

$$e^+ e^- \rightarrow \nu\nu \mathbf{H} (\rightarrow \mu\mu)$$

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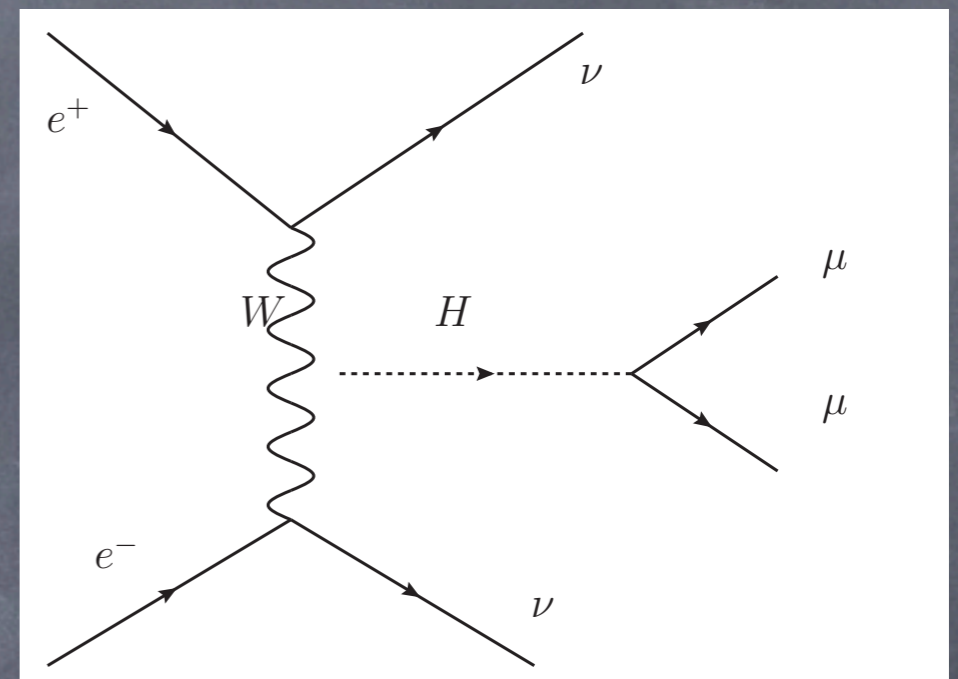
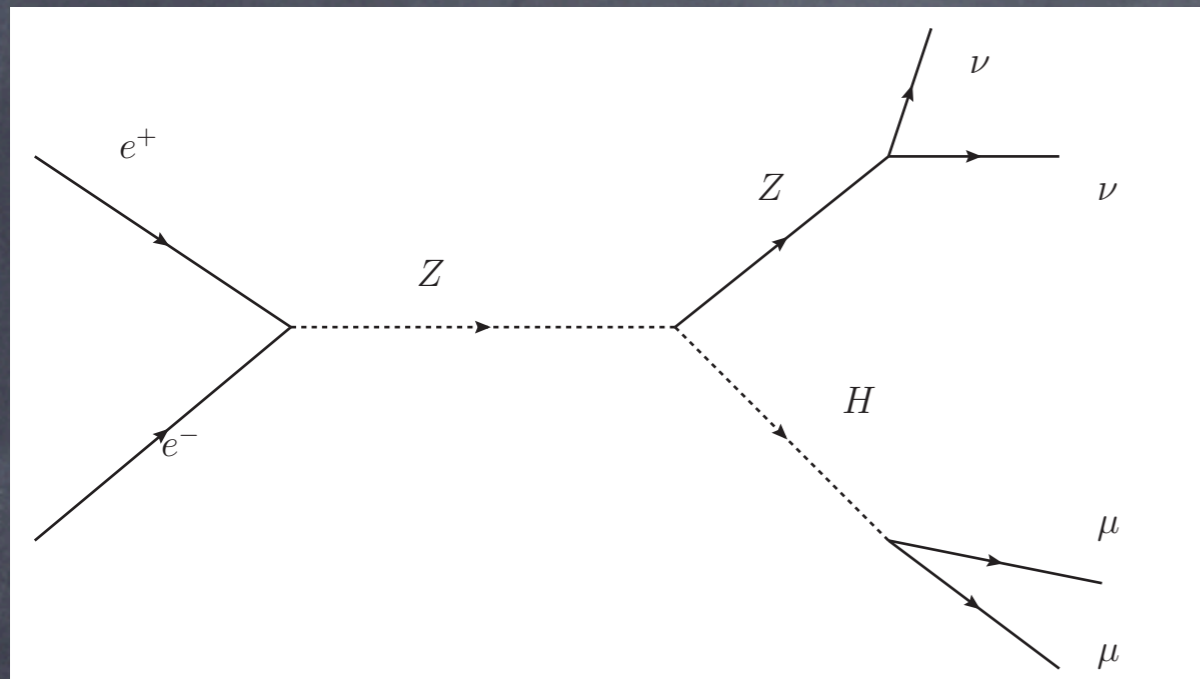
Motivation

