LFV τ decays using polarization

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Outline

- News since last meeting
- Moving to reconstructed variables
- Implementing BaBar Selection
- Conclusions

News

- Moved to reconstructed quantities from MC, using V0.2.5 of Fast Sim.
- 250K event produced for π and ρ tags for polarized signal, unpolarized signal and polarized $\tau \to \mu\nu\nu\gamma$ backgrounds

τ reconstruction

π: GoodTrackVeryLoose
γ:GoodPhotonDefault

Common vertex required
(γ considered to be coming from IR)
Loose mass selection

π^0 reconstruction

γ: Calor neutral

Photons required to have E_{lab}>100MeV
Reconstructed mass has to be $90<m_{\pi}<160$ MeV

ρ reconstruction

π^0: from the list
$\pi^{\pm}$:Charged Tracks

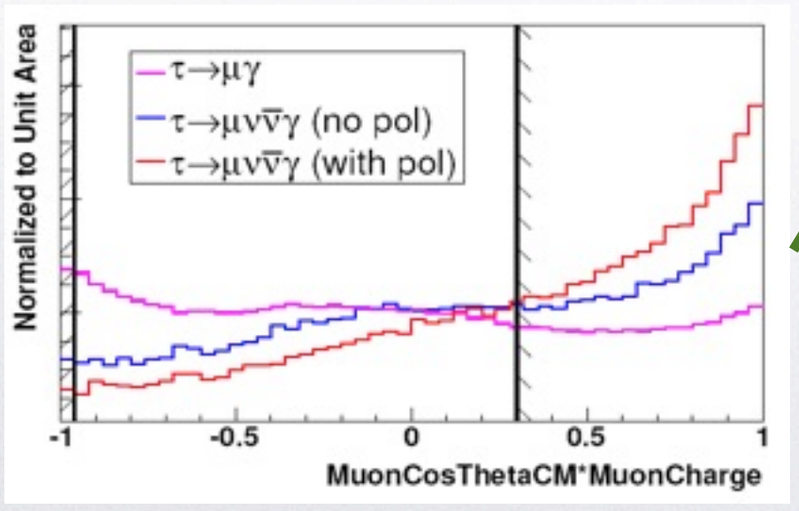
Reconstructed mass has to be
$pdg-320<m_{\rho}<pdg+320$

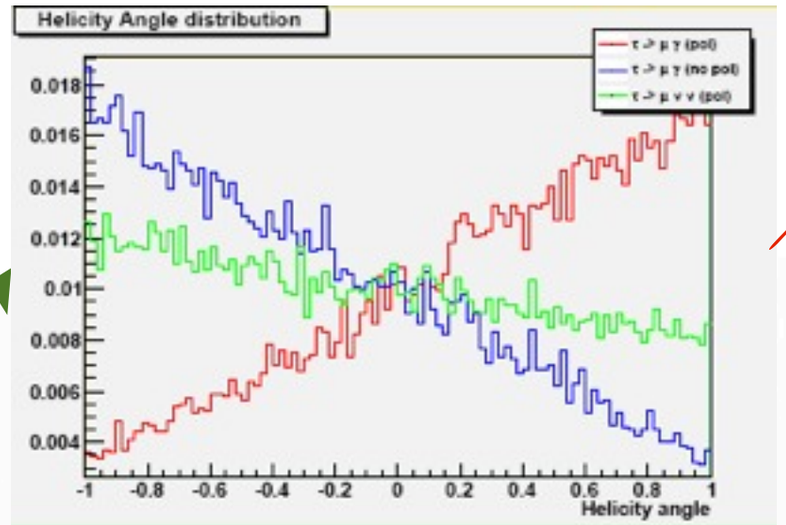
Valencia Plot Evolution

Polarization effect and selection potential is reduced due to experimental resolutions

