

## Electrostatic Splitter Test in the C Line

J. W. Glenn

March 1979

Collider Accelerator Department  
**Brookhaven National Laboratory**

**U.S. Department of Energy**

USDOE Office of Science (SC)

Notice: This technical note has been authored by employees of Brookhaven Science Associates, LLC under Contract No. DE-AC02-76CH00016 with the U.S. Department of Energy. The publisher by accepting the technical note for publication acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this technical note, or allow others to do so, for United States Government purposes.

## **DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Date 3/21/79 Time 1330-1430 Experimenters J.W. Glenn and H. Weisberg  
Subject Electrostatic Splitter Test in the C Line

### OBSERVATIONS AND CONCLUSION

#### Purpose:

Since 1/9/79 a prototype electrostatic beam splitter has been undergoing reliability testing in the C line, centered at the 373 ft position. The parameters of the splitter are: wire diameter 0.002 in.; wire material 75% Tungsten, 25% Rhenium; wire spacing 0.05 in.; septum length 120 in.; spacing between wire septum and cathodes 1.2 in. (each side); operating voltage 90 kV; operating field 30 kV/cm. The splitter has had HV on almost continuously during normal accelerator operations, with the beam going mainly on one side of the septum. In this study the septum was moved to the middle of the beam for the following tests: effect of beam on leakage current and vacuum; operation of loss monitors; and skew curves with and without HV.

#### Results:

The splitter produced a clear shadow on the CF383 flag and two well-separated spots at the C target, as had been observed earlier (Figure 1). With a beam intensity of about  $3 \times 10^{12}$  protons per 1.0 sec spill, a change of septum current during the spill was just barely perceptible, and amounted to about 0.01 A. The vacuum readback was  $3.0-3.5 \times 10^{-6}$  torr; it did not change when the beam was turned off for 30 sec.

Beam losses were monitored by ionization chamber loss monitors CL370 and CL378, located near the upstream and downstream ends of the splitter respectively. Figure 2 shows the loss monitor response vs septum skew for these two monitors. The upstream monitor responds only to general background, while the downstream one has a superimposed response to beam loss on the wire septum. When additional upstream losses were produced by inserting flags CF103 and CF204, both loss monitor responses increased considerably as shown. Both increased by about the same amount, suggesting that an electronic or software difference of the two signals would be a sensitive monitor of localized losses at the septum.

Figure 3 shows this difference for the two cases HV on and HV off. Figure 4 is the prediction of a numerical model.

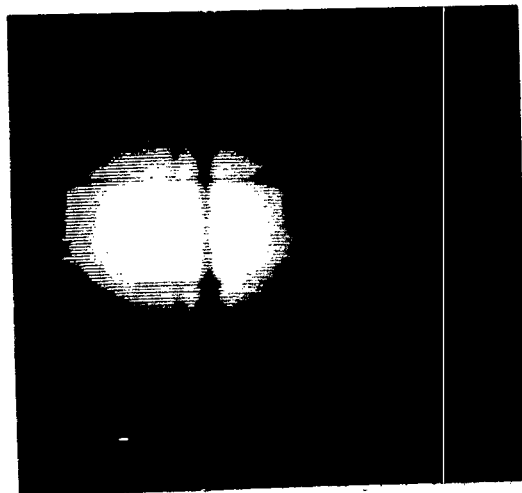
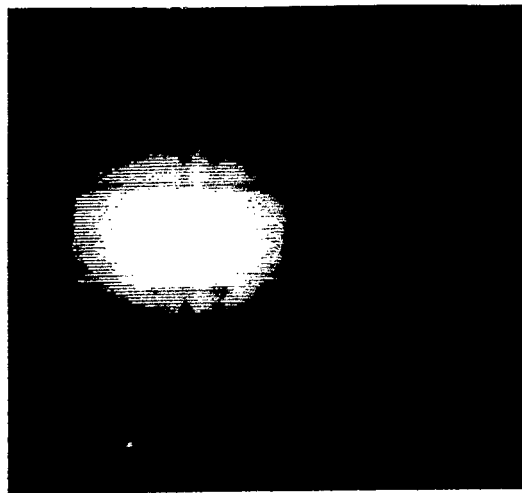
- 2 -

