Charm Electroproduction at JLab-12

April 12, 2000

1. Why?

    (a) try to discover reaction mechanism
    (b) not sure (much more work in other kinematic domains)

2. Can It Be Done?

    (a) kinematically: yes, even with current equipment
    (b) practically: will be very tough, but jury is still hearing testimony

3. What Next?

Why?

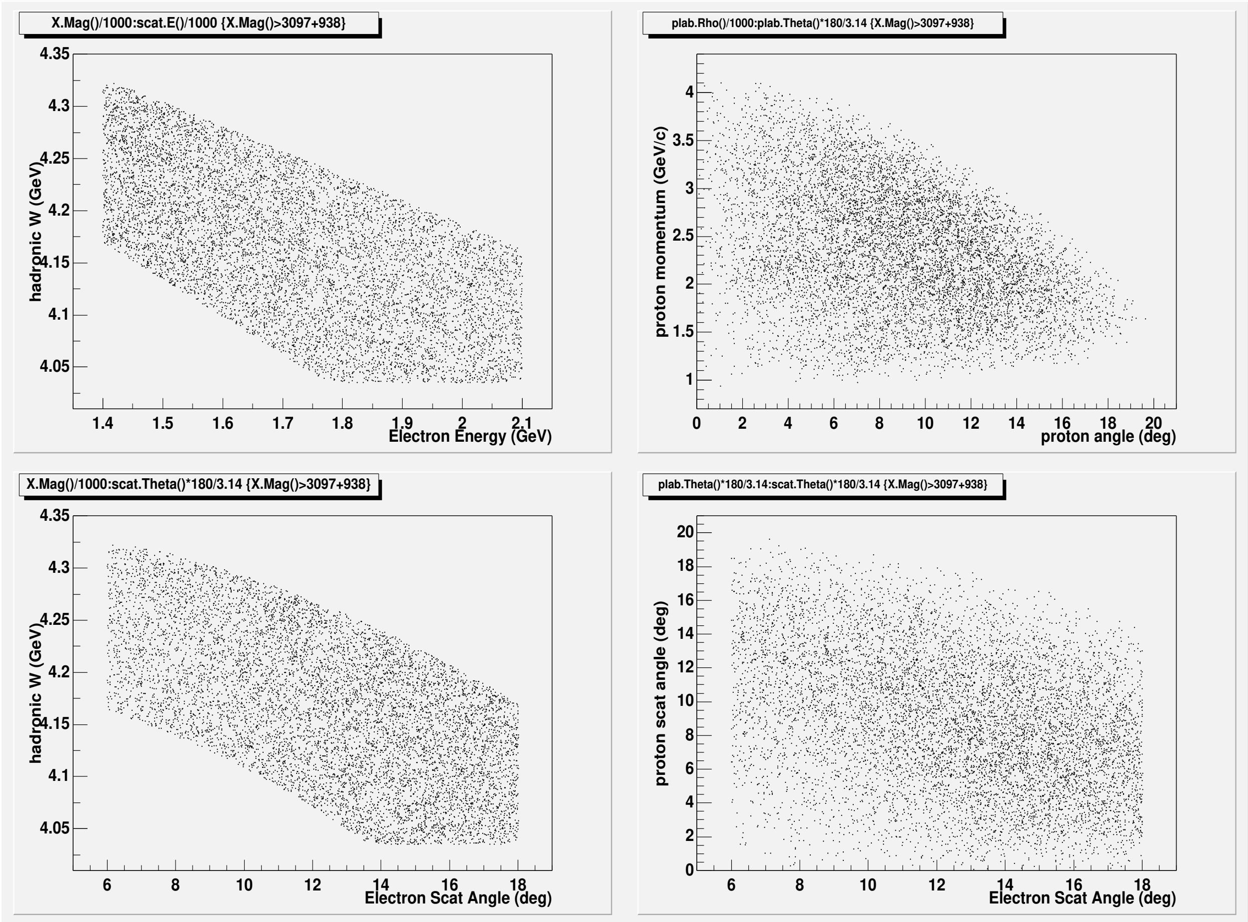
- Only previous experiments in this energy domain were inclusive (only ψ was detected)
- no discrimination between various ψ-production mechanisms
- only theoretical papers I could find were targeted towards ELFE project (15-30 GeV); must be much more interesting closer to threshold

Can We Do It?

