# Updates on Simulation of Ds Semileptonic Decay

Lu Cao

16-05-2014

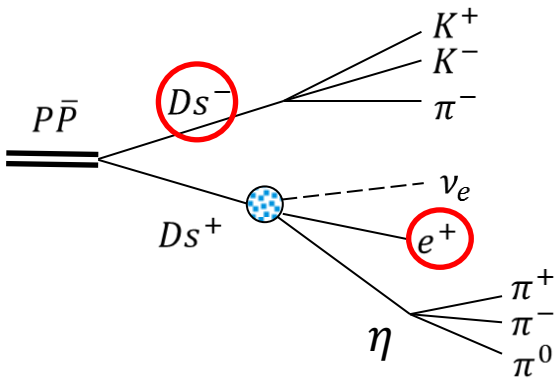
- Fast sim vs full sim with various PID
- Full sim: reconstruction of pi0

  Ds mass spectrum

# PID Algorithms

**Full:**

| | |
|---|---|
| PidAlgoIdealCharged | : true $P$=1; others $P$=0 |
| PidAlgoMvd | : MVD |
| PidAlgoMdtHardCuts | : MUO |
| PidAlgoDrc | : DRC |
| PidAlgoDisc | : DISC |
| PidAlgoStt | : STT |
| PidAlgoEmcBayes | : EMC |

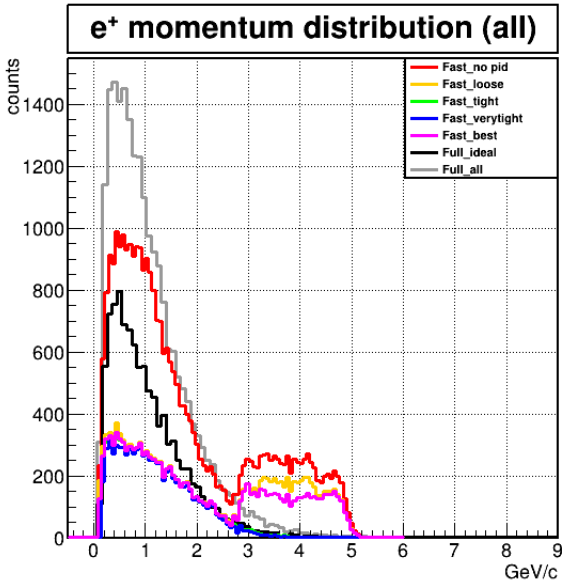


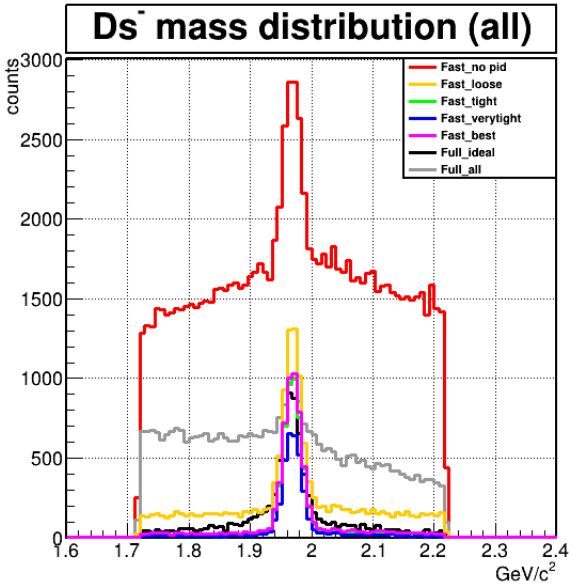

**Fast:** **IdealPidProbability ： ideal PID in fast sim (newly implemented since #24883)**

```
PidChargedProbability      : combination of all
ScEmcPidFSProbability      : EMC forward spectrometer
ScEmcPidFwCapProbability   : EMC forward endcap
ScEmcPidBarrelProbability  : EMC barrel
ScEmcPidBwCapProbability   : EMC backward endcap
DrcBarrelProbability       : Barrel DIRC
DrcDiscProbability         : Disc DIRC
MvdPidProbability          : MVD
SttPidProbability          : STT
RichProbability            : RICH
ScMdtPidBarrelProbability  : MUO barrel
ScMdtPidForwardProbability : MUO endcap
```

