



ILD group

Status of discussions at Santander  
Ties Behnke, DESY



# Agenda of the Meeting

Friday	Saturday	Sunday
Analyses (common ILD, Sid, CLIC)	Subdetectors 1	Optimization: Calorimetry
Analyses (common ILD, SiD, CLIC)	Subdetectors 2	Discussion/ Conclusion
General ILD session	Software and Reconstruction	
Central Design group	Optimization: Tracking	

Number of participants around 55-60, of course some decrease towards Sunday  
Dinner on Friday evening: 52 participants

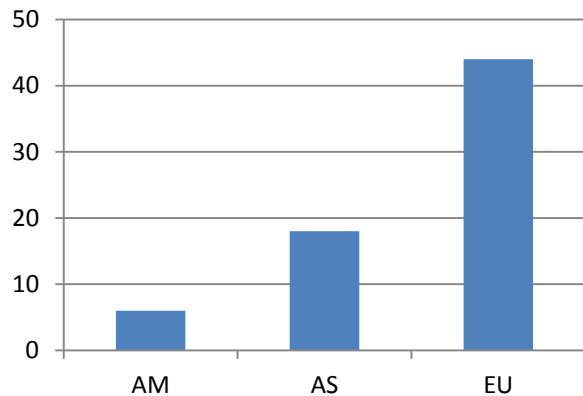


# ILD: The Group

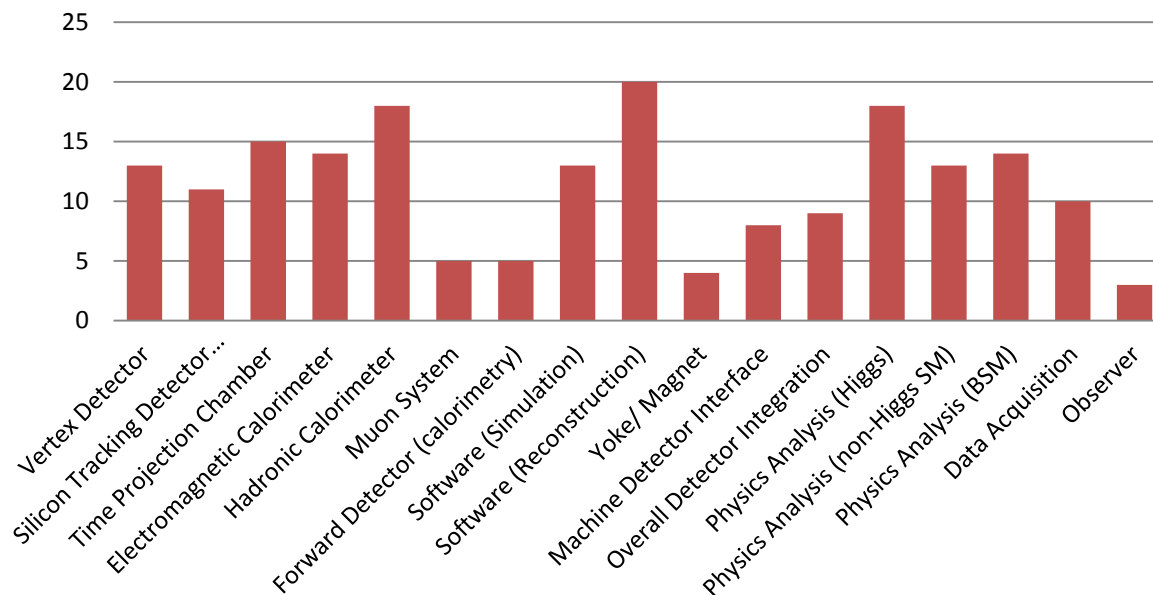
ILD:

Currently 71 groups signed up

## Region of Origin



## ILD activities matrix





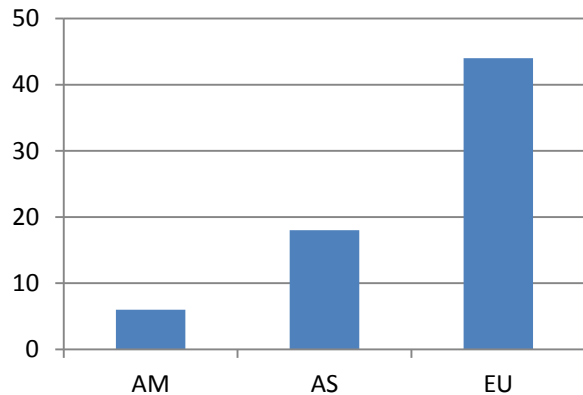
# ILD: The Group

Weighted by available personpower (percentage to all)