Starting Point: experiment with existing equipment

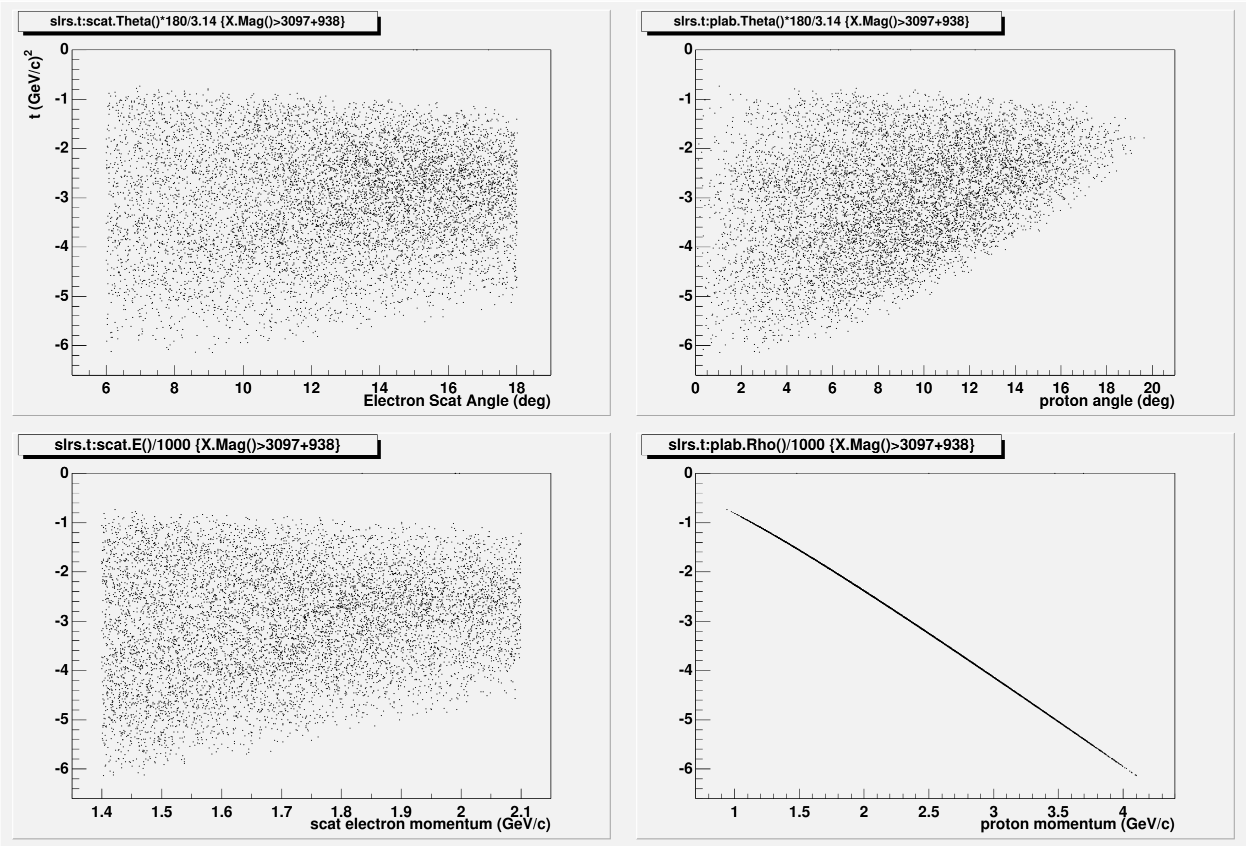
- hall A spectrometers + septa:
  - six deg minimum scattering angle
  - max detected momenta around 3–4 GeV/c
- try detecting scattered electron and recoil proton
- kinematics simulation:
  - beam energy 11 GeV
  - random electrons, momenta 1.4 – 2.2 GeV/c and angular range $6 \leq \theta \leq 18$ deg
  - ψ's produced in random directions in hadronic recoil rest frame

Basic Kinematics



Correlations With t

Cross section falls exponentially (?) with t



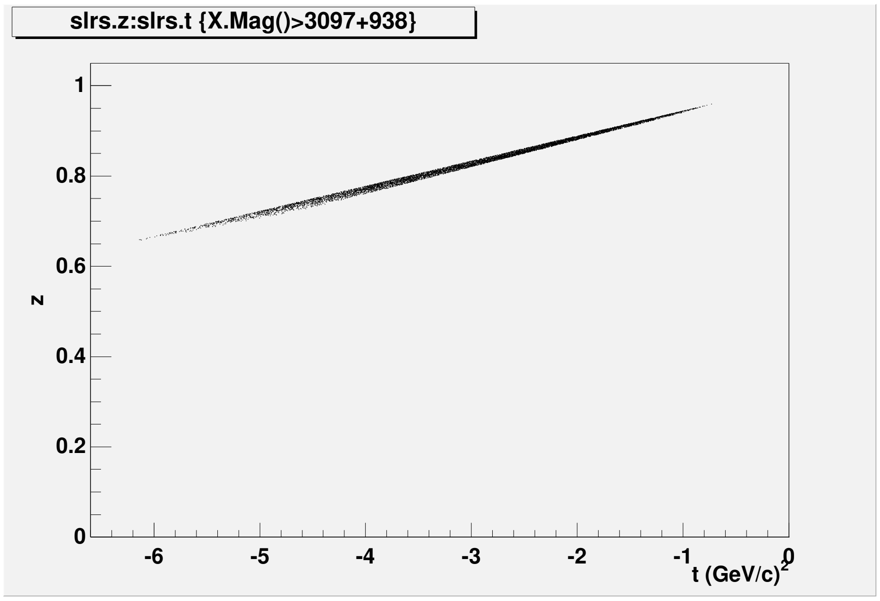
Note $t \equiv (\gamma^* - \psi)^2 = 2m_p^2c^2 - 2E_{p'}m_p$

pQCD vs. VMD

Relevant parameter[1] is $z \equiv E_\psi/\omega$

"Small" z means "pQCD works" (Color Singlet Model)

$z \sim 1$ means VMD should dominate



too bad, probably no rate at "small" z

[1] V. Breton and C. Martin, Nucl. Phys. **A532**, 451c (1991)

Practicality

Information from Breton/Martin paper:

- 15 GeV, 20 μA beam, 0.1 $\mathrm{g/cm^2}$ target
- about 1700 ψ/hr for *all* $Q^2 \geq 0.001\ (\mathrm{GeV}/c)^2$ (integral)
- cross section must be dropping like a rock

This would be routine except for large energy loss — $\omega/E_0 \sim 0.85$! Estimates (differential!) are needed to determine feasibility

What Next?

1. figure out if a γ^* will tell us anything new compared to a γ (theorists??)

2. semi-realistic cross section modeling (Breton/Martin appropriate?)

3. revisit point (1)

4. comparison to singles rates

5. revisit point (3)

6. which set of particles is best to catch?? (cf Eugene's detector).