

# Momentum estimation from dEdx method in SVD

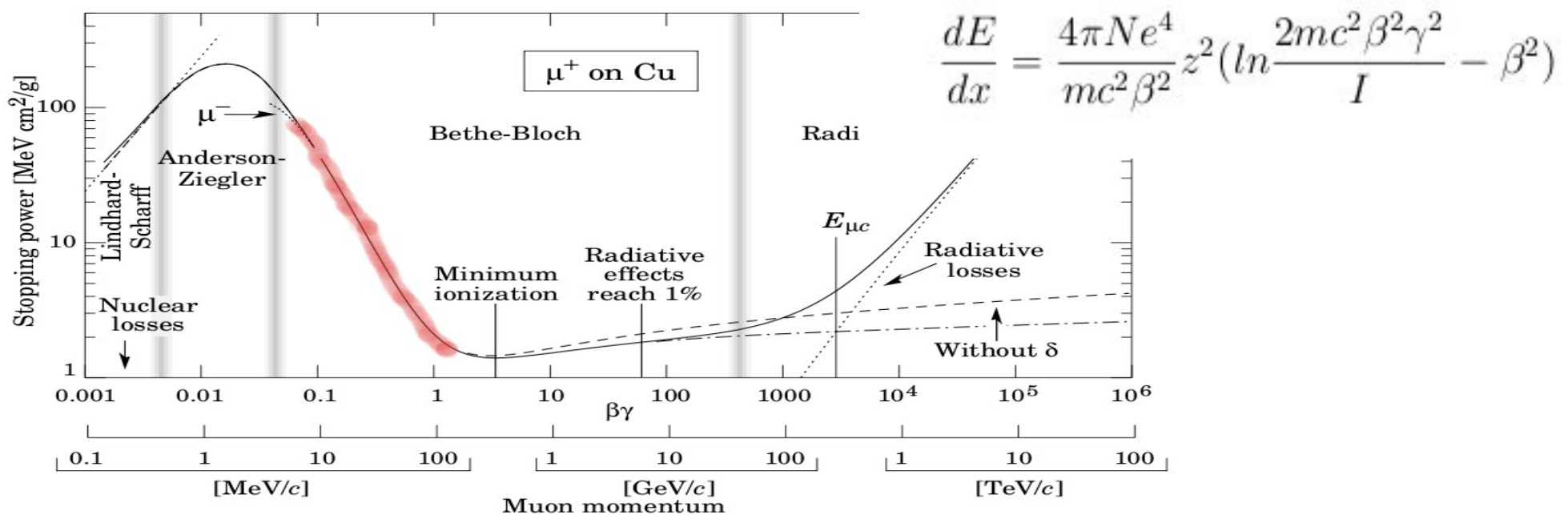
Karol Adamczyk  
(INP PAS Kraków)

**PLAN:**

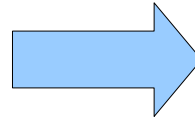
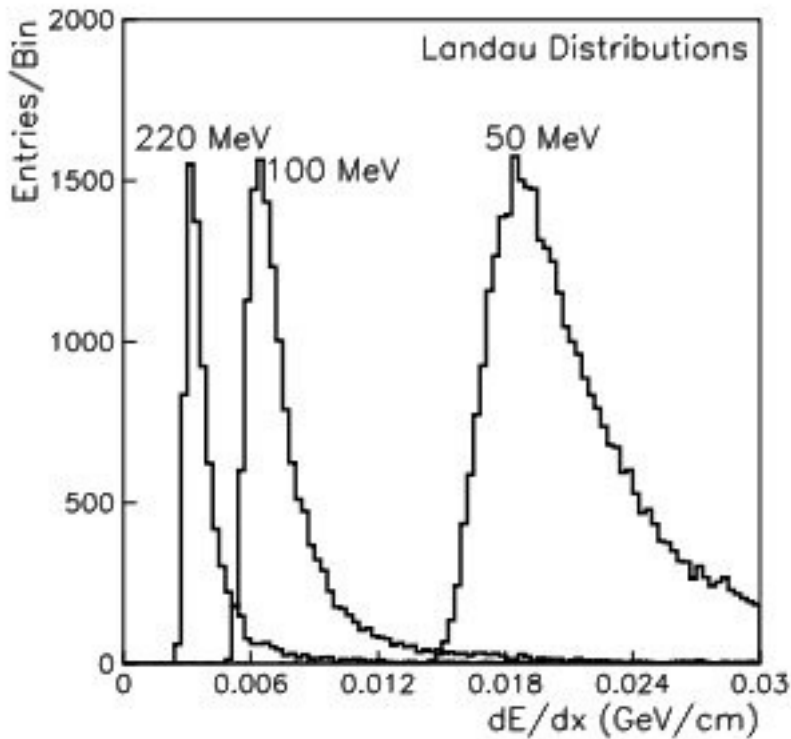
- 1.Method description**
- 2.Simulation details**
- 3.Results of simulation**
- 4.Plans (to do list)**

# Method description

- **Motivation:** study the feasibility of improving the momentum resolution for low momentum charged particle
- **Method:** particle momenta determined from the measured Landau  $dEdx$  distribution using **Bethe-Bloch formula:**

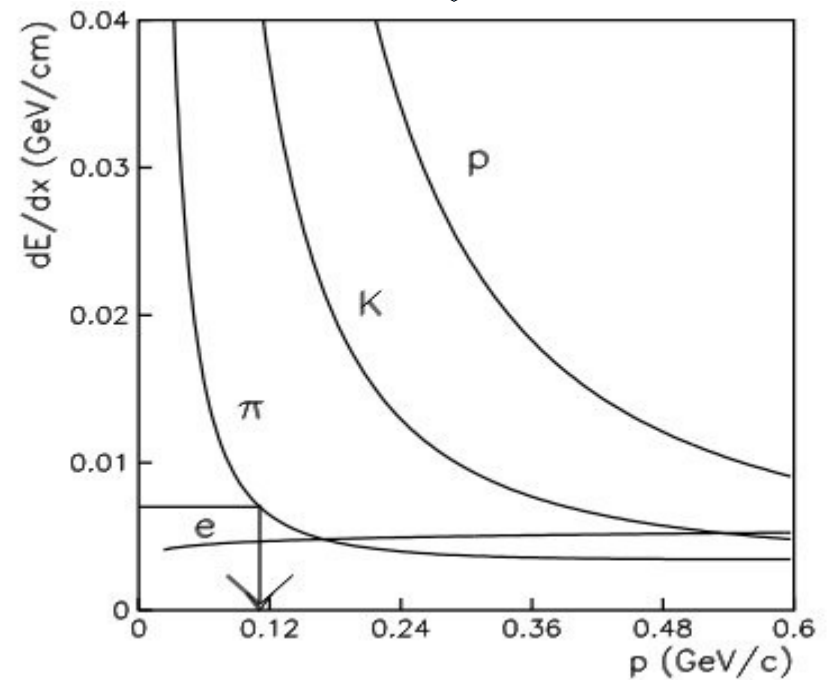
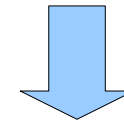


