

## Facts and the way ahead



Roman Pöschl



Many thanks to

J. Fuster, N. Walker, F. Richard,  
F. LeDiberder, A. Variola

## **Disclaimer:**

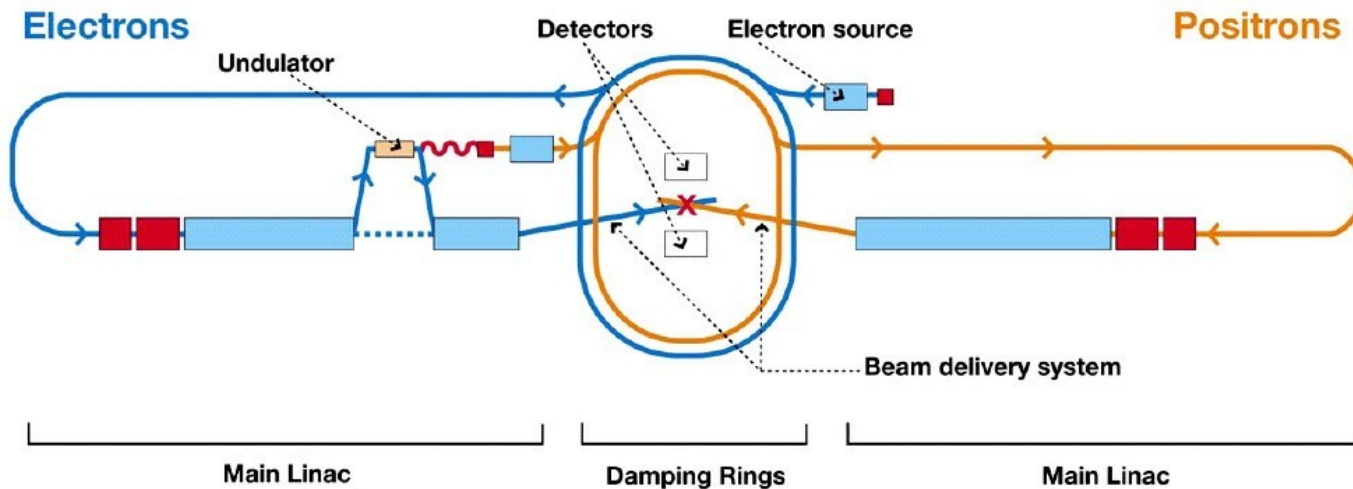
**The following is a personal collection/view  
on the developments and prospects in Europe**

**I have of course consulted a number of colleagues**

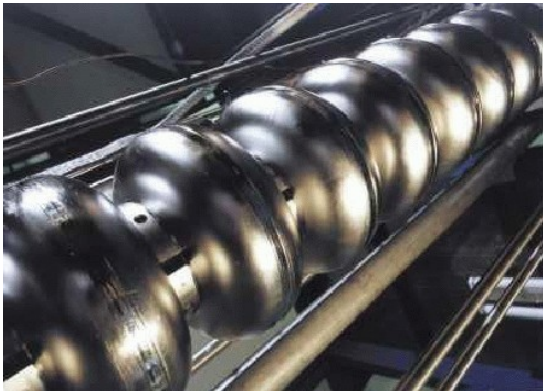
**I speak in no way for any European Body**

# The International Linear Collider ILC

## Linear Electron-Positron Collider



**Total Footprint 31 km**



### Technology for Main Linac

Superconductive RF cavity

ITRP Recommendation  
at ICHEP 2004 in Beijing

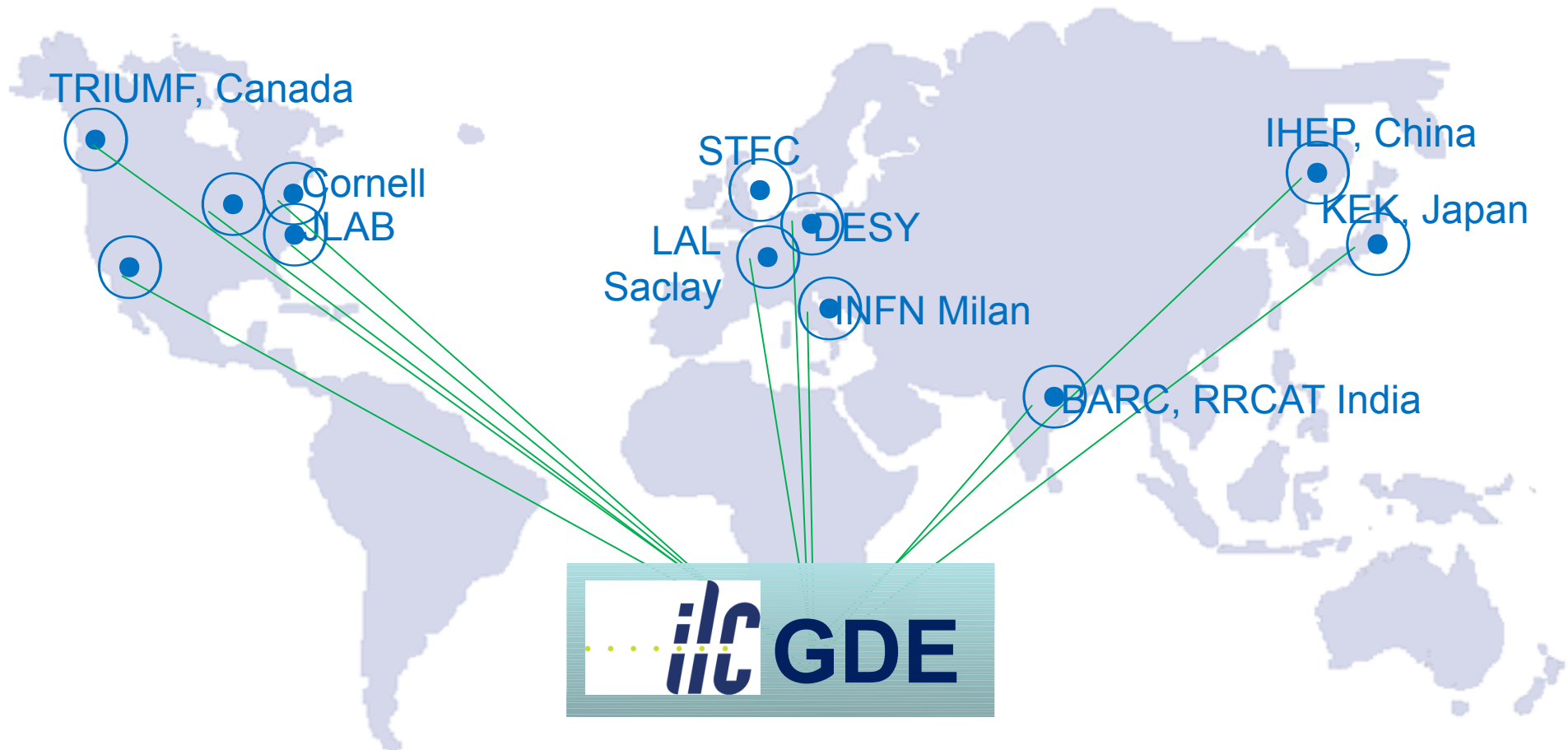
### Main parameters

- $\sqrt{s}$  adjustable from 200 - 500 GeV
- Luminosity  $\rightarrow \int L dt = 500 \text{ fb}^{-1}$  in 4 years
- Ability to scan between 200 and 500 GeV
- Energy stability and precision below 0.1%
- Electron polarisation of at least 80% Option: Polarised Positrons
- **To be upgradeable to 1 TeV**

**Present outlook**

- $\rightarrow$  Technical design report 2012
- $\rightarrow$  **R&D Project for higher Energies CLIC**

