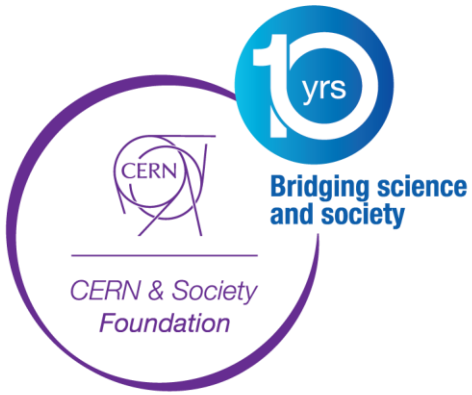
Beamline for Schools

A physics competition for high-school students



What is BL4S?

Perform your own experiment at a real particle accelerator!

You can be a scientist

Teams of high school students from all around the world can propose an experiment that they want to perform at a particle accelerator.

Milestones

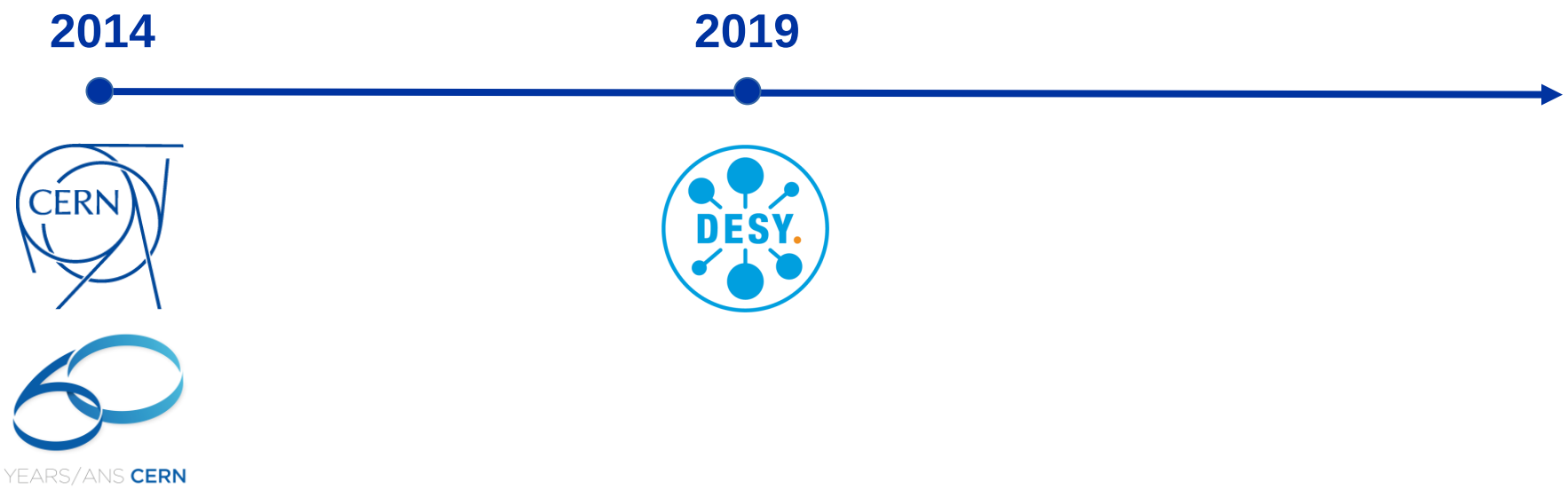
Foundation

2014

Milestones

Continuous and successful collaboration with DESY

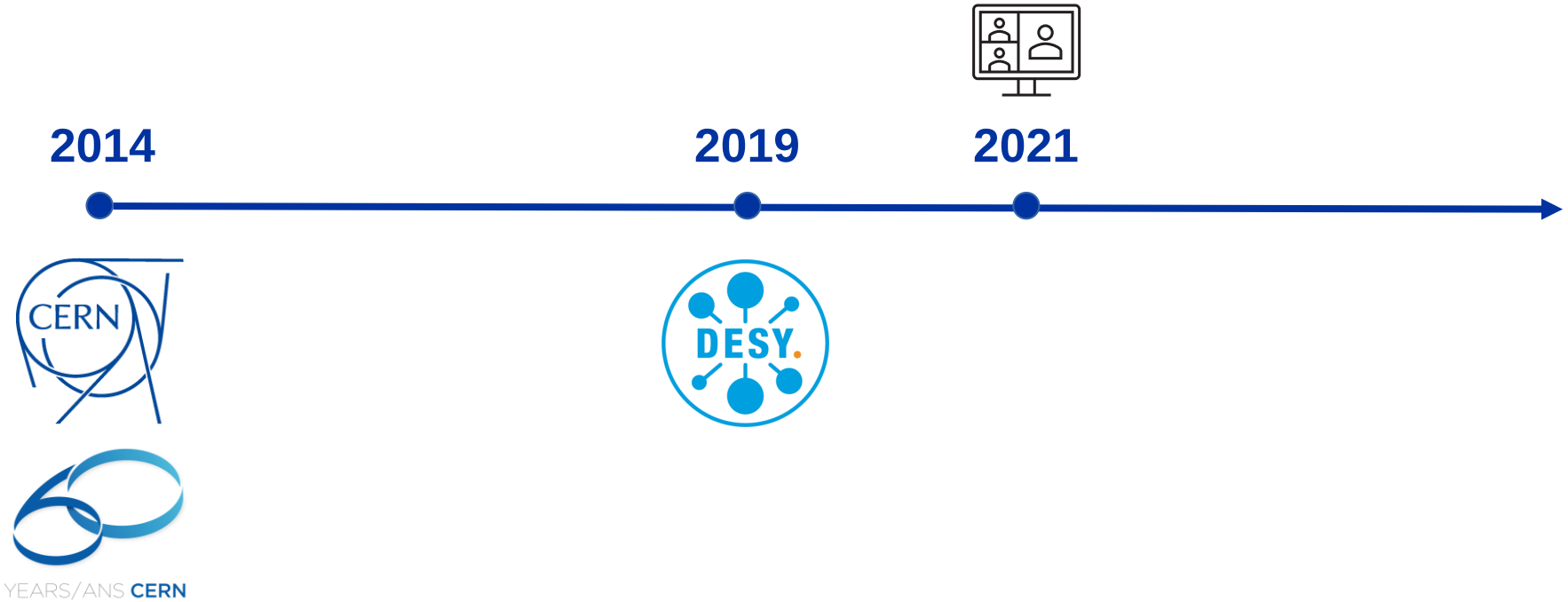
