Round table discussion

Subjects to discuss

- Heavy leptons
  - $\tau^+\tau^-$, $\mu^+\mu^-$

- Radiative corrections on e^+e^-
  - First tests by Alaa et al
  - New calculation by Jacques and Saro

Heavy leptons

- Muons ($\mu^+\mu^-$)
  - PID (dE/dx, TOF, Cerenkov, ECAL, MUON)
  - Kinematics
  - Can we reach a supression factor of $1:10^8$?
- Taus ($\tau^+\tau^-$)
  - Access to polarisation: phase of G_E, G_M
  - Reaction identification wrt background

τ^- Decay modes	$\pi^-\nu_\tau$	$K^-\nu_\tau$	$\mu^-\bar{\nu}_\mu\nu_\tau$
Branching ratio %	10.91 ± 0.07	6.96 ± 0.23	17.36 ± 0.05

Courtesy Alaa

$\tau^+ \tau^-$ (continued)

- Born approximation
- Single exchange photon
  - Differential Cross section
  - Simple, double and triple spin observables calculated with polarized P/anti_p or/and polarised lepton/anti_lepton

Alaa et al

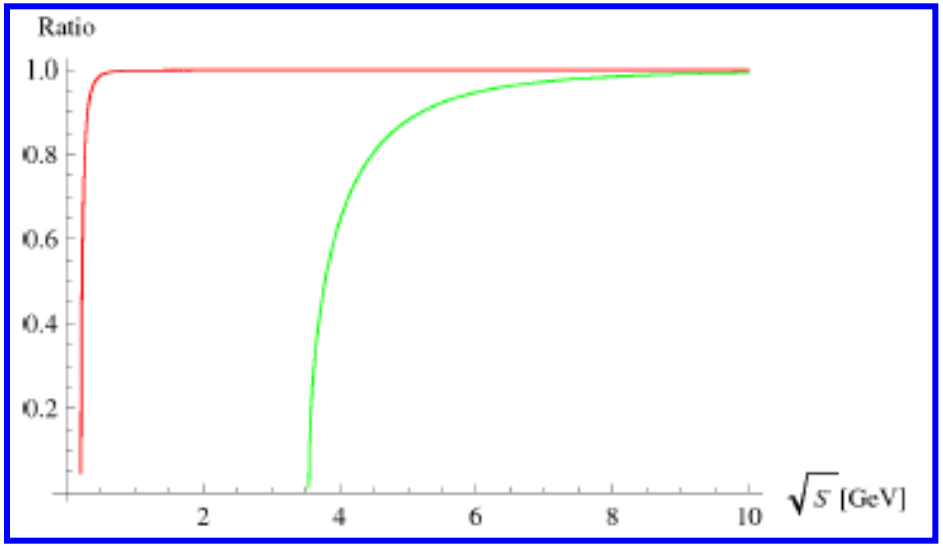
Total cross section:

$$\sigma = \frac{\pi\alpha^2}{3s}\frac{\beta_\ell}{\beta_p}\left(2+\frac{1}{\tau_e}\right)\left[\frac{|G_E|^2}{\tau_p}+2|G_M|^2\right]$$

$$R_\ell = \frac{\sigma(\ell^+\ell^-)}{\sigma(e^+e^-)} = \frac{1}{2}\beta_\ell(3-\beta_\ell^2), \quad \beta_\ell^2 = 1-4m_\ell/s$$

Access to phase difference through polarisation of one outgoing lepton:

Modulation term in sin(2θ)



$\tau^+ \tau^-$ (continued)

- Counting rate with πs (2 missing neutrinos)
- At s=16 $(GeV/c)^2$ $\sigma_{\tau\tau} = 0.7 * \sigma_{ee} = 0.7$ pb

→ $N(\pi^+\pi^-) = 0.7 * 2000\ pb^{-1} * (0.1)^2 = 14$

SIGNAL

BUT $N(\pi\pi$ from $\pi^+\pi^-\pi^0) = 10^{12}\ fb * 2\ fb^{-1} = 2.\ 10^{12}$

BCKG

Tools at hand: kinematical constraints + hermiticity
Is that enough/worth the effort

Polarisation via the Angular distribution of the π in the τ frame → how to access the τ direction?

