1. dE/dx (and dN/dx) vs. p
2. Cluster counting efficiency vs. p

G. Finocchiaro
INFN – LNF

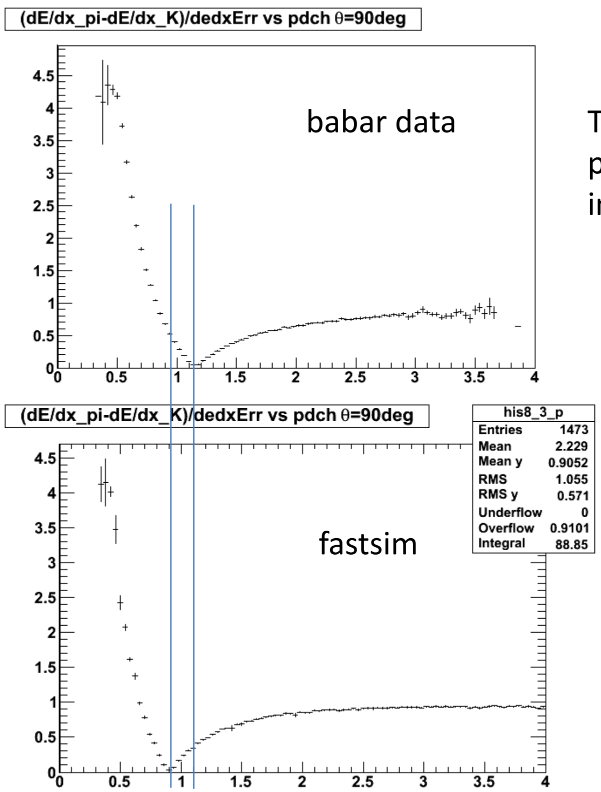
10000 Garfield tracks x 31 momentum points in the range 100-4000 MeV/c in a (1.4x1.4)cm^2 cell

- courtesy C. Gatti

Crossover point in p÷K dE/dx curves

- From Matteo's post ("old" FastSim)

pi/K separation Babar vs fastsim



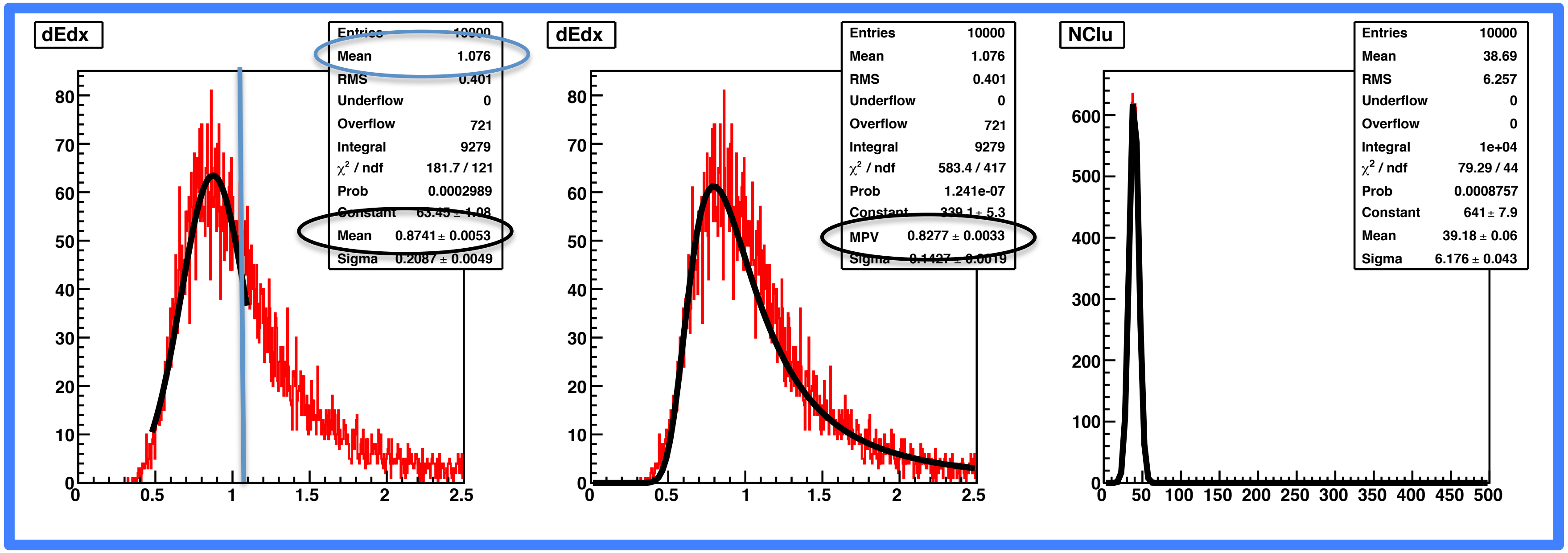
The point of zero K/pi separation is at p=1.15 GeV in Babar and at p=0.90 GeV in fastsim.

Garfield 90%He-10%iC4H10

- Why K/pi crossover point different for average dE/dx (old FastSim) and Most Probable Value (MPV) (BaBar)?
- Investigate different dE/dx variables

