Status report

Jurina Nakajima(SOKENDAI)

11,April 2024

Introduction

Improving kink finder and detected kink and displaced vertex in TPC for SM particles, LLP, SUSY …

→ It is good study to simulate power of TPC

First, we check Kaon events

The how and why we make special kaon events

Endpoint(MC) inside TPC, (MC)E_{kaon}>10 GeV, (MC) # of charged daughter = 1

Pulling out only interesting events from exisiting samples

100,000→164

To evaluate the power of standard kink finder, we want to increase # of kaon events decayed inside TPC

→we need to set $K^{\pm}$ mean lifetime shorter (usual kaons often don't decay inside TPC?)

Geant4 has information reffered to PDG

$$c\tau_{K^{\pm}} = 3.70900 \times 10^{3}\ [\mathrm{mm}]$$

$$c\tau_{K^{\pm}} = 5.0 \times 10^{2}\ [\mathrm{mm}]$$

$$\gamma = \frac{E}{m} = \frac{10\,\mathrm{GeV}}{493\,\mathrm{MeV}} \simeq 20 \qquad \gamma c\tau_{K^{\pm}} = 1.00 \times 10^{3}\ [\mathrm{mm}]$$

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$c\tau_{K^{\pm}}$ = 3 0 [mm]

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$\gamma = \frac{E}{m} = \frac{10\,\mathrm{Ge}}{493\,\mathrm{M}}$ 20 $^{\pm}$ = 1.00 × 10^3 [mm]

Don't allow to overwrite known particles infomation in Geant4

New plan

We give up changing lifetime and making special events which more Kaons are decayed inside TPC.

1. How do we enhance statistics?

To enhance statistics from the current 100,000 events, we **skip the time-consuming calorimeter (HCAL) simulation** and make samples.

2. How do we deside interesting events?

Untill now…

Endpoint(MC) inside TPC, (MC)E_{kaon}>10 GeV, (MC) # of charged daughter = 1

When specifying the energy of the kaon to be 10 GeV, kaon energy is slightly smearing around 10 GeV.

Considering the **decay length** as a criterion of **whether it is** $r < 1.77\,[\mathrm{m}],\ |z| < 2.35\,[\mathrm{m}]$ seems to be more effective and efficient.

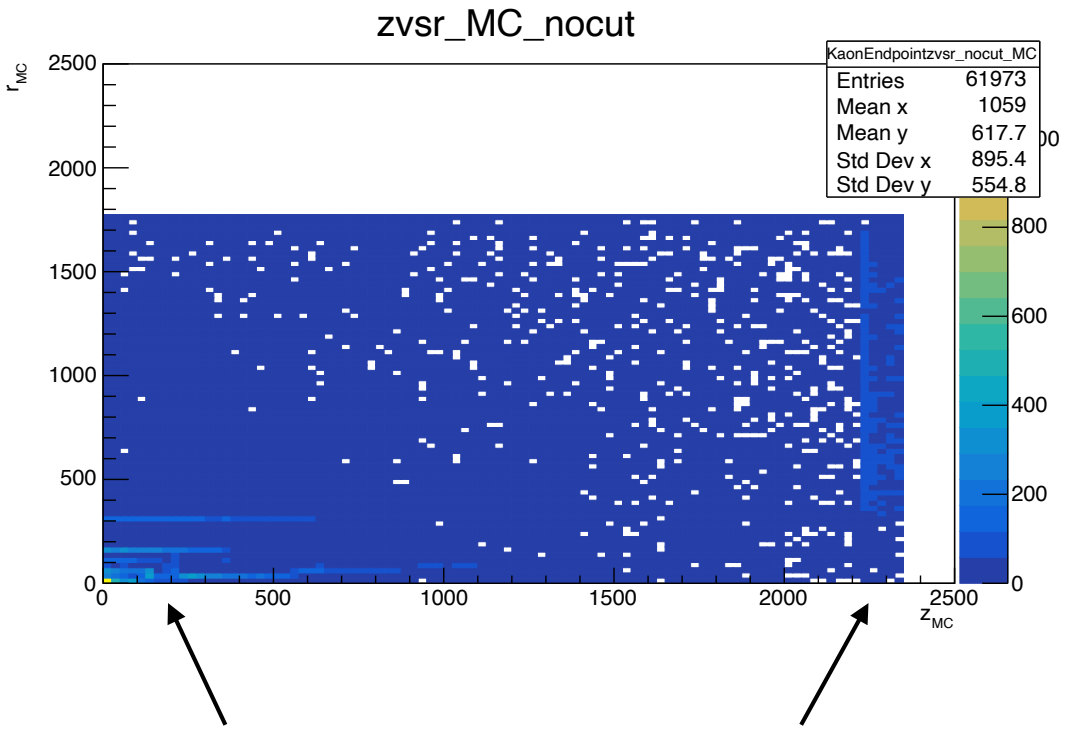
$E_{K^{\pm}}(MC)$

Kaon's end point (MC) Z vs r

・Endpoint(MC) inside TPC: $r_{in} > 329 + 100$ [mm] $r_{out} < 1770 - 100$ [mm] $|z_{max}| < 2350 - 250$[mm]

