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Evaluation of the Backup Signal-Processing System of the KSTAR Quench Detection System

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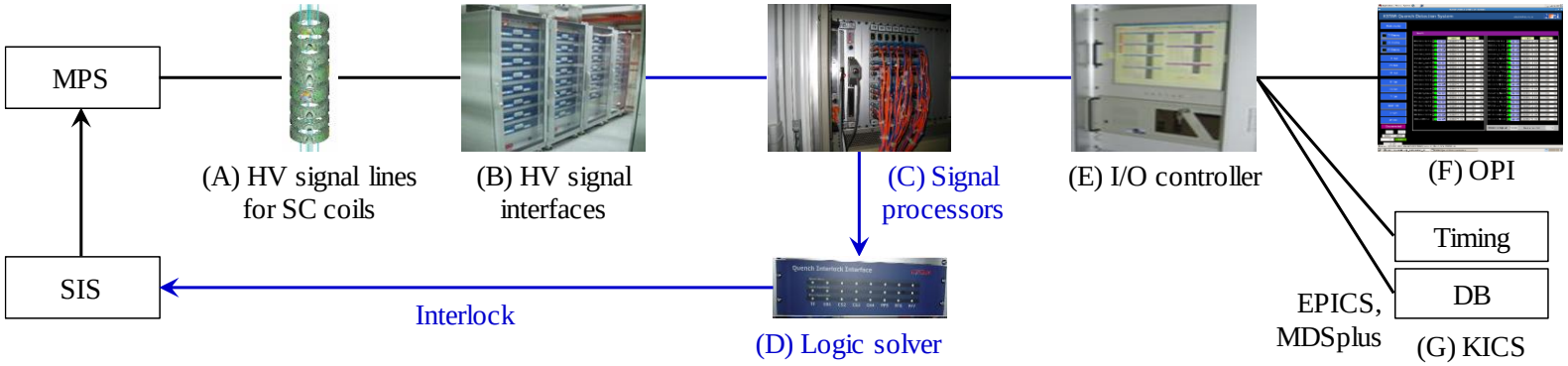
Hirofumi Yonekawa, Jinsub Kim, Young-ok Kim,
Kwang-pyo Kim, and Yong Chu

NFRI 국가핵융합연구소
National Fusion Research Institute

Evaluation of the Backup Signal-Processing System of the KSTAR Quench Detection System (1/2)

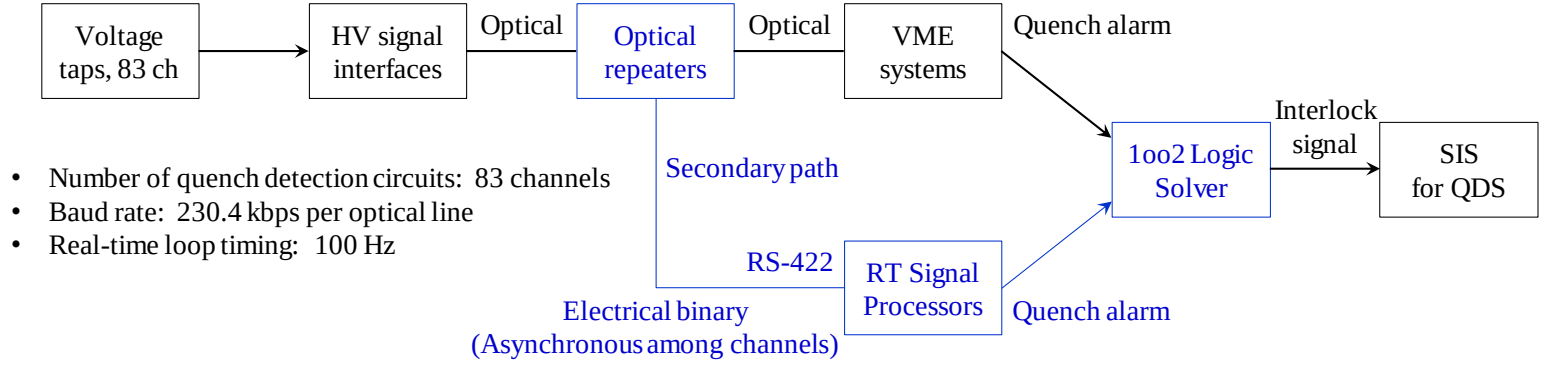
Quench Detection System

- Quench is an unrecoverable thermal runaway in superconductors by breaking critical conditions.
- Emergent discharge is necessary to prevent from overheating the superconductors if quench occurs.
- Quench may be detected by discriminating a change of physical parameters such as conductor voltage.



Backup Signal-Processing System (BSPS)

- BSPS duplicates the path of quench detection signals without any change of the existing components.
- BSPS conducts quench detection by using hardware logics including FPGAs.
- BSPS and the existing components simultaneously operate to detect quench with 1oo2 voting logic.



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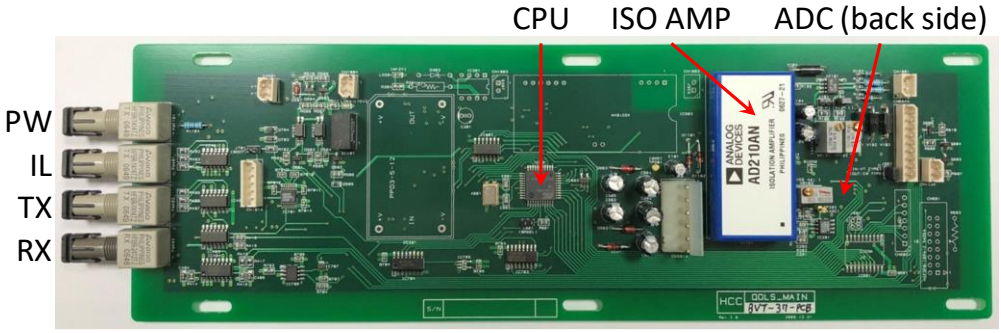
Technical Features



Control Module of the HV Signal Interface, 83 EA

VME System, 3 sets

Optical-Signal Repeater, 3 sets

RT Signal Processor, 7 sets

Logic Solver, 1 set

Remarks

- BSPS may take over the total functions of the VME systems if the VME systems break down.
- BSPS demonstrated expected functions for the PF1–PF4 coils in the KSTAR campaign 2018, while the existing components were also fully operational with no modification.
- BSPS's FPGAs operated at a RT cycle latency of 10 ms in a time accuracy better than 1 μs, and there was no malfunction during the plasma experiments in the last KSTAR campaign.