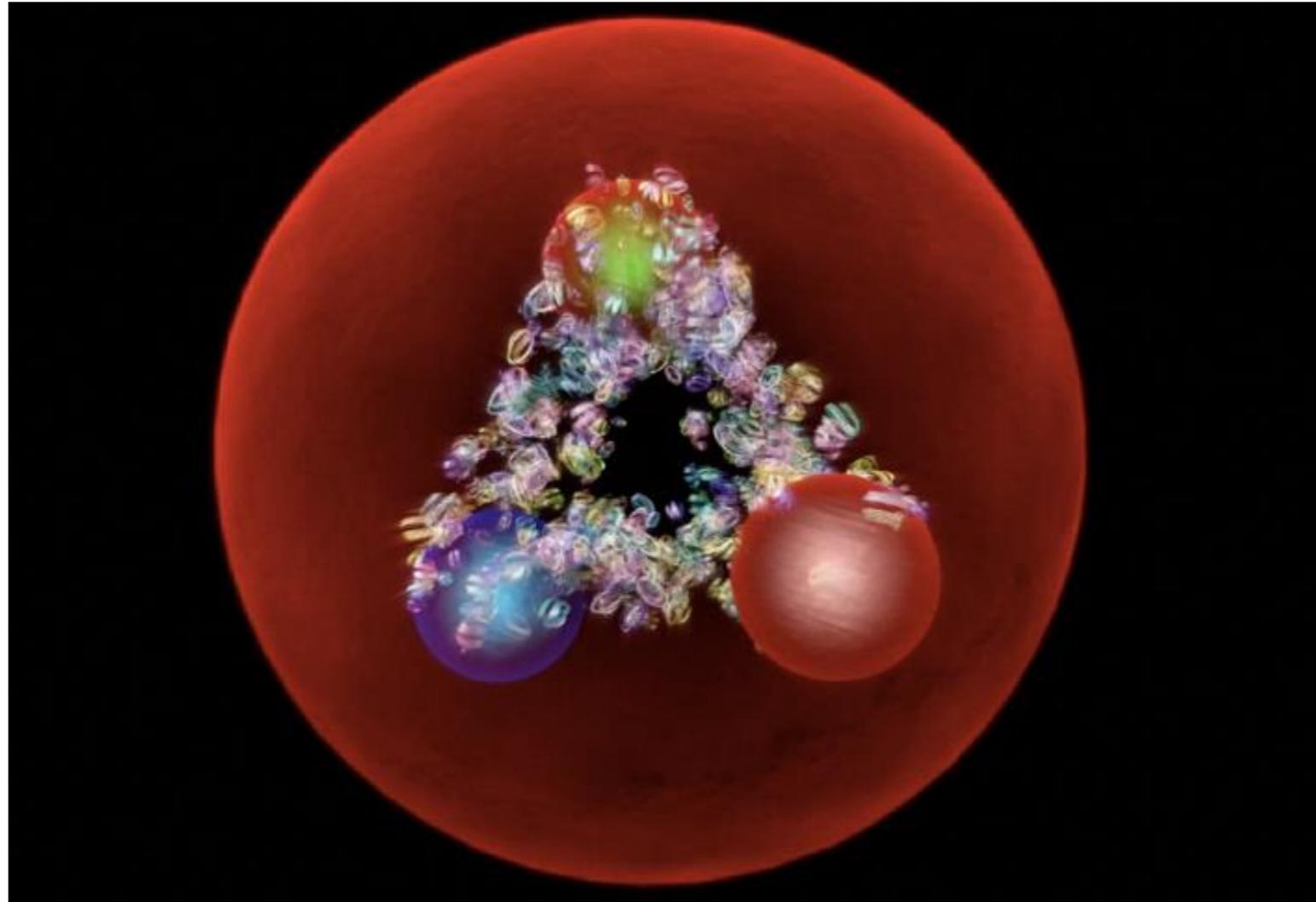




CERN - Education Resources



Rolf Landua

CERN

Head of Exhibitions and Global Engagement

Animations and Posters

<http://cern60.web.cern.ch/en/cern-exhibitions-content>

Build your own exhibition

Pick your favourite animations

Build your own exhibition

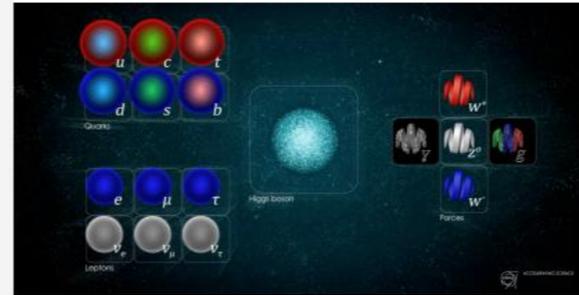
CERN exhibitions content

Overview



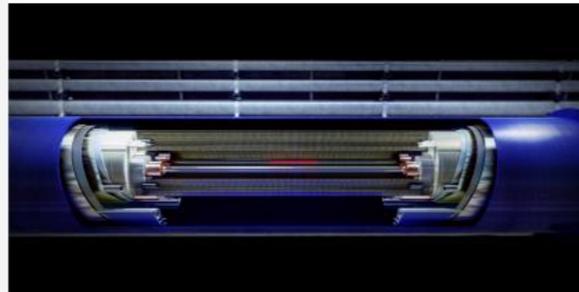
[VIEW CONTENT >](#)

