



# Report from the Technical Board



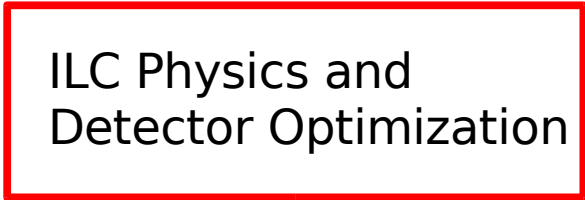
Roman Pöschl  
LAL Orsay

- Role of Calorimeter R&D for the ILC
- Towards the US-DHCAL and a combined test beam
- Towards the technological Prototypes
- Summary and Conclusion

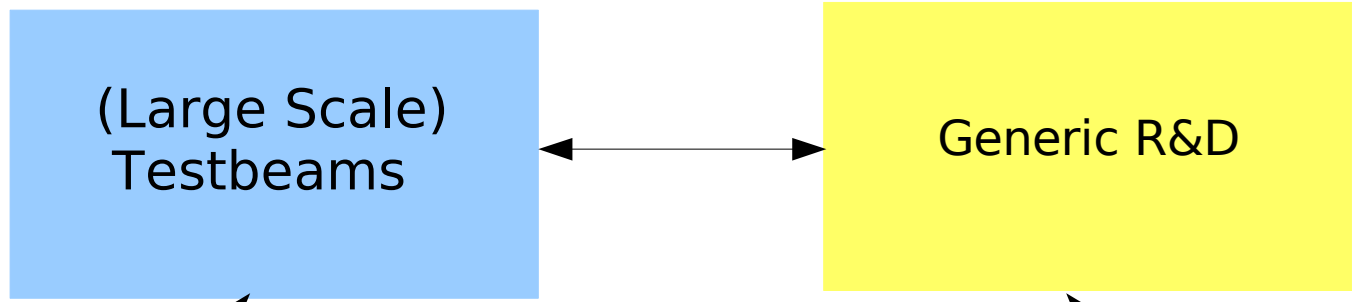
CALICE Collaboration Meeting Lyon September 2009

# The Calo Machinery

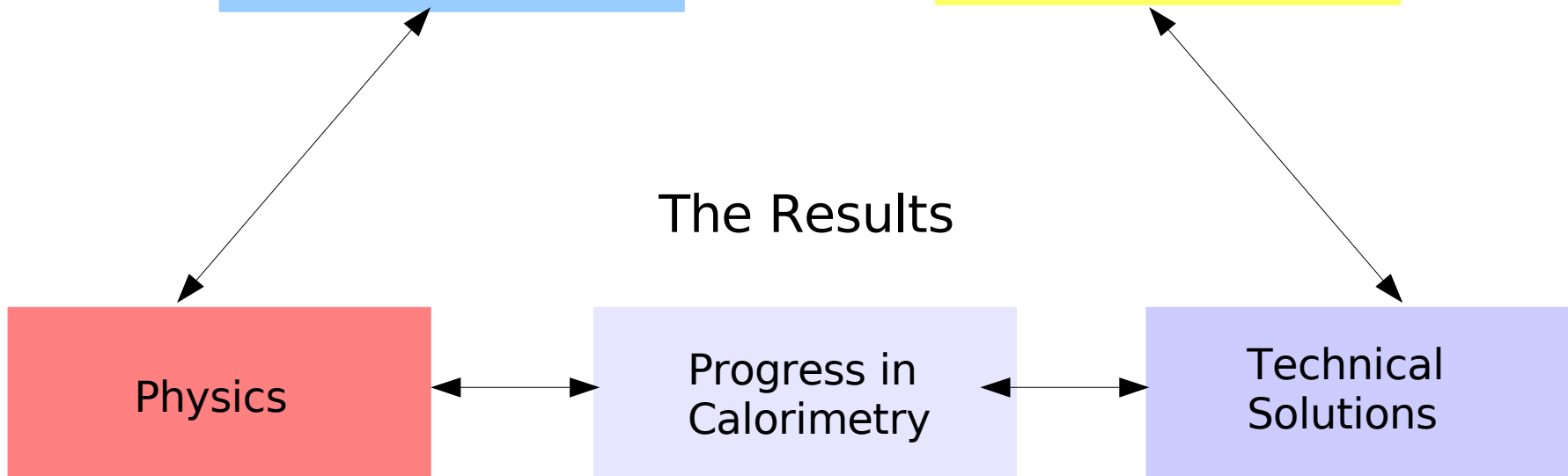
The driving force



The Programs



The Results



All issues addressed in Calorimeter Development for the ILC

# Technical Board Review Meeting

Time and Venue: 16/6/09 – 17/6/09 at Fermilab

Two major topics:

- US-DHCAL and combined test beam in 2010
- Towards the Technological Prototype Phase
  
- **Open Session on 16/6/09**
  - Towards construction of US-DHCAL
  - Status reports from components participating in a combined test beam
  - Reports from all projects which head towards technological prototypes
  
- **Closed Session on 17/6/09**
  - Critical review of US-DHCAL status
  - Launching of TB-Review Document on a roadmap for the Technological Prototypes

# The “Logical” Way

- Concluding the “Physics Prototype Phase” - Phase CALICE I - with completion of the US-DHCAL and combined test beam at FNAL with the SiW Ecal and TCMT