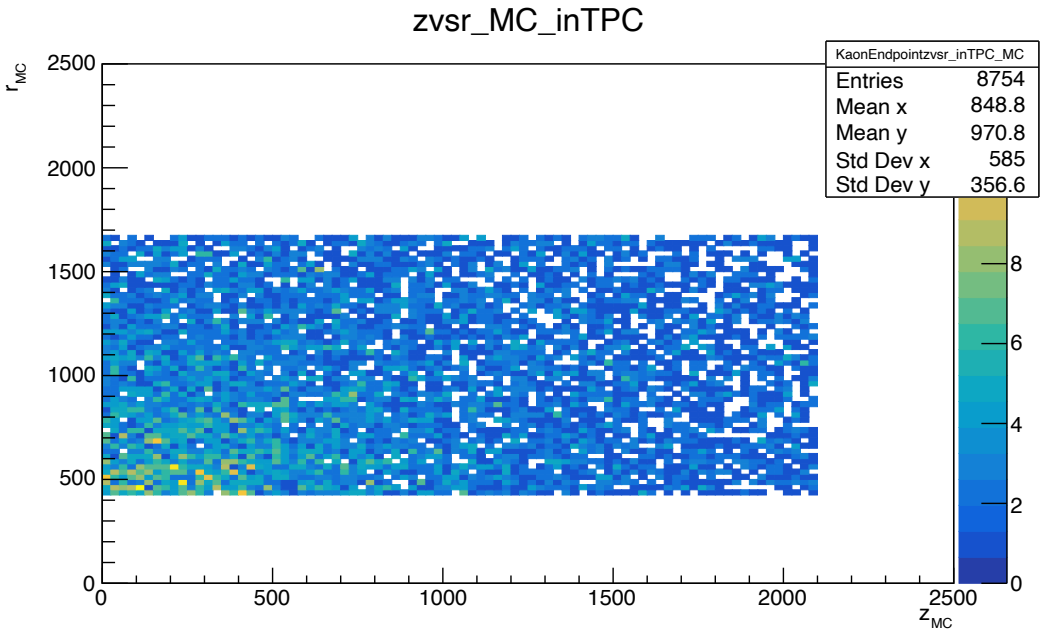
・(MC) # of charged daughter of Kaon = 1 Condition made from **MCparticles**

Kaon endpoint
($r < 1.77$ [m], $|z| < 2.35$ [m])



Collide with detectors and beampipe

Kaon endpoint applyed conditon



Number of kinks by standard kink finder

・Endpoint(MC) inside TPC: $r_{in} > 329 + 100$ [mm] $r_{out} < 1770 - 100$ [mm] $|z_{max}| < 2350 - 250$[mm]

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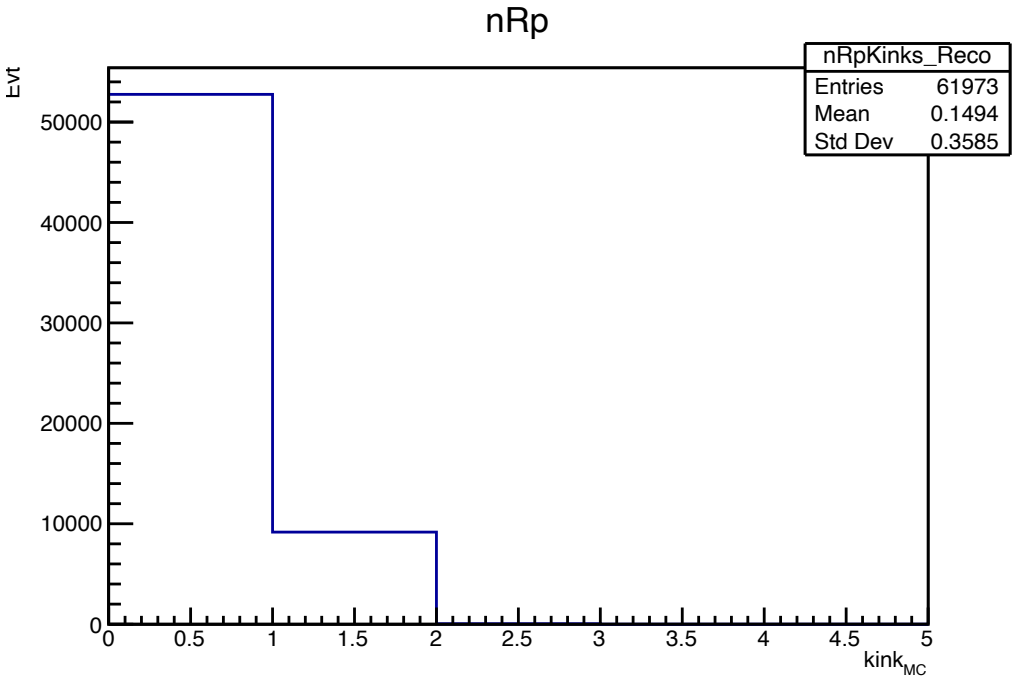
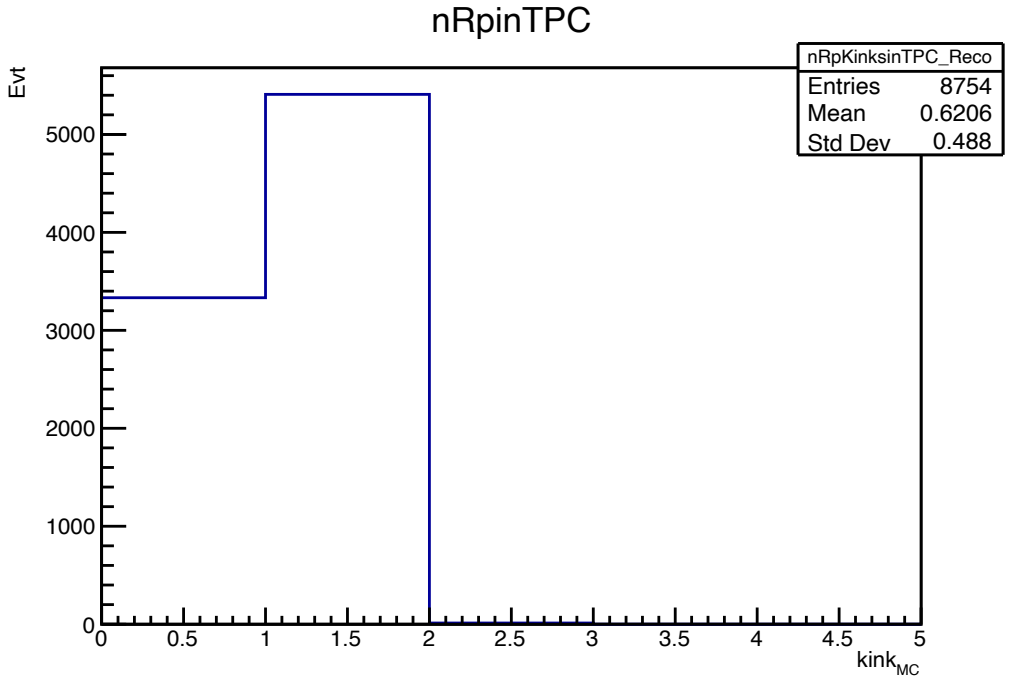
Number of **reconstructed** kinks by standard kink finder inside TPC ($r < 1.77$ [m], $|z| < 2.35$ [m])



