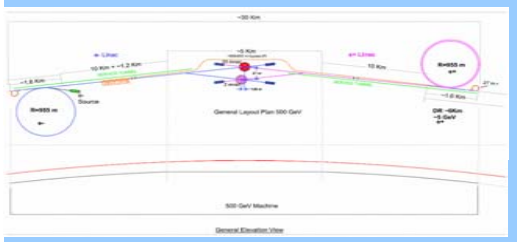
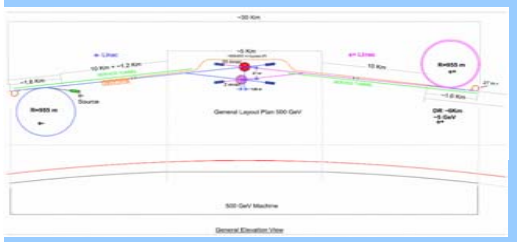


SiD Talk

ILC – The International Linear Collider Project

SIMULATION OF BEAMCAL WITH B FIELDS

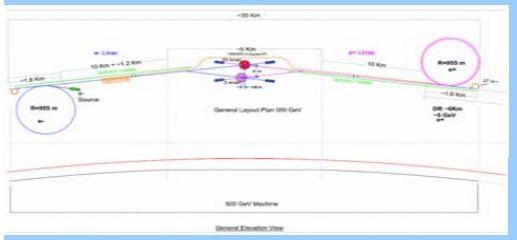
Keith Drake, Tera Dunn, Jack Gill,
Maria Person Gulda , Uriel Nauenberg, Gleb Oleinik,
Joseph Proulx, Elliot Smith, Paul Steinbrecher
Jonathan Varkovitzky



SiD Talk

ILC – The International Linear Collider Project

The FCAL Collaboration



SiD Talk

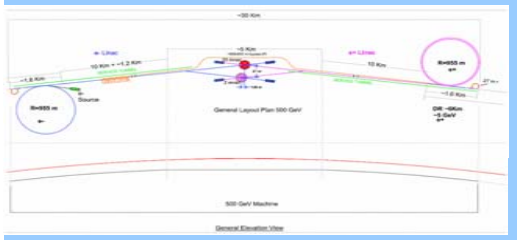
ILC – The International Linear Collider Project

Study of the Beamstrahlung Spectrum at the BEAMCAL detector

First calibrated the Anti-DiD field proposed by Andrei Seryi so that most of the energy goes into the beampipe

Second, look at the energy deposition by the beamstrahlung in 1 x 1 cm^2 (Moliere radius of showers)

Third, we need to study the 2 γ process to determine detection efficiency

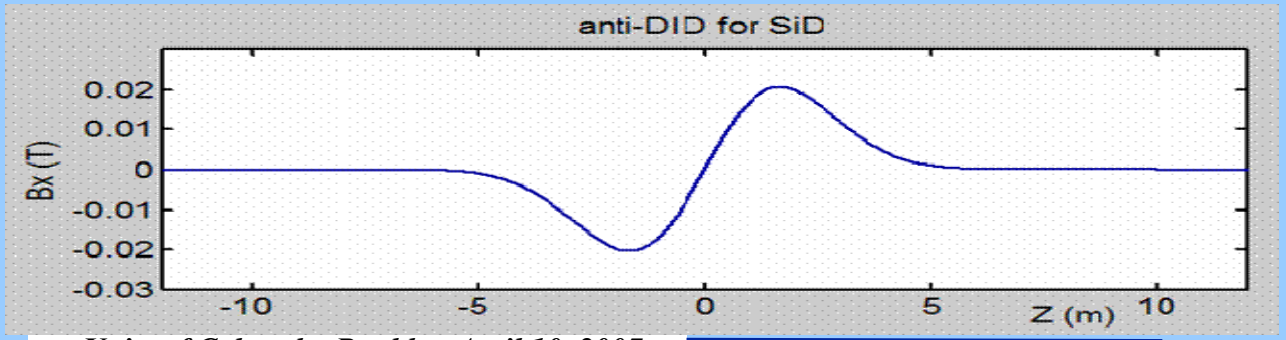


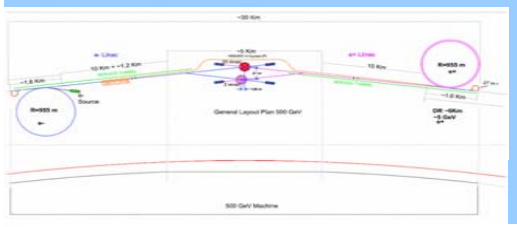
SiD Talk

ILC – The International Linear Collider Project

Solenoid field keeps the low energy charged particle in the forward direction. Beam hole is at 7 mrad.

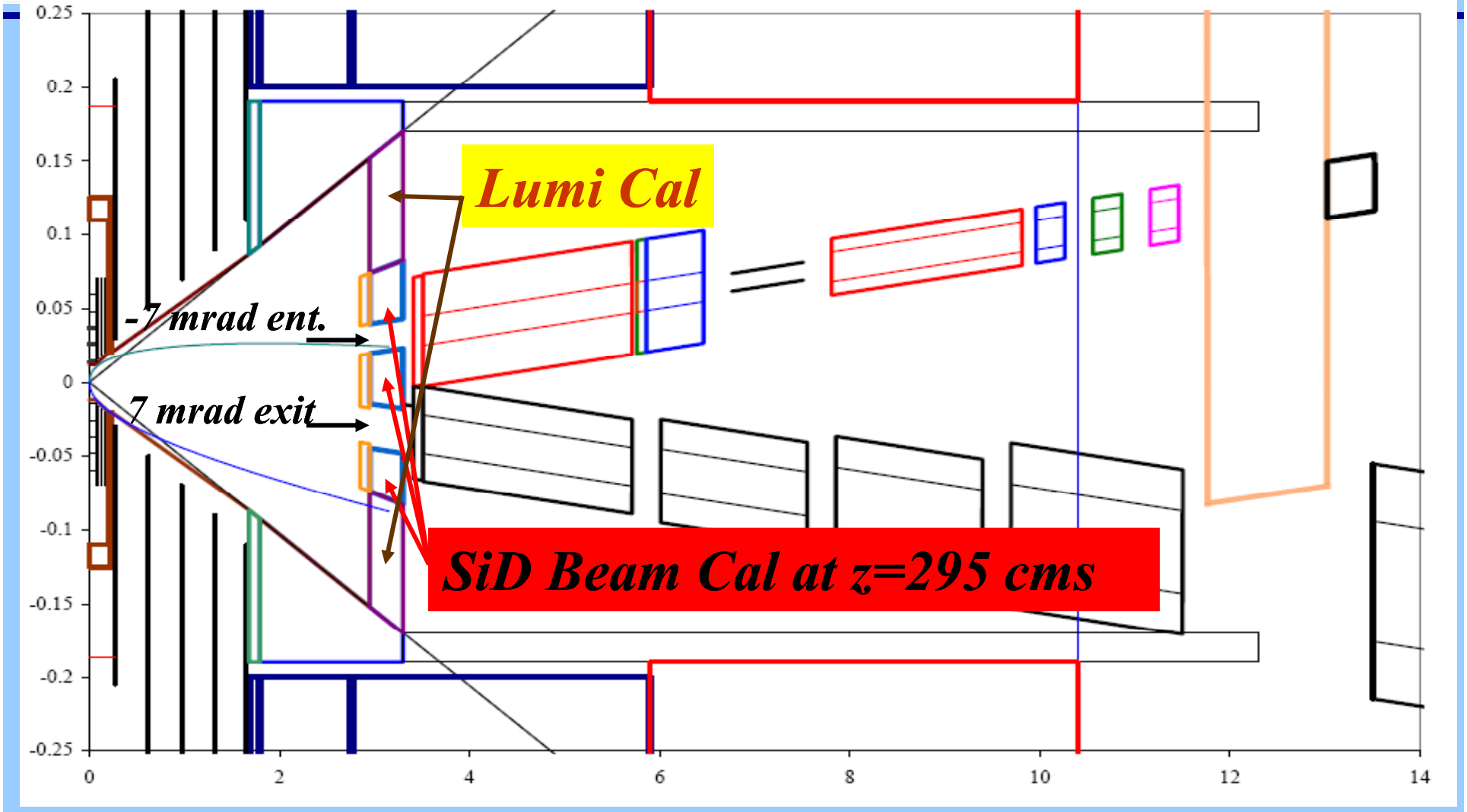
Need to add an x field component to move low energy charged particles in the 7 mrad direction. Anti-DiD dipole field proposed by Andrei Seryi.