## Roadmap issue of TB Review meeting

- Preparing/Realising the “Technological prototype phase” - Phase CALICE II

Three/Four prototypes moving towards construction phase

- SiW Ecal prototype expected beginning of 2011
  - Mechanics issues mostly solved
  - Priority to establish VFE electronics
  - **Cost for Silicon Wafers**
- SDHCAL-GRPC
  - Mechanics designed but recommended for revision
  - First project to test 2<sup>nd</sup> Generation of VFE electronics
- DHCAL with Micromegas
  - Construction of a first 1m<sup>2</sup> ongoing
  - Mechanics/VFE together with SDHCAL-GRPC?
- AHCAL
  - Mechanics under study
  - Well advanced VFE

## Towards the US-DHCAL – Issues raised by TB

- US-DHCAL needs to construct 1 m<sup>2</sup> layers with new (so far) untested components and newly developed manufacturing techniques
  - Large GRPC (w.r.t vertical slice test) including resistive painting
  - New Chip DCAL III (single unit test and mass test)
  - New FE Boards adapted to needs of 1m<sup>2</sup> layers
  - Mastering the manufacturing process (Building of frames, Gluing of different components)
  - Integration of DAQ and s/w into existing calice scheme
- 1<sup>st</sup> layer anticipated on timescale of 1 ½ month after TB Review Meeting
- TB asked for a time plan on the mass production of 120 Chambers to make up the 40 Layers needed
  - Timeplan to be established until 1<sup>st</sup> September
  - Expected to learn details in corresponding DHCAL session at this meeting
- TB strongly recommends a 1<sup>st</sup> Layer integration
  - Mounting a first completed layer on the CALICE stack in MTEST to identify critical items early enough
- Integration of the GEM structures have to be better elaborated

## Combined test beam – Detector Status and Constraints

### - SiW Ecal

Back in France to investigate reason for dead areas

Tests during summer on LLR test bench

(Preliminary result: Dead zones not reproducible)

**SiW Ecal is ready at any time to be put back into the test beam**

N.B.: In order to save travel money Test beam have to be conducted with minimal man power on site

Shifts vai remote control room -> to be established in France

### - TCMT

- Currently no funding for TCMT available

- Detector would be run by DESY colleagues with local support by NIU

**TCMT is however operational**

### - Beamline/trigger

- Commissioning by DESY with support from other testbeam participants

### - Two important issues to be mentioned

1) The stage at FNAL is unused since June 2009

2) Due to customs regulations the stage has to be transported back to Europe by **April 2011**

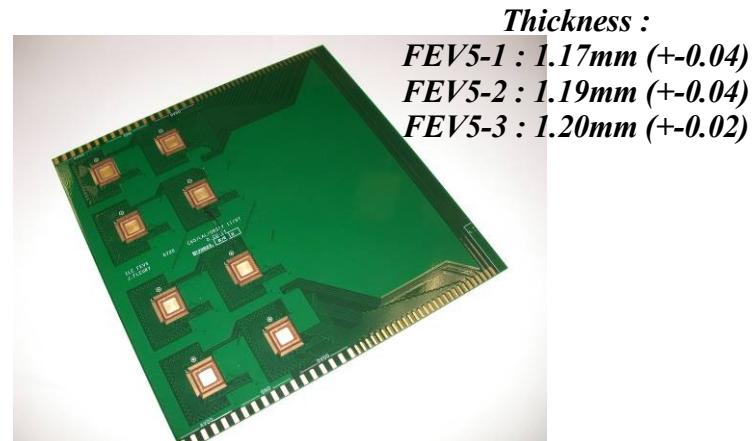
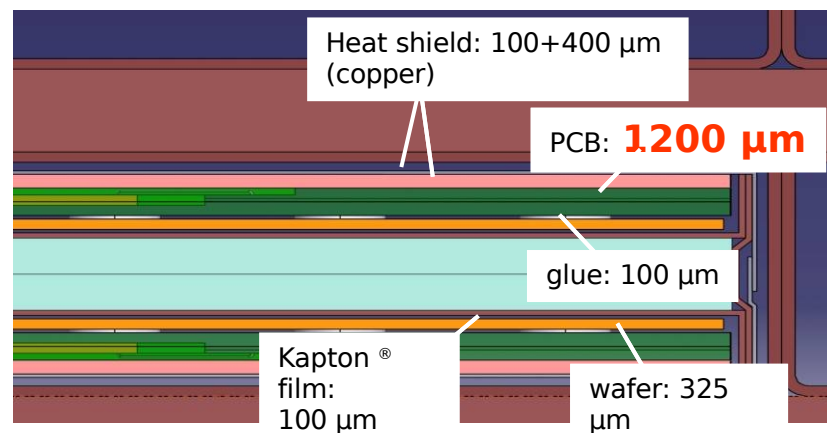
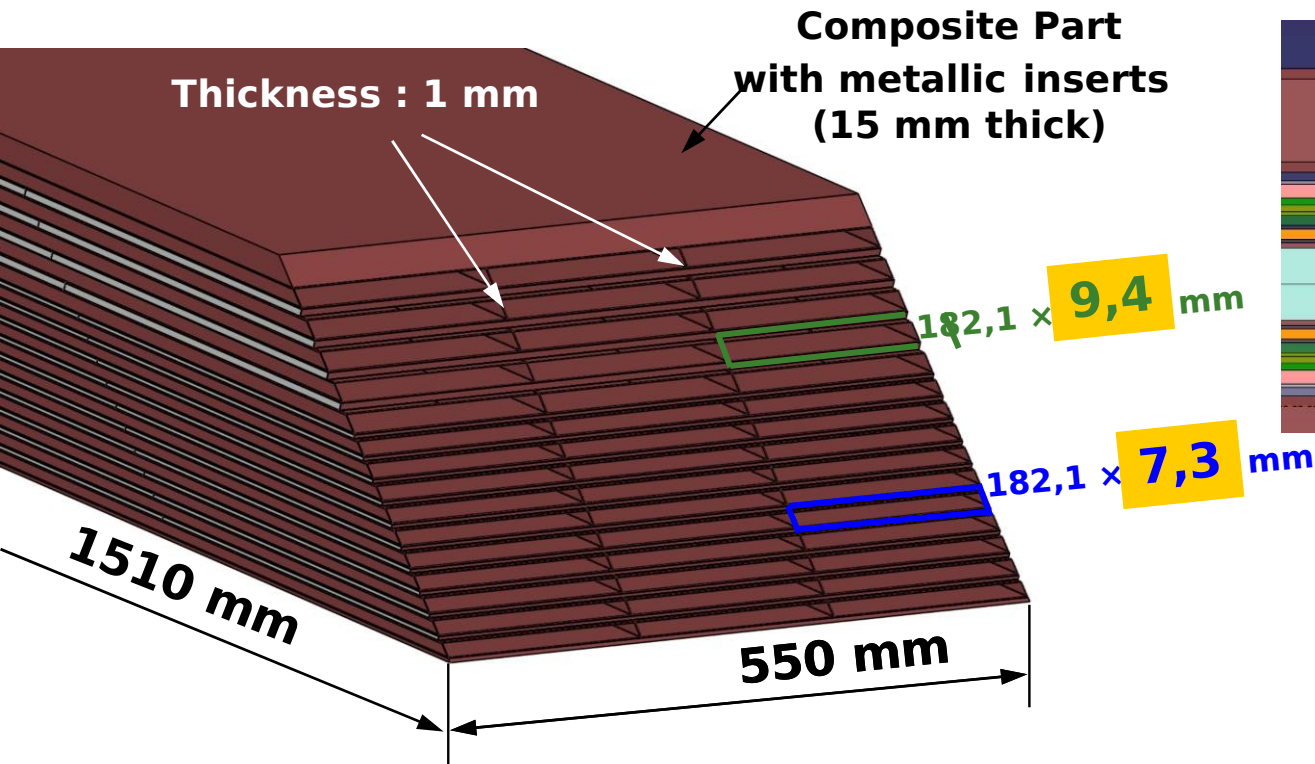
# Entering the “Technological Prototype Phase” - Phase CALICE II

