
Sensitivity improvements with hadronic energy fraction binning

Numu group, Sep. 2016

Luke Vinton, University of Sussex

Version details

- Running in **S16-09-13**
- Using FD and ND numu decafs found here: [/pnfs/nova/persistent/production/concat/R16-03-03-prod2reco.d/](#)

Outline

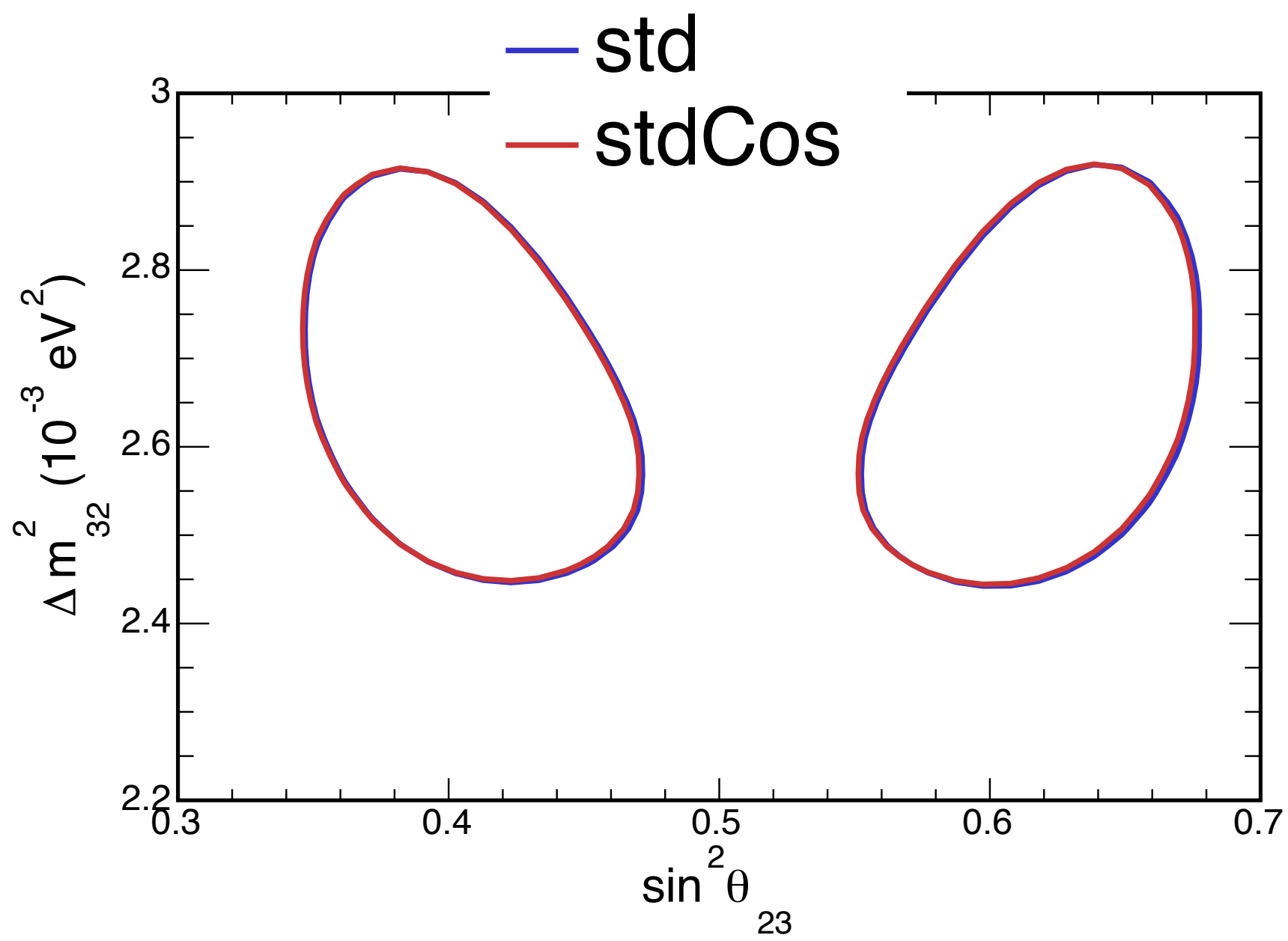
- All Sensitivities shown made with the SA numu (non max mixing) oscillation parameters

Oscillation parameters

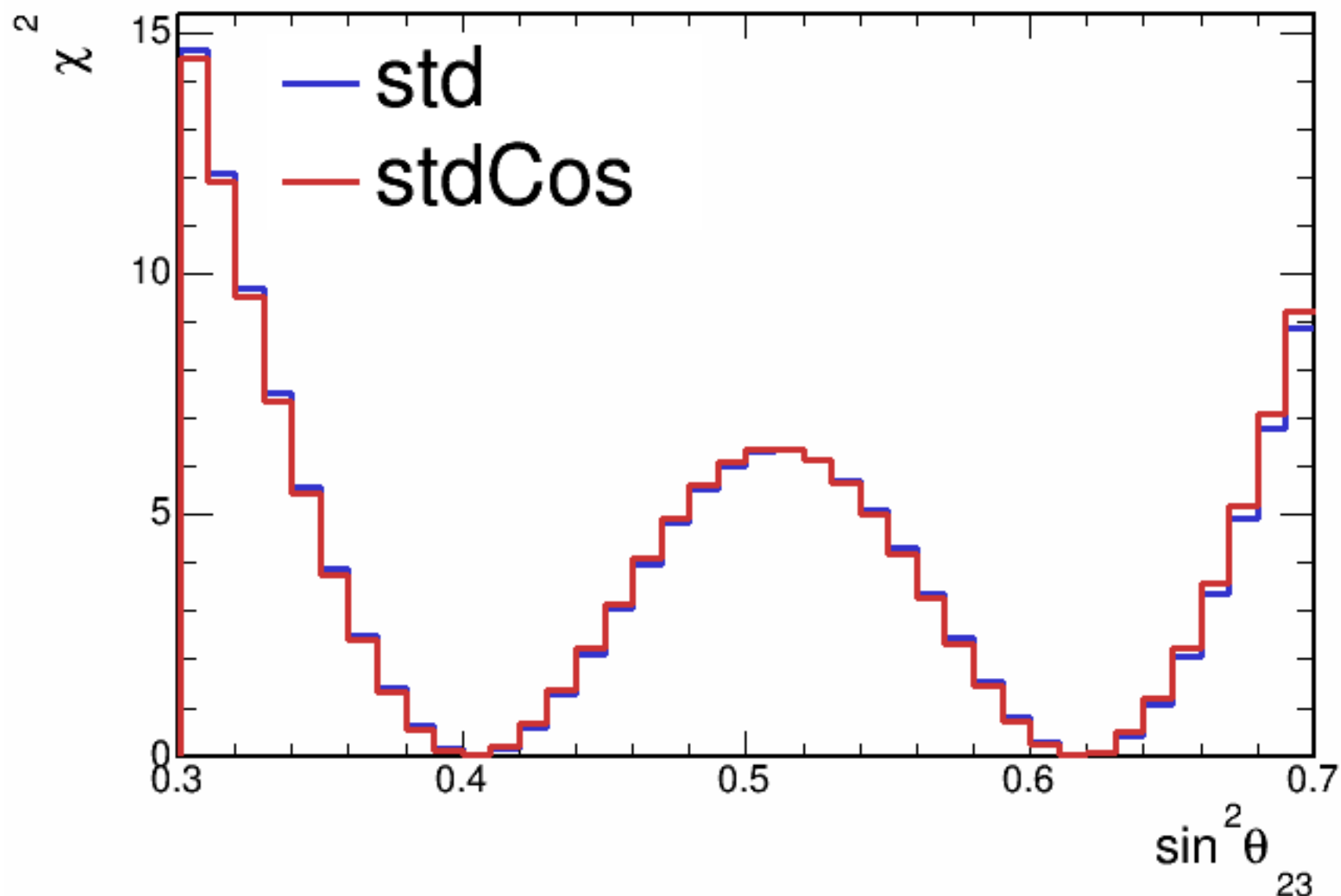
```
SetL(810);  
SetRho(0); // No matter effects  
SetDmsq21(7.59e-5);  
SetDmsq32(2.6746e-3);  
SetTh12(.601);  
SetTh13(.1567);  
SetdCP(0);  
SetTh23(0.68696); // non max (ssqth23 = 0.4022)
```

