ELECTRON

$11.99

SKU: PRR010

Qty

1

ADD TO CART

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A negatively charged, diminutive ball of motion. Kind of like some cats I know. **ELECTRON** is also part of the Lepton 6-pack, Everyday Matter 6-pack and Atomic 3-pack. It gets around!

Approximately 2 oz (57 gm); 4 inches (10 cm) across.
For ages 5 and up as it contains glued-on/small parts.

POSITRON

$11.99

SKU: PRR011

Qty

1

ADD TO CART

← Previous Product Next Product →

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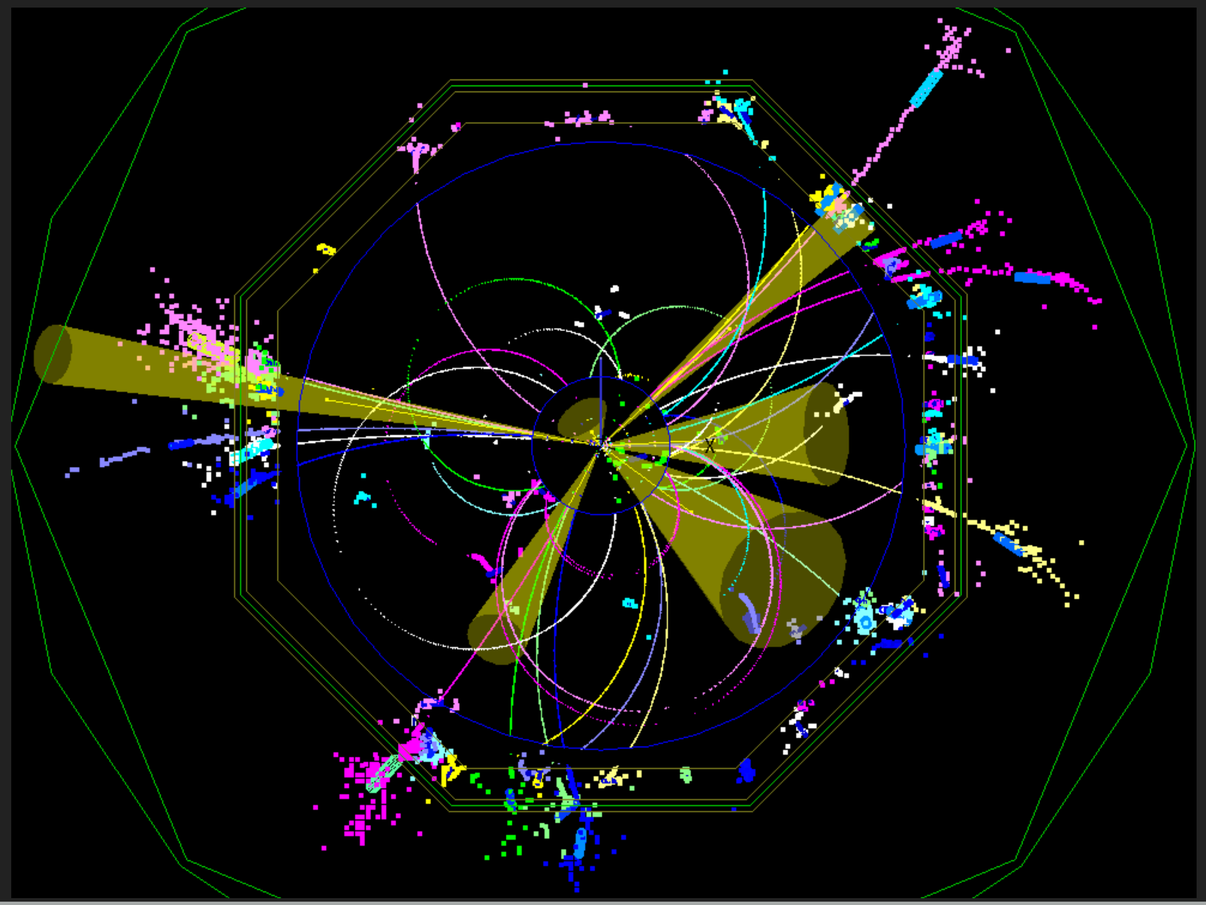
Does this guy *look* like he's into annihilation? Be careful when ordering this little piece of antimatter–he's likely to explode on contact. One very positive thing about the **POSITRON** is his work in PET – Positron Emission Tomography, used to detect disease in the body.

Approximately 2 oz (57 gm); 4 inches (10 cm) across.
For ages 5 and up as it contains glued-on/small parts.