Number of **reconstructed** kink by standard kink finder after imposing condition from **MCparticles**



Standard kink finder efficiency ～ 60%

The number of MarlinTrks (Reconstructed)

・Endpoint(MC) inside TPC: $r_{in} > 329 + 100$ [mm] $r_{out} < 1770 - 100$ [mm] $|z_{max}| < 2350 - 250$[mm]

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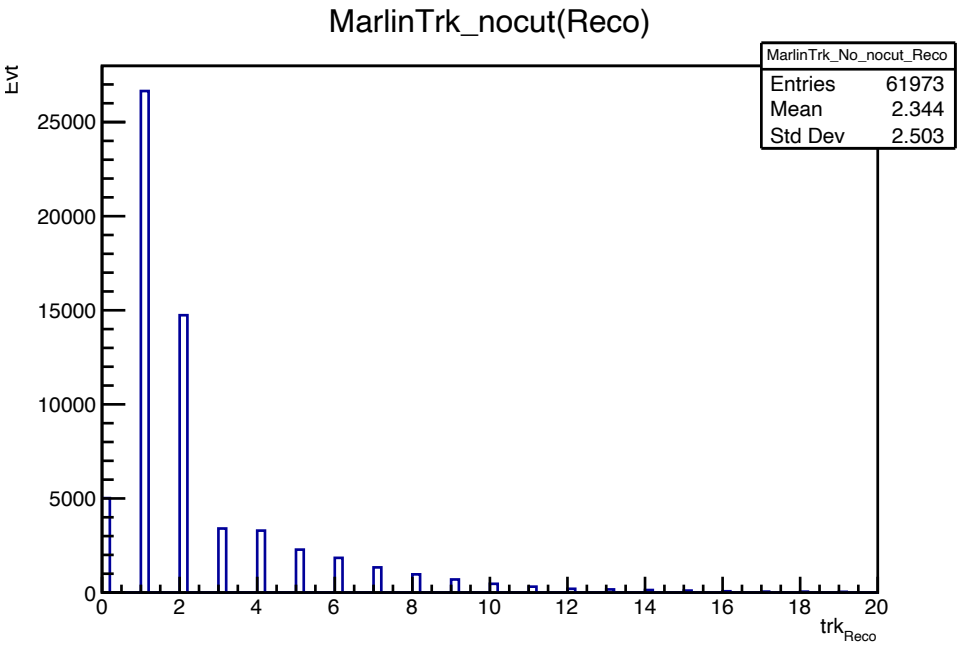

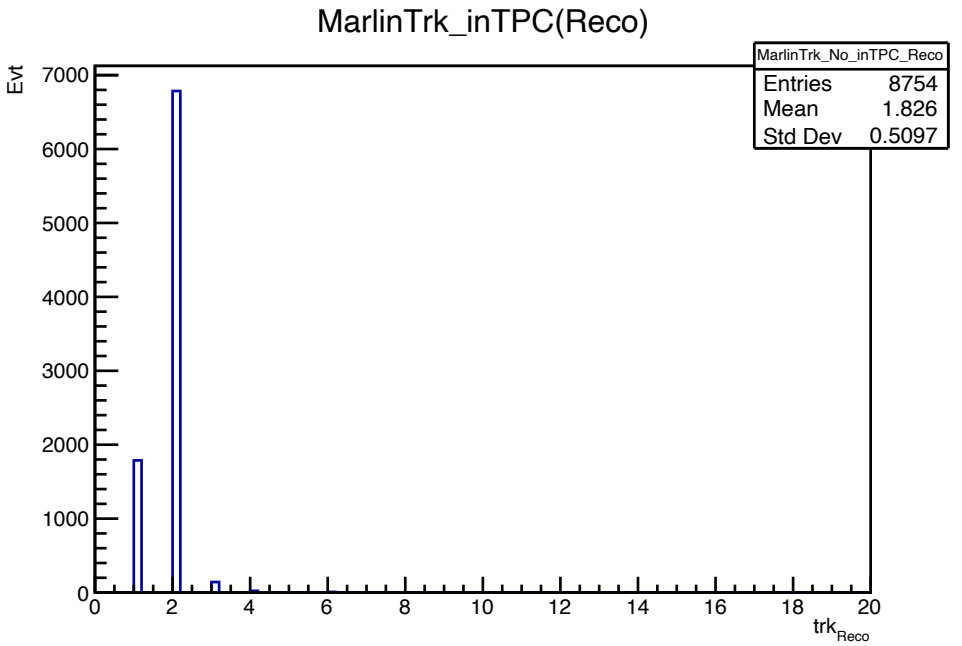

MarlinTrks = 1 never makes kinks

→ throw away 1 track event and impose **MarlinTrks is exactly 2**

Kaon's decay length distribution

・Endpoint(MC) inside TPC: $r_{in} > 329 + 100$ [mm] $r_{out} < 1770 - 100$ [mm] $|z_{max}| < 2350 - 250$[mm]

