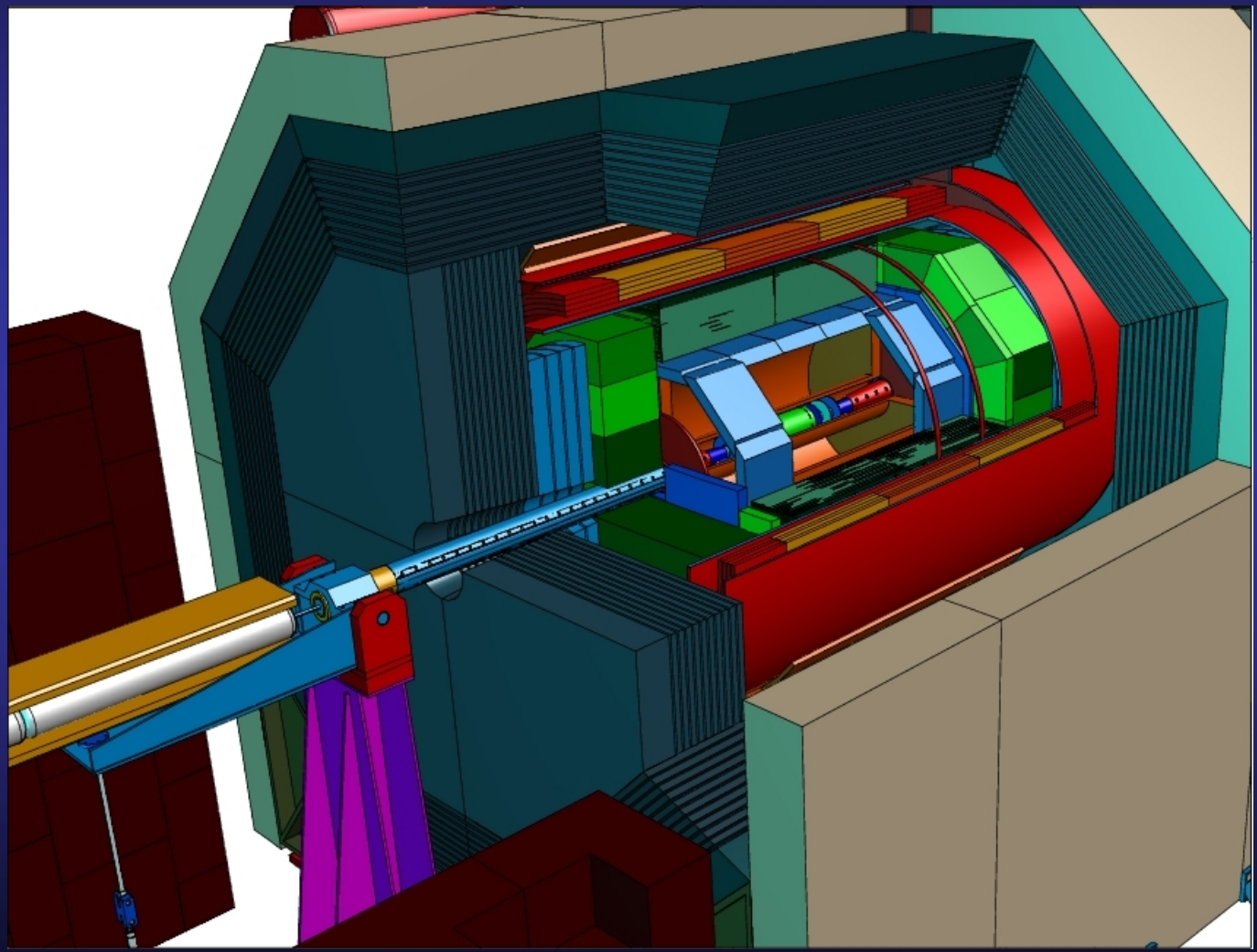
TESLA R&D: LCAL/LAT

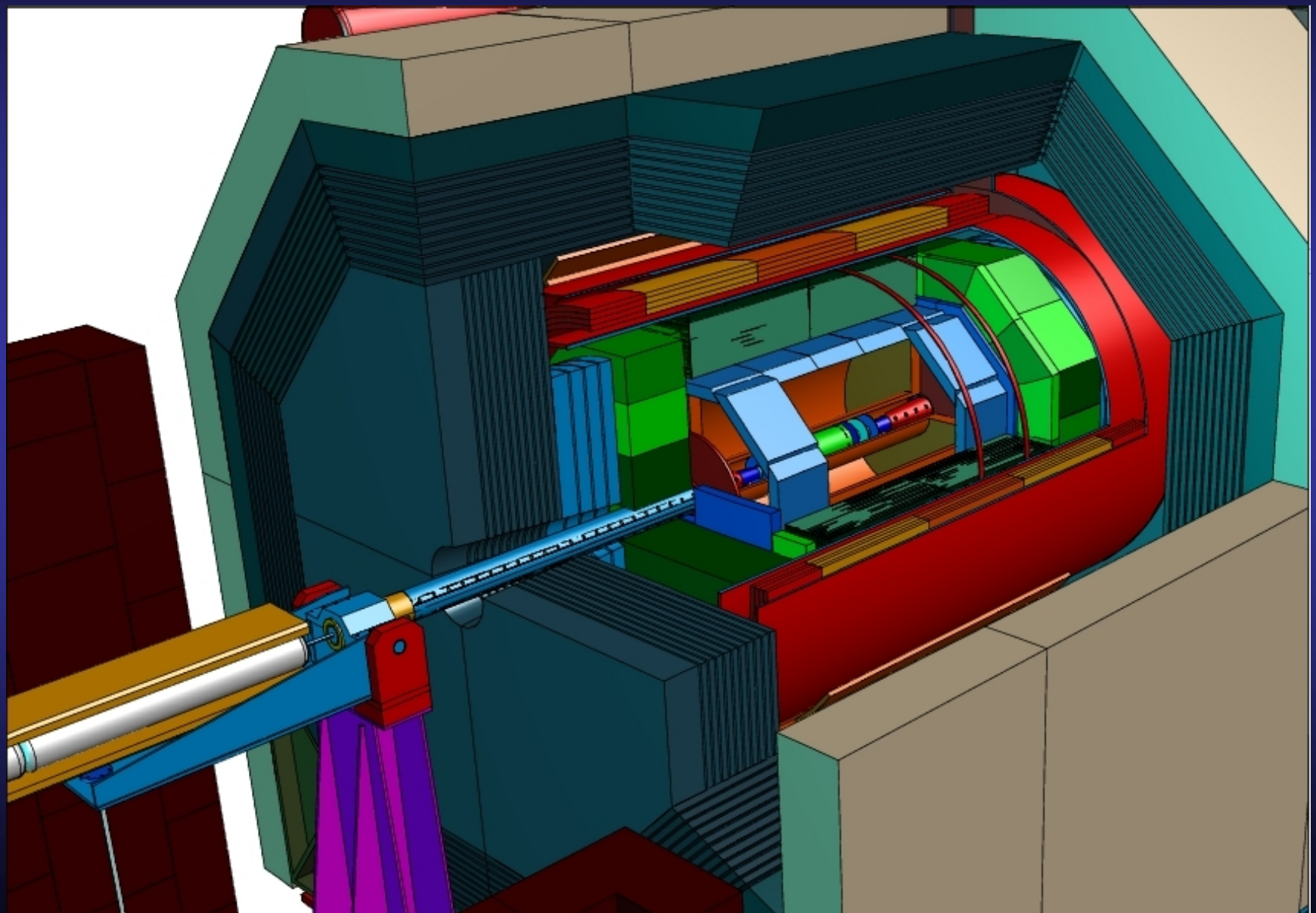


Cracow
Tel Aviv
Minsk
Prague
Colorado
Protvino
UCL London
Dubna

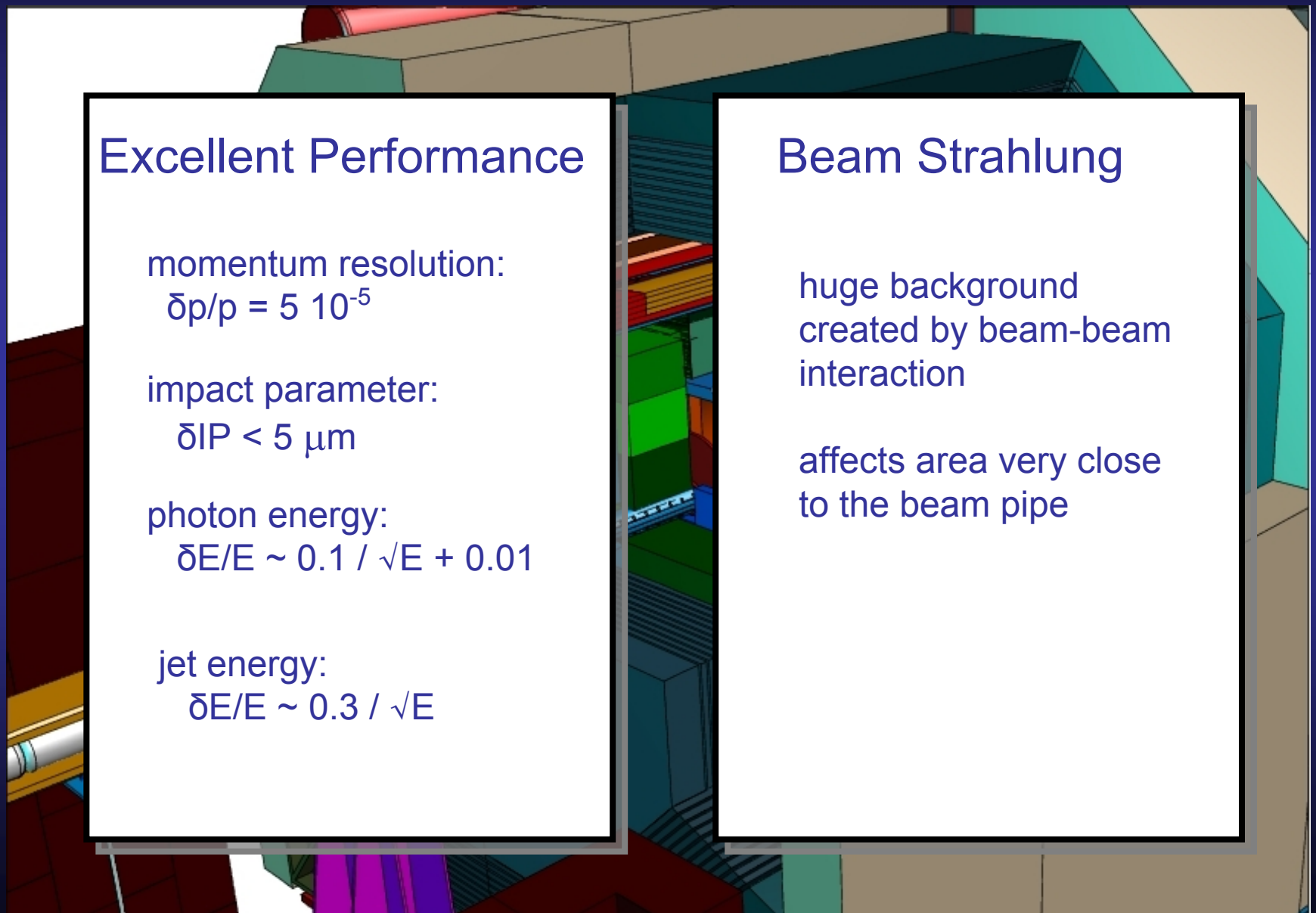
Achim Stahl