⇨ *continuation during LS2*



Milestones

COVID: establishing a continuous and successful online component

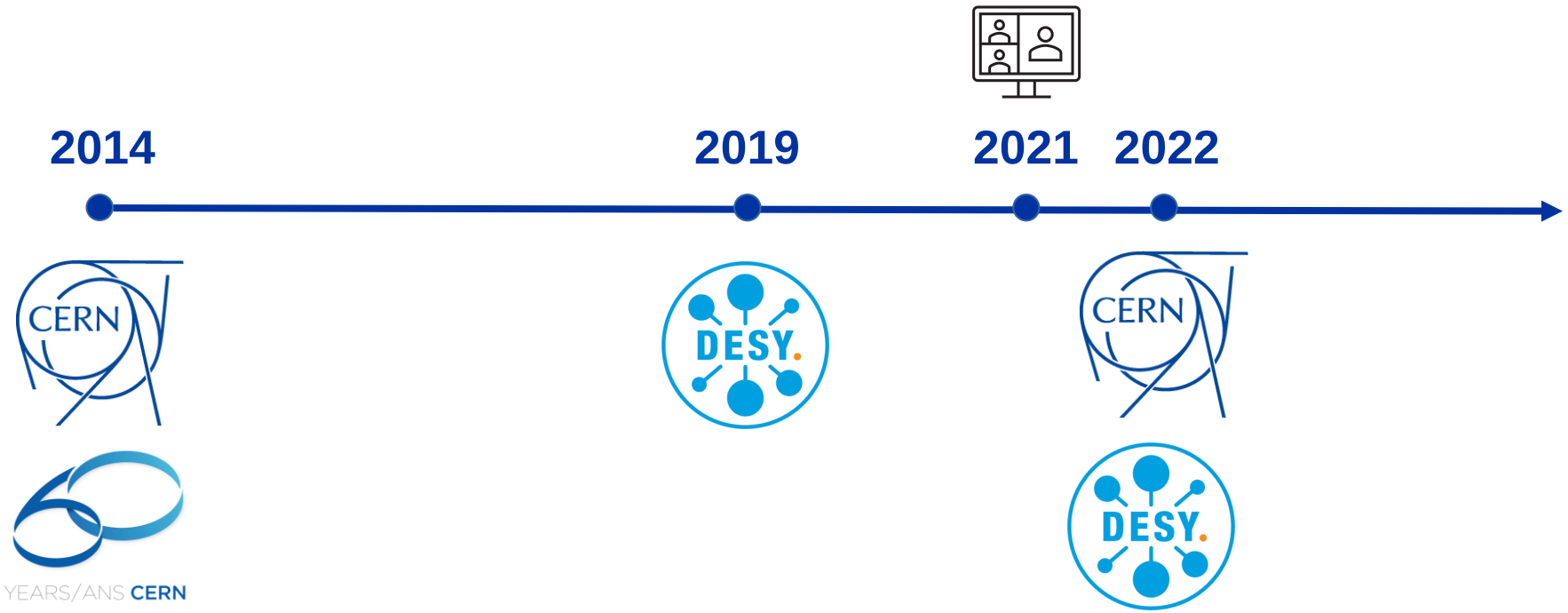
⇨ *increased number of submitted proposals*



Milestones

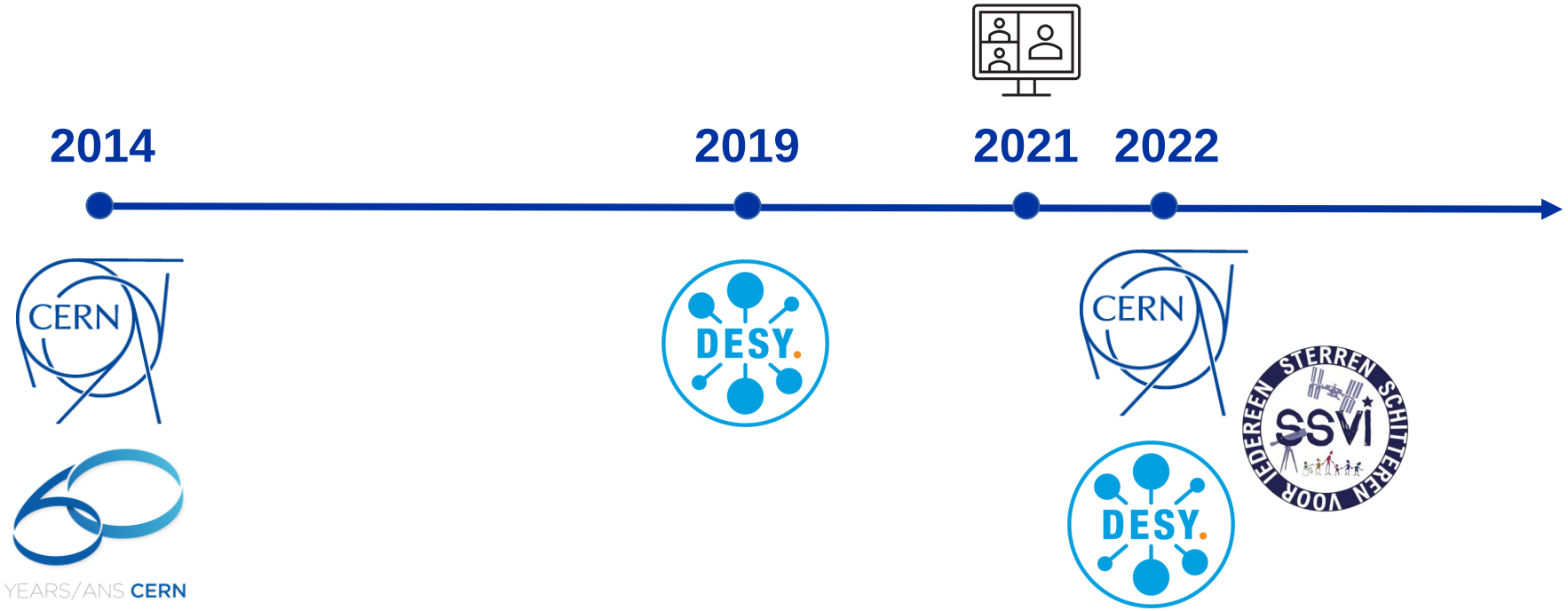
Continuous and successful collaboration with DESY

⇨ *increased number of winning teams per year*



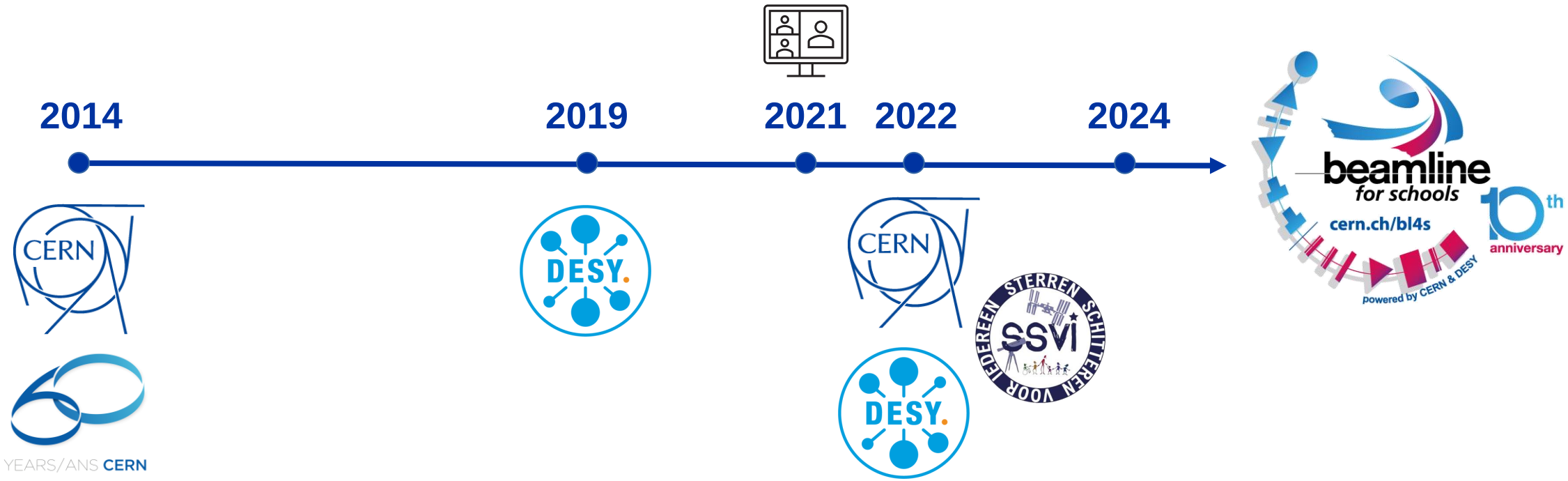
Milestones

Continuous and successful collaboration with “Stars shine for everyone” (SSVI)! ⇨ *increased number of special prizes per year*

