

Dark matter search with light scalar mediator

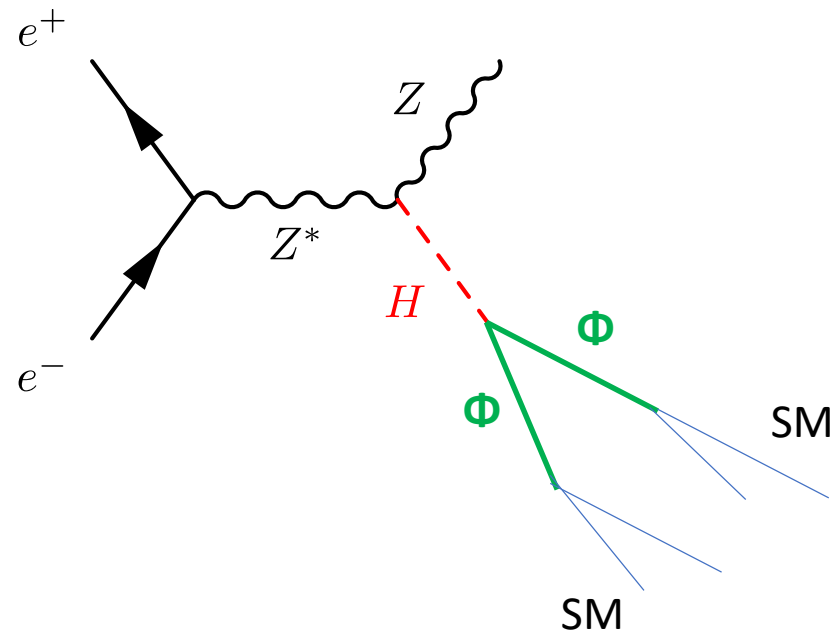
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General Physics Meeting

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Introduction

- We have to explore the possibility of BSM
- Dark matter is one of the big topic to access BSM
- WIMP is one candidate
 - This should be singlet
 - To bridge SM world and WIMP world, additional (bosonic) mediator is necessary
 - Mixing of H and Φ , H - Φ interaction and Φ -SM particle interaction possible
 - So, we can search using
@ $\sqrt{s}=250\text{GeV}$