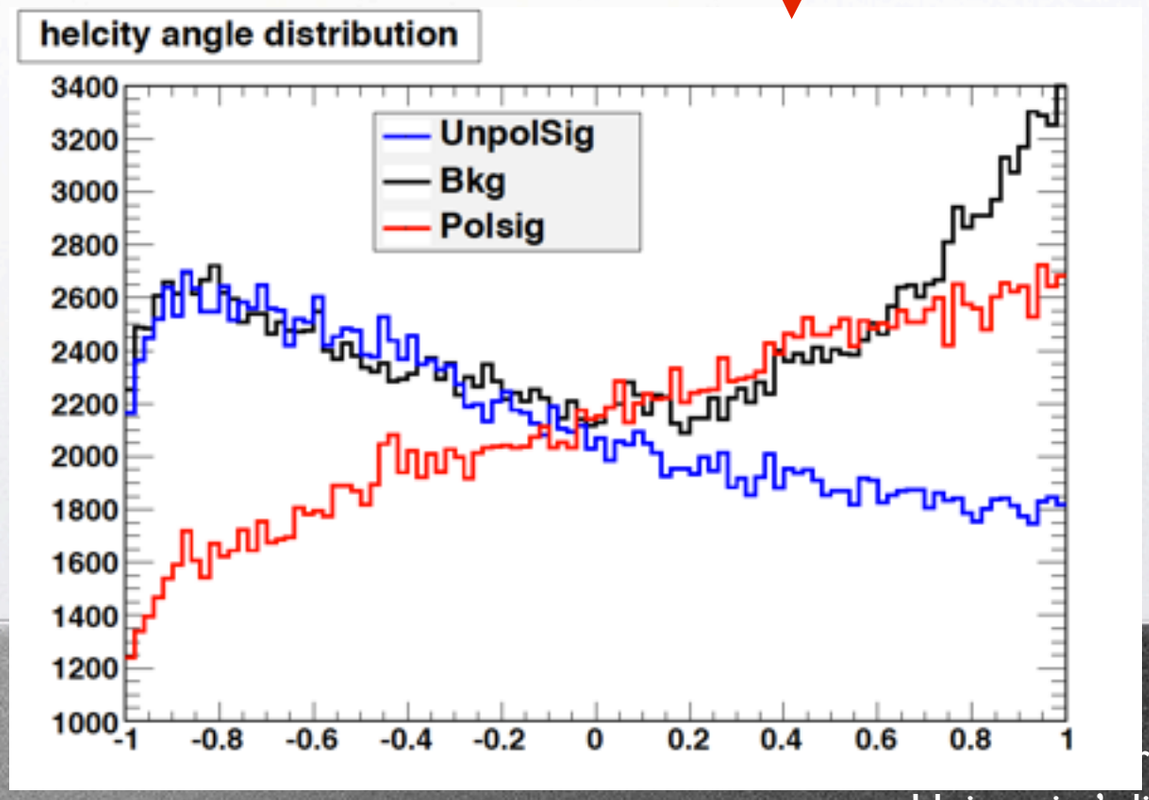
Main issue is photon direction reconstruction to reconstruct signal tau direction

