

Beamline for Schools

A physics competition for high-school students

Welcome to ATLAS!



What will we do in the next hour?



Purpose and functional principle of ATLAS

Virtual visit of ATLAS

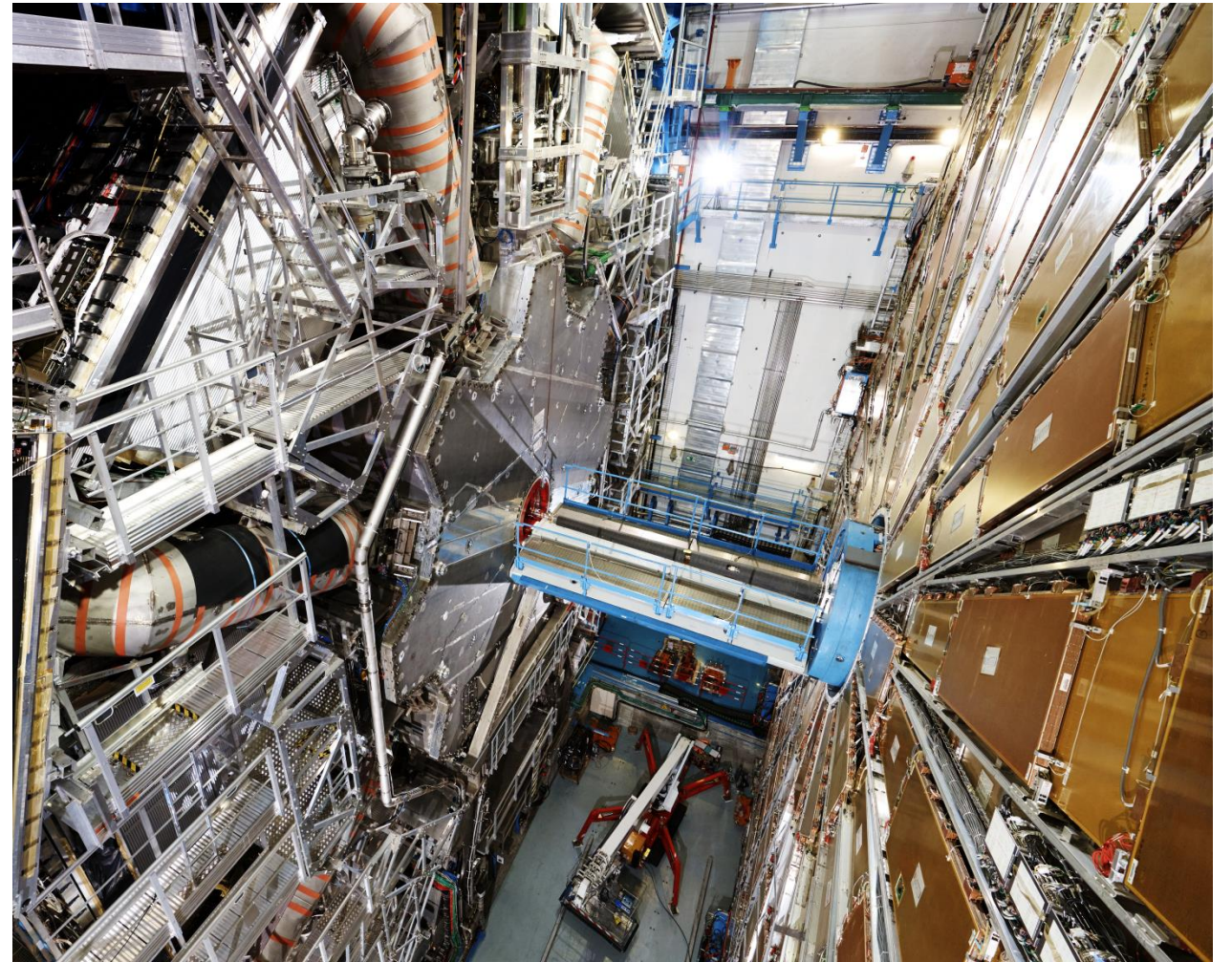
Q&A session

What is ATLAS?

