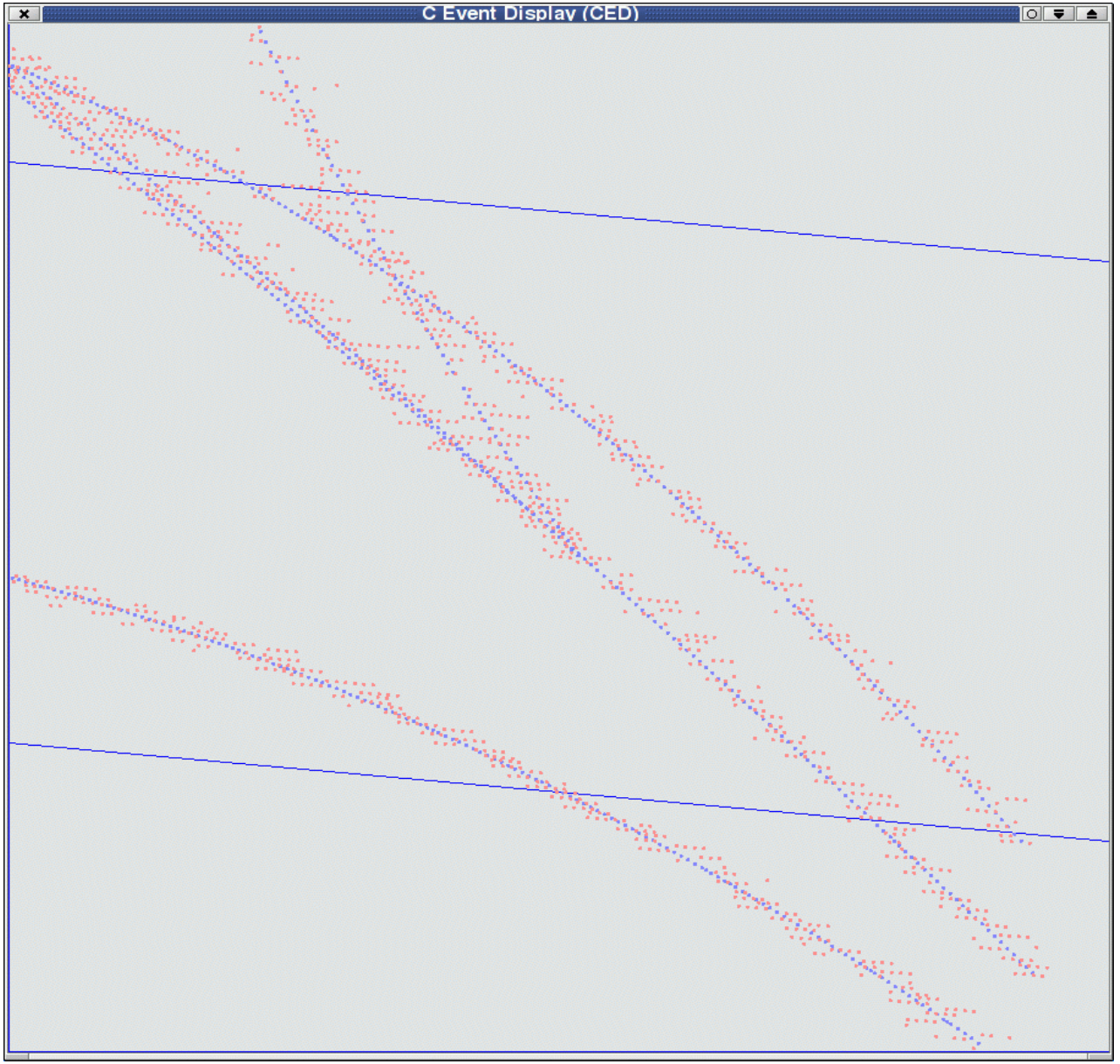
Current Activities at MPI and DESY-Zeuthen