10k evt

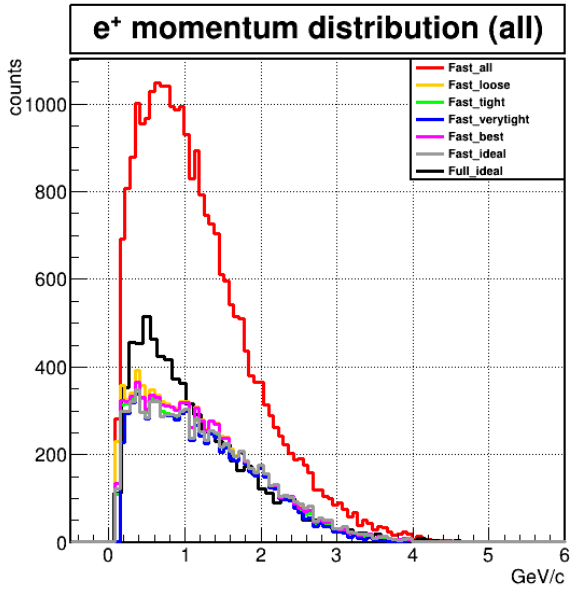
#24697

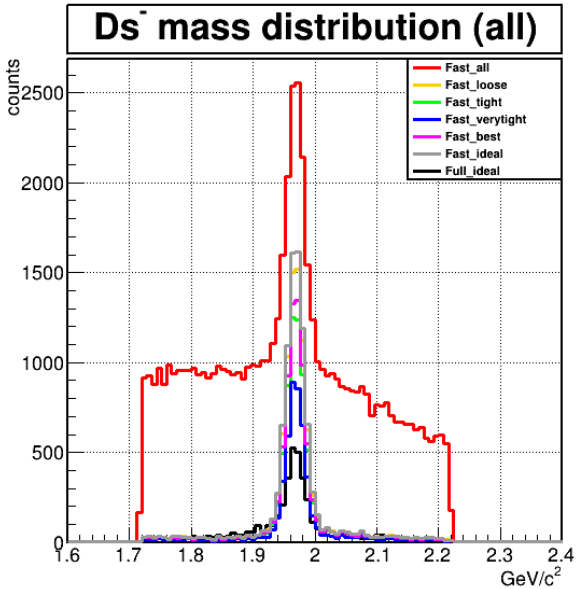



Gray line symbolizes differently in two versions!!

#24883



# Pi0 reconstruction in full simulation

Two ways:

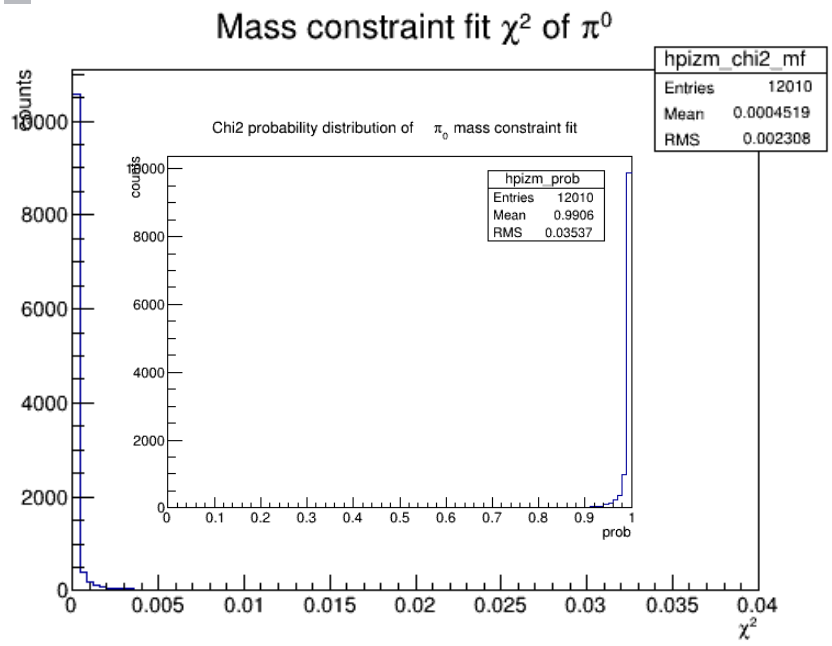
- mass constraint fit for two photons (PndKinFitter in PandaRoot) *fitter fixed since #24893 (3 days ago)*
- photon energy scaling method *Nucl. Instr. and Meth. A 453 (2000) 606 pdf*

