Twisted Electrons Planning Discussion

April 1, 2015

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- Goals
  - ✓ success testing modified Mott cross-section
  - ✓ more success learning how making twisted electrons from GaAs
  - ✓ even more success testing spin-polarized twisted-electrons
  - ✓ unlikely amounts of success achieve results from GaAs-tip

- U. of Oregon Tests

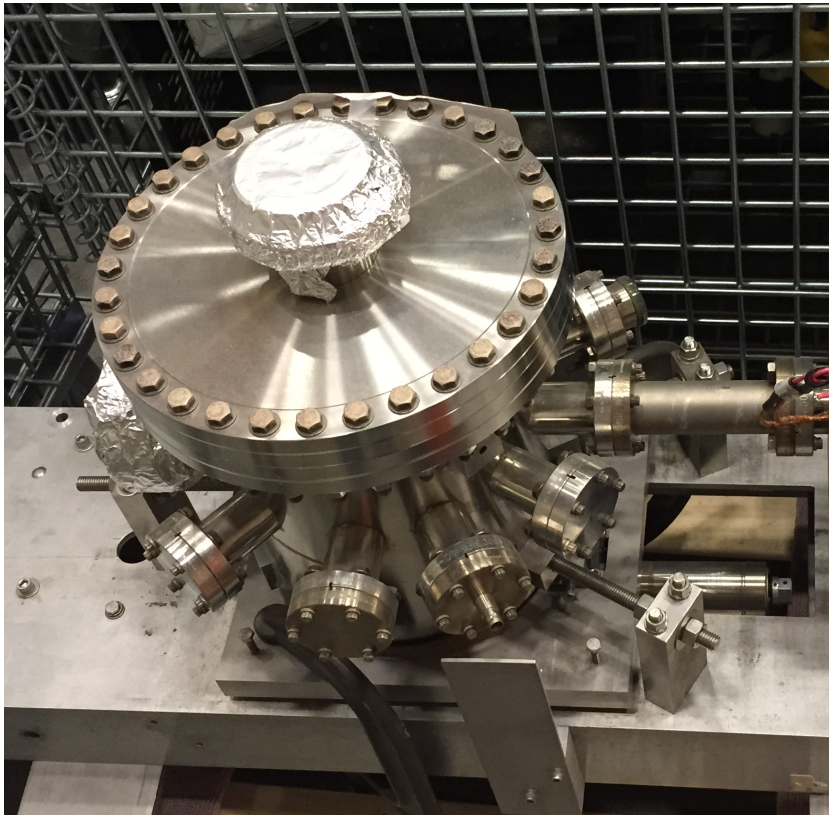
  - ✓ Learn if Ben's electron gun can accept Mott style detector
  - ✓ Test Dipangkar's modified Mott cross-section w/ and w/o twisted electrons