**The aim is to build and operate prototypes as close as possible to what we would like to have for the ILC**

- How well do the ongoing projects meet this requirement?
- What steps are needed to complete the prototypes
- Where can we act as a collaboration?



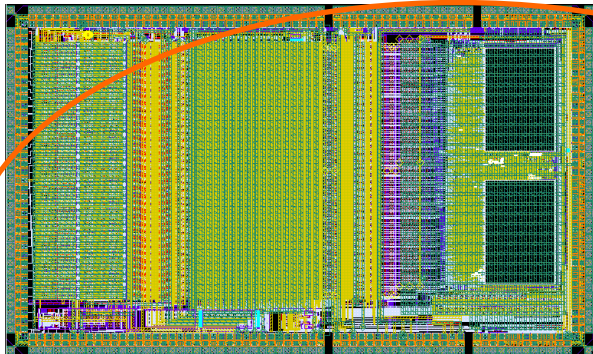
# SiW Technological Prototype - EUDET Module



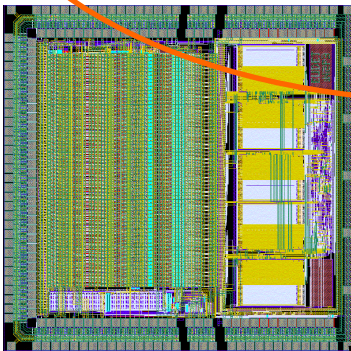
- Design of prototype fully compliant with ILC Detector proposals!!!!
- VFE (Chips and boards) determines rhythm of project



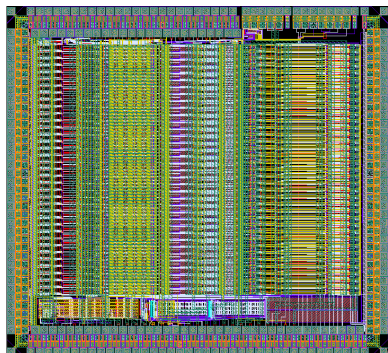
# Very Front End ASICs: The 'ROC' Family



