ELECTROSTATIC SEPARATOR AND MASS SEPARATION

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Abstract

Present operation and performance of KEK electrostatic separator (Mark I) and the results of the mass separation test using this separator are described. Maximum high voltages supplied across the electrode spacing of 10 cm were 900kV for the 3 m separator and 800kV for the 9 m separator. Mass separation quality of 11.8/3.3 between pion and proton was obtained. Kaon yields were enriched from 1/200 to 1/15 at the mass slit.

1. KEK Electrostatic Separator

The very stable and compact electrostatic separators with built-in high voltage generators were developed at KEK[1]. A cross view of the 9 m separator is shown in Fig. 1. The positive and negative 600 kV high voltage generators were directly mounted on the separator and, therefore, the electrostatically stored energy between both high voltages was minimised because of using no high voltage cable. Consequently, sparking damage of the electrodes and insulators were minimised and the stable operation with high field was expected. Present performance of the 9 m separator is shown in Table 1. The electrode materials were stainless steel plate and anodised aluminium plate for the positive and negative electrode, respectively[2]. Pressure were controlled automatically, flowing the gas mixture of Ne-He[3].

Electrode length	9 m
Electrode width	40 cm
Maximum field	80 kV/cm
Electrode gap	10 cm
Max. high voltage	800 kV
Working field	70 kV/cm
Working high voltage	700 kV
Spark rate	2 per day
Working time between conditioning	500 h
Deconditioning rate	1×10^{-5} Torr/d
Pressure plateau	5×10^{-4} Torr at 700 kV

Table 1. Performance of 9m separator

2. Mass Separation

Mass separation test using the 9 m separator was performed at

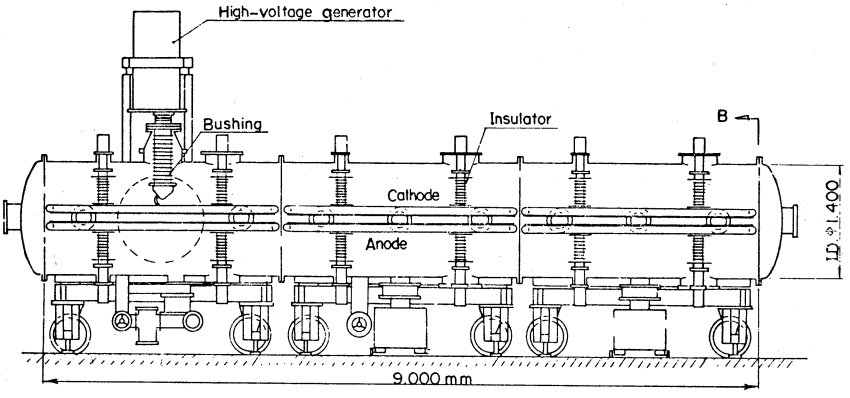

Fig. 1. Cross view of the 9m electrostatic separator.

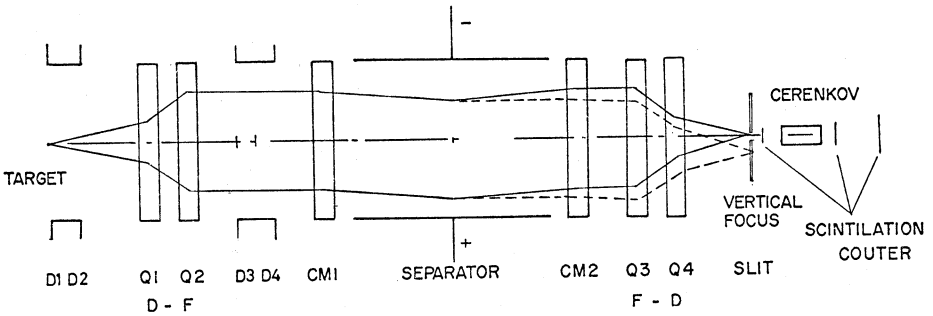

Fig. 2. Schematic layout of beam K1 and vertical beam envelopes.

beam K1. Beam line layout and beam envelopes for mass separation test are shown in Fig. 2. The wanted particles were corrected their electrostatically deflected orbits at the separator by two correction magnets, and went through the mass slit as shown by the solid line in Fig. 2. The unwanted particles were not corrected their orbits and were stopped by the mass slit as shown by the dotted line in Fig. 2. The wanted particles transmitted through the mass slit were counted by the counter telescope in three fold coincidence and were identified by the Cherenkov counters and time of flight. Mass separation qualities were measured from the vertical beam profile at the mass slit. Sweeping the correction magnet (M2), the particles transmitted through the mass slit were counted to measure the vertical beam profile . The spatial mass separation length between pions and protons was 11.8 mm at the momentum of 3.5 Gev/c. The each beam width of pions and protons was 3.3 mm. The mass separation quality factor was presented by 11.8/3.3. Purity of the proton at the proton peak was above 99%. The kaon yields are enriched from 1/200 to 1/15 at the kaon peak of the vertical profile at the mass slit.

3. Conclusion

The very stable and compact electrostatic separators were developed , and installed in the beam K1. Mass separation test using this separator was performed and the results of the test were agree with the theoretical calculations.

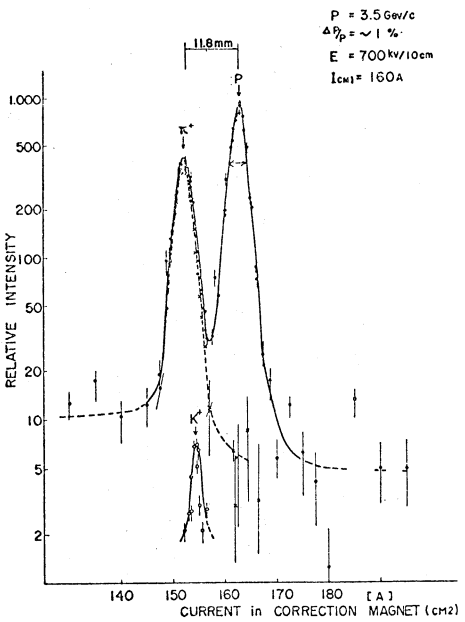

Fig. 3. Vertical beam profile and mass separation at the mass slit.

References

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