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Design and CW RF transmission test up to 100 kW of L-band high-power input coupler

Monday 22 September 2025 14:30 (3 hours)

A high-power input coupler was developed to transmit 100 kW-class RF power in continuous wave (CW) mode to a 1.3 GHz conduction-cooled superconducting accelerator. Both RF and thermal design optimizations were carried out to ensure efficient performance and compatibility with cryogenic constraints. Results of RF simulations showed a reflection coefficient of S1,1 = −44 dB at 1.3 GHz and a bandwidth of 24.6 MHz at the −20 dB level. Thermal simulations estimated the total static heat load to be approximately 1.2 W at the 4 K stage and 11.3 W at the 35 K stage, which is well within the cooling capacity of the available cryocoolers. To suppress the temperature increase under high RF power transmission, active water cooling was integrated into critical components, including the warm inner conductor, warm outer conductor antenna, and RF window. The newly developed coupler was successfully tested at a test stand under RF power up to CW 100 kW at room temperature conditions. A temperature rise at the inner conductor, which is the most critical component, was 15 ℃. A maximum temperature rise of 19 ℃ was recorded at the doorknob. The high-power test results demonstrated the coupler's capability to handle the target power level reliably while effectively mitigating thermal load during CW operation.

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Yes

Footnotes

Funding Agency

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