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ACE Injector for Burst Mode Operation in a ICS Source

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At Eindhoven university an inverse Compton scattering (ICS) source is being built. The ICS source consists of a 100kV photo gun electron injector, X-band accelerator, and interaction laser. One of the first upgrades for this ICS source is operating in a so-called burst mode. In burst mode, the electron injector is replaced by the advanced continuous electron (ACE) injector and a Fabry-Perot cavity is added to the laser. Both systems work in a 100 nanosecond long burst. Significantly increasing the current x-ray yield and the brilliance of the ICS source.

The ACE injector works by generating 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.

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Primary authors: VAN DEN BERG, Rick (Technische Universiteit Eindhoven); TOONEN, Wiebe (Technische Universiteit Eindhoven)

Co-authors: LUITEN, Jom (Technische Universiteit Eindhoven); MUTSAERS, Peter (Technische Universiteit Eindhoven)

Presenter: VAN DEN BERG, Rick (Technische Universiteit Eindhoven)

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