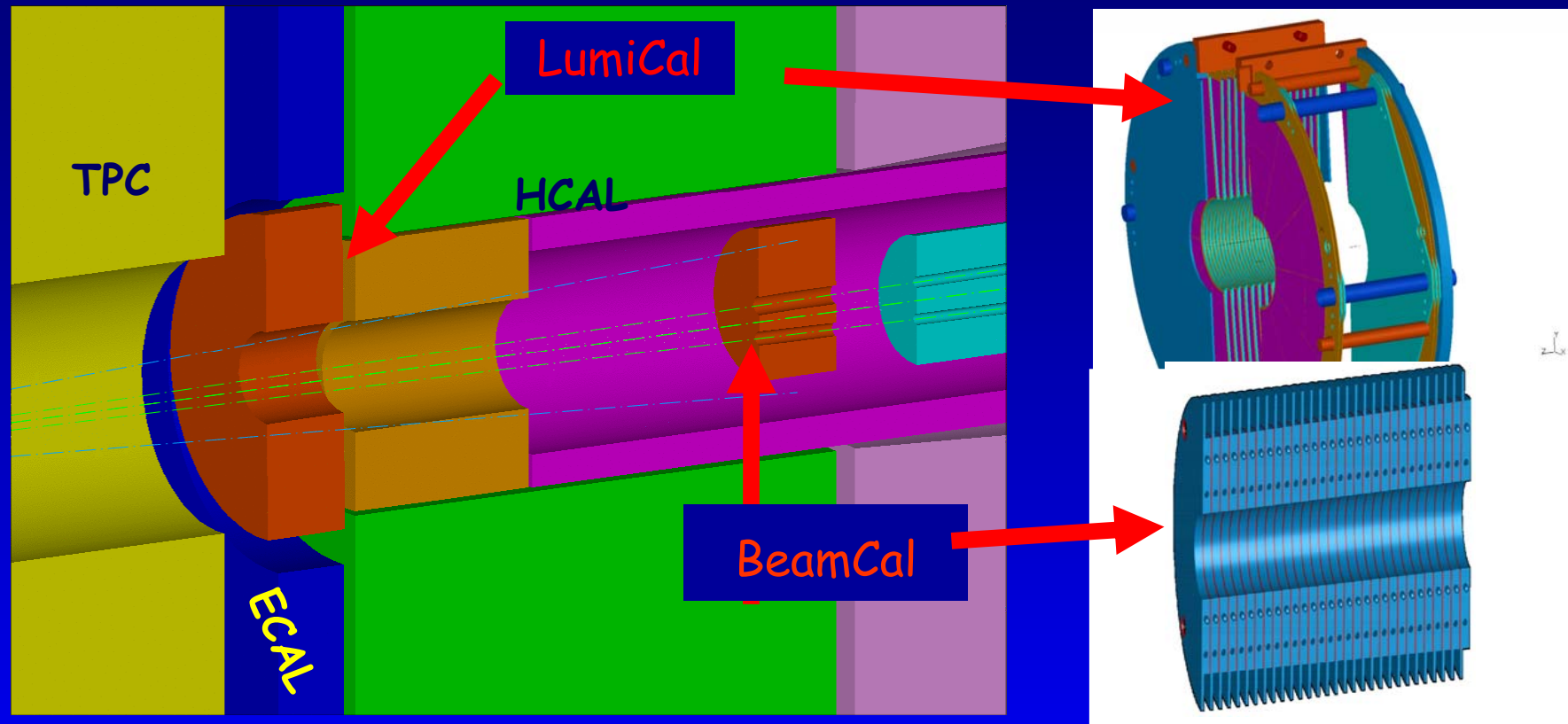


Very Forward Instrumentation of the ILC Detector



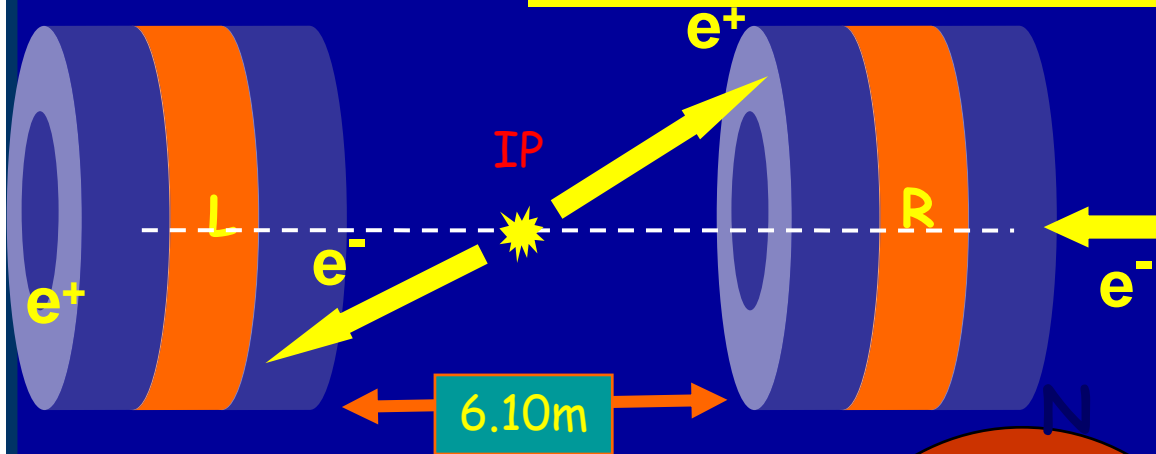
Wolfgang Lohmann,
DESY

BeamCal and LumiCal (Example LDC, 14 mrad):



- precise (LumiCal) and fast (BeamCal) luminosity measurement
- hermeticity (electron detection at low polar angles)
- mask for the inner detectors
- GamCal ~150 m downstream for fast luminosity