Trigger?

K channel? μ channel?

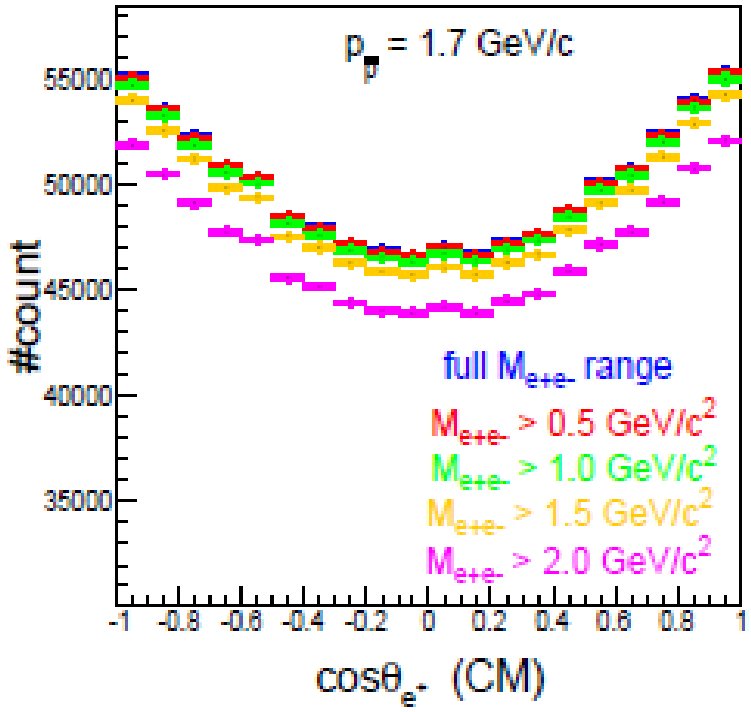
More evaluation/simulation needed

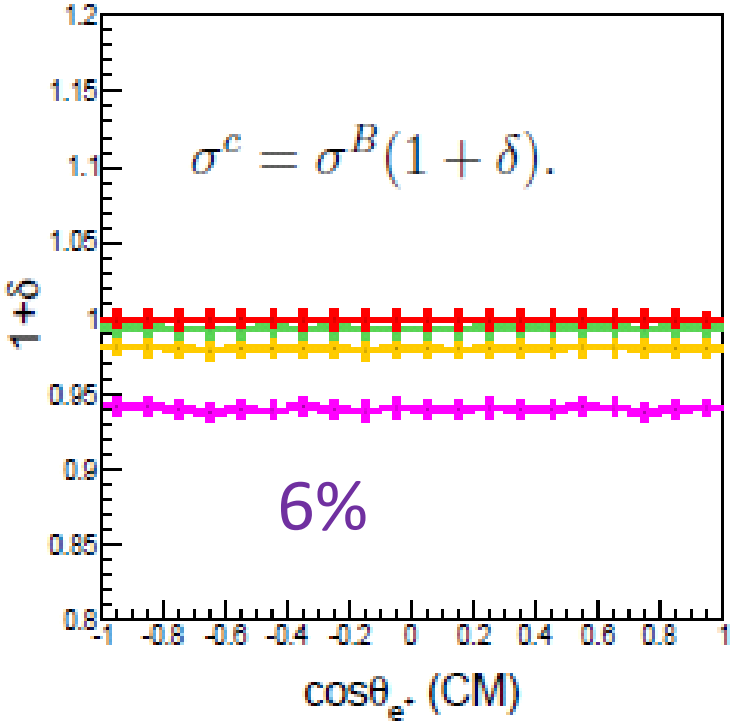
Radiative corrections

- Alaa et al simulations based on the package PHOTOS

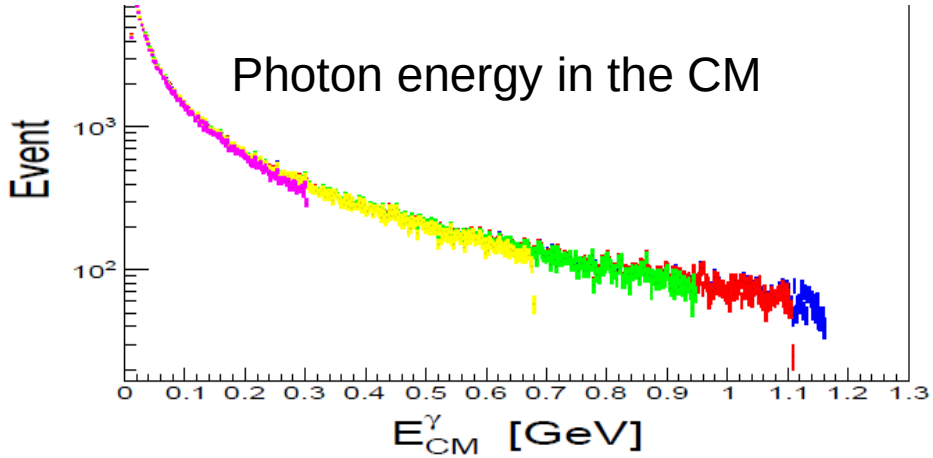
  • No photon emission from initial state and no vacuum polarisation inside Photos.
  • Photons are emitted collinearly to the the direction of parent particle.
  • Real photons are generated above a certain energy defined by Photos

