Update on ZH → Z +γγ Simulation Studies –12/19/06

IMSA : Stephanie Bian, Je-ok Choi, Angela Suh

Fermilab : John Yoh

SLAC : (Tim Barklow)

Goal of this SIR project

- SIR = Student Inquiry and Research, which juniors at IMSA need to partake
- This project involves 22 Wednesdays between Aug 30 and April 11. Now is the Winter break
- Goal is ILC Simulation/Physics study
- We are looking into the process

$ZH \rightarrow Z + \gamma\gamma$; First looking at $ZH \rightarrow \nu\nu + \gamma\gamma$

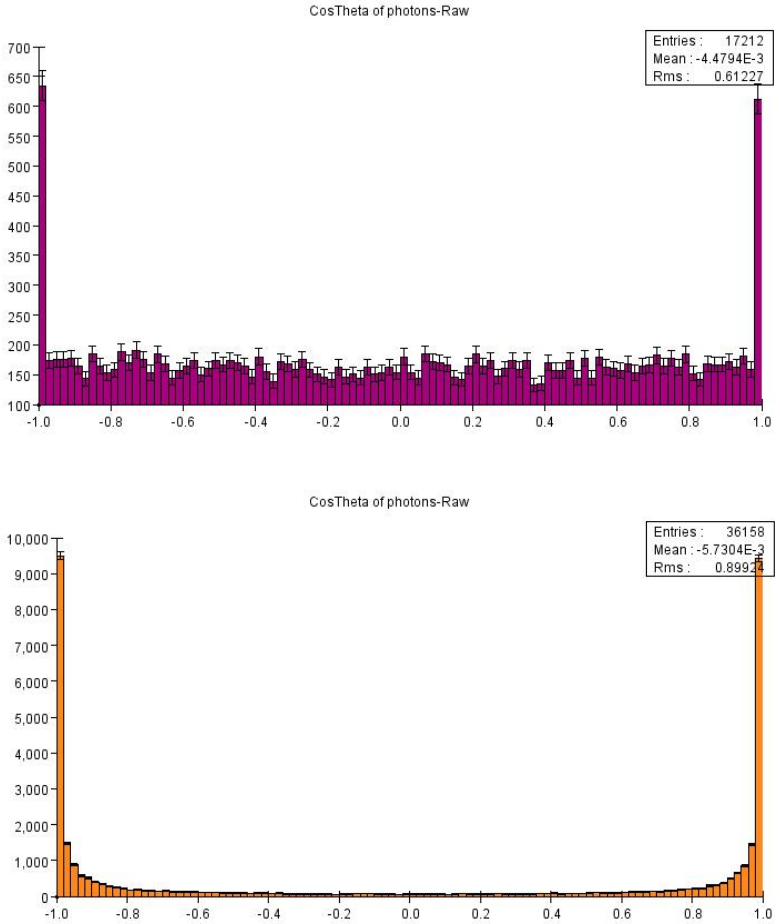
Datasets (Thanks to TB)

- Signal : ZH → $\nu\nu + \gamma\gamma$ (Higgs Mass 120 Gev)
- Backgrounds : $\nu\nu + \gamma\gamma$ (Mostly $Z + \gamma\gamma$)
- At this moment, we are doing particle level studies (no simulation); will move to FASTMC soon.

