

Students recognised in particle physics

A group of seven young women, Year 13 students at Waiuku College, reached the shortlist for an international competition to run an experiment on a particle accelerator in Europe. This is an achievement about which their school is very proud. NZASE communicator Mike Stone explains.

Beamline competition

Beamline for Schools (BL4S) is an international competition for high school students to propose an experiment to run at CERN's T9 beamline. A beamline is a path of subatomic particles used for experiments, and is operated at a particle accelerator such as CERN's Proton-Synchrotron on the French-Swiss border or DESY in Germany.



The competition began in 2014 for CERN's 60th anniversary and since then over 14,000 students have participated. "Taking part in Beamline for Schools offers a unique opportunity to learn about particle physics and take the first steps

in scientific research," says Margherita Boselli, BL4S project manager.

This year 304 teams from 71 countries entered proposals to a committee of scientists from the two European accelerators. Of the two New Zealand teams, EM/H Kiwi from Waiuku College reached the shortlist of 25. The competition was won by teams from Egypt, France and Spain. The Waiuku team received a t-shirt, a kit to build a 'do-it-yourself particle detector', and a cloud chamber kit.

The team

Waiuku College is a medium-sized, semi-rural, co-ed high school, whose motto Titiro Teitei

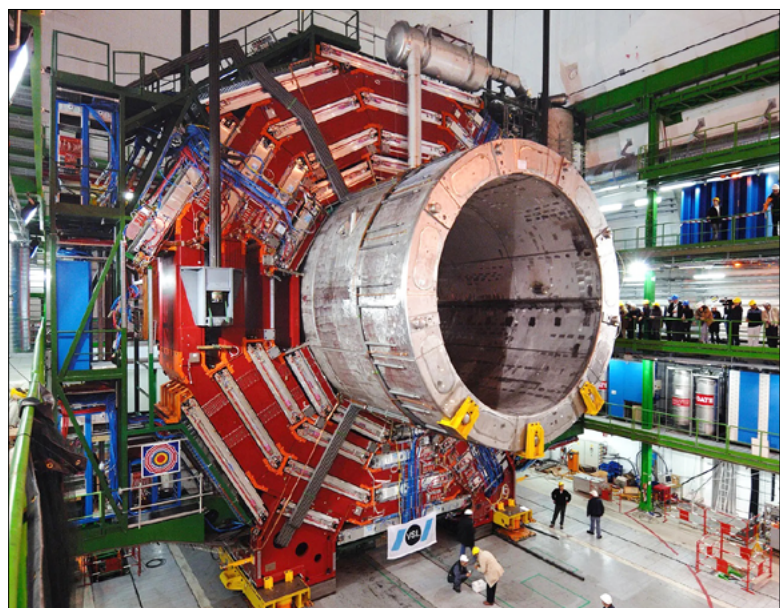
The Large Hadron Collider (LHC) near Geneva is the largest synchrotron-type accelerator in the world, with a 27 km circumference, run by the European Organization for Nuclear Research (CERN). The LHC boosts beams of particles, such as protons, to a speed close to that of light, where they collide with other protons travelling in the opposite direction, producing massive composite particles (hadrons).

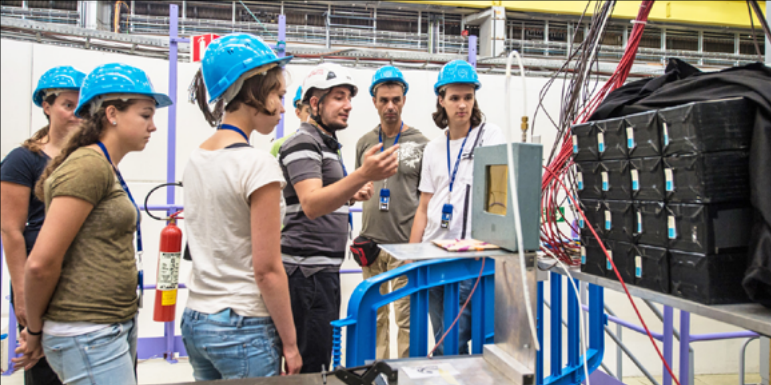
exhorts students to aim for their best in all they do. These students exemplified that in an international arena.

