
PVDIS Cherenkov update

August, 6, 2012

Changed the field from BaBar (v4) to CLEO(v8):

Field at observer: $B_r = 61.2 \text{ G}$, $B_z = -110.5 \text{ G}$

(BaBar: $B_r = 133.7 \text{ G}$, $B_z = -81.8 \text{ G}$)

Kept everything else identic – **including the tank**;

About the tank: the new tank should be 6 cm longer (starting at 194 cm instead of 200 cm in z). Since it is not yet 100% sure, I'd rather keep the old one for now.

The new tank is however narrower at the “nose” to fit into the new coil geometry. I checked that the new geometry was not damaging the p.e. yield at the extreme edges of the acceptance.

TODO, but not priority: compute the new tank dimensions that would fit the new coil and that would start at 200 cm.

Another thing to discuss wrt the tank: Zhiwen asked about the thickness of the cherenkov window:

who would be best to give an answer, knowing that:

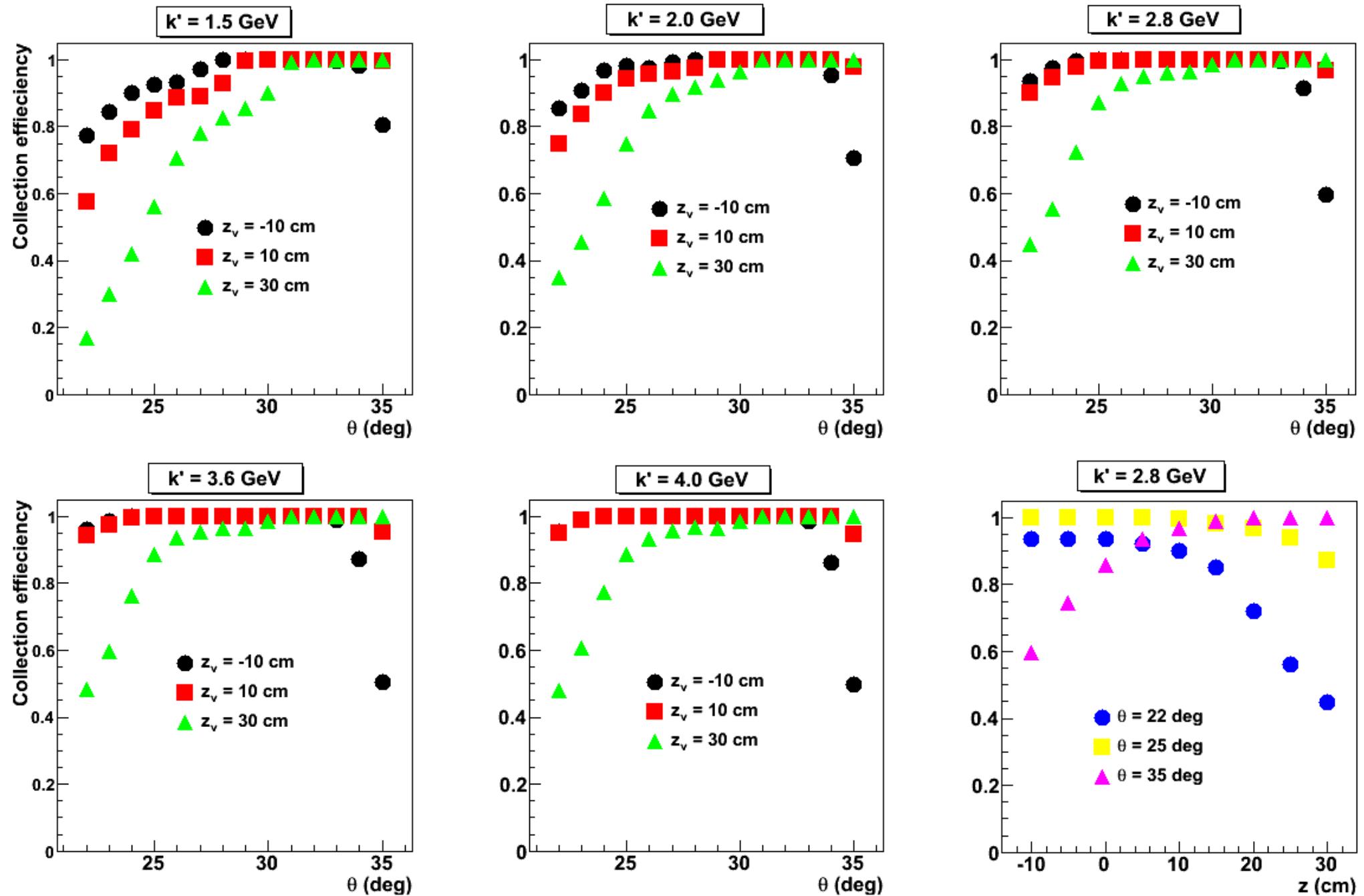
- so far, it used to be 0.4 mm thick aluminum;
- the tank is at atmospheric pressure.

Changed the field from BaBar (v4) to CLEO(v8):

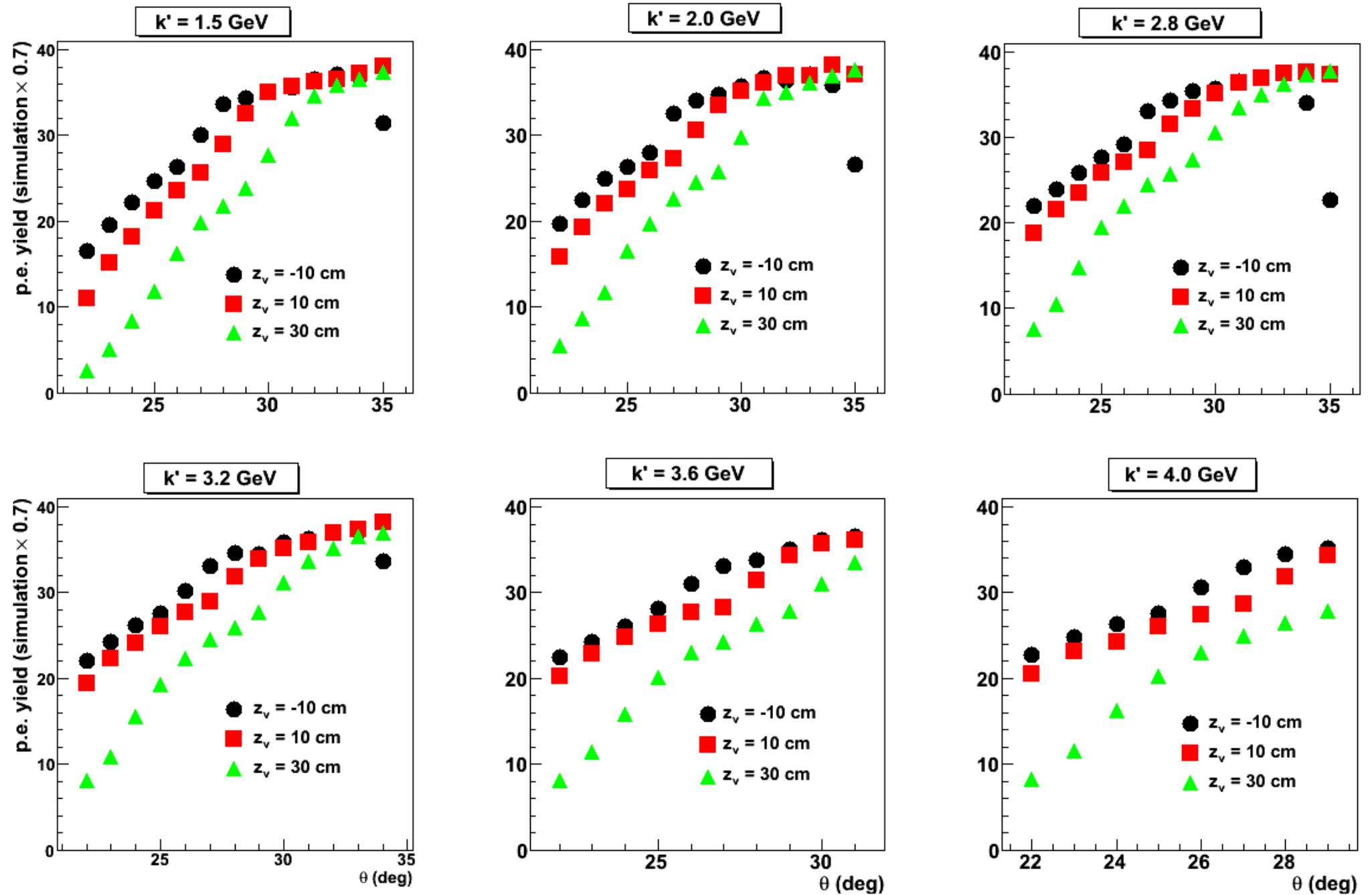
Kept everything else identic, including the tank:

- optics;
- p.e. yield for electrons, electrons+pions;
- efficiency;
- misidentification;
- contamination;
- Online selection.

