



# Status Report

*Fanny Dufour, June 19th, 2006*

# Outline



- Reproducing Maxim's results: done!
- Energy plots
- Overall status & plan
  - Histograms for each step

# Maxim's results

	$\nu_\mu$ CC mis-ID	NC	Beam $\nu_e$	Signal (chooz)
FC,FV,Evis>100 (MeV)	2081.7	801.37	182.9	217.9
Single ring	983 (47.2%)	214.7 (26.8%)	89 (48.7%)	1843 (84.6%)
E-like	39.0 (1.9%)	168.3 (21.0%)	86.7 (47.4%)	182.2 (83.6%)
No decay e-	13.6 (0.65%)	149.9 (18.7%)	72.4 (39.6%)	166.4 (76.2%)
0.35<E $\nu$ <0.85 (Gev)	1.37(0.07%)	50.8 (6.3%)	20.7 (11.3%)	127.2 (58.3%)
$\text{Cos}\theta_{\nu\text{lepton}} < 0.9$	1.025 (0.05%)	35.8 (4.5%)	17.5 (9.6%)	111.4 (51.1%)
Polfit $M_{\gamma\gamma} < 100 \text{ MeV}/c^2$	0.47 (0.02%)	11.8 (1.5%)	13.9 (7.6%)	94.1 (43.2%)
$\Delta\text{logLikelihood} < 80$	0.35(0.017%)	9.8 (1.2%)	13.5 (7.4%)	91.9 (42.2%)

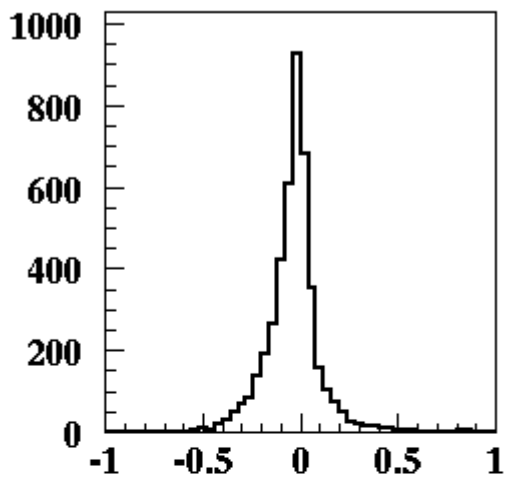
FCFV	2068	821.2	156	214.5				
single ring	971	46.95%	222.2	27.10%	81.5	52.20%	181.1	84.40%
e-like	38.8	1.88%	175.1	21.30%	80.9	51.80%	179.8	83.80%
no decay_e	16.7	0.81%	156.9	19.10%	68.8	44.10%	165	76.90%
0.35<E<0.85	1.5	0.07%	53.1	6.50%	18.9	12.10%	125.9	58.70%
Likelihood	0.5	0.023%	10.9	1.30%	15.4	9.90%	102.6	47.80%

Difference due to the fact that Maxim had NC in  $\nu_e$  sample

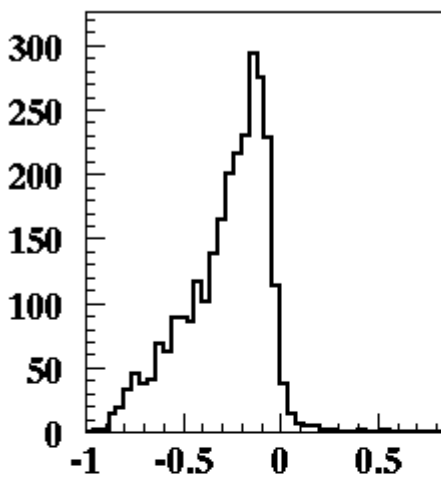
# $(E_{\text{rec}} - E_{\text{true}}) / E_{\text{true}}$

