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Improvement of a central region for performance enhancement in Sumitomo SC230 cyclotron

Tuesday 3 June 2025 16:00 (2 hours)

We Sumitomo Heavy Industries, Ltd. developed the superconducting azimuthally varying field (AVF) cyclotron SC230 for proton therapy in 2021. Superconducting coils and new RF cavities have achieved energy-saving operation with power consumption of 200 kW or less, reduced to 3/5 times of conventional cyclotron P235. It delivers the highest intensity beam of 1 μA among all accelerators for proton therapy in the world. Also its extraction efficiency from cyclotron is achieved at 67 %. High intensity beam contributes to both decreased treatment time and increased treatment capacity. However, RF discharge during irradiation can cause treatment delay. This was a reason that the Kilpatrick value was large in central region, which is the indicator of ease of RF discharge. Therefore, we modified the electrode shape in central region to make it small. As a result of performance test at prototype SC230, we confirmed that not only the discharge frequency was reduced than that of the former, but also the extraction efficiency was improved up to 75 %. We report the design of central electrode and the result of performance test.

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