On the Time Resolution of the BCAL and Its Dependence on Pulse Height

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Abstract

The GlueX barrel calorimeter (BCAL) plays a dual role as an electromagnetic calorimeter and as a time-of-flight detector for charged particles. The time resolution of the BCAL is important for its performance in both roles. A simple statistical model of the time resolution is presented. A fundamental link between photoelectron statistics and time resolution is demonstrated.

1 Leading Edge Timing

Two methods are commonly used to extract accurate leading-edge timing information from a scintillation pulse. The first method employs a constant-voltage discriminator whose output transitions when the input pulse rises through a fixed threshold that is set as low as possible for optimal time resolution, typically a few sigma above the electronic noise. The second method uses a constant-fraction discriminator which transitions at the point where the leading edge of the pulse rises through a fixed fraction of its total pulse height. In either case, a second discriminator with a fixed second threshold is often used in combination with the first, to provide a hit pattern based on a flexible threshold.

2 Statistical Model

3 Results and Discussion

References

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