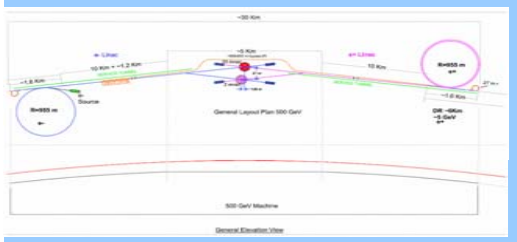




SiD Talk

ILC – The International Linear Collider Project

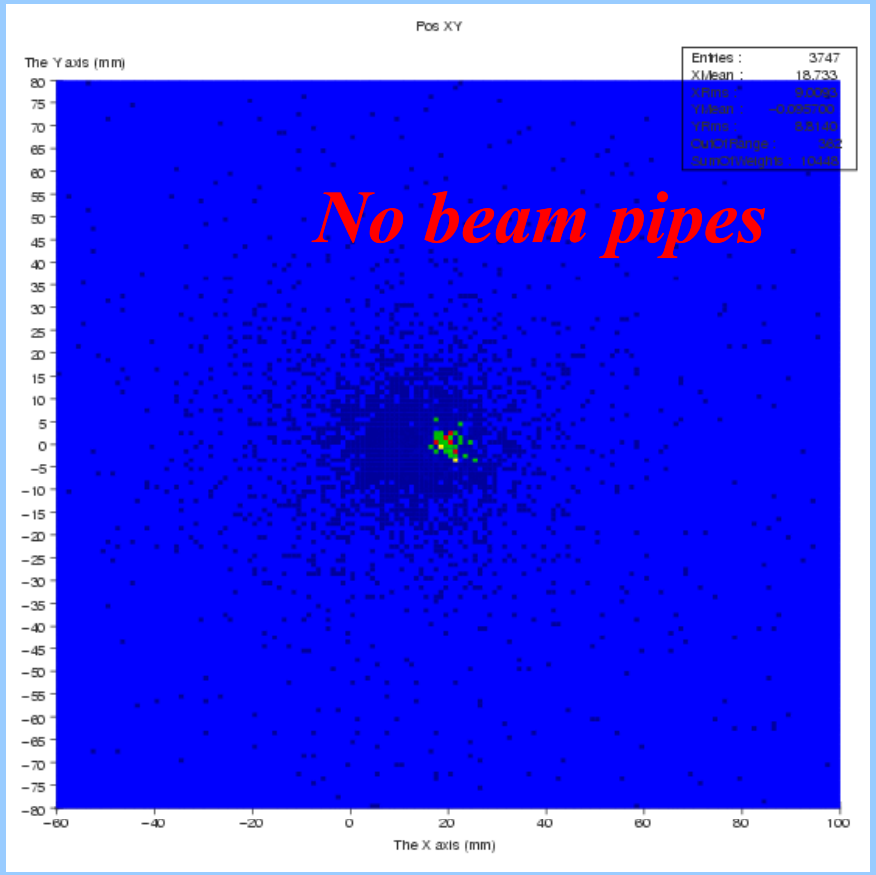


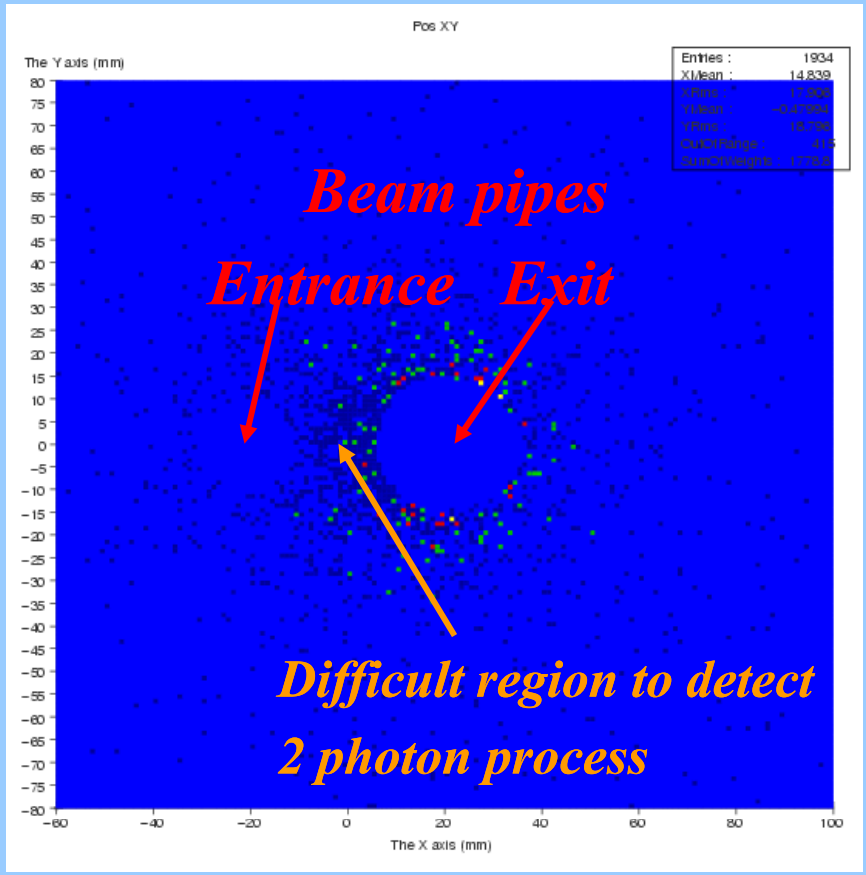


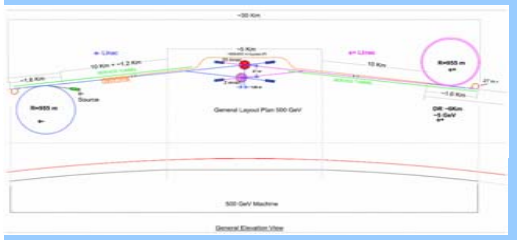
SiD Talk

ILC – The International Linear Collider Project

Beamstrahlung Distribution with Solenoid + Anti-DiD



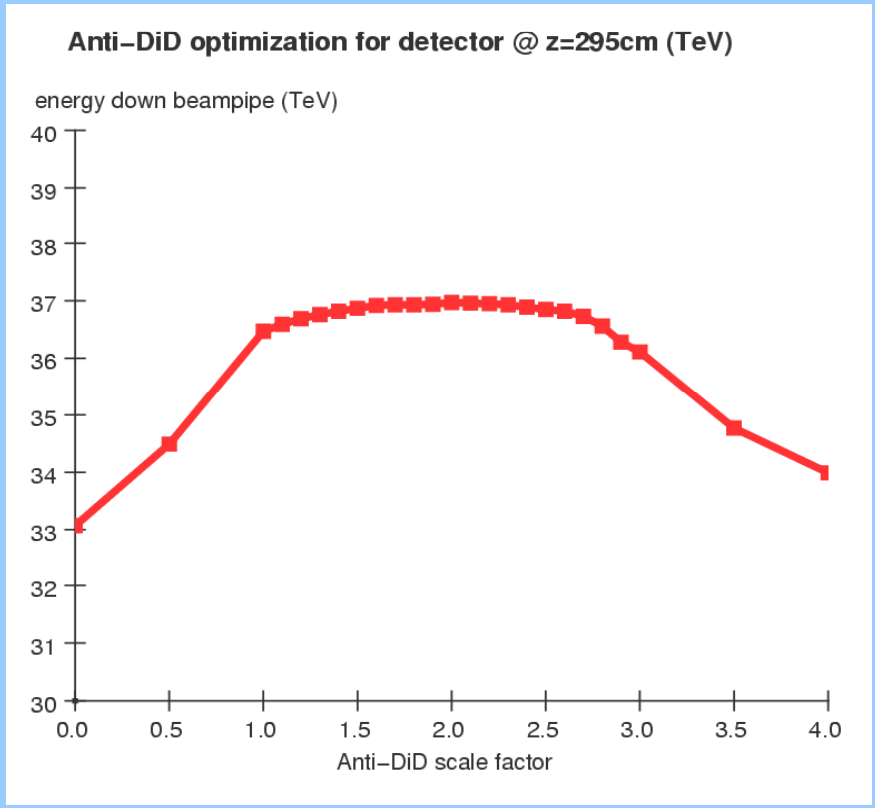