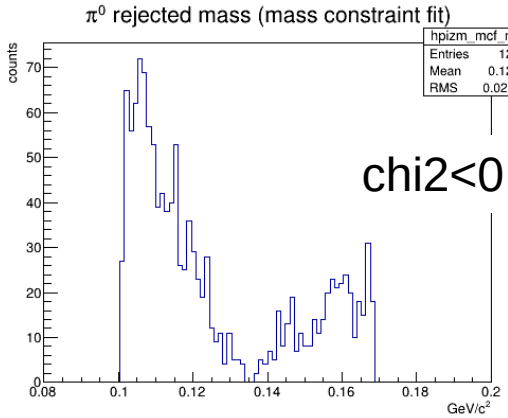
# Pi0 reconstruction in full simulation

Two ways:

- mass constraint fit for two photons (PndKinFitter in PandaRoot) *fitter fixed since #24893 (3 days ago)*
- photon energy scaling method *Nucl. Instr. and Meth. A 453 (2000) 606*

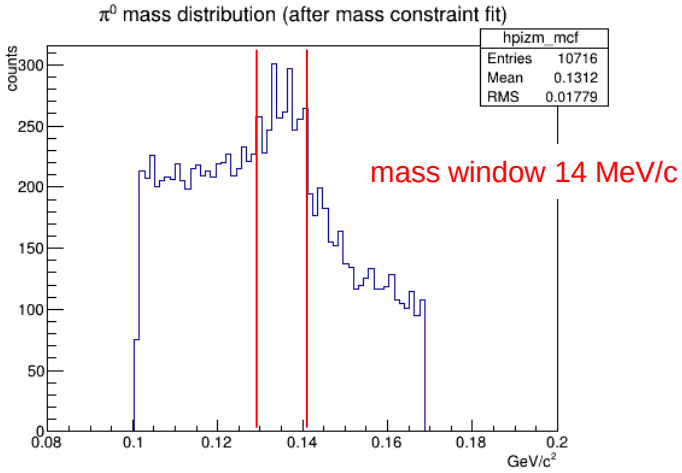
mass constraint fit




chi2<0.0005

2k evt
#24910




mass window 14 MeV/c

## Energy scaling method

*Nucl. Instr. and Meth. A 453 (2000) 606* pdf

TAPS

**Reconstruction of the $\pi^\circ$ kinematics from $\gamma\gamma$ decay**

K. Korzecka, T. Matulewicz*

*Institute of Experimental Physics, Warsaw University, Hoża 69, PL-00-681 Warszawa, Poland*

Invariant mass of two-photon:

$$m_{\gamma\gamma} = \sqrt{2E_{\gamma_1} E_{\gamma_2}(1 - \cos\theta_{\gamma\gamma})}$$

Photon energy $E_{\gamma i}$ will be scaled to $E_{\gamma i}^{REC}$:

$$E_{\gamma_i}^{\mathrm{REC}} = \frac{m_\pi}{m_{\gamma\gamma}} E_{\gamma_i}$$

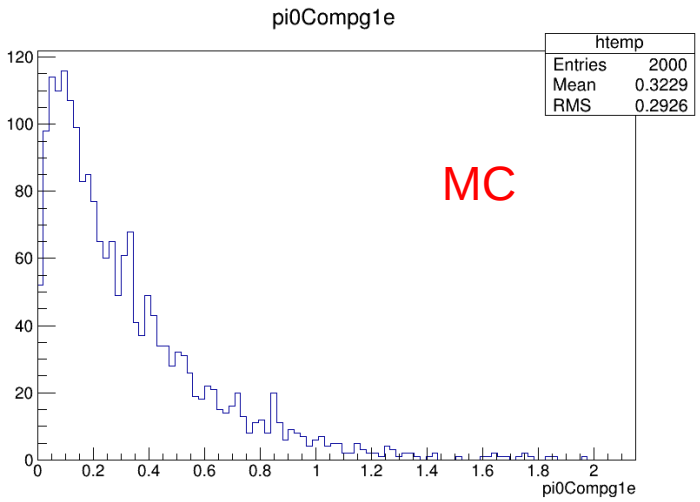
with $E_{\gamma i}^{REC}$ and angular information fixed, the 4-momenta of pi0 can be written as:

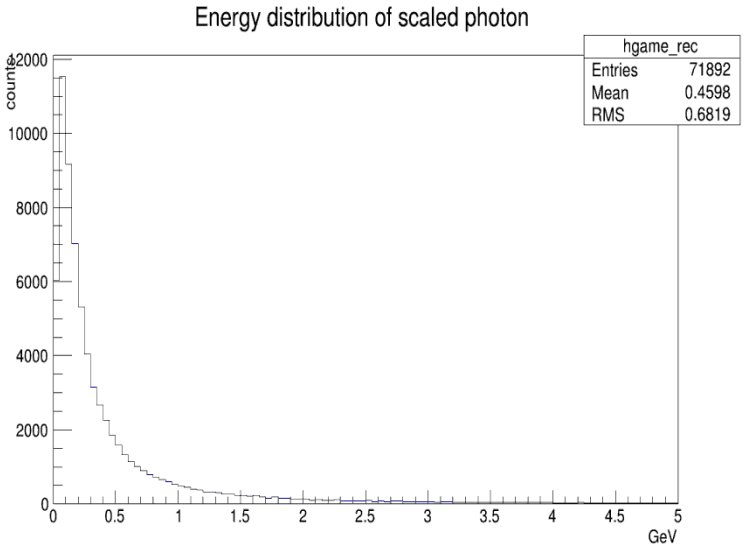
$$\boldsymbol{p}_\pi = \boldsymbol{p}_{\gamma_1}^{\mathrm{REC}} + \boldsymbol{p}_{\gamma_2}^{\mathrm{REC}}$$

This method is appropriate when the accuracy of the angular measurements is much better compared to the energy measurements.

Otherwise, not only the photon energies have to be corrected, but also their emission angles (kinematical fit).

