

RECENT PROGRESS OF THE BEAM PROFILE MEASUREMENTS
FOR KEK 12 GEV PROTON SYNCHROTRON

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Various beam profile monitor systems has been installed for studying beam behavior and operating the machine throughout the acceleration cycle at main ring and booster. Non-destructive profile monitors have been used for injection, rf acceleration, internal target, fast extraction and slow extraction tuning. Single wire monitors have been used for injection study of circulating beam. Multiwire monitor were used for injection tuning and extraction tuning.

Electrostatic parallel plates and multi-channel ion collector scheme are applied.¹⁾ To improve the spacial resolution 64 and 32 ion collector electrodes were mounted for main ring and booster respectively. For main ring horizontal resolution was 2 mm and vertical was 1 mm. For booster horizontal resolution was 4 mm and vertical is 2 mm. Applied voltage on the electrodes was 10 kV which is correspond to electric field of about 1.4 kV/cm. To increase the sensitivity the gas injector was installed in the monitor vacuum chamber. The pump down had been raised rarely for frequently gas injection. The small sputter ion pump which was 160 ℓ /sec should be replaced to large sputter ion pump. For booster the gas injector was not necessary, because improvement of the signal to noise ratio, high ionization cross section of residual gas and high intensity beam. The signal display on the storage scope has been performed automatically. An example of the mountain view in the horizontal and the vertical plane are shown in Fig. 1. The photographs show the beam blow up horizontally at about 17 ms after injection. An example of the horizontal profile in 1 pulse and 9 pulse acceleration of main ring are shown in Fig. 2. The expansion of the beam profile due to space charge effect by high intensity beam had been observed in the booster monitor. The accuracy of this monitor is under testing with the single wire scanner at the injection and the rotary scraper²⁾ during the acceleration.

Single wire scanners were installed in main ring and booster for the horizontal and the vertical profile measurement at injection stage. These wire scanners have fast time response to observe profile of single bunch. The single wire scanner is proved to be very useful to decrease injection error. The profile are displayed on the storage scope automatically.

Multi-wire secondary emission monitors were installed to obtain accurate information on the shape and position of the beam at injection, and at extraction. To improve the spacial resolution 32ch sample/hold and 32ch analogue multiplexer were used. Resolution is 2.5 mm for the horizontal and the vertical plane. Horizontal and vertical input were switched by the 32ch reed relay in front of the 32ch preamplifier. The monitor head made of glass epoxy was replaced by the metalized ceramic card as shown in Fig. 3. The aluminium window frames whose size of inner square is smaller than the aperture of the ceramic frame to suppress secondary electrons produced by high energy protons. Applied voltage of the window frame is 300 volts positively. The metal surface was coated by gold 3 μ m thickness. The wire is gold plated tungsten of 0.03 mm in diameter. The posts which made of Kovar were soldered by silver. Wiring of the tungsten to the posts was soldered after three winding. The connection of the monitor frame and the 64ch 0.8D coaxial cable was used of the 66 pins flat connector with wire wrapping. The connection of the 64ch coaxial cables in vacuum side and the 64ch 1.5D coaxial cables was used of

four 22 pins vacuum feedthroughs.³⁾ An example of the beam profile at the booster beam dump line is shown in Fig.4. Recently, the signal processing and display of the beam profile have been performed with computer.⁴⁾

Reference

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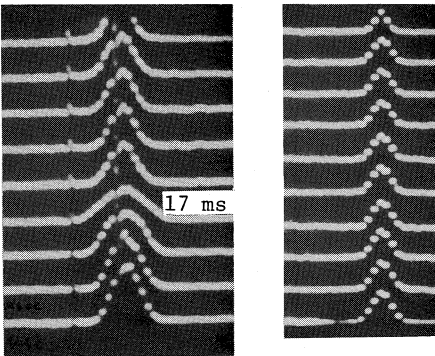


Fig. 1. Mountain view profile in the horizontal (left) and the vertical (right) plane of the booster. Beam blow up appears horizontally at 17 ms after injection. 0.6 ms/step.

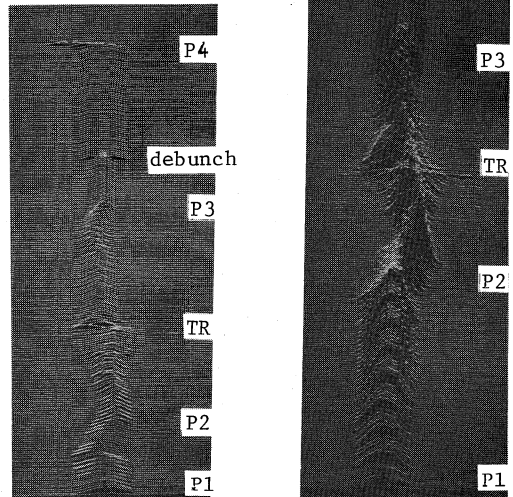


Fig.2 Horizontal profile in 1 pulse (left) and 9 pulse (right) acceleration of the main ring. 5 msec/steps.

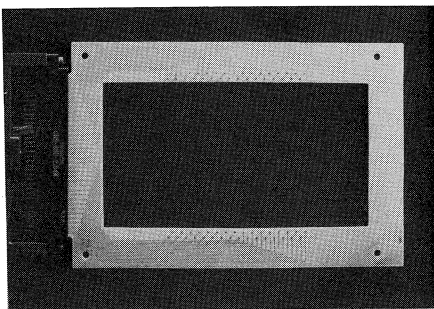


Fig. 3. A monitor head of multi-wire profile made of the metalized ceramic. Pitch of wires is 2.5 mm.

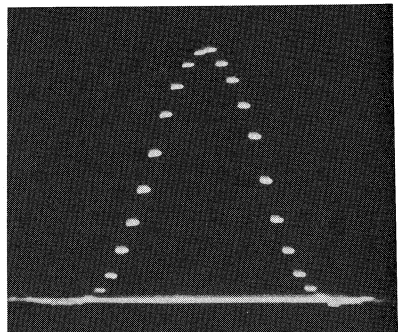


Fig. 4. Beam profile in the horizontal plane of the booster beam dump line.