

Update on $ZH \rightarrow Z + \gamma\gamma$ Simulation Studies –12/19/06

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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 $ZH \rightarrow \nu\nu + \gamma\gamma$

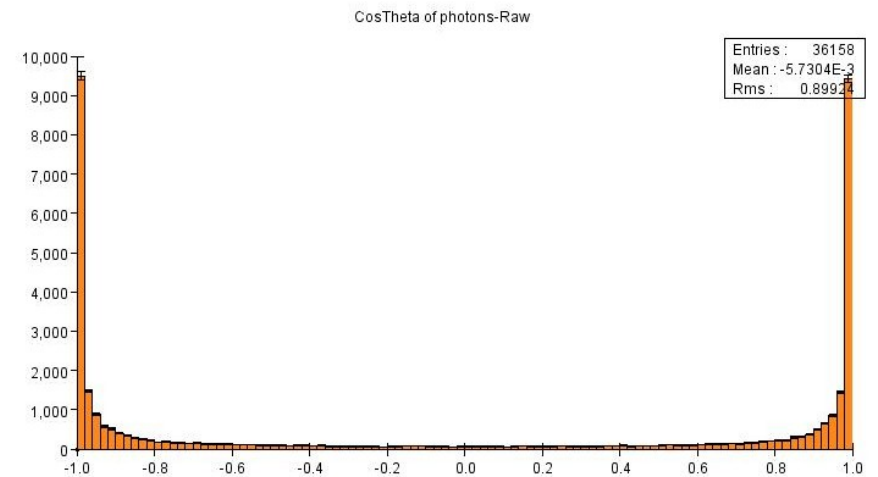
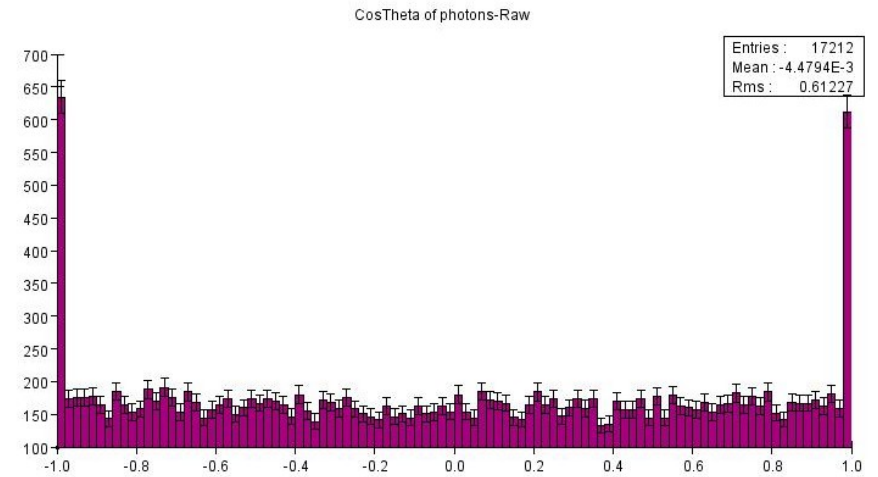
Datasets (Thanks to TB)

