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

The I.FAST Challenge Based Innovation

Presentation to JUAS students
10th February 2023

iFAST

The I.FAST project

- I.FAST = Innovation Fostering in Accelerator Science and Technology
- https://ifast-project.eu/home
- 49 partners (research organizations, industry,…) including: CERN, CNRS (France), University of Oxford and other UK Universities, INFN (Italy), DESY, GSI (Germany), ESI,…
- Gathering top researchers in the field of particle accelerators
- Looking at innovative applications of accelerator technology

EU projects in the accelerator community

- The community of scientists working on particle accelerators has a strong tradition of collaboration between institutes and between countries
- Over the past 20 years there has been several EU funded projects gathering research from all across Europe: TIARA, EuCard, ARIES, I.FAST…
- These project encourage institutes from several different countries to work together on a given topic.
- For example in I.FAST:
  - Collaboration in ultra-low emittance storage rings
  - Collaboration on superconducting magnets
  - Collaboration on novel particle accelerators concepts
  - Collaboration on the additive manufacturing of accelerator components
- These collaboration also strongly involve industrial partners
- The MOOC you took at the beginning of this course was funded by ARIES

I.FAST Challenge based innovation?

- During 10 days 4 teams of 6 students try to suggest innovative solutions based on accelerators technologies to address a challenge.
- On the last day they present their work in front of a jury at CERN.

The Challenge

- The aim of the challenge:
  - Use accelerator technology to address a given problem:
    “Accelerators for the environment”
  - Can you suggest innovative use of accelerator technology to address the challenge?

Topic 2022

- We decided to have a topic in line with the Horizon Europe missions:
  - Cancer
  - Adaptation to climate change including societal transformation
  - Healthy oceans, seas coastal and inland waters
  - Climate-neutral and smart cities
  - Soil health and food
    - More details on these missions can be found at https://ec.europa.eu/info/horizon-europe/missions-horizon-europe_en
  - A program committee drawn from experts from I.FAST and beyond was asked to give advice on which topic would be the most suited.

Members of the program Committee:
Giovanni Anelli (CERN), Sam Bayat (CHU Grenoble), Christine Darve (ESS), Robert Edgecock (STFC), Angeles Faus-Golfe (CNRS), Markus Nordberg (CERN), Tatiana Pieloni (EPFL), Karolos Potamianos(U. Oxford), Toms Torims (Riga Technical University and CERN) and Carsten P. Welsch (U. Liverpool)
+ the steering committee:
Phil Burrows (Oxford), Bob Holland (ESI), Elias Metral (CERN), Louis Rinolfi (ESI), Maurizio Vretenar (CERN) and Nicolas Delerue (CNRS)

Accelerators for the environment

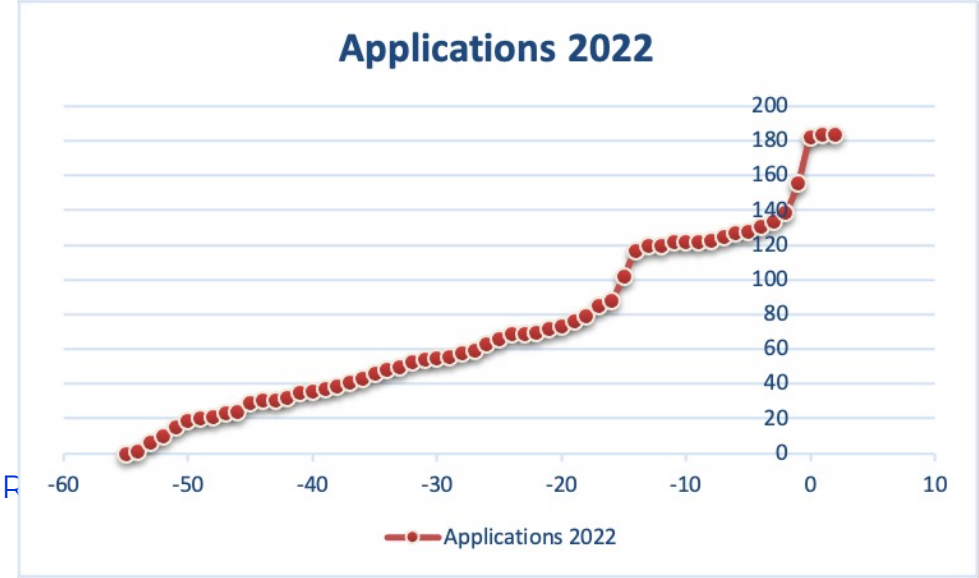
- The selected topic for 2022 was "**Accelerators for the environment**" (which covers both the maritime environment and the terrestrial environment).
- The topic for the 2023 CBI will be the same.
- A new topic will be selected by the experts panel for 2024.

Who/when /where?

- The target audience is students sufficiently advanced in their studies but not yet too specialized.
  - Students in their 2nd cycle of studies (typically 3rd to 5th year of University), before the start of doctoral studies.
- 24 students have been selected.
- Multidisciplinarity of the teams is key to have them propose projects that are well suited.
- All expenses, including travel are covered by the project.

