Λ RECONSTRUCTION to OPTIMIZE the PANDA MICRO-VERTEX-DETECTOR (MVD)

a Status Report of my Diploma Work

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Structure

Motivation

Monte Carlo Studies

Detector Simulations

- Λ Reconstruction
- $\overline{\Lambda}$ Reconstruction

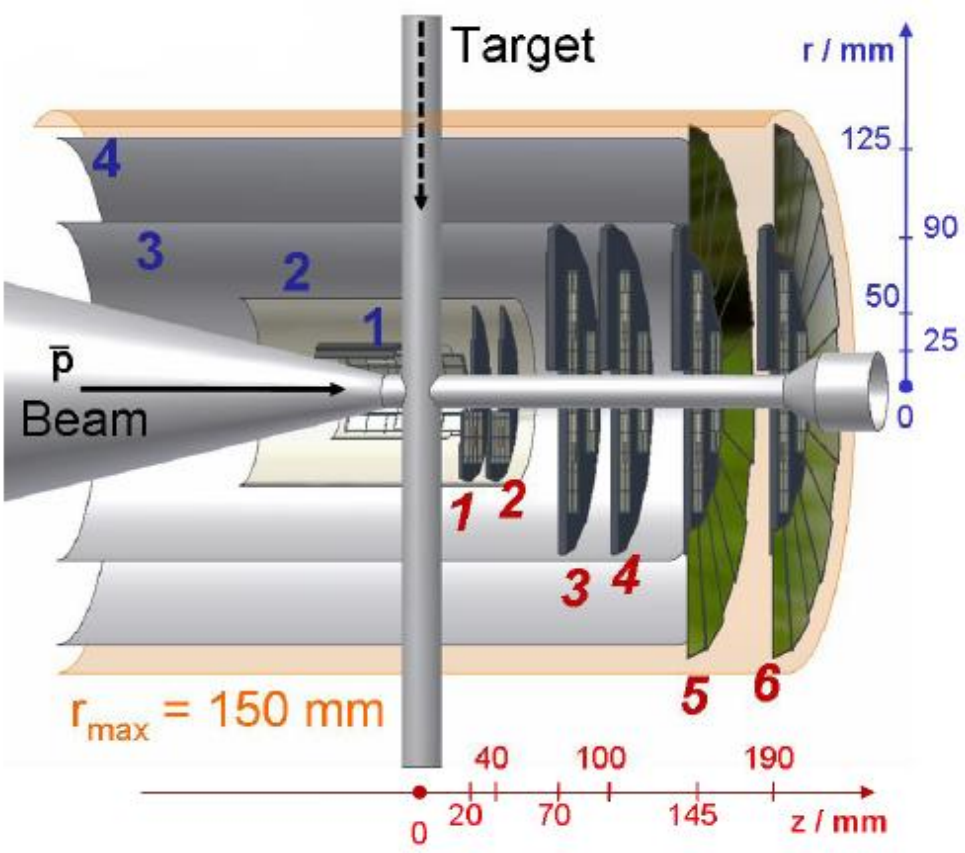
Summary/Outlook

- Four barrel layers
- Six disk layers

$$\overline{P} + P \longrightarrow \Lambda + \overline{\Lambda}$$

$$\Lambda \longrightarrow p + \pi^-$$

$$\overline{\Lambda} \longrightarrow \overline{p} + \pi^+$$



Additional forward discs?

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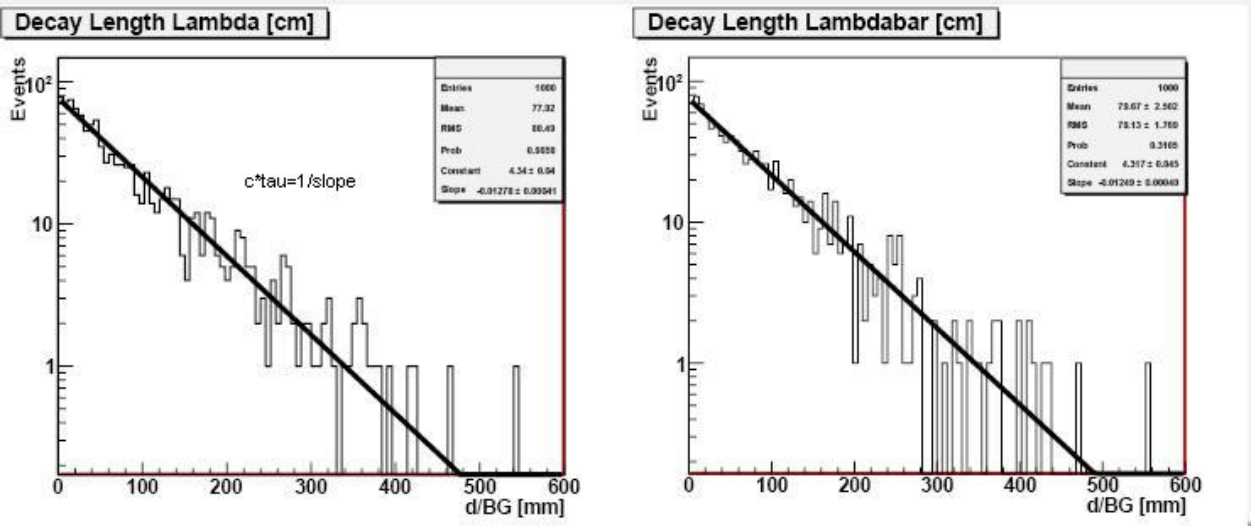
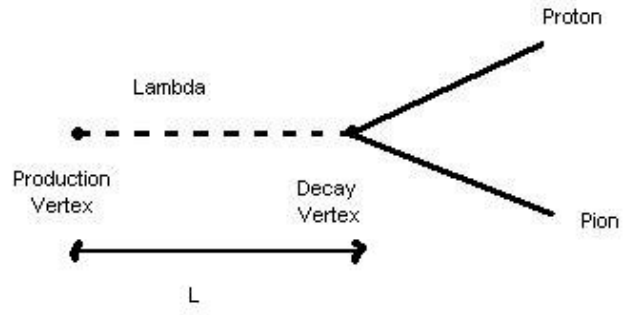
Decay Length





