Introduction to the workshop

Aharon Levy

Tel Aviv University

Wolfgang and CMS

- Currently we install in CMS a beam halo and online luminosity detector using 24 single crystal diamond sensors and FE ASICs developed in a collobaoration of UST Cracow and CERN.
- It as a little beamcal/lumical measuring the rate of hadrons in a certain polar angle range. For sure, the precision of the luminosity measurment will be less precise, but what we are using are technologies developed, at least partially, in FCAL.

FCAL issues

- Report from LCWS14
- FCAL and talks @ ICHEP14, LCWS14
- TB 2010-11 results paper
- CERN TB preparations
- Working groups
- FCAL outlook

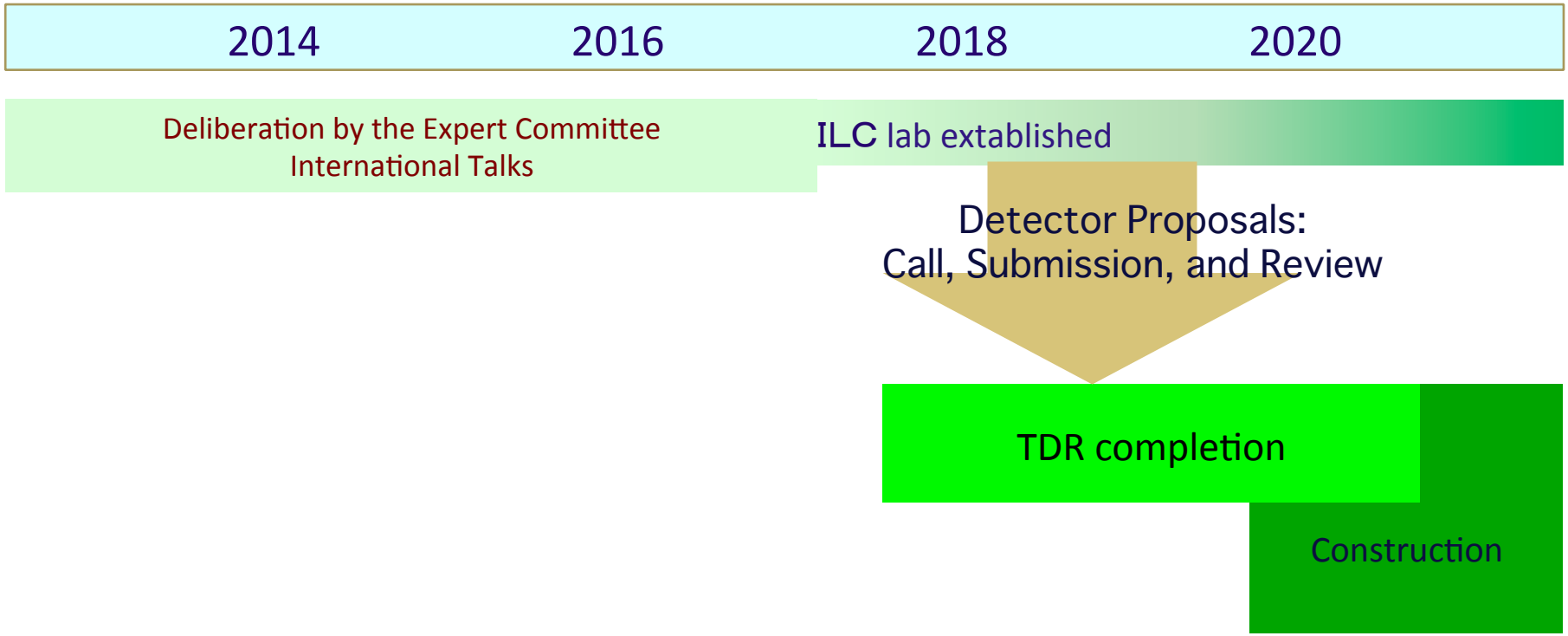
Science Council of Japan

"The Committee appreciates that the ILC enables the precision measurements of the detailed properties of the Higgs particle and the top quark, thereby exploring the physics beyond the Standard Model of particle physics and, therefore, it acknowledges that the ILC is endowed with the scientific value in particle physics. The Committee, however, expresses the desire for more compelling and articulate argument to justify the ILC project in order to search for unknown particles and the physics beyond the Standard Model, running concurrently with the upgraded LHC, given the considerable investment it will require."

