

# ECFA linear collider physics and detector study (status report 2014)



LINEAR COLLIDER COLLABORATION



Juan A. Fuster Verdú, IFIC-Valencia

Plenary ECFA Meeting, CERN November 20-21 2014

*Thanks for providing material and discussions to:*

T. Behnke, J.-C. Brient, I. Bosovic-Jeliasavcic, P. Burrows, M. Caccia,  
P. Colas, K. Desch, K. Fujii, L. Linssen, W. Lohmann, G. Moorgat-Pick,  
R. Poeschl, A. Ruiz, F. Sefkow, M. Stanitzki, M. Thomson, M. Titov,  
I. Vila, M. Winter, H. Yamamoto

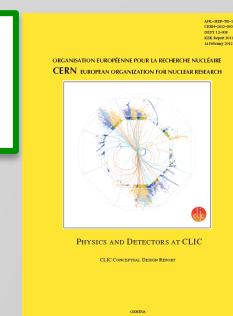
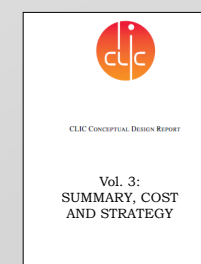
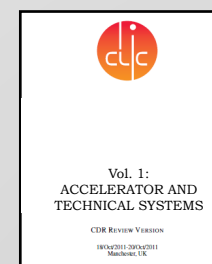
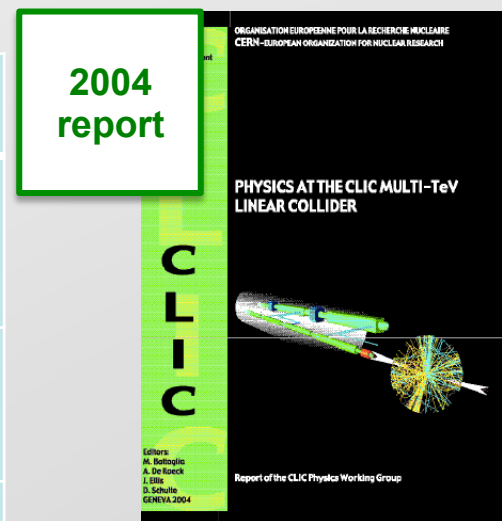
- The new LCC structure (overview)
- Activities 2014: Physics and detector R&D
- Conferences 2014-2015:
- Summary





# CLIC Physics and Detector Roadmap

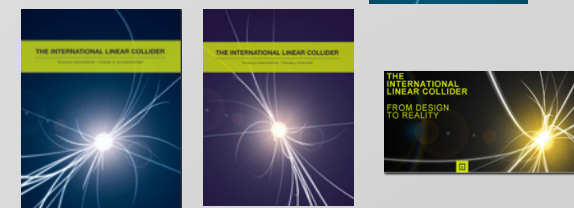
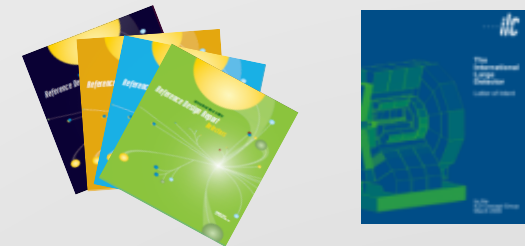
<b>2001</b>	“Physics motivations for future CERN accelerators” <a href="http://arxiv.org/pdf/hep-ex/0112004v1">http://arxiv.org/pdf/hep-ex/0112004v1</a>
<b>2004</b>	“Physics at the CLIC multi-TeV linear collider” Report on physics potential <a href="http://inspirehep.net/record/667395?ln=en">http://inspirehep.net/record/667395?ln=en</a>
<b>2008</b>	New start of CLIC physics and detector studies First meetings between ILC and CLIC physics efforts Start Linear Collider Detector (LCD) effort @ CERN
<b>2009</b>	IDAG meeting: Plan ILC-CLIC cooperation Pursue ILD & SID concepts for CLIC CDR
<b>2012</b>	Publication of “Physics and Detectors at CLIC”, CDR, <a href="http://arxiv.org/abs/1202.5940">http://arxiv.org/abs/1202.5940</a> with >1300 signatories Publication of “The CLIC Programme: Towards a Staged e+e- Linear Collider exploring the Terascale”, CDR, and <i>input to European Strategy process</i> <a href="http://arxiv.org/abs/arXiv:1209.2543">http://arxiv.org/abs/arXiv:1209.2543</a> Establishing a “ <i>memorandum on Cooperation</i> ” (MoC) for CLIC detector and Physics study, with CERN as the host laboratory
<b>2013</b>	<i>CLIC input to the Snowmass process</i> (with many new Higgs physics studies), <a href="http://arxiv.org/abs/1307.5288">http://arxiv.org/abs/1307.5288</a> 20 institutes have signed the MoC





# ILC Physics and Detector Roadmap

<b>Aug. 2007</b>	Detector Concept Report, Four detector concepts: LDC, GLD, SiD, 4 <sup>th</sup>
<b>Oct. 2007</b>	ILCSC calls for LOIs and appoints Research Director (RD)
<b>Jan. 2008</b>	RD forms detector management
<b>Mar. 2008</b>	IDAG formed, Three LOIs groups identified
<b>Mar. 2009</b>	Three LOIs submitted (detector description, status of R&D, GEANT4 simulation, benchmark process, costs..)
<b>Mar. 2009</b>	IDAG began monitoring the progress
<b>Aug. 2009</b>	IDAG recommends validation of two (2) and ILCSC approves
<b>Oct. 2009</b>	Work plan of the validated groups
<b>End 2011</b>	Interim Report being produced <a href="http://www.linearcollider.org/about/Publications/interim-report">http://www.linearcollider.org/about/Publications/interim-report</a>
<b>End 2012</b>	Physics at the International Linear Collider (ILC TDR Vol. 2) Detailed Baseline Design Report (ILC TDR Vol. 4) <a href="http://www.linearcollider.org/ILC/Publications/Technical-Design-Report">http://www.linearcollider.org/ILC/Publications/Technical-Design-Report</a>
<b>June 12<sup>th</sup> 2013</b>	Public TDR Launch event worldwide <a href="http://www.linearcollider.org/events/2013/ilc-tdr-world-wide-event">http://www.linearcollider.org/events/2013/ilc-tdr-world-wide-event</a>





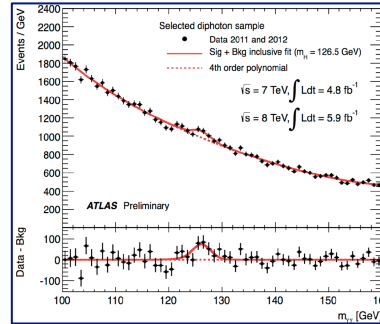
# ILC: From Design to reality

1980 ~

- Basic Study started

2004

- SCRF Technology selected



Higgs discovered



LHC

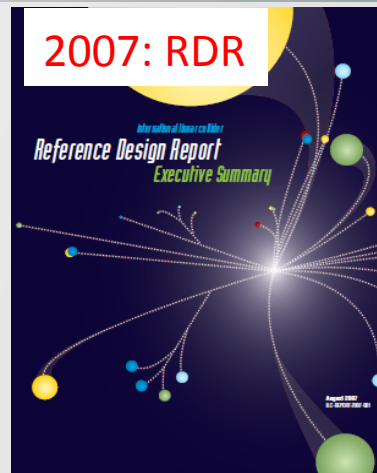
2005 2006 2007 2008 2009 2010 2011 2012 2013

ILC - GLOBAL DESIGN EFFORT (GDE)

Ref. Design Report (RDR)



A. Yamamoto - ICHEP 2014



2013: TDR

THE INTERNATIONAL LINEAR COLLIDER  
 TECHNICAL DESIGN REPORT | VOLUME 3: ACCELERATOR R&D



COMPLETED

LCC

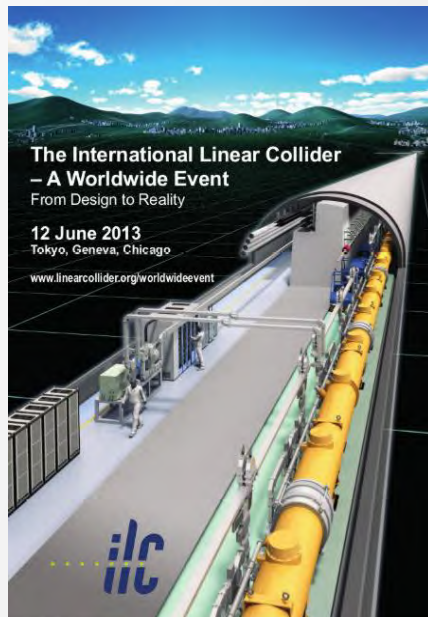
Linear Collider Collaboration





# ILC: From Design to reality

## Official Completion of ILC TDR “From Design to Reality” June 12, 2013:



TDR handed to LCC Director Lyn Evans



U. Tokyo



CERN



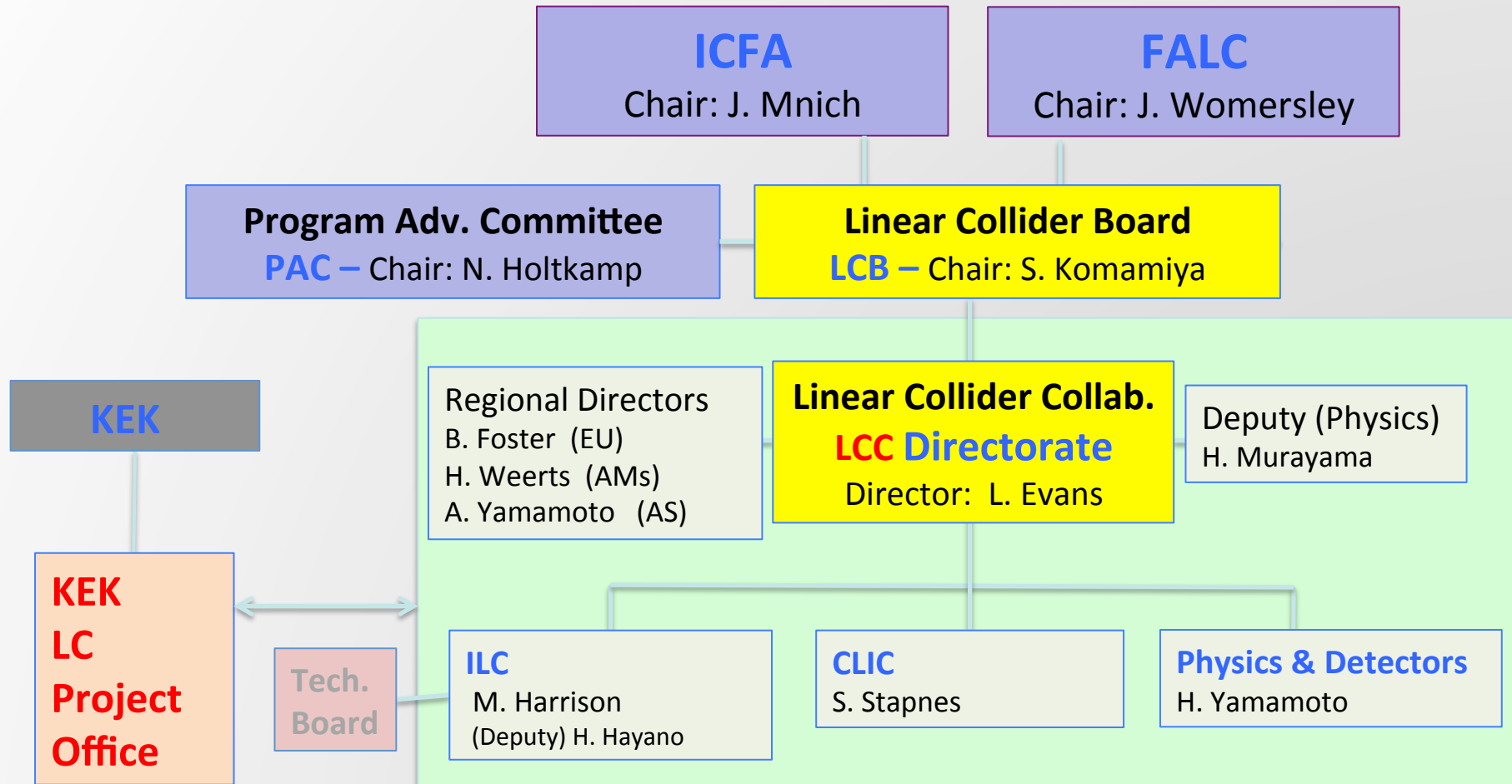
Fermilab

ILC TDR published in a Worldwide Event:

Tokyo → Geneva → Chicago



# The new Linear Collider Collaboration





## **Lyn Evans statements at LCWS12 (Arlington, Oct. 22 2012):**

- Strongly support the Japanese initiative to construct a linear collider as a staged project in Japan.
- Prepare CLIC machine and detectors as an option for a future high-energy linear collider at CERN.
- Further improve collaboration between CLIC and ILC machine experts.
- Move towards a “more normal” structure of collaboration in the detector community to prepare for the construction of two high-performance detectors.





# The new Linear Collider Collaboration: LCB members

**5 members x 3 regions + chair = 16 members + secretary**

Chair Sachio Komamiya (The University of Tokyo)

Americas Jonathan Bagger (TRIUMF)  
Nigel Lockyer (Fermilab Director)  
David MacFarlane (SLAC)  
Lia Merminga (TRIUMF)  
Hugh Montgomery (Jefferson Lab)

Asia Jie Gao (IHEP, Beijing)  
Rohini Godbole (Indian Institute of Science)  
Sunkee Kim (RISP)  
Atsuto Suzuki (KEK Director)  
Yifang Wang (IHEP Director)

Europe Rolf Heuer (CERN Director-General)  
Joachim Mnich (DESY Director of Particle Physics)  
Victor Mateev (JINR Director)  
Francois Le Diberder (IN2P3) } Nominated by ECFA  
Lenny Rivkin (PSI)

Secretary Roy Rubinstein



# The new Linear Collider Collaboration: PAC members

## PAC (Project Advisory Committee) Members

LCC requested to postpone the First meeting.

The first meeting PAC Meeting will be held in April 2015 at LAL Orsay.

Report:

Overview Lyn Evans

ILC Mike Harrison

CLIC Steinar Stepnes

SRF Akira Yamamoto

Conv.Fac. Expert from KEK

Cavity Prod. Olivier Napoly

ILC Lab Org. Brian Foster

Run strategy Jim Brau

Physics/Detector discuss with Hitoshi Yamamoto

**S. Komamiya ICFA Seminar**

Chair	Norbert Holtkamp	
Deputy Chair	Michel Davier	
Accelerator and Project		
	Hans Weise (DESY)	Linac Construction
	Robert Orr (Tronto)	Cavity R&D
	Mark Palmer (FNAL)	Large Science Facilities
	Philippe Lebrun (CERN)	PM / Cost
	Osamu Kamigaito (RFBF Riken)	Facility construction
	Moo Hyun Cho (PAL Korea)	Linac Technology
	Eisuke Tada (JAEA/ITER)	PM / Integration
	Shinichi Akutagawa (Kobe University)	Construction Management
	Norihito Ohuchi (KEK) NOT AVAILABLE	SC-RF/ Cryomodule product.
Experiments		
	Joe Lykken (FNAL)	Physics
	Peter Jenni (CERN/ATLAS)	Detector/Physics
	Tomio Kobayashi (ICEPP, Tokyo)	Detector/ Experiments
	Hesheng Chen (IHEP, Beijing)	Detector/Experiments



# The new Linear Collider Collaboration: World Wide Study (finished its role)

Asia	Europe	North America
Atul Gurtu <i>Tata Institute (India)</i>	Ties Behnke <i>DESY (Germany)</i>	<b>Jim Brau</b> <i>U. of Oregon (USA)</i>
Yee Bob Hsiung <i>National Taiwan U. (Taiwan)</i>	<b>Juan Fuster</b> <i>IFIC Valencia (Spain)</i>	John Jaros <i>SLAC (USA)</i>
Weiguo Li <i>IHEP Beijing (China)</i>	Lucie Linssen <i>CERN (Switzerland)</i>	Dean Karlen <i>U. of Victoria (Canada)</i>
Akiya Miyamoto <i>KEK (Japan)</i>	Ron Settles <i>MPI Munich (Germany)</i>	Andreas Kronfeld <i>Fermilab (USA)</i>
Hwanbae Park <i>Kyungpook National U. Korea</i>	Jan Timmermans <i>NIKHEF (Netherlands)</i>	Ritchie Patterson <i>Cornell U. (USA)</i>
<b>Hitoshi Yamamoto</b> <i>Tohoku U. (Japan)</i>	Mark Thomson <i>Cambridge (UK)</i>	Harry Weerts <i>Argonne (USA)</i>

Blue: WWS co-chairs

European team was enlarged internally including:

- Ph. Bambade (LAL Orsay, France),
- J. Kalinowski (University Warsaw, Poland)
- F. Le Diberder (LAL, Orsay, France) ex-officio as representing the P&D community at LCC





## The new Linear Collider Collaboration: World Wide Study (finished its role)

---

The physics case of the LC is dealt with by the physics Working Group of LCC, and the organization of LCWS is now done by LCC with the three associate directors being co-chairs of the organization committee.

On the other hand, regional meetings are organized by regional initiatives as before.

In this circumstance, it seems that there is not enough mandate for the WWS which have performed critical roles in physics and detector activities of linear colliders since its inception about 16 years ago.

**Many thanks to WWS for its inputs and past efforts to the LC project.**



# The new Linear Collider Collaboration: European LC Forum

## ECFA European Committee for Future Accelerators

### European LC Forum

#### Purpose

Act as a bidirectional information channel from the European members of the LCB to the Linear Collider community in Europe.