The basic assumption of the model is that multiple Coulomb scattering is the dominant effect, so that most of the protons emerge from the wires without having undergone a strong interaction. The loss monitors respond to the rare protons which do interact; therefore the quantity plotted is the average pathlength in the wires per incident proton per unit beam width. A uniformly distributed beam divergence of 0.20 mrad full width is assumed.

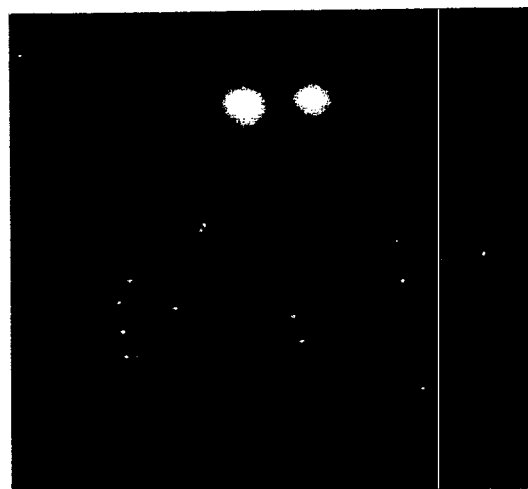
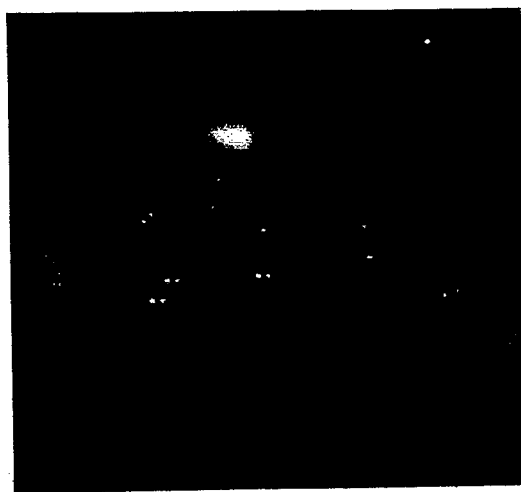
The measurements agree with the model.

HV OFF

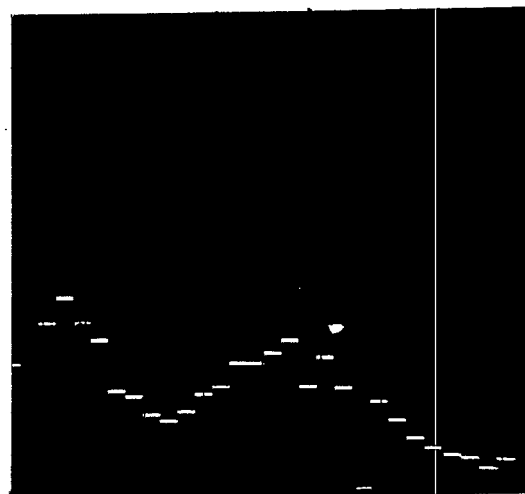
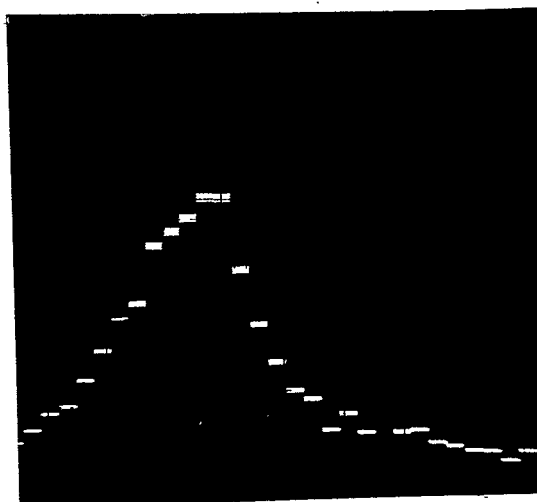
HV = 90 kV



CF383 Flag



C Target Flag



C Target SWIC

Figure 1. Operation of beam splitter as seen on the CF383 and C Target flags and the C Target SWIC. Observations made 1/9/79. Beam intensity in C line:  $2.2 \times 10^{12}$ .