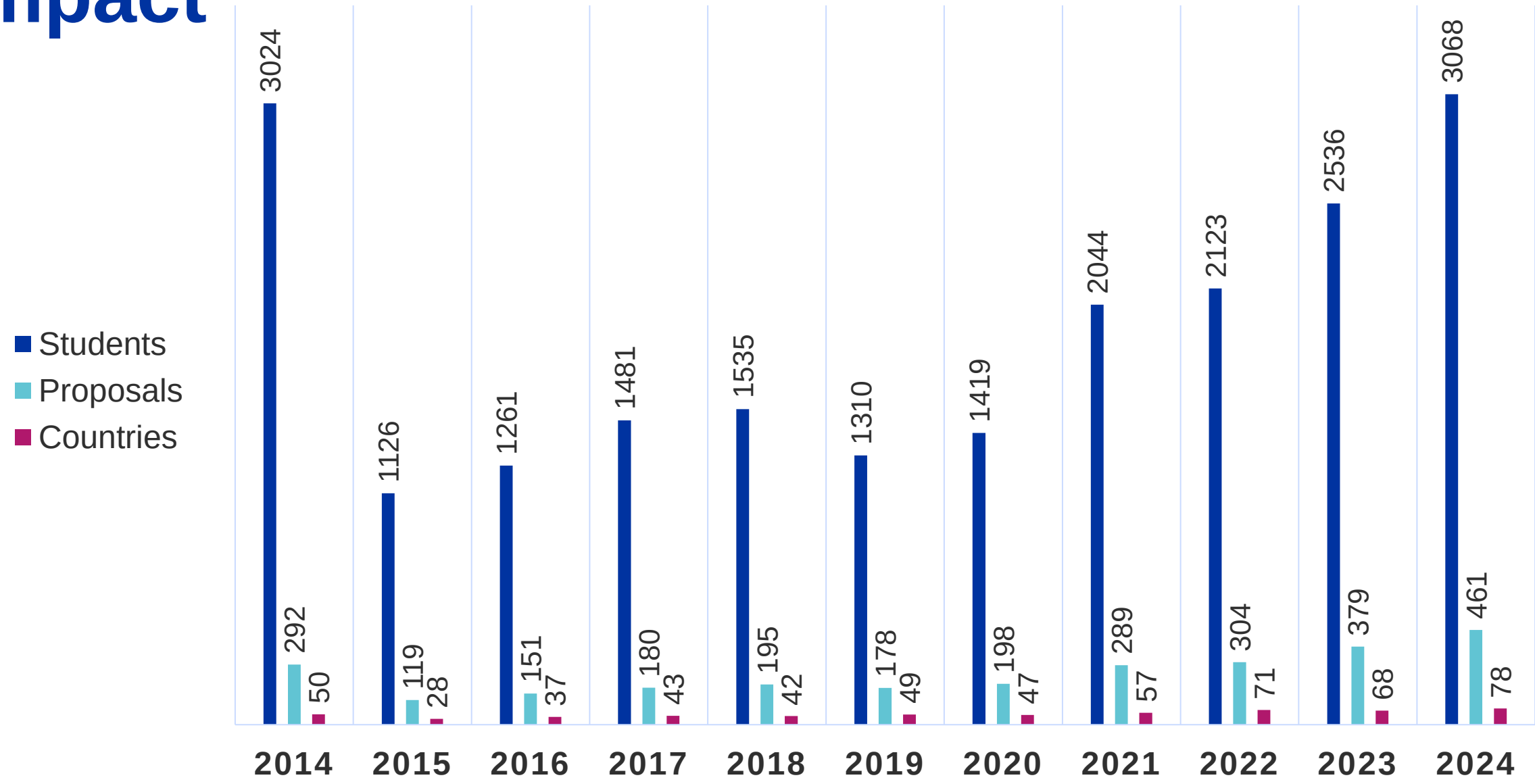


Milestones

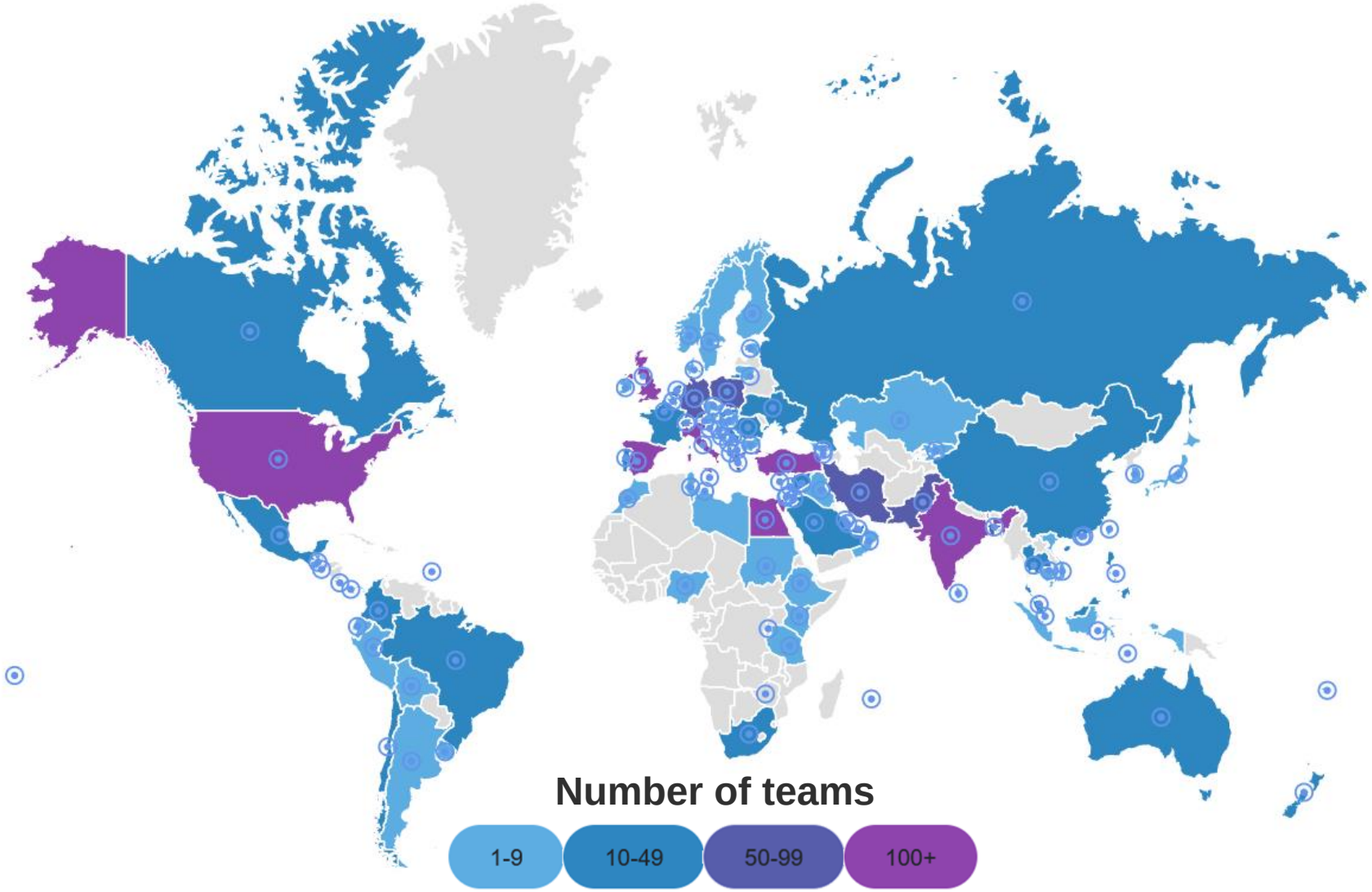
The 2024 edition marks the 10th anniversary of the competition!



