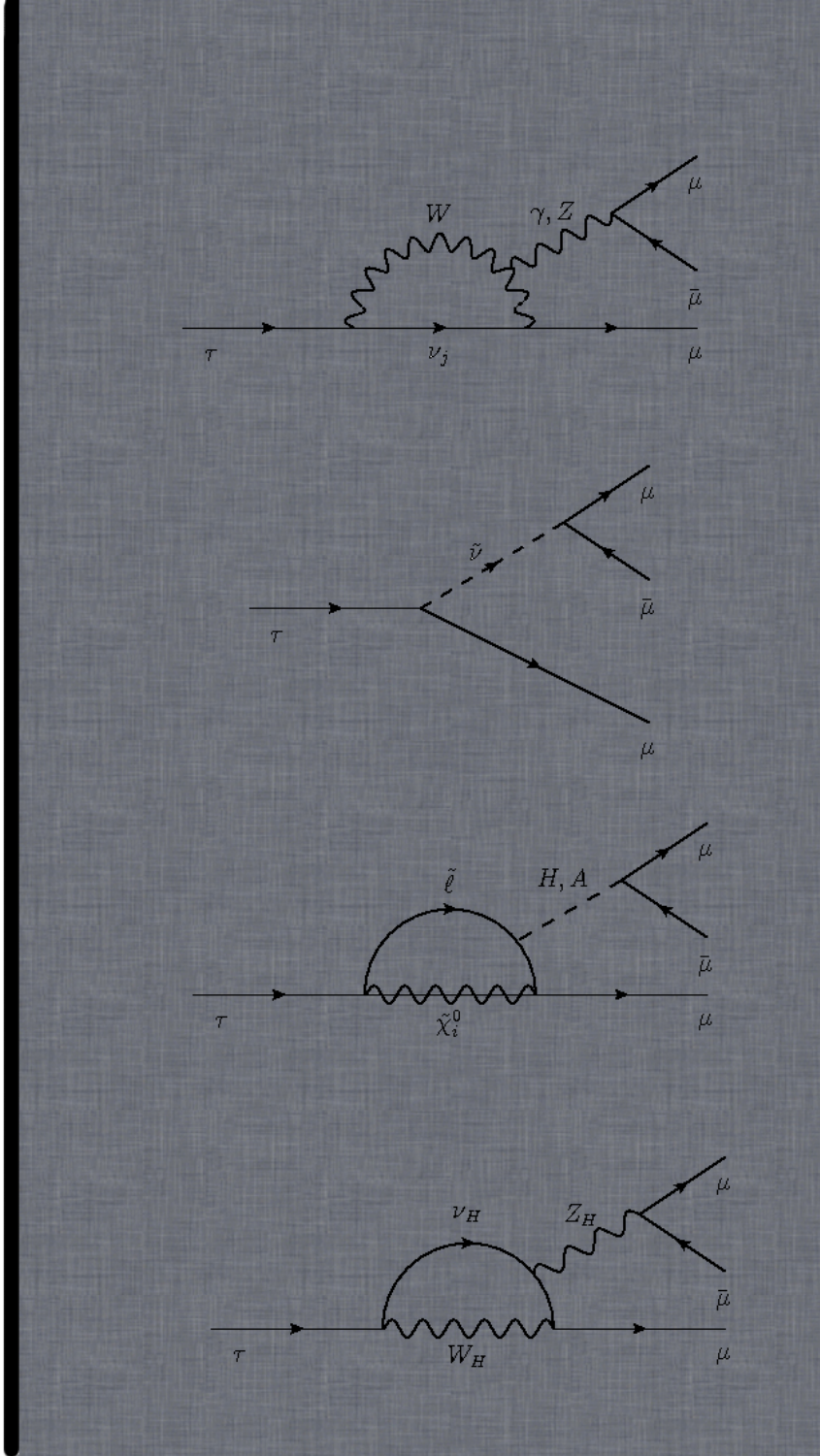
Updates on activities.

Marcin Chrząszcz[1,2] , Nicola Serra[1]

[1] University of Zurich , [2] Institute of Nuclear Physics, Krakow,

9*th* July 2013

University of Zurich[UZH]



Inflaton analysis

- Introduction
- Simulation
- Resolution

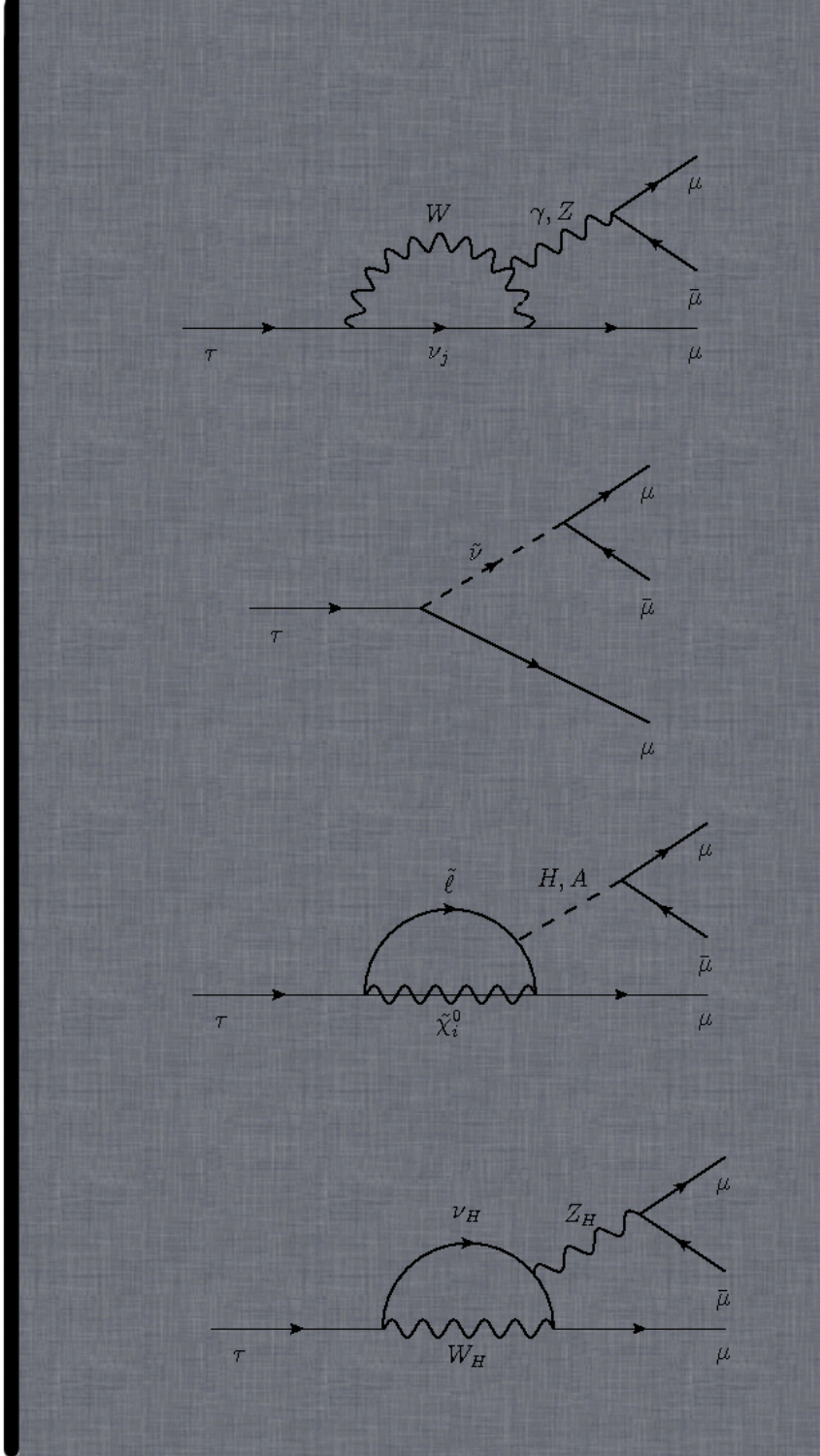
Summary

$\tau \to 3\mu$, $\tau \to p\mu\mu$ analysis

BEC and FDC

Other analysis with smaller progress

BACKUP



Inflaton analysis

Motivation:

- Probing low energy particle physics.

$$\mathcal{L}_{XSM} = \int \sqrt{-g} d^4x (\mathcal{L}_{SM} + \mathcal{L}_X + \mathcal{L}_{grav})$$

- Coupling to SM via scalar potential.
- Solves cosmological problems.
- Long lived particles. Life time $10^{-9} - 10^{-10} s$
- Mass $1 - 2 GeV$.
- Reheats the early universe.[1]

[1] arXiv:0912.0390, arXiv:1303.4395

M.Chrząszcz, N.Serra 2013

Work done so far

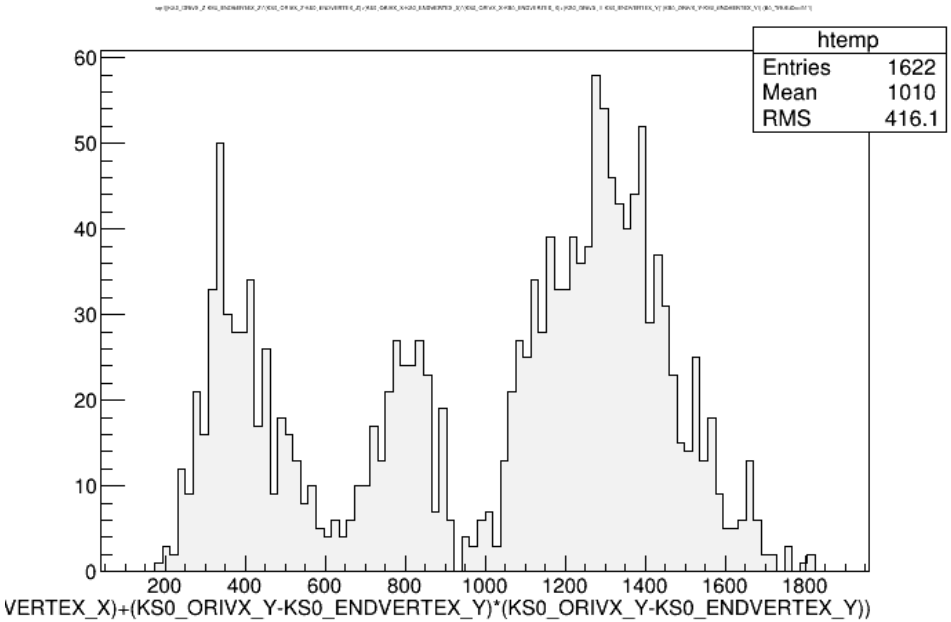
Work done:

- Prepare a decfile. v27r8 released
- Simulated 1.3*M* events, pythia8, siom08.
- Implemented isolation parameters in DecayTreeTuple package(extrnal c++ module).
- Started looking at signal efficiency.
- Signal is split into two samples: Downstream μ and "normal" μ.