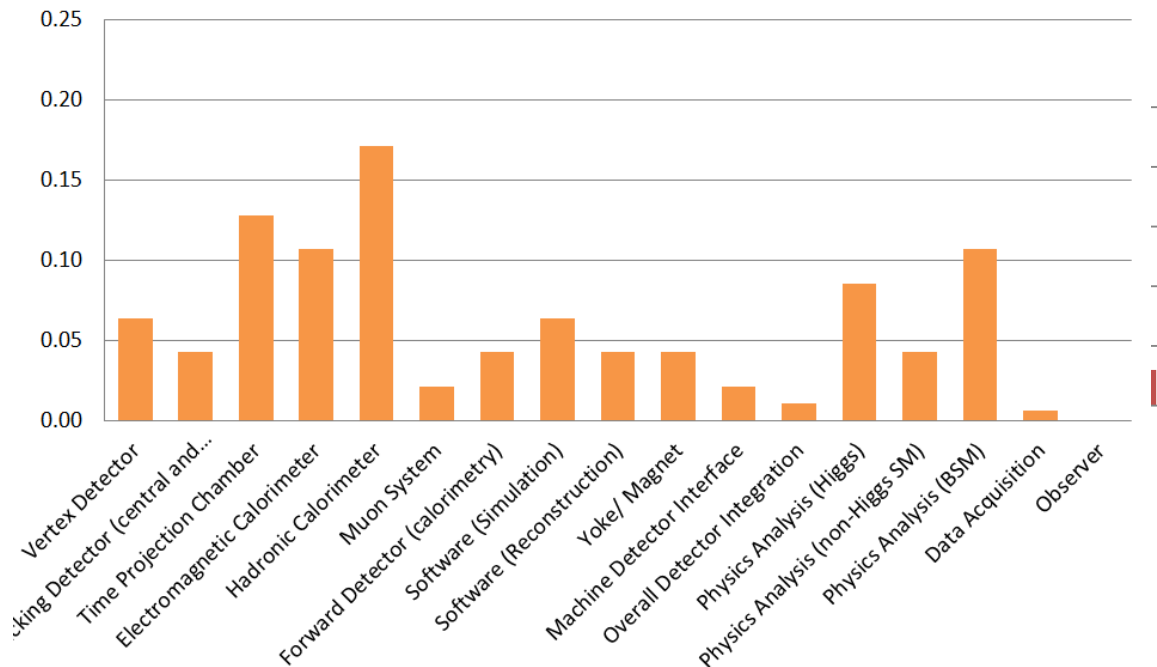
ILD:

Currently 68 groups signed up

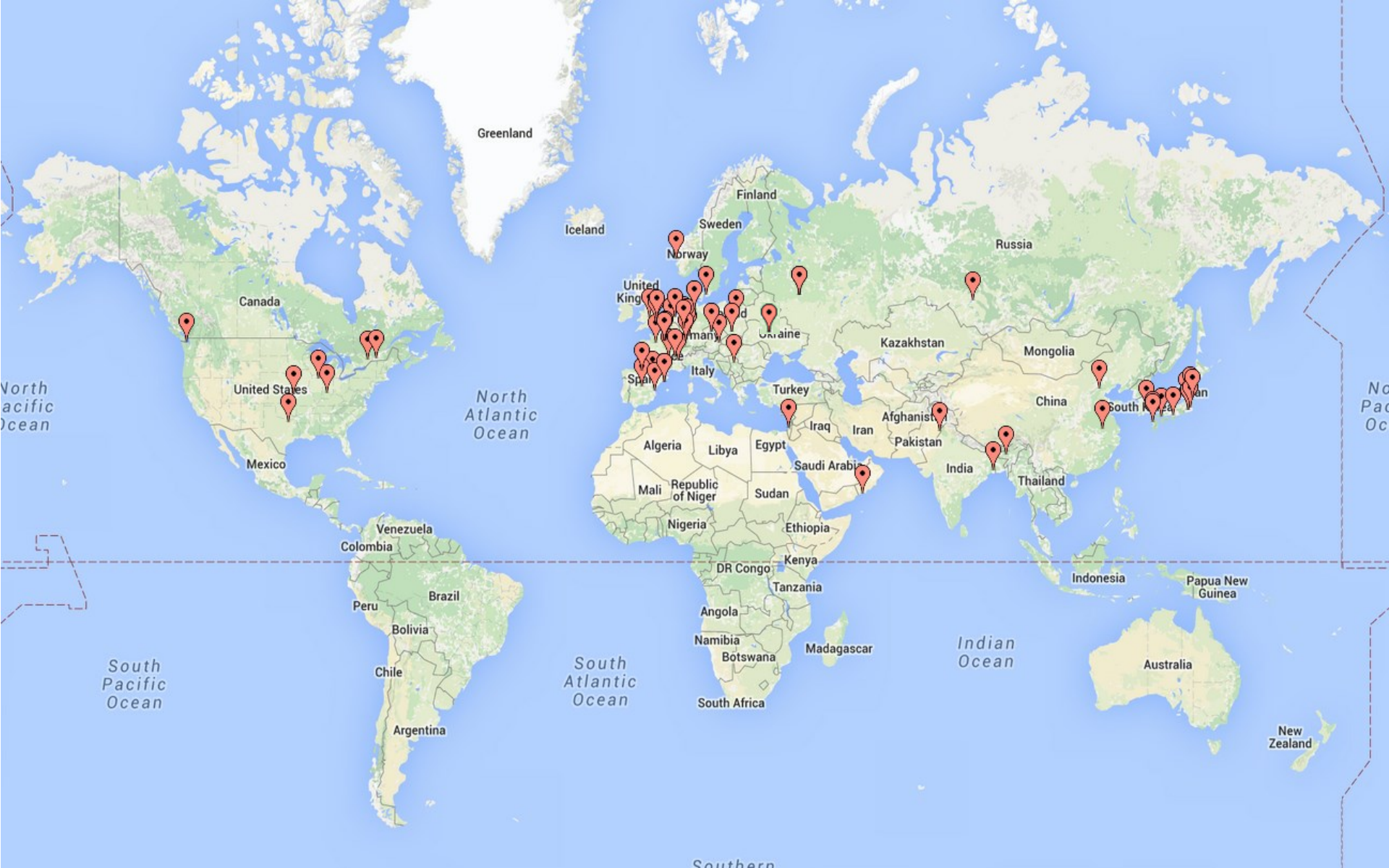
## Region of Origin



6/3/2016



ILD: Status and Plans





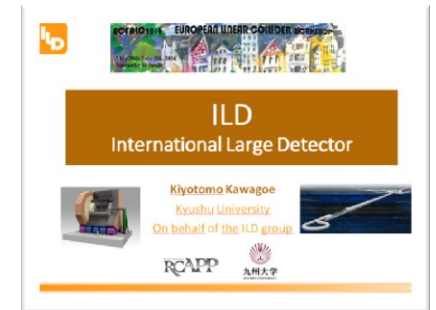
# Overall Strategy

Make the scientific case for the ILC

Move forward as one community  
Join forces with SiD  
Integrate Theory and experiment  
Interact with the Japanese review process

Develop and optimize ILD

Adapt the ILD design for the Japanese site



See plenary talk by Kiyotomo Kawagoe  
on Thursday at this conference.



# Goals of this meeting

- Understand the state of the optimization of ILD
- Formulate a set of clear goals for the optimization process
- Converge towards O(2) new baseline models for ILD
- Decide on a time line
- Decide on a final deliverable of the optimization

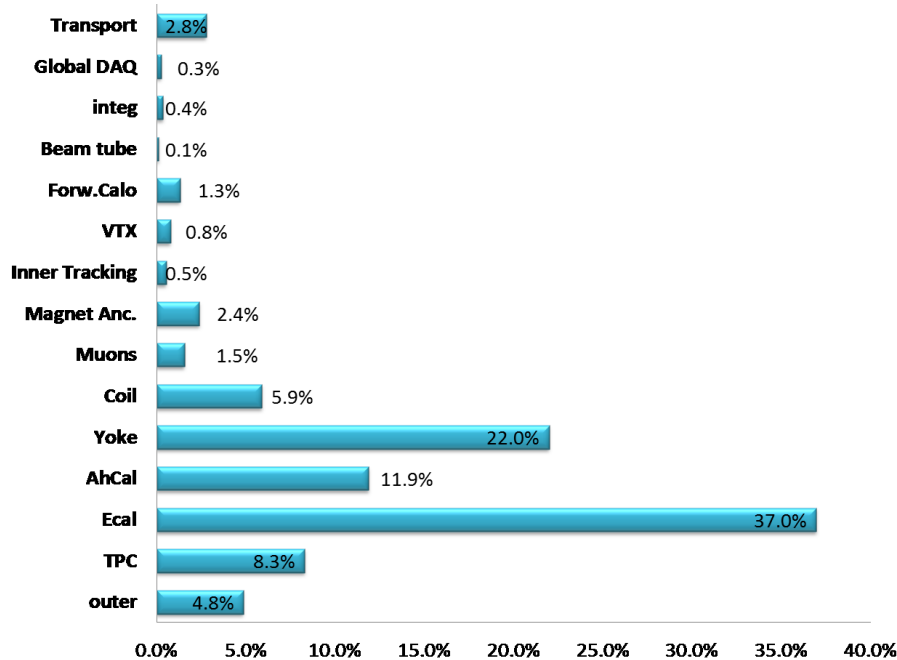


# ILD Optimization

Excellent overall performance

Large detector: relatively large costs.

- Careful study needed of cost vs. performance
- Strong focus on making the connection between the detector design and the physics performance explicit.

