

Welcome to the 29. FCAL WS

September 2016

Tel Aviv University

Wolfgang Lohmann, BTU, DESY and RWTH

Mission of FCAL

Luminosity Measurement, Beam Tuning, Physics

- The luminosity is a key parameter of an e^+e^- linear collider
 - High Luminosity ensures access to rare processes (e.g. triple Higgs boson coupling)
 - Precise luminosity measurement is a prerequisite for precision tests (e.g. Standard Model on the quantum level)

Development of detectors for bunch-by-bunch luminosity measurement and fast feed-back to the machine

- BeamCal and Pair Monitor (exploiting BeamStrahlung)

Development of Detectors to measure precisely the luminosity

- LumiCal and very forward tracker

Exploit these Detectors for physics

- Susy searches, two photon physics

Technological Challenges

for a highly compact calorimeter

- novel connectivity technology (e.g. bump bonding, thin fan-out PCB)

Construction of a demonstrator calorimeter

- completion of the mechanical structure (+laser alignment)
 - production of sufficient ASICs in 130 nm technology
 - demonstration of power pulsing
 - readout board with data concentrator and data transfer
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- Beam tests
 - Energy resolution (luminosity spectrum)
 - spatial resolution (angular spectrum)
 - bias in the angular measurements (systematic shift to be quantified)

FCAL Structure in work

Governing body is the institute board, chair Aharon Levy

Spokesperson and deputy, me and Marek Idzik

Technical Coordinator, Yan Benhammu

Speakers and Publications committee, chair Strahinja Lukic

Regular bi-weekly “software and analysis” and hardware meetings (thanks to Olexandr Borysov and Marek Idzik)

Kiev University became a full member

2 Measurement of shower development and its 3 Molière radius with a four-plane LumiCal prototype

H. Abramowicz^a, A. Abusleme^b, K. Afanaciev^c, Y. Benhammou^a, L. Bortko^{d,1},
O. Borysov^a, I. Bozovic-Jelisavcic^e, G. Chelkov^f, C. Coca^g, W. Daniluk^h,
D. Dannheimⁱ, L. Dumitru^g, K. Elsenerⁱ, M. Firlej^j, E. Firtu^k, T. Fiutowski^j,
V. Ghenescu^k, M. Gostkin^f, M. Hempel^{d,2}, H. Henschel^d, M. Idzik^j, A. Ignatenko^{c,2},
A. Ishikawa^l, S. Kananov^a, O. Karacheban^{d,2}, W. Klemptⁱ, S. Kotov^g, J. Kotula^h,
D. Kozhevnikov^g, V. Kruchonok^f, B. Krupa^h, Sz. Kulisiⁱ, W. Lange^d, J. Leonard^d,
T. Lesiak^h, A. Levy^a, I. Levy^a, W. Lohmann^{d,2}, S. Lukic^e, R.E. Mikkelsen^m, J. Moron^j,
A. Moszczynski^h, A.T. Neagu^k, F.-X. Nuijⁱ, M. Orlandea^h, M. Pandurovic^e,
B. Pawlik^h, T. Preda^k, O. Rosenblatt^a, A. Sailerⁱ, B. Schummⁿ, S. Schuwalow^{d,3},
I. Smiljanic^e, P. Smolyanskiy^f, K. Swientek^j, P. Terlecki^j, U.I. Uggerhoj^m,
T.N. Wistisen^m, T. Wojton^h, H. Yamamoto^l, L. Zawiejski^h, I.S. Zgura^k,
A. Zhemchugov^f

63 authors

² **Measurement of shower development and its** ³ **Molière radius with a four-plane LumiCal prototype**

^a*Tel Aviv University, Tel Aviv, Israel*

^b*Pontificia Universidad Catolica de Chile, Santiago, Chile*

^c*NC PHEP, Belarusian State University, Minsk, Belarus*

^d*DESY, Zeuthen, Germany*

^e*Vinca Institute of Nuclear Sciences, University of Belgrade, Serbia*

^f*JINR, Dubna, Russia*

^g*IFIN-HH, Bucharest, Romania*

^h*IFJ PAN, PL-31342, Krakow, Poland*

ⁱ*CERN, Geneva, Switzerland*

^j*Faculty of Physics and Applied Computer Science, AGH University of Science and Technology,
Krakow, Poland*