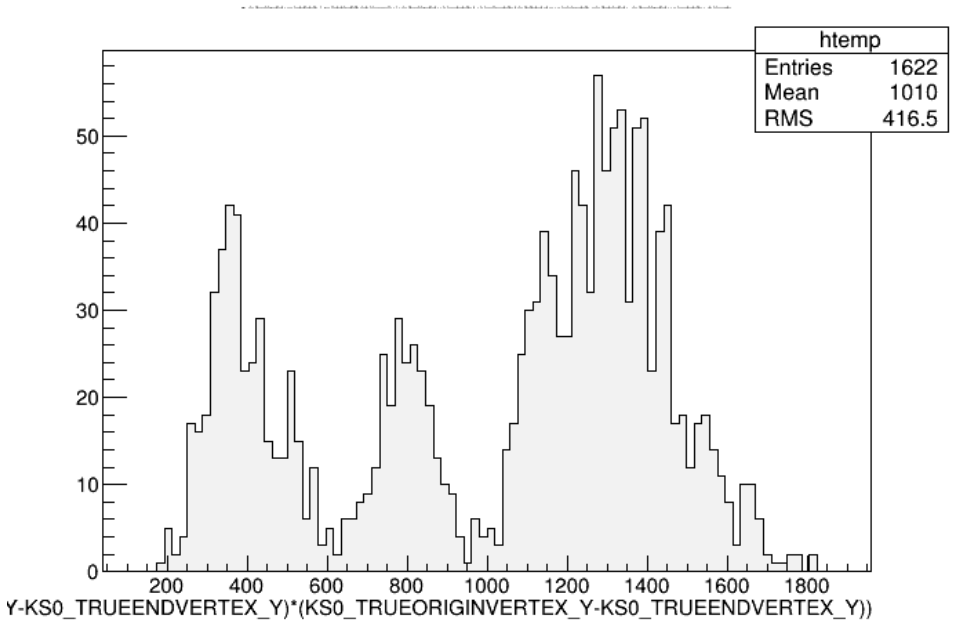
M.Chrząszcz, N.Serra 2013

Flight distance of Inflaton

Reconstructed



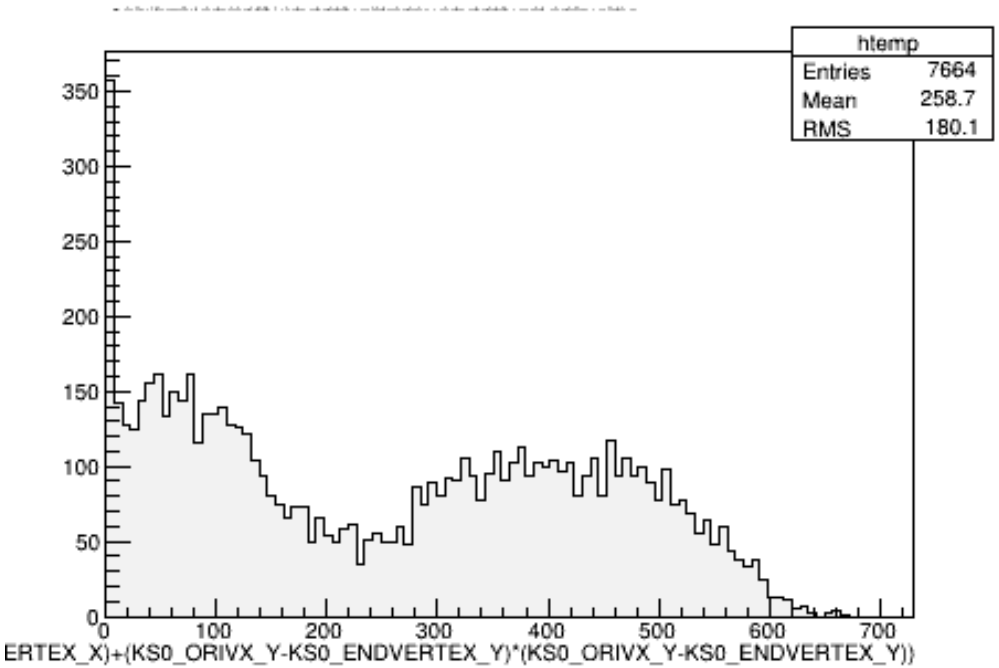
Truth Matched



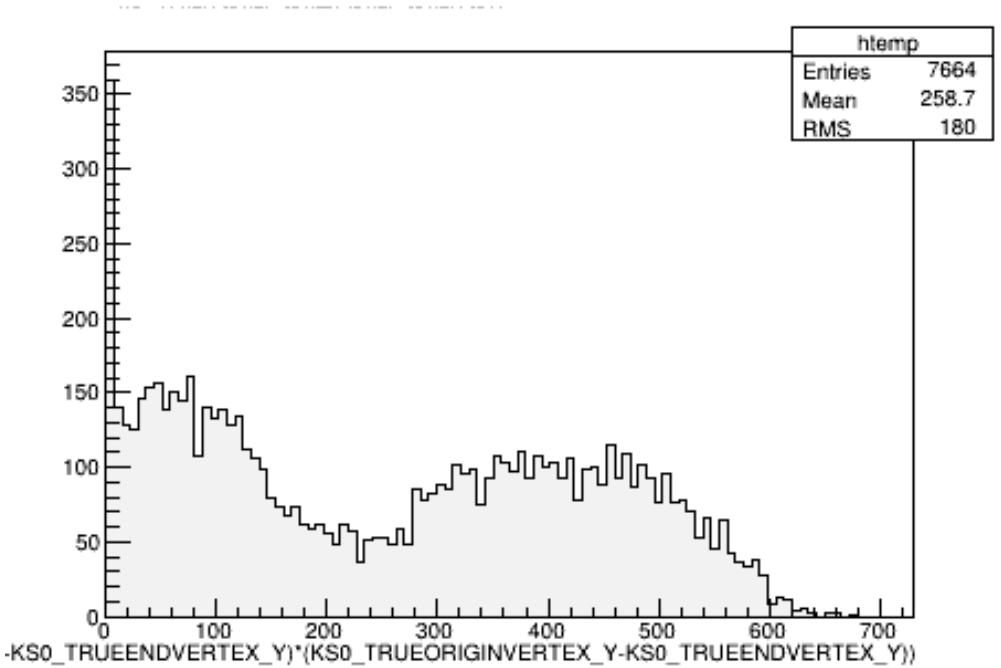
M.Chrząszcz, N.Serra 2013

Flight distance of Inflaton, "normal" μ

Reconstructed



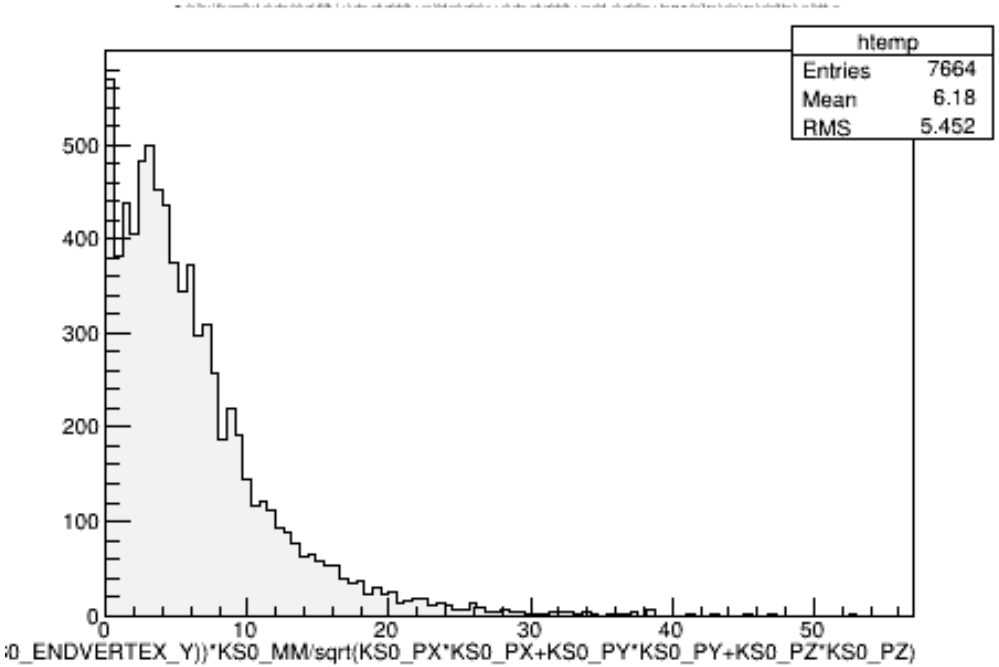
Truth Matched



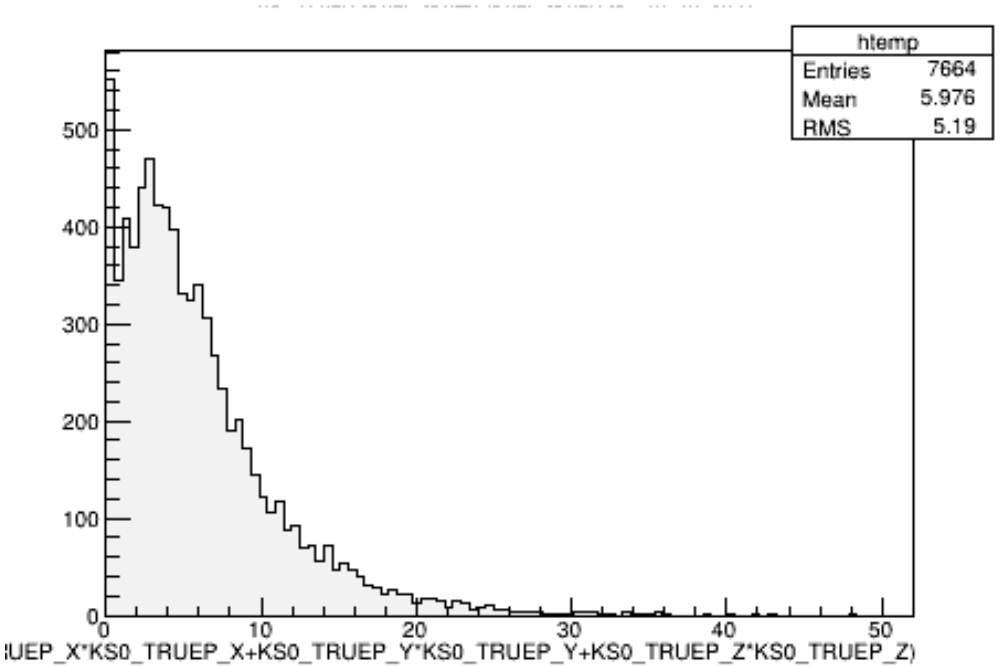
M.Chrząszcz, N.Serra 2013

Life time of Inflaton, "normal" μ

Reconstructed



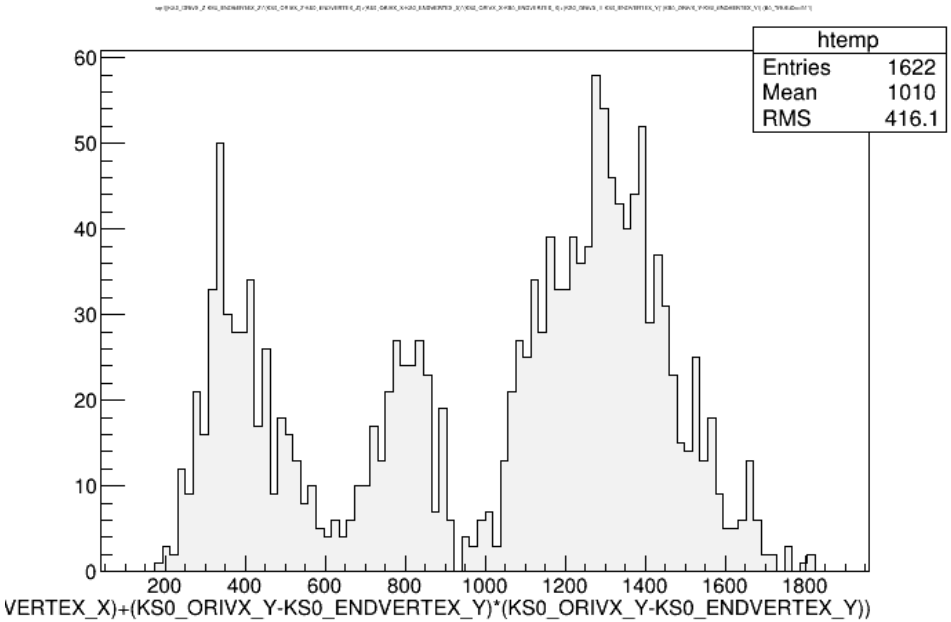