Science Council of Japan

"Before making the final decision of whether the ILC should be hosted in Japan, the issues and concerns described in this document should be fully investigated and a clear vision for solutions needs to be provided. They include the whole profile of project cost for the construction, operation, upgrades and decommissioning, as well as prospect for cost-sharing among the countries involved. Also included are the issues related to human resources and management/operation organization."

Possible Timeline of ILC Detectors

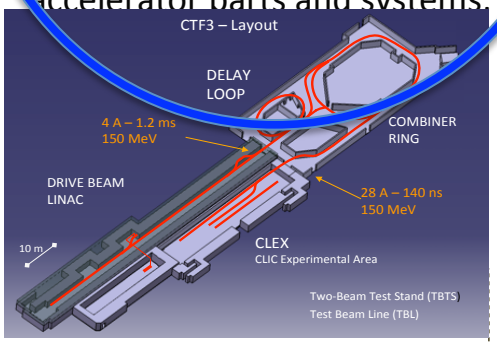


Detector groups are preparing for this period by re-optimizing and re-organizing their detectors.

CLIC timeline

2013-18 Development Phase

Develop a Project Plan for a staged implementation in agreement with LHC findings; further technical developments with industry, performance studies for accelerator parts and systems.



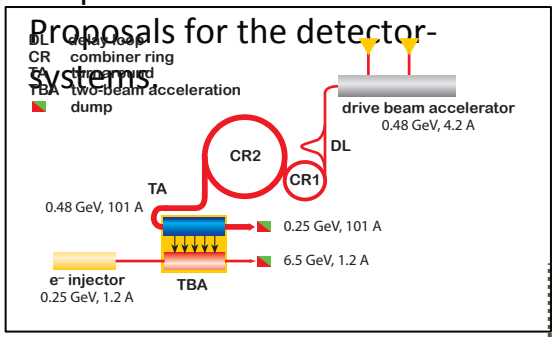
2018-19 Decisions

On the basis of LHC data and Project Plans (for CLIC and FCC in particular), take decisions about next project(s) at the High Energy Frontier.

4-5 year Preparation Phase

Finalise implementation parameters, Drive Beam Facility and other system verifications, site authorisation and preparation for industrial procurement.

Prepare detailed Technical Proposals for the detector-systems.



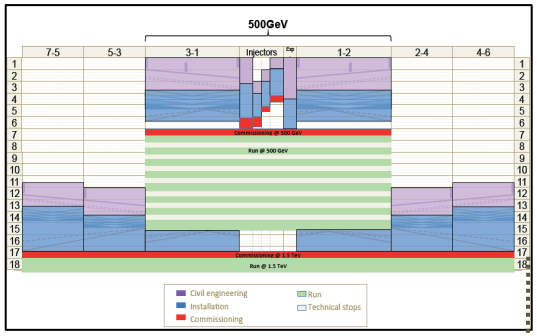
2024-25 Construction Start

Ready for full construction and main tunnel excavation.

Construction Phase

Stage 1 construction of CLIC, in parallel with detector construction.

Preparation for implementation of further stages.