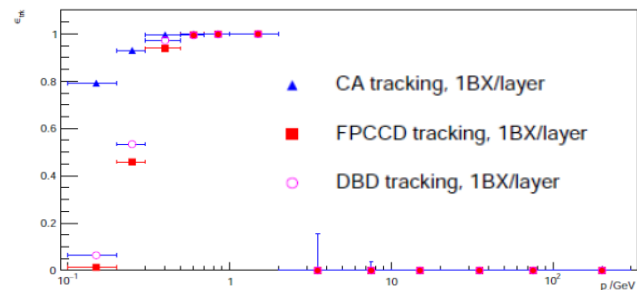
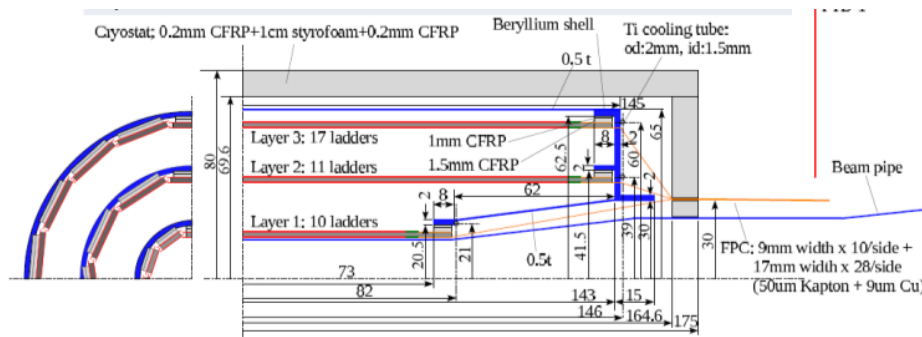


Total cost about 400 Mio ILCU (2012 costs)





# Highlights from Vertex



Reconstruction is making great progress  
we understand much better low momentum  
behaviour

Physics: Mat. budget and granularity

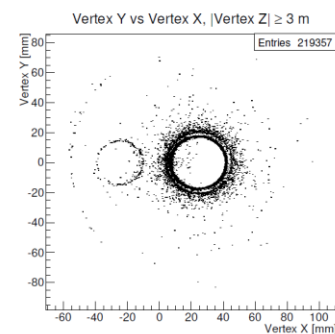
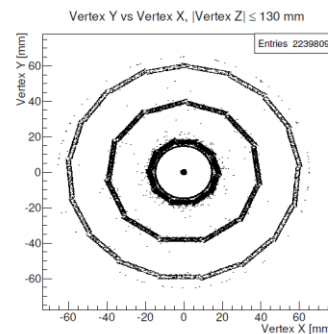
$$\sigma_{R\phi} \sim 3 \mu\text{m} \text{ (pitch } \sim 17 \mu\text{m)}$$

$$O(0.15\%X_0/\text{layer})$$

Baseline design has not been changed: is it still

Optimal:

- Backgrounds
- Integration time: Significant progress, reduction by factor of 10 has been demonstrated



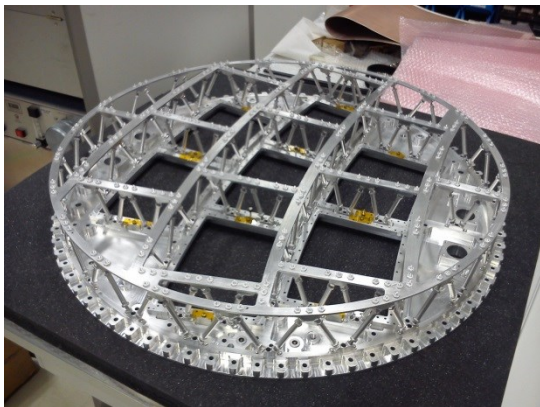
Design of the forward region impact on VXT design



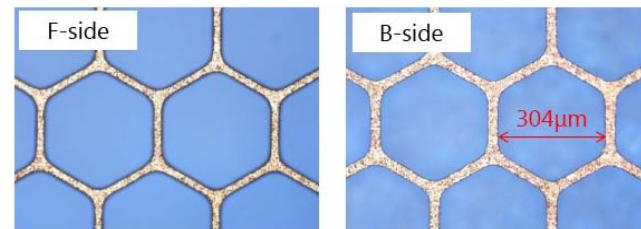
# Highlights from TPC

Critical issue: gating of the TPC

Ongoing improvement of DESY setup, light weight endplate ready to be used



Newly developed high transparency GEM from Japan: 84% optical transparency!

