Benchmark channel: $\bar{p}p \longrightarrow n(\pi^+\pi^-)$ (n=1,2)

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PANDA Collaboration Meeting - Paris
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Outline

- Kinematics of the reaction
- Data simulation
- Analysis
  - $\bar{p}p \longrightarrow \pi^+\pi^-$
  - $\bar{p}p \longrightarrow \pi^+\pi^-\pi^+\pi^-$
- Outlook

Kinematics of the reaction

- Multipion analysis was relevant for Central Tracker study in order to compare the two detector setup (STT and TPC).
- The study was included in the Technical Design Report for the Straw Tube Tracker (arXiv:1205.5441v2).

Now we can do the same analysis using also the Forward Tracker (with Ideal Tracking), and not only with barrel.

In particular the interesting figures of merit are:

- Invariant mass resolution of $\pi^+\pi^-$ and $\pi^+\pi^-\pi^+\pi^-$
- Reconstruction efficiency of $\bar{p}p \longrightarrow \pi^+\pi^-$ and $\bar{p}p \longrightarrow \pi^+\pi^-\pi^+\pi^-$
- Vertex resolution

How results are affected by Forward Tracker?

Data simulation

Energy in the center of mass system: 3.07 GeV; p_z=4.0 GeV

Cross section reference from: V. Flaminio, CERN-HERA 84-01:
- $\bar{p}p \rightarrow \pi^+\pi^-$: σ=0.007 mb at $E_{CM} = 3.07$ GeV
- $\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-$: σ=0.43 mb at $E_{CM} = 2.954$ GeV

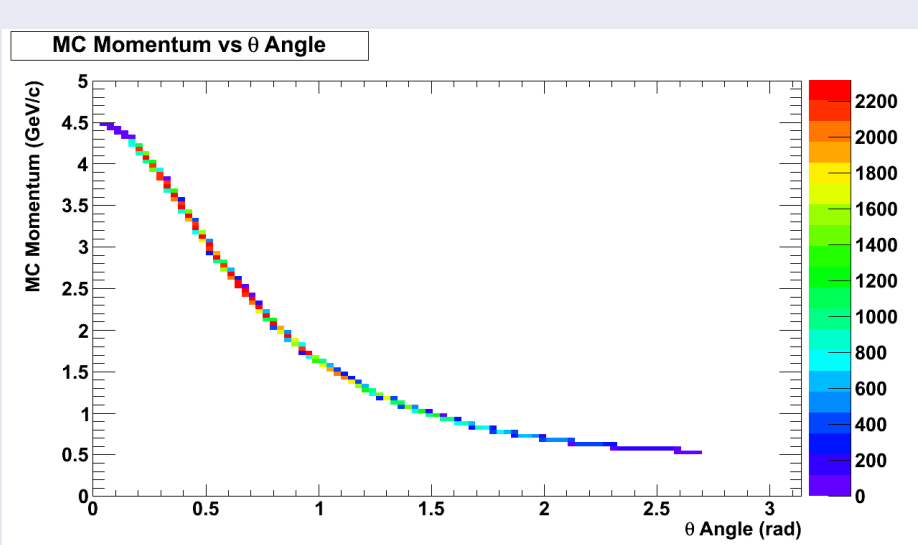
- Event generation is performed with EvtGen event generator using PHSP decay model
- MonteCarlo simulation, digitization and reconstruction is performed within pandaroot framework
- PID is based on MonteCarlo Truth information
- 1.000 events were produced.

