Simulation of physics background for luminosity measurement at ILC

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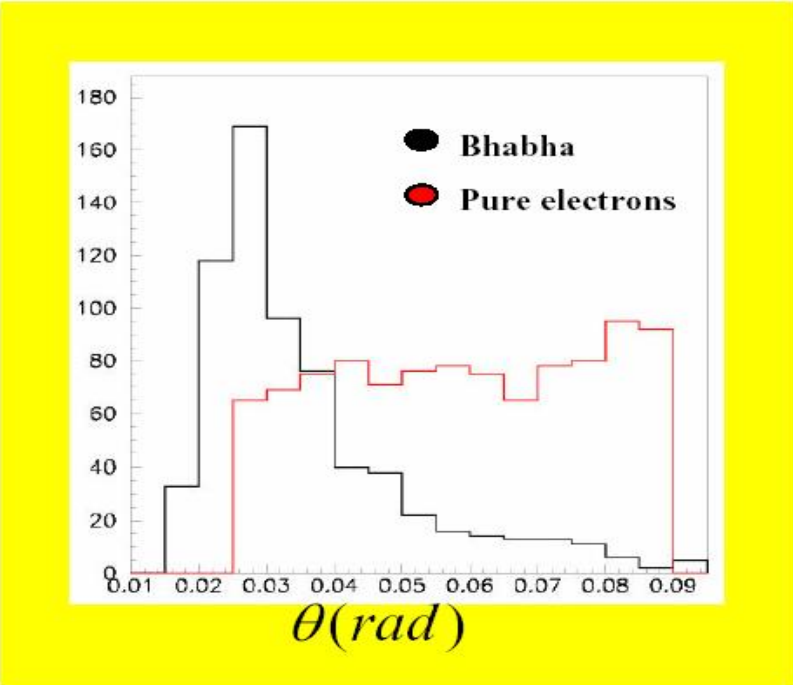
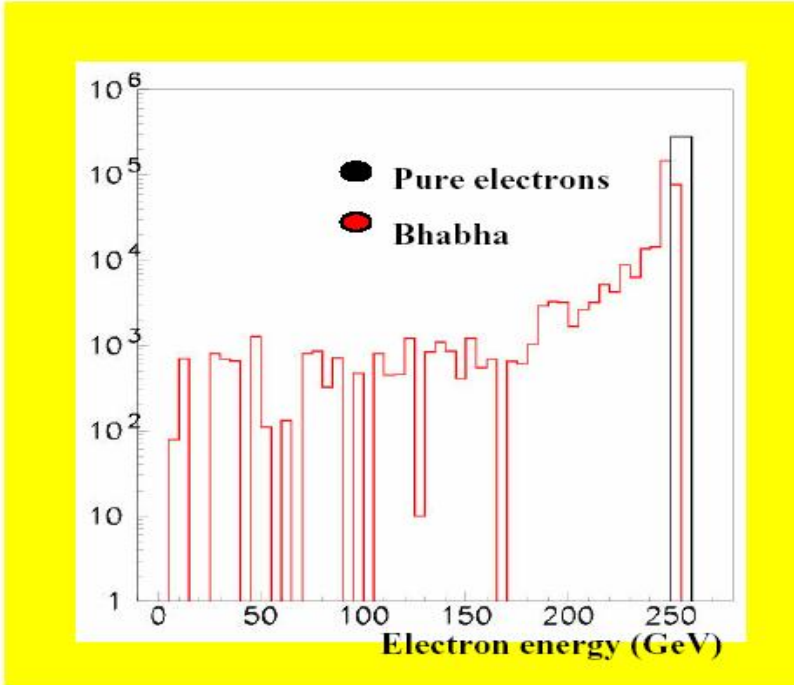
- Initial study of processes, known from previous analysis (experiments), in terms of the Very Forward Calorimetry

- Four-lepton and W-pair processes as a possible background for luminosity measurement

