The PYCBC package and its use in the search of the Gravitational waves detection

Its application in GPUs

Balázs Kacskovics[1]

[1]GPU Laboratory and Virgo Research Group
Wigner Research Centre of Physics

GPU Day 2016 - The Future of Many-Core Computing in Science

Abstract

In the last year, the first signal of gravitational waves were detected by the LIGO-Virgo group. A hungarian collaboration will join the examination of the data during Observation Run 2 (O2) of the Advanced detectors LIGO-Virgo. The PYCBC and its GPU application will provide a valuable contribution in this purpose. In our talk we introduce these possibilities.

Hungarian Collaboration

Wigner Cloud

Current Resources

Limit Summary

Instances
Used 8 of 200

VCPUs
Used 36 of 200

RAM
Used 73,728 of 800,000

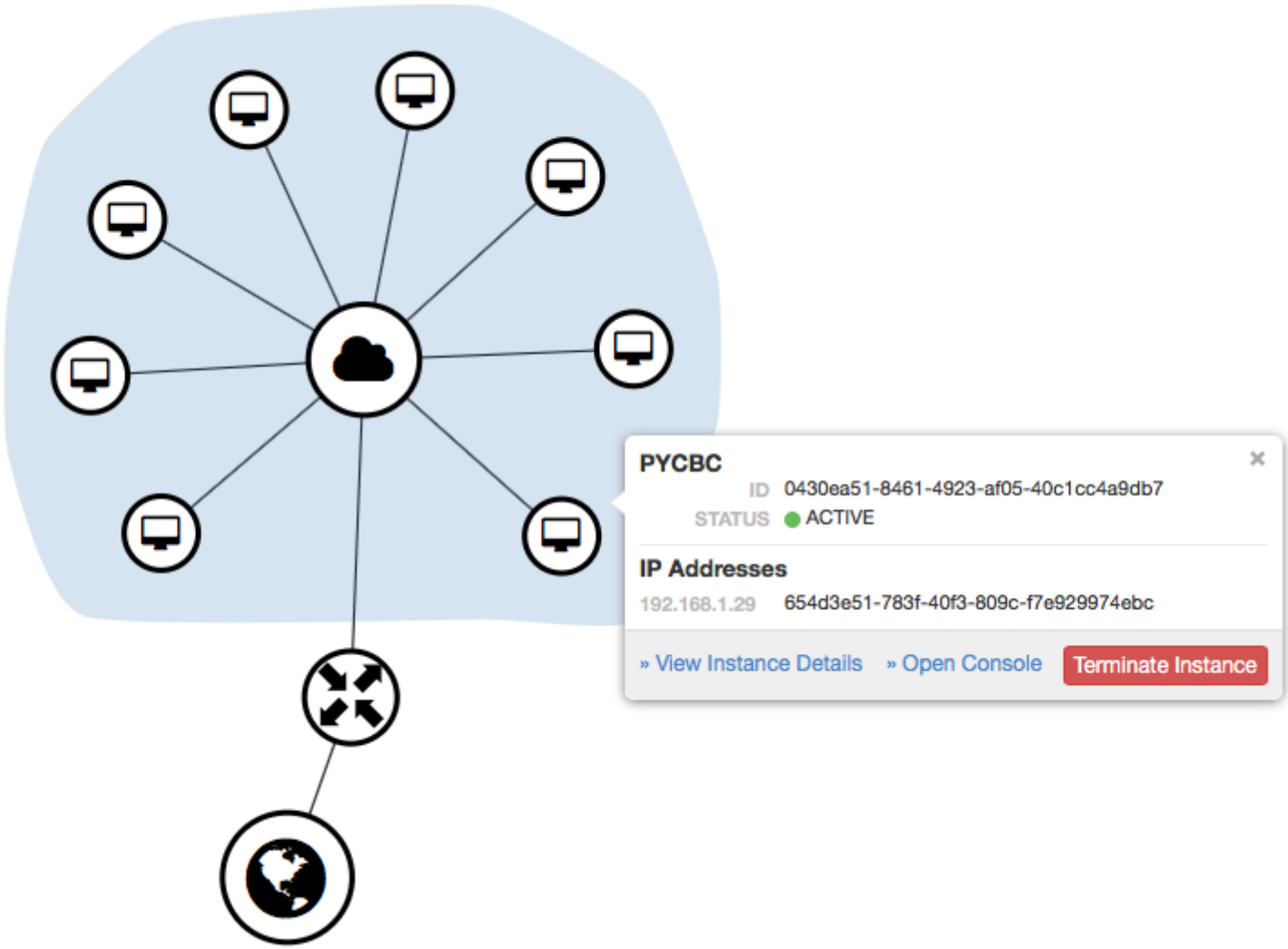
Floating IPs
Used 1 of 1

Security Groups
Used 3 of 10

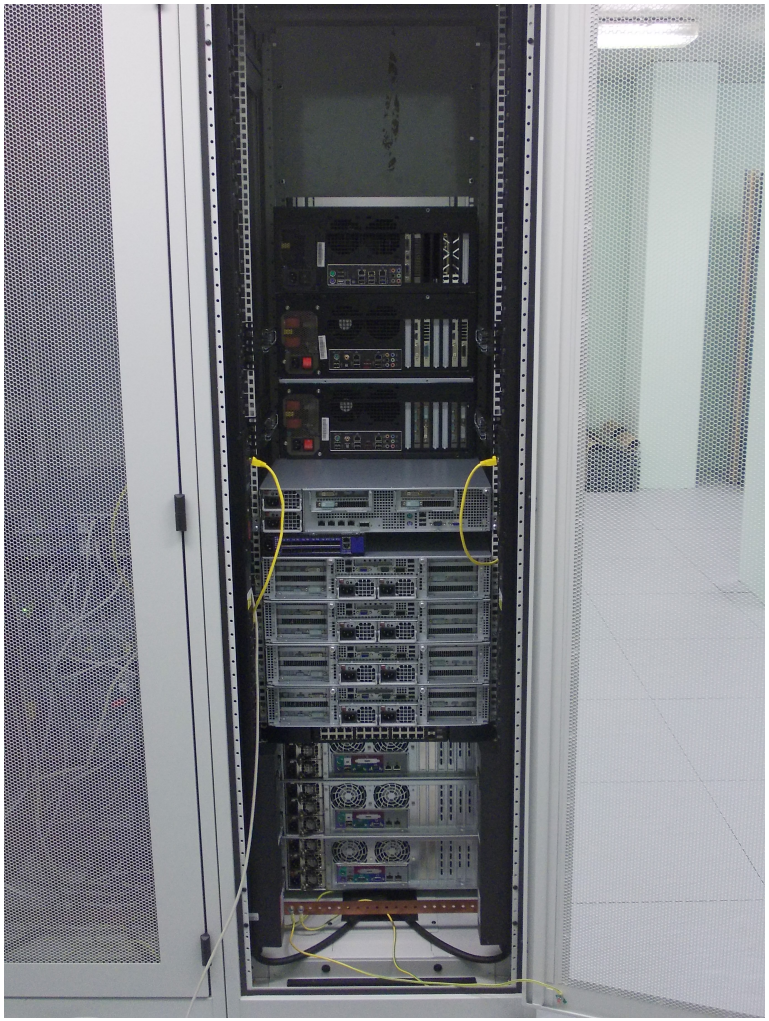
Volumes
Used 5 of 400

Volume Storage
Used 520 of 50,000

Wigner Cloud Network Topology

