

ILC Project status

Philip Burrows

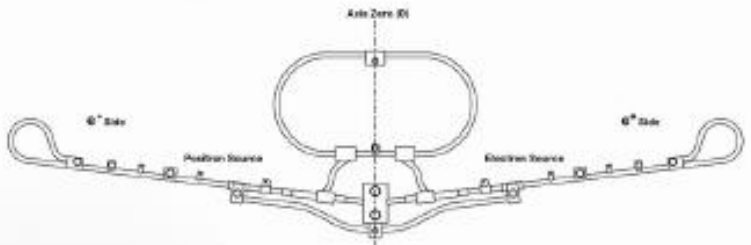
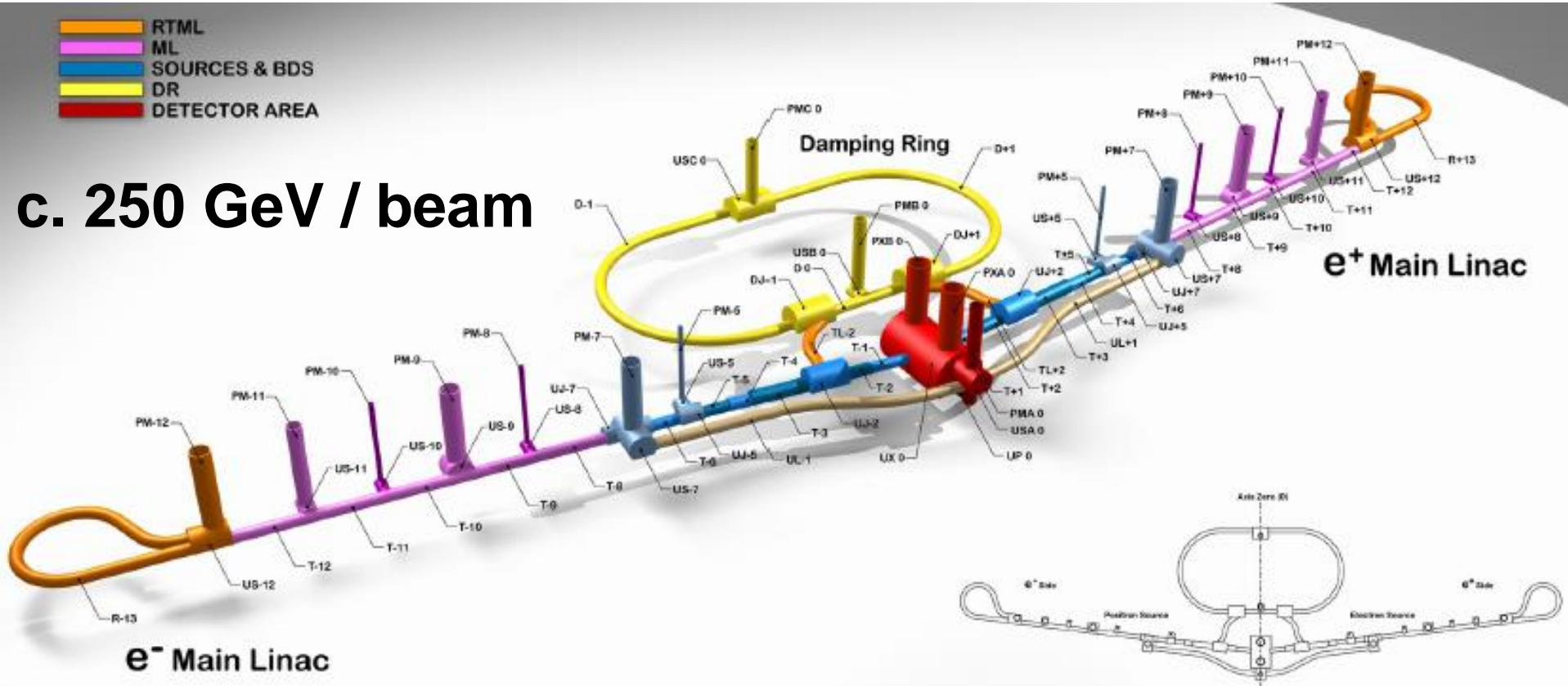
John Adams Institute

Oxford University

International Linear Collider (ILC)

- RTML
- ML
- SOURCES & BDS
- DR
- DETECTOR AREA

c. 250 GeV / beam



31 km

ILC Technical Design Report

THE INTERNATIONAL LINEAR COLLIDER

TECHNICAL DESIGN REPORT | VOLUME 3.1: ACCELERATOR R&D

Strong JAI leadership

Part I:

ILC R&D IN THE TECHNICAL DESIGN PHASE

Part II:

THE ILC BASELINE DESIGN

Editors:

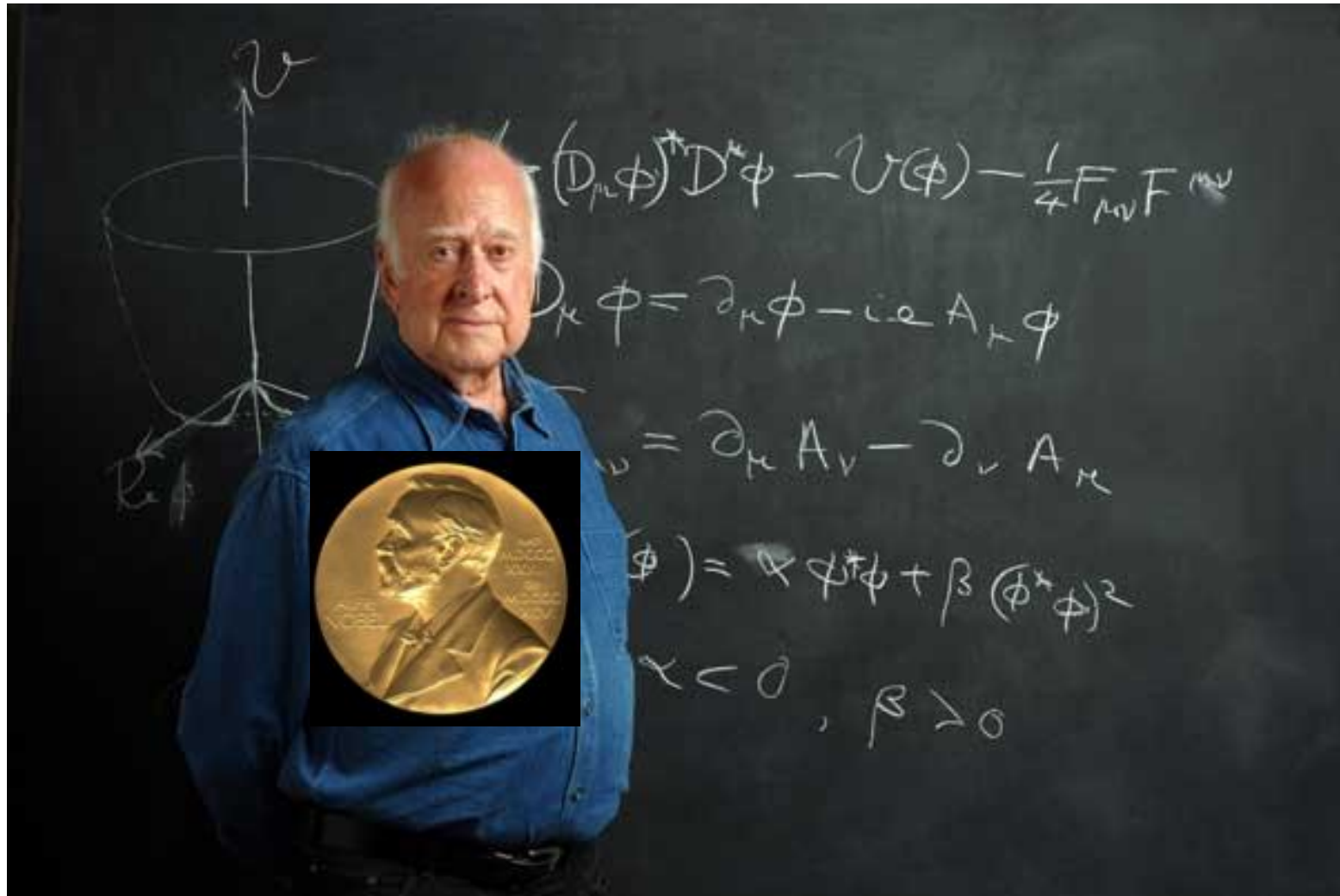
Phil BURROWS, John CARWARDINE, Eckhard ELSÉN,
Brian FOSTER, Mike HARRISON, Hitoshi HAYANO,
Nan PHINNEY, Marc ROSS, Nobu TOGE,
Nick WALKER, Akira YAMAMOTO, Kaoru YOKOYA

