

Acceptance and Resolution Studies for Forward Tracking Stations

11th March 2014

Elisa Fioravanti

Aim:

Study the x-y intensity distribution for pions at the z-position of tracking stations.

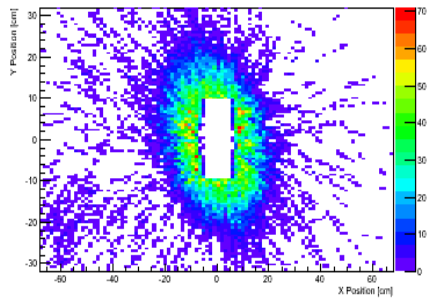
Strategy:

- BoxGenerator is used for the simulation
- **10.000 Pions** simulated with different momentum:
200 MeV, 500 MeV, 1 GeV, 2 GeV, 3 GeV, 4 GeV, 5 GeV
- Uniformly in phi: [0,360°]
- **Uniformly in theta: [0,10°]**
- **Uniformly in cos(theta)**
- Detectors included: MDV+GEM+FTS
- Beam Momentum = 15 GeV/c
- **Only primary tracks selected**
- Pandaroot version 23607

Pion momentum: 200 MeV

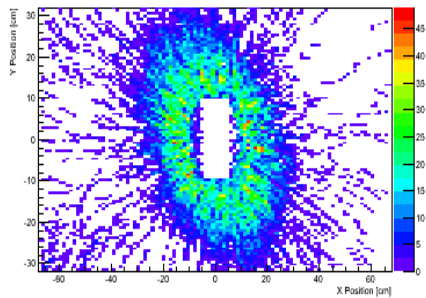
FTS 1

Y vs X (FTS1)



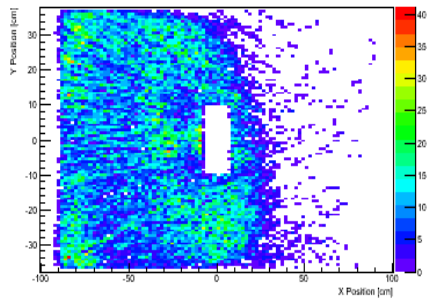
FTS 2

Y vs X (FTS2)



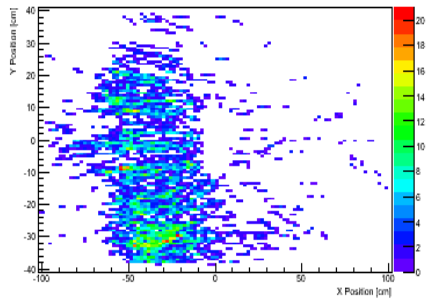
FTS 3

Y vs X (FTS3)



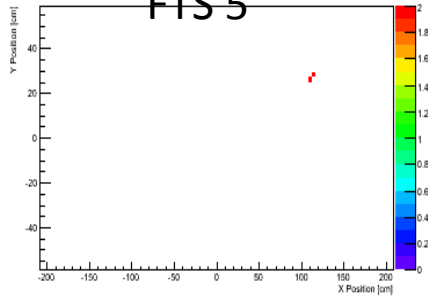
FTS 4

Y vs X (FTS4)



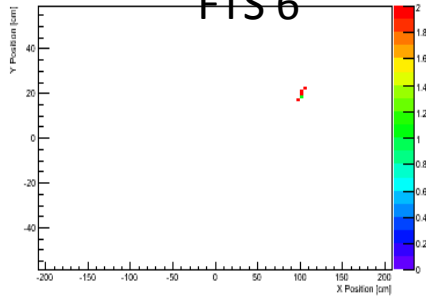
FTS 5

Y vs X (FTS5)



FTS 6

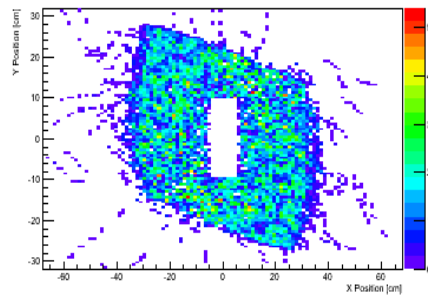
Y vs X (FTS6)



Pion momentum: 500 MeV

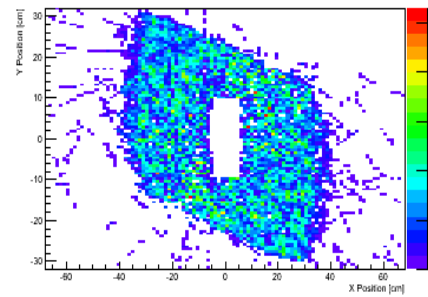
FTS 1

Y vs X (FTS1)



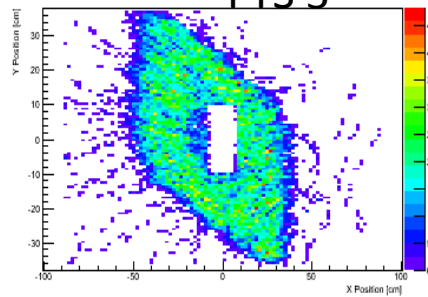
FTS 2

Y vs X (FTS2)



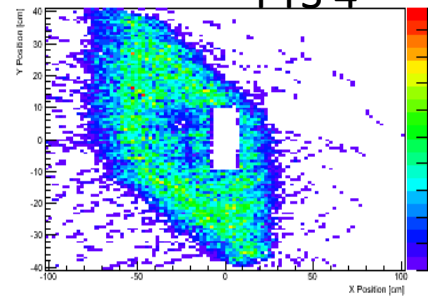
FTS 3

Y vs X (FTS3)



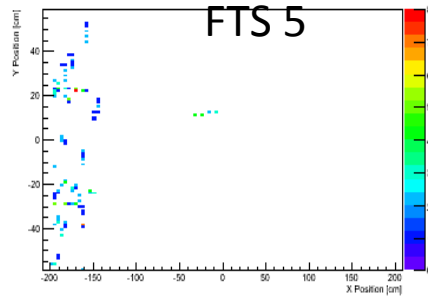
FTS 4

Y vs X (FTS4)



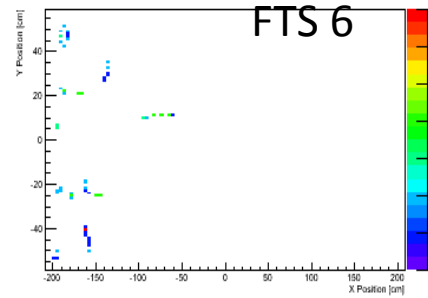
FTS 5

Y vs X (FTS5)



FTS 6

Y vs X (FTS6)

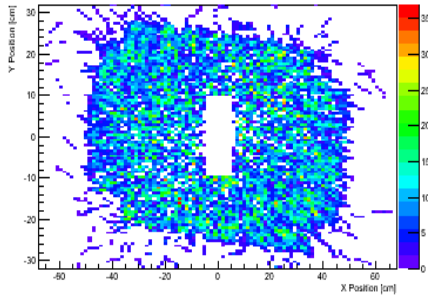


Pion momentum: 1 GeV

Pion momentum: 2 GeV

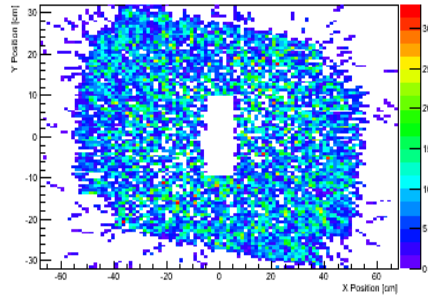
FTS 1

Y vs X (FTS1)



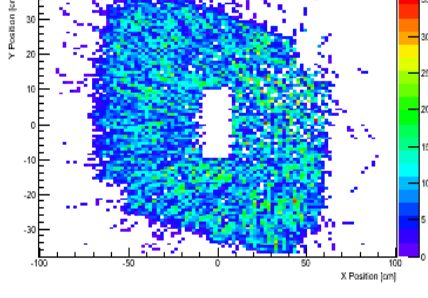
FTS 2

Y vs X (FTS2)



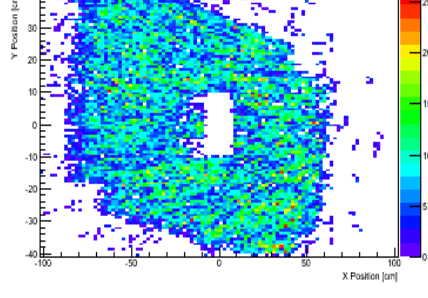
FTS 3

Y vs X (FTS3)



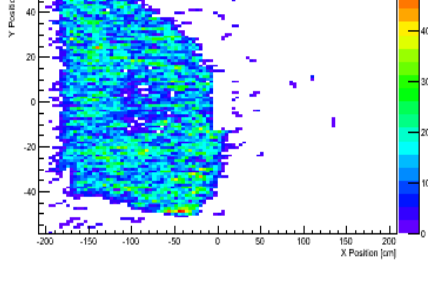
FTS 4

Y vs X (FTS4)



