Report from the ILD Meeting

Ties Behnke

ILC project meeting

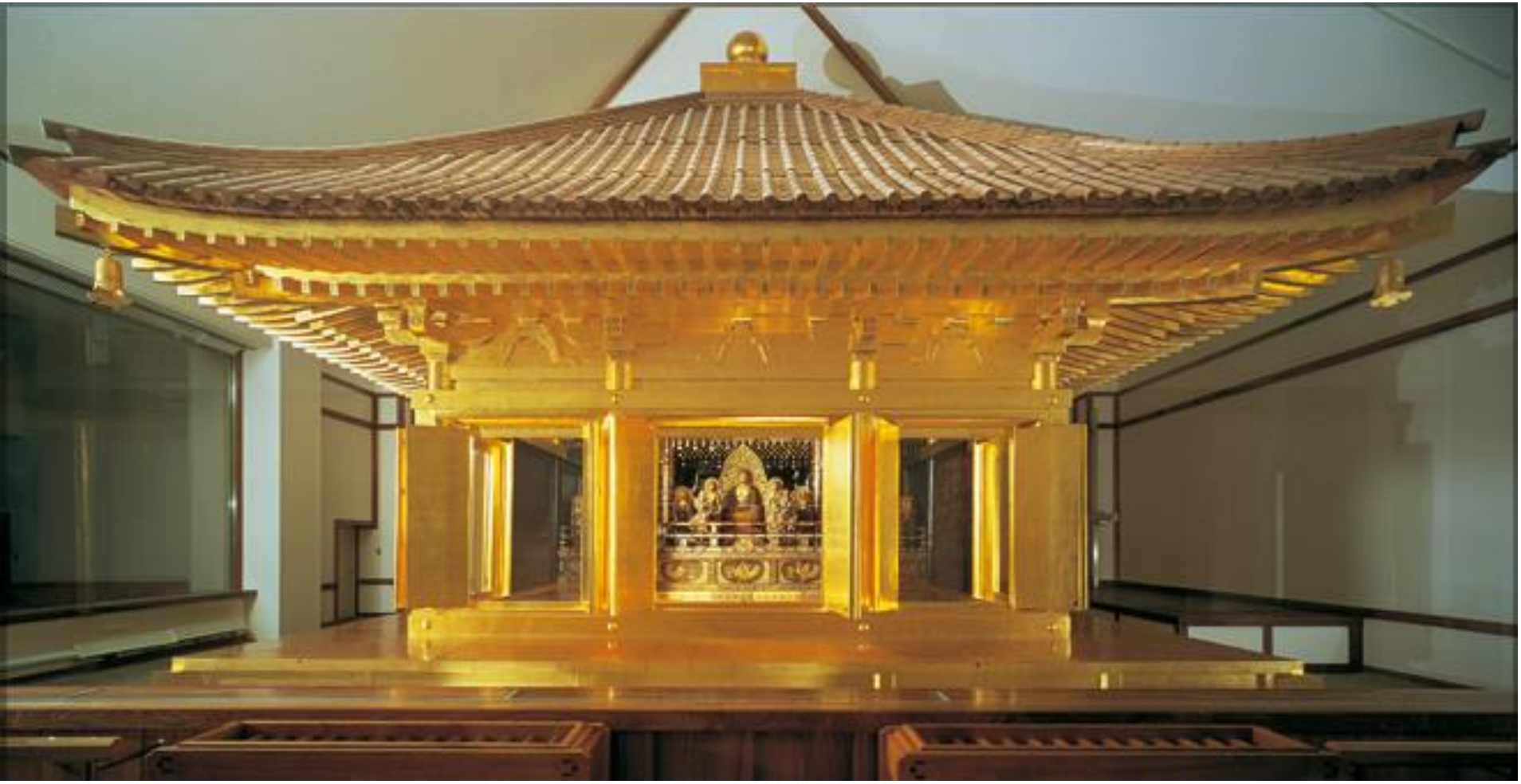
26.9.2014

ILD @ OSHU

Strong local support
ILD / ILC rather visible in the city


International Linear Collider
科学新世紀
歓迎
ILD meeting 2014
迎

UNESCO Heritage site: very close by

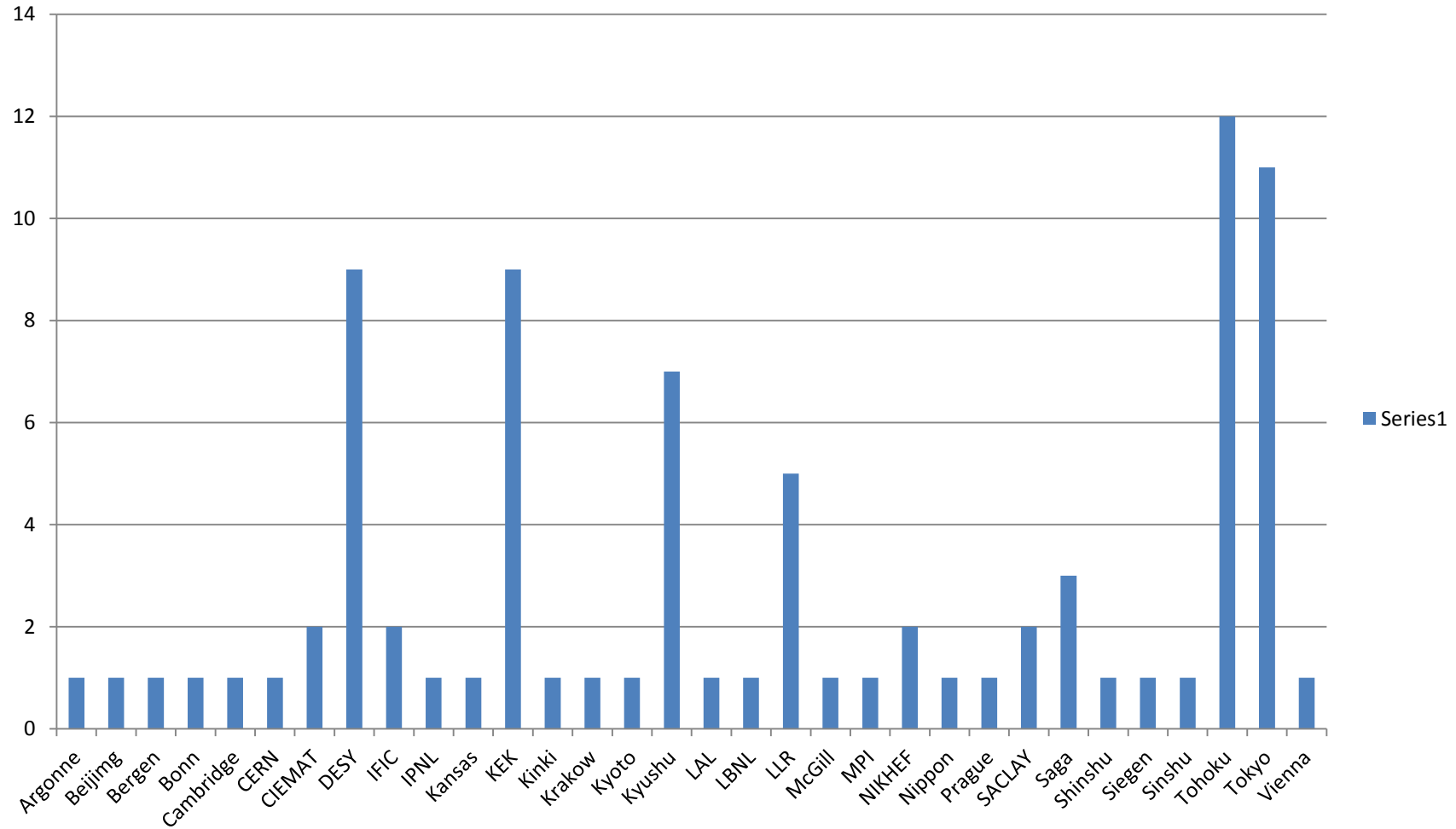


Close to the IP:
Project by local high school students

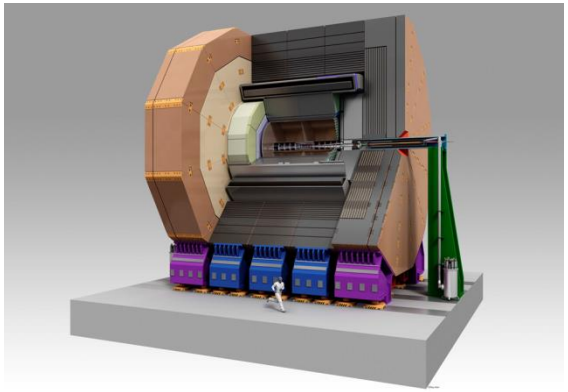
ILD meeting

85 registered participants from 32 institutes

Participants



Goals



Re-invent ILD “the detector”

Put ILD up against the physics agenda of the ILC: how are we doing?