**SPIROC**  
Analog HCAL  
(SiPM)  
36 ch. 32mm<sup>2</sup>

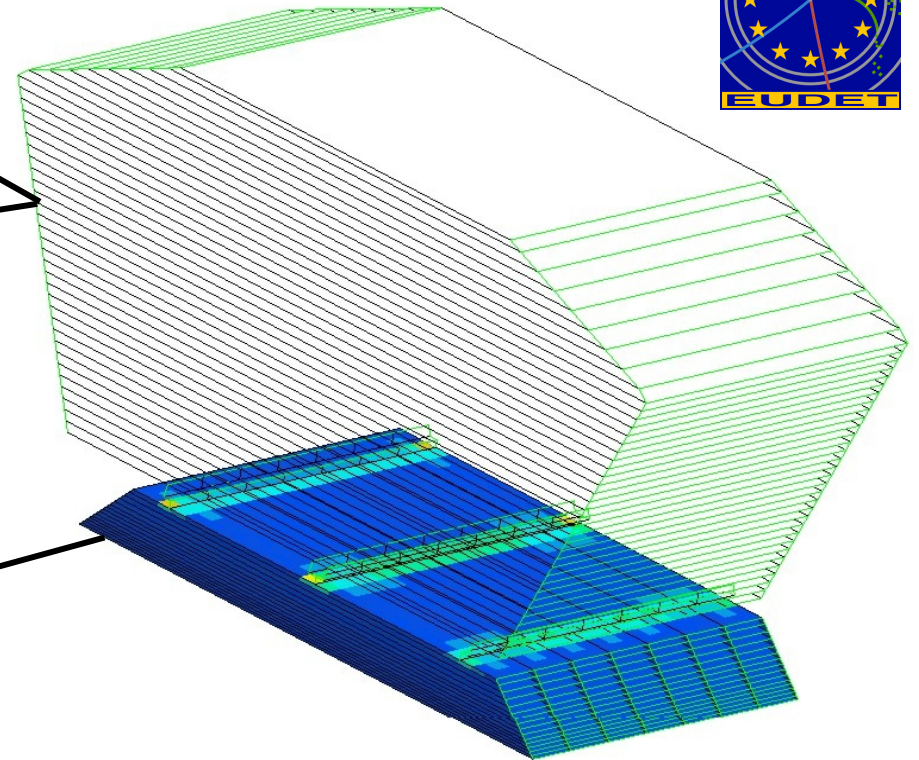


**HARDROC**  
Digital HCAL  
(RPC,  $\mu$ egas or GEMs)  
64 ch. 16mm<sup>2</sup>



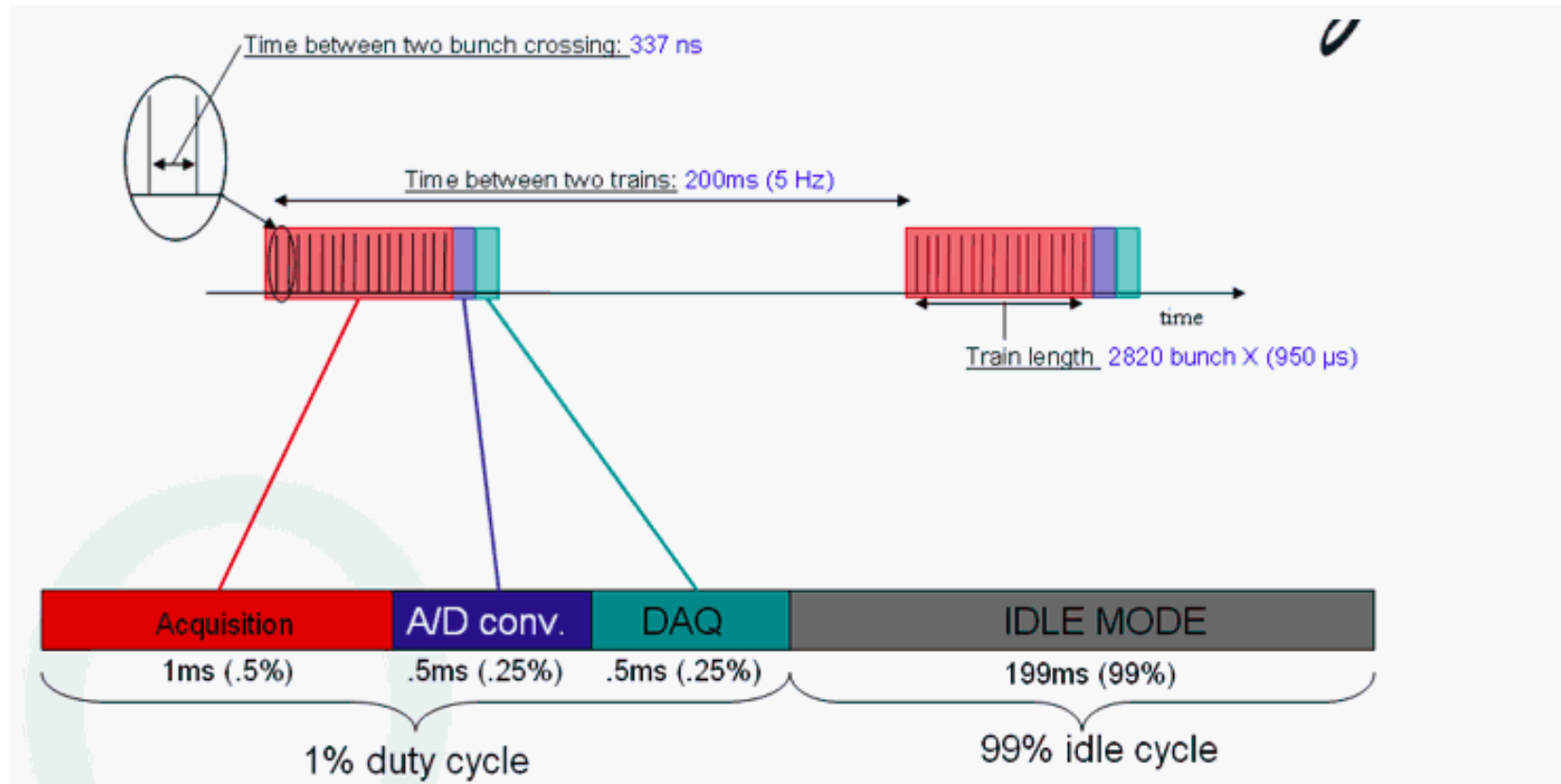
**SKIROC**  
ECAL  
(Si PIN diode)  
64 ch. 20mm<sup>2</sup>

- ECAL, AHCAL, DHCAL
- Employment for  $\mu$ Megas?  
O(10<sup>2</sup>)Smaller Signals
- Viable options DIRAC and DCAL IV



ROC family as priority for VFE Chip development !!!!  
Largest Synergies

# “Power Pulsing”



- The mastering of this technology is of interest for all calorimeters for the ILC
- It's studying should have very high priority in the R&D in the next two years
- Power dissipation of Chips for “physics testbeams”?