Cosmic background

Contours with and without cosmic bkg

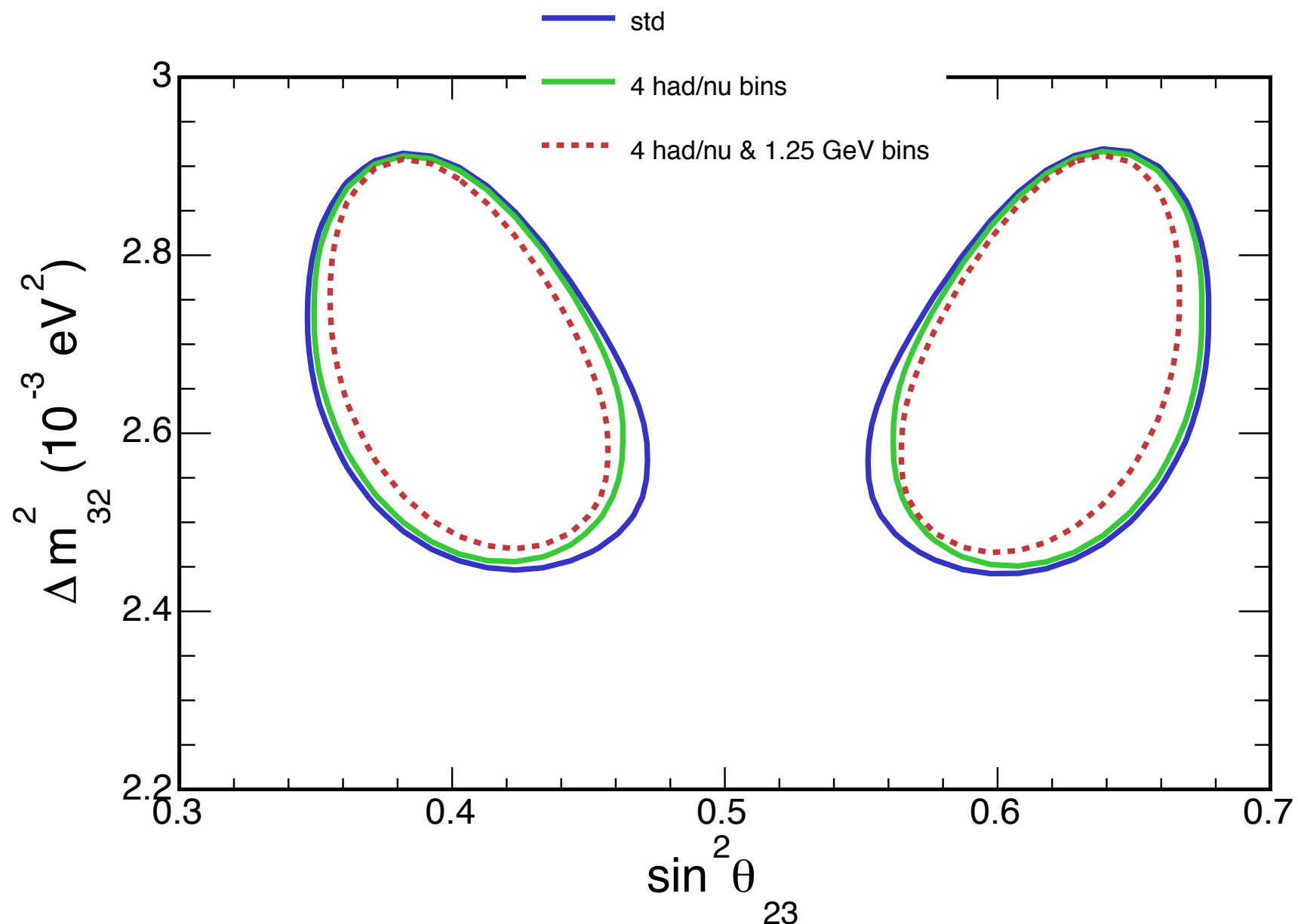


Contours with and without cosmic bkg

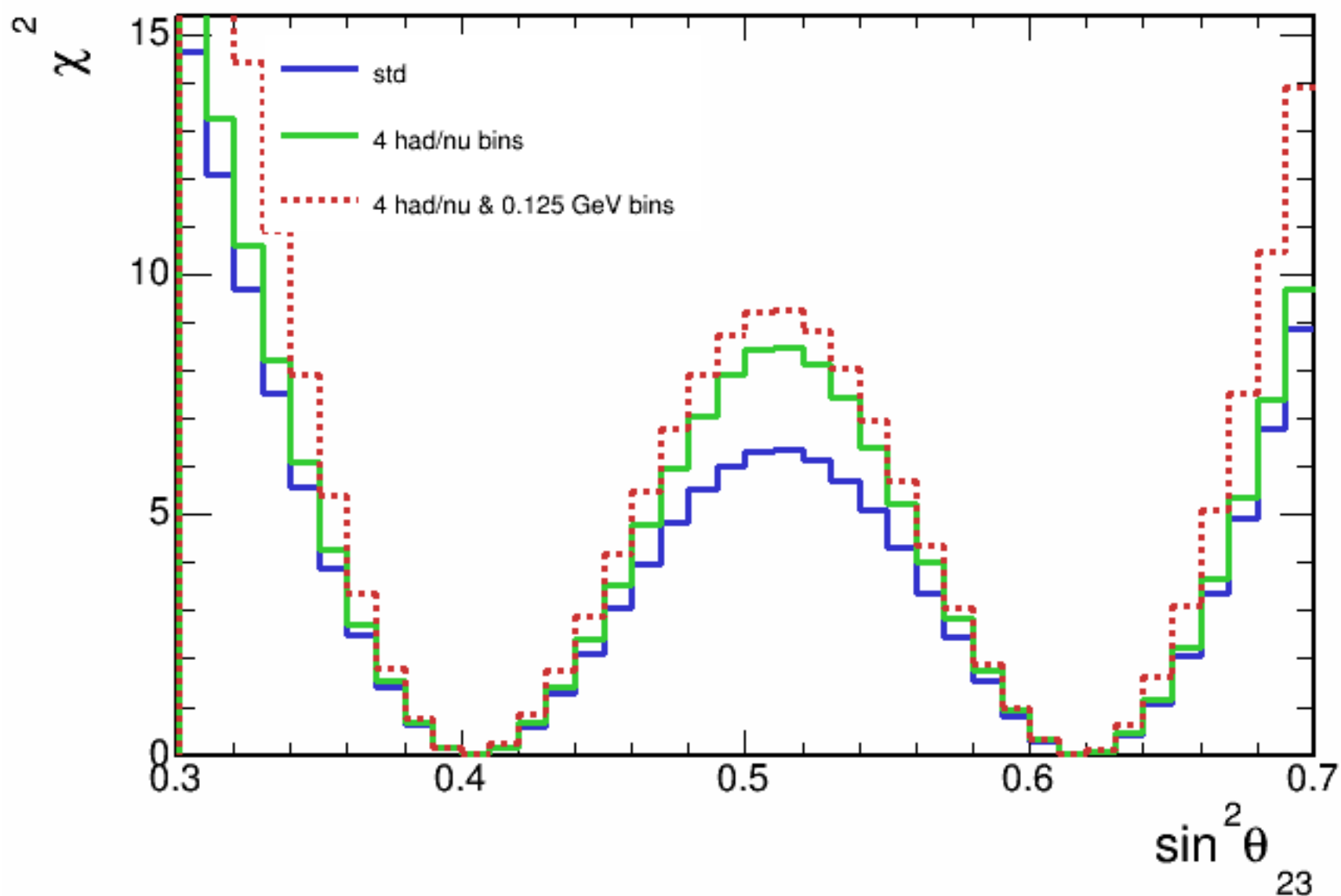


4 had frac. bins
and
0.125 GeV neutrino energy binning

Contours with and without cosmic bkg

