



A (virtual) visit to the beginning of everything @ the LHC

- Conference will start shortly
- Switch off camera and microphone
- Open the *chat* tool (down-right)



Alexis Kalogeropoulos
Princeton University / CERN

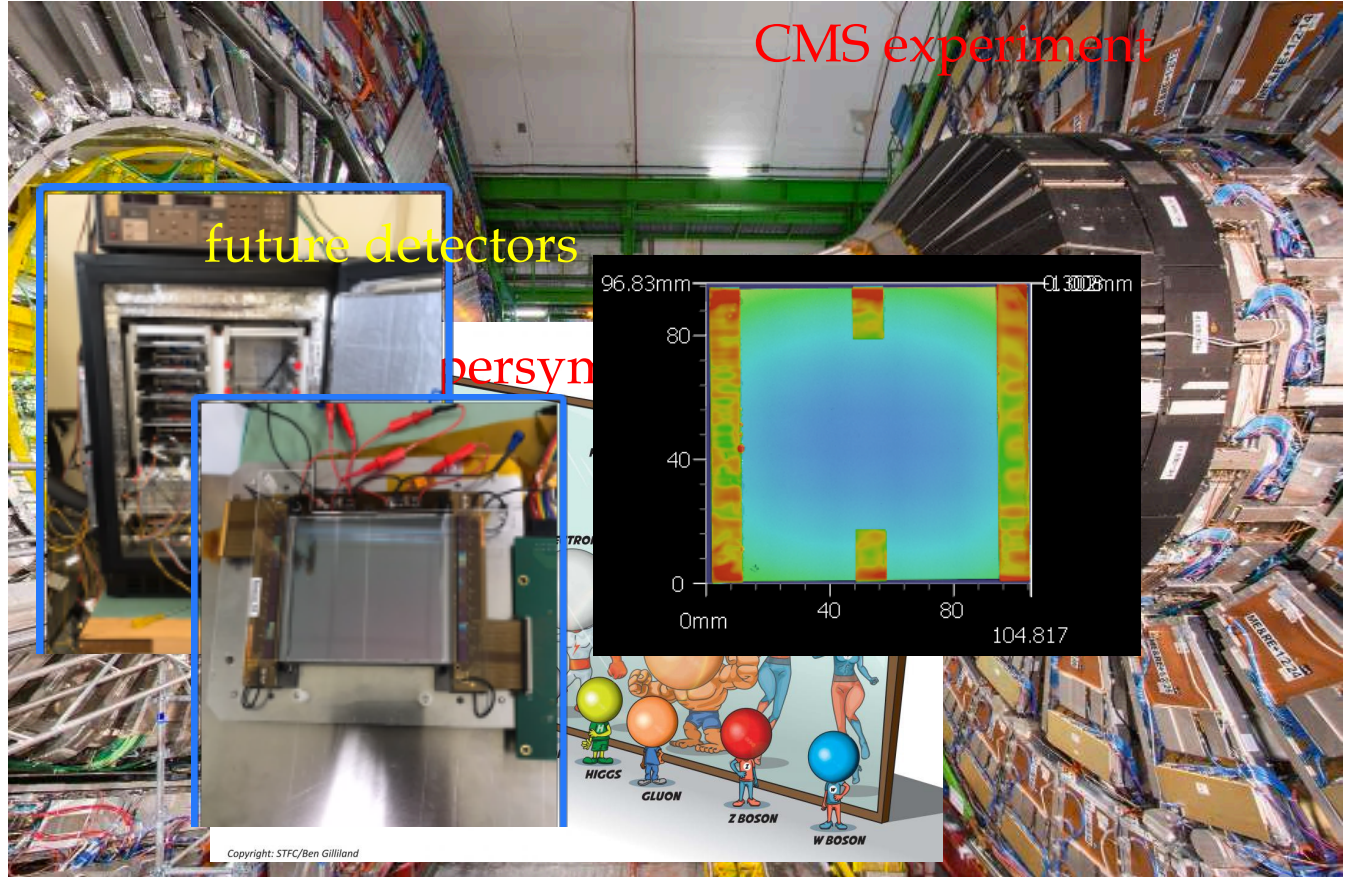


A detail of the LINAC2 drift tube (from [here](#))

What someone like me do at CERN ?



BSc, MSc : Univ. of Athens
PhD : IIHE-VUB/Belgium
Post-doc: DESY and now
Senior Researcher @ Princeton



