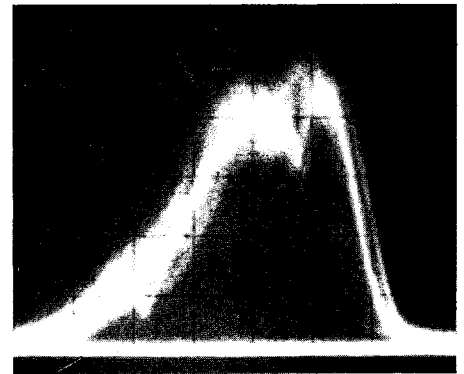


Below is a simplified drawing of the ISR beam profile detector, using a sodium gas jet, which is scheduled to be in action (one in each ring) next Spring. The detector collects the electrons from the ionization of the sodium atoms by the beam particles and, with electric and magnetic fields, directs them to a fluorescent screen where they represent the beam profile.

A detector of this type installed in Ring I is already in use collecting the electrons from ionization of the residual gas. The oscilloscope photograph on the right shows a signal from the detector proportional to the radial density of the beam.

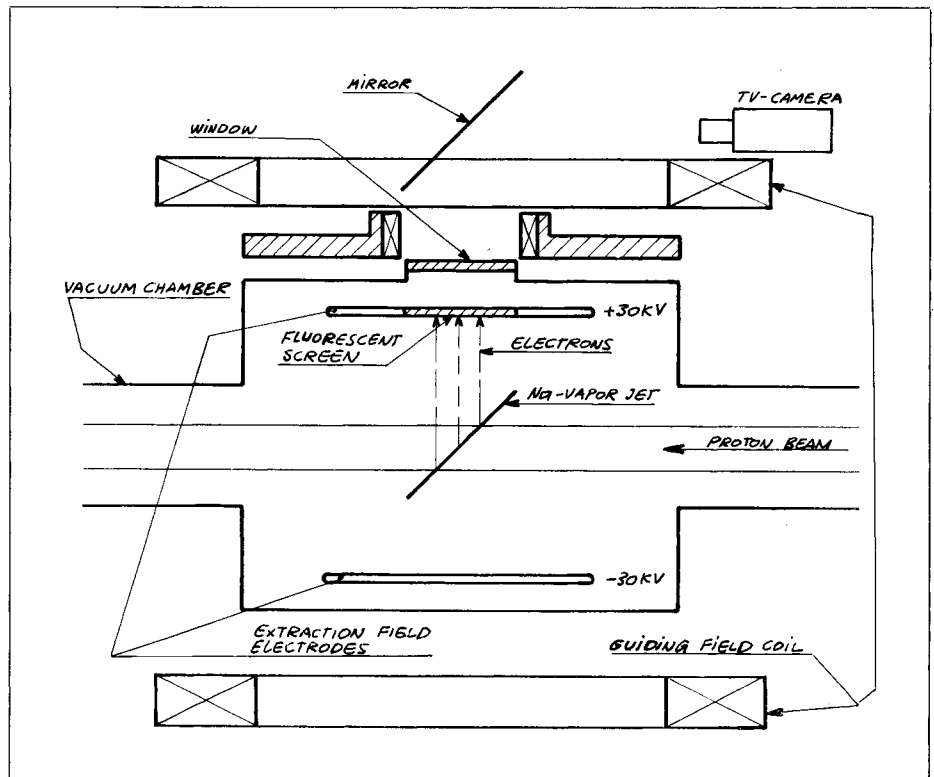


strophic effects which such a screen would have on a beam intended to circulate for hours, rule out the insertion of a fixed solid screen. One way of solving the problem (albeit while raising others) was put forward by the ISR Vacuum Group (Beam Profile Section). It involves the use of a screen, or curtain, of gas — sodium was chosen for reasons which will not be explained here.