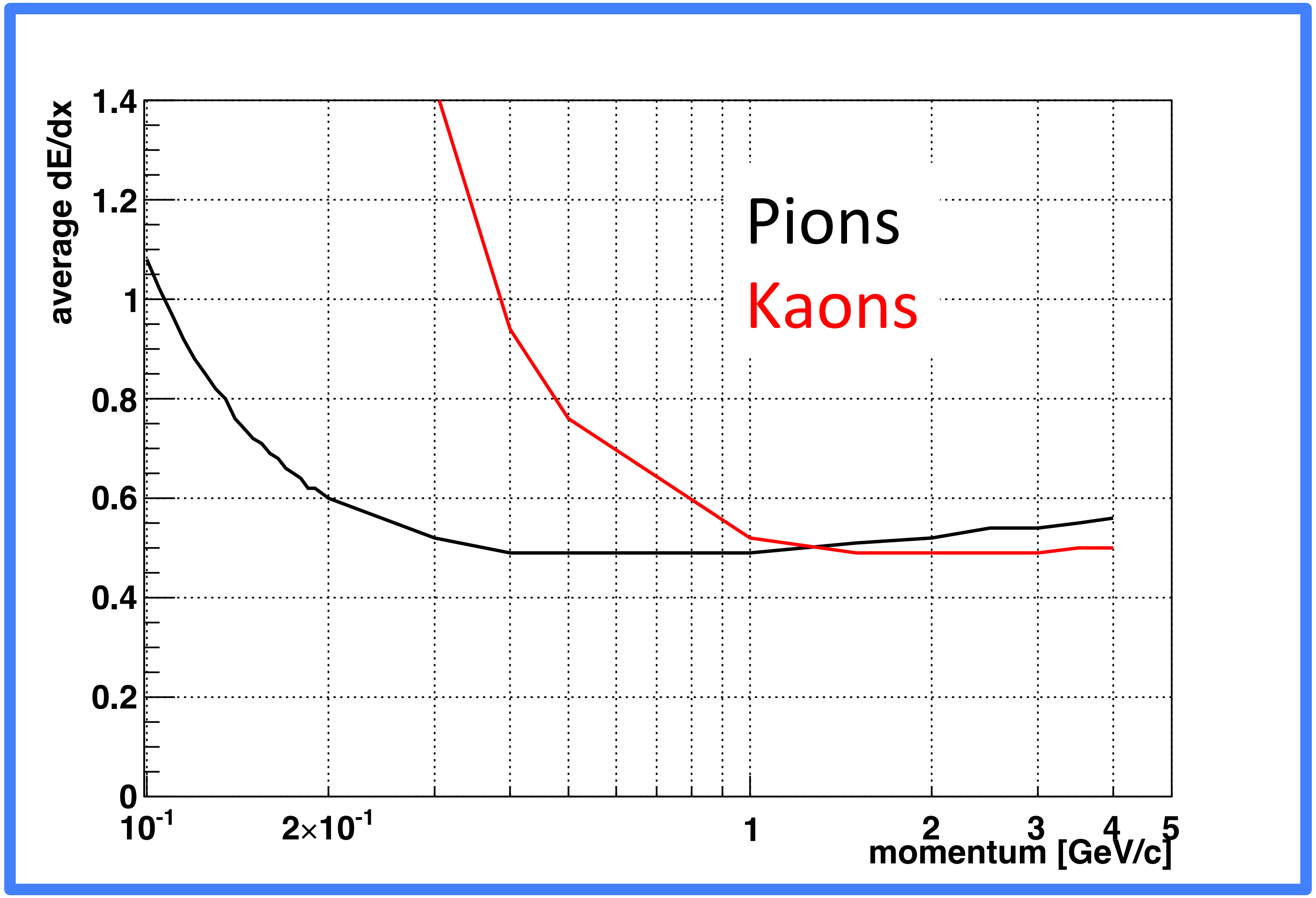
MPV from peak

MPV from Landau fit



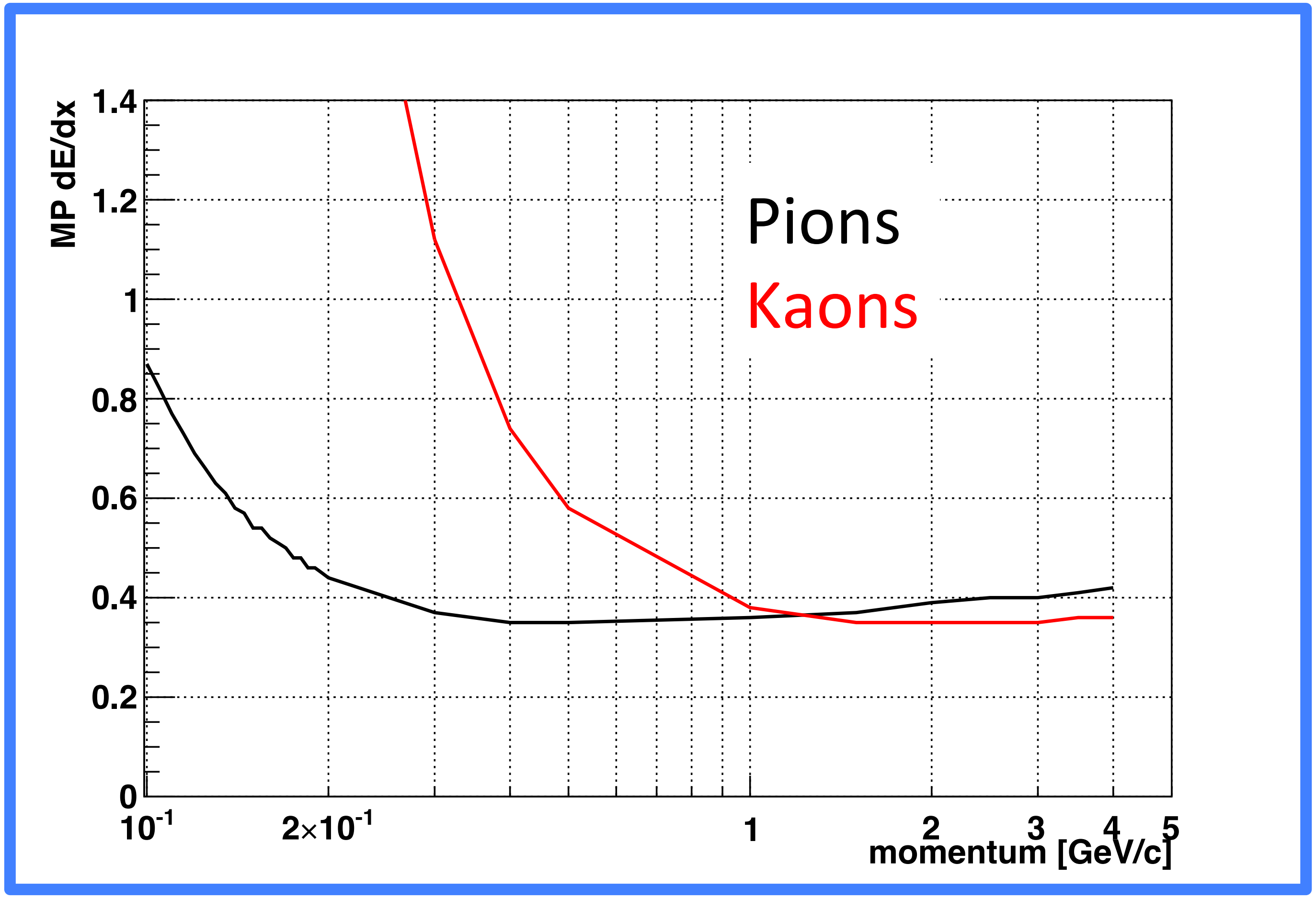
Garfield 90%He-10%iC4H10

- *Average* dE/dx



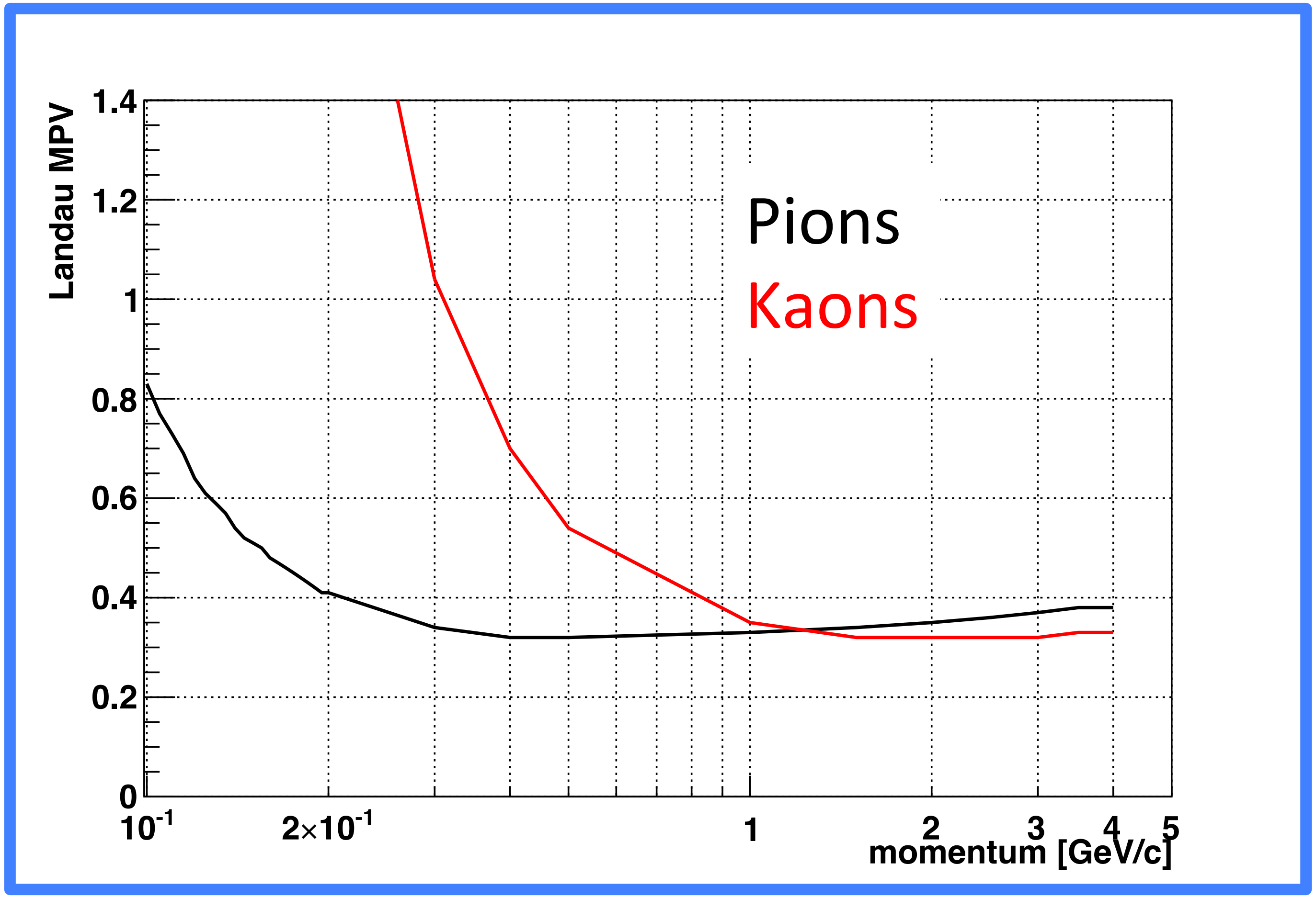
Garfield 90%He-10%iC4H10

- *Most probable* dE/dx



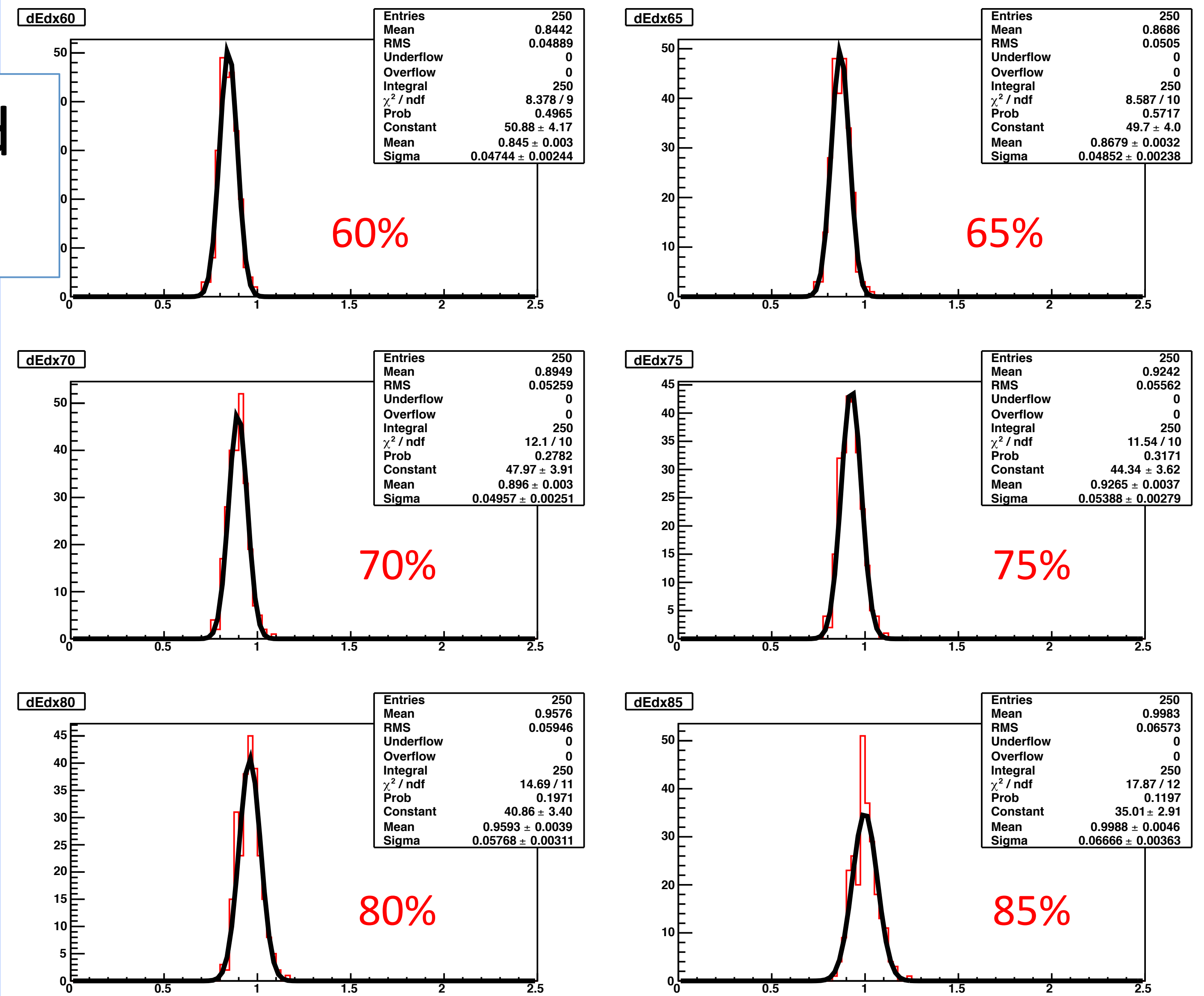
Garfield 90%He-10%iC4H10

- Landau MPV



Garfield 90%He-10%iC4H10

Truncated means

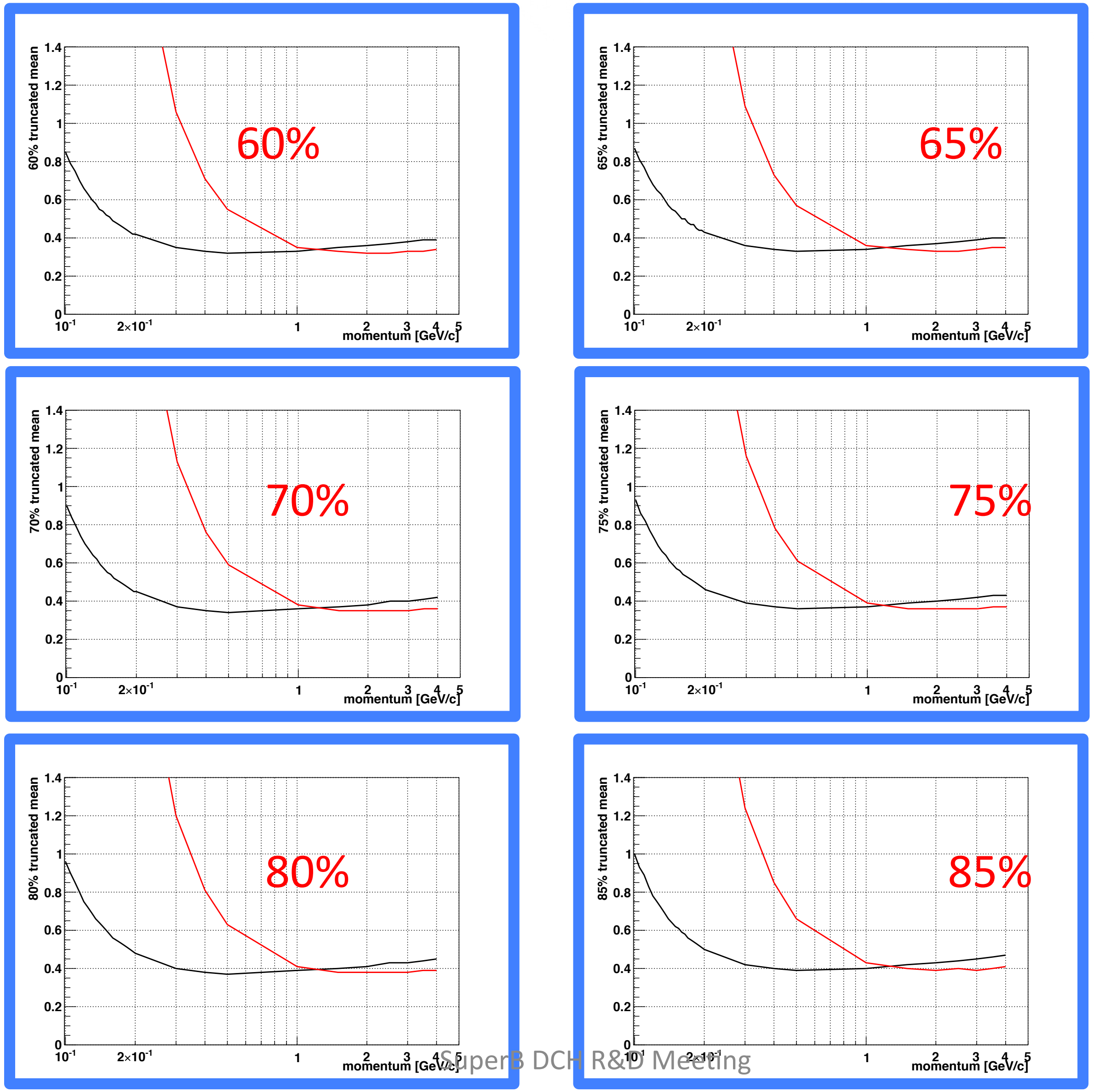


Garfield 90%He-10%iC4H10

- *Truncated mean* dE/dx(40 cells)

