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A Dilepton Spectrometer Project for SIS

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A Dilepton Spectrometer Project for SIS.

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The Dilepton Spectrometer (DLS) experimental setup has been thoroughly discussed by Saudinos[1]. I'll just add a few words about its acceptance shown in Figure 1 from ref. (2). There is a dead space (the dark region on the plot) that causes problems in the correction of the raw data. Furthermore, when the acceptance is very small, the finite resolution of the device adding to a large weight generates oscillations in the extracted cross sections. This is the reason why the first bin of the mass distribution (50-100 MeV) is always given as qualitative. The second mass bin (100-150 MeV) is however less affected, and we think the acceptance correction is reliable enough above 150 MeV.[3]

The characteristic of a two-dipole device is its limitation in y and p_t acceptance due to geometrical consideration in particular. For a symetrical system centered at $\theta_{cm} = 90°$, there is a region of lower acceptance around the $m \approx p_t$ line. However, it is a more simple and cost effective design. The scheme shown in Figures 2, 3 and 4 can be considered as an upgrade of a DLS type system. The improved features are:

- the magnets large dimension is vertical, the field direction being horizontal,
- electron identification is achieved with a very finely segmented Cherenkov counter and a calorimeter,
- the tracking chambers are located in between the magnet poles.

From the first feature result several advantages. The scattering angle and the bend angle through the field are decoupled. The charge detection is more symetrical. The p_t acceptance is improved. Notice that the magnets are high enough to allow detection of pairs with $\Delta\phi \lesssim 90°$, which is a condition to fill up the low acceptance region indicated above. Furthermore, their vertical shape is meant to keep all detector parts at about the same distance from the target, which also helps in $\Delta\phi$ acceptance.

The use of a very finely segmented photomultiplier array makes possible the detection of the Cherenkov ring, while providing a trigger signal. With the addition of a calorimeter after the magnets, the system achieves a suitable electron identification against the high hadron flux. This scheme allows both dilepton and real photon measurements. Moreover, the replacement of the Cherenkov detector in the rear (cf. DLS) by a calorimeter makes the detection of low momenta easier and more efficient, thus improving once more the acceptance.

The location of the tracking chambers in between the magnet poles do not present much difficulty owing to the rather low field value needed. It will slightly reduce the available magnet aperture, which is largely compensated by the reduction in total length.

The solid angle covered by each magnet is only slightly larger than that of the DLS (30-50%). Thus, gain in acquisition rate and false pair rejection will be the key to high statistical accuracy. The above arrangement of Cherenkov detector is more efficient for false pair rejection, and the tracking chambers in particular will have to accomodate high interaction rates. Besides, the whole system will have to handle multiplicities up to gold on gold at 1 GeV per nucleon.

This scheme is meant to provide a first step for a large dilepton/real photon spectrometer design. It will be discussed at a workshop to be held in Clermont-Ferrand on January 10-11, 1991.

Footnotes and references.

(1) J. Saudinos, see previous talk at the same meeting.
(2) A. Yegneswaran *et al.*, Nuc. Inst. and Meth. in Phys. Res. A290, 61 (1990).
(3) A. Letessier-Selvon *et al.*, Phys. Rev. C40, 1513 (1989).

