Vertex reconstruction and measurements with the PANDA Micro-Vertex-Detector

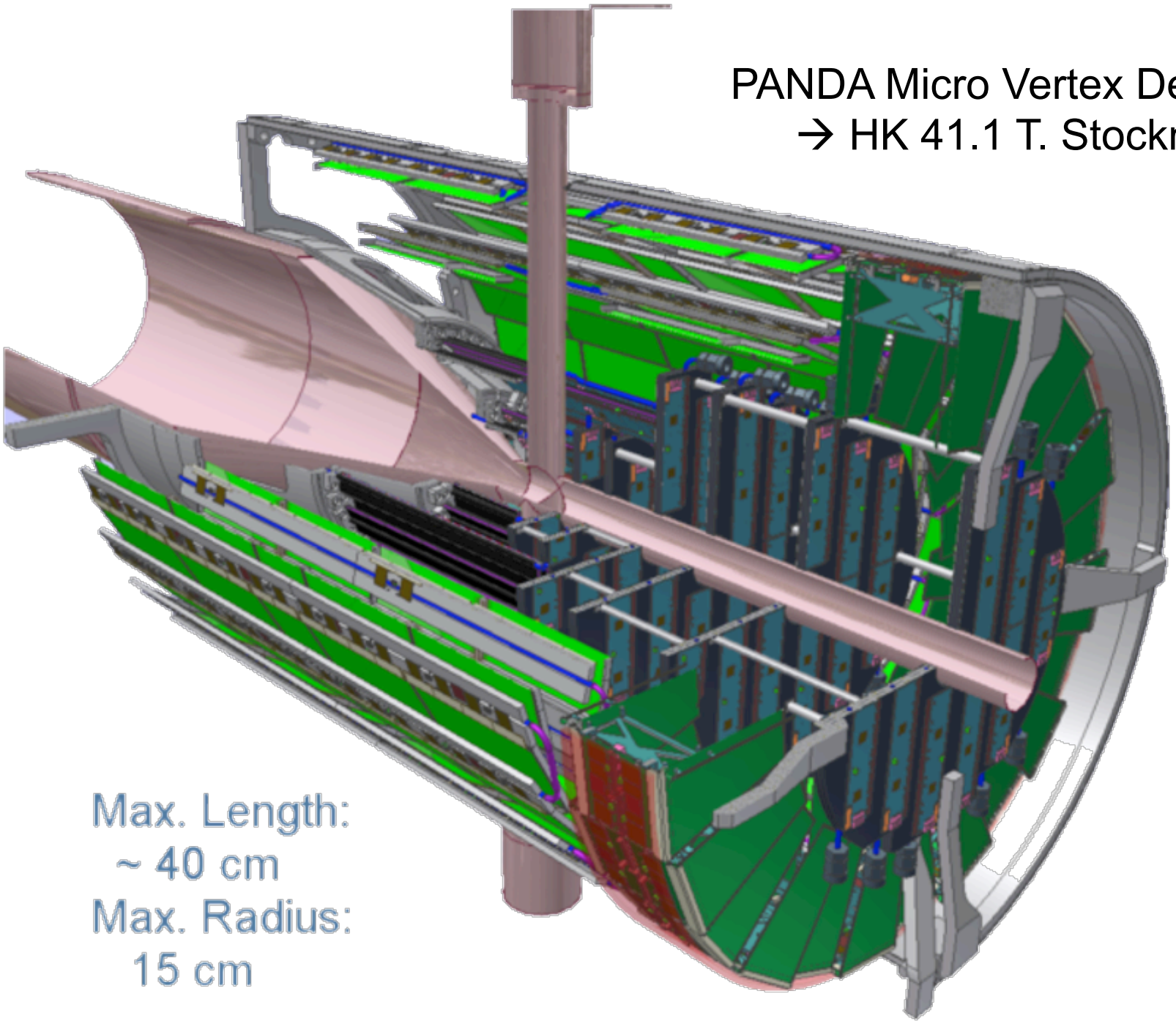
Simone Bianco, Max Becker, Kai-Thomas Brinkmann, Ralf Kliemt, Karsten Koop, Andreas Pitka, Robert Schnell, Thomas Würschig, Hans Georg Zaunick

Bundesministerium für Bildung und Forschung

DPG Spring Meeting 2012, Mainz 22.03.2012 - HK.203

Bonn-Cologne Graduate School of Physics and Astronomy

PANDA Micro Vertex Detector
→ HK 41.1 T. Stockmanns



Max. Length:
~ 40 cm
Max. Radius:
15 cm

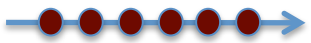
Vertex reconstruction with the PANDA Micro-Vertex-Detector

“4 Pions Scans”: 4 pions (2 π^+ and 2 π^-) propagated from a common vertex

Momentum: 1 GeV/c ϑ [10°,140°] φ [0°,360°]

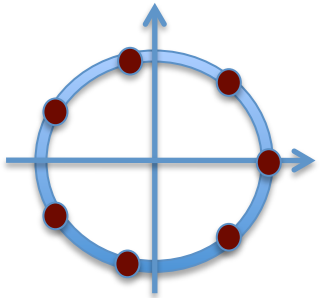
Detectors: MVD, STT, FTS

<u>Moving the common vertex:</u>



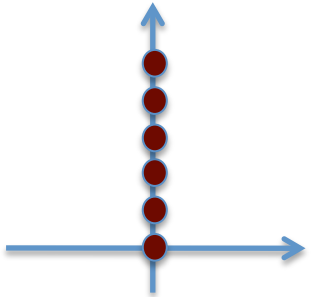
“Z – Scan”

along the z axis in [-1,+1] cm



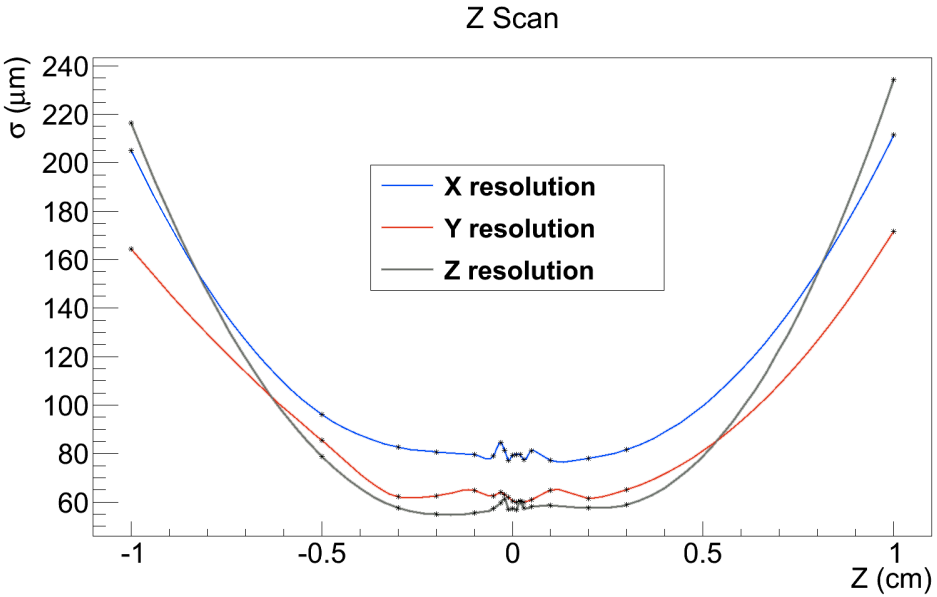
“φ – Scan”

