A Portable ReadOut ModulE for Tilecal ElectrOnics

PROMETEO

Xifeng RUAN (Wits)
Carlos Solans (Cern)
Bruce Mellado (Wits)
Robert Graham Reed (Wits)
Reto Suter (Wits)
Charles John Sandrock (Wits)

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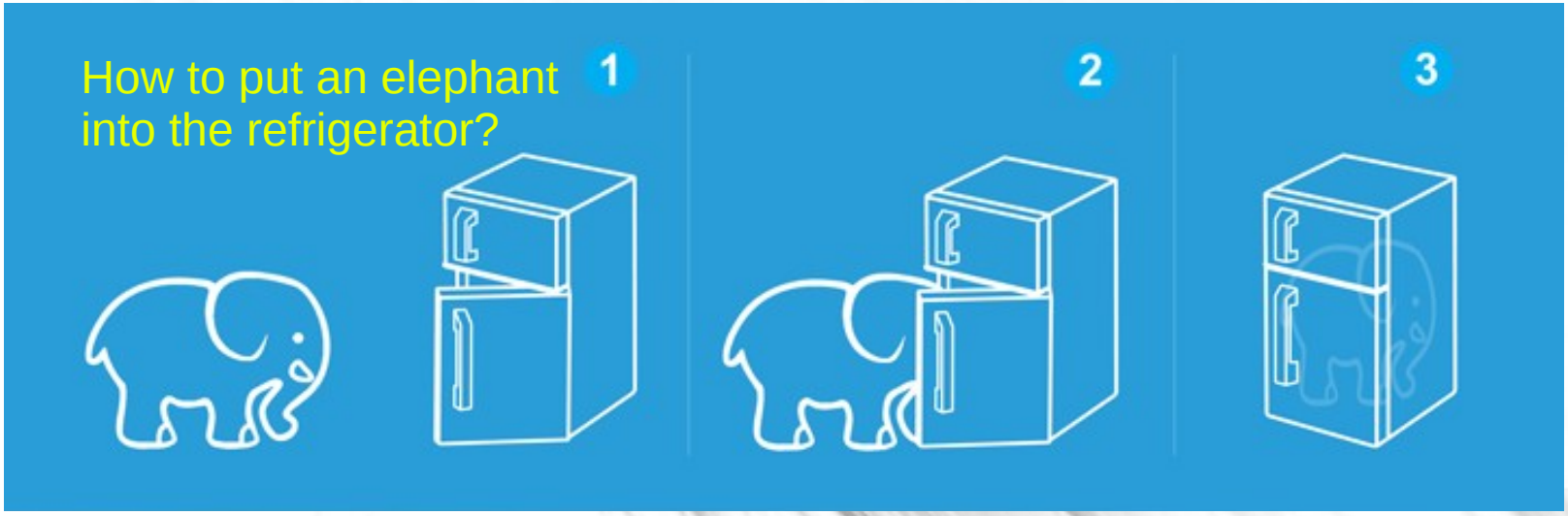
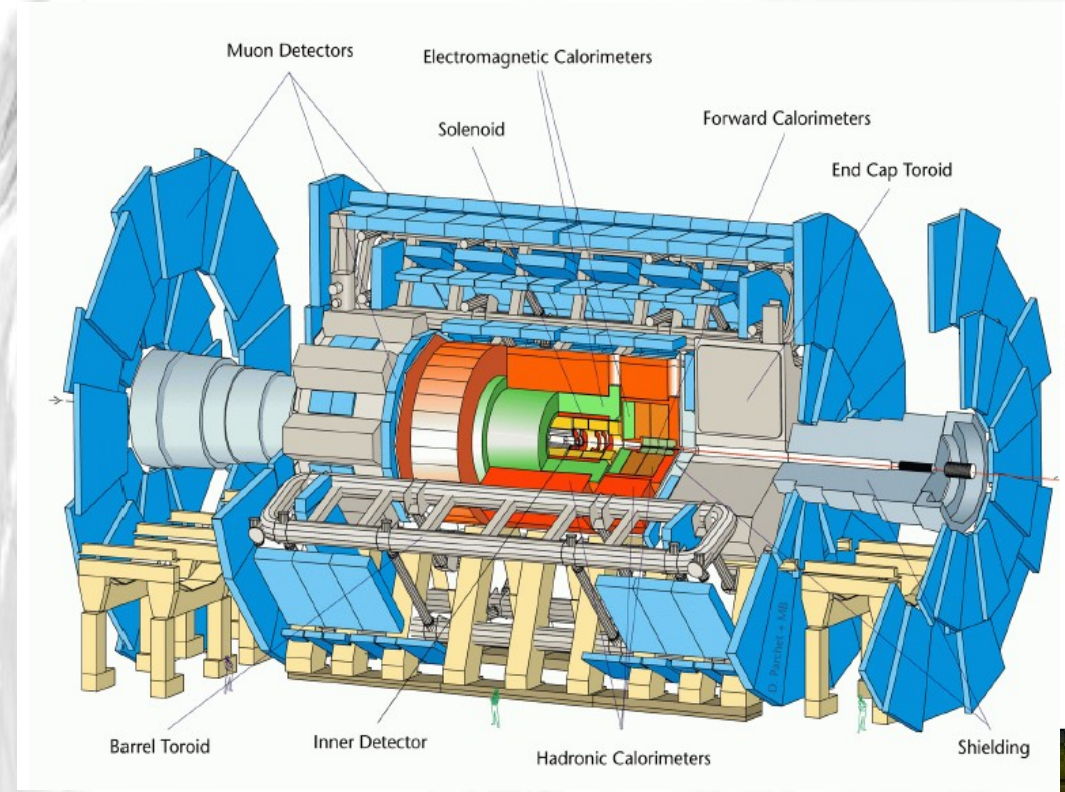
- Introduction
- The upgrades of the front end electronics of the ATLAS Tile Cal
- The Test Benches and QA system – from Mobidick 4 to Prometeo
- The Mechanical design
- The Software of Prometeo
- Prospect

