Charged pion analysis

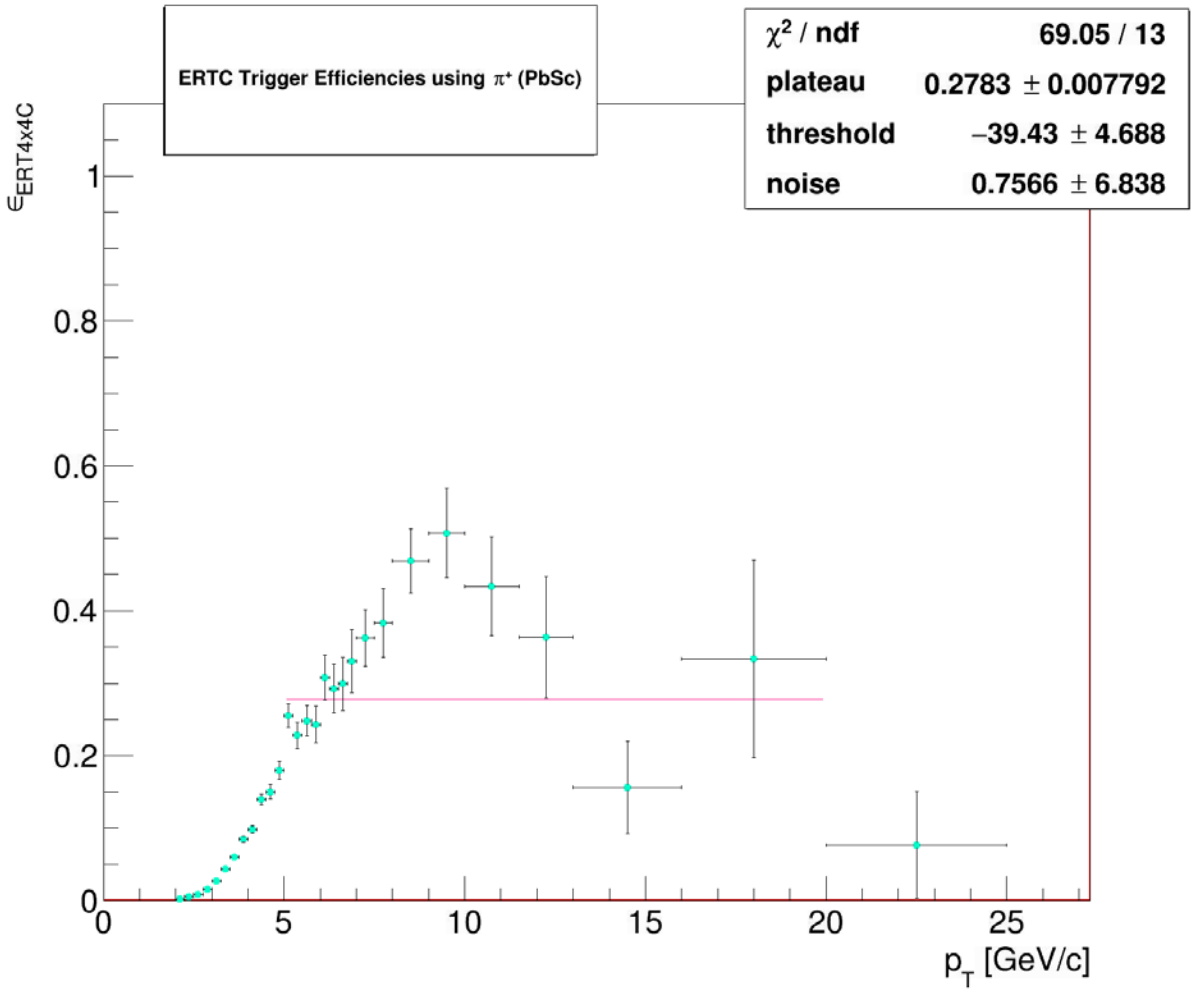
Cross section study

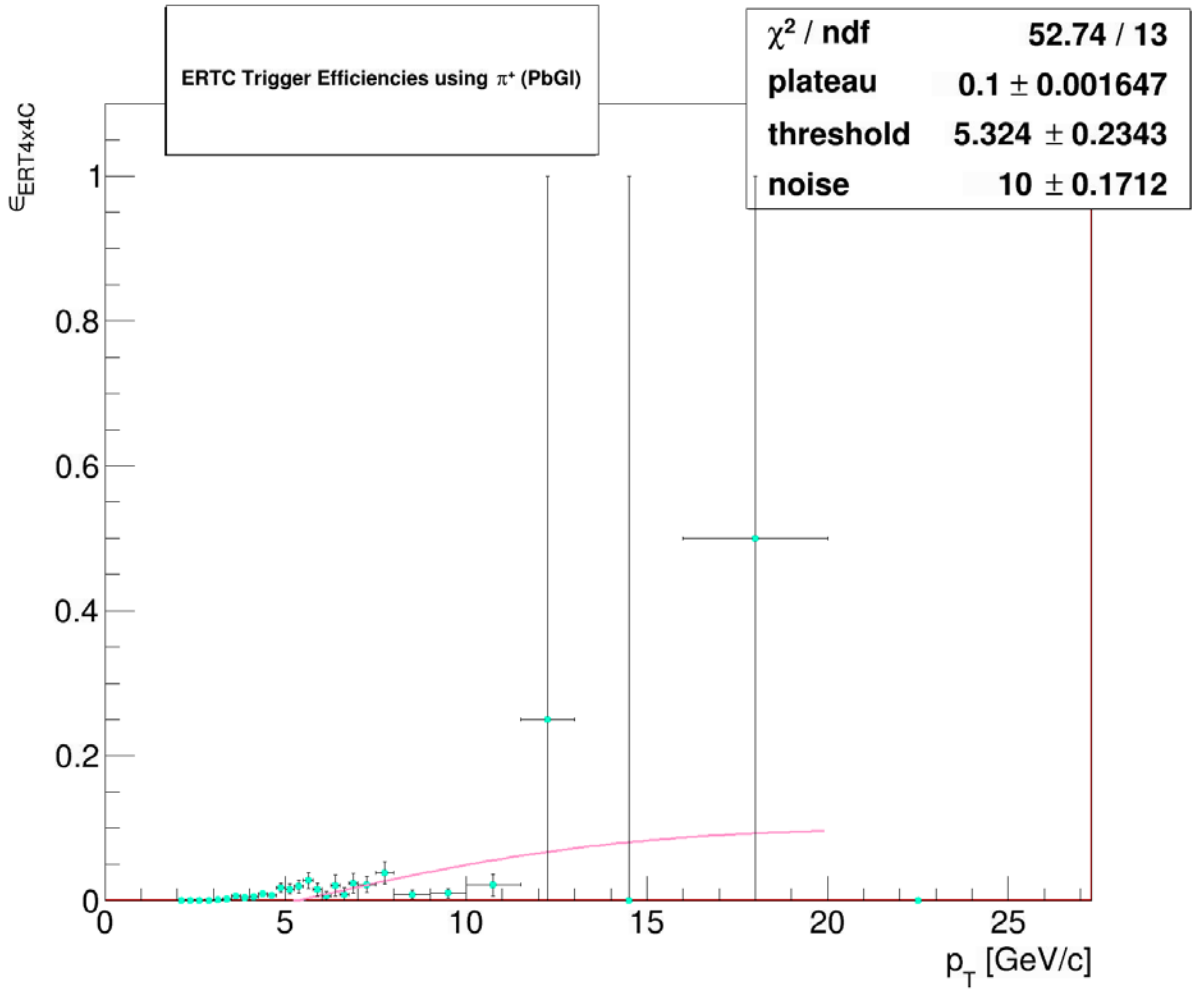
- Trigger Efficiencys as fuction of pT

Korea Univ.
Jaehee Yoo

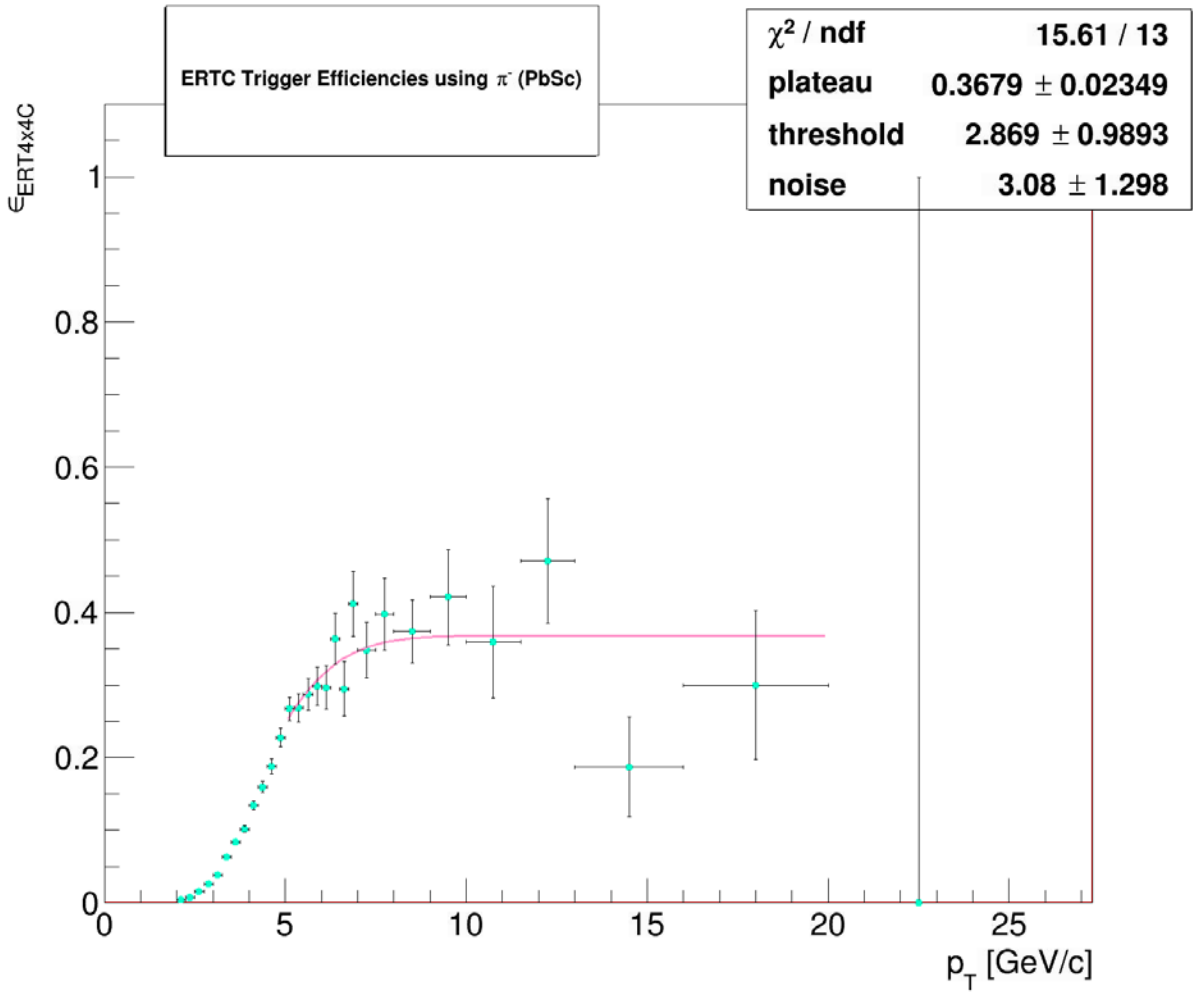
2019. 07. 18 Radiation lab. meeting

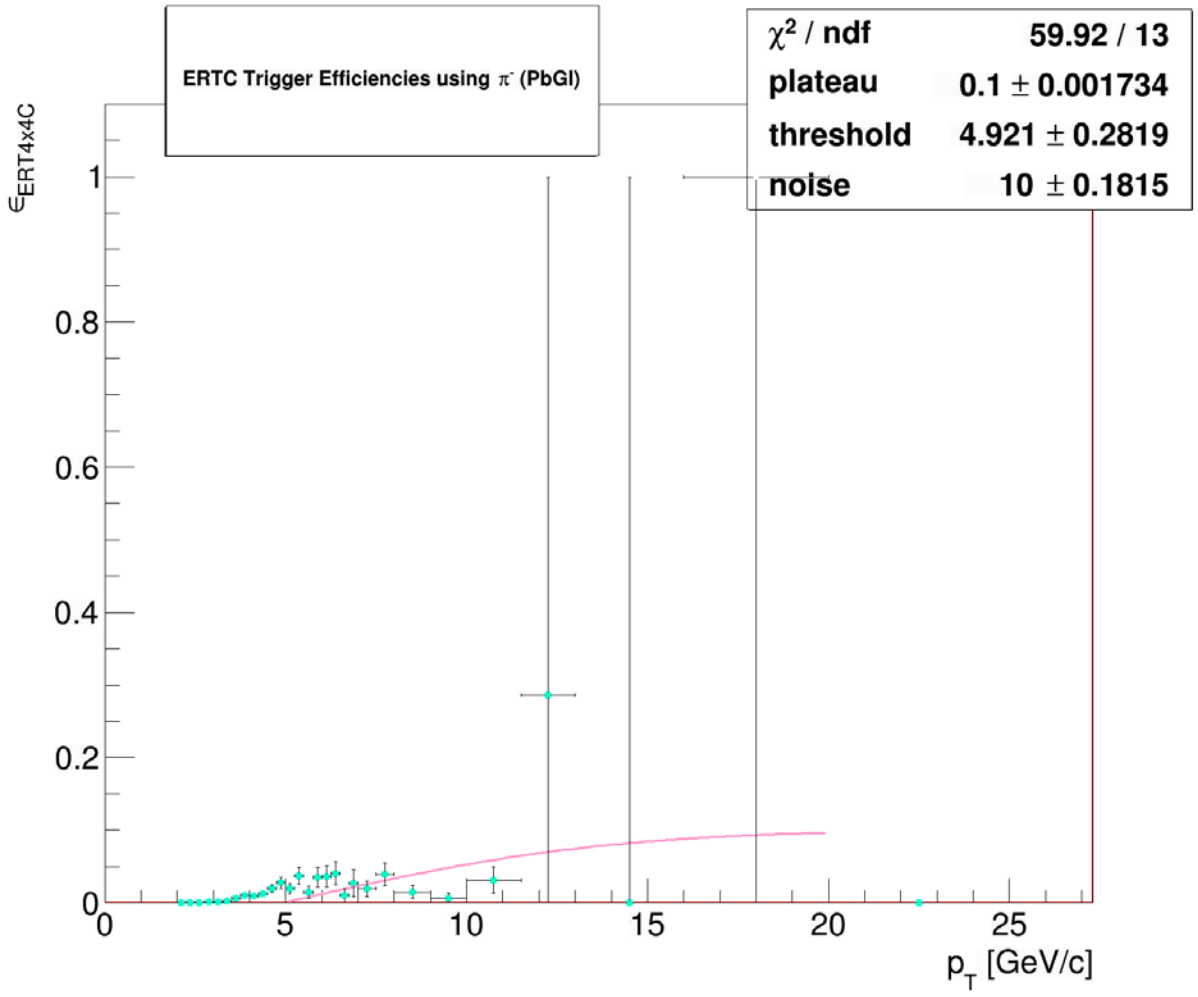
Pi+


ERTC Trigger Efficiencies using π⁺ (PbSc)
χ² / ndf 69.05 / 13
plateau 0.2783 ± 0.007792
threshold −39.43 ± 4.688
noise 0.7566 ± 6.838
ϵERT4x4C
p_T [GeV/c]


ERTC Trigger Efficiencies using π⁺ (PbGl)
χ² / ndf 52.74 / 13
plateau 0.1 ± 0.001647
threshold 5.324 ± 0.2343
noise 10 ± 0.1712
ϵERT4x4C
p_T [GeV/c]

Pi-


ERTC Trigger Efficiencies using π⁻ (PbSc)
χ² / ndf 15.61 / 13
plateau 0.3679 ± 0.02349
threshold 2.869 ± 0.9893
noise 3.08 ± 1.298
ε_ERT4x4C
p_T [GeV/c]

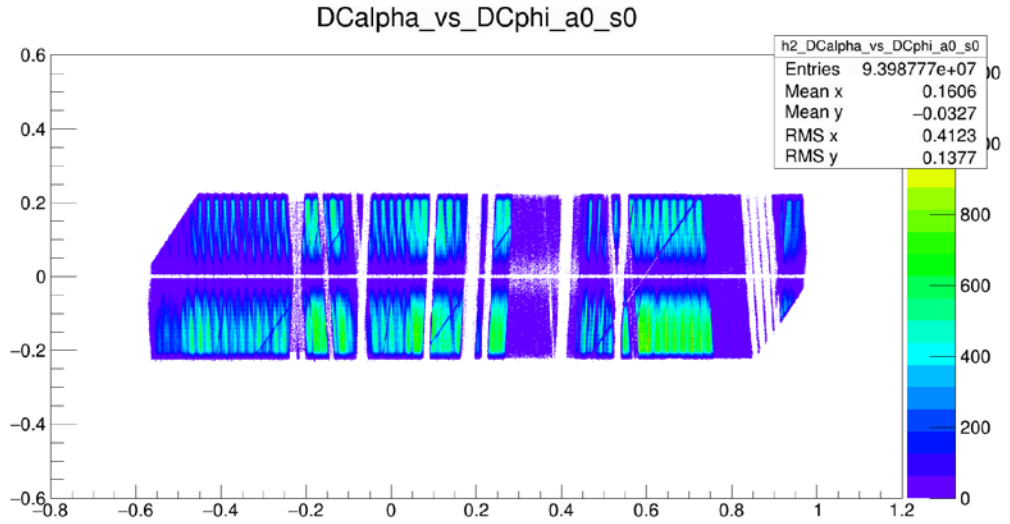

ERTC Trigger Efficiencies using π⁻ (PbGl)
χ² / ndf 59.92 / 13
plateau 0.1 ± 0.001734
threshold 4.921 ± 0.2819
noise 10 ± 0.1815
ε_ERT4x4C
p_T [GeV/c]

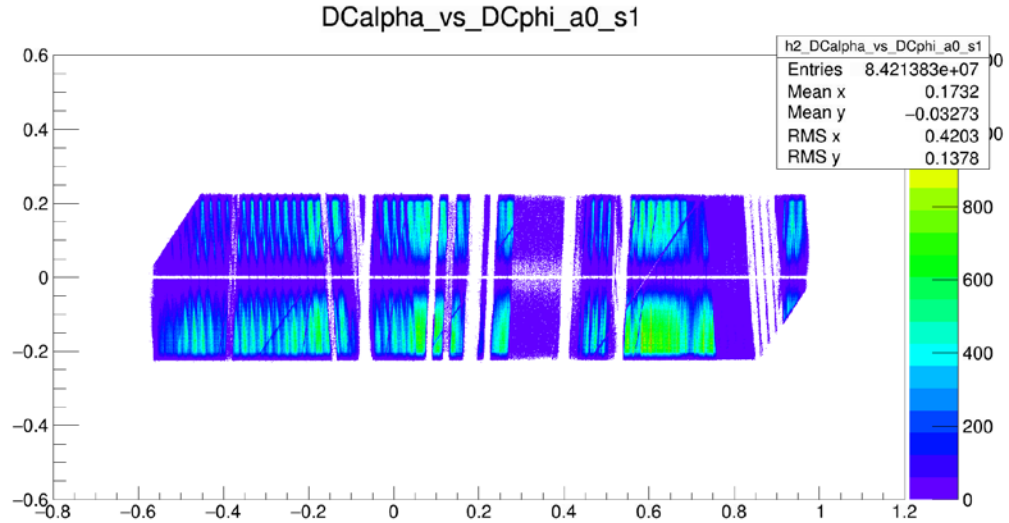
Thank you.

Back up

Fiducial cut

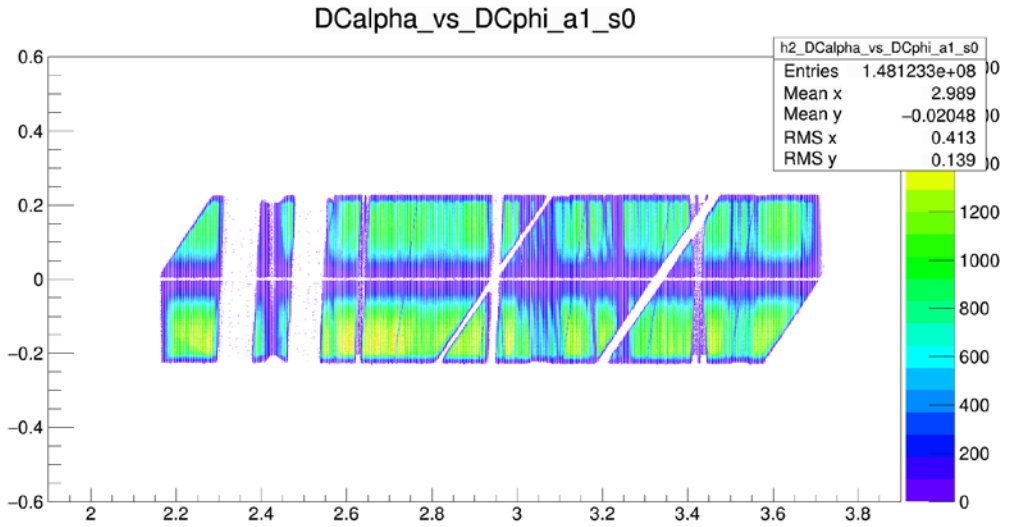
Comparision of masked EMCal warnmap or not

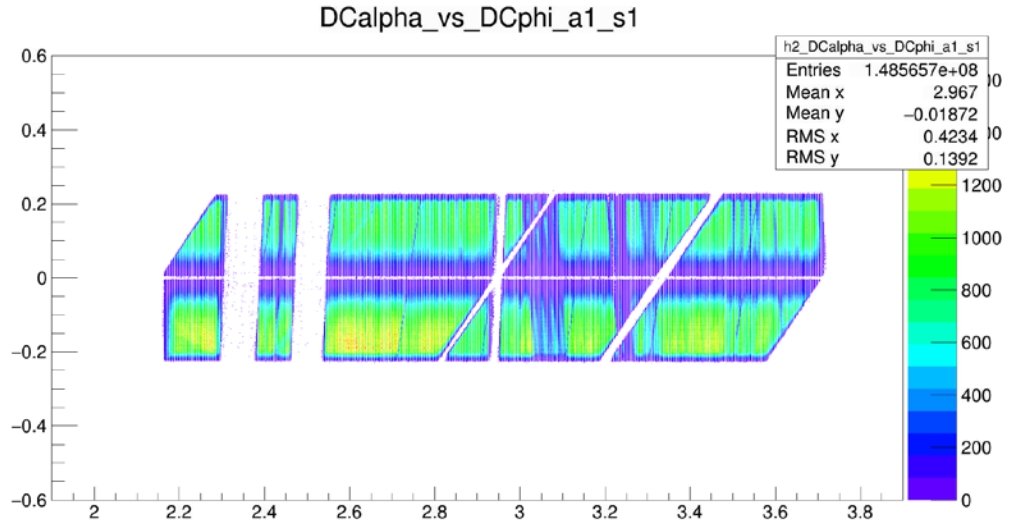




West

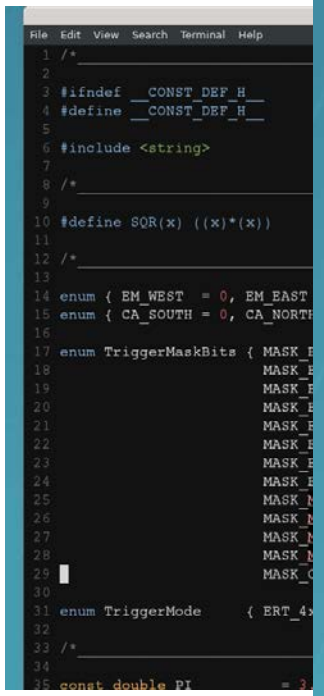
East





plan

1. Run QA	
2. calribration - EMCal gain matching (carried norbert) - PC calibration -	
3. Event selection - Convincing evidences of each cuts.	
4. Suvival rate true events Background rejection power	
4.1 trigger efficeiency calculation	
4.2 Simulation and recon_eff	12.01 ~ 05.07
5. Luminosity study	05.07 ~ 05.14
6. Cross section as function of pT compare with π^0	05.14 ~ 06.14
7. A_N spin anaysis +-	06.14 ~ 08.14
8. Systematic error	08.14 ~ 09.14
9. Preliminary	???