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

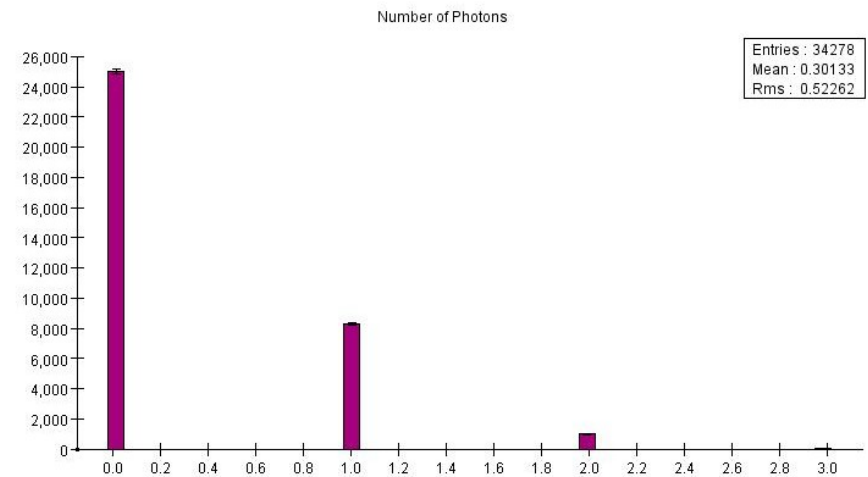
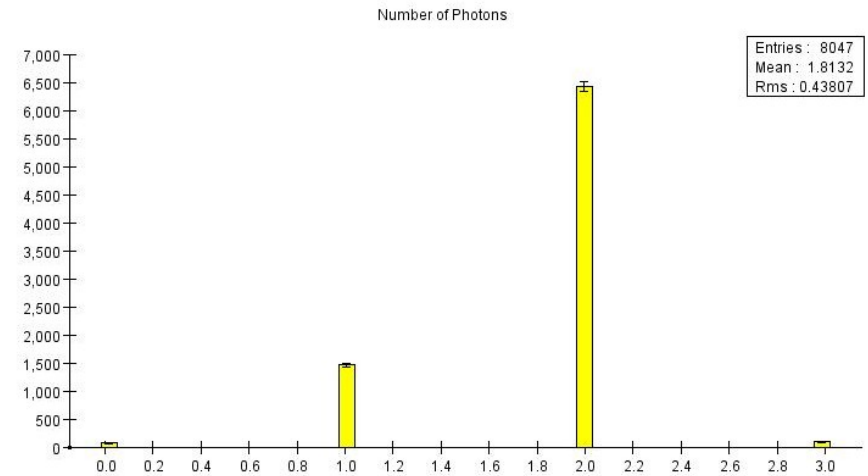
First level Cuts

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

- $\text{Cos}(\theta)$ of γ 's for Signal(Top) and Background(Bottom)

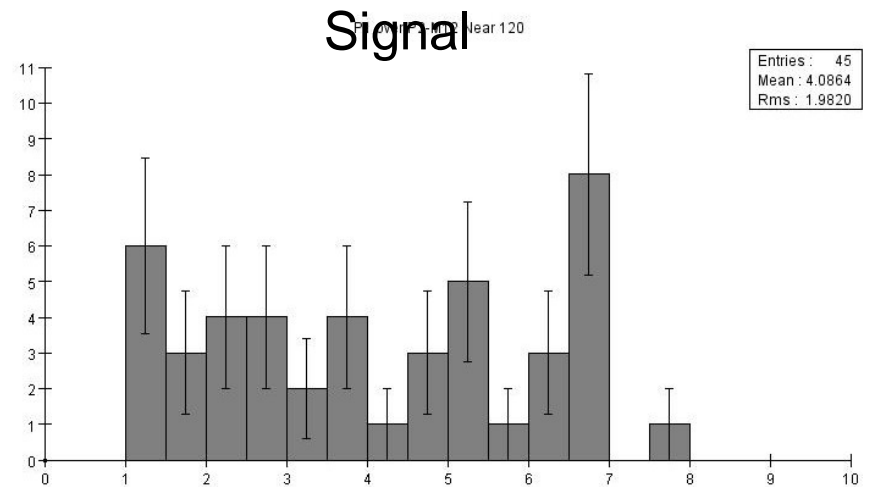
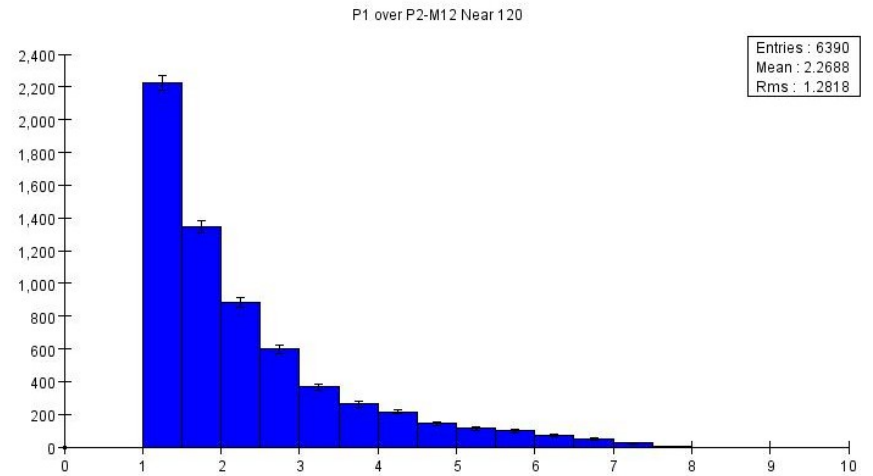


- Number of γ 's in Signal (Top) and Background(Bottom) satisfying Energy and Cos(θ) cuts



