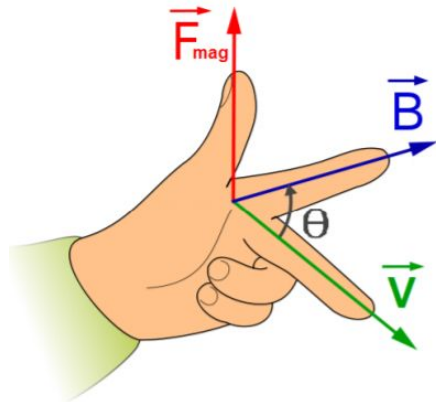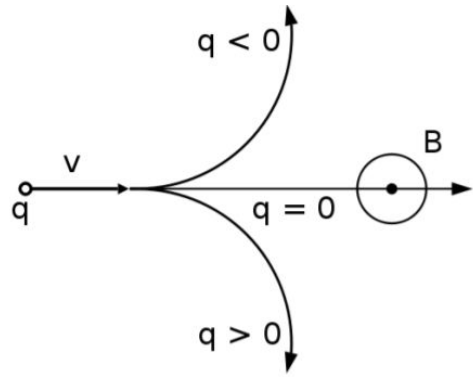# Tracks Reconstruction with BDT-GBM

Angelo Santos - 2020/06/10

SPRACE

Measuring Momentum (I)

$$F_{cp} = F_{mag}$$

$$\frac{m\,\vec{v}^{\,2}}{R} = q\,\vec{v} \times \vec{B}$$

$$mv = qBR$$

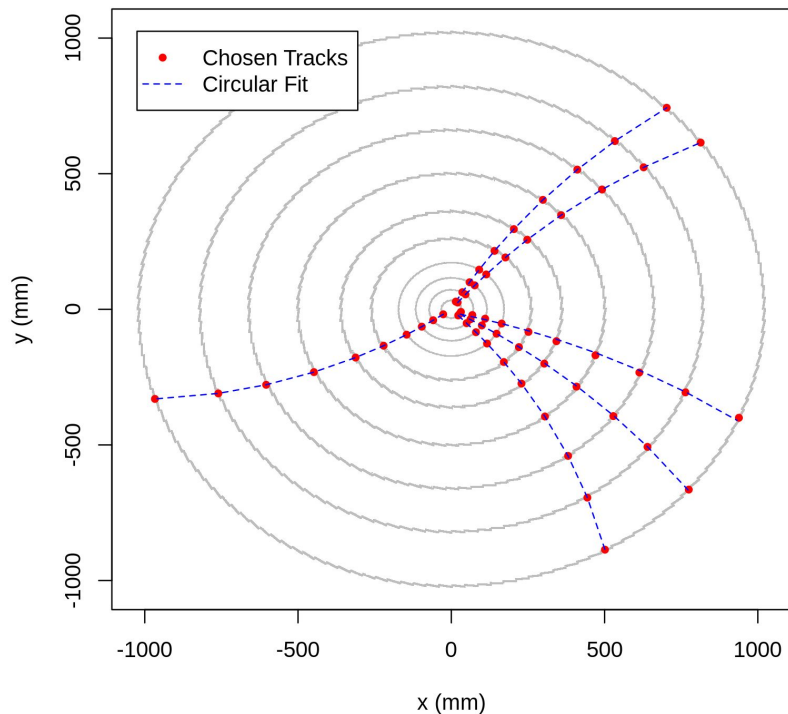$$p_T = qBR$$

$$p(x,y) = \sqrt{p_x^2 + p_y^2} \equiv p_T$$

Measuring Momentum (II)

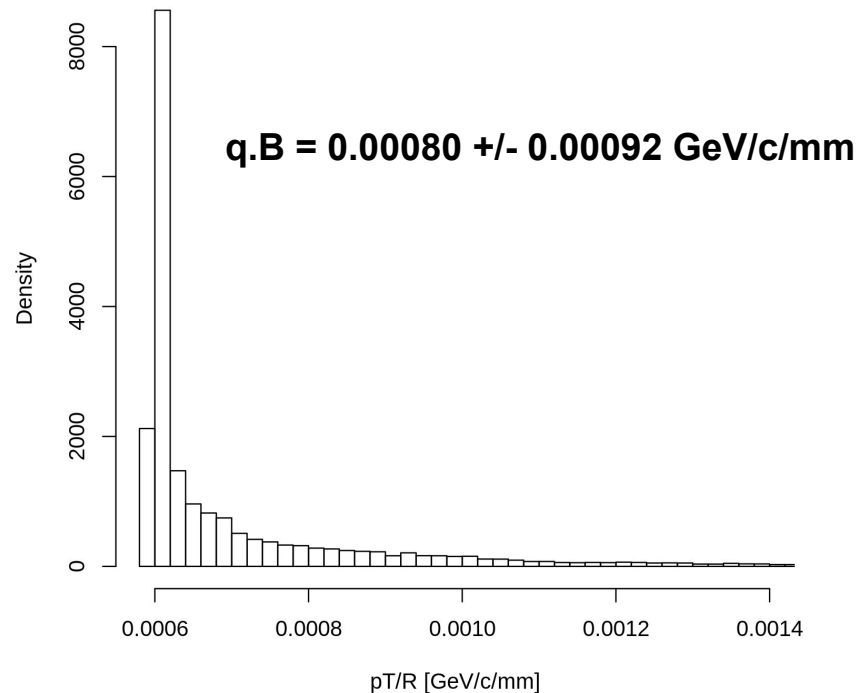- https://indico.cern.ch/event/96989/contributions/2124495/attachments/1114189/1589705/WellsTracking.pdf

$$p_T[GeV/c] = 0.3 \cdot B[T] \cdot R[m]$$

Computing Radius and Constant (q.B)