Impact


Students
Proposals
Countries
3024
292
50
1126
119
28
1261
151
37
1481
180
43
1535
195
42
1310
178
49
1419
198
47
2044
289
57
2123
304
71
2536
379
68
3068
461
78
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024

Countries participating in BL4S since 2014



Winning teams

America:

Canada, Mexico, USA (x3)

Africa:

Egypt, South Africa

Asia:

India, Japan, Pakistan, Philippines

Europe:

Estonia, France, Germany, Great Brittain, Greece, Italy (x3), Netherlands (x3), Poland, Spain, Switzerland

Special support

will.i.am (2014)

The Script (2016)

Bastille (2016)

Special support (2023, 2024)

Testimonies

Main project challenges

Experiments: beam time (e.g. LS2), detectors (e.g. Delay Wire Chambers in bad condition)

Students: cultural differences among the winning teams (e.g. punctuality)

⇨ **Challenges result in authentic experience for the students**

Project future

BL4S 2024: Happy 10th anniversary!

participation certificates, 62 special prizes,
3 winning teams

Long-term: Increased engagement

- more **online events** ✓ (ongoing)
- improve **learning material** ~ (in progress)
- more teams to receive **additional prizes**
- more **advertisement**

Winning teams 2024

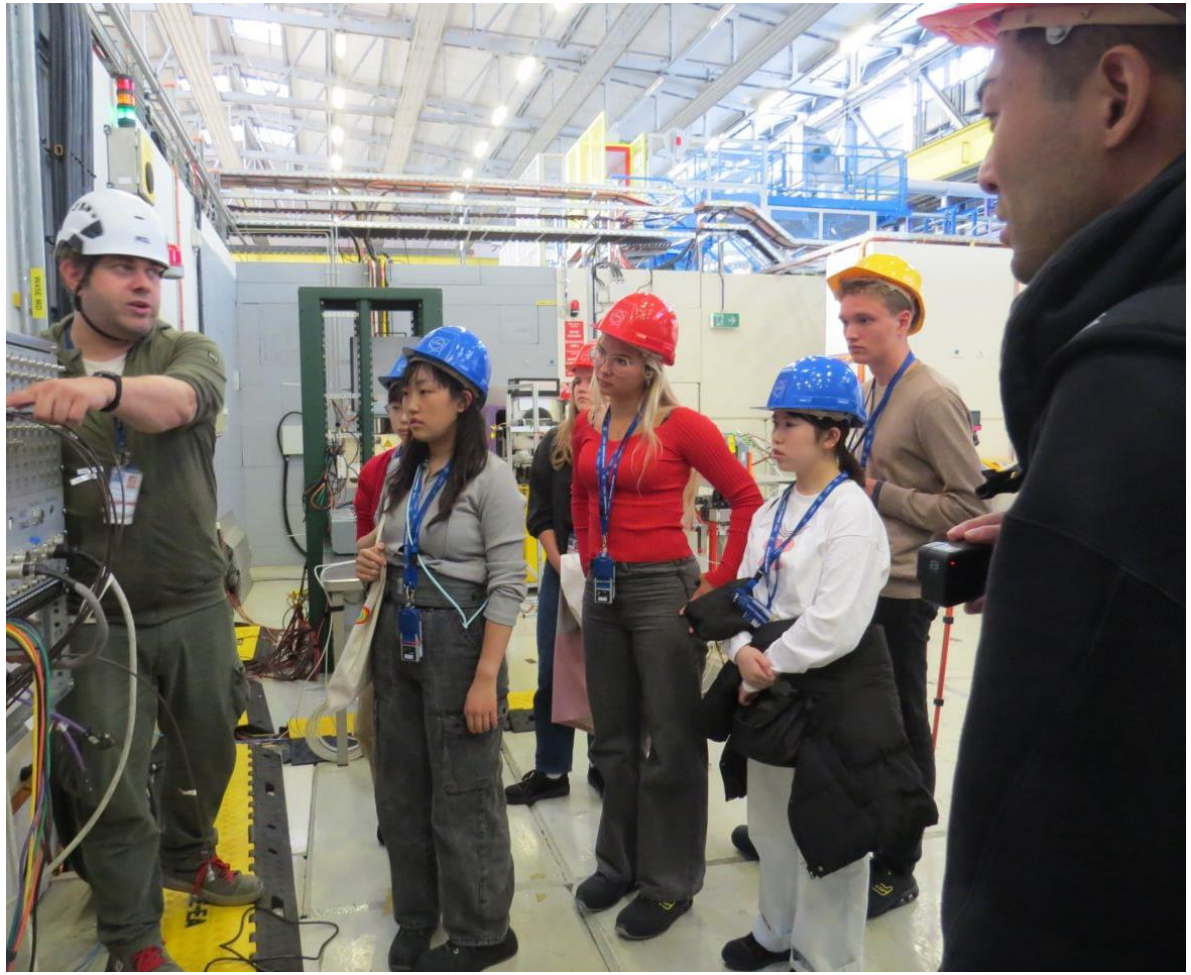
- **“Mavericks" from Estonia (CERN)** calibrate their homemade muon detector for high-altitude ballooning applications
- **“Sakura Particles" from Japan (CERN)** optimise their homemade two-dimensional muon detector for muon tomography applications
- **“SPEEDers" from the USA (DESY)** research Smith Purcell radiation as a tool for beam diagnostics

Winners of the 2024 CERN Beamline for Schools competition: Sakura Particles” from Japan (left), “Mavericks” from Estonia (top right) and “SPEEDers” from the USA (bottom right) “(Images: Sakura Particles, Mavericks, SPEEDers)

