ECFA linear collider physics and detector study
(status report)

LINEAR COLLIDER COLLABORATION

Juan A. Fuster Verdú, IFIC-Valencia

XI Spanish Network For Futurure Linear Colliders,
Barcelona January 15-16 2015

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

LINEAR COLLIDER COLLABORATION

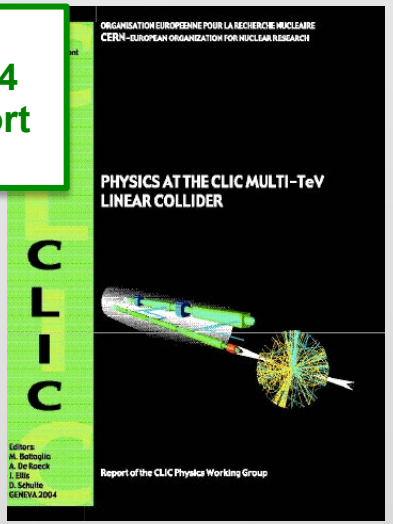
Outline

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

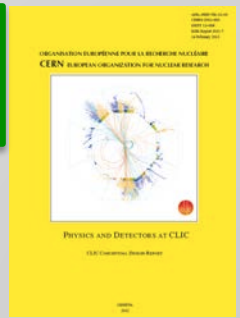
CLIC Physics and Detector Roadmap

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

2004 report



CDR 2012



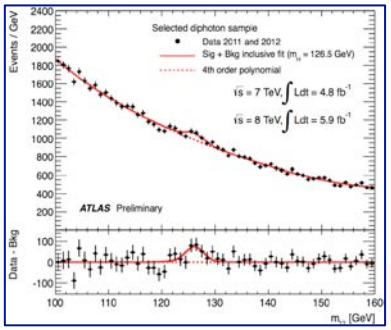
ILC Physics and Detector Roadmap

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

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

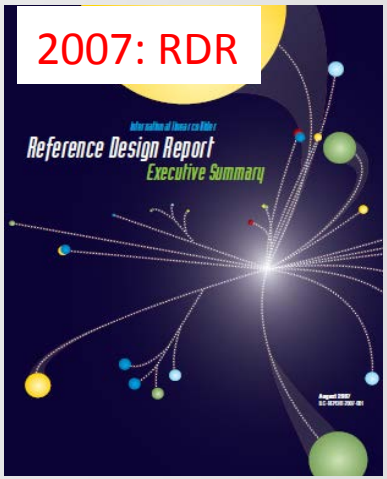
ILC - GLOBAL DESIGN EFFORT (GDE)

LCC

Linear Collider Collaboration

Ref. Design Report (RDR)

2007: RDR



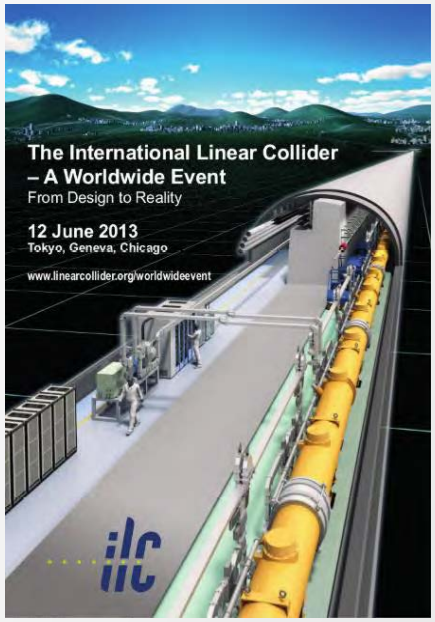
2013: TDR

COMPLETED

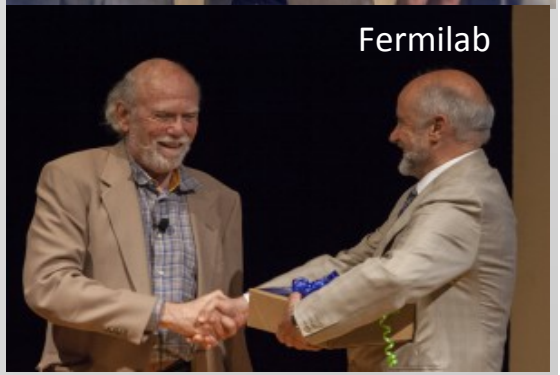
Official Completion of ILC TDR

"From Design to Reality"

June 12, 2013:



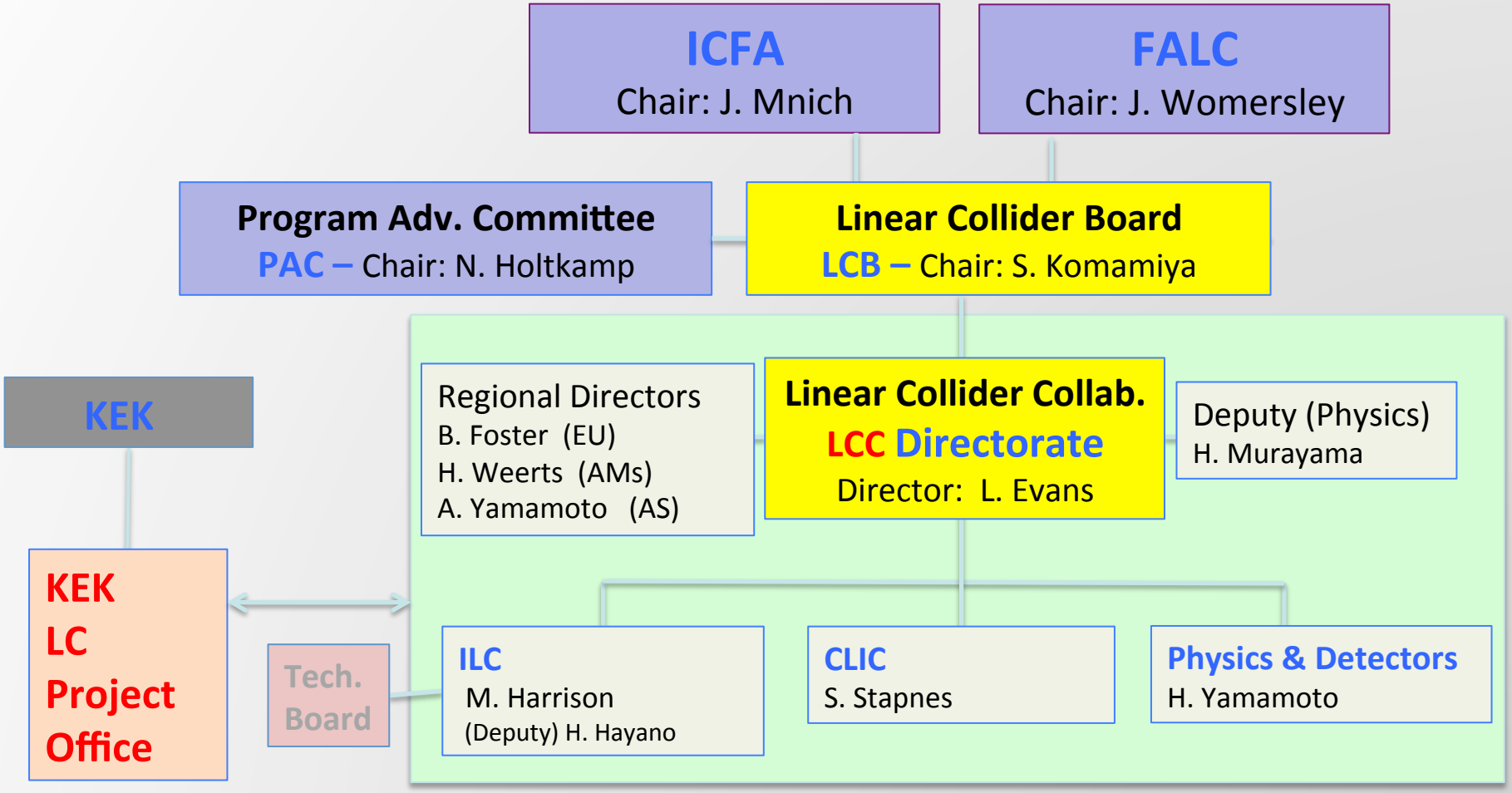
TDR handed to LCC Director Lyn Evans



ILC TDR published in a Worldwide Event:

Tokyo → Geneva → Chicago

The new Linear Collider Collaboration



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: 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

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 Facilties
	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: 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) Lenny Rivkin (PSI)
Secretary	Roy Rubinstein

} Nominated by ECFA

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.

J. Mnich – ICHEP 2014

Update of the European Particle Strategy

Europe has a strategy!

First "official" strategy approved by the CERN Council 14th July 2006. It contains 17 statements on scientific and organizational matters.

Strategy Update in 2012/2013:

- **Open Symposium** (Kracow), September 2012
- **Scientific Briefing Book*,** December 2012
- **Strategy Group drafting session** (Erice), January 2013
- **CERN Council formally adopts the Strategy,** May 30 2013
  at a special European Strategy Session of Council in Brussels

http://europeanstrategygroup.web.cern.ch/europeanstrategygroup/Briefing_book.pdf

M. Krammer ICHEP 2015 (ECFA chair)
https://indico.ific.uv.es/indico/contributionDisplay.py?sessionId=22&contribId=1057&confId=2025

Update of the European Particle Strategy

Large Scale Scientific Activities:

The strategy update had to find a balance between maintaining the diversity of the scientific program and setting priorities since the available resources are limited.

- Only large scale projects are prioritized
- Competitive small and medium size projects (national, regional) are important to keep the diversity of our field, since a breakthrough often emerges in unexpected areas

After careful analysis of many possible large-scale scientific activities requiring significant resources, sizeable collaborations and sustained commitment, the following four activities have been identified as carrying the highest priority.

➔ **4 High priority Large-Scale Scientific Activities identified**

Pursuing all 4 activities: there is a logical time line – peak investments not at the same time – and a difference in the scale of the involvement.

1.- LHC and HL-LHC

> c) ... *Europe's top priority should be the exploitation of the full potential of the LHC, including the high-luminosity upgrade of the machine and detectors with a view to collecting ten times more data than in the initial design, by around 2030. …*

The strategy recommends to go for the full LHC upgrade, i.e. a target integrated luminosity of 3 ab^{-1}.

Major interventions necessary for the LHC machine, large upgrade project of the experiments, contributions from other regions than Europe are crucial.

This is the next big challenge for particle physics world-wide.

1.- LHC and HL-LHC

> c) ... *Europe's top priority should be the exploitation of the full potential of the LHC, including the high-luminosity upgrade of the machine and detectors with a view to collecting ten times more data than in the initial design, by around 2030. …*

The strategy recommends to go for the full LHC upgrade, i.e. a target integrated luminosity of 3 ab^{-1}.

Major interventions necessary for the LHC machine, large upgrade project of the experiments, contributions from other regions than Europe are crucial.

This is the next big challenge for particle physics world-wide.

Programme for the near future!

2.- Design studies and R&D for post-LHC projects:

d) … *CERN should undertake design studies for accelerator projects in a global context, with emphasis on proton-proton and electron-positron high-energy frontier machines …*

Europe has a vision for CERN's future as the laboratory at the energy frontier.

Possible post-LHC machines are CLIC, HE-LHC, FCC-hh, FCC-ee (as a precursor for FCC-hh)

More scientific input is needed before one can decide on a next large machine at CERN.

Update of the European Particle Strategy

2.- Design studies and R&D for post-LHC projects:

d) … *CERN should undertake design studies for accelerator projects in a global context, with emphasis on proton-proton and electron-positron high-energy frontier machines …*

Europe has a vision for CERN's future as the laboratory at the energy frontier.

Possible post-LHC machines are CLIC, HE-LHC, FCC-hh, FCC-ee (as a precursor for FCC-hh)

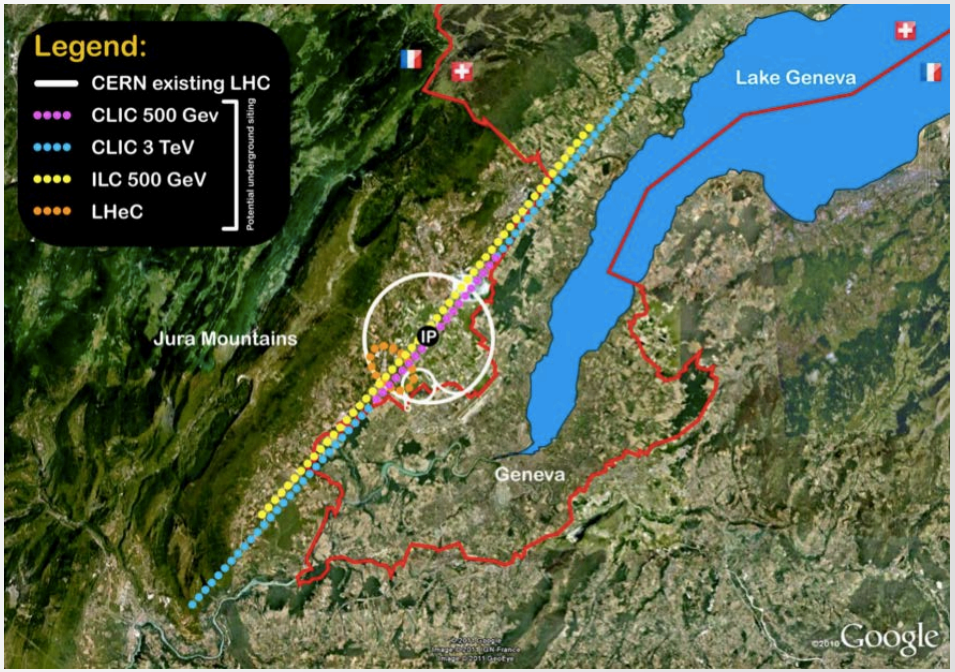
More scientific input is needed before one can decide on a next large machine at CERN.

Long-time Programme !
Prepare now for physics >2035

Update of the European Particle Strategy

Implementation, study on CLIC:

Two beam acceleration: low energy, high current drive beam powers RF cavities of main linac (cavities ~100 MV/m), e^+e^- energy up to 3 TeV c.m. in stages.



- Conceptual Design Report published in 2012:
  - CERN-2012-003, arXiv: 1202.5940,
  - CERN-2012-005, arXiv: 1209.2543
- Prove of principle of two beam acceleration demonstrated!
- Study continues as part of the LC organisation.

Update of the European Particle Strategy

3.- International Linear Collider (ILC):

> e) There is a strong scientific case for an electron-positron collider … European groups are eager to participate. *Europe looks forward to a proposal from Japan to discuss a possible participation.*

This is a strong statement in favor of the ILC and in particular of the Japanese initiative.

The European strategy supports a machine with an initial energy of 250 GeV to perform Higgs studies and sees the energy upgradability of the ILC as major asset!

TDR for the ILC submitted 2013:
http://www.linearcollider.org/ILC/Publications/Technical-Design-Report
Europe is the largest community in the LC Organisation.

Implementation:
Work on ILC (machine and detectors) continues in many European institutes with support by CERN (e.g. hosting the LC Directorate).

Update of the European Particle Strategy

3.- International Linear Collider (ILC):

e) There is a strong scientific case for an electron-positron collider … European groups are eager to participate. *Europe looks forward to a proposal from Japan to discuss a possible participation.*

This is a strong statement in favor of the ILC and in particular of the Japanese initiative.