Are we doing the right things?
Are we doing things right?

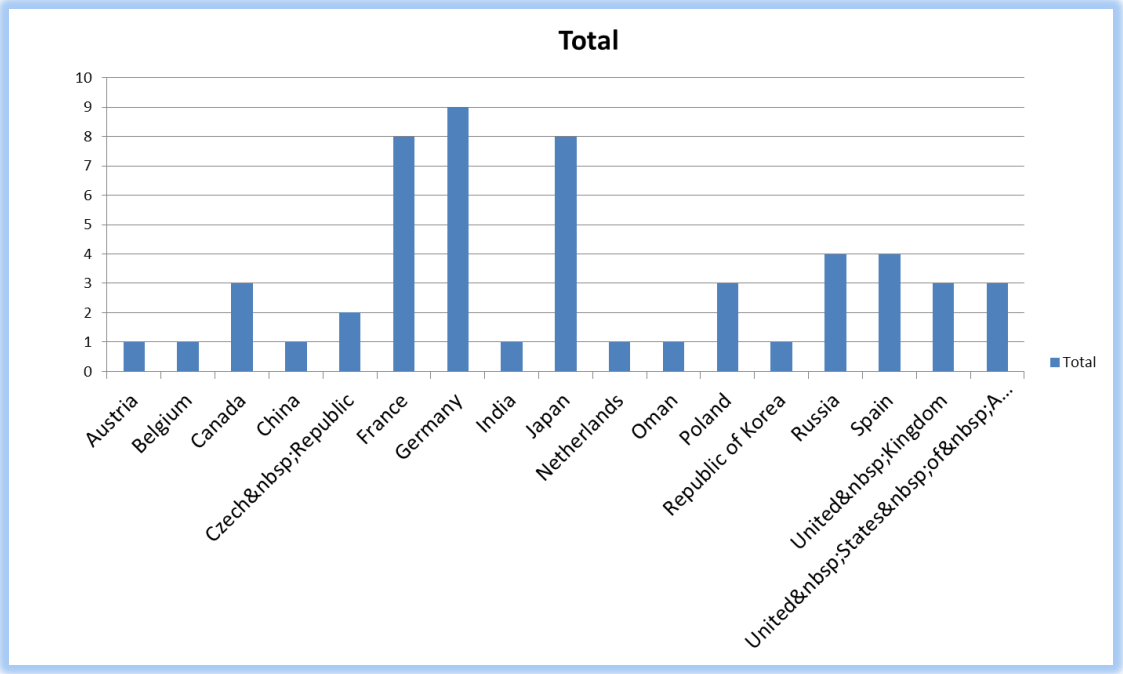
Re-invent ILD “the organisation”

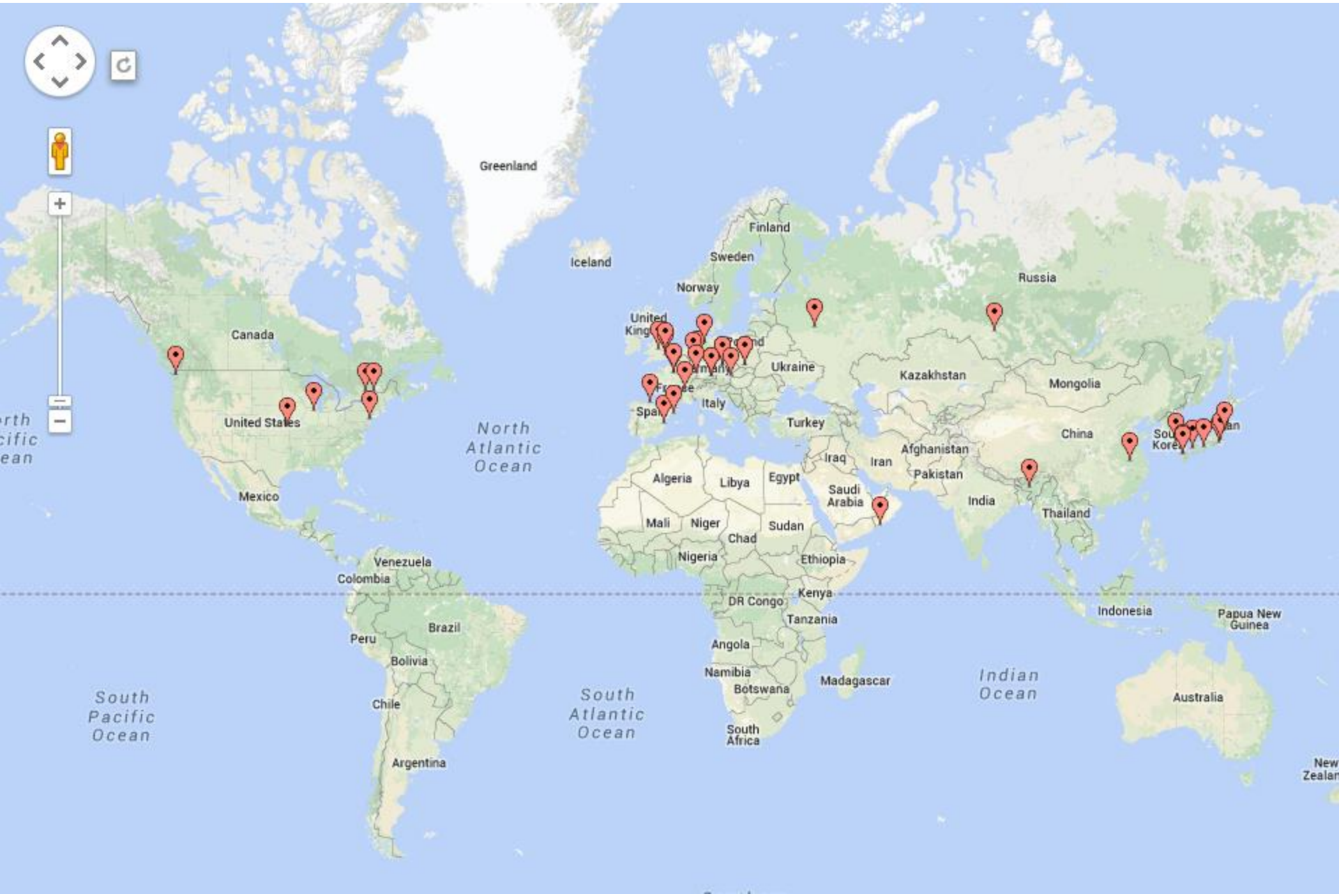
Make the physics case through realistic physics studies

Reinvent ILD: Organisation

Signup Procedure for ILD:

- 57 groups so far have signed the memorandum of participation by ILD
- Institute assembly has been met the first time
- Election for chair of the institute assembly is ongoing.
- Discussion on new structure for ILD will be driven by the institute assembly.