Split according to E-true only  
CC events

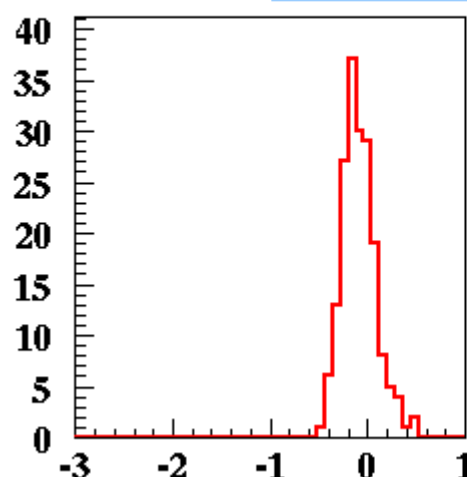
— CCQE events



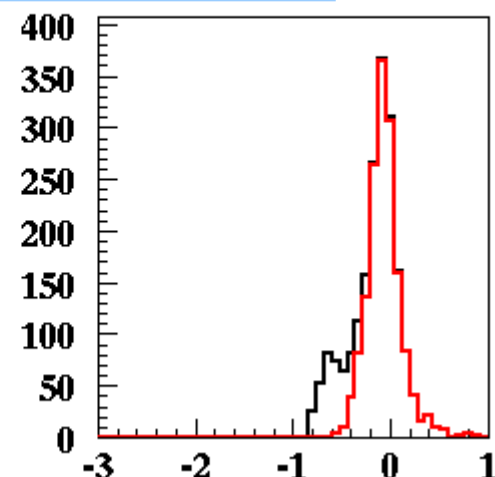
CCQE



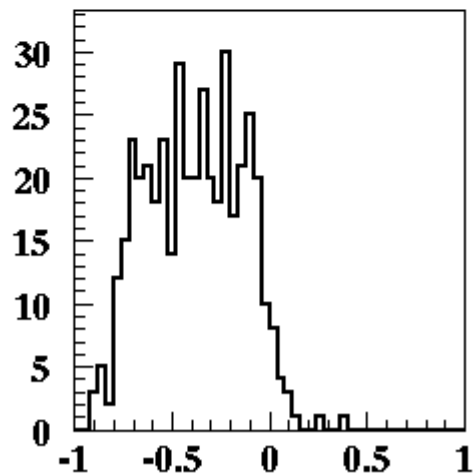
NUC CC



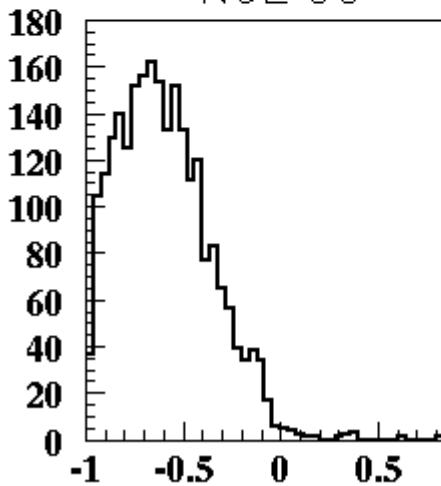
E 0.35



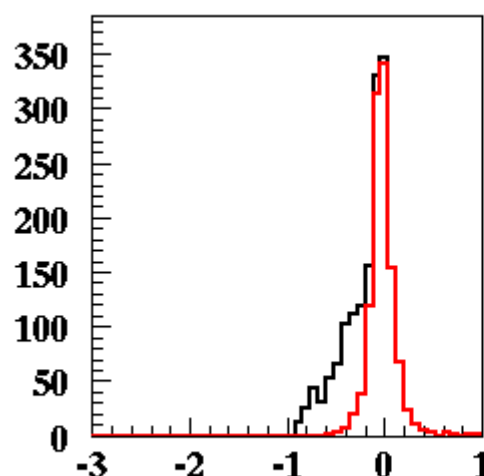
0.35 E 0.85



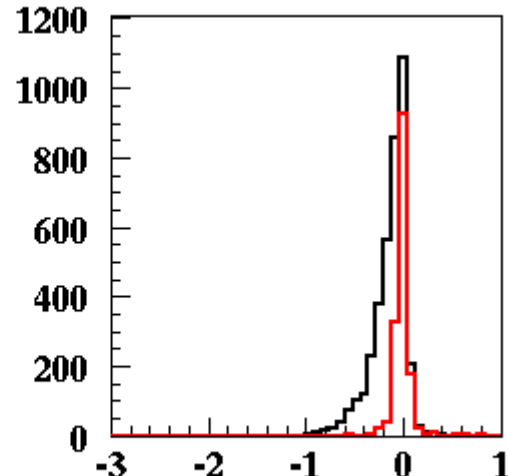
NUMU CC



NC



0.85 E 1.5



E 1.5

# Event by event method

## For each event:

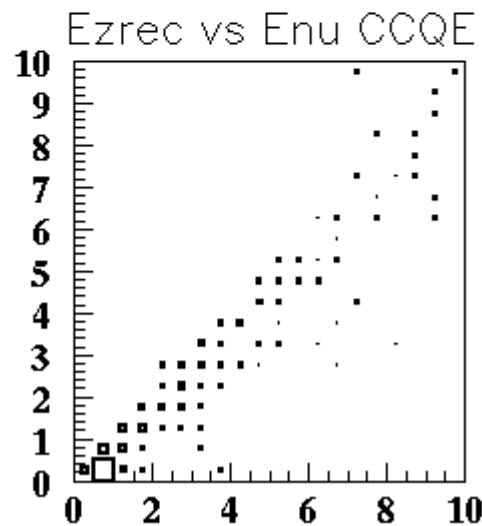
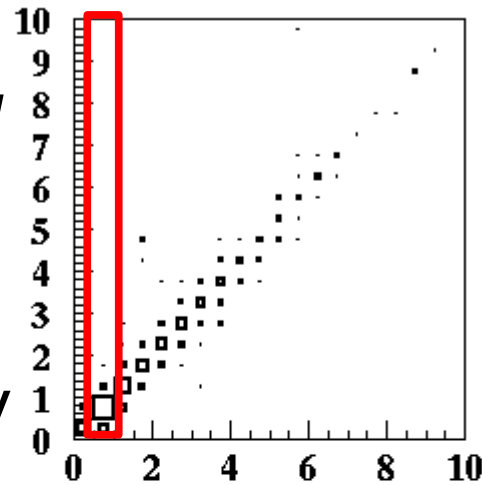
- read  $E_{true}$
- assign  $E_{rec}$  according to the matrix of  $E_{rec}$  vs  $E_{true}$

**Example:**  $E_{true} = 0.85 \text{ GeV}$   
for a CCQE event:

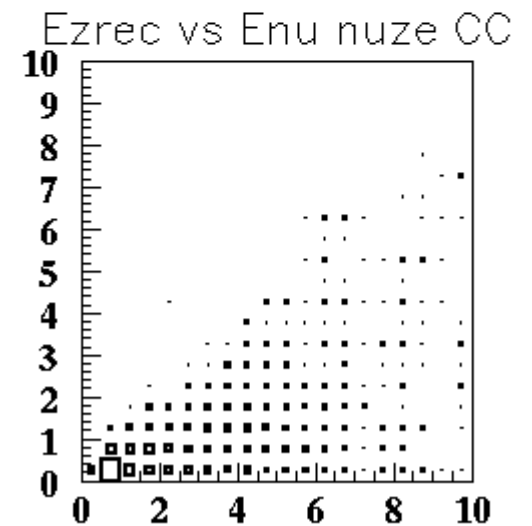
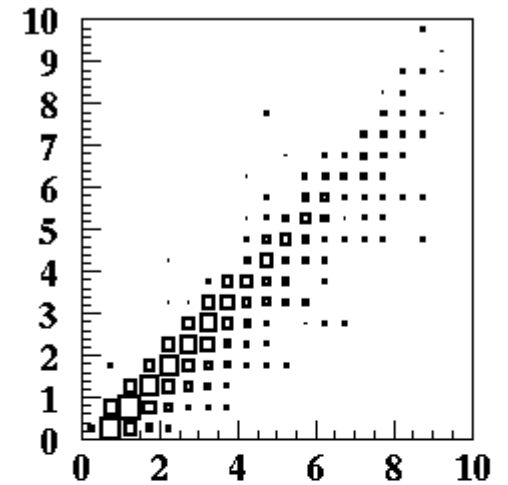
$E_{rec} = 0.25 \text{ GeV}$   
10% of time

