Polarized Radiative Corrections at G2P Kinematics

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IDEA

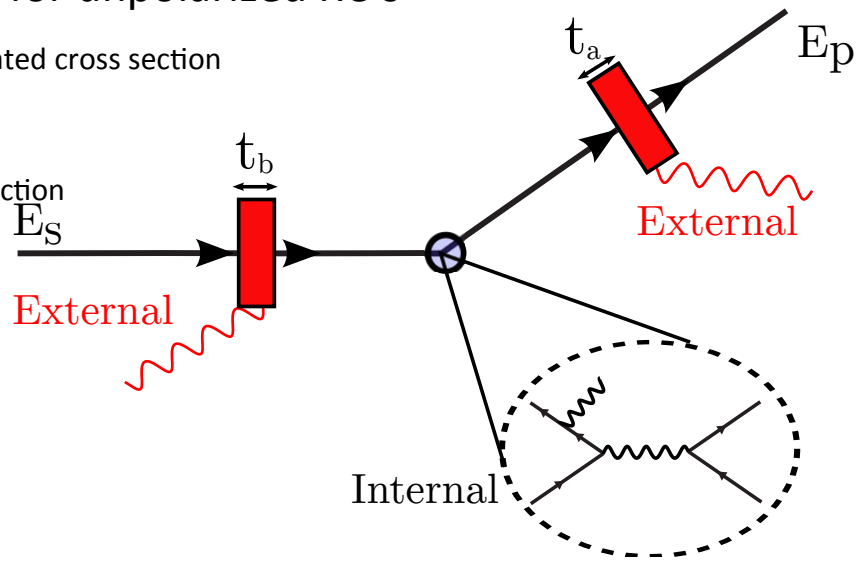
- Look at polarized radiative (POLRAD) corrections with model generated at g2p kin
  - Just the inelastic RC's
  - Use fits to scattering angle that I showed on 10/5/16 and P0 range from taken data
  - MAID 2007 to generate the polarized DS's
  - POLRAD Formalism by Akushevich, Ilyichev and Shumeiko
    - http://arxiv.org/abs/hep-ph/0106180
    - Modify existing code to read in a scattering angle from the data file as opposed to a constant parameter
- For this study focusing on RC'ing the 2.254 GeV 5.0 T data-set

