Global PID

MICE CM40

26/10/14

Celeste Pidcott
University of Warwick

Status of PID at CM39

- Single (1D) variable framework has been in MAUS since v0.8.2

- Expansion of framework to use 2D PDFs in MAUS since v0.8.4

- Global PID documentation has been incorporated into MAUS User Guide since v0.9.0

- Global datastructure expanded to include KL and Ckov detector information, and code written to import KL information into global event, in MAUS since v0.9.0

Outline

Main points for this talk:

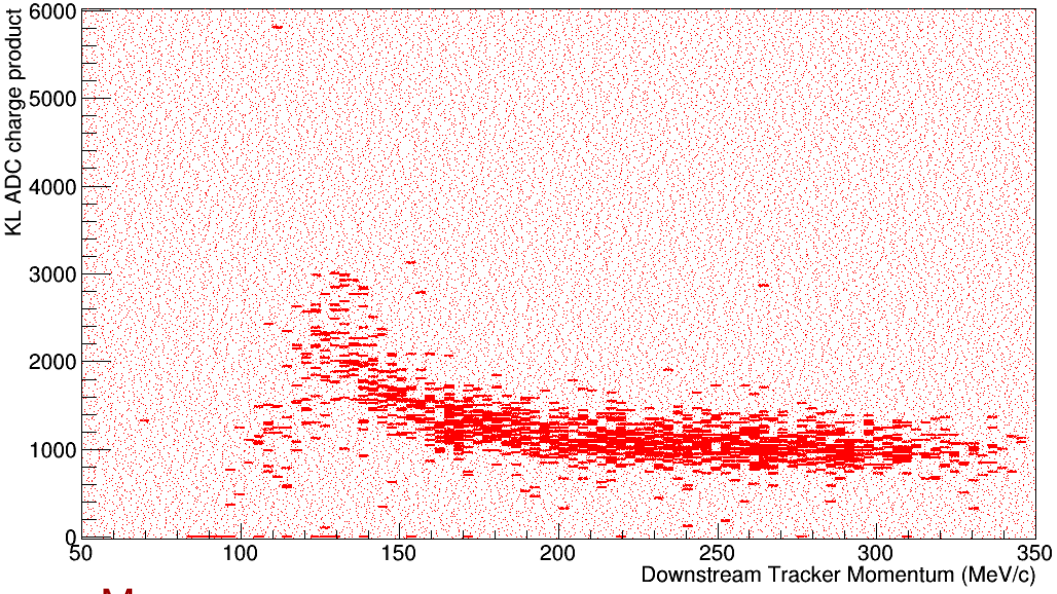
- Tracker/KL PID variable
- Efficiency and Purity of PID

PIDVarC (KL ADC charge product vs Downstream Tracker Momentum)

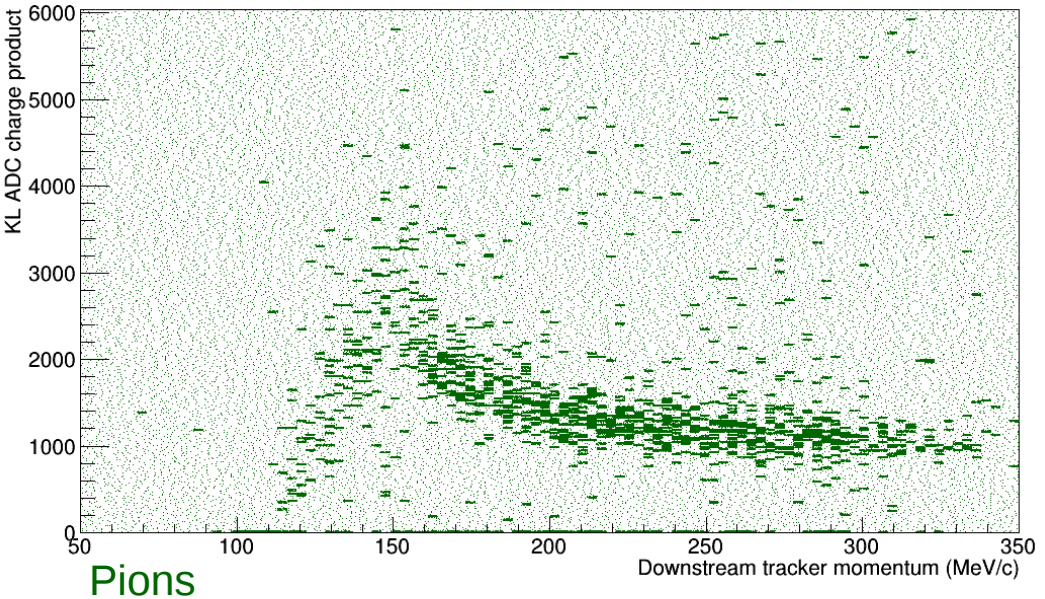
- KL is intended to separate muons from decay electrons
- ADC charge product measured by KL has a momentum dependence (see slide 15)

