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TGdEdX cut

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Abstract

We observed a 9% acceptance loss in TGdEdX compared to what Bipul measured in E787-PNN2. I describe how the cut works, changes made to the cut, and the how I re-calibrated this cut with current data.

1 TGdEdX

The dEdx of pions in the PNN2 box 140 MeV/c to 199.5 MeV/c changes from 3.08 MeV/cm to 2.47 MeV/cm in scintillator Therefore the target dEdx cut has to be performed as a function of momentum for PNN2. The TGdEdX cut calculates the target dEdX "likelihood" using the total measured momentum (*ptot*) target range (*rtg*), and target energy (*etg*). PISCAT monitors are used to determine the expected *rtg* based upon the observed *ptot, etg*. The data was chosen to be in the pion band. The target range was quantified in 5 momentum bins ($< 170, 170-180, 180-188, 188-199.53, > 199.53$ and 14 target energy bins (0-2MeV, 2-4MeV,..., 26-28MeV); The value of a 15th bin is equal to the 14th bin. For each bin we store the fitted mean and sigma of the measured target range. A Gaussian distribution is assumed during the calibration. Signal events are cut by TGdEdX if $like_{tgdedx} < 0.05$.

$$like_{tgdedx} = \frac{1}{2} \cdot (1 + erf\Big(\frac{rtgrtg_{exp}(etg, ptot)}{\sigma_{exp}(etg, ptot)}\Big)) \quad (1)$$

2 Calibration

The calibration uses Piscat Monitors. The cuts used to determine the final sample are shown in Table **??**. The last cut on *Kpiang* was not used in the final determination of the sample due to lack of statistics.

Table 1: Kin tgdedx calib Branch no. 1

Cuts	pi acc
$BADRUN$	5859925 (-)
$DUPEV$	5859925 (-)
RD_TRK	5859442 (-)
$TRKTIM$	5856748 (-)
$TARGET$	5856748 (-)
$STLAY$	4949979 (-)
UTC	4593392 (-)
$RDUTM$	4497125 (-)
PDC	2833580 (-)
$ICbit$	2833580 (-)
$b4abm2$	1986916 (-)
$tpi-trs$	1881543 (-)
$ictime-trs$	1847951 (-)
BAD_STC	**1845076** (-)
$TGCUT$	1508139 (0.817386)
$tgqualt$	1435572 (0.951883)
$npitg$	1435572 (1)
$timcon$	1430524 (0.996484)
$tgtcon$	1390018 (0.971685)
$b4etcon$	1360826 (0.978999)
$targf$	1278186 (0.939272)
$dtgttp$	1278117 (0.999946)
$rtdif$	1181683 (0.92455)
$eiccon$	1149627 (0.972873)
$ticcon$	1149616 (0.99999)
$pigap$	1034138 (0.899551)
$tgdb4$	886404 (0.857143)
$tgdb4tip$	561715 (0.633701)
$tgdvxtip$	466019 (0.829636)
$tgdvxpi$	427166 (0.916628)
TGB4	427166 (1)
$phivtx1$	315481 (0.738544)
$pv(not\ tg)\ Loose60$	87063 (0.275969)
$cos3d$	76823 (0.882384)
$utcqual\ Loose$	72564 (0.944561)
$rngmom$	65767 (0.906331)
$rsdedxmax$	46384 (0.705278)
$rsdedxcl$	41896 (0.903242)
$rslike$	41429 (0.988853)
RSDEDX	41429 (1)
$tgz > -10.$	41244 (0.995535)

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Cuts	pi acc
$Kpiang > 35$	**23662** (0.573708)
Total Acc.	$0.0128244 \pm 9.44126E-06$

