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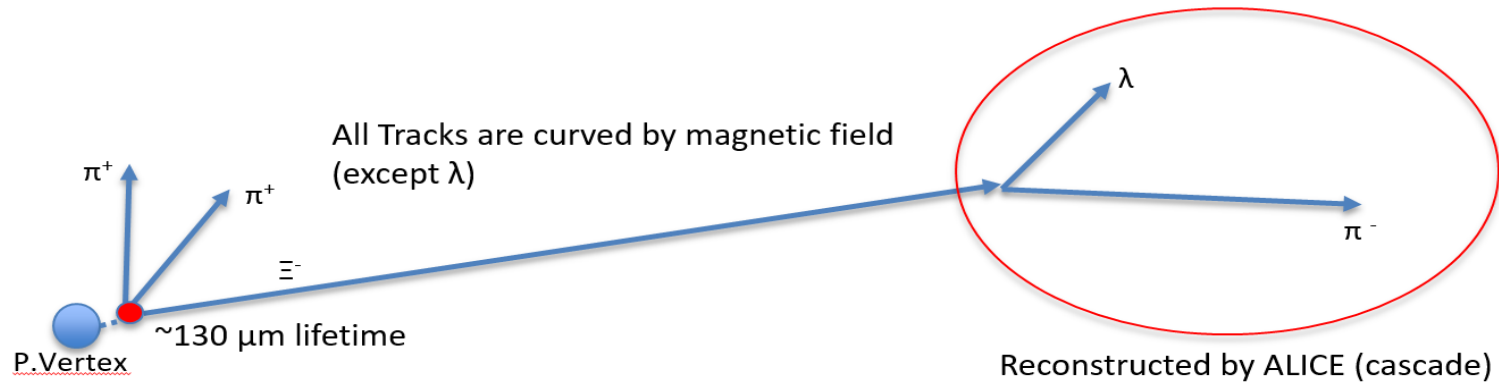


Ξ_c^+ Hadronic Channel Reconstruction at 13TeV in pp collisions with ALICE / Starting Counter DAQ

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Motivation



- Charmed baryon is good probe on fragmentation modification compared e+e process
 - Baryon/Meson ratio
 - System dependence (pp, pPb, PbPb)
- Ξ^- , π^+ , π^+ vs K^- , π^+ , P
- Pros :
 - Larger branching ratio (x5)
 - Resonance channel provide further constraints on signal selection (Mass window cut)
- Cons :
 - Prompt π^+ cause large combinatoric

Ξ_c^+ Decay Modes

| | | | |
|-----------------------------|--|-----|-----|
| $\Sigma(1385)^+ K^- \pi^+$ | $[b,g] < 0.3$ | 90% | 678 |
| $\Sigma^+ K^- \pi^+$ | $[g] 0.94 \pm 0.11$ | | 811 |
| $\Sigma^+ \bar{K}^*(892)^0$ | $[b,g] 0.81 \pm 0.15$ | | 658 |
| $\Sigma^0 K^- \pi^+ \pi^+$ | $[g] 0.29 \pm 0.16$ | | 735 |
| $\Xi^0 \pi^+$ | $[g] 0.55 \pm 0.16$ | | 877 |
| $\Xi^- \pi^+ \pi^+$ | $[g] \text{ DEFINED AS } 1$ | | 851 |
| $\Xi(1530)^0 \pi^+$ | $[b,g] < 0.1$ | 90% | 750 |
| $\Xi^0 \pi^+ \pi^0$ | $[g] 2.34 \pm 0.68$ | | 856 |
| $\Xi^0 \pi^+ \pi^+ \pi^-$ | $[g] 1.74 \pm 0.50$ | | 818 |
| $\Xi^0 e^+ \nu_e$ | $[g] 2.3 \begin{matrix} +0.7 \\ -0.9 \end{matrix}$ | | 884 |
| $\Omega^- K^+ \pi^+$ | $[g] 0.07 \pm 0.04$ | | 399 |

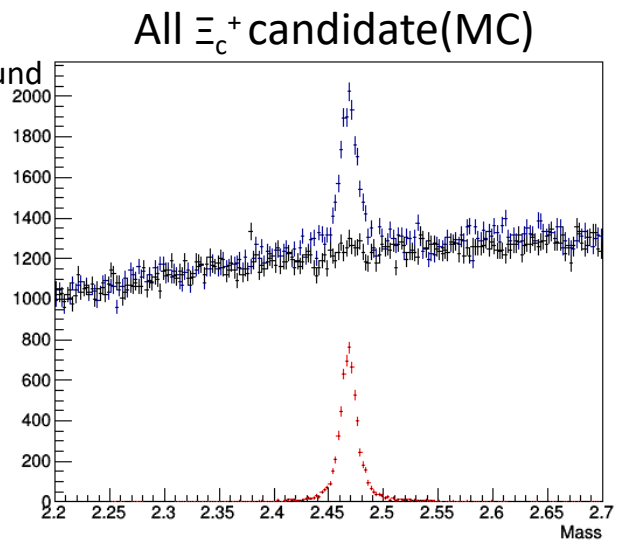
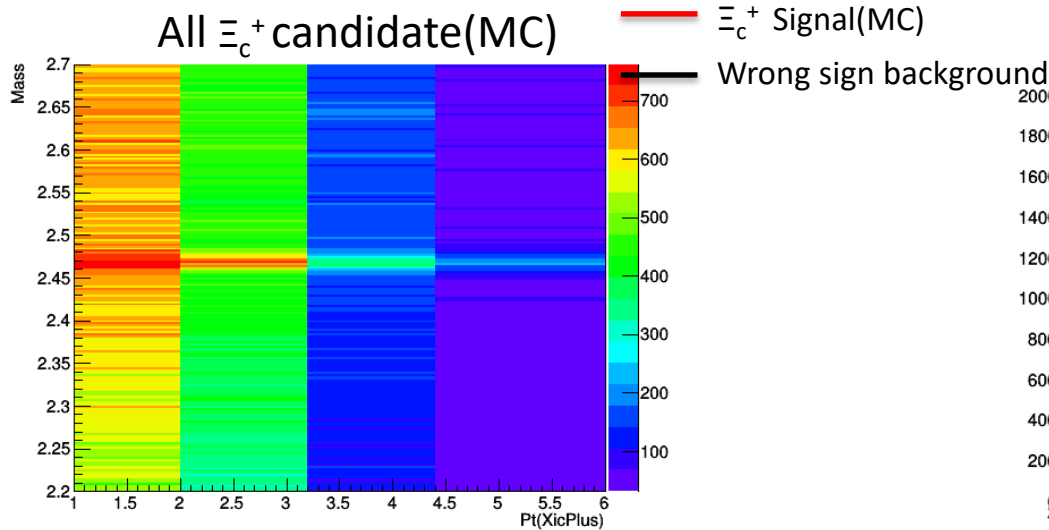
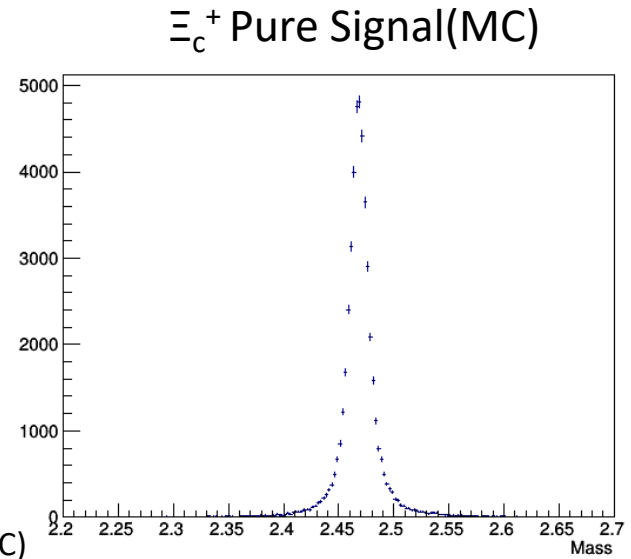
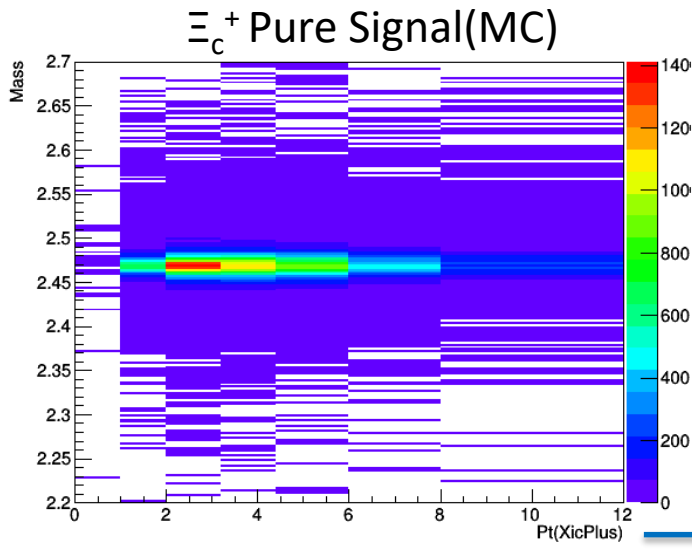
Cabibbo-suppressed decays