Greenland
Iceland
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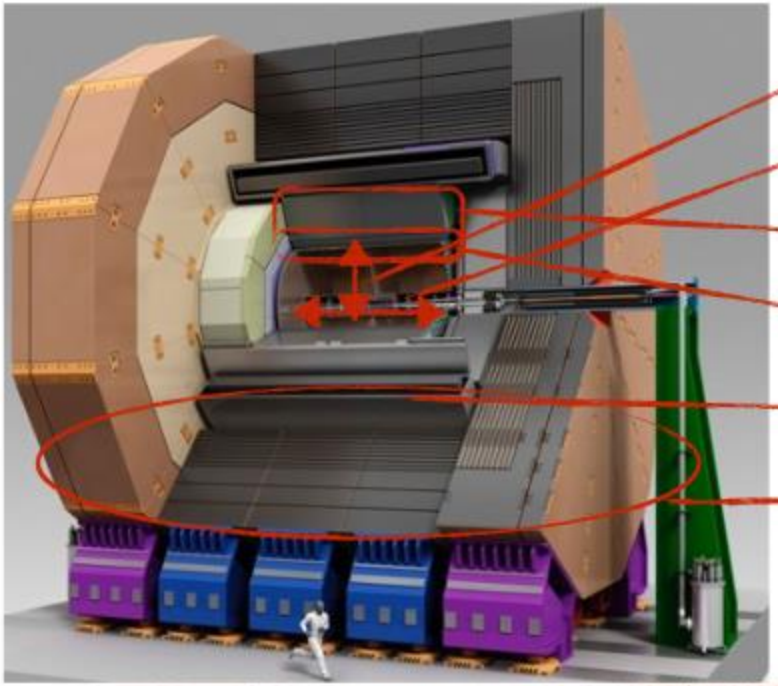
Sweden
Norway
Russia
Canada
United States
Mexico
Ukraine
Kazakhstan
Mongolia
China
Italy
Turkey
Iraq
Iran
Afghanistan
Pakistan
India
Thailand
Algeria
Libya
Egypt
Saudi Arabia
Mali
Niger
Chad
Sudan
Nigeria
Ethiopia
Kenya
DR Congo
Tanzania
Angola
Namibia
Botswana
South Africa
Madagascar
Venezuela
Colombia
Brazil
Peru
Bolivia
Chile
Argentina
Indonesia
Papua New Guinea
Australia
North Atlantic Ocean
South Atlantic Ocean
South Pacific Ocean
Indian Ocean

Reinvent ILD: Detector



main tracker radius & aspect ratio

number and placement of tracker layers

calorimeter granularity (in 3D!)

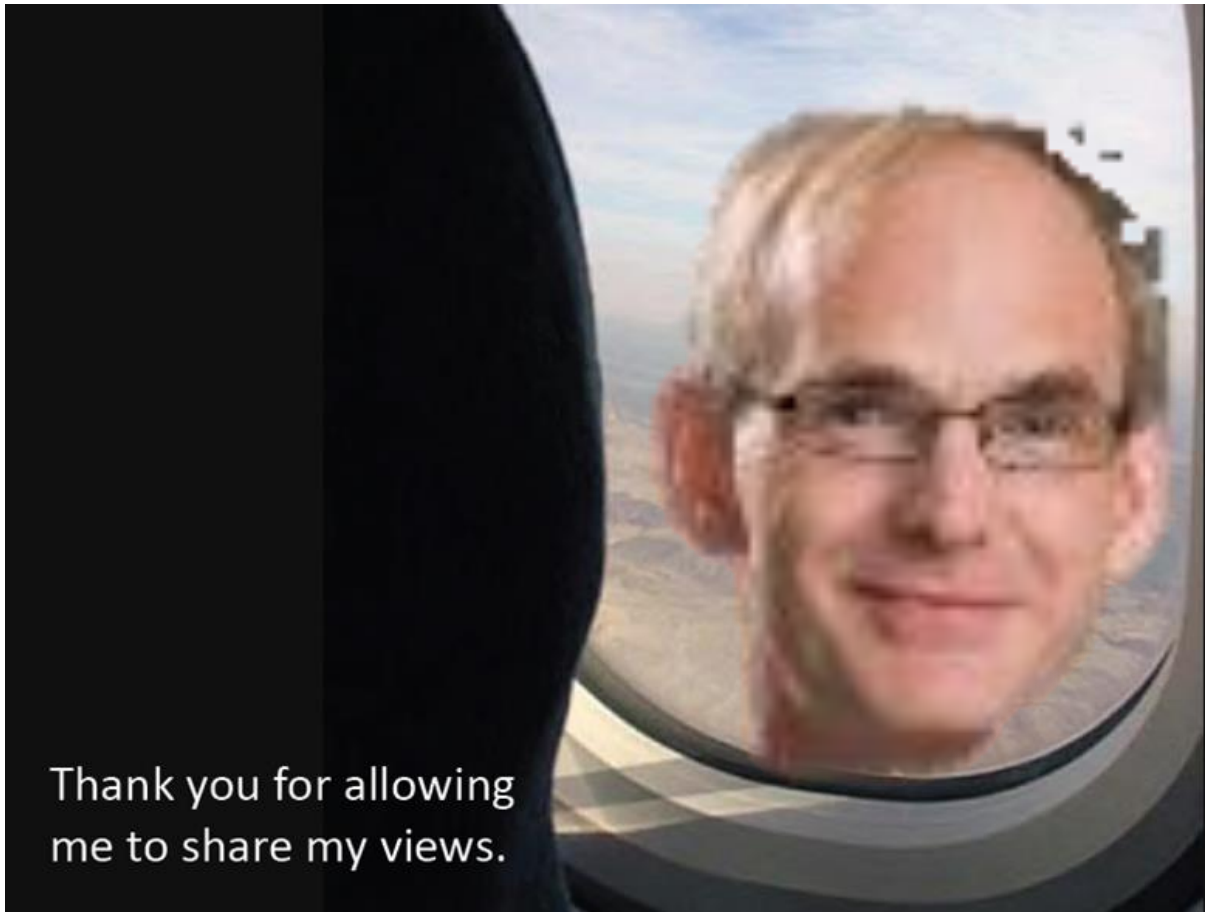
ECAL technology: Si / Scint / Hybrid

magnetic field

yoke & stray field

…

External Review of ILD



Demarteau: Key Statements

.. a strength of ILD is that it is BIG.

.. A weakness of the ILD is the use of a TPC.

..although the SIT is reasonably well motivated the need for SET and ETD has not been demonstrated.

.. On the very positive side ILD has been fairly aggressive in designing a most comprehensive ILD detector that is very performant

.. On the negative side, the detector resorts to the use of multiple technologies to overcome the shortcomings of main technologies.

