



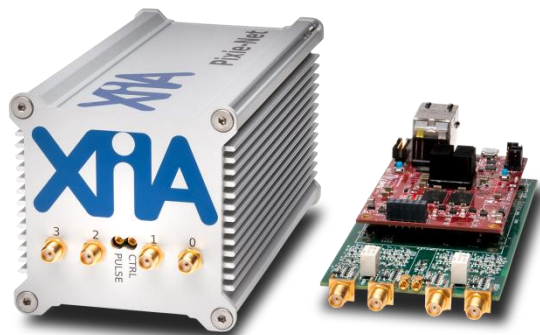
Instruments That Advance The Art

Pixie-Net

4 channel 250 MHz Desktop Digital Spectrometer

FEATURES

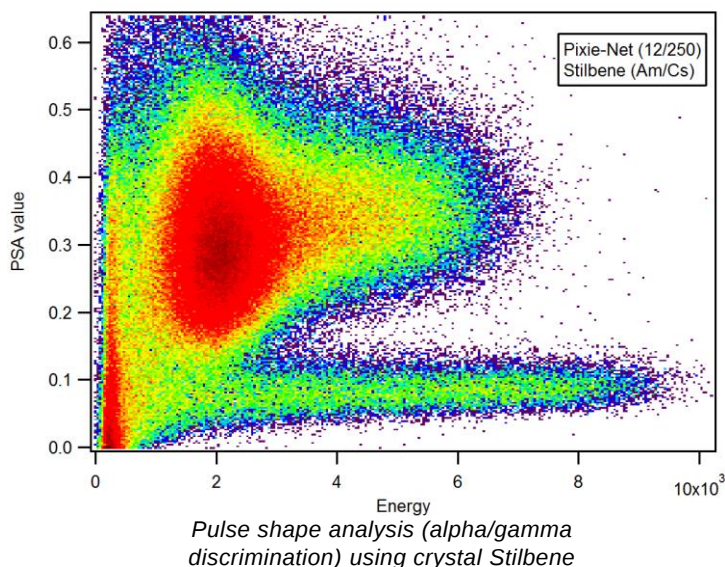
- Compact standalone detector readout electronics.
- 4 channels, 12 or 14 bit, 250 MSPS pulse processor.
- 32K on-board MCA spectrum per channel.
- Waveform capture and Pulse Shape Analysis.
- Sub-nanosecond Timing Resolution.
- Embedded Linux platform.
- Front and back panel digital I/O signals.
- Gbit Ethernet, local USB storage, web interface.
- Approx. 8x8x14cm, 1 kg, 18 W
- Low cost



OVERVIEW

The Pixie-Net is a multi-channel digital spectrometer for radiation detectors in desktop format with integrated networking and USB resources. Designed for high-precision coincidence gamma-ray spectroscopy using HPGe detectors, scintillators, or silicon detectors, the Pixie-Net offers not only waveform digitization and capture but also pulse height measurements, on-board energy histograms, time stamping and constant fraction timing, pileup inspection, external gating and online pulse shape analysis. Besides nuclear spectroscopy, the Pixie-Net can be used for neutron/gamma discrimination, time-of-flight measurements, and coincidence/anti-coincidence measurements.

The Pixie-Net combines an embedded Linux system with XIA's digital pulse processing developed on the Pixie PXI spectrometer series. Incoming signals are digitized at 250 MSPS with 12 or 14 bit ADCs. Using a ZYNQ All Programmable SoC with programmable logic (FPGA) and dual-core ARM[®] processor on the same chip, the ADC data stream is captured and processed in the FPGA section and the ARM processor writes the results to a removable USB drive or makes them available on a web server. Multiple units can share signals through GPIO.



APPLICATIONS

- Scintillator, HPGe, Si detectors
- Real-time Pulse-Shape Discrimination
- Clover detectors
- Distributed Data Acquisition
- Homeland Security
- OEM systems
- Remote monitoring

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SPECIFICATIONS

Front/Rear Panel I/O

- 4 analog signal inputs. Impedance 50 Ω or 2 k Ω .
- 10 digital inputs / outputs for triggers or veto signals
- 5V power supply and control for active PMT bases
- Simple pulser for system check and diagnostics
- RJ45 Ethernet
- USB type A (for peripherals)
- USB type micro-B (for UART control from PC)