#### Membership

- Senior members of the European Linear Collider community will be invited to join and participate in the forum. (*i.e. start with the list of colleagues nominated through RECFA*)
- The forum is open to all members of the European Linear Collider community. A web based application procedure will be implemented. (*e.g. a moderator/secretary decides to accept or reject an application, to prevent abuses*)

#### Activities

- Create a web space to share relevant documents from the LCB
- Organise regular video meetings before/after LCB meetings

November 21/22 2013

94nd Plenary ECFA CERN

17



**ICFA Statement on its Support of the ILC, its Endorsement of the Strategic Plans of Europe, Asia and the United States, and its Encouragement of International Studies of Future Circular Colliders**

**ICFA endorses the particle physics strategic plans produced in Europe, Asia and the United States and the globally aligned priorities contained therein. Here, ICFA reaffirms its support of the ILC, which is in a mature state of technical development and offers unprecedented opportunities for precision studies of the newly discovered Higgs boson. In addition, ICFA continues to encourage international studies of circular colliders, with an ultimate goal of proton-proton collisions at energies much higher than those of the LHC.**





- MEXT has requested \$0.5M for investigatory study which was approved on Dec 24, 2013.
  - Not a fund request by a researcher, but by MEXT.
  - Approved by the ministry of finance and then by an official cabinet decision.
  - Will be doubled next year (i.e. ~1M\$)
- An expert committee was established under MEXT
  - 13 members (could increase)
    - A few particle physicists included
    - No 'ILC proponents'
  - Kickoff meeting held on May 8, 2014
  - Report to be completed by FY2015 (i.e. end of March 2016)
- The outcome is critically important for the ILC

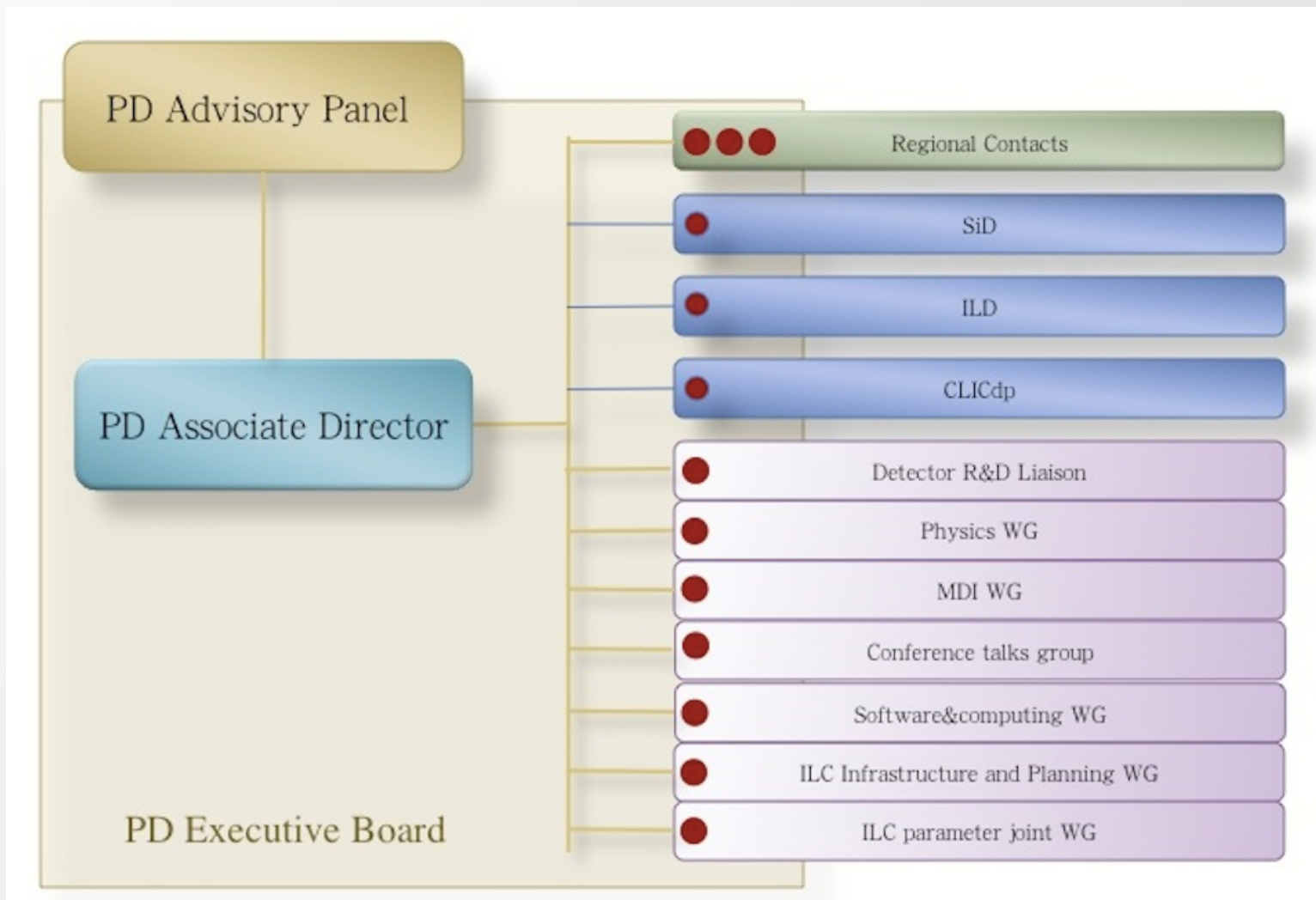


- The topics to be evaluated includes:
  - Physics case of the ILC
  - Total budget and international sharing
  - Prospects for securing necessary human resources during construction and operation
  - Domestic organization for the ILC
  - Social and economic effects by siting the ILC in Japan
- Two subcommittees started: reports in ~1 year
  1. On the ILC physics case with respect to other future projects
  2. On the project readiness including human and financial resources

Material is requested at any time.



# The new Linear Collider Collaboration: Physics and Detectors



<https://www.linearcollider.org/P-D/Organisation>

## EB members

- Hitoshi Yamamoto, *Associate Director*
- Juan Fuster, *European Regional Contact*
- Dmitri Denisov, *North American Regional Contact*
- Keisuke Fujii, *Asian Regional Contact & Physics*
- Mark Thomson, *CLICdp*
- Marcel Stanitzki, *SiD*
- Ties Behnke, *ILD*
- Maksym Titov, *Detector R&D liaison*
- Christophe Grojean, *Physics*
- Michael Peskin, *Physics*
- Karsten Buesser, *MDI*
- Frank Simon, *Conference Talks*
- Norman Graf, *Software & Computing*
- Jim Brau, *ILC Parameters*
- Sakue Yamada, *ILC Infrastructure & Planning*

EB meets every two weeks



## The LCCPD-EB: Physics Working Group

---

- Conveners
  - Keisuke Fujii, Christophe Grojean. Michael Peskin
- Members:
  - (Americas) Tim Barklow, Maxim Perelstein, James Wells, Jaehoon Yu
  - (Europe) Roberto Contino, Jenny List, Juergen Reuter, Frank Simon
  - (Asia) Shinya Kanemura, Hyungdo Kim, Mihoko Nojiri, Tomohiko Tanabe, Yuanning Gao
- Observer
  - Hitoshi Murayama (LCC deputy director)
- **For the MEXT subcommittee:**
  - Preparing material presented to the MEXT subcommittee
    - Together with the Japanese group (a large overlap of membership)
  - Producing a brief document on the ILC physics case
    - Intended for intelligent non-experts





# The LCCPD-EB: ILC parameter joint Working Group

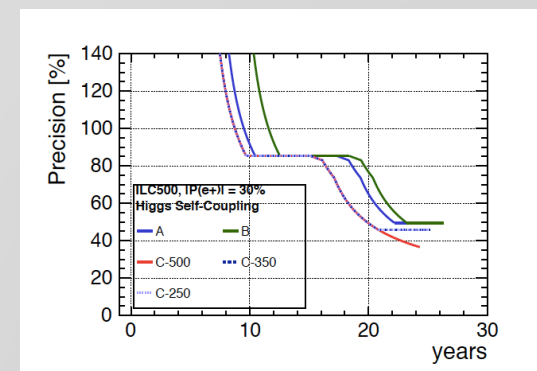
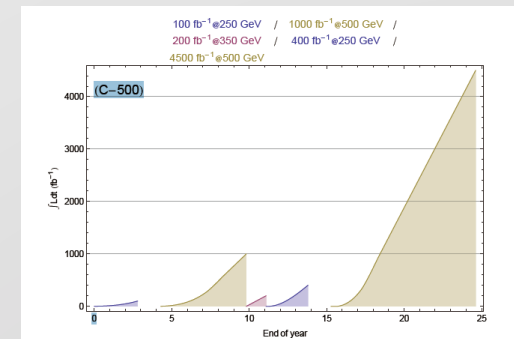
**Goal:** to come up with energy staging scenarios of ILC

- **Members**

- **Physics/Detector:** Tim Barklow, Jim Brau (co-convener), Jenny List, Keisuke Fujii
- **Accelerator:** Gao Jie, Nick Walker (co-convener), Kaoru Yokoya

- **Procedure :**

- ILC parameter WG produces ‘a few’ scenarios
  - A draft is have been produced, was reviewed by the physics WG and LCCPDeb
- LCC/LCB will review the draft





## The LCCPD-EB: ILC Infrastructure and planning Working Group

---

- **Charge**
  - Studies the time-profiles of the human and budgetary needs of the ILC detector activities.
  - Proposes the organizational structure where the detector groups interact with the ILC laboratory.
- **Members**
  - **Sakue Yamada (chair)**, Kiyotomo Kawagoe, Yasuhiro Sugimoto, Frank Simon(Mary-Cruz Fouz:deputy), Karsten Buesser, Marcel Stanitzki, Marty Breidenbach
- **Inputs to the MEXT TDR validation working group**
  - The TDR validation WG is to review the detector issues in ~Feb, 2015
  - Inputs to the LCB subcommittee on governance and management



# The LCCPD-EB: Detector R&D liason

- **Conveners:**
  - Maksym Titov
  - Jan Strube
- A document describing current detector R&Ds relevant to LC is produced
- To be updated
  - Software R&Ds are to be included

INTERNATIONAL WORKSHOP ON FUTURE LINEAR COLLIDERS  
06 - 10 OCTOBER '14  
INN VINCA  
BELGRADE  
SERBIA  
EUROPE

LC Detector R&D: Report from Liaisons

Jan Strube (Tohoku University)  
Maxim Titov (CEA Saclay)

INTERNATIONAL ADVISORY COMMITTEE  
The workshop will be devoted to the study of the physics cases for future high energy linear electron position colliders, taking into account the recent results from LHC, and to review the progress in the detector and accelerator design for both the ILC and CLIC projects

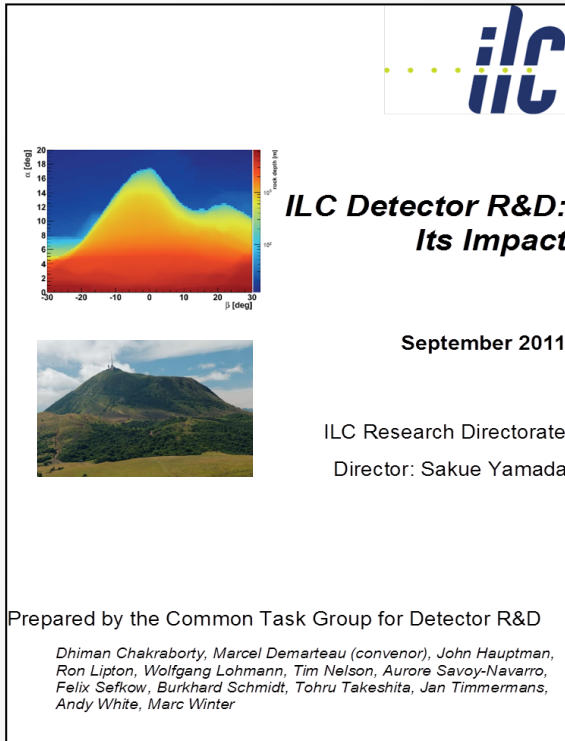
INTERNATIONAL ORGANIZING COMMITTEE

LOCAL ORGANIZING COMMITTEE

http://lcws14.vinca.rs    lcws14@vinca.rs    Plenary Talk, Belgrade, Serbia, October 6, 2014

- For a description of current R&D activities see talk by M. Titov at:  
<http://agenda.linearcollider.org/event/6389/session/17/contribution/19>

# Spinoffs derived from LC detector R&D



**ILC Detector R&D:  
Its Impact**

September 2011

ILC Research Directorate  
Director: Sakue Yamada

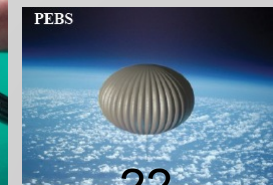
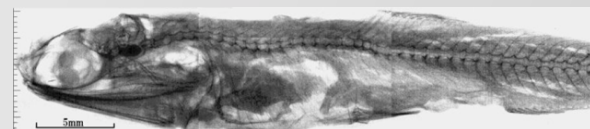
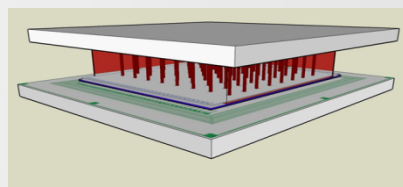
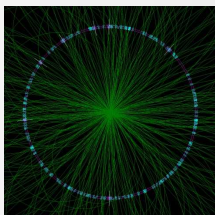
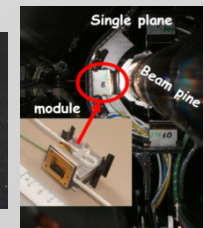
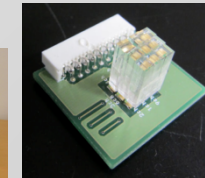
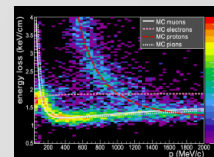
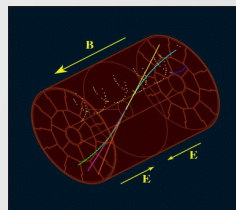
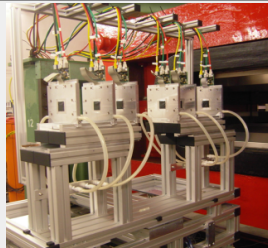
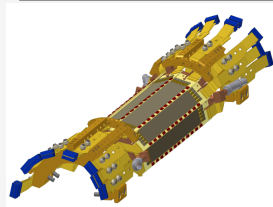
Prepared by the Common Task Group for Detector R&D

*Dhiman Chakraborty, Marcel Demarteau (convenor), John Hauptman, Ron Lipton, Wolfgang Lohmann, Tim Nelson, Aurore Savoy-Navarro, Felix Sefkow, Burkhard Schmidt, Tohru Takeshita, Jan Timmermans, Andy White, Marc Winter*

An study of the spinoffs derived by the LC detector R&D has been performed (worth reading!)

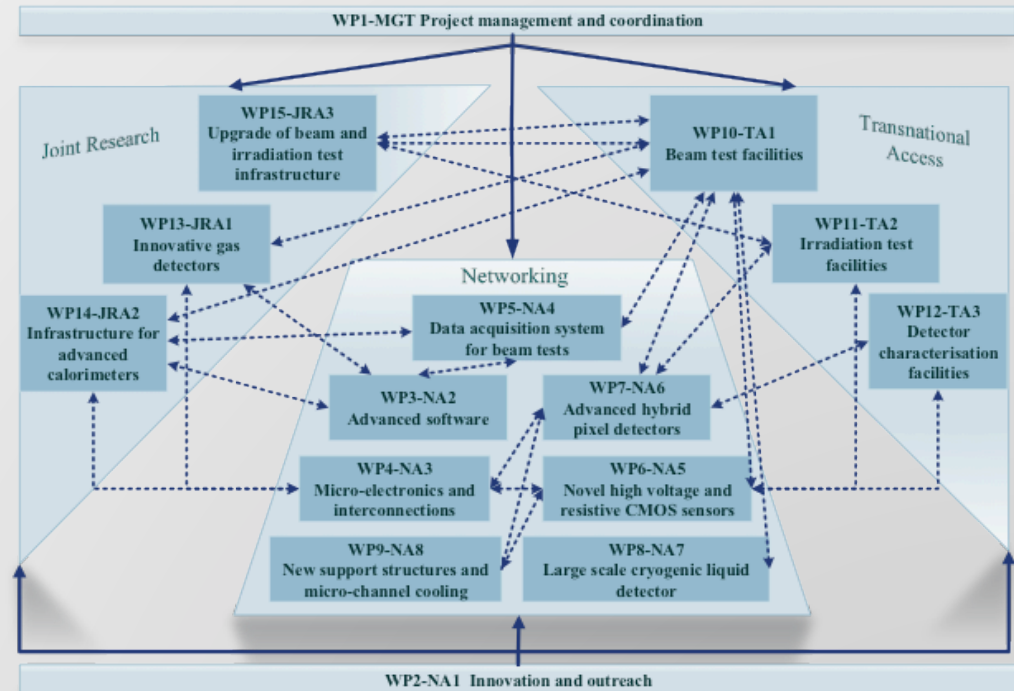
It includes:

- HEP applications:
  - ✓ vertex developments (ALICE-ITS, CBM-FAIR, Star, BelleII)
  - ✓ TPC Micromegas (T2K)
  - ✓ Calorimeters (LHC, CMS)
  - ✓ trigger development (LHC, CAST)
  - ✓ software (Belle II, NOVA, AIDA, CLIC,  $\mu$ -collider)
  
- None HEP applications:
  - ✓ X-ray imaging (astronomy, medicine, proton tomography, volcano tomography)
  - ✓ ASICs for Balloon experiments



The AIDA-2020 proposal was submitted EU by early September 2014 (L. Serin)

Key R&D issues	WPs related to activity
<b>HL-LHC</b>	
Radiation hard detectors : - New pixel and tracker detector - Forward Calorimeter - Micro-Electronics Beam and irradiation prototypes testing, Industrialisation process, Software simulation and reconstruction	WP 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15
<b>ILC</b>	
Low mass pixel and track detectors, High granularity calorimeters, Low power electronics, Industrialisation, Combined system performance, Software simulation and reconstruction	WP 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15
<b>CLIC (Compact Linear Collider)</b>	
As for ILC, plus the need for nano-second time stamping in all systems	WP 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15
<b>Long-baseline neutrinos</b>	
Large-scale cryogenic detectors, electronics Beam test	WP 2, 3, 8, 10
<b>FCC (Future Circular Collider)</b>	
See HL-LHC	WP 2, 3



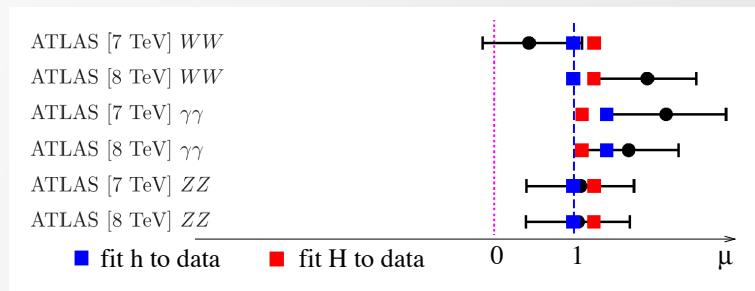
About 25% include Linear Collider R&D related activities



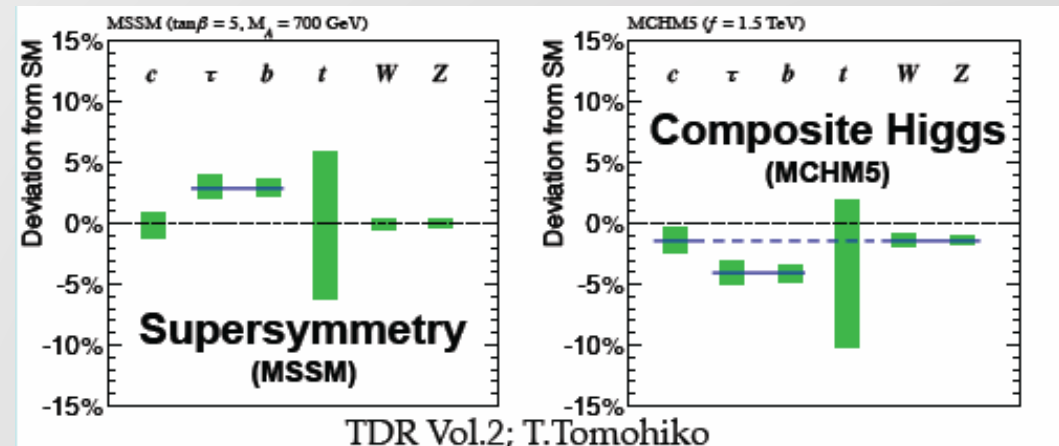
One example:

Fit LHC and Tevatron „signal strength“ parameters to the MSSM taking into account limits, B-physics constraints etc.