- PID variable incorporating ADC charge product with momentum measured in downstream tracker proposed to remove dependence
- Variable written, currently writing tests before submitting to MAUS

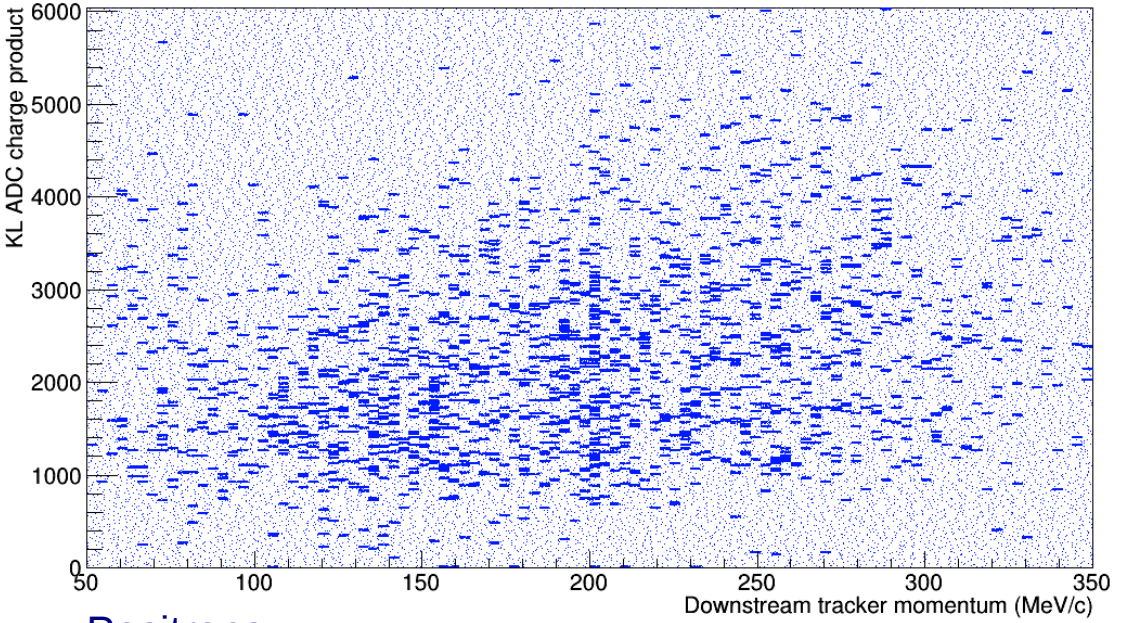
PIDVarC (KL ADC charge product vs Downstream Tracker Momentum)



Muons



Pions



Positrons

Efficiency and Purity

- Work on determining preliminary efficiency and purity for Global PID has begun.
- Currently only considered case for a 200 MeV/c muon beam, with decays off, for PIDVarA and B separately. PIDVarC to follow.
- Next steps will be to consider beams of different momenta, and with a mix of particle species.
- Need global tracking to consider scatters and decays.

Efficiency and Purity – Important definitions

- Undefined track : Value of PID variable has been calculated, however cannot be distinguished between particle hypotheses.

- Unsuitable track : One which does not meet the requirements to calculate the value of a PID variable, e.g. missing required detector information, and so cannot be identified
    - This is a problem with the reconstructed track, not the PID, and so when calculating the efficiency strictly for the PID should not be considered.

