



Spinfest Student session I

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New Mexico State University

2013/07/03, RIKEN



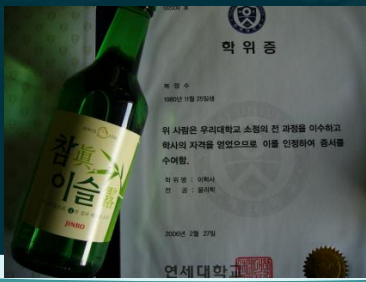
Introducing myself

- ◆ Born in Incheon, South Korea, Grown in Seoul
- ◆ Enjoyed physics, nourished soul



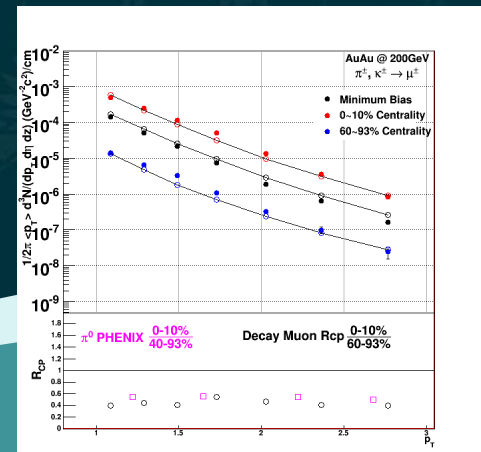
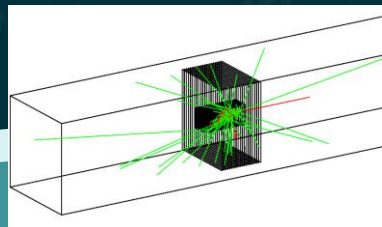
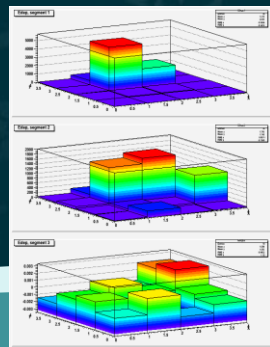
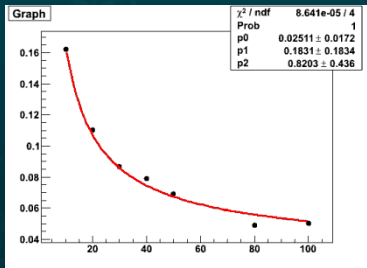
Taebong entered Yonsei Univ

./submit_delete.sh mybrain



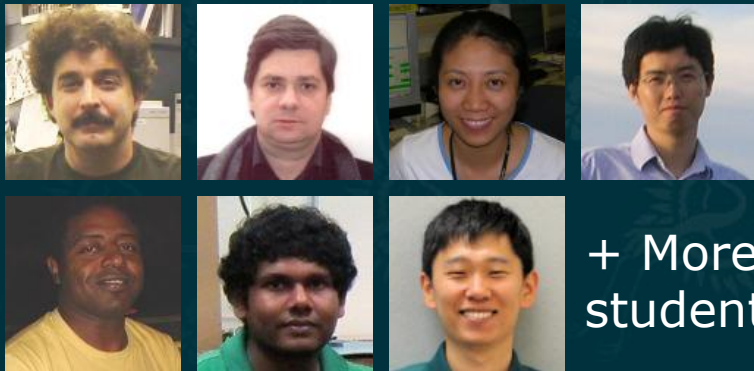
Introducing myself

- ◆ MS degree, Yonsei Univ, Seoul
 - ◆ Nuclear Physics Group
 - ◆ Linux cluster management (from credit card to data)
 - ◆ FoCal work (beam test, simulation...)
 - ◆ Single muon analysis (AuAu decay muon)

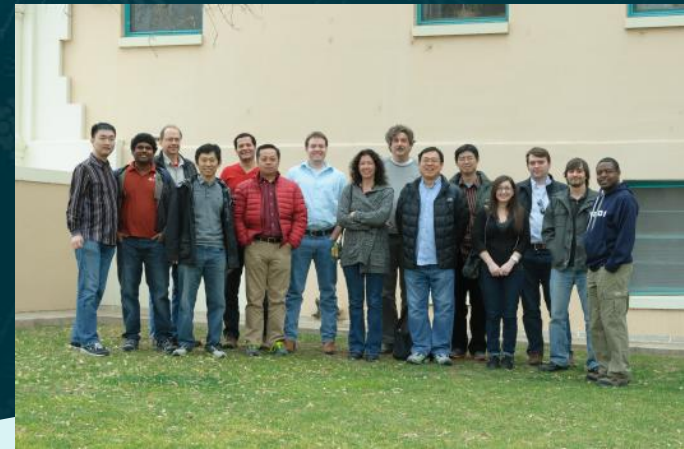


Introducing myself

- ◆ Grad. Study, New Mexico State Univ
 - ◆ Nuclear and Particle Physics Group
 - ◆ 3 prof. 1 postdoc, 3 student and more.
 - ◆ Spin & FVTX