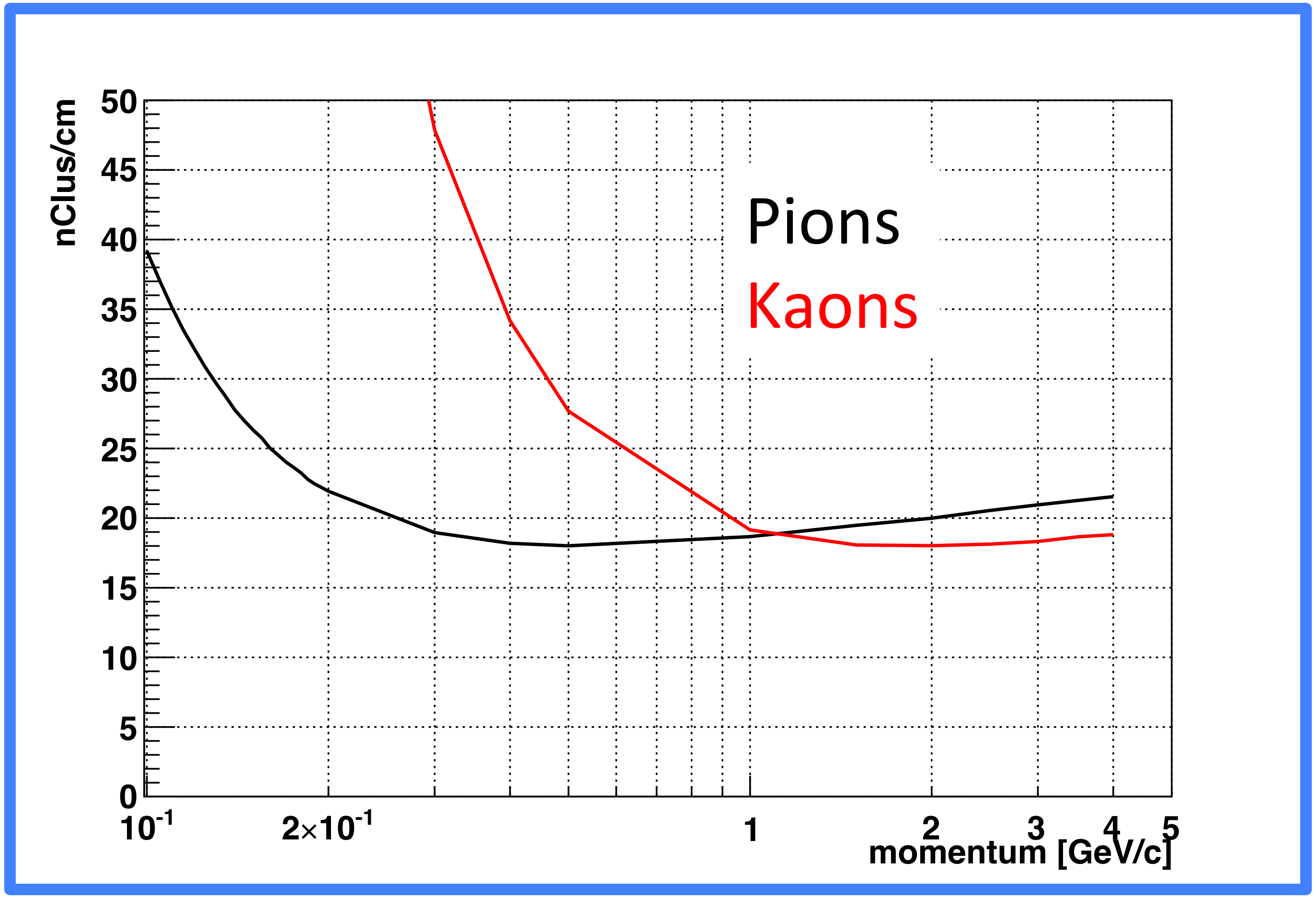
Pions

Kaons



Garfield 90%He-10%iC4H10

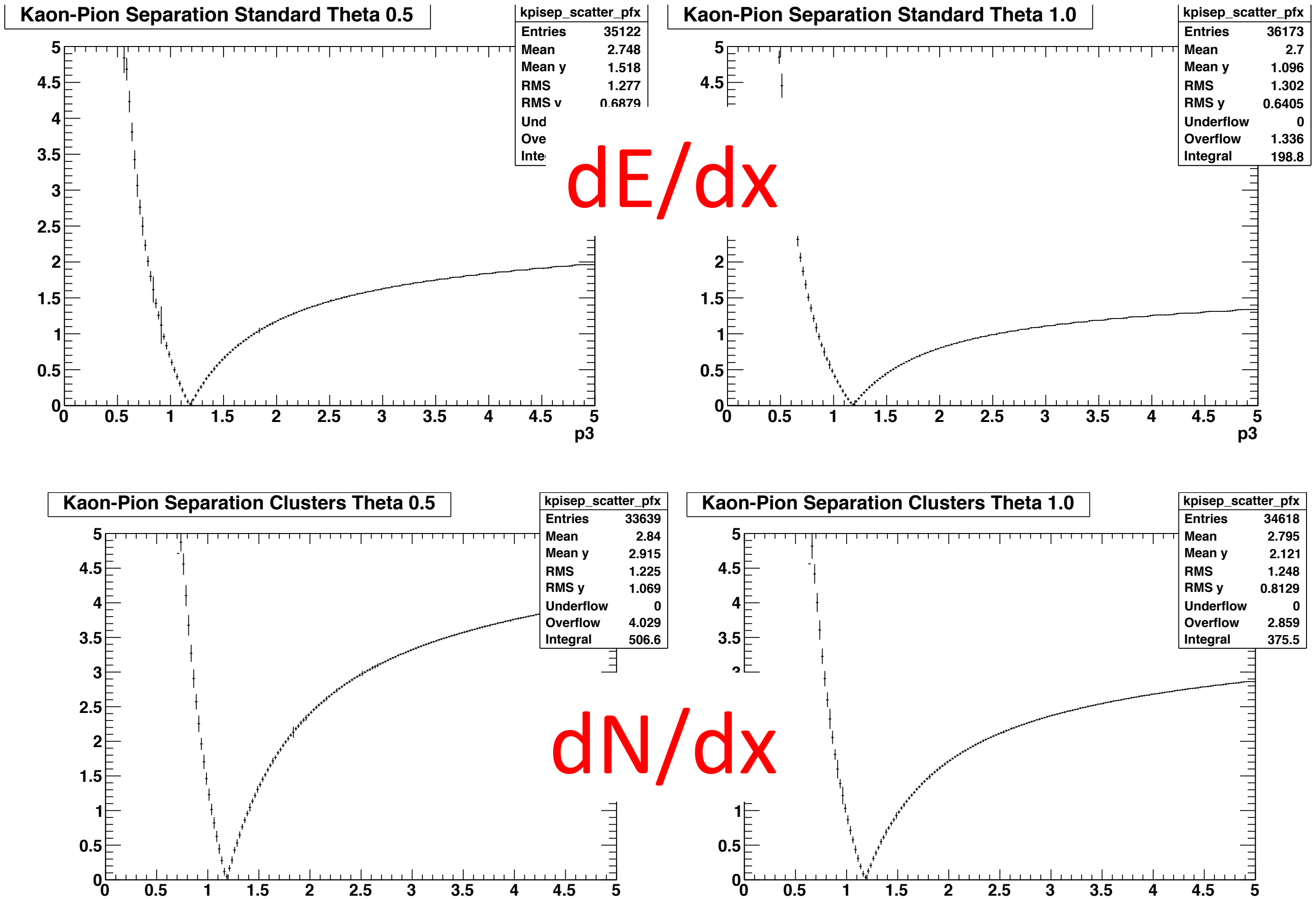
- NClus



Part I – summary

- dE/dx curves for π and K cross around p~1.3GeV/c
  - no big differences
- Cross-over for Nclus ~ 1GeV/c
- MPV best reproduced with truncFrac=60%
  - in data, 65-70%
- Cluster density (obviously) function of β (***p***, particle)
  - counting efficiency will also depend on β → *Part II*

Part II: Cluster counting efficiency vs. p



J.F.Caron
12-04-2012

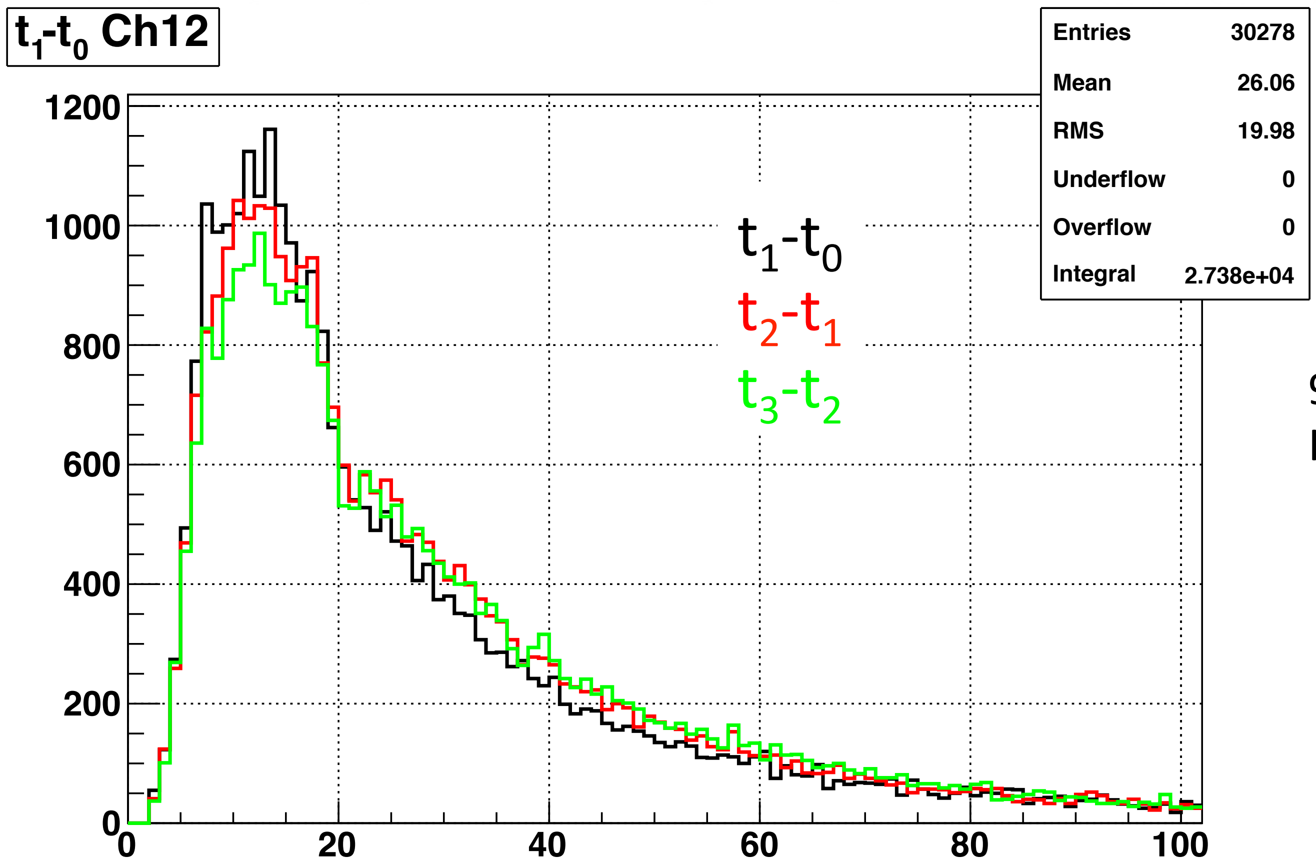
$$p_1 = \frac{C}{\sqrt{N_{min}\epsilon}}$$

with ε=0.6 (estimated on data and MC)
Is a flat efficiency appropriate?

Counting inefficiencies

- Efficiency for detecting clusters mainly depends on
  1. time separation between clusters
  2. S/N ratio, amplification fluctuations
- Will study effect 1. in the next slides
- Define $\Delta t_{min} \equiv t_{i+1} - t_i$ as the minimum time needed to detect cluster (*i+1*) after cluster (*i*) has been detected