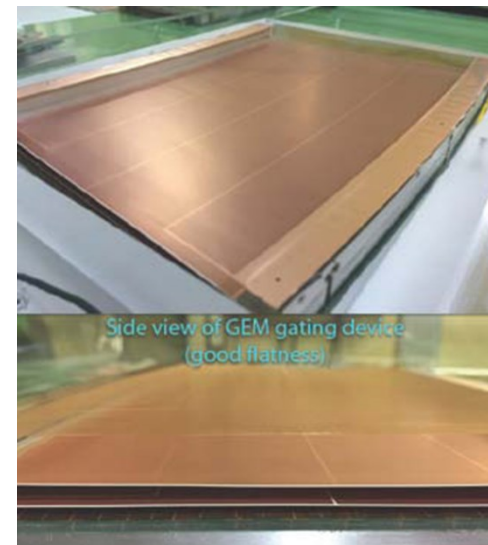


Asian GEM module Equipped with gating GEM (not visible..)

First tests anticipated fall 2016 here at DESY

Last step in the proof of concept phase.

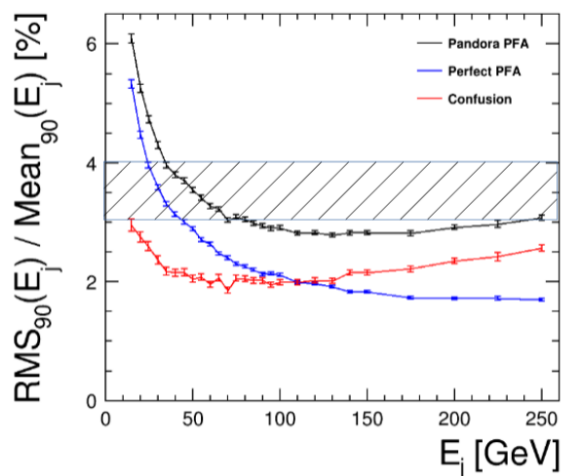
Many other studies: stability new DESY module, pixel readout are ongoing.





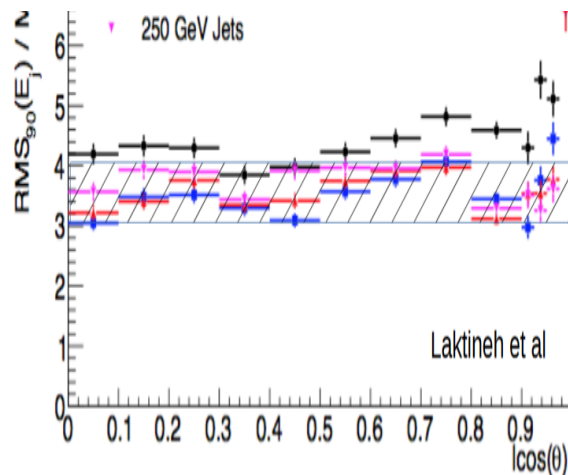
# Highlights from Calo

No comments on hardware developments...apologies



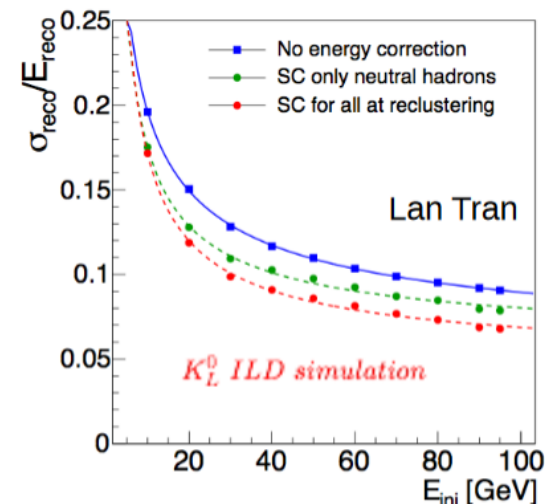
SIECAL + AHCAL

Particle flow performance for ILD DBD model.



