AKBP 14: RF Cavities II

Time: Thursday 15:00–15:45 Location: SCH/A117

AKBP 14.1 Thu 15:00 SCH/A117

Development and Realization of a new Chopper Cavity for the S-DALINAC* — •Vincent Pruy, Arnold Michaela, Ruben Grewe, Katharina E. Ide, Lars Jürgensen, Lisa Dingeldein, Clemens M. Nickel, Norbert Pietralla, and Dominic Schneider — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

The operation of the superconducting radio-frequency cavities of the S-DALINAC [1] relies on a bunched electron beam. Currently, the continuous beam generated by the thermionic gun is divided into bunches using a chopper system incorporating a single deflecting cavity. However, this system induces nonlinear curvatures in the beam trajectory. A second, identically constructed deflecting cavity can be employed to re-bend the beam thus counteracting the nonlinear distortions. Comprehensive electromagnetic and particle-tracking simulations aimed at optimizing the cavitiy's deflection behavior and quality factor have already been completed. This work further concluded the in-house fabrication of the cavity and its commissioning in the injector beamline of the S-DALINAC. In this contribution, we report on the manufacturing process and the measured properties of the cavity. In addition, we propose a viable concept realizing a double chopper system based on the existing components.

[1] N. Pietralla, Nucl. Phys. News, Vol. 28, No. 2, 4 (2018).

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AKBP 14.2 Thu 15:15 SCH/A117

Development of a New Prebuncher for the 26 MeV S-band Linac at ELSA — •Nicholas Treska, Klaus Desch, Jerome Orbons, Michael Switka, Dennis Proft, and Philipp Hänisch — Physikalisches Institut der Universität Bonn

A new prebuncher for the 26 MeV S-band linac at ELSA is being developed. A range of CST simulations and prototype measurements indicate the potential for improvements in transfer efficiency, vacuum performance, and electric field characteristics. A test stand for the characterization of prototypes is set up. The work focuses on assessing the feasibility and performance of the new design.

AKBP 14.3 Thu 15:30 SCH/A117

Design of a fast reactive tuner for 1.3 GHz TESLA cavities at MESA — •Ricardo Monroy-Villa[1], Ilan Ben-Zvi[2], Florian Hug[1], and Timo Stengler[1] — [1]Institute for Nuclear Physics, Johannes Gutenberg-Universität Mainz, Mainz, Germany — [2]Physics and Astronomy Department, Stony Brook University, New York, USA

We present a state-of-the-art design of a Ferroelectric Fast Reactive Tuner (FE-FRT), capable of modulating high reactive power in TESLA-type cavities on a microsecond time scale. The Mainz Energy-Recovering Superconducting Accelerator employs 1.3 GHz superconducting radio-frequency (SRF) cavities, achieving quality factors of the order of 10^10. However, detuning of 25 Hz induced by microphonics has led to the use of strong coupling for the fundamental power coupler, requiring high-power amplifiers, orders of magnitude above the intrinsic dissipation. Current solutions to mitigate microphonics rely on piezoelectric tuners, which are not fast enough for the spectral range of the microphonics. A novel alternative is the FE-FRT, a technology made possible by low-loss ferroelectric materials, which offer sub-microsecond response times. Analytical results are provided along with their validation through finite-element simulations. The FE-FRT can handle substantial reactive power while offering a tuning range of 50 Hz in SRF cavities, resulting in a reduction in peak forward RF power by about an order of magnitude.