DUTCH ESPP INPUT:
ELECTRON–POSITRON COLLIDERS



DUTCH ESPP INPUT:
ELECTRON–POSITRON COLLIDERS

DUTCH ESPP INPUT:
ELECTRON–POSITRON COLLIDERS

PREVIOUS ROUND:

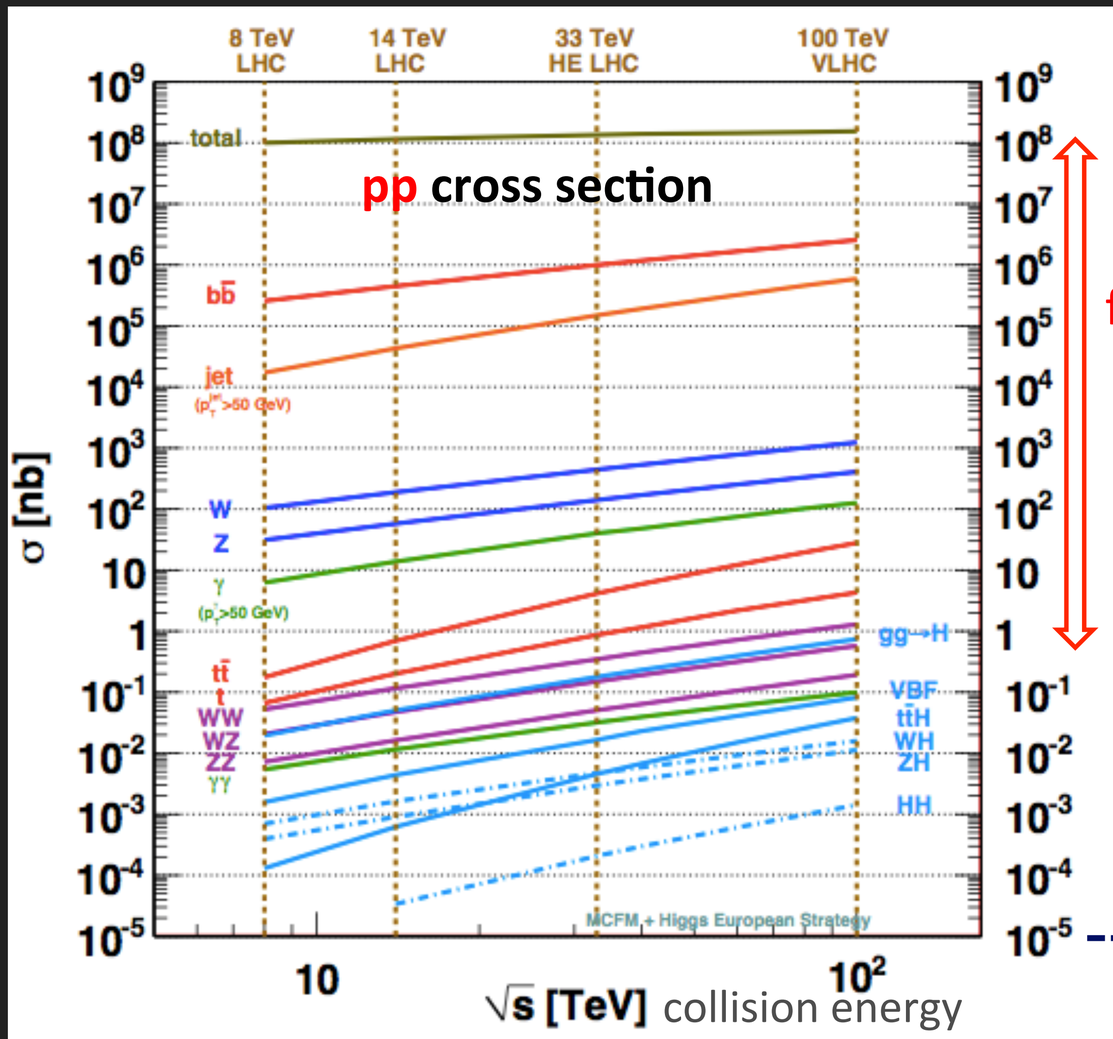
- (Tatsuya Nakada / EPFL – LCWS2017 Strassbourg)

An extract from Deliberation Paper on the update of the European Strategy for Particle Physics

submitted to the CERN Council in May 2013 by the European Strategy Group

- There is also a strong scientific case for an electron-positron collider that could initially study the Higgs properties with high precision, in a way complementary to the LHC, and later be upgraded to higher energy. Already at energies around 250 GeV, such a machine could perform precise and model-independent measurements of the Higgs branching ratios, with sensitivity to most decay modes at the percent level. At energies around 350 GeV, such a machine could perform precision tests of the top quark properties. At energies of 500 GeV and higher, such a machine could explore the Higgs properties further, for example the coupling to the top quark, the self-coupling and the total width. It could also search for colour-neutral new particles, for example some dark matter candidates that may have escaped detection at the LHC. The Japanese initiative to offer to host the ILC opens a new window of opportunity in particle physics. European groups have already made several crucial contributions to the recently- completed Technical Design Report and are very interested in participating in the ILC project. Until now, it is the Japanese high-energy physics community that has expressed unanimous support for hosting the ILC in Japan. Nonetheless, much progress on the political side has been reported to the ESG meetings and Europe thus needs to be prepared in the event that the Japanese government comes forward with a clear plan for hosting the ILC in Japan and invites Europe to participate.

