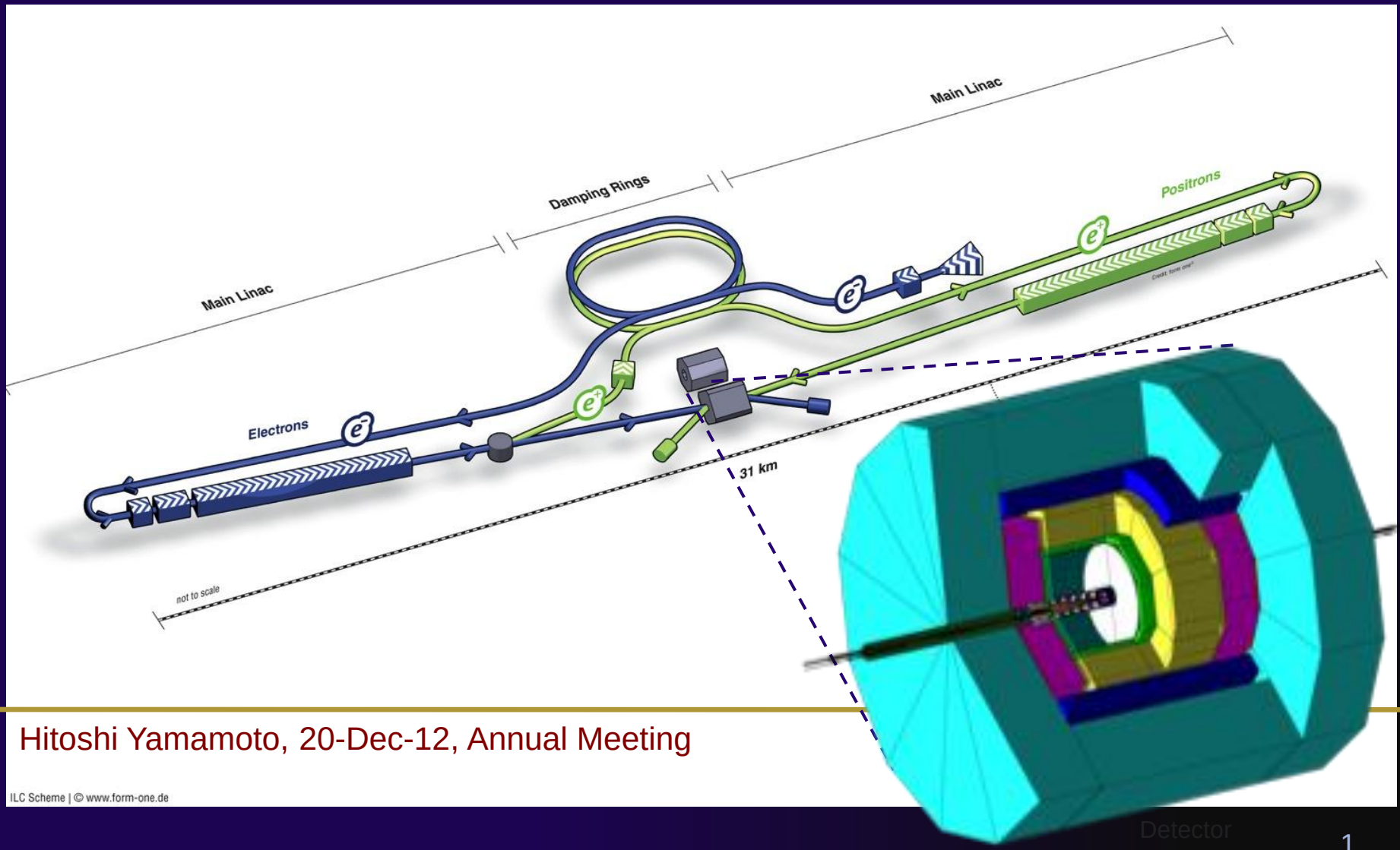
JSPS specially-promoted research

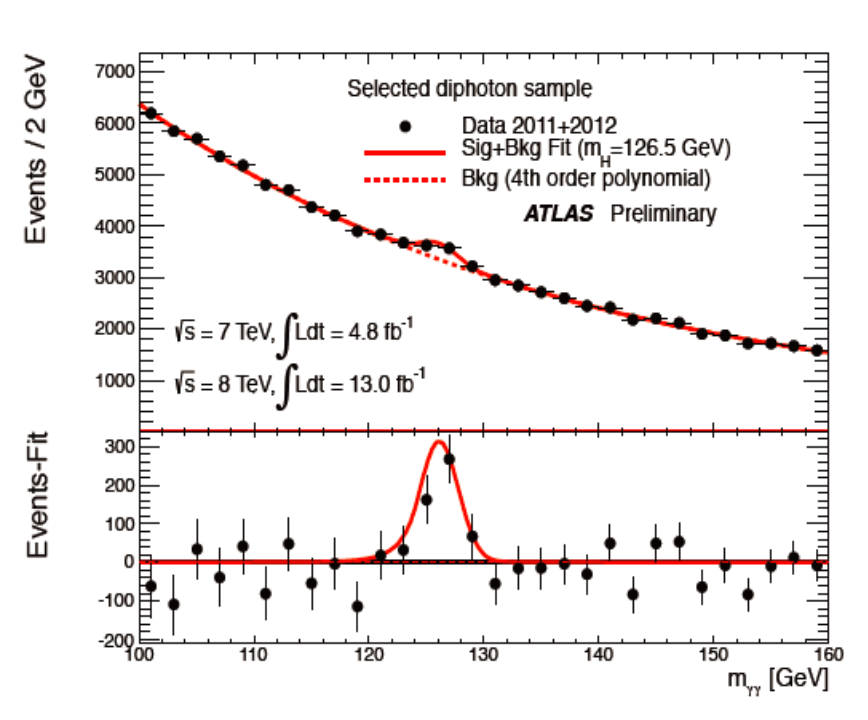
A Global R&D Program of a State-of-the-art Detector System for ILC