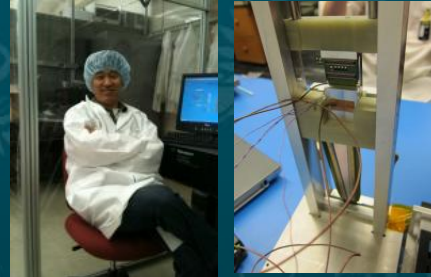
+ More students



I've been working on

◆ FVTX hardware

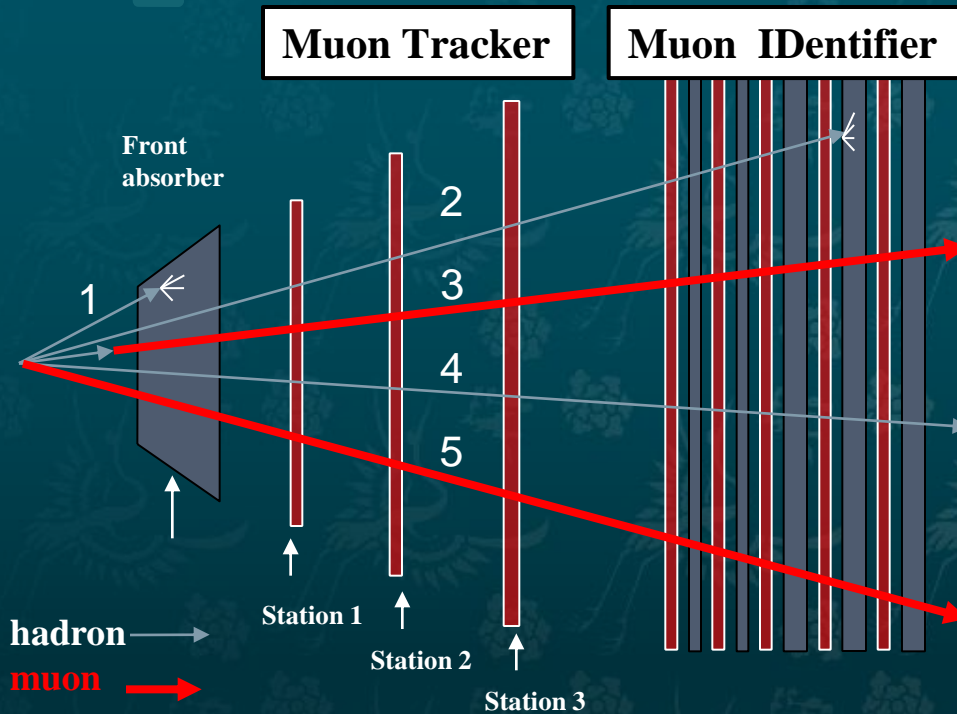
- ◆ Test sensor, module
- ◆ bending, assembly



◆ Analysis

- ◆ Open heavy flavor with FVTX
 - ◆ Run12 pp 510GeV (first FVTX pp data)
 - ◆ Background rejection, c/b separation
- ◆ Single muon analysis

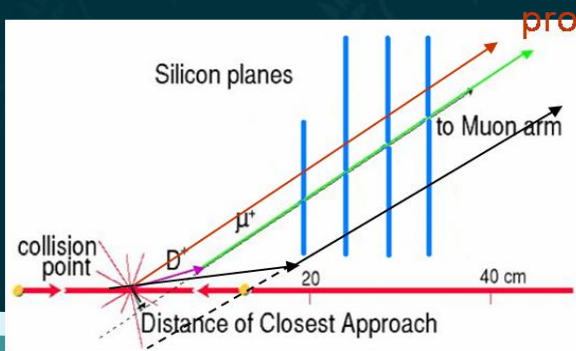
PHENIX Forward Muon Spectrometer



1. *Absorbed* : $(e^\pm, \gamma, p, \pi, K\dots)$
2. *Stopped hadron* : (π, K)
3. *Decay muon* : $(\pi^\pm \rightarrow \mu^\pm + X, K^\pm \rightarrow \mu^\pm + X)$
4. *Punch through* : *hadron* (π^\pm, K^\pm)
5. *prompt muon* : $(B, D \rightarrow \mu + X)$

□ Previous heavy-quark production measurements studied indirectly via the measurement of leptons (muons) from semileptonic decays of charm or beauty

