

DUNE the movie has just been released.

DUNE the movie has just been released.

There is an ECFA Workshop discussing a future electron positron machine and a potential hadron collider in the same tunnel afterwards.

DUNE the movie has just been released.

There is an ECFA Workshop discussing a future electron positron machine and a potential hadron collider in the same tunnel afterwards.

The year is 1984





LEP to the LHC

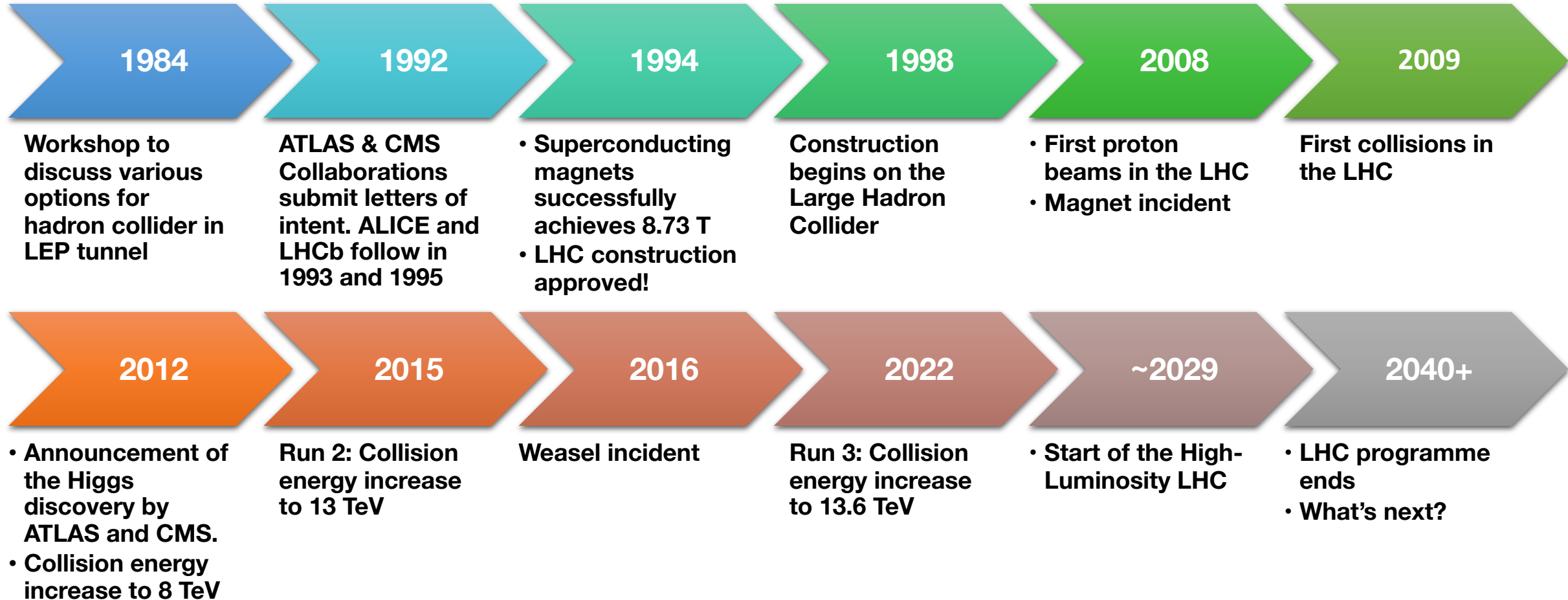
Clara Nellist

Topical Lectures

22.04.24

Travel through time

60 year journey!