DESY Zeuthen

A Standard e^+e^- Detector



Two Challenges



Excellent Performance

momentum resolution:
$\delta p/p = 5\ 10^{-5}$

impact parameter:
$\delta IP < 5\ \mu m$

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

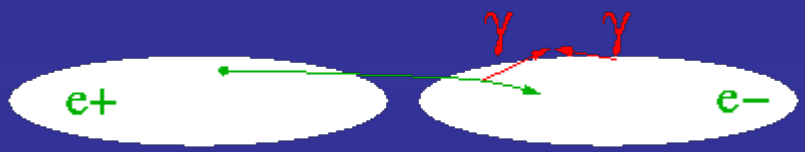
and

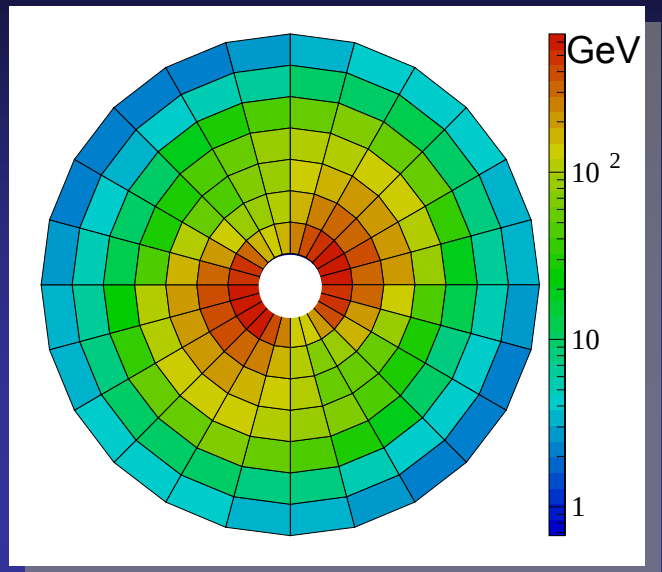
Veto of Electrons

Background-Info: Beam-Strahlung

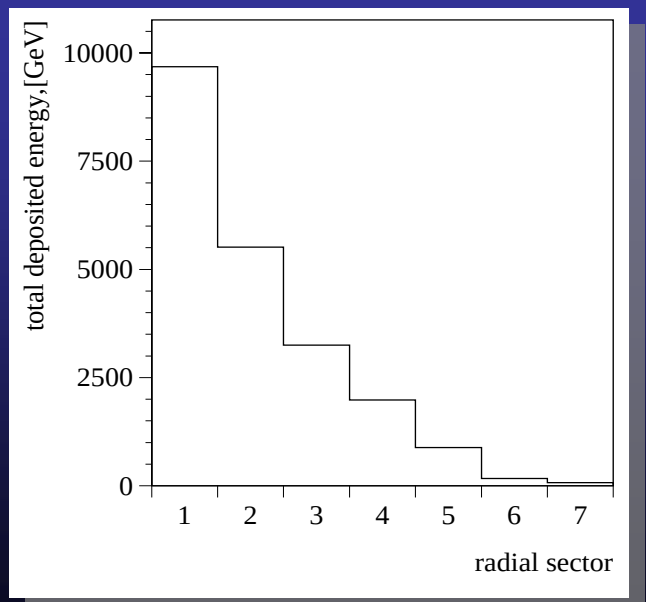
Radiation created in the electro-magnetic fields of the bunches