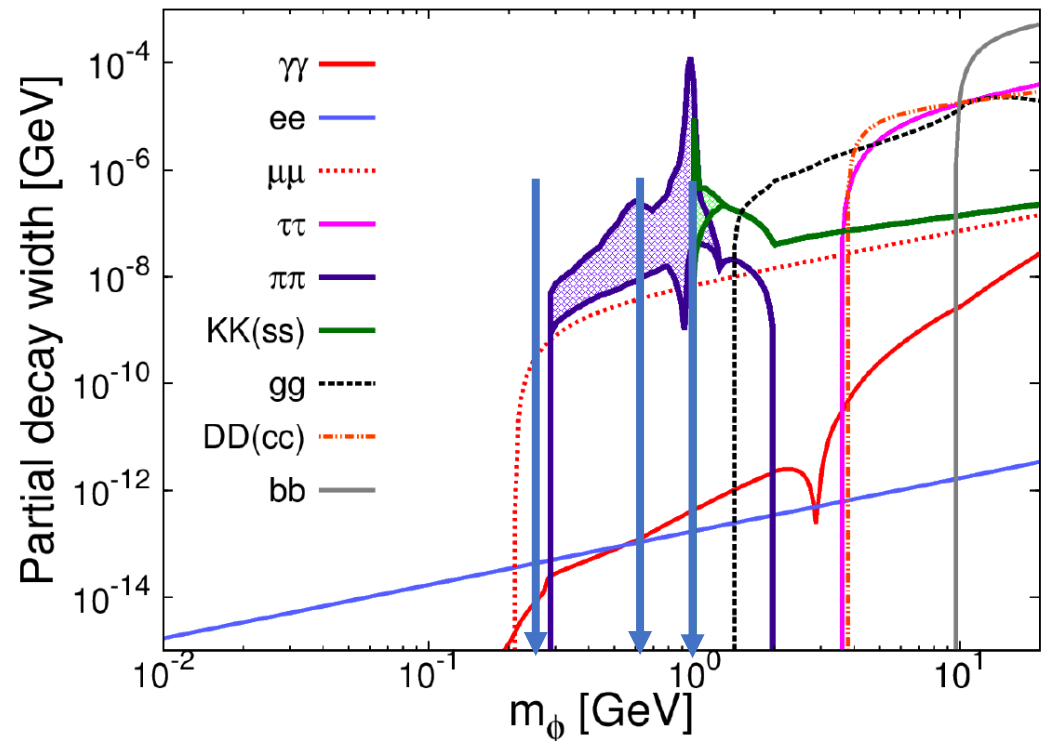
status

- Trying to construct a generator
- Path through simulation & reconstruction
- Check some distributions with different setup

setup

- Mass (GeV/c^2) (0.25, 0.50, 1.0)
- Decay length (mm) ($1.0e^{-3}$, $1.0e^{-2}$, $1.0e^{-1}$, 1.0)
- Mediator has same character as Higgs, so
 - $\Phi \rightarrow \mu\mu$ (0.25) $\pi\pi$ (0.50) KK (1.0)
 - Other decay modes are regarded as zero so far

- Use SGV, DBD setup
 - $ZH \rightarrow \mu\mu\Phi\Phi$
 - $E_{\text{cm}} = 250 \text{ GeV}$
 - eL.pR

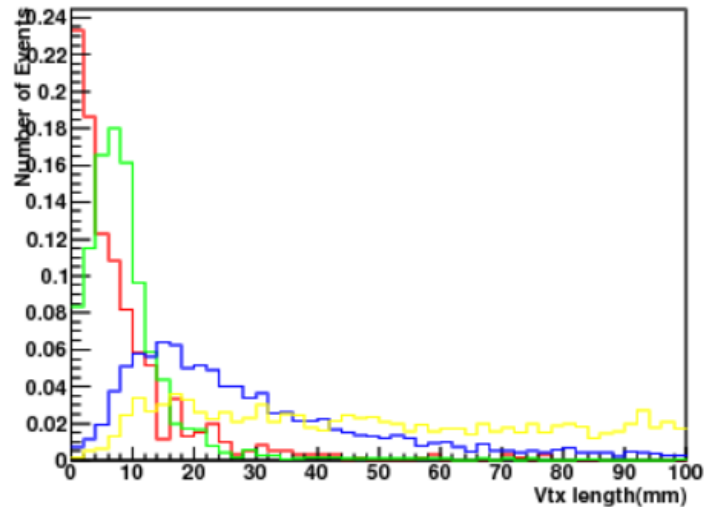
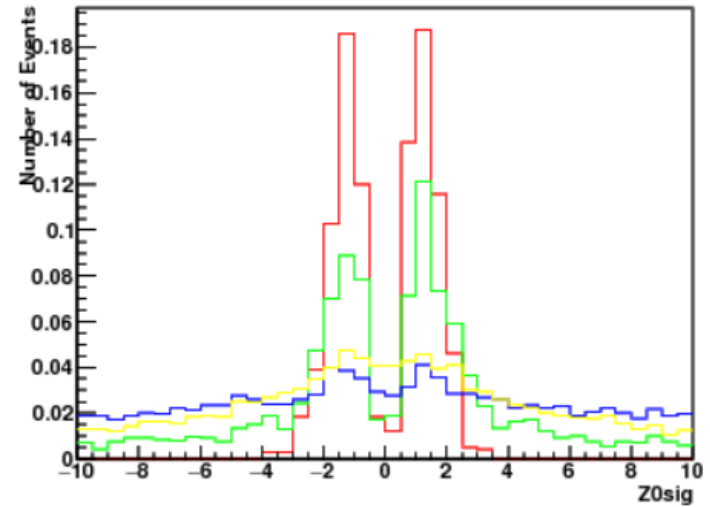
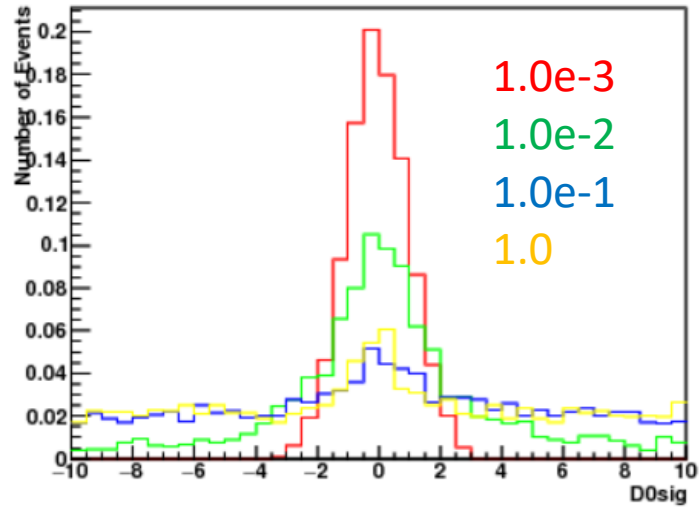