Polarized Models

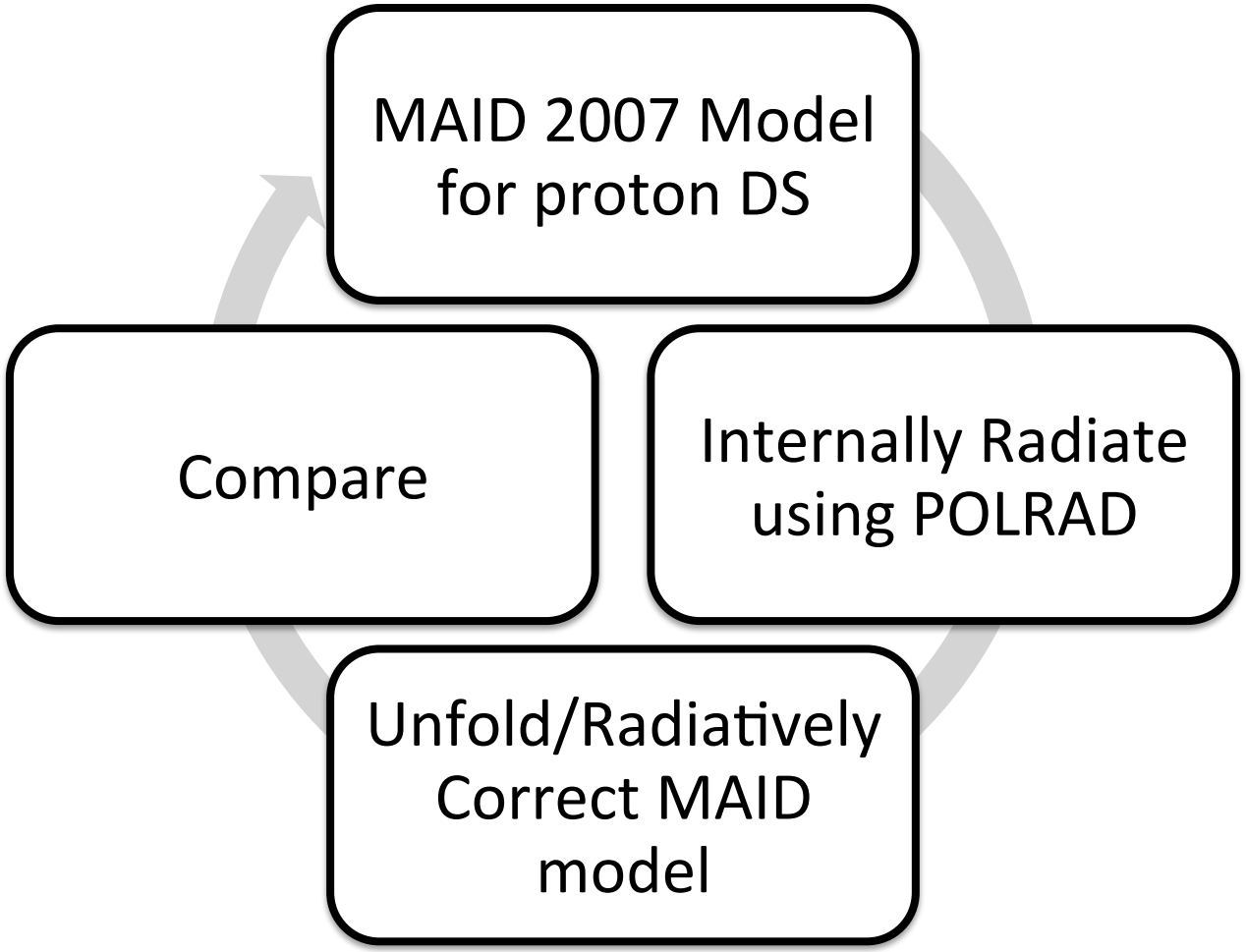
- Use MAID 2007 to generate polarized cross sections (*Δσ)*
  - http://portal.kph.uni-mainz.de/MAID//maid2007/
  - Output is virtual photon/proton cross sections
  - Kinematic relations convert virtual photon/proton cross sections *to Δσ*
    - Can be used for asymmetries and unpolarized cross sections too!
    - Use Hand convention for virtual photon flux factor
    - See http://arxiv.org/abs/hep-ph/9810480 for kinematic relations
- Also have Hall B model set-up for use in the future

Polarized Radiative Corrections

- Polarized RC's are only for internal corrections!
  - Mo and Tsai formulation still used for the external corrections
- Iterative process is the same as it was for unpolarized RC's
  - Guess at initial Born cross section based on a radiated cross section
  - Radiate the guess for the Born Cross Section
  - Compare radiated guess to input radiated cross section
  - Improve the initial guess based on differences
  - Iterate and converge!