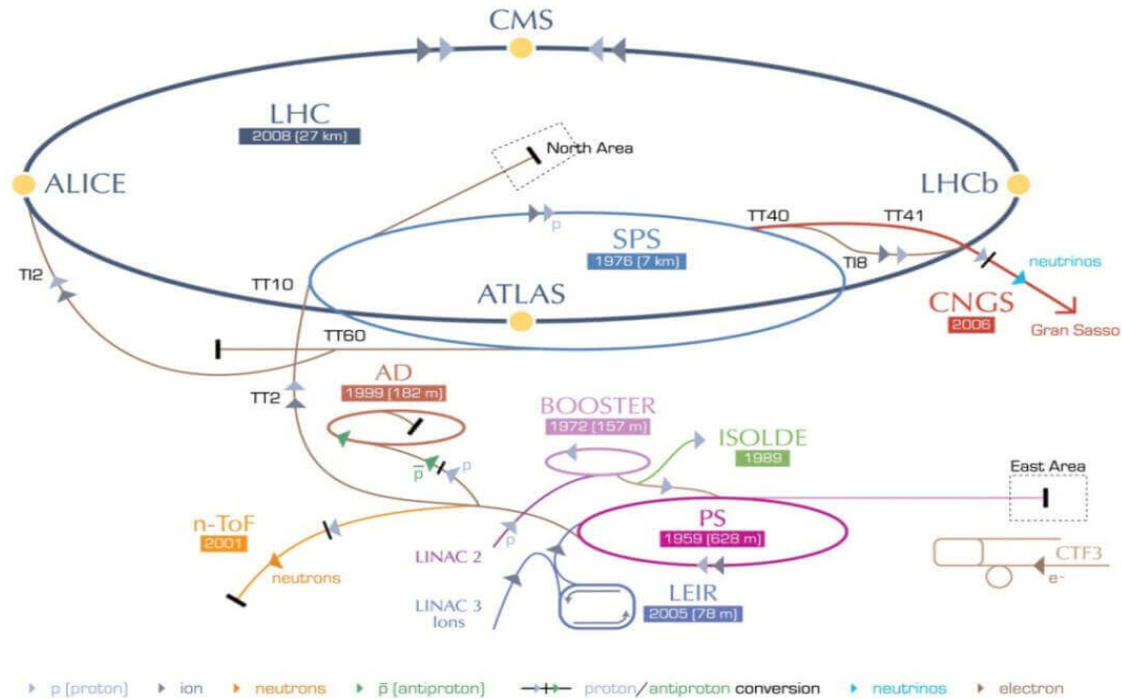
What are we going to see today?



But let's take a step back....

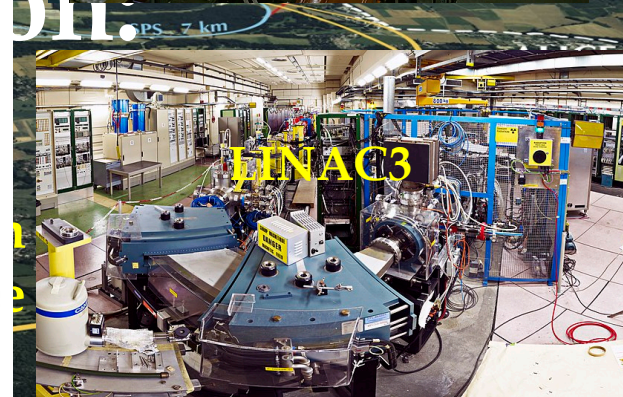
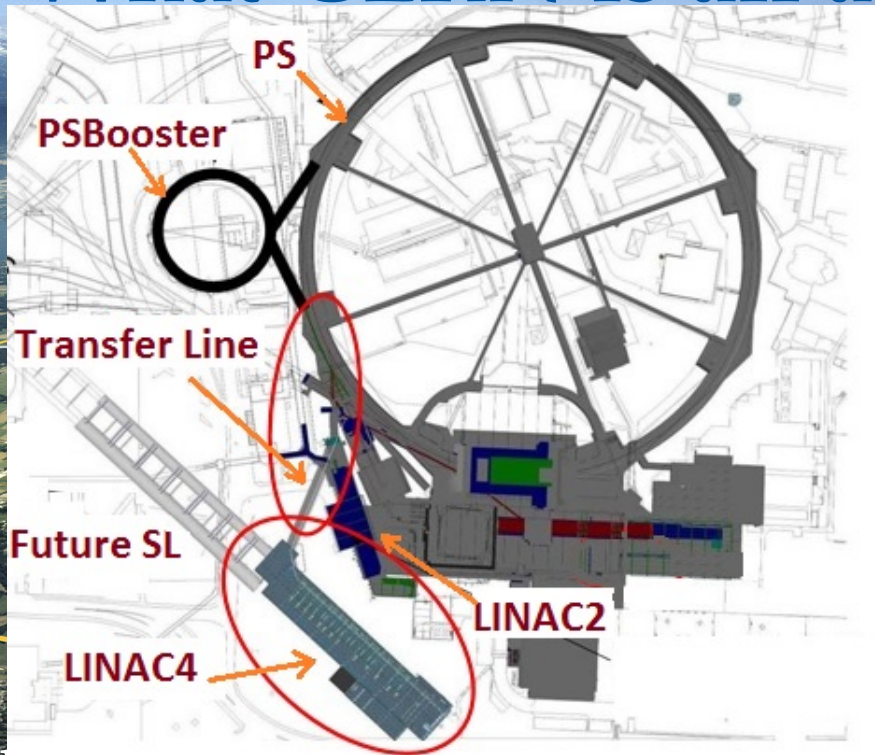
Alexis Kalogeropoulos - Virtual Conference @ CERN

CERN's accelerator complex



LHC Large Hadron Collider SPS Super Proton Synchrotron PS Proton Synchrotron
 AD Antiproton Decelerator CTF3 Clic Test Facility CNGS Cern Neutrinos to Gran Sasso ISOLDE Isotope Separator On-Line DEvice
 LEIR Low Energy Ion Ring LINAC LINear ACcelerator n-ToF Neutrons Time Of Flight

What CERN is all about?



