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Application of new PICMG MicroTCA for physics specifications to accelerator control

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The PICMG xTCA for Physics Specifications Extensions nearing completion are being tested in linac controls applications at DESY (EU XFEL) and at SLAC (ILC R&D, LCLS). New standard crate and module prototypes have been developed through industry partners while a flexible controls architecture is emerging based on a few powerful generic AMC modules backed by application-specific µRTMs. The lab-industry collaboration is proving highly successful in leveraging the strengths of the community for rapid development and deployment of crates and modules for the next-generation standard. Specific applications in progress at DESY and SLAC as well as work of the standards collaboration will be described.
PICMG – PCI Industrial Computer Manufacturers Group
AMC – Advanced Mezzanine card
µRTM – Micro Rear Transition Module

Summary

The simultaneous emergence of the competing ILC and TESLA 1 TeV electron-positron colliders sparked a strong interest in the ATCA and MicroTCA high availability high bandwidth serial backplane standards announced by PICMG in mid 2004. A major motivation was that the availability of the machines would be severely compromised without improvements over all subsystems that could not be achieved by trying to improve component reliability; N+1 redundant systems were needed. The ATCA model provided an architecture to gauge not just instrumentation and controls but all major subsystems. However the other major feature of ATCA was its complete shift to switched serial backplane technology which was driven by the telecommunications industry and supporting computing chip manufacturers.

There were many well- documented experiments being made among the physics community to exploit this architecture during this early period but it was only after two workshops 2007 and 2008 that an interest group converged in a decision to form a Subcommittee for Physics under PICMG. A primary reason was that although neither ILC nor TESLA was approved, the XFEL was approved and provided a strong motivation for both LLRF and Controls groups at DESY to begin actual prototyping with both the ATCA and MicroTCA platforms. The insights gained at DESY were pivotal in shaping the views of the new committee in their quest to enhance both ATCA and MicroTCA platforms for physics applications.
The new committee was chartered in early June of 2009 and set up three Technical Subcommittees: Coordinating; I/O, Timing and Synchronization; and Software. These report independently to the PICMG Technical Officer and are generally called Coordinating, Hardware and Software. The work product of the Coordinating committee is to provide overall management and guidance, while the Hardware committee develops thoroughly documented Specifications Extensions for I/o and timing and the Software Committee develops Guidelines to promote greater hardware-software interoperability and high availability. Finally, the IPMI, Intelligent Platform Management Interface underlying ATCA plays a pivotal role in the future success of large systems. This standard pre-dates ATCA and is well proven by previous incarnations in the Telecom industry. Capturing the functionality of this system in physics products and hewing to its standards brings unprecedented abilities to build and maintain large complex machines with availability heretofore not possible. Again, the utilization of IPMI is not limited to instrumentation and control systems but extends to major power subsystems as well. The large real cost of an idle mega-machine easily justifies the investment in these new platforms and management tools.

The paper will discuss specific examples of new implementations mainly in accelerator control and report briefly on the ongoing work the lab-industry standards collaboration.

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