MEASUREMENT OF BR(K_{0S}) IN SEMILEPTONIC DECAY WITH THE KLOE EXPERIMENT

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GENERAL MEETING 23/09/2018

$K_S3/K_S\pi^+\pi^-$

- $BR(K_S \to \pi e \nu) = (7.05 \pm 0.09) * 10^{-4}$ KLOE06 on 0.4 fb^{-1}
- $BR(K_S \to \pi mu \nu)$ not measured, expected BR(KSmu3)=4.69 ± 0.06 10^{-4}
- The plan is to measure the ratio $Ks3/Ks\pi^+\pi^-$
  - $BR(K_S \to \pi i \nu) = (N_{sel}/\epsilon)_{\pi i \nu} * (\epsilon/N_{sel})_{\pi\pi} * R\epsilon * BR(K_S \to \pi^+\pi^-)$
  - Where i= e, mu
- Main source of background
  $BR(K_S \to \pi+\pi-) = 0.6902 \pm 0.0005$ (KLOE), 10^3 times than $K_S \to \pi i \nu$
- Preselection: Trigger, Cosmic rejection, FILFO, Stream K_0
- K_L-crash: one isolated cluster (no track associated)
  E_{cr}>100MeV, 0.18<beta<0.27
- K_S ID: two tracks of opposite charge, determining one vertex in a cylinder R<5cm,|z|<10cm
- $\pi^+\pi^-$ selection and count
- Ks3 selection from bkg

K_S3 SELECTION

- Preselection: Trigger, Cosmic rejection, FILFO, Stream K_0
- K_L crash && Ks tag
- $\pi^+\pi^-$ selection and count
- Ks3 selection from bkg (mainly $\pi^+\pi^-$)
  - MVA Preselection
    - 2TCA, -95<dp<190, 15<teta_ks<165, 15<teta_crash<165, p<330
  - MVA analysis (no dtof)
  - Dtof analysis
  - Fit on M^2 to extract $N_{\pi en}$

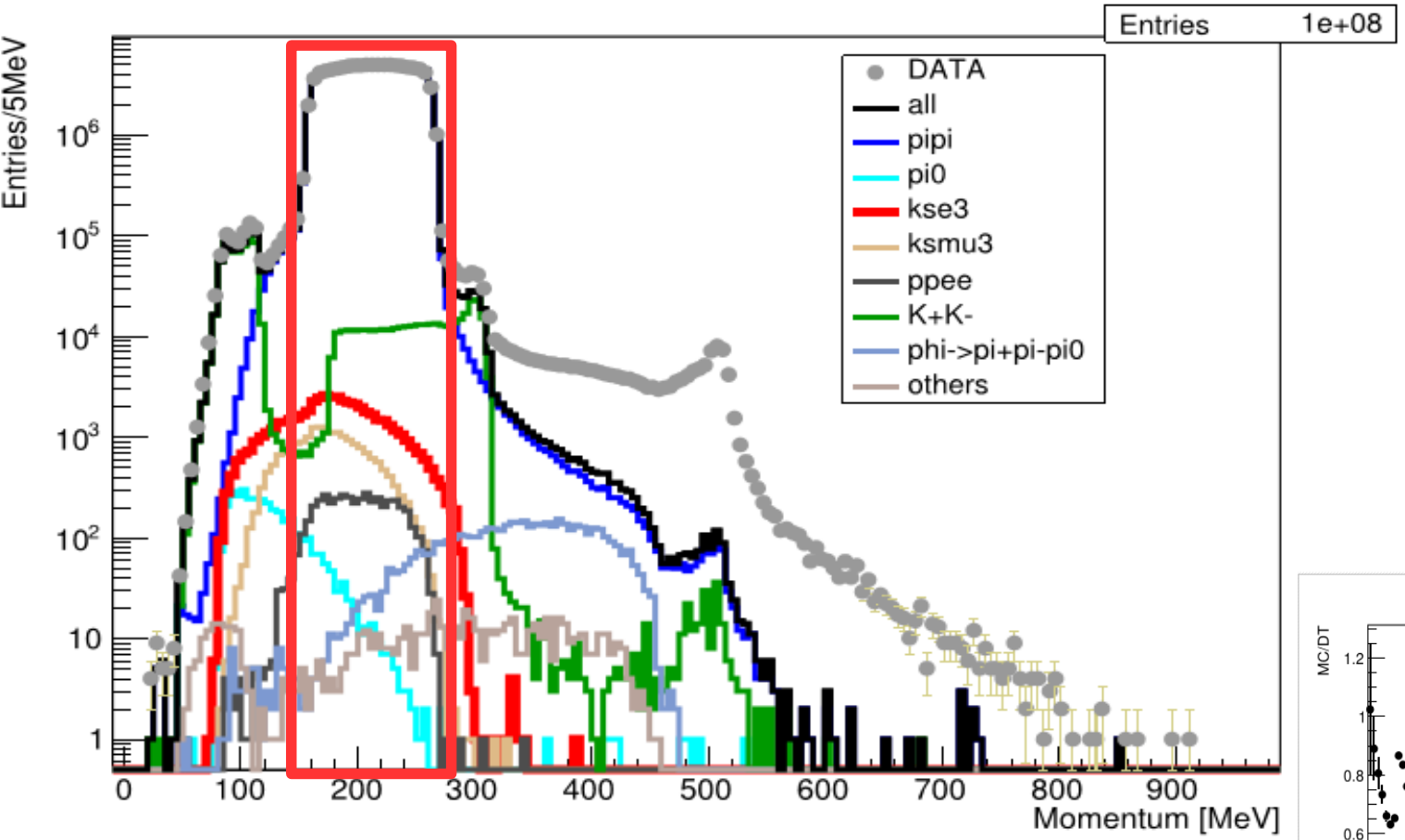
Eff from MC

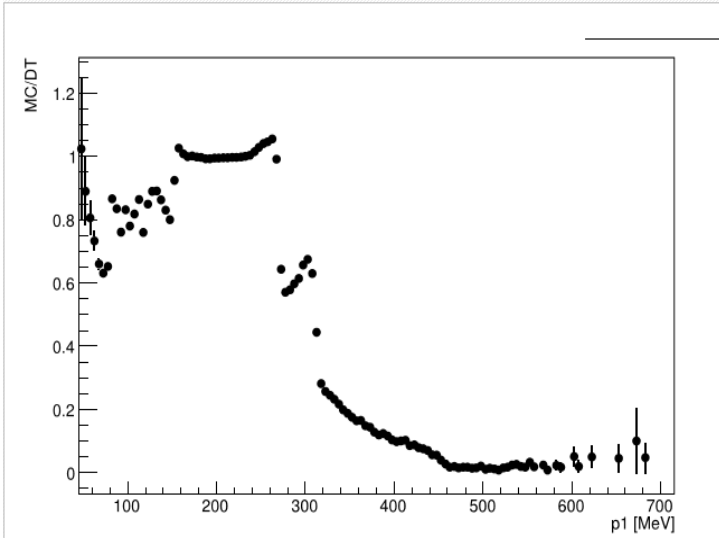
III

SELECTION & EFFICIENCY

$K_S3\pi\pi$ SELECTION

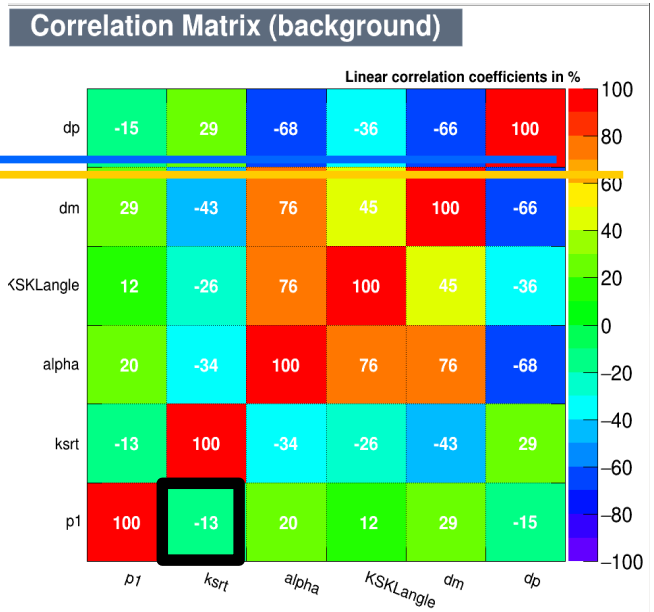
$\pi\pi$ selected with a cut on the track momentum
140<|p|<280 MeV

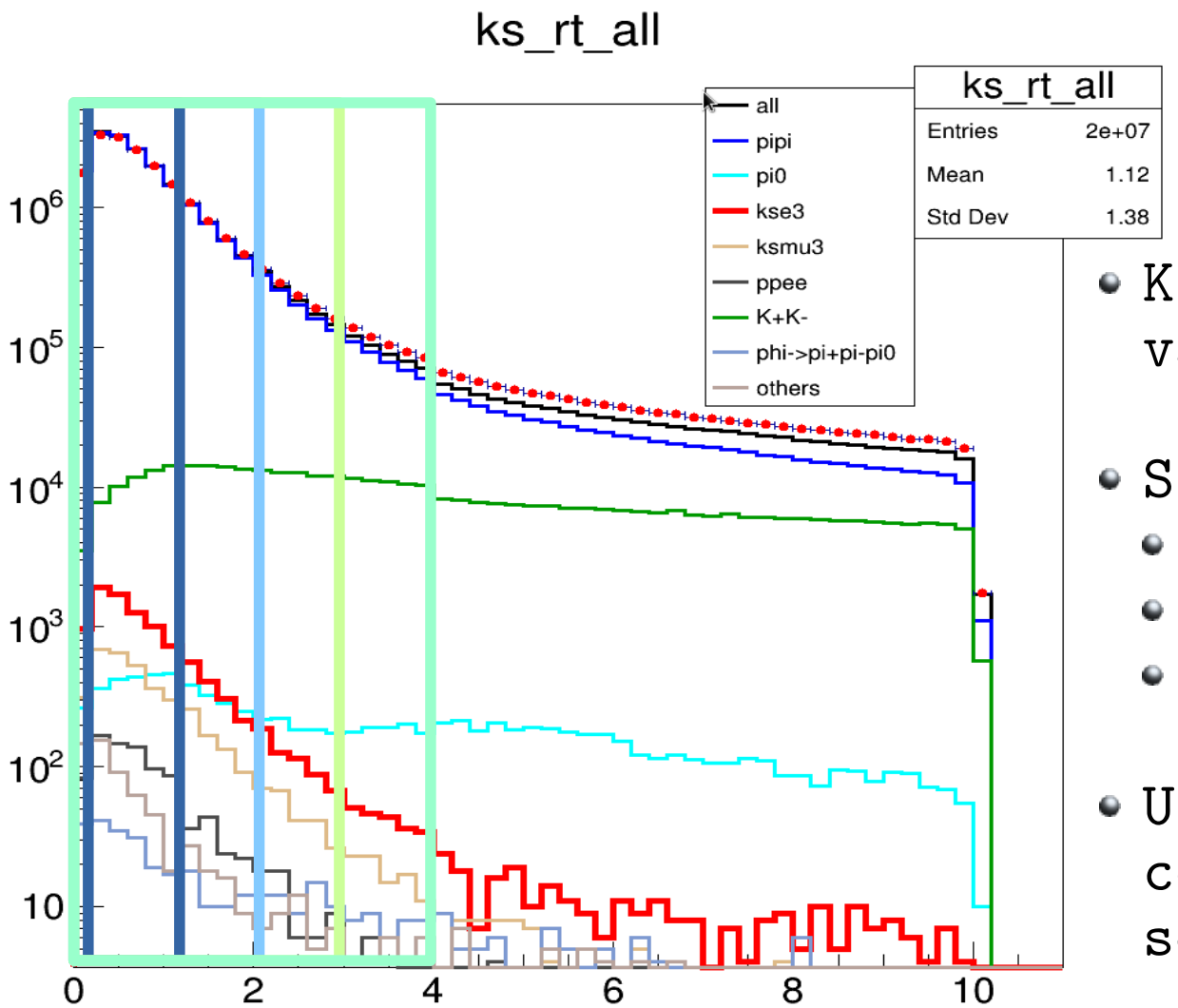




ππ CONTROL SAMPLE

- ππ control samples from DATA, cutting on Ks_rt, vertex position in transverse plane





- Ks_rt correlation with p variable is -13%
- Scan in Ks_rt:
  - Ks_rt<1cm purity 98%
  - Ks_rt<2cm purity 97%
  - ..
- Use these pure samples to compute efficiency on p-cut selecting pipi

ππ CONTROL SAMPLE _ EFF

$\epsilon_{DT(Kse3)} = \epsilon_{DT(CS)} * (\epsilon_{MCch(Kse3)}/\epsilon_{MCch(CS)}) * p/q = \epsilon_{(CS)} * p/q$

ρ_{VTX} $[cm]$	purity %	$140 < \|p\| < 280$ MeV efficiency %
$\rho_{VTX} < 5$	96.79	96.657 ± 0.002
$\rho_{VTX} < 4$	97.12	96.772 ± 0.002
$\rho_{VTX} < 3$	97.63	96.933 ± 0.002
$\rho_{VTX} < 2$	98.23	97.125 ± 0.002
$\rho_{VTX} < 1.5$	98.58	97.234 ± 0.002
$\rho_{VTX} < 1$	98.96	97.339 ± 0.002

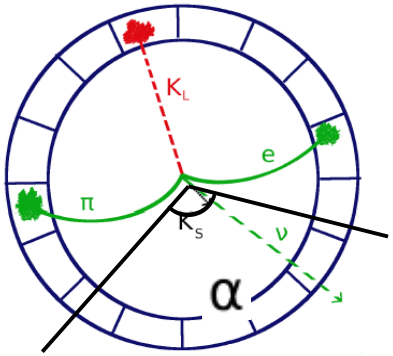
- $\epsilon_{\pi\pi}$
  - Direct from data with purity correction $\epsilon_{\pi\pi}$=96,66%
  - Extrapolation of the ϵ from different CS, $\epsilon_{\pi\pi}$=96,56%
  - First preferred (less bias), difference as systematic
- $N_{\pi\pi} = N_{\pi\pi}(140<|p|<280,rt<5)/\epsilon_{\pi\pi} = 292077295$

K_S3 SELECTION

- Preselection: Trigger, Cosmic rejection, FILFO, Stream K_0
- K_L crash && Ks tag
- $\pi^+\pi^-$ selection and count
- Ks3 selection from bkg (mainly $\pi^+\pi^-$)
    - MVA Preselection

BDT INPUT VARIABLE

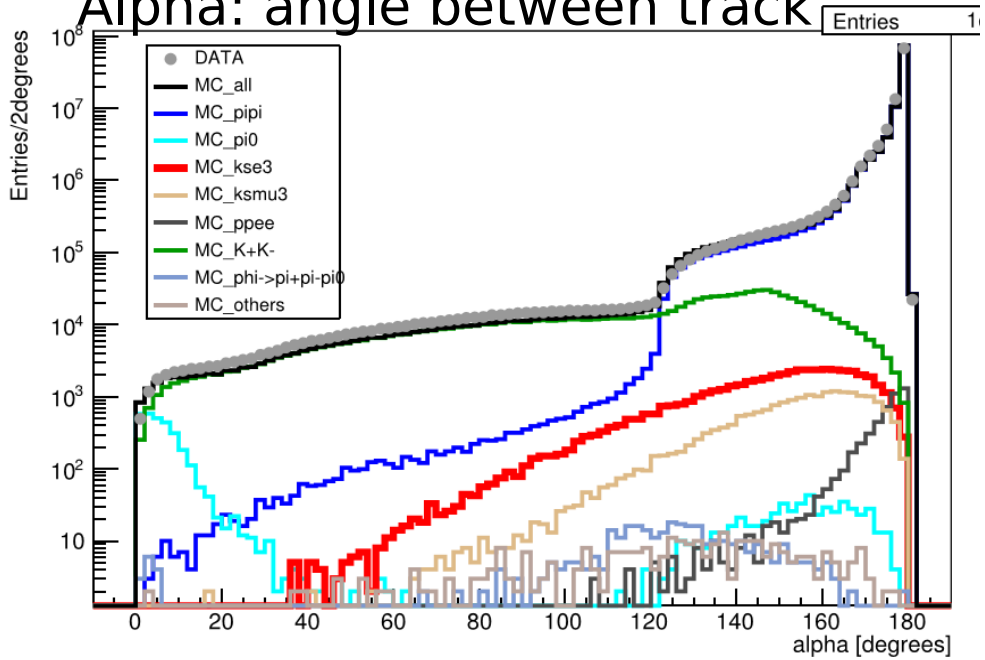
VARIABLE DESCRIPTION



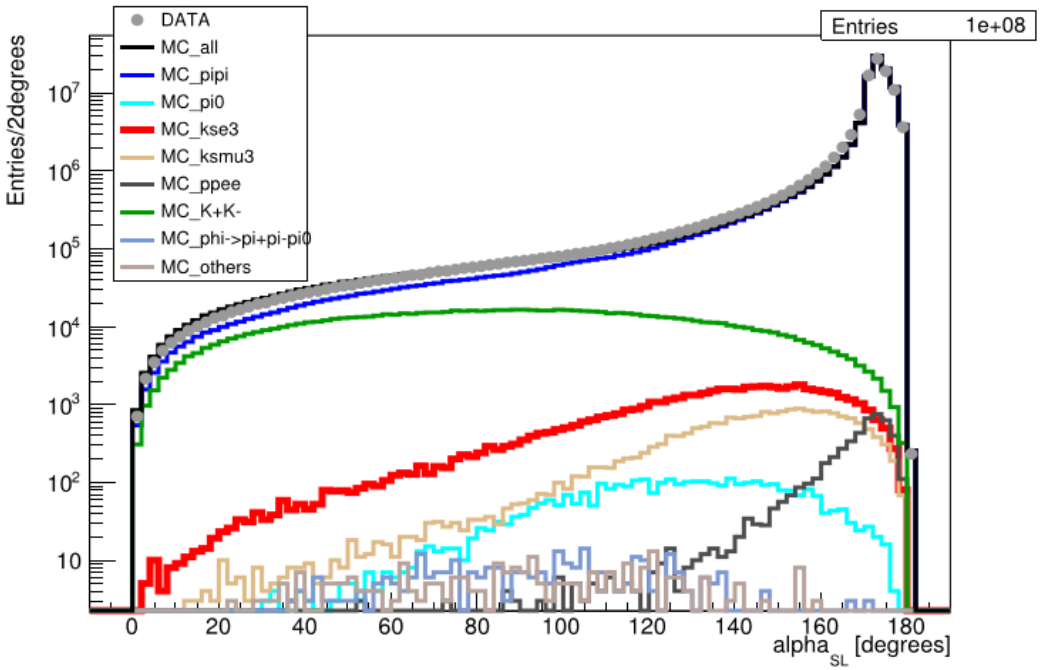
- Teta_cr: teta angle of the crash cluster
- Teta_Ks: teta angle of the cluster associated to Ks daughter
- Ks_rt: Ks vertex (from 2 track) position in xy plane
- α: angle between the 2 tracks in Ks CM
- α_{SL}: angle between crash direction and Ks direction from Ks vertex tracks (mostly ππ)
- $M_{inv}(\pi\pi)$: invariant mass recostructed from the 2 tracks from Ks vertex ($\pi^+\pi^-$ mass hypothesis)
- dp: difference between momentum of the Ks from the two track and from K_L-crash

