Weekly Updates On nu e Meeting

Chi_Squared check

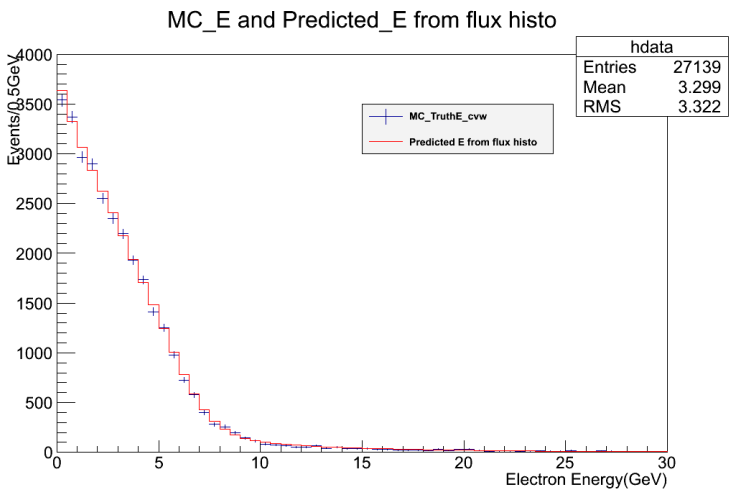
Wenting Tan

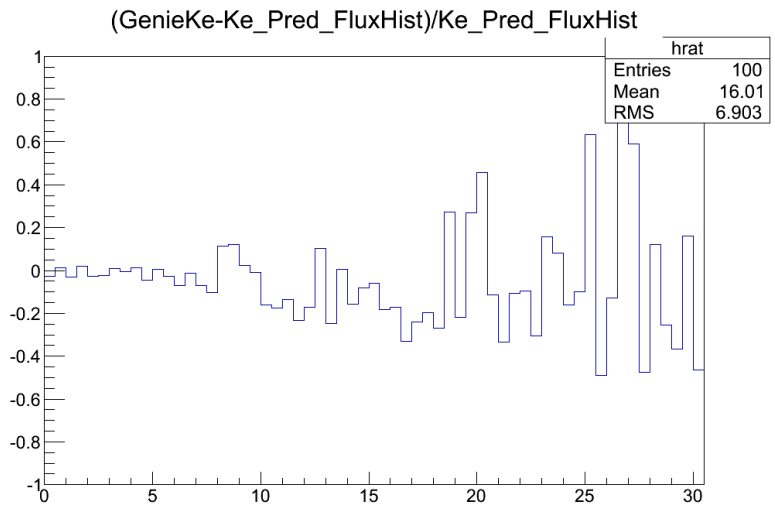
Hampton University

August 6, 2013

;

Genie Data and Ke Prediction from Original Flux Histogram





Genie Data and Ke Prediction from Original Flux Histogram

Genie weak mixing angle=0.2277; New weak mixing angle=0.23149

Bin-size: 0.5 GeV

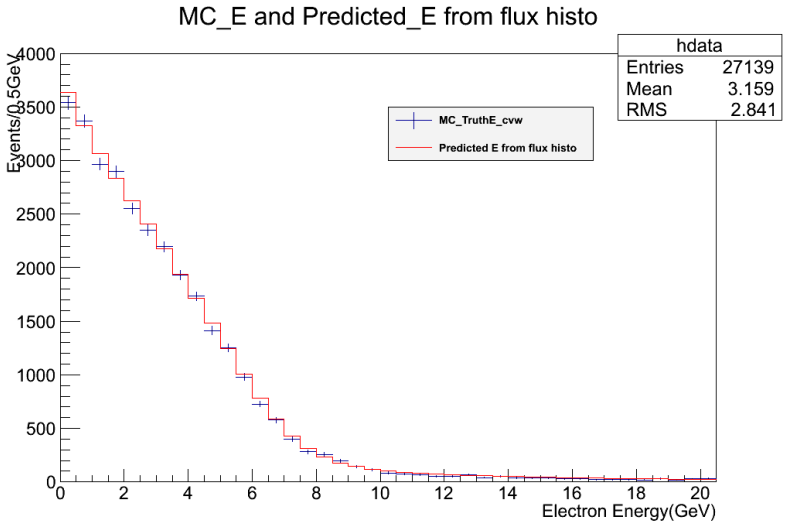
Range(GeV)	0-5	5-10	10-15	15-20	20-25	25-30	0-30
chi2	1.474	1.614	2.202	1.919	0.947	1.713	1.645
(GenieMixAg)chi2	2.833	2.519	2.751	2.226	1.038	1.777	2.191