- Golden channel to test second generation couplings
- Golden channel for track resolution benchmarking

The Setup

- Pythia 6.4.13
 - no beamstrahlung
- org.lcsim Fast MC

Samples to consider



Backgrounds:

4 fermion

$WW \rightarrow \nu\mu \nu\mu$

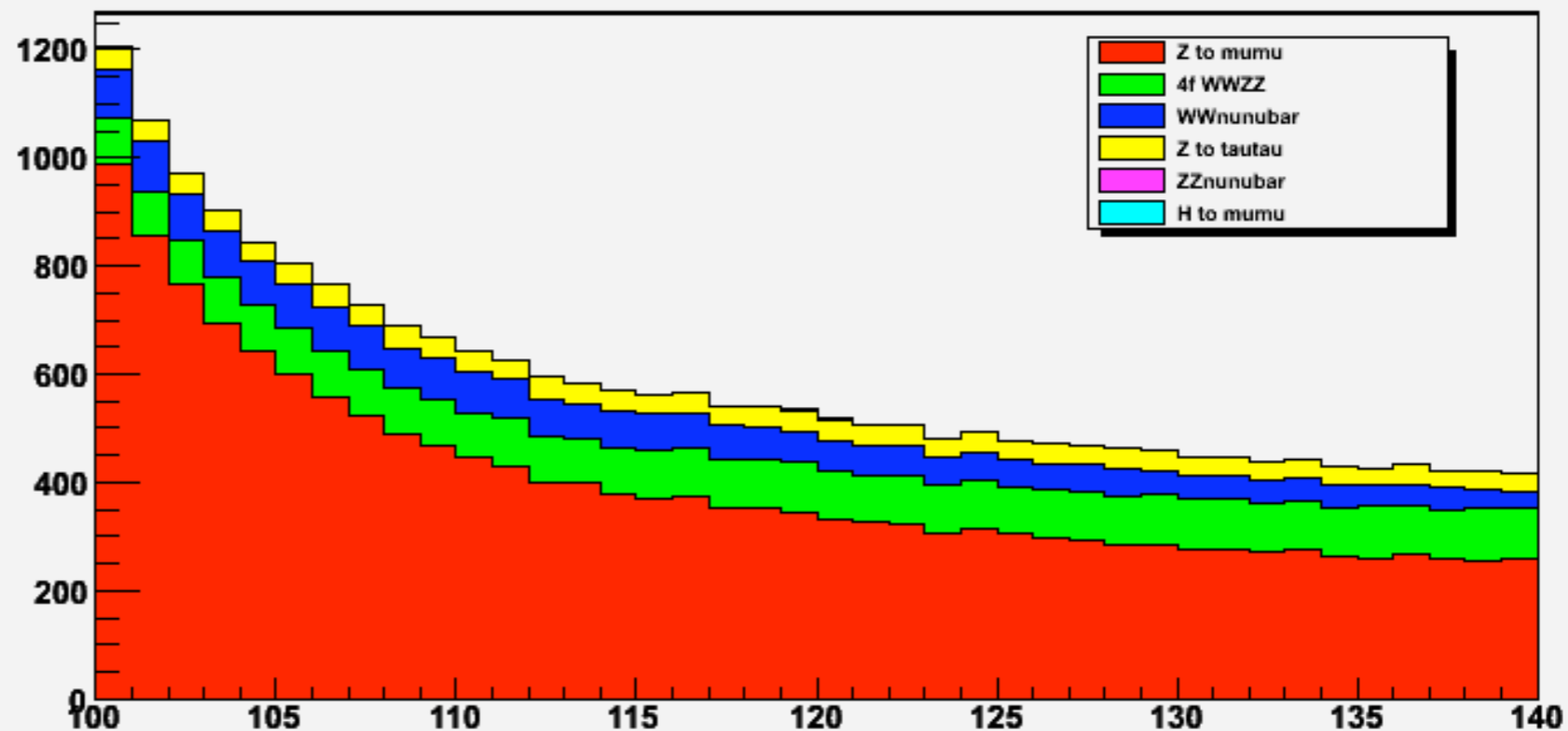
$ZZ \rightarrow \nu\nu \mu\mu$

$Z \rightarrow \mu\mu$

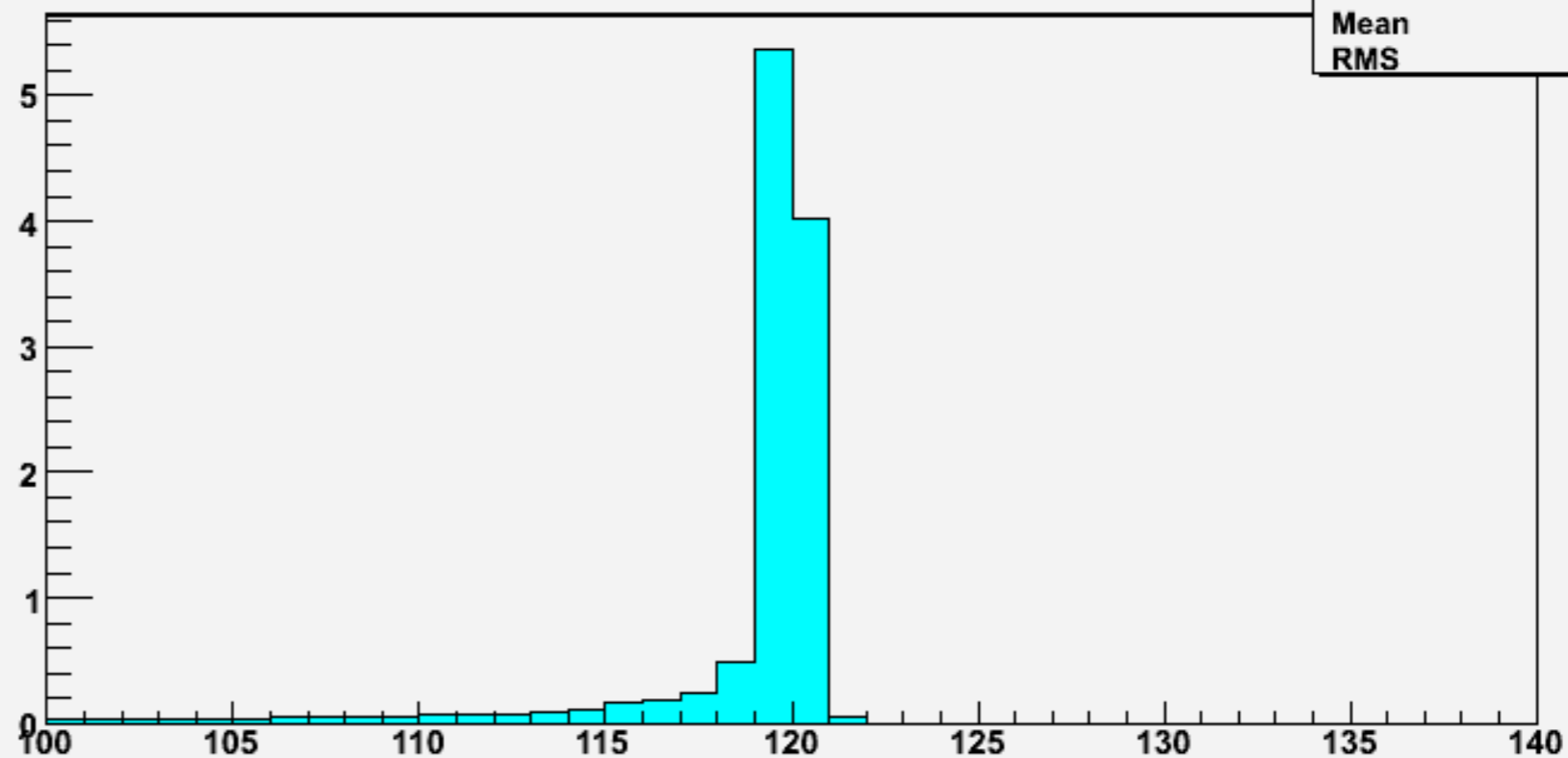
$Z \rightarrow \tau\tau$

Starting
point

Stack: Dimuon mass 00 two muons required



H to mumu Dimuon mass 00 two muons required



H to mumu Dimuon mass 00 two muons required	
Entries	9868
Mean	118.9
RMS	3.087

Analysis Strategy

- Require muon ID(100 %)
- Event shapes
- Good muon selection (multi-variate classifier)
 - $\cos\Theta$, energy, pt, forward or endcap
- discriminating variable(s) (likelihood fit)
 - flat bg, peaking signal

