A Brief Discussion of NIM, CAMAC and VME Standards

Timothy Hoagland

December 2, 2004

There have been three major data acquisition standards used in modern nuclear physics. The first to be introduced was the NIM standard and was used to provide power to for the electronics. CAMAC went further and allowed data transfer on the crates backplane. The current standard is VME, expanded on CAMAC by providing more options and a faster bus speed.

In today's modern labs you are likely to find any or all of these standards coexisting. For that reason it is necessary to have a working understanding of all three

1 NIM

The NIM standard is the first crate standard widely accepted by physicists. It provided a way to organize and distribute power to their electronics. The power was distributed by a series of connectors on the back of the crate. A low voltage power supply is either behind the crate or sat in the crate along side the other modules. Typical voltages distributed were +/-6V, +/-12V, and +/-24V, although many custom power supplies have been built for NIM crates. NIM crates have 12 slots.

Today NIM crates are often used for small setups with only a handful of detectors because their low overhead makes setup easy. They are often used in larger experiments for setup and to handle logic signals and analog electronics. Some of the most often used modules are amplifiers, gate and delay generators, discriminators, high voltage modules, and linear fan-in fan-out units.

One of the biggest problems with NIM is the low channel density. Because NIM modules use knobs and switches on the front panel, which take up a lot of space, to adjust parameters, the number of channels per module was always low.

2 CAMAC

CAMAC answers many of the shortcomings of NIM. CAMAC offers a backplane that could transfer data. That means the parameters for each channel can be adjusted via the backplane and data can be readout the same way, opening the front panel up for more channels of input. Each CAMAC crate has 25 slots, which meant twice as many modules than a NIM crate. The last two slots in the crate are always reserved for the CAMAC crate controller, which interfaces the crate with a computer. The backplane had one card style connector for each slot, which the modules plugged into.

CAMAC is more overhead intensive than NIM because even for small setups programs had to be written and tested. For many years most medium to large-scale nuclear physics were done using CAMAC modules. Typical modules used in a CAMAC crates are ADC's and TDC's.

As experiments grew and more modules were needed with a higher channel density the CAMAC bus was not able to keep up. There were several extensions made to the CAMAC modules to help them keep up, FERA bus being the most popular.

Most of the CAMAC crates and modules found in experiments today are there because they were already owned, or the software had already been developed, making the experiment cheaper and/or easier.

3 VME

VME like CAMAC offered a rear backplane for fast and efficient data transfer. However, VME offered a faster and more versatile bus. The VME bus is industry standard used in physics this means that there is a larger variety of crates and modules commercially available at low prices than for CAMAC. The faster bus also meant that more data could be transferred and channel density increased. This makes VME a very attractive alternative to CAMAC.

VME crate have slots for 21 modules, the first is reserved for a crate controller. The VME backplane has two 3-row connectors (J1 & J2) per module, these are for both data and power distribution. VME also offers options for incorporating CAMAC crates into a VME setup this is done with a VME to CAMAC bridge and allows experimenters to use CAMAC modules and crates they already have keeping experiment cost down. VME is currently the used in most large-scale experiments and is becoming more popular in smaller scale experiments.

VME has several extensions. VME 430 added a third, smaller, connector to the backplane, called Jaux this connector is used for additional power distribution and user defined operations. VME 64X is an extension of VME 430 and adds two rows of connectors to each of the three connectors, the extra rows were added in such away that a regular VME module would be compatible with VME 64X.

This is intended only as a general introduction to the three major electronics standards used by physicists. This should not be considered in any way complete. There is much more to know about each of these standards and you should pursue additional information about a standard if you find you need it.

If you feel that something important has been left out here please contact **daqdocs@nscl.msu.edu** .