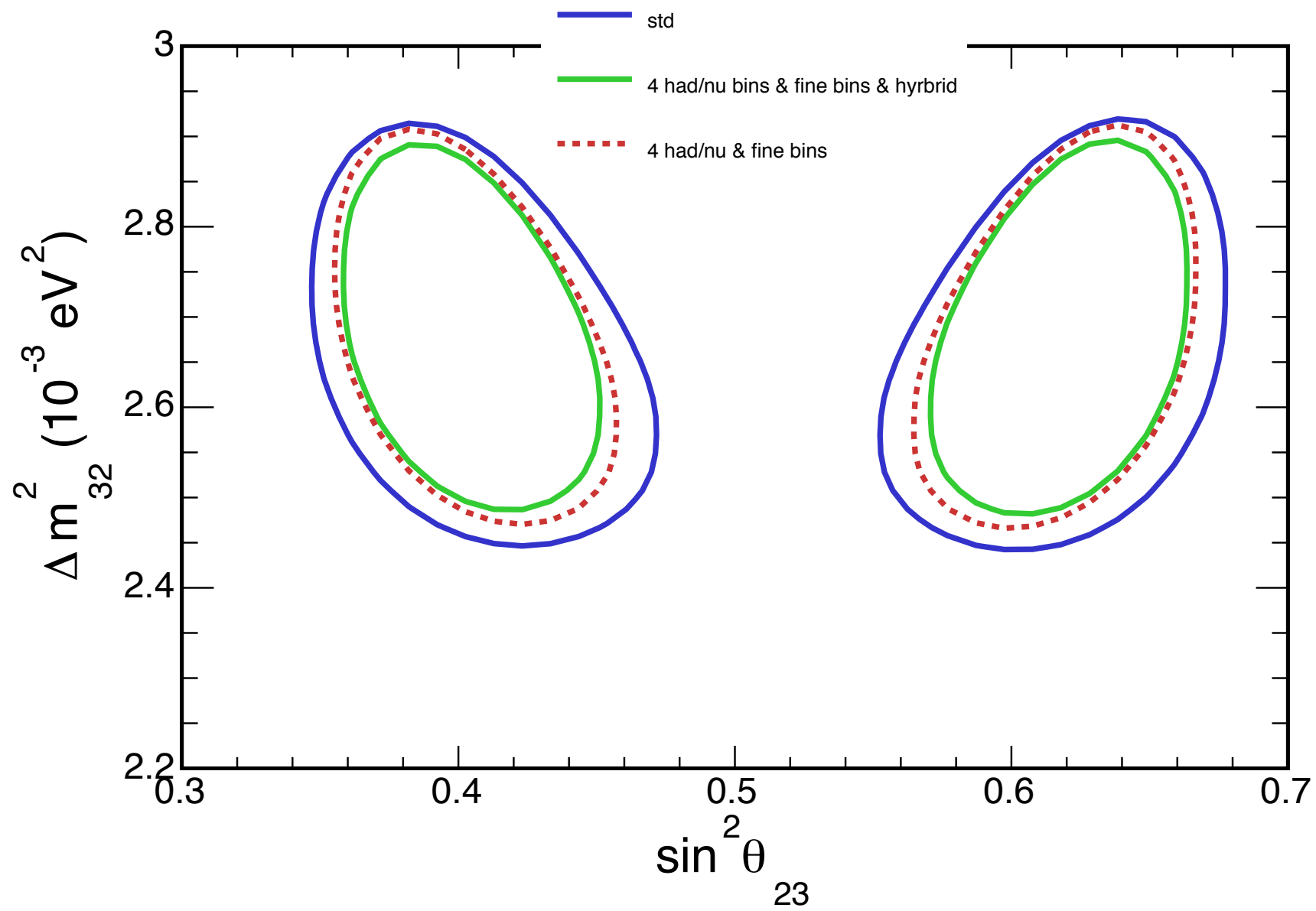


Contours with and without cosmic bkg

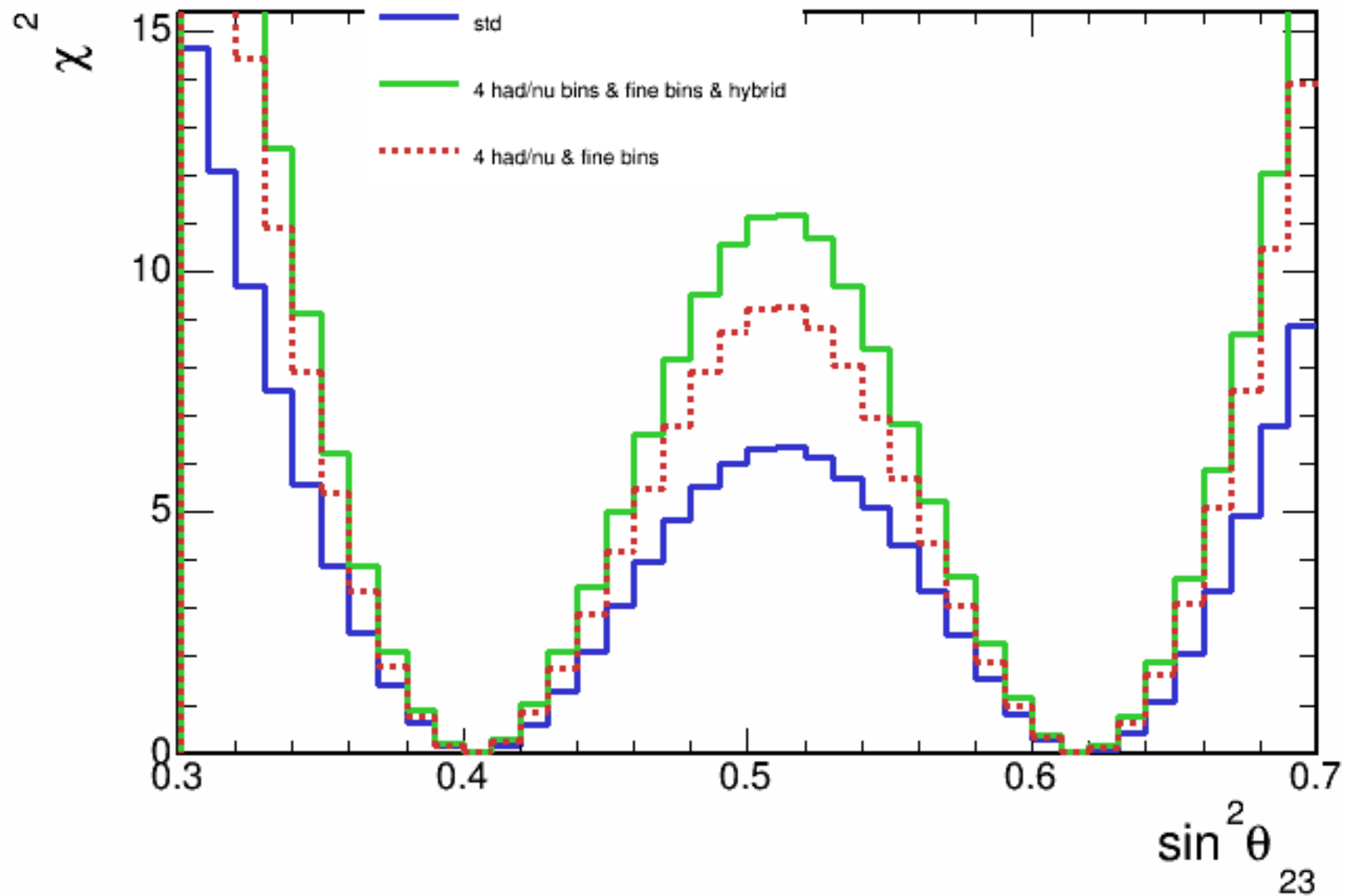


CVN and ReMId hybrid selection

Contours with and without cosmic bkg



Contours with and without cosmic bkg

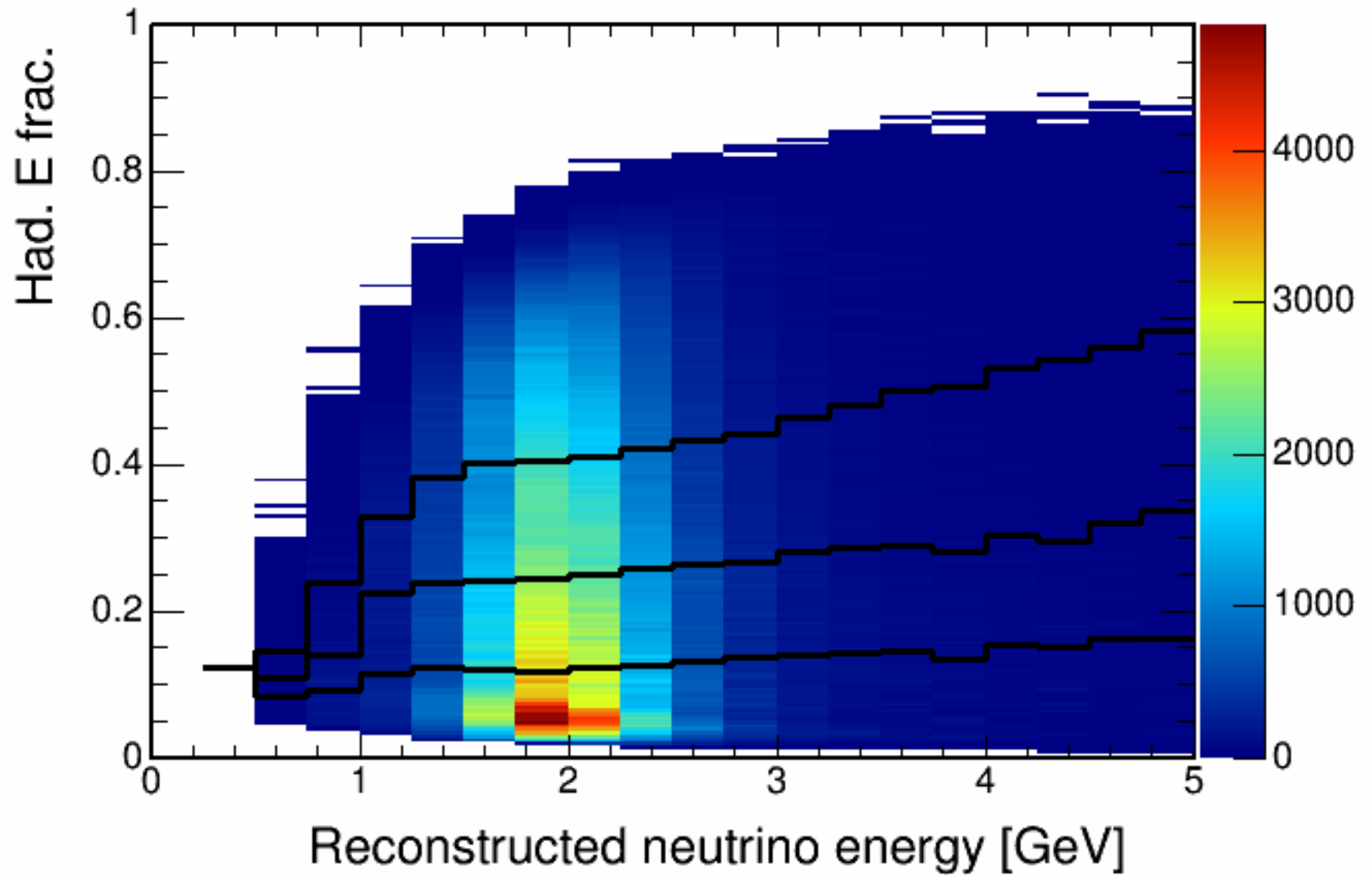