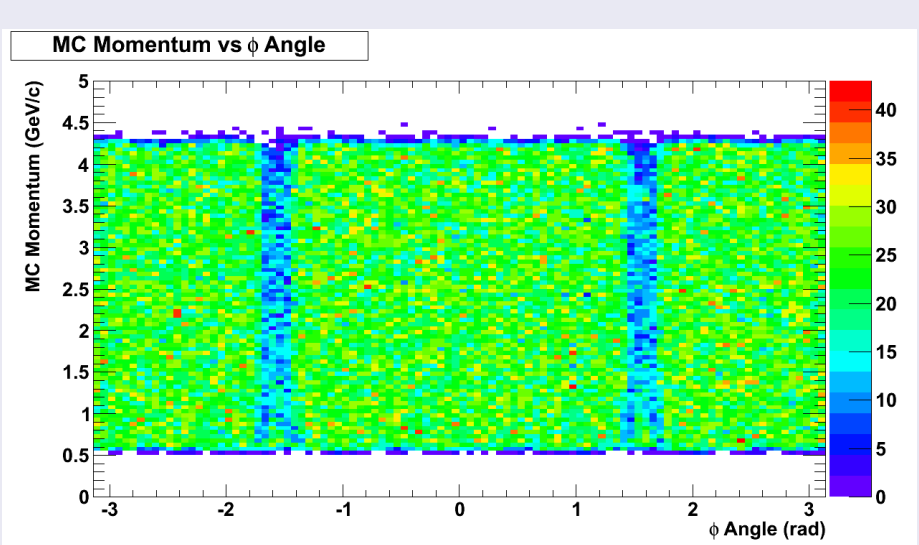
Analysis

- Analysis is performed with PndAnalysis
- No background suppression is studies
- Events with 2.07 GeV $< m(\pi^+\pi^-) <$ 4.07 GeV are selected
- Events with 2.57 GeV $< m(\pi^+\pi^-\pi^+\pi^-) <$ 3.57 GeV are selected
- Vertex fit is performed and best candidate in each event is selected by minimal χ^2

$$\bar{p}p \longrightarrow \pi^+\pi^-$$

Pion momentum distributions

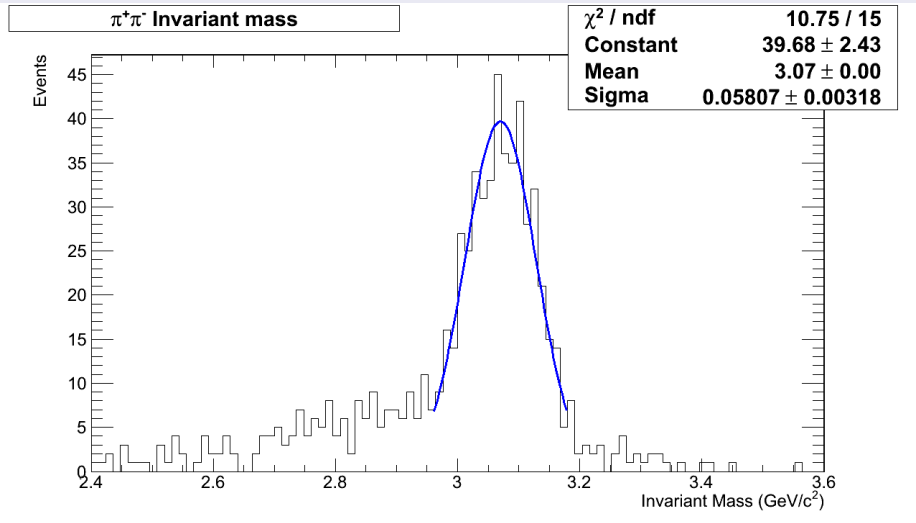




The majority of pions has:
- momentum between 1 GeV/c and 4 GeV/c
- polar angular range between 0.4 rad and 1.1 rad.

