

## Development of high power energy recovery absorbing load for large scale accelerators

For large particle accelerators, the radio-frequency (RF) power source system constitutes the most significant portion of total energy consumption. A substantial fraction of the RF energy not utilized for charged particle acceleration is directed to an absorption load at the output of the accelerating structure, where it is converted into thermal energy and dissipated. To use this otherwise wasted energy, RF-DC rectification technology presents a viable solution for converting the RF power back into usable DC electricity. Historically, the performance of this technology has been constrained by the limited high-frequency and high-power handling capabilities of transistors. Consequently, despite its conceptual appeal, this approach has not been implemented in experimental or engineering applications.

However, the recent advent of fourth-generation transistors based on Gallium Nitride (GaN) has significantly advanced these capabilities, renewing the experimental prospects of this energy recovery method. This work is dedicated to investigating the feasibility of this GaN-based RF rectification scheme. Furthermore, we will assess its potential application for future colliders, such as the Circular Electron Positron Collider (CEPC), with the goal of substantially improving overall energy efficiency.

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**Session Classification:** Poster

**Track Classification:** Accelerator: 02: Accelerator technology