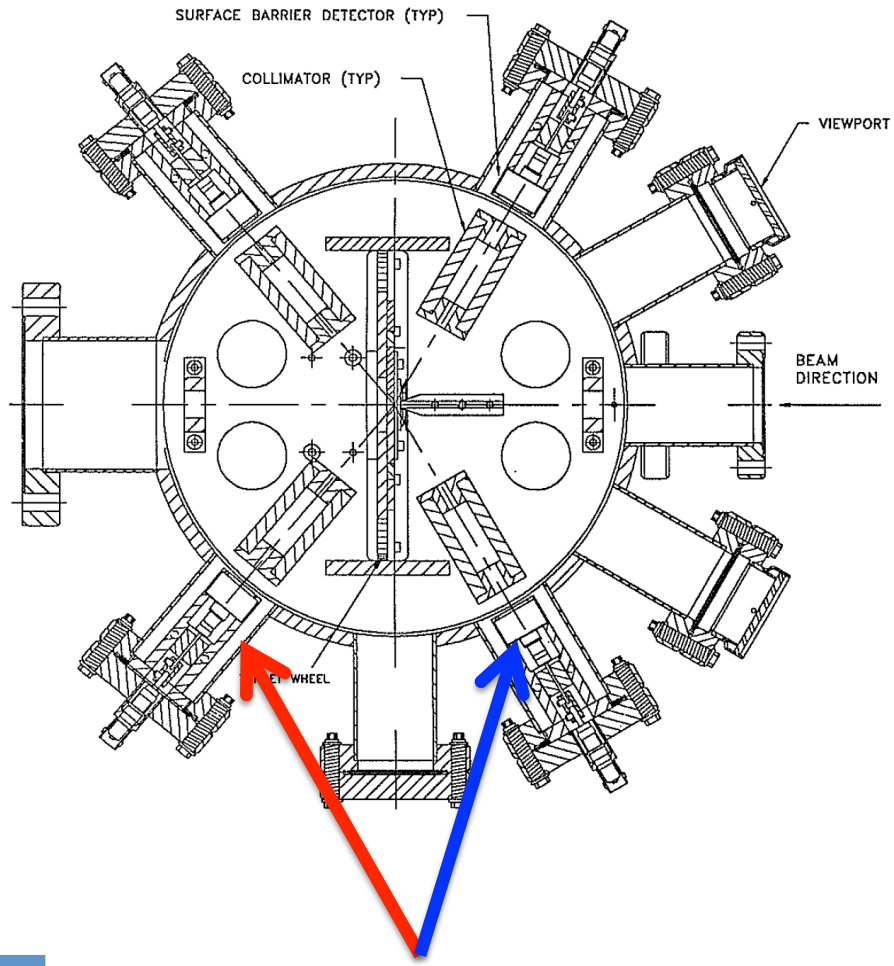
- If we are unable to perform test using Oregon FE gun or demonstrate modified cross-section from twisted-electrons makes sense to continue with tests at JLAB

- JLAB Tests

  - ✓ Test if GaAs makes twisted electrons using holographic filter + imaging
  - ✓ If GaAs unsuccessful consider adding FE-source
    - Learn how to fabricate and operate (HV or light)
    - Characterize beam brightness vs. GaAs (how different?)
    - What are the limitations
  - ✓ Test Dipangkar's modified cross-section w/ and w/o twisted electrons