Some highlights

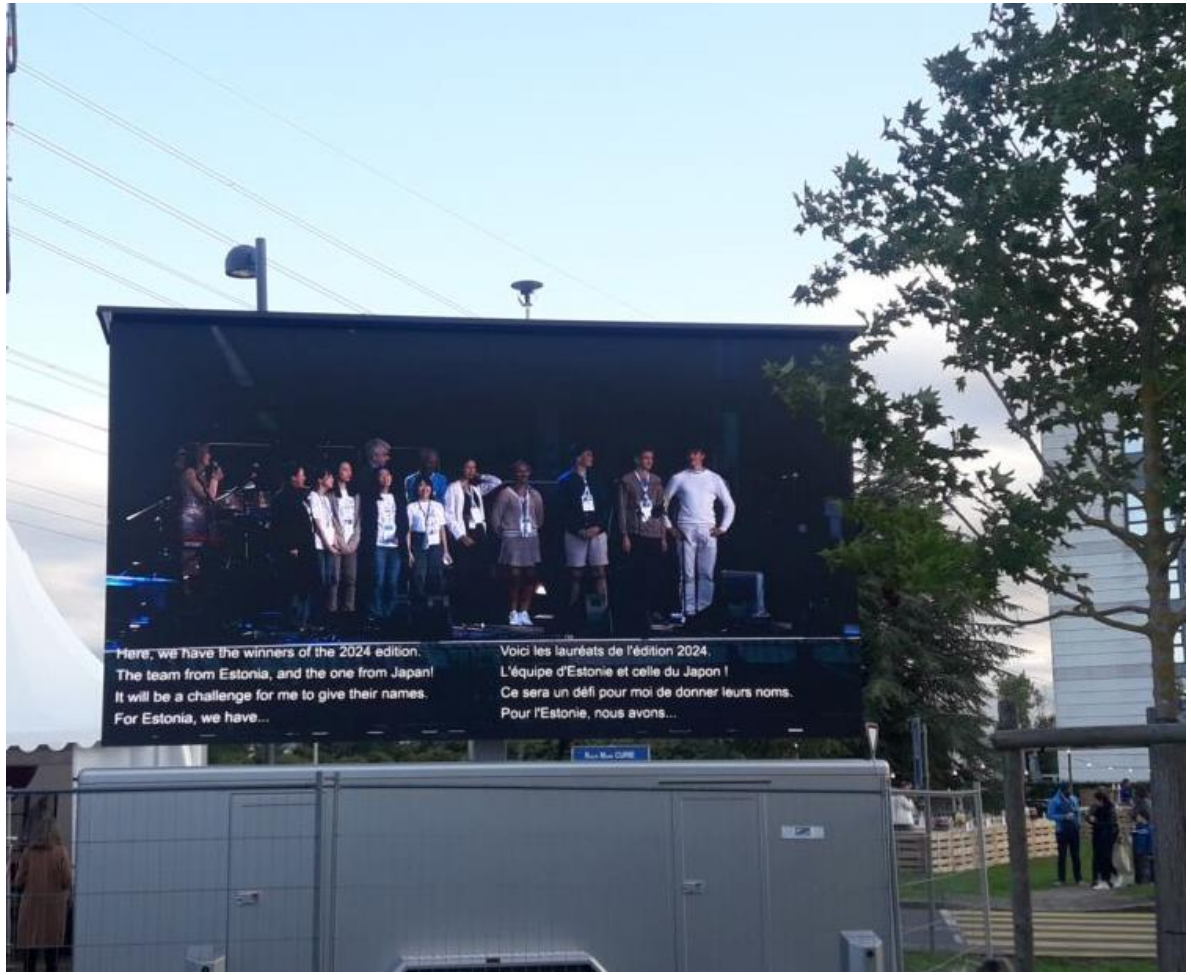
Some highlights

Some highlights



Some highlights

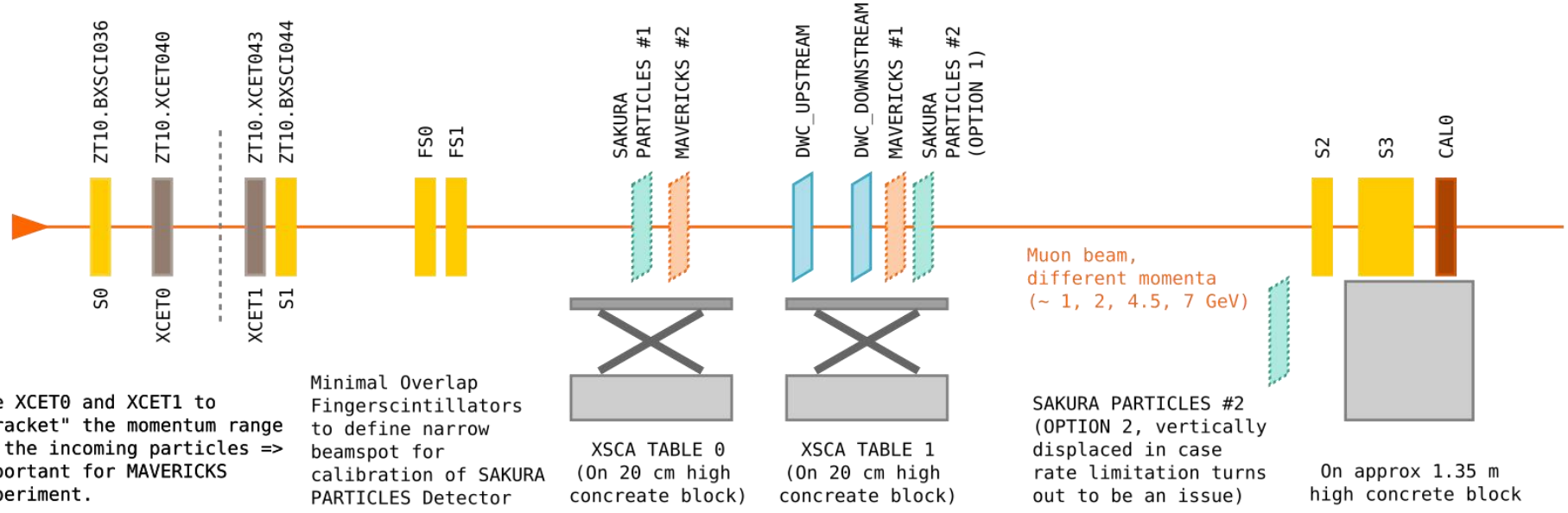
Some highlights

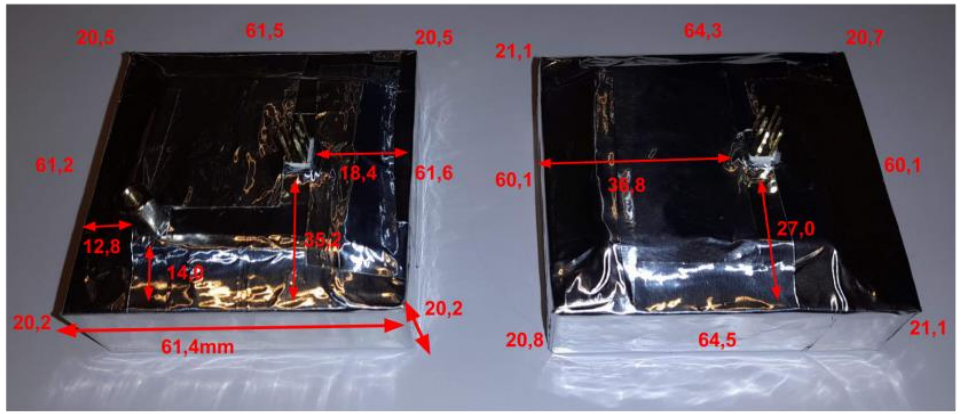


Some highlights

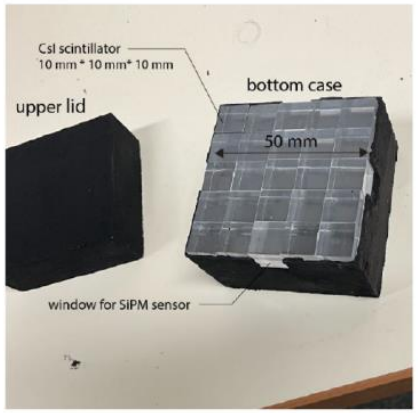
Some highlights

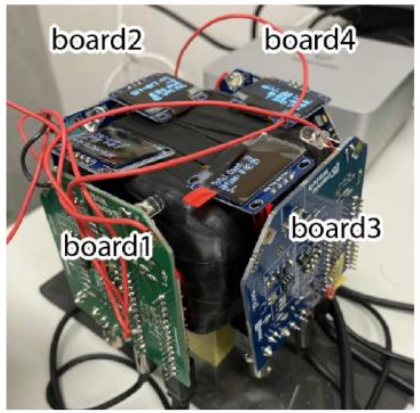
Setup





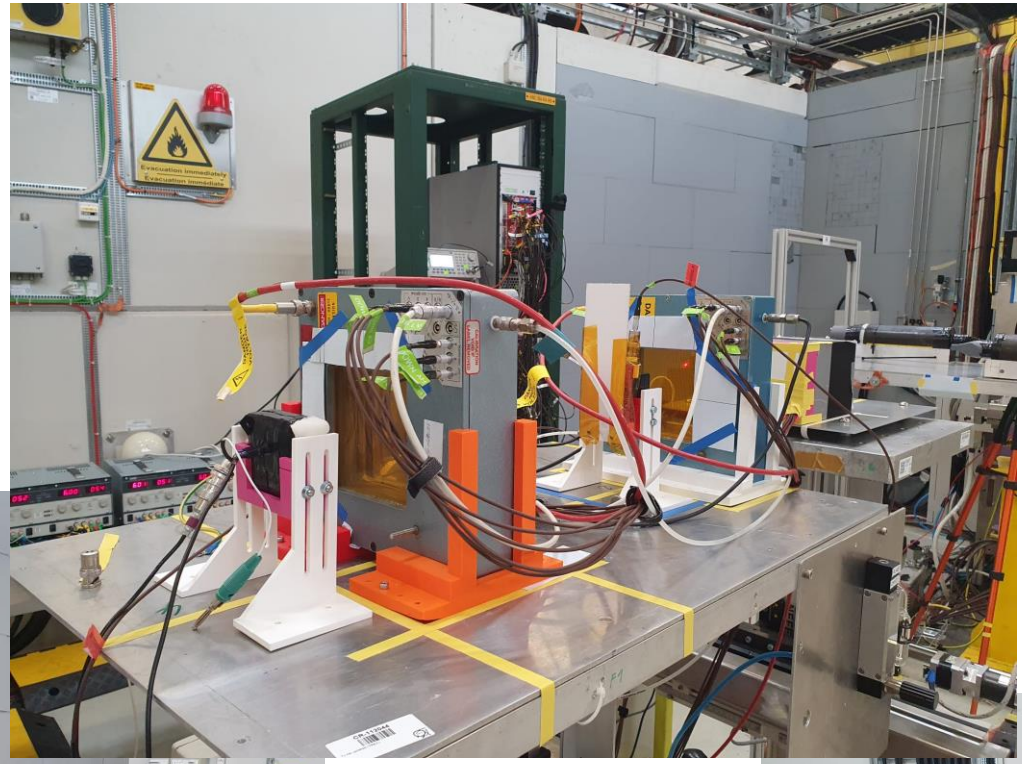