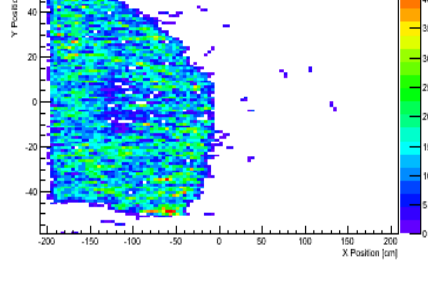
FTS 5

Y vs X (FTS5)



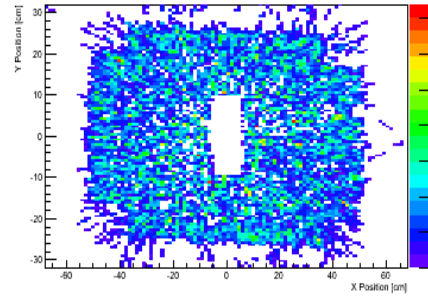
FTS 6

Y vs X (FTS6)



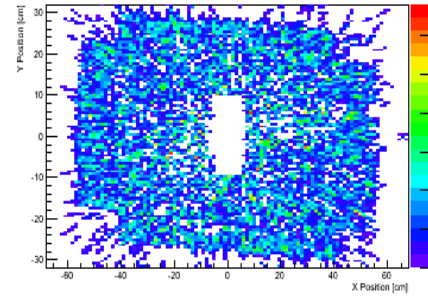
FTS 1

Y vs X (FTS1)



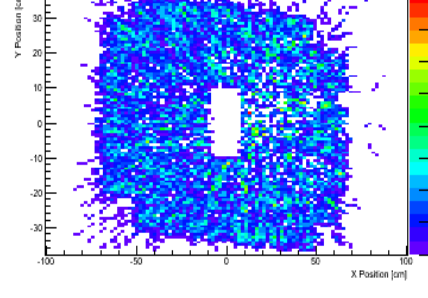
FTS 2

Y vs X (FTS2)



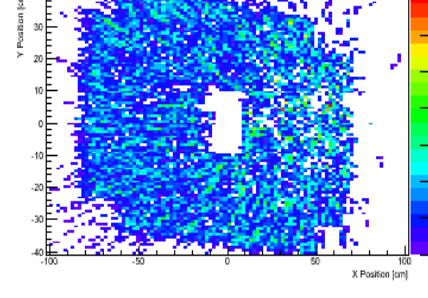
FTS 3

Y vs X (FTS3)



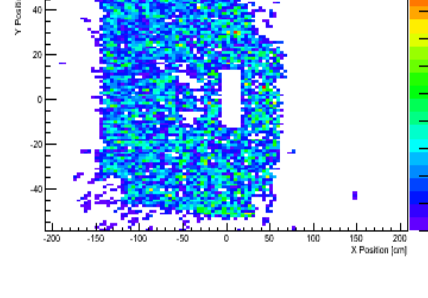
FTS 4

Y vs X (FTS4)



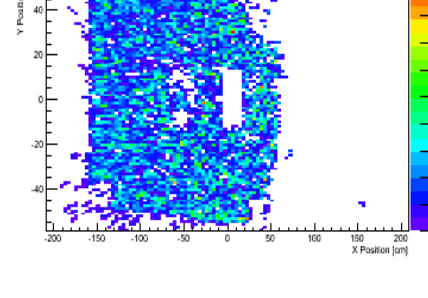
FTS 5

Y vs X (FTS5)



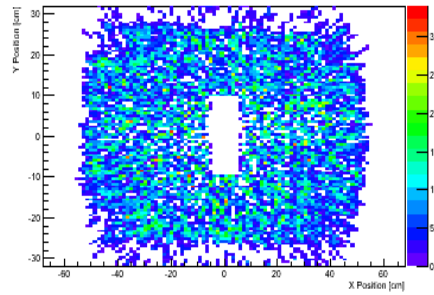
FTS 6

Y vs X (FTS6)

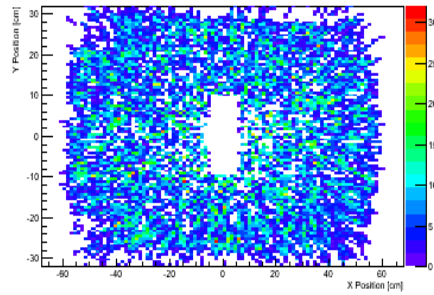


Pion momentum: 5 GeV

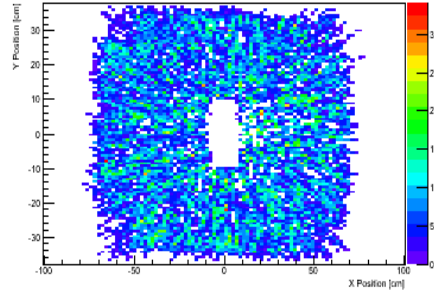
FTS 1



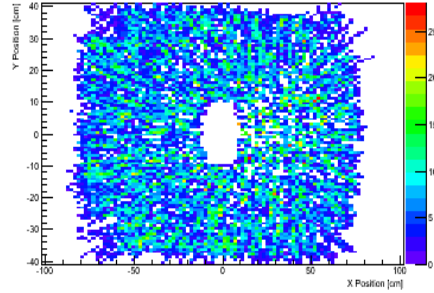
FTS 2



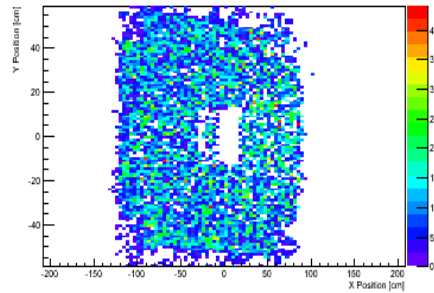
FTS 3



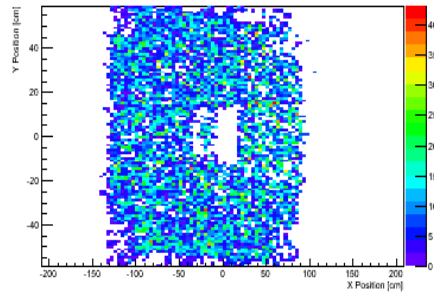
FTS 4



FTS 5



FTS 6



How many particles hit each chamber?

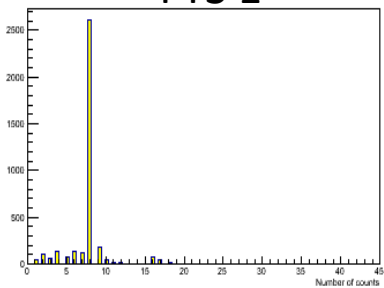
Uniformly in theta: [2,5°]