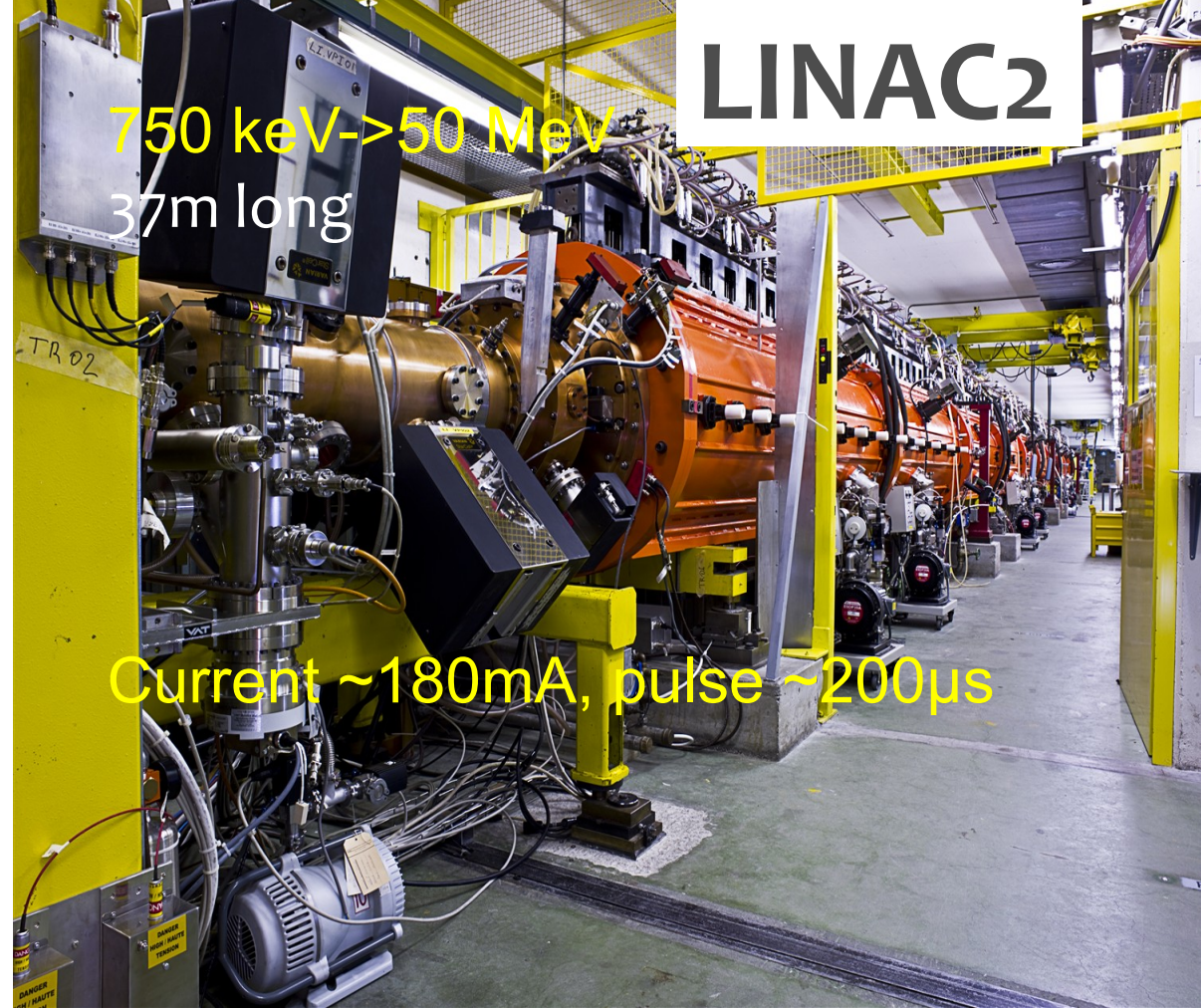
Understanding the nature and the laws of the universe

