Update on PID studies for ITS upgrade

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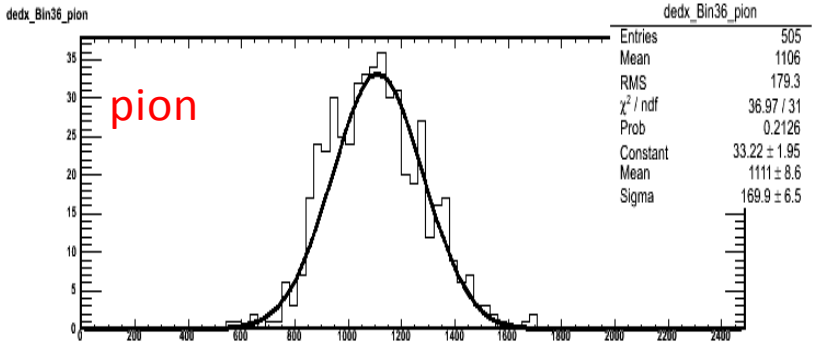
ITS CONFIGURATIONS

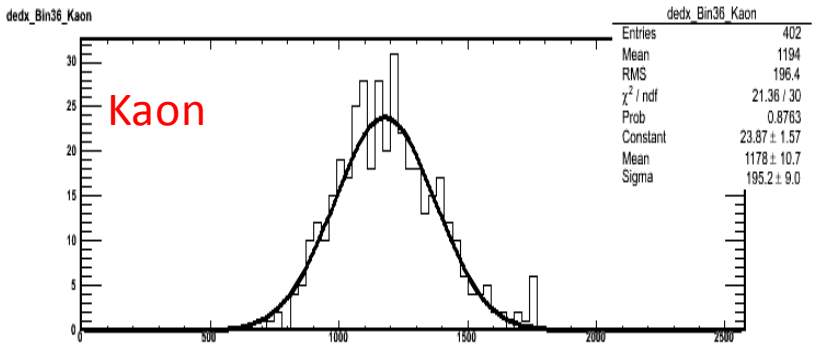
"Fast" tool:

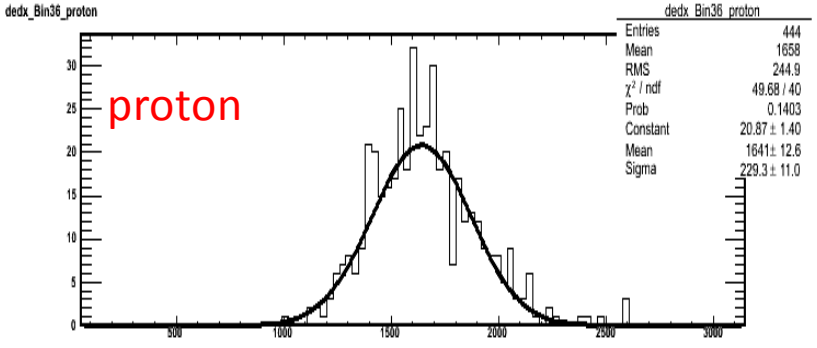
ITS with 7 layers: Generated 100K events: π^+, K^+, p (0.040 GeV/c < mom < 2 GeV/c) with relative abundances equal 1/3 for π^+, K^+, p

- 7 SPD with different thickness: 10 μm, 15 μm and 18 μm
- Study of the particle separation and ITS resolution for each configuration with different number of ADC bit
- Study of efficiency and contamination for 7 silicon layers of 15 μm using an ADC with 10 bit and three value of noise : 10 e^-, 20 e^- and 40 e^-

