

LPCCaen – LIDA

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Activities at LPCCaen

Nuclear physics

- Nuclear structure : on accelerators GANIL, RIKEN....
- Nuclear thermodynamics
- phenomenology

Applied physics

- med./indust. appl. : hadrontherapy, beam monitoring
- nuclear power cycle : ADS, σ measurements

Activities at LPCCaen

Particles and fundamental physics

- Precision low energy measurements : CP violation (beyond the SM)
- ★ Astroparticles and multi-messagers
 - neutrino oscillation : SOLID, Km3Net/Orca
 - nature of the neutrino : SuperNEMO
 - ★ Grav Wave Observatory : LISA (since 2018), Virgo, ET

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Particles and fundamental physics

- Precision low energy measurements : CP violation (beyond the SM)
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 - neutrino oscillation : SOLID, Km3Net/Orca
 - nature of the neutrino : SuperNEMO
 - ★ Grav Wave Observatory : LISA (since 2018), Virgo, ET

⇒ Young, small group from neutrino physics moved to GW physics

Grav Wave team at LPCCaen

LISA

- PU Frc. Mauger (15 % ETP)
- MC Y. Lemière (50 % ETP) Perf. model + Data Analysis
- 2 IT support MGSE + ControlCommand (XX % ETP) IDS
- ★ R. Costa-Barroso (Phd oct2022 : 100%ETP) Data Analysis

VIRGO/ET

- CR S Salvador (50 % ETP) : mirror discharging system

⇒ expert discussion with Gilles (ML) and Sam (GPU, Det Char.)

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 - ★ R. Costa-Barroso (Phd oct2022 : 100%ETP) Data Analysis
 - ★ 2 years IN2P3 PostDoc position (from 2022) : Correlated Noises formulation, LISA simulation

VIRGO/ET

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1 year Data Analysis story

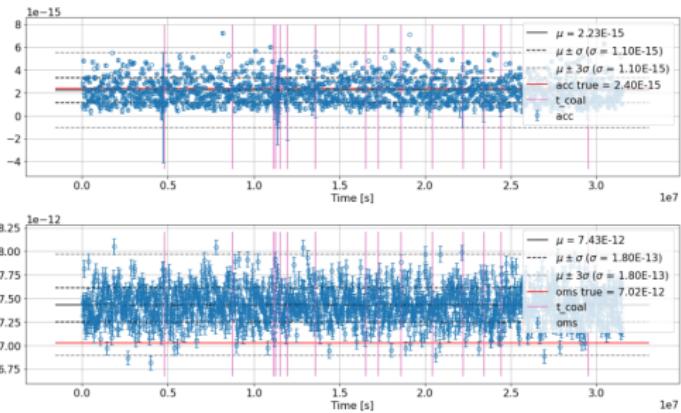
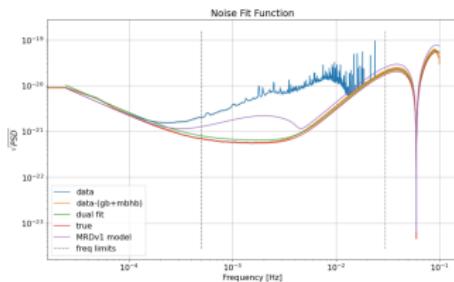
Favorite *apéritif* : SANGRIA

- Take advantage from LDC tutorials
- Try our own noise estimator (fit Acc, OMs noises models)
- Test our preliminary Merger Identificator