The European strategy supports a machine with an initial energy of 250 GeV to perform Higgs studies and sees the energy upgradability of the ILC as major asset!

TDR for the ILC submitted 2013:
http://www.linearcollider.org/ILC/Publications/Technical-Design-Report
Europe is the largest community in the LC Organisation.

Implementation:

Medium-term Programme !
Peak of investments from Europe to the ILC will come after HL-LHC and before the next large facility at CERN.

Scientific Strategy:

- Two main pillars of physics activities at CERN
  - ✓ High Energy Frontier, i.e. LHC, FCC, CLIC
  - ✓ Unique fixed target program, i.e. AD and ELENA, HIE-Isolde (and TSR), n-ToF(EAR1,2)

- Two main pillars for physics activities outside CERN
  - ✓ Neutrino Platform (mainly towards activities in the US: LBNF)
  - ✓ ILC

- R.-D. Heuer, 96th Plenary ECFA – CERN, Nov. 20-21, 2014

http://indico.cern.ch/event/346283/

The new Linear Collider Collaboration: CERN

Scientific Strategy:

- Two main pillars of physics activities at CERN
  - ✓ High Energy Frontier, i.e. LHC, FCC, CLIC
  - ✓ Unique fixed target program, i.e. AD and ELENA, HIE-Isolde (and TSR), n-ToF(EAR1,2)

- Two main pillars for physics activities outside CERN
  - ✓ Neutrino Platform (mainly towards activities in the US: LBNF)
  - ✓ ILC

Collaboration forming

ICARUS has arrived at CERN

- R.-D. Heuer, 96th Plenary ECFA – CERN, Nov. 20-21, 2014

http://indico.cern.ch/event/346283/

The new Linear Collider Collaboration: CERN

Scientific Strategy:

- Two main pillars of physics activities at CERN
  - ✓ High Energy Frontier, i.e. LHC, FCC, CLIC
  - ✓ Unique fixed target program, i.e. AD and ELENA, HIE-Isolde (and TSR), n-ToF(EAR1,2)

- Two main pillars for physics activities outside CERN
  - ✓ Neutrino Platform (mainly towards activities in the US: LBNF)
  - ✓ ILC

Collaboration forming

ICARUS has arrived at CERN

KEK <-> CERN offices opened

- R.-D. Heuer, 96th Plenary ECFA – CERN, Nov. 20-21, 2014

http://indico.cern.ch/event/346283/

The new Linear Collider Collaboration: CERN & KEK

New International Offices of KEK and CERN

November 25, 2014

KEK and CERN have agreed to establish mutual offices at the respective labs: a CERN office at KEK and a KEK office at CERN, to facilitate and enhance common work on future accelerator projects and other related scientific projects of common interest.

Taking the occasion of the 9th CERN-KEK Meeting, which took place on 21 November 2014 at KEK, Atsuto Suzuki, Director-General of KEK, and Rüdiger Voss, Head of International Relations of CERN, signed the Appendix to the umbrella agreement, which was concluded between CERN and KEK in 2009, to establish the offices.

Signing ceremony at KEK for new international offices of KEK and CERN

Each party is involved both in the operation of existing accelerator complexes and in research and development of future accelerators and accelerator concepts. There are multiple collaborative projects in these domains between the parties. Current collaborative projects cover in particular aspects of LHC and its upgrade, the LHC injectors, ILC, CLIC, J-PARC and ATF/ATF2, with common activities related to the FCC study and SuperKEKB currently under preparation.

The Report

Building for Discovery

Strategic Plan for U.S. Particle Physics in the Global Context

Report of the Particle Physics Project Prioritization Panel (P5)

http://usparticlephysics.org/p5/

Provide "an updated strategic plan for the U.S. that can be executed over a ten-year timescale, in the context of a twenty-year global vision for the field."

Submitted in May 2014, 80 pages, 29 recommendations

Budget Scenarios

Scenario C
Influx from "beyond the envelope", i.e., line item in budget

Scenario B
"Optimistic"

Scenario A
"Realistic"
rise ~inflation

Total DoE HEP Budget

$950
900
850
800
750
700
650
600

2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

10 years, plan out to 20

P5 Recommendations – Large Projects (>200 million)

Scenarios

Project/Activity	Scenarios: Scenario A	Scenario B	Scenario C	Science Drivers: Higgs	Neutrinos	Dark Matter	Cosm. Accel.	The Unknown	Technique (Frontier)
Large Projects									
Muon program: Mu2e, Muon g-2	Y, Mu2e small reprole needed	Y	Y						I
HL-LHC	Y	Y	Y						E
LBNF + PIP-II	Y, LBNF components delayed relative to Scenario B.	Y	Y, enhanced						I,C
ILC	R&D only	R&D, possibly small hardware contributions. See text.	Y						E
NuSTORM	N	N	N						I
RADAR	N	N	N						I

NuSTORM = simplest implementation of neutrino factor, short baseline, $370M

RADAR = R&D Liquid Argon detector at NOvA, $170M

P5 Statement on the ILC

ILC — **International Linear Collider ($e^+ e^-$)**

The interest expressed in Japan in hosting the International Linear Collider (ILC) is an exciting development.

Participation by the U.S. in project construction depends on a number of important factors, some of which are beyond the scope of P5 and some of which depend on budget Scenarios.

As the physics case is extremely strong, all Scenarios include ILC support at some level through a decision point within the next 5 years.

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

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

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

M. Krammer – PECFA, Nov 2013

Japan: Academic Expert Committee

- 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

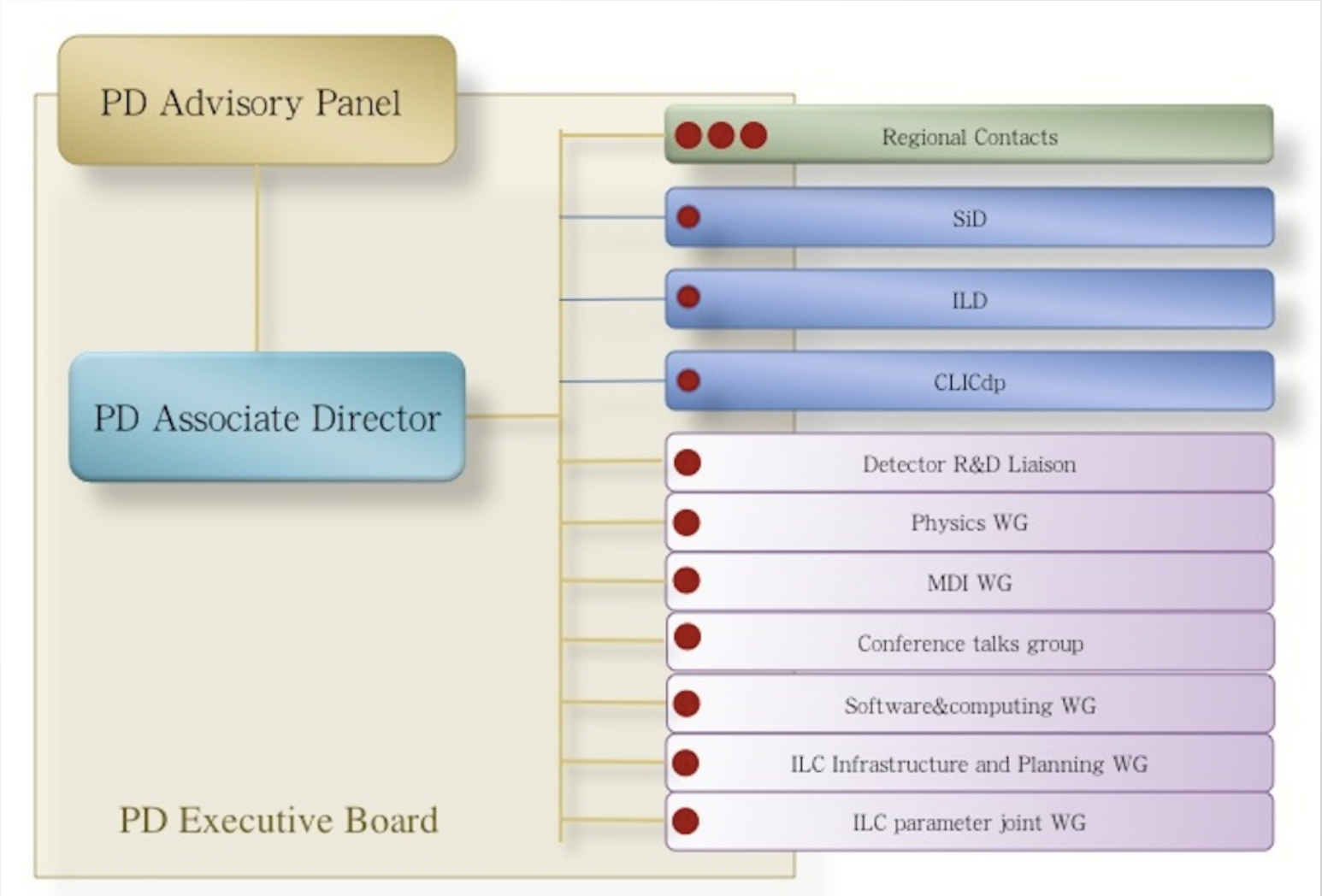
Japan: Academic Expert Committee

- 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

LINEAR COLLIDER COLLABORATION

New LCC Physics and Detector structure

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

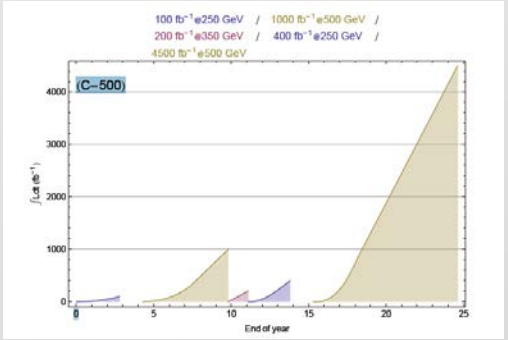
- Observer
  - Hitoshi Murayama (LCC deputy director)

- **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

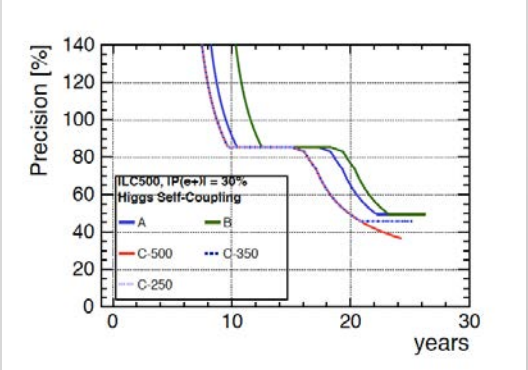
The LCCPD-EB: ILC parameter joint Working Group

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

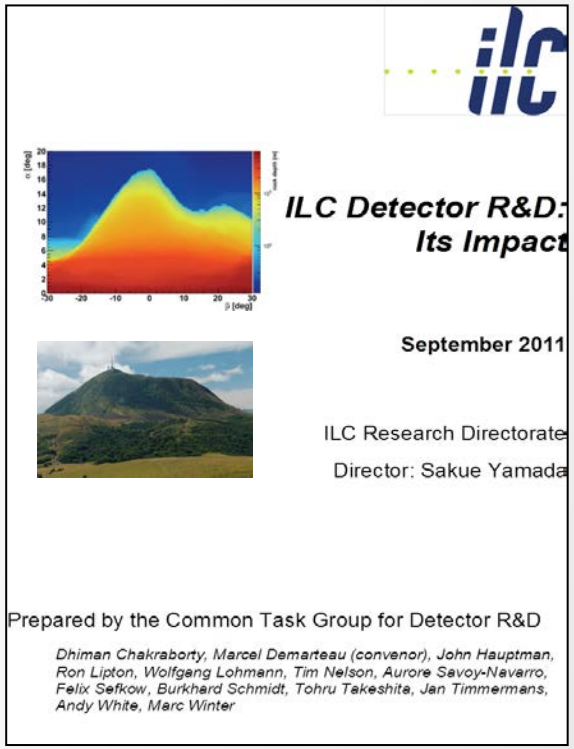
- **Conveners:**
  - Maksym Titov
  - Jan Strube

  - A document describing current detector R&Ds relevant to LC is produced

- To be updated
  - Software R&Ds are to be included

- 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

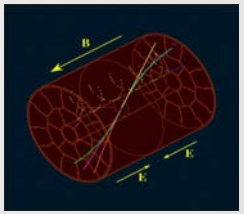


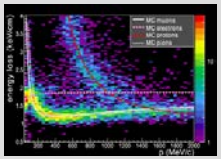
An study of the spinoffs derived by the LC detector R&D has been performed (worth reading!)

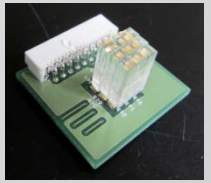
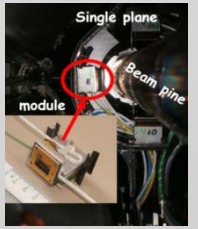
It includes:

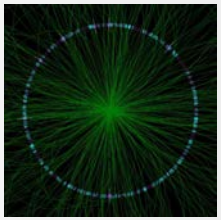
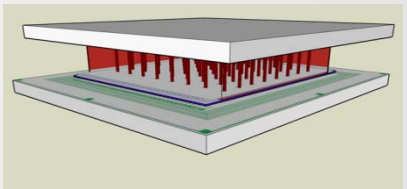
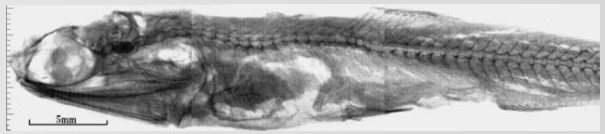
- HEP applications:
  - ✓ vertex developments (ALICE-ITS, CBM-FAIR,Star, BelleII)
  - ✓ TPC Micromegas (T2K)
  - ✓ Calorimeters (CMS)
  - ✓ Luminomiter and beam instrumentation (LHC, CMS)
  - ✓ trigger development (LHC, CAST)
  - ✓ software (Belle II, NOVA, AIDA, CLIC, μ-collider)
- None HEP applications: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