.. The collaboration has very effectively used the R&D collaborations in their design efforts and performance studies

.. The collaboration would profit from clear technology decisions over the next couple of years

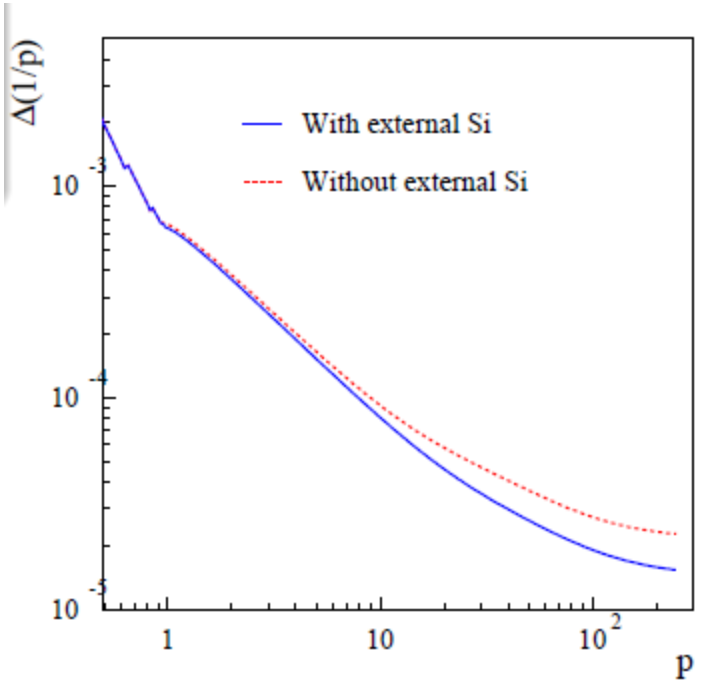
1. Demonstrate ILD Capabilities & Choices

- Quantify requirements for light Higgsino benchmark based on FullSim:
  - Particle ID from DE/dx & calorimeter
  - Low p_t tracking in pair background -> VTX timing
- Jet / vertex charge for A_{FB}(top)
- Systematics for at least one ultra-precise channel, eg H->bb , M_W or top couplings:
  - formulate as requirements on JES, p-scale, etc

2. Justify our basic choices

- Why a TPC?
  - Expect several arguments out of studies on previous slide: dE/dx, low momentum tracks, …
- Physics driven requirements on
  - Momentum & impact parameter resolutions
  - Photon energy & angle resolution
  - JER
  - dE/dx ?
  - Low mometum reach

Tracking



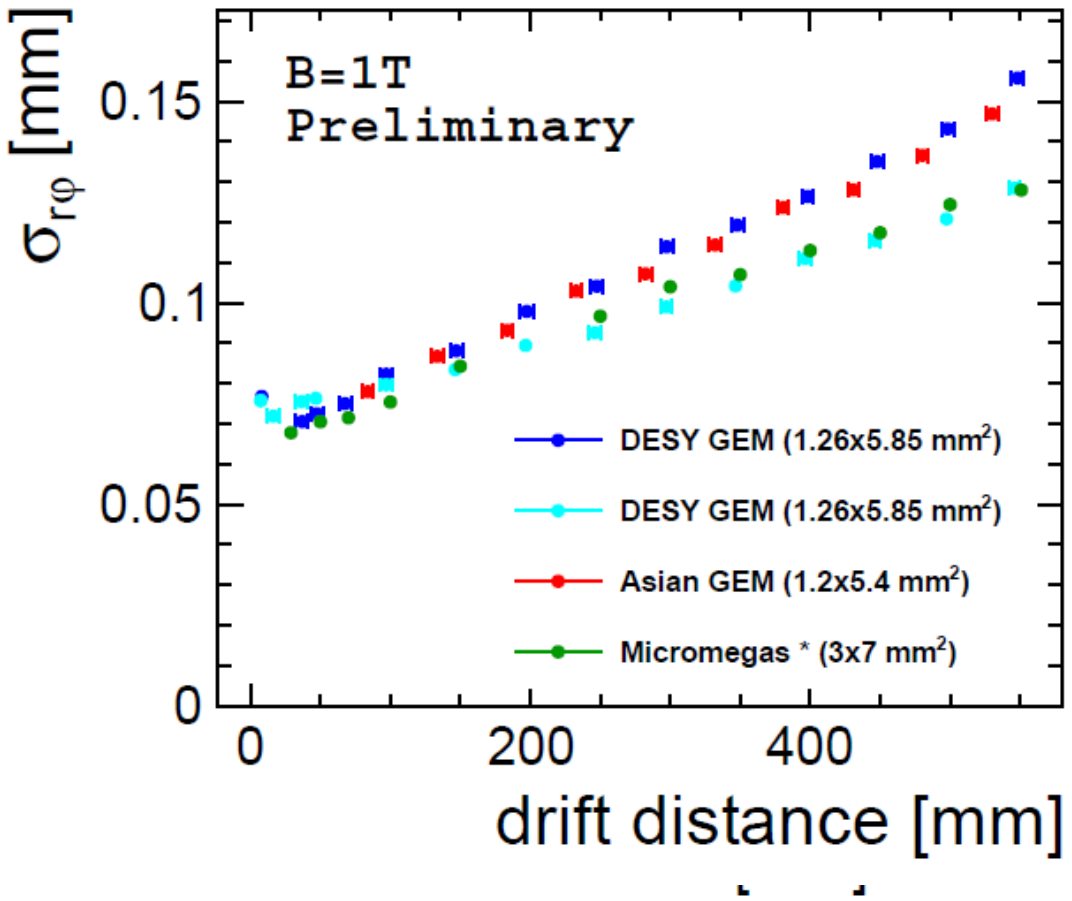
Contribution of SET to the overall tracking performance.

ILD has a composite system

- TPC central tracker
- Silicon outside and inside
- O(10um) resolution for Silicon system

SET justification 1:
Improvement of the momentum resolution

Tracking



Major issue:

Field distortions in the TPC.

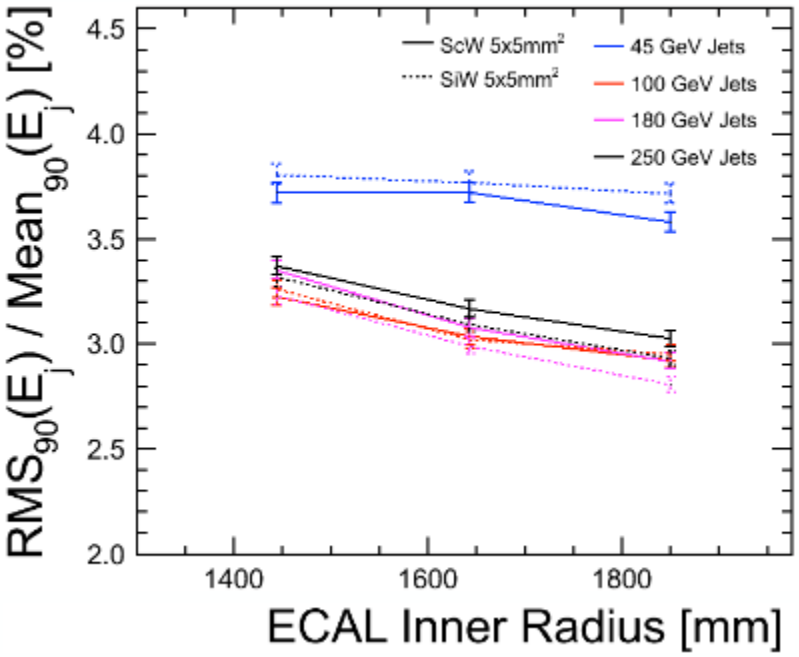
- From local E-field effects
- From global B-field effects