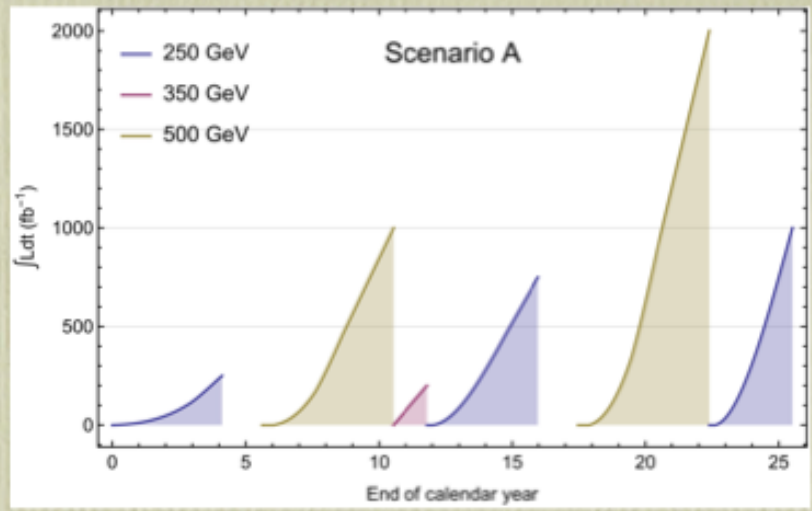


Commissioning

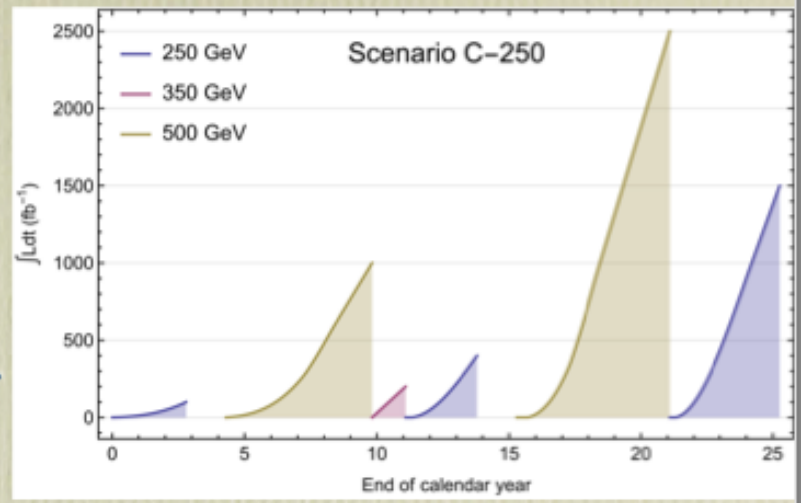
Becoming ready for data-taking as the LHC programme reaches completion.

Scenarios

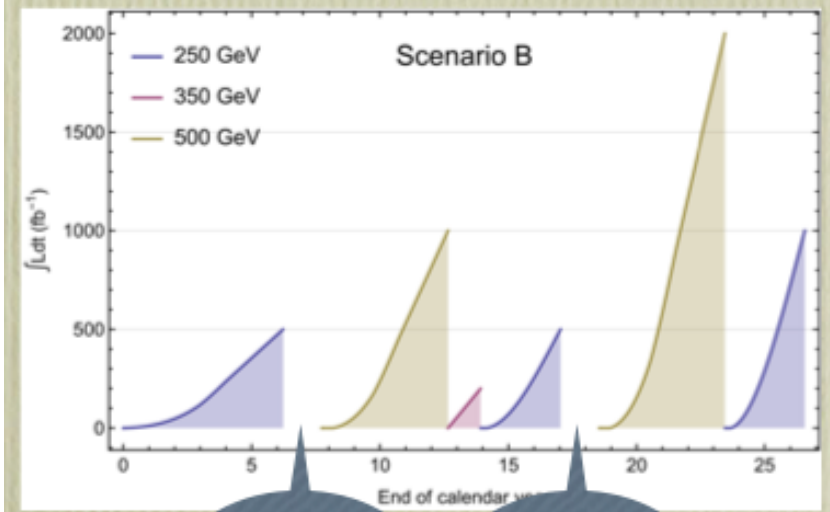
- A: run for 250 fb^{-1} during initial 250 GeV phase (4.1 calendar years) then upgrade to 500 GeV
- B: run for 500 fb^{-1} @ 250 GeV before beginning 500 GeV upgrade (6.2 calendar years)
- C: run for 100 fb^{-1} @ 250 GeV (2.8 calendar years, minimum time required to produce all cryomodules) and then upgrade to 500 GeV
  - variants of C: 250 GeV or 500 GeV emphasis in last phase (C-250 and C-500)

