



MIDAS workshop 2019/08/07

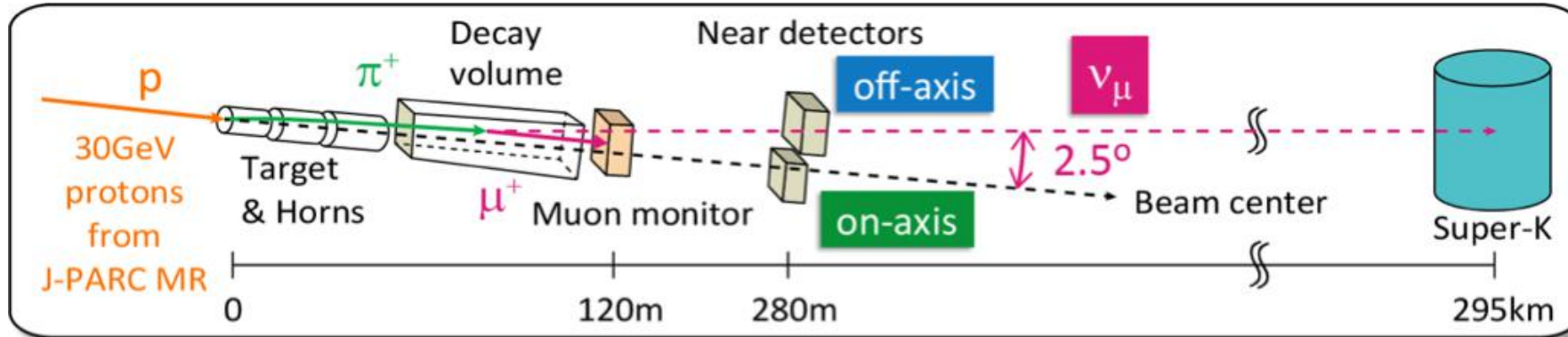
Pintaudi Giorgio, Ph.D. student
Yokohama National University



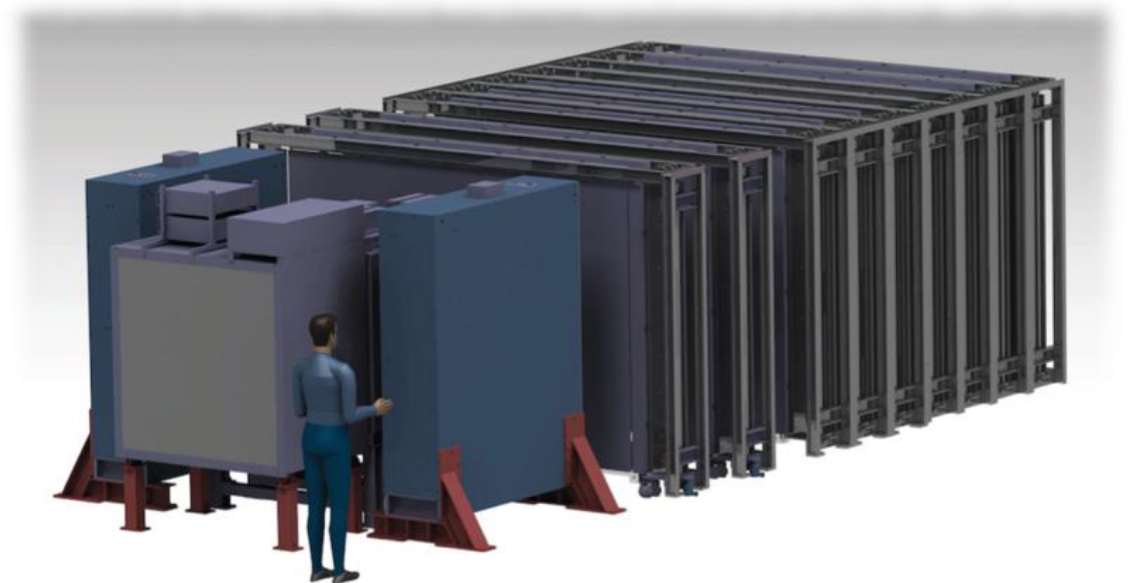
Content

- Introduction to the WAGASCI experiment
- Old DAQ and new DAQ
- Pyrame : WAGASCI frontend software
- BabyMIND DAQ
- MIDAS as a user interface
- What I have done
- What is left to do

