$\nu_\mu \rightarrow \nu_e$ sterile analysis status

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Counting Analysis

No systematic effects

Matter effects (const. density)

POI:

- $\sin^2 2\theta_{\mu e} = 4\left|U_{\mu 4}\right|^2 |U_{e4}|^2$
- Δm^2_{41}

Nuisance parameters:

$\theta_{12}, \theta_{13}, \theta_{23}, \theta_{34}, \delta_1, \delta_2, \delta_3$

Costants: Δm^2_{21}

Prior on Δm^2_{31}

- Signal channels:
  - $\boldsymbol{\nu_\mu \to \nu_e}$
  - $\boldsymbol{\bar{\nu}_\mu \to \bar{\nu}_e}$
- Background channels:
  - $\boldsymbol{\nu_e \to \nu_e}$
  - $\boldsymbol{\bar{\nu}_e \to \bar{\nu}_e}$
- Background (not osc):
  - ***NC***
  - $\boldsymbol{\tau \to e}$

NB: θ_{ij} and δ_k are not physical observables. They depend on the model and parametrization.
In particular, they are not the same ones of a 3-ν model.

Efficiency and Smearing Matrix

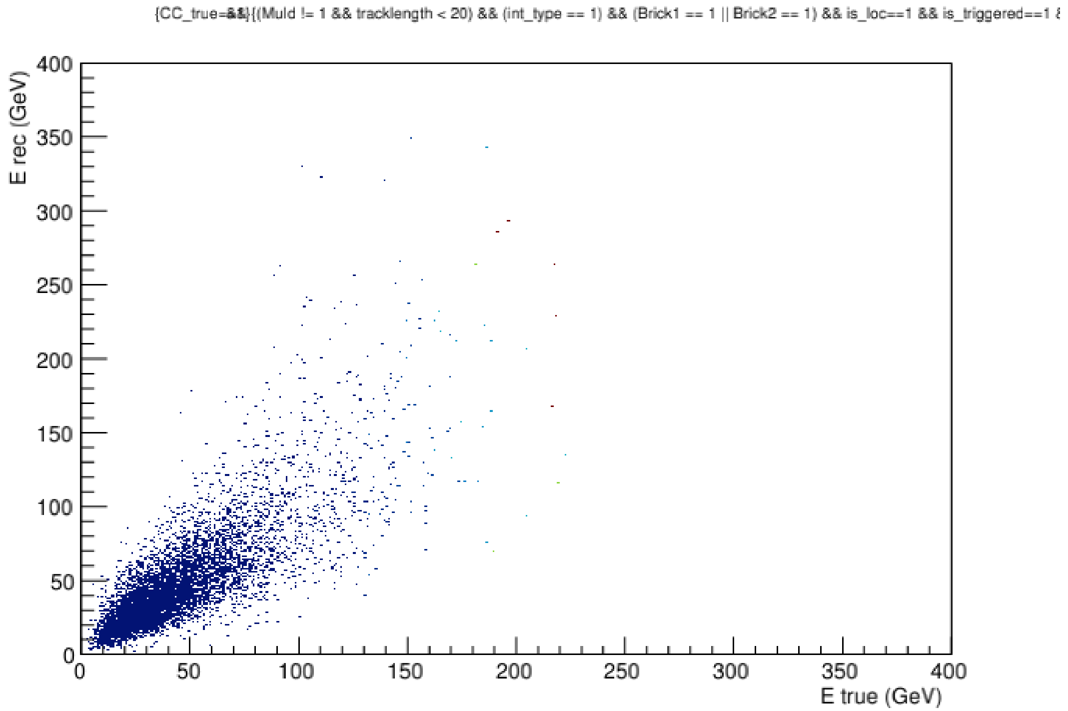
- Evaluation from MC: [True Energy of ν_e CC] vs [Rec. Energy of ν_e cand.]

