Status of the Neutrinos Angra Experiment

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on behalf of Neutrinos Angra Collaboration

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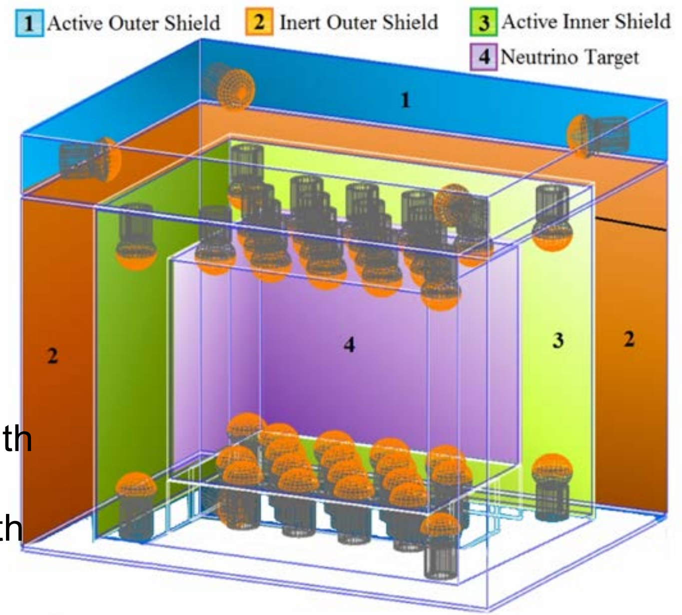
Motivation and Design

Objectives:

- Build a small surface detector for Nuclear safeguard with water Cherenkov technique
- Development (detector, electronics…) entirely in Brazil;

The Neutrinos Angra Detector is an assembly of four systems:

- A top active veto with 25 cm height filled with pure water and equipped with 4 PMTs each;
- A Non-Active volume around the detector with 25 cm height filled with pure water, to reduce the flux of low energy particles background;
- An Active Inner Veto around the detector with 25 cm height filled with pure water and equipped with 4 PMTs;
- The Neutrino Target, filled with GdCl3 doped water (0,2%) and equipped with 32 PMTS.