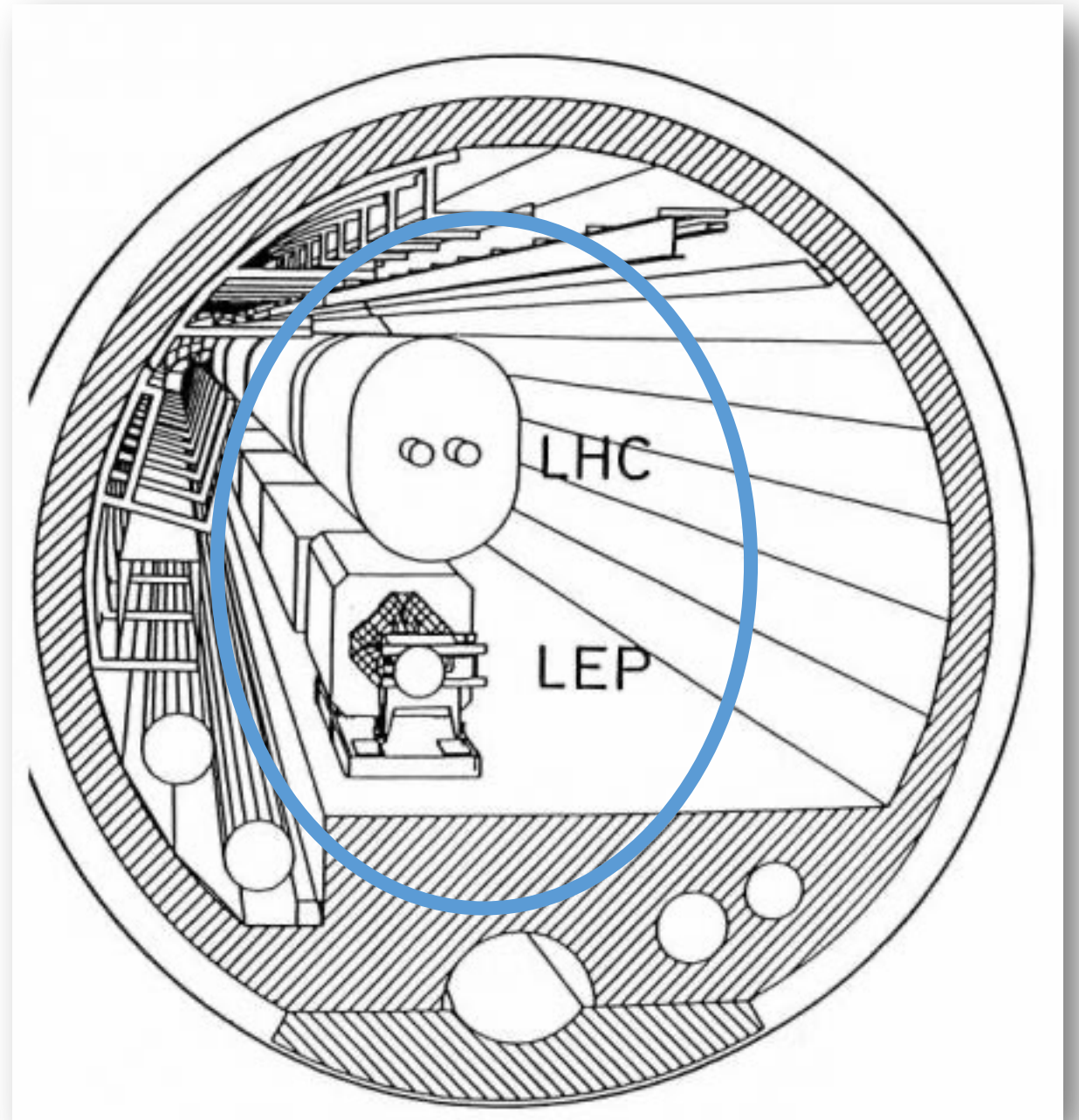


1984

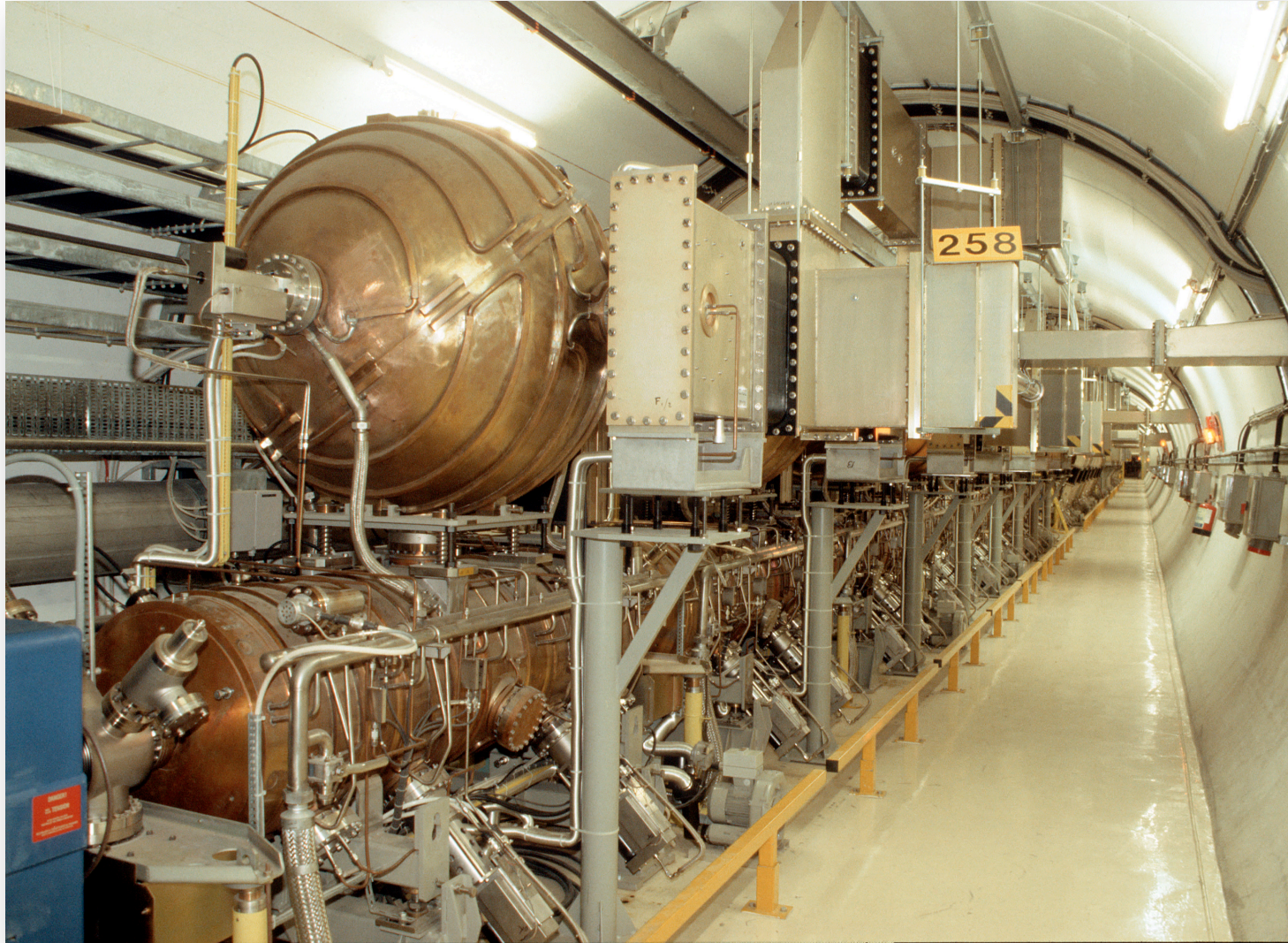
ECFA – CERN Workshop

Proposal: A Large Hadron Collider in the tunnel for the Large Electron Positron machine

Originally, the idea was to have both the LHC and LEP together (pe collider) after the end of LEP, but this was not done due to budget reasons.



