Everything you always wanted to know about MDT but were afraid to ask

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UNIVERSITÀ DEGLI STUDI DI TORINO
ALMA UNIVERSITAS TAURINENSIS

INFN
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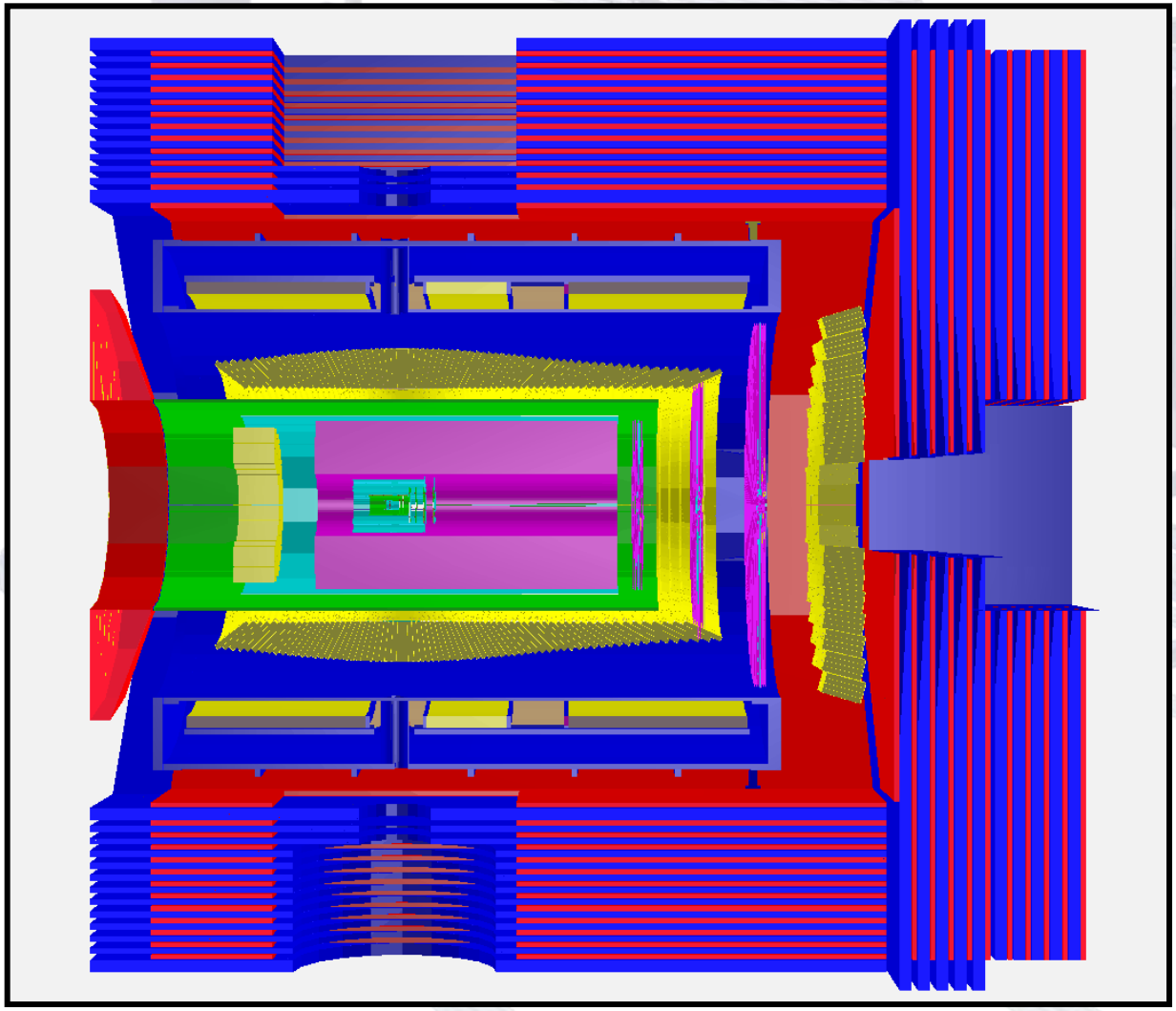
Sezione di Torino

Design of Muon Tracker (MDT)

collaboration
JINR – Dubna (RU)
Gießen – Germany (D)



highest efficiency in muon identification

strong hadronic background

benchmark channel

Drell-Yan

$$\bar{p}p \rightarrow \mu^+ \mu^- X$$

signal-to-noise ~ 10^{-6}

Geometry Implementations

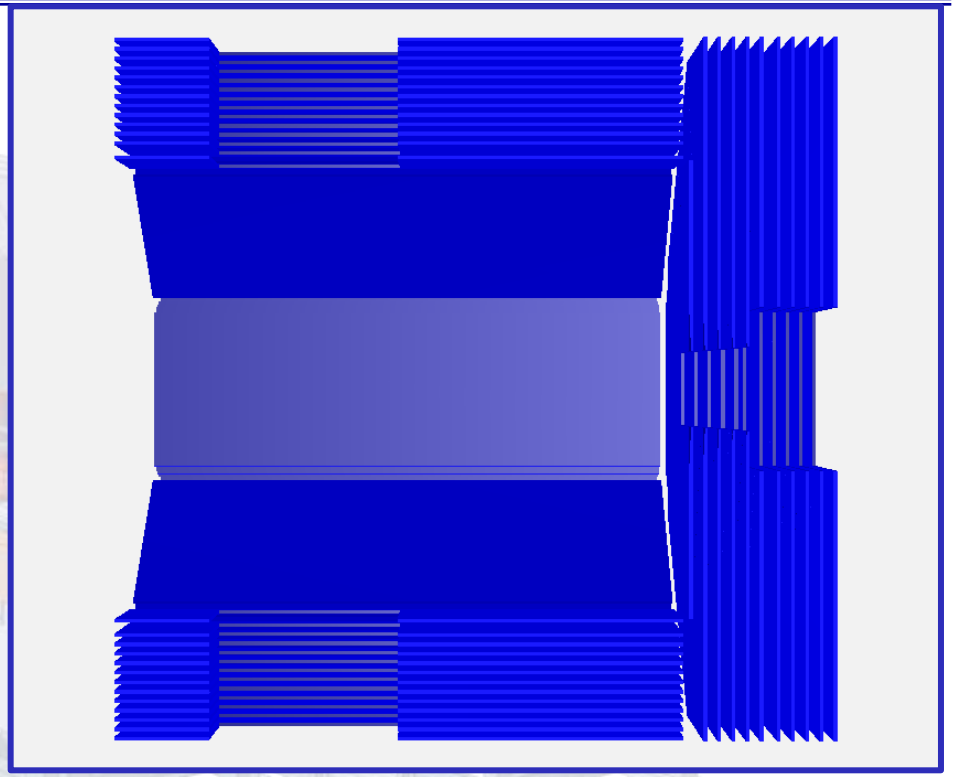
MDT Design

Dubna Endcap
does not follow TDR
(overlaps with yoke)

Dubna geometry
not optimized

more recent design

Simplified Geometry
(George Serbanut)



simplified geometry
$ArCo_2$ planes
2,5 cm thickness

- ✓ Barrel
- ✓ Encap
- ✓ Muon Filter

passive iron of the MF

macro/mdt/sim_muo.C

```
PndMdt *Muo = new PndMdt("MDT",kTRUE):
Muo->SetBarrel("fast");
Muo->SetEndcap("fast");
Muo->SetMuonFilter("fast");
Muo->SetMdtMFIron(kTRUE);
fRun->AddModule(Muo);
```

