Tracking Status

Steve Aplin
and Alexei Raspiareza

ILD Optimisation Meeting
12 March 2008

Introduction

- Several Modifications to code which feeds into the Tracking code
- The Tracking code itself has not been modified

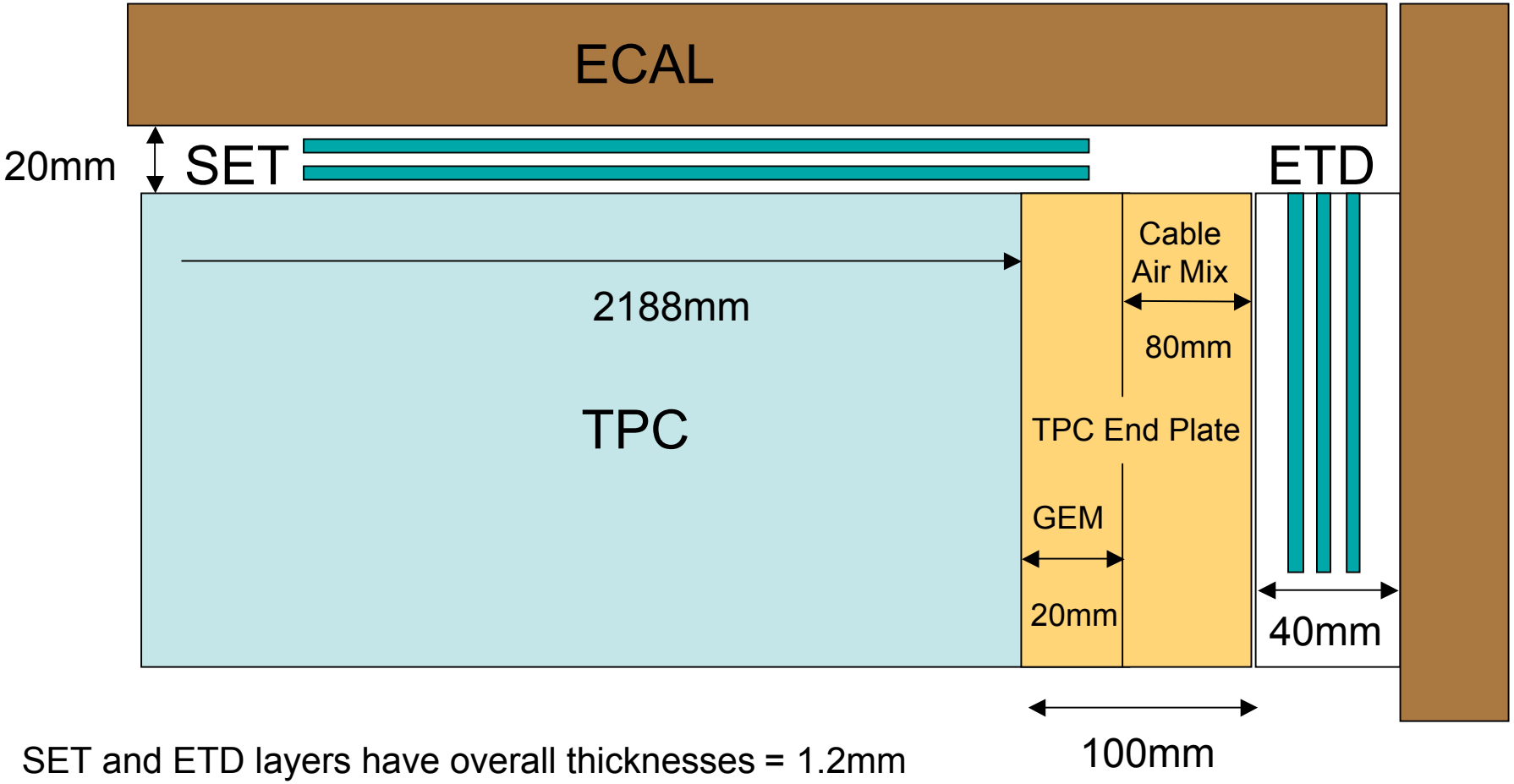
Digitisers

- TPC Digitiser
  - Modification of TPC hit creation: Ring Based
  - Point Resolutions as suggested by LCTPC
- VTX Digitiser
  - Smearing along ladders

Geometry

- Implementation of new Mokka drivers SIT, FTD, ETD, SET
- Geometry correctly propagated through GEAR
- Update of MaterialDB: used by Kalman Filter in Tracking code