Event Shape Cuts

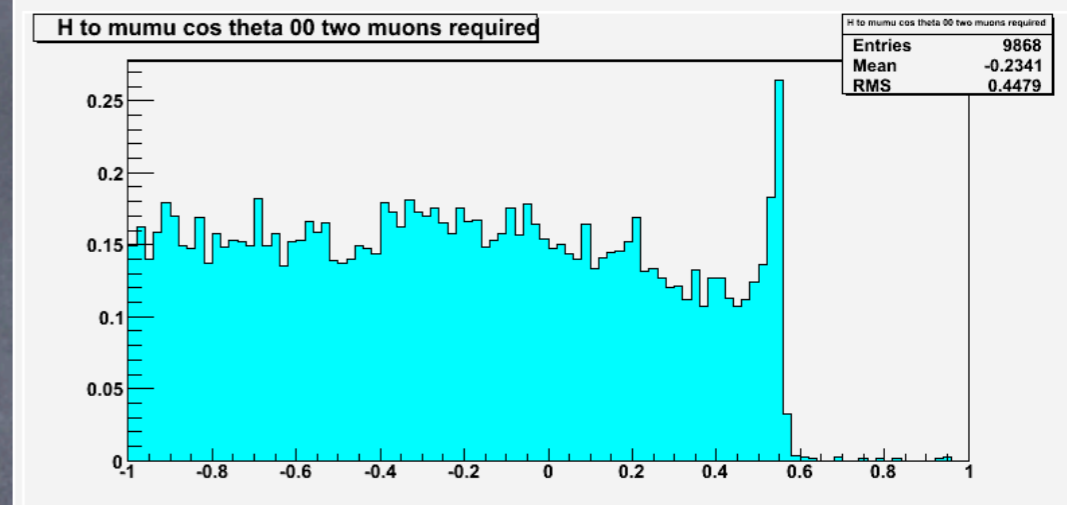
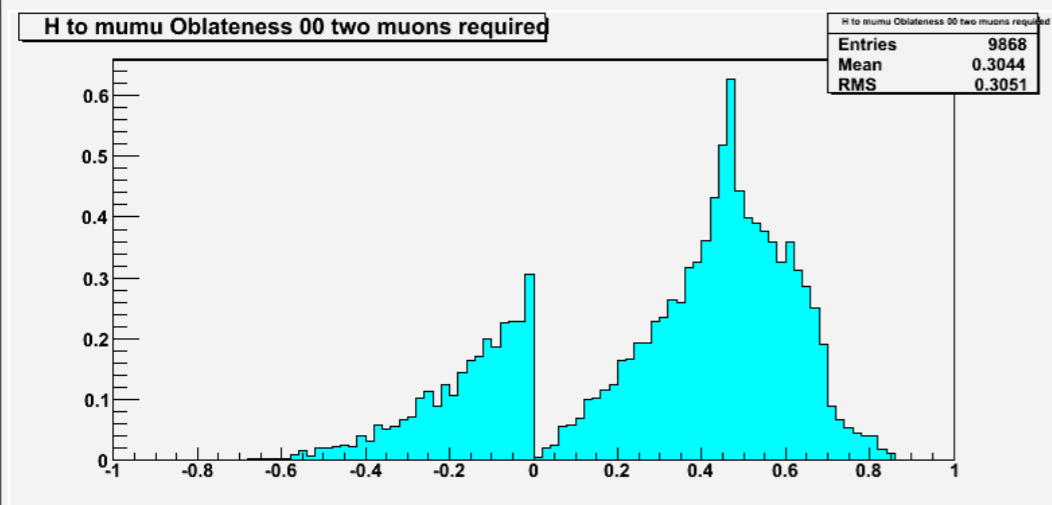