# Method description



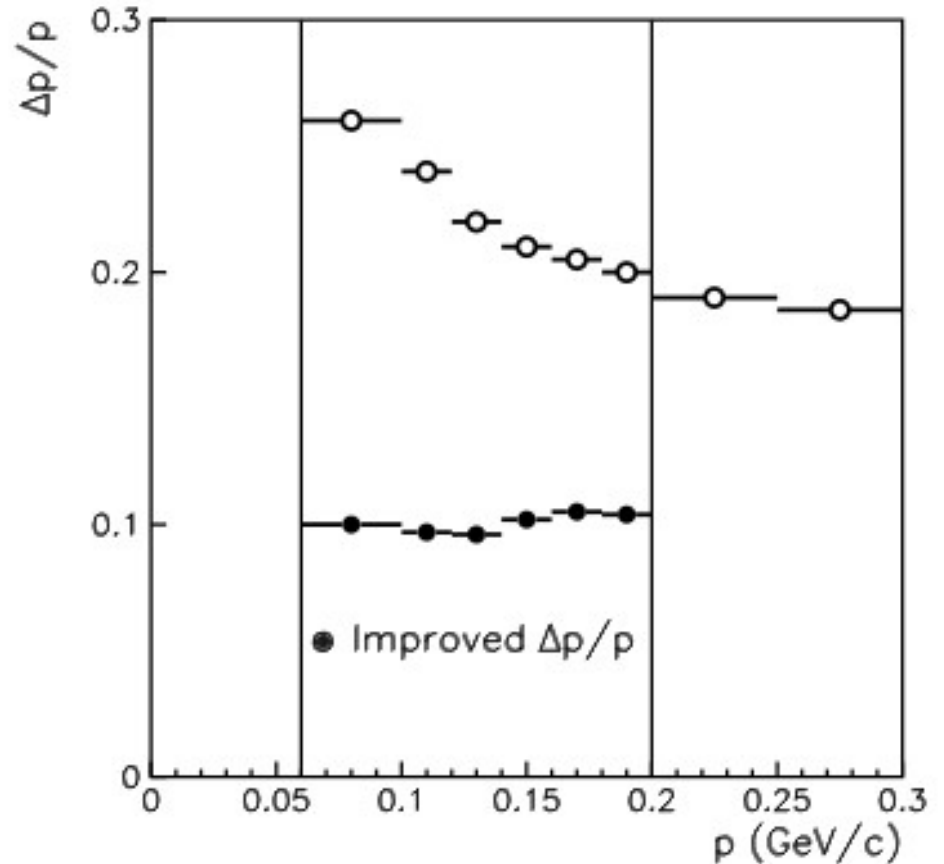
$$\frac{dE}{dx} = \frac{4\pi N e^4}{m c^2 \beta^2} z^2 \left( \ln \frac{2 m c^2 \beta^2 \gamma^2}{I} - \beta^2 \right)$$

$$\beta \gamma = p / M c$$



# Method in practice

- for very low momentum tracks the  $dE/dx$  in silicon is very depend on the momentum.  
(arXiv:hepex/0104006v1)
- open circle - resolution obtained by a helix fit  
( $dp/p \sim 25\%$ , due to multiple Coulomb scattering)
- filled circle - resolution when the momentum is extracted from  $dE/dx$  information ( $dp/p \sim 10\%$  in  $1/\text{Beta}^2$  region)



# Simulation details

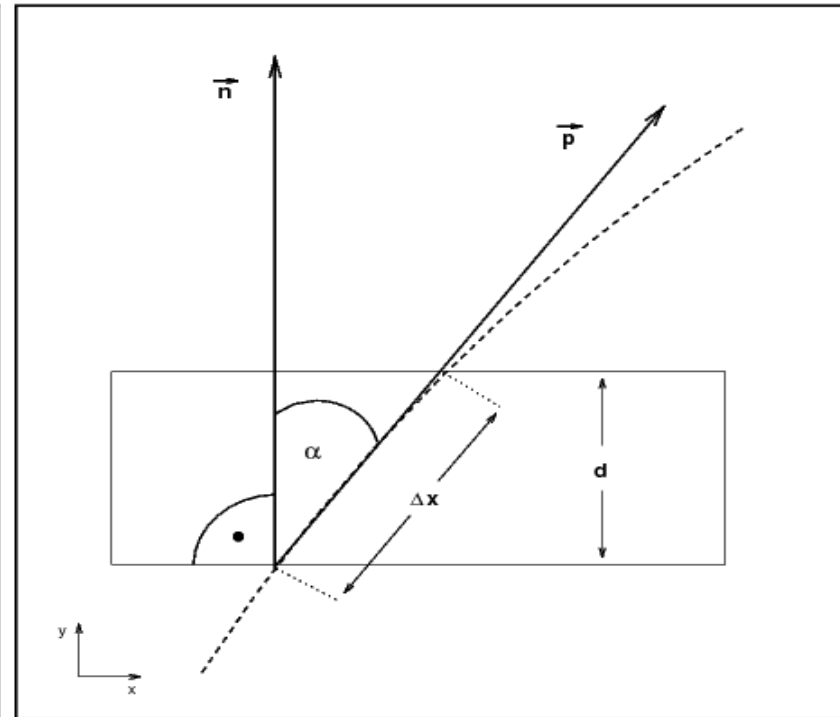
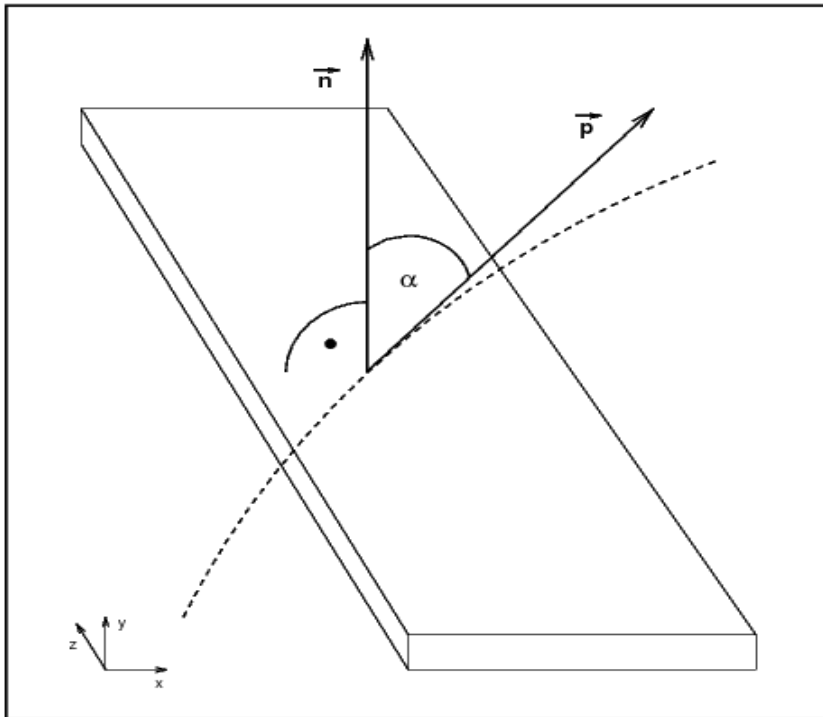
- Geometry Model: **VTXBelleII\_PXD075um1600\_Model\_NB**
- generation of 1024 events (**definite momentum**) using particle gun (geant4) (direction:(0,1,0); smearing: phi=0-180, theta=0-20)
- reconstruction of tracks (Marlin processors)

```
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<processor name="MySiStripClus"/>  
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<processor name="MydEdxVTXProcessor"/>  
<processor name="MyLCIOOutputProcessor"/>
```