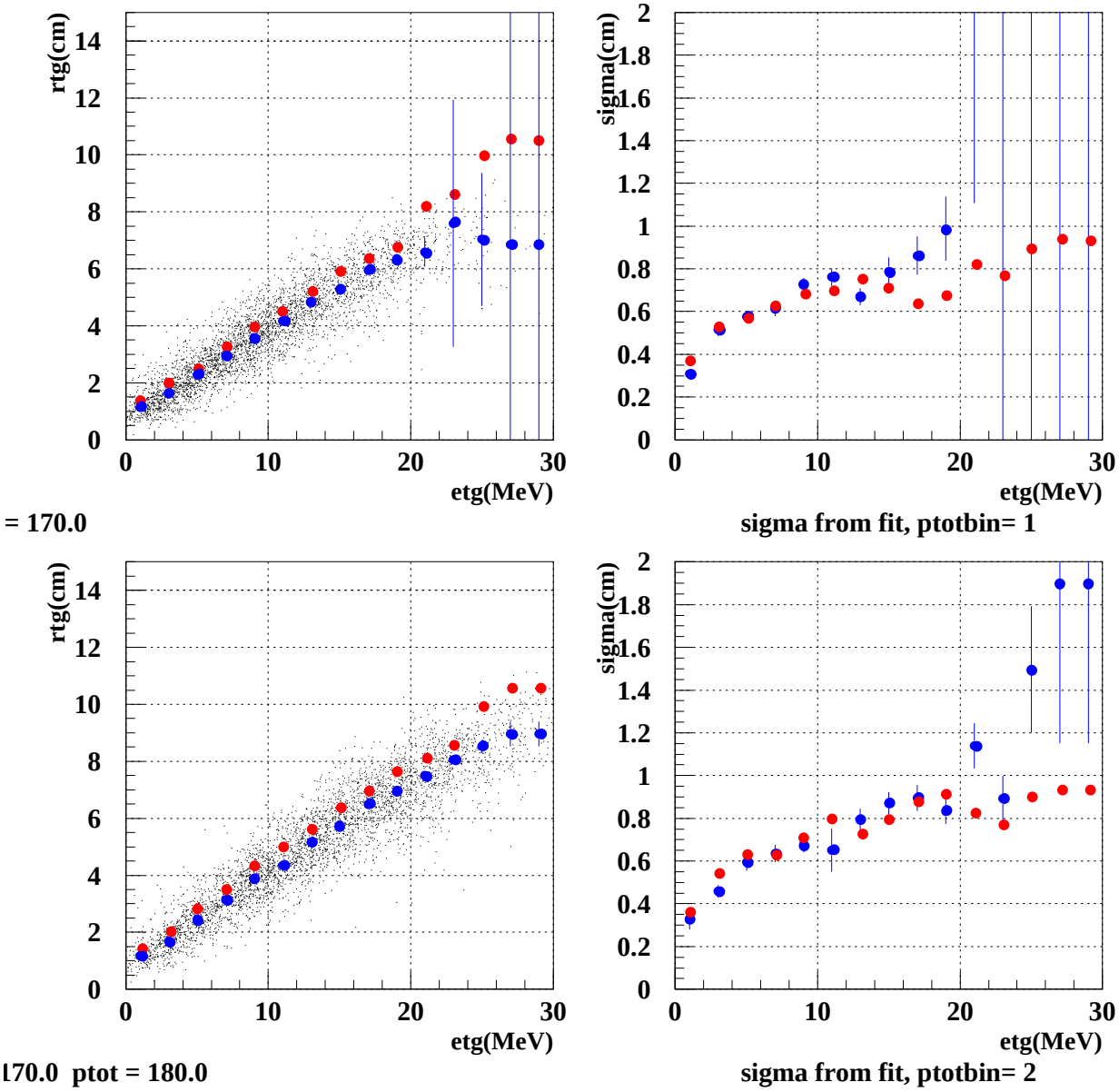


Figure 1: Calibration of new means. Red points are the original means. Blue points are the new means with error bars being the uncertainty on the mean from a gaussian fit