The WAGASCI experiment

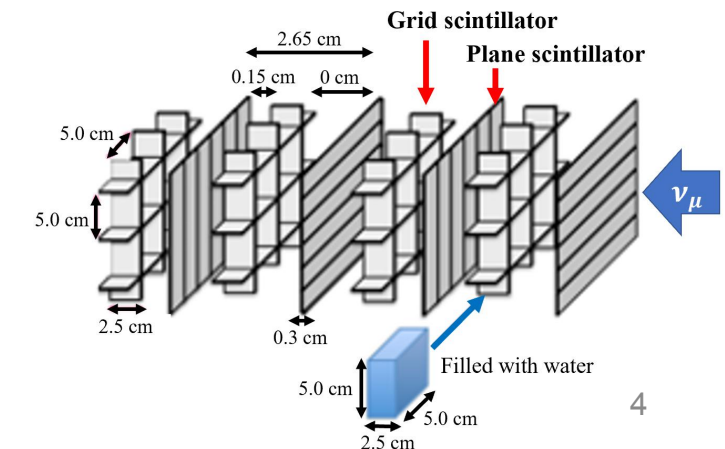
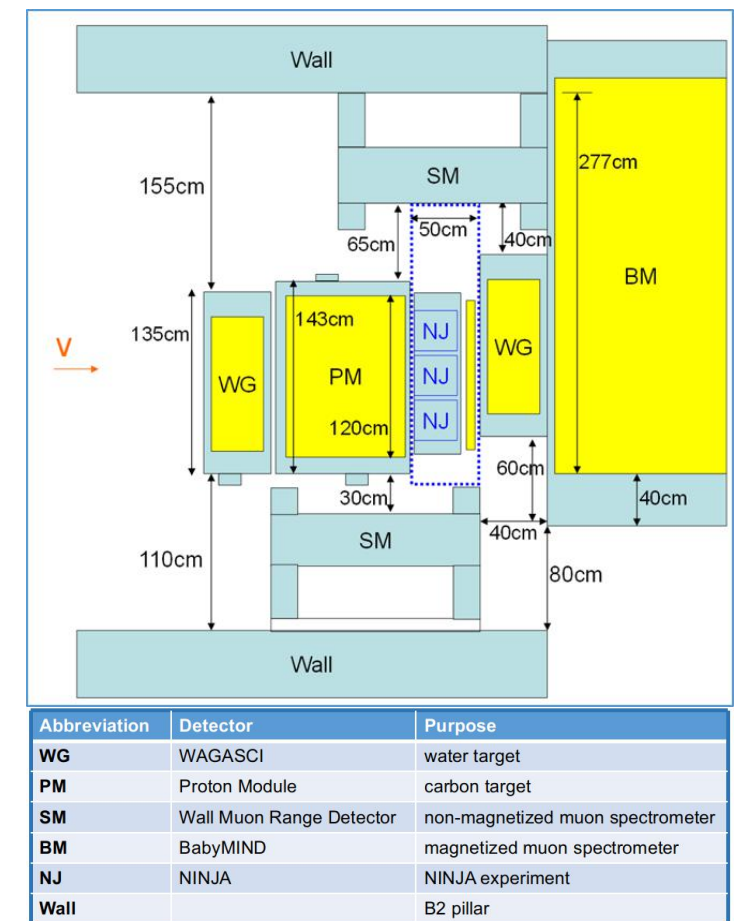


- WAGASCI is a new **neutrino-water cross section experiment**.
- WAGASCI is now officially part of **T2K**
- It uses the same neutrino beam as ND280 and is located just below it, but the **off-axis angle is different**:
 - ND280 = 2.5° off-axis
 - WAGASCI = 1.5° off-axis



The WAGASCI experiment

- It is aimed at measuring the neutrino-water and neutrino-hydrocarbon **cross section** and their ratio
- Its main target is made of **water**:
 - water = 80%
 - hydrocarbon = 20%
- Because of its grid-like structure it has **4pi acceptance**
- The **BabyMIND** magnetized muon spectrometer can measure the charge of the outgoing muons (useful to suppress the wrong sign background)

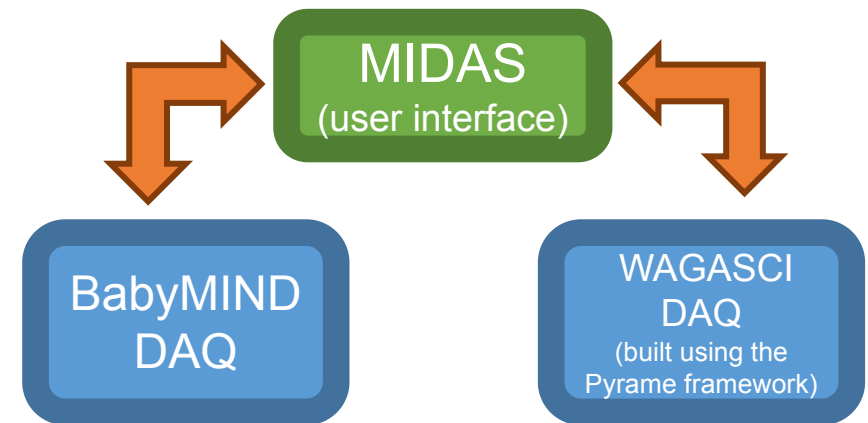


Commissioning phase (2017-2018)

- Only a small subset of the detectors (no SMRD nor BabyMIND)
- The DAQ used during the commissioning phase was developed internally. It was not meant to be readable or maintainable (**no documentation, no comments, no internal coherence**). Basically it was just a bunch of Python and bash scripts
- On top of that the old DAQ had the following shortcomings:
 - **No online monitor** (only semi-offline monitor)
 - **No database** (no info about the runs is stored)
 - **Many memory leaks** (in the calibration and analysis code)
- We should teach students good coding practices. IMHO writing bad code is forgivable, not following good coding practices is not.

