Spin Studies Status

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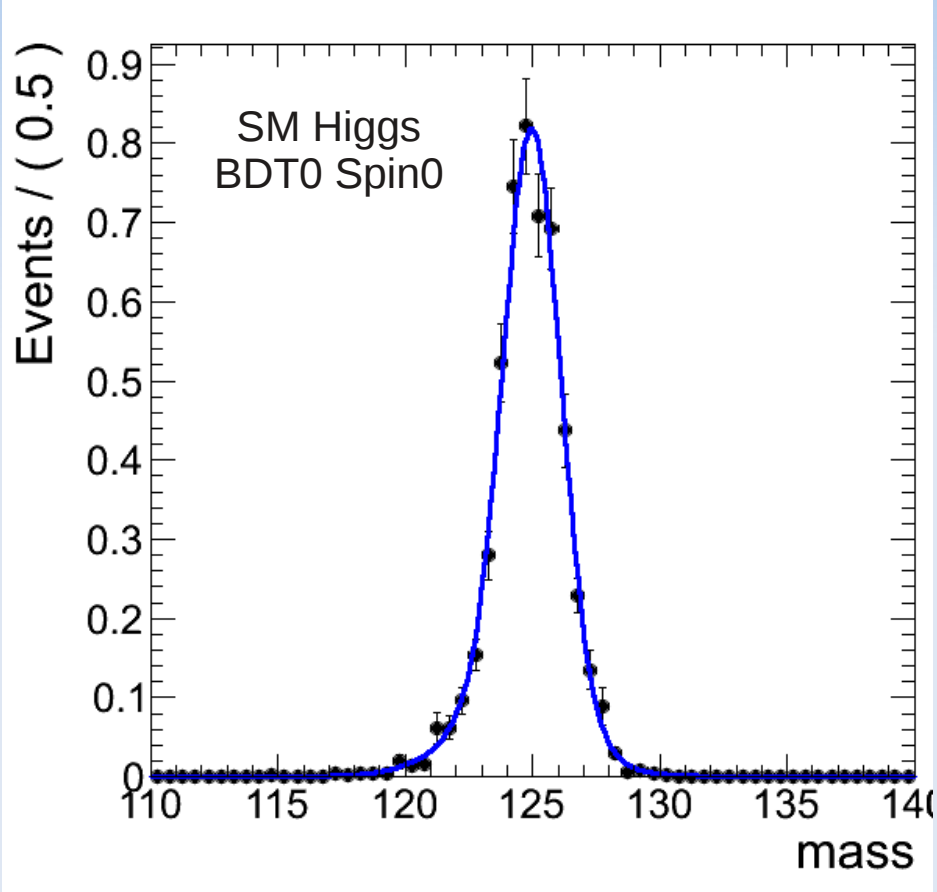
Since last week...

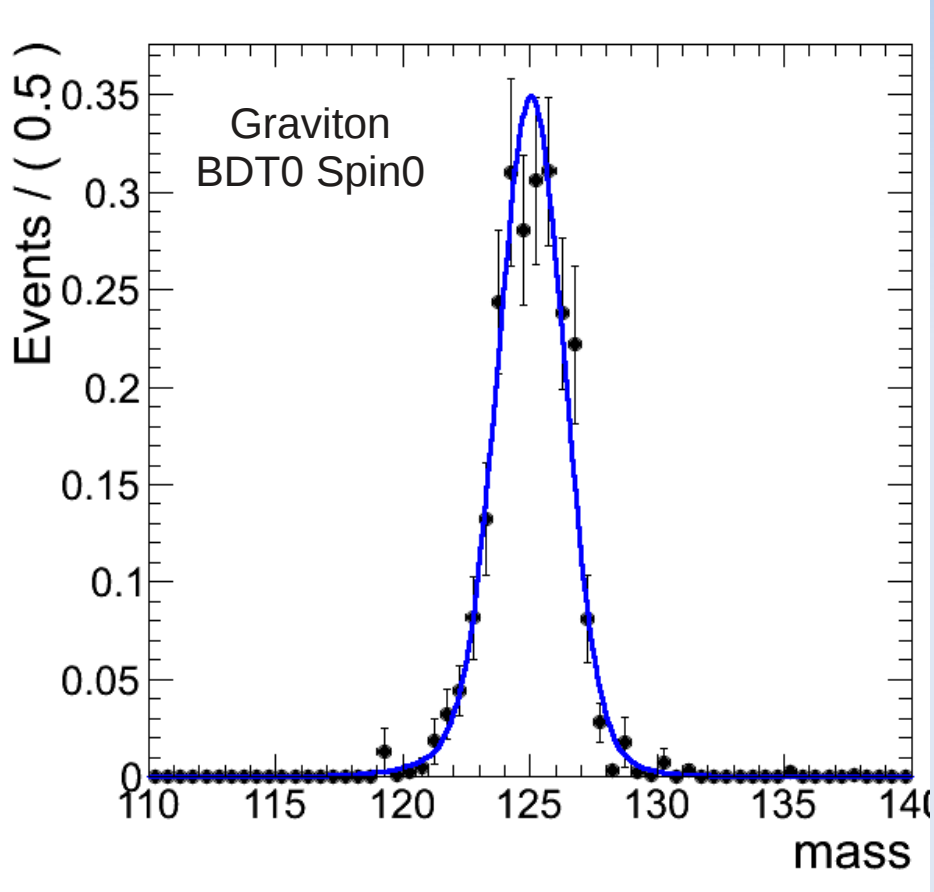
- Dropped the “two μ” analysis
  - Results would be difficult to interpret.
  - Plugin to existing tools not straight forward.
- New approach, combined simultaneous fit to all categories
  - Single μ for each model (SM Higgs and Graviton)
  - Uses shape and relative yields information
  - Can be directly plugged in to “combine” using existing two signal tests.