Physics



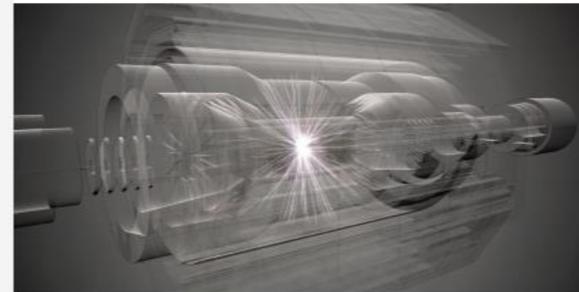
[VIEW CONTENT >](#)

LHC Accelerators



[VIEW CONTENT >](#)

Experiments



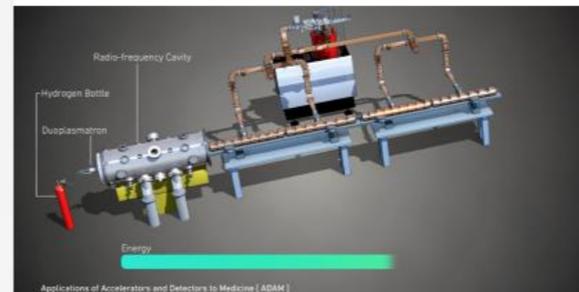
[VIEW CONTENT >](#)

Computing



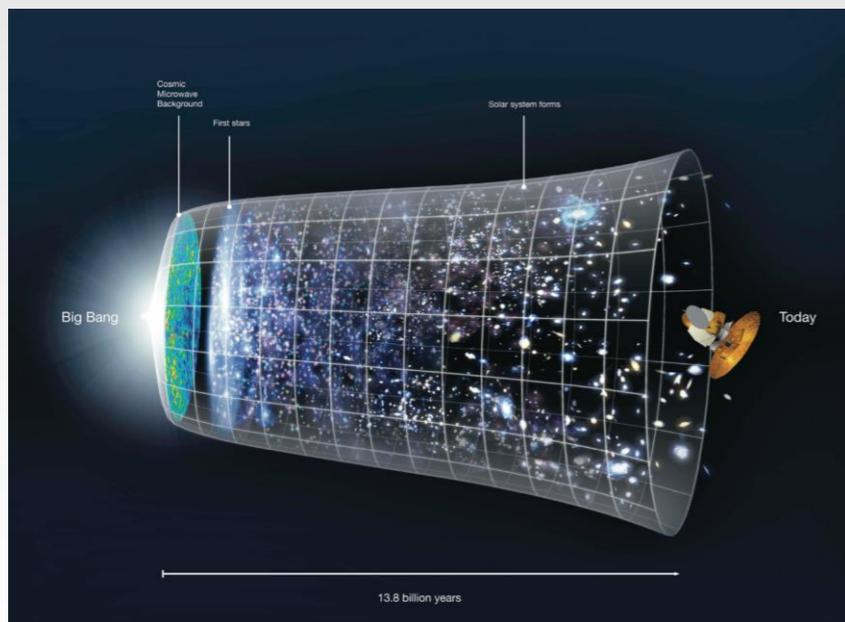
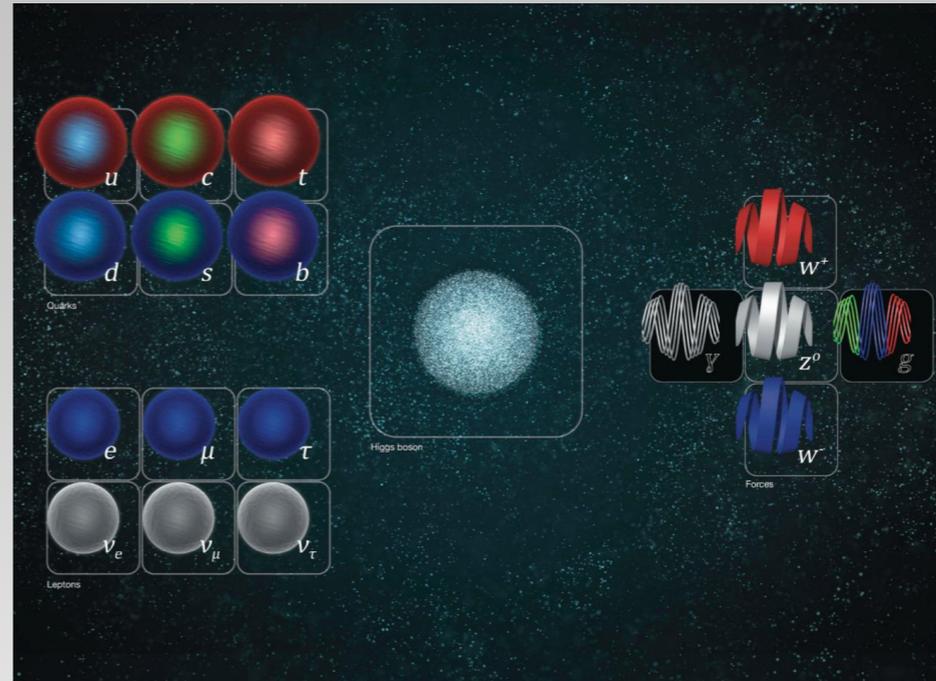
[VIEW CONTENT >](#)