Measurement of \mathcal{L}



$$\mathcal{L} = N / \sigma$$

Count
Bhabha
events

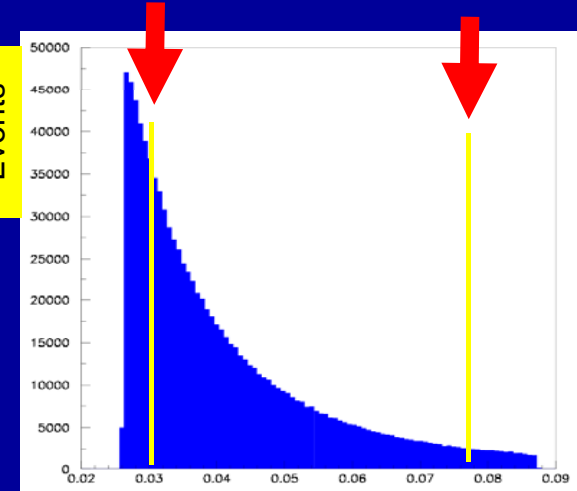
From
theory

Goal: Precision $< 10^{-3}$

Inner acceptance radius : $< 10 \mu\text{m}$

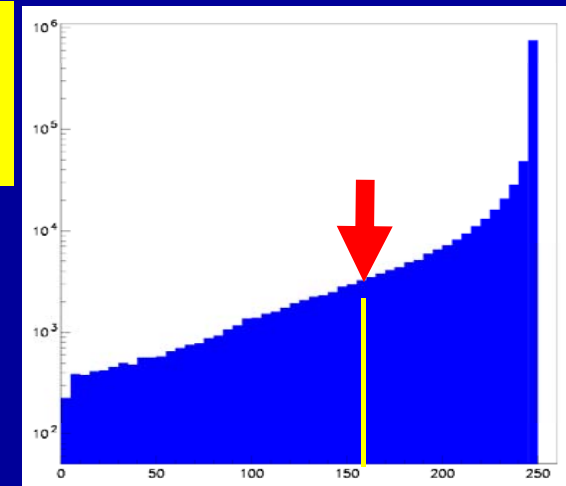
Distance between Calorimeters: $< 600 \mu\text{m}$

Beam position inside Calorimeter: $< 1000 \mu\text{m}$



Events

Θ , (rad)