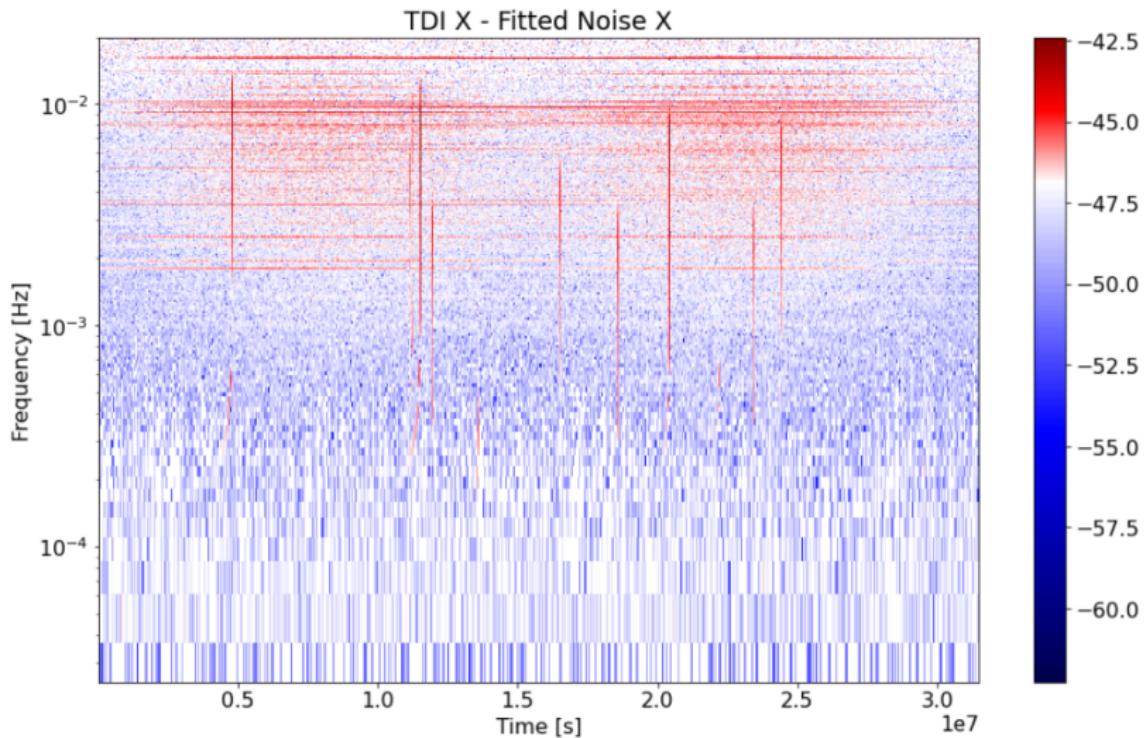
Actual status

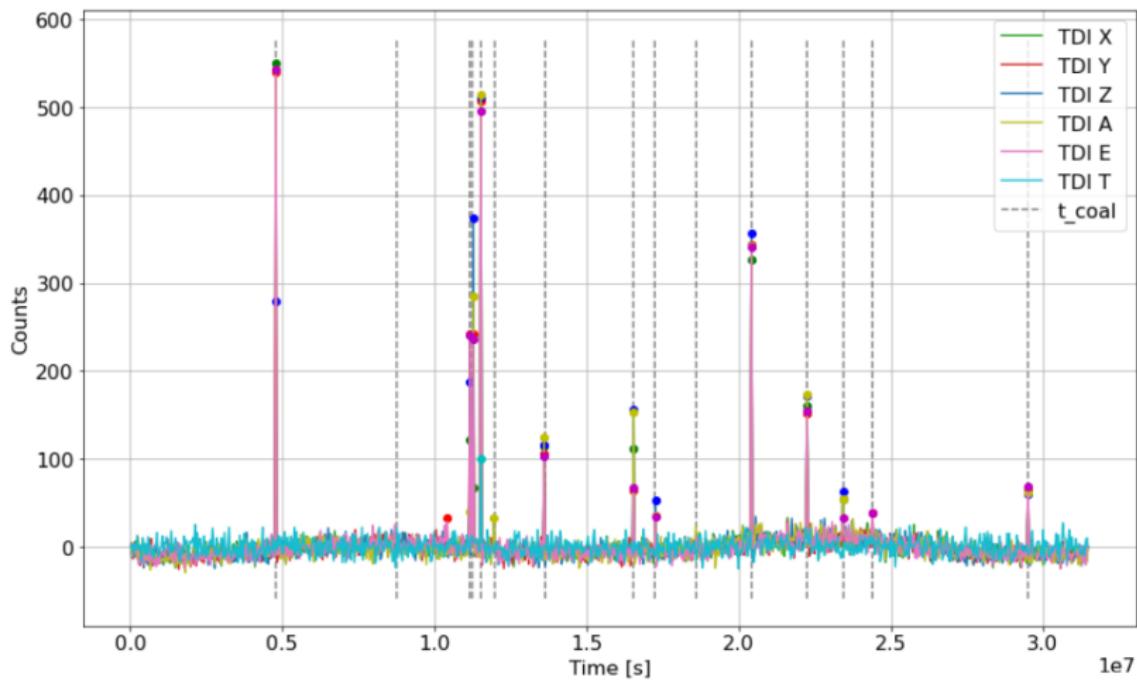
- 2 undergraduate students : Wavelet method, GB WF modulation
- Raissa since mid-March : Merger ID + Params

Short summary



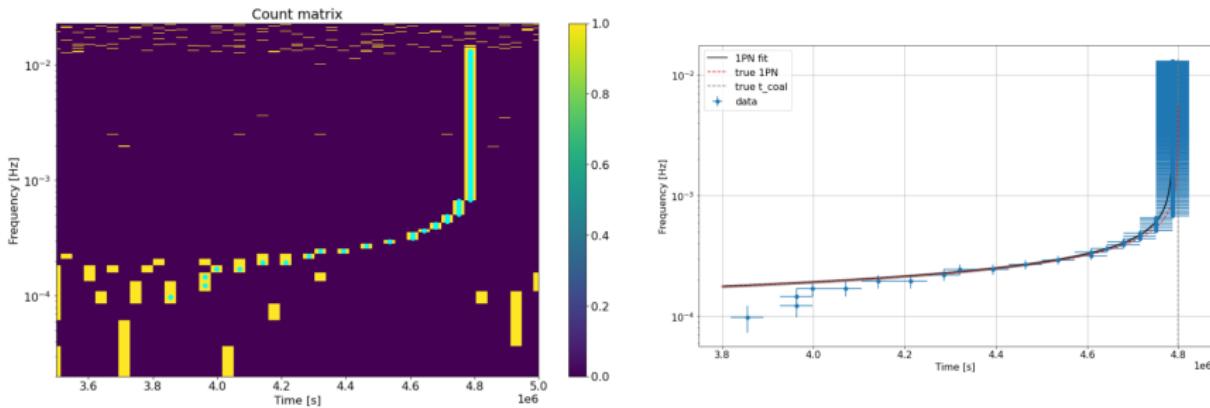
Unexpected systematic error on OMS is
... expected !