Truth Matched



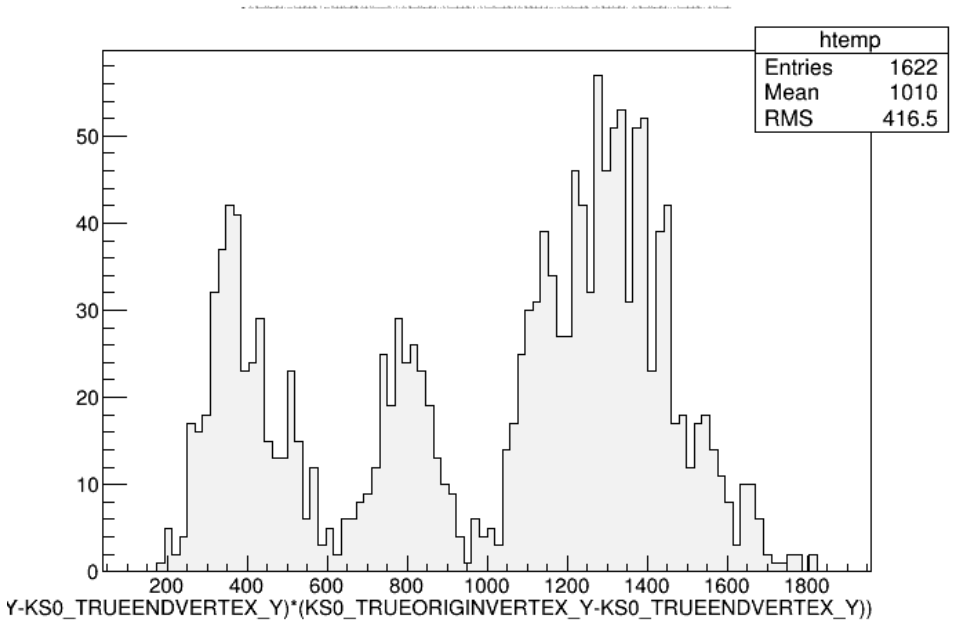
M.Chrząszcz, N.Serra 2013

Flight distance of Inflaton, downstream μ

Reconstructed



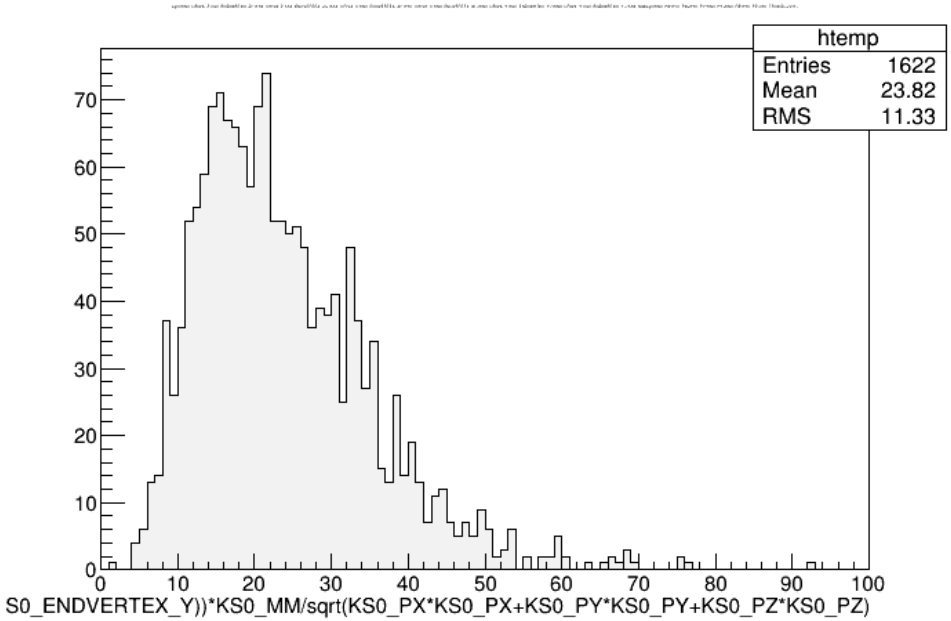
Truth Matched



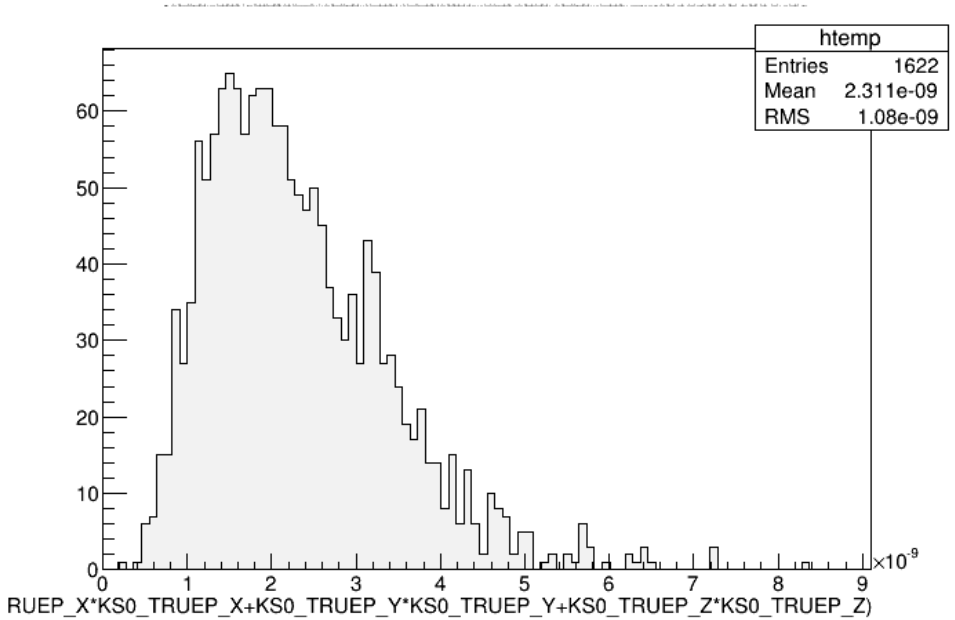
M.Chrząszcz, N.Serra 2013

Life time of Inflaton, downstream μ

Reconstructed



Truth Matched



M.Chrząszcz, N.Serra 2013

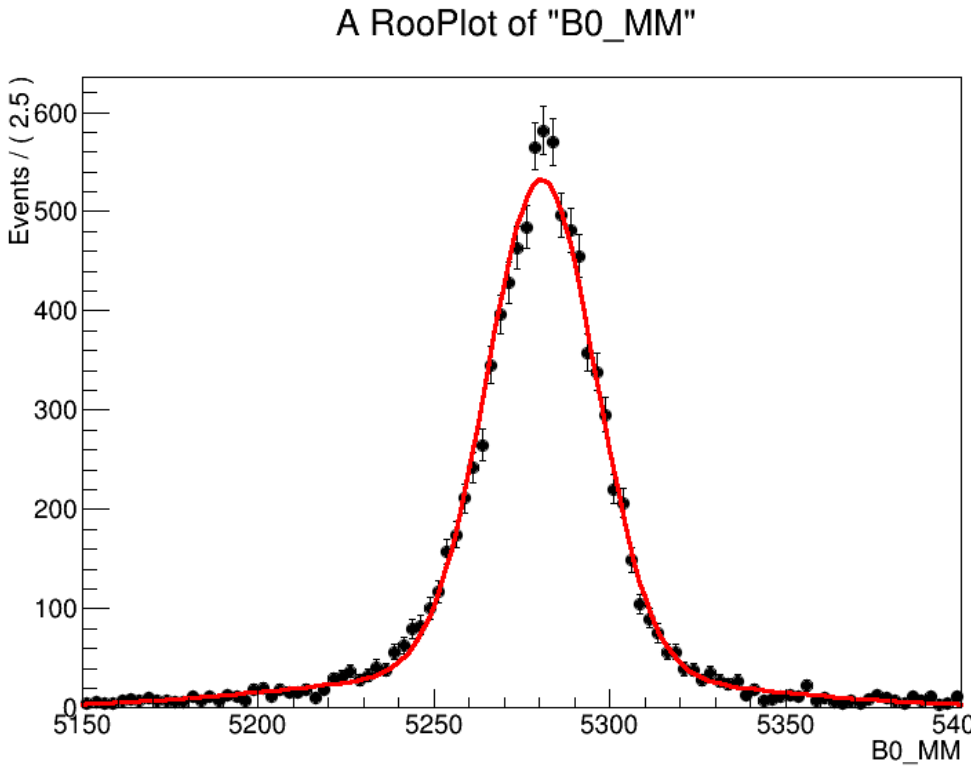
Mass Resolution

- Fitted separately for $\mathrm{B}0$ and χ
- Fitting model: Double Gauss.
- Single Gauss didn't work.
