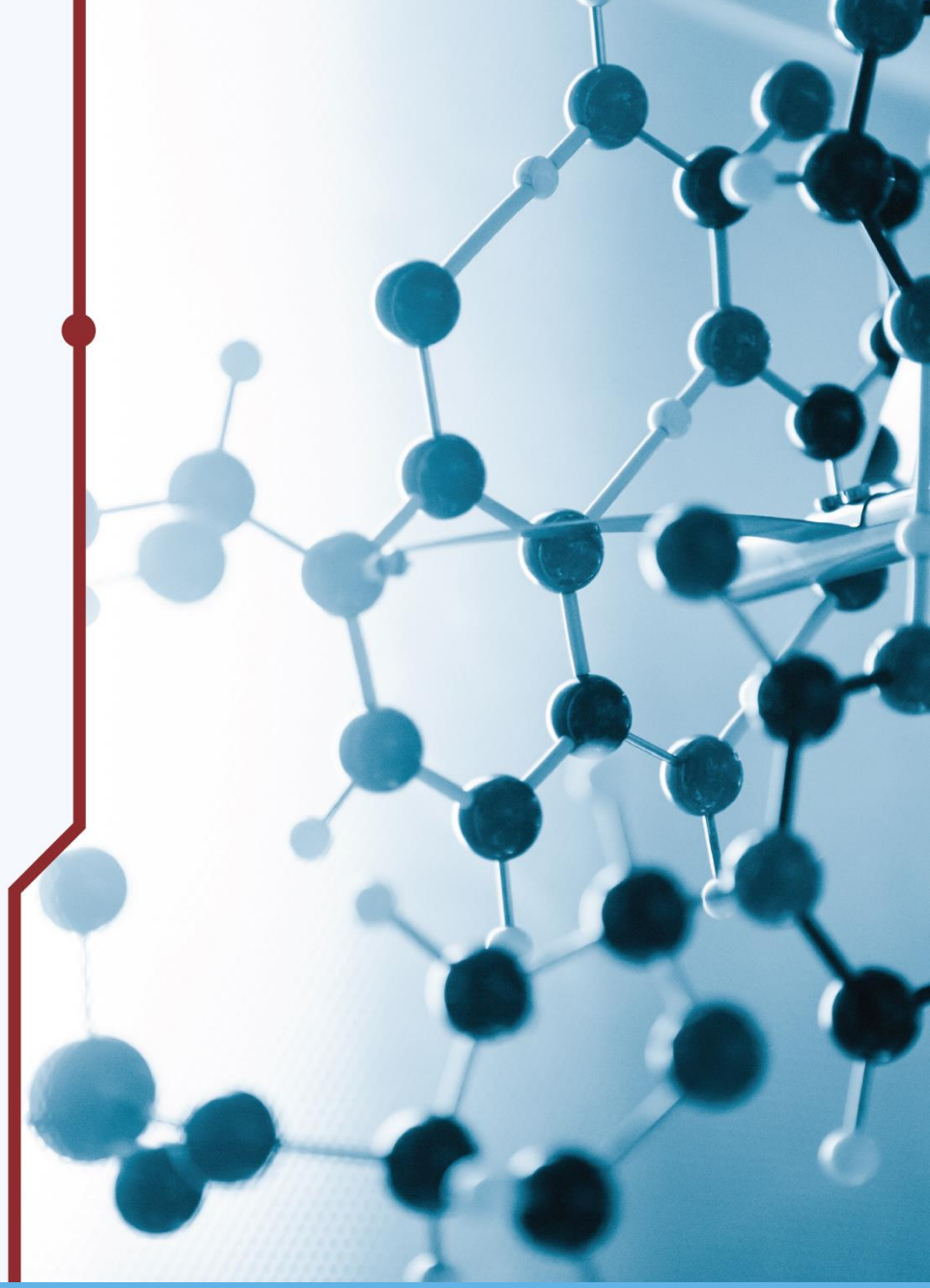
REINFORCE

REsearch INfrastructures FOR Citizens in Europe

Deep Sea Hunters on Zooniverse

Rémy Le Breton

February 26, 2021, 15:20 CET

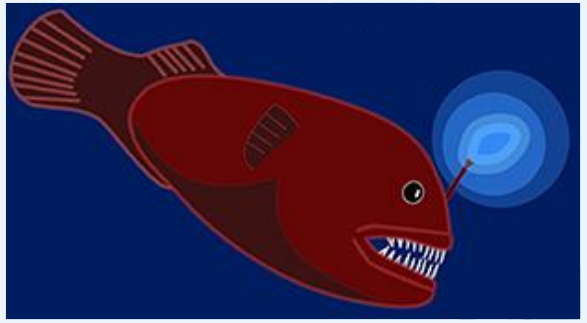


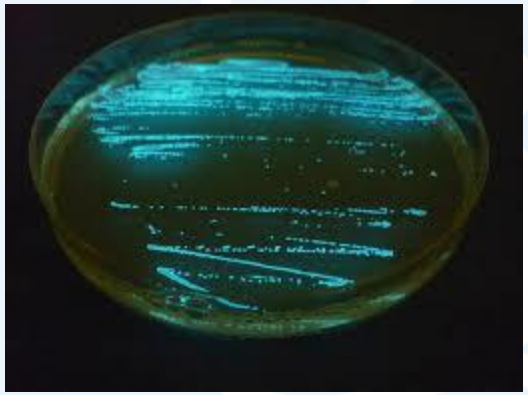
From Gwenhaël's talk you have learned:

- We can detect **light** at the bottom of the sea thanks to KM3NeT's DOM

One KM3NeT DOM (31 PMT)

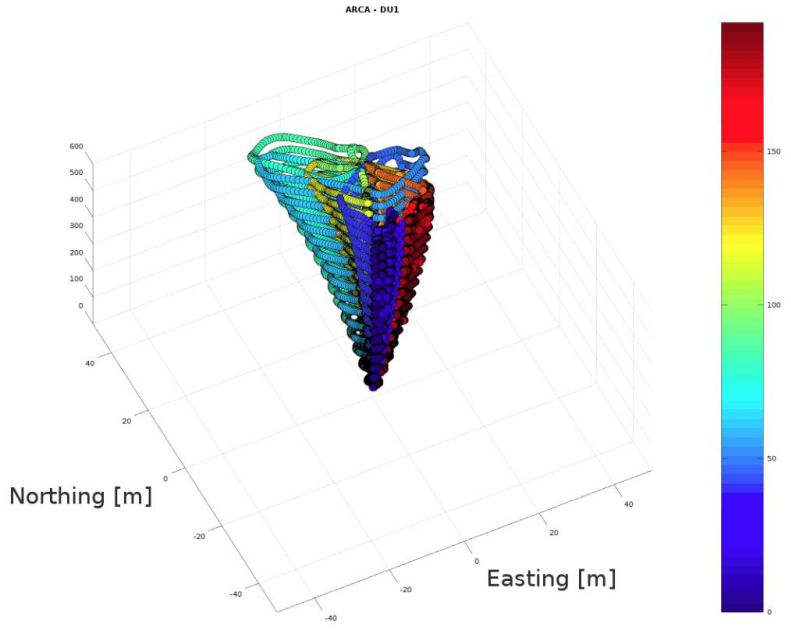
- Any kind of light:
  - Light coming from neutrino interactions of course
  - But also light coming from life forms!
- We can study marine biodiversity with a neutrino telescope!





We can also detect sound! How and why?