→ both h and H provide a reasonable fit

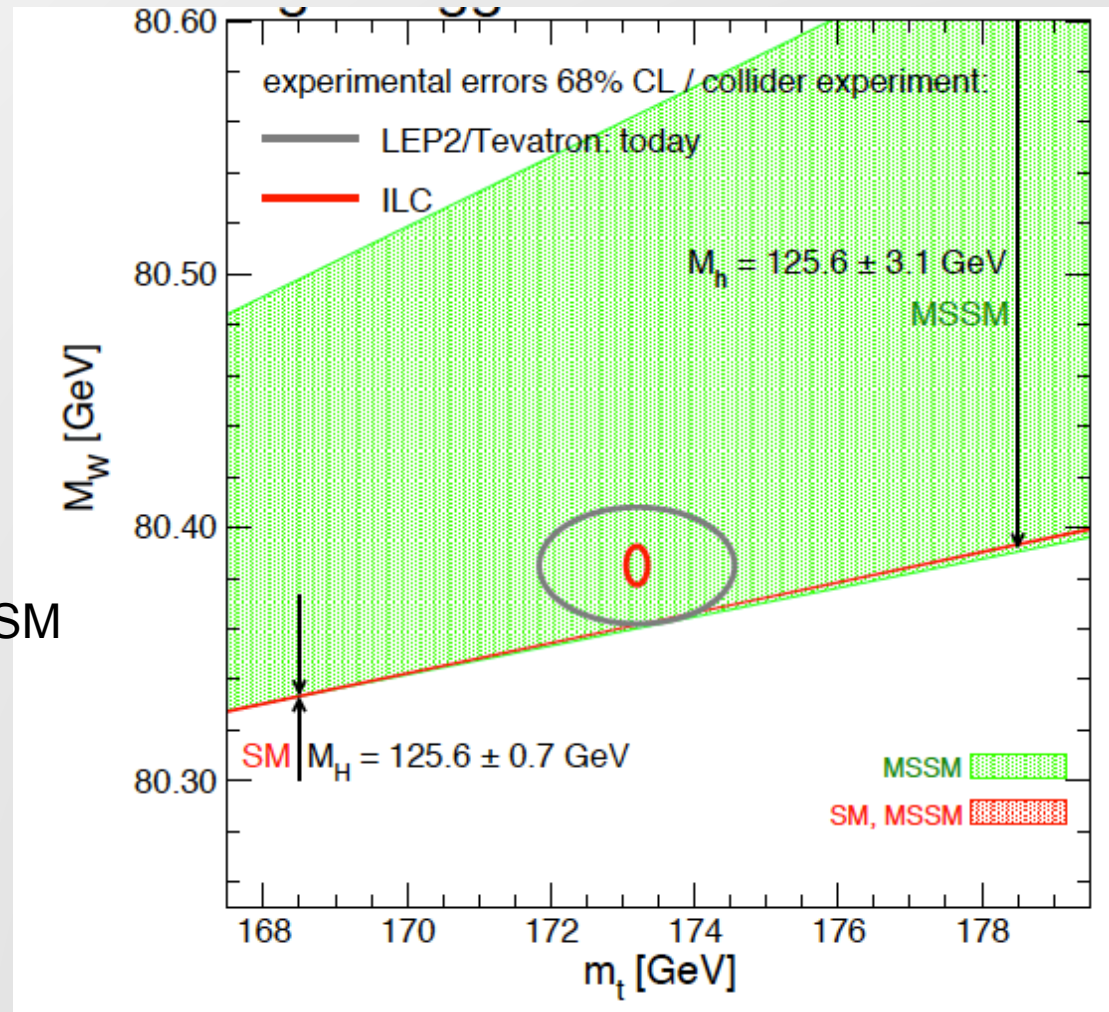


[Bechtle, Heinemeyer, Stal, Stefaniak, Weiglein, Zeune arXiv:1211.1955]

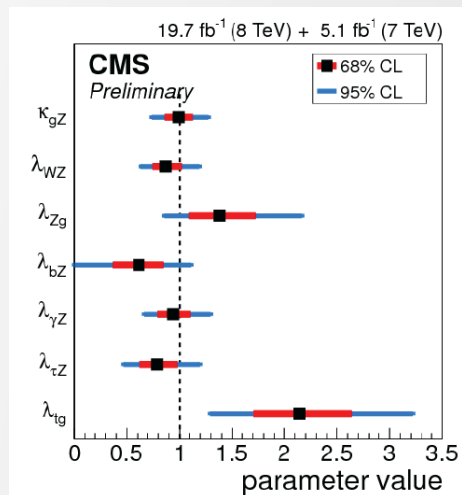
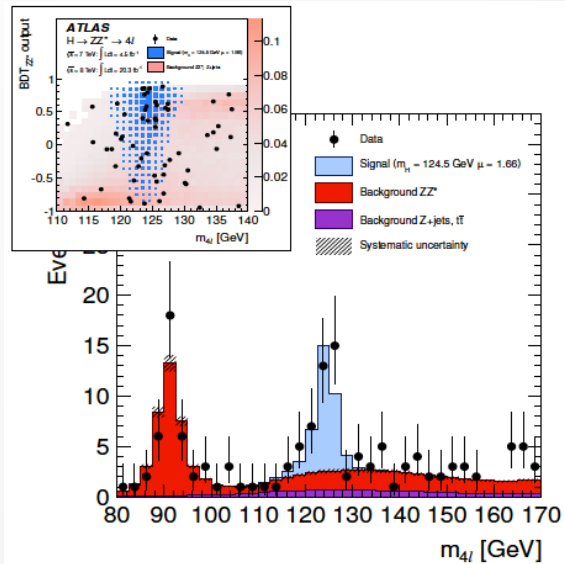


- tiny differences between best fit and SM
- tiny differences between h and H hypotheses
- $\Delta\mu/\mu \lesssim 5\%-20\%$
- In general precision at  $\sim\%$  or better is required

Consistency checks with the SM  
 and possible New Physics



[S. Heinemeyer, W. Hollik, G. W., L. Zeune '14]



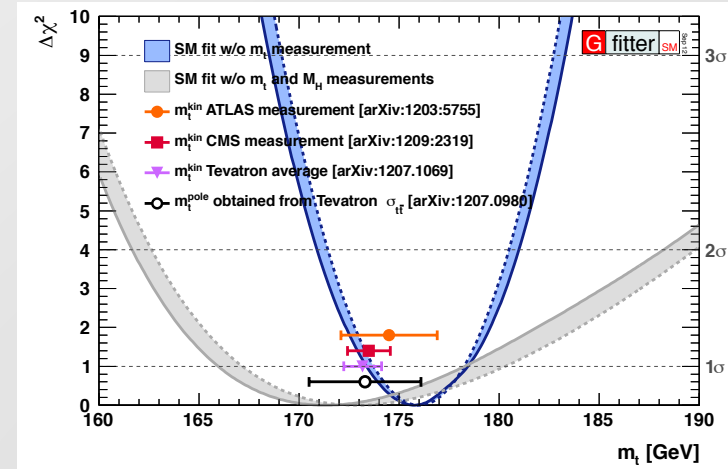
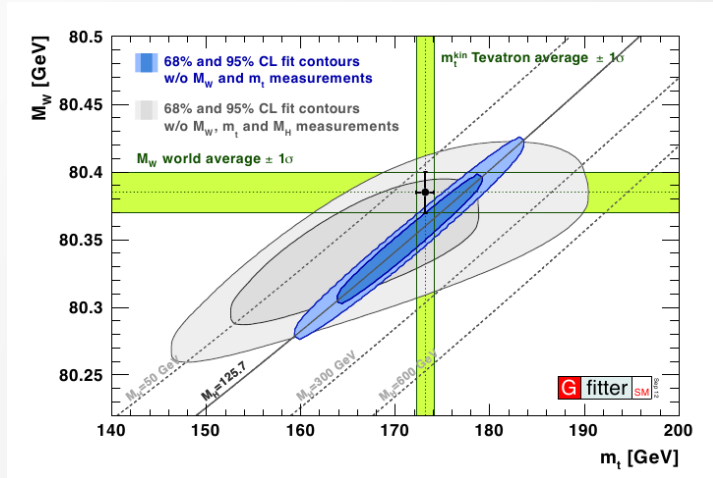
The open questions about the “Higgs” :

1. is it the boson of the (minimal) Standard Model ?
2. is it an elementary or composite particle ?
3. is it unique/solitary ?
4. is it eternal/temporary (stability of SM vacuum) ?
5. is it natural ?
6. is it the first supersymmetric particle ever observed ?
7. is it really “responsible” for the masses of all elementary particles ?
8. is it mainly produced by top quarks or by new heavy vector-like particles ?
9. is it at the origin of the matter-antimatter asymmetry ?
10. has it driven the inflationary expansion of the Universe ?

# The need for precision: EW consistency, top, W,Z

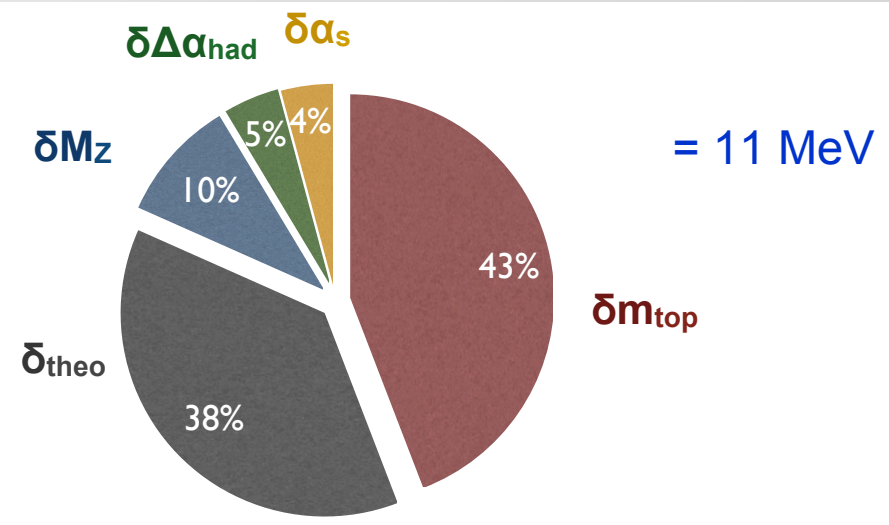
## EW consistency between: $M_W \otimes M_H \otimes M_t$

[M. Baak IVICFA + CERN 2013]



■ Indirect result:  $m_t = 175.8^{+2.7}_{-2.4}$  GeV (Tevatron w.a.:  $173.2 \pm 0.9$  GeV)

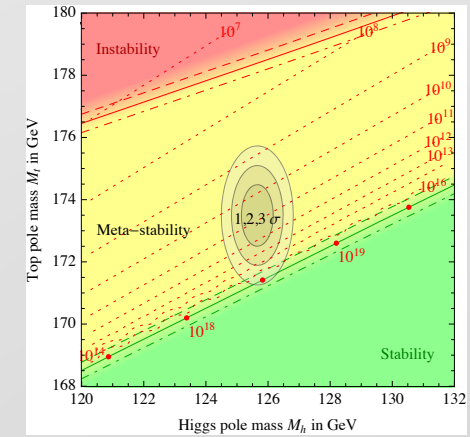
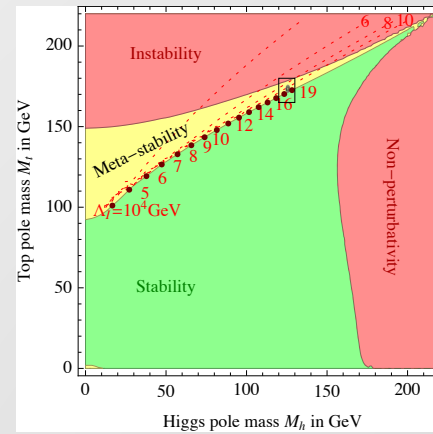
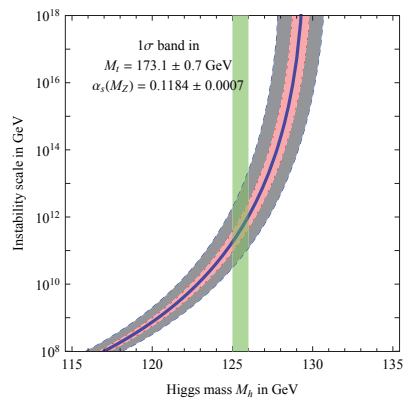
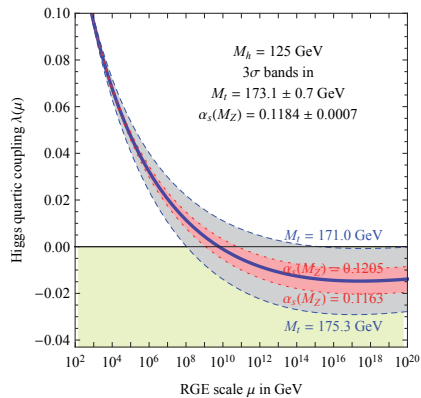
- $\delta M_W$  (indirect) =
  - Large contributions to  $\delta M_W$  (and  $\delta \sin^2 \theta_{\text{eff}}^l$ ) from top and unknown higher-order EW corrections.
- $\delta M_W$  (direct) = 15 MeV



Vacuum Stability ( $\lambda(\Lambda) \geq 0$ )

$\lambda(\Lambda)$  the  $\overline{\text{MS}}$  quartic Higgs Coupling

Degrassi et al, *JHEP* 1208 (2012) 098  
Butazzo et al, 1307.3536 (2013)



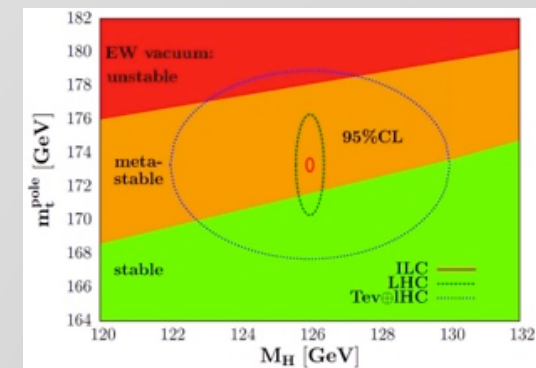
Assume SM valid up to  $\Lambda \leq M_{\text{planck}}$

$$M_t = (173.35 \pm 0.72) \text{ GeV} \longrightarrow M_h > (129.6 \pm 1.5) \text{ GeV}$$

$$M_h = (125.66 \pm 0.34) \text{ GeV} \longrightarrow M_t < (171.36 \pm 0.46) \text{ GeV}$$

