

RD-DBD Status

DBD Physics Chapter

Physics at the International Linear Collider

Physics Chapter of the ILC Detailed Baseline Design Report

Preliminary Version: Draft of October 10, 2012

please address questions or comments to: mpeskin@slac.stanford.edu

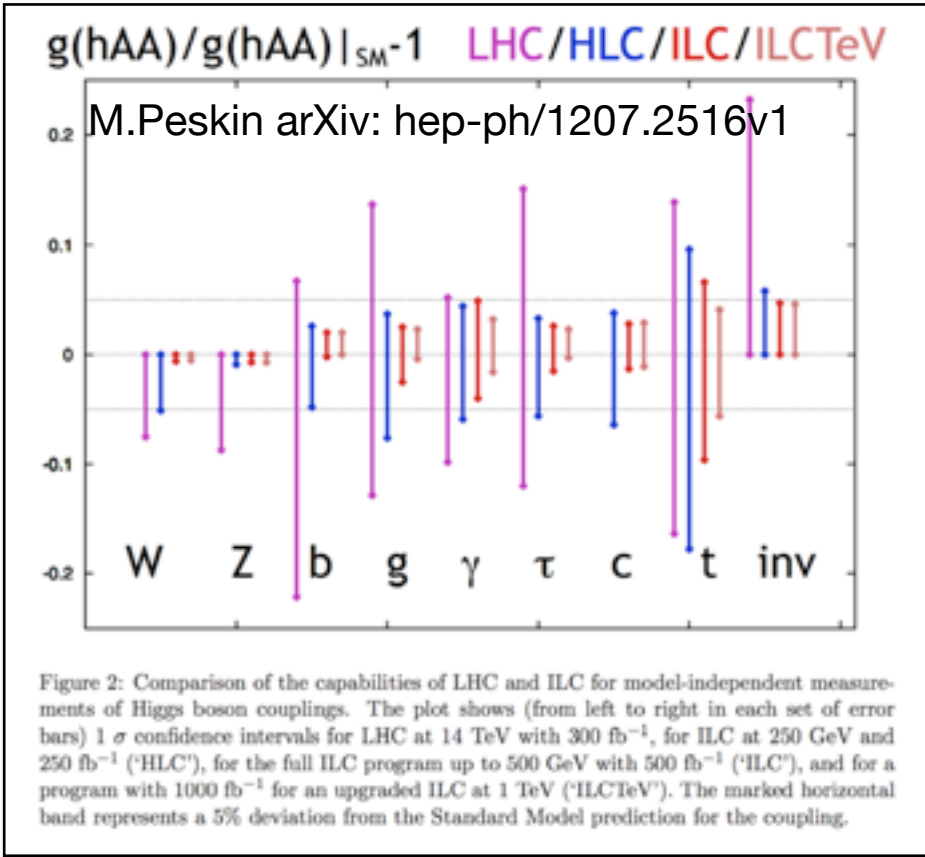
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Introduction	10 pages
Standard Model Higgs	45 pages
Two-Fermion Processes	12 pages
W and Z Boson Physics	39 pages
Top Quark	20 pages
Extended Higgs Sectors	26 pages
SUSY	34 pages
Cosmological Connections	26 pages

Total ~220 pages

Given the discovery of a 126 GeV Higgs candidate, emphasis is put on the electroweak symmetry breaking physics, **precision Higgs studies**, in articular:



Maximum deviation when nothing but the 125 GeV object would be found at LHC

	ΔhVV	Δhtt	Δhbb
Mixed-in Singlet	6%	6%	6%
Composite Higgs	8%	tens of %	tens of %
Minimal Supersymmetry	< 1%	3%	10% ^a , 100% ^b
LHC 14 TeV, 3 ab ⁻¹	8%	10%	15%

R.S.Gupta, H.Rzehak, J.D.Wells

arXiv: 1206.3560v1

Emphasis also on searches for new **color neutral particles** such as Dark Matter