MAVERICKS detectors #1 and #2: Scintillator blocks + SiPM, with attached frontend electronics board based upon the CosmicWatch Design v1.x. Measures in mm

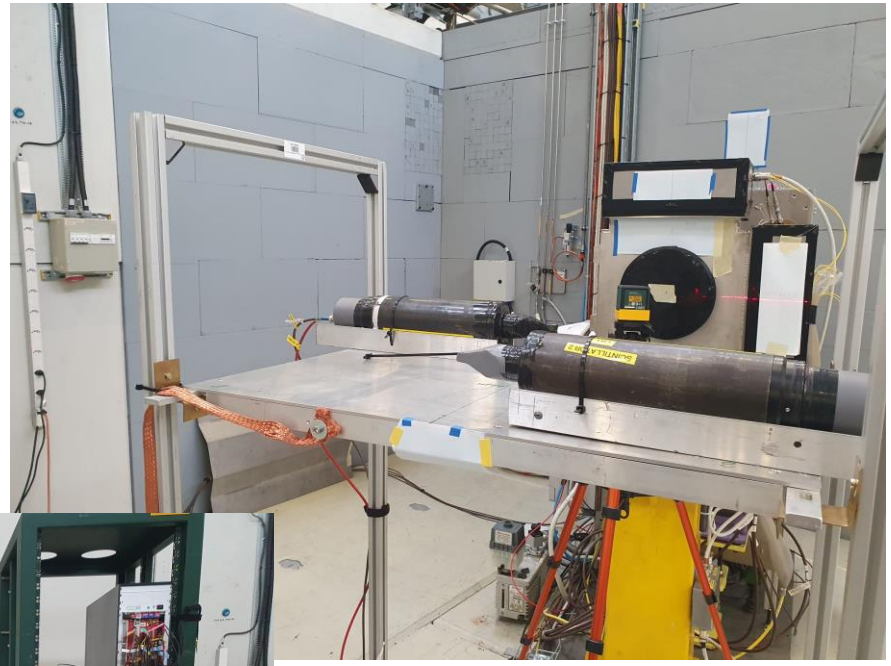


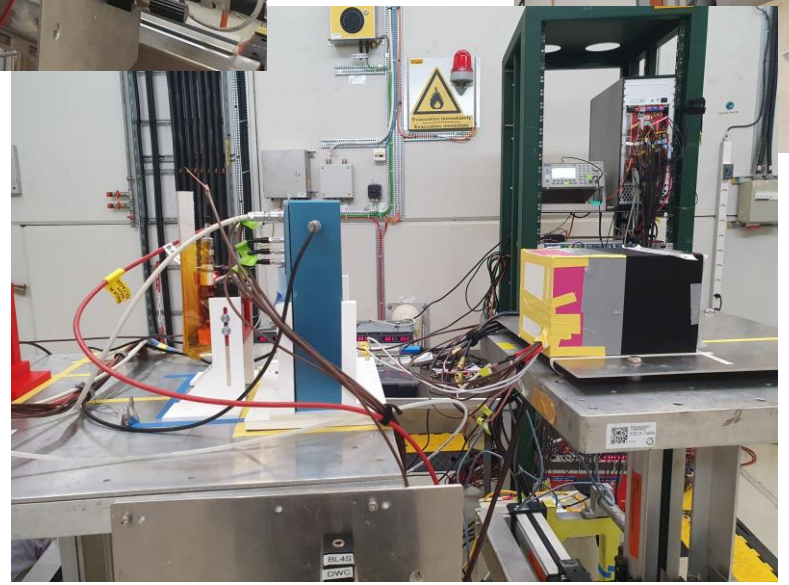


Original version of the SAKURA PARTICLES detector, also based on CosmicWatch v1.x design (most recent iteration uses custom Data Acquistion based upon RedPitaya SOC)

