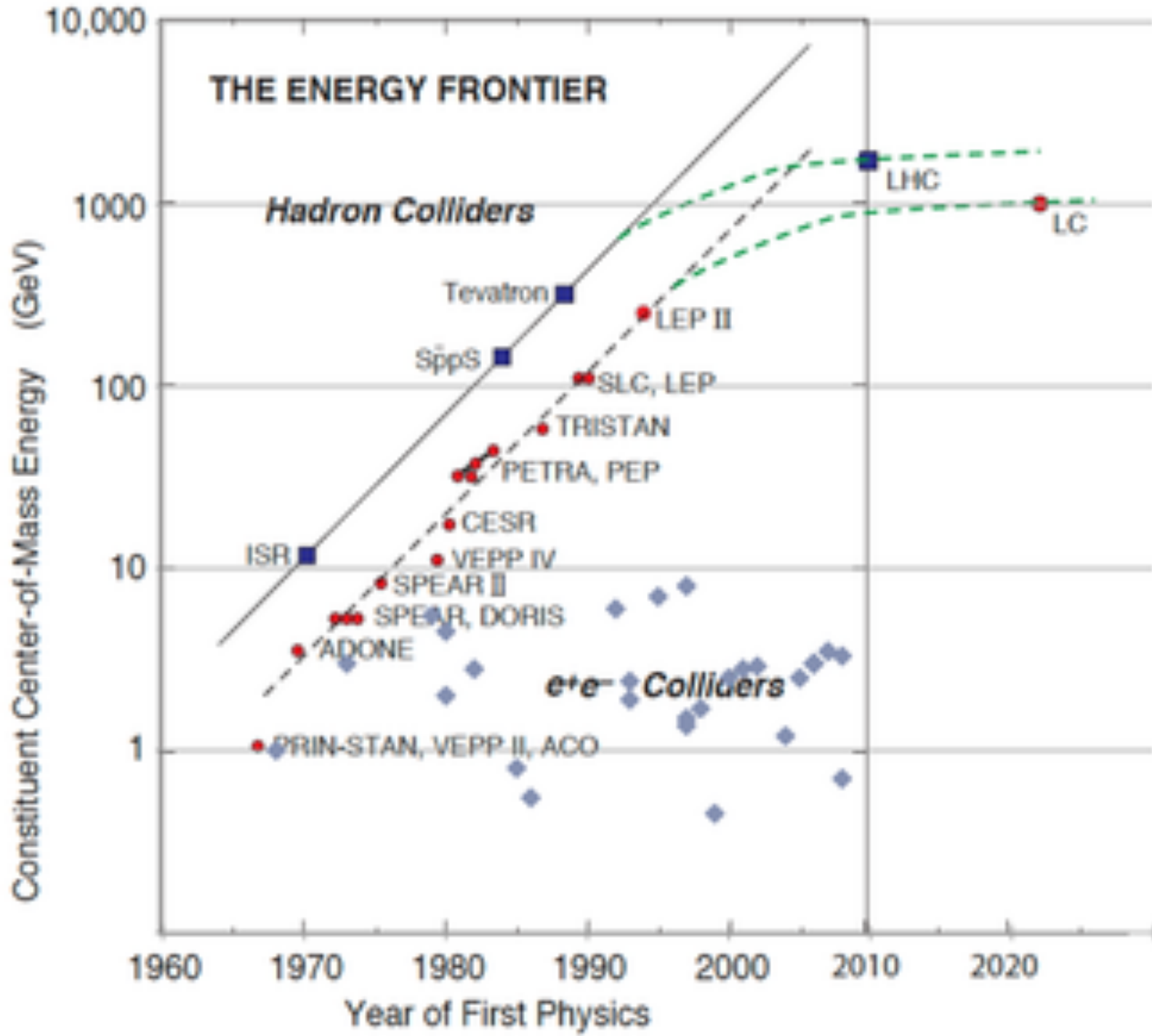