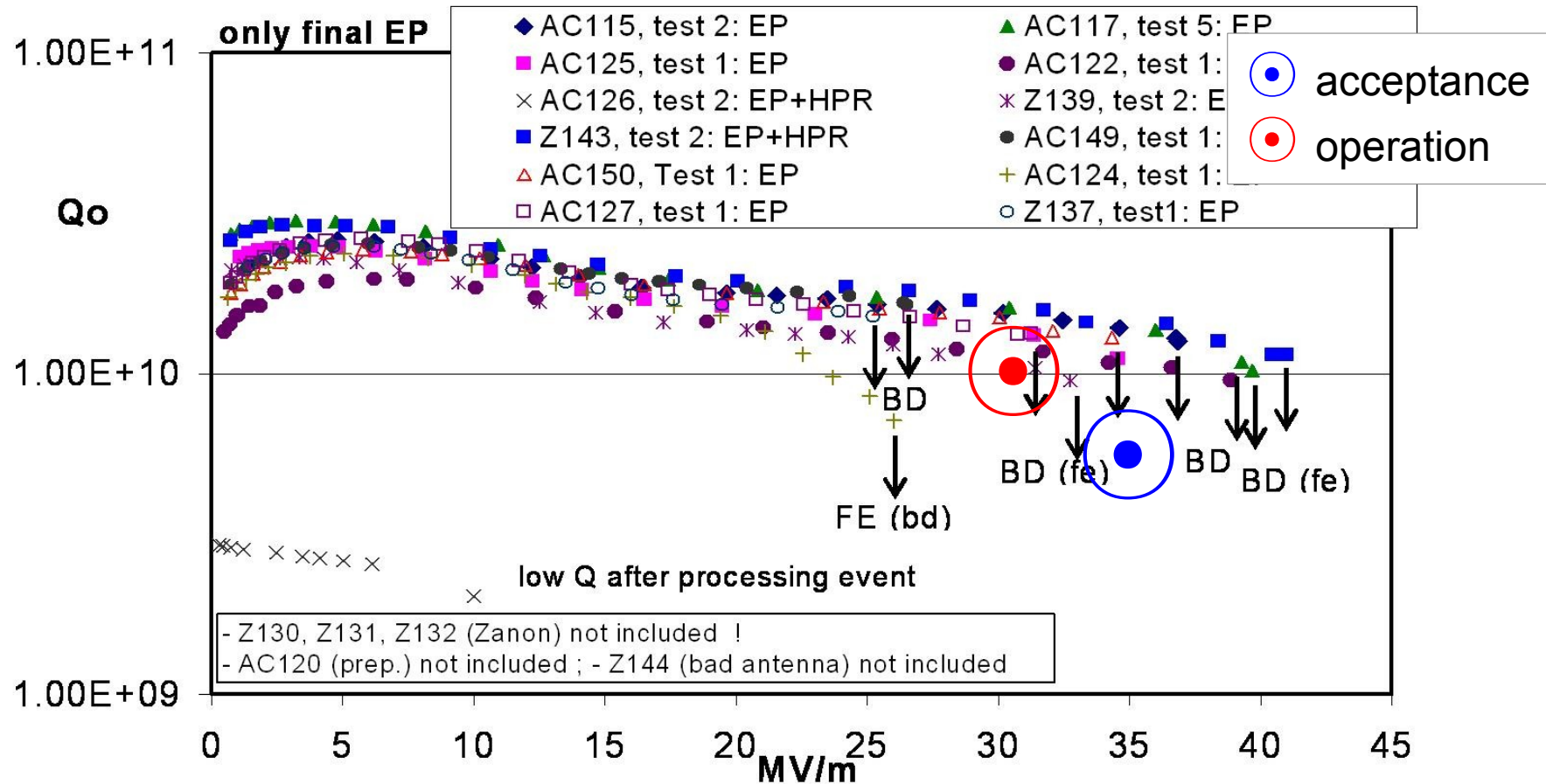
# Global SCRF technology



**Important GDE goal:**

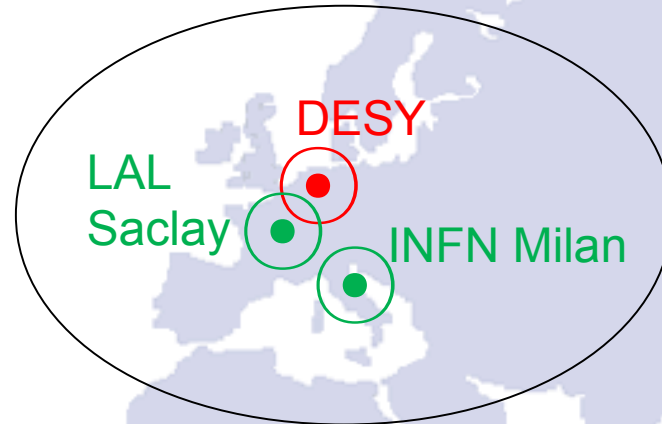
**Promote development of 1.3GHz nine-cell expertise & infrastructure in all three regions**

# Global cavity gradient result - EU



DESY data, D. Reschke et al., SRF2009, TUPPO051.

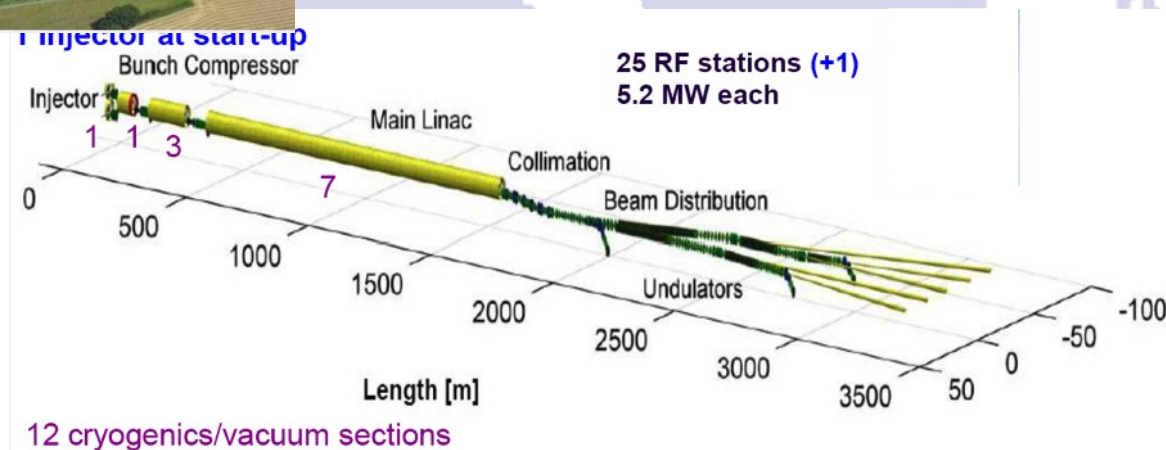
# European effort in RF Technology



- 17.5 GeV (20 GeV)
- 100 Cryomodules
- 800 cavities
- Gradient:
  - **23.5 MV/m**
  - **(28 MV/m)**

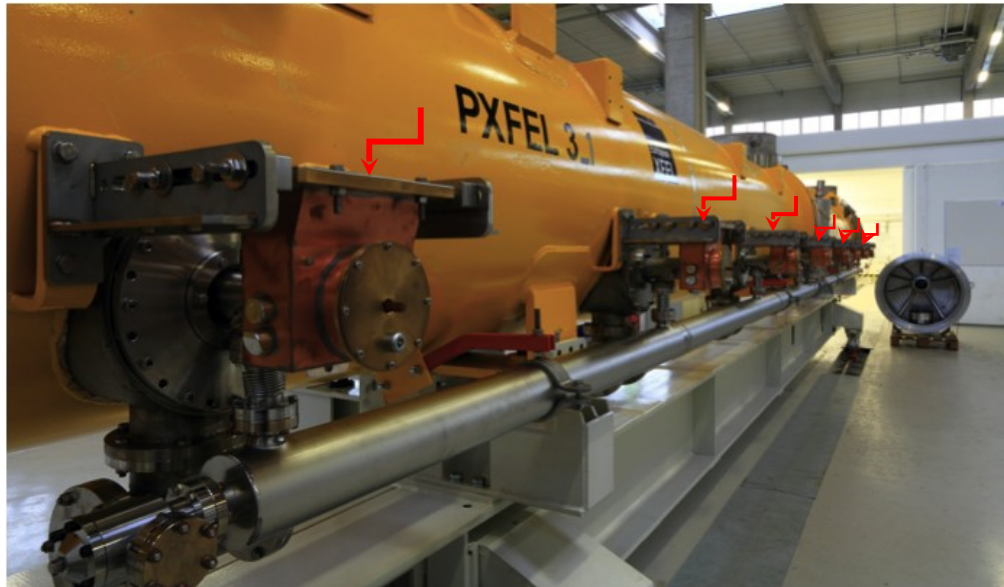
- Industrialisation & mass production
  - **1 CM / week**

- “In-kind” international model



# Couplers and Cryomodules for XFEL in France

The linac will consist of 100 Cryo-modules equipped with 800 power couplers (8 coupler/module).



