

## A FAST COINCIDENCE PREAMPLIFIER FOR SOLID STATE RADIATION DETECTORS

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A preamplifier allowing both good time and energy resolution for the particle detection with p-n junctions is described. Corresponding to one coincidence channel, 0.22 nsec and 1 nsec time resolution for  $\alpha$ -particles of 10 MeV and 1 MeV respectively

were obtained using a small area surface barrier detector with 15 nsec rise time. The limitation of the time resolution due to electronic noise is discussed.

### 1. Introduction

For coincidence work with strong sources or high background, a good time discrimination of non-correlated events is often desirable in addition to good energy resolution in order to minimize the counting rate due to the accidental coincidences. In low energy physics, because of the better energy resolution and similar time resolution of semiconductor counters compared to scintillation counters with NaI or CsI crystals, the semiconductor detectors have some advantage in the detection of charged particles.

coincidence sorts out the desired events with a time resolution of about  $10^{-6}$  sec, see fig. 1.

### 2. Influence of Noise

Due to the fact that the collection time of electron-hole pairs is small—for instance in a p-n junction made of 100–1000  $\Omega \cdot \text{cm}$  n-silicon below 1 nsec when it is sufficiently biased<sup>3)</sup>—the time jitter due to statistical fluctuations in the collection of charge carriers will be negligible. However, if the same charge is accumulated for each pulse (cf. ref.<sup>4)</sup>, it is reasonable to assume that the fluctua-



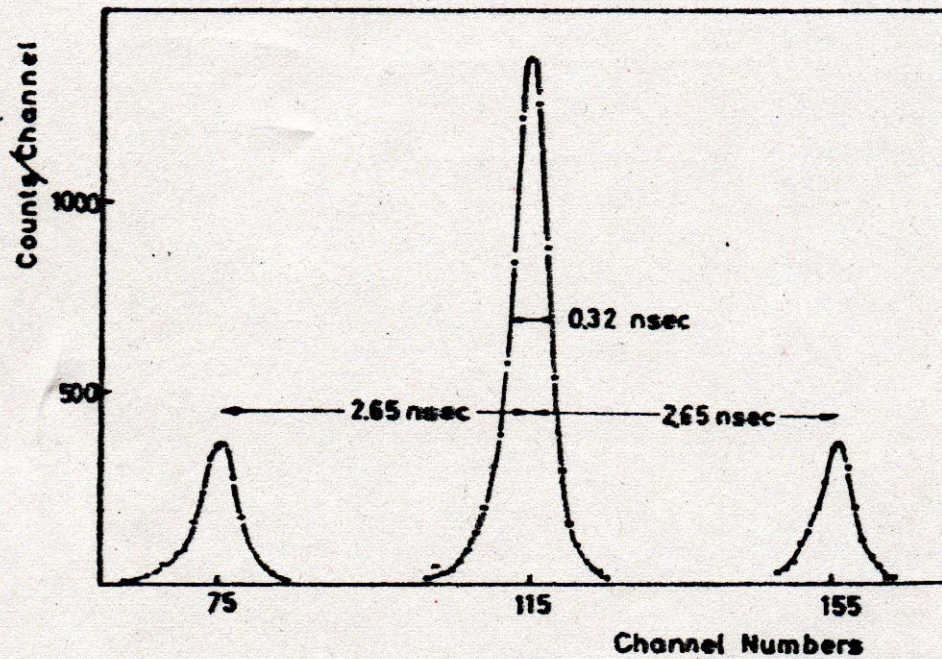


Fig. 3. Pulse-height distribution of the time-to-pulse-height converter with coincidences of two 10 MeV  $\alpha$ -particles (cf. sec. 4). For calibrating the time scale three measurements with different delays by known lengths of cables were superimposed.



Congratulations !