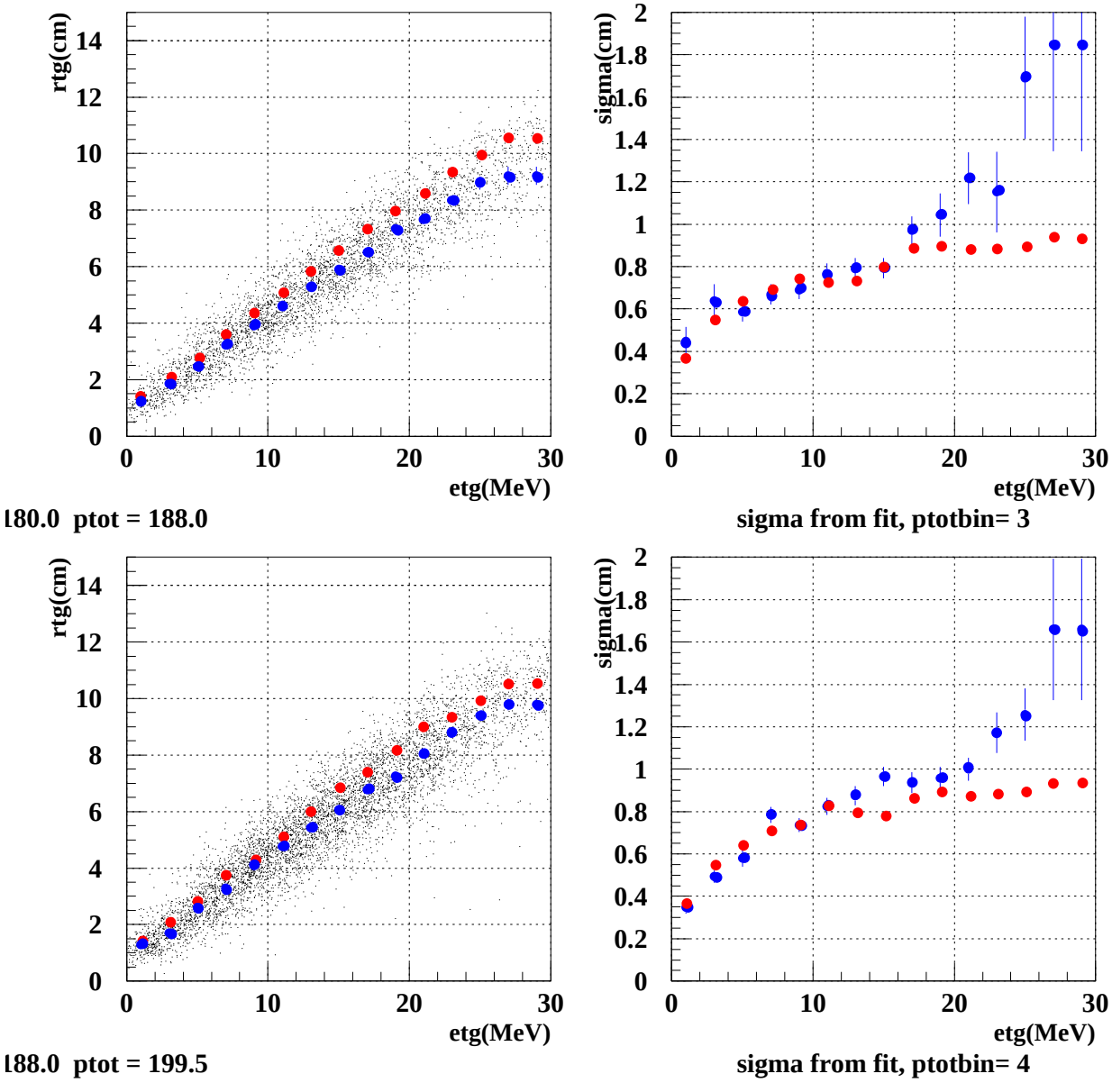


Figure 2: Calibration of new means. Red points are the original means. Blue points are the new means with error bars being the uncertainty on the mean from a gaussian fit