- We will account for MC/DATA difference.

M.Chrząszcz, N.Serra 2013

Mass Resolution

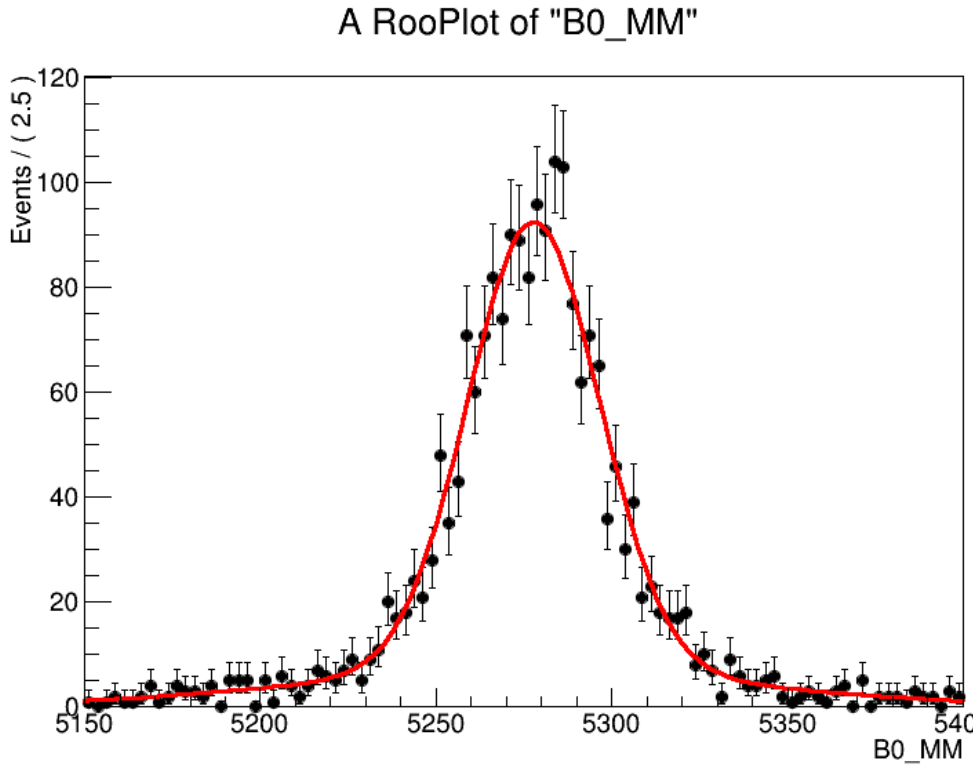
StdMuons



$mean_1 = 5.288 \times 10^{+03} \pm 0.21 MeV$,
$mean_2 = 5.27 \times 10^{+03} \pm 1.56 MeV$
$\sigma_1 = 58.8 \pm 2.24$, $\sigma_2 = 15.5 \pm 0.23$

$f = 0.79 \pm 0.01$

Downstream



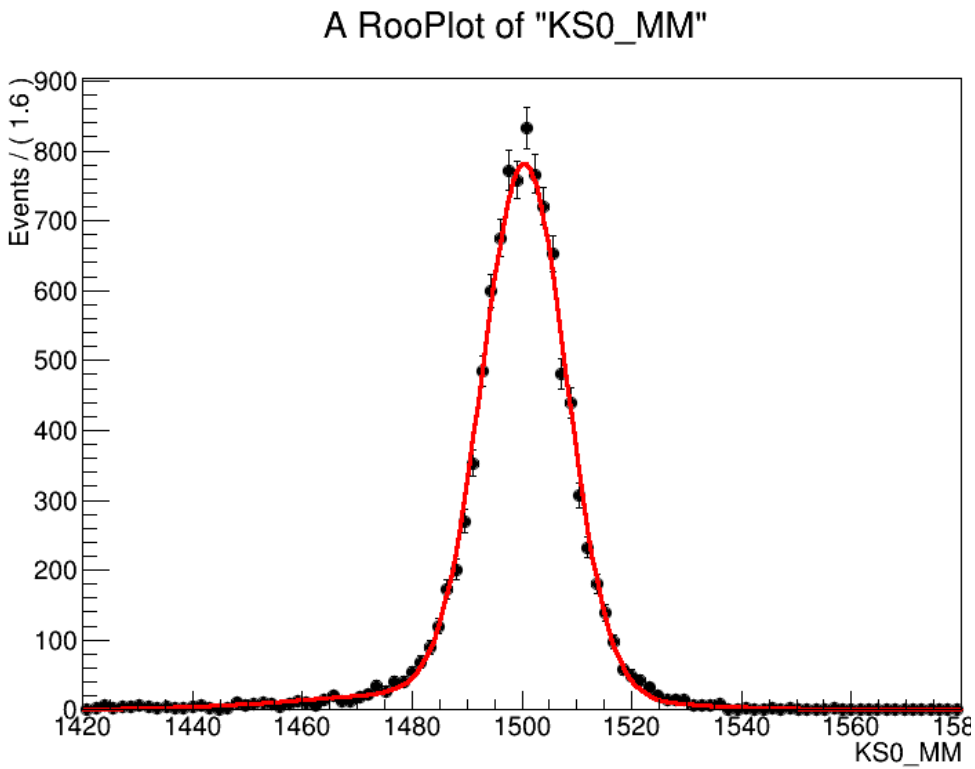
$mean_1 = 5.28 \times 10^{+03} \pm 4.18 MeV$,
$mean_2 = 5.28 \times 10^{+03} \pm 0.56 MeV$
$\sigma_1 = 66.6 \pm 7.56$, $\sigma_2 = 18.7 \pm 0.65$