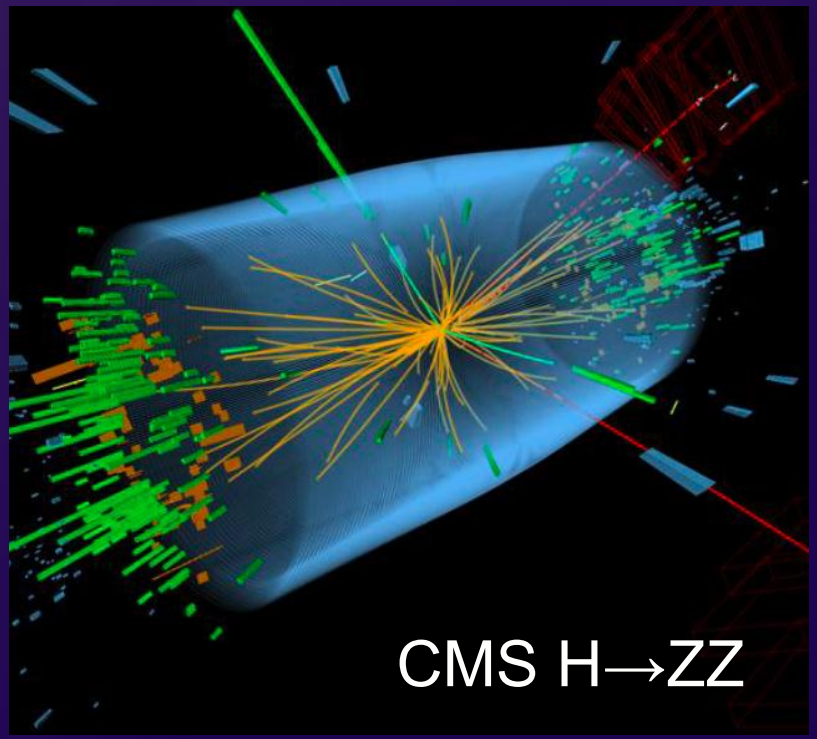
Hitoshi Yamamoto, 20-Dec-12, Annual Meeting

Higgs-like Particle Discovered

2012 July 4



ATLAS H→γγ
(Dec 13, 2012)

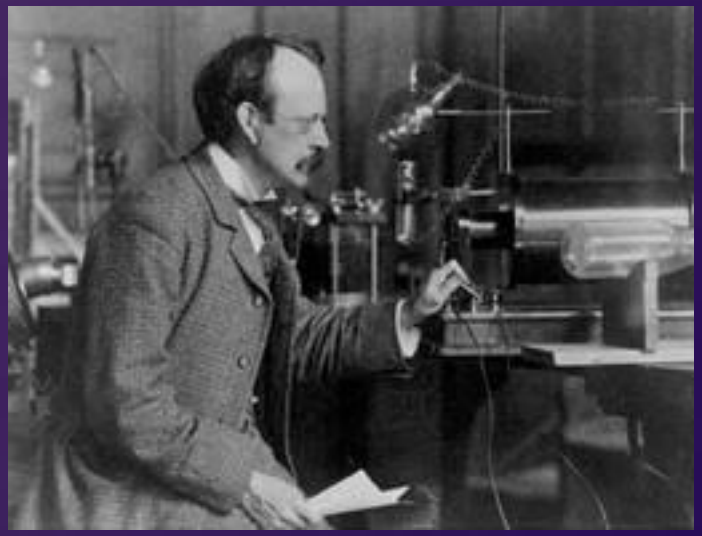


What the Discovery Means

- Higgs is unlike any other elementary particles
  - It is not spin-1/2 (fermions), not spin-1 (gauge particles)
  - Fills the vacuum of Universe
  - Source of all masses of particles in the standard model
- Higgs is the last particle to be discovered in the standard model
- Not the end of the story:
  - Mass of Higgs does not make sense (the fine tuning problem)
  - Drak matter is not in the standard model
  - So many parameters with indicative patterns

A New Era of Particle Physics Has Begun!