Technical Editors:

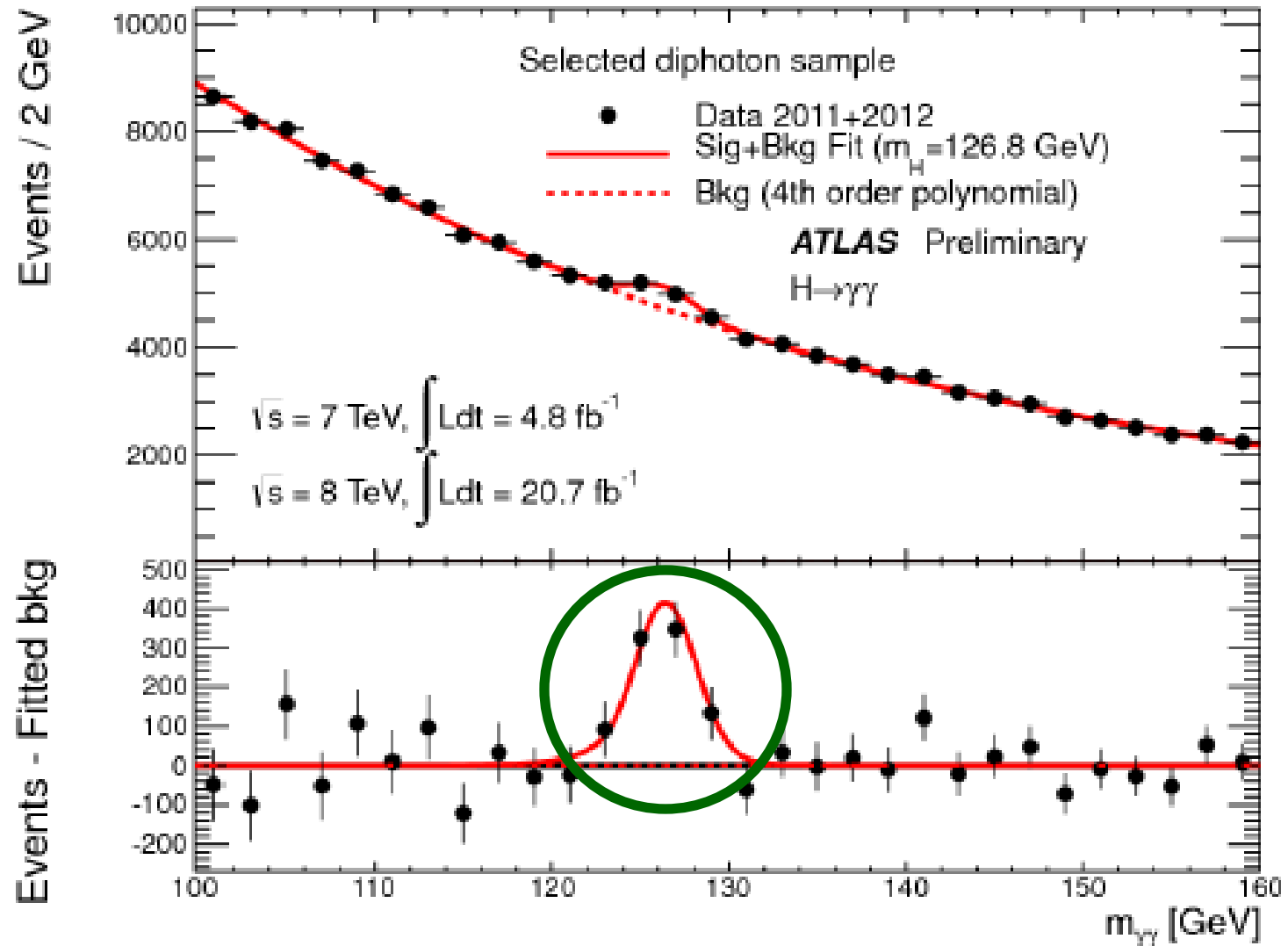
Maura BARONE, Benno LIST

+ Andrei Seryi

2013 Nobel Prize in Physics



LHC discovery 2012

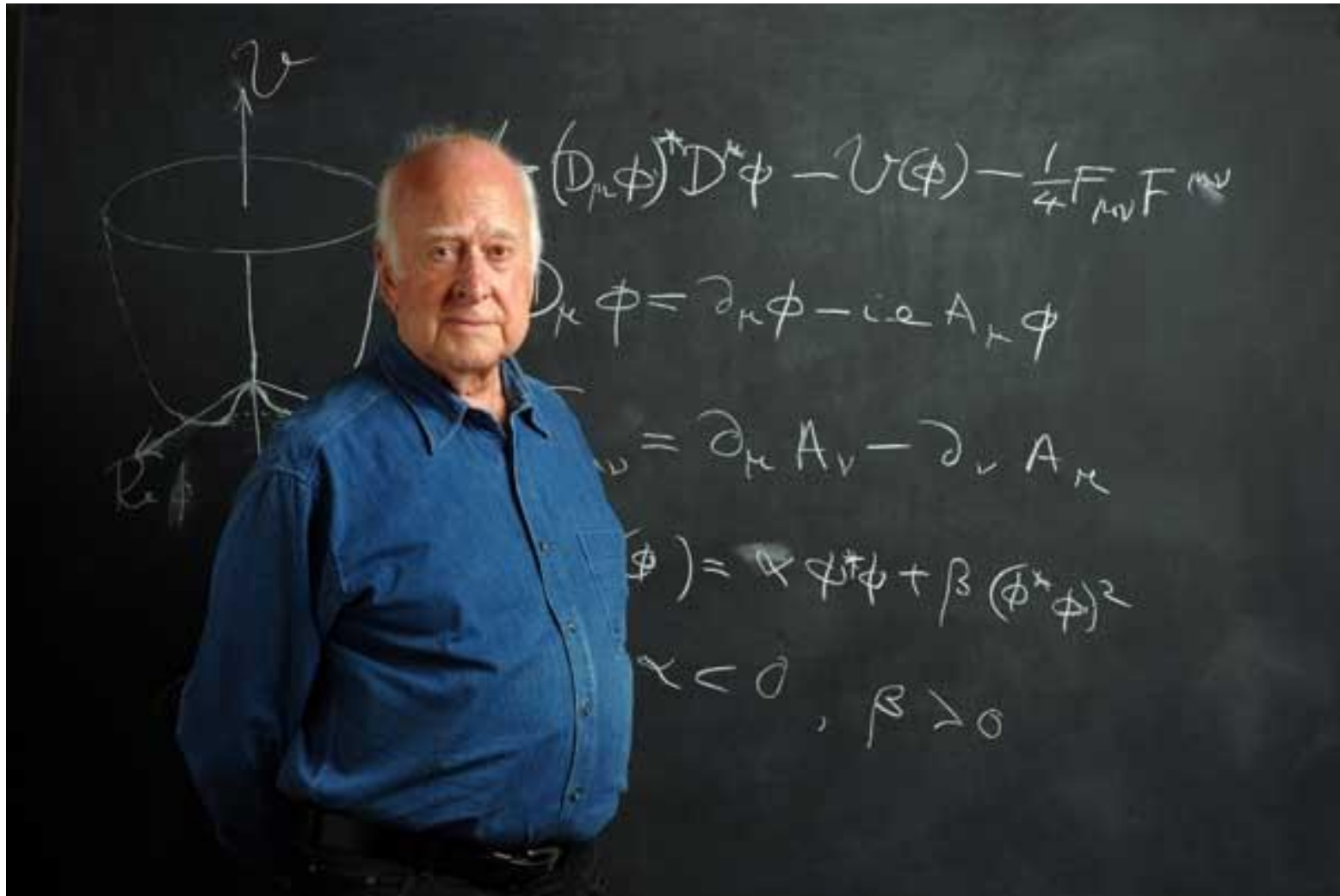


Finger-printing the new boson

Determine its 'profile':

- **Mass**
- **Width**
- **Spin**
- **CP nature**
- **Coupling to fermions**
- **Coupling to gauge bosons**
- **Yukawa coupling to top quark**
- **Self coupling \rightarrow Higgs potential**

Higgs et al Mechanism



Finger-printing the Higgs boson

Is it:

the Higgs Boson of the Standard Model?

another type of Higgs boson?

something that looks like a Higgs boson but is actually more complicated?

Finger-printing the Higgs boson

Is it:

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something that looks like a Higgs boson but is actually more complicated?

→ Measurements of the Higgs couplings to the different species of quarks, leptons and gauge bosons are the key to answering these questions

e+e- Higgs factory

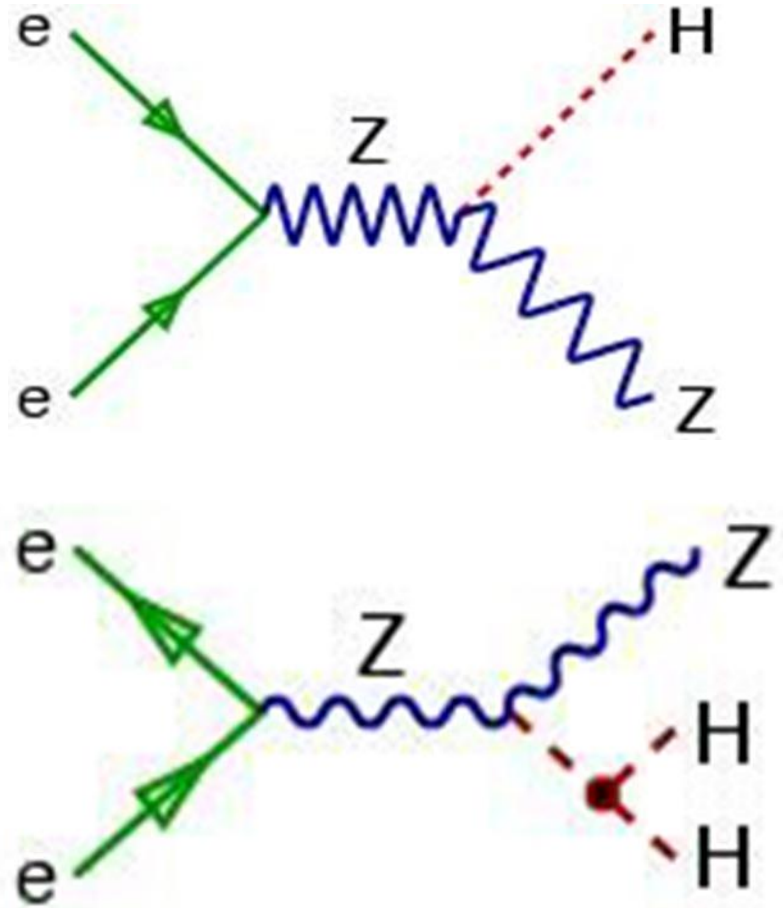
e+e- annihilations:

$E > 91 + 125 = 216 \text{ GeV}$

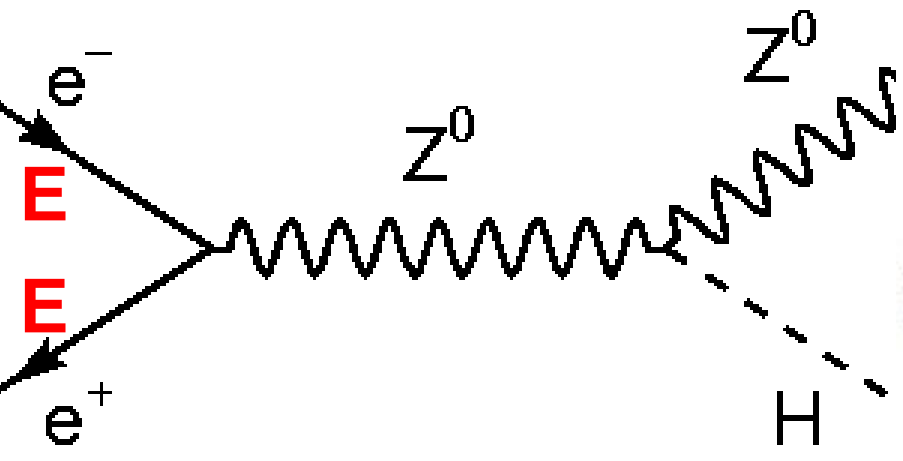
$E \sim 250 \text{ GeV}$

$E > 91 + 250 = 341 \text{ GeV}$

$E \sim 500 \text{ GeV}$

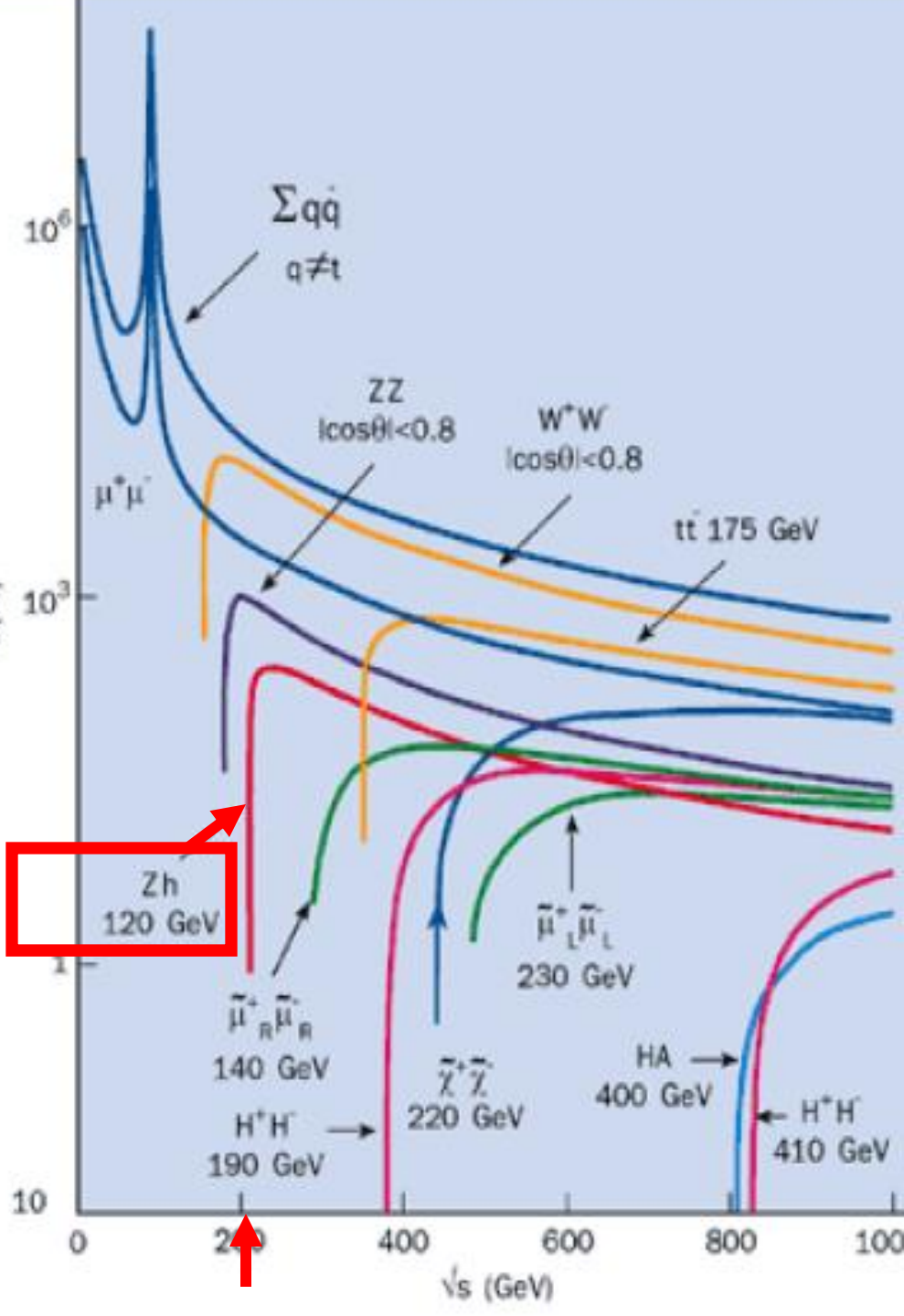


e+e- annihilations

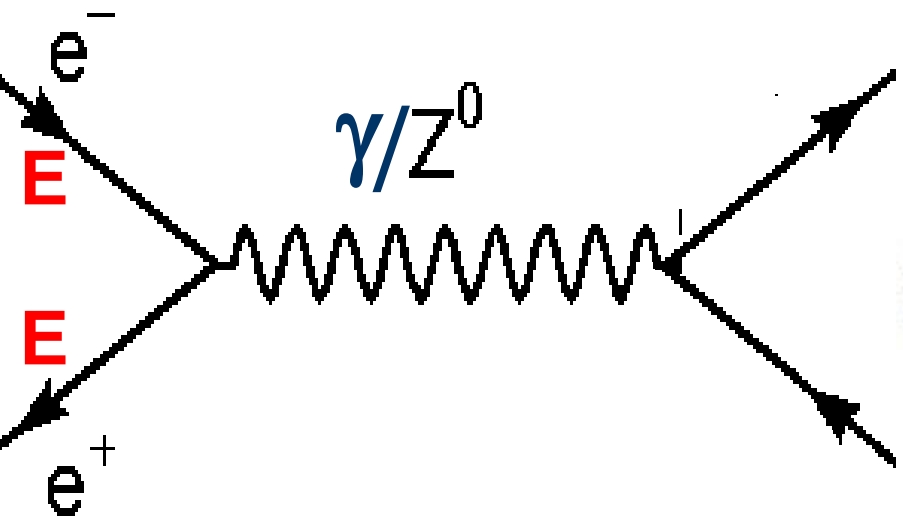


$2E > 220 \text{ GeV}$

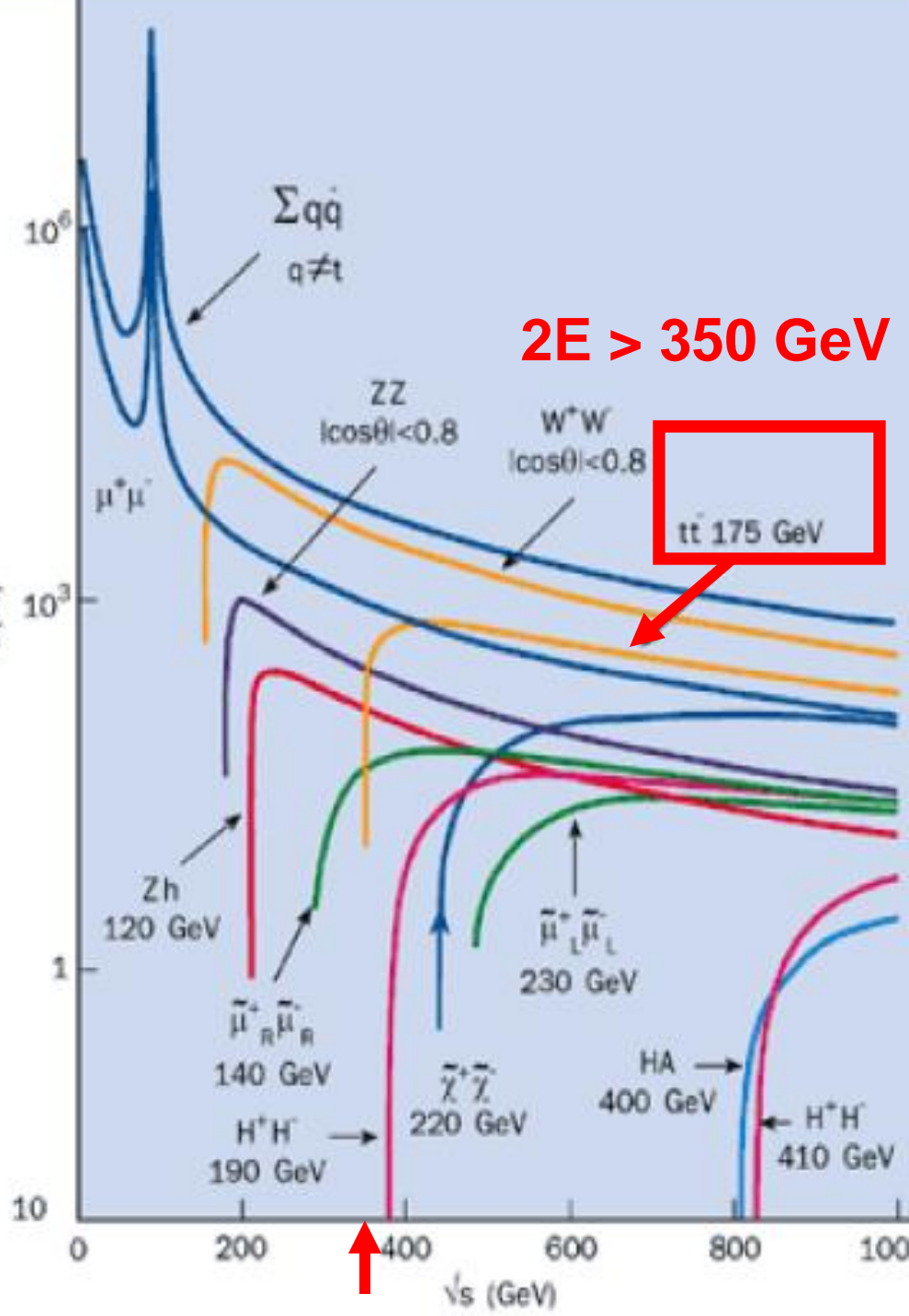
$\rightarrow 20,000 \text{ H / year}$



e+e- annihilations



→ 100,000 t / year



ILC Higgs/top Factory Roadmap

250 GeV: Higgs

Mass, Spin, CP nature

Absolute meas. of HZZ

BRs Higgs \rightarrow qq, ll, VV

350 GeV: Top quarks + Higgs

Top threshold: mass, width, anomalous couplings ...