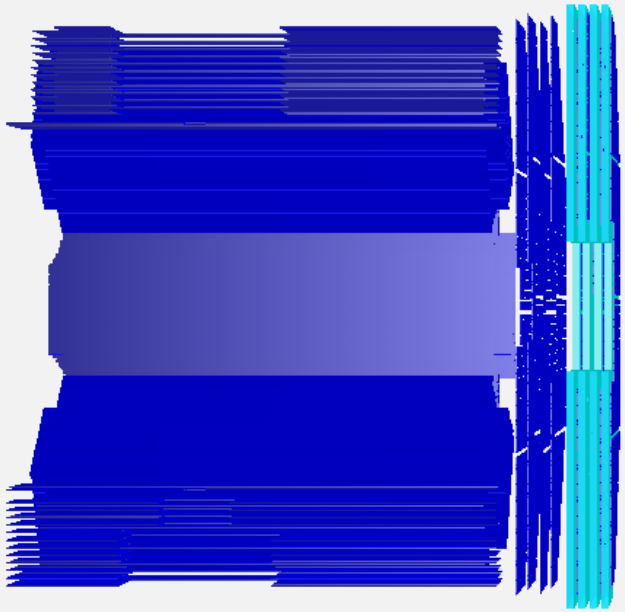
Realistic Geometry

(Valery Rodionov)

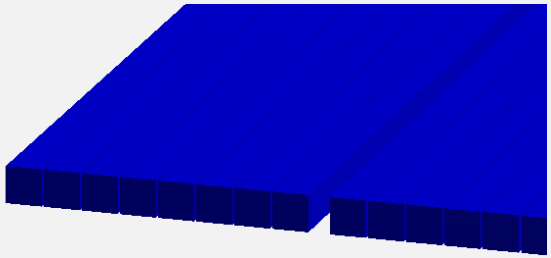
macro/mdt/sim_muo_dub.C

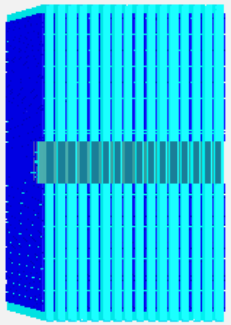
```
PndMdt *Muo = new PndMdt("MDT",kTRUE);
Muo->SetBarrel(""muon_TS_barrel_strip_v1_noGeo.root");
Muo->SetEndcap("muon_TS_endcap_strip_v1_noGeo.root");
Muo->SetForward("muon_Forward_strip_v1_noGeo.root");
Muo->SetMuonFilter("muon_MuonFilter_strip_v1_noGeo.root");
fRun->AddModule(Muo);
```

- ✓ Barrel
- ✓ Encap
- ✓ Muon Filter
- ✓ Forward



detailed geometry

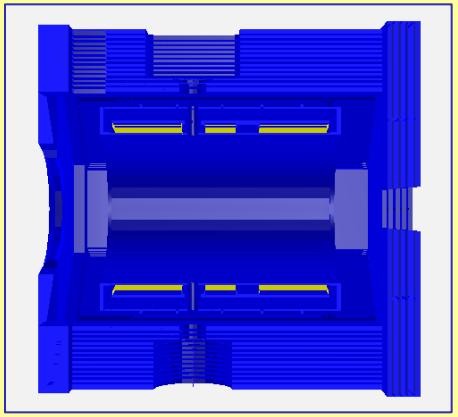




Magnet Design

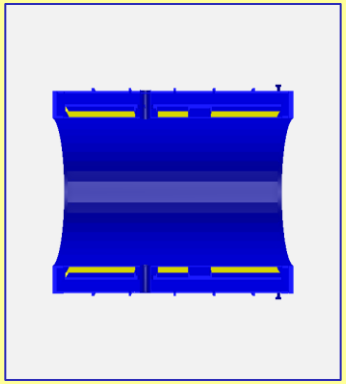
Full CAD conversion (Tobias Stockmanns)

```
FairModule *Magnet= new PndMagnet("MAGNET");
Magnet->SetGeometryFileName
                    ("FullSolenoid_V842.root");
fRun->AddModule(Magnet);
```



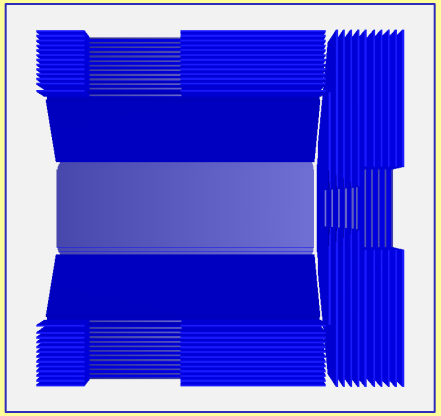
Coils CAD conversion (Tobias Stockmanns)

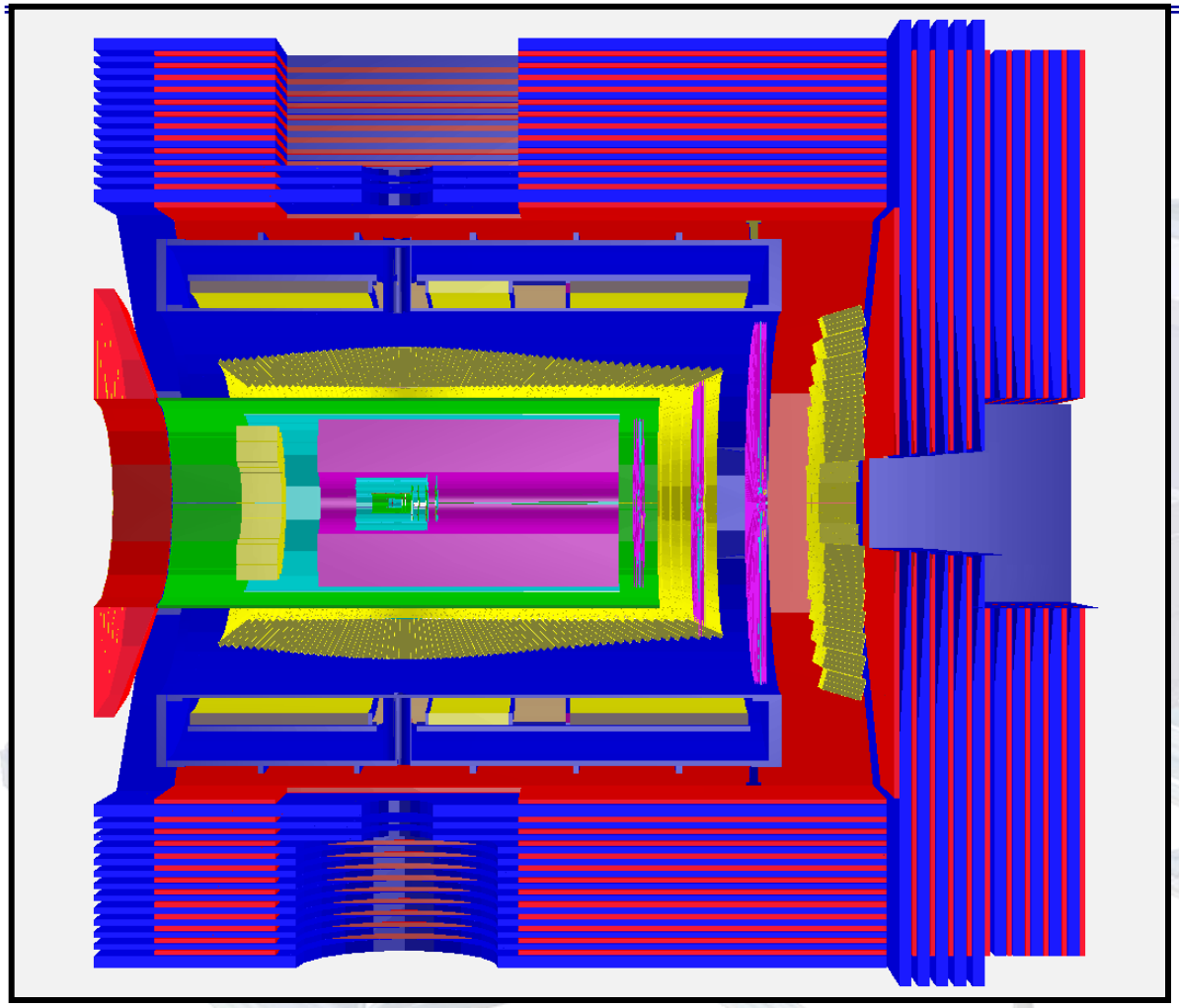
```
FairModule *Magnet= new PndMagnet("MAGNET");
Magnet->SetGeometryFileName
        ("FullSuperconductingSolenoid_V831.root");
fRun->AddModule(Magnet);
```