ATLAS is one of the four particle detectors at the Large Hadron Collider

General-purpose particle detector

⇒ designed to **observe any new physics phenomena** that the LHC might reveal



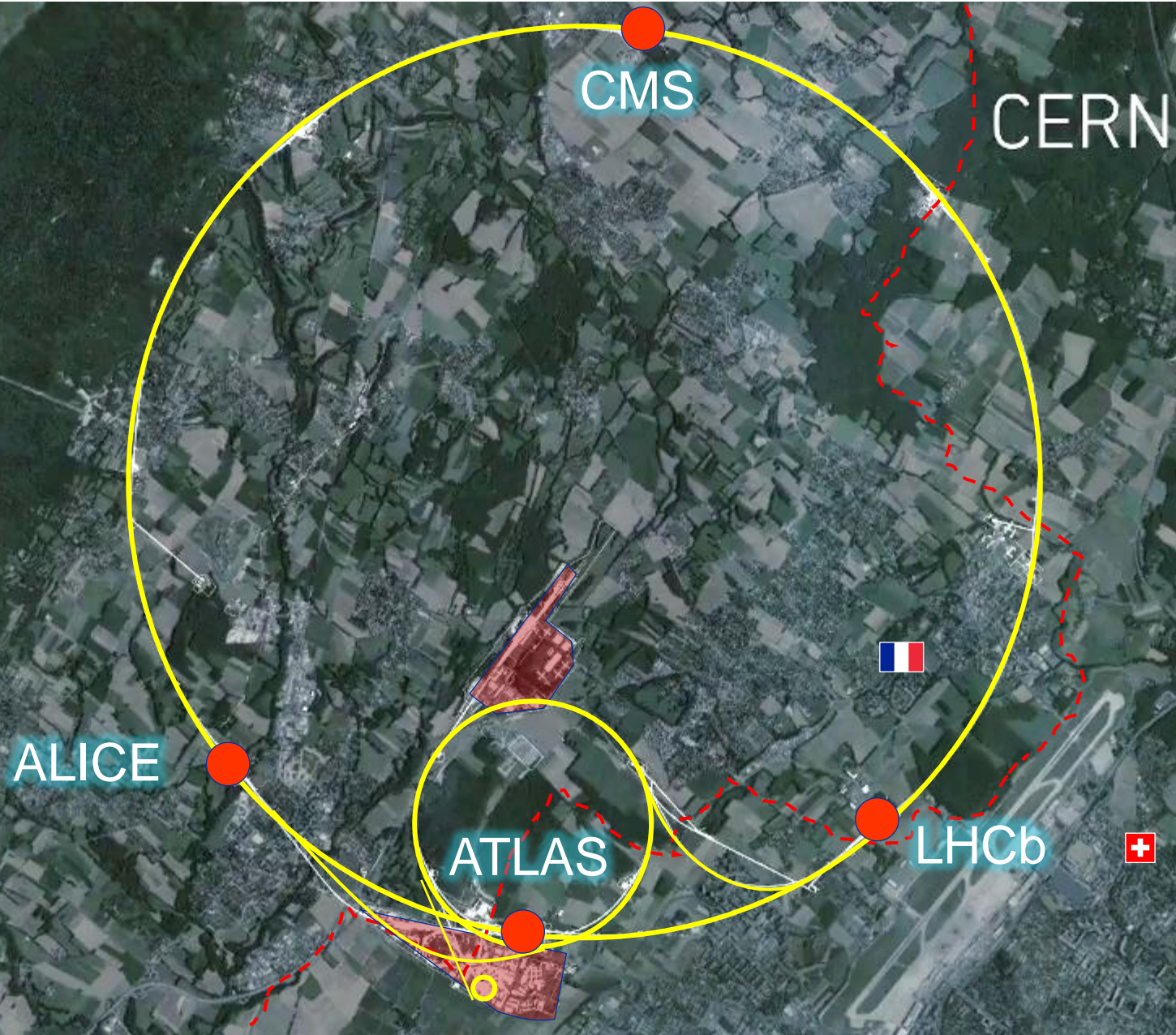
What is the LHC?