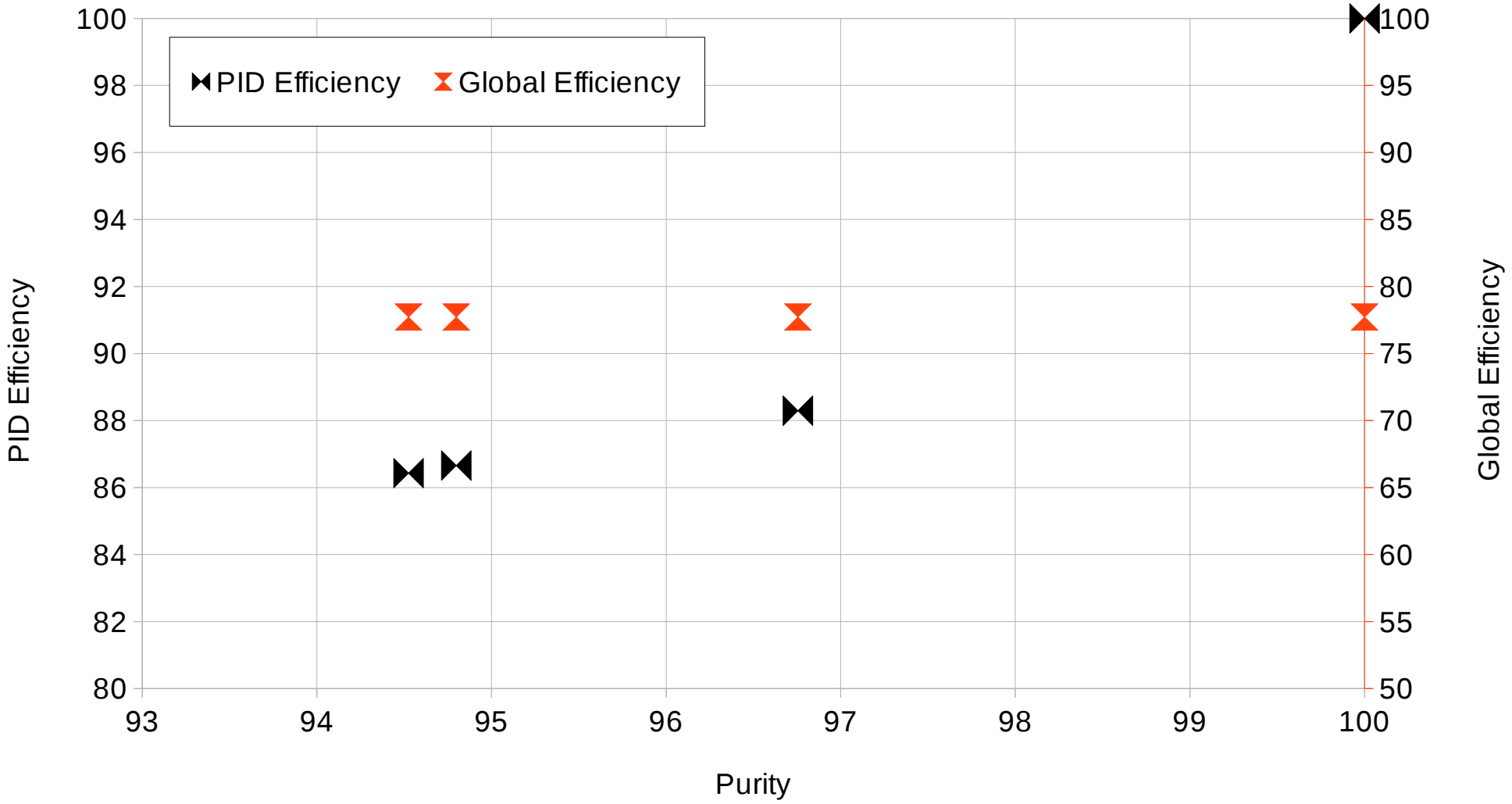
Efficiency and Purity – Important definitions

$$\text{Purity} = \frac{\text{\# of correct PID tracks}}{\text{\# tracks assigned a PID}}$$