- Comparable to discovery of electron, nucleus…
  - They opened the field of particle physics



J. J. Thomson

Earnest Rutherford

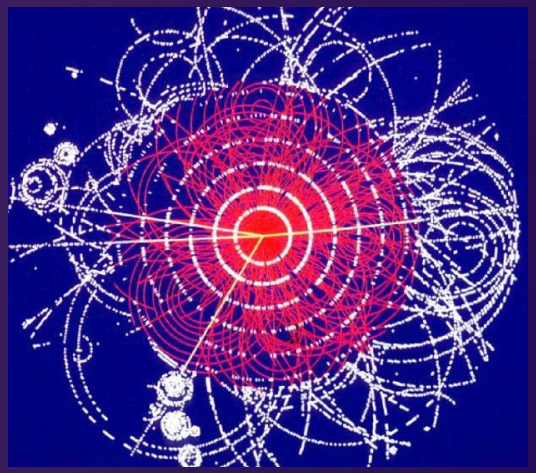
- The new era will be led by the ILC.

LC features : cleanliness

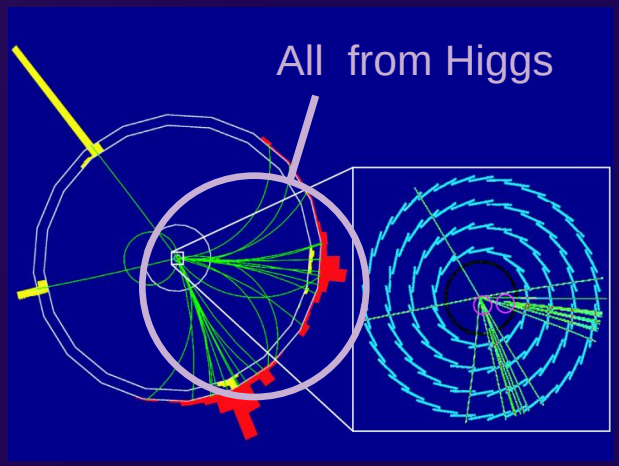
- Collision of two elementary particles
  - electron + positron at LC
  - proton + proton at LHC
    - Proton = 3 quarks + gluons

→ Signal is clearly seen without much noises
→ Trigger-less data taking
→ Theoretically clean (less theoretical uncertainties)

LHC



LC



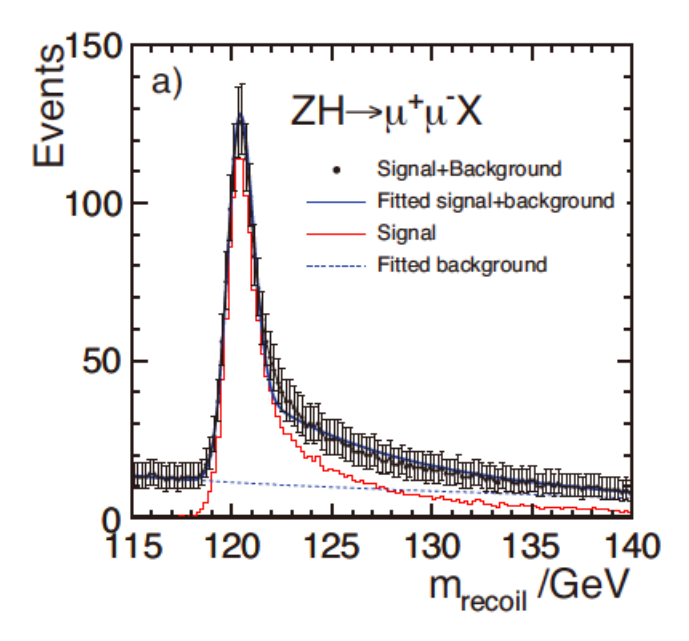
LC features : control

- Initial state of electron-positron interaction :
  - Energy-momentum 4-vector is specified
  - Electron polarization is specified
    - Positron polarization is optional

