

Beamline for Schools

A Physics Competition for High-school Students

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The Competition

Goal: bringing young people from all over the world close to the fundamental research in particle physics

Structure: teams of high-school students are invited to develop an original experiment to be performed at a testbeam facility. Learning by doing.

Prizes: two teams win the opportunity to perform their experiments at a fully equipped beamline with the support of a team of scientists. Additional prizes are awarded to a selection of ~ 20 teams.

History:



Team Structure

- Beamline for Schools is run in the Teacher and Student Programmes Section in CERN's International Relations Sector.
- **Core Team**
 - **Margherita Boselli, Project Manager, CERN**
 - **Markus Joos, Technical Coordinator, CERN**
- **Support Scientists**
 - **Cristovao Beirao da Cruz e Silva, CERN**
 - **Paul Schütze, DESY**
- 48 scientists from different countries contribute as national contacts.
- More than 40 experts from both CERN and DESY are part of the evaluation team.



Taking part in the competition

The participants have **to plan an experiment** following the requirements of the facility.

- Written proposal: English, ~ 1000 words.
- Video proposal, 1 minute, optional (special prize).

Evaluation criteria:

- Motivation of the team
- Feasibility of the experiment
- Creativity
- Ability to follow the scientific method

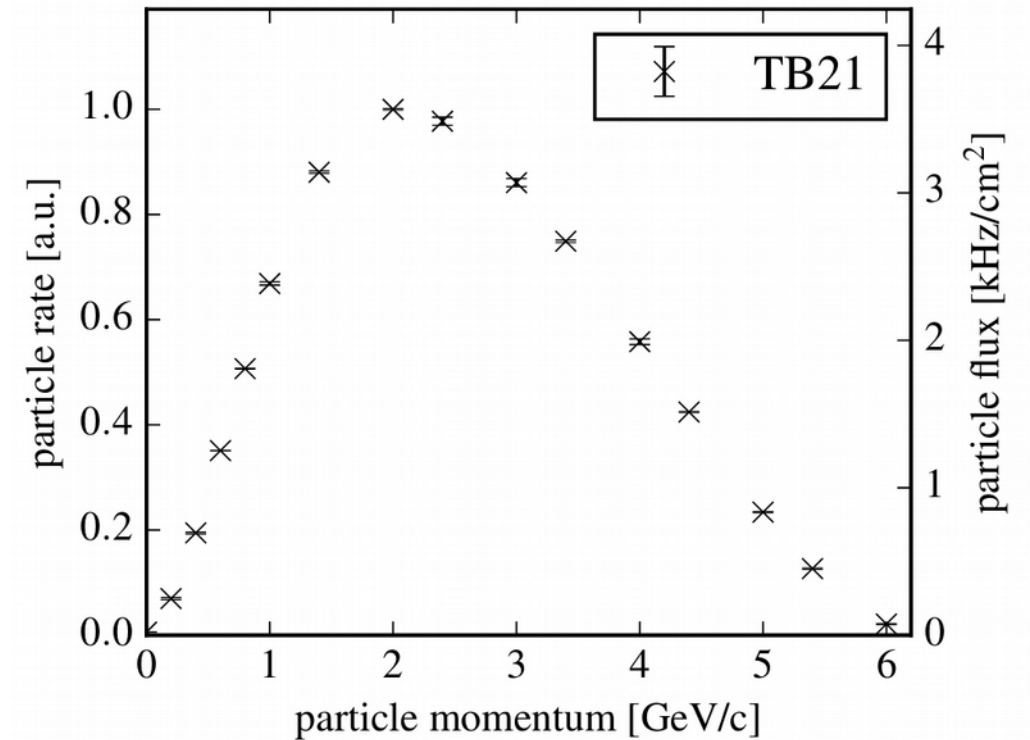
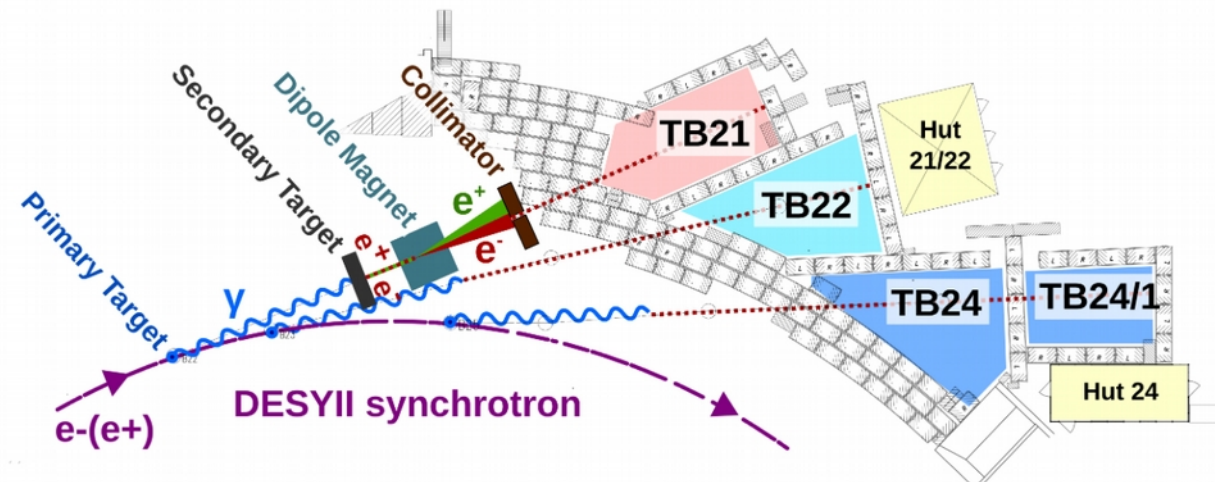
Support from the national contacts and BL4S team.