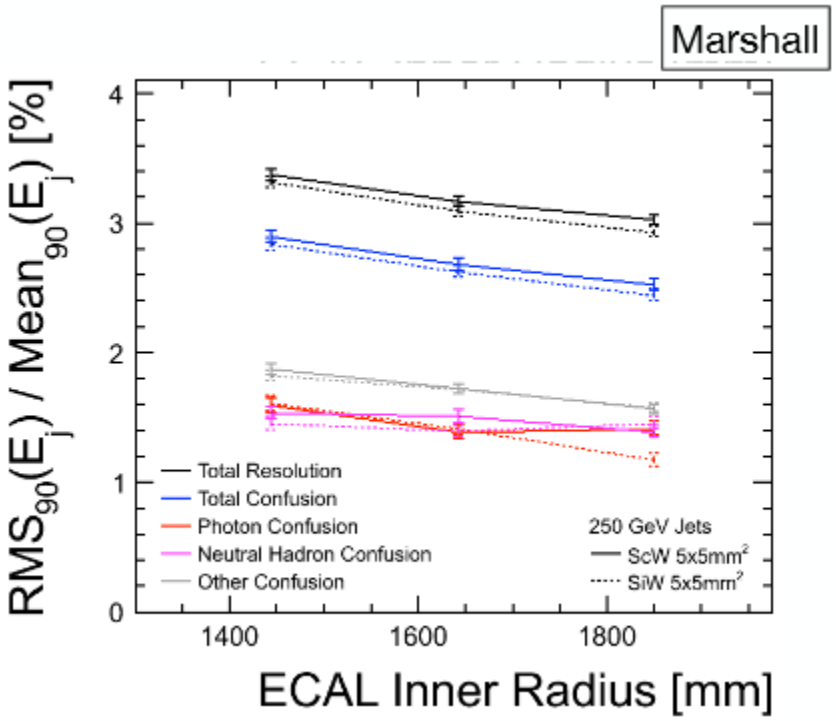
Calibration of possible using internal consistency

But

SET justification 2:
External point will help a lot (needed precision?)

Size optimization





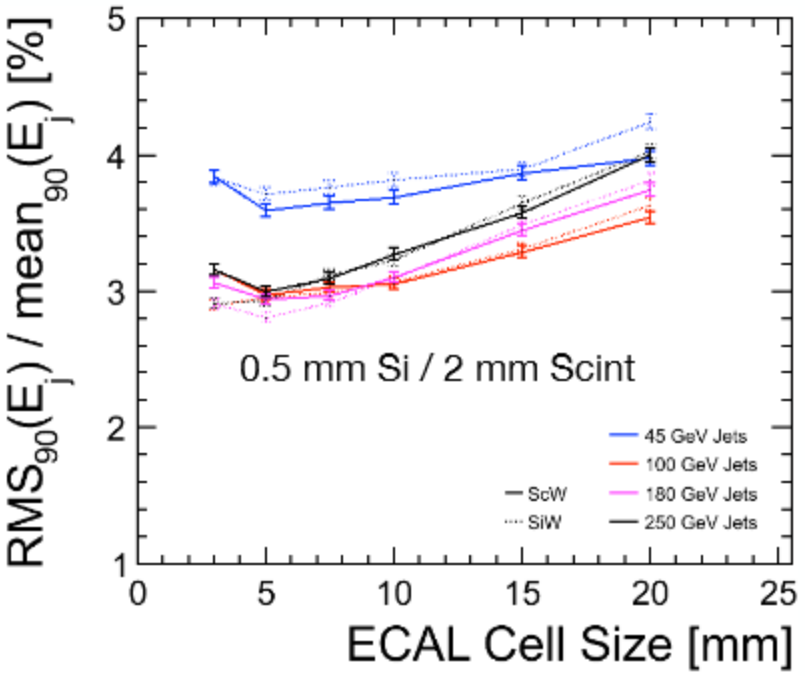
Impact of ECAL radius on particle flow performance:
Seems to be fairly flat.

Granularity optimization

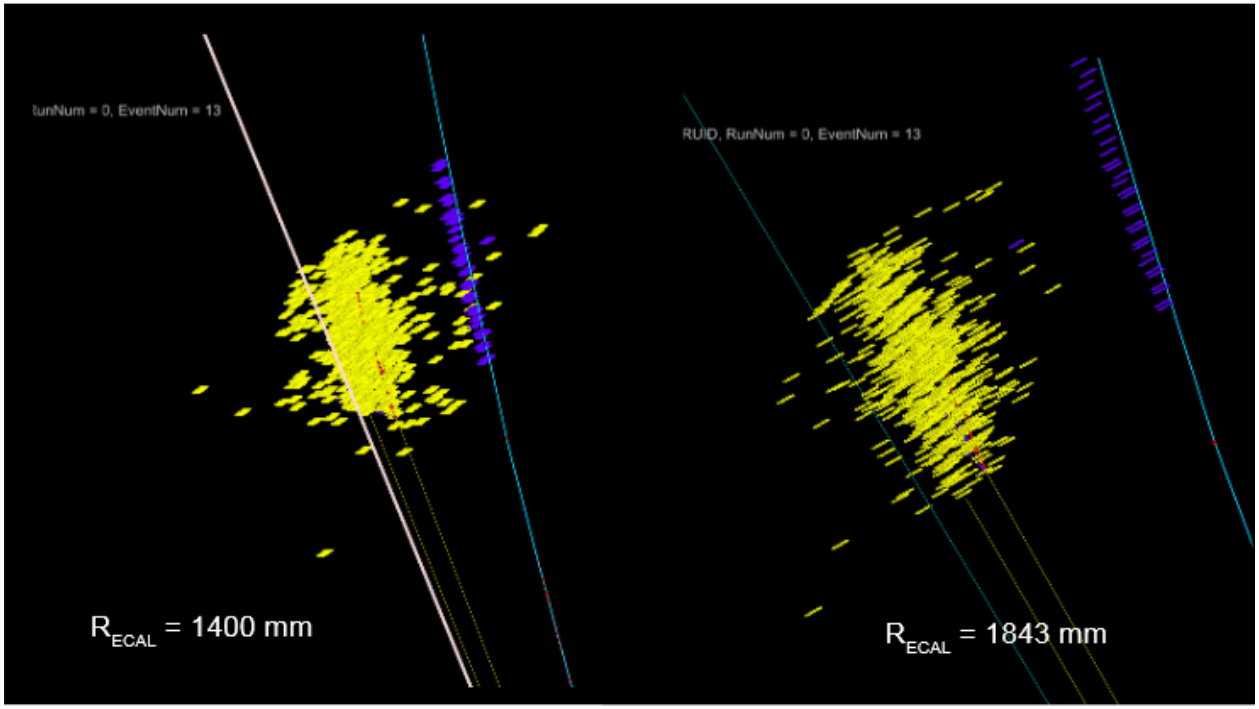
Dependence is stronger at higher energies

Behaviour at very small cell sizes: not understood.

(Software artefact?)



