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Ultrahigh vacuum S-band gun and advanced photocathode studies at Tsinghua University

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High brightness photoinjectors demand low thermal emittance and high electric field to deliver brighter electron beams for modern accelerator-based scientific instruments. High quantum efficiency, low thermal emittance photocathodes, mainly semiconductors, easily degrade in poor vacuum conditions and could not operate with an extended lifetime. Therefore, an ultrahigh vacuum electron gun is necessary to accommodate advanced photocathodes for high performance and reliable operation. In this paper, we report on the development of an ultrahigh vacuum, high gradient S-band gun at Tsinghua University. The gun geometry is redesigned to reach more than one order of magnitude improvement of the vacuum level at the photocathode. Preliminary commissioning results of the new gun will be presented. The new gun and beamline will partially serve as a test facility for advanced semiconductor photocathodes. We will also report on the design and commissioning results of an alkali antimonide photocathode deposition system.

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Primary author: HUANG, Peng-Wei (Tsinghua University in Beijing)

Co-authors: CHEN, Han (Tsinghua University in Beijing); ZHENG, Lianmin (Tsinghua University in Beijing); CHEN, Huaibi (Tsinghua University); LI, Renkai (Tsinghua University); DU, Yingchao (Tsinghua University in Beijing); SHI, Jiaru (Tsinghua University in Beijing); HUANG, Wenhui (Tsinghua University in Beijing); TANG, Chuanxiang (Tsinghua University in Beijing)

Presenter: HUANG, Peng-Wei (Tsinghua University in Beijing)

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