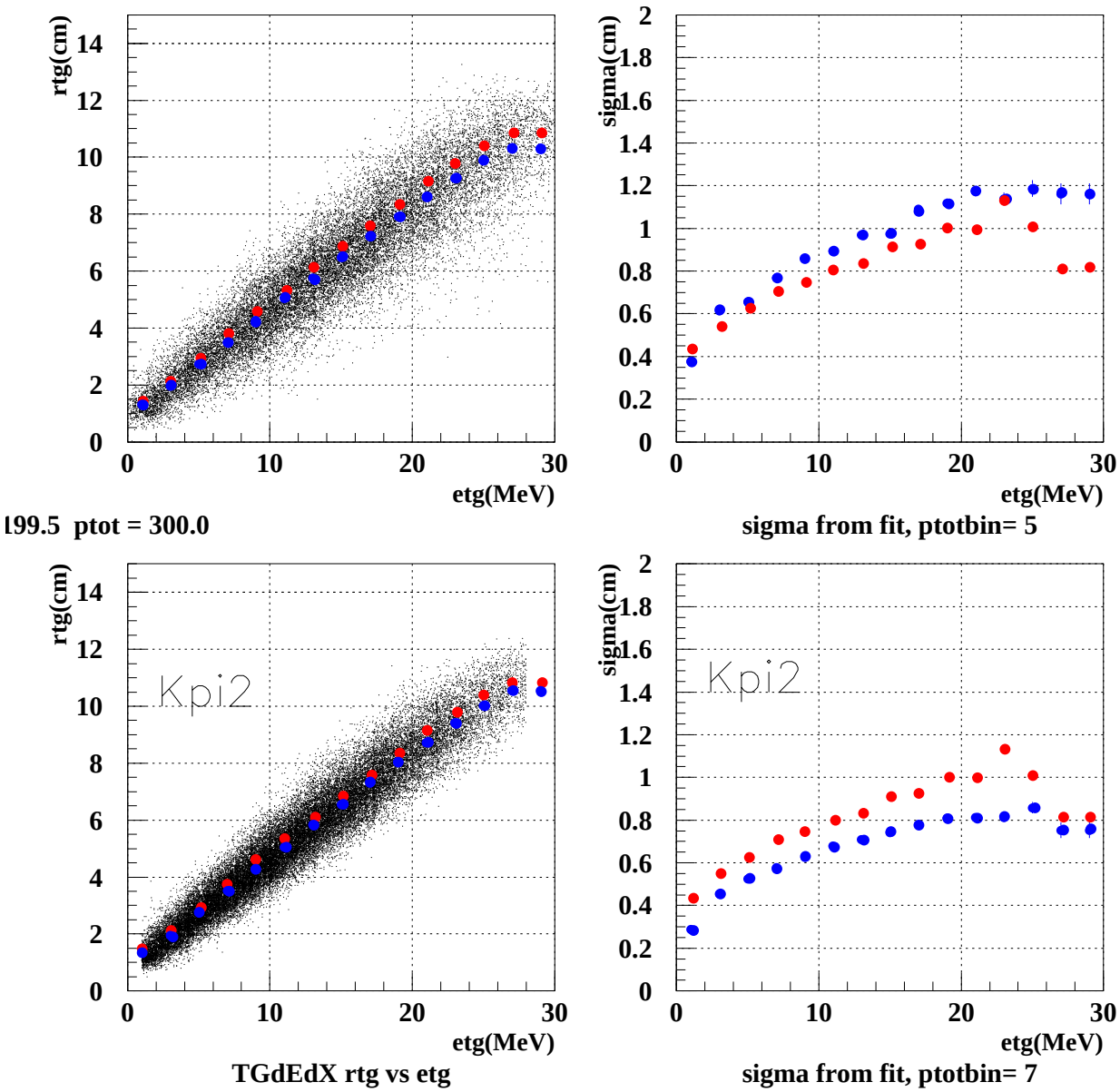


Figure 3: Calibration of new means. The bottom plot is doing the calibration process on Kpi2 montiors. Red points are the original means. Blue points are the new means with error bars being the uncertainty on the mean from a gaussian fit

2.1 Original Parameters

The means and sigmas are listed below in the 5 *ptot* bins. meanN, such that N= the ptot bin, ptot=170 is the first bin. Same notiation for sigmas.