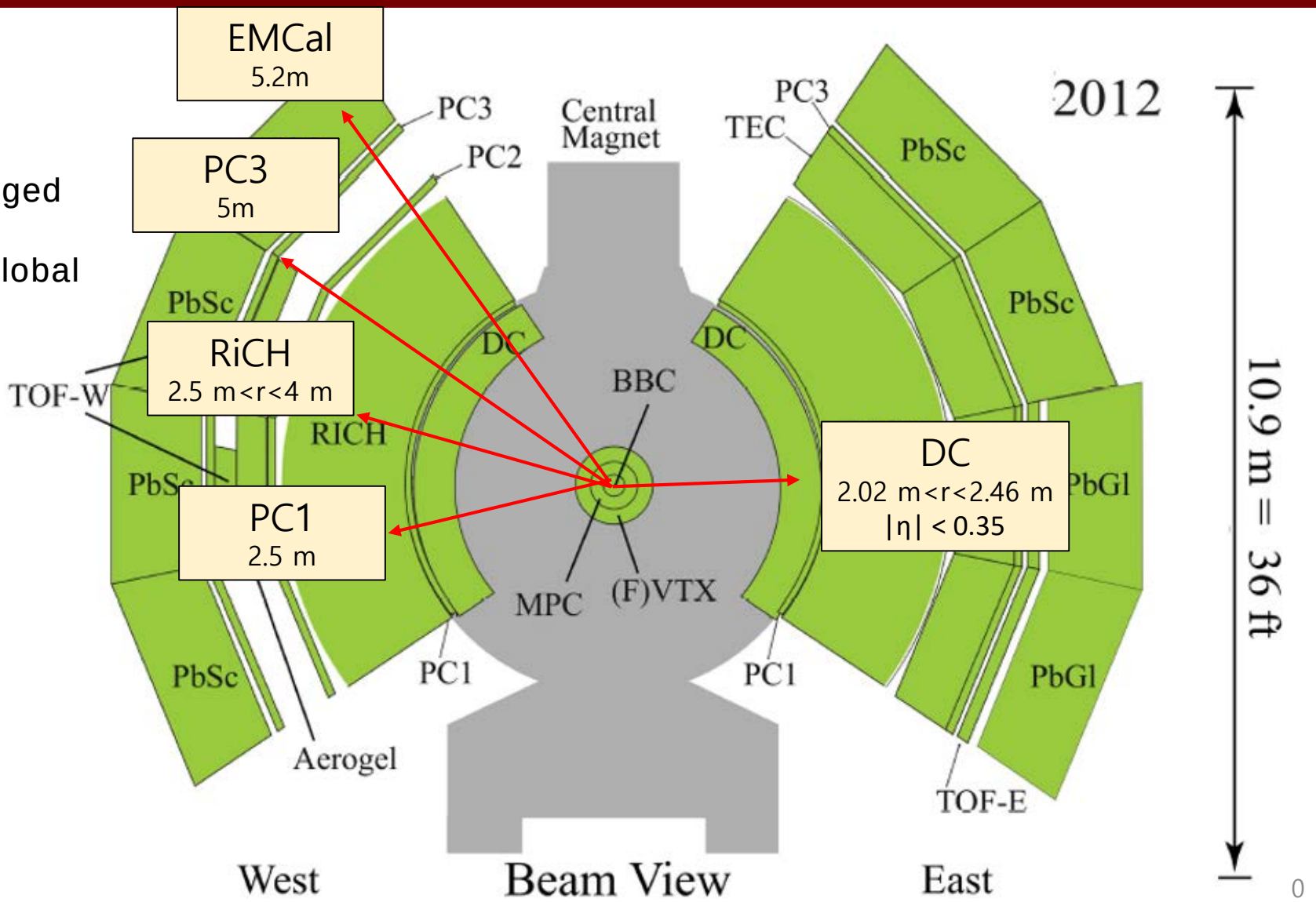

```
162
163 int
164 AnaTMChgPionRunQA::process_event(PHCompositeNode* topNode)
165 {
166
167   m_nevent++;
168   if ( m_nevent%50000 == 0 )
169     {
170       cout << "AnaTMChgPionRunQA::process_event() - event " << m_nevent << " is processing." << endl;
171     }
172
173   if ( getEventwiseNodes(topNode) != true ) return DISCARDEVENT;
174
175   if ( m_isSimulation == true && m_isAsymBgStudy != true ) startAnalysisGen();
176
177   h1_zbbc->Fill(d_anaevt->getZVertex());
178
179   if ( m_isSimulation != true && isPass1ZVertexOK(d_anaevt) != true ) return DISCARDEVENT;
180
181   // this counts #events after z-vertex cut.
182   fillHistForEvent();
183
184   // for ERT4x4C trigger efficiency calculation using MPC sample
185   // MPC sample includes ERT2x2 so that excludes this
186   //if ( m_isSimulation != true && m_isTrigEff == true &&
187   //     !(d_anaevt->getEvtMPCA()==true||d_anaevt->getEvtMPCB()==true||d_anaevt->getEvtMPCC()==true) )
188   //  return DISCARDEVENT;
189
190   // if you play with ERTC sample, use this for below purpose.
191   // (1) ERT4x4C trigger efficiency calculation using ERT4x4C sample itself.
192   //     but for other trigger samples, shoulbe commented out!
193   // (2) analysis using ERTC.
194   // (3) X-section measurement with ERTC sample
195   //if ( m_isSimulation != true && d_anaevt->getEvtERTC() != true ) return DISCARDEVENT;
196
197   // for X-section measurement we are using 10 cm z-vertex cut with BBC2 Live bit
198   // so comment in below if you want to measure x-section usign ERTC
199 //  if ( m_isSimulation != true && m_isTrigEff != true &&
200  //       d_anaevt->getLiveBBC2() != true ) return DISCARDEVENT;
201
202   // X-section measurement with MB sample
203   if ( m_isSimulation != true && d_anaevt->getEvtBBC2() != true ) return DISCARDEVENT;
204
205   startAnalysis();
206
207   return EVENT_OK;
208
209 } // AnaTMChgPionRunQA::process_event()
```

Drift Chamber for PHENIX

- Main purpose:
  - Precise measurement of the charged particle's momentum
  - Gives initial information for the global tracking in PHENIX

- Acceptance:
  - 2 arms 90° in ϕ each
  - ±90 cm in Z
  - 0.7 units of η

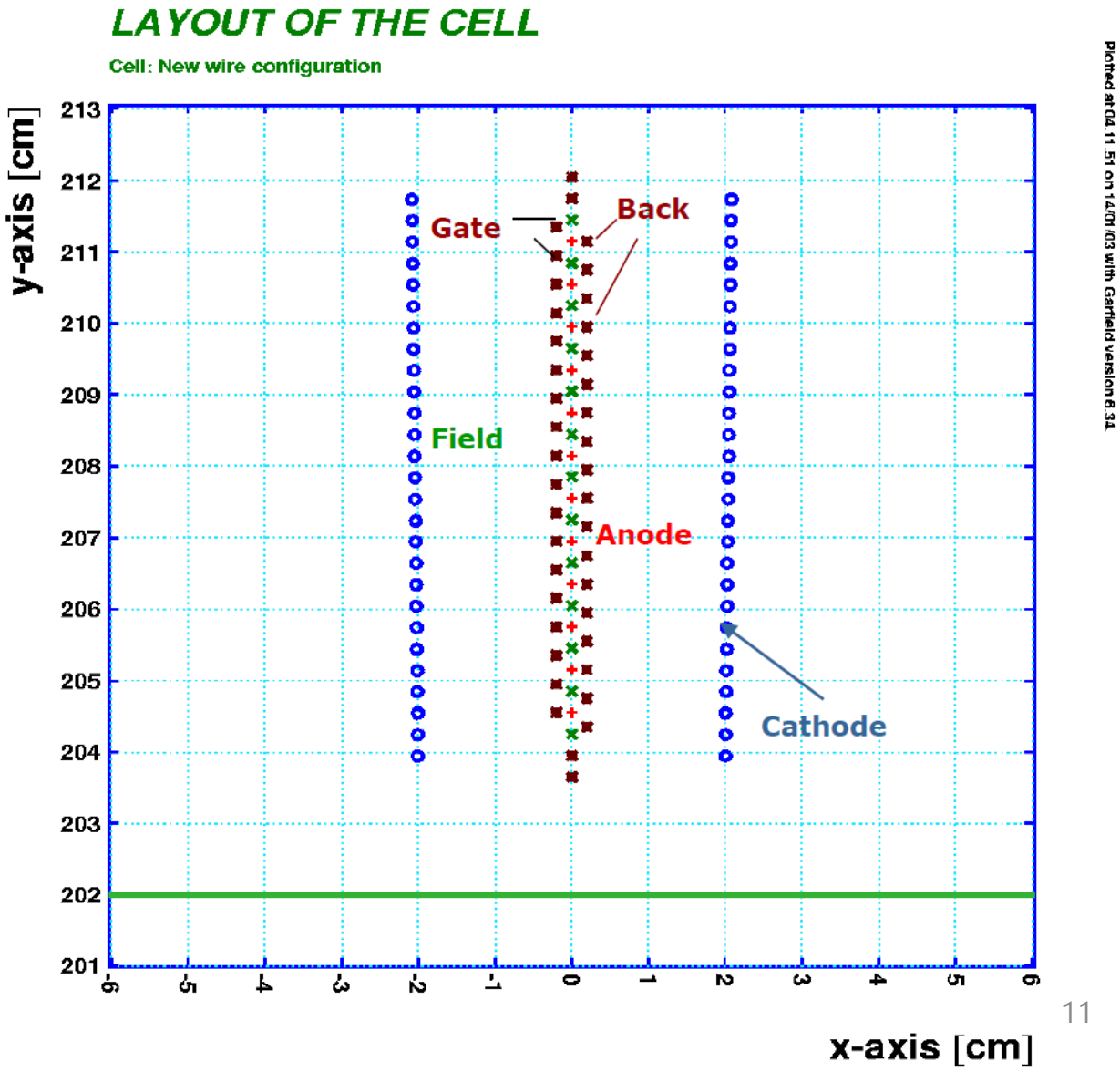
- Location:
  - Radial :2.02<R<2.48 m
  - Angular:
    - West: $-34° < \phi < 56°$
    - East : $125° < \phi < 215°$



Drift field configuration

Specific field configuration around **anode wire** called drift region is created by “field forming” wires:

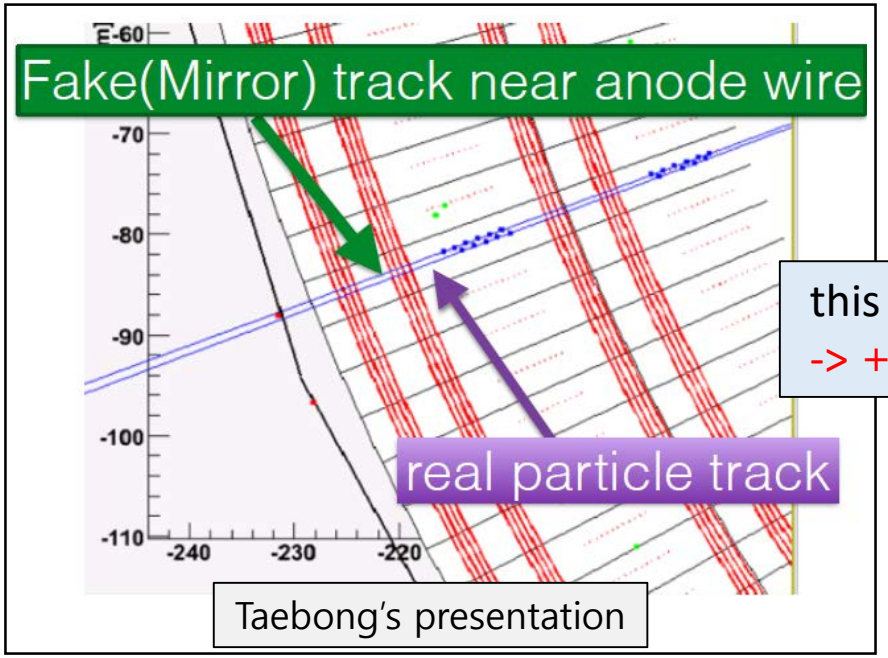
- **Cathode Wires** – Create uniform drift field between anode and cathode
- **Field Wires** – Create high electric field strength near the anode wire
- **Back Wires** – Stop drift from one side of the anode wire
- **Gate Wires** – Also create high field near the anode wire, Localize the drift region width



Drift Field Configuration

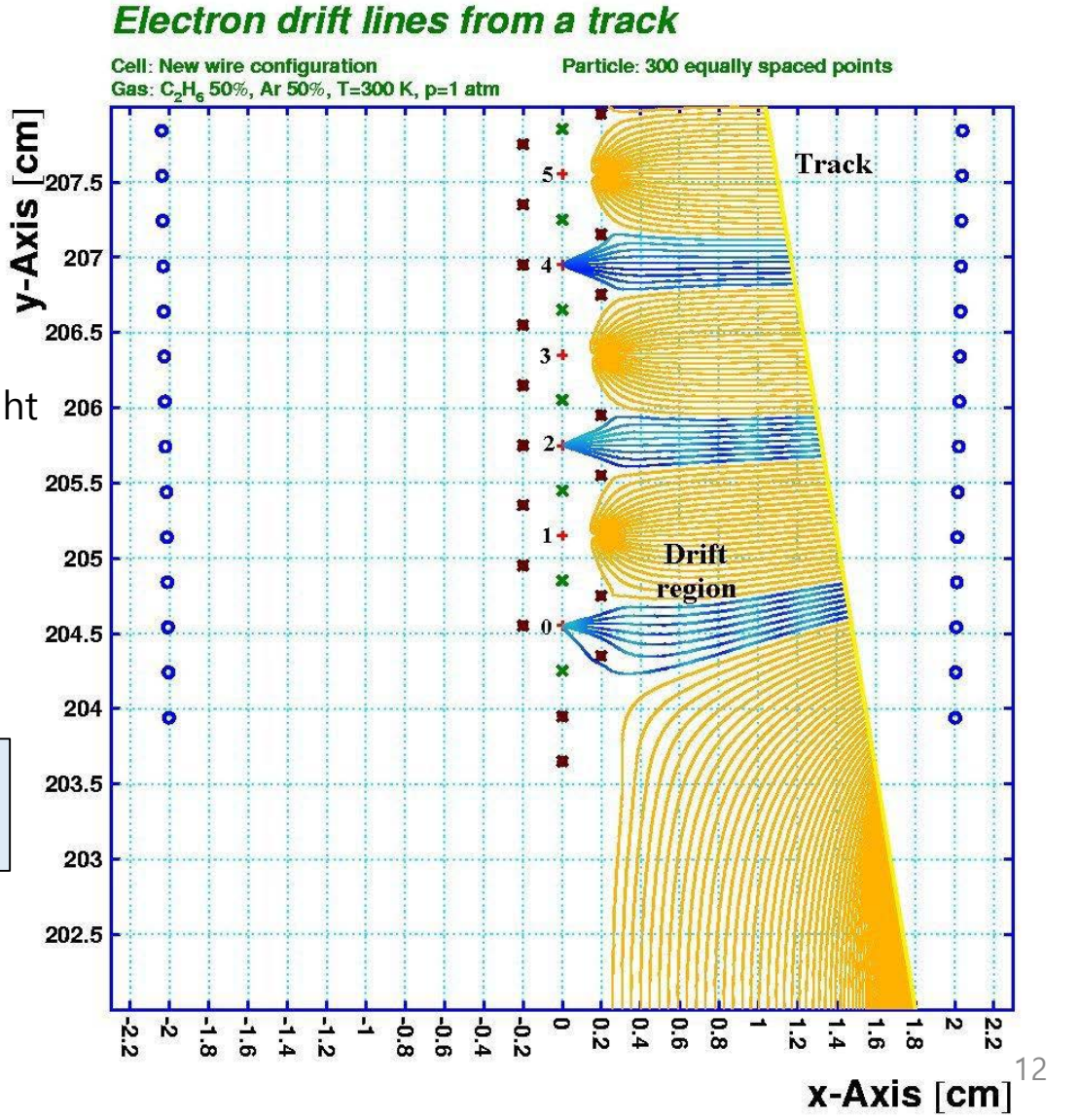
- Here is what happens when the charged particle passes through the wire cell
- Note that only even wires collect charge due to the **back wires** that block the odd anode wires !
- Back wires solves left-right ambiguity problem

-> But if High pT particle going through near anode wire region, left right ambiguity one more (fake) track might be reconstructed.



Taebong's presentation

this region should be masked
-> +-2mm from anode wire



Anode wire region

- define ϕ_{pair} angle

- If we require very narrow $\phi_{opening}$ angle of track pair and opposite sign, pair by fake and real track will survive.

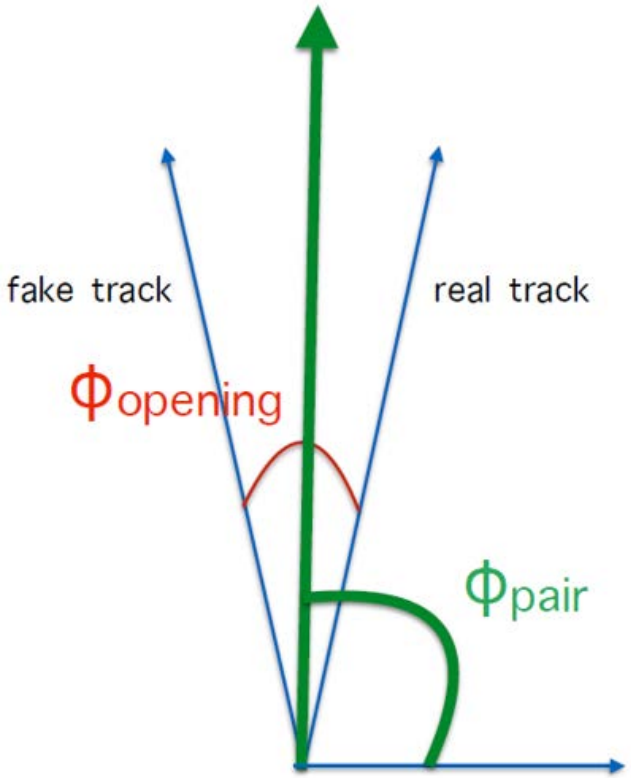
-> we can know anode wire position if drawing ϕ_{pair} distribution.

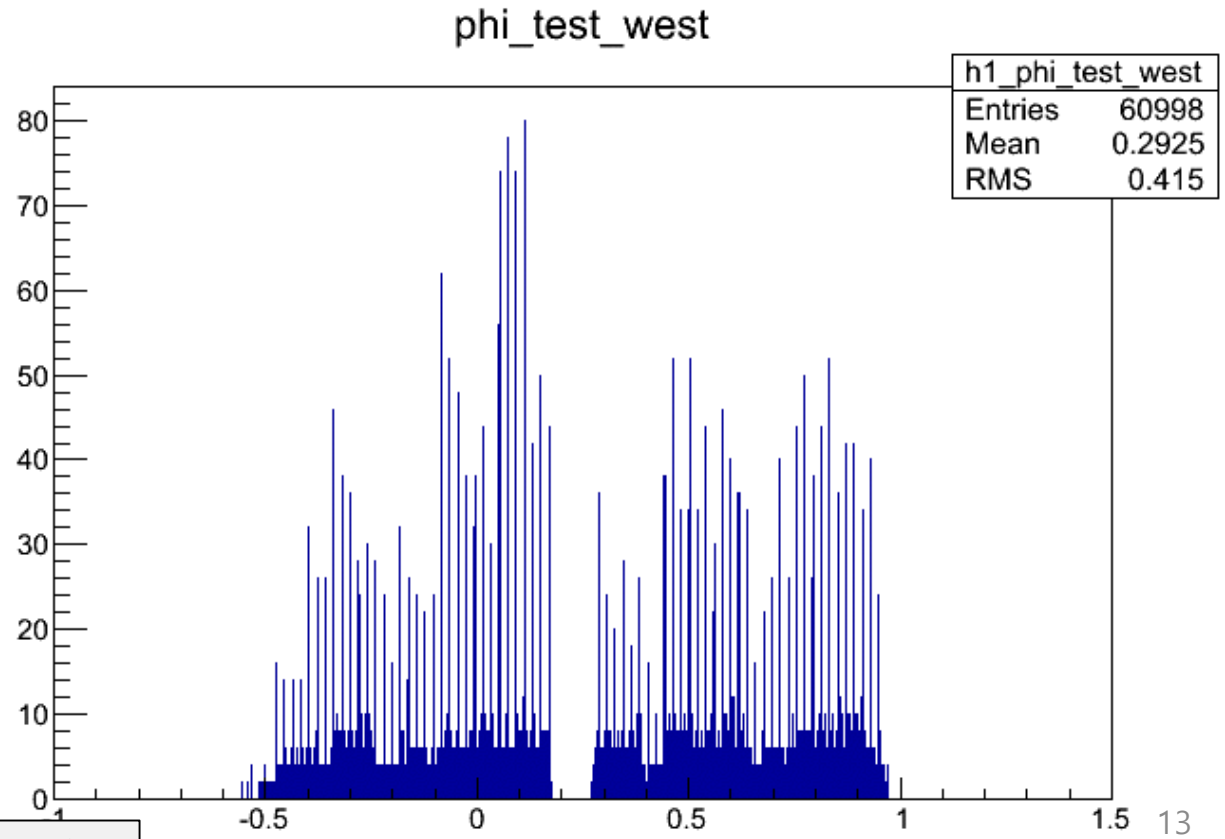
- Pair cuts

- opposite signed tracks in pair

- opening angle in phi < 0.002 [rad]

- DC track qualities in pair = 31 or 63 pT for each
track in pair > 0.5 [GeV/c]