Geometry



SET and ETD layers have overall thicknesses = 1.2mm
SET and ETD have layers gap = 5mm

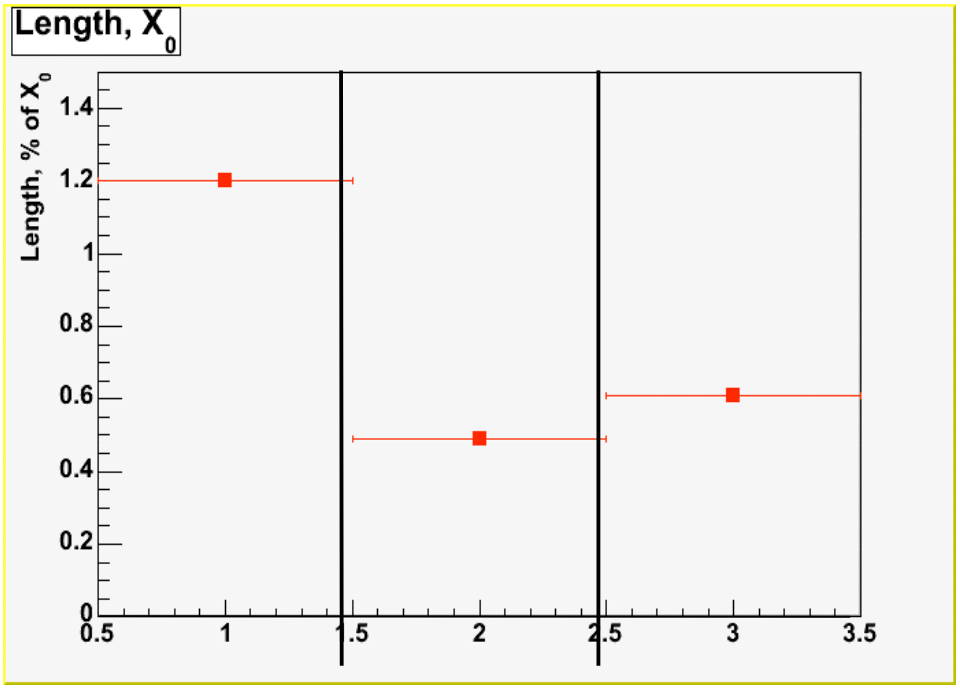
Not in anyway to scale

New SIT Driver

- Sit01 (support structure + sensitive layer)
  - Beryllium support, thickness = 1mm
  - Si sensitive layer, thickness = 0.2mm
  - Support cylinder is inside sensitive cylinder
  - Two layers : R_{in} = 160mm, R_{out} = 270mm
- Sit02 (sensitive layer + support structure)
  - Si sensitive layer, thickness = 0.2mm
  - Graphite support, thickness = 1mm
  - Support cylinder is outside sensitive cylinder
  - Two layers : R_{in} = 160mm, R_{out} = 270mm
- Updates of Sit00, Sit01, Sit02 Mokka drivers
- Changes to MaterialDB processor

New SIT Driver:Material

X_0 (%) per SIT layer



Example steering for Sit01

```
<detector name="SIT" geartype="GearParameters">
    <parameter name="SITModel" type="int" value="1" />
    <parameter name="SITLayerThickness" type="double" value="2.000000000e-01" />
    <parameter name="SITLayer_RadLen" type="double" value="9.366073396e+01" />
    <parameter name="SITLayer_dEdx" type="double" value="3.863182419e-04" />
    <parameter name="SITSupportLayerThickness" type="double" value="1.010000000e+00" />
    <parameter name="SITSupportLayer_RadLen" type="double" value="3.527598681e+02" />
    <parameter name="SITSupportLayer_dEdx" type="double" value="2.958134277e-04" />
    <parameter name="SITLayerHalfLength" type="DoubleVec" value="380 660" />
    <parameter name="SITLayerRadius" type="DoubleVec" value="161.11 271.11" />
    <parameter name="SITSupportLayerHalfLength" type="DoubleVec" value="380 660" />
    <parameter name="SITSupportLayerRadius" type="DoubleVec" value="160.505 270.505" />
</detector>
```

Gear steerings for Sit01/02 include:

- Radii and half length of support cyl.
- Parameter SITModel to tell Sit00 from Sit01/02 (0=Sit00, 1=Sit01/02)