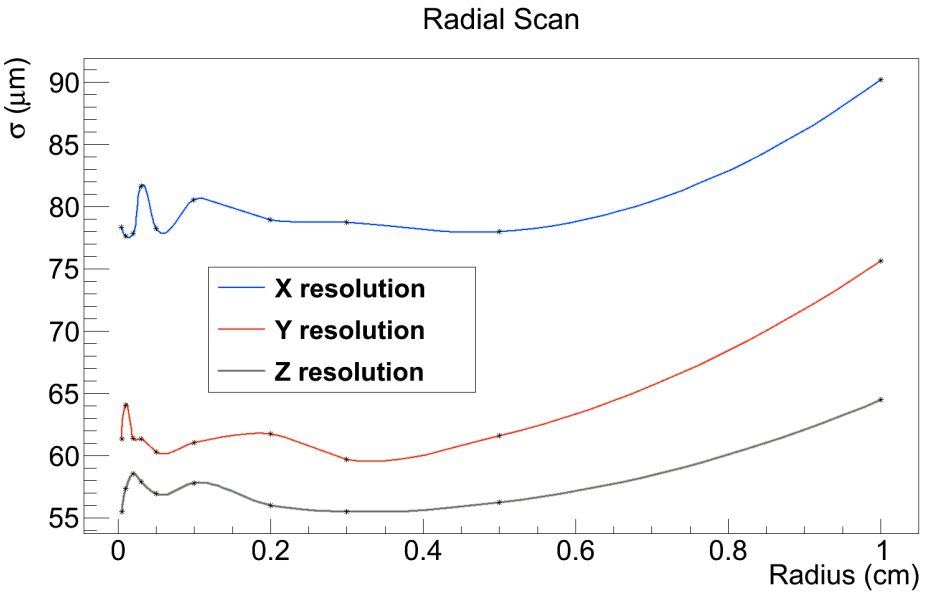
along a circle of radius 1cm in the transverse x-y plane

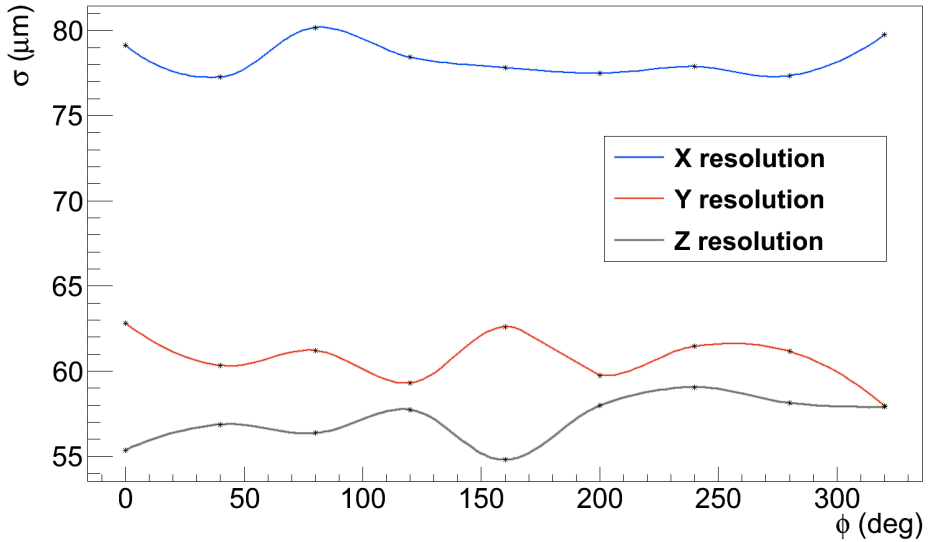


“r – Scan”

along a radius laying in the transverse x-y plane



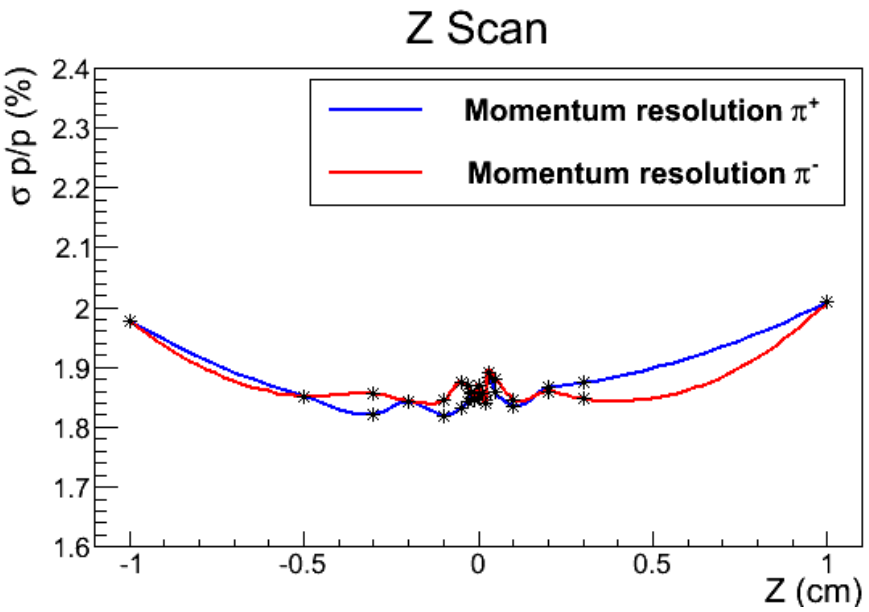


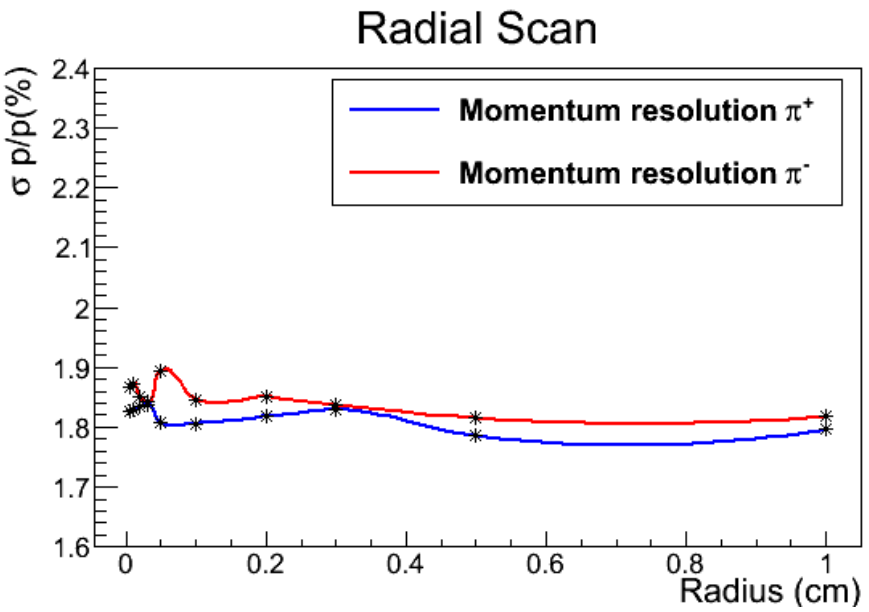


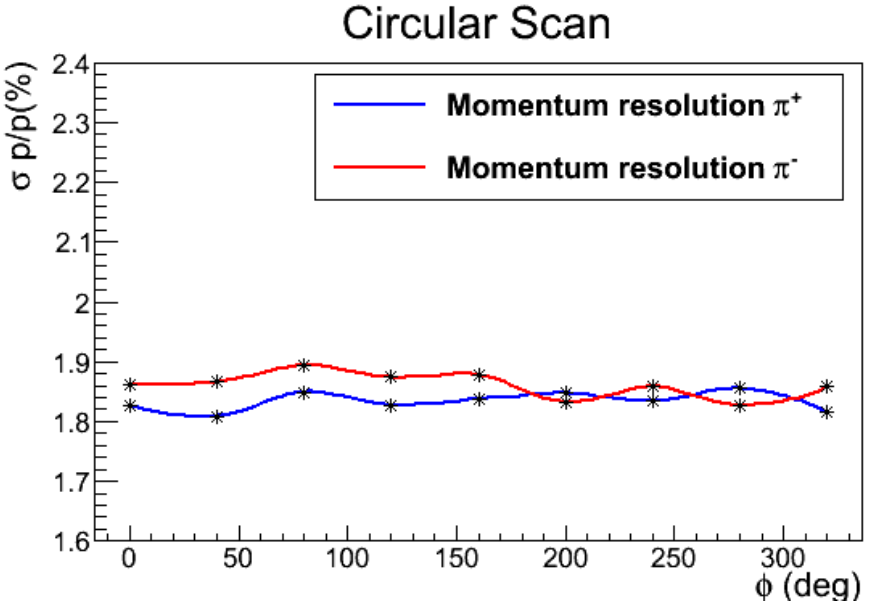
Vertices were determined with a POCA vertex finder:

→ Helices are projected to the transverse plane
→ There the POCA between couples of circles is found
→ The 3D POCA is found

The PR used here is efficient for primary vertices → max a few mm far from (0,0,0)



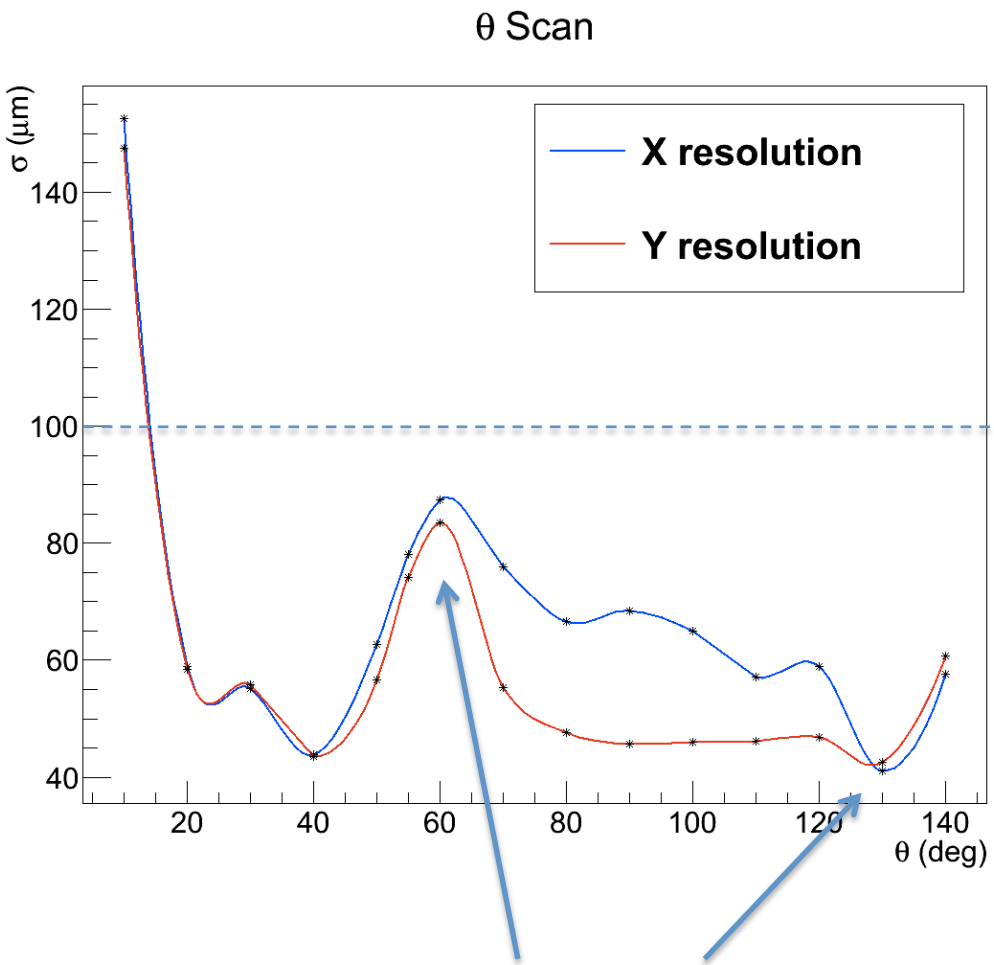


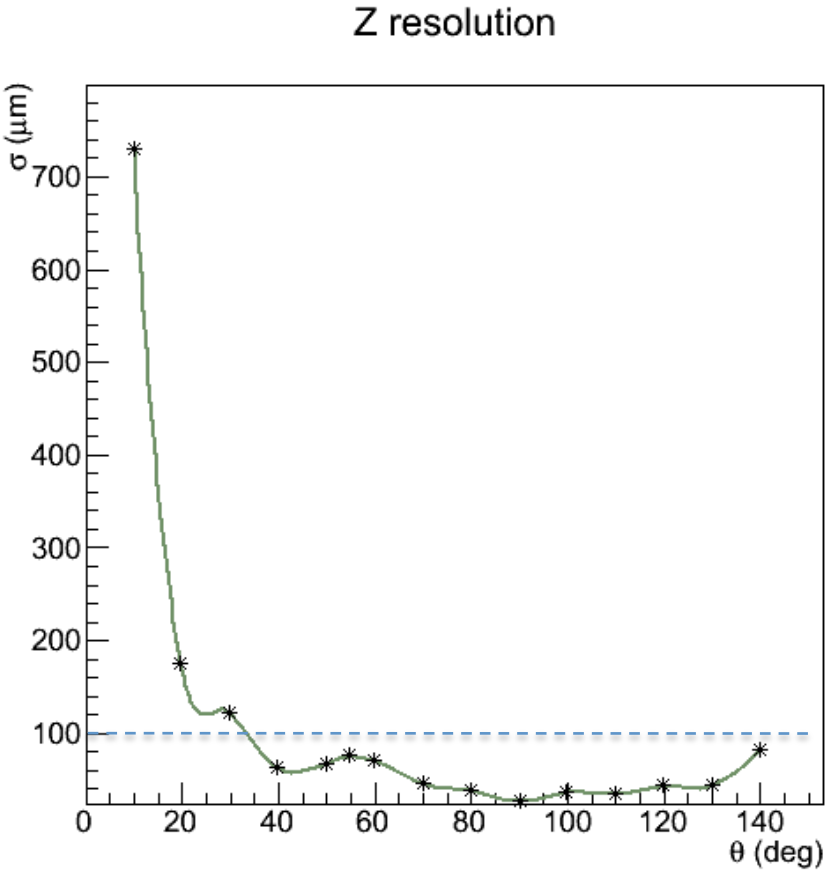


Momentum resolution really stable in all the scans both for π+ and π-.

σp/p stays in the range 1.8 - 1.9% during the performed characterization.

X-Y differences





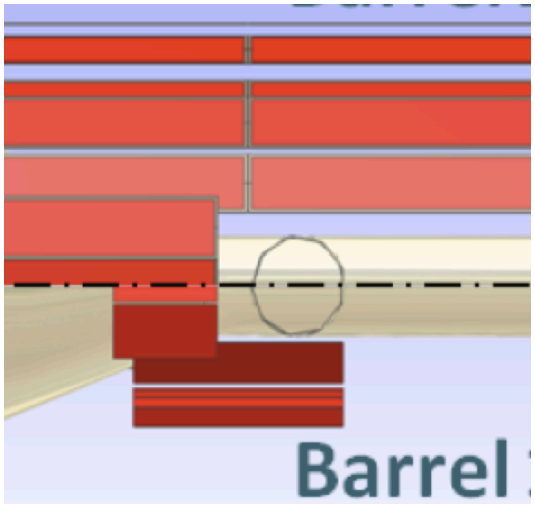
Different x-y performance of the vertexing in this range