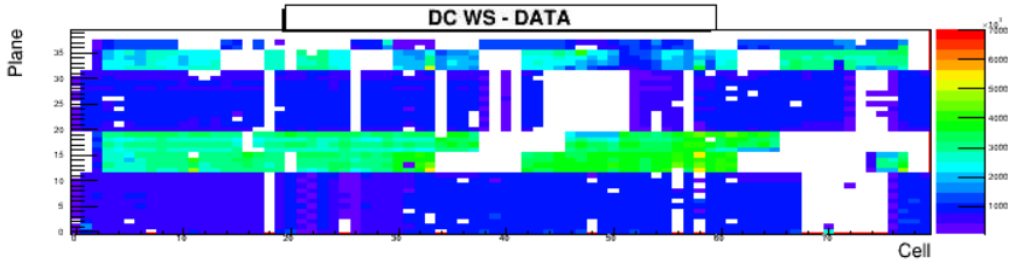


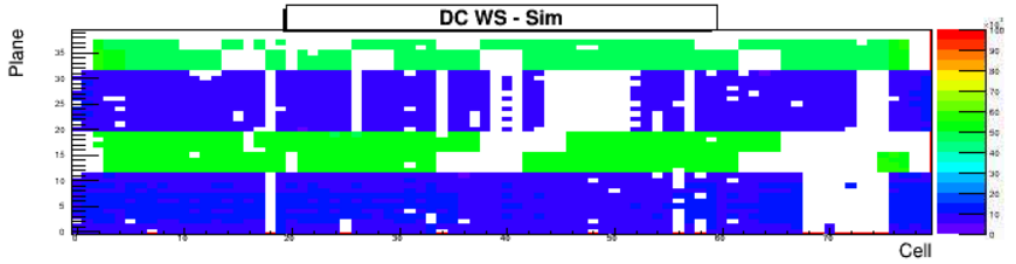
Taebong's presentation

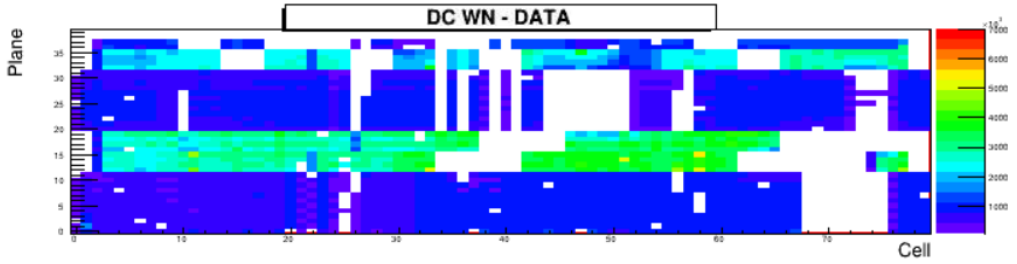
Dead map

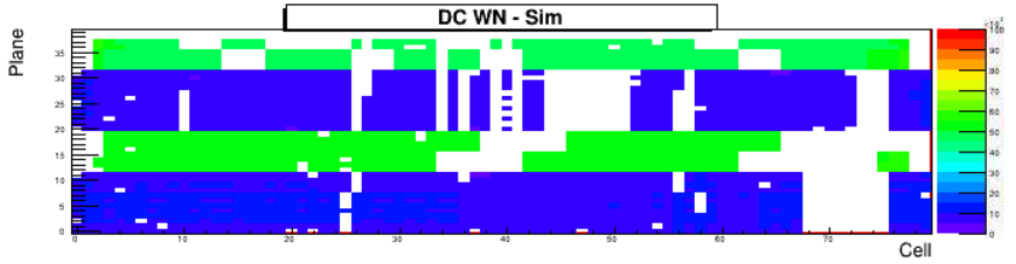
DC, PC, RICH for Run15

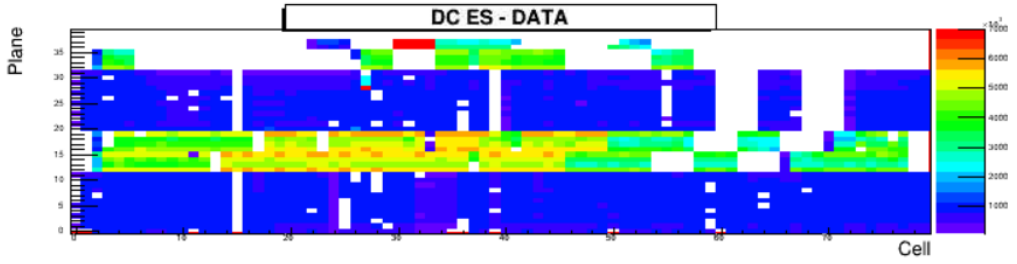
DC dead map

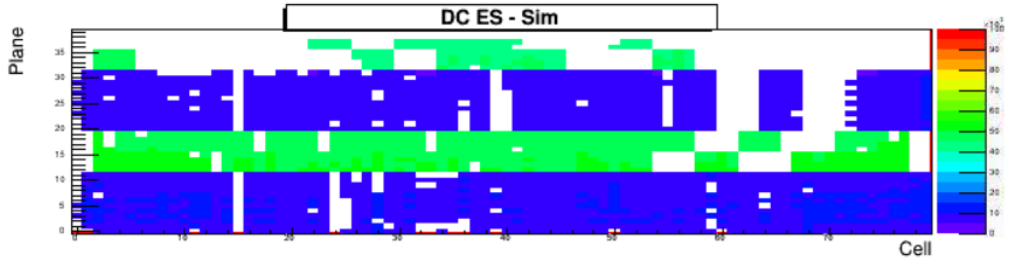

DC WS - DATA
Plane
Cell

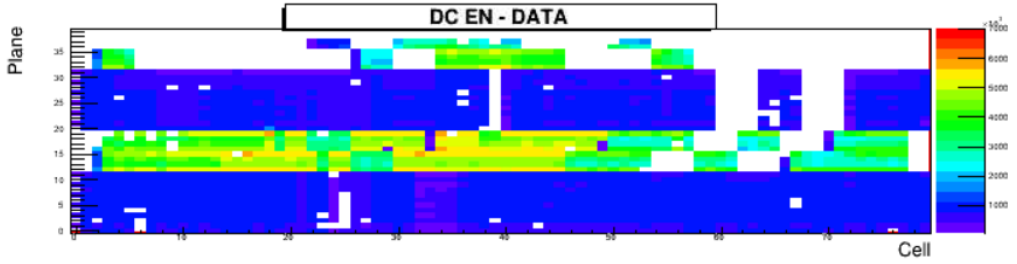

DC WS - Sim
Plane
Cell

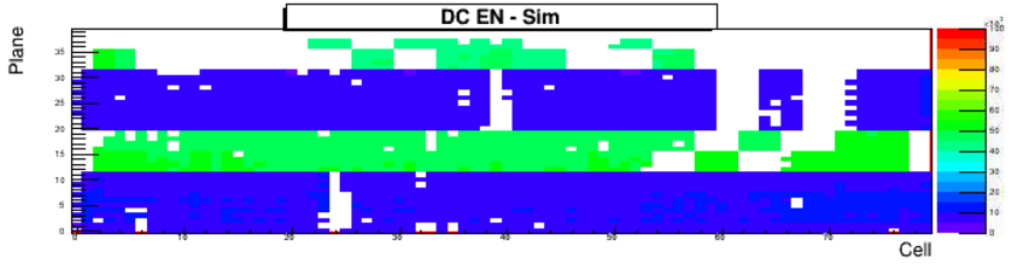

DC WN - DATA
Plane
Cell


DC WN - Sim
Plane
Cell

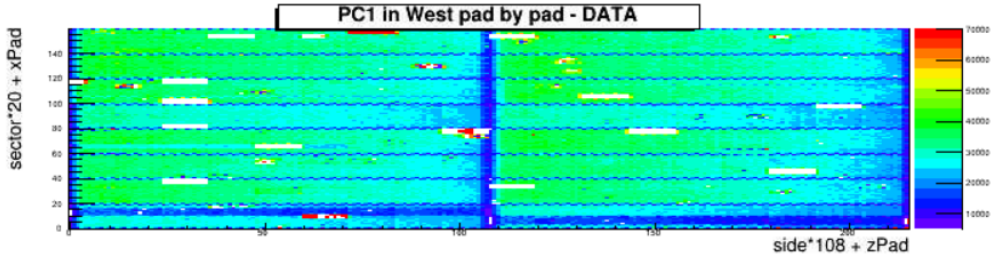

DC ES - DATA
Plane
Cell

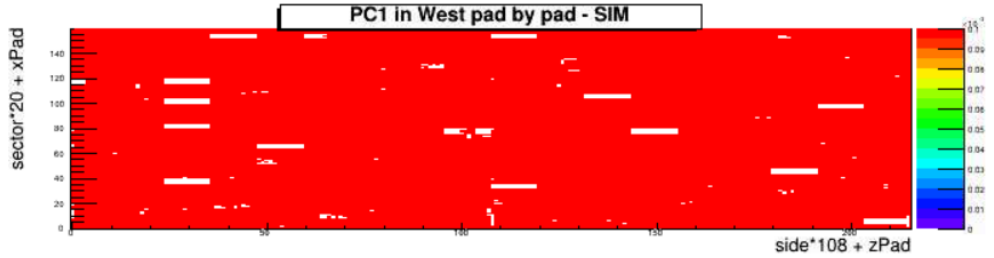

DC ES - Sim
Plane
Cell

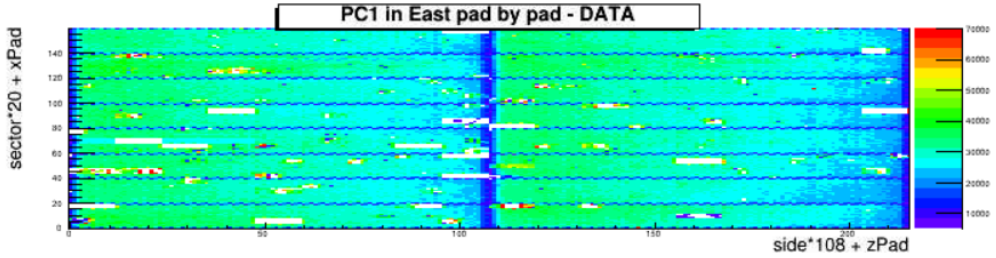

DC EN - DATA
Plane
Cell

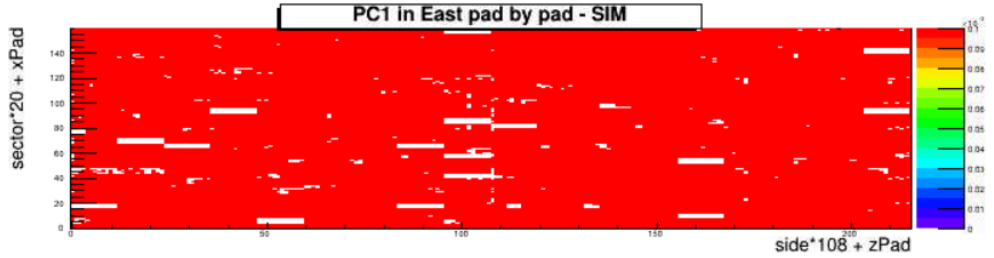

DC EN - Sim
Plane
Cell

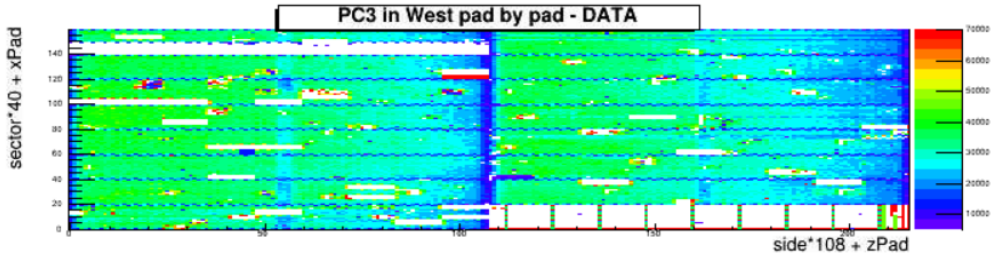
PC dead map

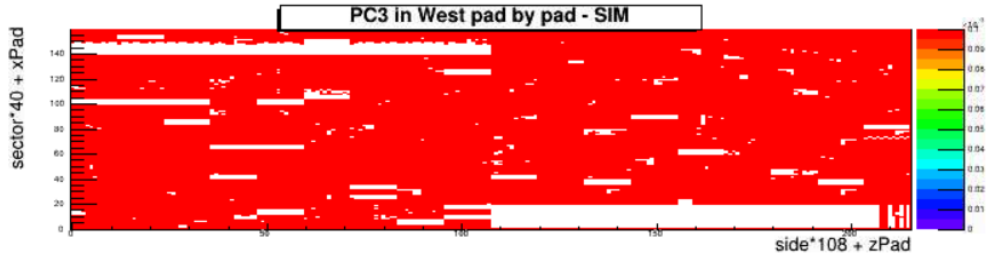

PC1 in West pad by pad - DATA
sector*20 + xPad
side*108 + zPad

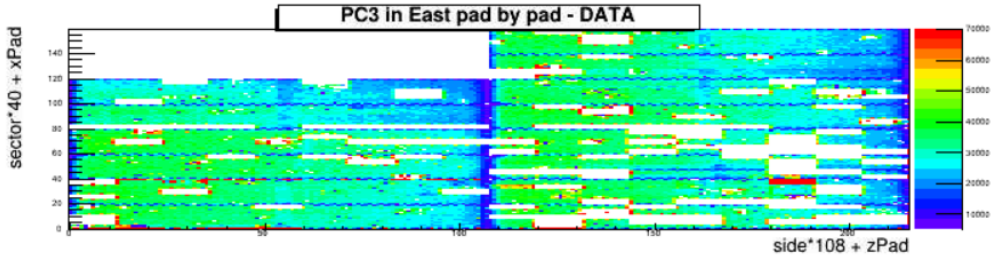

PC1 in West pad by pad - SIM
sector*20 + xPad
side*108 + zPad

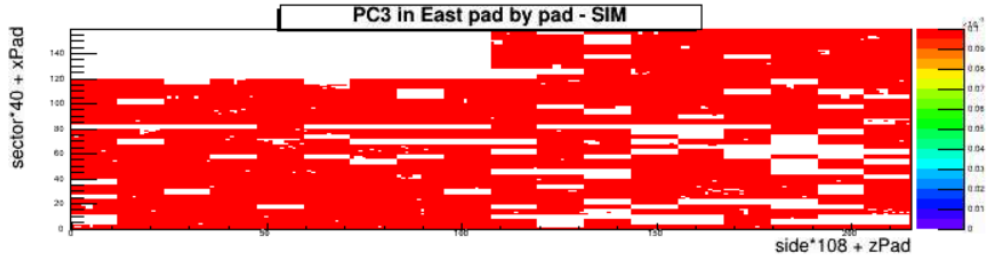

PC1 in East pad by pad - DATA
sector*20 + xPad
side*108 + zPad


PC1 in East pad by pad - SIM
sector*20 + xPad
side*108 + zPad

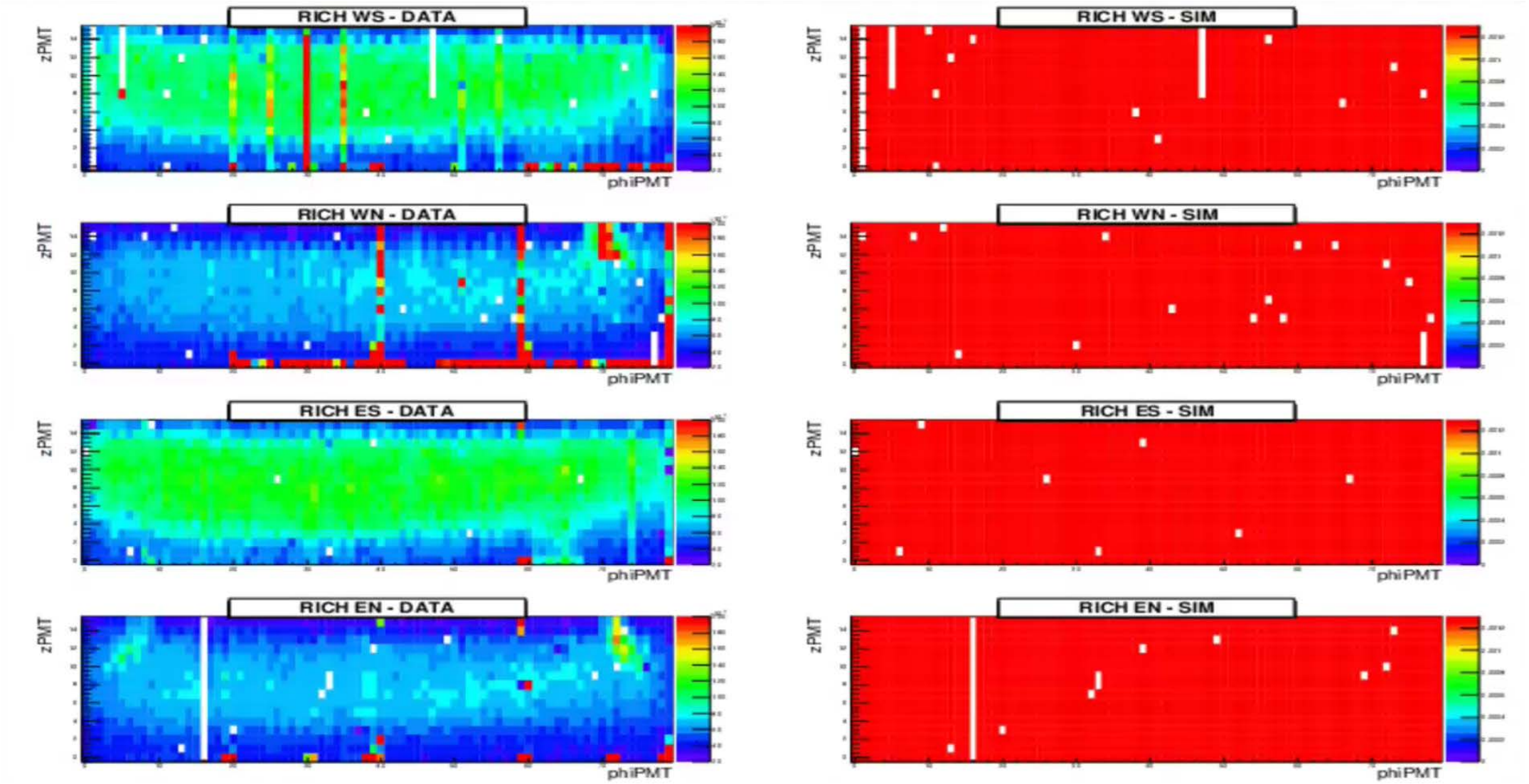

PC3 in West pad by pad - DATA
sector*40 + xPad
side*108 + zPad


PC3 in West pad by pad - SIM
sector*40 + xPad
side*108 + zPad

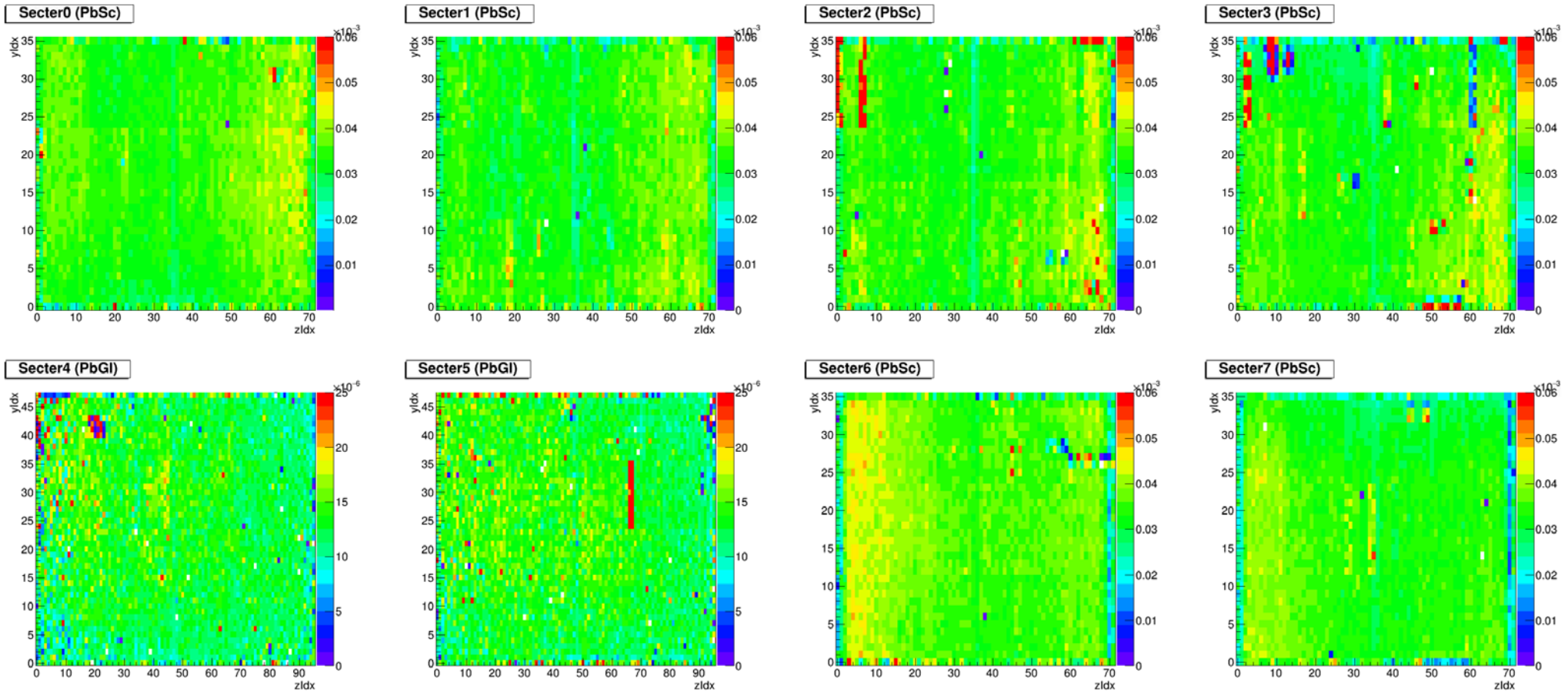

PC3 in East pad by pad - DATA
sector*40 + xPad
side*108 + zPad


PC3 in East pad by pad - SIM
sector*40 + xPad
side*108 + zPad

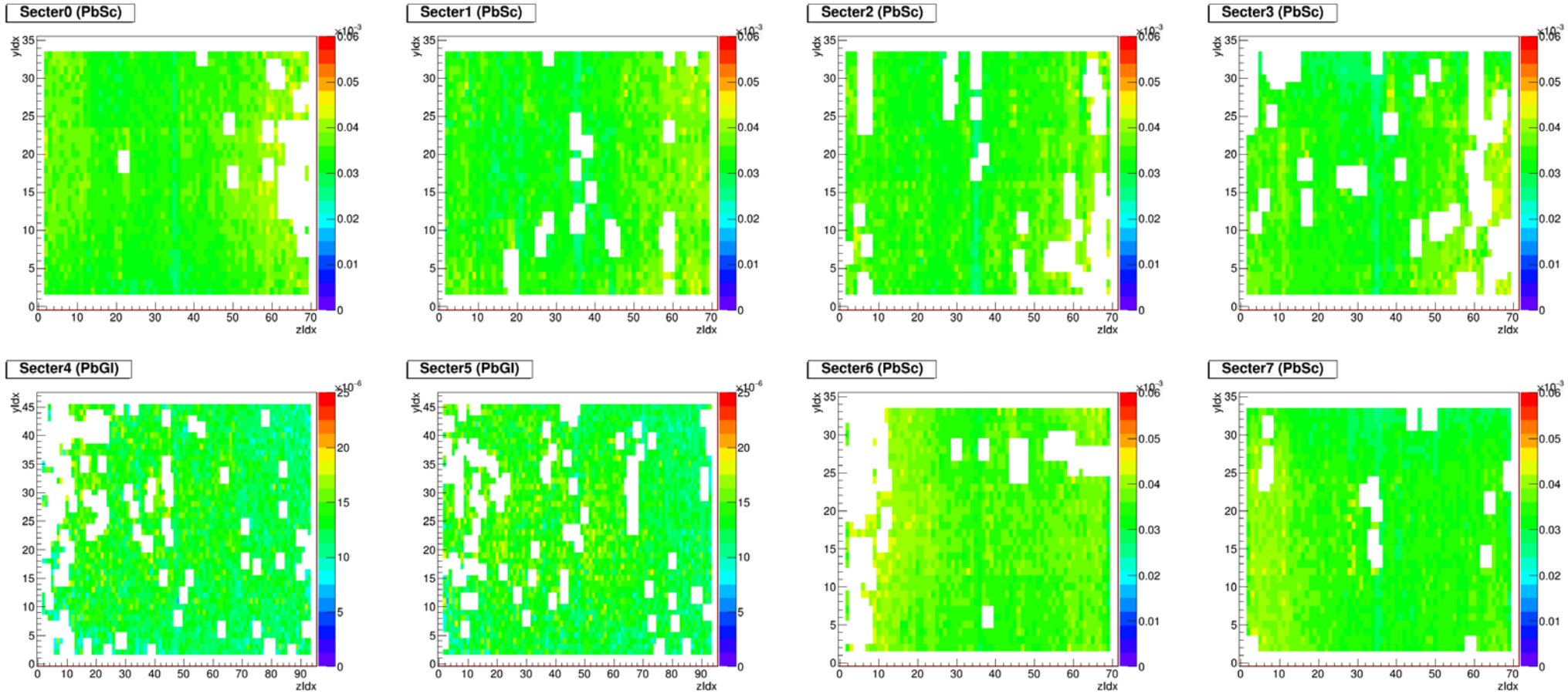
RICH dead map



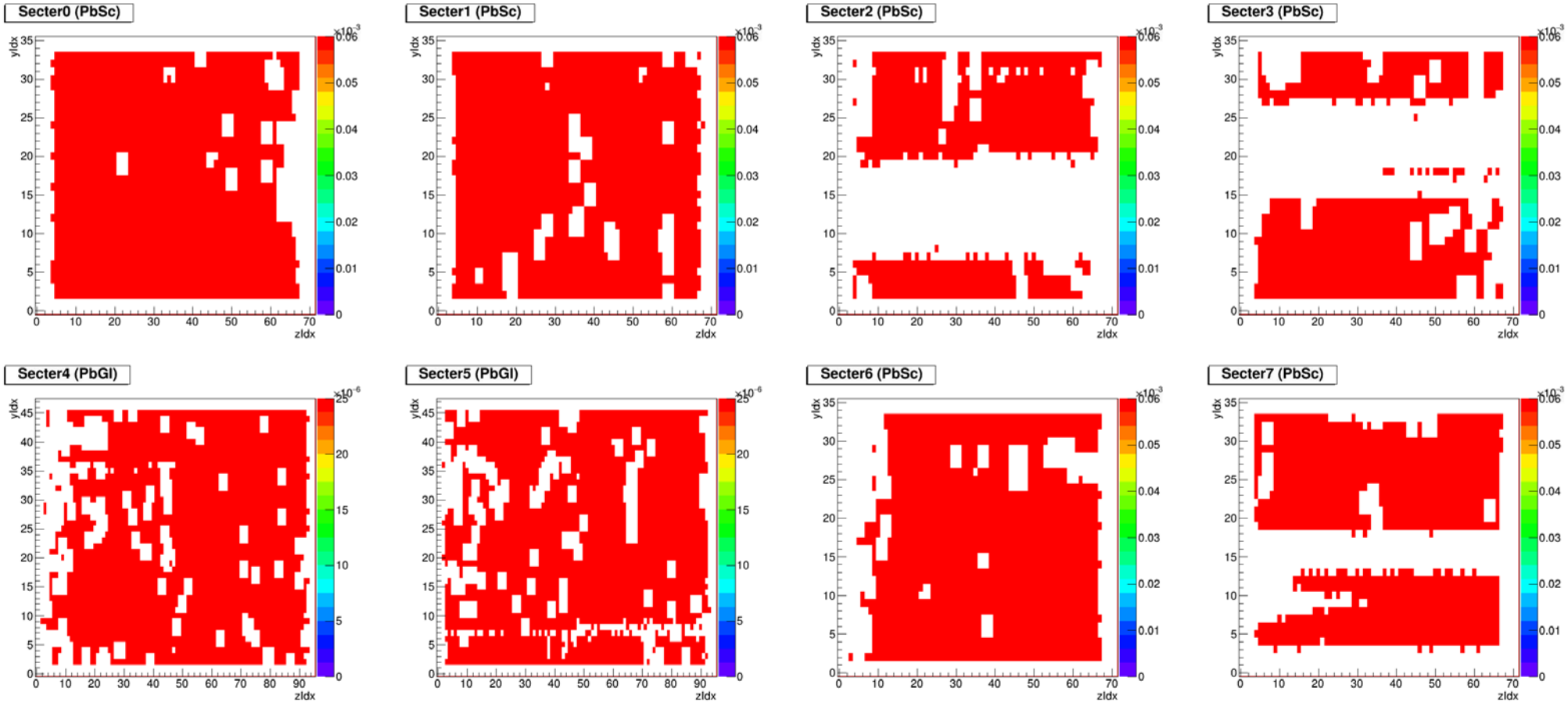
EMCal Distribution



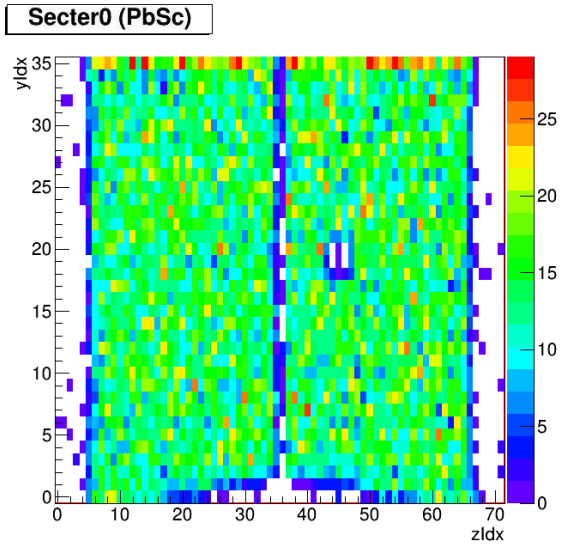
EMCal Warnmap Check

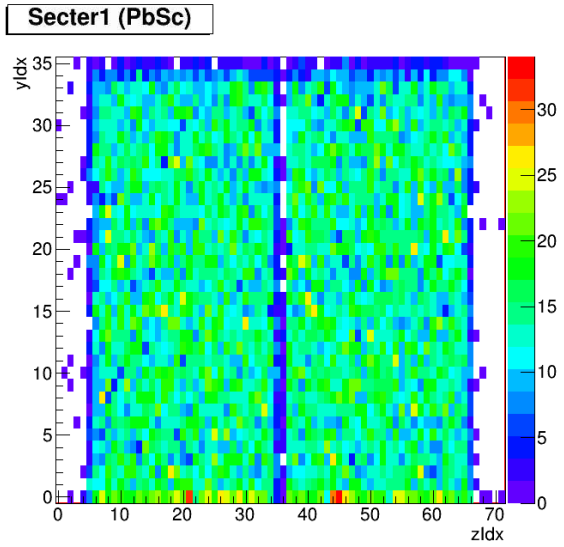


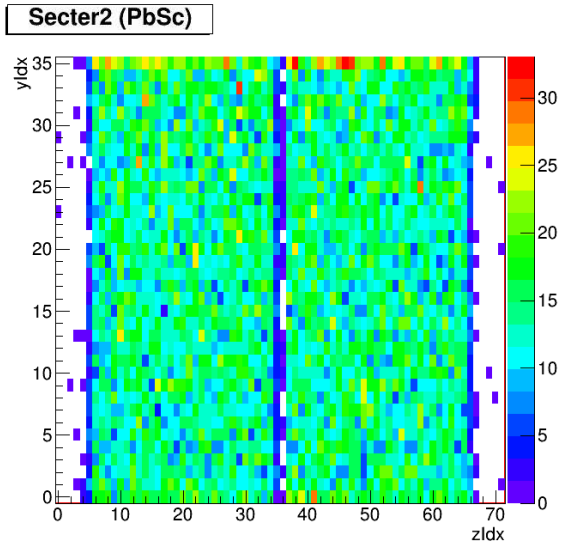
EMCal hit distribution for Simulation

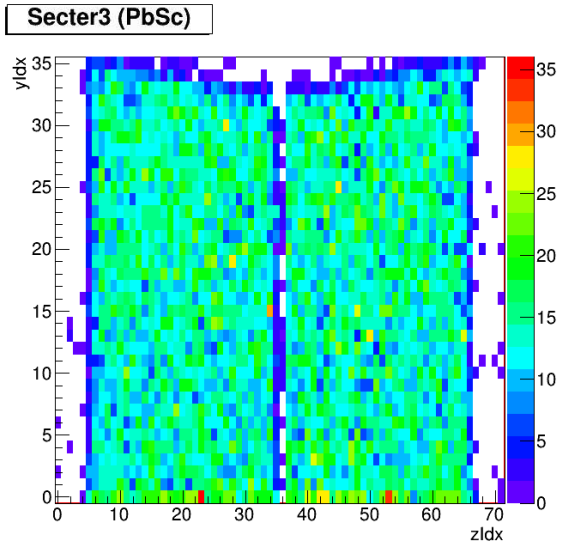


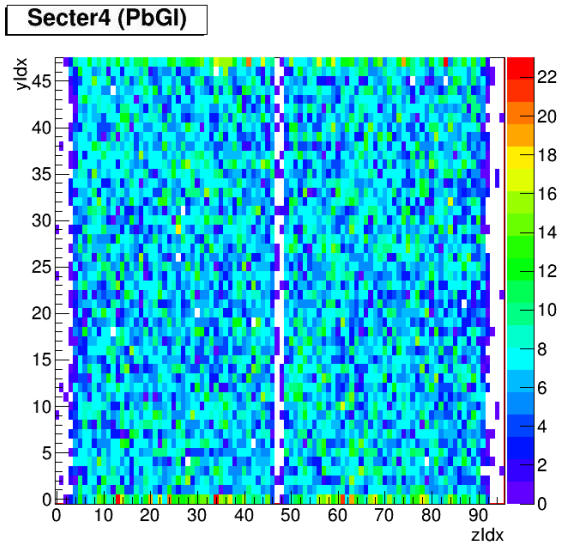
EMCal hit distribution for Simulation without deadmap