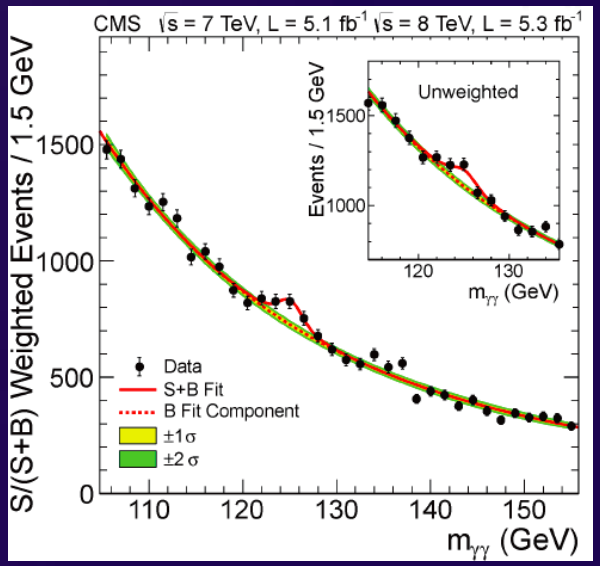
Energy-momentum 4-vector

→ e.g. recoil mass analysis

Higgs to ALL (including invisible final state) is seen



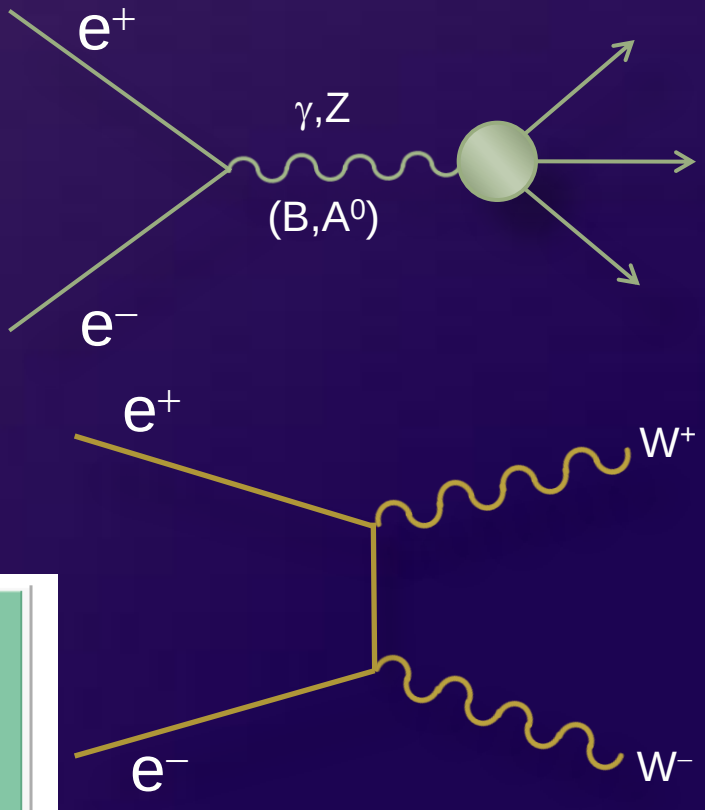
LC

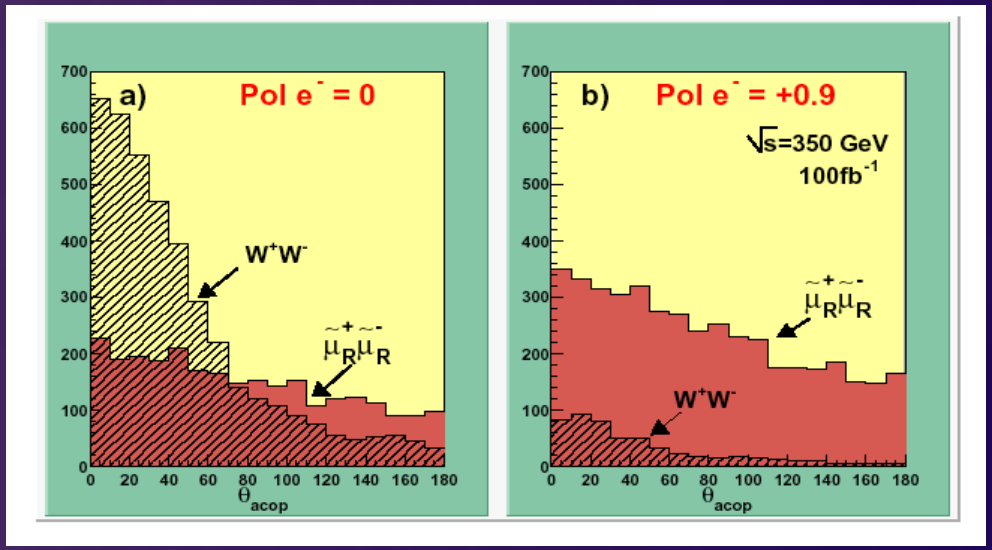


LHC

Electron polarization

- Specify the intermediate state
  - Right-handed e- turns off A^0
    - Information on the character of the final state
- Right-handed e- turns off W
  - Background rejection