- Test if existing simulation tools (WHIZARD, SIMDET) can be used for physics studies in the Very Forward Region (below 5 degrees)

- Luminosity measurement is based on counting Bhabha events in a certain polar angle range
- LumiCal is the luminometer at ILC
- Uncertainty of luminosity must be as small as 10^{-4} in order to exploit full ILC potential for precise measurements (GigaZ)



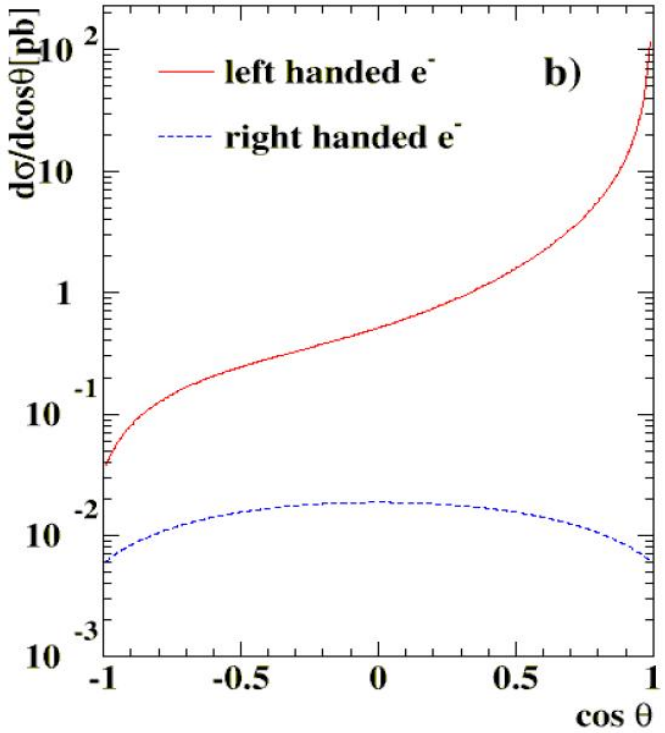


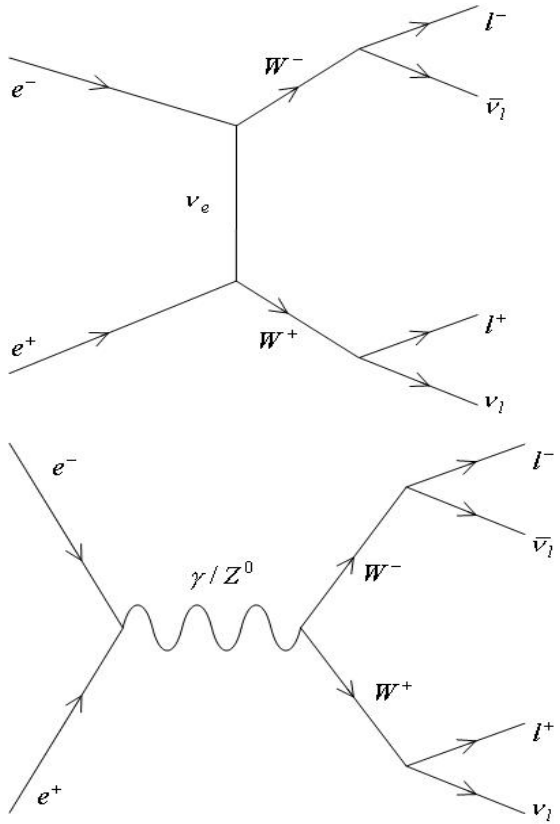
Courtesy of R. Ingbir

Four-lepton and W-pair processes as a possible background for Bhabha scattering

- Both processes are strongly peaked forward
- Both processes have cross sections of order of 10 pb or larger (at 500 GeV center of mass energy) that scales like $1/s$ (W-pair production) and $ln^2(s)$ (four-lepton processes)