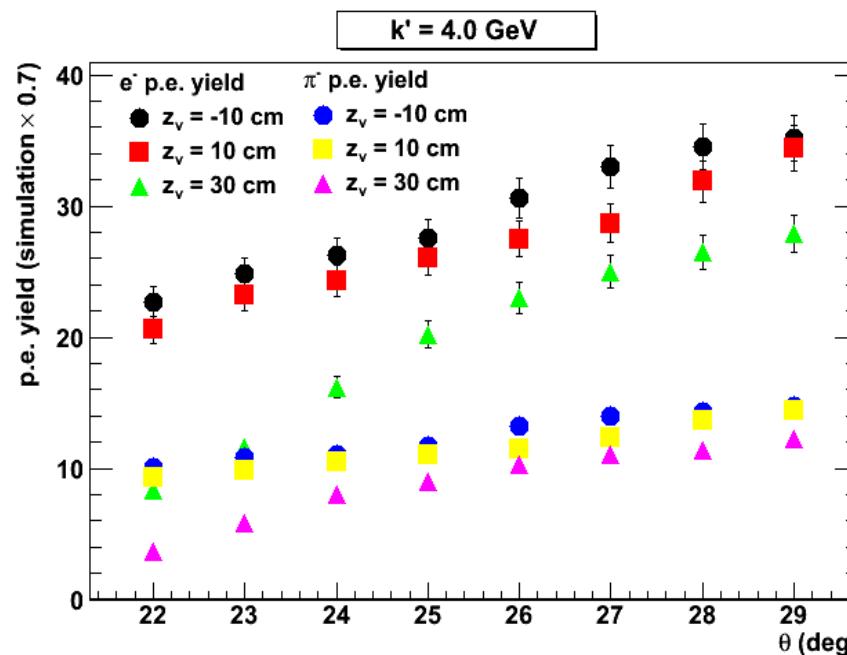
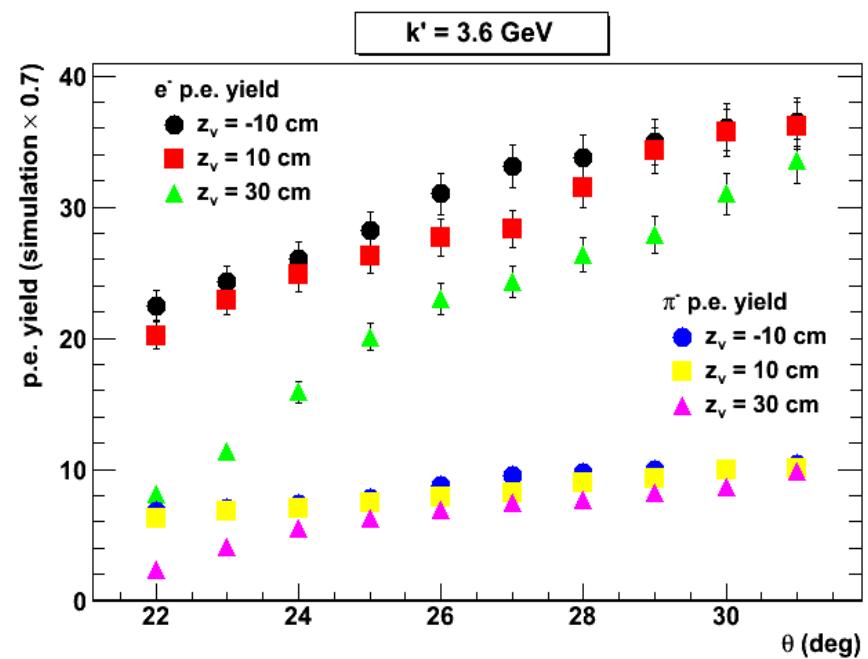
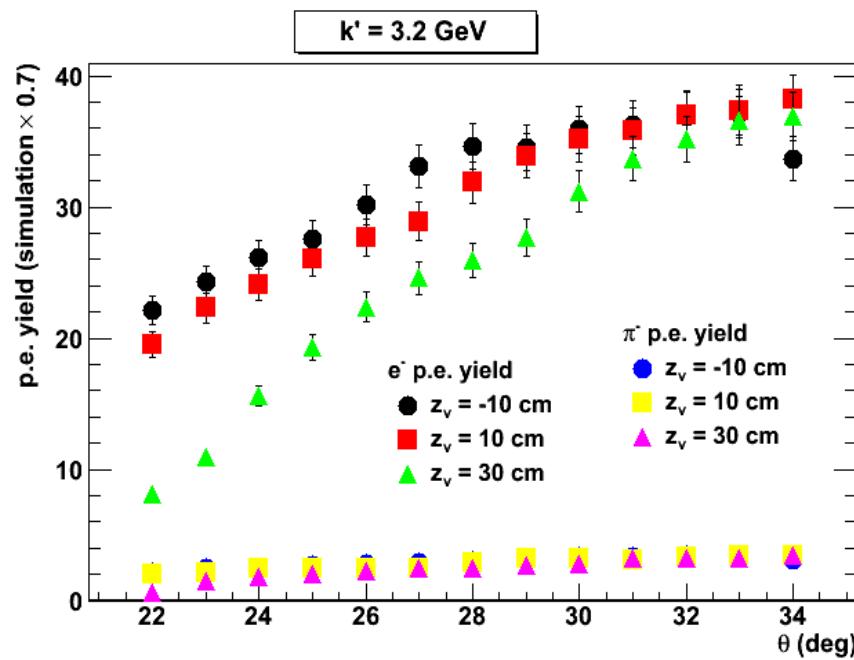
Optics



p.e. yields electrons



p.e. yields electrons vs pions



Cut optimisation

Pion signal: 1.0 p.e. (hypothesis)

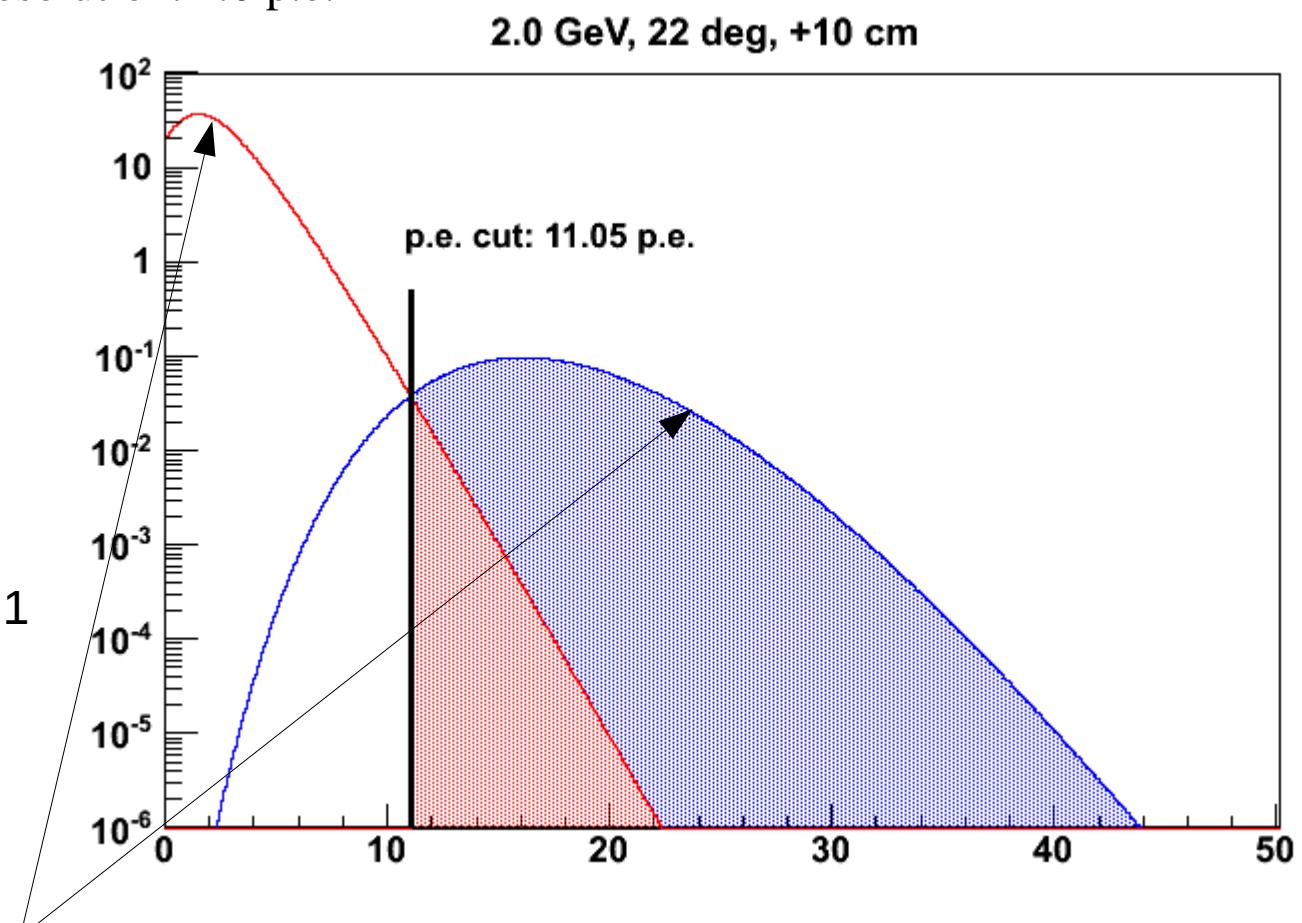
Electron signal: 16.0 p.e.

π/e ratio: 142.94

Detector resolution: 1.0 p.e.

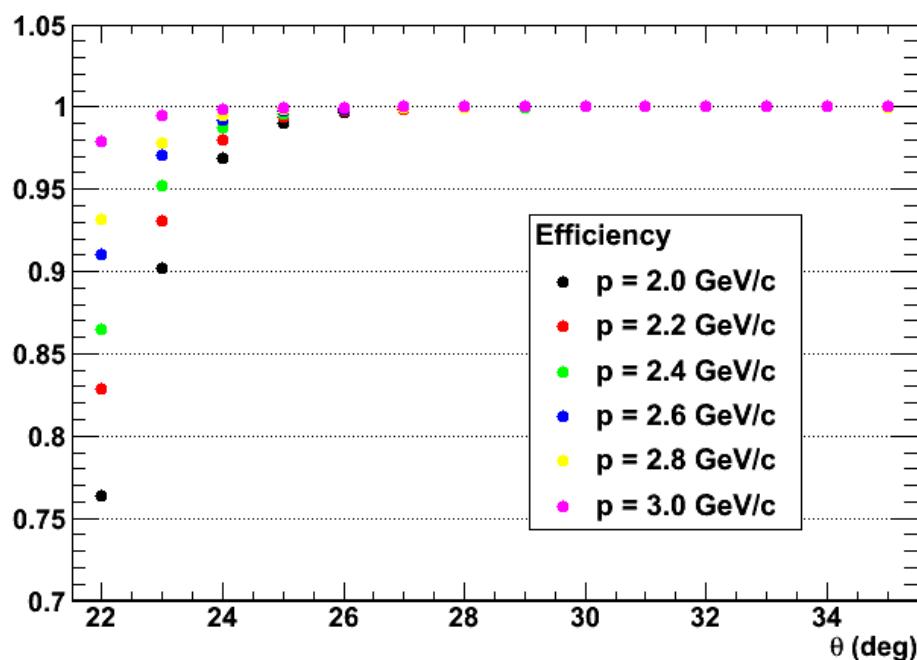
Pion PDF:
[Poisson(Pion signal) *
Gauss(Detector resolution)] x
 π/e ratio

Electron PDF:
[Poisson(Electron signal) *
Gauss(Detector resolution)] x 1

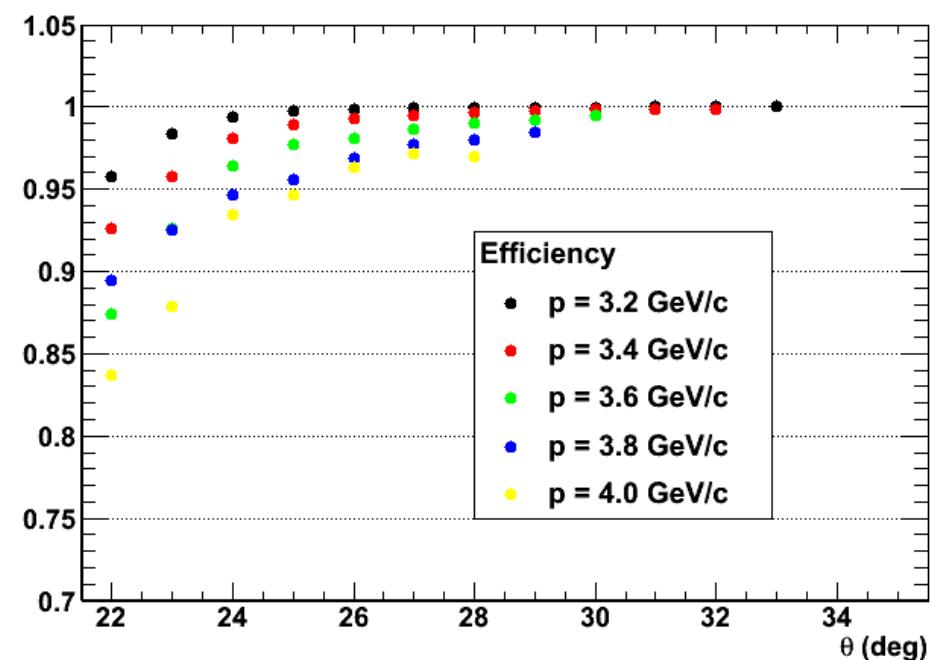


Addition of those two curves
should be as the ADC spectrum looks like (excluding pedestal)...