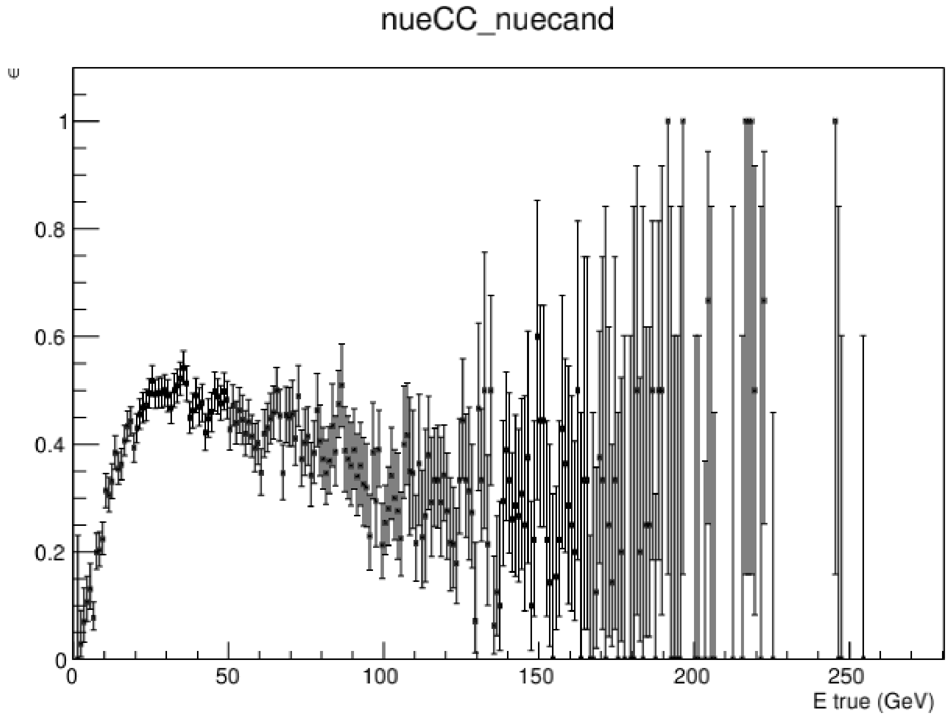
- ν_e CC selected as: *CC_true==1*

- ν_e cand. selected as:

  (MuId != 1 && tracklength < 20) &&
  (int_type == 1) &&
  (Brick1 == 1 || Brick2 == 1) &&
  is_loc==1 &&
  is_triggered==1 &&
  is_nue==1

Efficiency and Smearing Matrix





Sensitivity optimization

The sensitivity was maximized over several selections based on the reconstructed energy. The table shows the data used for computation.

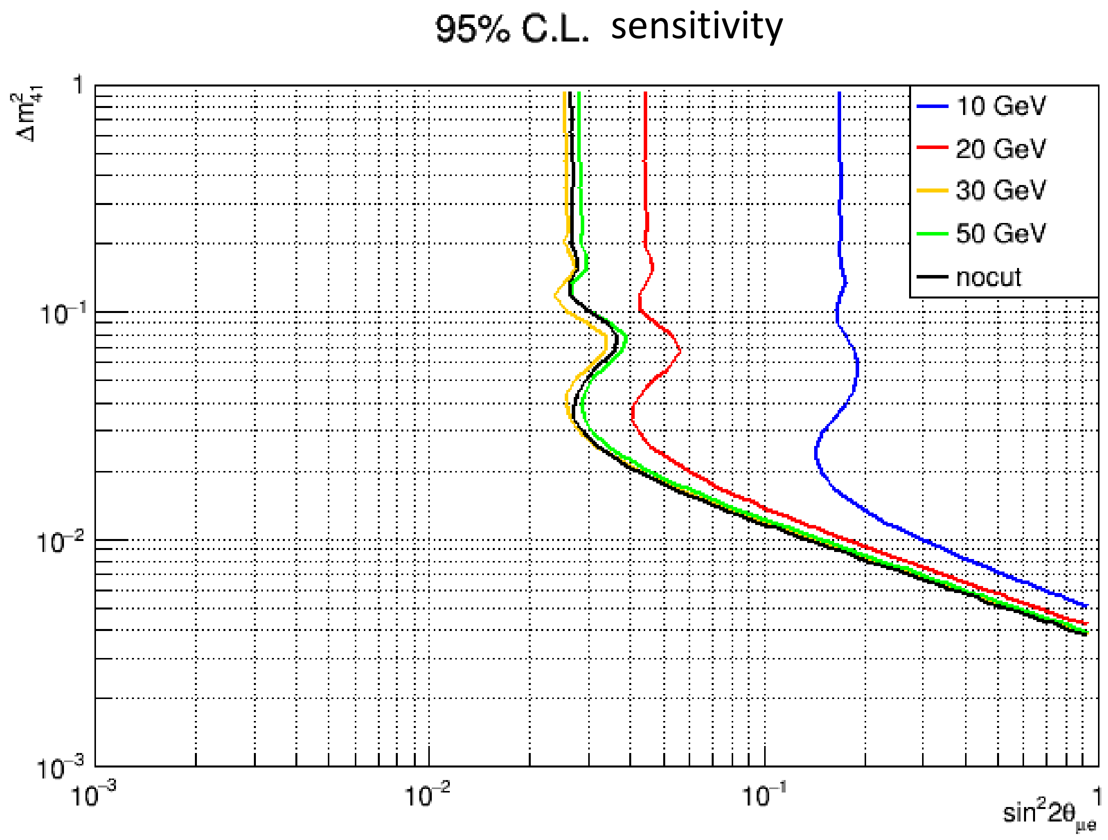
Normalization on expected $\nu_e + \overline{\nu}_e$ from beam without oscillation