Applications (2022)

- 187 applications
- 85% from I.FAST participant countries
- Gender: 57% male, 40% female, 6% no answer



Applications (2022)

- 187 applications
- 85% from I.FAST participant countries
- Applications by field of studies:
  - Engineering 39%
  - Physics 37%
  - Environmental science 11%
  - Other scientific fields: 9 applications
  - law students: 6 applications
  - management/business: 5
  - Humanities: 3
  - Medicine: 2
- Selection rate:
  - Physics and engineering: 8,5%
  - Environmental sciences: 20%
  - Other fields: 20%
- Gender: 57% male, 40% female, 6% no answer

Diversity

- Diversity is key to foster innovation
- The selection panel was careful to ensure diversity:
  - Diversity of country of study
  - Diversity of gender (12 male, 11 female, 1 N/A).
  - Diversity of studies (Physics, Engineering, Environmental sciences, law, business, communication)

Selected participants

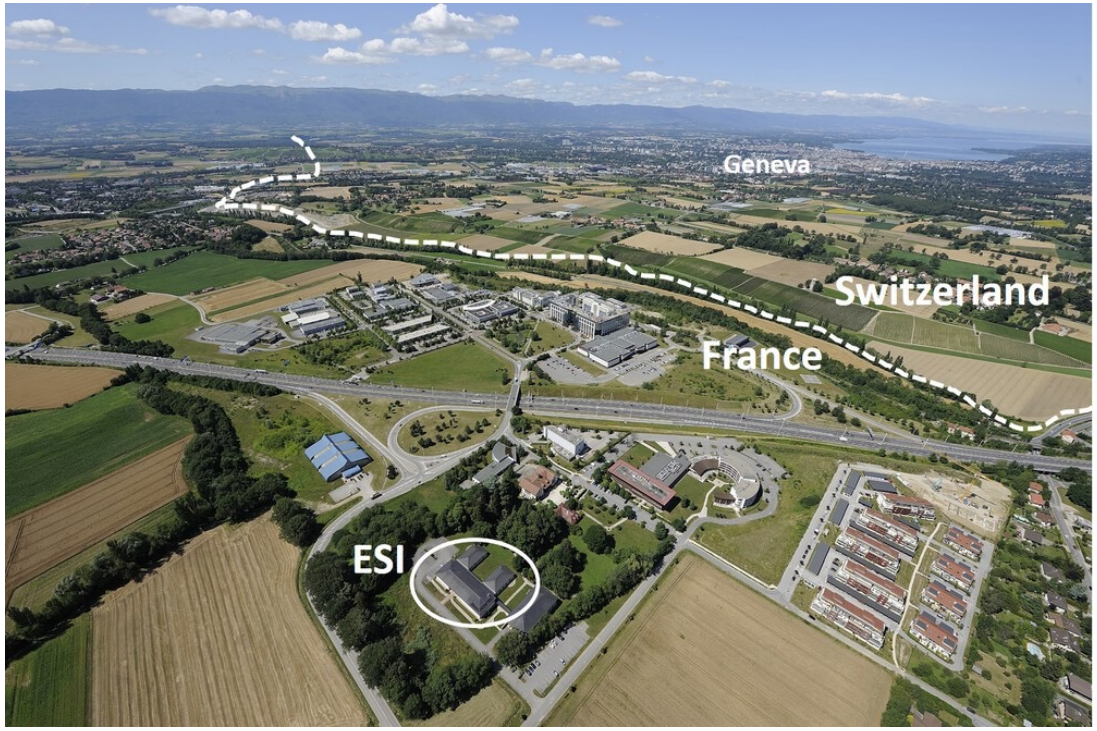
- The 24 selected participants come from institutions in 13 different I.FAST countries, they have 17 different citizenship (some from outside Europe: Colombia, Palestinian Territories,...).
- Good gender balance: 12 males, 11 females and 1 undisclosed.
- Field of studies:
  - 4 Accelerators experts
  - 4 Physicists
  - 4 Engineers
  - 4 Environmental scientists
  - 4 Lawyers
  - 4 from other fields

The teams (2022)

- In 2022 each team was made of :
  - One physicist
  - One engineer
  - One accelerator « expert » (eg: former JUAS student)
  - One environemental scientist
  - One lawyer
  - One student from other fields (business or media studies).

Hosting

- The challenge takes place HERE at the European Scientific Institute (ESI) in Archamps near Geneva: https://www.esi-archamps.eu/
- ESI has strong experience in hosting scientific schools
- The ESI team is taking care of the logistics, full board accommodation and travel arrangements for the participants.



The program 2022

- The program is aimed at giving the students the opportunity to learn about accelerators and their applications
- 4 online seminars before the challenge + video session to get to know each other (all together and by team)
- 8 in person seminars with experts of accelerators and/or their environmental applications
- 2 days at CERN
- 2 “conferences”

mardi 26 juillet 2022	mercredi 27 juillet 2022	jeudi 28 juillet 2022	vendredi 29 juillet 2022	samedi 30 juillet 2022	dimanche 31 juillet 2022
	09:30 Transport to CERN	09:30 Seminar	09:30 Prepare 1st conference	09:30 Private studies	
	10:30 Seminar	10:30 Team work		10:00 Feedback to teams 1 and 2	
	11:30 Team work			11:00 Feedback to teams 3 and 4	
12:00 Buffet Lunch	12:00 Lunch at CERN	12:30 Lunch	12:30 Lunch	12:00 Team work	10:45 Visit Annecy - Meet at ESI at 10:45 am to pick up your picnic bag. The bus will leave at 11.00am sharp! Departure from Annecy at 20:30. Remember that there is NO evening meal at ESI !
	13:00 Team work	13:30 Private studies	13:30 1st conference - individual presentations	12:30 Lunch	
14:00 Opening of the CBI	14:00 CERN Visit	14:00 Seminar		13:30 Private studies	
14:30 Break		15:00 Team work		14:00 Seminar	
14:40 Seminar				15:00 Team work	
			16:30 Break		
			16:40 Team work		
17:00 Introduction to the I.FAST CBI and Ice breaking activities			17:30 1st conference - team presentations		
			18:20 Free time		
18:30 Free time	18:00 Return from CERN	18:00 Free time	18:30 Conference feedback	18:00 Free time	
19:00 Welcome Dinner	19:15 Dinner	19:00 Dinner	19:30 Dinner	19:00 After work / Dinner	19:00 Dinner
20:00 Free time	20:15 Private studies	20:00 Private studies	20:15 Private studies	20:00 Social evening	20:00 Free time