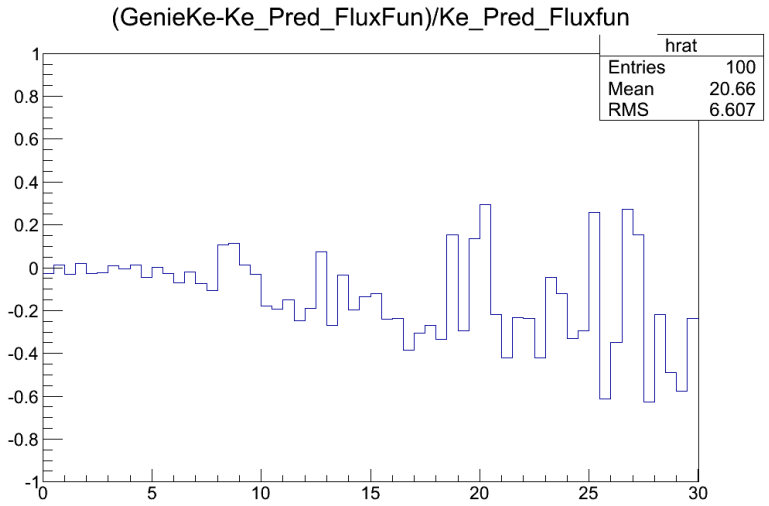
Bin-size: 0.1 GeV (Ke>18GeV, start to have 0 content bins)

Range(GeV)	0-5	5-10	10-15	15-18	0-18
chi2	1.175	1.188	2.202	1.977	1.597
(GenieMixAg)chi2	1.471	1.412	2.395	2.143	1.823

::

Genie Data and Ke Prediction from Flux Function





Genie Data and Ke Prediction from Flux Function Histogram

Bin-size: 0.5 GeV

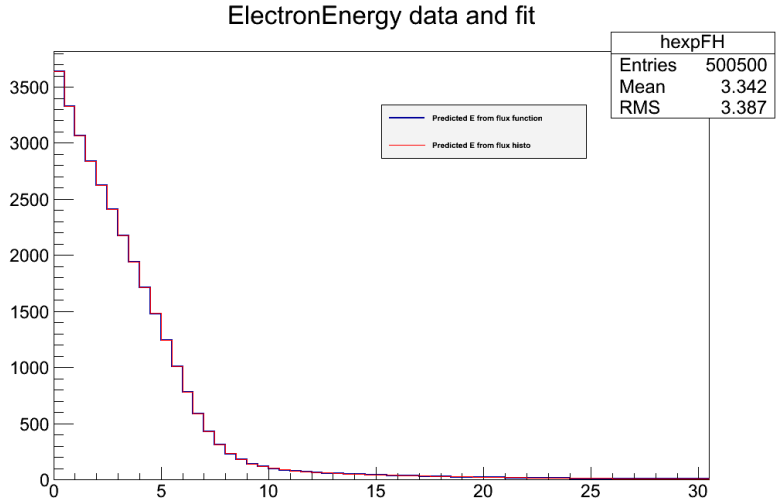
Range(GeV)	0-5	5-10	10-15	15-20	20-25	25-30	0-30
chi^2	1.483	1.665	2.856	3.255	2.178	4.076	2.586
(GenieMixAg)chi2	2.866	2.649	3.502	3.739	2.454	4.393	3.267

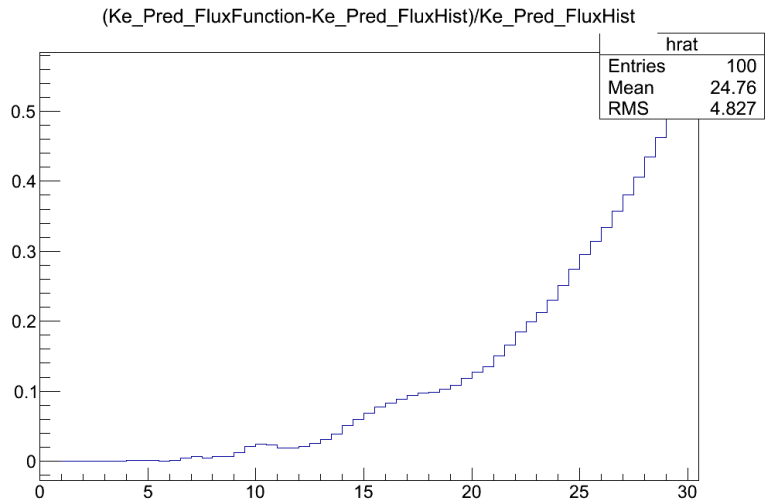
Bin-size: 0.1 GeV (Ke>18GeV, start to have 0 content bins)