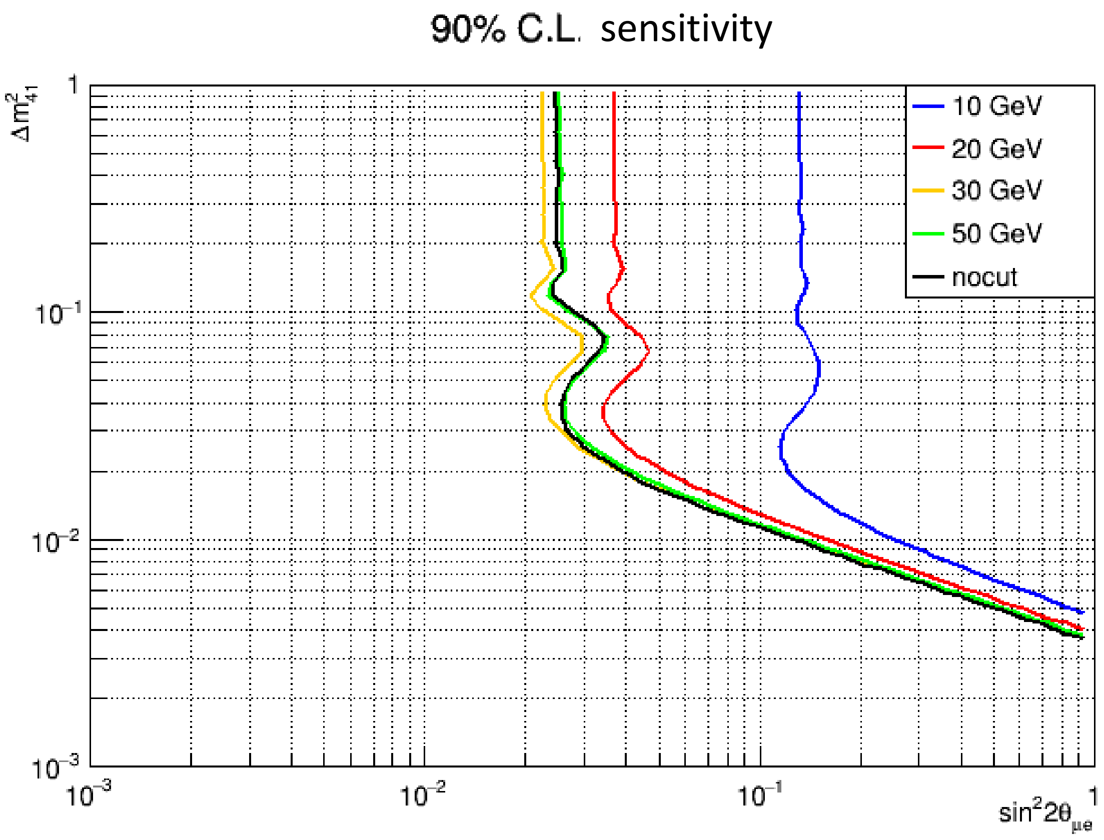
Cut on rec. energy	10 GeV;	20 GeV;	30 GeV;	50 GeV	No cut
found nue candidates:	1	7	13	21	34
osc(osc-beam) :	0.4(0.1)	2.8(0.7)	9.2(1.4)	14.9(1.7)	39.5 (3.0)
no osc(beam) :	0.3	2.1	7.8	13.2	36.5
tau->e :	0.1	0.4	0.5	0.6	0.7
pi0 :	0.1	0.3	0.4	0.4	0.5
Expected background					
bg(beam+pi+tau->e) :	0.5	2.8	8.7	14.2	37.7

For sensitivity

N.B. These data have a slight difference with respect to the more updated numbers

Sensitivity optimization





The optimal sensitivity is for cuts at high energy , $\boldsymbol{E_{cut} = 30\ GeV}$ or «no cut» ; but for a final choice we have to run with shape analysis.

