

Gridded RF gun design for SRF linac applications

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The concept of a compact linear accelerator for industrial application suggested in reference* is based on the use of SRF cavities. The design of a thermionic electron source which can either be directly connected to a superconducting cavity or be part of a normal conducting injector cavity is described. The direct connection option is applied in a prototype 1½ cell 650 MHz SRF cavity capable of delivering a 12.5 mA average beam current with a beam power of 20 kW which is currently being developed at Fermilab. As an external option we present the development of a CW normal conducting 1.3 GHz RF injector which consists of a gridded RF gun integrated with the first cell of a copper booster cavity.

The electron source concept is presented including the cathode-grid assembly and the gun resonator design. For the first case we considered thermal insulation of the cathode from the cavity, the cavity thermal load caused by the gun, including the static heat load, black body radiation, backward electron heating, etc.

For both projects we present the results of beam dynamics optimization, RF, thermomechanical, and engineering designs.

Footnotes

*R.D. Kephart et al, "SRF, Compact Accelerators for Industry and Society," 17th International Conference on RF Superconductivity, Whistler, September 13-18, 2015, FRBA03

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