New WAGASCI DAQ (switch to MIDAS)

- We wanted to improve on the existing DAQ while keeping as much code as we could
- At the same time, because ND280 is using MIDAS, we thought that it may be better to have a **similar user interface**
- If the user-interface is similar, we could have a **single shifter for ND280, INGRID and WAGASCI**
- The new DAQ should:
 - include an online monitor
 - organize the runs in a sort of database
 - use **MIDAS** at least as a user interface
 - have proper documentation
 - don't use bash scripts (at least not in production)



Frontend DAQ : Pyrame

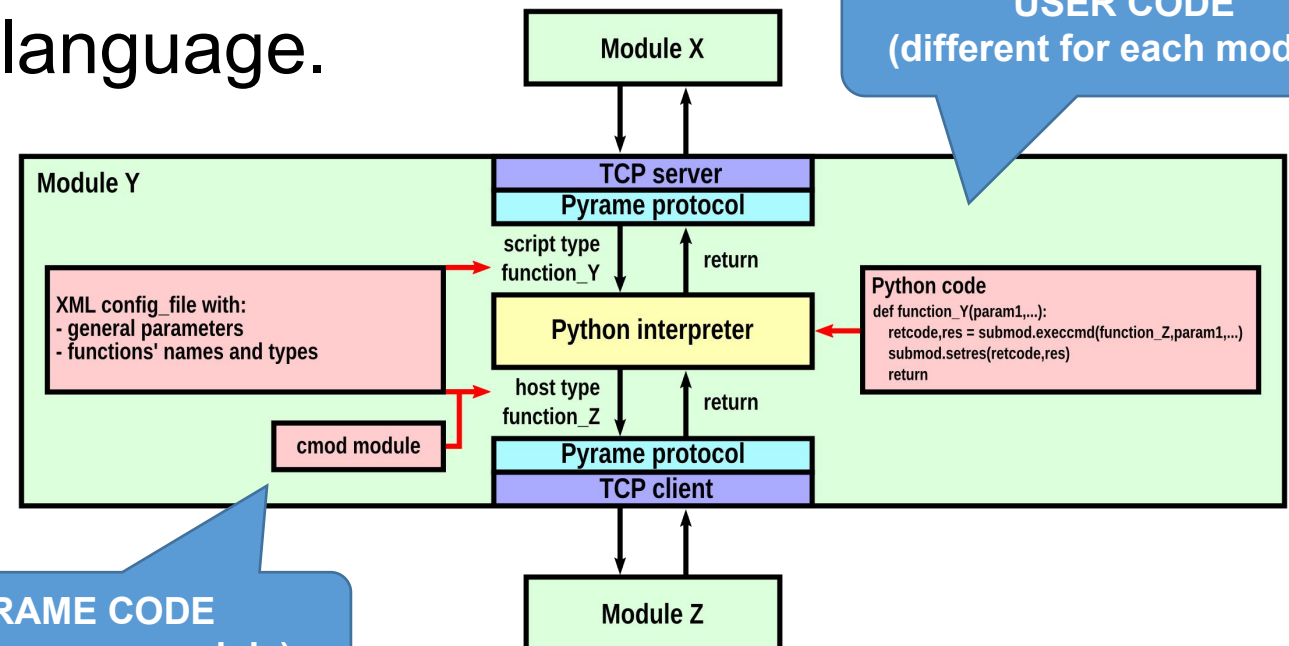
Developed at LLR
by Frederic
Magniette and
Miquel Rubio-Roy

- **Pyrame** is used as the frontend software for all the electronics and slow devices.
- It interfaces directly with the electronics and implements the most basic functions.
- Uses Python as a scripting language.

Pyrame is made up by “Pyrame modules”. Each module is independent from each other and has a well defined API.

PYRAME CODE
(same for every module)