More on the accelerator complex <https://videos.cern.ch/record/1125472>

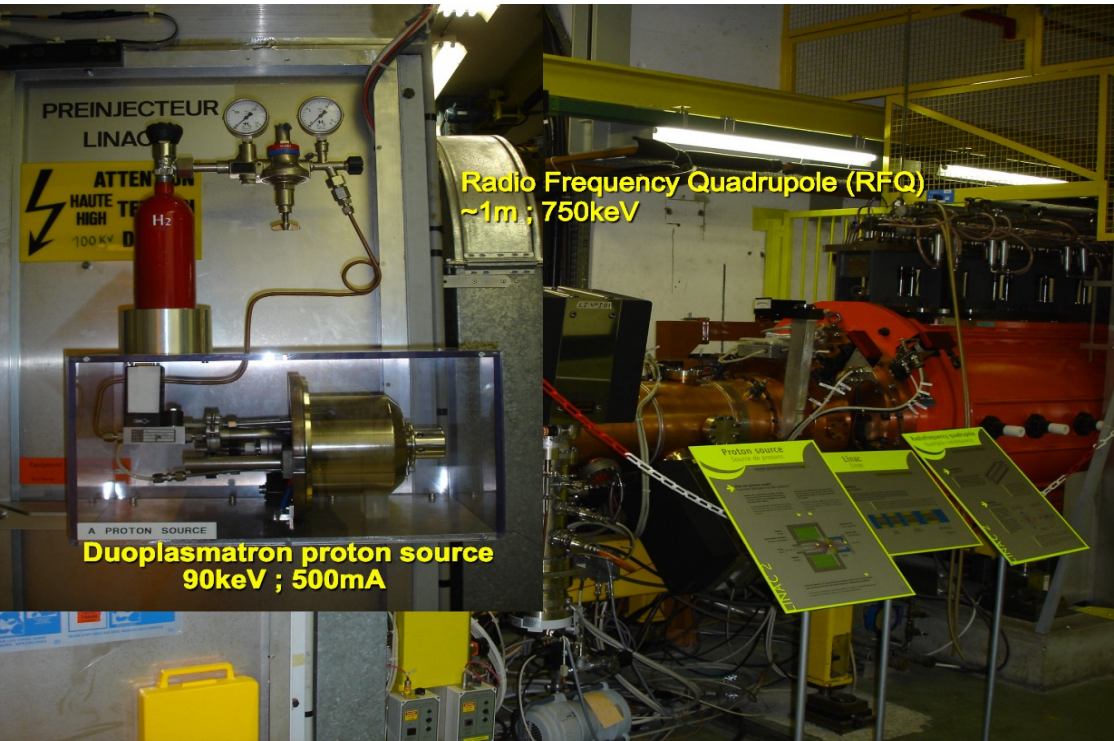
LINAC1



LINAC2



How to make a proton beam?



1. Everything starts from a plain bottle of H_2

2. Hydrogen atoms are stripped from their electrons

to get protons



For the LHC beam, we need:

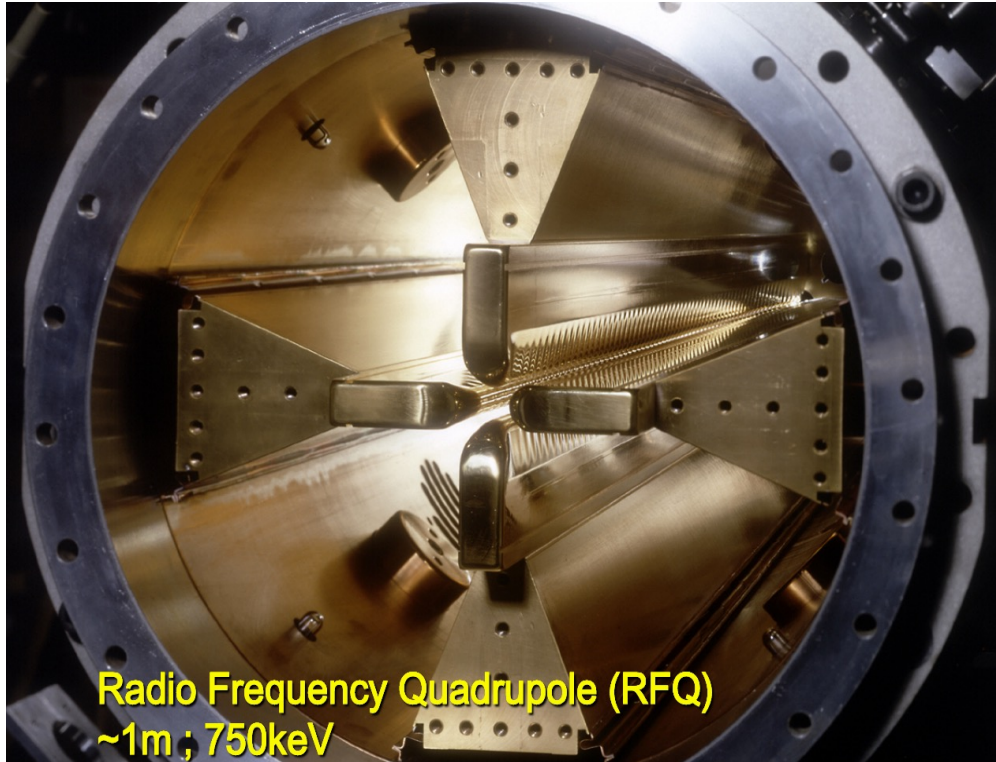
2808 bunches $\times 1.15 \cdot 10^{11} = 3 \cdot 10^{14}$ protons per beam
or, $6 \cdot 10^{14}$ protons for the two beams (1)

