I.FAST Final meeting

22nd October 2025

Nicolas DELERUE (CNRS) on behalf of the CBI steering committee

Reminder:
The I.FAST Challenge based innovation (CBI)

- A challenge to interest and attract students on the use of accelerator technology!
- **Who?**
  - 4 teams of 6 students or young professionals selected from more than 100 individual applications from across the world.
  - The teams are formed by the steering committee with diversity criteria in mind (academic, country of study, gender,…).
- **How?**
  - We set them a challenge and ask them to propose an innovative use of accelerator technology!
  - Online seminars before the CBI
  - In-person seminars during the CBI
  - On the last day they present their work in person in front of a jury at CERN.
- **When and where?**
  - During 10 days (typically the last two weeks of July) at the European Scientific Institute (ESI) in Archamps (near Geneva) with visits at CERN.

The I. FAST CBI 2025

- The 4th and final edition of the I.FAST CBI.
- Topic: "**Accelerators for healthcare**" (2nd year)
- 140 applications.
- Went very well: very positive feedback from the jury and from the participants.
- Idea proposed:
  - Address antimicrobial resistance by using targeted radioisotopes.
  - Coat arterial stent with drug released by X-ray irradiation.
  - Special glue for bones activated by X-rays.
  - Address pulmonary fibrosis by X-ray activated nanoparticles.
- 3 teams out of 4 would like to continue their project by performing a validation experiment and the 4th one is working on a publication/report.
- Financially: despite great cost-saving effort from the host (ESI), expenses have been higher by a few k€ than the support received (still waiting for reply from one sponsor that might help us break even).

The I. FAST CBI legacy: results (1/2)

- Thanks to the funding received from I.FAST but also from several partners (in-kind or in cash) we have run 4 successful edition of the I. FAST CBI.
- Milestone and deliverable submitted on time.
- Very good feedback from all participants.
- 16 interesting ideas from the students, some of these ideas even interested some industrial partners outside our usual comfort zone (textile industry).

The I. FAST CBI legacy: results (2/2)

- Press coverage:
  - All CBI were well covered by our usual communication channels (accelerating news,...).
  - Communications to learned societies (APS, SIF,...).
  - Linked-in communication by CERN and by some students' Universities.
  - Some proposal were also republished in more unusual journals (Textile fashion).
    => The CBI was a good vector to highlight applications of particle accelerators to other communities.
- One student created a start-up to follow-up on the idea formulated during the CBI.
- Students (including form other fields) have learnt about the application of particle accelerators. They became ambassadors of particle accelerators and their applications.

Lessons learned

- Applications of accelerators are fun and can interest students, even outside our field!
- Students can be highly motivated and have very interesting ideas.
- Number of applicants show that we have less application from fields outside physics and engineering. “Clusters” of application when communication reached the students.
  => Make sure that communication is circulated at University level.
- Double check that students have proper travel documents (visa,…) => big source of stress.
- Plan for the future of the projects: students keen on carrying on but:
  - Need to plan a validation experiment during the challenge (worked well in 2025)
  - Need help and (small amount of) money.
  - => Identify possible facilities keen to help ahead of the CBI and allocate small budget (~1-2k€/team).

The future

Next CBIs:

- The EPITA proposal includes proposal to continue the CBI.
- However EPITA's funding will arrive too late for 2026
- Hopefully, first EPITA CBI in 2027.
- There is an expression of interest for a CBI in Sarajevo (Bosnia Herzegovina) dedicated to problems related to the Balkans.
- Pattern alternating Europe-wide (EPITA funded CBI) in 2027 and 2029 and "regional" CBI (locally funded in 2026 and 2028)?

CBI Alumni:

- Plan to create an alumni network on Linked-in for the past participants.
- Do a survey in 1-2 years to know the whereabouts of past participants?

Beyond:

- Find a funding model to make the CBI financially sustainable?

Funding the CBI (1/3)

- The cost per participants is about 3k€ (might be reduced to 2.6k€). *[Catering & housing: 45%, Facility 35%, Travel to facility 12%,…]*
- **Who does the CBI bring value to?**
- 3 groups of main beneficiaries
  - Students
  - Universities
  - Accelerator community
- 3 other stakeholders:
  - Local government
  - Industry
  - The European Union

Funding the CBI (2/3)

- **Students** are the most visible beneficiaries, but may not be ready to pay to participate.
- Some **Universities** consortium and geographical groups (Baltic states, Bosnia,…) have agreed to sponsor the CBI in exchange for secured attendance for participants from their area.
  - This probably needs to be developed more, but each University is different, so we need an internal contact…
- **The accelerator community** has provided the bulk of the CBI funding so far through I.FAST but also big labs (CERN, ESS, GSI,…) and community groups (EPS-AG, TIARA) and projects (HITRI-plus, SEEIIST,…).
  - The next CBIs won't happen without extra support from the accelerator community (including EPITA funding).
  - If we want the next big machines to be funded, it is important to communicate on applications of particle accelerators to daily life. The CBI is on way to do so.
- The **local governments** (Archamps and surroundings) gave us free access to the ESI facility for 10 days.
- This year two **industrial** sponsors expressed interested and one (Kyma) sponsored one student's travel.
- The **European Union** funds us through I.FAST. Could we also get Erasmus funding?

Funding the CBI (3/3)

- EPITA funding will cover one CBI (if no other sponsorship found).
- If we want the next CBIs to happen, we need to find extra sponsors.
- Would you University be willing to pay to sponsor some local students?
- Would your lab be ready to sponsor the CBI to highlight accelerators applications?
- Would your national funding agency be willing to sponsors students?

We are grateful to the CBI sponsors

- The I. FAST CBI took place thanks to the generous contributions of the following sponsors:
- IFAST
- TIARA
- EPS-AG
- RTU
- CERN-ATS
- Three Physicists foundation
- HITRIPlus
- SEEIST
- ESS
- GSI/EMMI
- CNRS
- ESI
- Archparc

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

Future topics

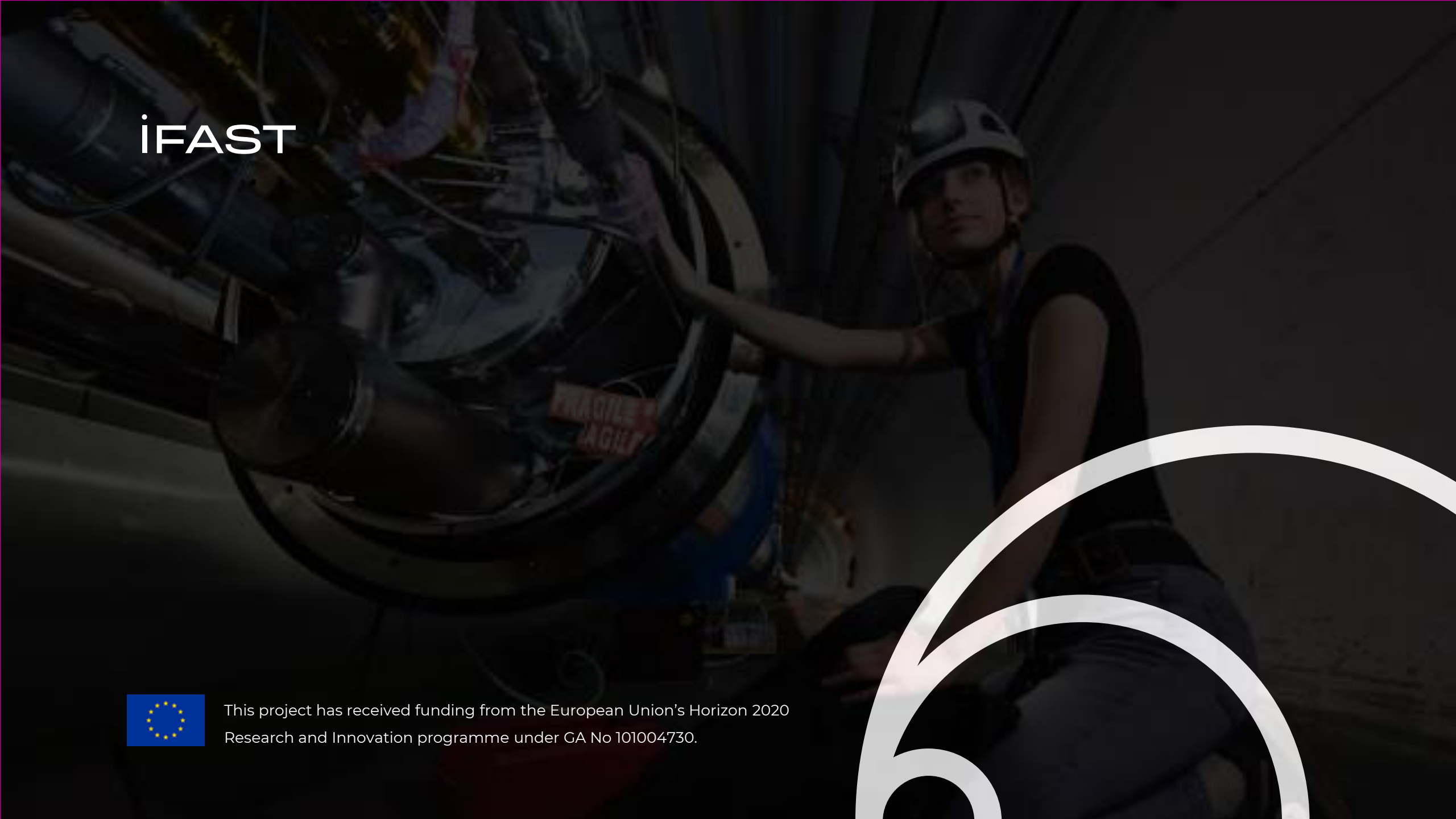
- Two topics considered so far:
  - Accelerators for the Environment (2022, 2023)
  - Accelerators for healthcare (2024, 2025)
- For the 2026 “regional” CBI: present a machine (to be installed soon) and some existing applications and encourage participants to invent new local applications.
- New topic to be decided for 2027.
- For EPITA we will probably rotate topics at each challenge.
- So far most applications were related to low energy machines, but would be happy to consider topics involving higher energy machines or other accelerator R&D.
- Topic has to be well defined enough to build a lecture program showcasing some applications around it.

Outlook

- The I. FAST CBI has been a great opportunity to highlight particle accelerators applications.
- Initial funding was estimated for one or two CBI but thanks to sponsors and cost savings we managed to have four CBIs.
- Hope to continue in the EPITA era.
- Interest for some “regional” CBI.
- For the future: need to identify facilities where students could test their ideas.

Thanks to all those who made it happen

- The lecturers (several of them from I. FAST WP) who travelled across Europe to deliver very interesting lectures.
- The jury members.
- The steering committee: Darina Baizhanova, Phil Burrows, Yiota Foka, Bob Holland, Elias Metral, Florence Mouthon, Louis Rinolfi, Valeriia Starovoitova and Maurizio Vretenar.
- The ESI team and coach: Darina Baizhanova, Florence Mouthon, Laly Rinolfi, Grace Rodriguez and Katarzyna Szymanska.
- Louis Rinolfi who had the original idea of the CBI.



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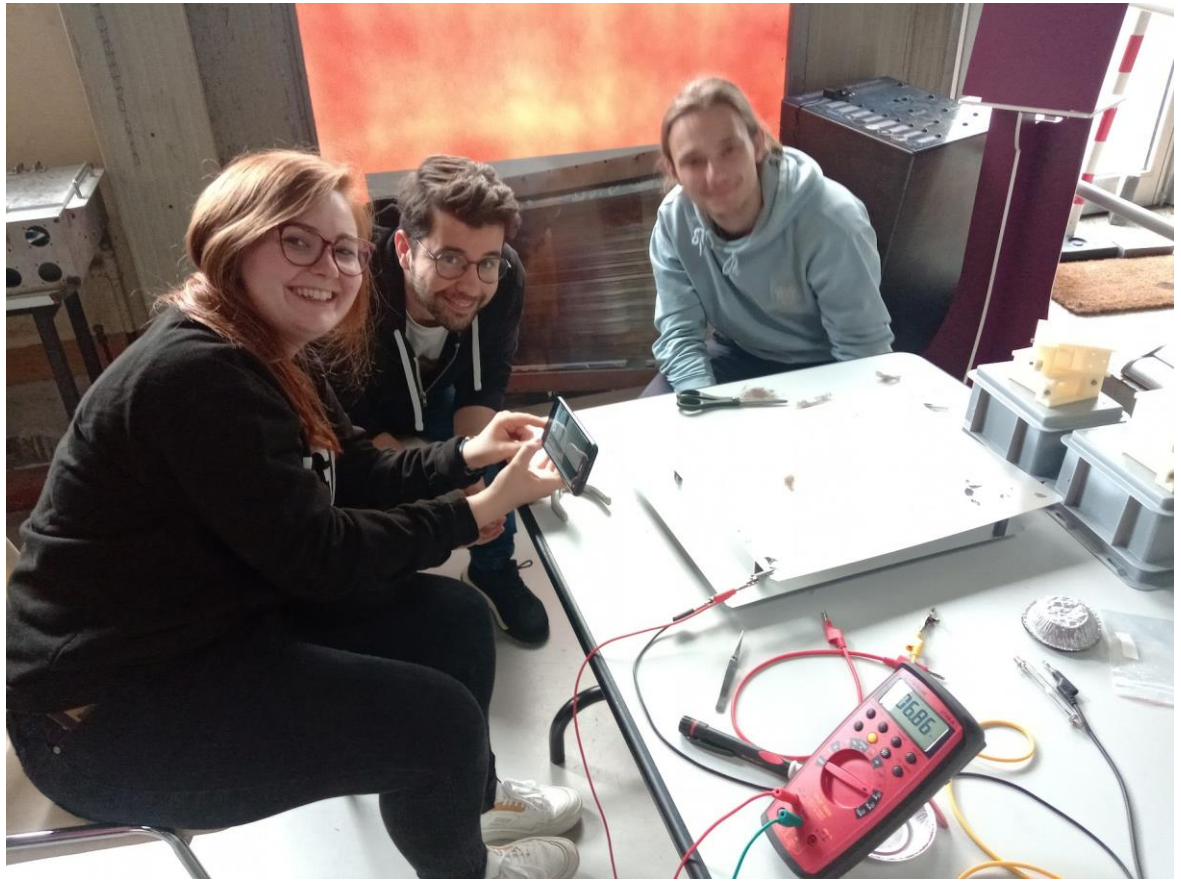
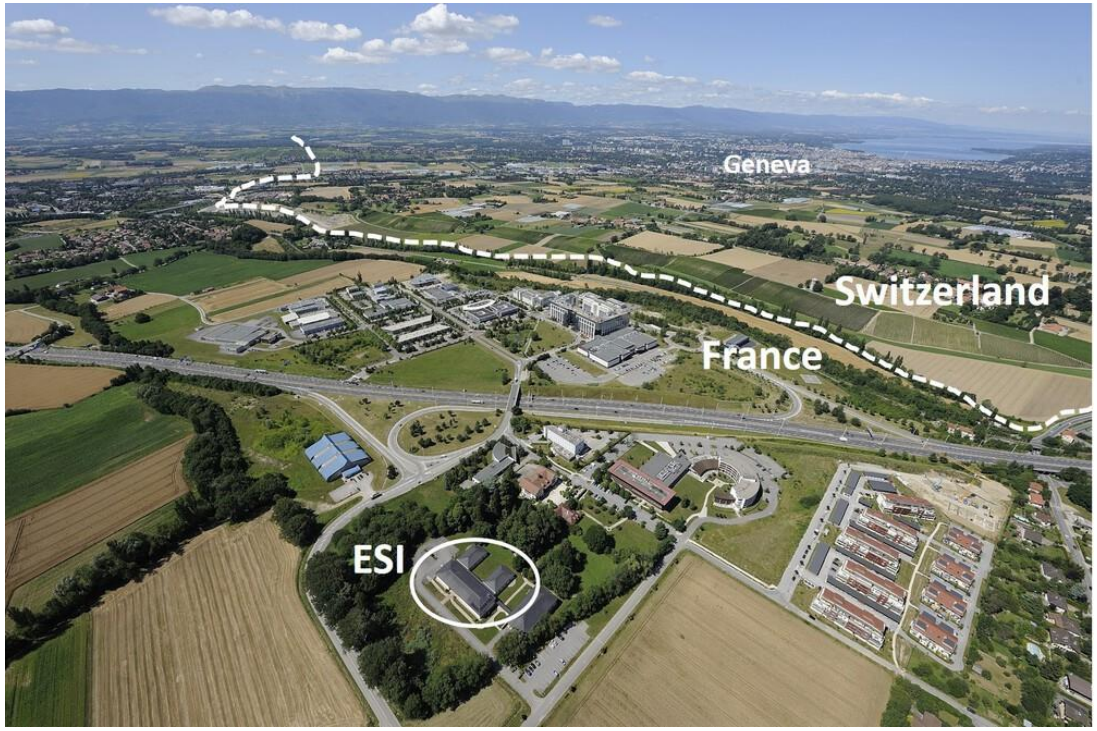
The projects after the CBI...

- This year 3 teams expressed interest in continuing their project after the CBI.
- Looking for funding to purchase chemicals to perform their validation experiment.
- One team from 2023 is still making progress on their ideas.



Hosting

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

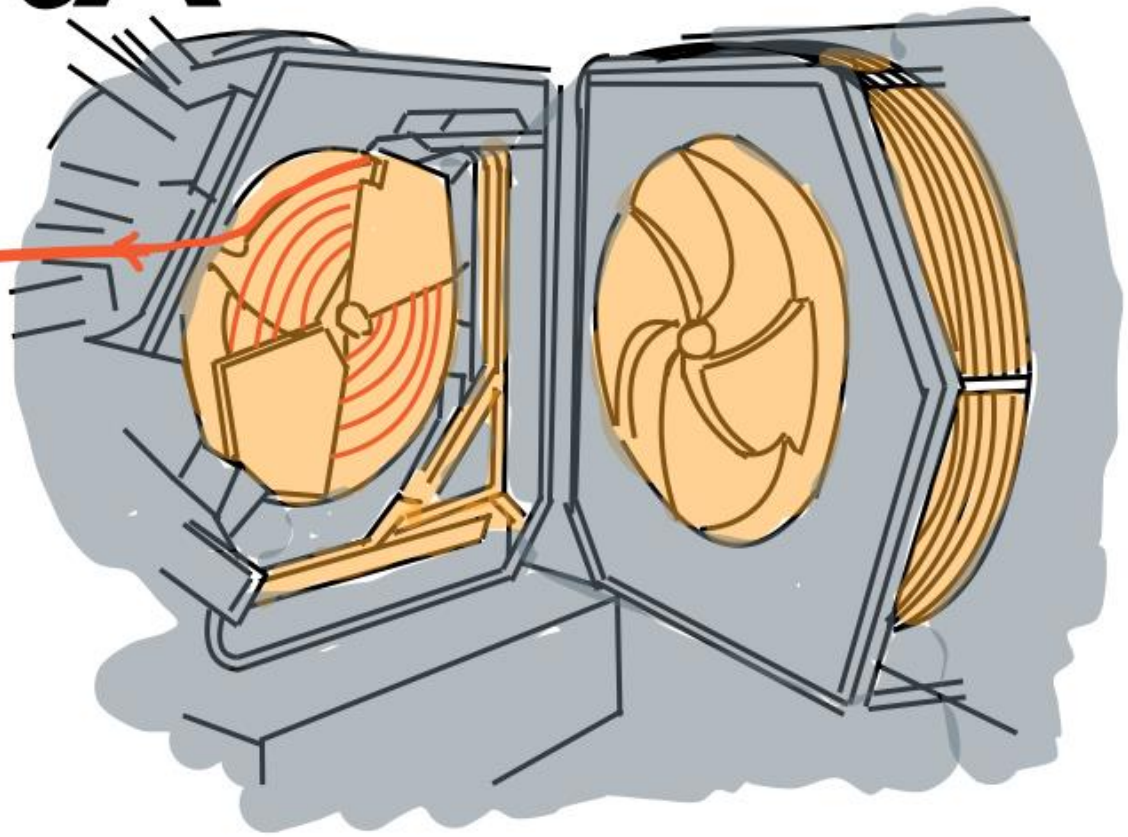


Past projects 2025

Targeted Auger electron therapy for antibiotic resistant bacteria

AuRA

Cyclotron



n

Sn

p

Target

^{119}Sb III/V

Radionuclide

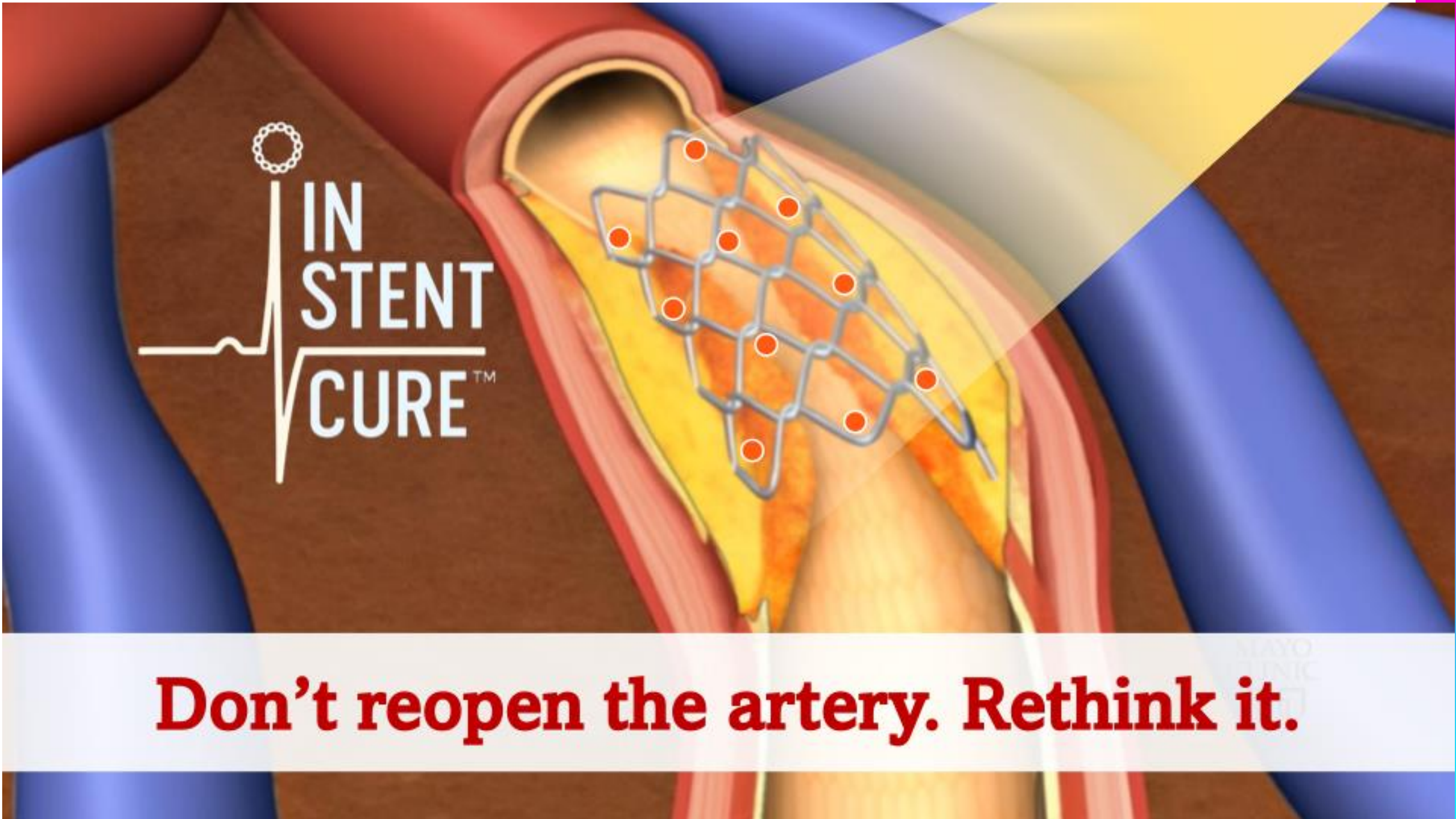
^{119}Sb

Auger e^-

Antibiotic-resistant bacteria

e.g. MRSA

IrradiAID+


IN STENT CURE™
Don’t reopen the artery. Rethink it.

Fibrosis Disruption

Photon RT

1-2 Gy
40 Gy/s

SMITE Protocol

Low Dose, High Dose Rate, & Spatially Fractionated RT

+

SMITE-activated Nanoparticles

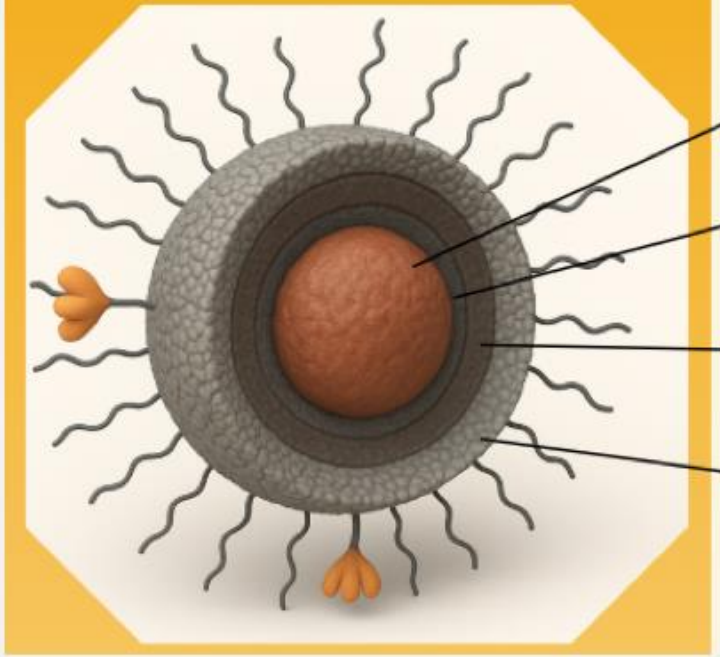
via inhalation

+

Anti-fibrotic Drug

Targeted delivery

SMITE-Activated Nanoparticle

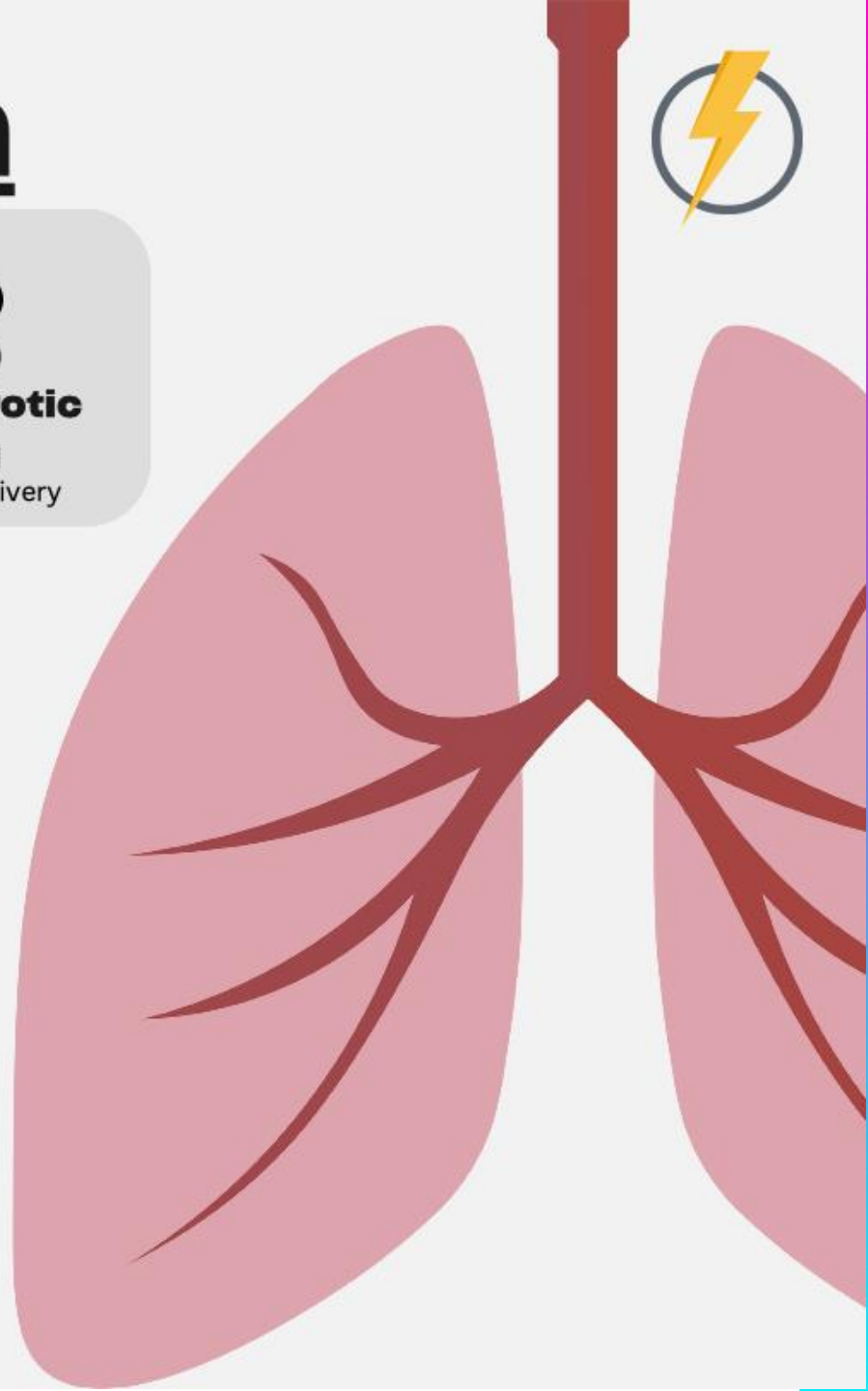


Core:
Delivery of the Anti-fibrotic payload
Taladegib-PLGA Polymeric Solid NP

Inner Core:
Localised Disruption of the Fibrotic ECM
MnO_2 Shell

Outer Core:
Ensuring Stability Until IR-Activation
PGLA-Thioketal Crosslink Shell

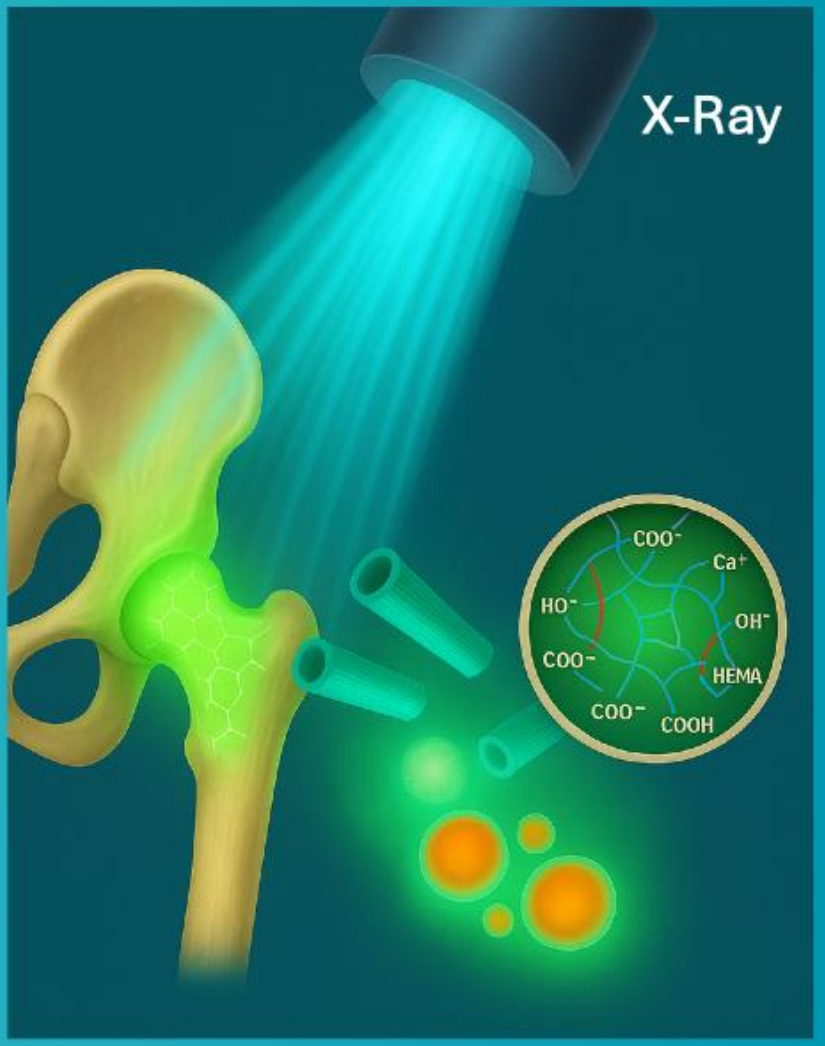
Surface:
Functionalisation
Anti-FAP Aptamer, Zwitterionic Coating, PEG Chain



X-Ray Magic

A new way to glue bones

1. Inject the material
2. Glow with X-Ray
3. Glue the bone

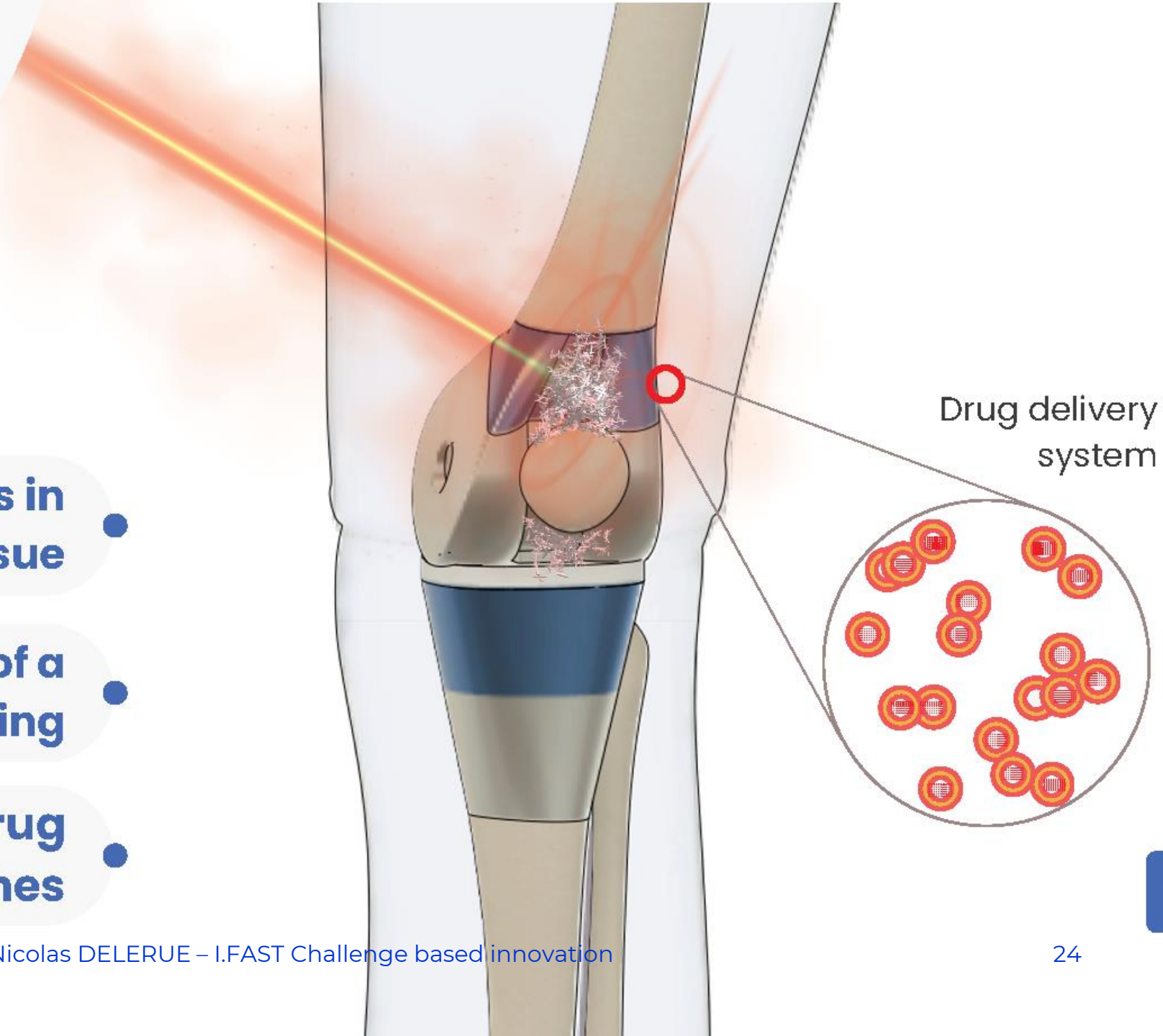


Past projects 2024

Triple functionality of

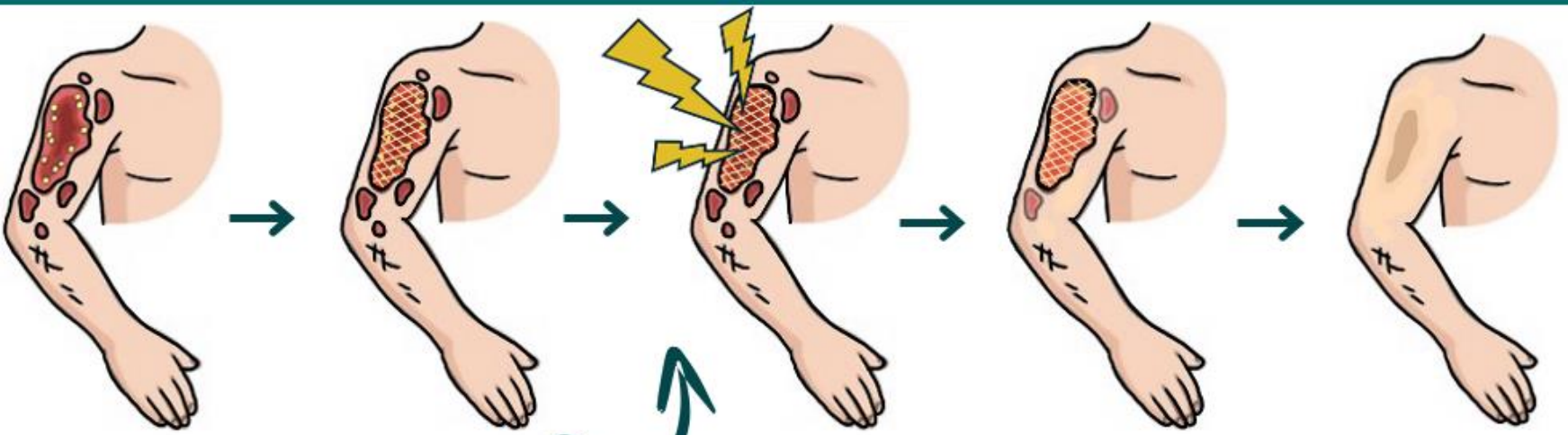
X-rays

- **Inducing apoptosis in the fibrotic tissue**
- **Activation of a degradable coating**
- **Release of a drug from liposomes**



05

Thermo-Relief: C-Arm for Accelerating the Recovery of Severe Burns



X-ray irradiation (40 - 110 kVp)

Low Dose Radiation (< 100mGy)

- ↓ Inflammation
- ↓ Risk of Infection
- ↓ Scarring
- ↑ Boost Immune Response
- — Avoid tissue damage

OctoCure

localization

Hydrogel injection

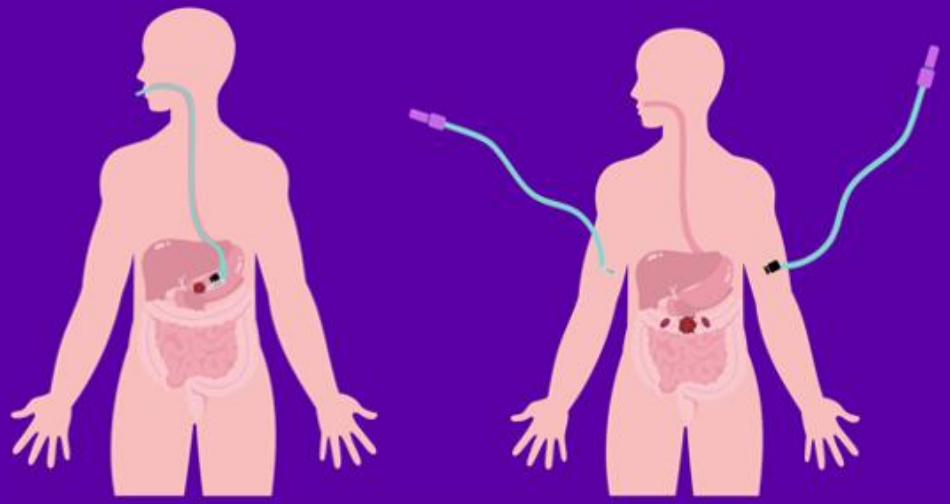
Radiation

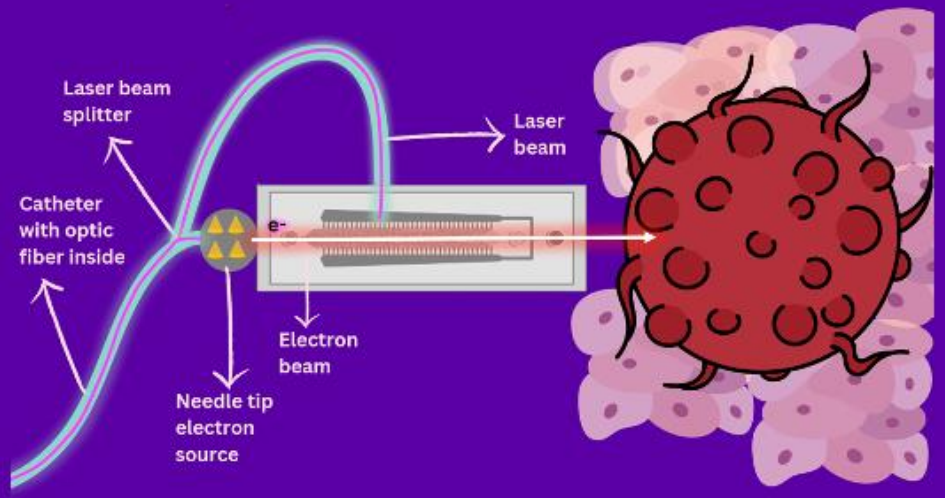
Antibiotics

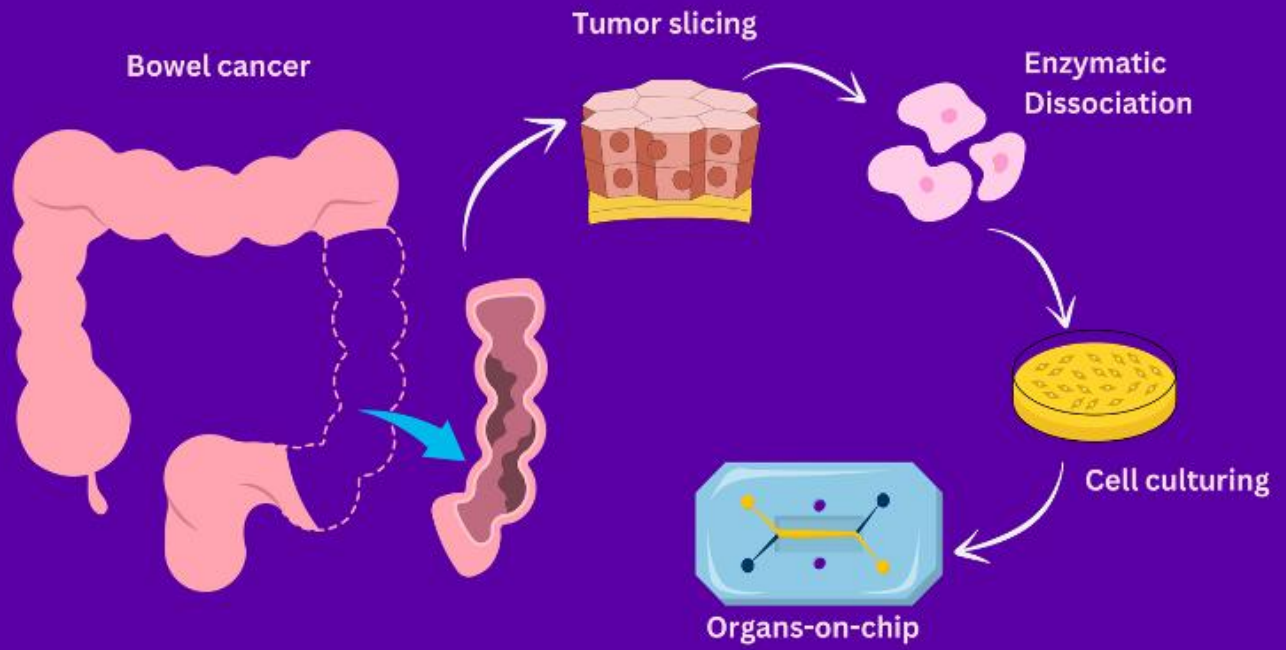
Mortality rates

μ-acc: Let's μ-acc a difference

Source: CERN





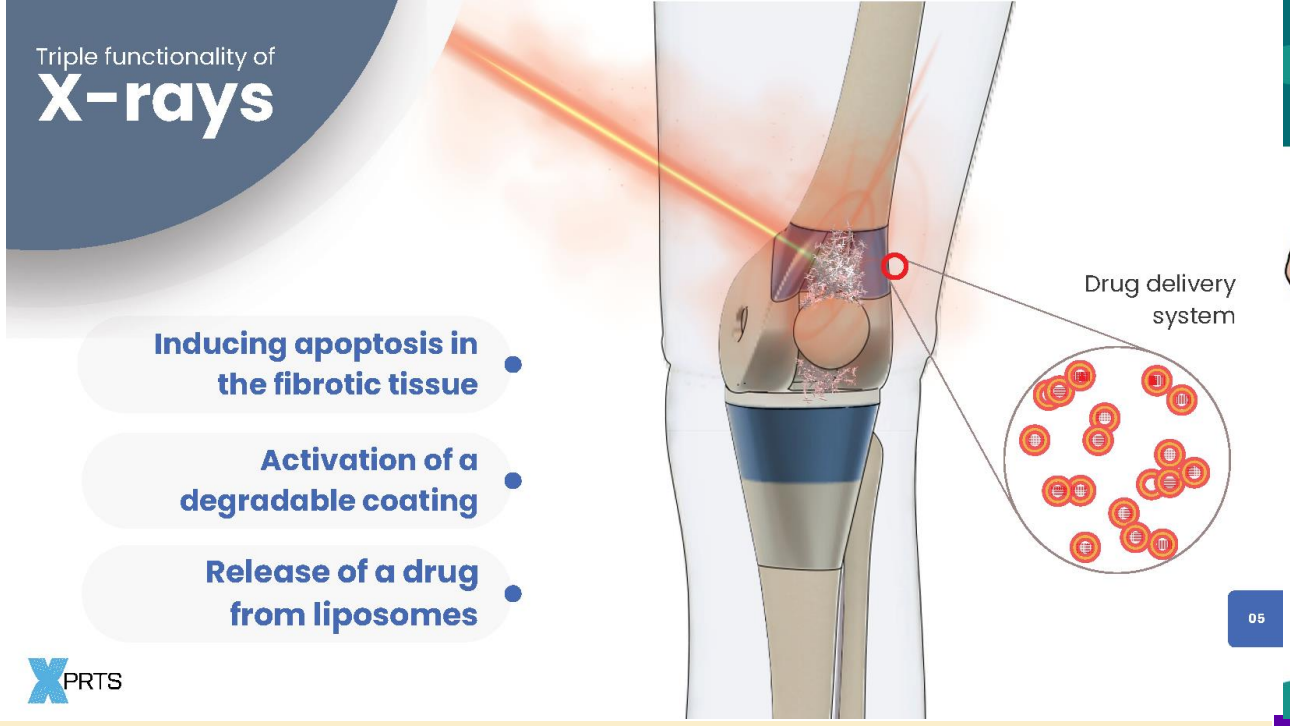


accelerator that would fit in your pocket

making cancer treatment more *robust*, *accessible*, and *effective*

Triple functionality of

X-rays



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XPRTS

05

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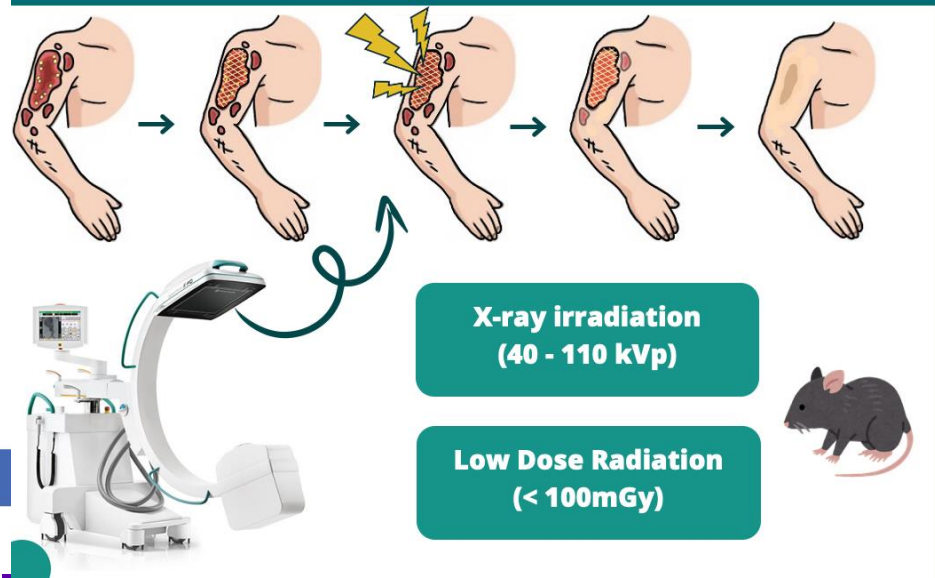

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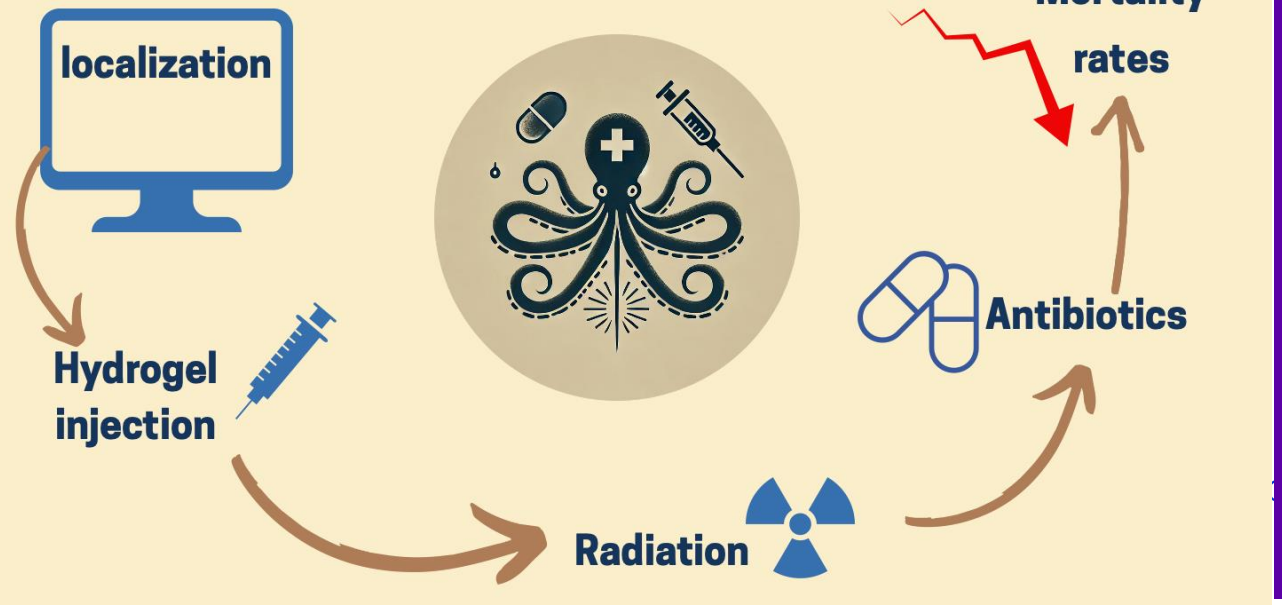
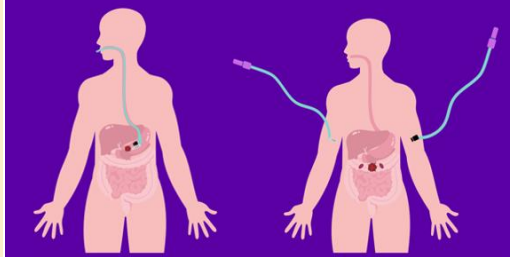
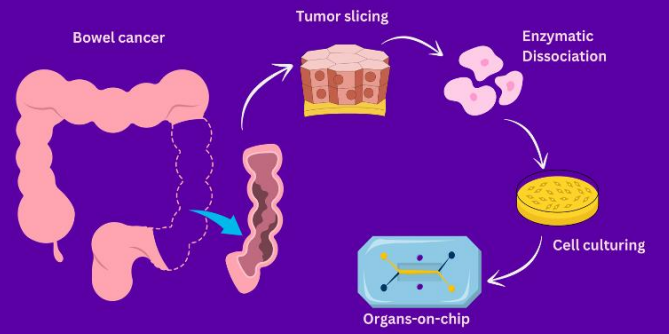
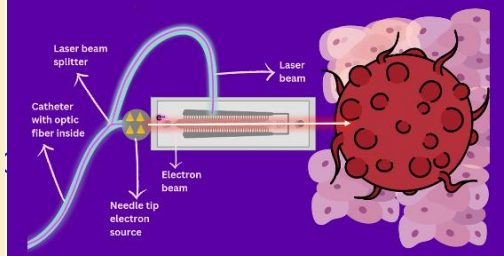
EctoCure



μ-acc: Let's μ-acc a difference







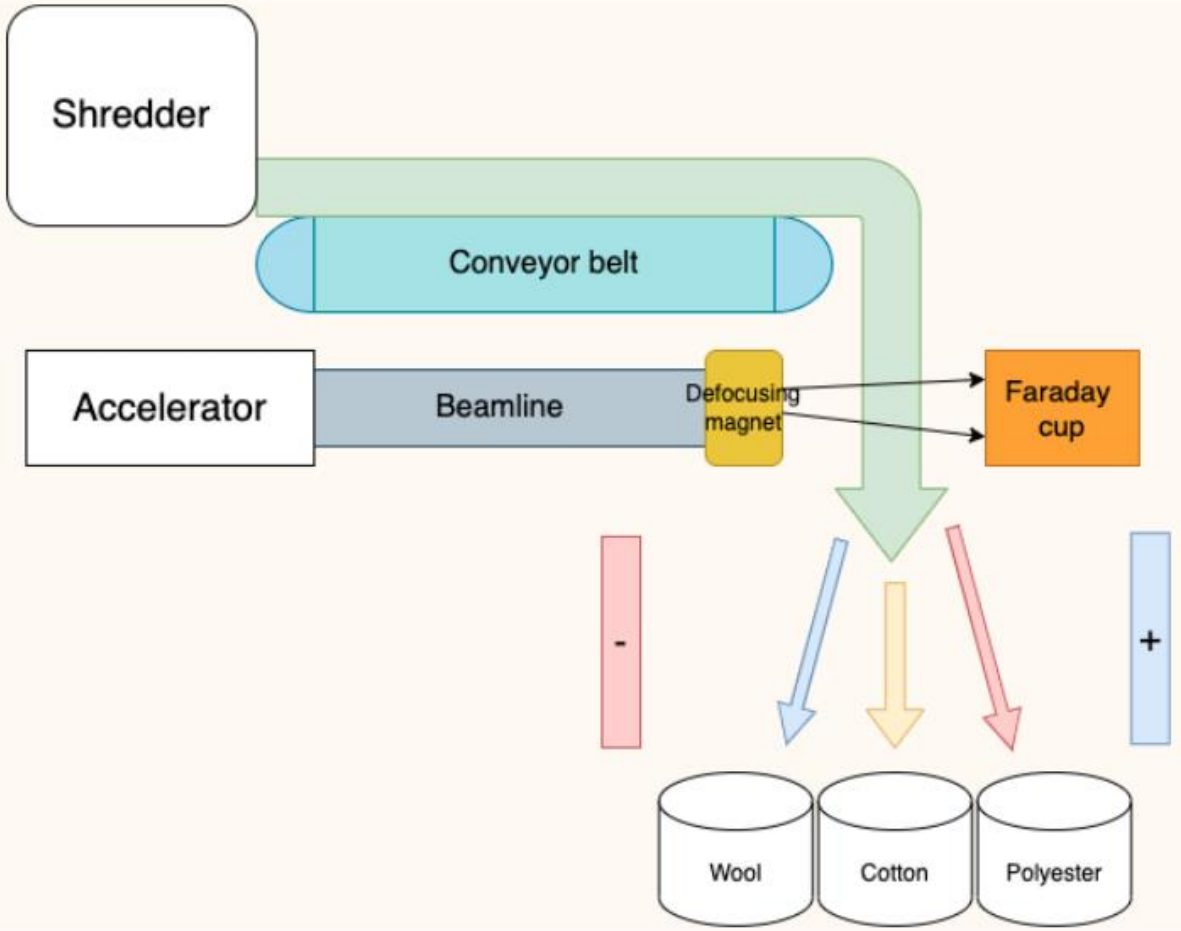
accelerator that would fit in your pocket

making cancer treatment more *robust*, *accessible*, and *effective*

Past projects 2023

Fast fashion recycling with a particle accelerator

THE APPROACH



Invasive plant pollen sterilisation

OUR AMAZING SOLUTION

targeting an invasive plant

sterilisation with a particle accelerator

natural pollination through wind

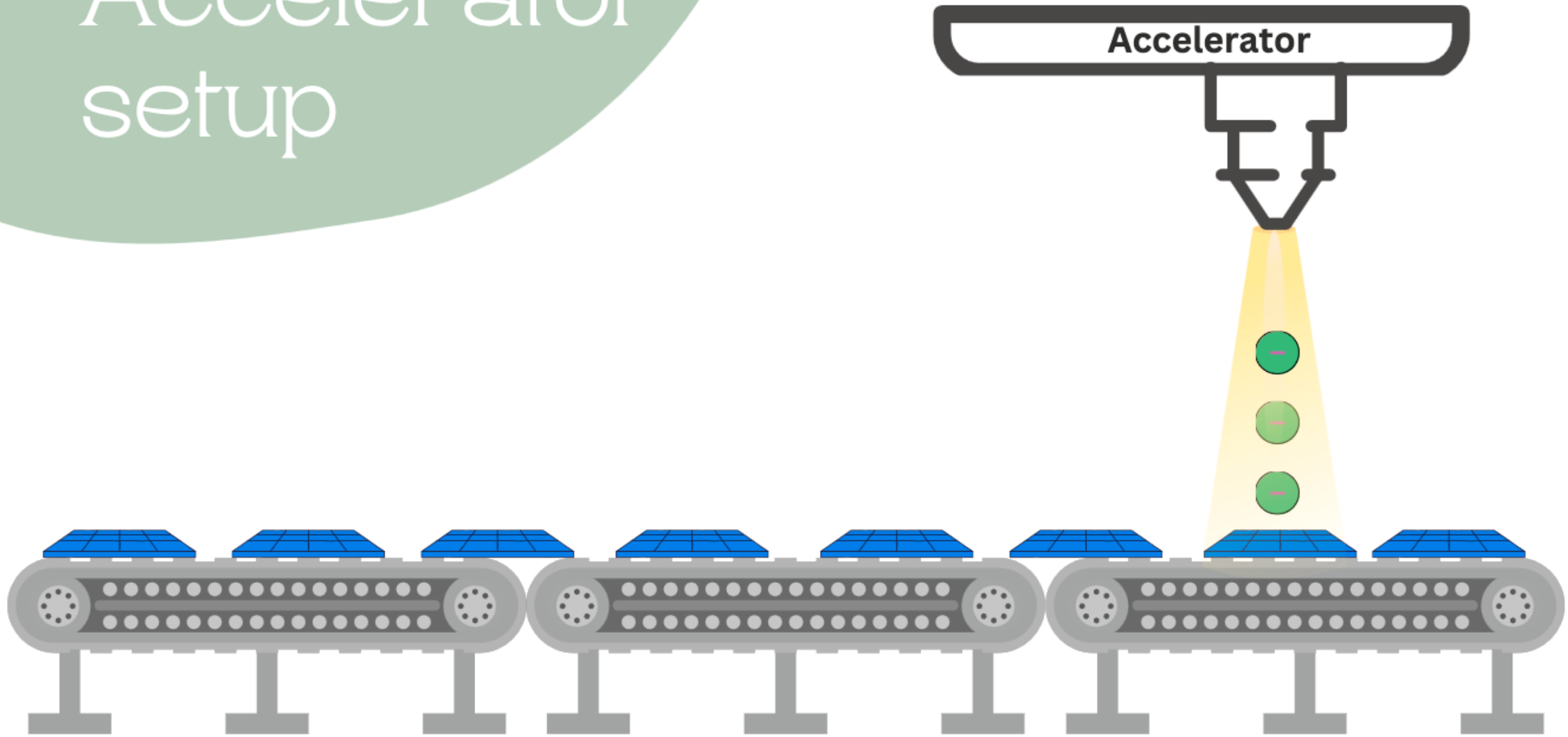
cannot reproduce

+

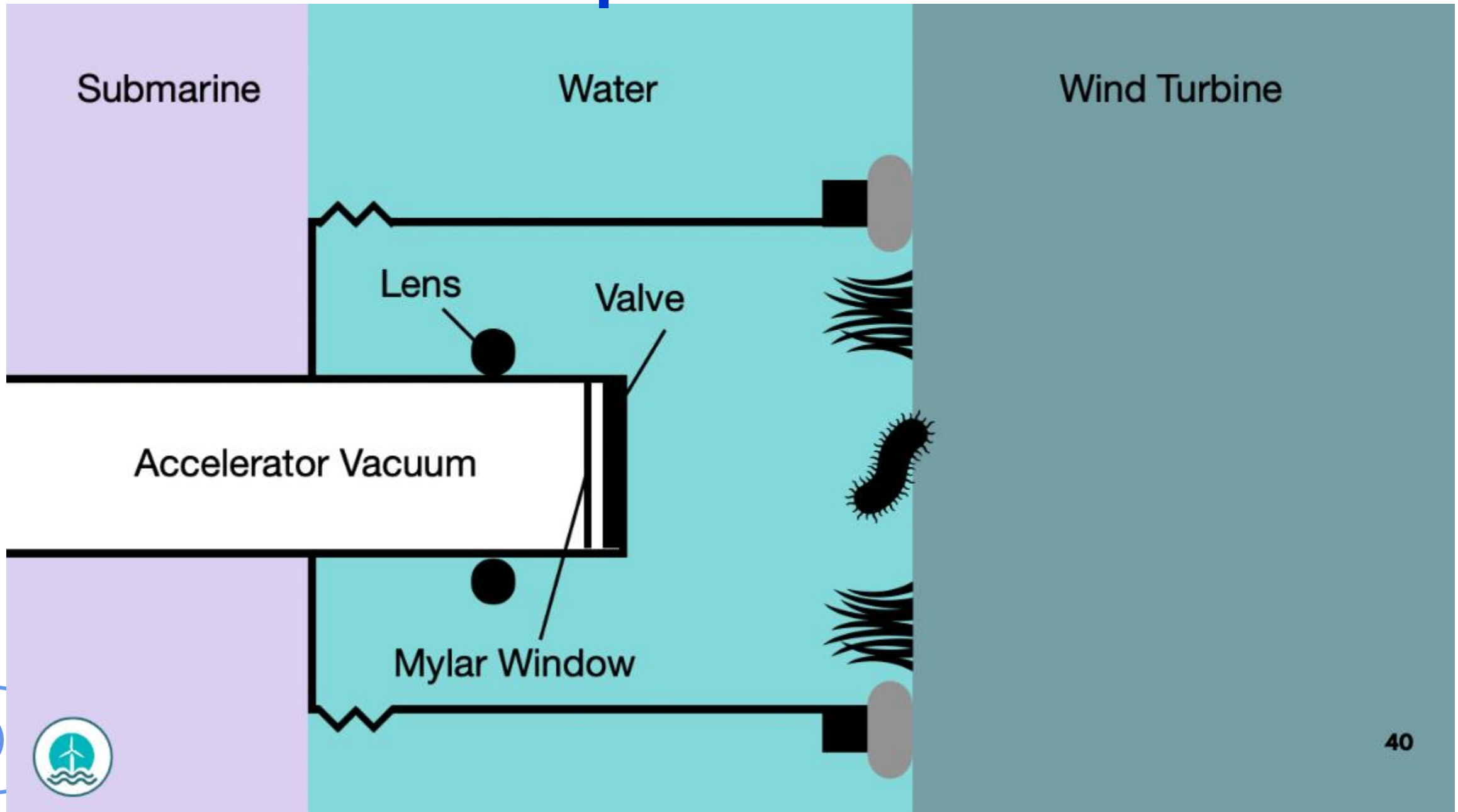
no effects on the surroundings

Glue removal and solar panel recycling

Accelerator setup

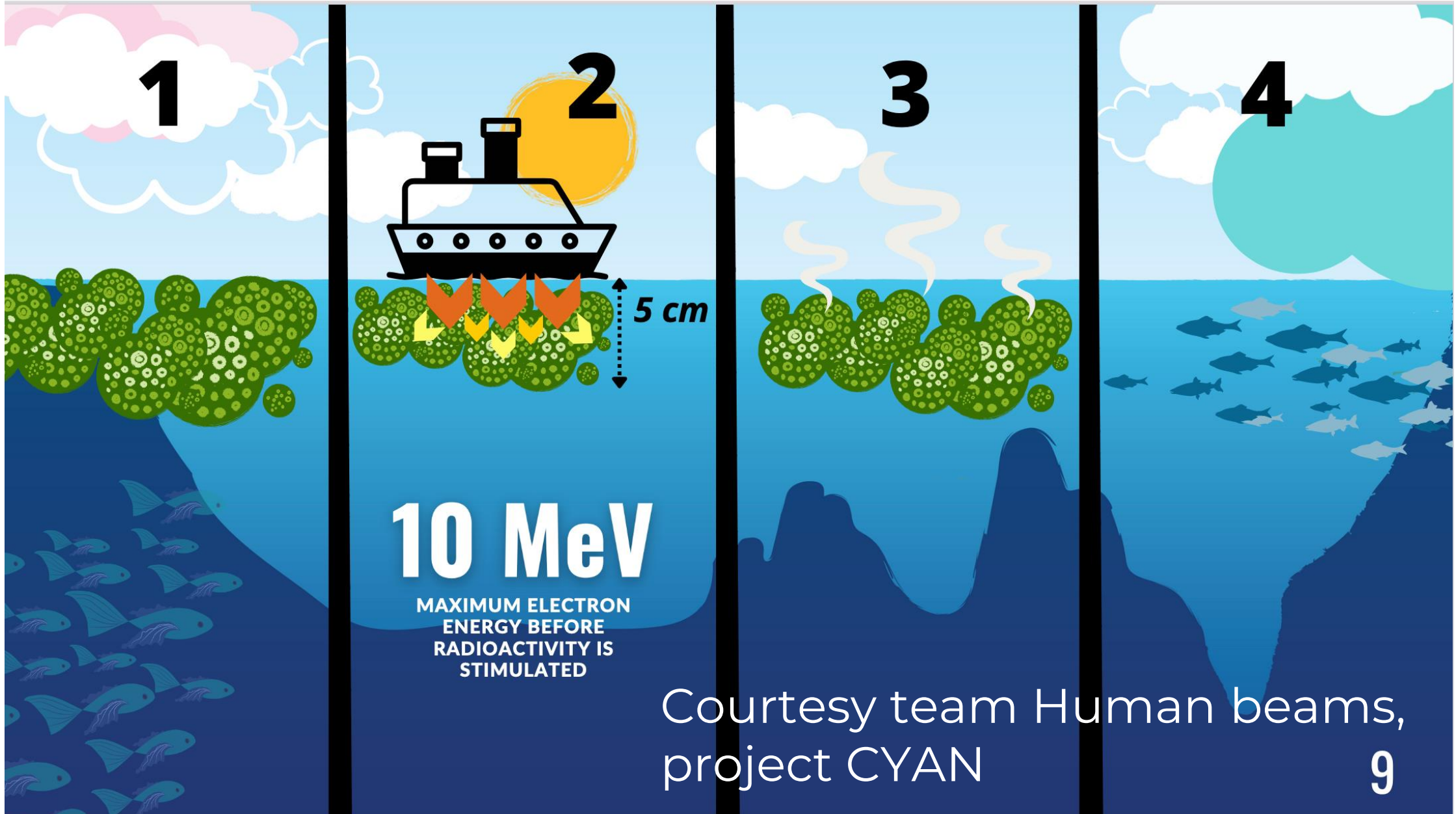


Off-shore wind mills corrosion protection by ion implantation



Past projects 2022

Algal bloom treatment by surface water sterilisation



Courtesy team Human beams, project CYAN

Wind mill blades strengthening

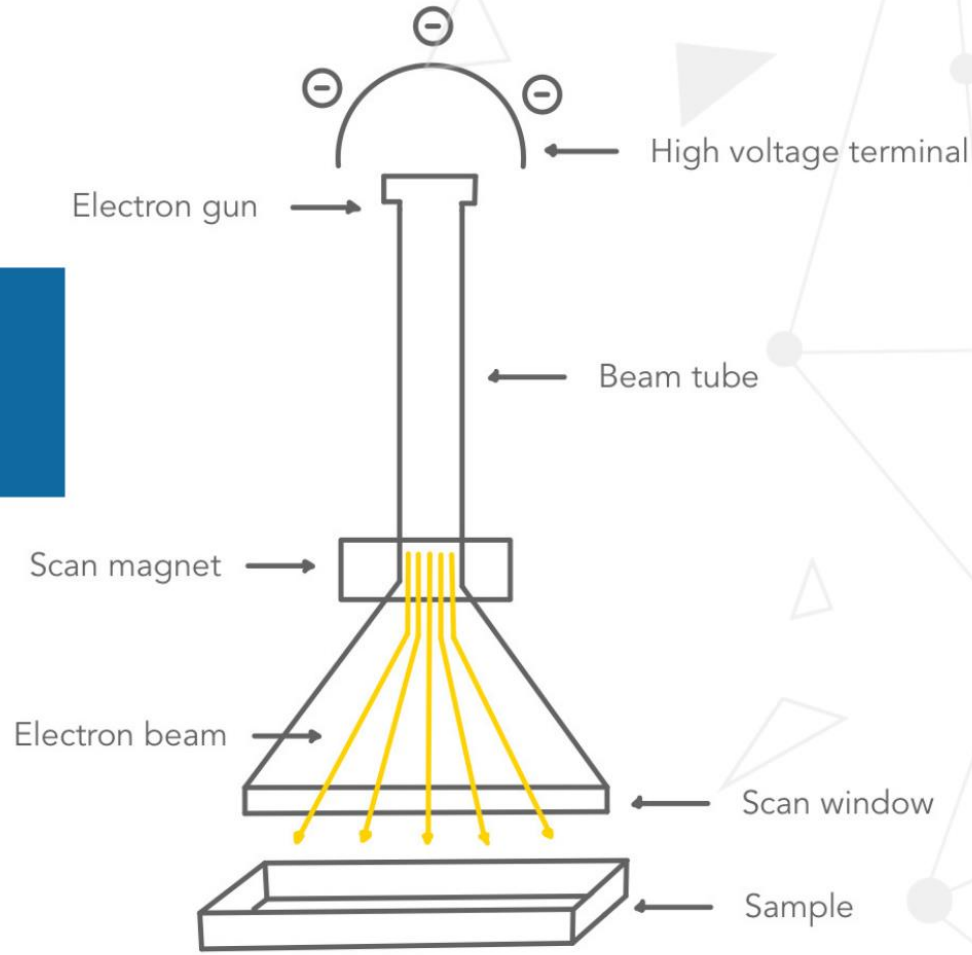
Goal: Functionalisation of CNF with e-beam irradiation

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

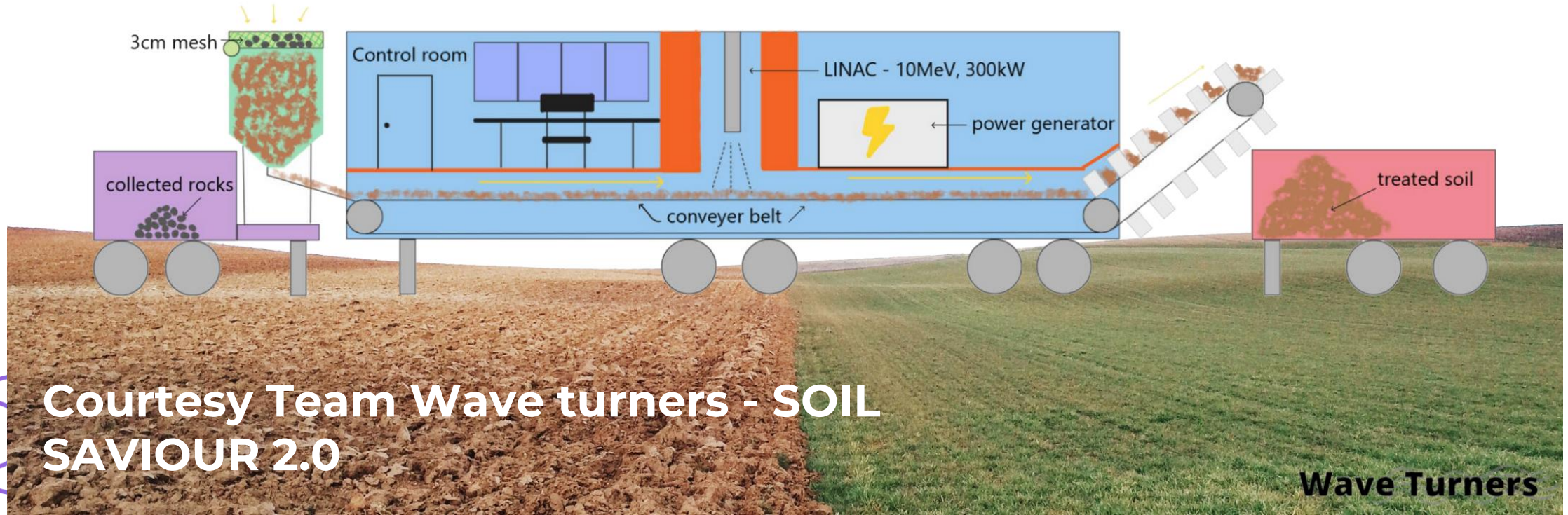
Microplastic studies in oceanic gyres with a compact Compton source on a boat

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

Polluted soils clean up

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

SOIL SAVIOUR 2.0



Courtesy Team Wave turners - SOIL SAVIOUR 2.0