Event selection

- Choose Isolated muon
 - $|d_0| < 0.05$ && $|z_0| < 0.05$
- Reconstruct Z using Isolated muon
- Other particles are regarded as daughter coming from mediator
 - Charged $N_{\text{pfo}} \geq 4$
 - Solve combination
 - Just minimize $|m_{12} - m_{34}|, E_{12} > E_{34}$
- So far do not impose any other cuts
- Check some variables

Track variables

- Particles coming from mediator

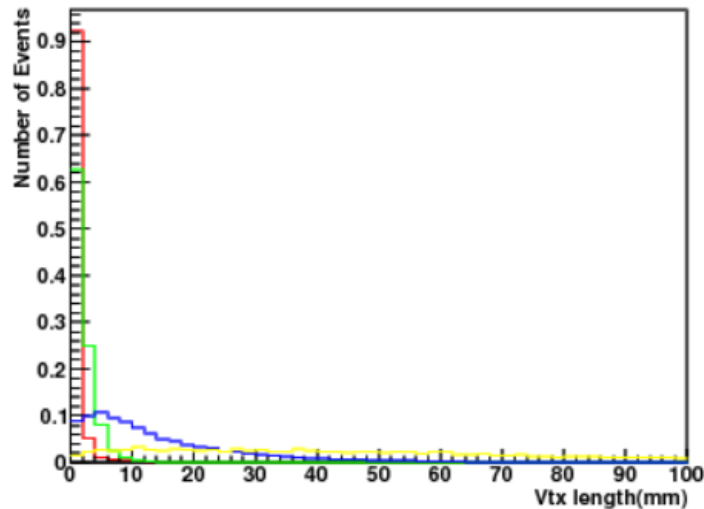
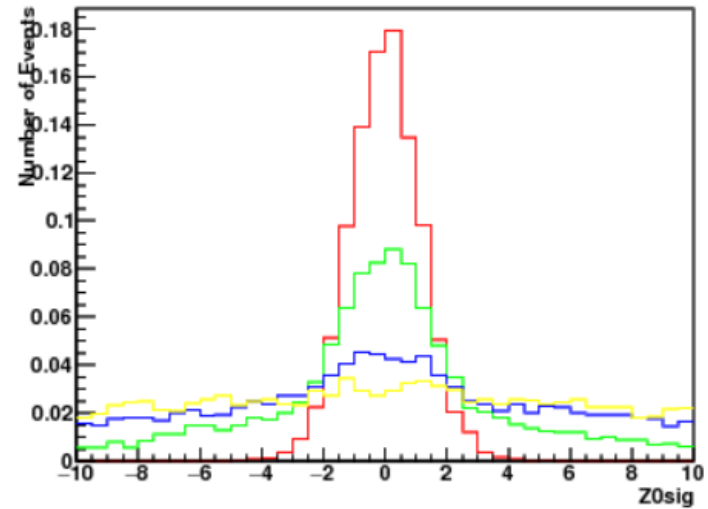
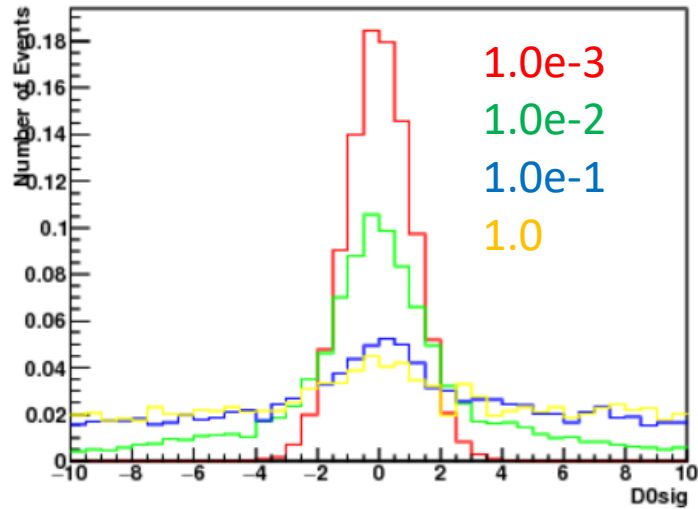