Beam properties

In 2021 BL4S takes place at the DESY II accelerator

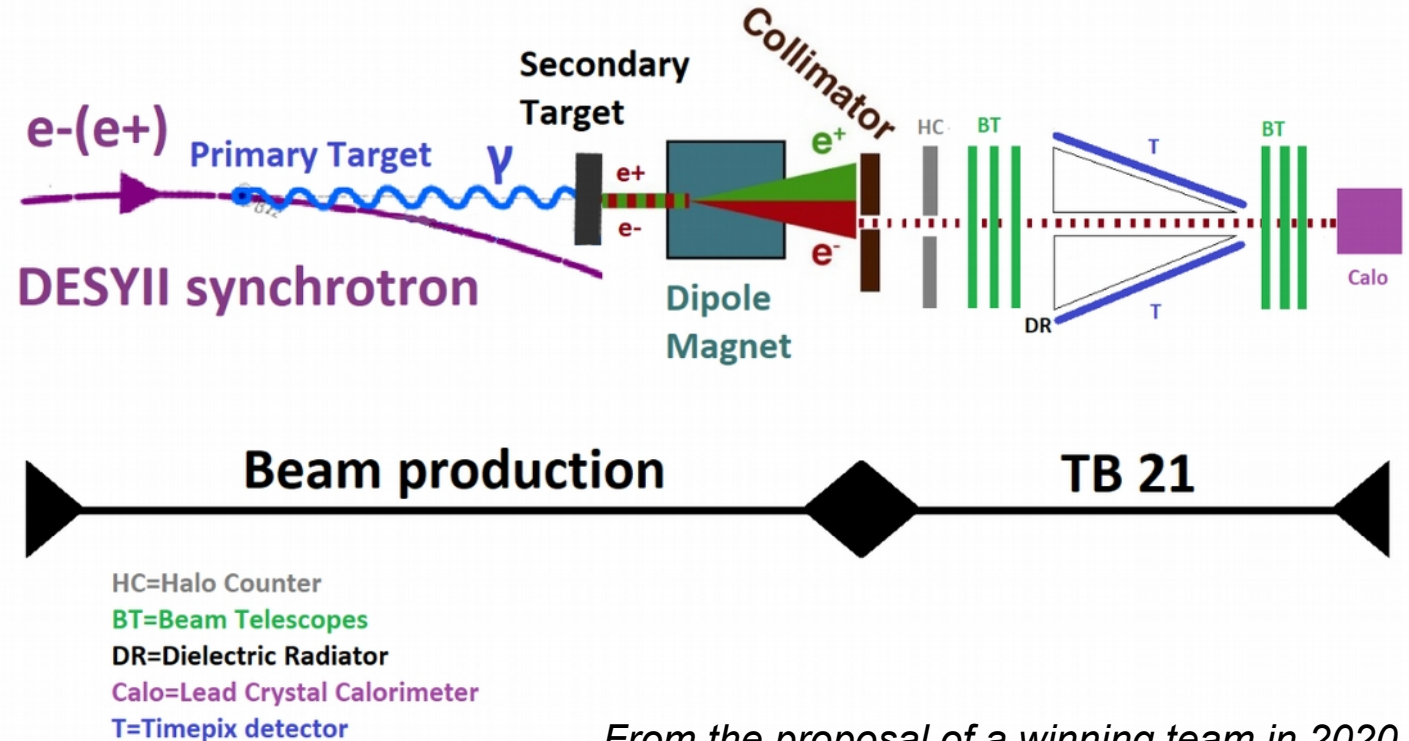
- Secondary beam of electrons or positrons
- Energy up to 6.3 GeV
- The users can select the particle type, the energy and the collimation
- Beam spot size : 2x2 cm