Cross check on a possible bias introduced by the vertex finder

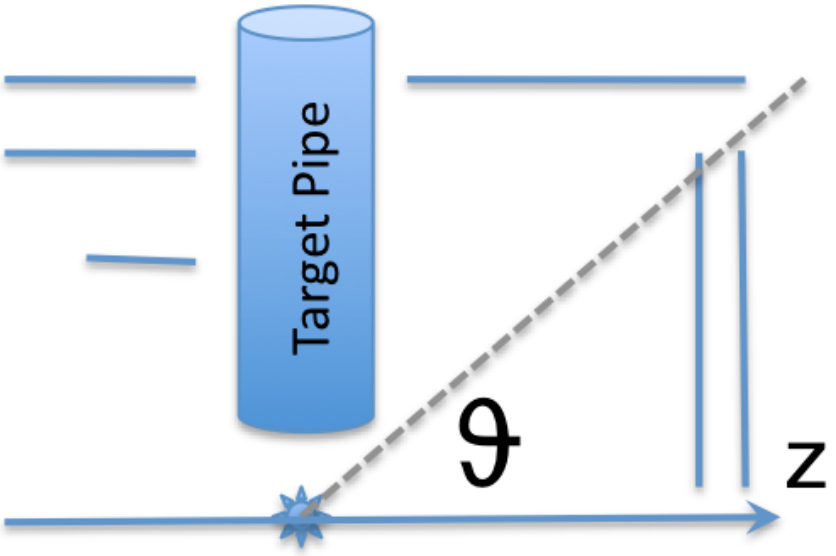
σ (μm)	No Rot	90°
x	88.3	69.4
y	69.4	88.3

Cross check on a possible bias introduced by the vertex finder

σ (μm)	No Rot	90°
x	88.3	69.4
y	69.4	88.3

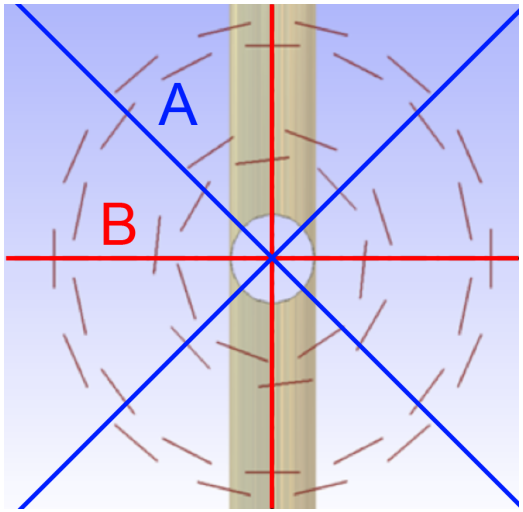


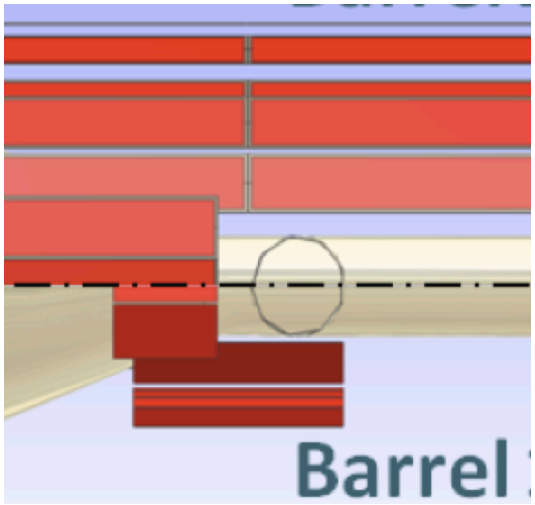
$$\alpha = \tan^{-1}\left(\frac{26.6\ \text{mm}}{14.4\ \text{mm}}\right) = 54°$$



Cross check on a possible bias introduced by the vertex finder

σ (μm)	No Rot	90°
x	88.3	69.4
y	69.4	88.3



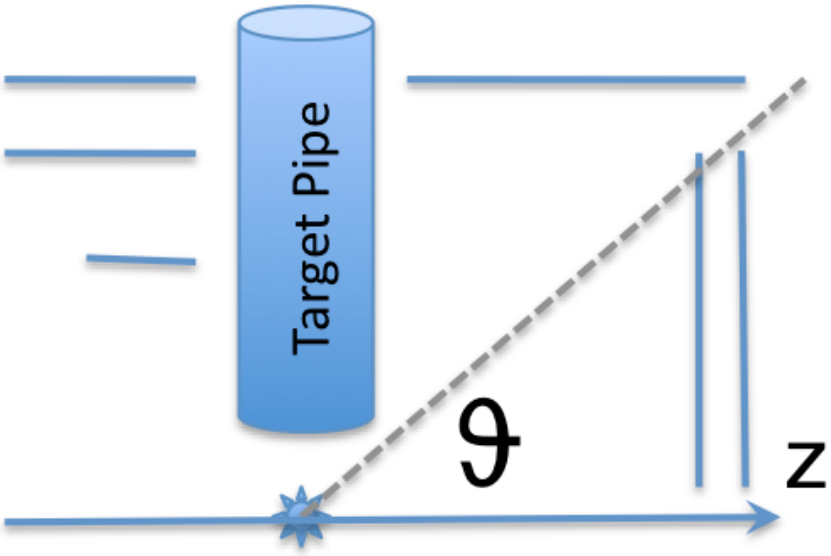


Two different schemes of the initial directions of the four pions.

ϑ fixed to 75°

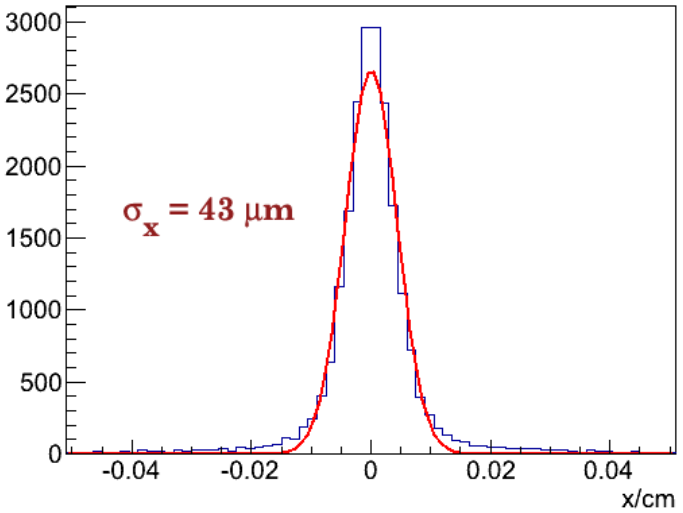
Setup	σ x (μm)	σ y (μm)
A cross, no pipes	30	30
A cross, pipes in	33	33
B cross, no pipes	103	29
B cross, pipes in	103	30
All ϕ, pipes in	67	47