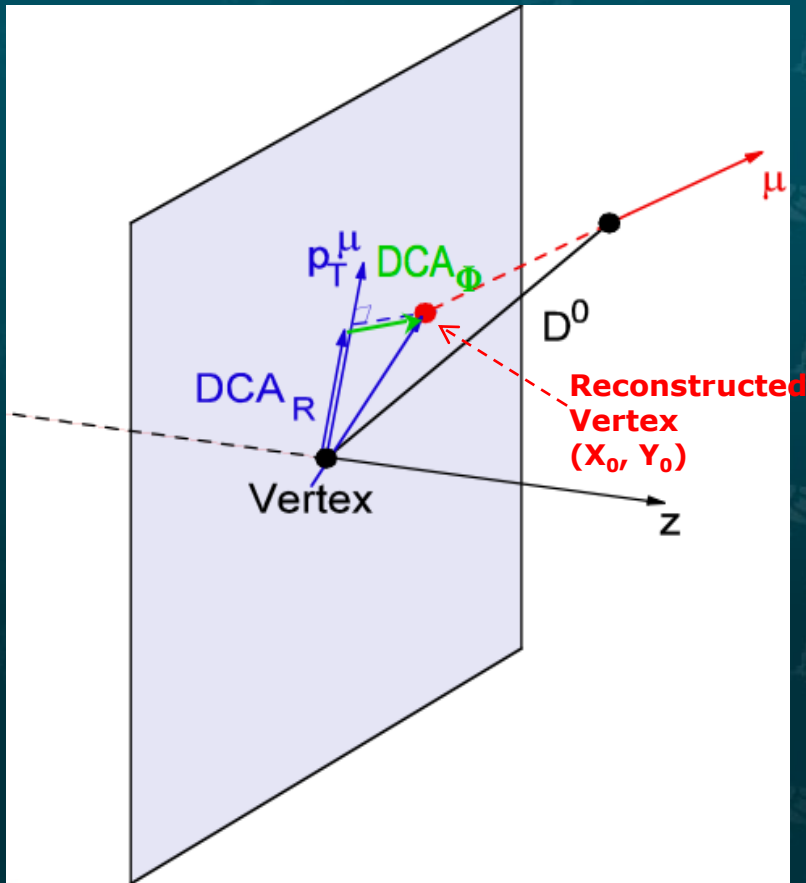
- without distinguishing between D- and B-mesons
- in large systematic errors (backgrounds $(\pi \rightarrow \mu)$ and $(K \rightarrow \mu)$ overwhelm the signal)



prompt □ FVTX can do

- D, B mesons travel ~ 1 mm (with boost) before semi-leptonic decay to muons
- By measuring DCA to primary vertex, We can separate D and B from long-lived decays like n, K
- Muons from D, B mesons have different DCA shape

Displaced Vertex, DCA_R



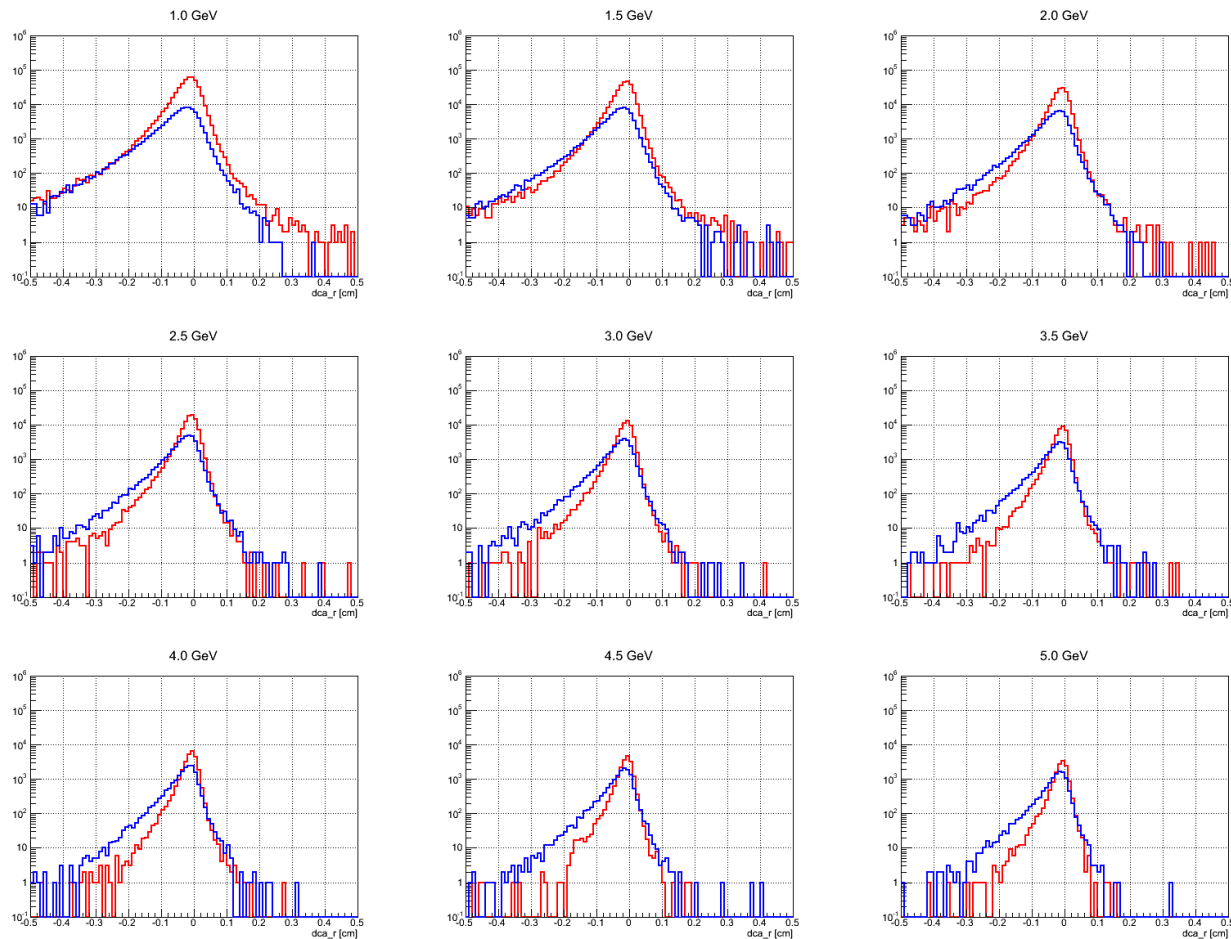
- DCA_R (Distance of Closest Approach, R)
: reconstructed vertex decomposed on muon p_T direction (FVTX has better resolution onto R direction)