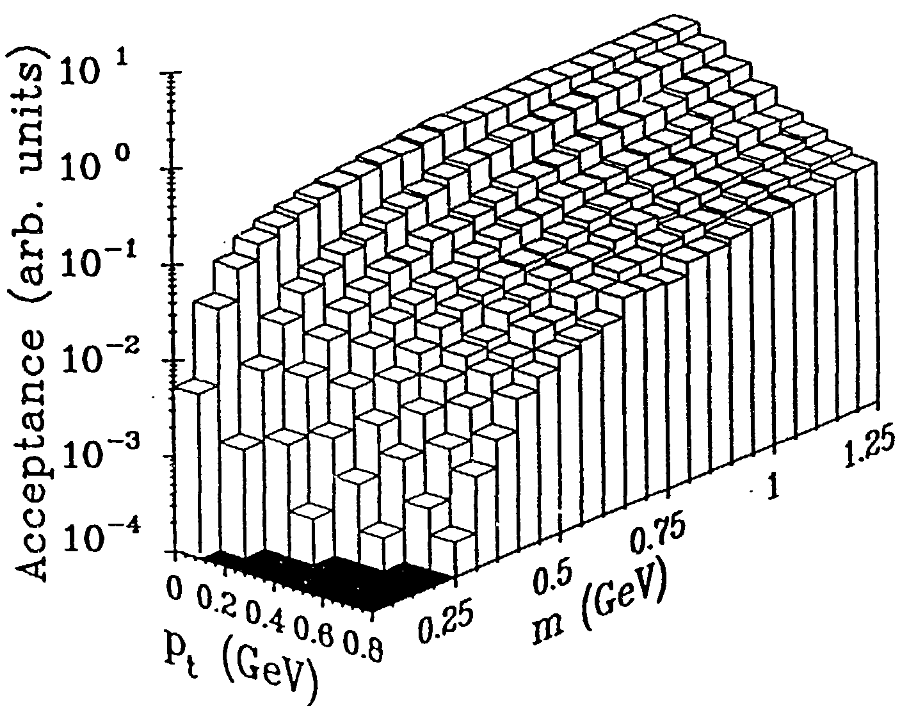

Fig. 1. The acceptance of the DLS as a function of m and p_t for a central field of 1.5 kG. The dark region is an area of zero acceptance. The figure is from ref. (2).