Backup

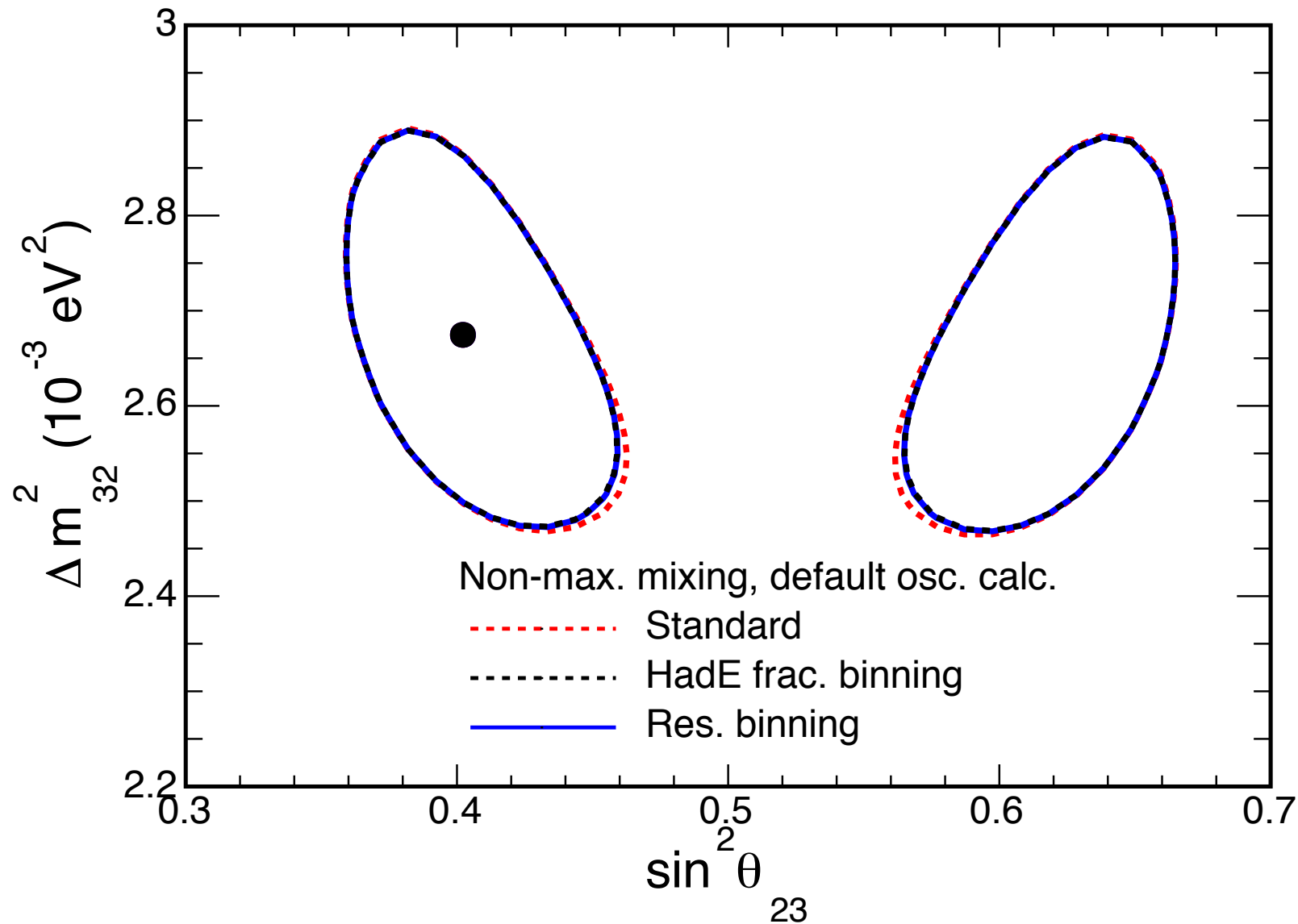
Recap

Following slides show the stats.
only (and no extrap.)
sensitivity with 4 hadronic
energy fraction bins

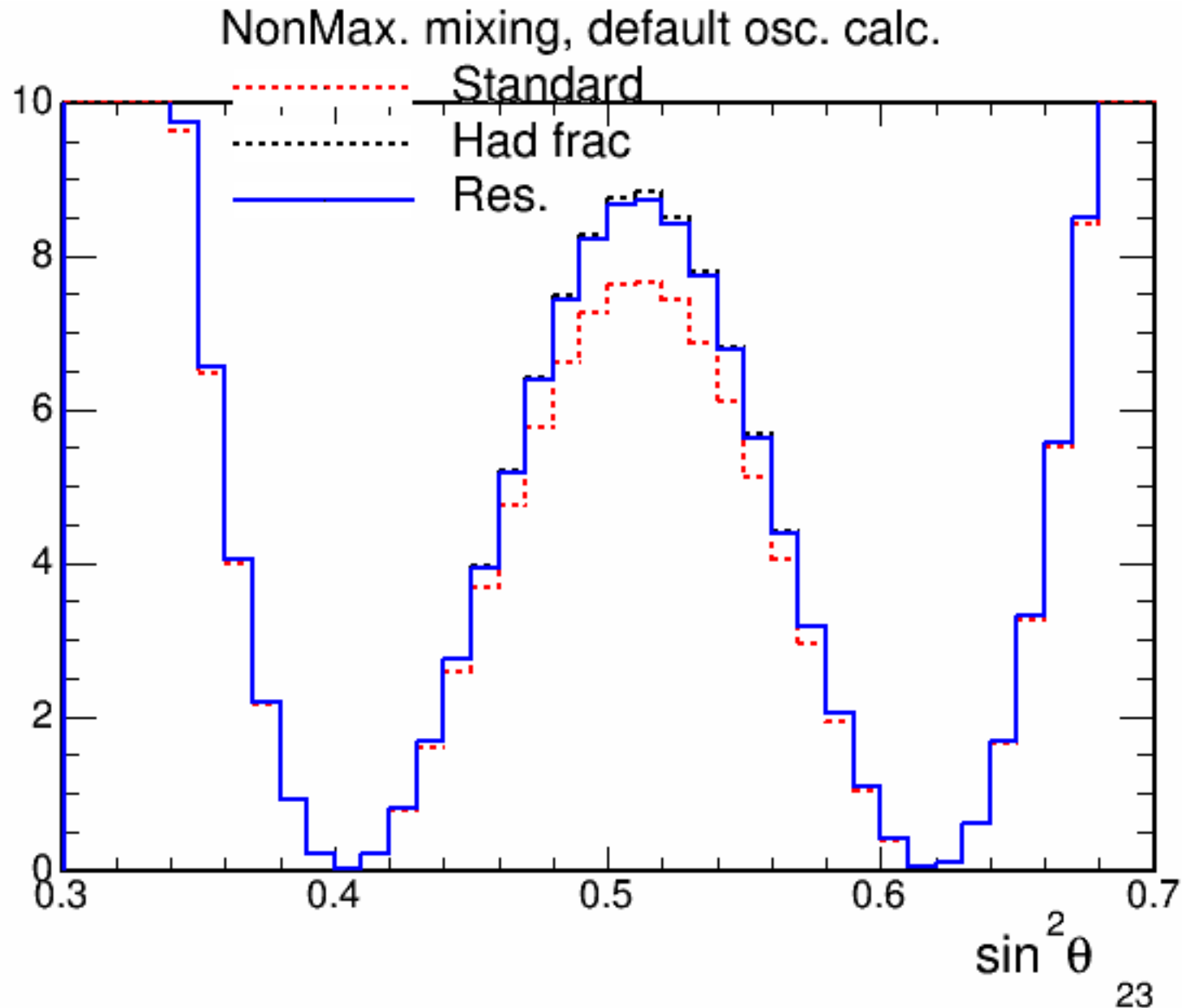
Hadronic energy fraction vs. reco. energy