$$\alpha = \tan^{-1}\left(\frac{26.6\ \text{mm}}{14.4\ \text{mm}}\right) = 54°$$

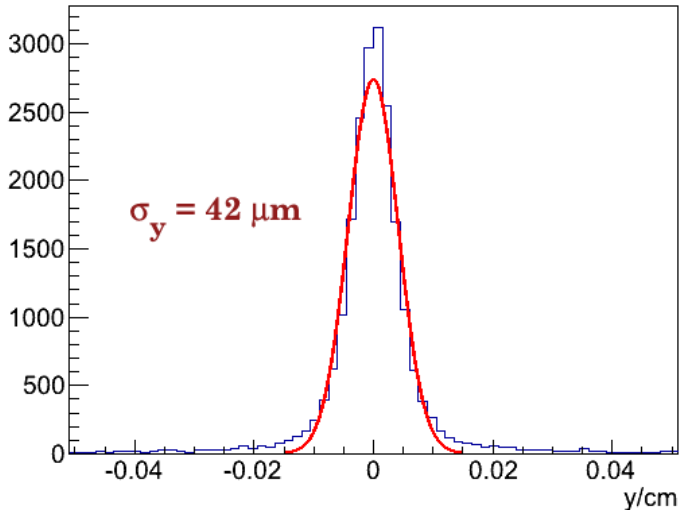


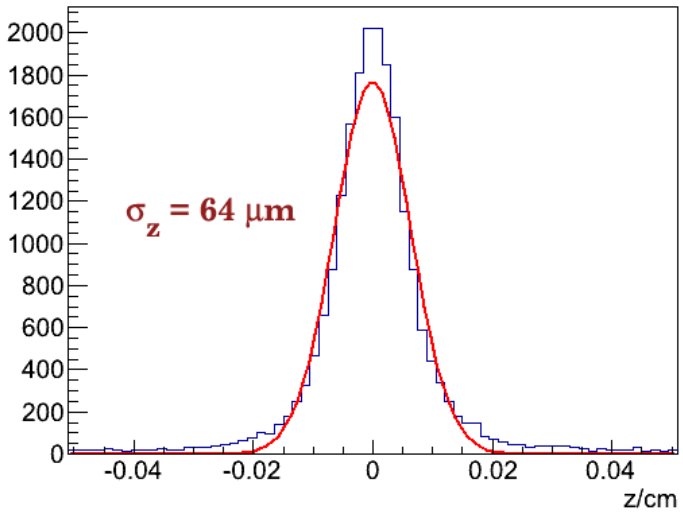
Primary Vertex Reconstruction

$$\bar{p}p \rightarrow \psi(2S) \rightarrow J/\psi\pi^+\pi^- \rightarrow \mu^+\mu^-\pi^+\pi^-$$

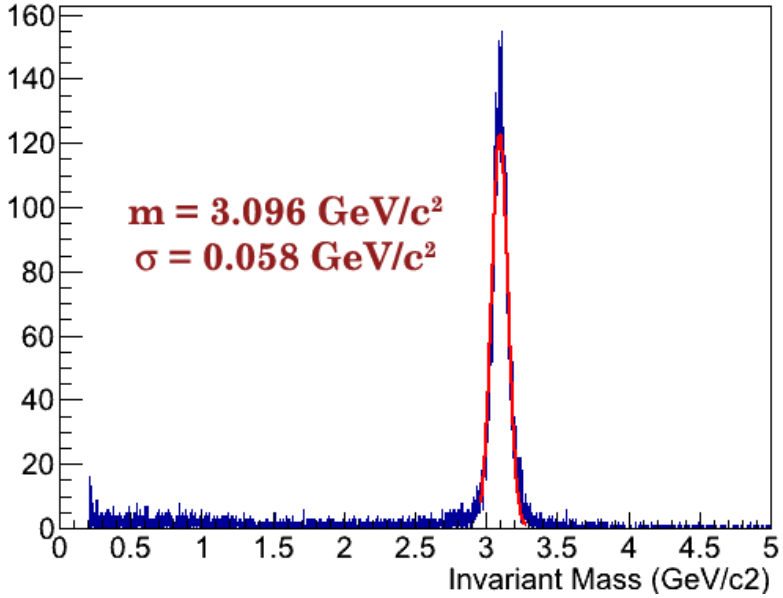


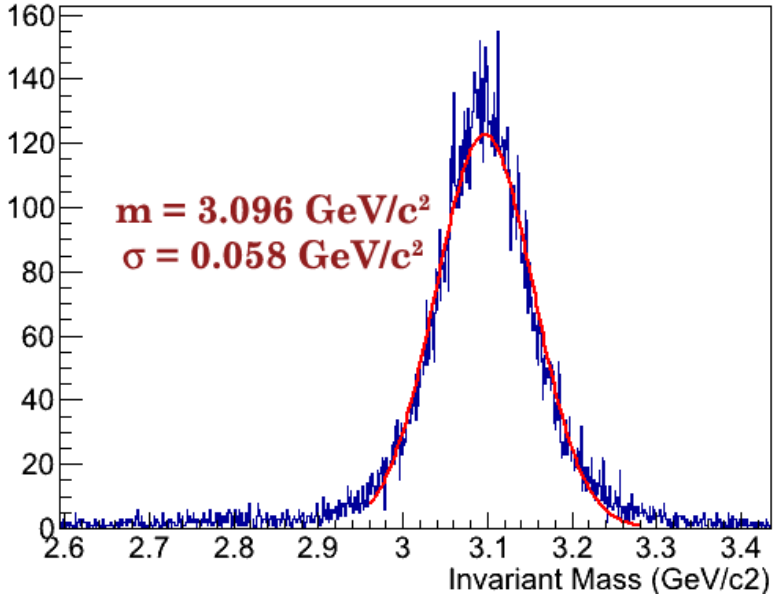
$J/\psi \rightarrow \mu^+\mu^-$ vertices