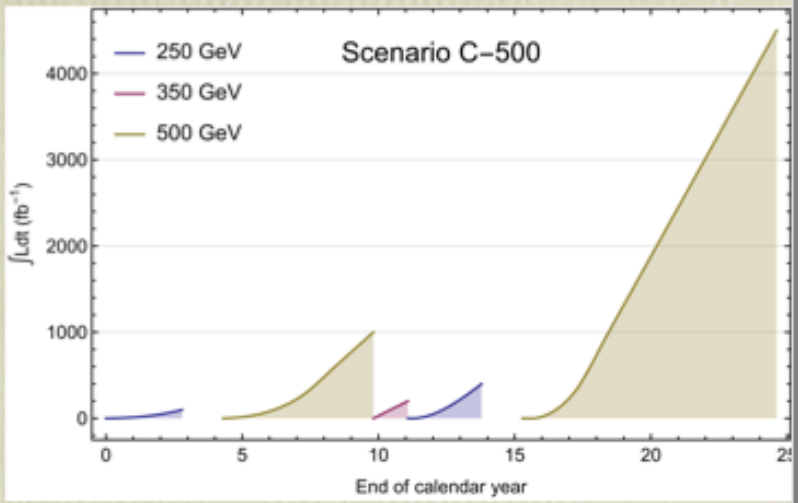


250 GeV
350 GeV
500 GeV



Projected evolution of integrated luminosity with realistic ramp-up and upgrade timelines





Note
- time is in <u>calendar years</u>

Energy Upgrade

Lumi Upgrade

new CLIC staging baseline (1)

A **new CLIC staging baseline**, aimed at providing:

- New reference for physics simulation (e.g. luminosity spectrum)
- Consistent set of information for public presentations

Scope:

- Define ***one CLIC staging baseline***
- Documented in a compact note/publication
- Document will also include one chapter on alternative optimised schemes for the lowest energy stage (e.g. a klystron-based option)

Timeline:

- be ready CLIC workshop, January 2015

Small **"editing team"**:

Phil Burrows, Philippe Lebrun, Daniel Schulte, Eva Sicking
Steinar Stapnes, Mark Thomson, LL

Studies to define the first stage (1)

$t\bar{t}$ pair production:

- Identifiy the relevant observables sensitive to BSM effects at 420 GeV and 500 GeV (production asymmetries, cross section, …)
- Decide on energy of first stage in the near future

→ generator level studies for the different energies (350 GeV, 420 GeV, 500 GeV)

- If energy higher then 350 GeV is chosen

→ full simulation studies for imprtant observabels

Studies to define the first stage (2)

Higgs physics:

- The Higgs program should not be affected significantly by the increased energy of the first stage
- The model-independent measurement of σ(HZ) using leptonic decays not precise enough above 350 GeV
(see LCD-Note-2012-015 for full simulation study at 500 GeV)
- However, the measurement using hadronic Z decays might benefit from higher energies
(better separation of Higgs and Z boson?)
→ redo analysis at 500 GeV before decision on first energy stage (using ILC samples?)
- If energy higher then 350 GeV is chosen
→ further full simulation studies of Higgs production will follow

Change Management - ILC Version 3.0

- ILC Baseline Design as described in TDR is now under change control
- Design changes need to follow a defined process and need approval by LCC directorate

1. Proposing a design change
- Change Request (CR)
- Change Request Creater (CRC)
- Written document
- Submitted to Change Management Board (CMB)

2. Expert review
- Reviewed by CMB with additional experts as needed
- CMB defines the scope of the review
- Communication with all stakeholders
- Capture relevant documents

3. Decision
- Results with recommendation from (2) presented to ILC Director
- Written summary document
- ILC Director (in consultation with the CMB) makes final decision, or
- Decision is escalated to LCC directorate.

4. Updating TDD to reflect the change
- CMB identiifies team (and team leader) to implement change.
- Generate scope of work
- Develope implementation plan
- Release of updated TDD

Change Requests

- Two change requests have impact on machine and detectors:
  - Common QD0 L*<=4m for both detectors
  - Vertical shaft detector assembly at Kitakami site

Change Request : L *

- Current L*'s
  - 4.4 m for ILD, 3.5 m for SiD
- Same L* is desirable
  - Machine tuning is easier, risk is minimized
- The smaller L* : better
  - Luminosity tends to be larger
- The same L* of 4 m or less is proposed

- Has already been submitted to CMB
  - Being discussed within the Phys&Det community
- A working group was established to clarify the implication of such L* for detectors
  - To come up with answer in a relatively short timescale (not =1 year)
  - Answer from the physics&detector community depends on it