ILD Detector Optimization
Phone Meeting, 28/11/2007

Our Group and Our Activities

- Group members:
  - MPI Munich : A.Frey, A.Raspereza, X.Chen, A.Moll, V.Morgunov
  - Zeuthen : W.Lohmann, M.Ohlerich, A.Schaelicke
- Activities:
  - Development of simulation tools: implementation of the DEPFET based VTX in Mokka and simulation of the DEPFET sensor response, implementation of realistic TPC digitization
  - Development of reconstruction software tools: tracking in the ILD detector, particle identification based on the calorimeter information, reconstruction of track hits from TPC pads wave-form, new PFA reconstruction (Boojum)
  - Physics analyses: determination of the *ZH* cross section and Higgs mass, using recoil mass technique in the $ZH \rightarrow ee(\mu\mu)X$, study of the slepton pair production

Realistic TPC Digitizer

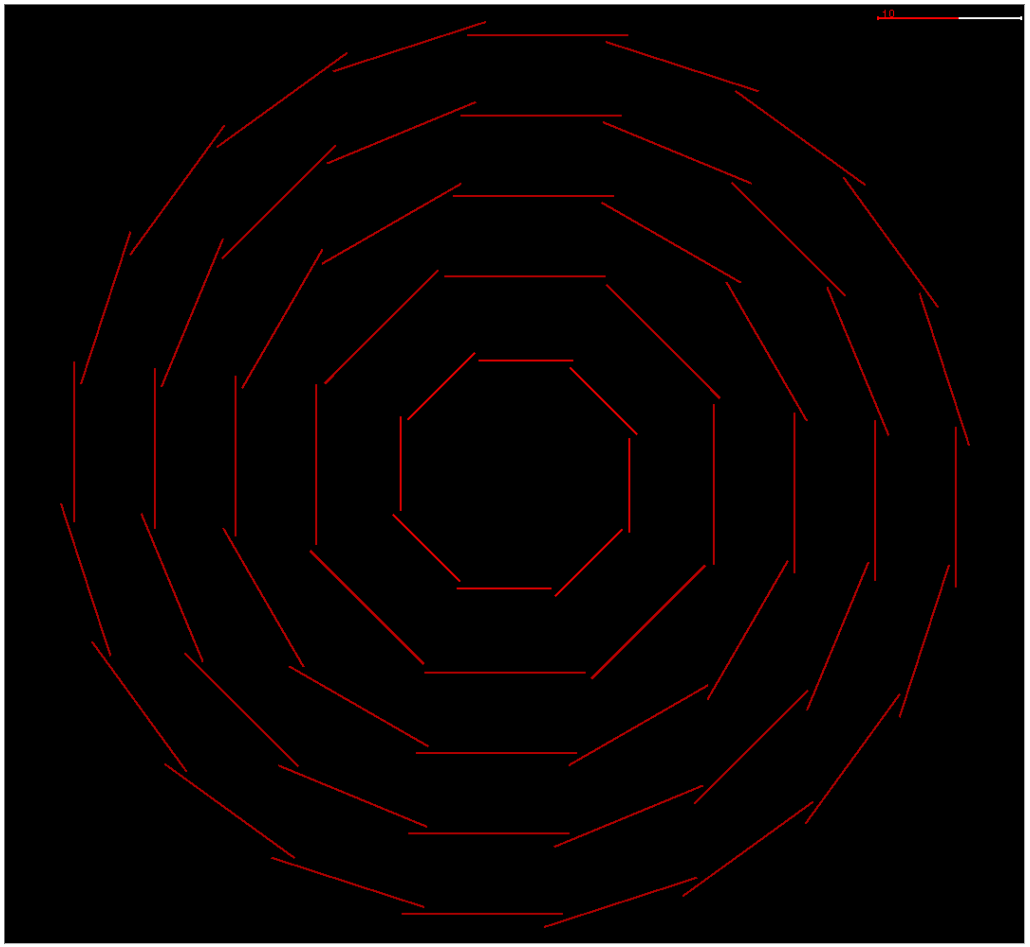


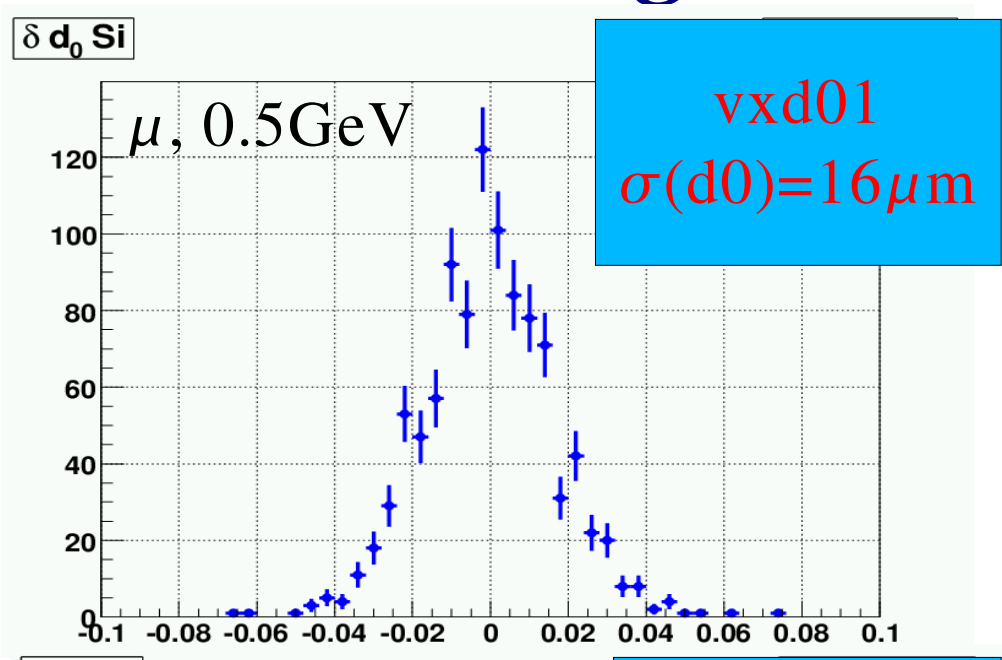
V. Morgunov

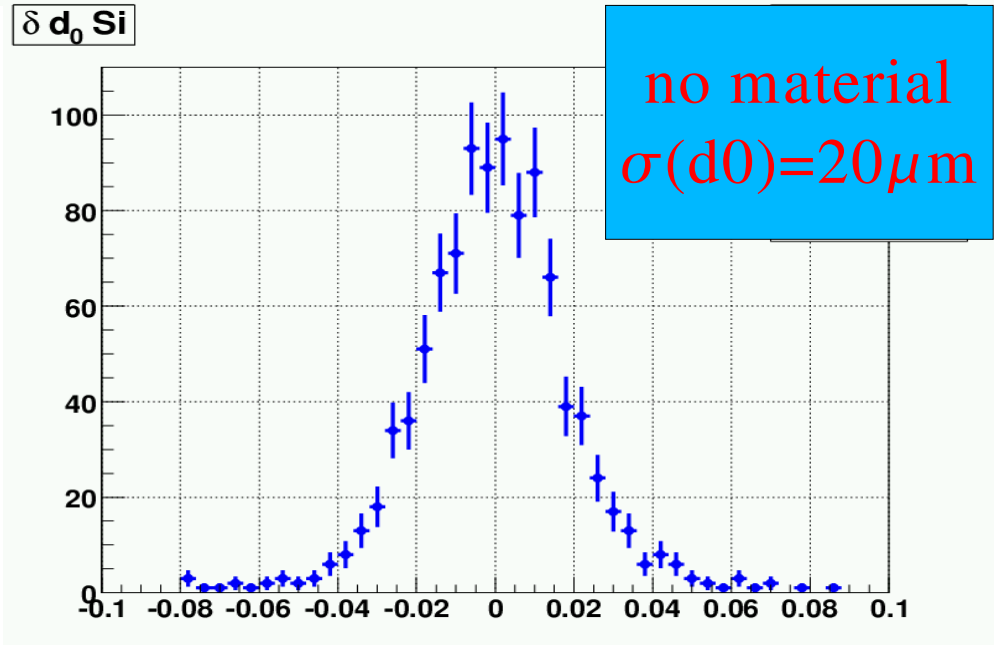
- Digitizer simulates diffusion of electron cloud, transports each electron to the pad plane and creates time wave-form for each pad
- SimTrackeHits (blue)
  Time wave-form (red)
- Simple TPC digitizer, performing 3D smearing of hit position, also available