- KM3NeT lines moves because of currents at the bottom of the sea
- We want to precisely monitor the positions of all our DOM
- We have installed acoustic emitters and receivers



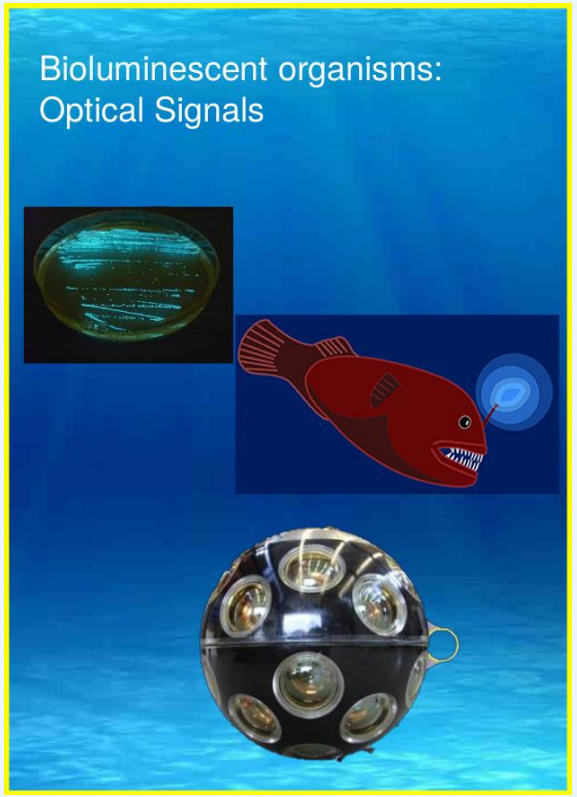
- Acoustic devices? We can detect sounds coming from different origins!
  - In particular from cetaceans!
- We can study sea mammals with a neutrino telescope!