Because of the low density in a gas curtain, the light emitted is too weak for photographic purposes or observation with a television camera. If, however, an electric field (4 kV/cm) is set up perpendicular to the beam, the electrons, coming from collisions between the beam particles and atoms in the gas, are accelerated perpendicularly to the beam so as to strike a fluorescent screen and produce an image of the beam. Light output is thus increased about 10 000 times. A magnetic field (0.03 T) is combined with the electric field to 'wind' the electrons around the lines of force of the electric field.

The gas curtain consists of a flat jet of sodium issuing from a slit inclined at 45° to the beam and projected at supersonic speed towards another slit on the opposite side of the vacuum chamber through which it emerges. The curtain is only 1 mm thick, so that good definition is obtained. After passing through the chamber, the sodium jet is recondensed and pumped back to a supply tank. (Sodium is highly corrosive at the high temperatures which are needed to have a supersonic jet of sodium gas; all the components which might come into contact with the sodium had to be made of a special stainless steel.)

The detector was fitted in Ring I in October while waiting for delivery of the gas jet generation system. After the optical system had been connected up, what became visible on



the screen was not the image of the beam cross-section (produced with the sodium curtain) but an image one would see looking from above the beam, due to electrons coming from ionization of the residual gas. Despite the very low residual pressure (less than 10^{-10} torr), the extreme sensitivity of the television cameras and the acceleration of about 60 kV given to the electrons yield a visible signal from the fluorescent screen. The electrons produce streaks of a thickness proportional to the radial density of the beam.

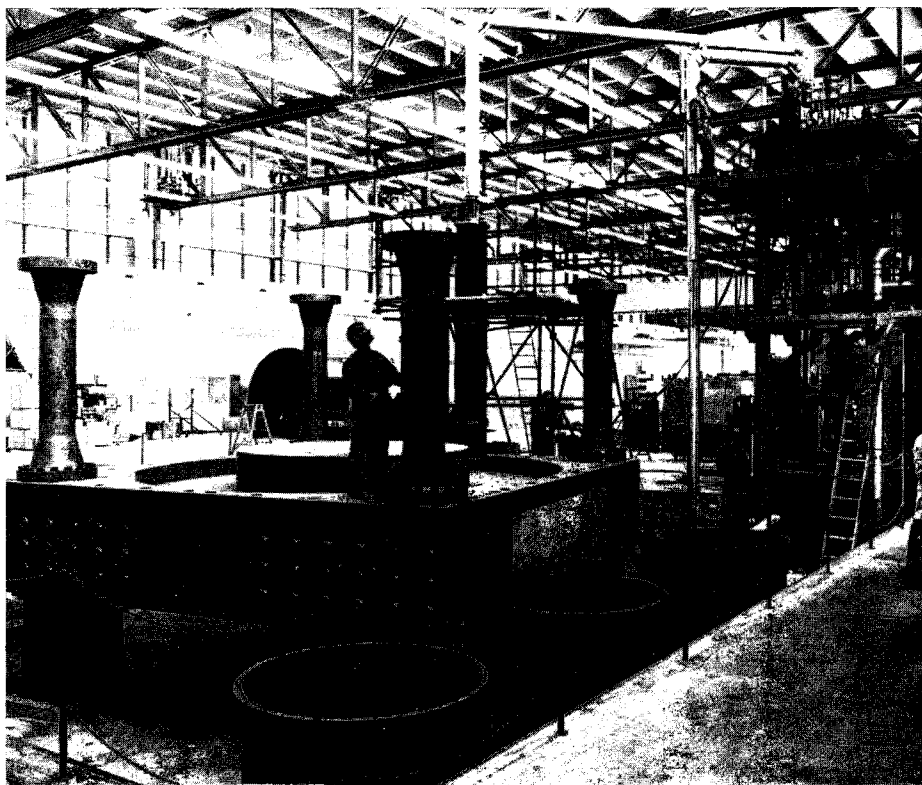
Using this signal, it was possible to produce the shape shown in the Figure, where the beam intensity is proportional to the height. Even with the detector in this state it is possible to follow the process of formation of the beam and its radial movements during stacking. Thus even before the sodium curtain is installed (scheduled for the Spring of next year), we have

available a beam profile detector which is already providing a great deal of useful information.