Efficiency

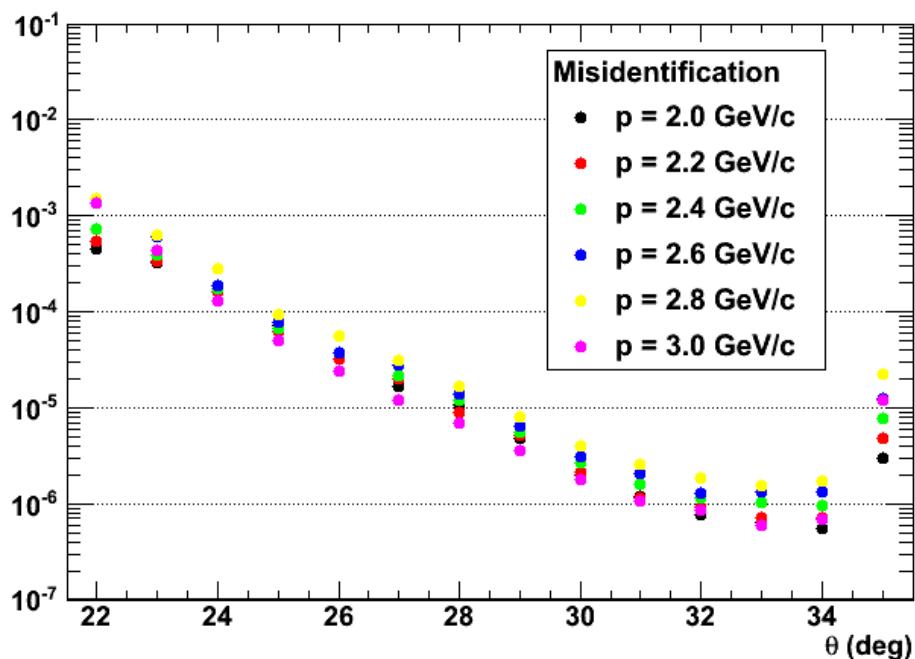


Efficiency over 2 - 3 GeV/c: **0.987**

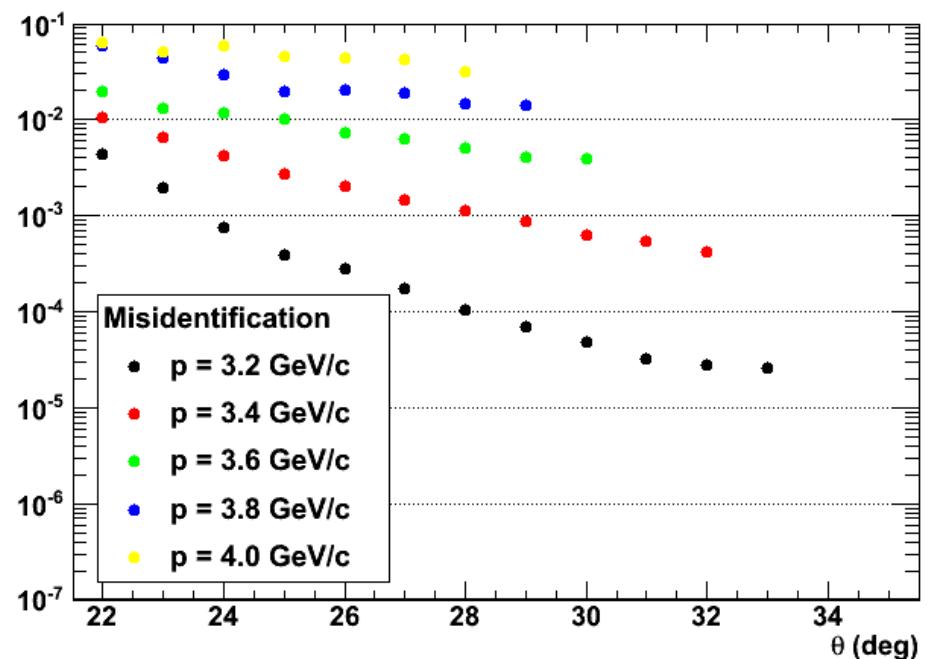


Efficiency over 3 - 4 GeV/c: **0.970**

Misidentification

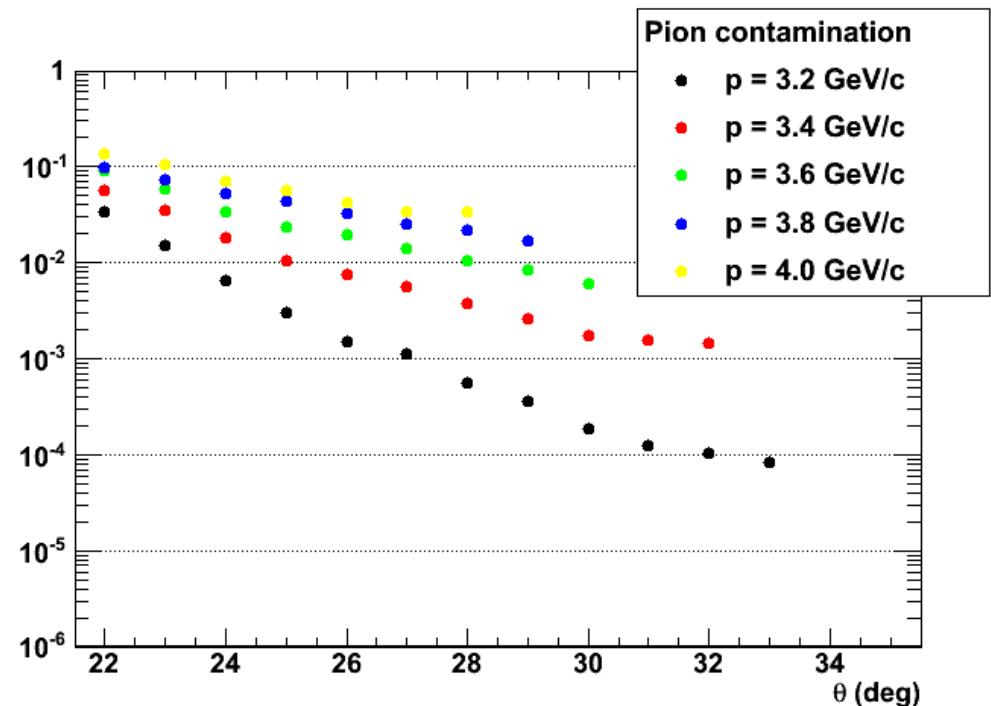
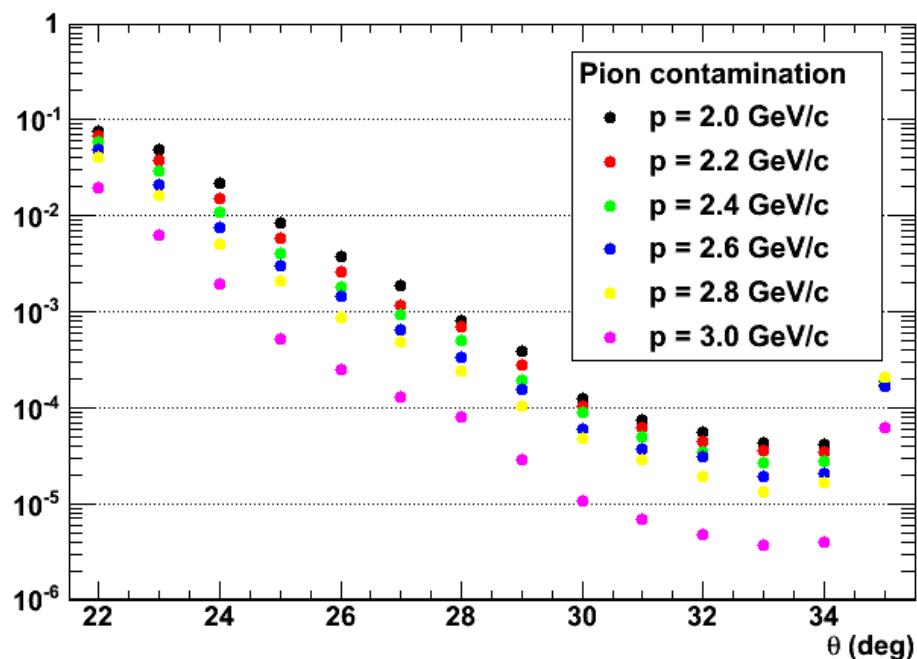


Misidentification (pion rejection)
over 2 - 3 GeV/c:
 1.27×10^{-4} (~8 10^3)