The time line of the LOI process

- Oct. 2007: **Call for LOIs was made by ILCSC**
appointment of RD to conduct the process
- Jan. 2008: Detector management was formed
- Mar.2008: IDAG formed, 3 LOI groups known
- Mar.2009: 3 LOIs submitted
- Summer 09: IDAG recommendation for
validation and ILCSC's approval
- Oct 2009: Work plan of the validated groups
- **End 2011: Interim Report completed**
- **End 2012: Detailed Baseline Design Report**

2007

RDR

2008

2009

2010

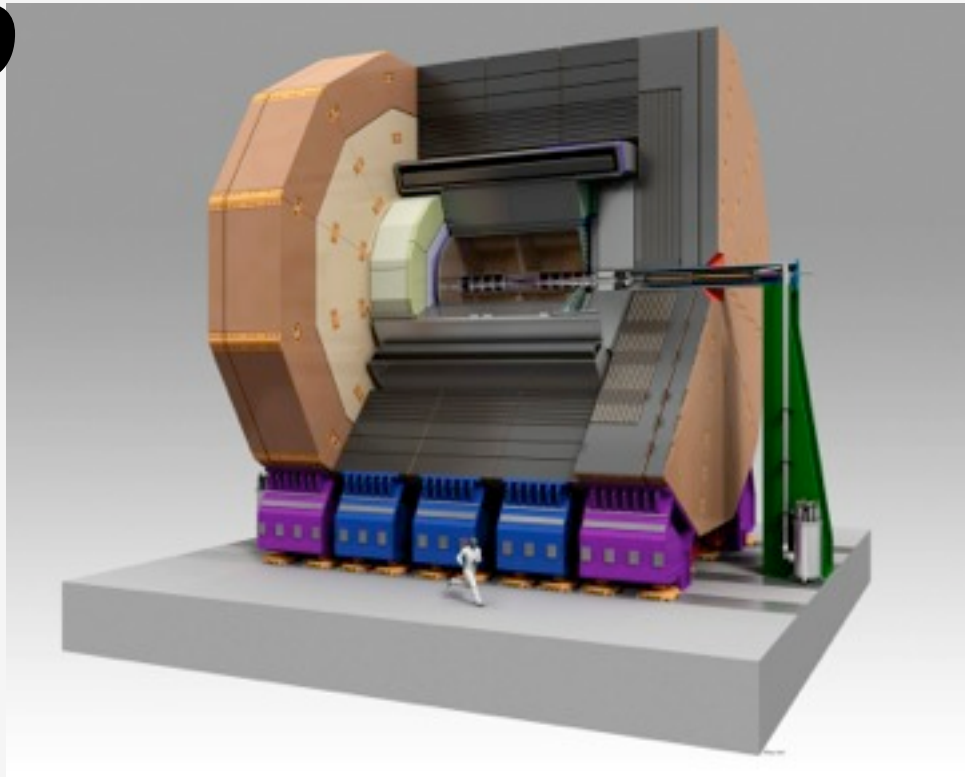
2011

2012

Now

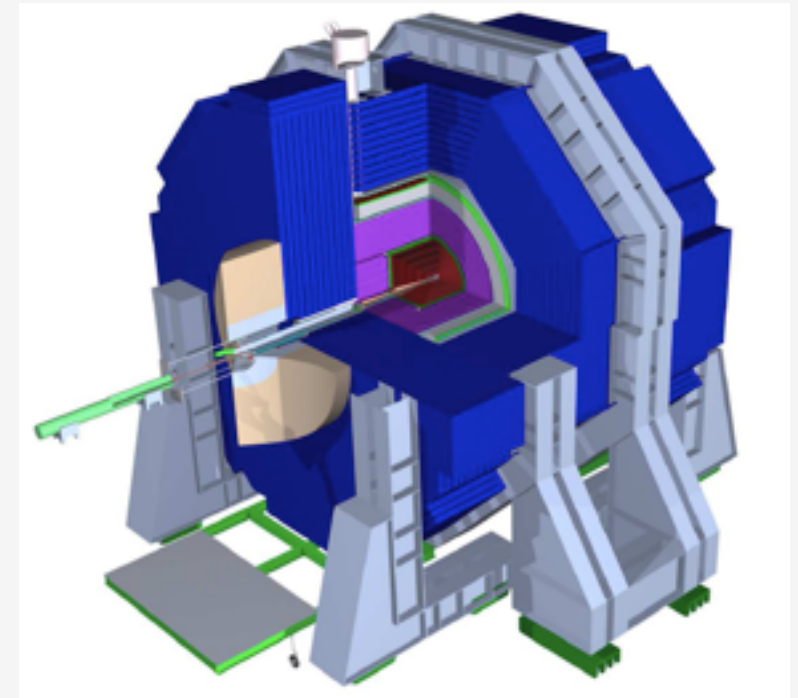
Detailed **B**aseline **D**esign Document

ILD



- Large **R** with TPC tracker
- 32 countries, 151 institutions, ~700 members
- Most members from Asia and Europe
- **B=3.5T**, TPC + Si trackers
- ECal: **R=1.8m**