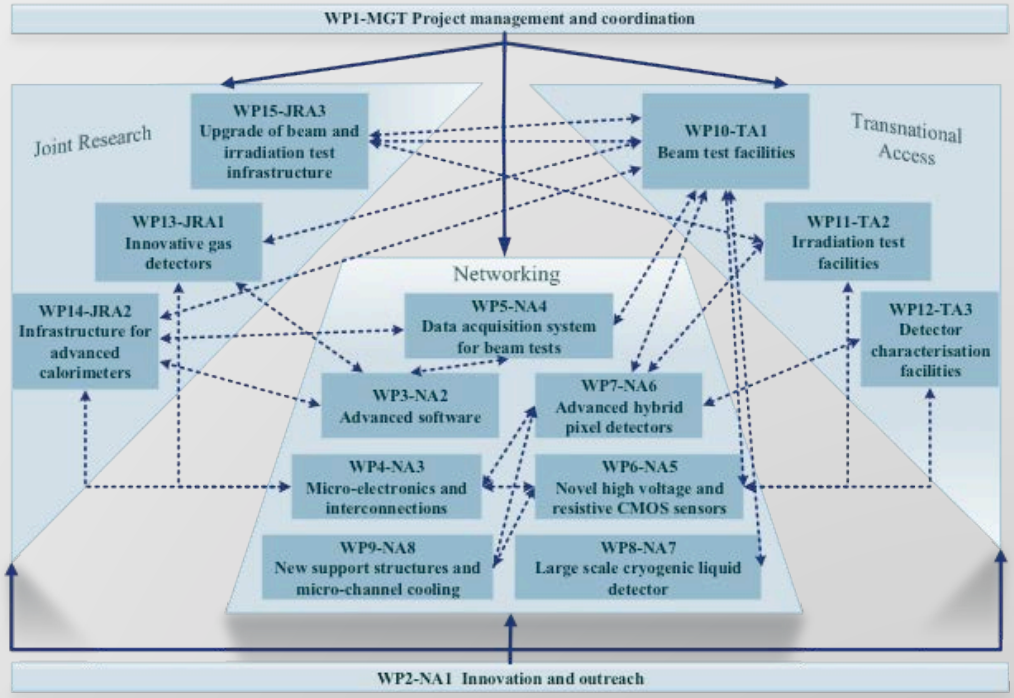




LC detector R&D: AIDA-H2020 proposal

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

Key R&D issues	WPs related to activity
HL-LHC	
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
ILC	
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
CLIC (Compact Linear Collider)	
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
Long-baseline neutrinos	
Large-scale cryogenic detectors, electronics Beam test	WP 2, 3, 8, 10
FCC (Future Circular Collider)	
See HL-LHC	WP 2, 3



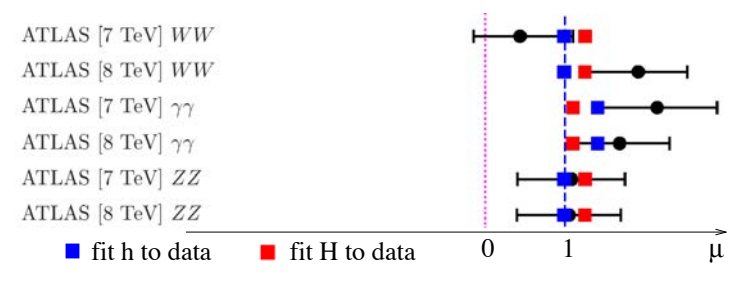
About 25% include Linear Collider R&D related activities

The need for precision: New Physics

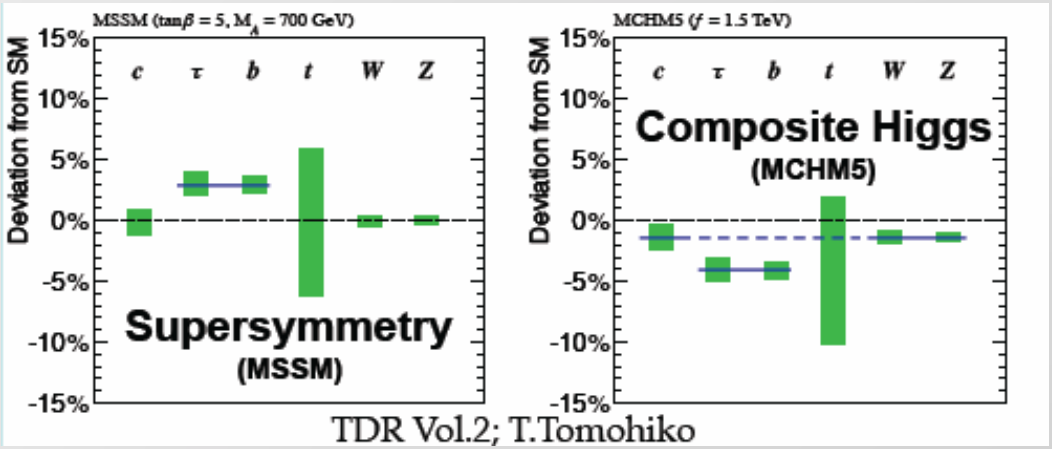
One example:

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



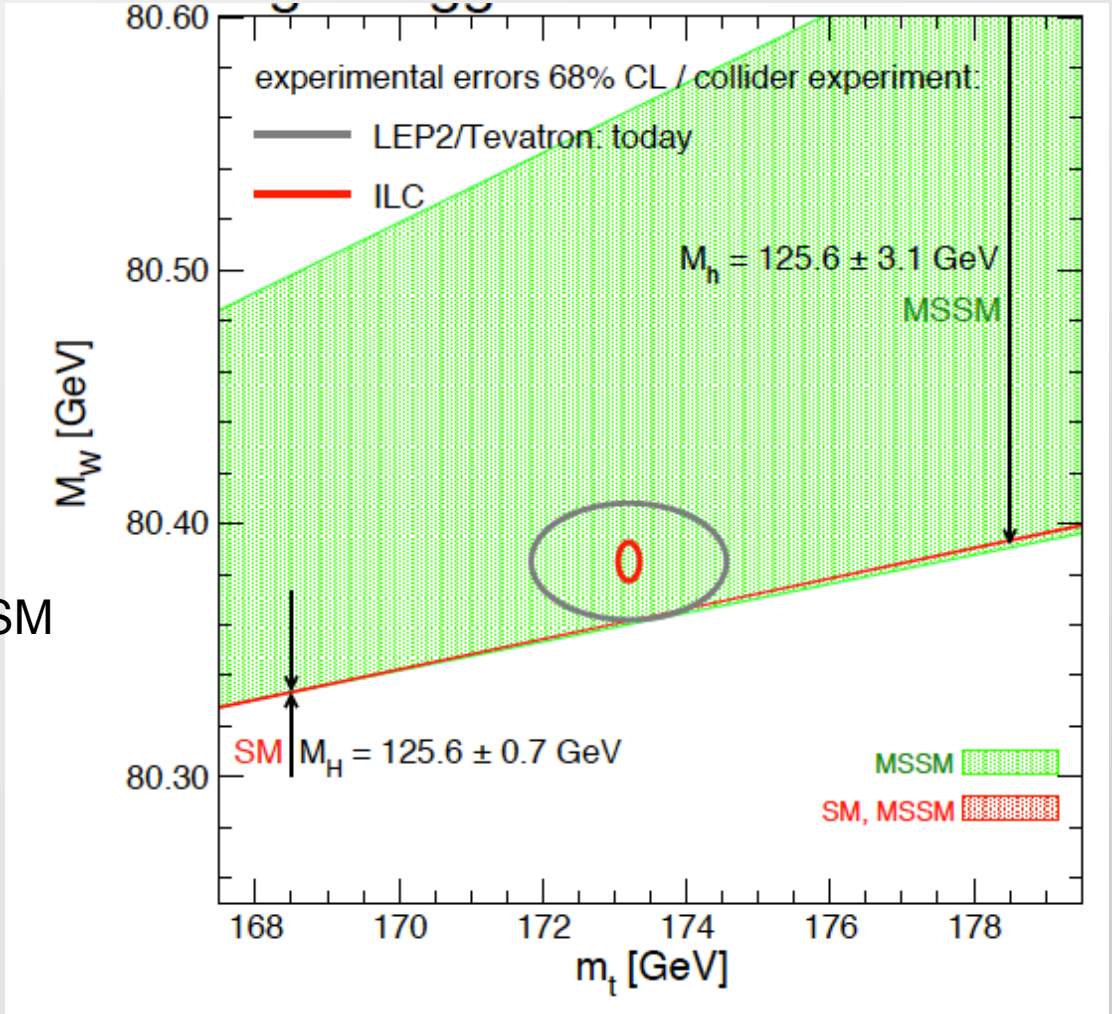
[Bechtle, Heinemeyer, Stal, Stefaniak, Weiglein, Zeune arXiv:1211.1955]



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

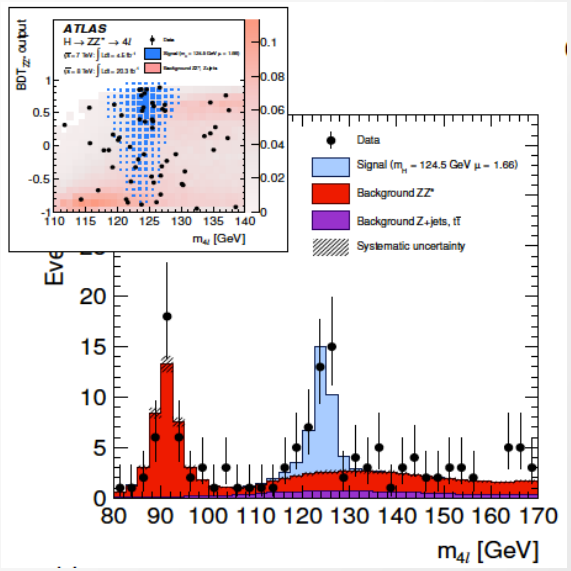
The need for precision: New Physics

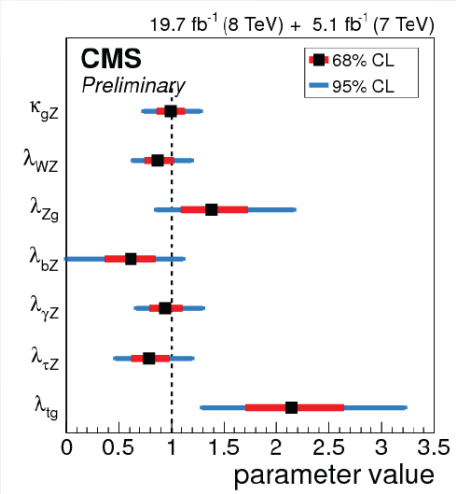
Consistency checks with the SM and possible New Physics



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

The need for precision: Higgs Physics





The open questions about the "Higgs" :

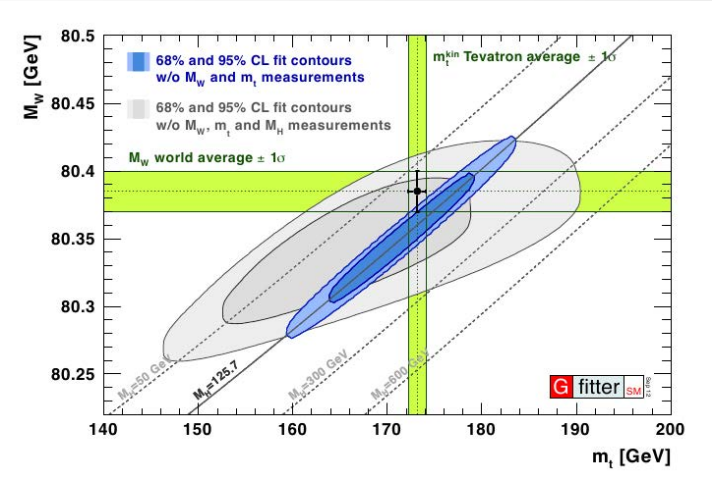
1. is it the boson of the (minimal) Standard Model ?
2. is it an elementary or composite particle ?
3. is it unique/solitary ?
4. is it eternal/temporary (stability of SM vacuum) ?
5. is it natural ?
6. is it the first supersymmetric particle ever observed ?
7. is it really "responsible" for the masses 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 ?

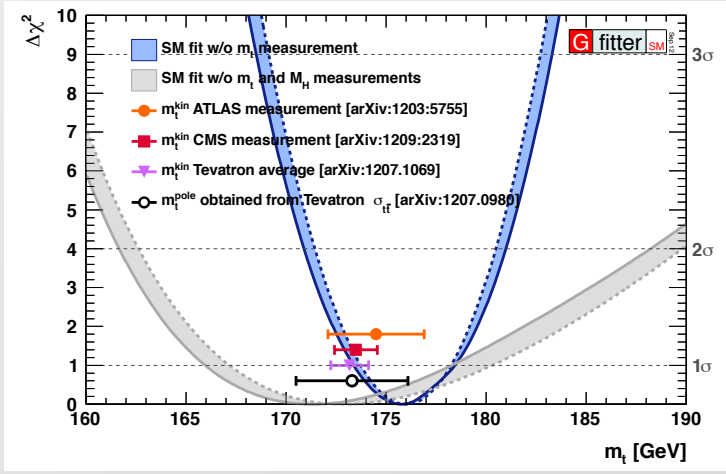
Ch. Grojean- ICHEP 2014

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

EW consistency between: M_W ⌘ M_H ⌘ M_t

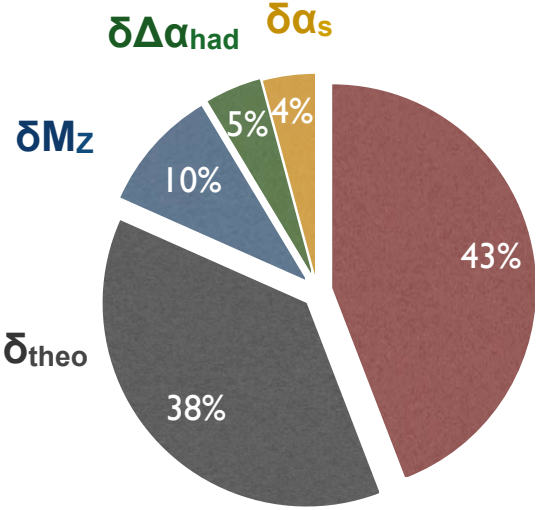
[M. Baak IVICFA + CERN 2013]





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

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



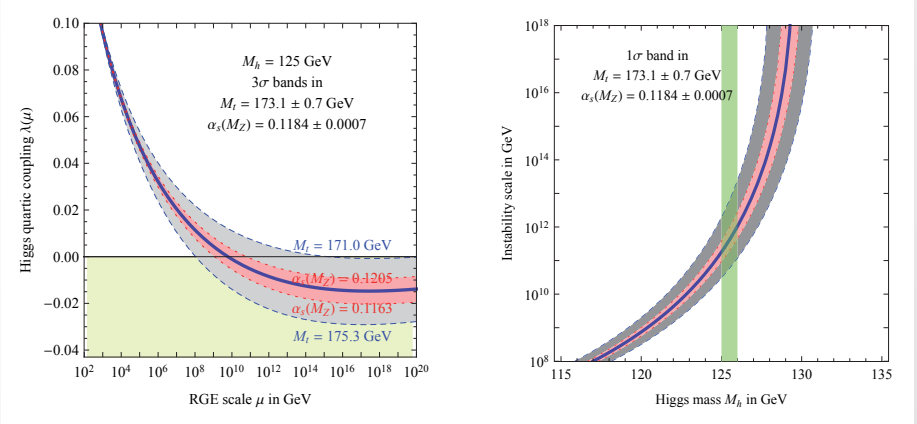
= 11 MeV

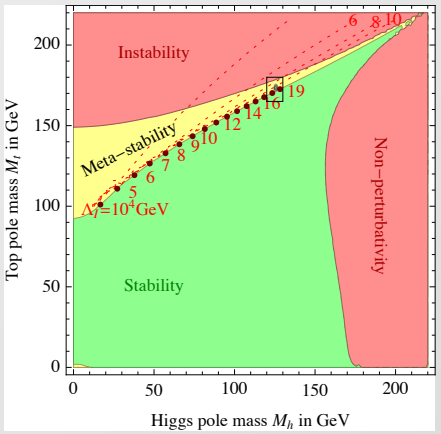
The need for precision: Vacuum Stability of the SM