Knowledge Transfer

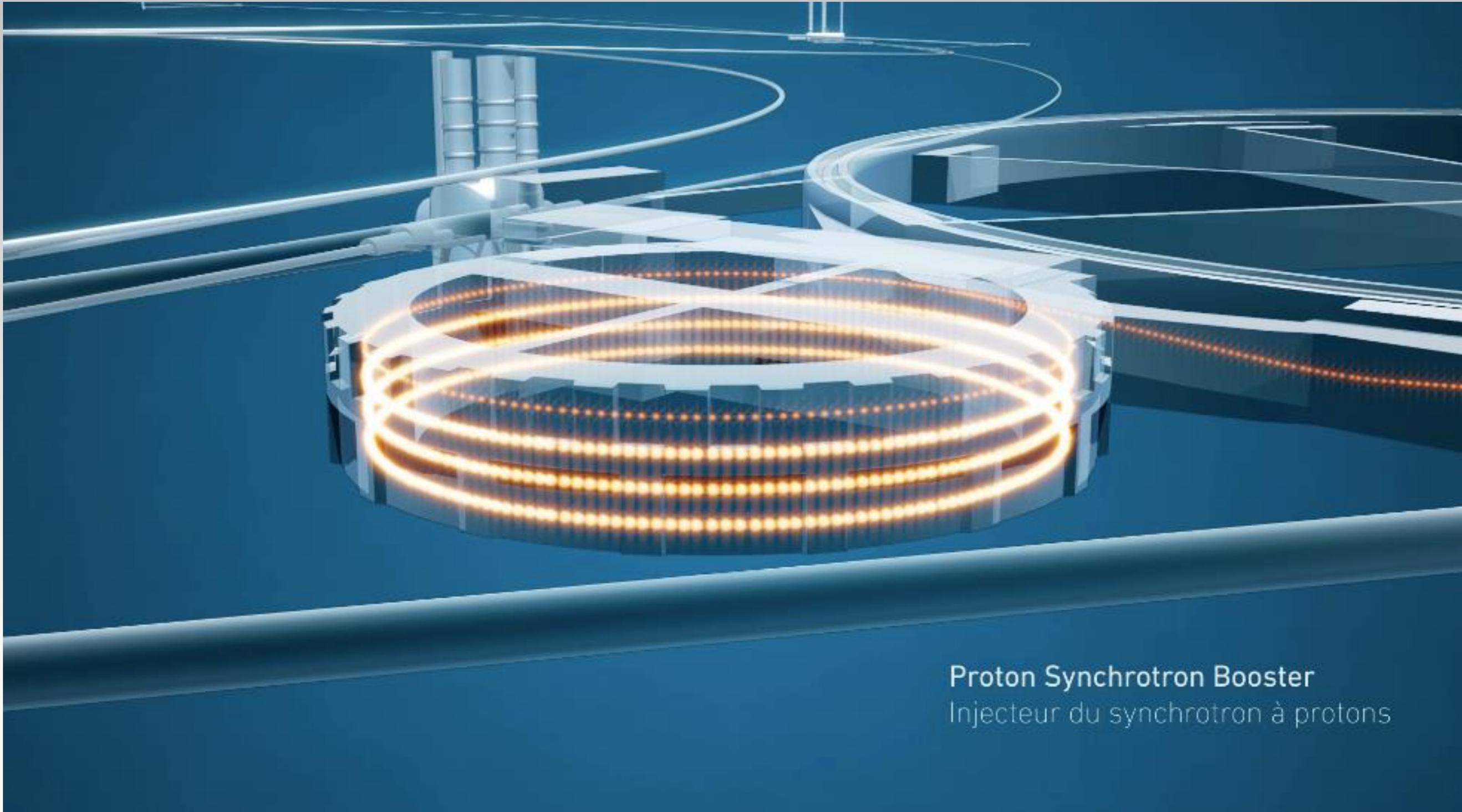


[VIEW CONTENT >](#)