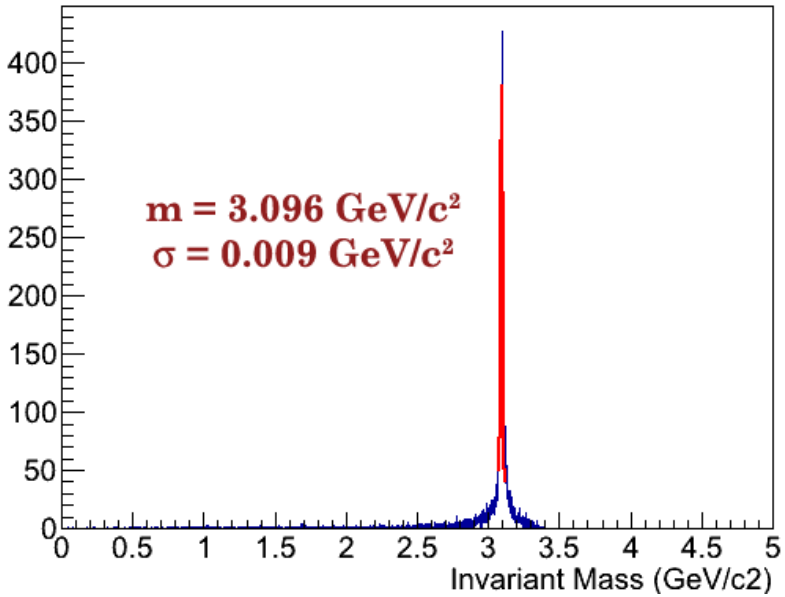


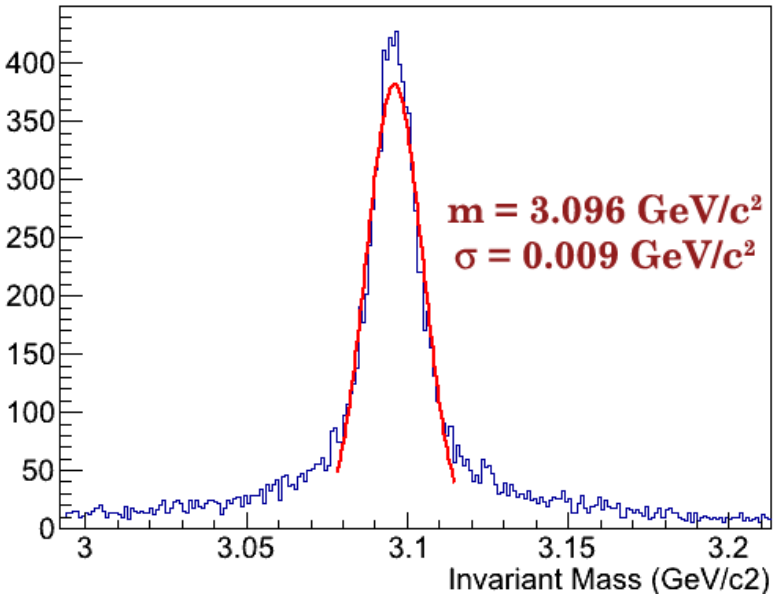
J/ψ mass



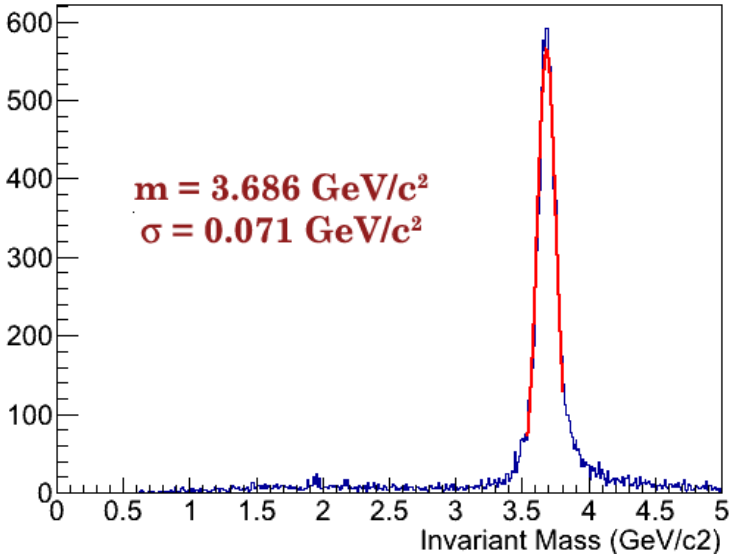


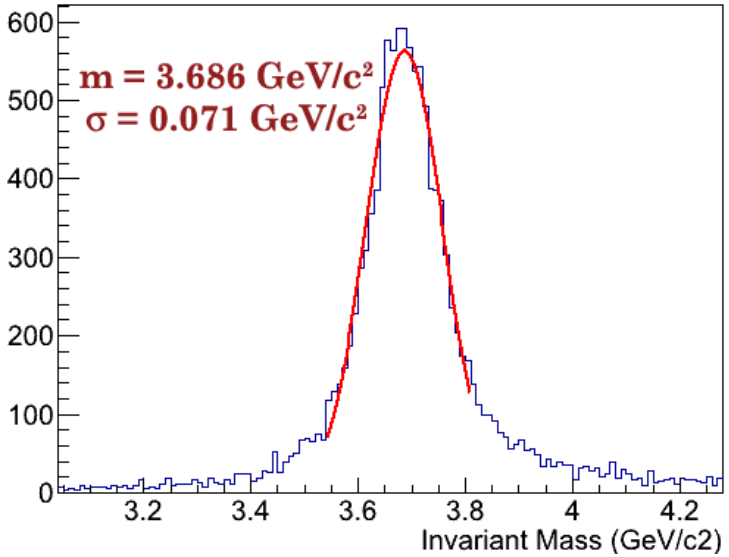
J/ψ missing mass





$\psi(2S)$ mass





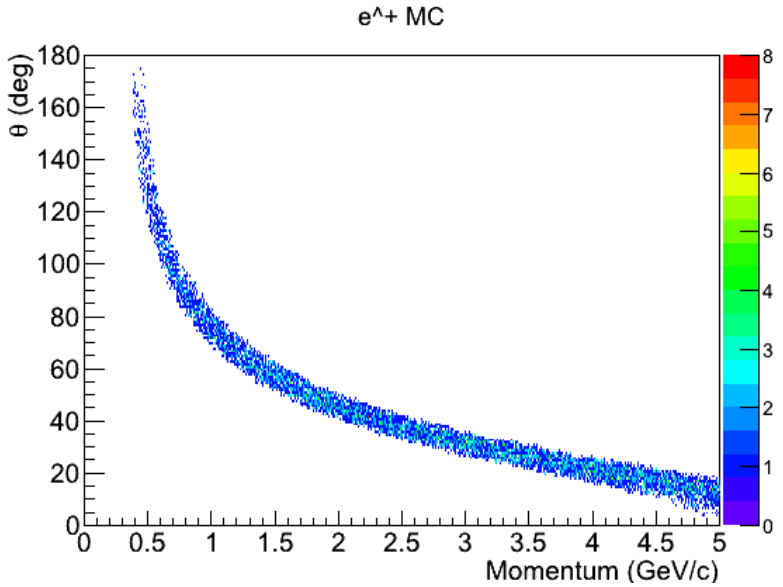
PDG:

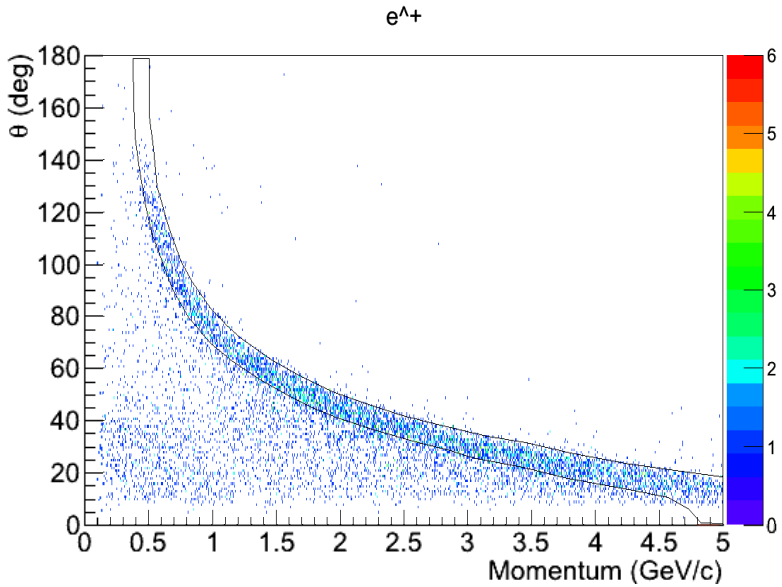
$m_{\psi(2S)} = 3.686\ \text{GeV}/c^2$

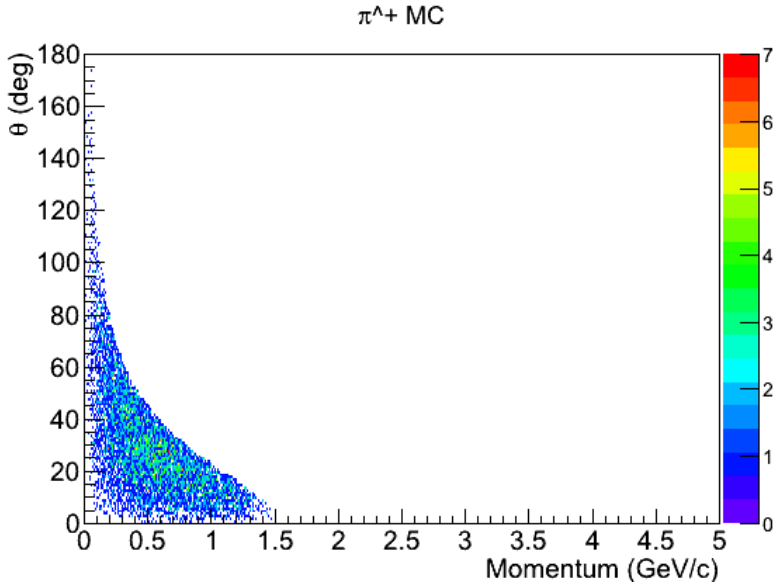
$\Gamma_{\psi(2S)} = 304\ \text{keV}/c^2$

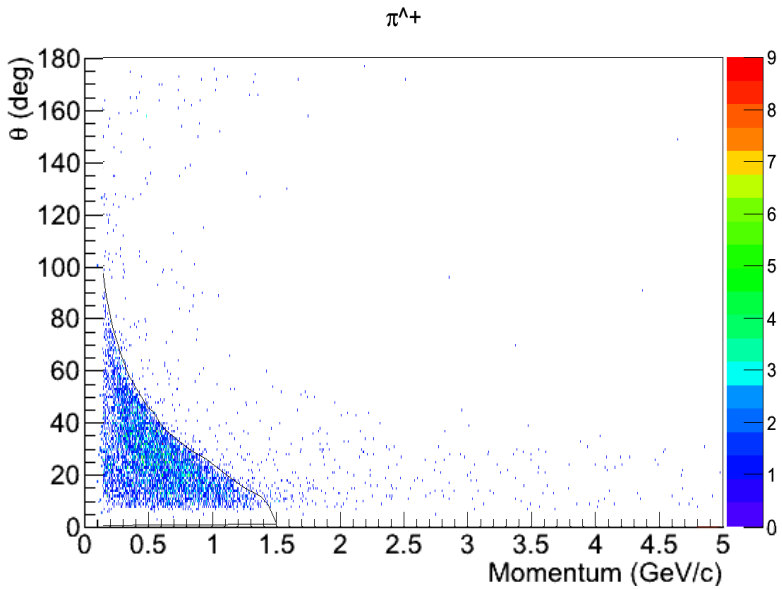
Primary Vertex Reconstruction

$$\bar{p}p \rightarrow \psi(2S) \rightarrow J/\psi\pi^+\pi^- \rightarrow e^+e^-\pi^+\pi^-$$