100 keV Mott Scattering Chamber





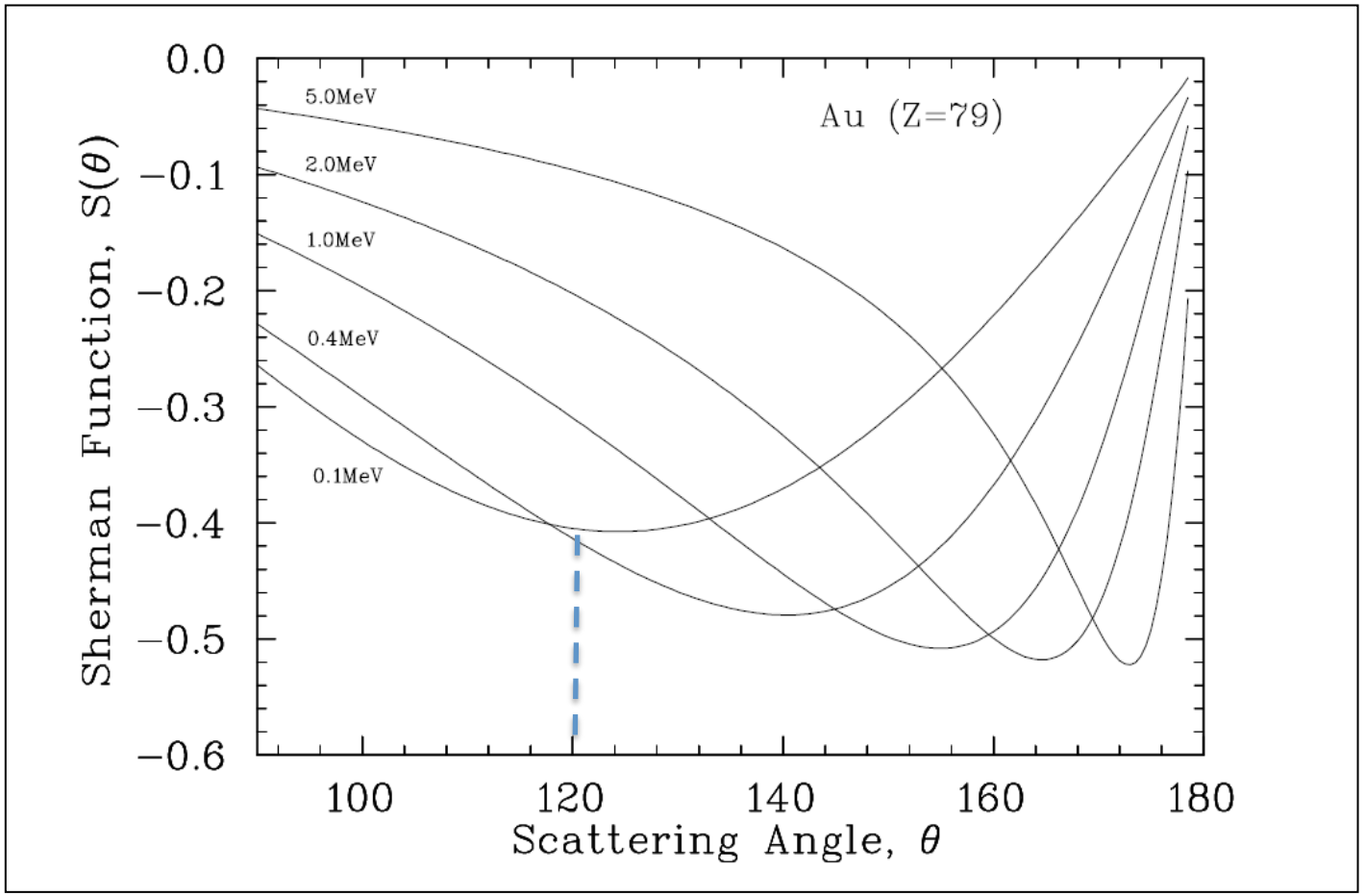
Port	Angle	Solid Angle (sr)
Forward	±50°	5.1×10^{-5}
Backward	±120°	5.5×10^{-4}

NH-016-050-300-S
SILICON SURFACE
BARRIER DETECTOR
ORTEC

Maximum Analyzing Power vs. Kinetic Energy

Polarized cross-section : $\sigma(\theta,\phi) = I(\theta)[1 + S(\theta)\vec{P}\cdot\hat{n}]$

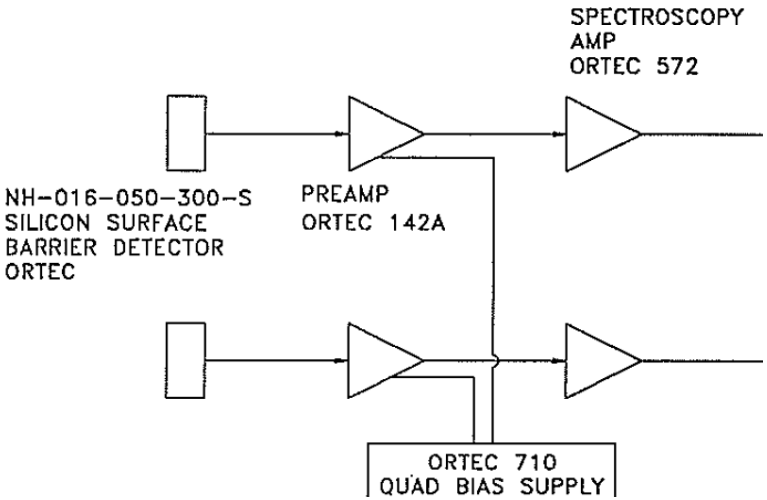
Unpolarized cross-section : $I(\theta) = \dfrac{Z^2e^4}{4m^2\beta^4c^4\sin^2(\theta/2)}[1-\beta^2\sin^2(\theta/2)](1-\beta^2)$



