IV Absolute Singles Efficiency

The absolute singles efficiency was measured using two NaI(Tl) detectors and a silicon beta detector. Approximately 1 μCi of 22Na was evaporated in a small indentation on a 0.7 mm thick polyethylene disk, adjacent to the silicon detector. Positrons detected in the silicon (ΔN) annihilated 511 keV gamma rays which were detected by the NaI(Tl) detector (N). Absolute efficiency (ε) is

\[ \epsilon = \frac{N}{\Delta N} \]

Only events in which a 1275 keV gamma ray entered the "Veto" detector were counted, eliminating 511 keV + 1275 keV sum events from the NaI(Tl) detector.

V Coincidence Efficiency

A third NaI(Tl) detector was added to the experiment to measure the absolute coincidence efficiency. Only events in which a 1275 keV gamma ray entered a "Veto" detector at the same time as two 511 keV gamma rays entered both detectors were counted.

VI Symmetric Coincidence Efficiency

The metal casing around the source-detector was removed in this redesign to reduce attenuating materials as much as possible. The silicon beta detector was replaced by a scintillator beta detector.

The plastic scintillator and source assembly. 22Na is deposited in two wells, on each side of a small plastic scintillator. Light pulses from the scintillator are detected by a photomultiplier after traveling through an acrylic light guide.

Photograph of the symmetric coincidence efficiency experiment. The plastic scintillator detector reduces material near the source.

Diagram of the electronics used for the coincidence efficiency experiment. The CAMAC system detects pulses from each detector and the time difference between the pulses.