Large Hadron Collider (LHC)

- ❖ 27-km long **particle accelerator**
- ❖ accelerates particles to nearly the speed of light in opposite directions and **brings these particles to collision** at four points
- ❖ accelerates protons or lead ions

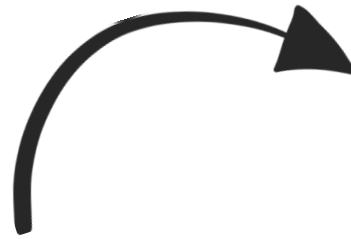
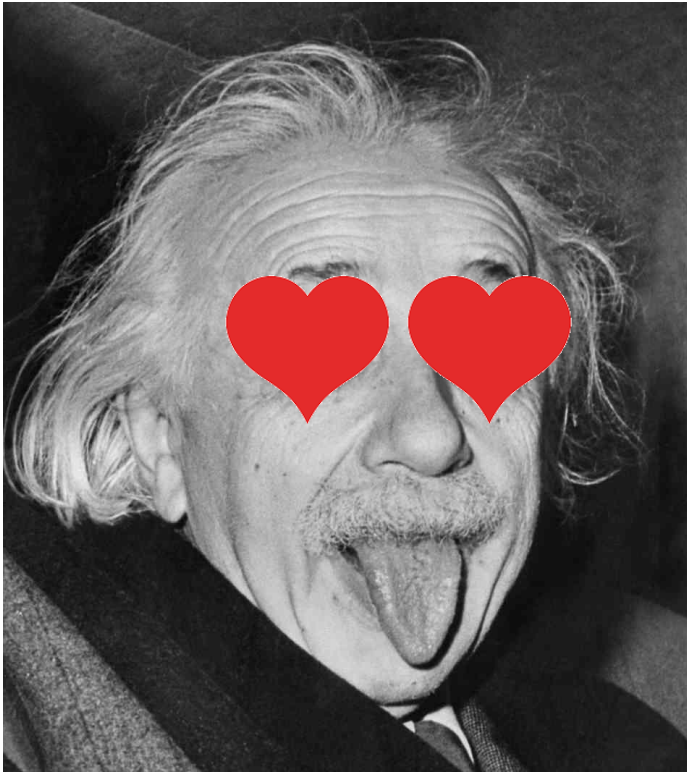