$$(c * \tau)_{\Lambda} = 7.826 \pm 0.2511 \text{ cm}$$

$$(c * \tau)_{\overline{\Lambda}} = 8.007 \pm 0.2574 \text{ cm}$$

Literature value is 7.89 cm

$$c * \tau = L \frac{M_{\Lambda}}{P_{\Lambda}}$$

$$= \frac{L}{\beta\gamma}$$

$$= \frac{1}{slope}$$

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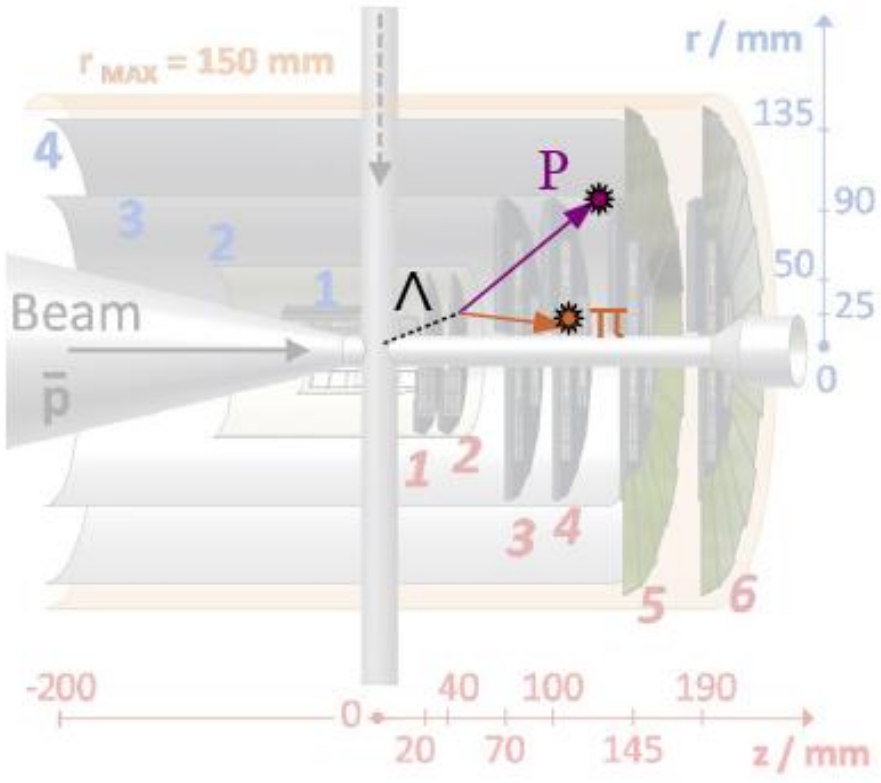
Back Propagation Method

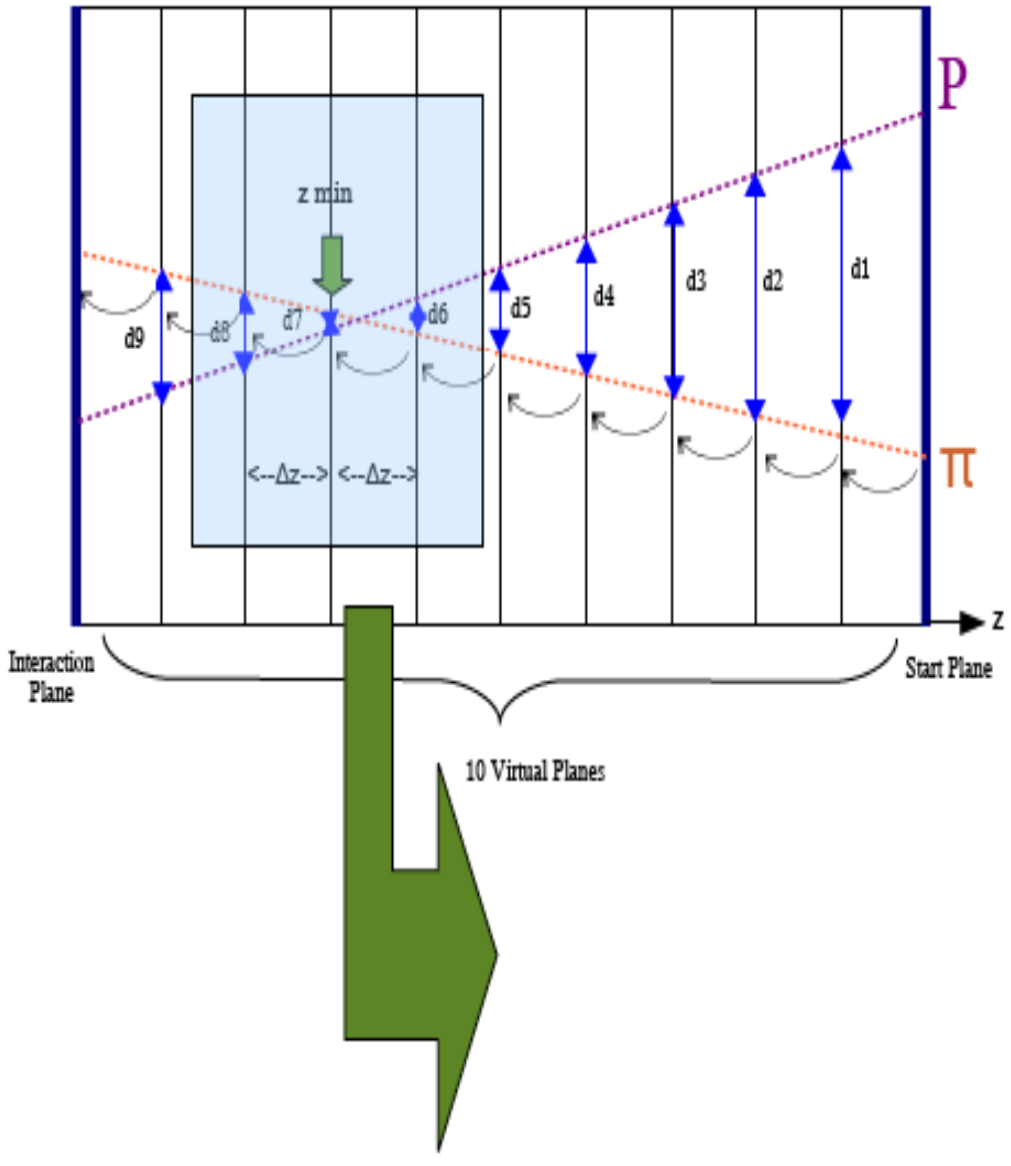
$$P + \overline{P} \longrightarrow \Lambda + \overline{\Lambda} \longrightarrow P + \pi^- + \overline{P} + \pi^+$$

