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Development of multi-channel time-division multiplexing RF signal conditioning front-end for CAFE2 Beam Position Monitor system

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The construction of China Accelerator Facility for Superheavy Elements(CAFe2) is advancing based on Chinese ADS Front-end Demo Linac(CAFe). However, the original Beam Position Monitor(BPM) read-out electronics of CAFe could not meet the requirements of the CAFe2 BPM probes in terms of quantity and the measurement demands of low-intensity heavy ion beams. In response to this challenge, a high-speed RF switch array supporting multi-channel multiplexing, adjustable gain and filtering was developed. This array served as the RF signal conditioning front-end, together with the RF front-end and digital signal processing platform, to constitute a complete BPM read-out electronics. Laboratory testing validated the feasibility of the high-speed RF switch array and the entire read-out electronics. Compared with traditional read-out electronics, the read-out electronics equipped with the high-speed RF switch array enables the measurement of 32 signals from 8 BPM probes. This approach significantly improves the system's integration and reusability, while offers an efficient solution for implementing multi-channel time-division multiplexing measurement under different beam intensities and operating frequencies. Additionally, by simultaneously accessing signals from multiple BPM probes, this system better supports differential measurement. Overall, the high-speed RF switch array not only meets the requirements of CAFe2 but is also applicable for other accelerators with multiple BPM probes.

Footnotes

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Primary author: DENG, Pengfei (Institute of Modern Physics, Chinese Academy of Sciences)

Co-authors: QIU, Feng (Institute of Modern Physics, Chinese Academy of Sciences); HUANG, Guirong (Institute of Modern Physics, Chinese Academy of Sciences); Ms MA, Jinying (Institute of Modern Physics, Chinese Academy of Sciences); HE, Yuan (Institute of Modern Physics, Chinese Academy of Sciences); Ms MA, Zhen (Institute of Modern Physics, Chinese Academy of Sciences); GAO, Zheng (Institute of Modern Physics, Chinese Academy of Sciences); Mr ZHU, Zhenglong (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: DENG, Pengfei (Institute of Modern Physics, Chinese Academy of Sciences)

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