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A robust and redundant design of the fast protection system for CSNS-II

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The Fast Protection System (FPS) is critical for ensuring the efficient and safe operation of the large-scale scientific facility at the China Spallation Neutron Source (CSNS). To address the enhanced requirements of CSNS-II, an advanced FPS architecture has been developed, leveraging high-performance field-programmable gate arrays (FPGAs), high-speed rocket IO serial communication links, and the advanced telecommunications computing architecture (ATCA) platform. The proposed hardware framework guarantees a system-wide response time of less than 8 microseconds, accounting for fiber optic transmission delays, circuit propagation times, and interlock logic processing. Compared with traditional FPS, the upgraded FPS architecture integrates critical diagnostic signals from devices such as the beam loss monitor (BLM) and the differential beam current monitor (D-BCM), improving in response time and reliability. This paper outlines the design principles, system architecture, and implementation strategy, achieving high availability, reliability, and real-time performance. The enhanced FPS is essential for maintaining operational stability with the long-term operation at higher beam powers.

Footnotes

Funding Agency

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Yes

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