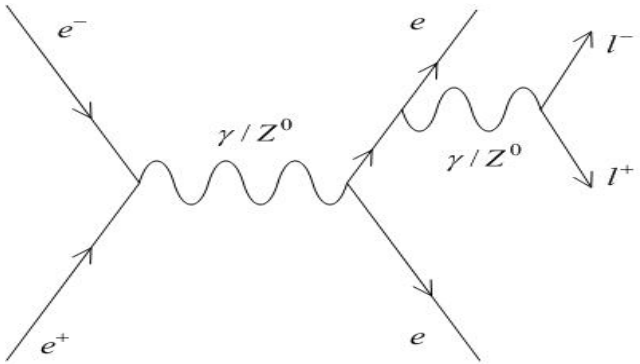
W-pair production



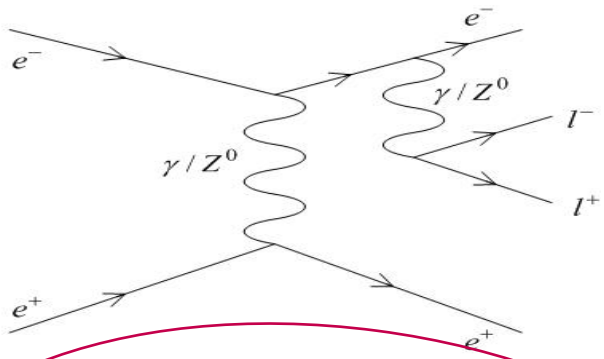


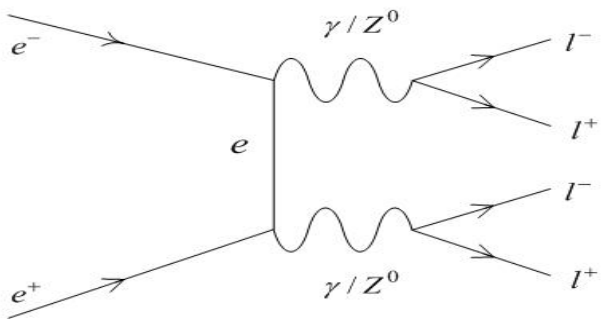
Four-lepton processes

Annihilation

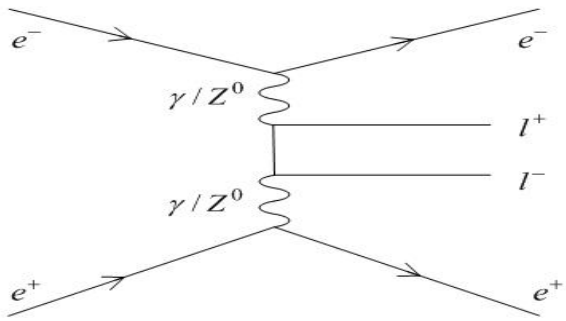


Bremsstrahlung