SiD



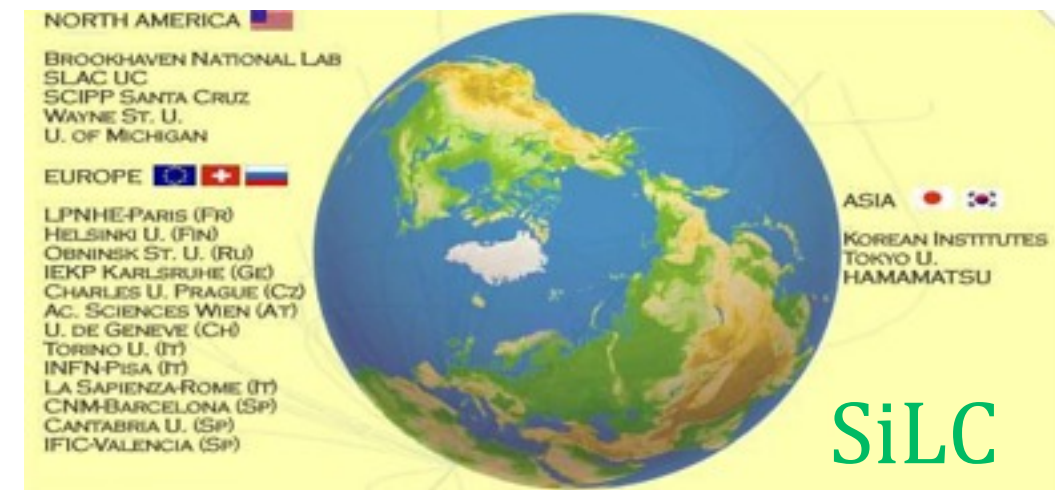
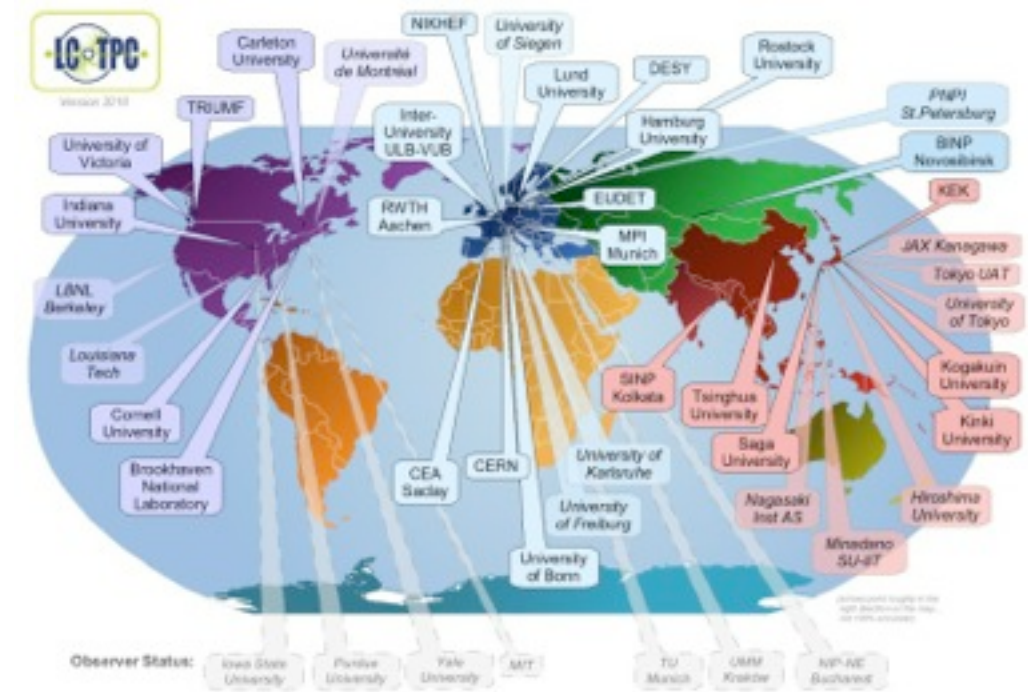
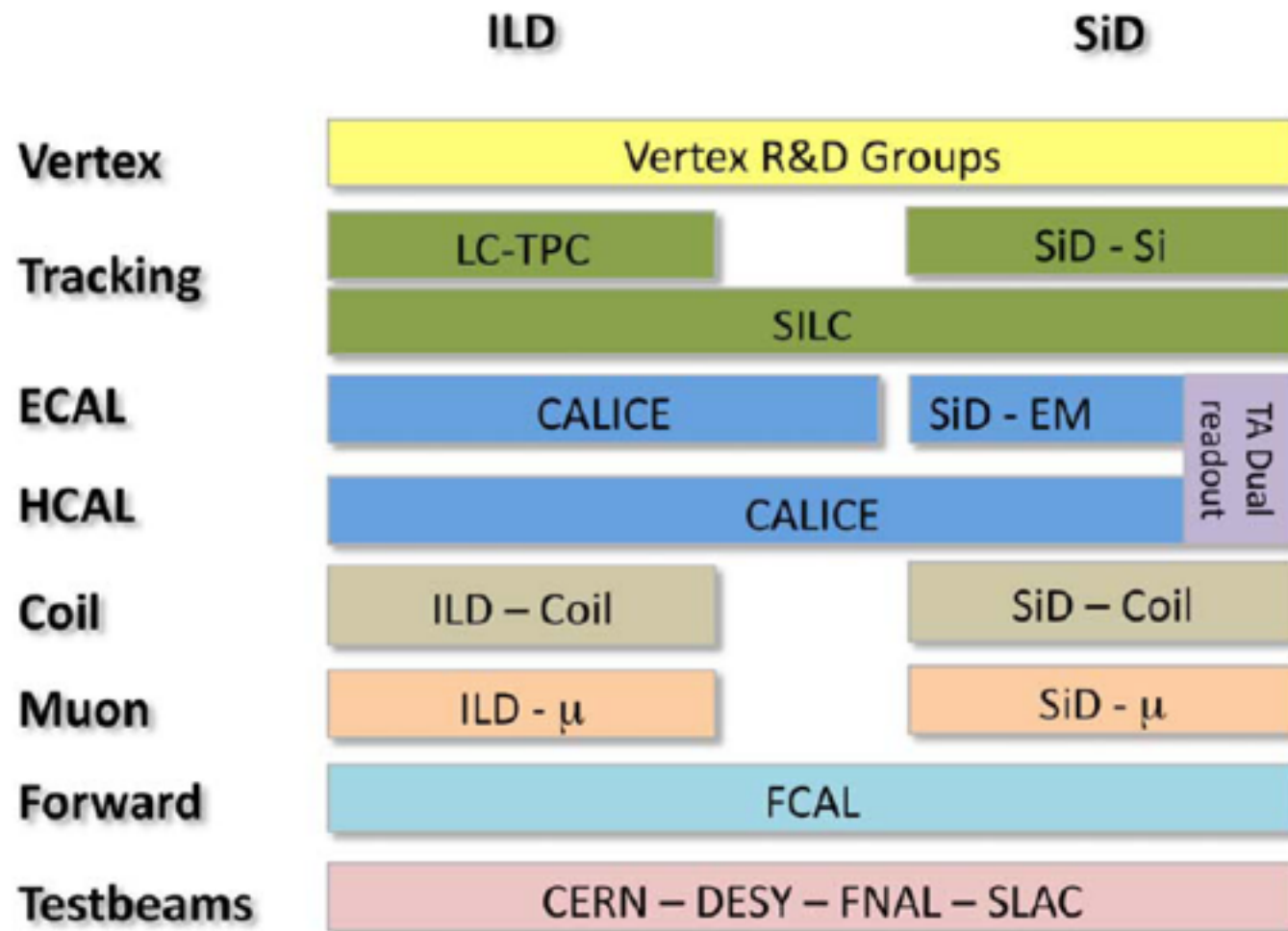
- High **B** with Si strip tracker
- 18 countries, 77 institutions, ~240 members
- Mostly American
- **B=5T**, Si only tracker
- ECal: **R=1.27m**

