

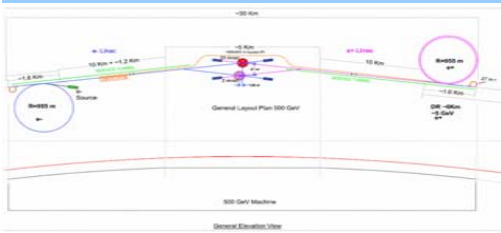
# *SiD Talk*



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

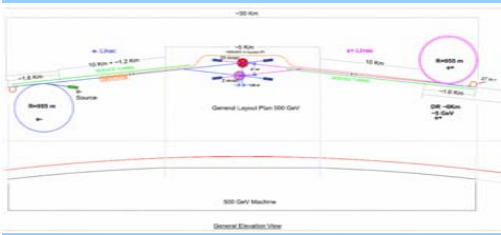


ILC - The International Linear Collider Project

## The FCAL Collaboration

**The Very Forward Calorimetry Collaboration**

see: PRC R&D 01/02 (2002)



# *SiD Talk*



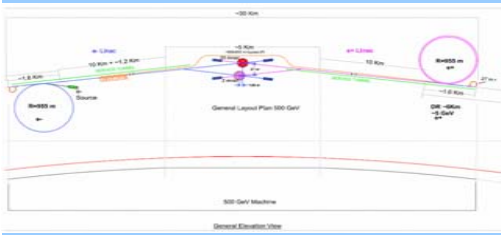
ILC – The International Linear Collider Project

## *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  $1 \times 1 \text{ cm}^2$  (Moliere radius of showers)*

*Third, we need to study the  $2 \gamma$  process to  
determine detection efficiency*



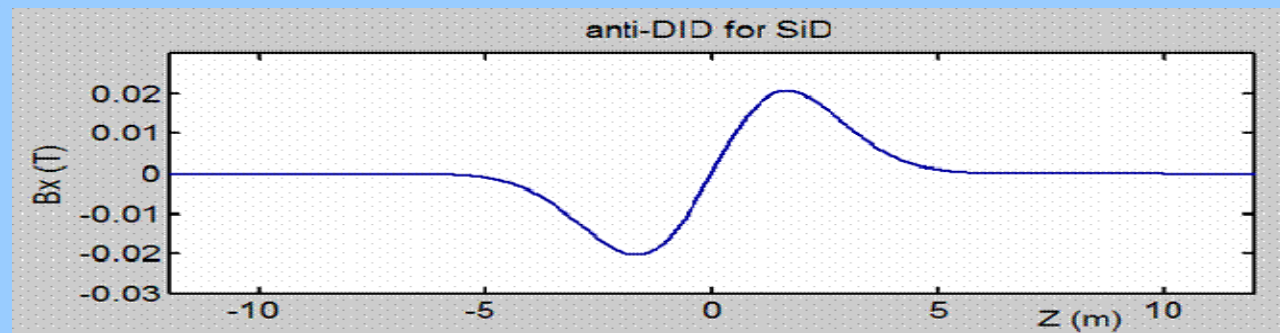
# SiD Talk



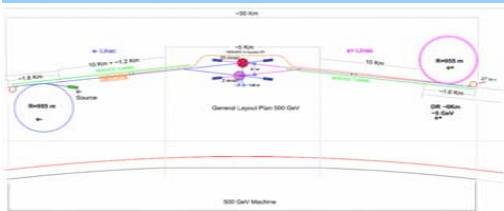
ILC – The International Linear Collider Project

*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.*



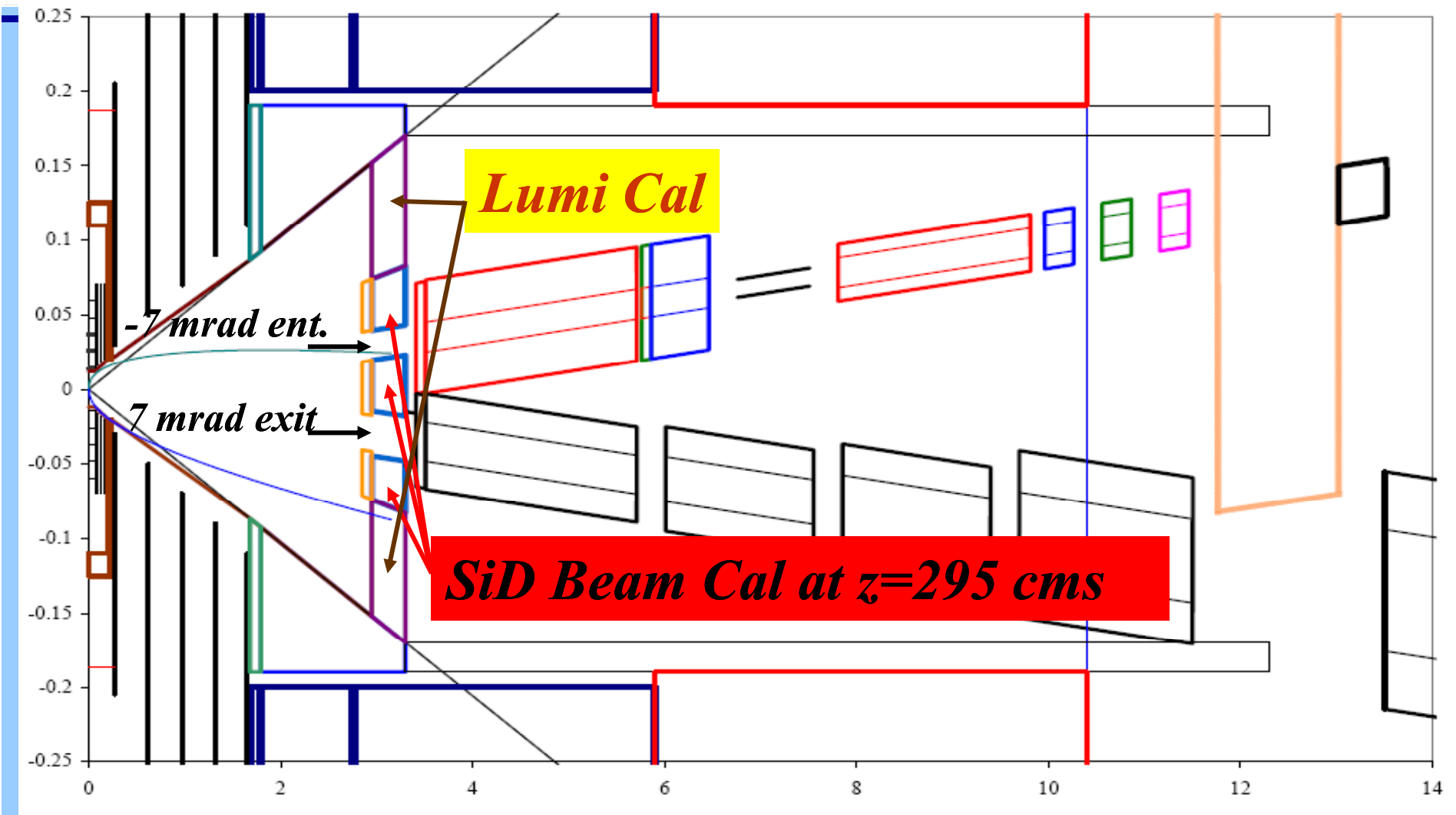
Univ. of Colorado, Boulder, April 10, 2007