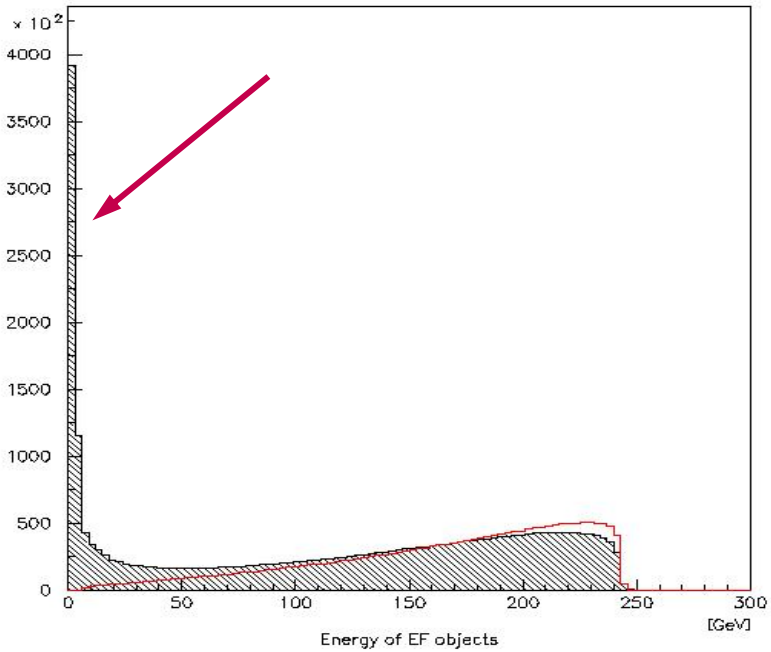


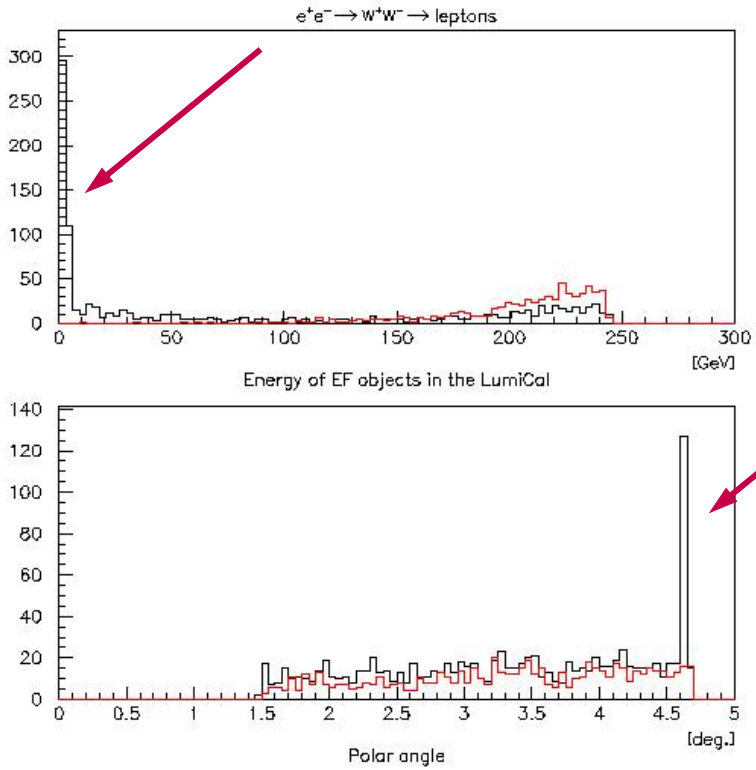
Conversion



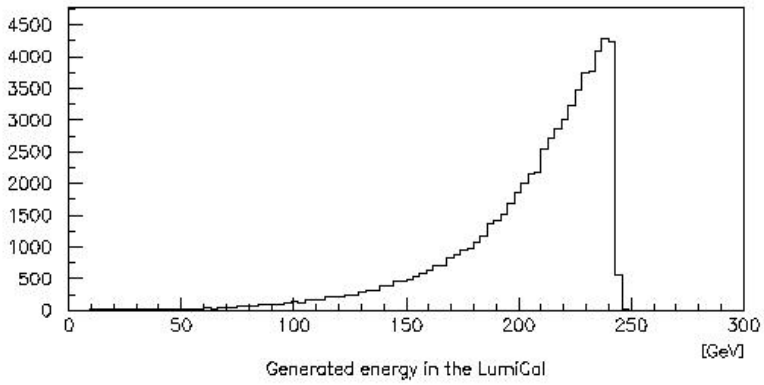
Multiperipheral

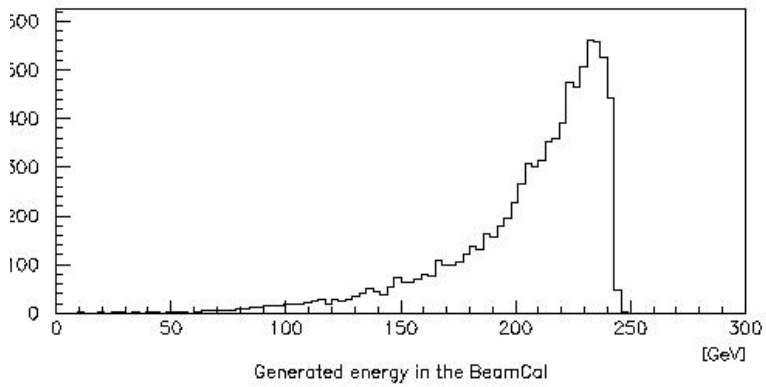
- W-pairs decay leptonicaly
- $\sqrt{s} = 500$ GeV
- tools: PYTHIA & SIMDET