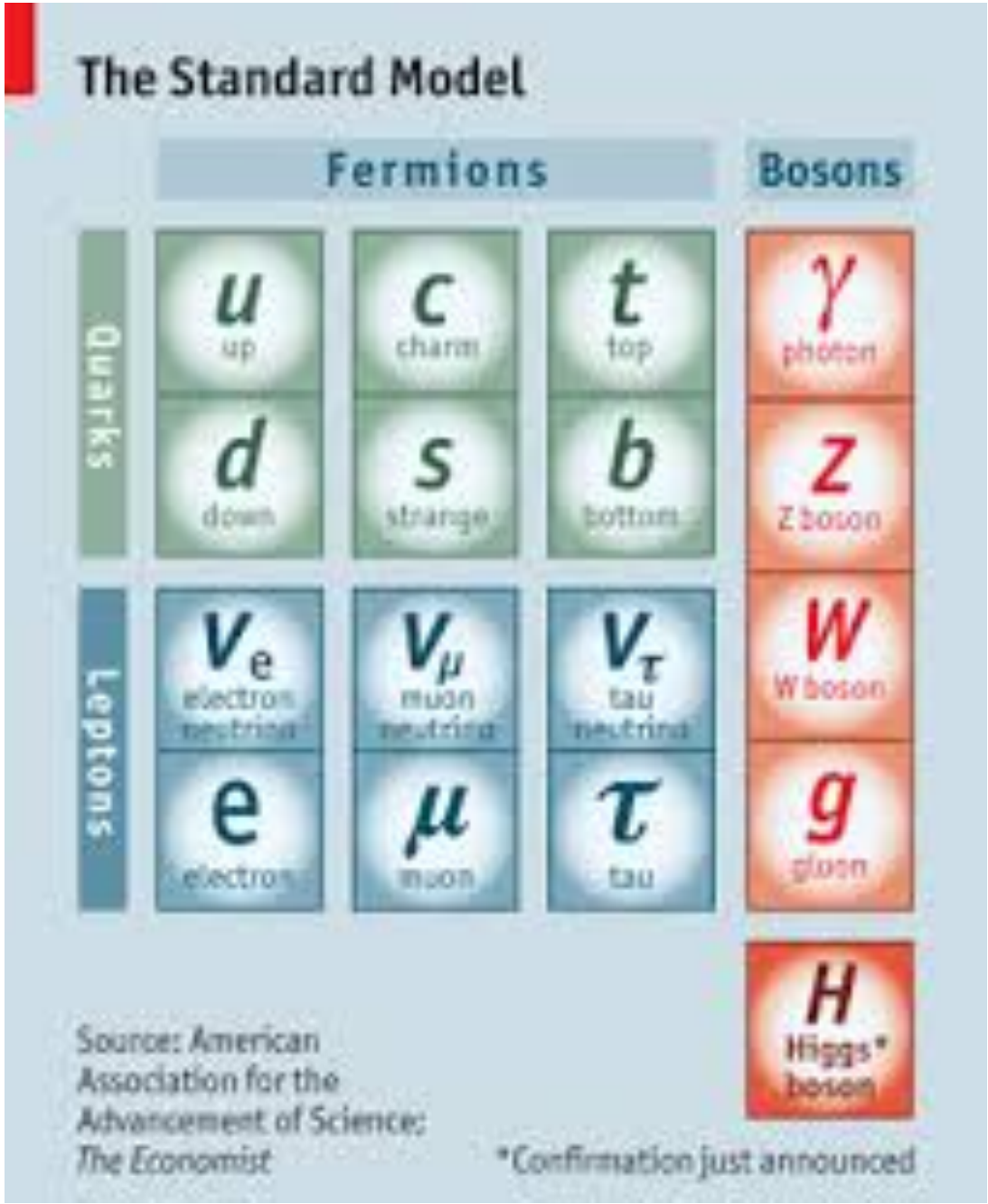