Stripped dolphin

Sperm whale

Two Workflows

Bioluminescence



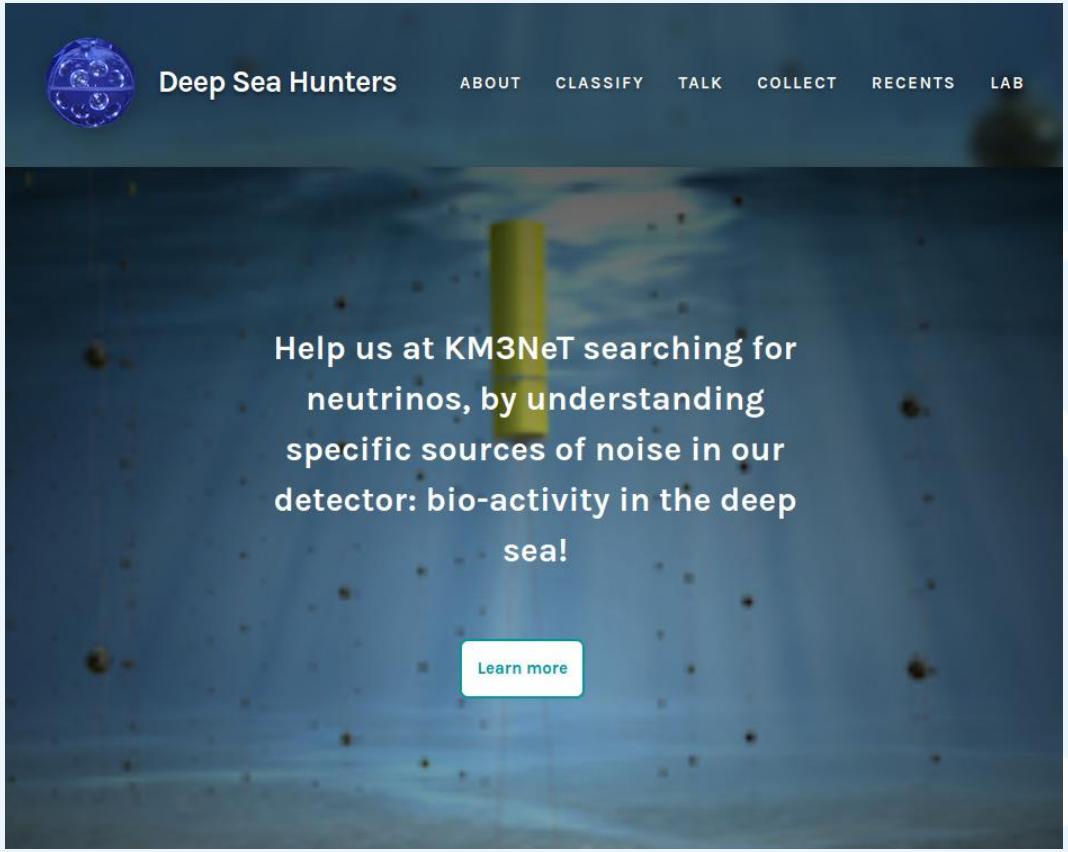
Bioacoustics

- Goal: Getting help from Citizen Scientists to classify the data recorded in KM3NeT

Deep Sea Hunters (WP4) Demonstrator

Live demo

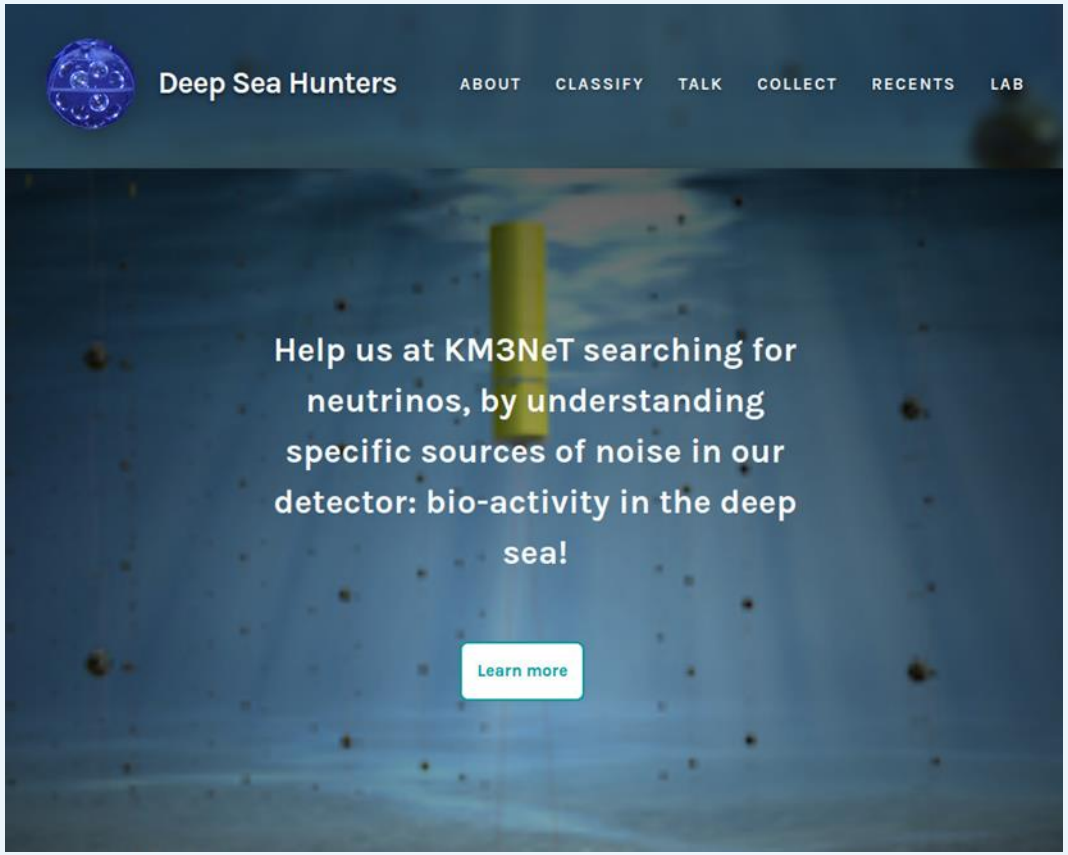
- Zooniverse : https://zooniverse.org
  - Front page
  - Introduction
  - Learn more:
    - Research Tab
    - Team Tab
  - Two workflows:
    - Bioluminescence
    - Bioacoustics