$\Phi \rightarrow \mu\mu$

- Hard to identify muon from mediator?
1.0e-3
1.0e-2

Track variables

- Particles coming from mediator

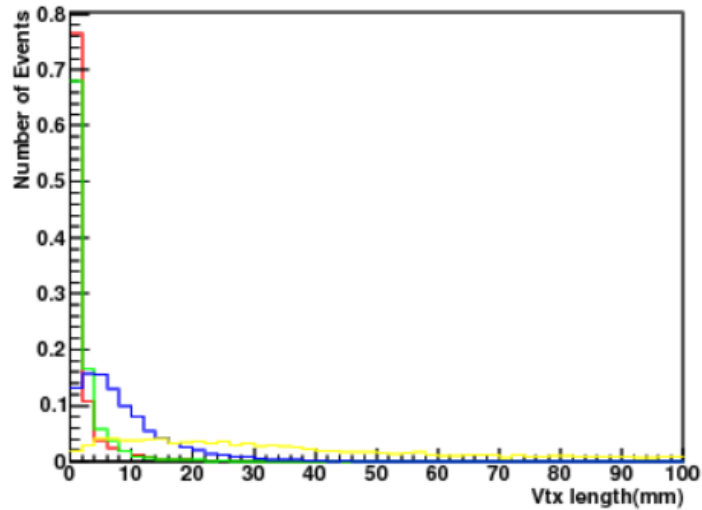
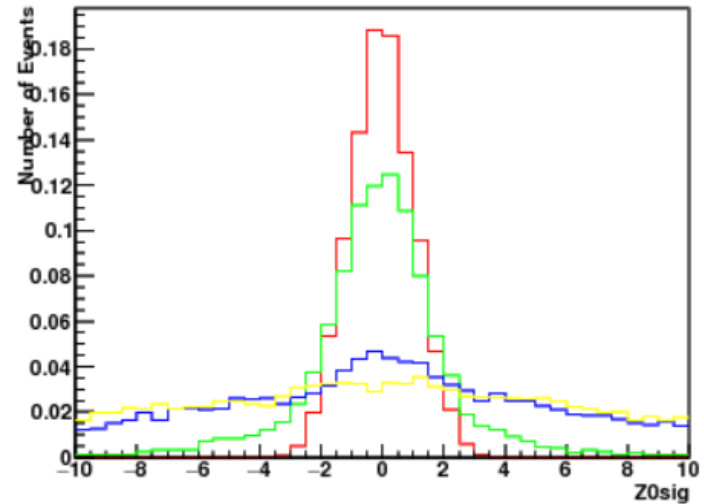
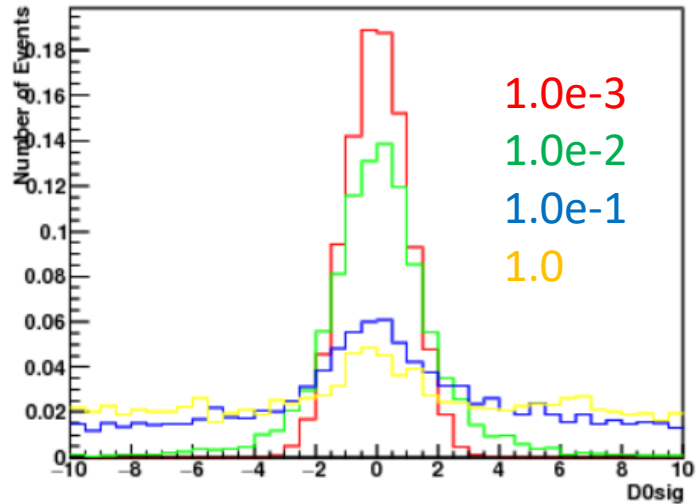