1990's Setup and Result

Most equipment available

- CF mount surface barrier detector
- Mini NIM crate
  - Bias supply
  - Pre-amp to improve S/N
  - Amplifier
  - Pulse height analyzer/ADC



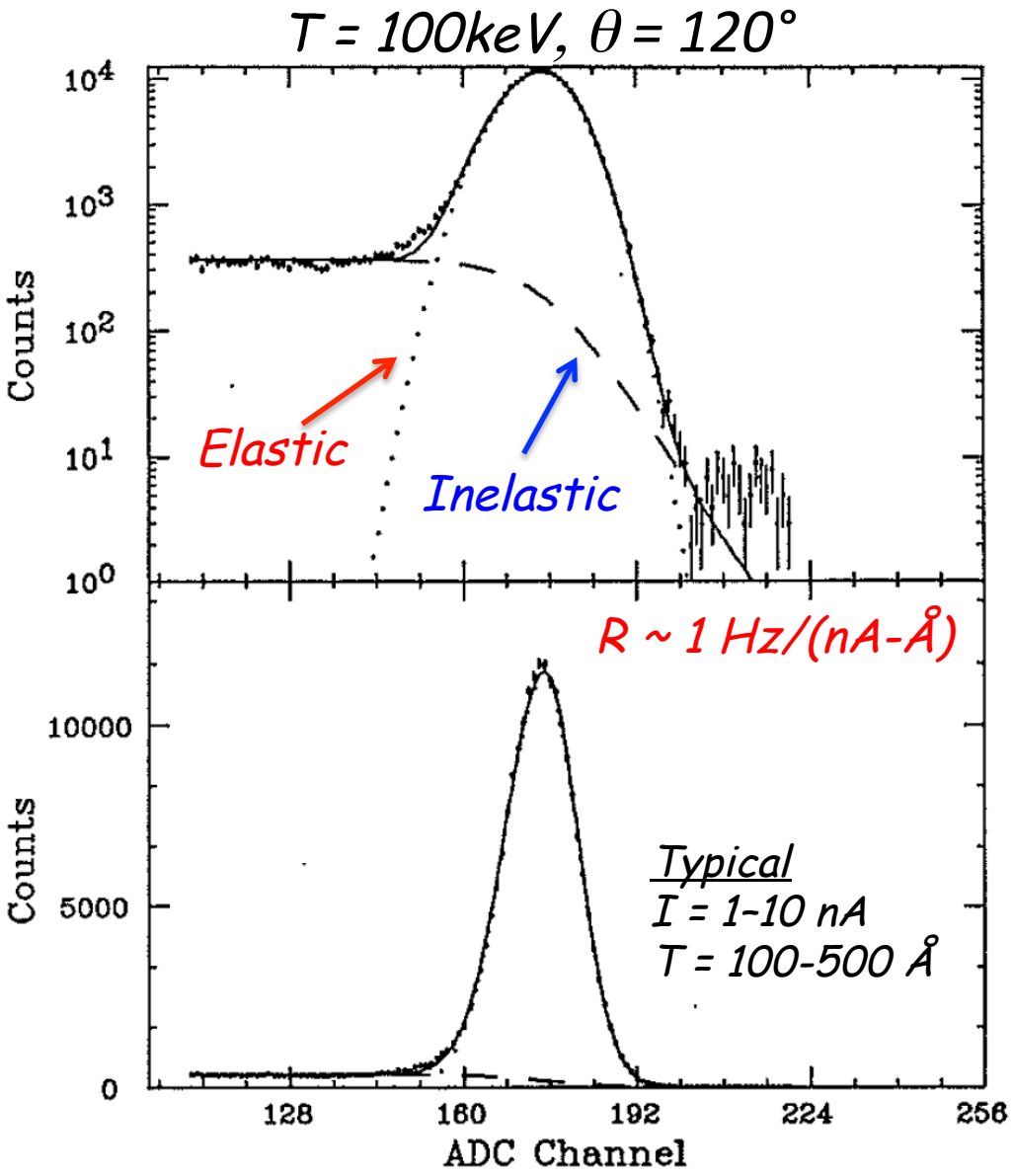
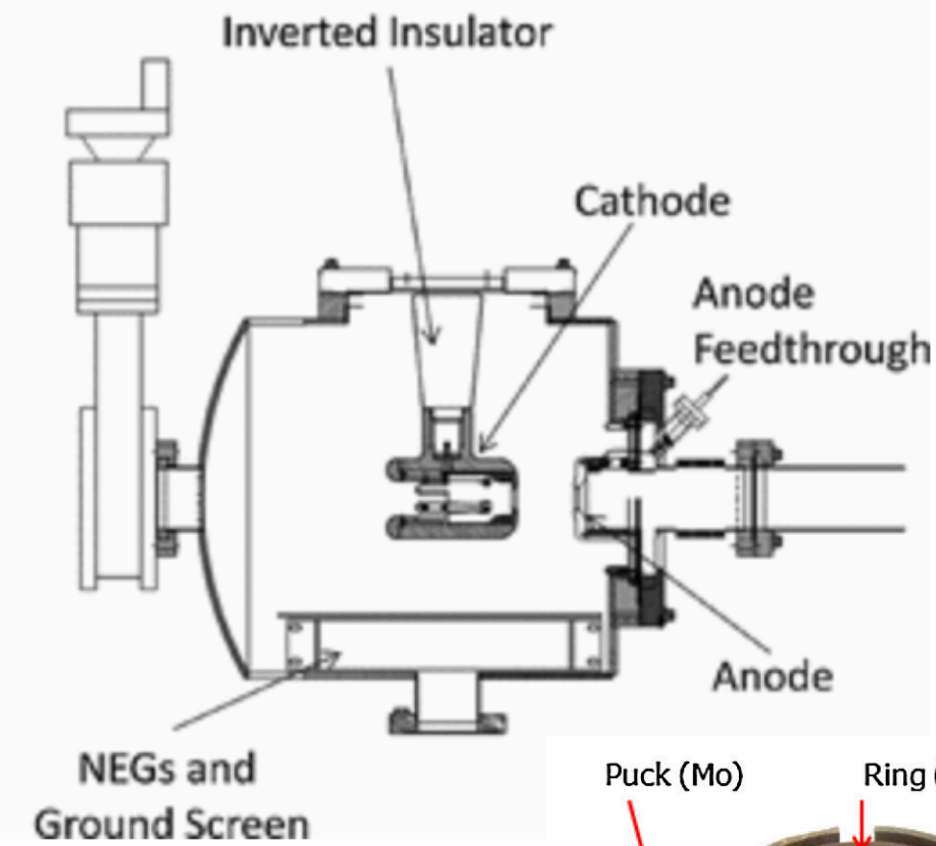
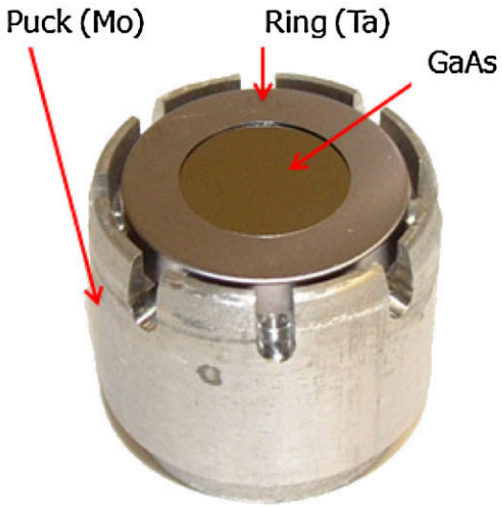
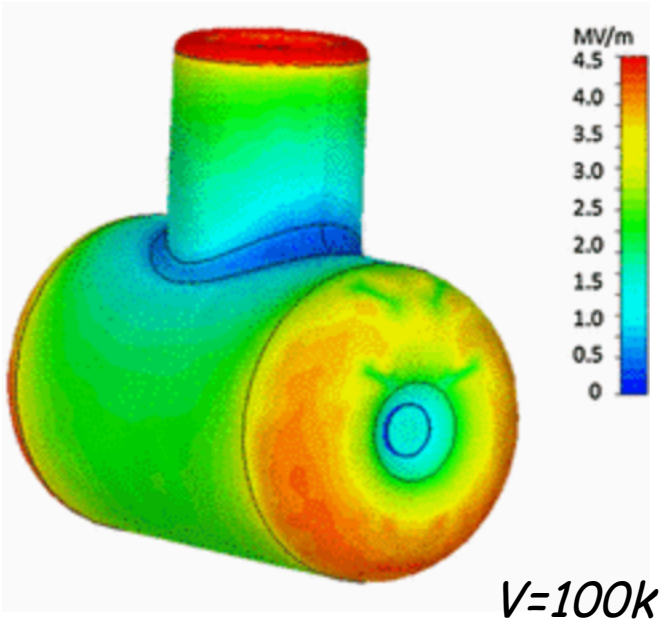


Photo-Emission and? Field-Emission





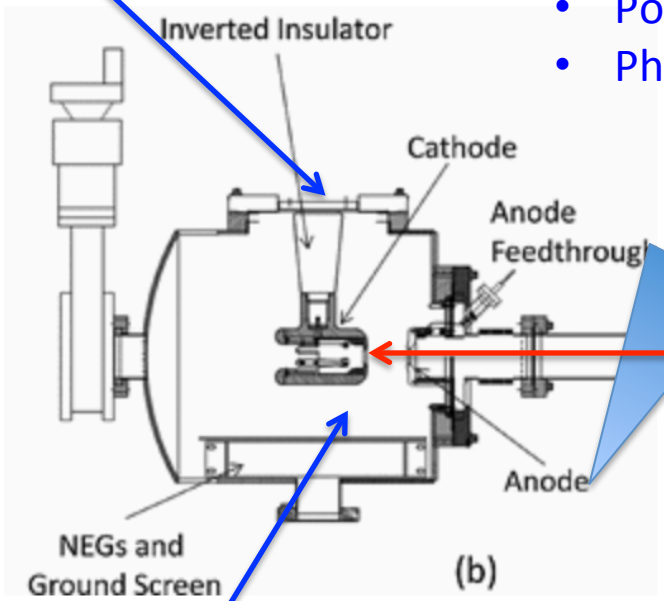


1. Use HV to achieve FE
2. Use anode for control?
3. Photo-assisted FE?

V=100kV

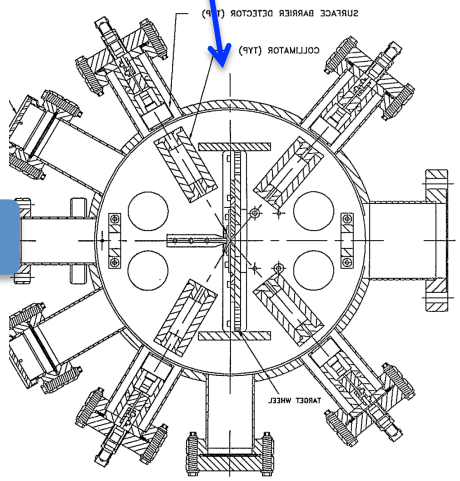
Oversimplified Test Stand Idea ?

HV < 200 kV



Polarized Laser
- Polarized photoemission
- Photo-assisted FE???

Mott Polarimeter
- Entrance aperture
- Scattering 50, 120 deg
- Asymmetry measurement
- Current monitoring



Mount to standard moly puck
- GaAs photocathode
- FE emission tip

Intensity Control
- Slit/aperture
- Cup/Plate monitor

Twisted Generator Cross
- Grating
- YAG viewscreen/camera