Large Electron Positron Collider

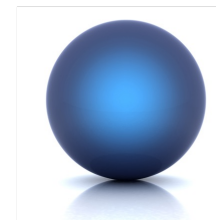


Size: 27km tunnel

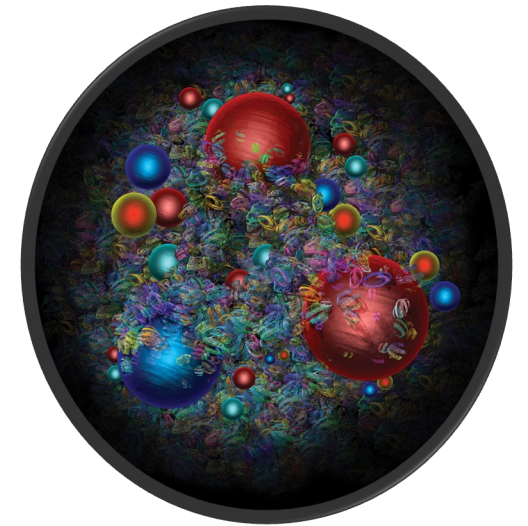
Electron-positron collider:

- Elementary particles
- Energy limited by synchrotron radiation due to the electron mass

Electron



Proton



~2000 times
more massive!

1984 The proposal of LHC in LEP tunnel

Whilst the installation of a large hadron collider in the LEP tunnel may at present be considered as a rather remote possibility, the design of the high-performance magnets which we would like to use for such a machine still demands a great amount of research and development; this indeed appears as a prerequisite for the definition of the parameters of such a project. A Workshop bringing together theorists, experimentalists, accelerator physicists, and also experts in superconducting magnets was thus deemed timely.

1994 The superconducting magnet technology



Message de J.-P. Gouber et R. Perin
à L. Evans
- on a atteint 8,73 tesla
100 quench

- Message received by Lyn Evans
Finance Committee April 1994

December 1994
LHC construction approved!

1998 The construction of LHC in LEP tunnel



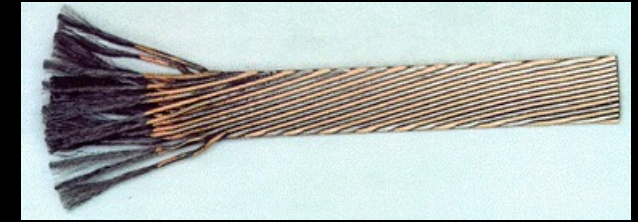
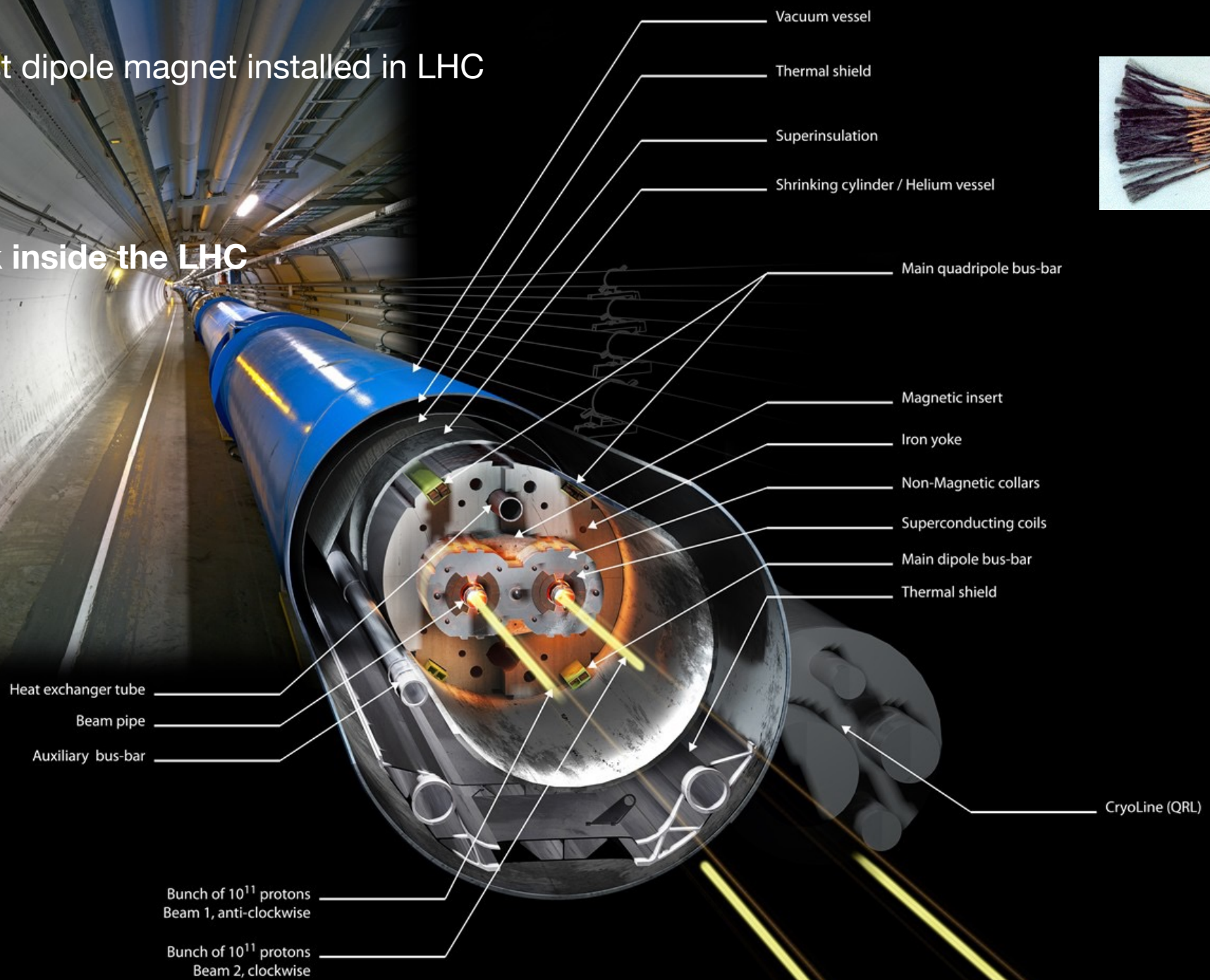
1998 Discovery of Gallo-Roman ruins at CMS site

