CERN Education Programs for High School Students

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11/11/2022

A few words about myself

- I am an Italian Physicists. After my studies in Italy and my Master Thesis in Paris, I moved to Geneva in 2014.
- Between 2014 and 2020 I worked at the University of Geneva as PhD student and post-doc. My specialty? The electronic properties of materials.
- In 2020 I started to work at CERN in the Teacher and Student Section, where I am responsible for some of the educational programs for high school students.
- Physics is not my only passion ;)

Let’s move from teachers to students

We currently have two interesting offers for high school students:

Beamline for Schools

CERN-Solvay Educational Program

Beamline for Schools - a physics competition!

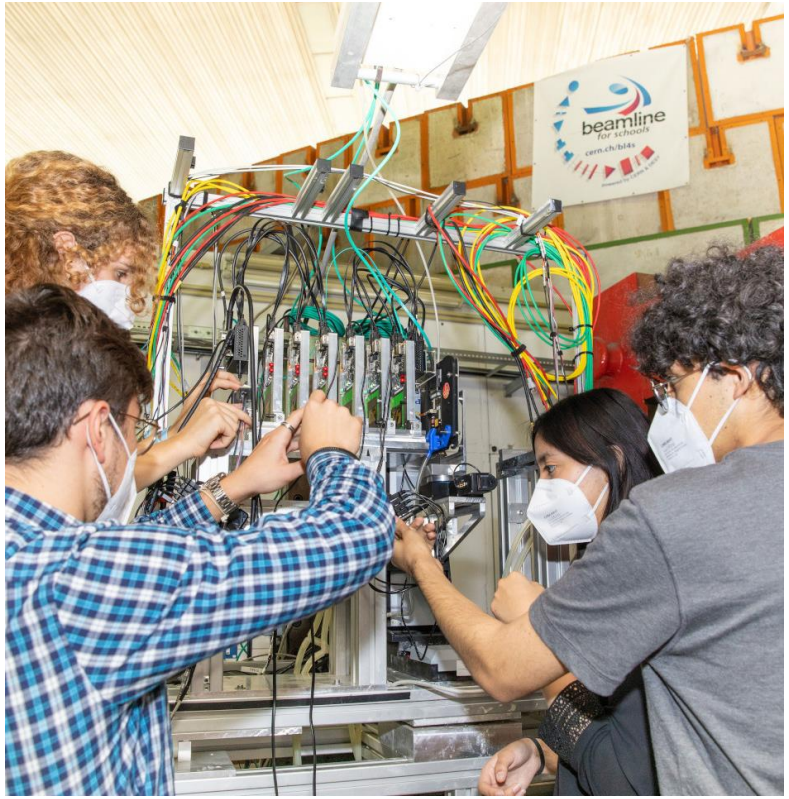
BL4S invites teams of high school students from all around the world to design an experiment that can be realised at the test beam facility of a particle accelerator. BL4S celebrates its 10th edition in 2023.

Goal: bringing young people close to the fundamental research in particle physics. Learning by doing.

Winners: A jury of scientists evaluate the proposals and select the teams who win the opportunity to carry out their experiments at the beamline. Additional prizes are awarded to a selection of 20-25 teams.

Beamline for Schools - a physics competition!

Students from all around the world have the opportunity to carry out a research project and get in touch with the international community of scientists



How to take part

Step 1

Pre-register a team of student

The pre-registration is not mandatory, but it is a necessary step to receive updates and take part in the different online events that we are organising.

Step 2

Prepare a proposal

Accompany your students in the preparation of their proposal. It should be their idea and their work. The students are encouraged to get in touch with researchers, us, and our national contacts.