Implementation of Laddered Geometry of VTX in Tracking

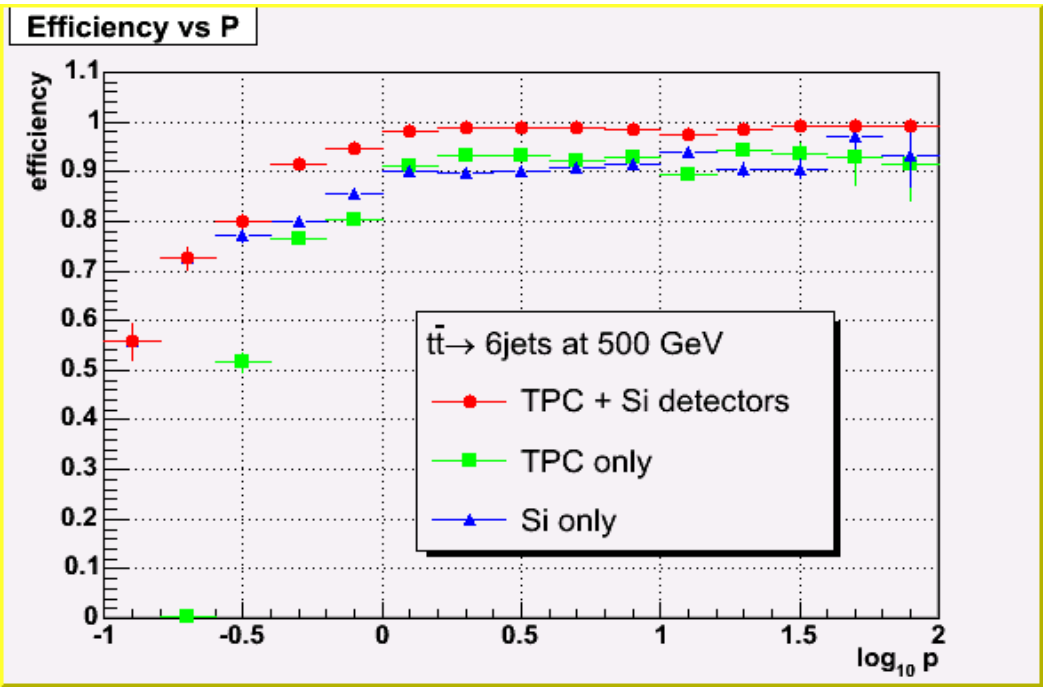
Andreas Moll

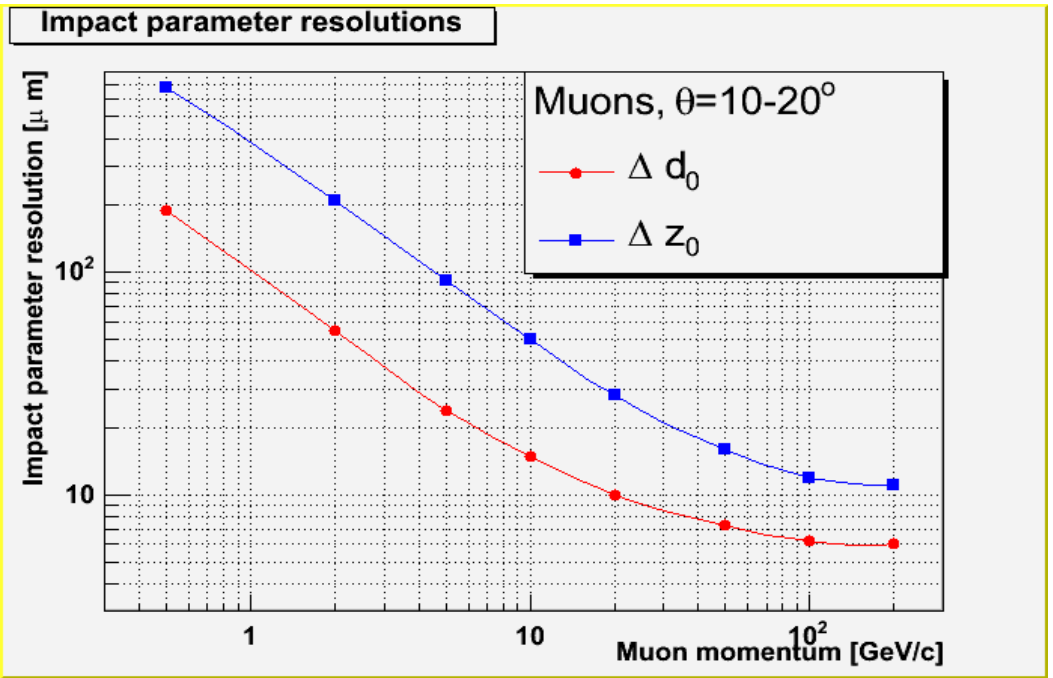






Tracking





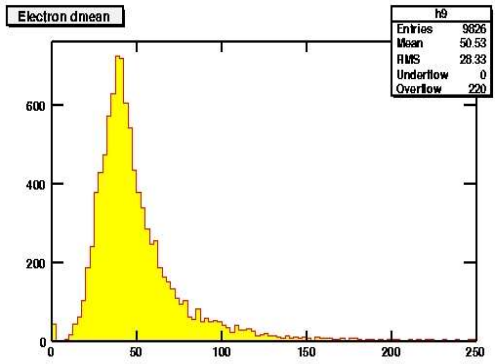
- Available tools (Tracking package in Marlin)
  - Tracking package in Marlin: digitization of hits
  - patrec in TPC and Si detectors
  - track fitting
- Potential contribution
  - Tracking performance in dependence of the detector design and B-field
  - track parameter resolutions, track finding efficiency, fake track rate