Excavations for the caverns to house the detectors began, and an interesting discovery was found:



2007 Last dipole magnet installed in LHC

Let's look inside the LHC



7000 km of superconducting cable!

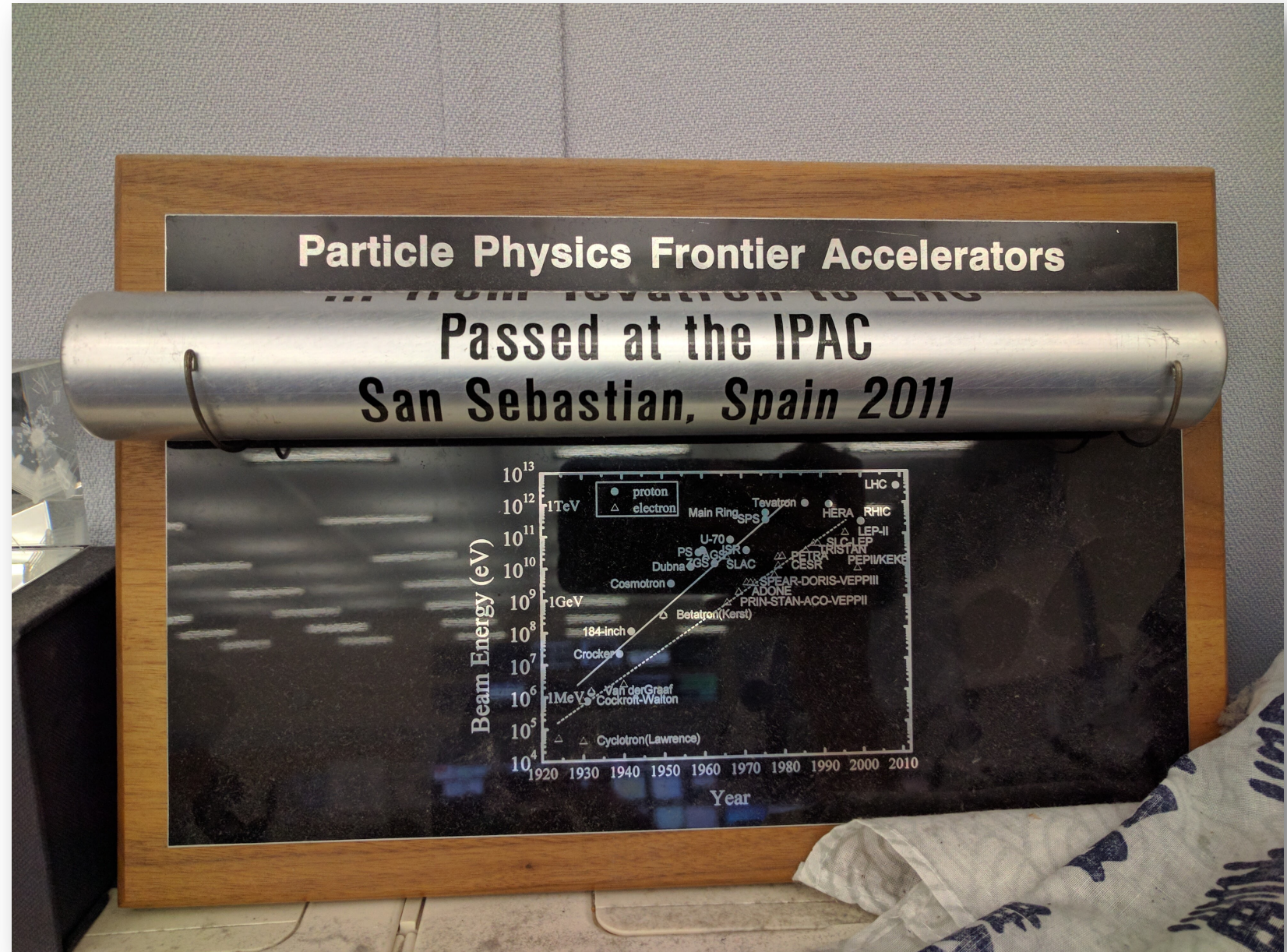


2009 Highest energy particle collider in the world!

First collisions were at 900 GeV.