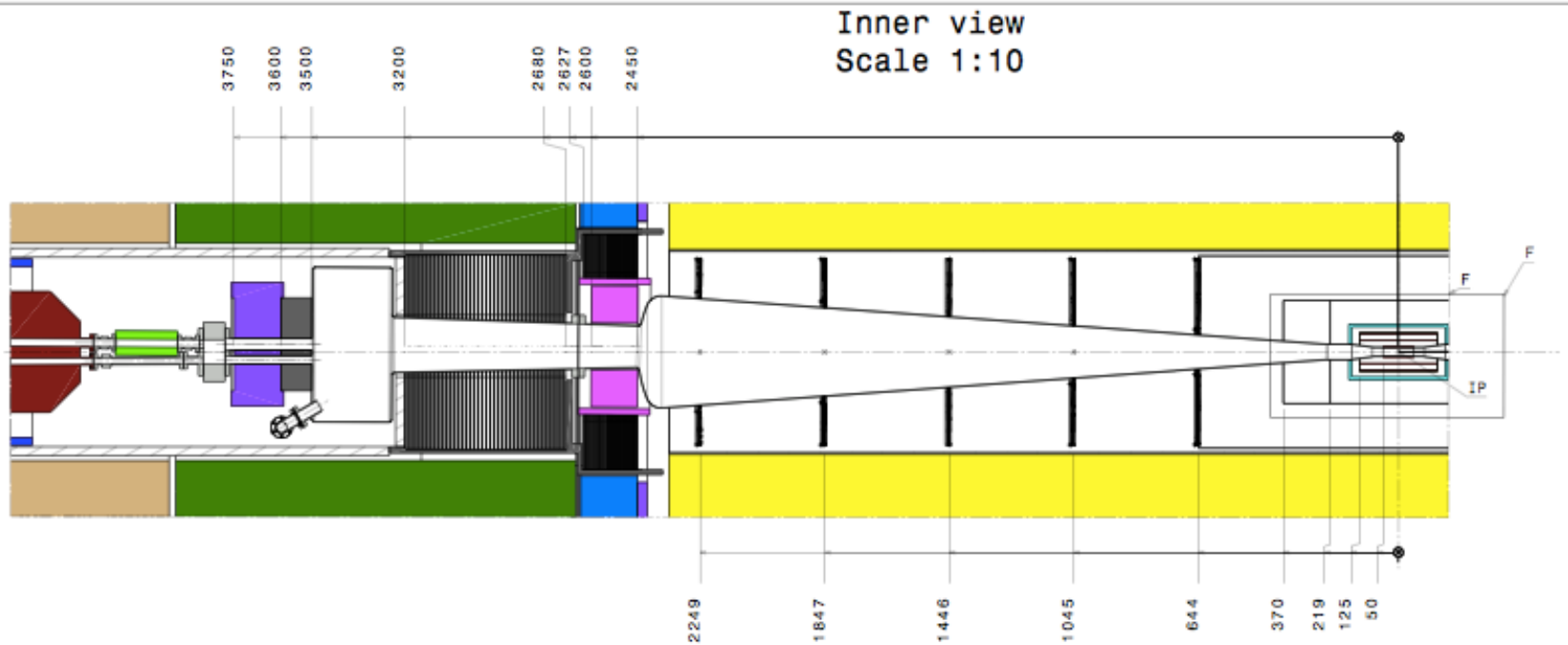
CR-002 – equalize L* for both Detectors

- ILD L* is 4.5m, SiD L* is 3.5m thus the hope is to reduce ILD. A significant part of the L* difference is due to the presence of a vacuum pump in the ILD layout.

- In addition the QD0 magnet design might be more compact

- In view of the multi-dimensional complexity of this issue we have formed a CR panel under Nobuhiro Teranuma to provide recommendations to the CMB.

ILD: Discussion Items



- What needs to be done to go to L* of 4m?
  - Is the pump needed at this location?
    - revisit vacuum requirements and conditions
    - impact on cold QD0?
  - Revisit FCAL design
- Discussions have started at this LCWS

FCAL and talks @ ICHEP14, LCWS14

ICHEP14

Ivanka (talk): Potential and challenges of the physics measurements with very forward detectors at linear colliders

Veta (poster): R&D with very forward detectors at linear colliders

LCWS14

Beata KRUPA The study of the photon structure functions at ILC energies

14:00	Overview of FCAL activities	O.Borysov
14:20	FCAL Sensor Irradiation Studies at SCIPP	B.Schumm
14:40	Electronics for FCAL detectors	A.Abusleme
15:00	Optimisation of the BeamCal segmentation	L.Bortko

TB 2010-11 results paper

Preprint typeset in JINST style - HYPER VERSION

Performance of a fully instrumented sensor plane of the forward calorimeter of a LC detector

