

Overview: Division 10 – Data Analysis Platform

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(for the chairs of Div10: Elena Cuoco, Gianluca Guidi, Tania Regimbau)

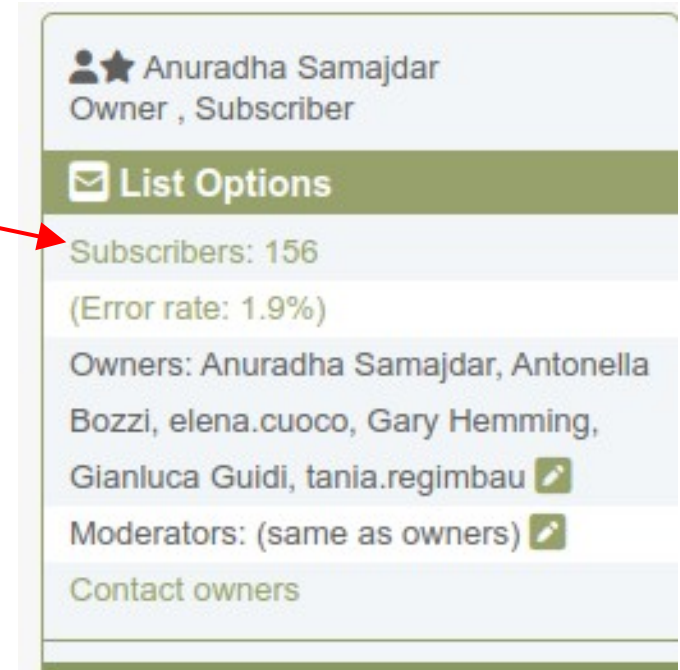
Goals of Division 10

- Data analysis methods for LVK network in place.
- Some problems arise when moving to 3G era:
 - Longer signals (hours to days)
 - Overlapping signals
 - Rising computational costs; very likely need not just faster but newer methodologies
 - Noise characterisation
 - Others?

Identify drawbacks of current methods and develop a common infrastructure to tackle this

Overview and goals

- Members
- Biweekly calls; additionally biweekly chairs-only calls
- Generating the Mock Data Challenge (MDC) (mainly, Tania...)
- Aim: use available and newly developed search and inference codes to use the MDC and infer parameters.
- First version already available, in use by several groups...
- ***Finding synergies with other divisions***



The screenshot shows a user profile for Anuradha Samajdar, who is an Owner and Subscriber. Below the profile name is a green bar with a white envelope icon and the text 'List Options'. Underneath this bar, the text 'Subscribers: 156' is displayed in a light blue background. A red arrow points from the word 'Members' in the list on the left to this 'Subscribers: 156' line. Below this, the text '(Error rate: 1.9%)' is shown. Further down, the 'Owners' list includes Anuradha Samajdar, Antonella Bozzi, elena.cuoco, Gary Hemming, and Gianluca Guidi, with a green edit icon next to the last name. The 'Moderators' list is '(same as owners)' with a green edit icon. At the bottom, there is a link 'Contact owners'.

MDC related analyses in progress...

The following is a table with the details of groups working on ET DA within obs-da div 10. Please indicate if you are running on MDC1 in the remarks :

Group	Expertise level	Brief explanation of aims	Software used	Contact person	Remarks
Utrecht University	Experts	Parameter estimation (automated classifier for telling number of overlapped signals), joint parameter estimation, Searches (template bank versus global optimisers, null stream background), Machine-learning	PyCBC , other software developed in UU...	Bhooshan Gadre, Thibau Wouters, Harsh Narola, Justin Janquart, Anuradha Samajdar,	MDC1
ICCUB	Medium	PE, searches	cWB, PyCBC	Tomas Andrade, Pablo barneo, Ruxandra Bondarescu	MDC1
University of Geneva	Beginners	CBC signals, early-inspiral regime	Not final, machine-learning related	Carlos Moreno Martinez, Sarah Baimukhametova, Steven Schramm	MDC1
JCLab	Experts	Test existing searches based on PySTAMPAS and PyCBC ; develop template banks for CBC searches	PySTAMPAS , PyCBC	Tito Dal Canton	MDC1
Annecky, Urbino	Experts	Test existing searches based on MBTA	MBTA, pycbc	Buskulic, Grimaud, Fabrizi, Guidi	MDC1
RWTH Aachen	Medium	Parameter estimation (Fast machine learning based posterior reconstruction)	LAL, pytorch, own developed software	Markus Bachlechner, Tobias Reike, Johannes Erdmann, Achim Stahl	MDC1
APC-Paris	Experts	BNS parameter estimation (DNN based Hamiltonian Monte Carlo)	Bilby, pytorch, own developed software	Ed Porter, Jules Perret	MDC1
Ewha Womans University (Korea)	Beginners	CBC signal search pipeline review/test with matched filtering, (plan) PE focusing on mass distributions of the detected sample (in relation with div3)	LAL, pyCBC (plan) Bilby	Sumi Lee, Seohyun Park, Chunglee Kim	MDC1
University of Pisa	Medium	Detection, PE and Early Warning for high SNR sources with Deep Learning	Pytorch, own developed software	Federico De Santi, Lucia Papalini, Massimiliano Razzano	MDC1

- Face-to-face held yesterday, plans to look in some technical details in the next few days.
- Results not available yet...planning for review, small review team in place, details to be sorted out

MDC related analyses in progress...