Step 3

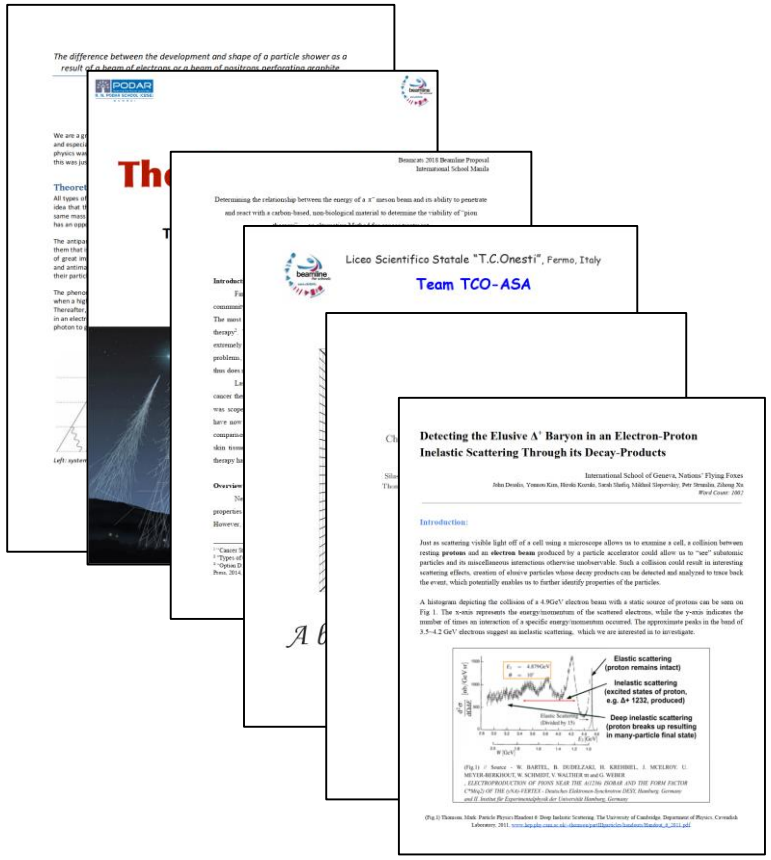
Submit the proposal

Submit the experiment proposal by the deadline, **April 12 2023, at midnight CET. The submission form will open in January 2023.**

Experiment proposal

When you register you are not expected to have an idea yet and/or to be an expert on particle physics.

Curiosity + Motivation will help you!



Communicate your idea in a written proposal (~1000 words) :

- Give us your motivation (~ 100 words)
- Detail how you would like to use the beam (~800 words)
- What you hope to take away from this experience (~100 words)

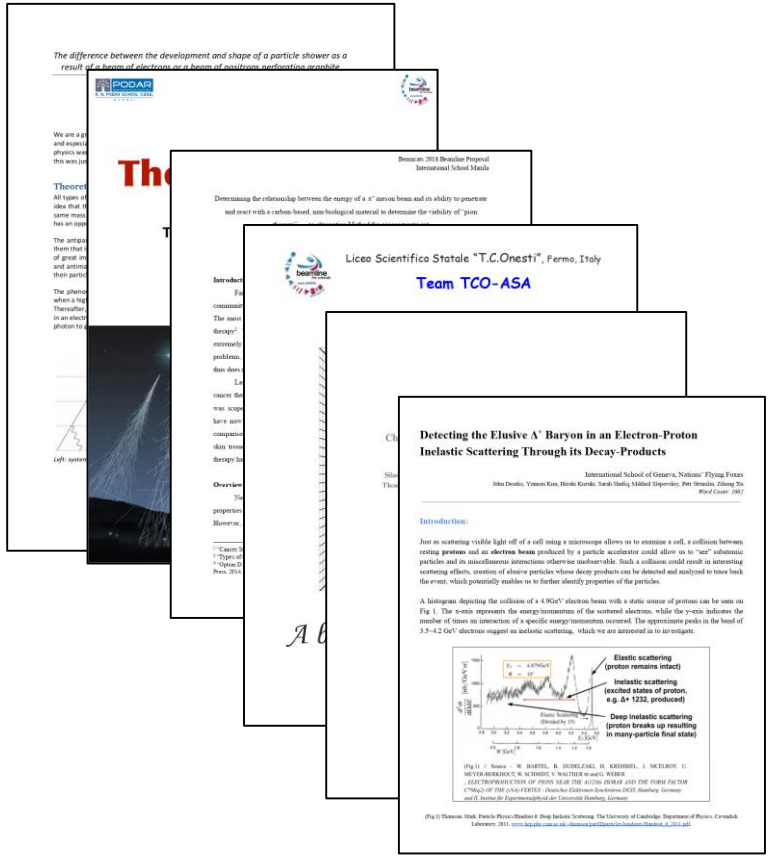
Realise a creative video to explain your idea. 1 minute, optional.

Experiment proposal

The proposals will be evaluated by a committee of scientists.

Evaluation Criteria:

- Feasibility of the experiment.
- Motivation of your experiment idea and your participation.
- Creativity of the experiment.
- Ability to follow the scientific method