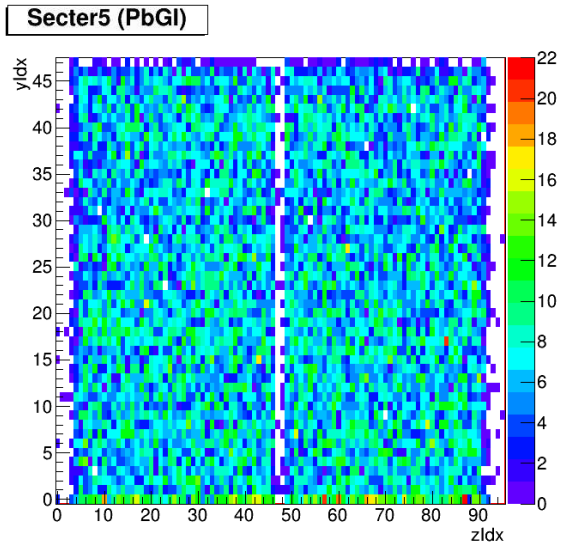


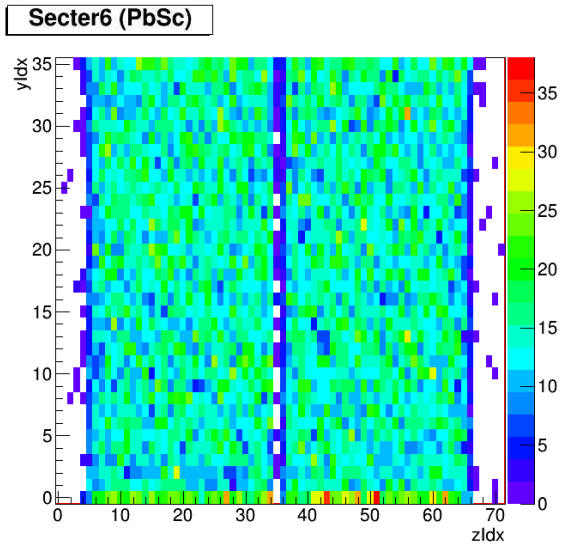


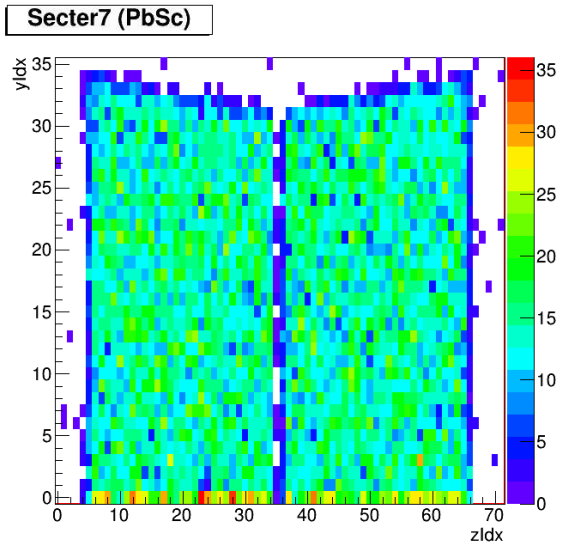




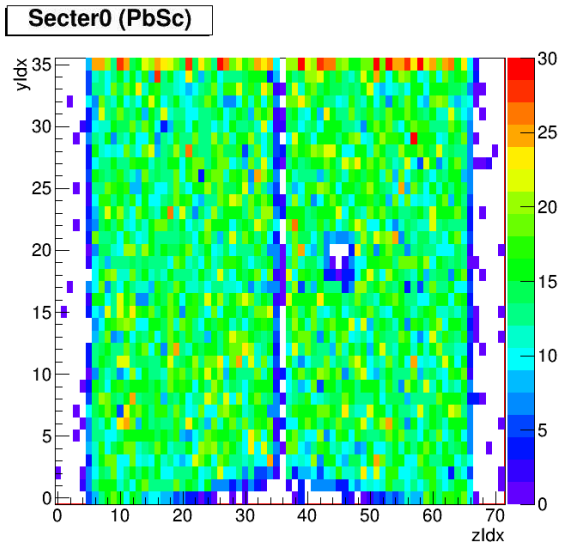


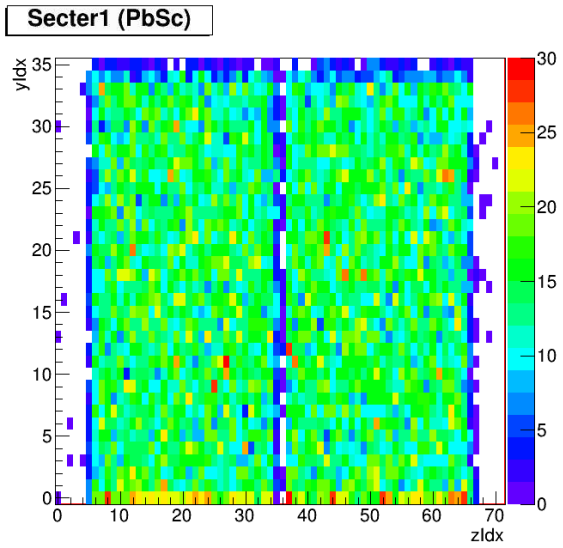


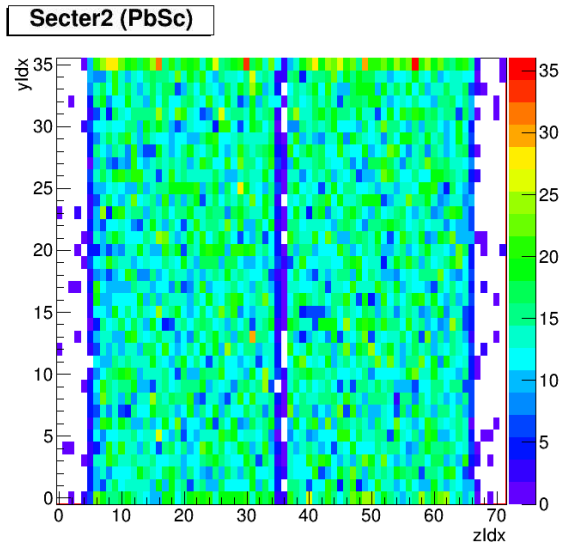


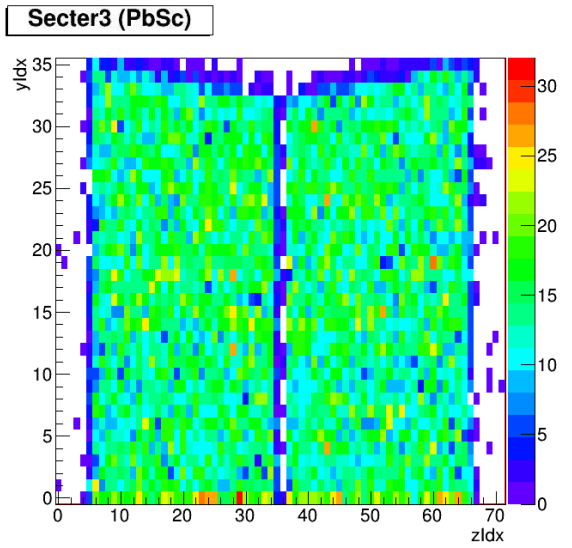


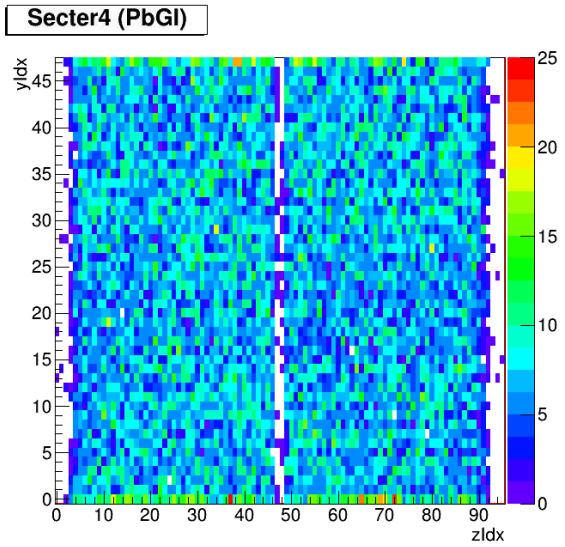
EMCal hit distribution for Simulation with RICH deadmap

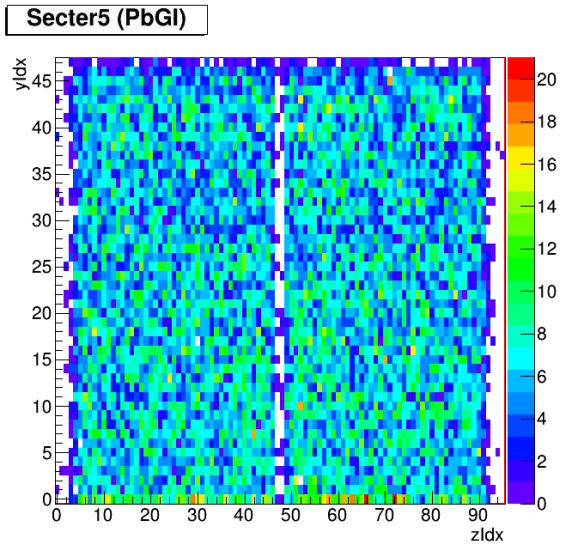


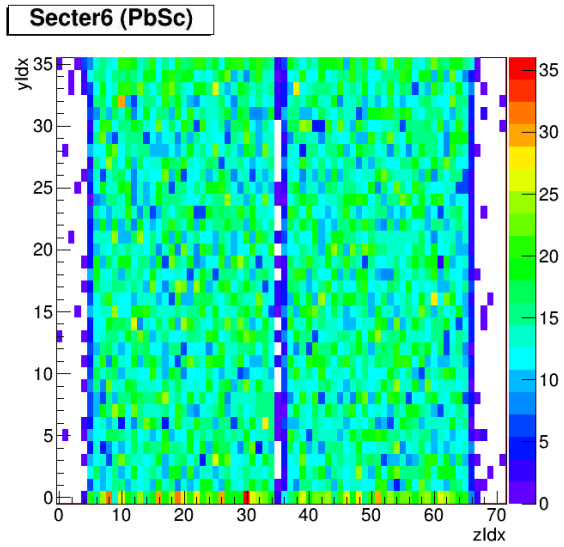


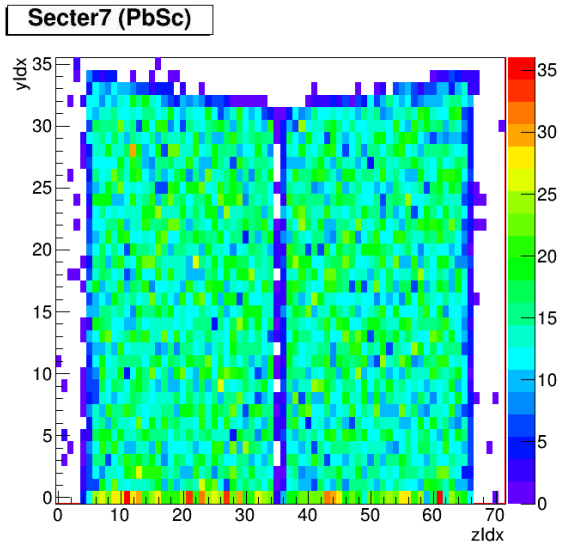




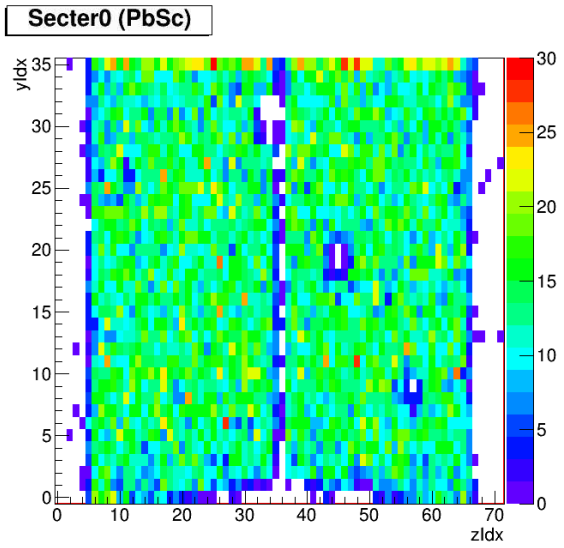


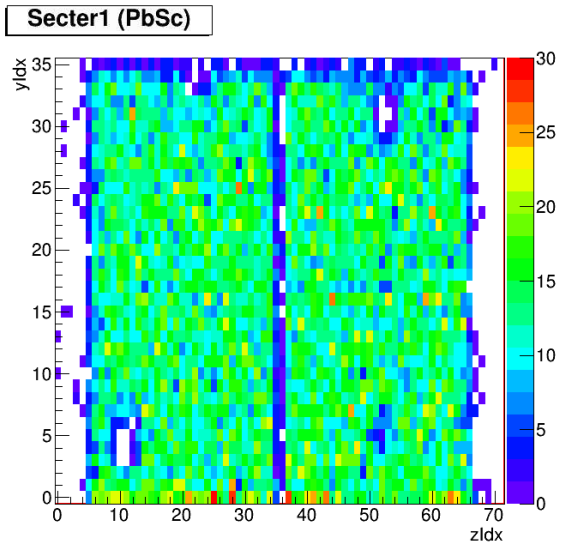


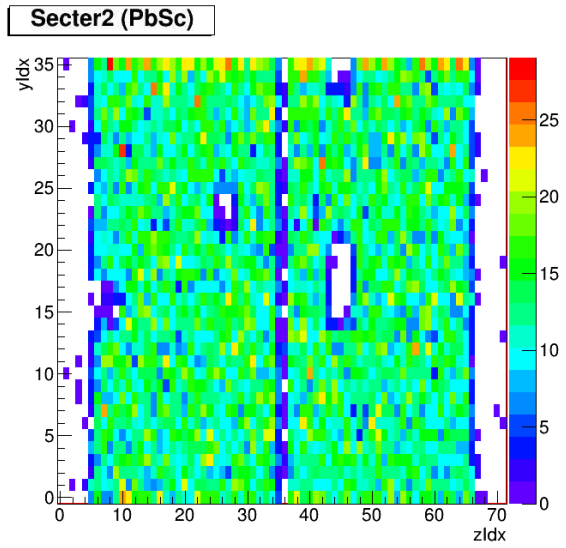


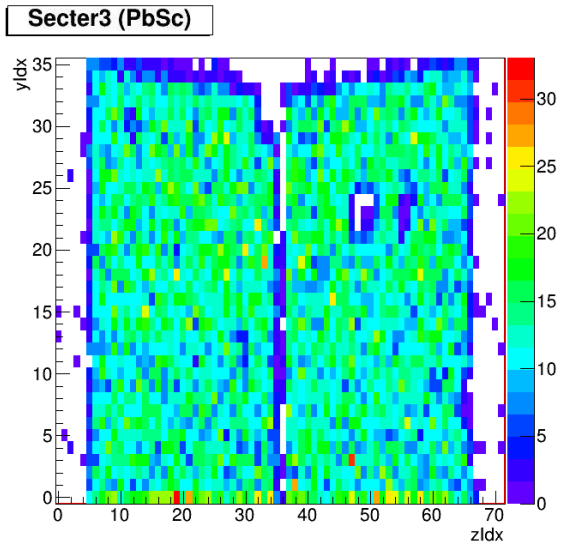


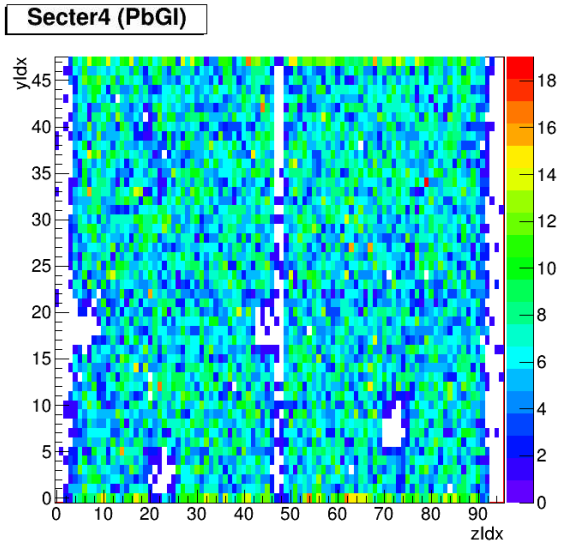
EMCal hit distribution for Simulation with PC deadmap

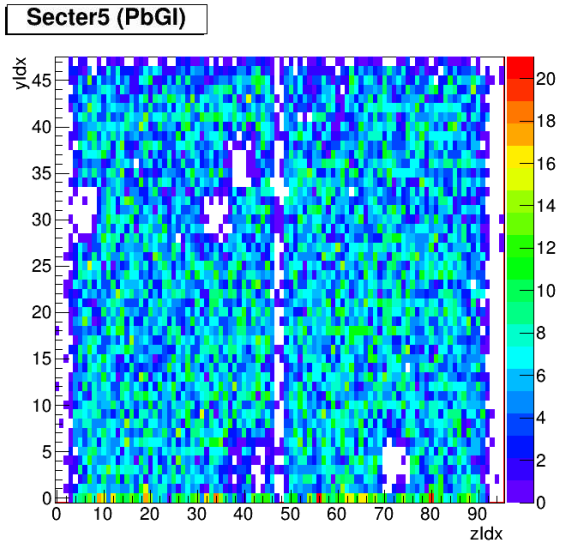


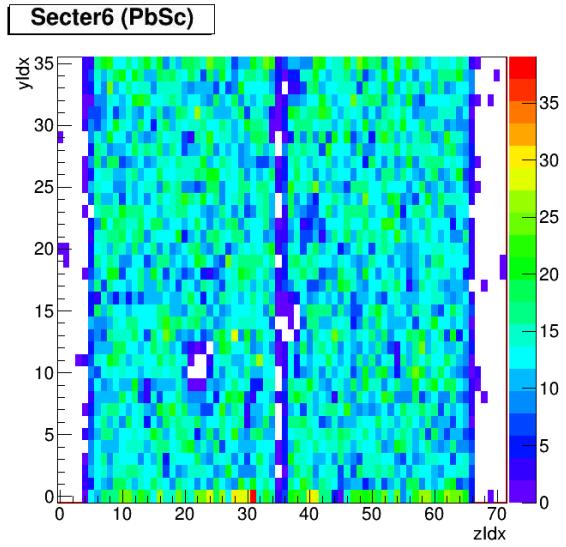


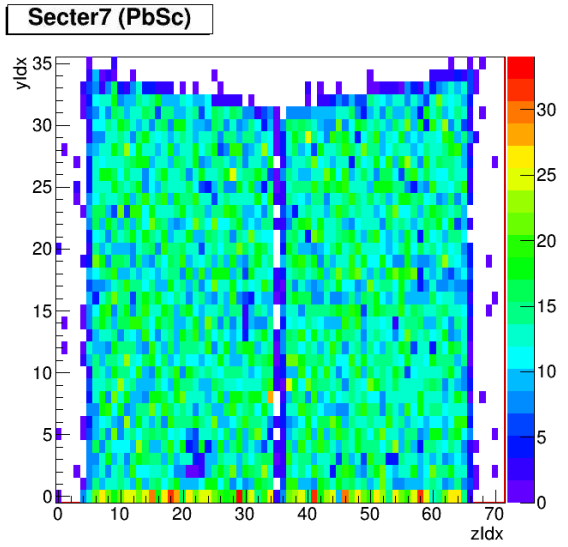




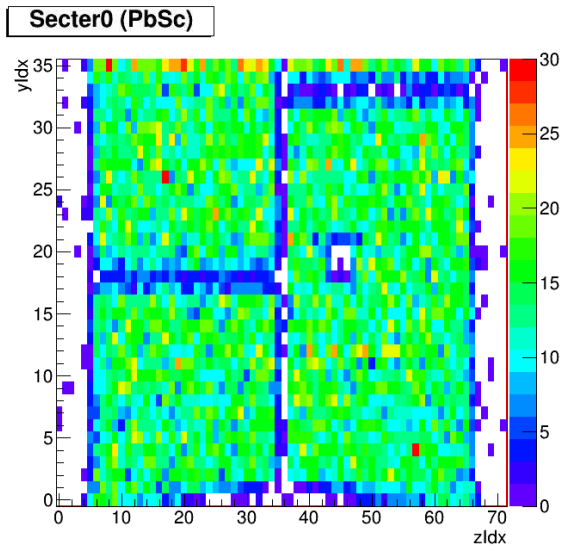


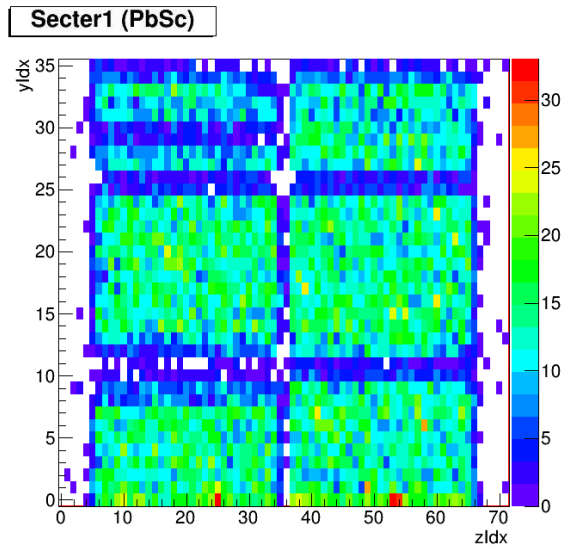


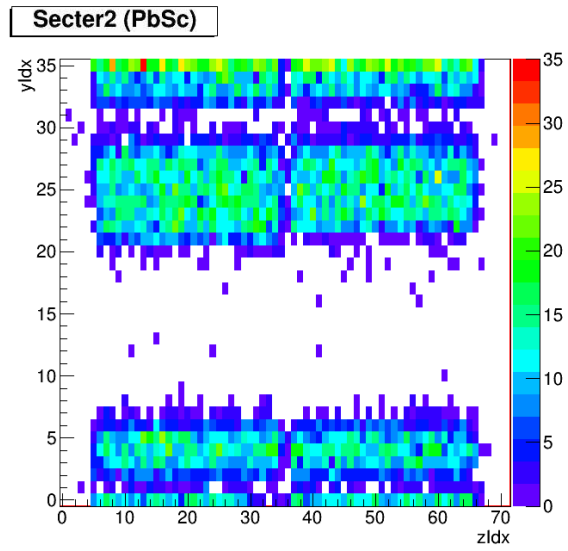


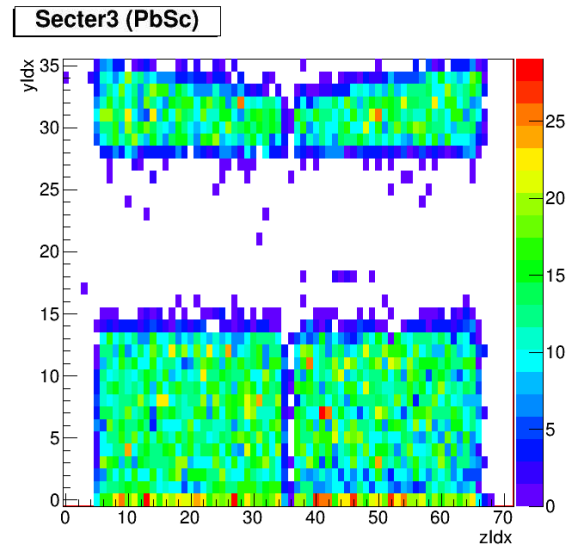


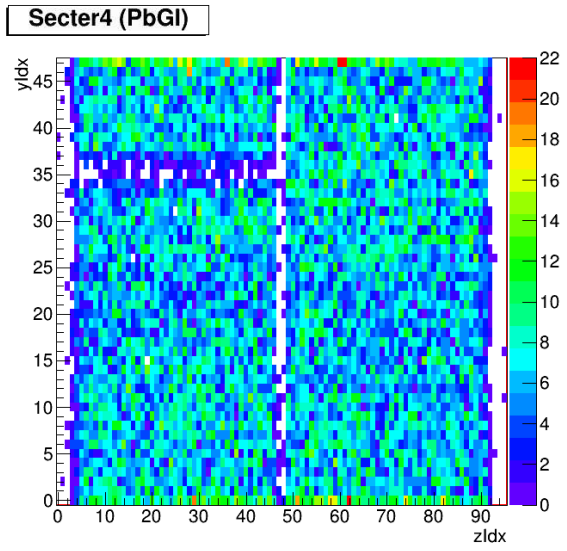
EMCal hit distribution for Simulation with DC deadmap

