

# CHALLENGE BASED INNOVATION “ACCELERATORS FOR THE ENVIRONMENT”\*

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## Abstract

We present an initiative to foster new ideas about the applications of accelerators to the Environment. Called “Challenge Based Innovation” (CBI) this initiative will gather four teams each of six master-level students each coming from different academic backgrounds. As part of the EU-funded I.FAST project (Innovation Fostering in Accelerator Science and Technology), they will gather during 10 days in Archamps near CERN to receive high level lectures on accelerators and the environment and to brainstorm on possible new applications of accelerators for the environment. At the end of the gathering, they will present their project at CERN to a jury made of experts.

## MOTIVATION

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 [1]. The I.FAST-CBI (hereafter called the challenge) stems from the historic collaboration between the European Scientific Institute (ESI) [2], CERN and others partners to run the Joint Universities Accelerator School (JUAS). This new collaboration has been inspired by the success of CERN’s IdeaSquare CBI program [3] but with a much shorter duration. For this challenge, 24 students from different countries will spend nine days at ESI in Archamps near Geneva exploring ways in which accelerators and related technologies could be used to meet a societal challenge related to one of the Horizon Europe missions [4]. The choice for the 2022 challenge is “Accelerators for the environment”. These students will form strongly multidisciplinary teams with students coming from law, environmental studies and, of course, physics and engineering. Working together in teams they will develop an innovative way to address the challenge using accelerators. On the tenth day, they will be invited to spend a day at CERN and present their work in front of a jury.

## STUDENTS APPLICATIONS

A call for application and a poster (shown on Fig. 1) were circulated in December 2021 through various networks, including the “Accelerating News” newsletters [5] and the ESI/JUAS network of universities.

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Figure 1: I.FAST CBI poster.

To apply students had to submit a form online and write short texts on their interest for particles accelerators and the applications of accelerators to the environment (which for most of them required some background reading). The application deadline was February 28<sup>th</sup>.

A total of 187 applications were received, 85 % of which were from I.FAST participant countries (Figure 2 shows the country of affiliation of students coming from the European Union or the UK). The country of affiliation of the selected participants reflects this diversity (see Fig. 3).

## COUNTRY OF AFFILIATION (EU STUDENTS)

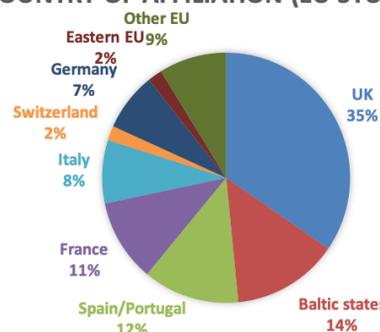


Figure 2: Country of affiliation of students coming from an University located in the European Union or the UK.

A good diversity of fields of studies was achieved (see Fig. 4): most of these applications were from engineering (39 %) and physics (37 %), but there were also 20 applications (11 %) from environmental sciences and 9 from other scientific fields. There were 6 applications from law students, 5 from management/business students, 3 from humanities students and 2 from medicine students.

**COUNTRY OF SELECTED PARTICIPANTS**

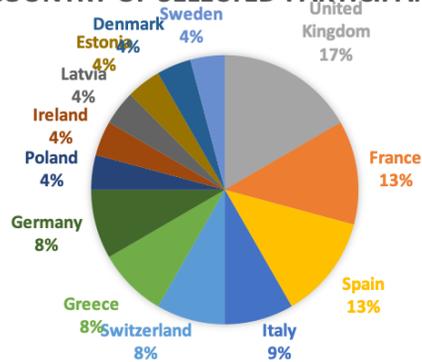


Figure 3: Country of affiliation of the students selected.

**GENDER OF PARTICIPANTS**

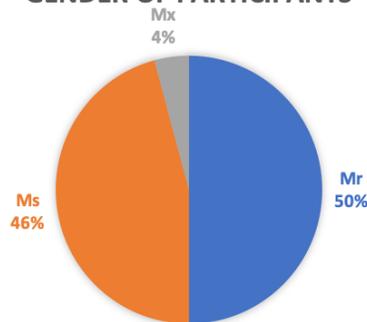


Figure 6: Gender of the participants.

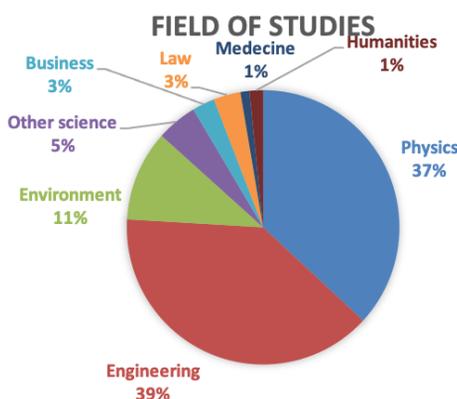


Figure 4: Field of study of the applicants.