MDT Design - TDR (George Serbanut)

```
PndMdt *Muo = new PndMdt("MDT",kTRUE);
Muo->SetBarrel…
Muo->SetMdtMagnet(kTRUE);
Muo->SetMdtMFIron(kTRUE);
fRun->AddModule(Muo);
```



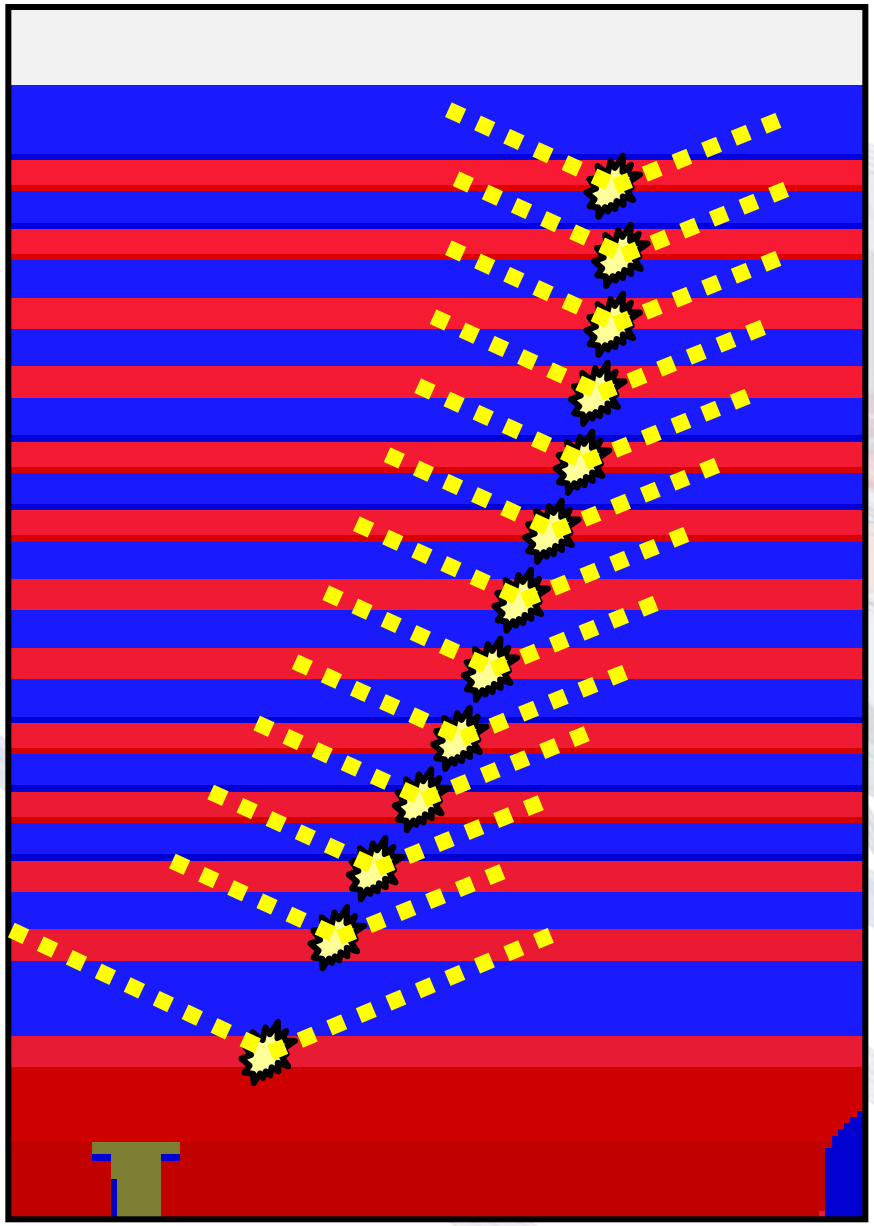


MDT Pattern Recognition

Only with "fast" geometry!