Introduction

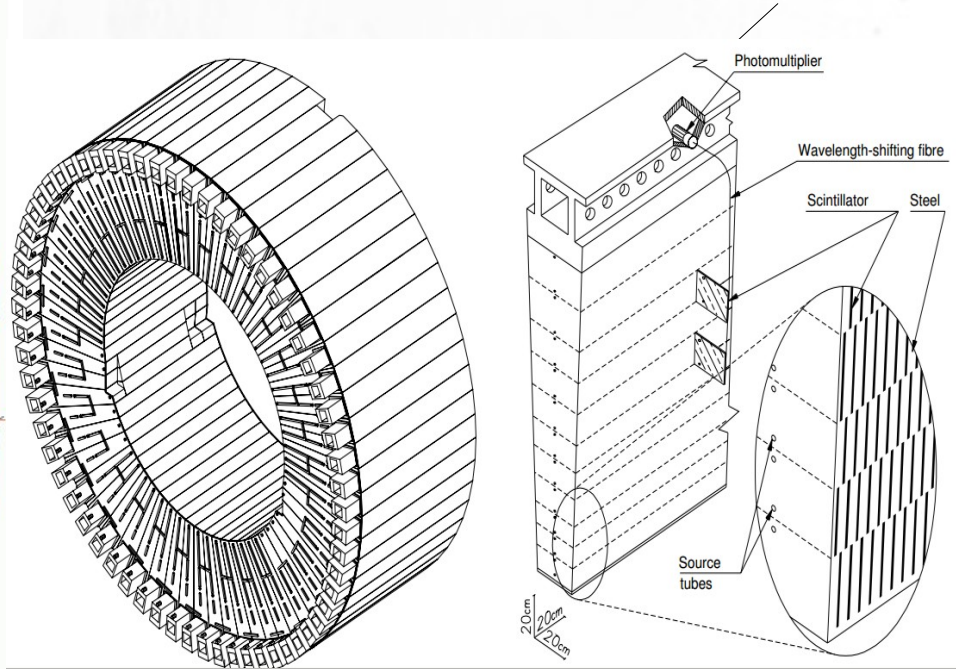
- Prometeo (A Portable ReadOut ModulE for Tilecal ElectrOnics) is the next generation test-bench for the certification of the Tile Cal electronics in the ATLAS upgrade Phase II.
    - Connect the Prometeo(box) to the TileCal front end electronics.
    - Click “Execute Test” to test all components and functionalities in the front end electronics.
    - Be happy with the results.



