

# A first look of new MC samples for $h \rightarrow \mu^+ \mu^-$ analysis

Shin-ichi Kawada (DESY)

ALCW2018 @ Fukuoka, Japan

2018/May/28 - June/1



**HELMHOLTZ**

RESEARCH FOR GRAND CHALLENGES

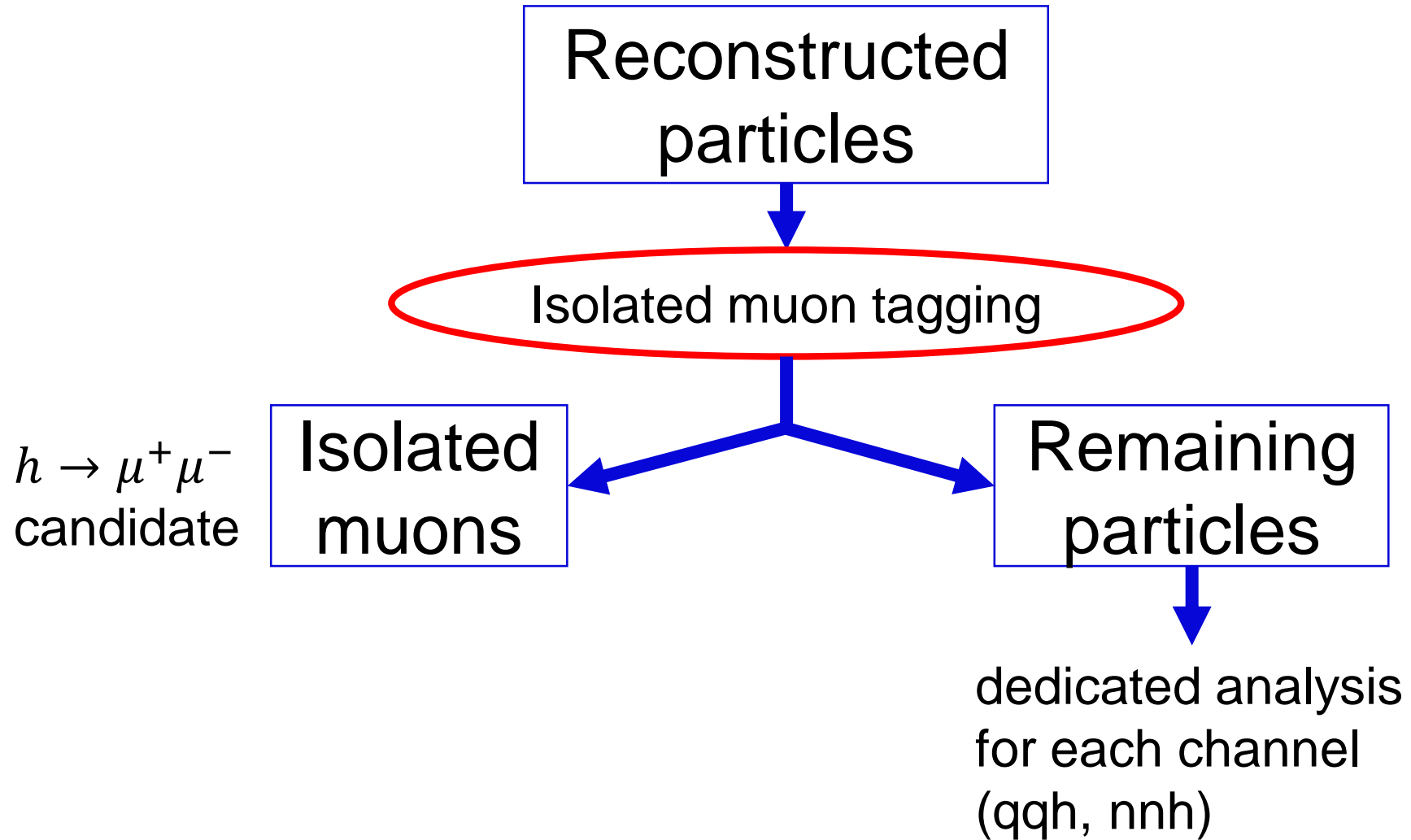
# Introduction

- In ILD, a MC production campaign has been started using ILCSoft v02-00.
- This talk is a simple report of first look of these samples for  $h \rightarrow \mu^+ \mu^-$  analysis.
  - I checked ffh\_mumu samples only, but some comparison between DBD and new is made.
  - I am a newcomer of ILCSoft v02-00, also report some problems when I worked for this.
  - Latest analysis results with DBD-style samples are already shown in Monday (Higgs/EW).