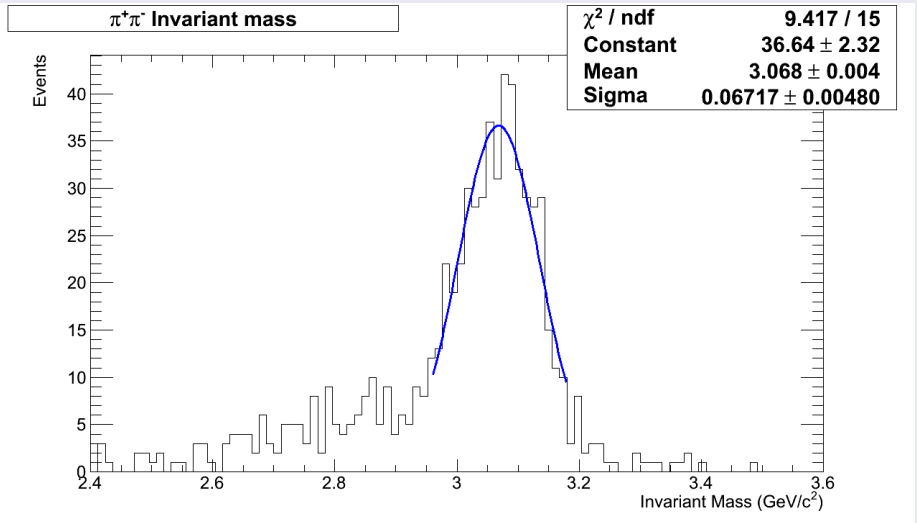
Invariant mass distribution

STT+MVD+GEM



Resolution $\sim$ 58 MeV
Efficiency $\sim$ 76%

STT+MVD+GEM+FTS

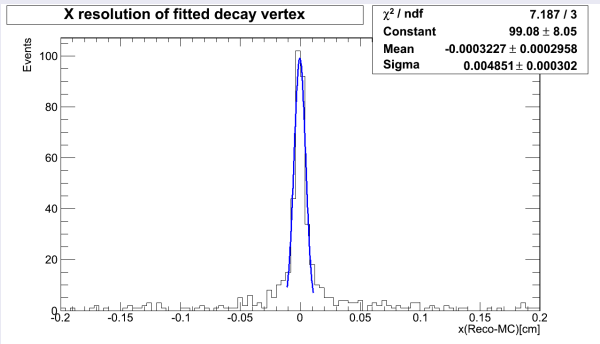


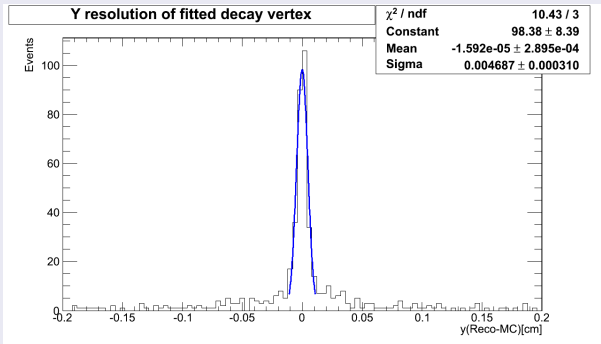
Resolution $\sim$ 67 MeV
Efficiency $\sim$ 75%

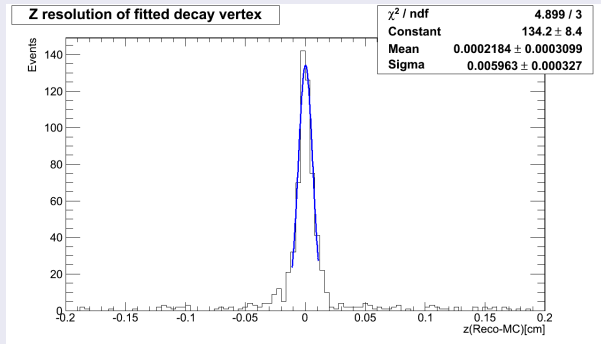
Efficiency=Number of reconstructed events/ number of generated events.

Vertex resolution

STT+MVD+GEM

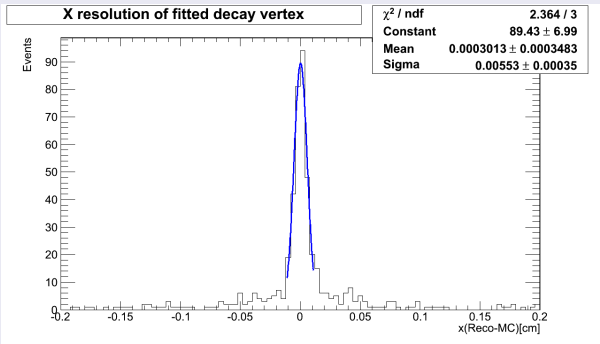


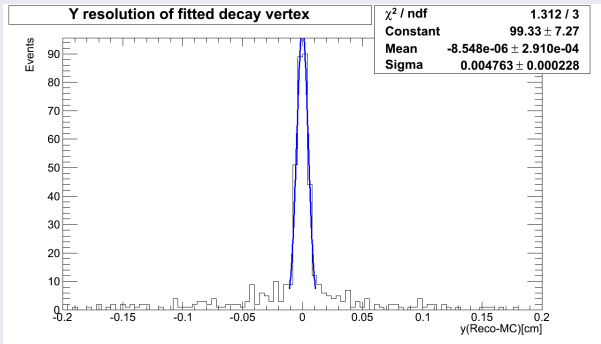


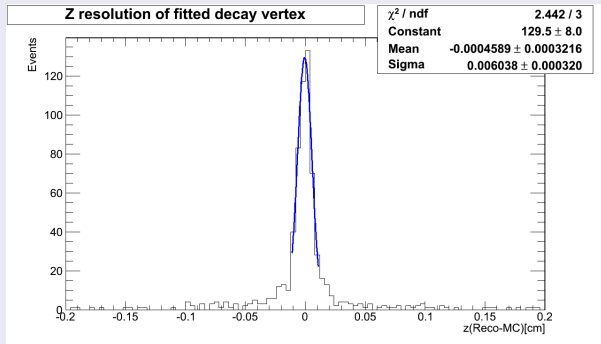


σ_x :∼49 μm; σ_y :∼47 μm; σ_z :∼60 μm;