Reminder on some definitions







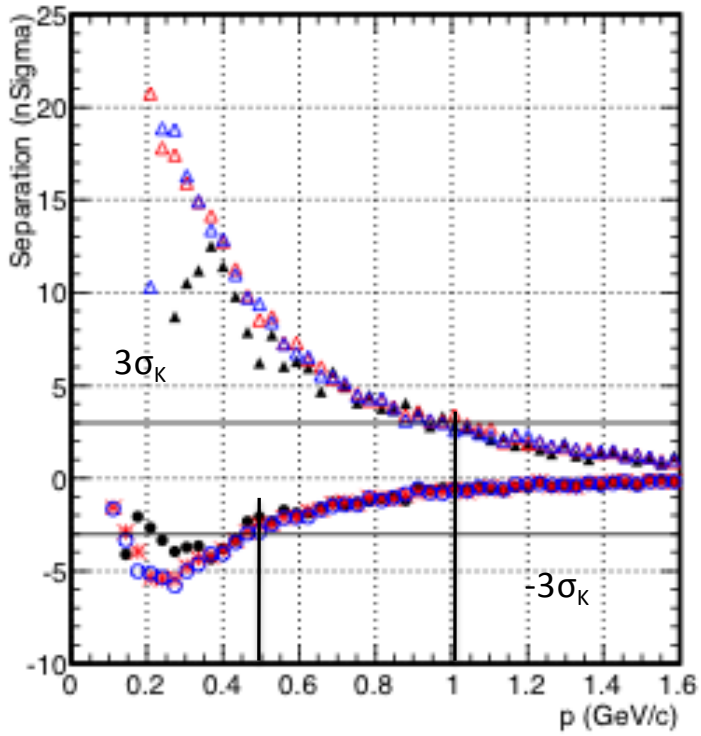
Parametrization for 7 layers

- Fit with a Gaussian function in a momentum bin for each particle type
- 2 x 3 Parameters extracted:
  - Mean value (mv) x π,K,p
  - Gaussian Width (σ) x π,K,p
- Calculation of BetheBloch(βγ) parameters by fit of mv values
- Parameterization of $\sigma_{part}(\beta\gamma)$
- Identity: the lowest $|DE/DX - BetheBloch(\beta\gamma, M_{part})|/\sigma_{part}(\beta\gamma)$

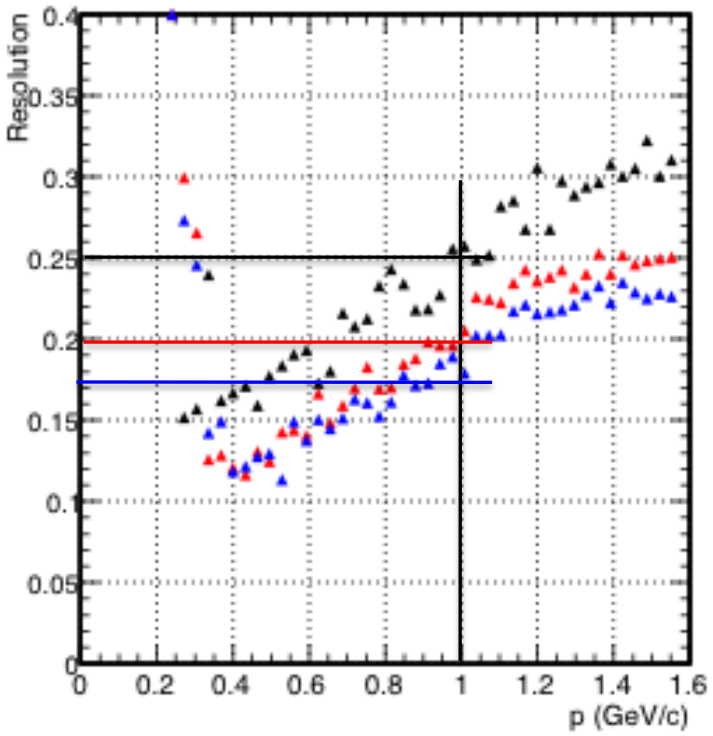
Efficiency = Right MCID/Identity
Contamination =
Wrong MCID/(Right MCID+WrongMCID)