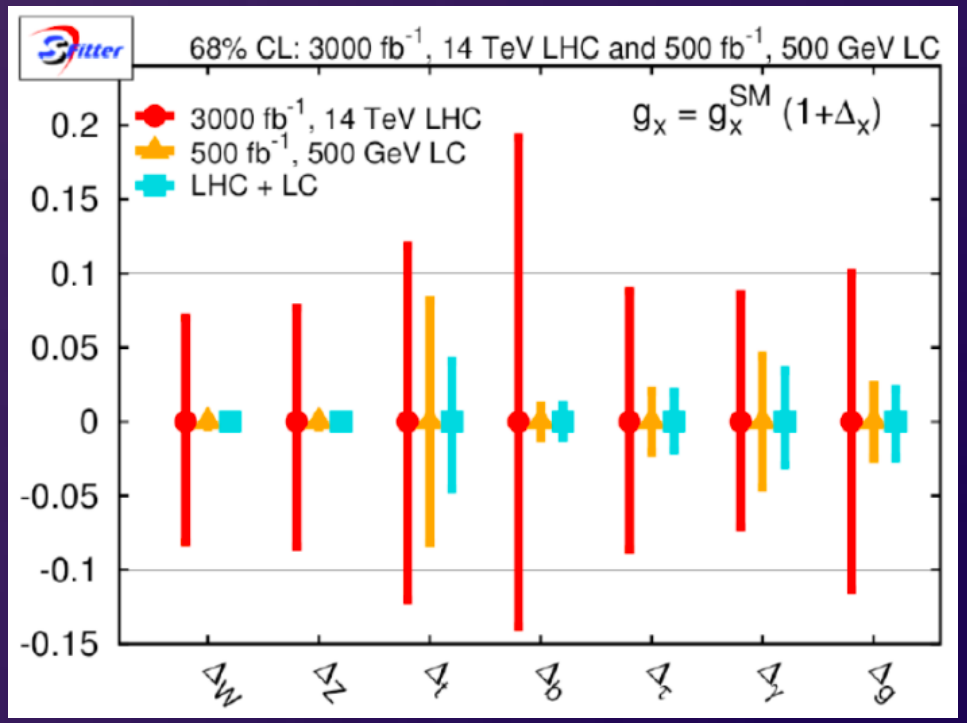




e.g. acoplanar muon pair produciton

Measurement errors of Higgs couplings

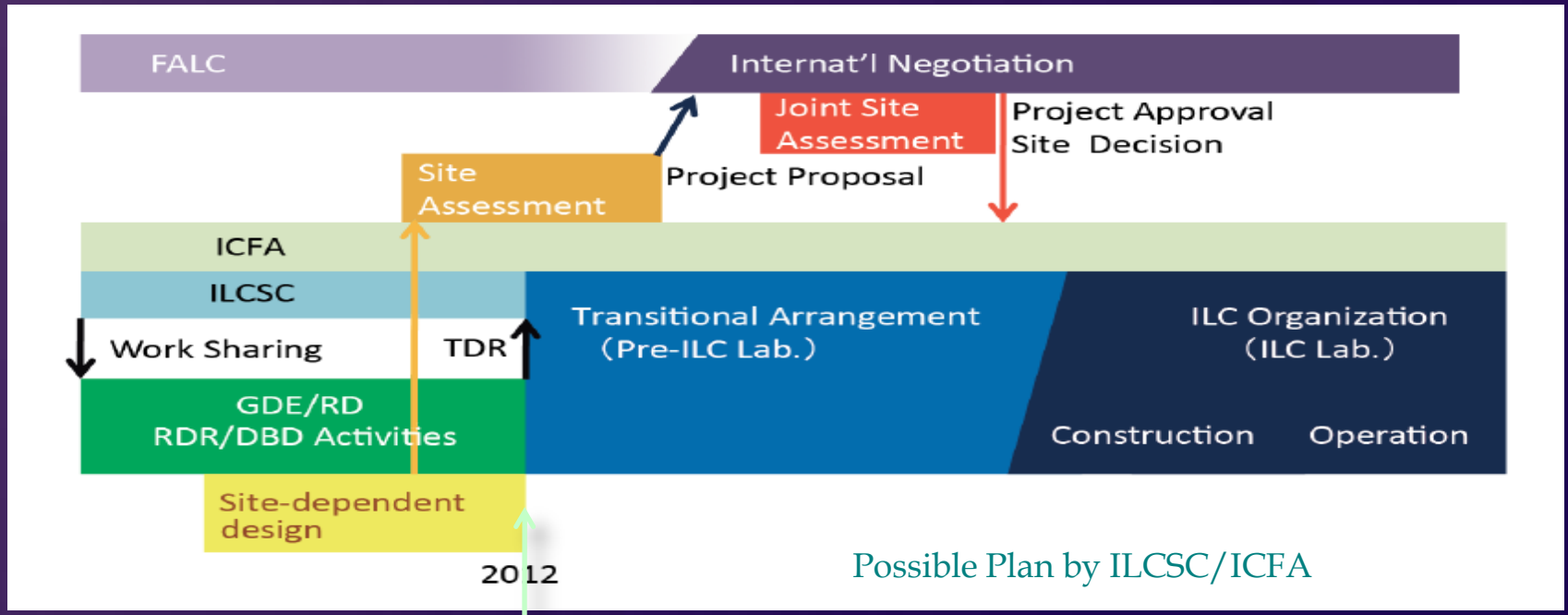
LHC 14 TeV 3000 fb-1 and LC 500 GeV 500 fb-1



D. Zerwas

Apart from top and γ, LC errors are 1/4~1/10 of LHC
(statistical equivalent: 1~2 orders of magnitude more)

ILC Timeline



TDR: important benchmark

ILC TDR

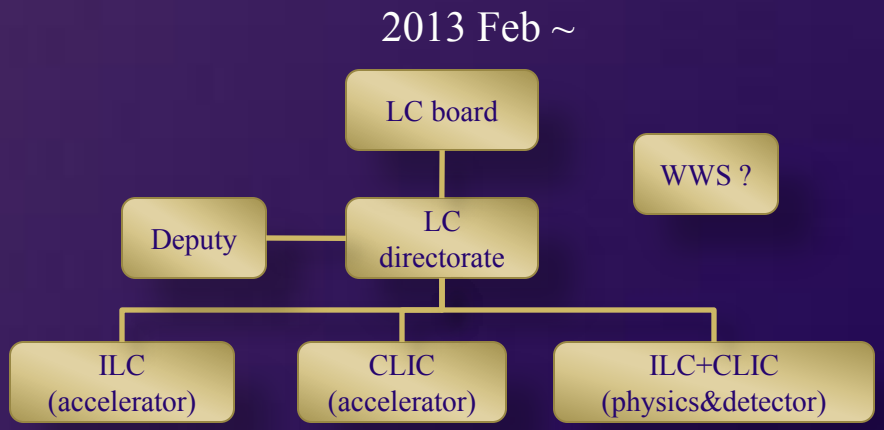
- Vol1: Physics
- Vol2: Accelerator
  - Part 1 - R&Ds
  - Part 2 - Baseline design
- Vol3: Detector ('Detailed Baseline Design')
  - URLs to be announced soon:
    - Documents: http://ific.uv.es/~fuster/DBD-Chapters
    - Signatories: http://www-flc.desy.de/dbd/