PHYSICS



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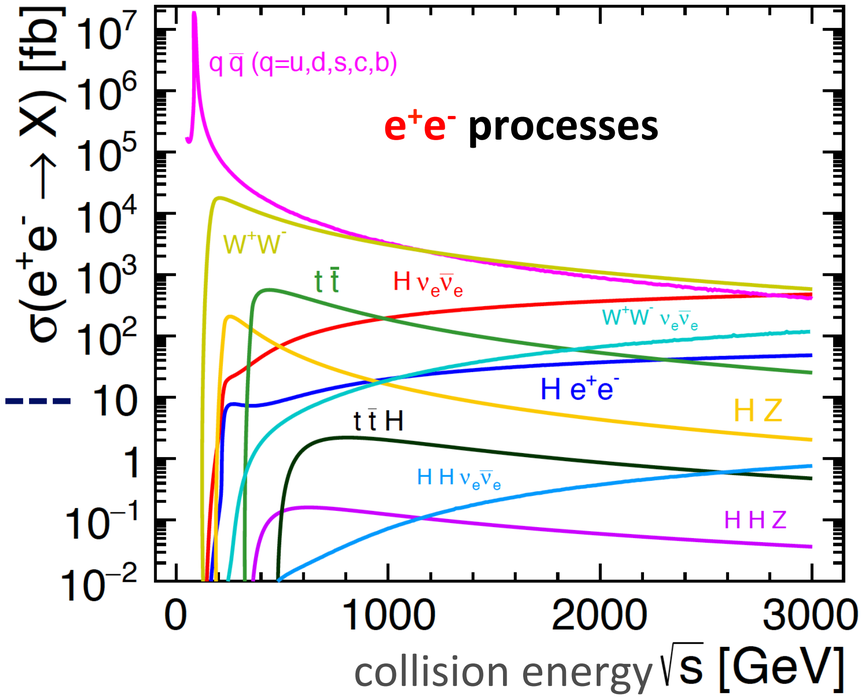
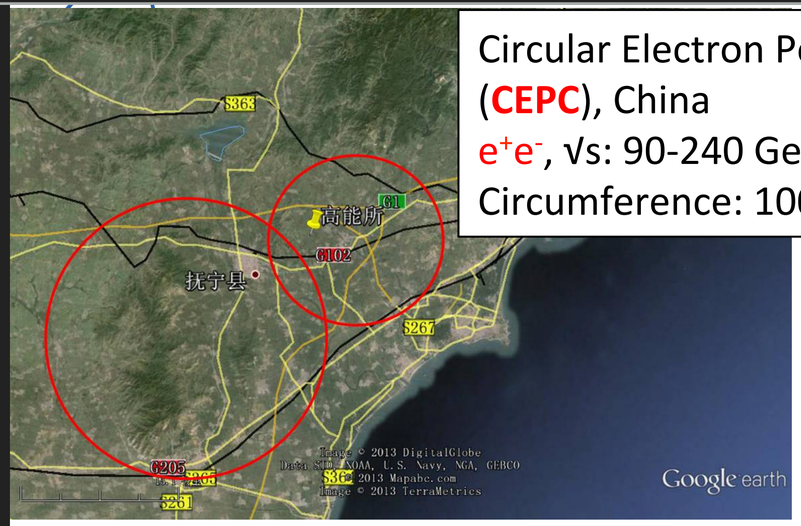


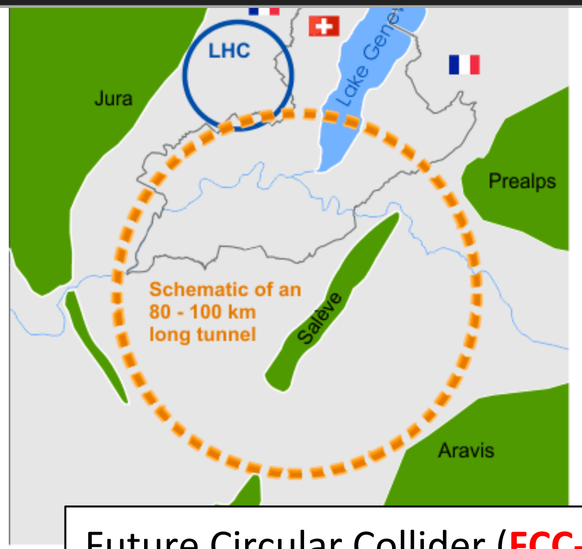
- (Luci Linsen / CERN)