- getting **E value** from hits in tracks : **Landau distribution**
- **path length** (dx) estimated using **geometrical method** (next slide)
- calculation **truncated <dEdx>**: hit with the highest E is removed

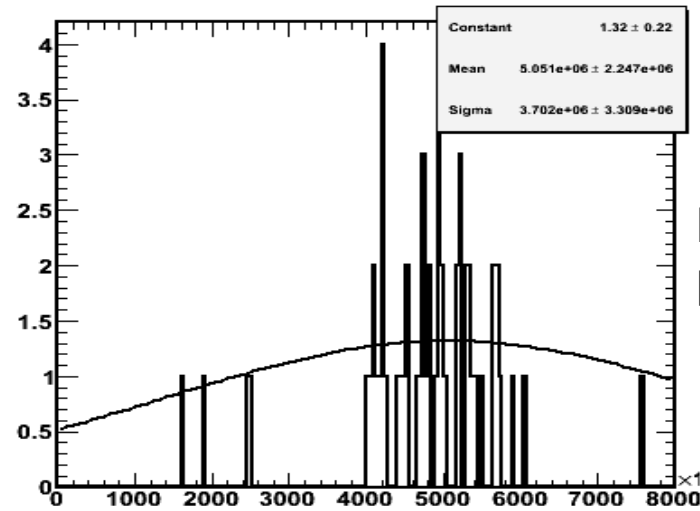
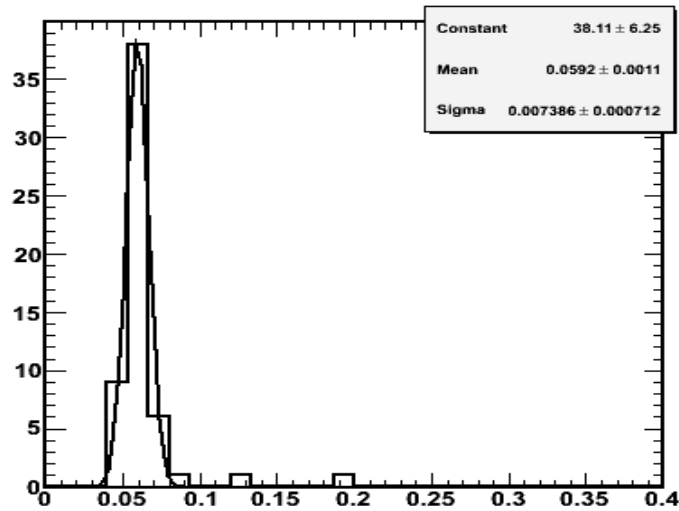
# Simulation details

- LayerID, LadderID, SensorID for hit taken by using SiStripGeom, SiPxlGeom (part of digitizers)
- **pathLength =  $d/\cos(\text{Alpha})$**  ( $d = 300 \text{ um}$  for SVD)

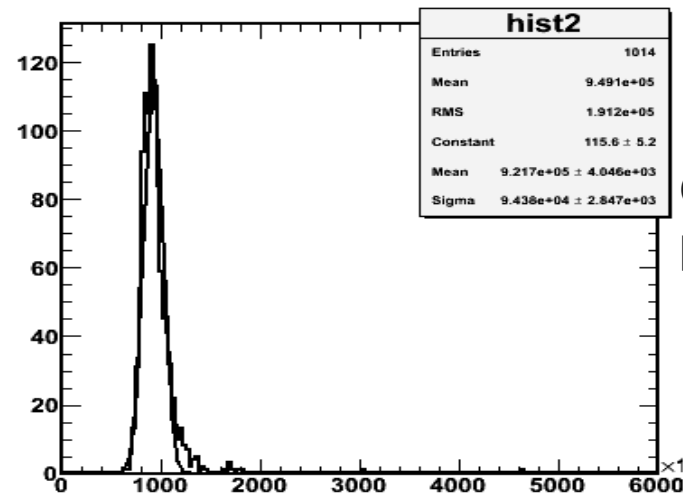
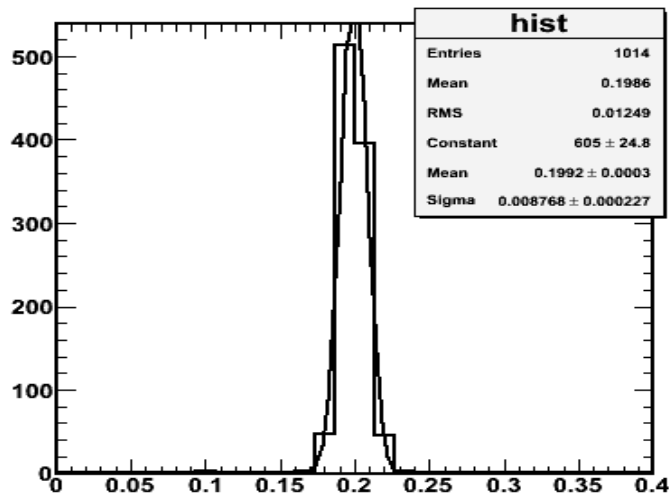