Front page

Live demo

- Access to the current workflows, some statistics about the project and short presentation



Learn more section

Live demo

- Research: main facts of the project and description of the science behind
- The Team: pictures and short description of the members

The Science Behind "Deep Sea Hunters"

The Deep Sea Hunters project takes place in the context of KM3NeT, the KiloMeter Cube Neutrino Telescope. The purpose of this introduction is to give you all the scientific background you need to fully enjoy the classifications you are going to achieve in this project. Why KiloMeter Cube? And Neutri-what? Reading through the following sections, you will be able to understand what is a neutrino, how they are produced, how we can detect them, why we want to observe them and (the most important!) **why we need you**!

The first part of this research tab is dedicated to the main aspects of the Deep Sea Hunters project. In the second part, you will find a lot more details!

Deep Sea Hunters: main facts!

- The Deep Sea Hunter project is related to the **KM3NeT** experiment, a neutrino telescope deployed in the Mediterranean Sea.
- **Neutrinos** are elementary particles extremely difficult to catch. We need huge detectors (at the cubic kilometer scale) to have a better chance to observe them.
- Neutrinos are produced in a lot of different mechanisms, all involving the **weak nuclear force**.
- Neutrinos have a lot of different origins: nuclear reactors on Earth, the Sun, supernovae and lot more.
- Neutrinos are invisible to us. To see them, we record **Cherenkov radiations**.
- The Cherenkov radiation is a kind of shock-wave phenomenon for light, similar to the acoustic shock-wave emitted when an airplane is going faster than the speed of sound.
- The Cherenkov radiation is seen in medium denser than vacuum, that is why KM3NeT is deployed in the seawater.
- The Seawater in the vicinity of our detector is full of life: **bioluminescence** and **marine mammals**.
- Bioluminescence and marine mammal are noises in our detector, **light and acoustic noises** respectively.
- Bioluminescence can be mixed with the Cherenkov radiation we want to detect. Marine mammals emit acoustic signals that can interfere with our acoustic triangulation system.
- Bioluminescence and marine mammals are also marine life that can be studied. **They have never been systematicaly studied in the deep sea.**
- Your classifications of light and acoustics "noises" from marine life will help us to better tuned our detector (for neutrino observations), AND to better understand life in the vicinity of our detector in the deep sea.

The KM3NeT Collaboration has started as an European collaboration, but is now an international collaboration! Each year, new countries are joining us. We are now more than 250 researchers, belonging to 51 institutes and groups. We are located in 41 cities and spread around 15 countries.

In addition to the members displayed on the map, we also have as observers: Algeria, AstroCeNT, Caen, Georgia and The United Arab Emirates.

In the following, you have a brief description of the members of the KM3NeT collaboration who are involved in the Deep Sea Hunters project.

