ISR-VA/KZ/sm 17th July 1973

ISR PERFORMANCE REPORT

Mlle P. SHINNIE Run 333, Ring 2, 13th July 1973

Determination of the energy of electrons produced by a proton beam of 22 GeV/c in the sodium curtain of the BP

Purpose : The resolution of the BP monitor depends on the initial velocities of the produced electrons. Since there are no experimental data available we intended to evaluate the initial energy of the electrons with the BP monitor in the following way:

Experiment : The image of the horizontal beam profile is cross-correlated to the energy distribution of the ejected electrons from the sodium curtain and the density distribution of the proton beam. If we take a pencil proton beam horizontally as small as possible the deconvolution problem is simplified, and one might hope to get some information about the energy distribution of the electrons. Hence we need a very narrow proton beam (spike) and a very dense sodium curtain.

At first we tried to find the best proton beam. A beam of 1 A was stacked in the middle of the chamber and was then scraped from the exterior side of the ring. The horizontal half width has been measured as a function of the beam current. The same procedure has been used for one bunch of 86 mA on the injection orbit. The 2 results are plotted in Figure 1 and one concludes that the first procedure yielded a better result.

Secondly, we succeeded in raising the density of the sodium curtain by a factor of more than 1000. In normal use the sodium source works as a Knudson source giving a sodium density equivalent to about 3×10^{-8} torr at the crossing section with the proton beam. When working as a supersonic nozzle source, a pressure better than 3×10^{-5} torr has been obtained. This has been checked by means of a platinum ionization filament, which was calibrated in comparing the proton image due to the residual gas pressure to the one due to the sodium curtain.

Finally 2 measurements with a proton beam of 35 mA and 55 mA respectively were performed in order to get an idea about the electron distribution. Unfortunately, a cold discharge perturbed the measurements and we had to work with a rather large beam (3 mm of horizontal beam width). After we had switched

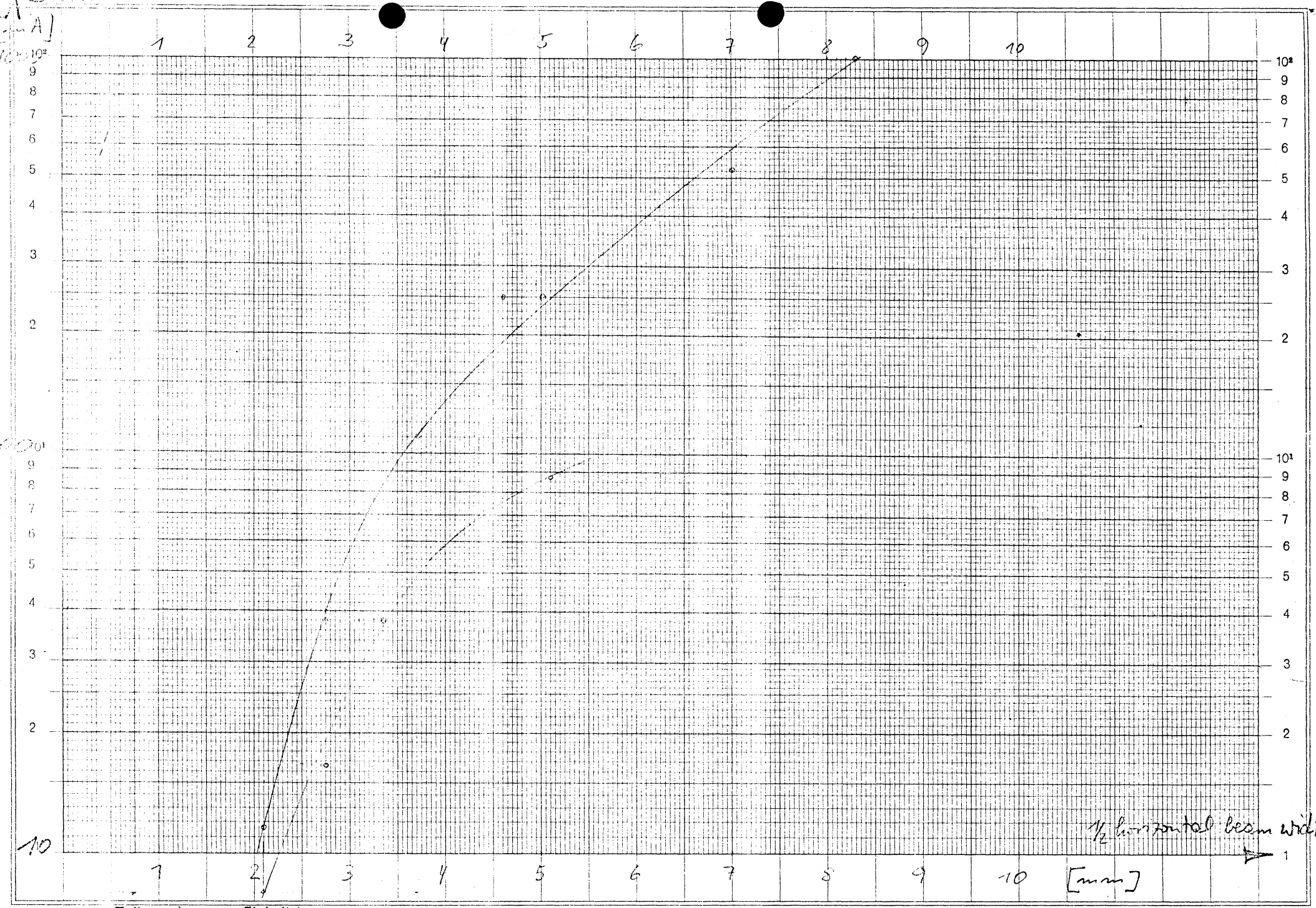
off the magnetic field of 300 gauss, which confines the electrons having an initial energy of 100 eV to a spiral of 1 mm in diameter, the height of the horizontal profile was reduced by one third while the width increased only by one tenth. (Figure 2). In reducing the electrical field from 25 kV to 10 kV an increase of about 10% of the width has been observed.