Both detector concepts are optimized for
Particle Flow Analysis

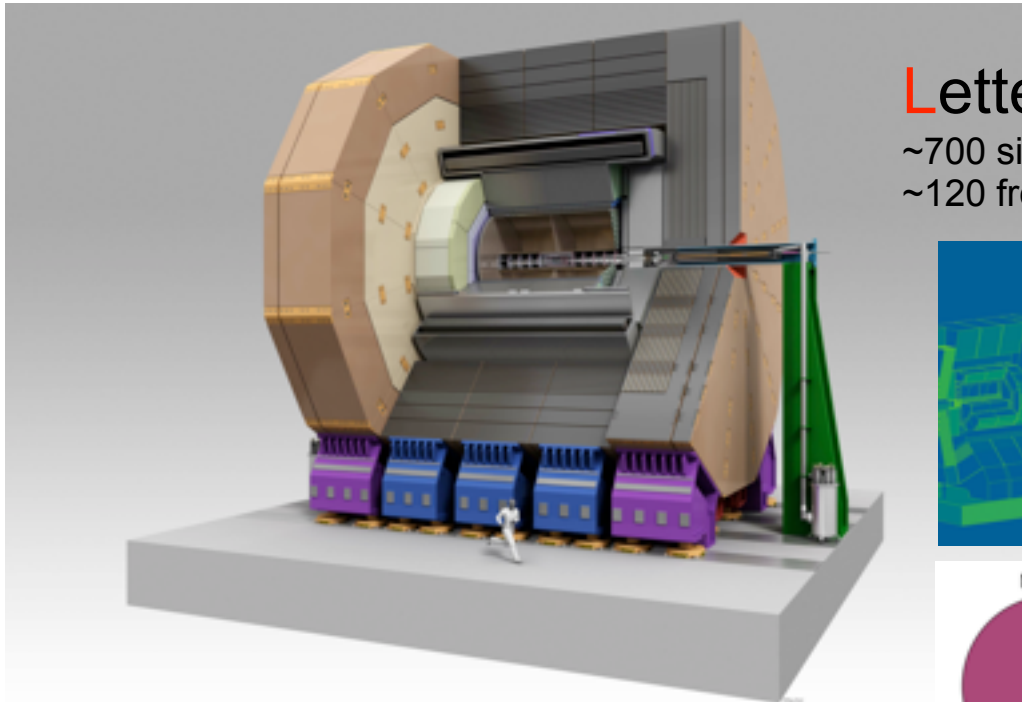
Detector R&D

International Collaboration

- Detector collaborations encompass concept groups to avoid duplicate effort.
- TPC : **LC-TPC**
- Calorimeter : **CALICE**
- Silicon tracker : SiLC
- Forward detector : FCAL