LHC: What next?
LHC: E a seguir?

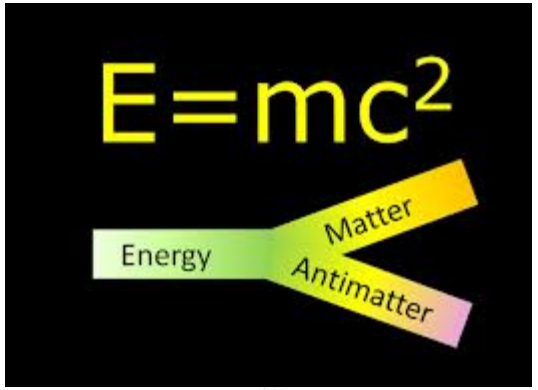
Lepton collider

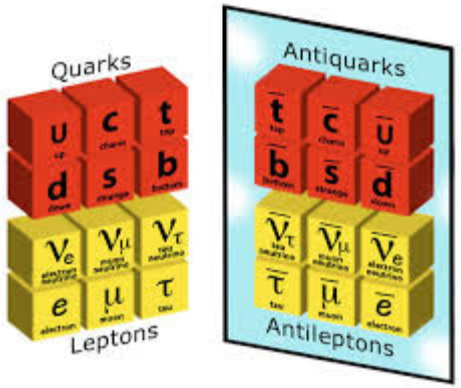
or

hadron collider?


THE ENERGY FRONTIER
Hadron Colliders
e+e− Colliders
LHC
LC
Tevatron
LEP II
SppS
SLC, LEP
TRISTAN
PETRA, PEP
CESR
ISR
VEPP IV
SPEAR II
SPEAR, DORIS
ADONE
PRIN-STAN, VEPP II, ACO
Constituent Center-of-Mass Energy (GeV)
10,000
1000
100
10
1
1960
1970
1980
1990
2000
2010
2020
Year of First Physics


The Standard Model
Fermions
Bosons
Quarks
u up
c charm
t top
γ photon
d down
s strange
b bottom
Z Z boson
Leptons
$\nu_e$ electron neutrino
$\nu_\mu$ muon neutrino
$\nu_\tau$ tau neutrino
W W boson
e electron
μ muon
τ tau
g gluon
H Higgs* boson
Source: American Association for the Advancement of Science; The Economist
*Confirmation just announced