MdtHit Energy Loss > 0

MdtHit Position Smearing 0.3 cm -> 1 cm bar



Pattern Recognition

MdtHit from inner layer

one tracklet PndMdtTrk

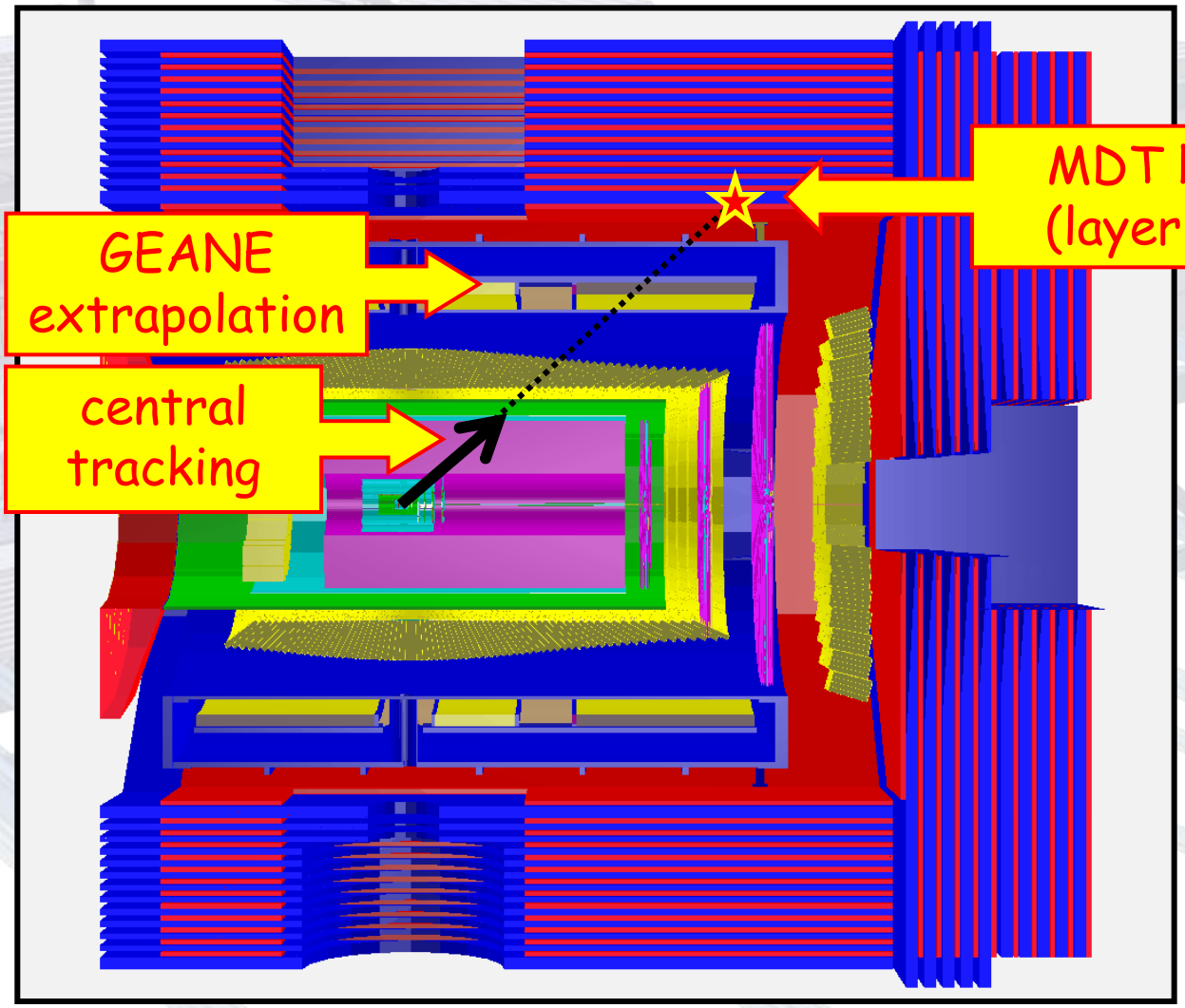
closest hit in next layer in a search cone

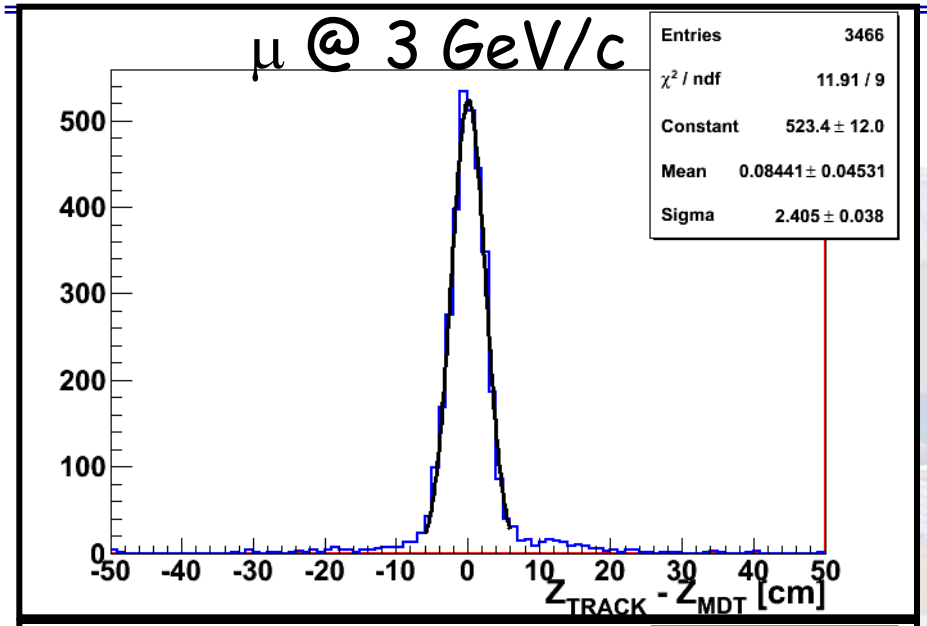
and so on...

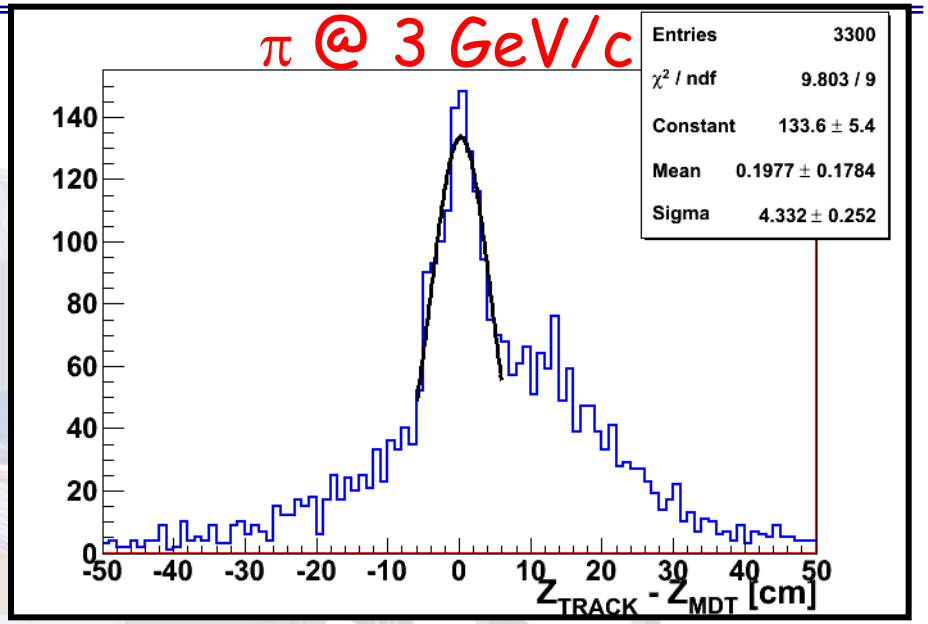
and so on...

