β Enhancement Studies with an RF Photocathode Gun

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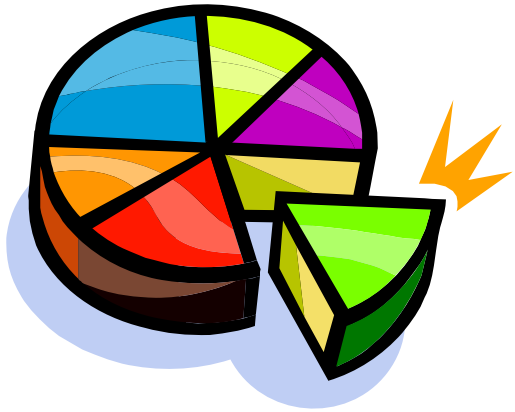
HG2006

ANL/SLAC collaboration

Motivation



RF breakdown (pie)

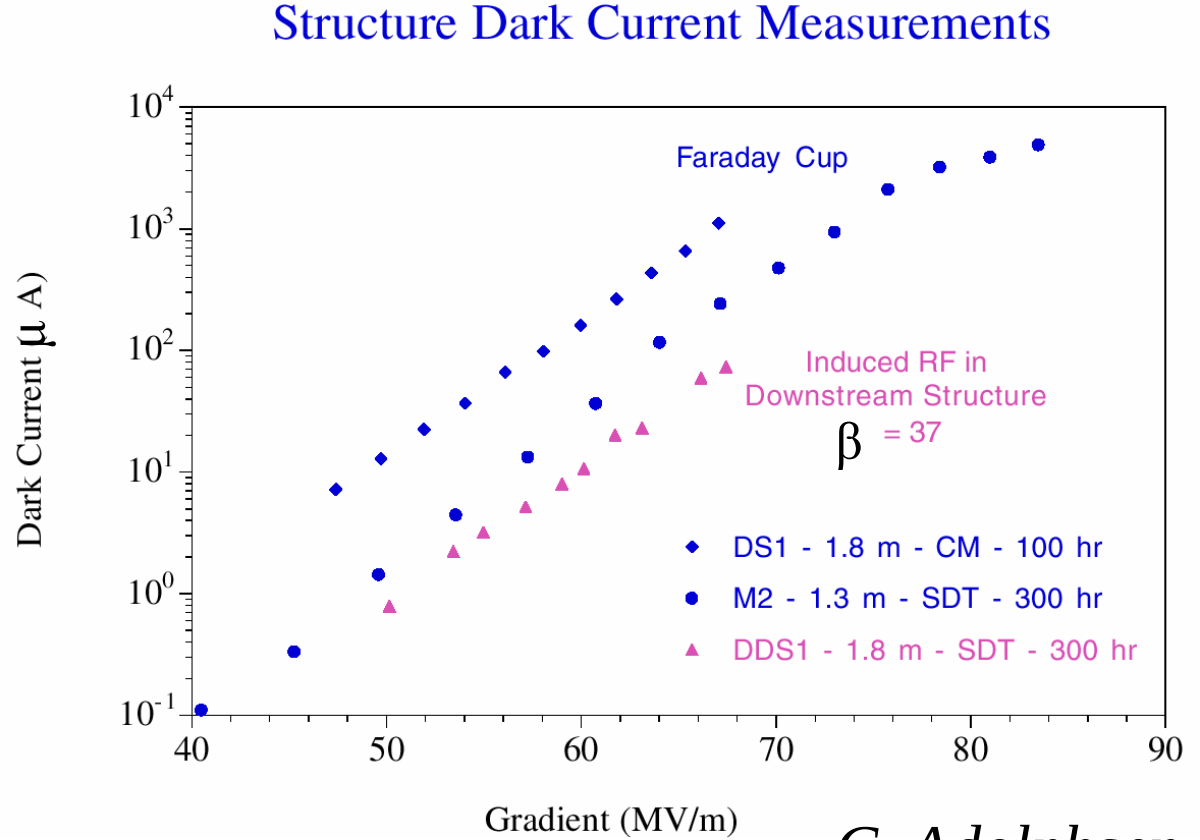
field enhancement
(slice)

