

Computer projects @IJCLab

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NPAC - 2023

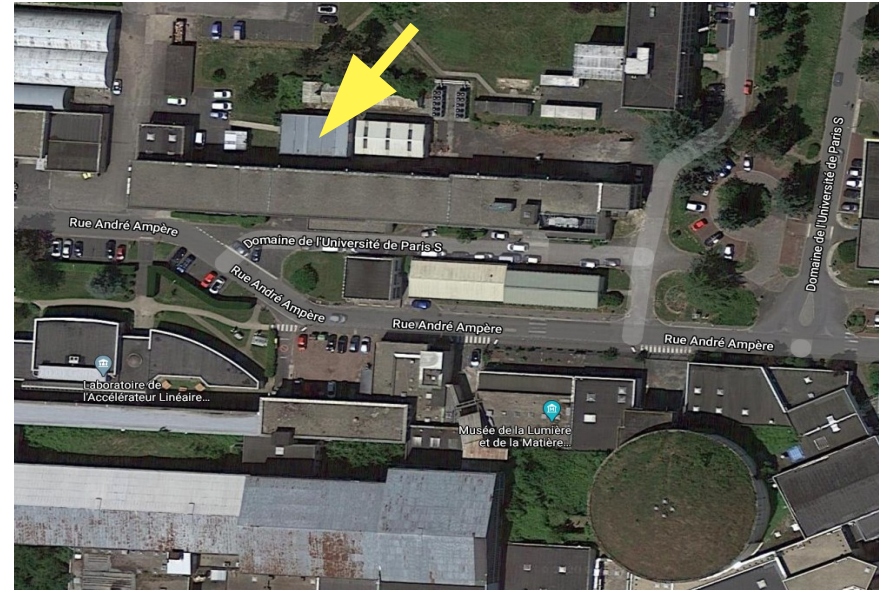
Computer projects @IJCLab

2 projects:

- Calorimeter simulation and reconstruction
- Search for gravitational waves

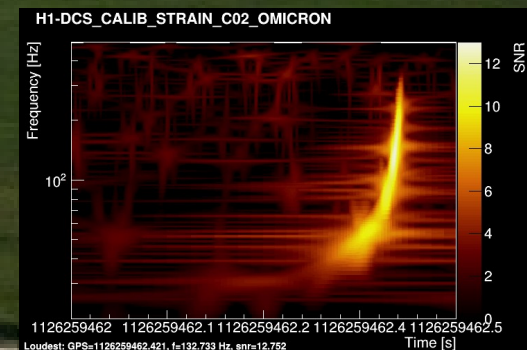
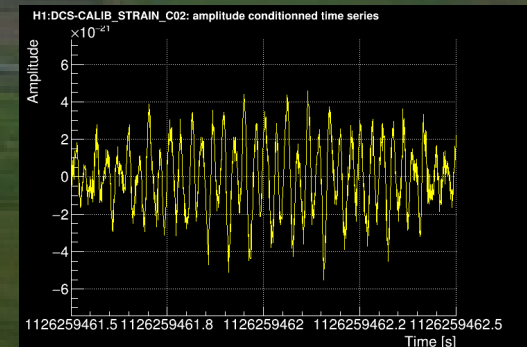
Practical information:

- Location: building 203
- Dates: Mar. 15-21
- Schedule: 9h → 12h and 13h → 17h
- Up to 6 pairs of students
- Evaluation:
 - 2/3 of the grade: methodology, algorithm development, algorithm validation, code quality, code documentation
 - 1/3 of the grade: 20' presentation at the end (Tuesday afternoon)



Search for gravitational waves

- Use of real LIGO data around the GW150914 signal
- Introduction to signal analysis methods
Fourier transform, filtering, whitening, noise characterization
- Stationary noise estimate (power spectral density)
- Spectrogram of GW150914
- Language: C++ or python
- External libraries:
 - C++: root (toolbox, visualization), FFTW (Fourier transforms)
 - python: numpy, scipy, matplotlib



Calorimeter simulation & reconstruction

Introduction

- Introduction to ROOT
- Introduction to histograms and fitting methods

Monte-Carlo simulation

- Simplified calorimeter description
- Electron and hadron showers

Reconstruction

- Particle reconstruction
- Detector characterization

Data analysis

- Electron/hadron discrimination

Language: C++

Use of ROOT libraries (plots/fits)

Work with C++ classes