The ATLAS Tile Calorimeter



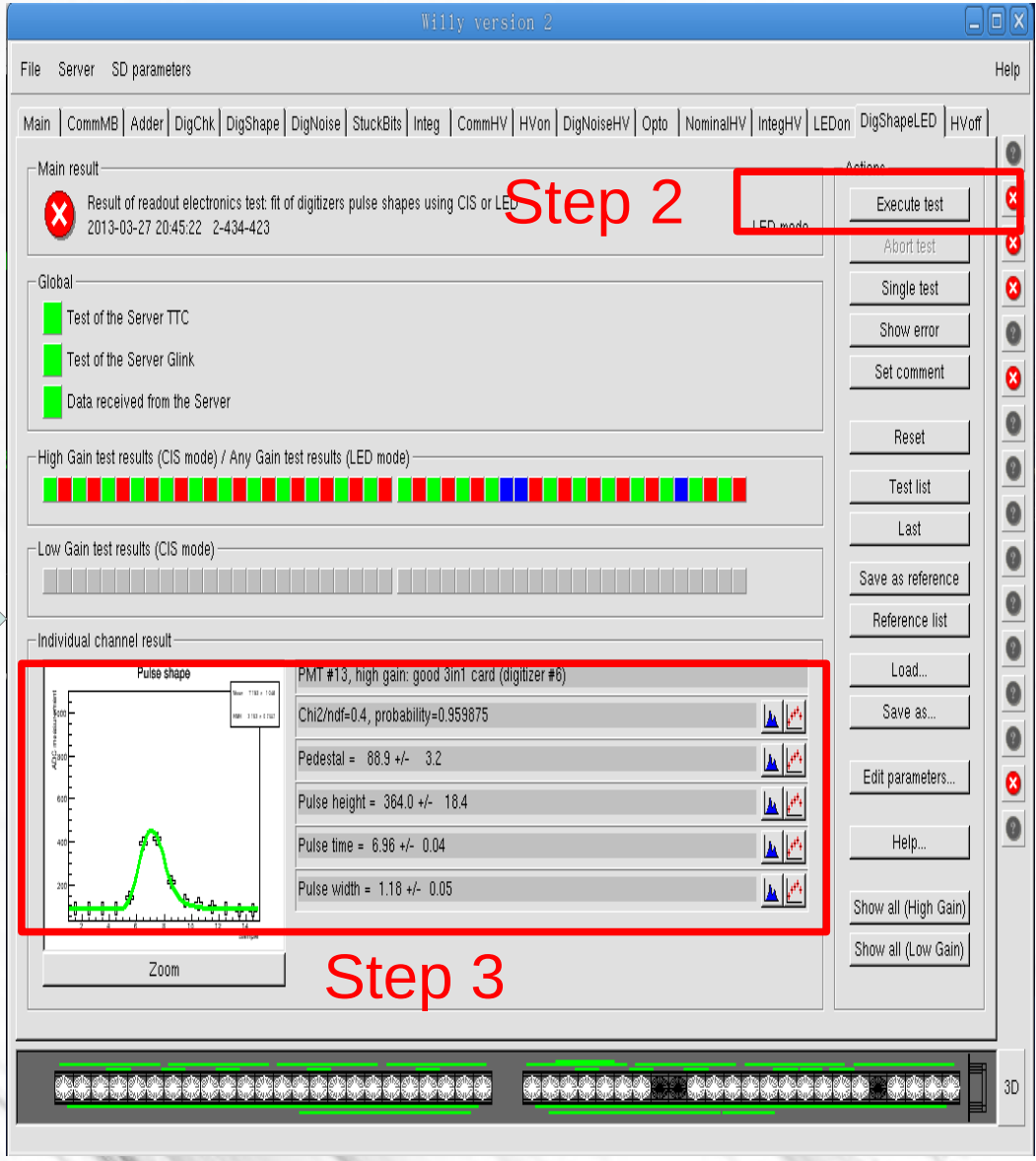
Superdrawer



- Steel (absorber) + plastic (scintillator)
- Coverage: |η| < 1.0 (central) 0.8 < |η| < 1.7 (extended) using 64 modules
- 48 cells (central) + 14 cells (each side) in each module.
- Data receiving 40 MHz

Current Mobidick 4

Step 1



What to test?

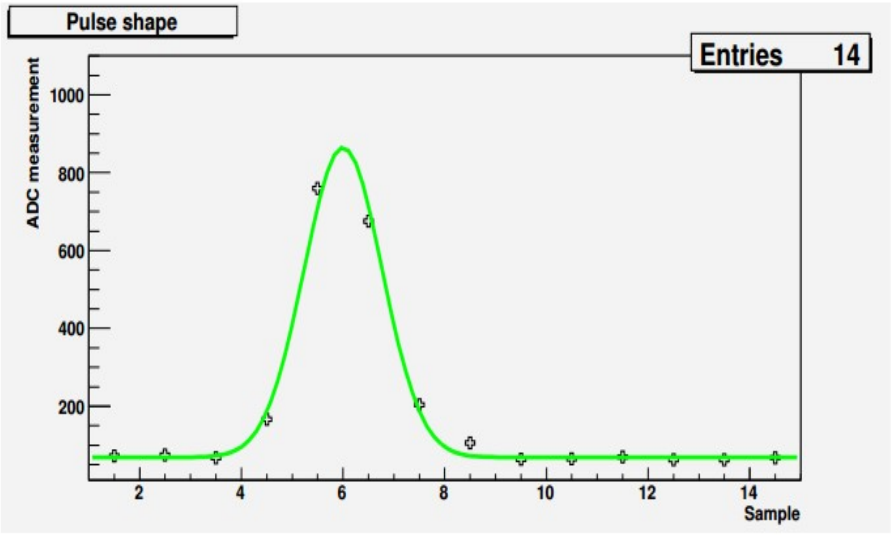


Figure 11: *Example of a digitized pulse shape generated by the CIS.*

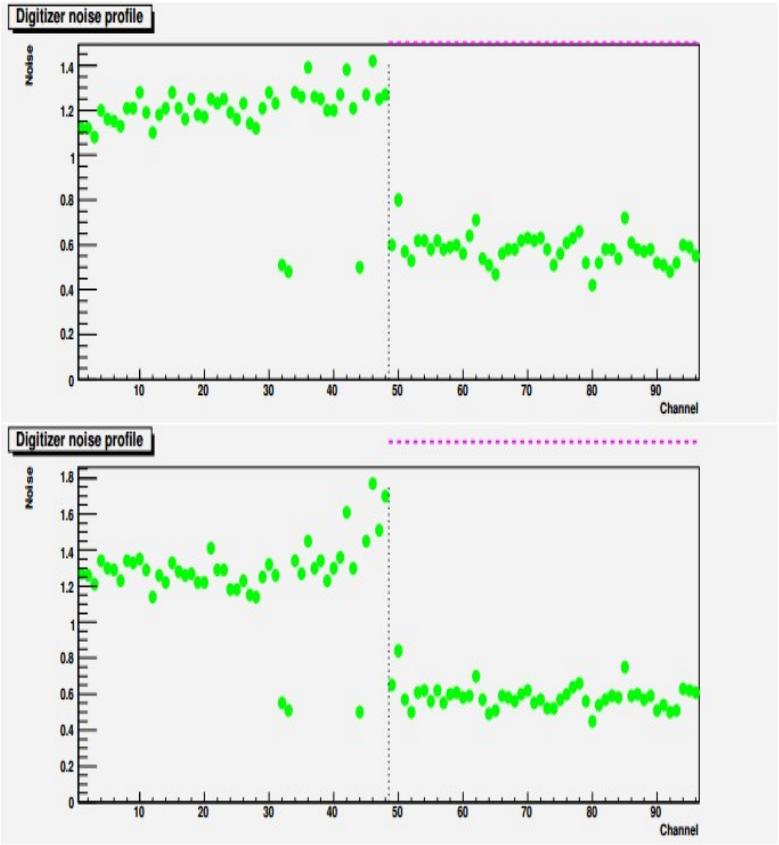


Figure 15: *Example of noise profile of a super-drawer. Left: high gain, right: low gain. Top: DigNoise, bottom: DigNoiseHV.*

- Communication between all components
- Digitized shape
  - from injected charge in 3in1 cards to test the front end electronics
  - LED illuminates PMTs to test PMT+front end electronics
- Noise measurement

