ILC Physics Analyses at DESY

Jenny List

DESY

ILD optimization meeting November 14 2007

Overview

topics

- main area: SUSY and Cold Dark Matter (given by special funding)
- Higgs (together with Zeuthen, Orsay, MPI Munich)
- polarisation determination

manpower in full simulation physics analyses

- 3 supervisors
- 1 postdoc (on maternity leave)
- 1 postdoc ((hopefully) from January on)
- 2 experienced PhD students
- 2 PhD and one Diploma student just started
- 3 PhD students will switch from hardware to analysis soon

Single Photons + Missing Energy (C.Bartels)

Simple final state with many physics applications:

- model-indepedent WIMP search (hep-ph/0403004)
- radiative neutralino production (hep-ph/07071642)
- extra dimensions (LC-PHSM-2001-010)
- ....

Detector and accelerator issues:

- photons → ECAL resolution, photon ID
- missing energy →
  - hermeticity
  - LUMICAL
  - beam background → rejection of radiative Bhabhas
- irreducible background $e^+e^- \to \nu\nu\gamma$: Polarisation

Single Photons + Missing Energy (C.Bartels)

WIMP search presented at LCWS07 (Cosmology session):

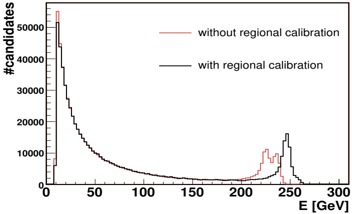
- simulation: LDC01_01Sc, Mokka 6.1
- reconstruction:
  - PFlow: WOLF + cluster merging
  - $E_\gamma > 10$ GeV
  - $20^\circ < \theta_\gamma < 160^\circ$

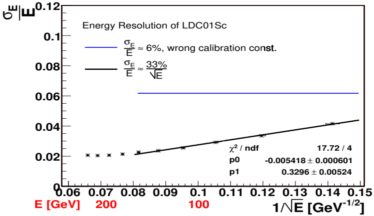
Since then:

- switch to Mokka 6.4, θ-dependent calibration
- collaboration with O. Kittel, J. Reuter on radiative neutralino interpretation
- first checks of LDC01_05Sc

Energy Calibration

switch to Mokka 6.4, θ-dependent calibration („regional calibration")

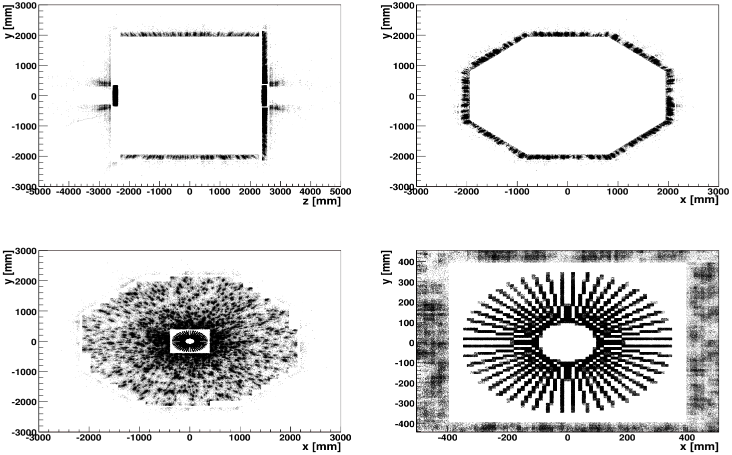




remaining difference to design goal vanishes when looking at particle gun events

First look at LDC01_05Sc

plot position of every SimCaloHit: -z ECAL endcap is on +z side



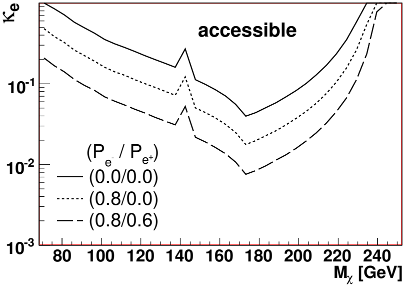
An example of an result: P-wave (J=1), $S_\chi = 1$ WIMP

Polarisation:

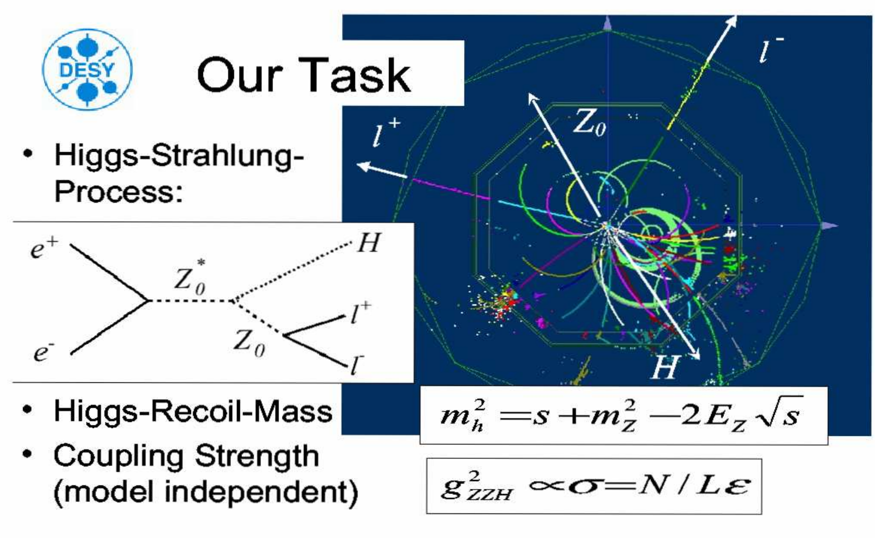
- **full line:** unpolarised beams
- **dotted line:** e^- only ($P_{e^-} = 0.8$)
- **dashed line:** additional e^+ ($P_{e^+} = 0.6$)

What's happening at $M = 140$ GeV?

coupling: P & H conserving



SM-Higgsstrahlung (DESY, Orsay, MPI Munich)



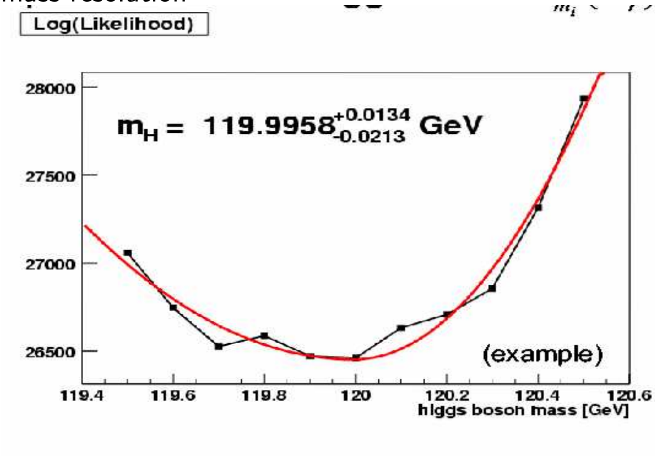
SM-Higgsstrahlung (DESY, Orsay, MPI Munich)

high precision recoil mass, model-indep. coupling strength

- high precision tracking, PFlow and lepton ID
- analysis flow
  - Pythia / Sherpa / BHWIDE incl. Beamstrahlung, ISR, FSR
  - Mokka
  - PFlow: Wolf / Pandora
  - Particle ID: MOID / PFOID
  - cut based preselection
  - final section likelihood based

SM-Higgsstrahlung (DESY, Orsay, MPI Munich)

mass resolution



Just started:

$e^+e^- \to \tilde{\tau}_1^+\tilde{\tau}_1^-$ **(O. Stempel)**

- started with SPS1a' (Point 1), later D' (Point 3)
- SIMDET/SGV studies from H.U. Martyn and Z.Zhang exist
- detector issues:
  - PFlow, τ-ID
  - hermeticity, LUMICAL, beam background $\to$ rejection of 2 photon events
- status:
  - fresh diploma thesis work
  - started to implement the event selection in Marlin using SIMDET events
  - switch to full simulation as soon as LDC01_05Sc is debugged and calibrated

Just started:

$e^+e^- \to \tilde{\tau}_1^+\tilde{\tau}_1^-$ **(O. Schäfer)**

- Point 6: heavy stable particle
- SIMDET study from H.U. Martyn exists
- detector issues:
  - Tracking, esp. dE/dx
  - calorimeter readout (late decays)
- status:
  - recently started second PhD topic (after TPC hardware)
  - currently implementing a sensible dE/dx simulation in TPC driver

Just started:

$e^+e^- \to W^+W^-$ **(I. Marchesini)**

- semileptonic channel: 3 jets $+\ l + \nu$
- goal: provide absolute scale for polarisation measurement
- detector issues:
  - PFlow
  - Lepton-ID
  - invariant mass resolution, WW / ZZ separation

Coming soon:

- $e^+e^- \rightarrow \tilde{\tau}_1^+\tilde{\tau}_1^-$ (P. Schade): $\tilde{\tau}$ polarisation measurement
- $e^+e^- \rightarrow \tilde{\mu}_1^+\tilde{\mu}_1^-$ (N.N.)
- $e^+e^- \rightarrow \tilde{\chi}^+\tilde{\chi}^-/\tilde{\chi}^0\tilde{\chi}^0$ (N.N.):
  existing in SIMDET (B. Sobloher)
- NMSSM Higgs (N.N.)
- $e^+e^- \rightarrow ZH \rightarrow ZWW^*$ (N.N.):
  existing in SIMDET+Marlin (J.Samson)

Summary

- only few mature full simulation studies right now
- the majority of analyses just started
- many analyses exist in fast simulation, some even using Marlin
- a steep ramp up in manpower currently happens and is needed
- many analysers are also burdened with grid production etc
- once LDC01_05Sc (or ILD00 or ...) MC becomes available, all analyses will switch to it