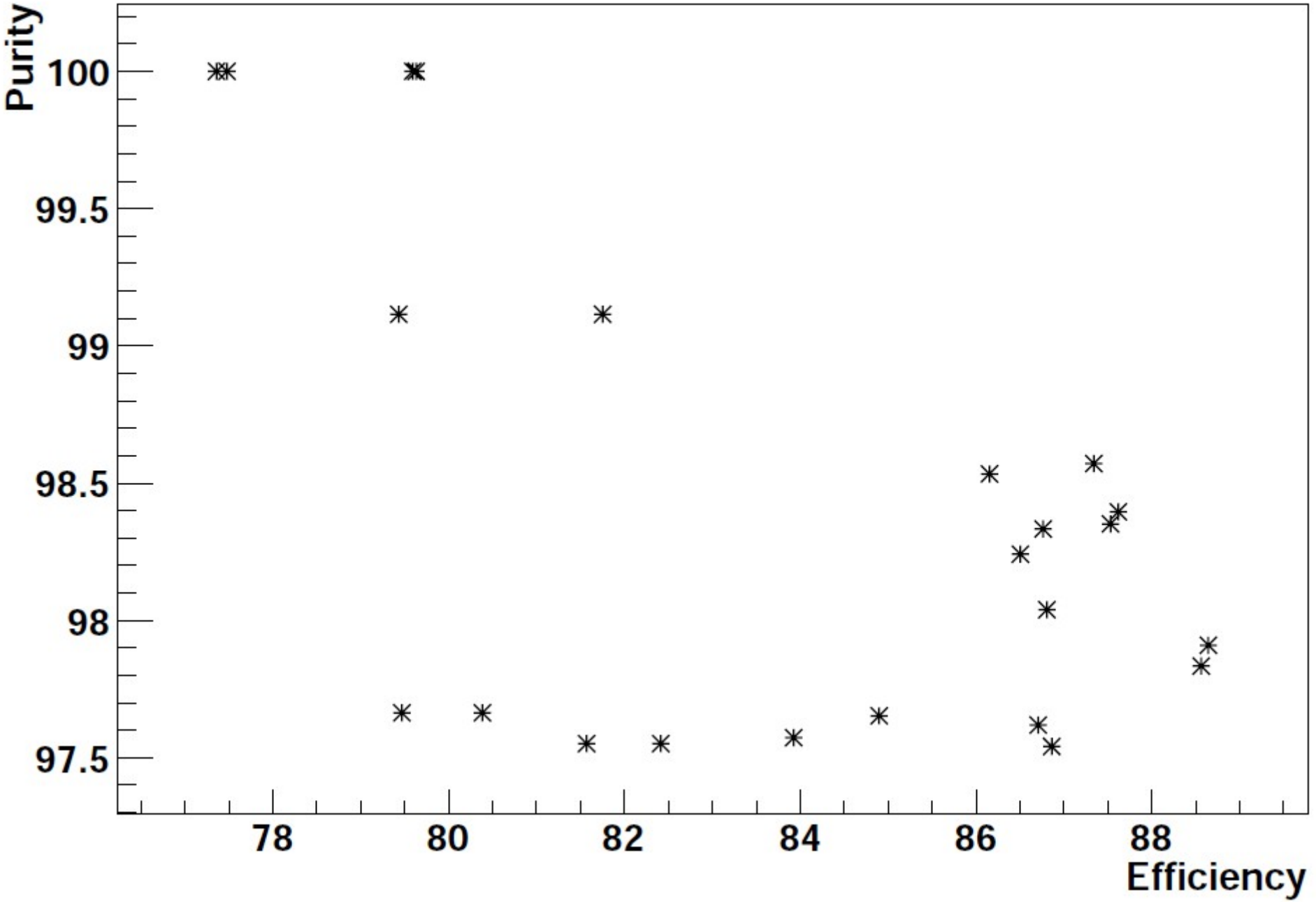
$$\text{PID efficiency} = \frac{\text{\# of correct PID tracks}}{\text{\# MC tracks - \# unsuitable tracks}}$$

$$\text{Global efficiency} = \frac{\text{\# of correct PID tracks}}{\text{\# MC tracks}}$$