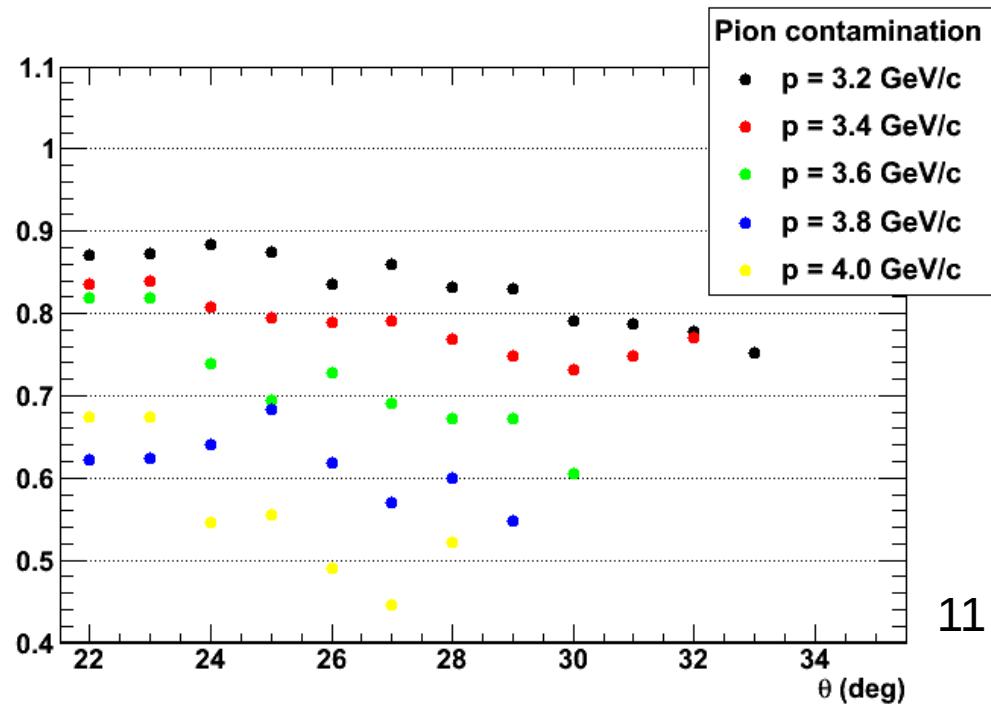
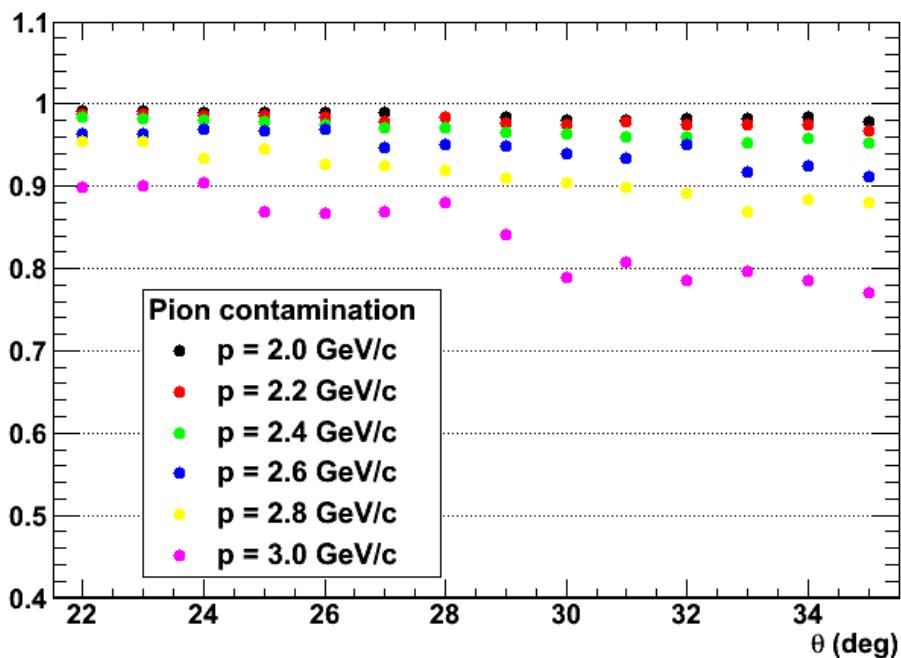
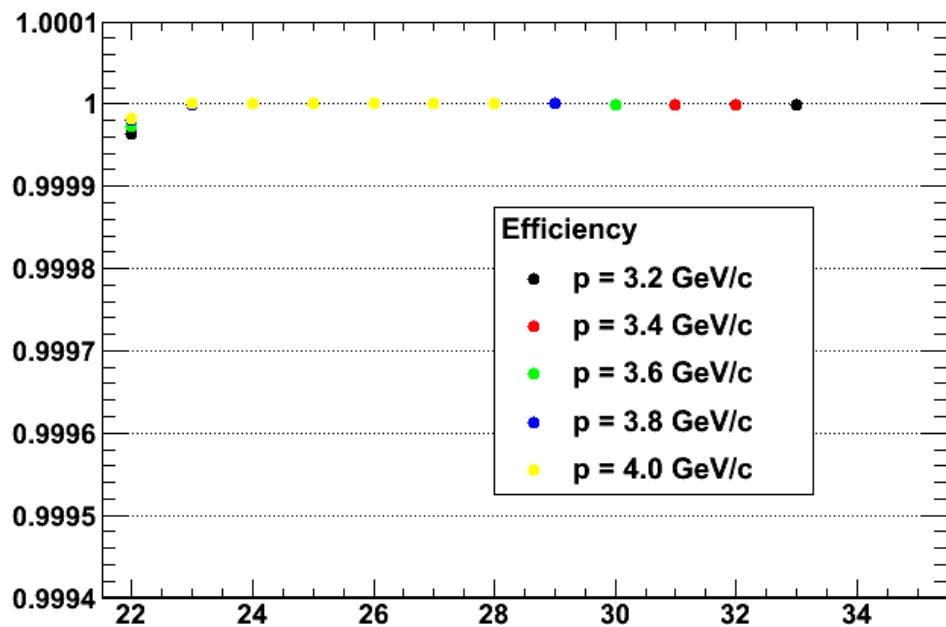
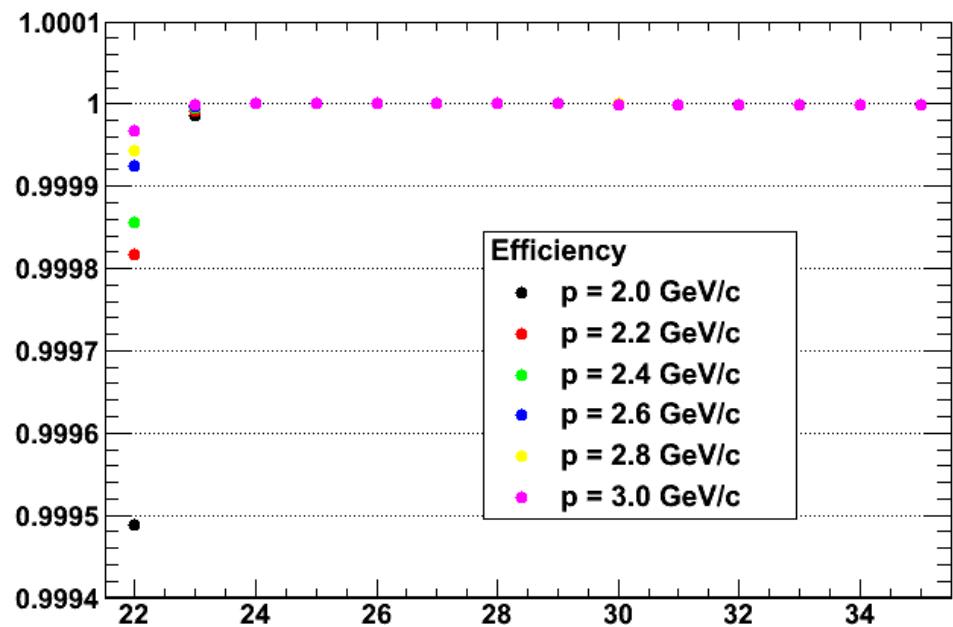
Misidentification (pion rejection)
over 3 - 4 GeV/c:
 1.44×10^{-2} (~70)

Contamination

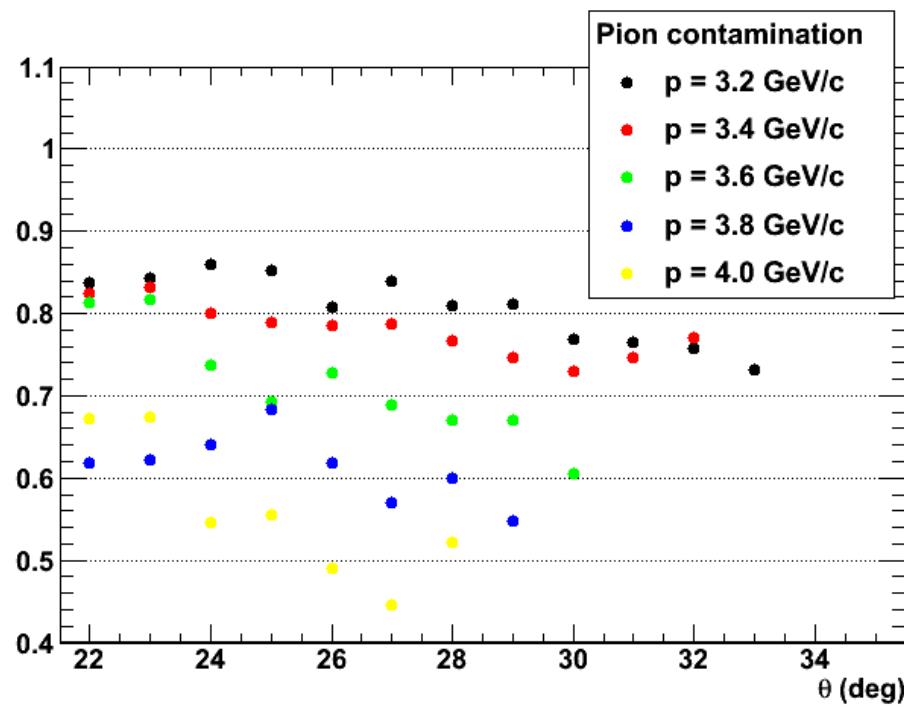
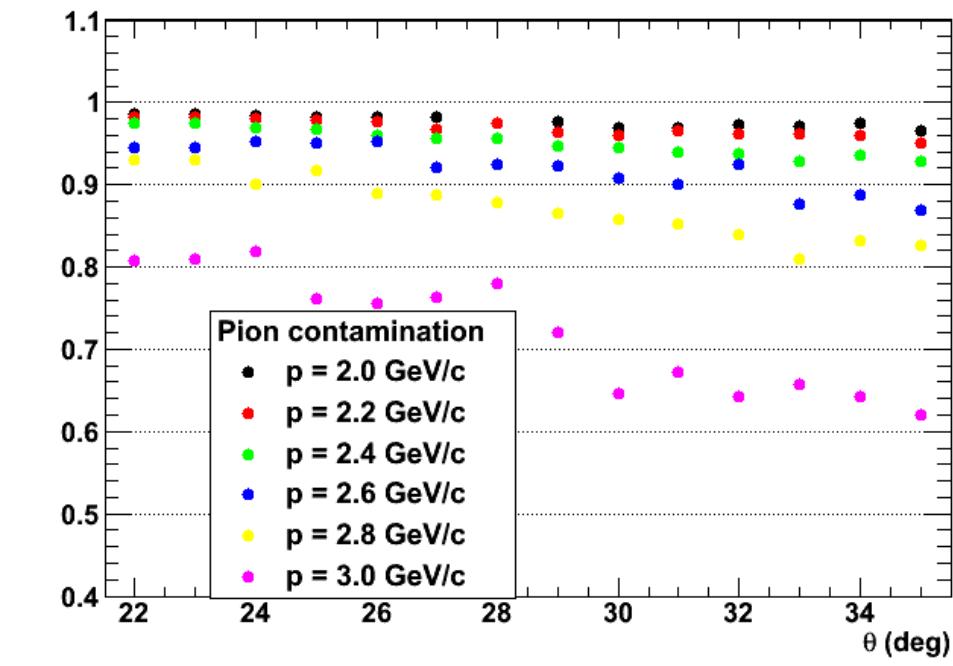
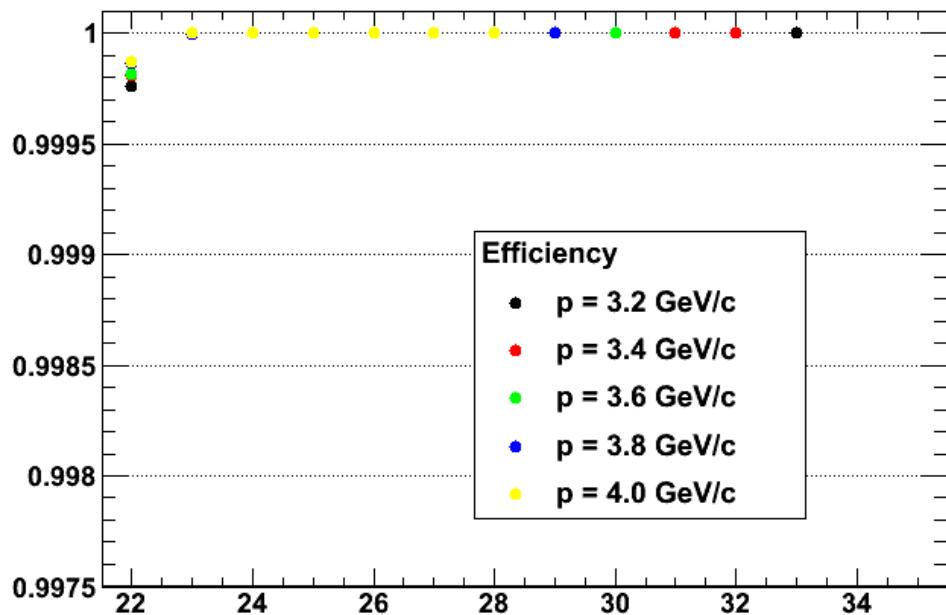
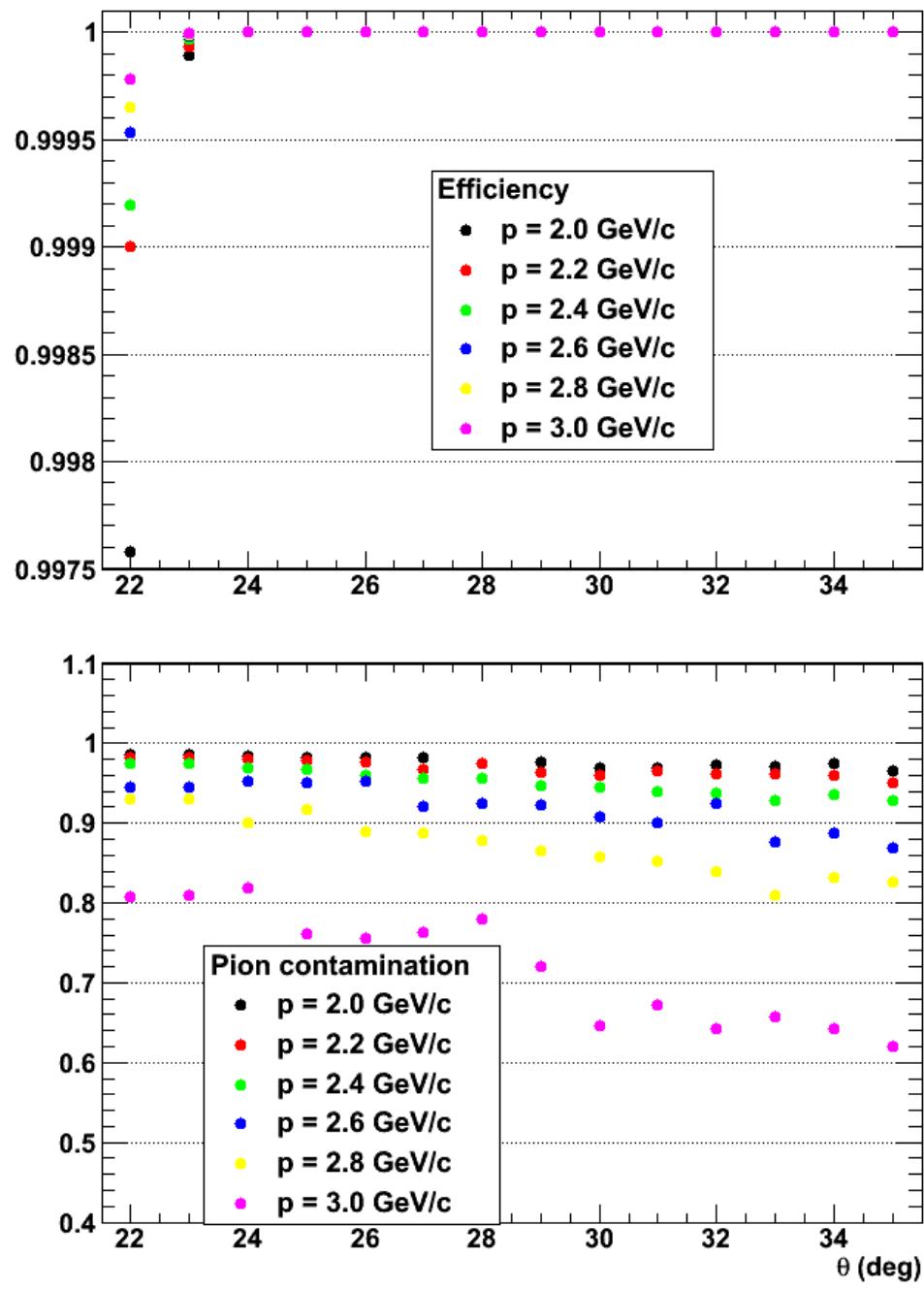


