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Success Story

Crump Institute initial results for OPET looking very promising

Problem

Need for analog-to-digital processing boards in advanced tomography project.

Solution

Use three VHS-ADC Virtex-4 in a cPCI chassis equipped with an Ethernet hard disk drive.

Results

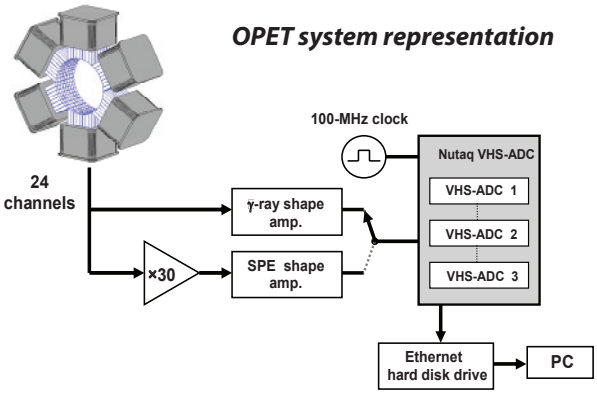
Time and money saved.

The Crump Institute is a multidisciplinary collaborative of scientists, students, and technologists. Researchers of the Crump Institute bridge physics, biology, chemistry, and computational sciences, leading to a streamlined approach to exploration and discovery.

Problem

The Crump Institute for Molecular Imaging at UCLA is currently developing a prototype dual-modality optical and positron emission tomography (OPET) small animal imaging tomograph. An OPET consists of a single ring of six detector modules of 3.4 cm in diameter. Each detector module is equipped of an 8 × 8 array of optically isolated bismuth germanate (BGO) scintillators coupled to multichannel photomultiplier tubes. Detector data channels are read through a custom multiplexed readout scheme, and filtered in analog circuitry.

The shaped pulses thus generated must be routed to a digital signal processing unit for event processing in such a way that only minimal post-processing becomes necessary before image reconstruction.



Solution

The digital processing units selected to process events were three Nutaq VHS-ADC Virtex-4, inserted in a cPCI chassis equipped with a CPU board and hard disk drive. The VHS-ADCs were selected because of their 105-MSPS analog-to-digital converters (ADCs), synchronized by a 100-MHz external clock. The 1-Gbps RapidCHANNEL links allow the transfer of digitized pulses between the VHS-ADC FPGAs. The FPGAa are programmed to process PET coincidence events or bioluminescence single-photon events (or SPEs).

Events are processed in real time by user-defined signal processing algorithms.

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Crump Institute initial results for OPET looking very promising (cont'd)

These algorithms were developed and tested with Simulink using Xilinx and Nutaq software tools. The algorithms are automatically converted to VHDL bitstreams that control the functionality of the VHS-ADCs.

The information derived through digital signal processing includes event timing, energy determination-discrimination, position determination-lookup, and coincidence processing. Coincidence events and SPEs are saved to the cPCI chassis' hard disk drive, minimizing post-processing.

Results

Time and money saved. Nutaq's complete solution, composed of three VHS-ADC Virtex-4 s and a cPCI chassis (equipped with a hard disk drive), as well as the product integration to The MathWorks tools allowed Crump Institute for Molecular Imaging reserachers to quickly set up and develop processing algorithms with a minimum of programming knowledge. The speed at which the FPGAs of the various VHS-ADCs could exchange information (8 Gbps raw) was also critical to the Crump Institute for Molecular Imaging OPET project.