Contribution ID: **50** Type: **Poster Presentation**

Development of multi-channel time-division multiplexing RF signal conditioning front-end for CAFe2 Beam Position Monitor system

Tuesday, 10 September 2024 16:00 (1h 30m)

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

Funding Agency

the National Natural Science Foundation of China (No. 12205344) and "Studies of intelligent LLRF control algorithms for superconducting RF cavities"(No.E129851YRO).

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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)

Session Classification: TUP: Tuesday Poster Session

Track Classification: MC3: Beam Position Monitors