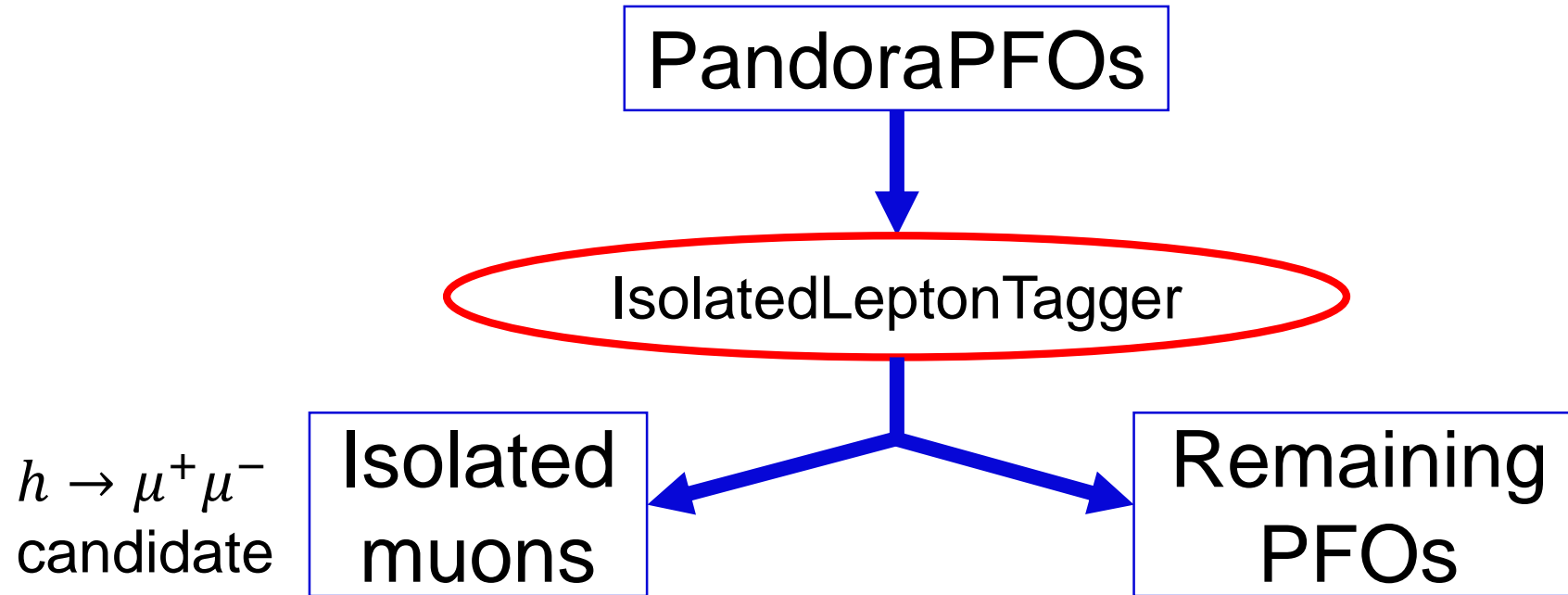
# Quick Summary of MC Samples

	New	DBD
ILCSoft version	v02-00	v01-16
Detector model	ILD_I5(s5)_o1_v02	ILD_o1_v05
Overlaid background	$\gamma\gamma \rightarrow$ hadrons $<1.2>$ $e^+e^-$ seeable pairs	$\gamma\gamma \rightarrow$ hadrons $<1.7>$
$E_{\text{CM}}$	only 500 GeV now	250 GeV, 500 GeV