SIECAL + SDHCAL

Enormous progress in understanding performance

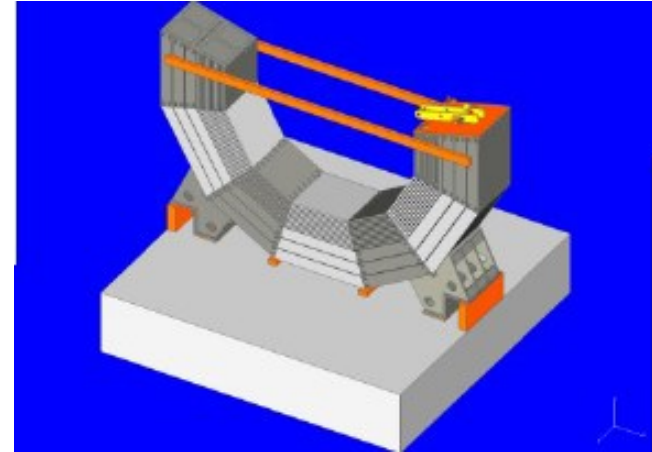


Single particle resolution hadrons, after energy correction



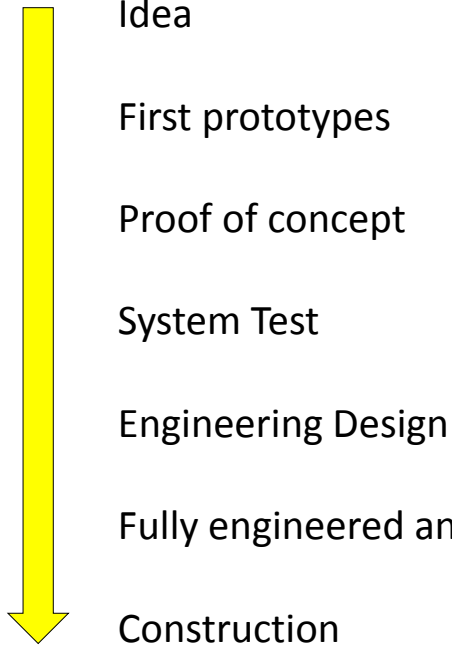
# Engineering

Engineering / Integration  
is central part of  
optimization:  
If we cannot build it, it is  
not optimized!



For most systems we are here

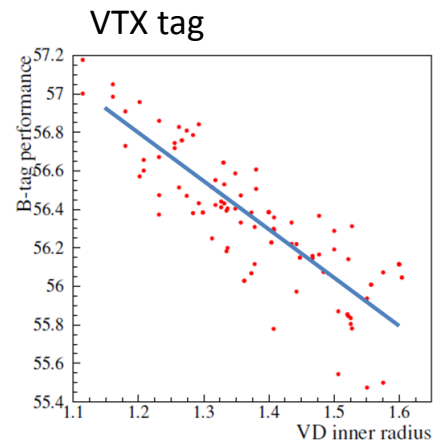
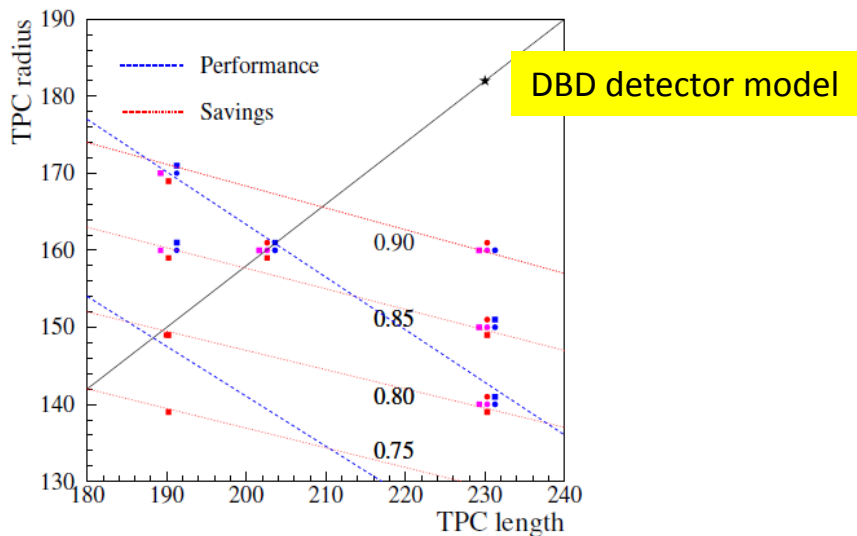
For large-scale serious engineering  
we lack resources!



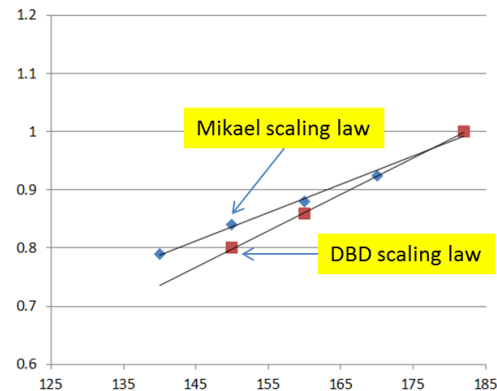


# Optimization of Tracking

No comments on hardware – apologies again...