/!\ : not in % !!!

Online selection: 1 p.e.



Online selection: 2 p.e.



Changed the field from BaBar (v4) to CLEO(v8):

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- efficiency;
- misidentification;
- contamination;
- Online selection.

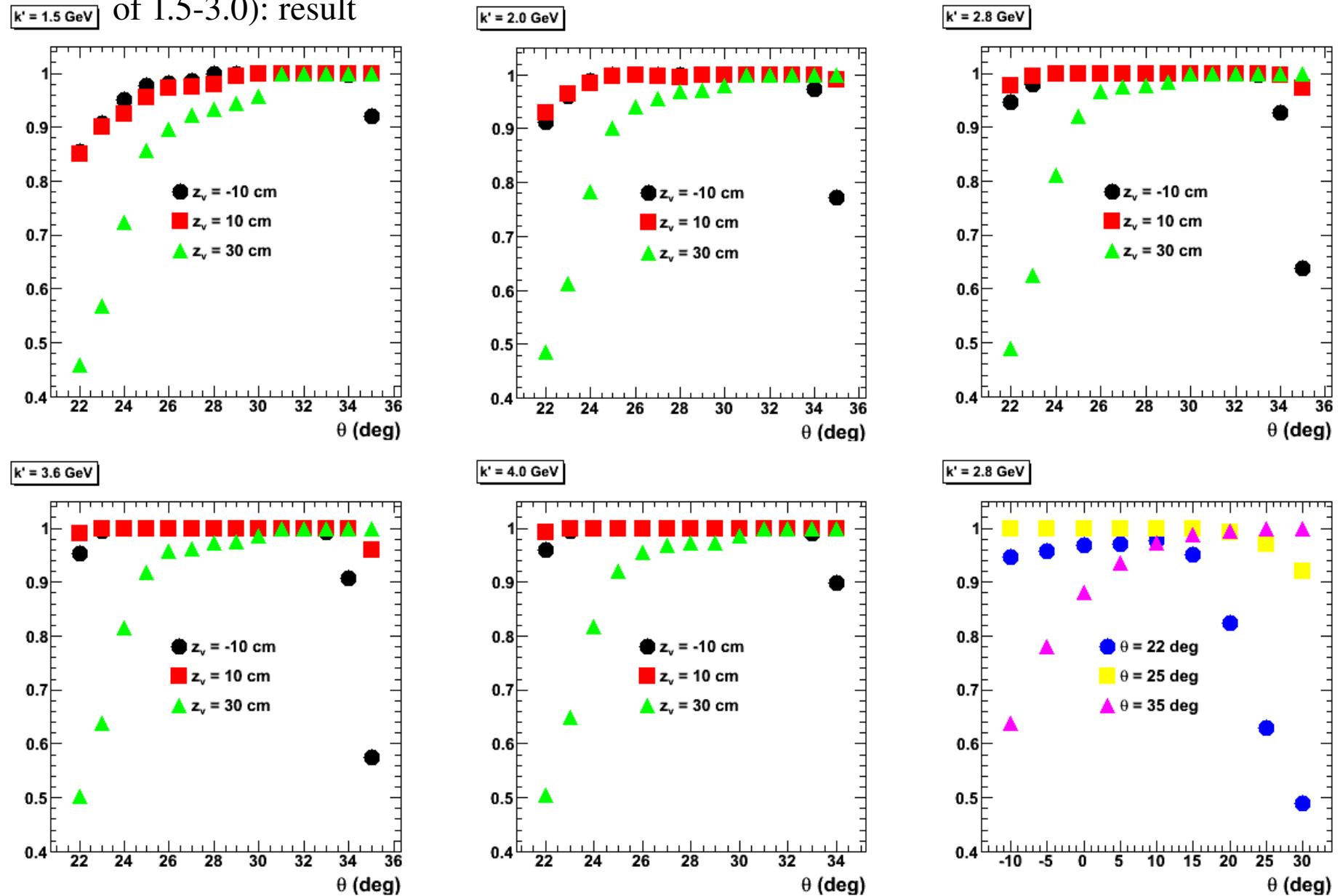
=> not as good as with BaBar field map (plots available in backup), but decent still.

Of course, room for further optimization.