7 layer 20 μm for comparison

p – K separation = $(mv_p - mv_K)/\sigma_K$



Protons



π – K separation = $(mv_\pi - mv_K)/\sigma_K$

Resolution=σ_p/mv_p

Particle mix: abundances equal to 1/3 for π^+, K^+, p

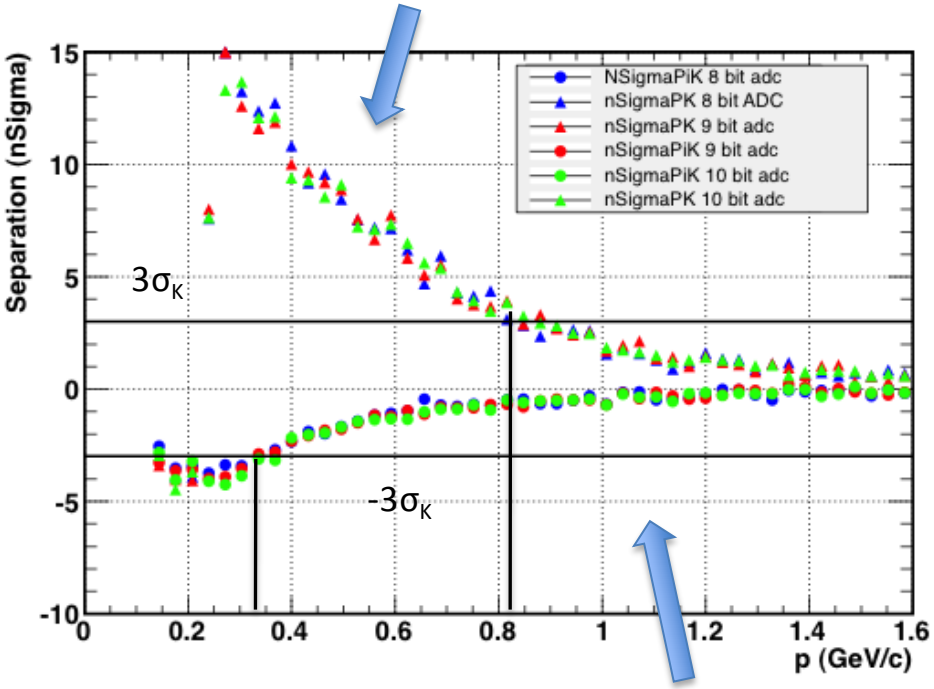
Blu 8 bit ADC

Red 6 bit ADC

Black 4 bit ADC

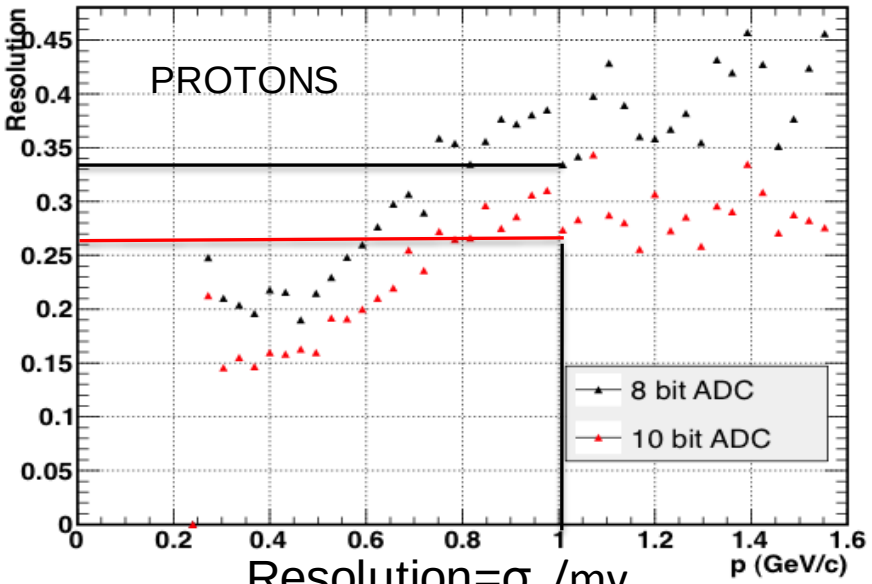
nSigma separation and resolution for 7 layers of 10 μm

p – K separation = $(mv_p - mv_K)/\sigma_K$

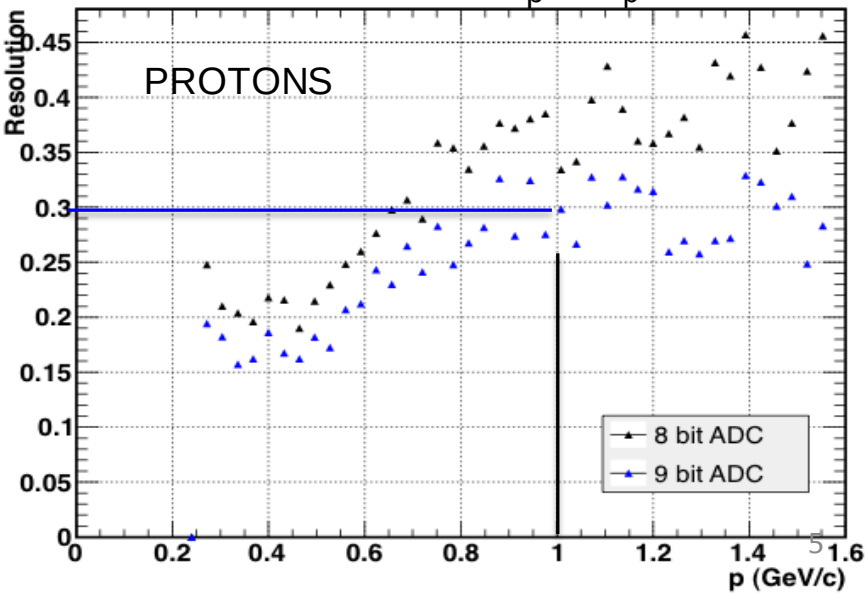


π – K separation = $(mv_\pi - mv_K)/\sigma_K$

Particle mix:
Abundances equal to 1/3 for π^+, K^+, p
Noise gaussian distributed of 20 e^-