It was decided to form 4 teams of 6 students (3 physicists and engineers), 1 environmental scientist and 2 students from other fields. Hence, in physics and engineering the selection rate was 8.5 %, in environmental sciences it was 20 % and in other fields it was 32 %.

Regarding gender balance, 57 % of the applicants were male, 40 % female and 3 % who did not answer that question (see Fig. 5) and a good balance was kept among selected students (Gender balance is 12 male, 11 female and one student who did not answer, see Figure 6).

**APPLICANTS GENDER**

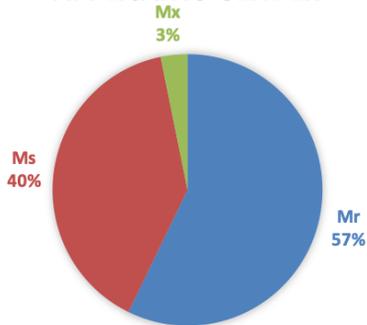


Figure 5: Gender of the applicants.

Among this large number of applications, 24 applicants have been selected. Among physicist and engineers it was noted that there were several “accelerator experts” (student who have already had some experience with accelerators in their career) hence the final team composition will be 1 physicist, 1 engineer, 1 accelerator expert, 1 environmental scientist and 1 lawyer and 1 student from other fields. All students are studying within I.FAST partner countries.

## PROGRAM

The participants will be in Archamps from July 26<sup>th</sup> until August 4<sup>th</sup>. During their stay they will attend several high level seminars presenting accelerators and environmental applications. There will also be some time devoted to team work or private studies. Two days will be devoted to mini-conferences, where all the students will present their progress. Like a real scientific conference we hope that this will be an opportunity for questions and constructive criticism on each other’s work.

There will also be a seminar series before the stay in Archamps so that students can arrive ready to work on their projects.

### Seminar

Here is a list of confirmed speakers for the seminars:

- Wim Mondelaers, “Small particle accelerators and their applications in medicine and industry”,
- Andrzej G Chmielewski, “Accelerators for the environment”,
- Lenny Rivkin, “General view about particle accelerators”,
- Christophe Goupil, “About the transition”,
- Valeriia Starovoitova, “Accelerators for environment: the IAEA perspective”,
- Maurizio Vretenar, “Overview of accelerators”,
- Rob Edgecock, “Example of applications of accelerators for the environment (Water)”.

Table 1: Evaluation Metric of the Students Proposals

	Oral presentation	Written Report	Total
Does the report include material covering all the academic fields present in the team?	5%	10%	15%
Have the strength and weaknesses of the proposal been correctly identified?	5%	10%	15%
What level of innovation is conveyed?	5%	10%	15%
Potential impact of the proposed activity	5%	10%	15%
Quality of the oral presentation	10%		10%
Support material	10%	10%	20%
Answer to questions	10%		10%
Total	50%	50%	100%

A few additional speakers have been contacted to give talks during the challenge at Archamps.

## EVALUATION OF STUDENTS PROPOSALS

At the end of their nine days in Archamps the student will be asked to propose an innovative solution on how to use accelerators to address the environmental crisis.

The will present this solution in a short written report (a few pages) and an oral presentation in front of a jury made of knowledge transfer experts at CERN. The evaluation criteria of the proposals are given in Table 1.

Although proposal will be evaluated at the end, it will be important to keep a collaborative mood between the teams, trying to emulate the spirit of the accelerator community. A prize will be given to the team with the best proposal but prizes will also be given to students who ask the most insightful or most constructive question during the event.

## CONCLUSION

This "Challenge Based Innovation" is a new activity within the accelerator community. We hope that it will bring new ideas on innovative solution to address the environmental crisis. It is also an opportunity to reach out to young student who may not be aware of what particle accelerators are and what their applications are. On that point the large number of applicants is already a success.

## ACKNOWLEDGEMENTS

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 101004730.

## REFERENCES

- [1] I. FAST Project, <https://ifast-project.eu/home/>.
- [2] European Scientific Institute, <https://www.esi-archamps.eu/>.
- [3] CERN's IdeaSquare Challenge Based Innovation course, <https://www.cbi-course.com/>.
- [4] "Horizon Europe Missions" [https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe\\_en](https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe_en)
- [5] "Accelerators for the environment: Announcing IFAST 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>