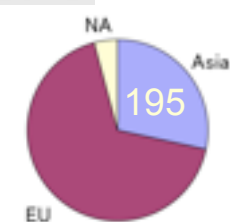


ILD Detailed Baseline Design



Letter of Intent

~700 signatories
~120 from Japan



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4.2.1	e^+e^-	
4.2.2	e^+e^-	
4.2.3	e^+e^-	
4.2.4	e^+e^-	
4.2.5	Other p	

5 ILD Costs

6 Summary



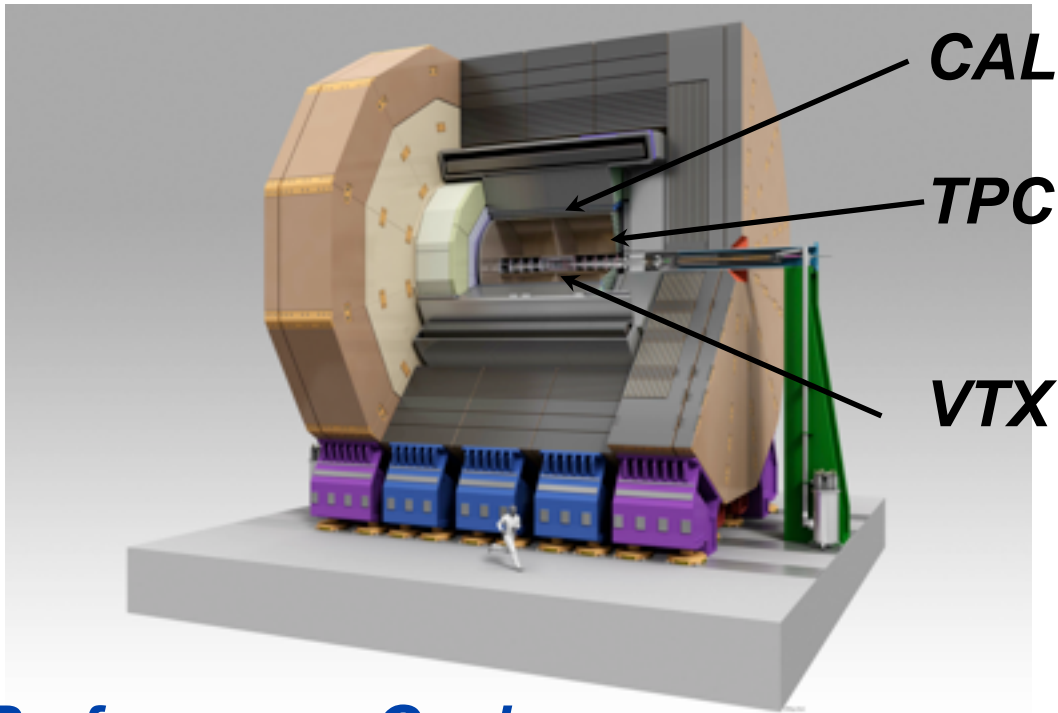
WORKSHOP
2012

Kyushu University, Fukuoka, Japan
23-25 May, 2012

Draft submitted to
International Detector Advisory Group
for Review at LCWS2012, Oct. 23-25, 2012