| | | | |
|---|-----------------------|-----|-----|
| $p K^- \pi^+$ | $[g] 0.21 \pm 0.03$ | | 944 |
| $p \bar{K}^*(892)^0$ | $[b,g] 0.12 \pm 0.02$ | | 828 |
| $\Sigma^+ K^+ K^-$ | $[g] 0.15 \pm 0.07$ | | 580 |
| $\Sigma^+ \phi$ | $[b,g] < 0.11$ | 90% | 549 |
| $\Xi(1690)^0 K^+, \Xi(1690)^0 \rightarrow \Sigma^+ K^-$ | $[g] < 0.05$ | 90% | 501 |

DataAnalysis

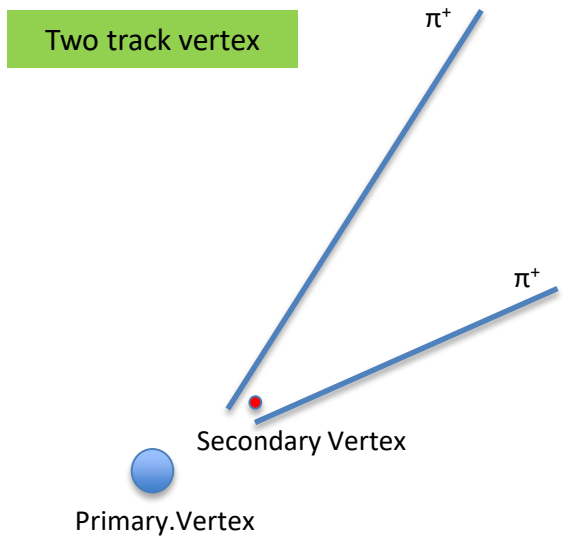
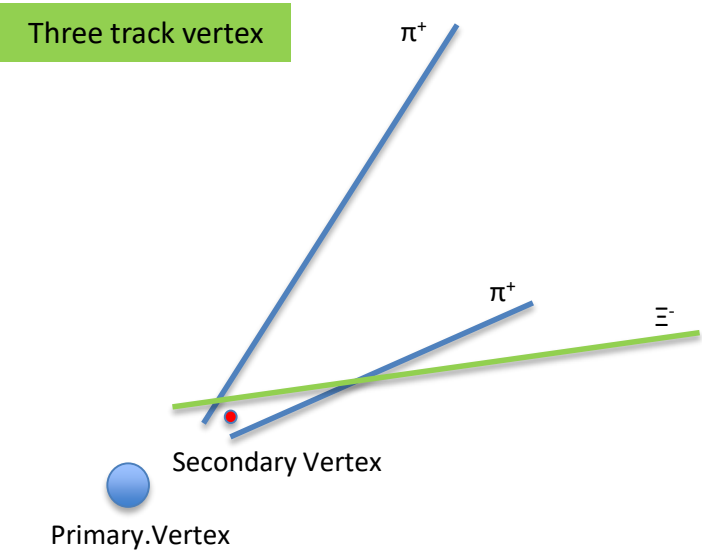
- DataSet
 - Heavy flavor enhanced event (Ξ_c^+ , Ξ_c^0) 3M Events (MC)
 - 1 Billion MB events from LHC16, 17, 18
 - Interested physics Ξ_c^+ decayed into $\Xi^- + \pi^+ + \pi^+$
- Tagged daughters from inclusive Ξ_c^+ and compared topological property with background (mostly prompt π^+)

Ξ_c^+ Reconstruction test (MC, Pt : 1-5GeV)