ILC TDR

Ceremony for draft completion

15 Dec 2012, Akihabara UDX, Tokyo

Post 2012



LC Board Chair: Sachio Komamiya
LC director: Lyn Evans
Deputy: Hitoshi Murayama
ILC accelerator: Mike Harrison
CLIC accelerator: defined?
ILC/CLIC phys/det : under selection process

Transition Timeline

Dec 15 : TDR (draft) completion

Old organization

Feb 21,22 : ILCSC/ICFA : ‘print-ready’ TDR
beginning of the transition period

Transition Period

June 12 : Hand TDR to the new organizaton,
end of transition period

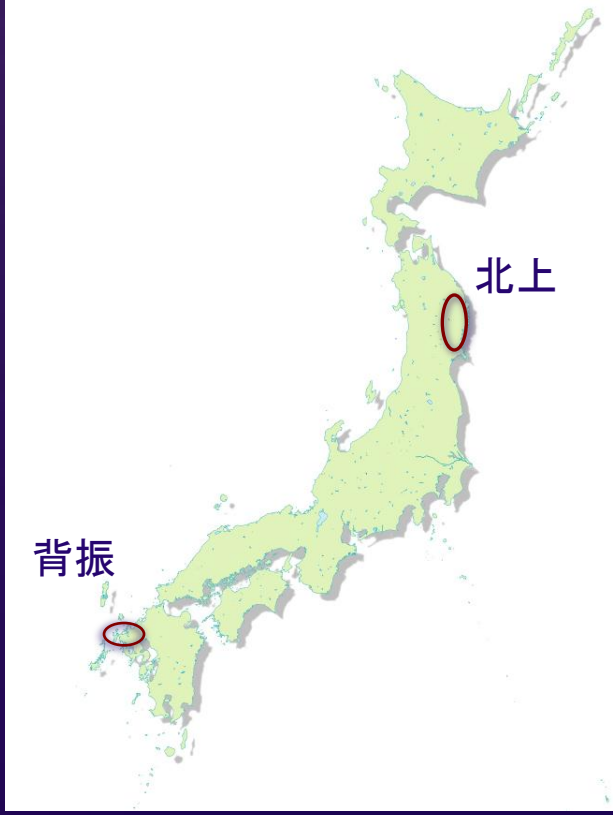
‘ILC – a worldwide event: from design to reality’
(June 24 : Lepton-Photon, TDR submission)

New organization

Two Candidate Sites

- Kyushu
  - Sefuri mountains
- Tohoku
  - Kitakami mountains

Strong local supports



It is of utmost importance that whichever is chosen, the community is united to support the selected site.

LDP election ‘promises’

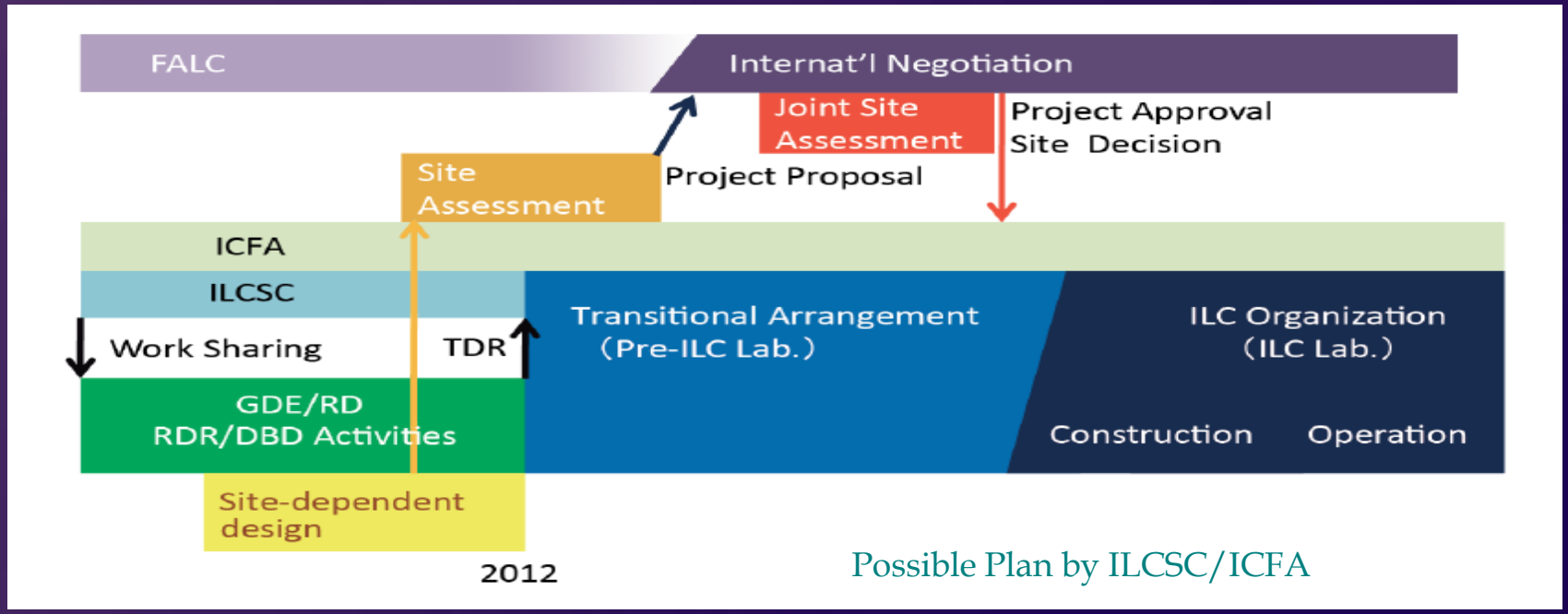
32 Rebuilding true command tower functions that strongly advance science and technology policies