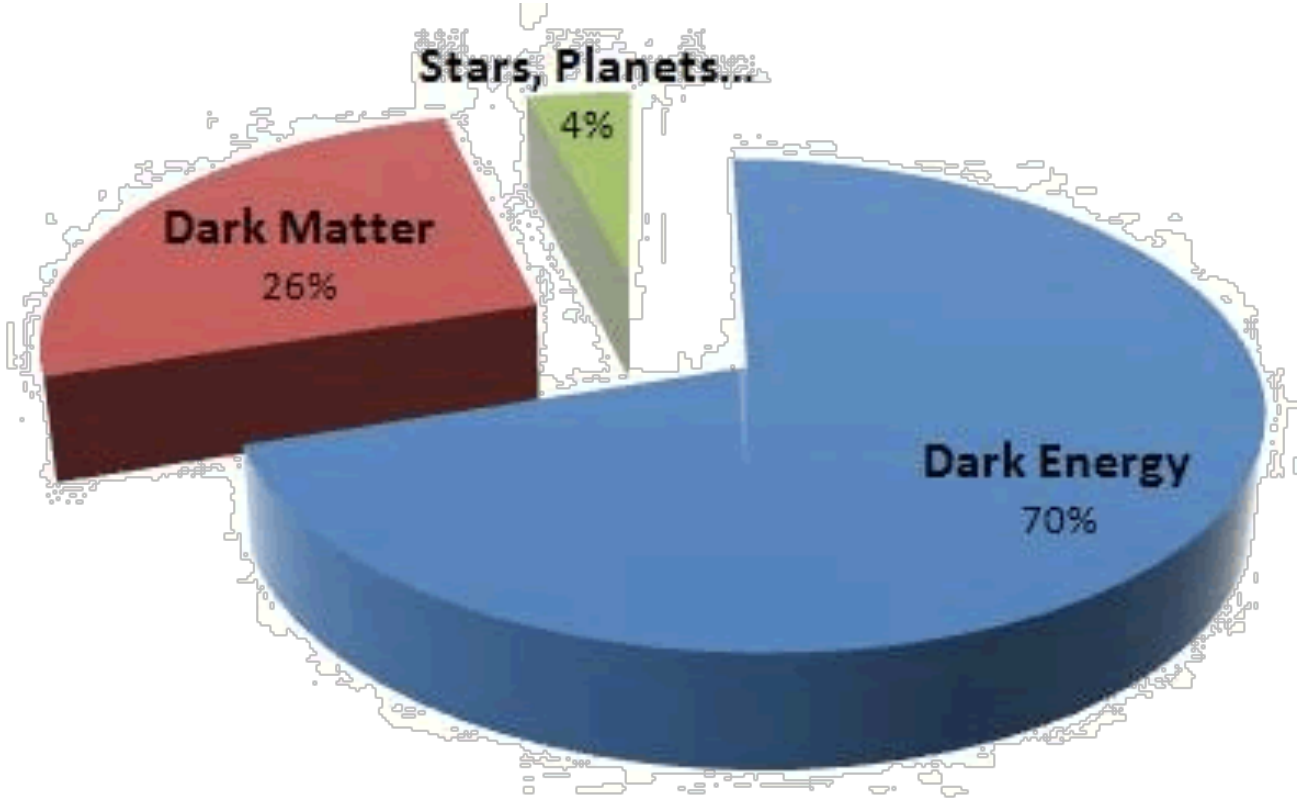



OK in the lab…

Not in the universe…

Experimental evidence!




Experimental evidence!