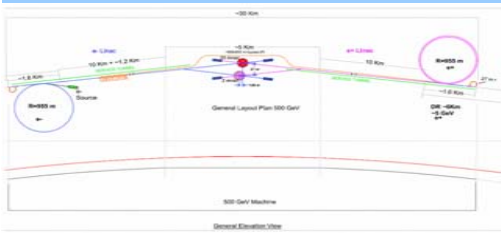


# SiD Talk



ILC - The International Linear Collider Project



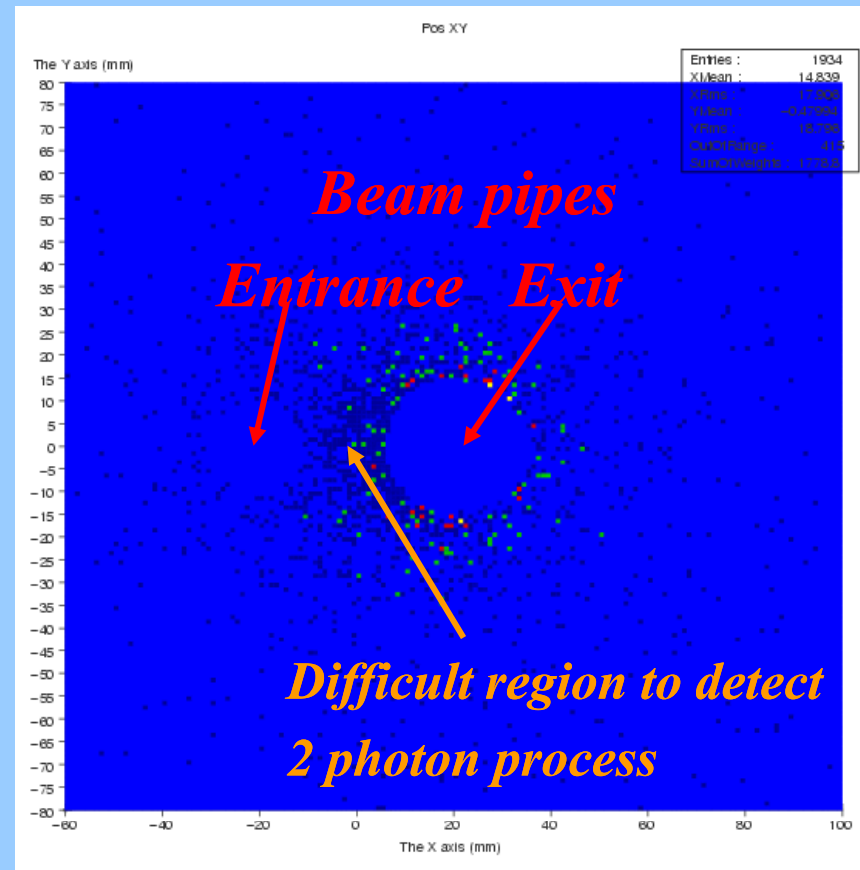
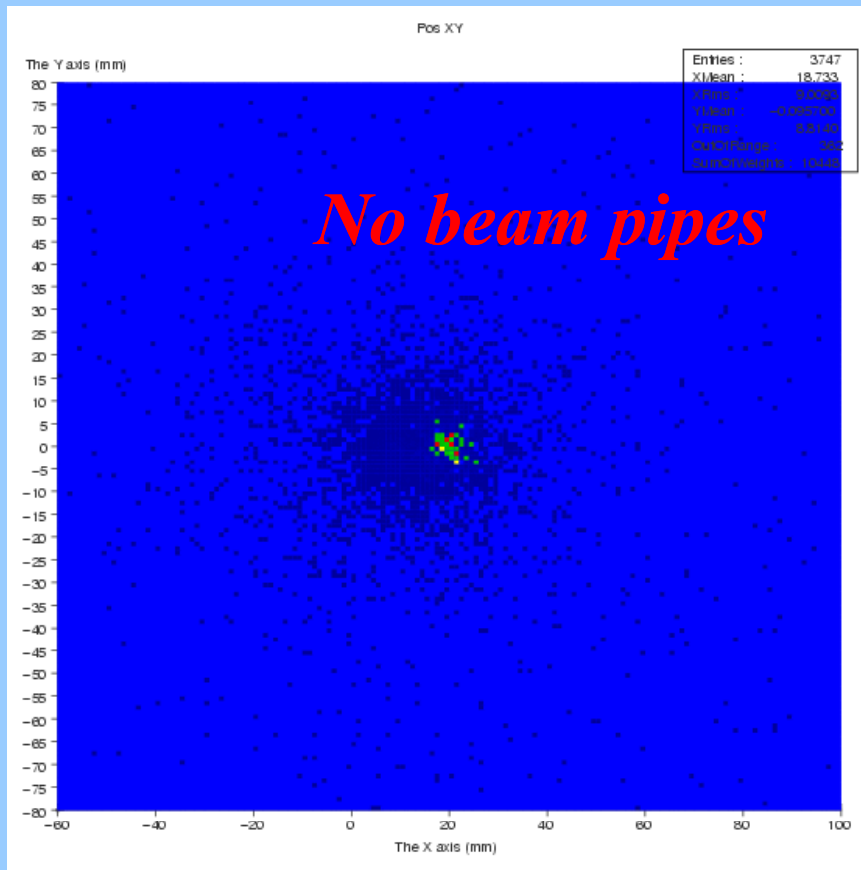