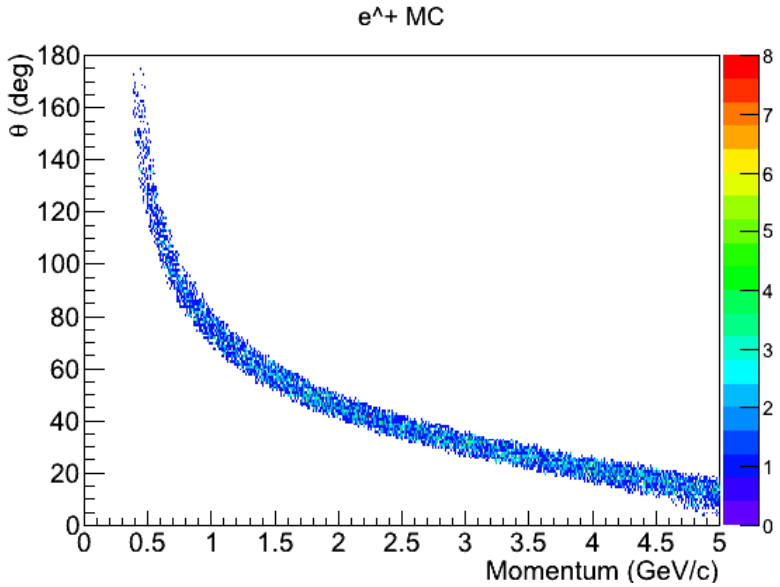


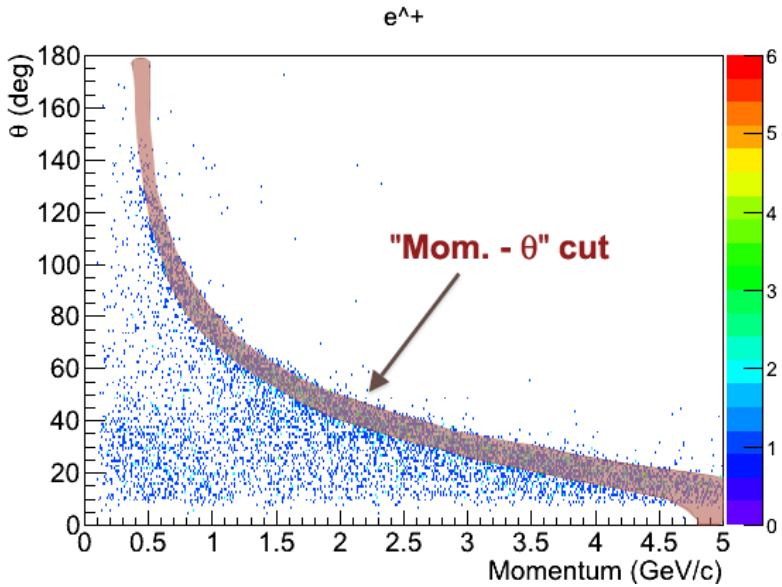


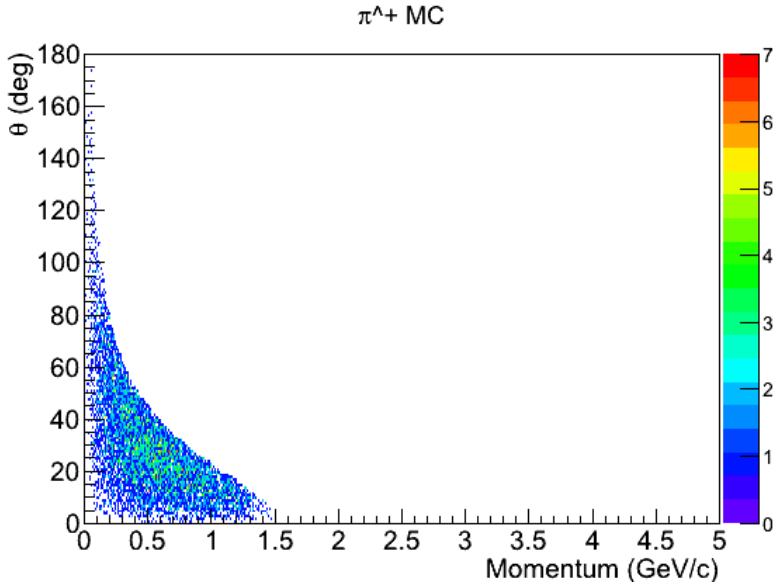


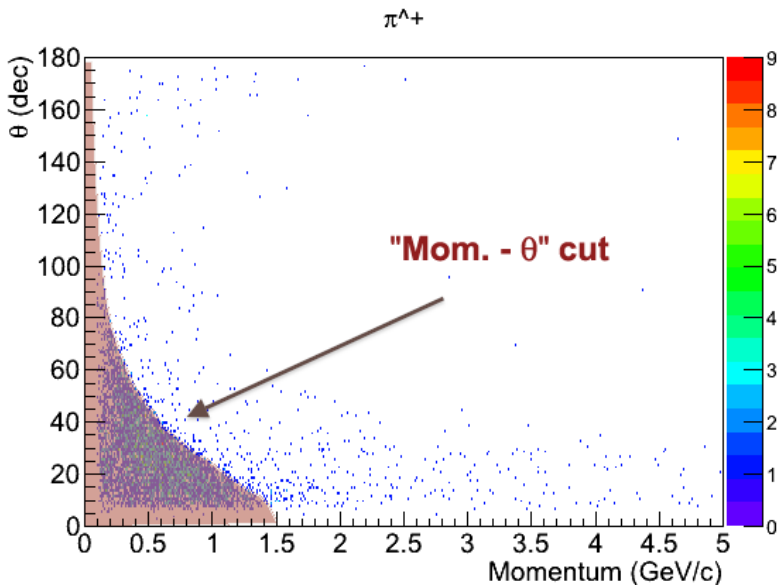
Primary Vertex Reconstruction

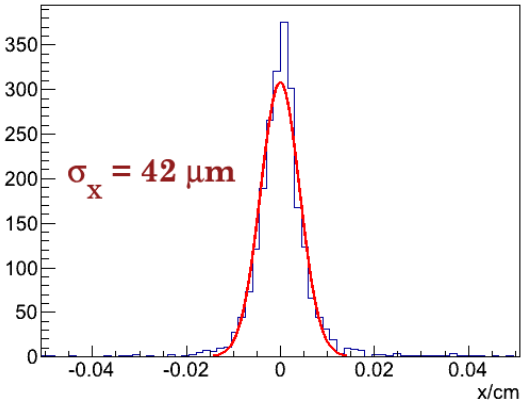
$$\bar{p}p \rightarrow \psi(2S) \rightarrow J/\psi\pi^+\pi^- \rightarrow e^+e^-\pi^+\pi^-$$

