Pixie-Net

*Instruments That Advance The Art*

# Pixie-Net

## 2-8 channel 125-500 MHz Desktop Digital Spectrometer

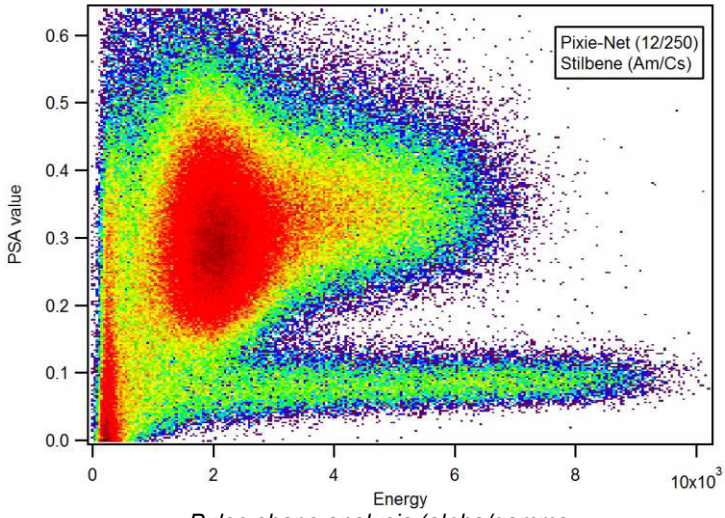
### FEATURES

- **Compact standalone detector readout electronics.**
- **2-8 channels, 12-16 bit, 125-500 MSPS pulse processor.**
- **32K on-board MCA spectrum per channel.**
- **Waveform capture and Pulse Shape Analysis.**
- **Sub-nanosec 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 125-500 MSPS with 12-16 bit ADCs, depending on the option purchased. 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 though GPIO.




*Pulse shape analysis (alpha/gamma discrimination) using crystal Stilbene*

### 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

- 2-8 analog signal inputs. Impedance 50 Ω or 2 kΩ.
- 10 digital inputs / ouputs 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 wifi, GPS, GPIO, I2C, SDI, LEDs)
- Linux based on Ubuntu 12.04 LTS
- Local file storage
- IEEE 1588 timing compatible

## Digital Controls

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

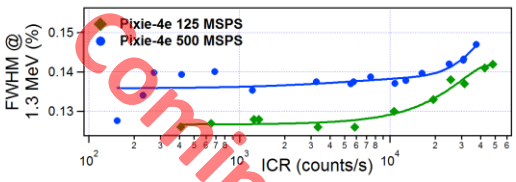
## Pulse Processing

- Signal digitized at 125-500 MSPS, 12-16 bit.
- Waveform capture at full ADC rate.
- 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.*

*Performance is expected to be largely equivalent to Pixie-4 Express, with the following exceptions:*

- *Lower processing throughput*
- *Lower data rate to file*
- *Shorter maximum waveform length*

Coming Soon

# SOFTWARE

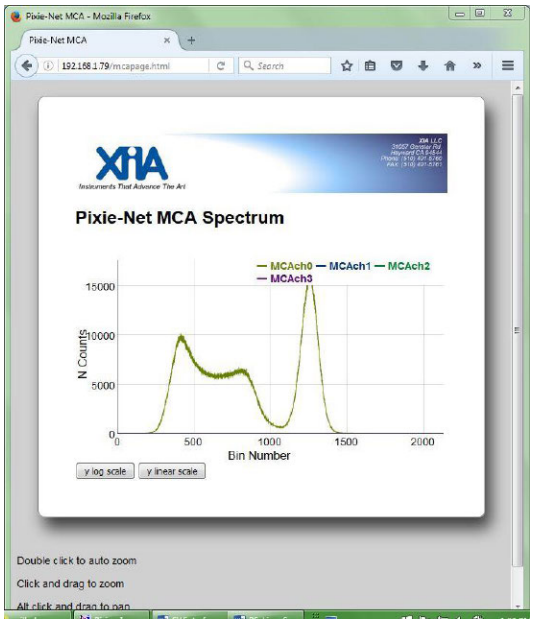
The Pixie-Net runs a customized version of Ubuntu 12.04 LTS. Many applications from the Linux universe are installed (gcc, ftp, http, ssh, etc), more can be added by the user. A number of simple programs read results and waveforms from the FPGA section, format and store them to file, and make them available on a web server. Settings and results can be managed through a web interface provided by XIA, or with plug-ins for common acquisition/analysis tools (LabVIEW, MATLAB, Igor Pro, etc). 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 basic terminal program
- 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 can be assembled as a distributed data acquisition system, each Pixie-Net collecting locally, yet synchronized over the network. Hardware support for IEEE 1588 clock synchronization is included in the Zynq SoC, allowing sub-microsecond synchronization of multiple devices.





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