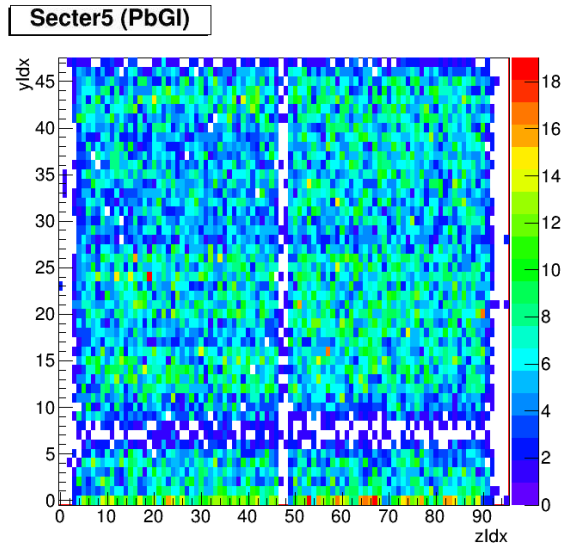


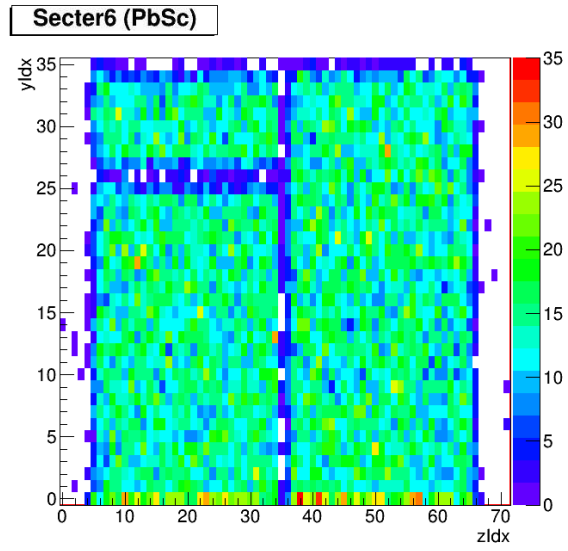


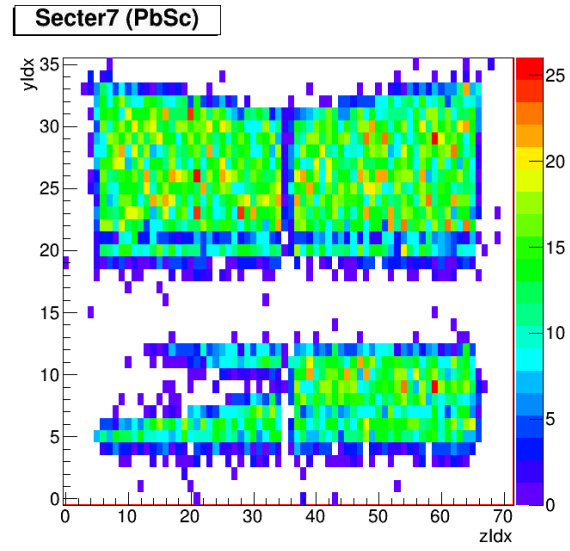




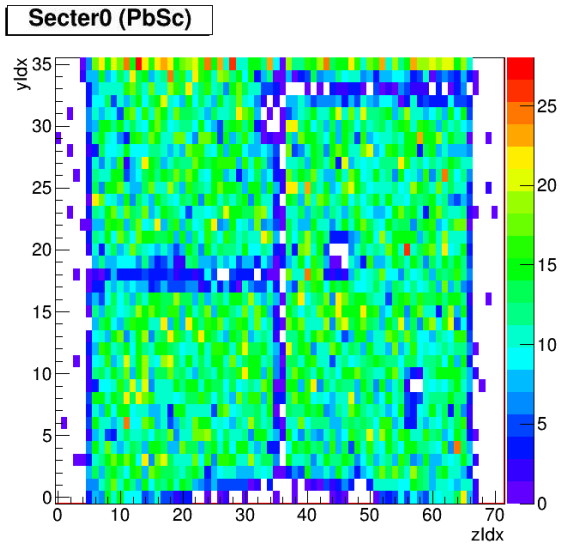


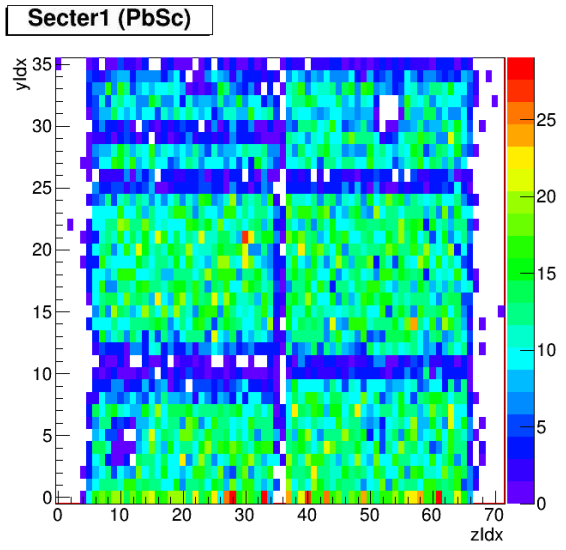


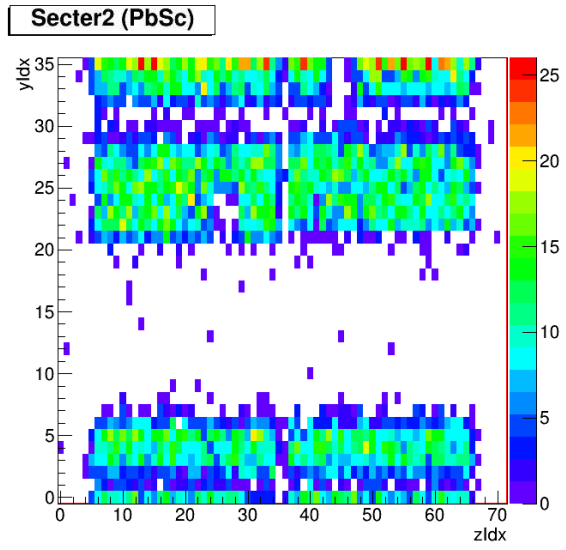


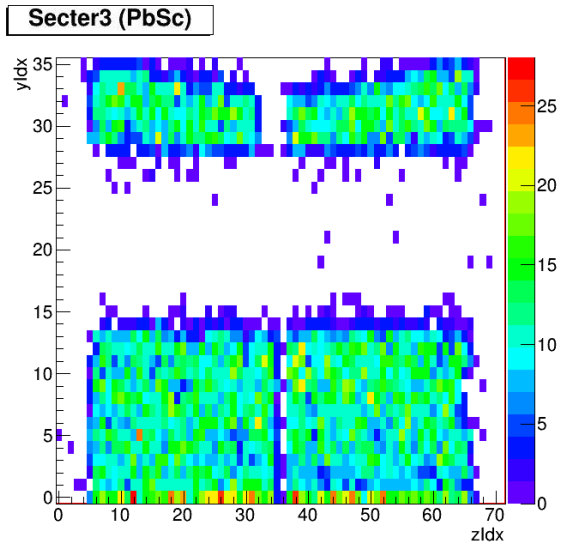


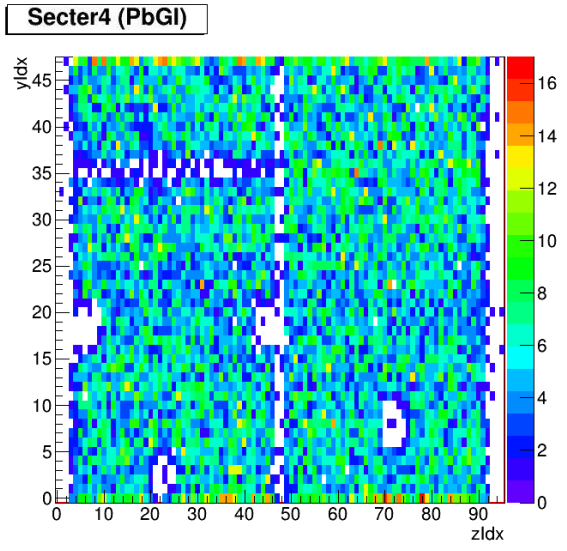
EMCal hit distribution for Simulation with DC, PC deadmap

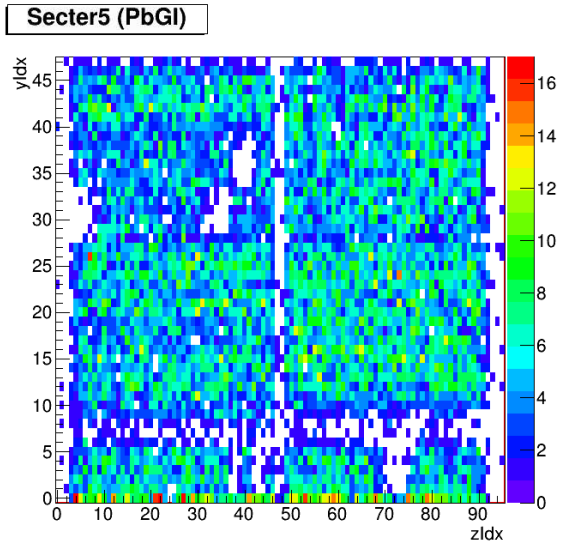


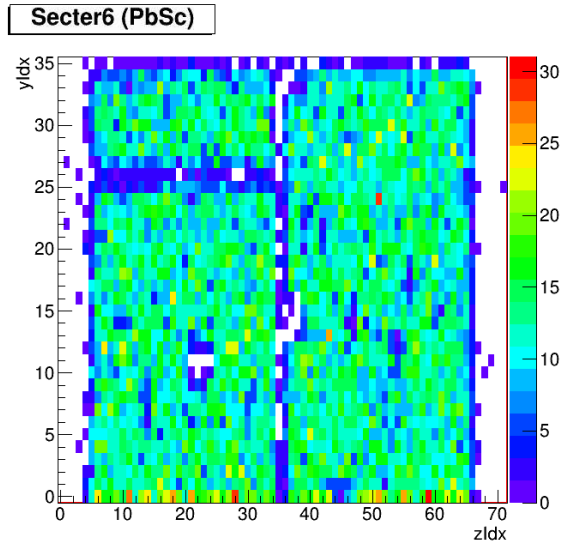


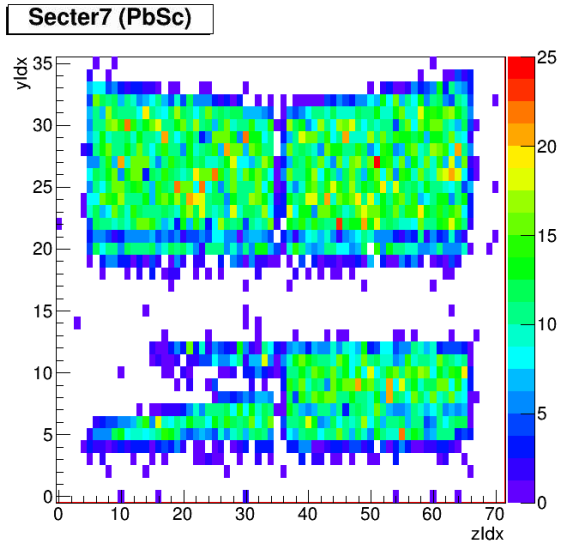




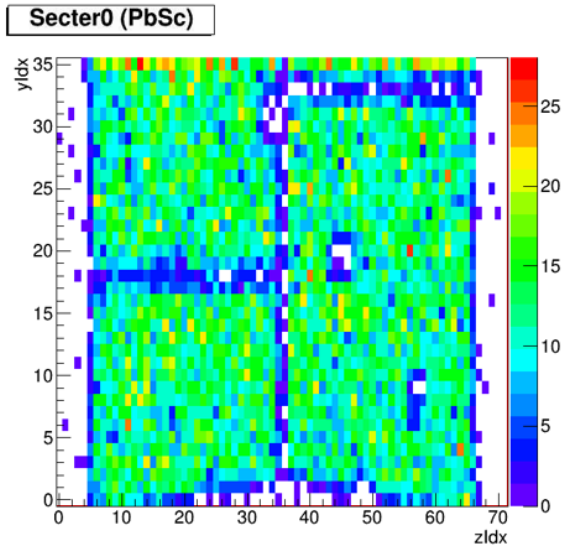


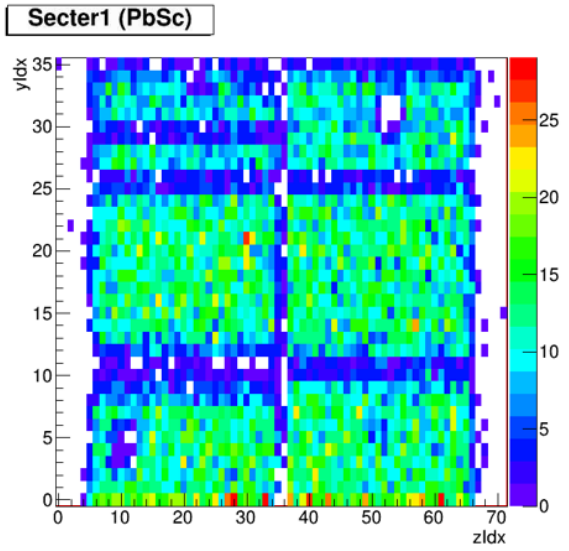


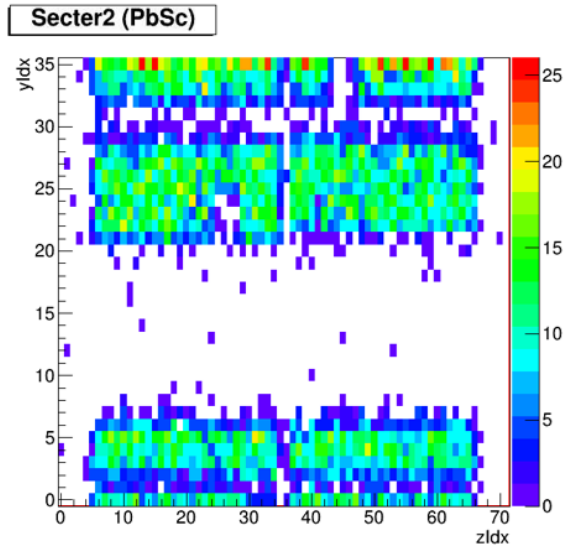


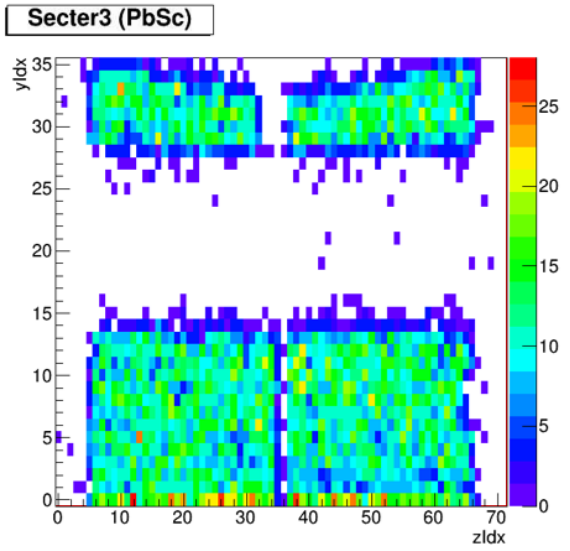


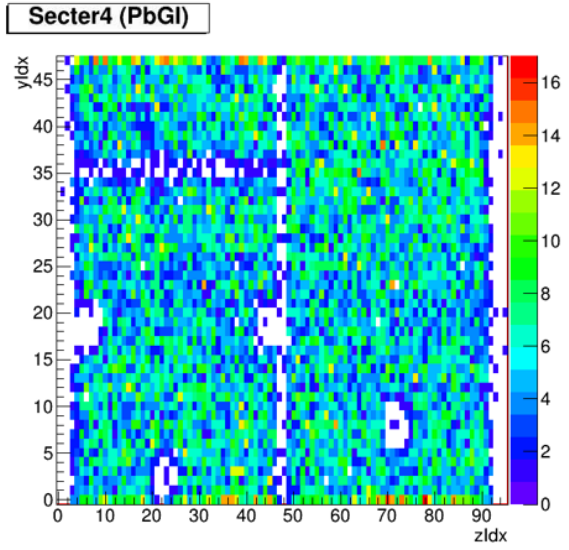
EMCal hit distribution for Simulation with deadmap(DC, PC, RICH)

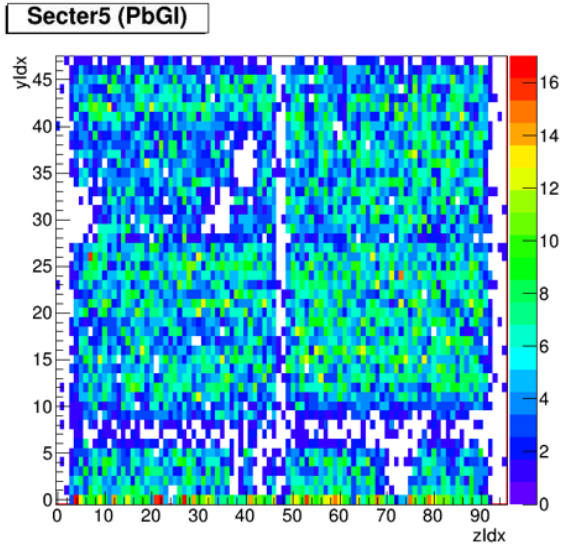


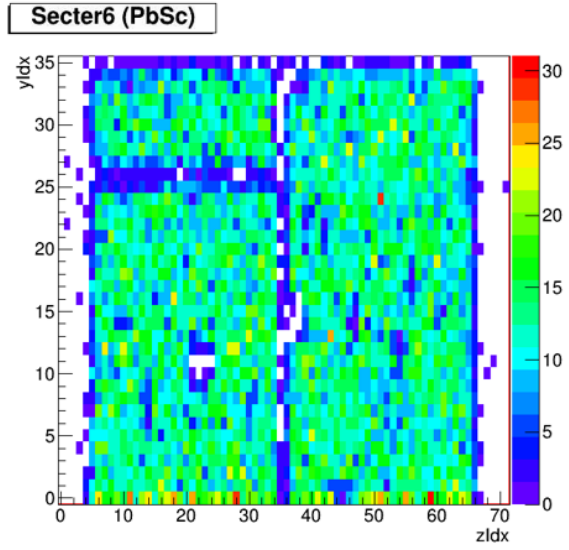


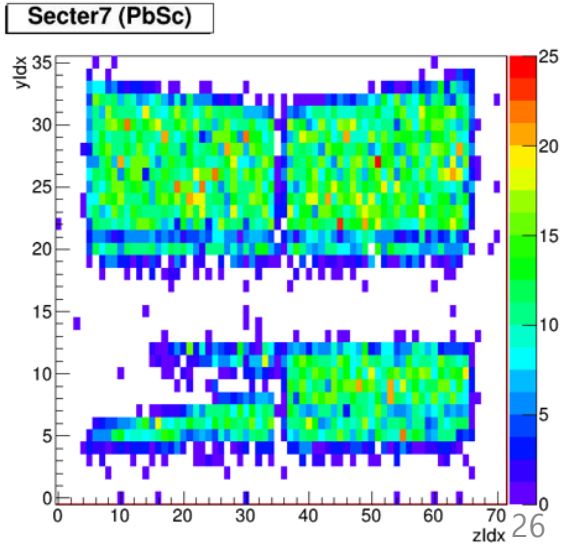












Acc. X Rec. efficiency

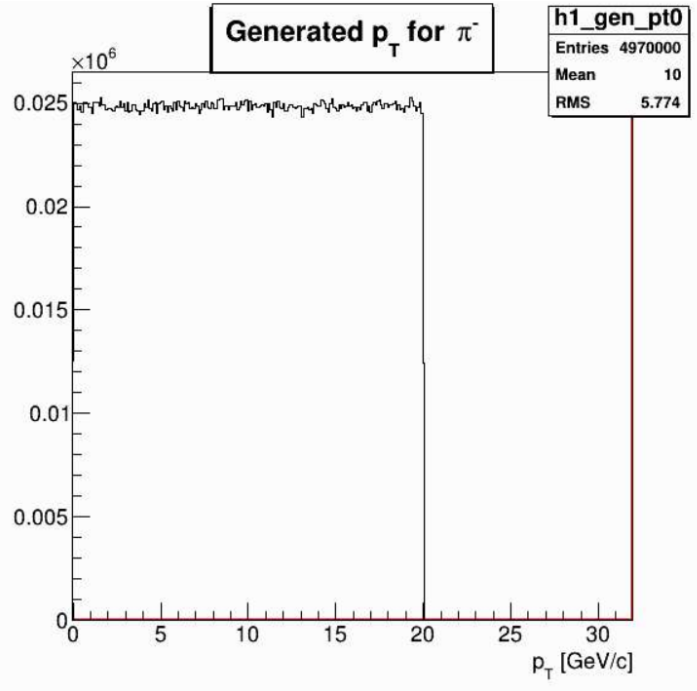
Without EMCal warnmap & Fiducial cut

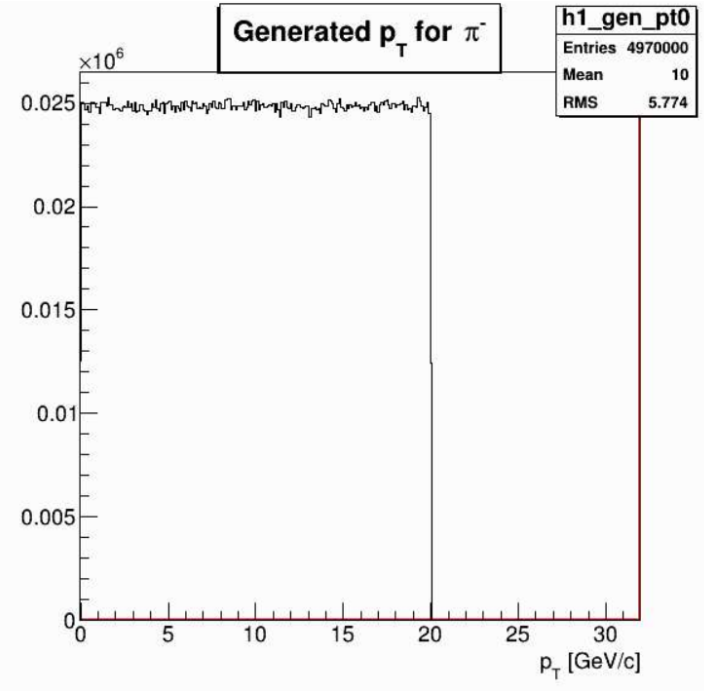
1. Single pi± generation

- Number of Pi± : 5,000,000 for each charge
- 0 < momentum < 20 GeV/c
- -0.5 < eta < 0.5
- 0 < pi < 2π
- Primary Vertex = (0,0,0)