$\Phi \rightarrow \pi\pi$

- Hard to reject backgrounds?
1.0e-3
1.0e-2

Track variables

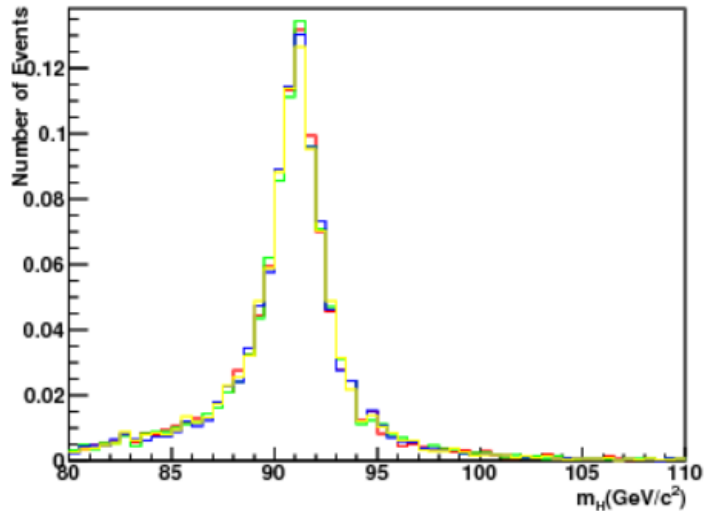
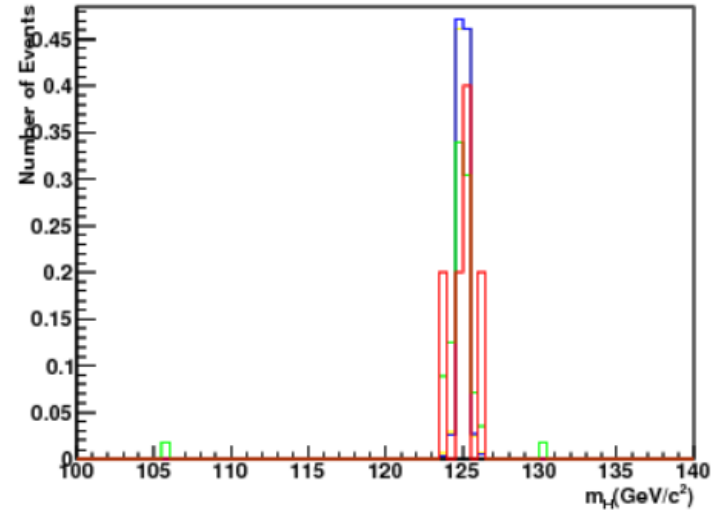
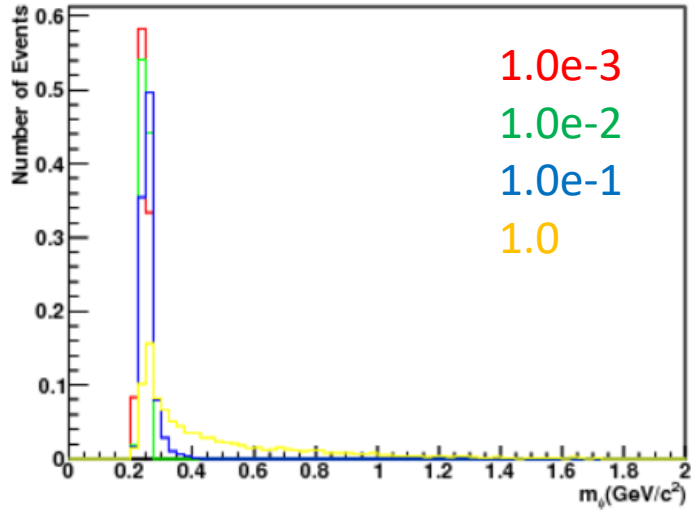
- Particles coming from mediator