lundi 1 août 2022	mardi 2 août 2022	mercredi 3 août 2022	jeudi 4 août 2022
			08:30 Transport to CERN
09:30 Seminar	09:30 2nd conference (15' presention + 15'question / team)	09:30 Prepare final report (due at noon)	09:30 Lunch at CERN + Free time
10:30 Team work		12:00 Free time	11:00 Final presentations
12:30 Lunch	13:00 Lunch	12:30 Lunch	
13:30 Private studies	14:00 2nd conference feedback	13:30 Private studies	14:30 Award ceremony
14:00 Seminar	15:00 Team work	14:00 Seminar	16:00 Return from CERN (optionnal)
15:00 Prepare 2nd conference		15:00 Prepare presentations	
17:35 Determine speaking order for		17:45 Fill feedback forms	
18:00 Free time		18:15 Free time	
19:00 Dinner	19:00 After work / Dinner	19:00 Dinner	
20:00 Private studies	20:00 Private studies	20:00 Finalize presentations	

Online seminars 2022

- Willy Mondelaers, "Small particle accelerators and their applications in medicine and industry"
- Andrzej G Chmielewski, "Accelerators for the environment”
- Lenny Rivkin, "Particle accelerators (general view)”
- Christophe Goupil, "A physicist's journey through the ecological transition"

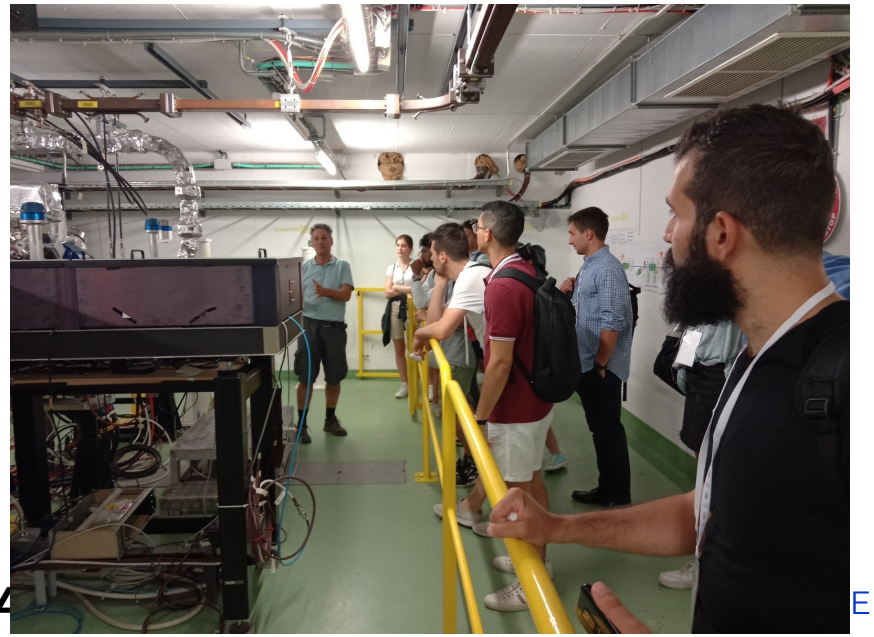
Seminar topics and speakers

- Accelerators for environment: the IAEA perspective by Valeriia STAROVOITOVA (IAEA)
- Overview of accelerators by Maurizio Vretenar (CERN)
- Planning around scientific experiment by Estrella Vergara Fernandez (CERN)
- Example of applications of accelerators for the environment (Water) by Rob Edgecock
- LHC for non-specialists by Xavier Buffat (CERN)
- How the synchrotron light could be used for environmental issues by Elena Longo (Elettra)
- Enabling Science using Neutrons at the European Spallation Source by Arno Hiess (ESS)
- Accelerating your Innovative Ecosystem by Christine Darve (ESS)

CERN visit

- Visit of 4 accelerators at CERN:
  - ELENA/AD
  - LINAC4
  - CLOUD
  - CLEAR or Cyclosynchrotron

CERN visit



Conferences / Pitching events

- Twice during the challenge there is a “conference” or “pitching event” gathering all participants.
- The first one is an opportunity for each participants to present the problem from the perspective of her/his field of studies.
- The second one is focussed on the solutions proposed by each team with constructive comments from the other teams
- We want constructive collaboration rather than competition between the teams.

Competition / collaboration

- We want constructive collaboration rather than competition between the teams.
- In the accelerator community each institute has its own facilities and tries to do the best with it but we all collaborate and help each other.
- This is what we try to emulate during the Challenge.

Team dynamics

- Organisation within the teams was left to the teams to decide
- 4 teams, 4 different organisations!
- Some very democratic
- Some followed a leader
- Some had disagreements
- Exactly like in real scientific projects!

The final presentations

- On the last day there were presentations in front of a jury made of senior scientist and knowledge transfer experts.
- The order in which the teams present is decided by a quiz on previous seminars.
- Each team presented its project and answered questions form the jury.
- In the afternoon there was an award ceremony with feedback from the Jury for each team.

The final presentations

- Each team presented its project from different point of view:
  - Environmental science: what is the problem to be addressed? The solution?
  - Accelerator: how to deliver the required beam?
  - Physics: how to deliver the expected result?
  - Engineering: how to make it fit?
  - Legal: safety or IP
  - Business: is it economically feasible?
  - Communication: Would such project be accepted by local communities?

