EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

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Memorandum

To: Members of the EEC

From: B. Blumenfeld, R.L. Cool, L. Di Lella, T. Kycia, L.M. Lederman, A. Placci, B. Pope, S. Segler, A. Smith, J. Yoh and E. Zavattini
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Subject: Request for PS time to calibrate the apparatus for e^+e^- detection at the ISR

The experimental apparatus to detect the reaction

$$pp \to e^+e^- + \text{anything},$$

at the ISR, consists mainly of a system of wire spark chambers to measure the opening angle α of the e^+e^- pair, and of two arrays of lead-glass Čerenkov counters to measure the energies E_+ and E_- of the two particles. With this information, the invariant mass of the pair, $M = 2\sqrt{E_+E_-}\,\sin\alpha/2$ can be determined[1].

Each array of lead-glass counters consists of 68 blocks of SF-5 glass, 450 mm long, with a section of 146 × 146 mm. Each block is seen by a photomultiplier RCA-8055.

Before installation on intersection region I1, the response of the lead-glass systems as a function of the electron energy must be known. This is done by sending an electron beam of known energy into each element of the array, and recording the corresponding pulse-height spectrum. This procedure must be repeated for three or four electron energies, in the range 5-15 GeV, in order to study the linearity of the system.

Beams of ∿ 100 electrons per PS burst are required.

The stability of the calibration curves obtained in this way will be checked periodically at the ISR during the main experiment, using sources of pulsed light of known intensity.

Electron beams at the PS are not a new feature. For example, using a neutral beam from target 1 at 51 mrad, and a suitable converter, a beam of 2×10^4 e^+/burst at 9.64 GeV was obtained in 1961, with $\sim$ 10% contamination from other particles[2].

Rather than requiring the construction of a new beam, we propose to use the natural contamination of electrons which is present in high-energy pion beams. Such contamination is relatively high in the beams existing in the East Hall, because of the thick external target, which allows conversion of the γ-rays from π^0 decay with high probability.

During the month of November 1968, a Milan-Saclay Collaboration used the electrons contained in the p_4 beam to calibrate a shower spark chamber employed in balloon flights to detect high-energy electrons in the primary cosmic radiation[3]. No difficulty was found to identify the electrons up to 14 GeV/c by means of two standard threshold Čerenkov counters filled with ^{4}He at atmospheric pressure. One of us (L. Di Lella) participated in the setting-up of the electron trigger.

On the basis of the previous considerations, we require <u>three weeks of PS time on the p_4 beam</u> during the month of August 1971. This date is an estimate of the time at which the two lead-glass systems are expected to be constructed, and it is therefore affected by some uncertainty.

A modified version of the p_4 beam has been studied, requiring the same bending power but approximately half of the quadrupoles used before the 1970 shut-down.

For the highest energy (15 GeV), it may be necessary to use a thinner external target, or a target of lighter material, to reduce bremsstrahlung energy losses of the electrons in the target itself. Such a target, the use of which could interfere with other experiments, would however be utilized only for a small fraction of the total running time.

In addition, we require the use of two 5 m long threshold Čerenkov counters, which will be filled with ^{4}He at atmospheric pressure. We expect 90% efficiency to detect electrons, while muons are just above threshold at 15 GeV. However, muons are easily recognized in the lead-glass counters, since they produce a peak in the pulse-height spectrum, corresponding to an energy loss of approximately 500 MeV.

The lead-glass systems will occupy a space of approximately 3 × 3 × 3 m. In addition, we need space for approximately four racks of electronics.

REFERENCES

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2) F. Fabiani, M. Fidecaro, G. Finocchiaro, G. Giacomelli, D. Harting, N.H. Lipman and G. Torelli, Nuovo Cimento 25, 655 (1962).

3) C.J. Bland, G. Boella, G. Degli Antoni, C. Dilworth, L. Scarsi and G. Sironi; B. Agrinier, Y. Koechlin, B. Parlier and J. Vasseur, Nuovo Cimento B 55, 451 (1968).