^k*ISS, Bucharest, Romania*

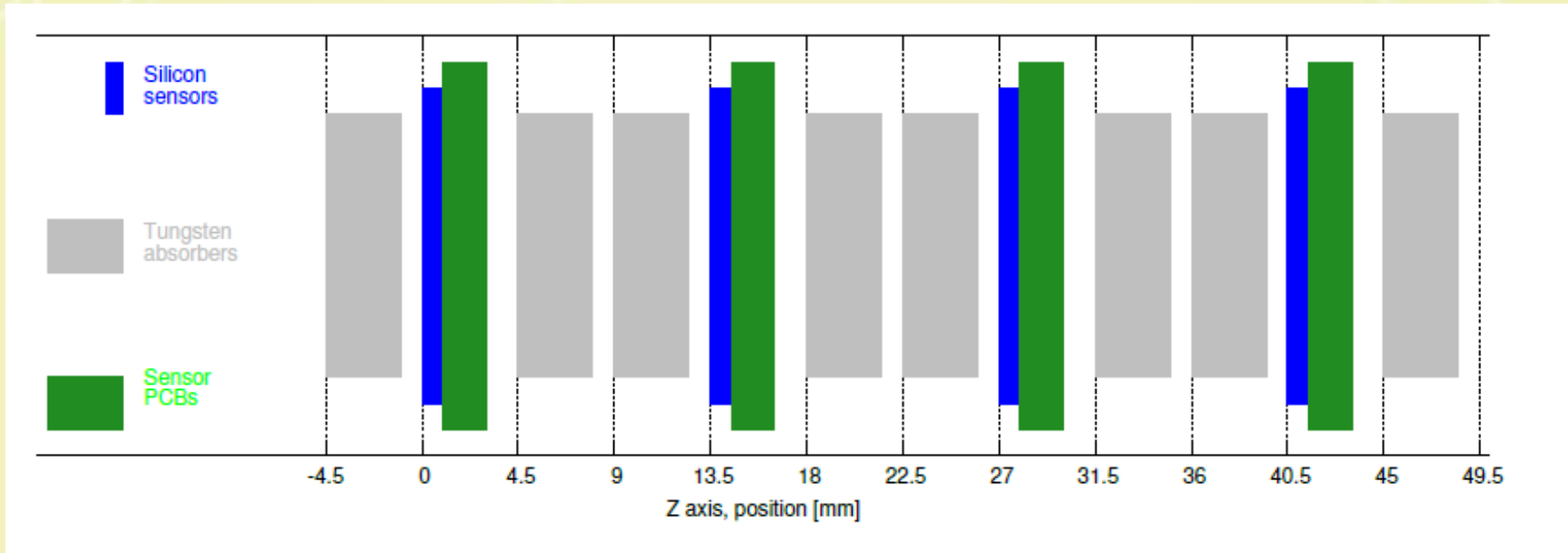
^l*Tohoku University, Sendai, Japan*

^m*Aarhus University, Aarhus, Denmark*

ⁿ*University of California, Santa Cruz, USA*

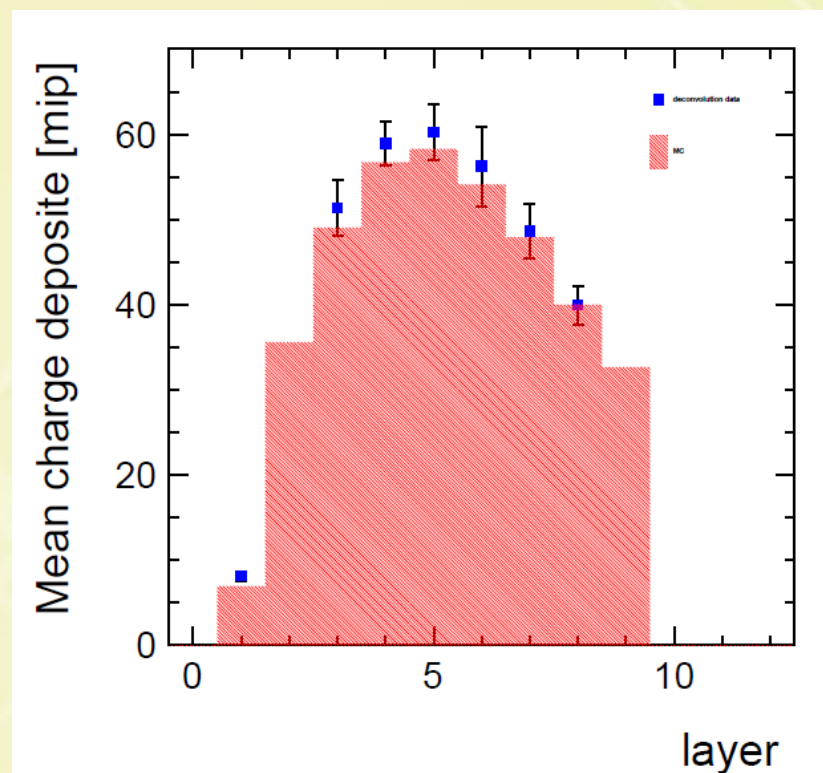
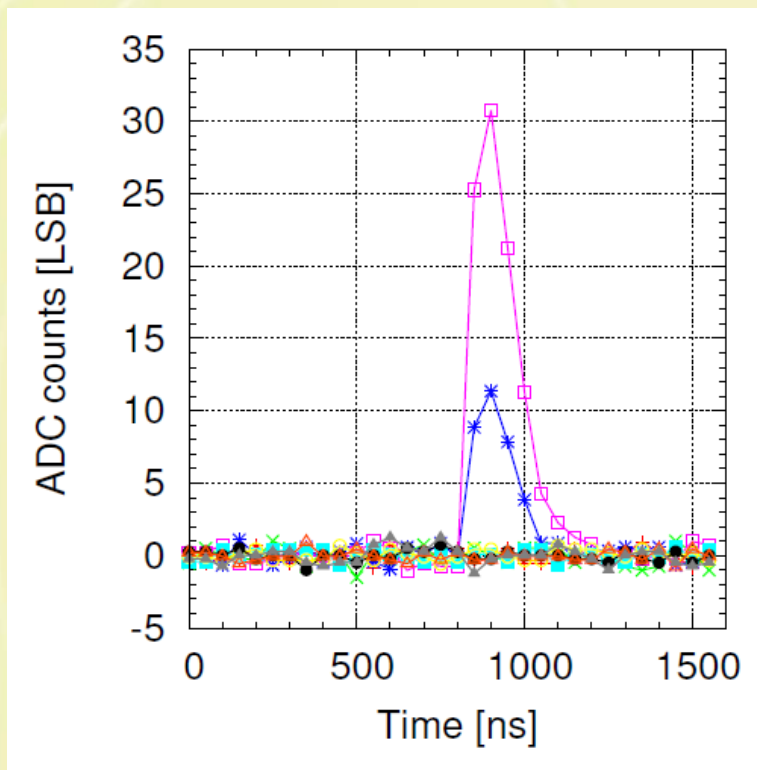
13 institutes