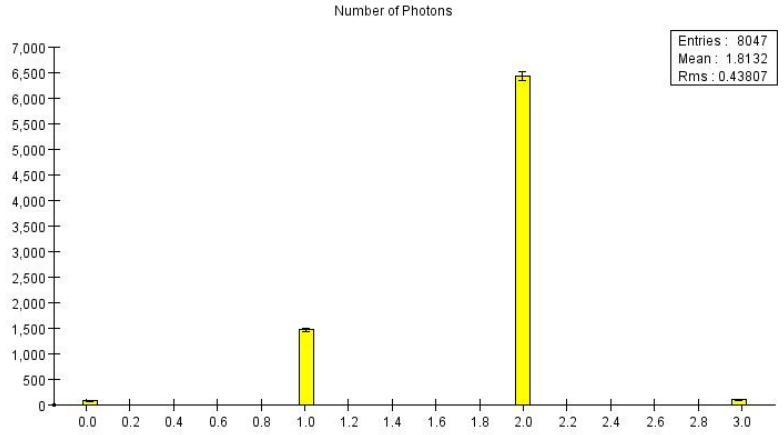
First level Cuts

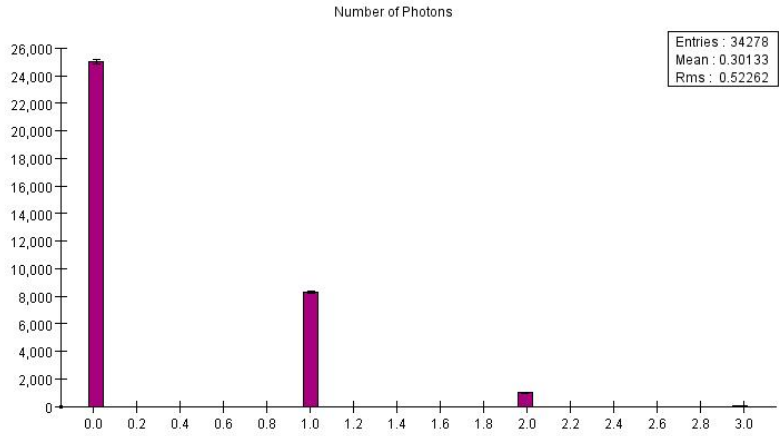
- Follow 11/2000 DESY Study of Boos et. al
- Requires 2 γ's with Energy > 20 GeV and $|\mathrm{Cos}(\theta)| < 0.9$ (about 25 º)
- Requires $M(\gamma\gamma)$ with $|\mathrm{Cos}(\theta)| < 0.8$ (34 º)

- Cos(θ) of γ's for Signal(Top) and Background(Bottom)



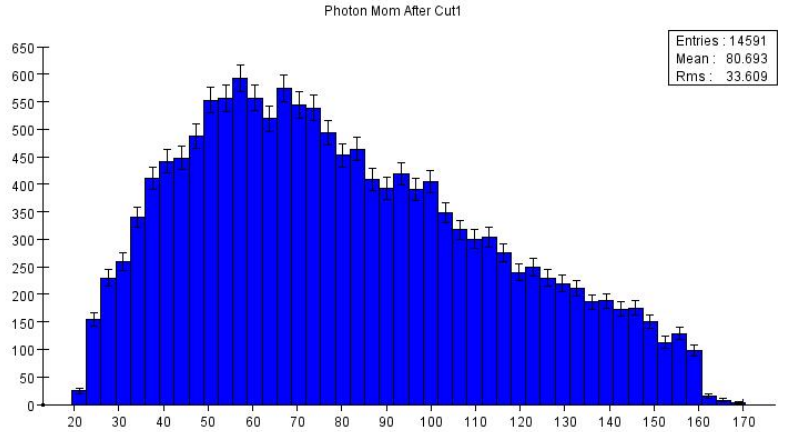
- Number of γ's in Signal (Top) and Background(Bottom) satisfying Energy and Cos(θ) cuts



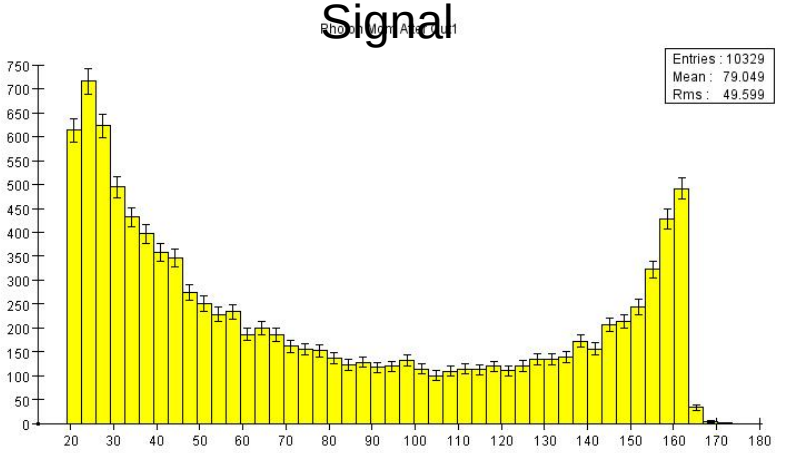


Photon Momentum

- A good discriminator between ZH signal and Z + $\gamma\gamma$ background is ratio of E1 over E2—Background come often from one high E and one low E