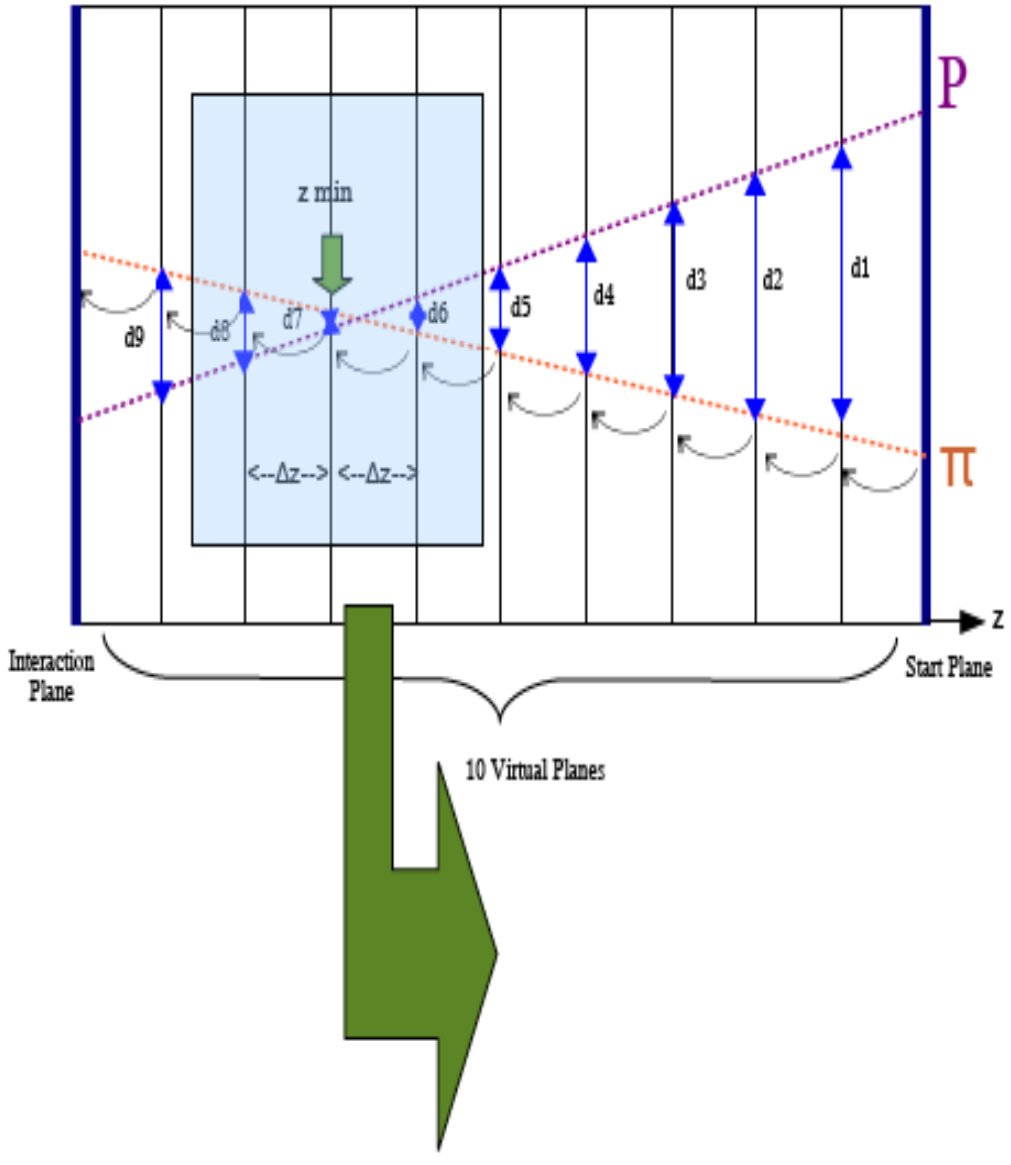
Case1:

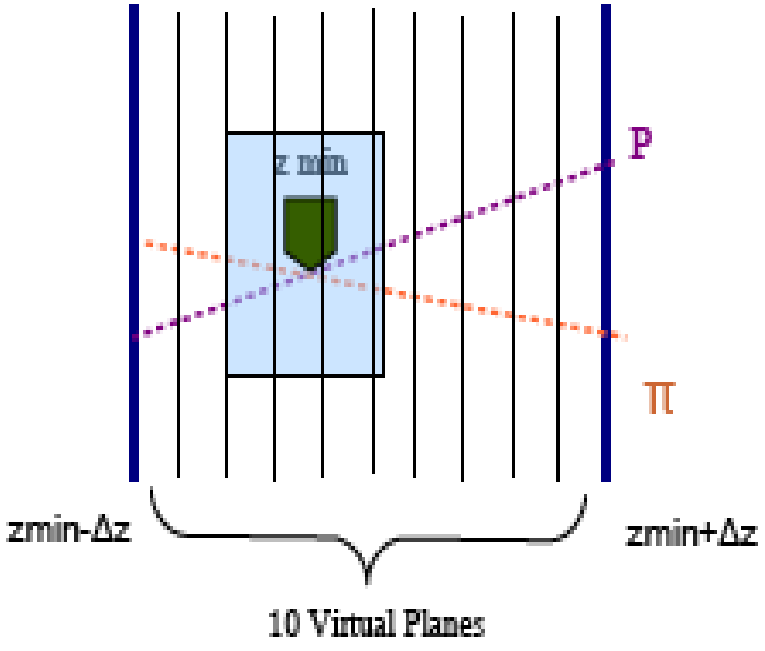
$$P^P_{Lon} > 0$$

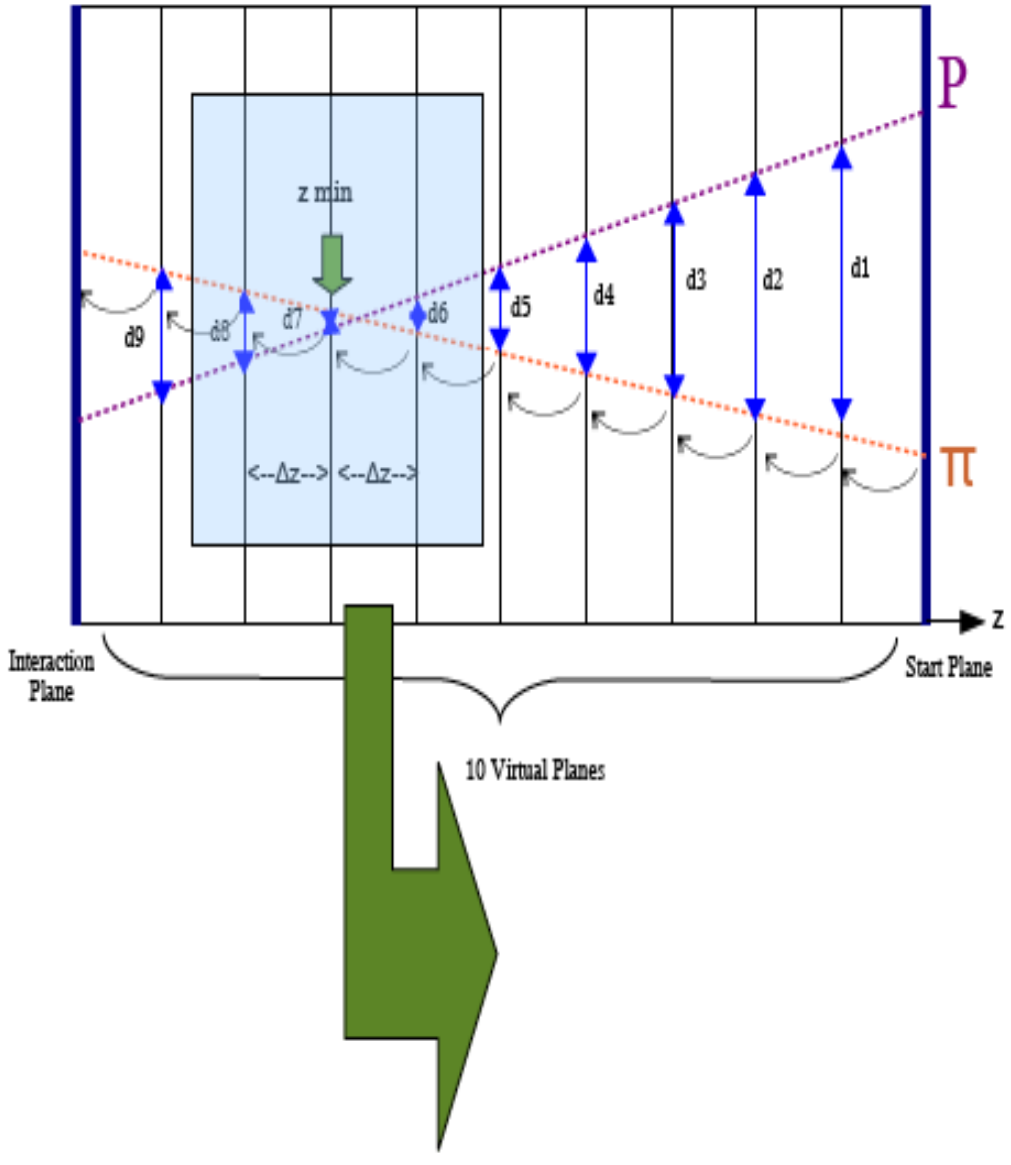
$$P^{\pi^-}_{Lon} > 0$$

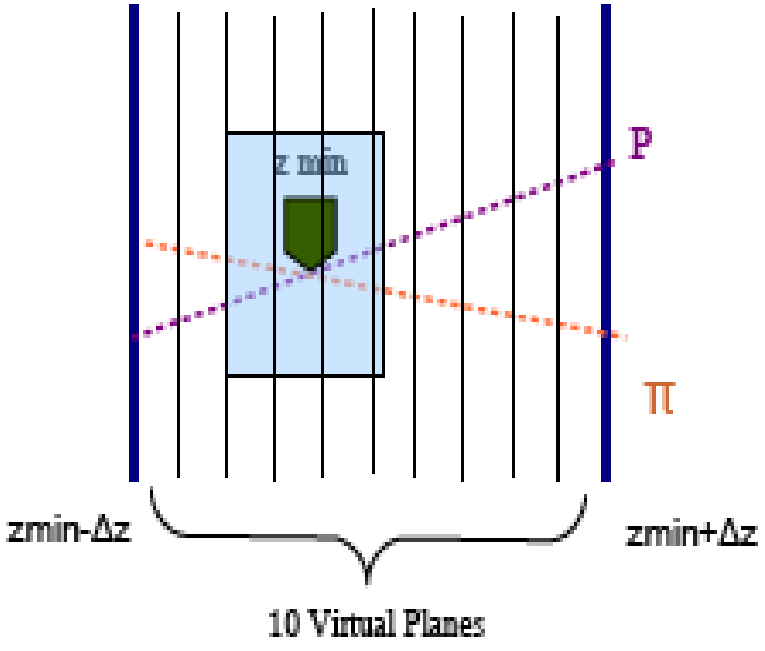



p
π
z min
d1
d2
d3
d4
d5
d6
d7
d8
d9
<--Δz--> <--Δz-->
z
Interaction Plane
Start Plane
10 Virtual Planes

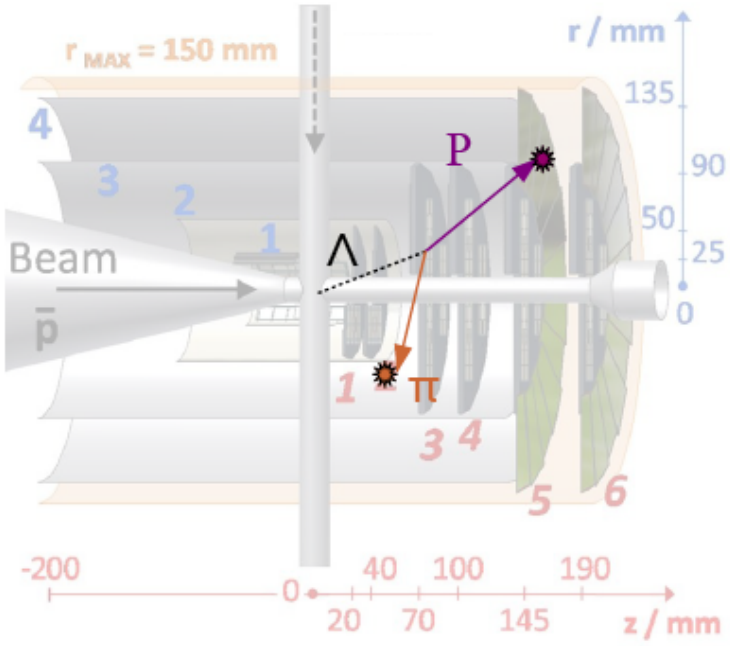

p
π
z min
d9
d8
d7
d6
d5
d4
d3
d2
d1
<--Δz--> <--Δz-->
z
Interaction Plane
Start Plane
10 Virtual Planes


z min
p
π
zmin-Δz
zmin+Δz
10 Virtual Planes


p
π
z min
d9
d8
d7
d6
d5
d4
d3
d2
d1
<--Δz--> <--Δz-->
z
Interaction Plane
Start Plane
10 Virtual Planes


