Spin Studies Status

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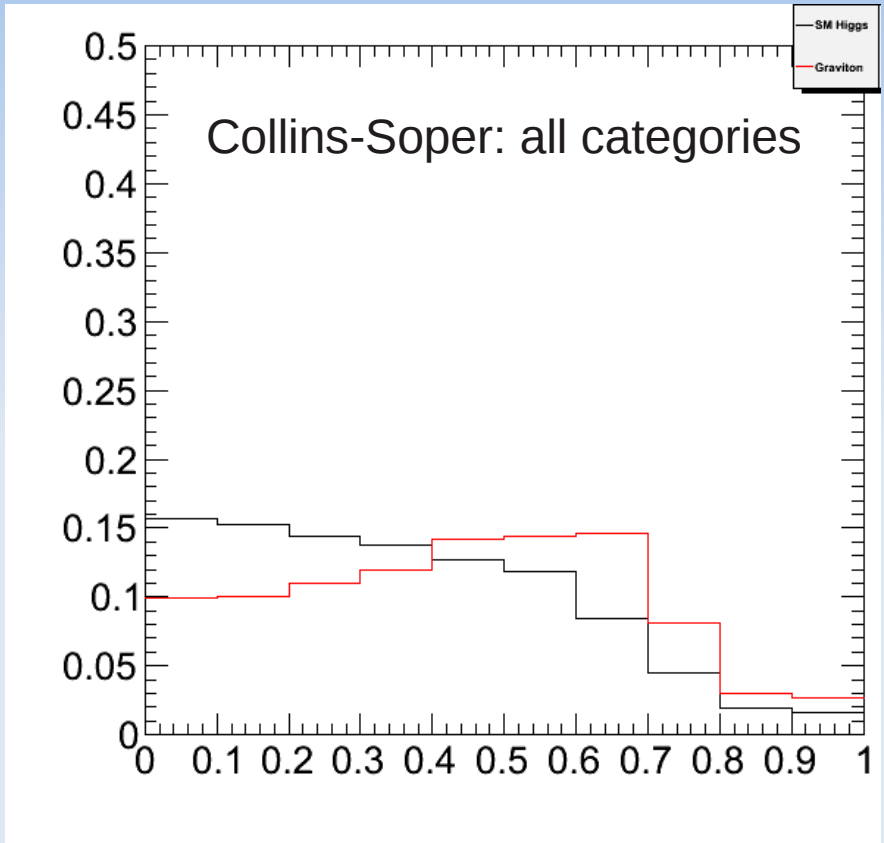
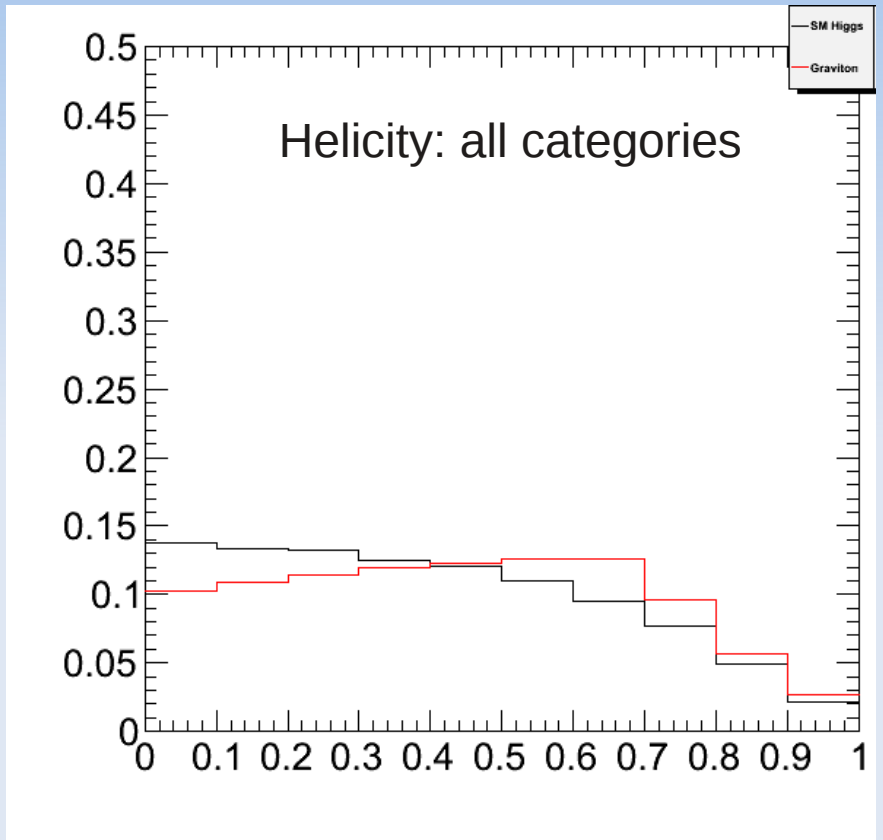
Getting the frames right