$\Phi \rightarrow KK$

- Hard to reject backgrounds?
1.0e-3
1.0e-2

Resonance



$\Phi \rightarrow \mu\mu$

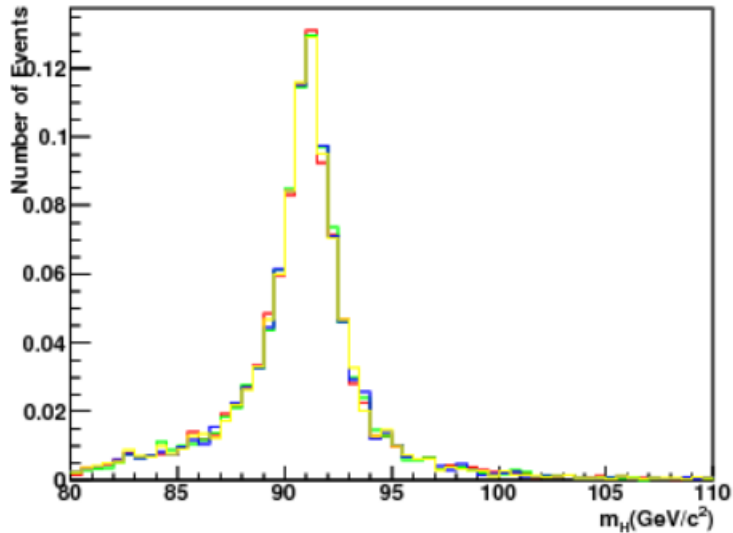
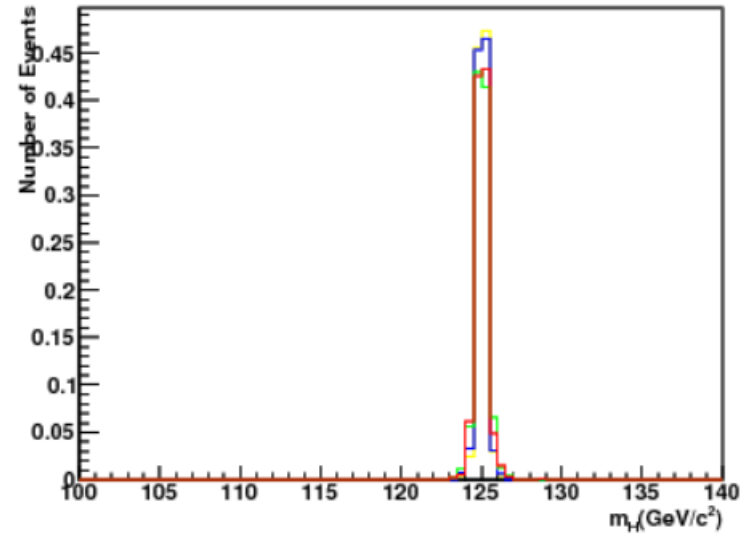
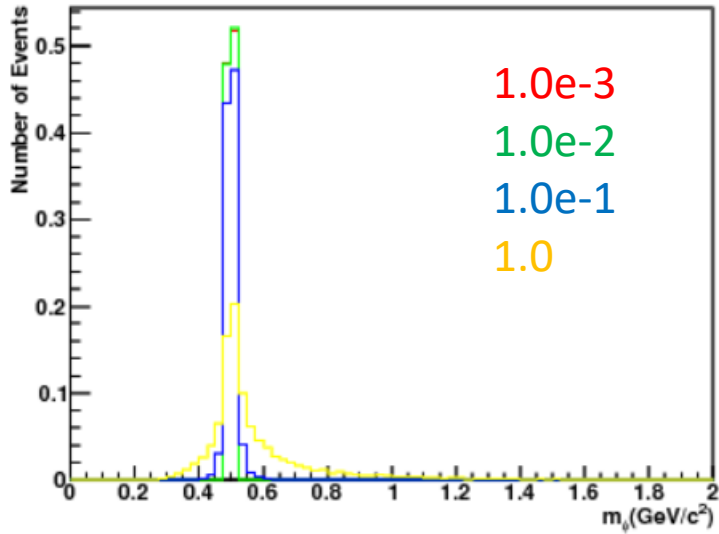
- Few events...