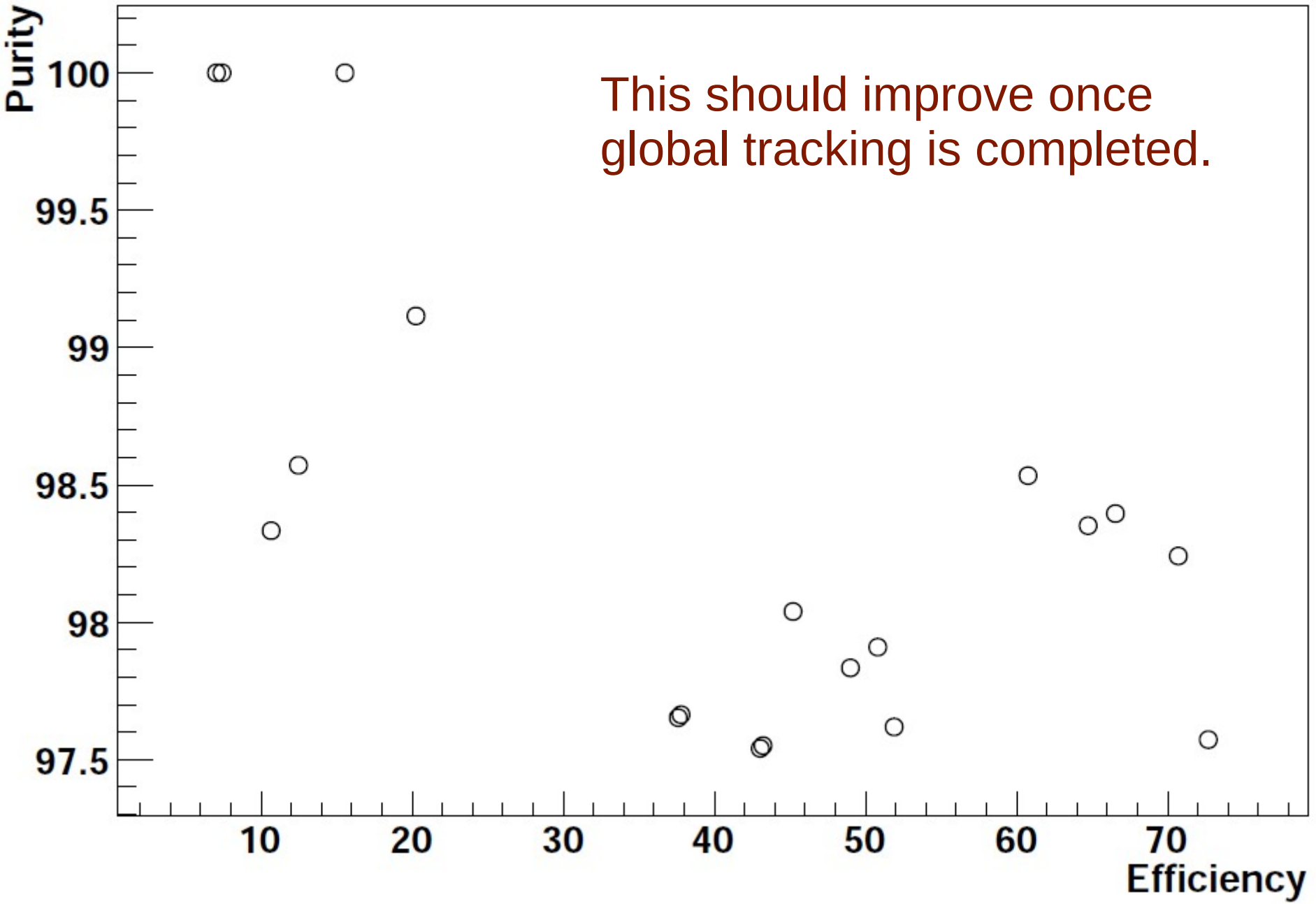
Efficiency and Purity for PIDVarA (TOF1_t - TOF0_t)



PID Efficiency and Purity for PIDVarB (TOF/Tracker)