- What was done:
  - Implemented Helicity (a la D. Futayan and C. Seez) properly (i.e. e1-e2/|(g1+g2).P|)
  - Implemented the Lisbon Quarkonia Frame changing software.
  - Found & correted some bugs in my code
- Impromented
  - All methods for same frame change for cos(theta*) distribution now match, including Helicity 3 implemented methods.

Choosing a Frame



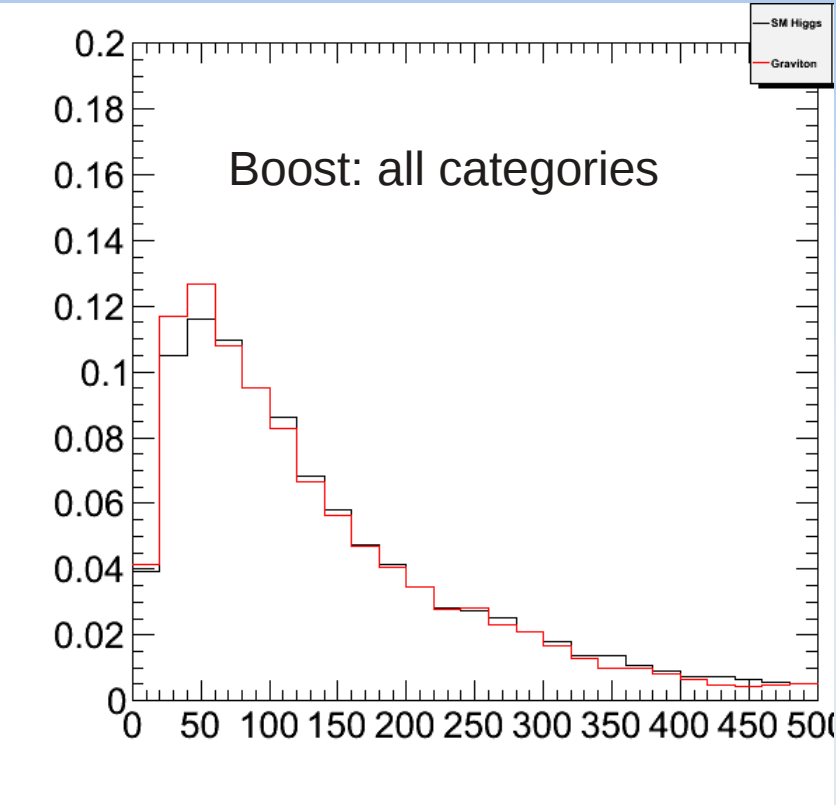


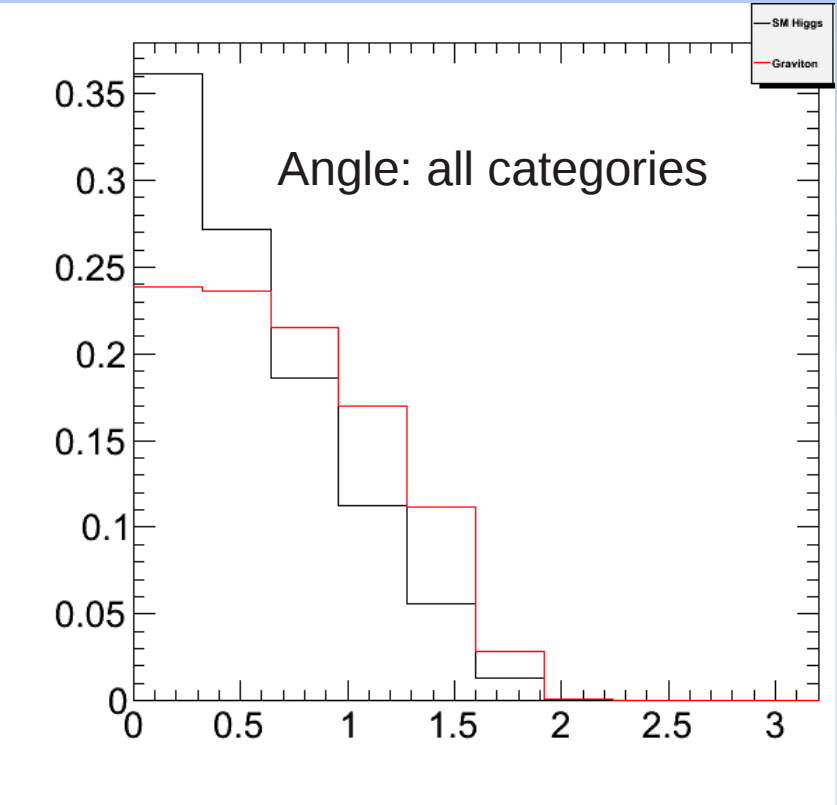
- The most promissing frame looks to be the Collins-Sopper.

