DXP xMAP

Instruments That Advance The Art

DXP xMAP

Four-channel PXI Digital X-ray Processor

FEATURES

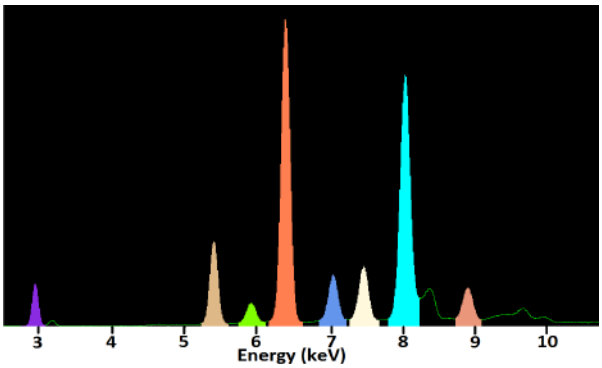
- **Four channels of pulse processing electronics in a single PXI/cPCI module with full MCA per channel.**
- **Maximum throughput up to 1,000,000 counts/sec/channel.**
- **Low noise front end offers excellent performance in the soft X-ray region.**
- **Facilitates automated gain setting and calibration to simplify tuning array detectors.**
- **Synchronization of data acquisiton between channels and multiple modules.**
- **Dead-time free Fast Mapping data transfer using 4MB buffer.**

OVERVIEW

The DXP xMAP packages 4 high speed digital signal processors into a compact 3U PXI/cPCI module. Each processor offers a peaking time range of 0.1 -100 µs, and can ouput up to 1,000,000 cps into the spectrum. The DXP xMAP has excellent noise performance and is well suited for energy dispersive x-ray measurements over the extended range 0.1 - 100 keV, using multi-element detector arrays with preamplifiers of any gain. It offers computer control over all amplifier and spectrometer controls including gains, peaking times, and pile-up inspection criteria.

The xMAP's trapezoidal digital FIR filters achieve significantly enhanced data throughputs at comparable energy resolutions when compared to analog systems, but at a lower cost per detector. Energy resolution is nearly independent of count rate up to maximum throughput. The full computer interface allows all data collection and calibration operations to be automated, greatly reducing the possibility of human error. Data can be collected either into a full spectrum of up to 8K channels or up to 32 regions of interest (ROIs), and passed to the host computer without stopping data collection. Full spectrum storage allows peaking fitting and/or deconvolution to be performed on a detector-by-detector basis, leading to more accurate intensity extractions, particularly where scatter peaks are changing rapidly with energy.

The DXP xMAP operates easily with a wide range of common reset-type detector/preamplifier systems of either polarity. There are several timing modes, including fast scanning with full MCA readout or multiple ROIs, as well as list mode readout, where time and energy are stored for each event. The onboard memory manager allows full access to the data even during data collection. For deadtimeless operation with fast scanning, the memory can be organized into two independent banks, allowing readout of one bank while the other is filled. Peak read-out speeds across the PCI interface exceed 100 MB/sec.



ROIs in an XRF spectrum from a complex metallic sample, collected with a 30-sqmm SDD

APPLICATIONS

- **Silicon Drift Detectors (SDDs):** Quad detector serviced by one xMAP card.
- **Multi-element HPGe X-ray detector arrays.**
- **Monolithic segmented HPGe X-ray detectors.**
- **High rate synchrotron beamline research.**

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SPECIFICATIONS

Front Panel Inputs

- **Analog:** 4 preamp signal inputs with jumper-selectable gain:
  0db (x1) with 10kΩ impedance, ± 4V range.
  12dB atten. (1/4 gain) with 1kΩ impedance, ± 16V range.
  Works with reset type preamplifiers of either ploarity.
- **Digital:** (TTL). Single LEMO connector pogrammed for one of the following functions:
  Gate: Suppresses data collection when actively held low.
  Sync: Logic input to control time resolved data collection, such as scanning.
  LBUS: Used to connect the backplane bussed run synchronization line between PXI segments.
- All digital signals are bussed along the PXI backplane. For Gate and Sync, one signal per backplane segment must be provided.