x axis: Number of hits

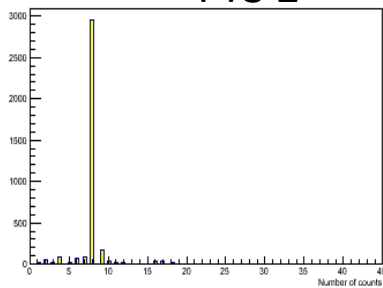
y axis: Counts

Pion momentum: 200 MeV

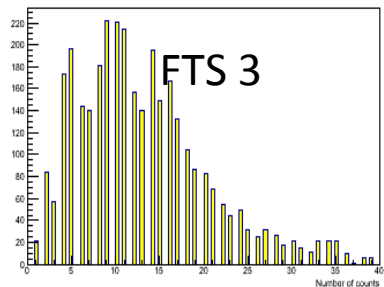
FTS 1



FTS 2

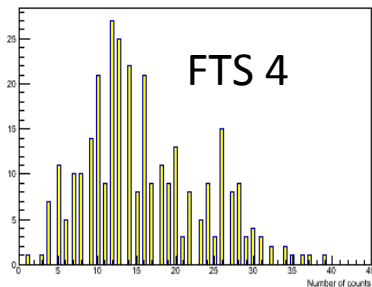


FTS3



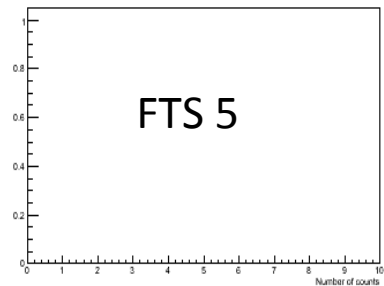
FTS 3

FTS4



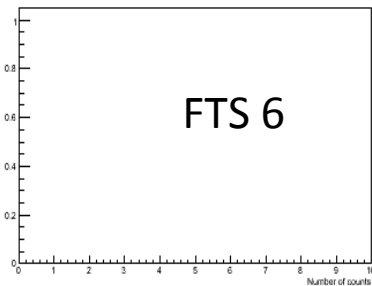
FTS 4

FTS5



FTS 5

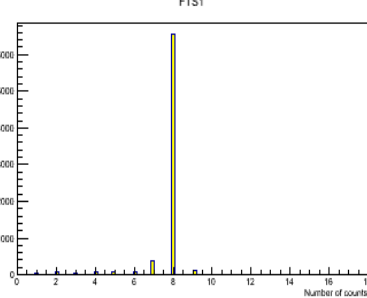
FTS6



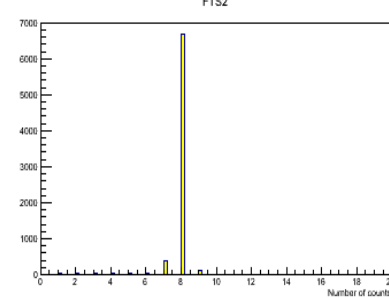
FTS 6

Pion momentum: 500 MeV

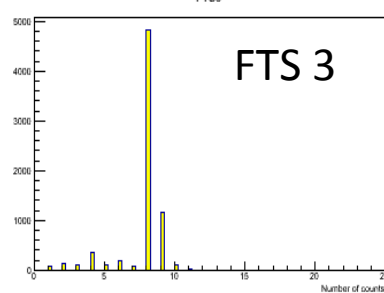
FTS 1



FTS 2

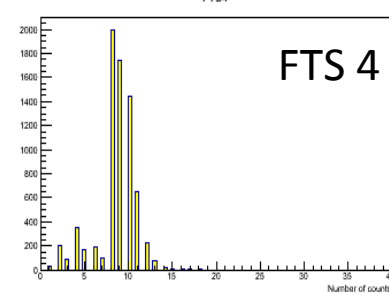


FTS3



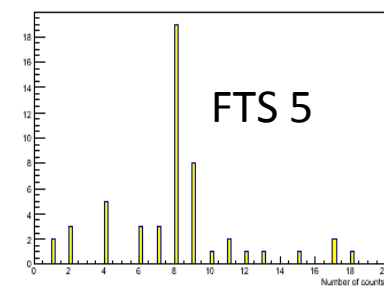
FTS 3

FTS4



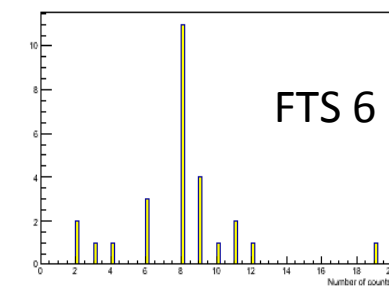
FTS 4

FTS5



FTS 5

FTS6



FTS 6

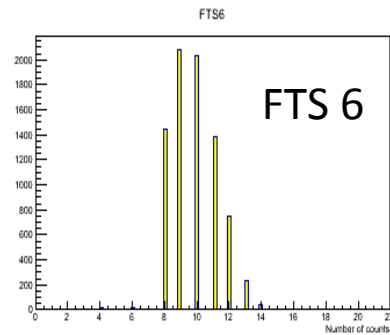
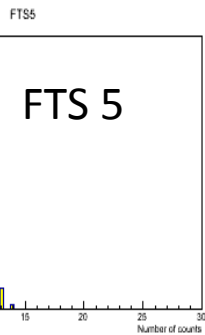
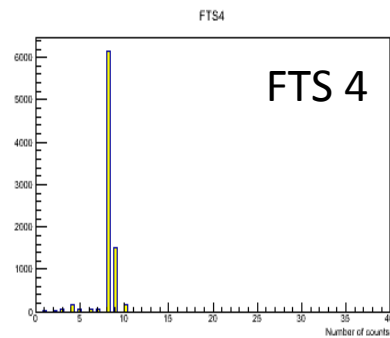
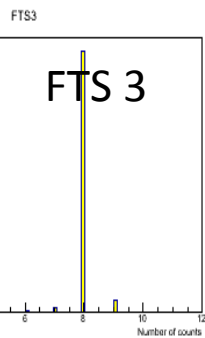
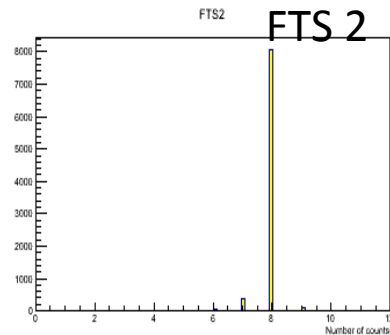
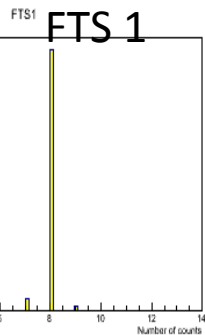
How many particles hit each chamber?

Uniformly in theta: [2,5°]

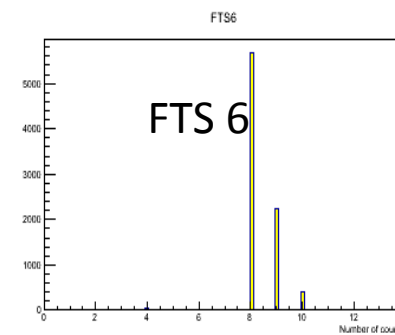
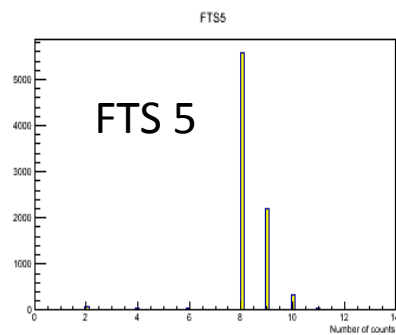
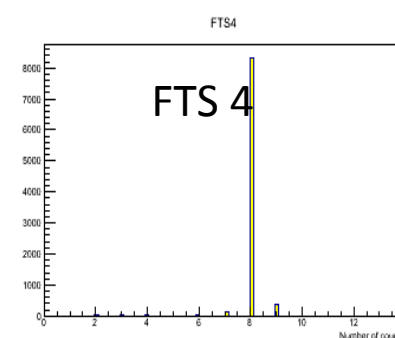
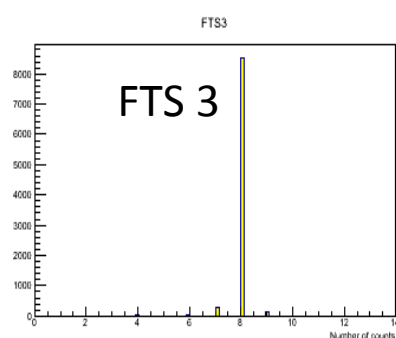
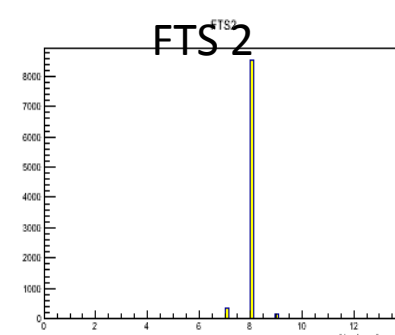
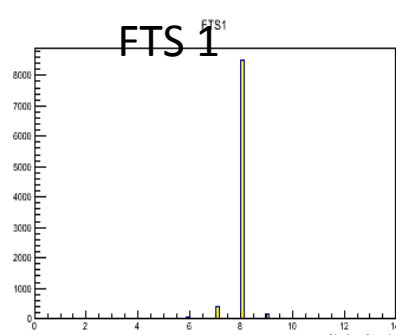
x axis: Number of hits

y axis: Counts

Pion momentum: 1 GeV



Pion momentum: 2 GeV



How many particles hit each chamber?

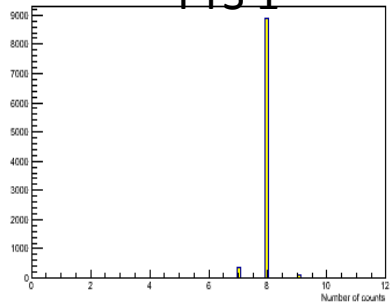
Uniformly in theta: [2,5°]