Range(GeV)	0-5	5-10	10-15	15-18	0-18
chi2	1.177	1.210	2.448	2.609	1.778
(GenieMixAg)chi2	1.478	1.451	2.662	2.823	2.023

:::

Ke_FluxFun vs Ke_FluxHist





right:
(Ke_Prid_FluxFunction-Ke_Prid_FluxHist)/Ke_Prid_FluxHist

Bin-size: 0.5 GeV

Range(GeV)	0-5	5-10	10-15	15-20	20-25	25-30	0-30
chi2	0.00034	0.01264	0.06130	0.23824	0.45991	0.87592	0.275
(GenieMixAg)chi2	0.00032	0.01227	0.05961	0.23682	0.46106	0.88577	0.276

Bin-size: 0.1 GeV (Ke>18GeV, start to have 0 content bins)

Range(GeV)	0-5	5-10	10-15	15-18	0-18
chi2	8.14e-5	2.60e-3	1.23e-2	0.045	0.012
(GenieMixAg)chi2	7.85e-5	2.53e-3	1.20e-2	0.045	0.012

Another Chi2 Definition Result

$$\chi^2 = \frac{1}{N}\sum_{i=1}^{N}\frac{(X_{observed}-X_{expected})^2}{X_{expected}}$$

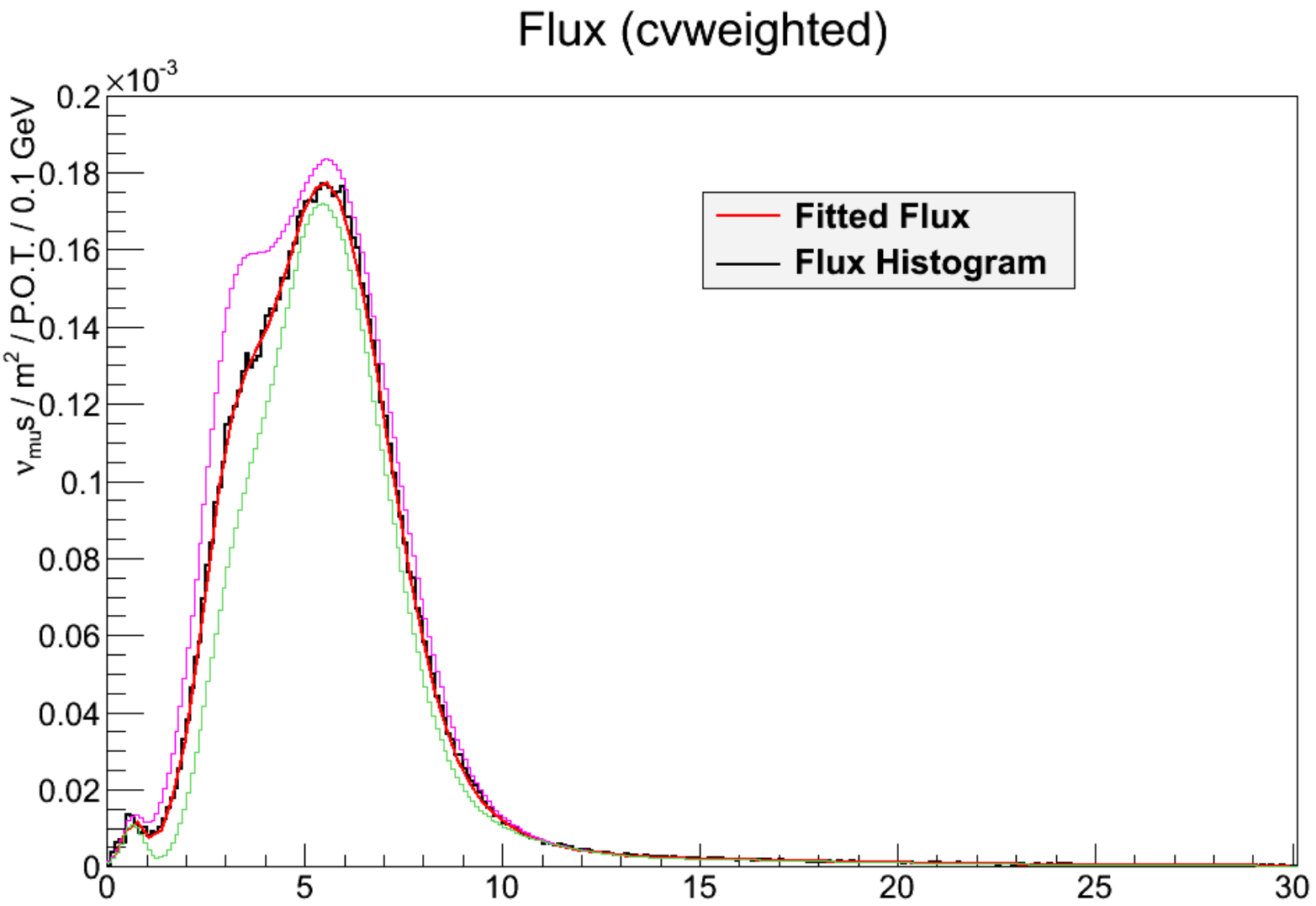
0-30 GeV; 0.5 Bin-Size;
Genie vs Ke from Flux Histogram: $\chi^2 = 1.505$
Genie vs Ke from Flux Function: $\chi^2 = 1.836$