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

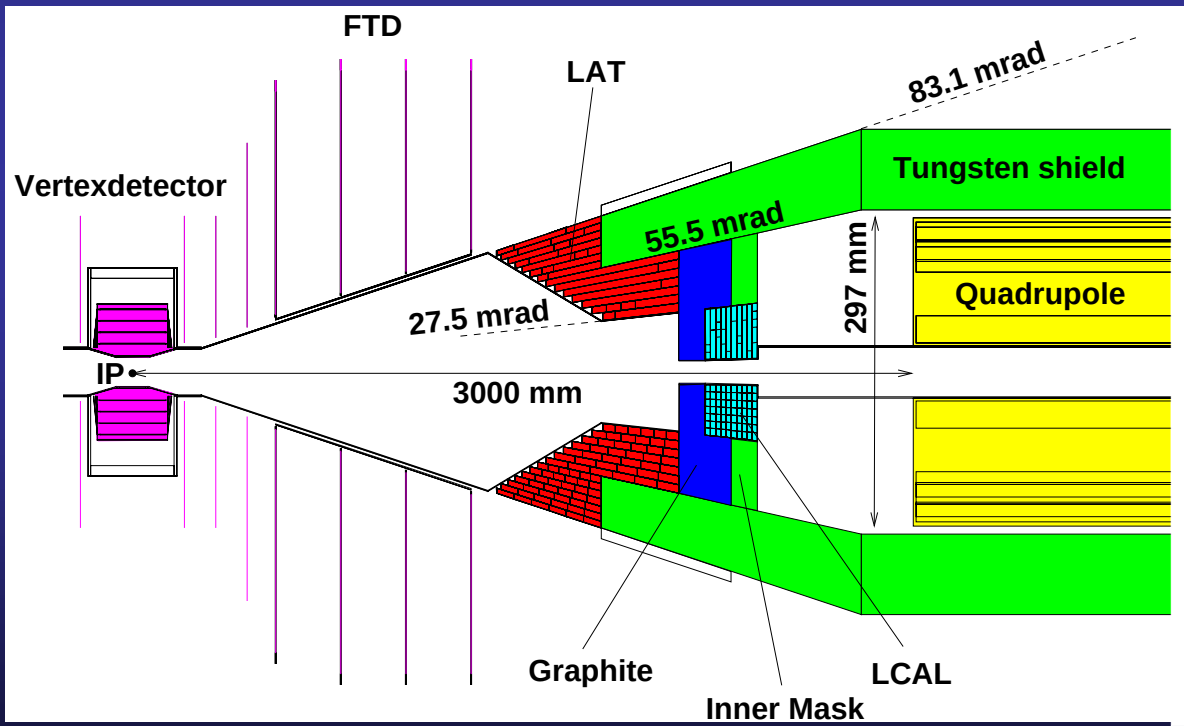




- 10 … 20 TeV per BX per Side
- typ. 10000 electrons/positrons
- mean energy of 1 GeV



The very forward region:



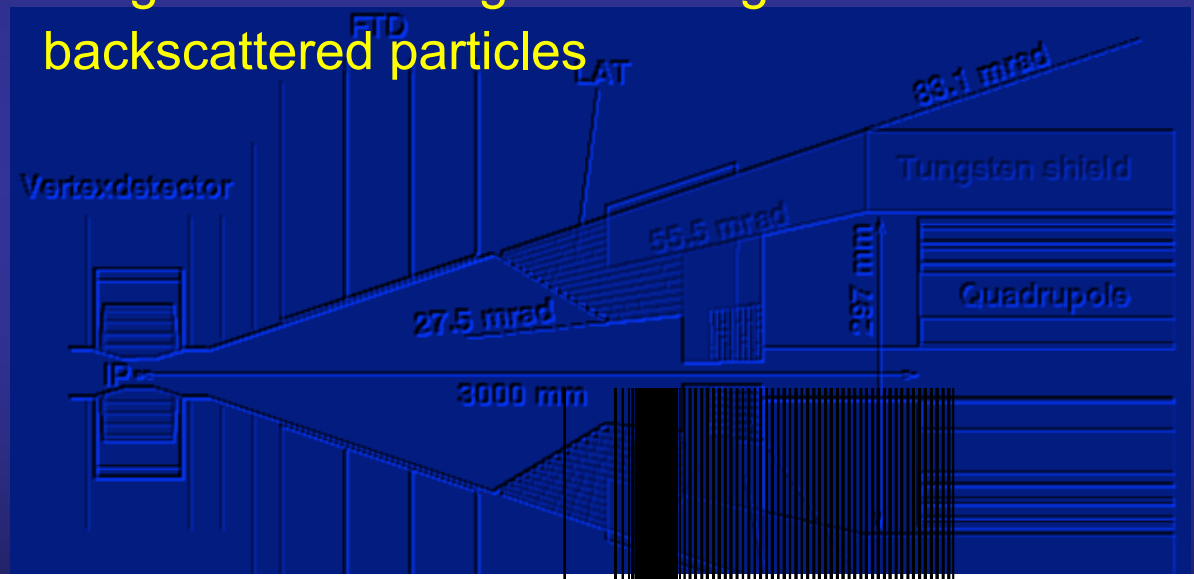
Design from the TDR

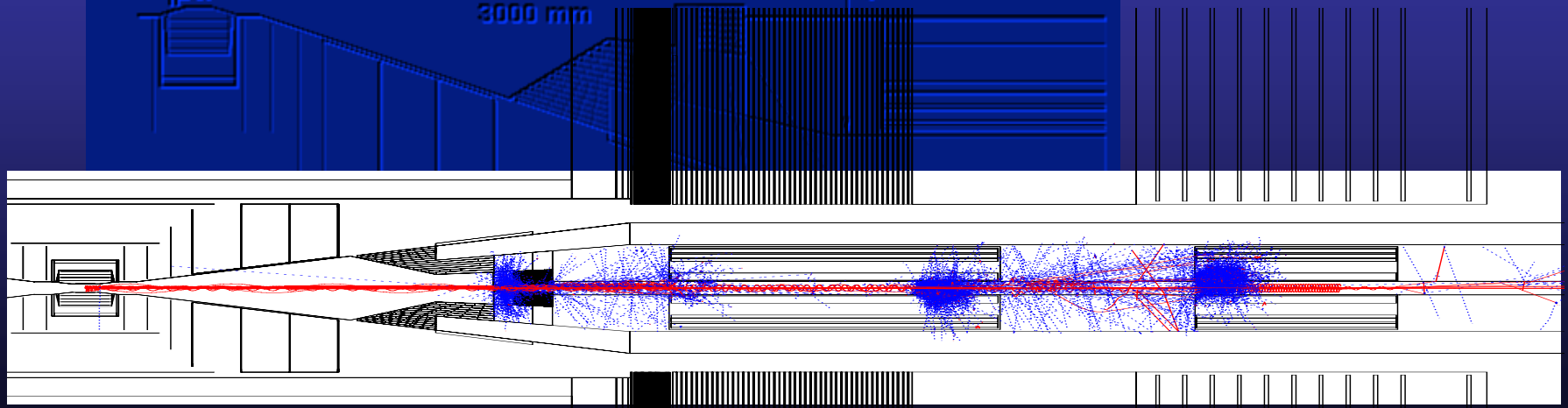
The very forward region: The Tasks

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

Shielding of the tracking volume against backscattered particles

- Masking



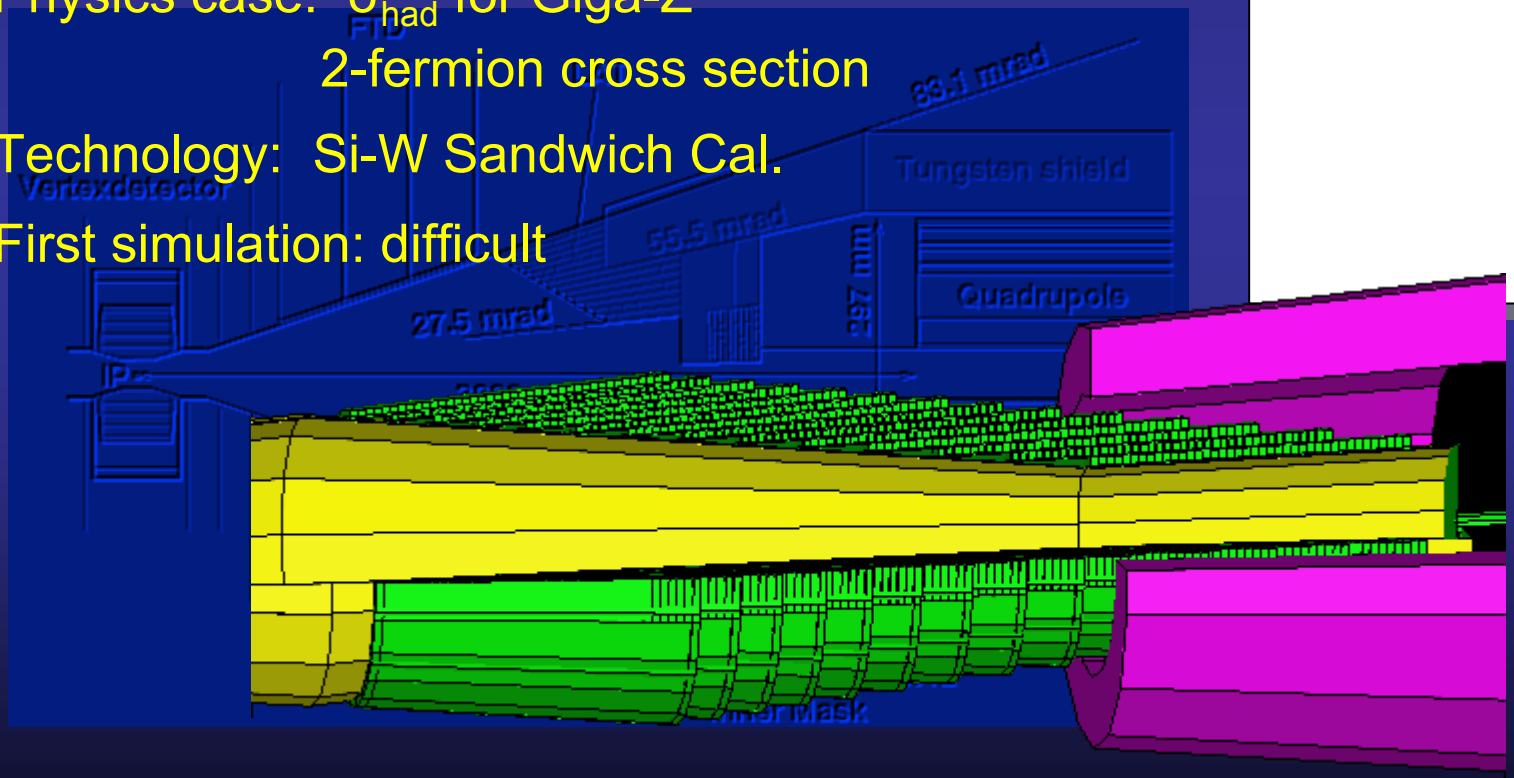