The Deep Sea Hunters team

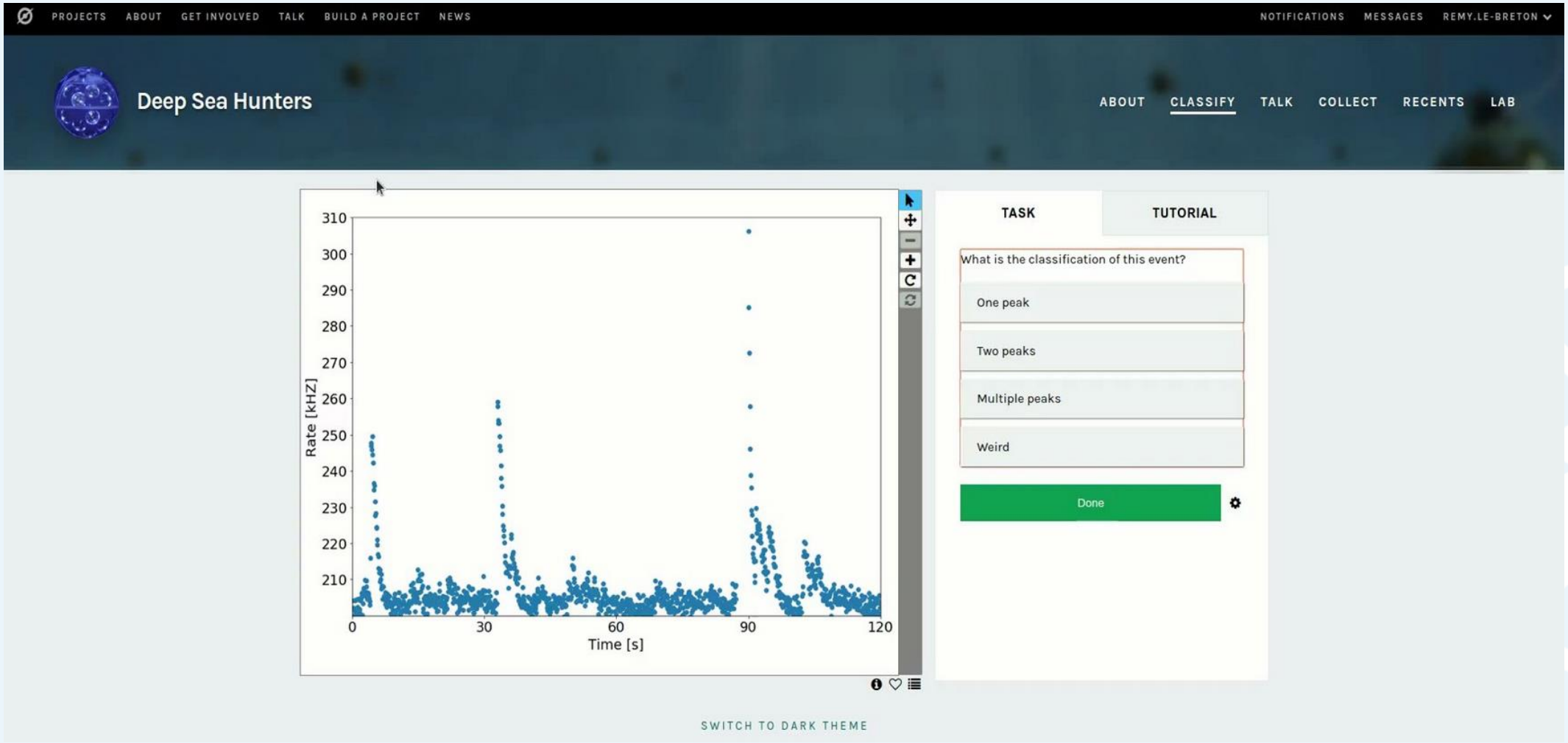
CPPM team

Vincent Bertin (High Energy Physics Researcher): *Instrumentation, Positioning calibration, Acoustics*

I am a CNRS researcher. After participating to two particle physics experiments at CERN, I have been involved in the neutrino detection in the deep sea for the last 25 years, first with the ANTARES neutrino telescope and then with KM3NeT. Thanks to these gigantic detectors, we can do a lot of exciting physics from multi-messenger astronomy to studies of the neutrino fundamental properties, and I have particular interest in the search for the still mysterious Dark Matter. I am also strongly involved in the acoustic positioning systems of the detectors, that we use to reconstruct in real time their geometry with few centimetres accuracy, and to multidisciplinary studies which very important to understand our detection medium. We warmly thank your participation to this project to help us characterize our backgrounds and the diversity in the deep sea !