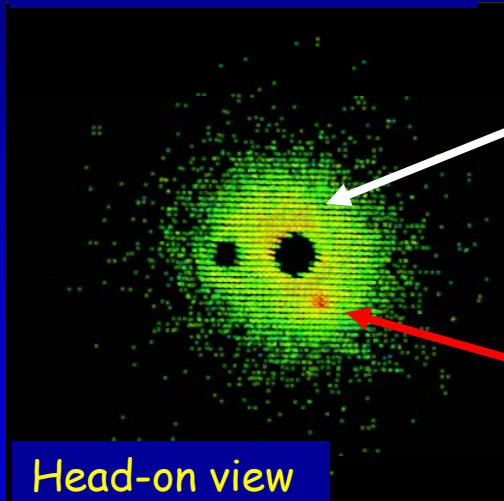
Events

Energy (GeV)

Precise mechanics, finely segmented, compact and homogeneous calorimeter

BeamCal Functions

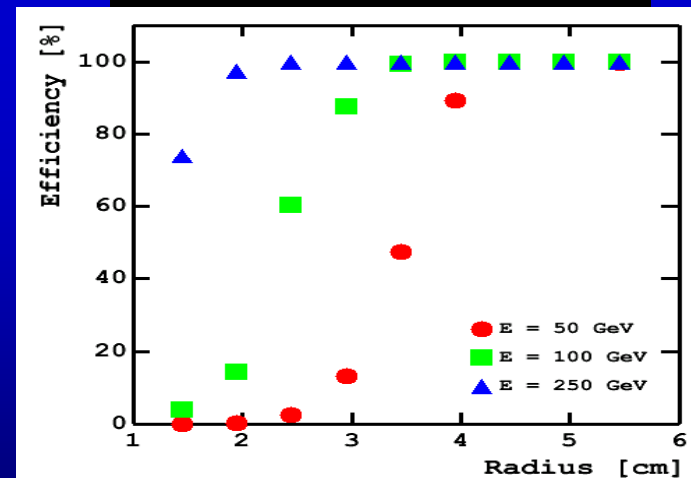
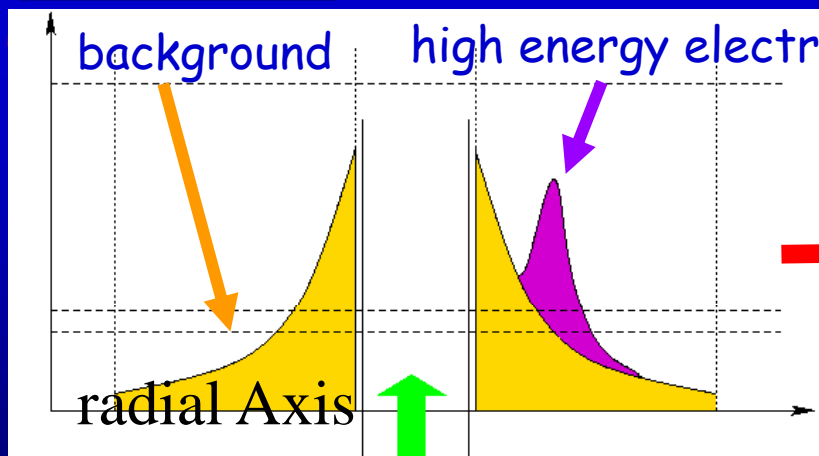
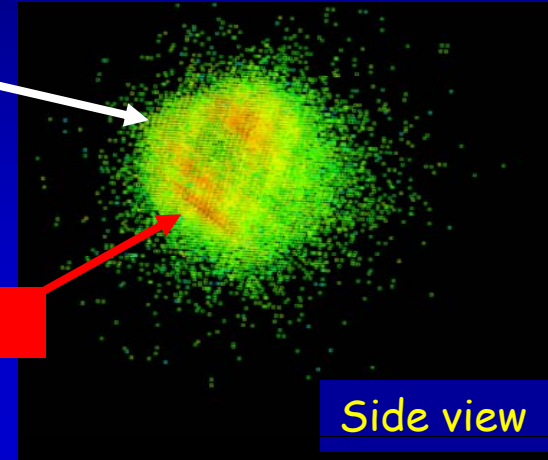
E.g. from UC Boulder