Detectors and experimental set-up

Depending on the purpose of the experiment, the teams combine the material available for them

- Different detectors: Scintillators + Photomultipliers, Delay Wire Chambers, MicroMegas, Beam Telescopes, Lead Crystal Calorimeters
- Magnets, absorbers



From the proposal of a winning team in 2020

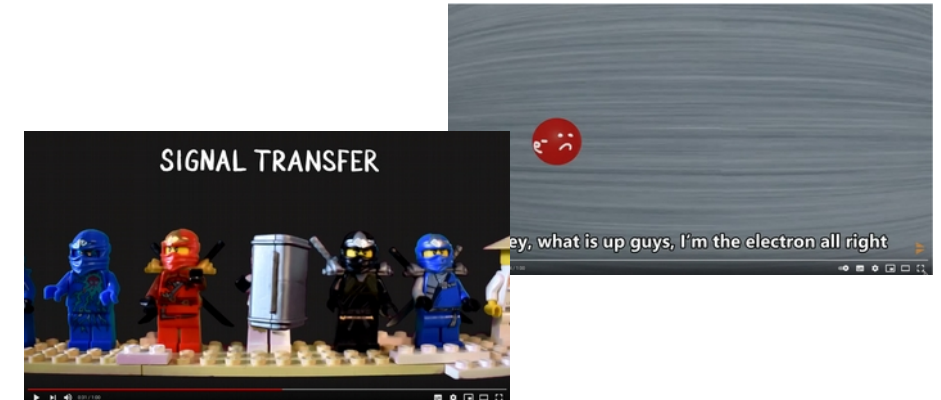
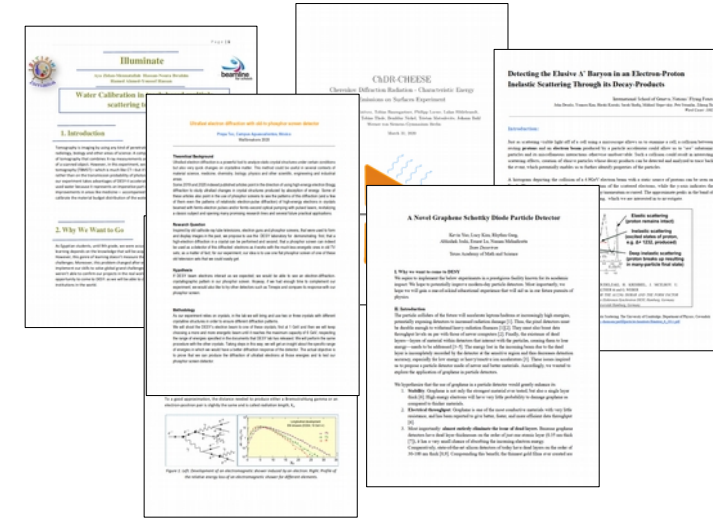
Once the winners are selected, the students work on the experimental set-up with the support of the BL4S team. Usually ~2 months to prepare the experiments.

Impact on Participants

Only a tiny fraction of the students taking part in the competition wins.

What are the participants learning from this experience ?