$E_{rec} = 0.75 \text{ GeV}$   
85% of time

$E_{rec} = 1.25 \text{ GeV}$   
5% of time



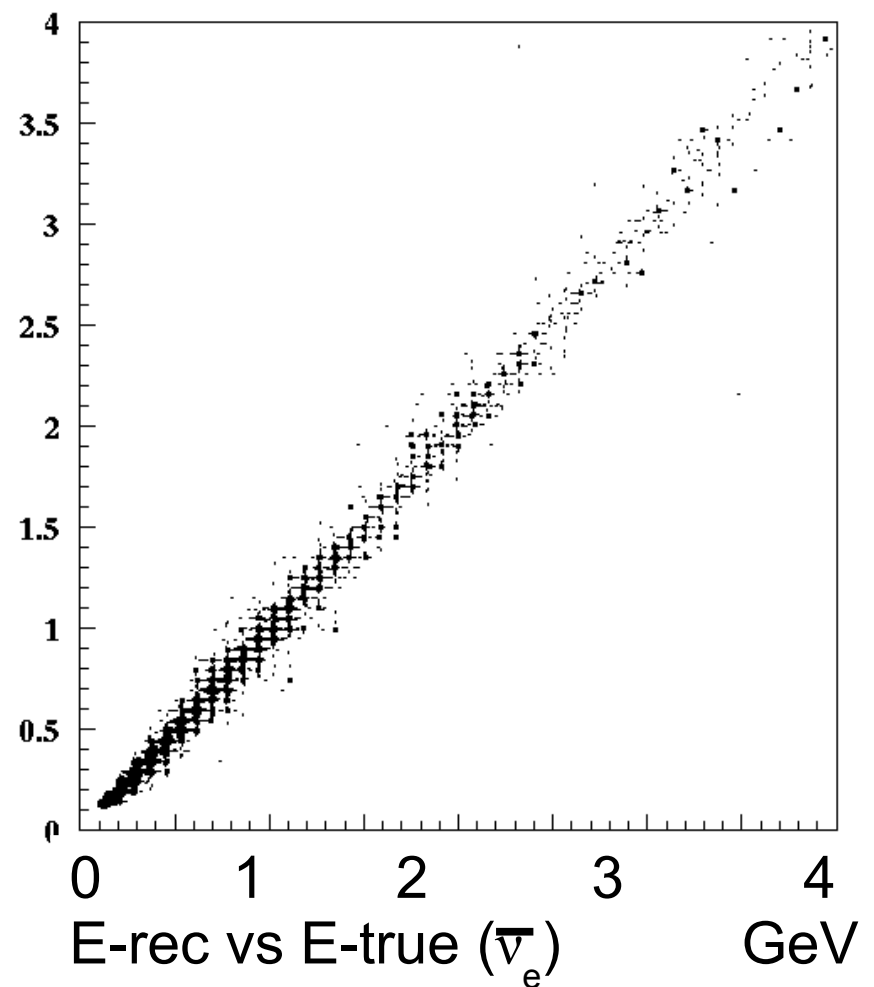
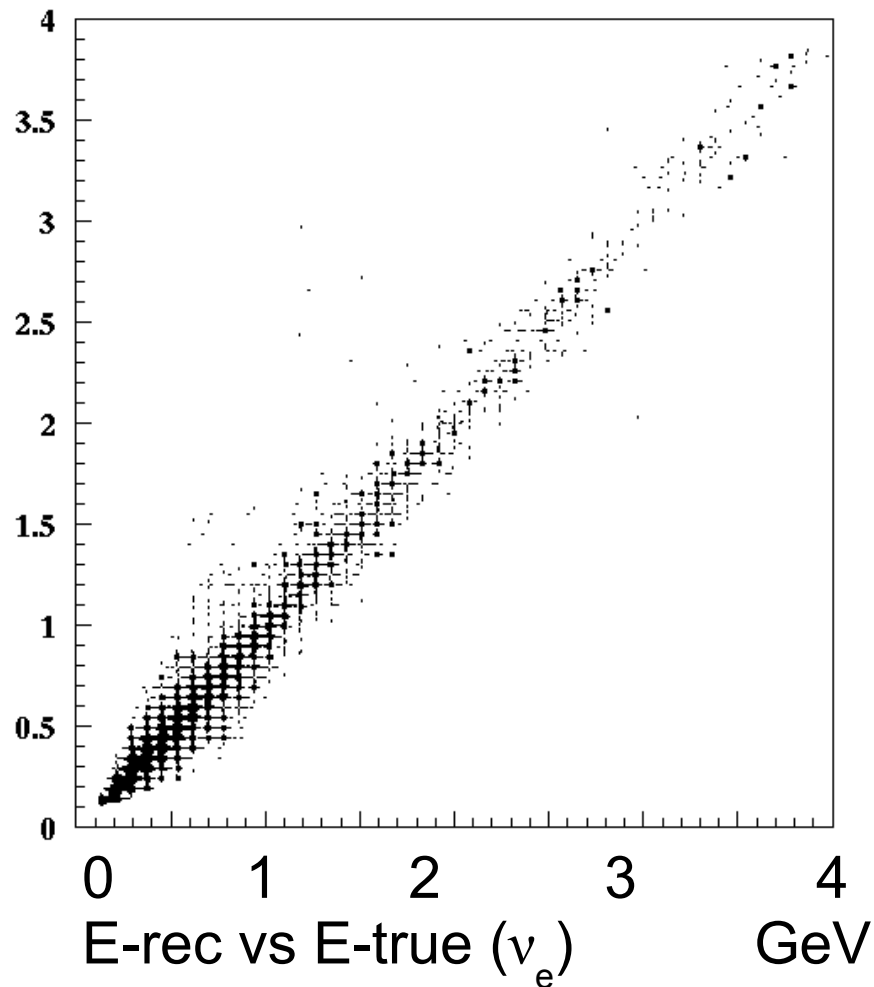
Ezrec vs Enu nuzmu CC