Goal: Functionalisation of CNF with e-beam irradiation

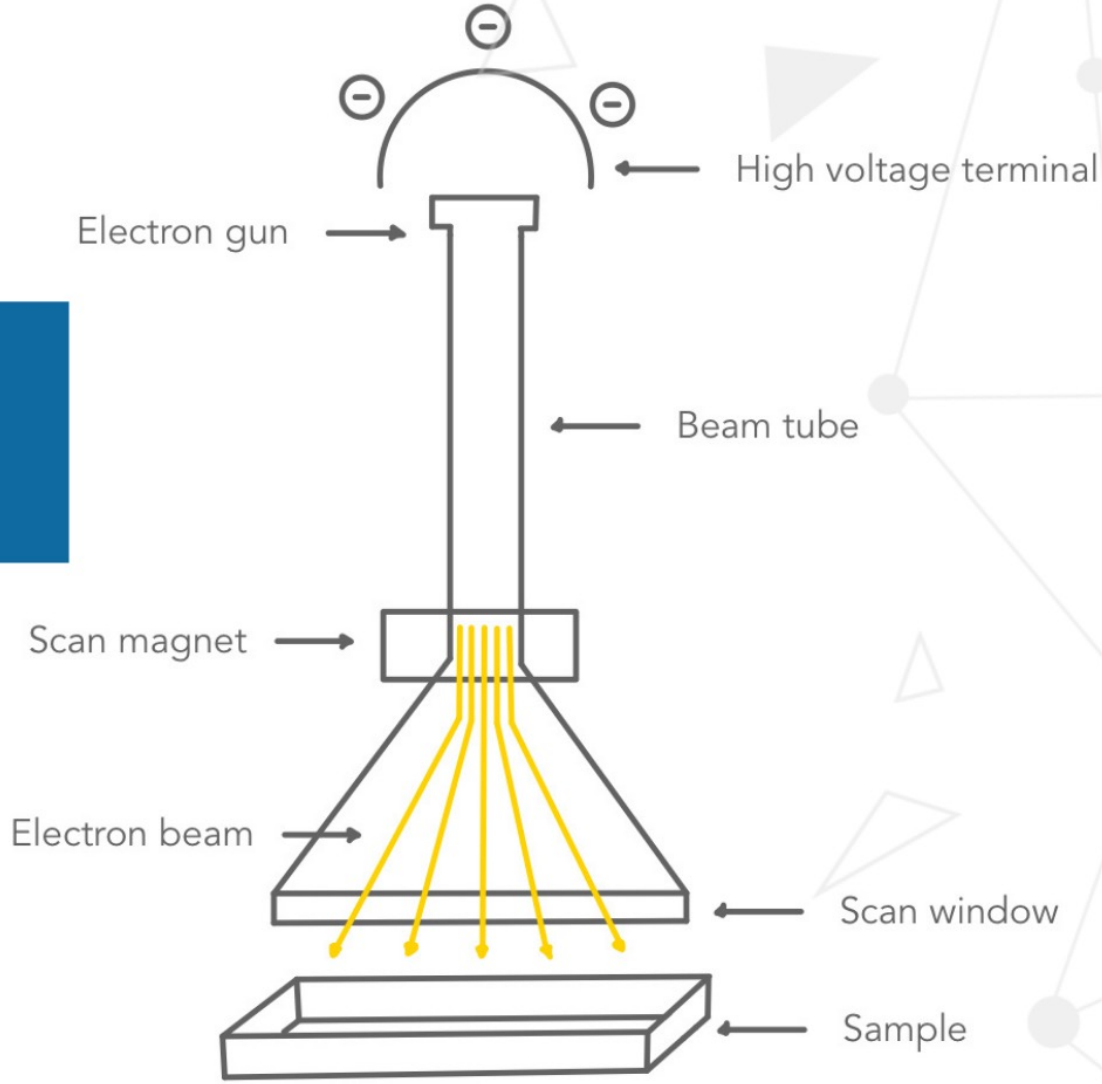
IFAST CHALLENGE

BEAM PARAMETERS

Energy: 3 MeV
Dose: 1000 kGy

SAMPLE

1.245 kg of CNF powder in aluminium pans



Linear accelerator commercially available through IONISOS (France)

Courtesy Team Fellowship of the accelerator ring - Durablade - Accelerating the Green Transition

THE PLAN

GET COMPACT LIGHT SOURCE: THE ACCLERATOR OF THE FUTURE!

