Charged pion analysis

Simulation
- Acc. X Rec. efficiency w/o dead map

Korea Univ.
Jaehee Yoo

2019. 04. 11 Radiation Lab spin group meeting

Number and size of PRDF files

- Number of PRDF files : 1769
- Total file size : 17 TB

```
total 17T
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 14:02 EVENTDATA_P00-0000434021-0000.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 14:02 EVENTDATA_P00-0000434021-0001.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 13:59 EVENTDATA_P00-0000434021-0002.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 13:43 EVENTDATA_P00-0000434021-0003.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 14:04 EVENTDATA_P00-0000434021-0004.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 13:53 EVENTDATA_P00-0000434021-0005.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 13:39 EVENTDATA_P00-0000434021-0006.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 13:57 EVENTDATA_P00-0000434021-0007.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 13:56 EVENTDATA_P00-0000434021-0008.PRDFF
-rw-r--r-- 1 phnxreco rhphenix  11G Mar 27 21:56 EVENTDATA_P00-0000434021-0009.PRDFF
```

- I'm using 135 PRDFF files (Runnumber : 434021)
- File size : 39 Gb

Production code

- PRDF -> DST
- Production macro
- OutputManager.C
- This part is for getting DC, PC, RICH hit information.

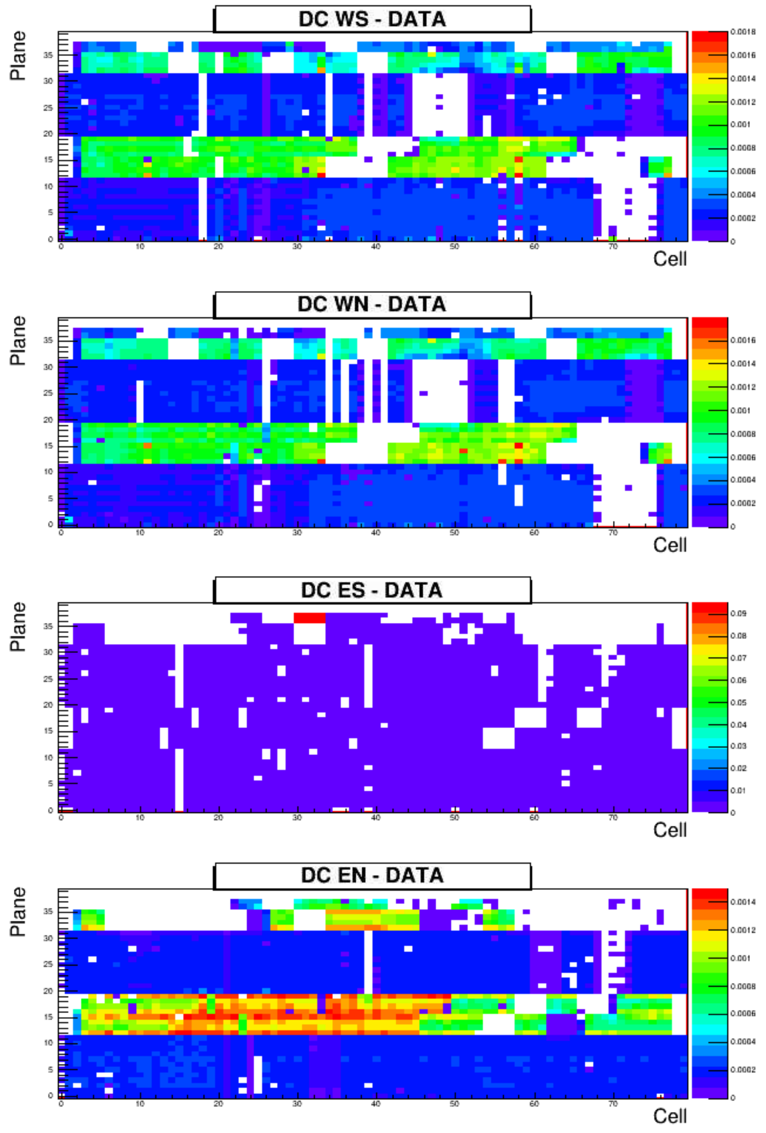
```
void CNT_Compact(const int runnumber,const int segment,const char *file,const char *trgsel = 0)
{

  MakeOutput(runnumber,segment,file);
  Fun4AllServer *se = Fun4AllServer::instance();
  Fun4AllDstOutputManager *CNTCOMPACT_Manager  = new Fun4AllDstOutputManager(file,output);

  if (trgsel)
    {
      CNTCOMPACT_Manager->AddEventSelector(trgsel);
    }

  addCommon(CNTCOMPACT_Manager);
  CNTCOMPACT_Manager->AddNode("PHGlobal");
  CNTCOMPACT_Manager->AddNode("PHGlobal_CENTRAL");
  CNTCOMPACT_Manager->AddNode("DchHit_VarArray");
  CNTCOMPACT_Manager->AddNode("EmcHit_VarArray");
  CNTCOMPACT_Manager->AddNode("Pc1Hit_VarArray");
  CNTCOMPACT_Manager->AddNode("Pc2Hit_VarArray");
  CNTCOMPACT_Manager->AddNode("Pc3Hit_VarArray");
  CNTCOMPACT_Manager->AddNode("TofeHit_VarArray");
  CNTCOMPACT_Manager->AddNode("TofwHit_VarArray");
  CNTCOMPACT_Manager->AddNode("CrkHit_VarArray");
  CNTCOMPACT_Manager->AddNode("AccHit_VarArray");
  CNTCOMPACT_Manager->AddNode("CglTrackHits_VarArray");
  CNTCOMPACT_Manager->AddNode("CglTrackBackHits_VarArray");
  CNTCOMPACT_Manager->AddNode("TrackProjection_VarArray");
  CNTCOMPACT_Manager->AddNode("TrackLineProjection_VarArray");
  CNTCOMPACT_Manager->AddNode("TrackPathLength_VarArray");
  CNTCOMPACT_Manager->AddNode("emcHitContainer");
  //CNTCOMPACT_Manager->AddNode("SpinDataEventOut");
  //CNTCOMPACT_Manager->AddNode("Pc1Raw");
  //CNTCOMPACT_Manager->AddNode("Pc2Raw");
  //CNTCOMPACT_Manager->AddNode("Pc3Raw");
  //CNTCOMPACT_Manager->AddNode("DchHitLineTable");
  //CNTCOMPACT_Manager->AddNode("CrkHit");
  //CNTCOMPACT_Manager->AddNode("emcTowerContainer");

  se->registerOutputManager(CNTCOMPACT_Manager);

}
```