The front end electronics in Tile Cal

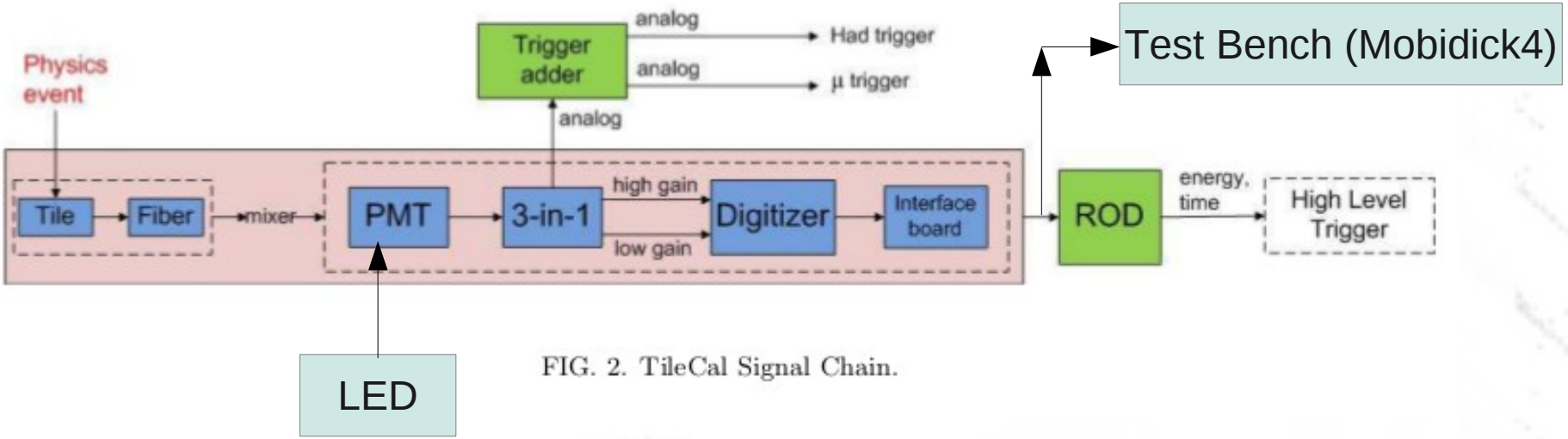


FIG. 2. TileCal Signal Chain.

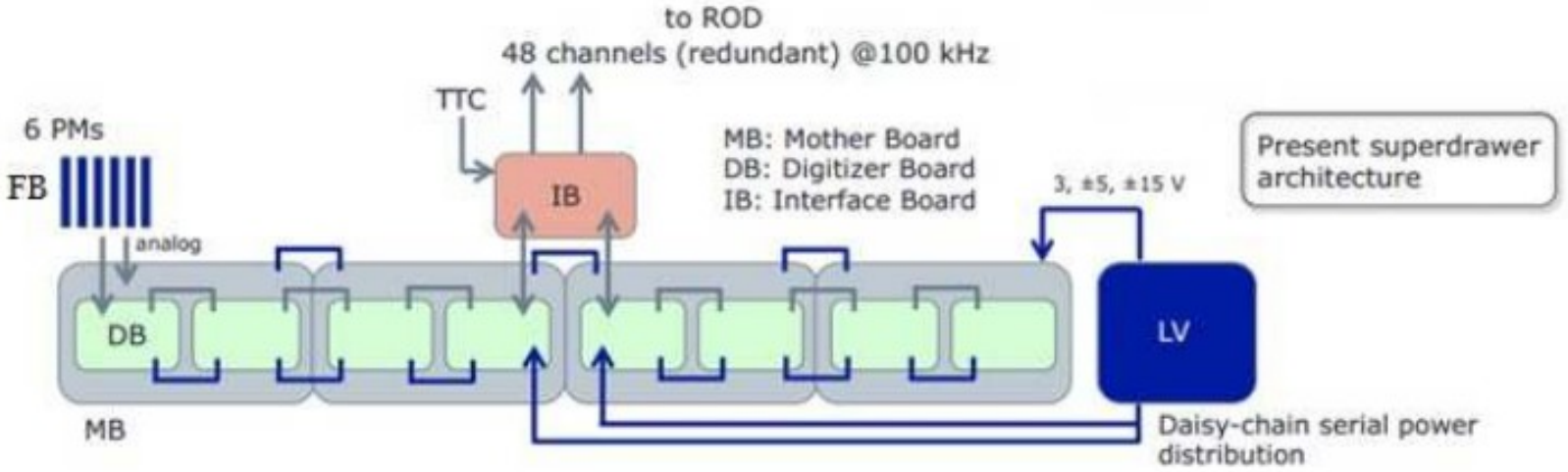


FIG. 3. Current archtecture of the TileCal electronics drawer.

