

AXIe in Big Physics Experiments

By [Frank Corry](#) and [Sophia-M Bowers](#)

Big physics experiments are critical for the advancement of fusion research (which holds the promise of clean sustainable energy), and particle physics research (which seeks to understand the origins of the universe through investigation and discovery of sub-atomic particles). These are often single-shot experiments, meaning researchers must take care in the design and set up of the experiment as they only have one chance to capture the data. Experiments can easily require tens of data acquisition channels, and some may even require hundreds, with many of these channels being digitizers that record short transient signals, providing an insight into dynamic phenomena. These high channel count systems must be integrated into the hardware environment of the experimental machine, which can be problematic due to space and power constraints.

AXIe provides a [robust platform](#) for big physics experiments, with AXIe based digitizers offering industry leading digitizer performance and channel density. For example:

- For performance, Keysight's [M9710A](#) provides 4 channels with 10-bit resolution at 5 GS/s, and with up to 8 GB of acquisition memory. It can also operate in interleaved mode, providing 2 channels with 10-bit resolution at 10 GS/s.
- For flexibility, Keysight's [M9703B](#) provides 8 channels with 12-bit resolution at 1.6 GS/s, and with up to 16 GB of acquisition memory. It can also operate in interleaved mode, providing 4 channels with 12-bit resolution at 3.2 GS/s.
- For channel density, Keysight's [M9709A](#) provides 32 channels with 8-bit resolution at 1 GS/s, and with up to 16 GB of acquisition memory.

Getting the right performance in the required footprint is only part of the challenge, as we also need a mechanism to control and configure the large number of channels in the acquisition system, especially if they are distributed in multiple chassis in various locations.

This is where a client-server-based software solution can help. Keysight's [U1092A](#) MAQS (Multichannel Acquisition) software provides unique features for massively multi-channel digitizer-based data acquisition systems. It was designed specifically for multichannel acquisition to enable both configuration management and visualization of data for hundreds of channels in a distributed system from a single console.

The fully configurable graphical user interface allows easy selection of instruments and channels for configuration of the acquisition parameters, with acquired data being presented in multiple, fully configurable display windows for immediate viewing. Additional display functions provide multi-record overlay, persistence, frequency spectrum (FFT with choice of windowing and selectable section of the signal) and scalar computations on each trace.

A special option for triggered single shot experiments adds advanced configuration management, digitizer memory protection locking and a fail-safe operation mode to prevent externally induced issues such as manipulation error, and connection problems.

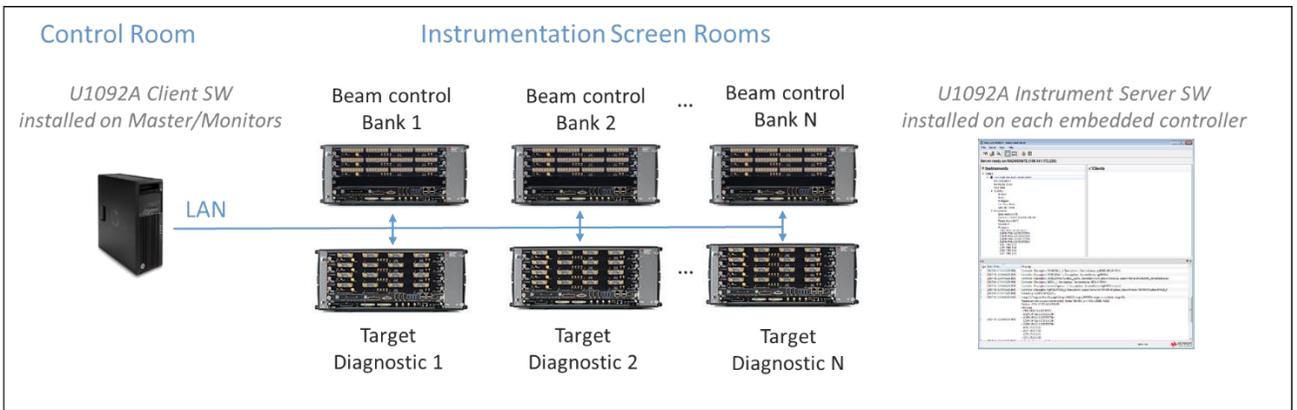


Figure 1: Large Single Shot Experiment example with MAQS SW