Understanding Differences

- Noticed that setting the cross section of SM Higgs and Gravition to the same value give different Yields on each categories.
  - Graviton and SM Higgs have different kinematic properties
- Decided to look at some kinematics from the diphoton system
  - Boost
  - Diphoton Angle

Diphoton boost & angle

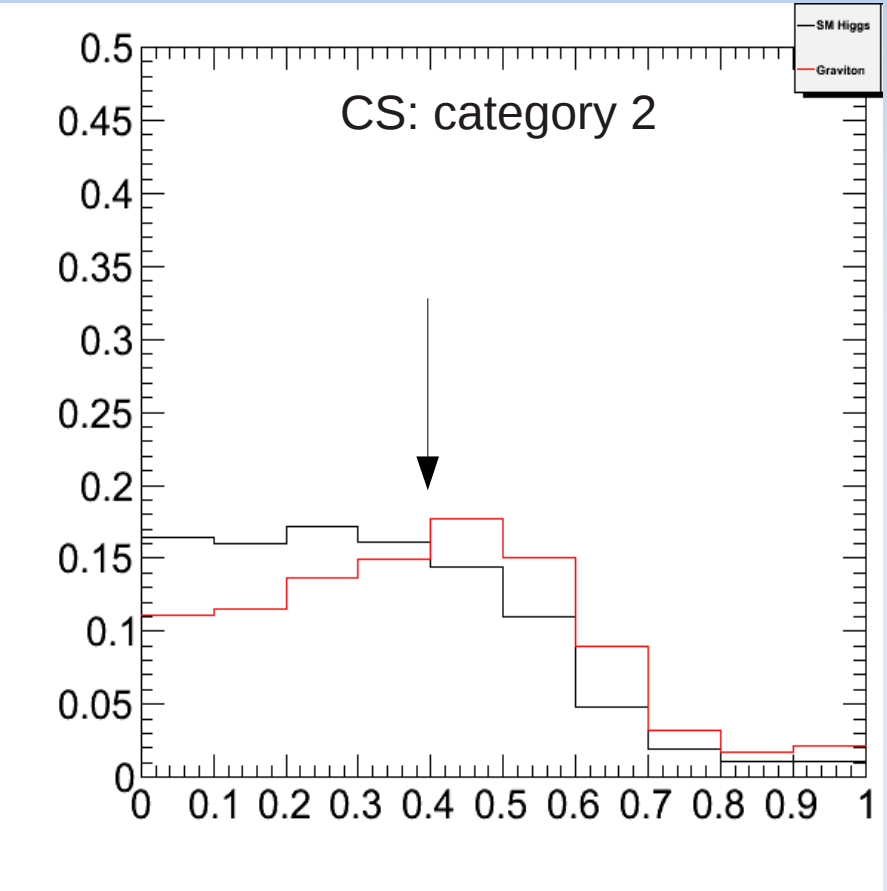




- Boost is similar on all categories
- Photons angle is different on all categories, and the graviton is on average higger than SM Higgs