TECHNOLOGY: COLLIDERS

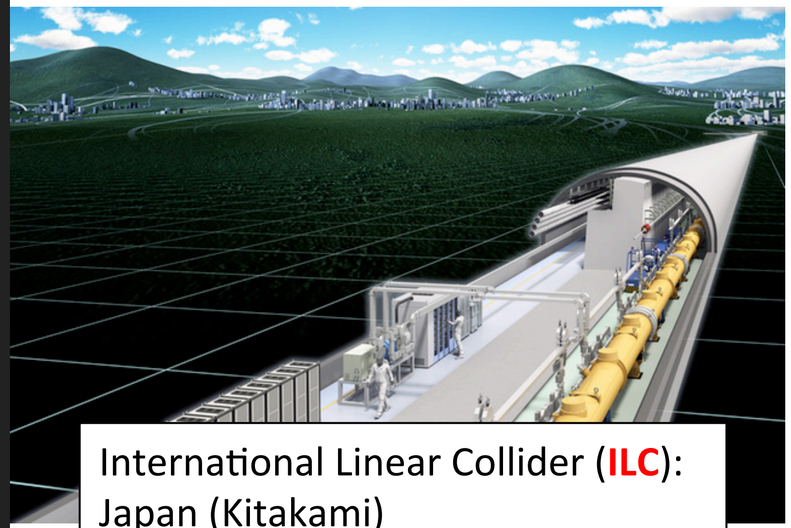
- (Luci Linsen / CERN)



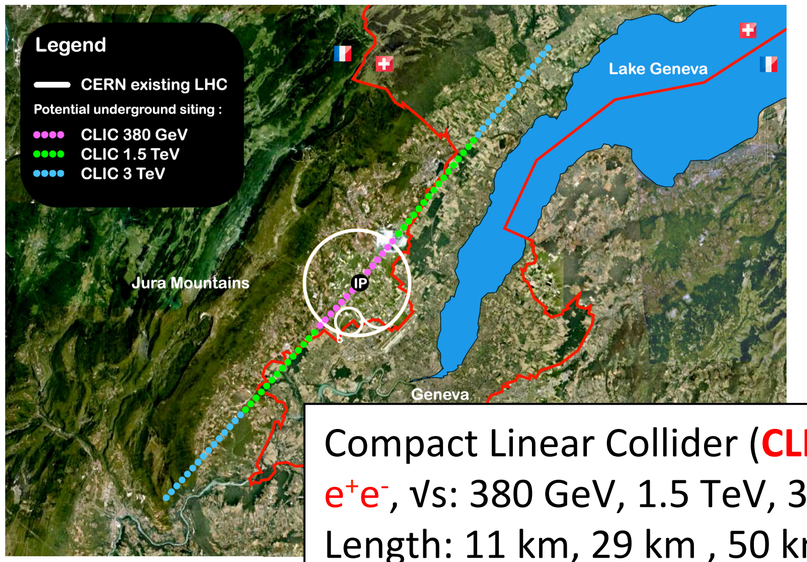
Circular Electron Positron Collider (**CEPC**), China
e^+e^-, √s: 90-240 GeV; SPPC pp,
Circumference: 100 km



Future Circular Collider (**FCC-ee**): CERN
e^+e^-, √s: 90 - 350 GeV; FCC-hh pp
Circumference: 97.75 km



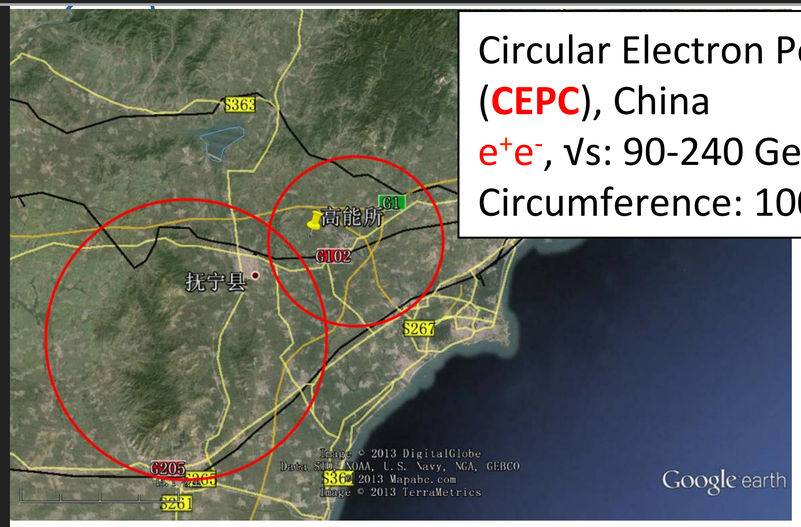
International Linear Collider (**ILC**): Japan (Kitakami)
e^+e^-, √s: 250 – 500 GeV (1 TeV)
Length: 17 km, 31 km (50 km)



Compact Linear Collider (**CLIC**): CERN
e^+e^-, √s: 380 GeV, 1.5 TeV, 3 TeV
Length: 11 km, 29 km , 50 km

TECHNOLOGY: COLLIDERS

- (Luci Linsen / CERN)