x axis: Number of hits

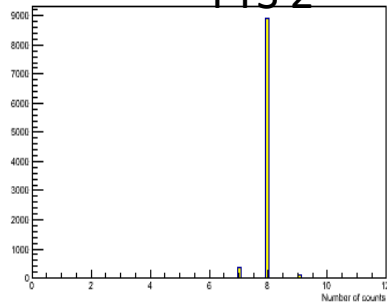
y axis: Counts

Pion momentum: 5 GeV

FTS 1

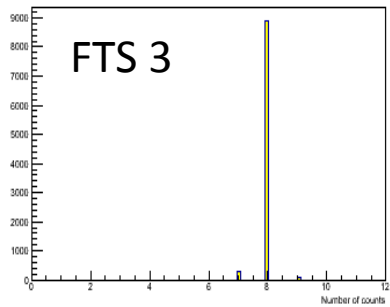


FTS 2



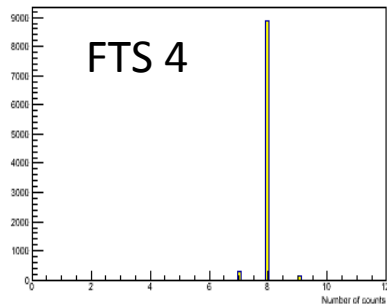
FTS 3

FTS 3



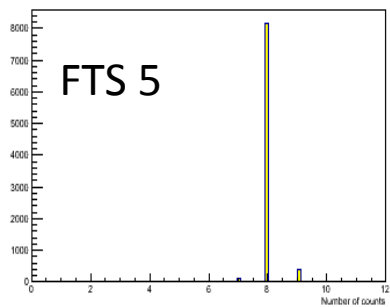
FTS 4

FTS 4



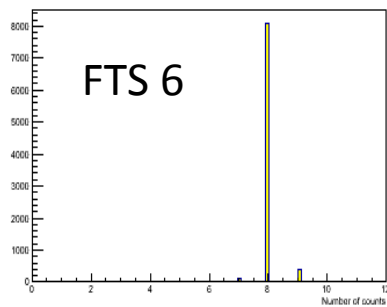
FTS 5

FTS 5



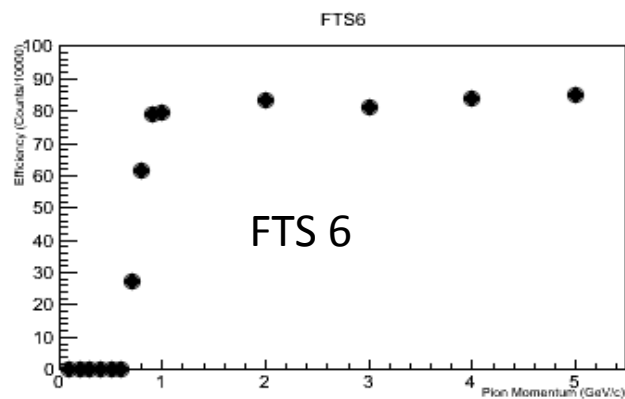
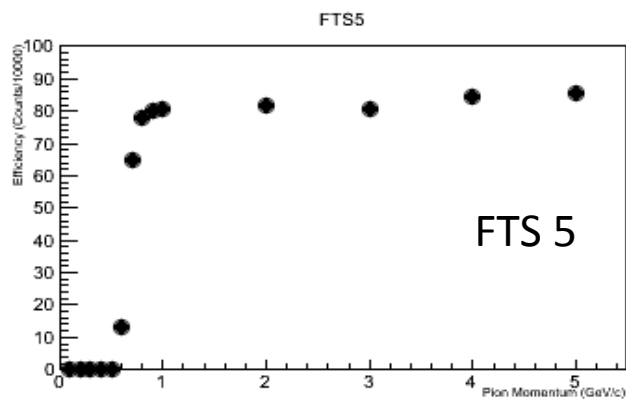
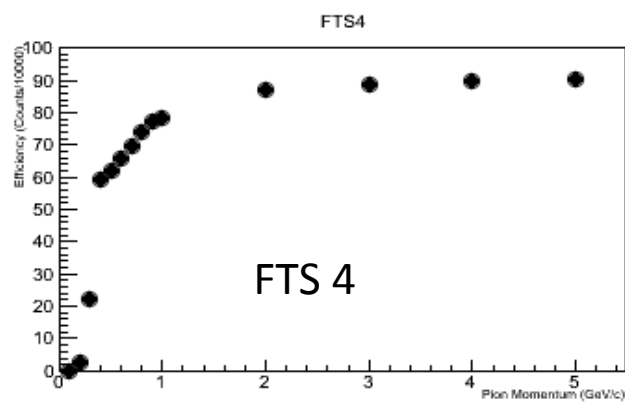
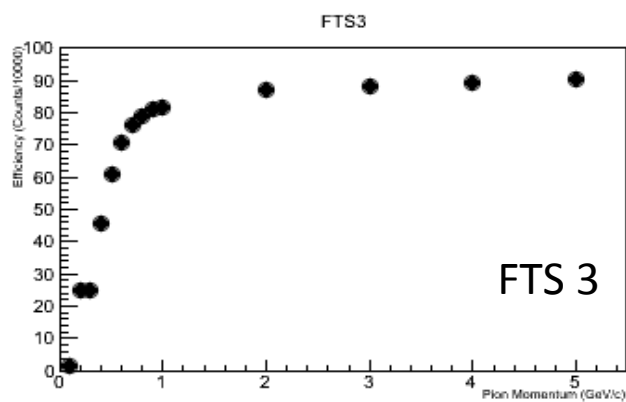
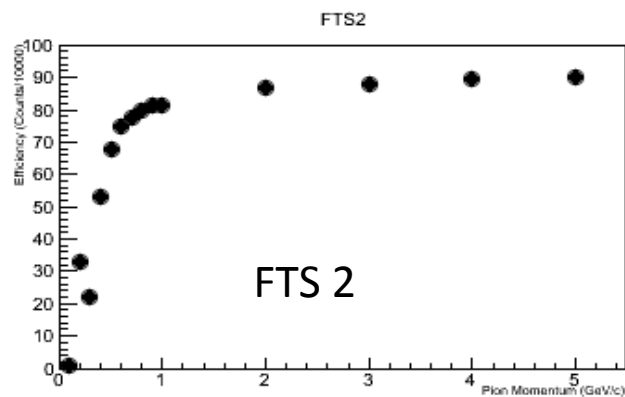
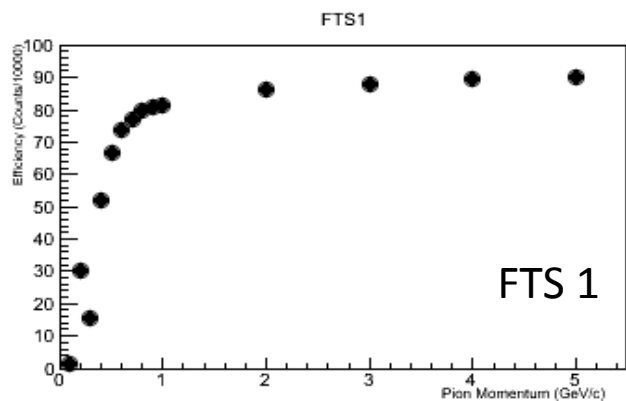
FTS 6