STT+MVD+GEM+FTS



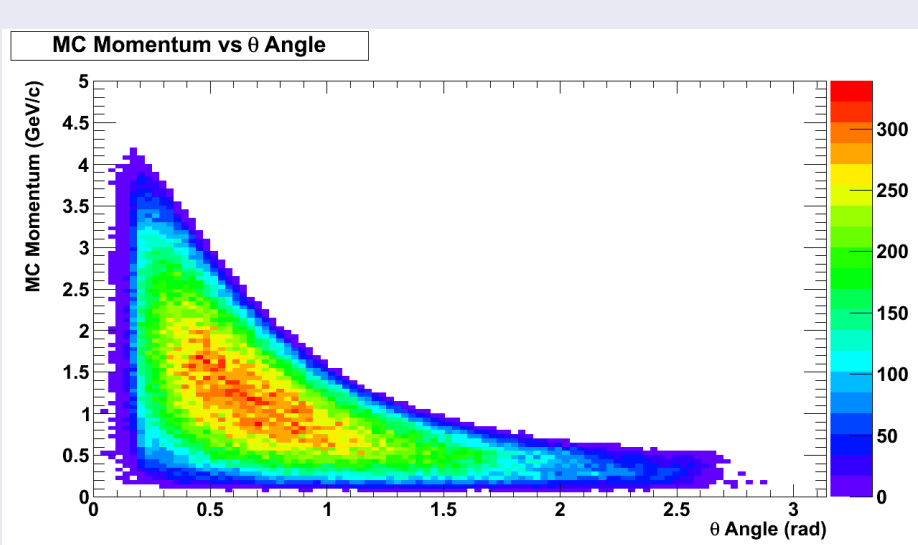


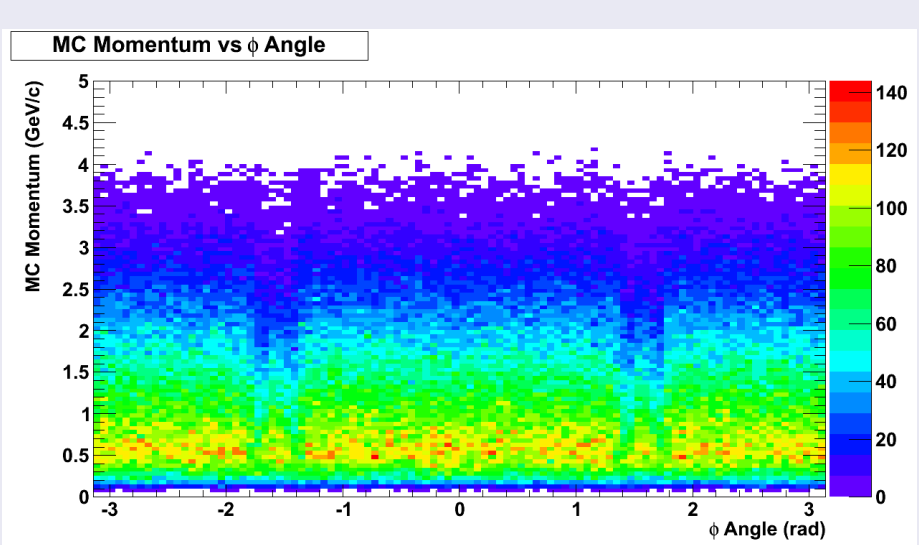


σ_x :∼55 μm; σ_y :∼48 μm; σ_z :∼60 μm;