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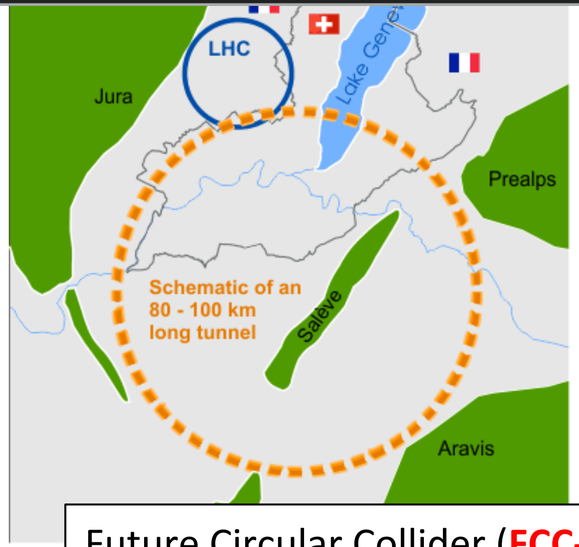

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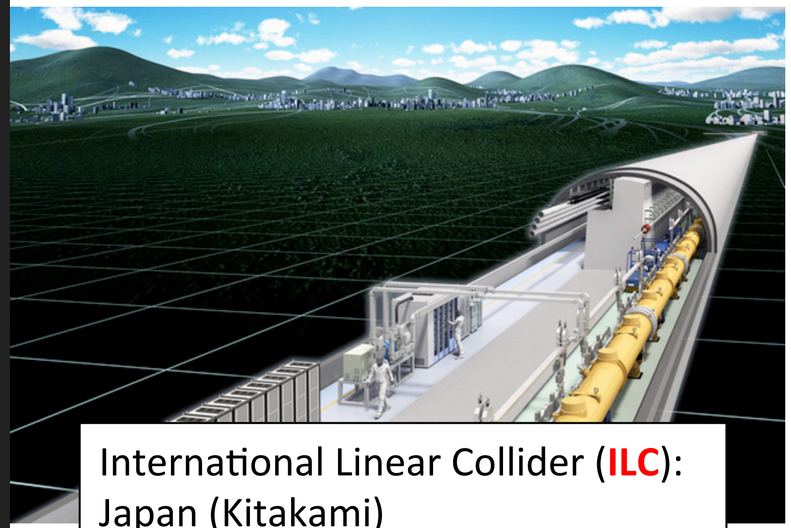

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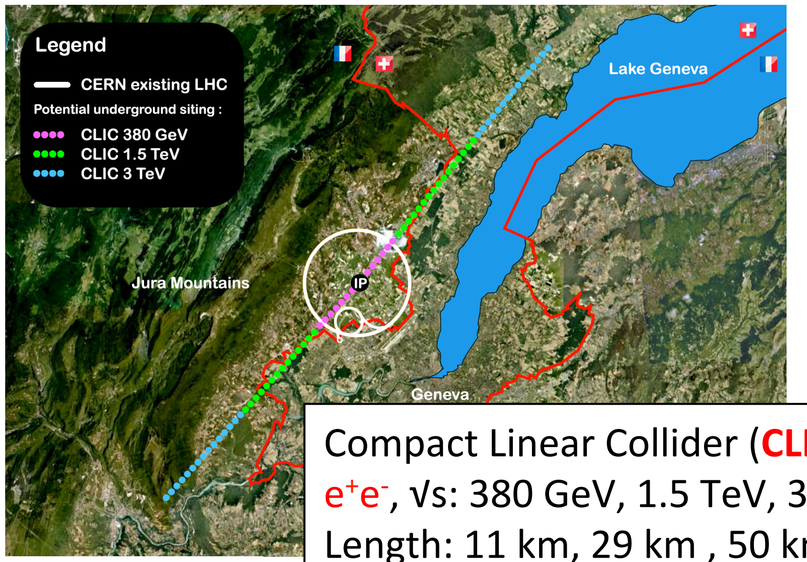