loocking for signal over threshold per freq. bandwith

Short summary

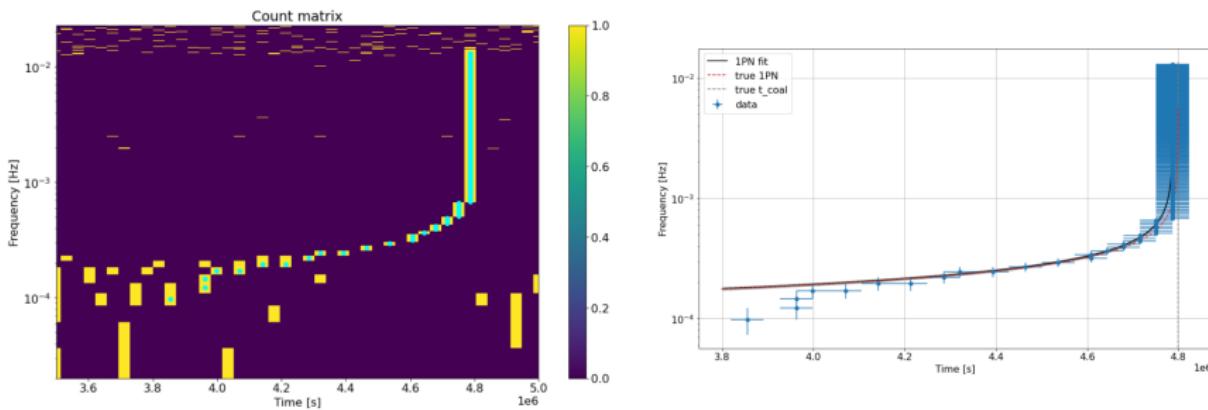


Implement chirp tracking to get good parameters guess

$$\text{Meas : } t_{coal} = 4.79 \cdot 10^6 \text{ s} \quad M_{chirp} = 1.56 \cdot 10^{36} \pm 5 \cdot 10^{34}$$

$$\text{True : } t_{coal} = 4.80 \cdot 10^6 \text{ s} \quad M_{chirp} = 1.55 \cdot 10^{36} \pm 5 \cdot 10^{34}$$

Short summary



- Many idea to improve the chirp tracking!
- Learning period to get more parameters (ϕ_{coal} , spins, location, . . .)
- Deeper noise monitoring as early transient ID

Photo Labos et institut

Science Softwares

L0->L1 SW

- INREP 1
- INREP 2
- ?

L1->L2 Alerts SW

- Low Latency Alert Pipeline 1
- Low Latency Alert Pipeline 2
- Deep Analysis Alert Pipeline

L1->L2 Deep Analysis

- Global Fit 1 pipeline
- Global Fit 2 pipeline
- Global Fit 3 pipeline

L1->L2 Mono-Blocks

- MBHB
- EMRIS
- SOBBH
- Galactic Binaries
- Unmodelled Sources
- Stochastic Background
- Instrumental Noise Cleaning
- L2->L3 SW

Simulation

Simulateur Instrumental

Simulation Workflow

Common SW and Tools

Comparison Methods

Wave Form generator (Fast Approximate and High fidelity)

WFG - MBHB

- WFG - MBHB - FA
- WFG - MBHB - HF

WFG - Galaxy

- WFG - Galaxy - FA
- WFG - Galaxy - HF

WFG - EMRIs

- WFG - EMRIs - FA
- WFG - EMRIs - HF

WFG - SOBBH

- WFG - SOBBH - FA
- WFG - SOBBH - HF

WFG - Stochastic Background

- Time series Management tool
- AI model

Generic Research Methods

External Preparatory Data

Data Quality Monitoring

And next ...

- ▶ MBHB parameters extraction and estimate algorithm sensitivity
- ▶ Early MBHB alert exploration (First t_{coal} , then sky location)
- ▶ Data Quality monitoring (in order to feed the early alert – LLP)
- ▶ Feed algo. with 24h dataset + non-stationnary noises + ...
⇒ downgrade SANGRIA data to take into account detector real life

PostDoc position at LPCCaen :

<https://emploi.cnrs.fr/Offres/CDD/UMR6534-AURGON-014/Default.aspx>