AKBP 1: Particle and Photon Sources

Time: Monday 16:00–17:45 Location: CHE/0183

AKBP 1.1 Mon 16:00 CHE/0183

Design of a New Photo and Thermionic Hybrid Mode 50 kV Pulsed Electron Gun for ELSA — •Samuel Kronenberg, Klaus Desch, Daniel Elsner, Dennis Proft, and Philipp Hänisch — Physikalisches Institut der Universität Bonn

For the Linac travelling wave S-band injector at ELSA a new electron gun is being designed, to enhance the beam parameters obtained from the old gun. Furthermore, a new single bunch injection mode is to be realized alongside the standard long pulse (multi bunch) mode, enabling single bunch operations for accelerator research and development in addition to the use for normal operation serving the experimental program. For that a dual-use design is pursued utilizing a caesium dispenser cathode both as photo- as well as thermionic cathode. First steps including the design of the gun assembly and studies about its usability as a photoemitter are conducted. A preliminary design of the gun is presented.

AKBP 1.2 Mon 16:15 CHE/0183

Automated Activation Procedure for GaAs Photocathodes at Photo-CATCH* — •Maximilian Herbert, Tobias Eggert, Joachim Enders, Markus Engart, Yuliya Fritzsche, and Vincent Wende — Technische Universität Darmstadt, Fachbereich Physik, Institut für Kernphysik, Schlossgartenstr. 9, 64289 Darmstadt

Photo-electron sources using GaAs-based photocathodes are used to provide high-brightness and high-current beams of spin-polarized electrons for accelerator applications such as ERLs. Such cathodes require a thin surface layer consisting of Cs and an oxidant in order to achieve negative electron affinity (NEA) for efficient photoemission. The layer is deposited during a so-called activation procedure, whose performance greatly influences the resulting quantum efficiency η of the photocathode and robustness of the layer. An automatization of the activation procedure could simplify and accelerate this process, indipendent from expert input, for operational use in an accelerator. At TU Darmstadt, the dedicated test stand Photo-CATCH is available for GaAs photocathode research. The components of its activation chamber are remote-controlled using EPICS. This contribution will present recent proof-of-principle studies of a basic automated activation procedure at Photo-CATCH. Using a co-deposition scheme with Cs and O_2, several automated activations have been performed. A good reproducibility of η has been observed, with a slight reduction in mean η compared to manual activation.

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AKBP 1.3 Mon 16:30 CHE/0183

Multi-alkali antimonide photocathodes for highly brilliant electron beams — •Chen Wang[1,2], Sonal Mistry[1], Julius Kühn[1], and Chen Wang[1,3] — [1]HZB, Berlin, Germany — [2]University of Siegen, Institute for Materials Engineering, Siegen, Germany — [3]Humboldt University of Berlin, Berlin, Germany

One important goal at the SEALab facility is to bring an innovative superconducting radio-frequency photoelectron injector into operation. As the electron source in the injector, a photocathode with high quantum efficiency (QE) and long operation lifetime is required. The family of multi-alkali antimonide photocathodes deposited on Mo substrate is chosen for this application due to its high QE (>1%) at visible wavelengths and good thermal conductivity. Currently, Na-K-Sb photocathodes are produced in a UHV preparation chamber at the photocathode lab of HZB. The influence of deposition parameters is studied to optimize the growth procedure and to achieve high stability at high operational temperatures as expected in the photoinjector. X-ray photoemission spectroscopy (XPS) and QE measurements are performed, and the correlation between chemical composition and QE value are presented in this contribution.

AKBP 1.4 Mon 16:45 CHE/0183

Development of Multi-alkali antimonides photocathodes for high brightness photoinjectors — •Sandeep Mohanty[1], Mikhail Krasilnikov[1], Anne Oppelt[1], Frank Stephan[1], Daniele Sertore[2], Laura Monaco[2], Carlo Pagani[3], and Wolfgang Hillert[4] — [1]DESY Zeuthen, Germany — [2]Istituto Nazionale di Fisica Nucleare - LASA, Segrate, Italy — [3]Università degli Studi di Milano & INFN, Segrate, Italy — [4]University of Hamburg