MOUNT THE ACCELERATOR ON A RESEARCH VESSEL

TRAVEL TO LOCATIONS OF INTEREST

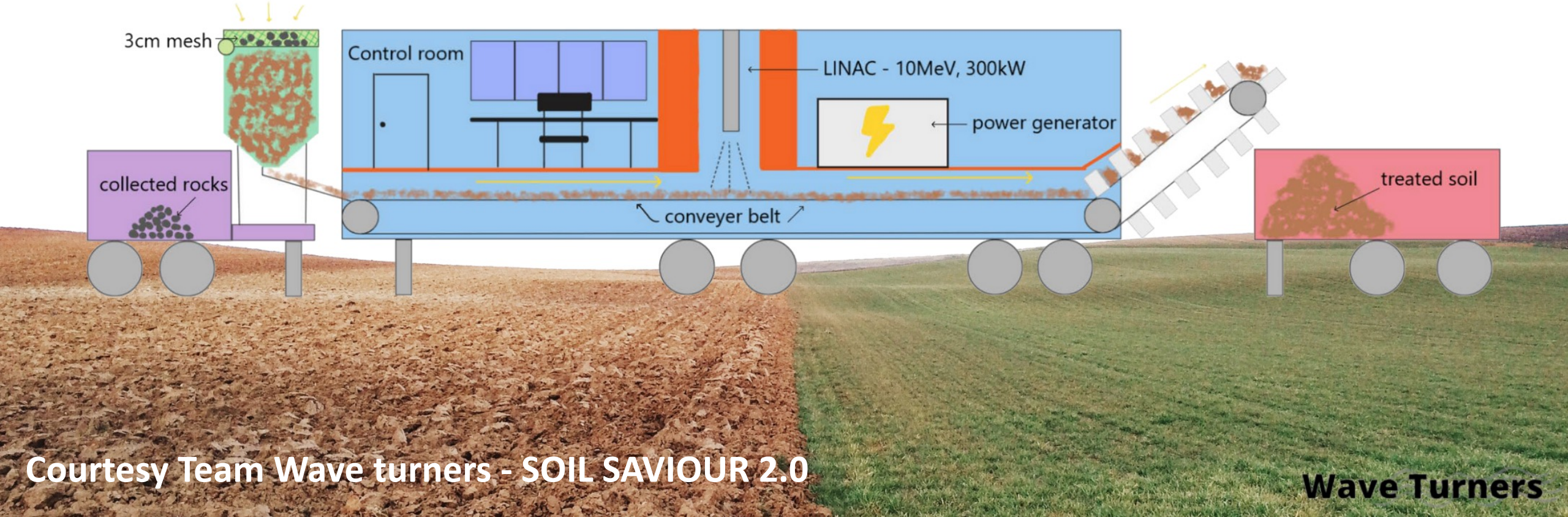
TAKE SAMPLES OF OCEAN WATER AND MICROORGAINISMS

USE THE ACCELERATOR TO IDENTIFY MICROPLASTICS AND TOXIC CHEMICALS IN SEA WATER/ORGAINISMS

Courtesy **Teams White Light - A.M.M.I.R.A : Accelerators for Marine Microplastics Investigation and Research Agency.**

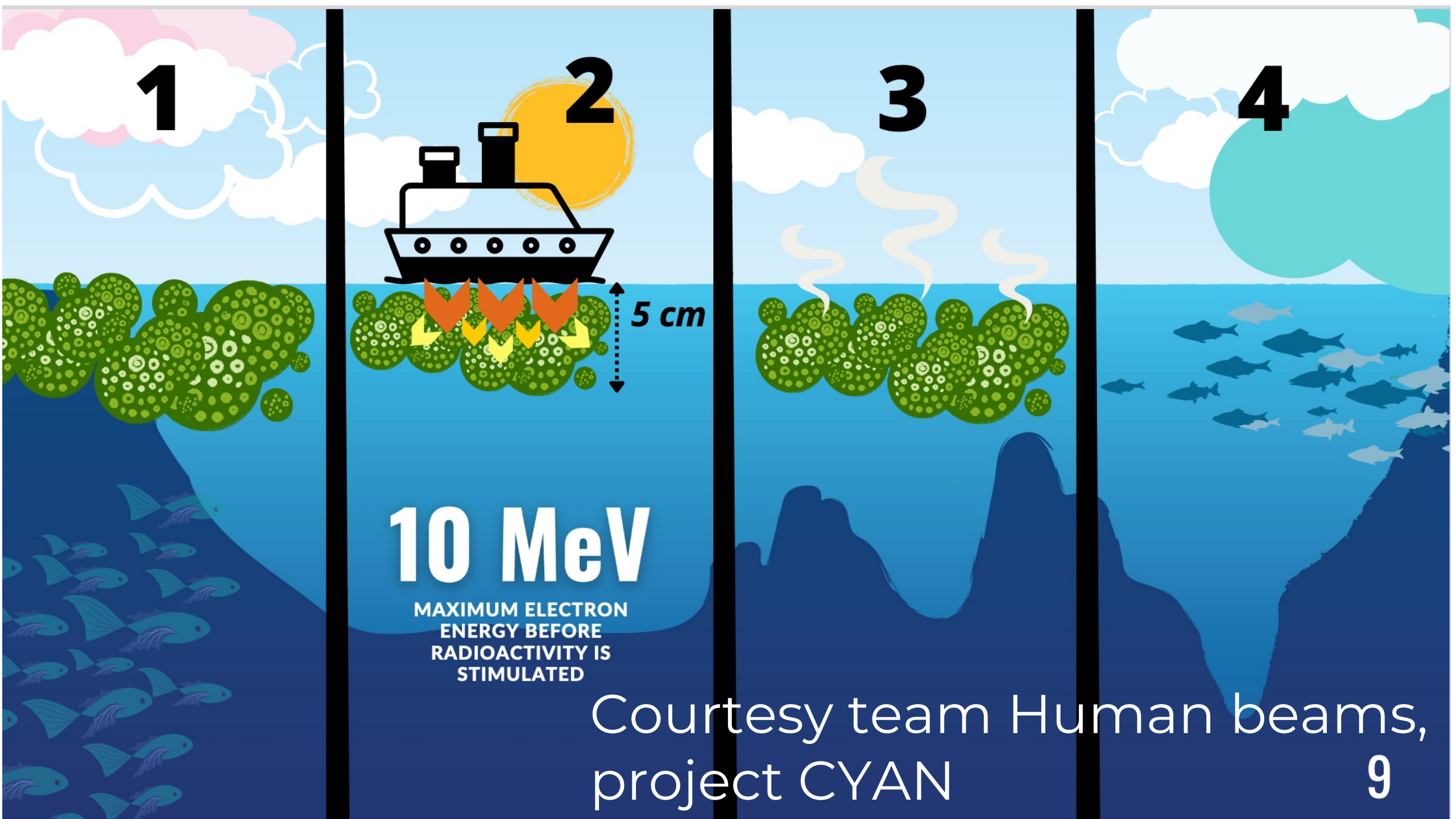
DEVELOPING TECHNOLOGY - THE SOIL SAVIOUR 2.0 & A PORTABLE PARTICLE ACCELERATOR

SOIL SAVIOUR 2.0



Courtesy Team Wave turners - SOIL SAVIOUR 2.0

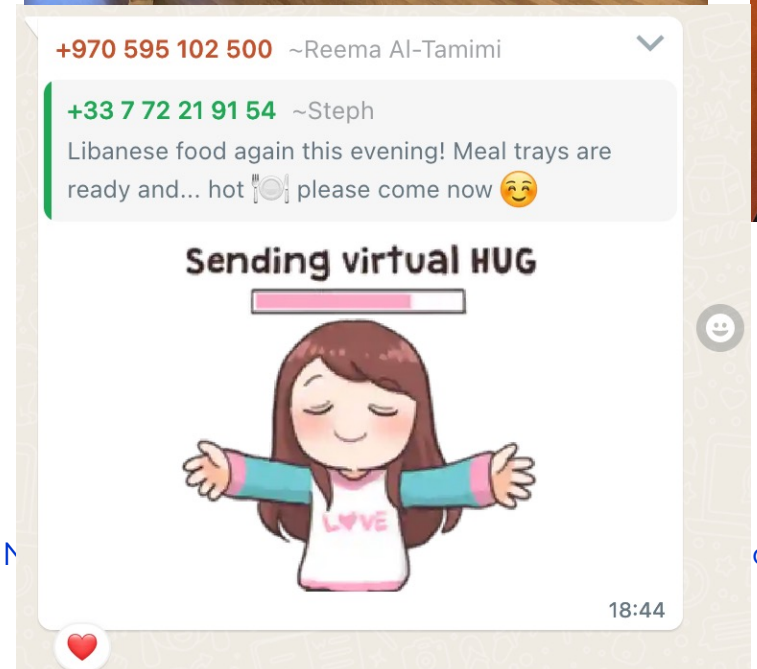
Wave Turners



Courtesy team Human beams, project CYAN

It was a lot of work...

… with some rest



iFAST

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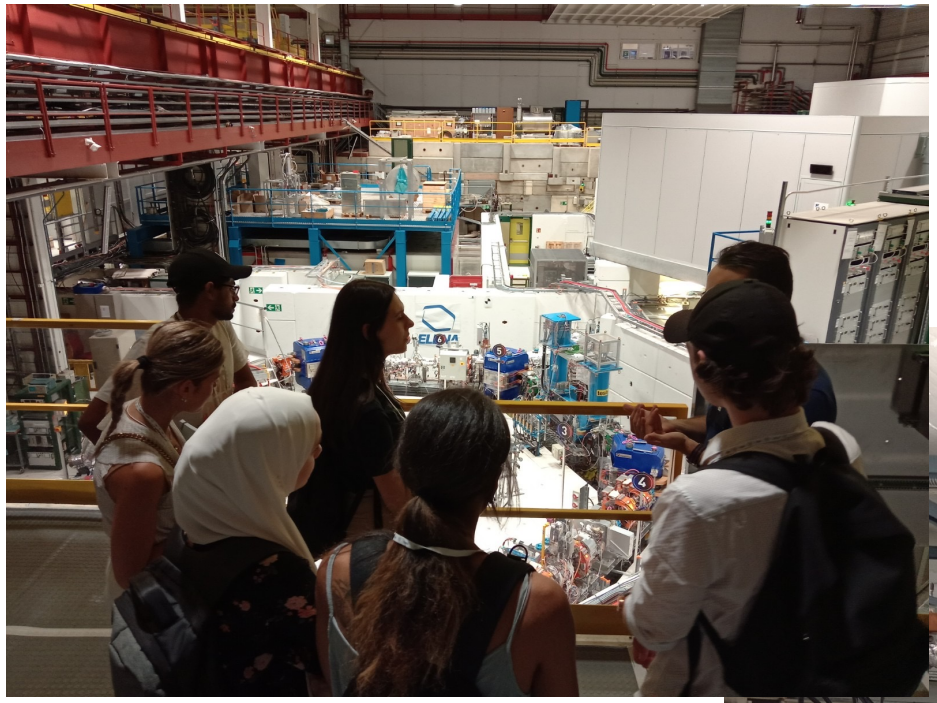
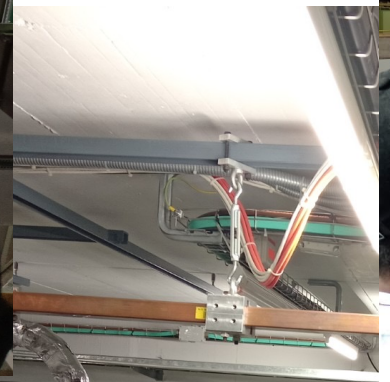
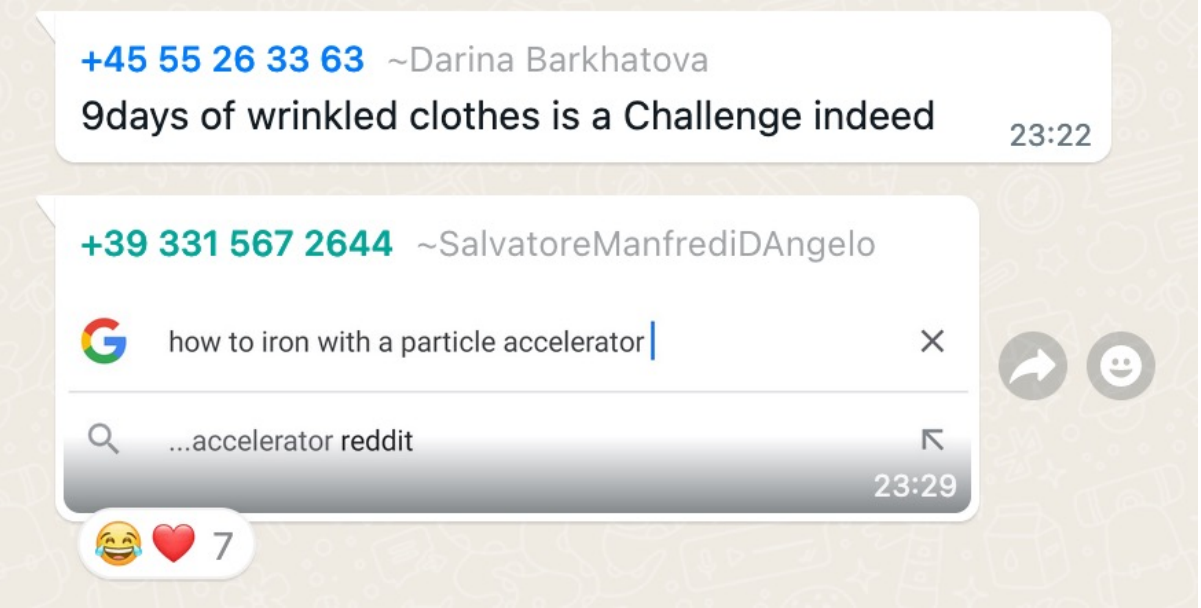
Learning what accelerators can do...





… and what they might do!



The program 2023

- Under preparation
- Same structure than in 2022:
  - Virtual get together on July 3rd
  - 4 Online seminars
  - 8-9 in-persons seminars
  - 25th July – 3rd August
- More seminars at the beginning and more time to focus on the projects at the end.

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ACCELERATORS FOR THE ENVIRONMENT

10-DAY CHALLENGE @ ESI & CERN
25 JULY - 03 AUGUST 2023

Are you...

...a senior bachelor or master student
(all backgrounds)

...from a European university

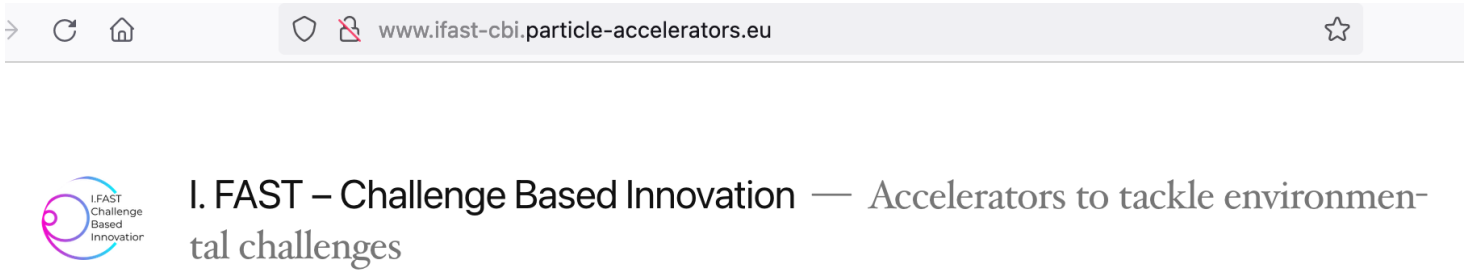
...interested in making an impact

APPLY NOW

ifast-cbi.particle-accelerators.eu

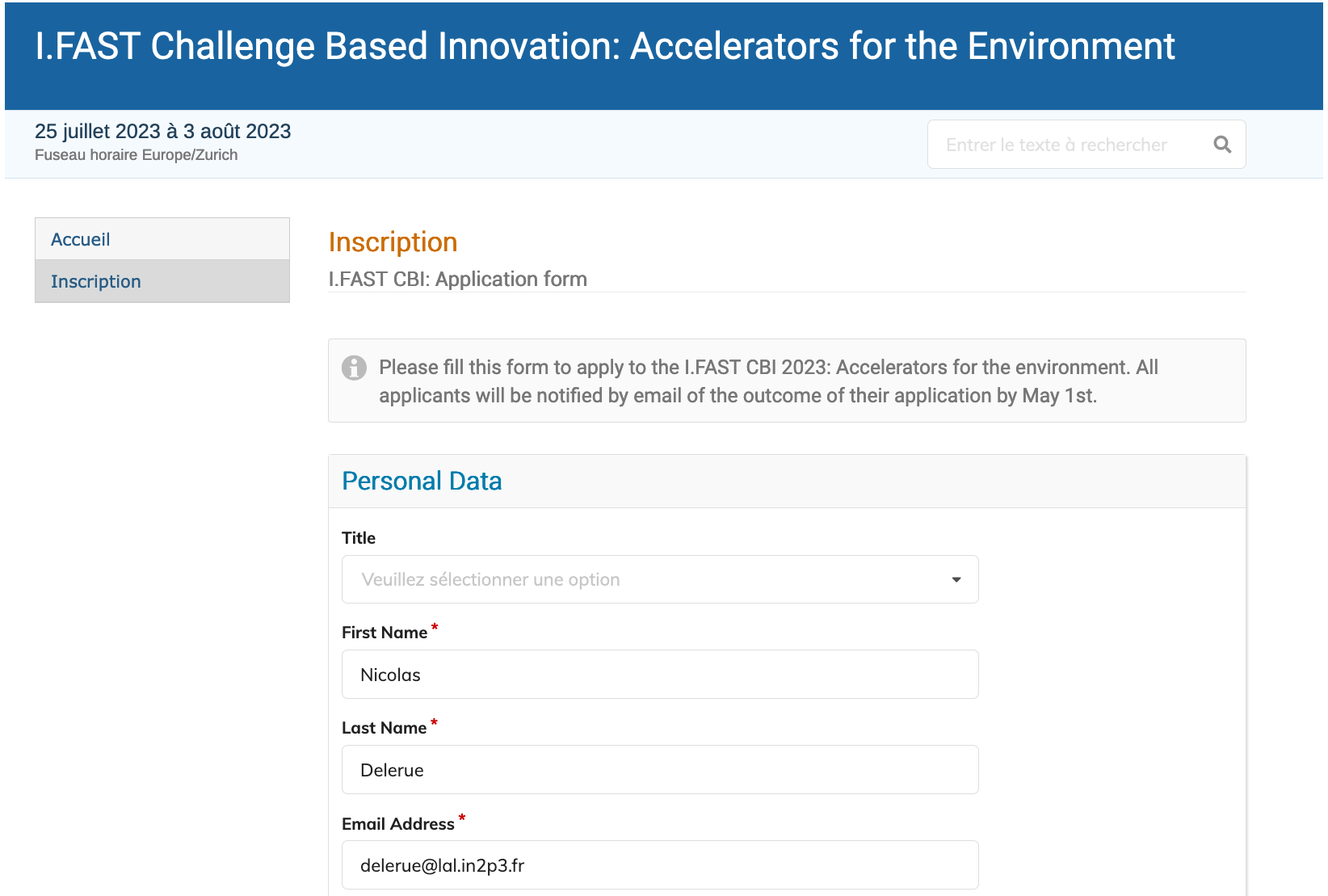
How to apply for 2023?