(more stats on Higgs BRs)

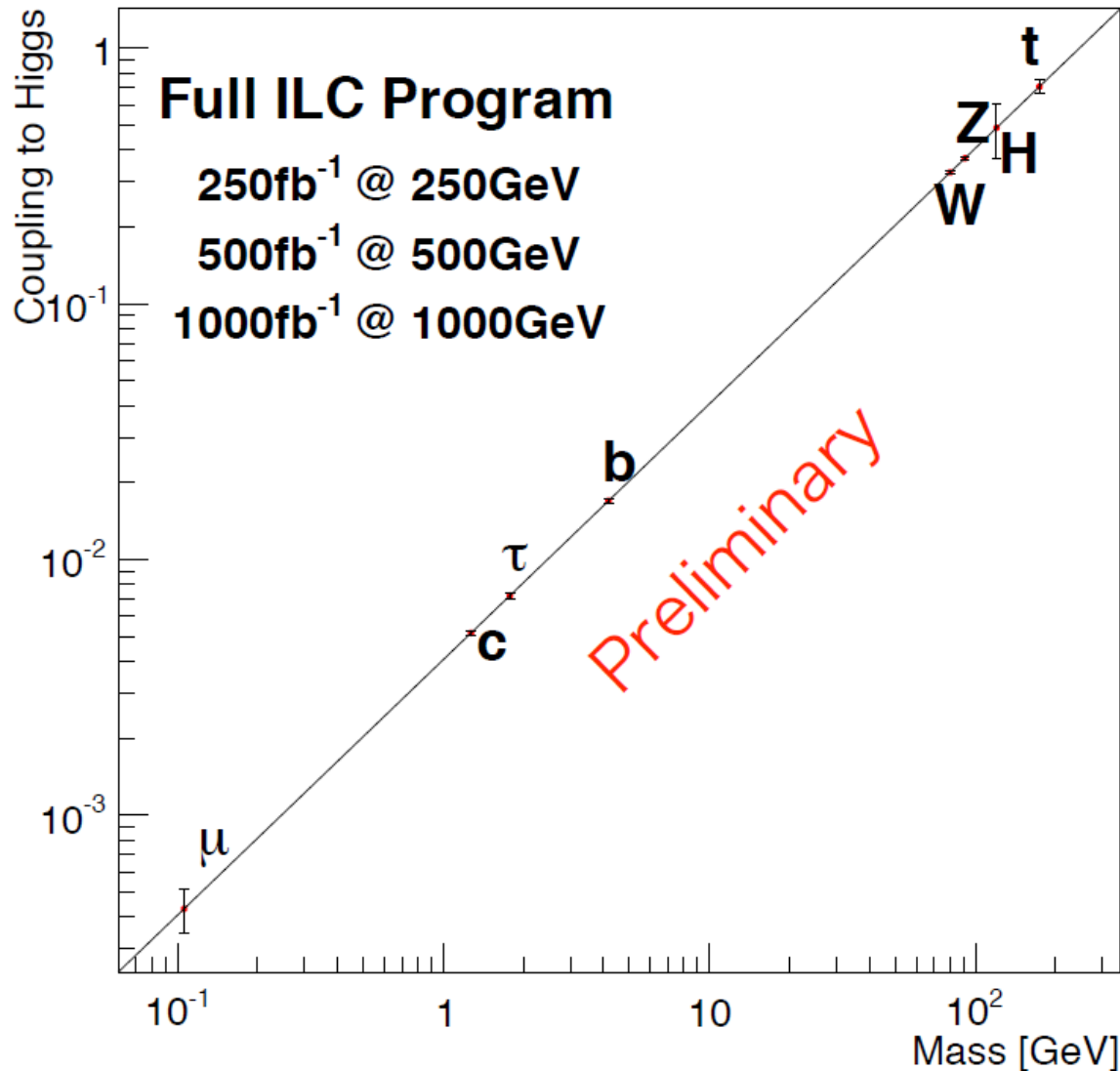
500 GeV: Higgs

HWW coupling \rightarrow total width \rightarrow absolute couplings

Higgs self coupling

Top Yukawa coupling

Higgs coupling map



(Fujii)

Japanese Initiative

- **They are very serious!**

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- **National policy initiative for major infrastructure investment, especially in tsunami-affected area**

ILC Plan in Japan

Our new prime minister
Shinzo Abe



LDP policy document
for the election

The ILC appears twice explicitly in
the policy document:

- Science and technology policies
- Creation of top-class research centers

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- **Japan physics community proposed to host ILC**

ILC Plan in Japan

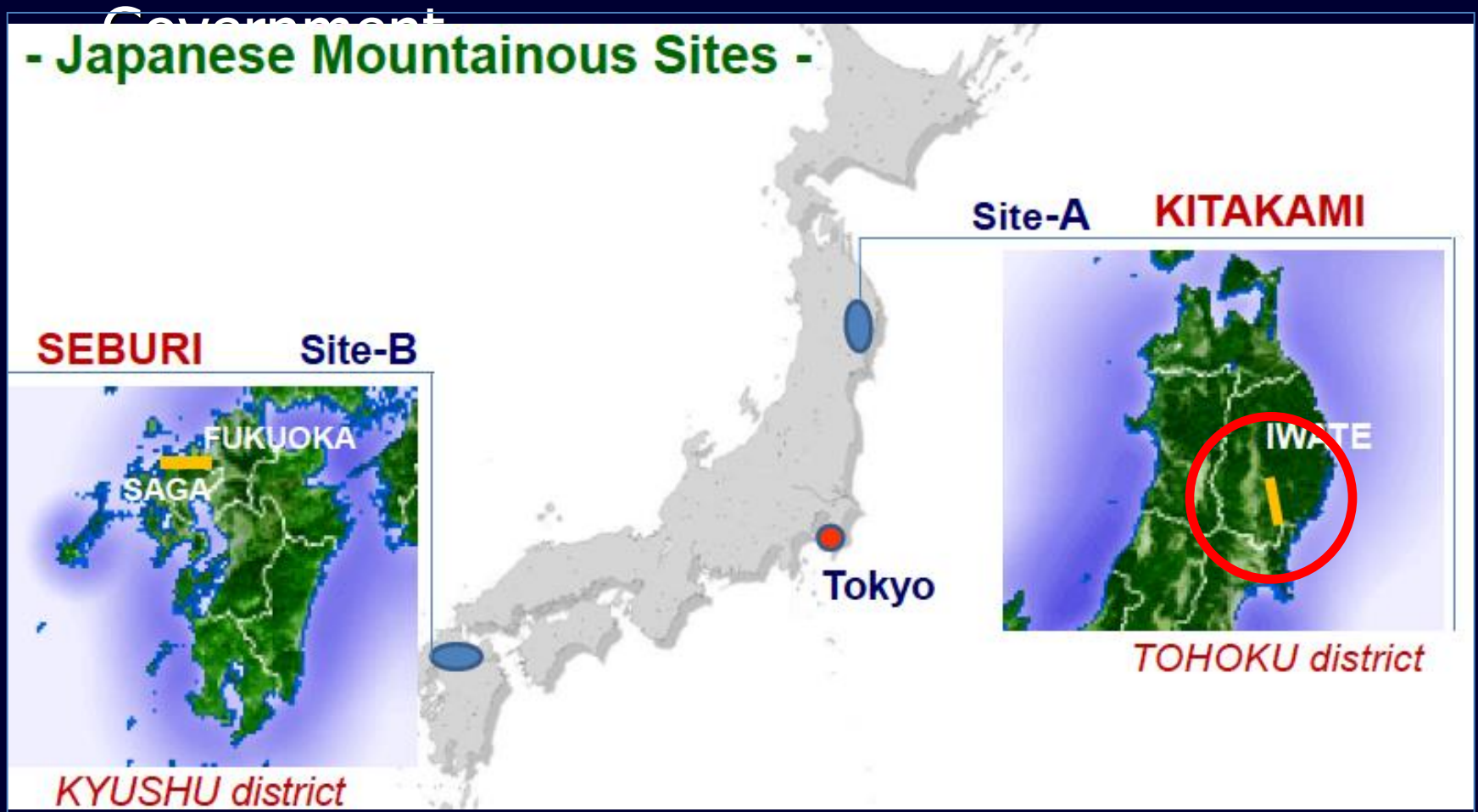
- ▶ Japanese HEP community proposes to host ILC based on the “staging scenario” to the Japanese Government.
 - ILC starts as a 250GeV Higgs factory, and will evolve to a 500GeV machine.
 - Technical extendability to 1TeV is to be preserved.