Majorana fermion

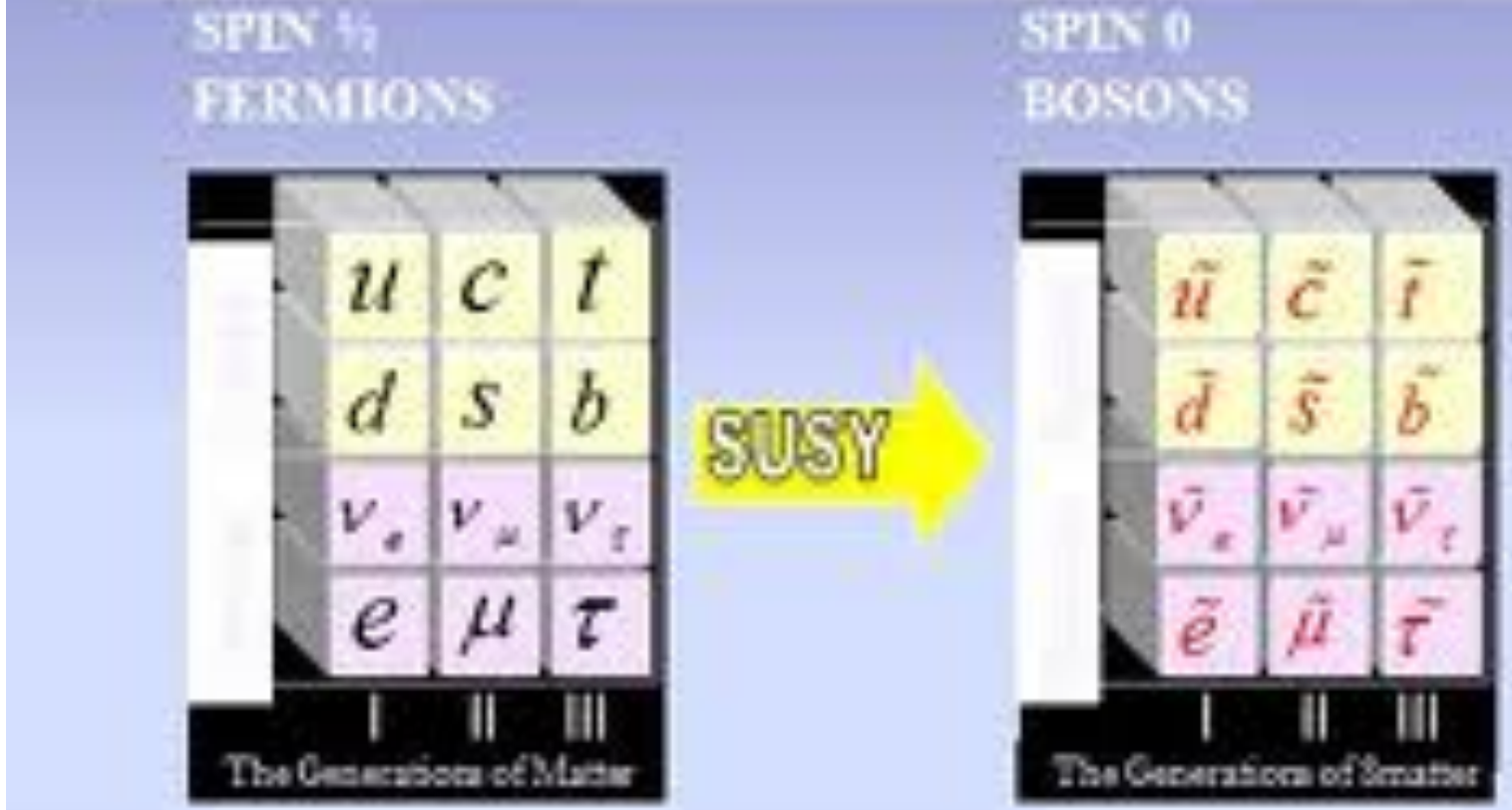
wimps

Lightest Supersymmetric Particle (LSP)

neutralinos

Sterile neutrino

# SUSY → Doubling the World



**Leptons** are fundamental particles

**Hadrons** are not fundamental

In a **lepton beam** of known energy, each particle has its energy

In a **hadron beam** each hadron's energy is shared out between its constituent particles in a constantly changing way

**The two types of machine compliment each other:**

**Hadron colliders are useful for discovering new physics or searching for new particles as they explore a wide range of collision energies with one beam energy.**

**Lepton machines can be used for precision measurements of particles after their discovery.**

**For example, the *W* and *Z* particles were discovered in CERN's SPS synchrotron by colliding protons and antiprotons. The LEP collider was then built to measure the *Z* mass to very high precision by colliding electrons and positrons at precisely the rest energy of the *Z*.**

**The total power radiated by a particle of energy $E \gg mc^2$ is equal to:**

$$-\frac{dE}{dt} = \frac{2e^4}{3m^4c^7} H_\perp^2 E^2 =$$

$$0.98 \times 10^{-3} H_\perp^2 \left(\frac{E}{mc^2}\right)^2 \quad \text{electron volts/sec}$$

**…So the loss rate for the electron is $(97833/54)^4$ or over $10^{13}$ times the loss for a proton of the same energy in the same accelerator…**