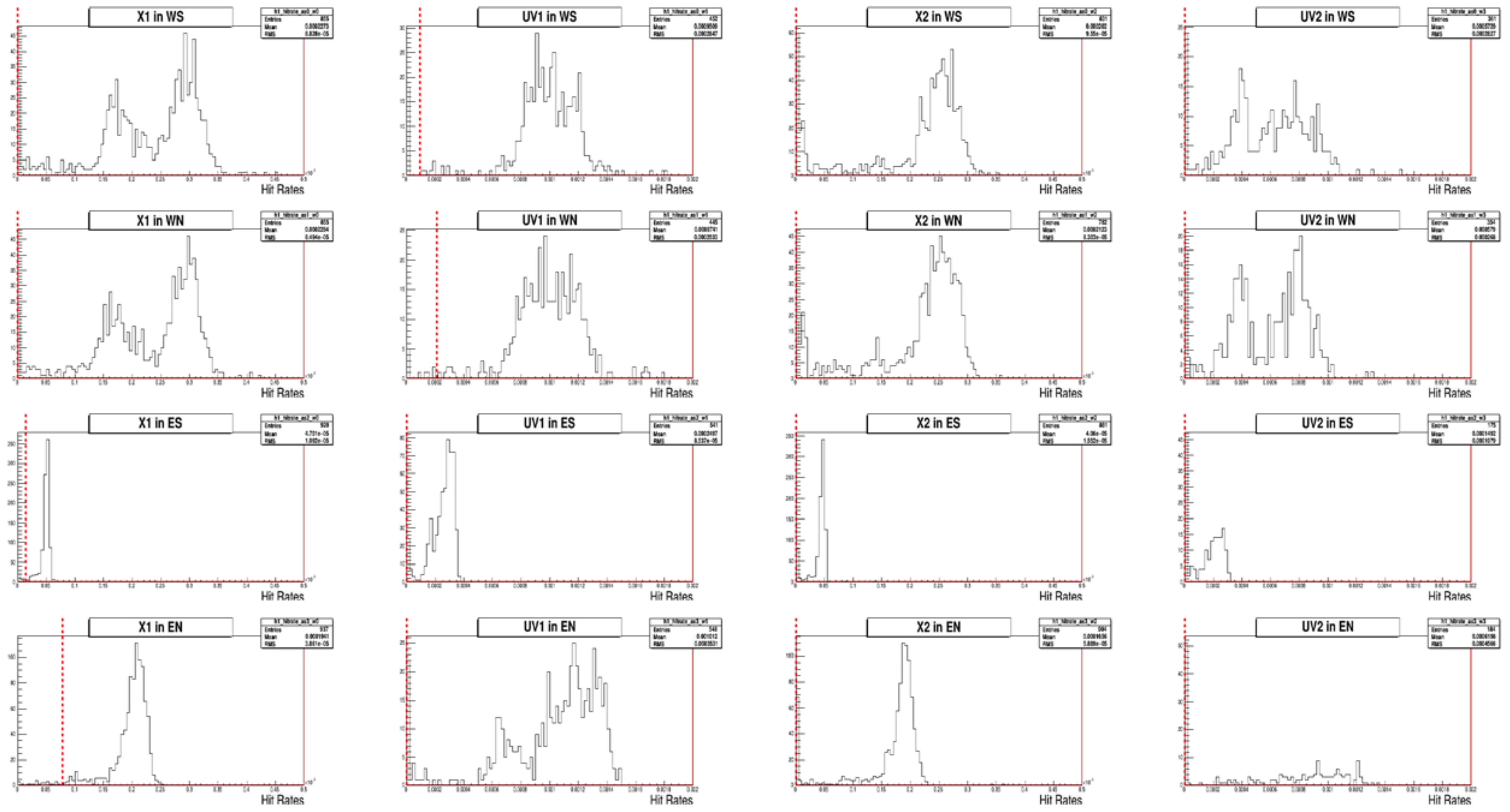
DST -> nDST

```
434021-000.root  434021-041.root  434021-079.root  434021-117.root  outfromdst_434021-000.root  outfromdst_434021-041.root  outfromdst_434021-079.root  outfromdst_434021-117.root
434021-001.root  434021-042.root  434021-080.root  434021-118.root  outfromdst_434021-001.root  outfromdst_434021-042.root  outfromdst_434021-080.root  outfromdst_434021-118.root
434021-002.root  434021-043.root  434021-081.root  434021-119.root  outfromdst_434021-002.root  outfromdst_434021-043.root  outfromdst_434021-081.root  outfromdst_434021-119.root
434021-003.root  434021-044.root  434021-082.root  434021-121.root  outfromdst_434021-003.root  outfromdst_434021-044.root  outfromdst_434021-082.root  outfromdst_434021-121.root
434021-004.root  434021-047.root  434021-083.root  434021-122.root  outfromdst_434021-004.root  outfromdst_434021-047.root  outfromdst_434021-083.root  outfromdst_434021-122.root
434021-006.root  434021-048.root  434021-084.root  434021-123.root  outfromdst_434021-006.root  outfromdst_434021-048.root  outfromdst_434021-084.root  outfromdst_434021-123.root
434021-007.root  434021-049.root  434021-085.root  434021-124.root  outfromdst_434021-007.root  outfromdst_434021-049.root  outfromdst_434021-085.root  outfromdst_434021-124.root
434021-008.root  434021-050.root  434021-086.root  434021-125.root  outfromdst_434021-008.root  outfromdst_434021-050.root  outfromdst_434021-086.root  outfromdst_434021-125.root
434021-009.root  434021-051.root  434021-087.root  434021-126.root  outfromdst_434021-009.root  outfromdst_434021-051.root  outfromdst_434021-087.root  outfromdst_434021-126.root
434021-010.root  434021-052.root  434021-088.root  434021-128.root  outfromdst_434021-010.root  outfromdst_434021-052.root  outfromdst_434021-088.root  outfromdst_434021-128.root
434021-011.root  434021-053.root  434021-089.root  434021-129.root  outfromdst_434021-011.root  outfromdst_434021-053.root  outfromdst_434021-089.root  outfromdst_434021-129.root
434021-013.root  434021-054.root  434021-090.root  434021-130.root  outfromdst_434021-013.root  outfromdst_434021-054.root  outfromdst_434021-090.root  outfromdst_434021-130.root
434021-014.root  434021-055.root  434021-091.root  434021-131.root  outfromdst_434021-014.root  outfromdst_434021-055.root  outfromdst_434021-091.root  outfromdst_434021-131.root
434021-016.root  434021-056.root  434021-092.root  434021-132.root  outfromdst_434021-016.root  outfromdst_434021-056.root  outfromdst_434021-092.root  outfromdst_434021-132.root
434021-017.root  434021-057.root  434021-093.root  434021-133.root  outfromdst_434021-017.root  outfromdst_434021-057.root  outfromdst_434021-093.root  outfromdst_434021-133.root
434021-018.root  434021-058.root  434021-094.root  434021-135.root  outfromdst_434021-018.root  outfromdst_434021-058.root  outfromdst_434021-094.root  outfromdst_434021-135.root
434021-020.root  434021-059.root  434021-095.root  434021-136.root  outfromdst_434021-020.root  outfromdst_434021-059.root  outfromdst_434021-095.root  outfromdst_434021-136.root