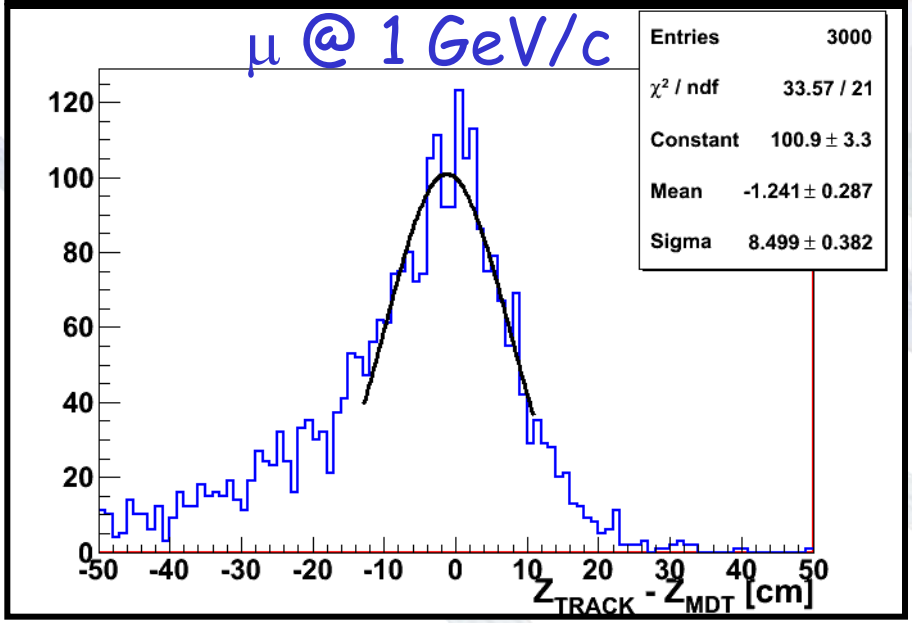
Enccap and Muon Filter threated as single module