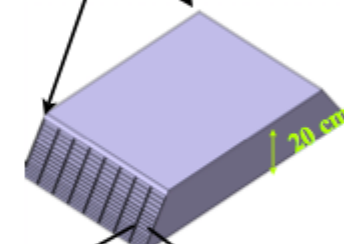
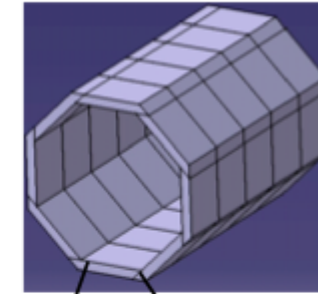
# Time line of SiW Ecal

	Mechanics	Electronics	Wafers	Integration
Q3-4 '09	Thermal tests	Tests of surface bonded SPIROC2	Test 40xHamamatsu	DAQ firmware
	Prepare assembly room		Guard ring test samples	Prepare cosmic bench
Q1-2 '10	Make alveolar structure	Tests of embedded SPIROC2	Test samples from other companies	Cosmic tests w/ SPIROC2
	Make 'H' structures	SKIROC2		
Q3-4 '10		PCB w/ embedded SKIROC2		Cosmic tests w/ SKIROC2
Q1-2 '11	Slab assembly		Order wafers	Start to instrument structure
Q3-4 '11				Partially instrumented
Q1 '12				Fully instrumented

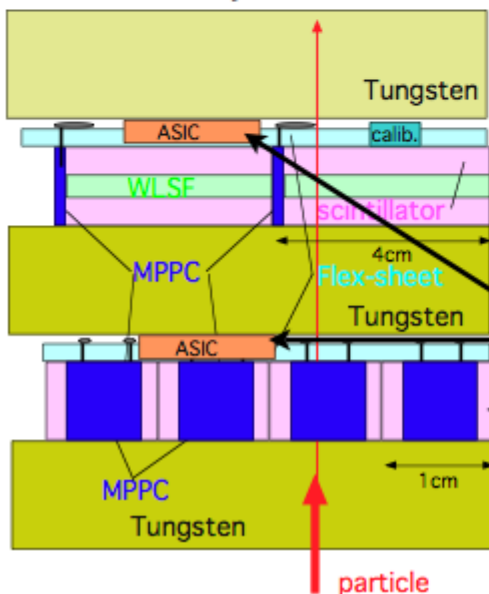
CdIT:  
Production Run with all ROCs beginning of 2010??

# ScEcal – Synergies with other Projects

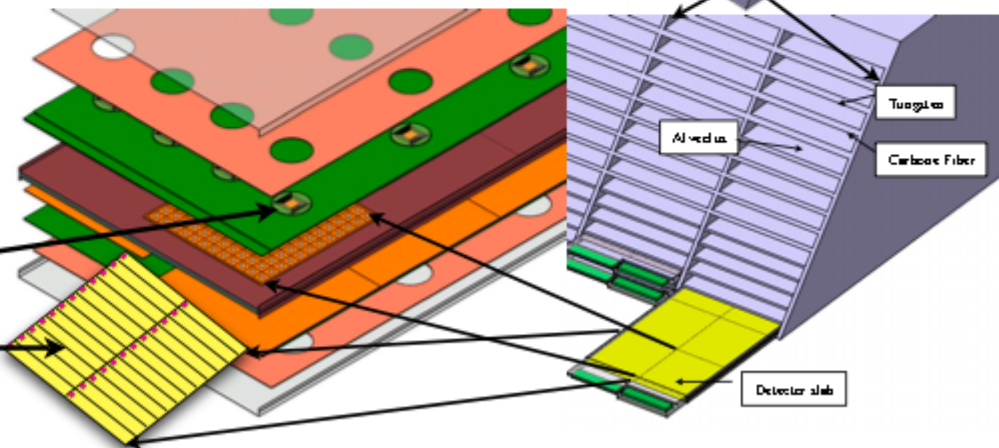
- Instrumented layer by ~2012
- AHCAL Electronics and SiW Ecal Mechanics
- Engineering of ScEcal layers should benefit from experience with EUDET Prototypes  
Re-usability of devices???
- Clear item for a collaborative effort



EM-Scintillator-layer model Cross section TT Oct 07



elec  
strip



# Entering the “Technological Prototype Phase” - Phase CALICE II

## Ecal Technological Prototypes

**The aim is to build and operate prototypes as close as possible to what we would like to have for the ILC**

- How well do the ongoing projects meet this requirement?  
Mechanics and Electronics ok
- Where can we act as a collaboration?  
Considerable synergies  
Should ponder them now to avoid construction of two prototypes!!!!

