

SLEAR/Note 2: Extraction of antiprotons from the PS for SuperLEAR

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Introduction

The geometry of the lay-out of the SuperLEAR machine in the East Experimental Area requires a fast extraction of antiprotons from the PS straight section 84. This note summarizes the lay-out of this extraction and gives its main characteristics.

Lay-out

A septum magnet should be mounted in straight section 84. The maximum vertical emittance is $2.5 \mu\text{m}$ and the vertical β at the septum is 22m, so that the vertical size of the beam is 15mm. We chose a gap size of 25mm, which gives enough margin in the vertical plane. This gap size and the maximum possible magnet length of .83m allow to calculate the maximum deflexion angle of the septum which is found to be 25 mrad at 12 GeV/c [1]. The tank, the septum displacement mechanism and the observation system (TV and screen) could be directly copied from the newly designed existing installation of straight section 57.

The standard high energy fast kickers can be used if the phase is corrected between straight sections 71 and 84 for negative particles (anti-clockwise). In addition, the horizontal betatron number of the PS will be increased to $Q_h = 6.3$ at the time of extraction with the help of the pole-face winding currents. A standard quadrupole of strength .047 rad/m, situated in straight section 67, fulfills this requirement. Adding a similar quadrupole in section 75 with inverse polarity increases the β -function in the kickers and limits its modulation to a minimum part of the machine. Moreover, this set of quadrupoles has the advantage of giving a zero dispersion at the extraction septum.

A local bump at the septum is given by standard dipoles in sections 80 and 88. The vacuum chambers are already enlarged in magnet units 84 and 85. A Y-shaped special chamber has to be designed for magnet unit 83. Magnet units 82 and 83 must be exchanged against units with internal yokes, as this has been done in the past for other extractions.

Power supplies must be provided for the quadrupoles, the bumper dipoles and the septum magnet, with their controls and timing system.

The limitations in emittance and energy dispersion are essentially determined by the extraction channel [2].

The main characteristics of the extracted beam, as seen after traversal of the field of the PS magnet unit 83, facing the middle of SS 83, are:

β_x	56,5 m
α_x	-11.5
D_x	1.13 m
D'_x	.29 rad
β_y	1.38 m
α_y	1.09
D_y	0
D'_y	0

The elements required are listed below with their strengths:

section	Element	Strength at 12 GeV/c
SS 67	Quad type 409 (D)	
SS 71	Existing kicker KFA (9 mod.)	.052 Tm (4 modules)
SS 75	Quad type 409 (F)	
SS 80	Dipole type 206	.2 Tm (630A)
SS 84	Septum (new development)	1 Tm (23400A)
SS 88	Dipole type 206	.2 Tm (630A)

The optics are illustrated on the attached pictures by the horizontal phase plane views in the straight sections 71 (kicker), 83, 84 (septum), and 85 for a $3\pi \mu\text{m}$ emittance.

References:

- [1] M. Thivent, private communication,
- [2] D.Manglunki, S.Maury, B.Williams "SLEAR/Note1: Antiproton injection line between PS and SuperLEAR", PS/OP/Note 92-30 or PS/AR/Note 92-10.