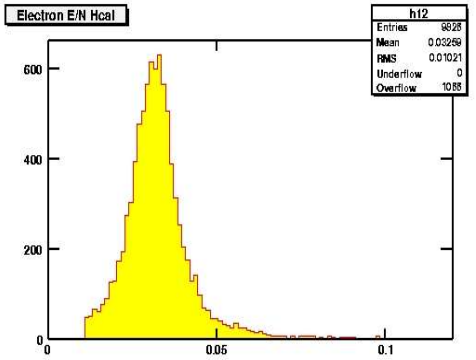
Particle ID

E_{HCAL}/N_{HCAL}

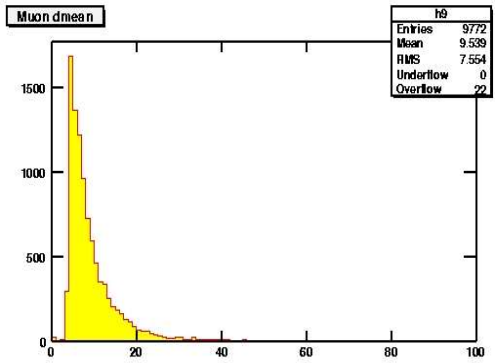
Mean hit-helix distance

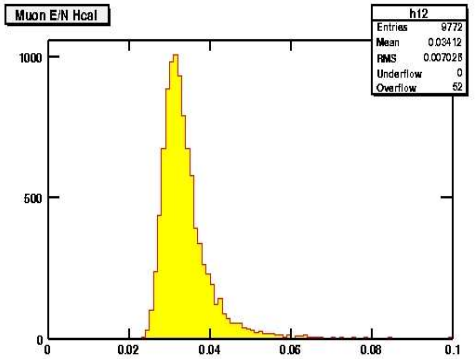
e



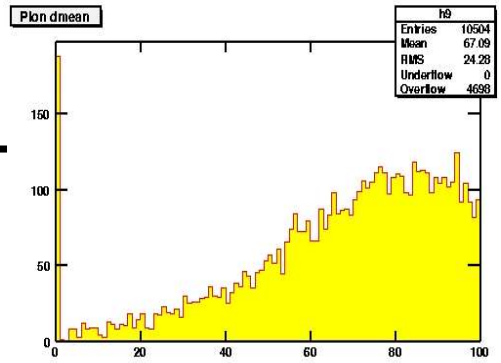


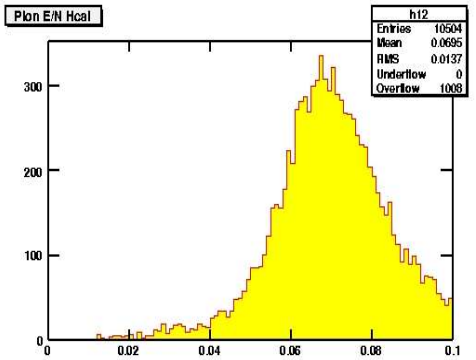
μ





π





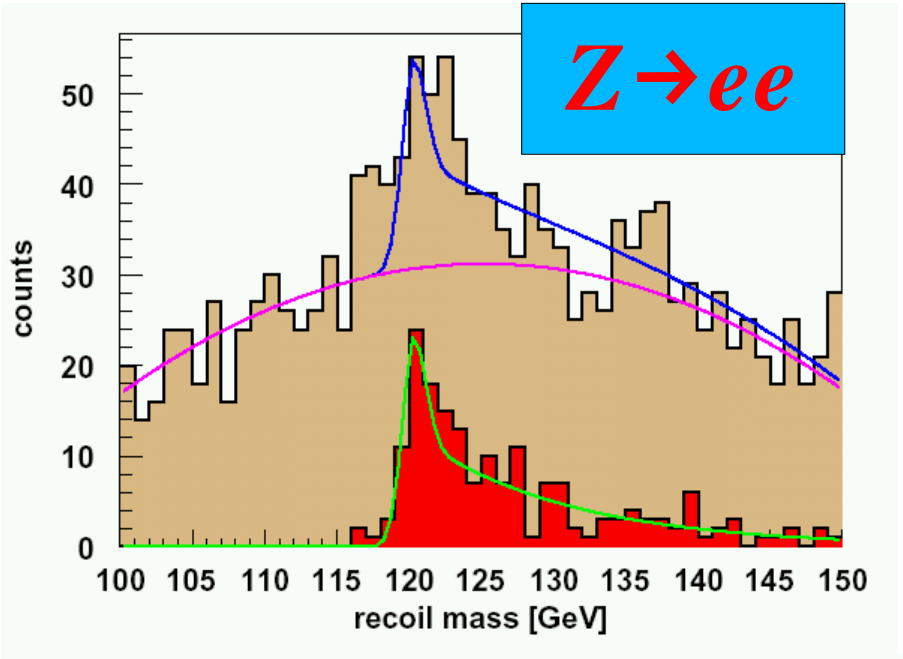
- Available tools
  - Particle ID processor in Marlin (M. Ohlerich)