Detector R&D : ILD

Component R&D



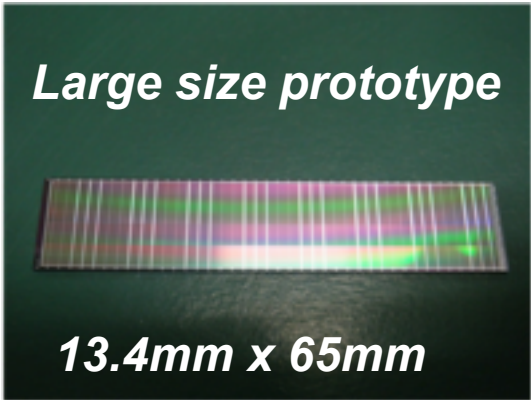
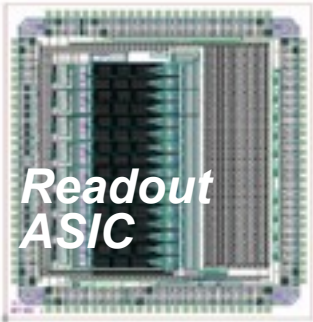
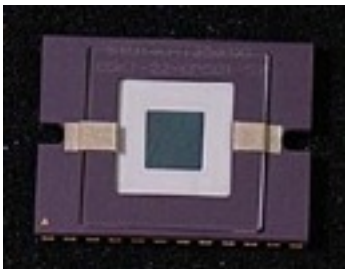
Performance Goal as compared to LHC detectors

Vertex resolution	2-7 times better
Momentum resolution	10 times better
Jet energy resolution	2 times better

Ultra high granularity is a key!

Detector	ILC	ATLAS	Granularity
Vertex Det.	5x5 μ m ²	400x50 μ m ²	x 800
Tracker	1x6mm ²	13mm ²	x 2.2
EM Calorimeter	Silicon: 5x5mm ²	39x39mm ²	x 61
	Scintillator: 5x45mm ²		x 7

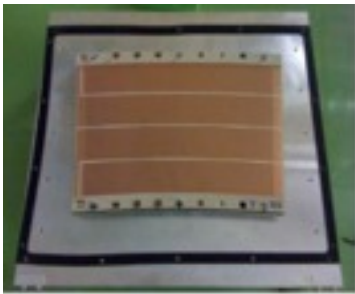
Vertex Detector R&D



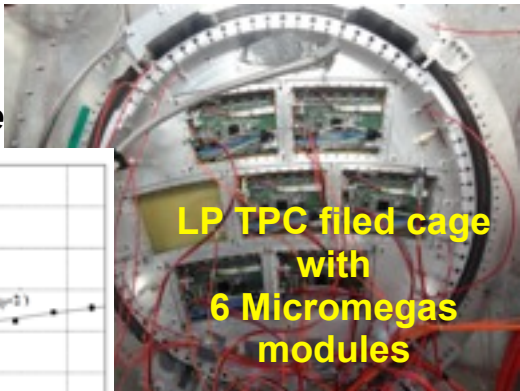
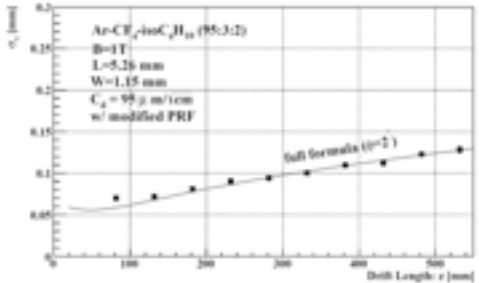
6um pixel now working!

Proof of principle for sensor technology finished!
Now R&D on ladder, support structure, and 2-phase CO2 cooling system.