Beamstrahlung
TeV per BX

electron from 2γ process

Efficient detection of high energy electrons is essential for search experiments

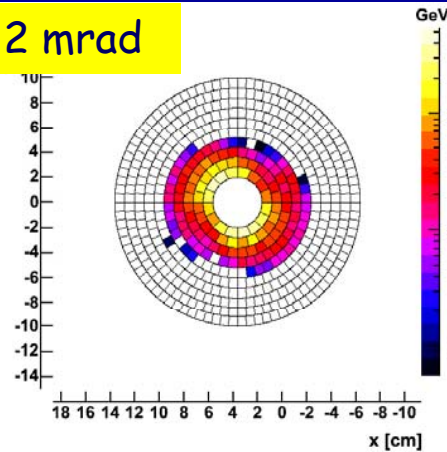


Finely segmented, compact calorimeter with fast readout

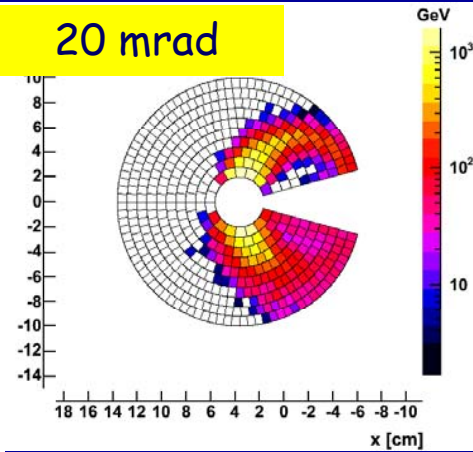
BeamCal & GamCal

Determination of beam parameters from beamstrahlung depositions on BeamCal:

2 mrad

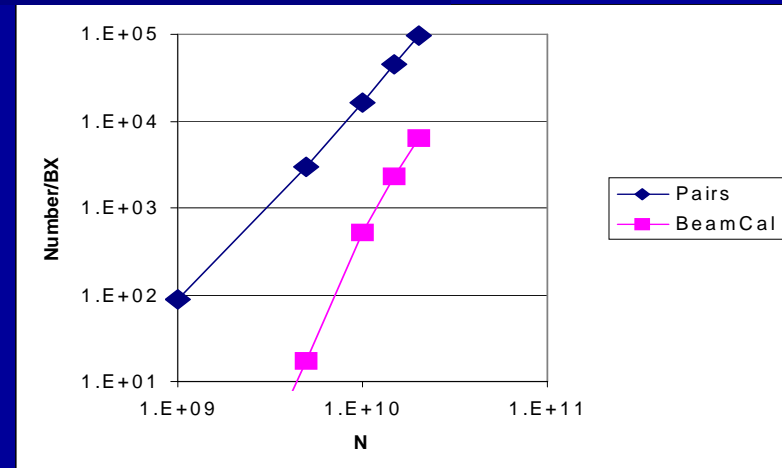
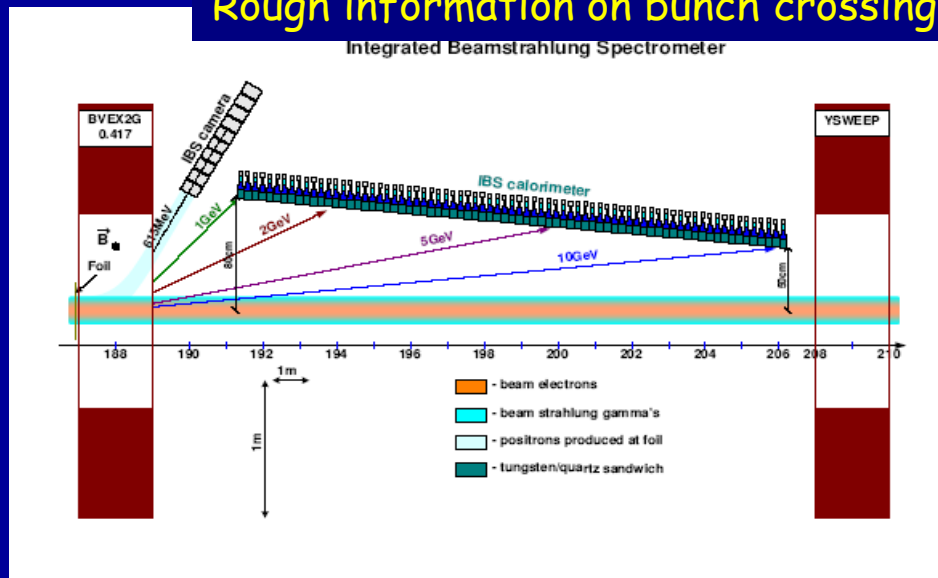


