Contribution ID: **61** Type: **Oral**

A Readout ASIC for CZT and Si Detectors

Tuesday 16 September 2008 15:25 (25 minutes)

Spectrometers that can identify the energy of gamma radiation and determine the source isotope have until recently used low temperature semiconductors. These require cooling which makes their portability difficult. A relatively new material, cadmium zinc telluride, is now available which operates at room temperature and can be used to measure the energy of gamma radiation. In a compton camera configuration the direction of the radiation can also be determined. A read-out ASIC has been developed which detects the ionised charge in such a system and processes this before outputting to a data acquisition system. ASIC test results will be presented.

Summary

A portable gamma camera has been developed which can detect both the position and isotope of material emitting gamma radiation. As part of this, a layered and pixellated cadmium zinc telluride (CZT) detector has been designed. Battery powered, the detector requires low power, and low noise read-out electronics to detect and process the ionised charge before it can be developed into an image.

The read-out ASIC has 100 channels. A preamplifier detects the ionised charge and integrates this into a voltage, the rise time of which can be used as a measurement of the depth of the ionising event within the detector. A differentiator and comparator measure this rise time and store it for later read-out. The comparator is also used to generate a time stamp of when the event occurred. A CR-RC filter shapes the voltage into a pulse which is easily processed by a peak hold circuit. The resulting amplitude is proportional to the energy of the ionising event in the detector. A comparator with a user defined threshold selects the energy level above which data will be digitised and read out. For every event above this energy, the chip converts the voltage held on the peak hold circuit into a 12 bit digital form, and reads this out together with the pixel address, time stamp, and rise time. Data from neighbouring pixels are also read out as part of the same event. The energy range for which the ASIC has been designed is 2MeV for CZT with 1keV resolution.

Read-out from the chip is 1 bit serial and data driven. The data transfer speed is 32MHz and a data packet consists of 34 bits. Consecutive data packets will be output without a break in the data.

Reference voltages and bias currents are internally generated to simplify external circuitry, and the user can modify the default settings using an I2C compatible interface which accesses the internal registers. The shaping is programmable between 500ns and 7.5us and the preamplifier has two gain settings optimised for CZT or Si detectors.

The ASIC has been designed and manufactured on an AMS 0.35□m process. Testing is ongoing and results will be presented.

Author: Mr JONES, Lawrence (STFC)

Co-authors: Mr LAZARUS, Ian (STFC); Mr PRYDDERCH, Mark (STFC); Mr COLEMAN-SMITH, Patrick (STFC); Mr SELLER, Paul (STFC)

Presenter: Mr JONES, Lawrence (STFC)

Session Classification: Parallel session A2 - ASICs