# Results of simulation

PION



**BAD EVENT**  
p=60MeV

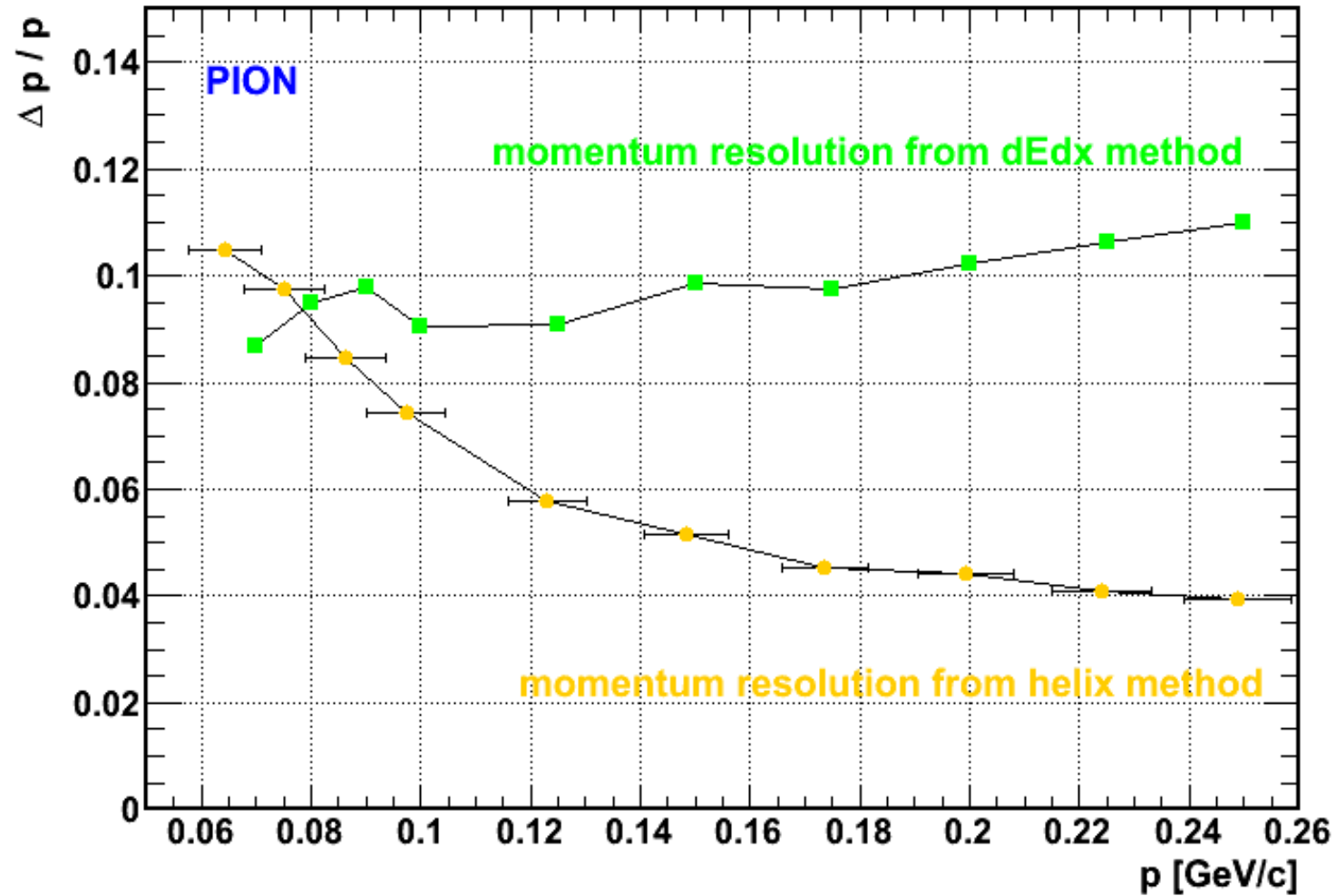


**GOOD EVENT**  
p=200MeV

momentum distribution

dedx distribution

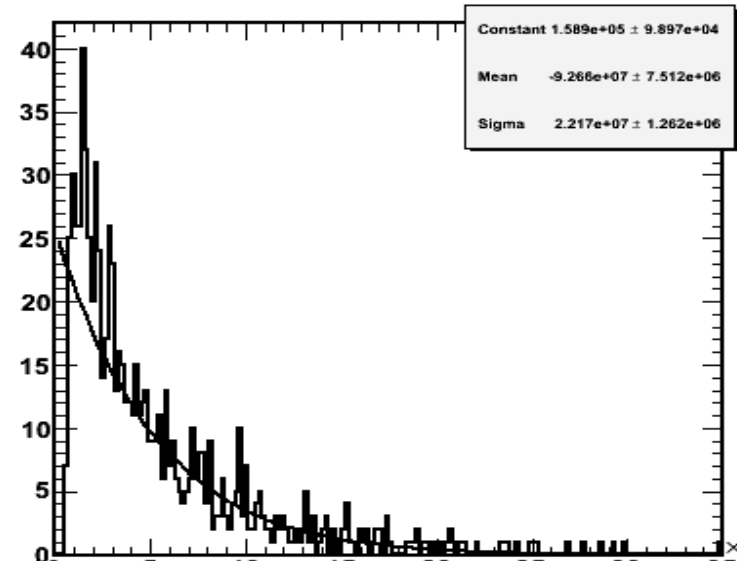
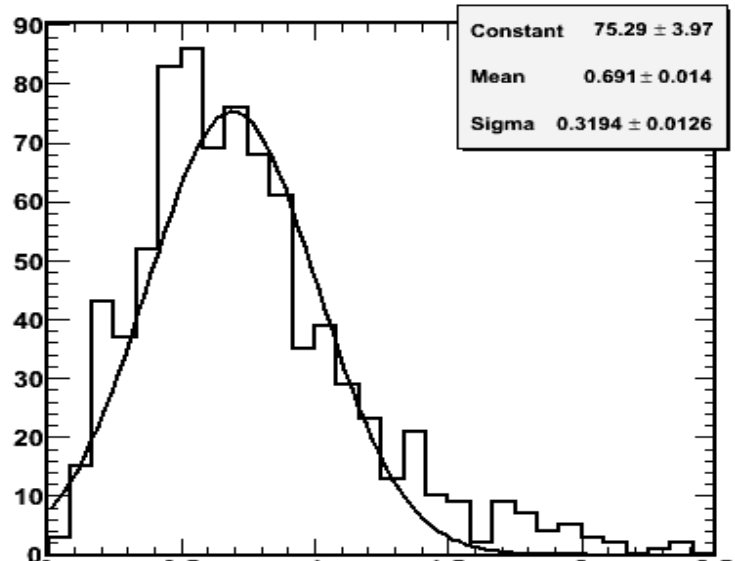
# Results of simulation