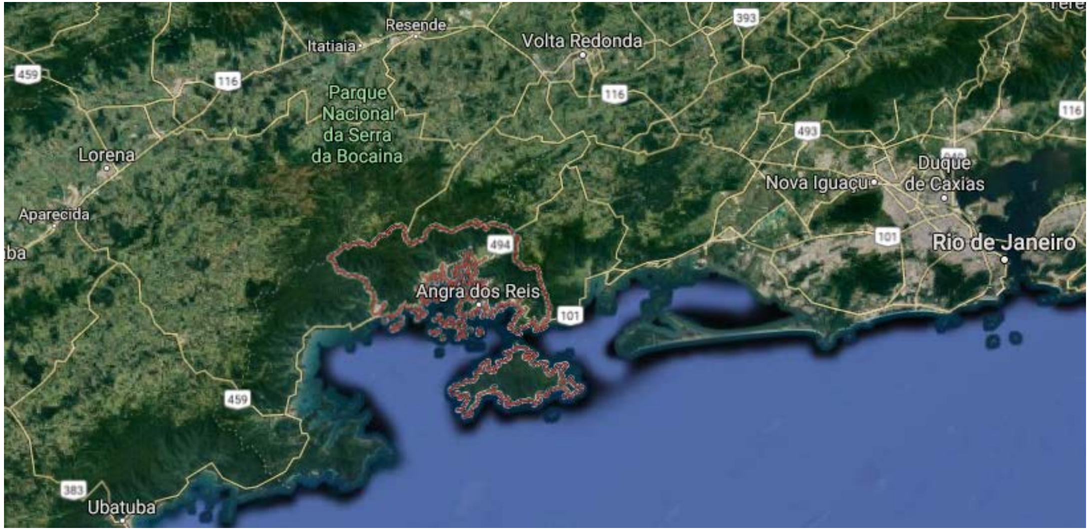
The Angra Collaboration

6 Brazilian Institutes:

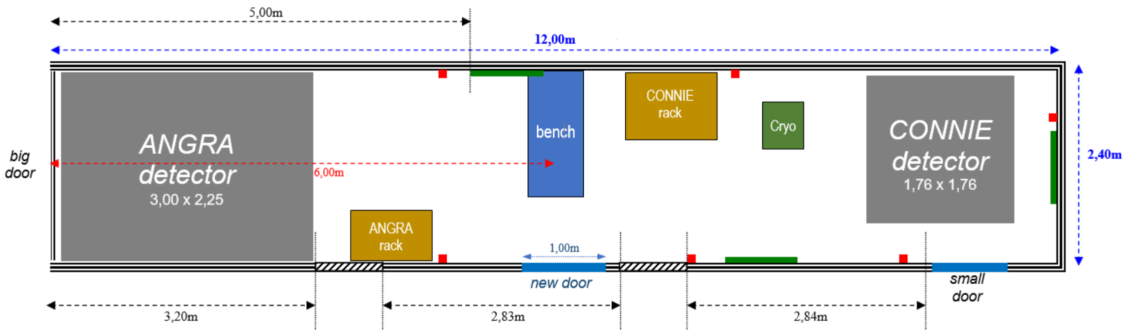
- CBPF (Rio de Janeiro - RJ)
- UEFS (Feira de Santana - BA)
- UEL (Londrina - PR)
- UFBA (Salvador - BA)
- UFJF (Juiz de Fora - MG)
- Unicamp (Campinas - SP)

