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SECONDARY BEAMS FOR TESTS IN THE PS EAST EXPERIMENTAL AREA

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1. Introduction

This report gives a description of the four secondary beams used at the moment in the PS East Experimental Area for testing of experimental apparatus.

Section 2 gives some information on the layout of the beams, whose main parameters (?) are given in Section 3.

Part 4 is a short handbook, where the future users will find some practical information on the available equipment (beam monitoring, targets, etc.) and (hopefully !) will find some help to operate the beams.

2. General layout in the East Area

A general view of the beams is shown on Fig. 1.

The primary proton beams, the four secondary beams themselves and the associated shielding, huts, etc. cover about 2000 m^2 (half the East Hall area), the downstream part being used since 1983 for the construction of a LEP experiment.

2.1 Primary beams

The test beams are all derived from the slow-extracted proton beam e17, ejected in the PS straight section 62.

This extracted beam, called primary beam, is split in two branches, e17 and e17-South, by a splitter magnet which feeds two production targets, sources of the four secondary beams.

The splitting is obtained by means of a special iron septum D.C. magnet (SMH01) with a vertical field, located on the extracted beam at a horizontal waist where the beam is vertically expanded. The gap and the vertical position of the splitting magnet may be adjusted by

remote control.

For a detailed description of the optics of the ejected primary beam e17, see: ..... (PS/EA/BL/NOTE 87- by K. Bätzner, D. Dumollard and D.J. Simon).

By playing both with the intensity and with the optics of the extracted primary beam, and also with the splitter parameters, it is possible to adjust the number of protons hitting the two production targets.

The main parameters of the primary beams are given in the following table.

TABLE 1

Characteristics of the primary beam
(slow extraction SE62)

Type of particles	:	protons*
Energy	:	24 GeV*
Typical beam spill length	:	400 msec
Typical repetition rate	:	1 to 3/14,4 sec (PS "supercycle")
Minimum repetition time	:	2,4 sec ("B cycle")
Maximum proton intensity on each target	:	2×10^{11} particles/pulse**

* Sometimes deuterons, 12 GeV/c per nucleon

** Limited by the radiation level in the downstream part of the East Hall

2.2 Secondary beams

Figure 2 gives a schematic layout of the secondary beam lines.

The North target (primary beam branch e17) is the source of the three secondary beams t9, t10 and t11; they are produced at different horizontal and vertical angles.

The South target (primary branch e17-South) is the source of the t7 beam (production angle 0°).

The usual height of the beams in the East Hall was 1,26 m above the floor level. In order to give the possibility of testing large pieces of 3 lines, namely t9, t10 and t11, as explained on Fig. 2: a vertical magnet BVT01 placed upstream of the North target bends the primary line e17 by 30 mrad. Then, by using different vertical production angles, it was possible to get beam levels as high as 2,28 m (t9) and 2,50 m (t10 and t11). The t7 beam, previously used for physics, remains at 1,28 m above the floor level.

3. Beam properties

3.1 Optics

The four beams* are designed in order to provide the users with momentum analyses, non-separated secondary particles (momentum resolution of the order of 1%), positive or negative polarity.

*) The t7 beam was built for the experiment PS188 (channelling)

They are intended to be used as test facilities for experimental apparatus.

The polarity, momentum, intensity and momentum bite may be adjusted inside a large range up to the nominal values. The experimental areas are large enough to house more than one user's apparatus at a time.

The beams consists of two focusing stages:

- the first one (2 quadrupoles and a bending magnet) performs the momentum analysis at variable-aperture horizontal collimator (MCH01), "momentum slit"). A vertical collimator MCV01 may be used to adjust the beam intensity;

- the second one performs the momentum recombination (use of a "field lens") and refocuses the beam into the experimental area.

The final focus may be moved along the area by changing the currents in the last pair of quadrupoles; steering dipoles are available in order to adjust the beam position.

The beams are equipped with detectors (scintillators, multiwire-proportional chambers MWPC, Cerenkov counters).

The necessary signals and equipment for beam tuning are available in the Control huts (EP27 for t7 and t9, EP18 for t10 and t11). More details will be found in Section 4.

3.2 Beam intensities

The following section gives the intensity estimations in the beams for p^+, π^+, π^- (and $\bar{p}$). In general, the numbers given are based on computations; but some measurements have been made (t7 beams) and are reported. Checks with previous beams show that these numbers are realistic.

As far as electrons (or positrons) are concerned, we have a good knowledge at zero degree production angle (t7 and t9 beams). For the other beams, no precise numbers can be given.

The secondary fluxes are calculated from:

$$N_S = N_\varrho \; \zeta \; \Omega \; \Delta p \; Y \; e^{-L/\lambda} \; i$$

where

N_ϱ = Number of protons impinging on the production targe

ζ = Target efficiency

Ω = Solid angle of the beam (steradion)

Δp = Secondary momentum bite (GeV/c)

? Y_i = Yield for the particle i

L = Beam length (metres)

λ_i = Decay length for the particle i (metres)