Abstract Submitted
for the APR14 Meeting of
The American Physical Society

Beam emittance from ARPES for photoinjectors[1] KATHERINE HARKAY, Argonne National Laboratory, LINDA SPENTZOURIS, KAROLY NEMETH, Illinois Institute of Technology, TIMOTHY DROUBAY, SCOTT CHAMBERS, ALAN JOLY, WAYNE HESS, Pacific Northwestern National Laboratory — A commonly-used beam emittance measurement for photoinjector sources involves accelerating a low-charge beam to a few megavolts in an electron gun, then using a pepper-pot emittance diagnostic to image the transverse charge distribution. The emission distribution at the cathode surface could in principle be deduced through simulations, but cannot be measured directly with this method. In the quest to develop ultra-bright photoinjectors, it would be advantageous to be able to measure the emission distribution directly, and use this as a screening process to characterize different photocathode candidates. Angle-resolved photoemission sepctroscopy (ARPES), used widely in surface science, has been proposed [H. Padmore (private communication)] as a method to measure the photocathode intrinsic emittance. A promising novel photocathode, a thin layer of MgO on Ag [K. Nemeth et al, PRL 104. 046801 (2010)] was recently fabricated and ARPES measurements were carried out [T.C. Droubay et al, PRL (in press)]. The analysis of these data and resulting emittance will be presented. Implications for its use in simulations and design of future photoinjectors will also be presented.

[1]This work was supported by the U.S. DOE Office of Science (DE-AC02-06CH11357) and the National Science Foundation (No. PHY-0969989). The measurements were carried out at the EMSL user facility at PNNL.

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Date submitted: 10 Jan 2014 Electronic form version 1.4