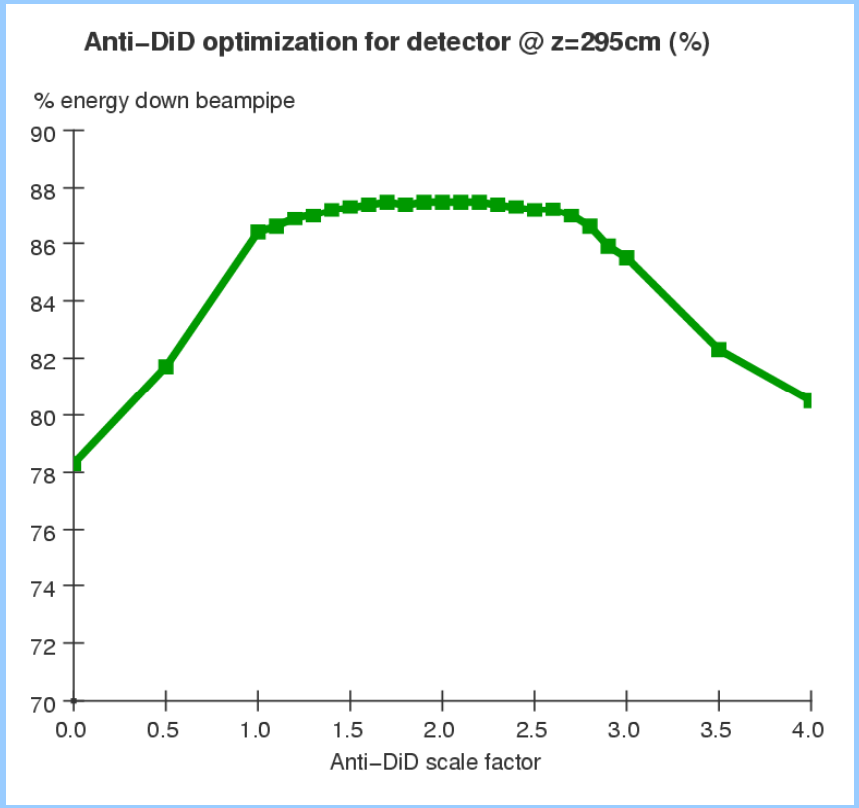


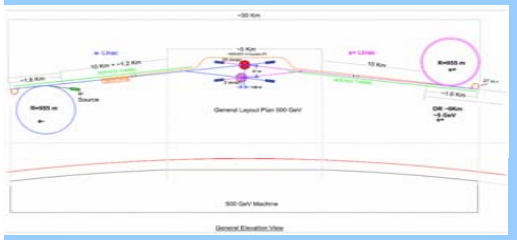
SiD Talk

ILC – The International Linear Collider Project

Anti-DiD Scale Factor to Maximize Energy into Beam Pipe



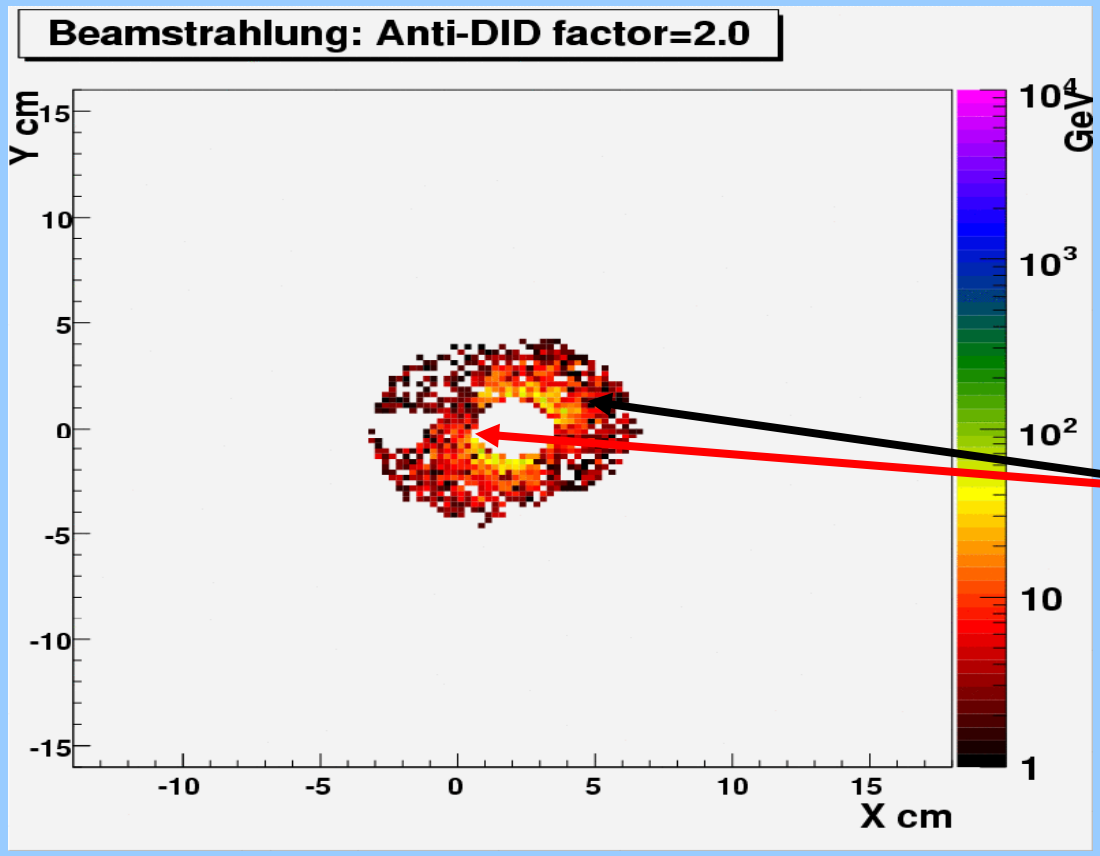




SiD Talk

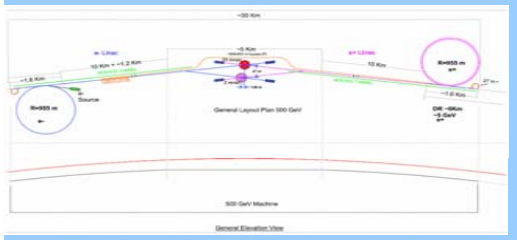
ILC – The International Linear Collider Project