Track Propagation to MDT layers



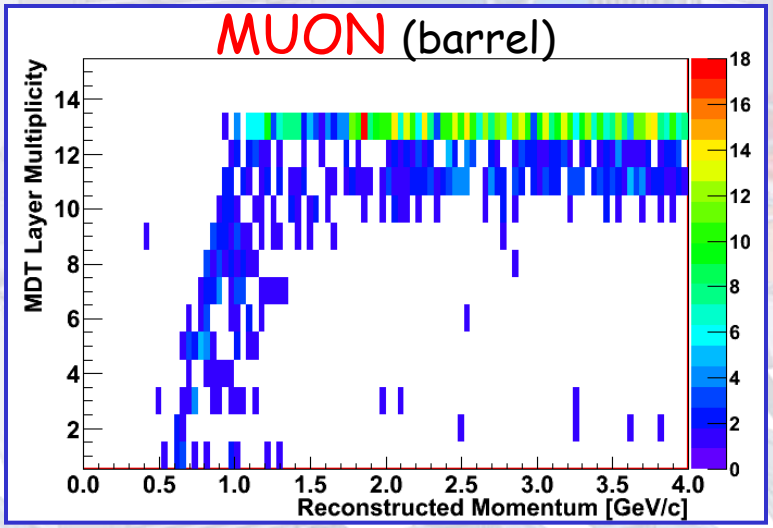


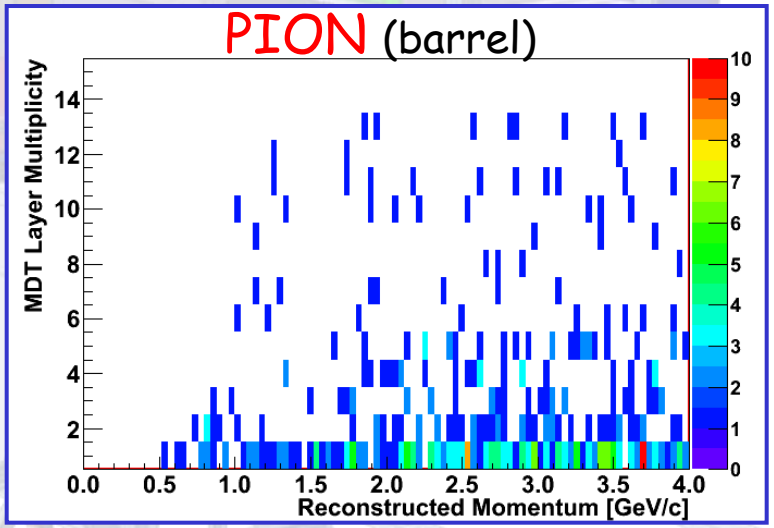




Barrel Propagation

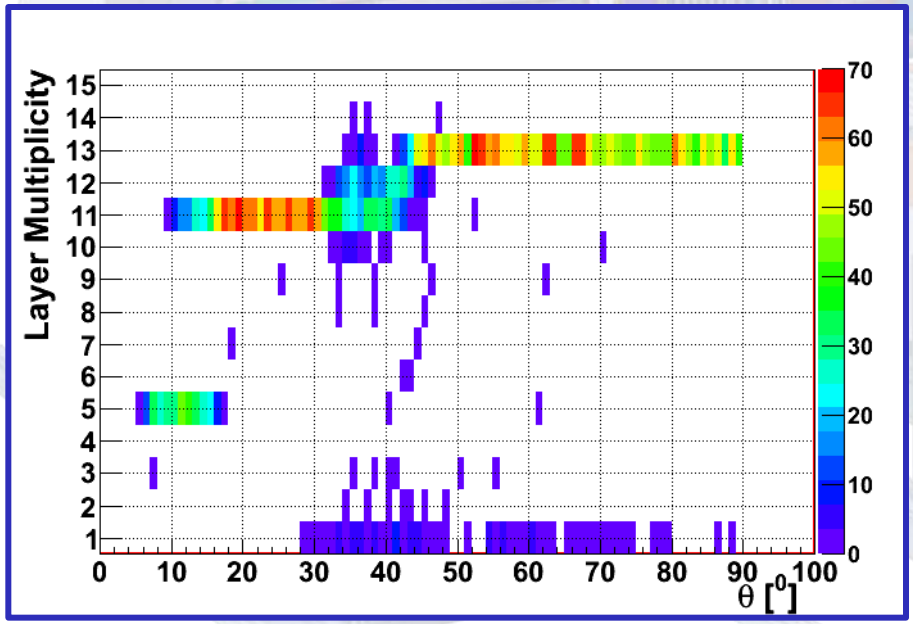
Muon Detection



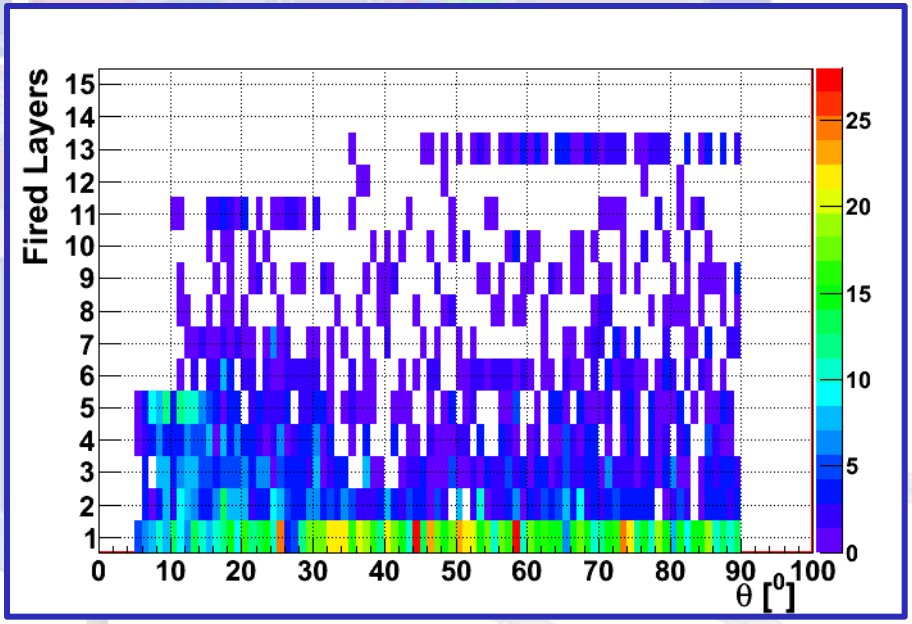


Fired Layers – 3 GeV/c

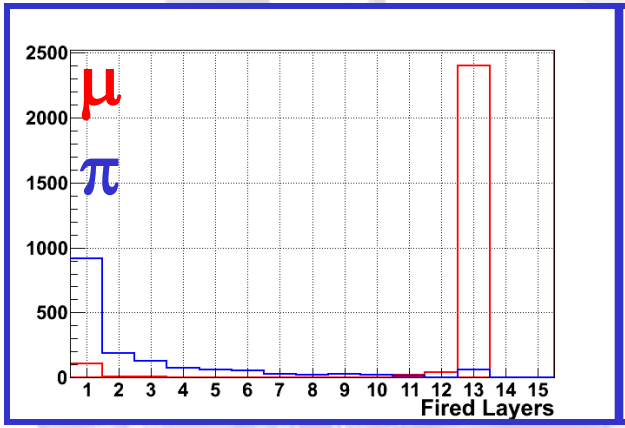
μ @ 3 GeV/c

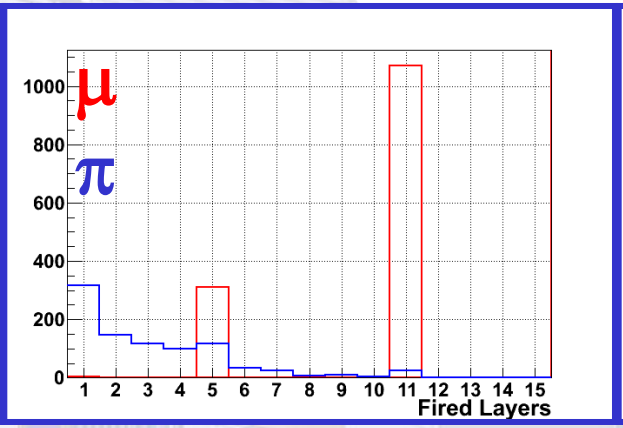


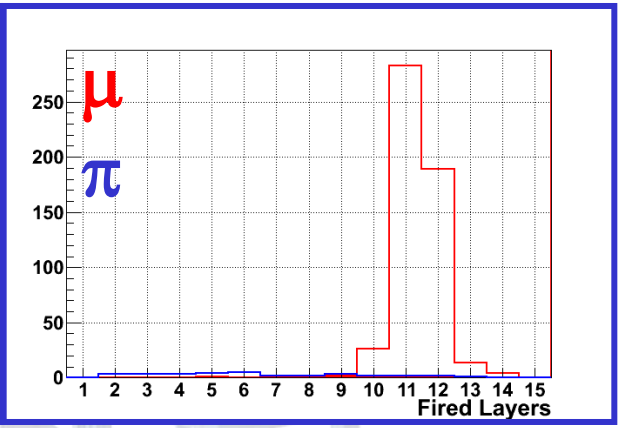
π @ 3 GeV/c



Fired Layers – 3 GeV/c



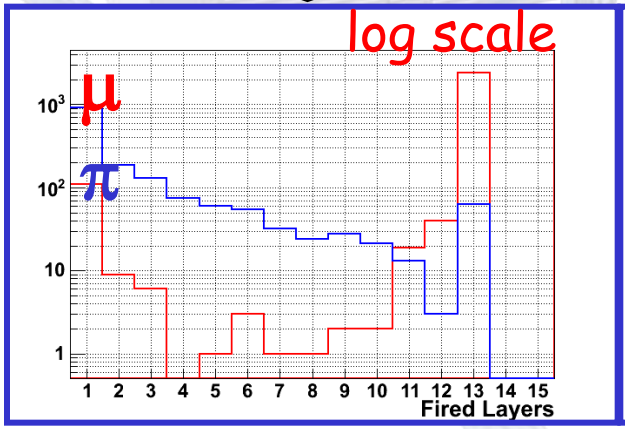


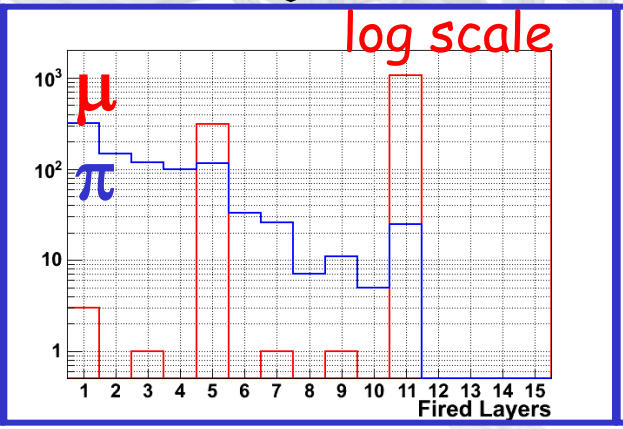