TPC R&D

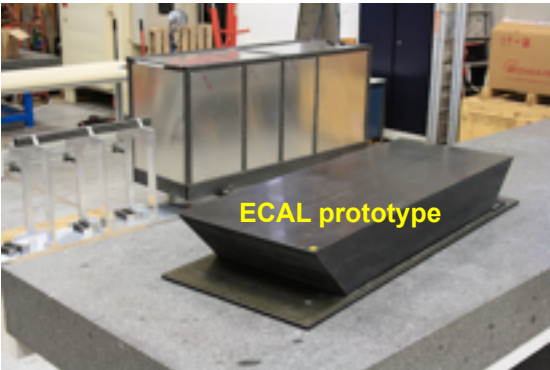
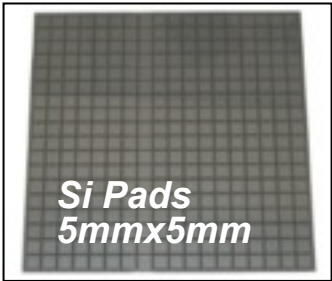
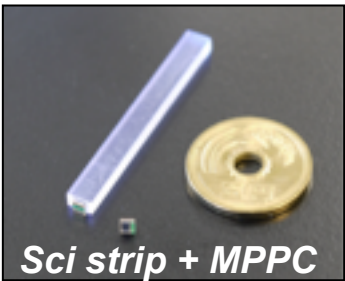


Spatial resolution
Asian GEM module



Both GEM and Micromegas modules have achieved the performance goal: point resolution < 100um (3.5T)

Calorimeter R&D



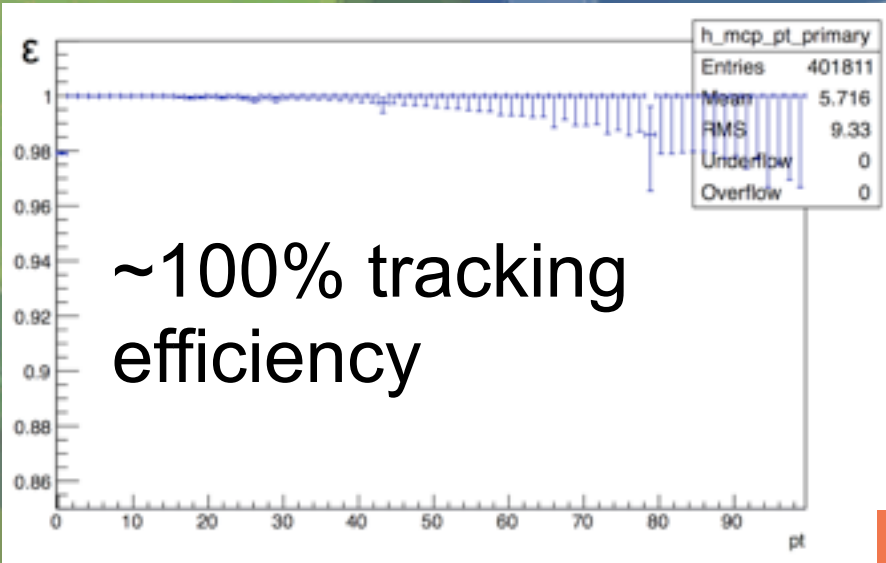
Test beam data well reproduced by MC simulation, one-particle energy resolution has reached performance goal!

Raw Hits

$e^+e^- \rightarrow t \bar{t}$ @1TeV

Tracking Code (MarlinTrk):
now fully C++

KEK developed Kalman Filter Package (KalTest)



Reconstructed Tracks

91 GeV	rms90	dE/E [%]*
ILD_00 [LOI]	2.40	3.71+-.05
MarlinTrk v01-15-01	2.38	3.73+-.05
MarlinTrk v01-15-02	2.32	3.64+-.05
500 GeV		
ILD_00 [LOI]	11.10	3.17+-.05
MarlinTrk v01-15-01	11.26	3.15+-.05
MarlinTrk v01-15-02	10.76	3.05+-.04

Particle Flow Analysis

Despite the more realism (cracks, support structures, and service materials) brought in to the simulator,

PFA performance is now better than that of Lol!

Simulation of benchmark process is on going!

~20M events/week at peak, using GRID (Dirac)
stdhep -> Mokka (G4) -> MarlinRec (Full rec.)