13 Researchers
15 Students

The Experimental Site

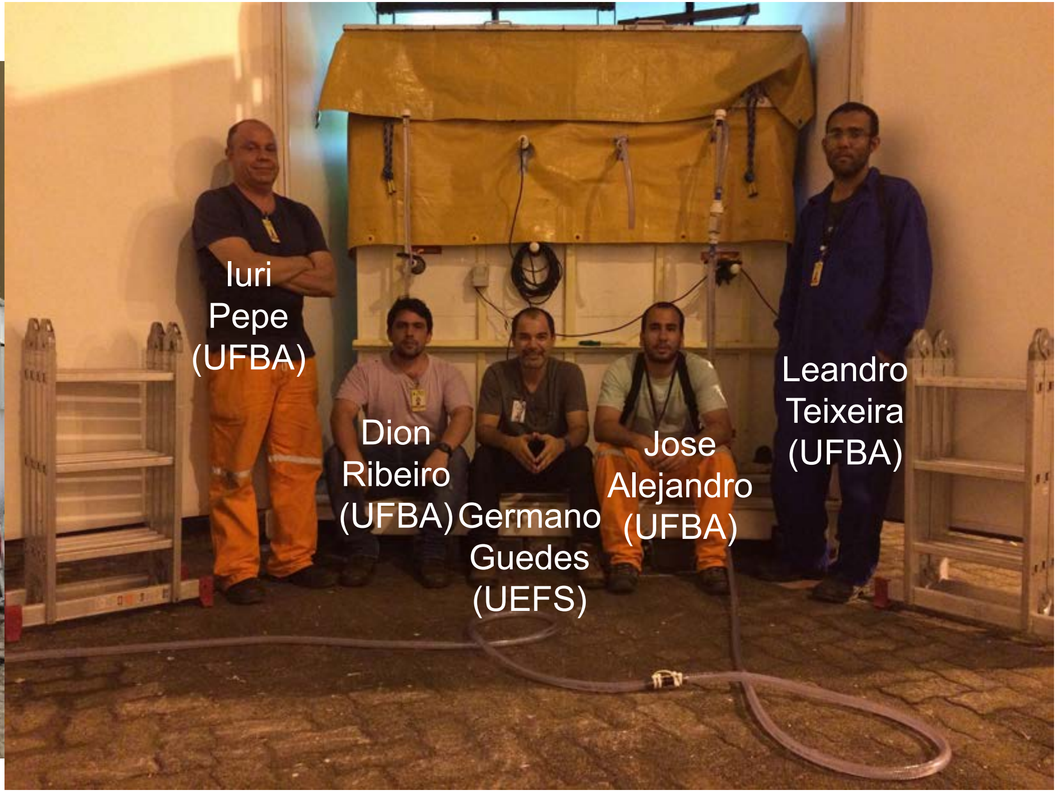


The Experimental Site



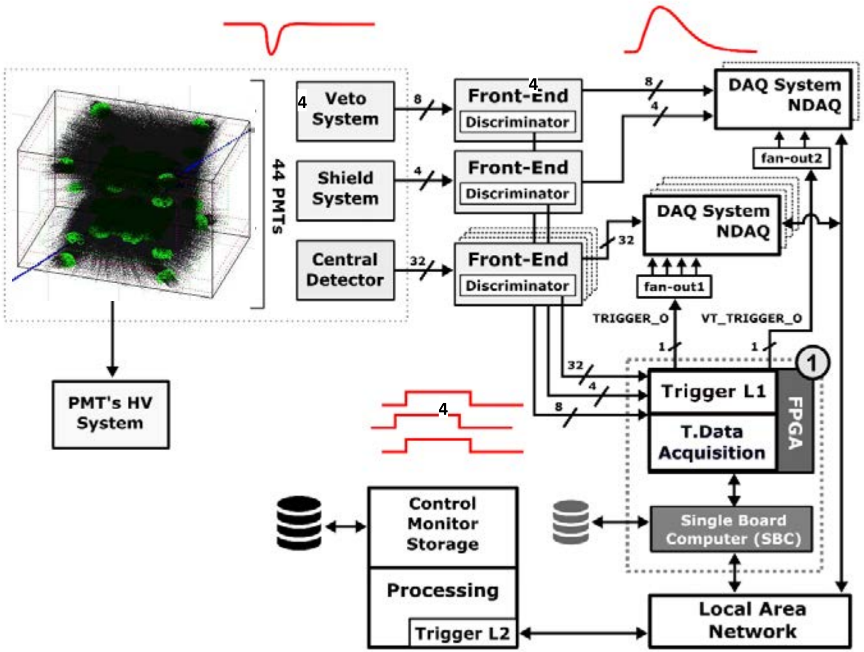
The Detector Assembly

The Detector Assembly



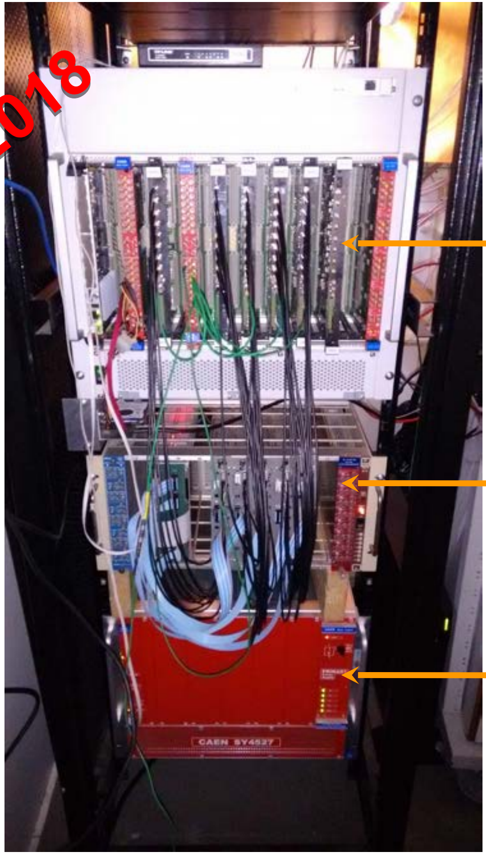
The DAQ: Electronics

- 40 PMTs (Hamamatsu R5912)
- 40 HV channels (CAEN SY4527)
- 5 Front-End boards (Custom)
- 5 Digitization Boards (NDAQ, custom)
- 1 SBC (*VME Single Board Computer*)
- 1 Trigger Boards L1 (FPGA)
- Online system



The DAQ Assembly

January 2018



Digitizer Modules (NDAQ)

8 channels/module × 5 modules
125 MHz, 10 bits (VME)