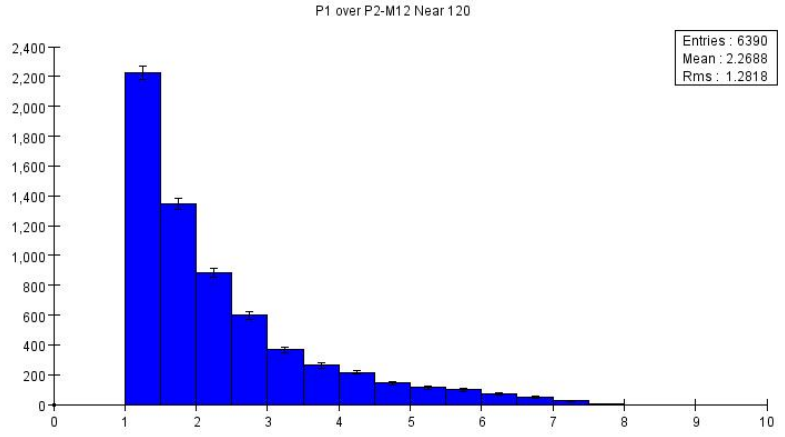
Signal



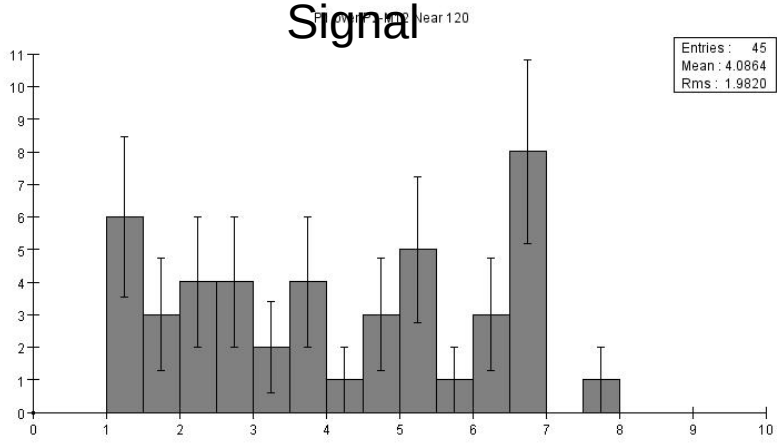
Background

E1/E2 plots

- E1/E2 distributions (Highest Et γ over Lower Et γ) for those Diphoton mass between 117 and 123 GeV

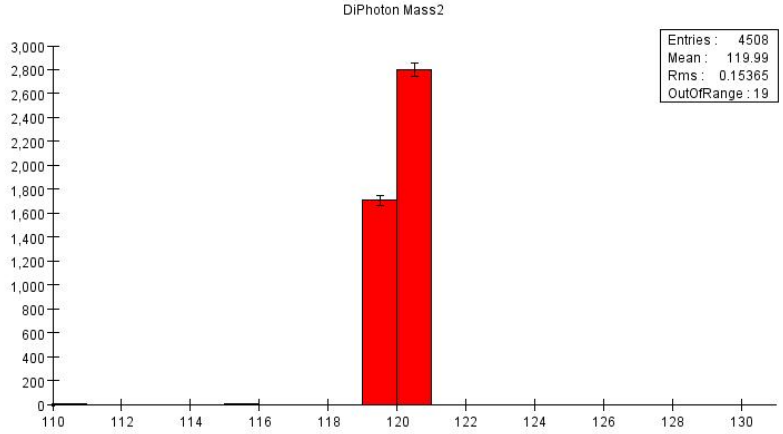


Signal

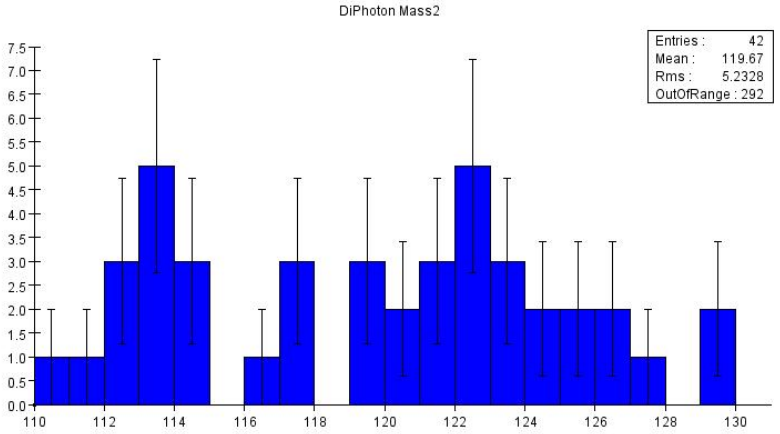


Background

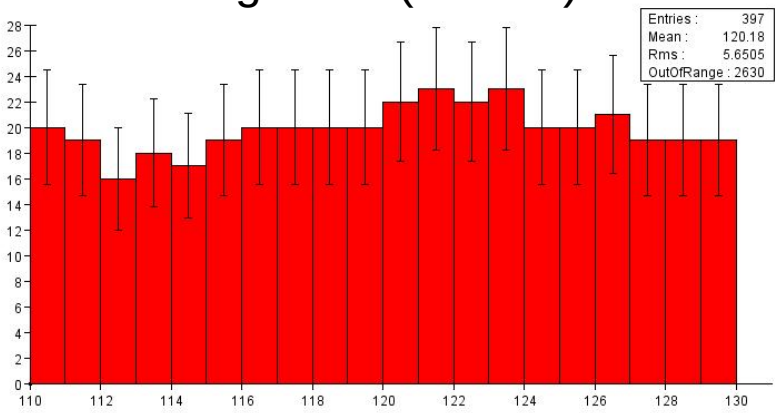
M(γγ) for E1/E2 < 4 in addition



Signal (50,500 fb-1)



Background (44 fb-1)



Background(Smoothed)(400 fb-1)

To Do

- FASTMC
- Neural Net (Improve S/B) ??
- ZH → qq + γγ (much more difficult—have to deal with real photons inside jets—need to implement photon selection criteria such as isolation, etc.)
- Other non-γ backgrounds