NUCLEAR INSTRUMENTS AND METHODS 136 (1976) 197–198; © NORTH-HOLLAND PUBLISHING CO.

LETTERS TO THE EDITOR

A STABLE LIGHT PULSER FOR GAIN STABILIZING PHOTOMULTIPLIER TUBES*

CHRISTOPHER L. MORRIS

University of Virginia, Charlottesville, Va. 22903, U.S.A. and
University of California, Los Alamos Scientific Laboratory, Los Alamos, N. M. 87545, U.S.A.

WILFRED J. BRAITHWAITE and C. FRED MOORE

University of Texas at Austin, Austin, Tx. 78712, U.S.A. and
University of California, Los Alamos Scientific Laboratory, Los Alamos, N. M. 87545, U.S.A.

Received 22 April 1976

We describe a light pulser consisting of an ^{241}Am source deposited on a CsI crystal, and a method for distinguishing these light pulses from those in a NaI scintillator.

Long term gain drifts in NaI(Tl) scintillation counters and associated electronics can limit the energy resolution in low counting rate experiments. A very stable light pulser with good pulse height resolution ($\approx 5\%$) has been developed to use in software gain stabilizing such a NaI counter system.

Fifty nCi of ^{241}Am (an alpha particle emitter) was deposited on the surface of a 0.25 cm × 0.25 cm × × 0.025 cm CsI(Tl) crystal. The CsI crystal was then attached to the side of the faceplate adapter between the 12.5 cm × 12.5 cm NaI scintillator and an RCA 4522 photomultiplier tube with optical coupling compound and sealed with white silicon rubber.

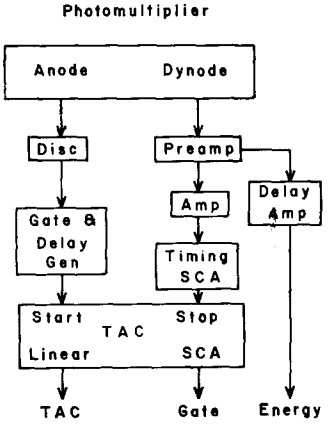

Fig. 1. A block diagram of the electronics used for these tests.

* This work has been supported in part by the United States Energy Research and Development Administration and in part by the Robert A. Welch Foundation.

By using a pulse shape discrimination (PSD) circuit (shown in fig. 1), to measure the difference in decay times for light pulses from the two crystals

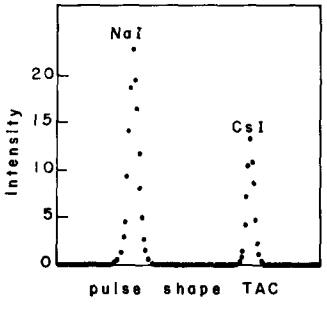

Fig. 2. A spectrum of the linear output from the PSD time-to-amplitude converter.

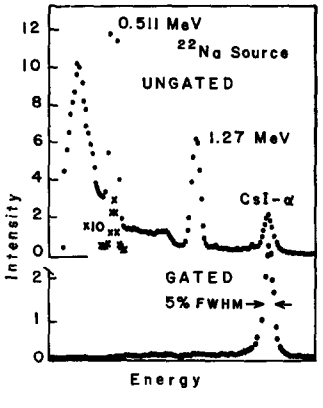

Fig. 3. The upper spectrum is the ungated linear pulse height output from scintillation counter. The lower spectrum is the same except it is gated by a window on the CsI peak in the PSD TAC output.

(230 ns for NaI, 650 ns for CsI), pulses from the different scintillators could be distinguished. Using this method, a very clean stable line from the CsI can be provided for a gain stabilizer. Furthermore, these pulses can be removed from the NaI energy spectrum.

The output spectrum from the PSD time-to-amplitude converter (TAC) is shown in fig. 2. One can see the excellent separation between the CsI pulses and the NaI pulses. In fig. 3 we present two spectra showing the pulse height distribution from the scintillation counter when it is illuminated with a ^{22}Na gamma ray source. Here the upper spectrum is ungated, and the lower spectrum is gated by a window on the CsI peak in the PSD TAC output.

This technique has been tested at counting rates up to 80 kHz. Although at these rates pileup events in the shaping amplifier produce a background under the CsI peak in the TAC, there is very little shift in the CsI peak. At these rates, and we expect even at higher rates, it is possible to keep the peak-to-background ratio for the CsI pulse height better than 10:1.