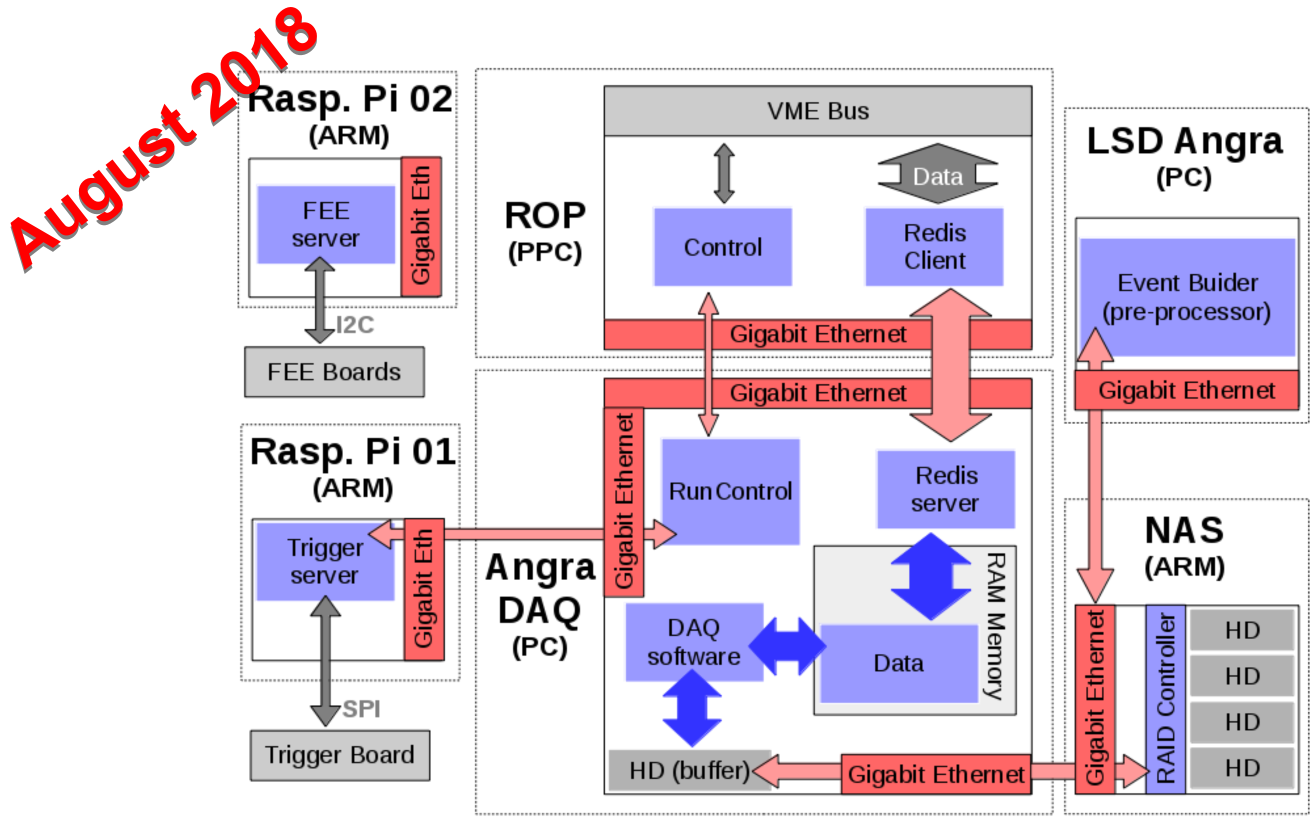
Front-End (FEE)

8 channels/module × 5 modules
(NIM)

High Voltage System (CAEN)