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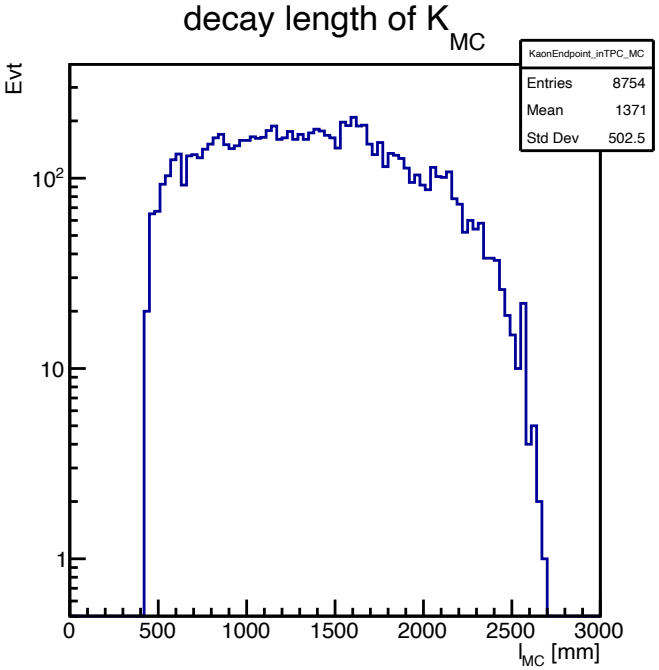
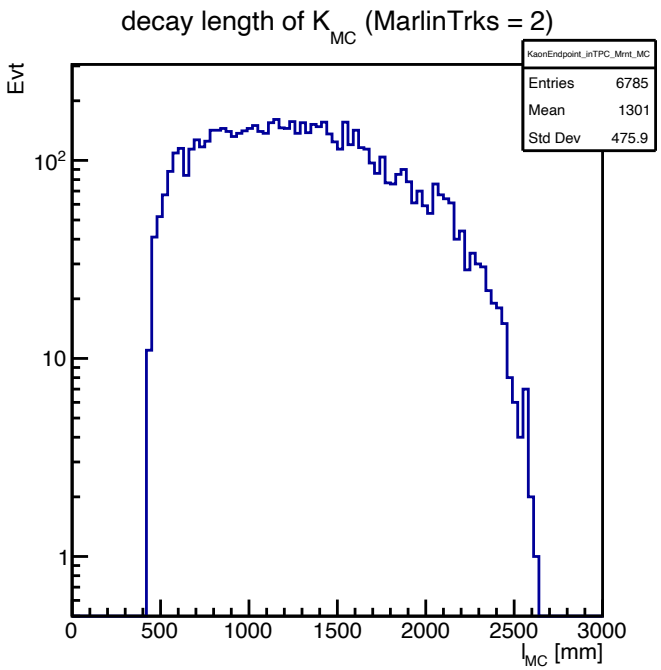
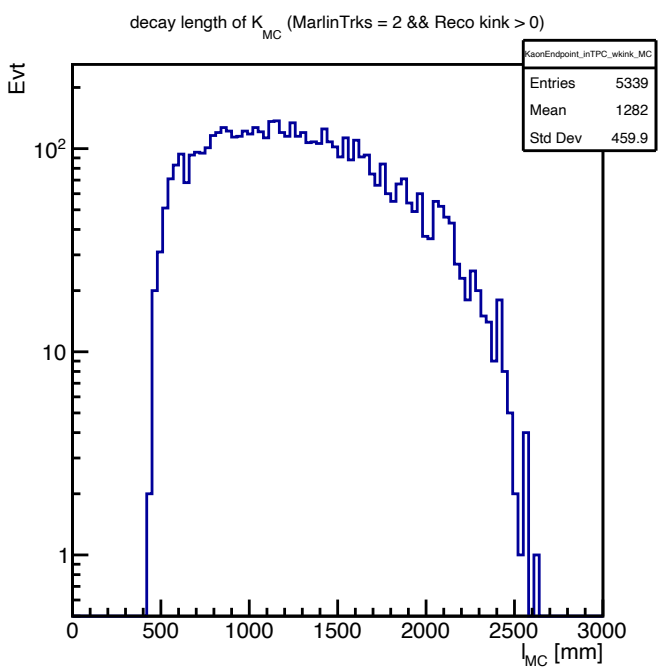
As a premise, these plots satisfy condition







Efficiency vs. decay length

・Endpoint(MC) inside TPC: $r_{in} > 329 + 100$ [mm] $r_{out} < 1770 - 100$ [mm] $|z_{max}| < 2350 - 250$[mm]

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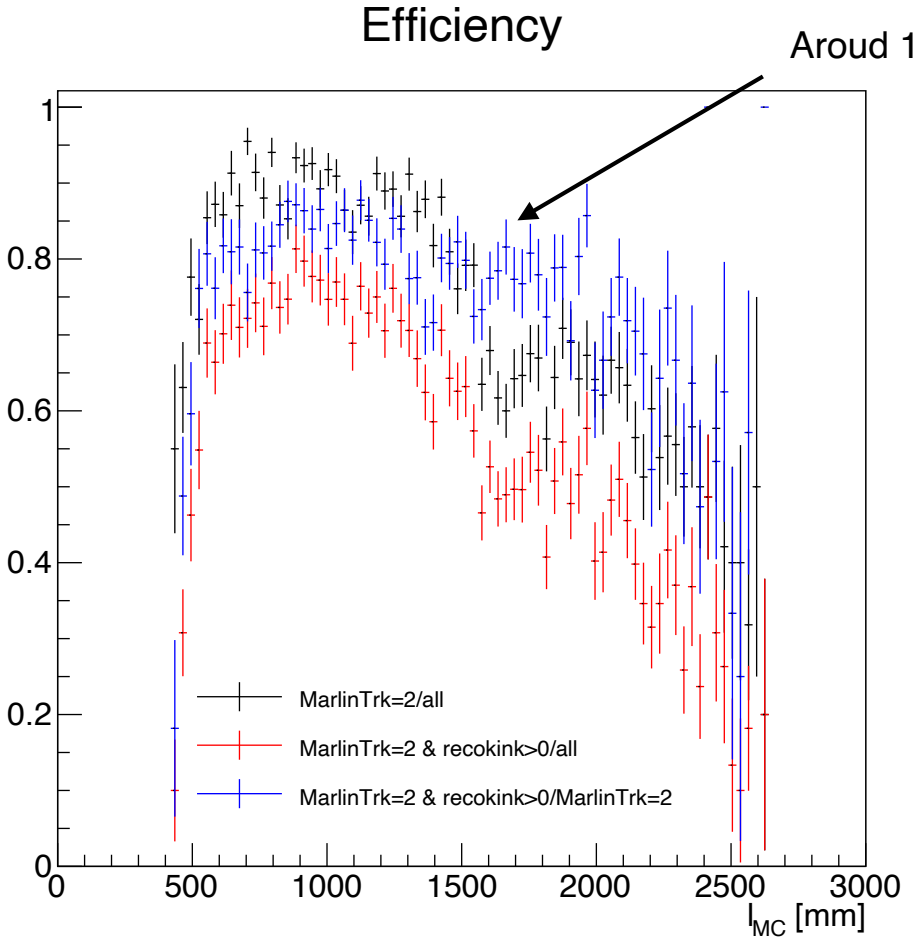

Decay length is longer then efficiency is worse.