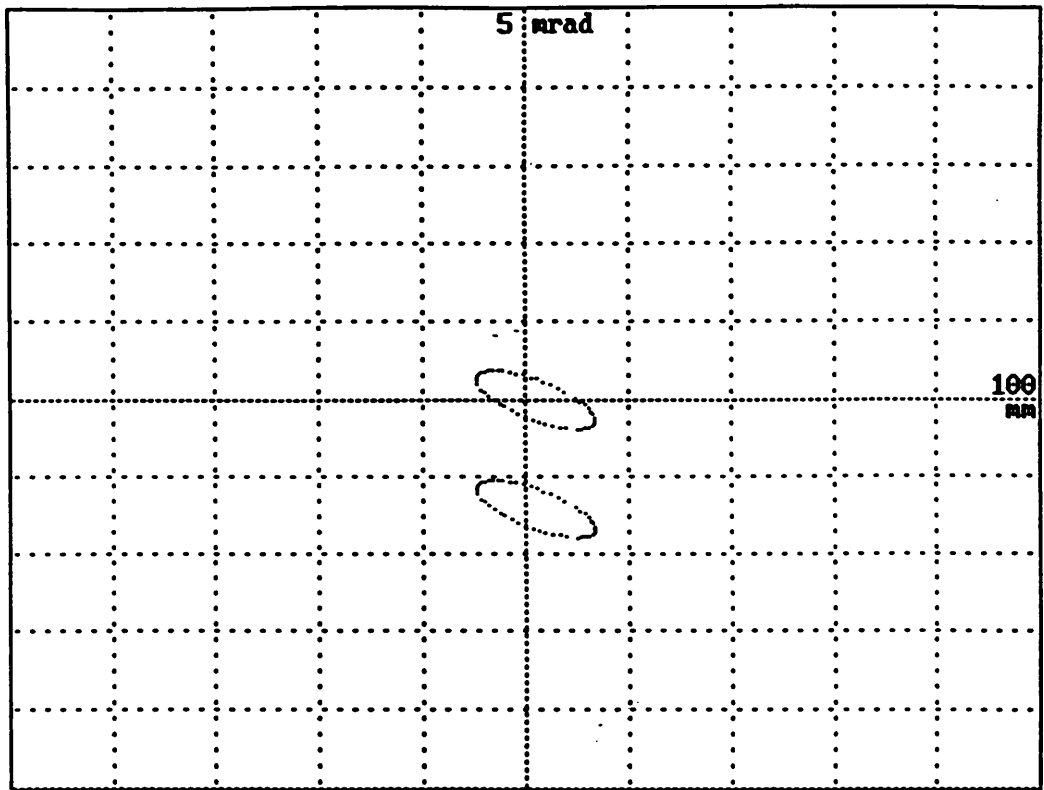


Fig. 1 - Phase plane at fast kicker in SS 71

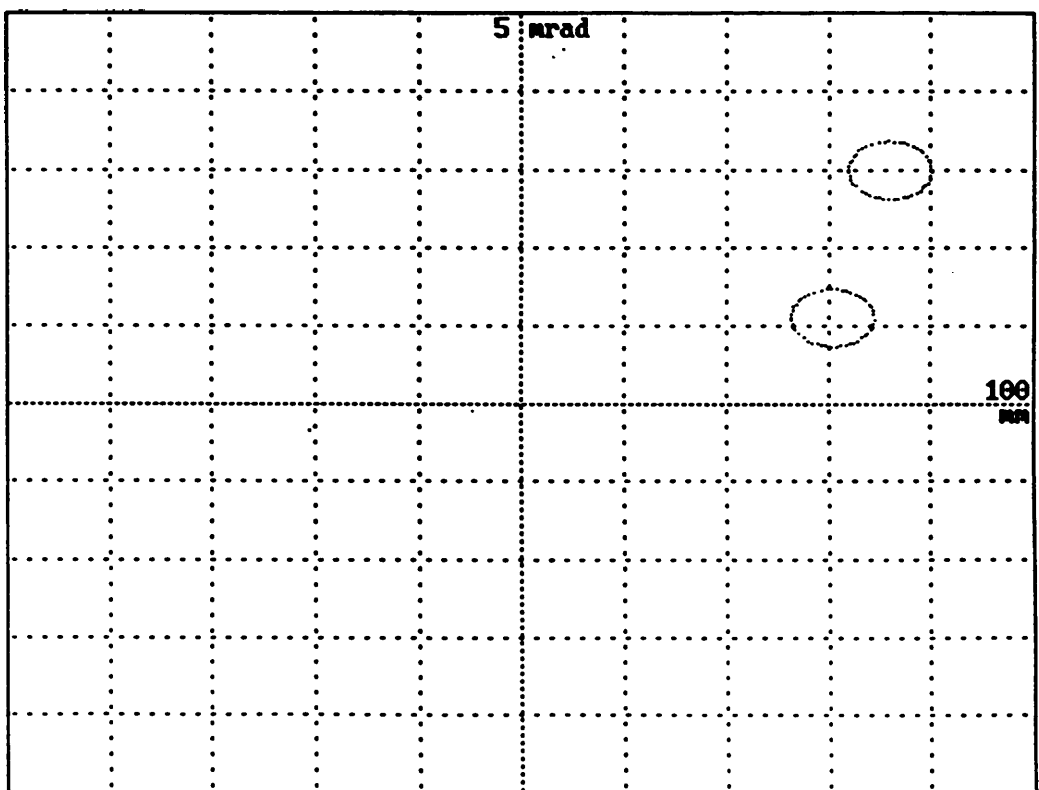


Fig. 2 - Phase plane in straight section 85

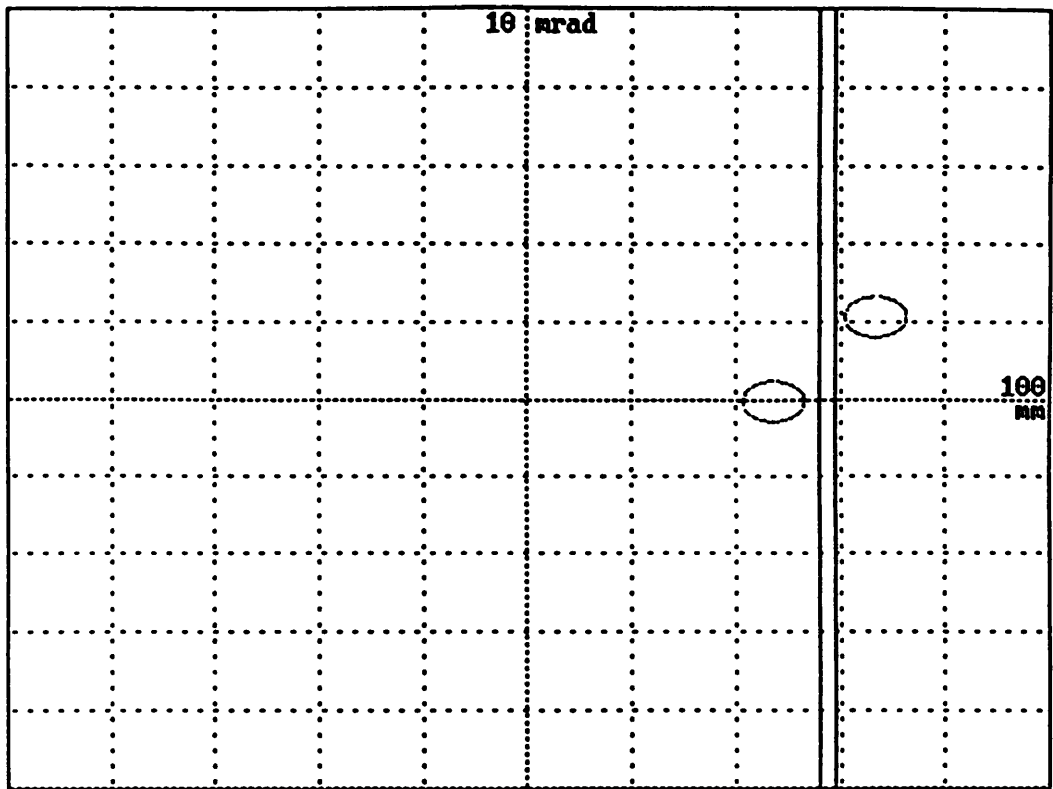


