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## **The Construction of the Inner Ion Source for SC200 Compact Superconducting Cyclotron**

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The SC200 compact superconducting cyclotron is supposed to contribute on the proton therapy under the collaboration of the Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP) and the Joint Institute for Nuclear Research (JINR). The energy of cyclotron is 200MeV with the maximum proton beam current of  $\sim 400\text{nA}$  from the cyclotron outlet. The hot cathode Penning Ionization Gauge (PIG) type proton source will be used in the cyclotron. The purpose of the article is to introduce the inner ion source from the design, simulation and dedicated test. Through the analysis and bench experiment results, the ion source shows a good performance which can provide enough protons to reach the cyclotron beam current. The lifetime of filament can reach more than 50 hours and the source operates at least 1h continuously. A layer-to-layer intensity modulation of the scanned beam is realized with the filament current and the arc voltage that need to vary the extracted beam current between maximum and zero. For the research the request for higher flexibility, in particular for faster beam intensity modulation. In order to explore capabilities of the machine for such research mode, a real-time control system of the arc power supply for ion source has been developed and will also be presented.

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