→ 2nd track is shorter and it is difficult to recognize as a nice track

Efficiency of kink angle

・Endpoint(MC) inside TPC: $r_{in} > 329 + 100$ [mm] $r_{out} < 1770 - 100$ [mm] $|z_{max}| < 2350 - 250$[mm]

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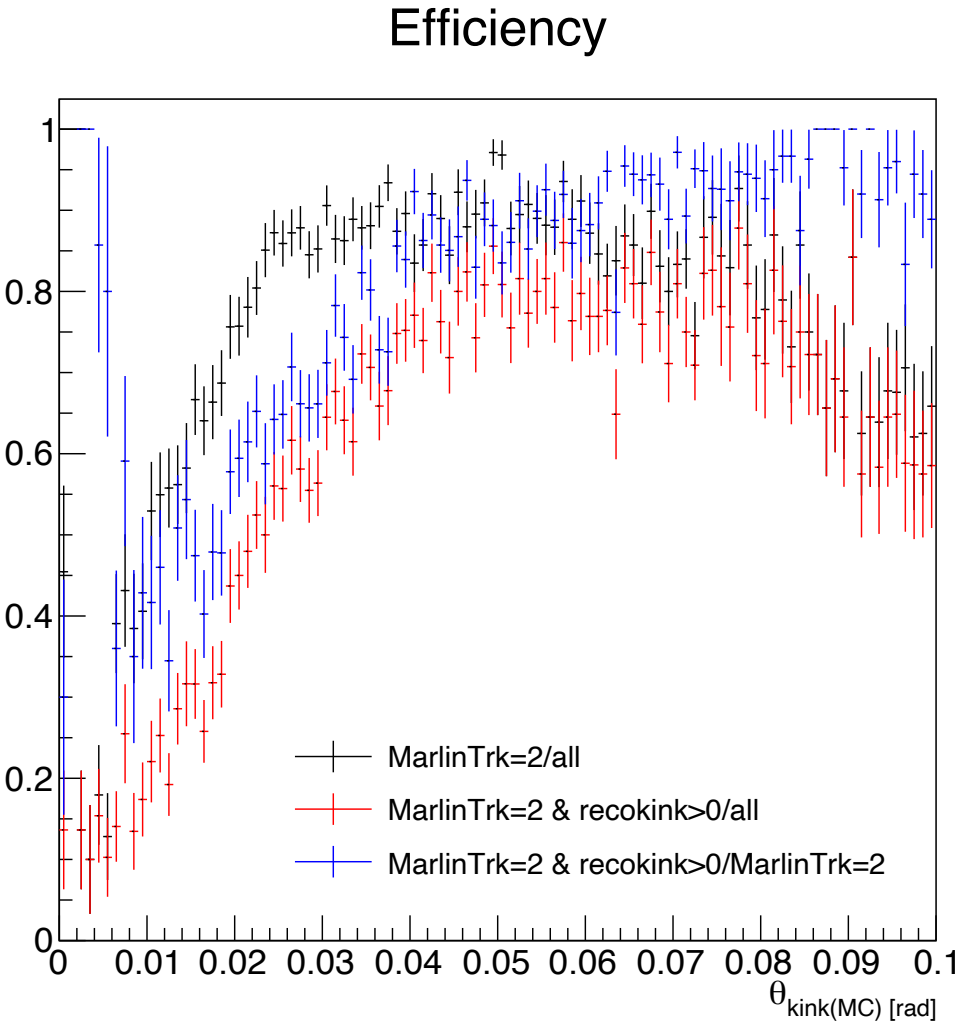

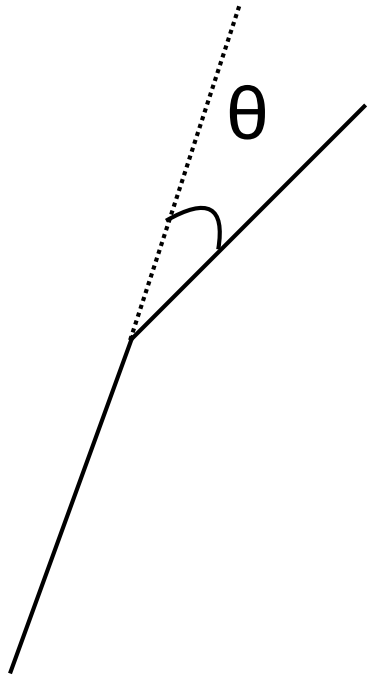

Efficiency of Kaon θ

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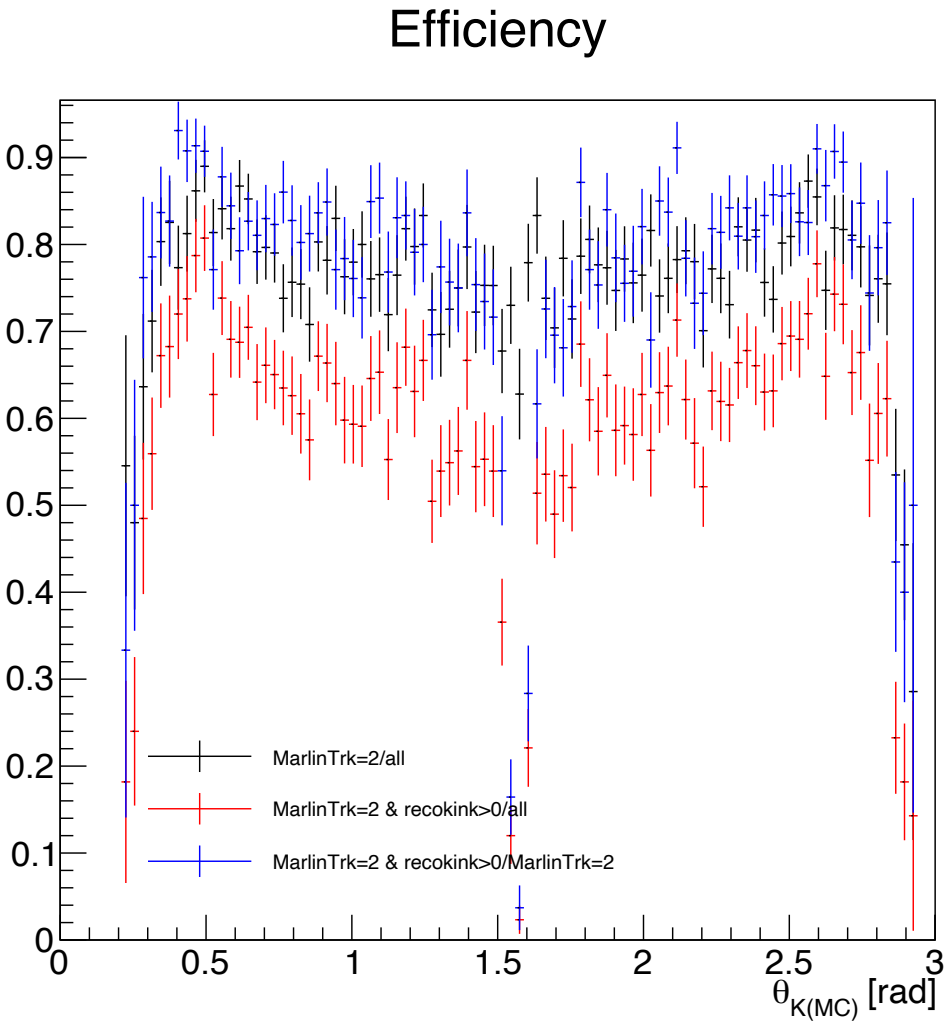