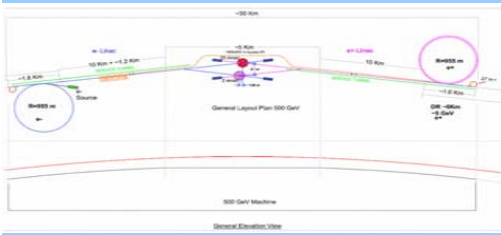
# SiD Talk



ILC - The International Linear Collider Project

## Beamstrahlung Distribution with Solenoid + Anti-DiD





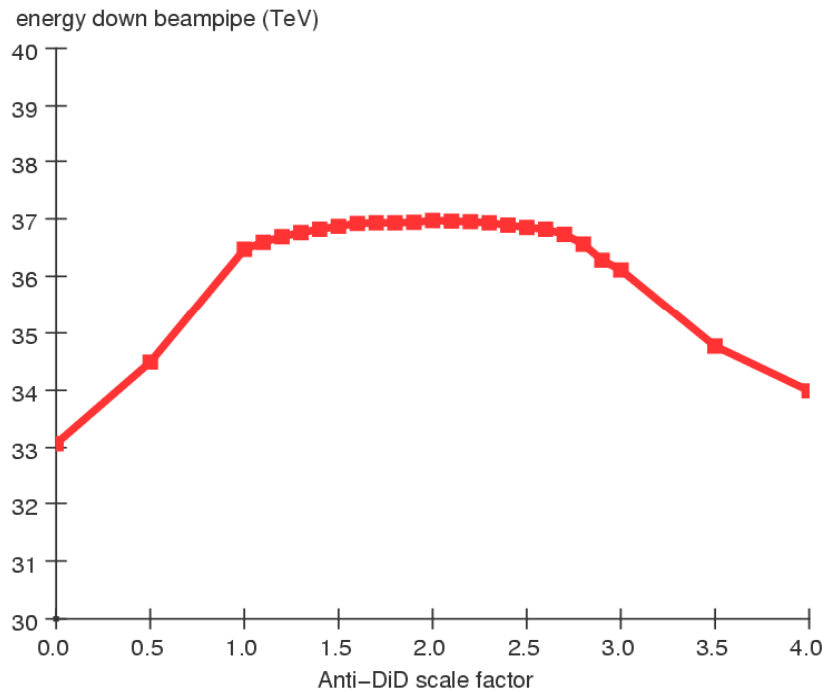
# SiD Talk



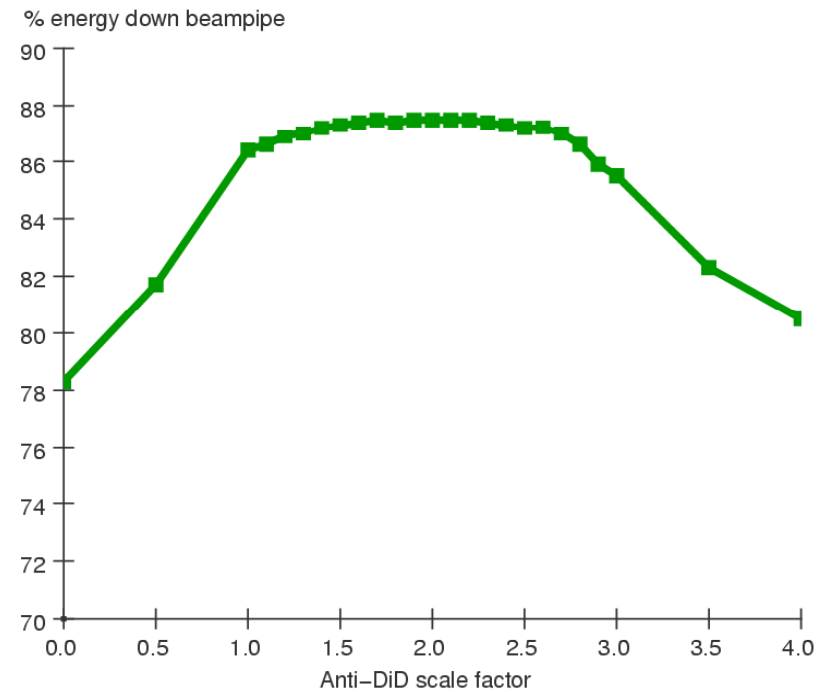
ILC – The International Linear Collider Project

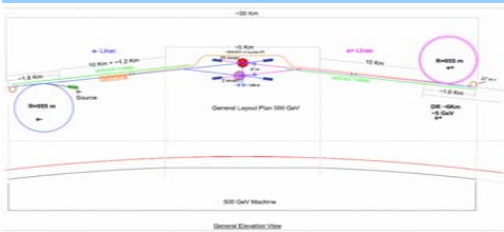
## *Anti-DiD Scale Factor to Maximize Energy into Beam Pipe*