FTS 6



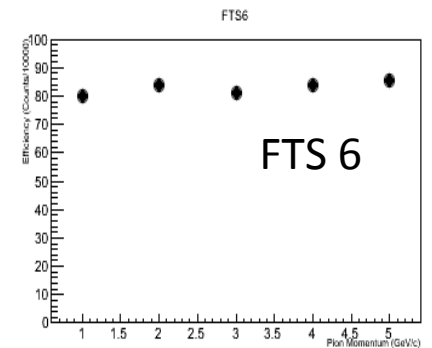
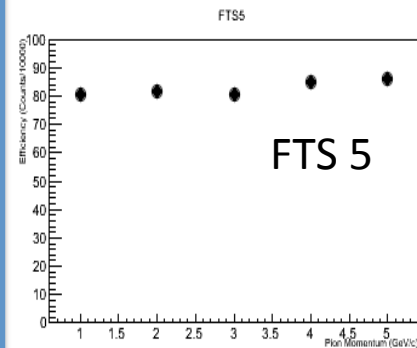
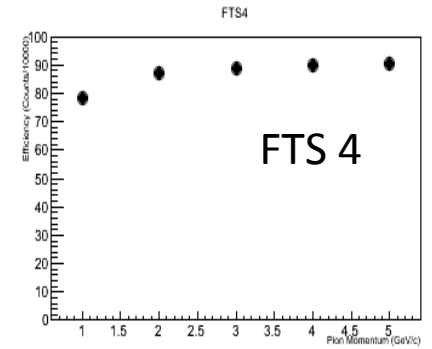
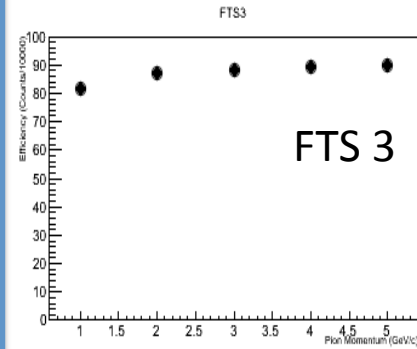
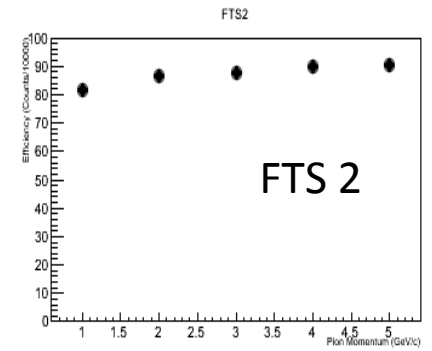
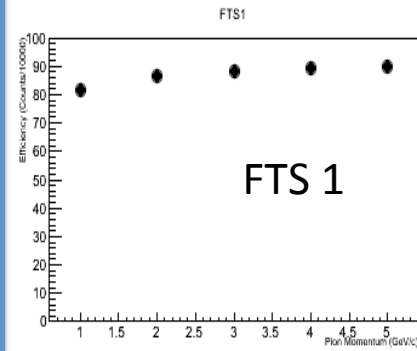
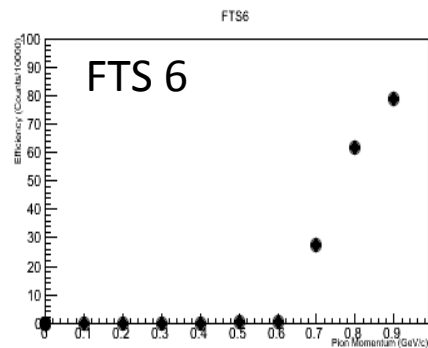
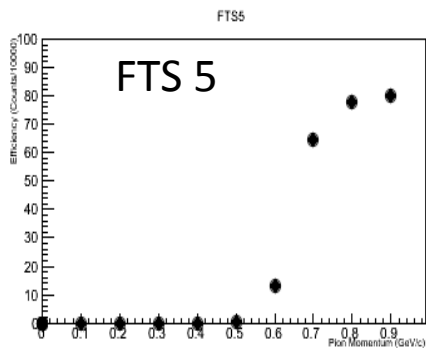
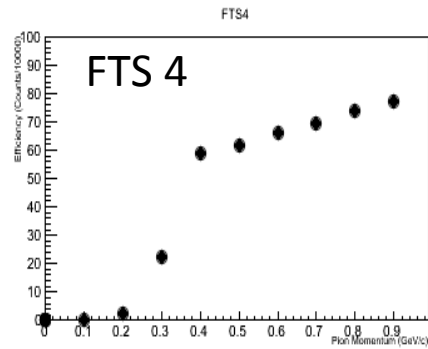
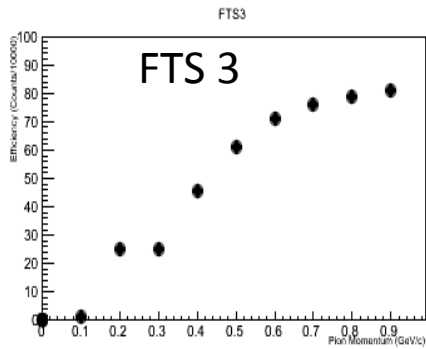
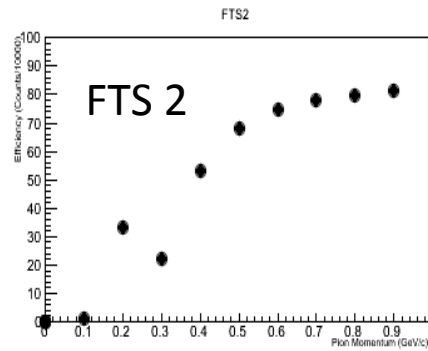
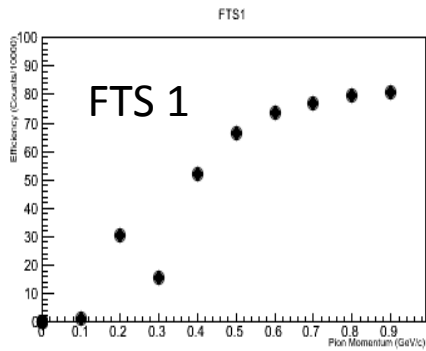
If we select number of hits is ≥ 8
(number of layer for each chamber=8)

x axis: Pion Momentum
y axis: Efficiency [%]



Momentum < 1 GeV

Momentum ≥ 1 GeV



Aim:

Study the **Momentum and Position Resolution** (x, y, z) of the **FTS Standalone** for muons at different momentum. The study is done for the standard straws inclinations of 5 degrees. Fit with a double gaussian function

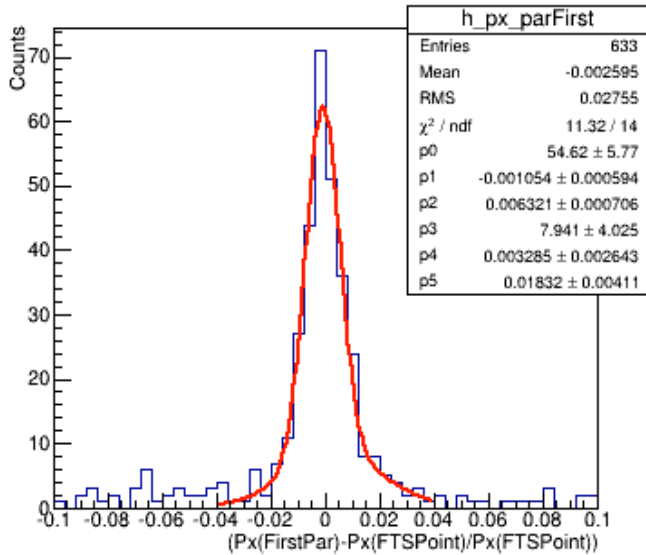
Strategy:

- BoxGenerator is used for the simulation
- **10.000 Muons** simulated with different momentum:
500 MeV, 1 GeV, 2 GeV, 3 GeV, 5 GeV
- Uniformly in phi: [0,360°]
- Uniformly in theta: [0,5°]
- Uniformly in cos(theta)
- FTS Standalone
- Beam Momentum = 15 GeV/c
- Only primary tracks selected
- **Ideal Forward Tracking**
- **Vertex smearing: (0.1, 2, 0.1) cm**
- **Momentum smearing: 10%**
- SetPropagateToIP(kFALSE)
- SetBackPropagate(kFALSE)
- Pandaroot version 23607

$$[\text{Pi}(\text{FirstPar}) - \text{Pi}(\text{FTSPoint})] / \text{Pi}(\text{FTSPoint})$$

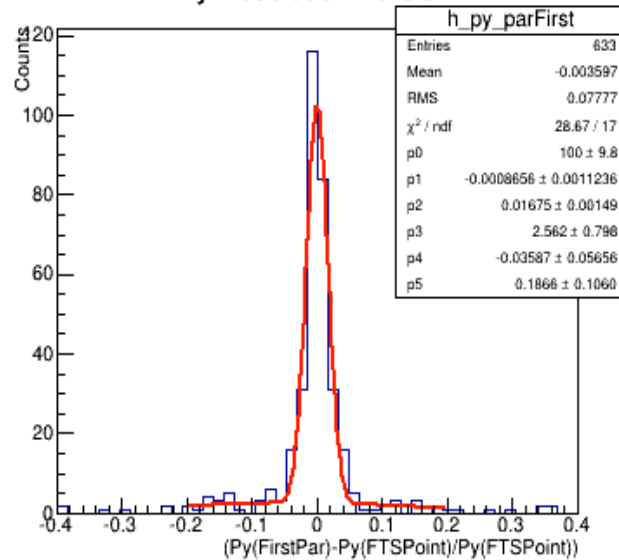
Residual momentum distribution of the first parameter of the track

Px Resolution - 3 GeV



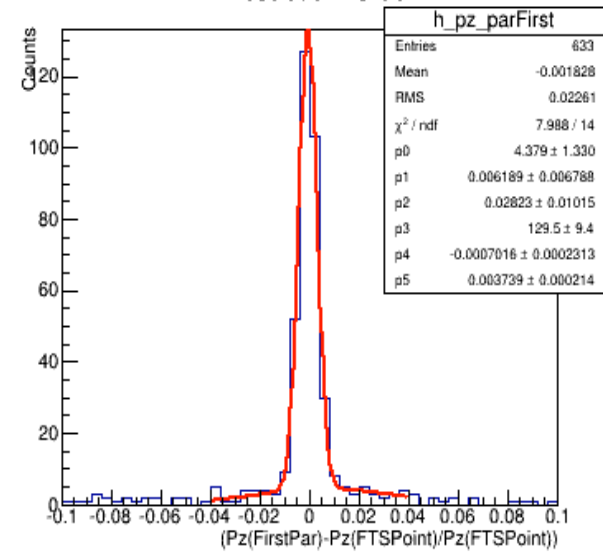
0.6%

Py Resolution - 3 GeV



1.7%

Pz Resolution - 3 GeV

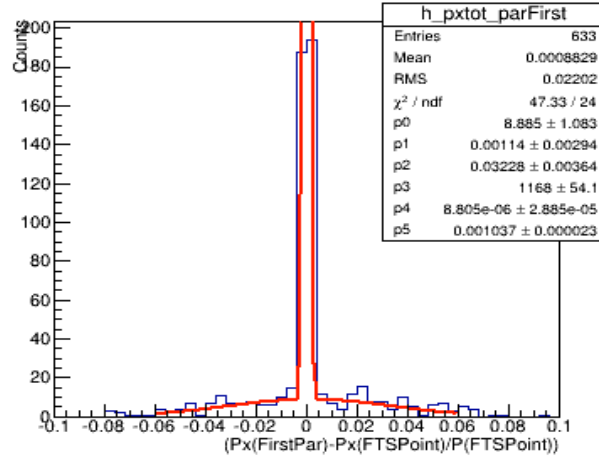


0.4%

$$\frac{[Pi(FirstPar)-Pi(FTSPoint)]}{Ptot(FTSPoint)}$$

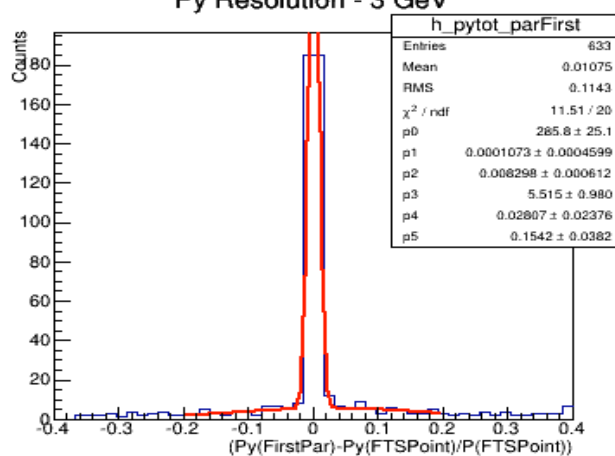
Residual momentum distribution of the first parameter of the track