Ξ_c^+ candidates are passed the tree production cuts listed on page 13

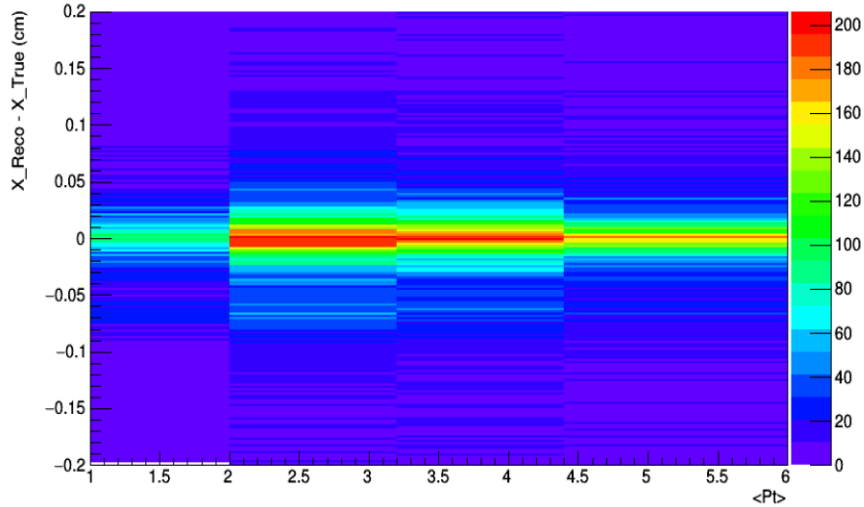
Secondary Vertex Reconstruction



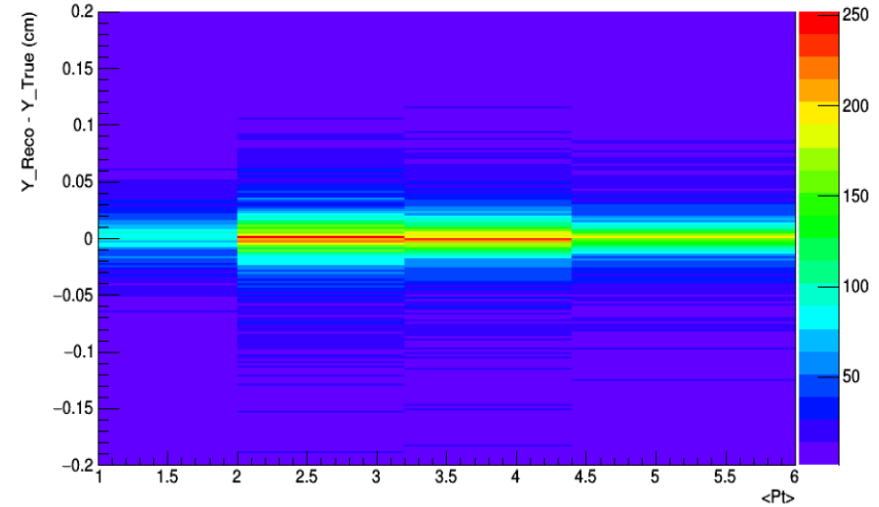
- AliVertexerTracks is used for searching vertex
 - Algorithm : 1 (Tracks are approximated as straight line)
- Cascade has much worse vertex resolution
 - Not causing too much problem since vertexer take into account track resolution
- Recalculated primary vertex if $NContributors < 20$

Two Track ($\pi^+ \pi^+$) Vertex Residual ($Pt_{\chi_{ic+}} : 1-5\text{GeV}$)

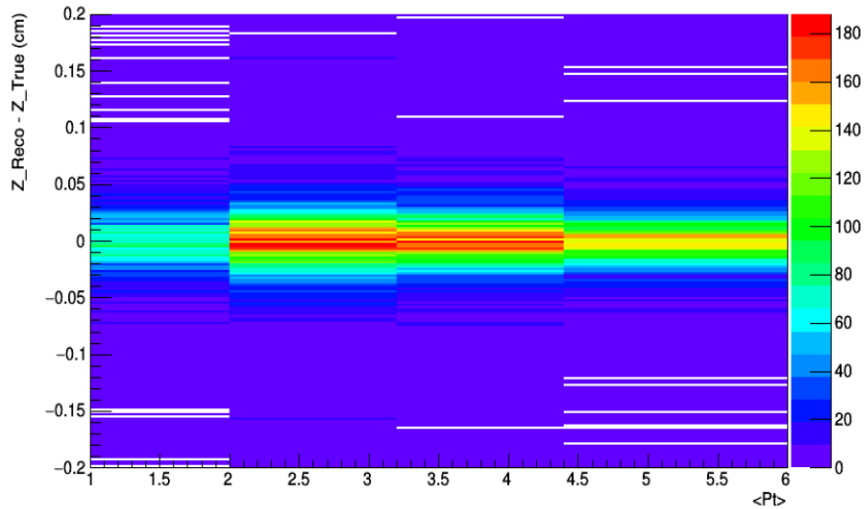
X Residual



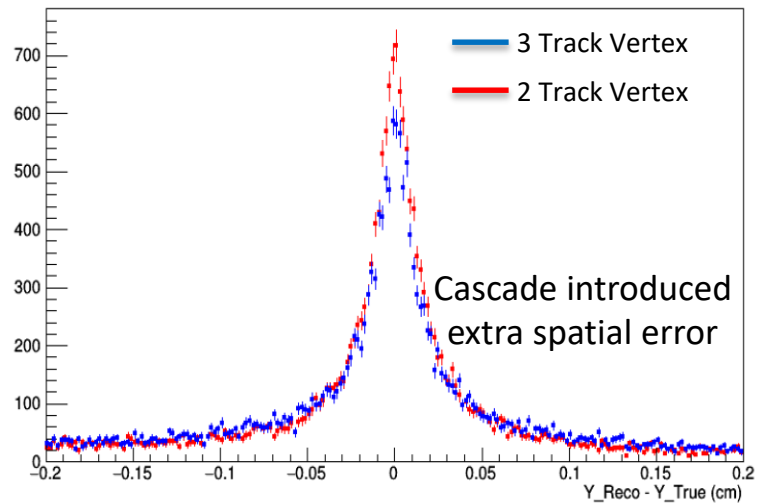
Y Residual



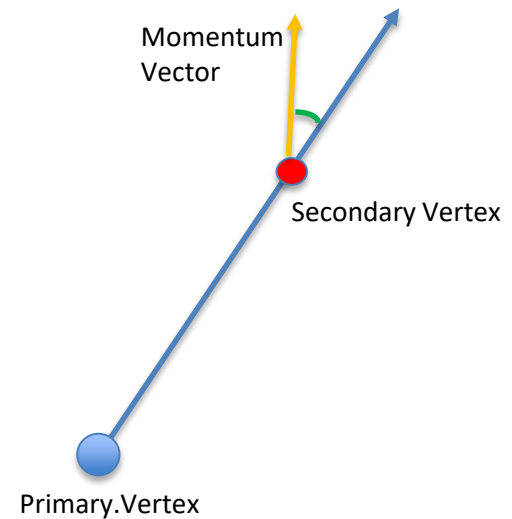
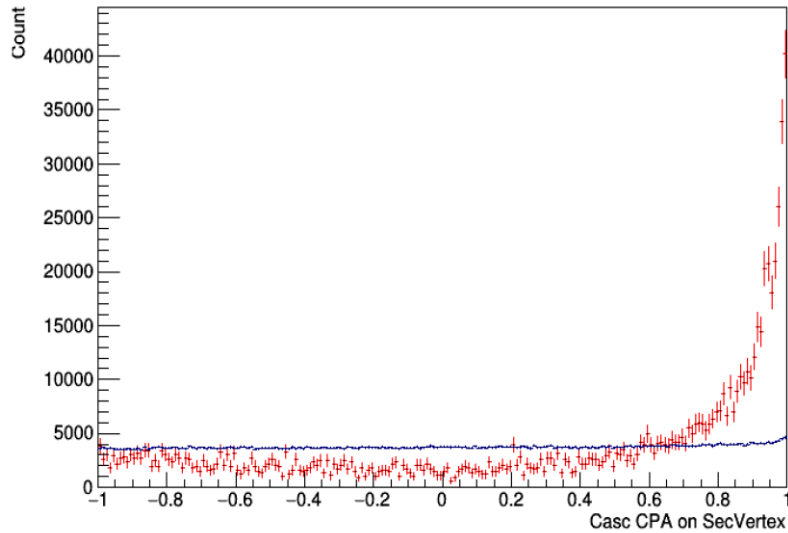
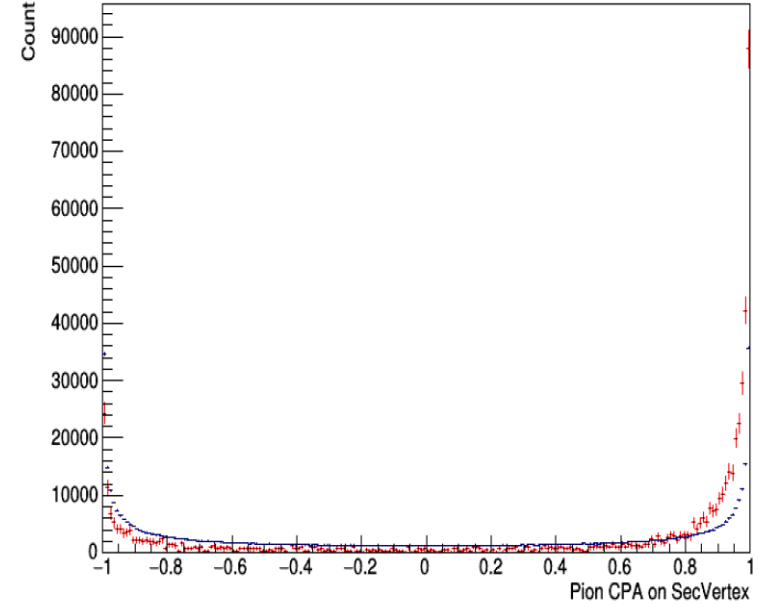
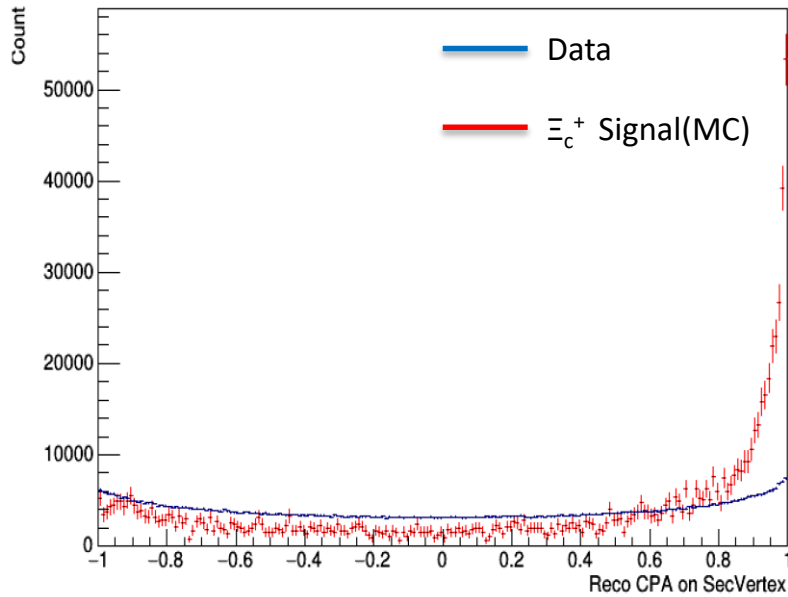
Z Residual