The LAL contributes to the XFEL project by assuming the following tasks:

- The industrial monitoring and coupler fabrication control at production sites.
- The RF conditioning of the 800 produced couplers at LAL

▪ Assembly of cryomodules at CEA/Saclay

## 2012 - The “TDR Year”

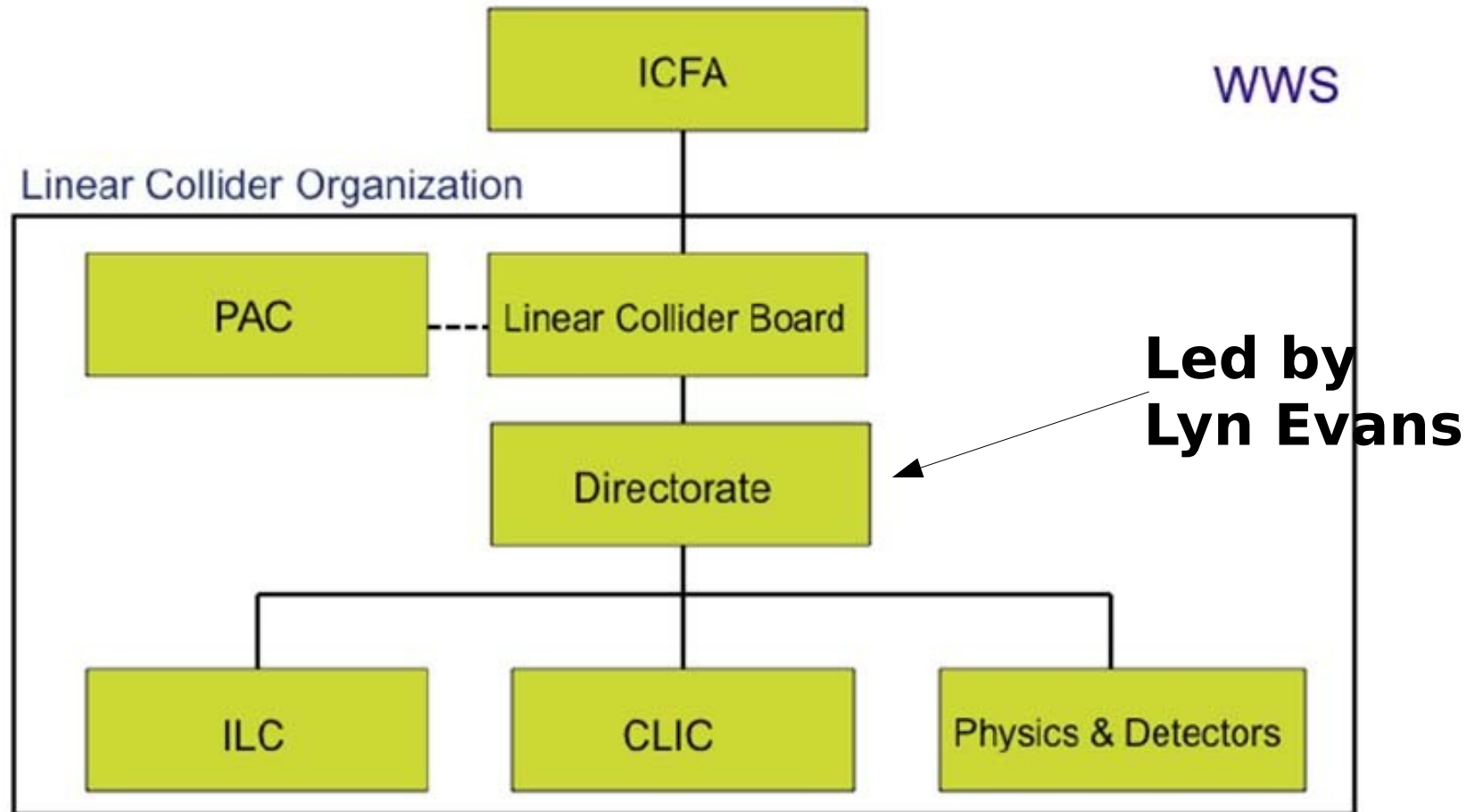
- June 2011: Publication of Interim Report
- TDR by the end of 2012
  - ... preceded by four Baseline Technical reviews
    - Positron source and damping rings
    - Accelerator systems
    - **Main linac and super-conducting radio frequency systems**
    - **Conventional facilities**
- 29/2/12 Release of final version of beam line parameters for TDR
  - No travelling focus, optimisation of crab waist shift to regain luminosity
- Official TDR ceremony at Tokyo 15/12/2012



# Next steps?

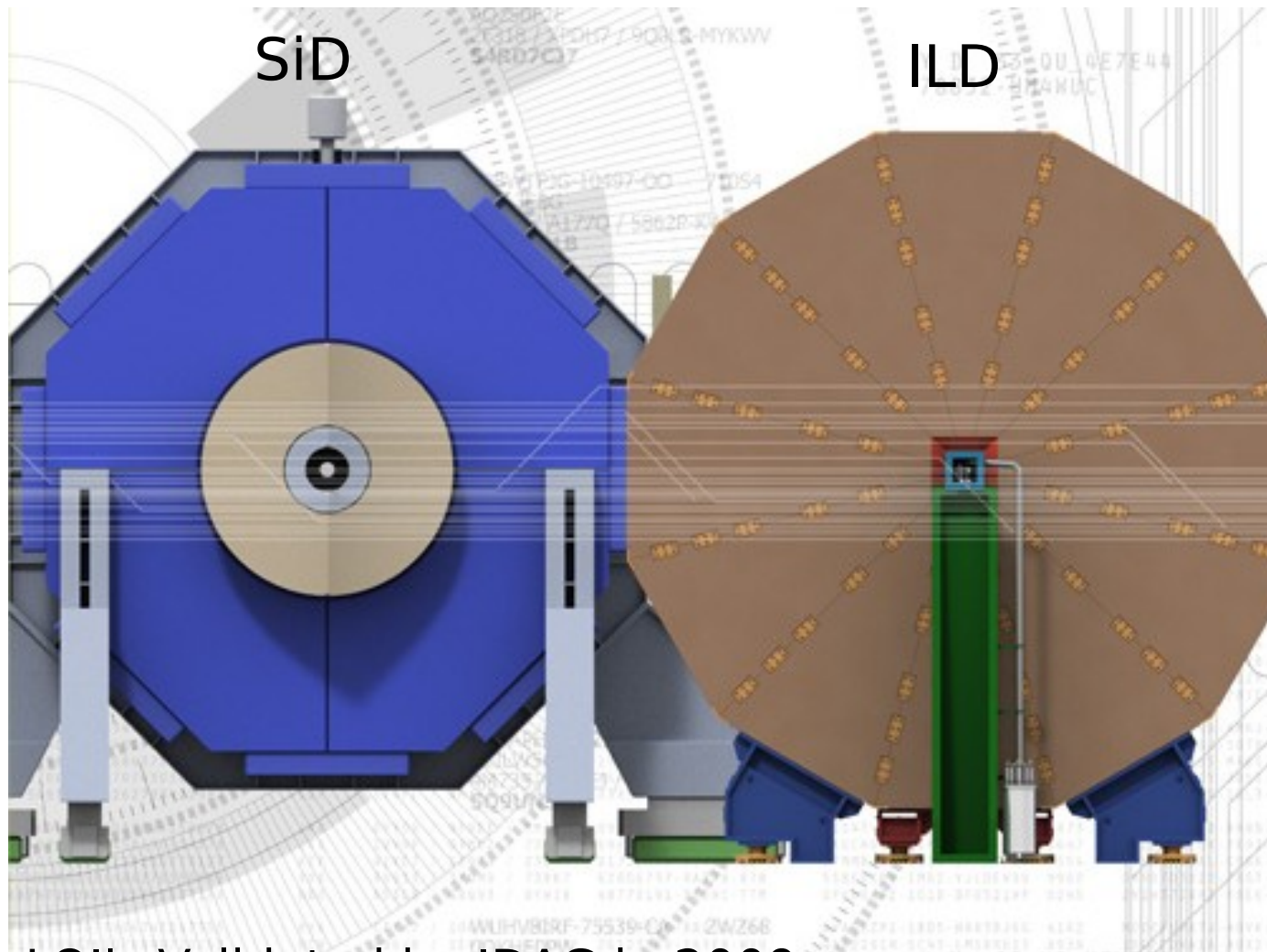
Mandate of GDE will end at the end of 2012