# Sirius: New Brazilian Synchrotron Light Source

# LHC Strategy (II)

**Full exploitation of the LHC physics potential**
**→ maximize integrated luminosity useful for physics**

- LHC operation until around 2030, aim at $\int Ldt \approx 3000/fb$

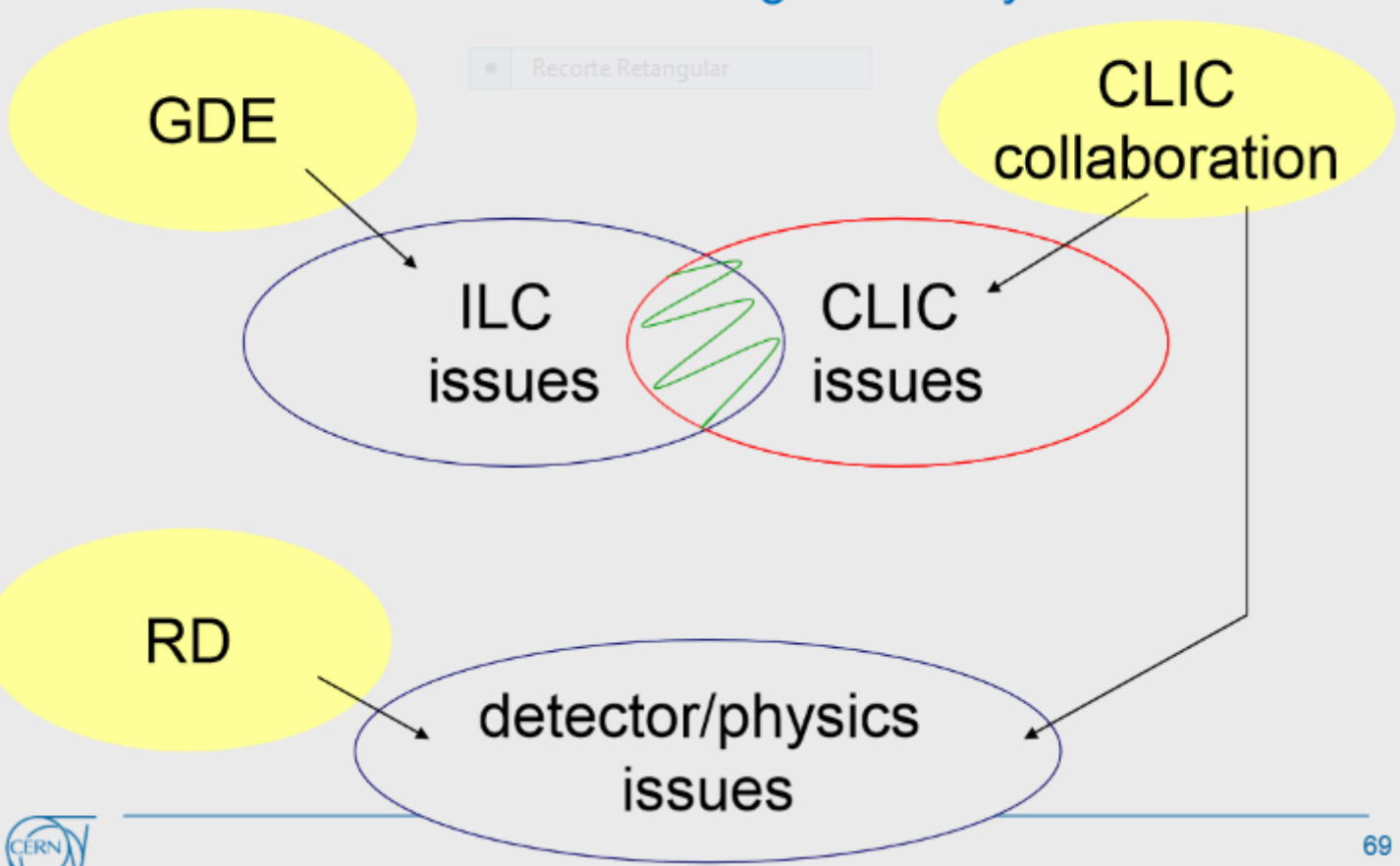
- Between 2010 and ~2020: ~design luminosity (~$10^{34}/cm^2/s$)
  connection of LINAC4 earliest 2015
  detector modifications to optimize data collection

- High Luminosity LHC (HL-LHC) from ~2020 to ~2030
  luminosity around $5x10^{34}/cm^2/s$, luminosity leveling
  new Inner Triplet around 2020 (combine both phases)
  detector upgrades around 2020 → R&D NOW