- Hands-on original and extra-curricular physics project
- Preparation of a scientific document (written proposal)
- Creative communication of their idea (video proposal)
- Team-work
- Deeper knowledge of physics research facilities
- Interaction with scientists (~50 % of the teams get in touch with the national contacts)
- International experience (participation of more and more cross-border teams)

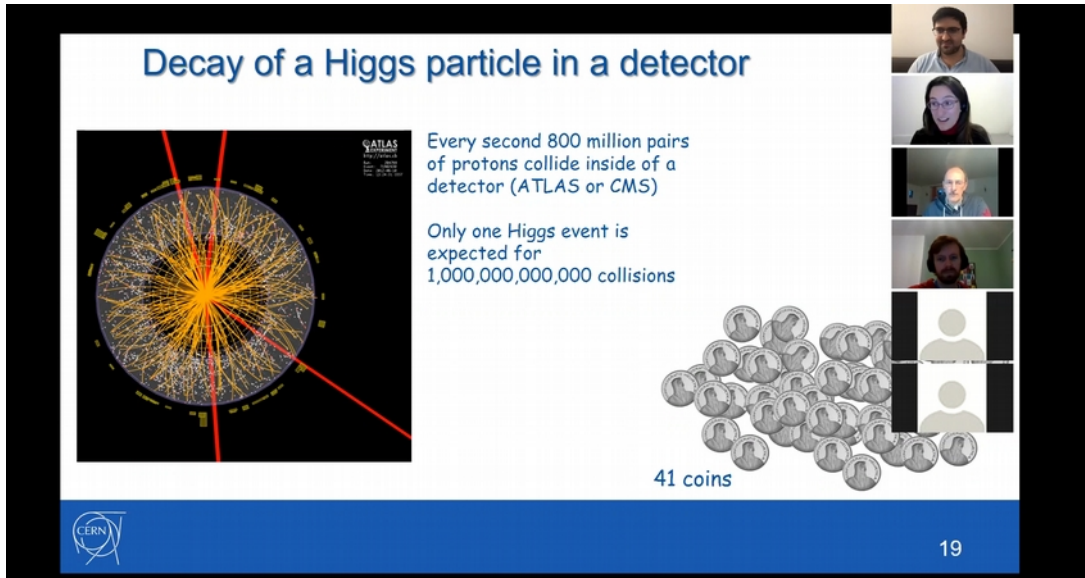


The Pandemic: an Opportunity

The pandemic offered an **opportunity** to increase the impact of the competition on all the participants.

- two online events organized for the participants in the 2021 edition and virtual visits for those who sent a proposal

CERN and its research/BL4S Q&A



Decay of a Higgs particle in a detector

Every second 800 million pairs of protons collide inside of a detector (ATLAS or CMS)

Only one Higgs event is expected for 1,000,000,000,000 collisions

41 coins

19

Virtual Visits

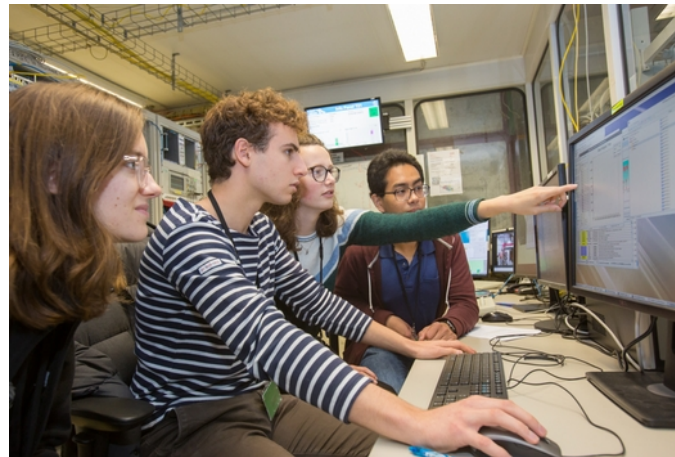


- More than 300 people took part in each event.

Impact on Winners

Since 2014, more than 100 students came on site to perform their experiments.