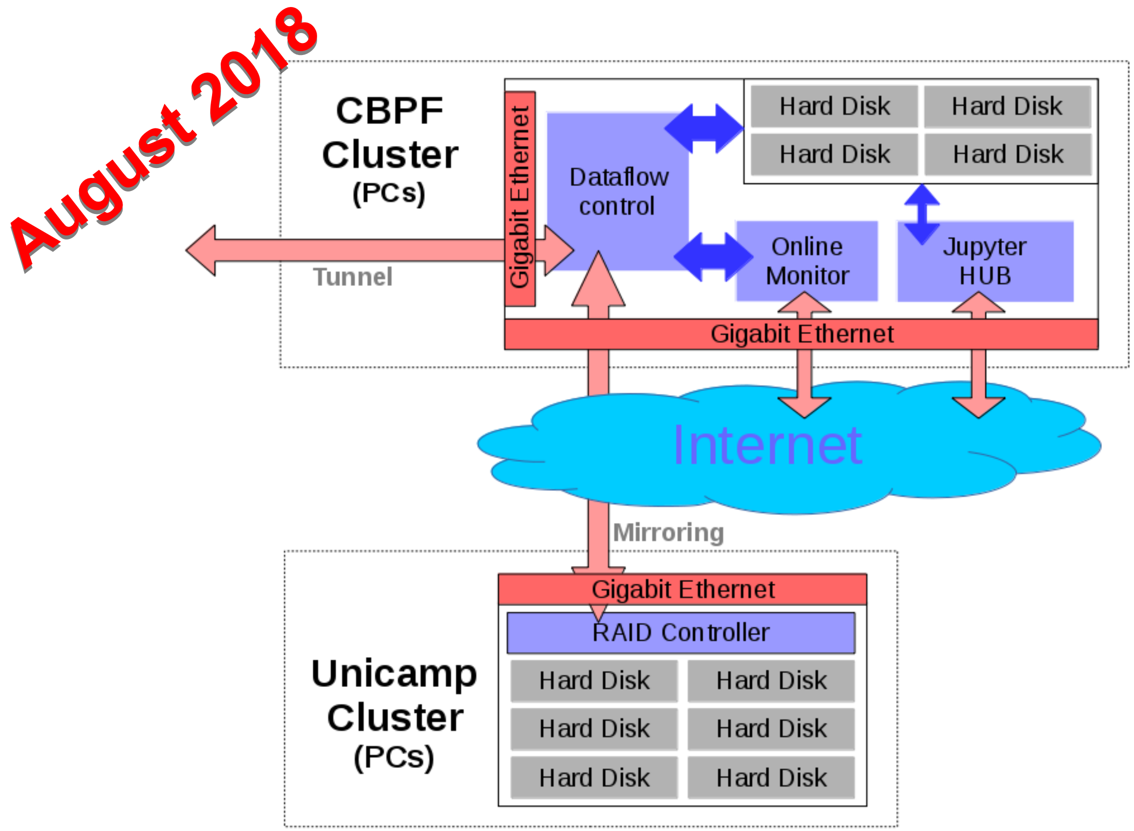
Model SY4527

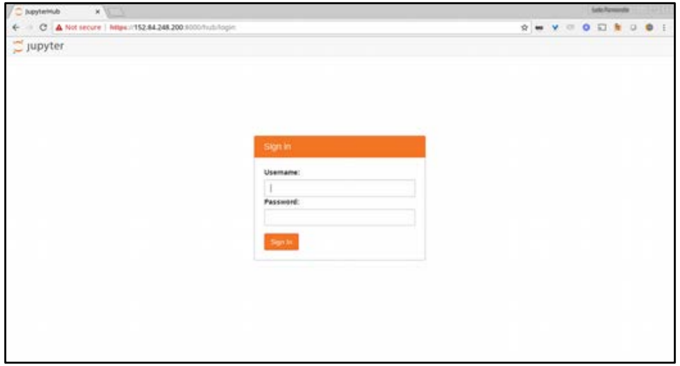
The DAQ: online

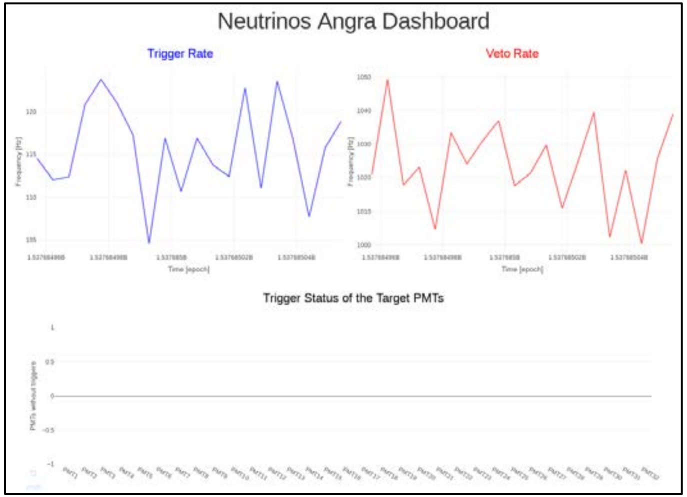


- First complete DAQ (v1);
- Trigger Bug was found: rate is ~150 Hz now;
- FEE Remote controlled;
- NAS Installed;
- Third Commissioning Campaign;

