Comparison of preliminary beam dynamic calculations between different codes for SRF-L accelerator in the Early Neutron Source project

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The Early Neutron Source project is part of the IFMIF (International Fusion Material Irradiation Facility) project of Bilateral Agreement between EU and Japan.

DONES (DEMO Oriented Neutron Source) system is designed to provide an accelerator-based D-Li neutron source that produces high energy neutrons at sufficient intensity to simulate the first wall neutron spectrum of future nuclear fusion reactors. The DONES plant will produce a 125 mA deuteron beam, which can be accelerated up to 40 MeV and shaped to have a nominal cross section of 100 mm x 50 mm, impinging on a liquid lithium curtain. The stripping reactions generate a large number of neutrons that interact with material samples located behind the lithium target.

The DONES Accelerator System includes an injector, a Low Energy Beam Transport (LEBT) section, a Radio Frequency Quadrupole (RFQ) accelerator, a Medium Energy Beam Transport (MEBT) section, a Superconducting Radio Frequency Linear Accelerator (SRF-L) and a High Energy Beam Transport Line (HEBT).

The aim of this work was to compare results of beam dynamic calculations performed for the SRF-L accelerator using two calculation codes: TraceWin and GPT (General Particle Tracer). The calculations results of beam energy losses, statistical parameters of the beam and beam density in analyzed phase spaces from both codes were compared. Comparison was done for the optimized beam with 40,19 MeV of deuteron energy and 8,36 W/m peak energy loss. The received results show that it is possible to use GPT code for independent optimization of RF field phases in SRF-L accelerator and thus may be used to verify optimization received with TraceWin code. In the next step we will estimate the precision given by GPT code and we will choose the best algorithm for this type of calculations.