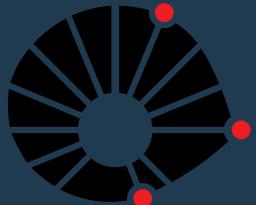


# Tanca Data Acquisition

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# Muons and Cherenkov Rad.



Primary Cosmic Radiation  
(mostly protons and helium nucleons)



N O

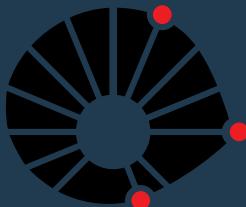
Interaction with nucleon in the atmosphere



Secondary Cosmic Radiation  
(with muons close to speed of light)



Cherenkov Radiation  
(because in the water muons are faster than light)



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# Measurement of Cherenkov Rad.

Collecting data from  
3 Photomultipliers



Digitizer:  
CAEN DT5720B

Running the  
Tanca Data Acquisition  
program

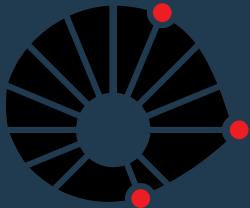


LabBook

Collecting data from  
environmental sensors



Arduino:  
Arduino UNO



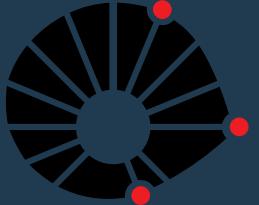
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# Tanca Data Acquisition program

The screenshot shows two windows of the Tanca Data Acquisition program. The left window displays the 'General Settings' tab, which includes fields for 'Working Dir:' (set to '/home/carapuca/Desktop/TancaData') and 'Backup Dir:' (set to '/home/carapuca/TancaBackup'), along with checkboxes for 'Enable Backup' and 'Enable Detailed Log'. The right window displays the 'Digitizer Settings' tab, containing fields for 'Record Length [samples]' (128), 'Post Trigger [%]' (20), 'Majority Level' (2), and three checkboxes for 'Channel 0', 'Channel 1', and 'Channel 2'. Below these are fields for 'dcOffset' (35265, 35411, 35059) and 'triggerThreshold' (1950, 1950, 1950). At the bottom of both windows are 'Start' and 'Stop' buttons.

```
INFO: Digitizer: loopCount: 3140940: 113 event(s) recognized
INFO: Digitizer: loopCount: 3140941: 154 event(s) recognized
INFO: Digitizer: loopCount: 3140942: 130 event(s) recognized
INFO: Digitizer: loopCount: 3140943: 116 event(s) recognized
INFO: Digitizer: loopCount: 3140944: 136 event(s) recognized
INFO: Digitizer: loopCount: 3140945: 132 event(s) recognized
INFO: Digitizer: loopCount: 3140946: 134 event(s) recognized
INFO: Digitizer: loopCount: 3140947: 133 event(s) recognized
INFO: Digitizer: loopCount: 3140948: 88 event(s) recognized
INFO: Arduino:onReadyRead: newLine: 329486
INFO: Digitizer: loopCount: 3140949: 190 event(s) recognized
INFO: Digitizer: loopCount: 3140950: 154 event(s) recognized
INFO: Digitizer: loopCount: 3140951: 134 event(s) recognized
INFO: Digitizer: loopCount: 3140952: 133 event(s) recognized
INFO: Digitizer: loopCount: 3140953: 147 event(s) recognized
INFO: Digitizer: loopCount: 3140954: 133 event(s) recognized
INFO: Digitizer: loopCount: 3140955: 130 event(s) recognized
INFO: Digitizer: loopCount: 3140956: 2 event(s) recognized
INFO: Digitizer: loopCount: 3140957: 286 event(s) recognized
INFO: Arduino:onReadyRead: newLine: 329487
INFO: Digitizer: loopCount: 3140958: 161 event(s) recognized
INFO: Digitizer: loopCount: 3140959: 157 event(s) recognized
INFO: Digitizer: loopCount: 3140960: 160 event(s) recognized
INFO: Digitizer: loopCount: 3140961: 132 event(s) recognized
INFO: Digitizer: loopCount: 3140962: 126 event(s) recognized
INFO: Digitizer: loopCount: 3140963: 1 event(s) recognized
INFO: Digitizer: loopCount: 3140964: 272 event(s) recognized
INFO: TimeTagHandler::decode: overflowCounter++
INFO: Digitizer: loopCount: 3140965: 158 event(s) recognized
INFO: Digitizer: loopCount: 3140966: 126 event(s) recognized
INFO: Digitizer: loopCount: 3140967: 130 event(s) recognized
INFO: Arduino:onReadyRead: newLine: 329488
INFO: Digitizer: loopCount: 3140968: 141 event(s) recognized
INFO: Digitizer: loopCount: 3140969: 125 event(s) recognized
INFO: Digitizer: loopCount: 3140970: 71 event(s) recognized
INFO: Digitizer: loopCount: 3140971: 209 event(s) recognized
INFO: Digitizer: loopCount: 3140972: 129 event(s) recognized
INFO: Digitizer: loopCount: 3140973: 145 event(s) recognized
INFO: Digitizer: loopCount: 3140974: 121 event(s) recognized
INFO: Digitizer: loopCount: 3140975: 146 event(s) recognized
```

