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First experiments with the Dresden EBIS-SC

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ABSTRACT: The Dresden EBIS-SC is a new superconducting EBIS designed for applications in medicine, basic research and other fields. After mechanical construction and a longer installation period first experiments have been accomplished to understand the source behavior and to get a well-founded sense about the working characteristics of the ion source. In a first step electrical properties were investigated and it was shown that the source works stable over a period of several days with electron beam currents I_e of up to 500 mA at an electron beam transmission of better than $0.999 I_e$. Actually using a cathode of 1.5 mm the source reaches electron beam currents up to 750 mA. All measurements were performed at magnetic fields of 6 T. First ion extraction experiments demonstrate that the H_2^+ output at a pulse repetition frequency of 330 Hz and an electron beam current of 300 mA is higher than 1×10^8 ions per pulse. This output is sufficient for medical applications, e.g. in so-called CYCLINACs. Furthermore, the corresponding DC beam was measured to about $1 \mu A$. The beam emittance of extracted carbon ions was determined to (7...25) mm mrad. Extracted ion pulses show pulse FWHM in the order of (4...12) μs . In this paper first ion extraction spectra of highly charged carbon, argon and xenon ions are presented for different source operation regimes. Additionally energy-dispersive measured X-ray spectra from argon and xenon ions are shown and discussed.

KEYWORDS: Instrumentation for particle-beam therapy; Instrumentation for particle accelerators and storage rings - low energy (linear accelerators, cyclotrons, electrostatic accelerators); Ion sources (positive ions, negative ions, electron cyclotron resonance (ECR), electron beam (EBIS))

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