$f = 0.21 \pm 0.02$

M.Chrząszcz, N.Serra 2013

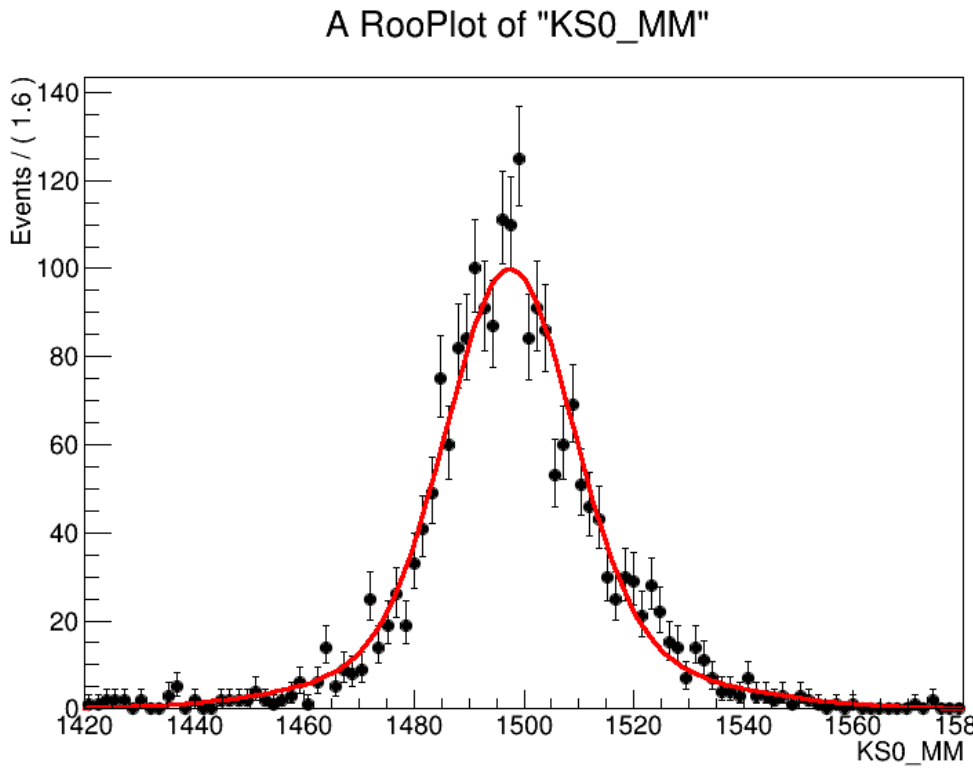
Mass Resolution

StdMuons



$mean_1 = 1.48893 \times 10^{+03} \pm 1.1 MeV$,
$mean_2 = 1.50046 \times 10^{+03} \pm 0.09 MeV$
$\sigma_1 = 25.7 \pm 0.83$, $\sigma_2 = 7.63 \pm 0.01$
$f = 0.104 \pm 0.007$

Downstream



$mean_1 = 1.49880 \times 10^{+03} \pm 1.41 MeV$,
$mean_2 = 1.49743 \times 10^{+03} \pm 0.51 MeV$
$\sigma_1 = 27.3 \pm 2.57$, $\sigma_2 = 11.34 \pm 0.88$
$f = 0.28 \pm 0.075$

M.Chrząszcz, N.Serra 2013

Summary on inflaton

- Good reconstruction of life time. ☺
- Excellent mass resolution. ☺
- Data from 2011 and 2012 are being processing with our preselection on DIRAC as we speak. ☺
- Poor efficiency: $\varepsilon_{rex} \times \varepsilon_{stripping} = 1\%$ ☹
- Need to investigate if this is due to reco or stripping.

M.Chrząszcz, N.Serra 2013

$\tau \to 3\mu$, $\tau \to p\mu\mu$ analysis

Where do we stand(last week development):

- Over 20 new DecFiles committed(Patrick will kill me).
- No more problem with reweighing the MC. ☺
- Smaller systematics.
- Implemented Generator cuts. Gained 10x in retention.
- Produced yesterday ntuples with new MC(done by me).
- Background grown more than expected in 2012.
- Investigating new trigger lines.
- Will have the conclusion on triggers for tomorrow's $\tau \to 3\mu$ meeting.

M.Chrząszcz, N.Serra 2013

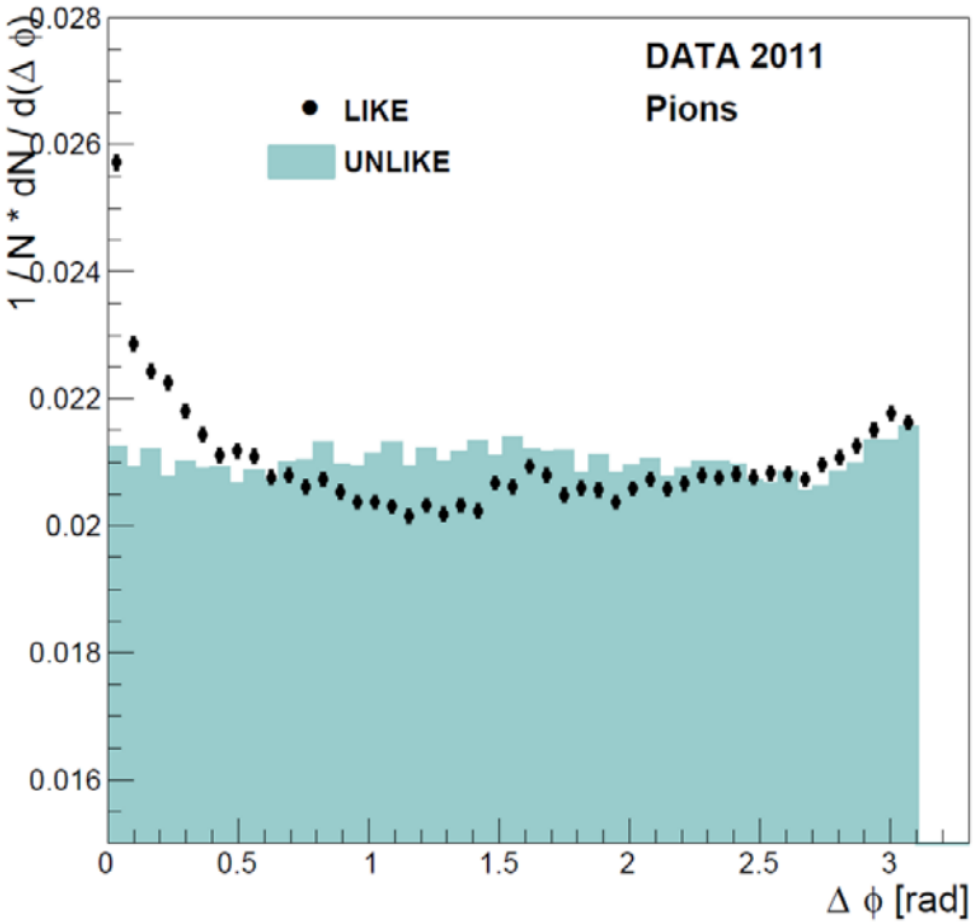
BEC and FDC

Where do we stand(last week development):

- I froze preselection.Moved only to PIDNN.(backup slides).
- Produce ntuples 2011+2012 data.
- We see enhancement in low q^2 region.
- Problems implementing LCMS.
- Thrust axis doesn't make sense in LHCb.
- On Wed soft-QCD prof. Bialas has talk about BEC ,discussion planned.