Electronics in tile Cal after the upgrade

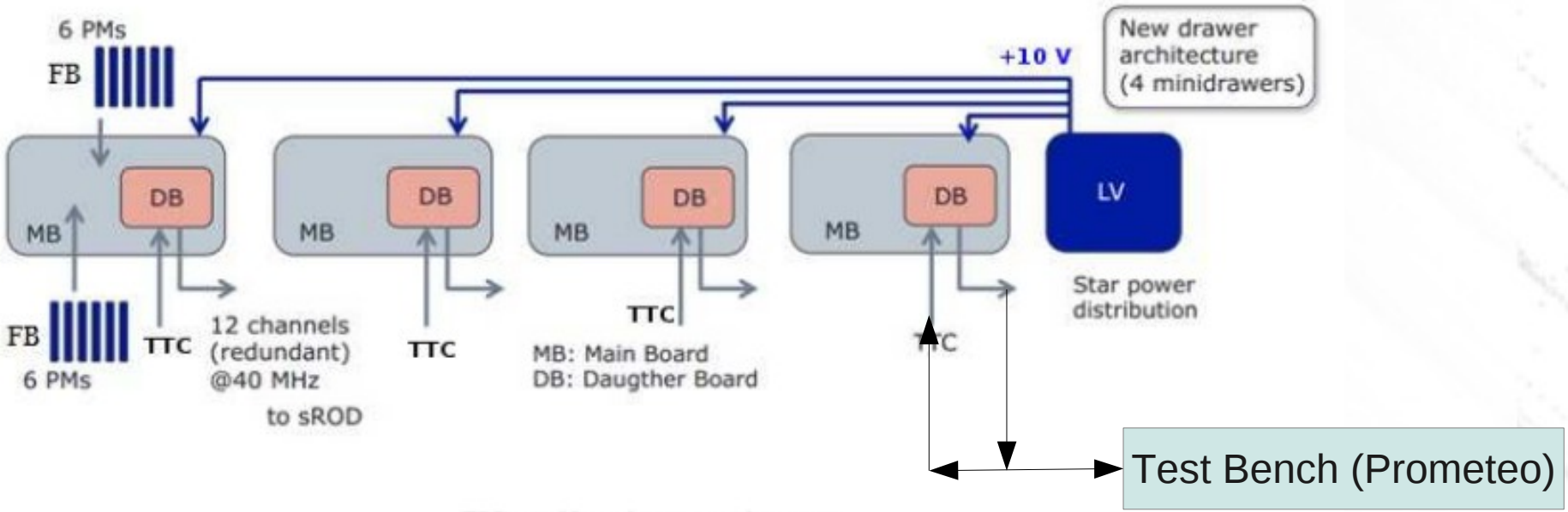
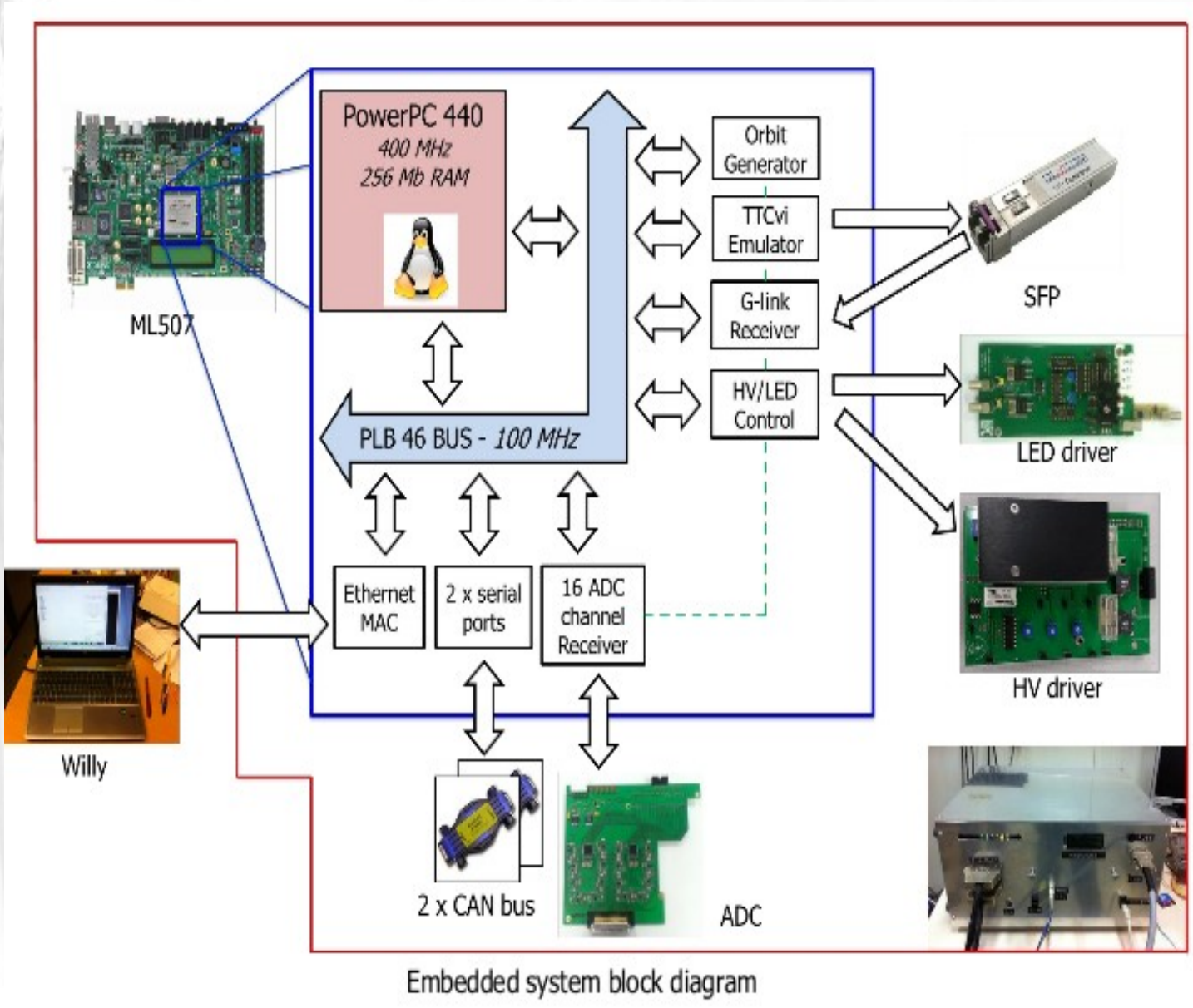


FIG. 4. New drawer archtecture.