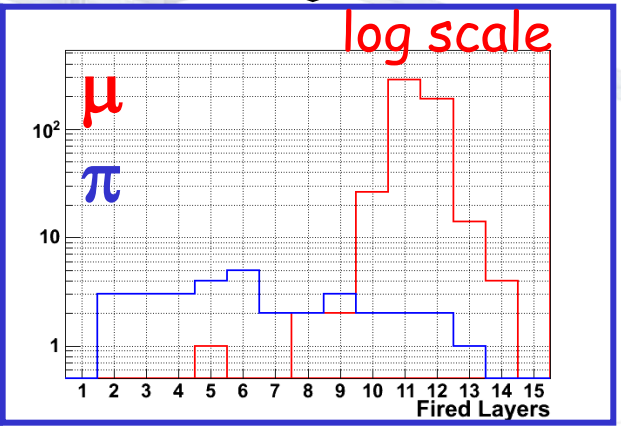
BARREL

EC+MF

HYBRID

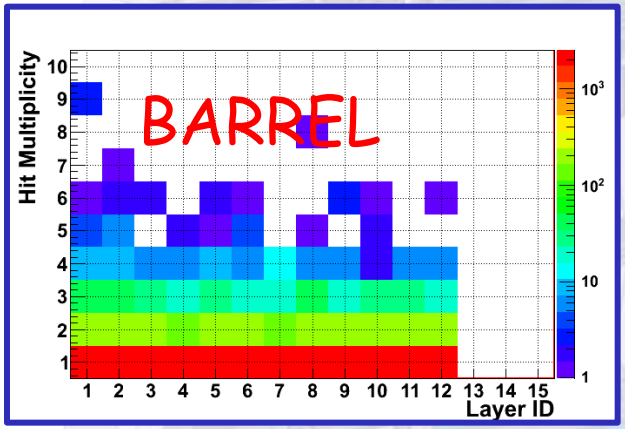


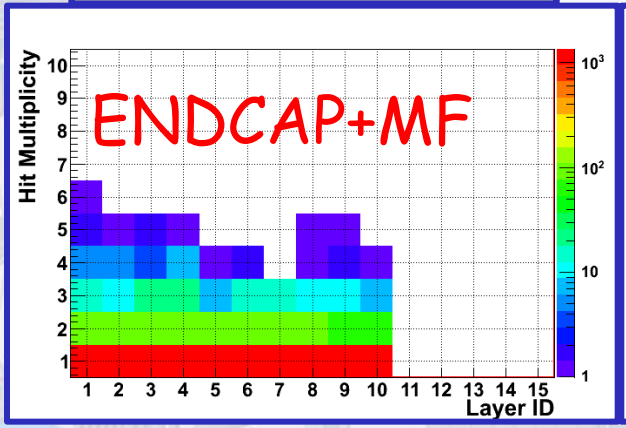


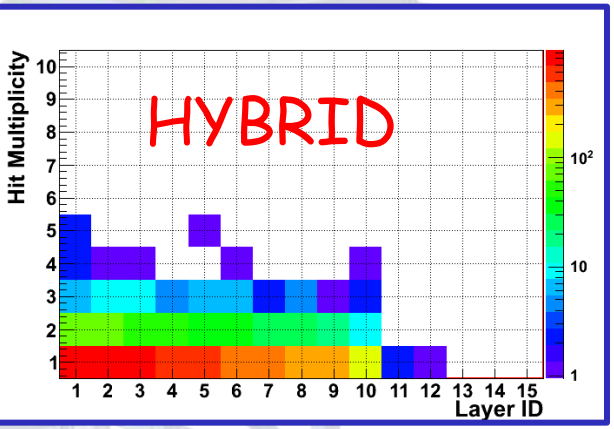


Hit Multiplicities for each Layer – 3 GeV/c

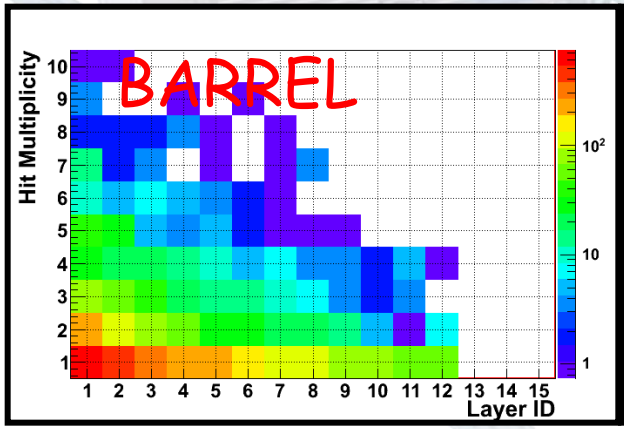
μ @ 3 GeV/c

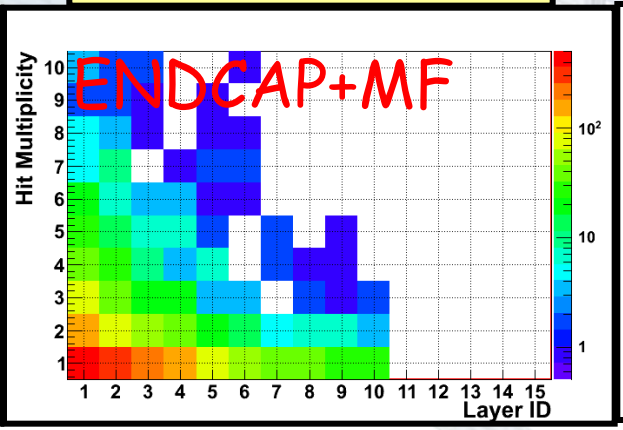


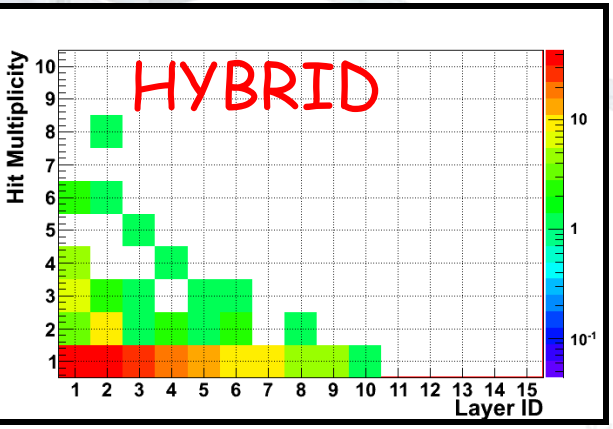




π @ 3 GeV/c

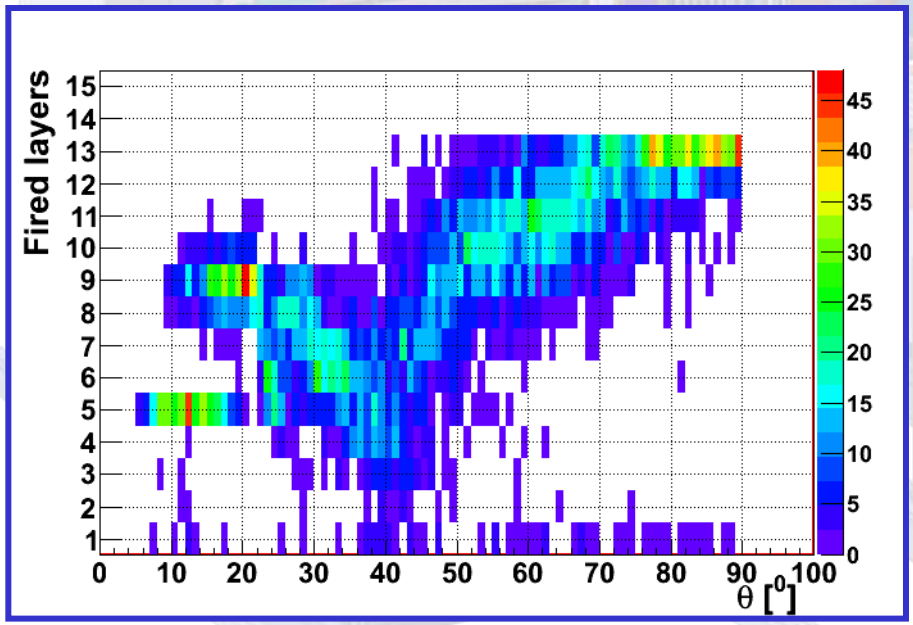




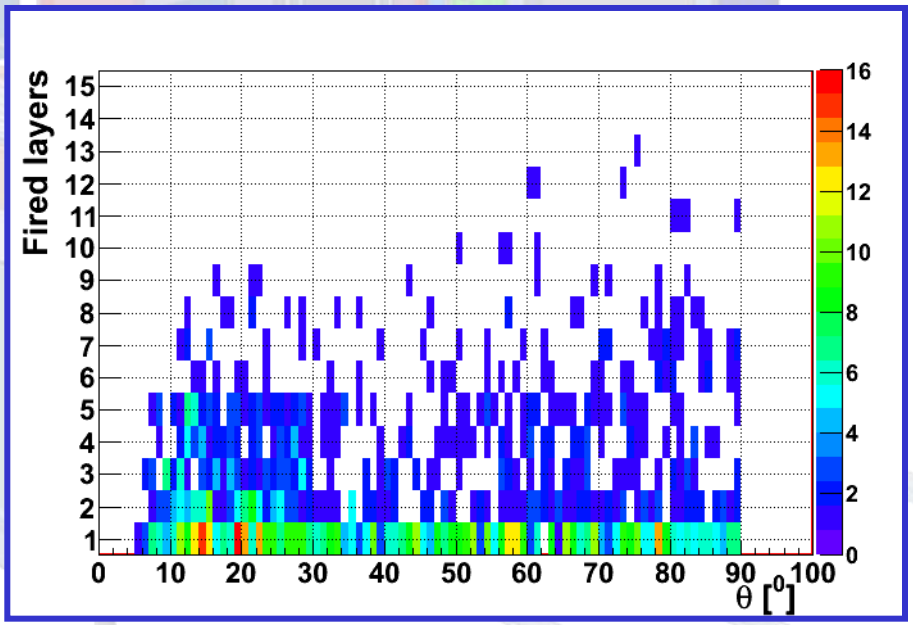


Fired Layers – 1 GeV/c

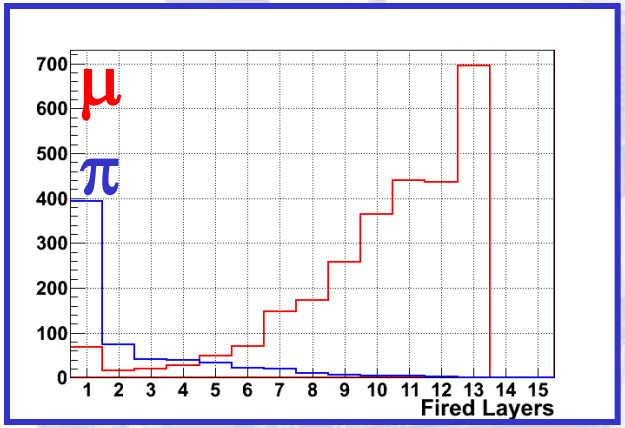
μ @ 1 GeV/c