Ezrec vs Enu NC

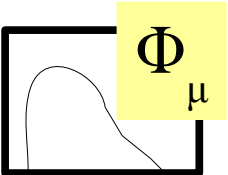
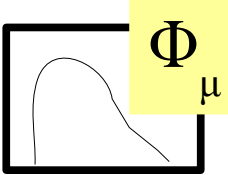
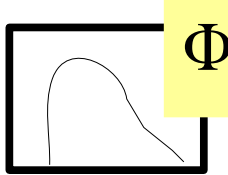
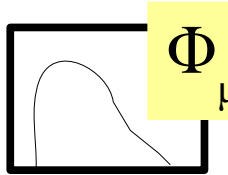
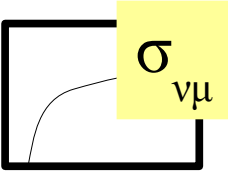
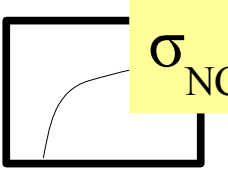
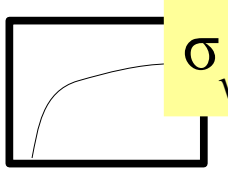
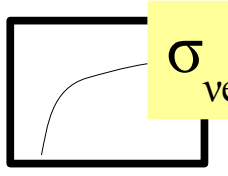
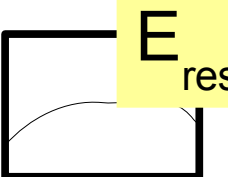
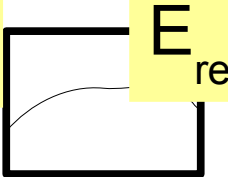
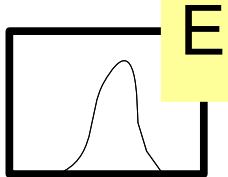
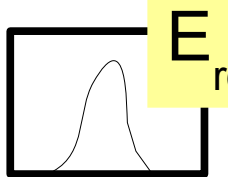
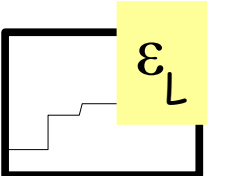
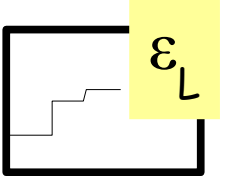
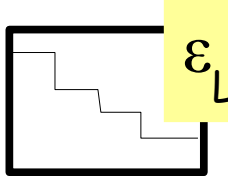
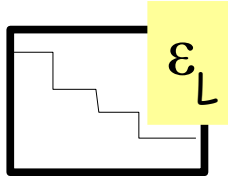
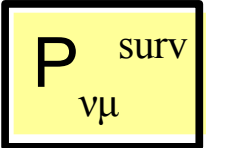
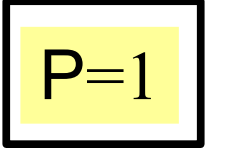
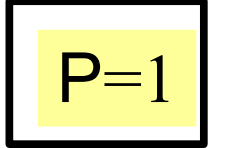
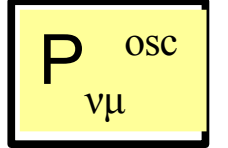
# Energy matrices for CCQE $\nu_e$ vs $\bar{\nu}_e$

Had to run on ATM MC since T2K doesn't have  $\bar{\nu}_e$

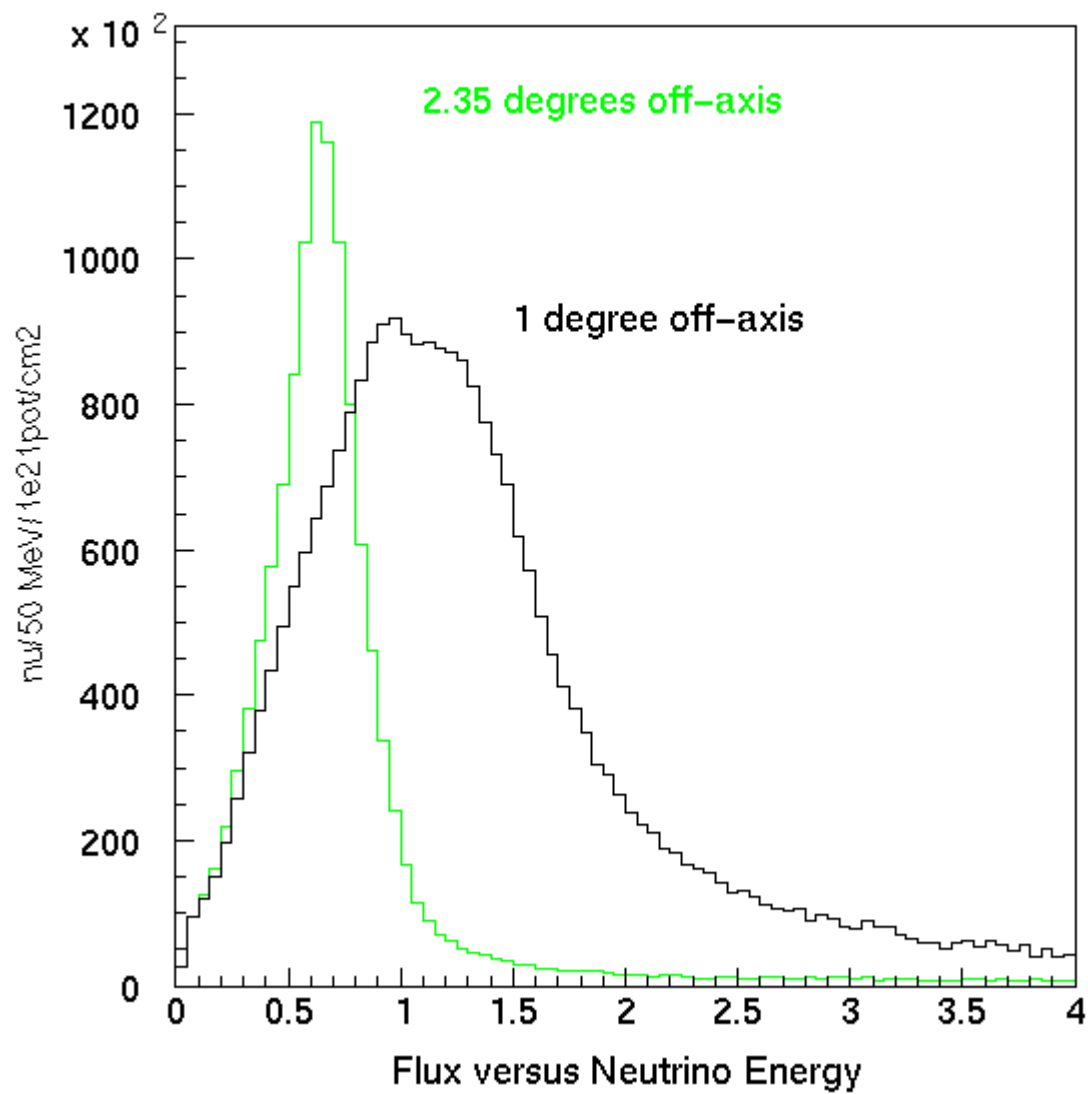


# Overall Status & plan

Wrote code to run event by event and do the following:

	$\nu_\mu$ CC	NC	beam $\nu_e$	Signal $\nu_e$	Energy
Done					True
Okumura-san Done?					True
Okumura-san & me: Done.					True ↓ Smear
Me, Done					Smear
Me, Done					True

# Flux



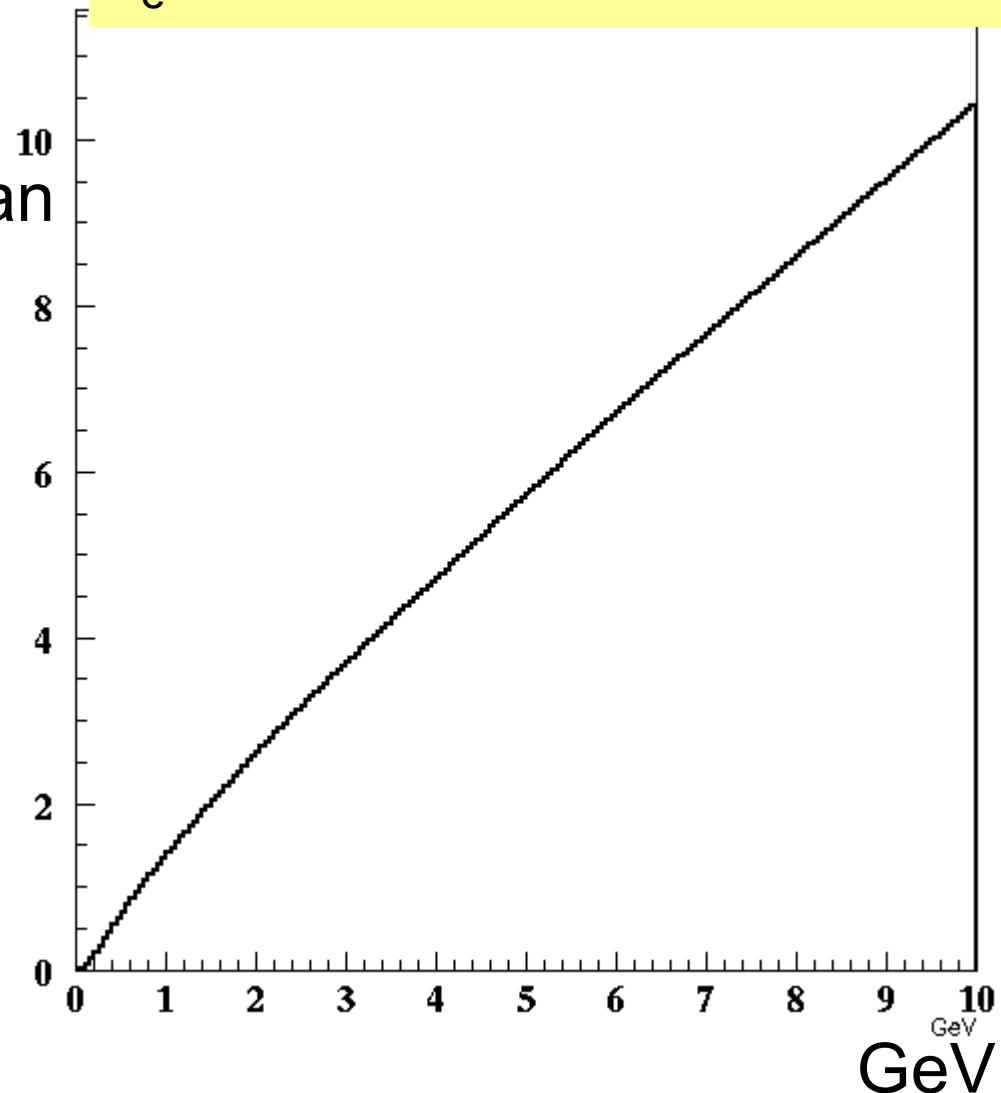


# Cross-section

$\nu_e$  Cross section from Mine.

I didn't have Okumura'san cross-section yet so I used Mine's.