Posters - some examples

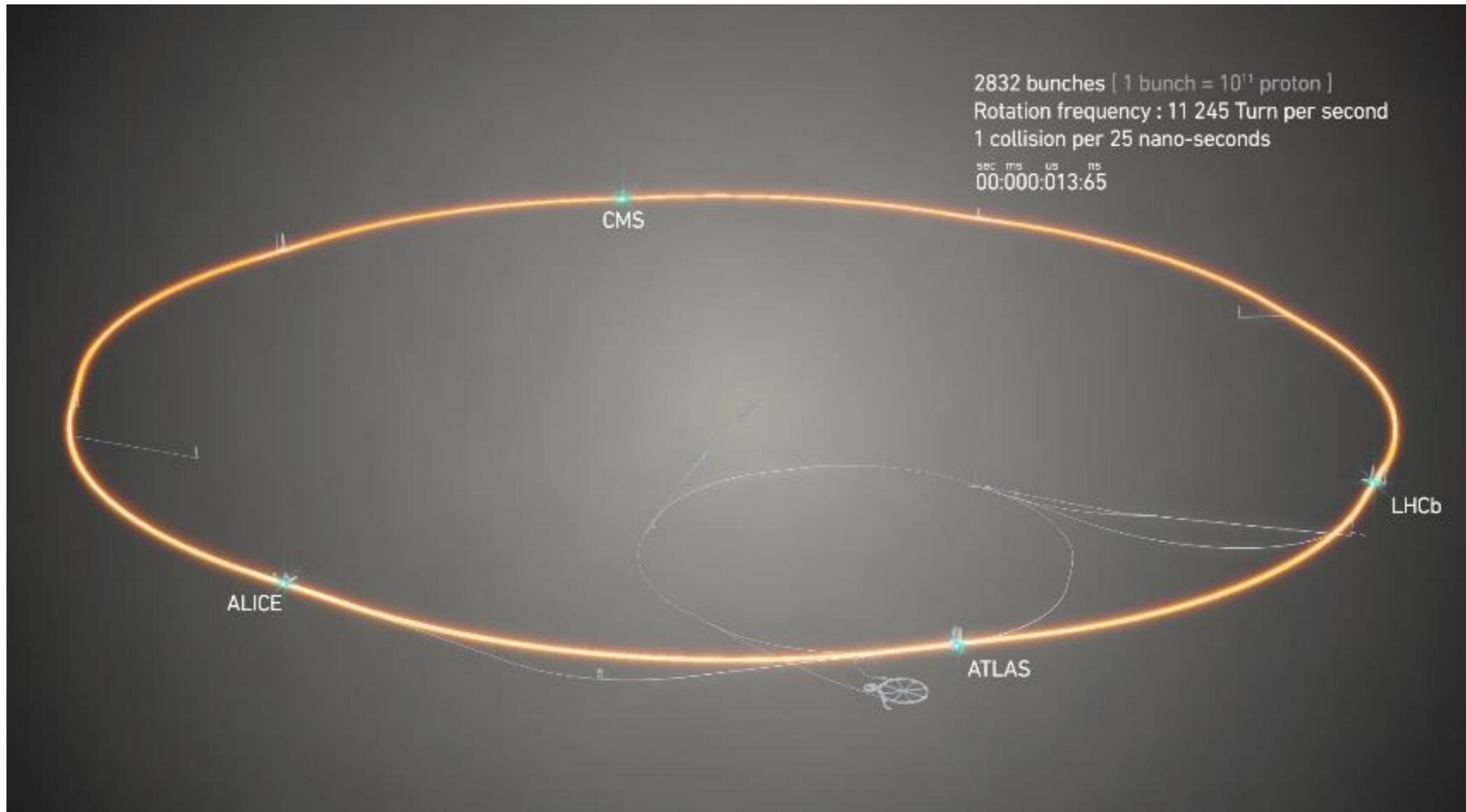


CERN accelerator ride - animation



Proton Synchrotron Booster
Injecteur du synchrotron à protons

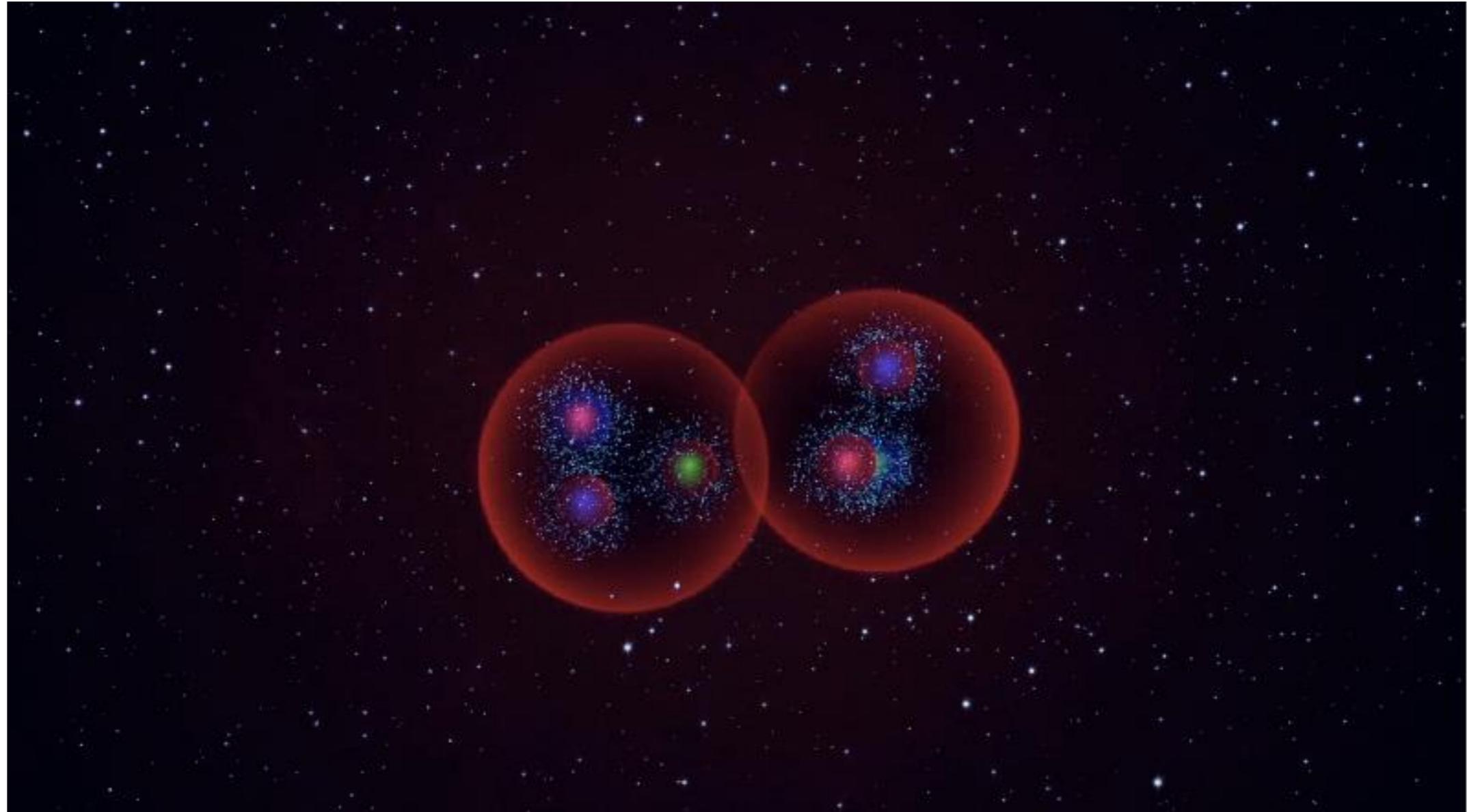
Teaching resources: Animations



Example: LHC and collisions in ATLAS detector

