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BACKGROUND IN NEUTRINO BEAM DUE TO BEAM LOSS

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Collider Accelerator Department

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AGS DIVISION TECHNICAL NOTE

No. 128

BACKGROUND IN NEUTRINO BEAM DUE TO BEAM LOSS

Y.Y. Lee and P.J. Wanderer
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We studied sources of background for neutrino experiments by inserting thin flags at several places in the U-line proton beam. Each flag was 1 mm plastic, intercepting ~ 0.2% of the beam. We recorded trigger rates for the E613 HPW liquid scintillator colorimeter. The front part (F) of the colorimeter has discriminators with ~ 4 mV thresholds, corresponding to an energy deposition of roughly 0.5 MeV.

The back part has 30 mV discriminator thresholds (roughly 5 MeV energy deposition).

Roughly speaking, F is most sensitive to low energy neutrons, B to higher energy neutrons. A F.B coincidence can be due to a muon from the beam or from an interaction in F. However, the increase in F.B due to the loss of a small part of the proton beam is mostly likely due to secondary muons produced near the flags.

The attached figure shows the rates for F, B, and F.B normalized to the rates with no flags, for the same number of protons on target. Errors are statistical. Low energy neutron backgrounds are worst for losses near UQ9 and the transmission target.

The radiation monitors were scanned as each flag was inserted into the beam. The radiation increased near the inserted flags, but not elsewhere in the beam line.

One can make the following observation; the rate of slow neutron gradually increases from right downstream of 8^{o} magnet to the 618 transmission target, then the rate drops very drastically. The rate of the

fast neutron and muon behaves approximately the same with slow neutron, except there is a dip around UQ9 area (~ 380 ft. from the H13 straight section). This is understandable because there is a large amount of close-in lead and steel shielding around the UQ9 area. The slow neutrons are relatively insensitive to this kind of shield. The cause of the background rise due to the losses around 300 to 650 ft. from H13 is not well understood, but one might make the following observations. There is a tunnel connected to the U-line (W-line) starting at the transmission target. The rate approximately corresponds to the leak through this tunnel. The sudden drop of background for the losses downstream of this tunnel certainly suggests the possibility. On the other hand, one might correlate the background pattern to the thickness of the dirt cover on the U-line tunnel, but this requires more detailed studies.

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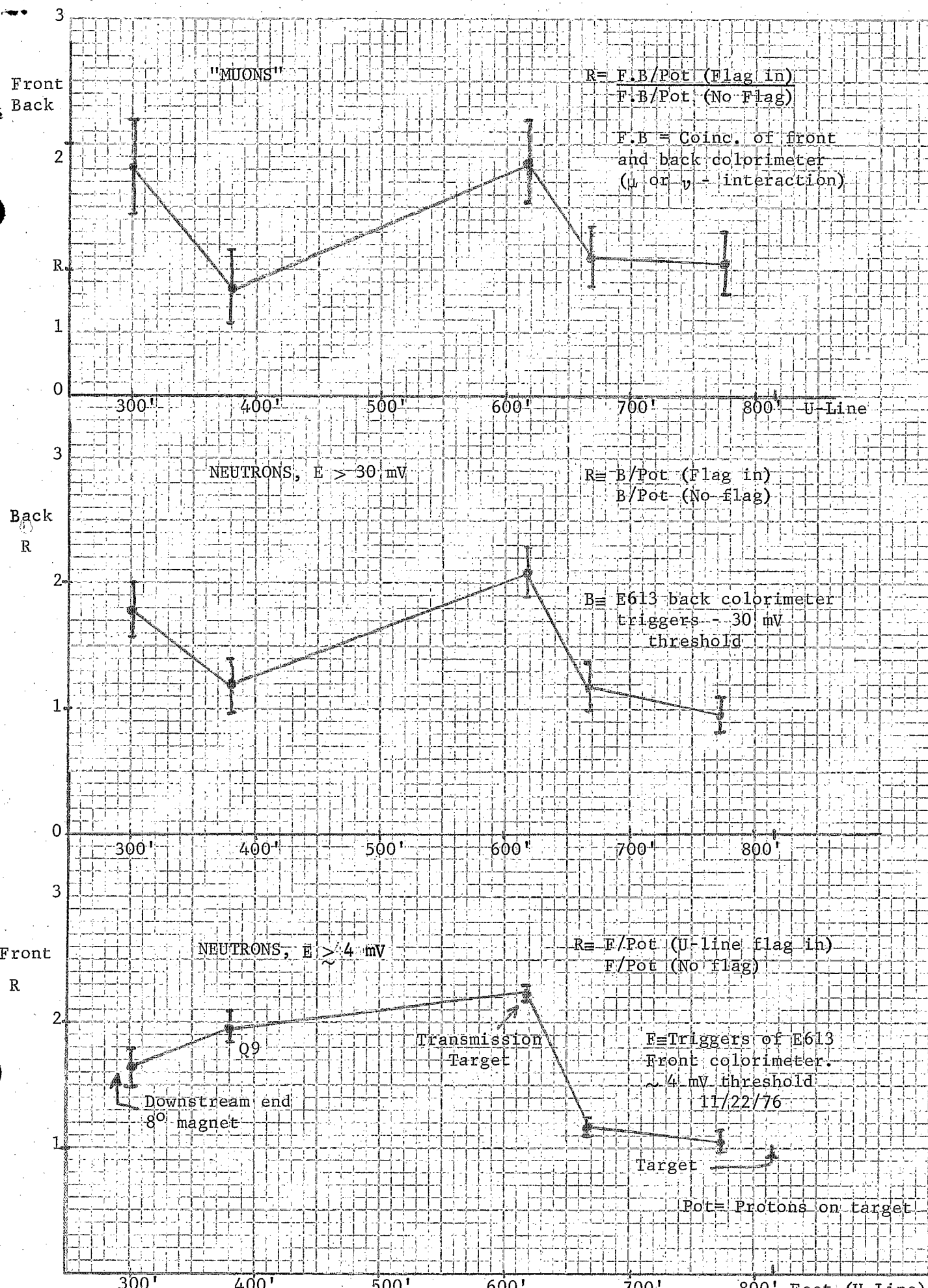
Front
Back
R
"MUONS"
R= F.B/Pot (Flag in)
F.B/Pot (No Flag)
F.B = Coinc. of front
and back colorimeter
(μ or ν - interaction)
3
2
1
0
300'
400'
500'
600'
700'
800'
U-Line
NEUTRONS, E > 30 mV
R≡ B/Pot (Flag in)
B/Pot (No flag)
B≡ E613 back colorimeter
triggers - 30 mV
threshold
NEUTRONS, E ≳ 4 mV
R≡ F/Pot (U-line flag in)
F/Pot (No flag)
Q9
Transmission
Target
Downstream end
8° magnet
F≡Triggers of E613
Front colorimeter.
~4 mV threshold
11/22/76
Target
Pot= Protons on target
Feet (U-Line)