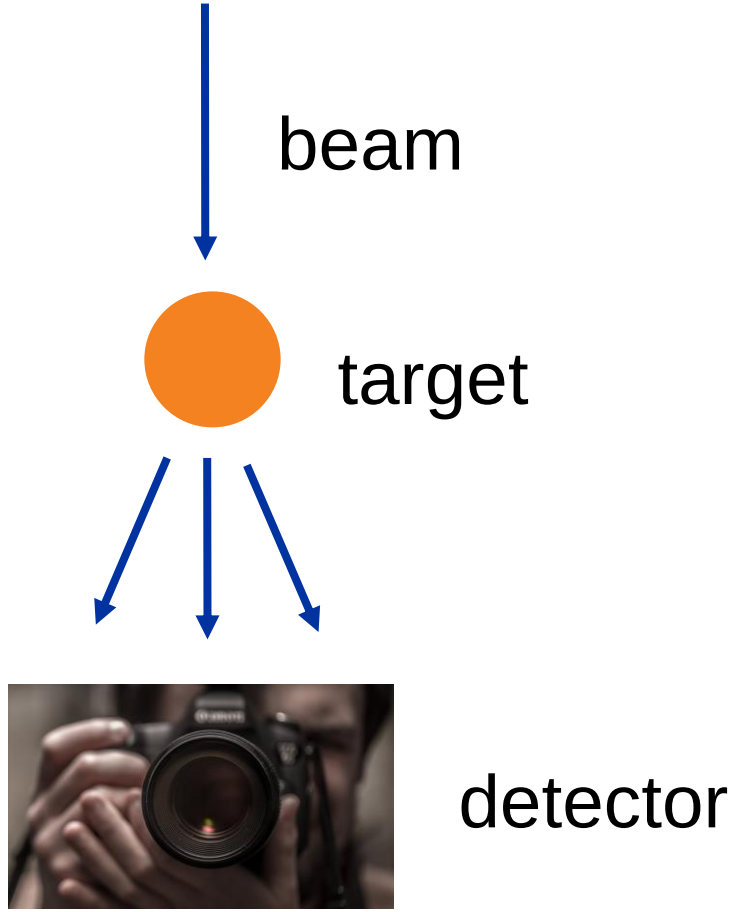


You are not alone!