LDC01_05Sc & LDCPrime_01Sc both use Sit01 driver

New FTD driver

- FTD01 (old driver) scaled superdriver SFtd02
  - 3 first disks of heavy Si (8.22 g/cm^3)
  - 4 last disks of normal Si (2.33 g/cm^3)
  - disk thickness = 0.3 mm
  - R_{in} = 29, 32, 46, 76, 106, 137, 167 [mm]
  - R_{out} = 140, 140, 210, 270, 290, 290, 290 [mm]
  - Z = 220, 350, 500, 850, 1200, 1550, 1900 [mm]
- FTD02 (new driver) scaled superdriver SFtd02
  - all 7 disks of normal Si (2.33 g/cm^3)
  - Disk thickness = 0.27 mm
  - R_{in} = 29, 32, 35, 51, 72, 93, 113 [mm]
  - R_{out} = 140, 140, 210, 270, 290, 290, 290 [mm]
  - Z = 200, 320, 440, 550, 800, 1050, 1300 [mm]
- FTD00 is currently used in LDC01_05Sc & LDCPrime_01Sc

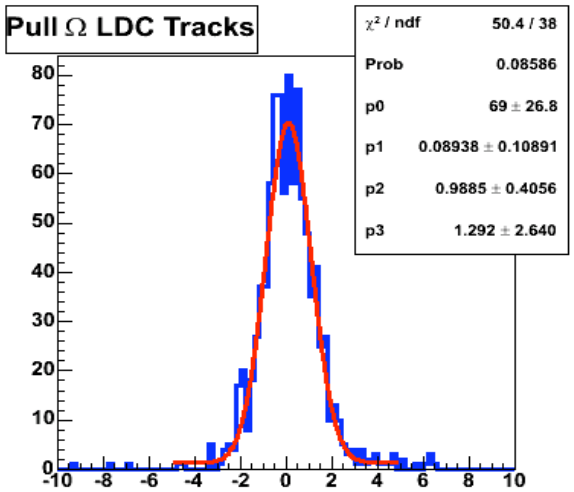
Digitisation

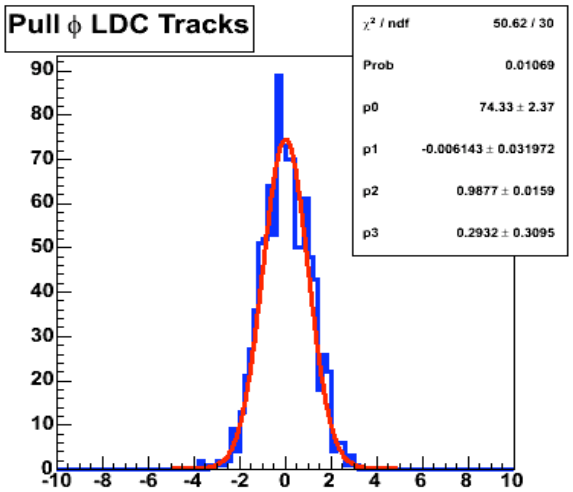
- Digitization procedure for TPC
  - Smearing of r-φ hit position according to formula

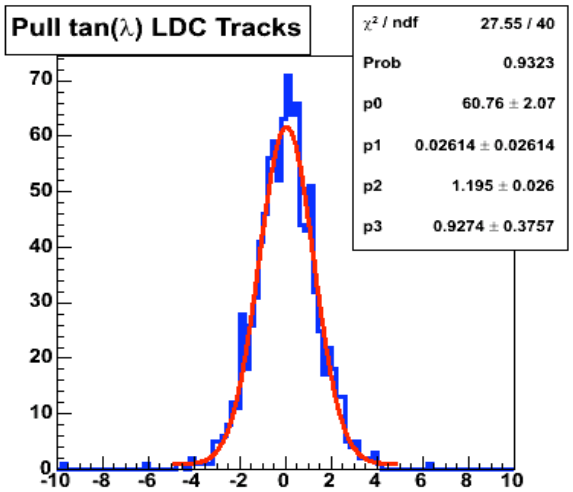
$$\sigma_{r\text{-}\varphi}^{2} = \sigma_{0}^{2} + D \cdot L_{drift}$$

