

Software session : D406 : Apoorva Bhat, Soham Bhattacharya, Suman Chatterji

- Basic concept of fit, use of root software – **Half**
 - Fit using analytic expression, grid search method as well as using “root” software :
fit_Gaussian.C : Given
 - Fit using root software (TMinuit) :
fit_lifetime.C : Given
 - Fit excluding a part of the histogramme (TMinuit)
fit_expoplusgaus.C : Assignment
 - Fit two independent histogrammes together.
If some one finish previous one
- Kinematic fittings – **Half**
 - Basic Kinematic fit with three angles of triangle
fit_triangle.C : Given
 - $\pi^0 \rightarrow \gamma\gamma$ decay, using π^0 mass constraint fit to improve three momenta of π^0
fit_pi0fitter.C : Given
 - Using top-mass constraint fit, how one can improve the reconstructed W mass resolution in hadronic decay mode
fit_topmass.C : Assignment
- Random number generator (all three procedures), starting from uniform number to a given distribution. – **One**
 - Prove that difference of two exponential function is also an exponential : Assignment
 - Estimation of the value of π and error on the value and also verify the error estimation : Assignment
 - Generation of event for Breit-Wigner function of mass and width of 91.2 GeV and 2.5 GeV respectively: Assignment
 - Compton scattering : Assignment
- Pythia8 event generator and use of (anti)-kt algorithm to reconstruct hadronic jet – **Half**
 - Pythia8 code with an example with default jet algorithms : Given
 - JADE algorithm : Given
 - Switch of decay mode or add new decay mode : Assignment
 - (anti)-kt algorithm : Assignment
- Geant4 example with tracker, ECAL and HCAL (a slice of CMS detector).
In digitisation stage, will use random number for efficiency, position/energy resolution and also addition of noise. – **One and half**

- serb2019_geant4 : Given
- Change ECAL geometry to real one : Assignment
- Change Physics list in EM and Hadron physics and pass variable from .mac file to change name of output root file : Assignment
- Store energy deposite and timing information of virtual signal in support material of track : Assignment
- Track momentum using those hits in tracker (using simple helical path concept and Simpson approximation. Concept of Kalman filter, but no exercise. – **One and half**
 - Hough Transformation as track finder
 - Fit using simple eqn of circle
 - Fit using Explicit track model
 - Modify track finding algorithm to sort out hits of multiple trajectories. **assignment**
 - Remove outliers hits in straight line fit of z - ρ plane during simple track fit **assignment**
 - Use covariance matrix in the χ^2 definition during the fit of circle. **assignment**
 - Include ionisation energy loss and multiple scattering inbetween two layers : **Assignment**
- Simple clustering algorithm using a seed to reconstruct of photon, calibration, π^0/γ separation using shape variables. – **One and half**
 - Basic clustering algorithm with energy calibration: Given
 - Choose optimum threshold for different noise level and calibration of photon : Assignment
 - π^0/γ separation using shape variables : Given
 - Same variables in TMVA : Given **Partially**
- Unfolding technique – **Half**
 - Gaussian smearing and then unfold : an example from Gaussian Convolved Landau function : Given
 - Unfold distribution which has a known Gaussian smearing (Position resolution in strip detector) : Given
 - An example of RooUnfold : Given
 - Example from TUnfold : Given
 - Convolute a Landau distribution with a Gaussian function. Using RooUnfold software to obtain the original Landau Function. **assignment**