Get in touch with the national contacts or with us at : bl4s.team@cern.ch

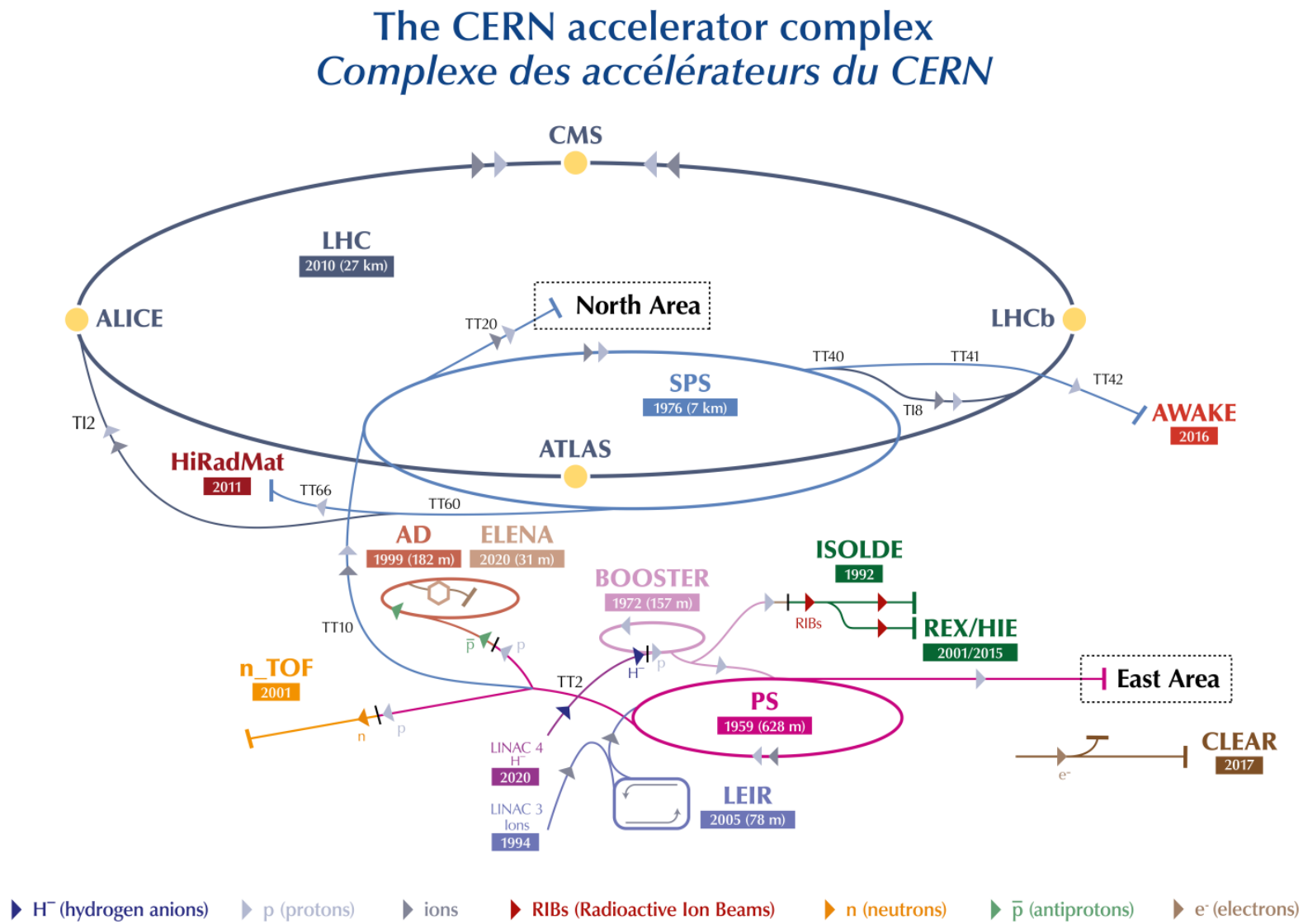
Experiment requirements

- The proposal has to be design for the test-beam facility of the CERN Proton Synchrotron accelerator or the DESY II accelerator in Germany.
- Fixed target configuration: particle beam crossing or passing close to a target (solid, liquid, gas).
- Experiment design:
  1. Beam
  2. Target
  3. Detectors
  4. Trigger/readout



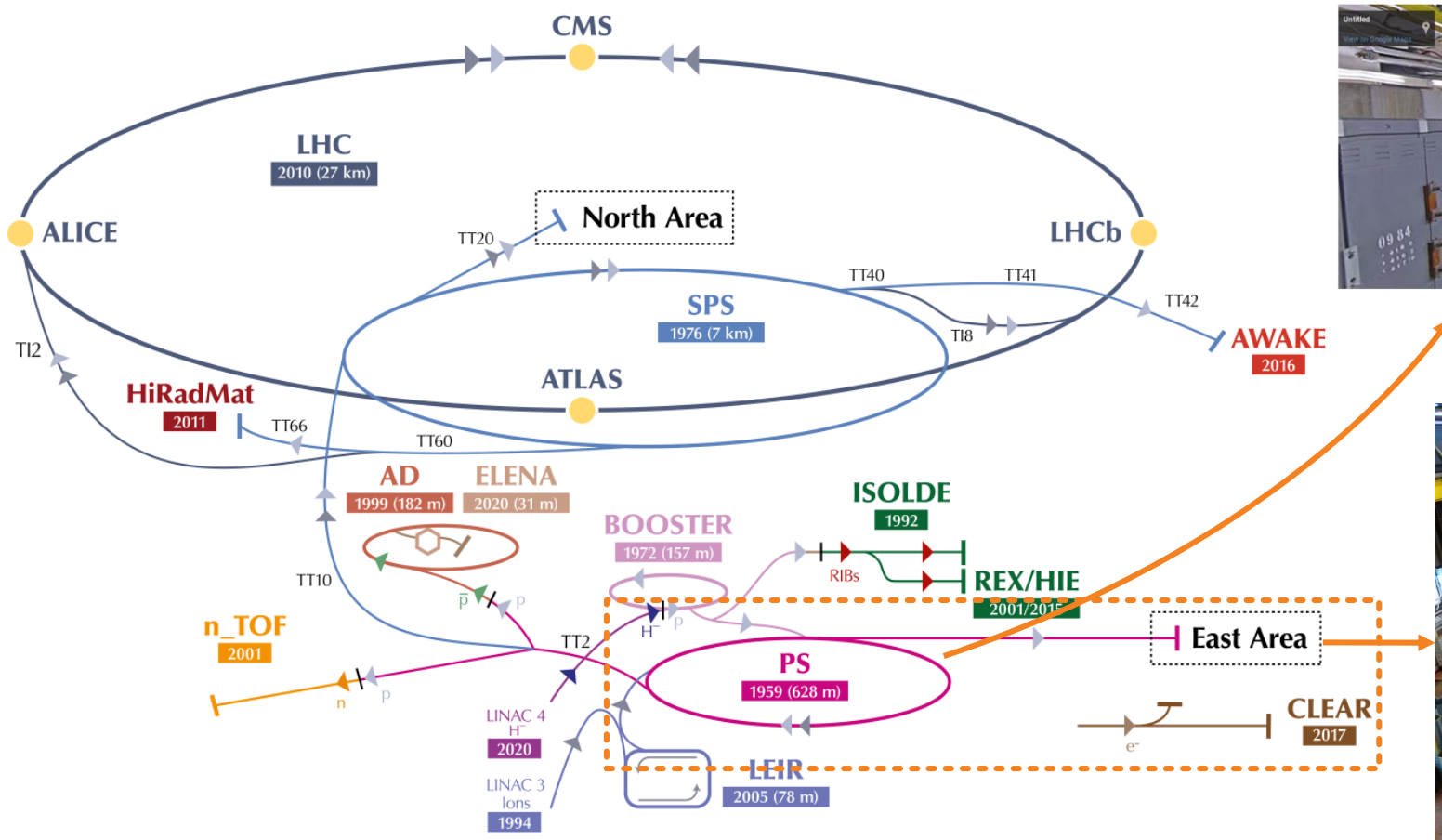
Experiment requirements

- We provide a detailed document that describes the beam conditions, at CERN and at DESY, and all the detectors available to setup an experiment.
- We provide also a document with a series of example experiments the students can get inspired from.
- All the information are available on our website and the new version should be published soon!