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Japanese Initiative

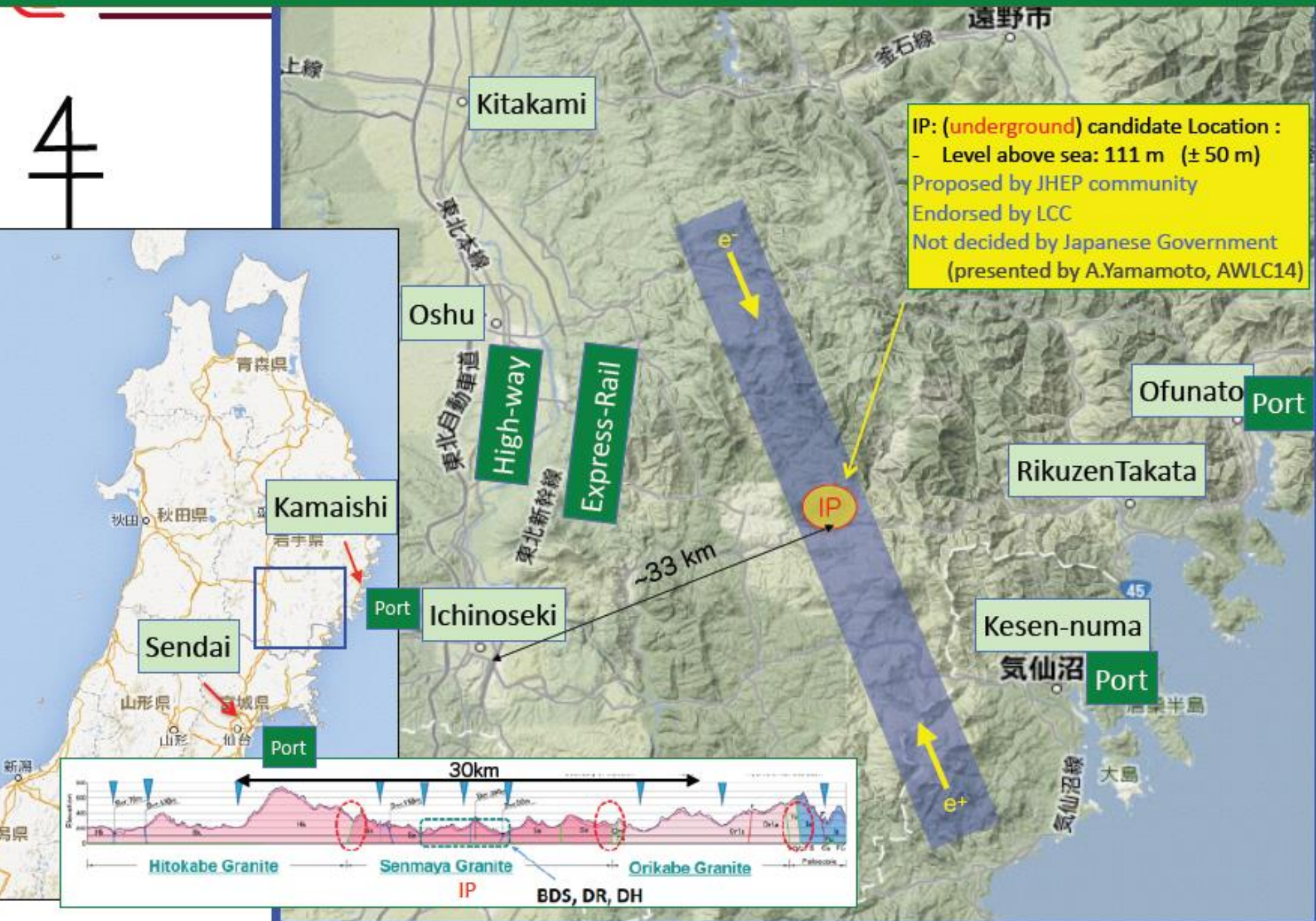
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- **Political approaches to USA + EU**

Possible Timeline

- July 2013
 - Non-political evaluation of 2 Japanese candidate sites complete, followed by down-selecting to one
- End 2013
 - Japanese government announces its intent to bid
- 2013~2015
 - Inter-governmental negotiations
 - Completion of R&Ds, preparation for the ILC lab.
- ~2015
 - Inputs from LHC@14TeV, decision to proceed
- 2015~16
 - Construction begins (incl. bidding)
- 2026~27
 - Commissioning

