



# Machine Learning in GW search: g2net next challenges

EGO, 28-30 September 2022



**COST ACTION CA17137**  
A NETWORK FOR GRAVITATIONAL  
WAVES, GEOPHYSICS AND  
MACHINE LEARNING

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Action Chair <https://www.cost.eu/actions/CA17137>



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# G2net: The dream of mixing the communities

1ST INTERDISCIPLINARY  
WORKSHOP @EGO

1ST COST PROPOSAL  
PREPARATION

October 2012

**Theory and applications of signal processing methods in GW detection, medical science and engineering**  
EGO/Virgo Site Cascina (Pisa) October 15th-17th

- Same signal processing techniques in different scientific fields (GW community, Medical science, Engineering, Telecommunications).
- Exchange of ideas and new techniques among scientists with different backgrounds.
- For young researchers, PhD students and anyone interested in signal processing.

**Lectures by**  
L. Barletta  
G. Debraezzen  
A. Chincarini  
F. Gini  
M.S. Greco  
S. Klimenko  
M. Magarini  
I. Pinto  
A. Spalvieri

Please register at  
<https://events.ego-gw.it/indico/conferenceDisplay.py?confId=...>

Organizer: Elena Cuoco  
Local scientific committee: F. Ferrini, M. Punturo, M. Tocco  
Secretariat: V. Colautti, S. Perus  
Technical support: S. Cortese, G. Di Biase

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 EGO  
FUNDATA  
L'ASSISTENZA AL  
DESVIAMENTO

January 2017

Virtual Data Science Institute  
Project Proposal  
(Draft: January 15, 2017)

**I. INITIAL SITUATION**

Extracting knowledge from datasets through techniques drawn from mathematics, information science, or computer science is the driving motivation of the interdisciplinary field of Data Science. At present, an ever stronger interest in Machine Learning, Deep Learning, classification problems, data mining and visualization and, in general, in the development of new techniques and algorithms for efficiently handling the complex and massive datasets found in what has been named "Big Data", is constantly increasing in different fields of research, from Social Sciences to Natural Sciences with little to none reverse. Interactions among small groups and collaborations already exist (e.g. [1, 2]) but no clear organizational setup of a working group on interdisciplinary data-driven problems has yet been established within the gravitational-wave community, with some exception of groups as LIGO.

**II. PROJECT OBJECTIVE**

The main objective of our proposal is to establish an international Virtual Data Science Institute (VDSI) to facilitate the tight collaboration among a number of European research groups including universities and research institutes, on intensive, data-driven, interdisciplinary projects. It is envisaged that such a collaboration will lead to dynamic working activities, the formation and exchange of young scientists and students, the advancement of researchers, and to coordinated activities for funding requests which are linked to data-intensive projects of common interest to the proposal partners. The collaboration will be based on open-science<sup>1</sup> produced and collected by the different institutions involved in the proposal.

**III. POSSIBLE APPROACHES**

It is manifest that adopting an interdisciplinary approach for data-science problems has a number of advantages to other, more traditional, approaches.

- Small individual groups are, in general, less competitive than large collaborations and, in this rapidly-evolving field, they may not be aligned with the most recent techniques for data analysis.
- The choice of a minimal approach focused on a single data-analysis topic<sup>2</sup>, gravitational-waveform extraction, would not allow a given group (small or large) to benefit from the diversity of different approaches used in other fields of research.
- The choice of an intermediate approach based on a multi-disciplinary, single-institution collection of institutions may be less competitive for successful funding requests.

From these considerations, the most advantageous choice is that comprising a critical mass of international institutions with multiple expertise in different fields of data-science research. This will create an environment where young researchers and students can be trained.