$$DCA_R = X_0 \times \left(\frac{P_x}{P_T} \right) + Y_0 \times \left(\frac{P_y}{P_T} \right)$$

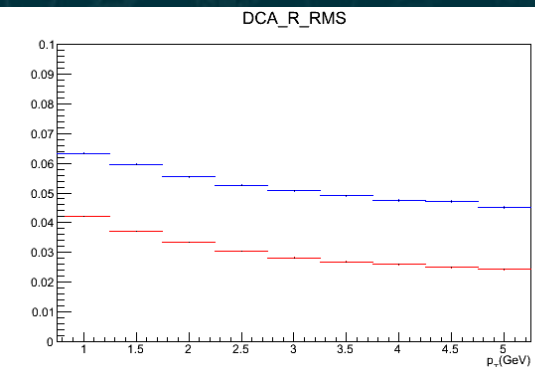
- Flying distance and decay angle of muons from π, K decay, muons from D and B and prompt muon will give us different DCA_R distributions

Particle	Mean lifetime (ps)	Decay length(mm) at $p=3$ GeV
π^\pm	2.60×10^4	167×10^3
K^\pm	1.24×10^4	22.9×10^3
D^0	0.410	0.197
B^0	1.530	0.261

DCAR p+p 510GeV simulation

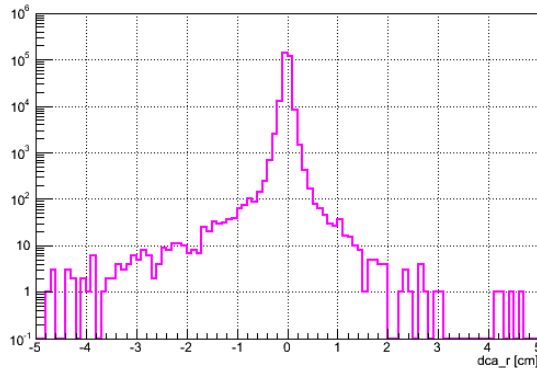


Blue : 50 mil B events
Red : 900mil D events

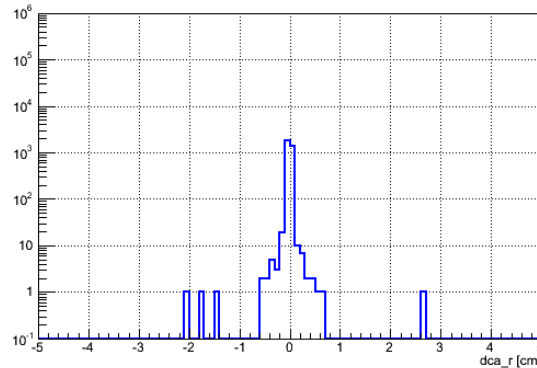


DCA_R Background simulation

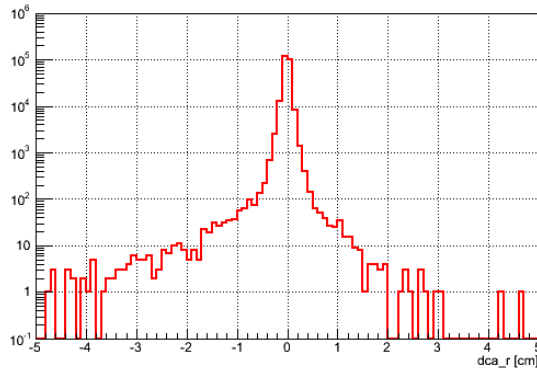
Deeply Penetrating MUID Gap4



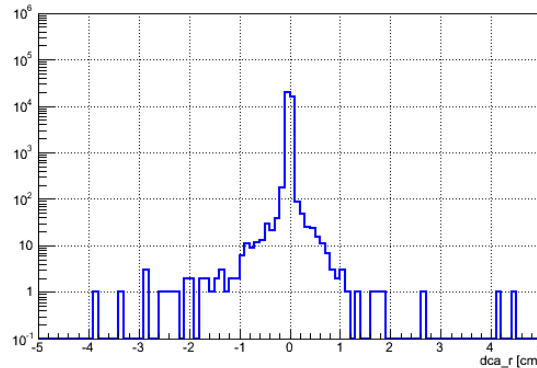
Stopped Hadron MUID Gap2,3



Penetrating Muons Gap4



Punch Through Hadron Gap4



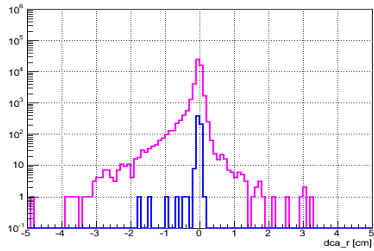
π^\pm input