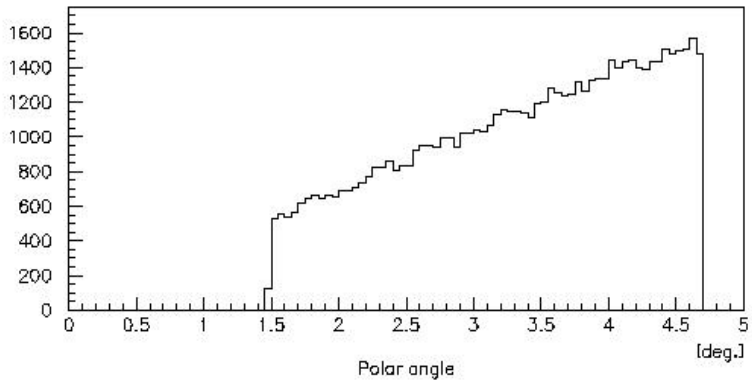


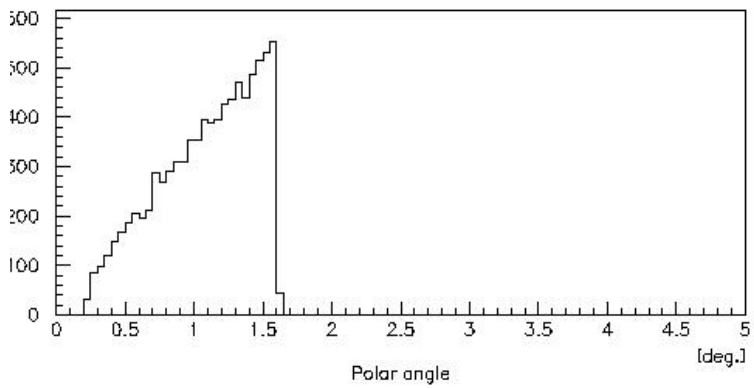


- E, θ distributions
- Generator level

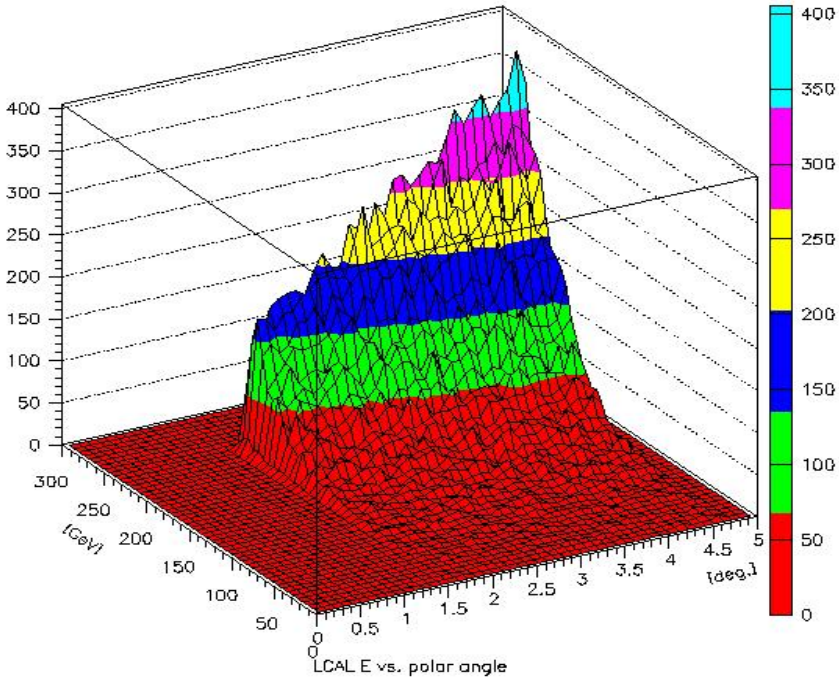