Y Residual_Projection

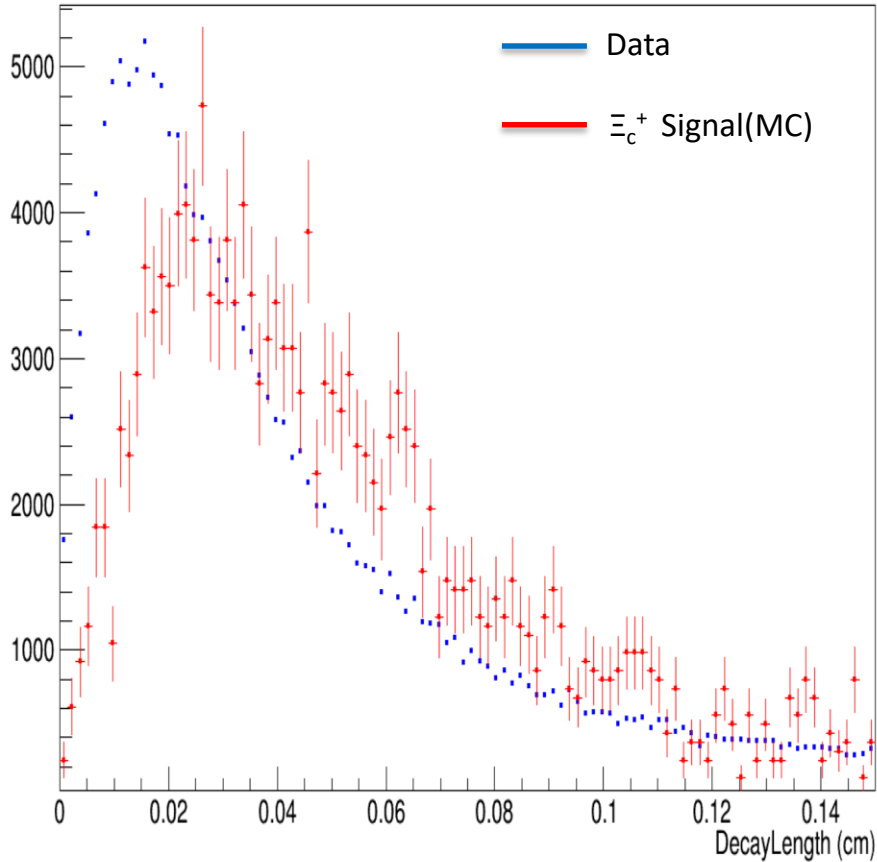


Cosine Pointing Angle at SecVertex (2Track)

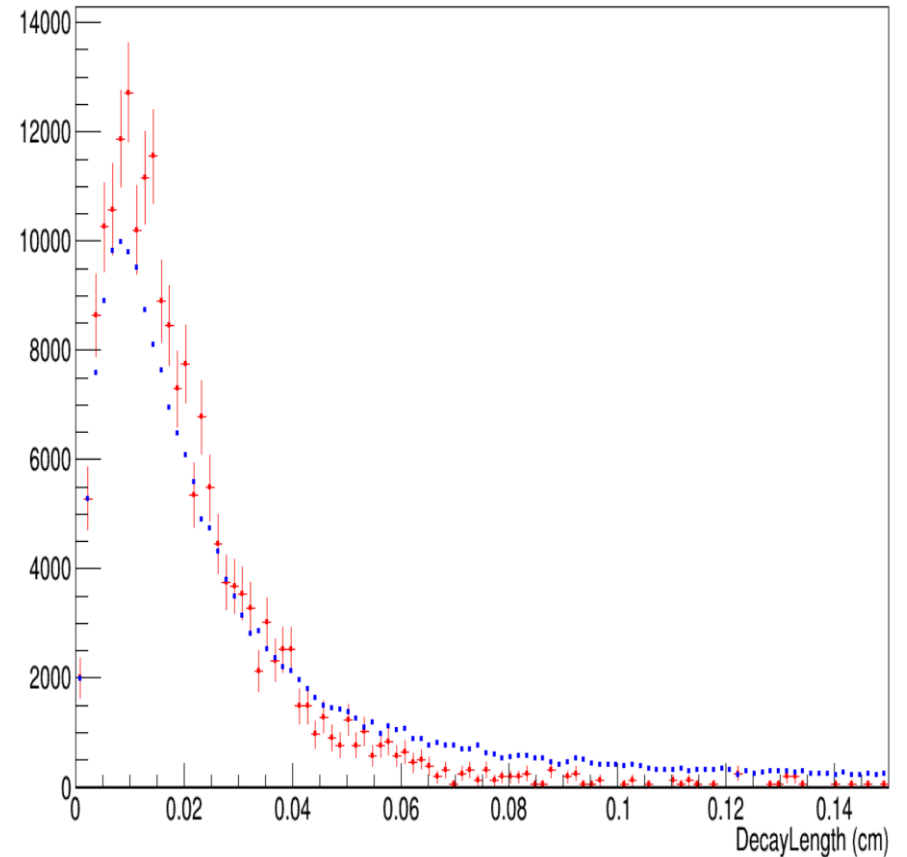


Topological variables ($Pt_{X_{ic+}} > 2\text{GeV}$)