Zynq "System on Chip" Platform

- Dual-core ARM[®] Cortex[™]-A9 with Xilinx 7-series FPGA section
- Gigabit Ethernet, 1GB RAM, USB2.0, 16GB SD
- PMOD expansion port (for Wi-Fi, GPS, GPIO, I2C, SDI, LEDs)
- Linux based on Ubuntu 18
- Local file storage
- IEEE 1588 timing compatible

Digital Controls

- Analog gain and digital gain adjustment
- Energy filter (0.048 - 63.4 μ s).
- Trigger filter and threshold
- Waveform length and delay
- Event acceptance: Hit pattern, external gating, coincidence window, input delays

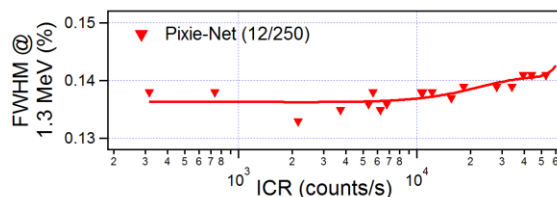
Pulse Processing

- Signal digitized at 250 MSPS, 12 or 14 bit. (inquire for higher rate/precision, or more channels)
- Energy filter operated at 125 MHz.
- Real time pulse shape analysis (charge integration)
- Real time constant fraction timing

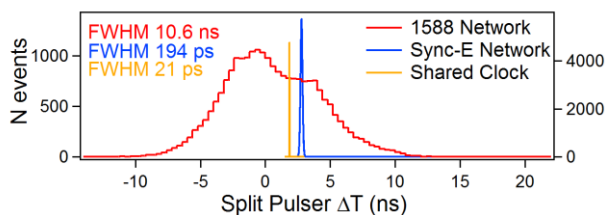
Data Reported

- Energy spectra (32K per channel).
- List mode data (energies, timestamps, and waveforms).
- Run statistics.

PERFORMANCE



Energy resolution as a function of input count rate.



Timing resolution within a Pixie-Net (shared clocks) and between two Pixie-Nets (network synchronization).

SOFTWARE

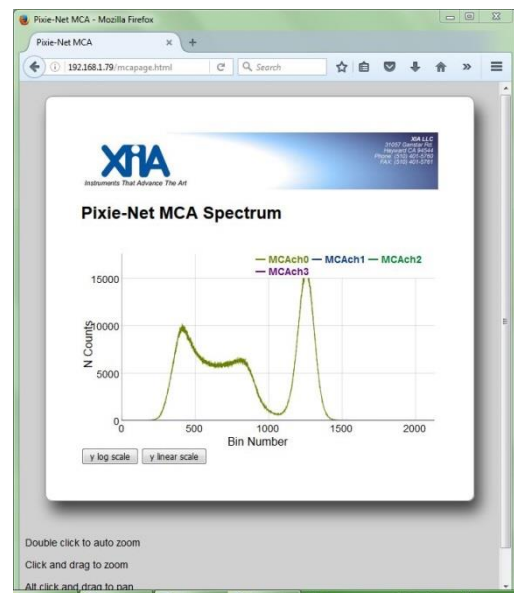
The Pixie-Net runs a customized version of Ubuntu 18. Many applications from the Linux universe are installed (gcc, ftp, http, ssh, etc); more can be added by the user. A number of simple programs read results and waveforms from the FPGA section, format and store them to file, and make them available on a web server. Settings and results can be managed through a web interface provided by XIA, or with a basic web API for common acquisition/analysis tools (e.g. Igor Pro) or a user's own interface. All parameters can be saved to disk for easy switching between applications.

The Pixie-Net is a standalone data acquisition system, eliminating the need for a host PC and software drivers to control and readout a USB or PXI peripheral. Data acquisition can be set up, started/stopped, and monitored over the network, with data saved to local storage or shared over the network.

Options for operation include:

- Remote login to the embedded Linux system via a UART/SSH terminal program or via Remote Desktop
- Monitor MCA spectra and run statistics via a web page hosted by the Pixie-Net Linux system
- Save data to mounted network drive or local USB drive
- Download MCA spectra, run statistics, and list mode data files from web server
- Integrate web API into front end GUI built on analysis software

Multiple Pixie-Net units can form a distributed data acquisition system synchronized over the data network. Each Pixie-Net can locally collect data with timestamps synchronized to sub-microsecond (or even sub-nanosecond) precision using IEEE 1588 clock synchronization or synchronous Ethernet, implemented in the Zynq Ethernet controller or a secondary Ethernet PHY.



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