- Particles are accelerated for different purposes.
- Different types of particles are available for fixed experiments (ATLAS, CMS, ALICE, LHCb, etc..) and for temporary users.
- BL4S winners are temporary users of the CERN beams.

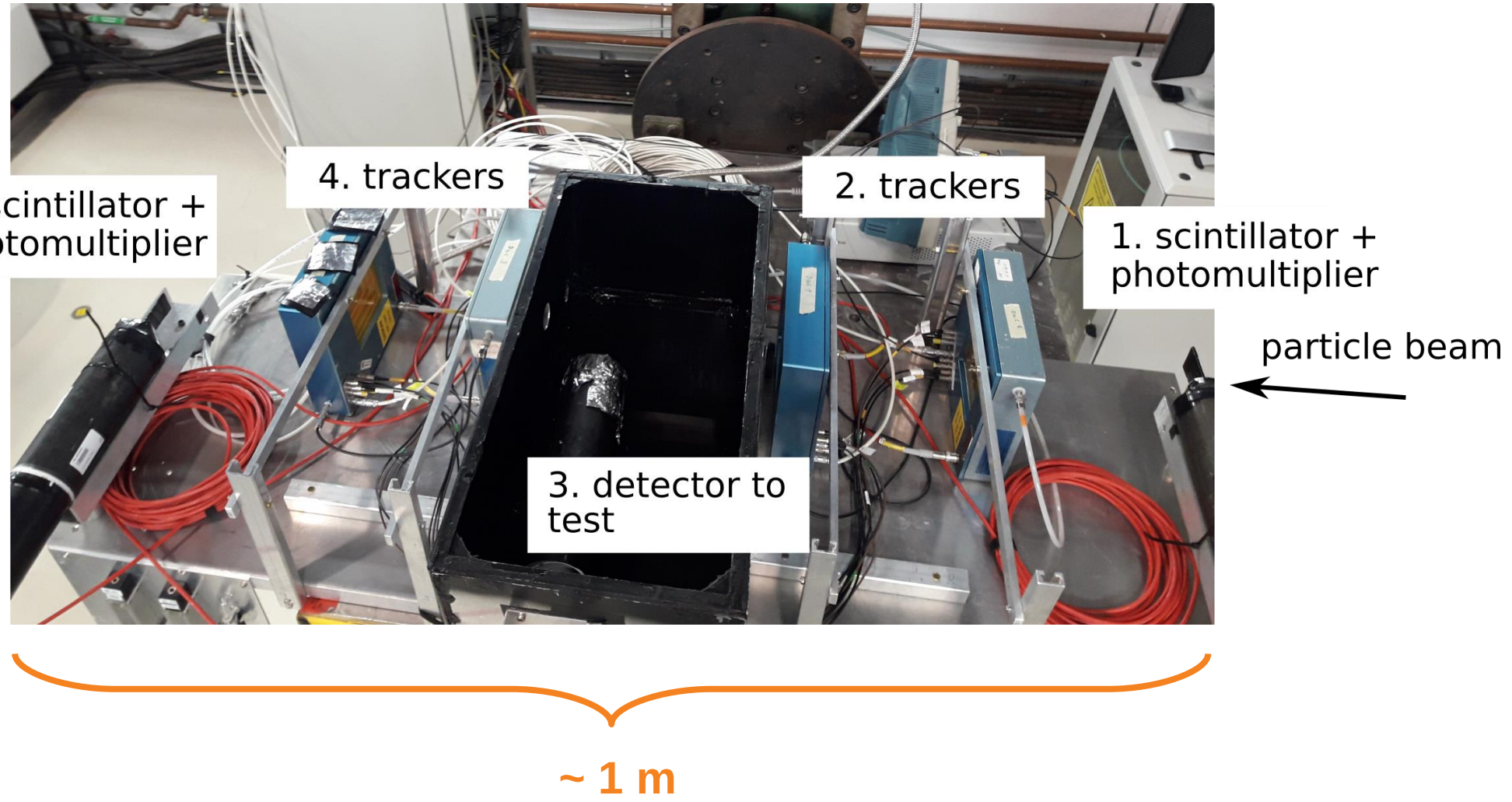
The CERN accelerator complex
Complexe des accélérateurs du CERN



T9 Beamline

- The beam is extracted in a dedicated room.
- It might look empty, but you will fill it with your experiments !