z min
p
π
zmin-Δz
zmin+Δz
10 Virtual Planes

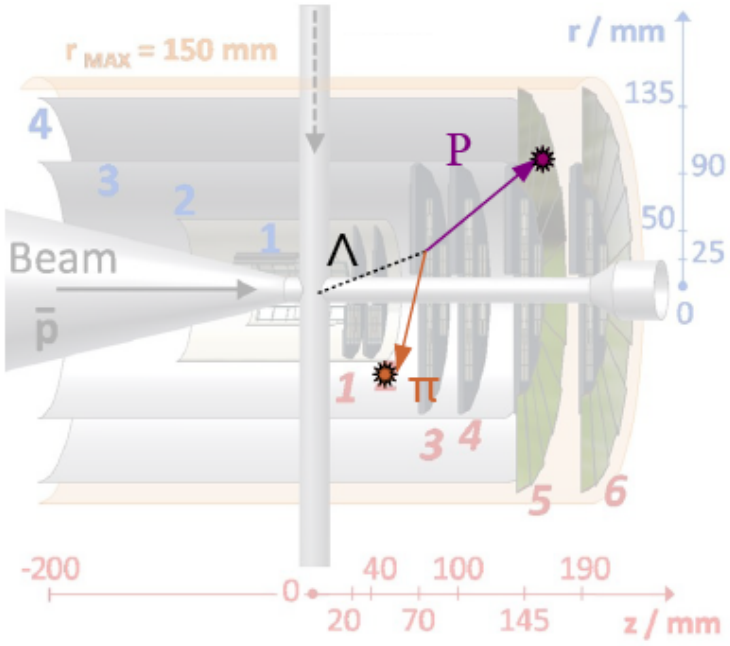
Case2:

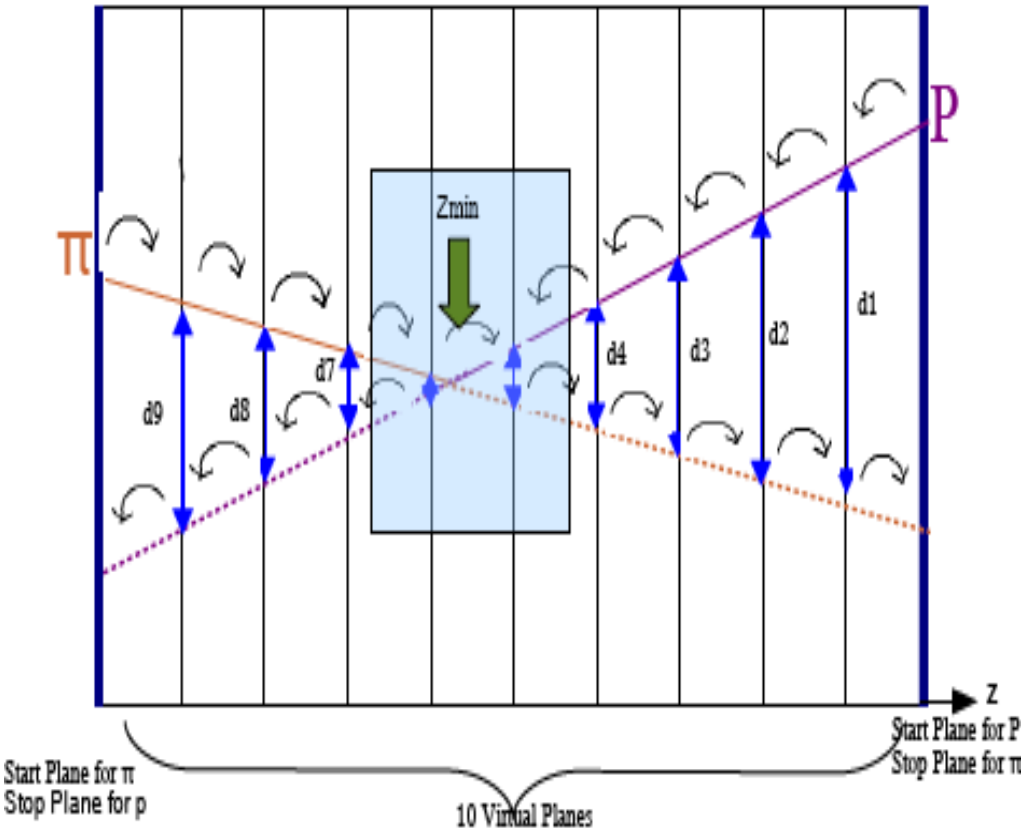


$$P^{P}_{Lon} > 0$$

$$P^{\pi^-}_{Lon} < 0$$

Case2:

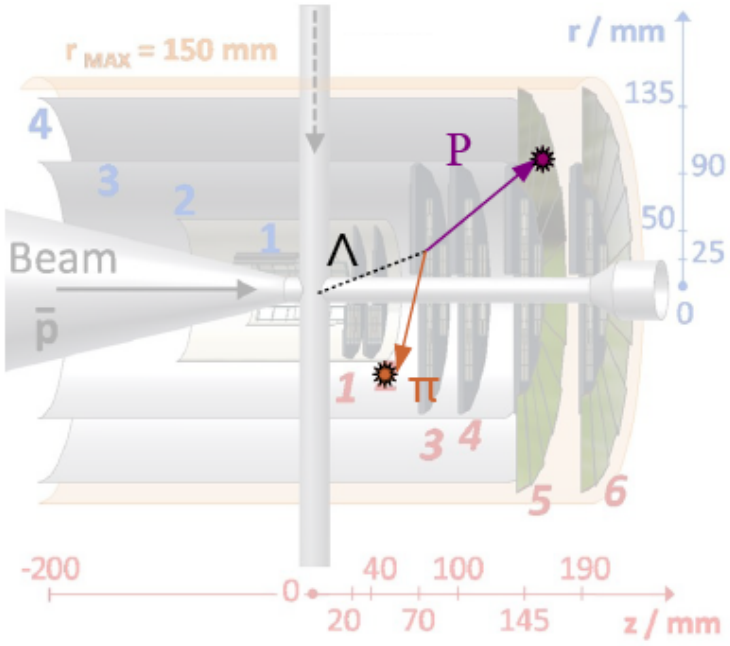


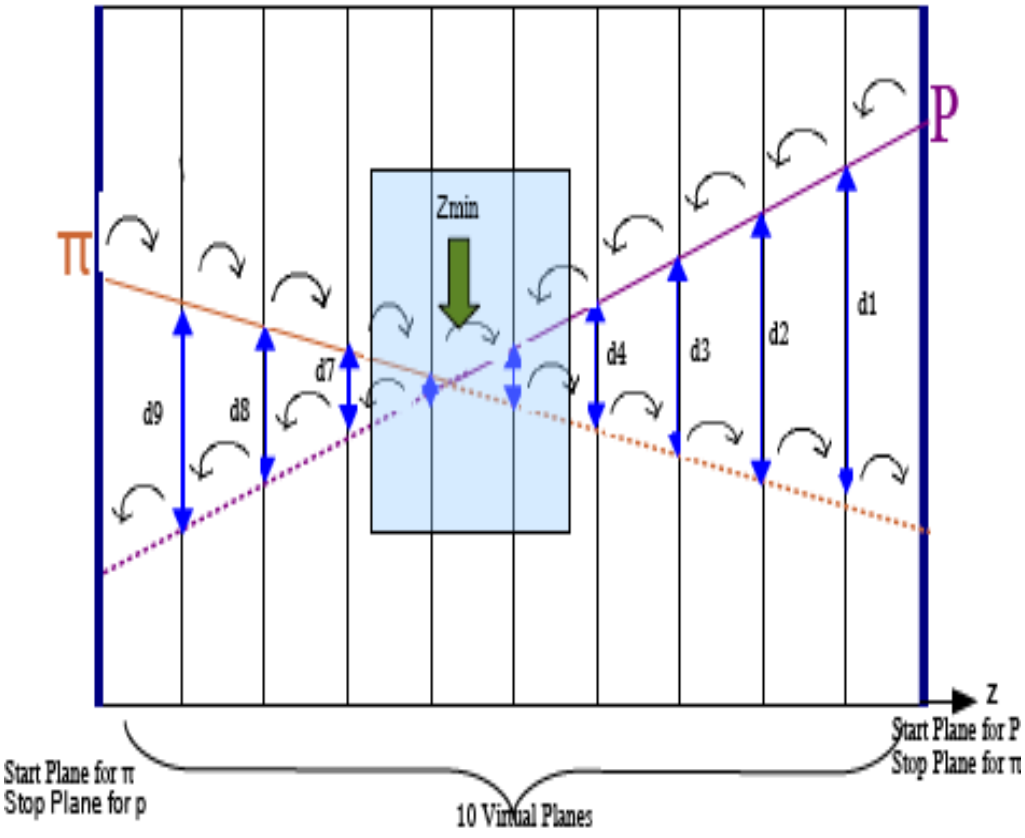


$$P^{P}_{Lon} > 0$$

$$P^{\pi^-}_{Lon} < 0$$

Case2:



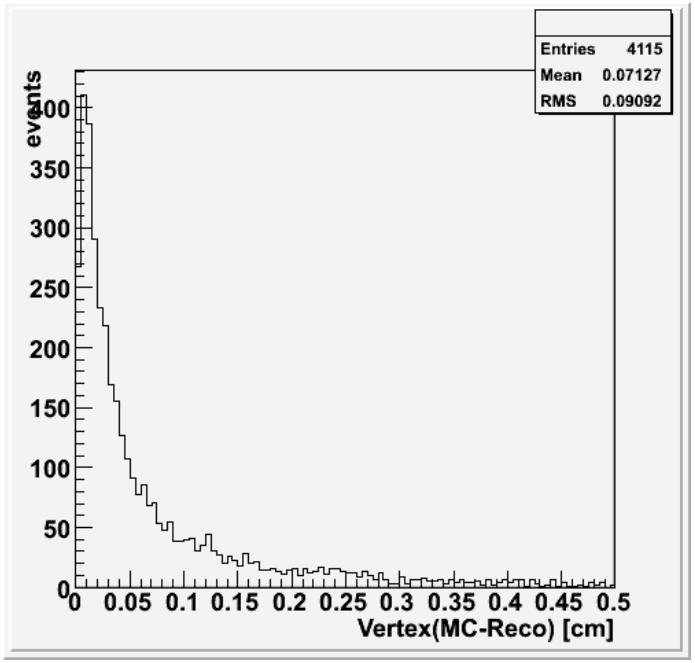


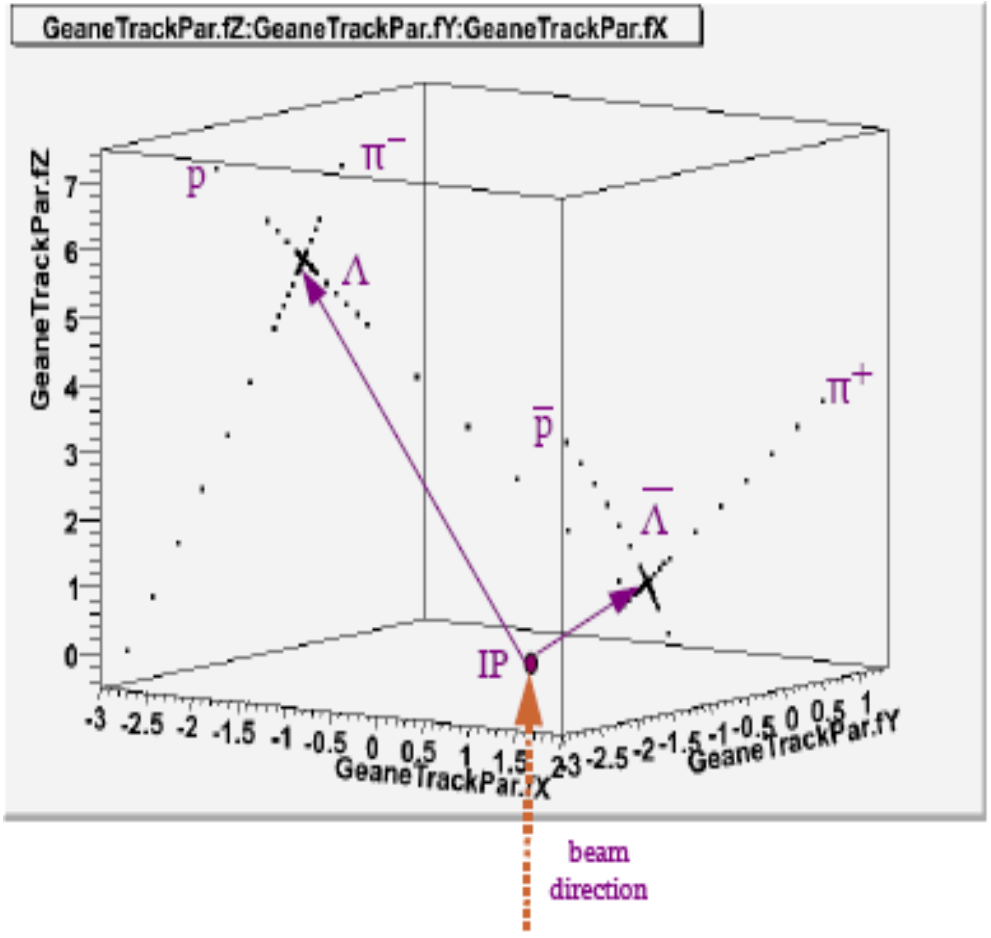
$$P^{P}_{Lon} > 0$$

$$P^{\pi^-}_{Lon} < 0$$

Only for one event

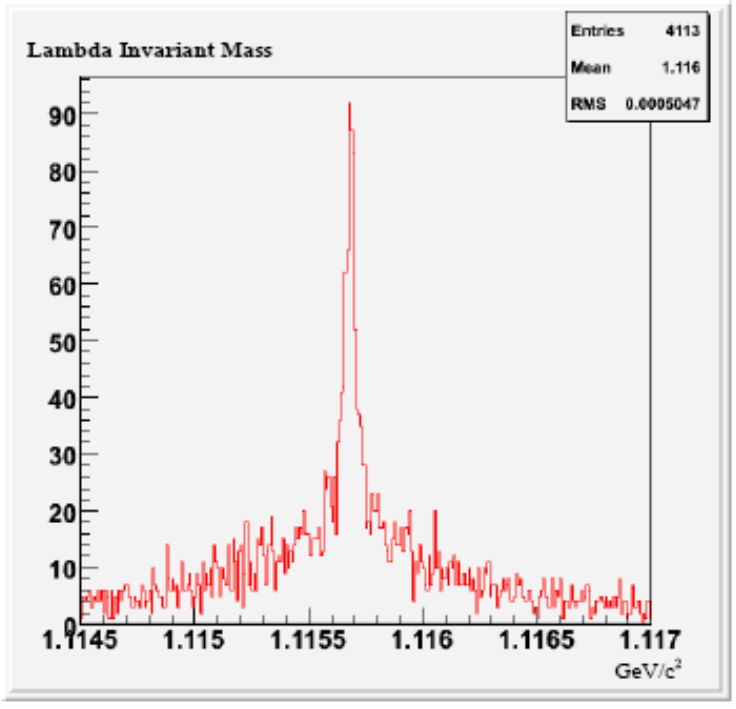
- Tracks of decay particles
- Vertices of Λ and $\overline{\Lambda}$
- Higher density of points close to the vertex

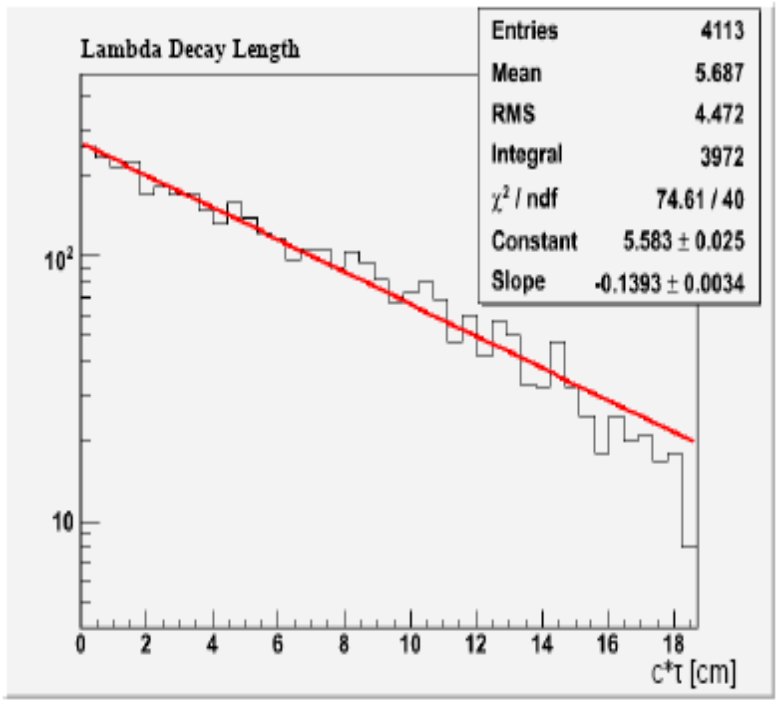




← Vertex Resolution ≈ 250 μm

Λ Reconstruction @ 2 GeV/c with MC-Truth (phase space)