A single cubic centimetre of hydrogen gas at room temperature contains $\sim N = 2.4 \cdot 10^{19}$ molecules

Since the LHC is filled every ten hours, this cylinder could be used for:

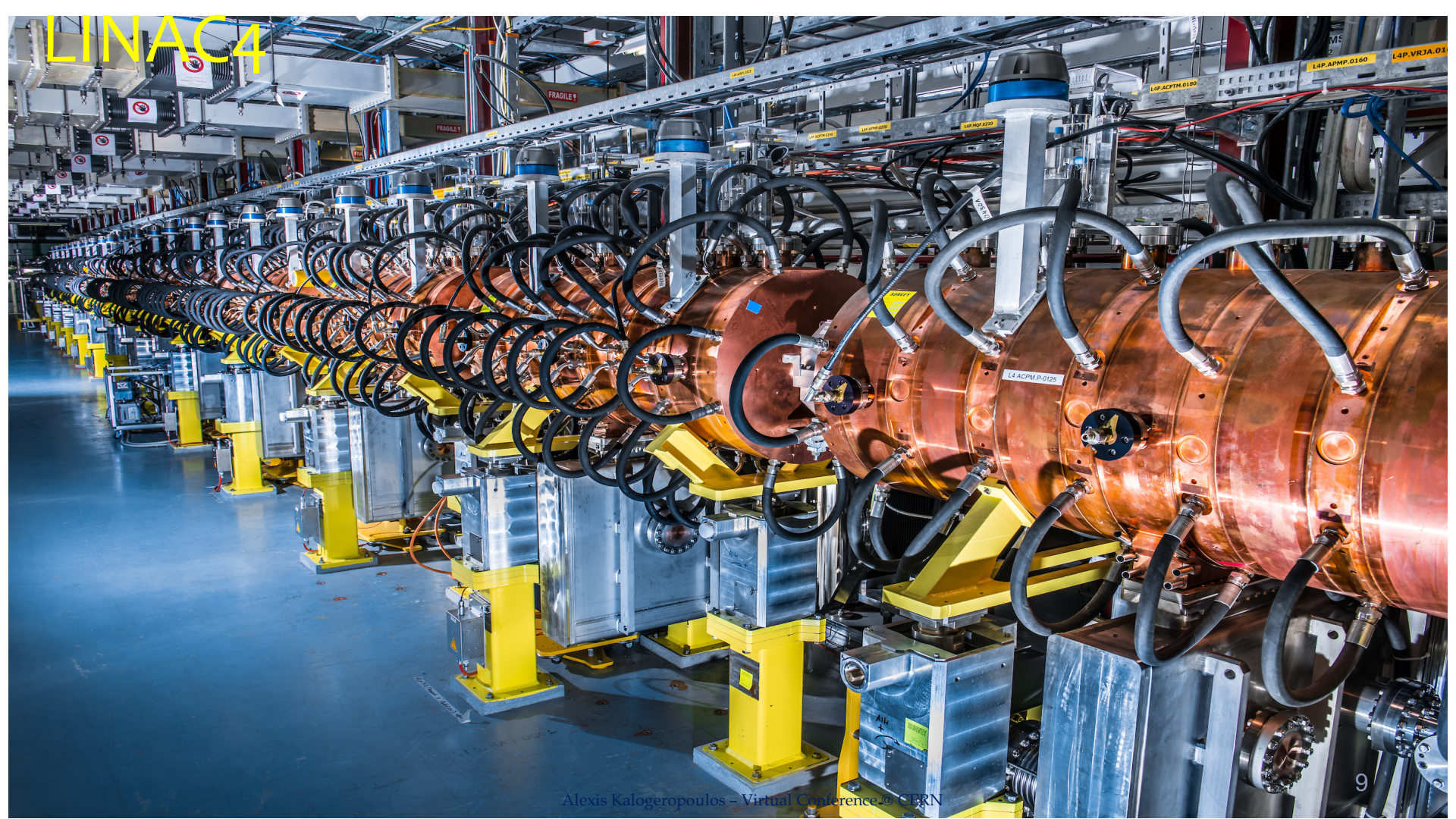
$$10 \times 3.5 \cdot 10^{12} = 3.5 \cdot 10^{13} \text{ hours} \\ \sim 4 \cdot 10^9 \text{ years !!!}$$

How to make a proton beam?