$$\bar{p}p \longrightarrow \pi^+\pi^-\pi^+\pi^-$$

Pion momentum distributions

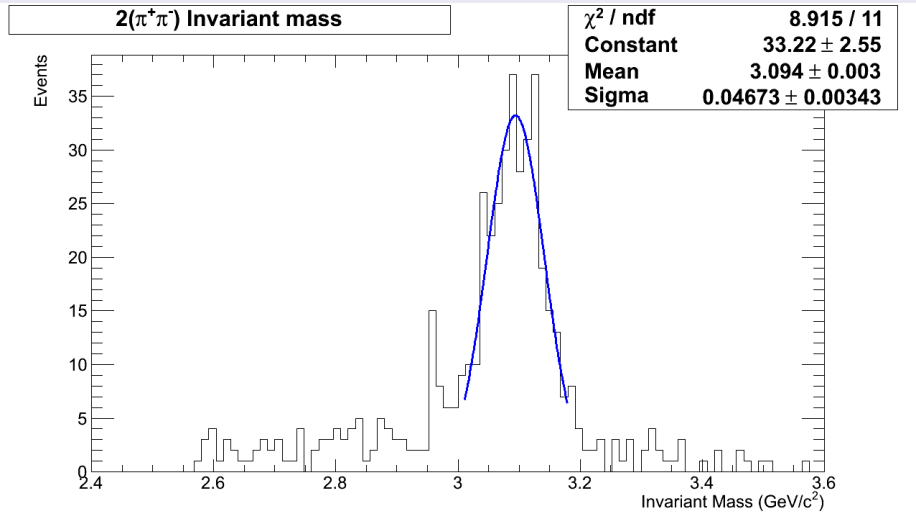




The majority of pions has:
- momentum between 0.5 GeV/c and 2.5 GeV/c
- polar angular range between 0.4 rad and 1.1 rad.

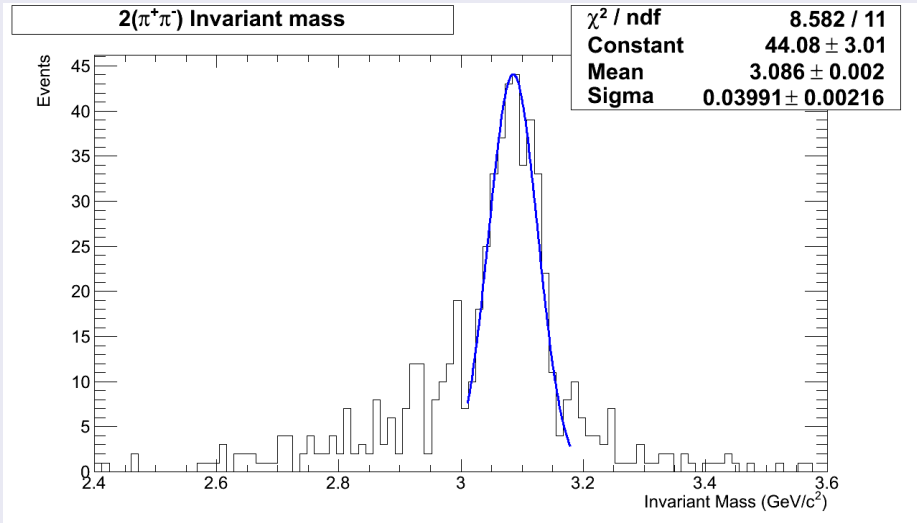
Invariant mass distribution

STT+MVD+GEM



Resolution $\sim$ 47 MeV
Efficiency $\sim$ 49%

STT+MVD+GEM+FTS

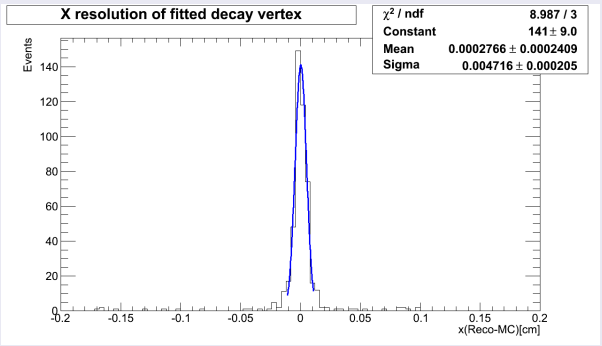


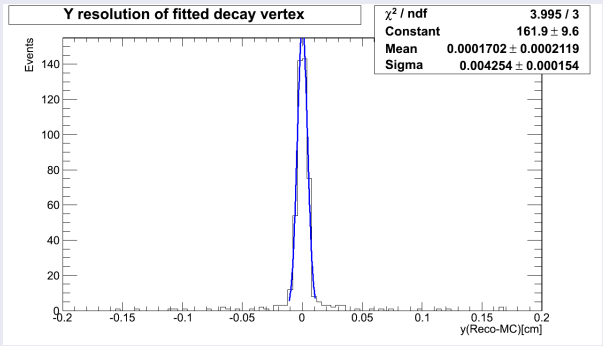
Resolution $\sim$ 40 MeV
Efficiency $\sim$ 59%