**Anti-DiD optimization for detector @ z=295cm (TeV)**



**Anti-DiD optimization for detector @ z=295cm (%)**



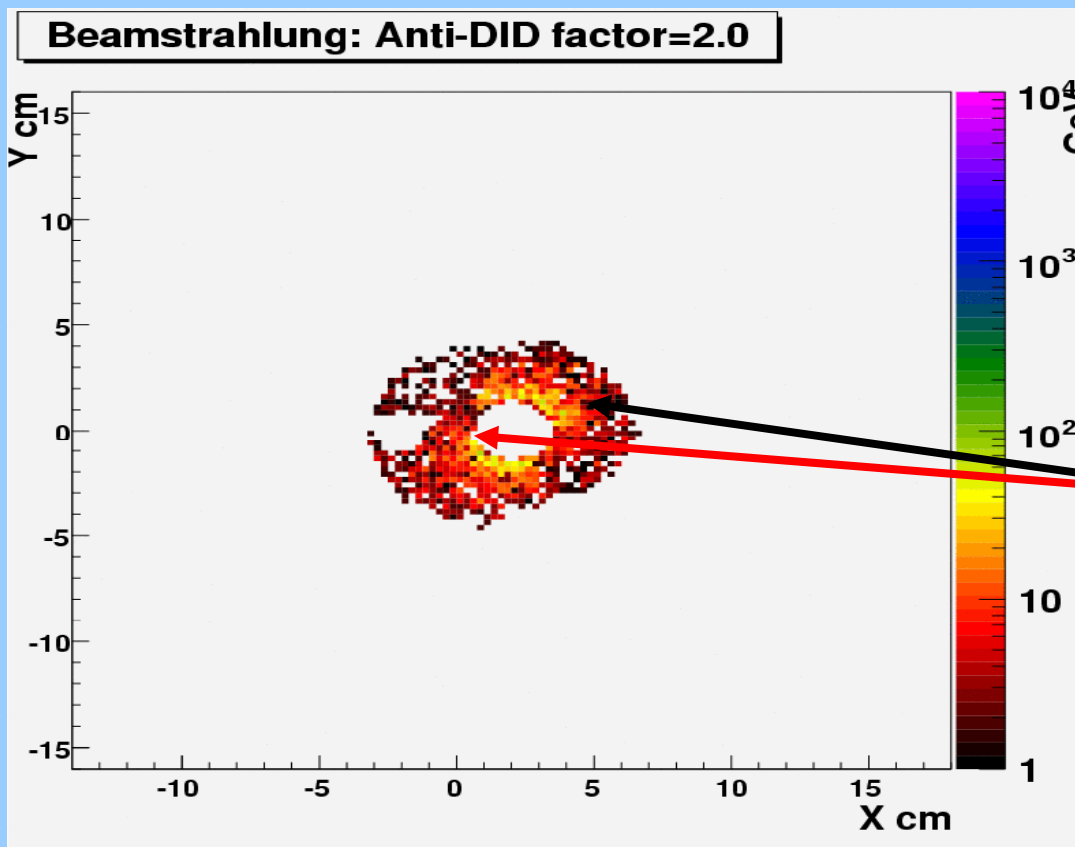


# SiD Talk



ILC - The International Linear Collider Project

## Beamstrahlung Energy Spectrum at the BeamCal

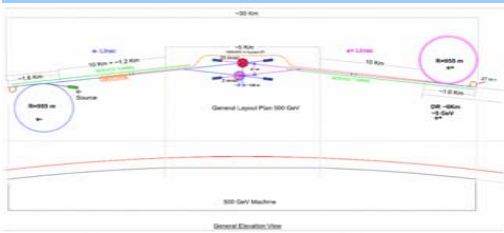


*In 0.25 x 0.25  
cm<sup>2</sup> areas*

*Not circularly  
uniform about exit  
beam hole*





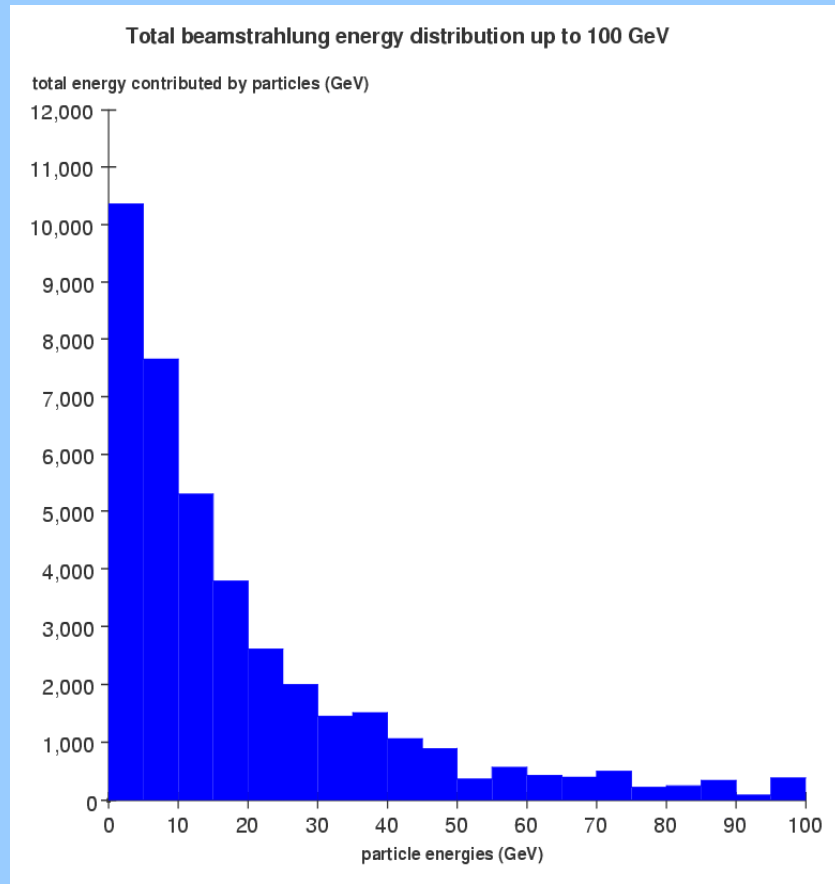


# SiD Talk

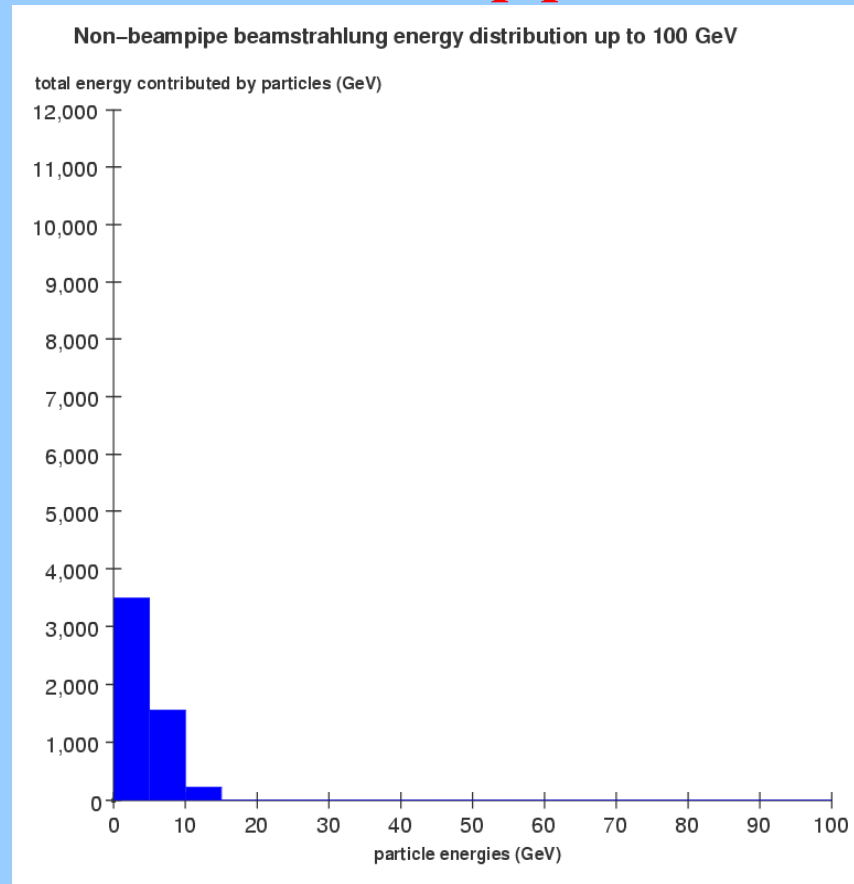


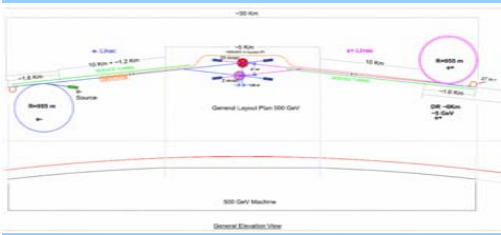
ILC - The International Linear Collider Project