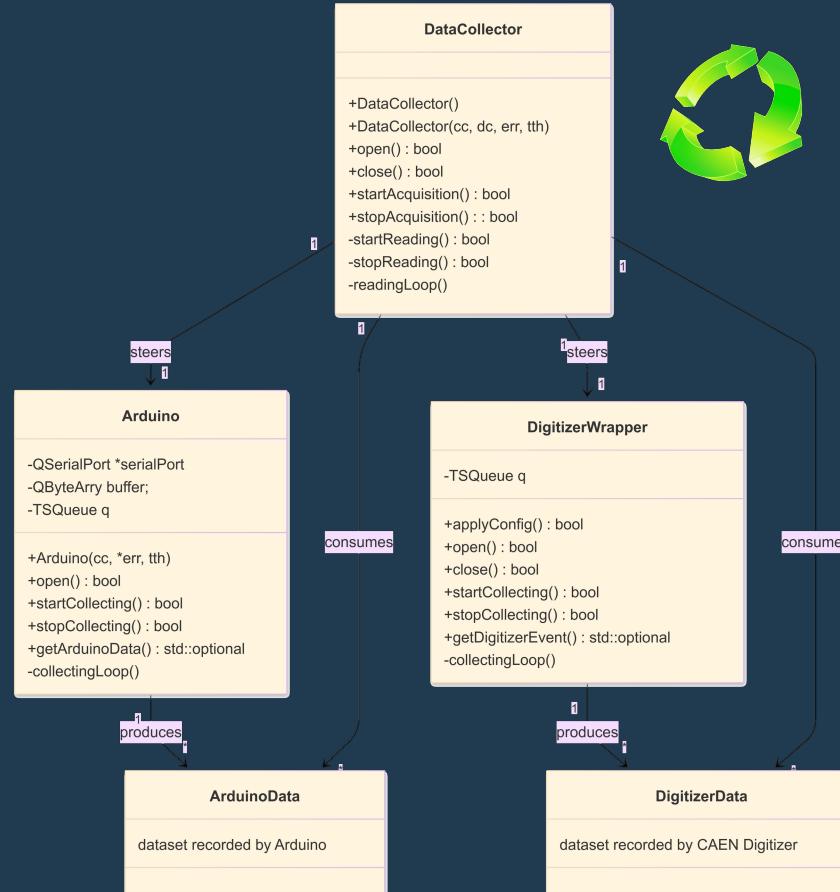
- Code written in C++
- Based on the CAEN C library
- GUI written in Qt for C++
- Configure the CAEN Digitizer
- Set Acquisition Settings
- Start and Stop Acquisition



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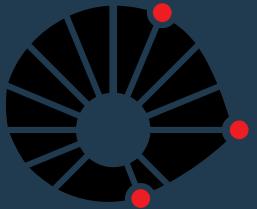
# Data Acquisition Code