data mean1/1.41,1.99,2.51,3.28,3.92,4.56,5.23,5.88,6.30,6.77,8.2,8.6,9.95,10.5,10.5/
data sigm1/0.36,0.53,0.57,0.62,0.69,0.70,0.76,0.71,0.64,0.67,0.83,0.77,0.90,0.93,0.93/
data mean2/1.41,2.09,2.82,3.50,4.29,5.02,5.62,6.31,6.96,7.60,8.17,8.58,9.95,10.5,10.5/
data sigm2/0.36,0.54,0.64,0.62,0.71,0.79,0.72,0.79,0.88,0.91,0.83,0.77,0.90,0.93,0.93/
data mean3/1.41,2.09,2.82,3.53,4.36,5.05,5.83,6.60,7.29,7.99,8.61,9.33,9.95,10.5,10.5/
data sigm3/0.36,0.54,0.64,0.70,0.74,0.72,0.73,0.79,0.89,0.90,0.87,0.89,0.90,0.93,0.93/
data mean4/1.41,2.09,2.82,3.72,4.28,5.17,6.06,6.83,7.39,8.17,8.93,9.33,9.95,10.5,10.5/
data sigm4/0.36,0.54,0.64,0.71,0.73,0.83,0.79,0.78,0.86,0.90,0.87,0.89,0.90,0.93,0.93/
data mean5/1.48,2.15,2.97,3.75,4.58,5.37,6.10,6.84,7.64,8.36,9.16,9.77,10.38,10.83,10.83/
data sigm5/0.44,0.54,0.62,0.71,0.74,0.80,0.84,0.91,0.92,1.0,0.99,1.14,1.0,0.81,0.81/

2.2 New Parameters

data mean1/1.15,1.64,2.27,2.96,3.59,4.16,4.83,5.29,5.95,6.35,6.58,7.,7.5,8.0,8.0/
data sigm1/0.31,0.52,0.57,0.61,0.72,0.76,0.67,0.79,0.86,0.99,1.04,1.28,1.28,1.28,1.28/
data mean2/1.17,1.69,2.45,3.15,3.86,4.35,5.17,5.77,6.49,6.91,7.50,8.05,8.53,8.96,8.96/
data sigm2/0.33,0.46,0.60,0.64,0.68,0.65,0.79,0.87,0.90,0.83,1.14,0.89,1.50,1.89,1.89/
data mean3/1.20,1.87,2.46,3.23,3.91,4.59,5.29,5.91,6.50,7.34,7.67,8.35,8.95,9.21,9.21/
data sigm3/0.45,0.64,0.59,0.67,0.69,0.77,0.79,0.79,0.97,1.04,1.22,1.15,1.69,1.85,1.85/
data mean4/1.29,1.71,2.61,3.29,4.08,4.77,5.43,6.07,6.76,7.27,8.04,8.78,9.40,9.80,9.80/
data sigm4/0.35,0.49,0.58,0.78,0.74,0.82,0.87,0.97,0.94,0.96,1.00,1.17,1.26,1.66,1.66/
data mean5/1.32,1.96,2.74,3.50,4.27,5.04,5.76,6.47,7.21,7.91,8.59,9.25,9.88,10.30,10.30/
data sigm5/0.38,0.61,0.66,0.77,0.86,0.89,0.97,0.97,1.09,1.12,1.17,1.14,1.19,1.16,1.16/

2.3 Manual changes

The fit in the *ptot* range of $< 170 MeV/c$ and $etg > 20 MeV$ was very poor due to lack of statistics. I modified the last 5 values. The means were determine by constraining the values below the values observed in mean2(11-15) and doing a linear extrapolation from the previous set of points. This was done by "eye". The last 4 sigmas were determine by doing a fit on rtg values with a slice of $20 < etg < 30$ and performing a gaussian fit. The 5th to last sigma (1.04) was done by extending the etg-slice to $17 < etg < 21$ to increase the statistics within the $etg = 19$ point.

- From fits

  data mean1/1.15,1.64,2.27,2.96,3.59,4.16,4.83,5.29,5.95,6.35,6.58,7.60,7.03,6.84,6.84/

  data sigm1/0.31,0.52,0.57,0.61,0.72,0.76,0.67,0.79,0.86,0.99,2.02,3.64,3.84,12.70,12.70/