SA numu result paramters (ssqth23 = 0.4022) sensitivity



SA numu result paramters (ssqth23 = 0.4022) sensitivity

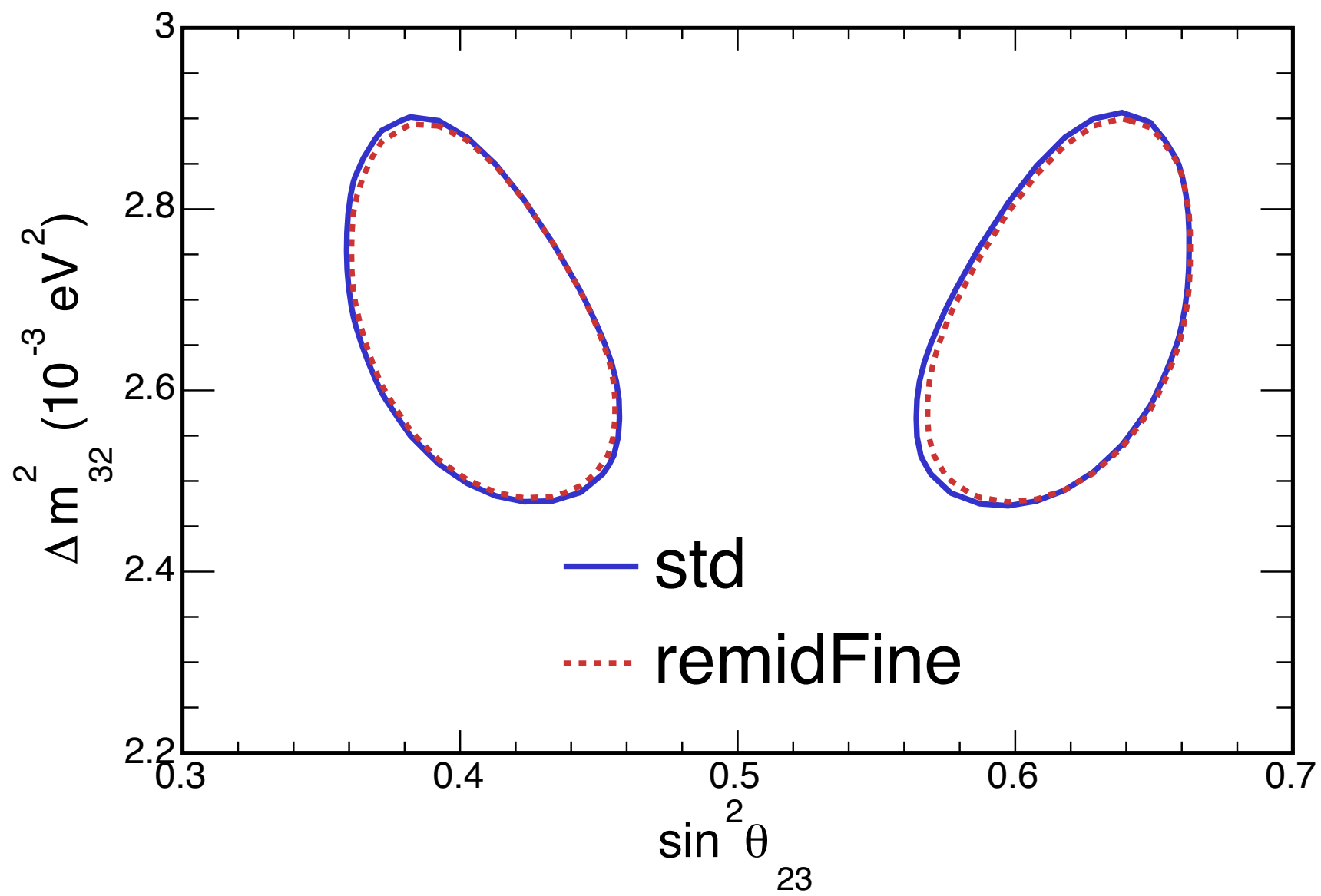


Fine ReMId binning

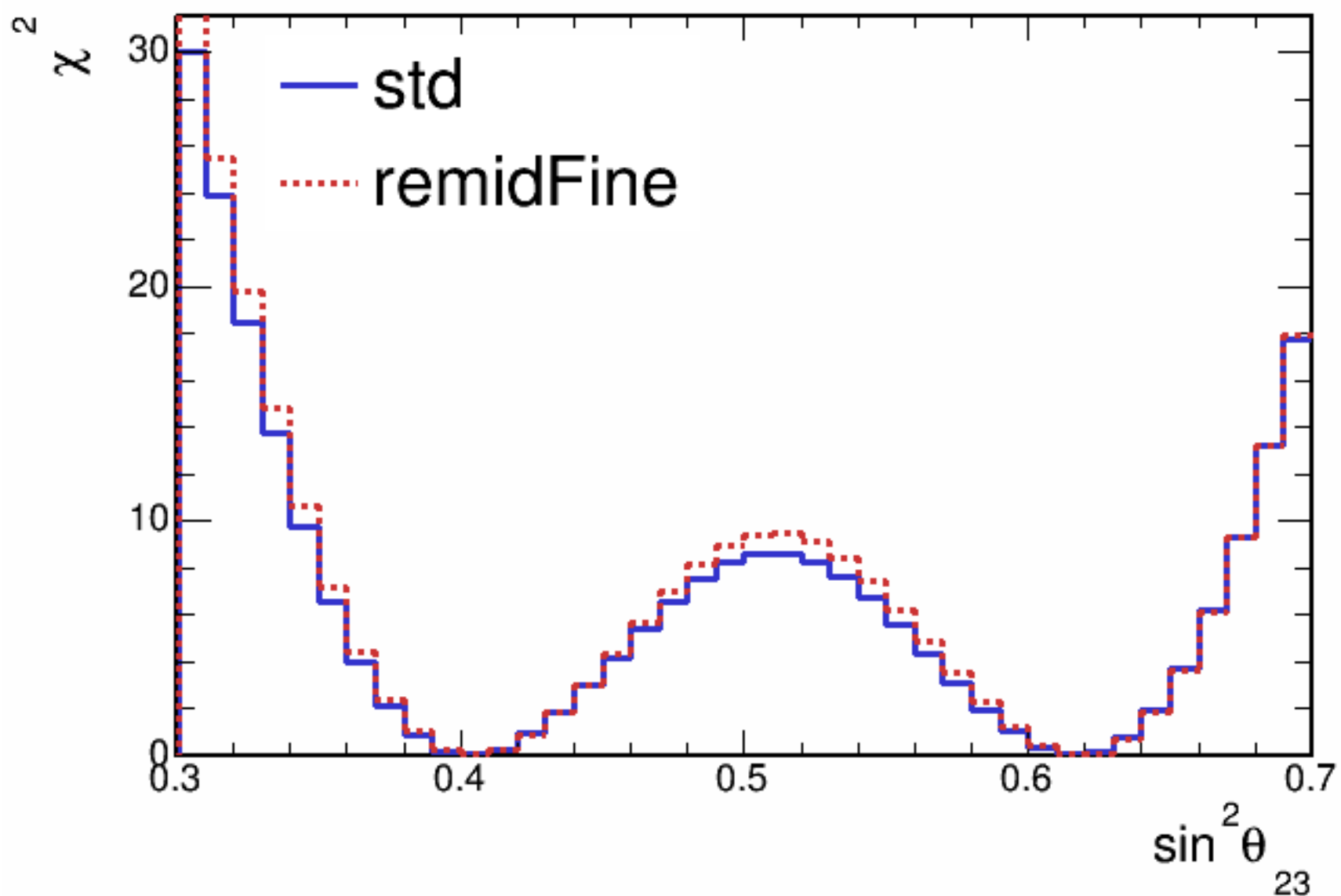
Binning scheme:

- split remid into 2 coarse bins below 0.9
 - $0.4 \leq \text{remid} < 0.75$
 - $0.75 \leq \text{remid} < 0.9$
- split into 8 fine bins above 0.9
 - $72/80 \leq \text{remid} < 73/80$
 - $73/80 \leq \text{remid} < 74/80$
 - etc.
 - $80/80 \leq \text{remid}$

Stats only sensitivity with fine ReMld binning



Stats only sensitivity with fine ReMId binning



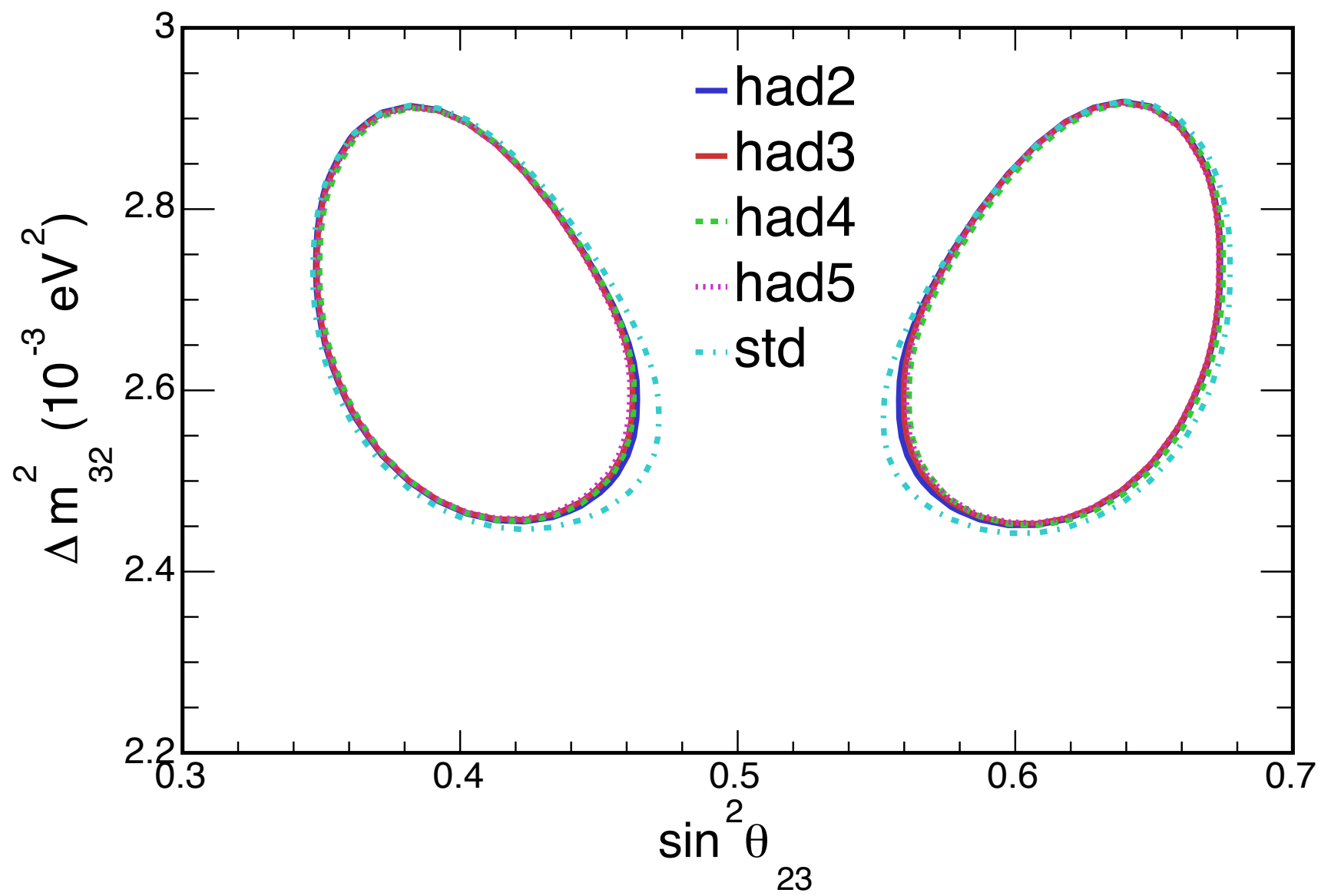
Hadronic energy fraction binning

Split events into hadronic energy quantiles

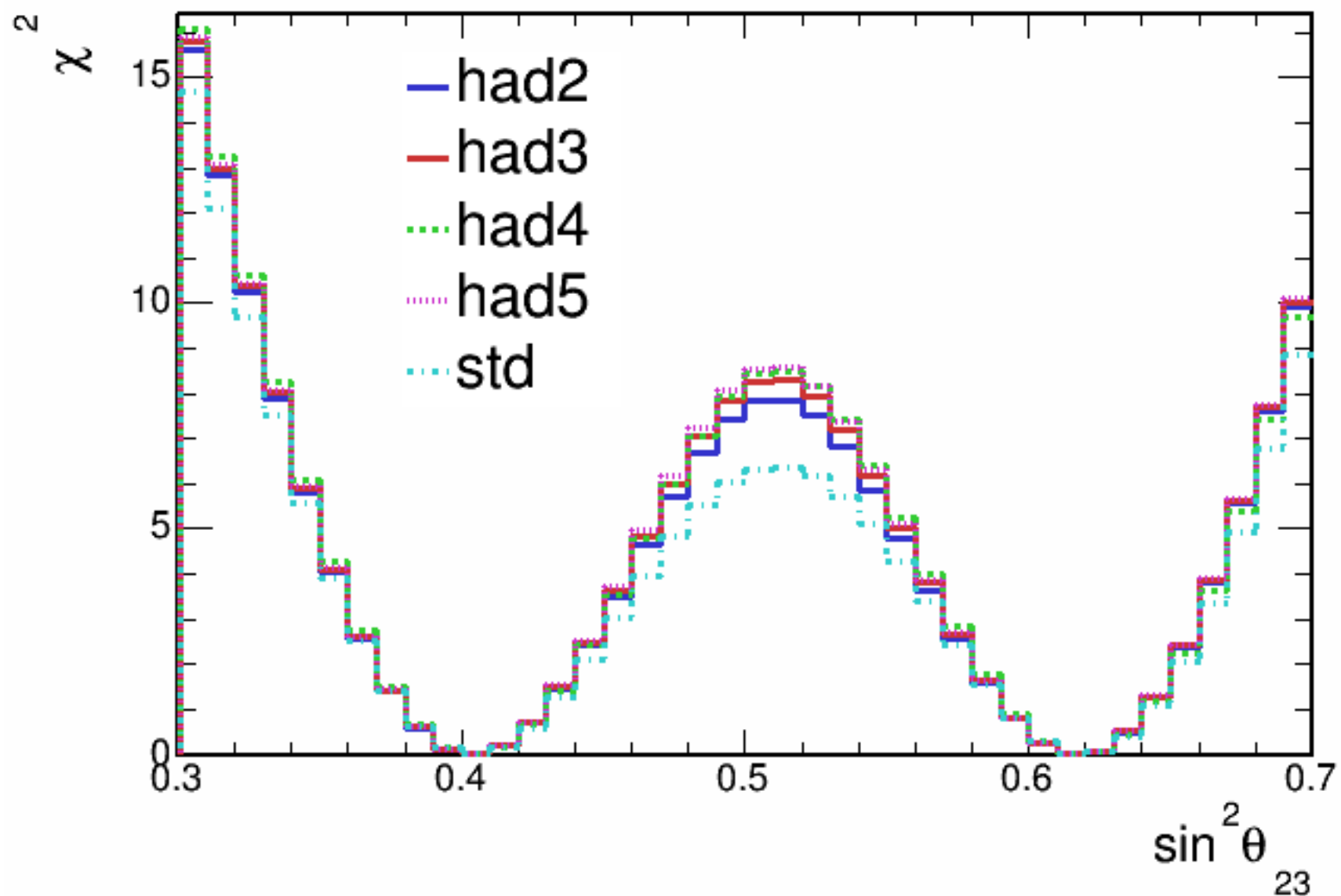
Quantiles made for each bin of reconstructed neutrino energy