434021-021.root  434021-060.root  434021-096.root  434021-137.root  outfromdst_434021-021.root  outfromdst_434021-060.root  outfromdst_434021-096.root  outfromdst_434021-137.root
434021-022.root  434021-061.root  434021-097.root  434021-138.root  outfromdst_434021-022.root  outfromdst_434021-061.root  outfromdst_434021-097.root  outfromdst_434021-138.root
434021-023.root  434021-062.root  434021-098.root  434021-140.root  outfromdst_434021-023.root  outfromdst_434021-062.root  outfromdst_434021-098.root  outfromdst_434021-140.root
434021-024.root  434021-063.root  434021-100.root  434021-141.root  outfromdst_434021-024.root  outfromdst_434021-063.root  outfromdst_434021-100.root  outfromdst_434021-141.root
434021-025.root  434021-064.root  434021-102.root  434021-144.root  outfromdst_434021-025.root  outfromdst_434021-064.root  outfromdst_434021-102.root  outfromdst_434021-144.root
434021-026.root  434021-065.root  434021-103.root  434021-145.root  outfromdst_434021-026.root  outfromdst_434021-065.root  outfromdst_434021-103.root  outfromdst_434021-145.root
434021-027.root  434021-066.root  434021-104.root  434021-147.root  outfromdst_434021-027.root  outfromdst_434021-066.root  outfromdst_434021-104.root  outfromdst_434021-147.root
434021-028.root  434021-067.root  434021-105.root  434021-148.root  outfromdst_434021-028.root  outfromdst_434021-067.root  outfromdst_434021-105.root  outfromdst_434021-149.root
434021-029.root  434021-068.root  434021-106.root  434021-149.root  outfromdst_434021-029.root  outfromdst_434021-068.root  outfromdst_434021-106.root  outfromdst_434021-150.root
434021-030.root  434021-069.root  434021-107.root  434021-150.root  outfromdst_434021-030.root  outfromdst_434021-069.root  outfromdst_434021-107.root  outfromdst_434021-151.root
434021-031.root  434021-070.root  434021-108.root  434021-151.root  outfromdst_434021-031.root  outfromdst_434021-070.root  outfromdst_434021-108.root  outfromdst_434021-152.root
434021-032.root  434021-071.root  434021-109.root  434021-152.root  outfromdst_434021-032.root  outfromdst_434021-071.root  outfromdst_434021-109.root  outfromdst_434021-155.root
434021-033.root  434021-074.root  434021-111.root  434021-155.root  outfromdst_434021-033.root  outfromdst_434021-074.root  outfromdst_434021-111.root  outfromdst_434021-156.root
434021-034.root  434021-075.root  434021-112.root  434021-156.root  outfromdst_434021-034.root  outfromdst_434021-075.root  outfromdst_434021-112.root  outfromdst_434021-158.root
434021-036.root  434021-076.root  434021-113.root  434021-157.root  outfromdst_434021-036.root  outfromdst_434021-076.root  outfromdst_434021-113.root  tmpscript
434021-037.root  434021-077.root  434021-114.root  434021-158.root  outfromdst_434021-037.root  outfromdst_434021-077.root  outfromdst_434021-114.root
434021-038.root  434021-078.root  434021-115.root  log              outfromdst_434021-038.root  outfromdst_434021-078.root  outfromdst_434021-115.root
```