The FCAL collaboration
October 10, 2014

H. Abramowicz[a], A. Abusleme[b], J. Aguilar[c,1], E. Alvarez[b], D. Avila[b], Y. Benhammou[a], L. Bortko[d,2], O. Borysov[a], M. Bergholz[d,2], I. Bozovic-Jelisavcic[e], E. Castro[d,3], C. Coca[f], W. Daniluk[c], L. Dumitru[f], K. Elsner[g], V. Fadeyev[h], M. Firlej[i], E. Firu[j], T. Fiutowski[i], V. Ghenescu[j], H. Henschel[d], M. Idzik[i], A. Ishikawa[k], S. Kananov[a], S. Kollowa[d,4], J. Kotula[c], B. Krupa[c], Sz. Kulis[i,5], W. Lange[d], T. Lesiak[c], A. Levy[a], I. Levy[a], W. Lohmann[d,2] S. Lukic[e], C. Milke[h], J. Moron[i], A. Moszczynski[c], A.T. Neagu[j], O. Novgorodova[d,6], M. Orlandea[f], K. Oliwa[c], M. Pandurovic[e], B. Pawlik[c], T. Preda[j], D. Przyborowski[i], O. Rosenblat[a], A. Sailer[g], Y. Sato[k,7], B. Schumm[h], S. Schuwalow[d,8], I. Smiljanic[e], K. Swientek[i], E. Teodorescu[f], P. Terlecki[i], W. Wierba[c], T. Wojton[c], S. Yamaguchi[k], H. Yamamoto[k], L. Zawiejski[c], I.S. Zgura[j]

[a] *Tel Aviv University, Tel Aviv, Israel*
[b] *Pontifica Universidad Catolica de Chile, Santiago, Chile*
[c] *INP PAN, Cracow, Poland*
[d] *DESY, Zeuthen, Germany*
[e] *Vinca Institute of Nuclear Sciences, University of Belgrade, Serbia*
[f] *INFIN-HH, Bucharest, Romania*
[g] *CERN, Geneva, Switzerland*
[h] *University of California, Santa Cruz, USA*
[i] *AGH University of Science and Technology, Cracow, Poland*
[j] *ISS, Bucharest, Romania*
[k] *Tohoku University, Sendai, Japan*

E-mail: levyaron@post.tau.ac.il

ABSTRACT: Sensor plane prototypes of the very forward calorimetry of a future detector at an e^+e^- collider have been built and their performance was measured in an electron beam. The sensor plane comprises silicon or GaAs pad sensors, dedicated front-end and ADC ASICs, and an FPGA for data concentration. Measurements of the signal-to-noise ratio for different feedback schemes and the response as a function of the position of the sensor are presented. A deconvolution method is successfully applied, and a comparison of the measured shower shape as a function of the absorber depth with a Monte-Carlo simulation is given.

Received comments from Angel, Cornelia, Konrad, Leszek, Marek, Titi

Took much too long. We should do it differently for the present test beam results (see later)

CERN TB preparations

- We started on August 29 bi-weekly meetings to prepare for the CERN test beam. Sergej is in charge of the TB.

- Discussions were very useful for preparing a solution for the Aarhus telescope.

- There will be three reports by Sergej, Marek and Itamar.

Working groups

- Following the Bucharest WS, Lucie suggested to start working groups so that we exchange information more than twice a year.

- In July we started a clustering working group, convened by Sasha, meeting every second Monday (4pm). Discussions were very useful. Details – tomorrow by Sasha.

- Will start now a second WG, a hardware working group, convened by Marek. Meeting should also be bi-weekly, maybe on the off-Mondays of the Clustering WG. CERN TB results should be handled by this group.

FCAL mailing list

Following suggestions of Konrad and of Lucie, and with the help of Kate, a new FCAL mailing list was produced on the CERN server. As basis used the updated list of Lucia.

fcal-members@cern.ch
fcal-ib@cern.ch
fcal-pscom@cern.ch

FCAL future topics

(From Wolfgang's presentation at the Bucharest WS)

- Finalize and submission of the paper on the test-beam results
- Preparation of the next test-beam with 4-5 sensor layers
- Continuation of the irradiation studies at SLAC
- Complete AIDA II application
- Design and realization of a ''full length calorimeter"
- Design optimization
- Physics case sharpening