$$\theta_h = \tau^{\mathrm{tag}}_{\mathrm{charge}} \cdot \theta_{h-tag}$$

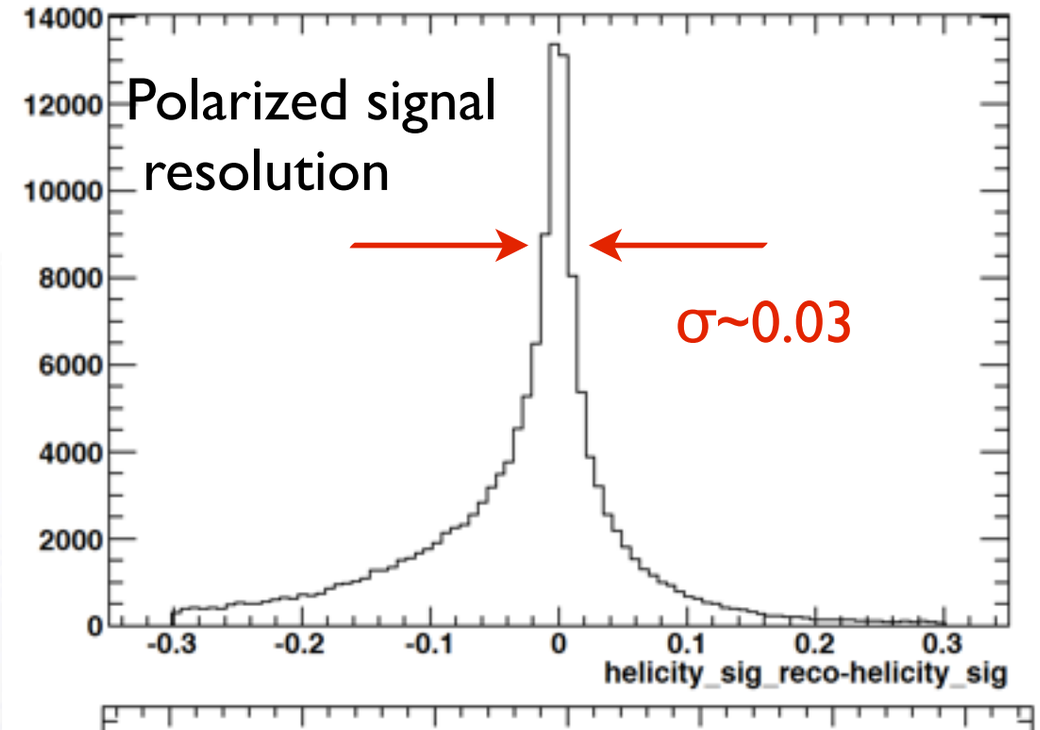


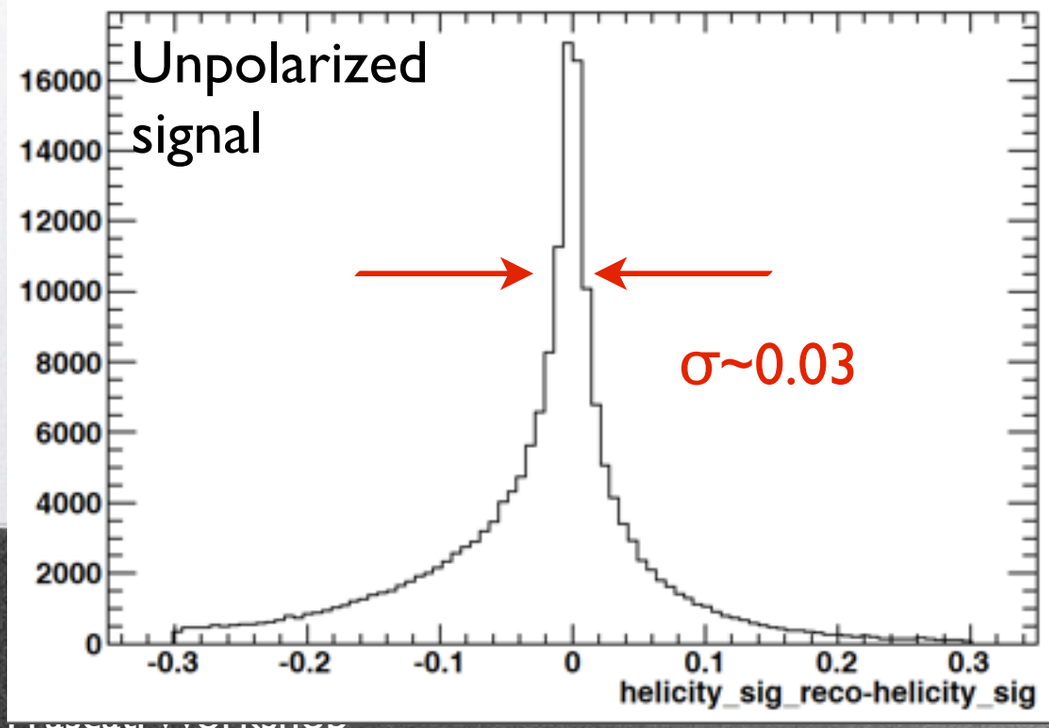


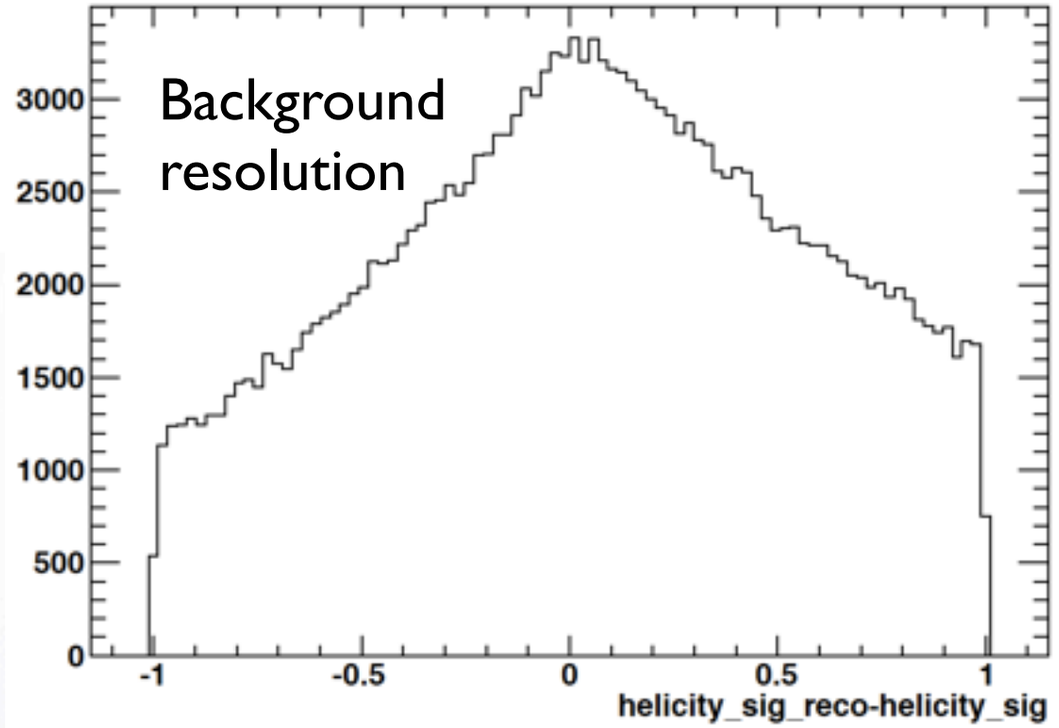
reconstruction



θh Resolution







Signal both polarized and unpolarized present similar resolution: real reconstructed τ

Backgrounds present a triangular distribution due to the missing neutrino momentum

Open Issues

- Not able to present Scatter plot due to lack of statistics
  - on a side note PacTauUser do not work on V0.2.7 of FastSim investigation ongoing
- Resolution effect seems to dilute polarization information: main problem is reconstruct τ direction (γ direction)
  - Possible solution: tighten cut on γ and energy deposits

Selection

- All plots presented were made after applying the selection used in BaBar latest analysis, except for NN selection and PID
- BaBar selection do not seem to alter helicity angle distribution ⇒polarization still is a good handle to reduce backgrounds

Global selection

Only two tracks in the event
Only 1 ρ candidate
Only 1 π^0 candidate
Only 1 γ with E>1GeV

Signal side selection

τ mass selection tightened
No deposit except signal γ
E_γ >1GeV
Sum of all deposit less than 100MeV

Tag side selection

Sum of all deposit less than 200MeV
m_ν in the hypothesis that the signal side is fully reconstructed.
$2\Sigma P^{CM}/\sqrt{s}$