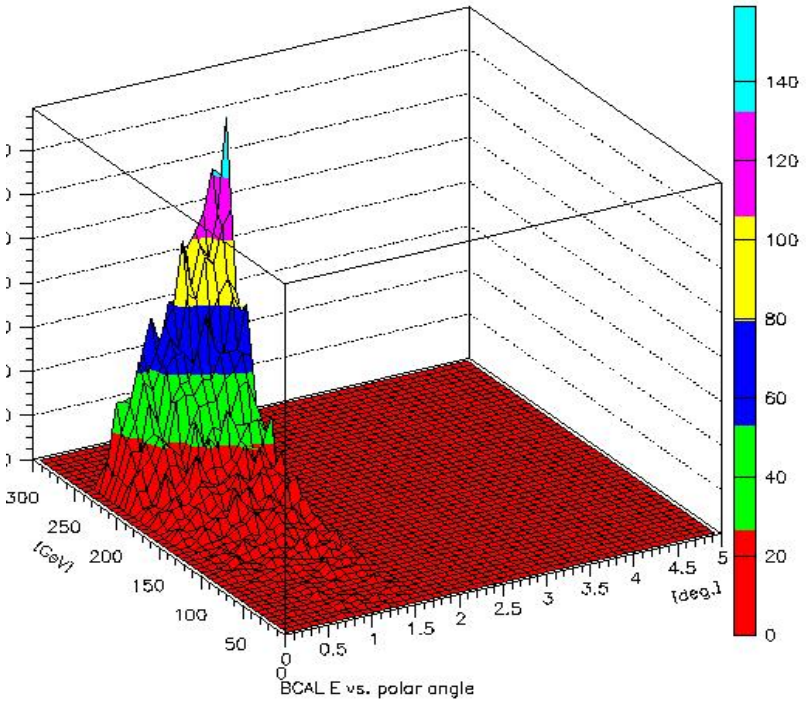




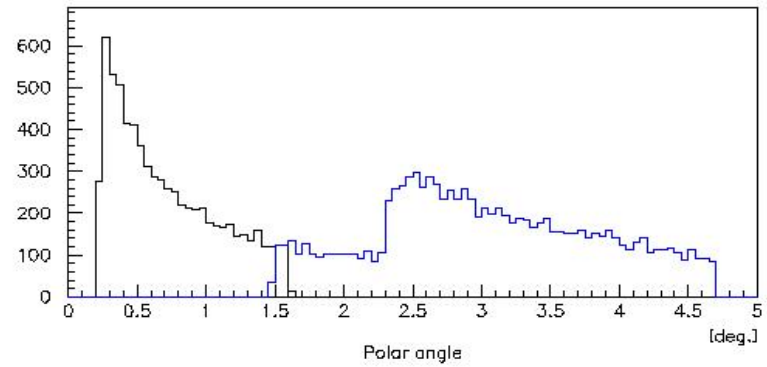


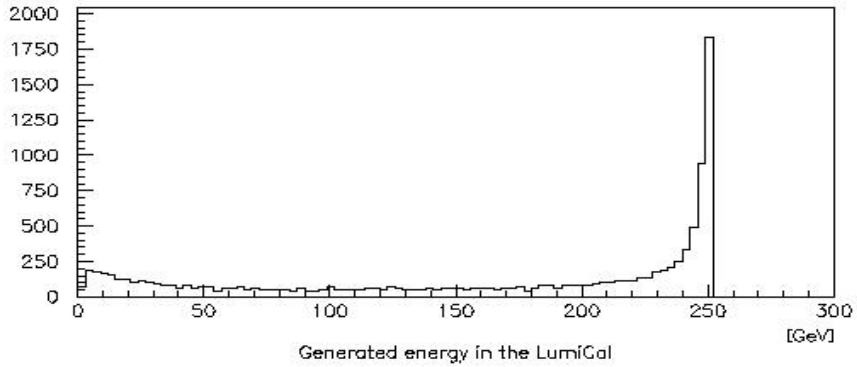
2-dim profiles E=E(θ)

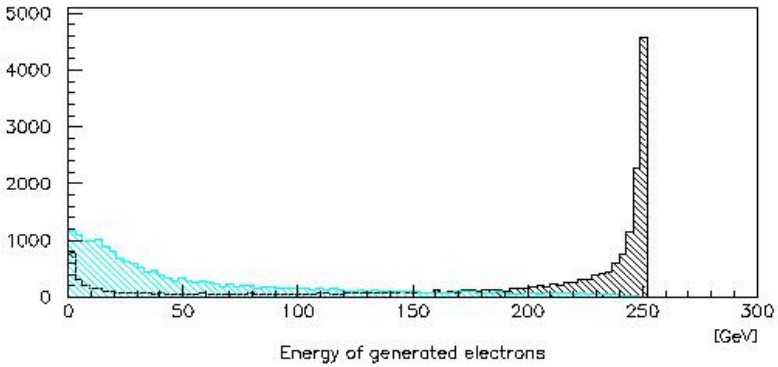


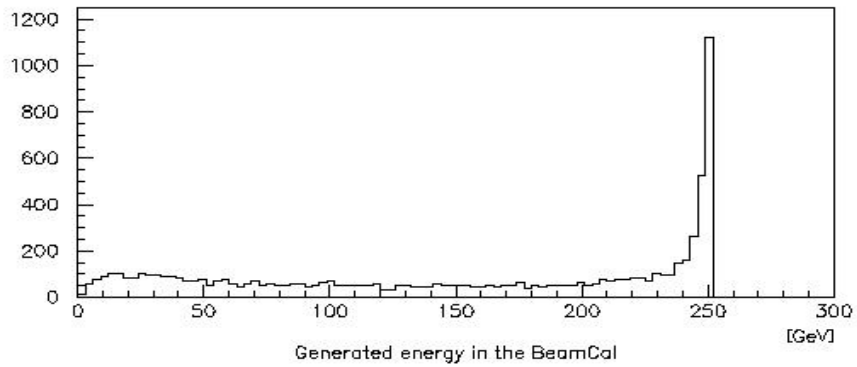


- di-muon final state
- high energetic electrons, close to the beam pipe
- $\sqrt{s} = 500$ GeV
- tools: WHIZARD









