

# Central Tracker Benchmark: $p\bar{p} \rightarrow n(\pi^+\pi^-)$ ( $n=1,2$ )

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

# Kinematics of the reaction

Multipion analysis is relevant for Central Tracker study in order to compare the two detector setup. In particular the interesting figures of merit are:

- Invariant mass resolution of  $\pi^+\pi^-$  and  $\pi^+\pi^-\pi^+\pi^-$
- Reconstruction efficiency of  $p\bar{p} \rightarrow \pi^+\pi^-$  and  $p\bar{p} \rightarrow \pi^+\pi^-\pi^+\pi^-$
- Single pion tracks resolution

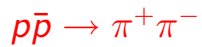
Energy in the center of mass system: 3.07 GeV;  $p_z=4.0$  GeV

Cross section reference from: [V. Flaminio, CERN-HERA 84-01](#)

- $p\bar{p} \rightarrow \pi^+\pi^-$ :  $\sigma=0.007$  mb at  $E_{CM} = 3.07$  GeV
- $p\bar{p} \rightarrow \pi^+\pi^-\pi^+\pi^-$ :  $\sigma=0.43$  mb at  $E_{CM} = 2.954$  GeV

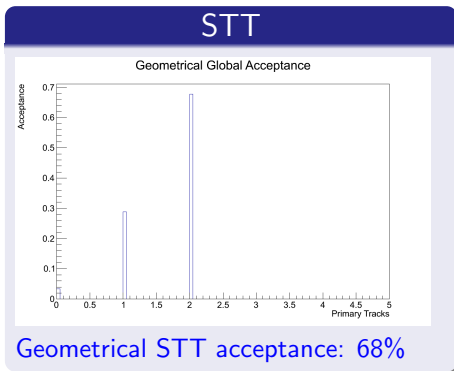
- Event generation is performed with EvtGen event generator using PHSP decay model
- MonteCarlo simulation, digitalization and reconstruction is performed within pandaroot framework
- PID is based on MonteCarlo Truth information
- 100.000 events were produced on the grid with STT and TPC.
- Events are produced with event mixing (250 signal events with 2000 dpm events).

- Analysis is performed with rho package
- Events with  $2.07 \text{ GeV} < m(\pi^+\pi^-) < 4.07 \text{ GeV}$  are selected
- Events with  $2.57 \text{ GeV} < m(\pi^+\pi^-\pi^+\pi^-) < 3.57 \text{ GeV}$  are selected
- Vertex fit is performed and best candidate in each event is selected by minimal  $\chi^2$



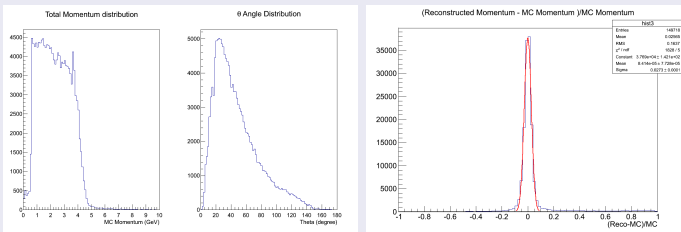
# Geometrical acceptance

Estimation is done based on MonteCarlo simulation. Track is considered to be within acceptance of detector if it creates at least one MonteCarlo hit.



# Single pion track reconstruction

## STT

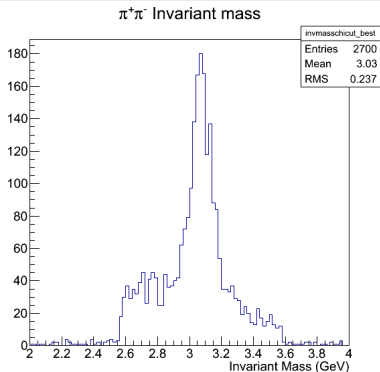


Single pion track resolution: STT 2.7%

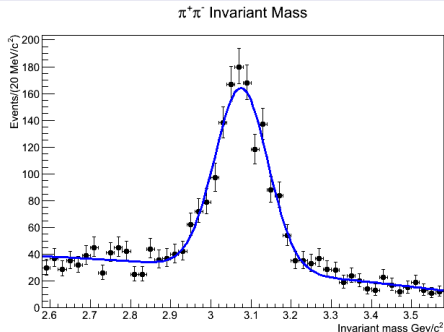


# Invariant mass distribution

## Invariant mass distribution



## Fit to the invariant mass



Mean:  $3.076 \pm 0.003$  GeV/c<sup>2</sup>

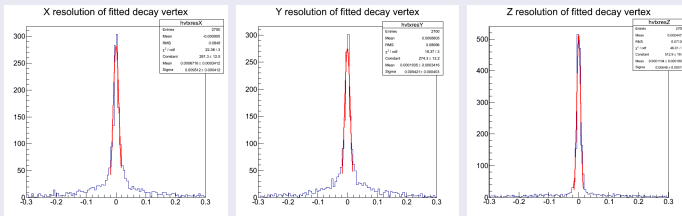
$\sigma$ :  $66.3 \pm 2.6$  MeV

$N_{\text{signal}}$ :  $1125 \pm 43$

$N_{\text{bkg}}$ :  $1378 \pm 45$

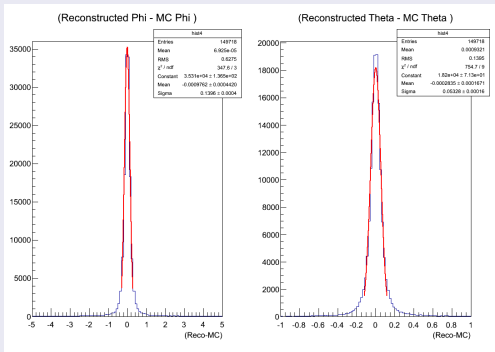
The fit is done with a gaussian convolved with a second order polynomial.

## STT



$\sigma_x$  :95.1  $\mu\text{m}$ ;  $\sigma_y$  :94.2  $\mu\text{m}$ ;  $\sigma_z$  :64.8  $\mu\text{m}$ ;

## STT



$$\sigma(\theta) = 0.140^\circ; \sigma(\phi) = 0.053^\circ$$

# STT - Resolution