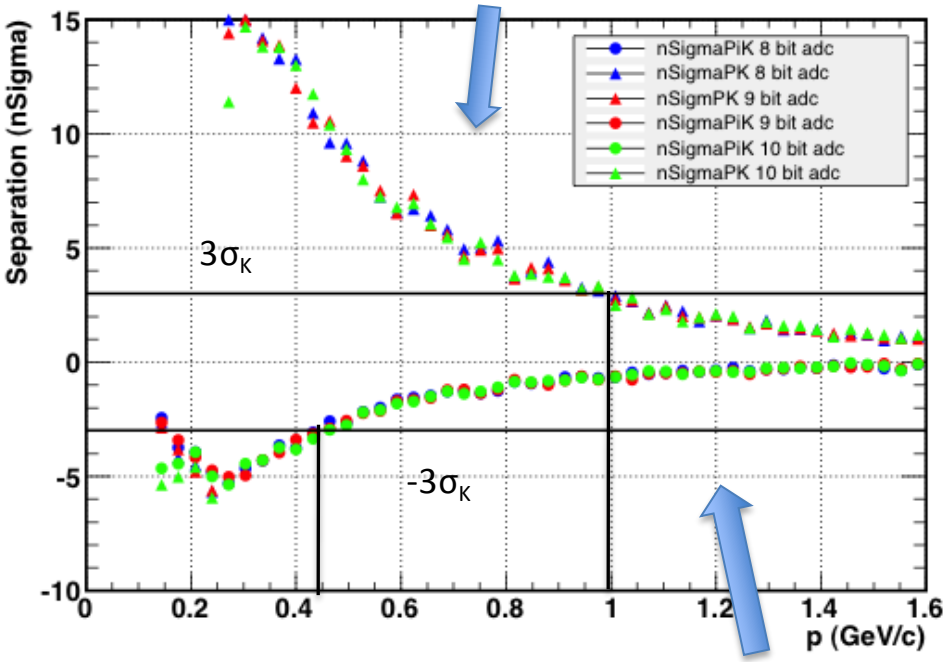


Resolution=σ_p/mv_p



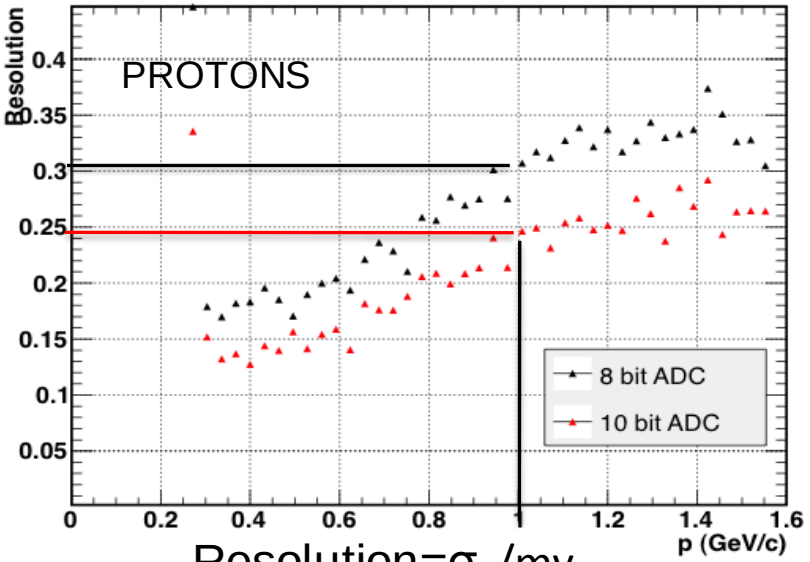
nSigma separation and resolution for 7 layers of 15 μm

