IEEE-CSC, ESAS and CSSJ SUPERCONDUCTIVITY NEWS FORUM (global edition), Issue No. 63, Mar. 2026

Superconducting Accelerators for Proton Therapy: Overview and the Compact AVF Cyclotron SC230

Yuta Ebara

Sumitomo Heavy Industries, Ltd., Kanagawa, Japan

E-mail: yuta.ebara@shi-g.com

***Abstract*—Proton therapy systems have traditionally required large-scale equipment and facilities. In recent years, however, the introduction of superconducting technology into proton therapy accelerators has enabled substantial miniaturization. This presentation will begin with an overview of proton therapy and accelerator technologies, followed by a review of commercially available superconducting accelerators. Currently, three types of accelerators are employed in proton therapy: AVF cyclotrons, synchrocyclotrons, and synchrotrons. Among these, superconducting designs are limited to synchrocyclotrons and AVF cyclotrons, while superconducting synchrotrons for proton therapy have not yet been realized. Synchrocyclotrons are optimized primarily for compactness, whereas AVF cyclotrons are expected to achieve both compactness and the high beam current required for clinical applications. We have developed the superconducting AVF cyclotron SC230 for proton therapy [1]. With a total weight of 65 t, the SC230 is currently the most compact AVF cyclotron for proton therapy and delivers a beam current of 1 μA, which is the highest among proton therapy accelerators. This cyclotron will also be presented.**

***Keywords (Index Terms)*— Proton therapy, Accelerator, Cyclotron**

Reference

[1] Y. Ebara, et al. "First beam extraction from a superconducting azimuthally varying field cyclotron for proton therapy." NIM-A 1056 (2023): 168629.

IEEE-CSC, ESAS and CSSJ SUPERCONDUCTIVITY NEWS FORUM (global edition), Issue No. 63, Mar. 2026.
Presentation given at ISS 2025, Nagasaki, Japan, Dec. 2025.