Back-up

Performances

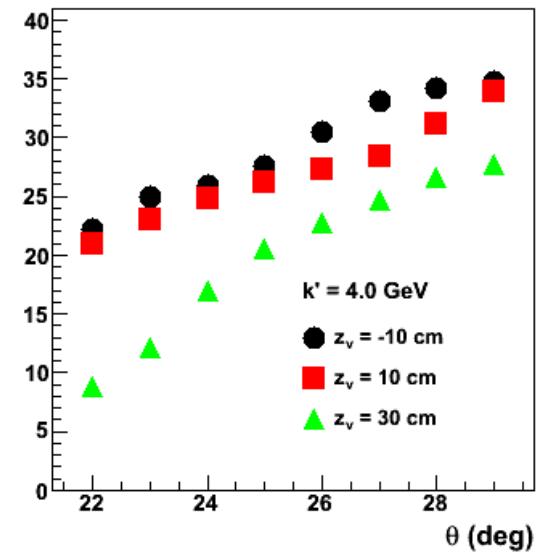
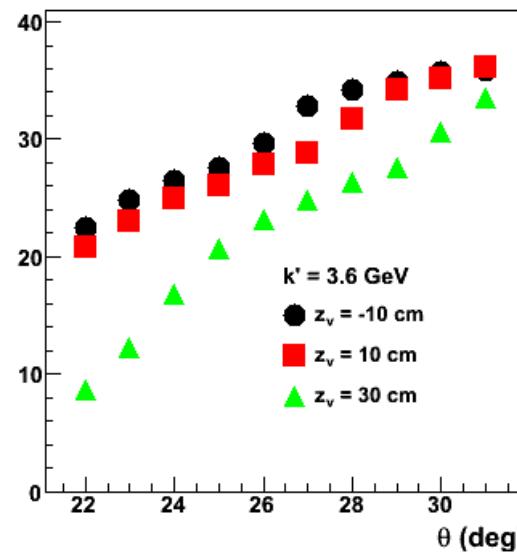
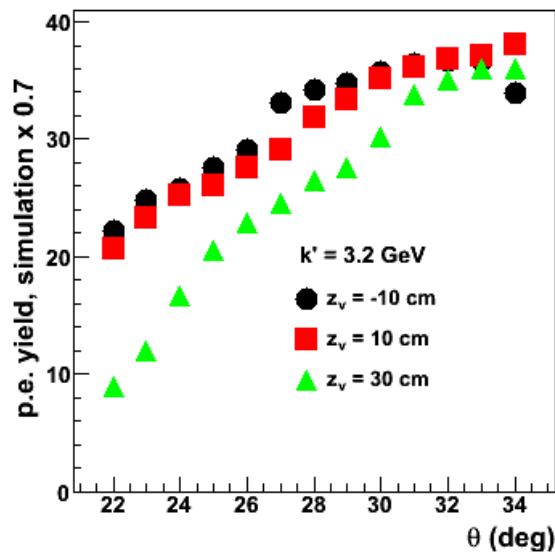
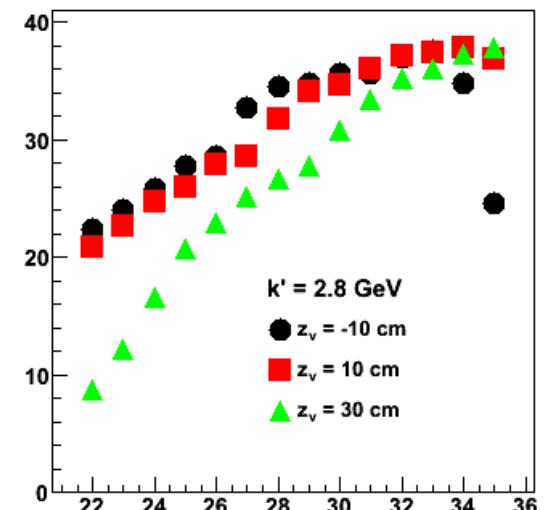
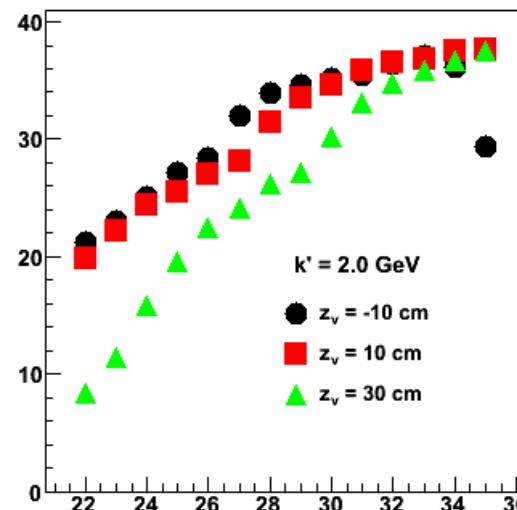
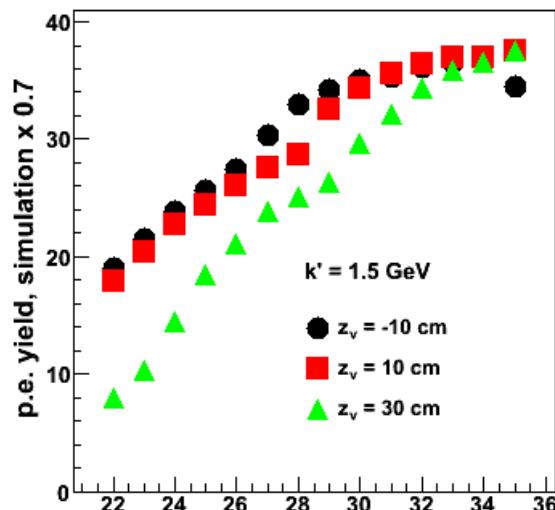
=> Design tweaks to optimize the collection between 2 and 4 GeV (instead of 1.5-3.0): result



Performances

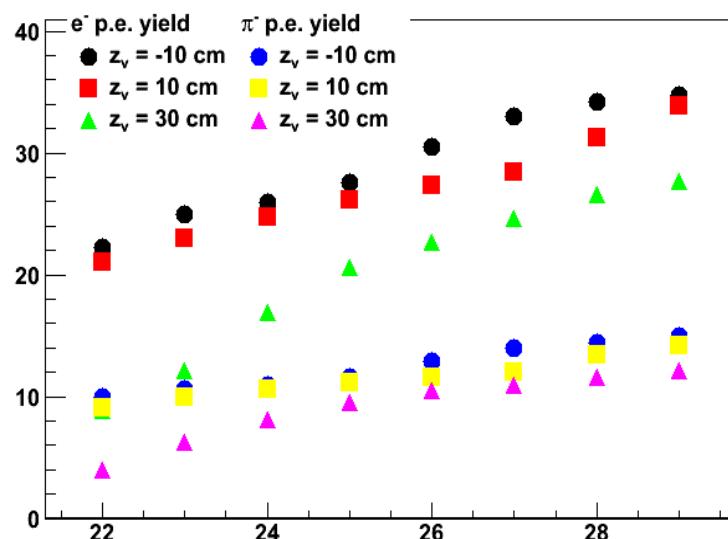
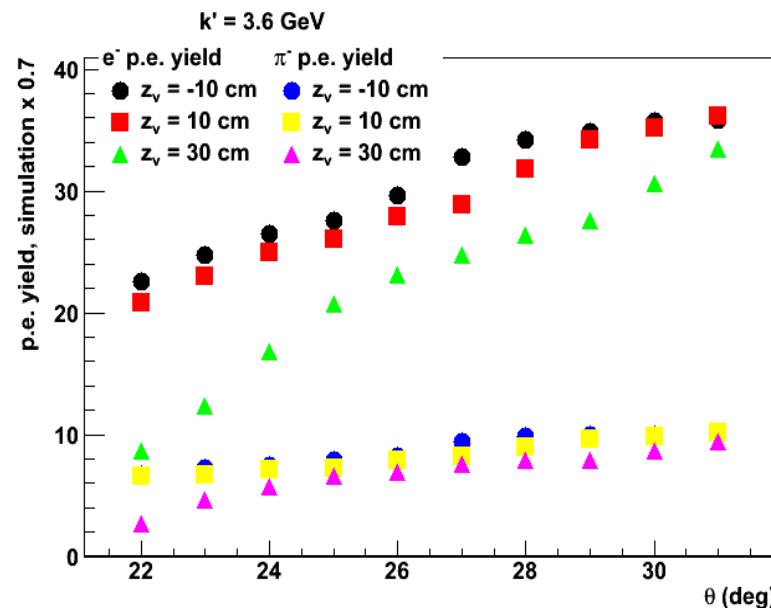
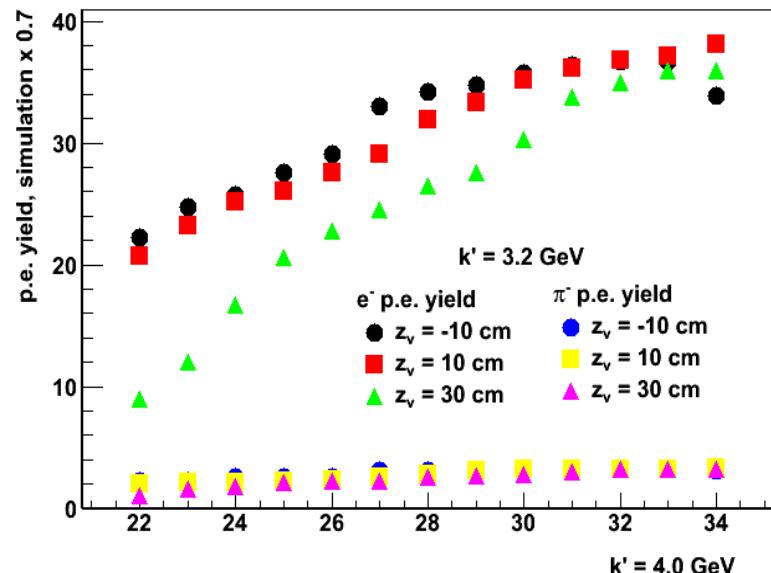
=>after discussions: “safety factor” set to 0.7 instead of 0.5.

Result on p.e. yield.



Pion rejection

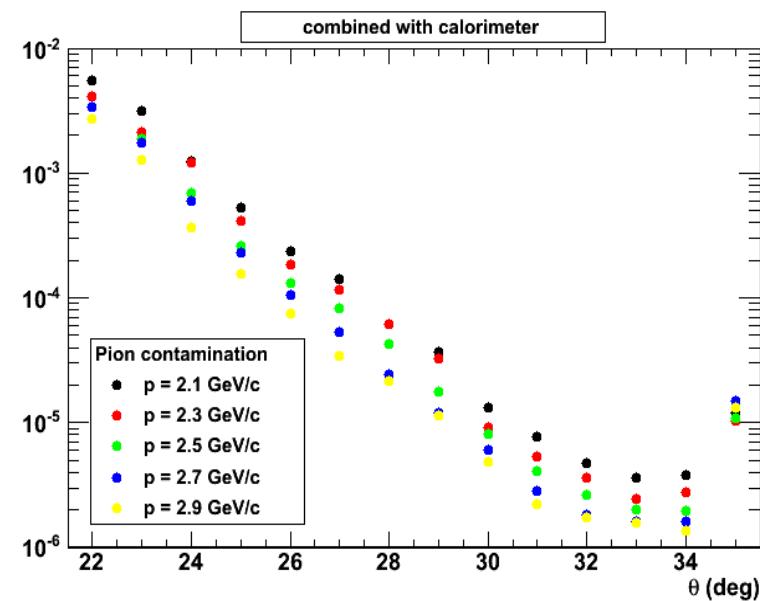
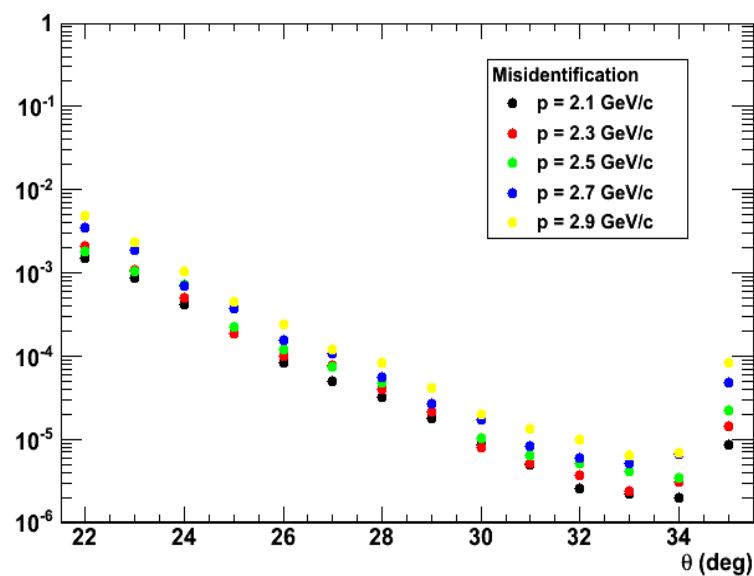
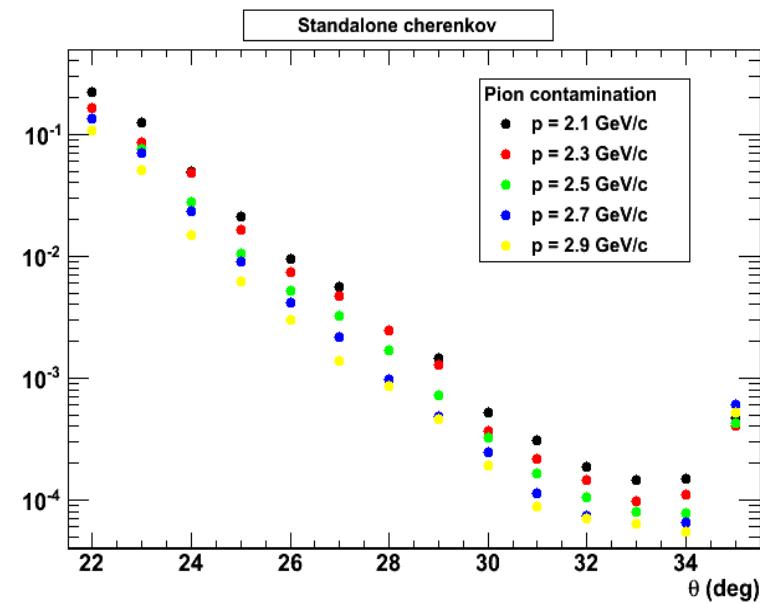
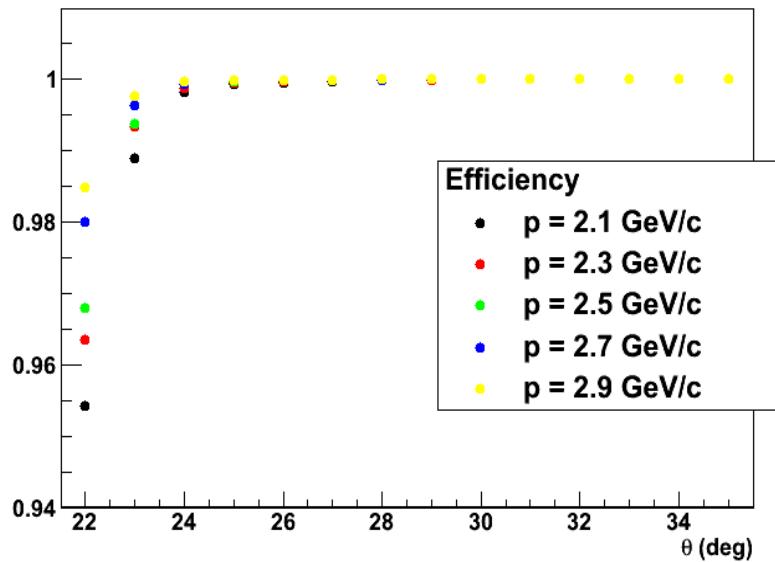
Comparison of p.e. yield for electrons vs pe yield for pions;