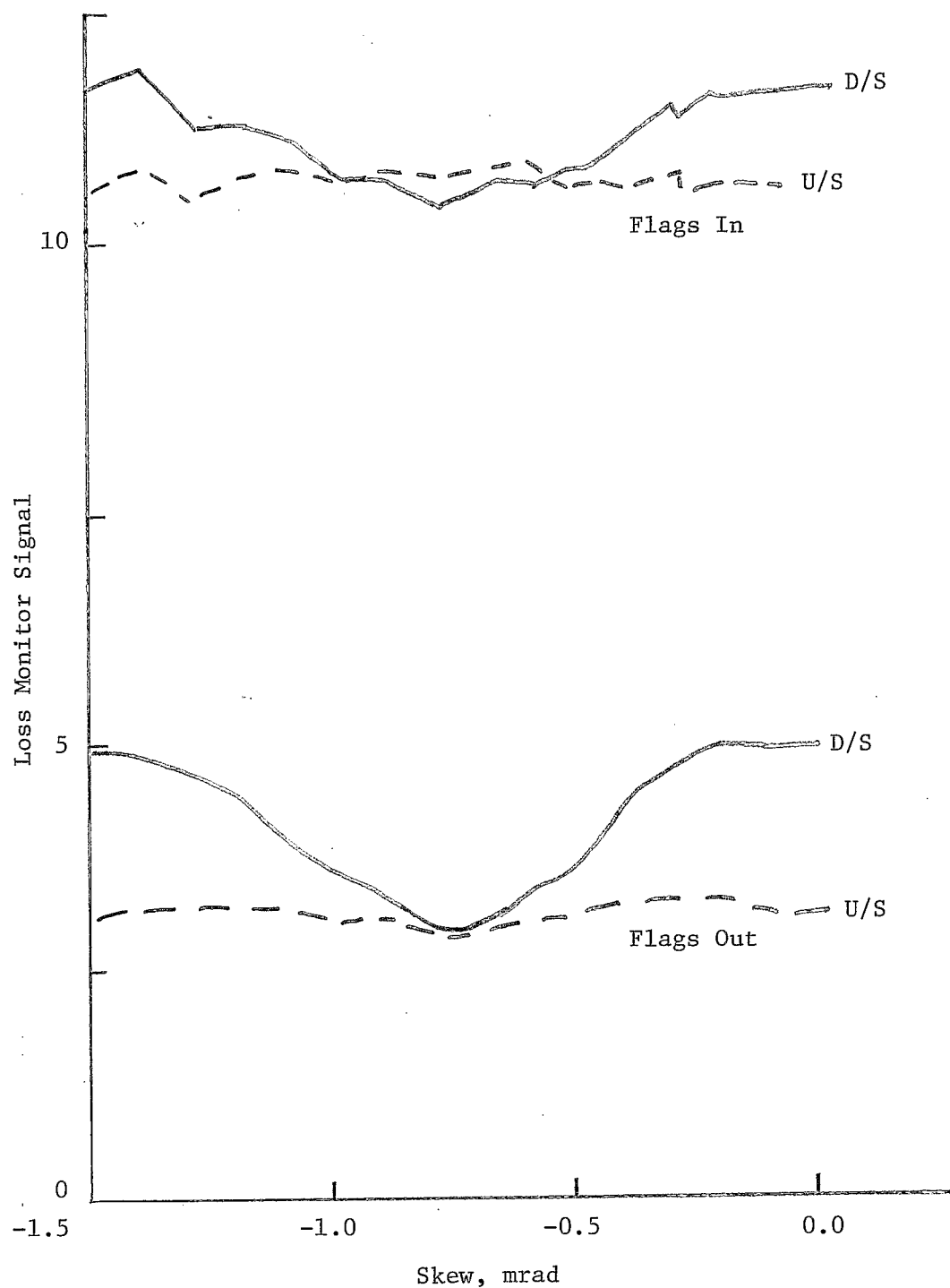


Figure 2. Loss monitor response vs septum skew. Responses are shown both for CL370 (U/S) and CL378 (D/S), and with flags CF103 and CF204 inserted (FLAGS IN) and retracted (FLAGS OUT). One unit of response corresponds to a signal of approximately 0.4 volts across a 0.1  $\mu$ F integrating capacitance.

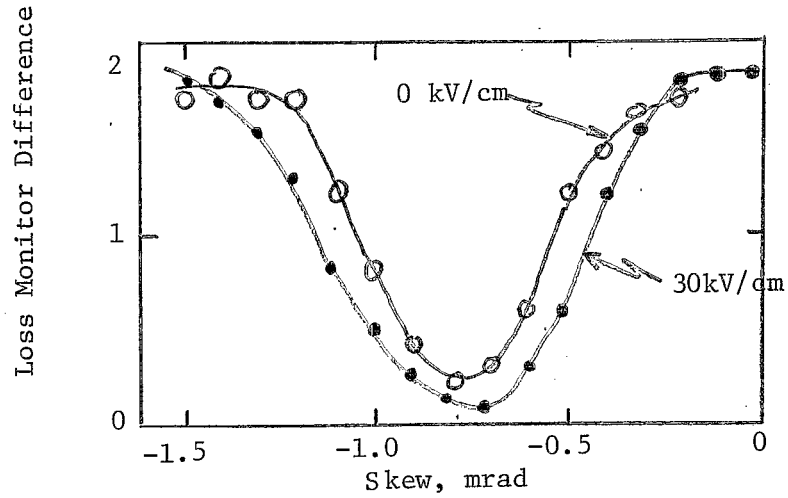