Px Resolution - 3 GeV



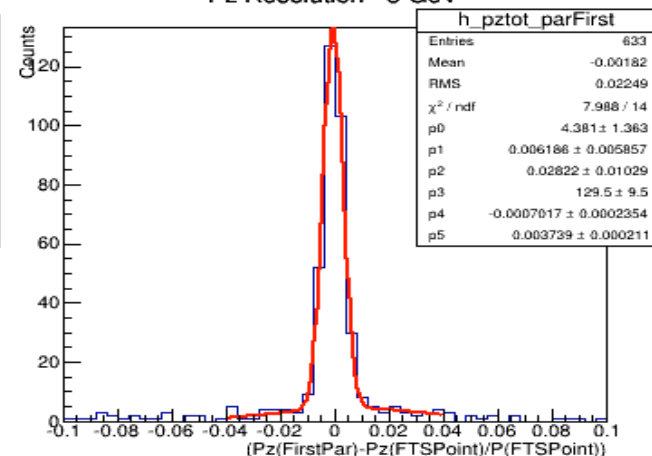
0.1%

Py Resolution - 3 GeV



0.6%

Pz Resolution - 3 GeV

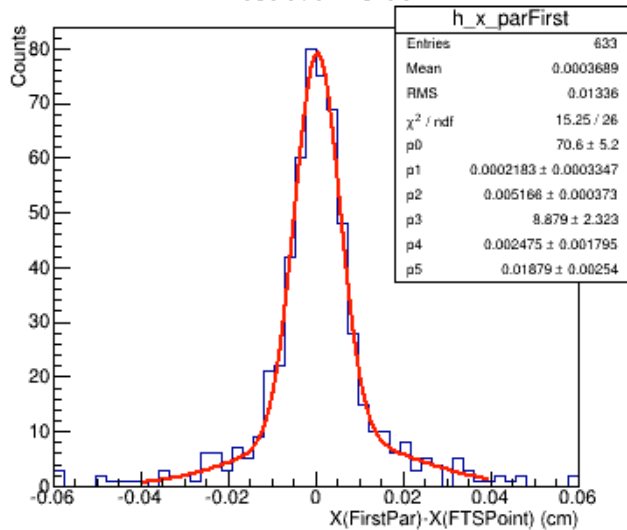


0.4%

(FirstPar)-(FTSPoint)

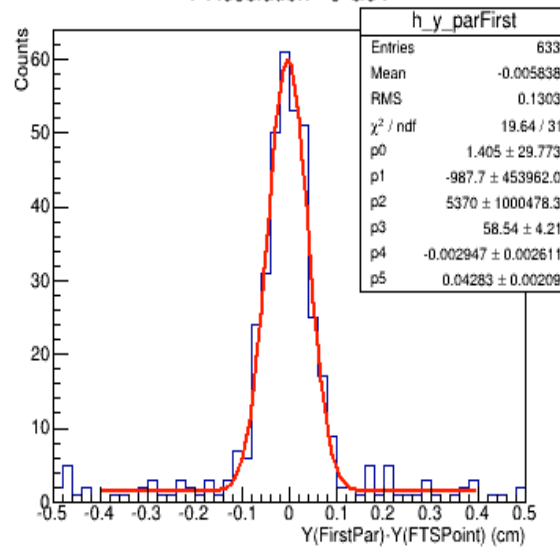
Residual position distribution of the first parameter of the track

X Resolution - 3 GeV



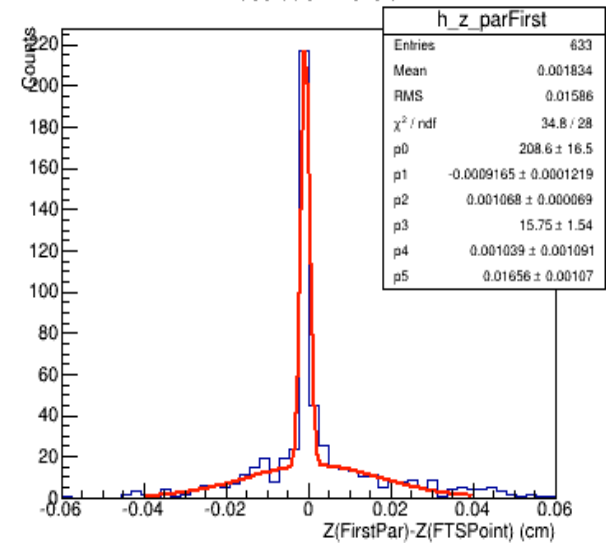
0.005 cm

Y Resolution - 3 GeV



0.040 cm

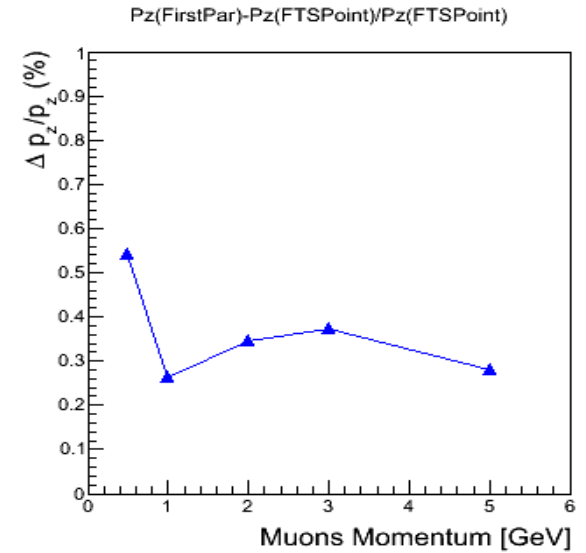
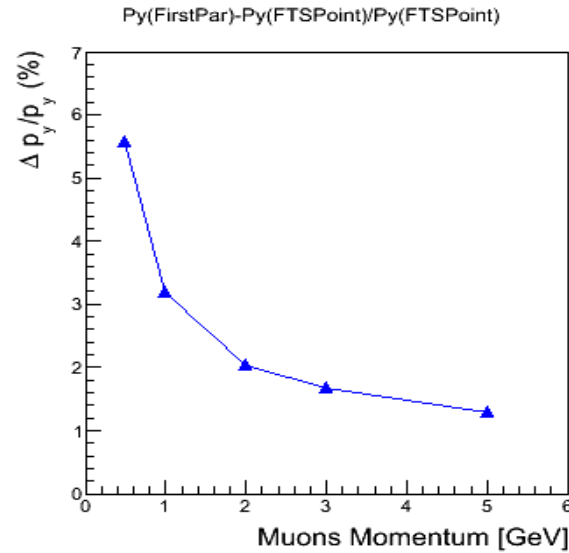
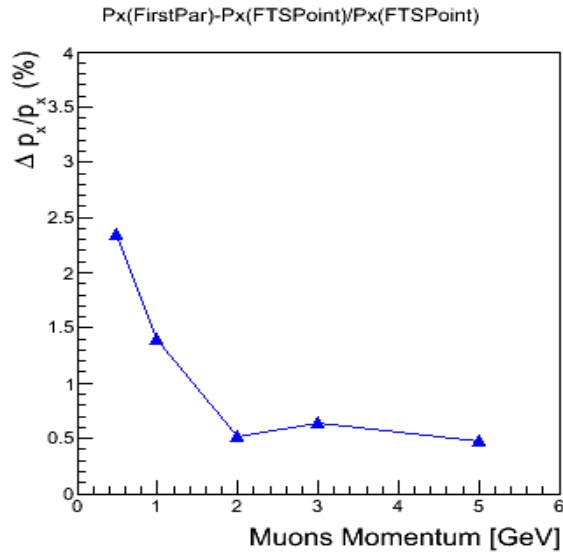
Z Resolution - 3 GeV