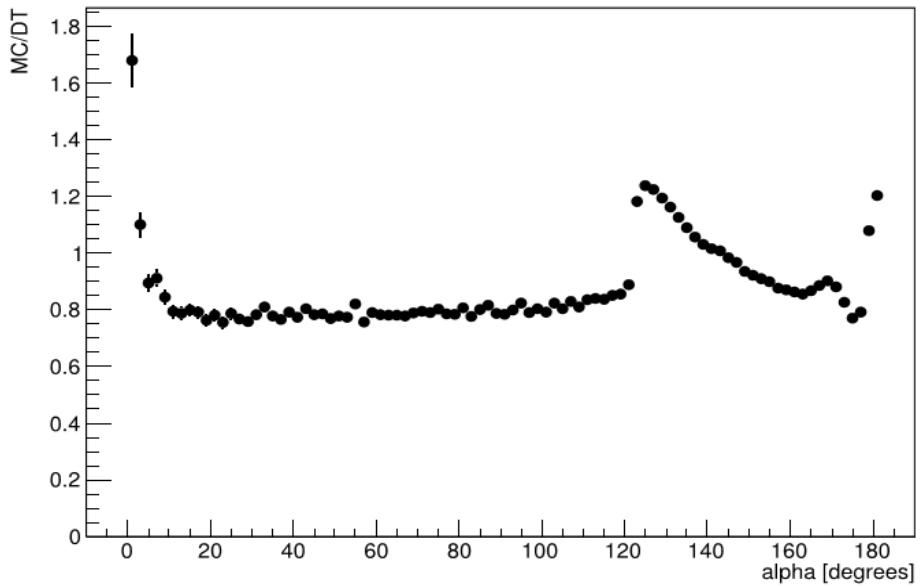
K_S3 BDT INPUT VARIABLE

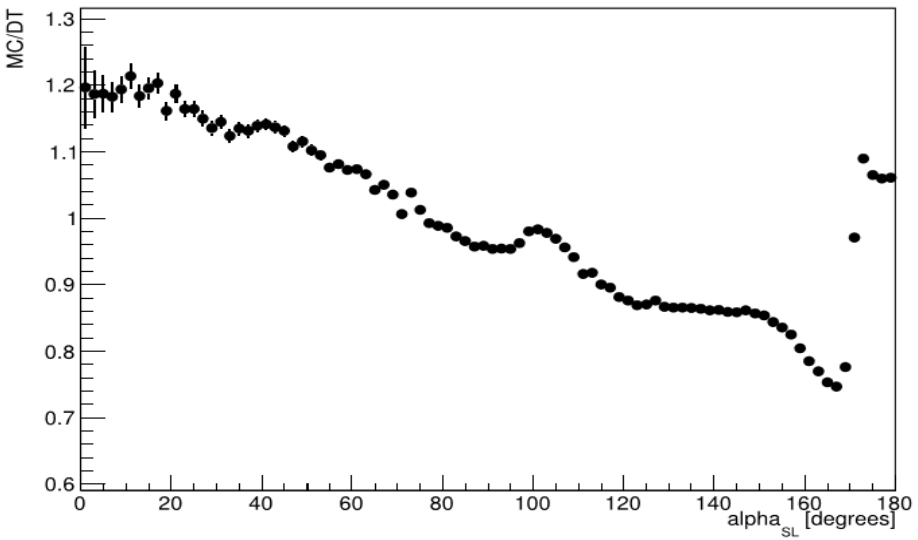
Alpha: angle between track



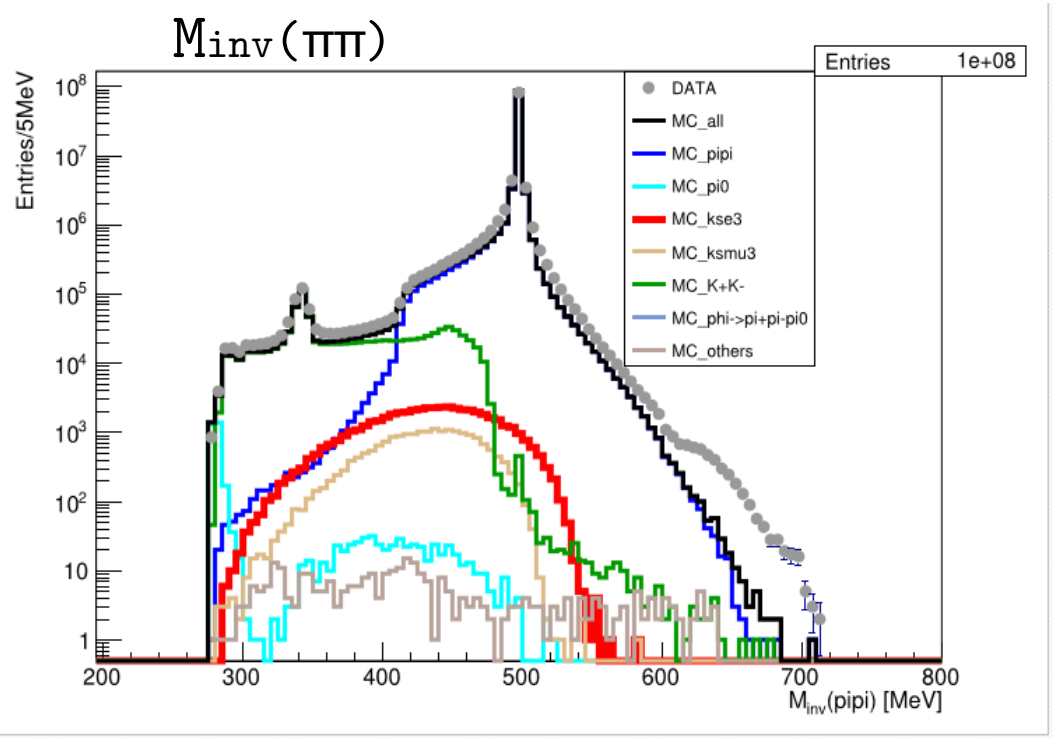
AlphaSL: angle between Ks-KL

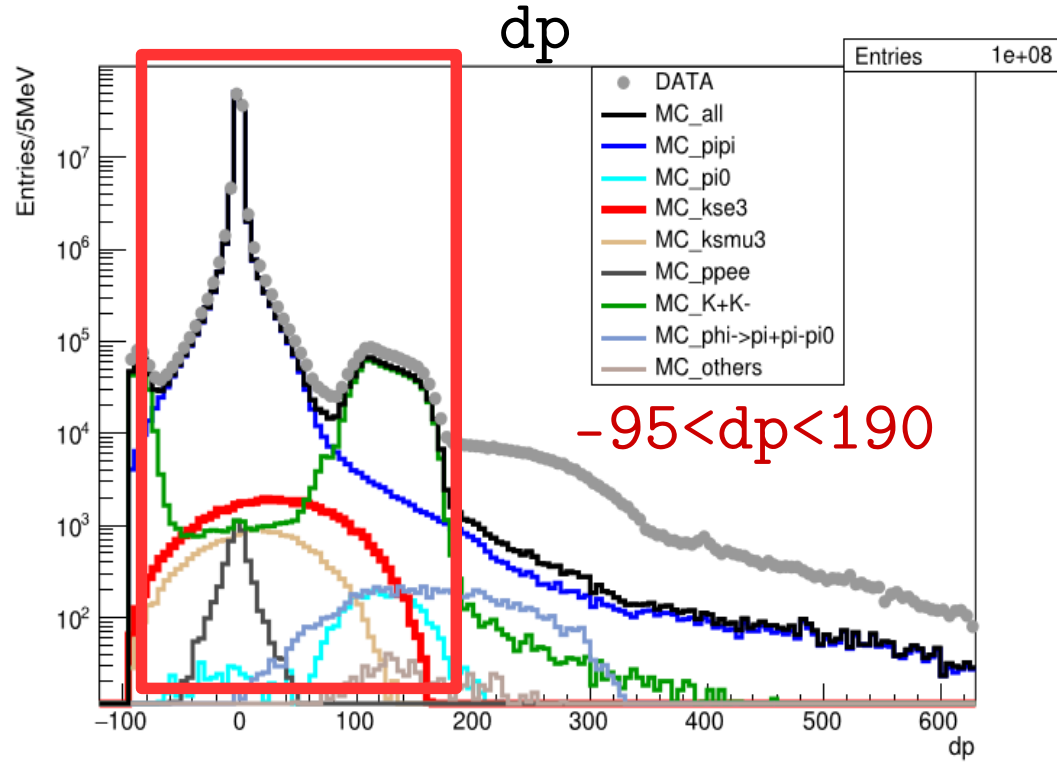


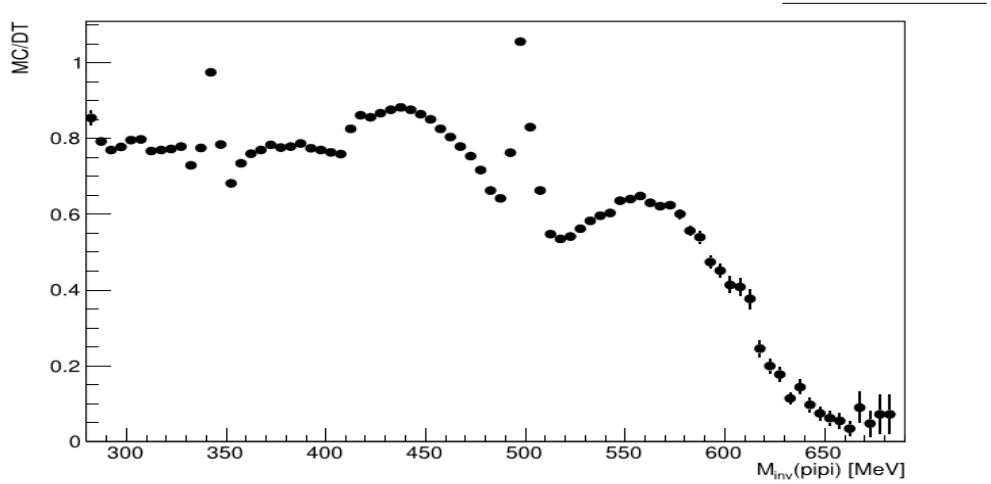


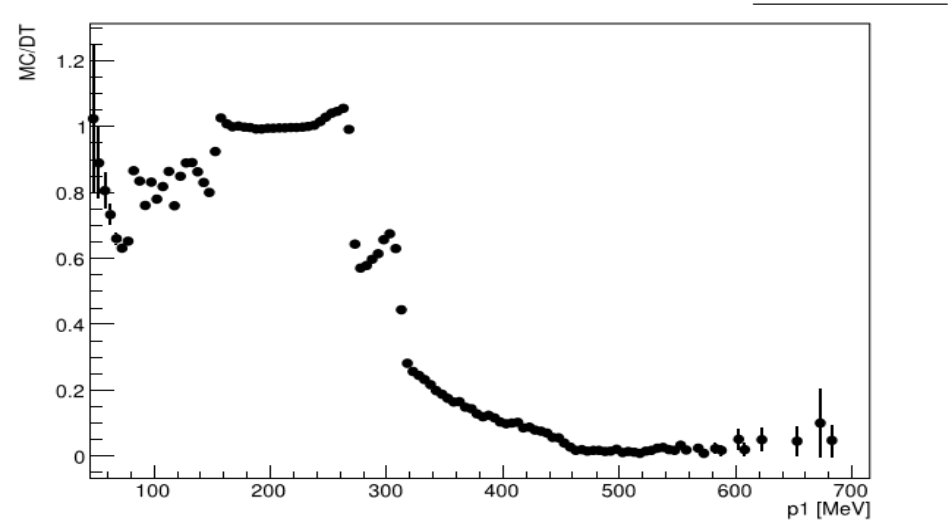


K_S3 BDT INPUT VARIABLE



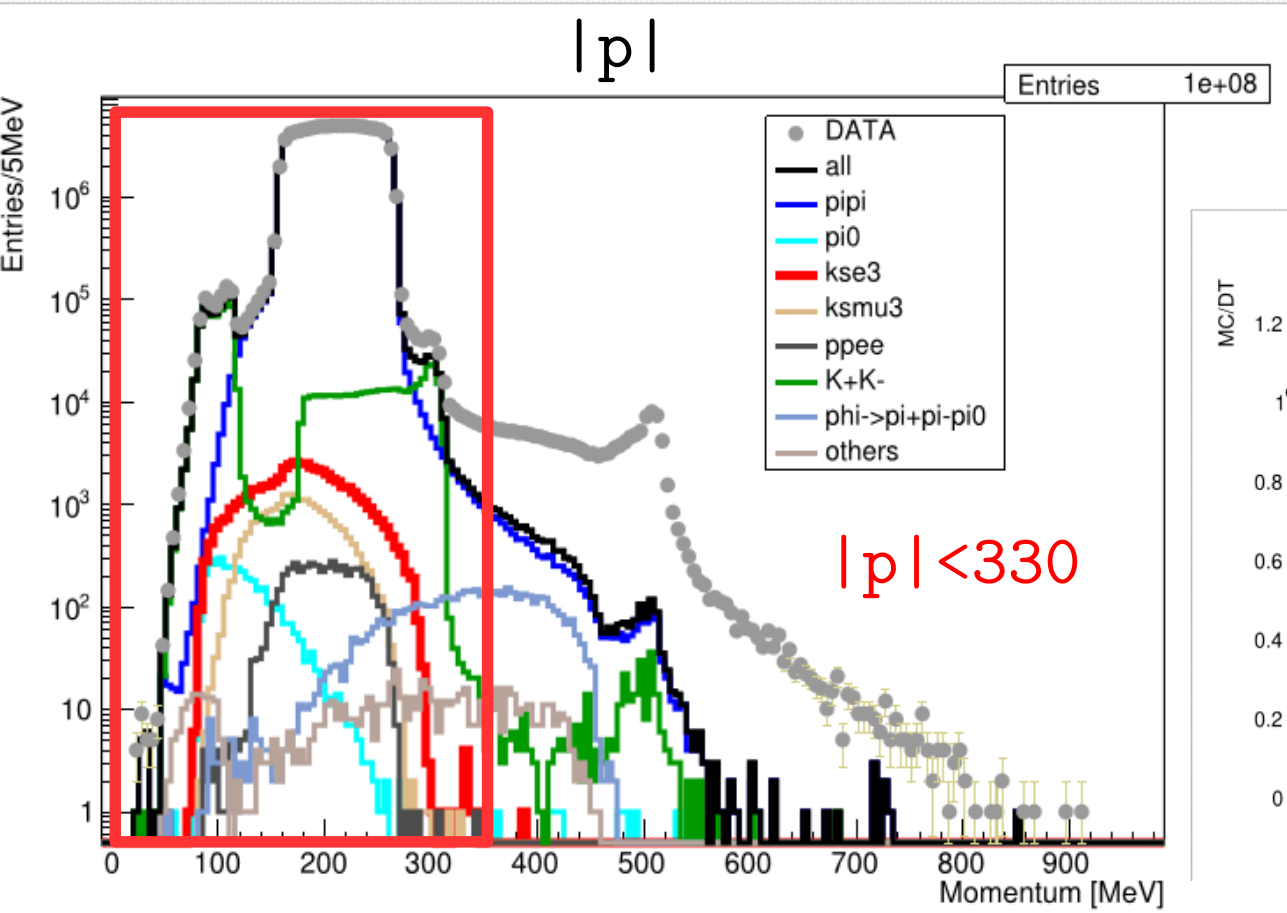


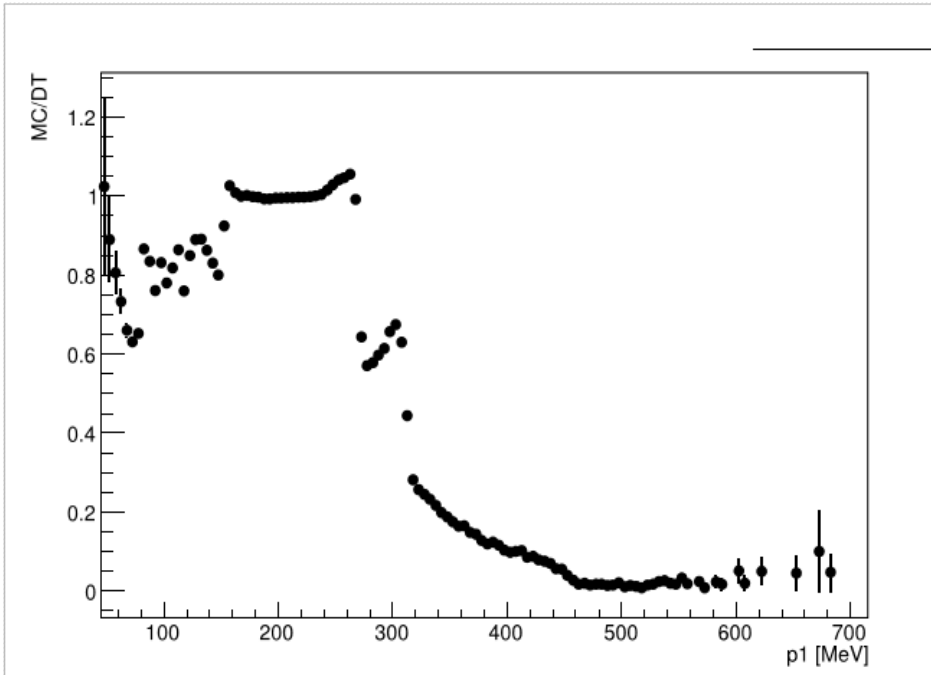




Eff from MC

Ks3 BDT INPUT VARIABLE



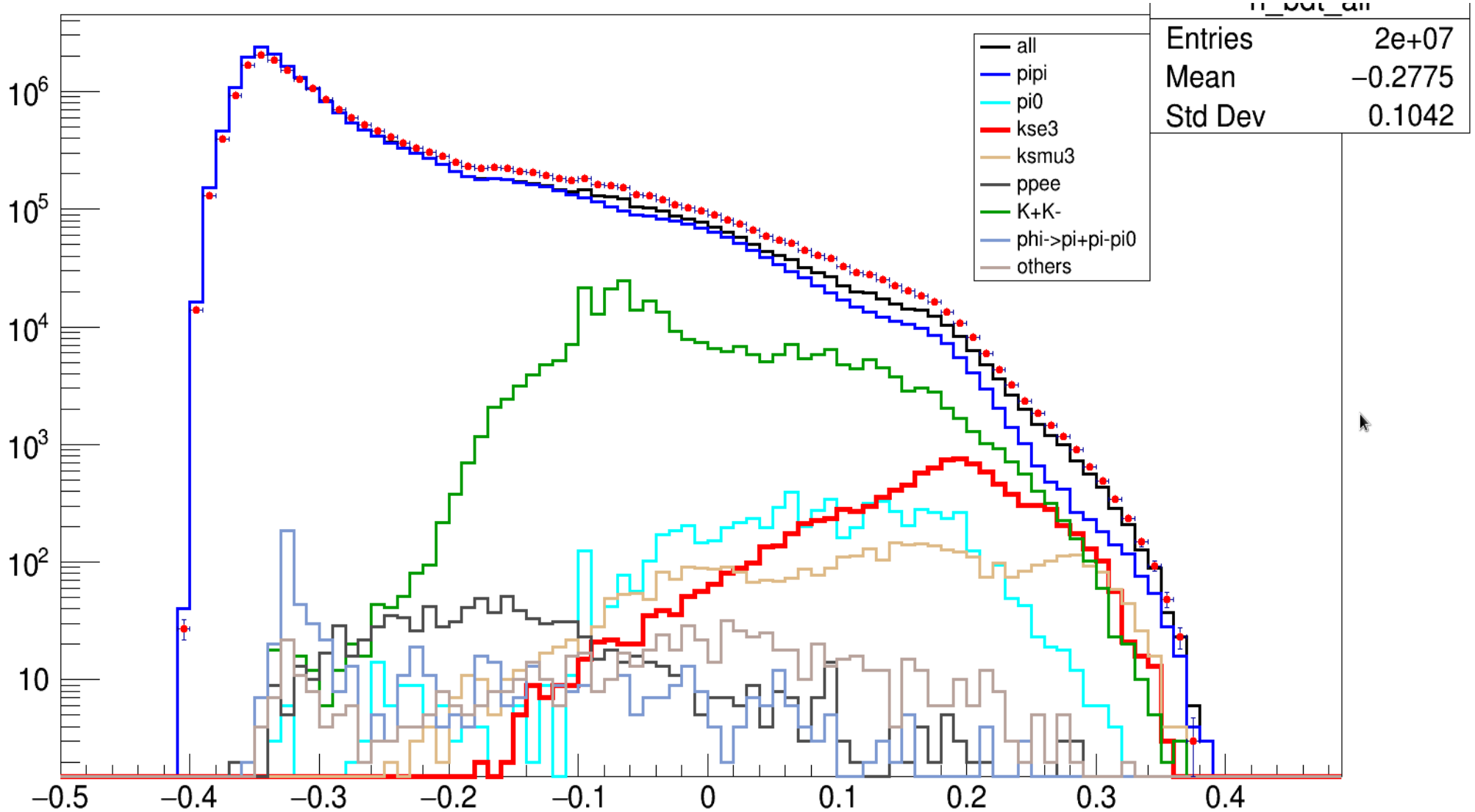


Kse3 ANALYSIS

Kse3 ANALYSIS SCHEME

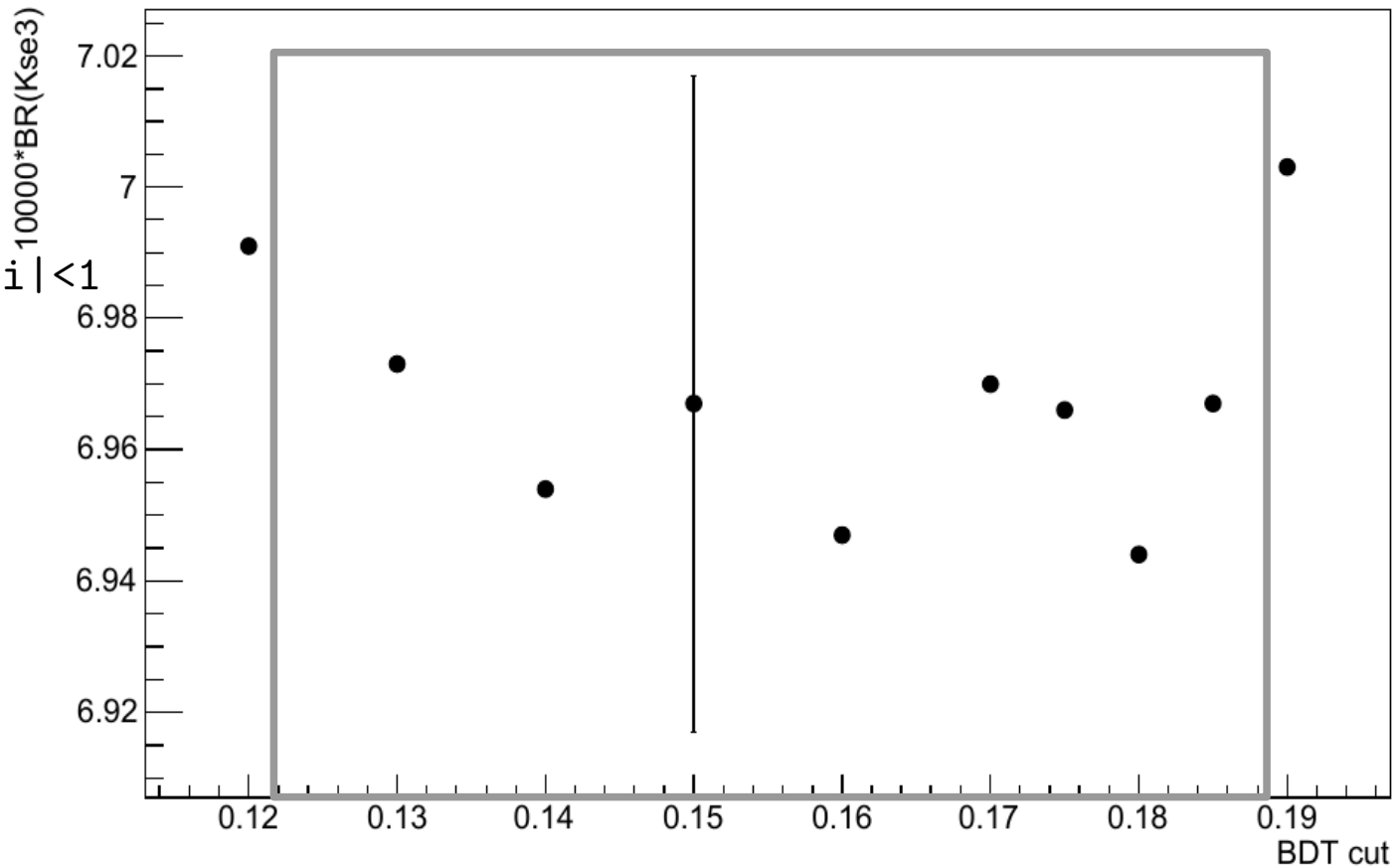
- Preselection: Trigger, Cosmic rejection, FILFO, Stream K_0
- K_L crash && Ks tag
- $\pi^+\pi^-$ selection and count
- Kse3 selection from bkg (mainly $\pi^+\pi^-$)
  - MVA Preselection
    - 2TCA, -95<dp<190, 15<teta_ks<165, 15<teta_crash<165, p<330
  - MVA analysis

Kse3 BDT


Entries 2e+07
Mean −0.2775
Std Dev 0.1042
all
pipi
pi0
kse3
ksmu3
ppee
K+K-
phi->pi+pi-pi0
others
10^6
10^5
10^4
10^3
10^2
10
−0.5
−0.4
−0.3
−0.2
−0.1
0
0.1
0.2
0.3
0.4

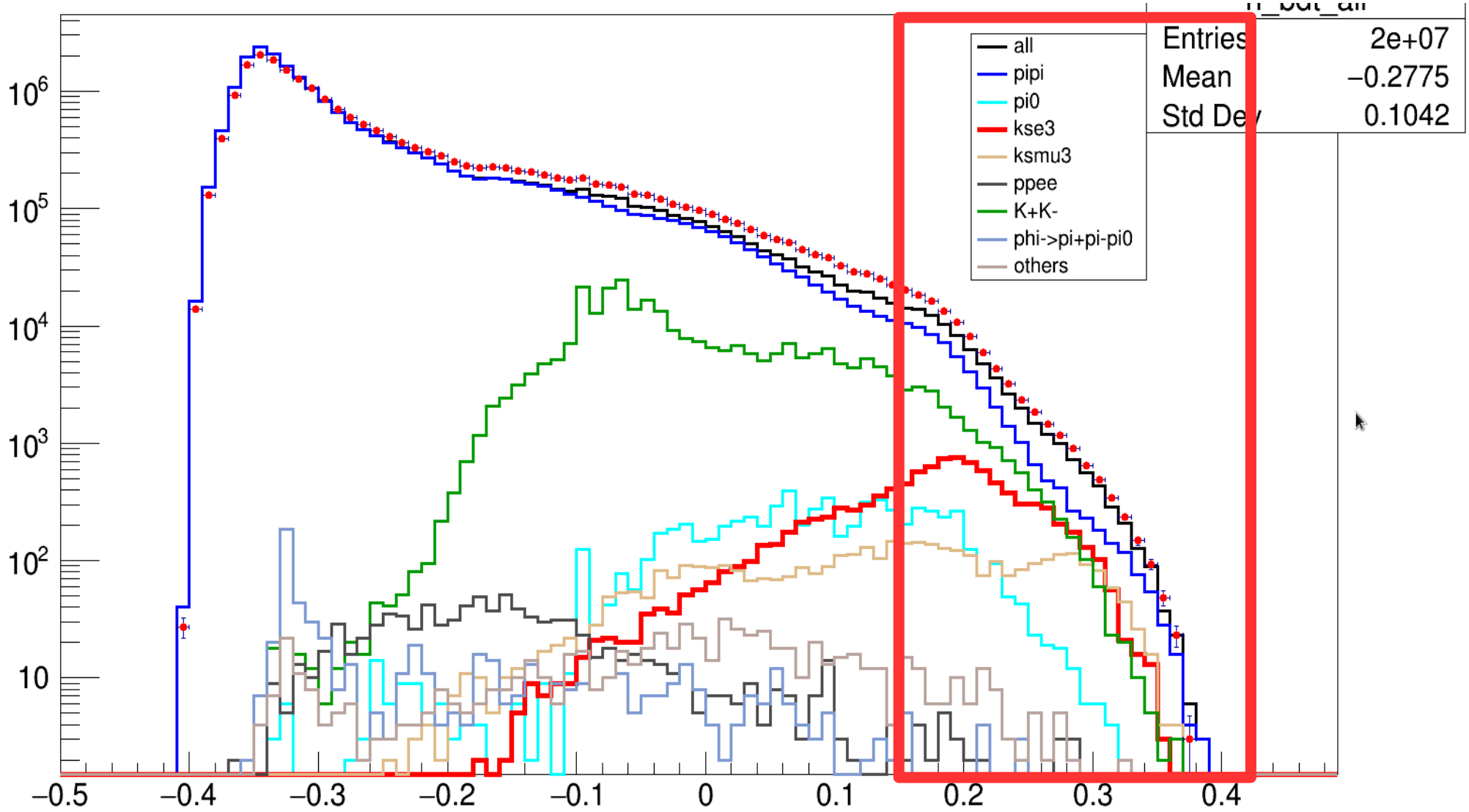
Kse3 BR vs BDT_CUT

- BDT SCAN
- Following Cut:
  - 1<|dDTOFpipi|<10
  - |dDTOFpie|<1 || |dDTOFepi|<1



- BDTcut>0.15:
  best compromise between Chi^2, stat err and s/sqrt(s+b)
- NEW BDT systematic RMS of value with:
  - Chi^2<4
  - s/sqrt(s+b)>170
- 0.19% (was 0.11%, only ±1sigma), but more robust

Kse3 BDT


all
pipi
pi0
kse3
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K+K-
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10^6
10^5
10^4
10^3
10^2
10
−0.5
−0.4
−0.3
−0.2
−0.1
0
0.1
0.2
0.3
0.4

Kse3 ANALYSIS SCHEME

- Preselection: Trigger, Cosmic rejection, FILFO, Stream K_0
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- $\pi^+\pi^-$ selection and count
- Kse3 selection from bkg (mainly $\pi^+\pi^-$)
  - MVA Preselection
    - 2TCA, -95<dp<190, 15<teta_ks<165, 15<teta_crash<165, p<330,
  - MVA analysis (no dtof)
    - BDT>0.150

Eff from MC

Kse3 ANALYSIS SCHEME

- Preselection: Trigger, Cosmic rejection, FILFO, Stream K_0
- K_L crash && Ks tag
- $\pi^+\pi^-$ selection and count
- Kse3 selection from bkg (mainly $\pi^+\pi^-$)
  - MVA Preselection
    - 2TCA, -95<dp<190, 15<teta_ks<165, 15<teta_crash<165, p<330,
  - MVA analysis (no dtof)
    - BDT>0.150
  - DTOF Analysis

Eff from MC

Kse3 DTOF ANALYSIS

- TCA needed on both clusters
- Time of Flight (TOF) differences

$$DTOF_i = T_{cl,i} - L_i/(c*\beta_i(m_x))$$

very good time resolution of the EMC (300 ps for 200MeV particle)