- http://www.ifast-cbi.particle-accelerators.eu/



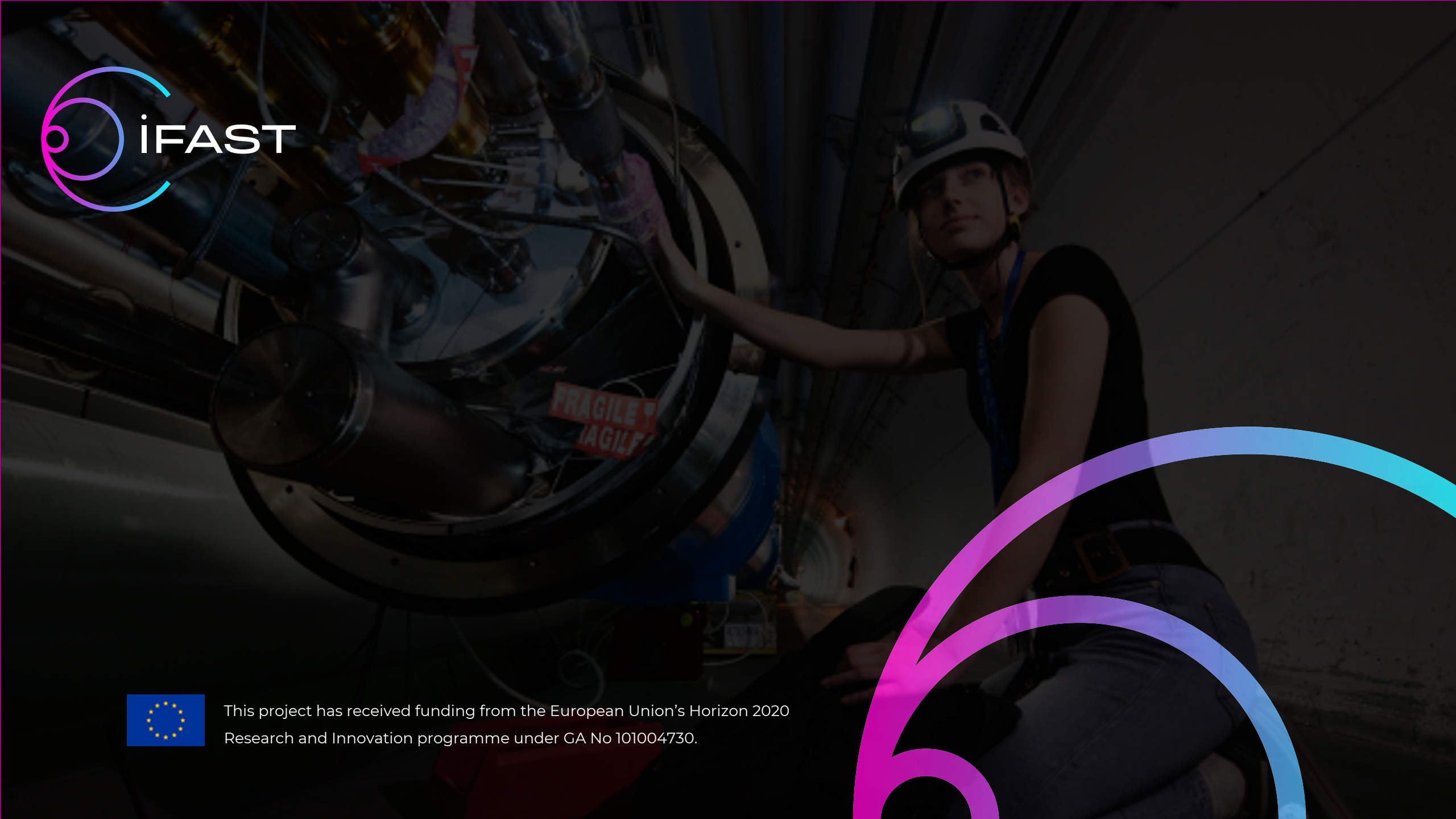
How to apply for 2023?

- http://www.ifast-cbi.particle-accelerators.eu/



Outlook

- The I.FAST CBI is a unique opportunity to study and work on accelerators application in a multidisciplinary environment.
- Like what we do as accelerator professionals!
- Applications are welcome until Feb. 28th
- If you have colleagues in environmental sciences, law, communication, physics or engineering at your home University, please encourage them to apply as well.
- Looking forward to meeting you at the I.FAST CBI 2023.



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