1.0e-3

1.0e-2

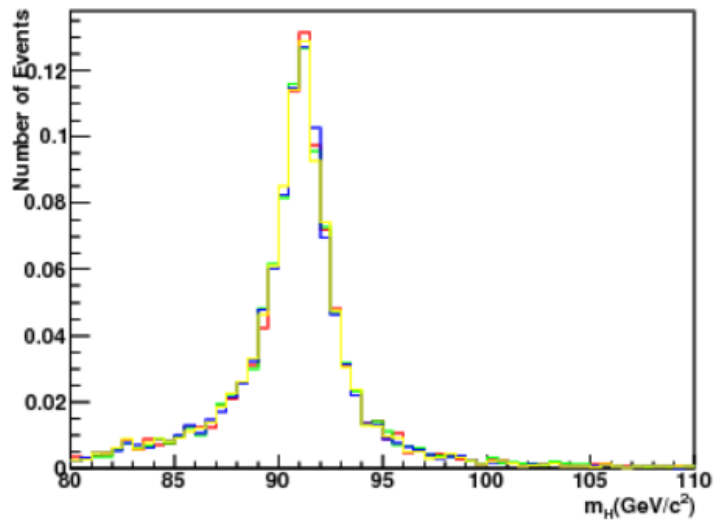
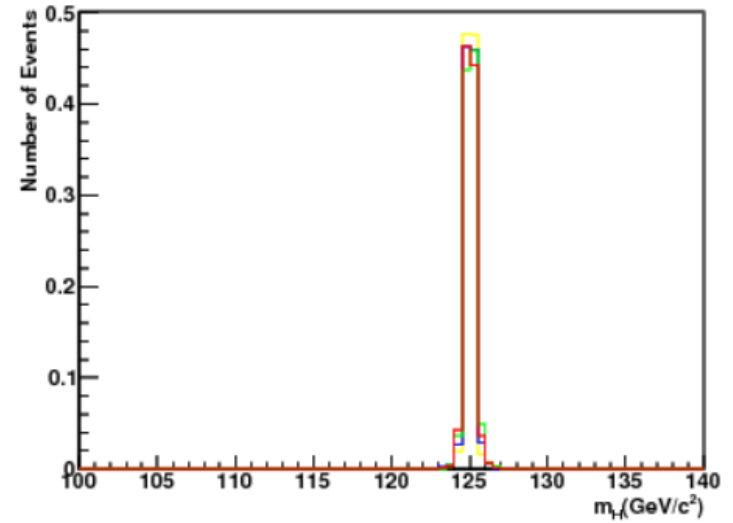
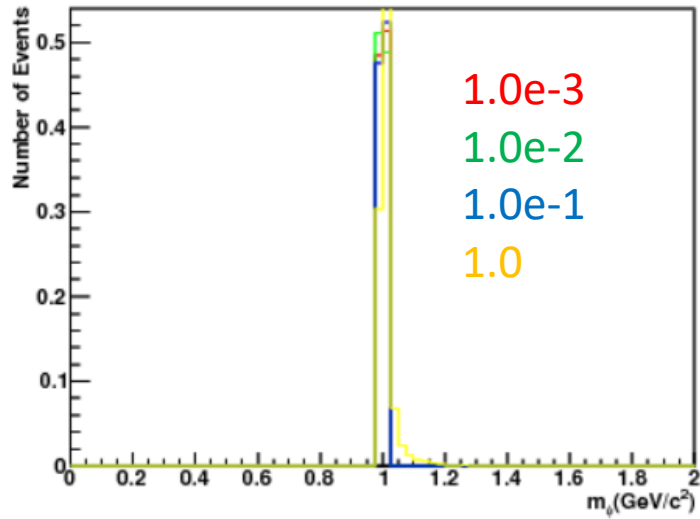
- Need to change selection

Resonance



$\Phi \rightarrow \pi\pi$
Resolution going worse
1.0

Resonance



$\Phi \rightarrow KK$
Resolution going worse
1.0

summary

- Continue to investigate
 - Looks OK when decay length is $>1.0e-1\text{mm}$
 - But mass resolution going worse
 - Need to change selection when $(\mu\mu)(\mu\mu\mu\mu)$
 - Carefully choose parameters
 - eeh
 - Going to jets $\phi \rightarrow cc, bb$
 - Backgrounds...