<http://cern60.web.cern.ch/en/cern-exhibitions-content>

Teaching resources: Animations



Example: Higgs boson production and decay

Synchrocyclotron: early history of CERN

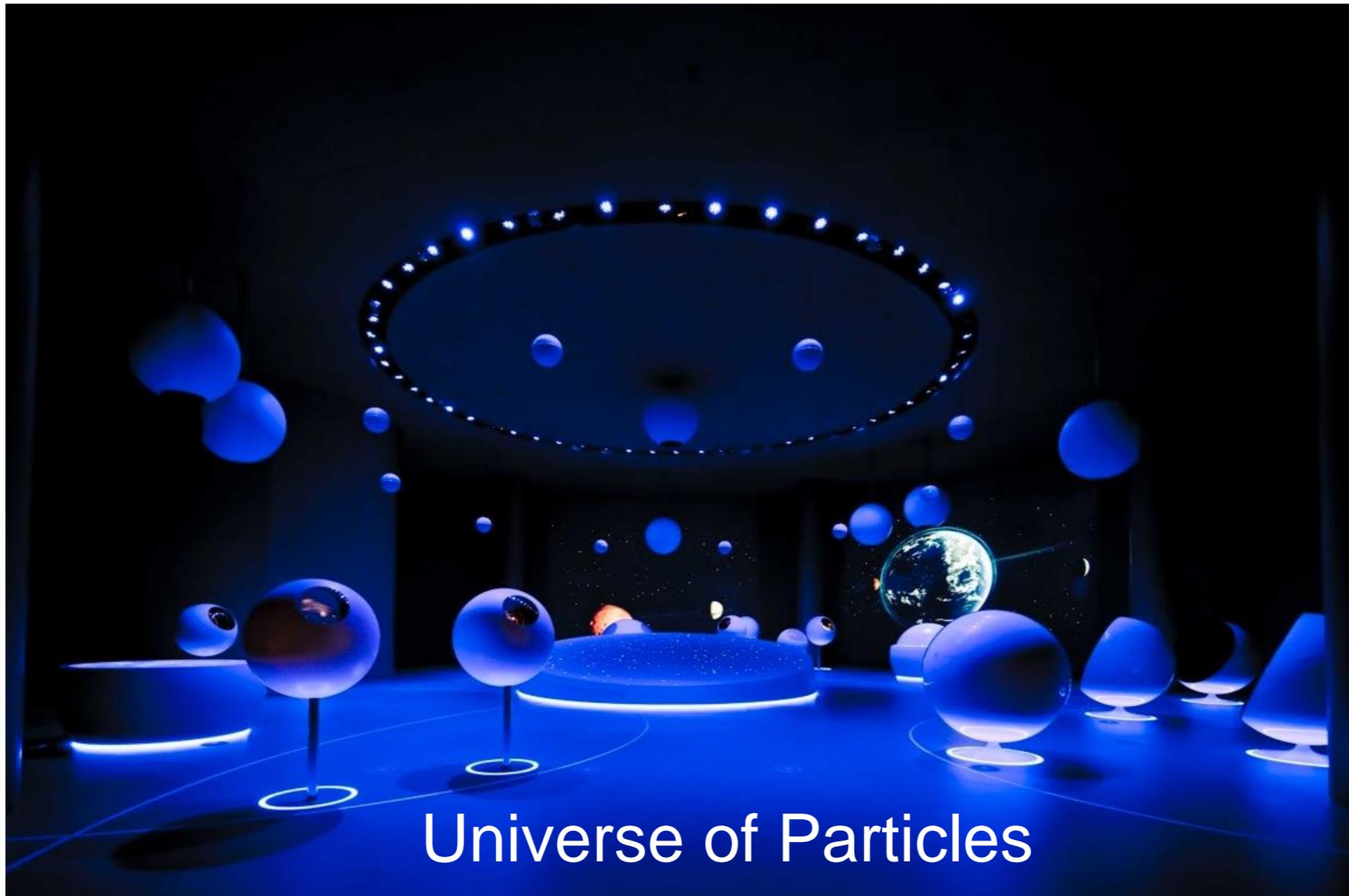


12 minute video and projection mapping on SC about the creation, the early history and the first scientific discoveries of CERN