Organisation after 2012



Transitional organisation to assure continuity of activities until project approval

# Physics and Detector R&D



- LOI's Validated by IDAG in 2009
- Now moving towards **D**etector **B**aseline **D**esign
- Publication at the end of 2012, i.e. in phase with TDR
- Concepts based on input from physics studies and detector R&D organised in R&D collaborations

# Physics studies

## LC Input to European Strategy

ILC ESD-2012/4, CLIC-Note-949 (July 30, 2012)

### The Physics Case for an $e^+e^-$ Linear Collider

James E. Brau<sup>a</sup>, Rohini M. Godbole<sup>b</sup>, Francois R. Le Diberder<sup>c</sup>, M.A. Thomson<sup>d</sup>,  
Harry Weerts<sup>e</sup>, Georg Weiglein<sup>f</sup>, James D. Wells<sup>g</sup>, Hitoshi Yamamoto<sup>h</sup>

*A Report Commissioned by the Linear Collider Community<sup>†</sup>*

<sup>(a)</sup>Center for High Energy Physics, University of Oregon, USA; <sup>(b)</sup>Centre for High Energy Physics, Indian Institute of Science, Bangalore, India; <sup>(c)</sup>Laboratoire de l'Accélérateur Linéaire, IN2P3/CNRS et Université Paris-Sud, France; <sup>(d)</sup>Cavendish Laboratory, University of Cambridge, UK; <sup>(e)</sup>Argonne National Laboratory, Argonne, USA; <sup>(f)</sup>DESY, Hamburg, Germany; <sup>(g)</sup>CERN, Geneva, Switzerland; <sup>(h)</sup>Tohoku University, Japan

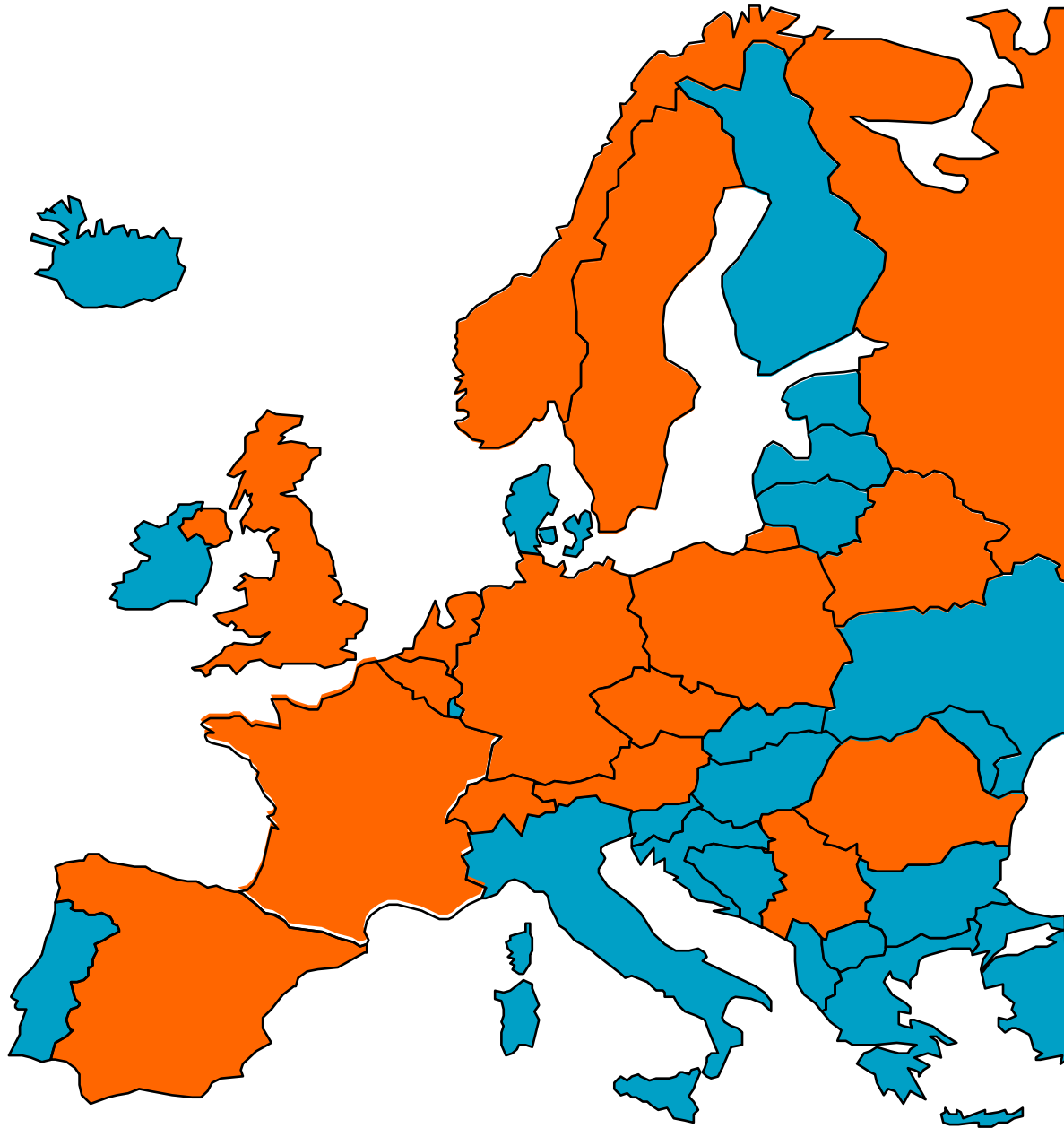
- Physics studies for DBD were performed in France, Germany, UK, CERN, Spain
- Not sure how many theory groups are working for LC  
I know of groups in Germany, France, Spain and Austria but there are for sure more

# Peskin's Editorial team for ILC Physics Book

General:	Jaehoon Yu
Higgs:	Keisuke Fujii, Heather Logan
Two-Fermion:	Yuanning Gao, Maxim Perelstein, <u>Sabine Riemann</u>
W bosons:	Tim Barklow, <u>Juergen Reuter</u>
Top quark:	Andre Hoang, Andrei Nomerotski, <u>Roman Poeschl</u>
Extended Higgs:	Shinya Kanemura, <u>Aurore Savoy-Navarro</u>
Supersymmetry:	Howard Baer, <u>Jenny List</u>
Cosmology:	<u>Geraldine Servant, Tim Tait</u>

and the many authors cited in the report who have investigated the physics capabilities of the ILC !

# (Generic) R&D for LC detectors in Europe



Remark: Detector R&D in Europe monitored by new ECFA panel 13

# Examples for detector R&D collaborations



Time Projection Chamber  
for Linear Collider



Highly granular calorimeters  
for Linear Collider



Forward calorimeters  
for Linear Collider

**S**ilicon tracking for the  
**I**nternational  
**L**inear  
**C**ollider

**PLUME**

Silicon tracking and  
ultrathin vertex detectors

- Continuing support in many European countries  
Fair to say that Germany, France and CERN hold the biggest share
- Structuring of R&D by support from EU



## Europe and the role of CERN

- CERN is the major research center in Europe for particle physics

Hot news: CERN is observer to United Nations General Assembly

Adoption of UN Resolution 14/12/12

Meeting CERN DG with UN General Secretary Ban Ki-moon on 17/12/12

- CERN Council has the charge to organise the particle physics research program in Europe  
Council is consulted by **S**cientific **P**olicy **C**ouncil
- Significant European participation in any major project in particle physics seeks support by CERN
- CERN permits 'smaller' countries the access to big science and therefore to unique research opportunities



# European strategy

To be reformulated each ~ 6 years, started in 2006

Preparatory group and strategy group set up by CERN Council

Written statements of  
different actors of PP

In **Europe and worldwide**

**Open symposium**  
**Cracow September 2012**  
**500 participants**

Summary of symposium  
In form of "briefing book"  
(available soon)