## Cost scaling

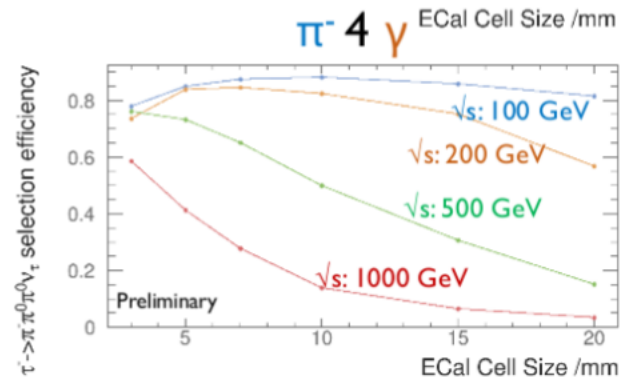
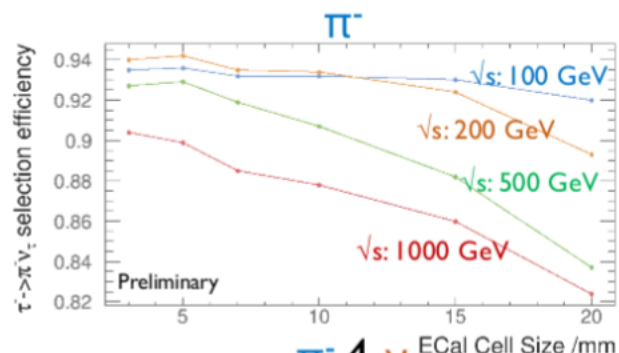
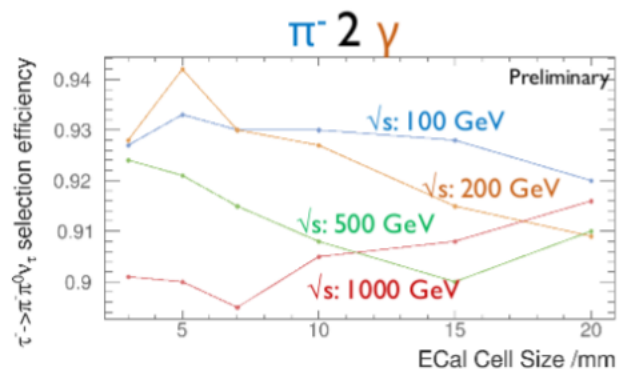




# ECAL Optimization

## ECal cell sizes study

- Compare  $\pi^-$  with 0/2/4  $\gamma$  final states, with varying ECal cell size, Si with ILD



31/05/2016



B. Xu, S. Green, J. Marshall, M.A. Thomson -  
University of Cambridge

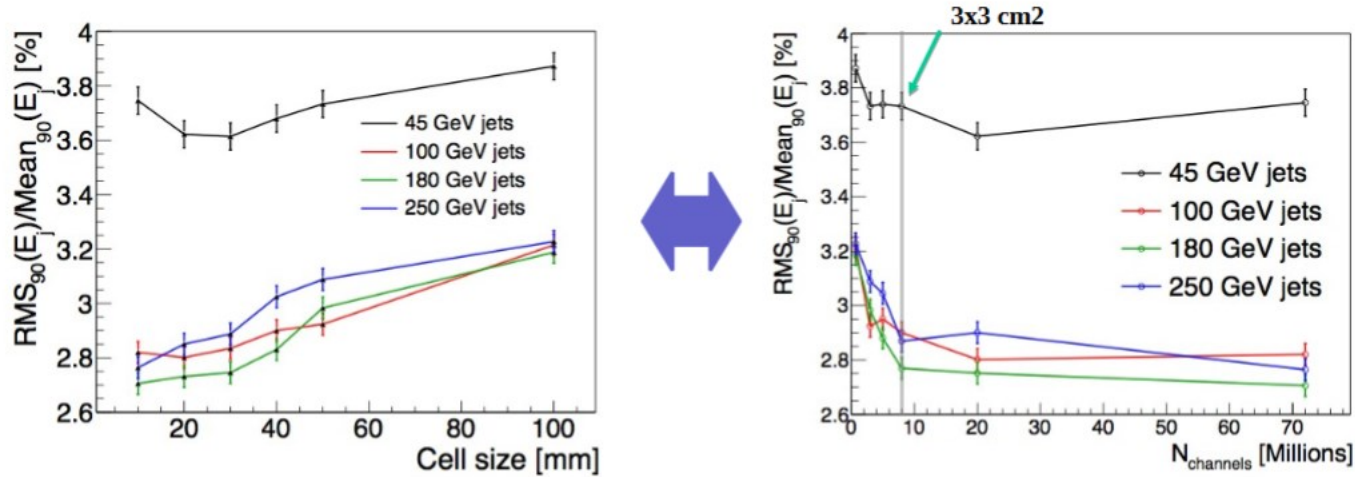


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# HCAL Optimization

Cell size optimization study (L. Tran, DESY)



Nicely translate plot into relevant metric.