Up next, sensitivities with events split into 2,3,4 and 5 hadronic energy fraction quantiles

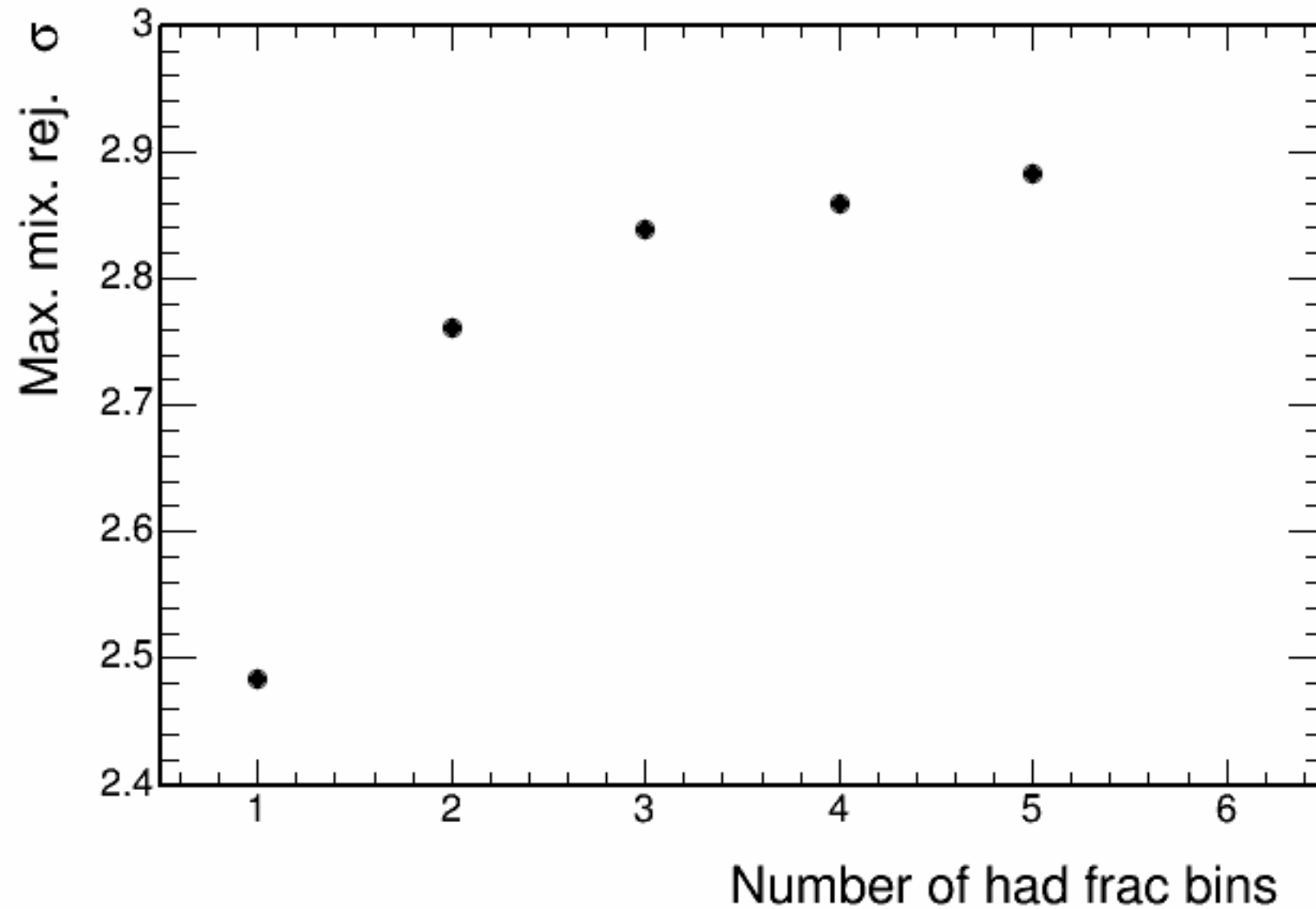
Sensitivity with hadronic energy fraction binning