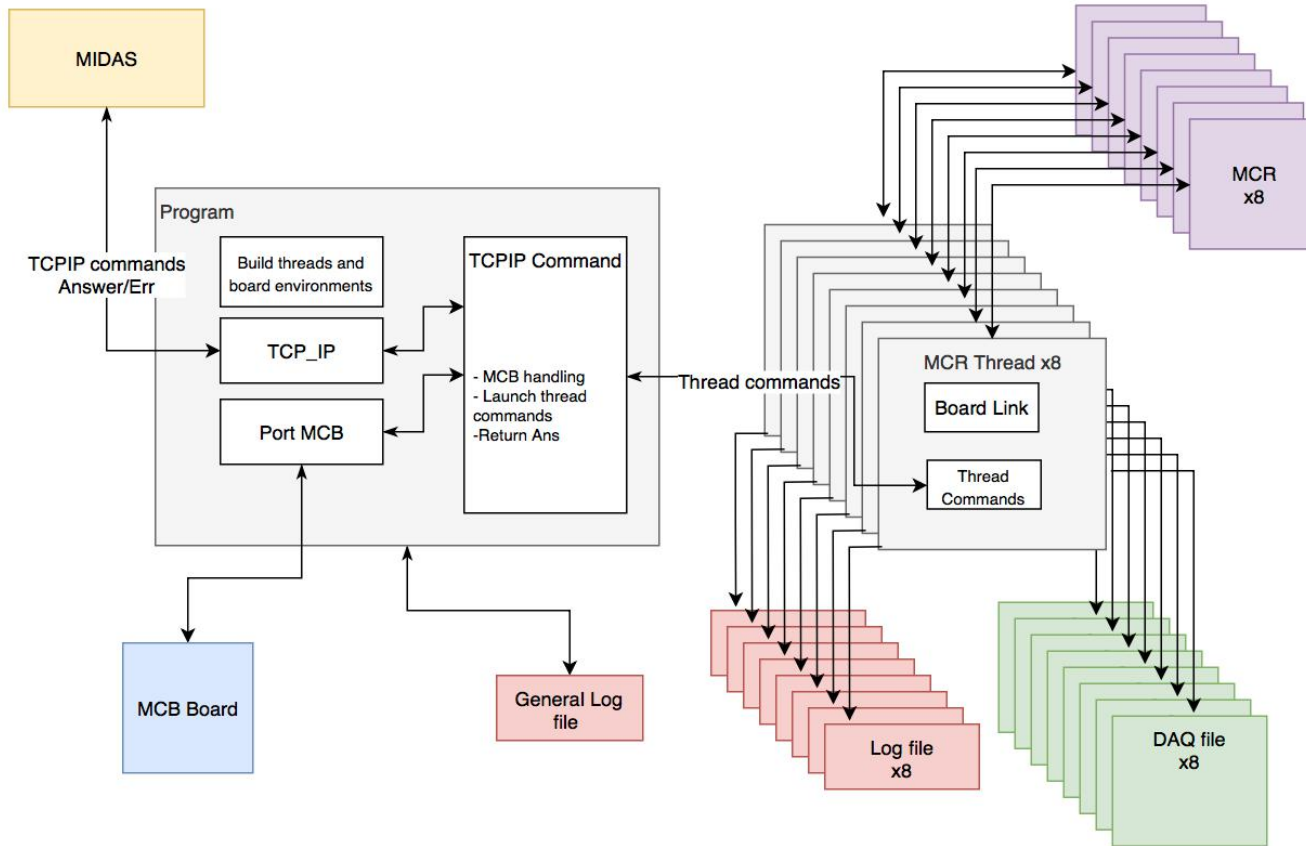
USER CODE
(different for each module)