## Total Energy Deposited



## Energy Deposited Outside Beampipes





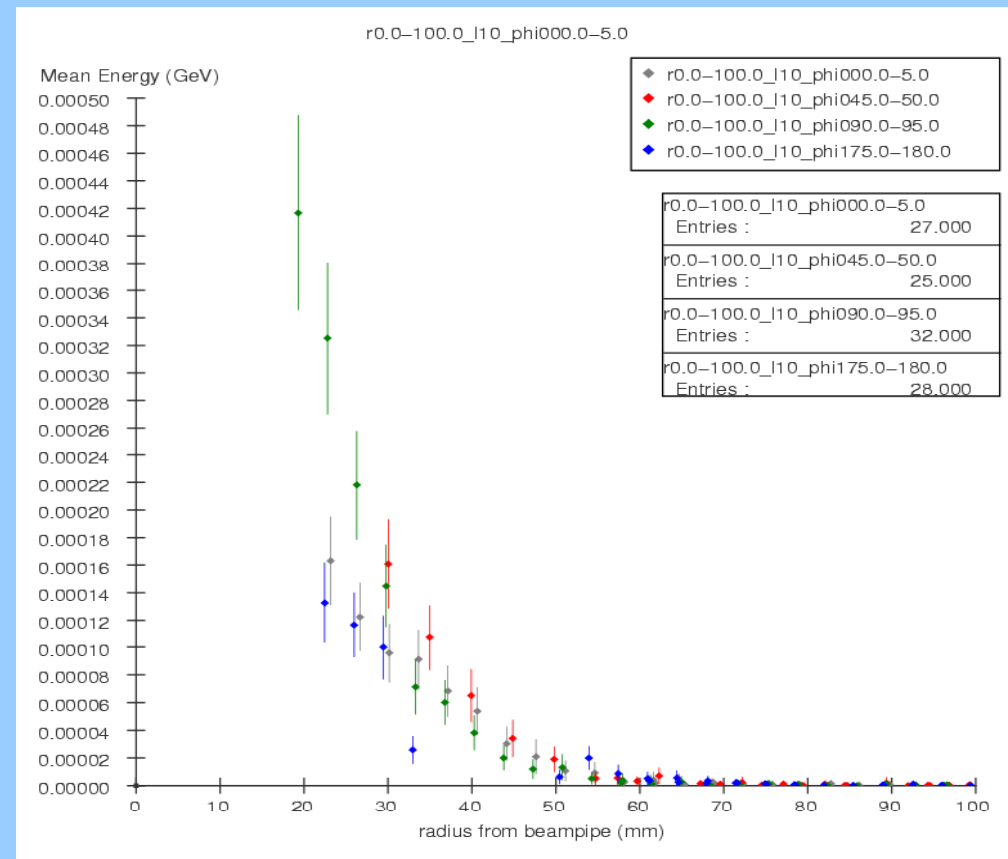
# SiD Talk

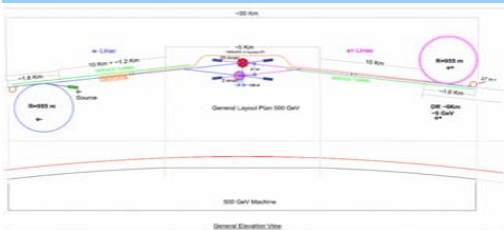


ILC - The International Linear Collider Project

## Beamstrahlung Energy Deposition

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



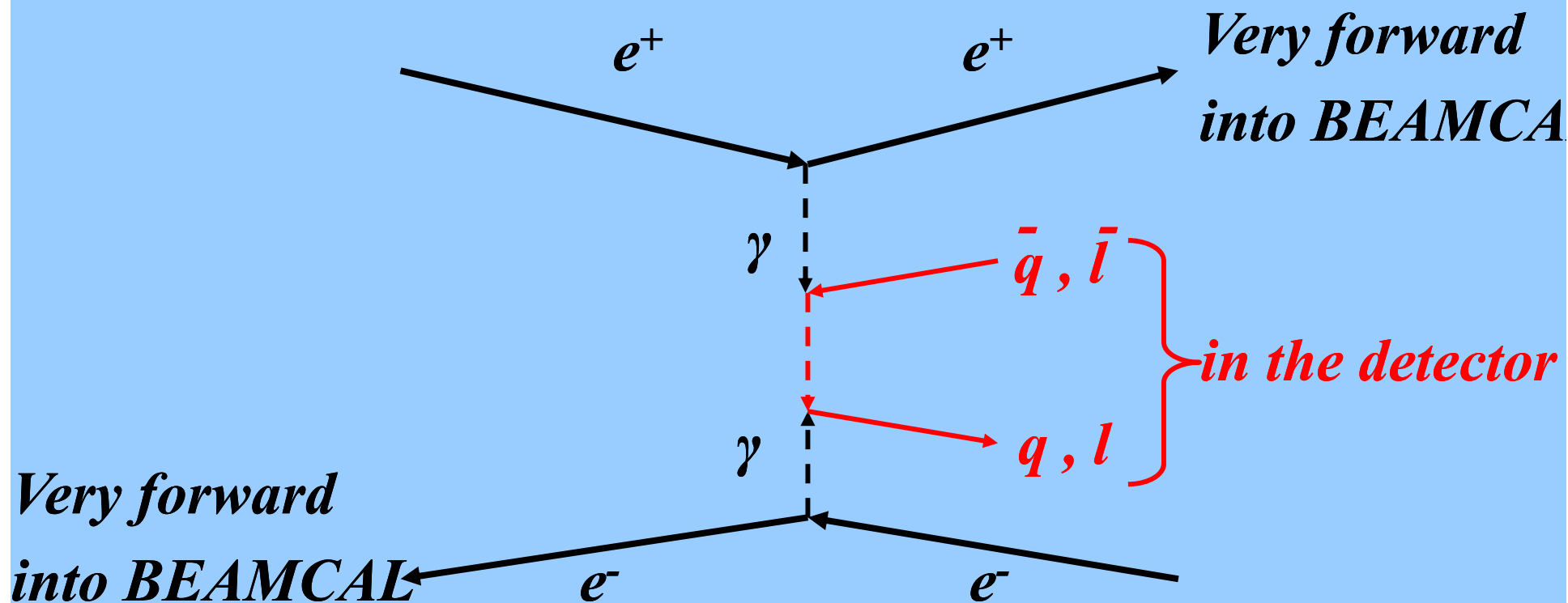


# SiD Talk

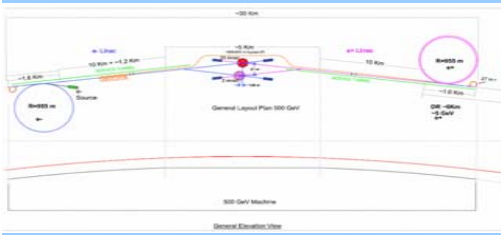


ILC - The International Linear Collider Project

## 2 Photon Process



*Discussion in Beam Cal section at end*



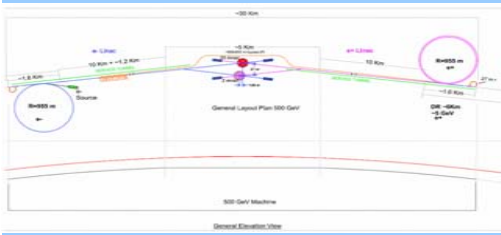
# *SiD Talk*



ILC – The International Linear Collider Project

## *The Simulation Aim*

*We want to determine how far down in  $P_t$  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



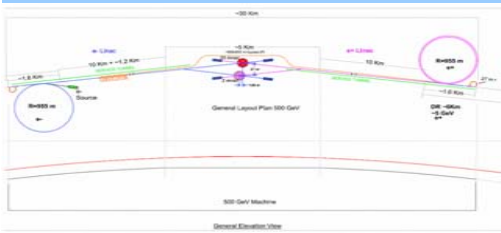
ILC – The International Linear Collider Project