Δt between clusters – BTF data

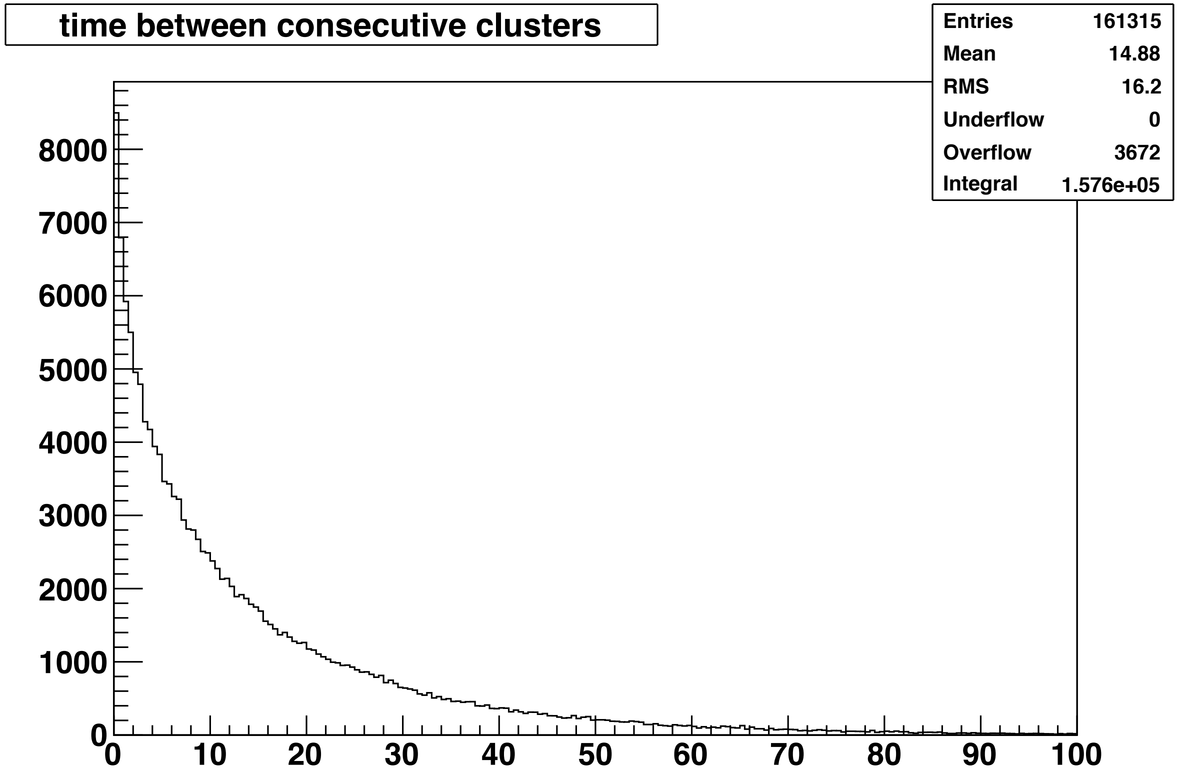


$90\%He\text{-}10\%iC_4H_{10}$
HV=1750V

Full detection efficiency after ~ 12 ns

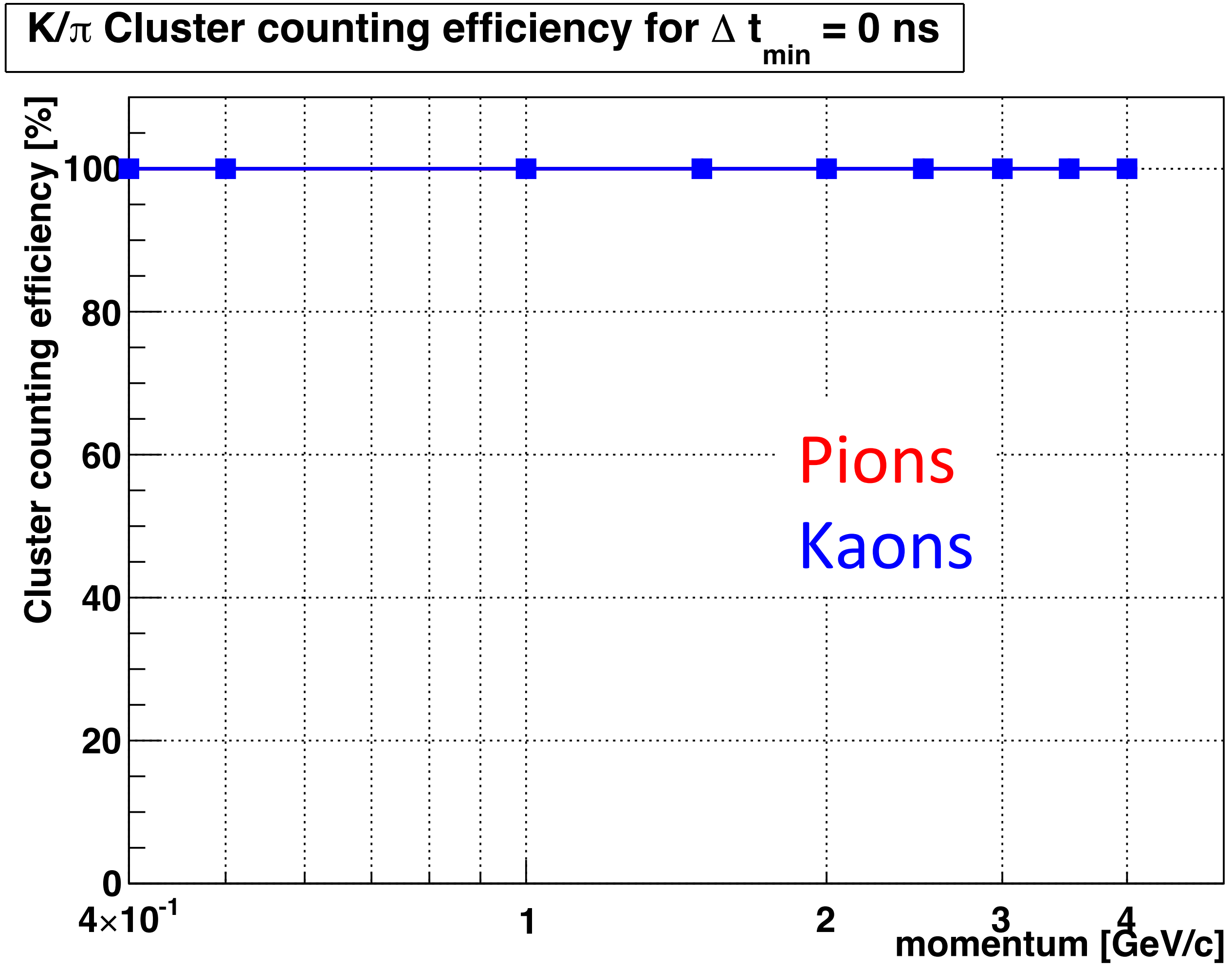
Cluster counting efficiency vs. p

- Δt between clusters – Garfield 500MeV/c pions

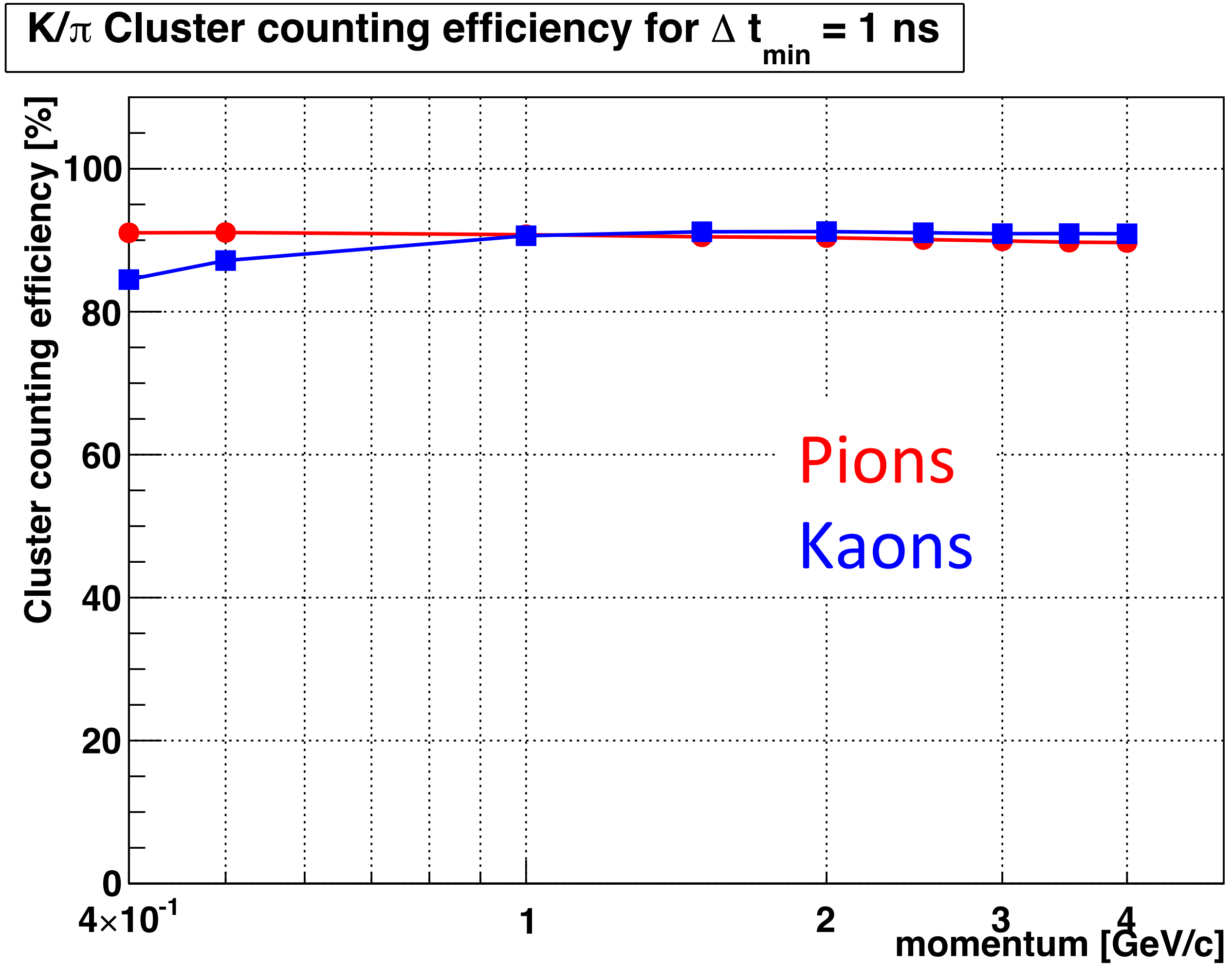


Estimate efficiency as a function of minimum Δt required to detect consecutive clusters

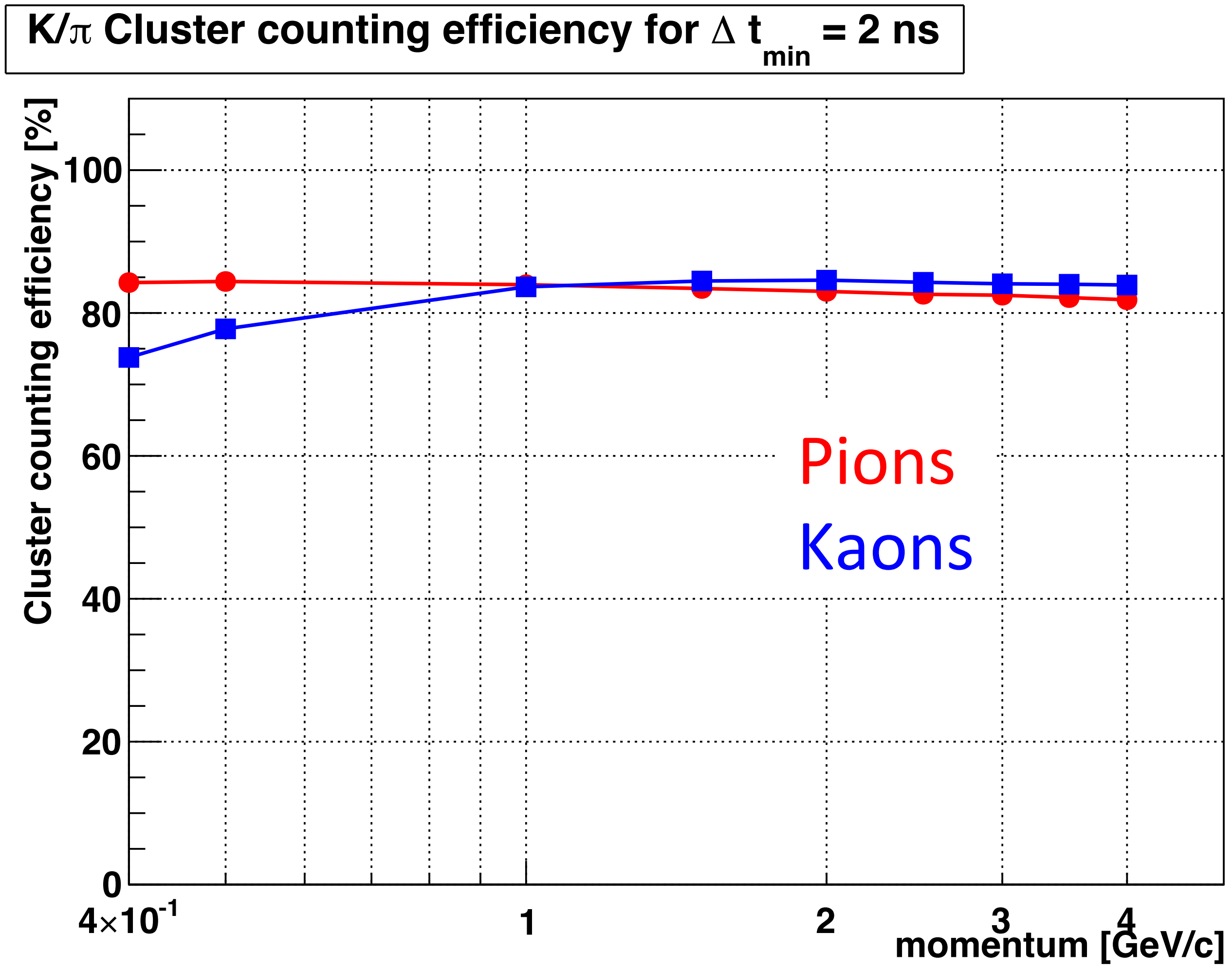
ε(cluster counting) vs. p for Δt_{min}=0ns