Using Run15 without dead channels of DC, PC, RICH for test

2. Generated pions

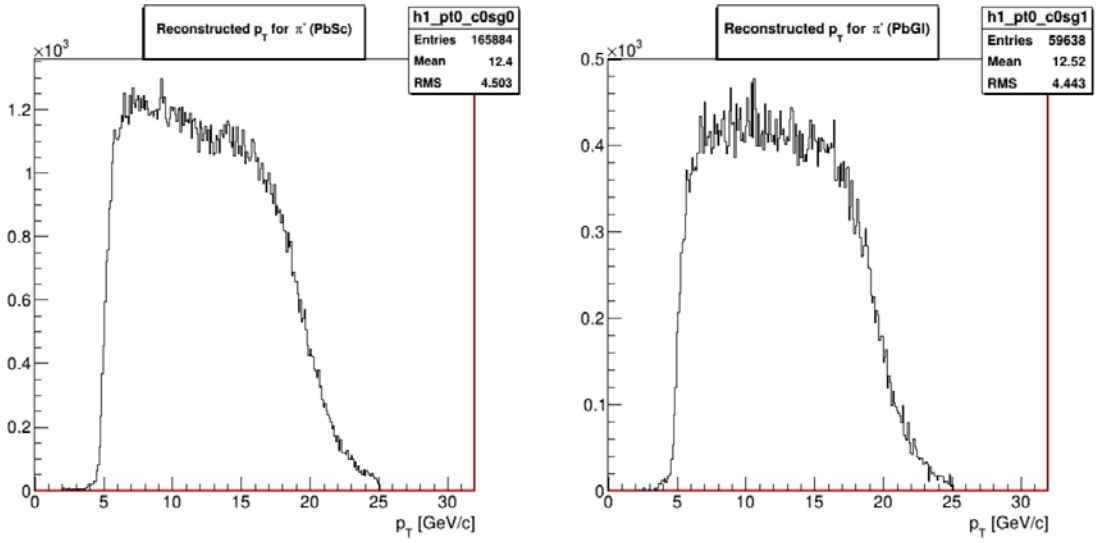


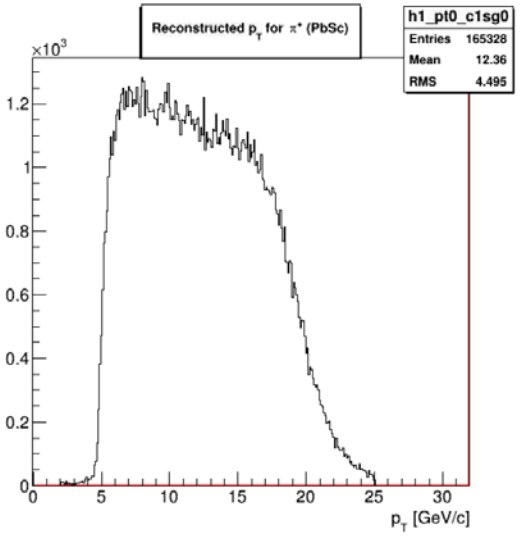


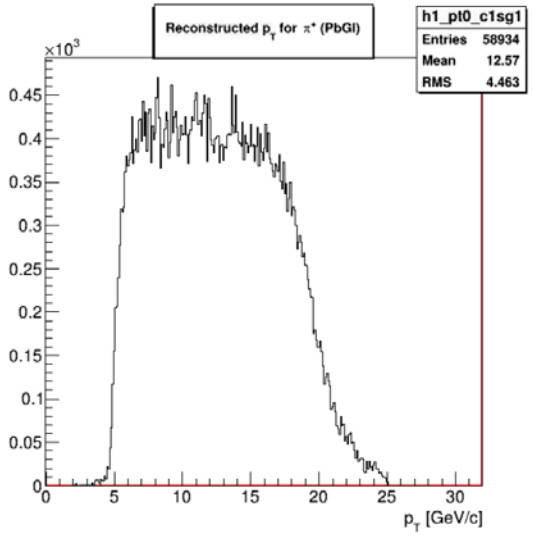
- $\pi^{\pm}$ Identication Cuts

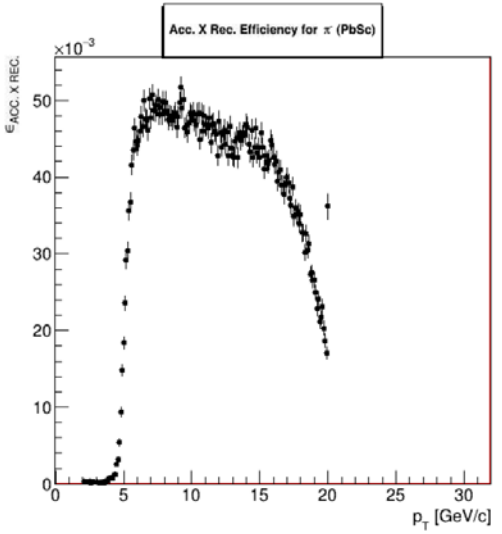
I. 2 < pT < 25 (GeV/c)
II. quality == 31 or 63
III. n1 >0
IV. $|BBCZ|$<30 (cm)
V. $|DCZed|$ < 70 (cm)
VI. $Shower\ shape\ (prob)$ < 0.1
VII. 0.2 < $emce/p$ < 0.8 sect > -9000

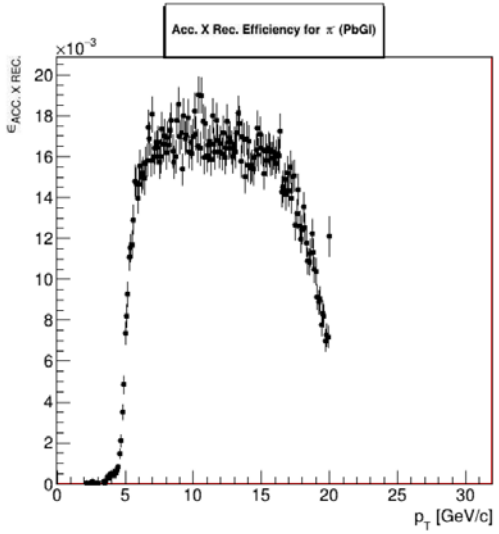
3. Reconstructed pions

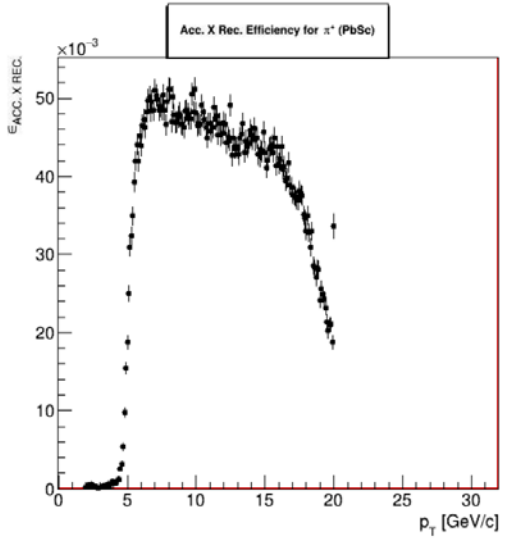


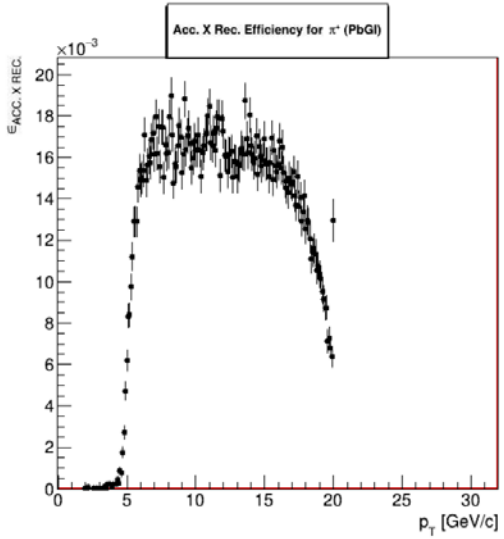




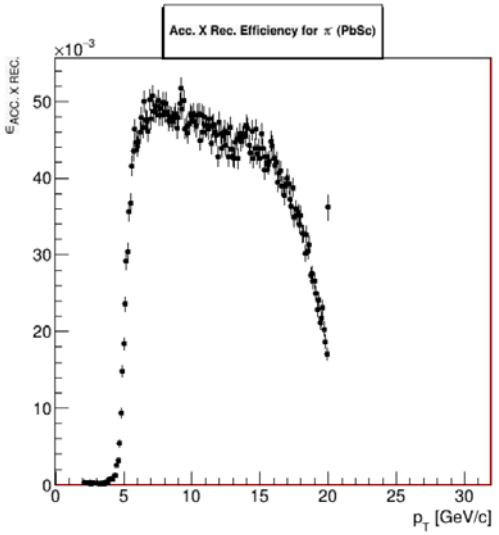


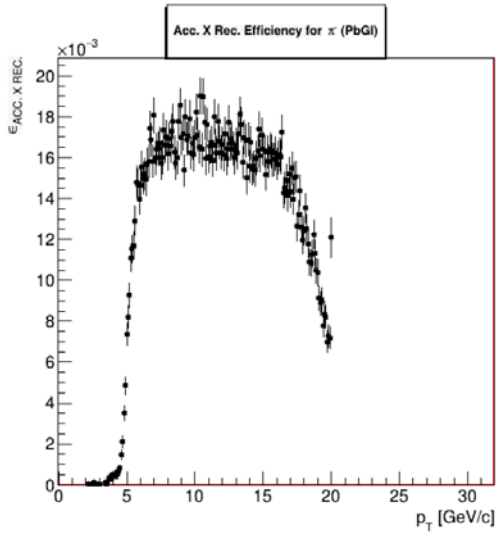




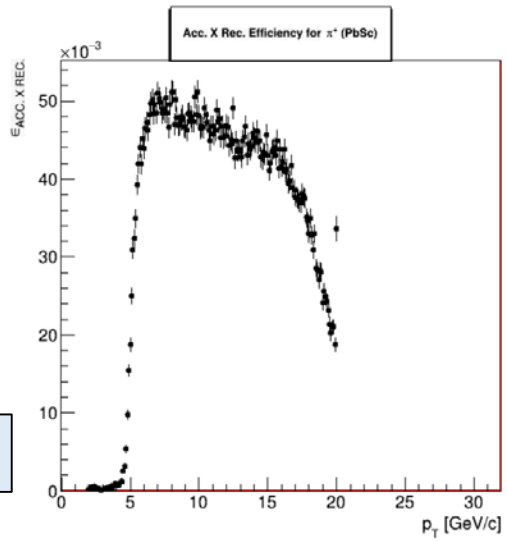


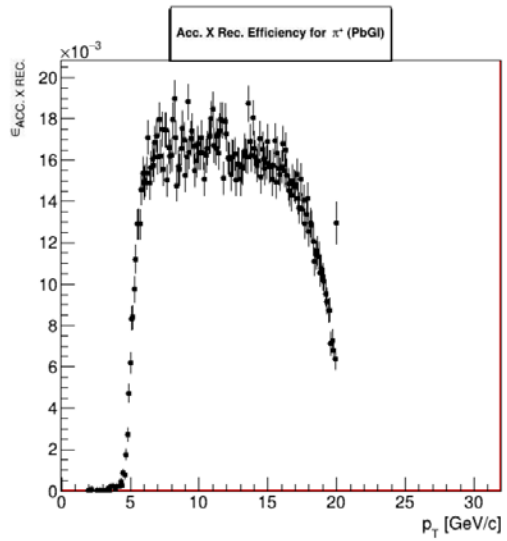
4. Compare with run13.



