AKBP 7: Particle Sources

Time: Tuesday 16:00–17:30 Location: AKBP-H13

AKBP 7.1 Tue 16:00 AKBP-H13

photocathodes for SRF photoinjectors: exploring GaN and multi-alkali options — •Chen Wang[1,2], Sonal Mistry[1], Julius Kühn[1], Thorsten Kamps[1,4], Qun Jin[2], Michael Vogel[2], Xin Jiang[2], Jana Schaber[3], Rong Xiang[3], and Andre Arnold[3] — [1]HZB, Berlin, Germany — [2]University of Siegen, Institute for Materials Engineering, Siegen, Germany — [3]HZDR, Dresden, Germany — [4]Humboldt University of Berlin, Berlin, Germany

Gallium nitride and multi-alkali antimonide photocathodes are two candidates for semiconducting photocathode materials for SRF photoinjectors. GaN photocathode has high thermal stability and can provides high QE under UV light, while multi-alkali antimonide provides high QE at visible wavelengths. The crystal quality and doping level of magnetron sputtered Mg doped GaN films are studied at University of Siegen, since they could affect the diffusion length of excited electrons and the electron affinity of the photocathode, which are related to QE of the sample. SEM and XRD methods are used to study the influence of substrates and sputtering conditions on crystal quality and structure. Doping levels are analyzed by hall effect measurement. QE measurements are conducted at HZDR and also in in-situ measurement chamber. Na-K-Sb photocathodes films are deposited on molybdenum substrates in UHV preparation chamber at HZB. The influence of deposition parameters is studied in order to optimize the growth procedure and to achieve better stability at higher temperature, which could benefit operational lifetime. The chemical compositions of films are analyzed by XPS, and then QE measurements are performed.

AKBP 7.2 Tue 16:15 AKBP-H13

Improved Performance of GaAs photo-cathodes activated by Cs, O_2 and Li — •Maximilian Herbert, Joachim Enders, Markus Engart, Yuliya Fritzsche, Julian Schulze, and Vincent Wende — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

Photo-cathodes based on GaAs can be characterized mainly by two parameters: quantum efficiency η and lifetime τ. The former describes the photo-emission efficiency, while the latter is an indicator for the decay of the surface layer required to achieve negative electron affinity (NEA) for GaAs. This layer typically consists of Cs in combination with an oxidant. Previous studies have suggested that the addition of Li to this layer can significantly increase cathode performance by boosting both η and τ. At the Institut für Kernphysik of the Technische Universität Darmstadt, a dedicated test stand for Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH) is available for GaAs photocathode research. This contribution will present recent performance studies at Photo-CATCH of bulk GaAs photo-cathodes activated with Cs, O_2, and Li in comparison to activations using Cs and O_2 only. An increase in τ by a factor of 7 has been observed without significant reduction of η for Li-enhanced activation.

AKBP 7.3 Tue 16:30 AKBP-H13

High bunch charges in the second injection beamline of MESA — •Anatolii Kalamaiko, Kurt Aulenbacher, Monika Dehn, and Simon Friederich — Institut für Kernphysik, Universität Mainz, Germany

MESA (Mainz Energy-recovering Superconducting Accelerator) is an accelerator with two laser-driven electron sources operating at 100 kV which is under construction at the Johannes Gutenberg University in Mainz. One of the sources is the unpolarized electron source MIST (MESA Injector Source Two) producing a bunch charge of up to 7.7 pC. This source and a Mott polarimeter will be arranged on the same height above the MESA injector main beamline. Thus, it is necessary to develop a parallel shifting beamline to transport electron beam from the source MIST to the main MESA beamline. Besides, the designed beamline should allow to transport beam from the electron source STEAM to the Mott polarimeter. This report is dedicated to the design of the separation beamline which transports and compresses highly charged electron bunches from the electron source MIST to the first acceleration section of MESA.

AKBP 7.4 Tue 16:45 AKBP-H13

RF Synchronised Semiconductor Laser System for MESA — •Rakshya Thapa — Institut für Kernphysik, Mainz, Germany

The Institute of Nuclear Physics at Johannes Gutenberg University Mainz is building the Mainz Energy-Recovering Superconducting Accelerator (MESA) facility. It is planned to operate with both polarised and unpolarised high average current electron beams. For both, a semiconductor photocathode is planned to be employed. To generate a polarised and unpolarised electron beam, laser beams with an emission wavelength in different regimes are used. However, to perform diagnostics that meet realistic beam dynamics, high bunch charge (≈1 pC) and low average beam power (1-10 W) is deemed vital. This can be achieved by the reduction of duty cycle. Therefore, a commercial TAIKO laser, which can be RF synchronised, with emission wavelength 400.8 nm was chosen and its temporal structure was investigated at the chopper system of the Mainz Microtron (MAMI) facility. Results concerning the electron bunch shape and its dependence on operating parameters like laser-pulse energy, electron bunch charge and down conversion factor will be reported.

AKBP 7.5 Tue 17:00 AKBP-H13

Preparation for plasma lens prototype as an optical matching device for the ILC — •Niclas Hamann[1], Manuel Formela[1], Gudrid Moortgat-Pick[2], Klaus Flöttman[3], and Gregor Loisch[3] — [1]Uni Hamburg — [2]Uni Hamburg/DESY — [3]DESY

The ILC is an ambitious project. Therefore many challenges have to be overcome. One of these is to optimize the positron yield after the source. In this talk a new concept for capturing is proposed, the plasma lens. The latest simulations will be shown and preparation tests for an upcoming prototype will also be discussed. The preparation tests are done with a plasma cell designed for PITZ.

AKBP 7.6 Tue 17:15 AKBP-H13

Latest developments and performance of the FLUTE laser system — •Matthias Nabinger, Thiemo Schmelzer, Michael Johannes Nasse, Nigel Smale, Jens Schäfer, Carl Sax, and Anke-Susanne Müller — Karlsruher Institut für Technologie, Karlsruhe, Deutschland

At the FLUTE linac-based accelerator short electron bunches are generated via a photo-injector system. The electrons are produced by laser pulses transported over several meters from the laser laboratory towards the photocathode. To ensure a controlled operation, the laser parameters are monitored and adjusted at several positions. In addition to electron generation, the pulses are used to generate THz pulses for a specific diagnostic experiment. Multiple systems are used to stabilize the laser pulses for optimal use. In this contribution, the latest developments of the FLUTE laser's improved performance will be presented.

Matthias Nabinger and Thiemo Schmelzer acknowledge the support by the Doctoral School KSETA 'Karlsruhe School of Elementary and Astroparticle Physics: Science and Technology'.