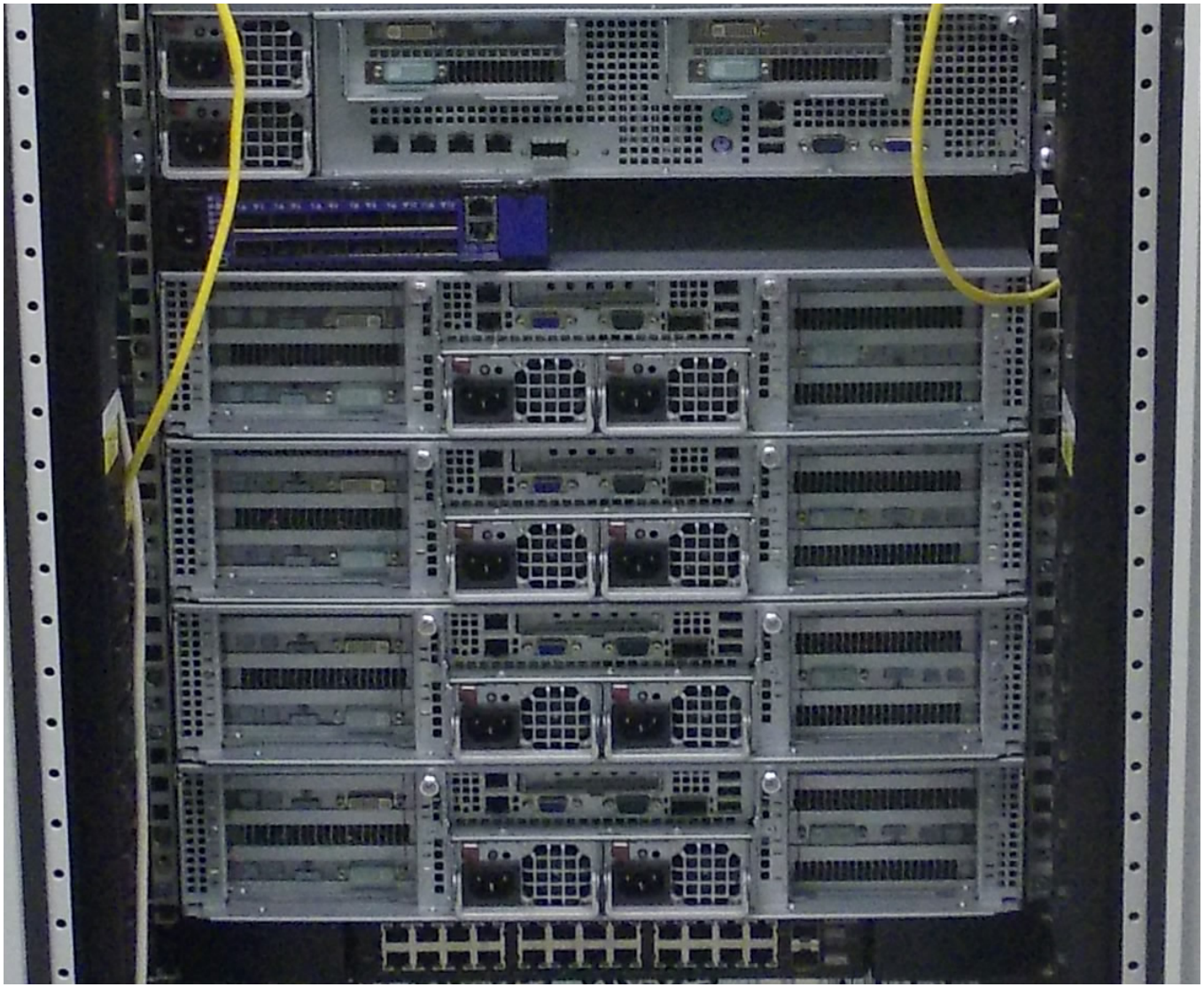


Opteron

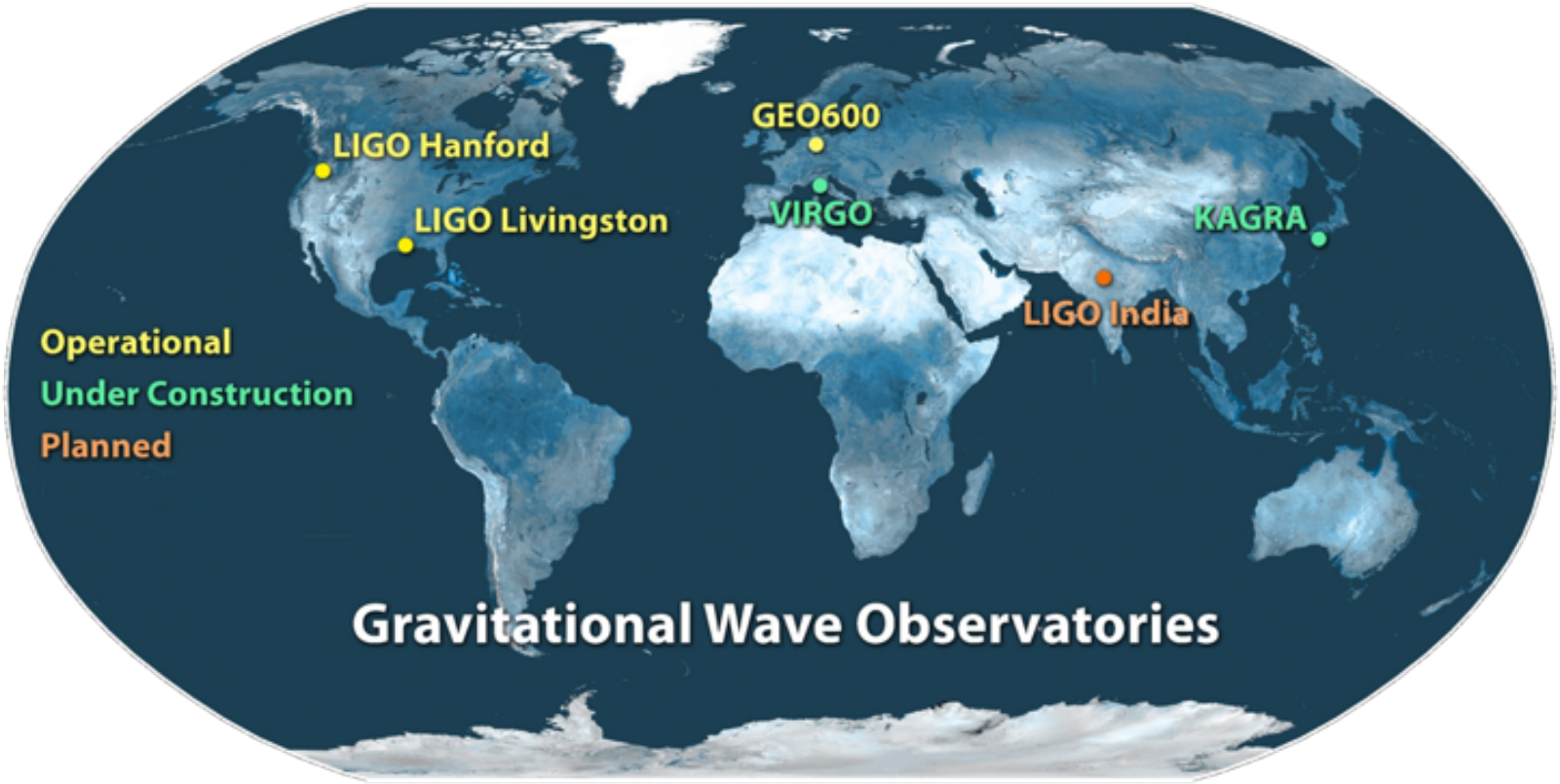


Opteron

Opteron

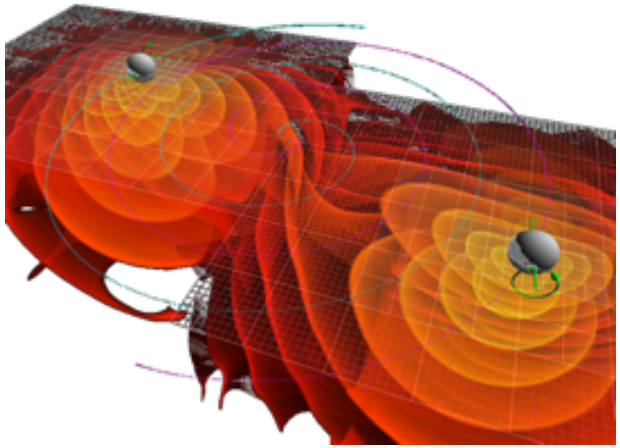


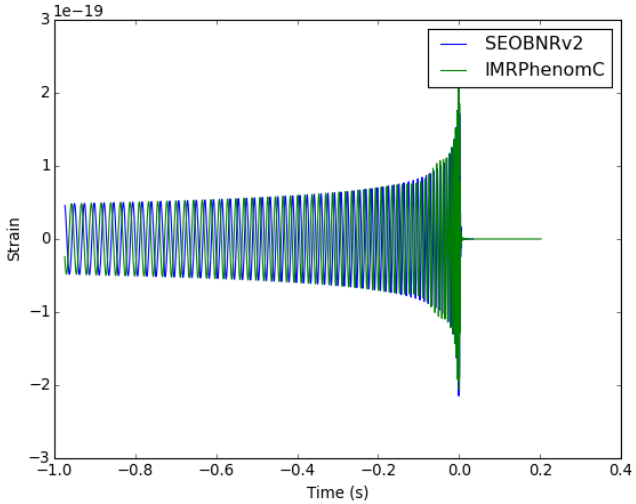
PYCBC


LIGO Hanford
LIGO Livingston
GEO600
VIRGO
KAGRA
LIGO India
Operational
Under Construction
Planned
Gravitational Wave Observatories