- Aiming at upgrade phase II (2022-2023)
- High luminosity(10X current)
- Increasing radiation tolerance
- Improvement of system reliability
- increase data precision
- improve the level one trigger system
- Improved Signal to Noise Ratio (SNR)

The current Mobidick 4

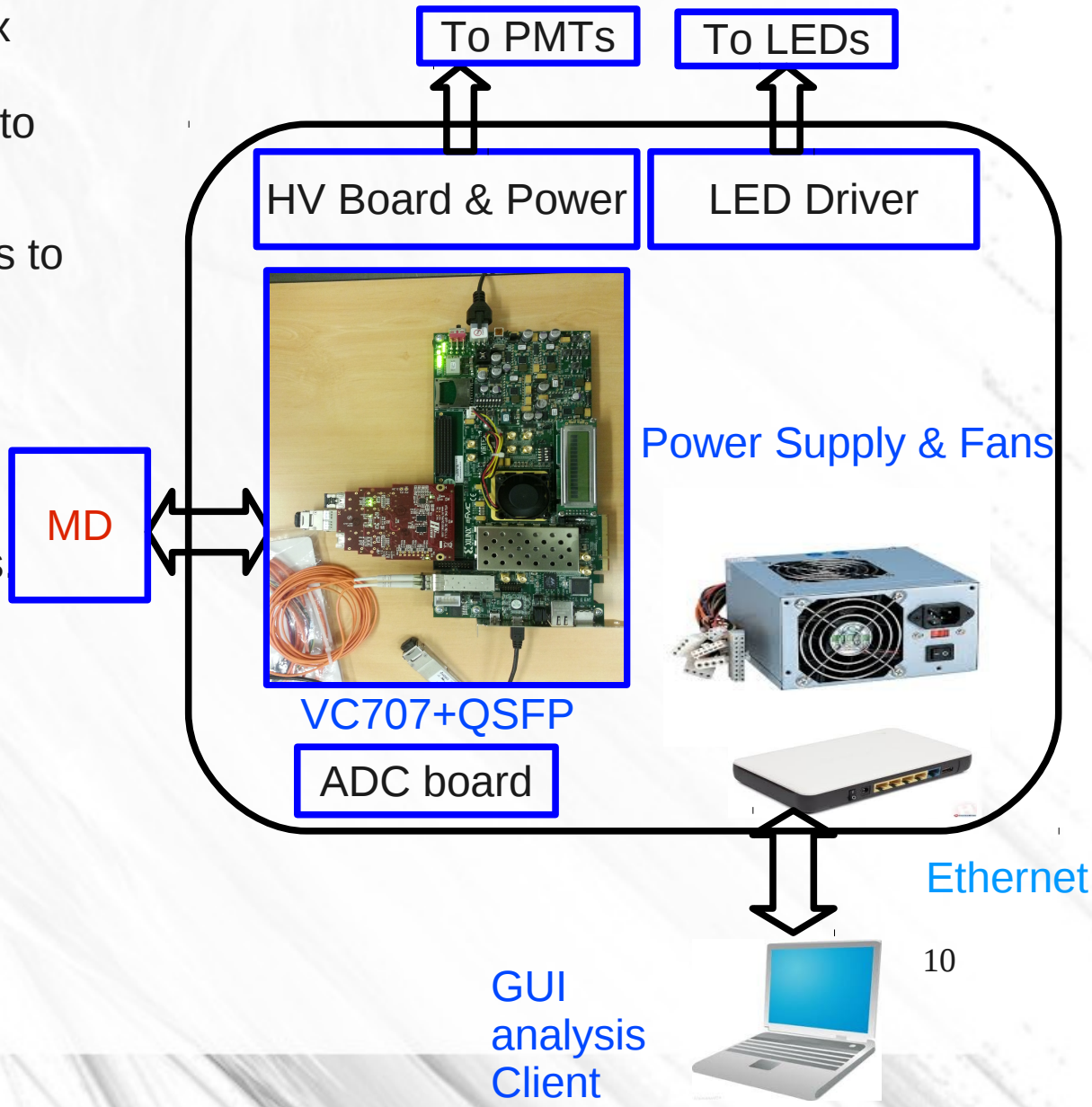


Embedded system block diagram

- Main board: ML507
- Recording data after Lv1 trigger @100kHz
- Using slow canbus to control 3in1 cards and HV in each PMT.
- Server running on PPC, connect by clients via Ethernet

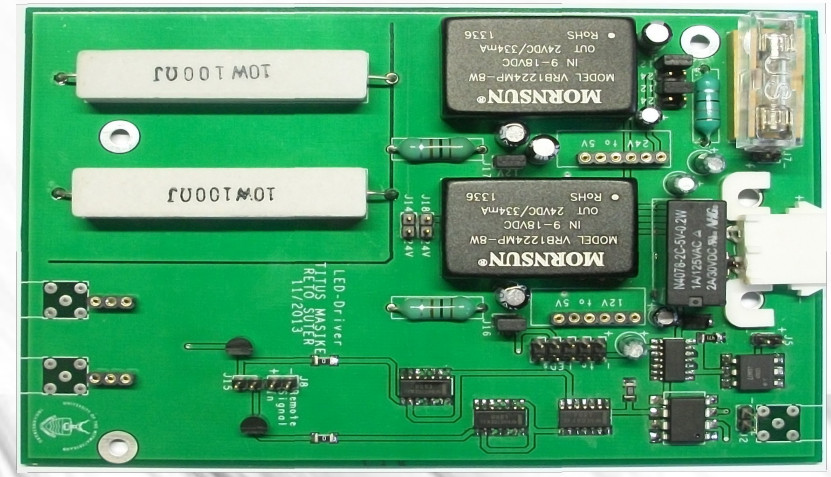
Mobidick 4 to Prometeo

- The main board of Prometeo is Xilinx VC707 and QSFP to transfer data through FMC connectors at 40MHz, to be replaced by sROD in the future.
- Bandwidth upgrades from 440Mbits/s to 40Gbit/s
- Full compatibility to sROD in the TileCal, internally implementing a 32 bin histogram to record noise
- Attached the current HV/LED boards.
- Keeping position for ADC boards to process the analog signal from mini drawers.
- Remove Canbus dongles
- Using IP bus protocol, firmware manipulated directly by client via Ethernet