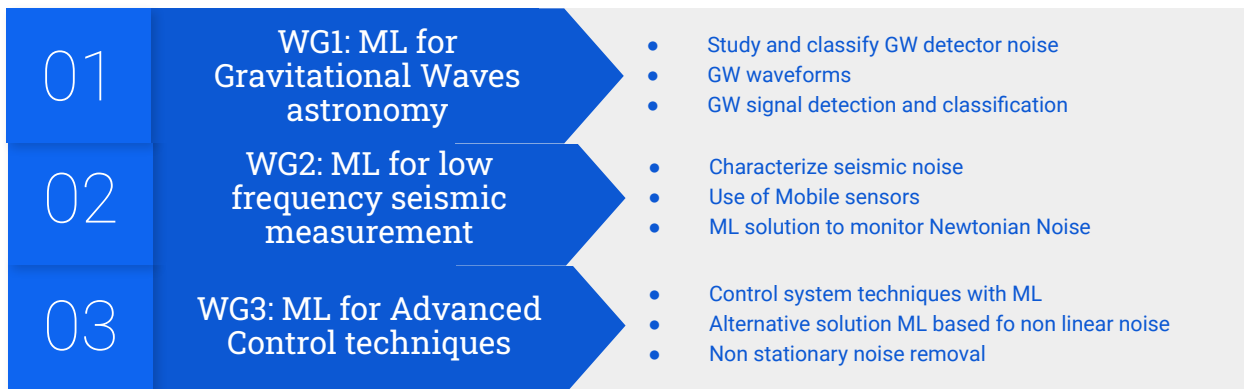
<sup>1</sup> Only open access data from GW community can be used





