Laboratori Nazionali di Frascati

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C. Bernardini, G. Corazza, G. Ghigo, B. Touschek: THE FRASCATI STORAGE RING.

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C. Bernardini, G.F. Corazza, G. Ghigo, B. Touschek: THE FRASCATI STORAGE RING (A.d.A.).

It was decided in February 1960 in Frascati to study the possibility of a colliding beam experiment employing electrons and positrons. The discussion of this proposal lead to the design of the machine which we want to describe briefly in this letter.

Electrons and positrons of 250 MeV each are stored in a DC weak focusing magnet. The electrons and positrons circulate on the same orbit meeting in the gap of the radiofrequency and in the neighbourhood of 3 other points spaced at 90° from one another. The particles are produced by converting the γ-rays of the Frascati electron-synchrotron on two targets alternately exposed to the beam.

The magnet, which weights about 8 tons is shown in the figure. It contains 4 'quasistraights' sections, 18 cms of lenght, accomodating respectively the radiofrequency, pumping and injection ports and the experimental section in which about 1/4 of all the reactions taking place in the acceleration chamber should become observable. The doughnut is made of stainless steel and it is intended to eva

cuate to about 10^{-10} mm Hg giving the beams a lifetime of about 250 hrs.

Work on the machine is scheduled to start in December and we shall at first study the process of injection and see how many particles can be accumulated in the machine. The electrons and positrons will be registered by observing their synchrotron radiation. It must be emphasized that current (statistical) theories of injection lead one to believe that it is impossible to accumulate a sufficient number of particles to observe for example the reaction

$$e^+ + e^- \longrightarrow \gamma + \gamma$$

at a rate of 1 event per second. (This would be the rate necessary to call the machine a success).

According to the theory an acceptance of about 1 particle per second can be taken for granted. On the other hand 2000 are needed for the 'successful machine'. To bridge this gap it is hoped that we can profit from some of the following factors:

Distance Synchrotron Ada 5
Non linear effects on injection 10
Improvement target 50
Improvement intensity Synchrotron 4

With a successful ring a study of the pion-pion interaction in the process

$$e^+ + e^- \longrightarrow \pi^+ + \pi^-$$

seems possible and feasible; the production of the muon pairs as a check of electrodynamics will require a slightly higher intensity and a measurement of the lifetime of the π^o by means of the reaction

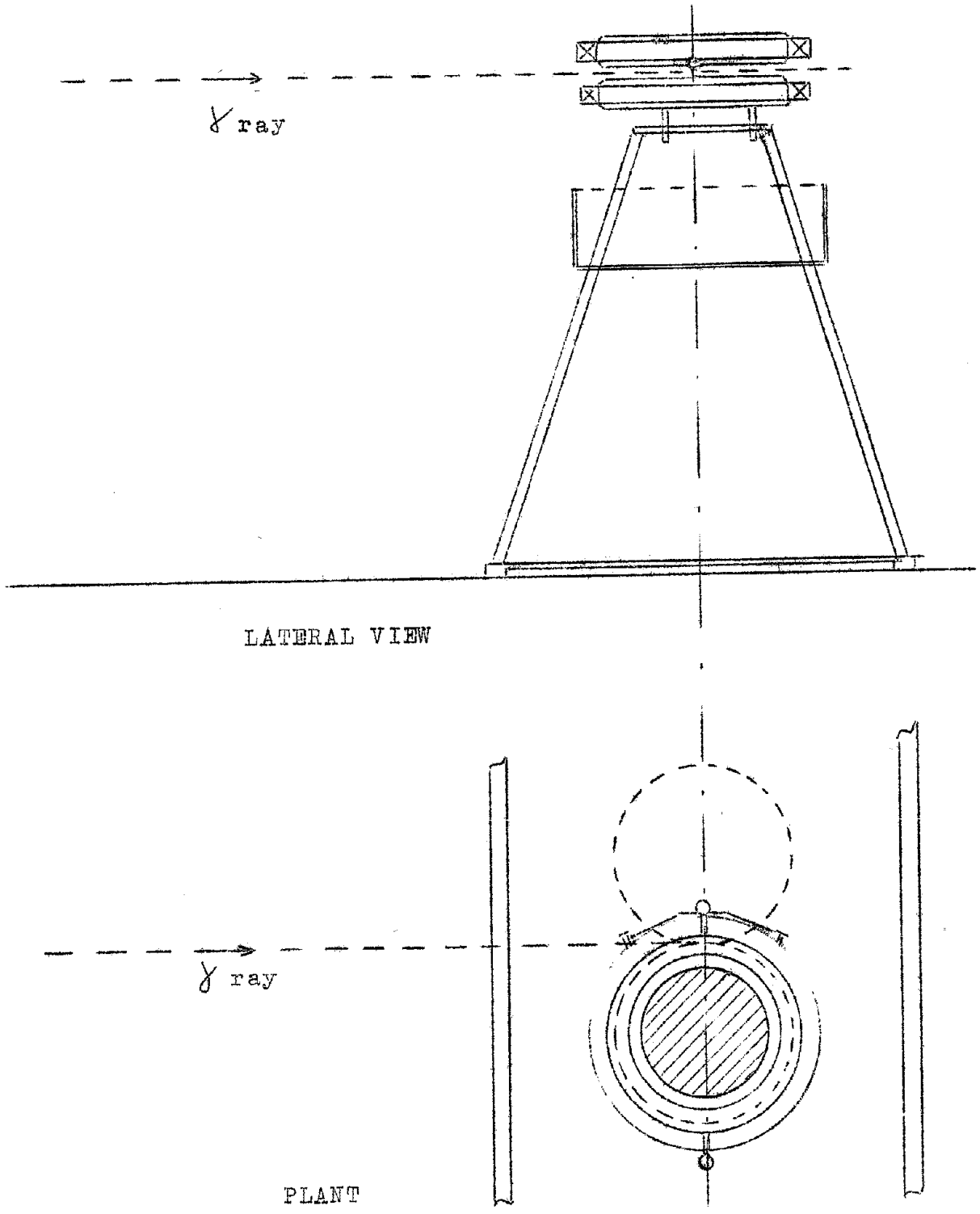
$$e^+ + e^- \longrightarrow \pi^o + \gamma$$

does not seem completely impossible.

In the following table we give a list of the rele-

vant data:

Orbit lenght	407 cms
Radio frequency	147 MHz
Radio voltage	10 kV
Lenght of bunches	16.7 cms
Radial width of bunches	22 cms
Height of bunches at a pressure of 10^{-10} mm	4.10^{-4} cms
Radiation loss/rev	520 eV
Lifetime of beam at 10^{-10} mm	250 hrs



The Fig. shows the situation in which electrons are injected. The dotted circle corresponds to the translated position in which positrons are injected.