Scientific essentials



- Demonstration that a multilayer structure can be operated, read out and analysed

Scientific essentials



- Demonstration of the excellent hardware performance
- Some problems still not fully understood

Scientific essentials

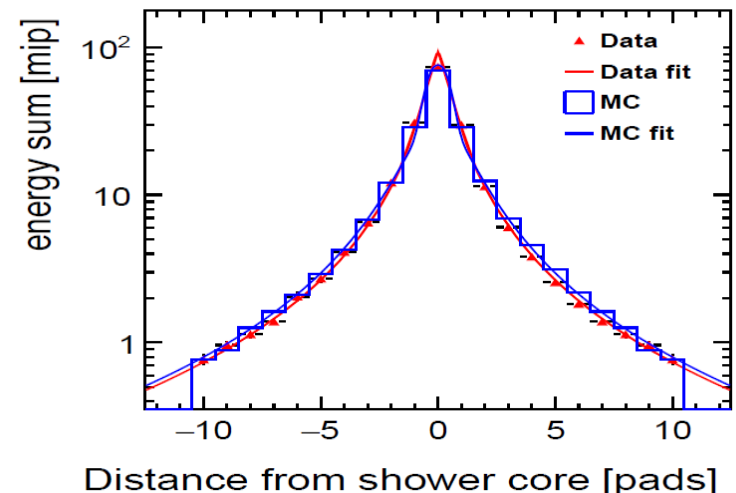
The lateral spread of the electromagnetic shower is characterized by the *Molière* radius, $R_{\mathcal{M}}$, given by [17]

$$R_{\mathcal{M}} = X_0 \frac{E_s}{E_c}, \quad (4.1)$$

where the multiple-scattering energy $E_s = 21$ MeV, E_c is the critical energy [18], and X_0 is the radiation length of the material. For a composite material or construction like the LumiCal prototype used in the beam test, the *Molière* radius can be obtained [17] using

$$\frac{1}{R_{\mathcal{M}}} = \frac{1}{E_s} \sum \frac{w_j E_{cj}}{X_{0j}} = \sum \frac{w_j}{R_{\mathcal{M}j}}, \quad (4.2)$$

- This study might interesting new physics
- We should fully exploit it
- Might be crucial for acceptance as a publication



New Testbeam Data

Testbeam Venture in the last week of August



- Several 10^6 trigger with 8 instrumented planes
- Tracking in front of the calorimeter
- Electron and photon trigger

Some critical issues to be discussed

- There is a very rich program of the workshop, consider more results for conference contributions and publications
- AIDA milestone „data concentrator“ (April 2017)
- Laser positioning system
- Design parameter for the beamcal radout of different calorimeter configurations
- Treatment of „competing analyses“ of e.g. testbeam data

Forthcoming events

- LCWS in December 2016 in Morioka, Japan
- Next FCAL workshop
- Other conferences