(π^\pm, K^\pm major source of background)

Magenta : Deeply penetrating muon, hadron
Red : Decay muon from π^\pm
Blue : hadrons penetrating front absorber

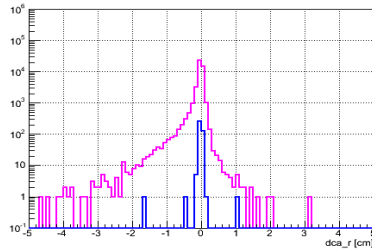
One of the major source of background, decay muon from hadron have broad DCA_R distribution

DCAR background π^\pm

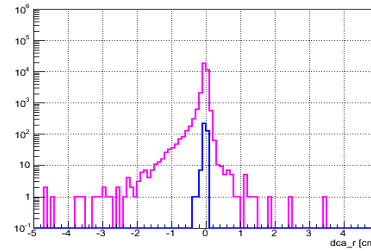
1.0 GeV



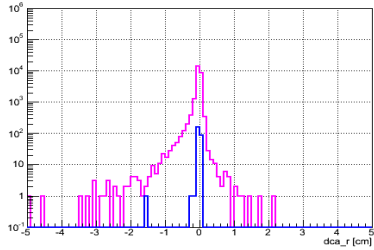
1.5 GeV



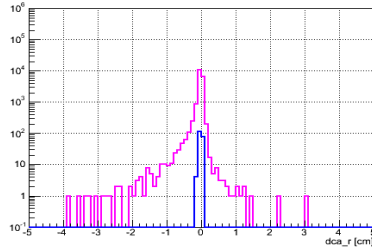
2.0 GeV



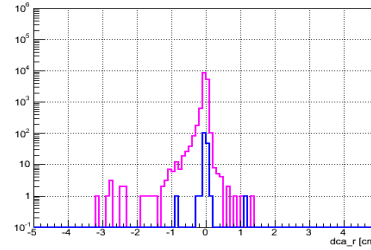
2.5 GeV



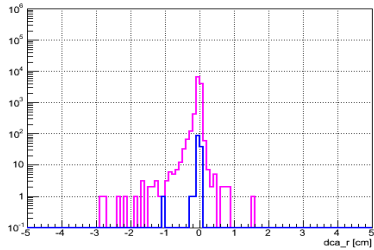
3.0 GeV



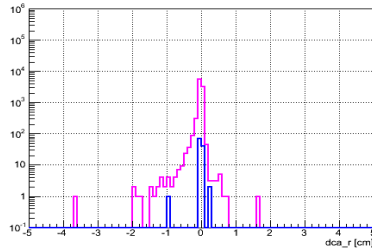
3.5 GeV



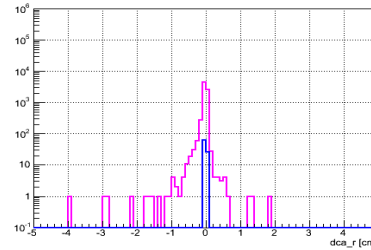
4.0 GeV



4.5 GeV



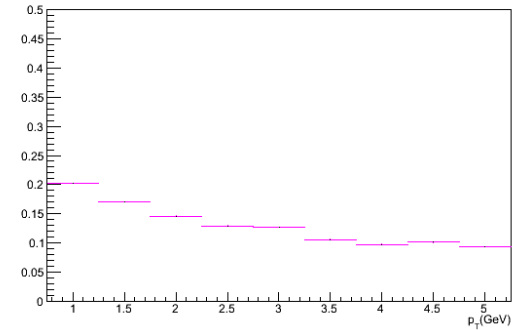
5.0 GeV



190mil π^\pm generation

Blue : stopped hadron
magenta : deeply penetrating
(decay muon including punch-through)