5Pars Fitting

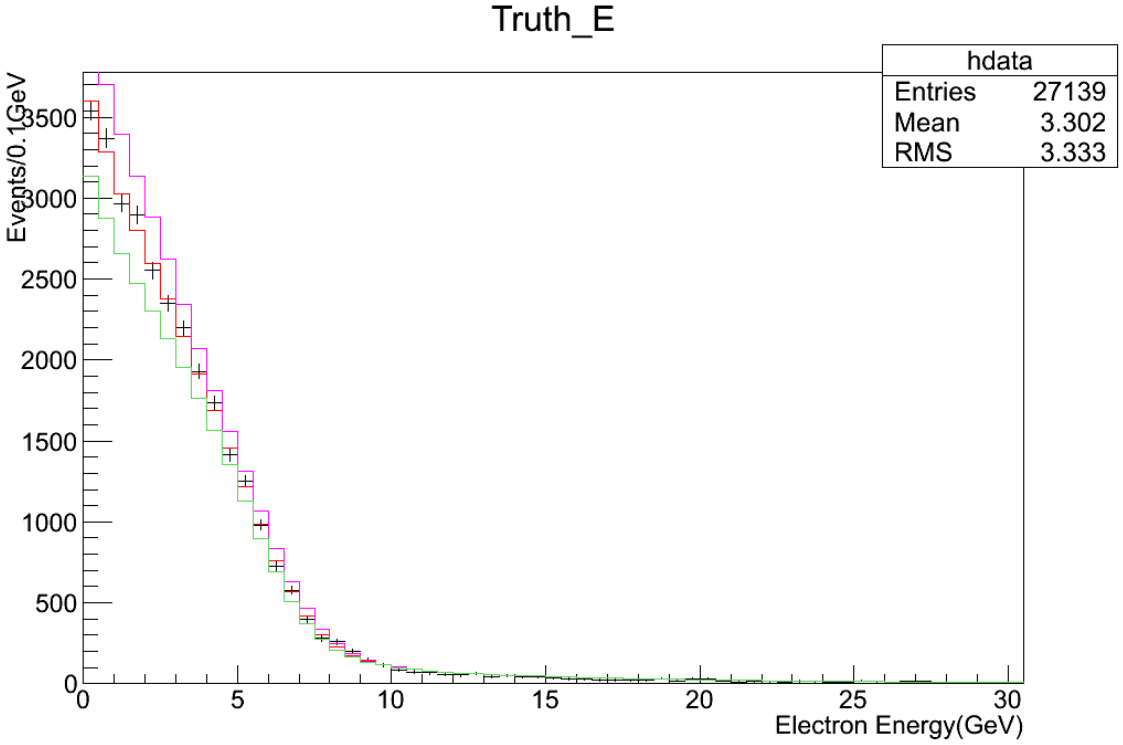
$$\chi^2 = 1.73$$

```
.
chi^2=1.73073
 MIGRAD MINIMIZATION HAS CONVERGED.
 FCN=1.73072 FROM MIGRAD    STATUS=CONVERGED     118 CALLS         119 TOTAL
                     EDM=8.11153e-05    STRATEGY= 1  ERROR MATRIX UNCERTAINTY  1
6.4 per cent
  EXT PARAMETER                                   STEP         FIRST
  NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
   1  a1           1.70962e-04   5.80432e-06   6.09819e-09  -7.09722e+02
   2  m1           5.45666e+00   8.04594e-02   3.19221e-04   2.02734e-01
   3  s1           1.56971e+00   6.13482e-02   2.01183e-04  -7.11233e-03
   4  a2           5.72996e-05   3.49777e-05  -3.61944e-07   5.57943e+02
   5  s2           7.24609e-01   2.12013e-01  -1.91947e-03  -6.22290e-02
 EXTERNAL ERROR MATRIX.    NDIM=  25    NPAR=  5    ERR DEF=1
  3.369e-11  3.011e-07  2.534e-07 -1.195e-10 -2.237e-07
  3.011e-07  6.474e-03  3.176e-03 -1.944e-06 -6.658e-04
  2.534e-07  3.176e-03  3.764e-03 -1.504e-06 -3.556e-03
 -1.195e-10 -1.944e-06 -1.504e-06  1.223e-09  2.449e-06
 -2.237e-07 -6.658e-04 -3.556e-03  2.449e-06  4.495e-02
 PARAMETER  CORRELATION COEFFICIENTS
       NO.  GLOBAL      1      2      3      4      5
        1  0.75304   1.000  0.645  0.712 -0.588 -0.182
        2  0.78228   0.645  1.000  0.644 -0.691 -0.039
        3  0.79986   0.712  0.644  1.000 -0.701 -0.273
        4  0.79482  -0.588 -0.691 -0.701  1.000  0.330
        5  0.44759  -0.182 -0.039 -0.273  0.330  1.000
par: 0.000170962, par error: 5.80432e-06
par: 5.45666, par error: 0.0804594
par: 1.56971, par error: 0.0613482
par: 5.72996e-05, par error: 3.49777e-05
par: 0.724609, par error: 0.212013
3.36901e-11 3.01079e-07 2.53381e-07 -1.1946e-10 -2.23689e-07
3.01079e-07 0.00647372 0.00317646 -1.94383e-06 -0.000665832
2.53381e-07 0.00317646 0.0037636 -1.50384e-06 -0.00355573
-1.1946e-10 -1.94383e-06 -1.50384e-06 1.22344e-09 2.44878e-06
-2.23689e-07 -0.000665832 -0.00355573 2.44878e-06 0.0449494
```