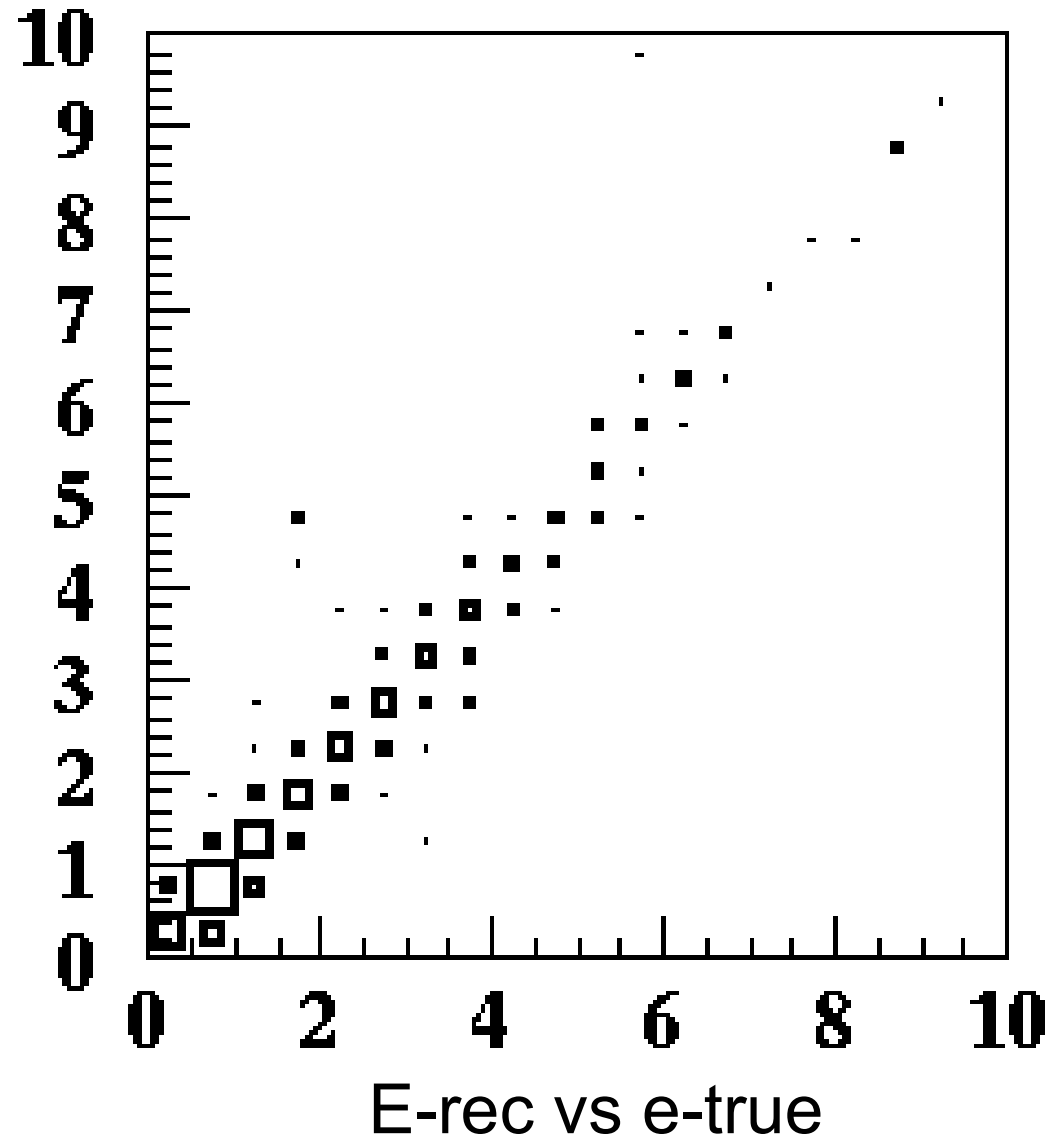
*What is Okumura-san's binning?*



# Energy Response

For each  $E_{\text{true}}$   
I associate  $E_{\text{smeared}}$   
according to the process  
explained earlier.

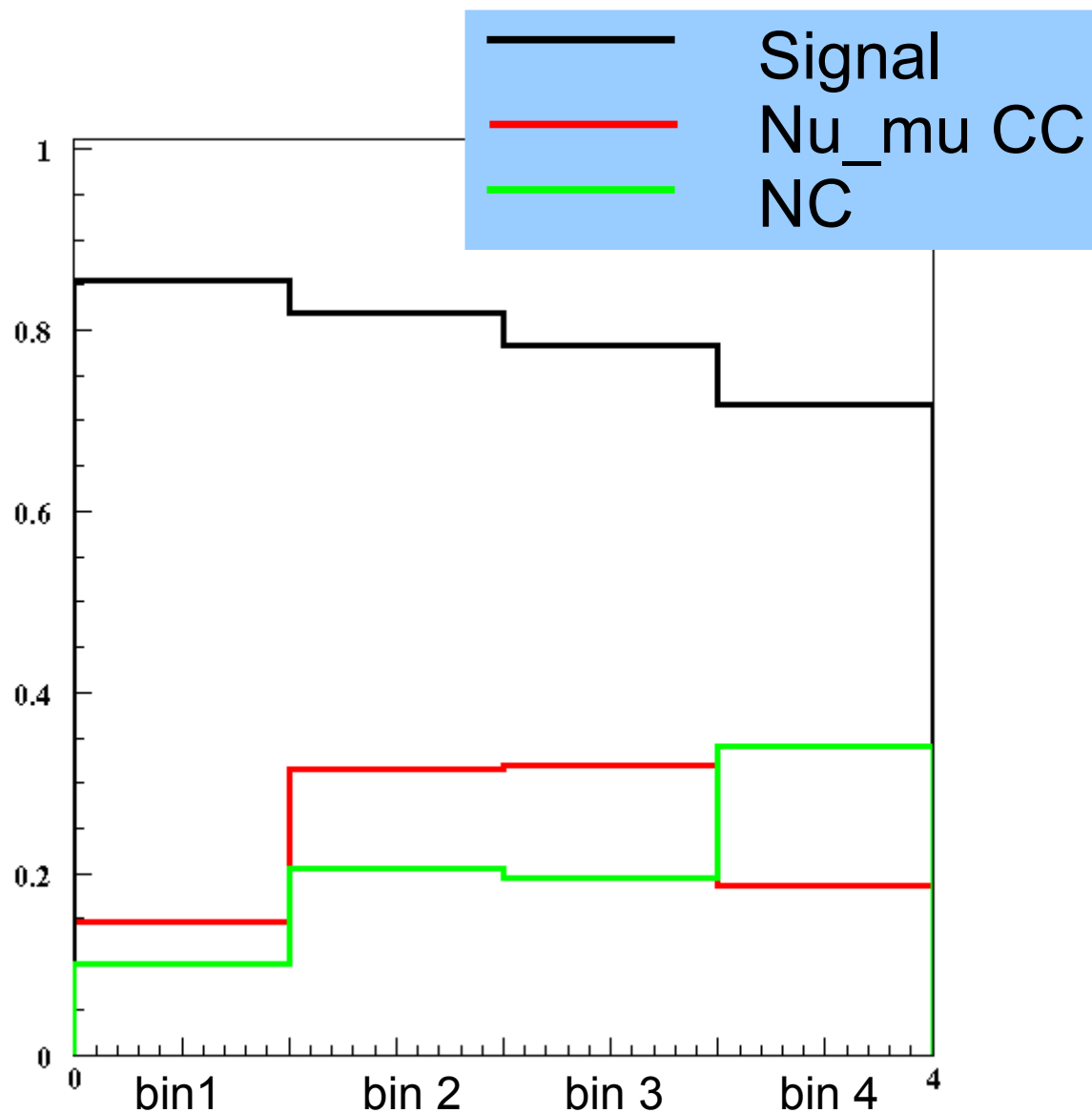
*Binning of the energy  
matrices is flexible.*