  - Likelihood for e, μ, $h^{\pm}$ and γ, h^0
  - Constructed from the number of variables, characterizing calorimeter cluster properties
- Possible contribution
  - Particle ID efficiency vs. detector design and B-field

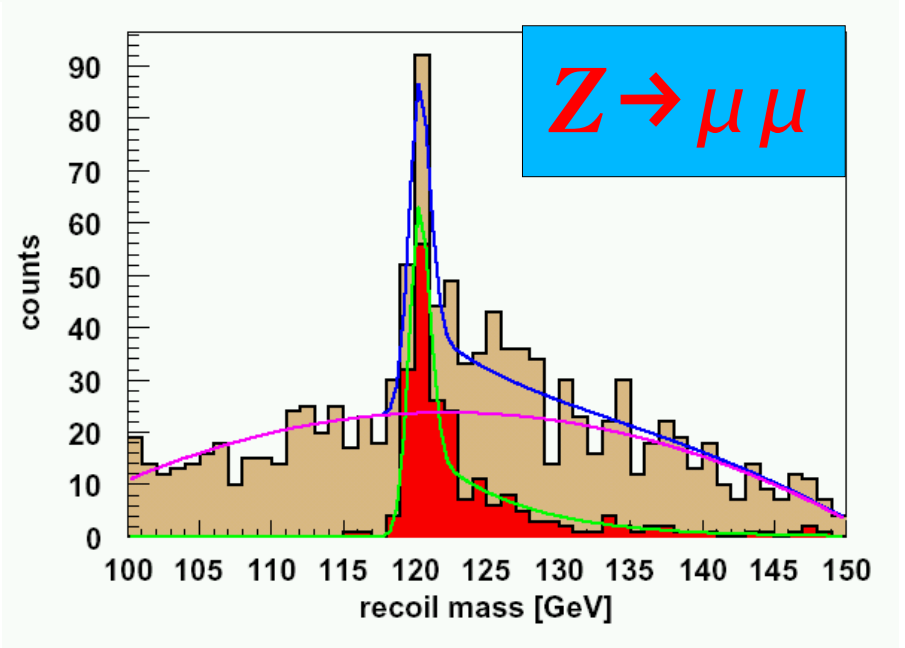
Particle ID Performance

Efficiency and misidentification in %
Single particles in 4π with energies between 1 and 50 GeV (Wolf-PFA)