- …We will actively promote the critical fields of energy creation, energy conservation, energy storage, etc. as knowledge-concentrated national strategies - for example, our country should be able to play a leading role in creation of international centers for scientific innovations such as the ILC (the international linear collider) project which is a grand project in the field of particle physics.

92 Creation of globally top-class centers for research and development

- ….We will significantly strengthen supports for universities and public research facilities that perform studies at levels above the intentional standards, such as significant expansion of WPIs and playing a leading role in creation of international centers for scientific innovations such as the ILC (the international linear collider construction) project which is a grand project in the field of particle physics.

Detector Timeline



This program

2011 2012 2013 2014 2015

DBD Engineering Report Collaboration

JSPS specially-promoted research

A Global R&D Program of a State-of-the-art Detector System for ILC

Goal

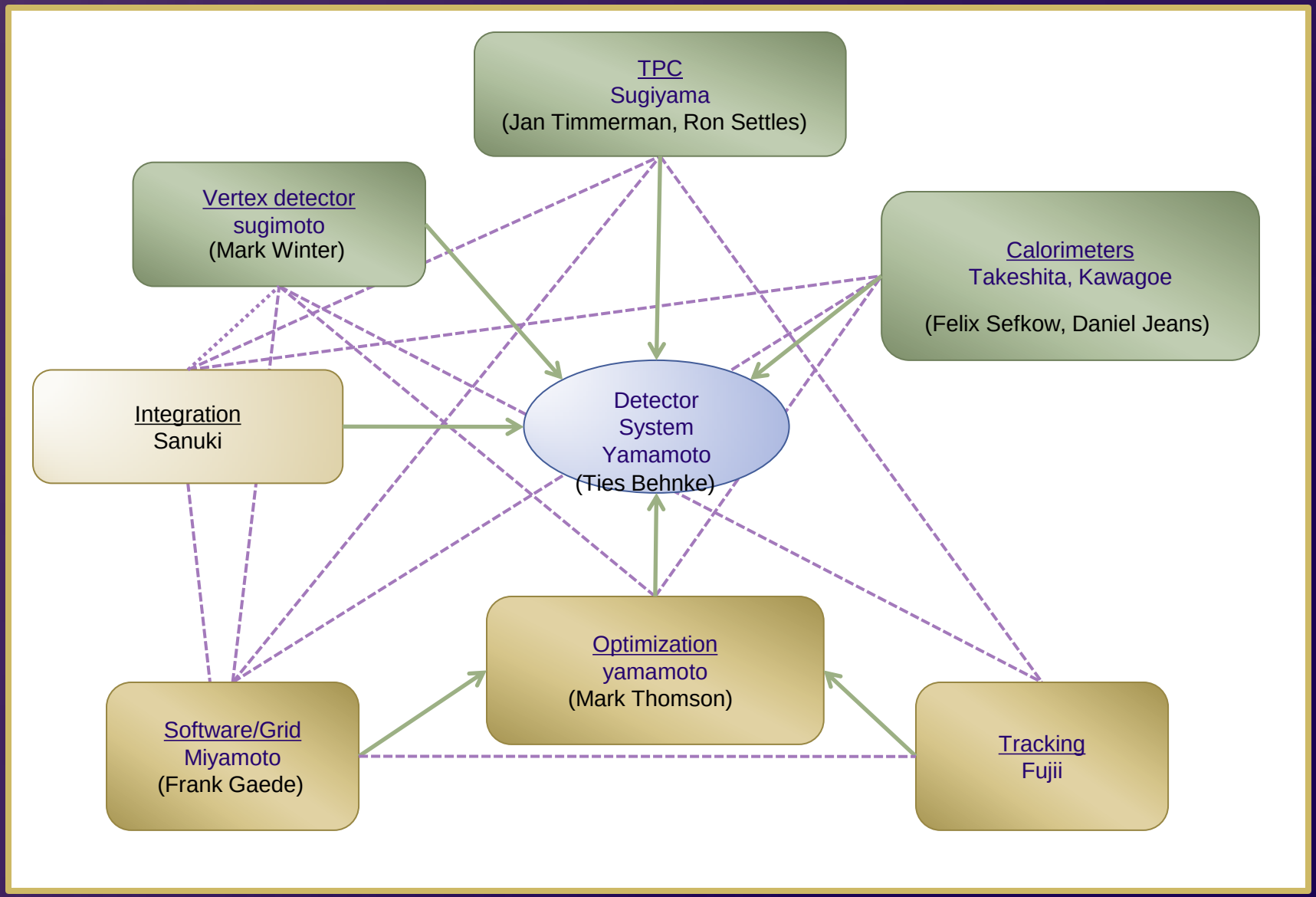
Develop the state-of-the-art components and systems, and complete the detector design based on the concept of PFA that realizes the physics of ILC within a framework of international collaboration.