M.Chrząszcz, N.Serra 2013

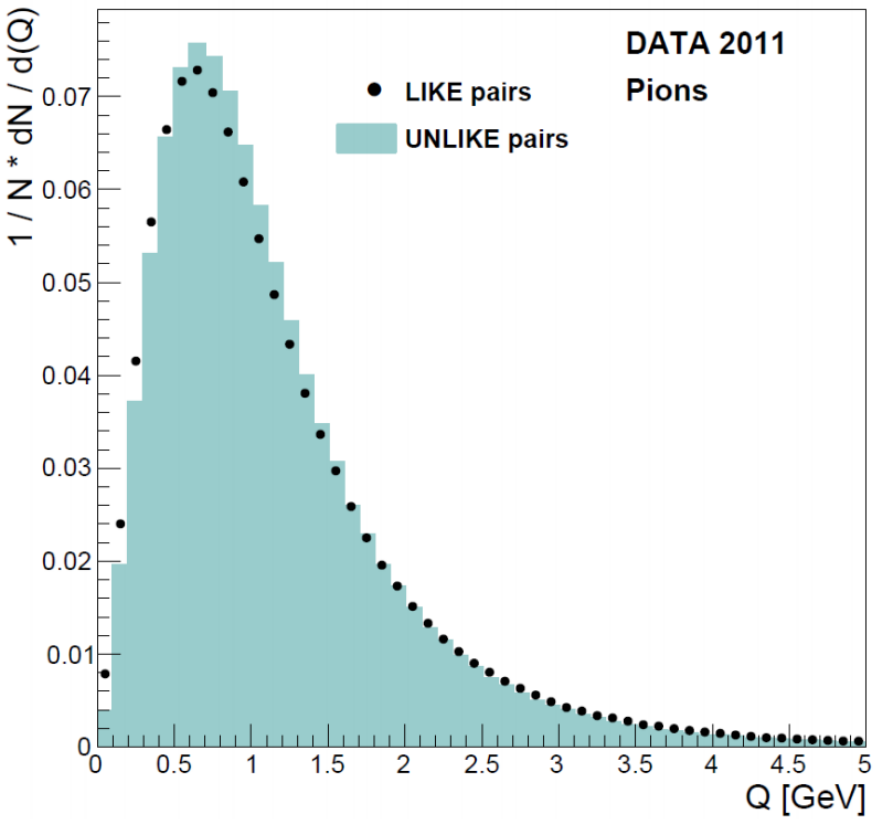
BEC and FDC

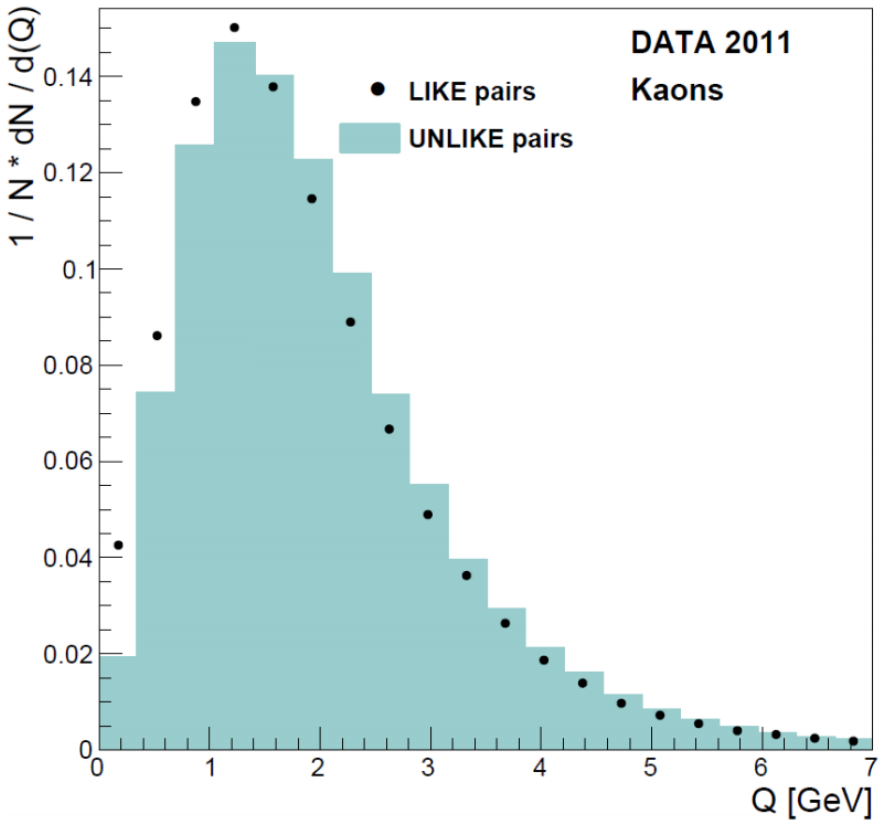


Enhancement in low ϕ region.

M.Chrząszcz, N.Serra 2013

BEC and FDC





Enhancement in low q^2 region.

M.Chrząszcz, N.Serra 2013

Other analysis with smaller progress

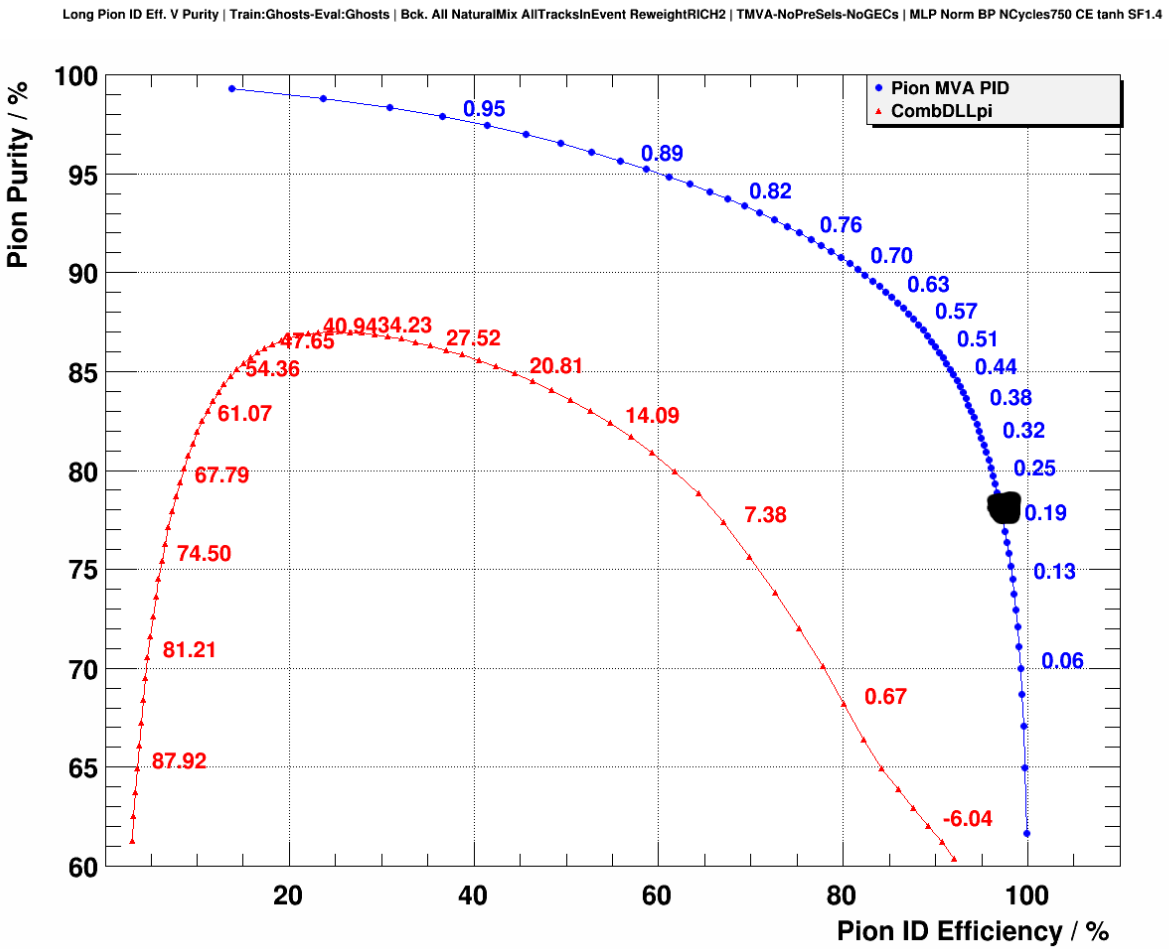
- $\Lambda_b \to h\mu$. We found bug in official MC. We have new one since last week. Playing around with isolating parameter.
- $\Lambda_c \to p\mu\mu$ At midnight DIRAC infromed me that official MC production started.