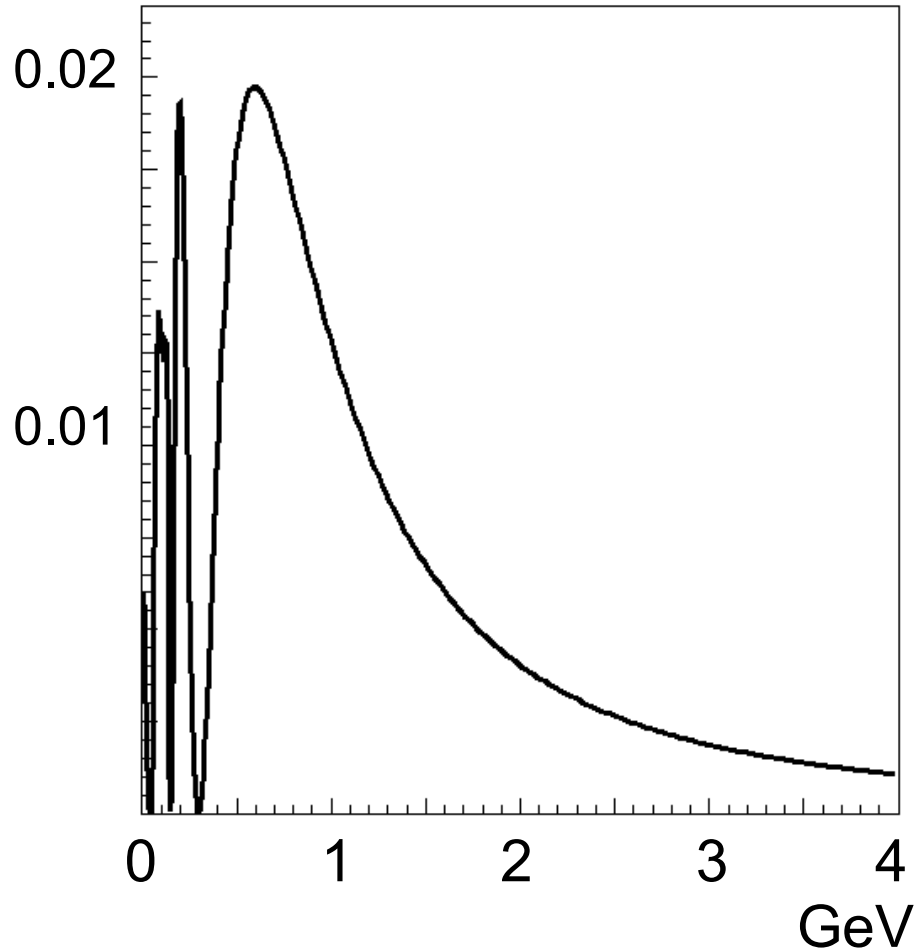
# Likelihood Efficiency

bin 1:  $E < 0.35$   
bin 2:  $0.35 < E < 0.85$   
bin 3:  $0.85 < E < 1.5$   
bin 4:  $1.5 < E$

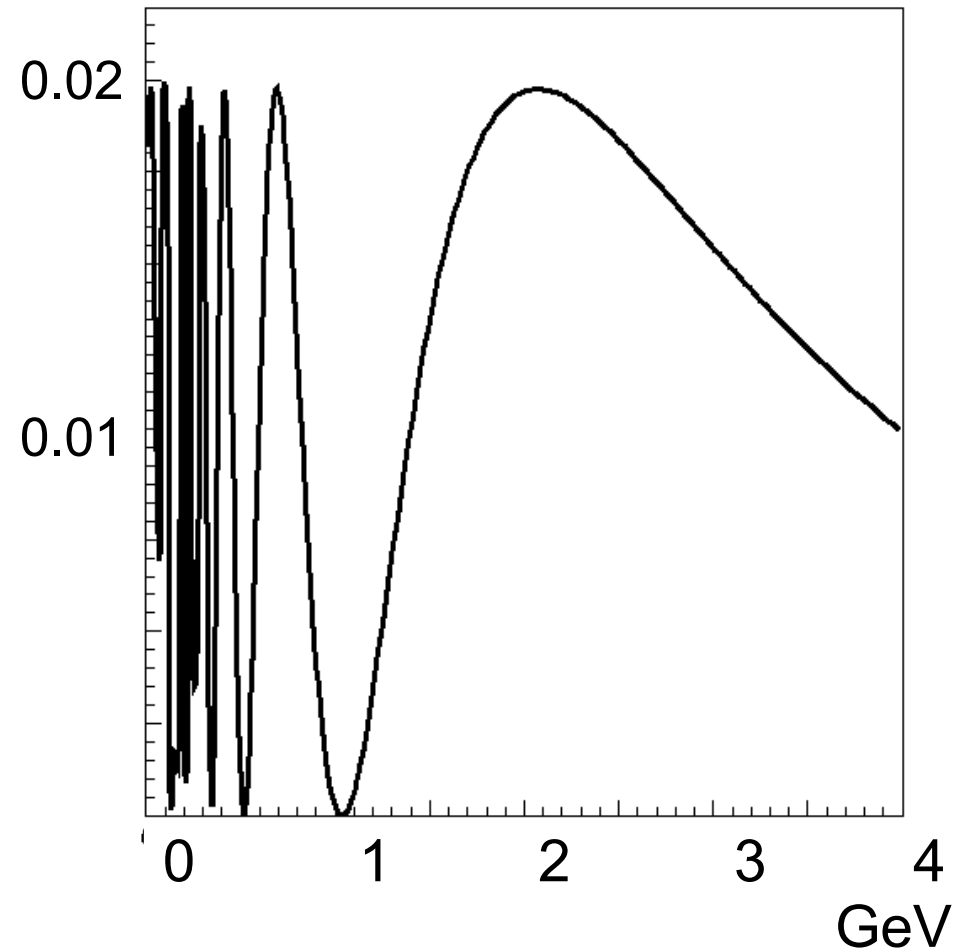
*Is this binning ok?*



# Oscillation probability



Prob  $\nu_{\mu} \rightarrow \nu_e$   
at Kamioka (L=295 km)



Prob  $\nu_{\mu} \rightarrow \nu_e$   
in Korea (L=1025km)

# Next steps

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- Polishing the code, start running.
- Do  $\chi^2$  analysis
- Prepare MC for SK-2 (for 20% vs 40% coverage study)

NB: all my talks are on:

<http://hep.bu.edu/~fdufour/t2kk/>

We need:

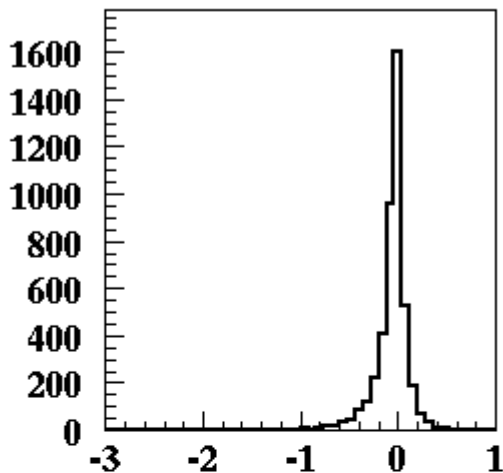
- all running:  
Nu-e Flux
- anti-neutrino running:  
Flux, Likelihood (efficiency)

# backups

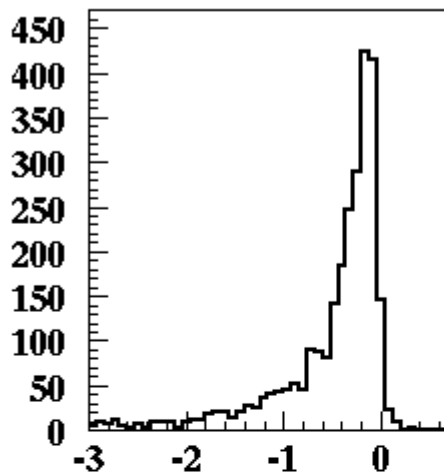


# $(E_{\text{rec}} - E_{\text{true}}) / E_{\text{rec}}$

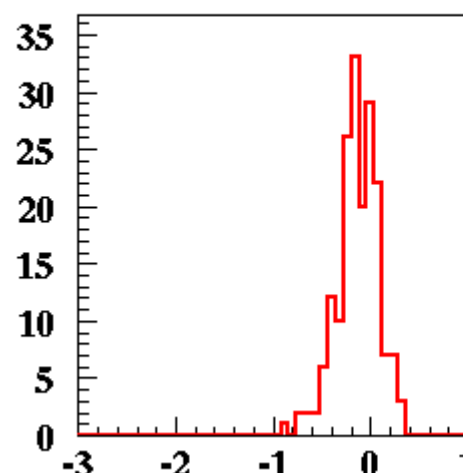
Split according to E-true only CC events  
— CCQE events



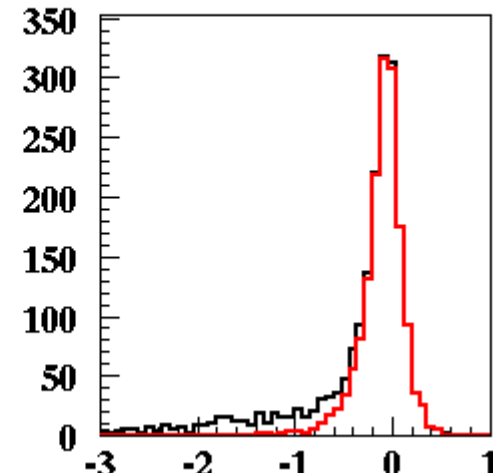
CCQE



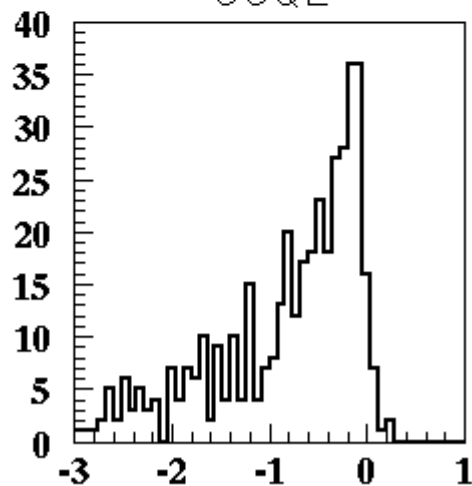
NUC CC



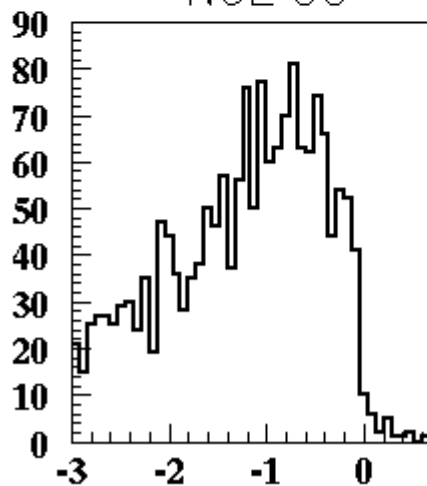
$E < 0.35$



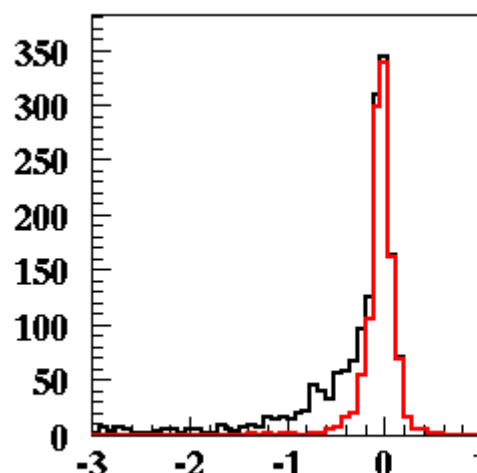
$0.35 < E < 0.85$



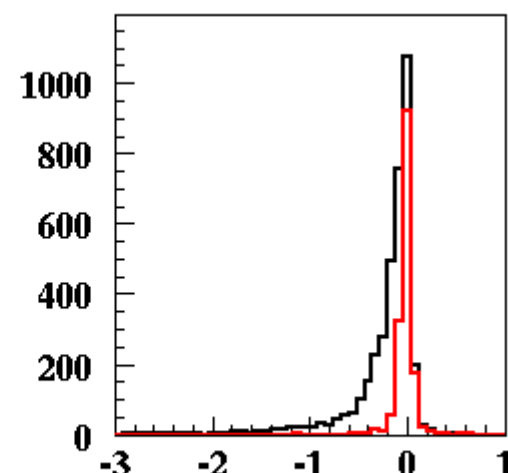
NUMU CC



NC



$0.85 < E < 1.5$



$E > 1.5$

NB see backups for plots including all events