Developed at
University of
Geneva by Favre Y.,
Parsa S. and others

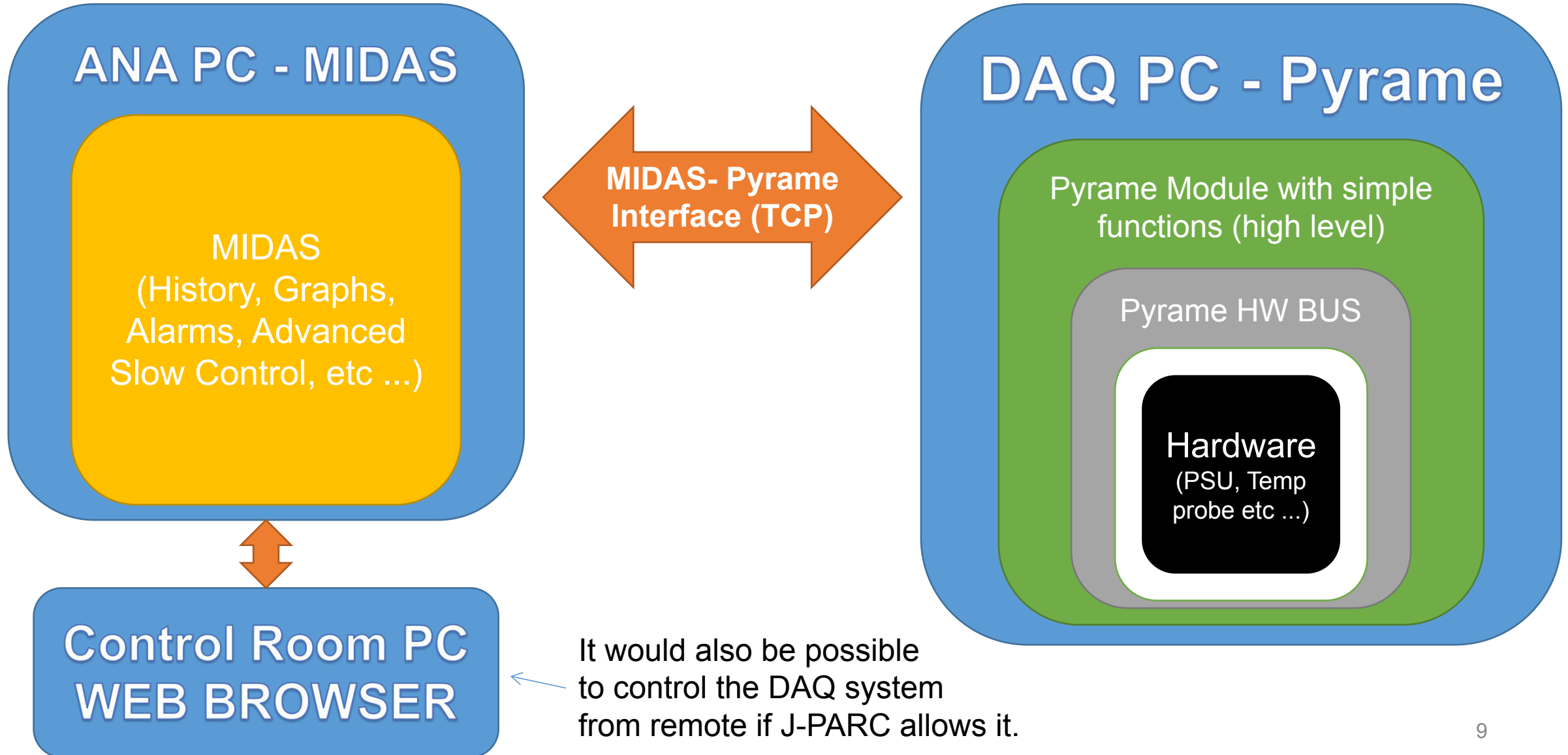
BabyMIND DAQ

The BabyMIND DAQ is completely
independent from the WAGASCI
DAQ



PROS	CONS
It has many features	There is no documentation
It is complete	It is sort of a black box
It has a nice GUI	It was not developed to interface with anything else
It runs both in Windows and Linux	It written in C# (not a language very used in the HEP world)
	No online monitor

MIDAS interface



```

WAGASCI Slow COK      nn0      o <10.0      es0.0      ex15      1083
=====
Run status:  Stopped      Run number 0
=====
Equipment      Status      Events      Events/sec Rate[B/s]  ODB->FE      FE->ODB
-----
High Voltage POK      0          0.0        0.0        14          891
    
```



Slow Control

保護されていない通信 | https://192.168.10.2:...

WAGASCI Alarms: None 3 Jan 2019, 21:11:07 GMT+9

Status

Transition

ODB

Messages

Chat

Elog

Alarms

Programs

History

MSCB

Sequencer

Config

Help

Slow Control

High Voltage

Ramp Up (All)
Ramp Down (All)

			Target Voltage (Volts)	Actual Voltage (Volts)	Actual Current (Amperes)
WAGASCI 1	Ramp Up	Ramp Down	0.00	0.00	-1.84e-11
WAGASCI 2	Ramp Up	Ramp Down	0.00	0.00	-1.84e-11
SideMRD 1	Ramp Up	Ramp Down	0.00	0.00	-1.84e-11
SideMRD 2	Ramp Up	Ramp Down	0.00	0.00	-1.84e-11

Custom pages

- Run control
- Slow control
- Configuration editor
- Backup and servers maintenance
- Online monitor (TO-DO)
- BabyMIND DAQ interface (TO-DO)

Start a new run

Run number: 79

Run Title: 190313_test_01

Run Description: test run

Run Type: Test

Buttons: Start, Cancel

High Voltage

	Ramp Up (All)	Ramp Down (All)	Target Voltage (Volts)	Actual Voltage (Volts)	Actual Current (Amps)
WAGASCI 1	Ramp Up	Ramp Down	0.00	0.00	0.00
WAGASCI 2	Ramp Up	Ramp Down	0.00	0.00	0.00
SideMRD 1	Ramp Up	Ramp Down	0.00	0.00	0.00
SideMRD 2	Ramp Up	Ramp Down	0.00	0.00	0.00

Low Voltage

	Ramp Up (All)	Ramp Down (All)	Target Voltage (Volts)	Actual Voltage (Volts)	Actual Current (Amps)
WAGASCI 1	Ramp Up	Ramp Down	0.00	0.00	0.00
WAGASCI 2	Ramp Up	Ramp Down	0.00	0.00	0.00
SideMRD 1	Ramp Up	Ramp Down	0.00	0.00	0.00
SideMRD 2	Ramp Up	Ramp Down	0.00	0.00	0.00

Bitstream files

Input bitstream file: [] Overwrite: Output bitstream file: []

Parameters

Global threshold: [0] Gain select discriminator: [0] Input DAC: [0] PreAmp feedback capacitors: [0]

Input DAC

Fine tuning: Chip ID: [0] Input DAC reference: 2.5V • 4.5V

WRITE

ANALYSIS PC

Remote Desktop Web Console IDRAQ

Server status = OK
Disk status = OK
Disk capacity = OK

Still to finish

MIDAS - Pyrame comparison

MIDAS	Pyrame
Full-blown DAQ software suited for middle/big experiments	suited for prototyping and small experiments
Powerful and very customizable GUI	Basic GUI
Many options to set up a database	There is a database but is very buggy and will be removed in the near future
Mainly written in C/C++/Javascript	Mainly written in C/Python
Quite steep learning curve	Quite easy to add new functionality
Still no support for the ROC chips	Complete support for the ROC chips

What I have done

- Temperature sensors frontend (C)
- Water level sensors frontend (C)
- Power supply frontend (C)
- Pyrame frontend (C)
- BabyMIND DAQ frontend (C)
- Trigger frontend (C++)
- Written some of the custom pages (in HTML and Javascript)

