

Progress of MTCA Platform and Applications in Large-scale scientific facilities

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Abstract: As an open-standard-compliant carrier platform, the Micro Telecommunications Computing Architecture (MTCA) chassis plays a key role in high-end computing and communication systems, and serves as a critical foundation for the technological upgrading of large-scale scientific facilities. In terms of platform development, the complete MTCA chassis components conforming to the MTCA.4 specification have achieved independent R&D and mass production. Constructed from high-strength aluminum alloy, the chassis is compatible with 19-inch standard racks and supports both 2U (6-slot) and 10U (12-slot) configurations to adapt to different scenarios. The chassis backplane, combined with a self-developed MCH, supports a differential data rate of 10.3125 Gbps, enabling a high-speed data exchange center. Together with the Hygon CPU, it realizes local/remote communication between AMC modules and processors, ensuring full domestic compatibility. Internally, a 2000W secondary power conversion module, a Power Management module and a domestic chip-based management module work together to ensure stable operation. Meanwhile, a high-performance Advanced Integrated Mezzanine Carrier (AIMC) board, centered on a Zynq processor and supporting scalable deployment and AI model integration, has also been developed synchronously as a supporting component of the platform.

In the aspect of application in large-scale scientific facilities, a high-speed digital Data Acquisition and Processing (DAQP) system has been developed based on the MTCA architecture. This system integrates a real-time pulse signal processing algorithm developed via FPGA technology, and has been successfully applied to neutron energy spectrum measurement in the EAST experiment, achieving a data transmission rate of 1.6 GB/s. This application not only validates the reliability and high performance of the domestically produced MTCA platform, but also provides effective technical solutions for nuclear fusion diagnostic and control system design, as well as high-precision data acquisition and processing in other large scientific facilities.

Keywords: MTCA.4; MCH; AMC; Nuclear Fusion; NES Neutron Energy Spectrum System

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