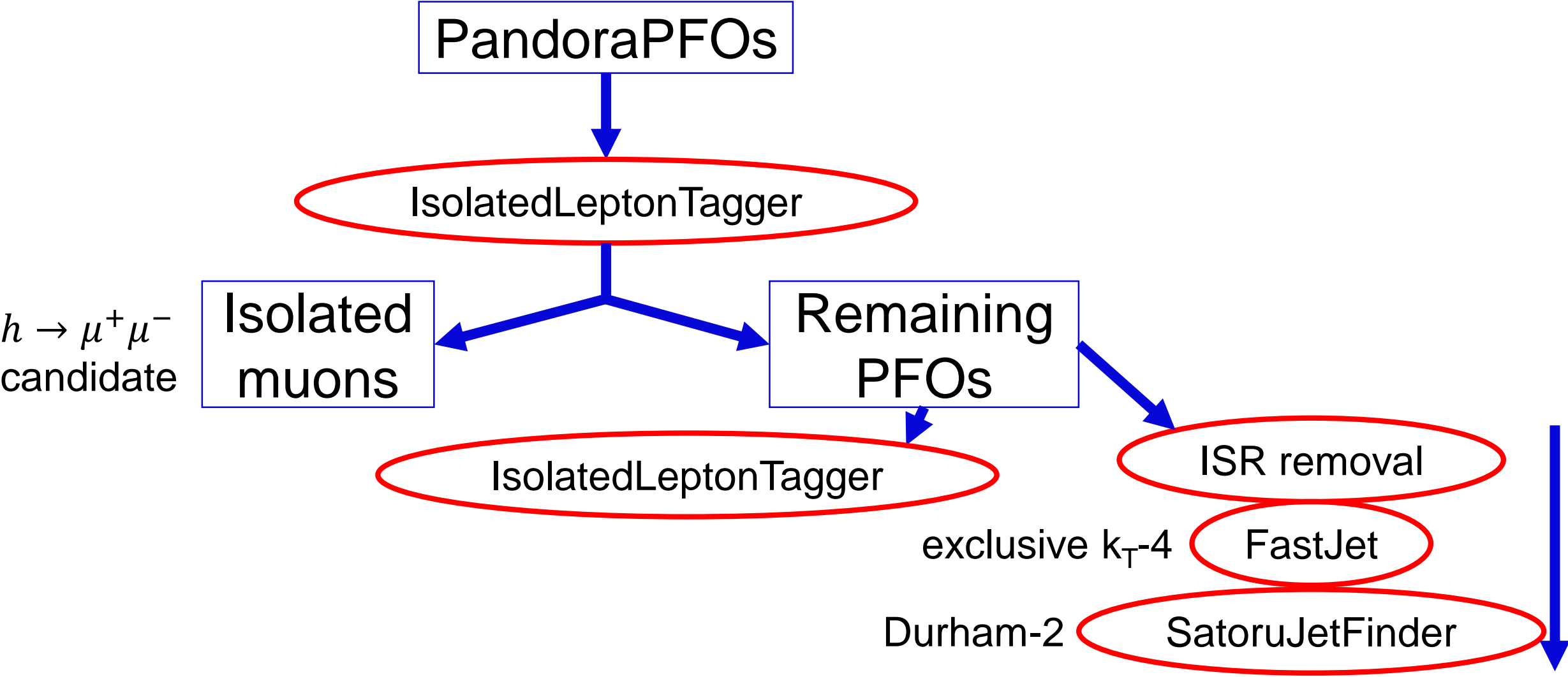
# General Event Reconstruction



# Real Working World (nnh500)



# Real Working World (qqh500)



# First Problem

- **In default, SatoruJetFinder never works!**
  - This processor contains Fortran code.
  - At some point (v01-19-05 -> v01-19-06?), cernlib is excluded from ILCSoft. The cernlib is used for Fortran code.
  - With experts help, now I can use SatoruJetFinder.

