I.FAST

Innovation Fostering in Accelerator Science and Technology

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DELIVERABLE REPORT

Challenge Based Innovation Scheme

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ABSTRACT

Task 2.3 is the organization of a challenge for University students and young professionals called the “I.FAST Challenge Based Innovation” (I.FAST CBI).

The first edition of the I.FAST CBI was held for the first time form July 26th to August 4th 2022 at the Europeean Scientific Institute in Archamps (France) and the second edition will be held from July 25th to August 3rd 2023. We present the organisation of the 2022 I.FAST CBI and the preliminary organisation of the 2023 I.FAST CBI.

For more information on IFAST, its partners and contributors please see https://ifast-project.eu/

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Based on the jury comments and the students feedback, we can consider that the first edition was a success.

1 Introduction

Sometimes taking a fresh look at an issue can help find new solutions. This is the idea underlying a Challenge Based Innovation (CBI) event called the I.FAST CBI which is task 2.3 of the I.FAST project.

The I.FAST CBI (hereafter called the challenge) stems from the historic collaboration between the European Scientific Institute (ESI - https://www.esi-archamps.eu/), CERN and others partners to run the Joint Universities Accelerator School. This new collaboration has been inspired by the success of CERN's IdeaSquare CBI program (https://www.cbi-course.com/) but with a much shorter duration. For this challenge, 24 students from different countries spend ten days together mostly at the ESI exploring ways in which accelerators and related technologies could be used to meet a societal challenge related to one of the Horizon Europe missions. The choice for the 2022 and 2023 challenges is "Accelerators for the environment". These students will form strongly multidisciplinary teams with students different academic fields such as communication, environmental studies and, of course, physics and engineering. Working together they will develop an innovative way to address the challenge using accelerators. At the end of their stay, they spend a day at CERN and present their work in front of a jury.

2 The I.FAST CBI

The challenge takes place during 10 days at the European Scientific Institute[1] in Archamps (France) near Geneva. Selected students and young professionals are invited for an all expenses paid stay at the institute. They form 4 teams of 6 people and each team has to suggest an innovation using accelerator technology.

The topic of the challenge is inspired from the Horizon Europe Missions[2] and has been selected by a panel of experts working on accelerators and their applications. For 2022 the topic was ``Accelerators for the environment'' and given the success of the 2022 edition it was decided to keep the same topic for 2023.

At the end of the 10 days, the teams write a short report on the innovation they suggest and make a presentation in front of a jury. In preparing the challenge we received help from the organisers of related events on different topics [3,4].

More details on the I.FAST 2022 can be found in [5]. Two articles have been published in the ``Accelerating News'' newsletter [6,7] and one was published in CORDIS [8].

3 Program of the I.FAST CBI 2022

To educate the participants about accelerator technology, seminars by accelerator experts are organised both before the challenge as online seminars and in person during the challenge.

The seminar program of the 2022 edition was given in [5]. For 2023 the program will be almost the same.

The participants also had the opportunity to visit several accelerators at CERN (ELENA, Linac 4, CLEAR, the Synchro-Cyclotron and CLOUD). For most of them it was the first time they saw a particle accelerator (figure 1).

Figure 1: Participants of the I.FAST CBI visiting particle accelerators at CERN. Left: LEAR, Right: ELENA.

Alike the accelerator community, it was felt important to create a collaborative spirit between the teams. To achieve this, two special days called “conferences” where dedicated to cross-pitching across teams.

During the first “conference” each participant was asked to present his/her perspective on the challenge based on his/her academic studies. At the end of the day, each team presented briefly the ideas on which they were working (see figure 2).

Figure 2: Participants present their perspective on accelerators for the environment during the first "conference". Left: an engineering student presenting RF issues, Right: a law student talking about occupational safety.

This was an opportunity to ensure that the teams were working on different ideas and to exchange though on these ideas.

The second "conference" was dedicated to longer presentation by each team during which they presented in details the project they were working on from the perspective of each team member. The other teams were invited to give ideas and advices.

4 Diversity and participants selections

During such events diversity is key to ensure fruitful exchanges of ideas. To achieve this goal the committee in charge of participants selection paid careful attention to different aspects of diversity: diversity in academic fields and diversity in countries of origin and diversity in gender.