**Strategy group**  
- Delegates of members  
states  
- Directors of major  
european labs

**Drafting session**  
**Erice Jan.2013**

Presentation of  
draft to CERN Council  
March 2013

Adoption  
Strategy by  
CERN Council  
In May 2013

**The next European strategy will be presented to politicians  
and general public in summer 2013**

# (Personal) summary of Cracow meeting

## - Broad consensus that LHC will have priority

The beast is there and takes beautiful data

## - What's next?

Also a consensus that there has to be a e+e- machine to fully understand 'new' discovered state

Three possibilities:

LEP3: Would allow 'only' Higgs measurements  
and may interfere with LHC operation

CLIC: The broad feeling was that CLIC is not mature  
enough to be decided now

ILC: Physics up to 500 GeV (at least)

Mature technology

Intervention in part. from CERN colleagues to take opportunity in Japan

## - Neutrino physics

Increase the role of CERN in neutrino physics

planning of a long base line experiment CERN → Finland

Speaker emphasised that Neutrino programme is less costly than ILC

## - Smaller projects at CERN e.g. LHeC

... were not discussed in full depth at Cracow

# Remarkable facts/statements around European strategy

- LC Event at IEEE

Statement by DG of CERN that CERN will not be in competition with an ILC in Japan  
CLIC is rather for Strategy 2018/19

- Statement by the German KET

Welcomes with enthusiasm the efforts in Japan

- Foundation of LC Committee in France

Animated by Marc Winter (IPHC)

Positive atmosphere at IN2P3/IRFU perspectives meeting in April 2012

- Spanish community expressed strong interest in ILC

- Apologises if I have missed other statements/events

# ECFA LC2013

European Linear Collider Workshop

27 – 31 May 2013

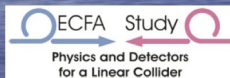
DESY, Hamburg

Programme Committee

NN  
NN  
NN



DFG



Local Organising Committee

Ties Behnke (DESY), Karsten Buescher (DESY, chair), Eckhard Elsen (DESY), Manfred Fleischer (DESY), Brian Foster (DESY and Univ. of Hamburg), Volker Guelzow (DESY), Wolfgang Lohmann (DESY), Joachim Mnich (DESY), Gudrid Moortgat-Pick (Univ. of Hamburg), Christian Mrotzek (DESY), Felix Sefkow (DESY), Nicholas Walker (DESY), Georg Weiglein (DESY)



HELMHOLTZ  
GEMEINSCHAFT



<http://lc2013.desy.de>

## ECFA Workshop 2013

- Comes right after 'digestion' of TDR, DBD etc.
- Comes right after adoption of European strategy
- Comes right to prepare LCWS13 at Tokyo

=> The place to go  
In May 2013

# Summary and outlook

- Europe has a strong commitment to the SCRF technology due to XFEL Great science machine which is ideally placed to prepare the ILC
- European strategy making is in full swing
- Europe's first priority will remain the LHC

Magic question (not only in Europe):

What precisions can LHC reach with  $\sim 3\text{ab}^{-1}$  for Higgs, top

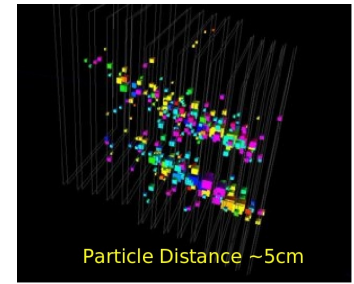
- Many people **feel/fear** that precision measurements at the ILC are the way to go
  - (I think) we need to repeat over again that an ILC in Asia is no threat to future of CERN
  - CERN management has clear view on that
- Encouraging messages/news/statements from European countries and CERN management
- Stay tuned for news about European strategy

# Backup

# Detector R&D

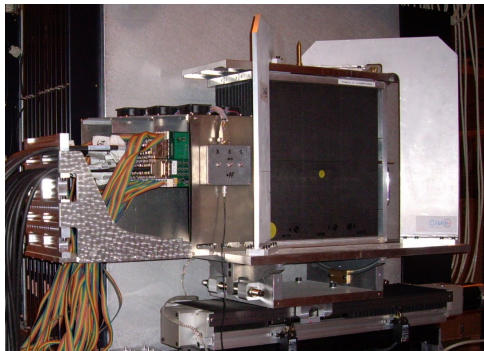


Precision physics at LC require highly granular calorimeters



## Physics Prototypes

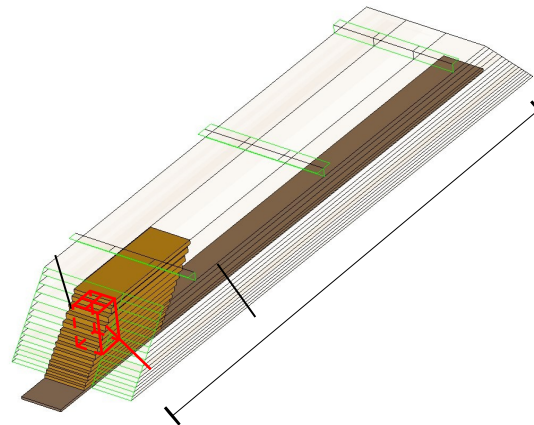
Proof of principle  
2003 - 2011



- Number of channels : **9720**
- Weight : **~ 200 Kg**

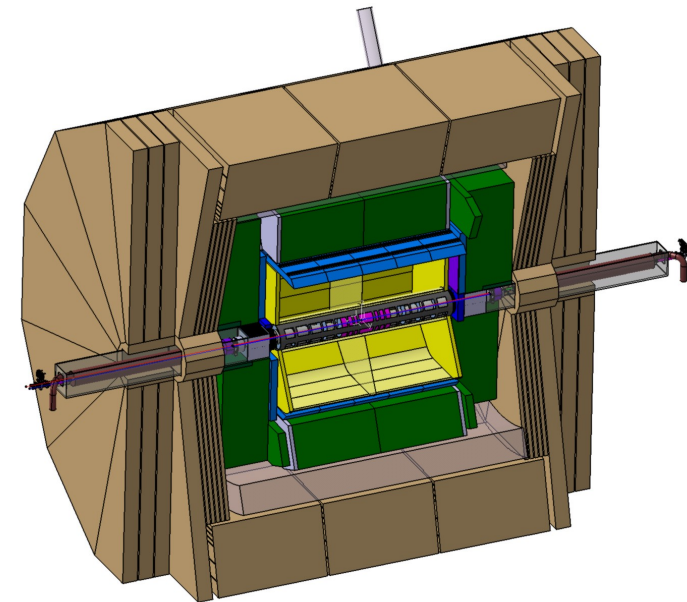
## Technological Prototypes

Engineering challenges  
2009 - ...