20 mrad



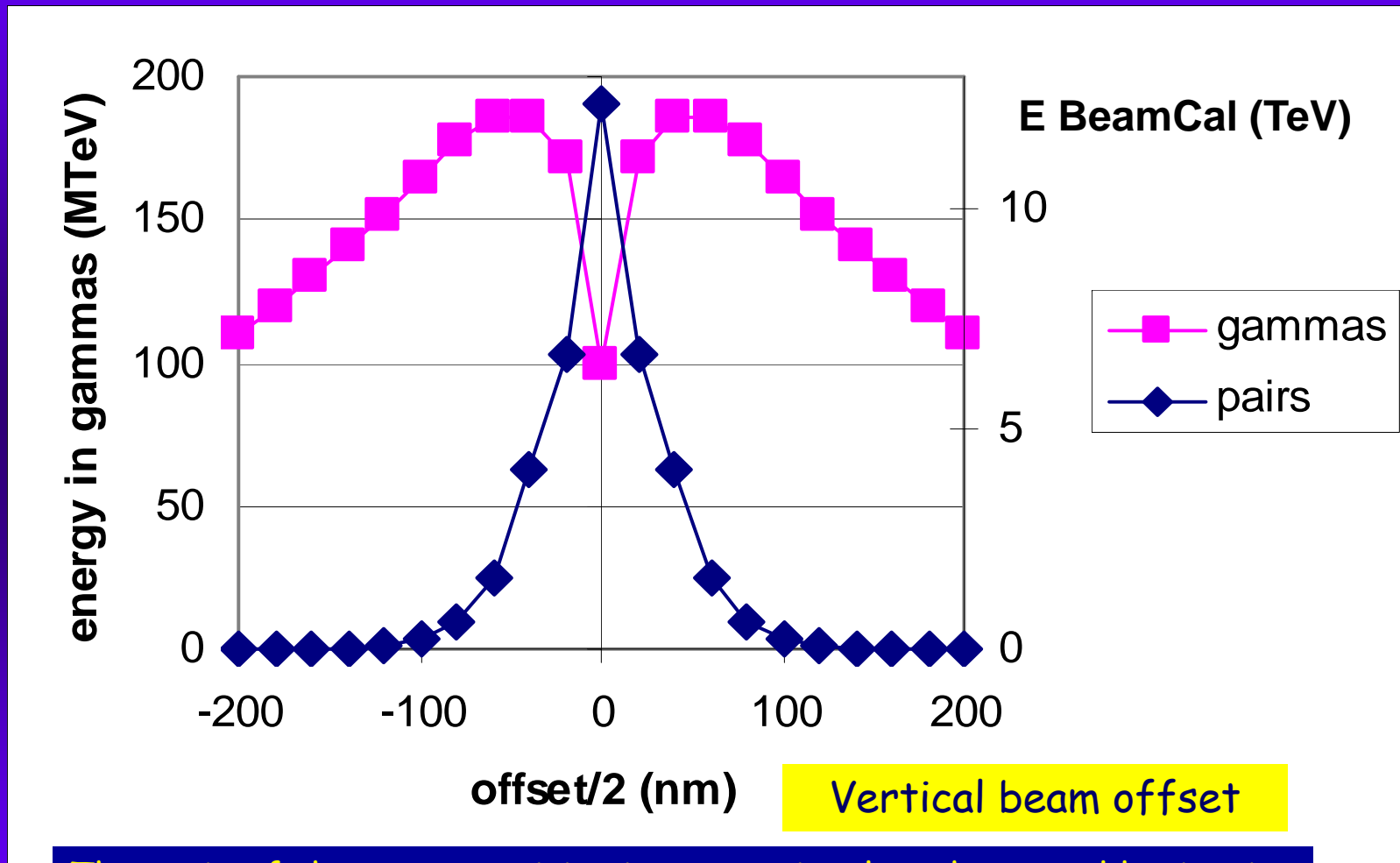
Quantity	Nominal Value	Precision
σ_x	553 nm	2.9
σ_y	5.0 nm	0.2
σ_z	300 μm	8.5

Rough information on bunch crossing at low bunch charges



BeamCal & GamCal

Combine informations from pairs and photons (B. Morse)