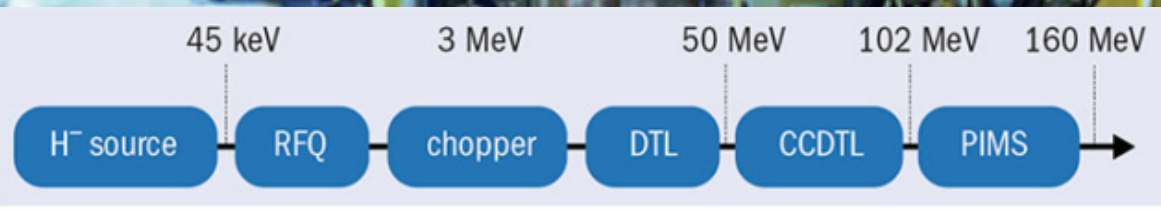
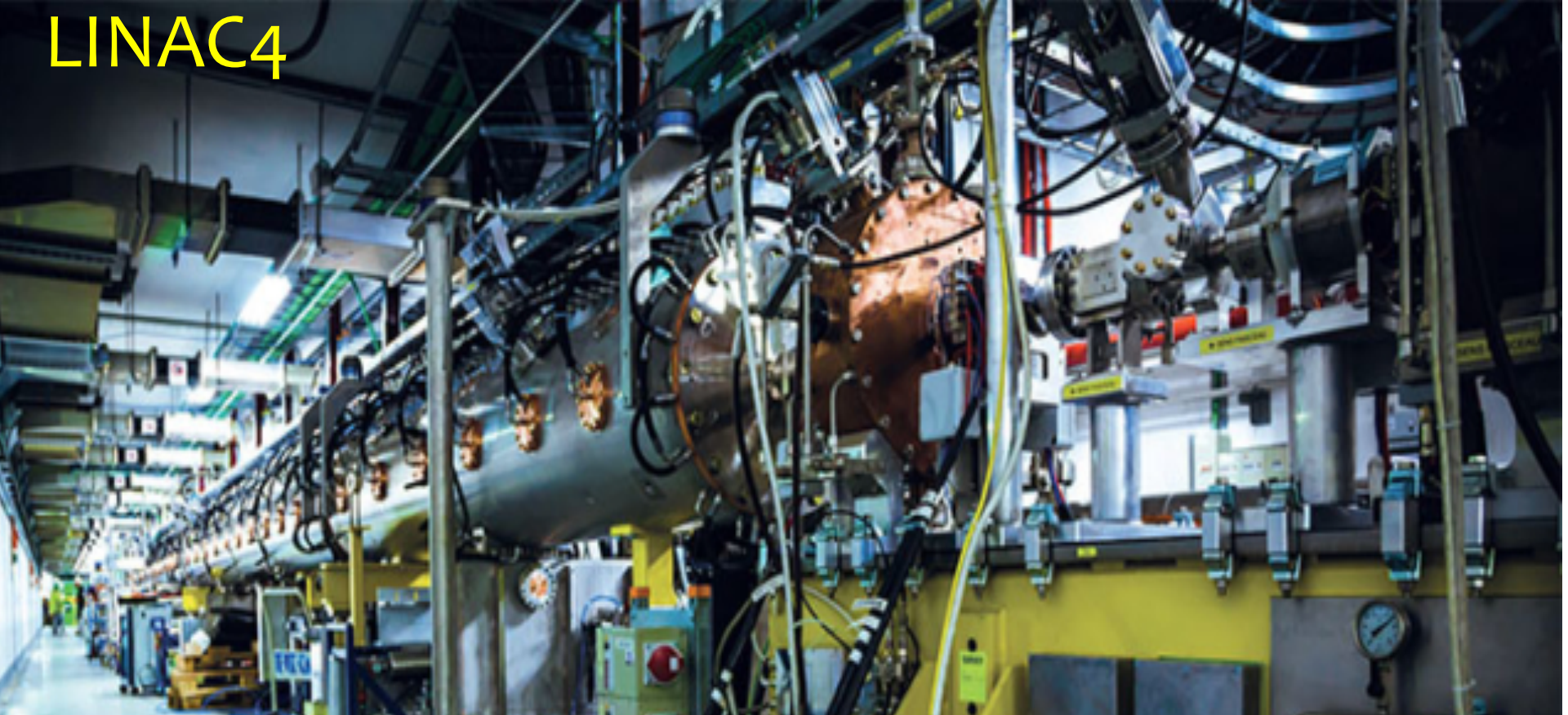


1. Everything starts from a plain bottle of H_2
2. Hydrogen atoms are stripped from their electrons to get protons
3. Protons are guided through a sequence of several different “boosters” to build momentum
4. Once they have enough momentum, they are injected into the LHC tunnel to collide