- Number of channels : **45360**
- Weight : **~ 700 Kg**

## LC Detector

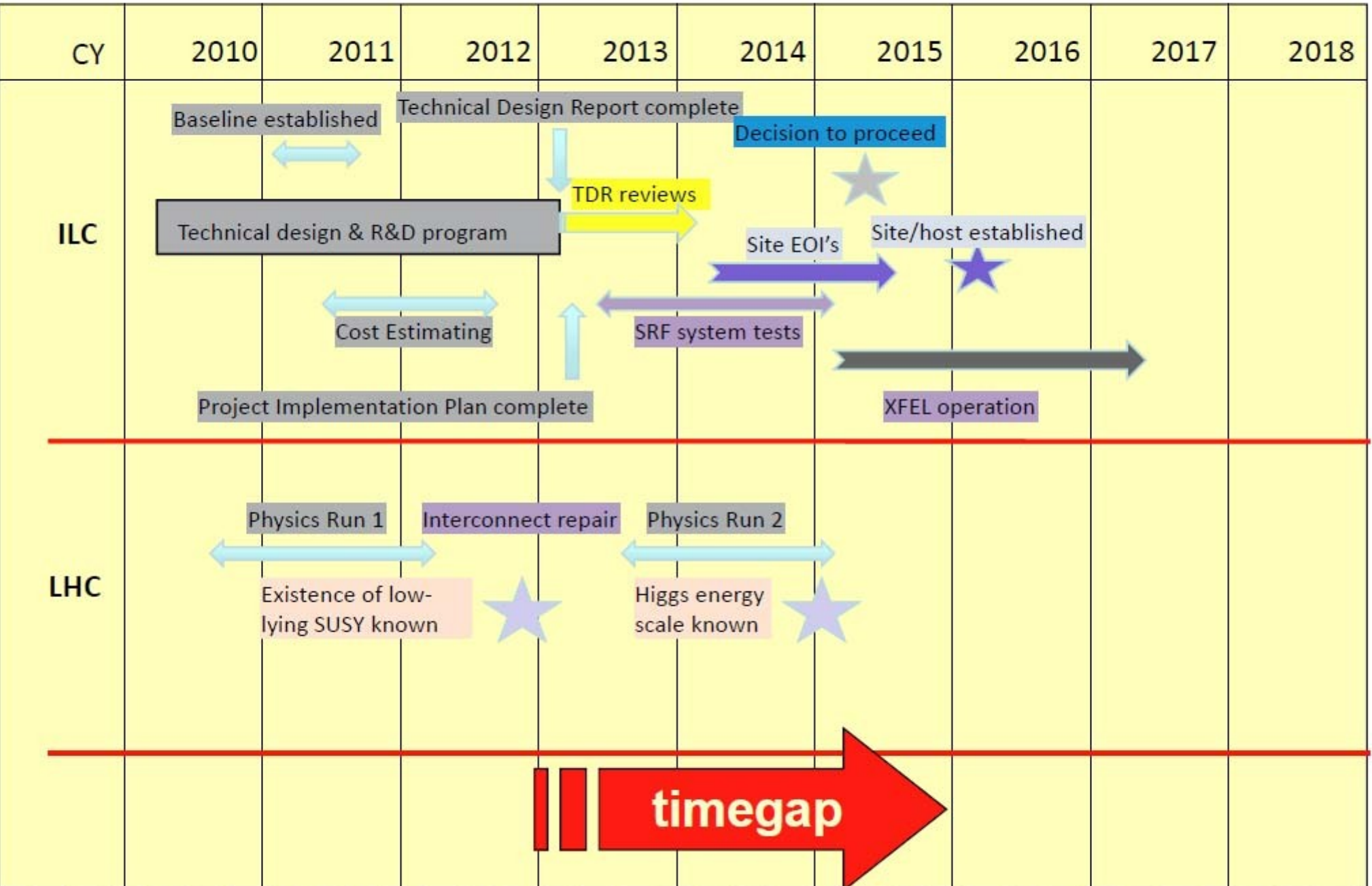


- **Electromagnetic Calorimeter :**
- Channels : **110 10<sup>6</sup>**
- Total Weight : **~130 t**

2012 prototypes for DBD are taking shape

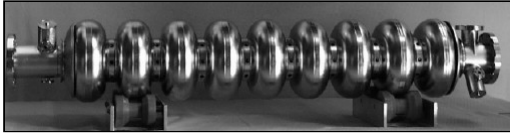


# ILC possible timeline





# Progress in Cavity Yield

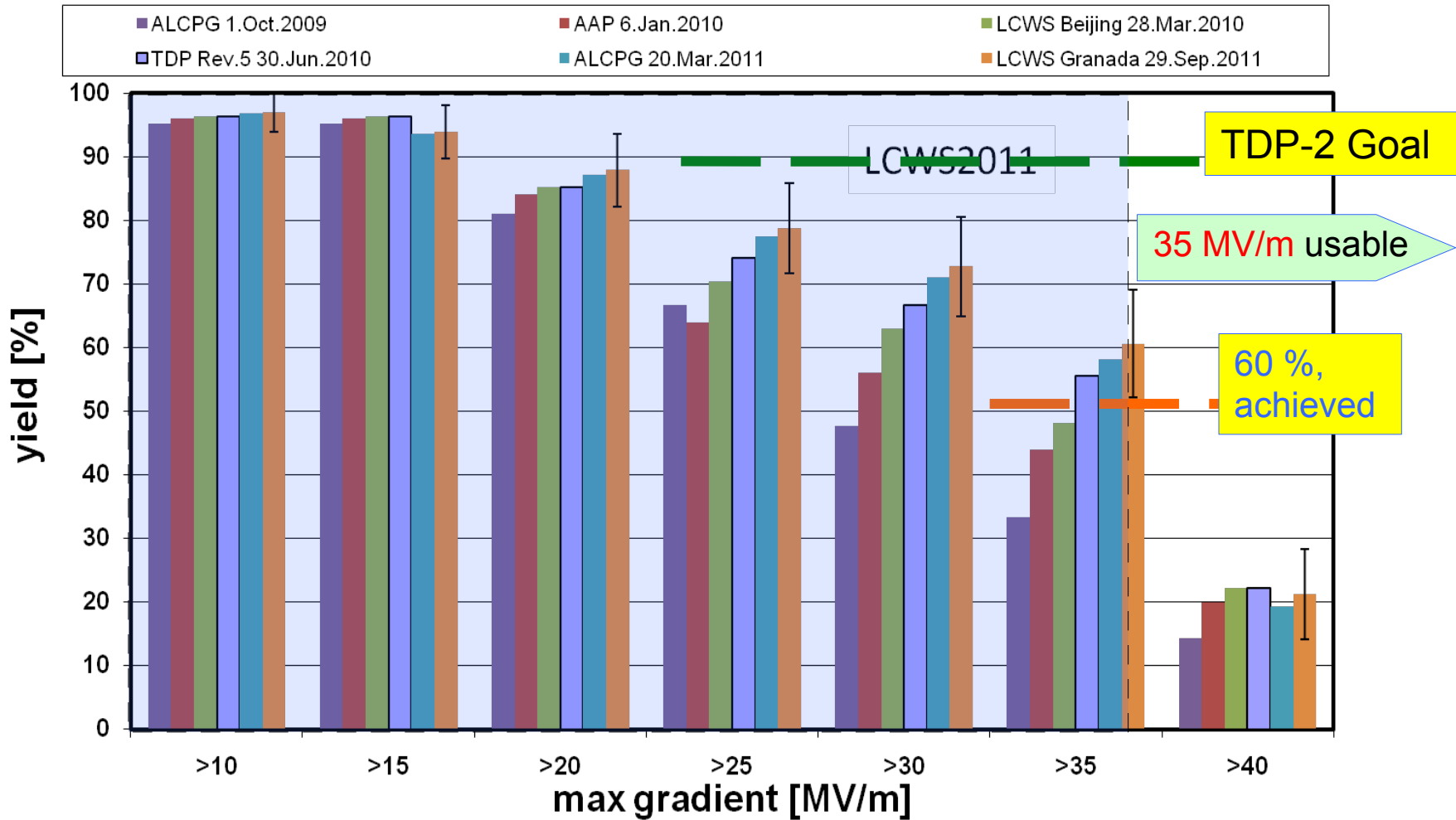


Updated, Sept., 2011

Electropolished 9-cell cavities

Plot courtesy  
Camille Ginsburg of FNAL

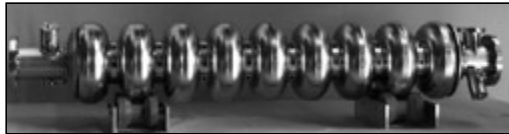
/KEK (combined) up-to-second successful test of  
cavities from established vendors