Fig. 3 - Phase plane at septum in SS 84

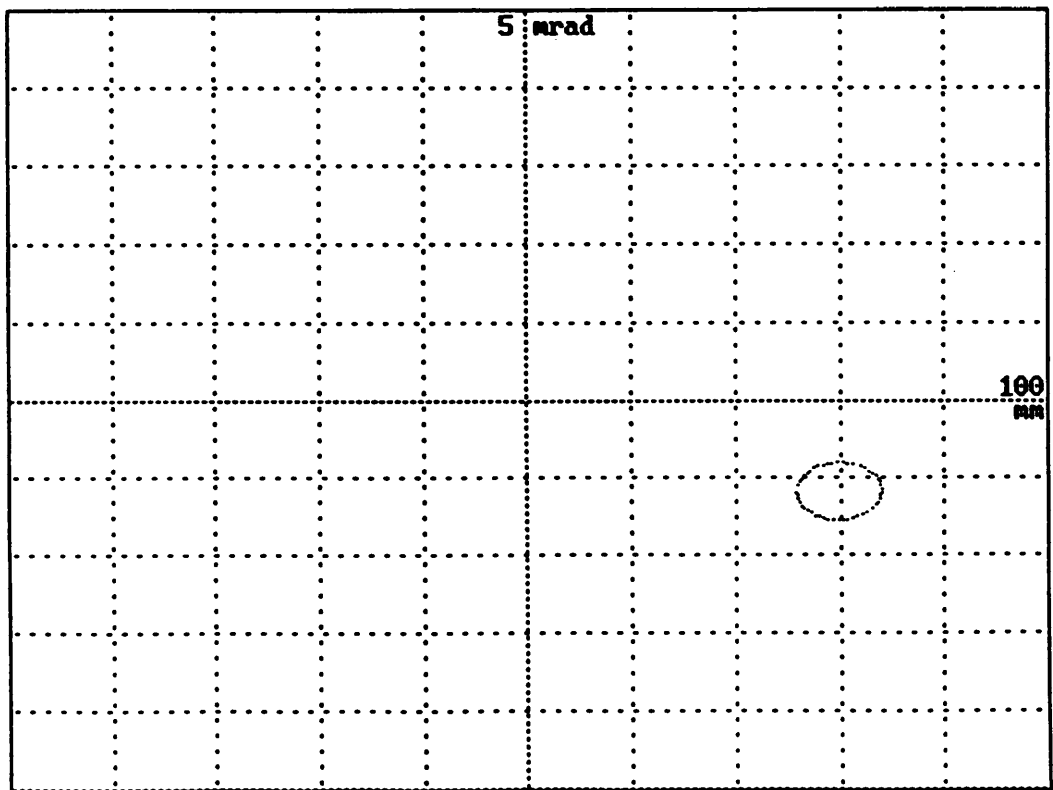


Fig. 4 - Phase plane in straight section 83

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