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

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

*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.*

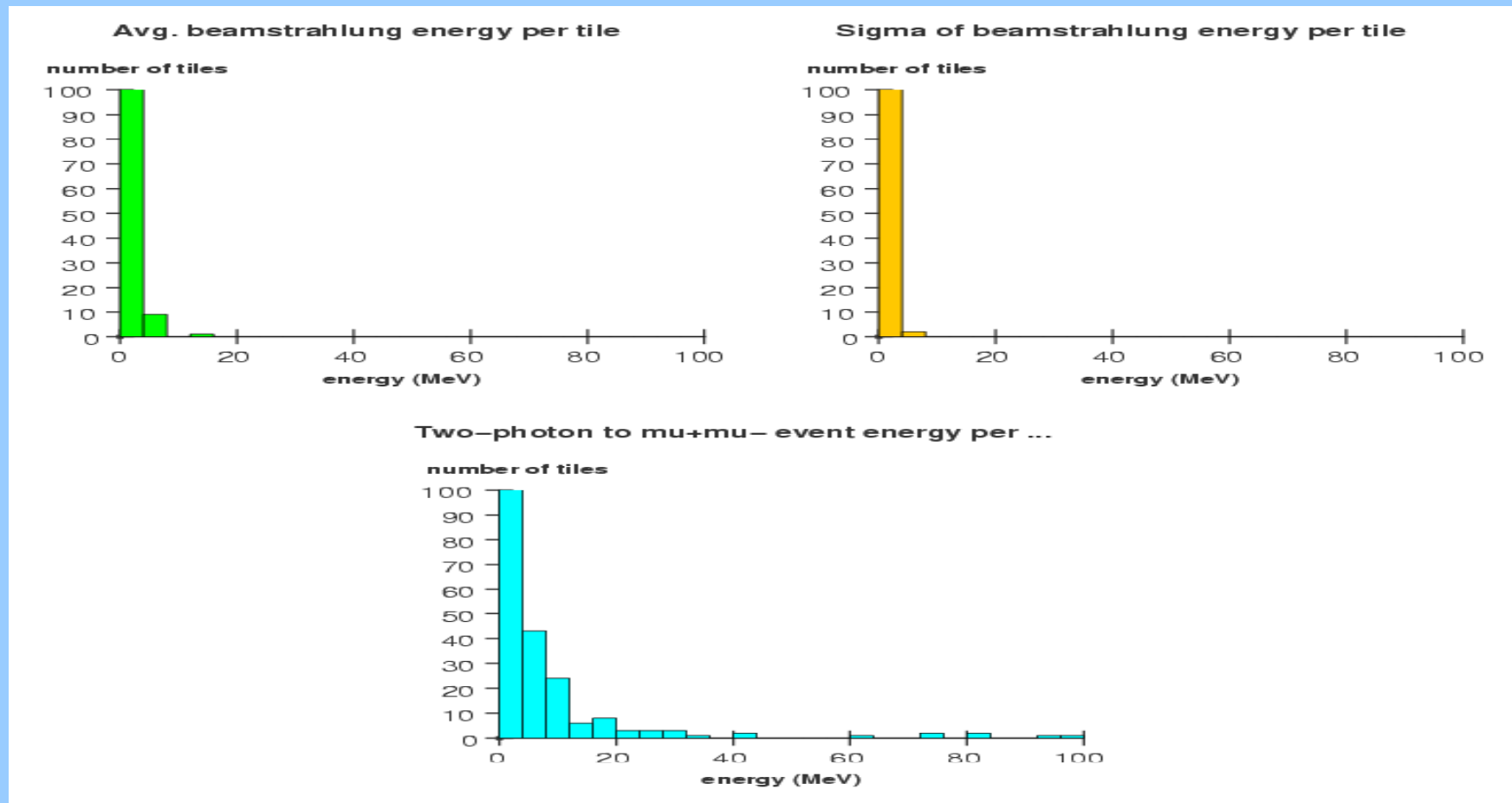


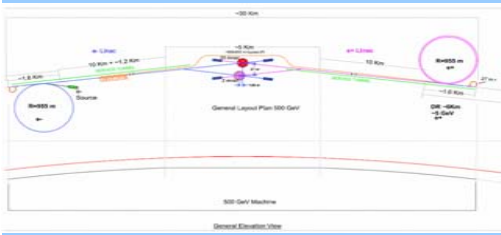
# SiD Talk



ILC - The International Linear Collider Project

## Energy Deposition of the Beamstrahlung and 2-Photon Process



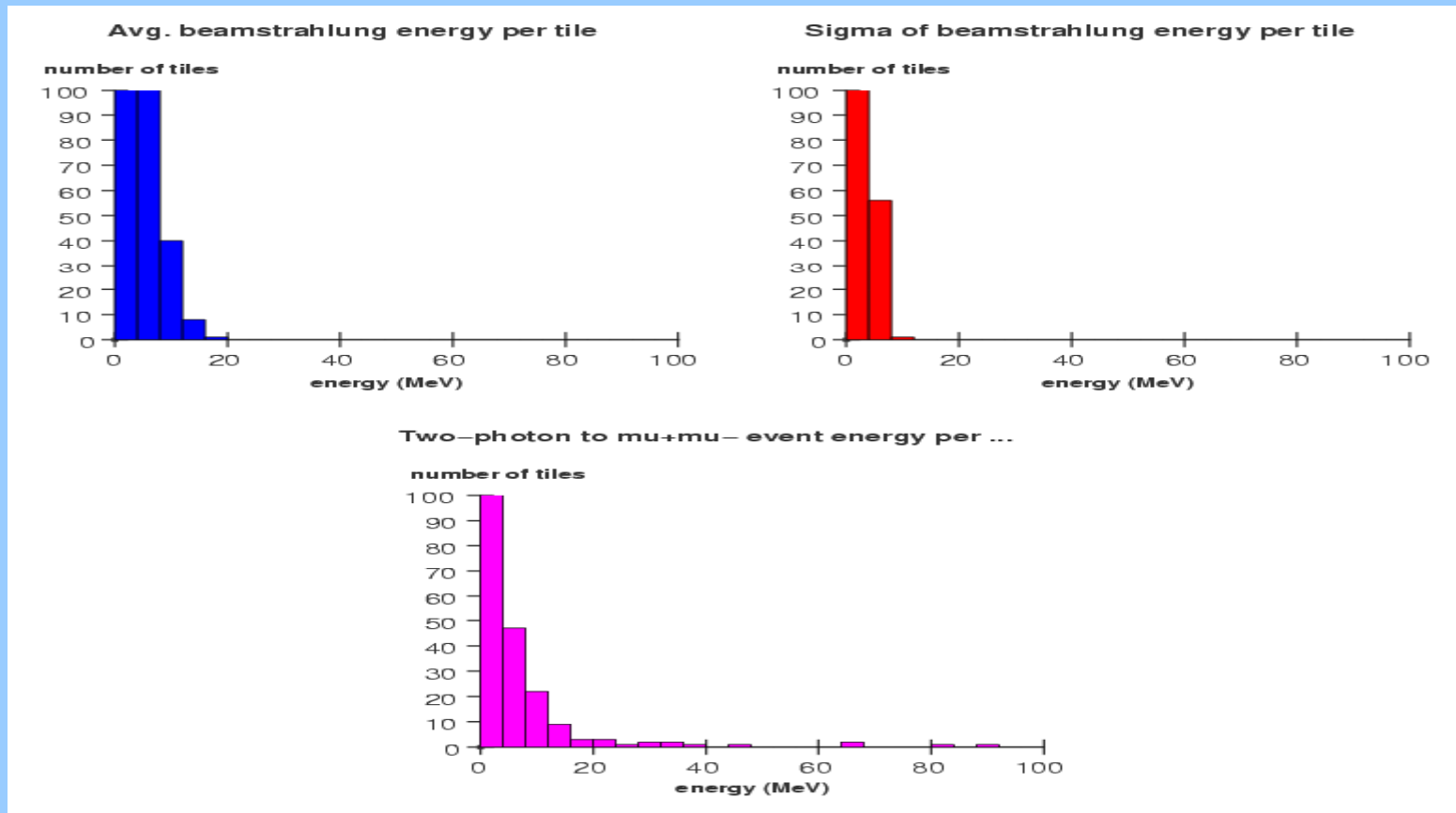


# SiD Talk

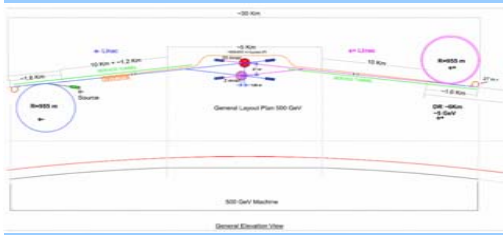


ILC - The International Linear Collider Project

## Energy Deposition of the Beamstrahlung and 2-Photon Process







# *SiD Talk*



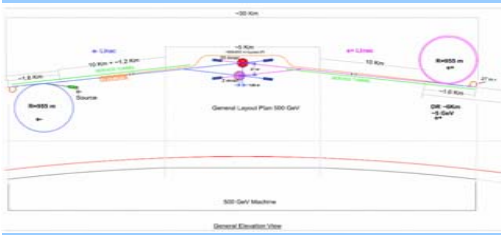
ILC – The International Linear Collider Project