At the end of January, 2022, student My Anh Vu came across CERN in social media and in a [citizen science project on Zooniverse](#) about using the ATLAS detector at CERN. It piqued her interest, and when she found out about BL4S, My Anh wanted to enter. But she needed to be part of a team of at least six.

So she approached her chemistry teacher, HoF Colin North. Together they found six others who were excited to get involved. The team, EM/H Kiwi, was led by My Anh Vu and included Cherry Ang, Newrea Yong, Suhyun Kim, Cerys McFarlane, Kaitlyn Grinder and Abbey Carroll. The website indicates that an all-girls' team is

The 2007 arrival of the Compact Muon Solenoid magnet shows the scale of CERN's Large Hadron Collider. Photo: CERN.





Detector physicist Cenk Yidriz centre, centre, in white helmet, explains the setup of the first Beamline for Schools experiment at the T9 beamline in 2014. Photo: Guillaume Jeanerret, CERN.

unique among the competing teams.

The team had to learn about particle physics, decide what experiment they wanted to run, write a proposal, and make an explanatory video. While My Anh had the drive and was already somewhat ahead in understanding, they all needed to grasp what was involved so they could create the video. As many physicists do, they found it very helpful to draw images to explain the process.

Some of their chemistry and physics lessons helped the team learn about particle physics, but much of it they had to do on their own. They found texts, resources and videos online but had lots of questions. BL4S was only available to answer some, so Colin searched for a support scientist.

He asked physics professors and chemistry teachers he knew and eventually connected with Arkady Lokhovitskiy, who works at Canterbury University and is also a CERN scientist. He answered questions and referred students to appropriate journal articles and resources to help them learn more about particle physics and the experimental area at the Proton-Synchrotron.

Other scientists also helped: CERN physicists Margherita Boselli and Sven Menke introduced the students to GEANT4 as a way of simulating high-energy particle showers, and engineer Markus Joos provided technical details of the T9 beamline equipment.

The proposal

My Anh suggested that they propose an experiment comparing the particle showers initiated by electrons and charged pions as they interact with material. She made [GEANT4 simulations](#) to visualise the trajectories of shower particles in homogenous and sampling calorimeters, and tried to figure out a way to approximate the energy deposited by a seemingly chaotic π -shower using a rough mathe-

matical model. She tried 32 simulations.

The team began working on this proposal early in term 1, in lunchtimes and free periods. The deadline for uploading the written proposal and video was midnight on April 15, Easter weekend. They were very thankful that Aotearoa NZ was 11 hours behind as that gave them a little extra time.

Impacts

The team is proud of their efforts and learned a lot from the process. Kaitlyn enjoyed the in-depth learning that is not taught in class. Abbey found even the semi-understanding of science at this level helped them in NCEA. Newrea and Cherry were surprised at the range of physics they covered in what might be seen as a narrow field.

My Anh said Biology was her only science subject in Year 12, “and I was terrible in Year 10 and 11”, but she is now much more interested in scientific and mathematical research. Her passion is obvious as she describes the detail of the physics she learnt and holds up a book she found useful, Roger Penrose’s *Road to Reality*, a real doorstopper!

Reaching this level has sparked a passion for science and a confidence in the students’ ability to find things out and accomplish a difficult goal, which will stand them in good stead.

Resources

CERN, June 2022, [BL4S winners](#).

CERN, 2022, [Beams and detectors](#), Beamline information for schools.

EM/H Kiwi 2022, [BL4S video proposal](#).

Ngā Kupu

Iraoho – Proton

Korakora hihiko – Charged particle

Mātai ahupūngao – Physics

Matūriki – Subatomic particle

Rangahau – Research

Whaihanga – Simulate, simulation

Whakatere (~a ~nga) – Accelerate.

Te Aka Maori Dictionary
and Paekupu



NZASE

New Zealand Association of Science Educators

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