Regarding academic diversity, in 2022, each team comprised an ``accelerator expert" (i.e. a student who had attended an advanced training about accelerators), a physicist, an engineer, an environmental scientist, a lawyer and a business student or a communication student). At the time, the classification of students was done by the selection committee.

For the 2023 challenge we asked candidates to choose the academic field closest from their area of expertise in a list (physicists, engineers, environmental scientists, other scientific fields, lawyers or communication/marketing). In addition candidates were asked if they had attended an advanced training in accelerators to help the selection panel fill the ``accelerator expert" category. This last question seem to have been misunderstood as many students tried to justify their expertise with accelerators even when they had almost none.

The teams for the 2023 challenge will comprise two accelerator experts (one with a more physics oriented profile and one with a more engineering oriented profile), one physicist, one engineer, one environmental scientist and one communication expert or a sociologist. This change in teams composition arose from the limited number of applications from lawyers and the very good field of applications from accelerator scientists.

Both in 2022 and 2023, the call for applications was circulated in December with a deadline in February. The poster of the 2023 edition is shown on figure 3.

Figure 3: Poster of the 2023 I.FAST CBI.

The number of applications received versus the number of days before the deadline did not follow the same trajectory in 2022 and 2023 (see figure 4): in 2022 it was more or less linear until two days before the deadline during which we received 29 applications. We had then decided to extend the deadline by two weeks and had then received an extra 67 applications. In 2023 the number of applications received was more exponential with a steady growth and a peak of 47 applications during the last two days. In 2023 we did not extend the deadline for scientists and engineers, only for lawyers and communication/marketing candidates. As we had a limited number of candidates in these two fields, we launched a social network campaign to try to attract more applications from these fields but this brought only one extra application which was finally not selected.

We have no explanation of the difference in trajectories for the application curves but one should remember that when during the application period in 2022 there were still many uncertainties related to the CoVid-19 pandemic.

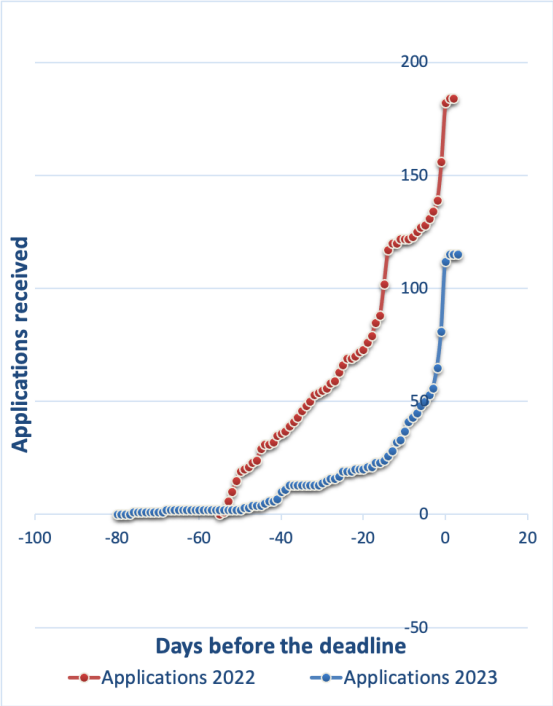

Figure 4: Number of applications received versus the number of days before the deadline.

The number of applications in each field for 2022 and 2023 are given in table 1. Both in 2022 and 2023 the fraction of applications coming from physics and engineering was about three quarters but whereas in 2022 it was evenly split between physics and engineering, in 2023 there were twice as many physicists than engineers.

Field	2022	2023
Physics	37%	54%
Engineering	39%	27%
Env. sciences	11%	7%
Other sciences	5%	7%
Business (*)	3%	-
Law	3%	1%
Marketing & communication	1%	4%
Other (*)	1%	-
(*) Not offered as choice in 2023.		

Table 1: Field of studies of the participants in 2022 and 2023.

The figures in table 1 highlight the fact the challenge is seen as very attractive for physicists and engineers but we have more difficulties reaching out to other fields.

Diversity of geographical origin (country of affiliation) is also important. In 2023 the applicants came from universities in 18 different countries in Europe and a few came from Asia and Africa. Also, 23% of the applicants were part of the Erasmus Mundus program. The selection process ensured that there were not more than 4 participants coming from the same country (one per team maximum).

