Efficiency Studies of Pilot Y, Pilot F and NE 110 Scintillator⁺

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In the process of constructing a thin counter hodoscope to be used in the SLAC K^0 spectrometer facility⁽¹⁾ we made a careful study of the counting efficiency of various plastic scintillation materials as a function of the distance (L) from the scintillator - lucite light pipe joint. Although these tests are in no way meant to be exhaustive, we feel some of the results are of general interest. This K^0 spectrometer is being used in a study of various K_L decay studies. Hence, it is important that all scintillator hodoscopes have a constant detection efficiency across their surface to avoid biases in the Dalitz Plot.

Test of the counting efficiency were carried out in NE 110, Pilot Y, and Pilot F plastic scintillators.⁽²⁾ Each scintillator measured 24" long x 2" wide x 1/8" thick. The final hodoscope was a square array 48" on a side. Because of the large length (L) and small thickness we felt there could be a counting rate dependence on L. The scintillator was wrapped in household aluminum foil and taped with scotch electrical tape to eliminate light leaks. The light from the scintillators was detected by an Amperex 56 AVP photo-multiplier tube through a lucite light pipe made of 2 bent lucite strips 14" long x 1" wide x 1/4" thick.

In order to define a value of L along the length of the test scintillator we set up an arrangement as shown in Fig. 1. Two narrow scintillators were placed perpendicular to the scintillator being tested one above and the other below. A third scintillator identical in shape to the one being tested was added resting on top. The particles being used were cosmic rays. Output signals from all four scintillators were sent to LeCroy 321B discriminators with a threshold level of .1V. The

The discriminator outputs were fed to LeCroy 165 coincidence circuits. The circuit diagram is shown in Figure 2.

The counting efficiency was calculated as the ratio Q/T of the quadrupole coincidence rate to the triple coincidence among the counters not being tested. Figure 3 shows the counting efficiency as a function of L for various voltages. The lines are only an eye fit to the points to indicate the trend of the measurements. The data show that only Pilot Y plastic scintillator had a constant counting efficiency over the range of 24 inches.

Bibliography

- 1) A Data-Acquisition System for a Large Wire Chamber Spectrometer, R. Coombes, D. Fryberger, D. Hitlin, R. Piccioni, D. Porat and D. Dorfman, Nuclear Instruments and Methods 98 (1972) 317-328.
- 2) The Pilot scintillator is made by New England Nuclear, Watertown, Mass. and NE 110 is made by Nuclear Enterprises, Santa Clara, California.

TEST AND COINCIDENCE COUNTER ARRANGEMENT

COUNTER #1: 1"x2"x1/8"

" #2: 2"x24"x1/8"

" #3: 2"x24"x1/8"

" #4: 3"x3"x1/8"

#2 IS THE COUNTER UNDER TEST

FIGURE 1

COUNTING LOGIC

FIGURE 2

EFFICIENCY AS A FUNCTION OF POSITION

FIGURE 3