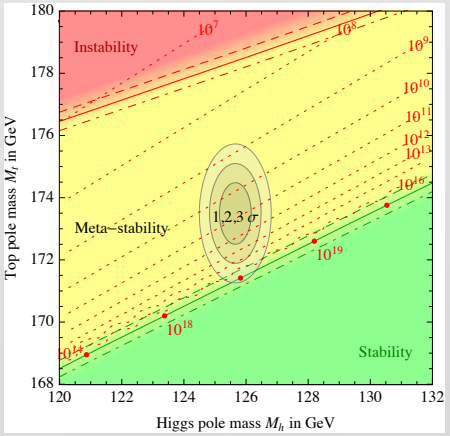
Vacuum Stability ($\lambda(\Lambda) \geq 0$)

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

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







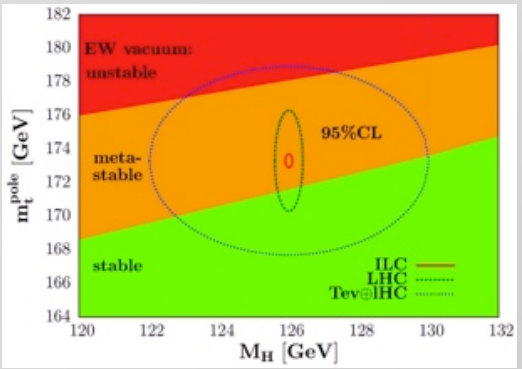
Assume SM valid up to $\Lambda \leq M_{planck}$

M_t = (173.35 ± 0.72) GeV ⟶ M_h > (129.6 ± 1.5) GeV

M_h = (125.66 ± 0.34) GeV ⟶ M_t < (171.36 ± 0.46) GeV

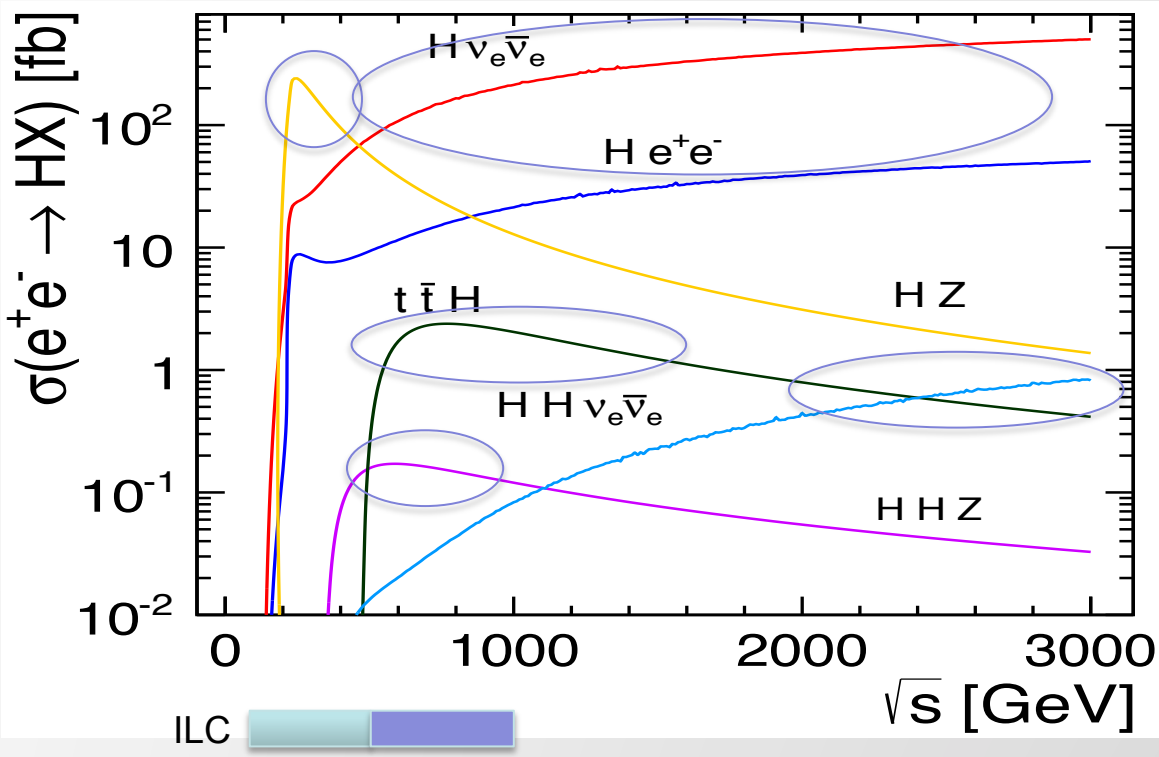
Take M_t from ttbar X-section (pole mass)

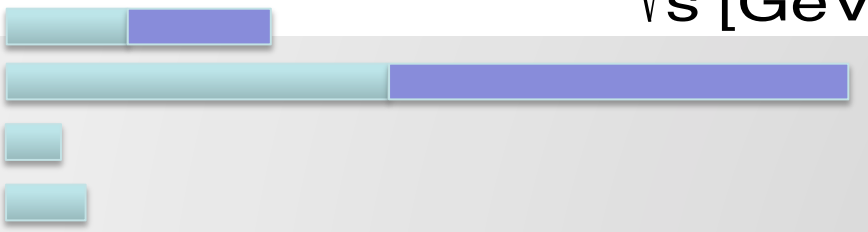
M_t = (173.3 ± 2.8) GeV ⟶ M_h > (129.4 ± 5.6) GeV



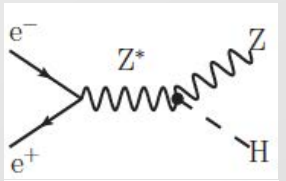
Alekhin et al, **Phys.Lett. B716 (2012) 214**

e^+e^- Higgs physics

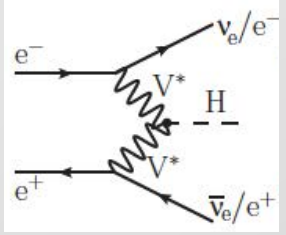




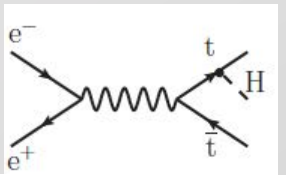
Many processes at different √s needed & accessible



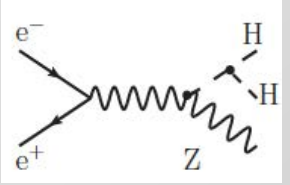
Mass
g_Z (m.i.)
BR´s
(LHC)-invisible



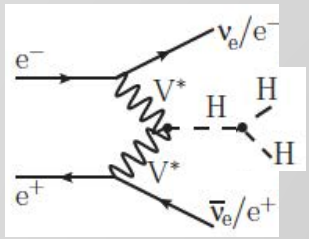
Γ_{tot}



g_t (ILC,CLIC)



g_{HHH} (ILC500)



g_{HHH} (ILC1000, CLIC)

Model-independent Global Fit for Couplings

Baseline LC program

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

($M_H = 125$ GeV)

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	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%
Hττ	5.7%	2.3%	1.6%
Hγγ	18%	8.4%	4%
Hμμ	91%	91%	16%
Γ_0	12%	4.9%	4.5%
Htt	-	14%	3.1%
HHH	-	83%(*)	21%(*)

) With H->WW (preliminary), if we include expected improvements in jet clustering it would become 17%!

Model-independent Global Fit for Couplings

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

→

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

Luminosity Upgraded LC

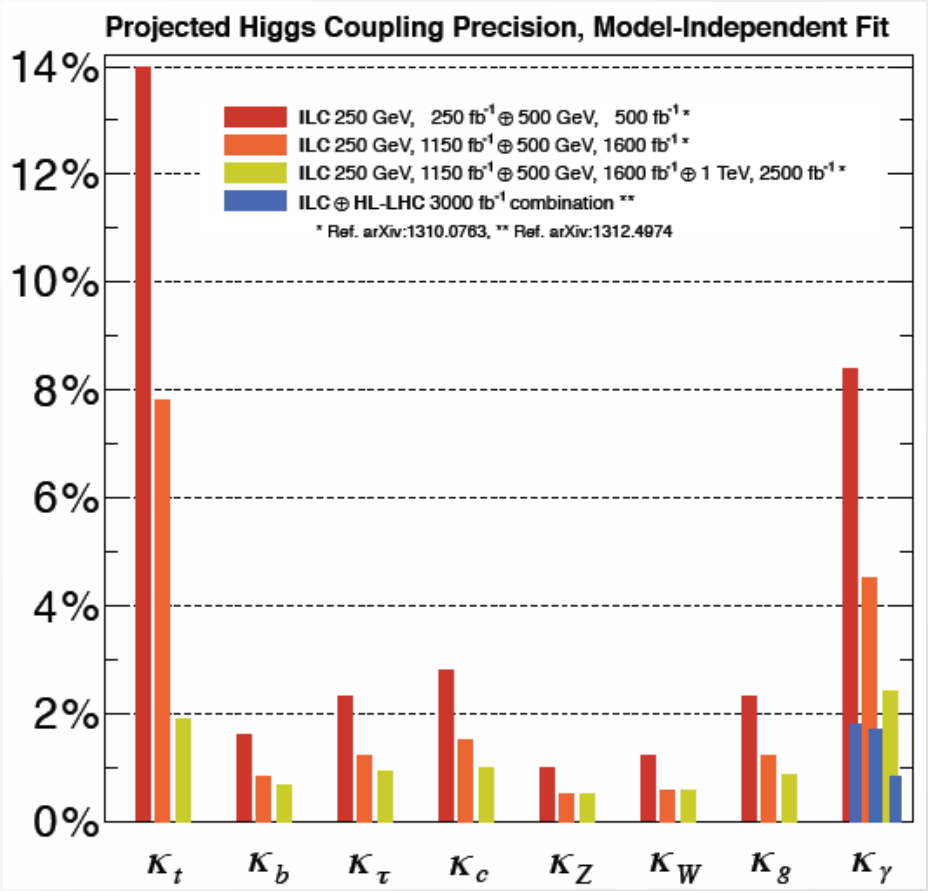
($M_H = 125$ GeV)

P(e-,e+)=(-0.8,+0.3) @ 250, 500 GeV P(e-,e+)=(-0.8,+0.2) @ 1 TeV

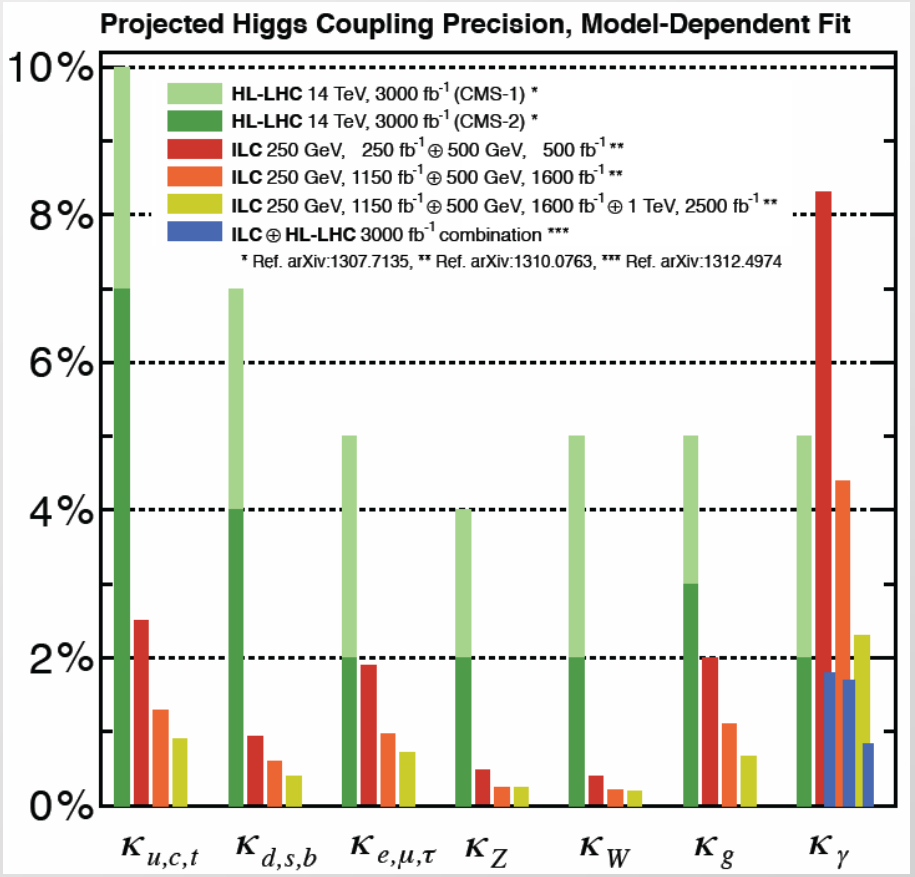
coupling	250 GeV	250 GeV + 500 GeV	250 GeV + 500 GeV + 1 TeV
HZZ	0.6%	0.5%	0.5%
HWW	2.3%	0.6%	0.6%
Hbb	2.5%	0.8%	0.7%
Hcc	3.2%	1.5%	1%
Hgg	3%	1.2%	0.93%
Hττ	2.7%	1.2%	0.9%
Hγγ	8.2%	4.5%	2.4%
Hμμ	42%	42%	10%
Γ_0	5.4%	2.5%	2.3%
Htt	-	7.8%	1.9%
HHH	-	46%(*)	13%(*)

) With H->WW (preliminary), if we include expected improvements in jet clustering, it would become 10%!