$\beta = p/sqrt(p^2+m_x^2)$

L=Track length

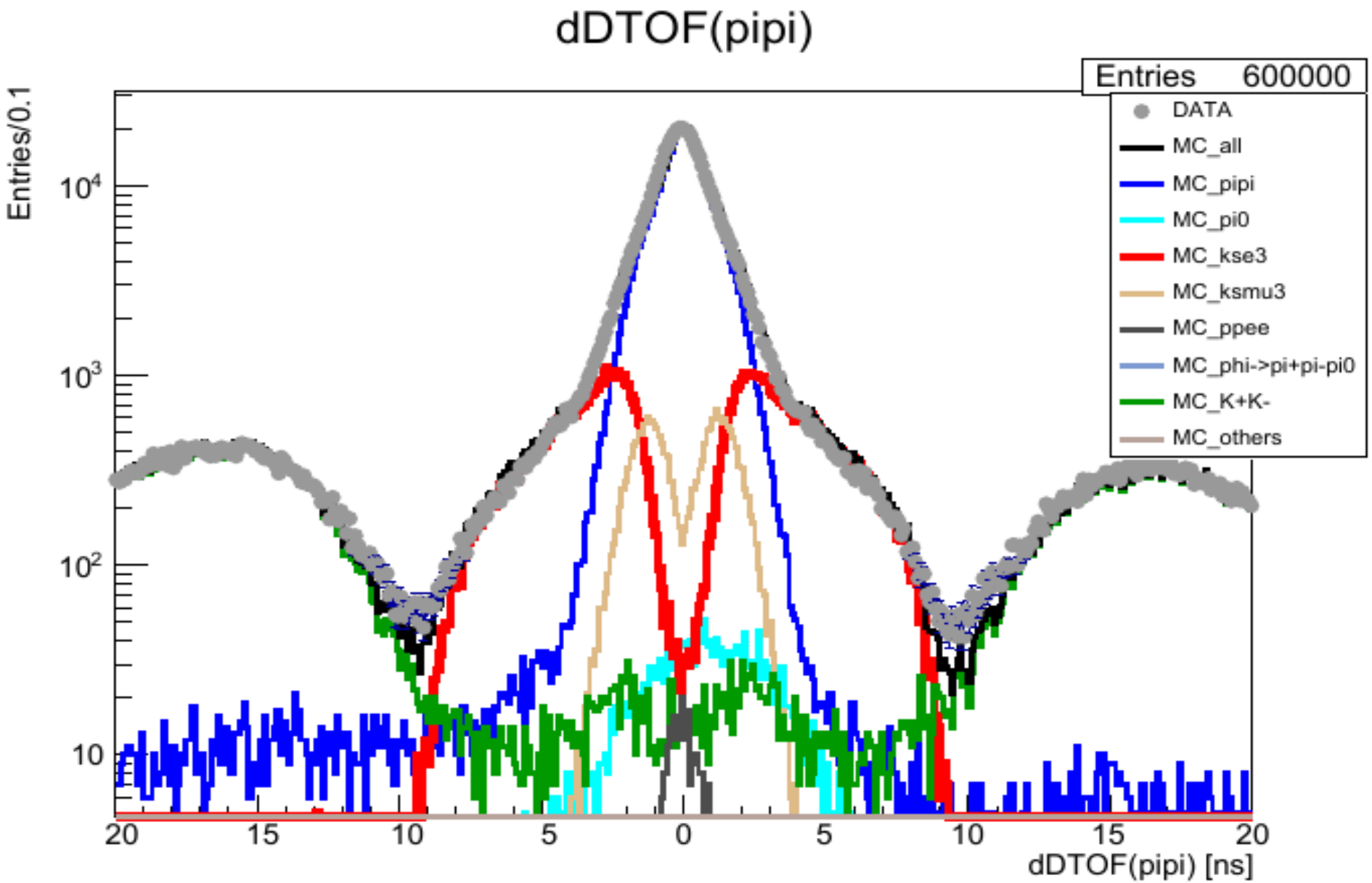
T_{cl} = time of the associated cluster

- $dDTOF = DTOF_1 - DTOF_2$ to avoid error in the T0 event time (bunch crossing related)

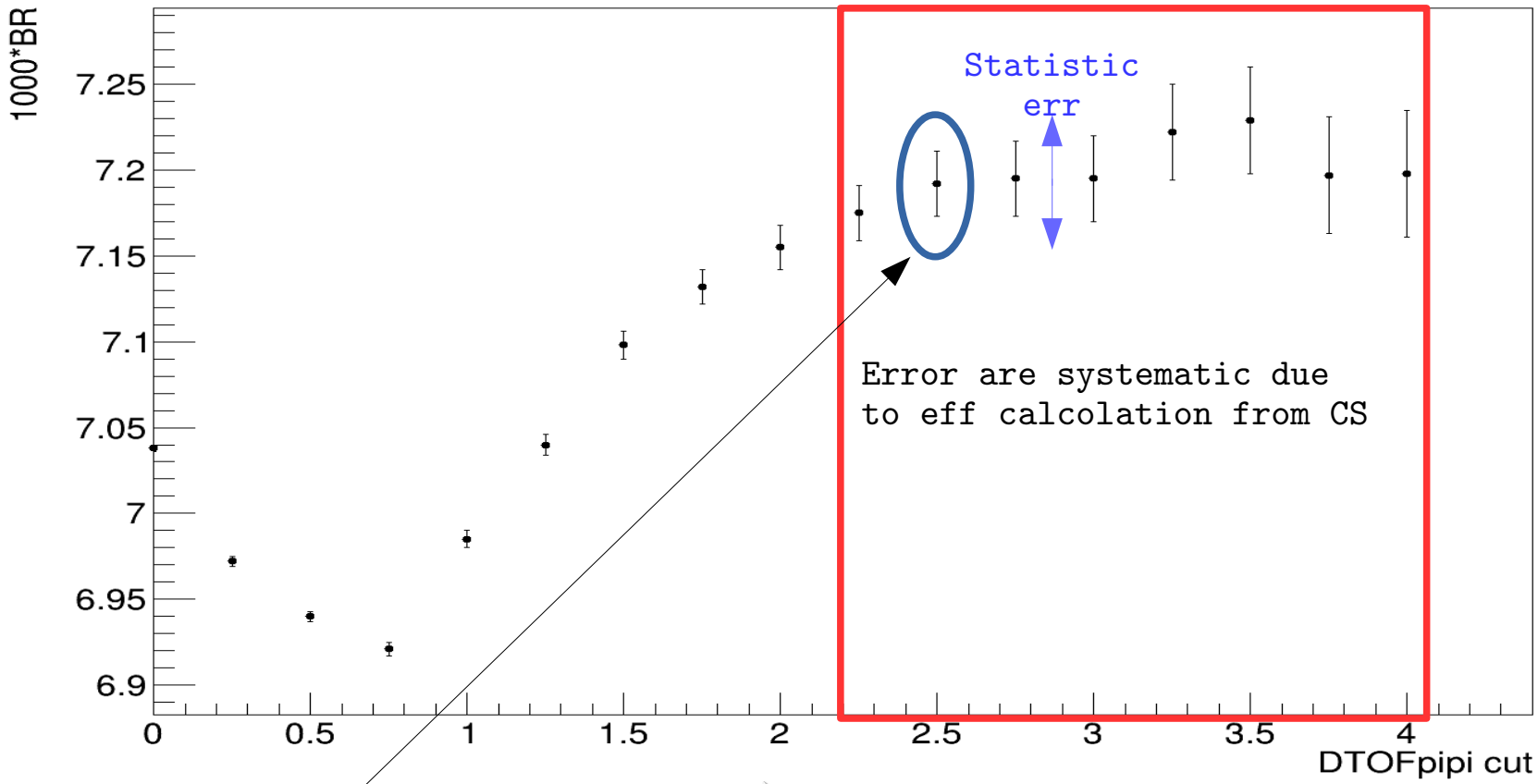
Computed for different mass hypotesis

- Under ππ mass hypothesis: for ππ dDTOF~0, bkg
- For others events, both the πe and eπ are tested: dDTOF~0 will be the correct hypothesis

Kse3 DTOFpipi



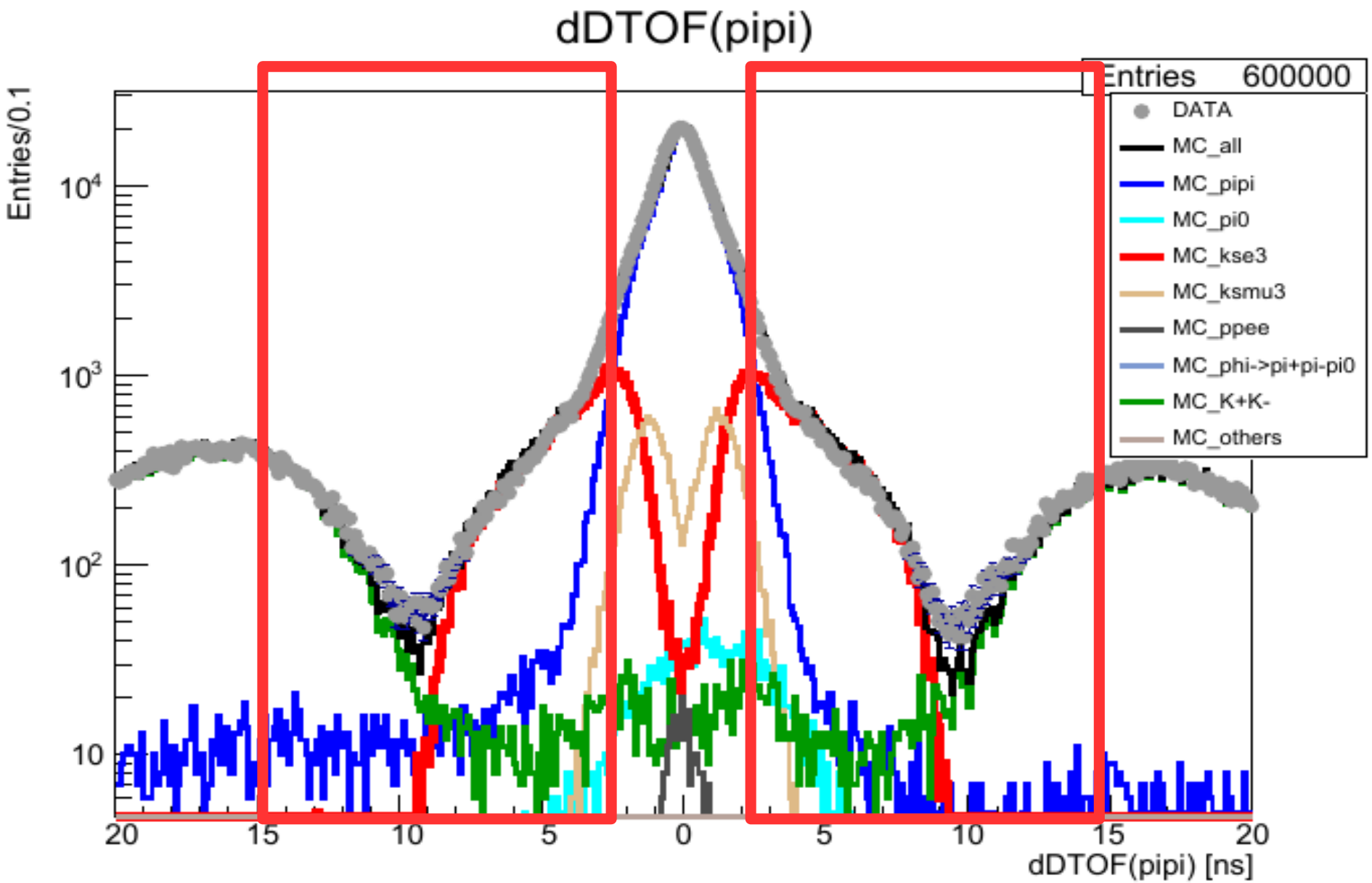
Kse3 DTOFpipi LOW CUT SCAN



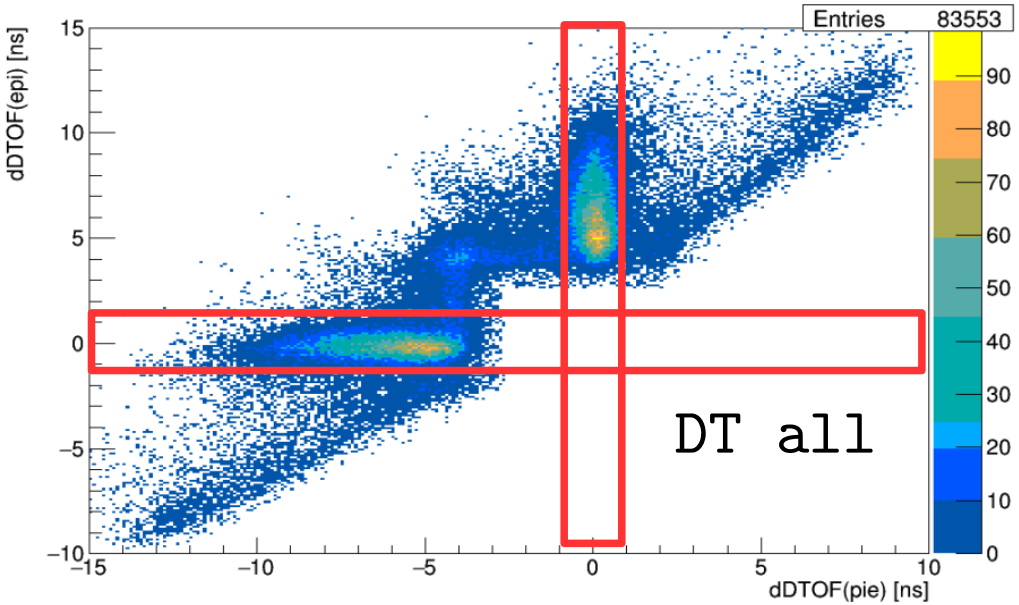
- |DTOFpipi|>2.50: |dDTOFpie|<1 || |dDTOFepi|<1
  best statistical error and s/sqrt(s+b)

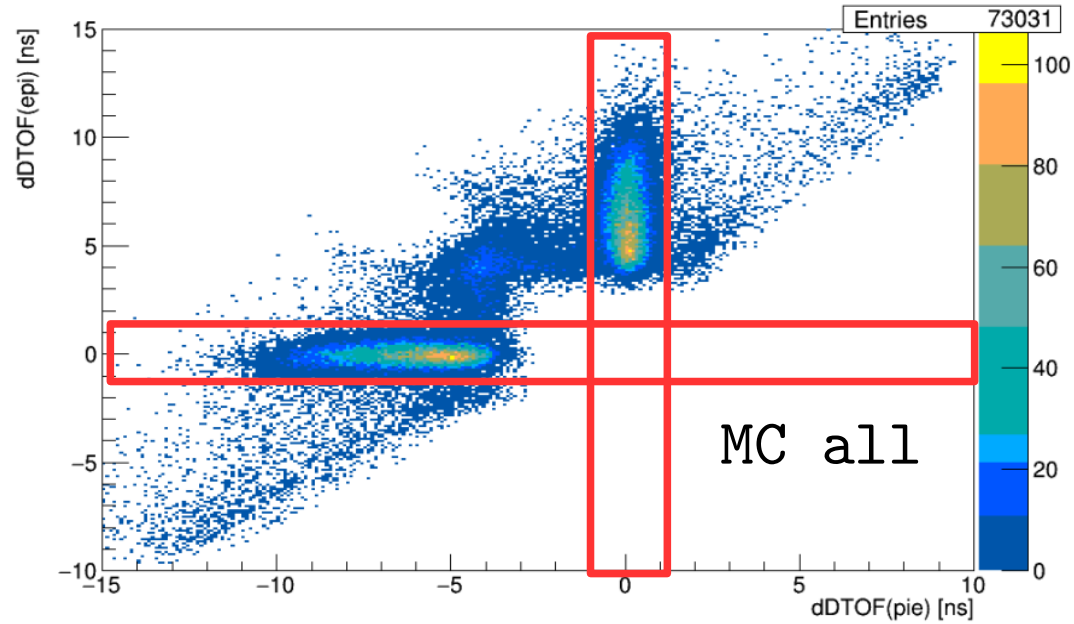
- NEW BDT systematic RMS of value in plateau (box):
  - 0.273% (was 0.19%, with smearing method)
    but more robust

Kse3 DTOFpipi NEW CUT

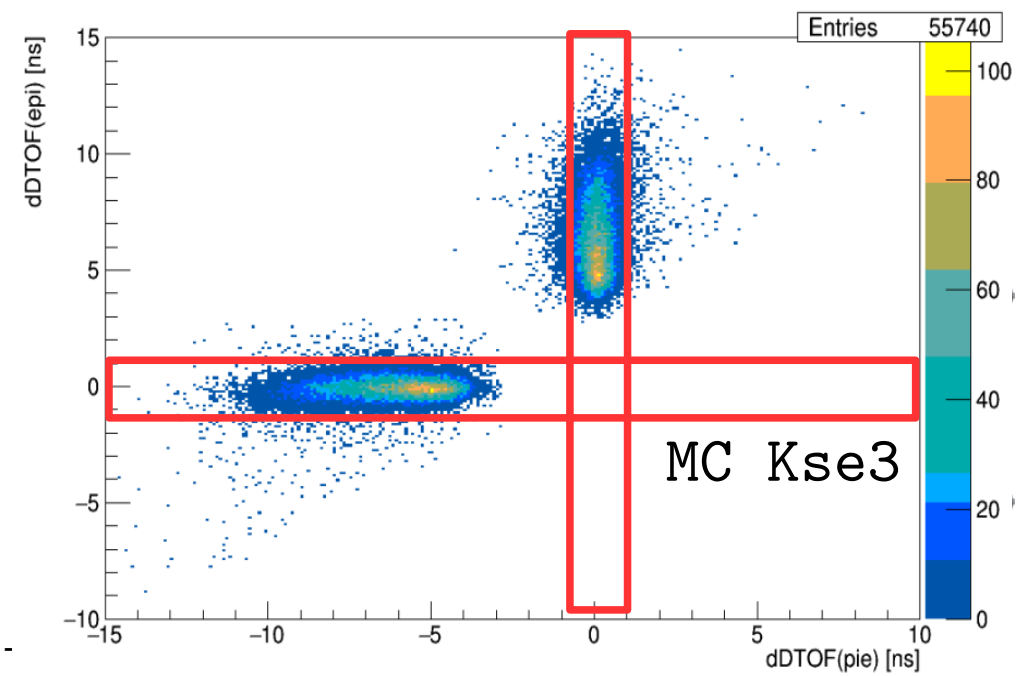


Kse3 DTOFpie SELECTION





|DTOFPIe|<1 || |DTOFePI|<1



Kse3 ANALYSIS SCHEME

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  - MVA Preselection
    - 2TCA, -95<dp<190, 15<teta_ks<165, 15<teta_crash<165, p<330,
  - MVA analysis (no dtof)
    - BDT>150
  - DTOF analysis
    - 2.5<|DTOFPIPI|<10
    - |DTOFPIe|<1 || |DTOFePI|<1

Eff from MC

Kse3 SMEARING

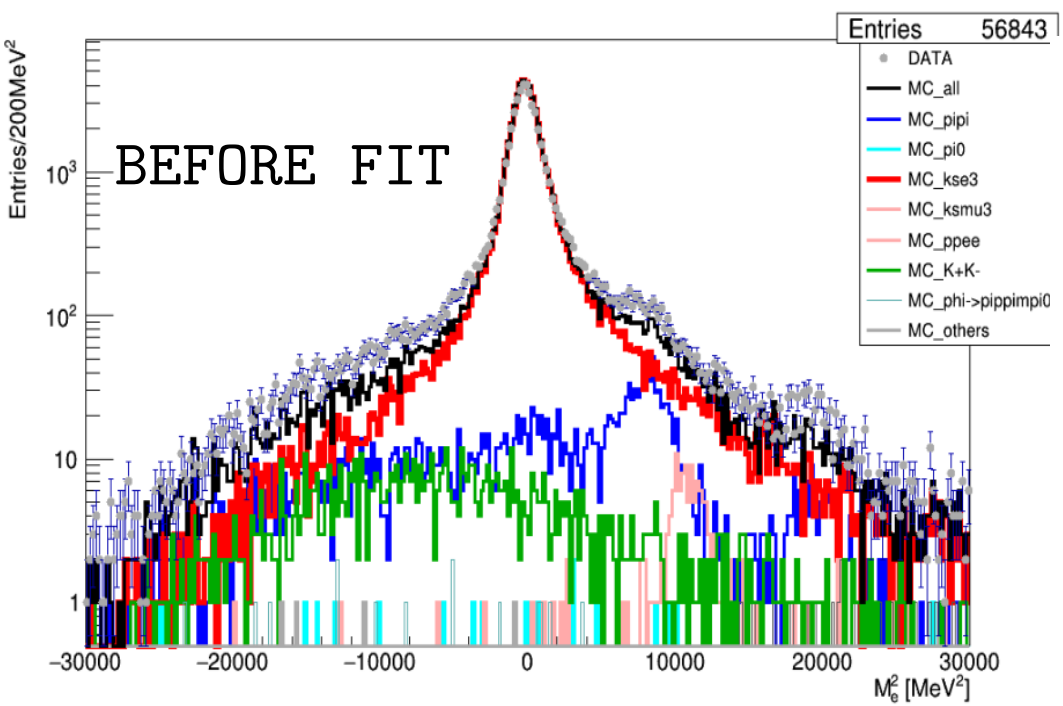
- SMEARING PROCEDURE BEFORE FIT to increase DT-MC agreement and Chi^2 of the fit

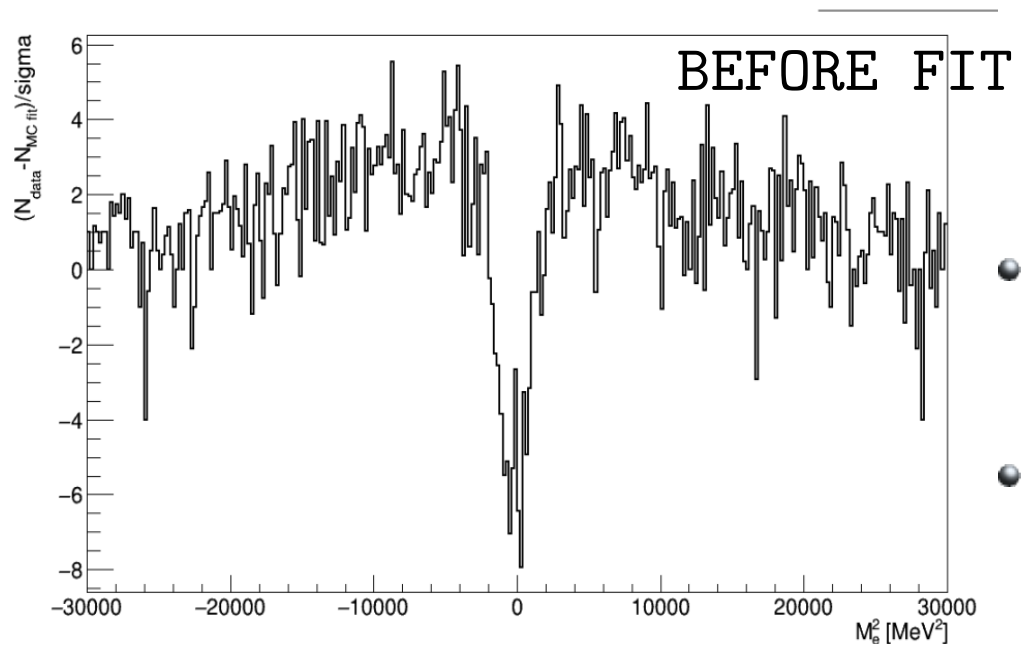
$$p_i(j)' = p_i(j) \times (1 + p_{\text{shift}}) \times (1 + ranG(0, 0.004))$$

$$i = e, \pi; \quad j = x, y, z$$

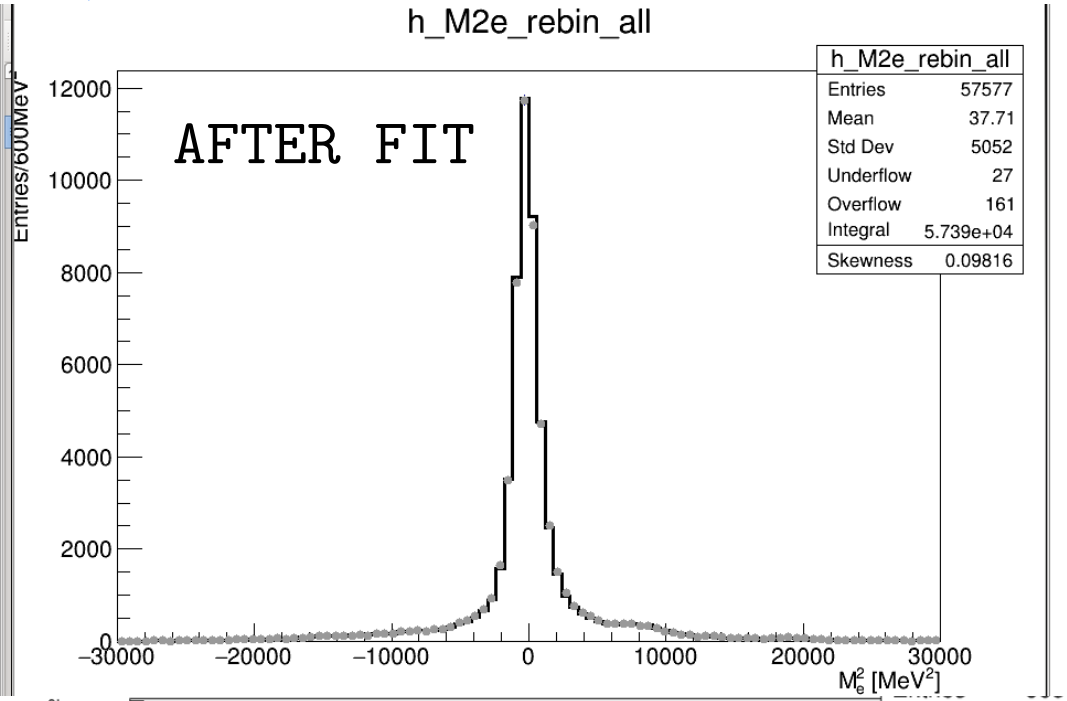
$p_{\text{shift}} = 0.00013705$ and $ranG(\mu, \sigma)$ is a Gaussian distributed number.