DecayLength along p direction



DecayLength along normal direction



Cut List

Tree Production cuts

$N_{\text{TPC_Cluster}} > 80$

$N_{\text{ITS_Cluster}} > 2$

$\text{TPC } \chi^2 < 3$

$\text{TPC Frac} > 0.8$

ITS_Refit

$P_t > 0.2\text{GeV}$

$|\text{TPC Pion PID}| < 4\sigma$

Ξ^- Mass tolerance (8MeV)

PiPi DCA < 700um

Ξ^- Cosine Pointing Angle at secondary vertex > 0.8

Topological cuts

Ξ^- Cosine Pointing Angle at secondary vertex > 0.94

Pion1, 2 Cosine Pointing Angle at secondary vertex > 0.6

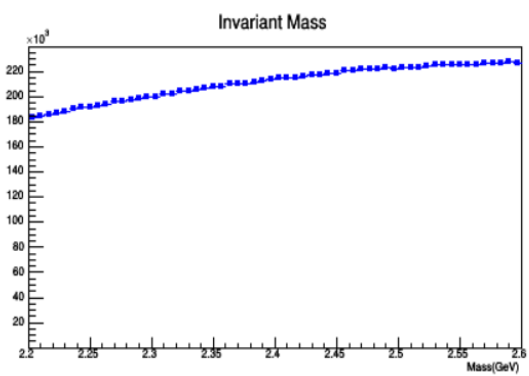
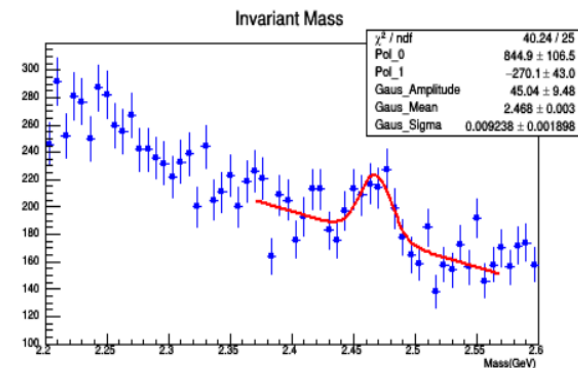
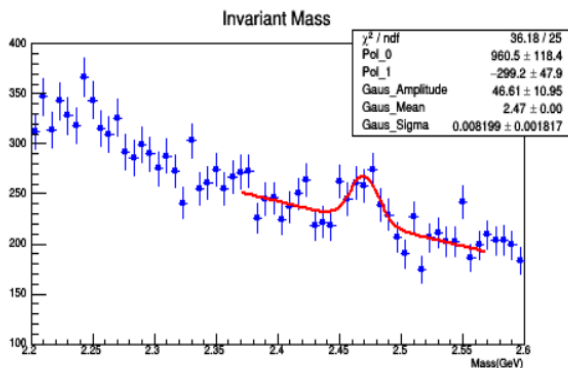
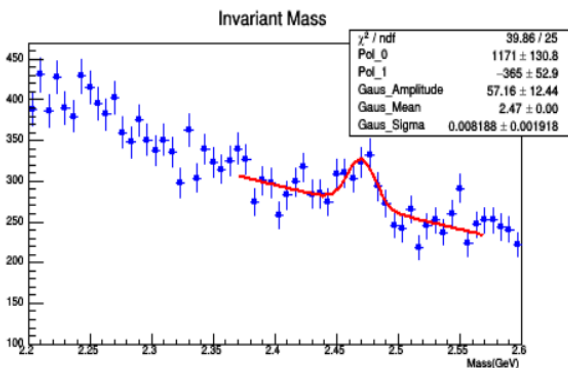
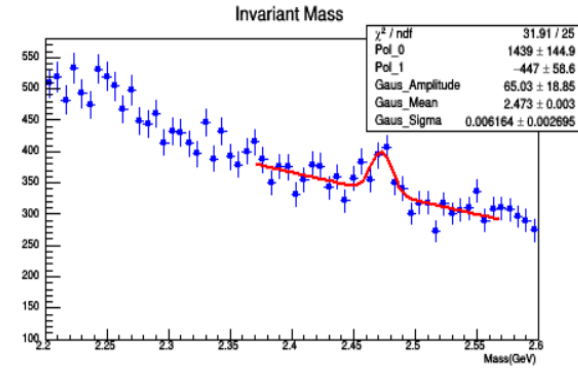
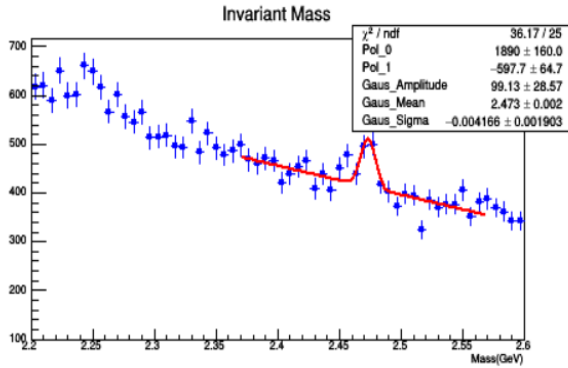
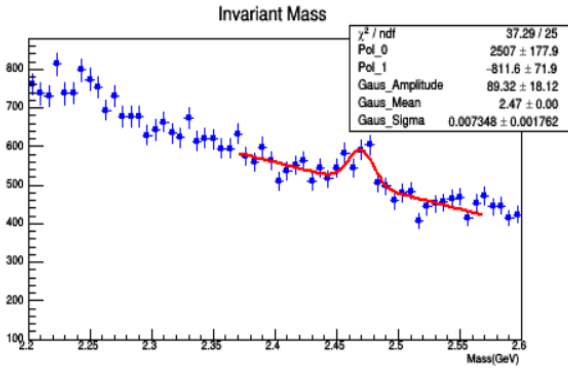
DecayLength along momentum direction > 350 μm

Z-direction PiPi DCA < 290 μm

Pion $P_t > 0.6\text{GeV}$

Ξ^- $P_t > 2.5\text{ GeV}$ (This is similar to 3GeV Min P_t cut)