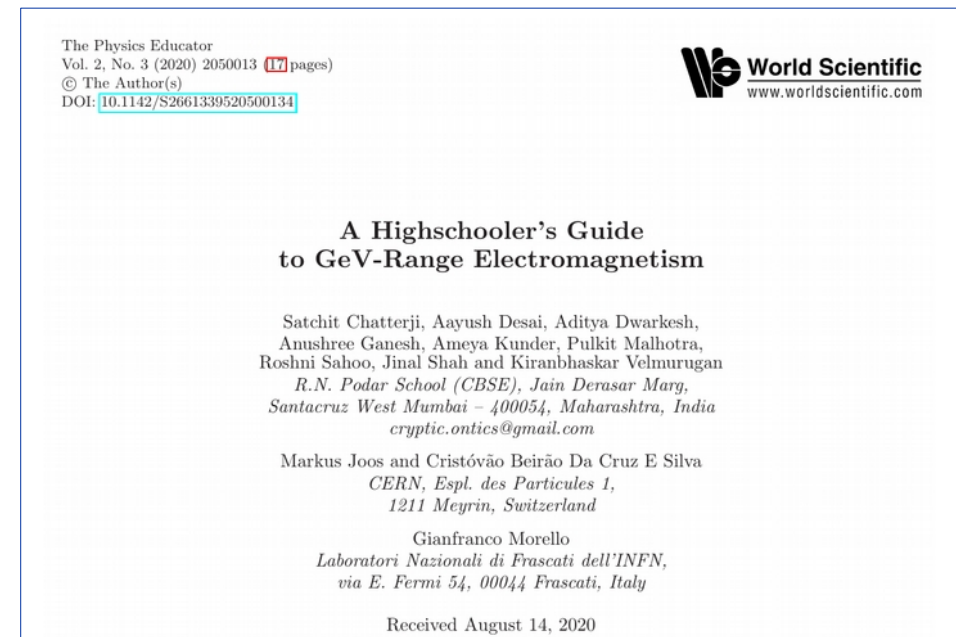
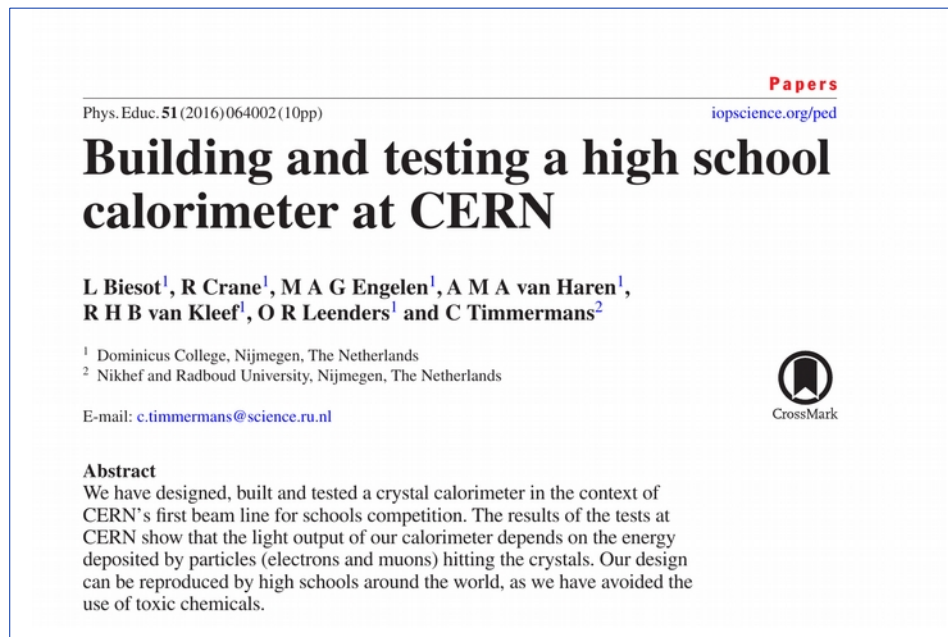
- Unique opportunity to conduct an original experiment at a particle physics facility
- Deep understanding of all the steps required to conduct an experiment
- Responsibility and problem solving
- Team-work
- Interaction and exchange with scientists
- Role models for their peers
- **Impact on their career choice**



[Alumni videos available on our website](#)