What I still need to do

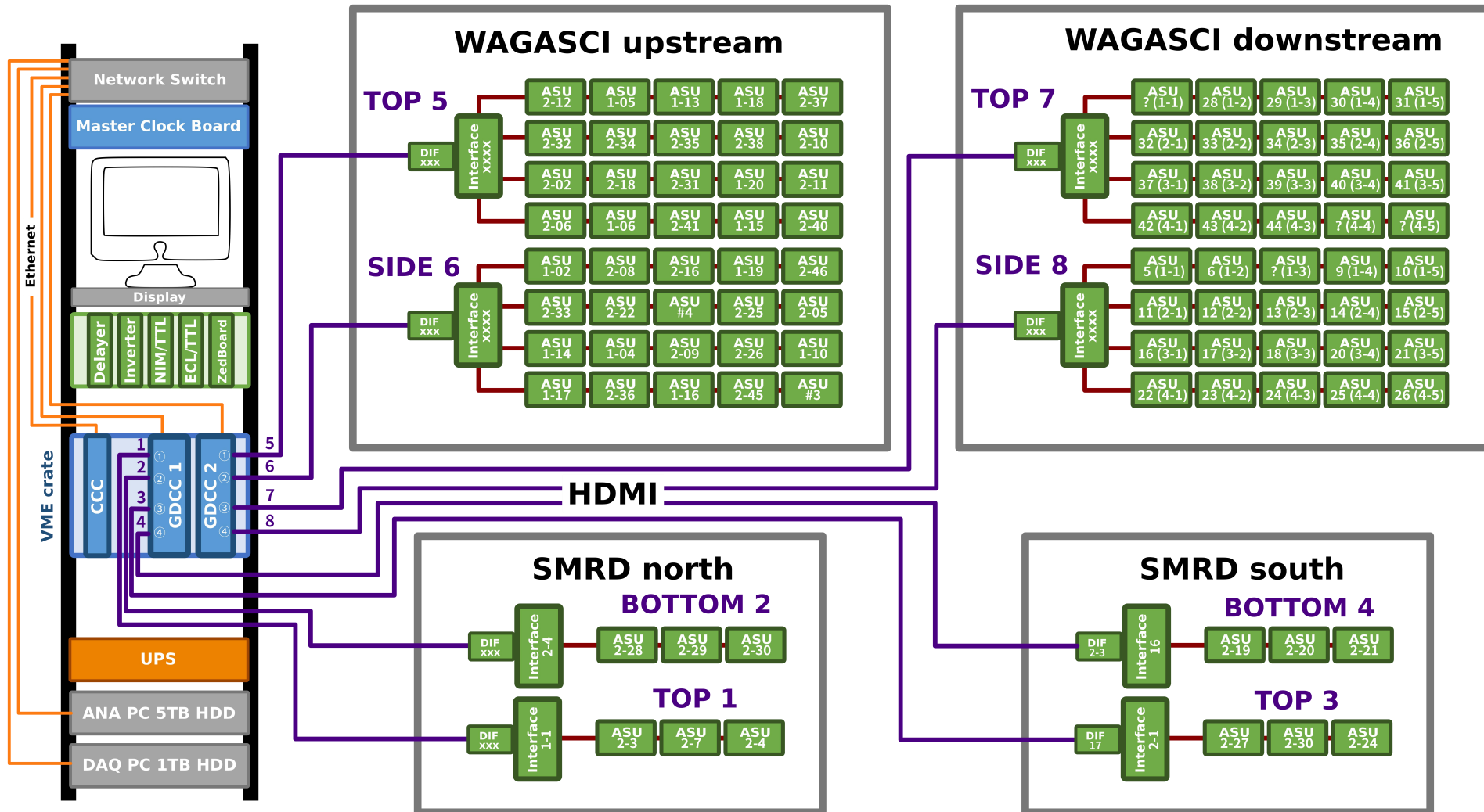
- Port all the C frontends to C++
- Online monitor custom page
- Interface between MIDAS and BabyMIND
- History plots for the slow control (should be easy)
- Familiarize with the alarm system
- Find a way to send the WAGASCI raw data to MIDAS using MIDAS events (it should be possible)
- Find a way to send the BabyMIND raw data to MIDAS using MIDAS events (it may be not possible)