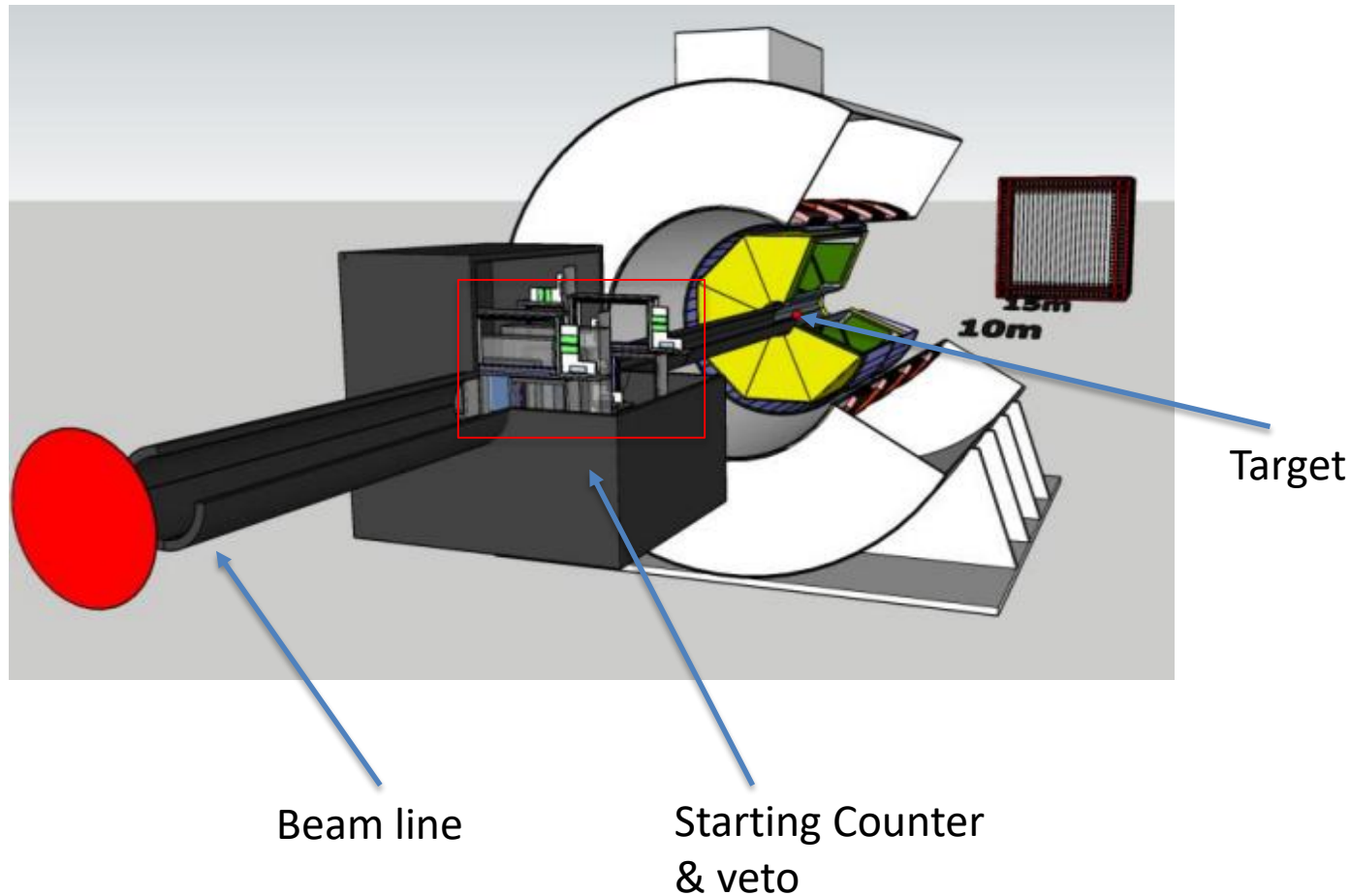
Mass Distribution(Data, $P_{t_{Xic+}} > \sim 3\text{GeV}$)



Each Canvas corresponds to different cut setup
(Last one is with only tree production cuts)

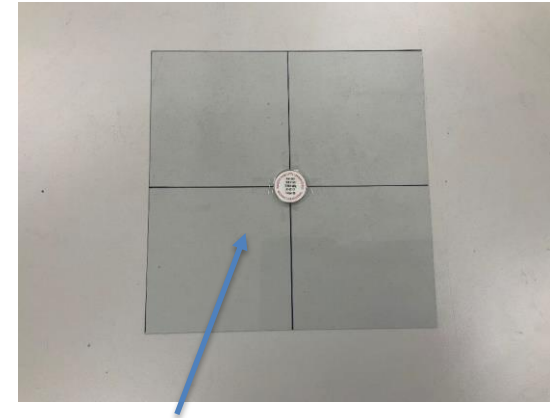
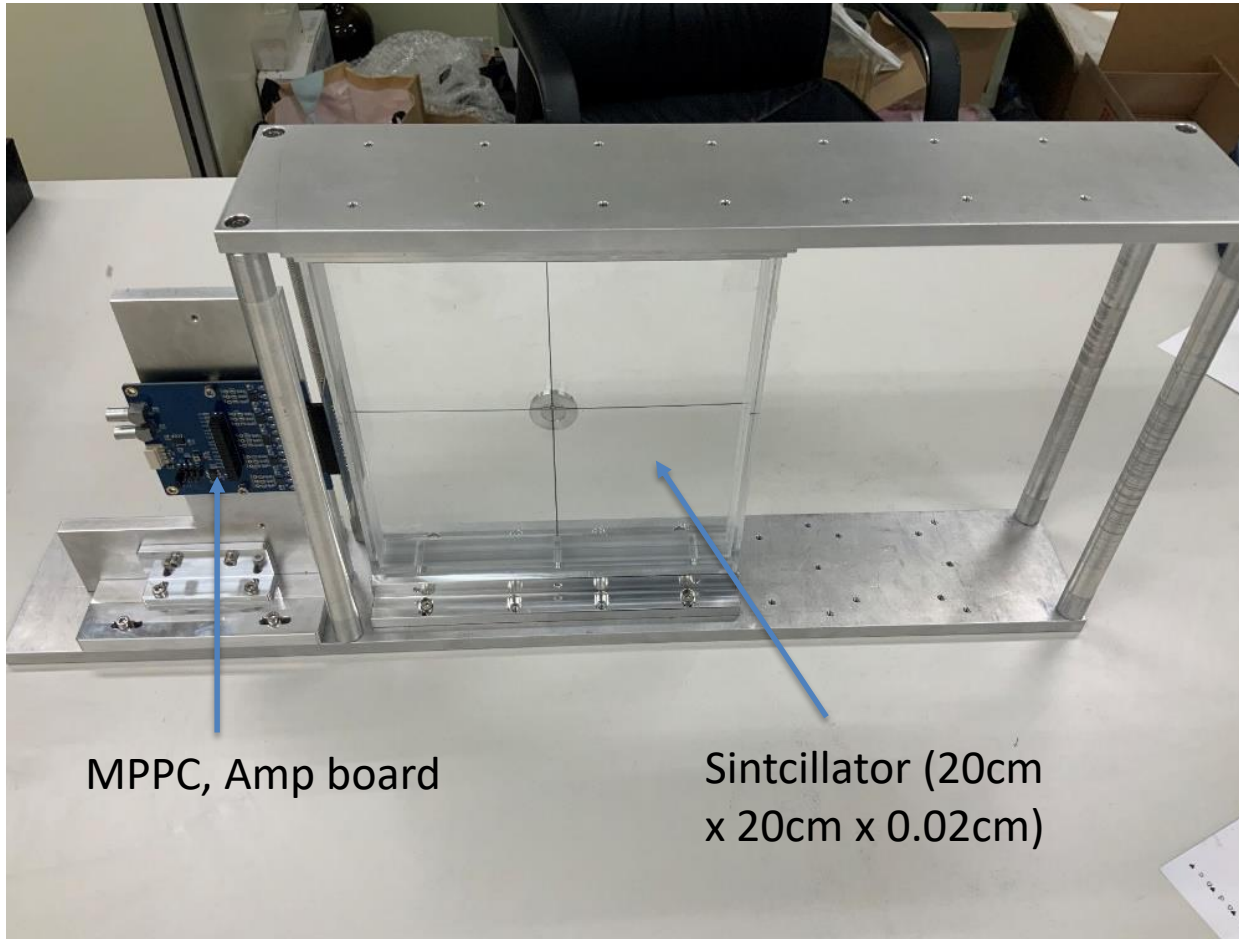
LAMPS Starting Counter

