CERN & Society Foundation

Beamline for Schools Competition 2019

Evaluation Report

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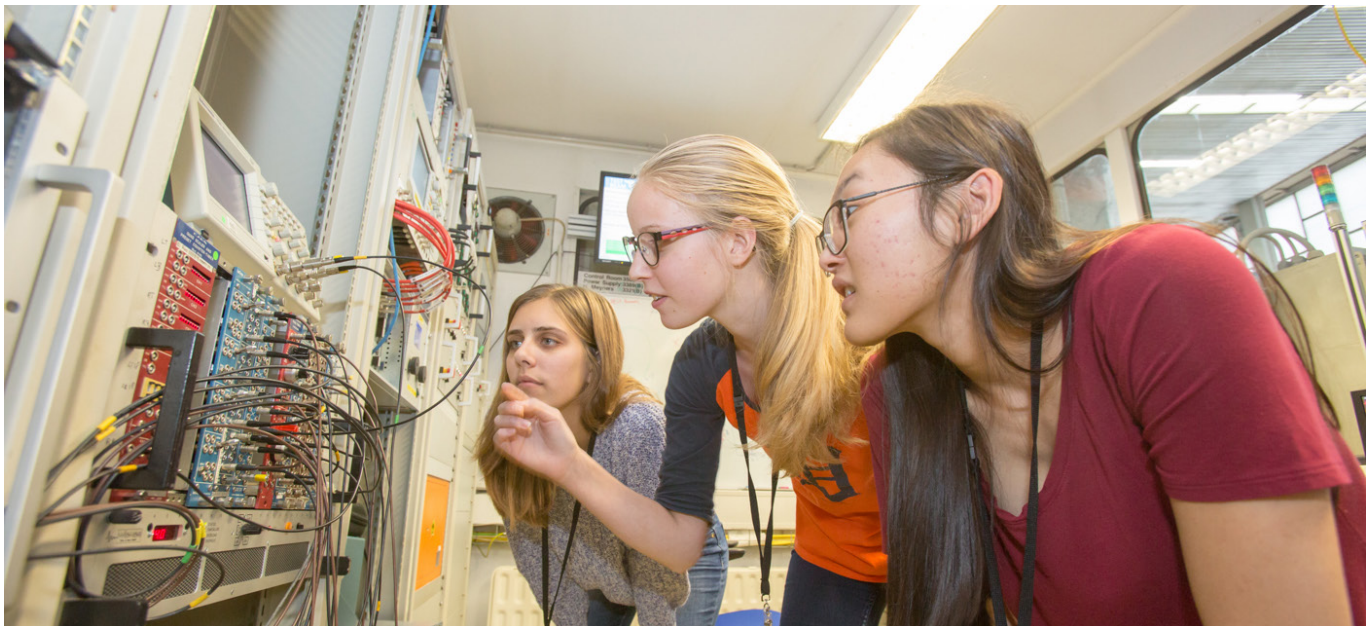
CERN Beamline for Schools Competition (BL4S) 2019

Evaluation report



_the competition

2019 marked the beginning of a new era for the Competition. Due to the second Long Shutdown of CERN's accelerators for maintenance and upgrades, there is currently no beam at CERN, which has opened up opportunities to explore partnerships with other laboratories, namely DESY.

This year, students from all over the world submitted their full proposals by the end of March 2019. **178 high school teams** from **49 countries** worldwide participated with a full experimental proposal and a short video, representing **1311 students** (approximately 33% female) from all over the world (23 applications were received from Turkey, 18 from India, 15 from Iran, 10 from the United Kingdom, 8 from the United States etc.)