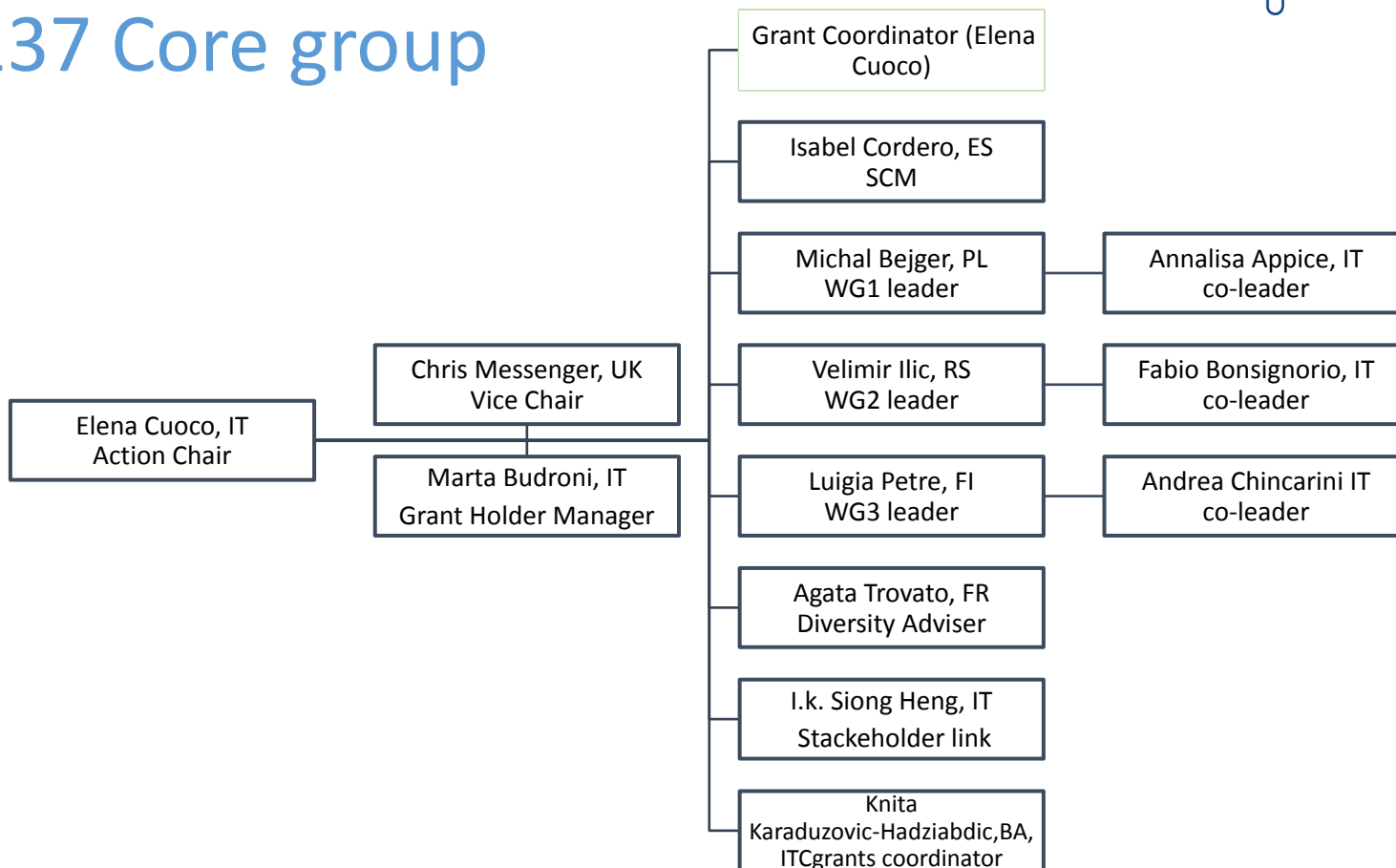
# CA17137 main activities

*We started on October 18th 2018*



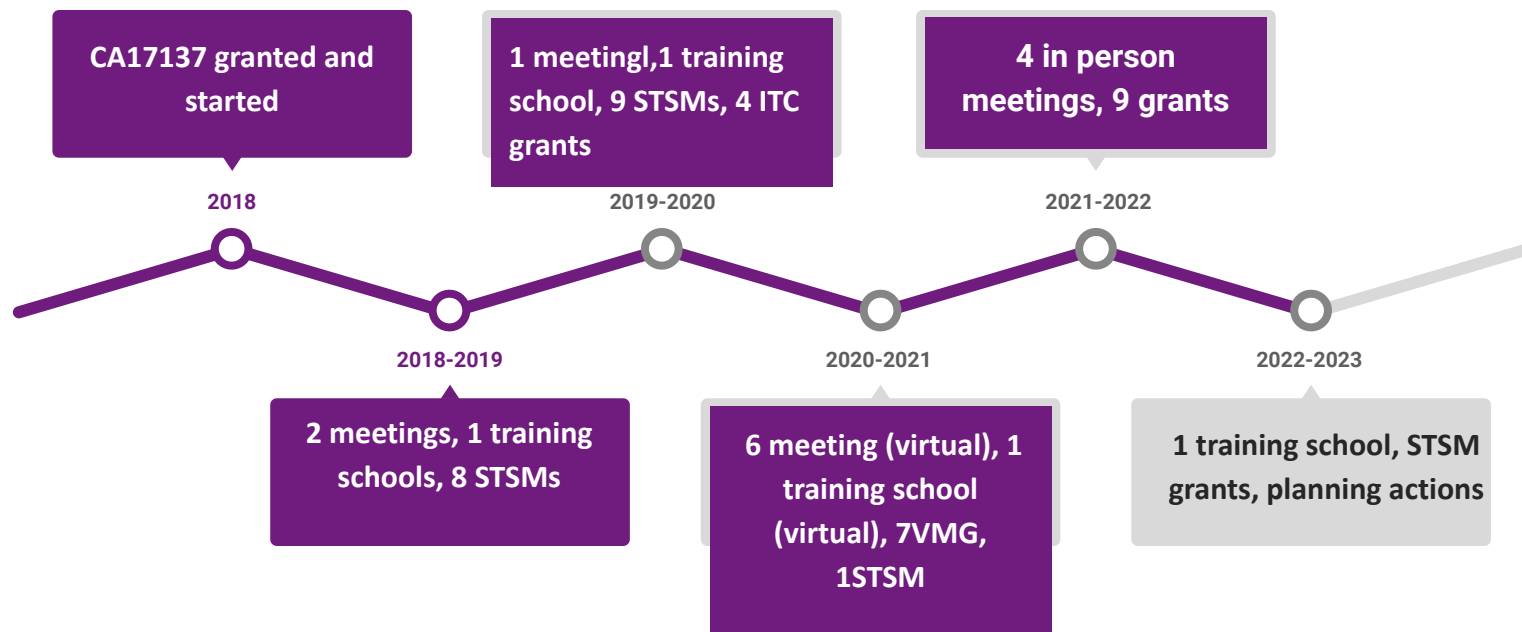


# CA17137 Core group





# A network for GW, Geophysics and Machine Learning





# Goals achieved (POV from action chair)

- **Built a network, a working core group, and strong team**
- **Consolidated more and more the activities about Machine Learning application and Gravitational wave search**
- **Started building teams and works around Machine learning for control system and mobile sensors**
- **Trained many young researchers. Many of them participate as speakers**
- **Involved more and more young students**
- **Proud to see big interest in continuing this collaboration and g2net working groups!**





# Agenda and time table

- ❖ We have 4 brilliant invited speakers (2 in presence and 2 remote talks)
- ❖ Almost 20 contributed talks
- ❖ Space for open discussion after each session
- ❖ Virgo Tour and G2net movie projections...
- ❖ Future challenges for G2net collaboration