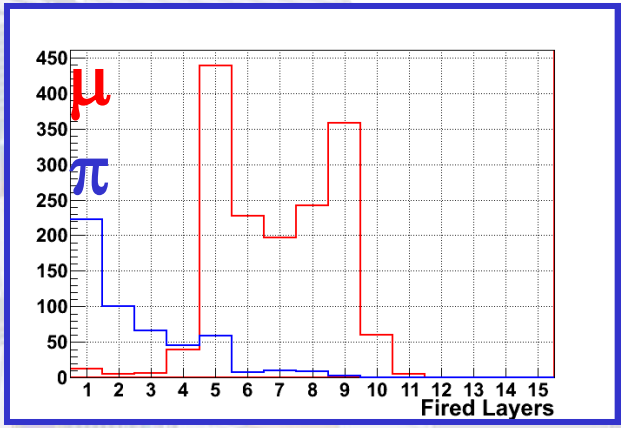


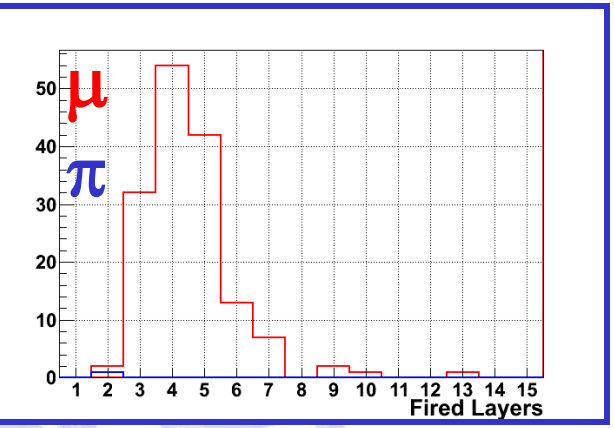
π @ 1 GeV/c



Fired Layers – 1 GeV/c



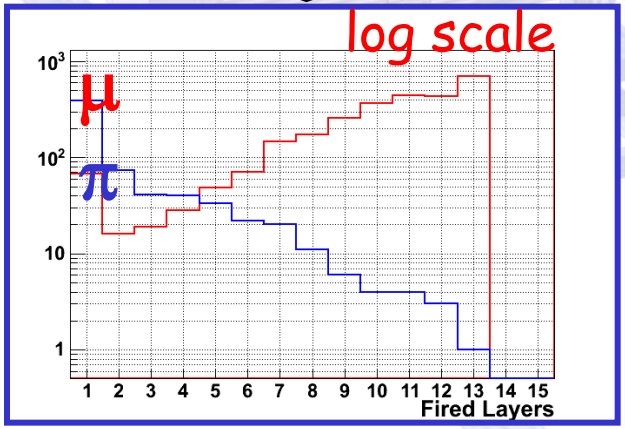


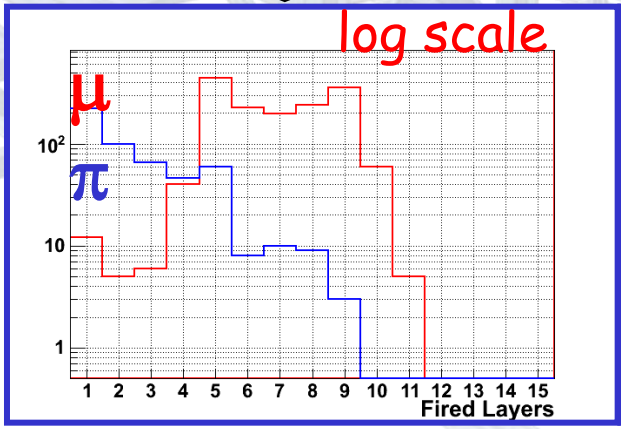


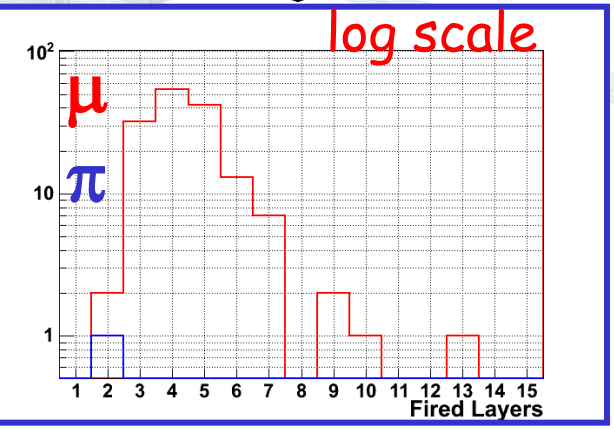
BARREL

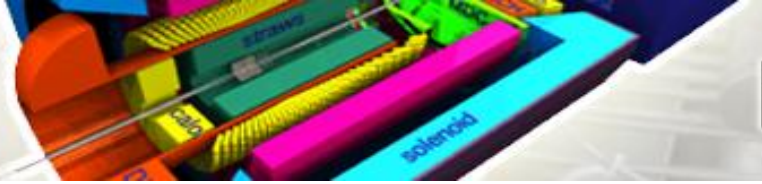
EC+MF

HYBRID









Things to do

- Forward Geometry in the "fast" option
- Realistic digitization/clusterization for the "full" geometry
- Reconstruction for the "full" geometry
- MDT inside Kalman
- Propagating important information into PID
- PID studies (TMVA)