Global Efficiency and Purity for PIDVarB



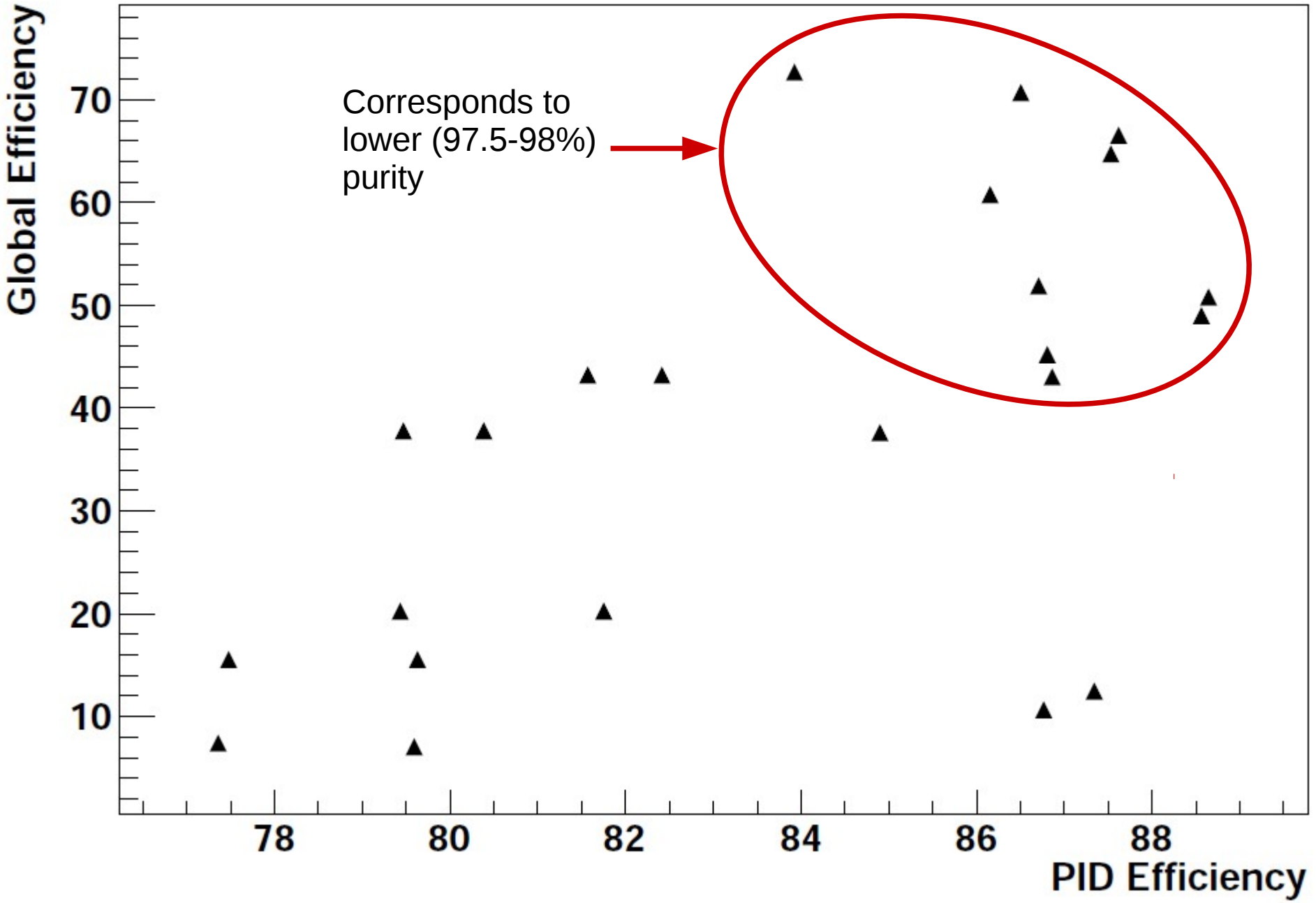
Summary and next steps

- A third PID variable, using the KL and downstream tracker has been developed.
- Work on determining the efficiency and purity of the PID has begun.