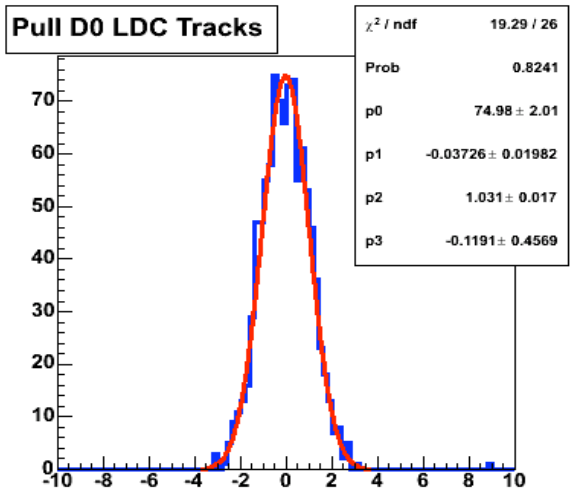
  - σ_0^2 & σ_D^2 are specified as Marlin parameters : $\sigma_0 = 0.055\text{mm}$, $D = 0.003\text{mm}$
  - σ_z is assumed to be constant along z : $\sigma_z = 0.4\text{mm}$ [suggested by R. Settles]
- Simple digitization is done by Gaussian smearing of SimTrackerHits
  - VTX, SIT, TPC : r-ϕ & z positions are smeared
    - VTX ------- : $\sigma_{r\text{-}\phi} = \sigma_z = 4\mu\text{m}$ (smearing along ladder plane)
    - SIT -------- : $\sigma_{r\text{-}\phi} = \sigma_z = 10\mu\text{m}$ (smearing along cylindrical surface)
  - Planar detectors (FTD) : (x,y) is smeared isotropically ($\sigma_x = \sigma_y = 10\mu\text{m}$)
- Spatial resolutions are stored in the vector of hit position covariance matrix (LCIO TrackerHit class) ⇒ they are specified once and forever at the digitization step and used later on by fitting routine (no duplication in Tracking code)