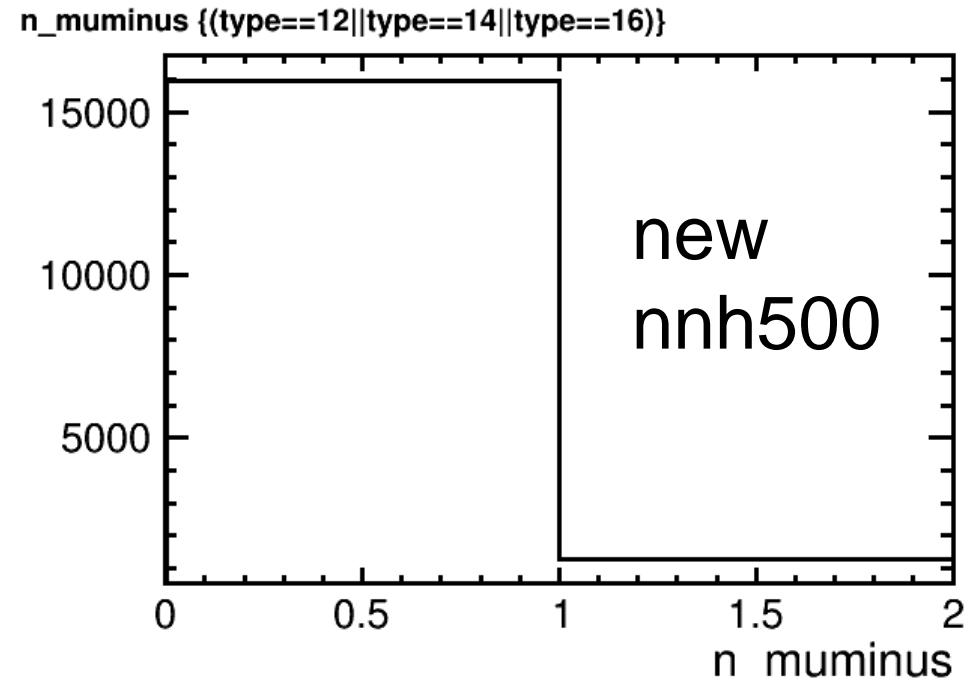
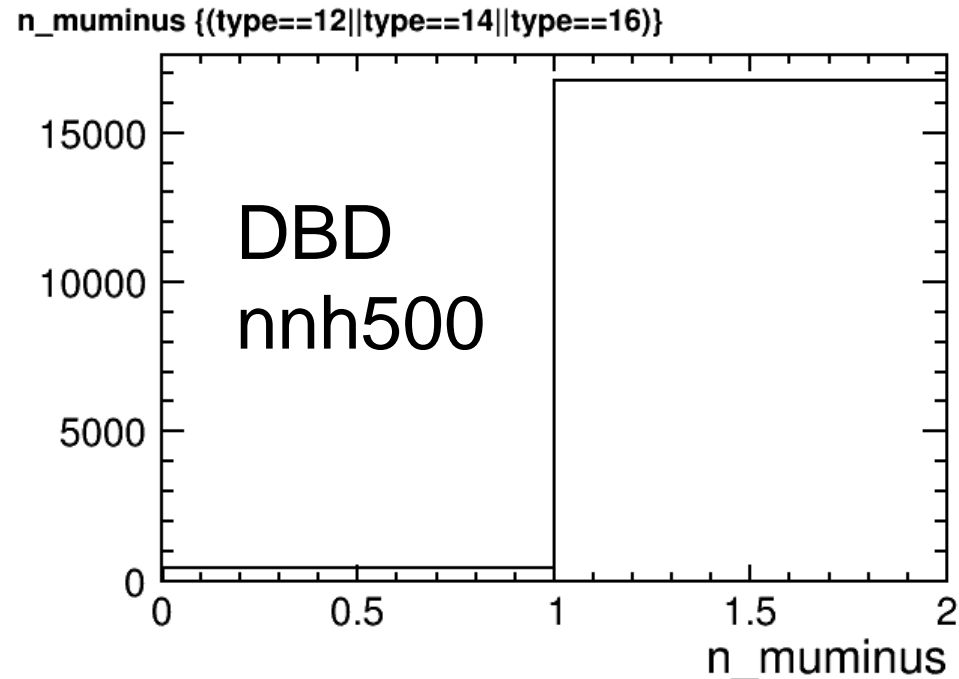
# Fortran/cernlib

- If you are an expert or working with expert, then no problem.
- But consider a newcomer without enough knowledge and without expert's help.
- Other Fortran codes will also be affected.
  - EventShape\_Fortran, BCalTagEfficiency
  - others?
- What should we do for Fortran code? We don't need to decide now, but discussion is necessary in future.