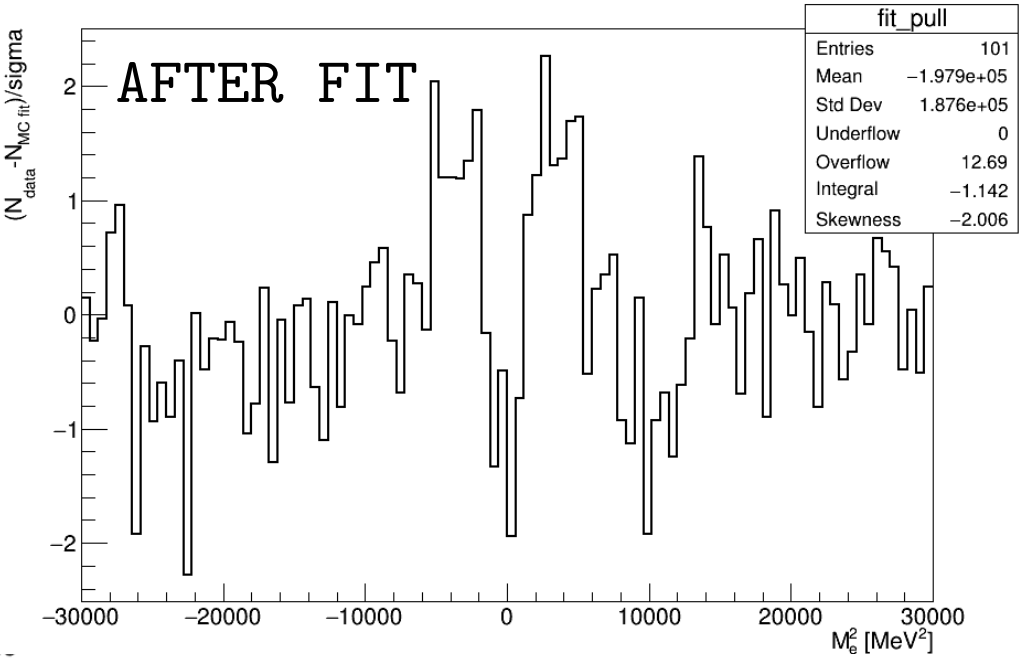
- Fit on electron invariant mass $M_e^2 = (E_{K_S\text{tag}} - E_\pi - p_{\text{mis}})^2 - p_e^2$

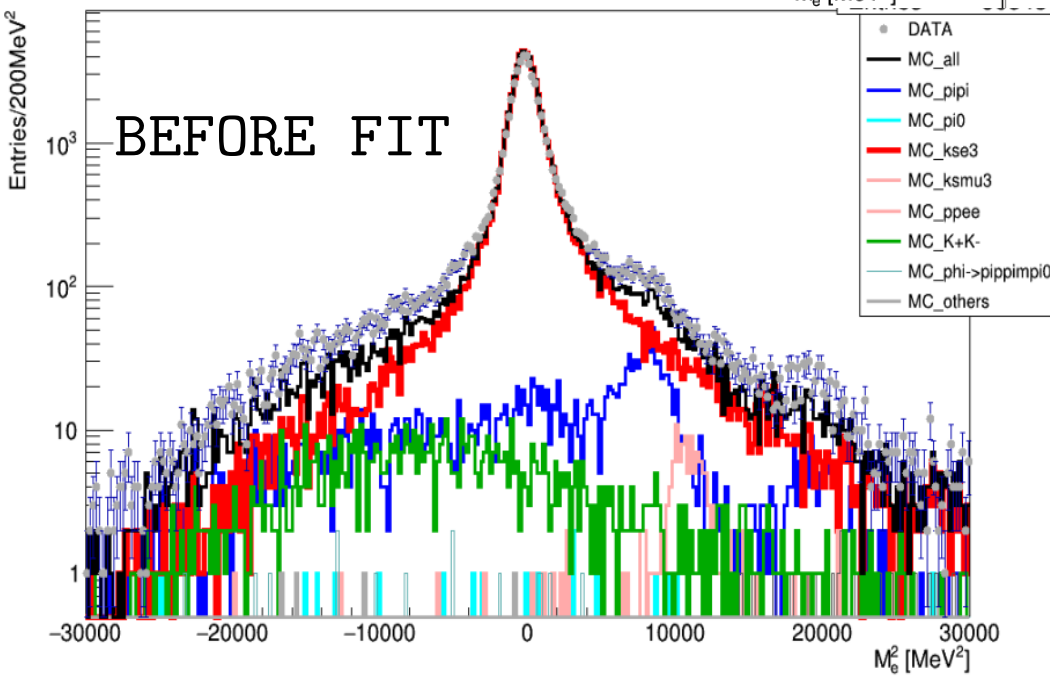


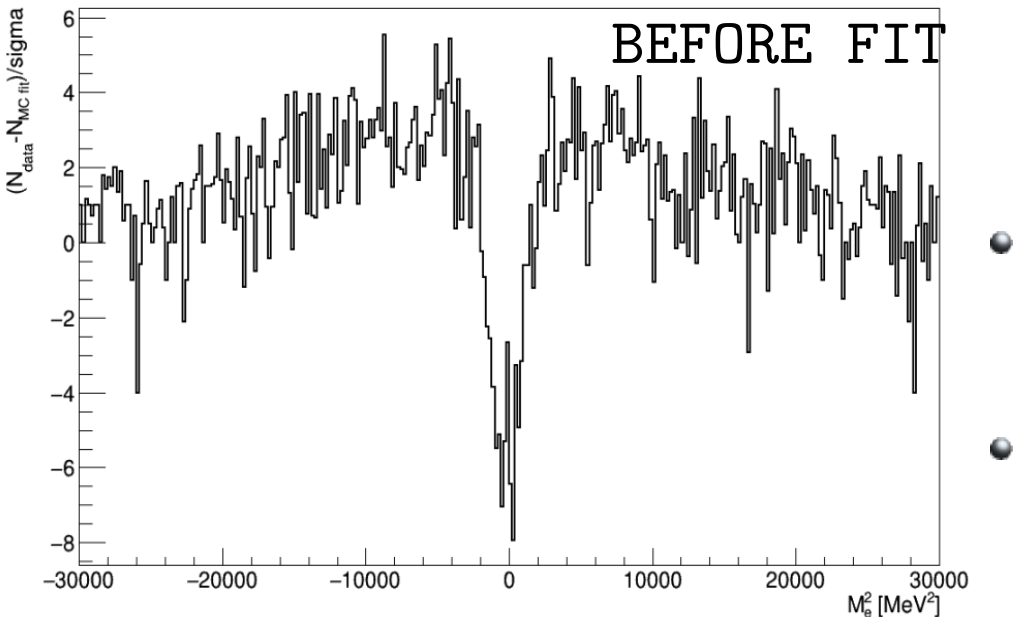


Kse3 FIT

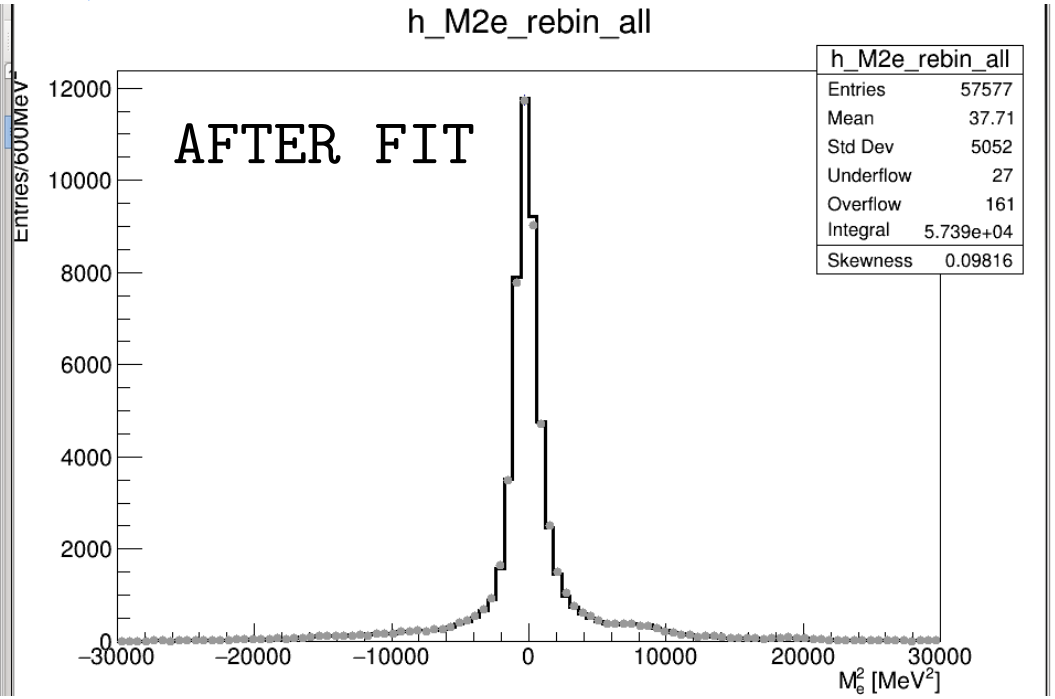

h_M2e_rebin_all
AFTER FIT
h_M2e_rebin_all
Entries 57577
Mean 37.71
Std Dev 5052
Underflow 27
Overflow 161
Integral 5.739e+04
Skewness 0.09816
Entries/600MeV²
M_e^2 [MeV²]

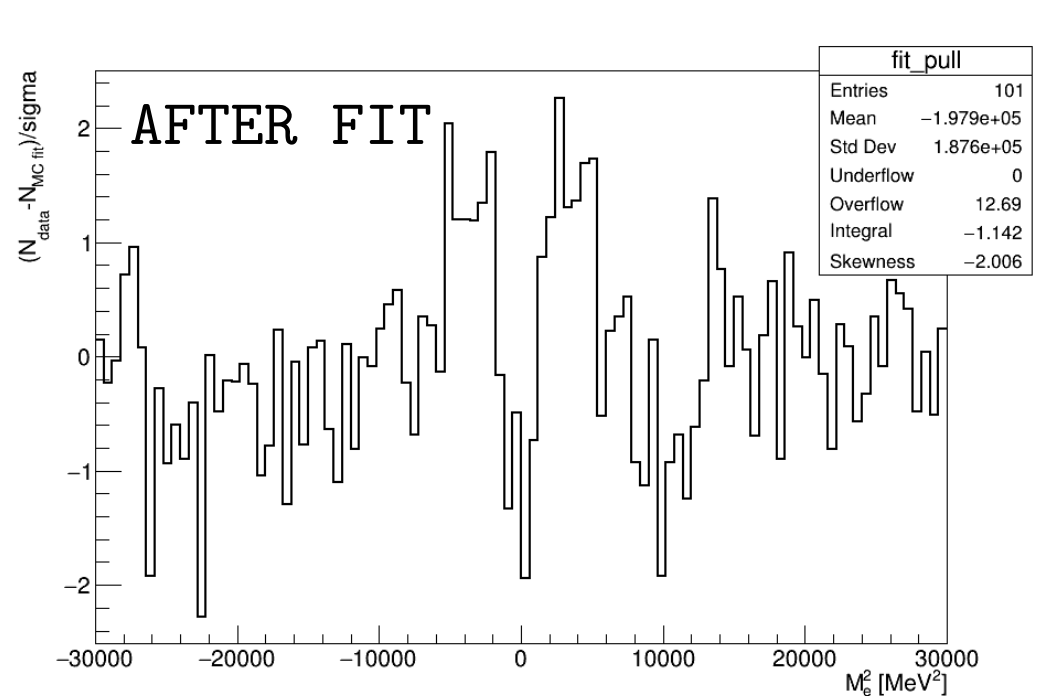

AFTER FIT
fit_pull
Entries 101
Mean −1.979e+05
Std Dev 1.876e+05
Underflow 0
Overflow 12.69
Integral −1.142
Skewness −2.006
$(N_{data}-N_{MC\ fit})$/sigma
M_e^2 [MeV²]


BEFORE FIT
DATA
MC_all
MC_pipi
MC_pi0
MC_kse3
MC_ksmu3
MC_ppee
MC_K+K-
MC_phi->pippimpi0
MC_others
Entries/200MeV²
M_e^2 [MeV²]


BEFORE FIT
$(N_{data}-N_{MC\ fit})$/sigma
M_e^2 [MeV²]

Kse3 FIT





	fraction	events	relative error [%]
$\pi e \nu$	0.87	49 647 ± 316	0.64
$\pi^+\pi^-$	0.08	4 379 ± 388	8.85
all others	0.06	3 363 ± 384	11.42
Total		57 239	
χ^2	1.98		

Kse3 FIT ERROR CORRECTION

- A. Nappi, A Pitfall in the use of extended likelihood for fitting fractions of pure samples in mixed samples, Comput.Phys.Commun. 180 (2009) 269-275.

The results provided by these packages are valid for what concerns the estimates of the event fractions, but are incorrect for what concerns the errors, because they are based on the assumption that the normalization condition for the parameters incorrectly interpreted as event fractions, which holds only at the likelihood maximum, is valid everywhere. As a practical remark, the correct errors can be computed from the covariance matrix provided by these packages, applying error propagation to the formula

$$p_s = \frac{\hat{p}_s}{\sum_s \hat{p}_s}$$

Note, however, that the full covariance matrix of the $\hat{p}_s$ must be used in this.

- Recomputed fit error 0.39% (was 0.63%)
- In agreement with multinomial distribution error

EFFICIENCY COMPUTATION

- The plan is to measure the ratio $K_{se3}/K_s\pi^+\pi^-$
  - $BR(K_s\rightarrow\pi e\nu)=(N_{sel}/\epsilon)_{\pi e\nu}*(\epsilon/N_{sel})_{\pi\pi}*R_\epsilon*BR(K_s\rightarrow\pi^+\pi^-)$

- $\epsilon_{\pi e\nu}=\epsilon_{TCA}*\epsilon_{preMVA}*\epsilon_{BDT}*\epsilon_{DTOF}$, all from KL control sample

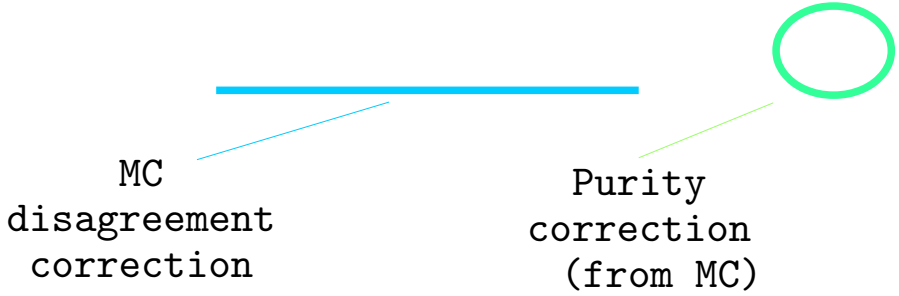
- $\epsilon_{\pi\pi}$ is the efficiency of the single selection to count $\pi\pi$ (see next slide)

- Ratio of efficiency $\pi\pi$ over $\pi e\nu$, common selection
  - $R_\epsilon= R_{evmask}*R_{T0tf}*R_{tag}*R_{Ks}$

all from MC till now

$R_{evmask}=R_{Trg}*R_{FILFO}*R_{EVC}$

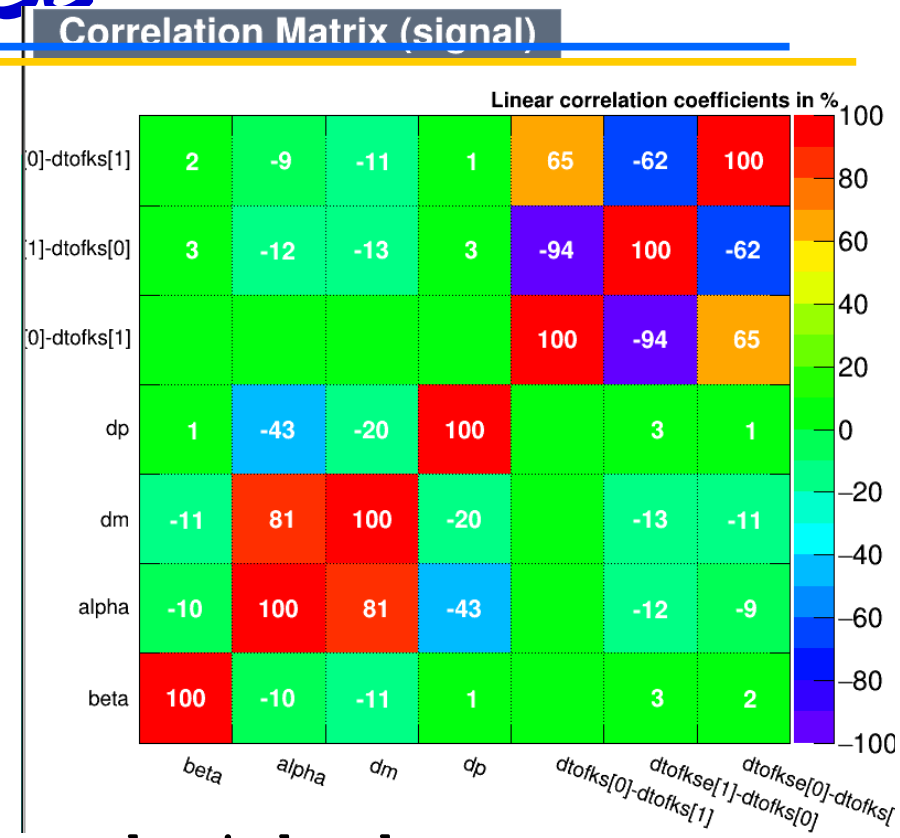
- Efficiency computation from Control Sample (CS) for most cuts
- $\epsilon_{DT(Kse3)}= \epsilon_{DT(CS)}*(\epsilon_{MCch(Kse3)})/\epsilon_{MCch(CS)})* p/q = \epsilon_{(CS)} * p/q$



p: MC purity of the CS after cut
q: MC purity of the CS before cut

KLe3 CONTROL SAMPLE

- Needed to compute:
  - MVA-Preselection and BDTcut eff
  - TCA and dDTOF cuts
- K_L CS tagged from Ks->pi+pi-
- High contamination from Ksmu3
- High purity is needed
  - Selection on variable not correlated with the one we want to compute efficiency on
  - CS1 for MVA-Preselection and BDTcut eff --> cut on dtof
  - CS2 TCA and Dtof cuts eff --> cut on dm vs Mmiss



PURITY= 95-97%

Kse3 EFFICIENCIES

- Efficiency computation from Control Sample (CS) for most cuts
- $\epsilon_{DT(Kse3)} = \epsilon_{DT(CS)} * (\epsilon_{MCch(Kse3)} / \epsilon_{MCch(CS)}) * p/q = \epsilon_{(CS)} * p/q$

Selection	Efficiency
TCA	0.4639 ± 0.0020
CS Preselection	0.9720 ± 0.0007
MC Preselection	0.9661 ± 0.0002
BDT selection	0.6534 ± 0.0018
TOF selection	0.7168 ± 0.0018
FIT interval	0.9985 ± 0.0001
TOT	0.2106 ± 0.0032

-95<dp
15<teta_crash<165

Kse3 Reff COMPUTATION

- Ratio of efficiency ππ over πev
  - $R_\epsilon = R_{evmask} * R_{T0tf} * R_{tag} * R_{fiducial}$

till now, all from MC

$R_{evmask} = R_{Trg} * R_{FILFO} * R_{ECL}$

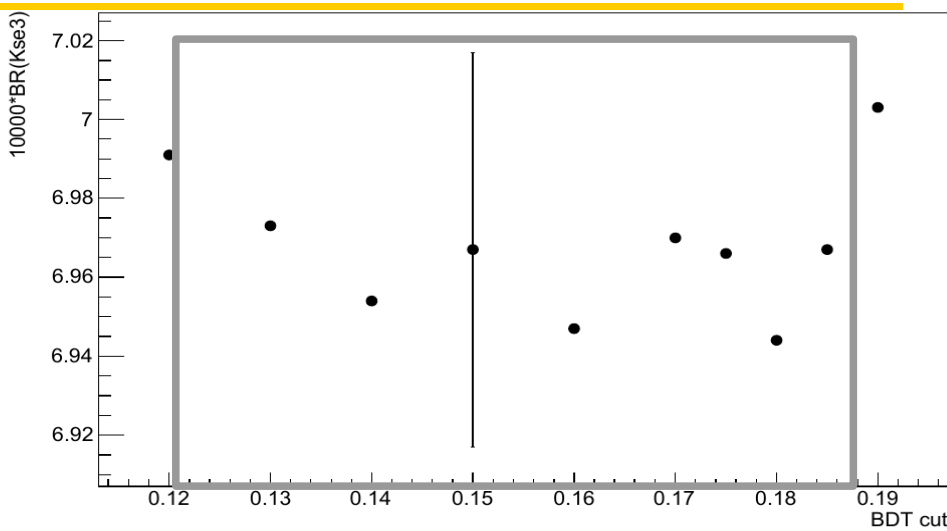
Selection	Ratio of efficiency
Trigger	1.0297 ± 0.0004
FILFO	1.0054 ± 0.0001
Event Classification	1.0635 ± 0.0005
T0 time fix	1.0063 ± 0.0001
K_L–crash	1.0295 ± 0.0024
K_S ID	1.0418 ± 0.0009
R_ϵ	1.1882 ± 0.0030

Kse3 SYSTEMATICS COMPUTATION

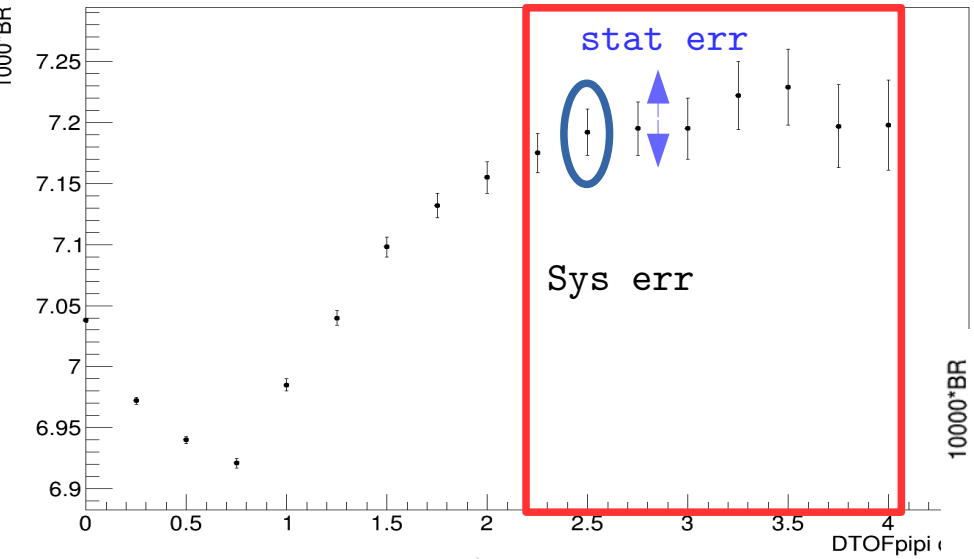
Selection	Relative systematic error [%]
TOF	0.270
BDT	0.187
K_L CS statistics	0.108
$\pi^+\pi^-$ CS statistics	$2\ 10^{-4}$
MC sample statistics	0.143
TCA efficiency II	0.008
$\pi^+\pi^-$ efficiency II	0.092
TOT	0.387

Kse3 CUT VARIATION RECAP

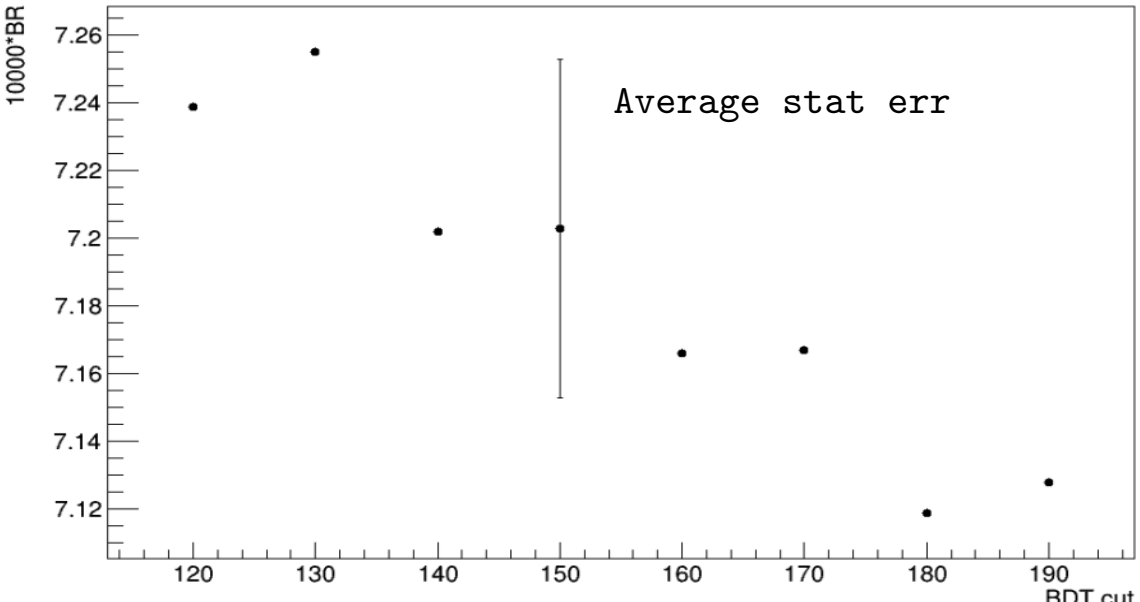
- First scheme
  - BDT>0.15 (after BDT scan)
  - 1<|dDTOFpipi|<10
  - |dDTOFpie|<1 || |dDTOFepi|<1



- Than DTOFpipi scan:



- DTOFpipi moved to 2.5<|dDTOFpipi|<10
- BDT scan redone



- Situation in worst than before
- Move again cut in more stable region?
- Add systematics due to cut variation?

A. Sel

Kse3 BRANCHING RATIO

Final results is:

$$BR(K_s \to \pi e \nu) = (7.192 \pm 0.028_{syst} \pm 0.028_{stat}) \cdot 10^{-4} = (7.192 \pm 0.039) \cdot 10^{-4}$$

The relative error on the measure is:

$$0.387_{syst}\% \pm 0.390_{stat}\% = 0.549\%$$ + cut var sys???

