TESLA R&D: LCAL/LAT

Cracow
Tel Aviv
Minsk
Prague
Colorado
Protvino
UCL London
Dubna

Achim Stahl
DESY Zeuthen
A Standard $e^+e^-$ Detector
Two Challenges

Excellent Performance

- momentum resolution: \( \delta p/p = 5 \times 10^{-5} \)
- impact parameter: \( \delta I P < 5 \mu m \)
- photon energy: \( \delta E/E \sim 0.1 / \sqrt{E} + 0.01 \)
- jet energy: \( \delta E/E \sim 0.3 / \sqrt{E} \)

Beam Strahlung

- huge background created by beam-beam interaction
- affects area very close to the beam pipe
Proposal: 2-Year R&D Program

Instrumentation of the very forward region

**LumCal**
Calorimeter for Precision luminosity measurement

**BeamCal**
Measurement of Beam-Strahlung and Veto of Electrons
Background-Info: Beam-Strahlung

Radiation created in the electromagnetic fields of the bunches

Mainly photons, but $e^+e^-$ pairs get deflected into the detector

- $10 \ldots 20$ TeV per BX per Side
- typ. 10000 electrons/positrons
- mean energy of 1 GeV
The very forward region:

Design from the TDR
The very forward region: The Tasks

Interaction of beam-strahlung with beam pipe quadrupole, etc.

Shielding of the tracking volume against backscattered particles

• Masking
Precision Luminosity

Goal: $10^{-4}$ Precision  (LEP: $3.4 \times 10^{-4}$)

- Theorists working (T. Riemann et al.)
- Physics case: $\sigma_{\text{had}}$ for Giga-Z 2-fermion cross section
- Technology: Si-W Sandwich Cal.
- First simulation: difficult
Two-Photon Events: Significant Background to Searches, if scattered electron is not detected

Initial Simulation:

Veto: 100 GeV $e^-$
- Beam Energy: 250 GeV
- False Vetos: 1% Physics
  2% Fakes

- Masking
- Precision Lumi
- Electron Veto
- 2-Photon-Tags
Fast Beam Diagnosis

Energy Distribution of Beam-Strahlung depends on Charge Distribution of Bunches

Initial Simulation:
Possible to measure several parameters from a few bunches

- Masking
- Precision Lumi
- Electron Veto
- 2-Photon-Tags
- fast beam diag
- Energy flow
- .......

![Graph showing energy distribution](image)
LumiCal (LAT) Technology:

Si-W Sandwich Calorimeter (as ECal)

BeamCal (LCal) Technologies:

Requirements:

- Small Molière Radius
- High Granularity (transverse)
- Longitudinal Segmentation
- Radiation Hardness (< 10 MGy/year)
BeamCal Potential Technologies:

- tungsten sandwich
  - Si or Diamond sensors
- Tungsten sandwich
  - with passive gas gaps
- Xtal calorimeter
  - with fiber readout
- Xtal calorimeter
  - with thin phototriodes
Proposal: 2-Year R&D Program

Instrumentation of the very forward region

**LumCal**
- Design & Simulation
- Exp. Limitations
- Physics Needs

**BeamCal**
- Lab Tests & Simulation
- Identify most suitable technology