## **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.**



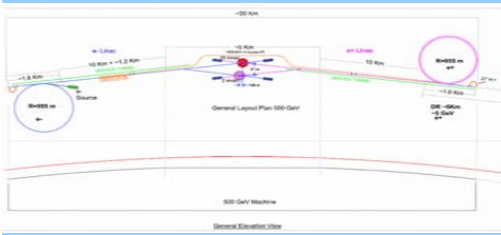
# *SiD Talk*



ILC – The International Linear Collider Project

## *NEXT STEPS*

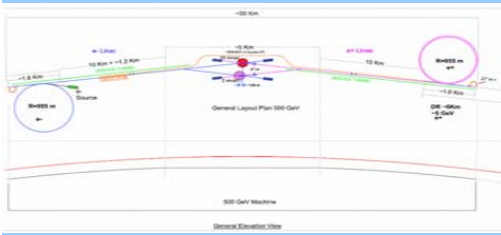
*Overlay 2 photon processes on the beamstrahlung data and extract the energy of the high momentum electrons by removing average energy depositions from beamstrahlung to determine how well we can determine the missing  $P_t$  in order to extract the correct background from extraneous events.*



# *SiD Talk*



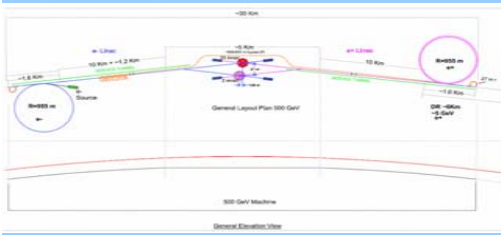
ILC – The International Linear Collider Project



# *SiD Talk*

ILC – The International Linear Collider Project

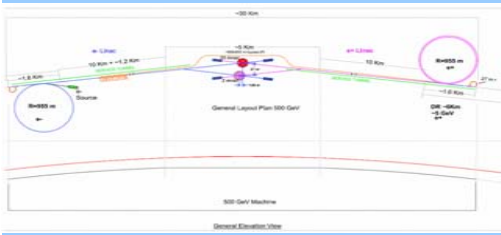




# *SiD Talk*



ILC – The International Linear Collider Project



# *SiD Talk*



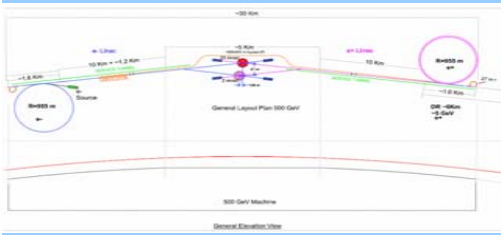
ILC – The International Linear Collider Project

*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  $P_t$ . Needed to measure the masses.*

*Work by Paul Steinbrecher and Gleb Oleinik*

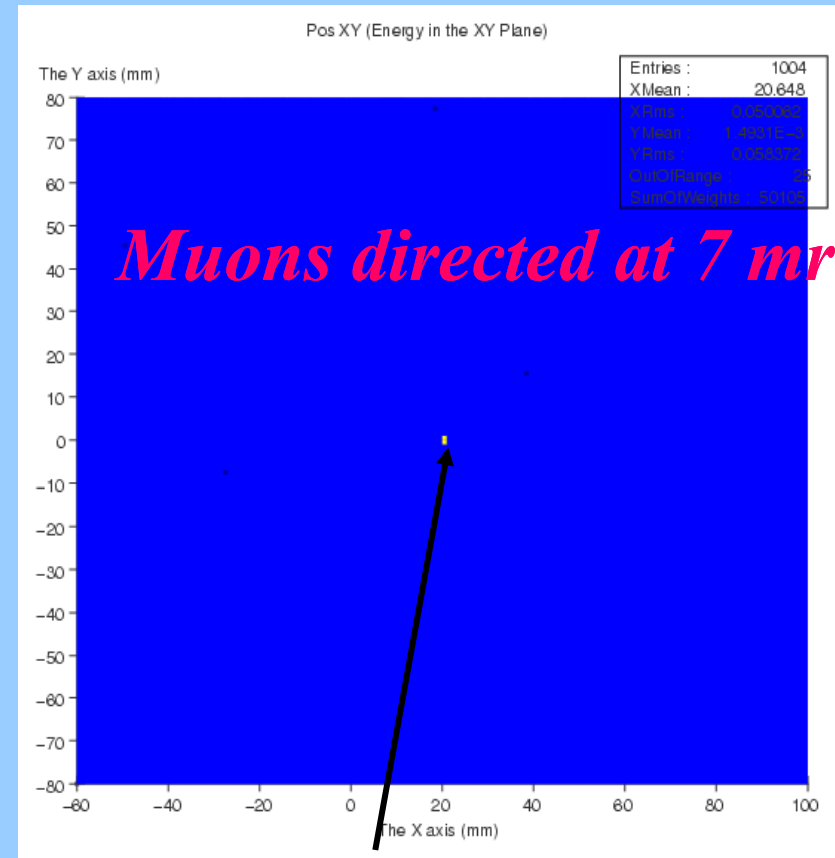
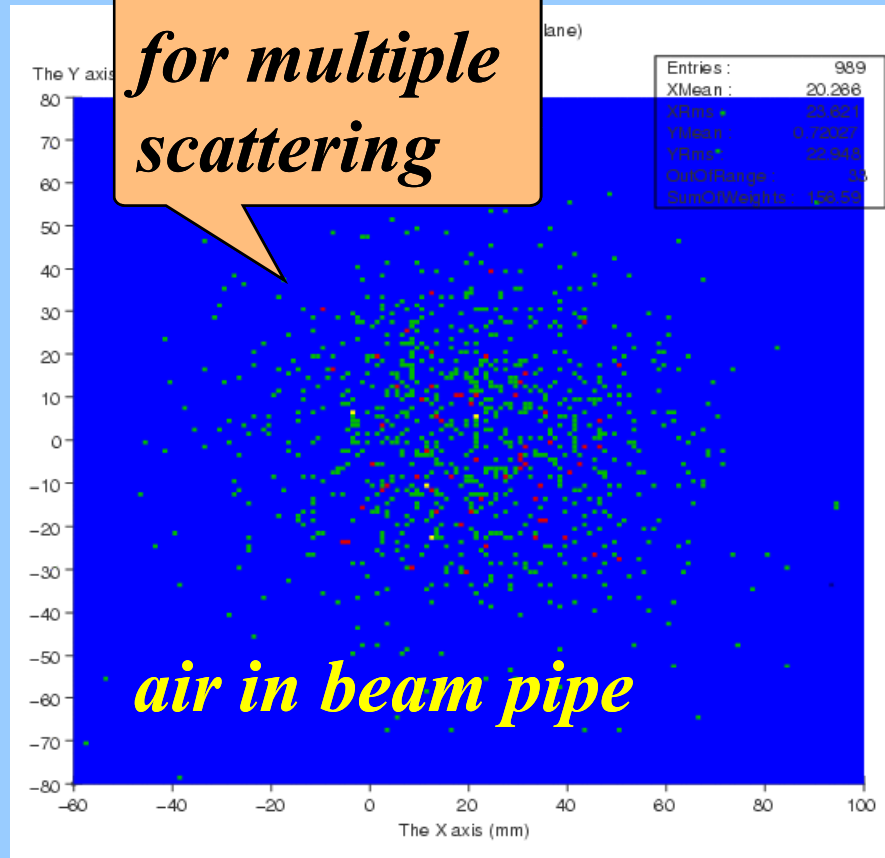
# SiD Talk