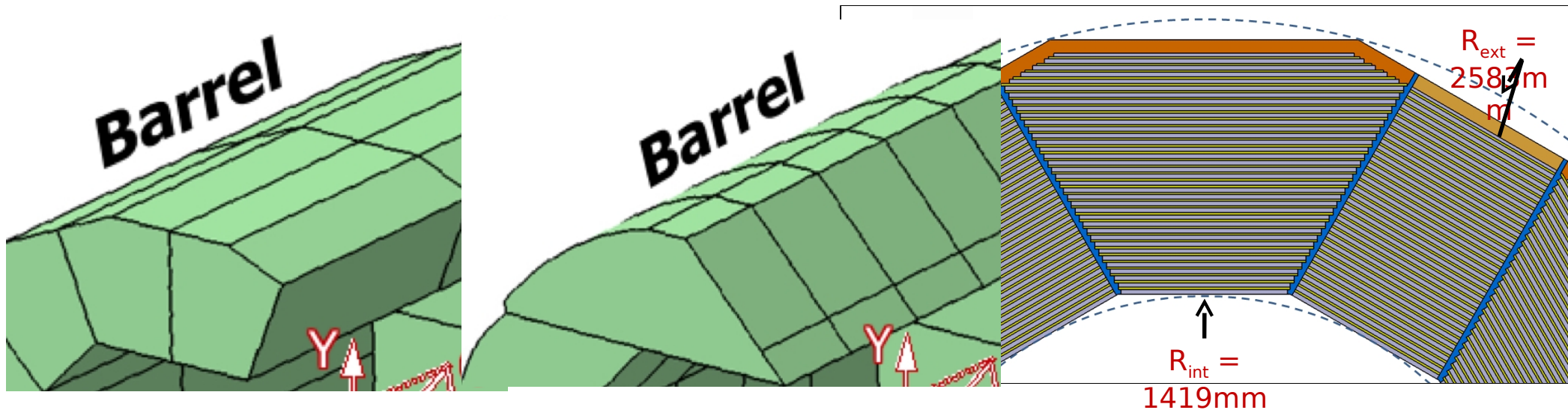
# Entering the “Technological Prototype Phase” - Phase CALICE II

## Hcal Technological Prototypes

**The aim is to build and operate prototypes as close as possible to what we would like to have for the ILC**

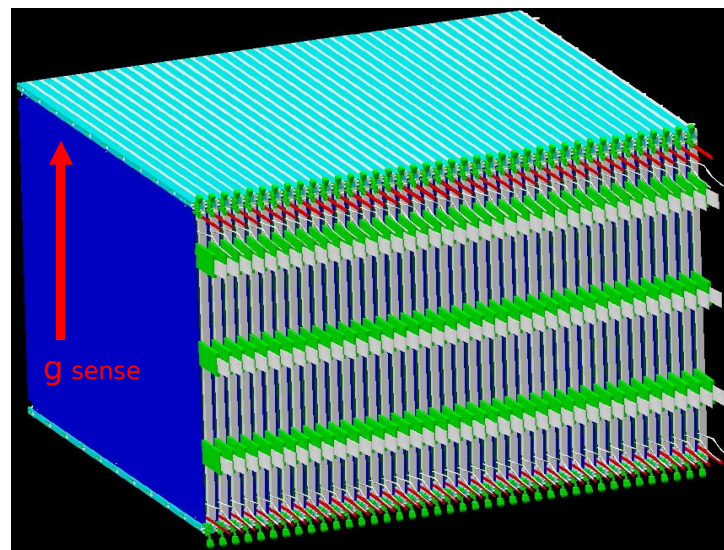
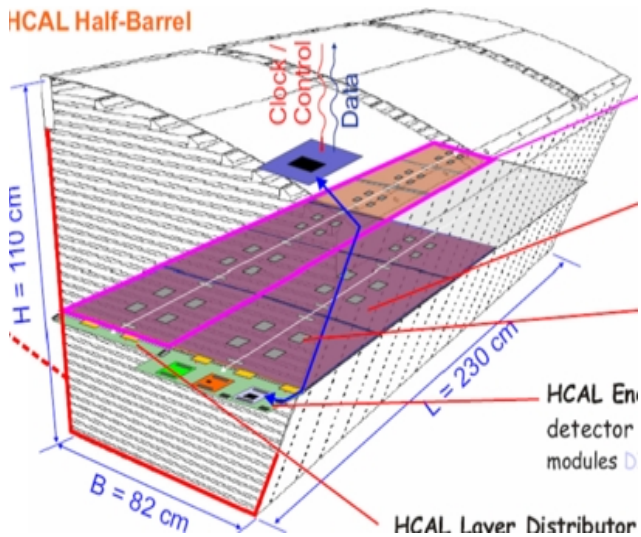
- How well do the ongoing projects meet this requirement?  
**Electronics ok!!!**
- What steps are needed to complete the prototypes
- Where can we act as a collaboration?