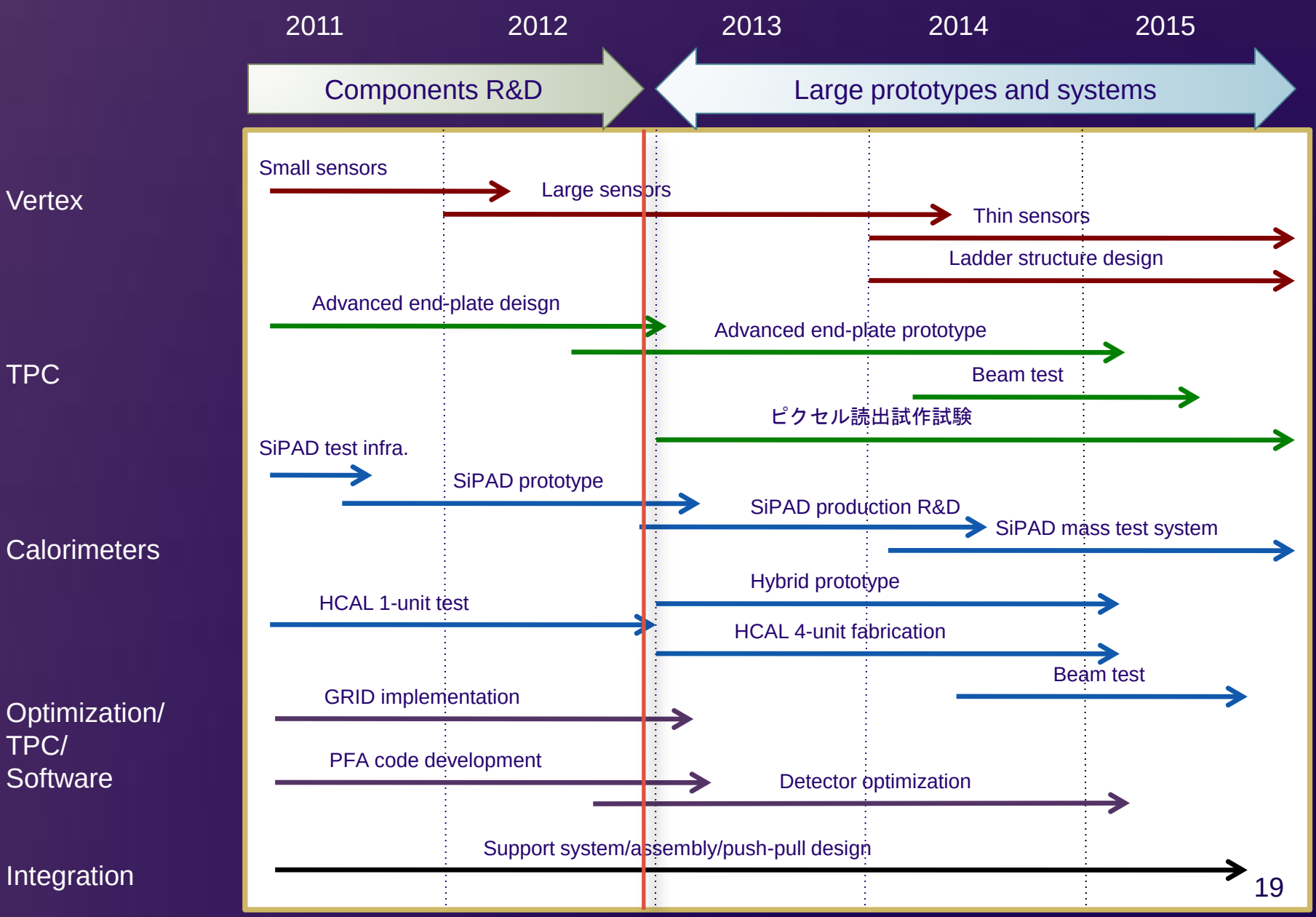
→ lead the formation of a detector collaboration

PFA

Key components : Vertex detector, TPC, Calorimeters

Organization




2011
2012
2013
2014
2015
Components R&D
Large prototypes and systems
Vertex
TPC
Calorimeters
Optimization/
TPC/
Software
Integration
Small sensors
Large sensors
Thin sensors
Ladder structure design
Advanced end-plate deisgn
Advanced end-plate prototype
Beam test
ピクセル読出試作試験
SiPAD test infra.
SiPAD prototype
SiPAD production R&D
SiPAD mass test system
Hybrid prototype
HCAL 1-unit test
HCAL 4-unit fabrication
Beam test
GRID implementation
PFA code development
Detector optimization
Support system/assembly/push-pull design

Summary

New era of particle physics has begun.

Detailed Baseline Design (DBD) is to be completed soon.
We will move to system design and engineering phase.
And toward formation of international collaboration
under the new global organization

Political climate is ever more favorable!