ILC Higgs physics

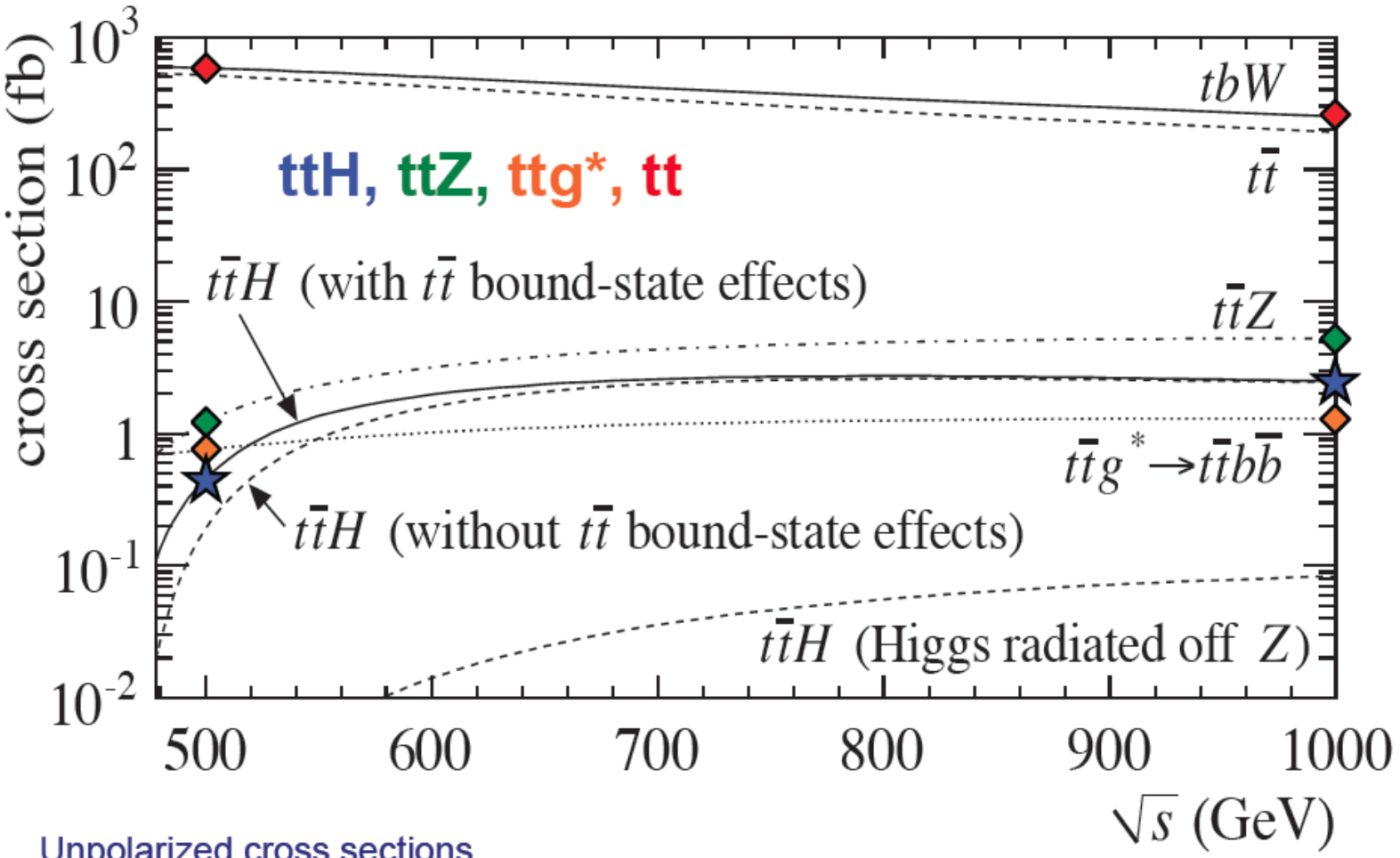


Fully model-independent



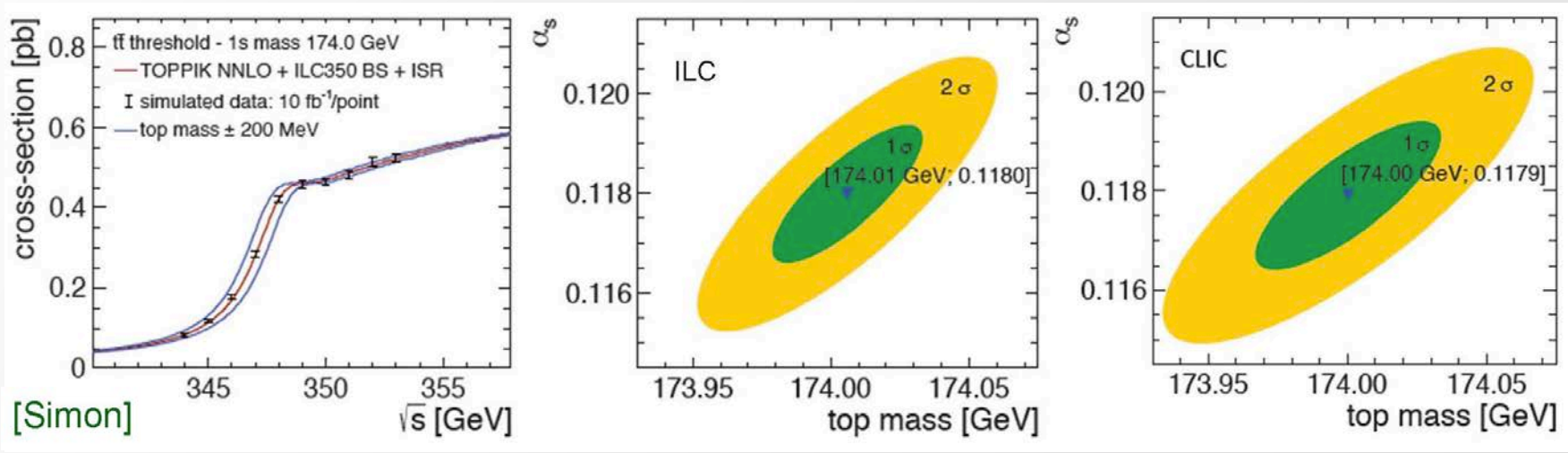
LHC-like fits, assuming SM decay modes only

Cross Sections



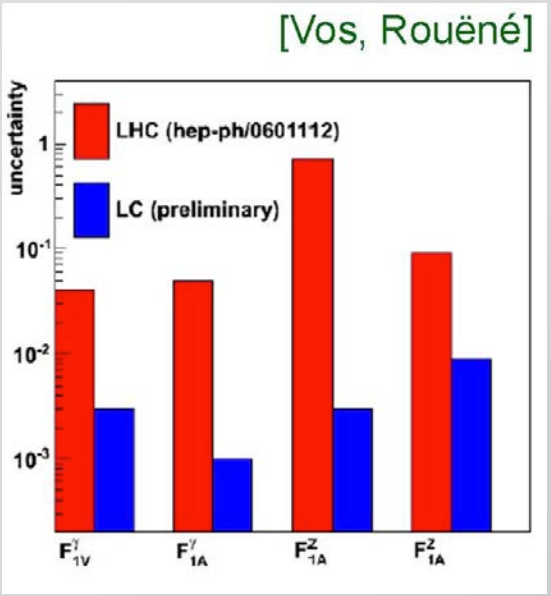
Unpolarized cross sections.
For ttH: m_H = 120 GeV

top physics



Top mass:

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



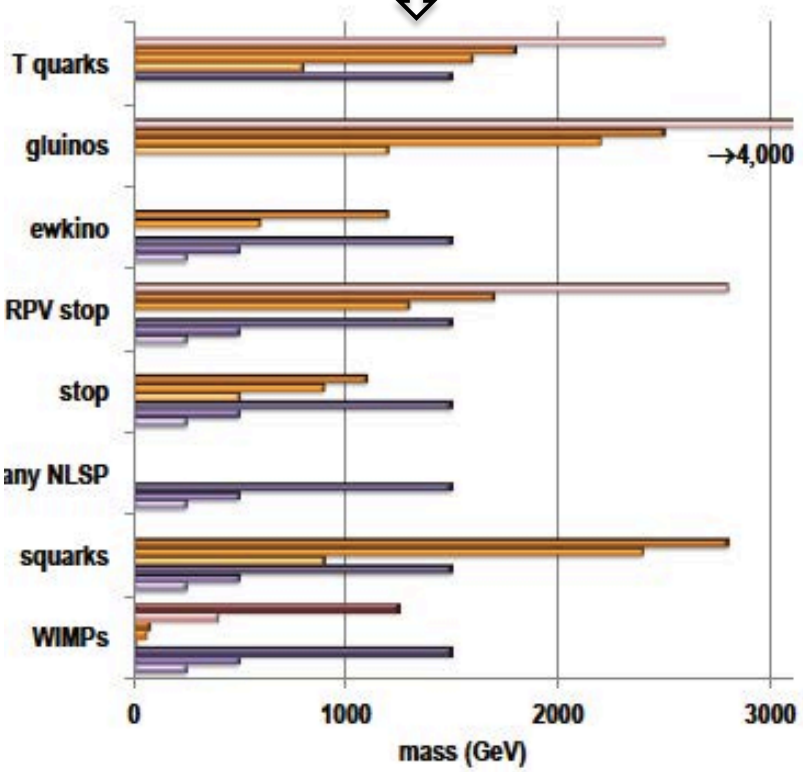
- ✓ M. Martínez, R. Miquel, Eur. Phys. J. C27 49 (2003)
- ✓ K. Seidel, F. Simon, M. Tesař, S. Poss, Eur. Phys. J. C73 2530 (2013) (no polarization)
- ✓ T. Horiguchi, A. Isihikawa, T. Suehara, K. Fuji, Y. Sumino, Y. Kiyo, Y. Yamamoto (with polarization)

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

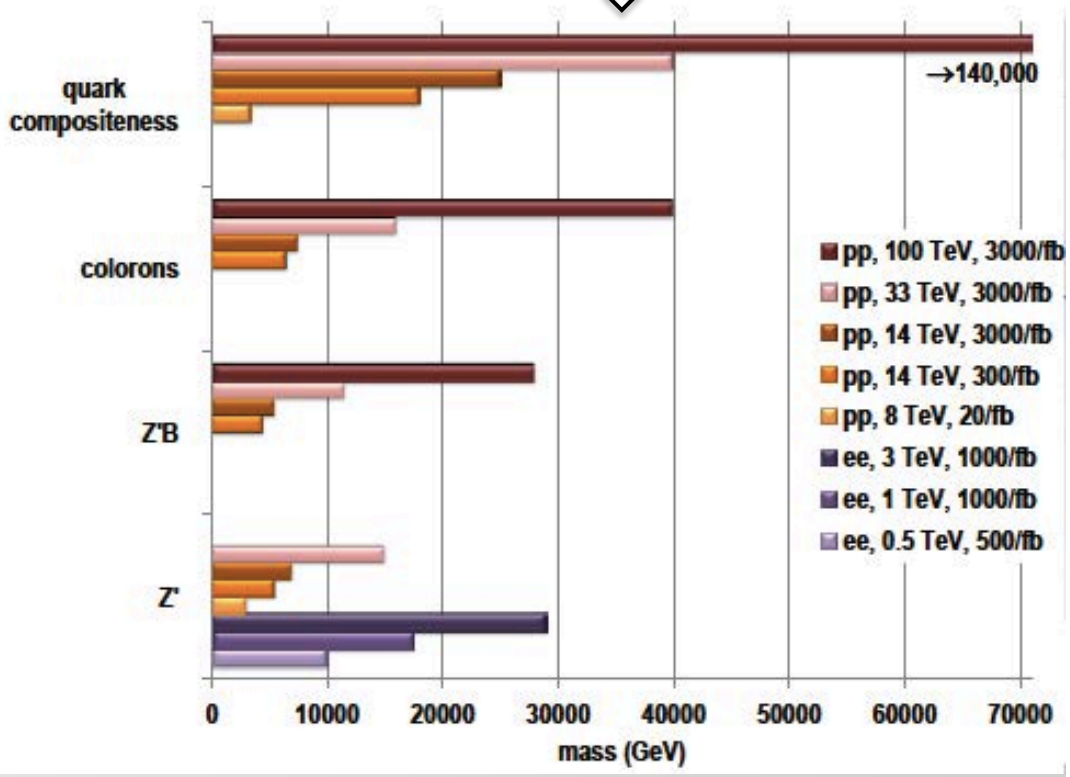
- ✓ LAL-Orsay, IFIC-Valencia

Reach on New Physics searches

Direct searches up to mass M ≤ √s/2

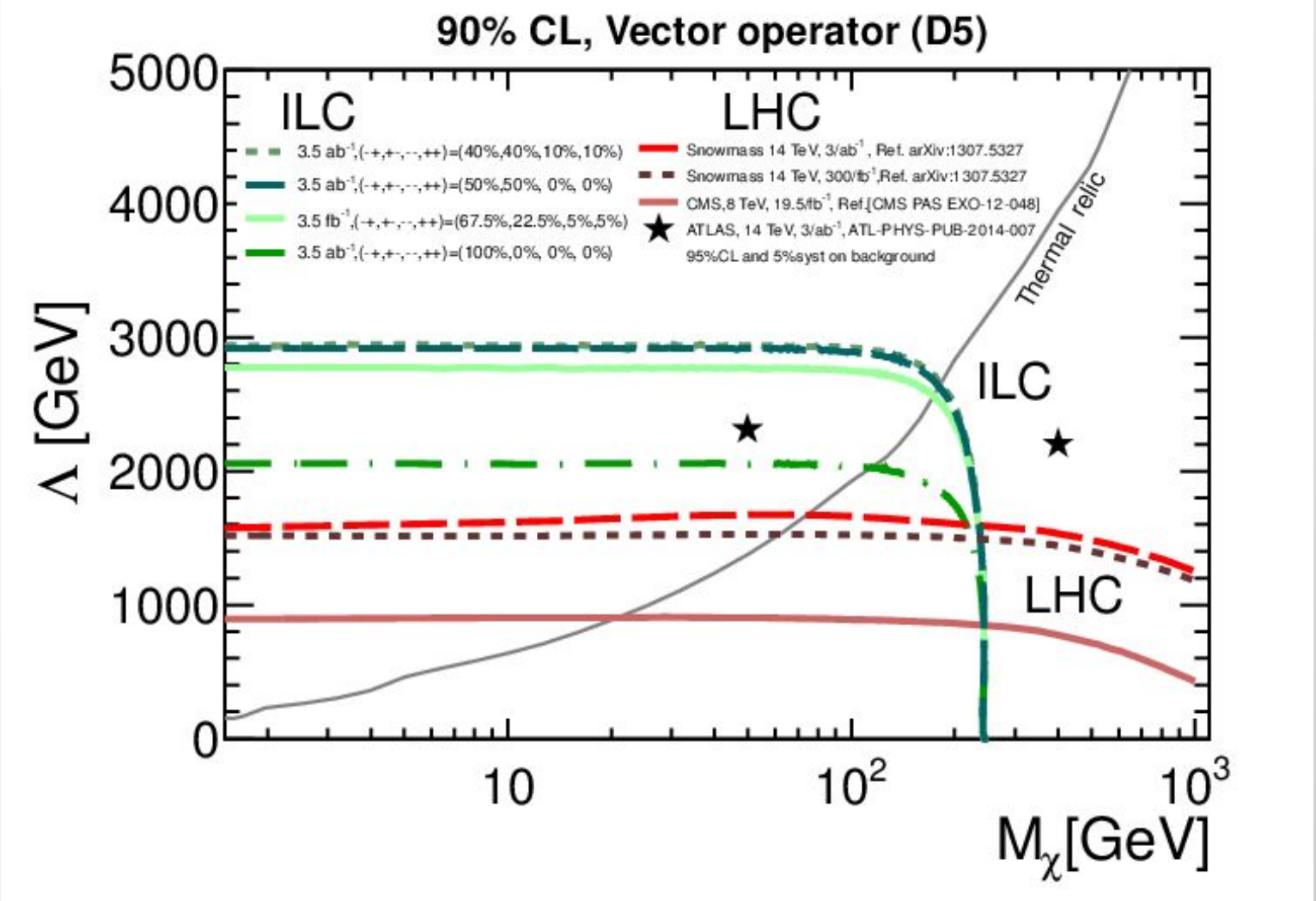


Indirect input from precision measurements

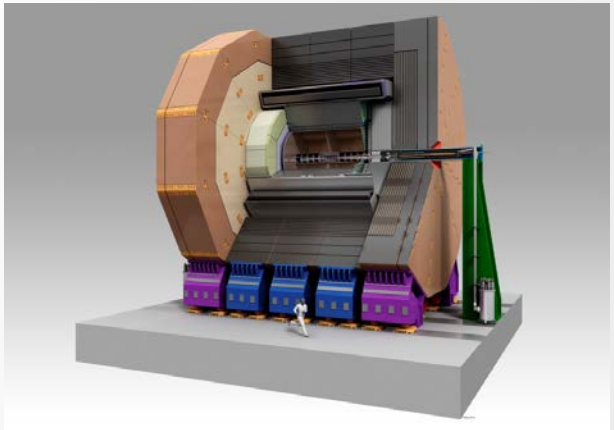


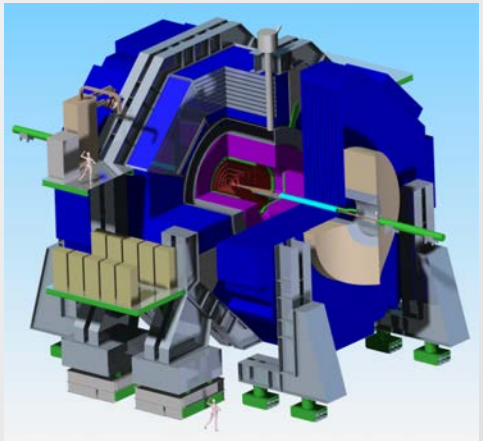
arXiv:1311.0299 (Snowmass)