- 434021-*.root files include Tree information.
- Outfromdst_*.root files include various histograms. (e.g. DC hit distribution.)

DC hit distribution & DC hit rate





Next step

- Same work for every runnumbers.
- Making plot for DC, PC, RICH.
- Getting dead map from hit distribution.
- Apply dead map to simulation then calculate Acc. X Rec. efficiency.

Thank you.

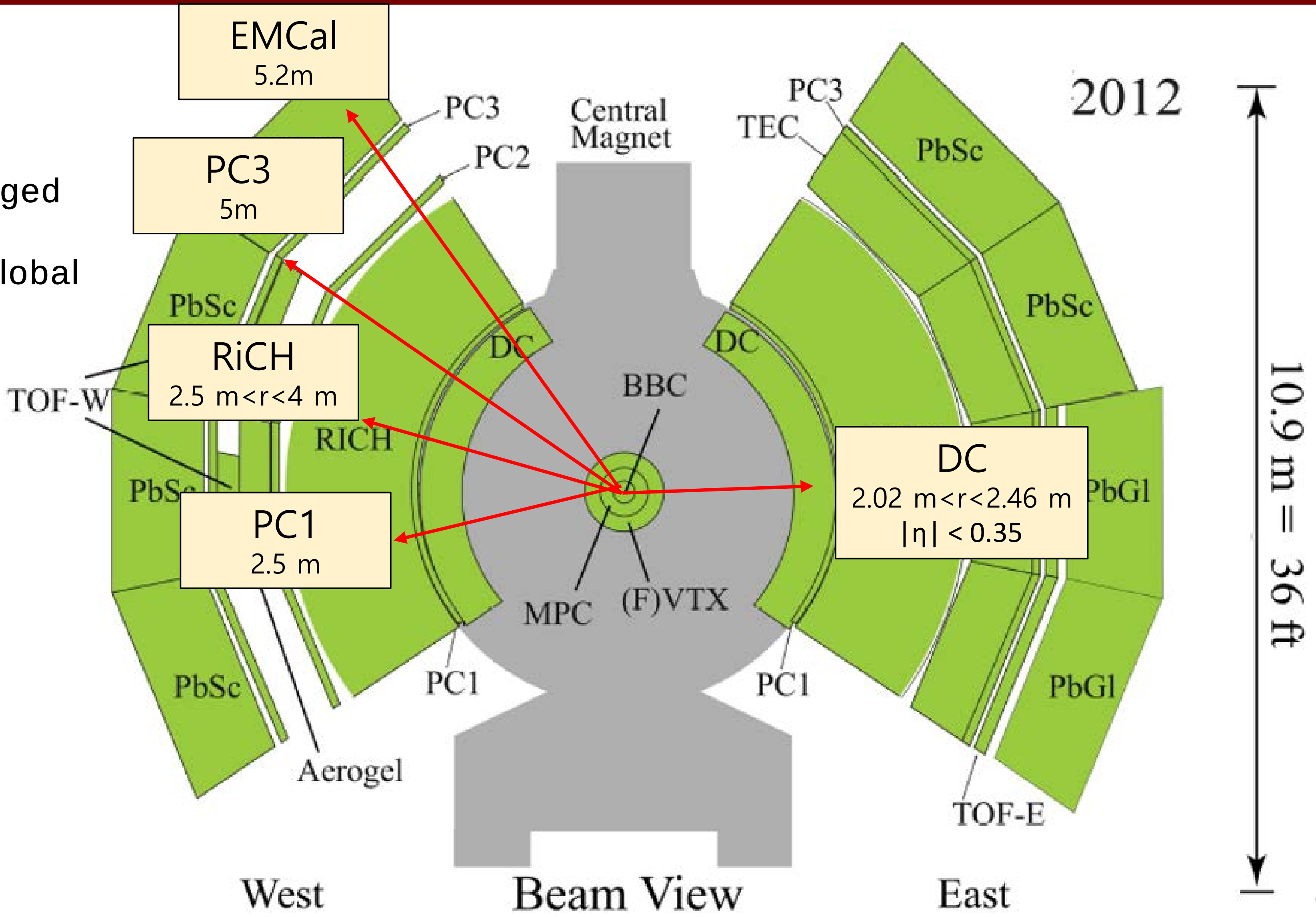
Back up

Drift Chamber for PHENIX

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