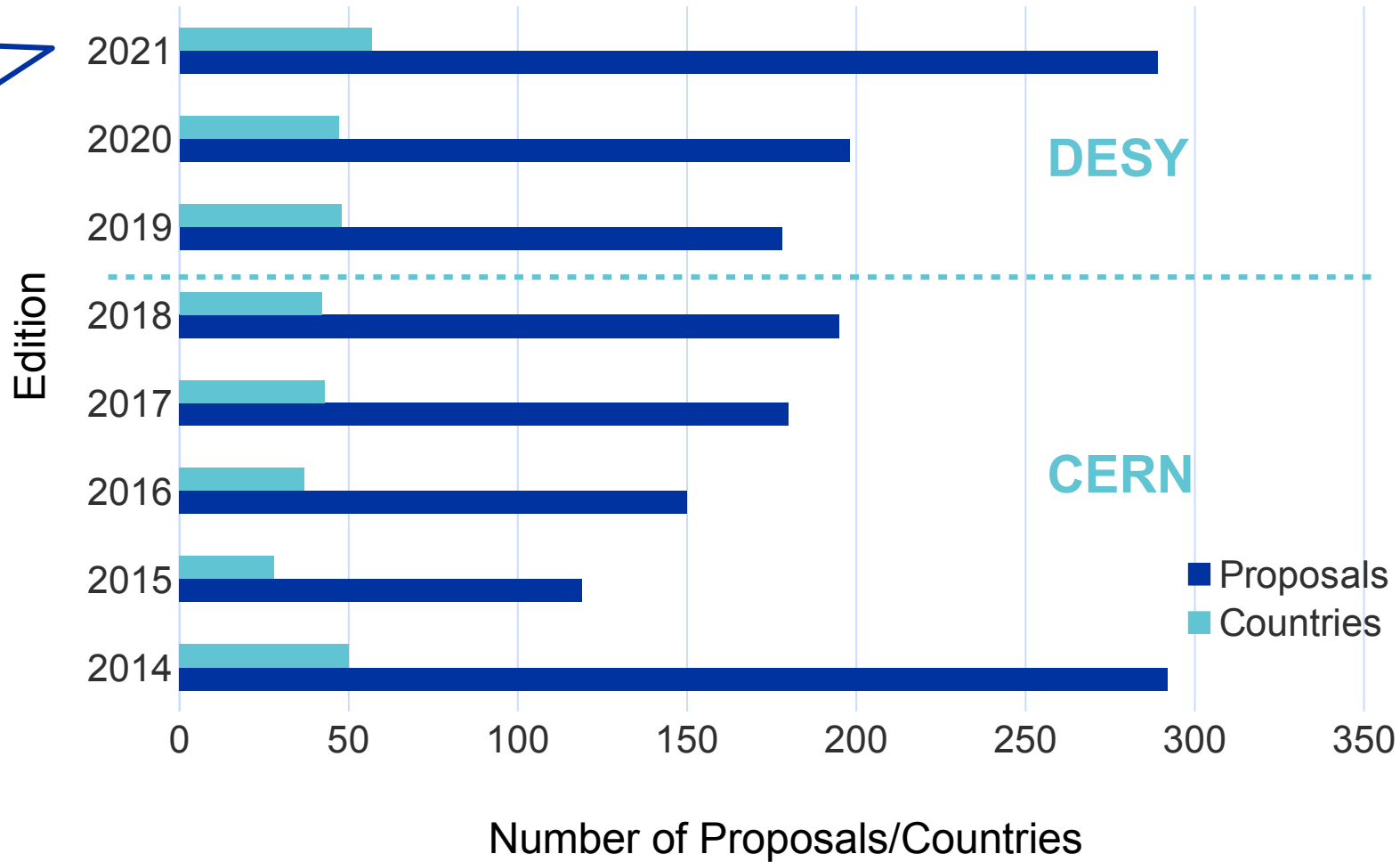
Scientific Publications

- After the beam time the winning teams are guided during the analysis and interpretation of their data.
- Five winning teams already published their results on peer reviewed journals: *Physics Education* (IOPScience), and *The Physics Educator* (World Scientific).
- One winning team presented its results at the « 8th Beam Telescopes and Test Beams Workshop », 2020.



Participation Overview

289 proposals, 57 countries represented



Perspectives



The participation rate is on a very good track

After LS2 the competition will return to CERN

We are currently looking for **support scientists** for the 2022 edition.

**Do not hesitate to get in touch
with us if you want to collaborate**

Thank you !



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