PYCBC

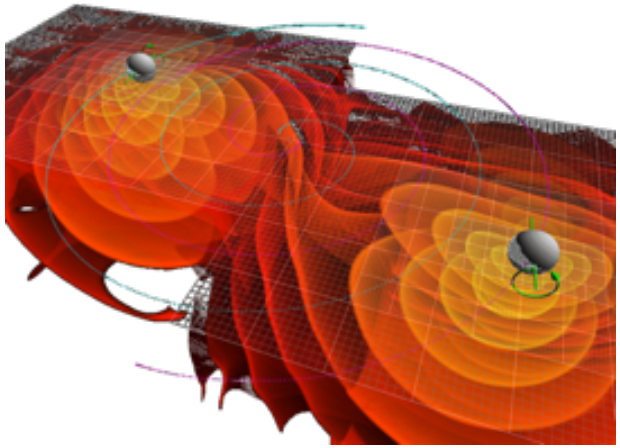
- Python software package for GW data analysis

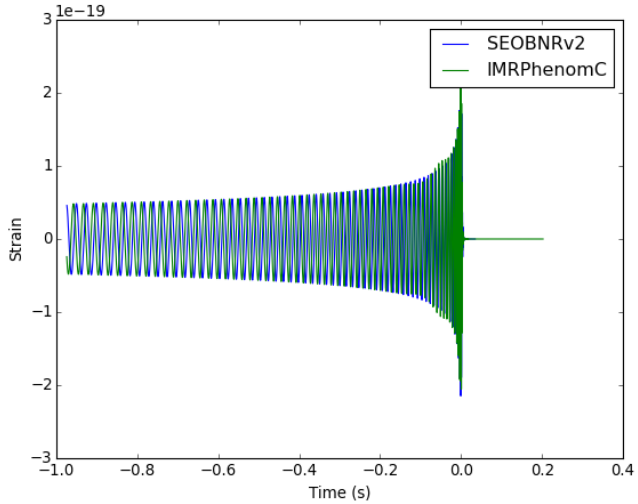




PYCBC

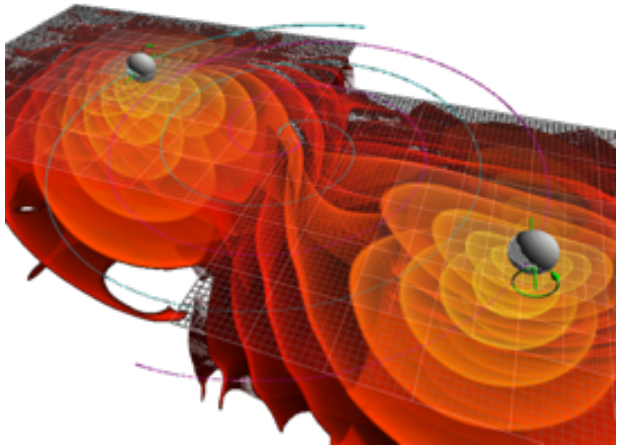
- Python software package for GW data analysis
- Searching for inspiralling compact binaries:
  - matched filtering
  - post-Newtonian approximation
  - spinning components
  - IMR waveforms