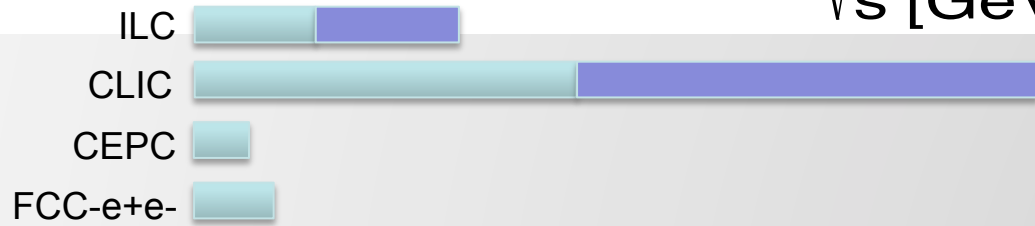
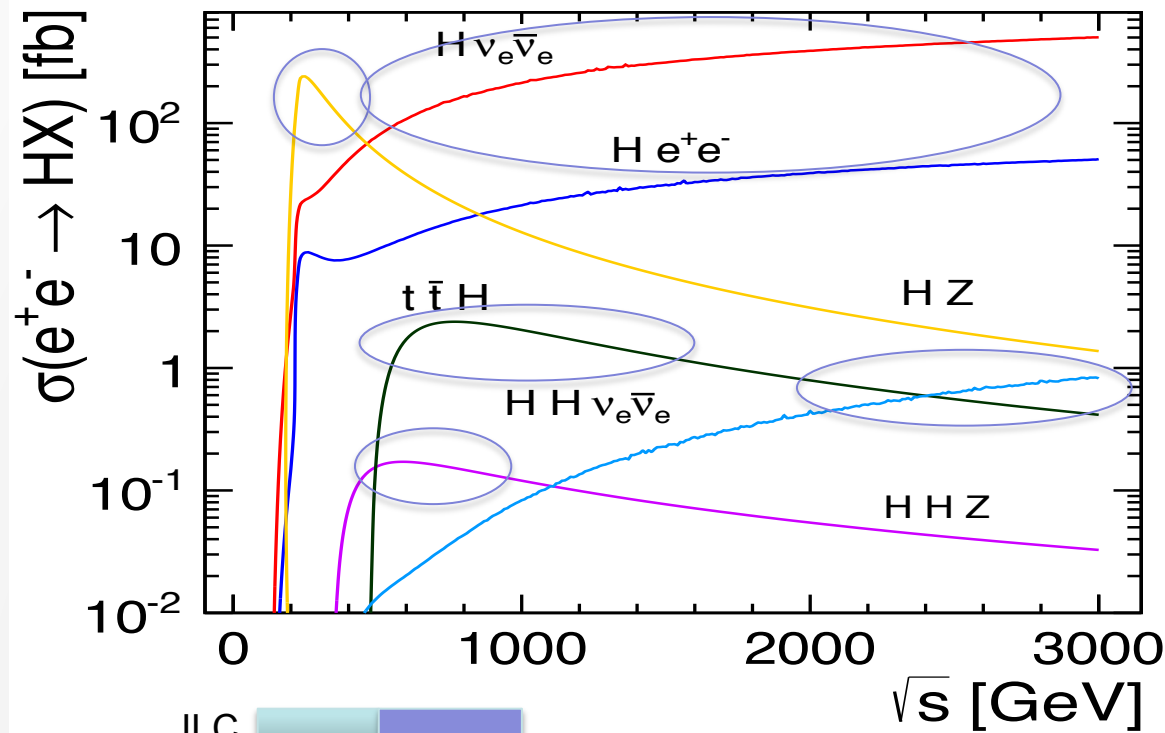
Take  $M_t$  from  $t\bar{t}$  X-section (pole mass)

$$M_t = (173.3 \pm 2.8) \text{ GeV} \longrightarrow M_h > (129.4 \pm 5.6) \text{ GeV}$$

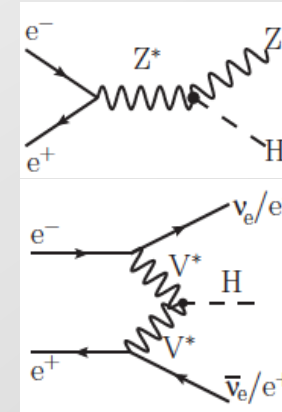


Alekhin et al, *Phys.Lett.* B716 (2012) 214



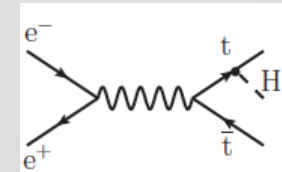


Many processes at different  $\sqrt{s}$  needed & accessible

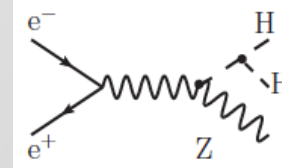


Mass  
 $g_Z$  (m.i.)  
 BR's  
 (LHC)-invisible

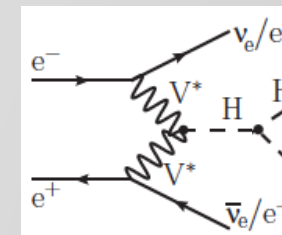
$\Gamma_{\text{tot}}$



$g_t$  (ILC, CLIC)



$g_{\text{HHH}}$  (ILC500)



$g_{\text{HHH}}$  (ILC1000, CLIC)

## Model-independent Global Fit for Couplings

### Baseline LC program

 $(M_H = 125 \text{ GeV})$ 

250 GeV: 250  $\text{fb}^{-1}$   
 500 GeV: 500  $\text{fb}^{-1}$   
 1 TeV: 1000  $\text{fb}^{-1}$

 $P(e^-,e^+) = (-0.8, +0.3) @ 250, 500 \text{ GeV}$ 
 $P(e^-,e^+) = (-0.8, +0.2) @ 1 \text{ TeV}$ 

coupling	250 GeV	250 GeV + 500 GeV	250 GeV + 500 GeV + 1 TeV
HZZ	1.3%	1%	1%
HWW	4.8%	1.1%	1.1%
Hbb	5.3%	1.6%	1.3%
Hcc	6.8%	2.8%	1.8%
Hgg	6.4%	2.3%	1.6%
H $\tau\tau$	5.7%	2.3%	1.6%
H $\gamma\gamma$	18%	8.4%	4%
H $\mu\mu$	91%	91%	16%
$\Gamma_0$	12%	4.9%	4.5%
Htt	-	14%	3.1%
HHH	-	83%(*)	21%(*)

\*) With H $\rightarrow$ WW\* (preliminary), if we include expected improvements in jet clustering it would become 17%!

# Model-independent Global Fit for Couplings

## Luminosity Upgraded LC ( $M_H = 125$ GeV)

250 GeV: 250  $\text{fb}^{-1}$   
500 GeV: 500  $\text{fb}^{-1}$   
1 TeV: 1000  $\text{fb}^{-1}$



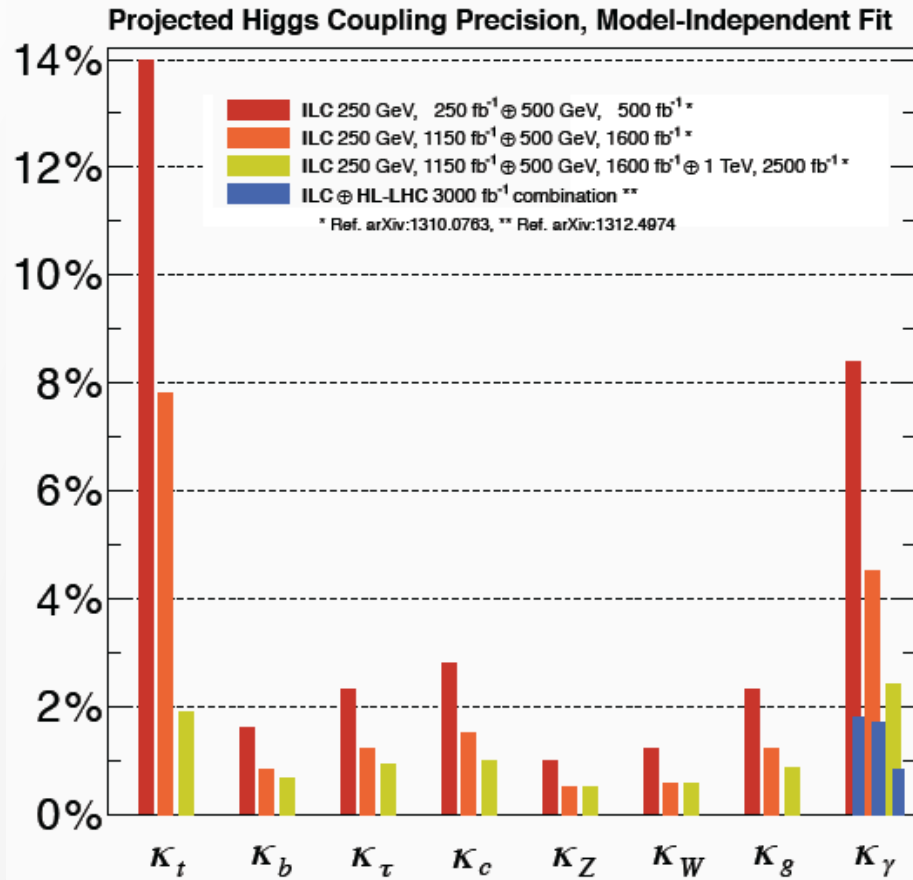
250 GeV: 1150  $\text{fb}^{-1}$   
500 GeV: 1600  $\text{fb}^{-1}$   
1 TeV: 2500  $\text{fb}^{-1}$

$P(e^-,e^+) = (-0.8, +0.3)$  @ 250, 500 GeV

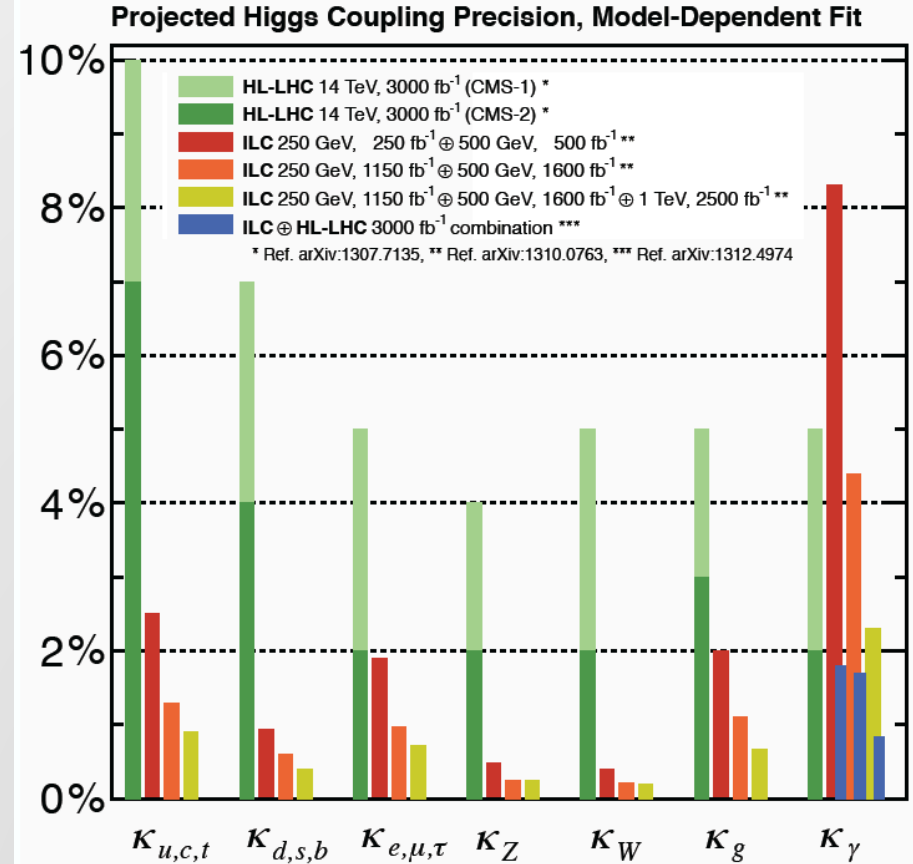
$P(e^-,e^+) = (-0.8, +0.2)$  @ 1 TeV

coupling	250 GeV	250 GeV + 500 GeV	250 GeV + 500 GeV + 1 TeV
HZZ	0.6%	0.5%	0.5%
HWW	2.3%	0.6%	0.6%
Hbb	2.5%	0.8%	0.7%
Hcc	3.2%	1.5%	1%
Hgg	3%	1.2%	0.93%
H $\tau\tau$	2.7%	1.2%	0.9%
H $\gamma\gamma$	8.2%	4.5%	2.4%
H $\mu\mu$	42%	42%	10%
$\Gamma_0$	5.4%	2.5%	2.3%
Htt	-	7.8%	1.9%
HHH	-	46% (*)	13% (*)

\*) With  $H \rightarrow WW^*$  (preliminary), if we include expected improvements in jet clustering, it would become 10%!

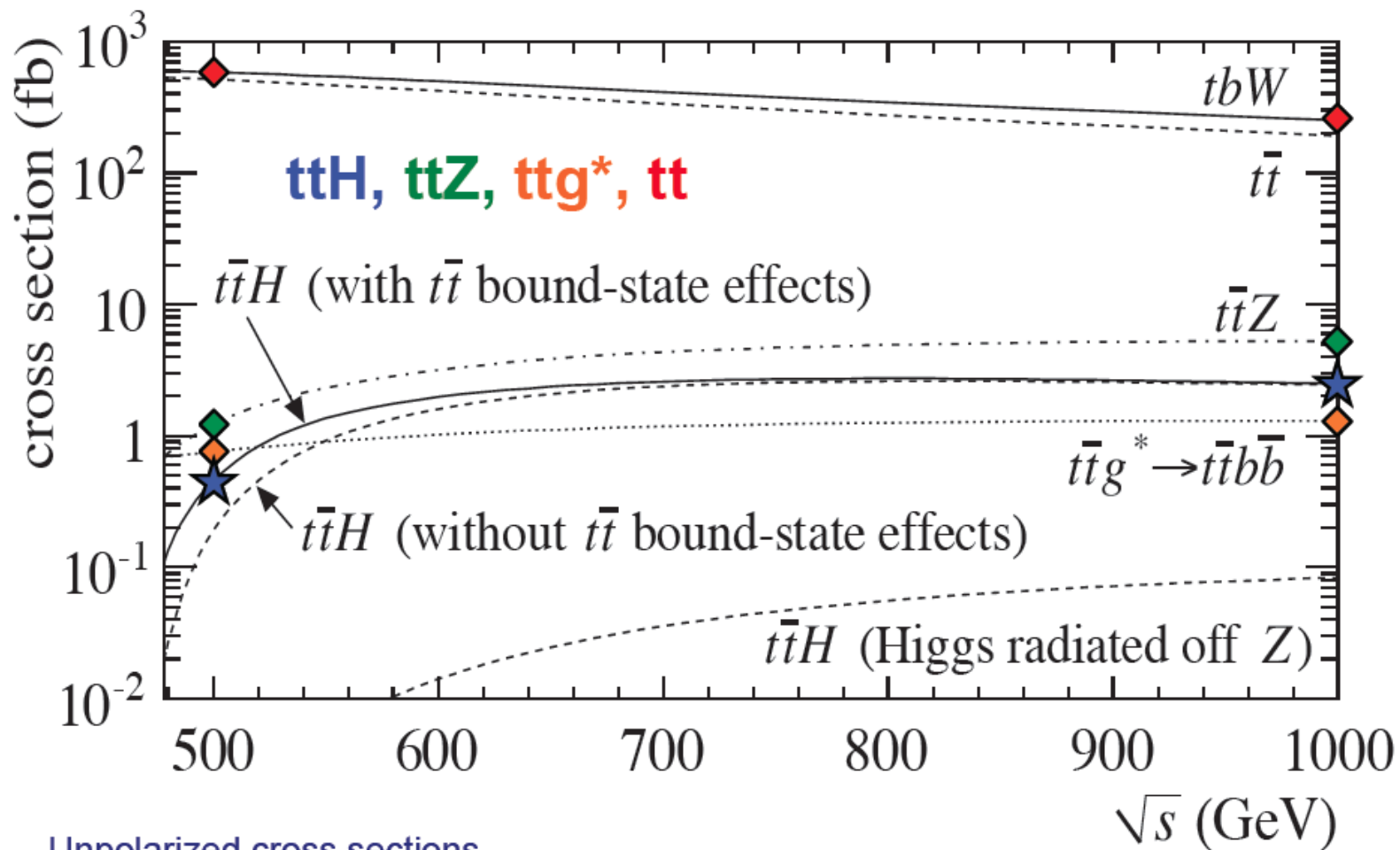


Fully model-independent



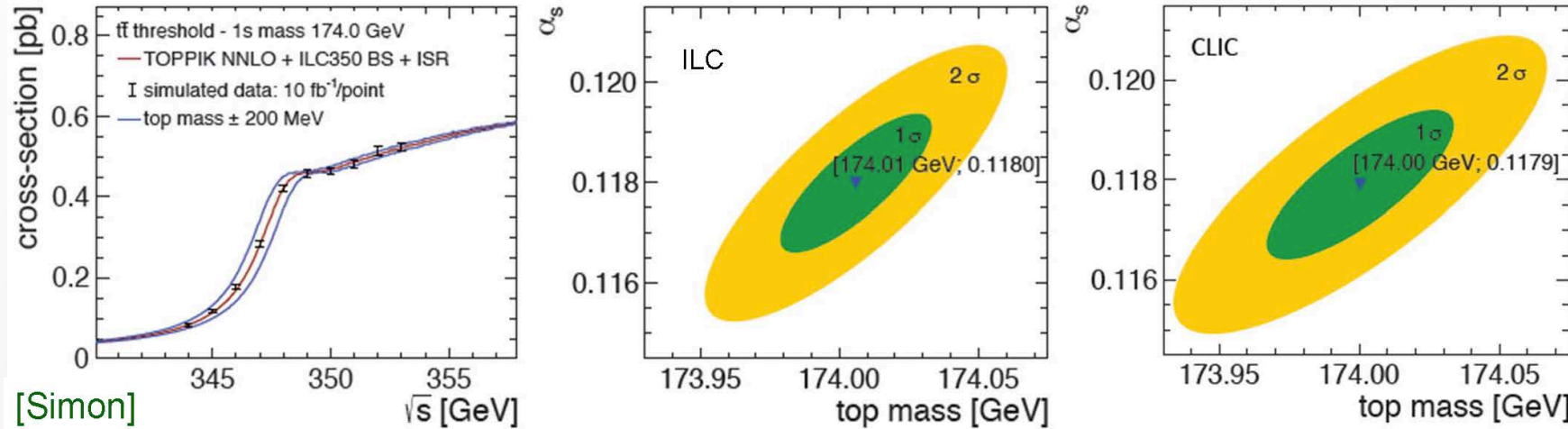
LHC-like fits, assuming SM decay modes only