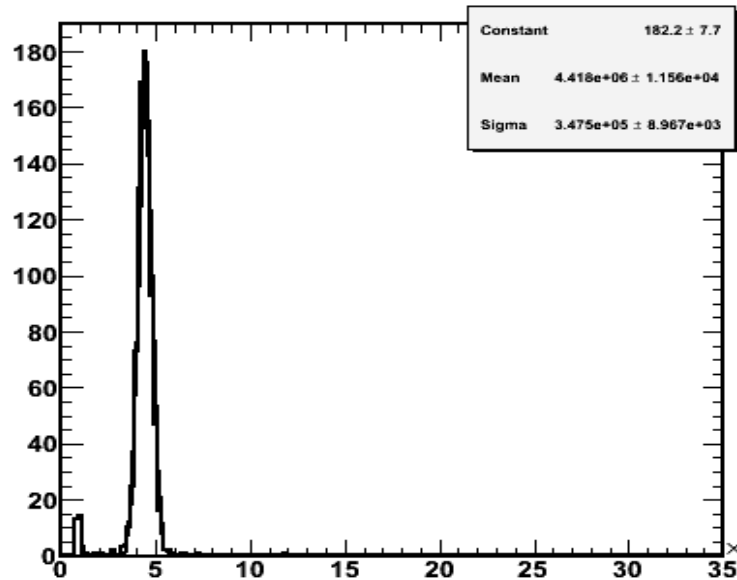
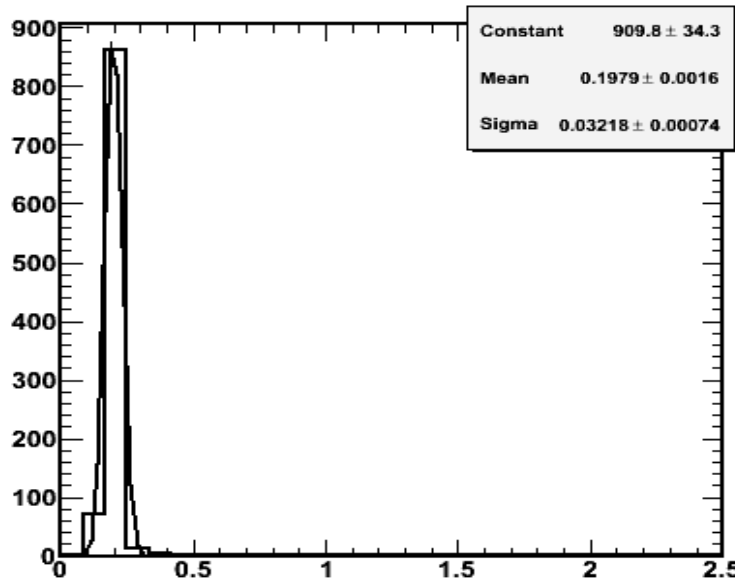