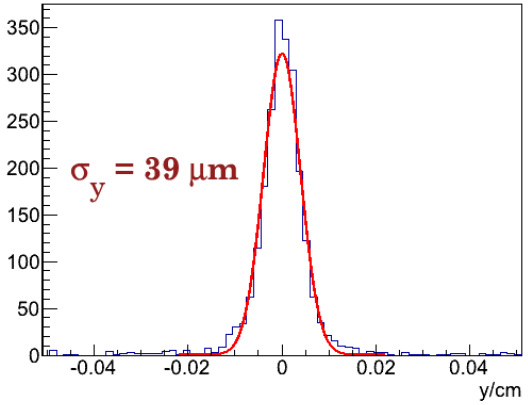


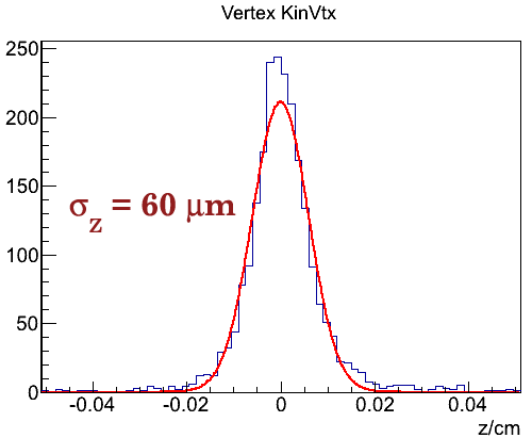




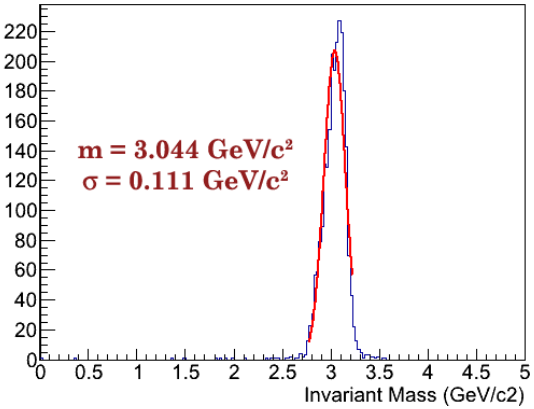


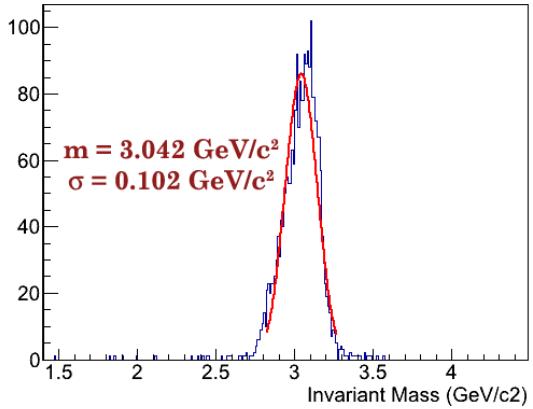




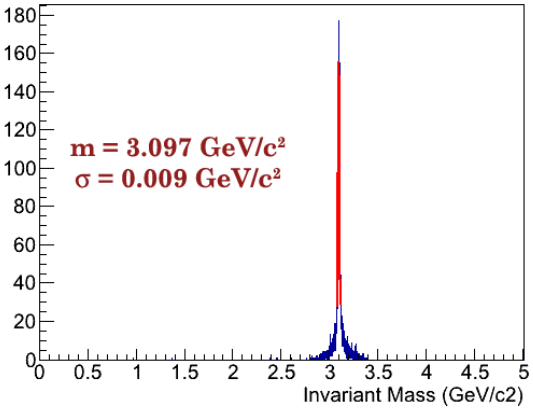


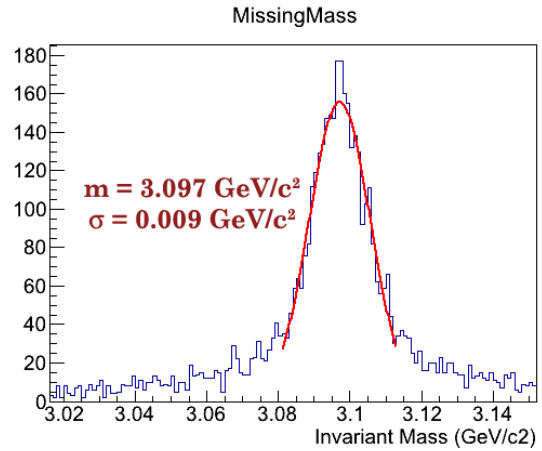
$J/\psi \rightarrow \pi^+\pi^-$ vertices



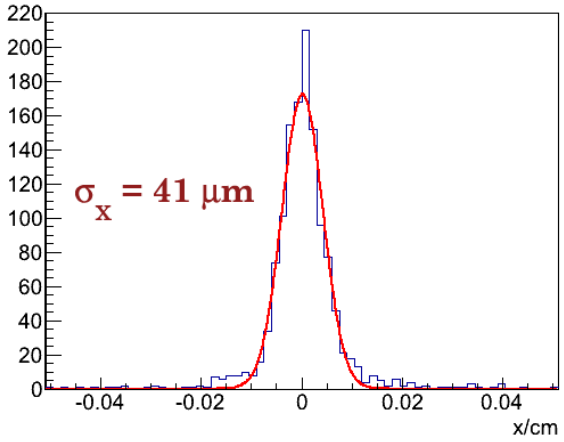


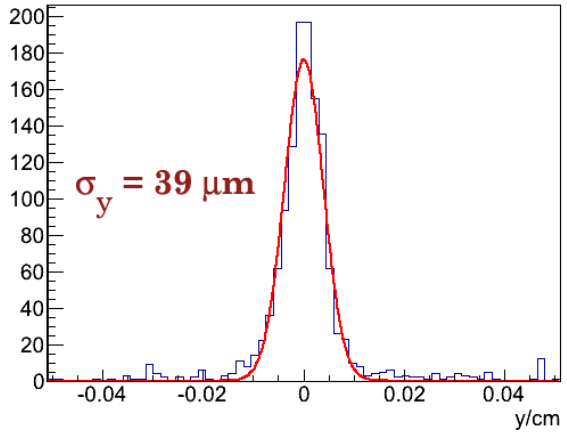
J/ψ mass

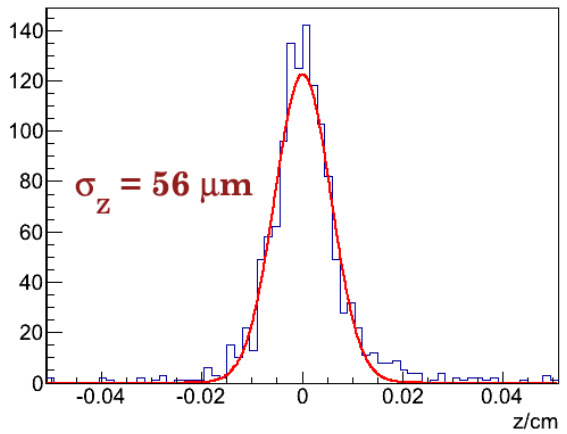




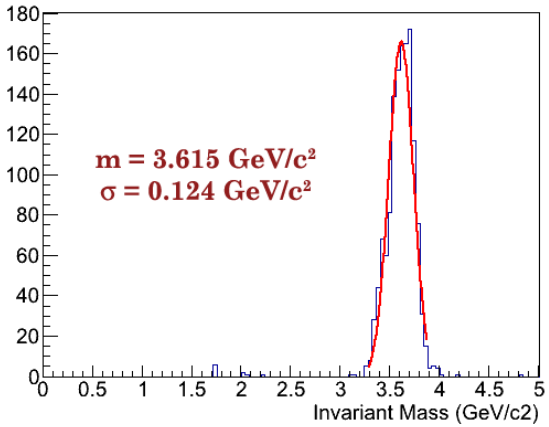
J/ψ missing mass







ψ(2S) vertices



PDG:

$m_{\psi(2S)} = 3.686\ \text{GeV}/c^2$

$\Gamma_{\psi(2S)} = 304\ \text{keV}/c^2$

Thanks for your attention!