Fitting Tracks

Histogram of q.B

q.B = 0.00080 +/- 0.00092 GeV/c/mm

Computing pT from Recontructed Tracks

- Compute constant (q.B) from training samples
  - 21,000 tracks
- Validate calculation of pT with optimization sample
  - 3,000 tracks
- Appy results to application sample
  - 6,000 tracks
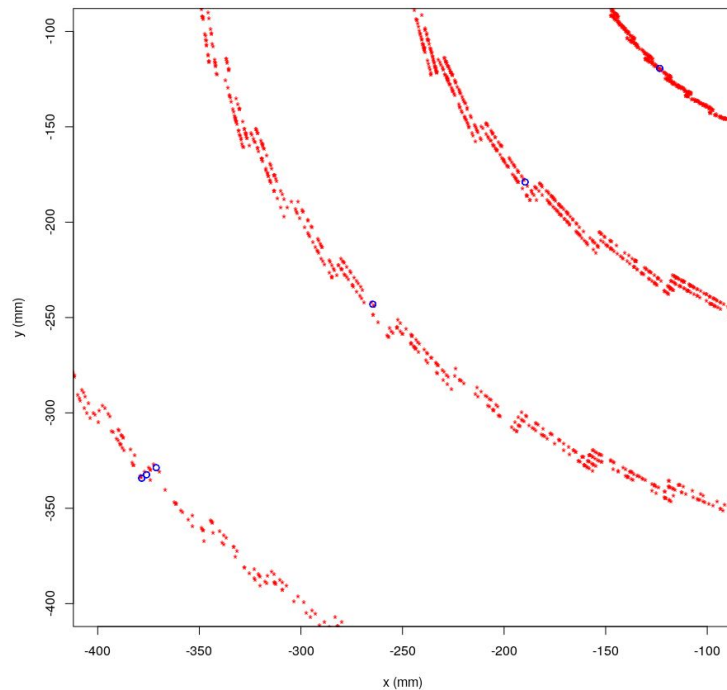
Other Tasks

Trying to Improve Reconstruction (I)

- Using cylindrical coordinates (ρ, ϕ, z)
  - Large errors from ρ
  - Similar problem as datasets containing tracks with and without holes
  - 5th hit from 4 previous ones
    - 2^5 = 32 possibilities
      - 21000 tracks /32 possib. ~ 656 tracks/possib.
    - 4^5 = 1024 possibilities
      - 21000 tracks / 1024 possib. ~ 20 tracks/possib.

Results with Cylindrical Coordinates

Optimization Step

Legend:
○ Data
+ f(rho) = -9.513 + 1.037.rho

X axis: Predicted rho (mm)
Y axis: Real rho (mm)
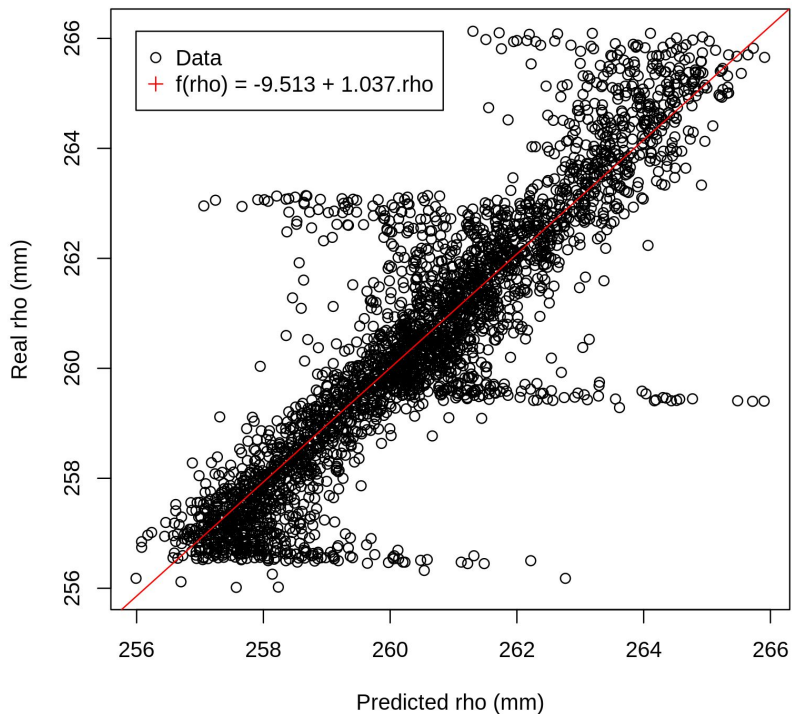
Hits in the CMS Detector

X axis: x (mm)
Y axis: y (mm)

Trying to Improve Reconstruction (II)

- Using cartesian coordinates (x, y, z)
  - Dividing training samples to get more than one predicted values
    - 10 training samples (21,000/10 = 10 poss. x   2,100 tracks)
    - 03 training samples (21,000/03 = 03 poss. x   7,000 tracks)
    - 02 training samples (21,000/02 = 02 poss. x 10,500 tracks)
  - Large errors from x coordinates
- To-do list
  - Checking scripts
  - Trying to understanding large errors

To-Do List

- Understand problems with datasets
- Compute track scores using Kaggle scores
- Compute pT for tracks from the application step