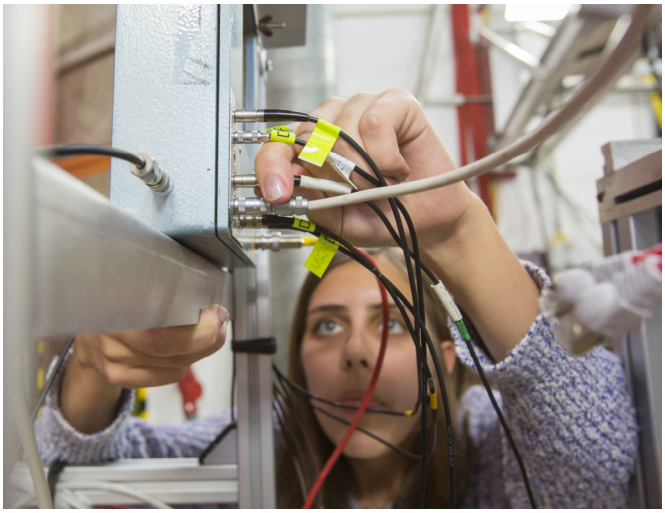
Seven countries were participating in the Competition for the first time this year (Albania, Ecuador, Fiji, Reunion, Sudan, Syria and Uruguay) which indicates that the Competition continues to generate interest worldwide and can inspire many more students to delve into STEM subjects in the future.

The 2019 winning teams were announced in June 2019. The team 'Particle Peers' came from the Praedinius Gymnasium in Groningen, the Netherlands, and the team 'DESY Chain' came from the West High School in Salt Lake City USA. A total of 15 students were invited to the DESY research centre in Hamburg, Germany in October 2019 to carry out their proposed experiments together with scientists from CERN and DESY.

_objectives

Feeding curious young minds, bringing science to the next generation and nurturing the scientists and engineers of tomorrow are the main goals of the Competition. The Competition addresses the need for a stronger educational focus on scientific subjects, and wants to attract more young people to STEM subjects and subsequent careers.

The project aims at inspiring and engaging high-school students with scientific education in a creative and hands-on way through a scientific competition. The students work in teams to develop and submit a scientific proposal for an experiment they could run at CERN, using specialised equipment and infrastructure. Every year, two winning teams of up to 10 students each are selected, as well as their teacher. The winning teams are then invited to CERN to conduct their experiment onsite, at one of the largest scientific laboratories in the world.



_ impact

Beamline for Schools targets high-school students aged 16-19 and teachers who are involved in the process of proposing (and possibly conducting) a science experiment at CERN. In 2019, two teams of 15 students and 3 teachers in total were chosen amongst 178 teams from all over the world. They came to DESY for 10 days and received training on experimental design and project management, gaining hands-on experience in particle physics under the constant guidance of dedicated CERN & DESY scientists.

CERN & DESY experts also shortlisted 20 teams, 10 of which received a special mention, who will receive secondary prizes for their motivation and quality of work (i.e. t-shirts and the choice between a detector of cosmic rays for their school - Cosmic Pi- and a package of CERN souvenirs). This will allow their schools to engage more students with science in the future.

Furthermore, the Competition also benefited hundreds of students who studied in teams for the experimental set up and elaborated full experimental proposals (1,311 students worldwide submitted a full proposal). This can also have a 'multiplier effect' as students and teachers will share the experience and knowledge with their fellow students or future classes respectively, ideally motivating new talents into science-related studies and careers.

Overall, the project's success goes beyond the actual Competition and is further reflected in the winners' scientific work following their experience at CERN. So far, three teams have published a scientific paper and an article about the experiments they conducted in Physics Education, the international journal of the Institute of Physics (IOP).

Finally, the Competition attracted considerable media attention, complementary to the project team's communication efforts. The Competition's international reach serves to convey the message of the importance of science education for young people to a large public.

_external resonance

The news of the winning teams attracted media attention and the attention of policy makers, which plays an essential role in raising awareness of the Competition and of CERN's efforts in scientific education for young people. It also demonstrates to the public how important it is for students to approach science in a creative, hands on way that can inspire the future generation of scientists. The news about the winners were diffused by national and international media (e.g. ABC, DESY, University of Groningen, University of Utah). The Consul General of the U.S. Consulate General in Hamburg, a delegation from the Dutch Embassy in the Department for Innovation, Technology and Science as well as the Mayor of the town of Groningen also visited the students at DESY and discussed with them about their experience and their experiments.