a complicated
multiphysics process

High field
emission regions

Surface
features

Macroscopic β Measurements



C. Adolphsen

Measures all the dark current from all the emitters

F-N fit →

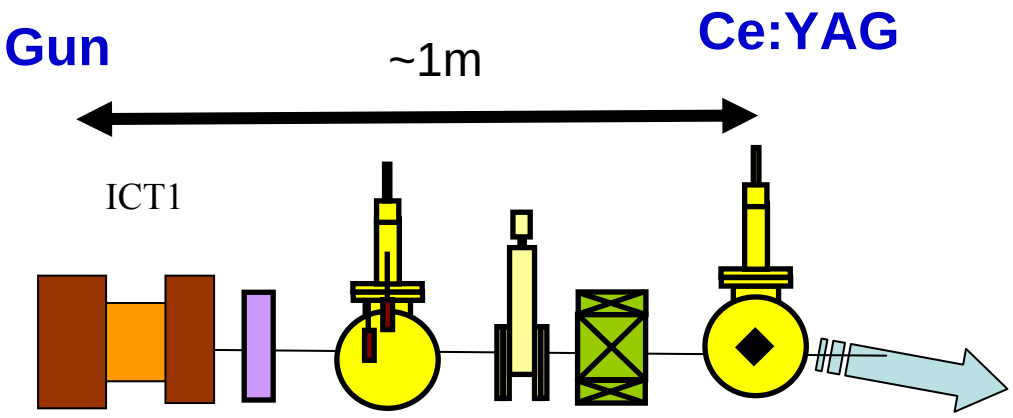
β ~ 30 – 1000

Area ~ (100 nm)^2

Problem

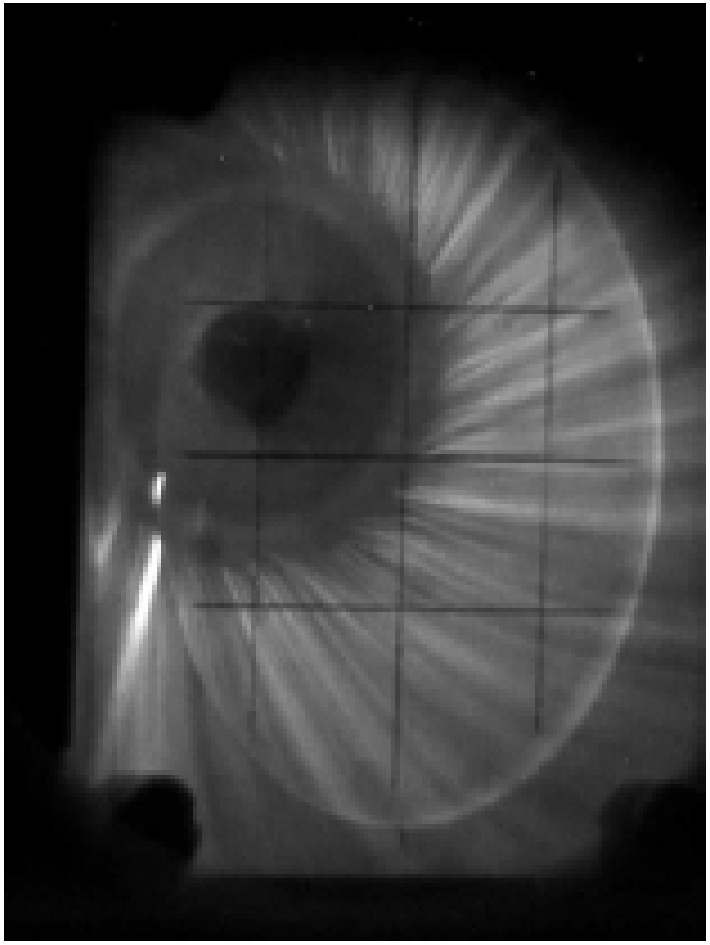
1. Relationship between β and the **surface features** is not known
2. Number and spatial distribution of the emitters is not known.

Dark Current Images from an RF Photocathode Gun



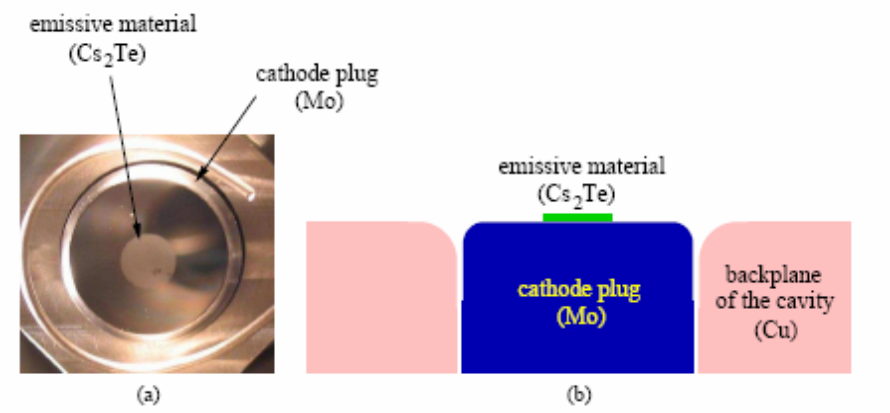
Use solenoids to make an image of the dark current at YAG screen