12-02-28, A.  
Yamamoto

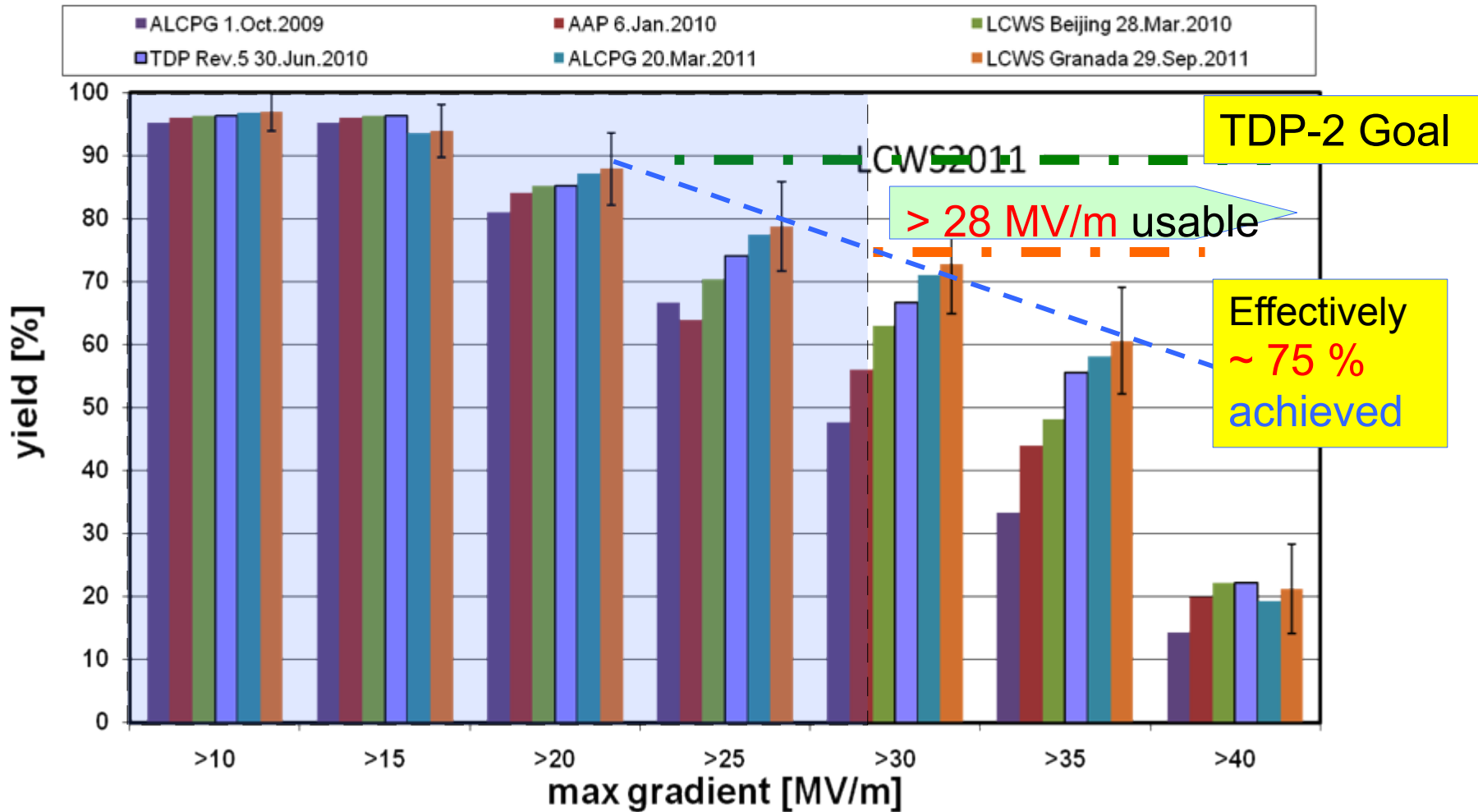
# Progress Integrated in Cavity Gradient Yield

Updated, Sept., 2011



Plot courtesy  
Camille Ginsburg of FNAL

Electropolished 9-cell cavities  
/KEK (combined) up-to-second successful test of  
cavities from established vendors