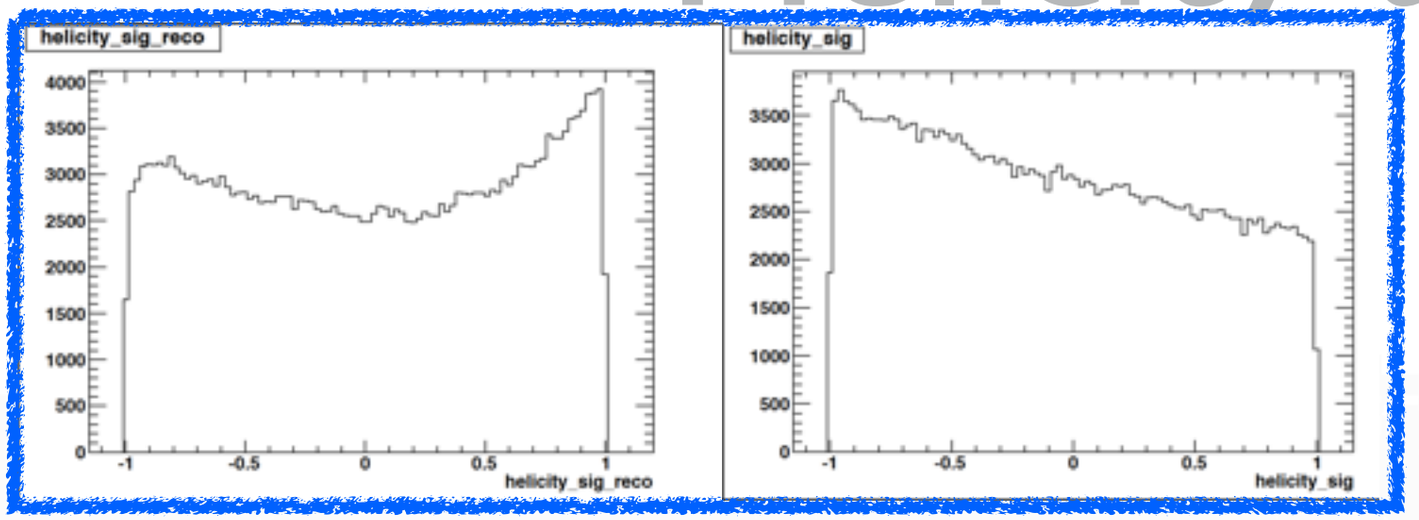
Conclusion

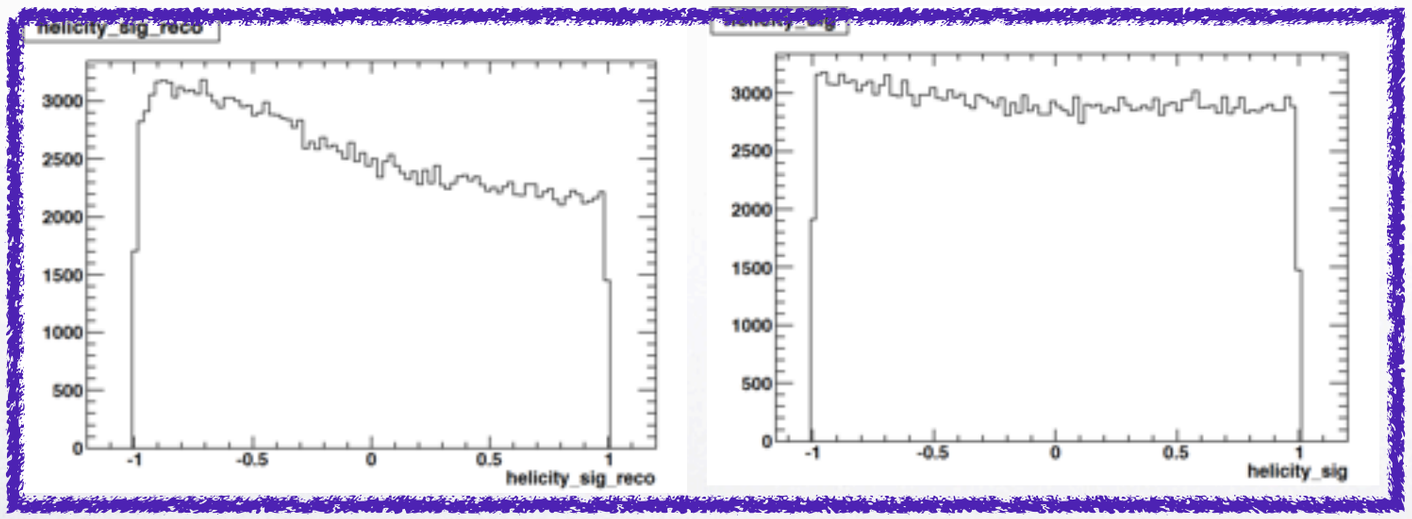
- Polarization can be used to reduce backgrounds, but resolution diminish its effect
  - Investigate γ reconstruction
  - tighten γ selection and tau reconstruction
- BaBar selection do not change the helicity angle distributions: the polarization information can be used on top of the old analysis
- More data production is ongoing, so that efficiency could be estimated for all the selection chain using the scatter plot seen in previous presentations