Interface

- Compact PCI standard, 33 MHz, 32-bit.
- Peak PCI transfer rate exceeds 100 MB/sec.

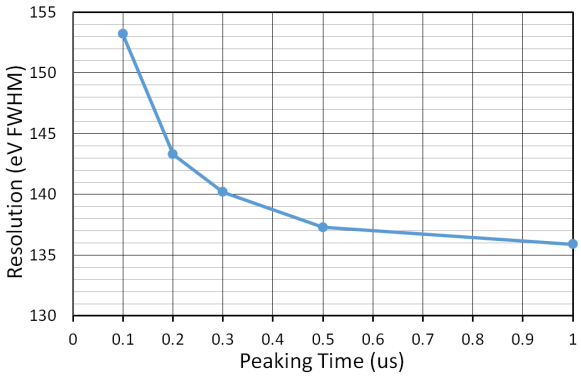
Digital Controls

- **Gain:** 100x range, controlled by 16-bit DAC. Preamplifier gain range from 0.1 to 10 mV/keV at standard settings.
- **Filtering:** Peaking times from 0.1 to 100 µs. Adjustable flat top to eliminate ballistic deficit effects.
- **Pileup:** Fast channel filter time, pulse detection threshold, and fast channel pile up may be set independently to optimize performance. (Pulse-pair resolution typ.<100 ns)
- **Data collection:** MCA limits, bin widths, ROIs.

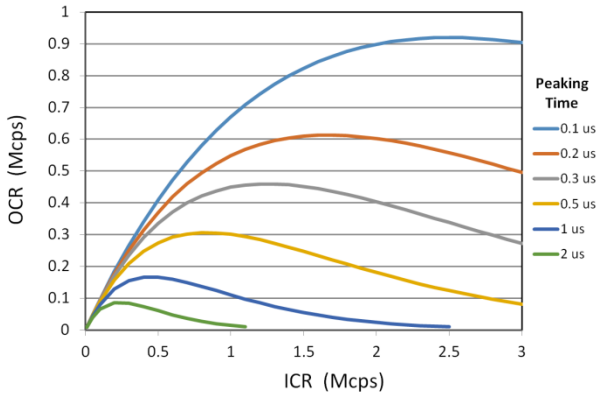
Pulse Processing & Data Outputs

- **Digitization:** 50 MSPS, 14 bit.
- **Spectrum:** Up to 8192 channels (32 bits deep).
- **ROIs:** Up to 32 ROI regions can be defined.
- **Timing:** Multiple spectra or sets of ROIs can be stored; continuous operation using dual-bank memory.
- **Statistics:** All values required for pileup correction are available; livetime, realtime, input events, output events.
- **Diagnostics:** ADC trace, baseline distribution and history.

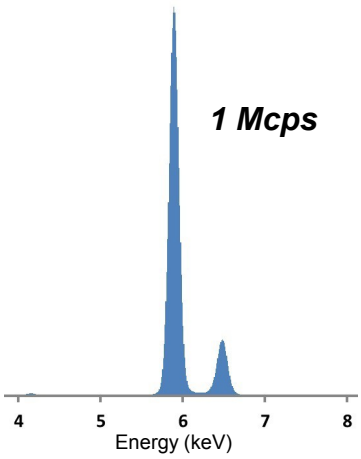
SAMPLE PERFORMANCE



*Energy Resolution at 5.9 keV vs Peaking Time with 30-sqmm SDD at **1 Mcps ICR***



Filter throughput rate at various peaking times for 0.1µs gap time



Mn spectrum collected at 1 Mcps with 30-sqmm SDD. 139.9 eV FWHM. 0.3µs peaking time.

SOFTWARE

XIA provides xManager, a software package primaily intended for setting up the xMAP operating parameters with detector arrays (including multi-channel gain calibration), for performing basic data acquisition and storage functions, and for generating configuration files for use by other control packages. Handel, a comprehensive set of C libraries, simplifies integration of xMAP control into existing data collection software. Several alternative control packages are available, either commercially or as open-source from National Laboratory groups.

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