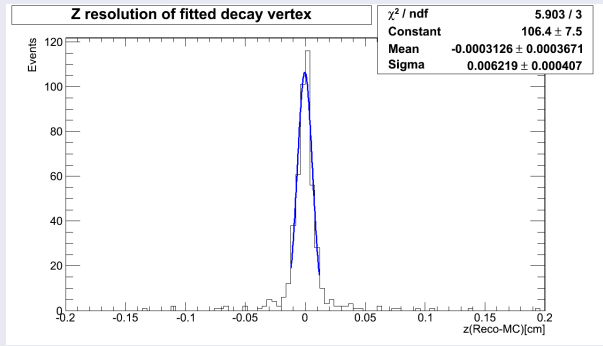
Efficiency=Number of reconstructed events/ number of generated events.

Vertex resolution

STT+MVD+GEM

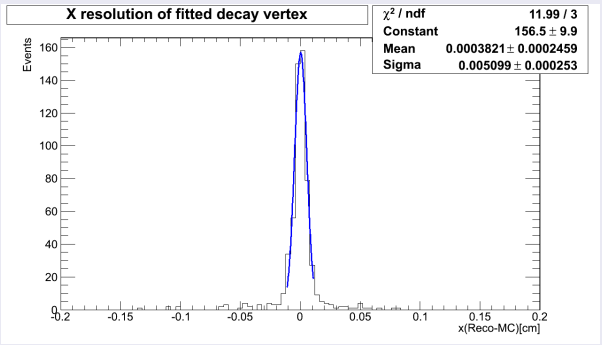


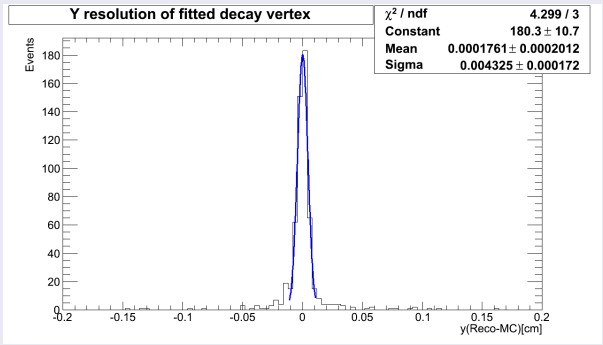


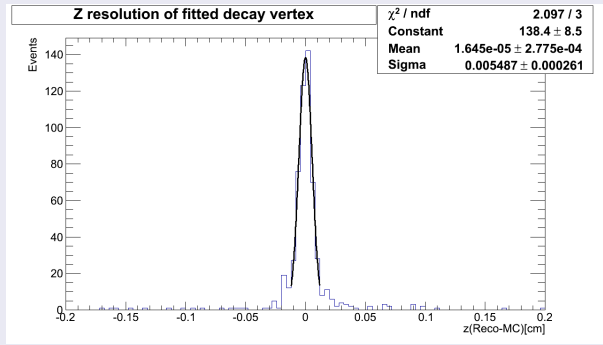


σ_x :∼47 μm; σ_y :∼43 μm; σ_z :∼62 μm;

STT+MVD+GEM+FTS







σ_x :∼51 μm; σ_y :∼43 μm; σ_z :∼55 μm;

Outlook

General comment: maybe we need to do the same study with more statistics.

	$\bar{p}p \rightarrow \pi^+\pi^-$		$\bar{p}p \rightarrow \pi^+\pi^-\pi^+\pi^-$	
	NO FTS	WITH FTS	NO FTS	WITH FTS
Invariant mass resolution	58 MeV	67 MeV	47 MeV	40 MeV
Invariant mass efficiency	76%	75%	49%	59%
Vertex: X resolution	49 μm	55 μm	47 μm	51 μm
Vertex: Y resolution	47 μm	48 μm	43 μm	43 μm
Vertex: Z resolution	60 μm	60 μm	62 μm	55 μm

THANKS FOR YOUR ATTENTION