Mechanics ... Well it depends



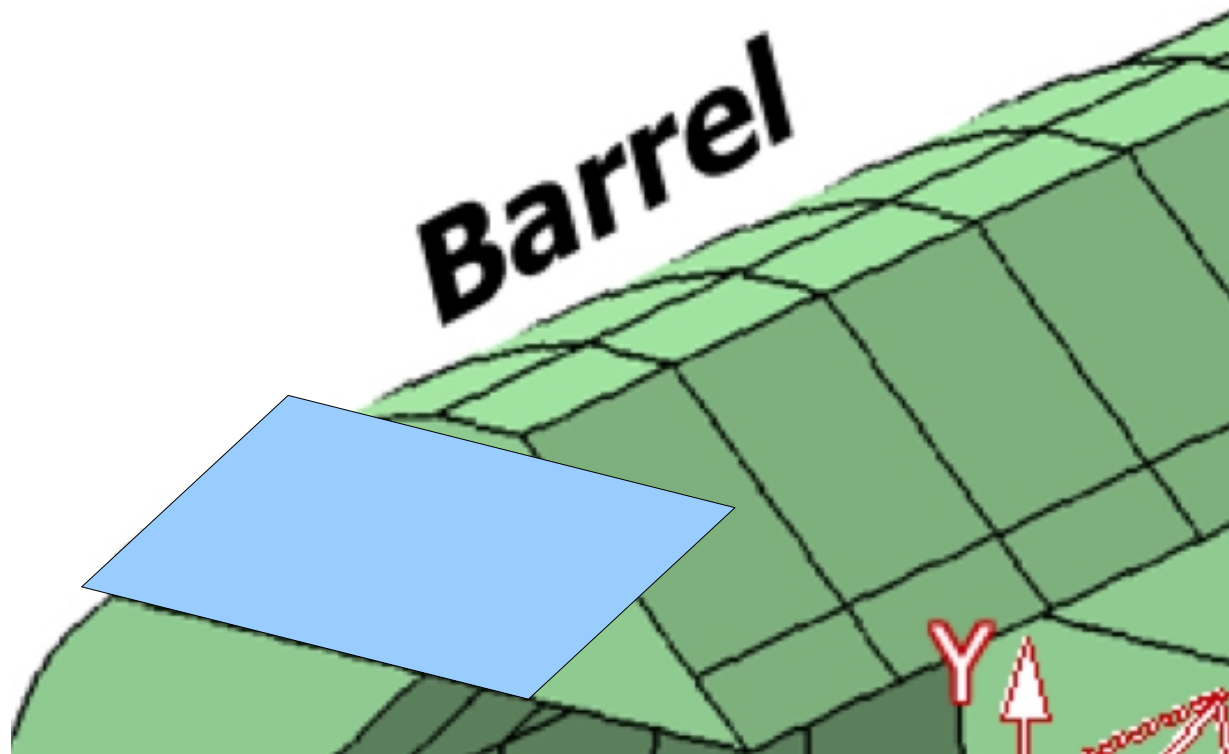
AHCAL Techprototype  
will It be built similar?

Cubic meter for DCHAL Technical prototype



If at all similar to SiD proposal

# Revision of DHCAL Mechanics



**- Installation in detector would require  
Self supporting structure**

- Parallelogram instead of square?

Would Approximate one half of the DHCAL Module

What is the principle problem to make modules  
with different length?

- The prototype(s) will be with us until roughly 2015

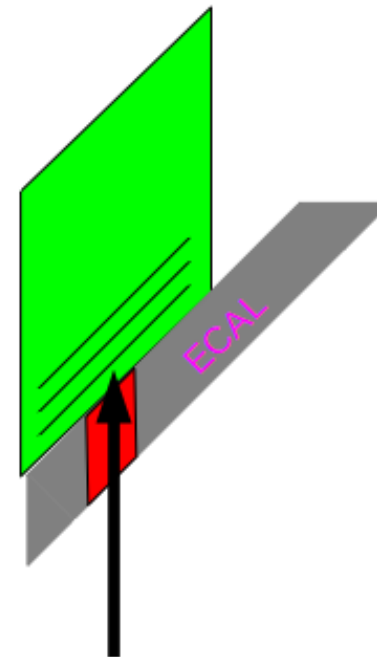
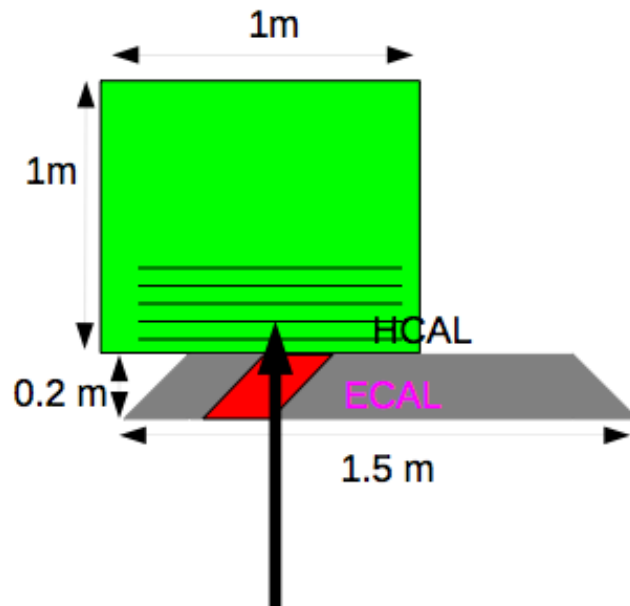
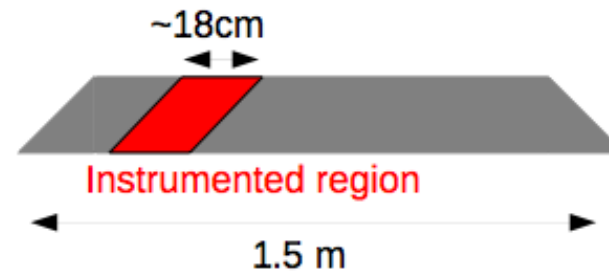
Accommodation of long layers?

