

Development of a High Counting Rate ASIC for Heavy-ion Beam Monitoring

Wednesday, September 4, 2013 11:30 AM (20 minutes)

Recently, we have developed a series of analog front-end ASICs for readout of semiconductor detectors such as CdTe, Si, and APD. While the main objective is to develop instruments for astrophysical observations, the same technology can be used in other fields. In this paper, we describe development of a 40 channel high counting rate ASIC, and its application to heavy-ion beam monitoring in the medical field. The heavy-ion radiotherapy is one of the most front-line therapy for cancer. The heavy ion beam is created by a synchrotron acceleration facility and targeted on a patient. The beam intensity reaches 10^{5-9} particles/sec. A realtime monitoring system of the beam position/shape is a key issue to realize efficient cancer treatments. The ASIC includes a current conveyer circuit to receive detector signals, window comparators for energy discrimination, and scalers. The ASIC delivers 21-bit digital counter values for each channel to back-end electronics. Using test pulse injection, two sequential pulses with 24 ns separation were successfully distinguished, which corresponds to 40 Mcps per channel. A Si strip detector with 300 um pitch was connected to the ASIC. A performance test in this configuration is planned to be performed.

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Session Classification: Session 5

Track Classification: Pixels (incl. CCD's) - X-ray imaging