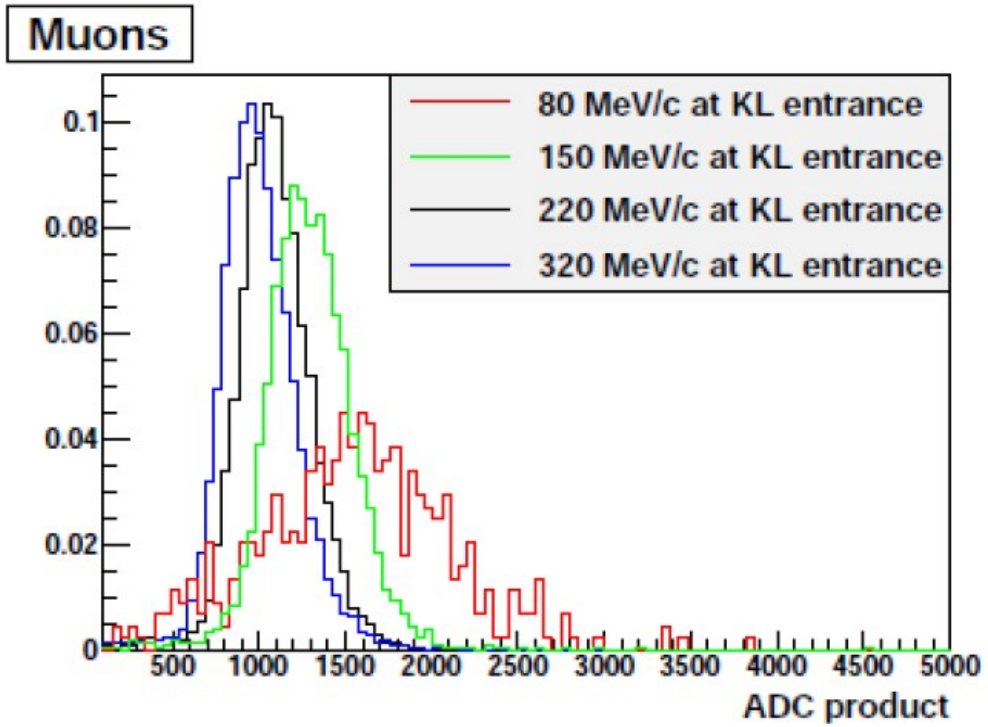
- Tests for PIDVarC currently being written, to then be uploaded to development branch and then added to MAUS.
- Continued work to be done on efficiency and purity.
- Once Ckov and EMR are included in MAUS, more PID variables will follow.

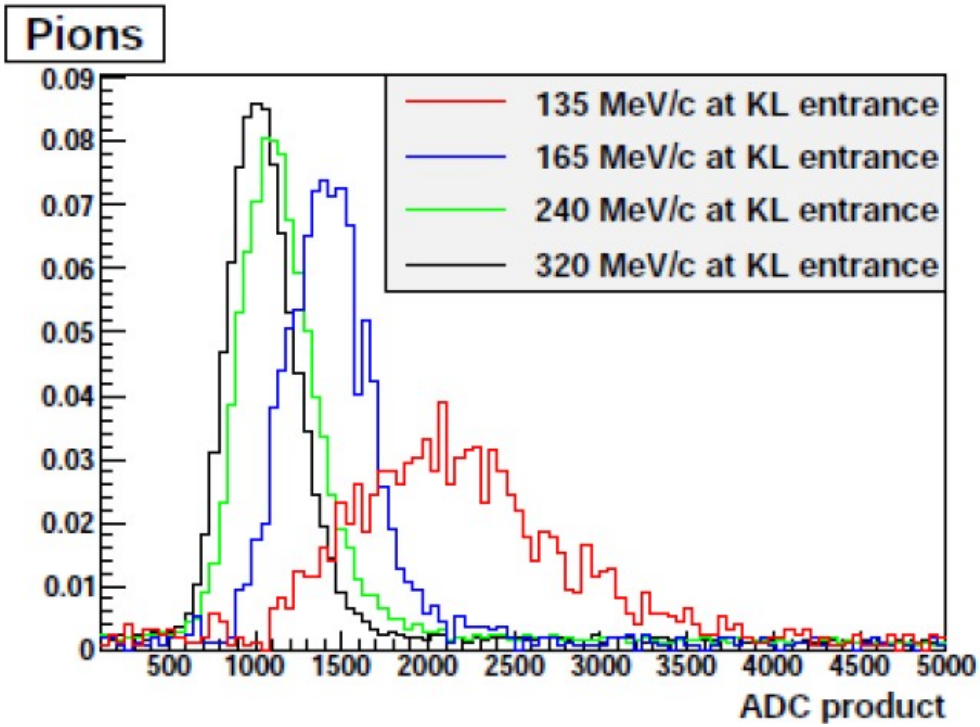
Additional Slides

Global efficiency vs PID efficiency for PIDVarB



KL ADC product momentum dependence





KL response (taken from arXiv:1203.4089v2)