AKBP 1: Particle Sources and Radiofrequency 1

Zeit: Montag 14:00–15:45 Raum: HS 8

AKBP 1.1 Mo 14:00 HS 8

Setup for cooled GaAs cathodes with increased charge lifetime — •Tobias Eggert, Joachim Enders, Martin Espig, Yuliya Fritsche, Dominik Gappa, Neeraj Kurichiyanil, and Markus Wagner — Institut für Kernphysik, TU Darmstadt

For high-current applications with spin-polarized electrons emitted from GaAs-photocathodes it is necessary to maximize the charge lifetime of the cathode material to ensure reliable operation. By using a cryogenic subvolume it is expected to improve the local vacuum conditions around the GaAs cathode, with its sensitive negative-electron-affinity surface. Furthermore, the cooling of the cathode itself also allows a higher laser power to be deposited in the material, resulting in higher possible currents. To further increase the lifetime, an electrostatic bend is introduced leading to the reduction of ion-backbombardment. Such an electron source is presently being developed at the Photo-CATCH test facility in Darmstadt. The current status of the source as well as future plans will be presented. Work supported by DFG (GRK 2128) and BMBF (05H18RDRB1).

AKBP 1.2 Mo 14:15 HS 8

Spin manipulation with the waveguide RF Wien filter — •Jamal Slim for the JEDI-Collaboration — III. Physikalisches Institut B, RWTH Aachen University, Aachen, Germany

The JEDI Collaboration aims at the first measurement of the Electric Dipole Moment of charged particles at the COoler SYnchrotron in Jülich. For this purpose a waveguide-based RF Wien filter has been developed and commissioned. This device acts as a spin rotator without inducing any beam distortion, i.e., beam steering and oscillation. This talk presents the preliminary measurement results of the spin manipulation with the RF Wien filter.

AKBP 1.3 Mo 14:30 HS 8

Systematic Studies of a Second Sound System for Quench Detection — •Bosse Bein[2], Wolfgang Hillert[2], Carsten Müller[1], Detlef Reschke[1], Jörn Schaffran[1], Sven Sievers[1], Lea Steder[1], and Mateusz Wiencek[1] — [1]DESY, Hamburg, Germany — [2]University of Hamburg, Hamburg, Germany

Several tools for quench detection of supra conducting radio frequency (SRF) cavities are existing. One of these techniques uses the excitation of temperature waves in liquid Helium which are created by a quench on the cavity surface. Below the lambda point so called second sound waves occur. Special sensors, like Oscillating Superleak Transducers (OSTs) are able to detect the waves. With the help of the OSTs the transit times of the signals are determined.

Using a set of algorithms one can postulate a most probable spot for the quench location. Two such methods are used at DESY: Multilateration and Raytracing. Their precision, their constraints and limits are compared, and the hardware systematics are studied. For this purpose a tool for calibration via simulation of a quench generated wave is developed. The simulation is done by injection of short heat pulses at exact known time and space coordinates.

Measurements with the calibration tool and results of data analyses obtained with both algorithms will be presented.

AKBP 1.4 Mo 14:45 HS 8

Updates on the RF Design of the 750 MHz PIXE RFQ — •Hermann Winrich Pommerenke[1,2], Vittorio Bencini[1], Amy Bilton[1], Lorenzo Giuntini[3], Alexej Grudiev[1], Alessandra Lombardi[1], Serge Mathot[1], Francesco Taccetti[3], Marc Timmins[1], Eric Montesinos[1], Ursula van Rienen[2], and Maurizio Vretenar[1] — [1]CERN, Geneva, Switzerland — [2]University of Rostock, Germany — [3]INFN, Florence, Italy

Protons with an energy of few MeV are commonly used for Ion Beam Analysis (IBA) of materials, in particular with the Proton Induced X-ray Emission technique (PIXE). The technique covers the non-destructive, quantitative analysis of elements with very good efficiency and ppm range detection limits. It it is widely used in different fields, in particular for the diagnosis of cultural heritage artwork.