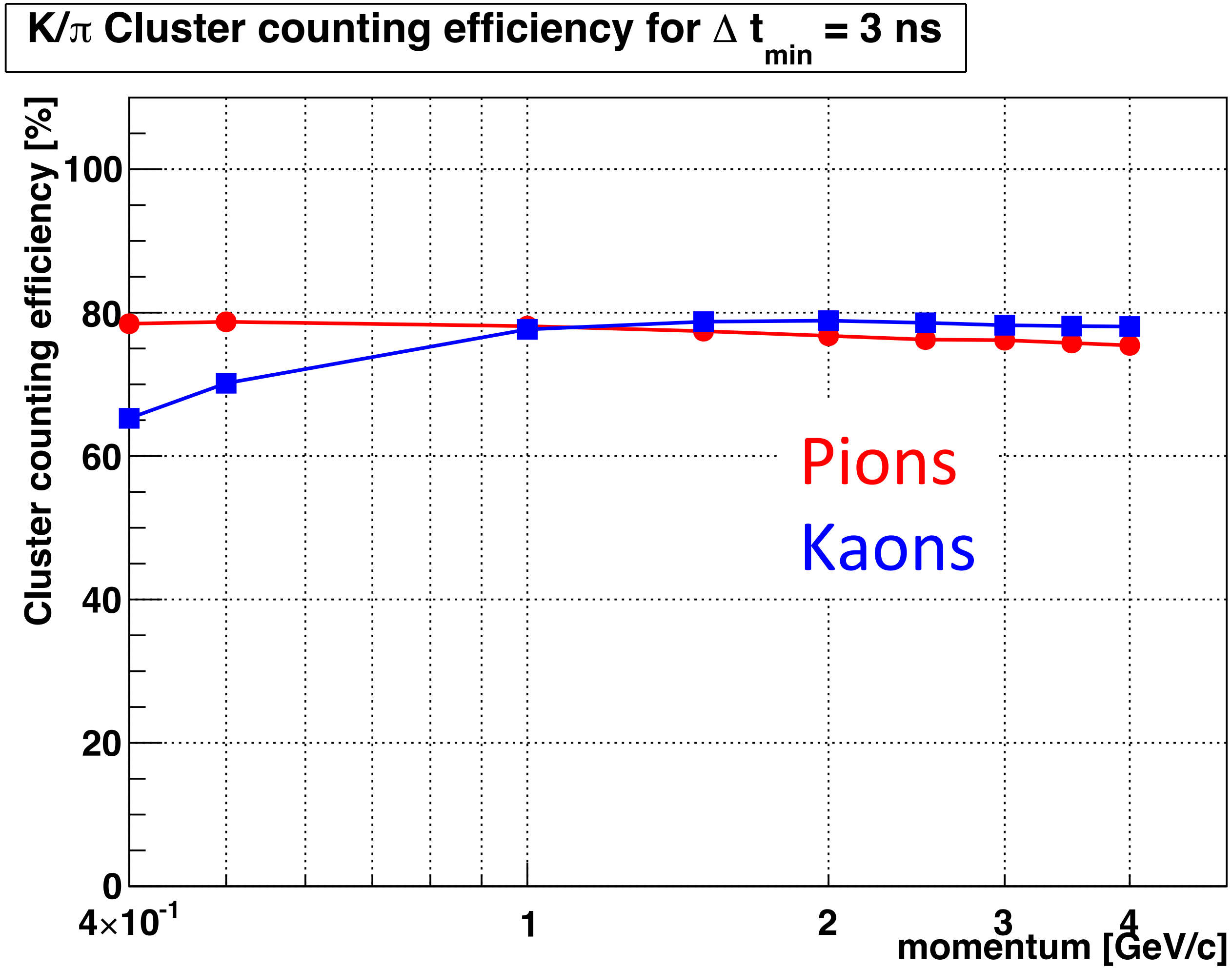
ε(cluster counting) vs. p for Δt_{min}=1ns



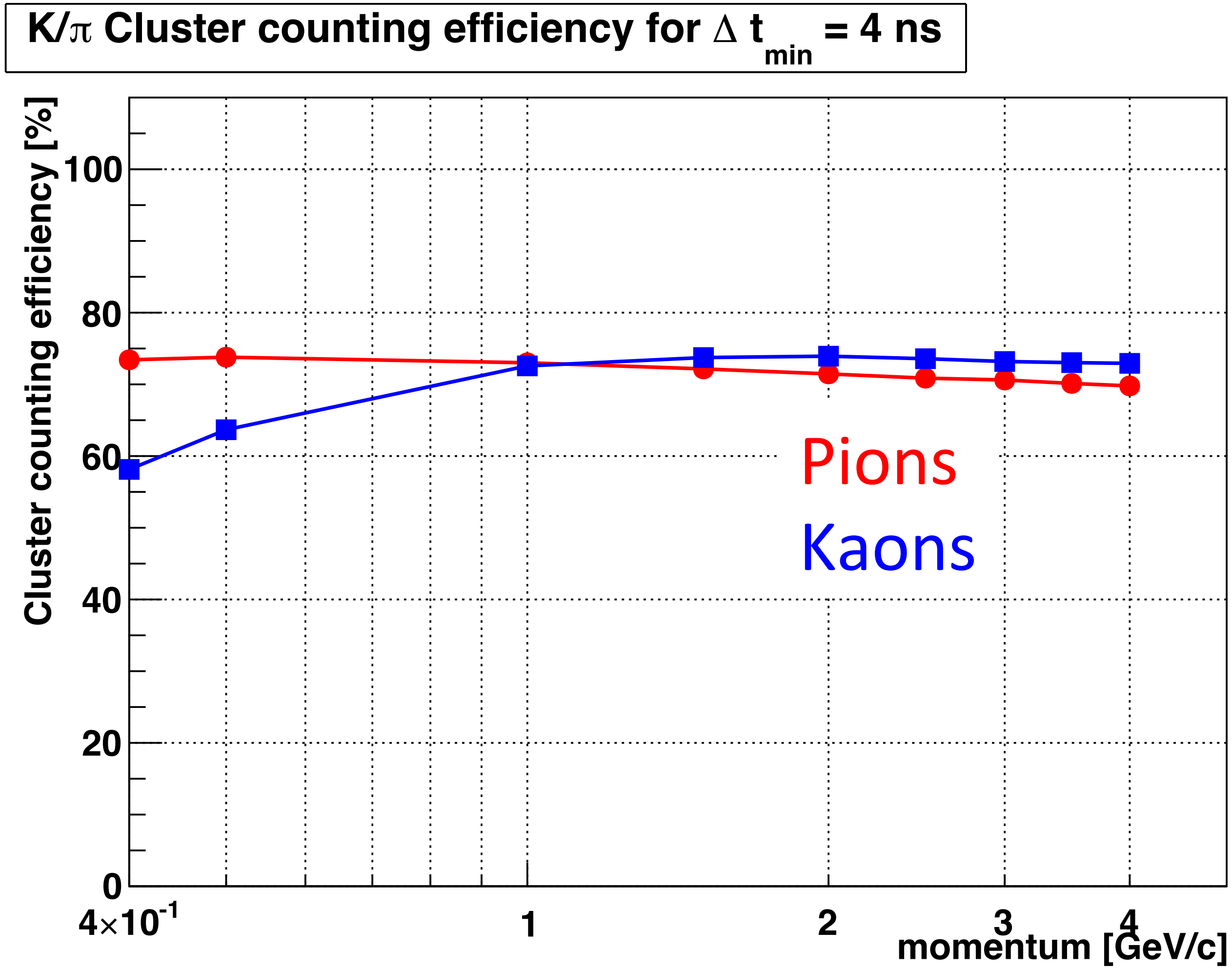
ε(cluster counting) vs. p for Δt_{min}=2ns



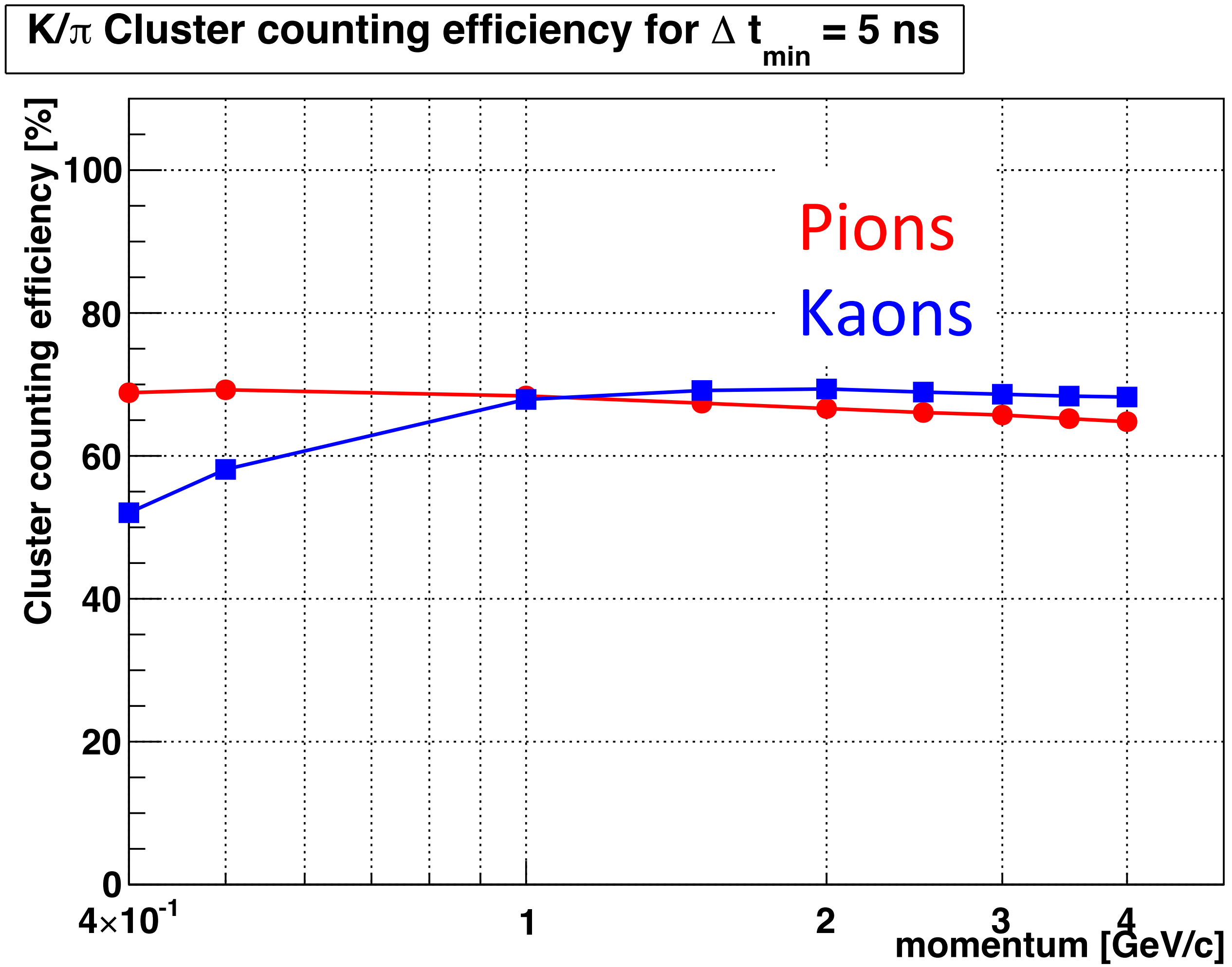
ε(cluster counting) vs. p for Δt_{min}=3ns