# Moving ahead

1. Define geometry of several baseline models
  - Radii, length, thickness
2. Validate the subdetector technologies
  - Availability of realistic models
  - Availability and test of digitization models
  - Availability and test of reconstruction code
3. Populate the subdetector geometries with validated technologies





# Options

- ILD has always carried technological options:
  - Central to make ILD attractive and flexible
  - Ensures a constant and productive iteration
  - Makes ILD very strong technologically
- We need to discuss and understand how to deal with options in the optimization process



# Goal of the Process

Define a new ILD baseline detector with options

- Based on detailed optimization studies
- Based on in –depth comparison of the few benchmark models

Demonstrate the performance of the new ILD baseline

Document the process and the results in a note

Timescale: about 2 years from today

Back this up by a series of publications of results of the studies and on technologies



# Small ILD?

Detektor	DBD		
B-Field	3.5 T		
VTX inner radius	1.6 cm		
TPC outer radius	180cm		
TPC inner radius	33 cm		
TPC # pad rows	220		
TPC length (z/2)	235cm		
Inner ECAL radius	184 cm		
ECAL $\Delta R$	18.5 cm		
ECAL # layers	29		
Inner HCAL radius	206 cm		
HCAL thickness	5.5 $\lambda$ (Fe)		
HCAL # layers	48		



# Small ILD?

Naïve scaling:  
Needs experts  
to look at  
and verify

Detektor	DBD	Small ILD	
B-Field	3.5 T	4 T	
VTX inner radius	1.6 cm	1.4 cm	
TPC outer radius	180cm	146cm	
TPC inner radius	33 cm	33 cm	
TPC # pad rows	220	134	
TPC length (z/2)	235cm	235 cm	
Inner ECAL radius	184 cm	150 cm	
ECAL $\Delta R$	18.5 cm	20.5 cm	
ECAL # layers	29	22	
Inner HCAL radius	206 cm	175 cm	
HCAL thickness	5.5 $\lambda$ (Fe)	5.5 $\lambda$ (Fe)	
HCAL # layers	48	?	



# Moving ILD into the Future

Organisationally: we think we are on track and setup the right structures

Technically:

- ILD maintains a broad option of technologies
- We are always open for new ideas and technologies
- Our baseline choices are still state-of-the-art
  
- For fundamentally new approaches we neither have the resources nor do we see the real need at this point
  
- We instead focus on preparing ILD for the time when decisions are needed



# The Future

ILC situation was discussed at this workshop:

- Careful optimism is in order, things are happening
- It is very hard to predict when things might take off
- “A Japanese decision will be input to the European Strategy process”, quote by KEK-DG yesterday



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# The Future

ILC situation was discussed at this workshop:

- Careful optimism is in order, things are happening
- It is very hard to predict when things might take off
- “A Japanese decision will be input to the European Strategy process”, quote by KEK-DG yesterday
- But we do not always understand each other right ...

We are currently operating in a bit of a vacuum:

- Messages are not always as clear as we like
- Funding is limited
- Fluctuations in person-power

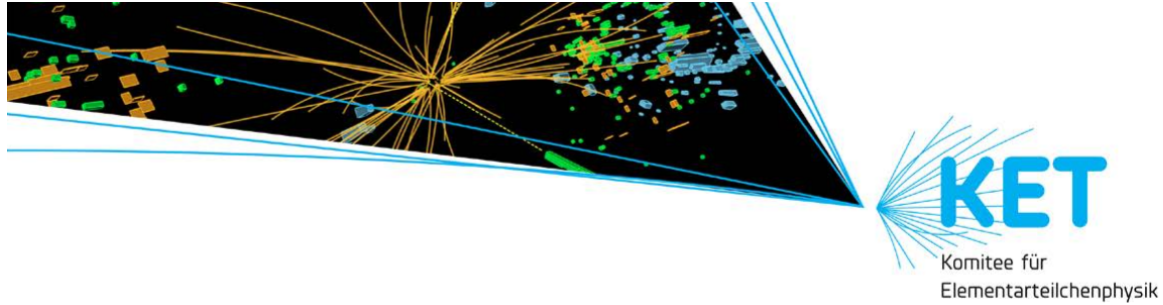
But we need to be prepared to move fast in case things take off.







# The case is strong!



Conclusions of the

## KET Workshop on Future $e^+e^-$ Colliders<sup>a</sup>

Max-Planck-Institut für Physik Munich, May 2-3, 2016

1. The physics case for a future  $e^+e^-$  collider, covering energies from  $M_z$  up to the TeV regime, is regarded to be very strong, justifying (and in fact requiring) the timely construction and operation of such a machine.<sup>i</sup>
2. The ILC meets all the requirements discussed at this workshop.<sup>ii</sup> It is currently the only project in a mature technical state. Therefore this project, as proposed by the international community and discussed to be hosted in Japan, should be realised with urgency. As the result of this workshop, this project receives our strongest support.<sup>iii</sup>



# ILD

ILD continues to be carried by a strong community

We have setup a good structure which us starting to work efficiently

Support however for work on ILD is marginal at best

To make real progress we would need significantly larger resources.

ILD@Americas continues to be very weak



ILD Meeting in Oshu City, Japan, 2014