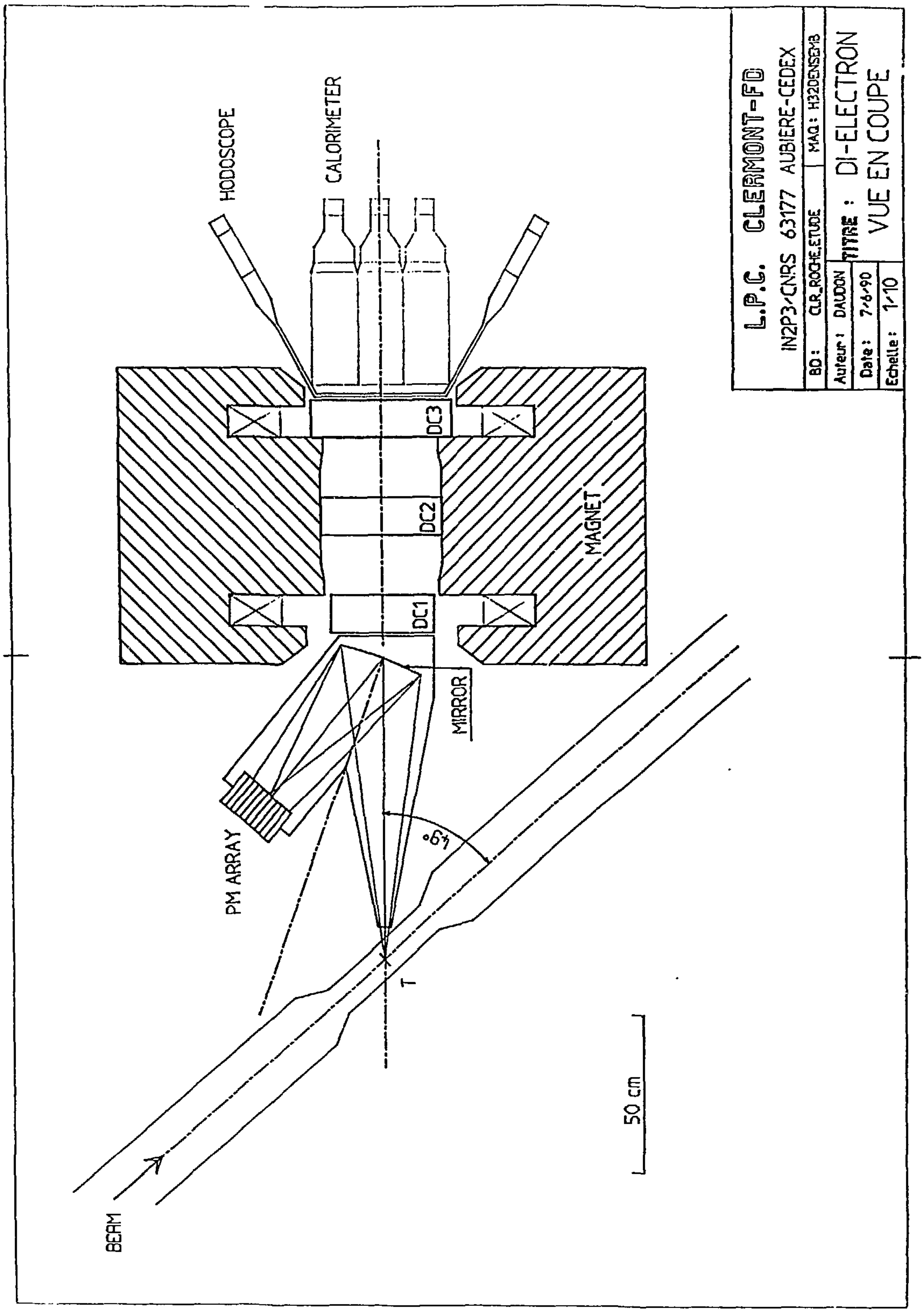

Fig. 2. The large dielectron/real photon spectrometer scheme: horizontal cut.

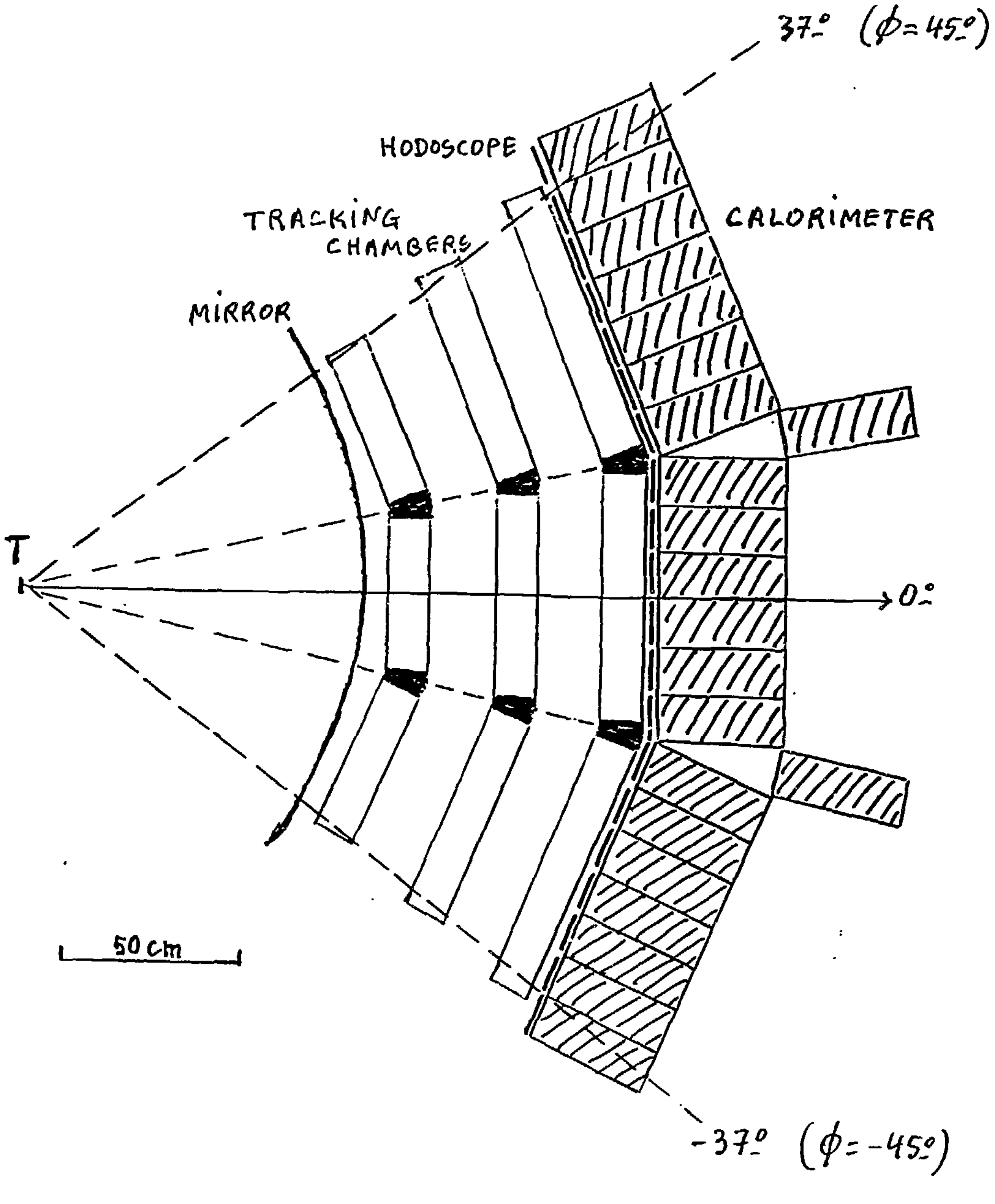

Fig. 3. The large dielectron/real photon spectrometer scheme: vertical cut.