An experimental setup

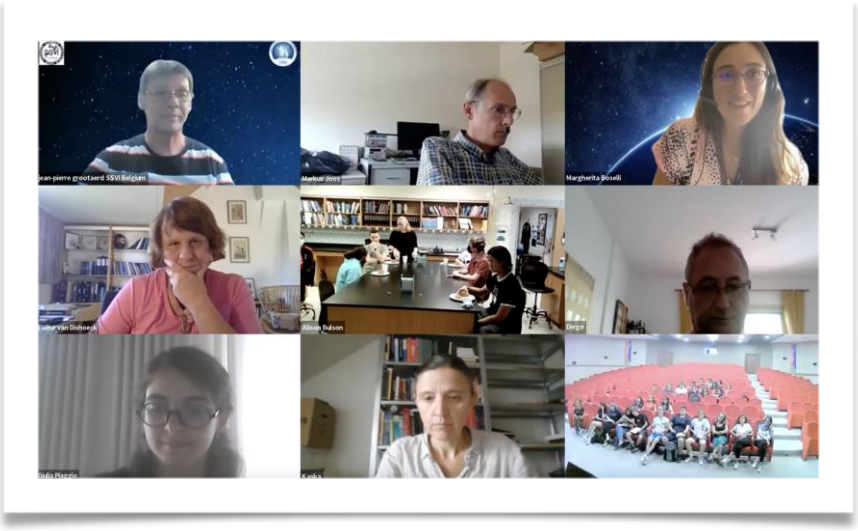


Impact on Participants

Only a few teams can come on-site and perform their experiments.

What is the impact on the participants?

- Hands-on original project
- Preparation of a scientific document (written proposal)
- Creative communication of their idea (video proposal, optional)
- Team-work
- Knowledge of physics research facilities
- Interaction with scientists
- International experience (also teams with participants from different countries)



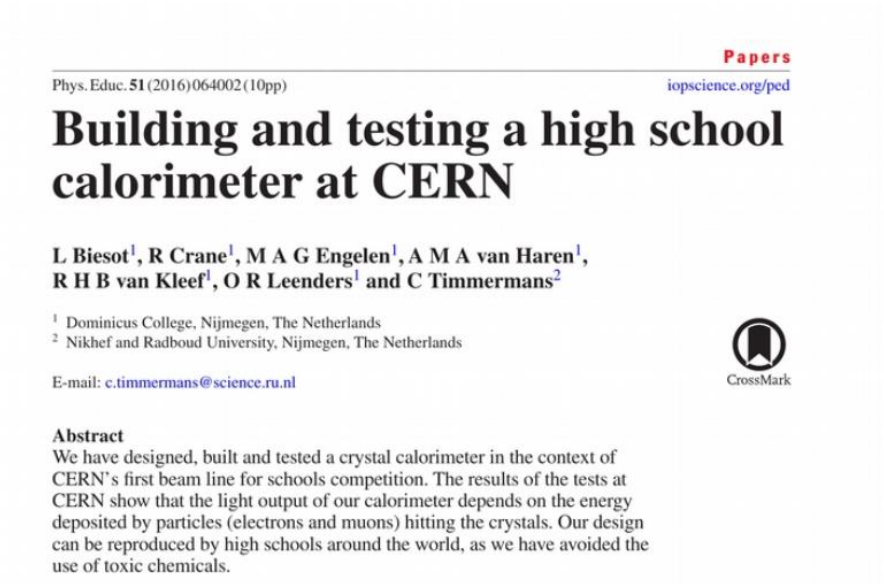
Impact on Winners

Since 2014, more then 130 students came on site to perform their experiments.

- Unique opportunity to conduct an original research project.
- Deep understanding of all the steps required to conduct an experiment.
- Responsibility and problem solving.
- Team-work.
- Interaction and exchanges with scientists.
- Impact on their career choices.

Scientific Publications

- After the test beam, the winning teams are guided in the analysis and interpretation of their data.
- Six winning teams already published their results on peer reviewed journals: Physics Education (IOPScience), and The Physics Educator (World Scientific).
- Two winning team presented their results in International Physics Conferences.