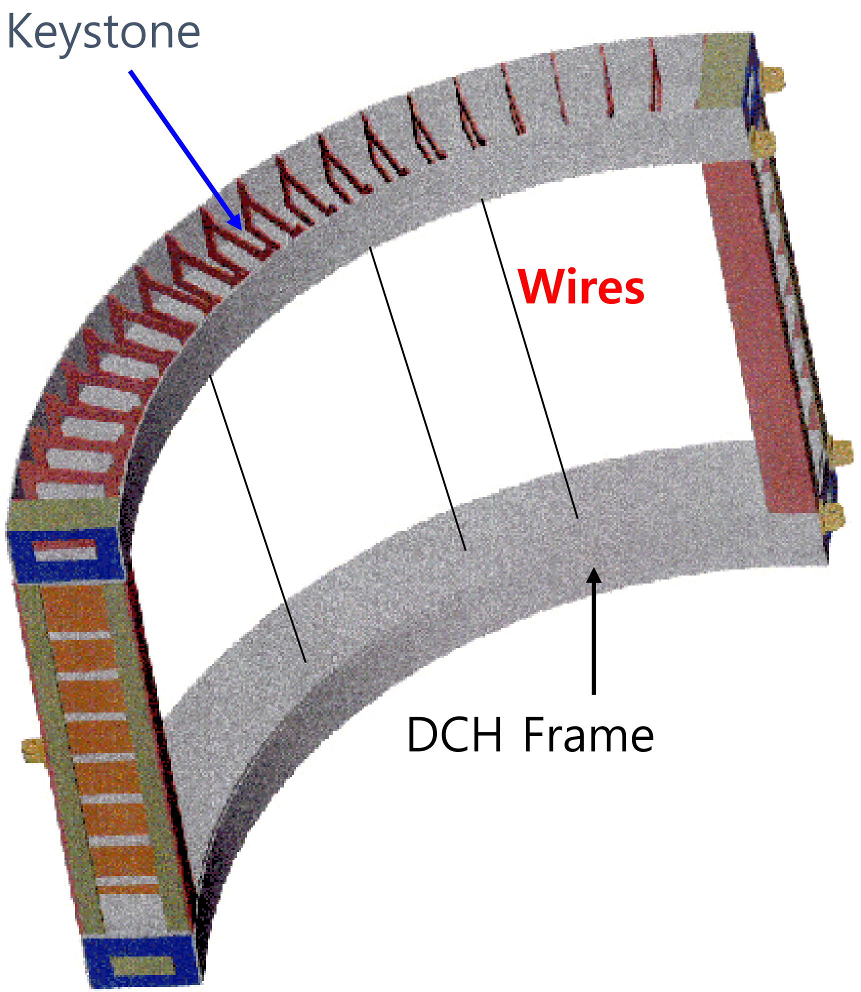
- **Acceptance:**
  - 2 arms 90º in ϕ each
  - ±90 cm in Z
  - 0.7 units of η

- **Location:**
  - Radial :2.02<R<2.48 m
  - Angular:
    - West: -34º < ϕ < 56º
    - East : 125º < ϕ < 215º



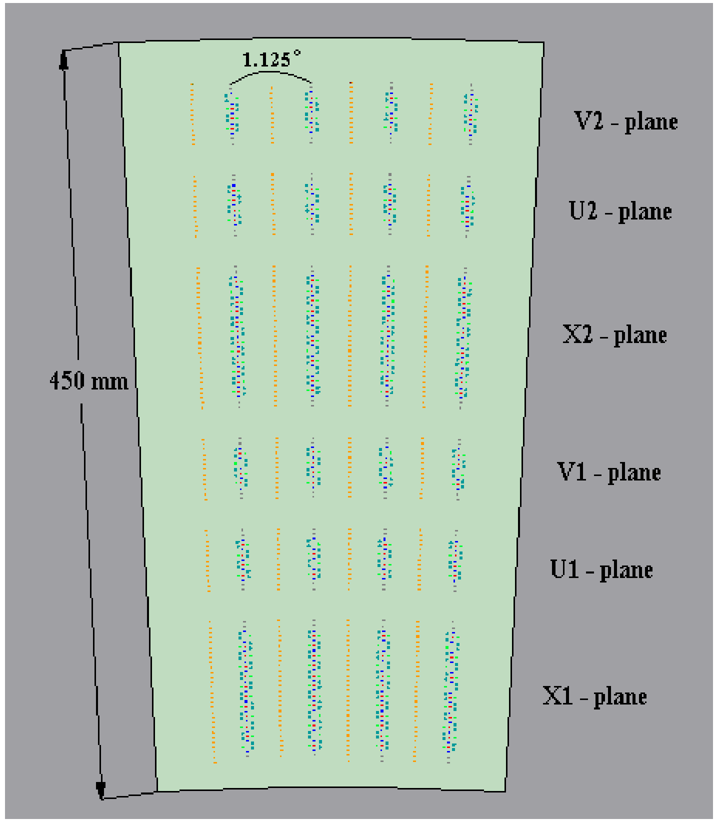
Drift Chamber design

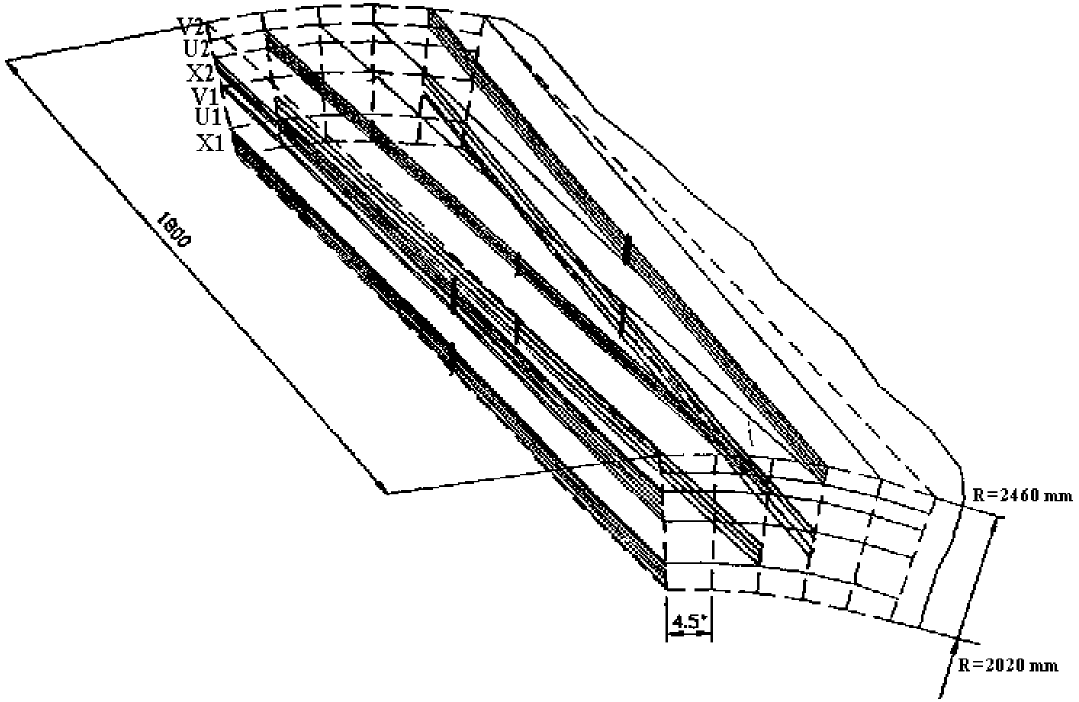
- Made of titanium
- Conists of 20 identical keystones
- Weight ~ 1.5 tons
- Total tension of wires ~ 3 tons