p – K separation = $(mv_p - mv_K)/\sigma_K$

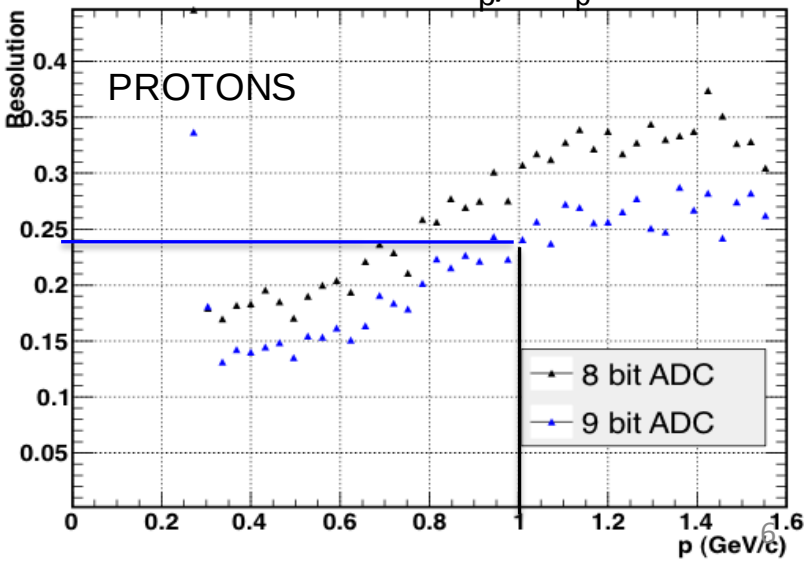


π – K separation = $(mv_\pi - mv_K)/\sigma_K$

Particle mix:
Abundances equal to 1/3 for π^+, K^+, p
Noise gaussian distributed of 20 e^-

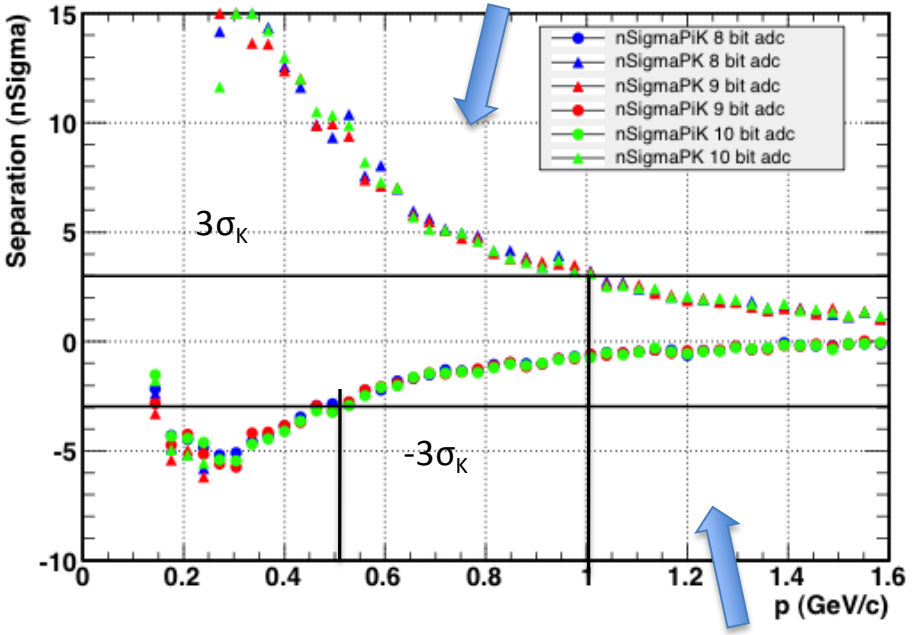


Resolution=σ_p/mv_p



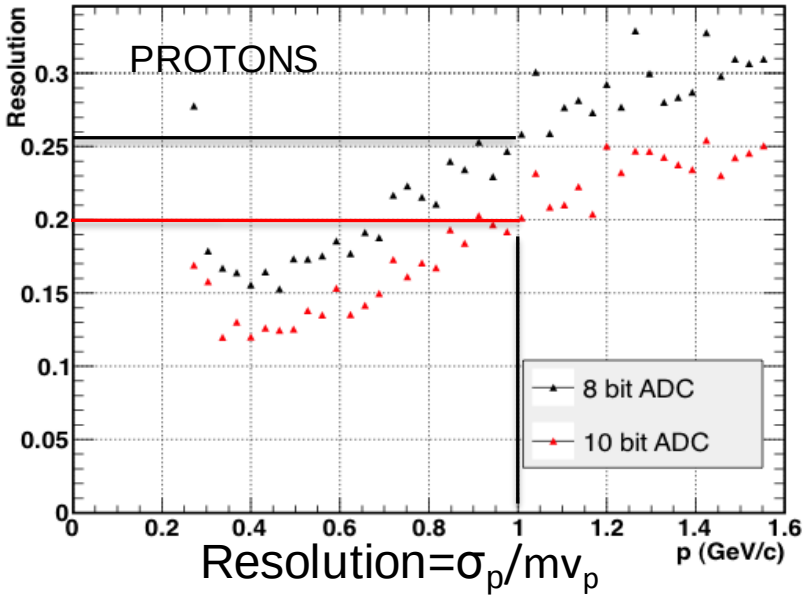
nSigma separation and resolution for 7 layers of 18 μm