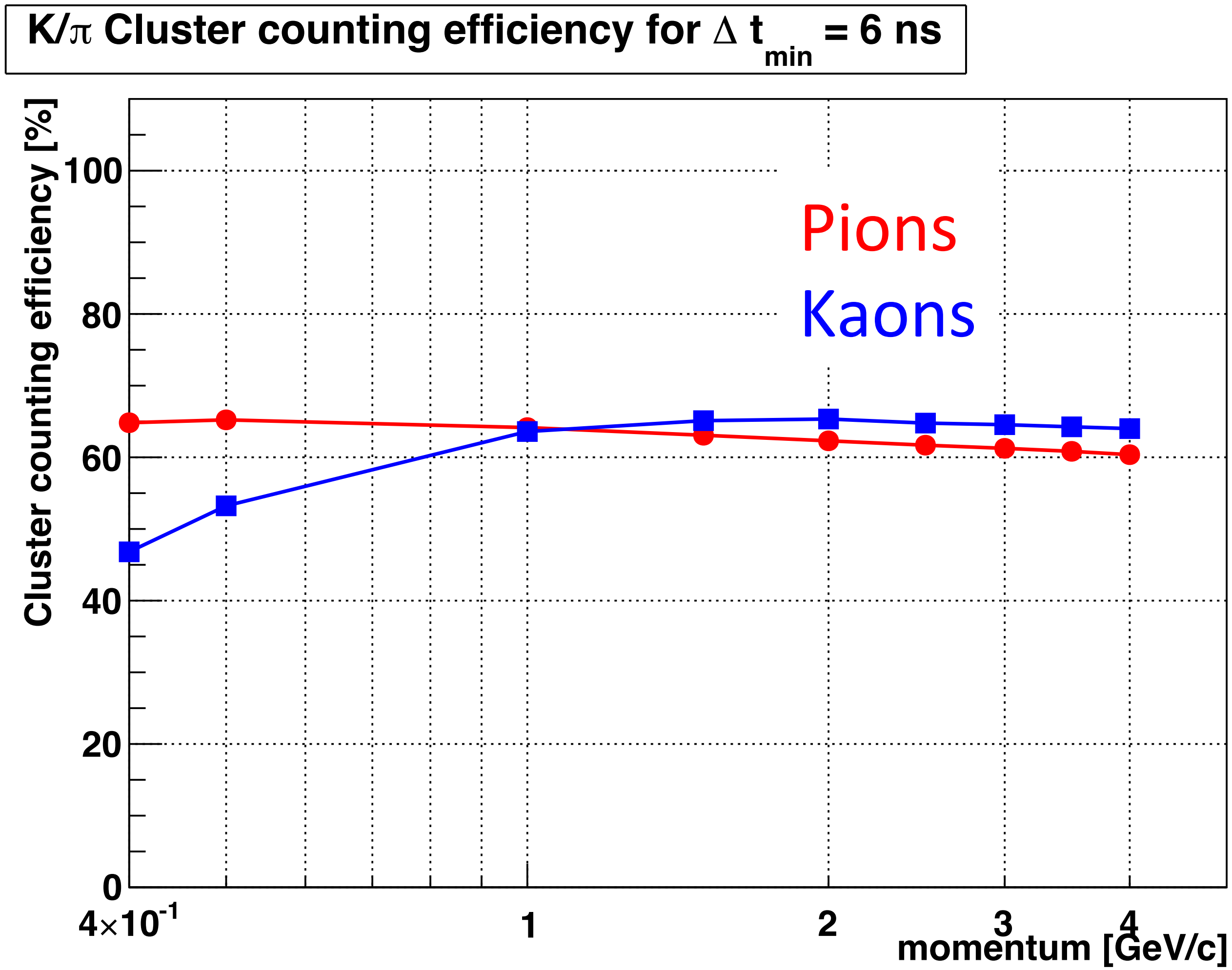
ε(cluster counting) vs. p for Δt_{min}=4ns



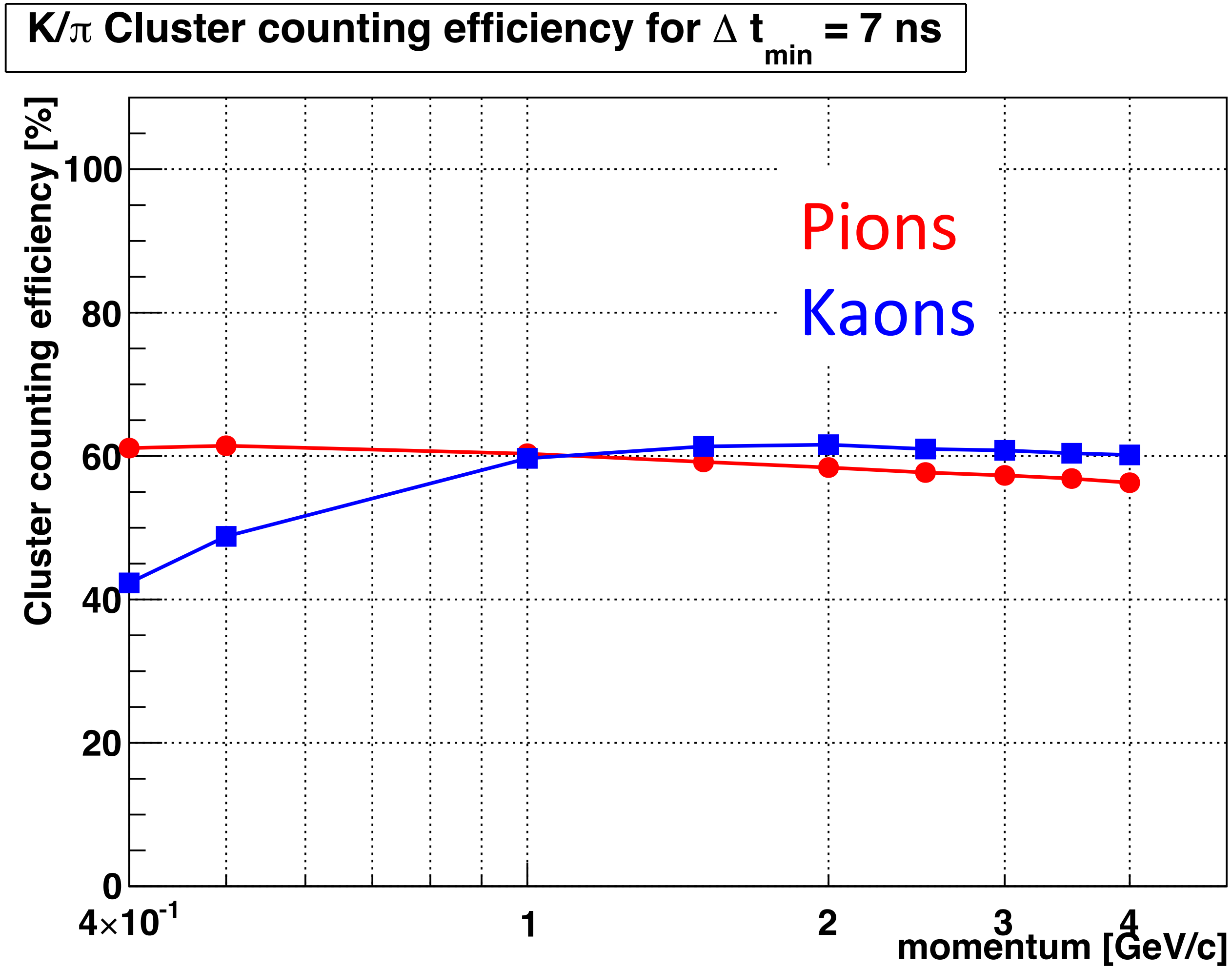
ε(cluster counting) vs. p for Δt_{min}=5ns



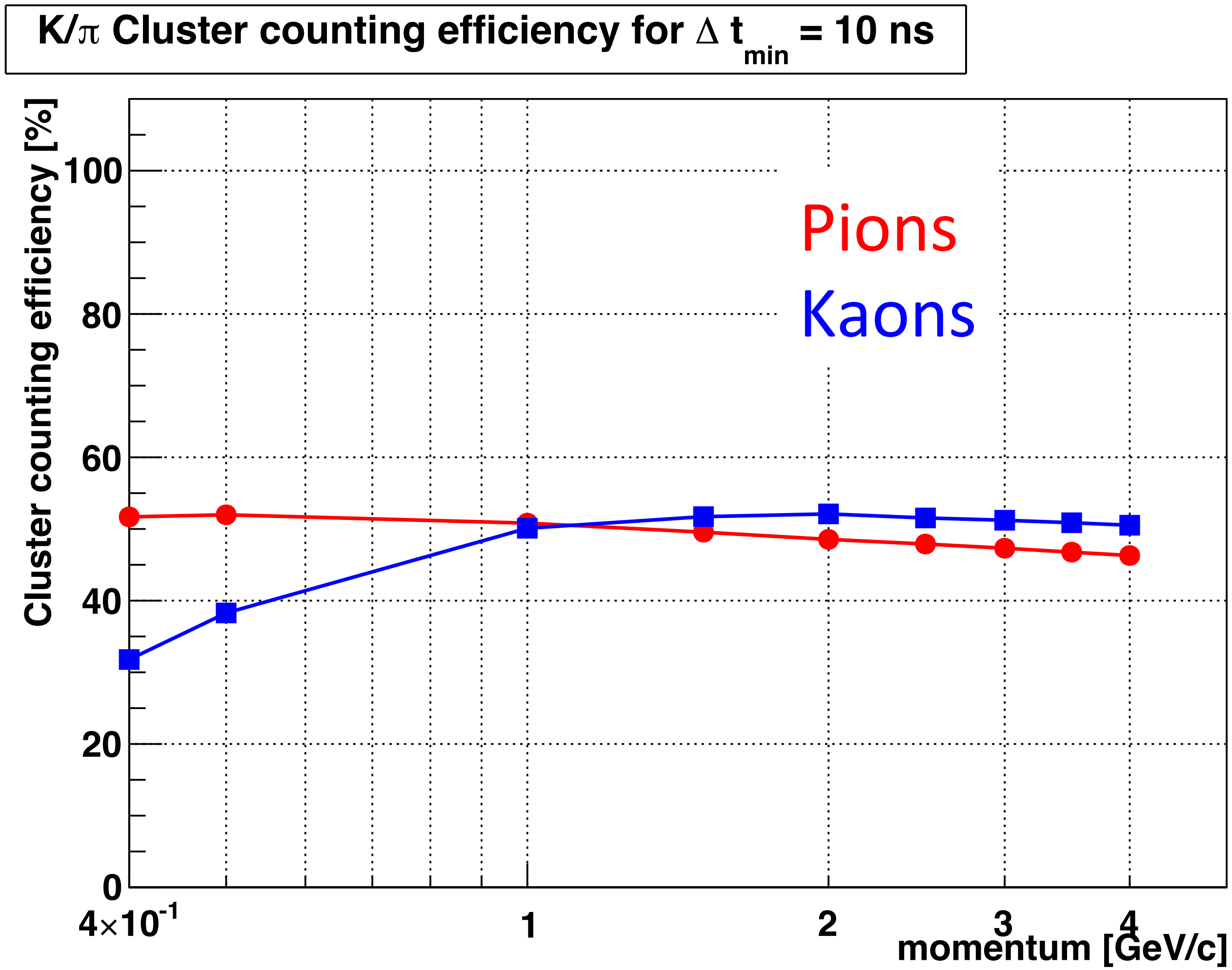
ε(cluster counting) vs. p for Δt_{min}=6ns



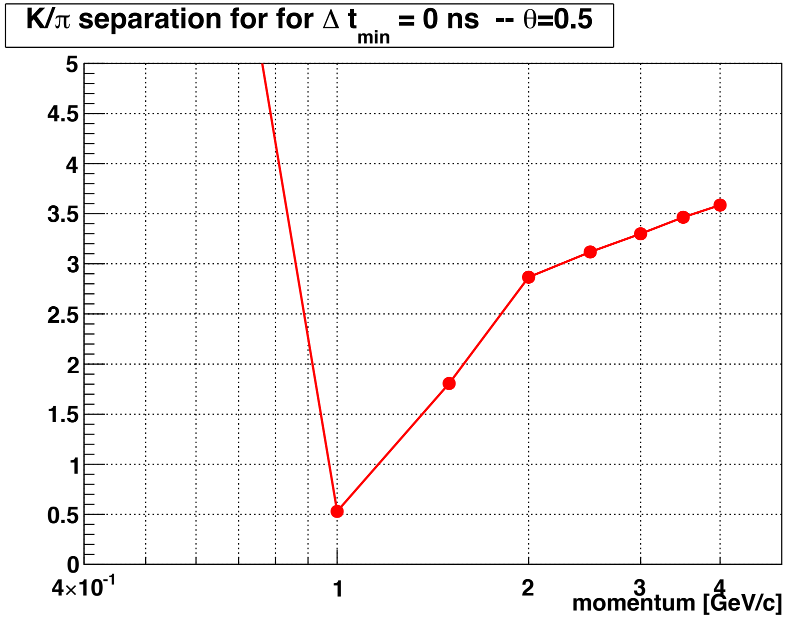
ε(cluster counting) vs. p for Δt_{min}=7ns