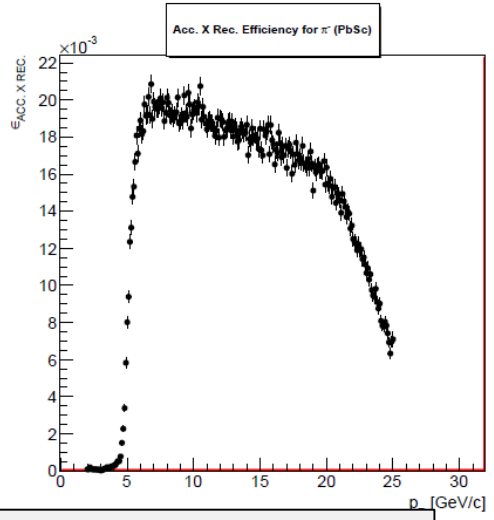


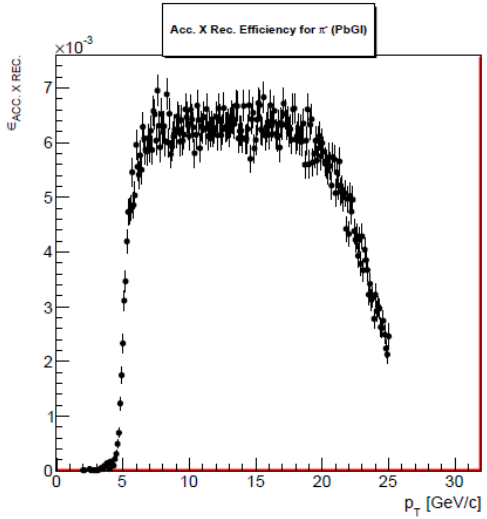
Run 15

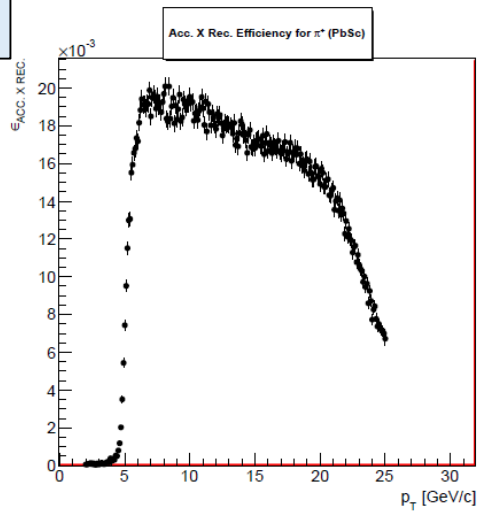


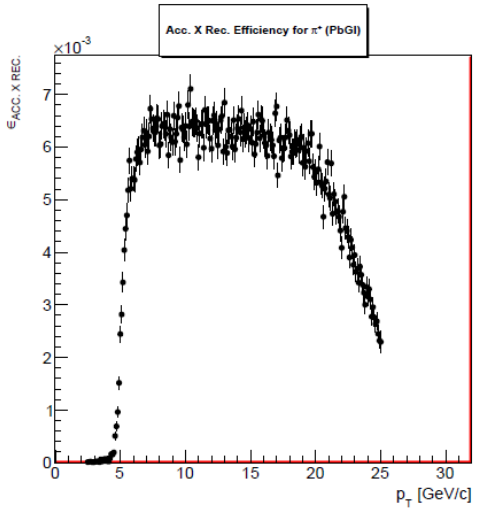


Run 13



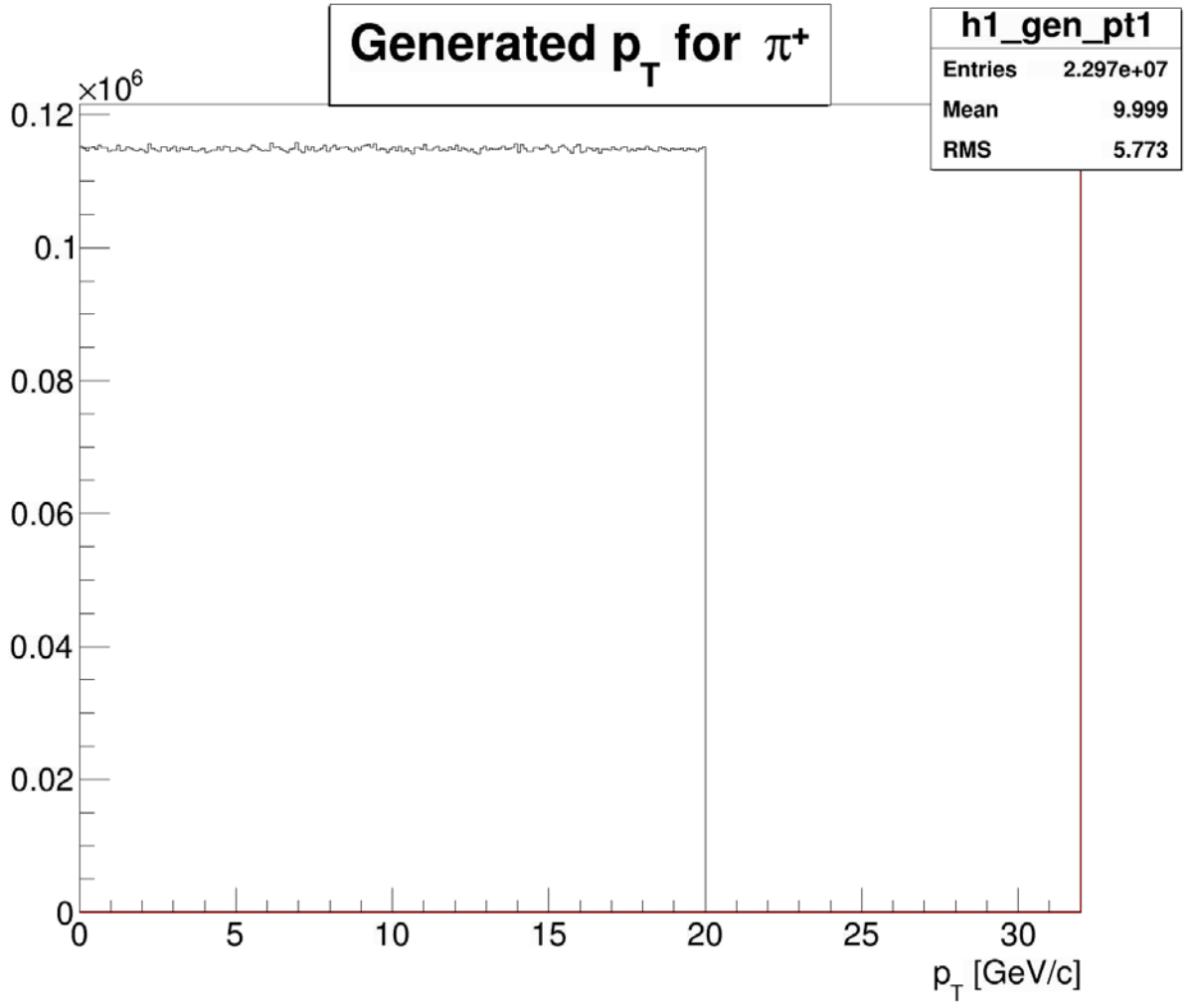




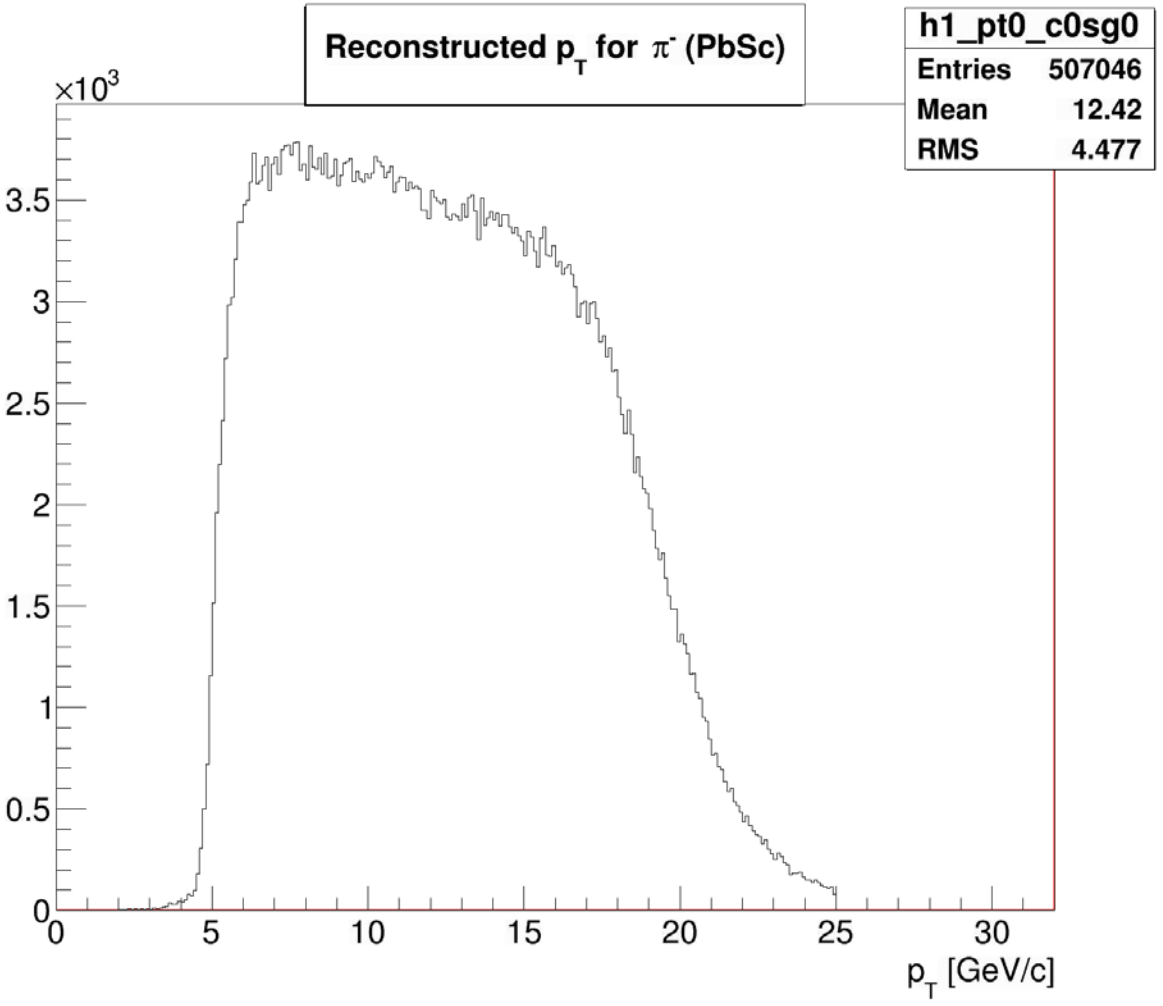


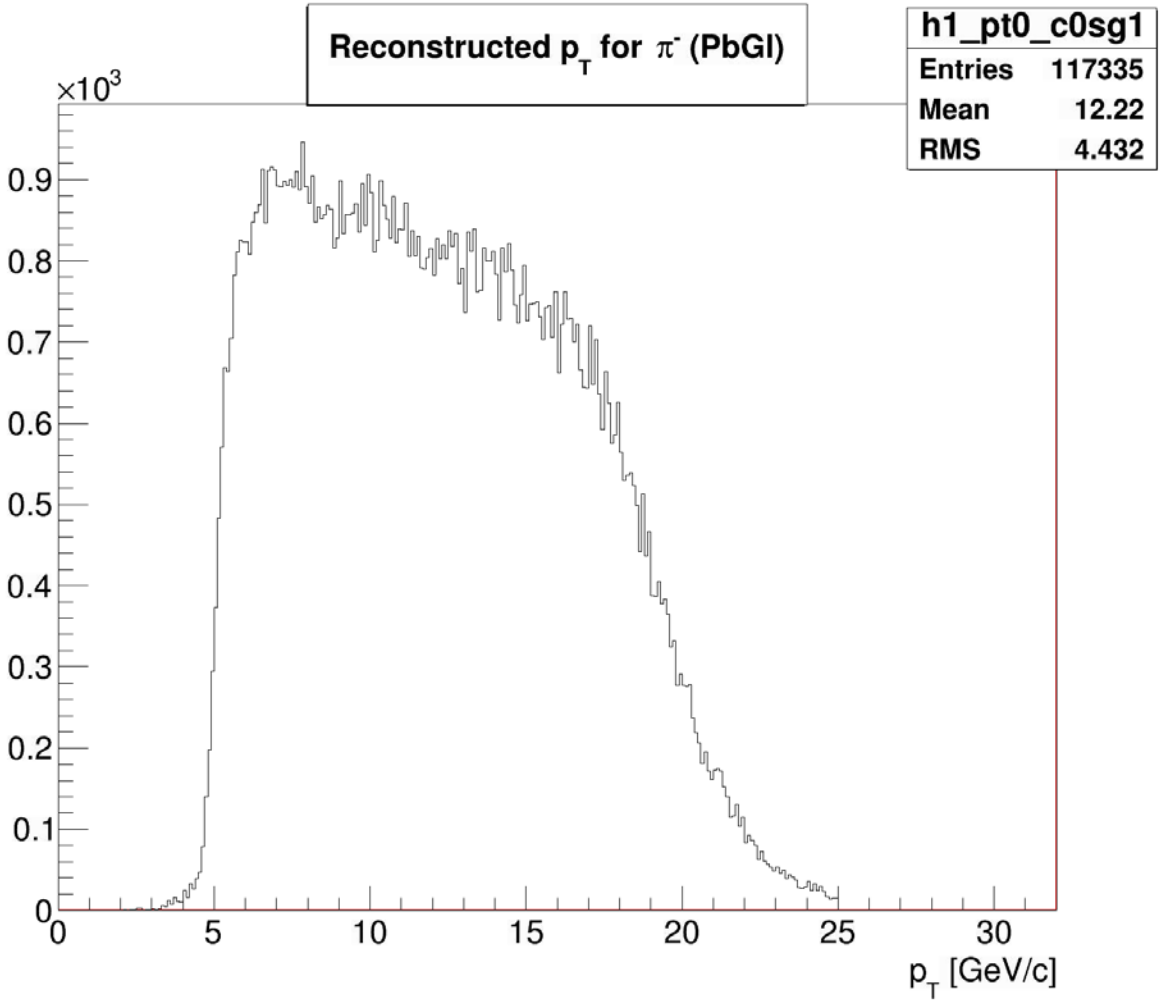
Taebong's analysis note

Generated pions

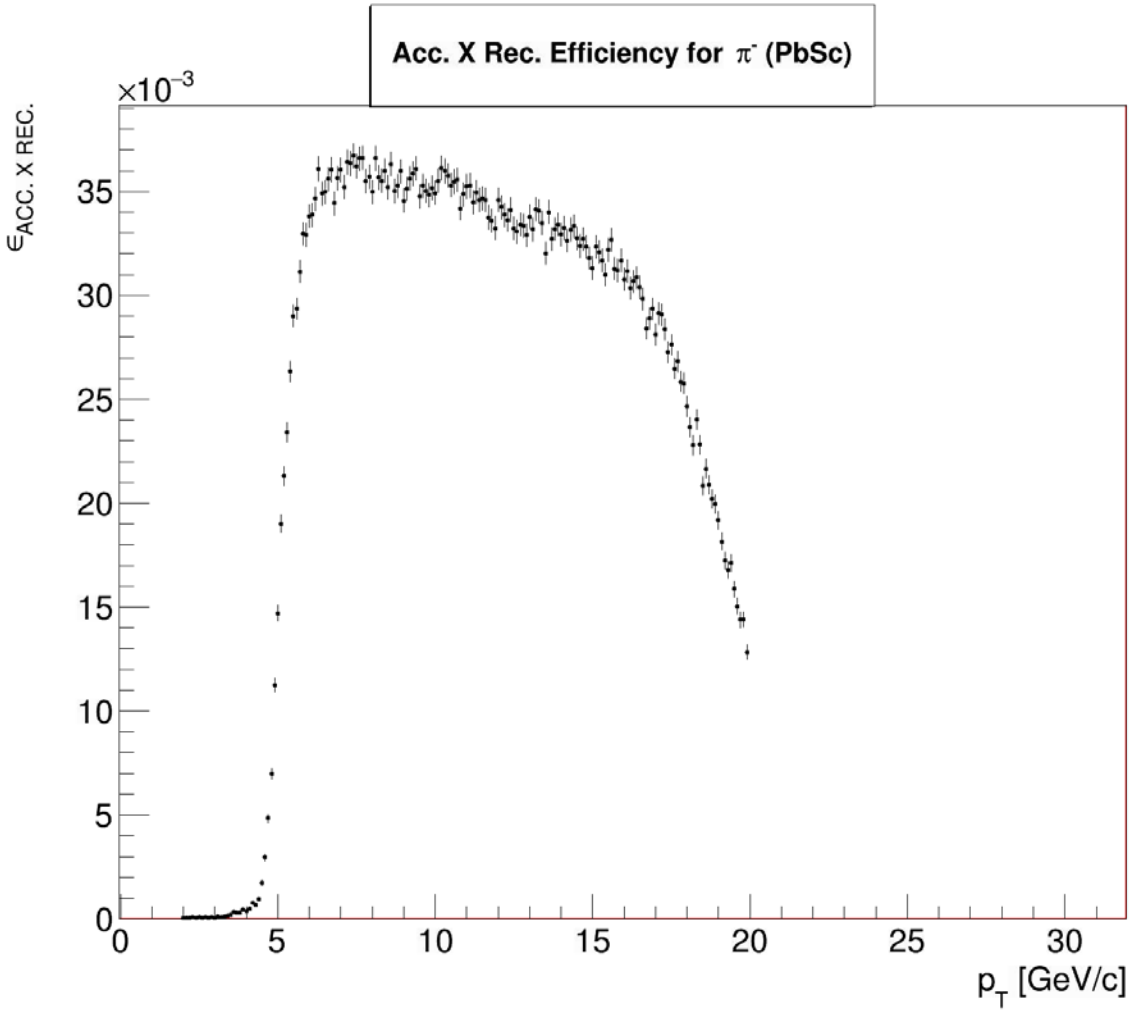


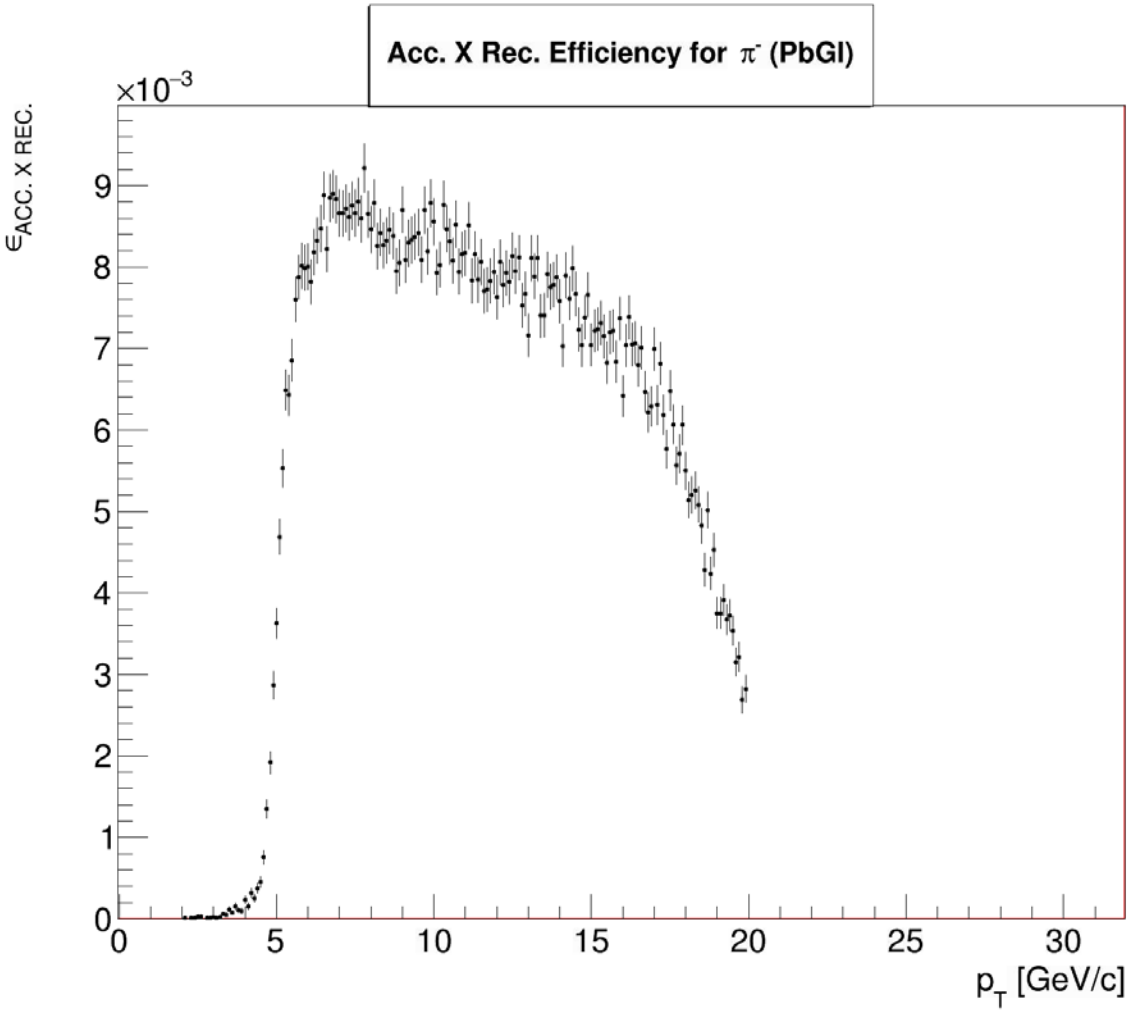
Reconstructed π^-



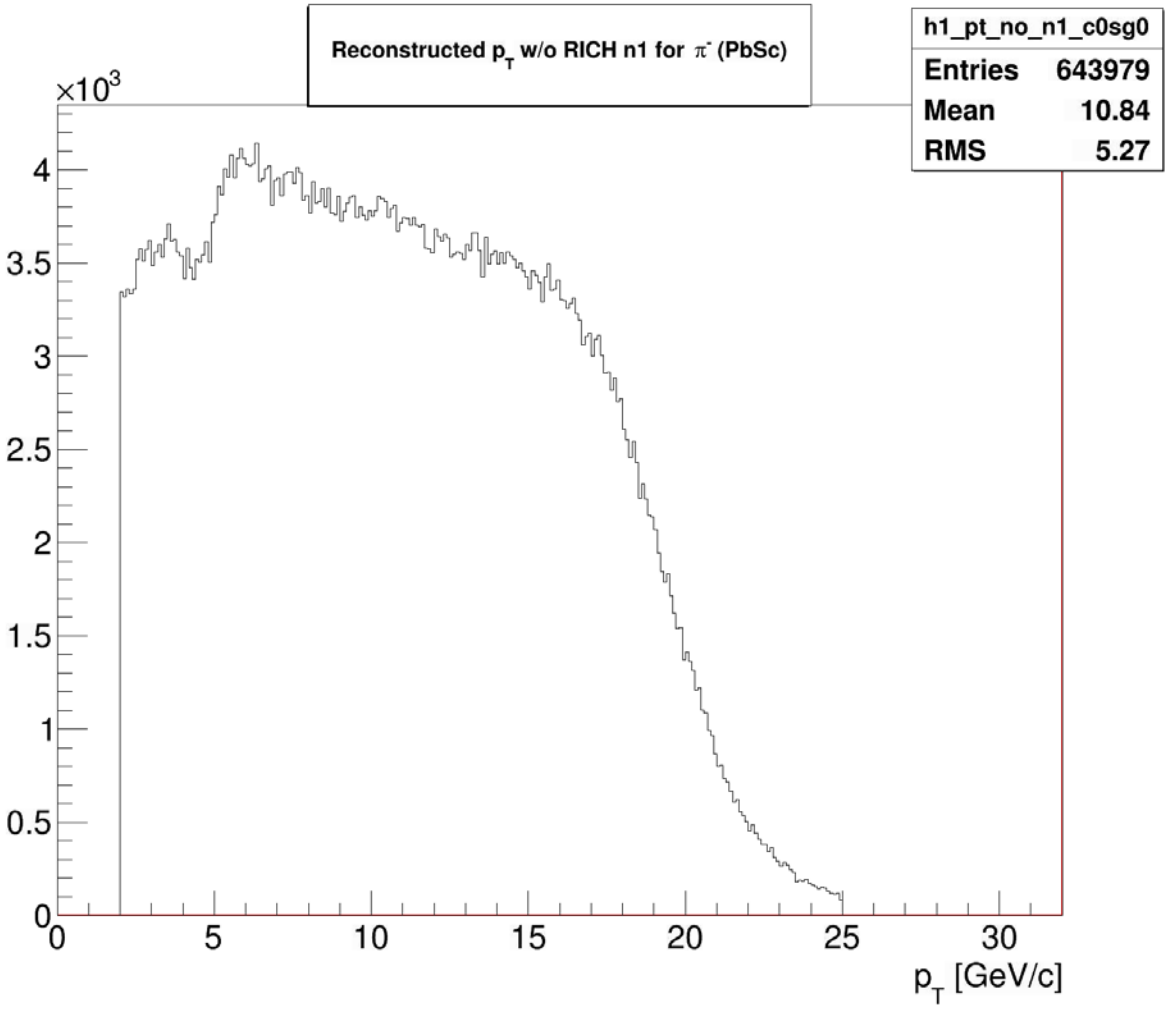


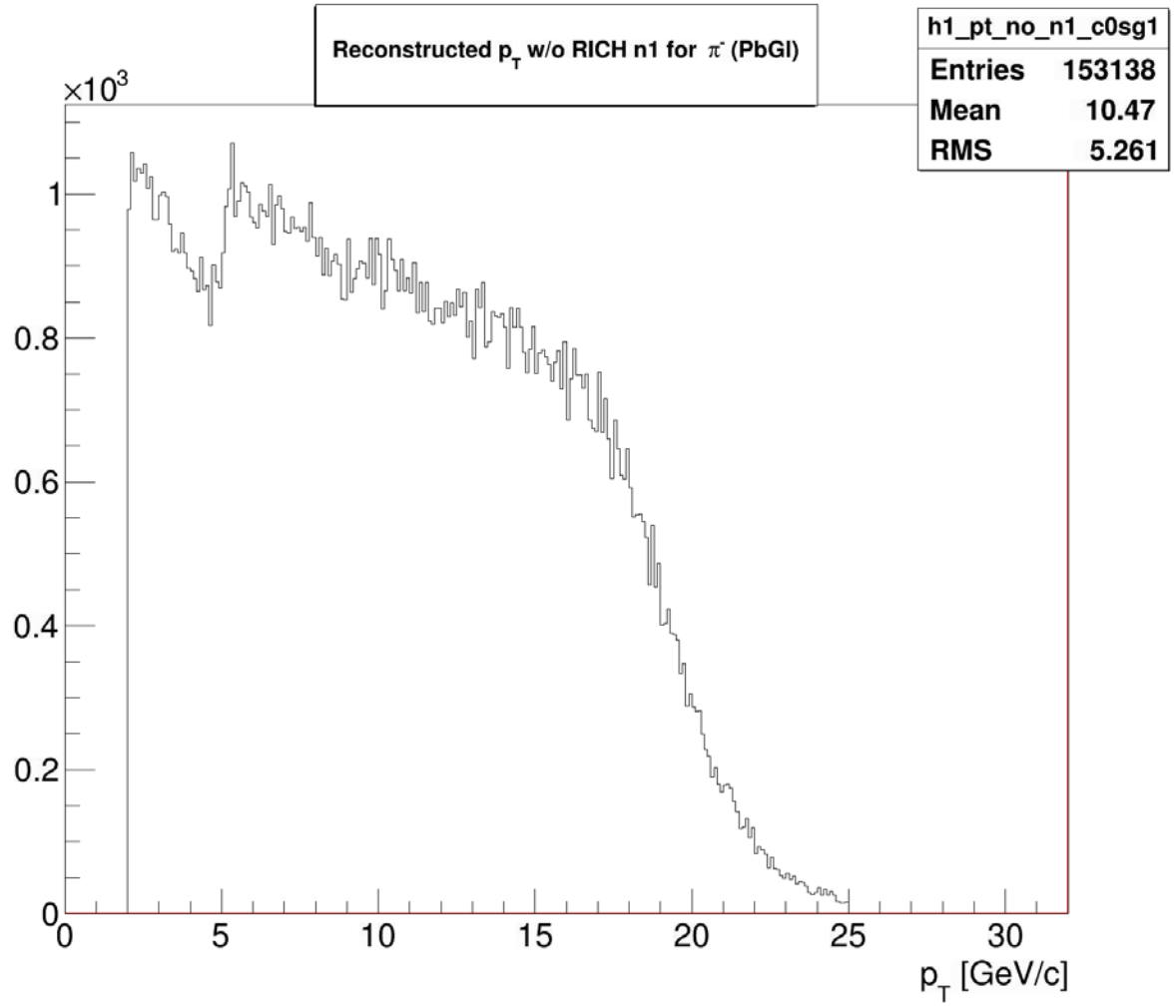
Acc. X Rec. efficiency for π^-



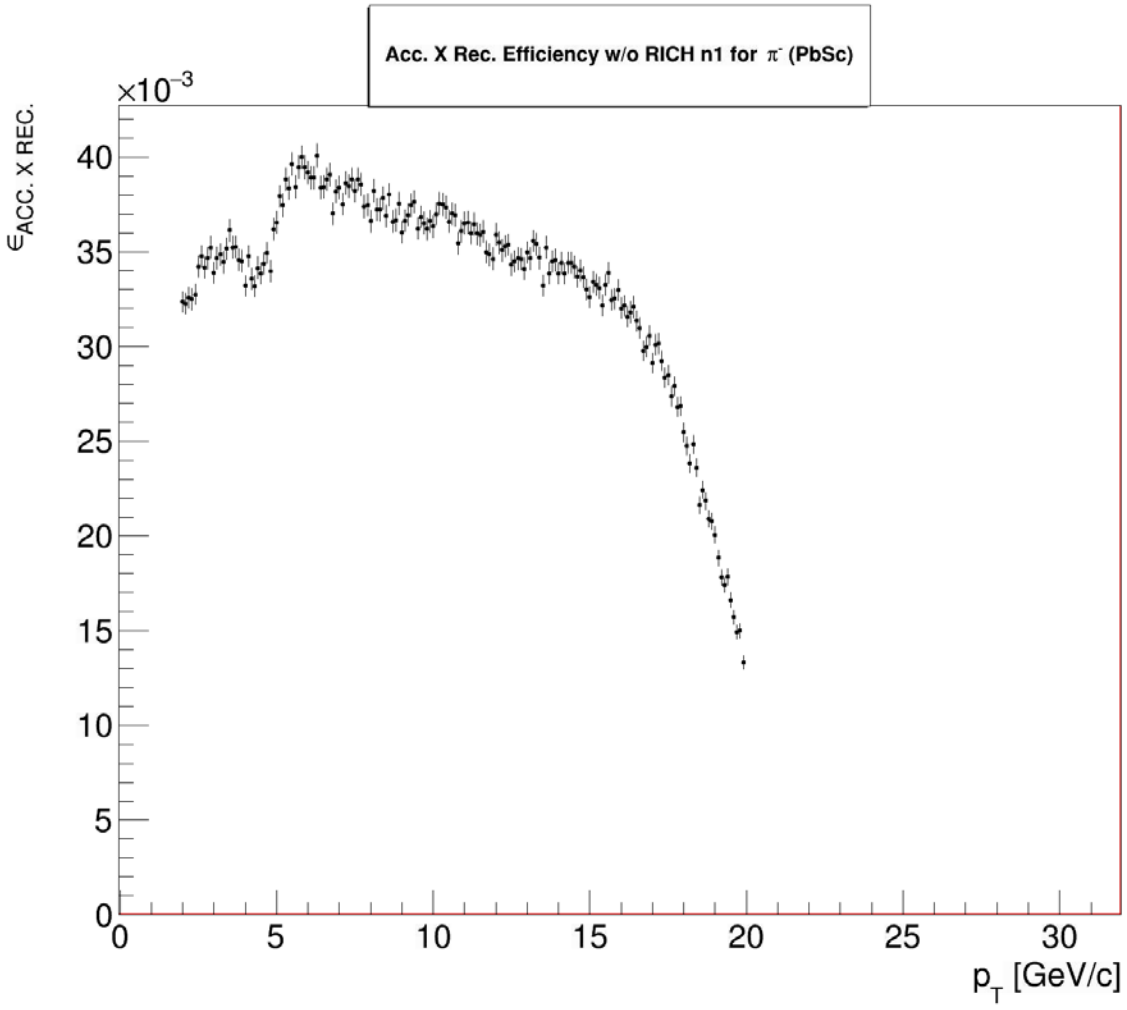


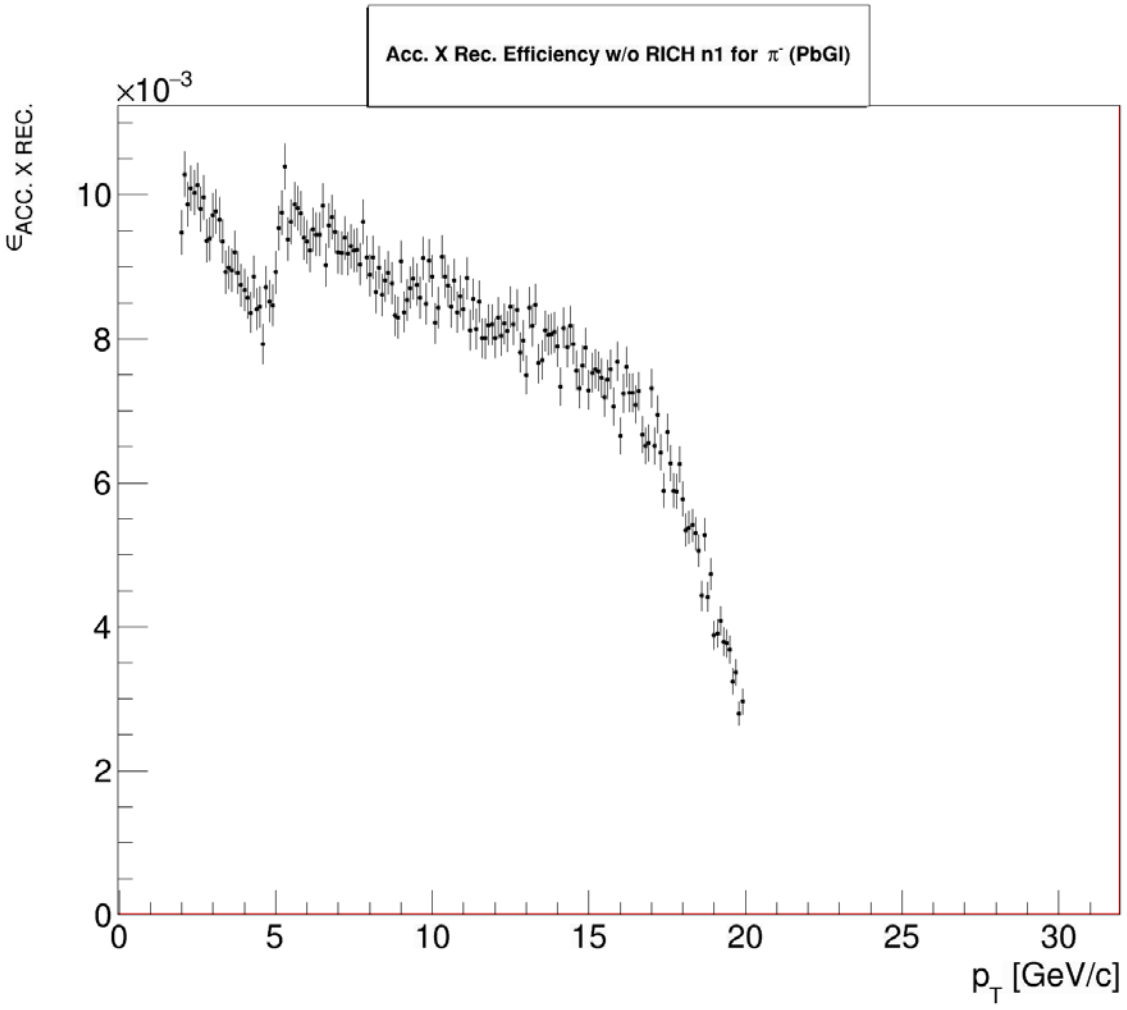
Reconstructed π^- without RICH n1 cut



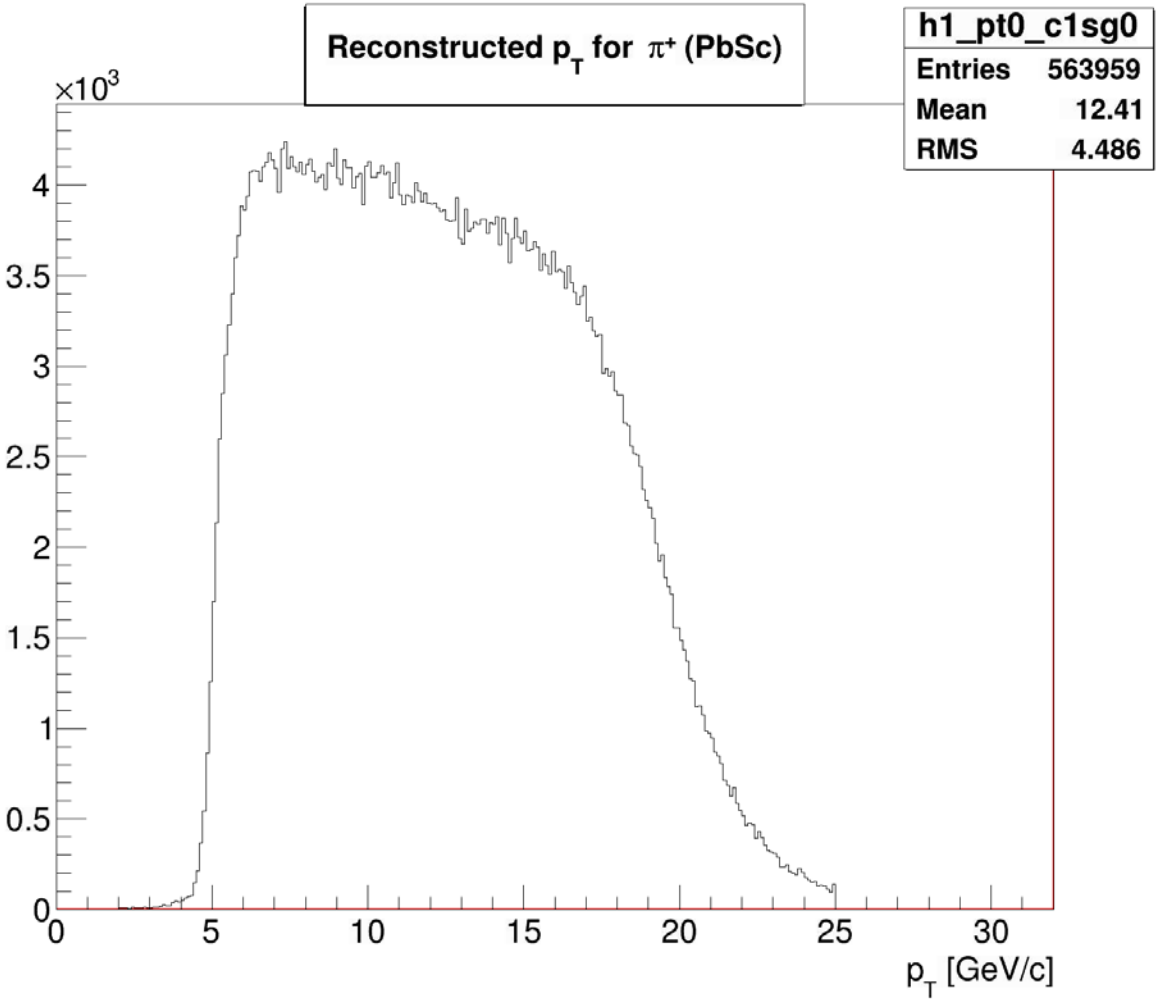


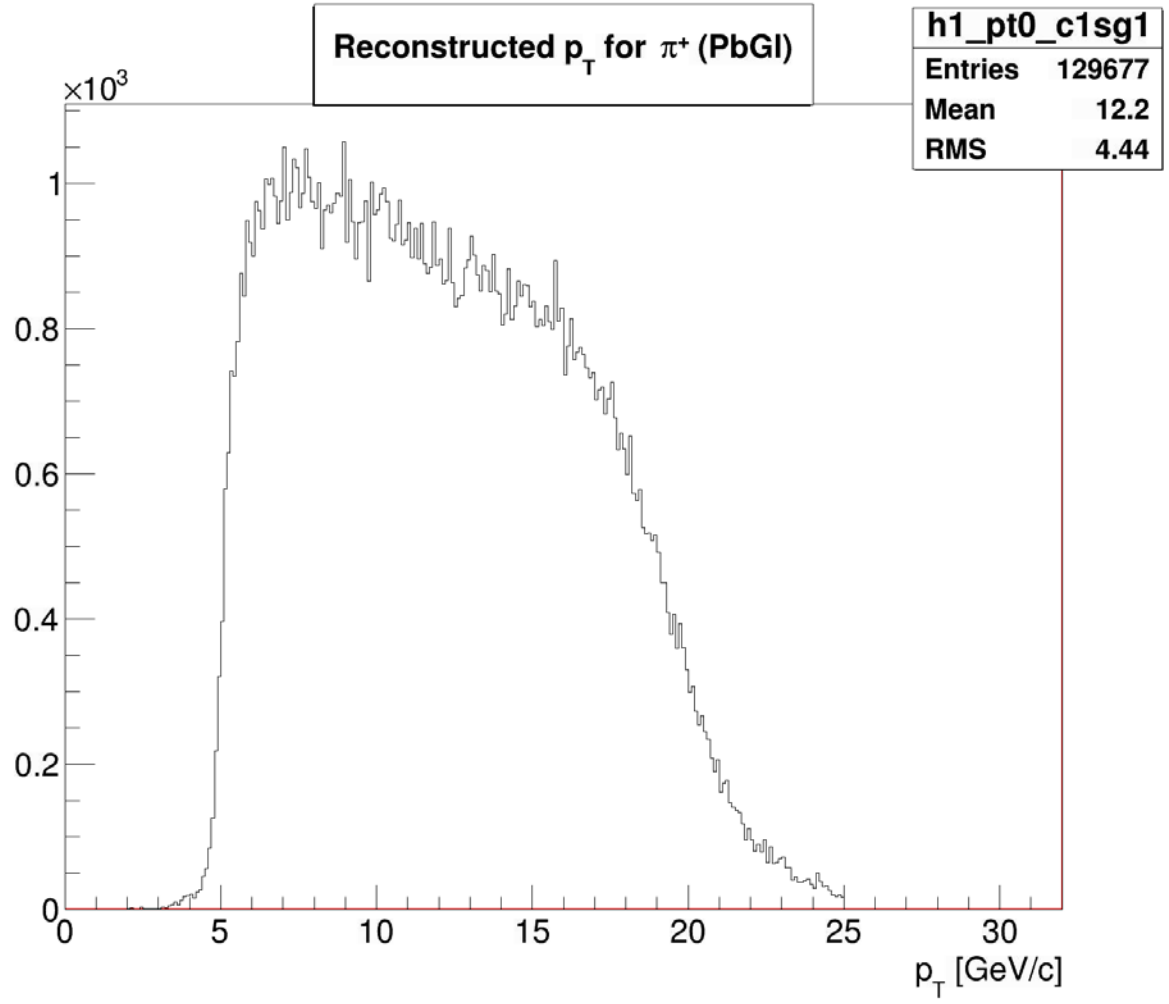
Acc. X Rec. efficiency for π^- without RICH