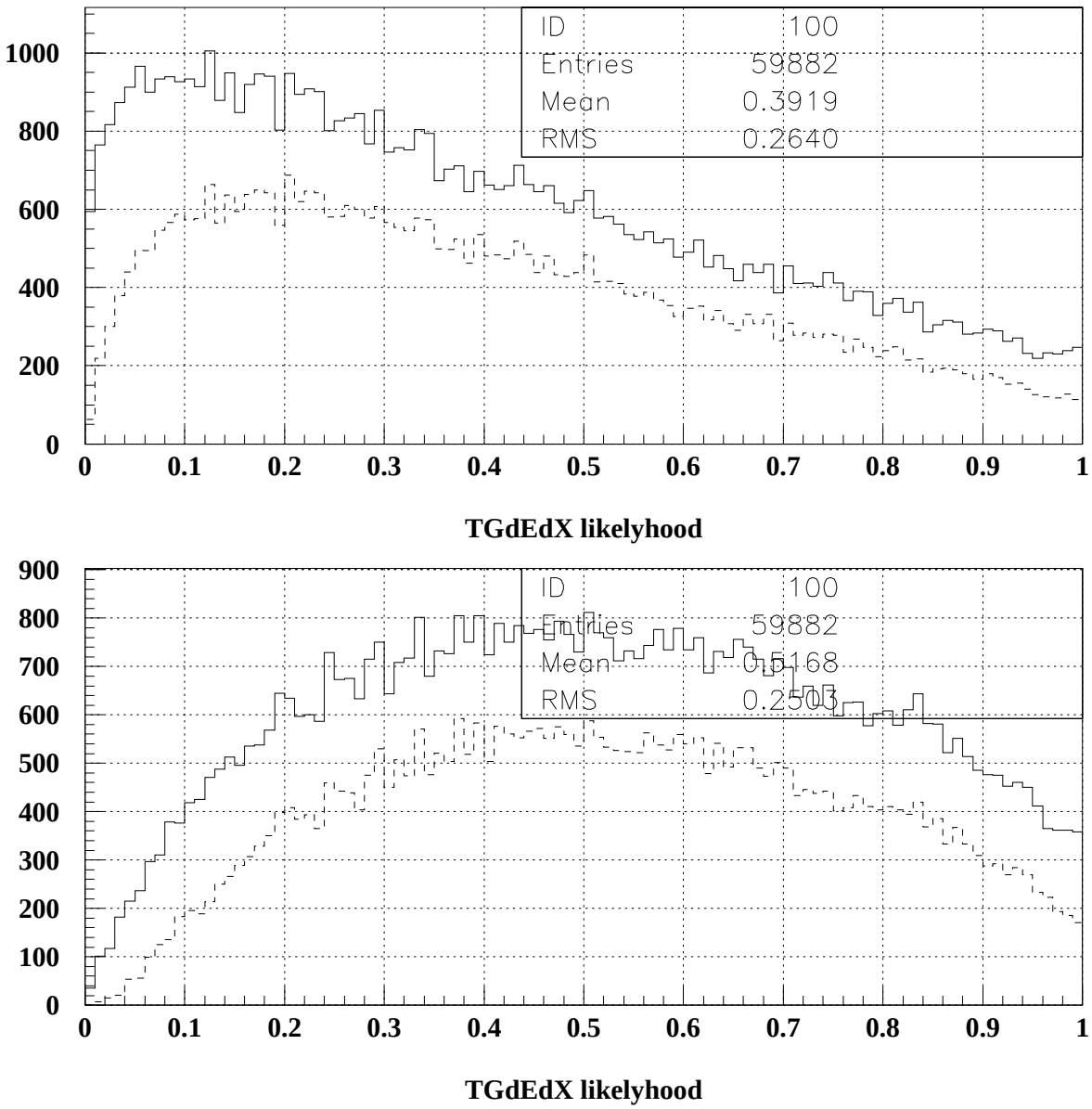
- By hand

  data mean1/1.15,1.64,2.27,2.96,3.59,4.16,4.83,5.29,5.95,6.35,6.58,7.,7.5,8.0,8.0/

  data sigm1/0.31,0.52,0.57,0.61,0.72,0.76,0.67,0.79,0.86,0.99,1.04,1.28,1.28,1.28,1.28/

3 Results

Acceptances: before: 0.934
after calibration: 0.989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Mean 0.3919
RMS 0.2640
1000
800
600
400
200
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
TGdEdX likelyhood
ID 100
Entries 59882
Mean 0.5168
RMS 0.2503
900
800
700
600
500
400
300
200
100
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
TGdEdX likelyhood

Figure 4: