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Development of the sub-nanosecond grid-controlled electron source for Hefei Advanced Light Facility injector

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The Hefei Advanced Light Facility (HALF), currently under construction, aims to be state-of-the-art diffraction-limited storage ring light source with a full-energy injector. A grid-controlled electron gun has been chosen as the electron source for HALF. The simulation of the electron source revealed that when using a pulser with width about 1 ns, the parasitic pulses reduce to 8.70%, therefore, the HALF's electron gun is more optimal with a pulse width of less than 1 ns.
To achieve such a narrow pulse, a sub-nanosecond pulse generator (sub-nano PG) based on avalanche transistors is developed. The sub-nano PG featured a tapered impedance structure, and a compensation inductance to reduce the pulse width. Offline measurements confirmed that the sub-nano PG can output a -757 V pulse with the FWHM of 510 ps. Further measurement of the beam current indicated that it could reach up to 1.1 A, with an FWHM reduced to 0.64 ns, and the beam stability at 10 pps was better than 1.6%.
This paper presents a detailed discussion of the sub-nanosecond grid-controlled electron source, its sub-nano PG and mechanical design, simulations, beam measurements, and future optimizations.

Footnotes

*Z. Sun and D. L. Feng. "Opportunities of Advanced Physical Studies at the Hefei Advanced Light Facility" [J]. Chinese Physics Letters.J. Y. Gao, et al. "A review on recent progress of thermionic cathode" [J]. https://doi.org/10.1007/s42864-020-00059-1.**C. Christou, et al. " The pre-injector linac for the diamond light source"[C].// Proceedings of LINAC 2004.

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