Einstein Telescope Mock Data Challenge

ET: Scienza e Tecnologia in Italia, Assisi, 20-23 February 2024

Elena Cuoco

European Gravitational Observatory

ET-0036A-24

2/20/2024, Elena Cuoco

ET-0036A-24

Why ET MDC

Training on simulated data to test methods and pipelines
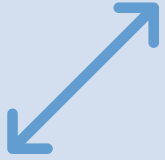
Find out the limitations of current methods

Encourage the community to develop new tools

Provide a common dataset for comparison of analysis methods

Assess the science potential with ET

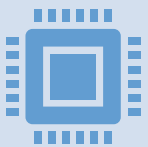Assess the requirements for computing infrastructure

What's in the ET MDC

Series of MDCs with increasing complexity

First MDC with Gaussian coloured noise and a cosmological population of CBCs (more details in the next slide)

Next MDCs with all type of sources, glitches, correlated noise (need to be implemented in the simulation code)

First ET MDC

1 month duration

→

Gaussian colored noise (ET-D 10 km, fMin=5Hz), triangle

Tania Regimbau, Thomas Dent, Walter Del Pozzo, Stefanos Giampanis, Tjonnie G. F. Li, Craig Robinson, Chris Van Den Broeck, Duncan Meacher, Carl Rodriguez, B. S. Sathyaprakash, and Katarzyna Wójcik
Phys. Rev. D **86**, 122001 – Published 3 December 2012

↓

CBC Waveforms: IMRPhenomXPHM for BBHs and BHNSs, and IMRPhenomPv2 with tidal effects NRTidalv2_V for BNSs.

←

Population of BBHs (10%), BNSs (87%) and NSBHs (3%) (see CoBA) with isotropic distribution in the sky.

Some Statistics about the injected signals

SNR>8: 11551 BNSs , 537 BHNSs, 6119 BBHs,

SNR>12: 4048 BNSs , 238 BHNSs, 5228 BBHs
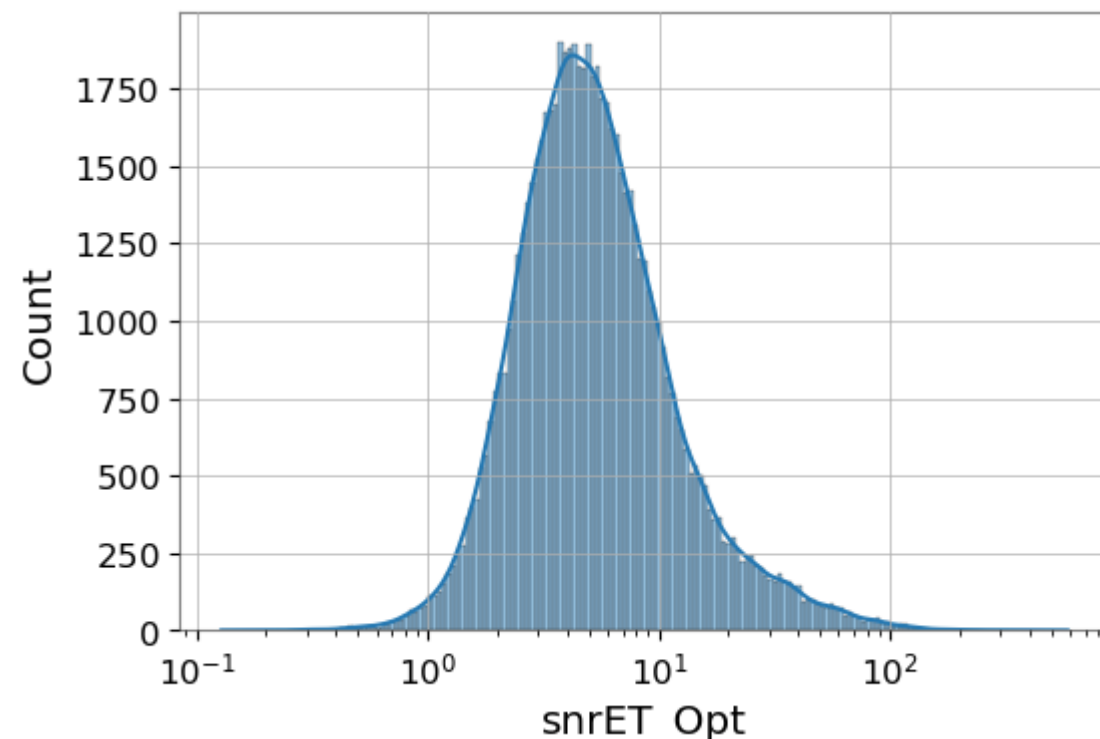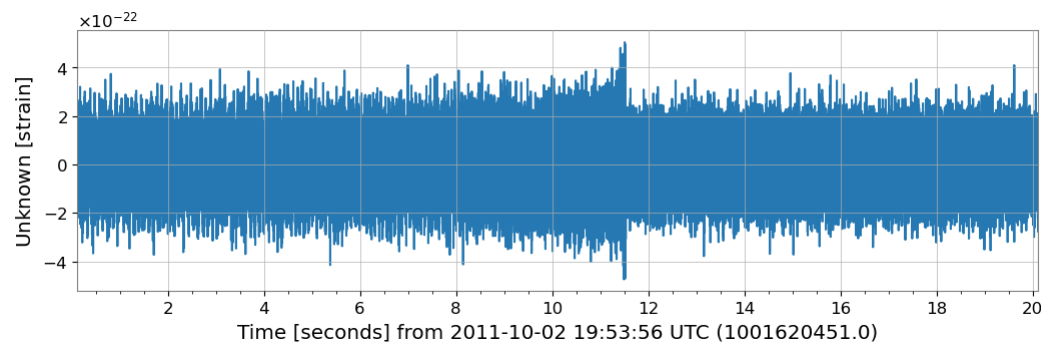
Challenges

Beginner

- Recovery of high-SNR signals within given time windows SNR = 597, 386, 383 (BNS), 374, 343, 306

Expert

- Parameter estimation of ultra-high SNR BBH signals
- Long duration binary neutron stars
- Overlapping signals

The Data

- /cvmfs/et-gw.osgstorage.org/et-gw/PUBLIC/MDC1

- Instructions here: https://wiki.et-gw.eu/EIB/SoftwareFrameworks/WebHome?validation key=e2698d03b6eff5856cfab4654d3fbfe5

- Frame files for E1, E2, E3 and E0 (set 0: noise only, set 1: noise+GWs)

- 1300 frames per detector of length 2048s and sampling rate 8192 Hz (1.3 TB) + frames for Cosmic Explorer, CEA and CEB

- Text files with lists with the source parameters and expected SNR

CernVM File System (CVMFS)

- The CernVM File System (CernVM-FS) provides a scalable, reliable and low- maintenance software distribution service…https://cvmfs.readthedocs.io/en/stable/

- If installed in your environment you can easily access the data as they were on local disks

- ESCAPE Data Lake

- ESCAPE AAI

The jupyter Environment

- The ESCAPE Virtual Research Environment
  - https://jhub-vre.cern.ch/

- We will find the data under the path /cvmfs/et-gw.osgstorage.org/et-gw/PUBLIC/MDC1

- You can find the notebooks at the github repo:
  - https://github.com/elenacuoco/ET-MDC-Tutorials

Notebooks

Read and Plot the Data	Estimate the Power Spectral Density	Whiten the data	Transform the data in Time-Frequency domain	Brief example of Matched Filter Application