Why the dip is made after recokink cut inculde?

Efficiency of Kaon ϕ

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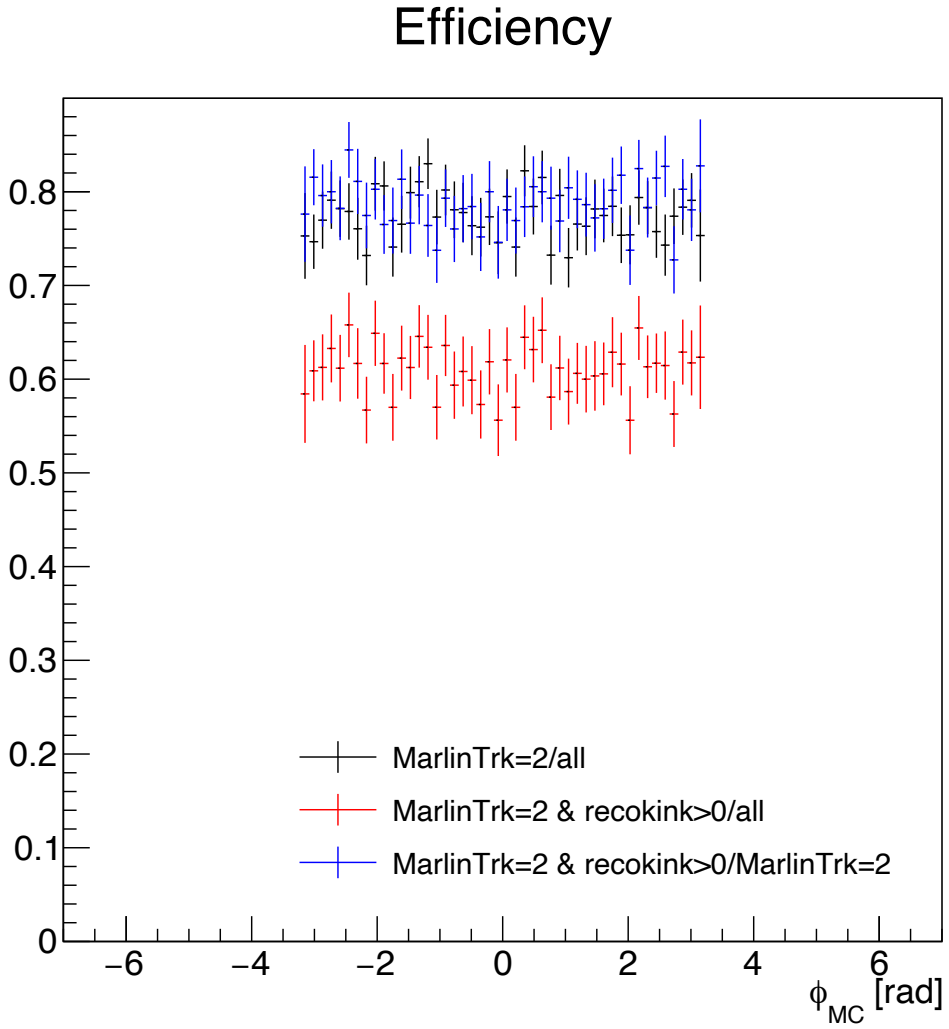

No dependent on ϕ_K

Next step

I have something to not understand.
→ I'm studying to understand "standard kink finder"

/cvmfs/ilc.desy.de/sw/x86_64_gcc103_centos7/v02-03/MarlinReco/v01-33/Tracking/KinkFinder/src/KinkFinder.cc

Measure fake kinks identification rate

Kink angle distribution

・Endpoint(MC) inside TPC: $r_{in} > 329 + 100$ [mm] $r_{out} < 1770 - 100$ [mm] $|z_{max}| < 2350 - 250$[mm]

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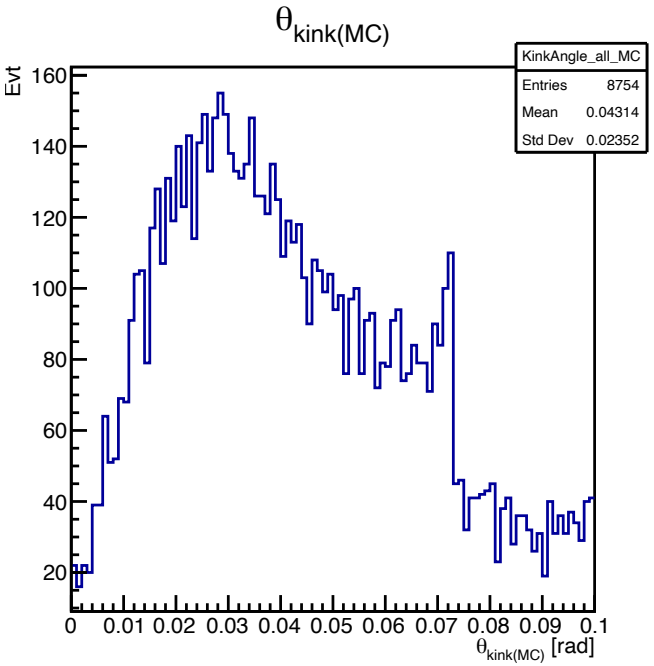