*CALICE Collaboration Meeting Sep. 2009*



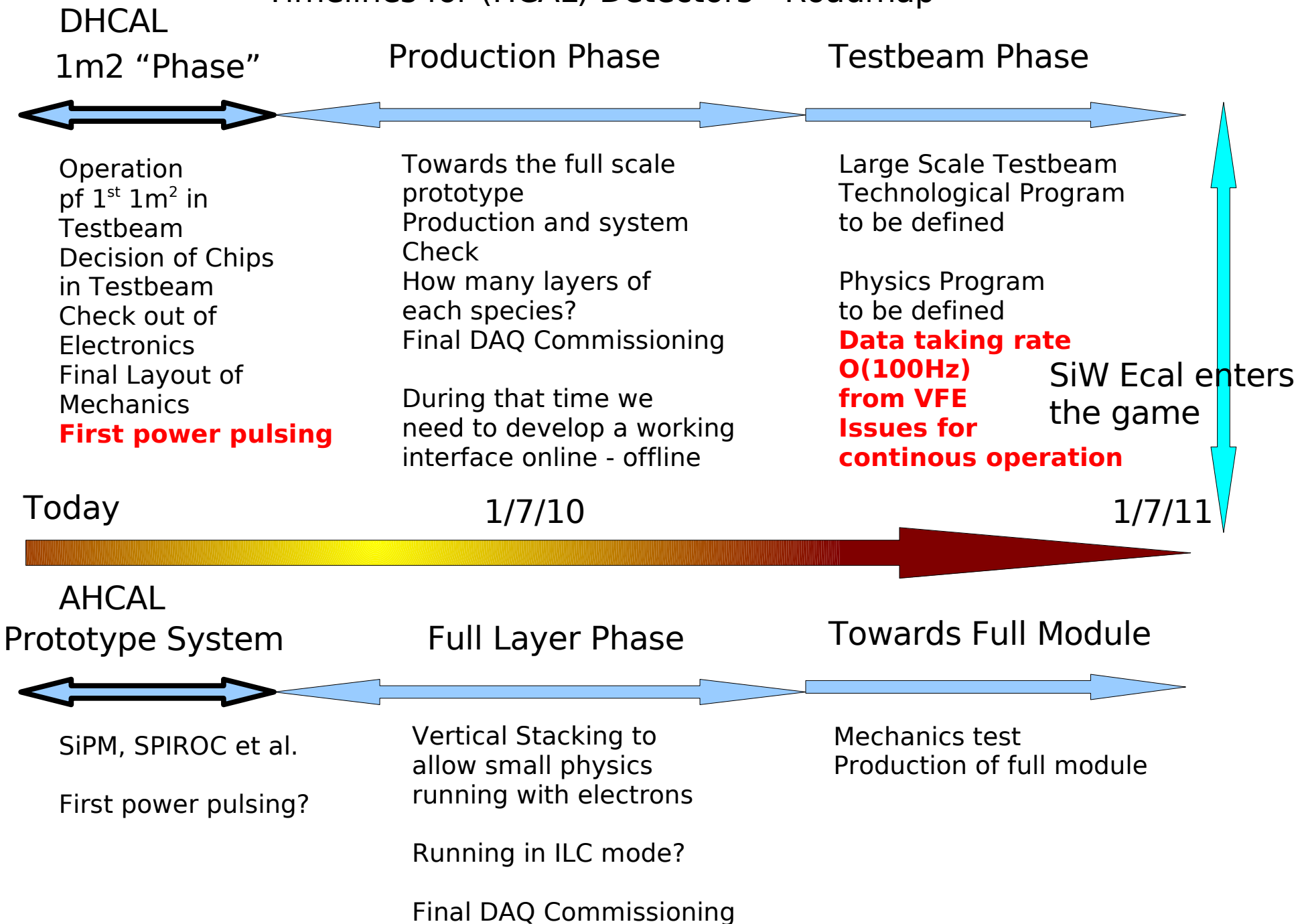
Now could this look in a Testbeam Setup?

Instrumented region & combined TB integration



Clearly to be discussed and elaborated further  
(This meeting!!!)

# Timelines for (HCAL) Detectors - Roadmap



## Collaboration in the DHCAL R&D

- There is a lot of room for new transfer of knowledge
- We will test the operation of (large) Glass RPCs

Exchange of Results outside of Collaboration Meetings!!!!

Less good examples: Development of resistive painting  
G4 modifications

- E.g. High Voltage system  
we should encourage regular exchange of information between  
Uni Iowa and the other partners
- Chamber Gases?
- Development of large size RPCs
- Common reconstruction algorithms  
Code can be identical after step to "RawCalorimeterHit?"
- **Common DHCAL meetings (e.g. 2 times a year) are strongly encouraged!!!**

## Conclusions and Outlook

- Priority to conclude 'Physics Prototype Phase – CALICE I – with combined testbeam SiW Ecal, US-DHCAL and TCMT  
=> Comparable data sets within common s/w framework
- CALICE continues to have a rich R&D programm and enters a phase in challenging technologies for ILC faces their realisation
- It is explicitly in the interest of CALICE to investigate several detector technologies
- Points for (new) collaboration/sharing of knowledge could have been identified and we should benefit from that
- TB Review document on “Future Calice Projects” transmitted to Steering Board
- Projects in early stages:
  - DECAL
  - Start of discussion on Hcal with tungsten absorbers  
Re-use of existing CALICE stack !?  
Going to learn more at this meeting