0.001 cm

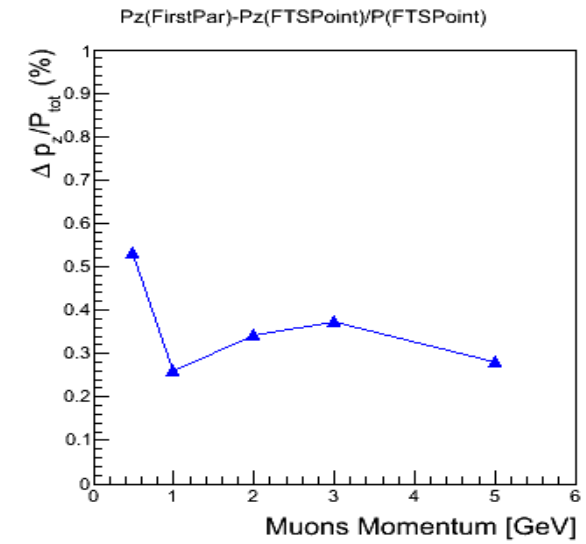
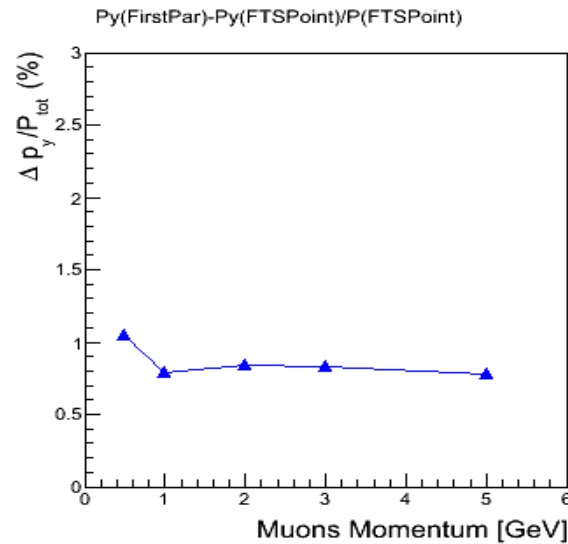
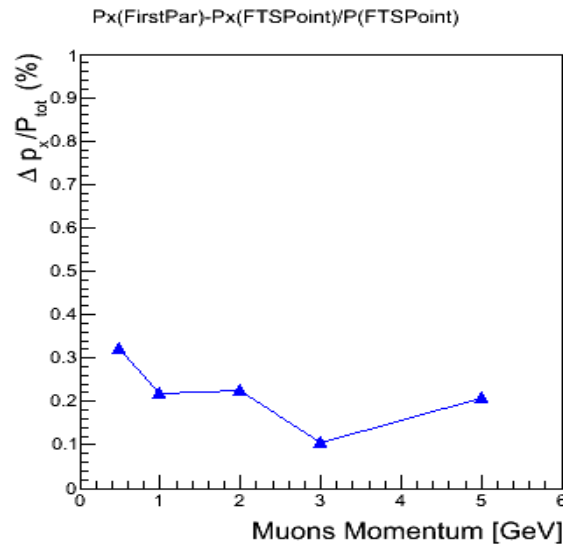
Momentum Resolution

$$\frac{[P_x(\text{FirstPar}) - P_x(\text{FTSPoint})]/P_x(\text{FTSPoint})}{[P_y(\text{FirstPar}) - P_y(\text{FTSPoint})]/P_y(\text{FTSPoint})}$$

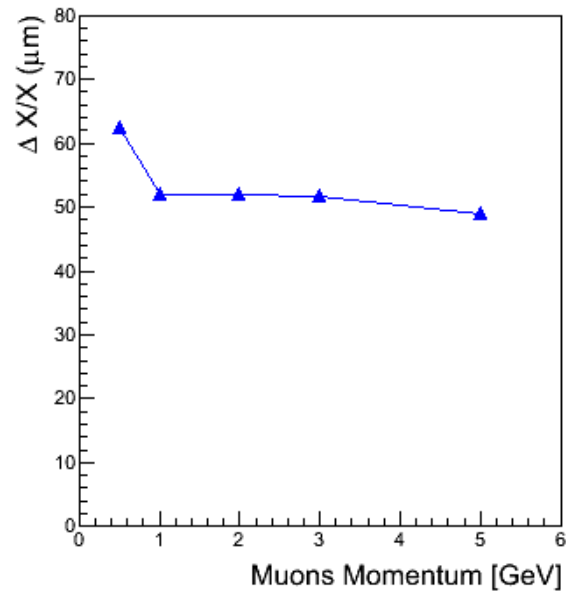


Momentum Resolution

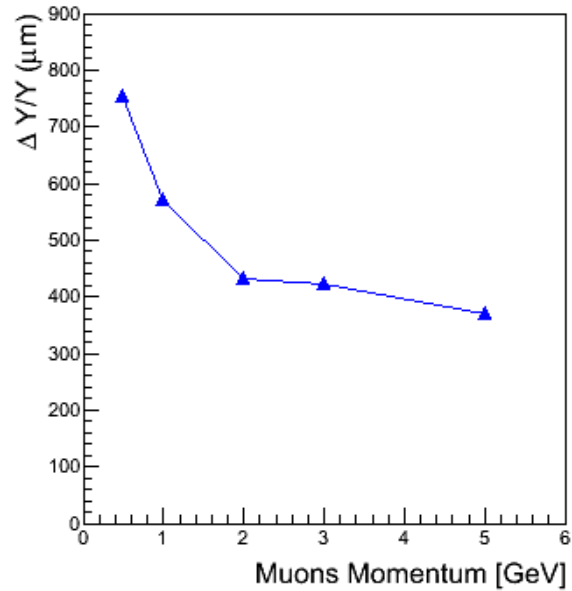
$$\frac{[P_x(\text{FirstPar}) - P_x(\text{FTSPoint})]/P_{\text{tot}}(\text{FTSPoint})}{[P_y(\text{FirstPar}) - P_y(\text{FTSPoint})]/P_{\text{tot}}(\text{FTSPoint})}$$



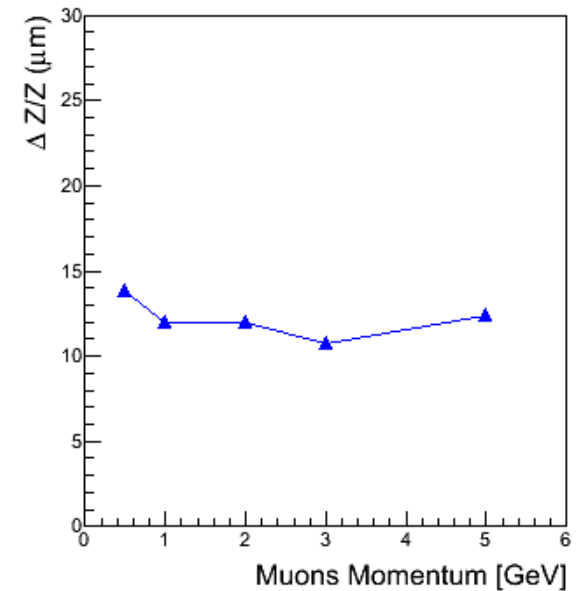
X(FirstPar)-X(FTSPoint)



Y(FirstPar)-Y(FTSPoint)



Z(FirstPar)-Z(FTSPoint)



Aim:

Study the **Momentum and Position Resolution** (x, y, z) of the **FTS Standalone** for muons at different momentum. The study is done for different skew angles. Fit with a double gaussian function

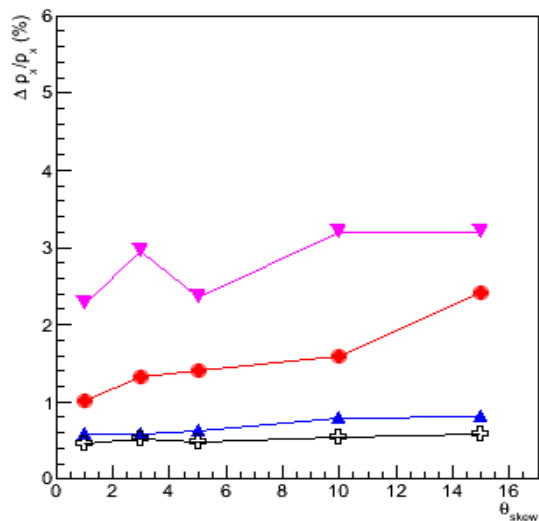
Strategy:

- BoxGenerator is used for the simulation
- **10.000 Muons** simulated with different momentum:
500 MeV, 1 GeV, 2 GeV, 3 GeV, 5 GeV
- Straws inclinations: 1, 3, 5 (standard), 10, 15 degrees
- Uniformly in phi: $[0, 360^\circ]$
- Uniformly in theta: $[0, 5^\circ]$
- Uniformly in $\cos(\theta)$
- FTS Standalone
- Beam Momentum = 15 GeV/c
- Only primary tracks selected
- **Ideal Forward Tracking**
- **Vertex smearing: (0.1, 2, 0.1) cm**
- **Momentum smearing: 10%**
- SetPropagateToIP(kFALSE)
- SetBackPropagate(kFALSE)
- Pandaroot version 23607