# Cross Sections



Unpolarized cross sections.  
For  $t\bar{t}H$ :  $m_H = 120$  GeV





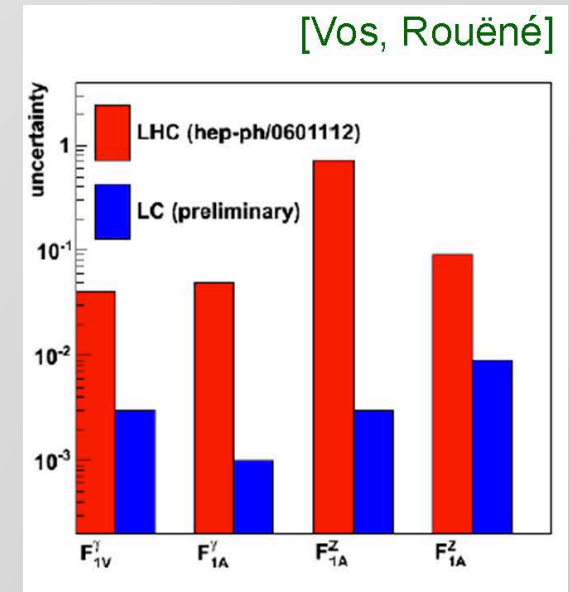
Top mass:

- At threshold, combined fit to  $1s$  mass and  $\alpha_s$ ,  $\Delta m_t$  (stat.)=34 MeV and  $\Delta \alpha_s$  (stat.)=0.0009,  $\Delta m_t$  (theo.)= $\sim 100 \text{ MeV}$   $100 \text{ fb}^{-1}$  @350 GeV
- Above threshold reconstructing the invariant mass,  $\Delta m_t$  (stat.)=80 MeV,  $100 \text{ fb}^{-1}$  @500 GeV
- New methods being pursued (above threshold) and well defined  $m_t$

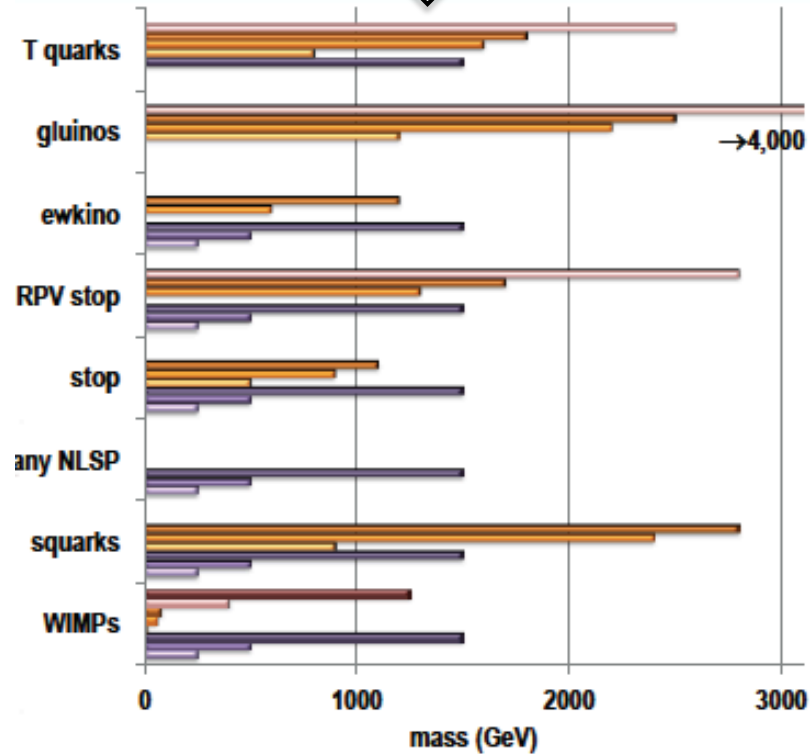
- ✓ M. Martínez, R. Miquel, Eur. Phys. J. C27 49 (2003)
- ✓ K. Seidel, F. Simon, M. Tesař, S. Poss, Eur. Phys. J. C73 2530 (2013) (no polarization)
- ✓ T. Horiguchi, A. Isihikawa, T. Suehara, K. Fuji, Y. Sumino, Y. Kiyo, Y. Yamamoto (with polarization)

Anomalous couplings:  $t\bar{t}Z + t\bar{t}\gamma$

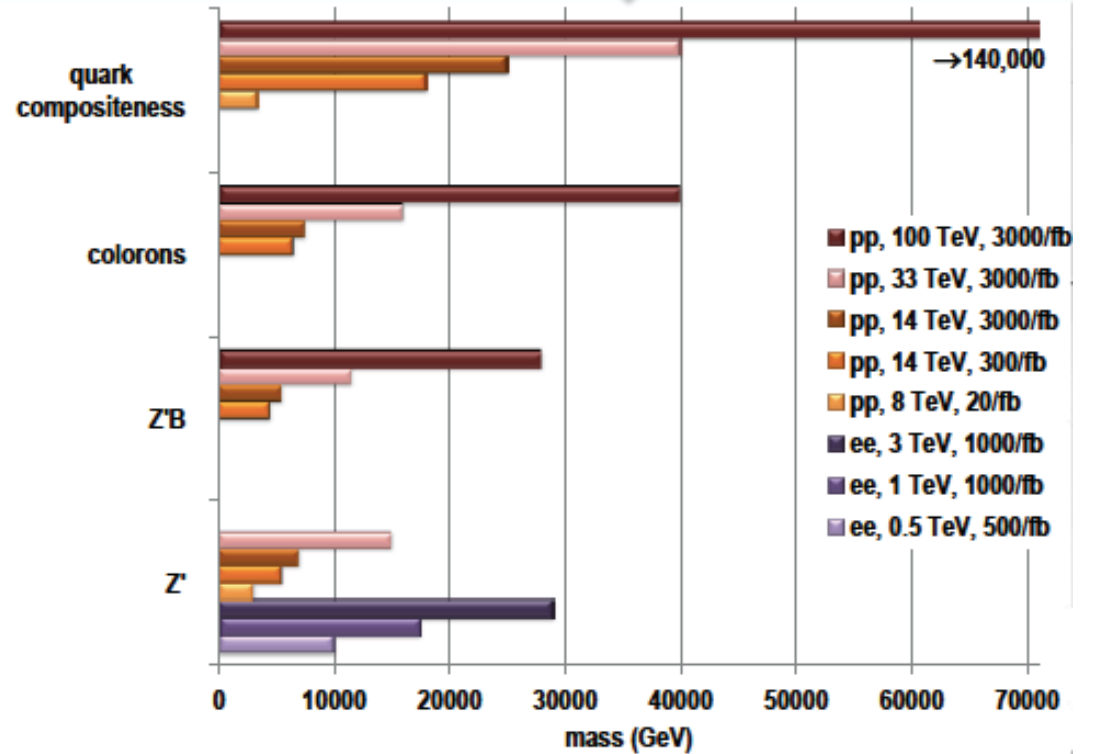
- ✓ LAL-Orsay, IFIC-Valencia

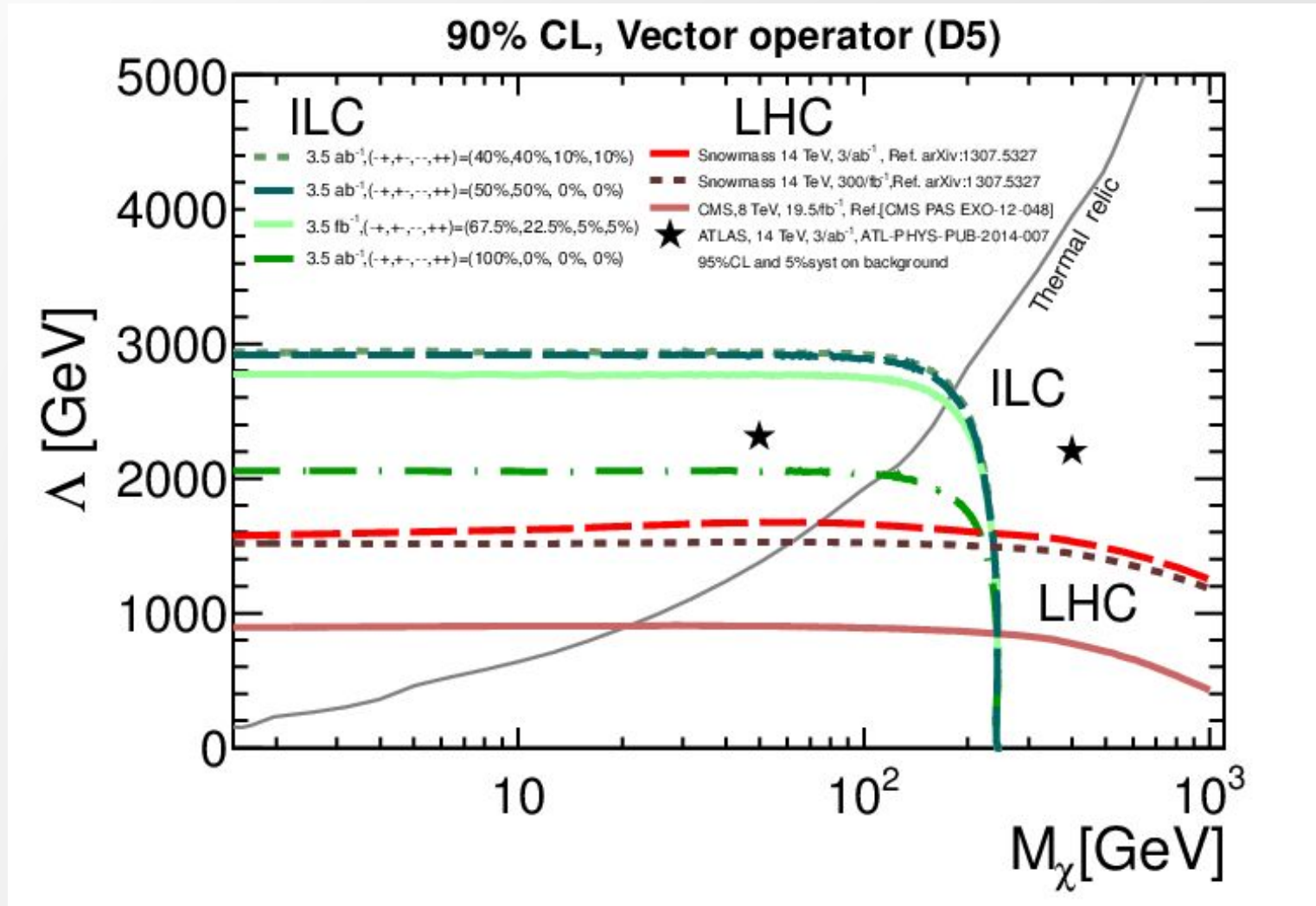


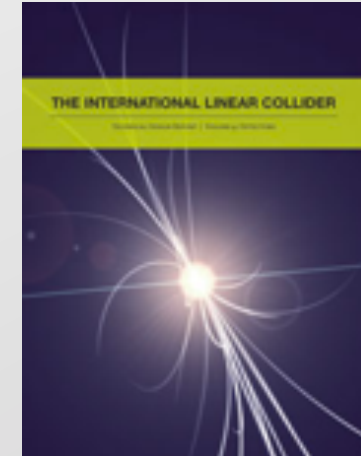
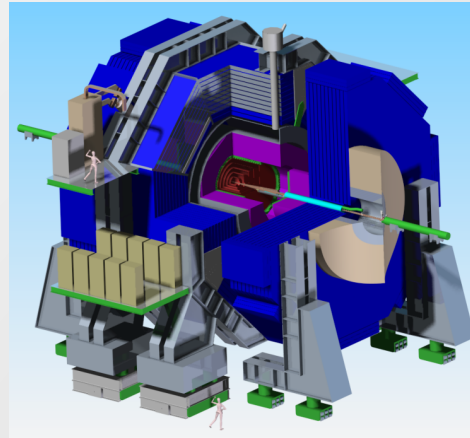
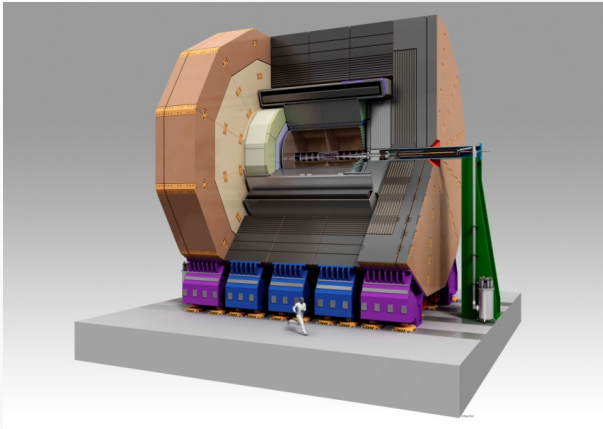
Direct searches up to mass  $M \leq \sqrt{s}/2$



Indirect input from precision measurements







**Major accomplishment has been to produce the Detailed Baseline Design report of the detectors for the ILC-TDR**

Successful cooperation between ILC and CLIC

<http://www.linearcollider.org/ILC/Publications/Technical-Design-Report>

Compact, pure Silicon based tracking, large B-field

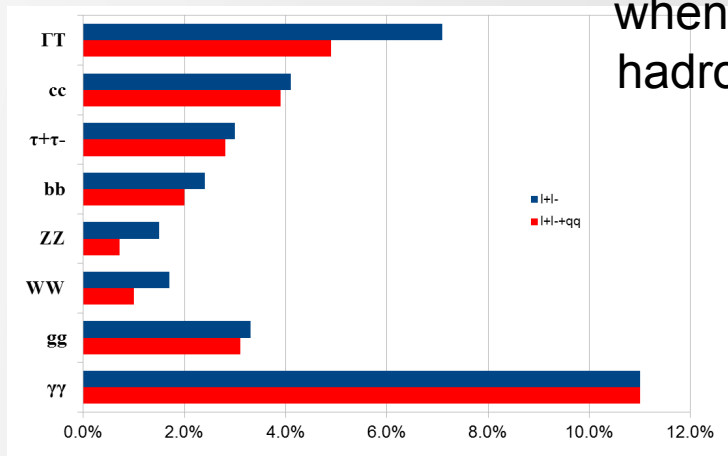
All driven by Particle Flow paradigm

Two Detector Concepts for the ILC: SiD and ILD

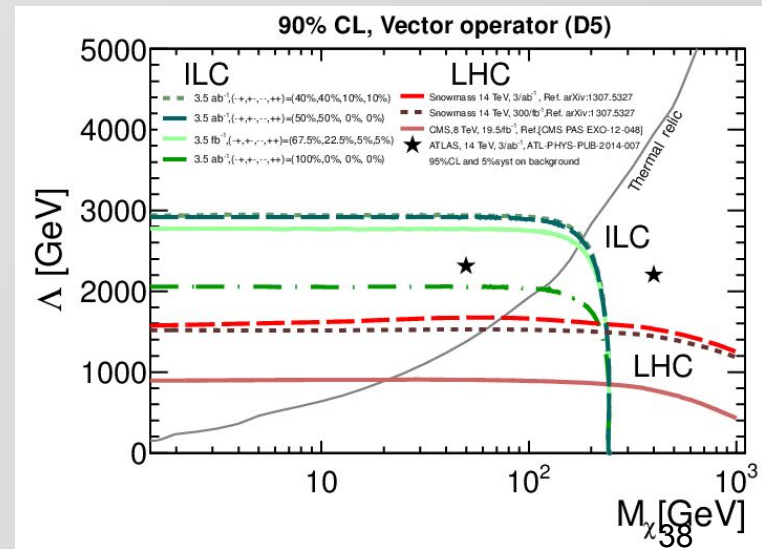
Large, gaseous & Si tracking, moderate B-field

- Consolidation of the detector designs (re-optimization)
- Intense studies of the physics reach

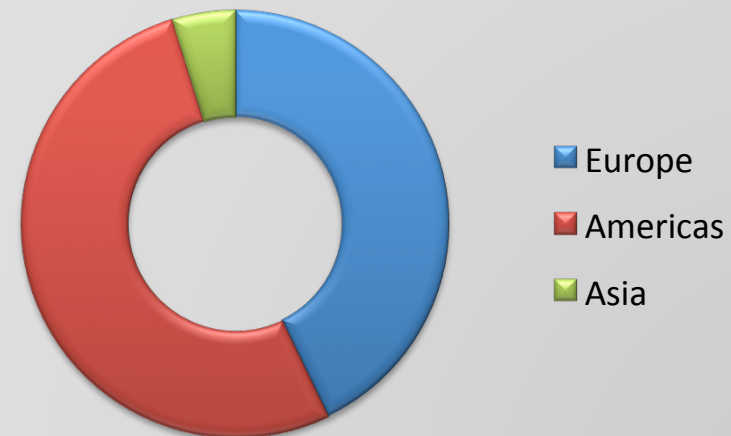
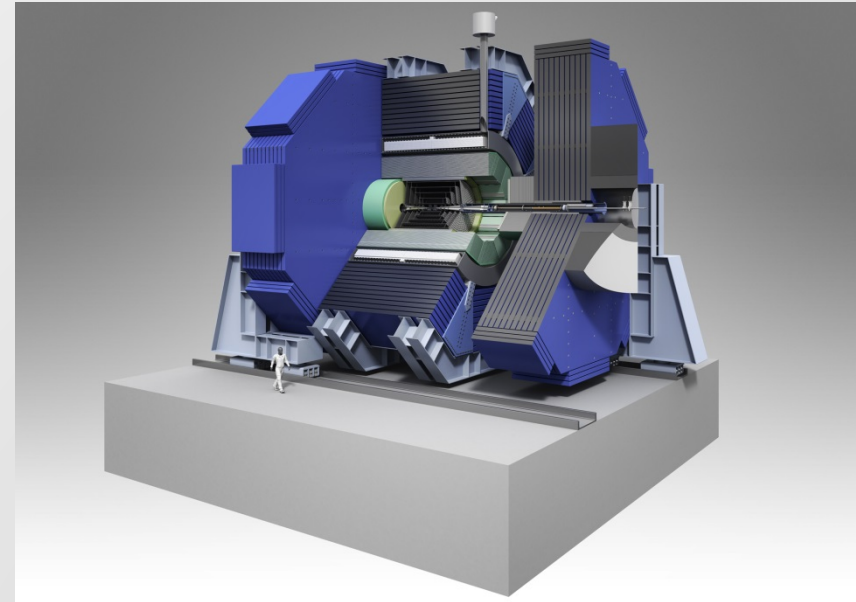
Potential improvement on Higgs couplings when including hadronic recoil