LINAC4



LINAC4



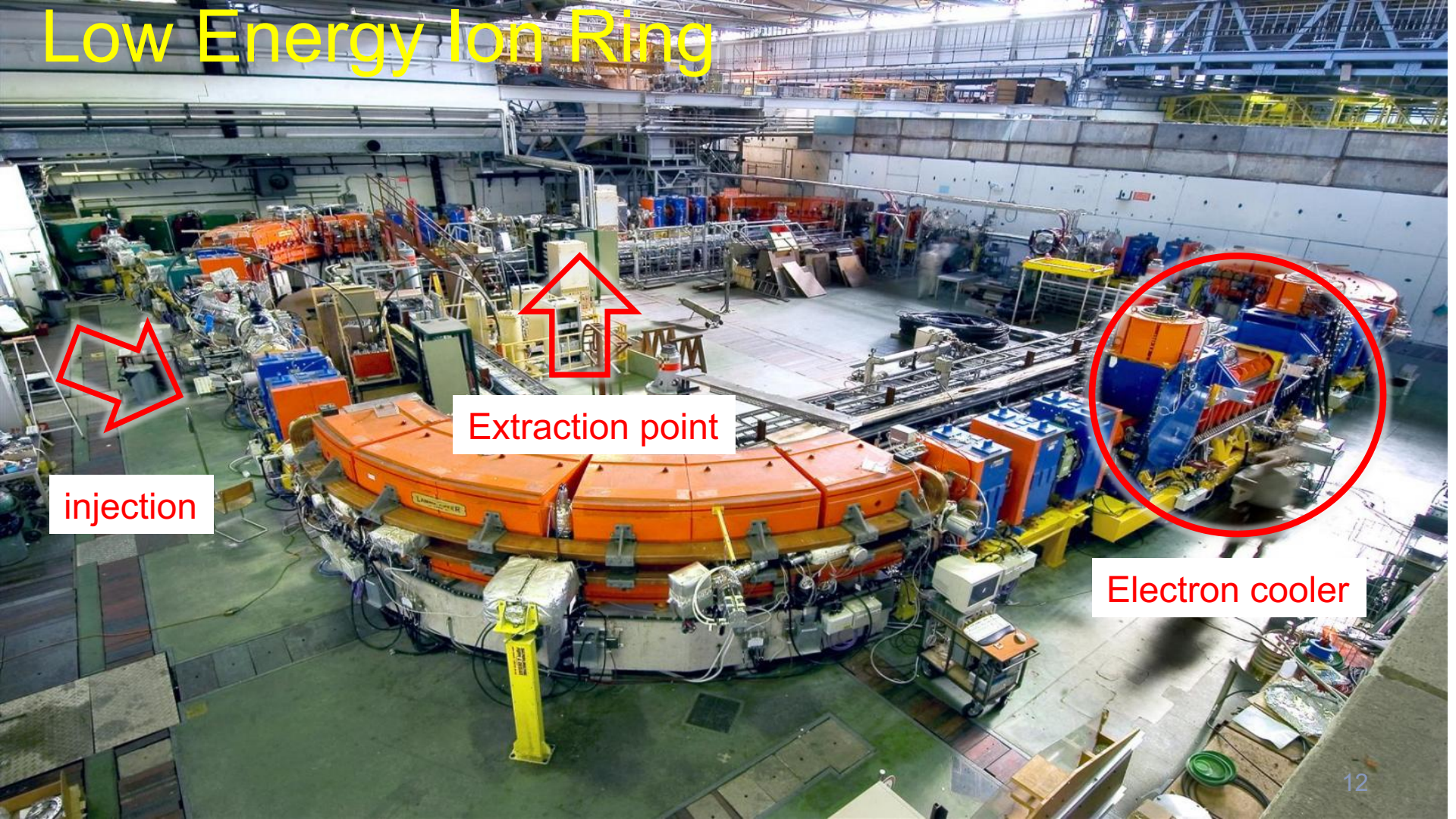
The Linac4 radio frequency quadrupole



<https://videos.cern.ch/record/2305457>

<https://videos.cern.ch/record/1275129>₁

Low Energy Ion Ring

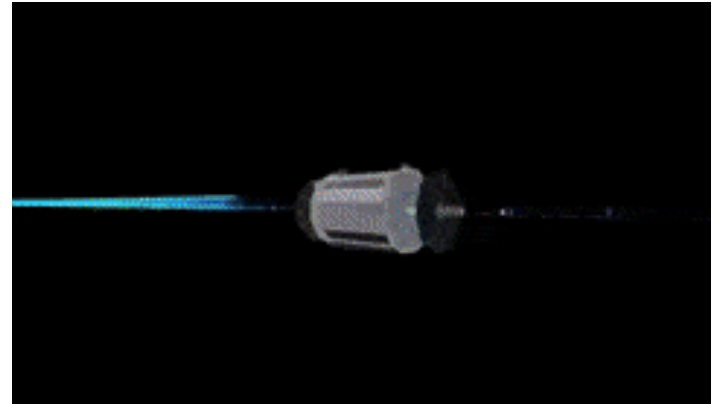
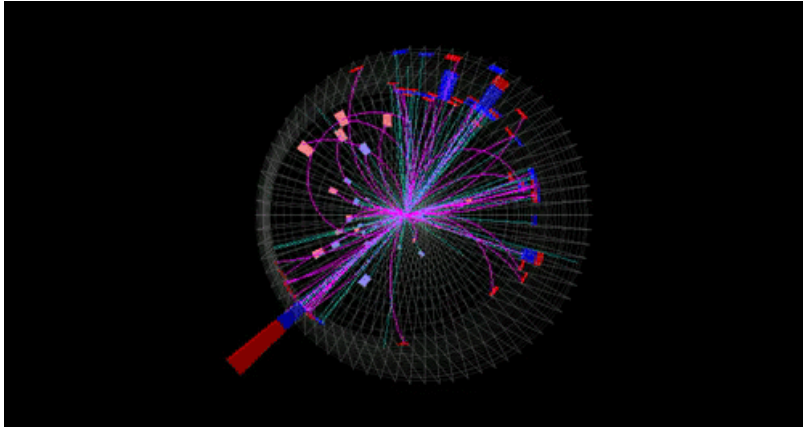
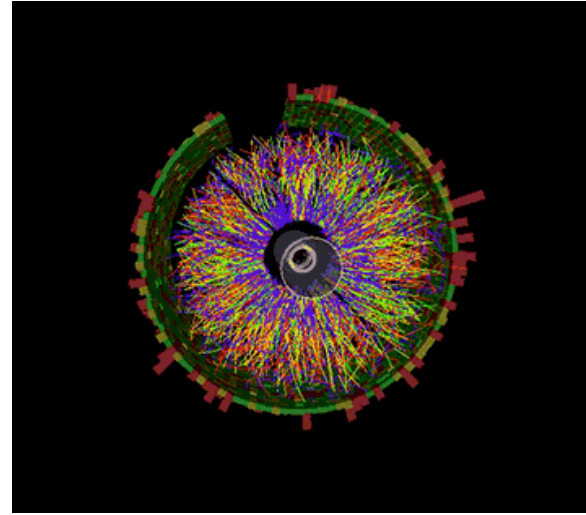
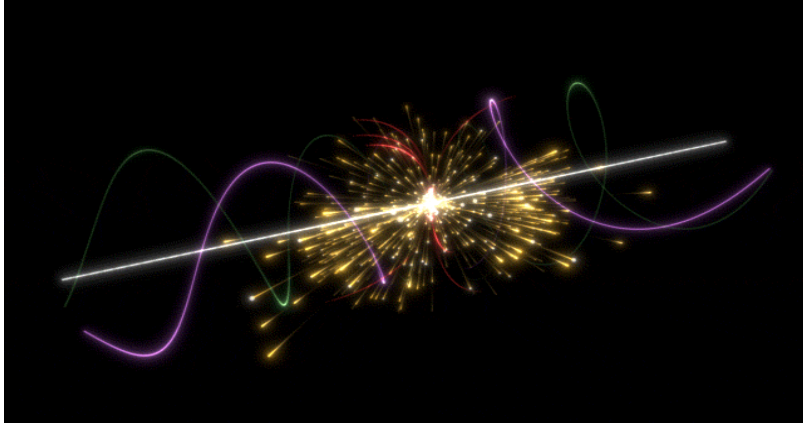


Extraction point

injection

Electron cooler

Millions of collisions!!!



Thanks for your attention!

To learn further...

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- visit.cern
- careers.cern

Thanks for filling
up survey!

Backup