Angular distribution with hard photon cut-off



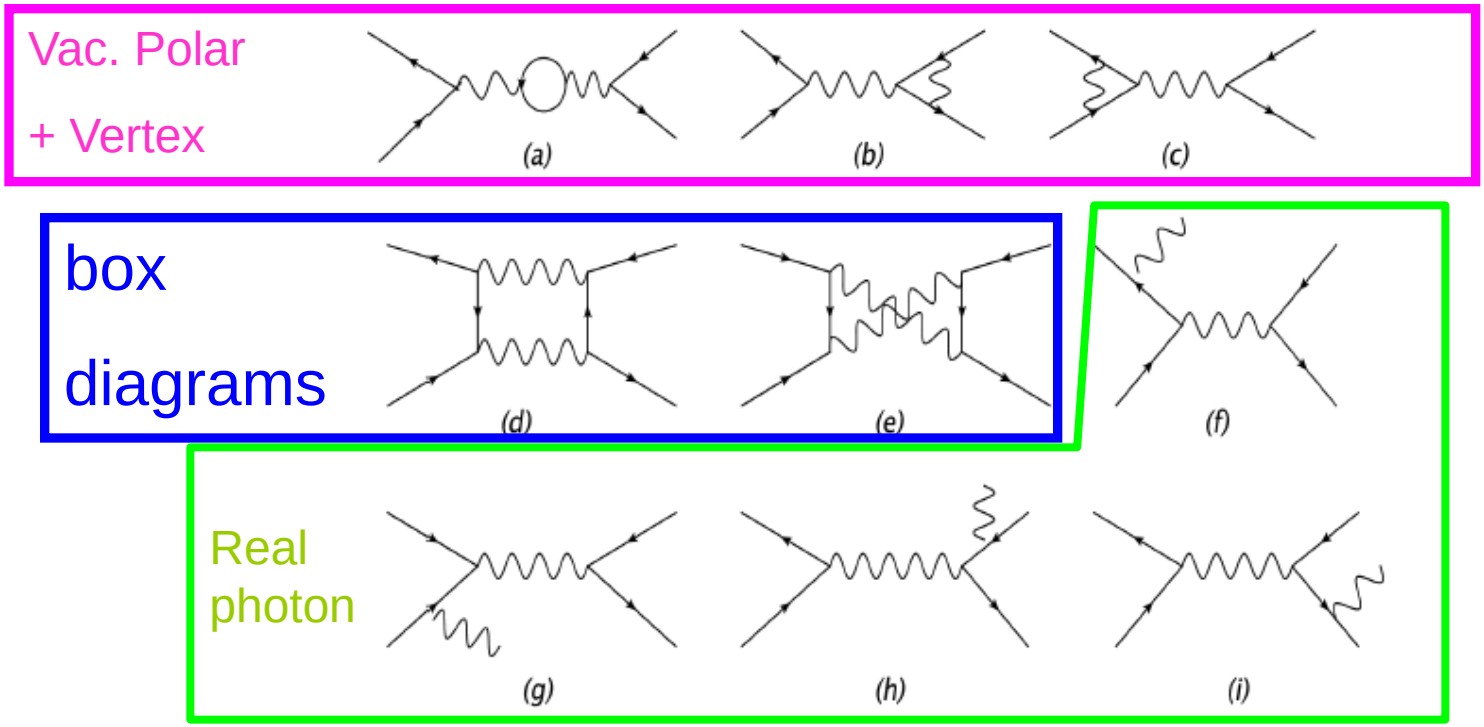


$s^{1/2}$=2.3 GeV/c^2

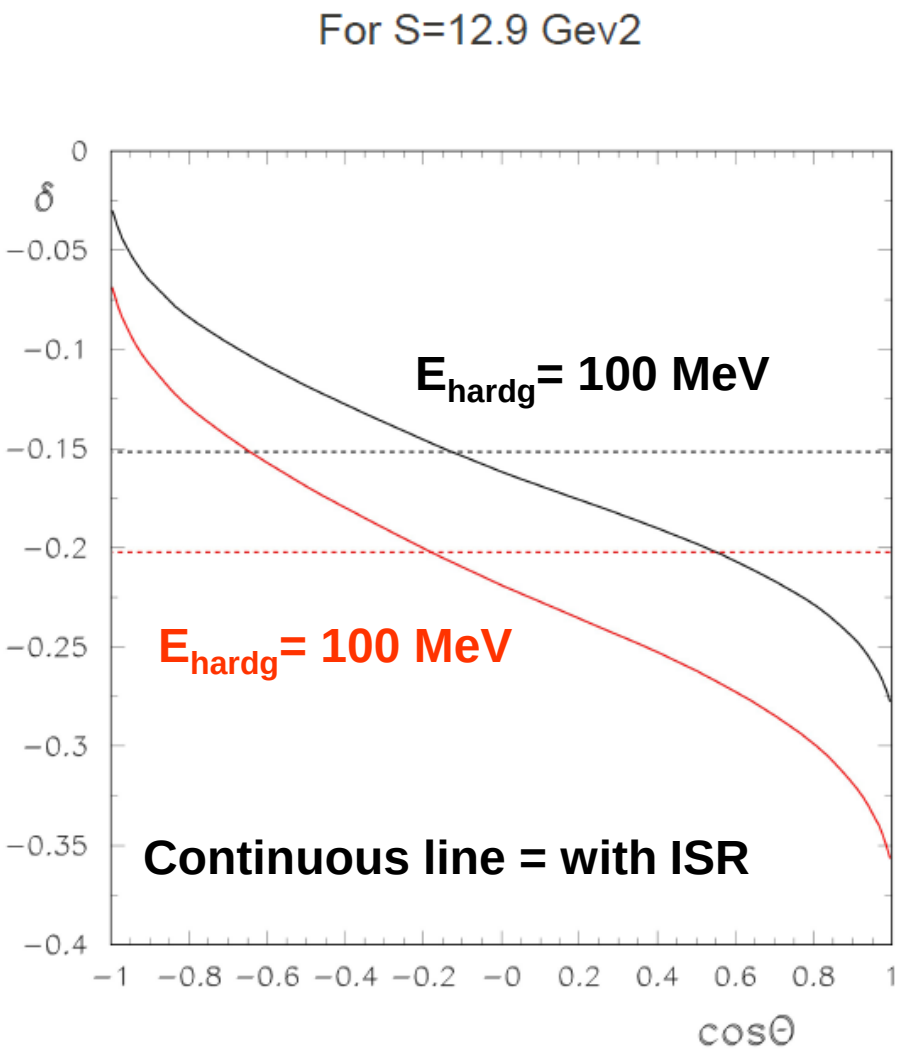


Radiative corrections (Saro +Jacques)

- Full calculation (Born term + α^6 term)



Effect on the angular distribution



If the precision of measurement reaches or is below 3-5%, pne must take into account the ISR (p and pbar)

Questions:

1. what would be the effect on the determination of G_E/G_M ?
2. How do we define the experimental cut?
3. Effect of kinematic fit?