Then the teams moved to 2.36 TeV - a new record!

Continued ramping up through to 2010 to reach 7 TeV centre of mass.



From Fermilab to CERN

PROTON PHYSICS: RAMP DOWN

Energy:

59 GeV

Post Mortem Information

PM event ID: Fri Sep 30 20:48:21 CEST 2011
 PM event category: PROTECTION_DUMP
 PM event classification: MULTIPLE_SYSTEM_DUMP
 PM BIS Analysis result: First USR_PERMIT change: Ch 4-Operator Buttons: A T -> F on CIB.CCR.LHC.B1
 PM comment:

Comments 30-09-2011 21:04:44 :

So long Tevatron. We'll miss you.
 Thanks for everything.

BIS status and SMP flags

B1 B2

Link Status of Beam Permits	false	false
Global Beam Permit	false	false
Setup Beam	true	true
Beam Presence	false	false
Moveable Devices Allowed In	false	false
Stable Beams	false	false

AFS: Single_2b+12small_13_1_1_1bpl14inj

PM Status B1

ENABLED

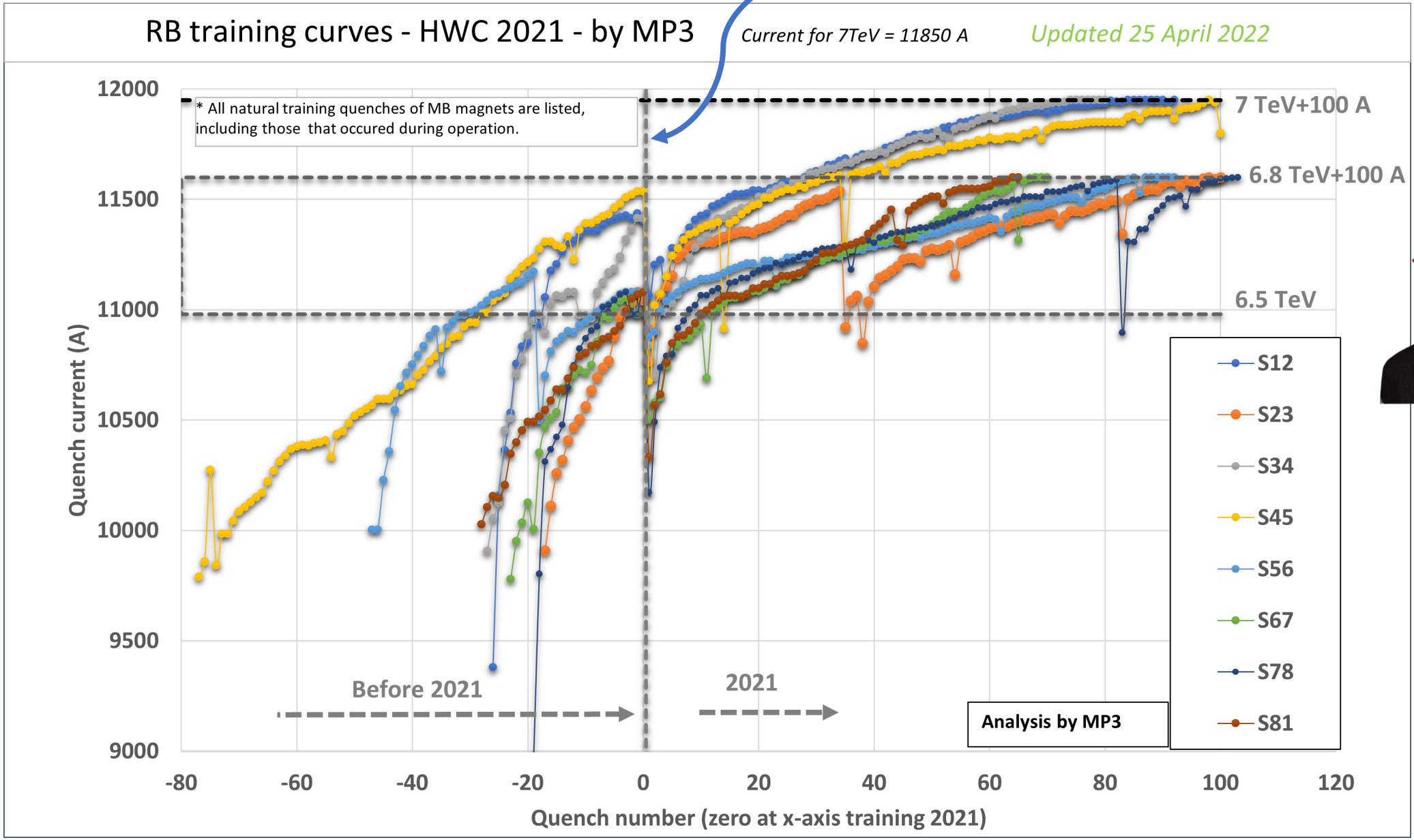
PM Status B2

ENABLED

2021 LHC still not at design energy (by choice)

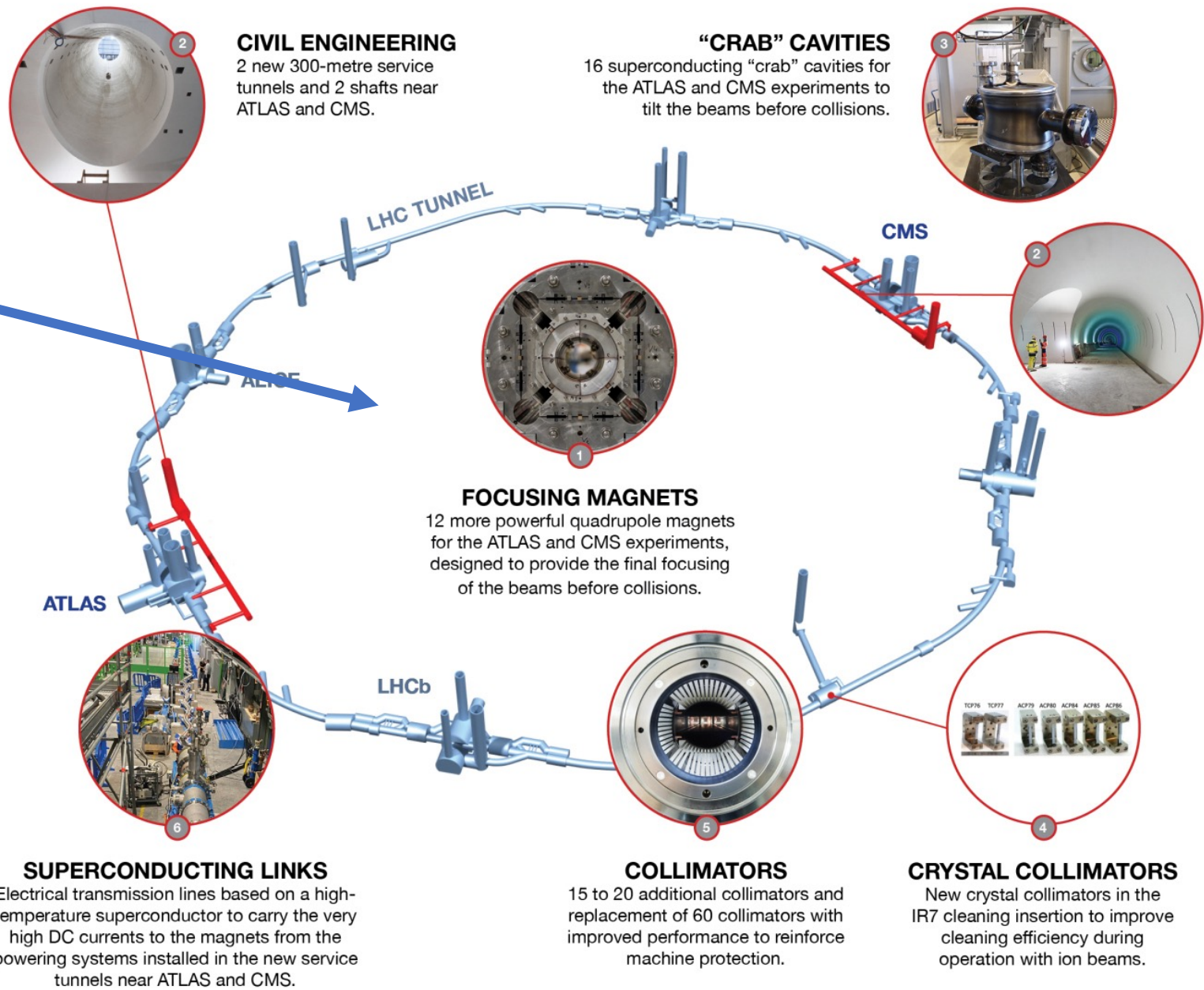
Current directly proportional to field strength and energy