# Results of simulation

KAON

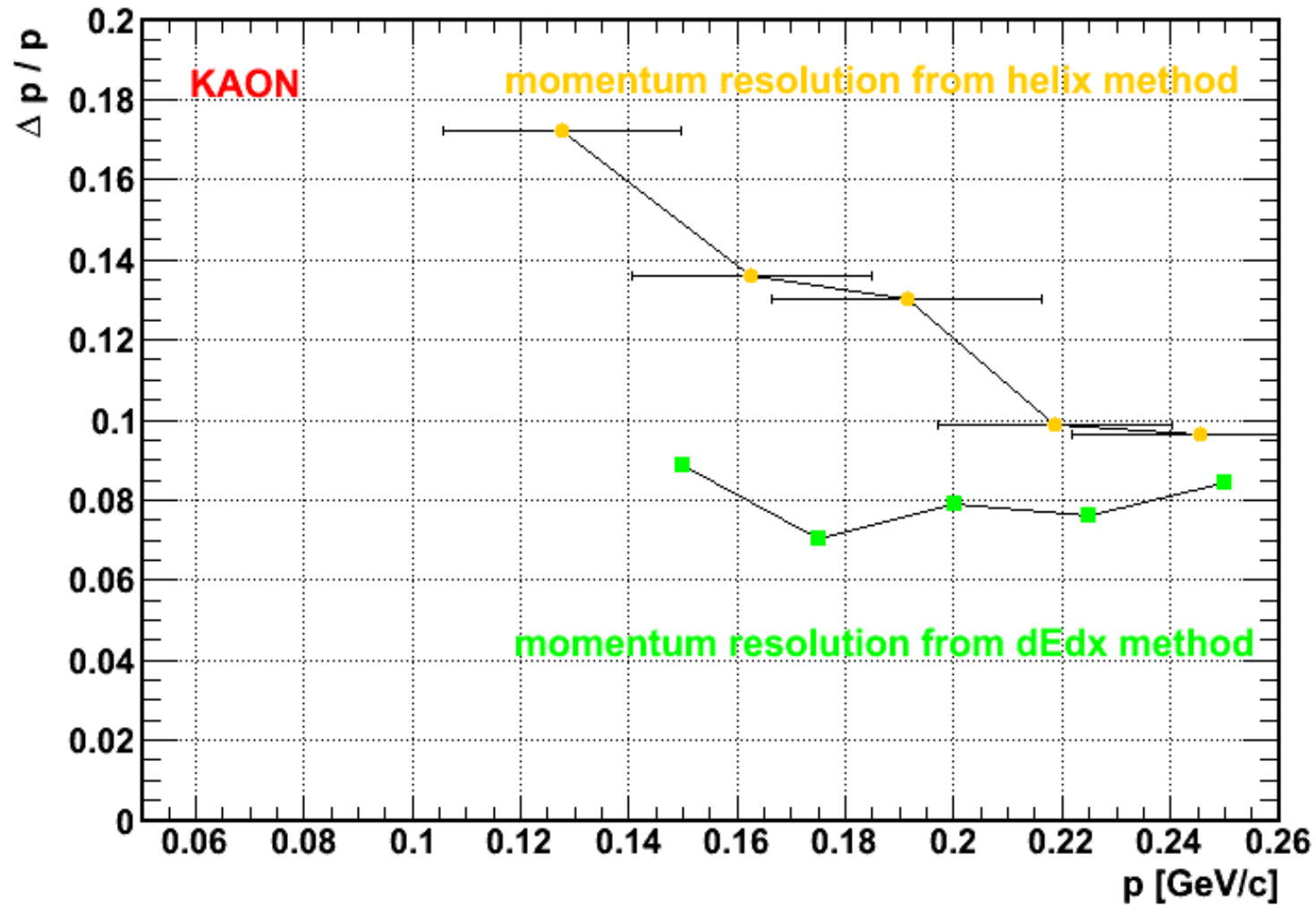


**BAD EVENT**  
**p=70MeV**

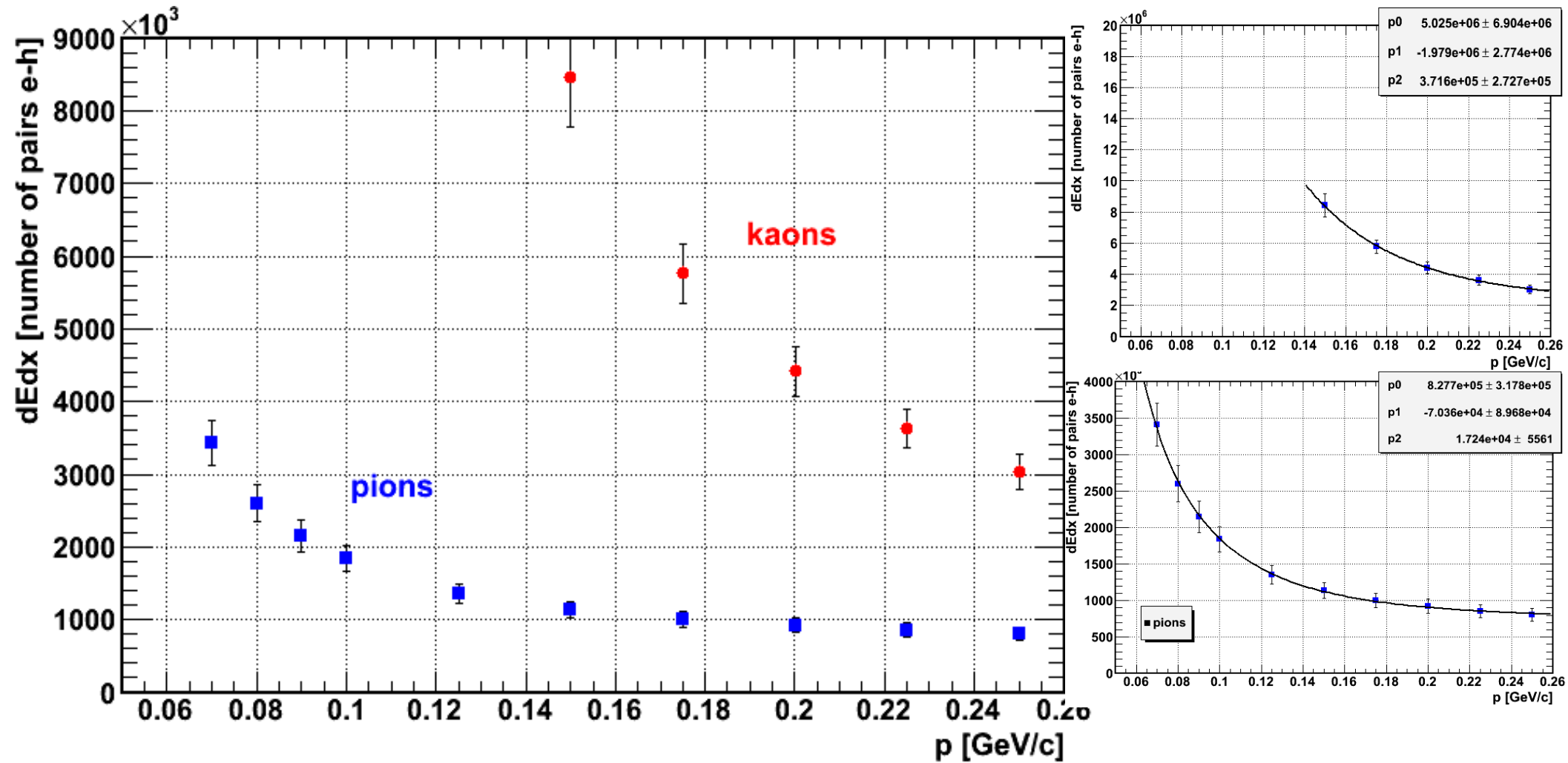


**GOOD EVENT**  
**p=200MeV**

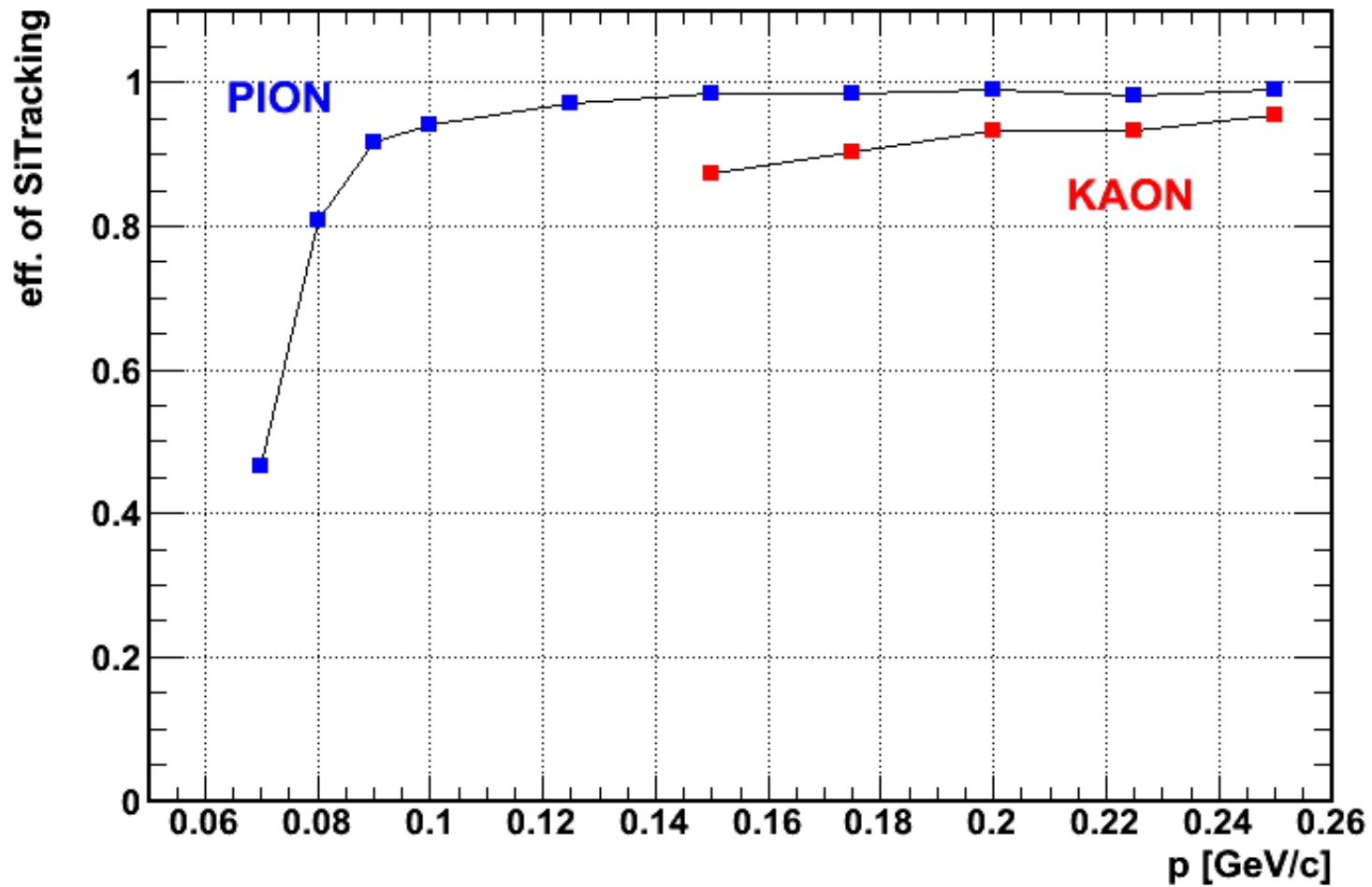
# Results of simulation



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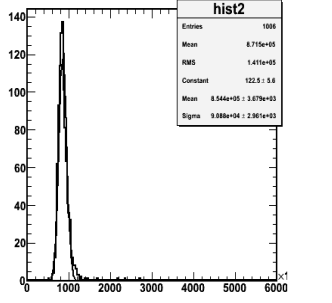
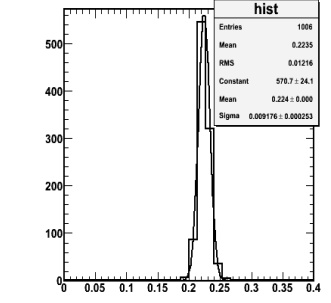
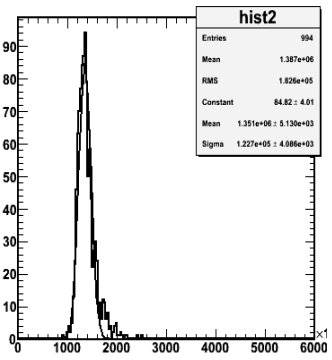
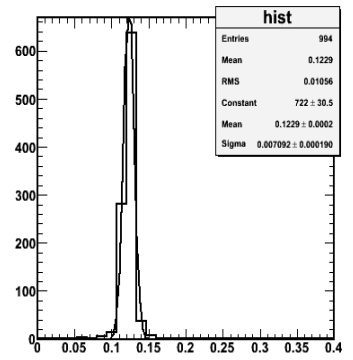
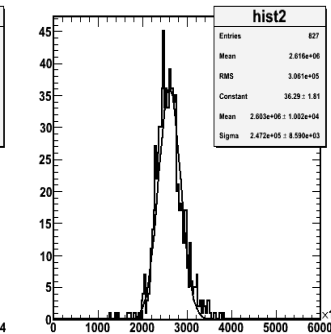
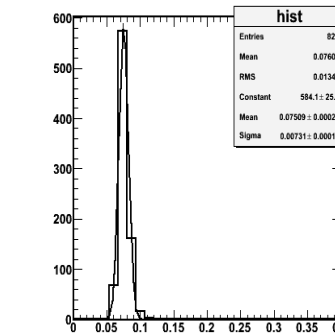