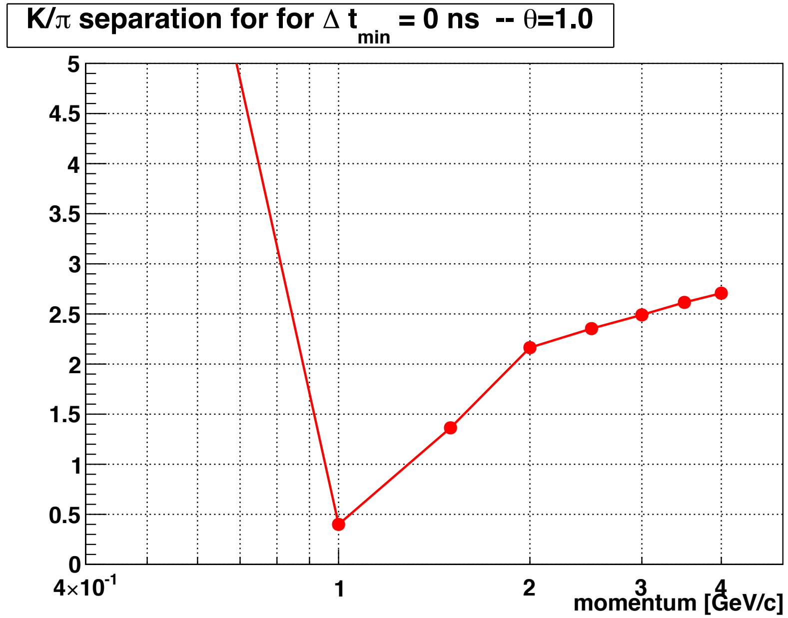


ε(cluster counting) vs. p for Δt_{min}=10ns



K/π separation for ε=1

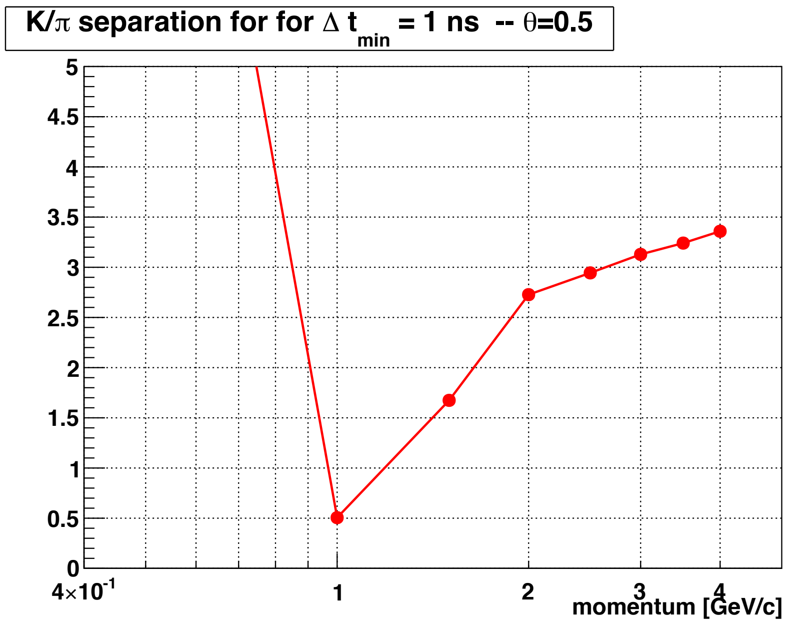


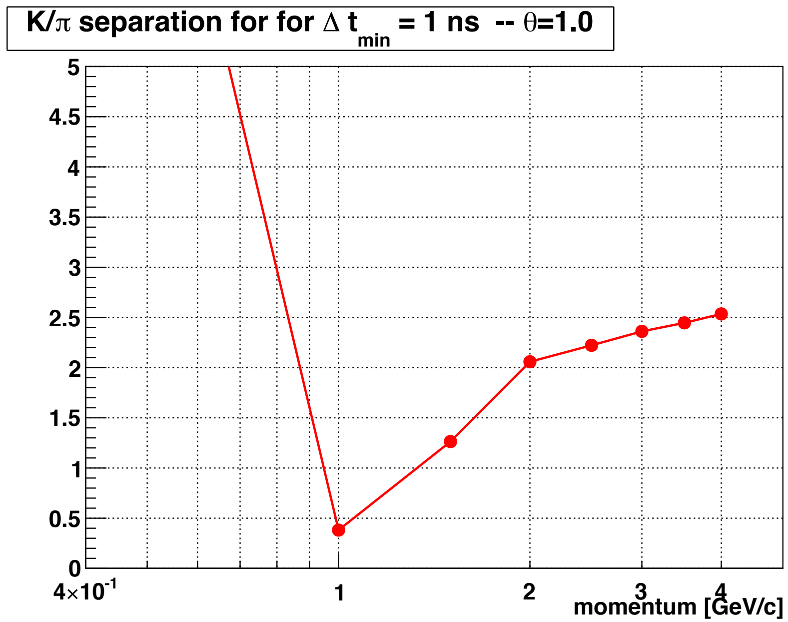


- Total track length normalized to a drift chamber with 40 layers of 1.2cm high rectangular cells.
- Note: the separation is defined here as

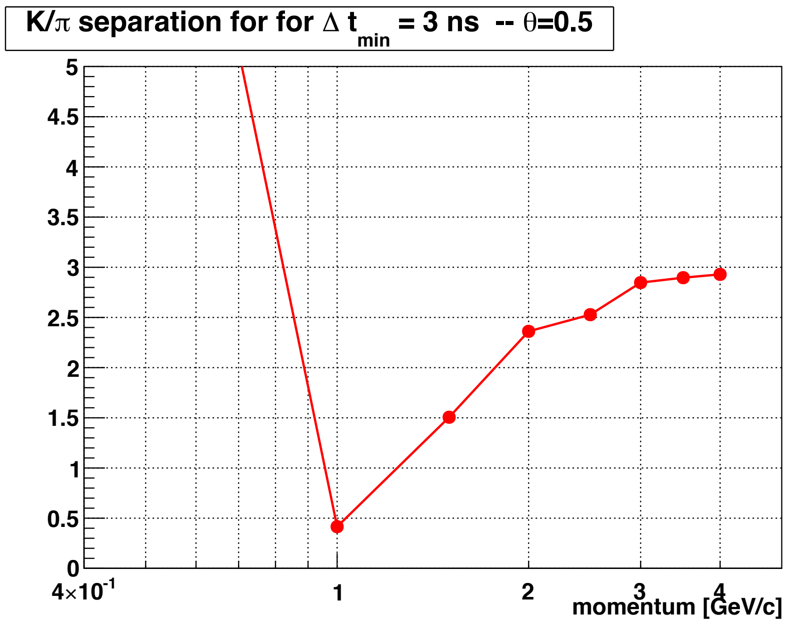
$$\frac{\left|\langle N_K \rangle - \langle N_\pi \rangle\right|}{\sqrt{\sigma_K^2 + \sigma_\pi^2}}$$

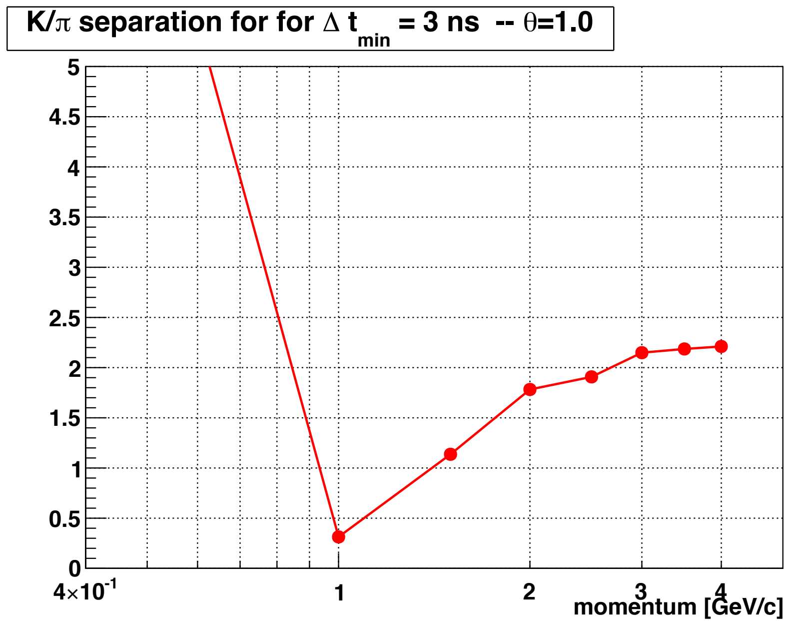
K/π separation for Δt_{min}= 1ns



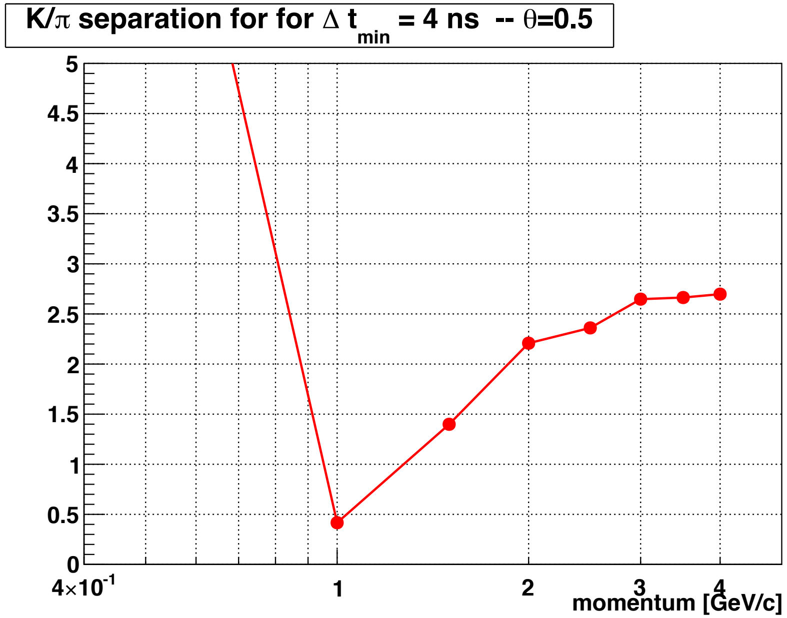


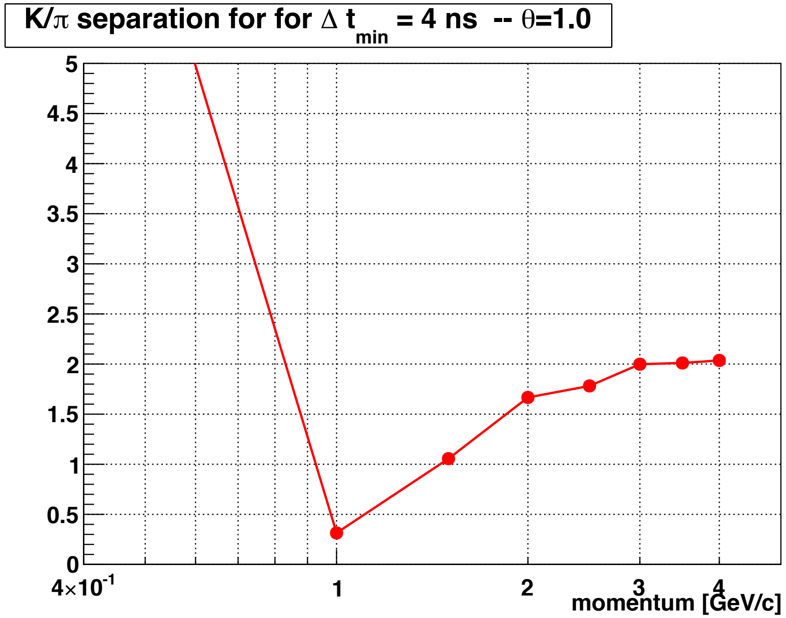
K/π separation for $\Delta t_{min} = 3ns$