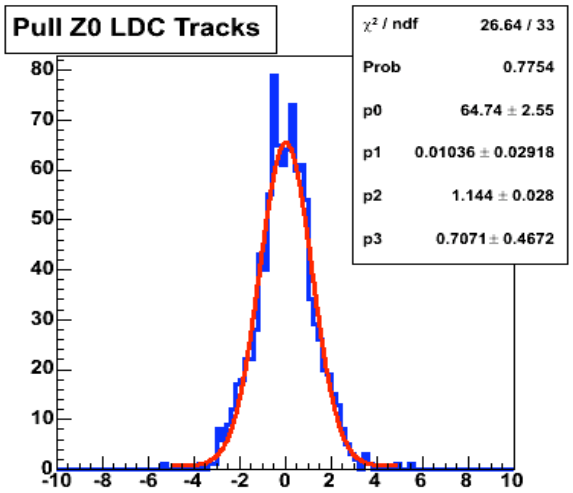
μ± 10GeV θ=80.5 LDCPrime_01Sc

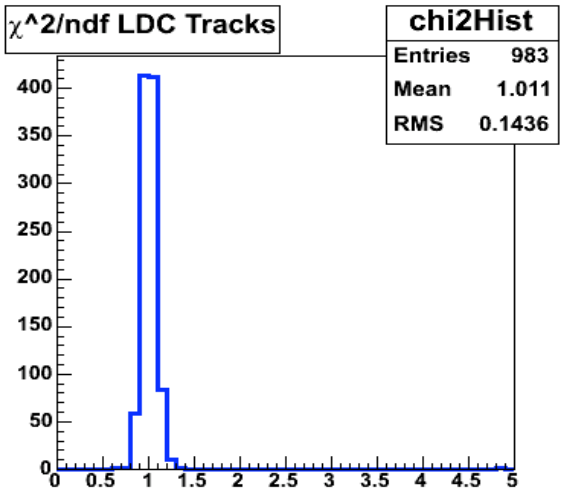




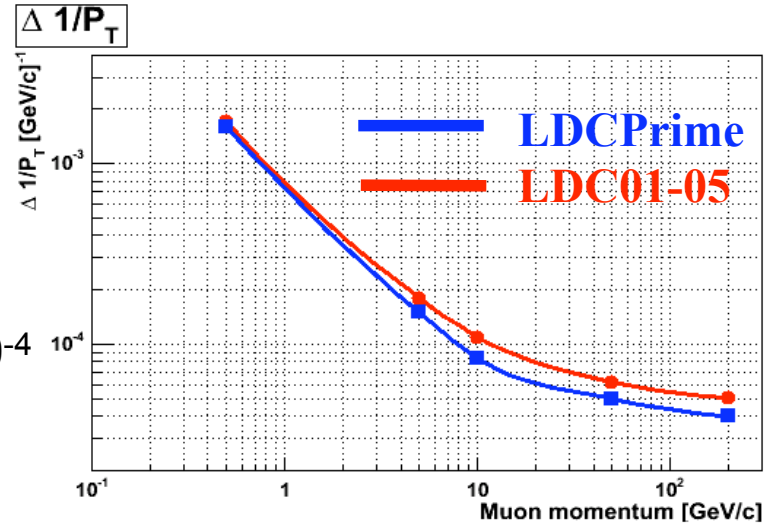




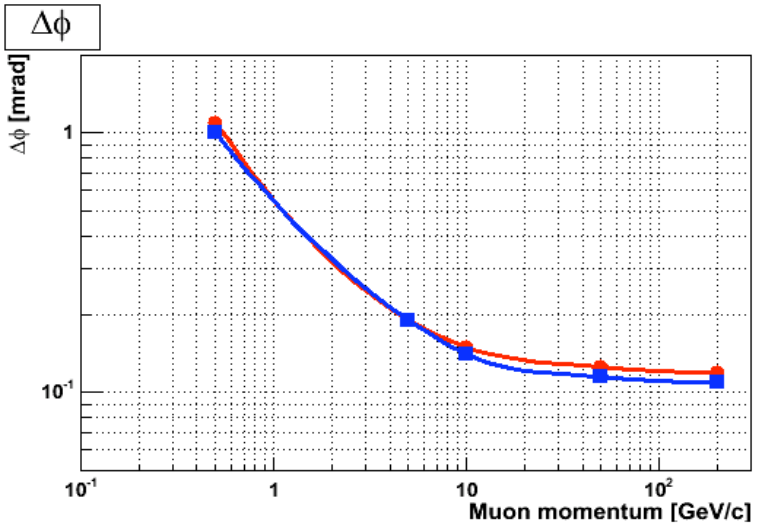


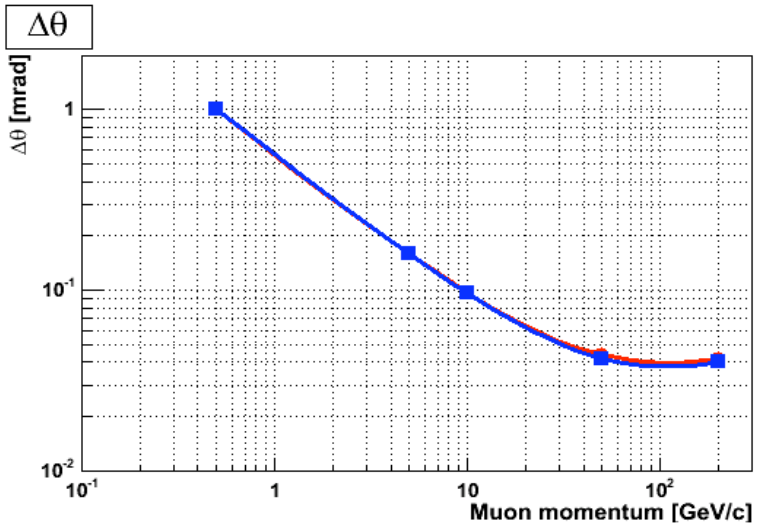


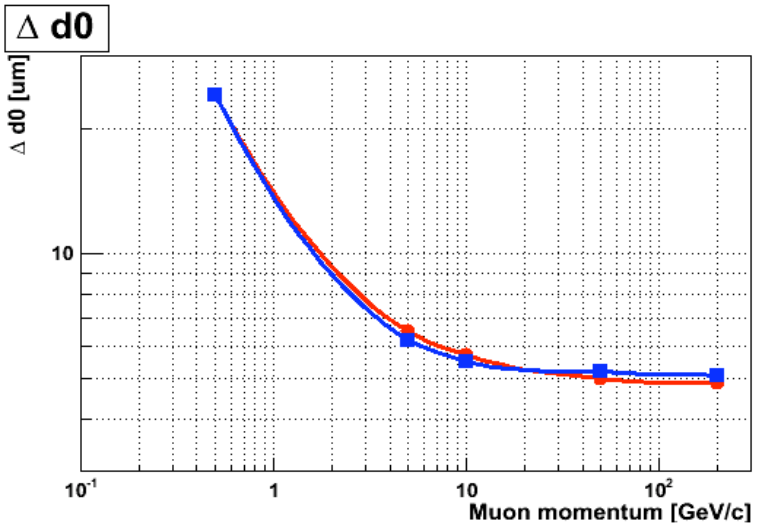
Track Parameter Resolution



10^{-4}







Conclusion

- We need a straight forward way to run Mokka only for Tracking studies
- Super Drivers for SILC need to be entered into the database
- Tracking with new SILC detectors not quite there yet “out of the box”
- Tracking using SET should be straight forward
- Tracking with ETD may be more complicated a lot of material is in between