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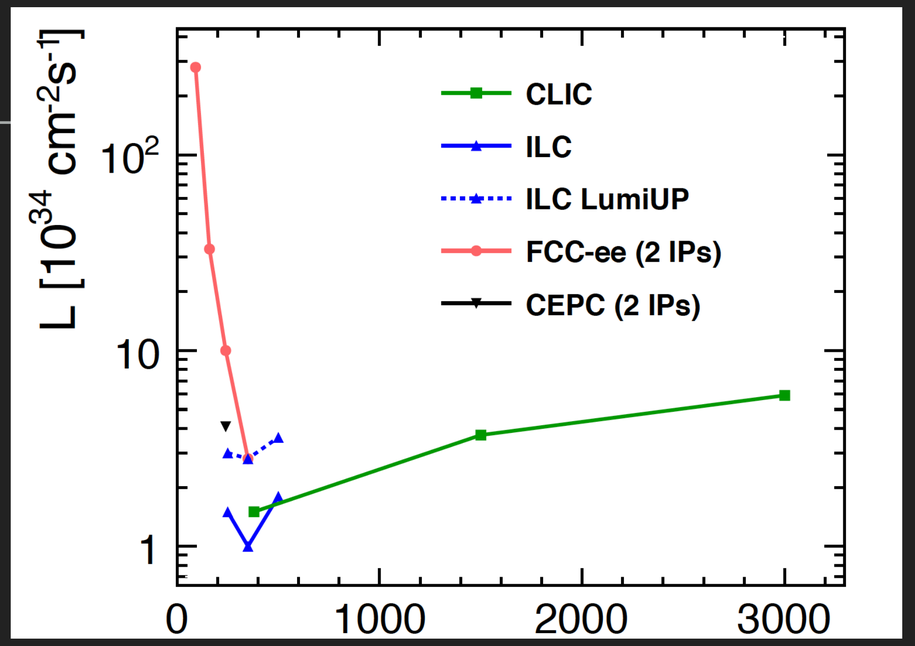
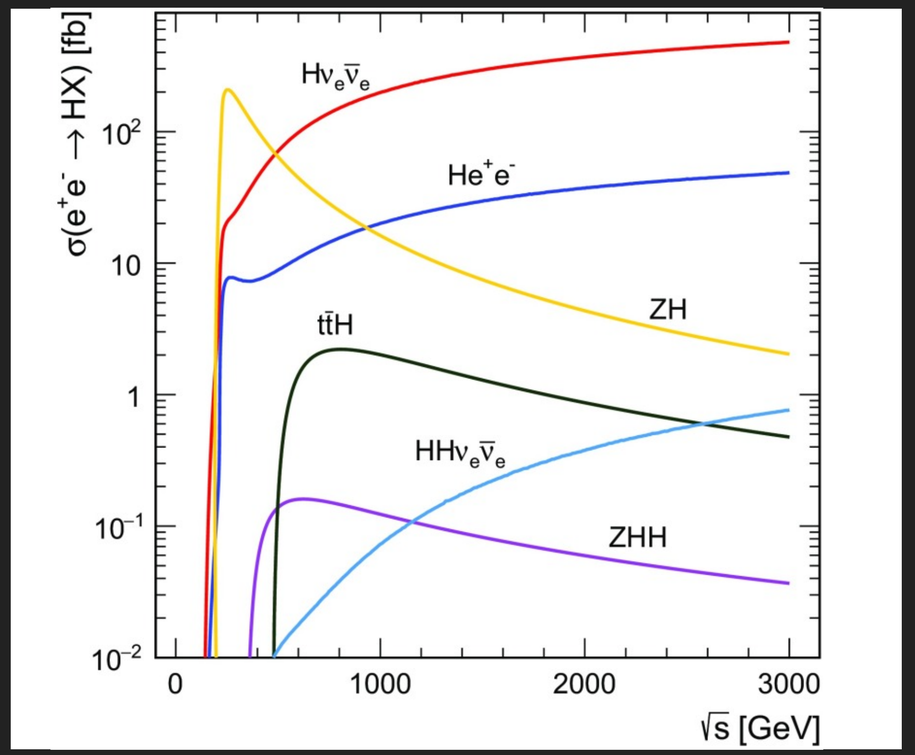
PHYSICS MEETS COLLIDERS





PHYSICS MEETS COLLIDERS

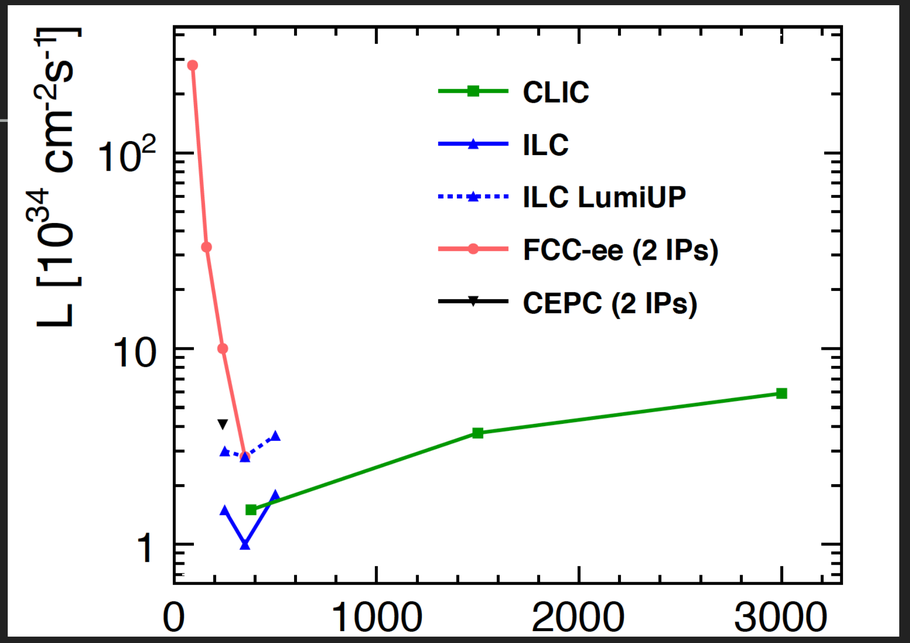
Future strategies for the discovery and the precise measurement of the Higgs self coupling

