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Simulation Optimisation of the 3.5-cell 1.3 GHz SRF Gun for DALI

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At HZDR, the development of the Dresden Advanced Light Infrastructure (DALI) - a successor of the existing ELBE user facility, is ongoing. The new user facility will operate several SRF linac-based MIR-THz sources. The main motivation for the new facility is the user community request to increase the photon pulse energy from a few µJ, available now, to a few hundred µJ and even a mJ, in the frequency range from 0.1 to 30 THz. The new facility will operate in CW mode, as supported by ELBE SRF linac technology, with a high pulse repetition rate ranging from 10 kHz through 1 MHz. Achieving the very high photon pulse energy required operation with a high bunch charge of about 1 nC. In this contribution, we present a study on the possibility of supplying the accelerators with a 1 nC beam by the SRF gun, similar to the one successfully operating at ELBE. Genetic optimizers were used to find the optimum injector settings for minimal transverse and longitudinal emittance of the electron beam.
Our contribution shows the baseline layout of the planned accelerator complex at DALI and a sketch of the considered SRF gun for DALI. We present the Pareto front of optimal beam properties achieved in ASTRA simulations, as well as the development of beam properties in the beamline and the phase spaces for one injector's possible working point as an example.

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