Lay-out of one keystone

- 6 radial layers of nets (X1,U1,V1,X2,U2,V2)



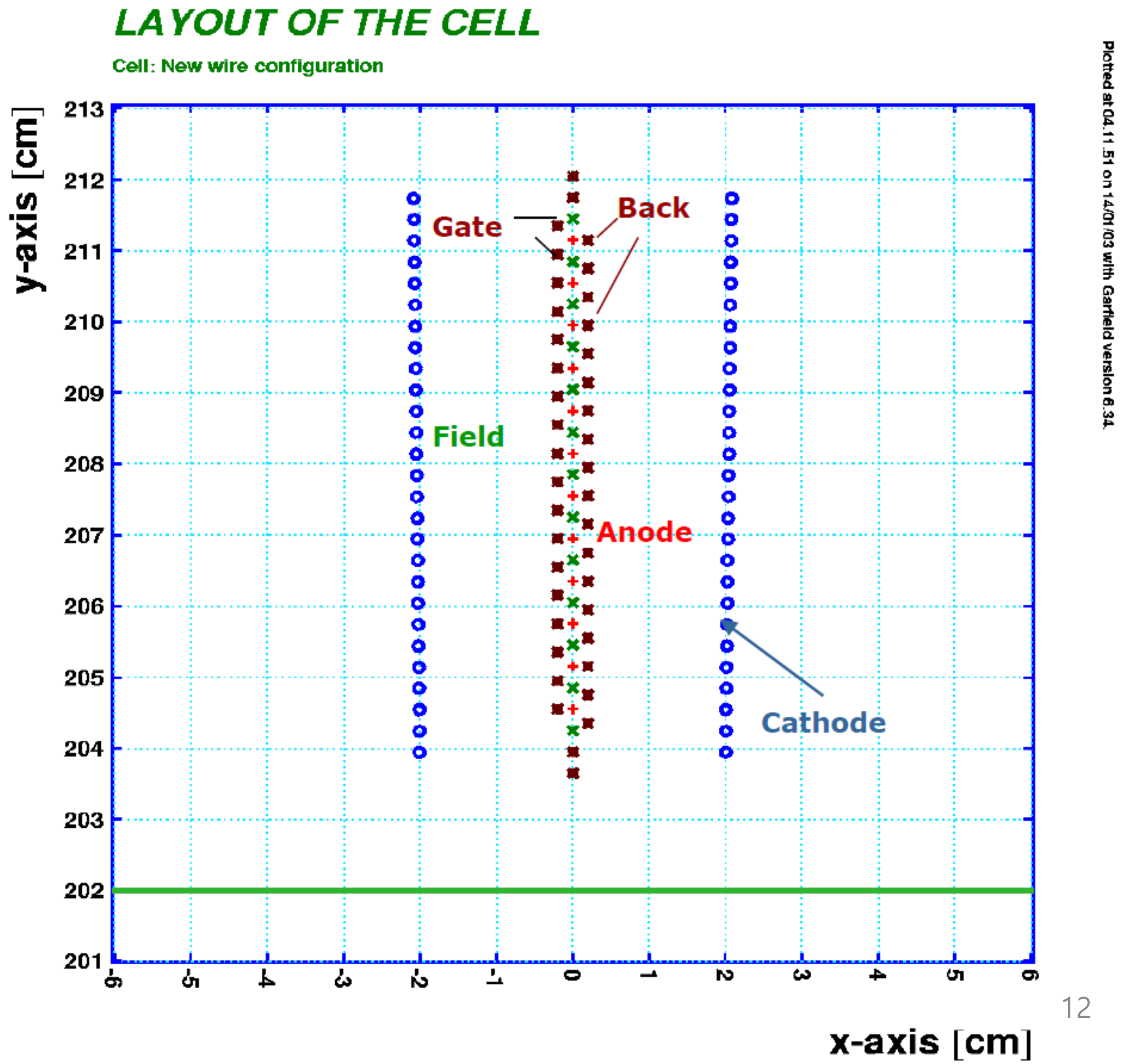


- **Stereo nets start in one keystone (n) and end in the neighbouring keystone e.g. (n+1) for U, (n-1) for V**
- **The tilt of UV nets along ϕ allows measurement of Z component of the track**