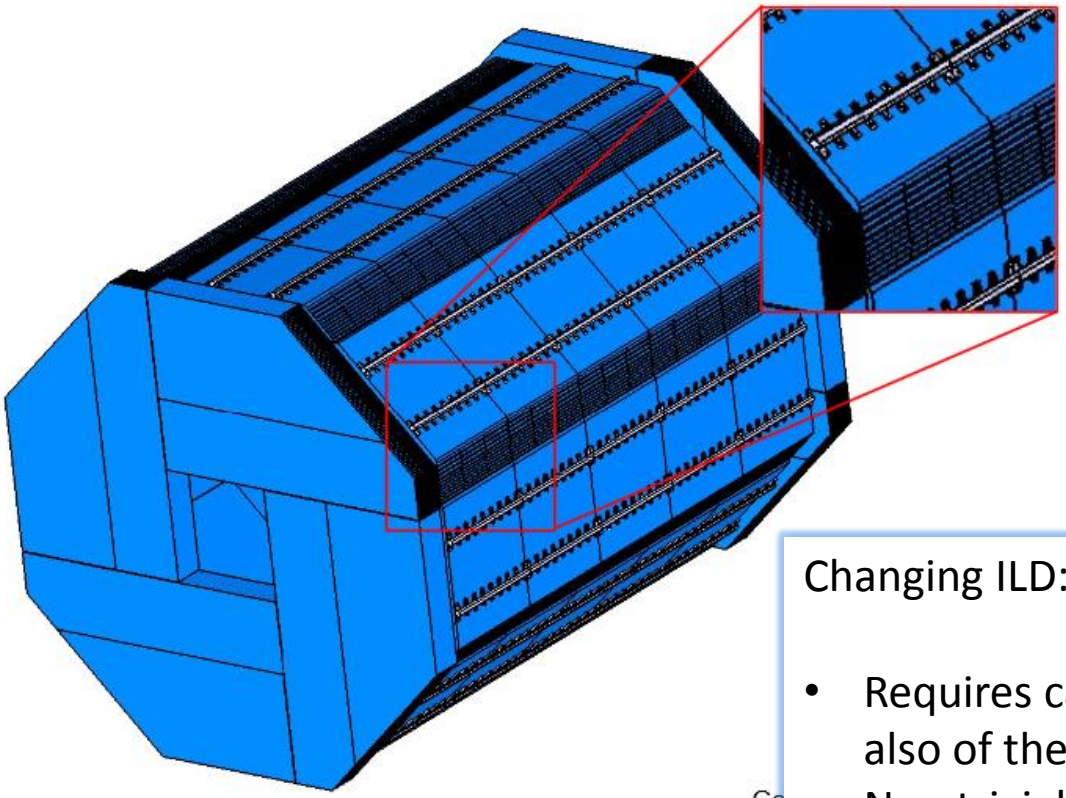
Tau reconstruction



Particle flow is not all:

- What about tau reconstruction/ other exclusive states?
- No conclusion yet, though initial studies suggest no strong dependence.

Changing the ILD size



Changing ILD:

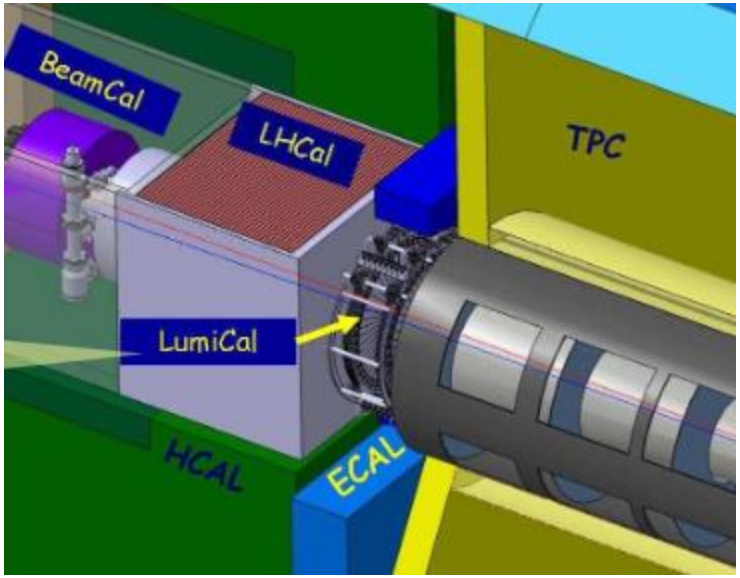
- Requires careful re-optimzation also of the hardware
- Non trivial task if you want to move away from simple naïve scaling models.

Forward Direction

Rather detailed design of the forward direction exists

Fairly complete engineering has been done

- L* change request
- Discussion on crossing angle



Re-optimization of the forward region would require a serious simulation effort to understand the impact on reducing L*.

ILD position: we need to study this, but are very sceptical to go below 4m

Calibration Scenarios

- Z-peak running:
  - Are the canonical numbers based on LEP experience (10 pb^{-1} commissioning, 0.5-1 pb^{-1} quick re-alignment) sufficient for ILD detector modularity?
  - Simulation alignment excercise needed?
- Alternatives at nominal beam energy?
  - Z return
  - Momentum calibration from Z, J/ψ, Y (e.g. Graham Wilson at AWLC14)
- Cosmics, yes (LHC has shown importance), but:
  - 0.5% duty cycle due to power pulsing
  - reduced rate, because of underground location, but maybe not so deep
- B-field mapping
  - Can we measure it precisely enough?

  (study on use of detailed map in reconstruction ongoing)