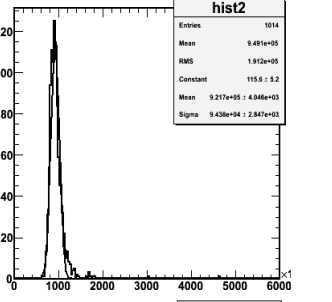
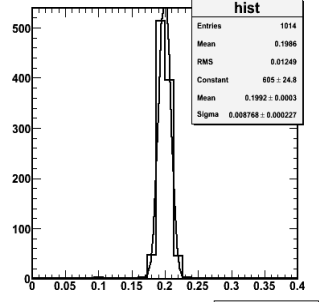
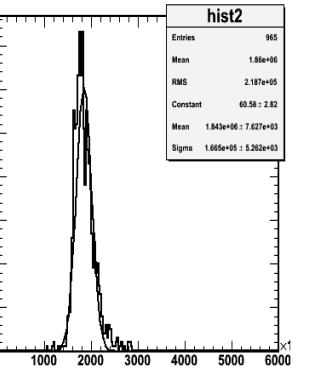
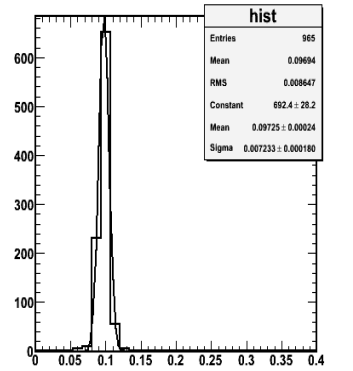
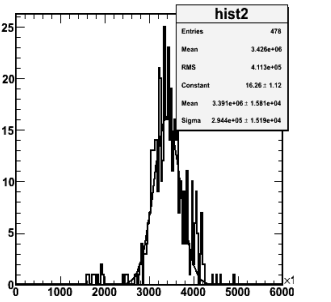
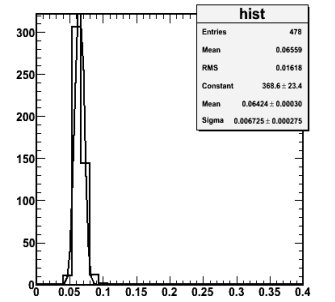
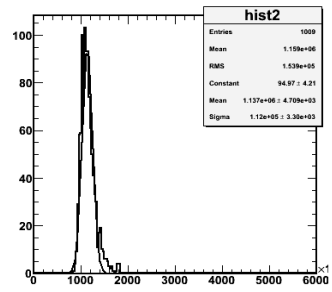
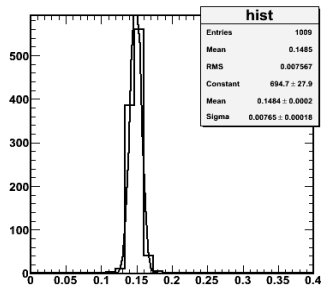
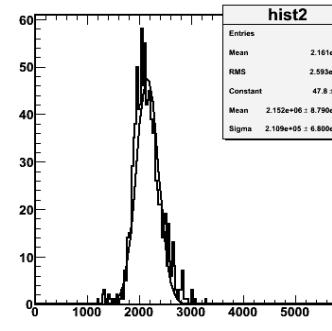
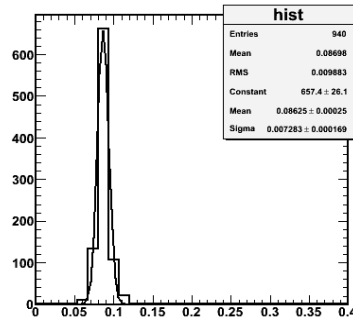
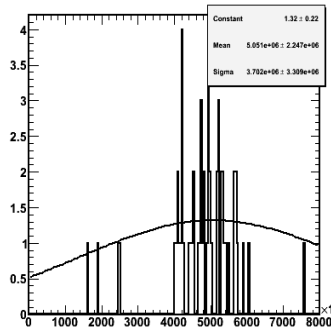
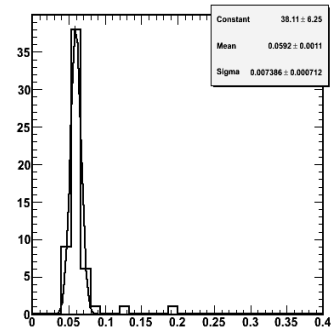
# Results of simulation