LAMPS Experiment Scheme

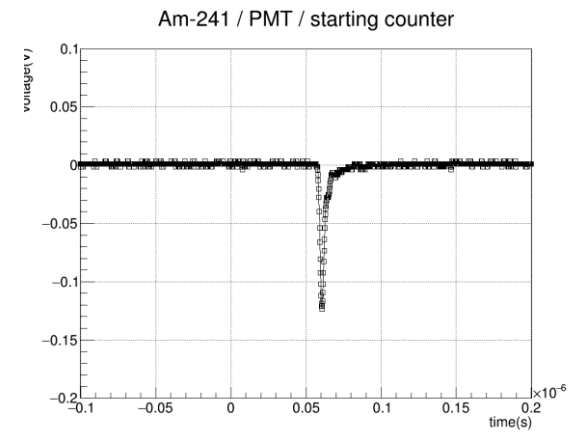


- Starting Counter is made of thin scintillator and photon detector placed in front of beam target, makes trigger signal

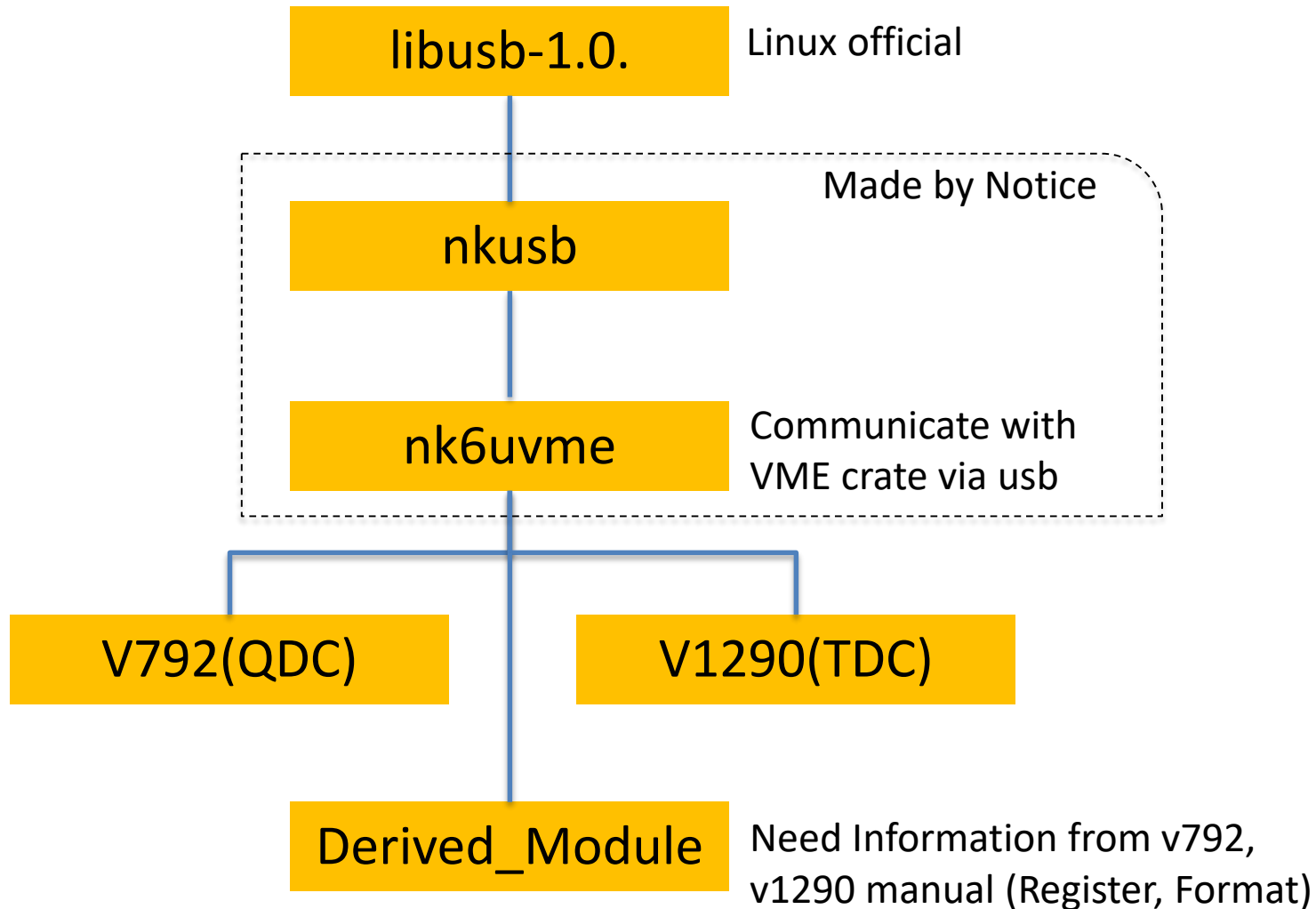
Starting Counter setup



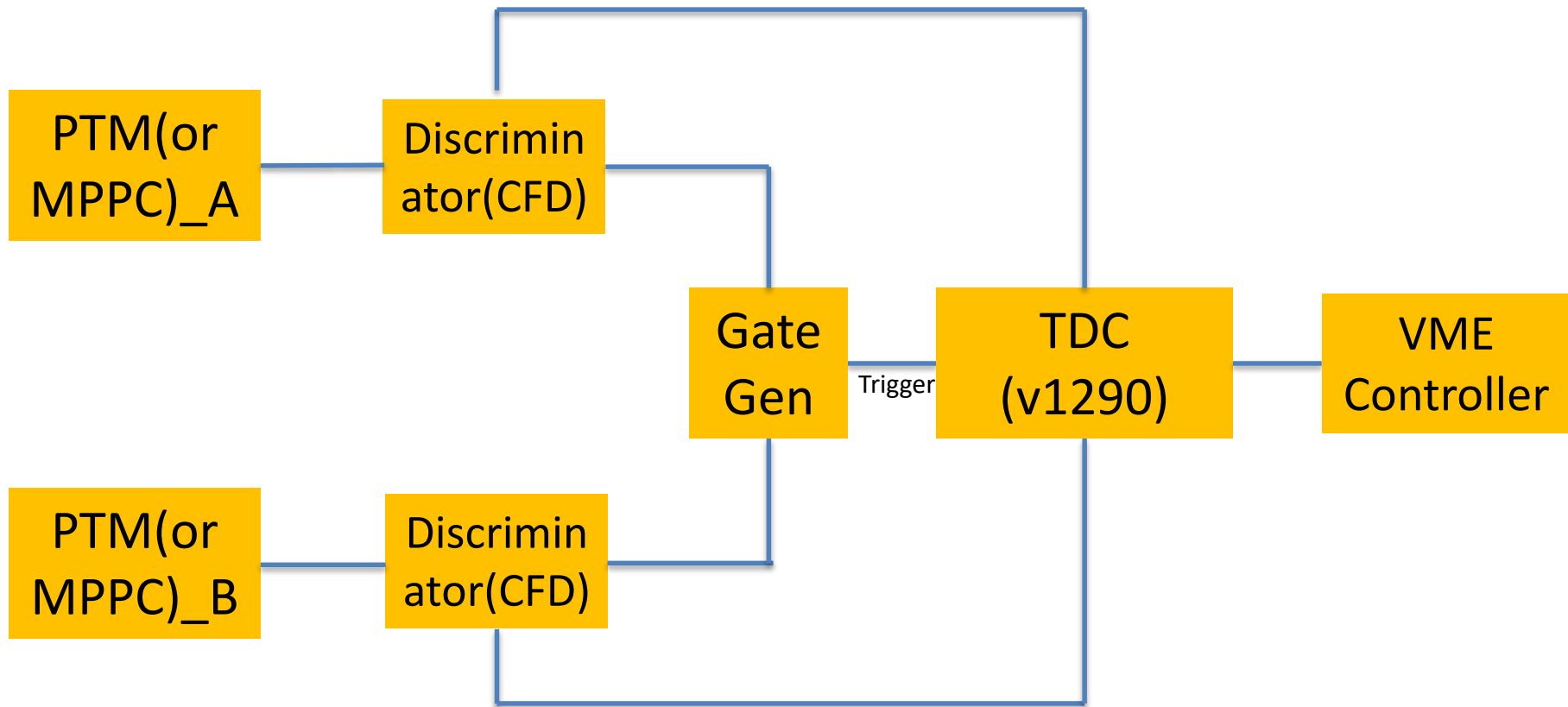
Americium Source



SC DAQ Code : Notice Framework



SC DAQ Code : Timing resolution DAQ Scheme



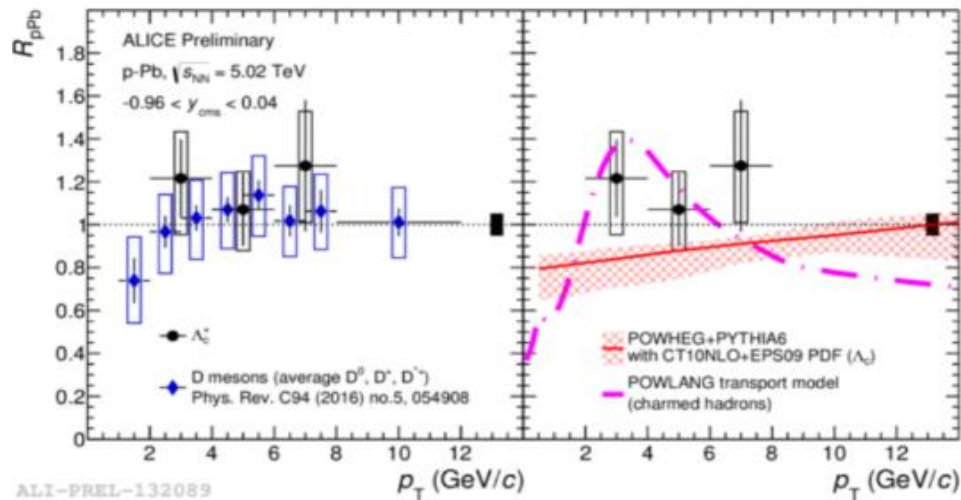
Summary & Outlook

- We found hadronic channel Ξ_c^+ mass peak at pp 13TeV MB events ($P_t > 3\text{GeV}$)
 - We'll focus on High Multiplicity Events in pp 13TeV data
- Developing LAMPS Starting counter DAQ system
 - Debugging DAQ code

Back up

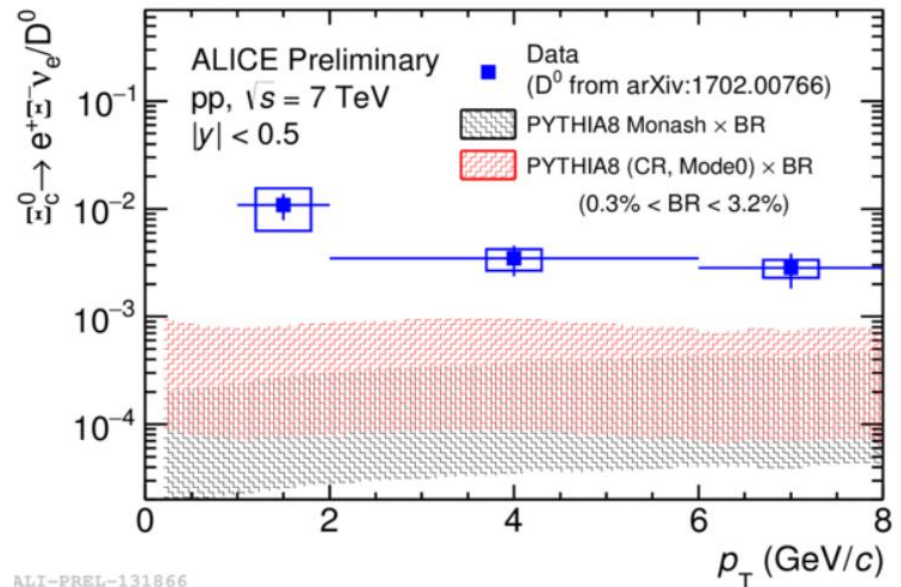