https://www.youtube.com/watch?feature=player_embedded&v=uw5ze9Svfvo



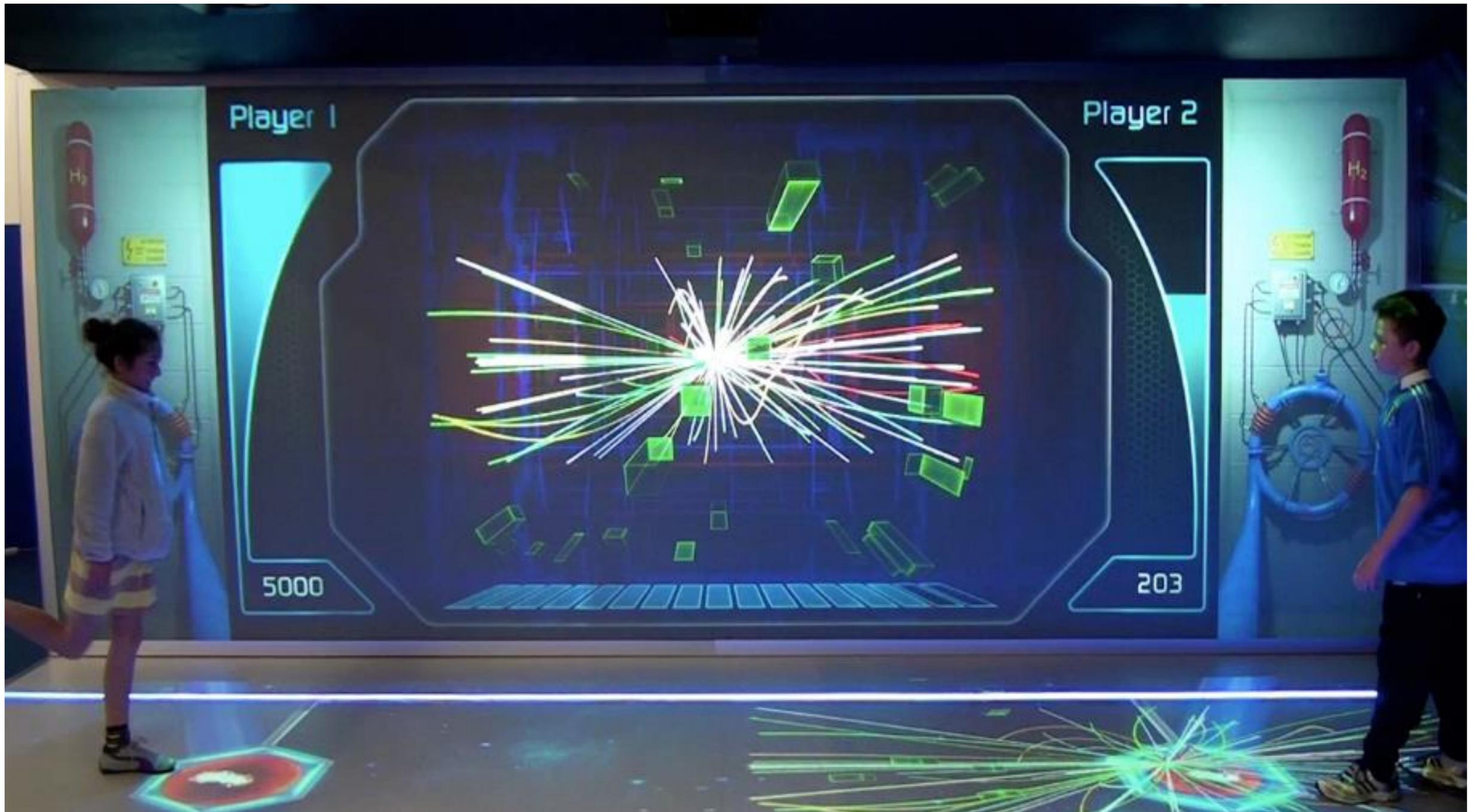
Permanent exhibition “Universe of Particles”



Universe of Particles

Interactive • Immersive • Inspiring
65,000 visitors per year (since July 2010)

Interactive LHC tunnel - a “hook”



“Virtual visits” with schools



Video chats

About 100 / year

- Professional: Polycom/Tandberg
- Skype, EVO, Google+
- Excellent feedback

Google + ‘hangouts’

From ATLAS, CMS, CCC

- Questions and Answers
- Talking to ‘real’ LHC physicists !



S'cool Lab for students: Hands-on modern physics



Fundamental experiments and modern detector technologies
for high school students (1/2 day programme at CERN)

Classics

Planck constant

Rutherford

Franck-Hertz

Electron tube

Hall effect

Charge-mass ratio

Detectors

Cloud chamber

Pixel detector

Scintillators

Cerenkov counter

Technologies

Superconductivity

Particle trap

X-ray unit

PET technology

Radiation detection

S'cool lab fact sheet

1/2 day of experiments

30 students

2 supervisors + teacher

Up to 3 different experiments



Teaching Resources for the class room



Lesson plans

- Antimatter
- Cosmic Rays
- Dark matter
- more to come

Posters

- Cosmic evolution
- Standard Model
- Collisions, aerial views



Cosmic Evolution (17 posters)

What is the Universe made of? How did it all begin?
L'Univers... Pourquoi? Comment?

We live on the Earth, a small blue-green planet third from the Sun, one of the hundred thousand million stars in the Milky Way galaxy, one of the hundred thousand million galaxies in the Universe.

Nous vivons sur la Terre, petite planète bleue du système solaire. C'est la troisième après le Soleil. Il y a des cent milliards d'étoiles de la Voie lactée, l'une des cent milliards de galaxies de l'Univers.

telescopes - télescopes **accelerators - accélérateurs**

Join us for a journey to the beginning of time
Une machine à remonter le temps

BIG BANG

Our Universe is expanding. By watching distant stars and galaxies through telescopes we can observe the Universe of the past, when it was smaller and hotter. But we have a challenge to meet: the first instants of the Universe are hidden from view. In particle collisions at CERN, we recreate the conditions just one millionth of a second after the beginning of the Universe.

Notre Univers est en expansion. En observant les étoiles et galaxies les plus lointaines, nous regardons l'Univers tel qu'il fut, beaucoup plus petit et plus chaud. Nous devons relever un défi: les tout premiers instants de l'Univers nous sont invisibles. Au CERN, dans les collisions de particules, nous recréons les conditions qui prévalaient juste un millionième de seconde après le Big Bang.

Life on Earth De la matière à la vie

Human-like beings have only existed for a few million years, and if we squeezed all the Earth's 4.5 billion-year history into one day, human civilization fits easily into the last second before midnight. Dinosaurs appeared 225 million years ago, the oldest fossils are 540 million years old and the first life forms are 3500 million years old.

Everything - rocks, plants, animals, humans - is made of the same particles. And these were born 13,700 million years ago at the big bang.

La vie humaine existe depuis quelques millions d'années, si nous comprimons l'histoire de la Terre, longue de 4,5 milliards d'années, en une journée, la civilisation humaine représente à peine la dernière seconde avant minuit... Les dinosaures apparurent quatre à cinq il y a 225 millions d'années, les plus vieux fossiles ont 540 millions d'années et les premières formes de la vie 3,5 milliards d'années.