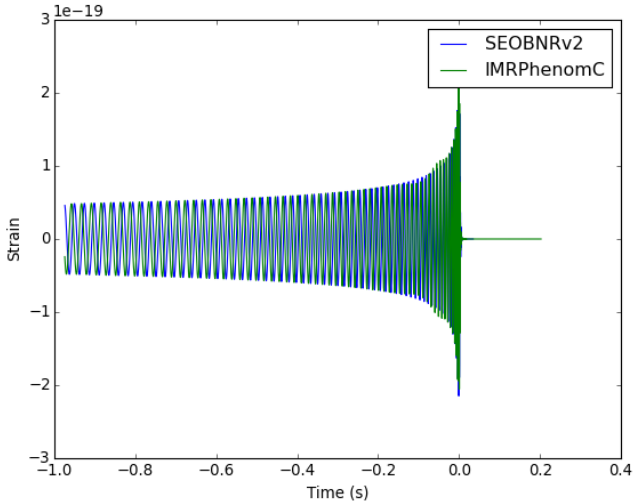




PYCBC

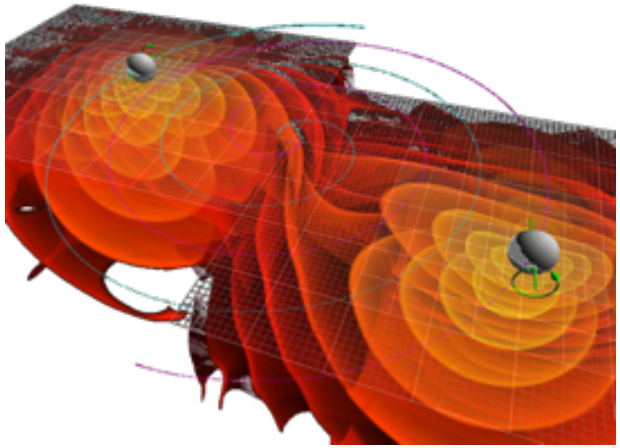
- Python software package for GW data analysis
- Searching for inspiralling compact binaries:
  - matched filtering
  - post-Newtonian approximation
  - spinning components
  - IMR waveforms
- Many core applications (CPU/GPU)

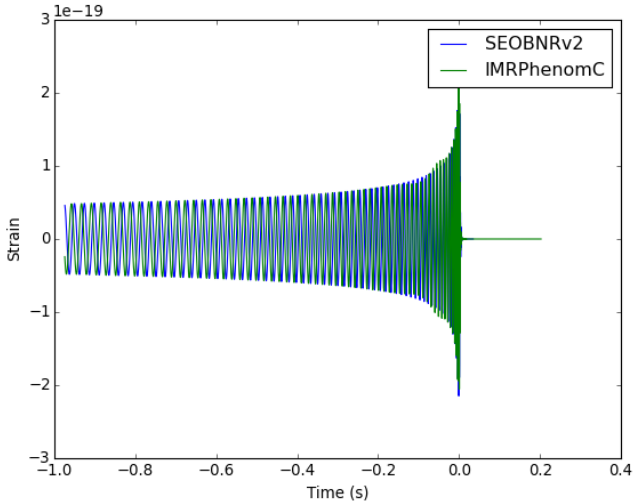




PYCBC

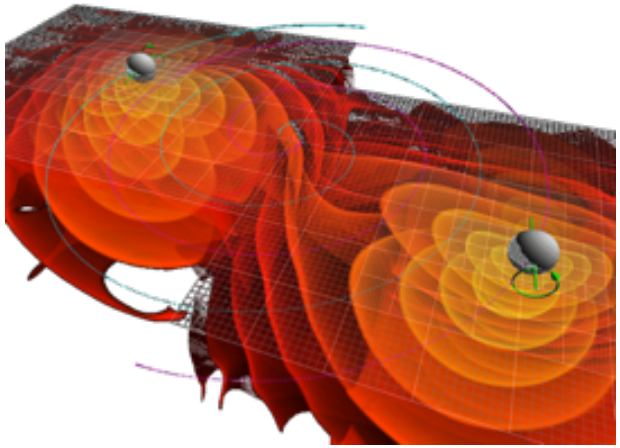
- Python software package for GW data analysis
- Searching for inspiralling compact binaries:
  - matched filtering
  - post-Newtonian approximation
  - spinning components
  - IMR waveforms
- Many core applications (CPU/GPU)
- Participation in the development

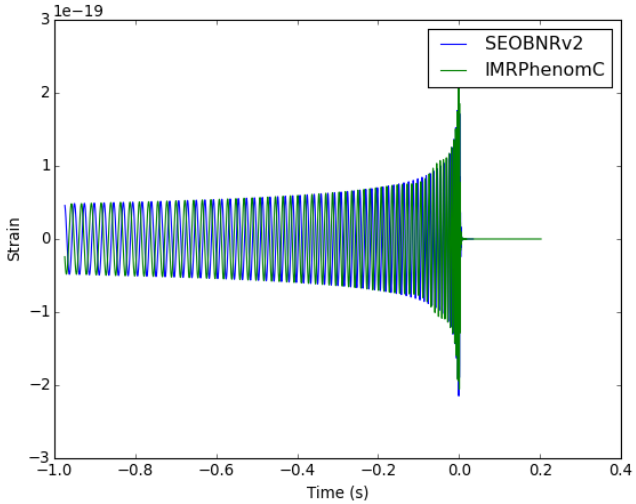




PYCBC

- Python software package for GW data analysis
- Searching for inspiralling compact binaries:
  - matched filtering
  - post-Newtonian approximation
  - spinning components
  - IMR waveforms
- Many core applications (CPU/GPU)
- Participation in the development
- Data analysis, parameter estimation