Drift field configuration

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

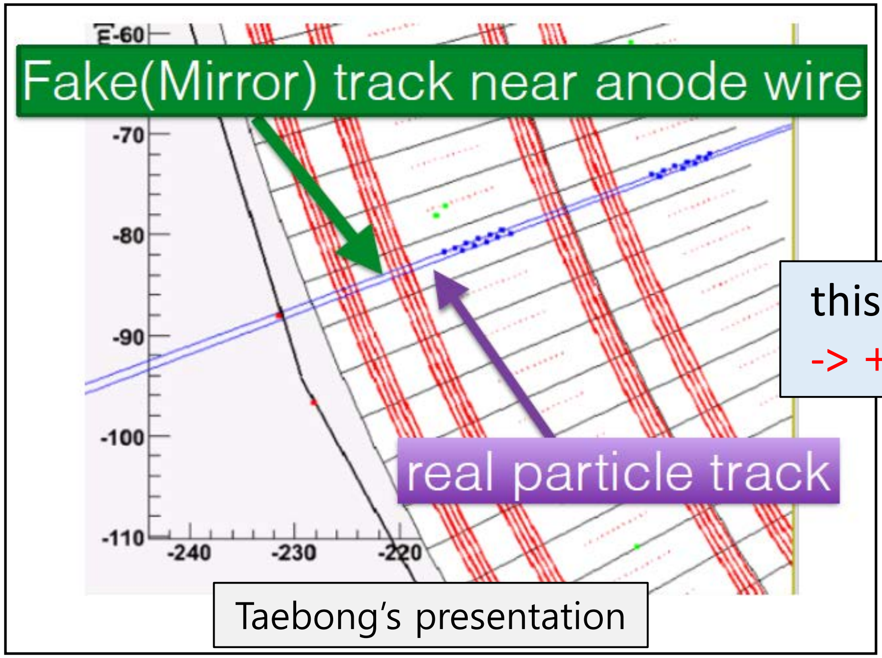
- **Cathode Wires** – Create uniform drift field between anode and cathode
- **Field Wires** – Create high electric field strength near the anode wire
- **Back Wires** – Stop drift from one side of the anode wire
- **Gate Wires** – Also create high field near the anode wire, Localize the drift region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



Drift Field Configuration

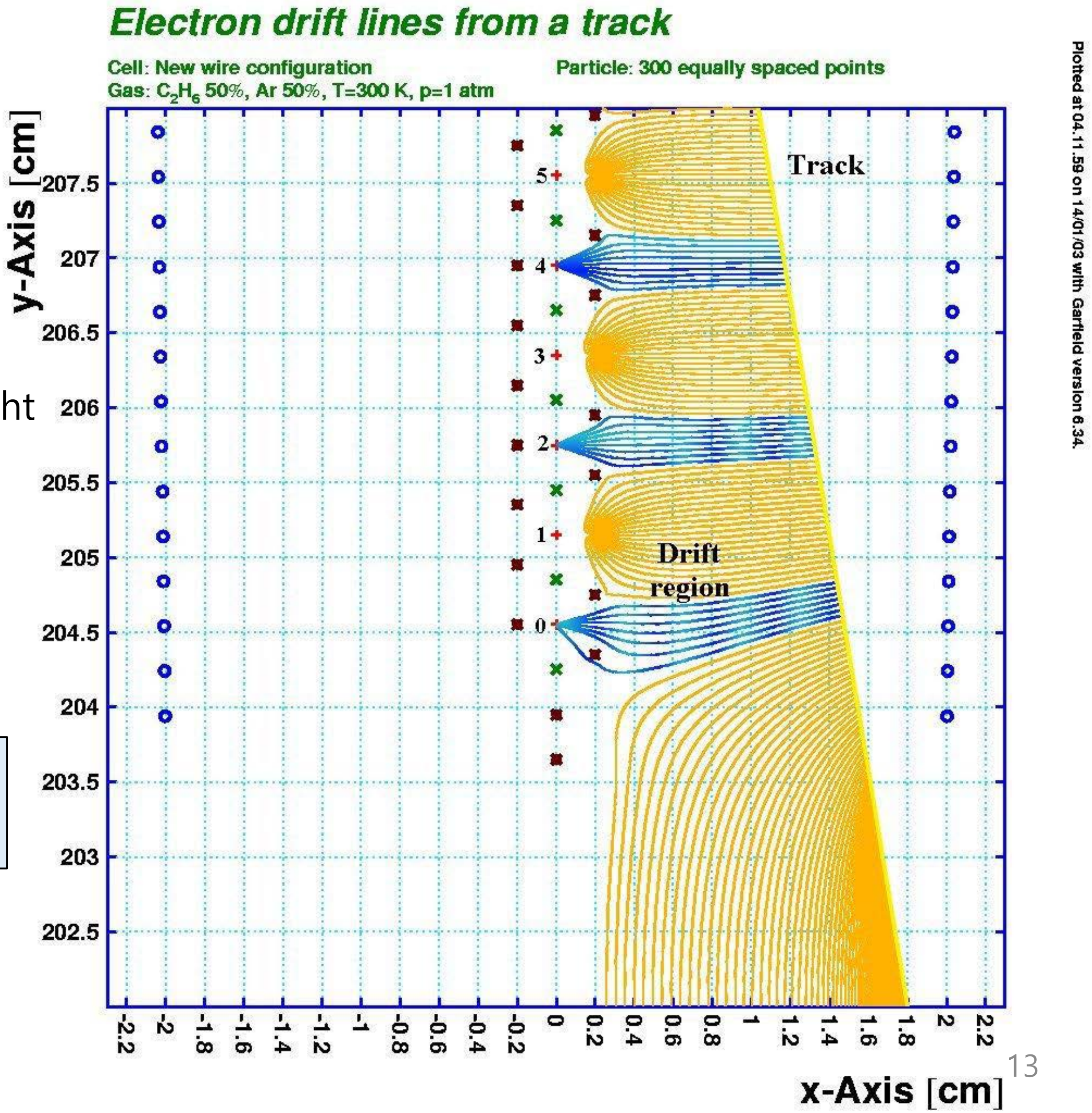
- Here is what happens when the charged particle passes through the wire cell
- Note that only even wires collect charge due to the **back wires** that block the odd anode wires !
- Back wires solves left-right ambiguity problem

-> 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.