LHC

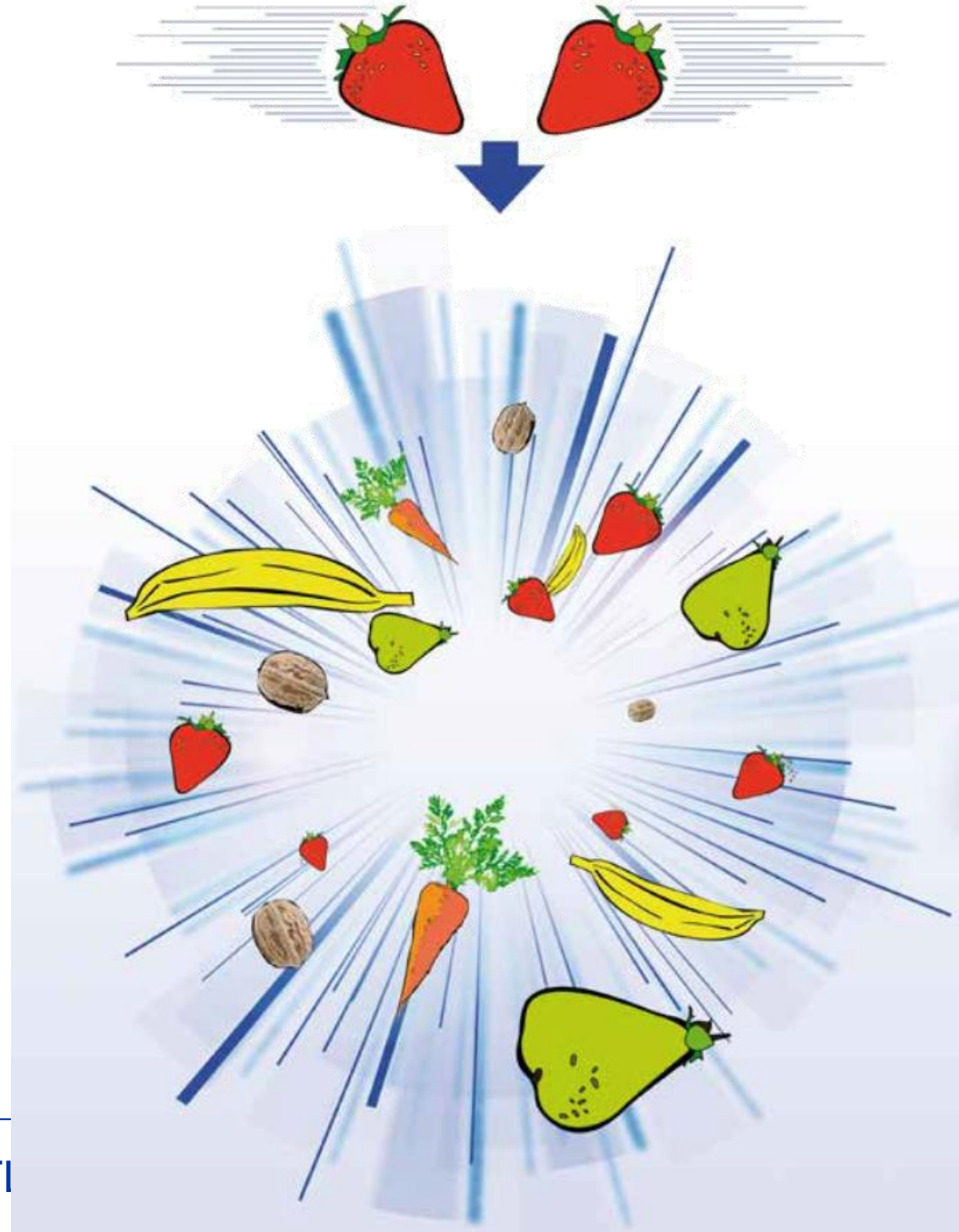


What happens in a particle collision?





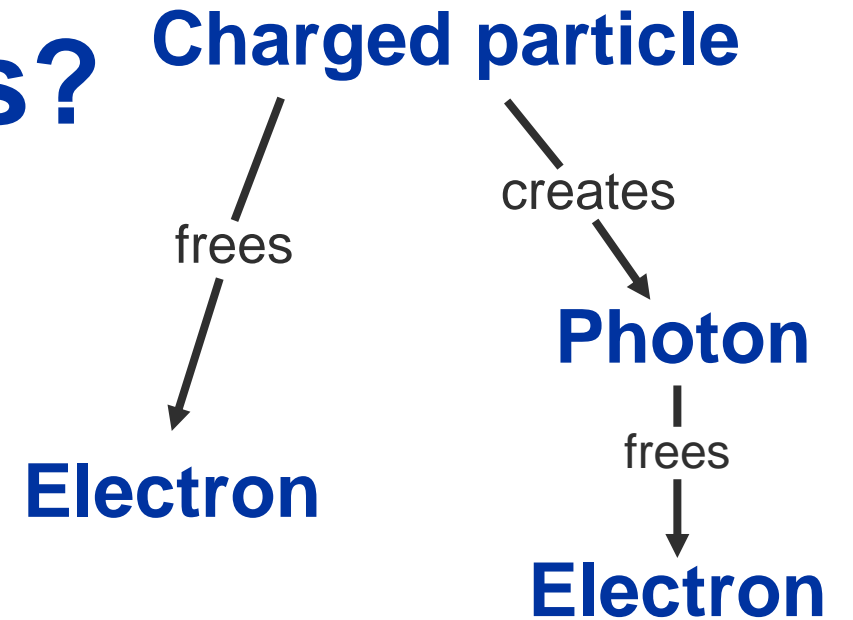
$$E=mc^2$$



How can we detect particles?