p – K separation = $(mv_p - mv_K)/\sigma_K$

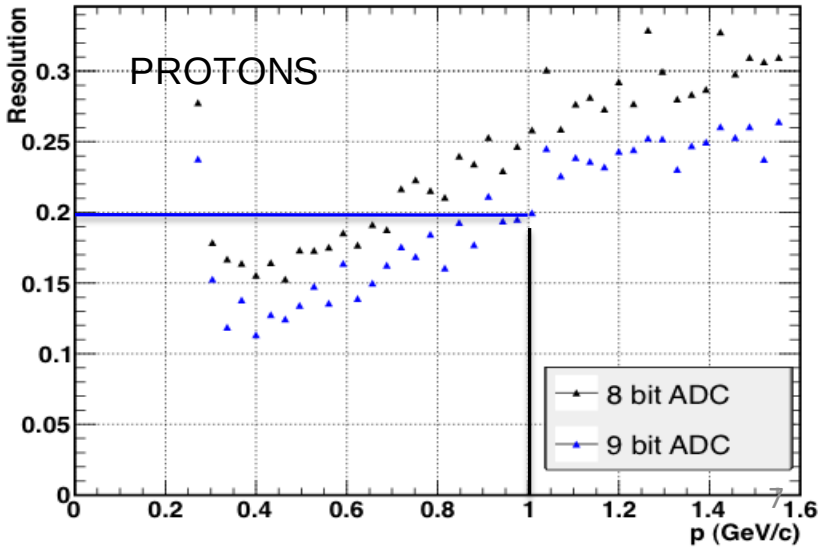


π – K separation = $(mv_\pi - mv_K)/\sigma_K$

Particle mix:
Abundances equal to 1/3 for π^+, K^+, p
Noise gaussian distributed of 20 e^-