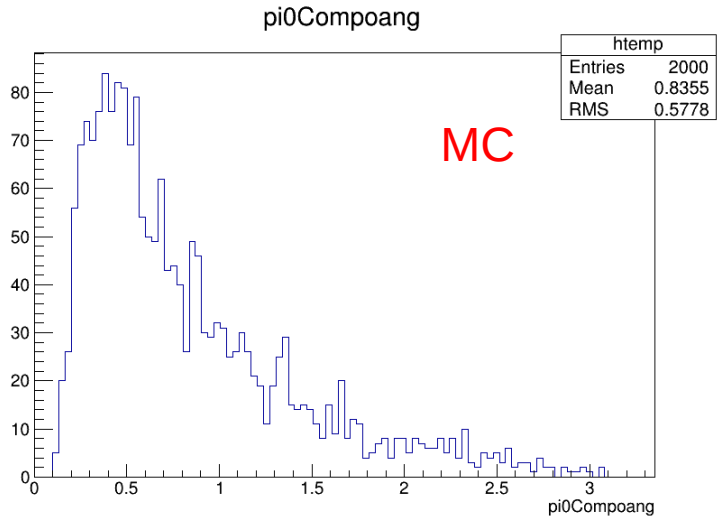
# Cutting 1: photon energy > 0.02 GeV

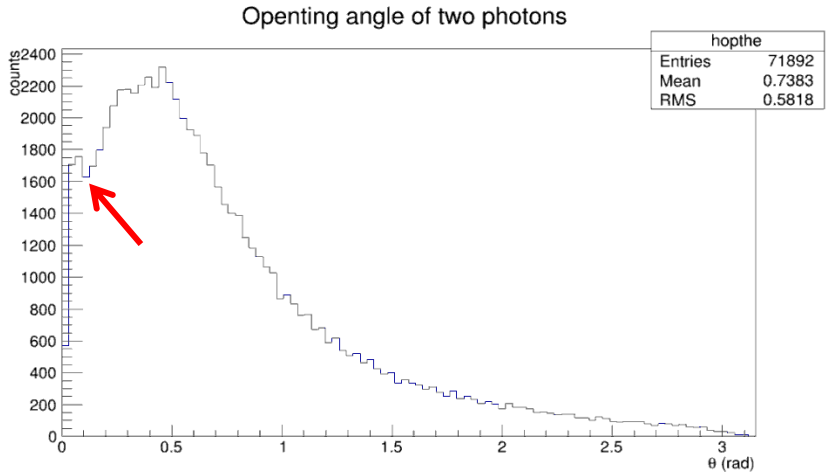



# Cutting 2: opening angle > 0.1 rad

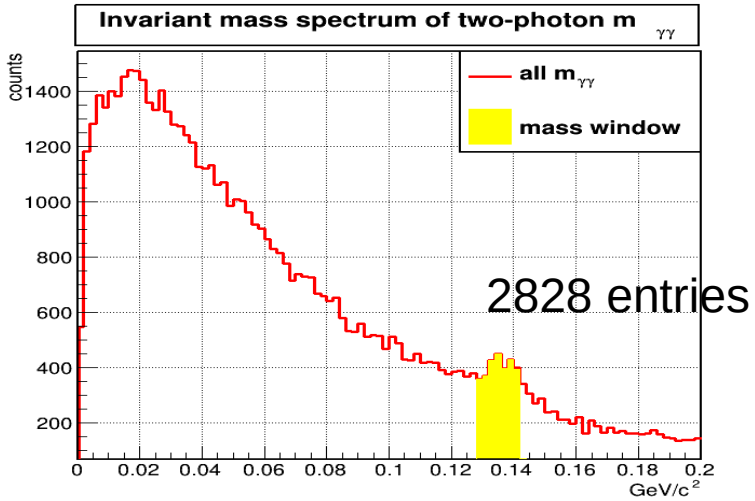
2k evt
#24910

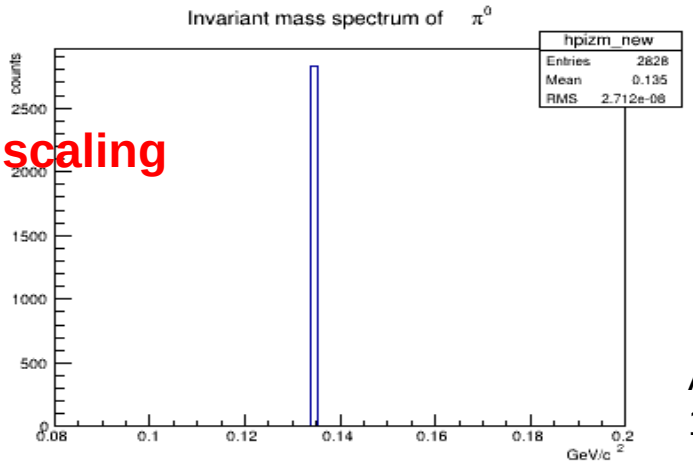


2k evt #24910

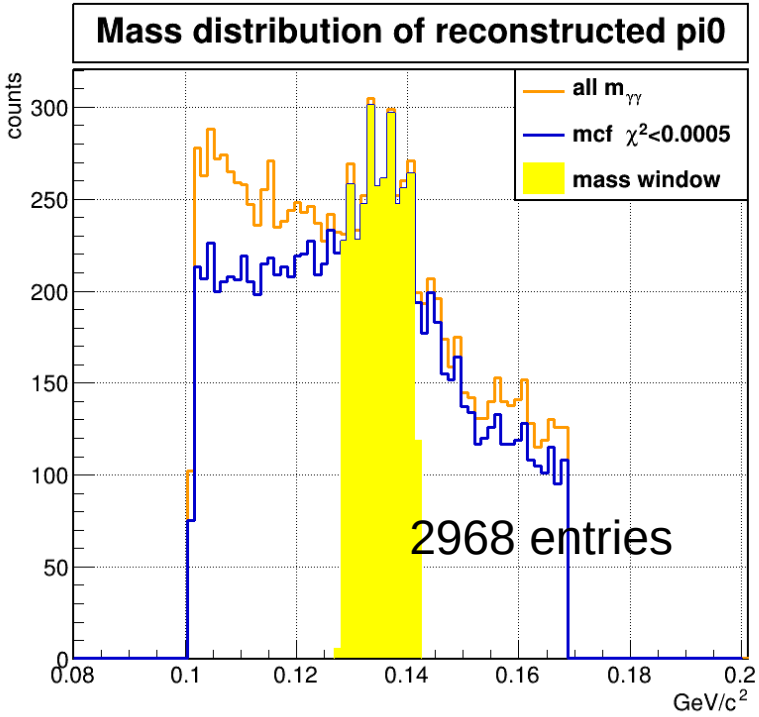
Cuttings in **energy scaling method**:
photon energy > 0.02 GeV
mass window on $m_{\gamma\gamma}$: 0.014 GeV/c
opening angle > 0.1 (1 evt )



