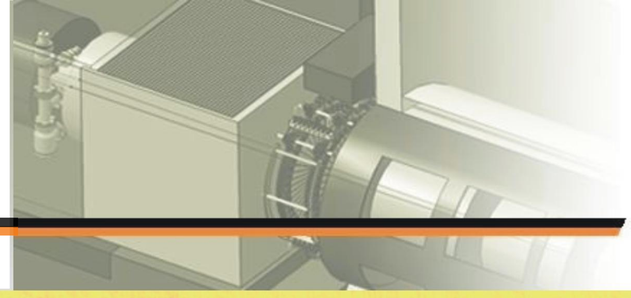
Forward Calorimeters Test Beam Results for Future Linear Colliders



FCAL Collaboration
High precision design

Test beam participants
DESY, Germany
[on behalf of the FCAL Collaboration]

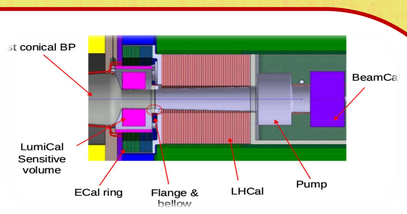
ICHEP2012, 4 --11 July, Melbourne, Australia

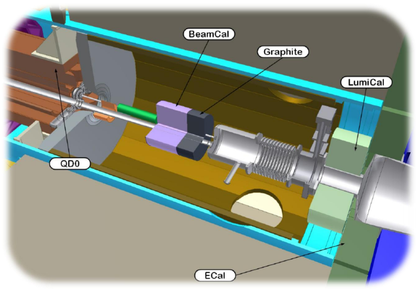
Abstract:
Two prototypes of calorimeters for the Future Linear Colliders were studied on the test beams 2010-2011 - a Beam Calorimeter (BeamCal) and LumiCal. LumiCal and BeamCal prototypes use common FE-Electronics. A prototypes made of GaAs and Si with pad structures were assembled and successfully tested in the laboratory and on the 4,5 GeV electron beam(DESY II, Hamburg). Two test beams results are present 2010-2011. The sensors were connected to a fan-out, and specially developed front-end ASICs and flash ADC. Multichannel read out was shown working with recently developed DAQ. Results are obtained for signal-to-noise and the response as a function of the position on and between the pads.
In addition, results of the sensor characterization are presented: the leakage current measured as a function of temperature and the charge collection efficiency as a function of the operation voltage.

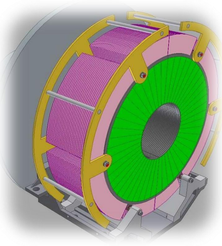
ILC & CLIC

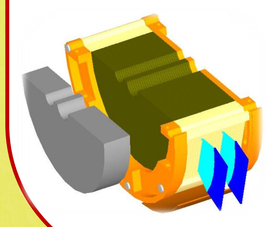
Forward Calorimeters Goals:
→ Precise luminosity measurement,
→Hermeticity (electron detection at low polar angles),
→ Assisting beam tuning (fast feedback of BeamCal data to machine)

Challenges:
→Radiation hardness (BeamCal),
→Hhigh precision (LumiCal) and fast readout (both)

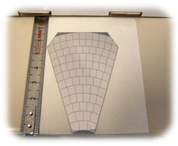


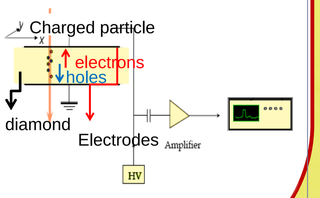




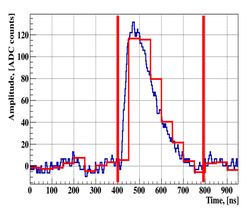


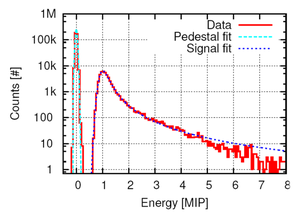
Beam Calorimeter –
Around Beam-pipe
30 Layers →tungsten sensors
Outer radius 15cm,
inner radius 2cm
depth 12 cm
Sensor segmentation 8x8 mm²

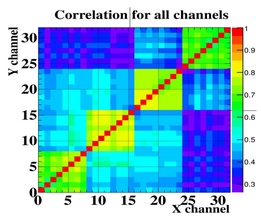




Signal Processing

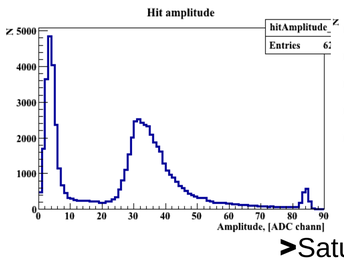


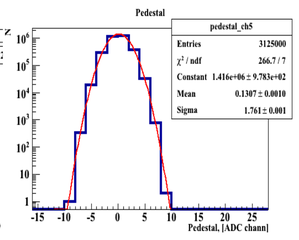


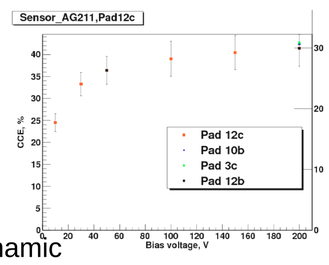


S/N ratio
CMN Subtraction
CCE
Stability
2ADC comparison

Missing – nice Amplitude spectrum and integral spectrum
S/N for all pads







>Saturation is a result of CAEN ADC dynamic range (0-255 ADC counts)
>MPV is stable, S/N varies between 10 to 20
>CMN was not subtracted

Test Beams

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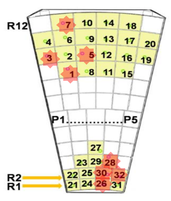

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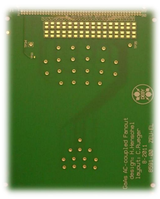

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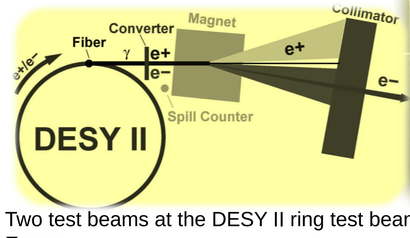
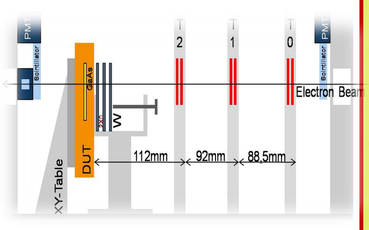
Description of the prototypes





Two test beams at the DESY II ring test beam lines were made in 2010-2011
Energy

Telescope description

Conclusions:

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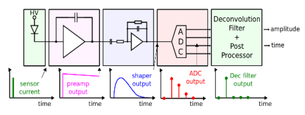

$$V_k = w_1 V_k + w_2 V_{k-1} + w_3 V_{k-2}$$

with the weights

$$w_1 = \frac{1}{x} e^{x-1}, \quad w_2 = -\frac{2}{x} e^{-1}, \quad w_3 = \frac{1}{x} e^{-(x+1)}$$