ILC - The International Linear Collider Project

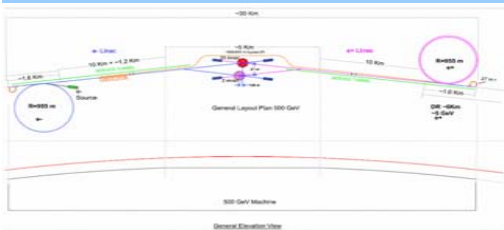
## Testing GEANT 4.0

*Evidence for multiple scattering*



*No field, 50 MeV muons*

*No field, 50 GeV muons*



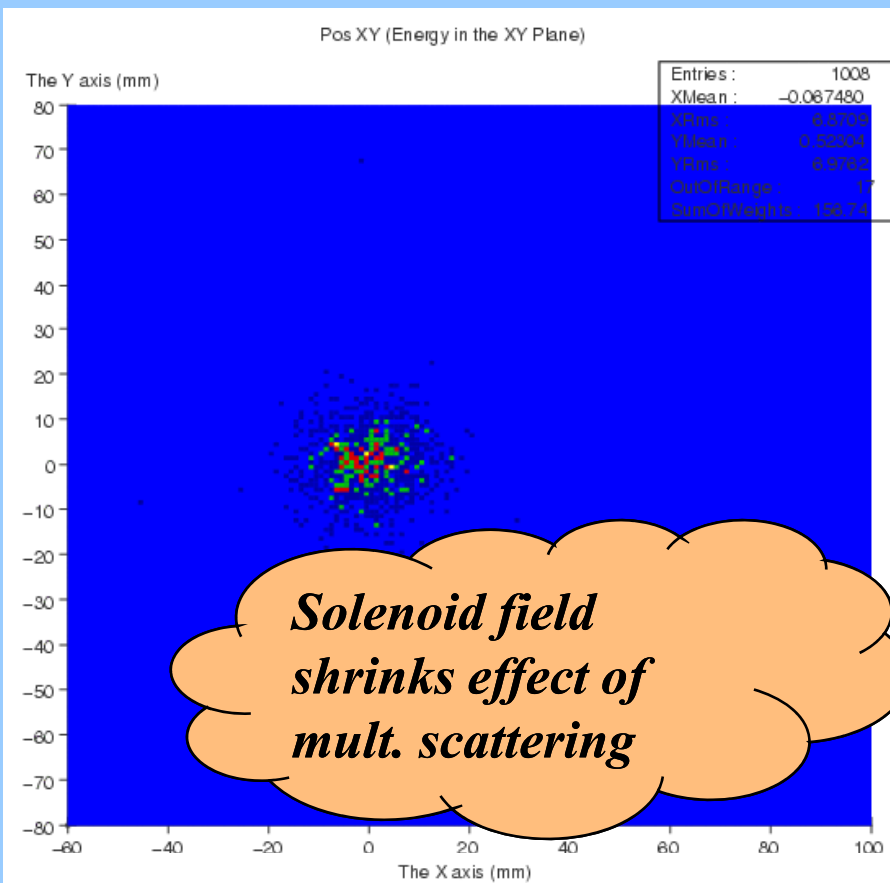
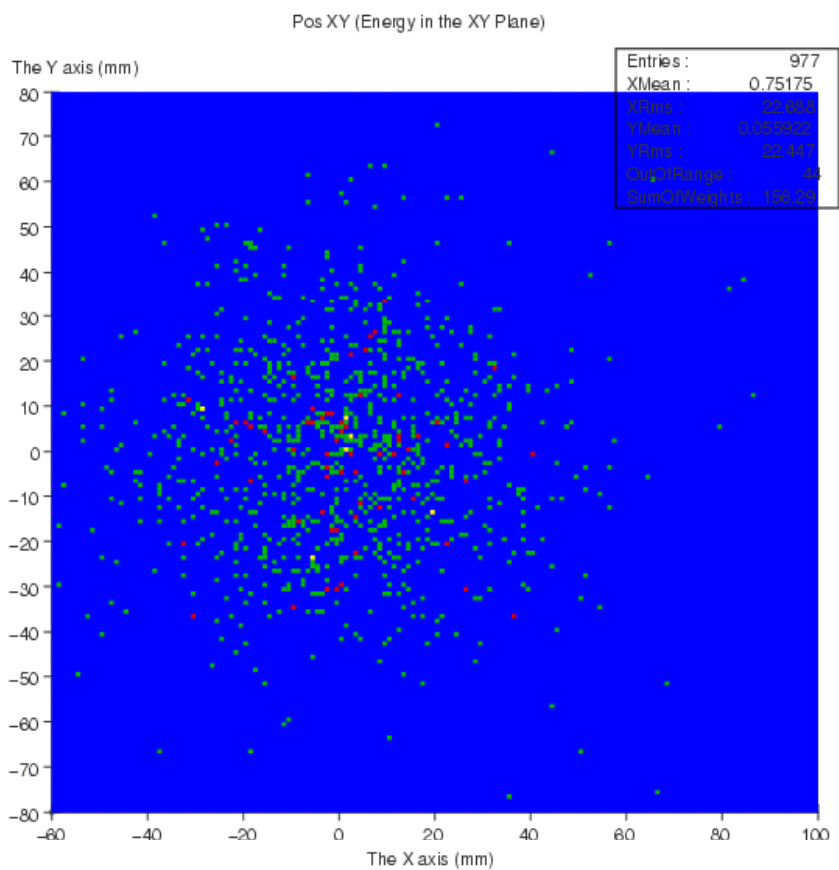
# SiD Talk



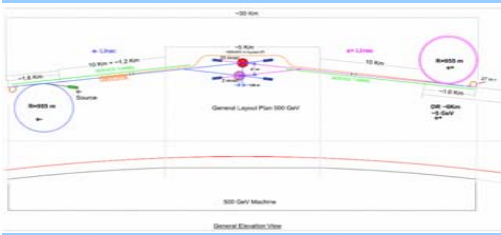
ILC - The International Linear Collider Project

*50 MeV, no field, forward*

*50 MeV, solenoid on, forward*







# *SiD Talk*

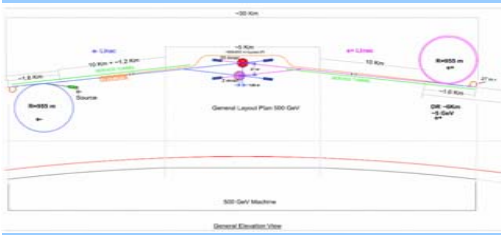


ILC – The International Linear Collider Project

*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  $L^* \sim 350$  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