Papers
Phys. Educ. **51** (2016) 064002 (10pp) iopscience.org/ped

Building and testing a high school calorimeter at CERN

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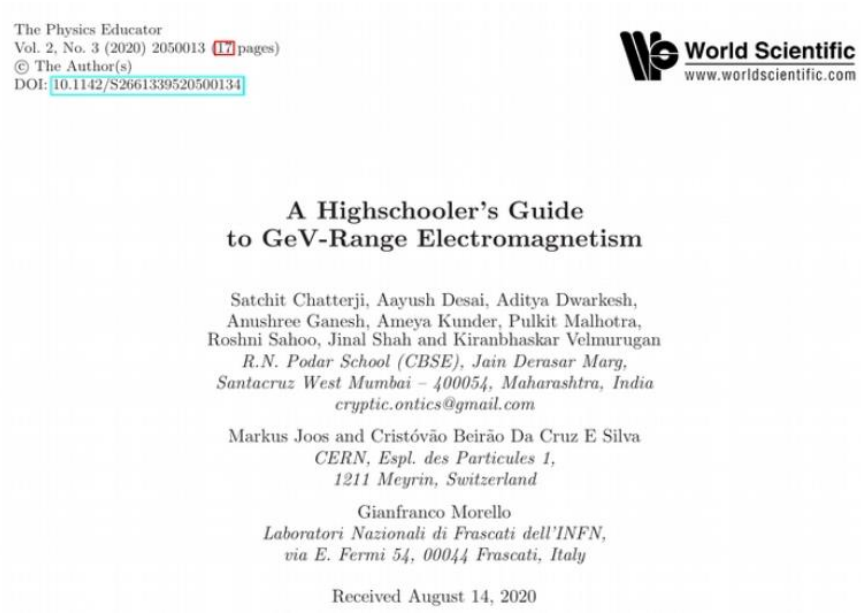
Abstract
We have designed, built and tested a crystal calorimeter in the context of CERN's first beam line for schools competition. The results of the tests at CERN show that the light output of our calorimeter depends on the energy deposited by particles (electrons and muons) hitting the crystals. Our design can be reproduced by high schools around the world, as we have avoided the use of toxic chemicals.



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World Scientific
www.worldscientific.com

A Highschooler's Guide to GeV-Range Electromagnetism

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Let’s move from teachers to students

We currently have to interesting offers for high school students:

Beamline for Schools

CERN-Solvay Educational Program

The Solvay Education Programme

level 1

Online social media educational videos
- Reach: 10^6 views per year via CERN channels
- Goal: to trigger STEM interest

level 2

Online course for high-school students
- Reach: 10^4 participants per year from around the world
- Goal: to develop interest in STEM

level 3

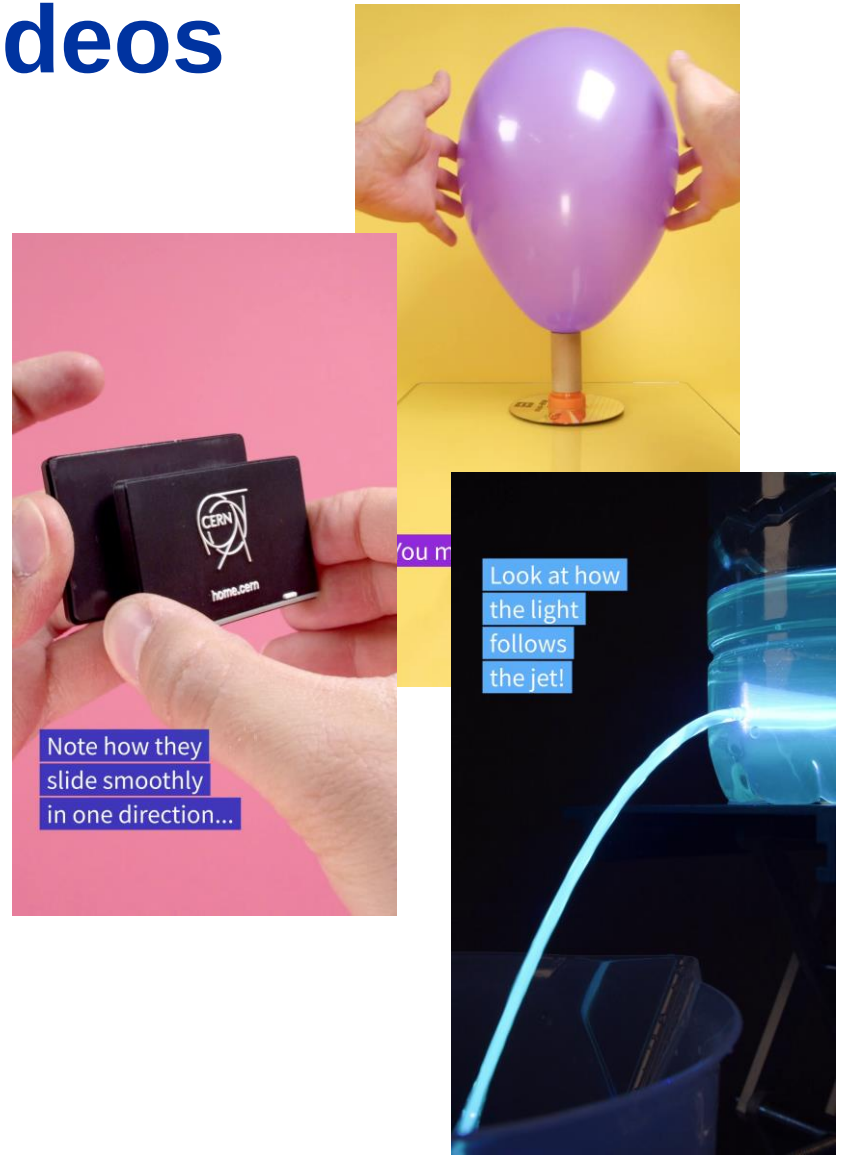
On-site camp for high-school students at CERN
- Reach: 10^2 participants in total from around the world
- Goal: to build confidence & transform STEM interest