CERN History

1954, CERN is born

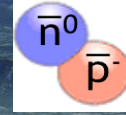


1957, 1st accelerator

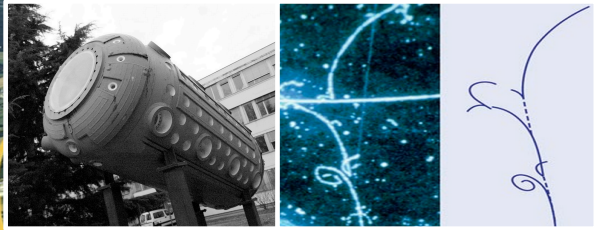


Synchro-Cyclotron (SC)

1965,
1st observations
of antinuclei
(antideuteron)



1973, Bubble chambers

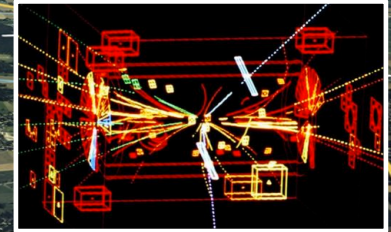


1976-83, SPS 7km



proton-antiproton
& Ion collisions

1983, Z^0 W^\pm discovery

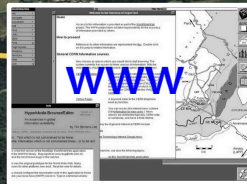


1989-2000,
LEP 27km,



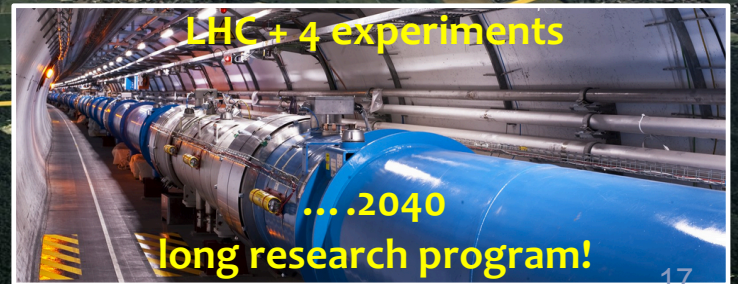
e^-e^+ collisions

1989



1st website/server

1998-2008,
LHC + 4 experiments



...2040

long research program!

Video: [CERN's history](#)