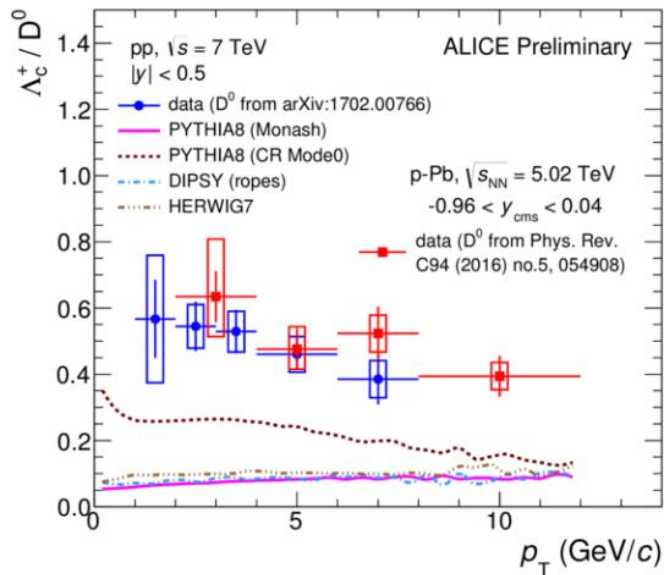
Charmed baryon

- Multiple parton interaction (MPI) and color reconnection (CR) could increase the baryon to meson ratio
 - pp charmed baryon measurement would be reference of bigger system (pPb, PbPb)
 - pPb collisions are further affected by cold nuclear matter effect and final state effect



Charmed baryon

- Fragmentation into charm baryons are well studied in e+e collisions
 - Fragmentation would be same in pp (or pPb, PbPb) system?
 - Interaction with surrounding partons (like color reconnection) can enhance baryons
 - Recent analysis reported charm baryon enhancement from model prediction, even with CR



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