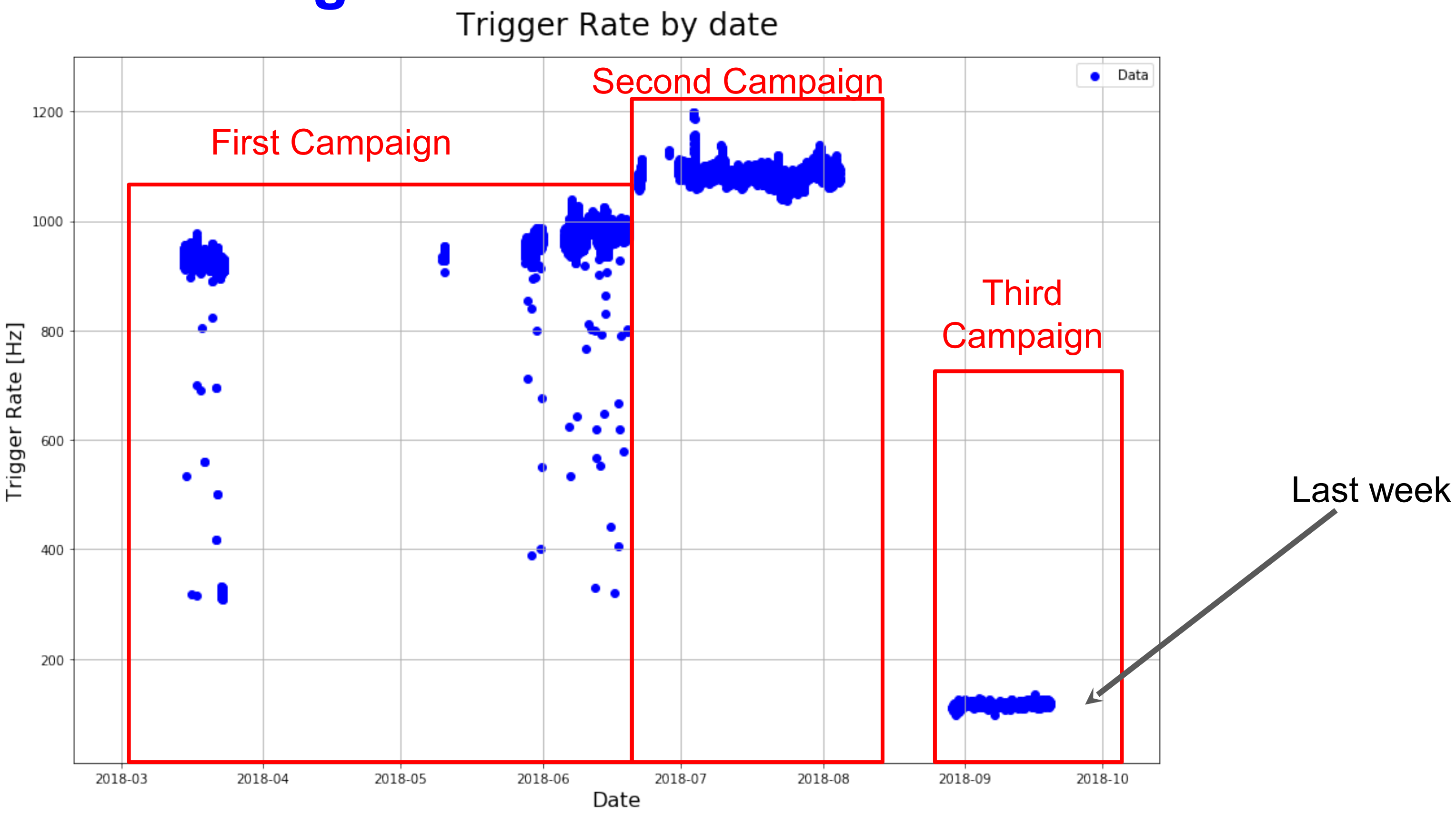
Storage and Computing



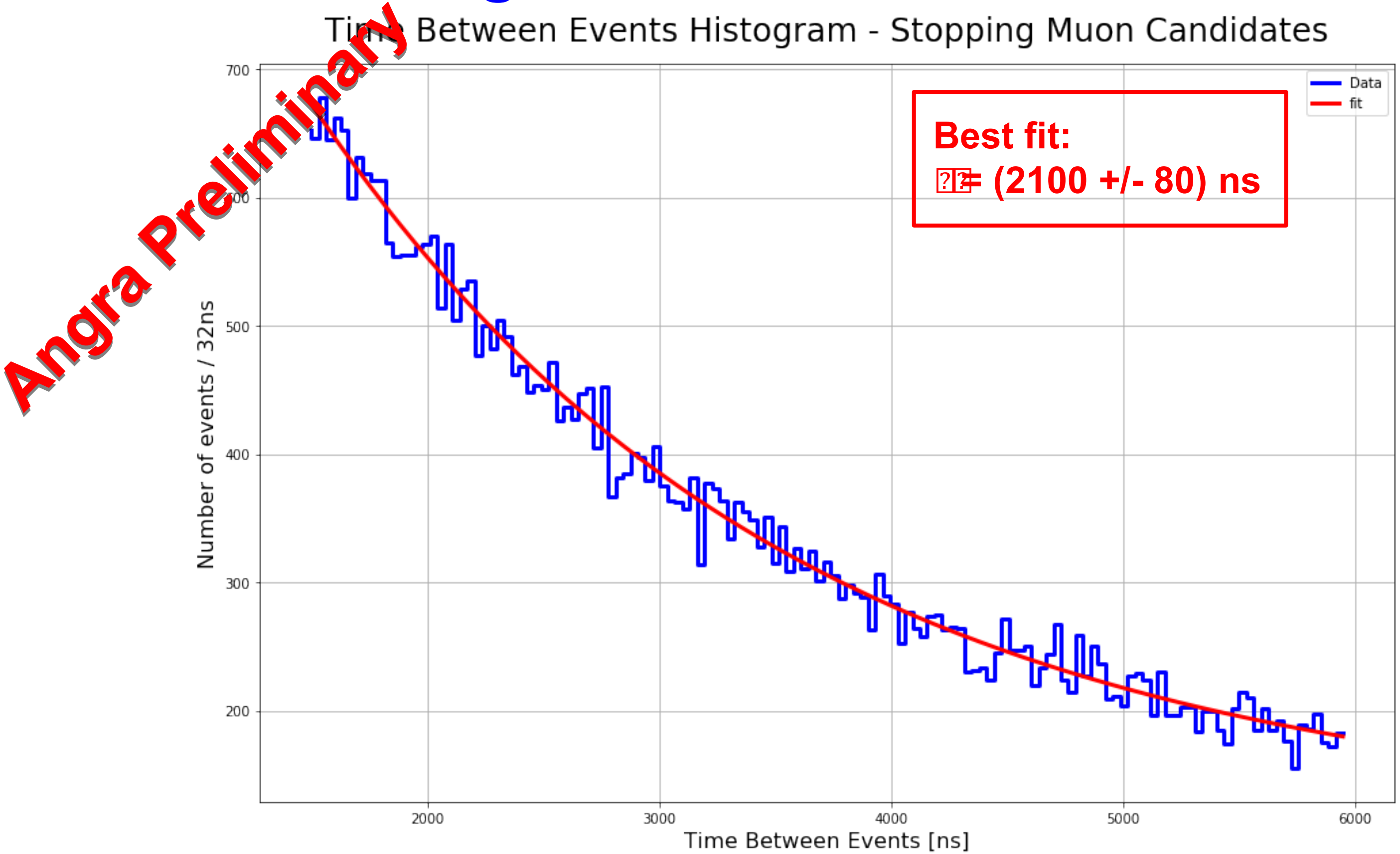




The Commissioning



The Commissioning



Data Analysis

- **Data Analysis meetings are ongoing to develop the software tools**
- **Main analysis is being developed in python on a collaborative way: testing on a Jupyter notebook and running the final code on a Server or Cluster**
- **Using python allow us to use a lot of libraries: pyRoot, numpy, SciPy, pandas, scikit-learn, tensorflow**
- **Data is being stored on Parquet format for efficient disk storage and fast data access**
- **Currently implementing methods for charge reconstruction on saturated pulses to improve the understanding of cosmogenic backgrounds**

Next steps

Steps for the fourth (and last) Commissioning Campaign:

- Generate a clock distributed for all the electronics;
- Acquire individual PMT trigger rate from the trigger system;
- Develop a Online Run Control for Shifters;
- Test the LED calibration system;
- Generate and distribute the clock for the TDCs;
- Include the TDC data into the datastream;

Develop the tools for the data analysis and start the first data analysis campaign after next reactor off period (February 2019).

Final Remarks

- **The detector is installed and taking Commissioning Data since March 2018;**
- **We will do 4 commissioning campaigns to improve the DAQ;**
- **We are now on the third one;**
- **Physics Data Taking will start on January 2019;**
- **So far the detector and electronics are stable;**
- **Next reactor off period will happen in February 2019;**
- **First Neutrino results are expected for April 2019.**

Thank you!