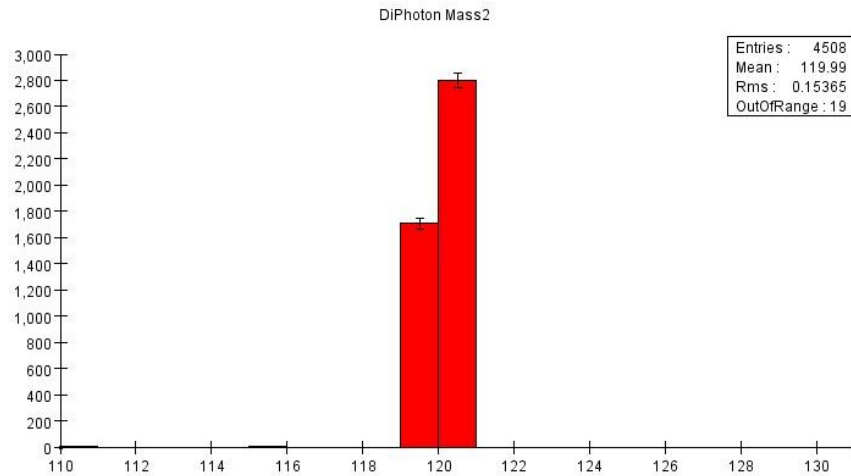
E1/E2 plots

- E1/E2 distributions (Highest $E_t \gamma$ over Lower $E_t \gamma$) for those Diphoton mass between 117 and 123 GeV

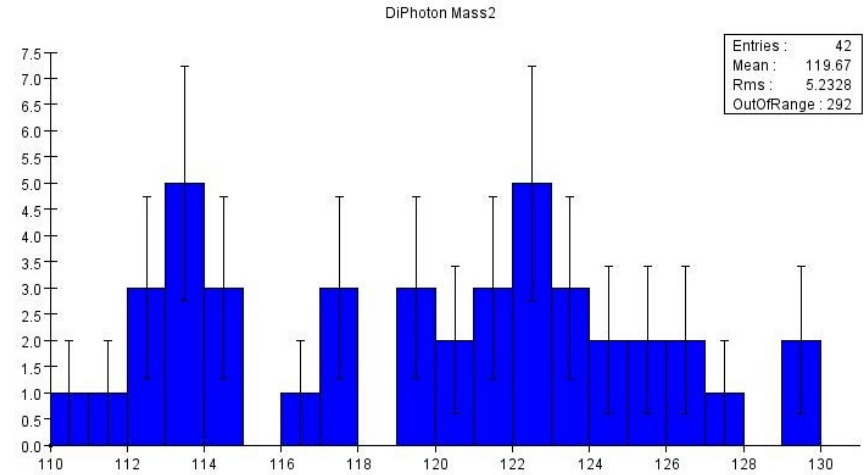


Background

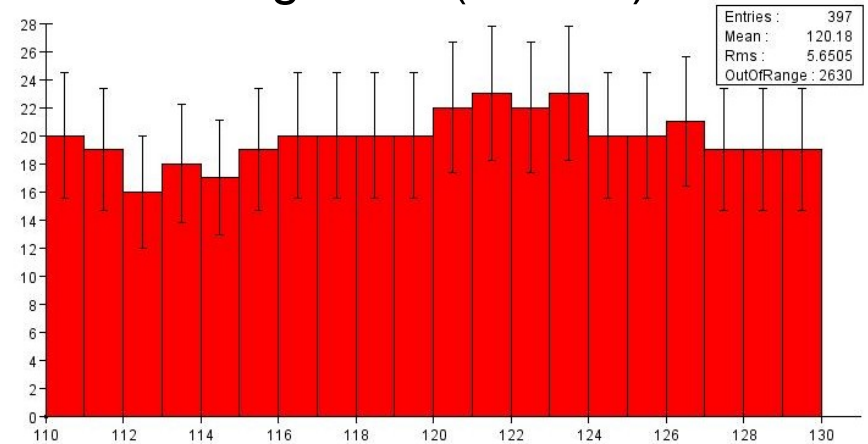
$M(\gamma\gamma)$ for $E1/E2 < 4$ in addition



Signal (50,500 fb-1)



Background (44 fb-1)



Background(Smoothed)(400 fb-1)

To Do

- FASTMC
- Neural Net (Improve S/B) ??
- $ZH \rightarrow qq + \gamma\gamma$ (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

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