



Instruments That Advance The Art

Pixie-16

16-Channel 100/250/500 MHz PXI Digital Processor

FEATURES

- Accepts input signals directly from detector preamplifier outputs or scintillator/PMT combinations.
- Signals digitized with 100-500 MSPS, 14-16 bit ADC.
- Synchronous acquisition of waveforms up to 163 μ s in length.
- Spectrum from 1K to 32K bins, up to 4.3 billion counts per bin.
- Onboard CFD trigger with adjustable parameters.
- List mode data buffered to allow zero dead-time acquisition.
- PXI backplane trigger distribution and run synchronization.
- Full speed 32-bit, 33 MHz PCI interface to host computer, up to 109 MBytes/s readout sustained.

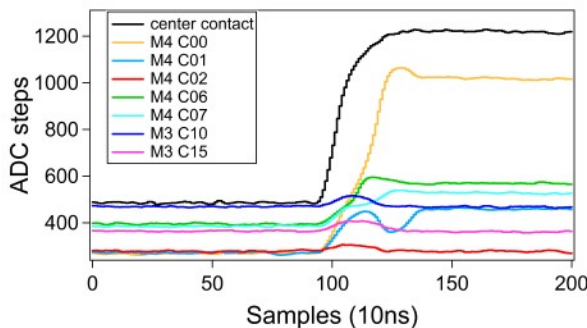
OVERVIEW

The Pixie-16 is a 16-channel all digital signal processor on a single 6U CompactPCI/PXI card. Designed for fast coincidence gamma-ray spectroscopy with segmented detectors or detector arrays, it offers both high speed waveform acquisition and MCA analysis at a low per-channel cost.

Each channel of the Pixie-16 accepts signals from virtually any radiation detector that has an exponential decay output. Incoming signals are digitized with 14 or 16-bit, 100, 250 or 500 MSPS ADCs. The digital data stream is used for triggering, pile-up inspection and filtering in real time. Waveforms with 10 or 4 or 2ns sampling intervals, up to 163 μ s in length, can be stored in a FIFO. Pulse height reconstruction, incrementing a 32K spectrum for each channel and optional pulse shape analysis is performed on an event-by-event basis by a 32-bit floating point digital signal processor (DSP). Waveforms and spectra can be read out at up to 109 Mbyte/s.

Multiple Pixie-16 modules can be synchronized and share basic triggers through the PXI section of the backplane. More than 160 additional backplane connections can be configured to distribute triggers, share multiplicity or coincidence information, or link the DSPs of different modules.

The Pixie-16 is operated through a simple graphical user interface running on Windows. A C driver library, compatible with Linux, is provided for users who plan to integrate Pixie-16 modules into a custom data acquisition system.



Synchronous waveforms acquired from a highly segmented HPGe detector. The center contact signal gives the energy, while segment signals can be used for gamma-ray tracking by pulse shape analysis.

APPLICATIONS

- **Segmented germanium detectors.**
- **Silicon Strip Detectors.**
- **Arrays of scintillation detectors.**
- **Synchronous waveform capture for gamma-ray tracking.**
- **Sub-nanosec timing measurements.**
- **Mixed systems with different detector types.**
All Pixie-16 variants (14-16 bit, 100-500 MSPS) can be operated simultaneously within the same crate with the same software interface.

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SPECIFICATIONS

Front Panel I/O

- 16 analog signal inputs, (SMB). Impedance 50 Ω or 1 k Ω or 4k Ω with jumper selectable 50 Ω input termination.
- 28 digital inputs/outputs, including 4 high speed LVDS input/output connections, 16 LVDS inputs for channel specific gating, LVTTTL inputs and outputs for general purpose.
- Option for external clock through front panel input.

Backplane I/O

- Low skew system clock distributed to all modules.
- Trigger, run synchronization, and global veto lines.
- ~150 configurable connections for complex trigger logic, multiplicity information, or data transfers between modules.

Data Reported

- Energy spectra.
- List mode data: Energies, timestamps (48-bit), QDC sums and waveforms.
- Run statistics.

Pulse Processing

- Signal digitized at 100, 250 or 500 MSPS, 14 or 16 bit.
- Broad range of peaking times, (varies with digitization rate).
- Differential Non-Linearity < 0.5 LSB.
- Integral Non-Linearity < 0.57 LSB/14-bit or <0.38 LSB/12-bit for a dynamic range of 3 MeV.
- Waveform capture at full ADC rate. (10, 4 or 2 ns sampling).