The procedure

- Fit Signal Model to MC (SM Higgs or Graviton) independently in each category (BDT and Spin)
  - Currently 3 Gaussian
- Fix all parameters after the fit.
- Create Extended PDF where the yield will be a product of:
  - The total number of MC events passing cuts in that category
  - Signal strength (same variable across all categories)
- Create Sig+Bkg model
  - With the already fitted Signal Model
  - Add Background Model, currently a Pow2
- Fit Sig+Bkg Model to to data simultaneously to all categories
- Extract μ, fits parameters and yields.

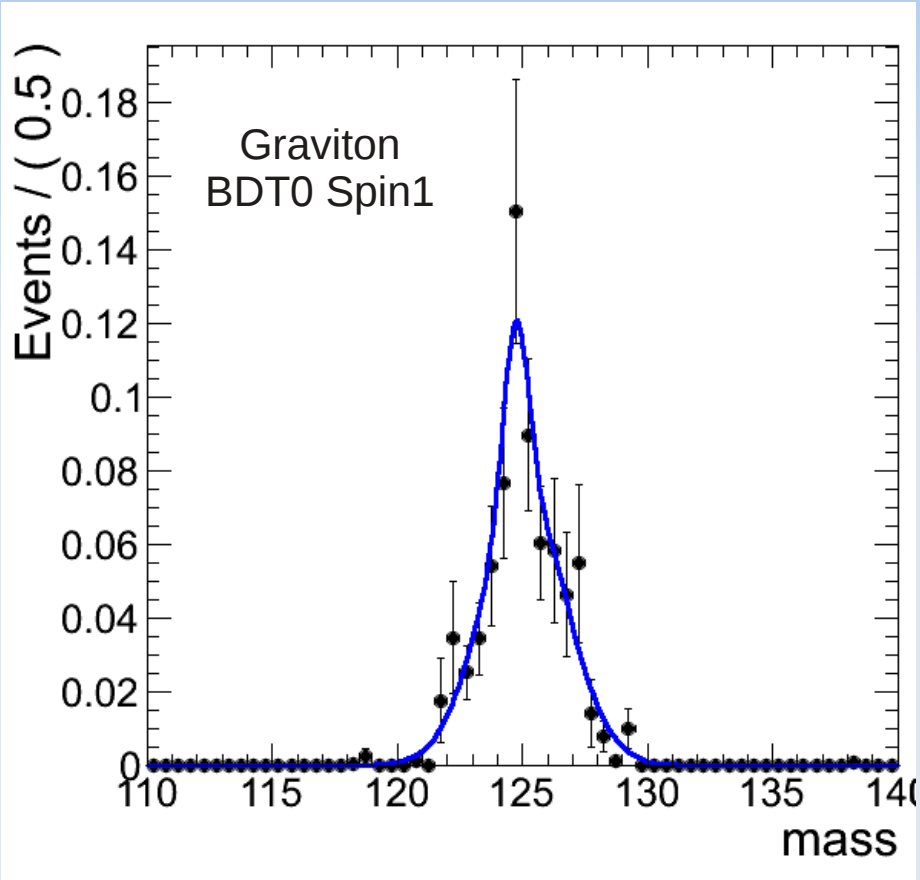
Signal Fits

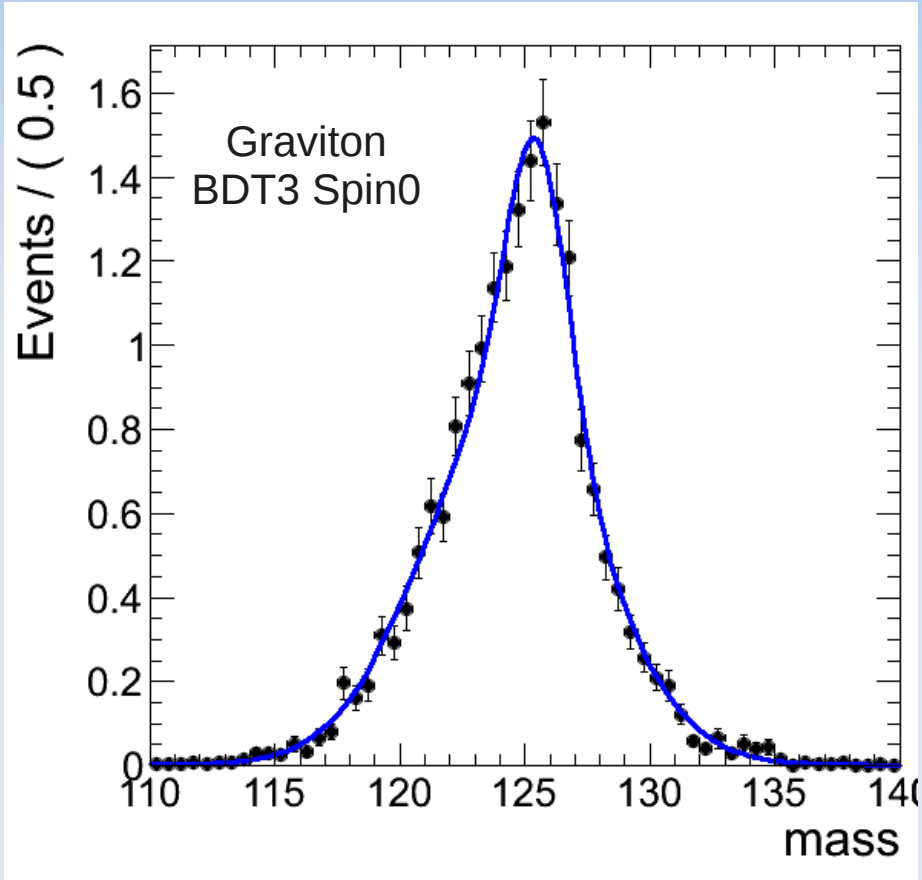




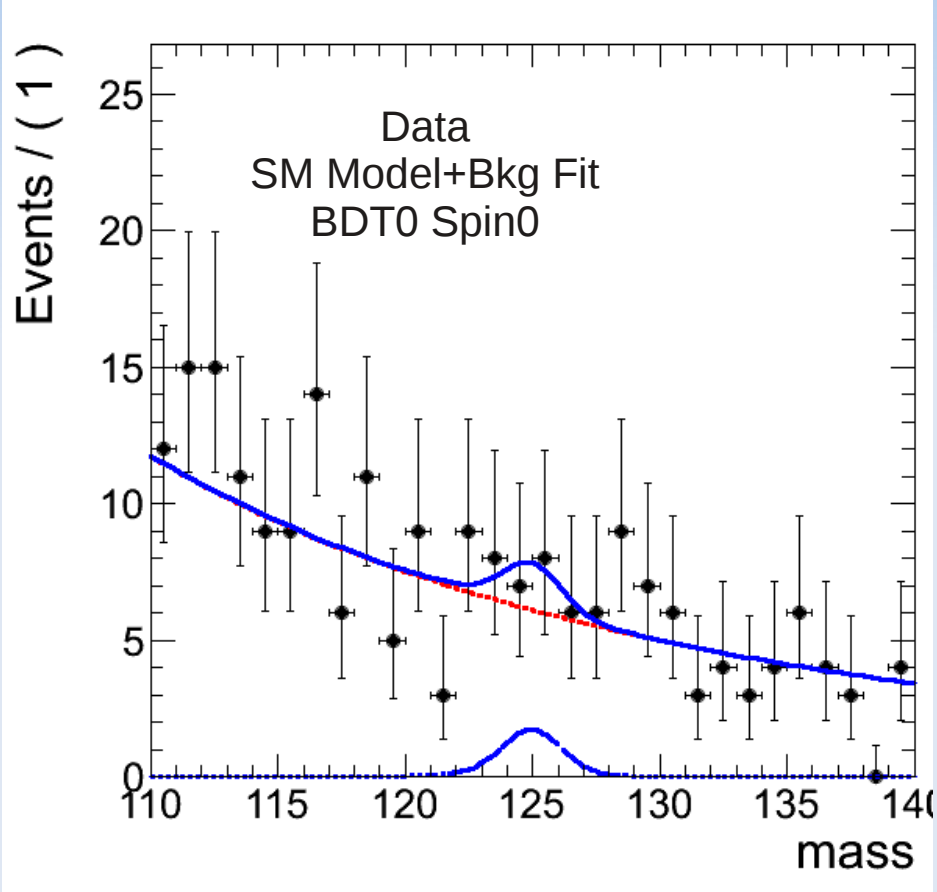
Rest of plots here:

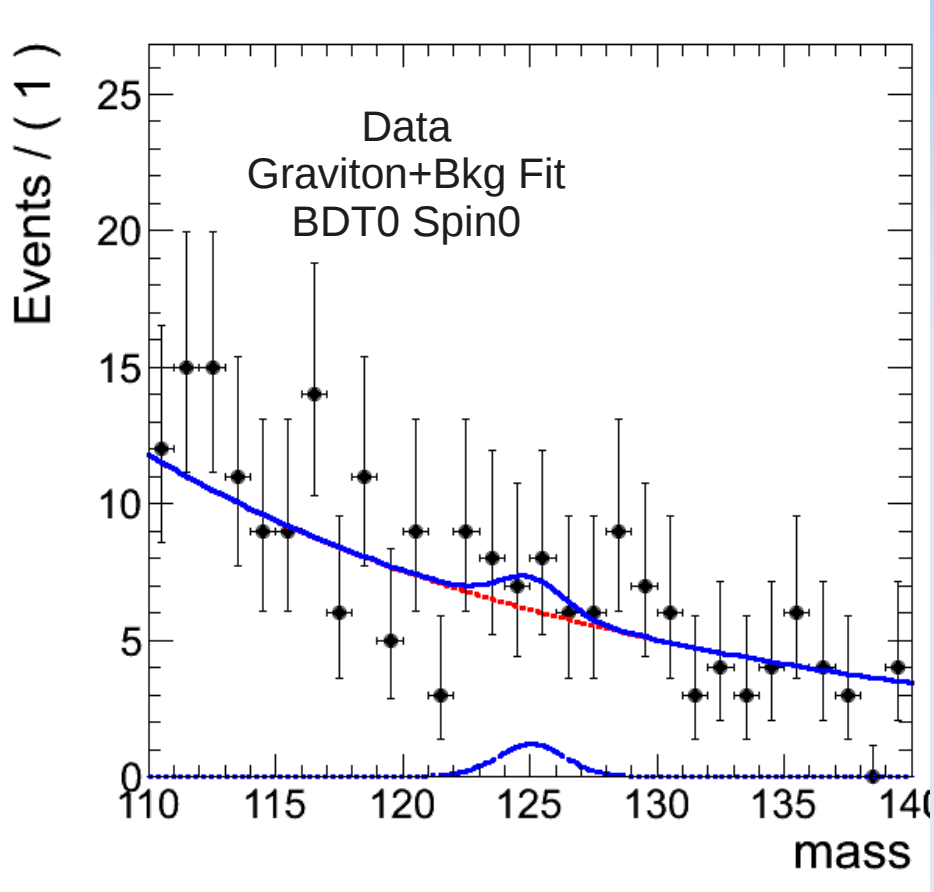
Some Strange/Pathological Fits





Fits to Data



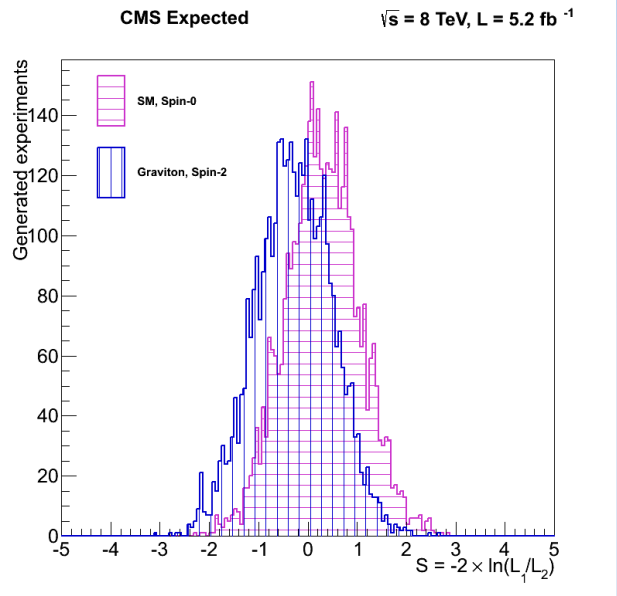


Rest of fits:

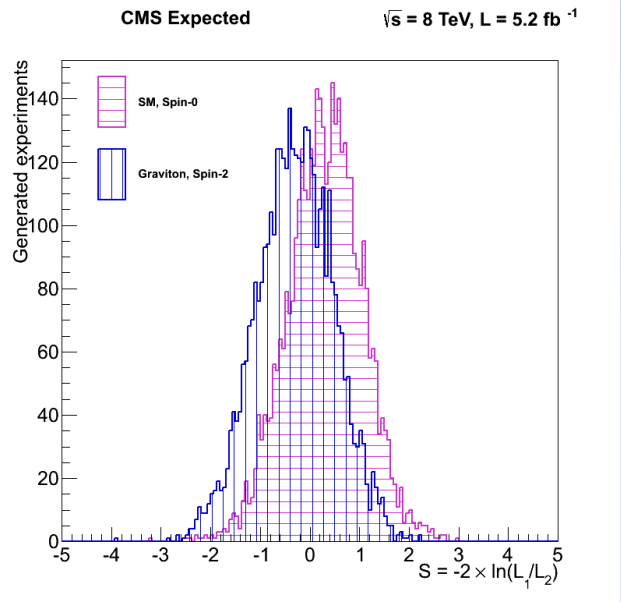
Extracted μ

- The results for 5.2fb-1 signal strength are:
  - SM Higgs: 1.0862 +/- 0.0199645
  - Graviton: 0.824353 +/- 0.0340936
- This result assumes initial graviton cross section the same of SM Higgs, implies:
  - Different total/relative yields of events across categories
  - Since we are using simultaneous fit to all categories μ will be correlated with graviton cross section.
- This results do not include systematics

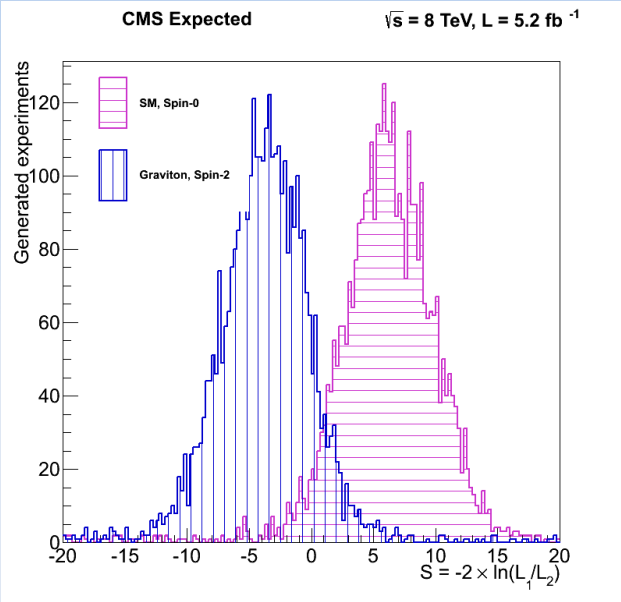
Signal Separation



Sig Separation Cut/Count (Refit)
Prob(q < median(P) | S) = 0.2235 (0.760426 sigma)
Prob(q > median(S) | P) = 0.24425 (0.692697 sigma)



Sig Separation Cut/Count (S/B Fit)
Prob(q < median(P) | S) = 0.2055 (0.822135 sigma)
Prob(q > median(S) | P) = 0.21775 (0.779815 sigma)



Sig Separation Parametric
Prob(q < median(P) | S) = 0.0173936 (2.11083 sigma)
Prob(q > median(S) | P) = 0.0102564 (2.31683 sigma)

Extrapolation

- Basic implementation attempted
  - Generate toys from Sig+Bkg Fit for 30fb-1 and fit each set with both hypothesis
- Results
  - Toys SM fit, SM Model Hyp.: 1.47751 +/- 0.213791
  - Toys SM fit, Graviton Model Hyp.: 0.973175 +/- 0.211463
  - Toys Graviton fit, SM Model Hyp.: 1.45687 +/- 0.21363
  - Toys Graviton fit, Graviton Modelc Hyp.: 0.971839 +/- 0.211487
- Code still under development (possibly buggy)
- Other possibility generate toys from bkg only fit and inject signal from MC fits

Conclusions

- Analysis progressing fast now
- More work to be done in the signal extrapolation
- Some open questions to deal with