streaks → emitter site

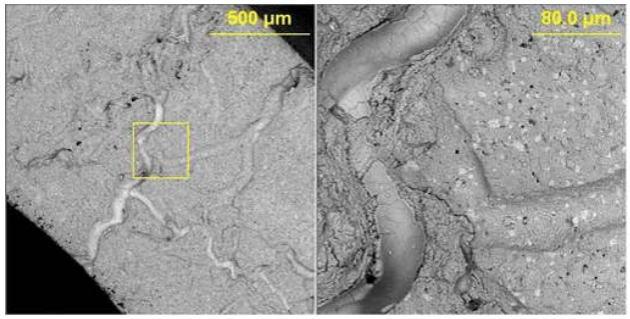


dark current image
Jang-Hui Han, Ph. D. Thesis

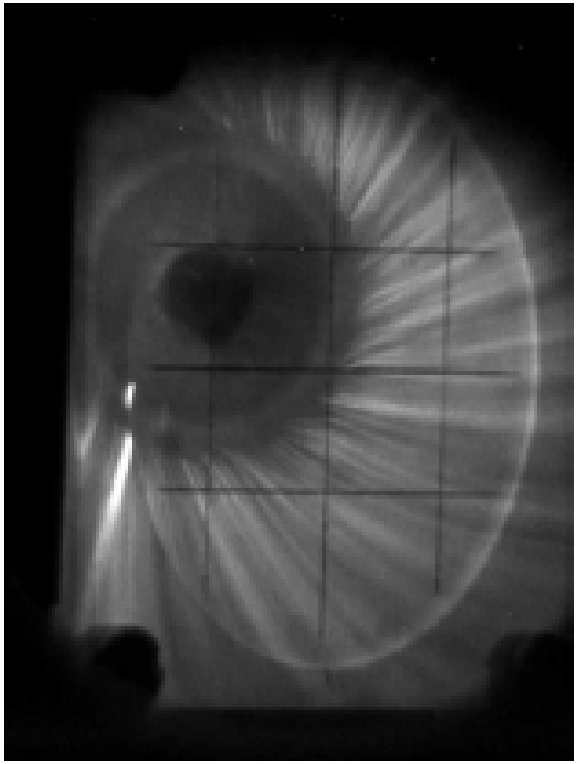
Microscopic β measurements



Surface Analysis of the emitter site

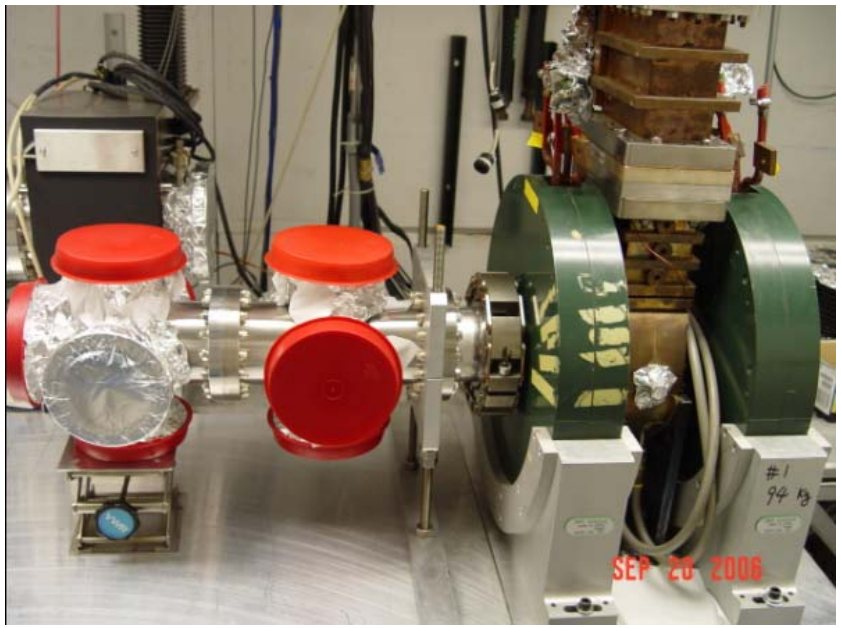


Surface feature
(Geometric or Impurity)



Local β measurement
(Light Intensity vs. field)

1.3 GHz RF Photocathode Gun at the AWA



Plan:
Commission Spring 2007??

- Removable cathode
  - Test Different Materials
  - Test Different Surface Preparation
- Diagnostics & Tools
  - High Resolution images of YAG-screen and Photocathode
  - Standard diagnostics available: energy, faraday cup, streak camera, etc.
  - Laser (248 nm, 372 nm, 744 nm) available to trigger a breakdown