Beamstrahlung Energy Spectrum at the BeamCal



In 0.25 x 0.25 cm^2 areas

Not circularly uniform about exit beam hole

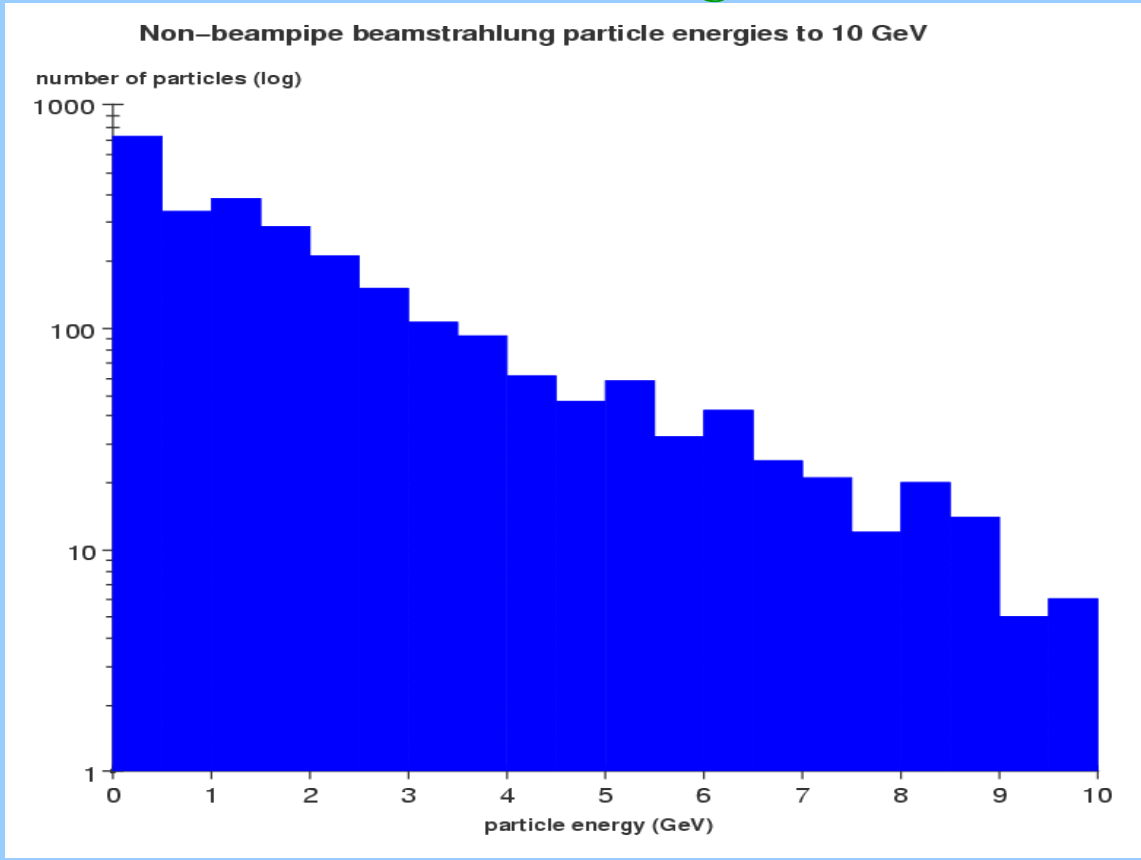


SiD Talk

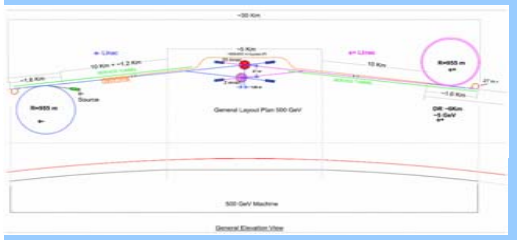
ILC – The International Linear Collider Project

Number of Beamstrahlung Electrons versus Energy

Log Scale



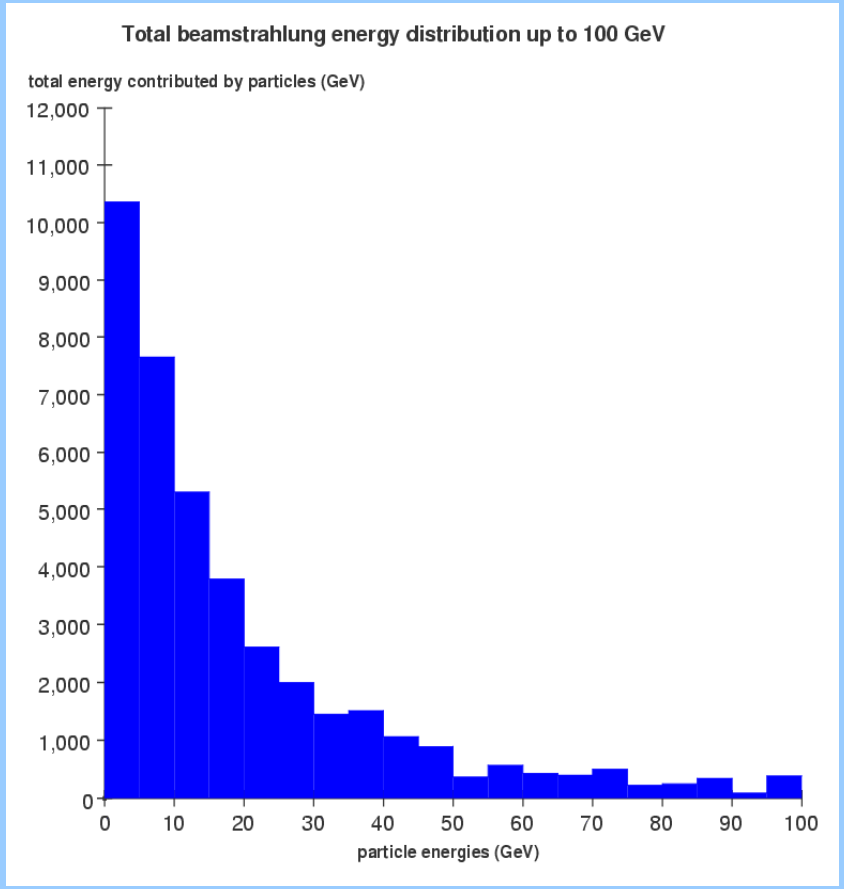
Most beamstrahlung electron/positrons are far lower energy than the 2γ electron/positrons



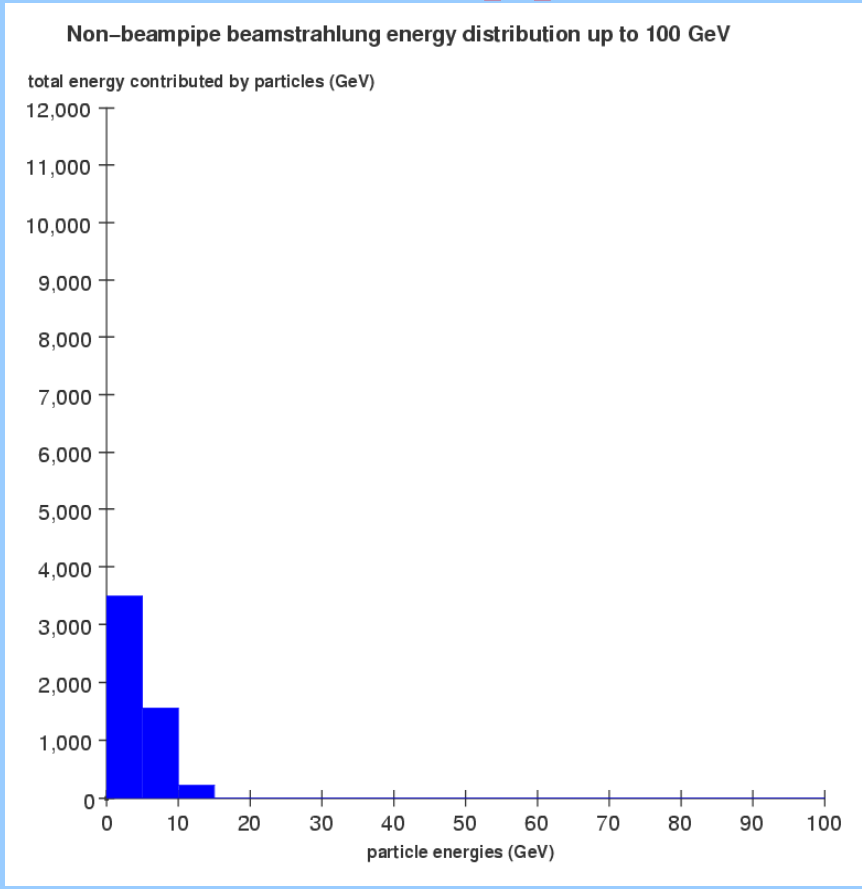
SiD Talk

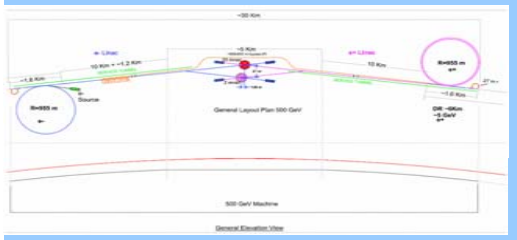
ILC – The International Linear Collider Project