Dark Matter search



ILC Detectors: SiD & ILD





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

ILC Detectors: SiD & ILD

Compact, pure Silicon based tracking, large B-field

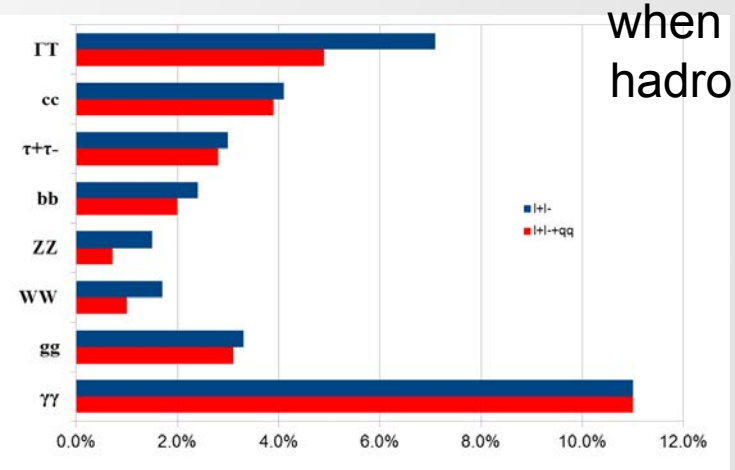
Two Detector Concepts for the ILC: SiD and ILD

All driven by Particle Flow paradigm

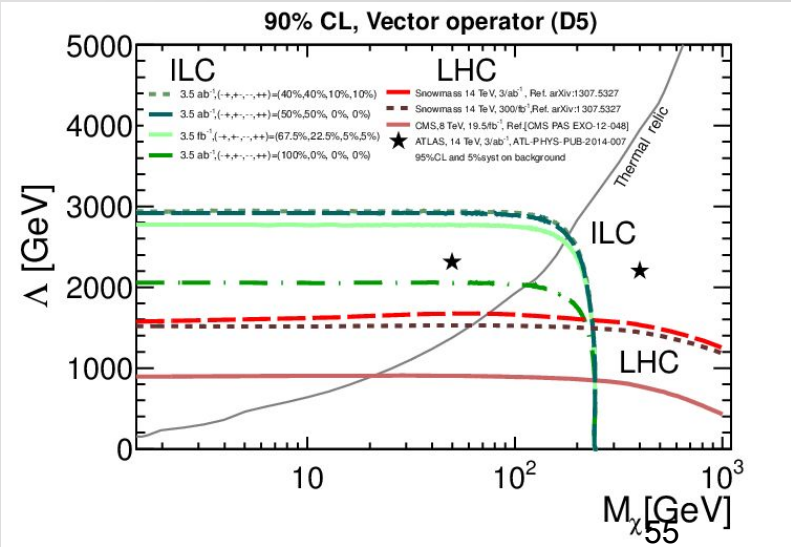
Large, gaseous & Si tracking, moderate B-field

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

Potential improvement on Higgs couplings when including hadronic recoil

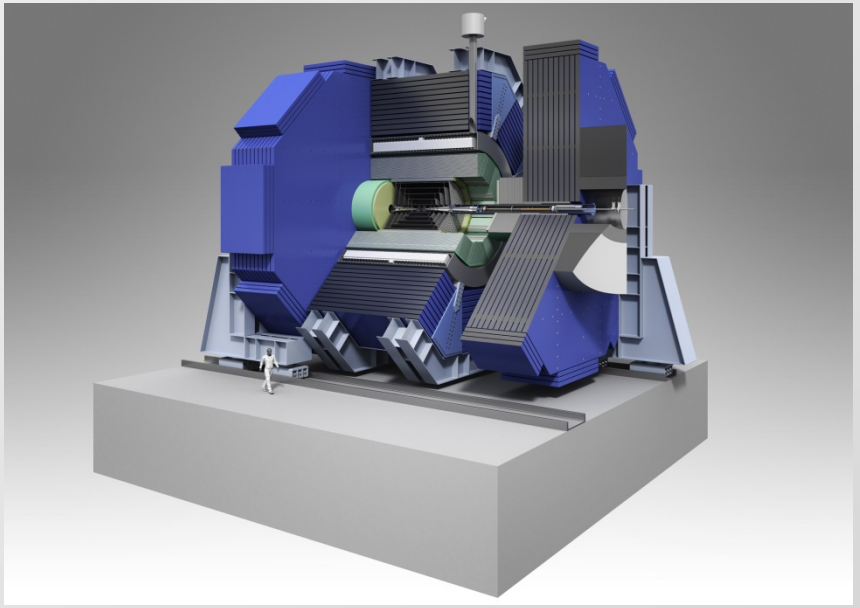


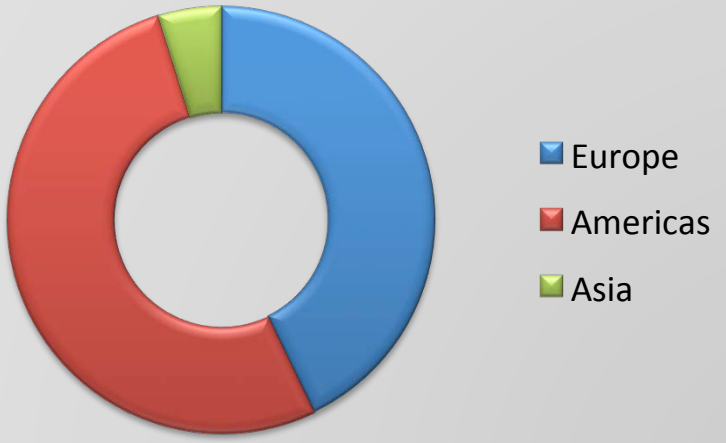
WIMP reach at ILC and LHC



SiD detector concept

- 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 12th-14th, 2015
  - www.silicondetector.org

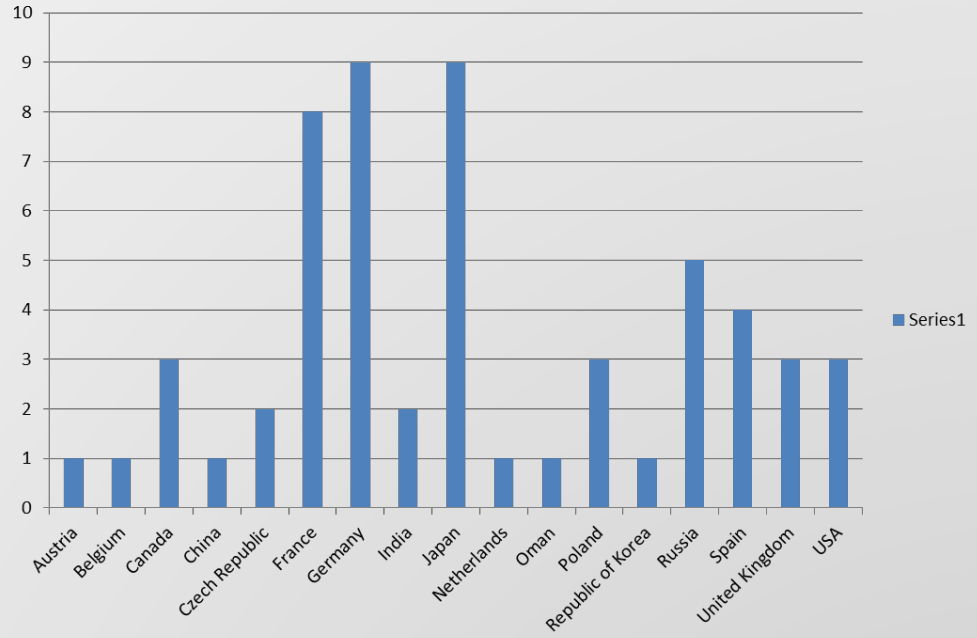




ILD detector concept

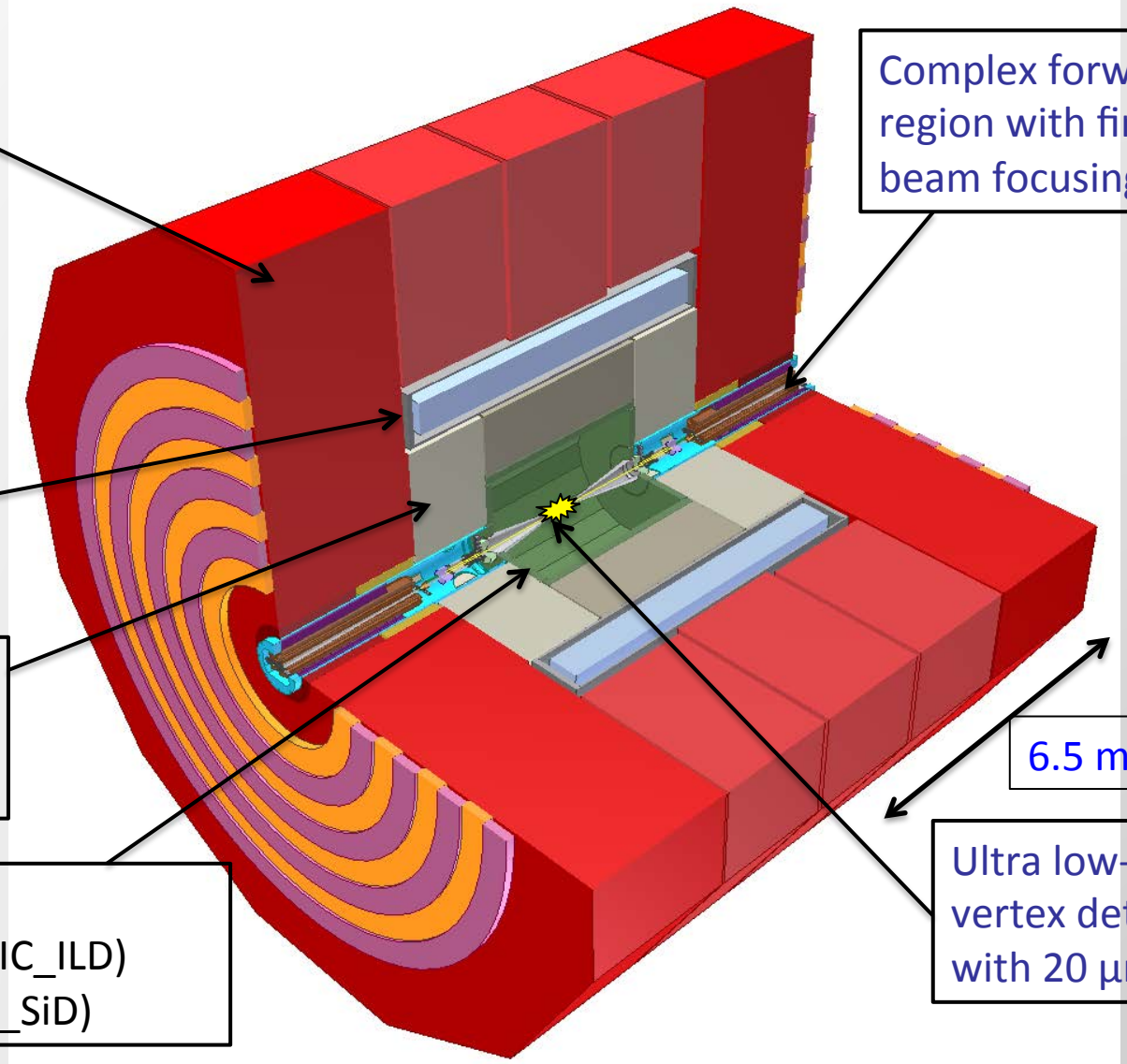
- ILD concept group:
  58 member institutes
  have signed up.

- 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

CLICdp



Instrumented return yoke for muon ID

Complex forward region with final beam focusing

Strong SC solenoid 4 T or 5 T

Fine grained calorimeters for PFA: 1 + 7.5 l_{int}

Tracking:
TPC+silicon (CLIC_ILD)
all-silicon (CLIC_SiD)

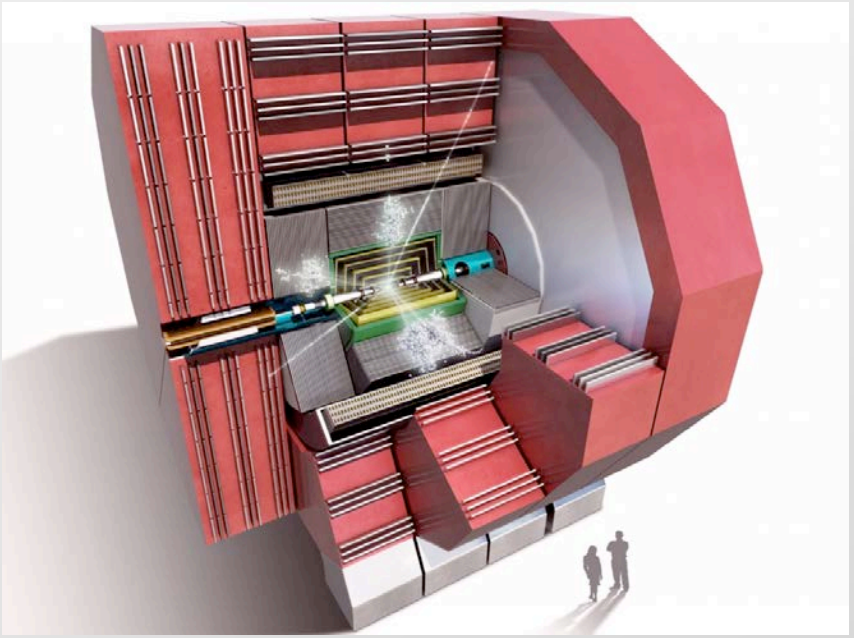
6.5 m

Ultra low-mass vertex detector with 20 µm pixels

CLICdp

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)

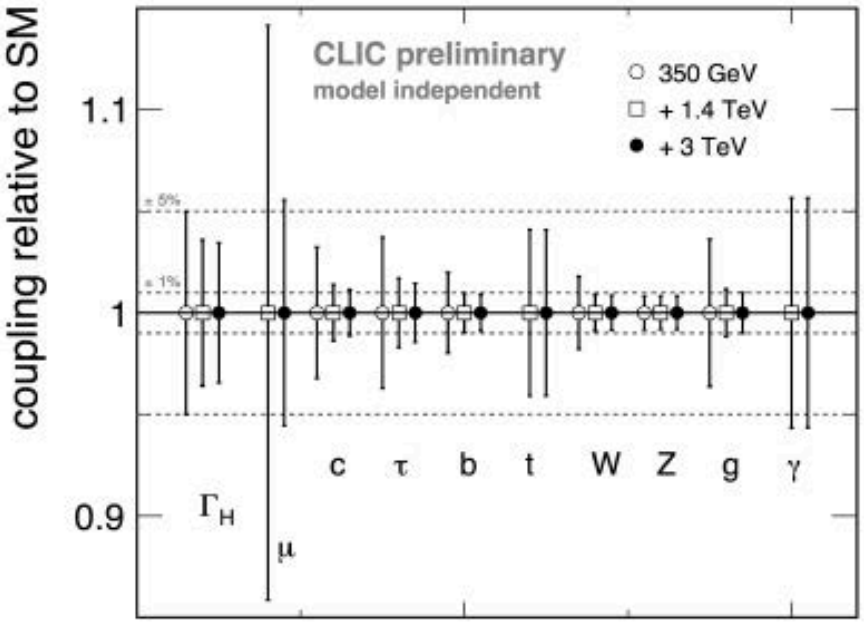
CLIC-specific activities:
- Detector optimisation for CLIC
- Detector R&D where CLIC sets special requirements
- CLIC physics studies, staged approach

CLIC physics studies

CLIC physics

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

- **Beyond the standard model**
  - Direct searches, accessible up to ~√s/2
  - Indirect searches via precision meas.