TOUT - minéraux, plantes, animaux, humains - est fait des mêmes particules, celles qui naquirent lors du Big Bang il y a 13,7 milliards d'années.

A star is born Une étoile est née

Our journey back in time continues... The formation of the Earth and the solar system happened about 4500 million years ago. The solar system formed from a cloud of interstellar dust made of hydrogen and helium with just 1% of heavier elements.

Remontons encore le fil du temps... Il y a environ 4,5 milliards d'années apparemment en Terre et le système solaire - l'ensemble d'un nuage de poussière interstellaire, constituée d'hydrogène, d'hélium, et de 1% seulement d'éléments lourds.

We are stardust Poussière d'étoile

Experiments at the ISOLDE facility at CERN study how elements, heavier than iron were forged in massive exploding stars.

Au CERN, les expériences du dispositif ISOLDE étudient comment des éléments plus lourds que le fer furent formés dans l'explosion d'étoiles massives.

Everything we see, touch, or taste is stardust. All of the carbon in our bodies, all of the oxygen in the air, all of the silicon in the rocks and sand came into existence inside ancient stars. At the end of their lives, in explosions of unimaginable ferocity, their debris was thrown into space. It took billions of years for this stardust to form new stars and planets under the influence of gravity.

Tout ce que nous touchons, voyons, goûtons... est poussière d'étoile. Le carbone de notre corps, l'oxygène de l'air, le silicium des minéraux et du sable proviennent d'anciennes étoiles. A la fin de leur vie, dans une explosion d'une violence inouïe, leurs débris furent dispersés dans l'espace. Après plusieurs milliards d'années et sous l'influence de la gravité, cette poussière créa de nouvelles étoiles et de jeunes planètes.

The Universe ignites L'Univers s'embrase

It took more than 200 million years from the Big Bang for hydrogen and helium atoms to gather under the influence of gravity. Giant balls of hydrogen and helium gas formed. They started to heat up and shine as nuclear fusion ignited these first stars.

Après le Big Bang, il fallut plus de 200 millions d'années aux atomes d'hydrogène et d'hélium pour s'assembler grâce à la gravité. Des boules de gaz géantes se formèrent, et commencèrent à bruler et à rayonner quand la fusion nucléaire enflamma ces premières étoiles.

Images taken by the Hubble space telescope give us information about the earliest galaxies found in the Universe, which are about 13,000 million years old.

Les images prises par le télescope Hubble nous éclairent sur les premières galaxies de l'Univers, âgées de 13 milliards d'années.



Antimatter - TED education

What happened to antimatter? - Rolf Landua

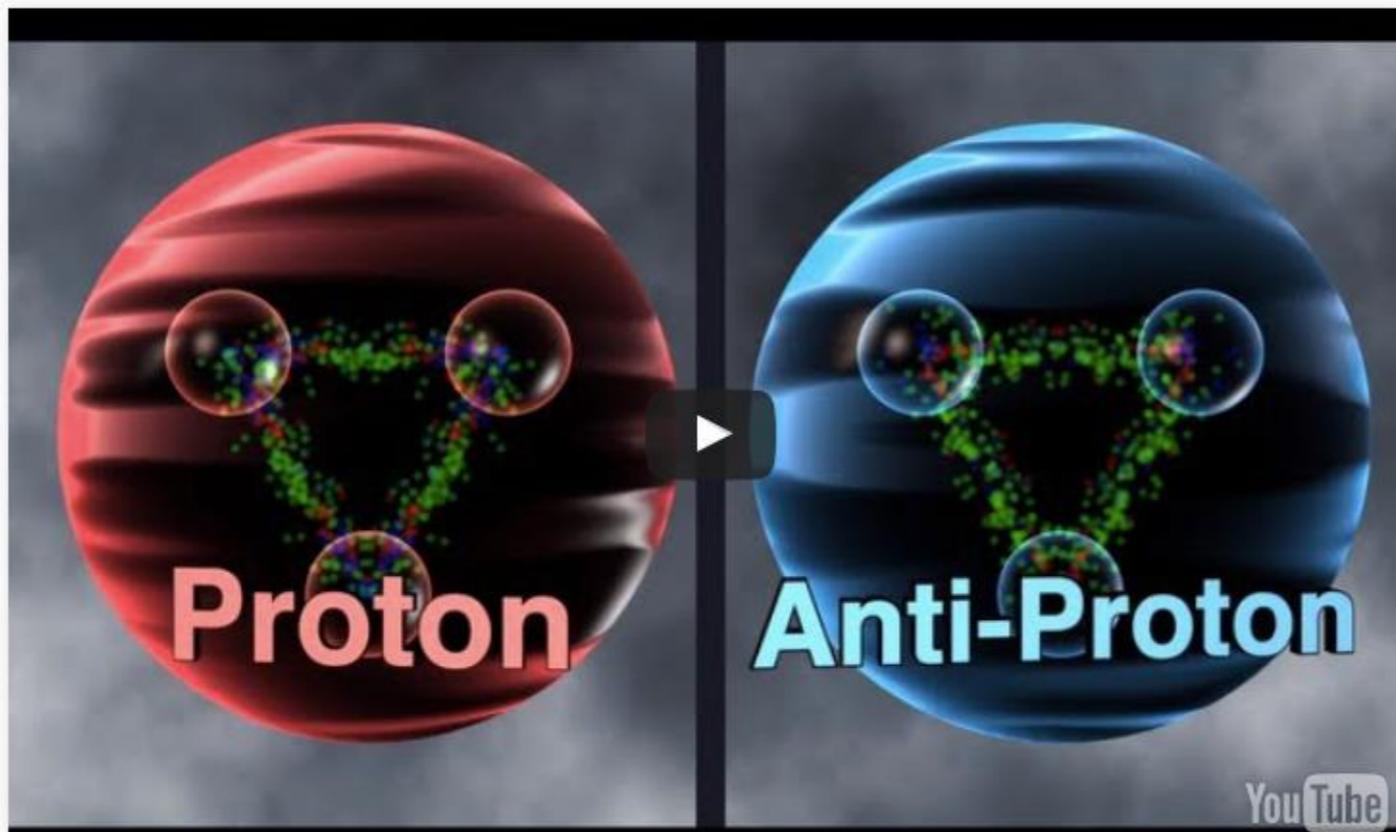


567,705 Views

654 Questions Answered

Let's Begin...