One of last year's 2018 winning students from India, Satchit Chatterji, is now studying artificial intelligence at the University of Groningen, Netherlands – just where one of the winning 2019 teams is located. They got in touch and soon after, Satchit gave the team a course in python and is now currently helping them with any physics-related programming questions.

"It's quite surreal to know that I would have never had met these new friends if not for this competition", said Satchit. "*Also, because we did our BL4S project in C/C++, it has helped me immensely in University, where there is a very intensive programming course in C. I think I owe that to you and the rest of the BL4S team for incentivising me to practice something that I now love and enjoy - and now I just try to spread that joy of learning.*"

_budget

This year, the project was made possible thanks to contributions from four supporters, including Amgen Switzerland SA., and CERN's and DESY's core support in terms of facilities and personnel time.

The support granted by Amgen Switzerland SA. of CHF 15'000 was used to fund part of the cost for the dedicated scientific support necessary for setting up the experiment (e.g. procure equipment, obtain safety clearance, arrange beam time), supervising and training the winning teams on project management and experimental design before, during and after the one-week experiment.

Since its first edition in 2014, the project has been welcomed with great enthusiasm from the main target groups, students and teachers, worldwide.

For monitoring and evaluation purposes, in 2019, we organised a focus group with the winning teams and conducted a post-competition survey to understand how the Competition is perceived by those mostly involved. Both winning teams were very satisfied with the CERN & DESY personnel and the equipment provided. They felt this was a very constructive experience in terms of skills acquired, and gaining a greater understanding of scientific concepts and teambuilding.

Sophie, student: '*Before I participated in the Competition, I didn't even consider the idea of studying physics in college. After this experience, it's near the top of my list!*'

Ariana, student: '*The overall style of learning is very different. At our school we do a lab to define an answer we already know, but here our opportunities and equipment are much more 'scientific' – we can come across entirely new things which we never thought of'.*

Teacher: *'The students have become noticeably more confident and competent in their interactions with the mentors in both formal presentations and the daily work'*

_the future of BL4S

The 2020 Competition will be open for proposal submissions in November 2019. The teams are requested to submit a full 1,000-word proposal and a 1-minute video (both in English only) by March 31st, 2020. CERN will announce the shortlisted teams and the final winners in June 2020.

For the 2020 Competition, two winning teams will once again be hosted at DESY, in Hamburg. Thanks to the popularity of the Competition and interest from other laboratories in hosting the finals, the Laboratori Nazionali di Frascati (LNF), near Rome in Italy, have expressed their interest to host a third winning team for their experiment. Hosting the Competition's finals in 2020 at both DESY and the LFN will help to sustain and even increase the reach of the Competition, as well as providing more motivation to the many participants from across the world by increasing the number of finalist teams.

The projected budget for 2020 is at the level of CHF 220'000, slightly higher than the 2019 project budget. This is mainly due to an increase in the estimated budget related to student costs, which, according to our experience so far, are highly dependent on the students' countries of origin.

The 2020 budget also takes into account the addition of a third winning team which will be hosted at the LFN.

As it is very important to ensure high-quality scientific support for the participants, 40% of the project budget (CHF 85'000) will be used to cover the cost for dedicated scientific coaching before, during and after the experimental week. The student allowances are estimated also at approximately 40% of the budget (CHF 87'500). This includes additional prizes for the shortlisted teams as an extra incentive to boost participation. The remaining 20% (CHF 48'000) will cover the budgeted cost for materials, including electronics, computing, mechanics, and infrastructure modifications necessary for the experimental set up - also highly dependent on the winning experiments' needs.

We have managed to secure so far approximately 50% of the projected 2020 budget, while additional applications to donors are still pending. A grant of CHF 82'000 from the Wilhelm and Else Heraeus Foundation has already been secured for the 2020 Competition, as has a grant of CHF 20'000 from the Arconic Foundation.

For 2020 and since the Competition will again take place at DESY, Germany, and the LFN in Italy, both institutes will provide additional administrative and scientific support.
Finally, CERN's core contribution will be in the form of CERN scientists' time for project management, technical coordination and administrative support in order to organise the Competition, review/evaluate the proposals and oversee the successful running of the winning experiments.