Below 3 GeV: assumed
1 p.e. signal for pions

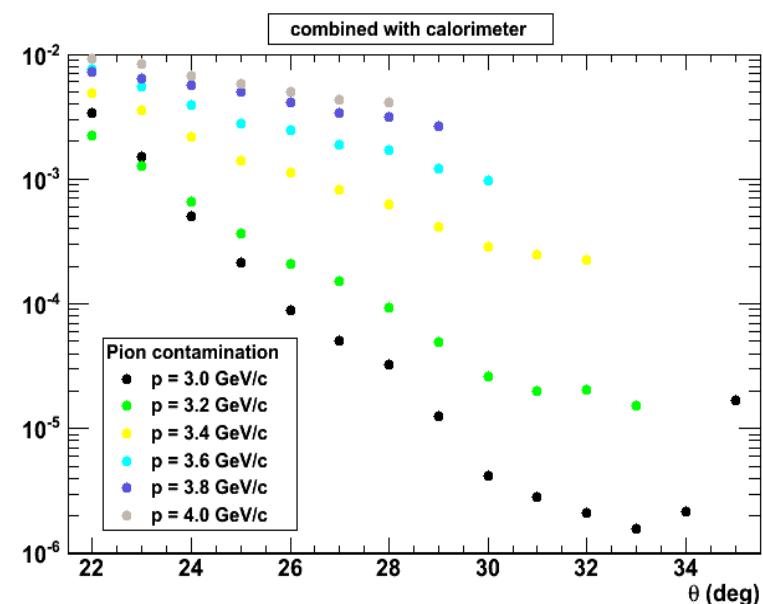
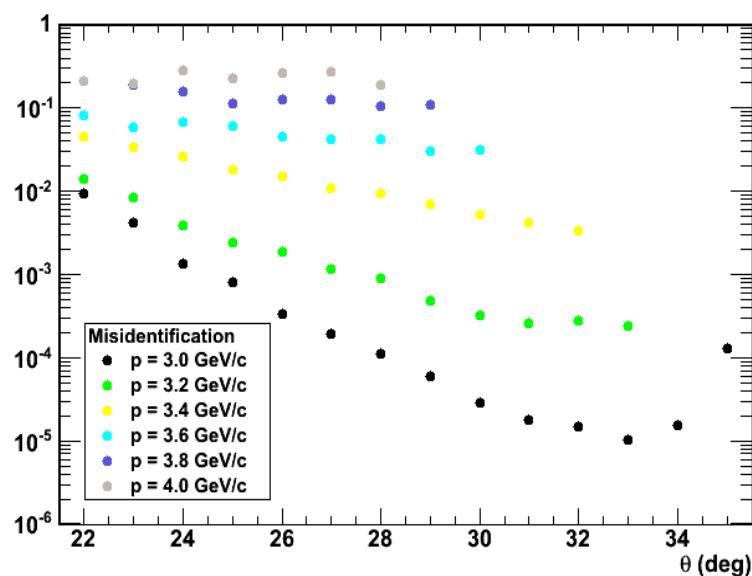
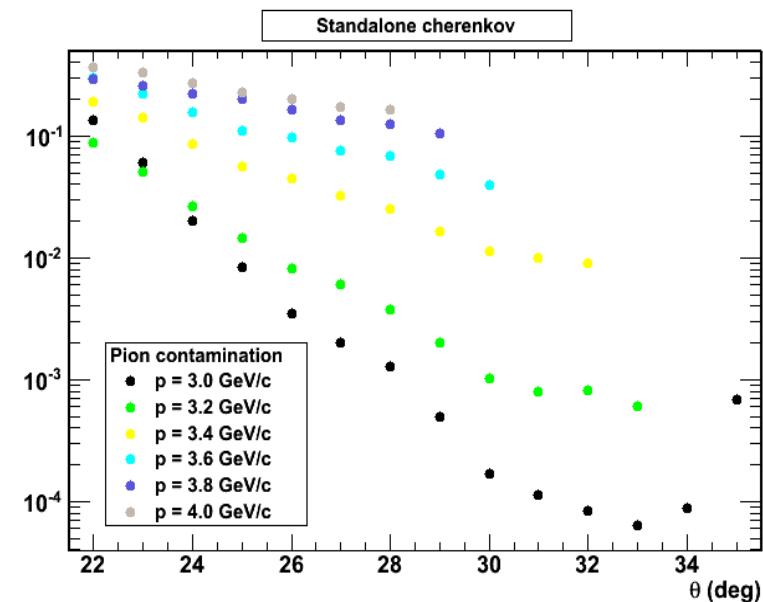
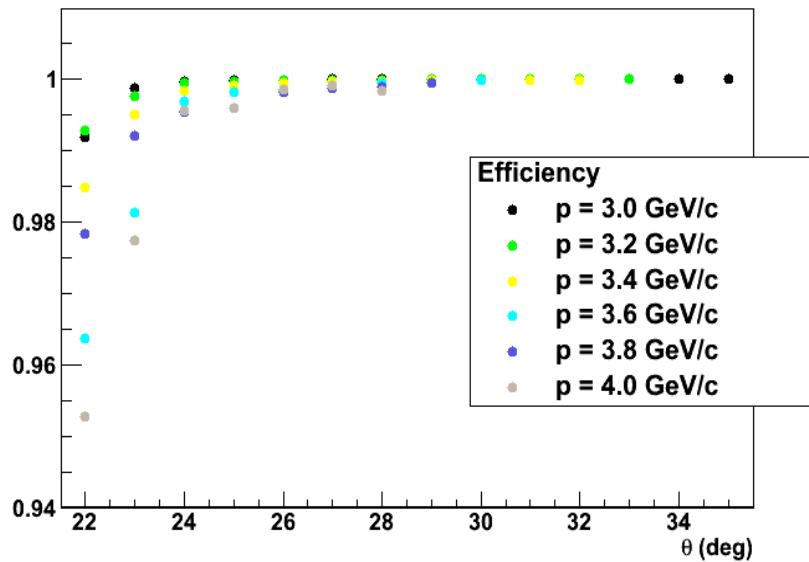
Global performance

$2 \text{ GeV}/c < p < 3 \text{ GeV}/c$:



Global performance

$3 \text{ GeV}/c < p < 4 \text{ GeV}/c$:

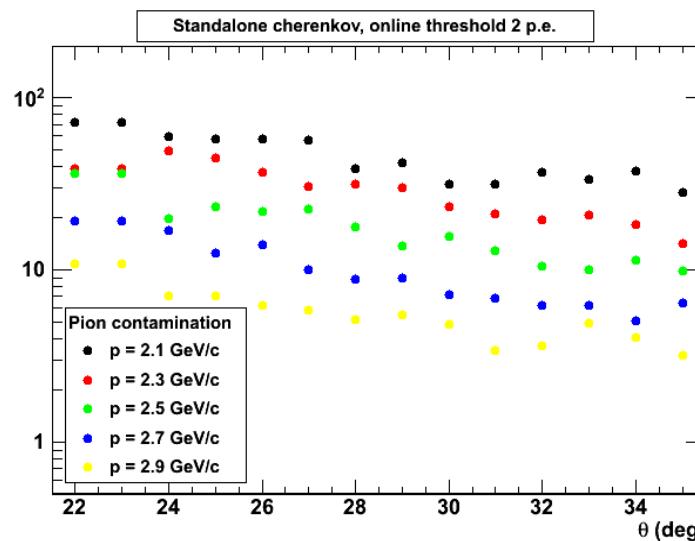
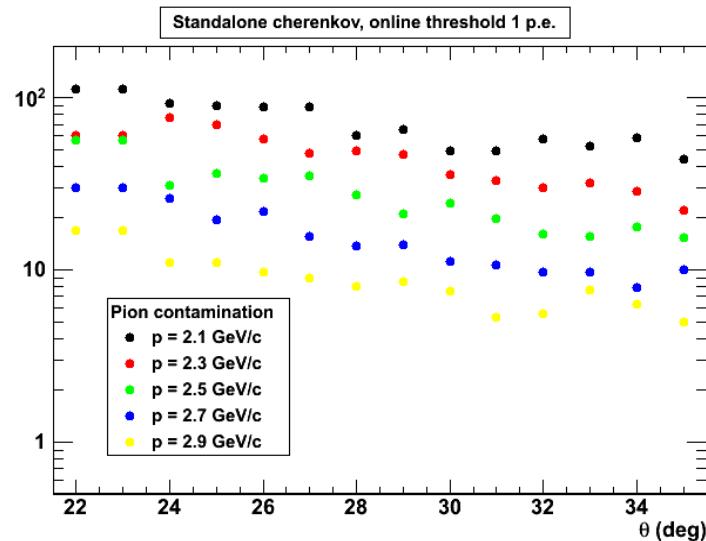
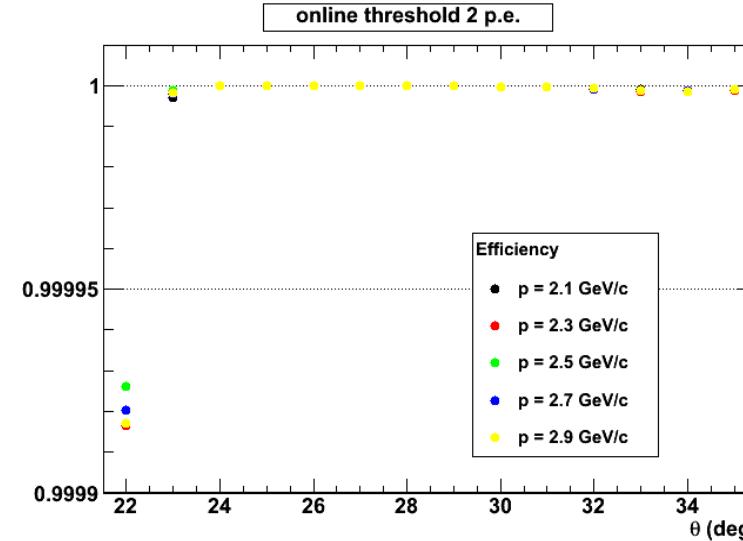
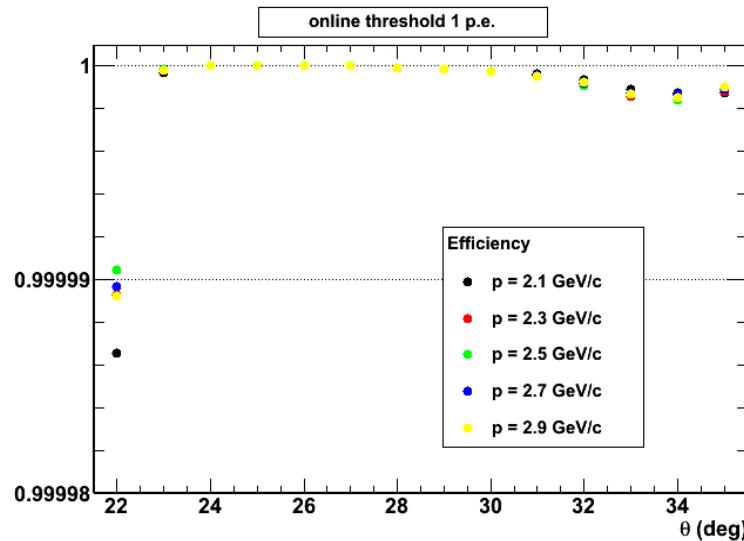


Online selection

Set an online threshold (1 or 2 p.e. at most) for:

- rate control;
- hypothetical inclusion in trigger.

$2 \text{ GeV}/c < p < 3 \text{ GeV}/c$:

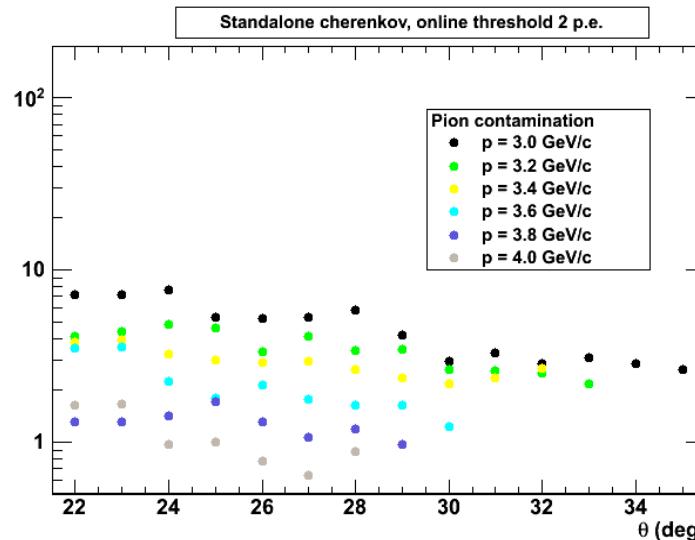
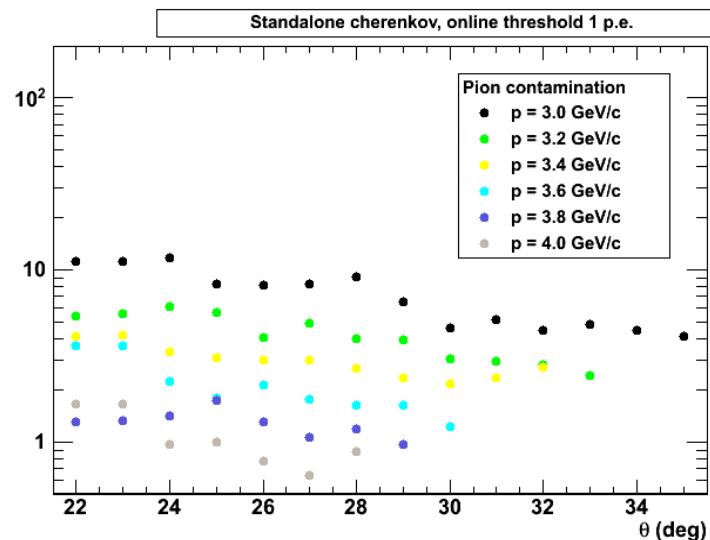
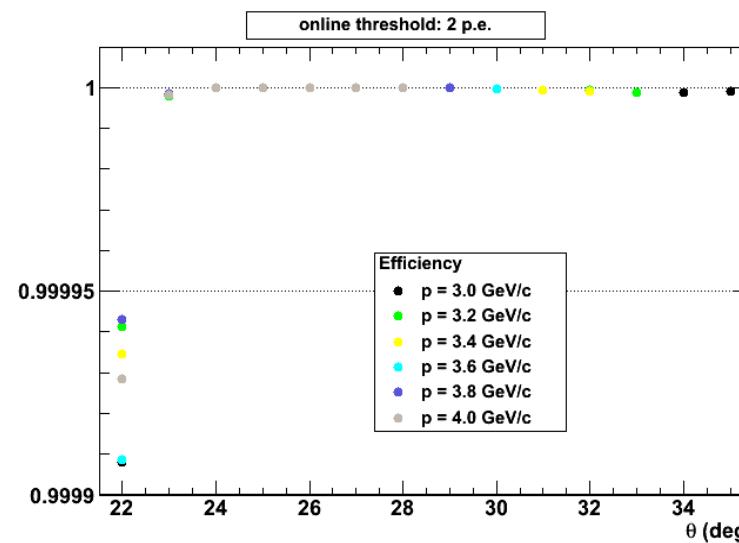
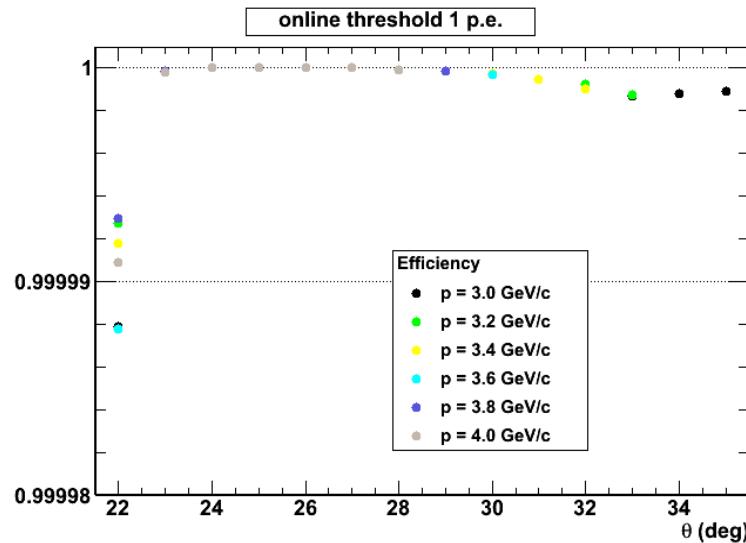


Online selection

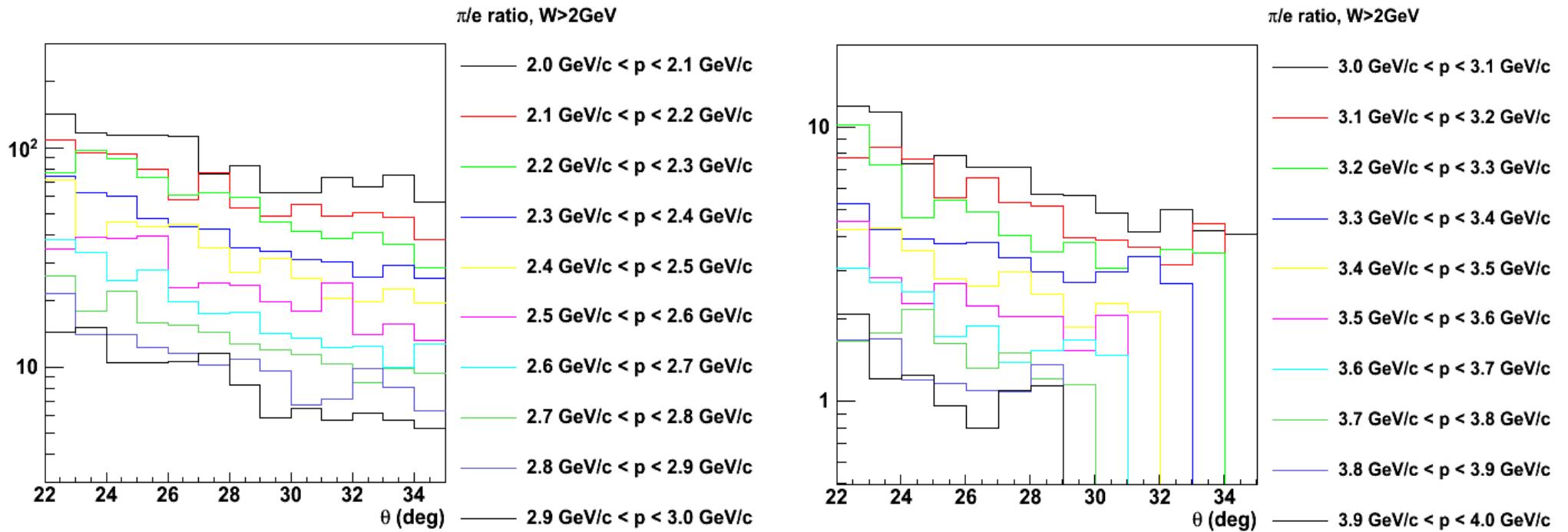
Set an online threshold (1 or 2 p.e. at most) for:

- rate control;
- hypothetical inclusion in trigger.

$3 \text{ GeV}/c < p < 4 \text{ GeV}/c$:



π/e ratio



$2 \text{GeV}/c < p < 3 \text{GeV}/c$:
40:1 pion rejection

Assumed the following
for the calorimeter:

$3 \text{GeV}/c < p < 4 \text{GeV}/c$:
50:1 pion rejection