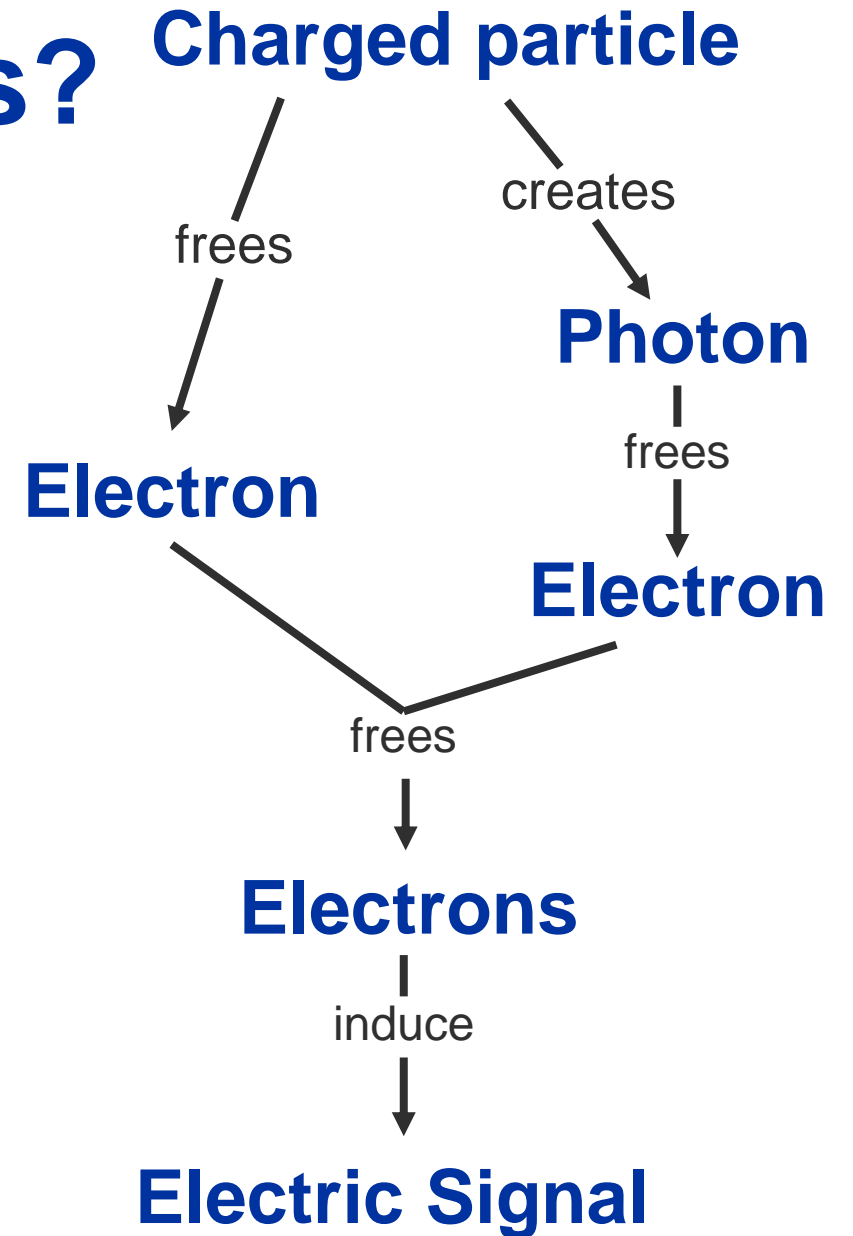
Electrically charged particle transfers some of its kinetic energy to the detector material

- (1) **Electrons are freed** (e.g. ionisation)
- (2) **Photons are created** (e.g. scintillation or Cherenkov) **that subsequently free electrons** (e.g. photoelectric effect)



How can we detect particles?

- ⇒ **Avalanche effect:** the electron gains kinetic energy in an electric field and transfers kinetic energy to another electron, which is freed and so on ...
- ⇒ **Electrostatic induction:** when the electrons approach the read-out electrode, they induce an electric signal



How is ATLAS structured?