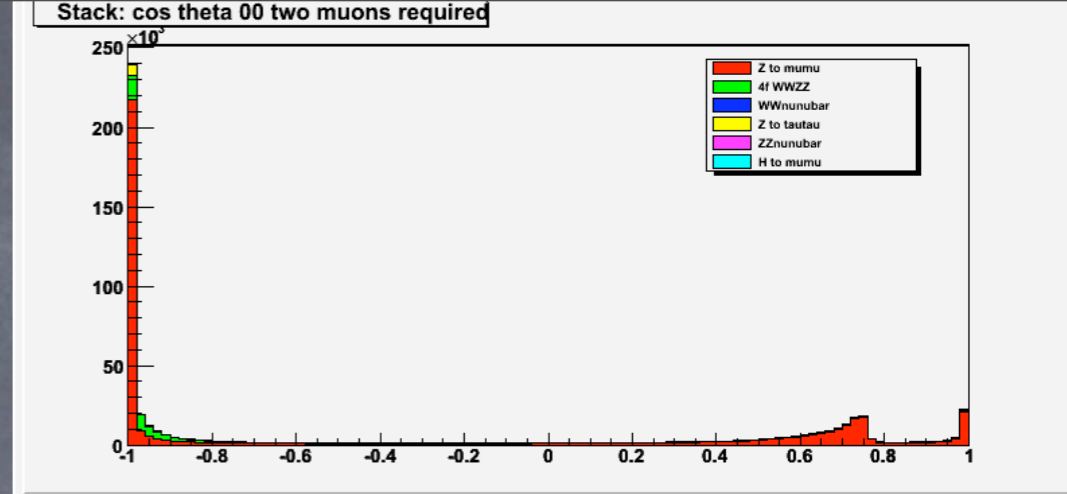
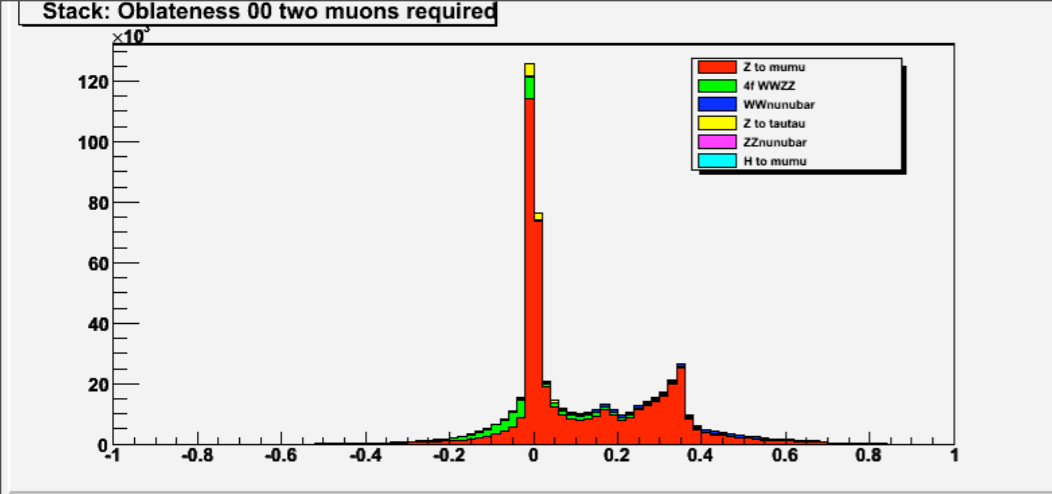
- Mass cut
- visible Energy
- acoplanarity
- oblateness