	μ	π	e
μ	88	12	0
π	3	89	8
e	0	3	97

Recoil Mass Analysis in $e^+e^-\rightarrow ZH$





Analysis code available

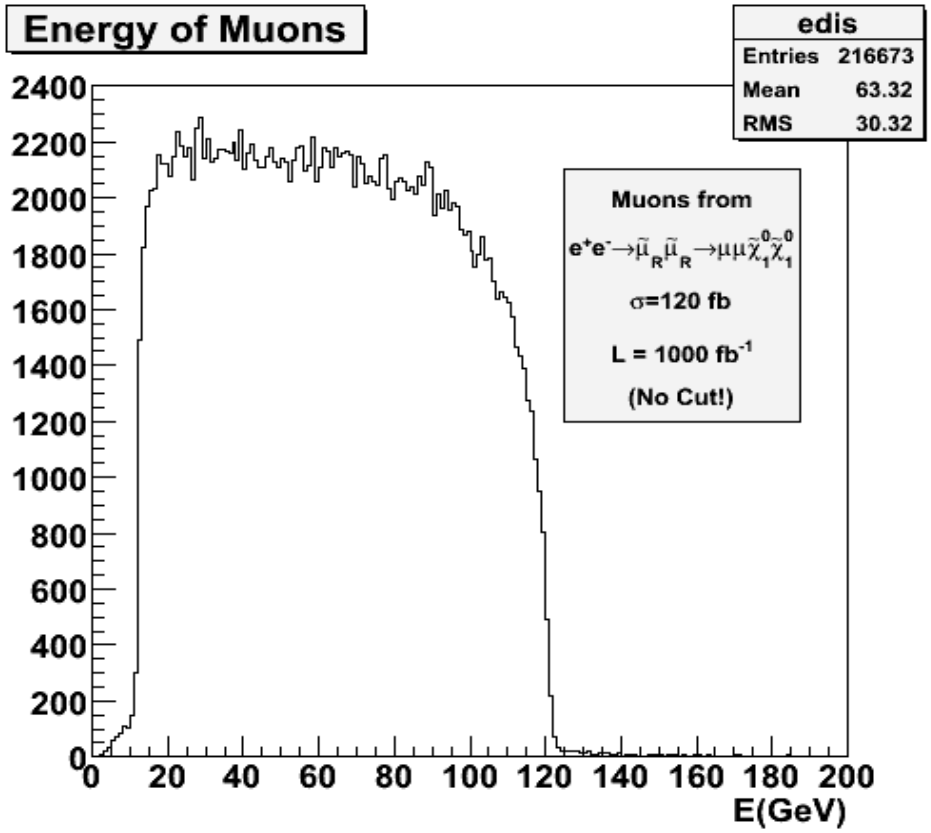
- Muon and electron identification
- Selection
- Analysis of recoil mass spectrum

Detector optimization

- Error on Higgs mass and *ZH* cross-section vs. detector design

Slepton Production

Xun Chen



- $e^+e^- \to l^+l^- \to l^+l^-\chi_1^0\chi_1^0$ (l=e, μ)
  - Generation of signal and background samples with PYTHIA
  - ISR + Beamstrahlung
  - Detector simulation with Mokka
  - Reconstruction with MarlinReco (FullLDCTracking + Wolf-PFA + PID)
  - Determination of slepton and neutralino masses from kinematic edges in the lepton energy spectrum, production cross section
- Ultimate goal : evaluate precision on slepton and lightest neutralino masses and slepton pair production cross-section

Summary

- MPI – DESY-Zeuthen group is eager to contribute to the ILD detector optimization studies in the following fields:
  - Tracking performance vs. detector design
  - Particle ID efficiency vs. detector design
  - Detector optimization using benchmark physics reactions
    - Higgs mass and Higgs-strahlung cross section measurements in $e^+e^- \rightarrow ZH$ using recoil mass technique
    - Measurement of slepton masses based on the analysis of the kinematic edges of the lepton energy spectrum