From N_Kse3= 49647 ± 316 events

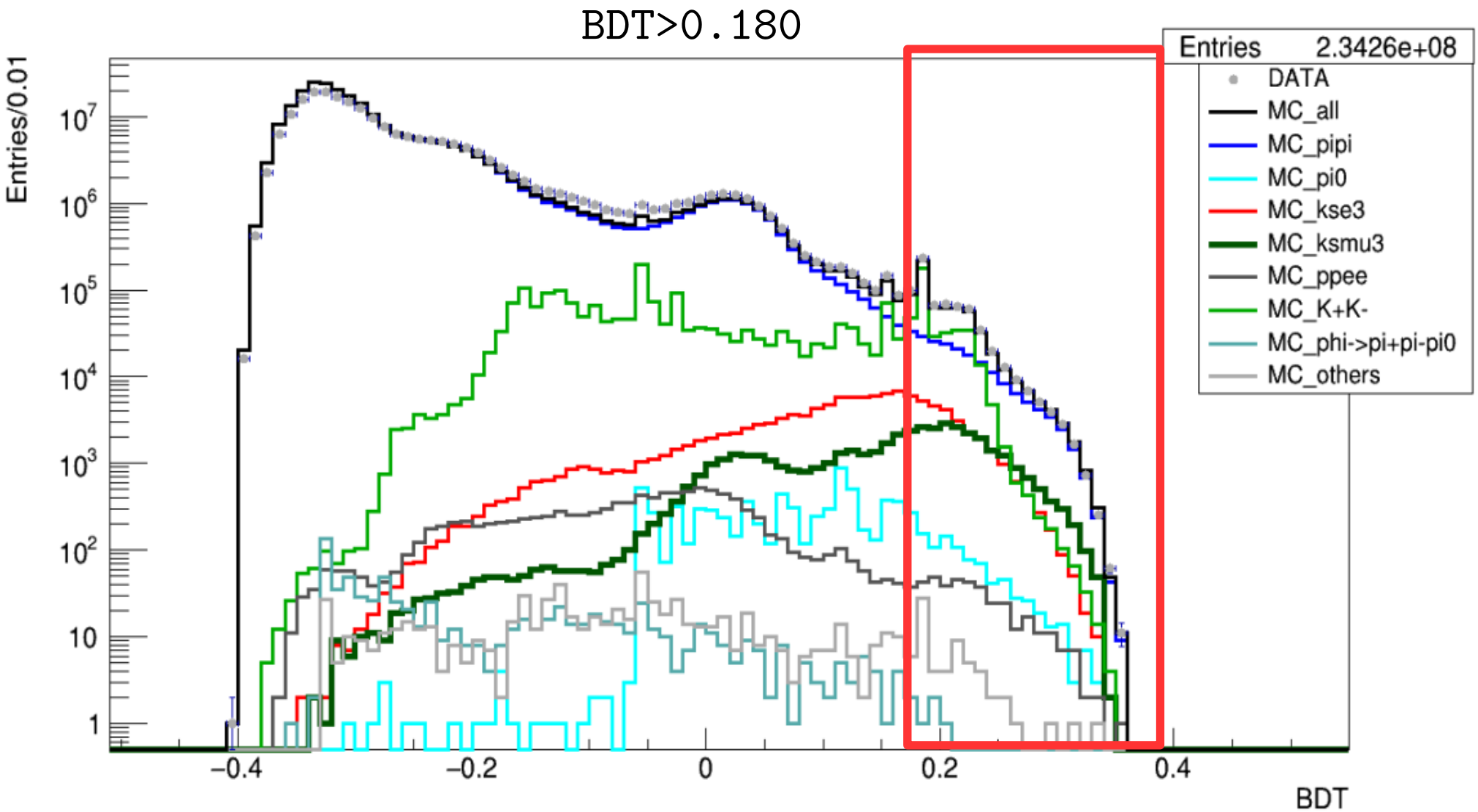
- Bad agreement with previous KLOE06 result (Spagatti):
  - BR(Kse3)=(7.046 ± 0.091)*10^{-4}
    - 1.1 % stat, 0.7 % syst, tot 1.3 %
    - Spadaro events 13612
- Expected 0.55% stat, less 0.7% syst, Tot Err expected = 0.89%
- Error better than expected, factor 2 on systematic
- Main value probably will decrease with Reff correction from data

$K_S\mu 3$

$K_S\mu 3$ ANALYSIS SCHEME

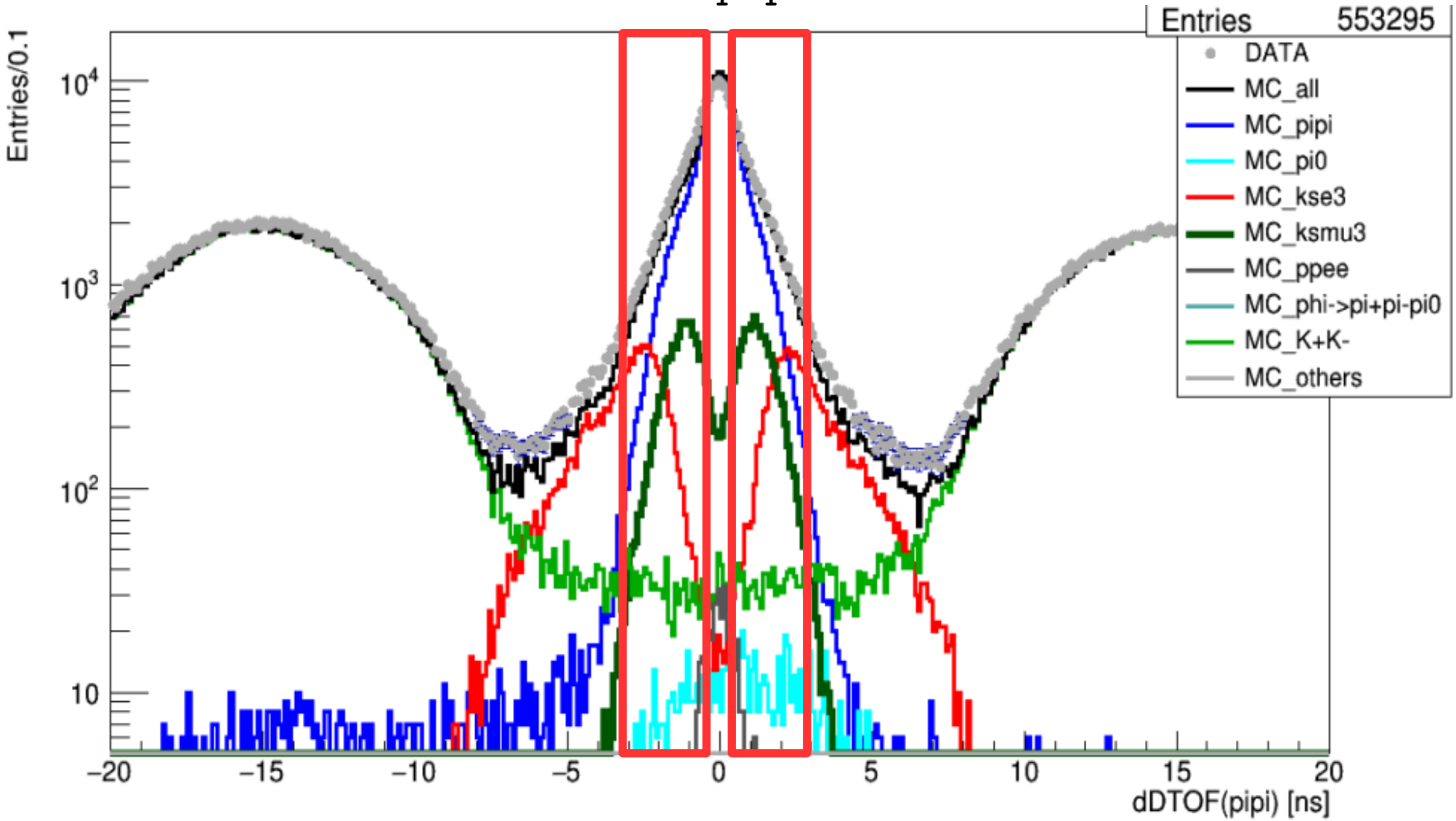
- Preselection: Trigger, Cosmic rejection, FILFO, Stream K_0
- K_L crash && Ks tag
- $\pi^+\pi^-$ selection and count
- Ksmu3 selection from bkg (mainly $\pi^+\pi^-$)
  - MVA Preselection
    - 2TCA, -95?<dp<190?, 15<teta_ks<165, 15<teta_crash<165, p<330, Eff from MC

Ksμ3 BDT


BDT>0.180
Entries 2.3426e+08
DATA
MC_all
MC_pipi
MC_pi0
MC_kse3
MC_ksmu3
MC_ppee
MC_K+K-
MC_phi->pi+pi-pi0
MC_others
Entries/0.01
BDT

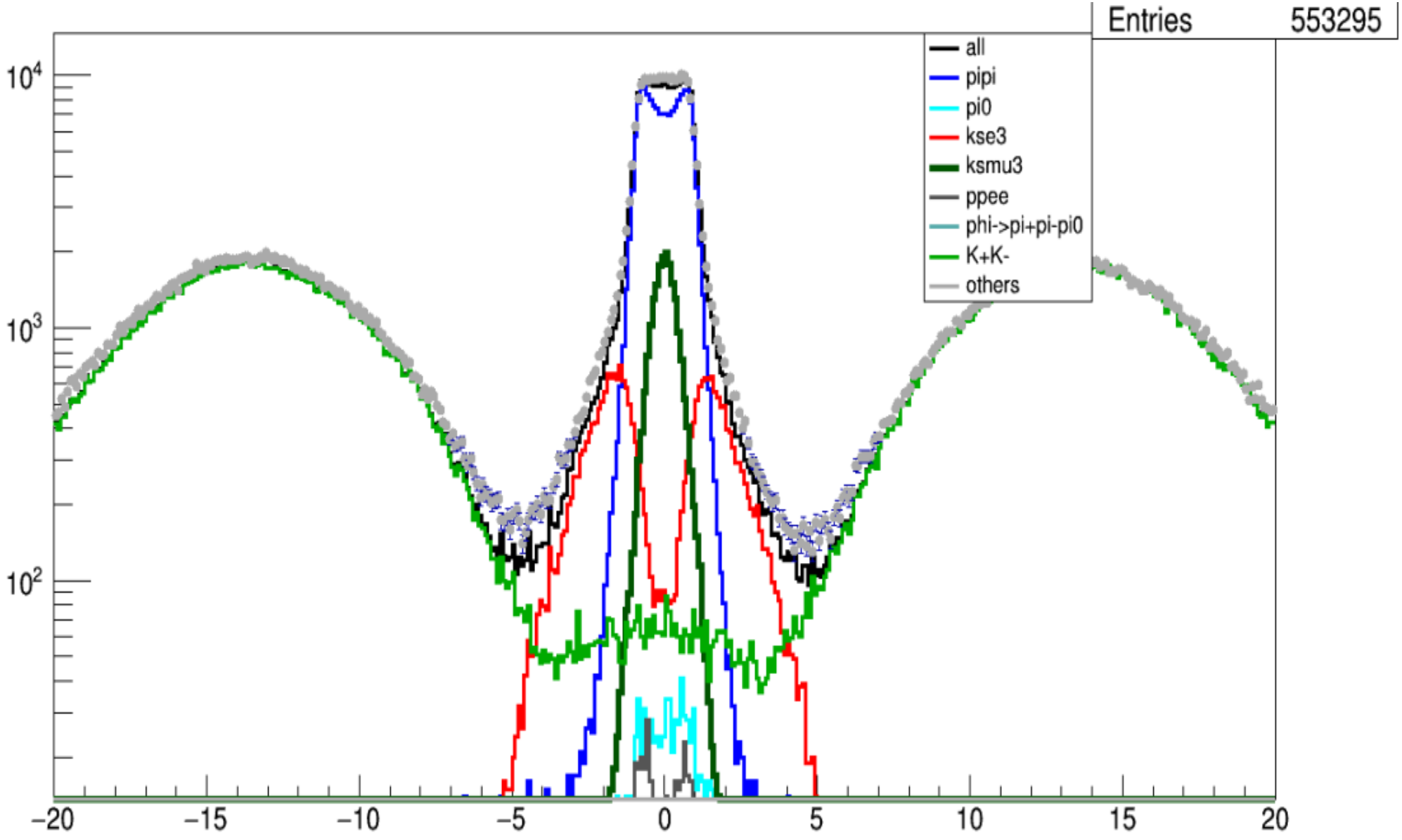
Ksμ3 DTOFPIPI

0.5<dDTOF(pipi)<3



Ksμ3 DTOFPIMU

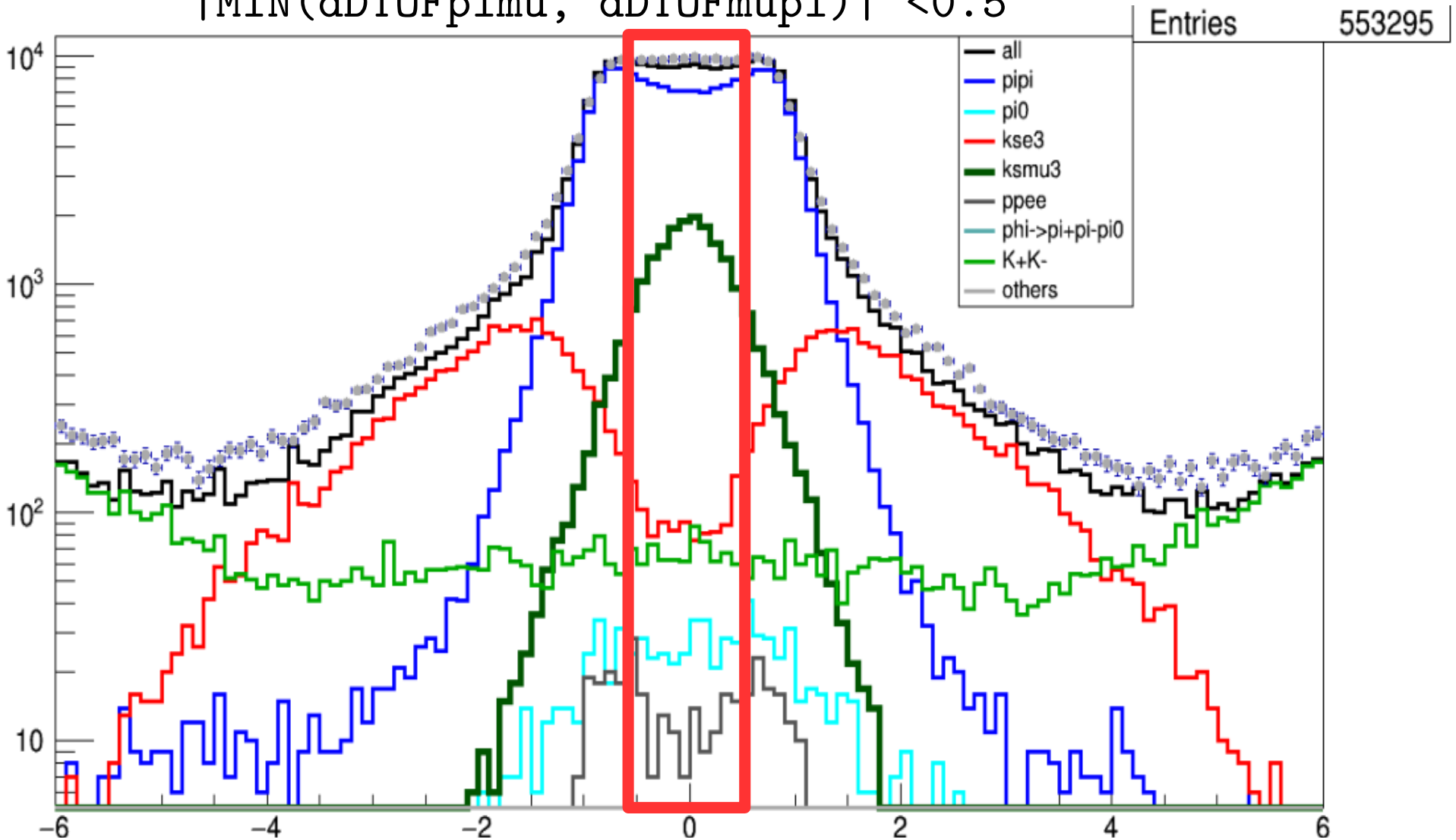
- Entering with MIN(dDTOFpimu, dDTOFmupi) that is the correct mass hypotesis



Ksμ3 DTOFPIMU

- Entering with MIN(dDTOFpimu, dDTOFmupi) that is the correct mass hypotesis

|MIN(dDTOFpimu, dDTOFmupi)| <0.5



$K_S\mu3$ ANALYSIS SCHEME

- Preselection: Trigger, Cosmic rejection, FILFO, Stream K_0
- K_L crash && Ks tag
- $\pi^+\pi^-$ selection and count
- $K_S\mu3$ selection from bkg (mainly $\pi^+\pi^-$)
  - MVA Preselection
    - 2TCA, -95<dp<190, 15<teta_ks<165, 15<teta_crash<165, p<330,
  - MVA analysis (no dtof)
    - BDT>180
  - DTOF analysis
    - 0.5<|DTOFPIPI|<3
    - |DTOFPImu|<0.5 || |DTOFmuPI|<0.5

Eff from MC

Ksμ3 Me^2

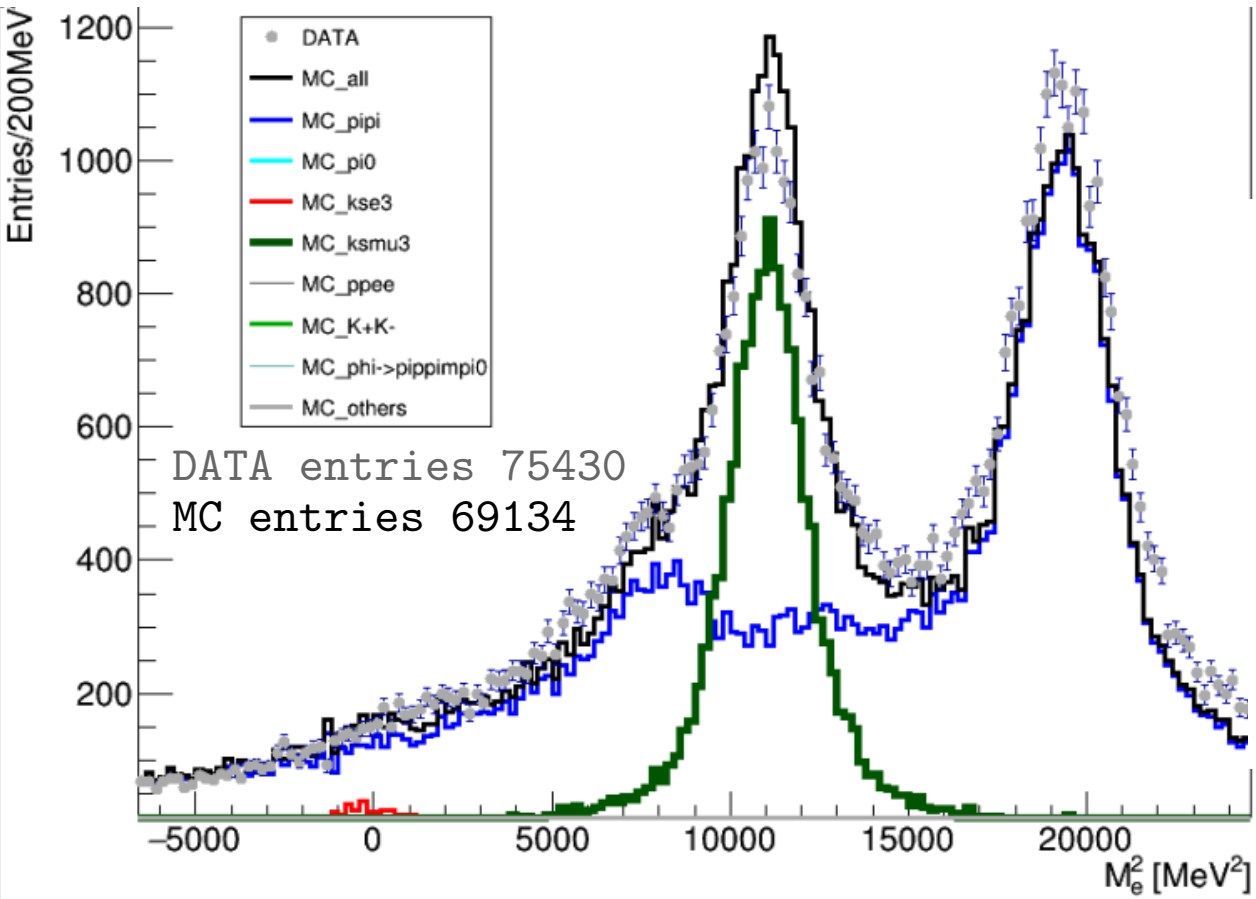
- SMEARING PROCEDURE BEFORE FIT to increase DT-MC agreement and Chi^2 of the fit

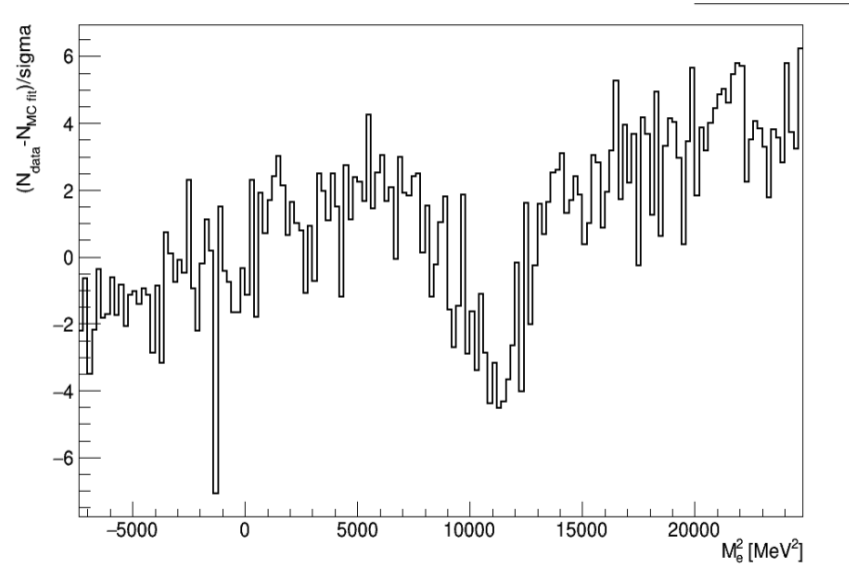
$$p_i(j)' = p_i(j) \times (1 + p_{\text{shift}}) \times (1 + ranG(0, 0.004))$$

$p_{\text{shift}} = 0.00013705$ and $ranG(\mu, \sigma)$ is a Gaussian distributed number.

i=mu,pi

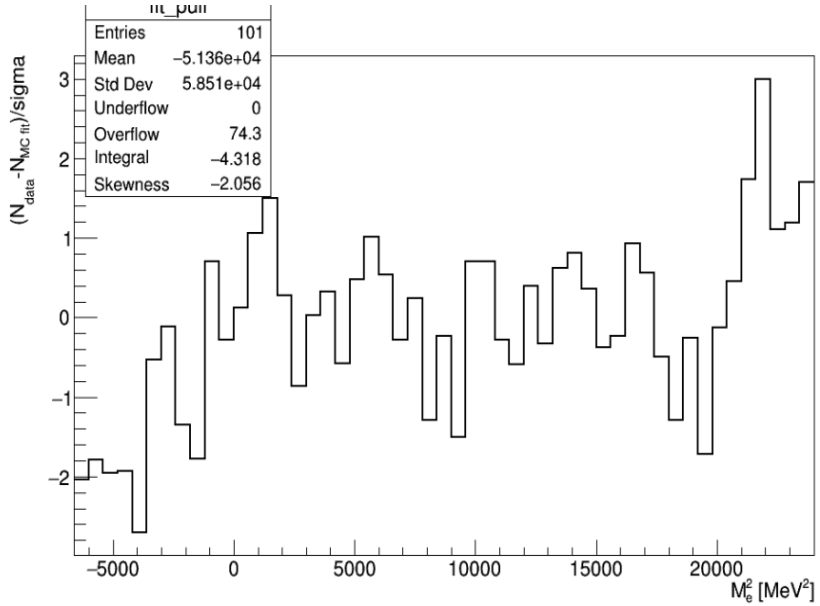
j=x,y,z

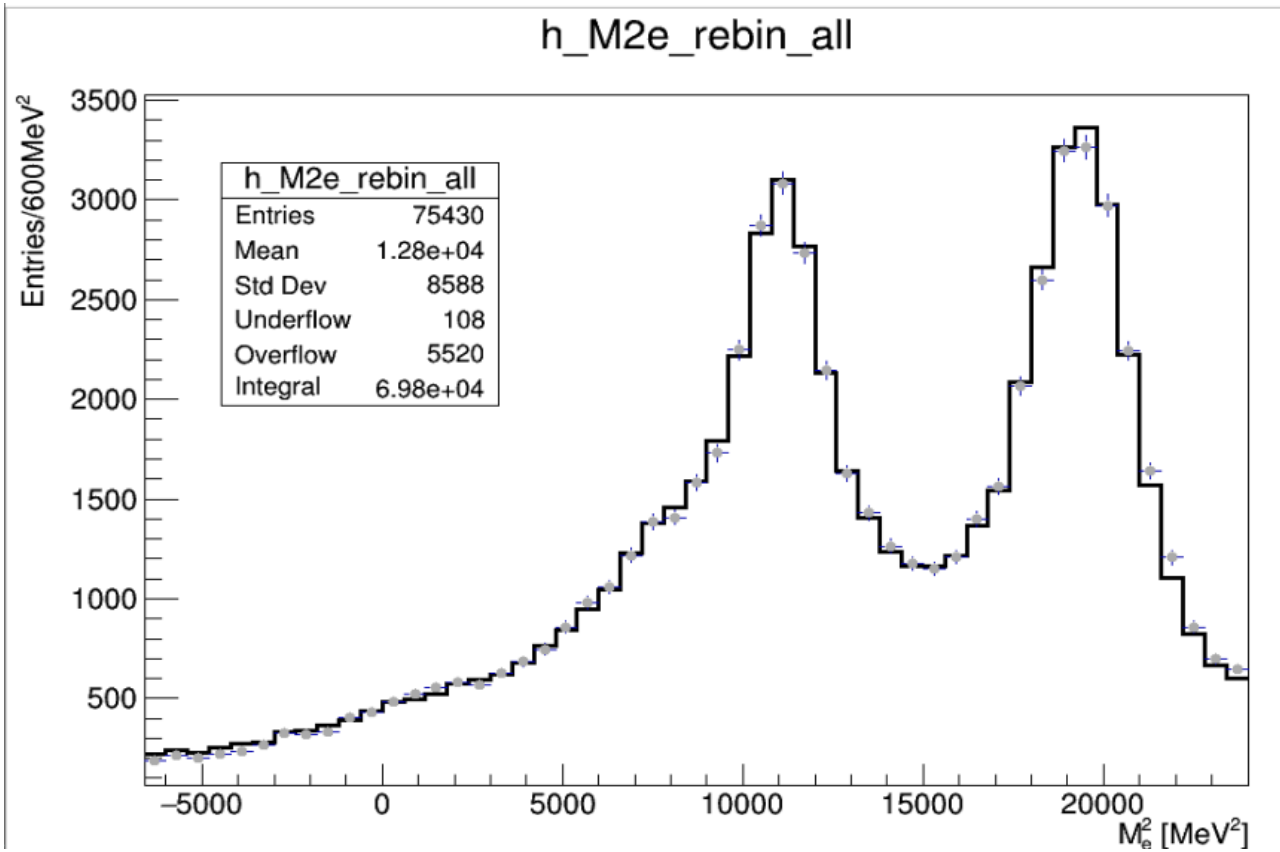




Ksμ3 FIT

chi2	frac	Ntot	err	Nkse3 fit	Err %	BR x10^4
2,82	0,18	63492	0,0036	11219	0,0205	4,699