Midi-console

A new item of control equipment, known as the 'midi-console' has been installed this month in the control room of the PS. It is a unit connected to the computer which concerns itself with the operational aspects of the booster (injection, transfer systems, etc.). The controls of the booster (which is now in its final stages of construction) are entirely piloted by the PS control computer, an IBM 1800, to which has been connected a satellite computer to generate all the time-varying functions.

Using a computer in the operation of an accelerator may be implemented in various ways by having :



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The lower section of the magnet core of the Omega spectrometer was installed in the West Experimental Hall in October. The four columns will support the upper section which is due early next year. The first coil of the superconducting magnet will then also be installed.

- 1) separate units independent of the computer, for giving commands ;
- 2) a console fully integrated with the computer, capable of being used as a centralized control station for all processes ;
- 3) several midi-consoles each handling some processes.

The booster midi-console was developed by the PS Control Group, the appropriate programs having been assigned to the booster. Its most obvious advantages are its simplicity, flexibility and speed. A very wide range of possibilities is offered by the computer which guides the operator by means of visual messages.

The console takes the form of a panel 60 cm wide and 1 m high. From top to bottom, it carries an alphanumeric display system, a control section with actuating push-buttons, and a selector section with as many keys as there are parameters to be controlled. When a command has to be given to a component (a change in magnet current for example) the appropriate key is operated (the magnet code and the minimum variation which may be given to the current would then appear on the screen).

The control section comprises two sets of graduated push-buttons : + 1000, + 100, + 10 and + 1 ; and - 1000, - 100, - 10 and - 1. It is also possible to switch components on and off and to reverse polarities. Each button is located opposite the

figures on the display unit and controls the appropriate instruments. If the limits are exceeded, or if the component does not respond, or if the command is impossible to execute, a clear indication appears on the screen. Advantage is taken of the computer's memory to allow the operator to return to a previous condition if he is in any doubt. Keys 'save and back' and 'restore preserved' are fitted for this purpose.

The midi-console permits simultaneous control to two different parameters, which may be currents or voltages to be regulated by the use of analog converters, or step-by-step motors, or preselection counters. Certain parameters may be controlled in a coupled manner by linearly correlated values. 256 parameters may be handled by one midi-console. The electronics system is of the 'modular' type, and a very legible luminous spot read-out is used.

The midi-console management program has a high-priority level in the central memory of the IBM 1800, and is designed to allow widely differing parameters (currents, positions, voltages, angles, frequencies, times, etc.) to be handled. Programs for specific functions are loaded into lower-priority levels of the central memory when requested by the management programme.

One unit of the midi-console is at present in use on an experimental

basis to control the back leg windings of the PS. It will be used from December to control the booster injection beam-line. Two further units will be fitted at the beginning of next year.

CERN School

The 1972 CERN School of Physics will be held at Grado in Italy from 15 to 31 May. It will be organized in collaboration with the International Centre for Theoretical Physics (ICTP), Trieste. The School will concentrate on various aspects of high energy physics, especially theoretical physics, and is directed particularly to young physicists from the CERN Member States (but also from other countries).

Six main topics will take up the bulk of the programme — Inclusive reactions (H. M. Chan) ; Longitudinal phase-space analysis (E. W. Kittel) ; Lepton deep inelastic scattering (M. Gourdin) ; High-energy two-body phenomenology (A. Donnachie) ; Neutrino, gamma and hadron interactions in nuclear matter (K. Gottfried) ; Electron-positron interactions (G. Kramer).

Among the speakers giving special lectures will be M. Gell-Mann (Nobel laureate), A. Salam (Director of ICTP), W. Jentschke (Director General of CERN Laboratory I) and probably A.M. Baldin (Director of the High Energy Laboratory at Dubna).

Students in CERN Member States can request further information or application forms from: Dr. W.O. Lock, Personnel Division, CERN 1211 Geneva 23, Switzerland. Students from other countries may contact JINR Dubna or CERN.