# Second Problem

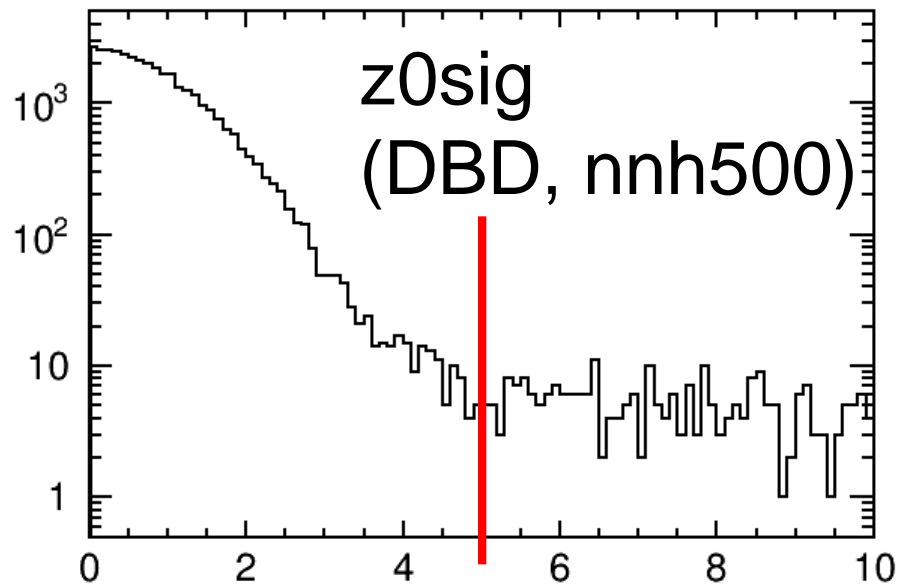
- **Performance of IsolatedLeptonTagger is too funny.**
  - Reconstruction efficiency (correctly reconstruct one mu+ and on-) is greater than 90% in DBD, but is less than 5% in new samples!



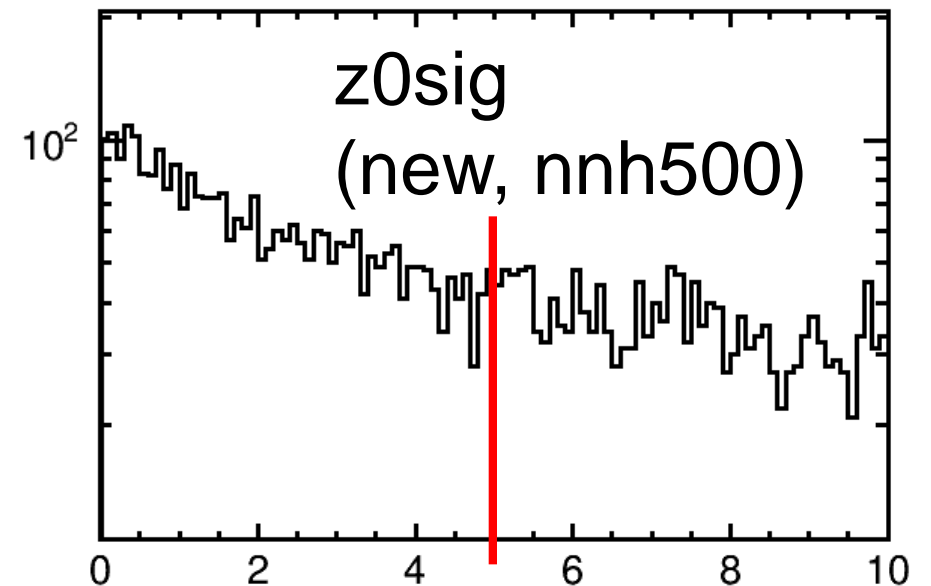
# Possible Reason

- Treatment in z-direction has been changed.
  - In DBD, everything happened in (0,0,0). But in new, the z-direction is smeared up to  $\sim 200 \mu\text{m}$ .

abs(pfo\_z0sig) {(type==12||type==14||type==16)&&pfo\_chrg!=0&&abs(pfo\_pid\_mc)==13}