BR(Ksμ3)

$4.7*10^{-4} \pm 2.05\%$

```
 EXT PARAMETER                                   STEP         FIRST
 NO.   NAME      VALUE            ERROR          SIZE      DERIVATIVE
  1  frac0       1.76703e-01   3.62545e-03   2.12372e-03  -1.13881e-03
  2  frac1       8.21493e-01   7.04000e-03   3.50385e-03  -8.51389e-04
  3  frac2       1.80473e-03   3.19730e-03   1.50002e-02  -8.17125e-04
                                ERR DEF= 0.5
fit status: 0
Info in <TCanvas::MakeDefCanvas>:  created default TCanvas with name c1
ChiSquare: 135.226
NDF: 48
```

$K_S\mu 3$ EFFICIENCIES

$K_L\mu 3$ CONTROL SAMPLE, similar selection, best PURITY87%

PRESELECTION CS	0,9857
PRESELECTION MC	0,9959
TCA	0,3471
BDT>0.18	0,4168
DTOF	0,5914
TOT	0,0840

$K_S\mu 3$ SYSTEMATICS

SYS SOURCE	REL ERR
pipi	-0,0009
MC sample sys	0,0068
Klcs syst	0,0045
BDT syst	-0,0030
TOF sys	expected to be bad
SYS ALL	0,0087
STAT all	0,0206
err tot	0,0223

±1 sigma

$K_S\mu3$ BRANCHING RATIO

- $BR(K_S \to \pi\mu\nu) = (N_{sel}/\epsilon)_{\pi\mu\nu} * (\epsilon/N_{sel})_{\pi\pi} * R_\epsilon * BR(K_S \to \pi^+\pi^-)$
  - $BR(K_S\mu3) = (4.728 \pm 0.041_{sys} \pm 0.097_{stat} + DTOF_{sys}?)10^{-4} =$

    $= (4.728 \pm 0.105)10^{-4}$

    - 2.05 % stat ± 0.87 % sys + DTOFsys? = 2.23 % tot
- Expected from PDG
  - $BR(K_S\mu3) = 4.69 \pm 0.06\ 10^{-4}$ (just 0.666[1]*BR(Kse3))
- About 1/3 sigma from PDG value

[1]assumes lepton universality, radiative corrections from ANDRE 2007 , and phase space integrals from KTeV,

CONCLUSIONS

- $BR(K_s \to \pi e \nu) = (7.192 \pm 0.028_{syst} \pm 0.028_{stat}) \cdot 10^{-4} = (7.192 \pm 0.039) \cdot 10^{-4}$
- $0.387_{syst}\% \pm 0.390_{stat}\% = 0.549\%$, was 1.1% stat and 0.7 syst, 1.4% tot
- Cut variation (mainly in DTOF(pipi) scan) to be understood, maybe a systematic have to be added

- BR(Ksμ3)= (4.728 ± 0.041sys ± 0.097 stat)10^{-4}=
  (4.728 ± 0.105)10^{-4}
- 0.87% syst ± 2.05 % stat
- First measurement of Ksμ3 decay

CONCLUSIONS

- $BR(K_s \to \pi e \nu) = (7.192 \pm 0.028_{syst} \pm 0.028_{stat}) \cdot 10^{-4} = (7.192 \pm 0.039) \cdot 10^{-4}$
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- 0.87% syst ± 2.05 % stat
- First measurement of Ksμ3 decay

THANK YOU FOR YOUR ATTENTION

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SPARES

[1]The 0.666 factor is obtained from AMBROSINO 2006E and assumes lepton universality, radiative corrections from ANDRE 2007 , and phase space integrals from KTeV, ALEXOPOULOS 2004A.

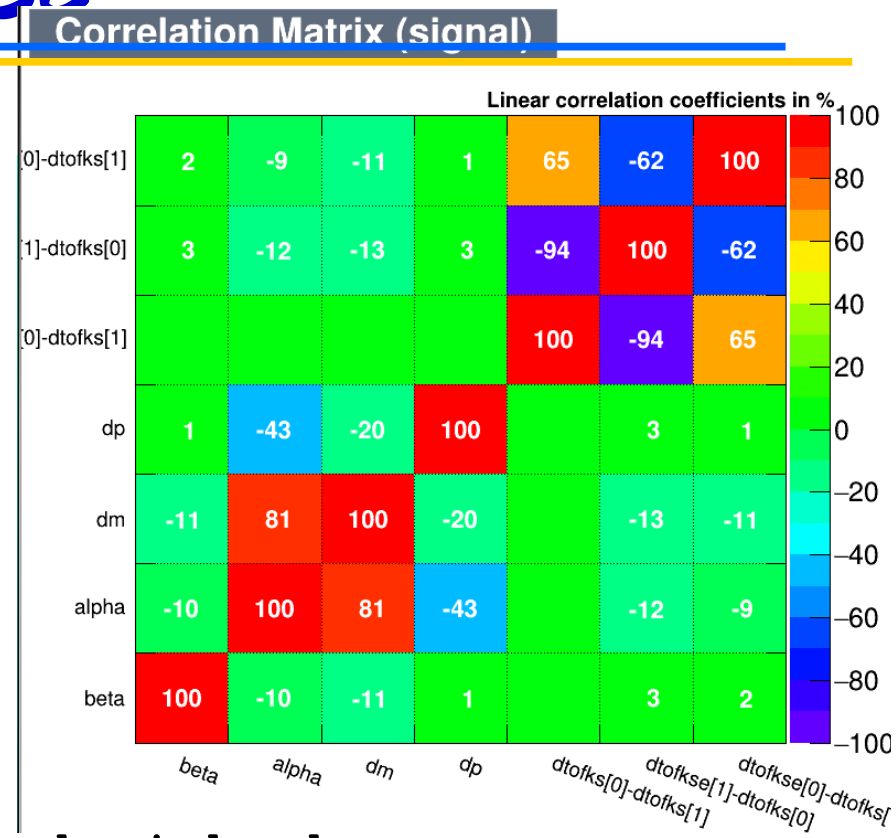
Assuming lepton universality, we have

$$r_{\mu e} = \frac{\Gamma\left(K_S \to \pi\mu\nu\right)}{\Gamma\left(K_S \to \pi e\nu\right)} = \frac{1+\delta_K^{\mu}}{1+\delta_K^{e}}\frac{I_K^{\mu}}{I_K^{e}}, \tag{8}$$

where $\delta_K^{\mu,e}$ are mode-dependent long-distance radiative corrections and $I_K^{\mu,e}$ are decay phase-space integrals. Using $I_K^{\mu}/I_K^{e} = 0.6622(18)$ from KTeV [24] and $(1+\delta_K^{\mu})/(1+\delta_K^{e}) = 1.0058(10)$ from Ref. 25, we get $r_{\mu e} = 0.6660(19)$. We

Kle3 CONTROL SAMPLE

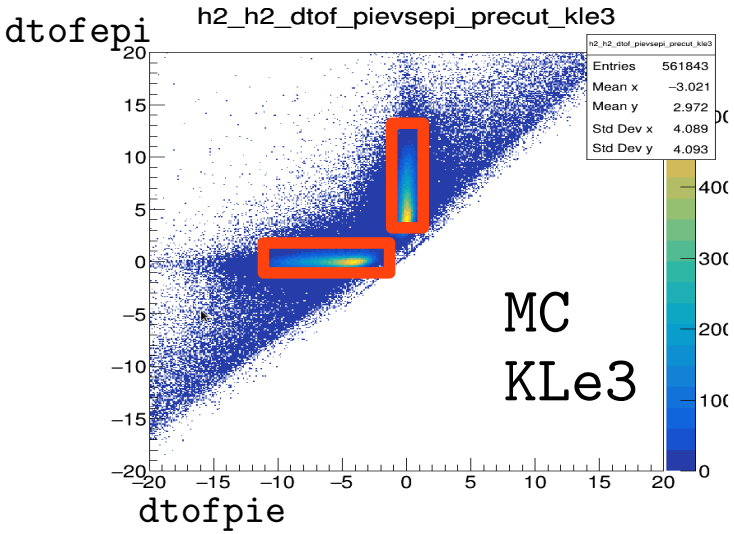
- Needed to compute:
  - MVA-Preselection and BDTcut eff
  - TCA and dtof cuts
- KL tagged from Ks->pi+pi-
- High contamination
- High purity is needed
  - cutting on variable not correlated with the one we want to compute efficiency on
    - MVA-Preselection and BDTcut eff --> cut on dtof
    - TCA and Dtof cuts eff --> cut on dm vs Mmiss

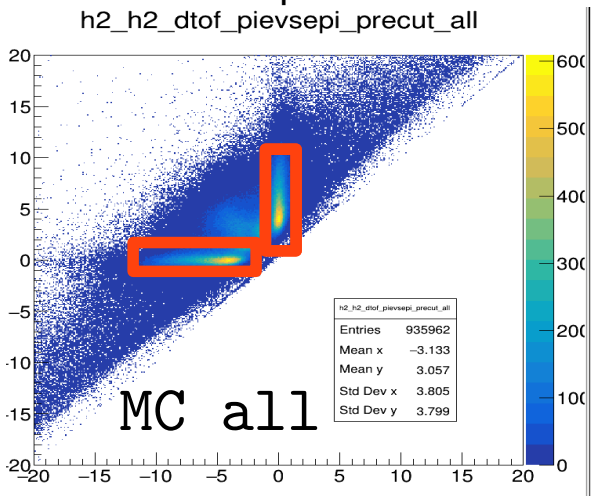


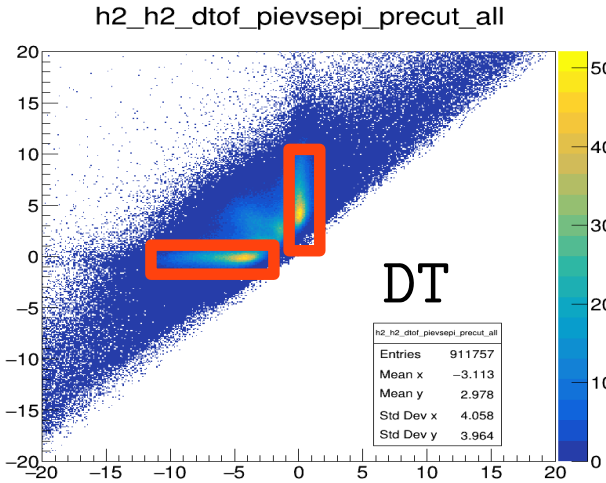
KLe3 CS SELECTION FOR BDT

- CS1 for BDT and PRESELECTION: cut on M^2mis, dtof_mupi_vs_pimu and on dtof_pie_vs_epi (2TCA needed)
  - dtofpie>-0.4 && dtofpie<0.7&&dtofepi > 2 && dtofepi<11
  - dtofepi > -0.7 && dtofepi<0.2 && dtofpie > -11 && dtofpie<-2

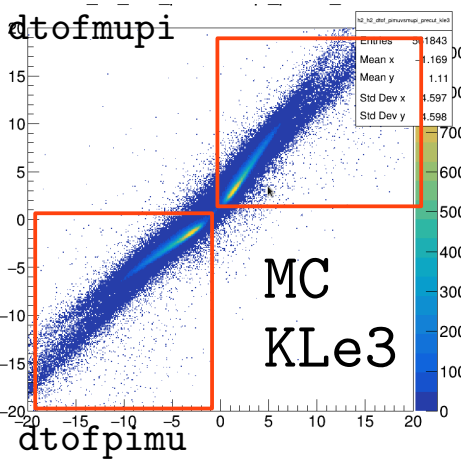
PURITY= 95-97%

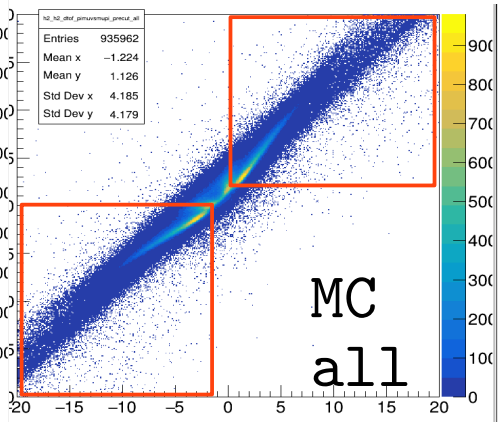


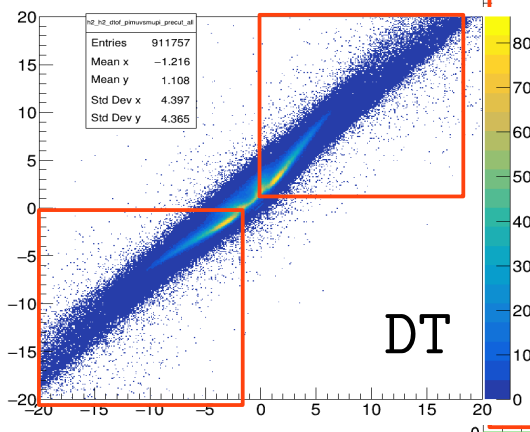




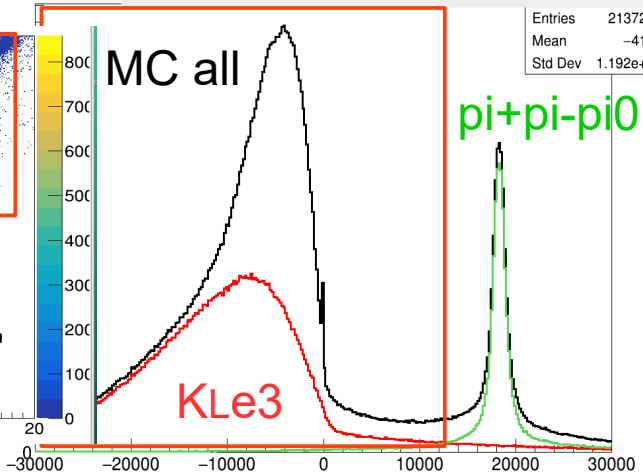
- (dtofpimu<-2&&dtofmupi<1)||(dtofpimu>1&&dtofmupi>0.8)))







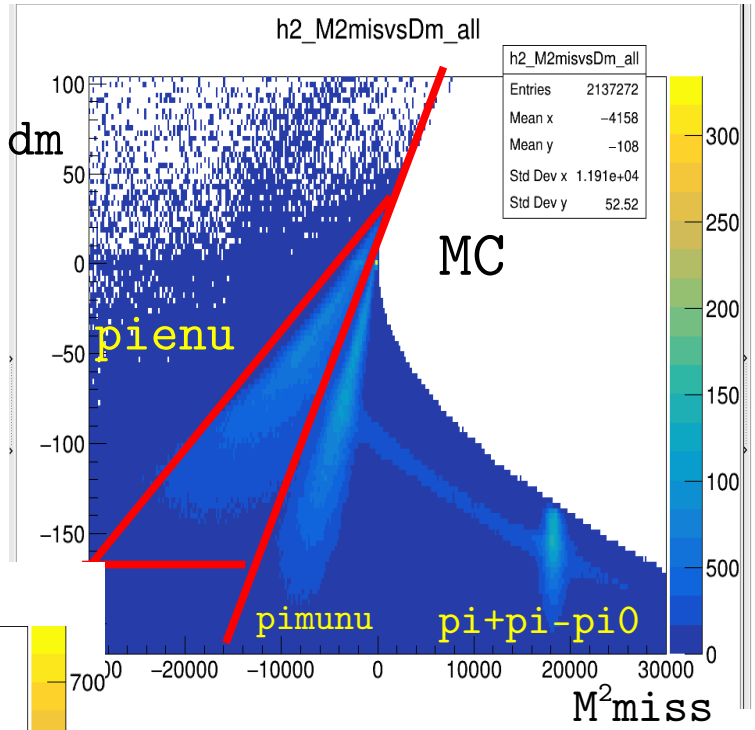
- M2mis<15000

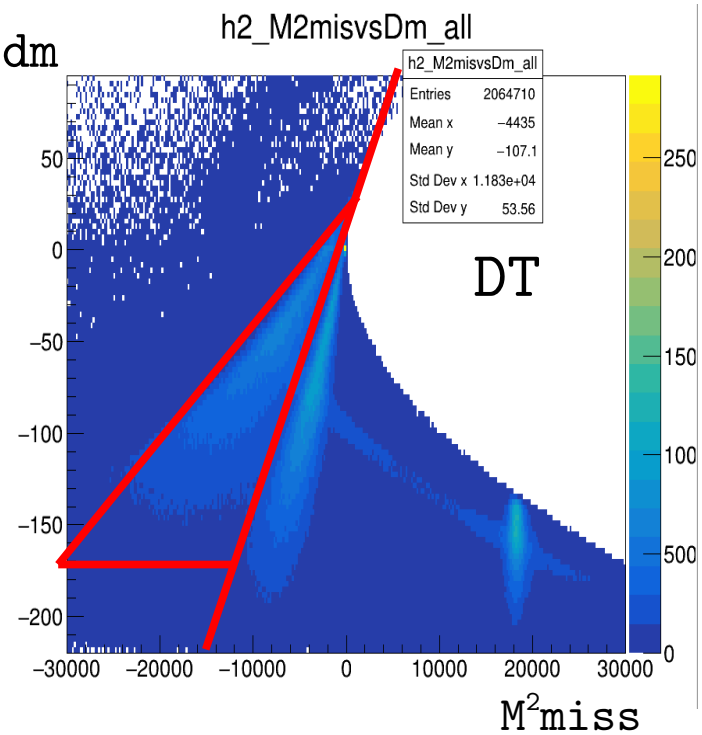


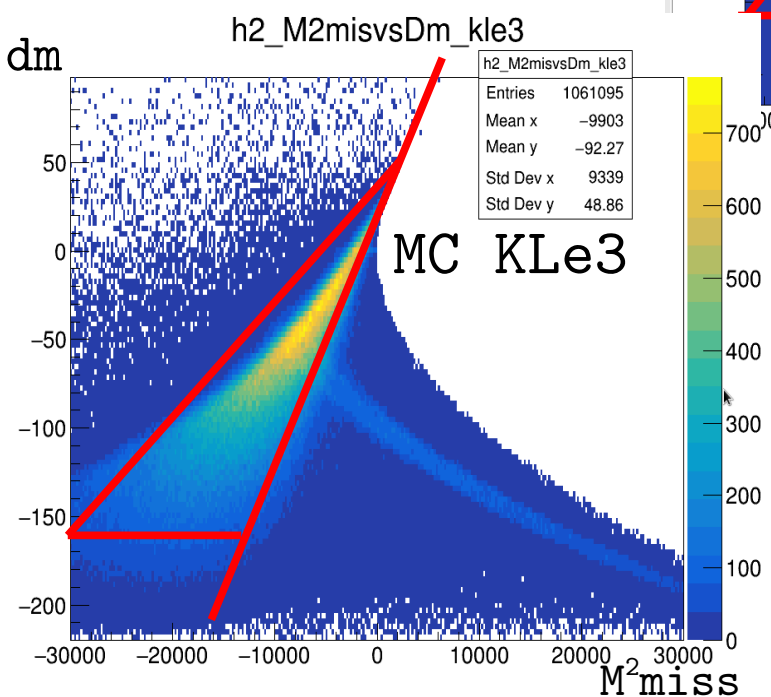
KLe3 CS SELECTION FOR DTOF

CS2 for DTOF&TCA ---> cut on dm vs M^2miss

PURITY= 95-98%







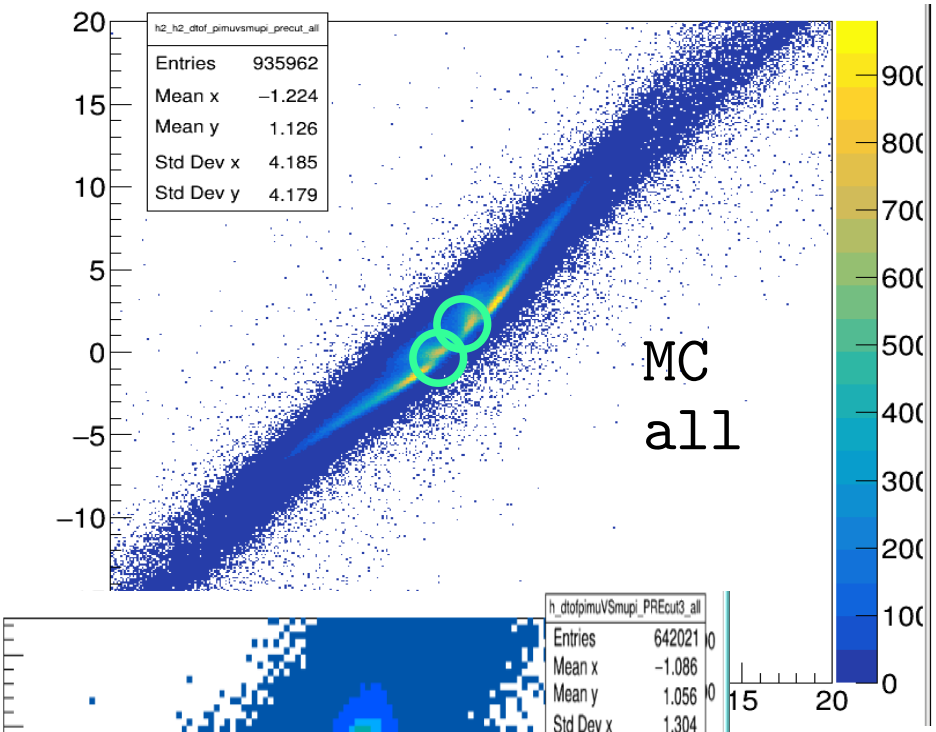
CUT2:

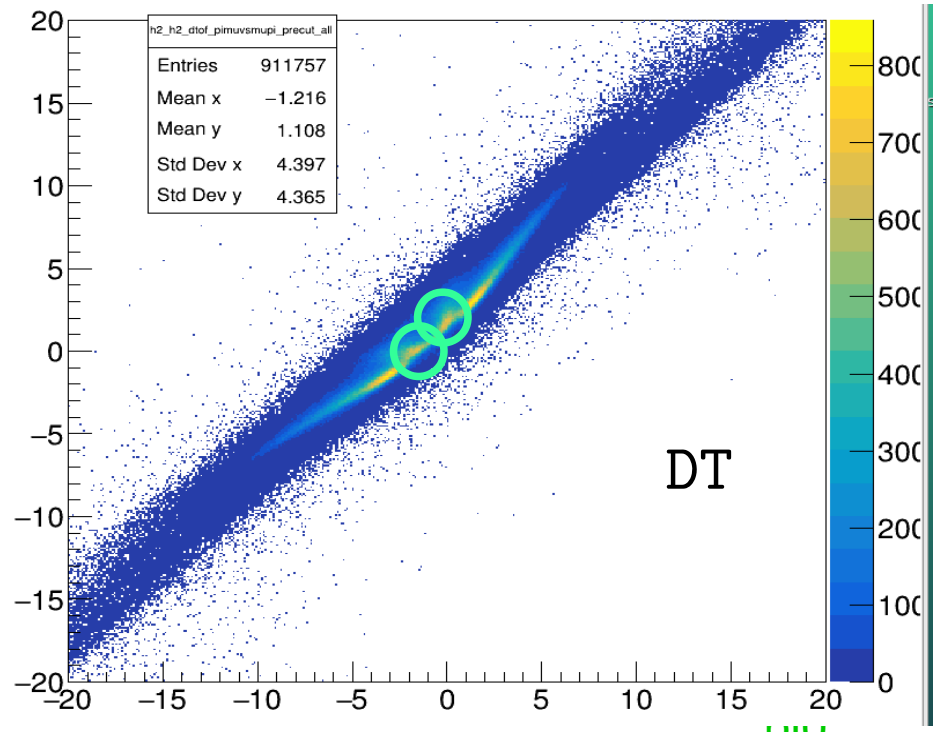
- dm2>0.015*M2mis+15.48
- dm2<0.0055*M2mis+32.4
- dm2>-170