Collecting on  
ReadyRead by  
Qt slot and  
add to Queue



Collecting in loop from  
Queue and write data in  
root files

Collecting in loop  
in own thread  
and add to Queue



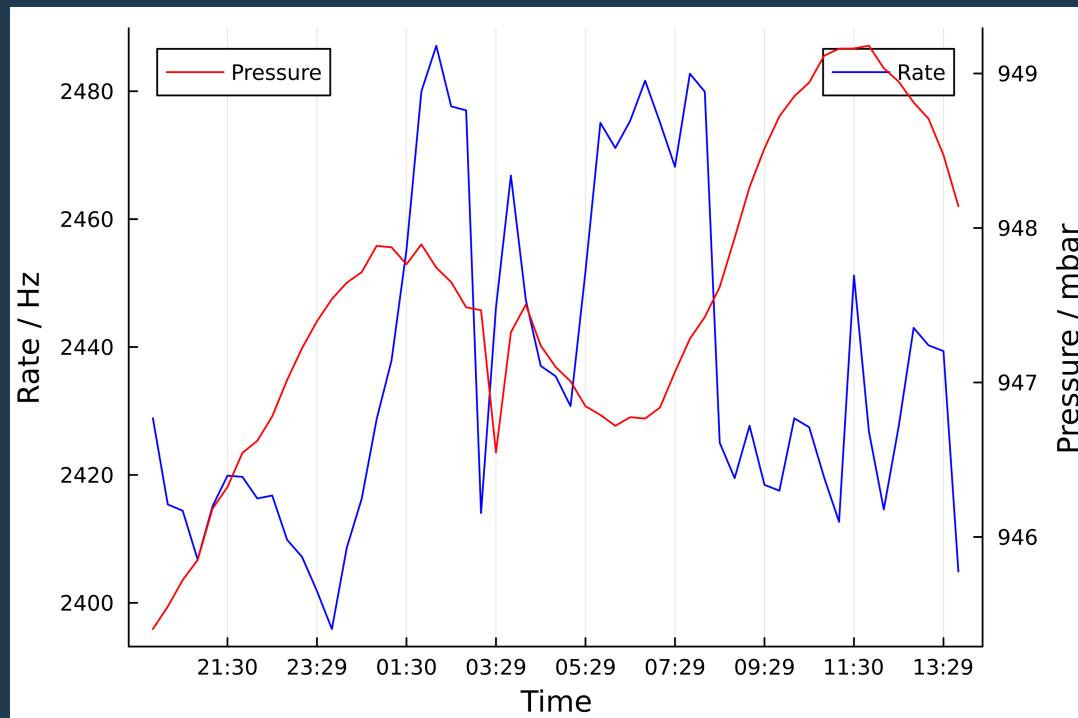
# Analysing The Data

- **High performance:** Just-in-time (JIT) compiled, often as fast as C.
- **Easy syntax:** High-level and expressive, like Python or MATLAB.
- **Built-in parallelism:** Supports multi-threading and distributed computing.
- **Efficient memory handling:** Designed for large arrays and numerical data.
- **Rich ecosystem:** Libraries for data analysis, statistics, machine learning.



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# Analysing Rate and pATM



`readData(workingDir::String,  
parts::Int)`

Reads all the root Data created by the TancaDataAcquisition program from one working directory.

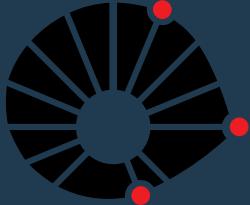
## Arguments

- `workingDir::String`  
folder of all root-Files
- `parts::Int`  
Number of Parts each hour is devided in for mean values

## Output

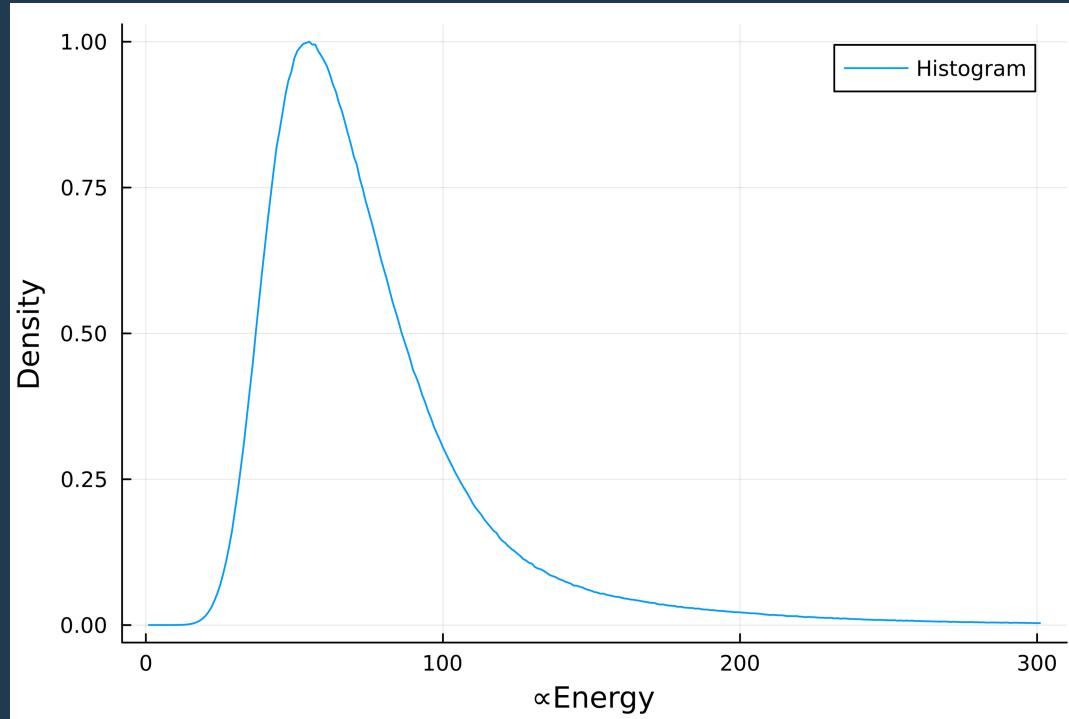
- `StructArrays(containerData2)`
- `StructArrays(containerData3)`

Returns List of Spectrums, one for every hour.



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# Analysing Spectrum



`getSpectrum(workingDir:String)`

Returns List of Spectrums, one for every hour.

## Arguments:

- `workingDir:String`  
folder of all root-Files
- `bins:Int`  
Number of bins for the Spectrum

## Output:

- `Array(Histogram)`