As transporting artworks to the IBA facilities is often unacceptable, the PIXE RFQ, a one-meter long radio frequency quadrupole operating at 750 MHz, has been developed as a transportable proton accelerator within the collaborative MACHINA project between CERN and INFN. The PIXE RFQ is constructed at CERN based on the experience from the high-frequency RFQ for medical applications. The construction will be completed in the first quarter of 2019 and first measurements on artwork are expected in 2020.

This talk gives an update on the RF design of the PIXE RFQ accelerator, including simulation results regarding cavity geometry, coupler, thermal behaviour, and beam dynamics studies.

AKBP 1.5 Mo 15:00 HS 8

Development of a 200 keV Inverted-Geometry Polarized Photo-Electron Gun for Photo-CATCH* — •Maximilian Herbert, Joachim Enders, Yuliya Fritzsche, and Vincent Wende — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

The institute for nuclear physics at TU Darmstadt houses a dedicated test stand for Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH). Using GaAs photocathodes to provide pulsed and/or polarized electron beams and featuring a 60 keV inverted-insulator geometry photo-electron gun with adjacent diagnostics beamline as well as a system for photocathode activation and cleaning, it furnishes the Superconducting Darmstadt Linear Accelerator S-DALINAC with an ideal environment for photo-electron gun research and development. Currently, an upgrade of the existing inverted geometry to 200 keV is being developed for operational tests at Photo-CATCH and future use at the S-DALINAC. This contribution will present status, challenges and perspectives of the 200 keV gun design.

*Supported by DFG through GRK 2128 "AccelencE".

AKBP 1.6 Mo 15:15 HS 8

Plasma Photocathode for Wakefield Acceleration — •Michael Stumpf, Severin Montag, and Georg Pretzler — Institut für Laser- und Plasmaphysik, Heinrich-Heine-Universität Düsseldorf

We present a newly developed setup for a plasma photocathode inside a wakefield acceleration structure that can be used in a Trojan Horse Injection scheme. The fs-laser based optical scheme provides precisely defined and modifiable electron bunch charges and volumes. Adaption to parameters required by the acceleration field is possible by exact control of the laser focus in intensity, size and 3D-shape. The modular, all-optical setup can be used in plasma and laser wakefield acceleration experiments. The injected charge has been simulated using different ionization models and is compared to experimentally obtained values. The agreement of those values also confirms the ultra-small initial spread of the electron bunch in time and space and the ultra-low transverse and longitudinal momenta. According to the Trojan Horse Injection scheme*, the electron bunch should keep low emittance in the nm rad regime after direct acceleration within a wakefield potential. *B. Hidding et al., Phys. Rev. Lett. 108, 034001 (2012)

AKBP 1.7 Mo 15:30 HS 8

Estimation of the Critical RF Fields on a SRF Cavity Flange Transition — •Jonas Christian Wolff[1,2], Jens Iversen[1], Daniel Klinke[1], Denis Kostin[1], Detlef Reschke[1], Sven Thorsten Sievers[1], Alexey Sulimov[1], Jan-Hendrik Thie[1], Ralf Wendel[2], and Mateusz Wiencek[1] — [1]DESY, Notkestraße 85, 22607 Hamburg, Germany — [2]Hochschule für Angewandte Wissenschaften Hamburg, Berliner Tor 7, 20099 Hamburg, Germany

To minimize the distance between the flange contact and the iris of a superconducting radio frequency (SRF) cavity, it is required to know the critical value for the RF fields. This allows us to prevent a potential early quench at its flange contact area (transition). To avoid changes on the SRF cavity used for the tests, all RF cryogenic experiments will be carried out by using a cylinder in the center of a 1-cell cavity drift tube to increase the field density at its flange contact. This cylinder was designed and optimized by CST Microwave Studio simulations for the use of a test cavity with a comparatively low gradient to avoid field restrictions by the cavity. The ongoing work investigates the distance limitation for commonly used flanges at 1.3 GHz TESLA-Shape SRF cavities, originally designed for low field areas. Due to the high losses at the non superconducting seal a relatively low value can be expected to be critical. For this reason approaches to increase the critical RF fields will be investigated during the further process.