Setup



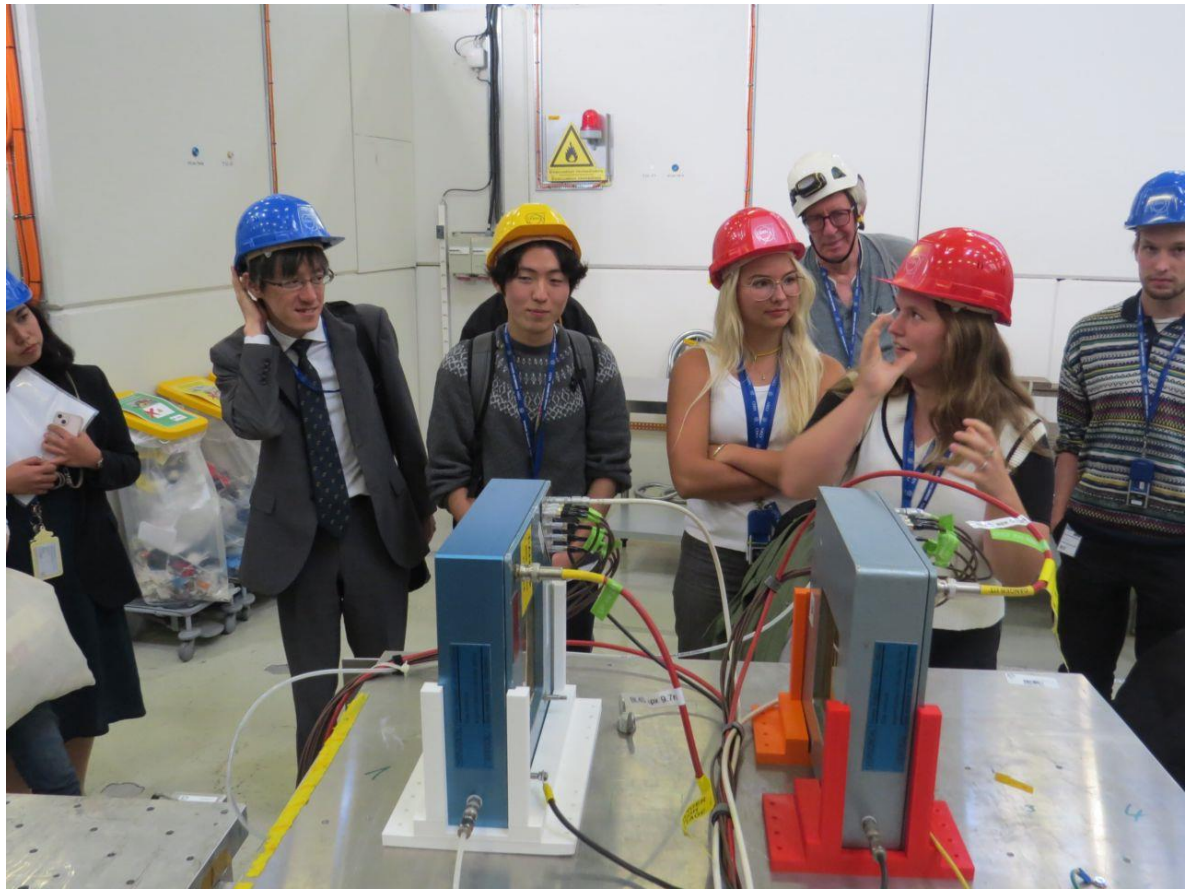




Visit of the experimental ares

SAFETY REQUIREMENTS: closed, flat shoes; above 16 years old; not pregnant; no Active Implantable Medical Devices (AIMD)

We will provide you with safety helmets to be worn during the visit.



Thank you so much for your support!

Questions?

Who can participate in BL4S?

- **Teams:** min. 5, max. 9 people
- Enrolled in **high-school** or gap between school and university
- Each team has to be led by an adult “**team coach**” (max. 2 per team)

Experiment proposal

Submission deadline:

April 10, 2024

You are not alone!

Get in touch with your national contacts or directly with us (see website)

Experiment proposal

Written proposal (~1000 words)

- Motivation (~ 100 words)
- Proposed experiment (~800 words)
- What you hope to take away from this experience (~100 words)

Video proposal

(~1 min, 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
- Following a scientific method

Proposal extension

Would you like to win an outreach prize (i.e. a telescope)?

Describe a **science education or outreach activity** that the members of your team have already organised or will organise in their community (up to 200 words; in addition to the 1000 words limit of your BL4S experiment proposal).

Target audience: a part of your community usually less exposed to science

Online events

Home » Outreach » Educational Outreach » Student Programmes » Beamline for Schools » Beamline for Schools 2024

Beamline for Schools 2024

Enter your search term

Create event

March 2024

- 19 Mar Beamline for Schools | Introduction and visit to engineering labs at CERN
- 14 Mar Beamline for Schools | Q&A session

February 2024

- 23 Feb Beamline for Schools | Interactive introduction to DESY

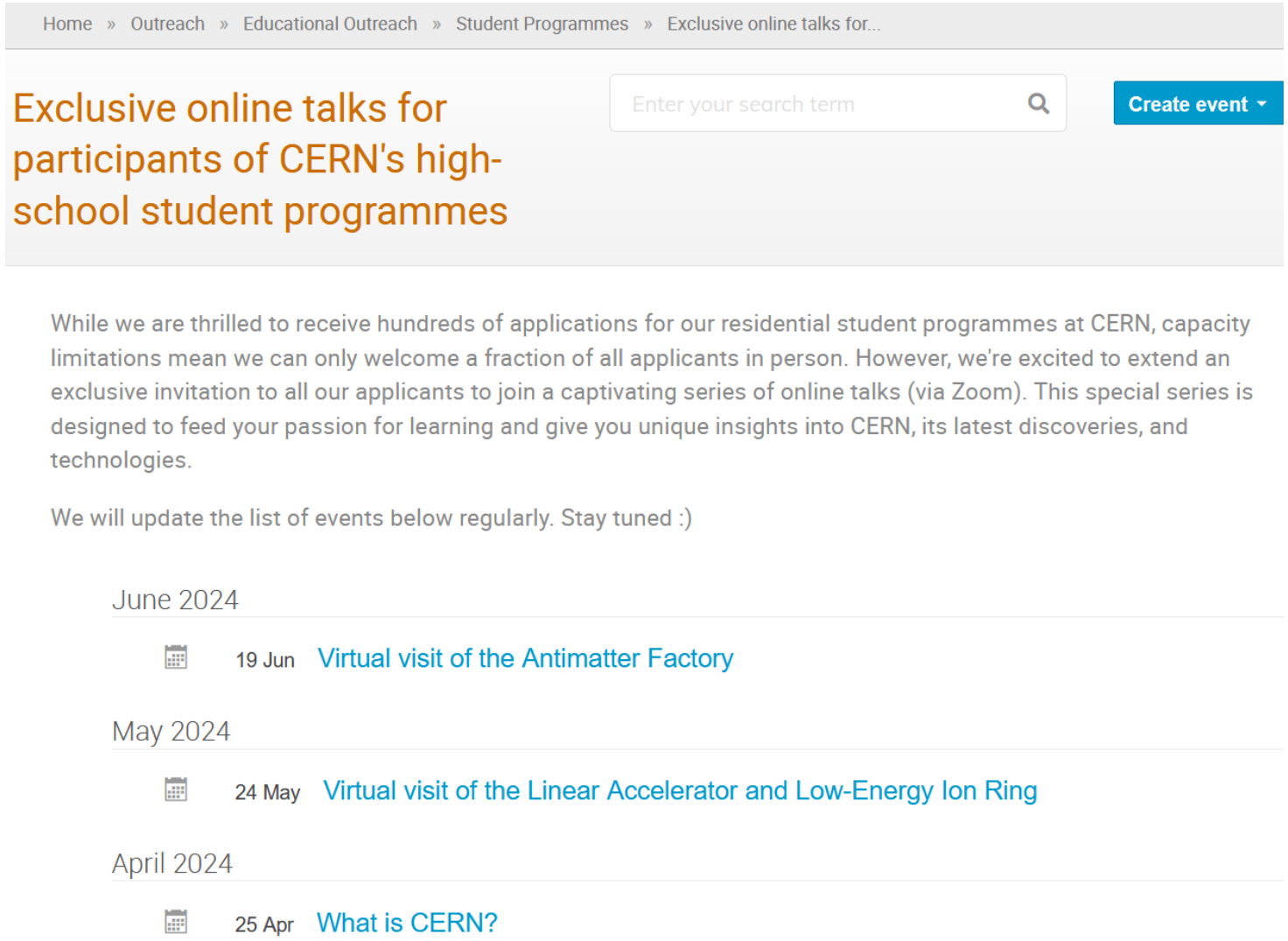
January 2024

- 26 Jan Beamline for Schools | Virtual visit to the ATLAS detector

December 2023

- 05 Dec Introduction to Beamline for Schools (incl. Q&A)
- 01 Dec Beamline for Schools | Interactive introduction to CERN

Online events



Preparing your experiment proposal

What is a beam and a beamline?

In particle physics, the term **'beam'** refers to a large number of particles moving in the same direction. These particles can be accelerated to high energies.

The term **'beamline'** commonly refers to a straight section of a particle accelerator leading the particles to an experimental area.