Each layer has its specific tasks:

- 1) **Tracking:** thanks to a magnetic field we can learn about the particles' **charge** and **momentum**
- 2) **Electromagnetic calorimeter:** measures the **energy** of all photons, electrons, and positrons
- 3) **Hadronic calorimeter:** measures the **energy** of all hadrons (e.g. protons, kaons, ...)
- 4) **Muon spectrometer:** thanks to a magnetic field we can determine the muons' **charge** and **momentum**



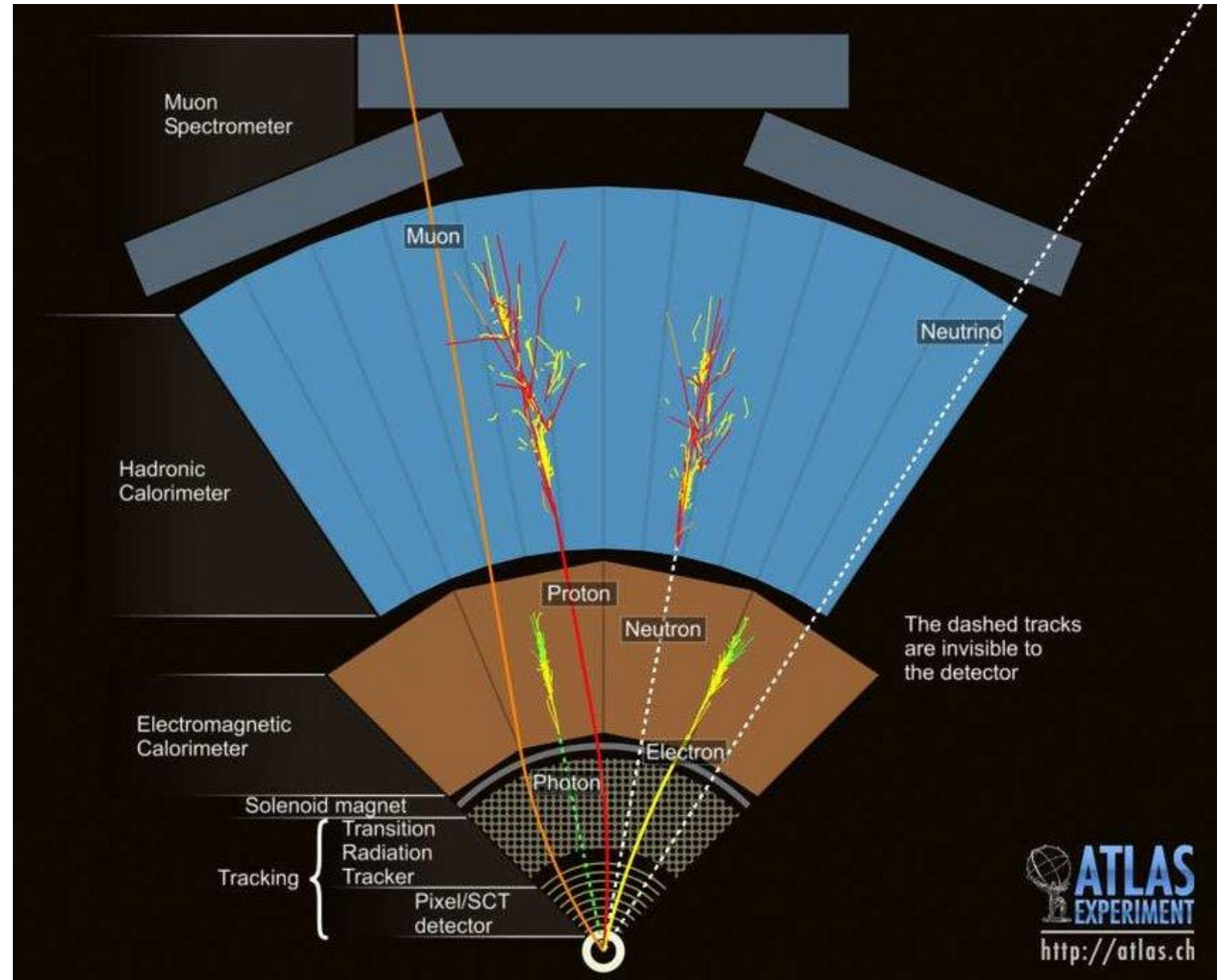
Particle tracks

Muon spectrometer

Hadronic calorimeter

Electromagnetic calorimeter

Tracking



Proposal submission

The submission is open.
Submission deadline:
April 10, 2025

Beamline 2018 Beamline Proposal
International School Manila

Determining the relationship between the energy of a
and react with a carbon-based, non-biological
therapy" — an alternative Med
See Jonn Chen, Yash Kar
Aarushi Tanuja, Ashish Tushk

Liceo Scientifico Statale "T.C.Onesti", Fermo, Italy
Team TCO-ASA

Introduction
Finding effective safe cancer therapy has
community. Two out of five individuals get diagnosed
The most common treatment options available today
therapy². These methods of treatment come with
extremely painful and known to cause fatigue and a
problems, irreversible hair loss, and vomiting³. Surgery
that does not necessarily eliminate all cancerous cells.
Last year, our school
cancer therapy — π^+ meson
was scope to develop it to
have now come up with
comparisons between pro
skin tissue using graphite
therapy has on human tissue

Overview and Background
Negative pions are
properties similar to heavy
However, pions being high

¹"Cancer Statistics" National
²"Types of Cancer Treatment"
³"Open D. Medical Channel"
Proc. 2014, p. 764

**Detecting the Elusive Δ^+ Baryon in an Electron-Proton
Inelastic Scattering Through its Decay-Products**

International School of Geneva, Nations' Flying Foxes
John Desalis, Yousoo Kim, Hiroki Kosaki, Sarah Shafiq, Mihail Stjepovskiy, Pen Struelens, Zihong Xu
