

Effective thermal load mitigation in cERL injector coupler through warm section modification

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Fundamental power couplers are utilized in SRF accelerators to transfer RF power from a source to the accelerating cavities. However, the issue of thermal heat load during high-power transmission in continuous wave (CW) mode operation poses a significant challenge for power couplers. To address this concern critical modifications have been implemented within the warm sections of the cERL injector prototype coupler which was previously tested for 30kW power level in CW mode operation. The modification includes implementation of active water cooling in the warm section of the coupler and material change from copper coated stainless steel to oxygen free copper for the inner conductor.

As a result, the thermal load at the inner and outer conductor was effectively mitigated during high power transmission in CW mode. Prior to the modifications, the inner conductor of the warm section reached a maximum temperature of 183°C at 27 kW power in CW mode. However, with the modified inner conductor with water cooling, the temperature was a mere 25°C. Additionally, the overall coupler temperature of the modified coupler was significantly reduced due to the conduction cooling effect applied to other components. These results underscore the effectiveness of the implemented modifications and represent a highly effective approach for mitigating thermal load in critical coupler components.

Footnotes

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Author: NAMA, Pragya (Sokendai, the Graduate University for Advanced Studies)

Co-authors: KUMAR, Ashish (High Energy Accelerator Research Organization); ARAKAWA, Dai (High Energy Accelerator Research Organization); KAKO, Eiji (High Energy Accelerator Research Organization); SAKAI, Hiroshi (High Energy Accelerator Research Organization); UMEMORI, Kensei (High Energy Accelerator Research Organization); MIURA, Takako (High Energy Accelerator Research Organization)

Presenter: NAMA, Pragya (Sokendai, the Graduate University for Advanced Studies)

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