

A new active base of photomultiplier R4125 designed for the lead tungstate calorimeter

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Abstract

This paper presents the design, performance, and results of radiation tests of an active base for a Hamamatsu 4125 photomultiplier tube. The active base was designed at Jefferson Lab and comprises a high voltage divider and an on-board amplifier. The photomultiplier with the active base is used to detect light from lead tungstate scintillating crystals of the forward electromagnetic calorimeter of the GlueX detector. The addition of the amplifier within the active base allows to operate the tube at lower high voltage, thereby limiting the photomultiplier anode current to a few microamperes even at a maximum counter rate of 1 MHz, while retaining the dynamic range of output signals. The performance of the active base and the calorimeter module assembly was studied using a bench test setup and a prototype positioned into a beam of photons. Measured key performance parameters such as linearity, high-rate capability, and the energy resolution verified that the active base design aligns with the detector specifications. Additionally, the resistance of the active base components to radiation was tested using a Caesium-137 source. Some damage observed during these tests required to make modifications to the original base design to improve its resilience.

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