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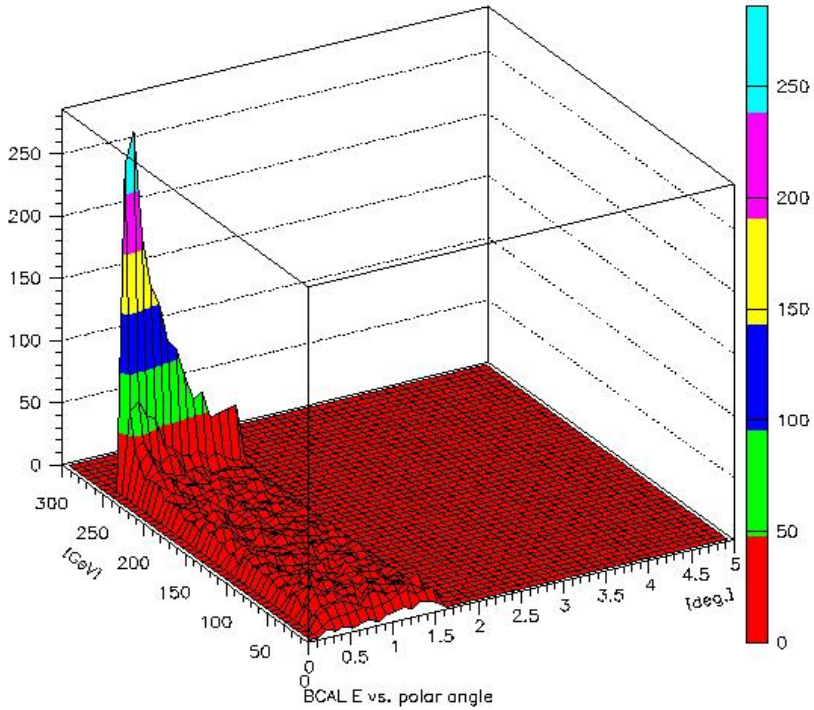

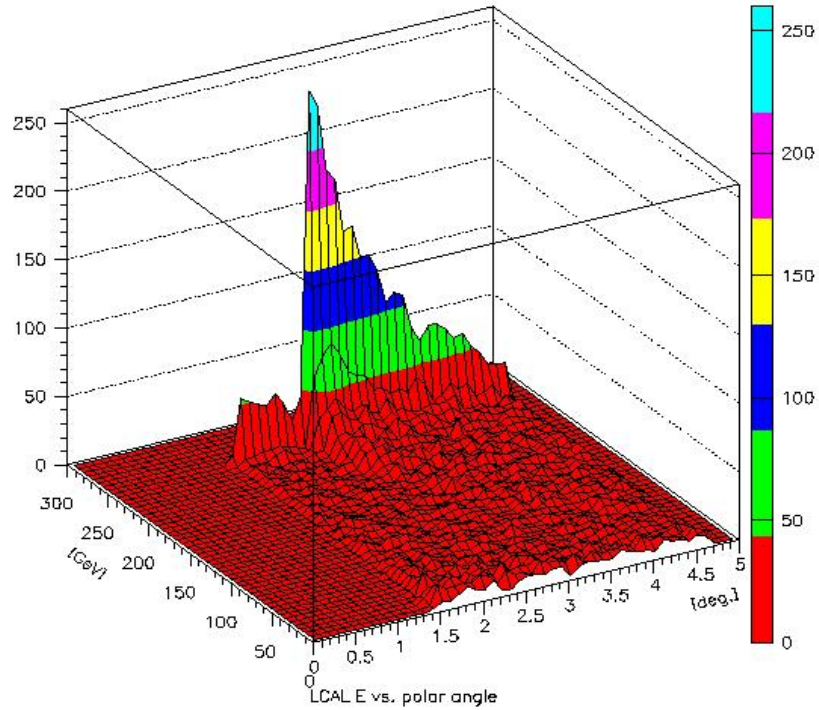

Summary

- Particles originating from leptonic W decays mostly dominate tail region of Bhabha's polar angle distribution, while four-lepton processes overlap it, and the most of these leptons are high energetic (above 100 GeV)

- From the energy and angular distributions of the studied processes, one may conclude that four-lepton processes are the potential background for Bhabha events, having in mind high cross section and the precision goals set for luminosity measurement

- These study will be continued to include:
  - comparison between signal and background in terms of statistics
  - fine tuning of generator parameters to provide optimal description of the region below 5 degrees
  - detector simulation (the problem with excess of low energy objects in SIMDET to be fixed)
  - selection criteria