Fitted Flux


Flux (cvweighted)
×10^-3
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
ν_mu s / m^2 / P.O.T. / 0.1 GeV
0
5
10
15
20
25
30
Fitted Flux
Flux Histogram

Check Error with Ke:



Ke from FittedFlux Upper Error: chi^2=6.66801 ;

Ke from FittedFlux Lower Error: chi^2=8.28197 ;

Fitted : chi^2=1.73249

High Energy Tail Normalization

Use the tail(20-50 GeV) of the electron energy data to constrain the flux high energy tail(20-50 GeV).

In the prediction(flux histogram):
take the ratio flux->Integral(20,50)/Ke data -> Integral(20,50)

$$R_1 = \frac{FluxHistoIntegral(20-50GeV)}{KePredictionIntegral(20-50GeV)} = \frac{8.0147e-6}{344}$$

In the ke fitting code, 20-50 tail integral of the ke data should be equal to the fitted ke:

$$R_2 = \frac{FittedFluxFunctionIntegral(20-50GeV)}{KeDataIntegral(20-50GeV)} = \frac{FittedFluxFunctionIntegral(20-50GeV)}{343}$$

the two ratio $R_1$and R_2should be equal, R_1 =R_2, then we get:
$FittedFluxFunctionIntegral(20-50GeV) = 7.9914e-6$
and because
$InitialFluxFunctionIntegral(20-50GeV) = 8.0091e-6$
ratio of the scaling parameter is
$\frac{FittedPar}{InitialPar} = \frac{7.9914e-6}{8.0091e-6} = 0.99779$
so, the Fitted Parameter is:
$FittedPar = 0.99779 \times InitialPar = 0.99779 \times 1.20056e-05 = 1.198e-05$
Error is :
$??Err = \sqrt{8.0147e-6} \times \frac{\sqrt{343}}{\sqrt{344}} \times 1.20056e-05 = 3.394e-08$

Par=1.198e-05±3.394e-08