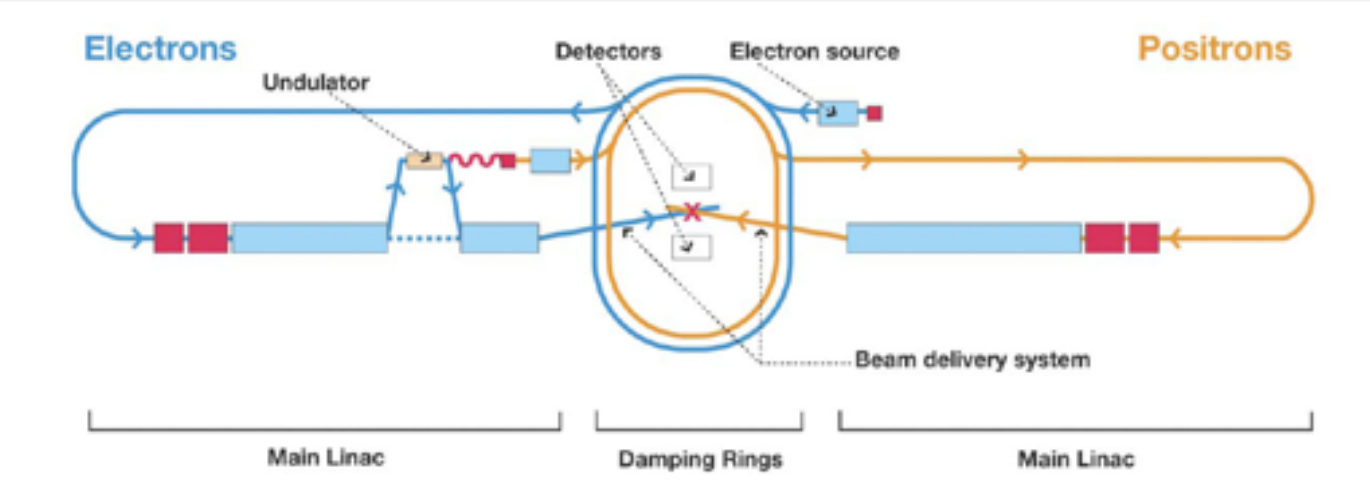
# Strategy to Address LC Key Issues

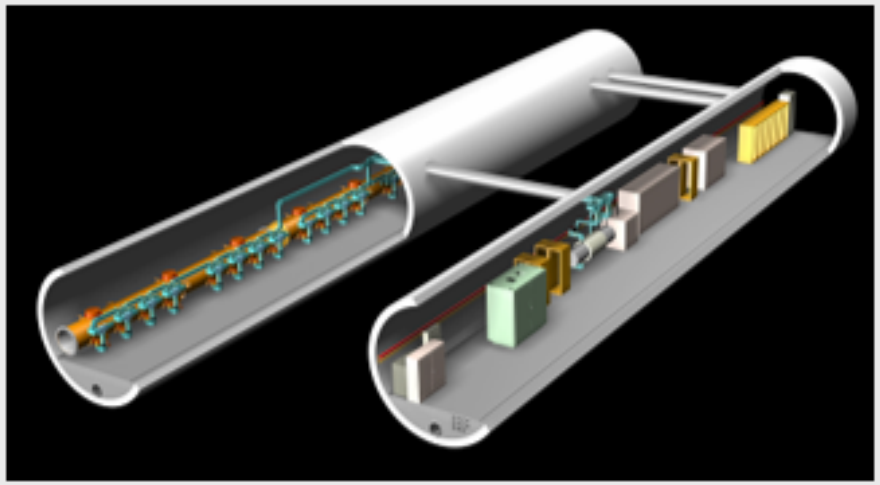
Recent progress: much closer collaboration