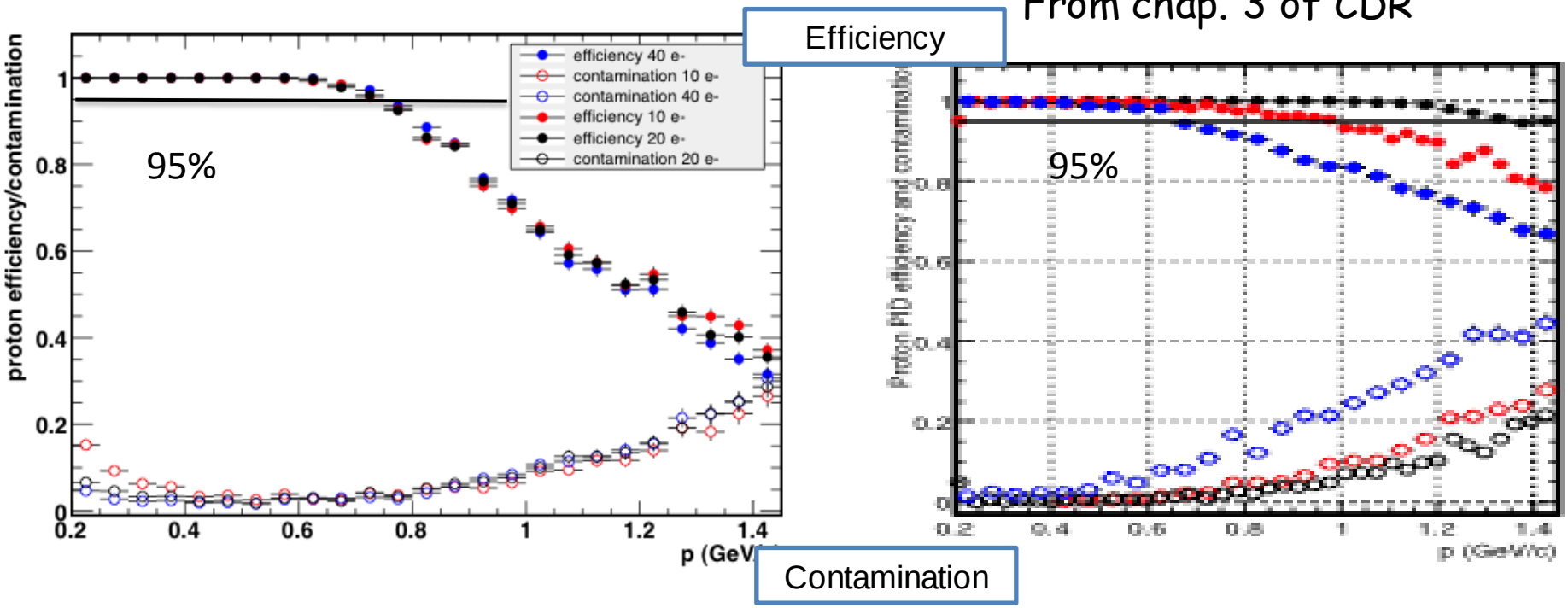
Resolution=σ_p/mv_p



Efficiency and Contamination [15 μm, 10 bit ADC]

PROTON

From chap. 3 of CDR



15 μm, 10 bit ADC
Relative abundances=1/3
for π^+, K^+, p

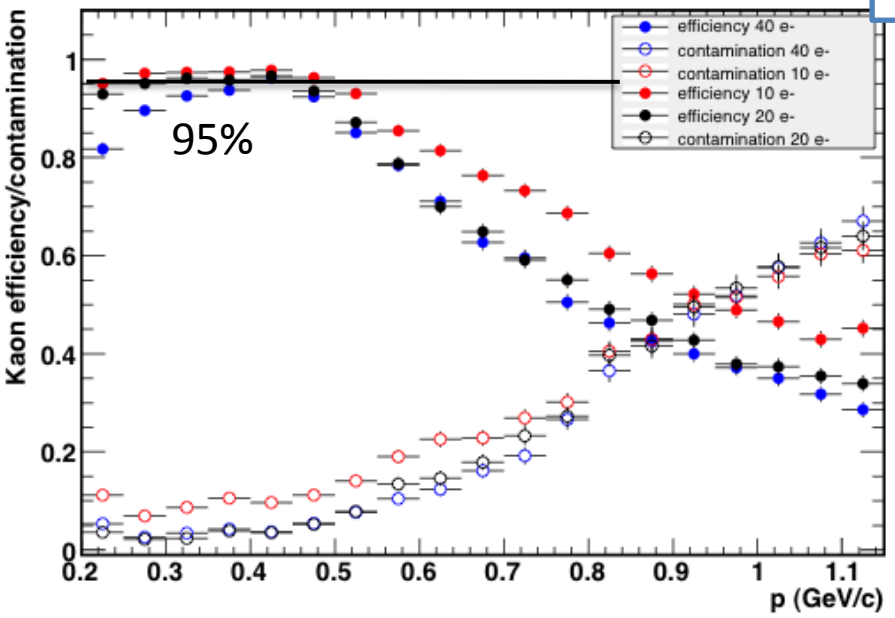
Blue symbols: 7 x 20 μm thick layers with 8 bit ADC

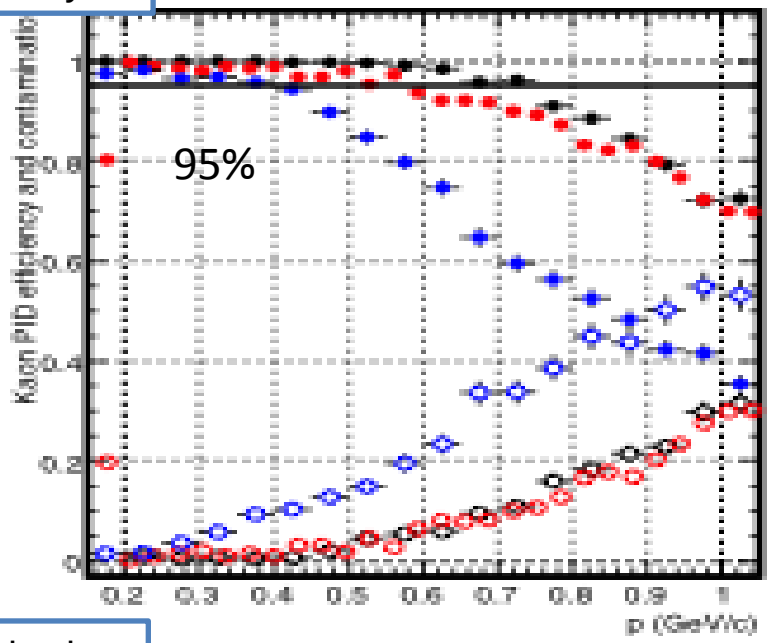
Efficiency and Contamination [15 μm, 10 bit ADC]