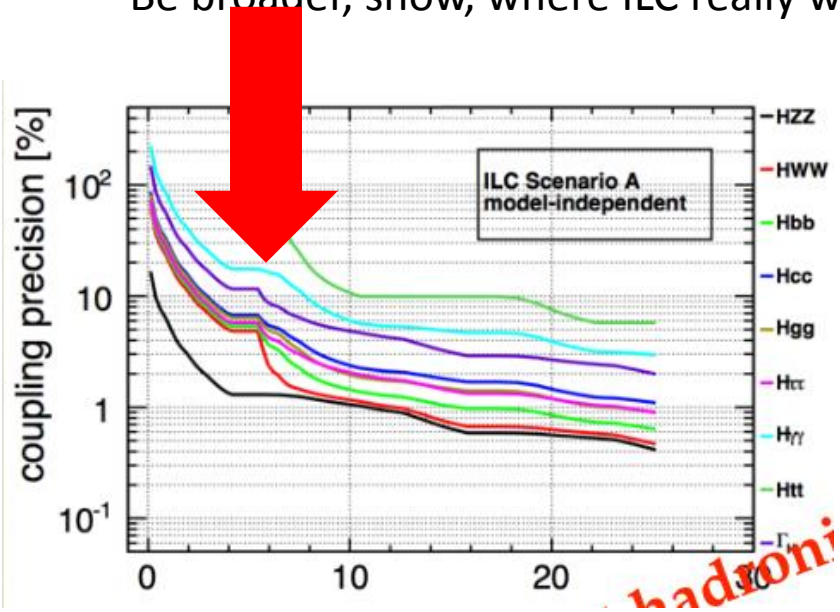
Physics at the ILC

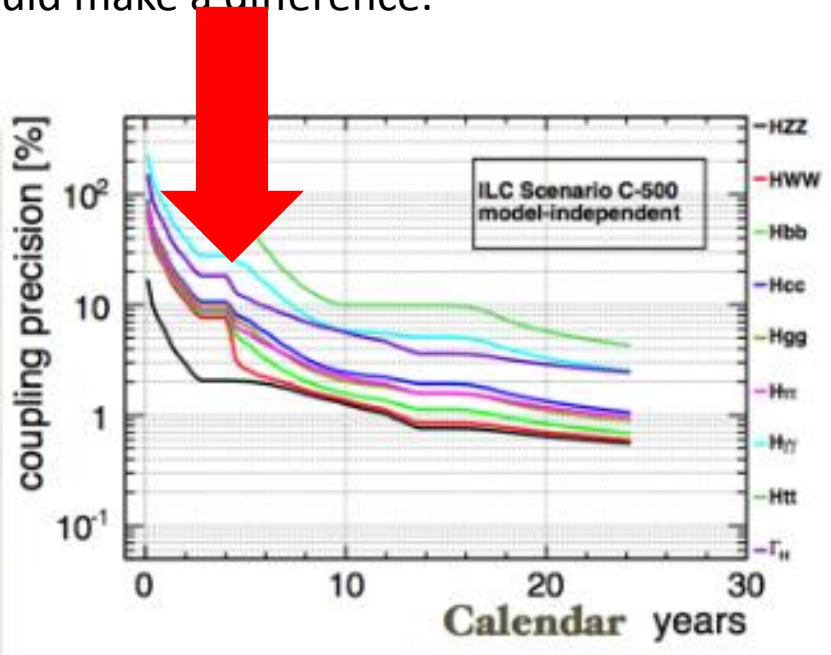
Physics case for the ILC has been made,

But

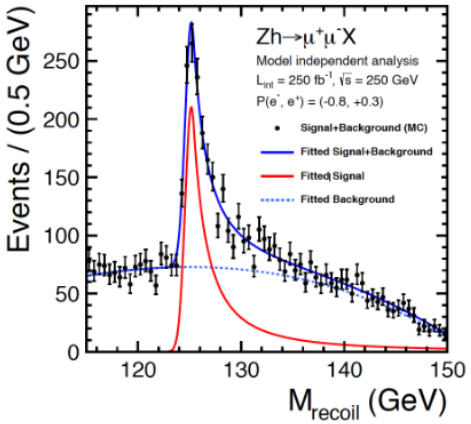
We need to get better!

- Be more realistic, in particular, fold in running scenarios.
- Be broader, show, where ILC really would make a difference.



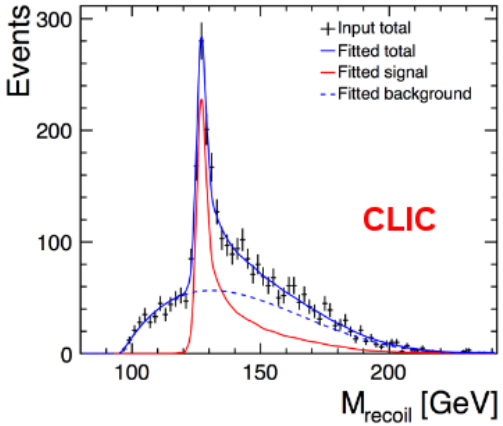


Higgs Physics



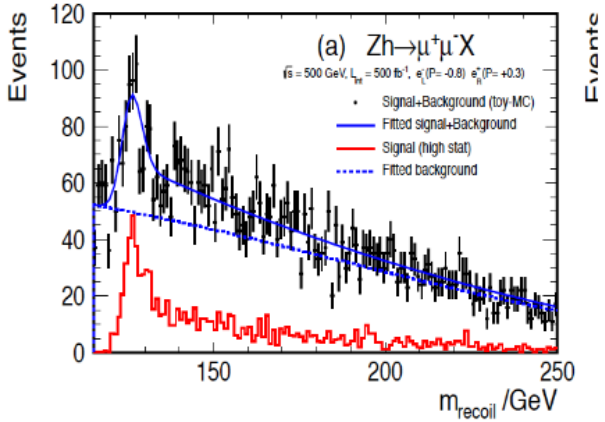
$$\frac{\Delta\sigma}{\sigma} = 2.6\,\%$$

$500\,\mathrm{fb}^{-1} @ \sqrt{s} = 350\,\mathrm{GeV}$



$$\frac{\Delta\sigma}{\sigma} = 4.7\,\%$$

$500\,\mathrm{fb}^{-1} @ \sqrt{s} = 500\,\mathrm{GeV}$



$$\frac{\Delta\sigma}{\sigma} = 6.5\,\%$$

Dominated by tracking resolution:
Challenge to the trackers?

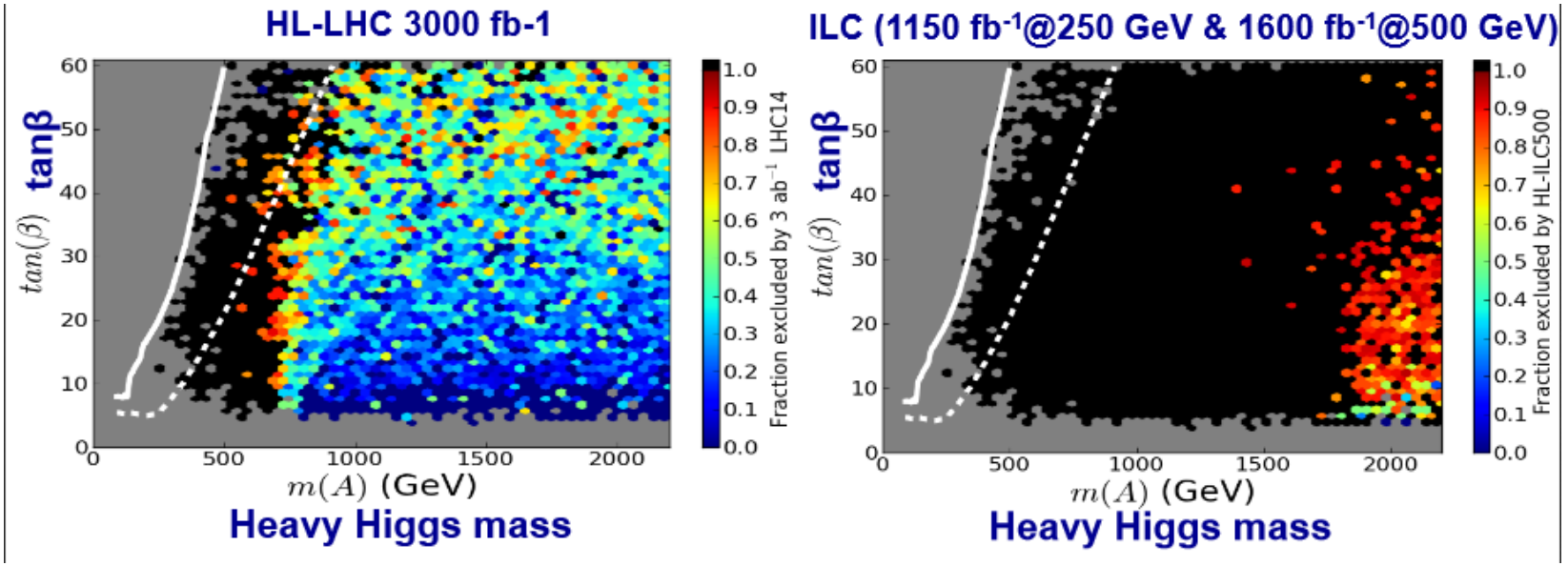
Higgs recoil is a strong point for 250 GeV running, BUT

- Utilize hadronic Higgs decays: 350 GeV as good?
- All other channels are better at 350+ GeV (WW Fusion contributes)

BSM Physics

A strong focus has been on Higgs Physics
We need to have a broader focus, and show the impact ILC will have on the overall physics landscape: Physics beyond the Standard Model

Impact of ILC on Heavy Higgs searches:



Where to go?