ILC Candidate Location: Kitakami Area

4



Kitakami Site: IP region



Local enthusiasm



Kitakami Site: IP area



Kitakami Site: IP



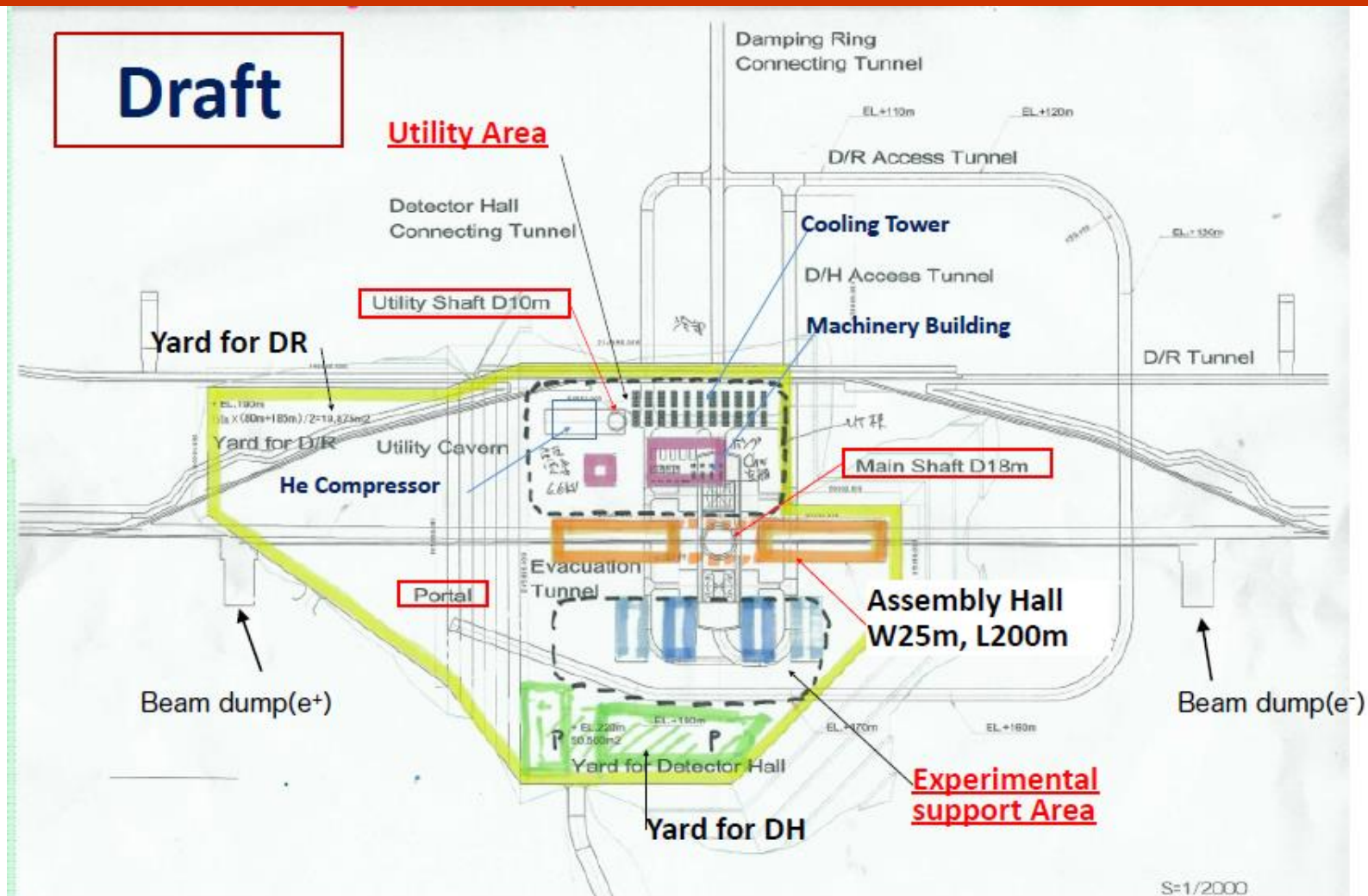
Kitakami Site: IP



Kitakami Site: IP



Kitakami Site: IP surface facilities



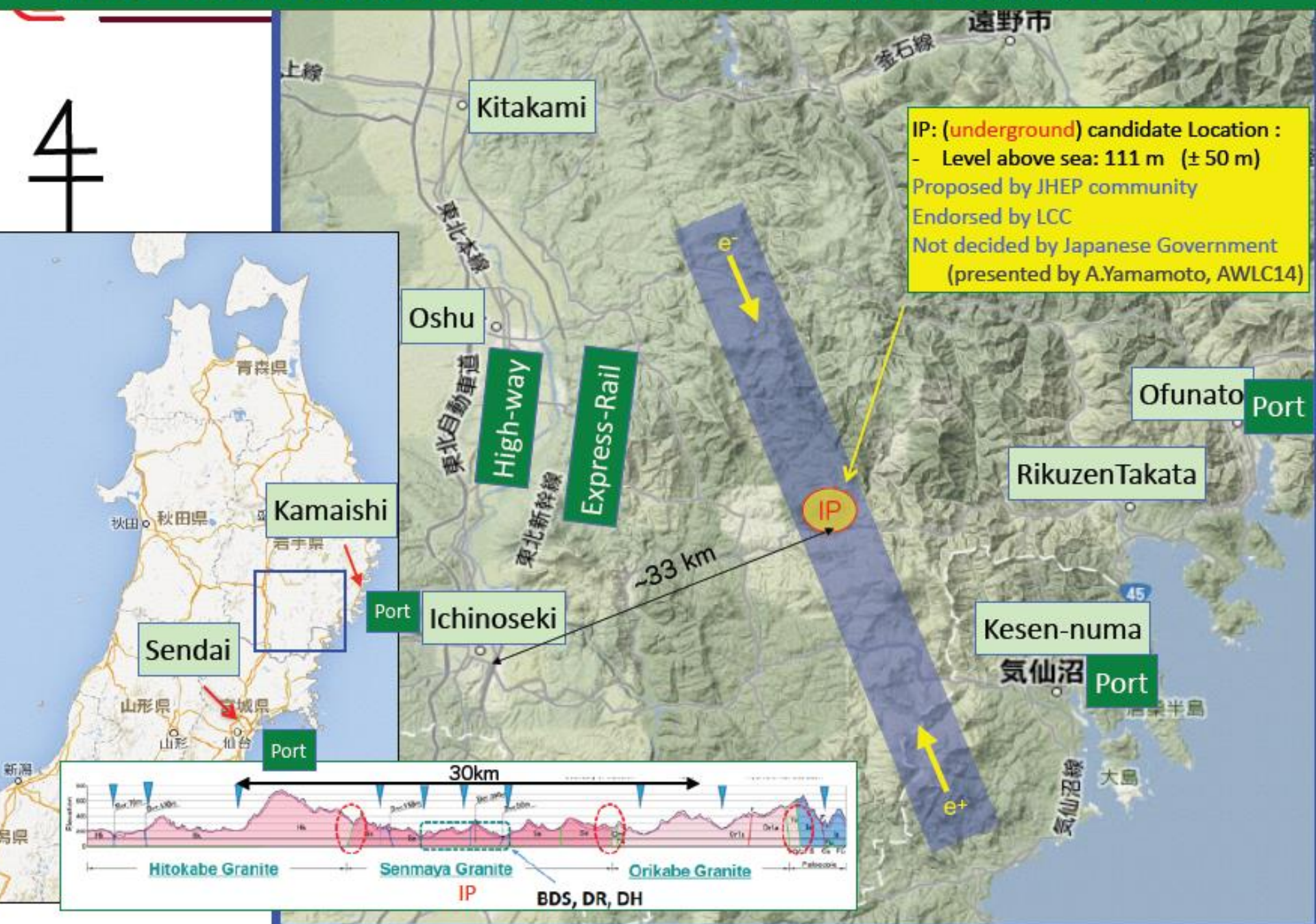
◆ This layout is in the preliminary draft for discussion

Kitakami Site: JAI house



ILC Candidate Location: Kitakami Area

4



Kitakami Site: road to port



Local news

平成26年(2014)9月6日 (土曜日)



2014
平成26年
9月6日
土曜日
ペガフ

具体的な設計向け

国際会議 研究成果示し意

次世代の大型加速器 国際リニアコライダー (ILC) に関する国際会議「MDI-CFES」が、6日、関市大手町の「関図書

高地の地形などを踏まえ、測定器が設置される衝突点付近の具体設計へ研究成果を示しながら意見を交わした。

MDI-CFESは、ILCの国際的な研究者推進組織「リニアコライダー・ヨーロッパ・ネットワーク」(LCC)の研究部門で、ILC全体のうち衝突点付近の測定器や加速器、地下トンネル、地上に設ける施設などの各設計を担当。地形や自然環境などに対する共通認識を深めた上で現地に特化した現実的で具体的な設計を詰めていくため、LCCと東北大ILC推進会議が初めて合同会議を開いた。