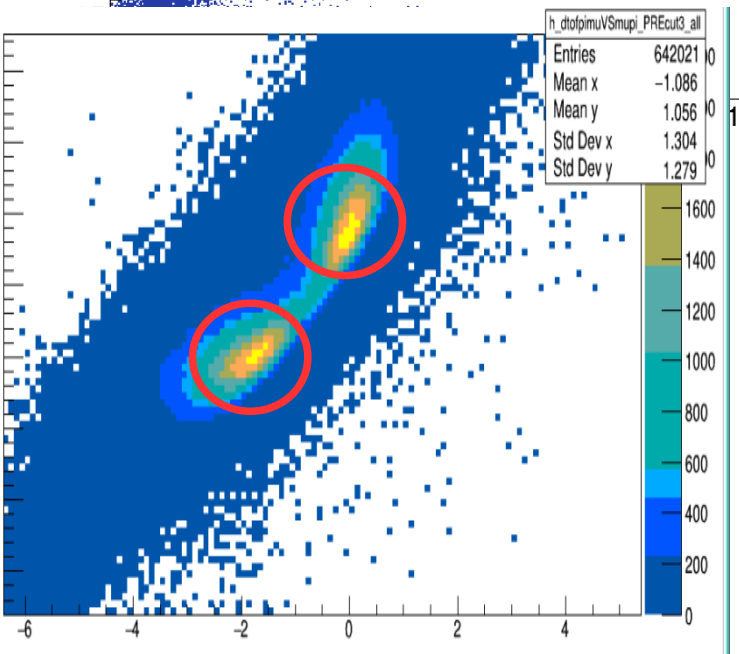
Kμ3 CS SELECTION FOR BDT

- CS1 for BDT and PRESELECTION: cut on M^2mis, dtof_mupi_vs_pimu and on dtof_pie_vs_epi (2TCA needed)

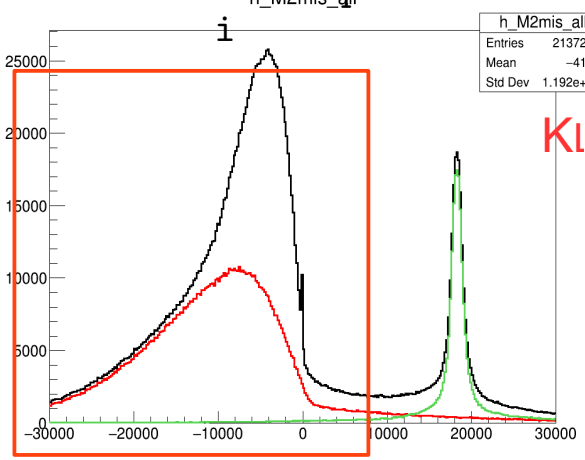
PURITY= 87%







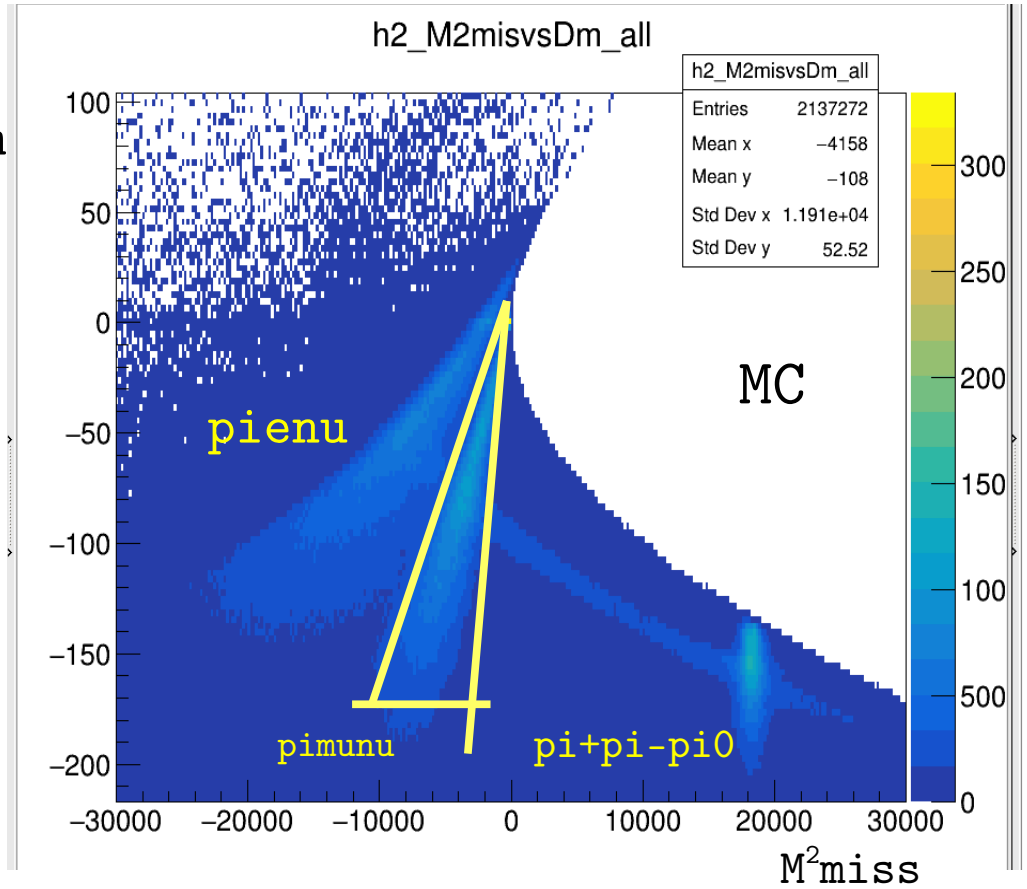
- Inside circonference
- C(-0.075, 1.8) R=0.4
- C(1.75, 0.12) R=0.4

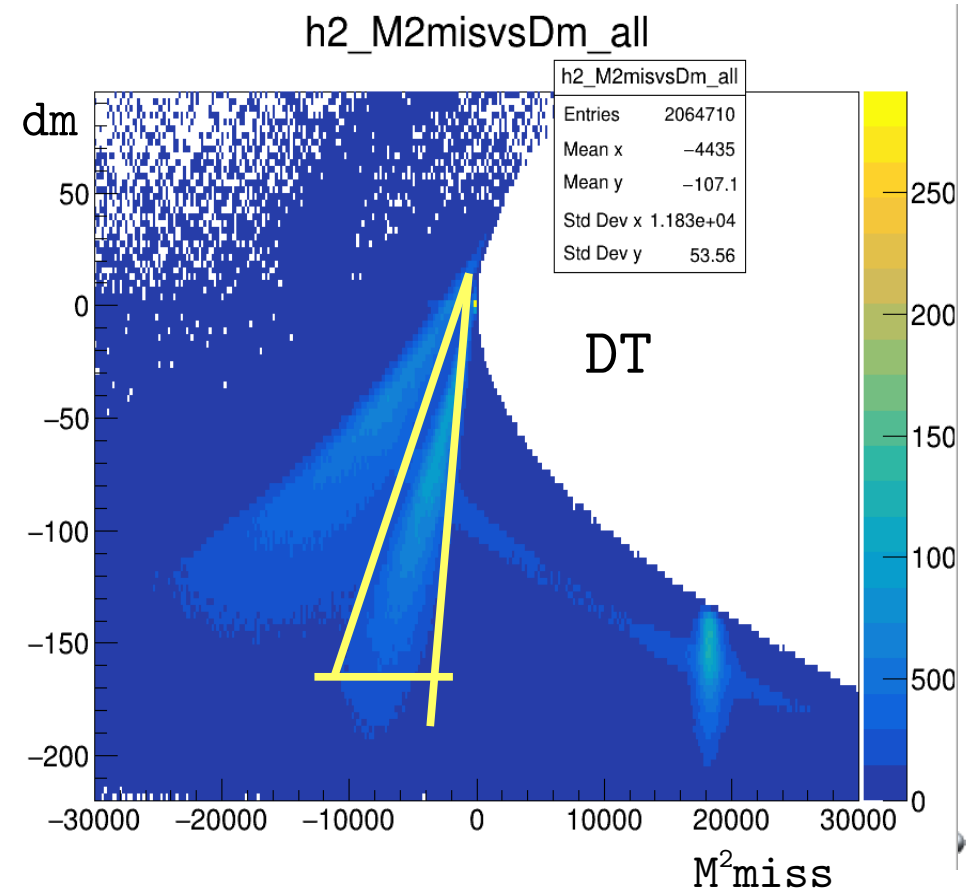


- (dt

Kμ3 CS SELECTION FOR DTOF

CS2 for DTOF&TCA ---> cut on dm vs M^2miss





CUT2:

dm2<0.015*(M2mis-1200)+15.48

dm2>0.055*M2mis+32.4

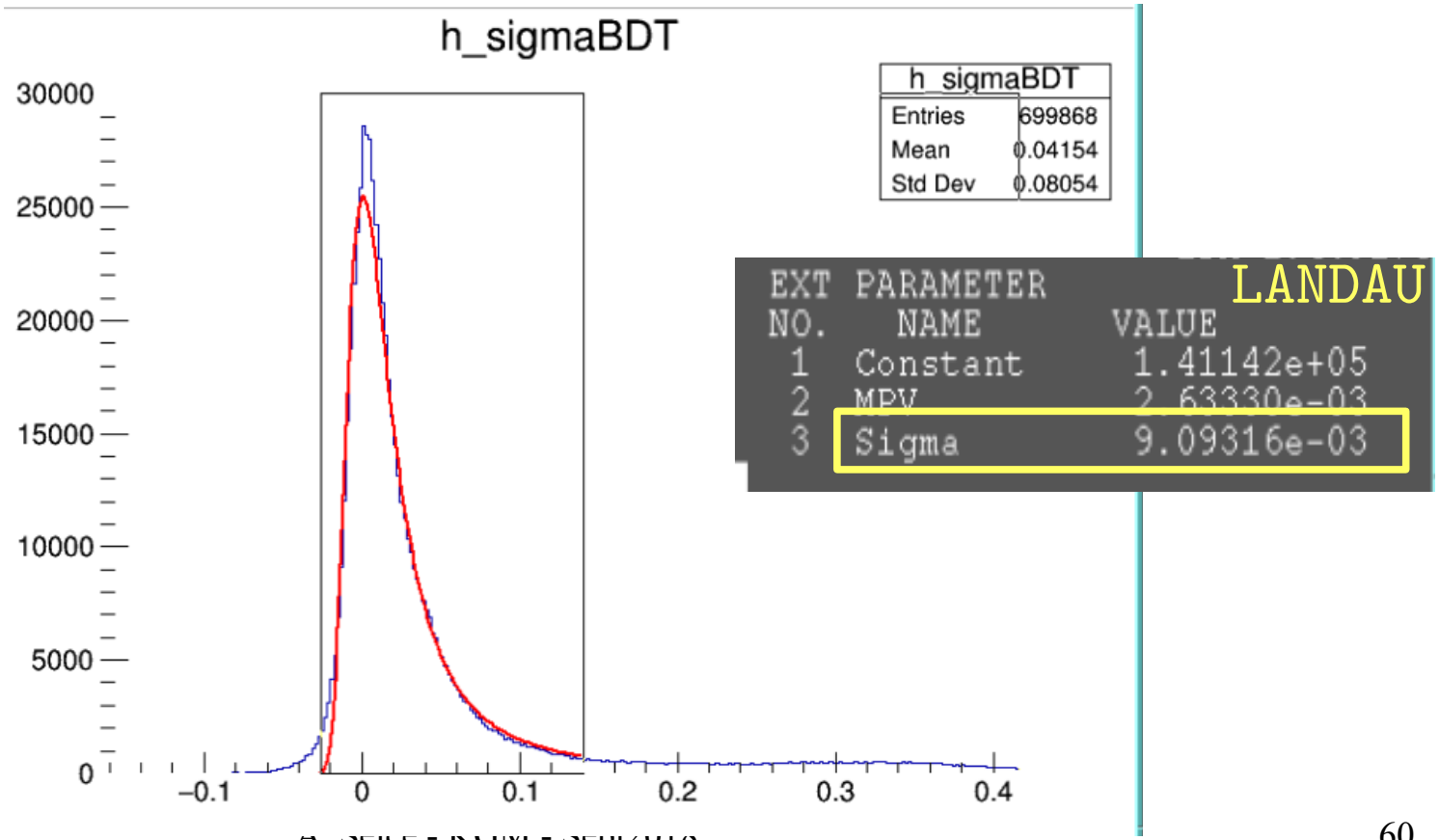
dm2>-180 && dm<-5

PURITY= 86%

Kse3 BDT SIGMA

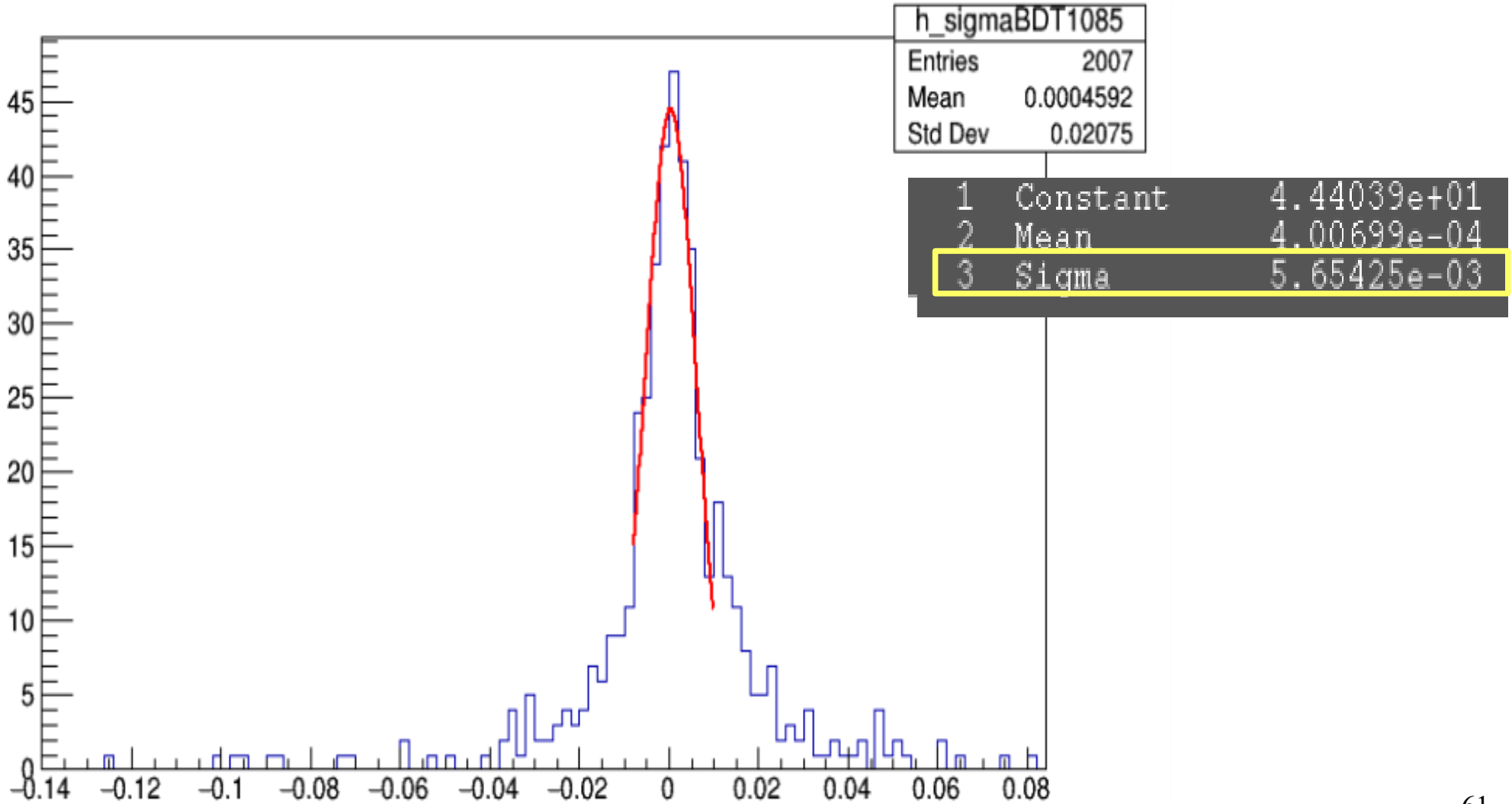
- BDT sigma not known; needed to compute systematics
- BDT uncertainties depends, via 5 viarible, from momentum uncertain (about 0.4 %)
- BDT re-processed with KINE-momentum in input (subsample)

Sigma =0.0091, about 5%



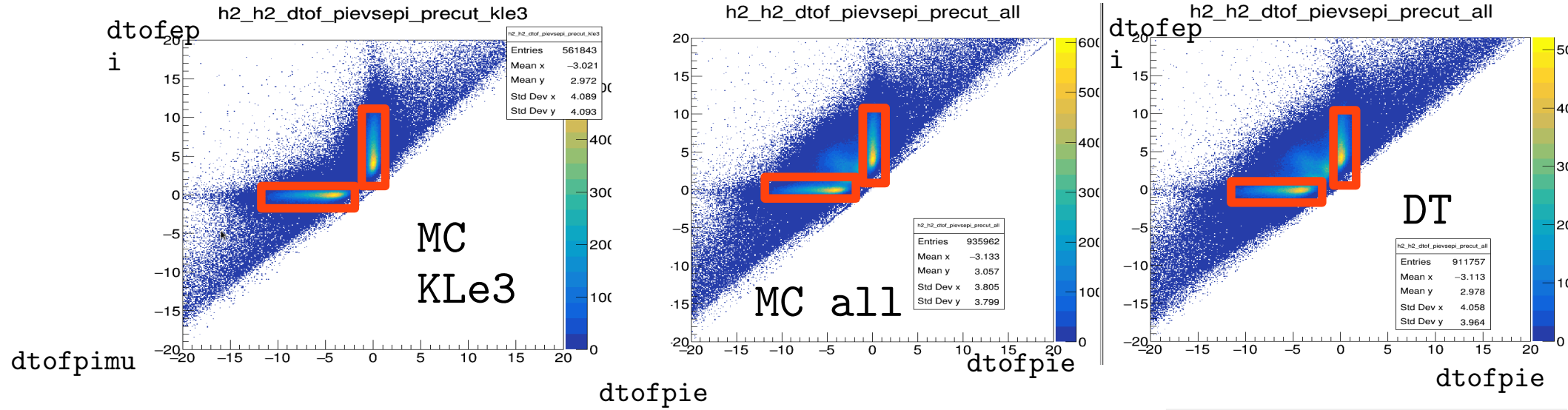
Kse3 BDT SIGMA

- Only around BDT cut (0.185)
- 0.160<BDT<0.21 range
- Sigma =0.0056, about 3%

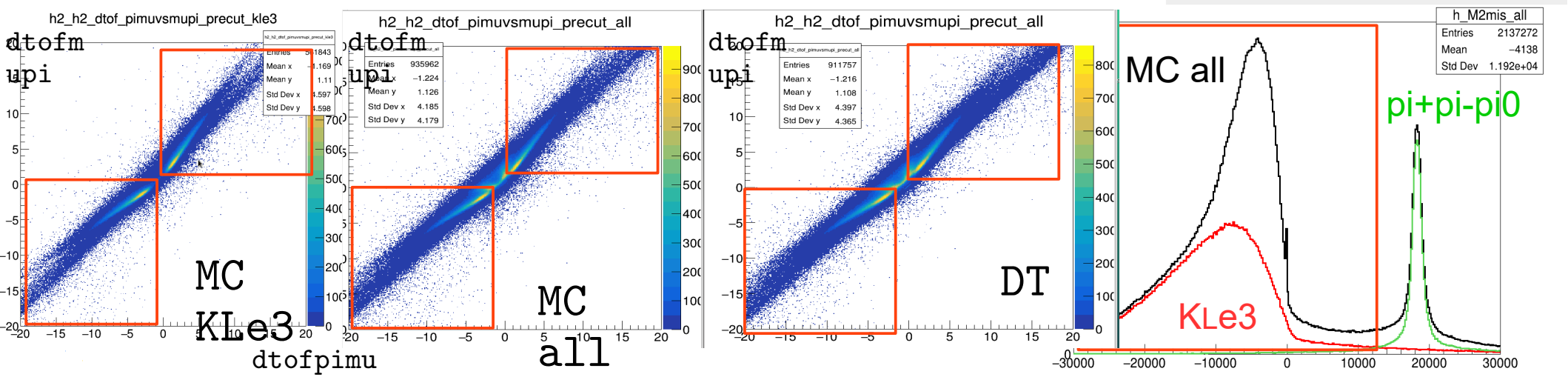


KLe3 CONTROL SAMPLE – BDT

- CUT1: cut on M^2mis, dtof_mupi_vs_pimu and on dtof_pie_vs_epi (2TCA needed)
  - dtofpie>-0.4 && dtofpie<0.7&&dtofepi > 2 && dtofepi<11
  - dtofepi > -0.7 && dtofepi<0.2 && dtofpie > -11 && dtofpie<-2

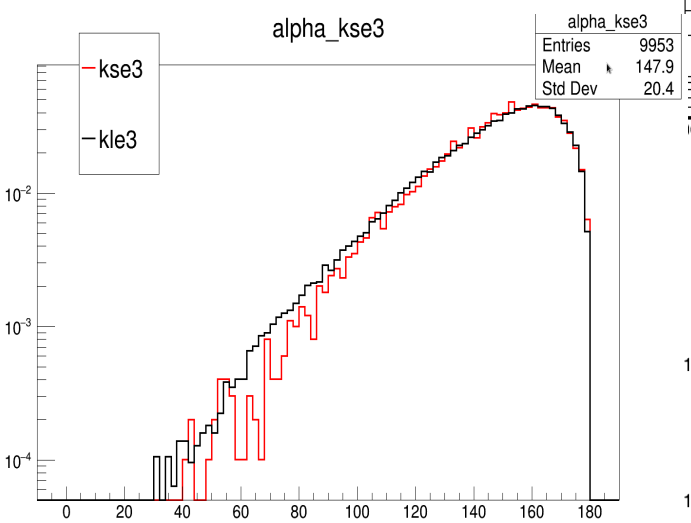


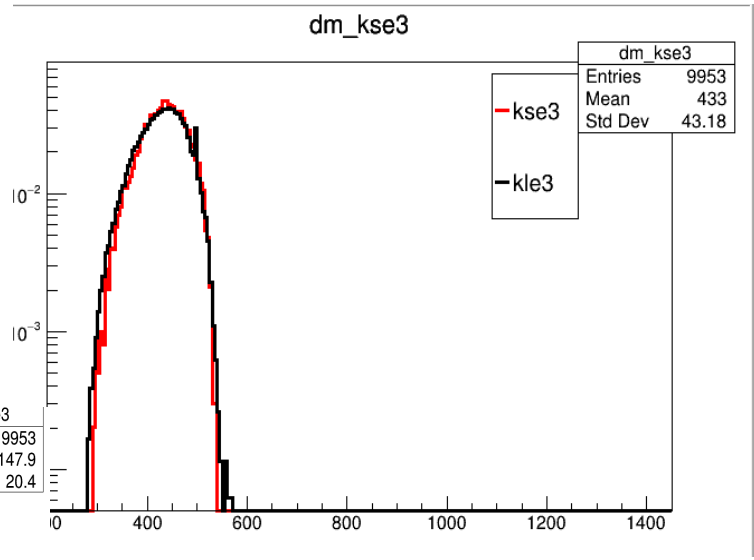
- (dtofpimu<-2&&dtofmupi<1)||(dtofpimu>1&&dtofmupi>0.8)))
- M2mis<15000

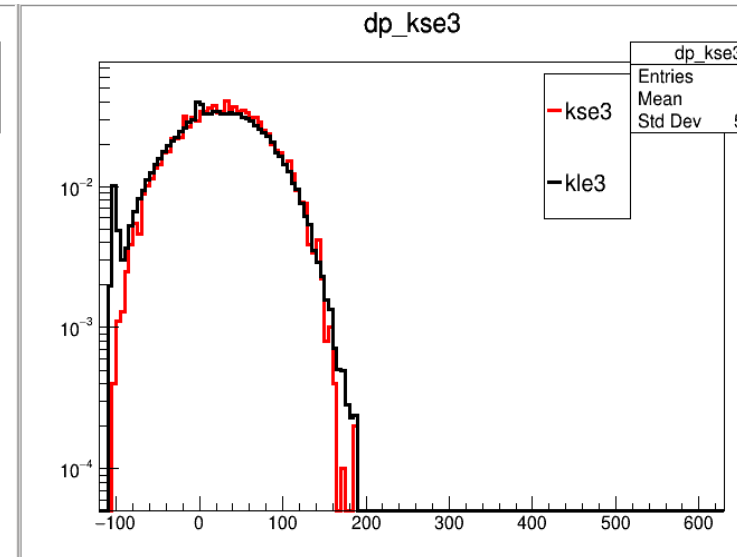


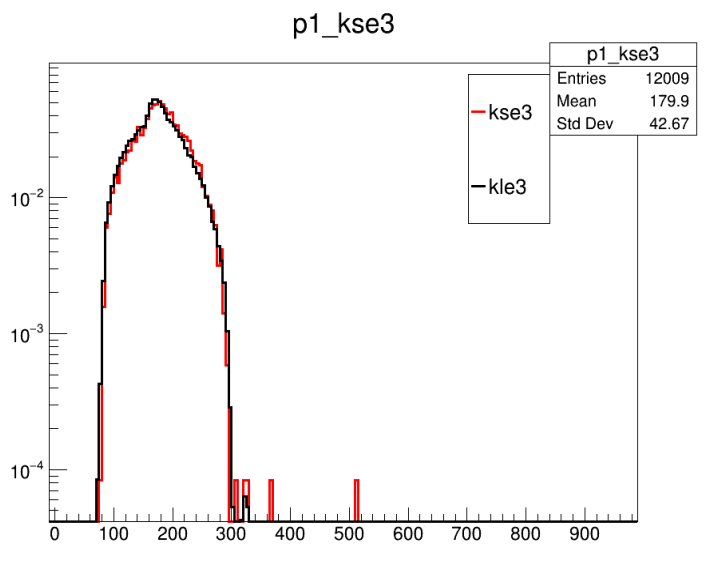
Kle3 CONTROL SAMPLE vs KSe3

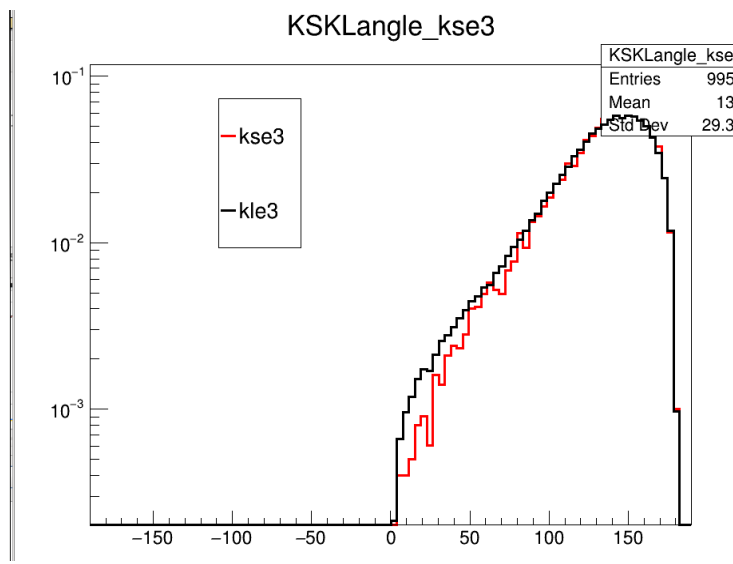
- Comparison of the 5 distribution of the input variable for the BDT