Gender diversity is also good both among the applicants (47% male, 52% female and 1% non binary in 2023; 57% male, 40% female and 3% non binary in 2022) and the selected participants (13 males, 11 females in 2023; 12 males, 11 females and 1 non-binary in 2022).

5 Projects proposed during I.FAST CBI 2022

On the last day of the challenge the teams presented their work in front of a jury made of senior accelerator physicists and knowledge transfer expert. In 2022 the jury was chaired by Frederick Bordry, former head of Accelerator and Technology sector at CERN. The other jury members were Giovanni Anneli and Luisa Ulrichi from the CERN Knowledge Transfer group and Julien Levallois from University of Geneva.

Each team had 15 minutes to present their project followed by 15 minutes of questions by the jury.

The projects presented are briefly described below.

5.1 A.M.M.I.R.A : Accelerators for Marine Microplastics Investigation and Research Agency

This proposal was to fit a Compact Compton source on a boat from a research fleet. The boat would then sail to the oceanic gyres to study in situ the microplastics found in the ocean and their effect on the plankton and other small marine life.

5.2 DURABLADE - ACCELERATING THE GREEN TRANSITION

The idea behind this proposal was that the lifetime of wind turbine blades is limited by the hardness of the polymer there are made of.

They proposed to extend this lifetime by irradiating this polymer and thus making it harder.

5.3 PROJECT CYAN

This project arose from the fact that lakes are sometimes affected by algal blooms that kill all forms of life underwater. To stop these algal blooms it was suggested to mount a small electron accelerator on a boat and irradiate the surface of the lake to kill all the algae.

5.4 SOIL SAVIOUR 2.0

In a similar spirit but on land, this project suggested to treat some polluted grounds by excavating the soil and irradiating it to destroy the toxic products that it contains. To perform such operation in situ a truck would be fitted with a small electron linac and driven where the treatment was needed.

5.5 WINNER

The jury was impressed by the quality of the projects:

“I was impressed by the skills and passion shown by the four teams. Such events are a great opportunity for students to learn more about accelerator science and to work on concrete challenges. Their different backgrounds allowed them to think about projects from distinct perspectives – from the scientific and technical to the economic and legal – the way it’s done in actual organizations,” said Frédérick Bordry.

The winning proposal was project CYAN.

5.6 PARTICIPANTS FEEDBACK

The European Scientific Institute has a strong experience in running school and asking student for feedback. At the end of the I.FAST CBI 2022 a feedback survey was given to all participants. Below are the average mark given by the participants in that survey:

- How do you rate your overall experience at I.FAST CBI? 9,4/10
- Did the challenge fulfil your expectations? 9,4/10
- How did you find the timetable in terms of volume of hours, number and length of sessions, balance between lectures and group work, etc.? 7,6/10
- How did you find the programme content in terms of balance between topics? 7,3/10
- 6) Was the speakers' expertise sufficiently diverse to help you build your project? 7,6/10

6 Outlook

The I.FAST CBI 2022 was a great opportunity to engage with students and young professionals. The proposals were of good quality given the short amount of time the participants had to work on them.

The preparation for the I.FAST CBI 2023 is well underway and we expect that it will lead to other interesting ideas of applications of accelerators to the environment.

Discussions have started to find how to organise a follow-up of some of these innovative proposals.

The funding received by the European Union will allow us to organise at least a third challenge in 2024. Applications will be welcome starting in December 2023 at http://www.ifast-cbi.particle-accelerators.eu/ .

7 References

[1] https://www.esi-archamps.eu/

[2] Horizon Europe Missions

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[3] CERN's IdeaSquare Challenge Based Innovation course https://www.cbi-course.com/

[4] THE Port Humanitarian Hackathon https://theport.ch/

[5] N.~Delerue, P.~Burrows, R.~Holland, E.~M\'etral, L.~Rinolfi and M.~Vretenar, ``Challenge Based Innovation "Accelerators for the Environment",''JACoW IPAC2022 (2022), 3077-3079 doi:10.18429/JACoW-IPAC2022-THPOMS048

[6] Accelerators for the environment: Announcing I.FAST Challenge-Based Innovation programme 2022, Accelerating News, Issue 38, December 2021. https://acceleratingnews.web.cern.ch/news/issue-38/ifast-ifa/accelerators-environment-announcing-ifast-challenge-based-innovation

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[8] Accelerating solutions for the environment, https://cordis.europa.eu/article/id/442504-accelerating-solutions-for-the-environment