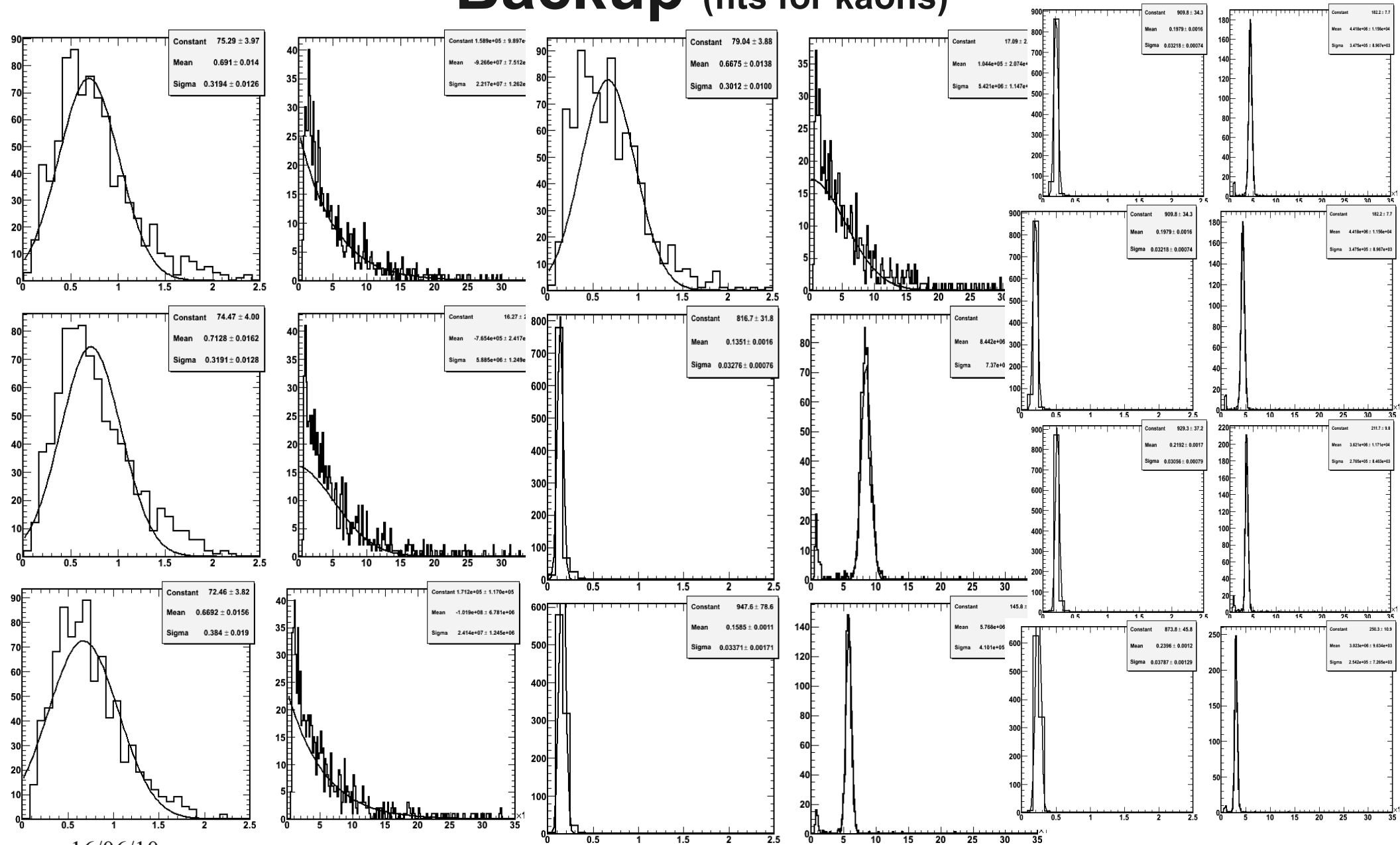
# Plans (to do list)

- using new SiStripDigi Processor (I used old one; ver 1.0)
- **FullTracking**: helix from CDC hits merged with helix from SVD (SiTracking) and then extrapolate to PXD hits (high background)
- **truncated  $\langle dE_{dx} \rangle$**  replace different method. e.g. fitting every track using Landau pdf.

# Backup (fits for pions)



# Backup (fits for kaons)



16/06/10

16/06/10