The ratio of the two quantities is proportional to the actual luminosity

Infrastructure for Sensor and FE Tests

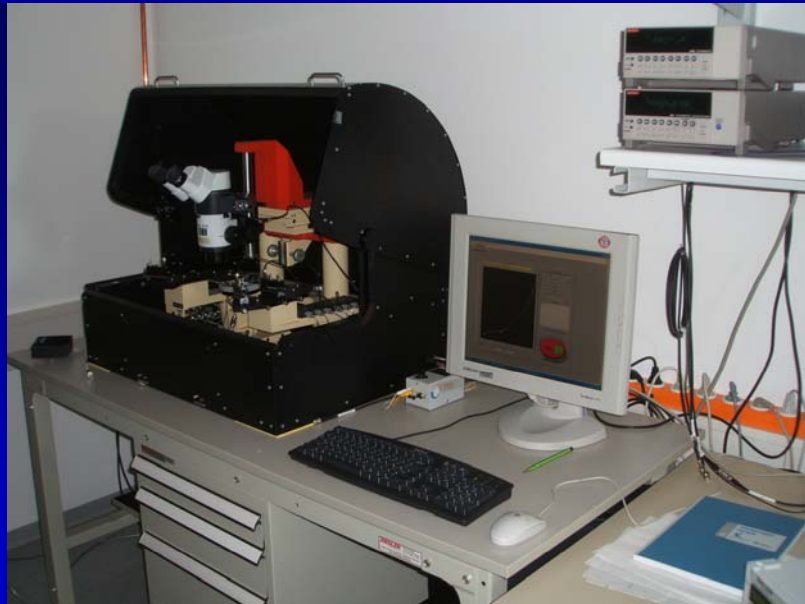
Rooms (Cracow, DESY):

two rooms with filtered air (10k), stabilized temperature

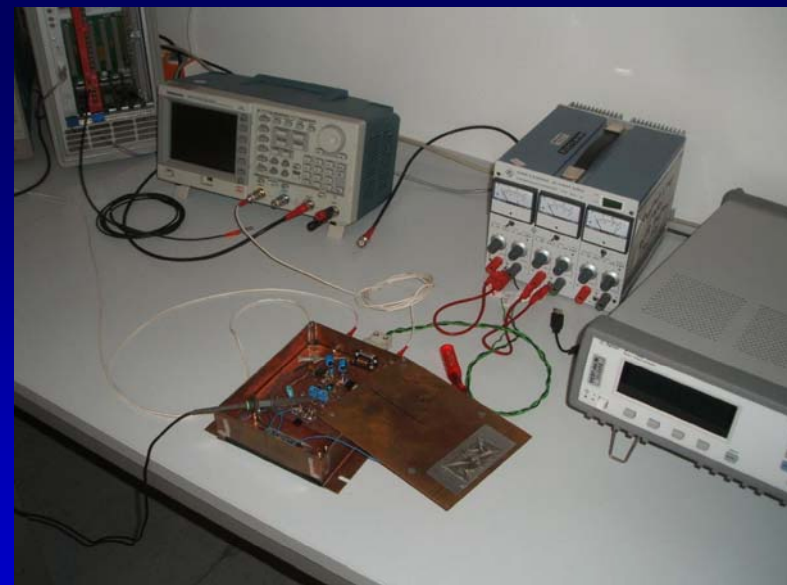
- room 1: bonding and assembly
- room 2: all measurements without radioactive source

Upgrade of the probe station at DESY

- New voltage- current devices (Keithley 6487)
- Control software
- Amplifier test bench