Total Energy Deposited



Energy Deposited Outside Beampipes



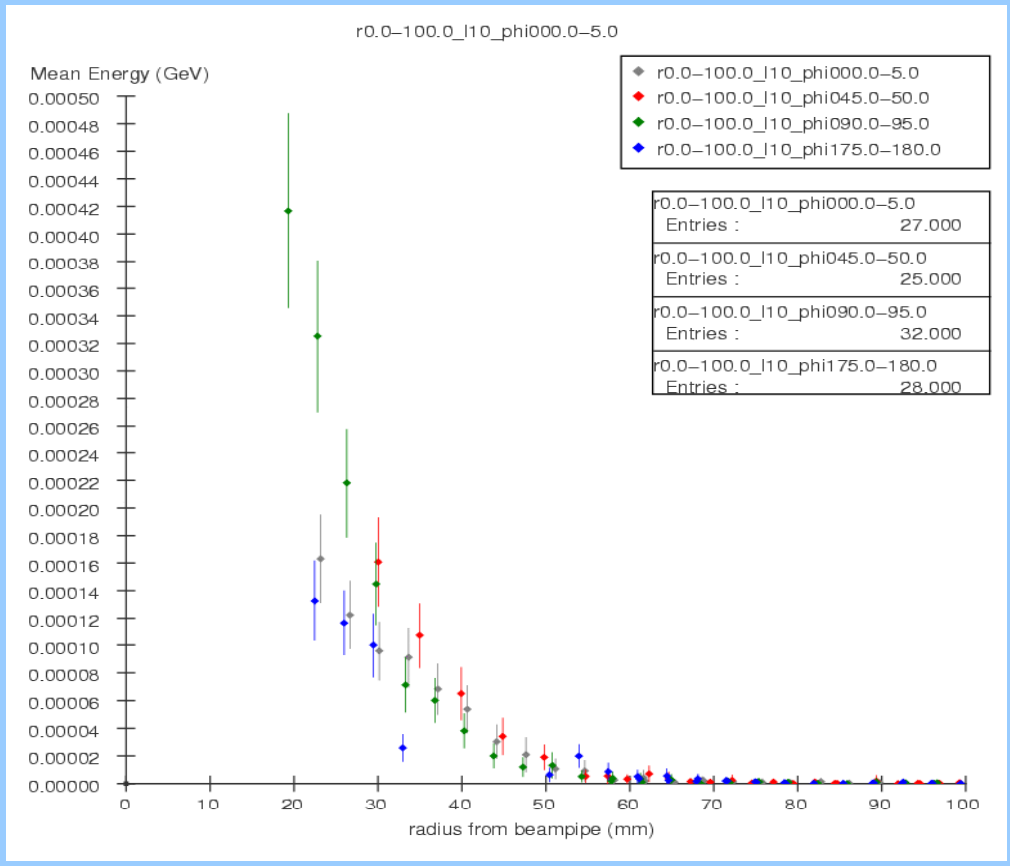


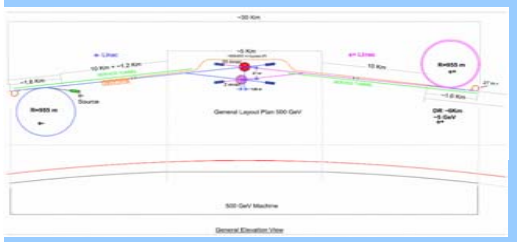
SiD Talk

ILC – The International Linear Collider Project

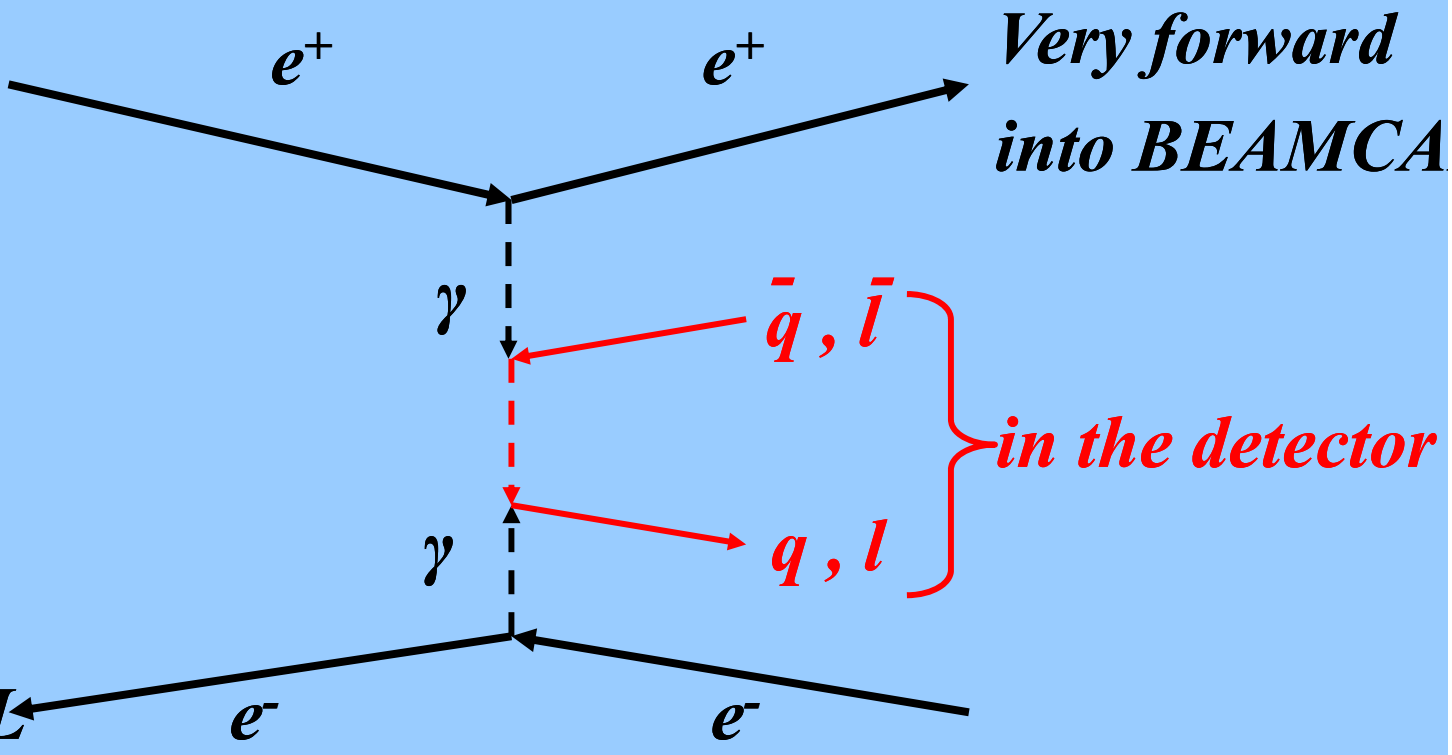
Beamstrahlung Energy Deposition

Means and Sigmas of energy deposited in layer 10 versus radius from beam pipe at given azimuthal angles

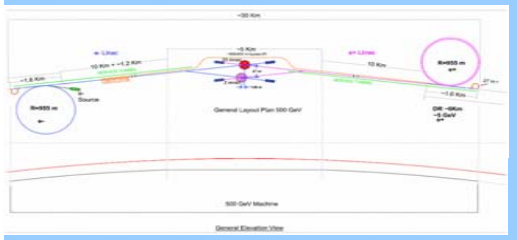




2 Photon Process



Discussion in Beam Cal section at end

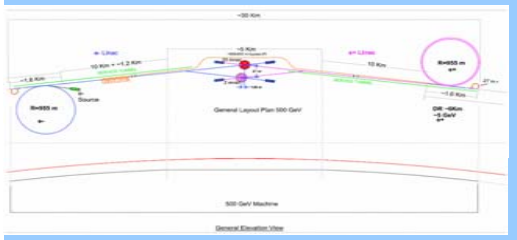


SiD Talk

ILC – The International Linear Collider Project

The Simulation Aim

We want to determine how far down in Pt we can observe the two photon background by requiring that we observe the forward electron and positron above the beamstrahlung. This will require that we distinguish shower shapes.



SiD Talk

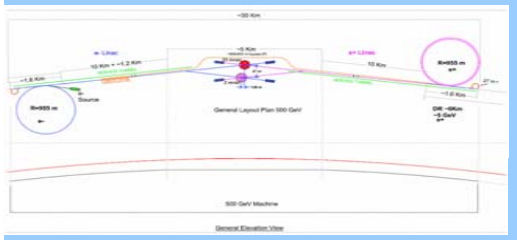
ILC – The International Linear Collider Project

The ILC Parameters Committee is asking us to evaluate how well one can observe the process

$$e^+ e^- \rightarrow \tilde{\tau}^+ \tilde{\tau}^- \rightarrow \tilde{\chi}^0_1 \tau^+ \tilde{\chi}^0_1 \tau^-$$

where the stau-neutralino mass difference is 5 GeV. This is roughly point 3 in the Snowmass 2001 parameter set.

