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Informal Proposal to NAL

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A Measurement of the Relativistic Rise in the Most Probable Energy Loss in Thin Solid Films

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Recent calculations[1] show that the most probable energy loss in thin films will have a $\ell n\gamma_L$ dependence for a relativisitc particle. The onset of this dependence appears when the crossing time of the film is short compared to a dielectric polarization time. The calculations show a significant $\ell n\gamma_L$ rise even when partial polarization occurs. This experiment proposes to test this theory.

The tagged-photon electron beam of NAL ex. #25 at the highest energies ($\gtrsim$ 200 GeV) in a parasitic mode would be sufficient for the measurement. A location immediately upstream from the electron tagging hodoscope is proposed. See Fig. 1.

In Fig. 2 we show a full scale drawing of the detector and mount. It is important to note that the thickest portion of the detector and mount as viewed by the beam is $\lesssim 4 \times 10^{-2}$ radiation lengths. Should backgrounds be prohibitive, a second detector of similar mount and thickness

5 pgs

but smaller diameter (Ø 15 mm) would follow the first detector at a distance of $\sim$ 1 cm serving as a trigger.

The detector would be mounted upon a table for easy movement across the momentum-dispersed beam at a distance of $\sim$ 30 cm from the windows of the vacuum system. This distance is required in order to give a lower energy cut-off in the δ-ray spectrum from the vacuum pipe window (1/64" steel, 2.2×10^{-3} r.l.). The 30 cm is also required in order to provide for a sufficient healing distance of the field carried by the particle after passing the window. Because our detector is thin (10^{-3} r.l.), bremsstrahlung is not expected to be a problem.

All the electronics and detectors would be supplied by the experimenters. Data rates of $1/cm^2sec$ to $10^5/cm^2sec$ are acceptable by the experiment. If the rates are too high we would move the detector to the lower side of the beam plane. The experiment will require a minimum of two days of data time and $\gtrsim 10^6$ events. We would require from NAL:

2 tables and chairs

1 beam TV monitor system

power 110 volts, $\lesssim$ 20 amps

REFERENCES

1. W. Ogle, Bulletin, Washington APS Meeting, 1976.

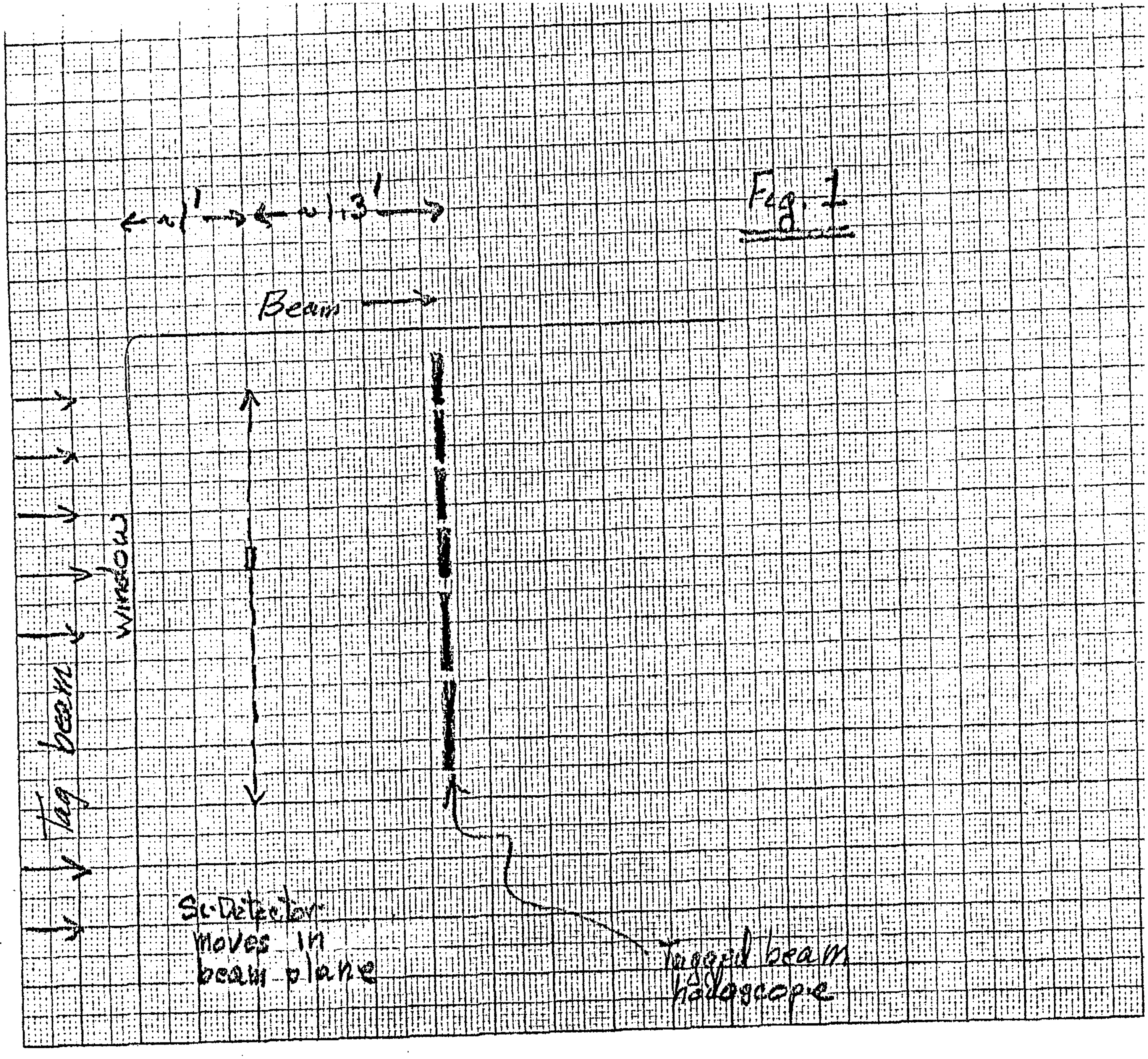
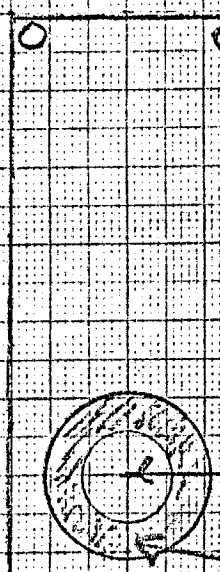

~1'
~1.3'
Beam
Tag beam
Window
Sc-Detector:
moves in
beam plane
Tagged beam
hadoscope

Fig. 1



4 screws, nuts, spring out of beam plane

Full scale drawing Detector & Mount

10^{-3} r.l. Si (100 μm) detector

4×10^{-2} r.l. ceramic (3.7mm thick) ring 22 mm OD 11 mm ID

5×10^{-3} r.l. Lucite (1.7mm) detector mount

$.7 \times 10^{-3}$ r.l. electrical connection to detector, Cu strip (25 μm)

BNC connector out of beam plane

Cable & preamp out of beam plane