Thermal cycle



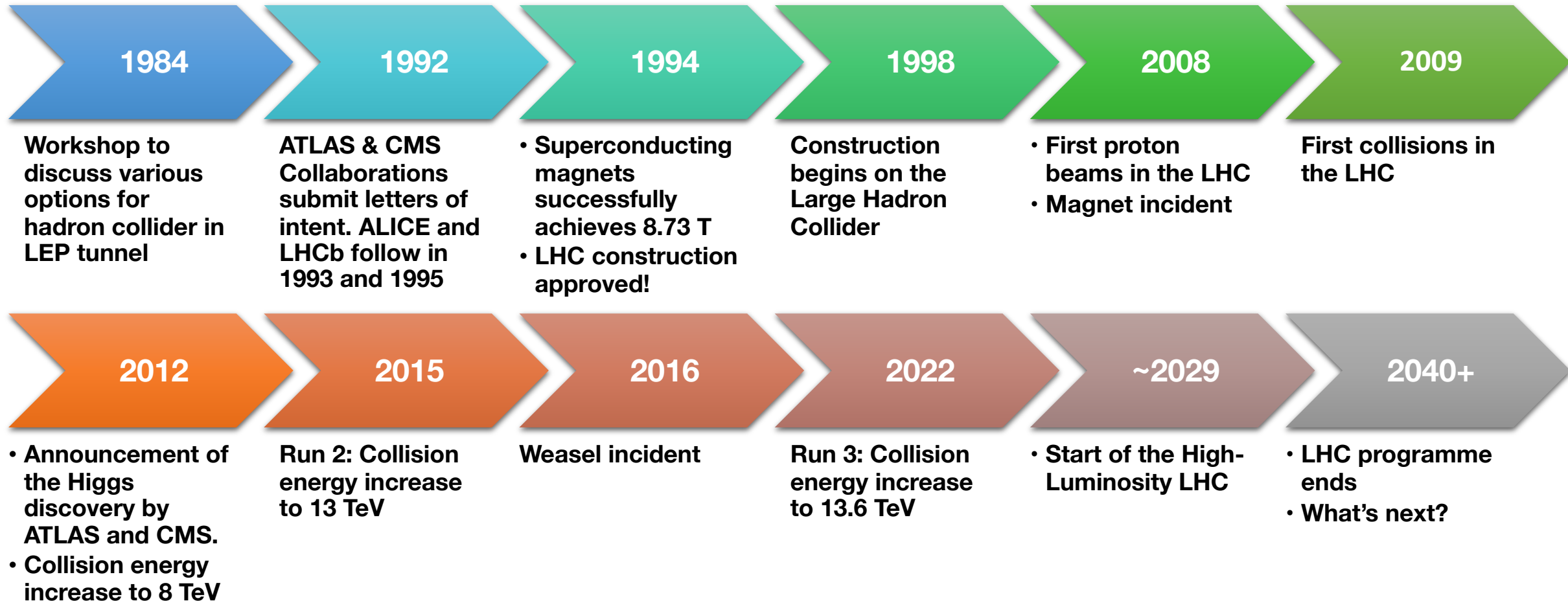
NEW TECHNOLOGIES FOR THE HIGH-LUMINOSITY LHC

These are Nb₃Sn, which is the technology that is baseline for muon colliders and FCChh (but at a lower field) -> First application of this technology



Travel through time

60 year journey!



Backup

Here's one I prepared earlier

2016

The pine marten and the weasel

29th April 2016

The LHC experiences a power cut due to a short-circuit.

The cause...?

A pine marten!

Large Hadron Collider on paws after creature chews through wiring

LHC to be out of action for a week while connections to transformer are replaced following visit from hungry fouine

**The
Guardian**

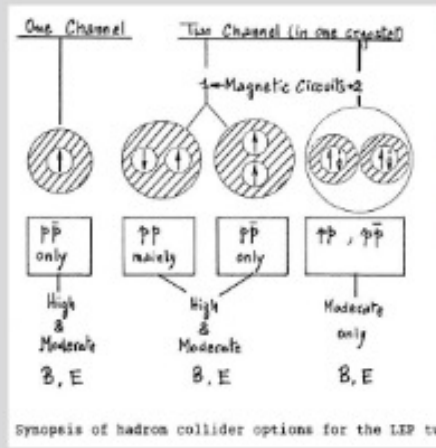
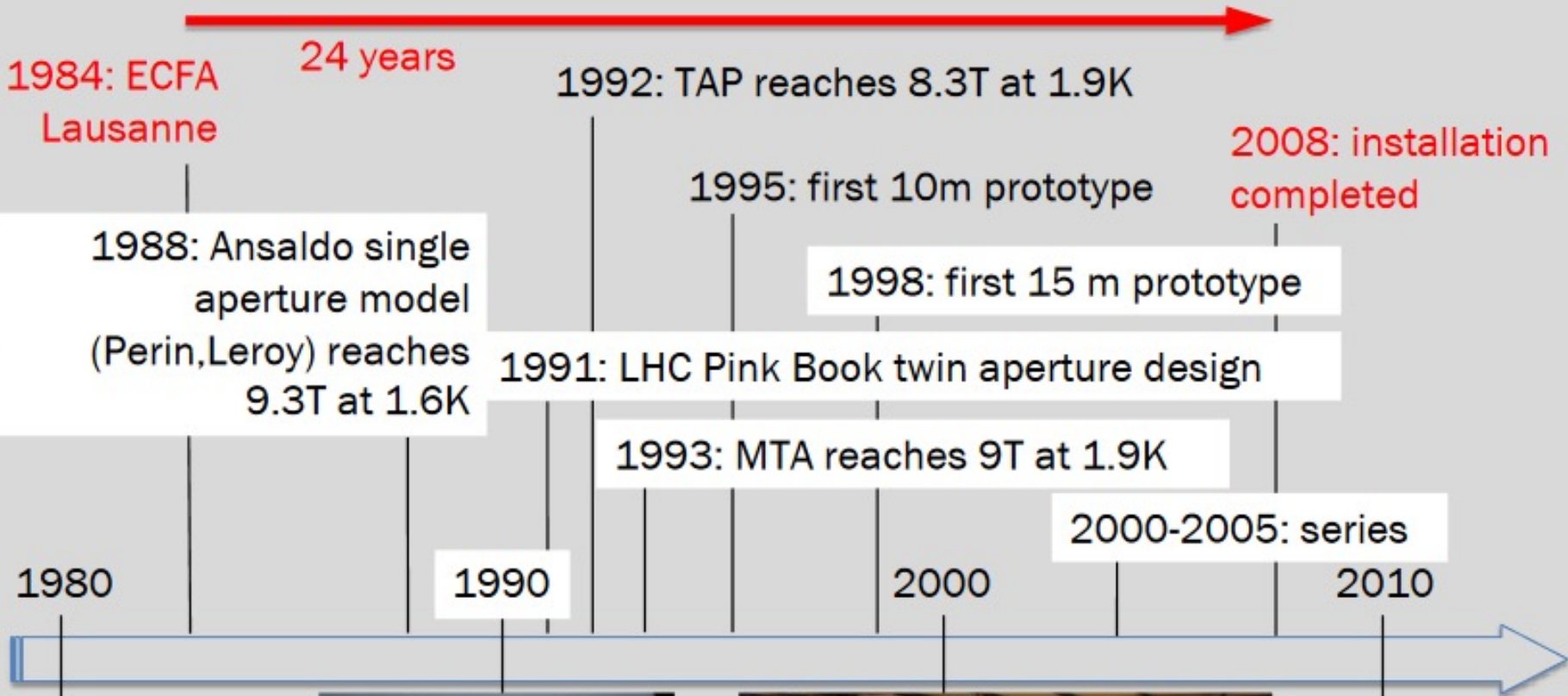


📷 A young beech marten, or fouine. Photograph: Alamy

The world's largest and most powerful particle accelerator has been brought to its knees by a beech marten, a member of the weasel family, that chewed through wiring connected to a 66,000-volt transformer.