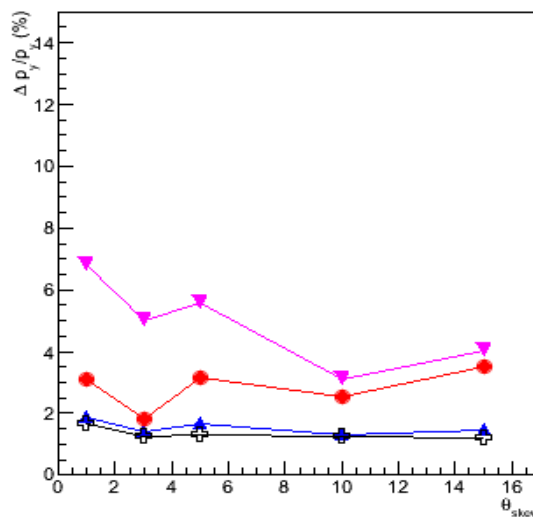
Momentum Resolution

$$[\text{Pi}(\text{FirstPar})-\text{Pi}(\text{FTSPoint})]/\text{Pi}(\text{FTSPoint})$$

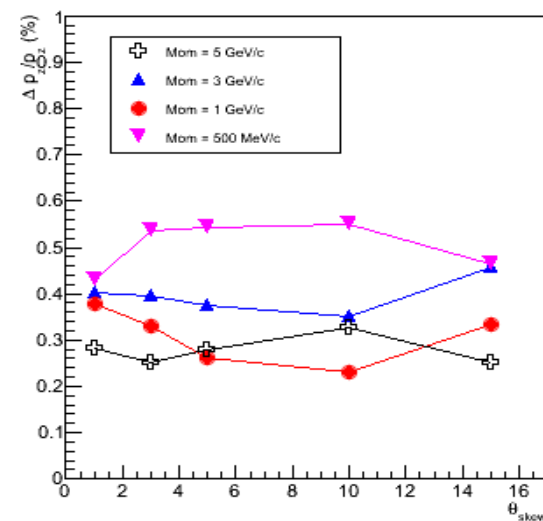
Px(FirstPar)-Px(FTSPoint)/Px(FTSPoint)



Py(FirstPar)-Py(FTSPoint)/Py(FTSPoint)



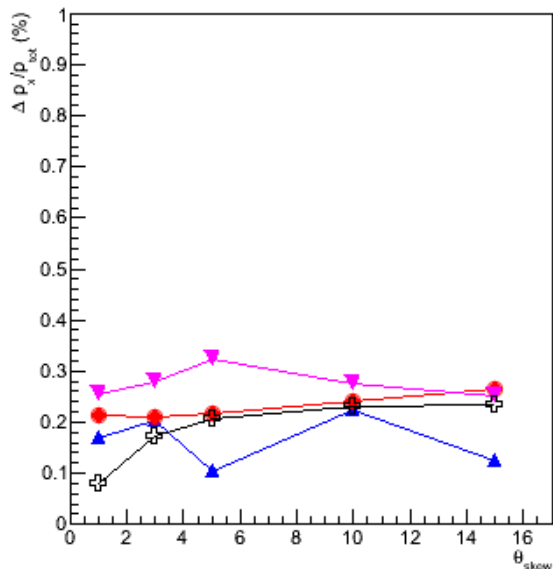
Pz(FirstPar)-Pz(FTSPoint)/Pz(FTSPoint)



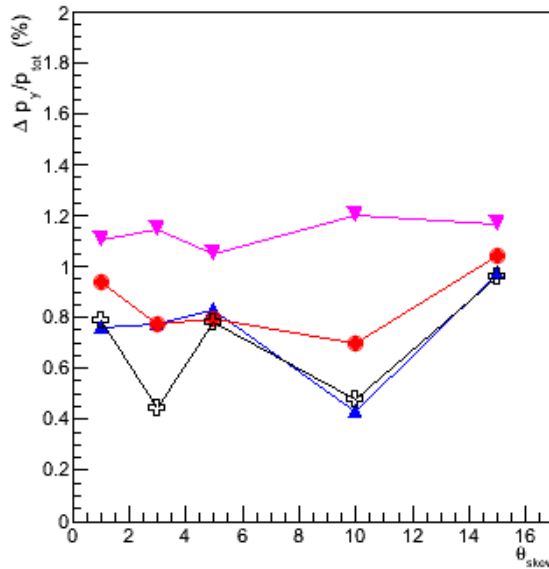
Momentum Resolution

$$[\text{Pi}(\text{FirstPar})-\text{Pi}(\text{FTSPoint})]/\text{Ptot}(\text{FTSPoint})$$

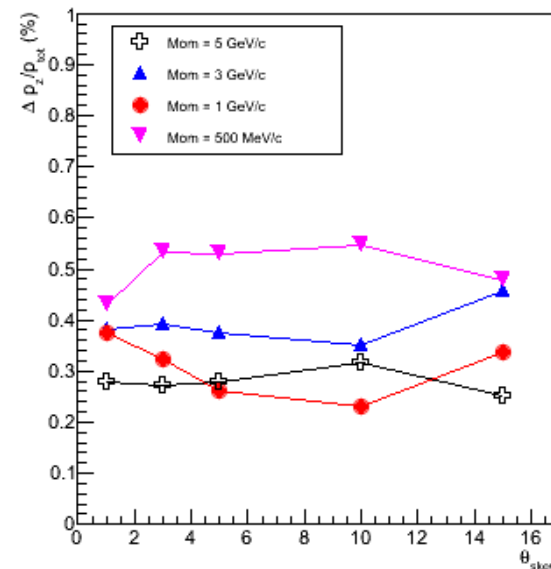
Px(FirstPar)-Px(FTSPoint)/Ptot(FTSPoint)



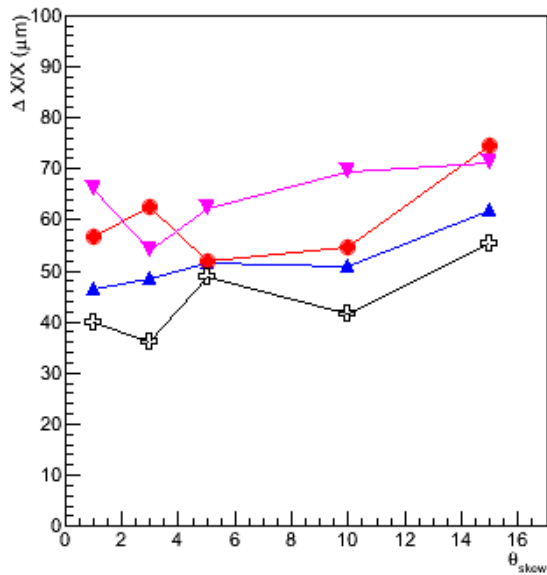
Py(FirstPar)-Py(FTSPoint)/Ptot(FTSPoint)



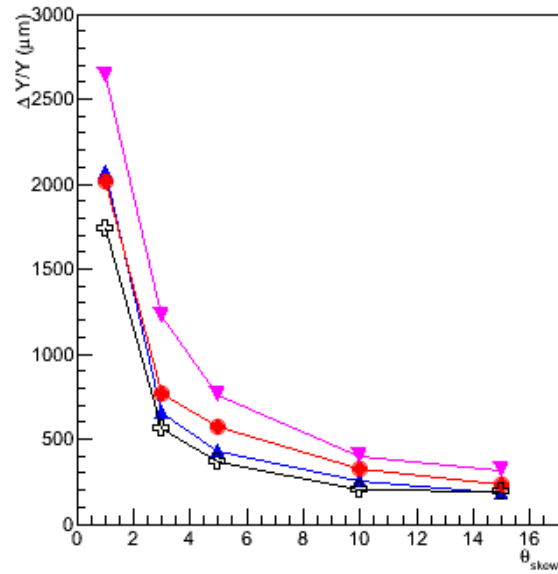
Pz(FirstPar)-Pz(FTSPoint)/Ptot(FTSPoint)



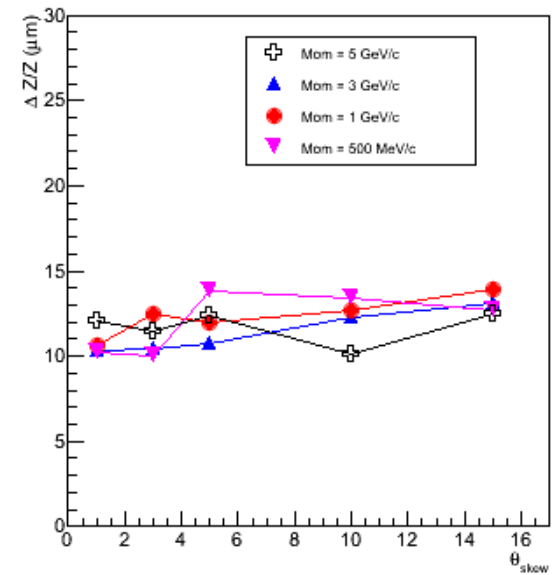
X(FirstPar)-X(FTSPoint)



Y(FirstPar)-Y(FTSPoint)



Z(FirstPar)-Z(FTSPoint)



Conclusions

Ferrara group is doing different studies about:

- **Resolution studies**
- **Acceptance studies**
- **Skew angles studies**

THANKS FOR YOUR ATTENTION