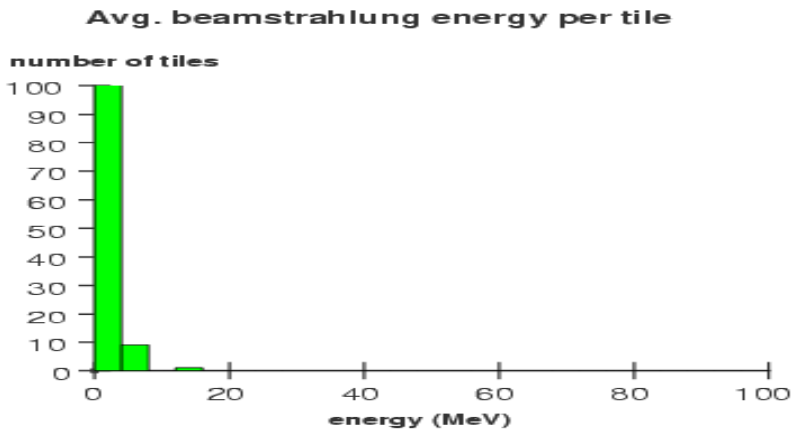
At the Valencia meeting this was discussed and our DESY colleagues pointed out that this signal can be observed.

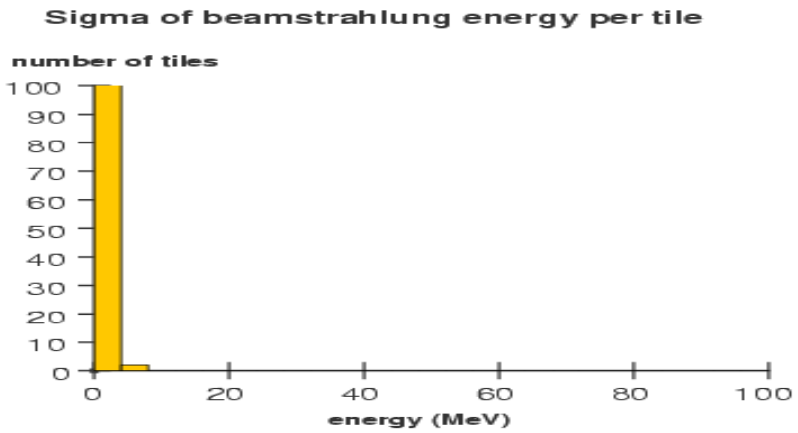


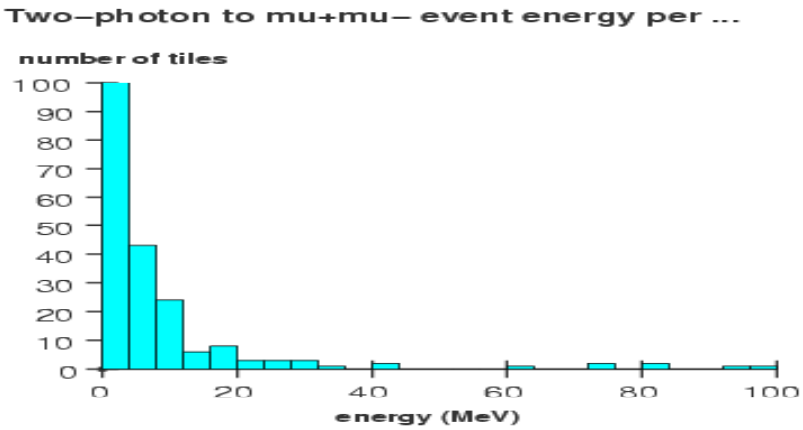
SiD Talk

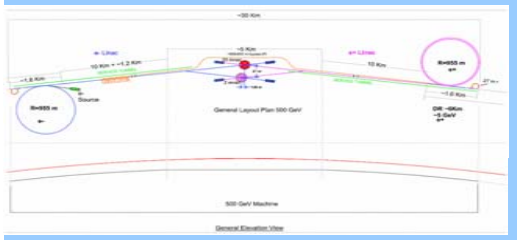
ILC – The International Linear Collider Project

Energy Deposition of the Beamstrahlung and 2-Photon Process





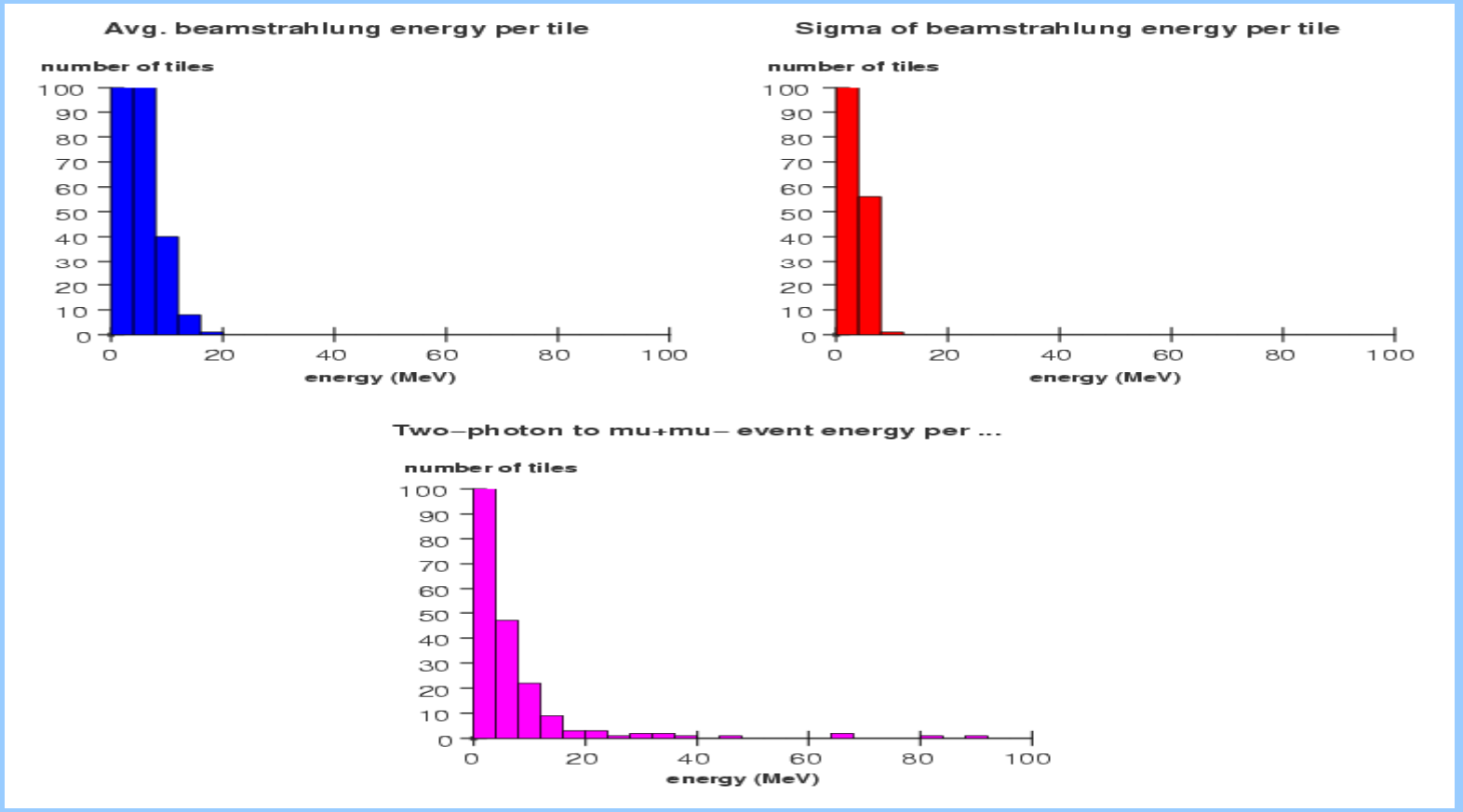


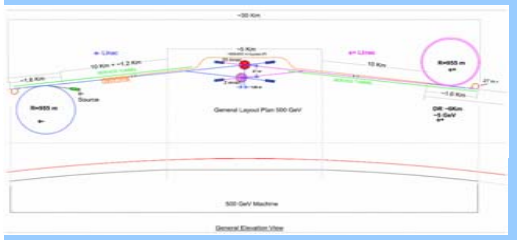


SiD Talk

ILC – The International Linear Collider Project

Energy Deposition of the Beamstrahlung and 2-Photon Process



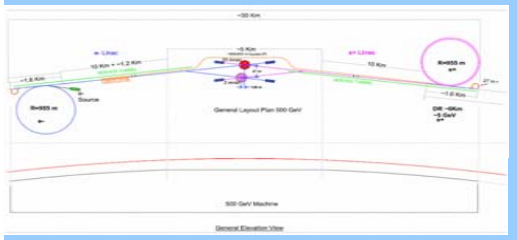


What Have we Accomplished

We have simulated with GEANT 4.0 the showers in the BeamCal due to the beamstrahlung and due to the 2-Photon process..

