AKBP 2: Radiofrequency Systems 1

Time: Monday 14:00–15:15 Location: AKBP-H14

AKBP 2.1 Mon 14:00 AKBP-H14

Goubau-Line Set Up for Bench Testing Impedance of IVU32 Components — •Paul Volz — Helmholtz-Zentrum Berlin — Johannes Gutenberg Universität Mainz

The worldwide first in-vacuum elliptical undulator, IVUE32, is being developed at Helmholtz-Zentrum Berlin. The 2.5 m long device with a period length of 3.2 cm and a minimum gap of about 7 mm is to be installed in the BESSY II storage ring. It will deliver radiation in the soft X-ray range to several beamlines. The proximity of the undulator structure to the electron beam makes the device susceptible to wakefield effects which can influence beam stability. A complete understanding of its impedance characteristics is required prior to installation and operation, as unforeseen heating of components could have catastrophic consequences. To understand and measure the IVU's impedance characteristics a Goubau-Line test stand is being designed. A Goubau-line is a single wire transmission line for high frequency surface waves with a transverse electric field resembling that of a charged particle beam out to a certain radial distance. A concept optimized for bench testing IVUE32-components will be discussed, microwave simulations will be presented, and progress towards a test bench prototype will be shown.

AKBP 2.2 Mon 14:15 AKBP-H14

Commissioning of a new B-Mapping System for SRF Cavity Performance Tests — •Jonas C. Wolff[1,2], Wolfgang C. A. Hillert[1,2], Andre Gössel[1], Detlef Reschke[1], Lea Steder[1], and Lennart Trelle[1] — [1]Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg — [2]Universität Hamburg - Institut für Experimentalphysik, Luruper Chaussee 149, 22761 Hamburg

Magnetic flux trapped in the Niobium bulk material of superconducting radio frequency (SRF) cavities degrades their quality factor and the accelerating gradient. The sensitivity for flux trapping is mainly determined by the treatment and the geometry of the cavity as well as the Niobium grain size and orientation. To potentially improve the flux expulsion characteristics of SRF cavities and hence the efficiency of future accelerator facilities, further studies of the trapping behavior are essential. For this purpose a so-called B-mapping system to monitor the magnetic flux along the outer cavity surface of 1.3 GHz TESLA-Type single-cell SRF cavities has been developed and is currently in the commissioning phase at DESY. Contrary to similar approaches, this system digitizes the sensor signals already inside of the cryostat to extensively reduce the number of required cable feedthroughs. Furthermore, the signal-to-noise ratio and consequently the measuring sensitivity can be enhanced by shorter analog signal lines, less thermal noise and the Mu-metal shielding of the cryostat. In this contribution the design, required signal processing circuitry for the calibration as well as first performance test results of the B-mapping system are presented in detail.

AKBP 2.3 Mon 14:30 AKBP-H14

Upgrading the Booster Synchrotron RF with a Solid State Amplifier — •Michael Switka, Frank Frommberger, Klaus Desch, Philipp Hänisch, and Daniel Elsner — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

The DESY-type RF resonator of the ELSA facility's 1.6 GeV synchrotron has been powered by a conventional klystron amplifier since its early days in 1967. The setup was modified to serve the ELSA stretcher ring as booster synchrotron in 1987, but the RF infrastructure was barely altered. As repairs of the reliable, but antiquated RF source become foreseeingly impossible due to the lack of spare part availability, the replacement of the klystron amplifier chain in favour of a state-of-the-art solid state amplifier is carried out. We present the current status of the replacement procedure and first results.

AKBP 2.4 Mon 14:45 AKBP-H14

Upgrade of the 25 MW RF Station for the Linear Accelerator LINAC2 at ELSA — •Dennis Proft, Klaus Desch, and Daniel Elsner — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

At the Electron Stretcher Facility ELSA the first acceleration stage consists of a 3 GHz traveling wave linear accelerator. It was powered by a 25 MW pulsed high power klystron amplifier. After a failure of the focusing solenoid the required output power could not be reached anymore resulting in an inadvertently complete overhaul of the RF station.

The new RF station has successfully been operating since the beginning of 2021. In this contribution I will present the new setup including the new parameter monitoring capabilities as well as the lessons learned in RF engineering as an accelerator physicist.

AKBP 2.5 Mon 15:00 AKBP-H14

Update of the Quadrupole Resonator for SRF R&D at DESY — •Ricardo Monroy-Villa[1,2], Detlef Reschke[1], Andrea Muhs[1], Jan-Hendrik Thie[1], Maike Röhling[1], Martin Lemke[1], Wolfgang Hillert[2], Marc Wenskat[2], Wolfgang Ackermann[3], Sebastian Keckert[4], and Oliver Kugeler[4] — [1]Deutsches Elektronen-Synchrotron, Hamburg, Germany — [2]Universität Hamburg, Institut für Experimentalphysik, Hamburg, Germany — [3]Institut für Teilchenbeschleunigung und Elektromagnetische Felder, Darmstadt, Germany — [4]Helmholtz-Zentrum Berlin, Berlin, Germany

Superconducting radiofrequency (RF) cavities made of Nb have been shown to achieve their theoretical limit, while only minor improvements using standard procedures are expected in operation. Hence, new treatments and materials that tailor the RF surface are mandatory. Since theoretical models of the RF behavior of such surfaces do not fully describe the observations, we lack guidance for future research and identifying important parameters. To provide experimental data to improve these theoretical models and study material properties, and their impact on the RF performance, a dedicated sample test system is needed. The quadrupole resonator (QPR) is such a test cavity and allows for investigating samples of 7.5 cm in diameter under superconducting-cavity-like conditions in a wide parameter space defined by temperature, magnetic field and frequency. In this work we report the status of the QPR being developed as a joint project of Universität Hamburg and DESY.