WIMP reach at ILC and LHC

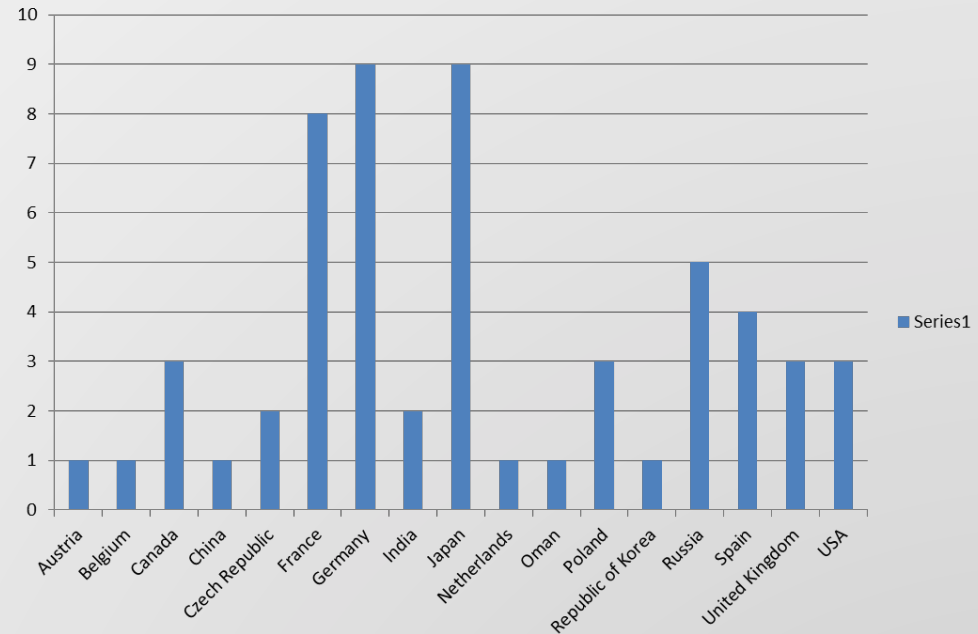


- SiD Goals for 2015
  - Reassess Detailed Baseline Design
  - Support the necessary detector R&D
  - Site-specific studies in Japan
  - Physics studies to further sharpen ILC physics
- SiD Consortium
  - Has been established, byelaws in place
  - IB board chair has been elected: Philip Burrows, Oxford
  - 22 Groups have signed on (40 % from Europe)
- Next Workshop
  - SLAC, January 12<sup>th</sup>-14<sup>th</sup>, 2015
  - [www.silicondetector.org](http://www.silicondetector.org)

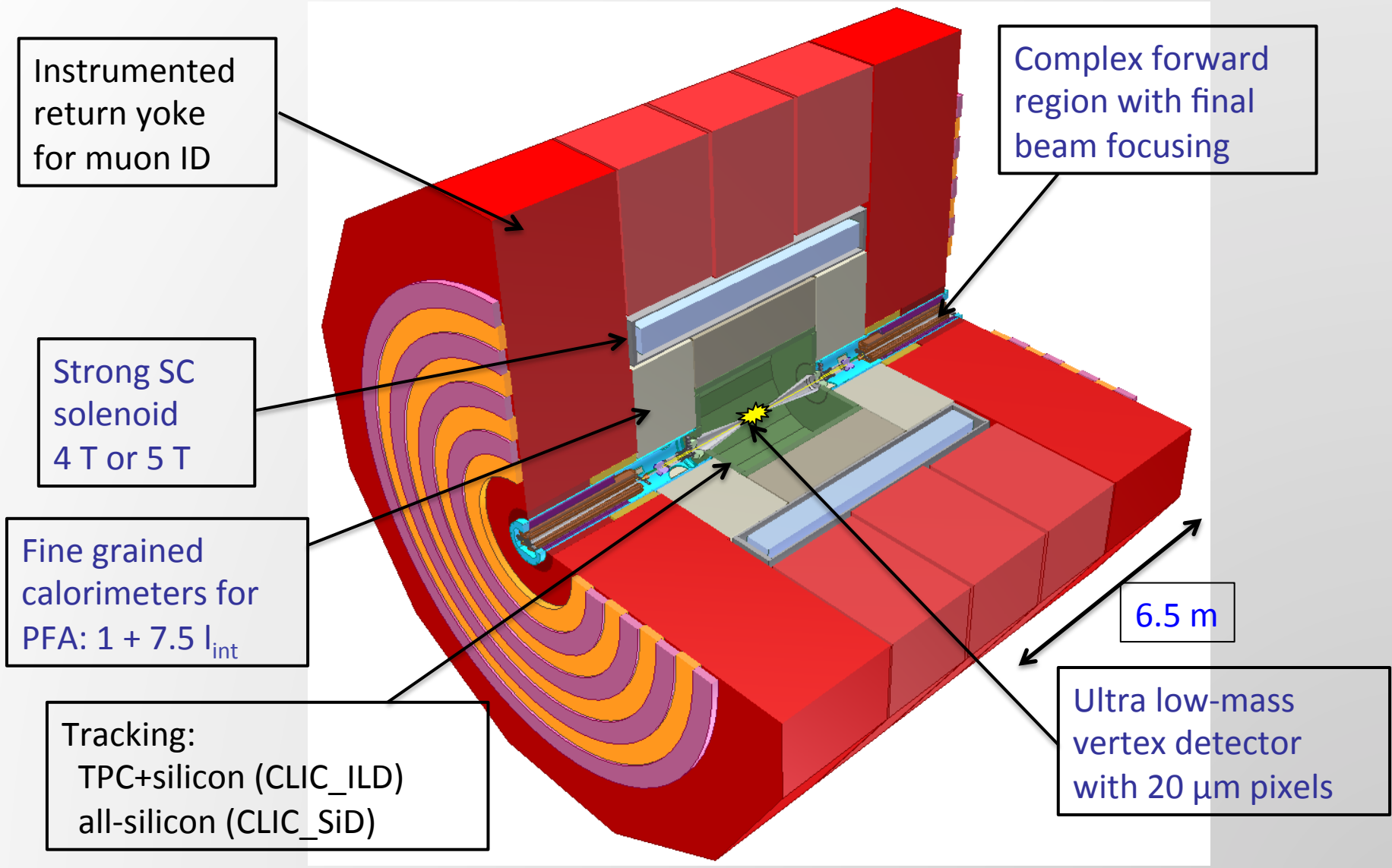




- ILD concept group:  
58 member institutes  
have signed up.
- Jan Timmermans elected  
first chair of institute  
assembly



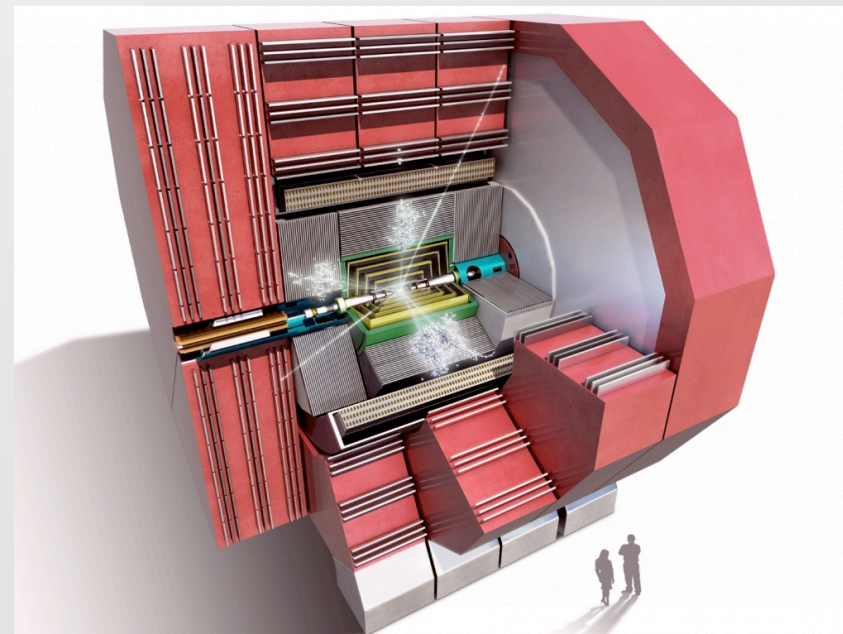
- Strengthen the physics case through comprehensive physics studies
- Goals: re-optimize the detector (cost – performance optimization)
- Prepare a scientific discussion of the different technological options, push technologies to be comparable
- Strong support to well focussed test beam effort to validate technologies



## CLIC detector and physics (CLICdp)

Light-weight collaborative structure based on “best effort”, with CERN as host lab  
~130 members from 23 institutions

<http://clicdp.web.cern.ch/>



## Many activities in common with ILC

(in particular hardware R&D, software developments, physics studies)

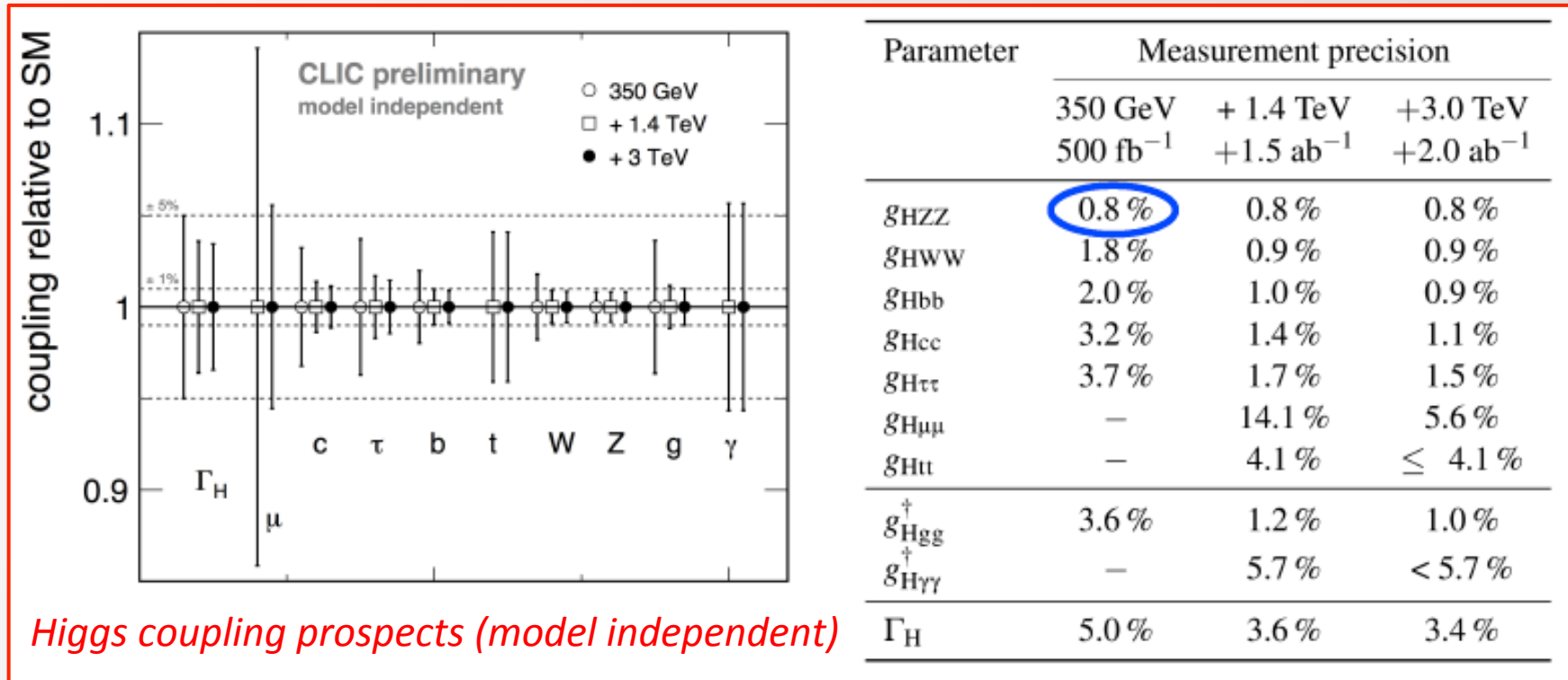
### CLIC-specific activities:

- Detector optimisation for CLIC
- Detector R&D where CLIC sets special requirements
- CLIC physics studies, staged approach

## CLIC physics

- **Standard model physics**
  - Focus on Higgs and top physics

- **Beyond the standard model**
  - Direct searches, accessible up to  $\sim \sqrt{s}/2$
  - Indirect searches via precision meas.



Higgs coupling prospects (model independent)

Focus on CLIC Higgs studies in the past ~2 years => overview paper nearly ready  
 Moving to other studies now: top, single W, dark matter, indirect searches, etc



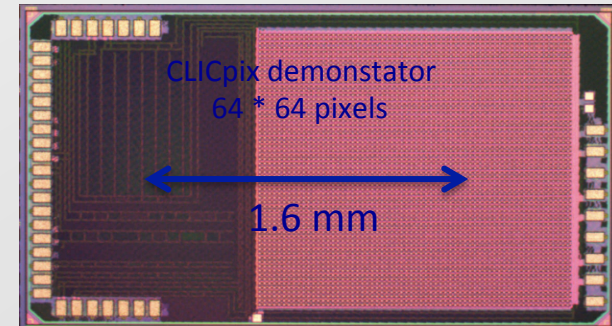
## CLIC sets challenging requirements:

- Very small pixels ( $25 \times 25 \mu\text{m}^2$ )
- Pulseheight measurement
- Timing  $\sim 10$  ns
- Very low mass
  - Power pulsing, air cooling

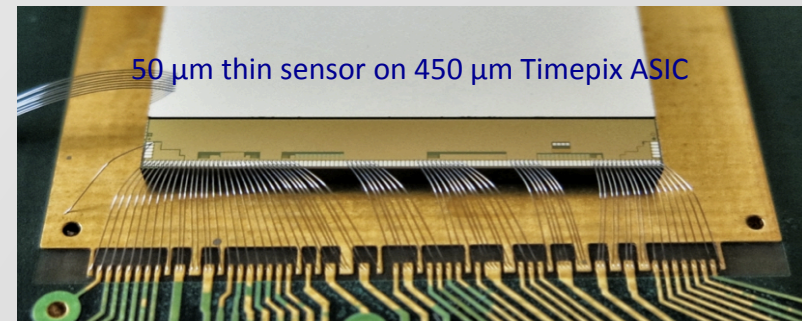
⇒ Integrated R&D with many aspects

⇒ Overlap with e.g. HL-LHC (RD53)

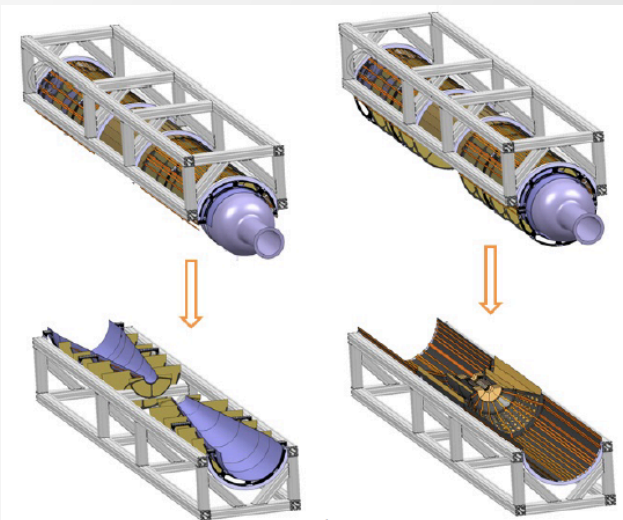
## Readout ASIC (65 nm)



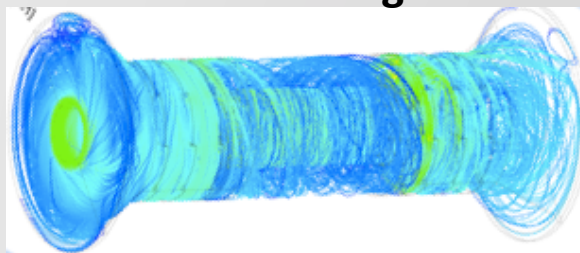
## Very thin sensors



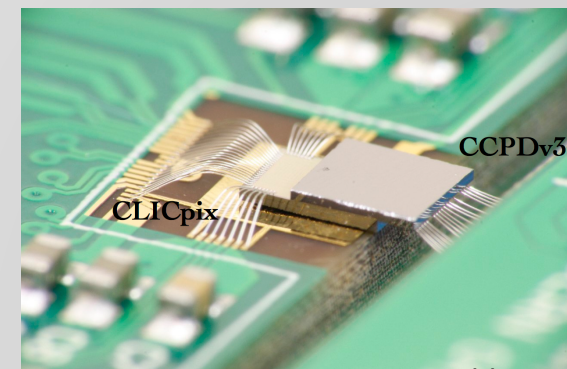
## Engineering and integration



## Air cooling



## New HV-CMOS technologies

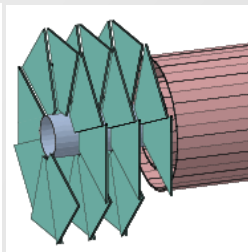
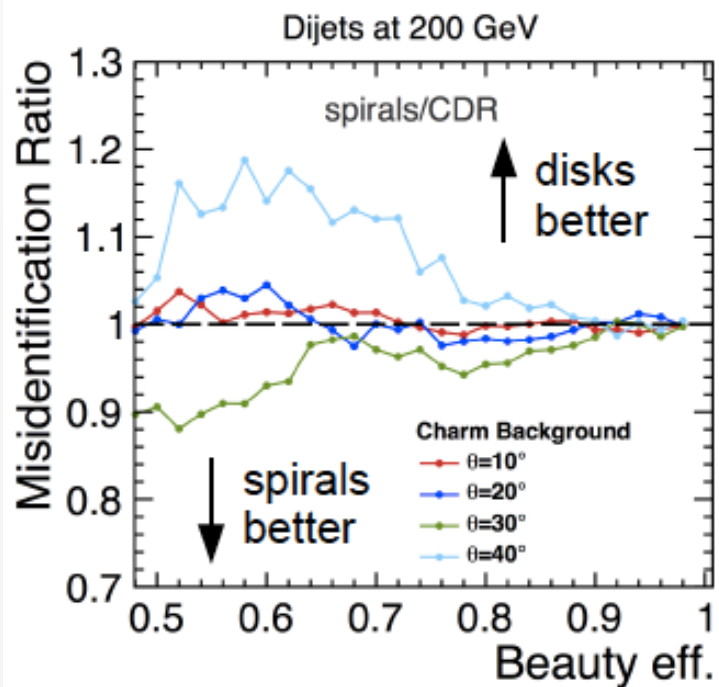