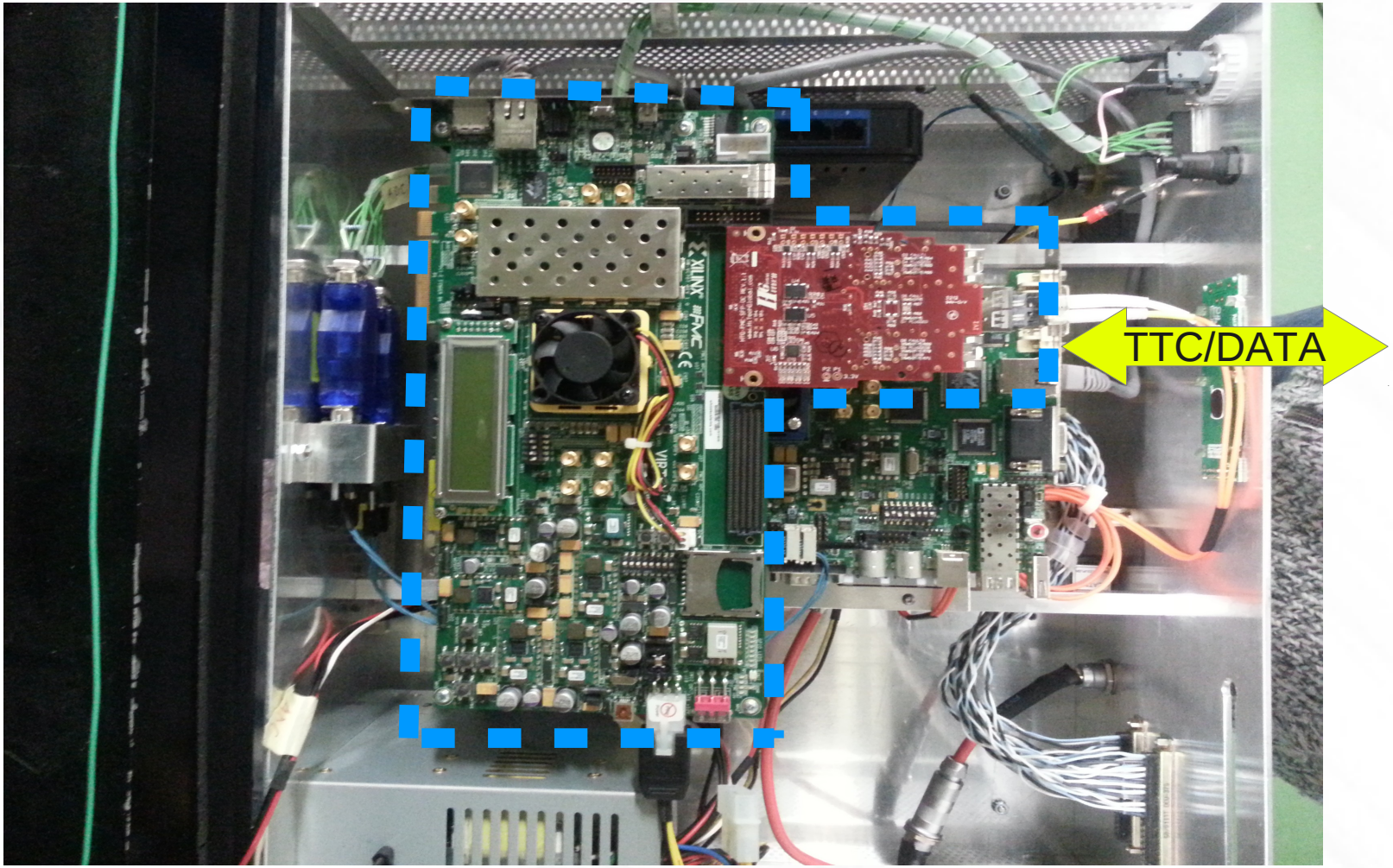


HV and LED boards

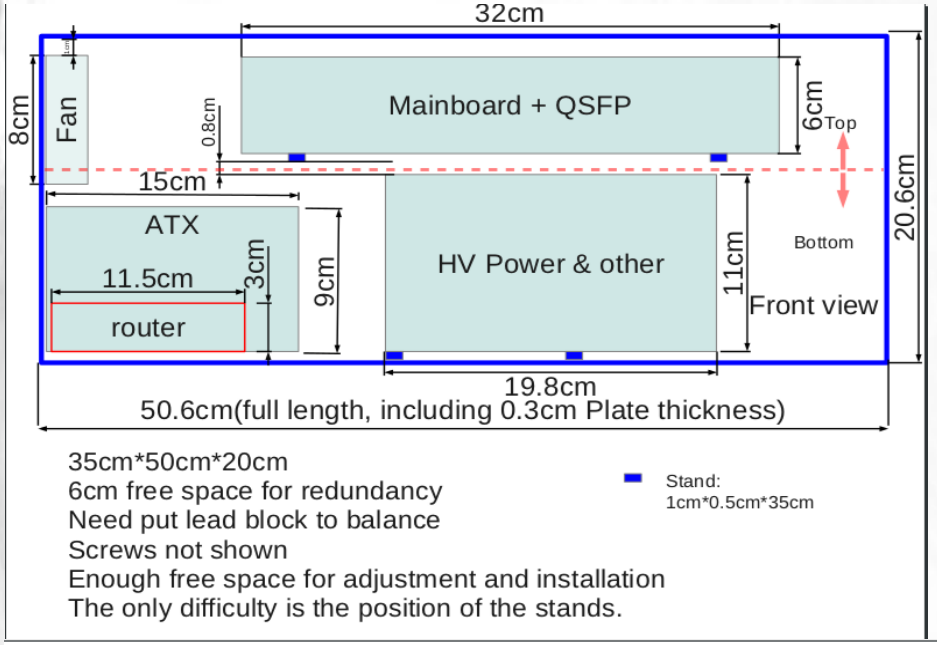
- HV Board:
  - Feeds PMTs with -830V
  - Prototype assembled and tested
  - Five more boards sent in for populating
  - All work perfectly
  - First version of HV and LED were designed/produced by Clermont Ferrand.
- LED board :
  - Generates a 20 V, 20 ns wide pulse to drive an LED
  - update the components used to increase lifetime