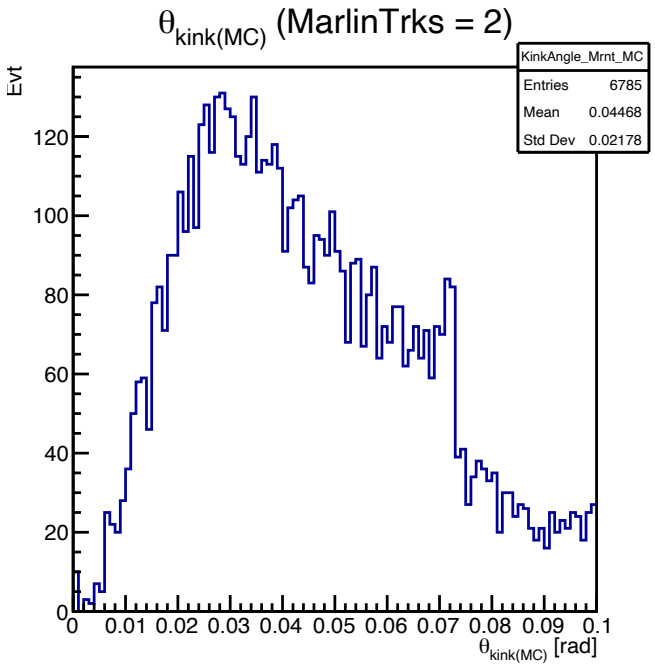

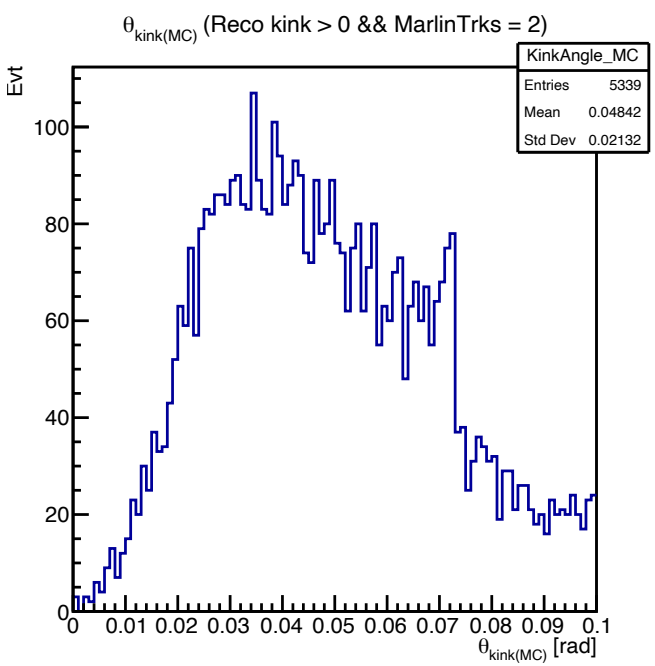

Kaon θ distribution

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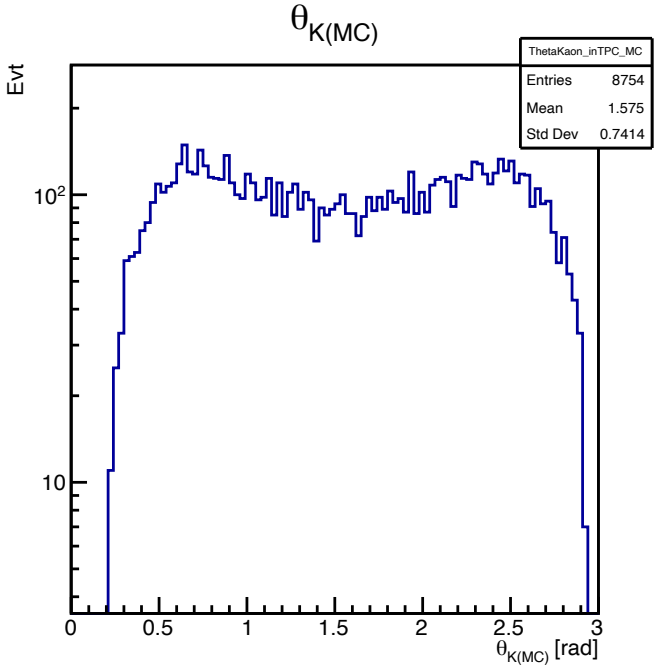