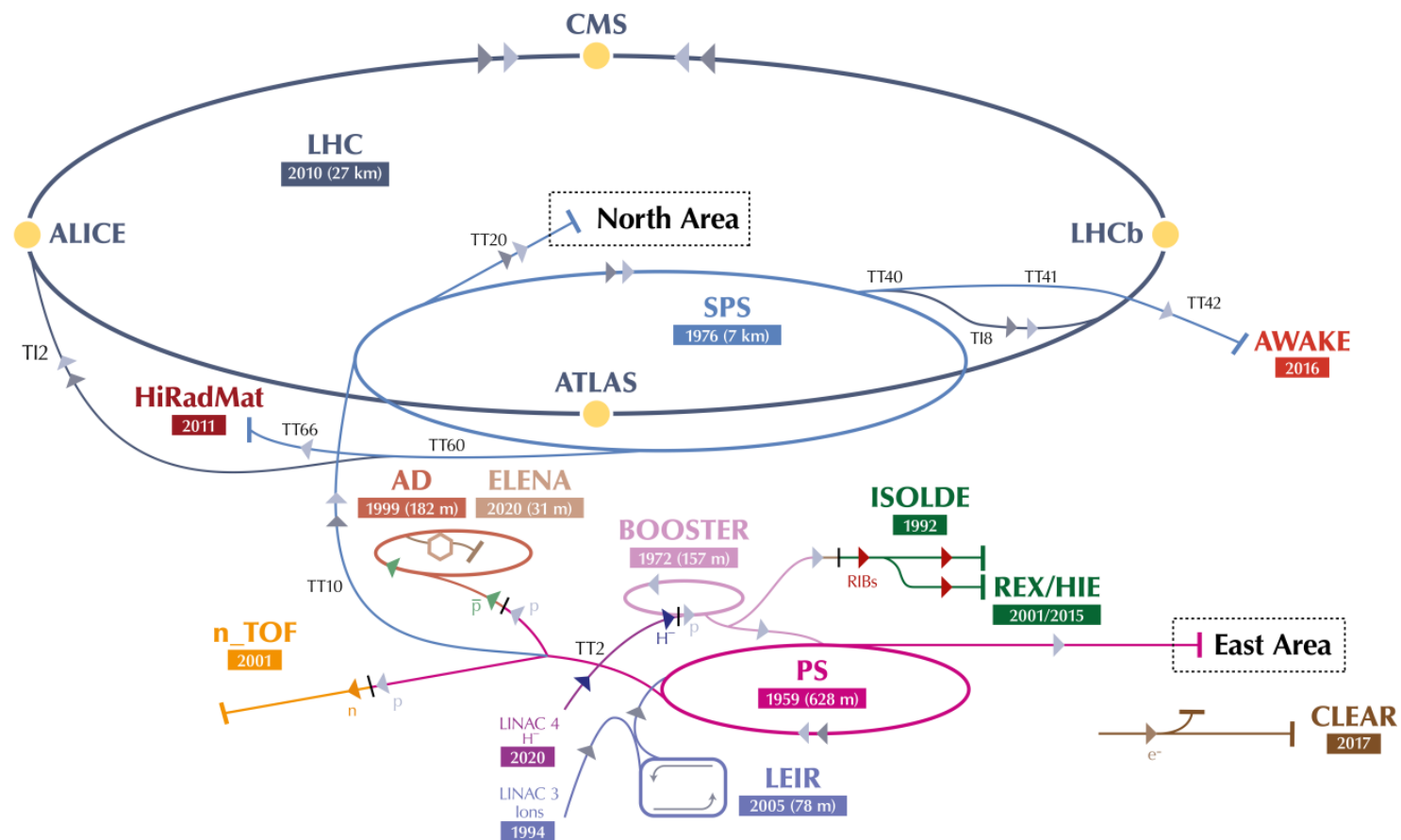
<https://www.theguardian.com/science/2016/apr/29/large-hadron-collider-fouine-chews-through-transformer-wiring>

LHC dipole timeline



The CERN accelerator complex

Complexe des accélérateurs du CERN



▶ H^- (hydrogen anions) ▶ p (protons) ▶ ions ▶ RIBs (Radioactive Ion Beams) ▶ n (neutrons) ▶ \bar{p} (antiprotons) ▶ e^- (electrons)

LHC - Large Hadron Collider // SPS - Super Proton Synchrotron // PS - Proton Synchrotron // AD - Antiproton Decelerator // CLEAR - CERN Linear Electron Accelerator for Research // AWAKE - Advanced WAKEfield Experiment // ISOLDE - Isotope Separator OnLine // REX/HIE - Radioactive Experiment/High Intensity and Energy ISOLDE // LEIR - Low Energy Ion Ring // LINAC - LINear ACcelerator // n_TOF - Neutrons Time Of Flight // HiRadMat - High-Radiation to Materials