同日は、国内をはじめ米国やイギリス、ドイツなど計6カ国から参加した加速器設計の専門家や物理学者ら計20人が、電子と陽電子の衝突反応を調べる測定器を対象とした約50の範囲を対象に、具体的な設計に向け検討を進めた。

東北大 佐藤 隆之 先生

八重樫、4度目防衛失敗

WBCフライ級 ゴンサレスにTKO

6回、ゴンサレス(右)に攻められる八重樫東(左)は、東京・代々木第2体育館



世界ボクシング評議会(WBC)のダフルタイプトルマッチ12回戦は5日、東京・代々木第2体育館で行われ、フライ級チャンピオンの八重樫東(大橋、北市出身)は20勝(10KO)4敗。ゴンサレスは階級制覇を果たし、40戦全勝(14KO)とした。

【8日面に関連】八重樫東、やっぱり強かった。ゴンサレスは強かった。打たれたら打ち返すという部分でしか勝負ができなかった。(相手は怖かったが、会場の応援がすこぶ力になった。

高泉さん

県農協肉牛枝肉研究会 研究会・東京

県農協肉牛枝肉研究会が3日、東京都の東京食肉市場で開かれた。JAいわて平泉の高泉茂美さん(88)は、関市花泉町金沢の去勢牛が最高賞の最優秀賞に輝くなど同JAから合わせて4頭が入賞した。

県内各地からえりすぐりの50頭が出品。中でも

県内の10代女性感染

18の両日、代々木公園周辺で過ごした際、蚊に足を刺された。同23日に39度台の発熱や頭痛、発疹などの症状が出たため中

など一連のデング熱患者と同型という。

関係者調査も行われ、女性と行動を共にした関係者らには蚊に刺されてお

デング熱

Local news

平成26年(2014)9月6日 (土曜日)



2014年
(平成26年)
9月6日
土曜日



ペガサス座

具休

国際

次世代の大型加速器「国際リニアコライダー (ILC)」に関する国際会議「MDI-CFS会議」は2日目の5日、一関市大手町の一関図書館
 ILC衝突点周辺の具休
 討するMDI-CFS会
 図書館

国際会議「MDI-CFS会議」が、方法などについて、世界
 手町の一関図書館の研究者らが議論を
 0日まで3日間
 世界ボクシング評議会 (WBC) のダブルタイ
 マッチ12回戦は5
 上の設計を検討する。世
 一行は会議初日の4
 線は実績値が予測の50率が20
 %に届かない

©暮らしの
 天頂近く、
 の目安とな

Local enthusiasm



Local enthusiasm



UK strategy on ILC

PPAP recommendation

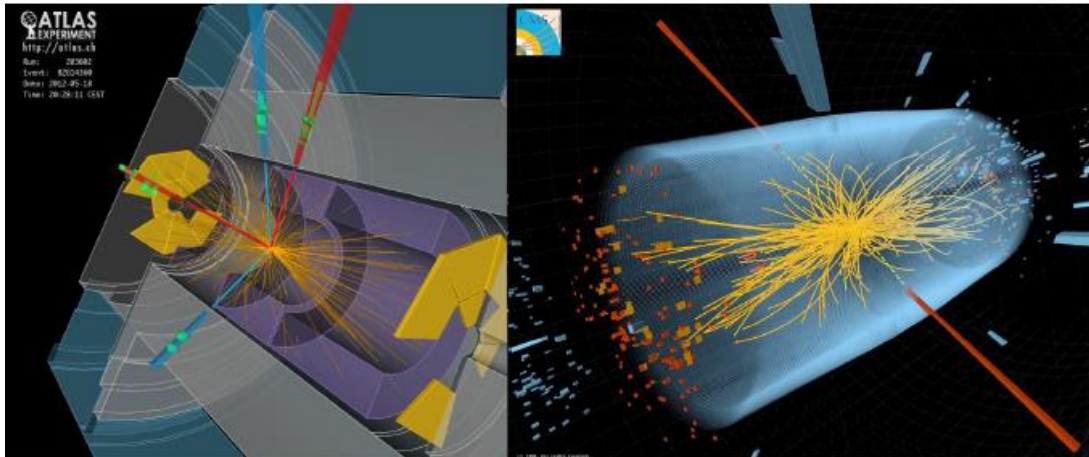
The UK Particle Physics Roadmap

Particle Physics Advisory Panel:

*P. N. Burrows, C. Da Via, E. W. N. Glover, P.R. Newman, J. Rademacker,
C. Shepherd-Themistocleous, W.J. Spence, M. A. Thomson and M. Wing*

7/11/12

‘It is essential that the UK engages with the Higgs Factory initiative and positions itself to play a leading role should the facility go ahead.’



LCUK

- **STFC Programmatic Review positive words on UK participation in Japan Higgs Factory**
- **LCUK submitted Sol to STFC - reviewed favourably by Science Board (July 2014)**
- **LCUK invited to submit (modest) proposal (Sept 2014)**

LCUK proposal

The ILC as a Higgs Factory

C. Hawkes, K. Nikolopoulos, M. F. Watson, N. Watson (**Birmingham**); D. Cussans, H. Flaecher, J. Goldstein, D. Newbold, J. Rademacker, J. Velthuis (**Bristol**); B. Gripaios, A. Mitov, M. Thomson, D. Ward (**Cambridge**); V. Martin (**Edinburgh**); R. Bates, A. Doyle, A. Robson (**Glasgow**); P. Dauncey (**Imperial College**); I. Bailey, G. Borissov, A. Finch, H. Fox (**Lancaster**); D. Hutchcroft, G. Casse, T. Jones, J. Vossebeld (**Liverpool**); R. Appleby, Y. Peters, S. Soldner-Rembold (**Manchester**); D. Bortoletto, P. Burrows, G. Christian, C. Gwenlan, B. Foster, A. Reichold, A. Seryi, I. Shipsey, G. Viehauser (**Oxford**); A. Bevan, J. Hays (**QMUL**); K. Stefanov (**Open University**); S. Boogert, G. Cowan, S. Gibson, P. Karataev, V. Boisvert (**RHUL**); S. Paganis (**Sheffield**); S. Moretti, E. Accomando (**Southampton**); D. Angal-Kalinin (**STFC-Daresbury**); S. Worm, F. Wilson (**STFC-RAL**); F. Salvatore (**Sussex**); F. Deppisch, M. Wing (**UCL**); S. Farrington, Y. Ramachers (**Warwick**).

1 The ILC

The ILC, shown schematically in Figure 1, is a proposed electron-positron linear collider (LC) designed to operate in the centre-of-mass energy range $\sqrt{s} = 250 - 500$ GeV, with the potential to be upgraded to 1 TeV. The energy and high luminosity (two orders of magnitude greater than LEP) make the ILC the ideal machine to study the Higgs boson, as well as a multitude of other processes, including top quark production. The ILC includes a super-conducting linear accelerator to provide the high-energy beams and a complex beam delivery system (BDS) to provide the nanometre-scale beam spots needed for high luminosity. The accelerator technology is mature and is being used for the European XFEL, being constructed at DESY. The development

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- **EJADE approved by EU H2020**
JAI, CERN, DESY, LAL w. KEK

The Future?



Opportunity for JAI

- **Lead player in coordinated European team to provide:**

Beam Delivery System

Machine-Detector Interface

- **Great synergy with VXD, tracker, forward systems**