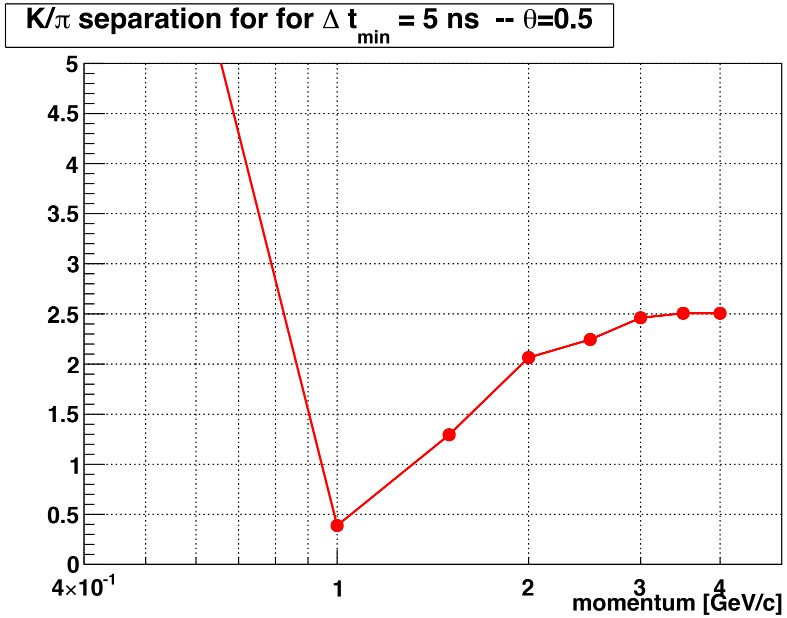


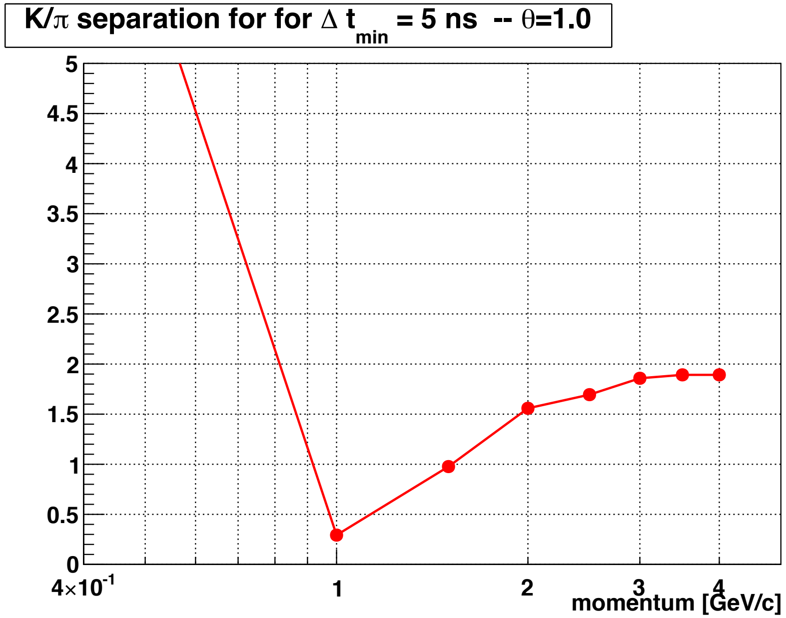
K/π separation for Δt_{min}= 4ns



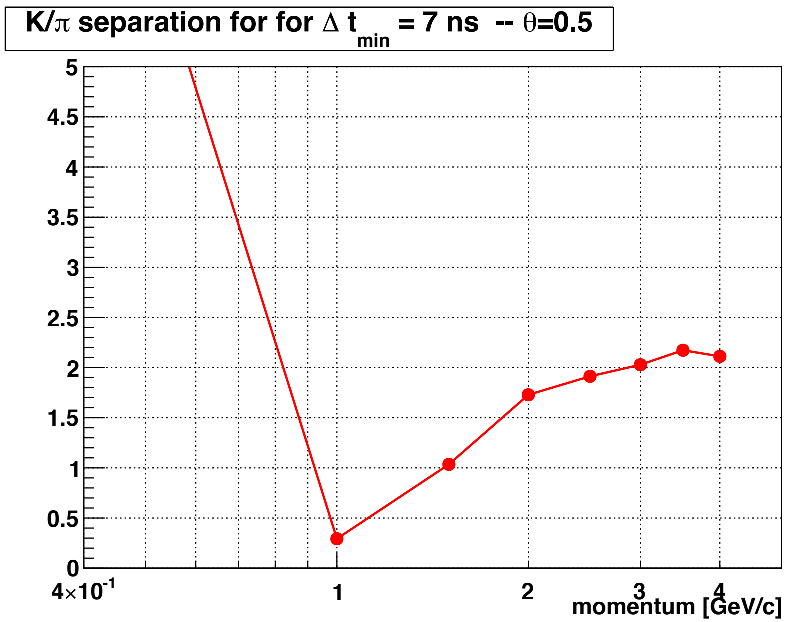


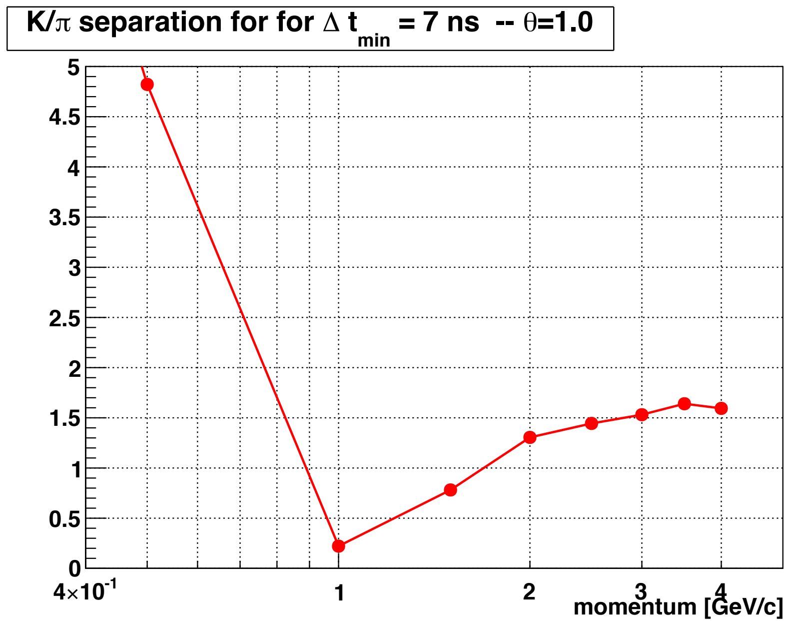
K/π separation for Δt_{min}= 5ns



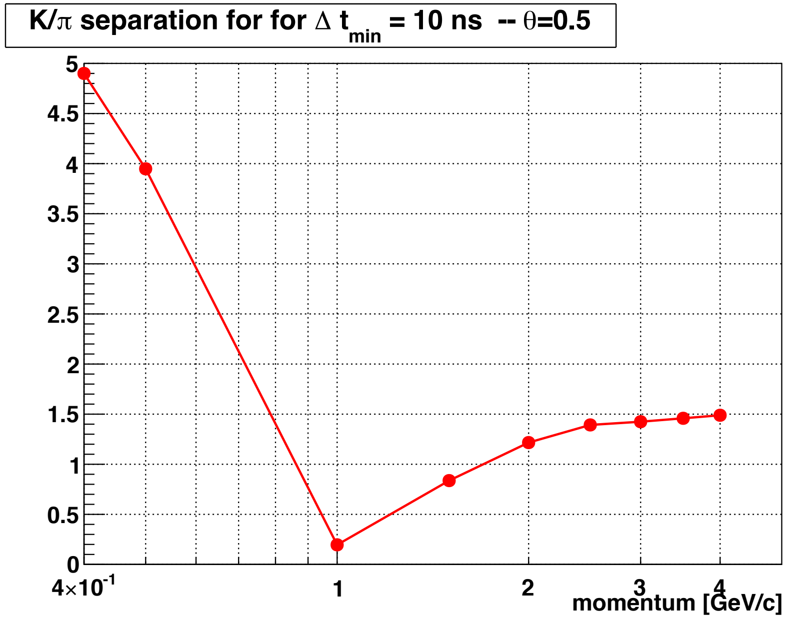


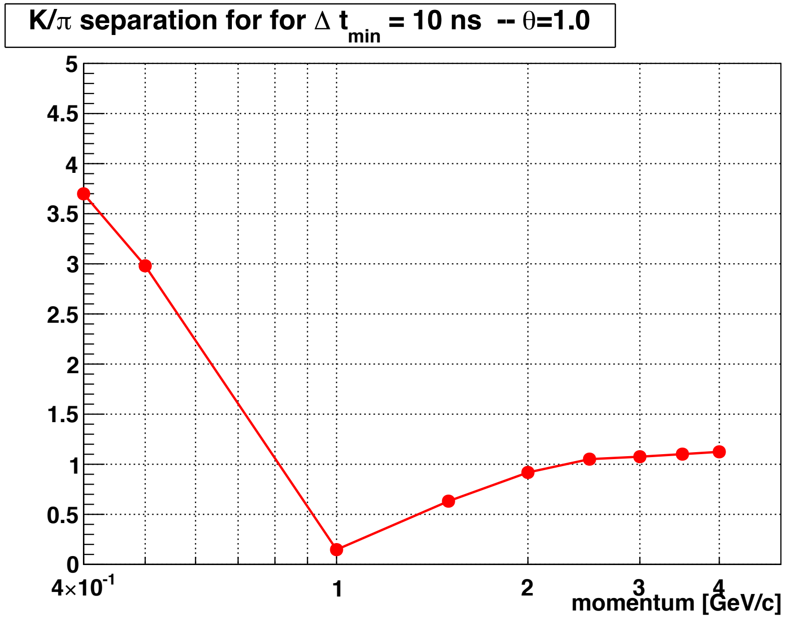
K/π separation for Δt_{min} = 7ns



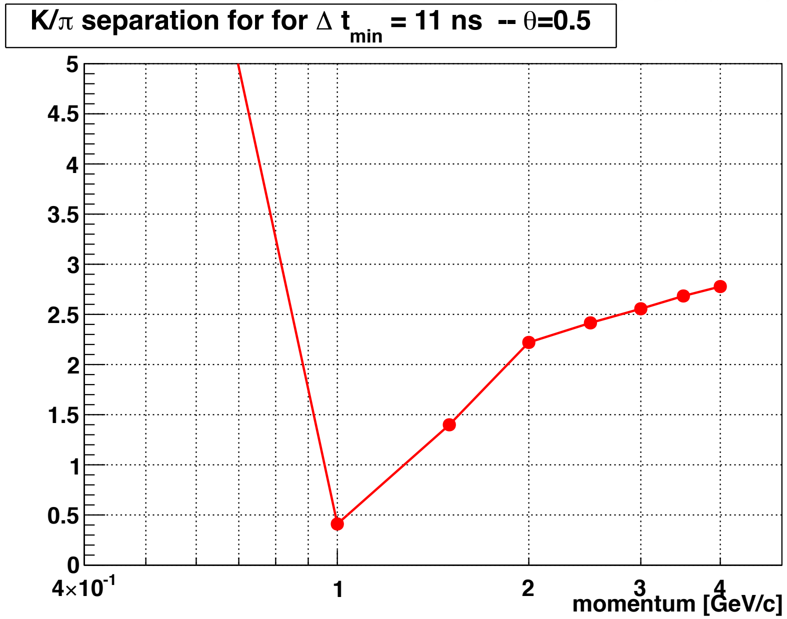


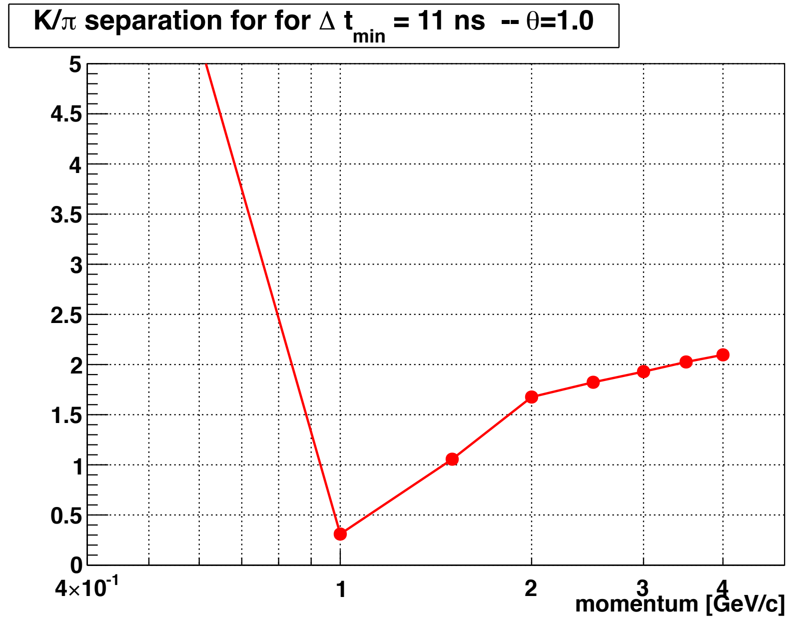
K/π separation for $\Delta t_{min} = 10ns$





K/π separation for ε=0.6 flat





- Note: ε=0.6 for Δt_{min}~7ns (pag. 22)
- However, separation for ε=0.6 flat (artificially) good as the one for Δt_{min} only ~4ns (pag. 27)
  - I believe because fluctuations on efficiency are not realistically taken into account with a flat efficiency

Conclusions (?)

- For our FastSim studies we should model counting (in) efficiencies as accurately as possible
- A flat efficiency, albeit derived from data at a given momentum, seems to be too optimistic
  - not consistent with improvement of dN/dx vs dE/dx measured on data (see e.g. M. Piccolo's presentation at the Dec 2011 LNF meeting: http://agenda.infn.it/getFile.py/access?contribId=106&sessionId=3&resId=0&materialId=slides&confId=4107)
- We need to decide soon the parameterization and start the FastSim run