Octobre 2007



LAL Orsay



Challenges of LumiCal front-end

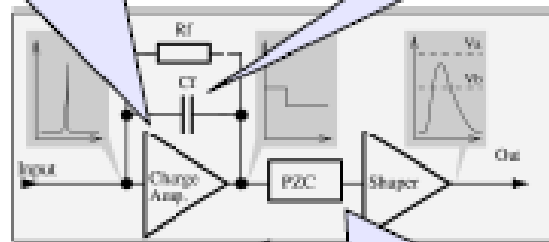
Large C_{det} range 10-100 pF

Test mode S/N ~ 10 for MIP

Charge sensitive amplifier

$Q_{max} \sim 10$ pC

$C_f \sim 10$ pF



Test & Physics mode

Variable gain

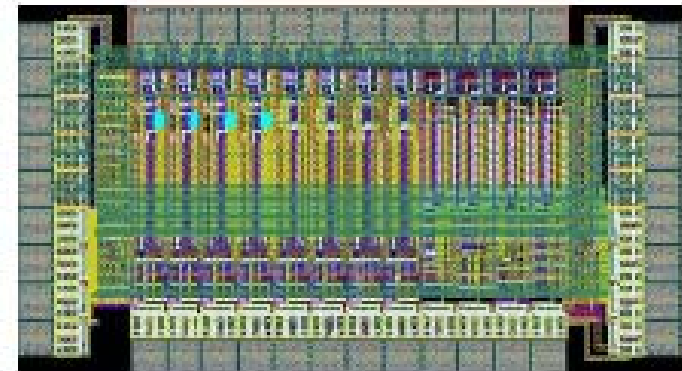
$\Delta t \approx 300$ ns, high occupancy

PZC + Shaper $T_{peak} \sim 60$ ns

Estimates of signal range and occupancy from MC simulations, translated into design requirements

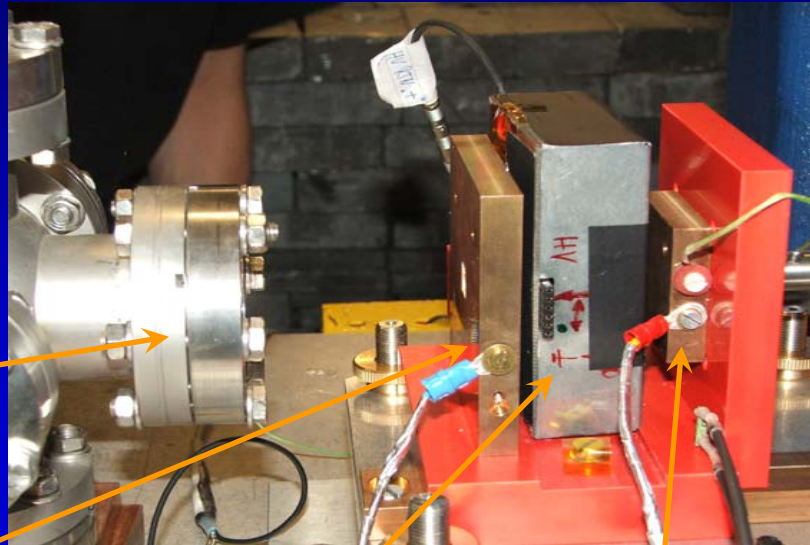
Prototype ASIC contains 8 channels with continuous shaping and 4 channels with switched-reset

First (few 10) pieces of FE ASICs
Produced and prepared for tests
Tests complete in December 2007
Submission based on a refined
design beginning of 2008



Pad Pitch 100 μ m

Testbeam 2007



Test of several sensor materials delivered by members of the collaboration

exit window of beam line

collimator (I_{Coll})

sensor box (I_{Dia} , T_{Dia} , HV)

Faraday cup (I_{FC} , T_{FC})

we will hear about the results here in Paris!



Where we are:

- Design studies of the calorimeters relatively advanced
- Lots of details need further studies
 - beam-pipe design, how much material in front of LumiCal can be tolerated
 - realistic detector, including calibration uncertainties, cross talk, noise.....
 - design studies for GamCal
- Engineering design- just good ideas
 - justification of the accuracy requirements by more realistic studies, including lumi-spectra, radiative events, energy-scale uncertainties
 - realistic design of a position control system, in the environment of the beam-delivery and detector
 - design of a compact, self-supporting calorimeter within the limited space available
- Big step forward in FE electronics
- Lot of effort for BeamCal sensor tests- no solution
- Sensor development for LumiCal just started.

- We found new partners in US
- Japanese colleagues will join us
- We had an encouraging review by the global review committee

However:

- About 80 Physicists signed the report to the committee
 - here we are 20-30
 - in the table of 'FTEs' working for FCAL I count 25
 - engineering support is far from sufficient
 - funding in Europe is tight, in US it is far from adequate
 - support for testbeam activities is not sufficient.

We are here, in the creative atmosphere in Paris to work
On these problems and we will find solutions;
Remember: EDR should be ready in 201x!

Octobre 2007

LAL Orsay