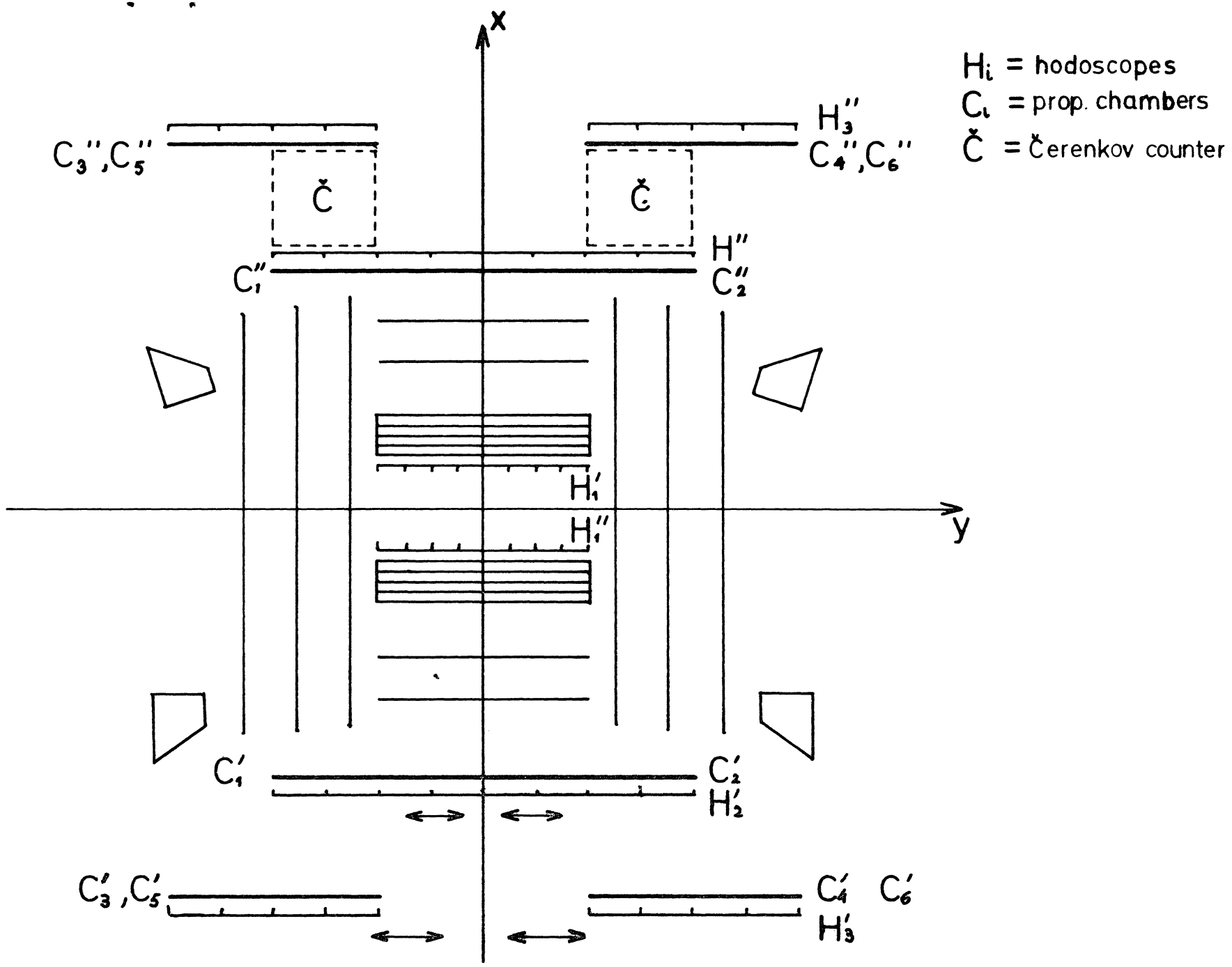
x
y
$H_i$ = hodoscopes
$C_i$ = prop. chambers
Č = Čerenkov counter
$H_3''$
$C_3'', C_5''$
$C_4'', C_6''$
Č
Č
$H''$
$C_1''$
$C_2''$
$H_1'$
$H_1''$
$C_1'$
$C_2'$
$H_2'$
$C_3', C_5'$
$C_4'$ $C_6'$
$H_3'$

Figure 1