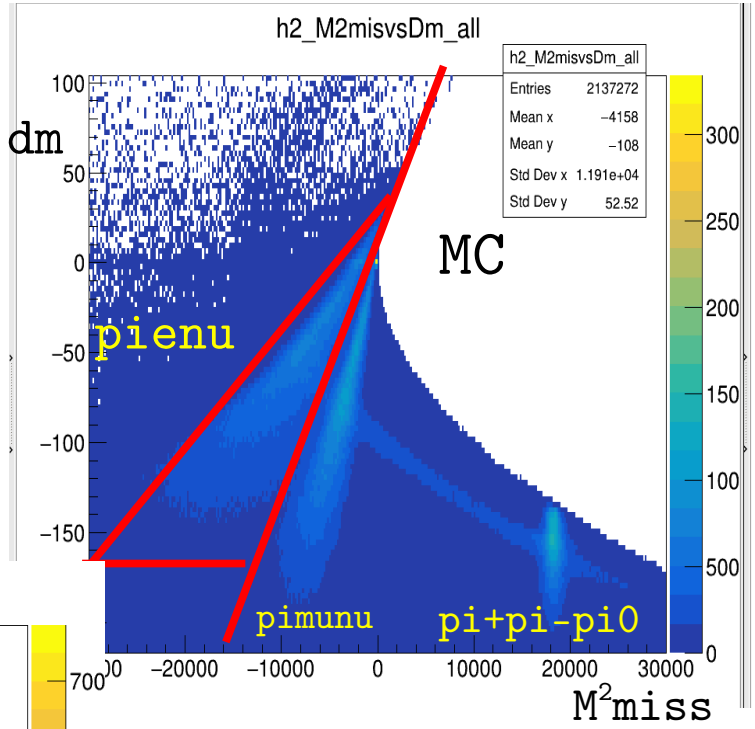


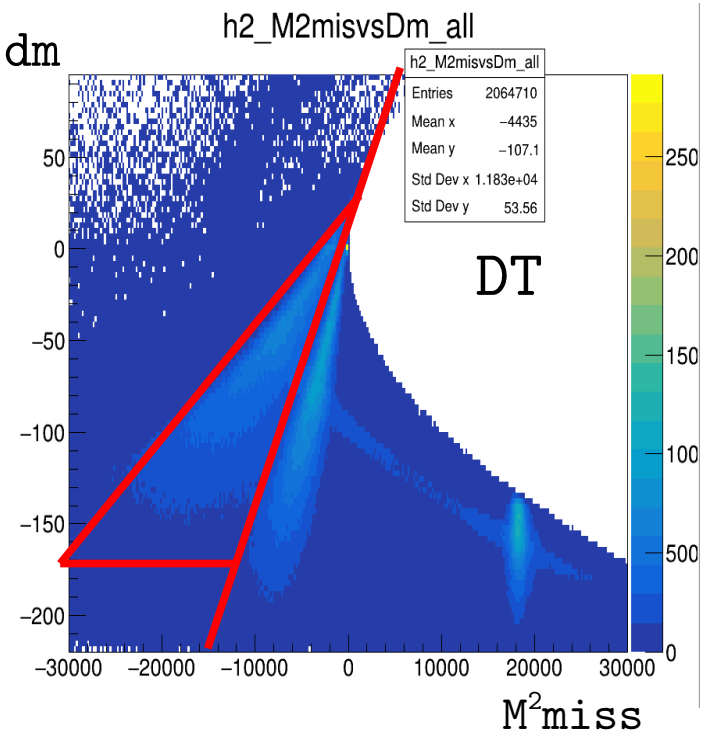


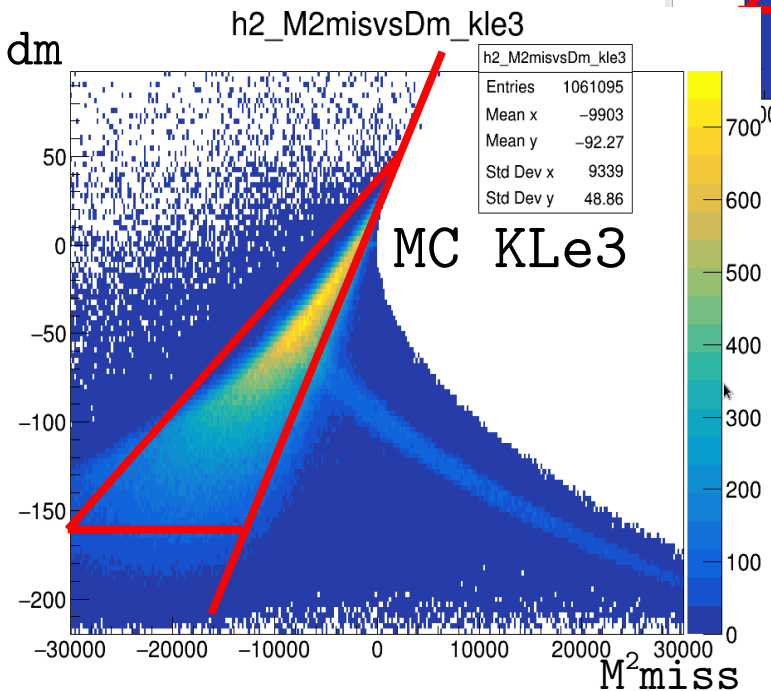


KLe3 CONTROL SAMPLE – DTOF

Dtof eff (and TCA?) ---> cut on dm vs M^2miss

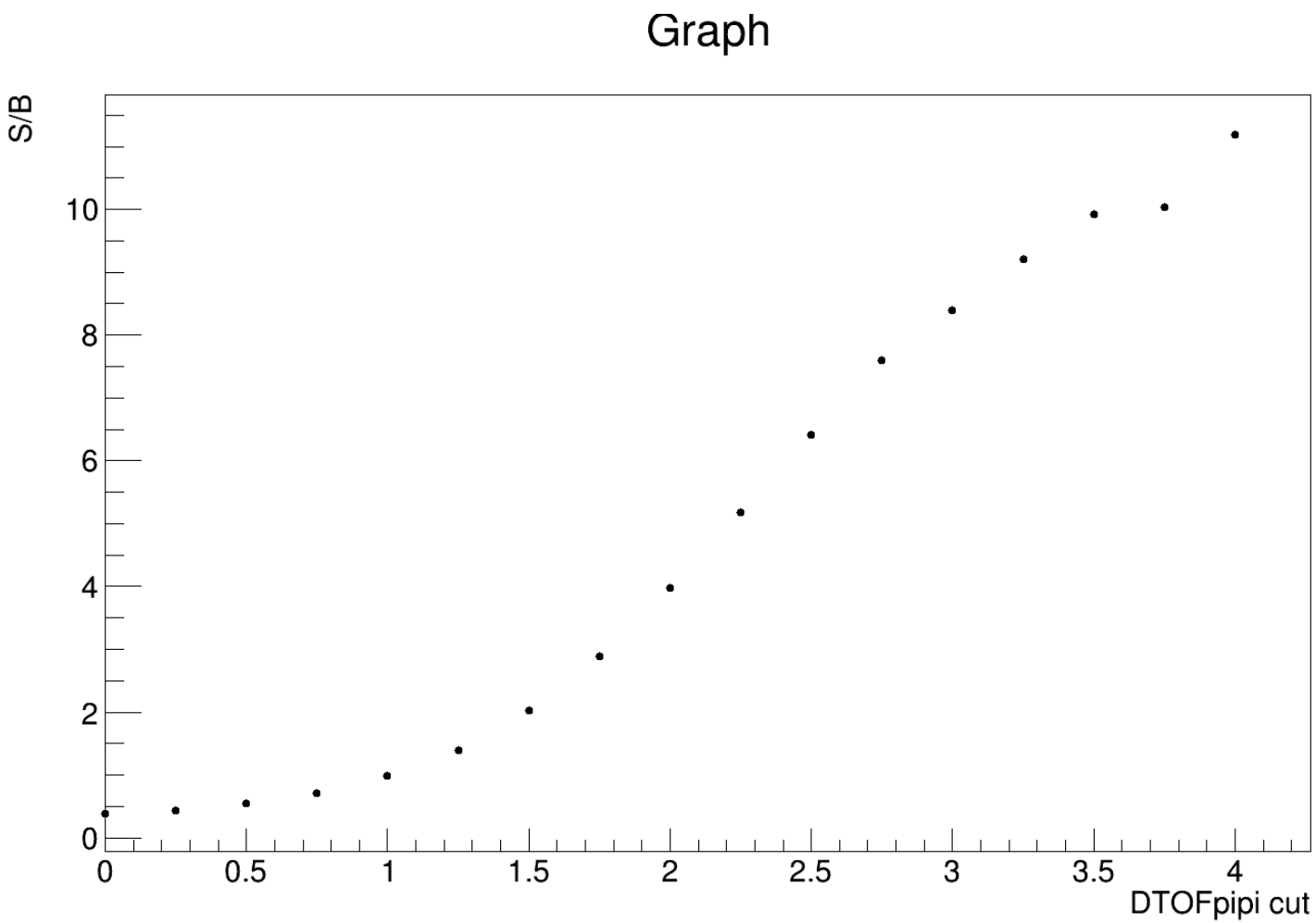


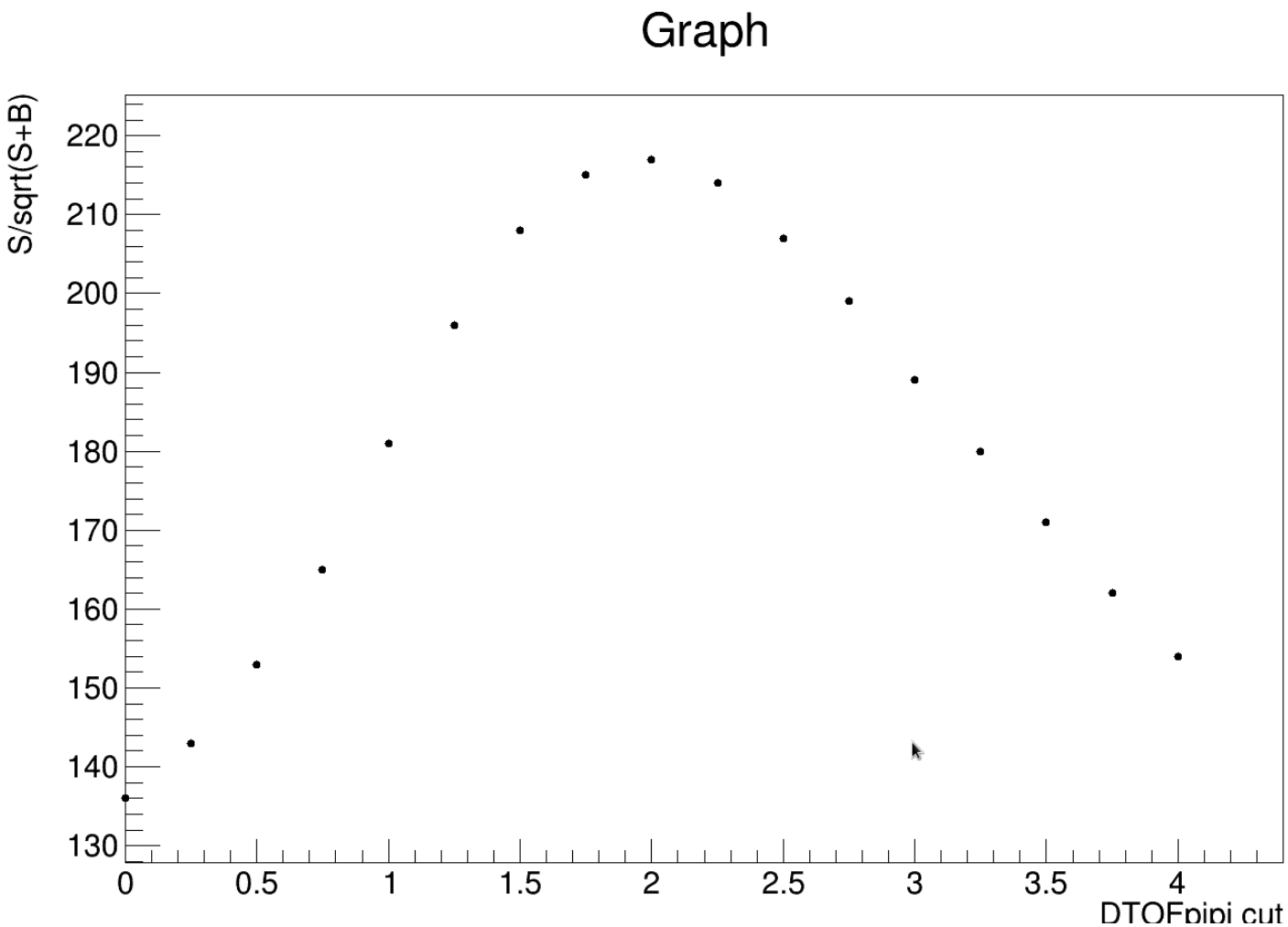


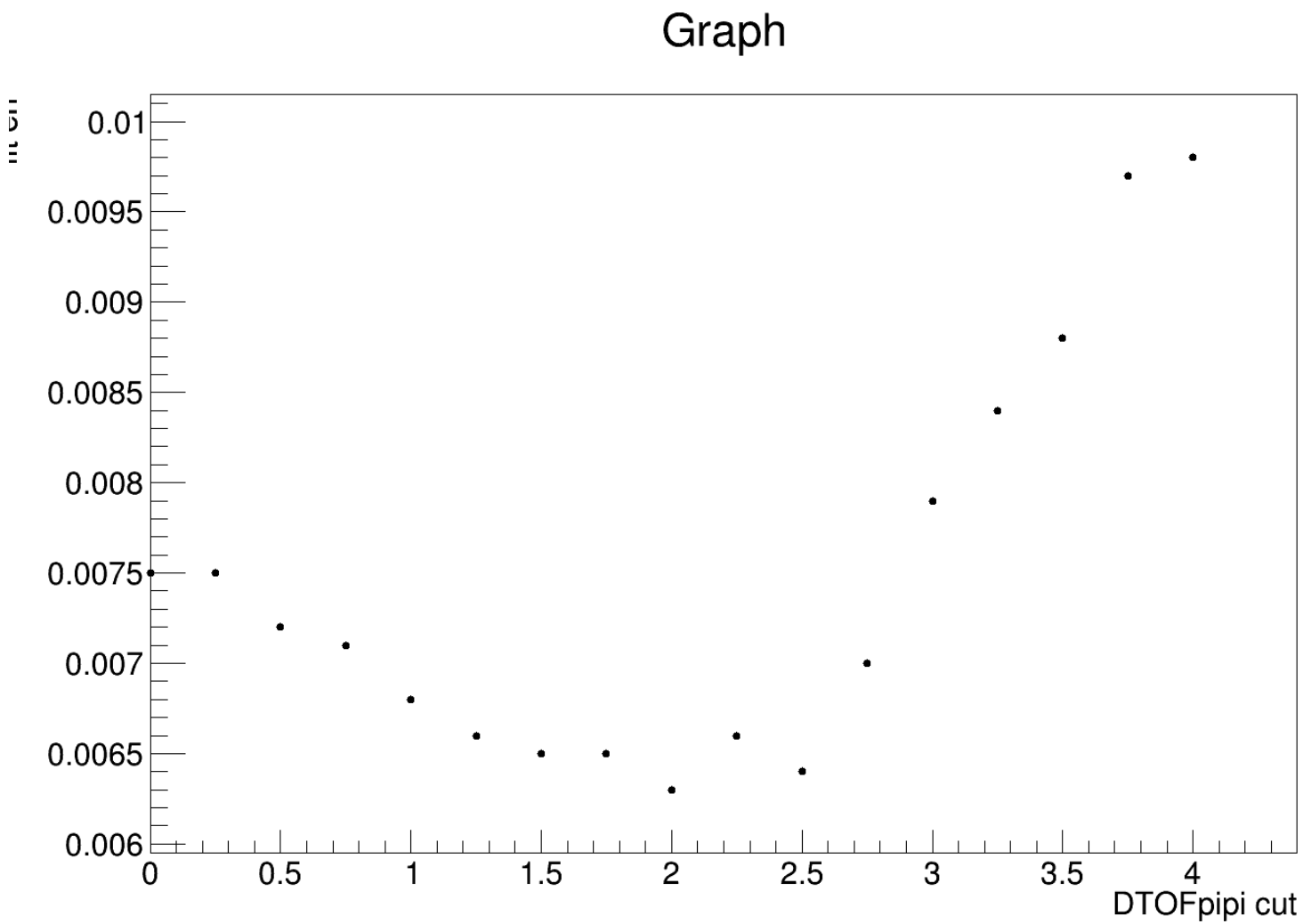


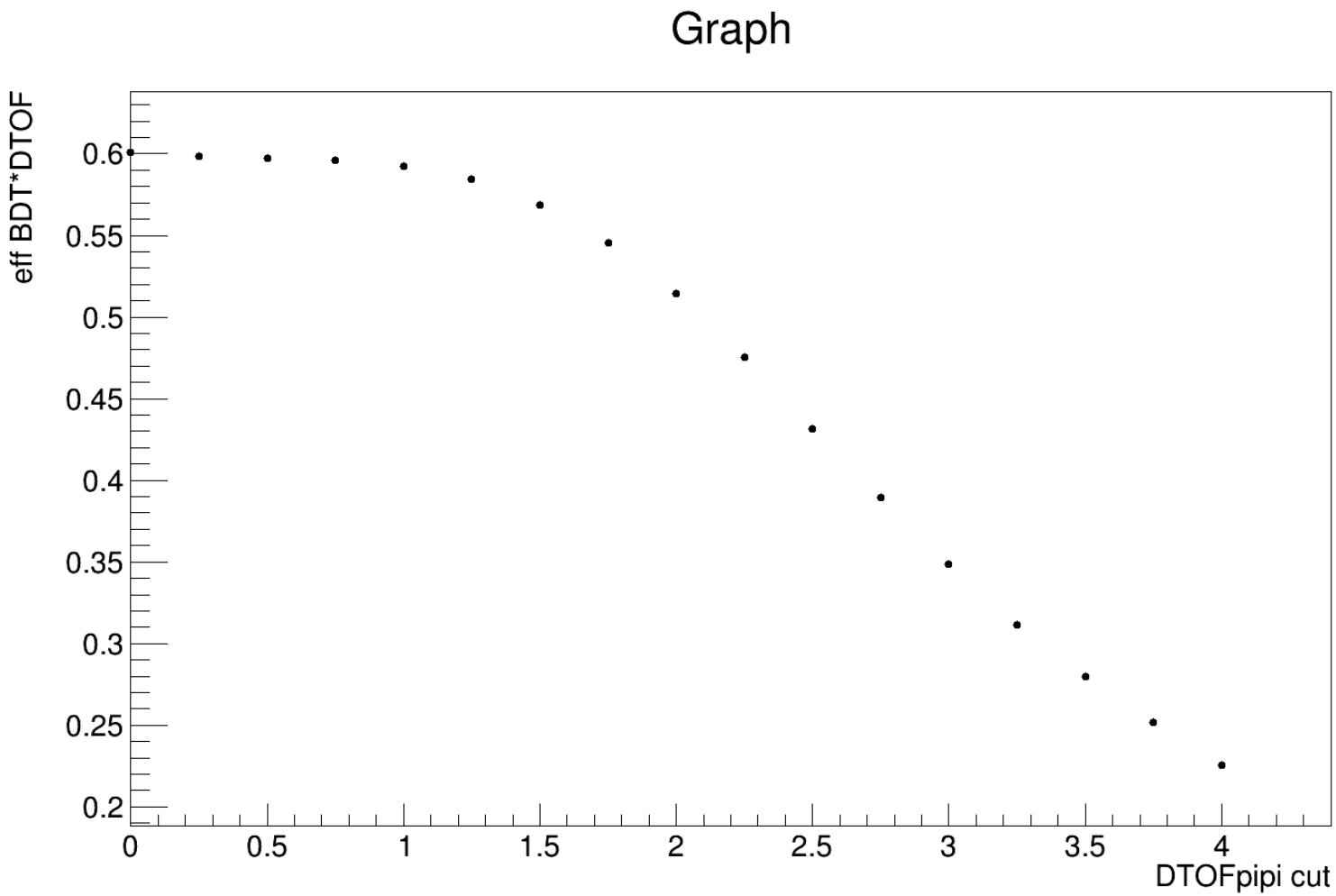
CUT2:

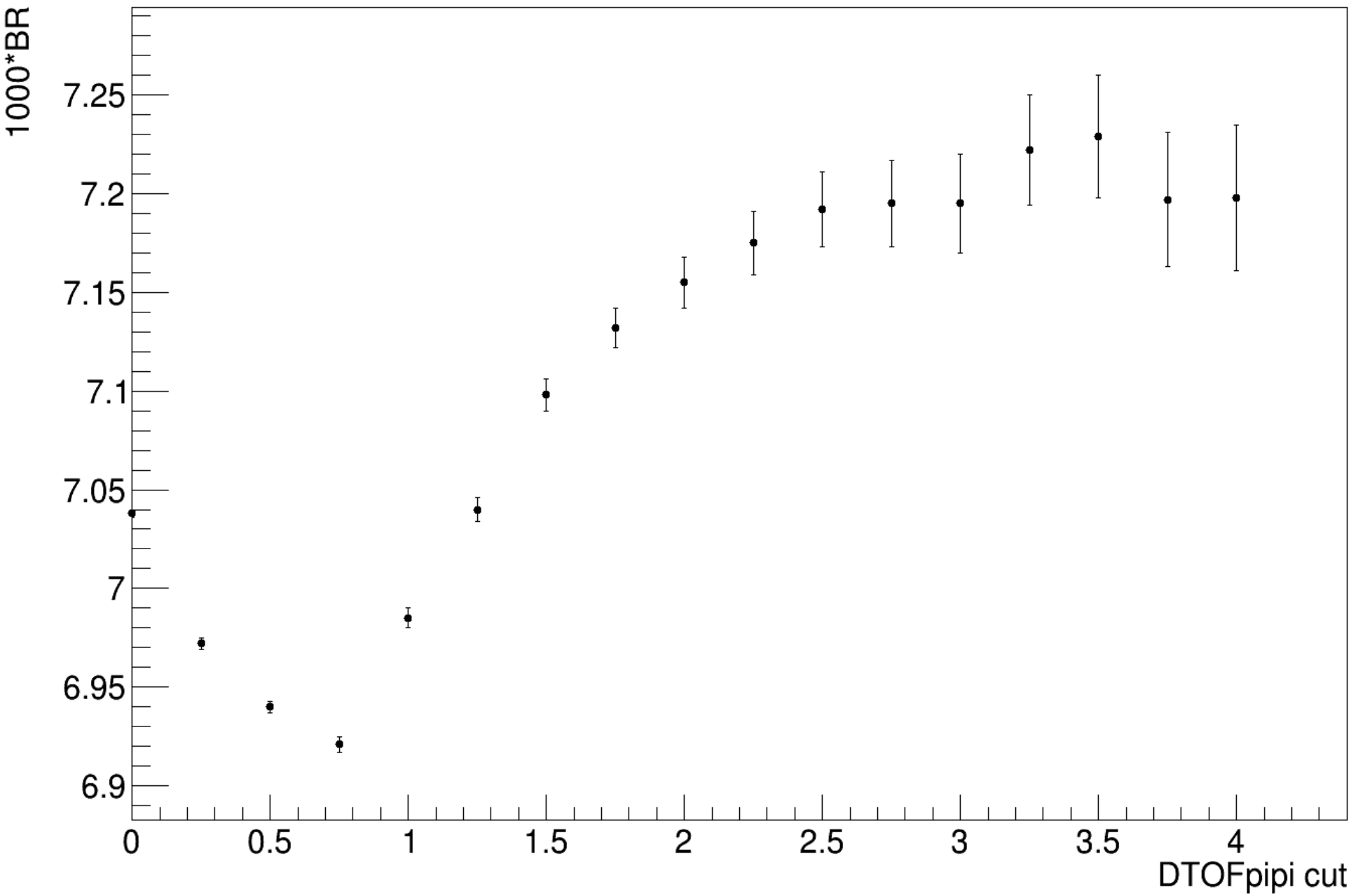
- dm2>0.015*M2mis+15.48
- dm2<0.0055*M2mis+32.4
- dm2>-170


Graph
S/B
0
2
4
6
8
10
0
0.5
1
1.5
2
2.5
3
3.5
4
DTOFpipi cut


Graph
S/sqrt(S+B)
220
210
200
190
180
170
160
150
140
130
0
0.5
1
1.5
2
2.5
3
3.5
4
DTOFpipi cut


Graph
0.01
0.0095
0.009
0.0085
0.008
0.0075
0.007
0.0065
0.006
0
0.5
1
1.5
2
2.5
3
3.5
4
DTOFpipi cut


Graph
eff BDT*DTOF
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0
0.5
1
1.5
2
2.5
3
3.5
4
DTOFpipi cut



Error is systematic one to DTOFpipi efficiency from control sample