Theoretical Uncertainties in Mott Scattering
– as understood by Allena

Mott scattering – electron scattering from nuclei

Calculations provided by Xavier & Chuck:

- DWBA for elastic electron scattering from Au and Ag
  - scatt angle in deg (th)
  - differential cross-sec (dS in cm^2/rad)
  - spin rotation functs (T and U)
  - Sherman Funct (S)
- Uncertainties
  - Numerical accuracy
  - Center of mass
  - Bremsstrahlung
  - Radiative corrections
  - Finite nucleus vs point nucleus
  - Screening of atomic electrons

Uncertainties – page 1

- Numerical accuracy
  - arises from convergence of the partial wave series
  - can be estimated by Xavier

- Center of mass
  - kinematic and dynamic corrections due to recoiling nucleus
  - kinematic corrections – can be accounted for
  - dynamic corrections – due to change in phase shift of outgoing electron

    change in scat amps proportional to (m_e/m_N)

    → change in diff cross sec scales with

    X $(\alpha\ Z\ m_e/m_N)\ (m_e/E_e)$ ie small effect

- Bremsstrahlung
  - may be accounted for in G4
  - generally, $E_{rad} < m_e c^2$ in elect frame or $< \gamma\ (m_e c^2)$ in lab frame
  - energetic e and heavy nuclei increase this radiation

Uncertainties – page 2

- Radiative corrections
  - “thought to be not relevant for parity conserving analyzing power”
  - Xavier can check this though

- Finite nucleus and point nucleus
  - both calcs can be done
  - but for few MeV electrons, details of nucl charge distrib not relevant
  - might use experimental charge densities parameterized with simple forms for calcs with finite size of nucleus considered

- Screening of atomic electrons
  - can be taken into account
  - But can be neglected for electrons with E > few MeV

Bottom Line

Should try to understand dynamic recoil effects

If electron beam with E = few MeV used →

should use medium = mass nuclei targets

because some corrections increase with

(m_e/m_N) and/or (αZ)