## Currently re-optimising the detector concept for CLIC

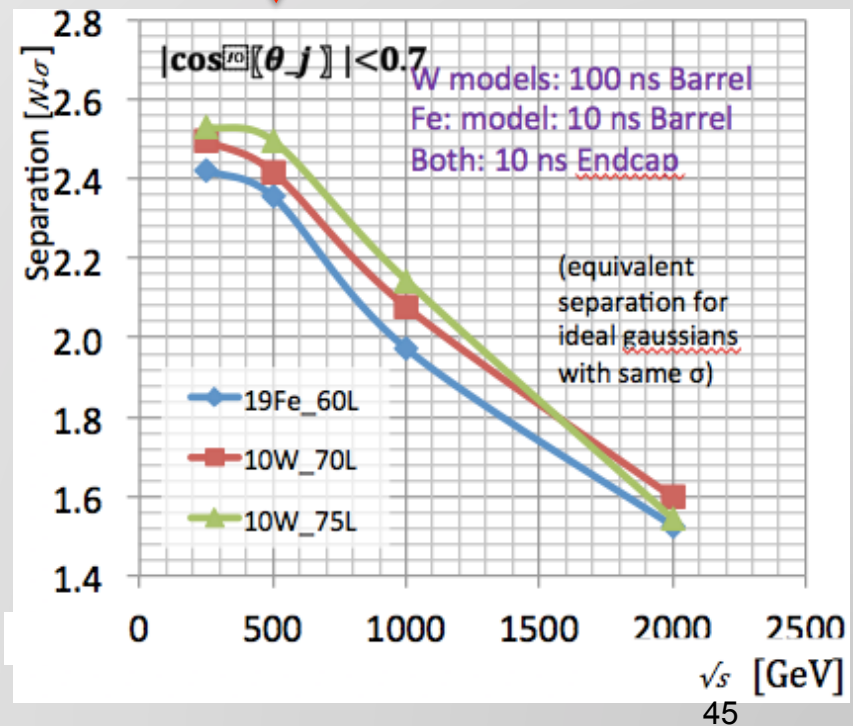
- ⇒ Lessons learnt from the CDR
  - ⇒ Reducing occupancies
  - ⇒ Extending coverage in forward region
- ⇒ Knowledge from hardware R&D
- ⇒ Optimising physics performance
- ⇒ Cost-effective approach

towards new  
CLIC detector model  
by mid-2015

↓ W ↔ Z separation for  
different HCAL absorbers



Flavour tagging:  
with realistic  
vertex geometry  
(air cooling)



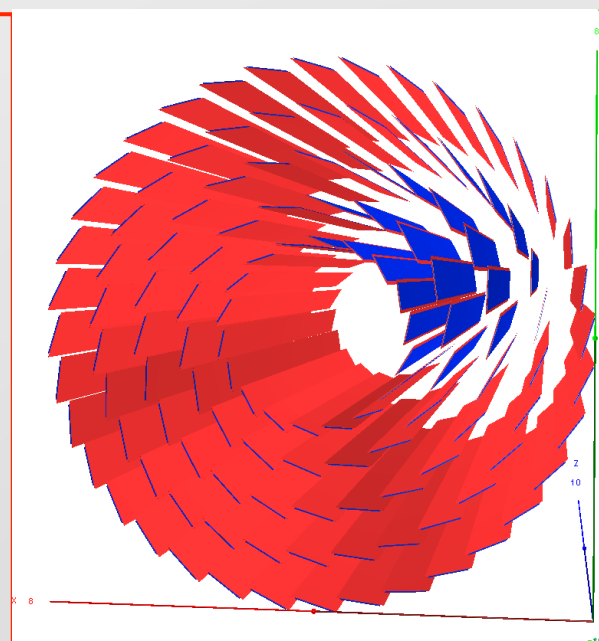


**Development of LC software chain** for detector optimisation, physics simulations, hardware R&D  
**=> Common to all Linear Collider detector concepts**

Current work focus:

- a new **geometry package (DD4hep)**:
  - single source of detector information for simulation, reconstruction, visualisation
- New **track reconstruction** package with enhanced features.

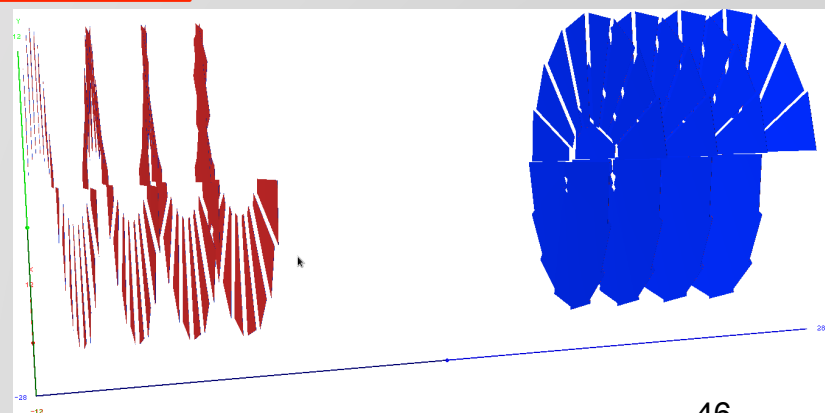
First complete implementation foreseen mid-2015, for the new CLIC detector concept.



*DD4hep visualisation*

*Broad scope of application:*

- *Linear Collider*
- *Synergies with FCC software development*
- *Development in framework AIDA (+AIDA2020)*



## Outlook to LC landscape by countries:

- France (IN2P3/CNRS and IRFU/CEA)
- Germany
- Spain
- United Kingdom

Apologies for rest of countries. They will be filled in future.  
Please send me information in this respect.

## Overall Progress of the Project in the IN2P3 & Irfu Landscape

- **Project evolution through 2014 :**
  - **Jan. '14 :** IN2P3 Science Council strongly supports detector R&D and physics studies of the 9 labs involved
  - **Aug. '14 :** Overview of ILC project and panorama of French activities (incl. XFEL contributions) transmitted to Ministry of Research
  - **Sept. '14 :** National meeting (lab directors & large project contacts) to debate participation of IN2P3 to future frontier collider projects : conclusions highlight asset of an e+e- collider with  $E \gtrsim 500$  GeV (like ILC), expected to bridge the gap between HL-LHC & FCC-hh
  - **Dec. '14 :** IN2P3-Irfu annual ILC workshop in Grenoble summarising 2014 progress & perspectives on accelerator and detector R&D as well as physics studies : *Journées Collisionneur Linéaire* ▷▷▷

- **Prospects impacted by difficult financial conditions :**

- Concern : funding for ILC detector construction may not become available before next decade
- R&D currently rather considered as general purpose activity
  - ⇒ minimal but  $\pm$  constant resources foreseen in the coming years (+ EU projects, ...)



**Journées Collisionneur Linéaire**  
1-3 décembre 2014, LPSC Grenoble

**Programme**  
Contexte politique et scientifique  
Études de physique  
R&D Détecteurs  
R&D Accélérateurs

Le projet ILC entre dans une nouvelle phase avec les pourparlers à tous les niveaux suite à la réflexion engagée par le gouvernement japonais. Ces journées vont permettre d'informer la communauté des actions en cours et de définir ce que pourrait être une position française dans ce projet.

**Comité d'organisation**  
Marc Besançon (CEA/IRFU)  
Vincent Boudry (LLR)  
Paul Colas (CEA/IRFU)  
Benjamin Fuks (IPHC)  
Andrea Jeremie (LAPP)  
Eric Kajfasz (CPPM)  
Annick Lleres (LPSC)  
Olivier Napoly (CEA/IRFU)  
Roman Pöschl (LAL)  
Maxim Titov (CEA/IRFU)  
Patrice Verdier (IPNL)

**Comité local**  
Jean-Yves Hostachy  
Jocelyne Riffault

LPSC Grenoble

<http://lpsc.in2p3.fr/Indico/conferenceDisplay.py?confId=1084>

## Achievements in Instrumental R&D and Physics Studies

- **General remarks :**
  - 9 IN2P3 labs + Irfu active since > 10 years in VD (CMOS pixels), ECAL (SiW), HCAL (RPC,  $\mu$ Megas), TPC, beam control
  - Present detector R&D addresses full scale prototype realisation and issues
  - All detector R&D pushed towards cross-fertilisation of non-ILC forthcoming/upcoming sub-systems (e.g. LHC)
  - Trend > 2014 : R&D community tends to get committed in spin-off applications  $\Rightarrow$  ILC (human) resource mitigation
- **PFA calorimetres :**
  - ECAL : towards fully equipped detection units & real size layers
  - HCAL : from  $m^3$  stack to real size layers
  - $\mu$ electronics (Omega) : R&D on issues and support to various calorimetre international R&D
  - Plan : combined ECAL + HCAL beam tests
- **Vertexing/tracking devices using CMOS pixel sensors :**
  - Primor : successful STAR-PXL physics run with CMOS pixel sensors
  - Goal : bunch tagging via sensors developed for ALICE-ITS upgrade
- **TPC with  $\mu$ Megas & Ingrid read-out :** leading role in LC-TPC & RD-51 collaborations
- **Accelerator related achievements (part of):**
  - Nanobeam tuning : ATF2 beam size monitoring (44 nm achieved in July)
  - XFEL : all couplers (IN2P3) & cryomodule assembly (Irfu) set in production mode
- **Physics studies :** contributions to Snowmass studies on top-quark characterisation & Higgs-couplings determination



## Illustrations of 2014 Achievements in Detector R&D

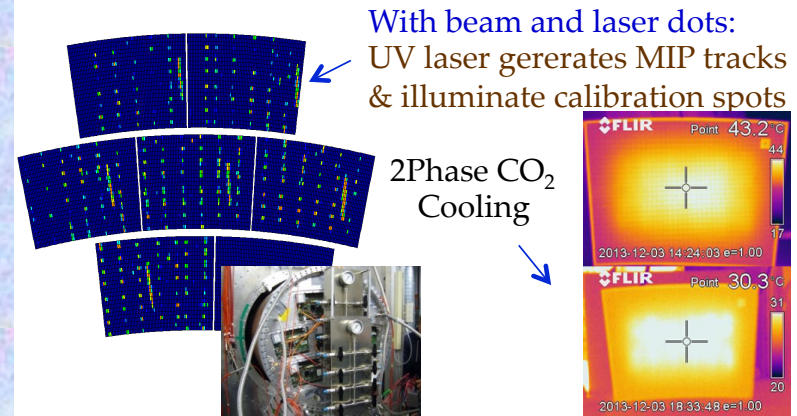
### ❖ CMOS pixel sensors on STAR-PXL :

1st (and successful) physics run (March - June '14) of a HEP detector using CMOS pixel sensors



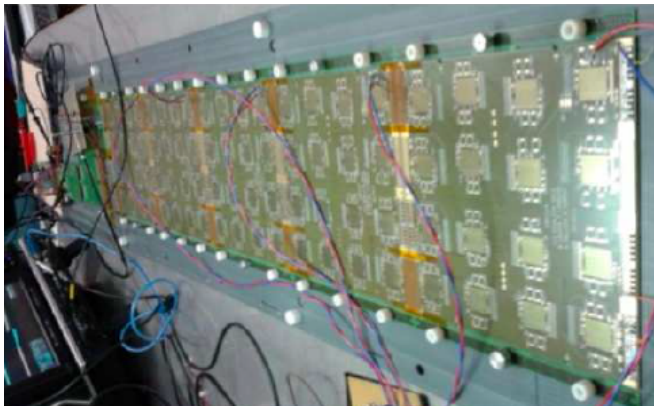
### ❖ Micromegas R&D for TPC Tracking :

7 Micromegas modules with 2-phase CO<sub>2</sub> cooling



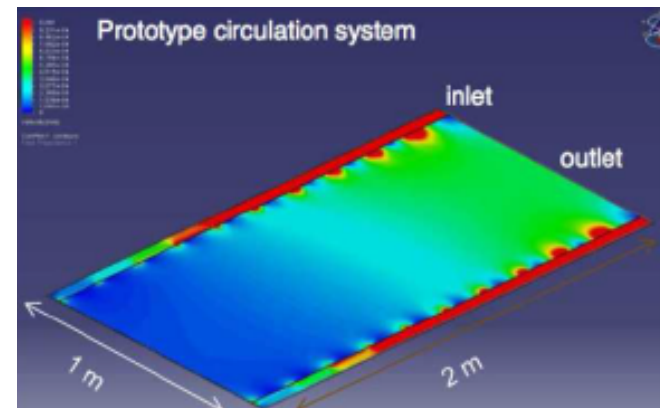
### ❖ SiW ECAL :

Real size read-out layer(16 ASICs/ASU, 10 ASU/layer)



### ❖ GRPC-HCAL :

1<sup>st</sup> proto to test 3<sup>rd</sup> gen. calorimeter read-out electronics



## Projects

- Hadronic Calorimeter (CALICE)
- Time projection chamber (LCTPC)
- Forward Calorimeter (FCAL)
- Vertex Detector
- Polarimeter



Strong contribution to Concept work:

- Mostly ILD
- SiD
- MDI integration

Strong foundation through contributions to common tools / services to the community

- Central Software support
- Test Beam
- General Integration support (HCAL, TPC)



Bonn, DESY (HH + Zeuthen), Hamburg, Heidelberg, Mainz, MPI Munich, Siegen, Wuppertal

**German HEP community statement (15-16 Nov. 2014) expressed:**  
strong support for the ILC as the next big project in particle physics

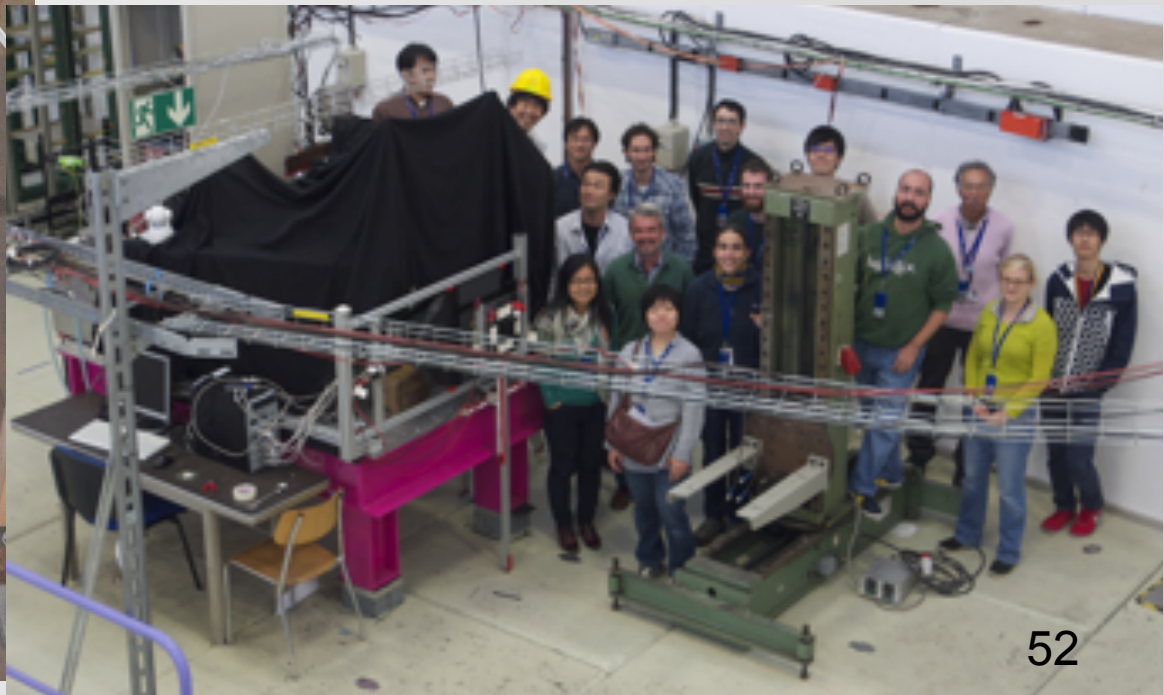


## One recent highlight: test beam @ CERN



Strong German and Japanese participation

- DESY, MPI Munich, U's Hamburg, Heidelberg, Mainz, Wuppertal
- U's Tokyo, Shinshu, Kyushu
- ITEP Moscow, Northern Illinois U



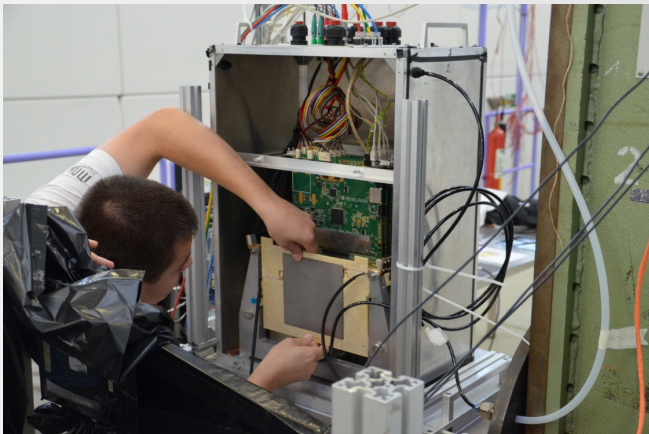
# FCAL test beam @ CERN

Oct. 2014, multilayer prototype

Strong German, Israel and Polish participation

- DESY
- CERN
- AGH-UST Cracow, IFJPAN Cracow
- Tel Aviv University
- ISS Bukarest, NCPHEP Minsk

**(More support is urgently needed in this area)**





## Spanish Network on Future Linear Collider

Chair: Alberto Ruiz (IFCA)

### Scope:

The main objective of this Thematic Network is to coordinate the Spanish activities on physics studies and development of new technologies in view of future linear colliders, (ILC & CLIC).