DCA_R_RMS



X axis is (-5cm,5cm) \rightarrow DCAR(π^\pm) \gg DCAR(B,D)

Single muon analysis

- ◆ pp 510 GeV open heavy flavor without FVTX
 - ◆ Baseline of c/b separation
 - ◆ Signal extraction step is openHF->c/b separation
 - ◆ No previous openHF measurement at forward rapidity 500GeV
 - ◆ B dominant area in Higher pT (with enough statistics)
- ◆ 510GeV data is first significant p+p data with FVTX, run12 pp 200GeV doesn't have.
 - ◆ Will compared with the data with FVTX this fall.
- ◆ Method is well-established, Run5pp, CuCu, run9pp, run8dAu
- ◆ A_{LL} ?

Thank you



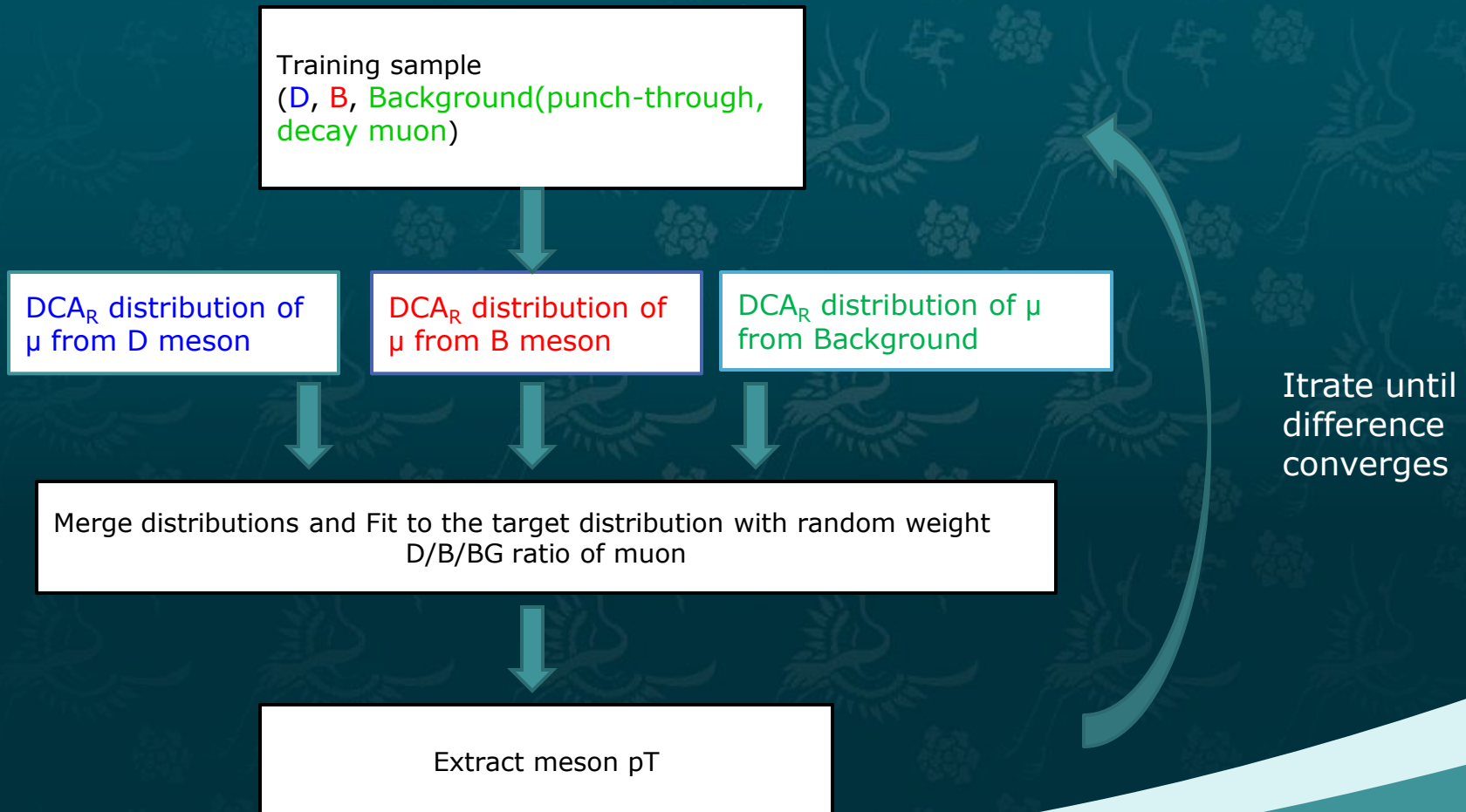


backup

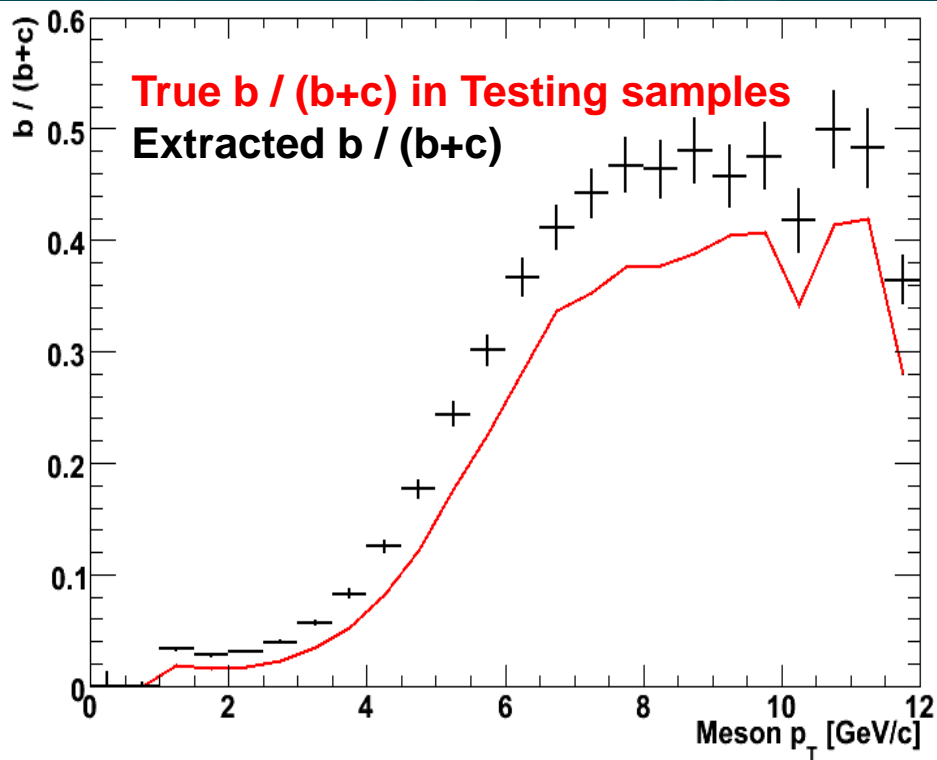


The background features a repeating pattern of stylized birds, possibly phoenixes, with their wings spread, and small floral motifs. The pattern is rendered in a lighter shade of the dark teal background color. A white curved line separates the dark teal upper section from a lighter teal lower section.