Multi-alkali antimonide photocathodes can have high quantum efficiency similar to UV-sensitive (Cs2Te) photocathodes, but with the advantages of photoemission sensitivity in the green wavelength and a significant reduction in the mean transverse energy of photoelectrons. In order to optimize and better understand the photo emissive film properties of KCsSb photocathodes, a batch of two photocathodes with different thicknesses was grown on molybdenum substrates via a sequential deposition method in a new preparation system at INFN LASA. During the deposition, a "multi-wavelengths" diagnostic, i.e. the measurements of the real-time photocurrent and reflectivity at different wavelengths (in the range from 254 nm - 690 nm) has been applied.The optical spectra of these semiconductors provide a rich source of information on their electronic properties.In this report, we present and discuss the experimental results obtained from the two different thickness KCsSb photocathodes, along with the effect of Sb thickness on the cathode's properties.

AKBP 1.5 Mon 17:00 CHE/0183

Investigation of structural changes in Ti-6Al-4V via high energy X-ray diffraction caused by fast cyclical heating — •Tim Lengler[1,2], Dieter Lott[2], Gudrid Moortgat-Pick[1,3], and Sabine Riemann[4] — [1]Universität Hamburg, Hamburg, Deutschland — [2]Helmholtz-Zentrum Hereon, Geesthacht, Deutschland — [3]DESY, Hamburg, Deutschland — [4]DESY, Zeuthen, Deutschland

For the planned International Linear Collider (ILC) a material for the positron source target is required which can withstand the high energy deposition needed for a high luminosity positron source. To distribute the load and keep the target at a reasonable temperature, the target is rotated with high velocity. Therefore, the material needs not only withstand the cyclical thermal load but also the simultaneous mechanical load. In this work, the behaviour of the material Ti-6Al-4V, which is considered as an appropriate target material, was studied via high energy X-ray diffraction during a cyclical heating process to gain information about changes in the crystal structure and consequently phase fractions. The material was heated homogeneously via induction to temperatures between 300 °C and 800 °C with heating rates of 100 °C/s and cooling rates in the range of 25 °C/s and 100 °C/s. Here, the influence of the maximum and minimum temperature as well as the cooling rate was investigated. The lattice parameter of the β phase turns out to be the most sensitive parameter that correlates to the changes in phase fractions at higher temperatures and thus provides a valuable reference for experiments at the Microtron MAMI, where Ti-6Al-4V targets will be irradiated by high energy electron beams.

AKBP 1.6 Mon 17:15 CHE/0183

Computational homogenisation of laminated yokes in finite-element models of fast-ramped orbit corrector magnets — Jan-Magnus Christmann[1], Moritz von Tresckow[1], •Herbert De Gersem[1], Alexander Aloev[2], Sajjad H. Mirza[2], Sven Pfeiffer[2], and Holger Schlarb[2] — [1]TEMF, TU Darmstadt, Germany — [2]DESY, Hamburg, Germany

Fast corrector magnets need to be equipped with iron yokes to keep their inductance sufficiently low. Even iron stacks with thin laminates suffer from relevant eddy-current losses at elevated frequencies, causing Joule losses and invoking a time delay between excitation current and aperture field. Resolving the individual laminates within a finite-element model is not feasible. Instead, computational homogenisation is applied. The lamination stack is modelled as a bulk part and represented by an anisotropic and frequency-dependent surrogate material. This contribution illustrates the validity of this approach. The correction magnets planned for the fast orbit feedback system of PETRA IV at DESY serve as an example.

AKBP 1.7 Mon 17:30 CHE/0183

The Merit of a Thomson backscattering based Gamma Source at MESA. — •Christoph Lorey[1] and Atoosa Meseck[1,2] — [1]Johannes Gutenberg Universität, Mainz, Germany — [2]Helmholtz Zentrum Berlin, Berlin, Germany

The Mainz Energy-recovering Superconducting Accelerator (MESA), currently under construction at the Johannes Gutenberg University (JGU) in Mainz, will offer two modes of operation, one of which is

an energy-recovering (ER) mode in order to deliver electron beams of up to 155 MeV to two experiments. As an ERL, MESA, with it's high brightness electron beam, is a promising accelerator for supplying a Thomson back scattering based Gamma source. Furthermore, at MESA, the polarization of the electron beam can be set by the injector. We will present the first results of our performance studies for a Thomson backscattering based gamma source at MESA. Different polarization scenarios will be discussed considering a selection of laser and MESA configurations.