Precision Luminosity

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

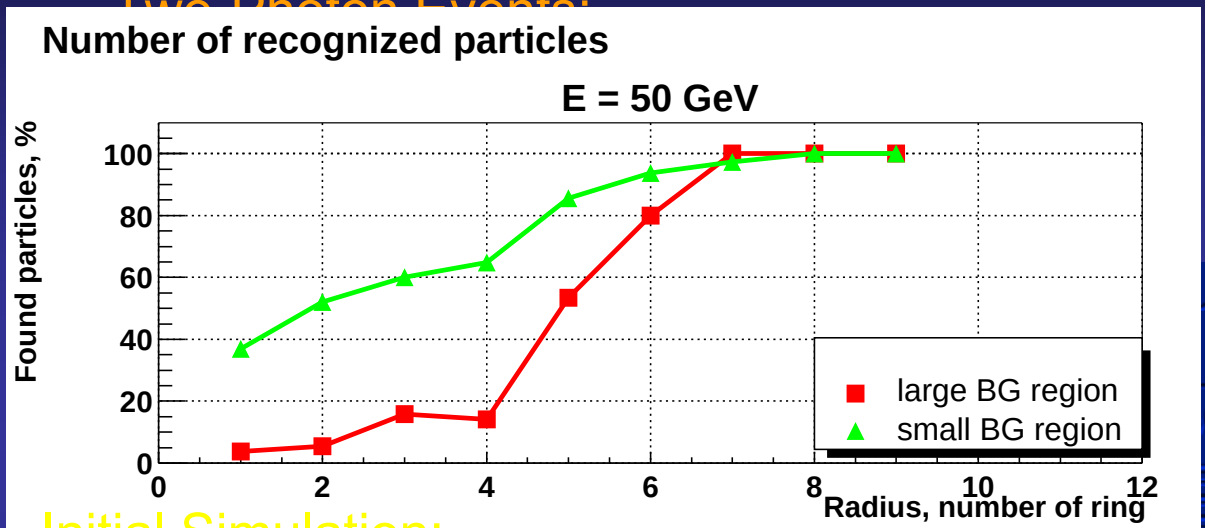
- Theorists working (T. Riemann et al.)
- Physics case: σ_{had} for Giga-Z
  2-fermion cross section
- Technology: Si-W Sandwich Cal.
- First simulation: difficult