Higgs coupling prospects (model independent)

Parameter	Measurement precision		
	350 GeV 500 fb^{-1}	+ 1.4 TeV +1.5 ab^{-1}	+3.0 TeV +2.0 ab^{-1}
g_{HZZ}	0.8 %	0.8 %	0.8 %
g_{HWW}	1.8 %	0.9 %	0.9 %
g_{Hbb}	2.0 %	1.0 %	0.9 %
g_{Hcc}	3.2 %	1.4 %	1.1 %
$g_{H\tau\tau}$	3.7 %	1.7 %	1.5 %
$g_{H\mu\mu}$	–	14.1 %	5.6 %
g_{Htt}	–	4.1 %	≤ 4.1 %
$g^{\dagger}_{Hgg}$	3.6 %	1.2 %	1.0 %
$g^{\dagger}_{H\gamma\gamma}$	–	5.7 %	< 5.7 %
Γ_H	5.0 %	3.6 %	3.4 %

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 vertex R&D

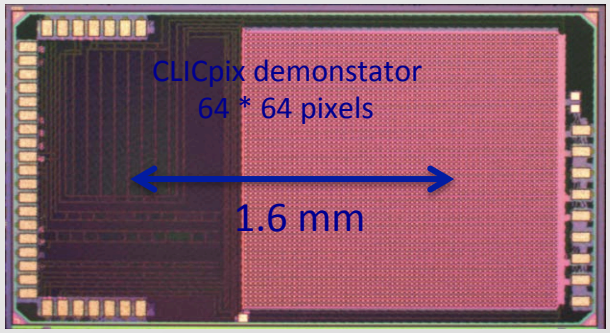
CLIC sets challenging requirements:

- Very small pixels (25×25 μm²)
- Pulseheight measurement
- Timing ~10 ns
- Very low mass
  - Power pulsing, air cooling

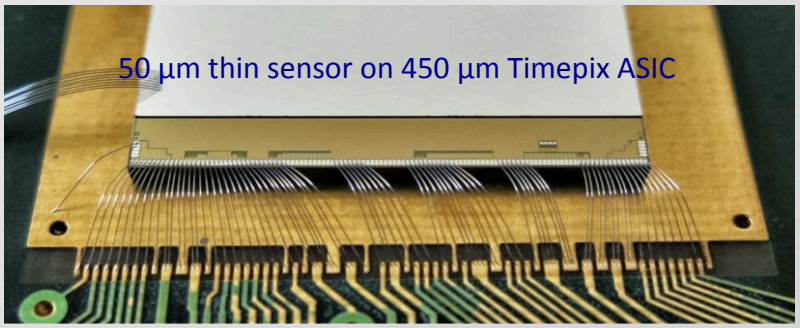
⇒ **Integrated R&D with many aspects**

⇒ **Overlap with e.g. HL-LHC (RD53)**

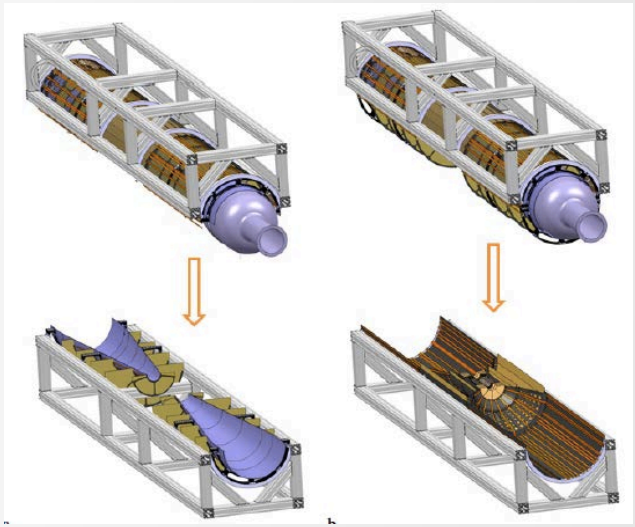
Readout ASIC (65 nm)



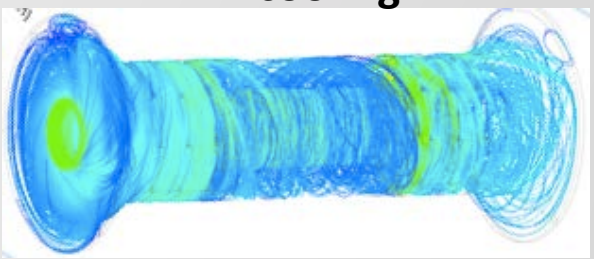
Very thin sensors



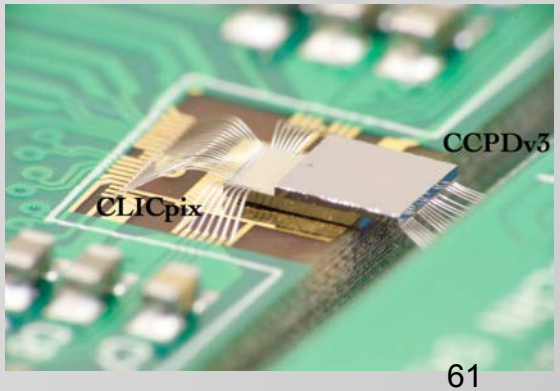
Engineering and integration



Air cooling



New HV-CMOS technologies



CLIC detector optimization

Currently re-optimising the detector concept for CLIC

⇒ Lessons learnt from the CDR

⇒ Reducing occupancies

⇒ Extending coverage in forward region

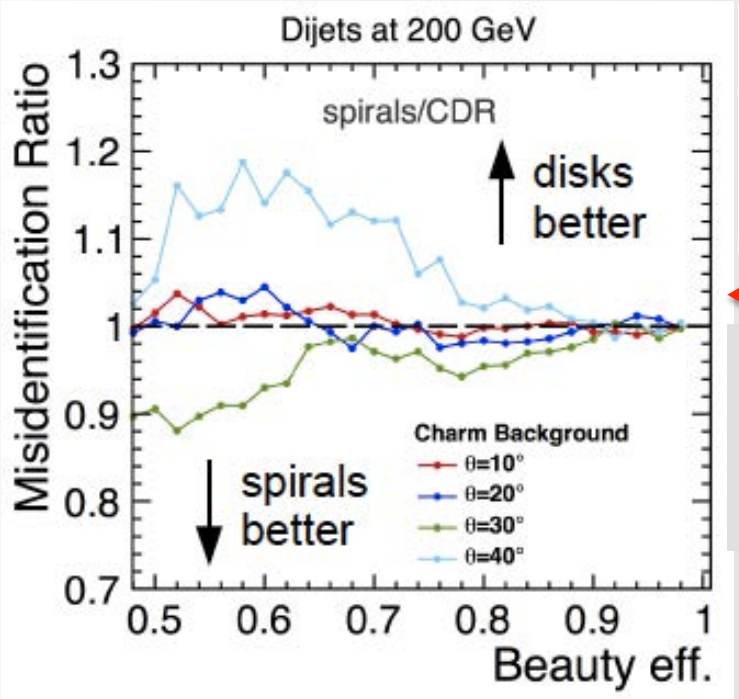
⇒ Knowledge from hardware R&D

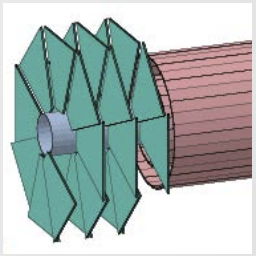
⇒ Optimising physics performance

⇒ Cost-effective approach

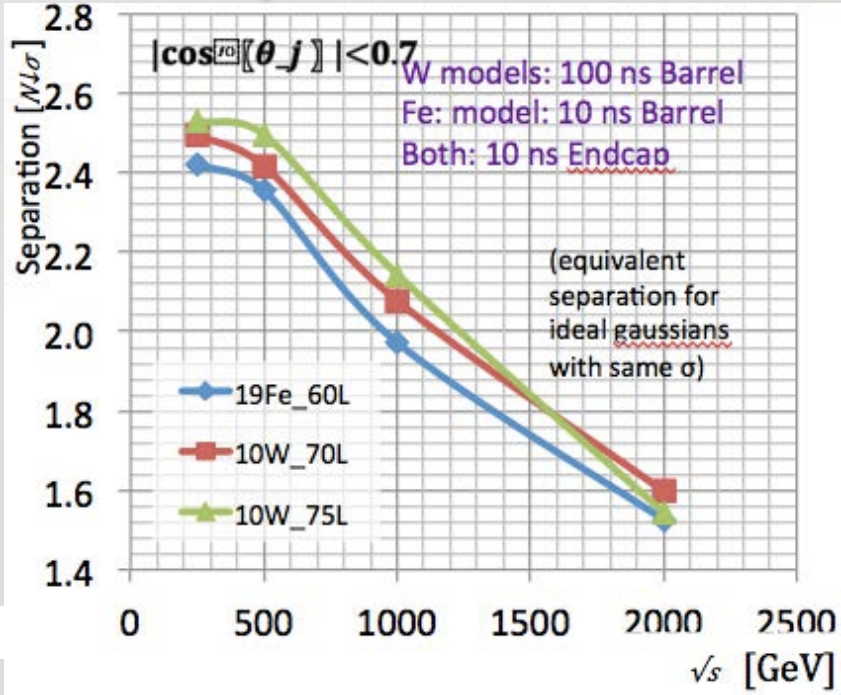
towards new CLIC detector model by mid-2015

W ⇔ Z separation for different HCAL absorbers





Flavour tagging: with realistic vertex geometry (air cooling)



LC software development

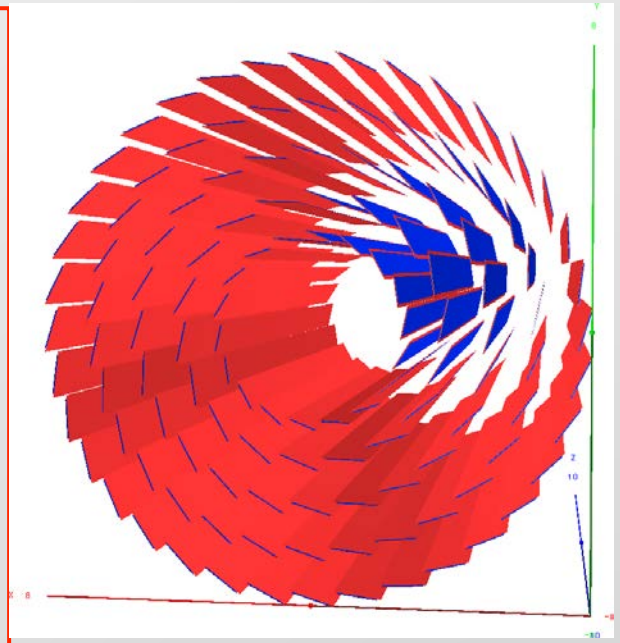
Development of LC software chain for detector optimisation, physics simulations, hardware R&D

=> 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.

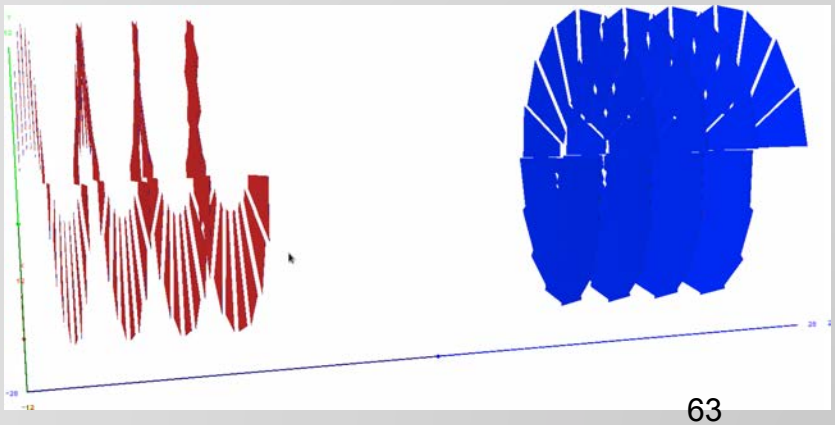
First complete implementation foreseen mid-2015, for the new CLIC detector concept.



DD4hep visualisation

Broad scope of application:

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



European participation in LC R&D

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.

EU in LC R&D: France

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 Ministery 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 ± constant resources foreseen in the coming years (+ EU projects, ...)