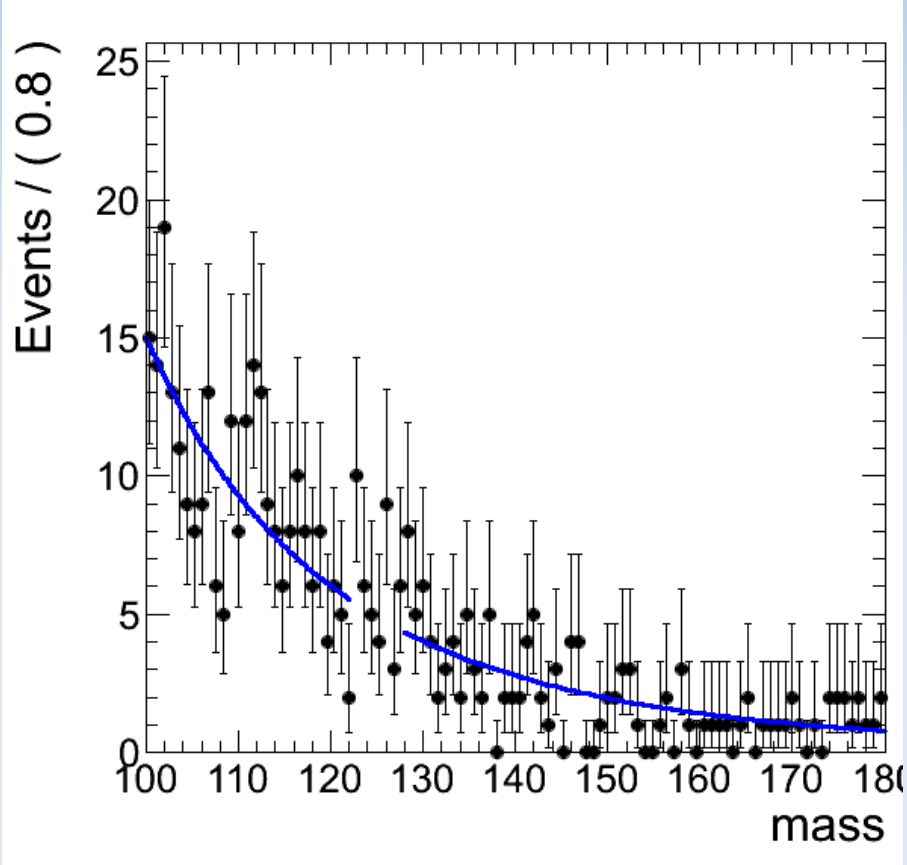
Splitting Categories on cos(Theta*) bins

- Decided to split all categories in 2 bins in cos(Theta*).
  - Choose the crossing point of each distribution
- Points
  - Cat0 : 0.7
  - Cat1 : 0.3
  - Cat2 : 0.4
  - Cat3 : 0.5



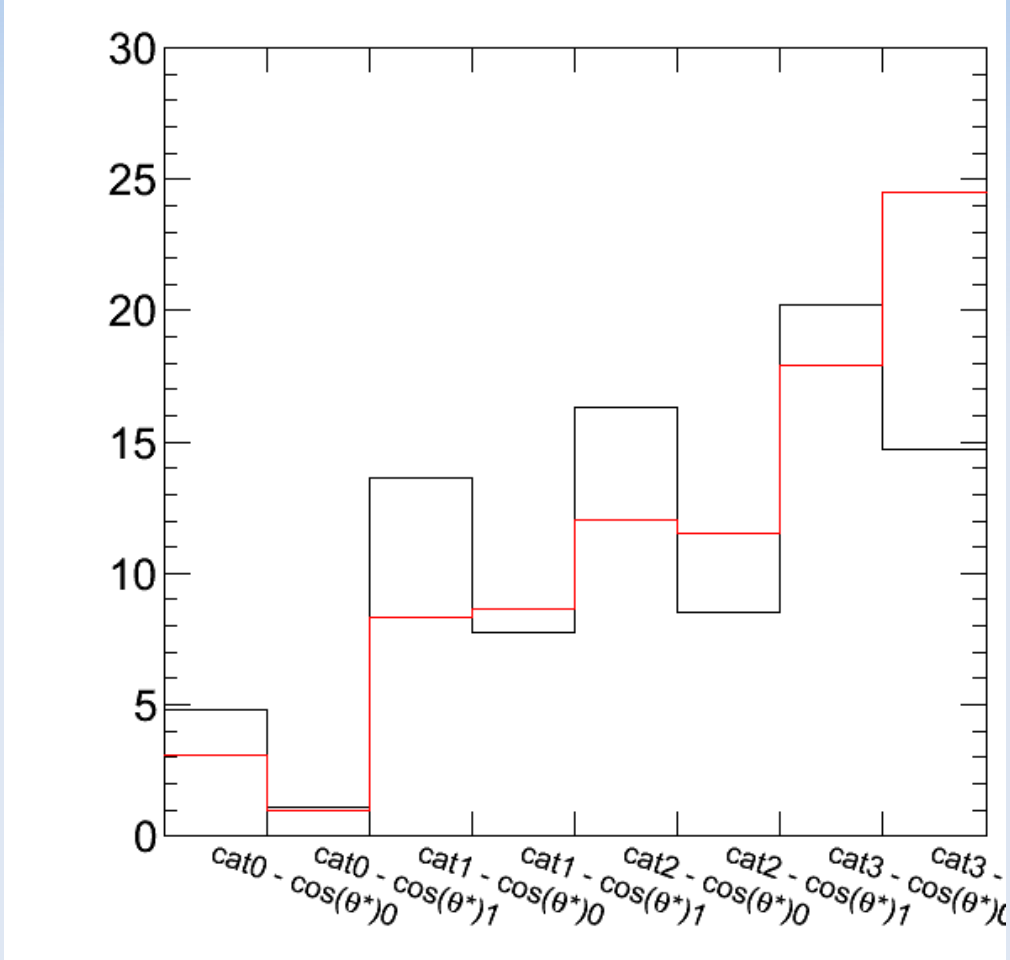
Mass Fitting in each Category

- Fitted mass spectrum in each category
  - Using a pow2 function
  - Excluding signal region (122 to 128 GeV)