Exclusion region evaluation

The exclusion region is evaluated for the selections which maximize the sensitivity ($E_{cut} = 30\ GeV$ and «no cut»).

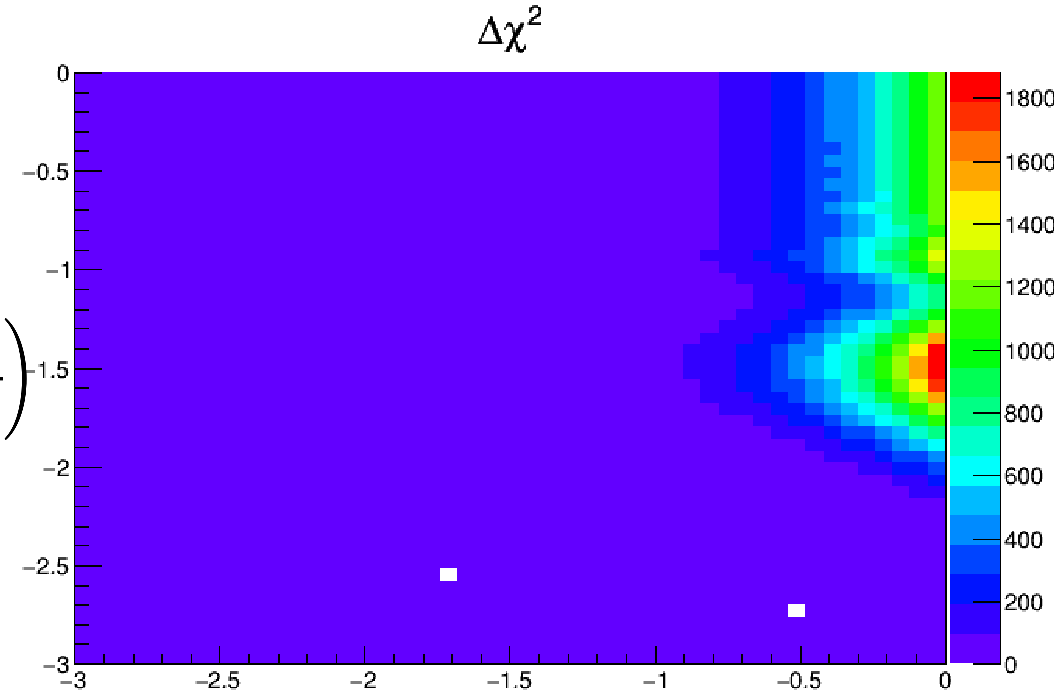
The data reported here are for reference ; they are the same ones of the slide 3.

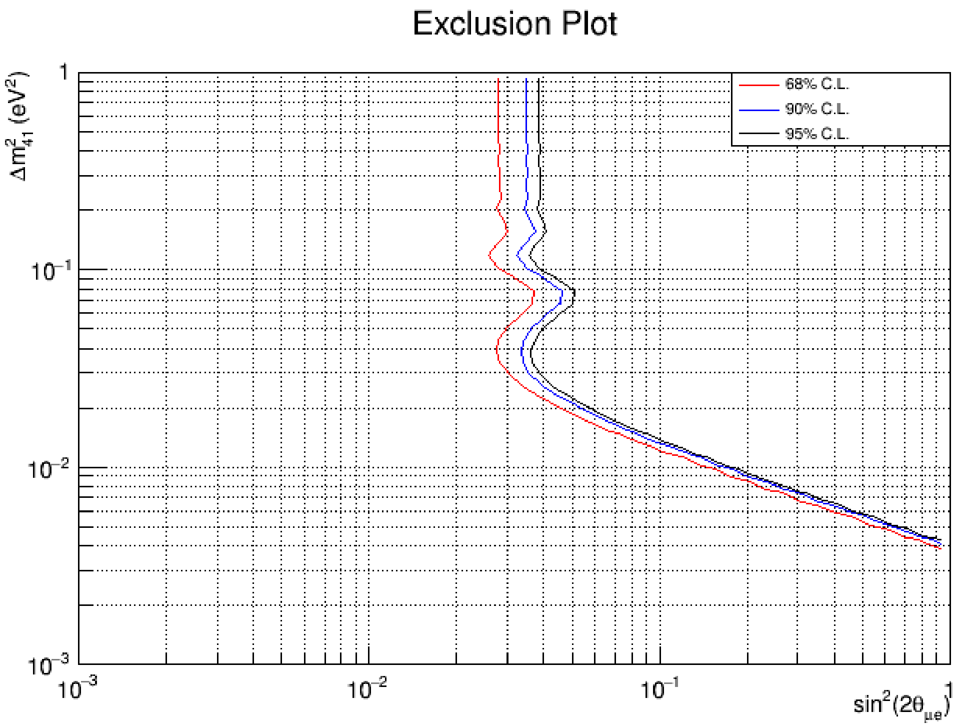
Cut on rec. energy :	30 GeV;	No cut
found nue candidates:	13	34
osc(osc-beam) :	9.2(1.4)	39.5 (3.0)
no osc(beam) :	7.8	36.5
tau->e :	0.5	0.7
pi0 :	0.4	0.5