Sensitivity with hadronic energy fraction binning



Sensitivity with hadronic energy fraction binning

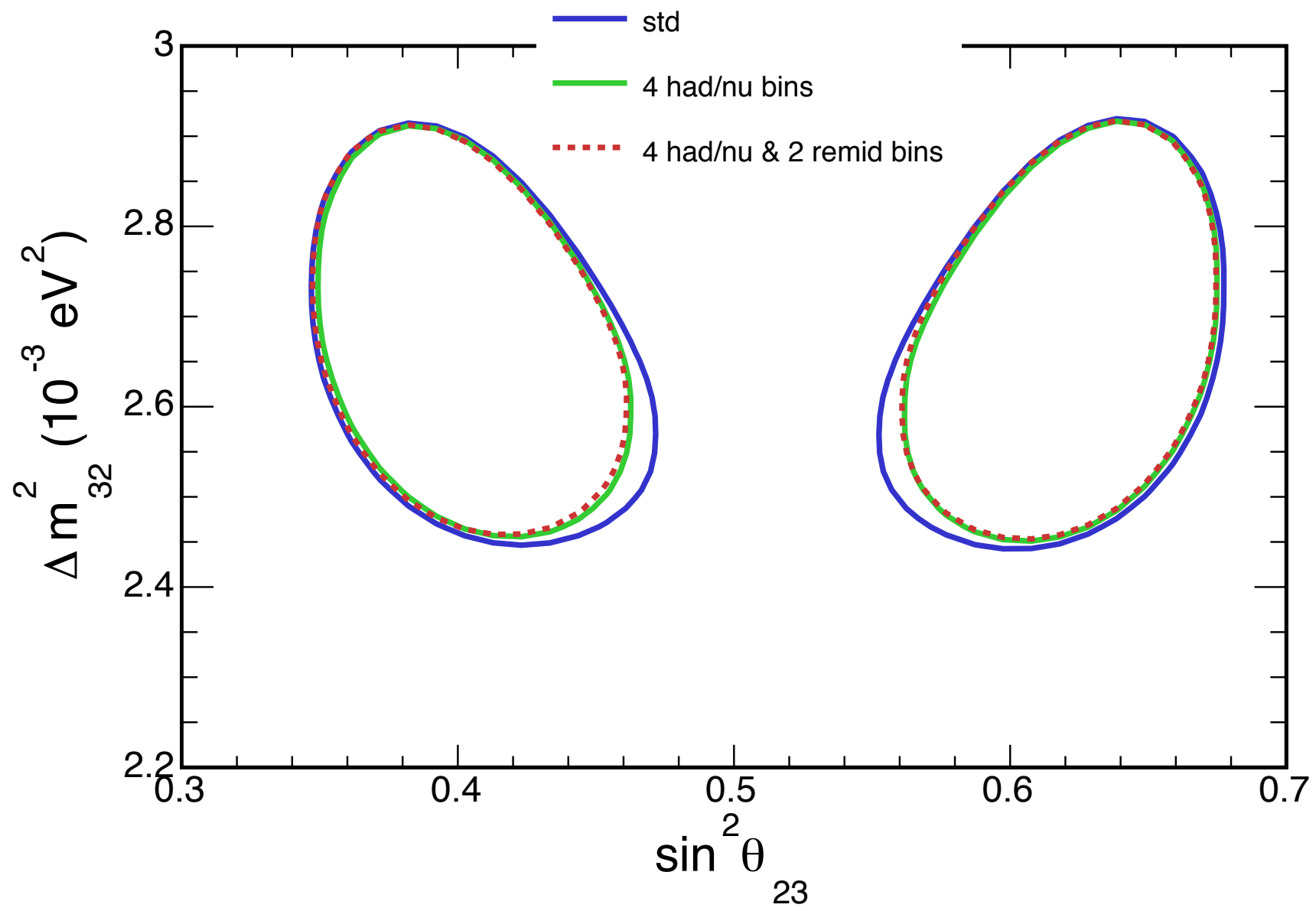


2D Hadronic energy fraction and remid binning

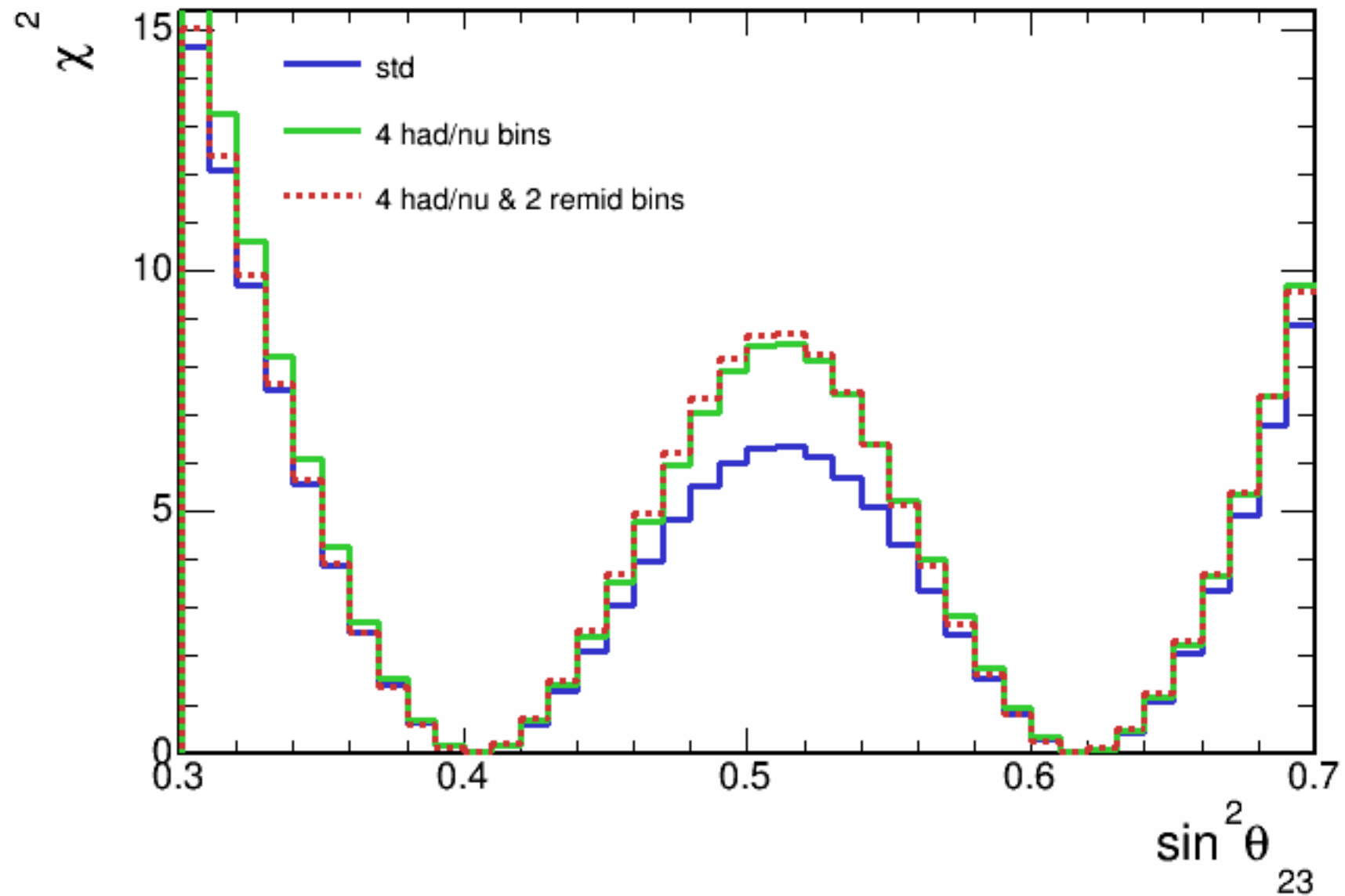
Split events into 4 hadE frac. quantiles and 2 remid bins (0.4-0.75, 0.75-1.0)

HadE frac. quantiles made for each bin of reconstructed neutrino energy and for each remid bin

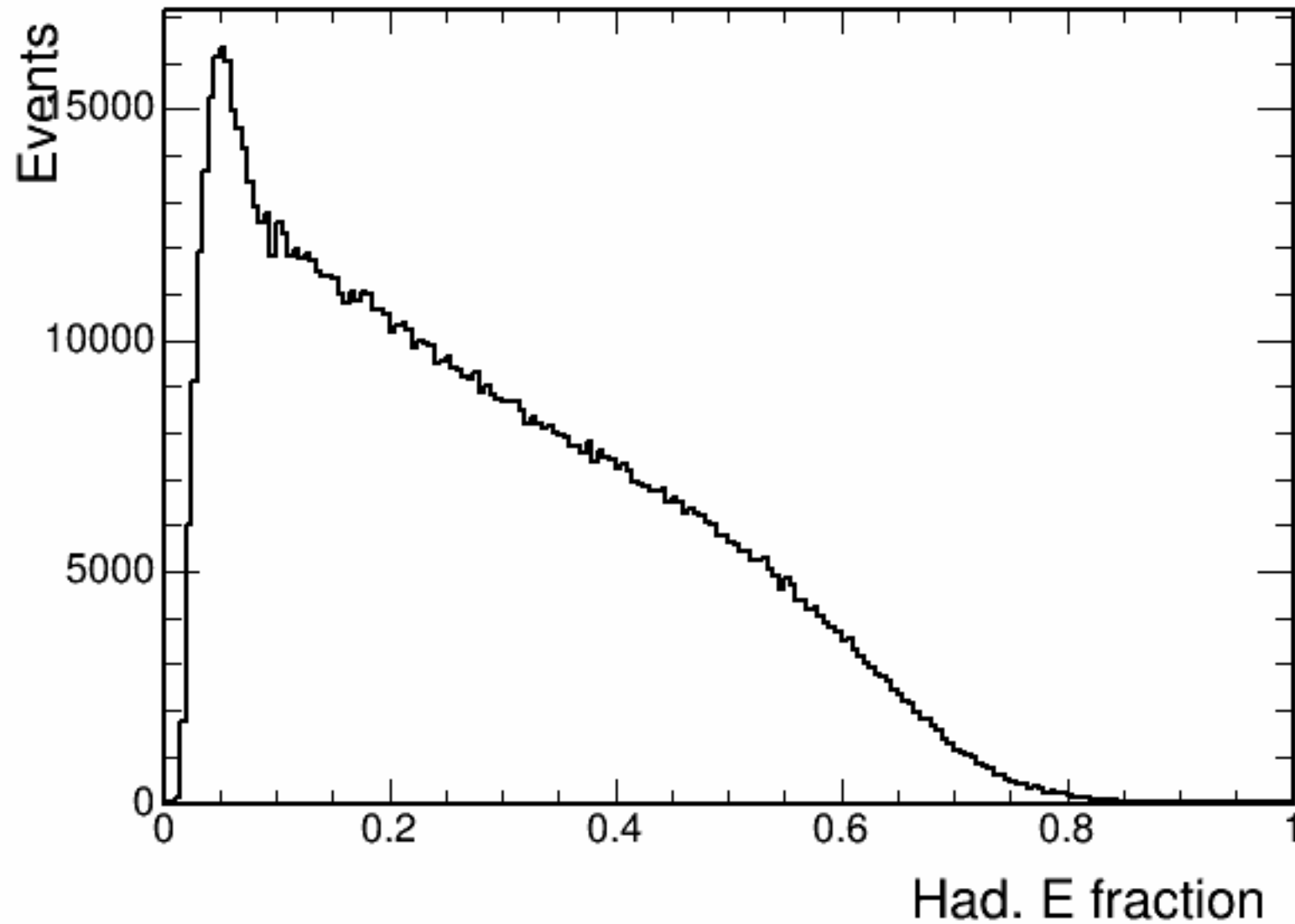
Sensitivity with hadronic energy fraction binning



Sensitivity with hadronic energy fraction binning



Hadronic energy fraction



Max. mixing paremeters sensitivity