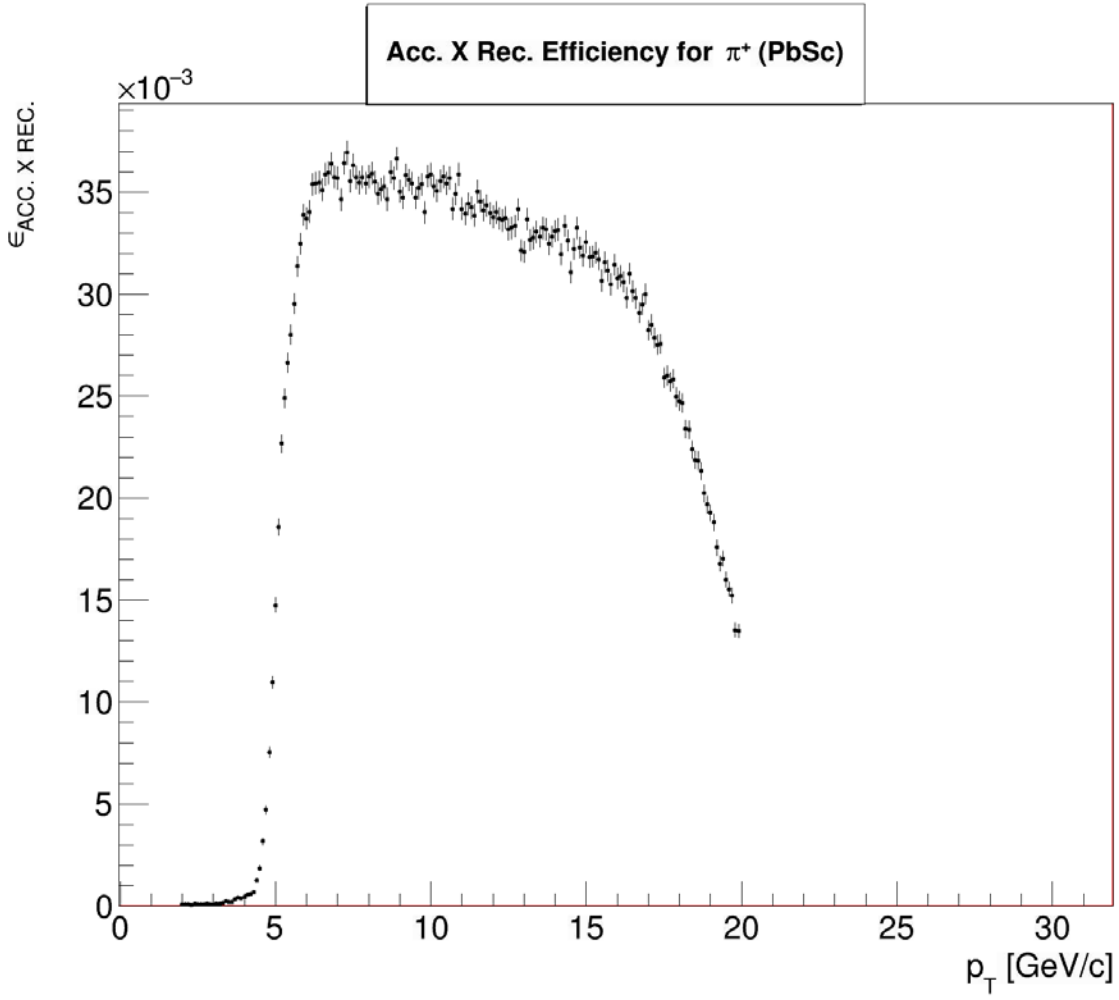


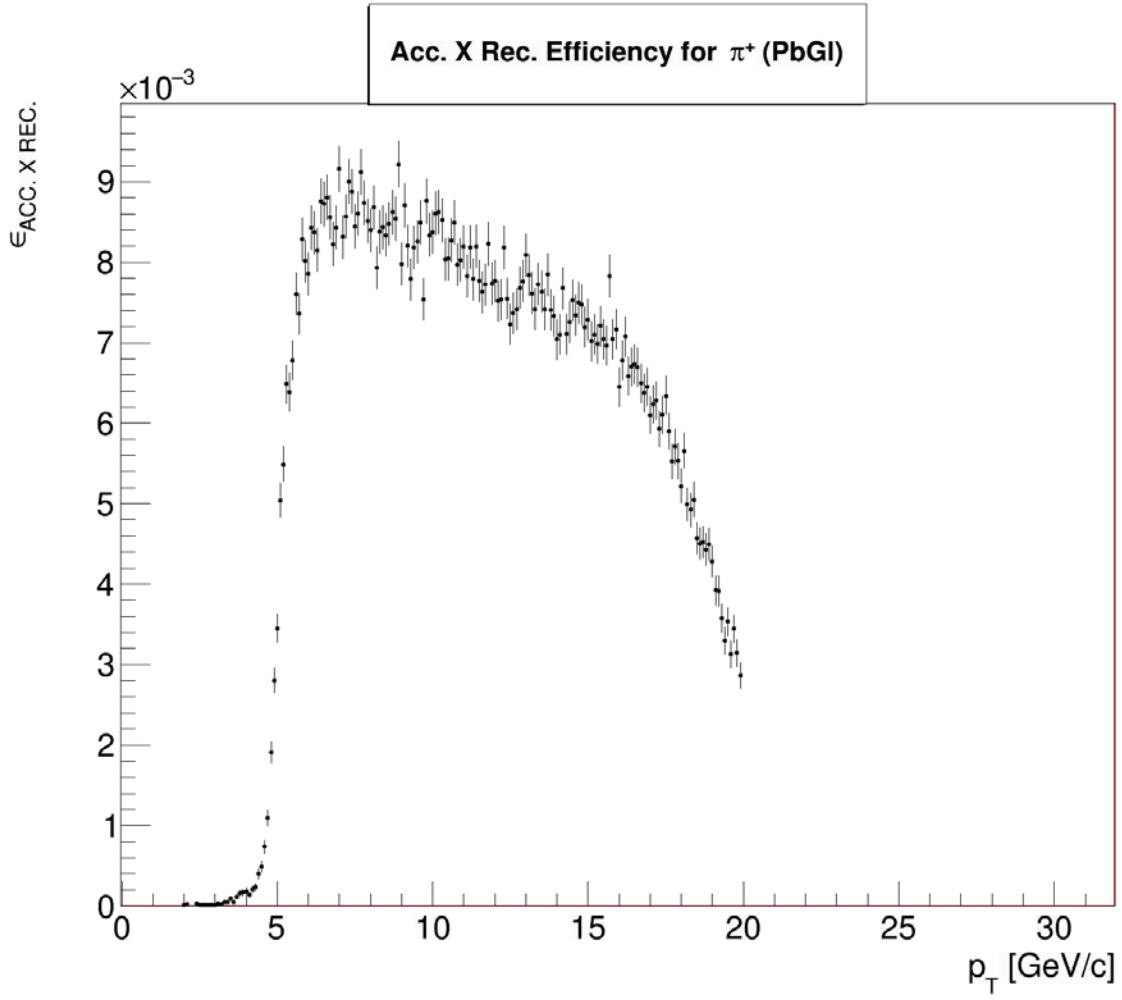
Reconstructed π^+



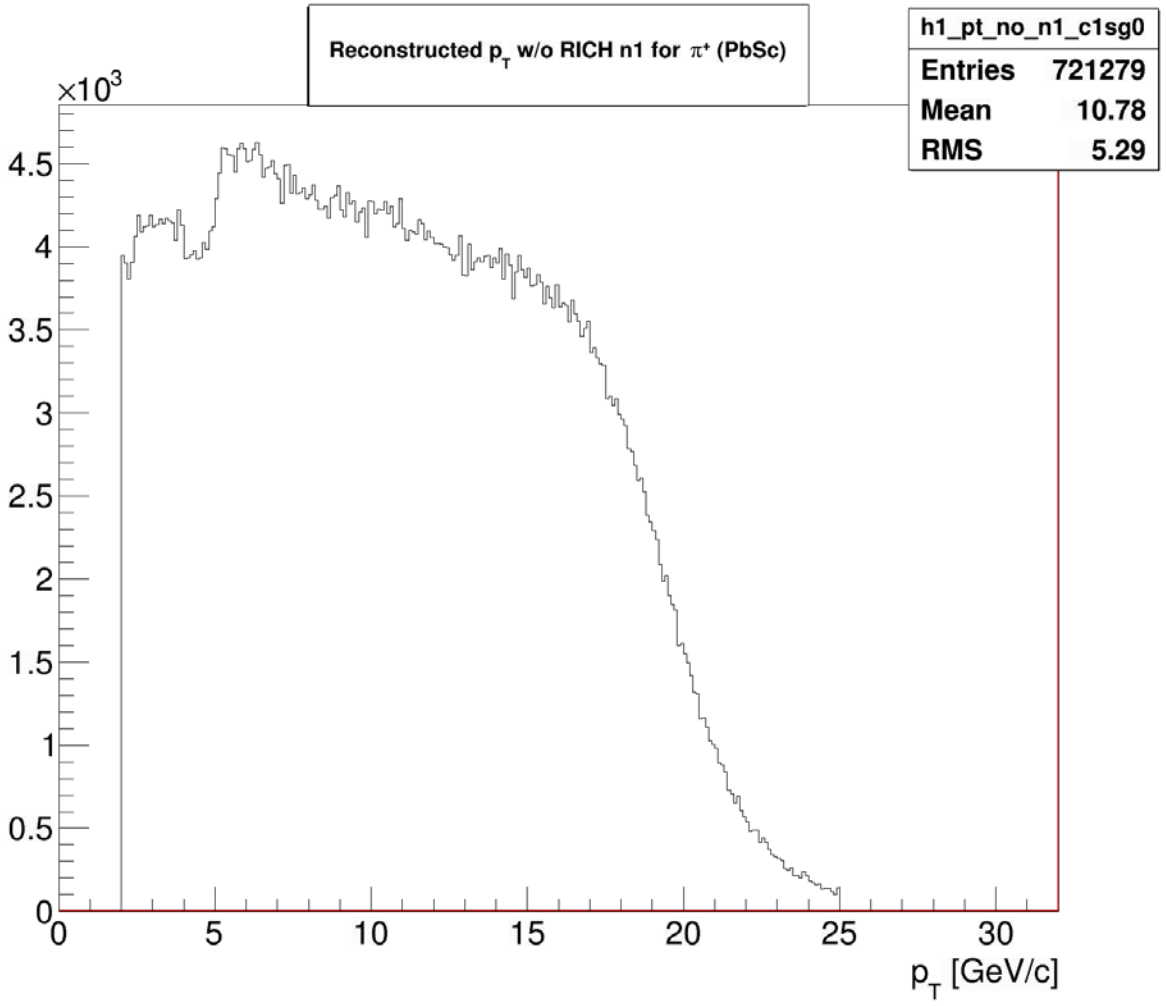


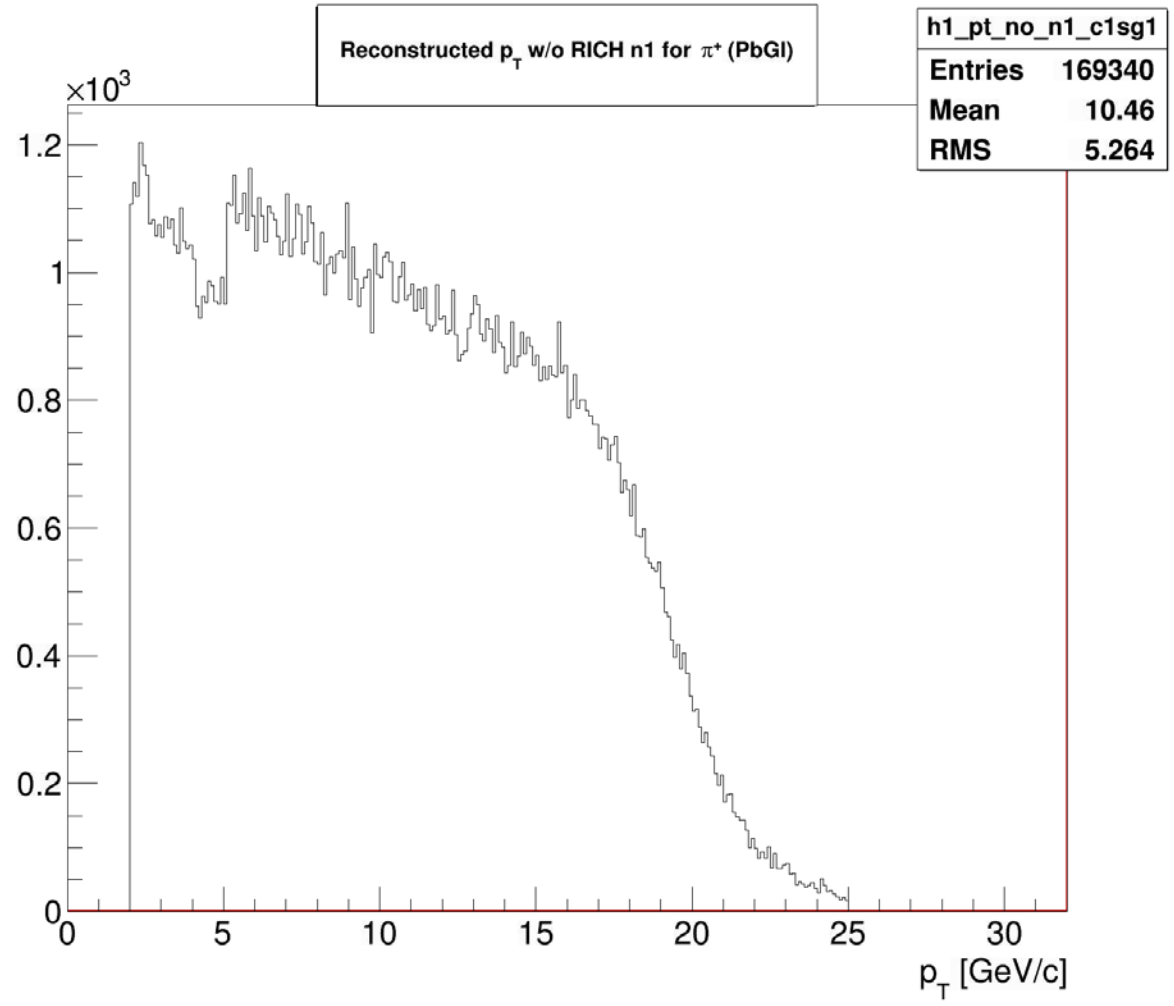
Acc. X Rec. efficiency for π^+



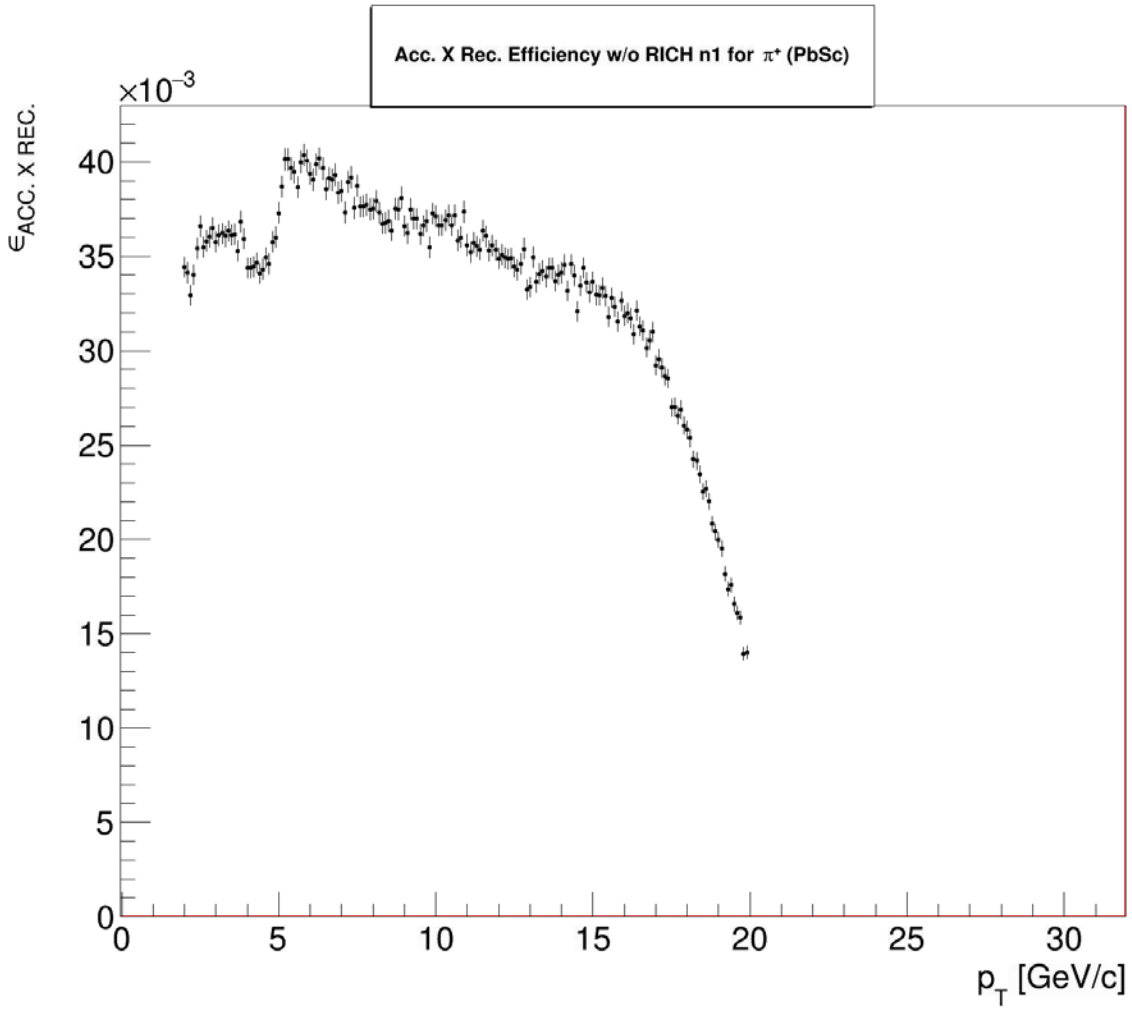


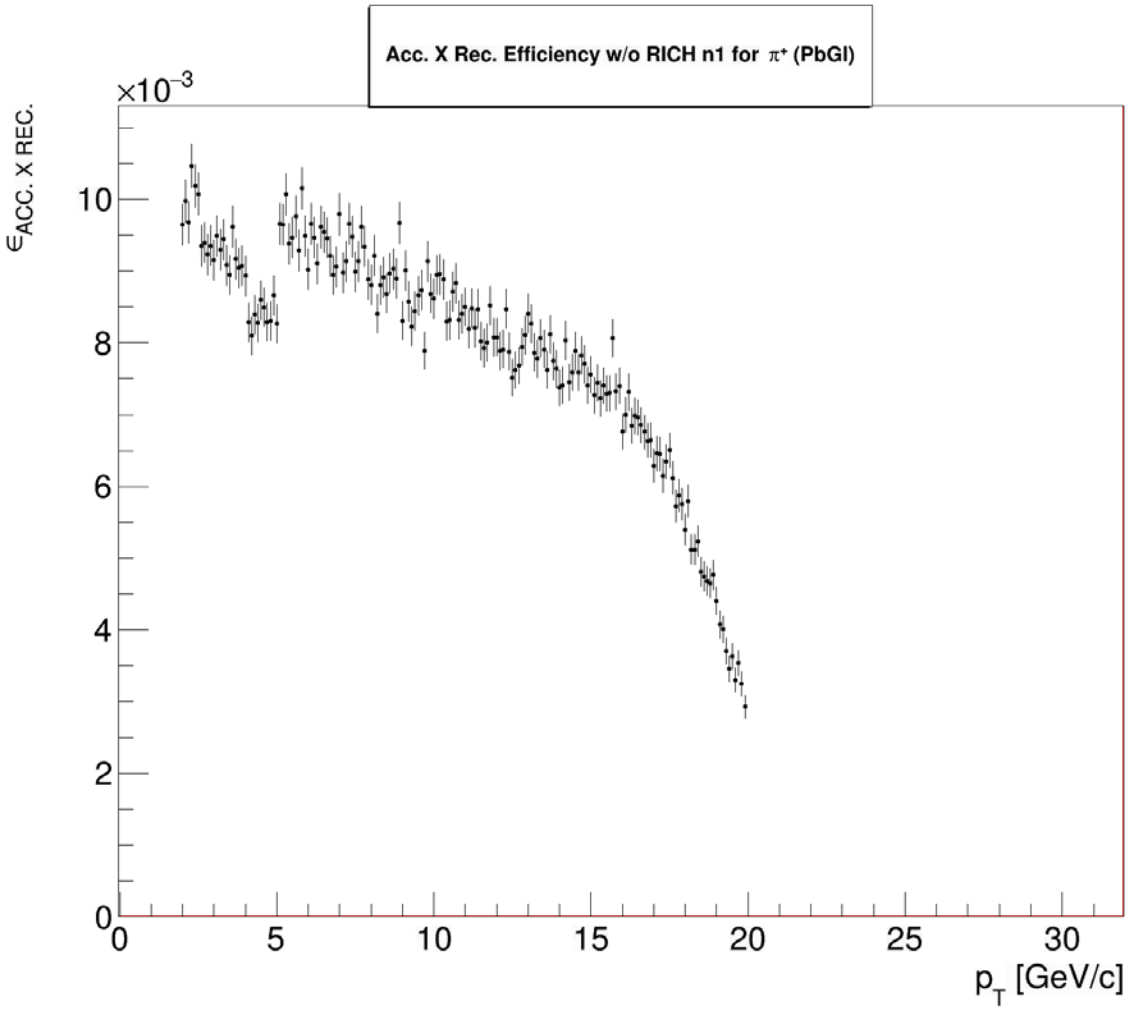
Reconstructed π^+ without RICH n1 cut



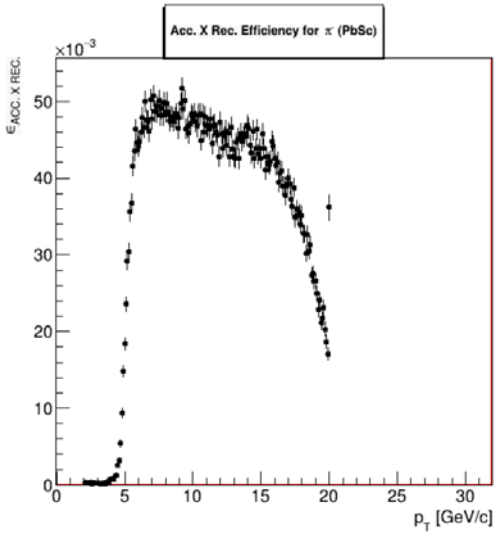


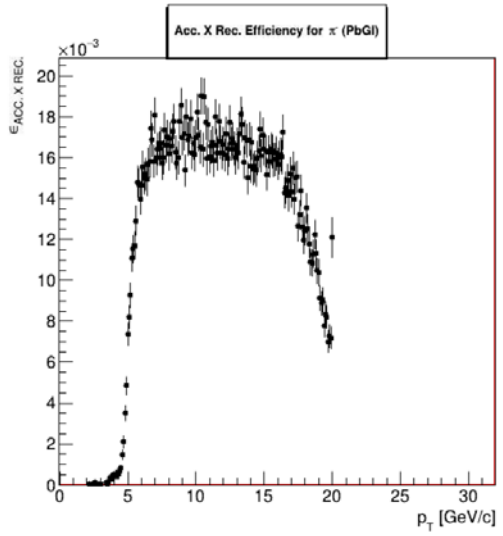
Acc. X Rec. efficiency for π^+ without RICH



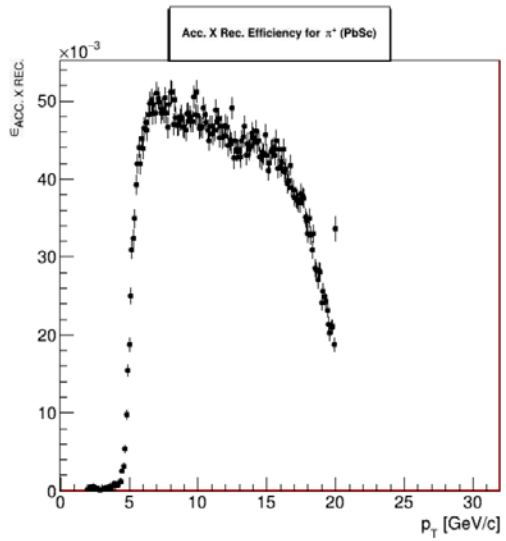


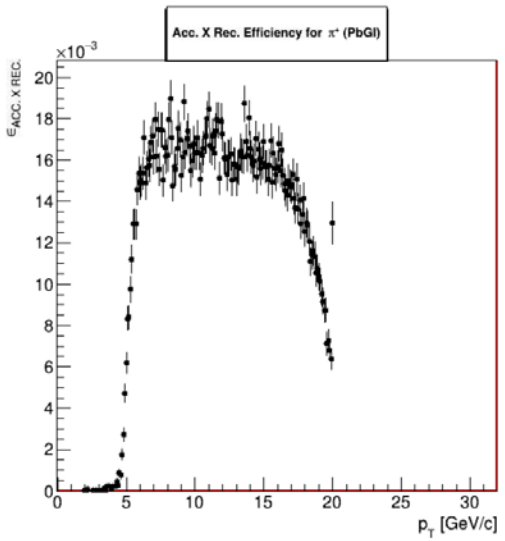
Comparision of masked EMCal warnmap or not





Without Warnmap





Applied Warnmap