IPAC 2018 Search

ID: 3450 Ion production at the JLab electron gun test stand and its impact on DC high voltage photogun operation

Presenter Cristhian Alfonso Valerio (ECFM-UAS, Culiacan, Sinaloa)

Authors Cristhian Alfonso Valerio (ECFM-UAS, Culiacan, Sinaloa), Don Bullard, Carlos Hernandez-Garcia, Md Abdullah A Mamun, Matt Poelker, Riad Suleiman, Yan Wang, Shukui Zhang (JLab, Newport News, Virginia)

Abstract The Gun Test Stand at Jefferson Lab consists of a bi-alkali antimonide photocathode deposition chamber, a 300kV DC high voltage photogun with inverted-insulator geometry, and a 4-meter long diagnostic beamline. Beam delivery at 4.5 mA using a DC laser at 532 nm was limited to just a few minutes due to arcing between the photocathode and the anode. However, when operating with a solenoid magnet located near the photogun and used to generate magnetized beam, beam delivery at 4.5 mA could be sustained for hours. To understand this behavior, beam dynamics simulations were performed that quantify ion production that results from electrons striking residual gas within the photogun and beam line. The generated ions also were tracked, with some ions striking the photocathode and generate secondary electron emission from its surface. Simulation results presented here suggest that the gun solenoid fortuitously helps to transport the ion-induced secondary electrons from the photocathode through the anode hole, which helps to preserve good vacuum near the photocathode, which minimizes the production of ions in the cathode/anode gap thereby suppressing arcing and increasing the photocathode lifetime.

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Type of Presentation Poster

Main Classification 02 Photon Sources and Electron Accelerators

Sub Classification A08 Linear Accelerators

ID: 3879 Production of Magnetized Electron Beam from a DC High Voltage Photogun

Presenter Md Abdullah A Mamun (JLab, Newport News, Virginia)

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Abstract Bunched-beam electron cooling is a key feature of all proposed designs of the future electron-ion collider, and a requirement for achieving the highest promised collision luminosity. At the Jefferson Lab Electron Ion Collider (JLEIC), fast cooling of ion beams will be accomplished via so-called 'magnetized cooling' implemented using a recirculator ring that employs an energy recovery linac. In this contribution, we describe the production of magnetized electron beam using a compact 300 kV DC high voltage photogun with an inverted insulator geometry, and using alkali-antimonide photocathodes. Beam magnetization was assessed using a modest diagnostic beamline that includes YAG view screens used to measure the rotation of the electron beamlet passing through a narrow upstream

aperture. Magnetization results are presented for different gun bias voltages and for different laser spot sizes at the photocathode, using 532 nm lasers with DC and RF time structure. Photocathode lifetime was measured at currents up to 4.5 mA, with and without beam magnetization.

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Type of Presentation Poster

Main Classification 02 Photon Sources and Electron Accelerators

Sub Classification T02 Electron Sources

ID: 2783 A Research in Inverted High Voltage DC Gun and CsK2Sb Photocathode

Presenter Yan Wang (JLab, Newport News, Virginia)

Authors Yan Wang, Carlos Hernandez-Garcia, Md Abdullah A Mamun, Matt Poelker, Riad Suleiman, Michael George Tiefenback, Shukui Zhang (JLab, Newport News, Virginia), Geoffrey Arthur Krafft (JLab, Newport News, Virginia; ODU, Norfolk, Virginia)

Abstract A compact inverted high voltage DC gun was designed, built, conditioned, and has been operated reliably at 300 kV. A thorough study of CsK2Sb photocathode was performed to characterize how the thickness of the Sb layer or roughness of the photocathode surface affects the electron beam emittance, and the life time and quantum efficiency of the photocathode. The performance of the electron gun and the findings of CsK2Sb photocathode studies will be presented.

Funding Agency This work is supported by the Department of Energy, Laboratory Directed Research and Development funding, under contract DE-AC05-06OR23177

Type of Presentation Poster

Main Classification 02 Photon Sources and Electron Accelerators

Sub Classification T02 Electron Sources

ID: 2562 Simulation Study of Magnetized Electron Beam

Presenter Sajini Anushika Kumari Wijethunga (ODU, Norfolk, Virginia)

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Abstract The proposed Jefferson Lab Electron Ion Collider (JLEIC) must provide ultra-high collision luminosity to achieve promised physics goals. Small transverse emittance at the ion-electron collision point is one of the key requirements of the collider design. Emittance growth that results from electron-ion collisions will be controlled by electron cooling of the ion beam and cooling can be enhanced using a magnetized electron beam, where the cooling process occurs inside a solenoid field. The radial fringe magnetic field at the entrance of the solenoid creates a large additional rotational motion which adversely affects the cooling process. At the electron source, we create the electron beam inside a similar field but inducing rotational motion in the opposite direction to compensate this effect. Beam-based magnetization measurements have been performed and this presentation provides a comparison to predictions based on simulations using ASTRA and GPT software, as a function of beam size variations along the beamline, for different solenoid currents, with and without space charges, and other parameters.

Funding Agency	This work is supported by the Department of Energy, Laboratory Directed Research and Development funding, under contract DE-AC05-06OR23177
Type of Presentation	Poster
Main Classification	05 Beam Dynamics and EM Fields
Sub Classification	D09 Emittance Manipulation, Bunch Compression and Cooling

ID: 3875 A Non-Invasive Magnetic Momentum Monitor Using a TE011 Cavity

Presenter	Jiquan Guo (JLab, Newport News, Virginia)
Authors	Jiquan Guo, Gary Guangfeng Cheng, Fredrik Fors, James Henry, Matt Poelker, Robert Rimmer, Riad Suleiman, Haipeng Wang (JLab, Newport News, Virginia)
Abstract	The Jefferson Lab Electron-Ion Collider (JLEIC) design relies on cooling of the ion beam with bunched electron beam. The bunched beam cooler complex consists of a high current magnetized electron source, an energy recovery linac, a circulating ring, and a pair of long solenoids where the cooling takes place. A non-invasive real time monitoring system is highly desired to quantify electron beam magnetization. The authors propose to use a passive copper RF cavity in TE011 mode as such a monitor. In this paper, we will show the mechanism and scaling law of this device, as well as the design and testing results of the prototype cavity.
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Type of Presentation	Poster
Main Classification	06 Beam Instrumentation, Controls, Feedback, and Operational Aspects
Sub Classification	T03 Beam Diagnostics and Instrumentation

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