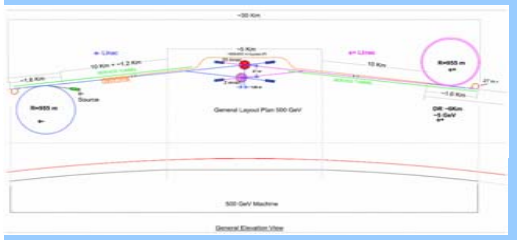
We have recorded the average energy deposition as a function of radius and angle from the center of the outgoing beampipe.

We have generated and recorded in a table the average energy deposited in each cell.



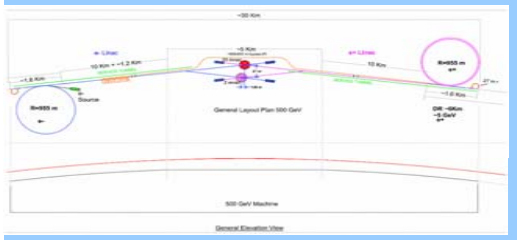
NEXT STEPS

Overlay 2 photon processes on the beamstrahlung data and extract the energy of the high momentum electrons by removing average energy depositions from beamstrahlung to determine how well we can determine the missing Pt in order to extract the correct background from extraneous events.



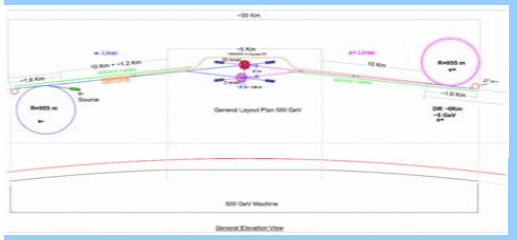
SiD Talk

ILC – The International Linear Collider Project



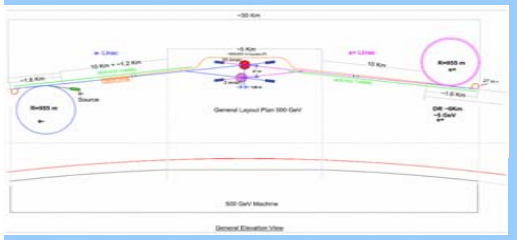
SiD Talk

ILC – The International Linear Collider Project



SiD Talk

ILC – The International Linear Collider Project



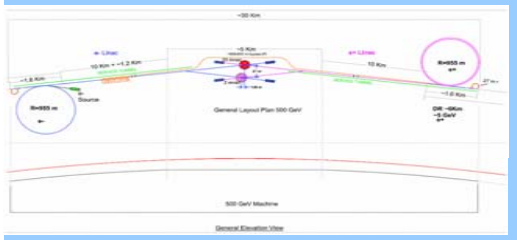
SiD Talk

ILC – The International Linear Collider Project

Study the efficiency to observe the electron and positron of the two photon process above the beamstrahlung background

Essential to remove this background in the study of Supersymmetry in the dynamical region of low Pt. Needed to measure the masses.