M.Chrząszcz, N.Serra 2013

BACKUP

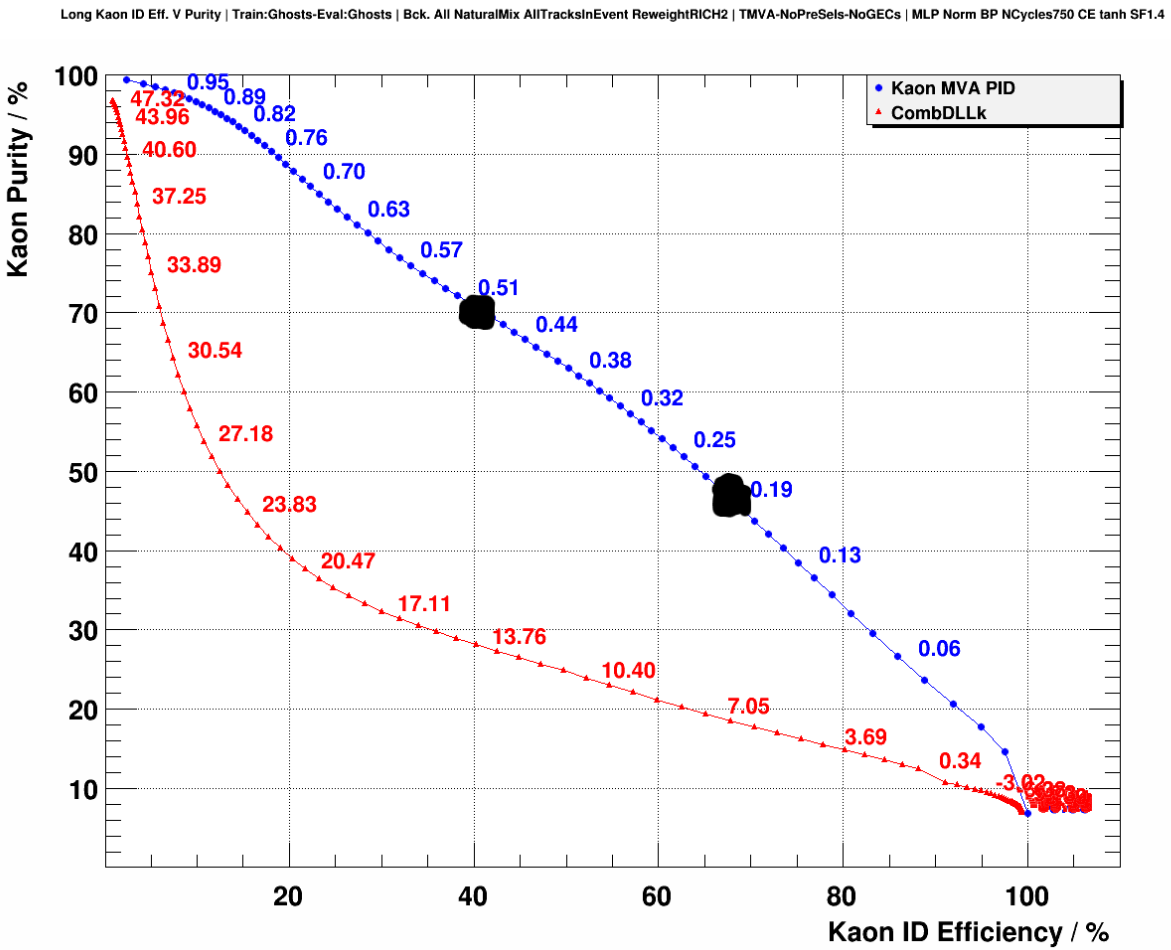
PID π

- No more DLL.
- Only *PIDNN* V2.



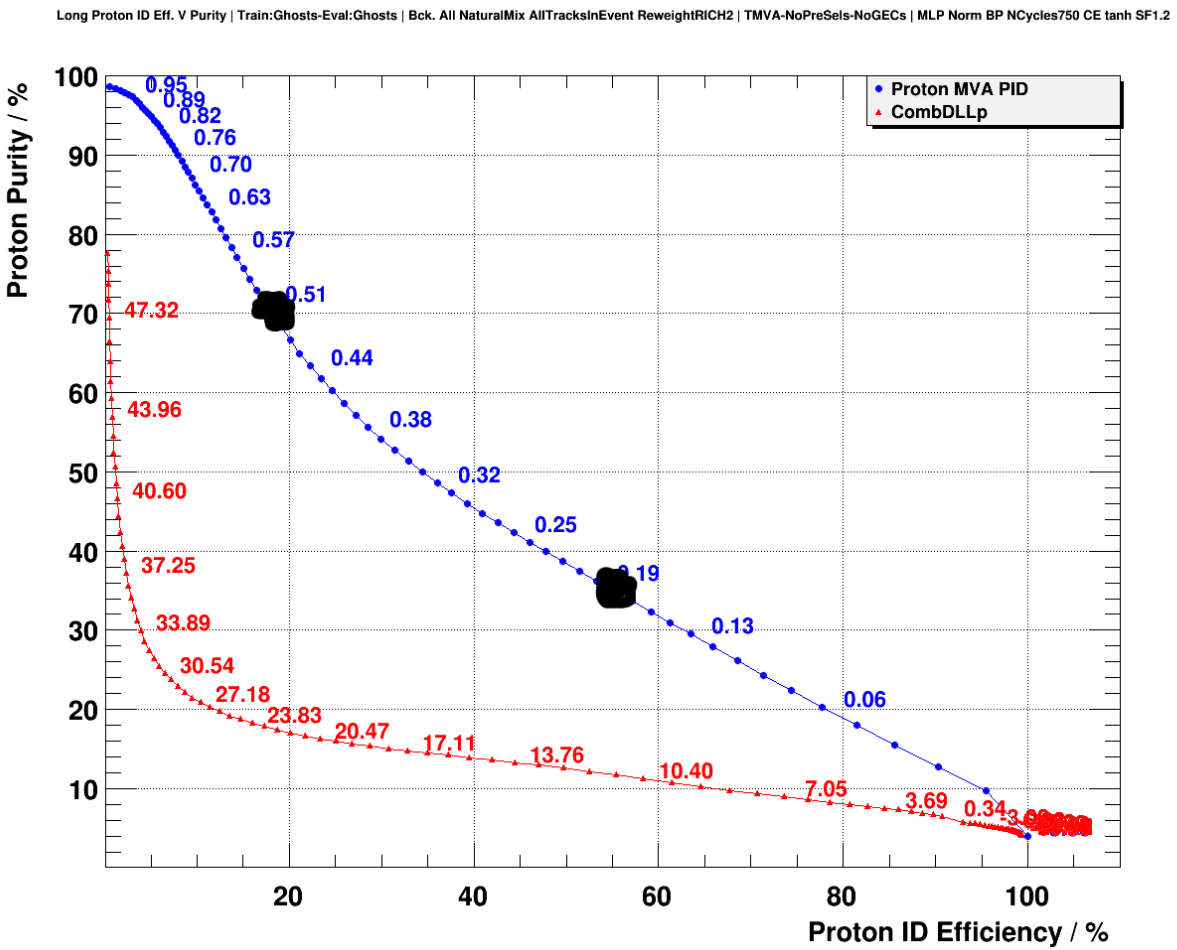
M.Chrząszcz 2013

PID K



M.Chrząszcz 2013

PID p



M.Chrząszcz 2013

Changes

- Let's Use the looser proposed PIDNN for preselection(backupslides)
- We might get into troubles with statistics for K/p modes.
- We should really start to think about dedicated stripping!
- Is a paper only with pions a possibility till we get new stripping?

M.Chrząszcz 2013