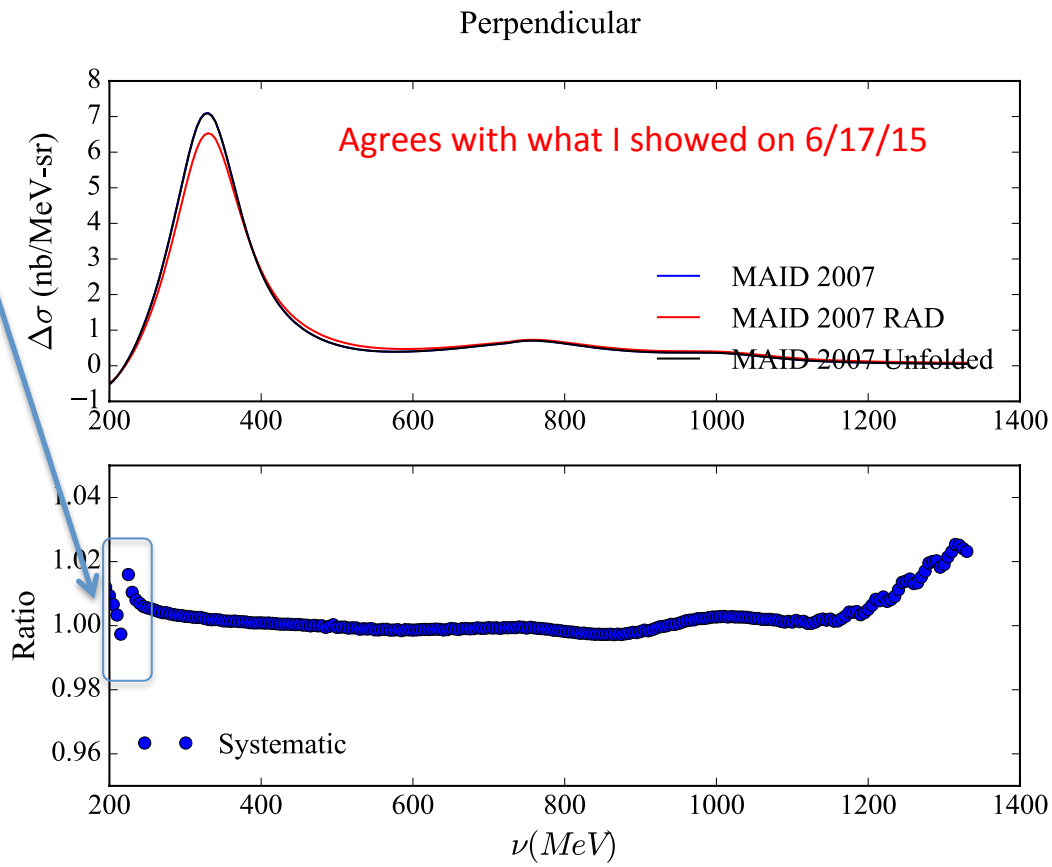


Systematic Study



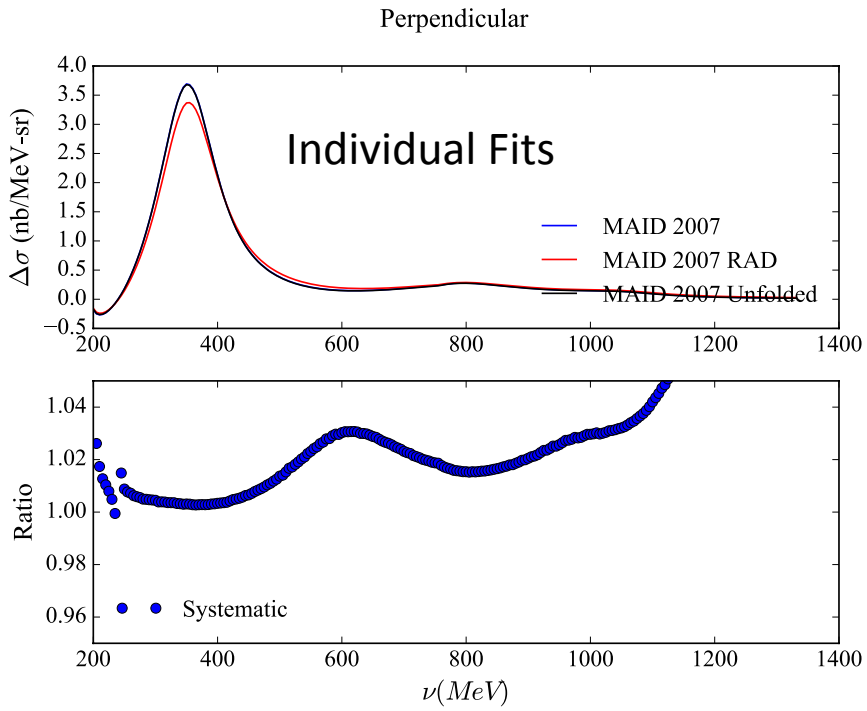
RESULTS: 2254 MeV

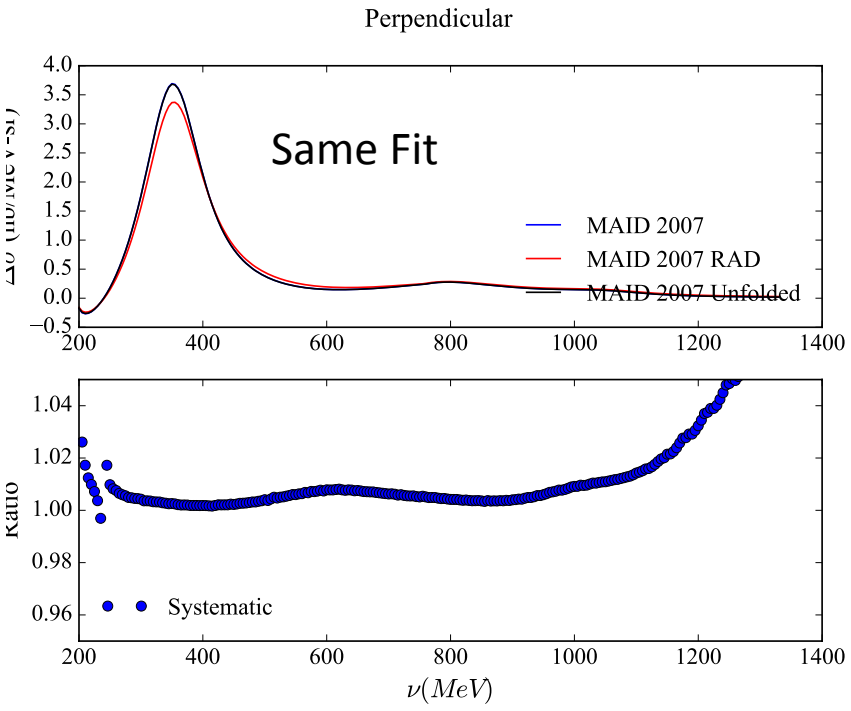
- Mimic g2p experimental conditions
  - Use radiated MAID 2007 at 1157 MeV/1711 MeV for interpolation
    - Use momentum range from the data we took during experiment
    - Use constant scattering angle (just to make sure I know what I'm doing)
    - Θ = 5.69 °
- When DS crosses 0, there is a jump in the ratio



RESULTS: 2254 MeV

- Mimic g2p experimental conditions
  - Use radiated MAID 2007 at 1157 MeV/1711 MeV for interpolation
    - Use momentum range from the data we took during experiment
    - Use individual fit for each E0 setting and using 2.2 GeV 5T fit for all settings
- When DS crosses 0, there is a jump in the ratio
- Same fit does better (same is true for parallel case but didn't show here)





Summary

- POLRAD now set-up to handle g2p kinematics for radiative corrections!
  - RADCOR also ready!!
  - Minimal changes need to be made to elastic tail codes..
- Testing POLRAD interpolation routine in RADCOR to see if that improves anything
  - Initial signs are that it doesn't but I still have some things I want to check
- Recommend models for interpolation/extrapolation to lower energies for RCs
  - Models run using same angle fit as from the data you are trying to RC
  - Could also think about using models to scale g2p data match angle you're trying to RC to
    - Is more than just a MOTT scaling (RADCOR divides out MOTT to remove dependence on RC's)
- Questions, Comments, Concerns?

FROM SLIDES I showed on 6/17/15

Additional Information

- Two different integration routines available to do POLRAD integrals
- Originally from CERNLIB but thanks to Karl, they now exist as stand-alone code
  - DGQUAD:
    - 96-point Gauss-Legendre quadrature formula
      - Fastest: Takes seconds to radiate and a few minutes to unfold
      - Has a harder time dealing with the 0-crossings but can add in additional spectra to help with the interpolations
  - DGUASS:
    - Can specify the accuracy required (1d-3 – 1d-6)
    - Radiating: results differ at the 4th decimal place between 1d-3/1d-6 and 1d-6 took a few days to run
    - Unradiating: 1d-3 takes a few hours, 1d-4 took approximately a week (never even tried 1d-6 but a few weeks? A month?!)
    - Results previously shown are 1d-3 precision in DGAUSS for unfolding

2254 MeV