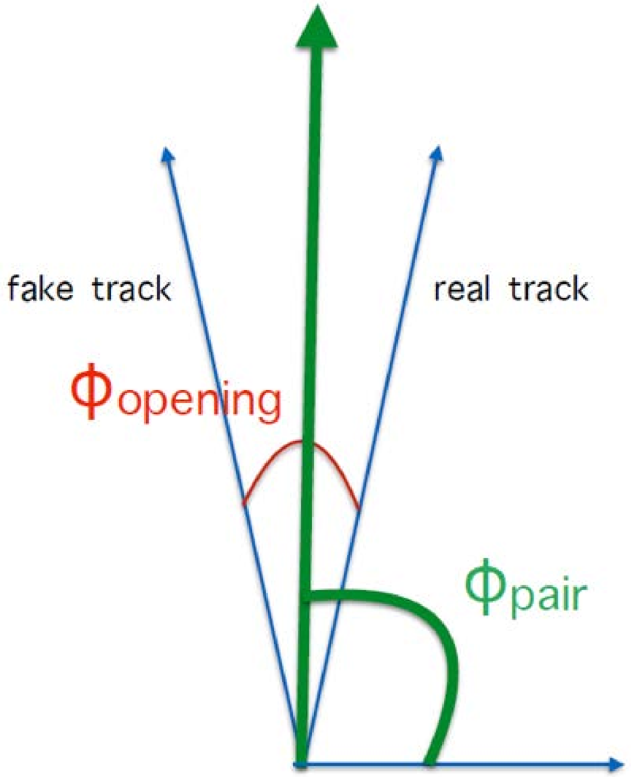
-> we can know anode wire position if drawing ϕ_{pair} distribution.

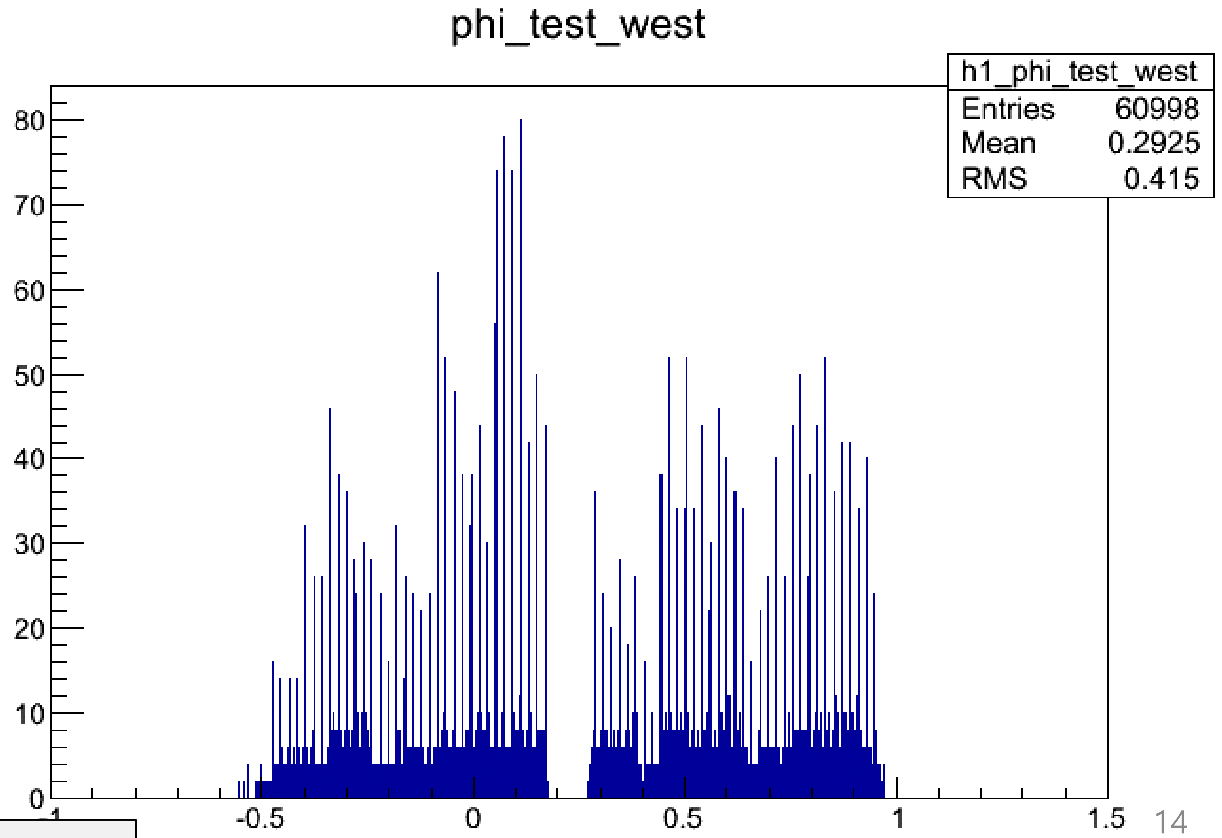
- Pair cuts

- 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