Particles come in pairs, which is why there should be an equal amount of matter and antimatter in the universe. Yet, scientists have not been able to detect any in the visible universe. Where is this missing antimatter? CERN scientist Rolf Landua returns to the seconds after the Big Bang to explain the disparity that allows humans to exist today.



Watch

Think

Dig Deeper

Discuss

Customize This Lesson

59

Create and share a new lesson based on this one.



CERN on TED education



73,463 Views

Inventions that Shape History

Big Data - Tim Smith

There is a mind-boggling amount of data floating around our society. Physicists at CERN have...



150,104 Views

Before and After Einstein

The basics of the Higgs boson - Dave Barney and Steve Goldfarb

In 2012, scientists at CERN discovered evidence of the Higgs boson. The what? The Higgs boson...



450,843 Views

Out of This World

The beginning of the universe, for beginners - Tom Whyntie

How did the universe begin -- and how is it expanding? CERN physicist Tom Whyntie shows how...



46,417 Views

Before and After Einstein

CERN's supercollider - Brian Cox

"Rock-star physicist" Brian Cox talks about his work on the Large Hadron Collider at CERN....



206,177 Views

Before and After Einstein

What happened to antimatter? - Rolf Landua

Particles come in pairs, which is why there should be an equal amount of matter and antimatter...



275,662 Views

Before and After Einstein

The fundamentals of space-time: Part 2 - Andrew Pontzen and Tom Whyntie

Light always travels at a speed of 299,792,458 meters per second. But if you're in motion...



97,447 Views

Before and After Einstein

The fundamentals of space-time: Part 3 - Andrew Pontzen and Tom Whyntie

In the first two lessons of this series on space-time, we've dealt with objects moving at...



255,882 Views

Before and After Einstein

Dark matter: The matter we can't see - James Gillies

The Greeks had a simple and elegant formula for the universe: just earth, fire, wind, and...



166,384 Views

Before and After Einstein

The Higgs Field, explained - Don Lincoln

One of the most significant scientific discoveries of the early 21st century is surely the...



34,137 Views

Before and After Einstein

How cosmic rays help us understand the universe - Veronica Bindi

We only know 4% of what the universe is made up of. Can we also know what lies beyond our...



53,902 Views

Before and After Einstein

If matter falls down, does antimatter fall up? - Chloé Malbrunot

Like positive and negative, or debit and credit, matter and antimatter are equal and opposite. So...



62,691 Views

Out of This World

The history of our world in 18 minutes - David Christian

Backed by stunning illustrations, David Christian narrates a complete history of the universe,...



CERN: Useful teaching resource websites

CERN websites:

Large collection of exhibition posters and 3D animations (about LHC, detectors, computing):

<http://cern60.web.cern.ch/en/cern-exhibitions-content>

CERN animations on the LHC, beam control, acceleration

<https://cds.cern.ch/record/1750716>

Short video clips about CERN (3 minutes), Higgs boson news, and a “CERN teaser”:

http://mini-and-tunnel.web.cern.ch/Mini-and-Tunnel/CERN_New_Mini/Documentation/Film%20New%20Mini/

Collection of brochures and the LHC guide (useful as general overview and introduction):

<http://project-physicsteaching.web.cern.ch/project%2Dphysicsteaching/english/brochures.htm>

Teaching resources at CERN and NASA

(antimatter, cosmics, series of 17 posters on evolution of the Universe)

<http://education.web.cern.ch/education/Chapter2/Teaching/from-the-big-bang-to-lhc.html>

<http://helios.gsfc.nasa.gov/cosmic.html>

TEDED Lessons about particle physics, the Universe and Big Data

<http://ed.ted.com/lessons/the-beginning-of-the-universe-for-beginners-tom-whyntie>

<http://ed.ted.com/lessons/exploration-on-the-big-data-frontier-tim-smith>

<http://ed.ted.com/lessons/dark-matter-the-matter-we-can-t-see-james-gillies>

<http://ed.ted.com/lessons/what-happened-to-antimatter-rolf-landua>

<http://ed.ted.com/lessons/the-basics-of-boson-dave-barney-and-steve-goldfarb>



... and more websites

Teacher resources for the class room

(medical physics to quantum physics, astronomy and space, with lesson plans)

<http://www.iop.org/education/teacher/resources/index.html>

Particle physics - comprehensive teaching website

<http://particleadventure.org/>

Multimedia resources from the world's leading particle physics laboratories

(image bank with best photos from CERN, Fermilab, BNL, SLAC, and other labs)

<http://www.interactions.org/cms/>

Feynman Lectures - online

<http://www.feynmanlectures.info/>

Feynman Science videos

(photons, Feynman diagrams, reflection/transmission, particle interactions)

<http://vega.org.uk/video/subseries/8>

Neutrino physics

(what are neutrinos, how they were discovered, details of neutrino experiments)

<http://wwwlapp.in2p3.fr/neutrinos/aneut.html>

Thank you for your attention