A beamline

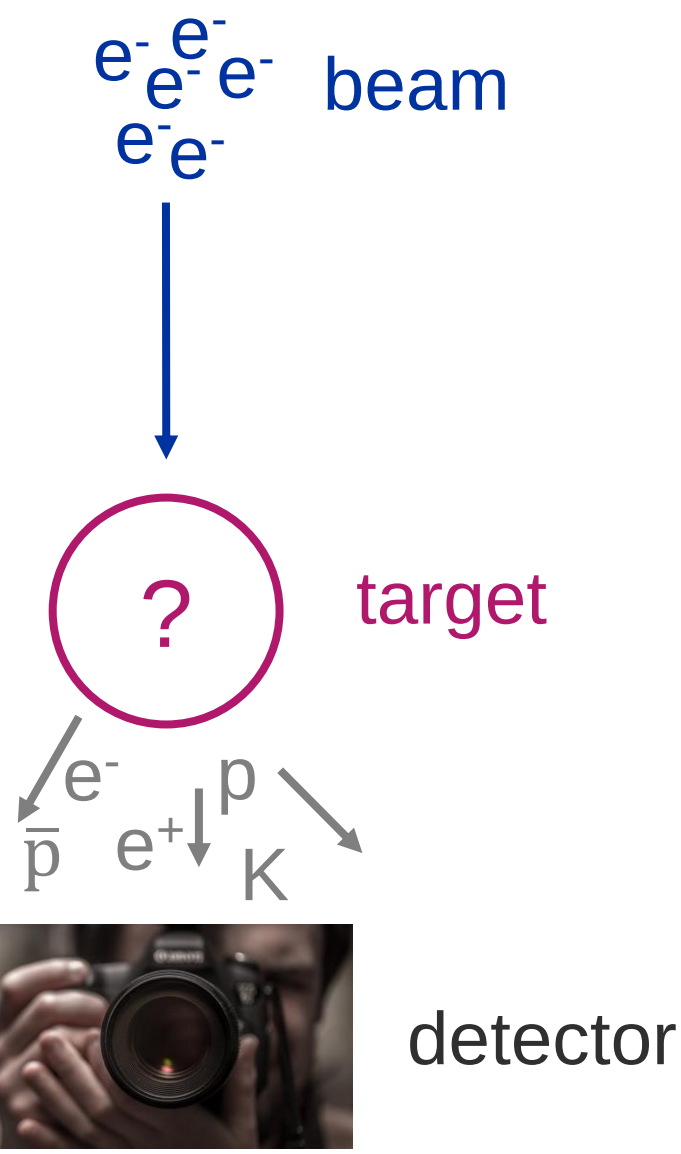
… is a straight section of a particle accelerator leading the particles to an experimental area.

This experimental area might look empty ⇨ You can fill it with your experiments! :)

Experiment requirements

The proposed experiment must be designed in a fixed target configuration.

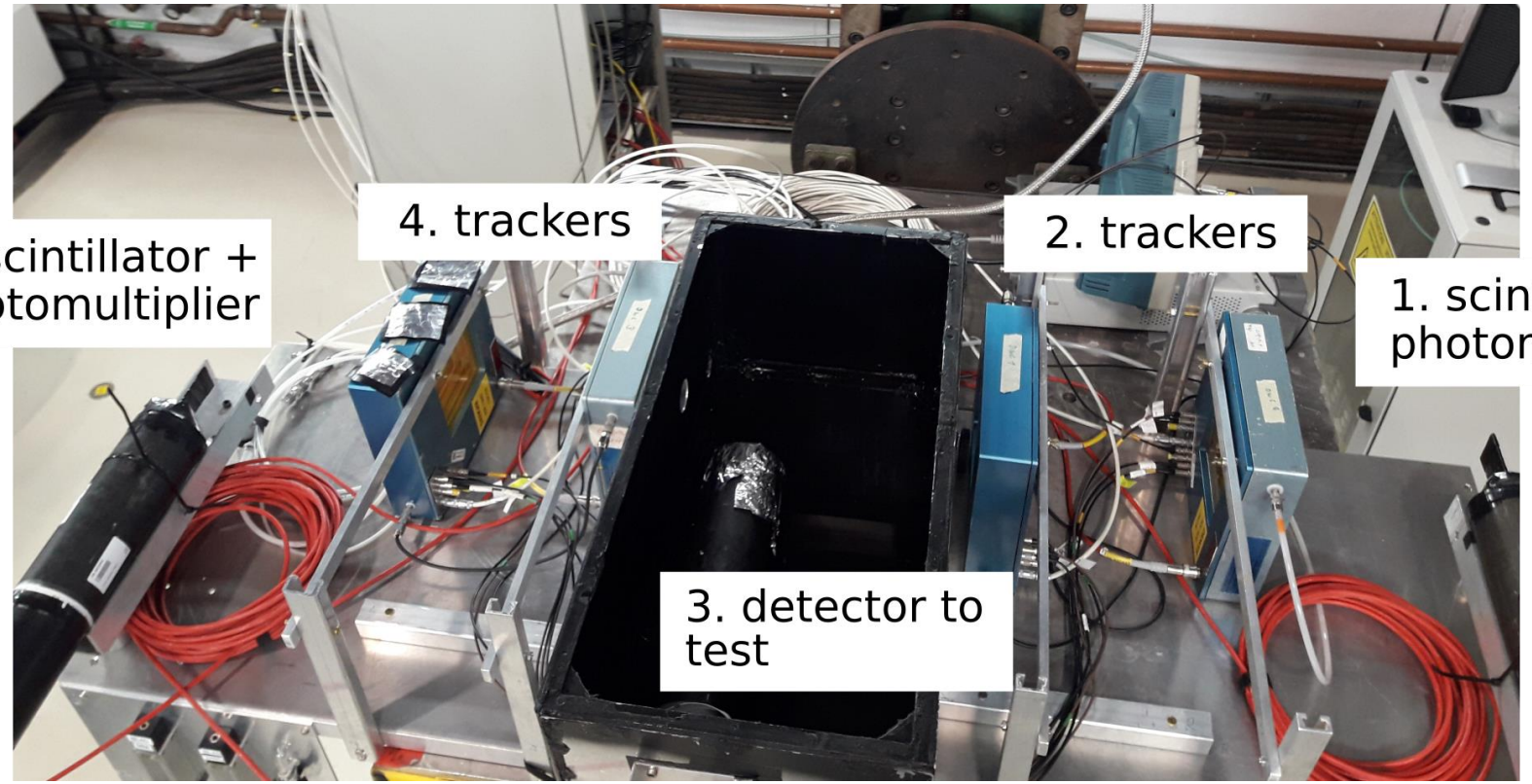
- **Fixed target configuration:** beam crossing or passing close to a target (solid, liquid, gas)
- **Experiment design:** beam, target, detectors, and trigger/readout



(new) particles moving in many different directions

Note that we cannot perform collider-type experiments in BL4S

An experimental setup



Winning teams

Number of	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	TOTAL
Students	3024	1126	1261	1481	1535	1310	1419	2044	2123	2536		17,709
Countries	50	28	37	43	42	49	47	57	71	68		
Female					519	429	537	781	862	706		
Male					1016	881	879	1263	1261	1136		
Other										694		
Proposals	292	119	151	180	195	178	198	289	304	379		2293
Winning teams	2	2	2	2	2	2	2	2	3	3		22
Countries of winners	Greece& Netherlands	Italy& South Africa	Poland& UK	Italy& Canada	Philipinnes&India	Netherlands&USA (DESY)	German& Switzerland (DESY)	Italy& Mexico (DESY)	Spain& Egyp&France	Pakistan & USA&Netherlands		