

# Physics and Applications of High Brightness Beams



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## A Versatile High Brightness Travelling-Wave Radio-Frequency Photogun

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S-band Standing-wave RF Photoguns represent the current state of the art for high brightness electron sources. These devices significantly contributed to the development of high brightness accelerators. However, the push for even brighter electron sources presents a significant technological challenge. Aiming to continue to push the boundaries of high brightness electron beams, a travelling-wave (TW) C-band RF photogun is under development as part of the IFAST programme. This TW photogun offers the ability to significantly increase peak cathode fields up to 200 MV/m through the use of very short RF pulses and higher operational frequencies. These short pulses also open up the possibility of RF pulse repetition rates up to 1 kHz. Finally, the TW gun presents a path to higher frequency RF photoguns without the need for RF circulators which are notoriously complex to fabricate at high frequencies. This presentation will detail the RF and mechanical design of the TW RF Photogun along with its application to an FEL injector demonstrating its ability to increase the SwissFEL 5D brightness by a factor of 5.

**Primary author:** LUCAS, Thomas Geoffrey (Paul Scherrer Institut)

**Co-authors:** Dr CRAIEVICH, Paolo (Paul Scherrer Institut); Dr REICHE, Sven (Paul Scherrer Institut); Dr ALESINI, David (INFN Frascati); Dr GIRIBONO, Anna (INFN Frascati)

**Presenter:** LUCAS, Thomas Geoffrey (Paul Scherrer Institut)

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