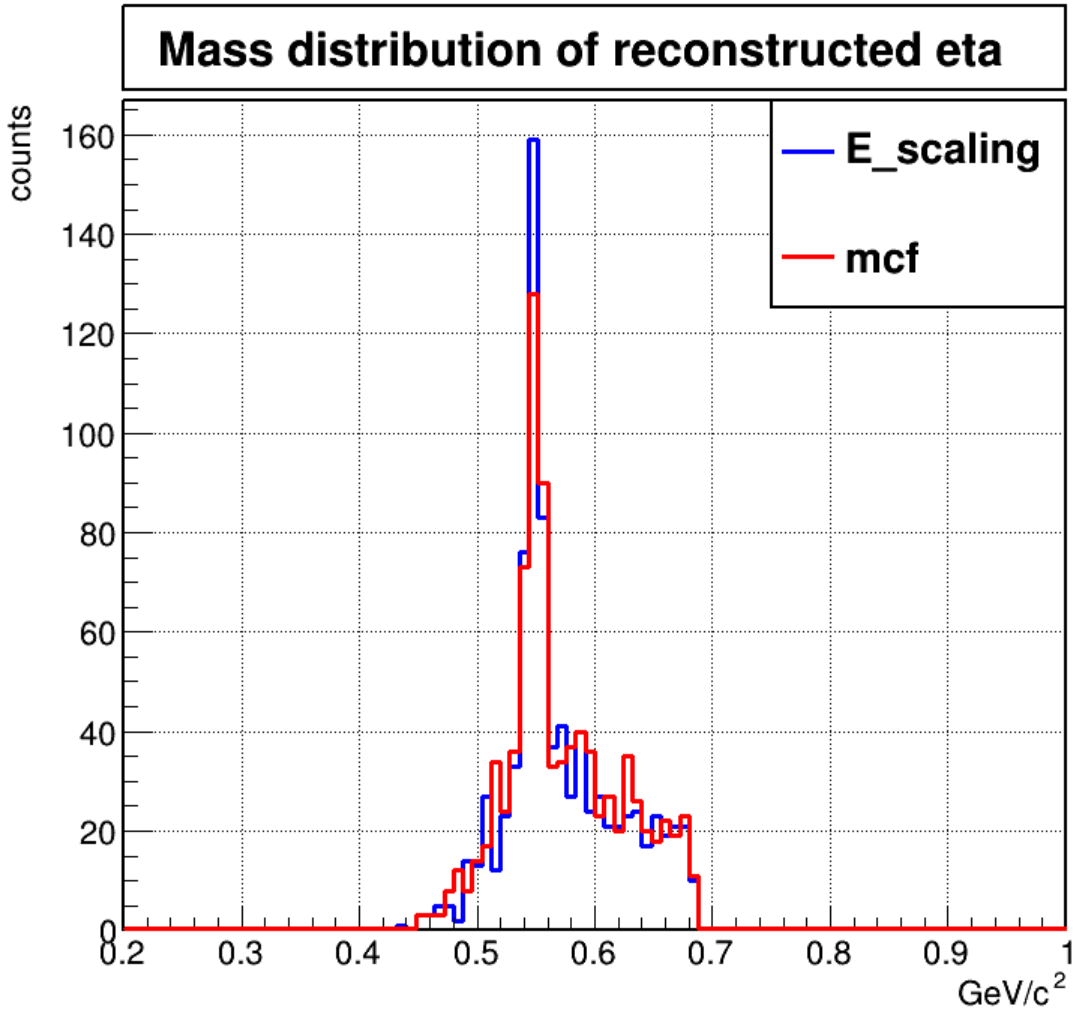

**after scaling**

Cuttings in **mcf method**:
photon energy > 0.02 GeV
mass window: 0.014 GeV/c
mcf chi2 < 0.0005




Additional reasonable cuttings are required!!!
1M evt for MC info will be considered.

2k evt #24910

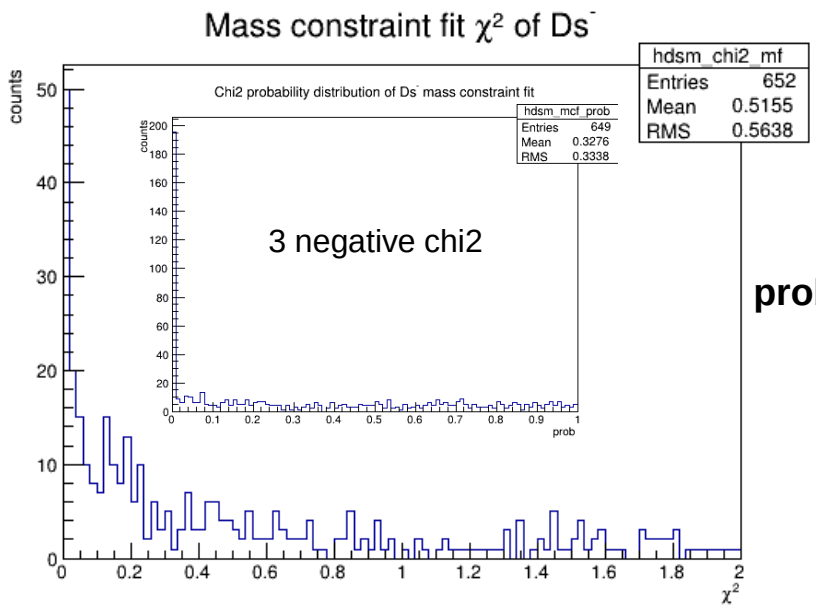



Next:

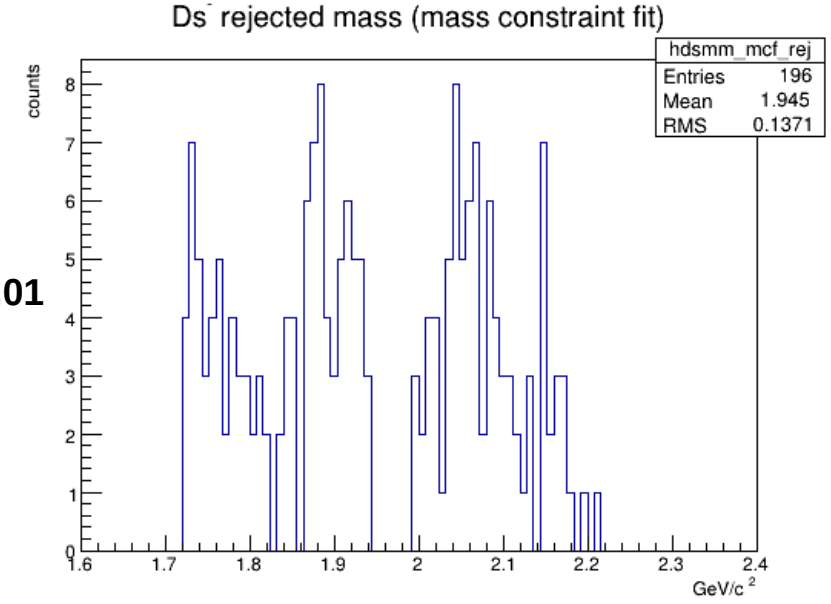
- consider additional cuttings
- increase statics

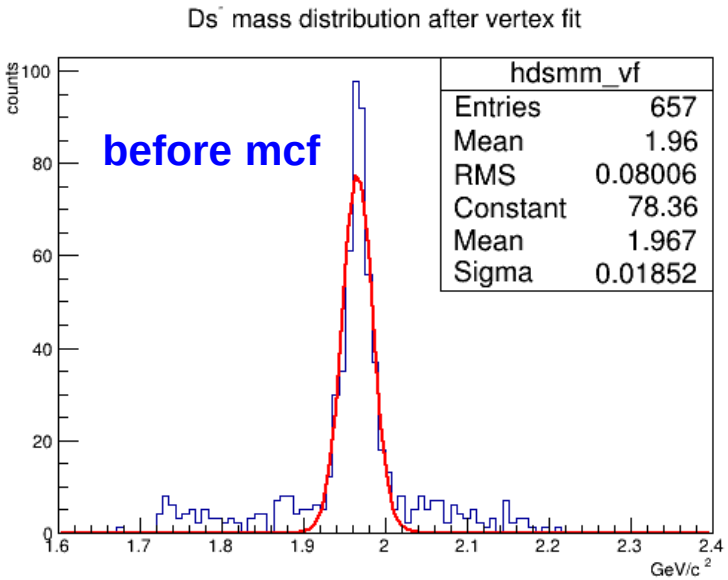
2k evt #24910

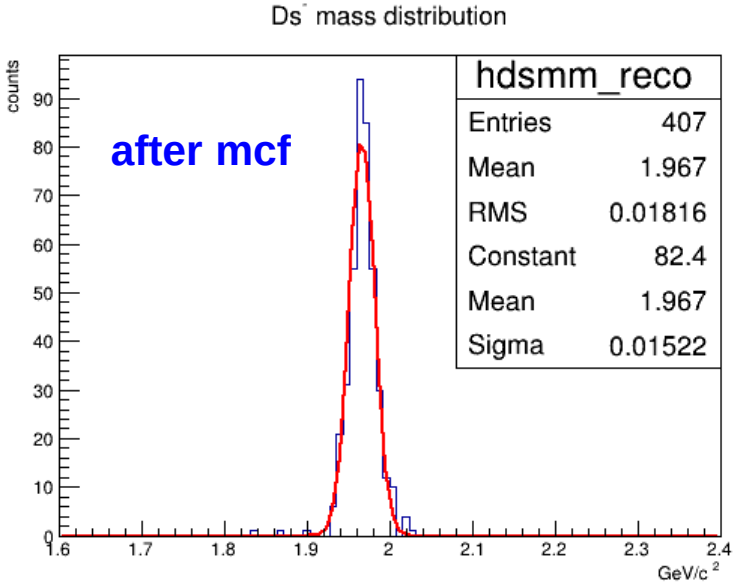
# Ds mass spectrum with updated kin. fitter