- “Technical” performance does not vary strongly with radius.
- Particle flow and tracking seem ok.
- What about other parameters?
  - Need to translate into proper physics performance
  - Need to study more than just particle flow
  - Need to understand behaviour at higher energies
  - Need to also look at impact on detector integration etc.
- Next step:
  - Define a number of benchmark reactions
  - Define a (small) number of ILD models to study

Committee under MEXT

ILC Task Force in MEXT

Academic experts committee

http://www.mext.go.jp/b_menu/shingi/chousa/shinkou/038/index.htm

Particle-Nuclear physics WG

Members are physicists from;

HEP(6), Nuclear physics, Cosmic-ray, Astronomy, Accelerator(2), Particle theory, Nuclear theory, Cosmology, Science communication

TDR validation WG

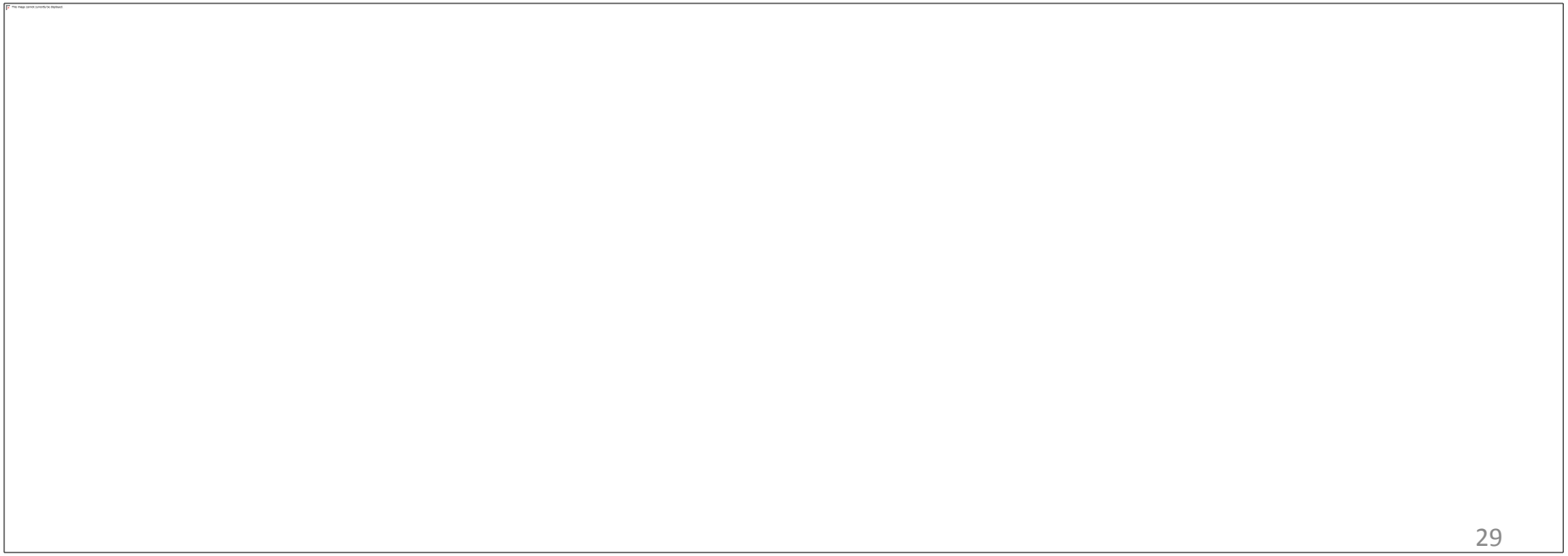
Members are accelerator physicists from;

KEK(3), JAERI, Riken(2), NIRS, HiSOR, JASRI/Spring8, CROSS-Tokai

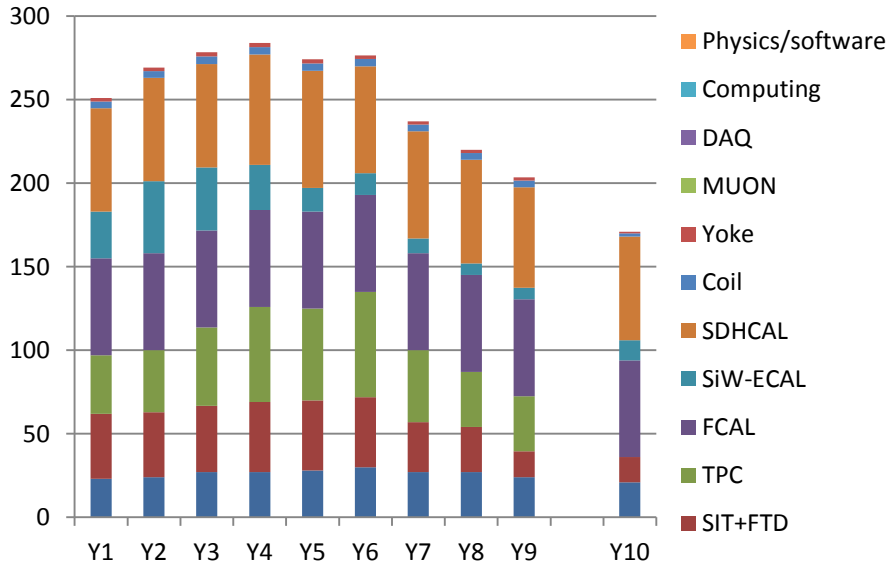
We need information from detector groups

Resource survey in ILD

- Timeline
  - Time line was drawn based on the schedule in TDR (Figure 14.10. in Vol.3-II) and recent CFS study
  - Assembly hall is assumed to be built in 2 years from ground breaking
  - Duration of “Assembly on site” can be modified by sub-system groups

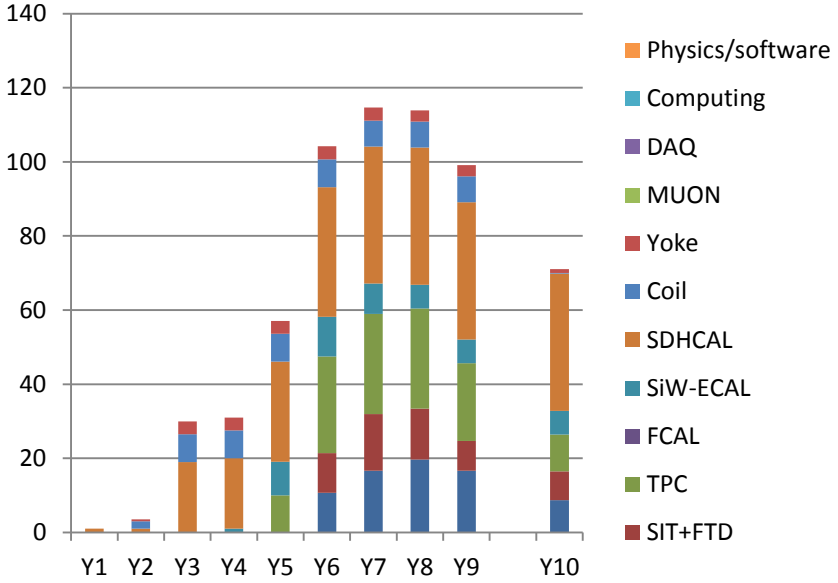


Status of the survey



Total FTE needed

Annual budget



FTE on site

Conclusion

ILD is alive and well
Significant interest and support
Active community does studies

Re-optimization of ILD is ongoing

Serious physics studies using ILD are ongoing

Not covered: Clear R&D plans exist for the major systems

Next meeting: at LCWS 2014 and Spring 2015 Asian workshop
Dedicated ILD workshop Summer 2015 in Europe