Call a C++ library (a function) from the GUI

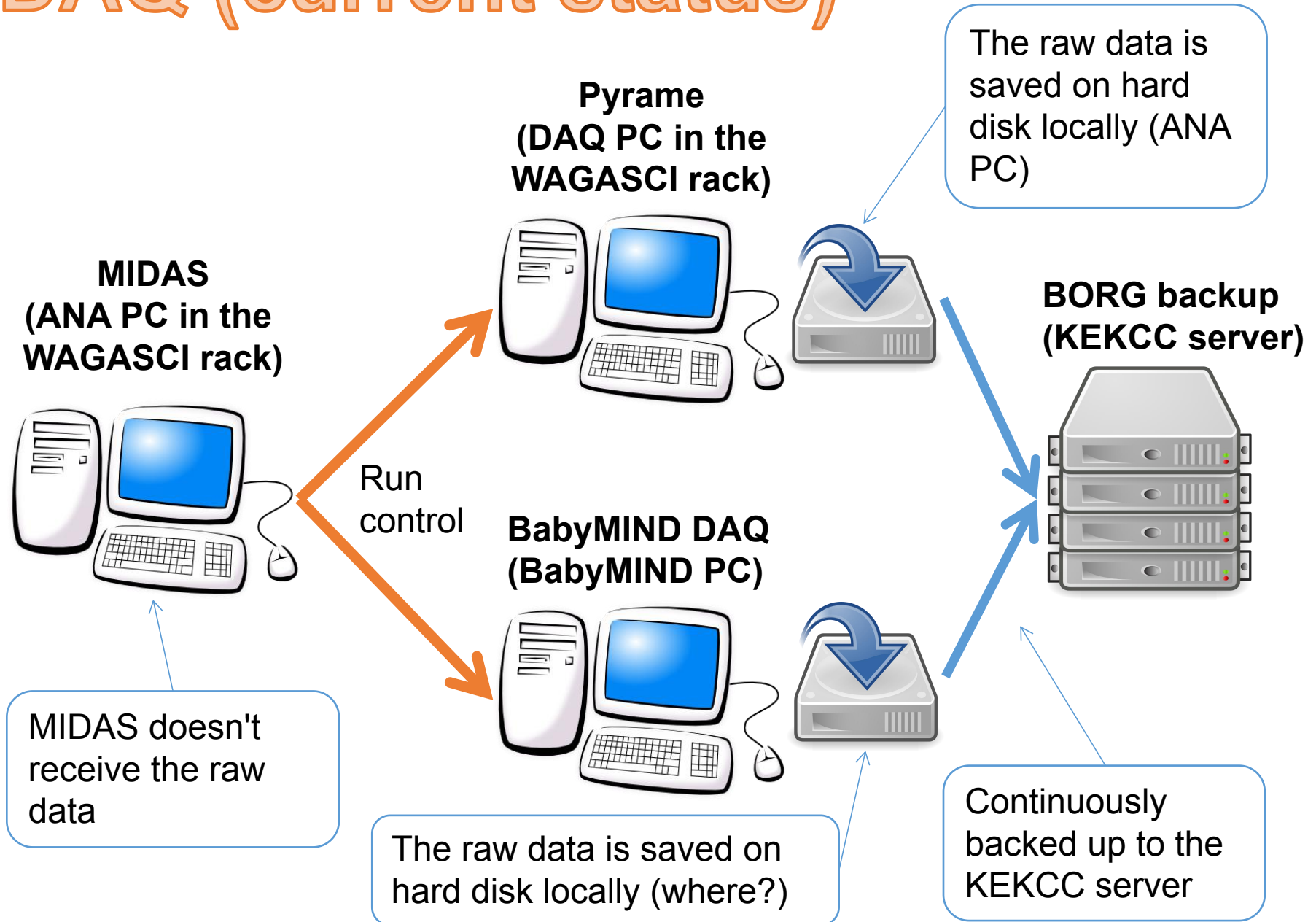
- I wanted to call a particular function of a C++ library from a custom page. I was able to do that by adding a few lines to the MIDAS server (mhttpd.cxx) to add a custom RPC call.
- Then I was told that there are some RPC calls just for that purpose (exec_script)
- I feel the need for a slightly easier/clearer way to call a local program or function from the GUI
- The documentation regarding this could use some work