Data Processing

- Participation in the development of the interconnectivity between different Grid infrastructures:

$$\text{EGI Grid} \leftrightarrow \text{OSG} \leftrightarrow \text{LDG}$$

Data Processing

- Participation in the development of the interconnectivity between different Grid infrastructures:

$$\text{EGI Grid} \leftrightarrow \text{OSG} \leftrightarrow \text{LDG}$$

  - The recorded scientific data (160 TB/year/IF) of the Interferometers has to be transferred, processed, analyzed, etc.

Data Processing

- Participation in the development of the interconnectivity between different Grid infrastructures:

$$\text{EGI Grid} \leftrightarrow \text{OSG} \leftrightarrow \text{LDG}$$

  - The recorded scientific data (160 TB/year/IF) of the Interferometers has to be transferred, processed, analyzed, etc.
  - Data analysis: Hannover, Bologna, Bp. and US clusters

Data Processing

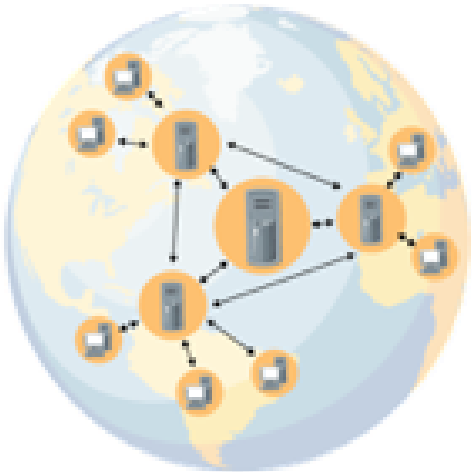
- Participation in the development of the interconnectivity between different Grid infrastructures:

$$\text{EGI Grid} \leftrightarrow \text{OSG} \leftrightarrow \text{LDG}$$

  - The recorded scientific data (160 TB/year/IF) of the Interferometers has to be transferred, processed, analyzed, etc.
  - Data analysis: Hannover, Bologna, Bp. and US clusters
- Development and implementation of search algorithms on GPUs (CUDA and OpenCL), which can be parallelized and/or independent calculations can be performed at the same time.

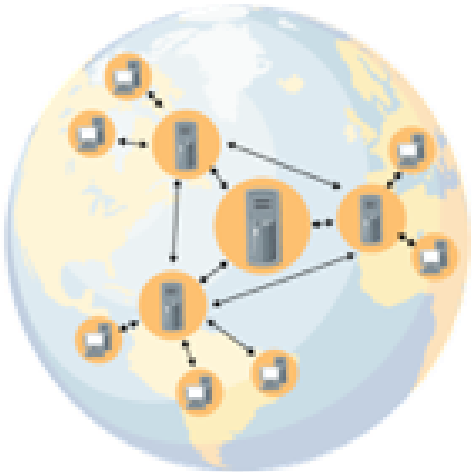
Data Processing

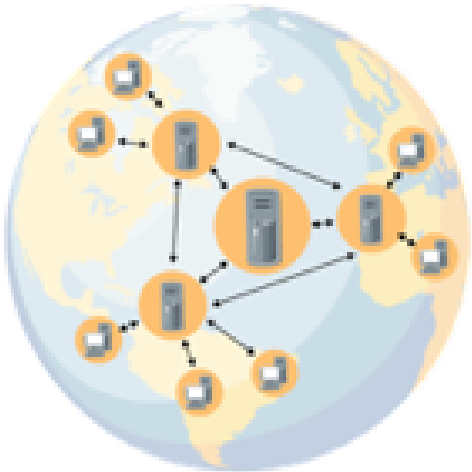
- Projects:



Data Processing

- Projects:
  - Compact binary coalescence search algorithms



Data Processing

- Projects:
  - Compact binary coalescence search algorithms
  - Continuous wave searches (F-statistics, Hough method)