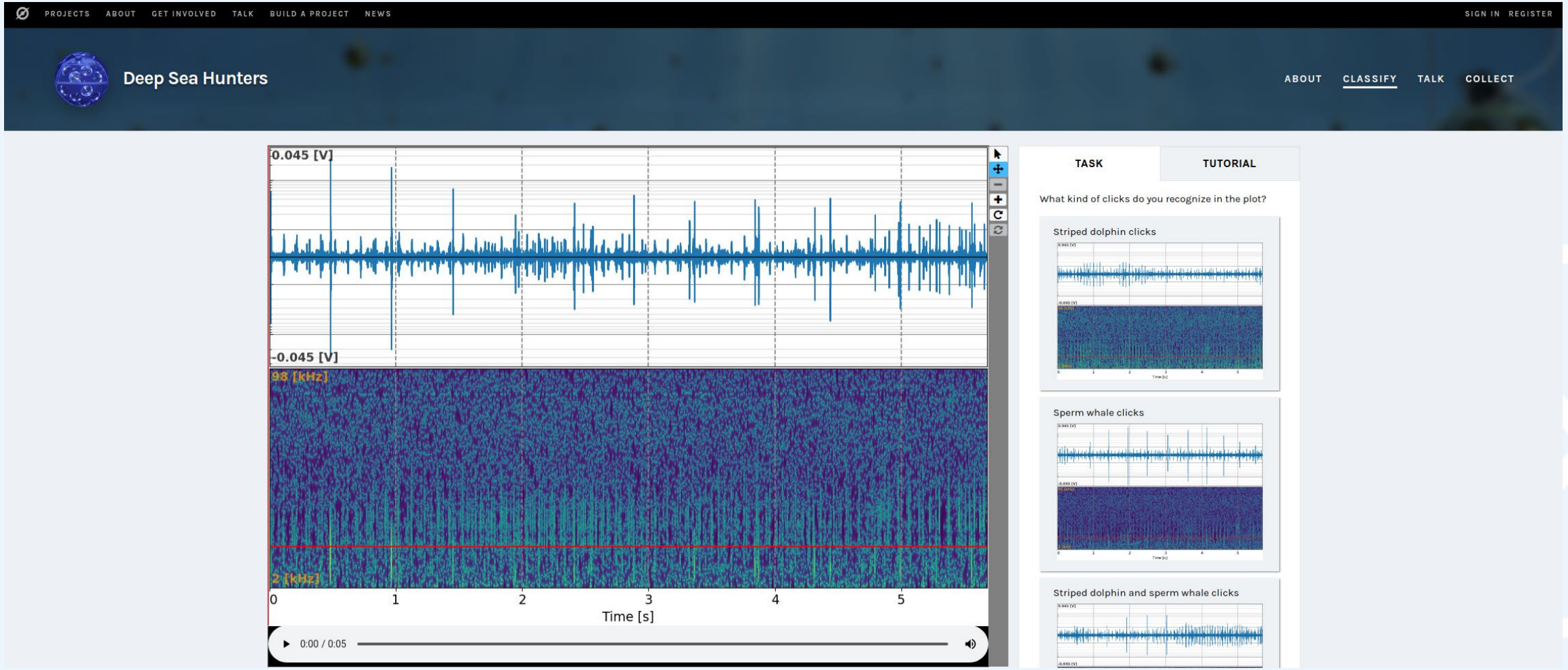
Bioluminescence Workflow

Live demo



Bioacoustics Workflow

Live demo



Conclusion

- Demonstrator not public yet, stay tuned!
  - Don't hesitate to subscribe to REINFORCE newsletter: https://reinforceeu.eu/newsletter
- Thanks to discussions with experts, we are improving the activities:
  - Séverine Martini, bioluminescence
  - Hervé Glotin, bioacoustics
- We will add new activities/workflows to the demonstrator!

Thanks!

REINFORCE

REsearch INfrastructures FOR Citizens in Europe

Join our community

www.reinforceeu.eu

company/reinforceeu

@ReinforceEU