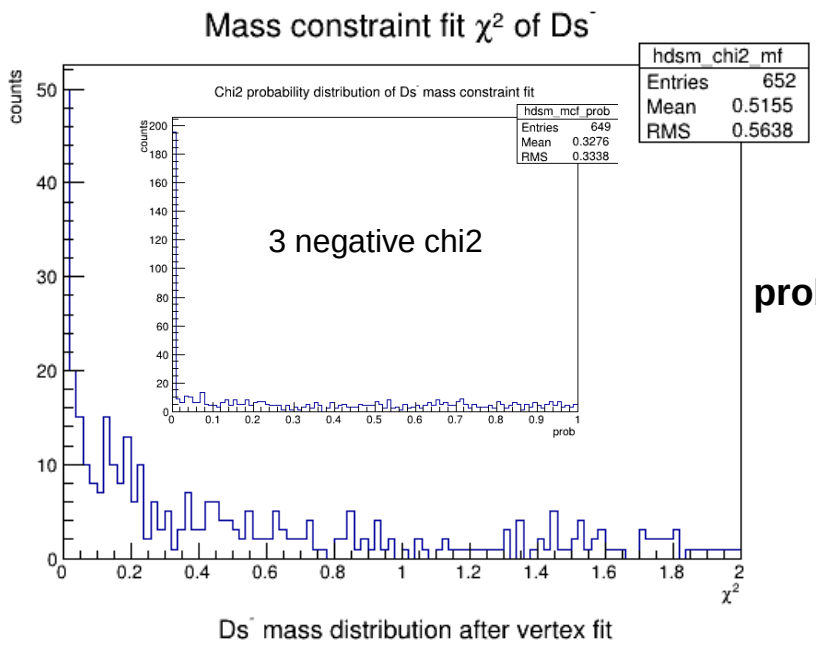

**prob > 0.01**



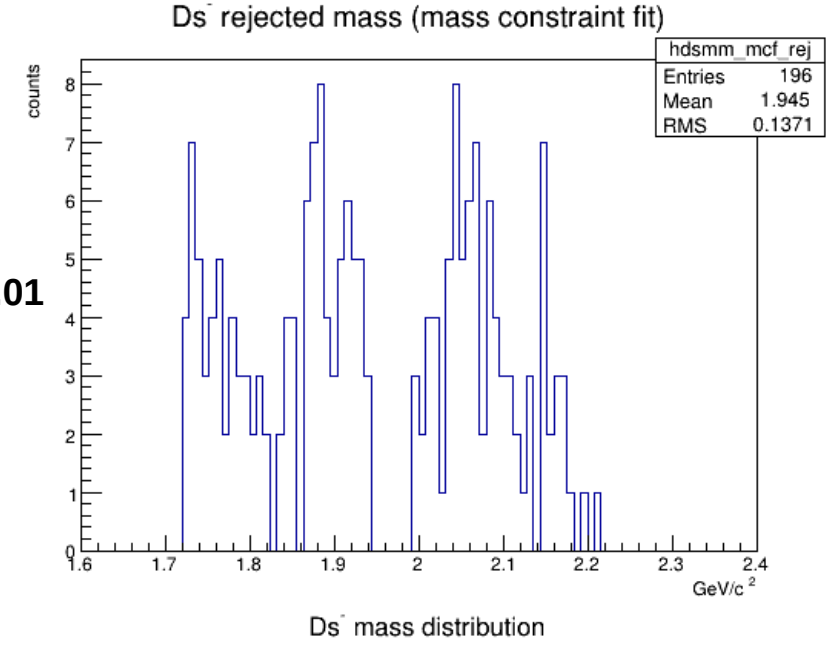



# Ds mass spectrum with updated kin. fitter




**prob > 0.01**




# Thank you!