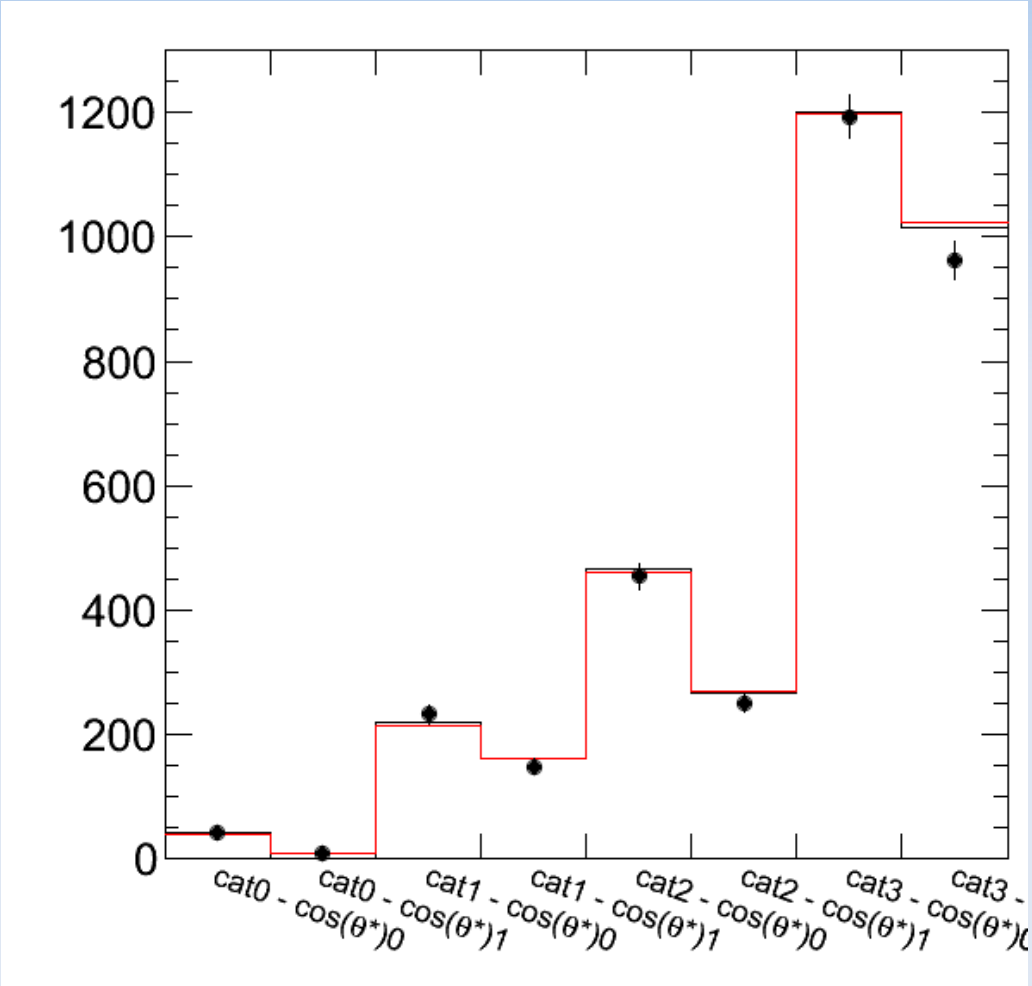
Comparison between signal

- Since event Yields for SM Higgs and Graviton are different between categories and even in the total of categories, I normalized Gaviton number of events to SM Higgs.
  - This is not valid!!! But what other option is?



Signal plus background

- Now adding signals to background estimation and overlaying data seen at signal area.



Next Steps & Questions

- Next Steps:
  - Look at normalization
  - Calculate Chi2
- Questions
  - What normalization to use?
  - Should I do background subtraction before Chi2 test? How to handle errors?

Results

- As usual results can be found at:

https://pela.web.cern.ch/pela/cms/ic/hgg/SpinStudies/