SOLVAY

Progress beyond

Level 1: Short-form educational videos

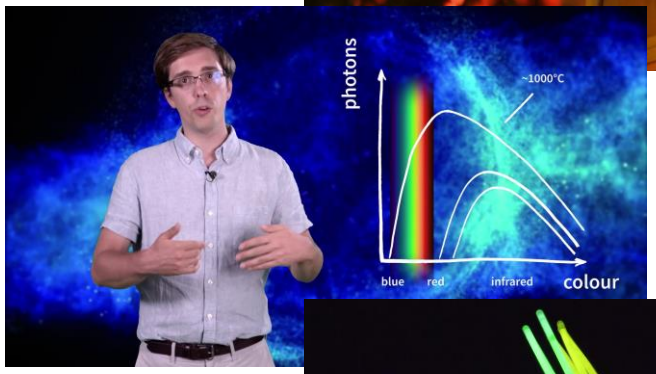
- Tiktok-style short videos, first-person view, vivid colors, released on all of CERN's SM platforms
- Making a connection between
  a simple « do-it-yourself » experiment
  and the research or technologies of CERN
  to make them more accessible
- Build a hovercraft which glides like the CMS detector
  Get a feel for multipolar magnets with fridge magnets
  Make an optical fiber with a leaky bottle
- A dozen videos a year
  Accompanied by online supporting information for educators

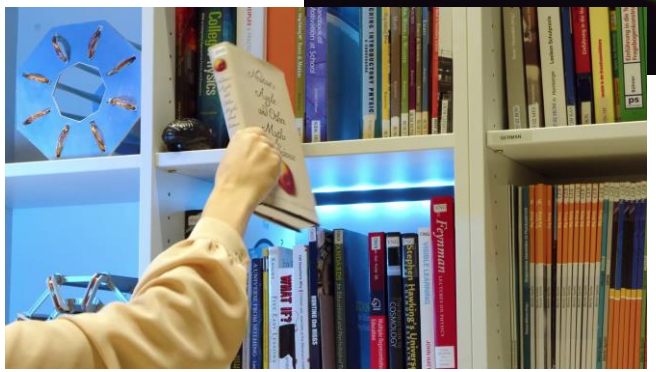


Level 2: Long-form explainer videos

- Online course for high-school students aged 14-19 made of 15-20 min long explainer videos
- Advanced high-school / early undergraduate topics to acquire a physics background relevant for the technologies and the science at CERN
- Luminescence, electromagnetism, superconductivity, radioactivity…
- Four interactive videos a year
  Self-grading quiz and certificate
  Successful participation required for level 3

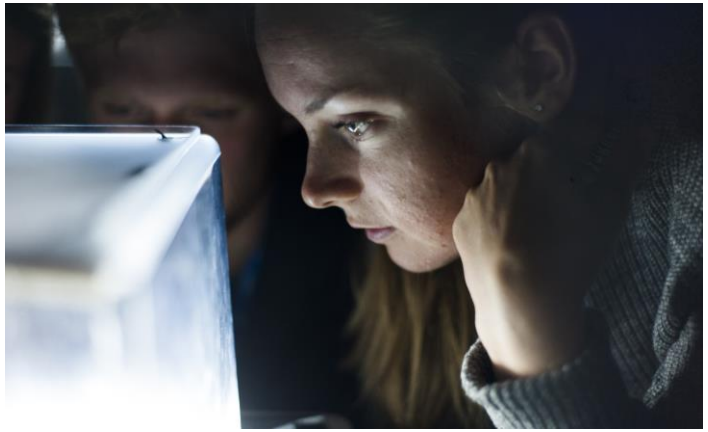
Have a look!





Level 3: On-site camp for highschoolers

- Bringing a selection of motivated high-school students aged 16-19 from around the world to CERN
- 7-day camp for 30 students, once a year, **first camp in Oct 2023, applications in Jan**
- Lectures, site visits, social events & work with CERN scientists on modern research topics in hands-on working group sessions
- Necessary condition: **follow all the videos of Level 2 and pass the quiz!**



To know more

cern.ch/bl4s

cern.ch/solvay-education-programme

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home.cern