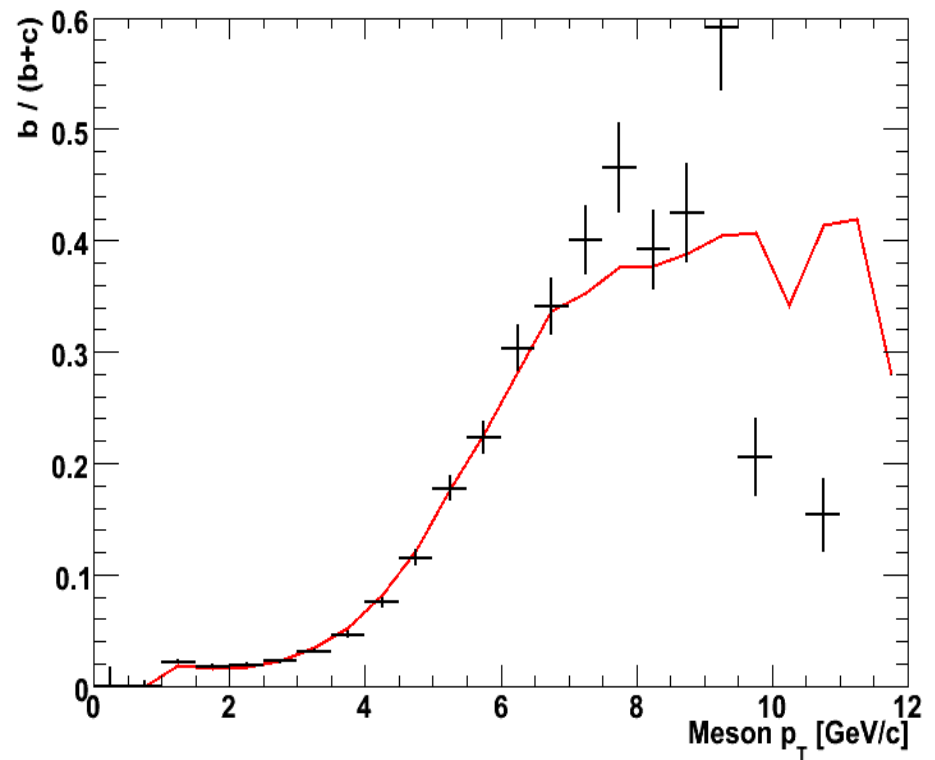
c/b separation



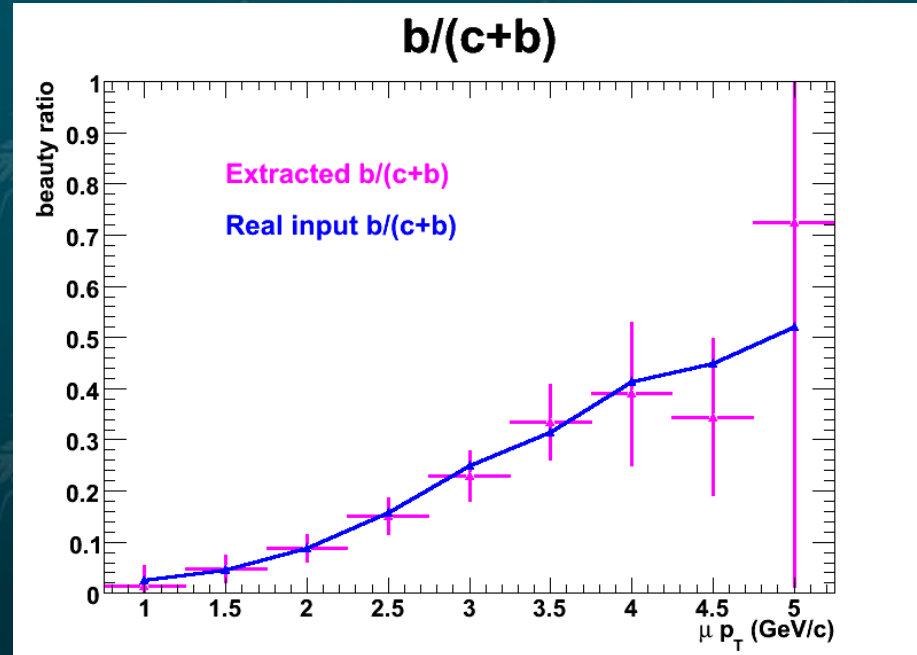
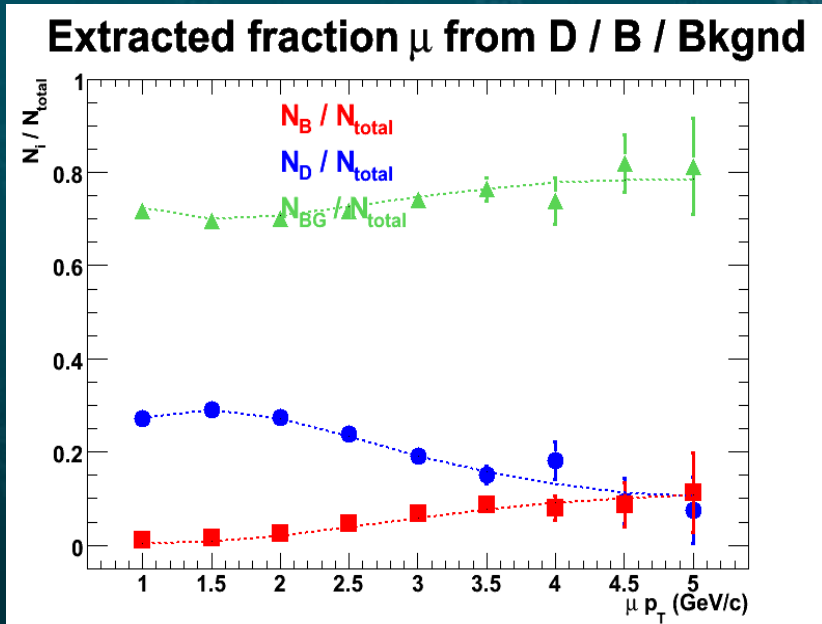
Before iteration



After 30 iterations



b/(c+b) ratio



finding proper weight which forms merged distribution with enough iteration,
→ signal/(signal+bg)
→ b/(c+b) ratio gets close to actual input.