Sample sizes

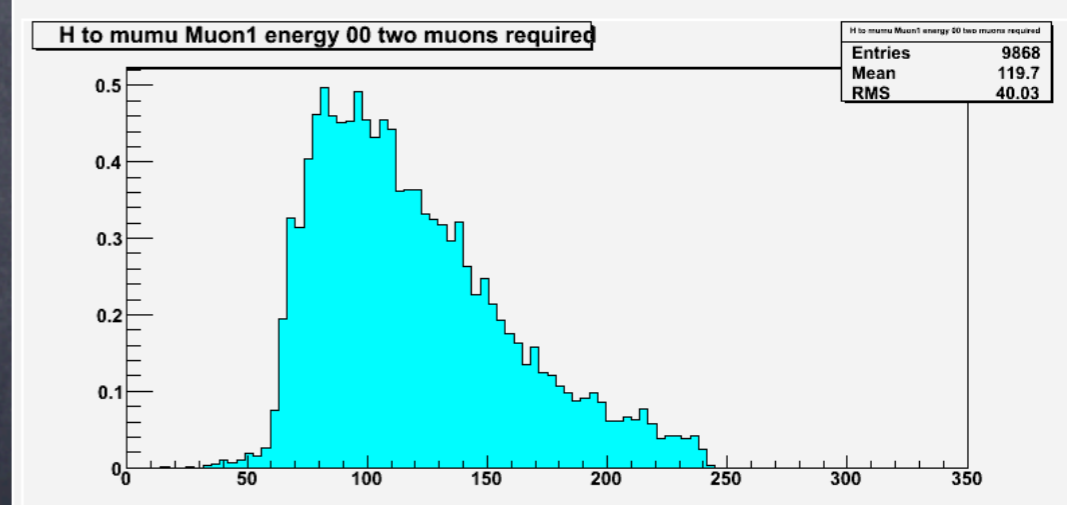
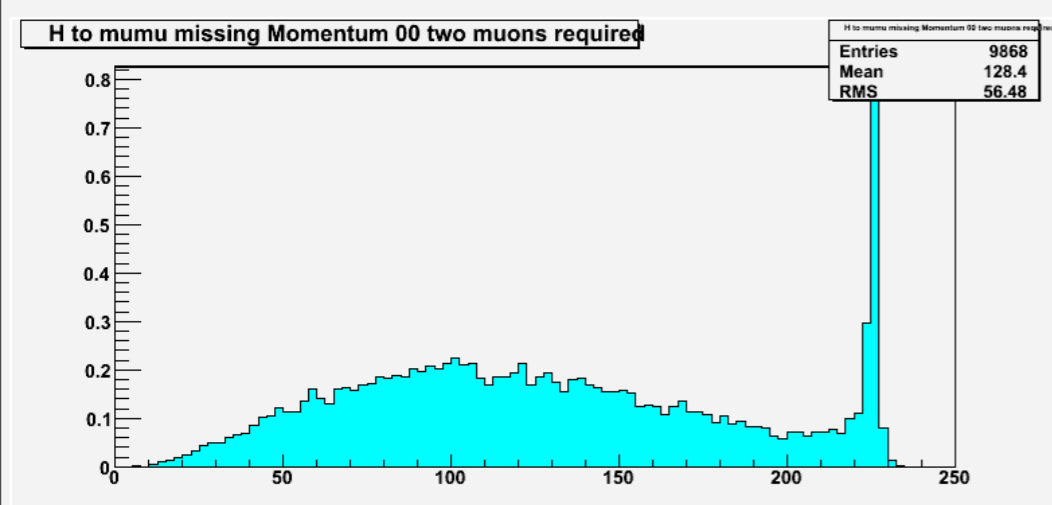
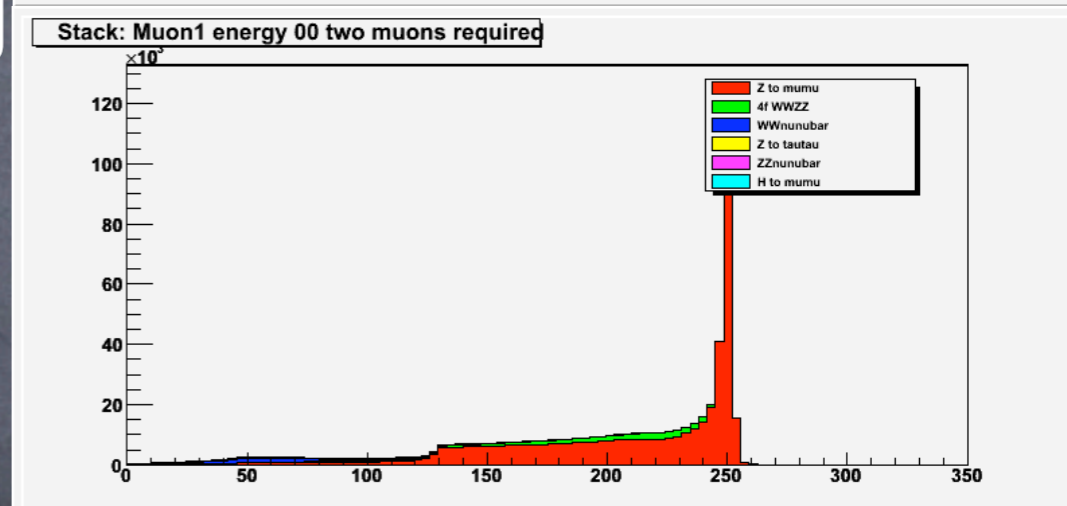
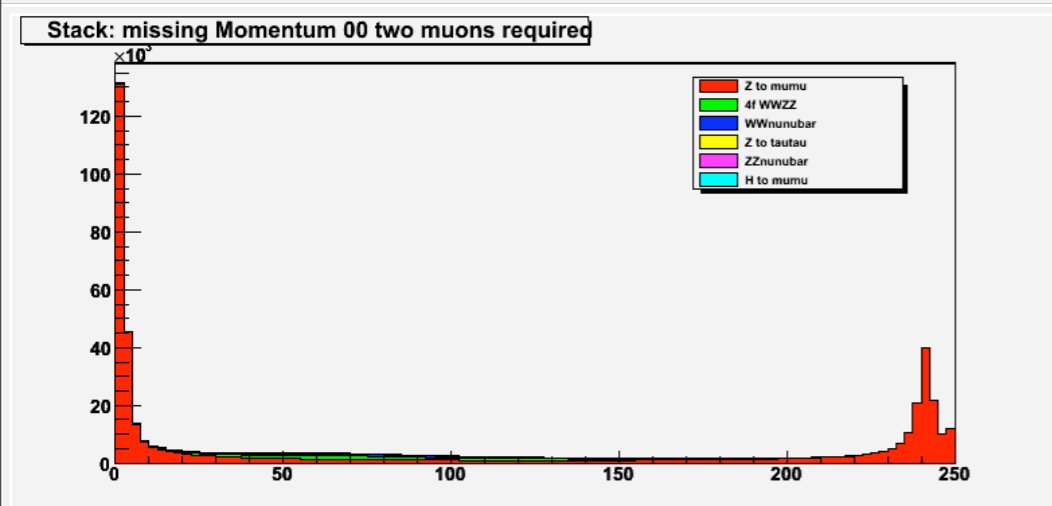
sample	tau tau	mu mu	4 f	WW nu nu	ZZ nu nu	signal
cross section	1.05 1E+03	1.07 1E+03	4.132 1E+02	3.13 1E+02	2.71 1E-03	2.41 1E-02
# available	1.1E+07	7.6E+06	5.8E+06	3.3E+06	50000	10000
shape cuts	825	6.8E+06	29068	9074	178	5114
scaled, 2 / ab	160.4	2867.9	4141.7	1721.3	0	24.6

Distinguishing Variables

- muon properties
 - $\cos \theta$
 - opening angle
 - energy
- Ratio of muon energies
- oblateness
- missing momentum
- mass
- missing mass



Some Distinguishing Variables



Status

- Boosted Decision Trees for sample separation
 - Outperforms all other classifiers in TMVA
- Only MVA, no kinematic fits
 - 1.85 sigma separation...
- Training / fitting is statistics limited

Future plans

- Kinematic fit to the di-muon mass should give much better statistical significance of signal
- use full 2 / ab sample