$M_\Lambda = 1.11567 \pm 0.00005 GeV/c^2$

Literature value is 1.1157 GeV/c^2

$(c * \tau)_\Lambda = 7.18 \pm 0.18$ cm

Literature value is 7.89 cm

Efficiency is 82%

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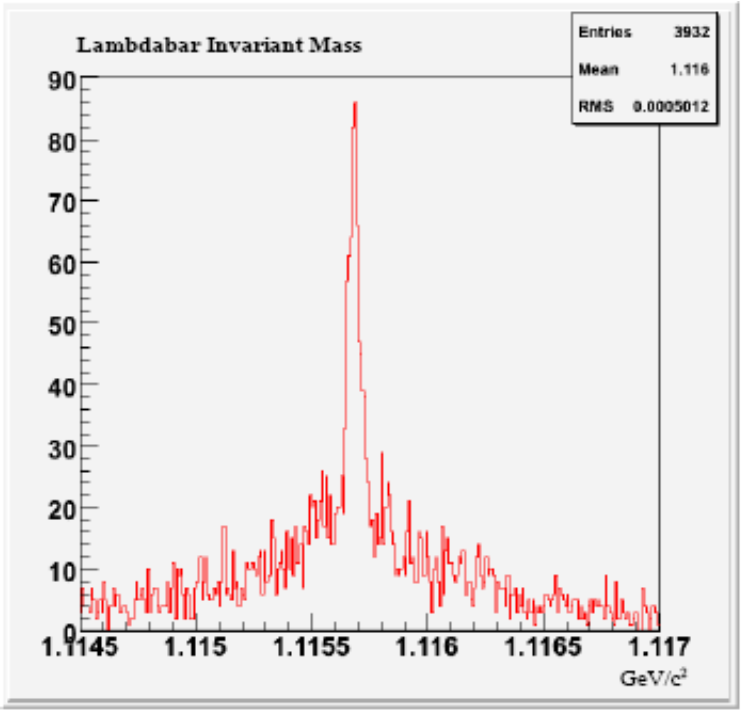
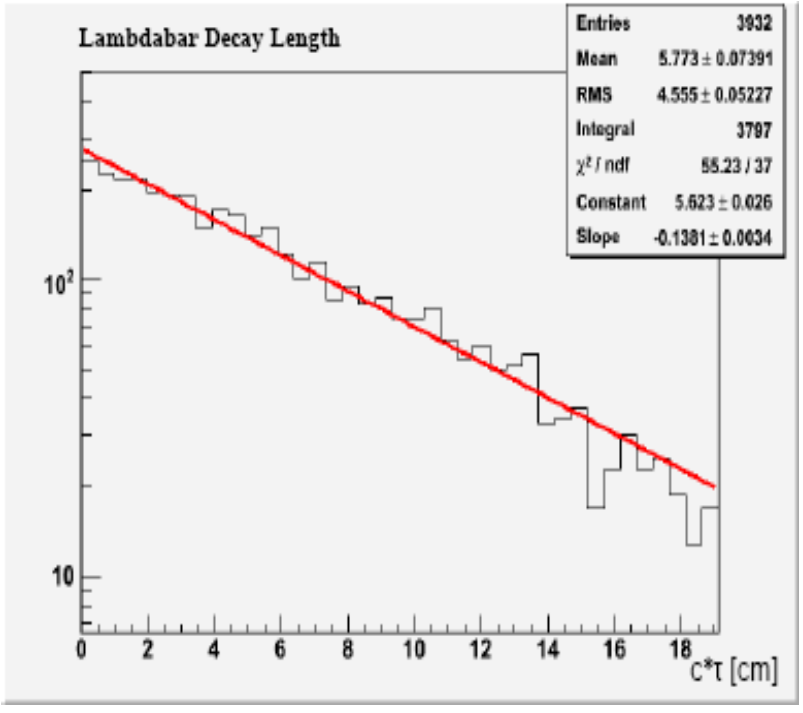
$\overline{\Lambda}$ Reconstruction @ 2 GeV/c with MC-Truth (phase space)





$M_{\overline{\Lambda}} = 1.11568 \pm 0.00006 GeV/c^2$

Literature value is 1.1157 GeV/c^2

$(c * \tau)_{\overline{\Lambda}} = 7.24 \pm 0.18$ cm

Literature value is 7.89 cm

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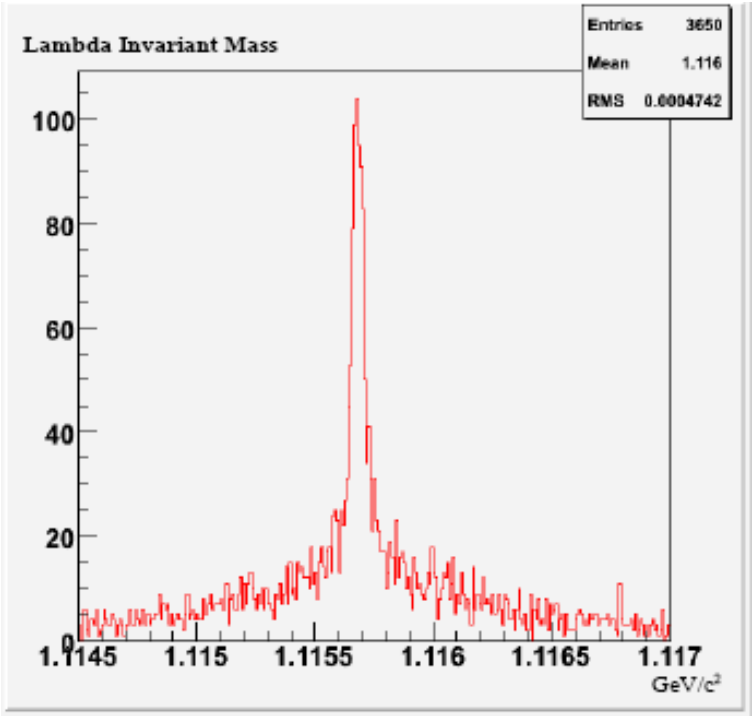
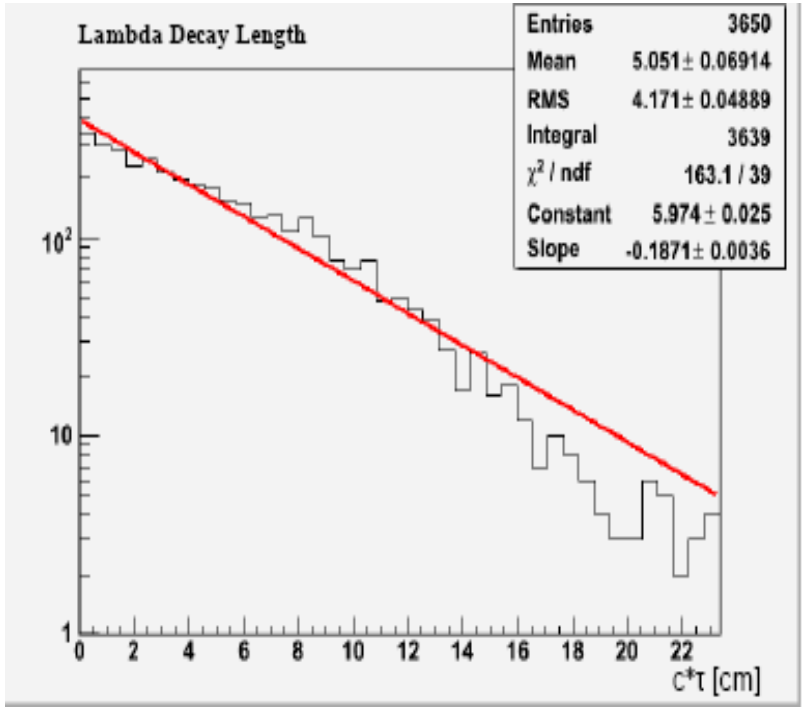
Λ Reconstruction @ 3 GeV/c with MC-Truth (phase space)





$M_\Lambda = 1.11573 \pm 0.00006 GeV/c^2$

Literature value is 1.1157 GeV/c^2

$(c * \tau)_\Lambda = 5.35 \pm 0.11$ cm

Literature value is 7.89 cm

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Summary/Outlook

- A simple and fast method to find Λ and $\overline{\Lambda}$ decay vertices
- First simulations of $\overline{p}p \rightarrow \Lambda\overline{\Lambda}$ at 2 GeV/c and 3 GeV/c

In the future

- Using reconstruction instead of MC hit
- Reconstruction of the reaction $P\overline{P} \rightarrow \Lambda\overline{\Lambda}$ with MVD+TPC (or MVD+STT)
- Consideration of realistic angular distribution