Conclusion : from these rough measurements one might conclude that about one third of the electrons produced have energies much higher than 100 eV.

Summary : Thanks to an increased density of the sodium curtain by a factor of 1000 some rough estimates about the energy of the electrons scattered from the sodium curtain by a narrow proton beam have been made.

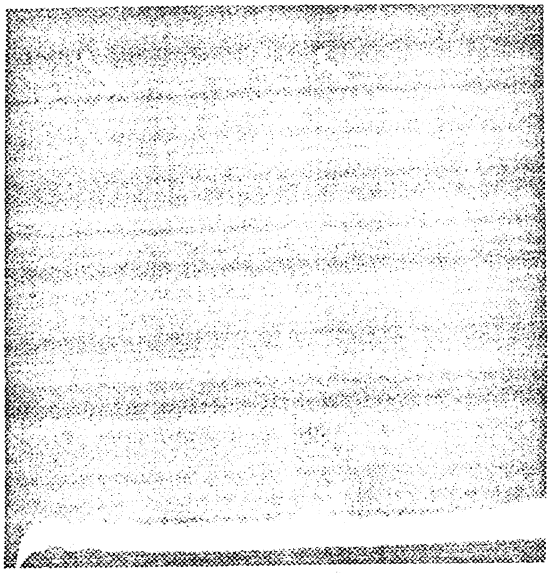
B. Vosicki

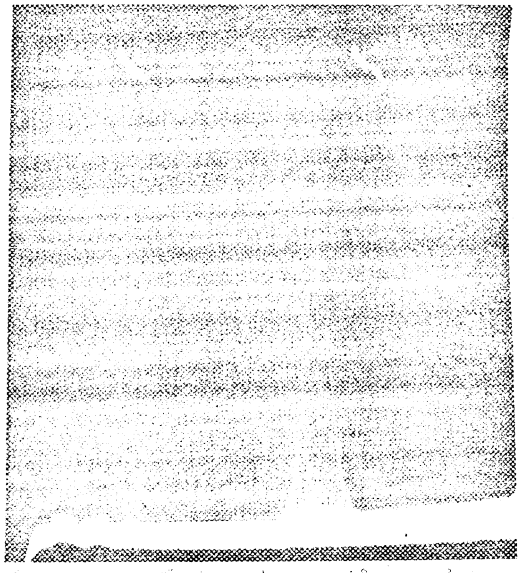
K. Zankel



Logar. Teilung / Division } 1 - 100, Einheit / Unité } 83,33 mm

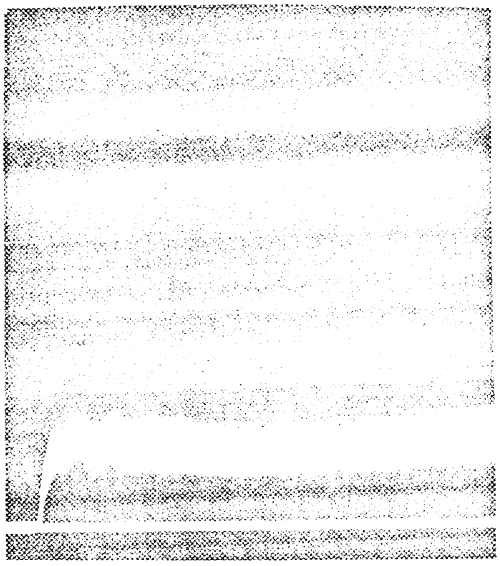
Ed. Aerni-Leuch, Bern Nr. 527





with magnetic field
300 Gauss

without magnetic field



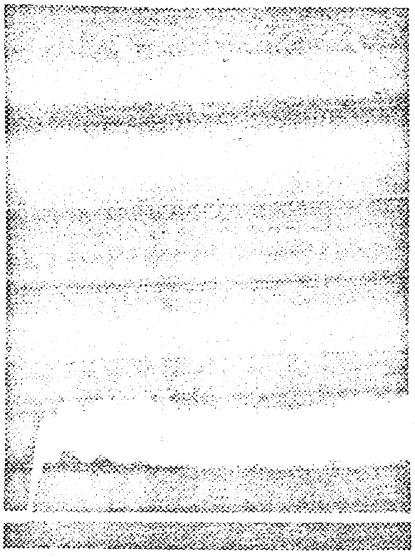


Figure 2