Analysis of ET MDC with PySTAMPAS



Adrian Macquet, Tito Dal Canton - IJCLab

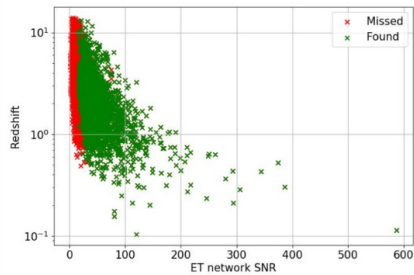
Group: Anancy, Urbino

Target: Test existing searches based on MBTA

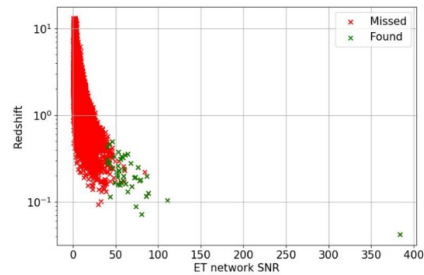
Code: MBTA, GWastro, PyCBC, hdbank

Current work: test bank construction

Network SNR vs redshift

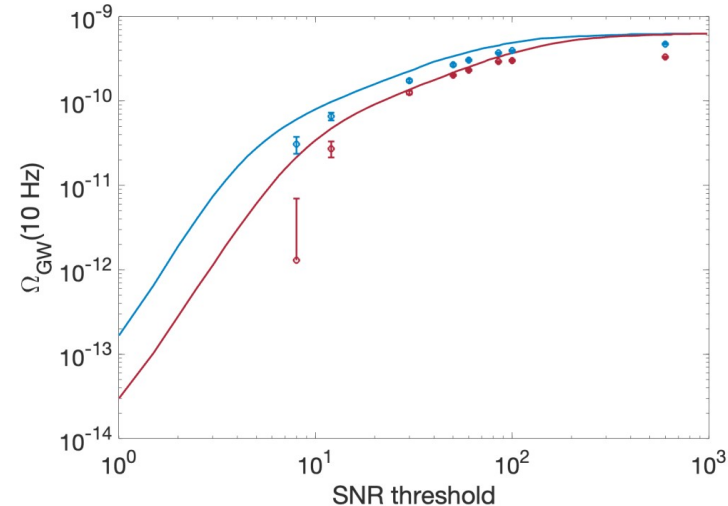


BBH



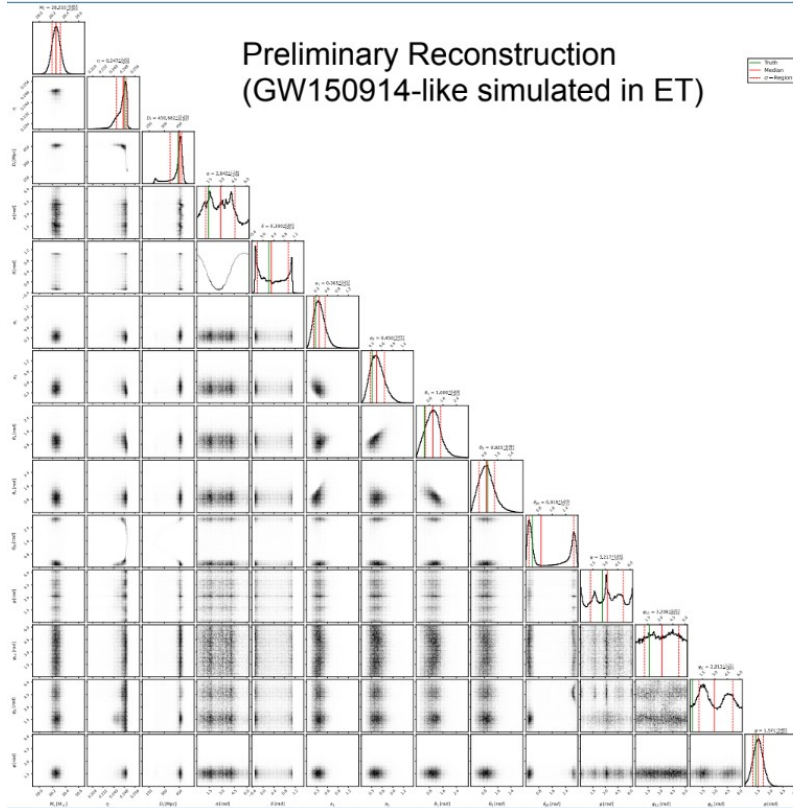
BNS

→ BBH are found at a lower SNR than BNS.



People involved:
Ebersold,
Regimbau,
Suresh

MDC related analyses in progress



Names of Participants:

- Achim Stahl, Johannes Erdmann, Markus Bachlechner, Tobias Reike



Bluebook chapter

Div 10: Data Analysis Platform

- Initial plan: put results from MDC
- Current plan: review of ET-focussed methods and few available results on MDC (stochastic background)

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Bluebook chapter...

Takeaways from face-to-face:

- Target timeline for “finish”: end May.
- Section on commonalities with other divisions: fundamental physics, synergies with other detectors, waveforms, extreme matter, populations?

Summary

- Working towards next MDC version:
 - Newer sources, glitches, correlated noise,...
- Prioritising bluebook chapter
- Obtaining results from MDC
- Talks coming up.

Binary Black Hole Parameter Estimation using a Conditioned Normalizing Flow	Markus Bachlechner
Room 2.1, MECC	11:45 - 12:00
Impact of Correlated Noise on Third-Generation Gravitational-Wave Detectors: Biases in Parameter Estimation and Design Performance	
Normalizing flows as an avenue to study overlapping gravitational wave signals	
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Robust parameter estimation on gravitational wave signals from binary neutron star inspirals within minutes	
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Parameter estimation of the overlapping signals: descending in frequency and ascending in speed	
Room 2.1, MECC	12:45 - 13:00
Deep learning to detect compact binary coalescences. A test with Einstein Telescope MDC.	Lucia Papalini
Room 2.1, MECC	14:00 - 14:15