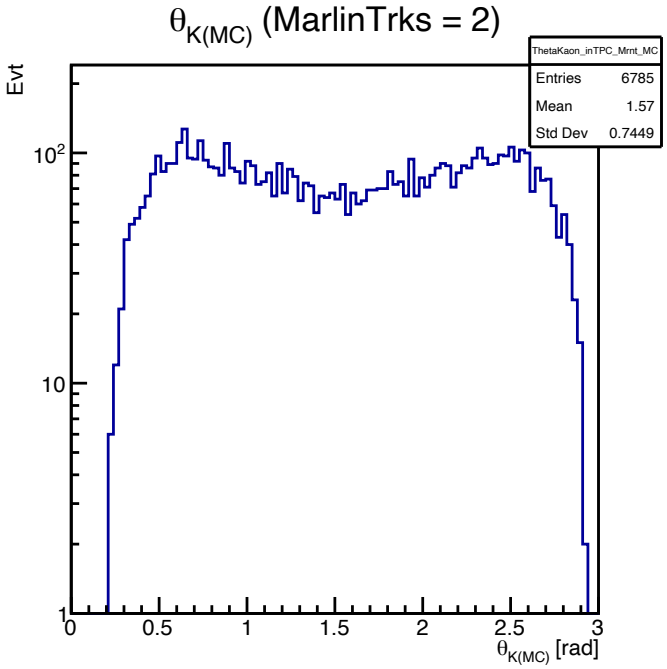

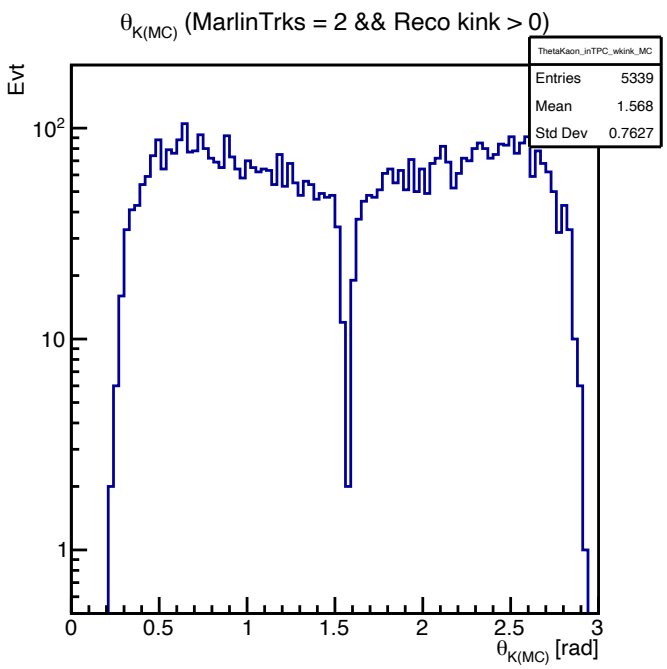

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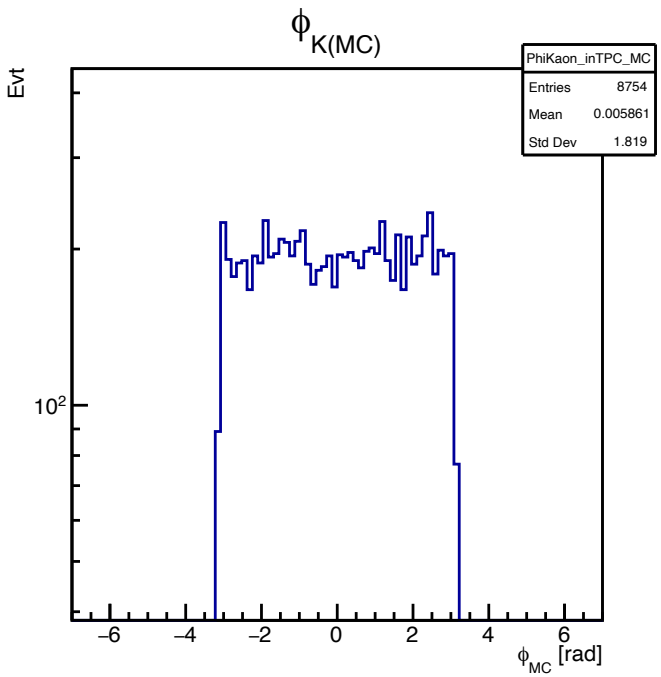

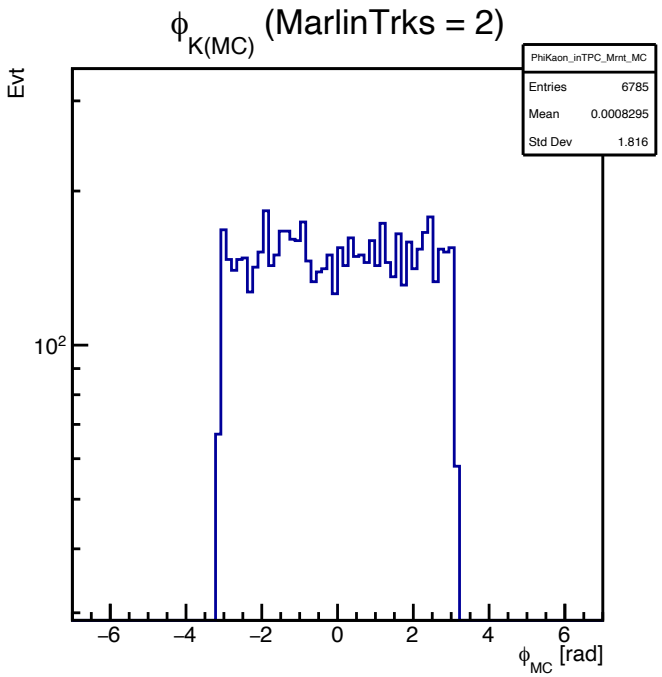

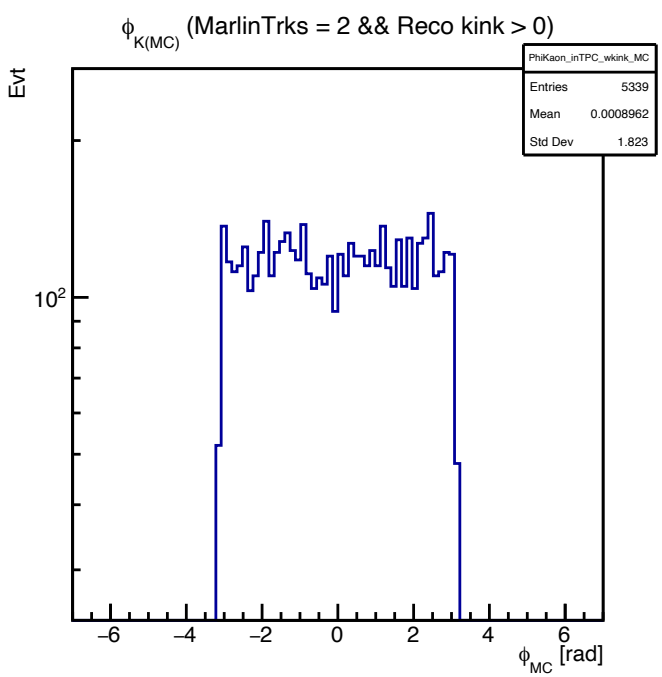

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