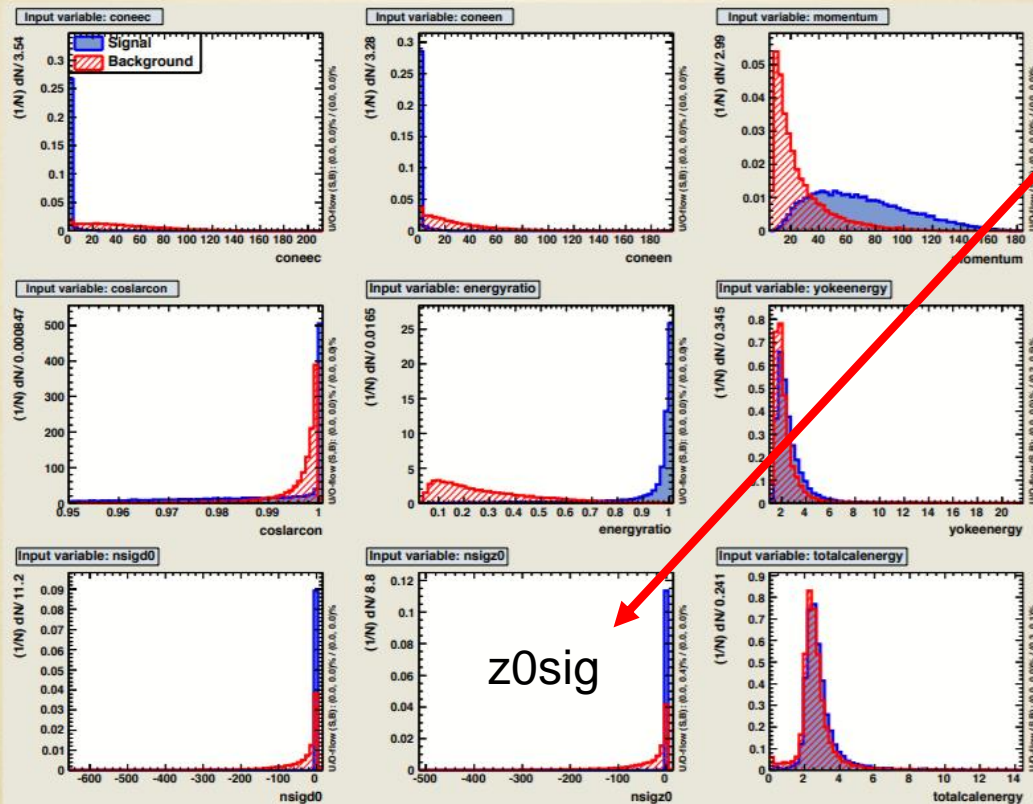


abs(pfo\_z0sig) {(type==12||type==14||type==16)&&pfo\_chrg!=0&&abs(pfo\_pid\_mc)==13}



# MVA in IsolatedLeptonTagger

input variables: muon



z0sig is the one of the input to MVA in IsolatedLeptonTagger

z0-related variables are changed significantly

need to re-train or use simple cut analysis

# Treatment in z-direction

- In any case, the treatment in z-direction has been changed. No longer (0,0,0).
- The variables  $d_0$  and  $z_0$  (and  $d_0\text{sig}$ ,  $z_0\text{sig}$ ) need to be defined with respect to primary vertex.
  - **This will affect to everything**, not only IsolatedLeptonTagger!
- This discovery is already triggered of expert's discussion.

# Third Problem (1)

- I found 2 strange MCParticle muons (genstat == 2) with the energy greater than 500 GeV.
  - ID = 108161, Event = 19926 (3300 GeV)
  - ID = 108163, Event = 6914 (92300 GeV)
- I did not find this kind of strange MCParticle in DBD samples.

# Third Problem (2)

- Common thing
  - Higgs decays to two muons, the simstat of one muon is “c”, and another is “l”.
  - These two muons go to PDG94.
  - PDG94 produces two muons, and one muon from PDG94 has too high energy.
- It will be fixed in v02-00-01, need to be checked.

# Summary

- Reported couple of things I found
  - SatoruJetFinder/Fortran/cernlib ---> need discussion in future
  - IsolatedLeptonTagger ---> new z-direction treatment, will affect to everything
  - Some strange things in new samples
- Need to check/study more
  - strange MCParticle
  - effect of  $\gamma\gamma \rightarrow$  hadrons and  $e^+e^-$  seeable pairs