Active since 2007

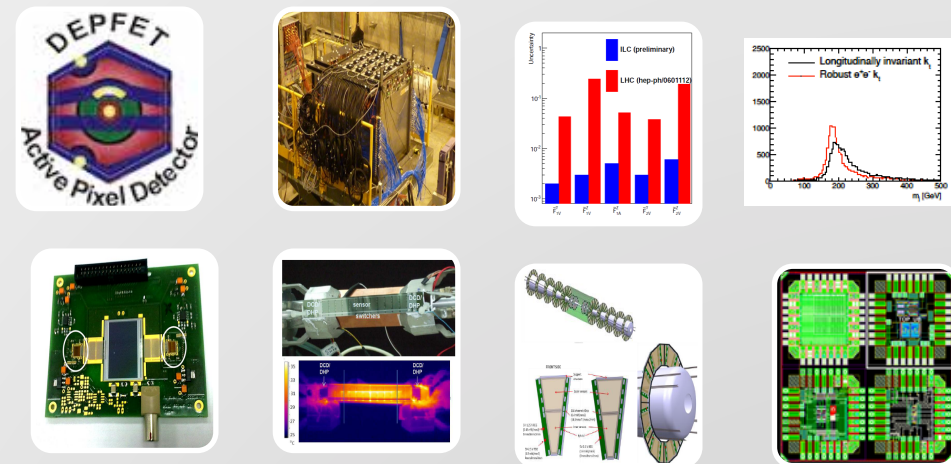
Organizes 1-2 national meetings every year

### Includes:

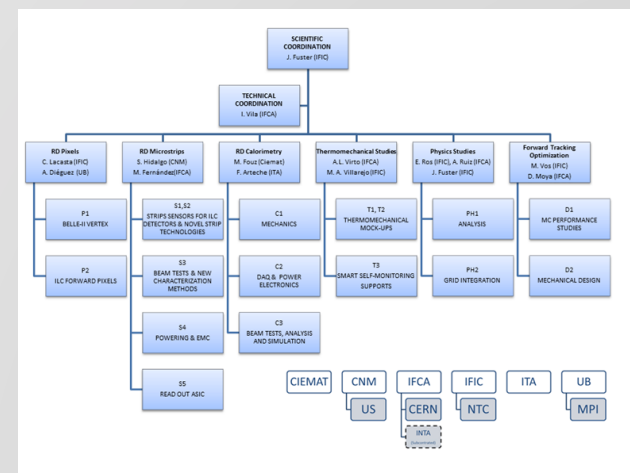
- Accelerator groups
- Theory groups
- Experimental groups
- Technological groups



- New grant awarded for the next 2 years. Small funding for travelling and keeping R&D activities.



- Main activities and interests:
  - Vertex detectors (DEPFET)
  - Innovative  $\mu$ Strip detectors
  - Ultra-high mechanics for trackers
  - Forward tracking optimization
  - ASIC design
  - Particle flow calorimetry
  - Physics analysis (top physics, jets)



## Financial & Political

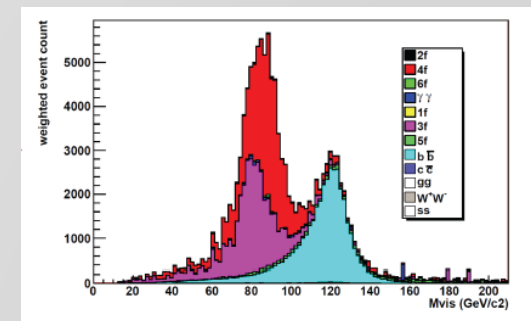
- great interest in the ILC;
- small-scale ILC proposal submitted to STFC, outcome should be known in December;
- signed by academics from all UK HEP groups (except one);
- request travel + limited R&D funding, a total of 125-250k€ per annum for next two years;
  
- whilst the money is not large, this will be an important starting step for UK ILC work
- will also enable UK academics to put time down against the ILC in their group STFC grants

## Main areas of UK interest:

- physics/detector optimisation
- silicon tracking, DAQ, calorimetry

## Physics Research

- UK academics active in physics studies for ILC and CLIC
  - studies of Higgs physics at CLIC
  - hadronic recoil mass at CLIC and ILC



- **CLIC workshop 2014, CERN, 3-7 Feb.**  
<http://indico.cern.ch/conferenceDisplay.py?confId=204269>

- **Americas Workshop on Linear Colliders 2014, May 12-16 2014**  
**Fermilab**

[www.linearcollider.org/awlc14/](http://www.linearcollider.org/awlc14/)

Local Chair: H. Weerts, D. Denisov

- **LCWS14, Belgrade (Serbia), Nov. 11-15, 2013**

<http://lcws14.vinca.rs/post-festum-lcws14/>

Local Chair: I. Bozovic-Jelisavcic

*Welcome address from the President of the Republic of Serbia: Mr. Tomislav Nikolic*





## LCWS14 BELGRADE 06-10 OCTOBER 2014

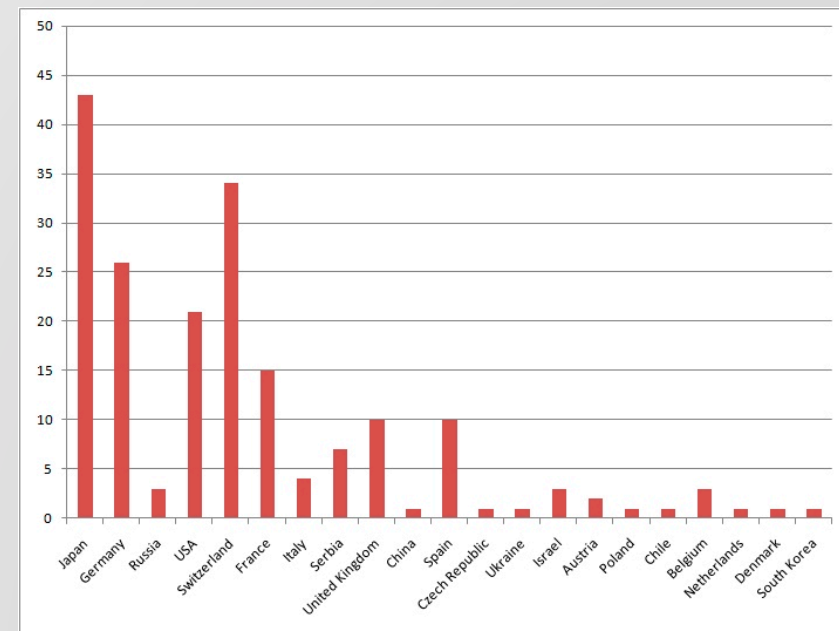
### INTERNATIONAL WORKSHOP ON FUTURE LINEAR COLLIDERS

*The workshop will be devoted to the study of the physics cases for future high energy linear electron position colliders, taking into account the recent results from LHC, and to review the progress in the detector and accelerator design for both the ILC and CLIC projects*

[www.vinca.rs/lcws14](http://www.vinca.rs/lcws14)    [lcws14@vinca.rs](mailto:lcws14@vinca.rs)



- Participants: 206
  - M/F: 182/24 (88/12)%
  - Countries: 21
  - Institutions: 84
- Talks: 243
- Total duration of talks: 114 h 10'



- **CLIC workshop 2015, CERN, 26-30 Jan.**  
<https://indico.cern.ch/event/336335/>



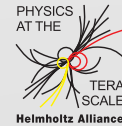
- **Asian Linear Collider Workshop 2015, 20-24 April**  
**KEK**  
Chair: Y. Okada. Local chair: A. Yamamoto  
Special separated event (April 22) with Japanese authorities is planned during the workshop at Tokio that will consist of a plenary session in the morning, and a (political) symposium in the afternoon.  
**Good attendance to this meeting will give an important and positive message to Japanese politicians**
- **LCWS15, Americas, 2015, Vancouver & date to be decided**

- Linear Collider School, 11-15 August 2014**  
**Frauenchiemsee (about 100 Km from Munich)**  
<http://lcschool.desy.de>  
 Local Chair: G. Moortgat-Pick (Helmholtz Alliance)
- The school is aimed at PhD students and postdoctoral researchers working on linear collider research. The programme consists of lectures covering the following topics:

  - Accelerators
  - Detectors
  - Standard Model
  - Higgs
  - Supersymmetry
  - Relation to LHC Physics
- Linear Collider School, 19-28 August 2016**  
**Frauenchiemsee (about 100 Km from Munich)**  
<http://lcschool.desy.de>  
 Local Chair: G. Moortgat-Pick

Helmholtz Alliance

## PHYSICS AT THE TERASCALE



Deutsches Elektronen-Synchrotron DESY ••• Karlsruhe Institut für Technologie - Großforschungsbereich ••• Max-Planck-Institut für Physik München ••• Rheinisch-Westfälische Technische Hochschule Aachen ••• Humboldt-Universität zu Berlin ••• Rheinische Friedrich-Wilhelms-Universität Bonn ••• Technische Universität Dortmund ••• Technische Universität Dresden ••• Albert-Ludwig-Universität Freiburg ••• Julius-Liebig-Universität Gießen ••• Georg-August-Universität Göttingen ••• Universität Hamburg ••• Ruprecht-Karls-Universität Heidelberg ••• Karlsruher Institut für Technologie - Universitätsbereich ••• Johannes Gutenberg-Universität Mainz ••• Ludwig-Maximilians-Universität München ••• Universität Regensburg ••• Universität Rostock ••• Universität Siegen ••• Julius-Maximilians-Universität Würzburg ••• Bergische Universität Wuppertal •••

## Fifth Linear Collider School

An introduction to the physics of linear colliders

### 11 - 15 August 2014

Frauenchiemsee, Germany

**Topics:**

- Accelerators – concepts, technology and realisation
- Detectors and detector integration
- Higgs and electroweak physics
- Top physics
- Beyond-Standard Model physics

**International Advisory Committee**

S. Bertolucci (CERN), P. Burrows (Univ. Oxford),  
 S. Chattopadhyay (Cockcroft Institute), C. Damerell (RAL),  
 B. Foster (DESY), N. Glover (Univ. Durham), R. Godbole  
 (Bangalore), W. Hollik (MPI for Physics, Munich), E. Iarocci  
 (INFN), J. Mnich (DESY), T. Omori (KEK), M. Oreglia (Univ.  
 Chicago), P. Osland (Univ. Bergen), F. Richard (Orsay),  
 D. Schulte (CERN), T. Teubner (Univ. Liverpool), M. Thomson  
 (Univ. Cambridge), H. Weerts (Argonne), S. Yamada (KEK),  
 H. Yamamoto (Univ. Tohoku)

**Programme and Organising Committee:**

K. Buesser (DESY), J. Fleck (Univ. Siegen),  
 J. List (DESY), G. Moortgat-Pick (Univ. Hamburg),  
 Z. Nagy (DESY), S. Riemann (DESY),  
 J. Reuter (DESY), T. Schörner-Sadenius (DESY),  
 F. Simon (MPI for Physics),  
 A. Sopczak (Univ. Prague),

Contact: [anacen@desy.de](mailto:anacen@desy.de)

For more information and registration go to:

[www.terascale.de/lcschool2014](http://www.terascale.de/lcschool2014)

<http://lcschool.desy.de>





About 40 participants with excellent feedback



Most of them from German groups. This needs to be changed in next editions and should be extended to more participants from all LC groups worldwide



# Outreach and dissemination during workshops



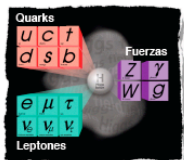
CONFERENCIA PÚBLICA

## Viaje al corazón de la materia

François Richard (Orsay)

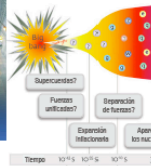
El descubrimiento de partículas más pesadas del mundo en el LHC, podrían a la vez ser la clave para entender el misterio de la materia oscura. ¿Por qué? ¿Por qué algunas partículas parecen estar hechas de la materia oscura? ¿Por qué algunas partículas parecen estar hechas de la materia oscura? ¿Por qué algunas partículas parecen estar hechas de la materia oscura? ...

Parque de las Ciencias  
27 de septiembre, 19 h  
(en español, entrada libre)



## Particle Physics Slam - ALCPG11 - Eugene - March 22, 2011

*Particle detectors: they're nearer than you think,* Marcel Demarteau  
*Seeking hidden dimensions,* Brian Foster  
*Neutrinos from outer space!* Garabed Halladjian  
*An illumination of dark matter,* JoAnne Hewett  
*Why physics, dude?* Marc Wenskat

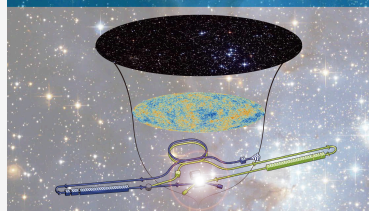


The International Linear Collider  
— A Worldwide Event  
From Design to Reality

12 June 2013  
Tokyo, Geneva, Chicago

[www.linearcollider.org/worldwideevent](http://www.linearcollider.org/worldwideevent)

一般公開講演会  
ビッグバンから138億年 宇宙はいま  
～宇宙観測から加速器実験まで～



日時 2013年11月14日(木) 18:30-20:00 (18:00開場)  
場所 東京大学 伊藤国際学術研究センター 伊藤謝恩ホール  
(先/内線: 大石野線・本館三丁目線より徒歩7分)  
発着予定者 村山 奇 (東京大学 量子情報科学研究所)  
杉山 直 (東京大学 量子情報科学研究所)  
対象 高校生以上の一般の方 参加無料  
募集人数 450名 ※要事前申込  
申込み先 東京大学 量子情報科学研究所  
問い合わせ 電話 03-3815-8384 / FAX 03-3815-8806  
Eメール [hiro@qipr.u-tokyo.ac.jp](mailto:hiro@qipr.u-tokyo.ac.jp)  
ウェブサイト <http://www.qipr.u-tokyo.ac.jp/lcws13/lecture/>  
主催者 リニアコライダー国際共同委員会  
共催者 東京大学 量子情報科学研究所

UNIVERSITY OF TEXAS ARLINGTON COLLEGE OF SCIENCE presents

### Dr. Steven Weinberg

Nobel Laureate and Distinguished Professor of the Department of Physics and Department of Astronomy at UT Austin

#### "The Standard Model, Higgs Boson: Who Cares?"

When: 7:30 p.m. Wednesday, October 24  
Where: Texas Hall, UT Arlington  
The event is free and open to the public

The International Workshop on Future Linear Colliders ([www.lcws1.org](http://www.lcws1.org)) will be held at UT Arlington from Oct. 22-26, 2012. The conference will draw hundreds of physicists from all over the world. As part of conference tradition, Professor Steven Weinberg of the University of Texas at Austin, a Nobel Laureate, will give a public lecture. He is one of the theorists responsible for the Standard Model and was awarded the Nobel Prize in 1979 along with S. Glashow and A. Salam. With the discovery of a Higgs-like boson at the Large Hadron Collider at the European Center for Nuclear and Particle Physics (CERN) in Geneva, Professor Weinberg will put the discovery in context of the Standard Model, the theory of particle physics, and give some perspectives on what the completion of the theory means for our everyday lives.

Steven Weinberg holds the Jack S. Bower-Welch Foundation Regentsal Chair in Science at UT Austin. His research on elementary particles and cosmology has been honored with numerous prizes and awards, including the Nobel Prize in Physics in 1979 and the National Medal of Science in 1995. In 2004 he received the Benjamin Franklin Medal of the American Philosophical Society, with a citation that said he is "considered by many to be the greatest theoretical physicist alive in the world today." He has been elected to the U.S. National Academy of Science and Britain's Royal Society, as well as the American Philosophical Society and the American Academy of Arts and Sciences. He is the author of over 100 articles on elementary particle physics as well as numerous books and periodical articles. Educated at Cornell, Copenhagen and Princeton, he also holds honorary doctoral degrees from 16 other universities. He taught at Columbia, Berkeley, M.I.T. and Harvard before coming to Texas in 1982.

This event is made possible thanks to the generous support of the UT Arlington Office of the President, support and assistance provided by the UT Arlington Department of Physics. For more information, please contact: Krupa Jackowicz [krupa@ut Arlington.edu](mailto:krupa@ut Arlington.edu), Dr. Jackson [ja@ut Arlington.edu](mailto:ja@ut Arlington.edu) or Dr. Andrew White [awhite@ut Arlington.edu](mailto:awhite@ut Arlington.edu).



# Summary

---

- The new Linear Collider Collaboration (LCC) structure has been defined and is fully operational.
- The Japanese Ministry of Education, Culture, Sports and Technology (MEXT) has set a committee to revisit the Scientific Merit of ILC and evaluate the TDR & Cost estimates & Risk. Reports should be ready by March 2016.
- Progress on the Linear Collider Physics Case and detector R&D for both ILC & CLIC is being made despite the small funding and few resources. The community is very solid and determined.
- Cooperation between ILC and CLIC is excellent in common work and development.
- Important efforts are being made in several European countries and the local scientific communities continue showing its “explicit” support (France, Germany).
- Compatibility of the LC activities with the LHC upgrade programme is possible and is essential to come to a success. See talk by M. Krammer at ICHEP 2014 <https://indico.ific.uv.es/indico/contributionDisplay.py?sessionId=22&contribId=1057&confId=2025>
- Next ALCW 2015 conference in KEK/Tokio (April 20-24) is an important event to attend.