Figure 3. The difference of upstream and downstream loss monitor signals vs septum skew. Responses are shown with HV off and on.

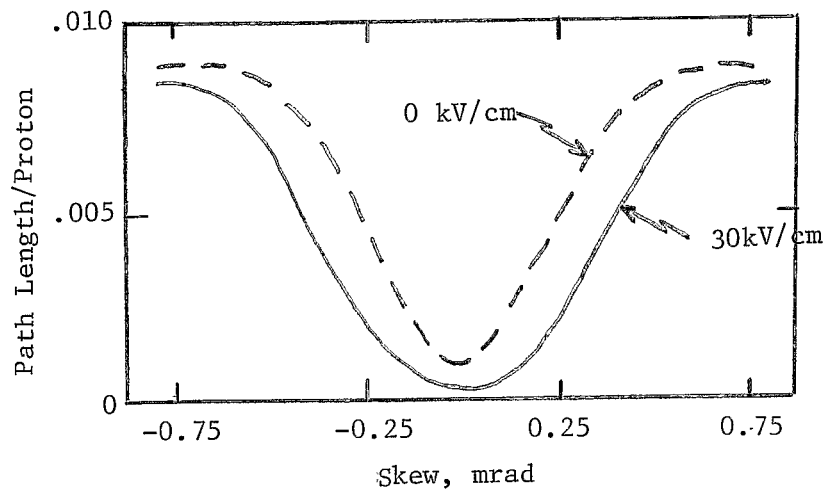


Figure 4. Predicted loss monitor signal vs septum skew. The quantity plotted is the average pathlength in the wires per incident proton per unit beam width, in inches/proton/inch.