Word Count: 2002

Introduction:
Just as scattering visible light off of a cell using a microscope allows us to examine a cell, a collision between
resting protons and an electron beam produced by a particle accelerator could allow us to "see" subatomic
particles and its miscellaneous interactions otherwise unobservable. Such a collision could result in interesting
scattering effects, creation of elusive particles whose decay products can be detected and analyzed to trace back
the event, which potentially enables us to further identify properties of the particles.

A histogram depicting the collision of a 4.9GeV electron beam with a static source of protons can be seen on
Fig 1. The x-axis represents the energy/momentum of the scattered electrons, while the y-axis indicates the
number of times an interaction of a specific energy/momentum occurred. The approximate peaks in the band of
3.5–4.2 GeV electrons suggest an inelastic scattering, which we are interested in to investigate.



Fig 1 | Source - W. BARTEL, B. DIEBELZAKI, H. KREIBHIL, J. MCELROY, U.
MEYER-BERKHOUT, W. SCHMIDT, V. WALTHER II and G. WEBER
ELECTROPRODUCTION OF PIONS NEAR THE $H(1115)$ RESONANCE AND THE FORM FACTOR
C-Mag2) OF THE (Δ^+) -VERTEX - Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany
and II. Institut für Experimentelle Physik der Universität Hamburg, Germany

Fig 1 | Thomson, Mark. Particle Physics Handbook 6: Deep Inelastic Scattering. The University of Cambridge, Department of Physics, Cavendish
Laboratory, 2011. www.hep.phy.cam.ac.uk/~thomson/particle-physics-handbook/Book_6_2011.pdf

ChDR-CHEESE
Cherenkov Diffraction Radiation - Characteristic Energy
Emissions on Surfaces Experiment

Silas Rahrberg Estévez, Tobias Baumgartner, Philipp Lowe, Lukas Hildebrandt,
Thomas Lebrach, Tobias Thode, Benjular Nickel, Tristan Matsudovits, Johann Bahl
Werner-von-Siemens-Gymnasium Berlin
March 31, 2020





It's time to write your proposals!

Questions?