first meeting: February 08



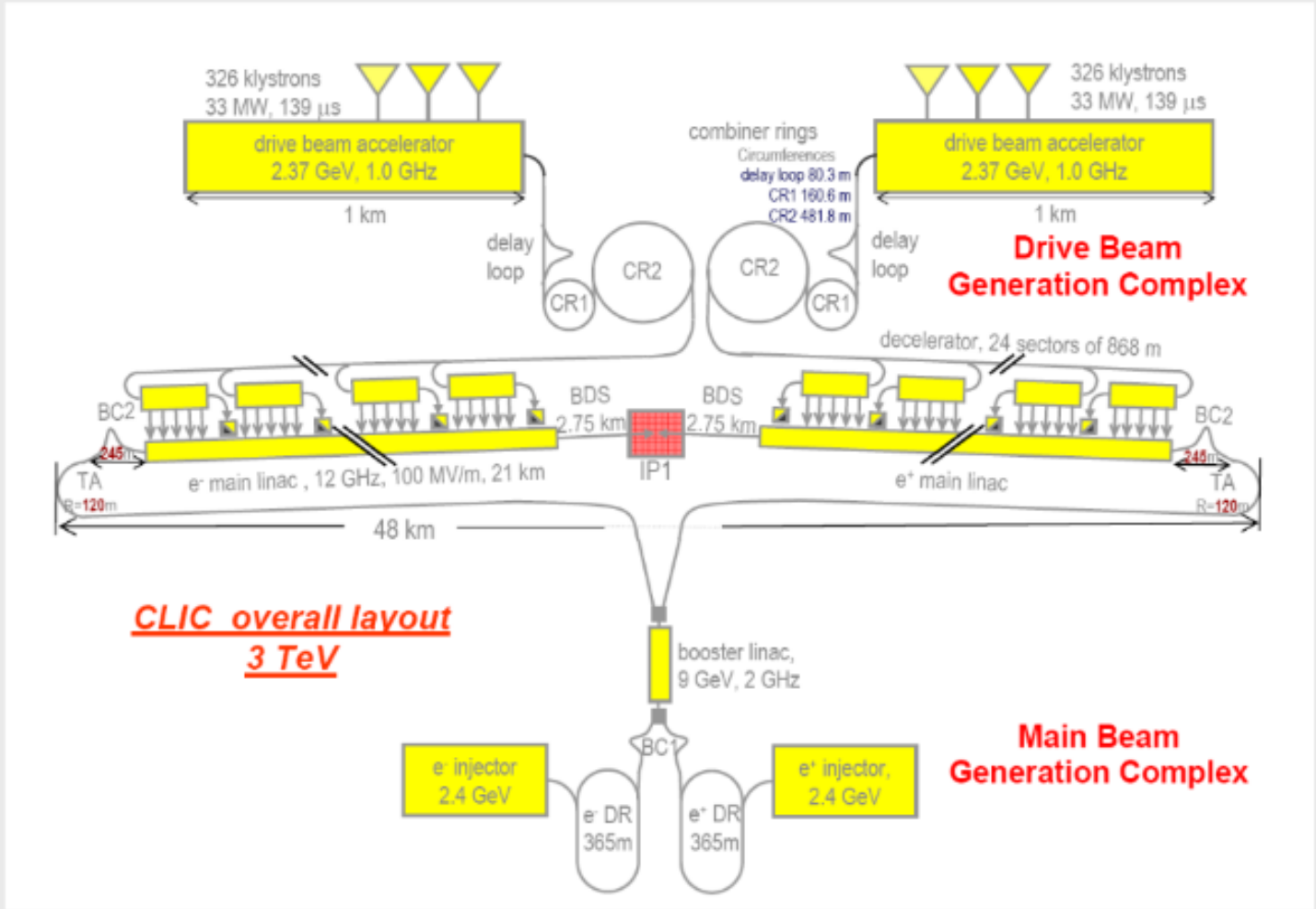
# The International Linear Collider



| | |
|---|---|
| Energy | 250 Gev x 250 GeV |
| # of RF Units | 560 |
| # of Cryomodules | 1680 |
| # of 9-cell Cavities | 14560 |
| Accelerating Gradient | 31.5 MeV/m |
| Peak luminosity | $2\ 10^{34}\ cm^{-2}s^{-1}$ |
| Rep. Rate | 5 Hz |
| IP | $\sigma_x$ 350 – 620 nm; $\sigma_y$ 3.5 – 9.0 nm |
| Total Power | ~230 MW |
| 2 Detectors Push-pull | |

# CLIC Overall Lay-out



# The year 2014 – The real starting year of the ILC?



Rika Takahashi | 6 February 2014

*KEK's Director General, Atsuto Suzuki talks about his plan with new Planning Office*

Close to the end of the year 2013, we had encouraging news for the ILC. On 24 December, the Japanese cabinet released the government budget decision for fiscal year 2014 – which includes an official budget for the International Linear Collider. The amount of the budget is 50 million yen, about half a million US dollars, which might not seem a lot at first glance. However, this budget is highly significant in a symbolical way towards the realisation of the ILC, since this budget represents a qualitative change in the status of the ILC in the Japanese government. It means that the ILC is now recognised as a formal project.

This budget will be used by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) to investigate and analyse the requirements and issues for the realisation of the ILC, and for collecting objective data which serves as the basis for the future governmental decision.

Along with this development at the government level, the Japanese research community is also taking a next step. On 6 February, KEK announced the creation of an office responsible for the ILC project, the ILC Planning Office. The office will be headed by Atsuto Suzuki, Director General of KEK.

KEK has been playing a leading role in research and development efforts for the ILC. "With the national budget officially allocated, the ILC project now needs the driving force to bring forward the project. The new office, the Planning Office for the International Linear Collider, will coordinate and integrate efforts on planning, scheduling, and managing research activities. It


LHC
Jura
Canton of Vaud
Lake Geneva
Prealps
Ain Department
Canton of Geneva
Haute-Savoie Department
Salève
Jura
Schematic of an
80-100 km long
circular tunnel
Aravis
Mandallaz
© Copyright CERN 2014

São horas de embalar as trouxas
É tarde oh Tia Maria
Por esses campos fora
Vamos lá saindo....

Canção dos camponeses  do Alentejo