

Acquiring Data for Event Reconstruction and Analysis

Submitted by [Keysight Technologies](#)

Your test goal is to quickly capture many different signals generated from an event and reconstruct the data for review and analysis. Timing and synchronization of the signals must be perfectly aligned in order to properly reconstruct the original event. Some signals may require further processing or conversion such as those acquired through transducers. How do you ensure test results are accurately captured? The challenges of complex high-speed multichannel acquisition systems are discussed further in this article.

Test system challenges

When collecting large amounts of data to reconstruct real-time and fast transient or single-shot events engineers face several test challenges. Selecting the best instruments to construct a reliable test system for data collection is most important. Capturing multiple real-time signals generated during the event requires a high-speed digitizer that can make many very fast, accurate measurements. The performance of the digitizer determines the quality of the signal measurements, with accurate triggering and timing across all the channels to ensure reliable reconstruction of the acquired data. Channel synchronization can become an even greater challenge as the number of monitored signals grows, requiring a complex multi-channel test system configuration.

Various transducers, detectors or instruments such as photomultiplier tubes (PMT), beam current transformers, spectrometers, or fast diodes may be used to capture energies that contribute to the reconstruction of the actual event. Measurements and reliable conversions are needed to accurately calculate the true energy source measured by transducers.

Other considerations include software, space and power. Software provides system control, measurement conversions, data storage management and signal analysis. Accommodating a small test area and limited power can be managed by selecting a digitizer in a format that offers flexibility for high channel count, power management and a smaller footprint such as PXI or AXIe.

Solution

A combined AXIe hardware and software solution offered by Keysight Technologies includes the AXIe M9703A and M9709A digitizers with the U1092A S0_x Acqiris MAQS multichannel acquisition software. The M9703A and M9709A digitizers provide 8 channels with 12-bit resolution or 32 channels with 8-bit resolution, respectively and enable synchronized channels across AXIe chassis for systems with up to 96 channels. On-board FPGA, consisting of four Virtex-6 FPGA, provides real-time processing for data reduction. The flexible AXIe configuration includes a chassis and controller with triggering and clock options for channel synchronization. Very fast data capture with measurement fidelity at GHz speed ensures crucial data is capture. Low noise and high dynamic range of the analog-to-digital conversion instill confidence in the acquired results for detailed event analysis.

An ideal test system for this application would provide accurate data capture, many fast reliable measurements, synchronized channels, precision triggering, system control, fit into a specific test area and be within power limits while achieving extreme speed and precision measurements.

For more information on the AXIe digitizers and use for large physics experiments click here: <http://literature.cdn.keysight.com/litweb/pdf/5991-0063EN.pdf>