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Evolution of the ELBE SRF gun - improvements towards the 3rd generation

Tuesday 23 September 2025 14:30 (3 hours)

HZDR has done pioneering work in the field of the superconducting photoelectron source (SRF gun). The development began more than 20 years ago with the first proof of concept experiment. This was the first time worldwide that electrons were generated from a normal-conducting semiconductor photocathode within a superconducting half-cell resonator [1]. Convinced by this success the work was continued by developing a 3½-cell prototype SRF gun (referred to as ELBE SRF gun I). During an operating time of about 5 years, various problems were solved and different routines were implemented, which finally made it possible to drive the free-electron laser of the ELBE accelerator by the SRF gun [2]. In order to take full advantage of the electron source an improved niobium cavity was built and together with a superconducting solenoid integrated in a new gun module (referred to as ELBE SRF gun II). Since 8 years this gun is in routine user operation, delivering bunches with 200 pC and a repetition rate of 100 kHz to generate THz radiation in a very stable and reliable manner [3]. The development of the third generation of this electron source is now concentrating on the cathode cooler, the cathode transfer system and the superconducting solenoid, while the cavity was refurbished with the help of HZB in Berlin. The contribution will present the lessons learned and the main technical changes of ELBE SRF gun III compared to its predecessors.

I have read and accept the Privacy Policy Statement

Yes

Footnotes

[1] D. Janssen et al., Nucl. Instr. Meth. A 507 (2003) 314 - 317
[2] J. Teichert, et al., Nucl. Instr. Meth. A 743 (2014) 114 - 120
[3] J. Teichert, et al., Phys. Rev. Accel. Beams 24, 033401 (2021)

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