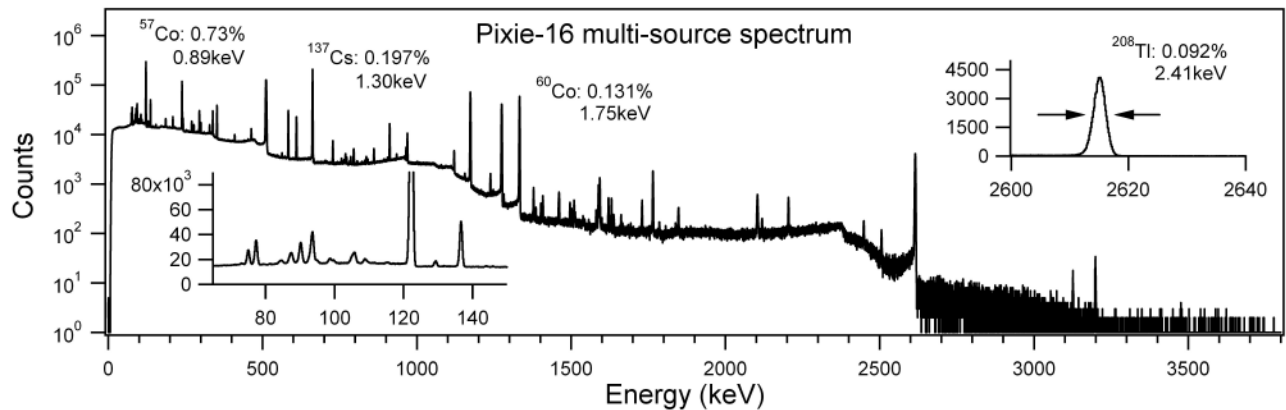
Digital Controls

- Input: Choice of two termination/attenuation options. Full scale range \pm 2V pp.
- Gain: Fixed analog voltage gain; digital adjustment \pm 10%.
- Offset: -1.5V to 1.5V in 65536 steps.
- Filter: Rise time and flat top: 0.02 - 80 μ s in small steps.

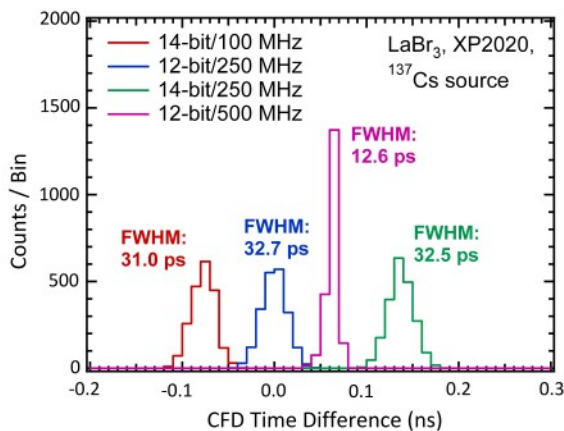
CompactPCI/PXI System

- 6U form factor with standard 3U cPCI/PXI 32-bit, 33 MHz interface.
- Customized power supplies and backplane I/O.

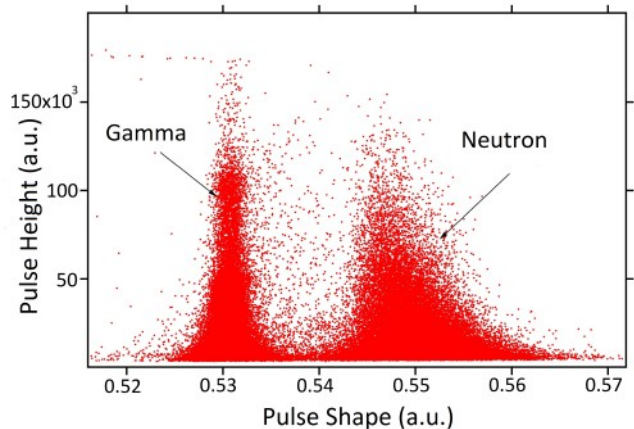
SAMPLE PERFORMANCE



Multi-source spectrum acquired with Pixie-16 and a 40% HPGe detector



Histogram of measured time difference ΔT between two channels, (common signal divided with 50 Ω splitters, - essentially the ADC's intrinsic resolution).



Neutron Gamma discrimination by pulse shape analysis using the Pixie-16