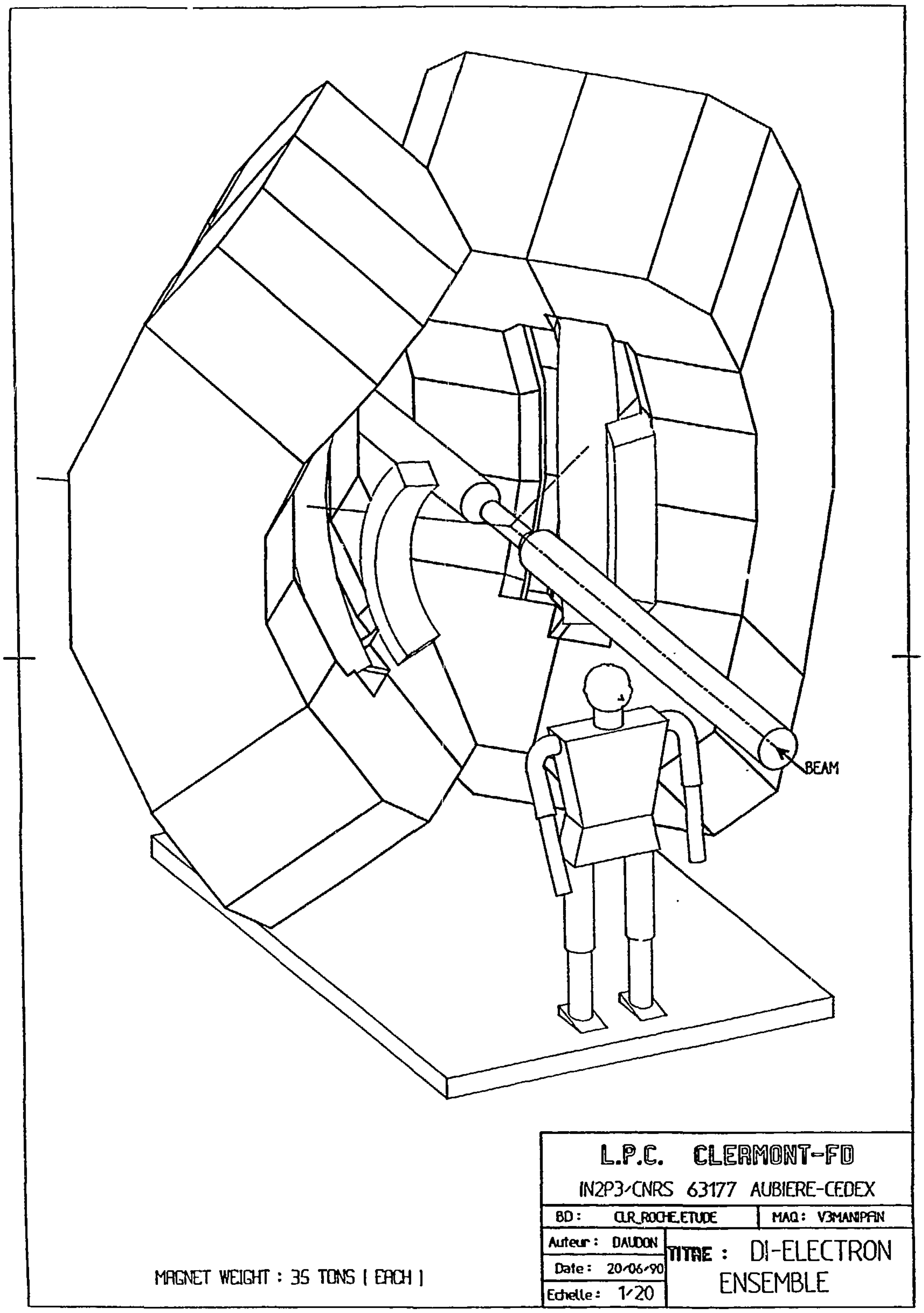

Fig. 4. A front view of the large dielectron/real photon spectrometer.