- Masking
- Precision Lumi

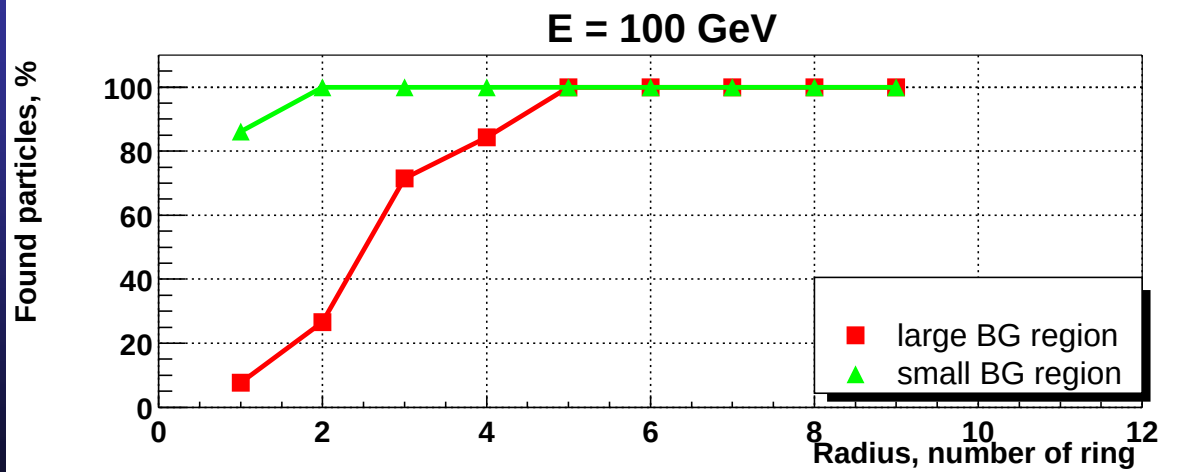


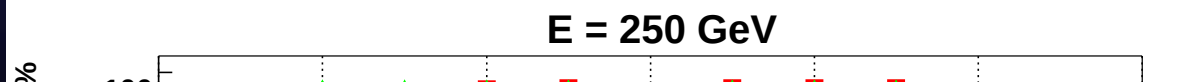
Veto: High Energetic Electrons

Two Photon Events:



Initial Simulation:



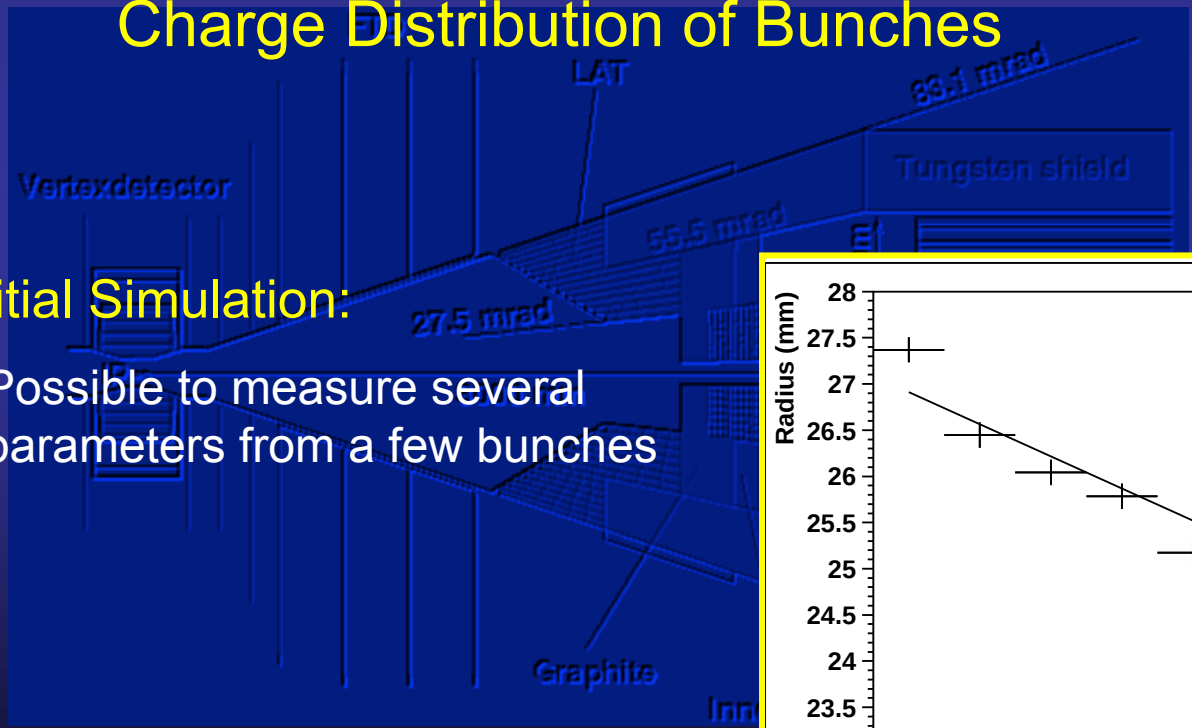


- Masking
- Precision Lumi
- Electron Veto
- 2-Photon-Tags

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

Fast Beam Diagnosis

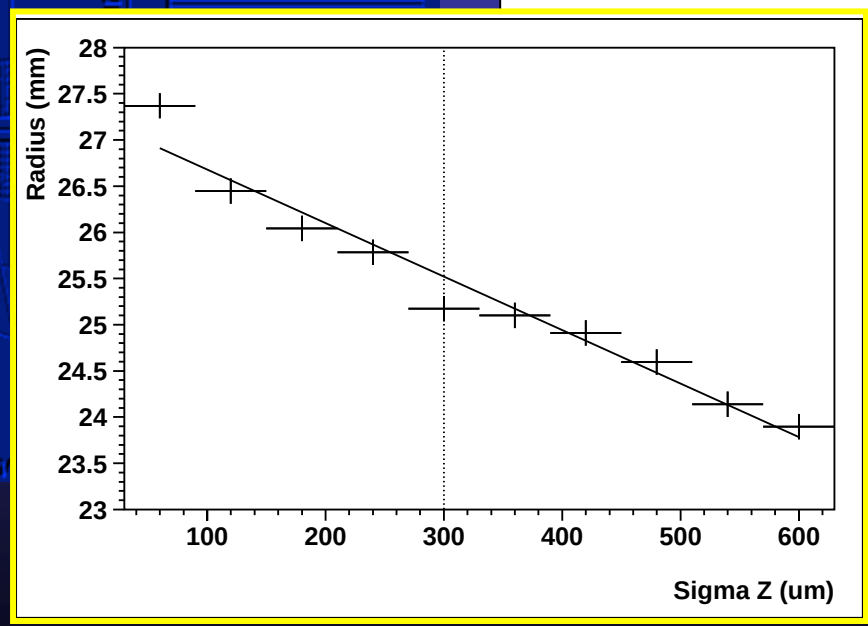
Energy Distribution of Beam-Strahlung
depends on
Charge Distribution of Bunches



Initial Simulation:

Possible to measure several parameters from a few bunches

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



LumiCal (LAT) Technology:

Si-W Sandwich Calorimeter (as ECal)

BeamCal (LCal) Technologies:

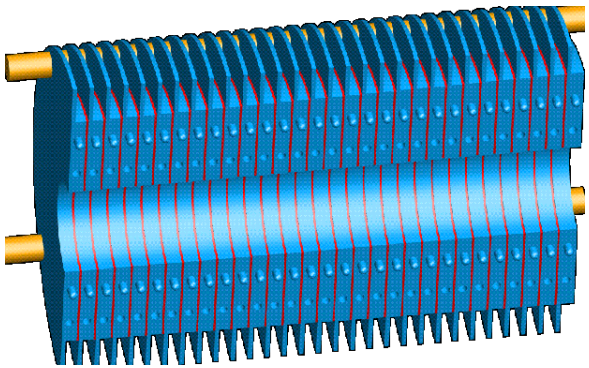
Requirements:

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

BeamCal Potential Technologies:

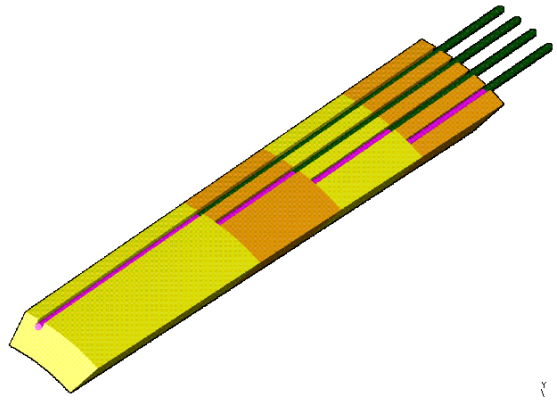
tungsten sandwich

Si or Diamond sensors



Xtal calorimeter

with fiber readout



Tungsten sandwich

with passive gas gaps

Xtal calorimeter

with thin phototriodes

Proposal: 2-Year R&D Program

Instrumentation of the very forward region

LumCal	BeamCal
Design & Simulation	Lab Tests & Simulation
Exp. Limitations Physics Needs	Identify most suitable technology