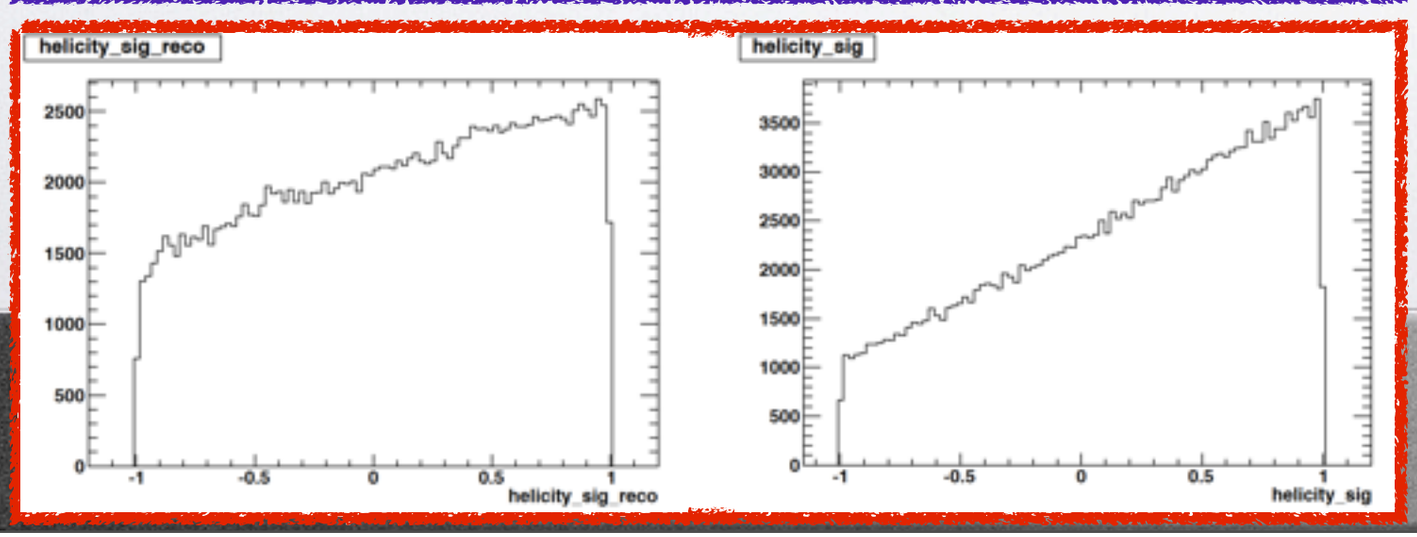
Thanks for your attention

Back up

Helicity angles







Effects of reconstruction on

Backgrounds

Unpolarized signal

Polarized signal

The signal present a diluition due to the convolution of the theory pdf with the experimental resolution

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