Work by Paul Steinbrecher and Gleb Oleinik

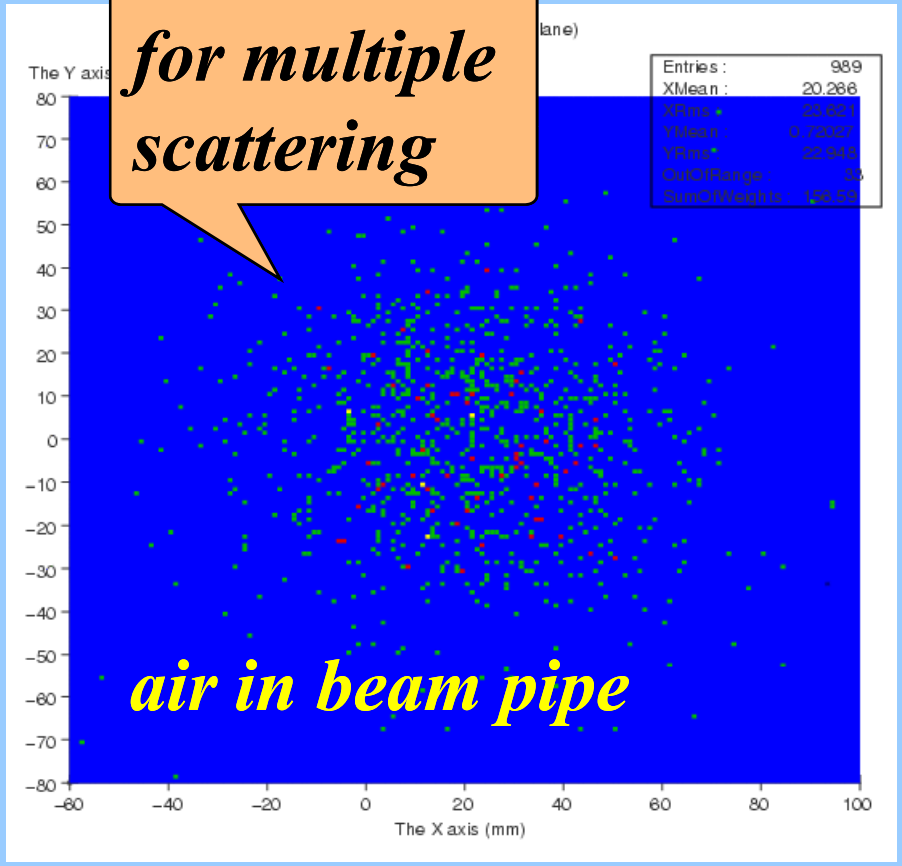


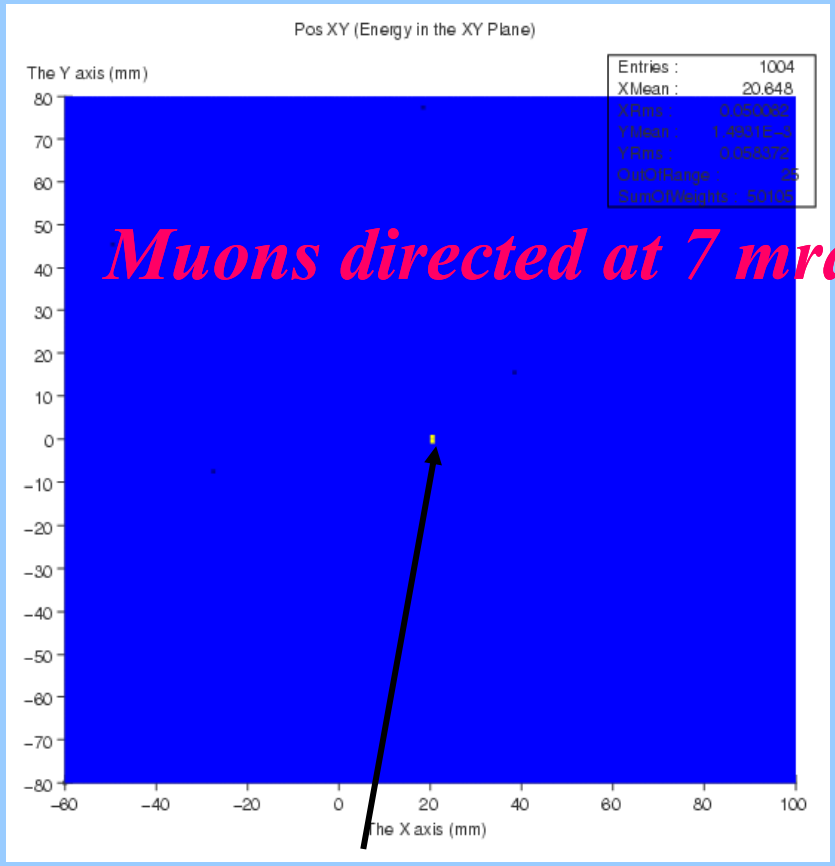
SiD Talk

ILC – The International Linear Collider Project

Testing GEANT 4.0

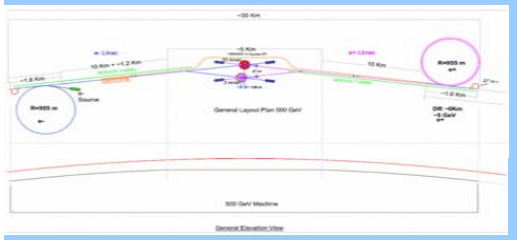
Evidence for multiple scattering





No field, 50 MeV muons

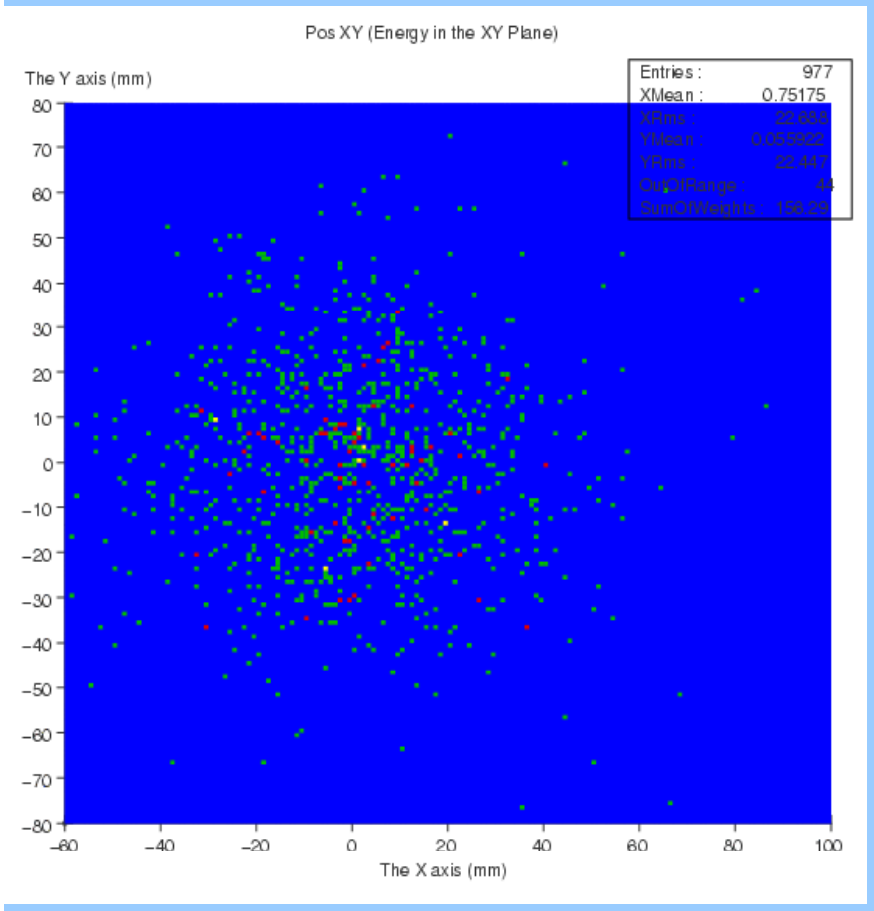
No field, 50 GeV muons



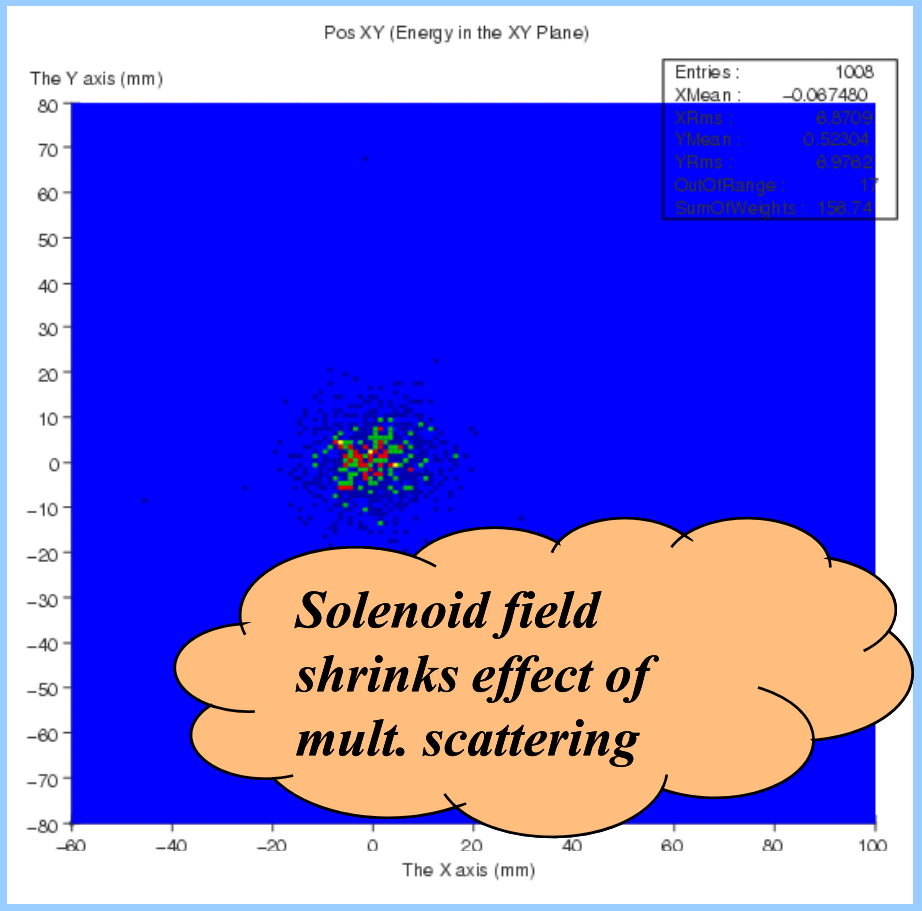
SiD Talk

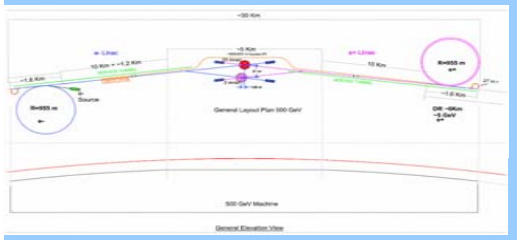
ILC – The International Linear Collider Project

50 MeV, no field, forward



50 MeV, solenoid on, forward





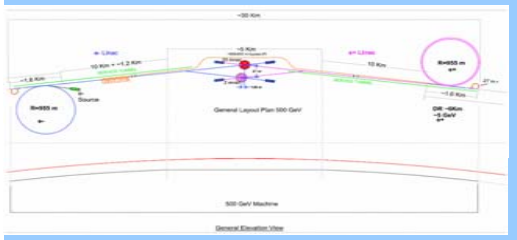
SiD Talk

ILC – The International Linear Collider Project

GEANT 4.0 seems to be working properly We have fixed various bugs in collaboration with SLAC team.

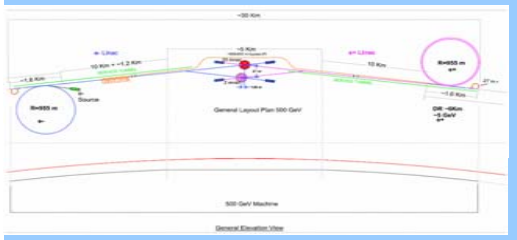
According to Seryi Anti-DiD was tuned assuming BEAM CAL is at L* ~ 350 cm. BEAM CAL for SiD is at 295 cm. Effect is clearly seen. Need to retune Anti-DiD to larger values. We are doing this.

All Simulation is work in progress.



SiD Talk

ILC – The International Linear Collider Project



SiD Talk

ILC – The International Linear Collider Project