Observed events

background

Preliminary results $[E_{cut} = 30\ GeV]$

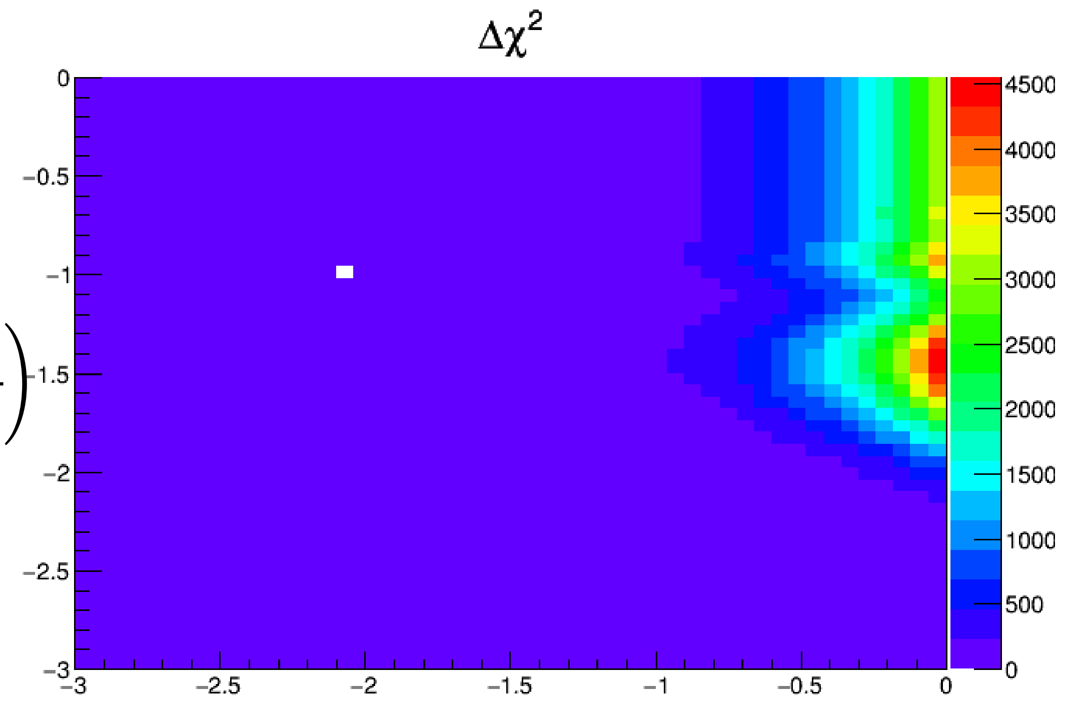


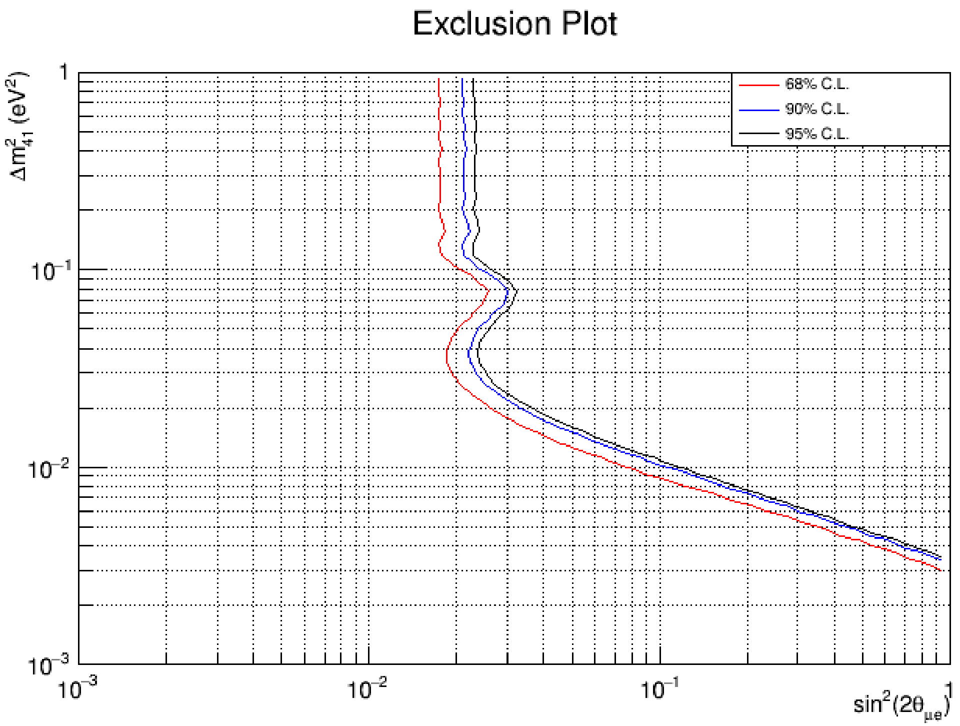


$\ln\left(\frac{\Delta m_{41}^2}{eV^2}\right)$

$\ln\left(\sin^2 2\theta_{\mu e}\right)$

Preliminary results $[no\ cut]$



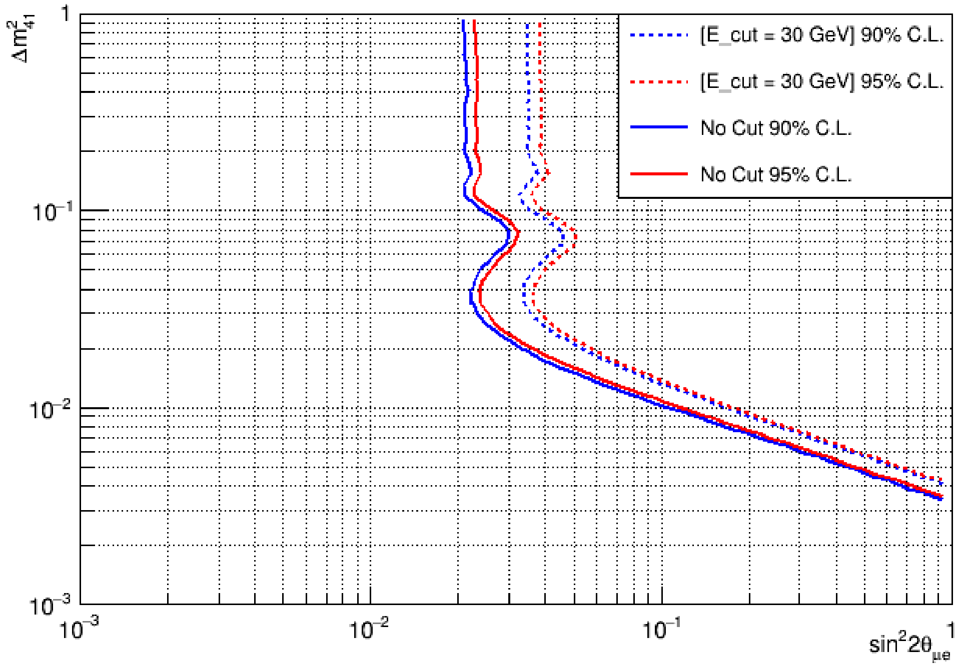


$\ln\left(\frac{\Delta m_{41}^2}{eV^2}\right)$

$\ln\left(\sin^2 2\theta_{\mu e}\right)$

Comparison

The difference (factor 2) depends on some **fluctuations** of the energy distribution bins.



Data Set	E (GeV)	Observed	Expected	Obs − Exp
OLD 27/06	< 30	13	9	4 (+30%)
	> 30	21	29	-8 (-28%)
UPDATED 30/06	< 30	13	11	2
	> 30	21	29	-8

Is just a matter of statistics ?

or is there information in the energy distribution which could be exploited by a **shape** analysis ?

To do list

- Shape analysis done
    - Check in progess
- Add systematics to do
    - *Most conservative approach is to use same systematic uncertainty with the previous article. It is 10% and 20% for energy above and below 10GeV respectively.*