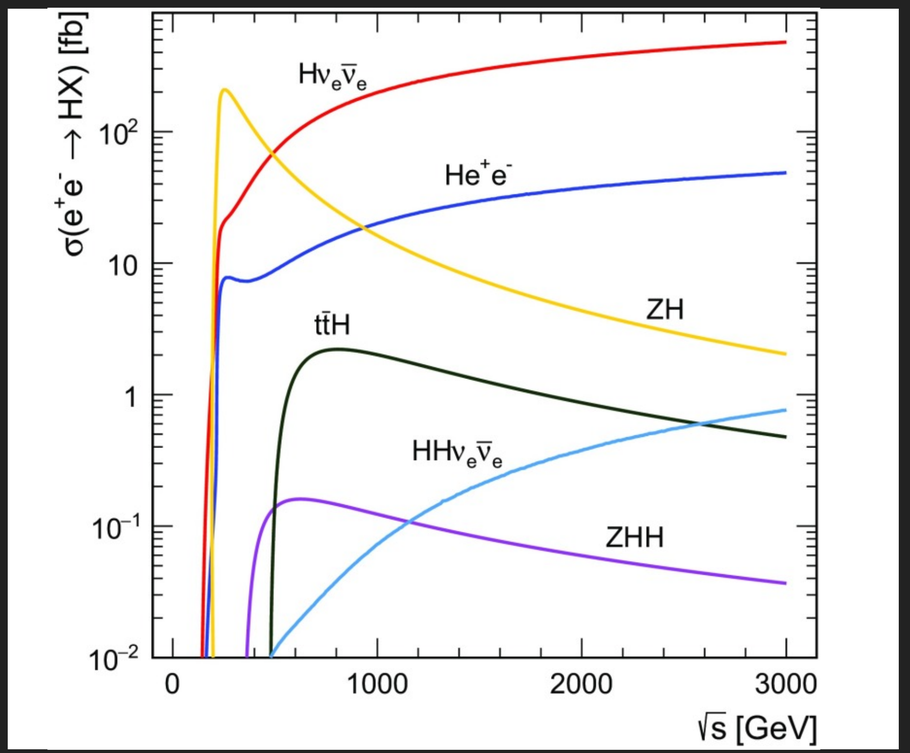
Alain Blondel, Patrick Janot

26 September 2018

The European Strategy for Particle Physics (ESSP) submitted in 2013 a deliberation document [1] to the CERN council explaining that a lepton collider with *"energies of 500 GeV or higher could explore the Higgs properties further, for example the* [Yukawa] *coupling to the top quark, the* [trilinear] *self-coupling and the total width."*. In view of the forthcoming ESPP update in 2020, variations on this qualitative theme have been applied, inaccurately, to the case of the ILC [2, 3], to argue that an upgrade to 500 GeV would allow the measurement of the Higgs potential and would increase the potential for new particle searches. As a consequence, the strategic question was raised again whether the FCC-ee design study ought to consider a 500 GeV energy upgrade. In this note, we revisit the ESSP 2013 statement quantitatively and find

- that the FCC-ee can measure the total width of the Higgs boson with a precision of 1.6% – the best precision on the market – with runs at $\sqrt{s} = 240$, 350, and 365 GeV, and without the need of an energy upgrade to 500 GeV;
- that the top Yukawa coupling will have been determined at HL-LHC at the ±4% level, albeit with some model dependence, without the need of 500 GeV e^+e^- collisions; and that the combination of this HL-LHC result with the FCC-ee absolute Higgs coupling and width measurements removes the model dependence, without the need of an energy upgrade to 500 GeV;
- that, with the run plan presented for the ILC, the trilinear Higgs self-coupling can be inferred with a 3σ significance from the double-Higgs production cross-section measurement at the ILC500 after three decades of operation; but that the FCC-ee provides a similar sensitivity in 15 years, from the precise measurement of the single-Higgs production cross section as a function of $\sqrt{s}$, without the need of an energy upgrade to 500 GeV;
- that the same FCC-ee, with four experiments instead of two, might well achieve the first 5σ demonstration of the existence of the trilinear Higgs self-coupling, while a centre-of-mass energy of about 1 TeV or more is required for a linear collider to reach a similar sensitivity in a reasonable amount of time; and that a precise measurement of the trilinear Higgs self-coupling at the few per-cent precision level can realistically only be provided by the combination of FCC-ee and FCC-hh, being beyond reach of lepton colliders with a centre-of-mass energy up to at least 3 TeV.





