

The high repetition rate thermionic injector

Wednesday, 5 October 2022 14:10 (15 minutes)

At Eindhoven university a high repetition rate thermionic injector is being built. The injector is capable of supplying electron bunches at a repetition rate of 1.5 GHz, which can be used for x-ray generation.

The electron source generates a continuous beam with a high current and low emittance through thermionic emission. The continuous electron beam is then chopped into a pulsed beam by a combination of a dual mode elliptical RF cavity and a knife-edge. The dual mode cavity uses both the fundamental mode (1.5 GHz) and its second harmonic (3.0 GHz) to increase the duty cycle of the chopping process to approximately 30% with a minimal loss of beam quality. Finally, a second dual mode elliptical RF cavity compresses the pulse length of the bunches, preparing the beam for injection into an X-band linear accelerator.

The first part of the injector is capable of operating at an emission current of 10 mA with a sub-50 nm rad transverse rms emittance. Construction of the elliptical chopper cavity has completed and is currently being implemented, after which the properties of the electron bunches after chopping will be measured.

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Session Classification: Electron Sources

Track Classification: Electron Sources