EU in LC R&D: France

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, μMegas), 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
  - μelectronics (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 μMegas & 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

EU LC R&D: France

Illustrations of 2014 Achievements in Detector R&D

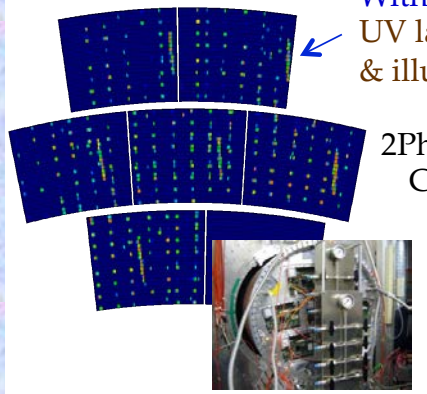
❖ **CMOS pixel sensors on STAR-PXL :**

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

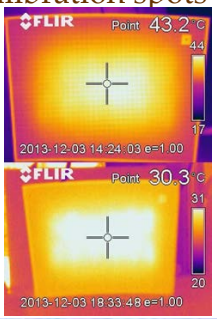
❖ **Micromegas R&D for TPC Tracking :**

7 Micromegas modules with 2-phase C02 cooling

With beam and laser dots:
UV laser gererates MIP tracks
& illuminate calibration spots

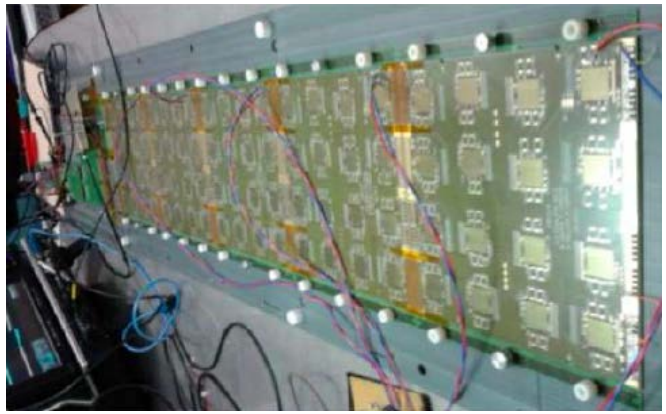


2Phase CO_2 Cooling



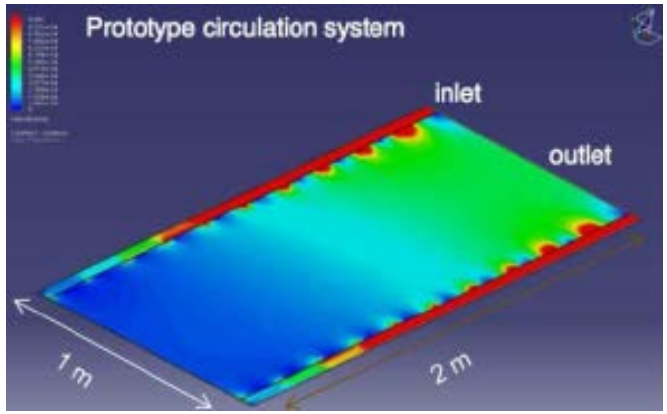
❖ **SiW ECAL :**

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



❖ **GRPC-HCAL :**

1st proto to test 3rd gen. calorimeter read-out electronics



EU LC R&D: Germany

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

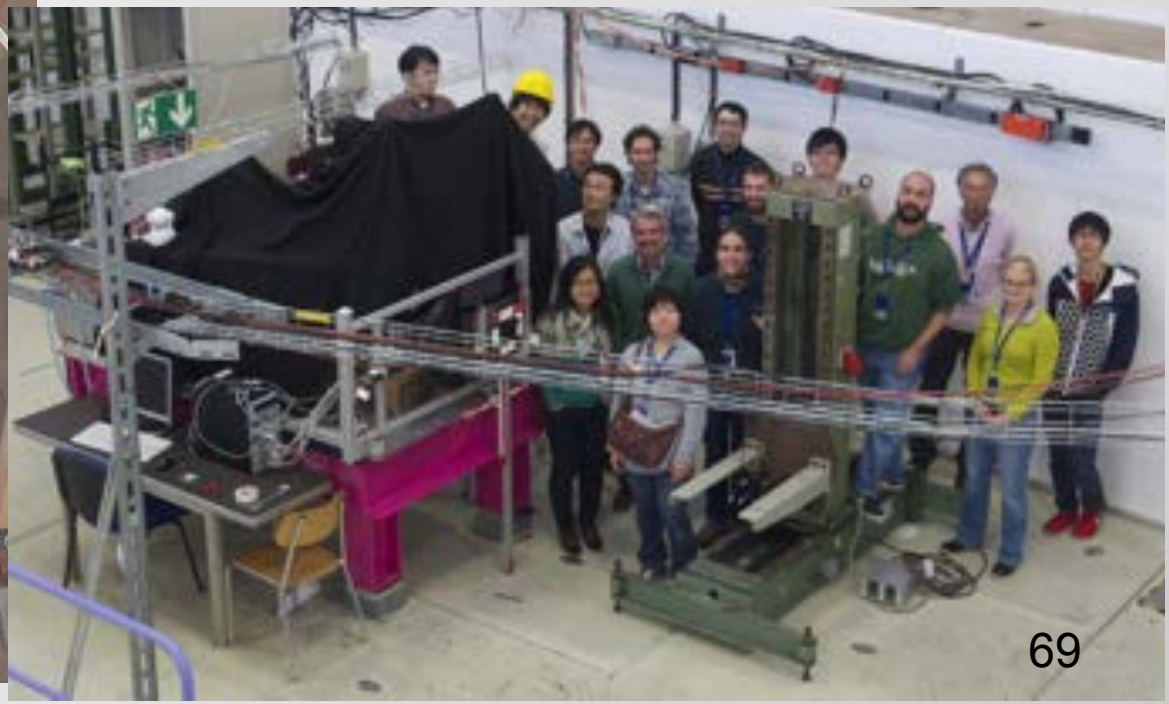
German HEP community statement (15-16 Nov. 2014) expressed:
strong support for the ILC as the next big project in particle physics

EU in LC R&D: Germany & Russia

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



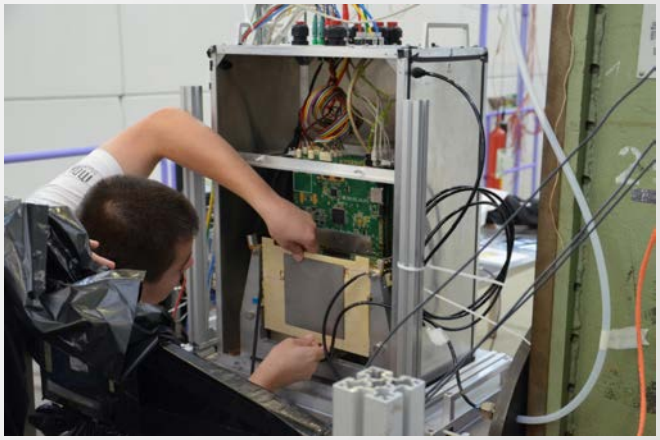
FCAL test beam @ CERN

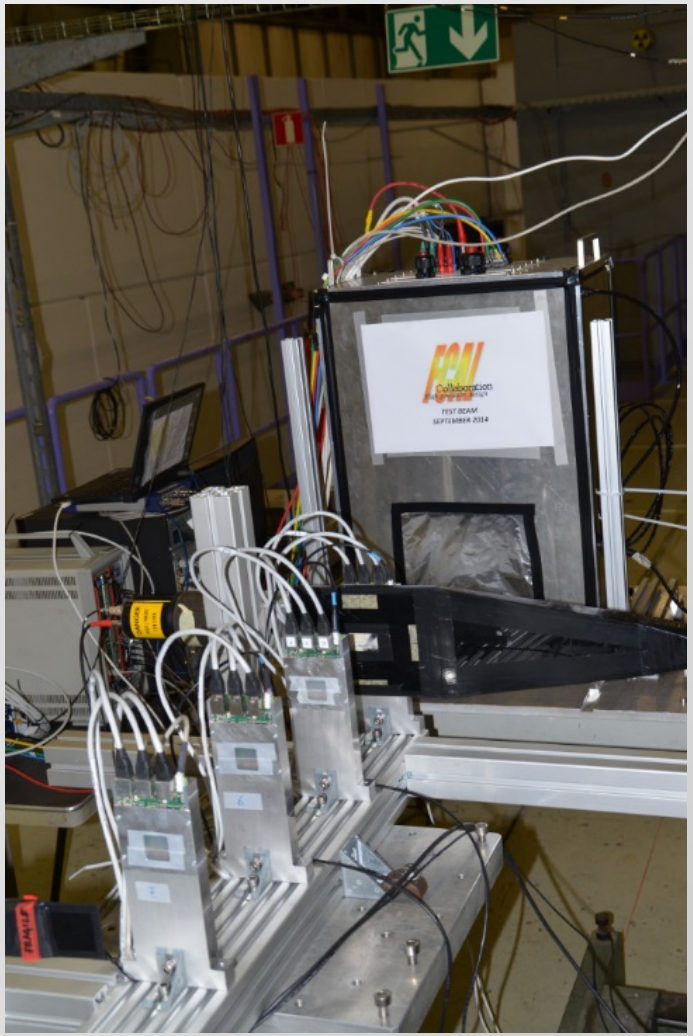
Oct. 2014, multilayer prototype

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)





EU in LC R&D: Spain

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

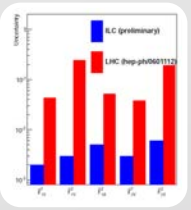
Organizes 1-2 national meetings every year

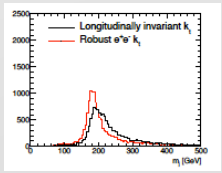
Includes:

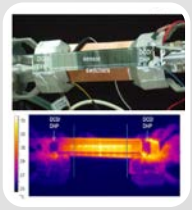
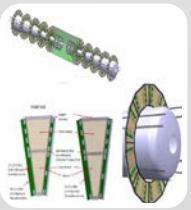
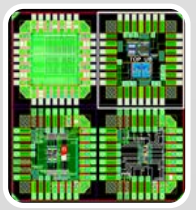
Accelerator groups
Theory groups
Experimental groups
Technological groups

EU in LC R&D: Spain

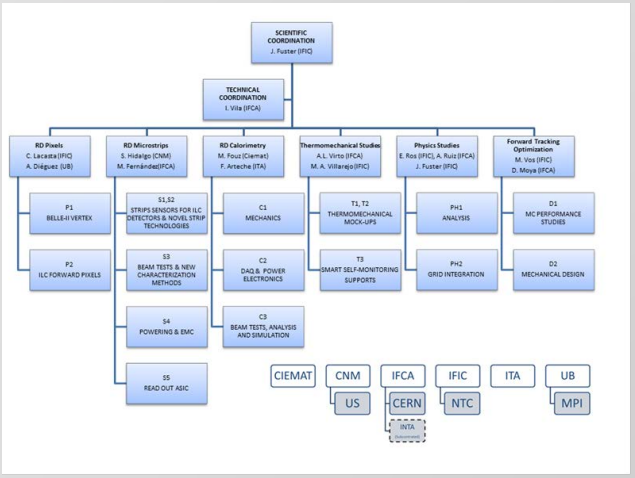
- New grant awarded for the next 2 years. Small funding for travelling and keeping R&D activities.



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



EU in LC R&D: UK

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;

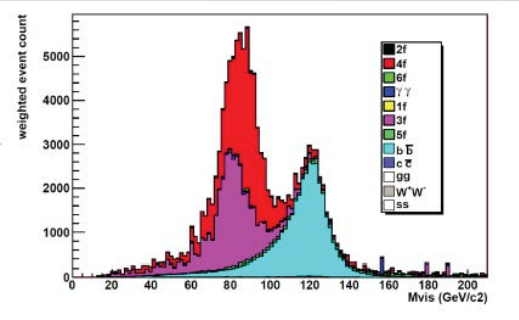
- whilst the money is not large, this will be an important starting step for UK ILC work
- will also enable UK academics to put time down against the ILC in their group STFC grants

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



LC workshops 2014

- **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/
  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

LC workshops 2014: LCWS14 figures

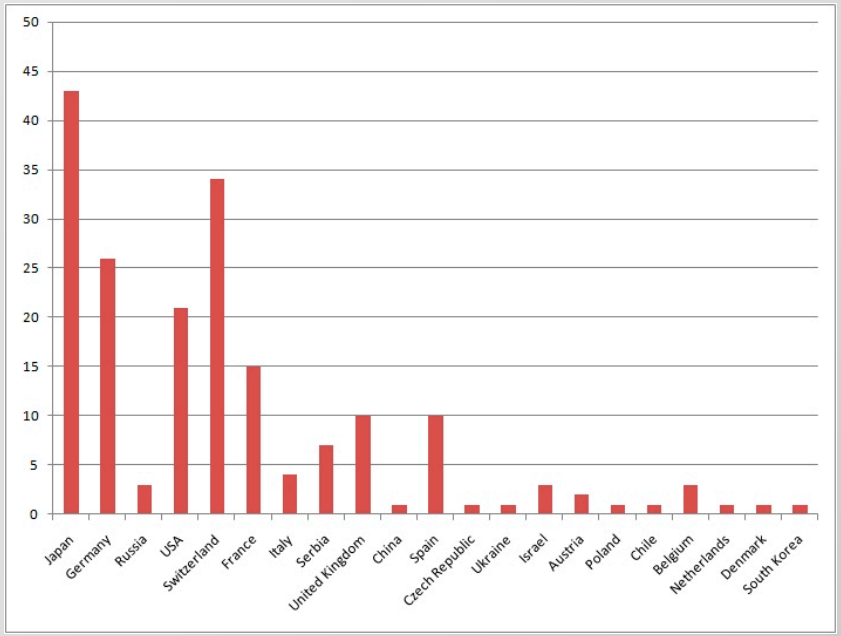
LCWS14 BELGRADE
06-10 OCTOBER 2014

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 lcws14@vinca.rs

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



LC workshops 2015

- **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. Miyamoto
  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**

LC School of Physics

- **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

LC School of Physics

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

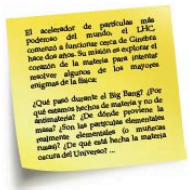
Outreach and dissemination during workshops

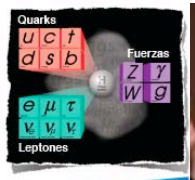
CONFERENCIA PÚBLICA

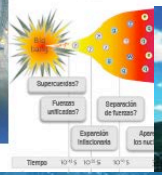
Viaje al corazón de la materia

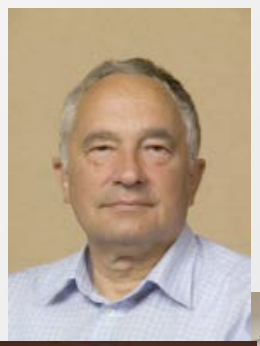
François Richard (Orsay)

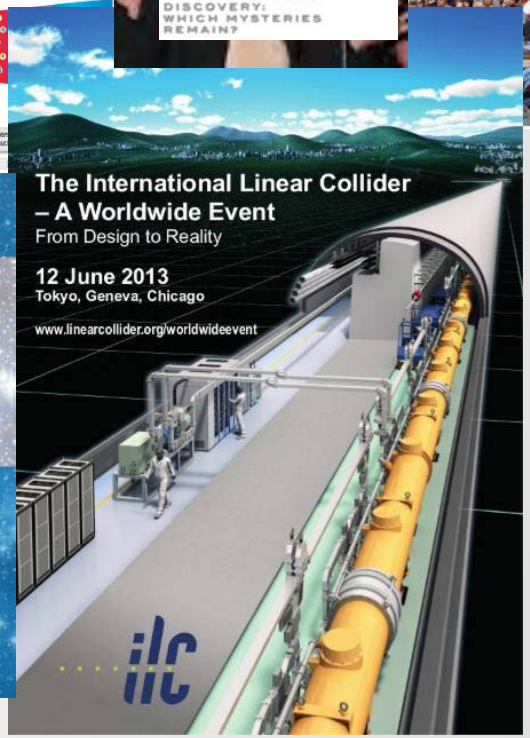
Parque de las Ciencias
27 de septiembre, 19 h
(en español, entrada libre)





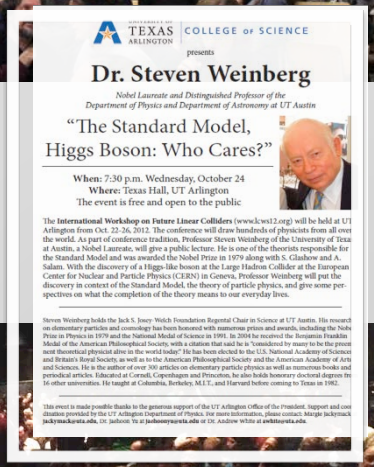






Particle Physics Slam - ALCPG11 - Eugene - March 22, 2011

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**



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.

My summary of the summary

Sense títol, 2009 **El Roto, Andrés Rábago García**

An “expert” has advised me that only the biggest and most aggressive will survive