PHYSICS MEETS POLITICS

- (Tatsuya Nakada / EPFL – LCWS2017 Strassbourg)

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The Japanese initiative to offer to host the ILC opens a new window of opportunity in particle physics. European groups have already made several crucial contributions to the recently- completed Technical Design Report and are very interested in participating in the ILC project. Until now, it is the Japanese high-energy physics community that has expressed unanimous support for hosting the ILC in Japan. Nonetheless, much progress on the political side has been reported to the ESG meetings and Europe thus needs to be prepared in the event that the Japanese government comes forward with a clear plan for hosting the ILC in Japan and invites Europe to participate.

THE EUROPEAN ACTION PLAN

- (Steiner Stapnes / CERN – LCWS2017 Strassbourg)

KEK-ILC Action Plan

KEK-DG Yamauchi set up a WG to develop a KEK-ILC action plan in May, 2015.

The KEK-ILC Action Plan was released in January 2016. It contains technical preparation tasks and a human resource development plan for the pre-preparation phase (current efforts) and the main-preparation phase (after "green sign" from MEXT). It focuses mainly on a development plan for KEK.

"Producing a EAP (European Action Plan) for the ILC in timely manner is very important."

"After having established a discussion group with DOE, discussions with Europe are likely to become the next important topic for MEXT."

Extracted from slides of Y.Okada, KEK – EJADE meeting 6.9.16

On the European side it was suggested to use the EJADE H2020 MC project to prepare the EAP – the effort was started October 2016

E-JADE

Europe-Japan Accelerator Development Exchange Programme

Programme 2015-2018:

- Three main technical WPs
- Supports extended stays of European Researchers in Japan
- Recently adapted to include detector and physics studies for ILC (new partners)

Technical WPs: WP1: LHC with upgrades/FFC/ SuperKEKb, WP2: ATF2, WP3: ILC/CLIC

Partners: CERN (coord), DESY, CEA, CNRS, CSIC, RHUL, OXF with Uni. Tokyo and KEK -> WG for EAP

New partners: VINCA, AGH-Cracow, Tel Aviv University, Liverpool University, Université de Strasbourg, Université Paris-Sud, Tohoku University and Kyushu University.

Authors of EAP:
For EJADE institutes:
CERN: S.Stapnes, CEA: O.Napoli, DESY: N.Walker/H.Weise/B.List, CNRS: P.Bambade/A.Jeremi, UK: P.Burrows, CSIC: A.Faust-Golfe

EJADE WP3 and centrally: T.Schoerner-Sadenius, M. Stanitzki
TDR: B.Foster

MEANWHILE, IN JAPAN:

The LDP, the governing party, formed a Liaison Council for ILC on Sep. 18 and adopted the following resolutions:

- **Position the ILC as a national project (which means an inter-ministry project to solve many different national issues)**
- **Allocate a separate budget for the ILC aside from the normal budget for science & technology/academia/ university funds**

Keisuki Fujii / October 2nd 2018

DRAFT DOCUMENT

Energy and precision frontier

8. The successful realization of the High Luminosity LHC is of highest priority, including upgraded general purpose experiments Atlas and CMS, as well as flavour physics with LHCb and heavy-ion physics with Alice.

9. There is a strong scientific case for an electron-positron collider, complementary to the LHC, that can study the properties of the Higgs boson and other particles with unprecedented precision and whose energy can be upgraded. Therefore, a 2018 statement is needed from Japan on hosting the ILC, including guidance about the resources foreseen. In the scenario that ILC (phase-1) project in Japan is approved, CERN should take a visible and vivid role in its design, construction and exploitation and utilize the full potential of CERN's capabilities.
    a. Any Dutch participation or investment to the ILC will be implemented under the umbrella of the overall CERN related particle physics funding.
    b. Subsequently, once the ILC phase-1 is approved, CERN's CLIC technology is the ideal opportunity for an energy upgrade in the ILC infrastructure in Japan.

10. Due to the high starting costs (tunnel infrastructure), the construction of the FCC-ee facility is only relevant with the vision to construct the FCC-pp in the future as well. CERN should increase the physics case for both FCC-ee and FCC-pp simultaneously.

11. Any sign of new physics beyond the Standard Model will give direction to the future generation of infrastructure. CERN should take all measures to optimize this potential and intensify the diversity physics program to reach this point.

DRAFT DOCUMENT

11. Any sign of new physics beyond the Standard Model will give direction to the future generation of infrastructure. CERN should take all measures to optimize this potential and intensify the diversity physics program to reach this point.
    a. The Netherlands support the construction of the SHIP experiment

12. In the case no new BSM physics is found at LHC, and Japan does not host ILC, CERN should optimize the costs to construct a high luminosity e+e- machine of 250 GeV to become online in the mid-2030-ies.

13. In the meantime, CERN should prepare for a future accelerator on-site by pushing the R&D efforts for high-gradient acceleration – e.g. wakefield- and high field magnet technology. In addition the feasibility of building a muon collider should be pursued.