KAON

From chap. 3 of CDR

Efficiency





Contamination

15 μm, 10 bit ADC
Relative abundances=1/3
for π^+, K^+, p

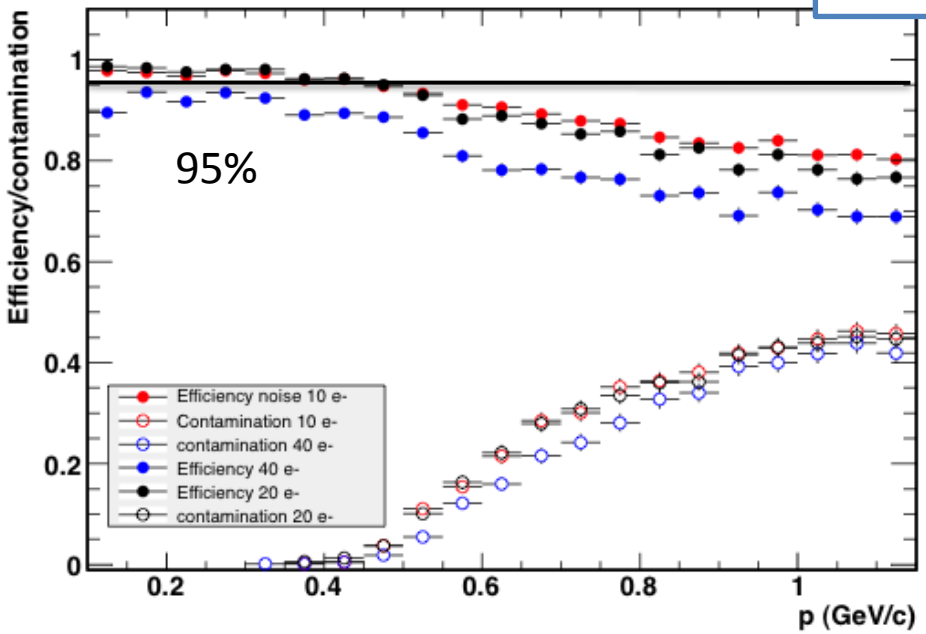
Blue symbols: 7 x 20 μm thick layers with 8 bit ADC

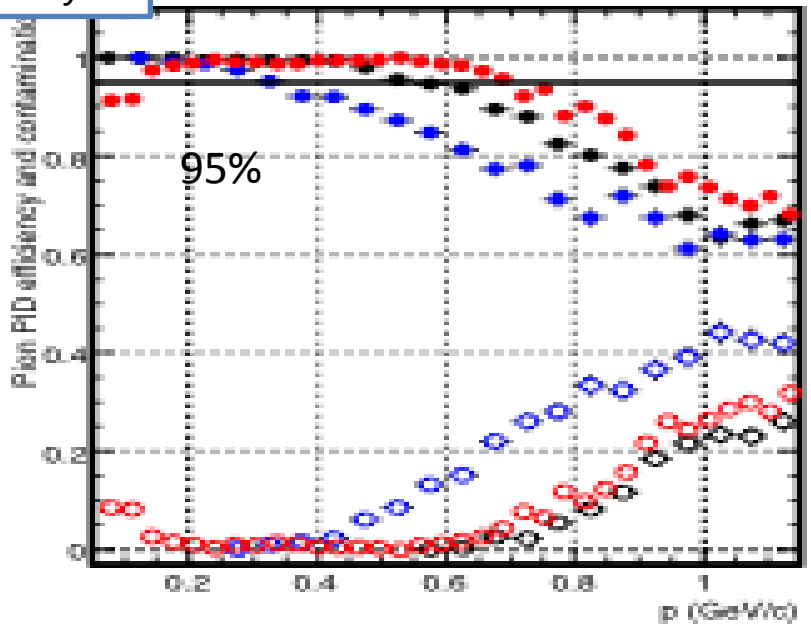
Efficiency and Contamination [15 μm, 10 bit ADC]

PION

From chap. 3 of CDR

Efficiency





Contamination

15 μm, 10 bit ADC
Relative abundances=1/3
for π^+, K^+, p

Blue symbols: 7 x 20 μm thick layers with 8 bit ADC

…to do

- Study of contamination and efficiency for the ITS configurations with 7 layers of 10 μm and 18 μm

- Generetion with particle mixes taken from pp data @ 900 GeV and PbPb data @ 2.76 TeV