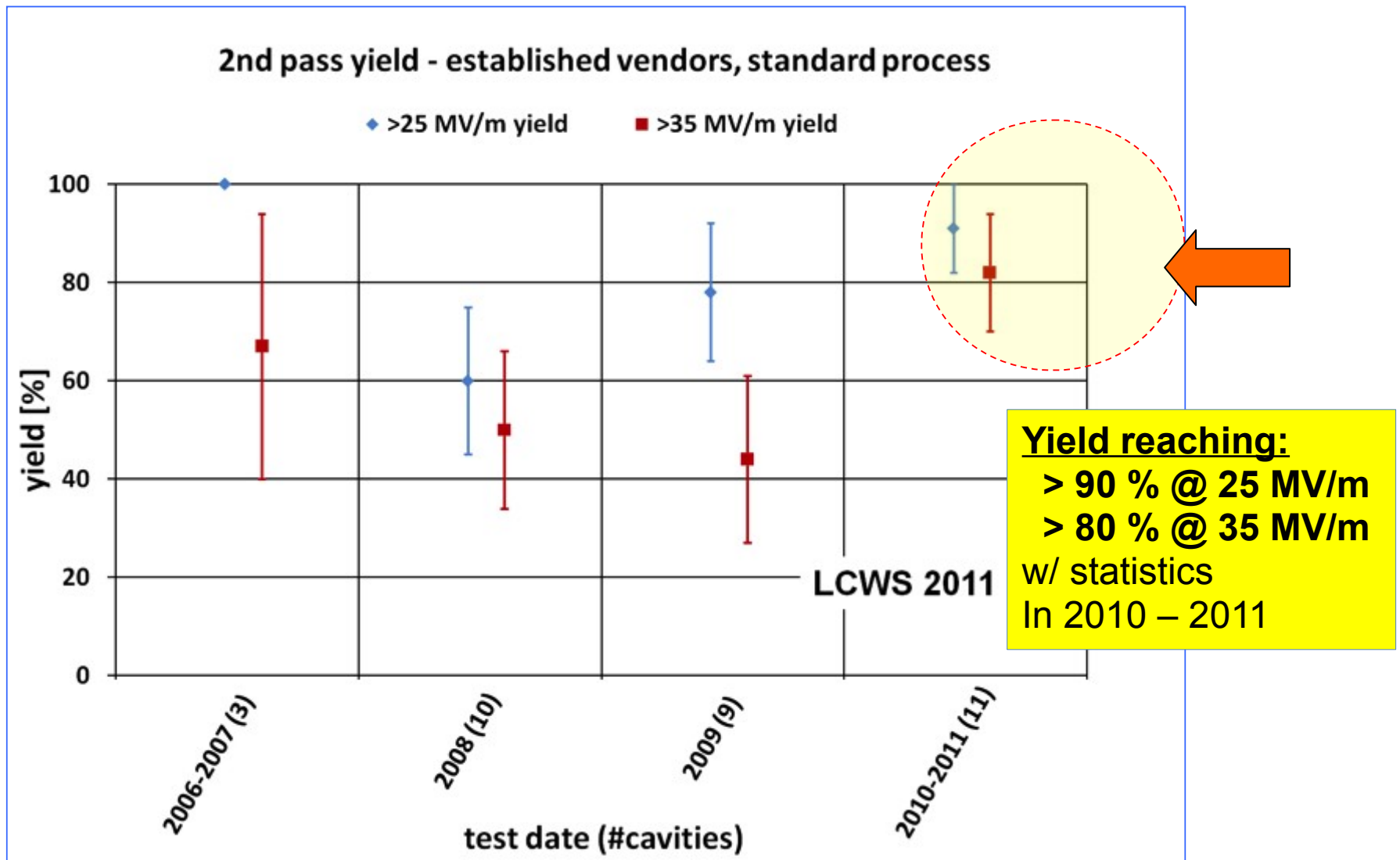


AAA-120215,  
Yamamoto

ILC-ml-scrf-Progress

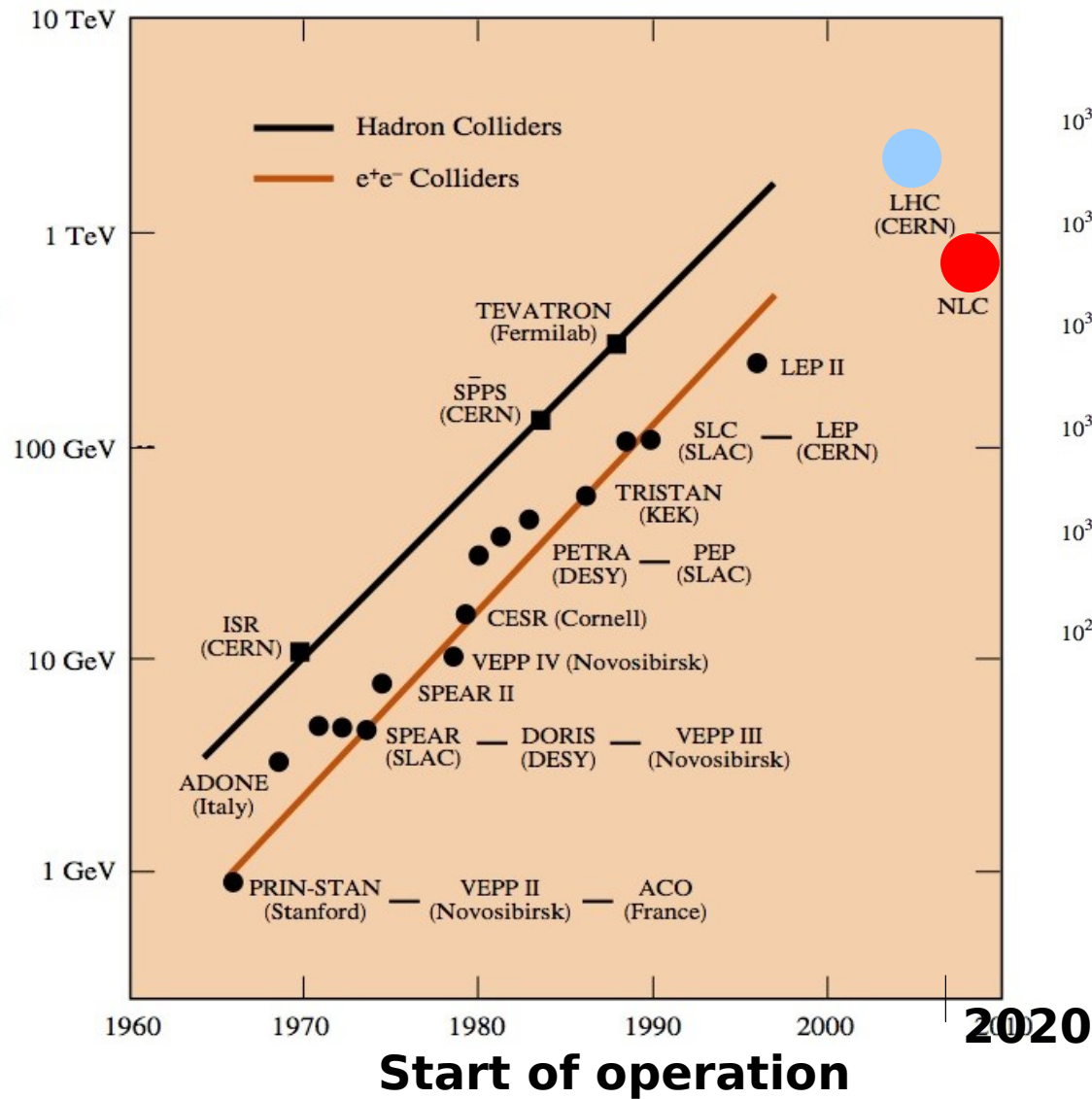
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# Yearly Progress in Cavity Gradient Yield

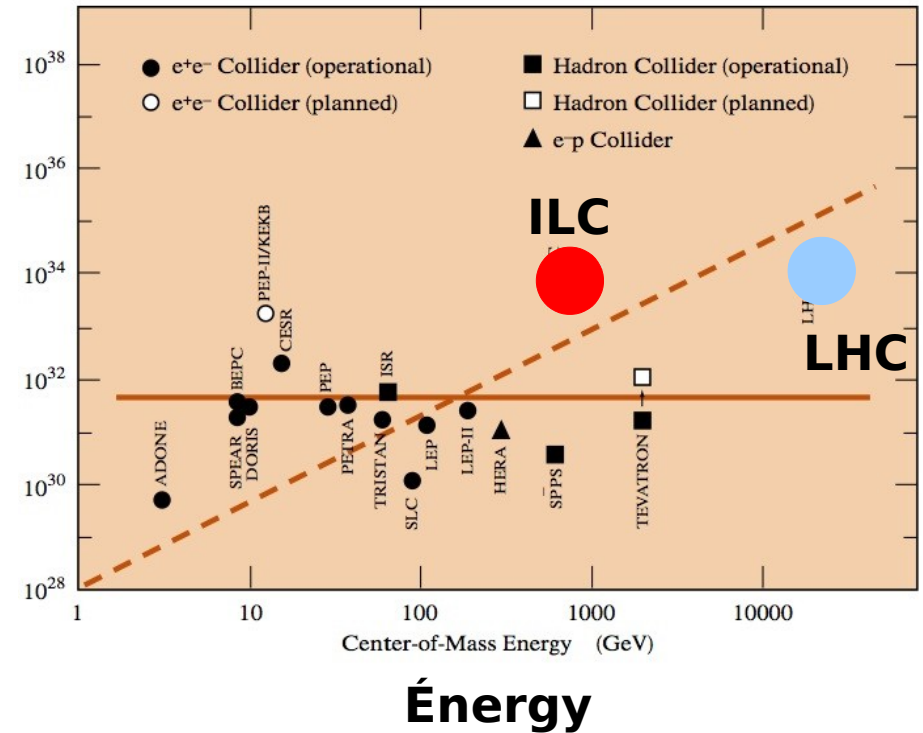


# Accelerators of yesterday, today and tomorrow

## Energy

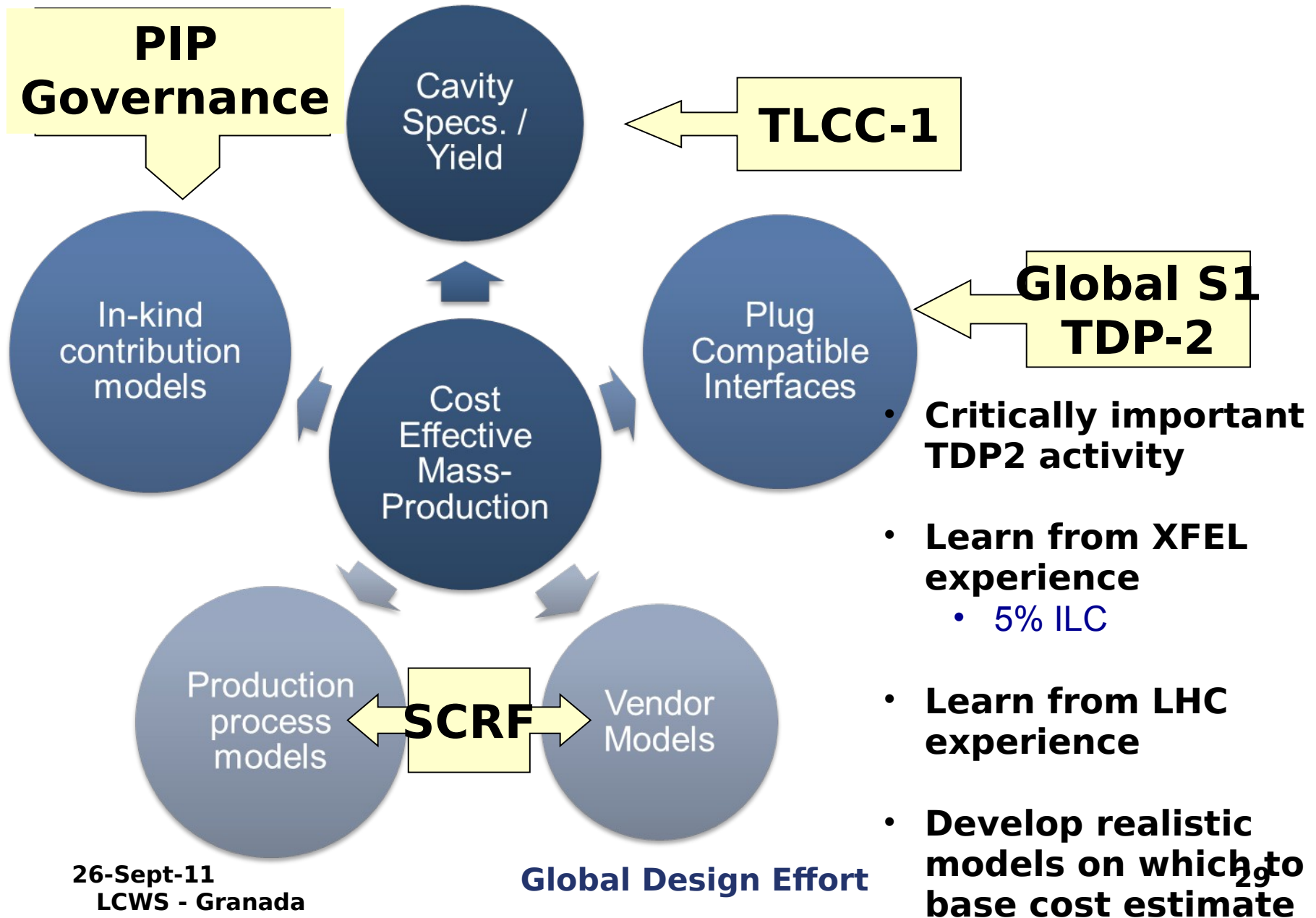


## Luminosity



## Parallel Running of Hadron and Electron Machines

# (Global) Mass Production (SCRIF)



26-Sept-11  
LCWS - Granada

# World wide R&D effort - Example LCTPC