Backup

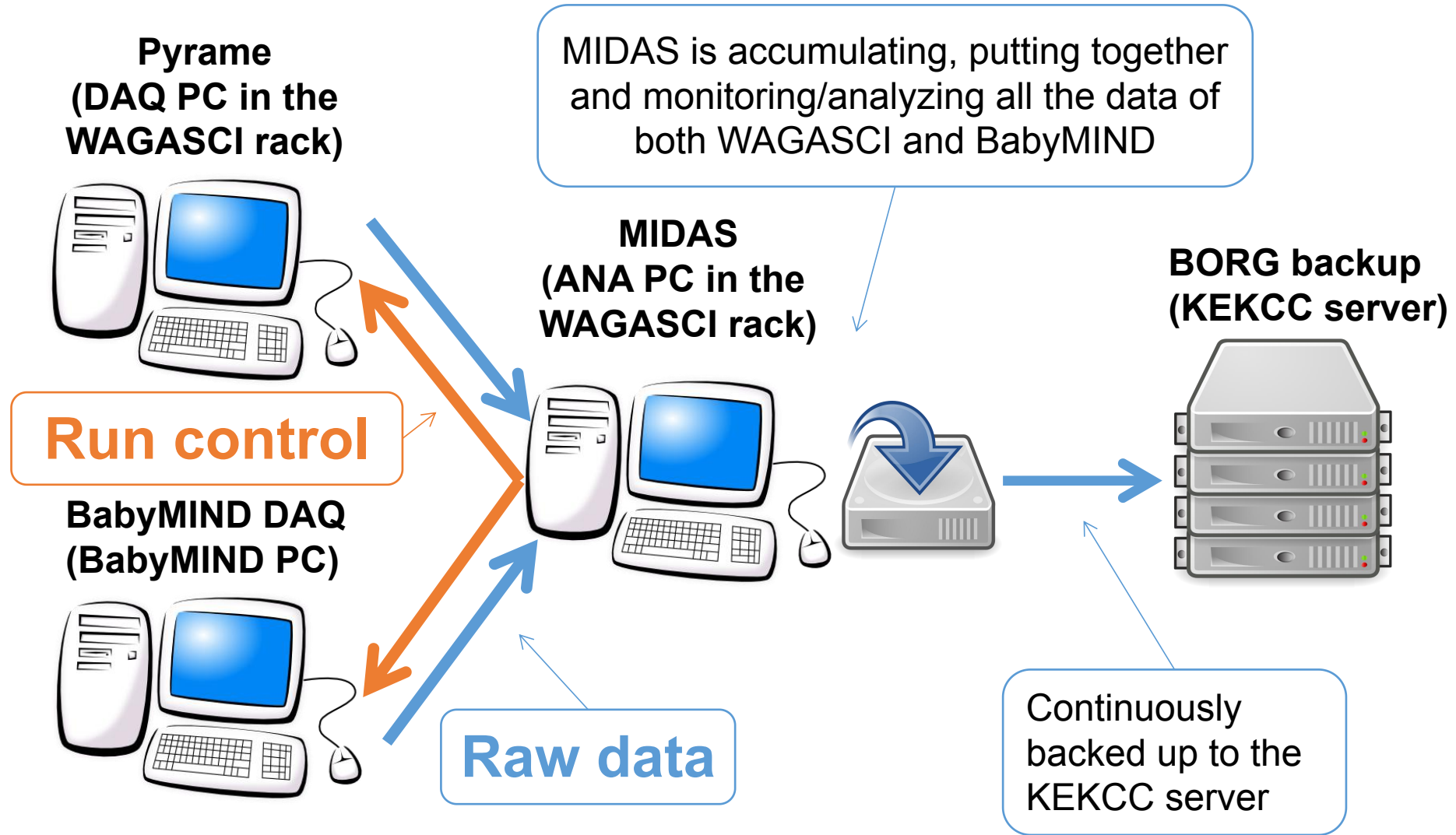
WAGASCI electronics



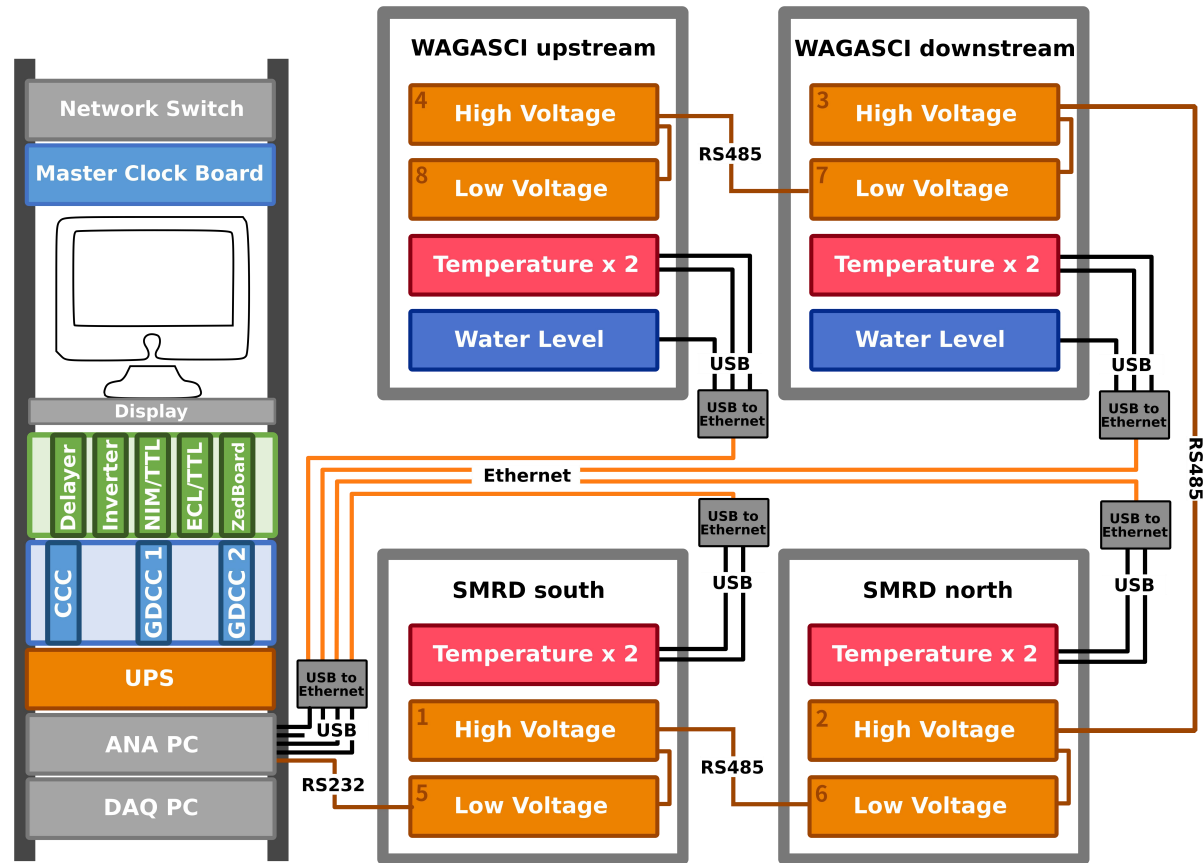
DAQ (current status)



DAQ (final goal)



Slow control



The cabling is not finished and the WAGASCI electronics is not fully operational, yet. So we had not a chance to test all the slow control devices all together.