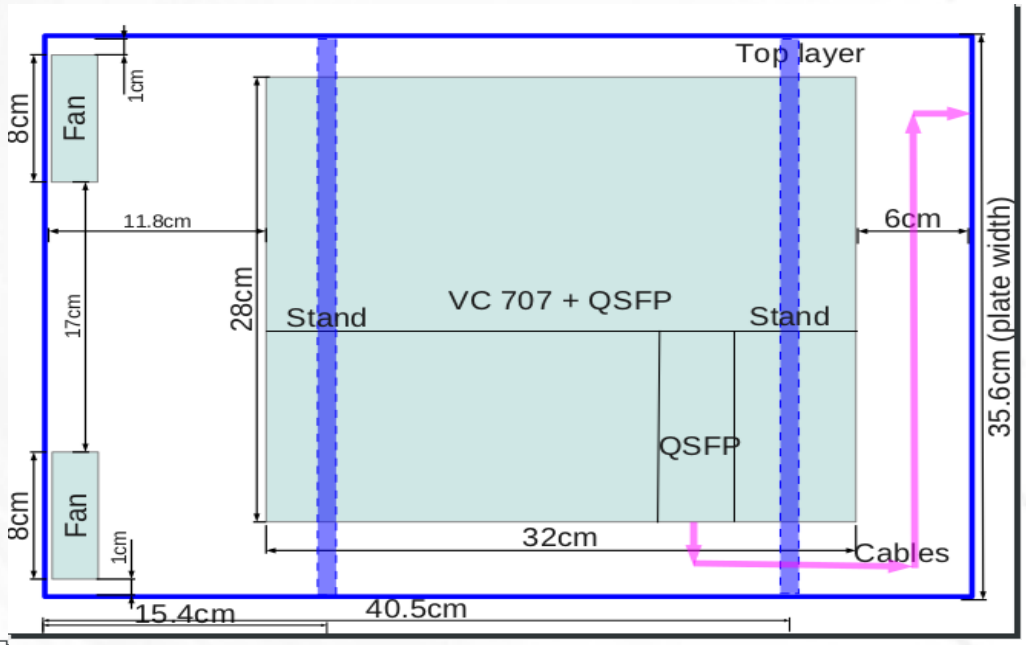


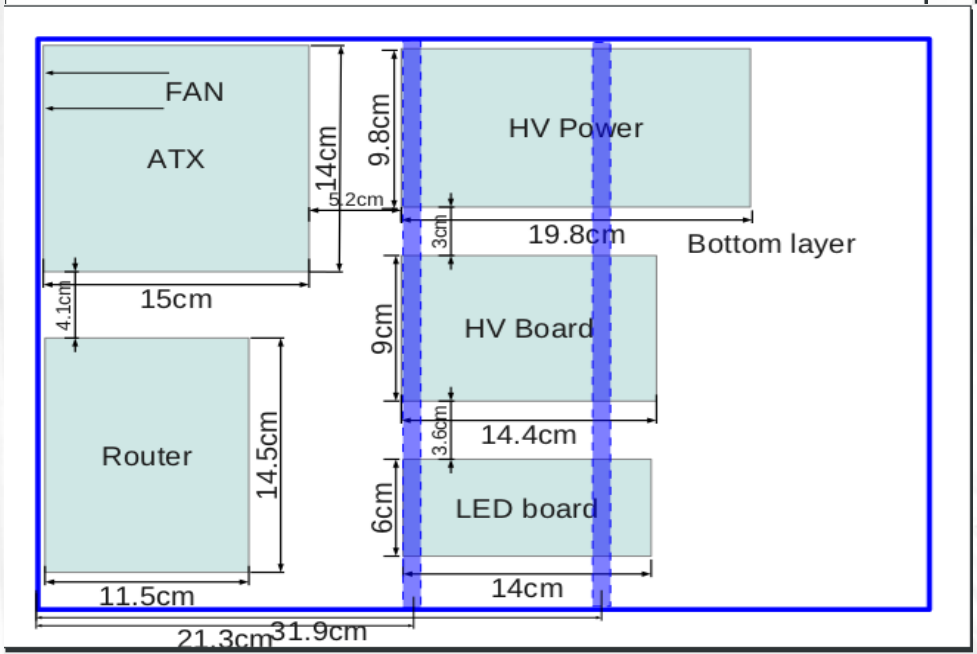
VC707 board and QSFP board on FMC connector putting in a Mobidick 4 box

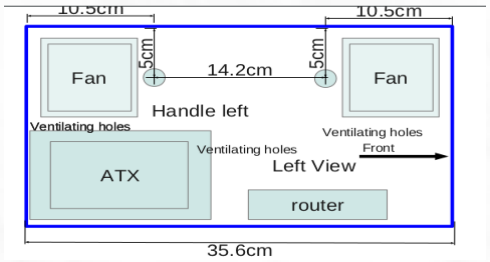


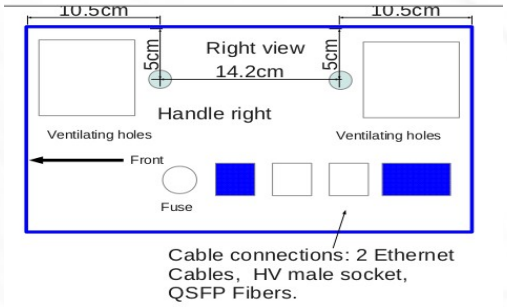
Mechanical design -being produced @ Wits





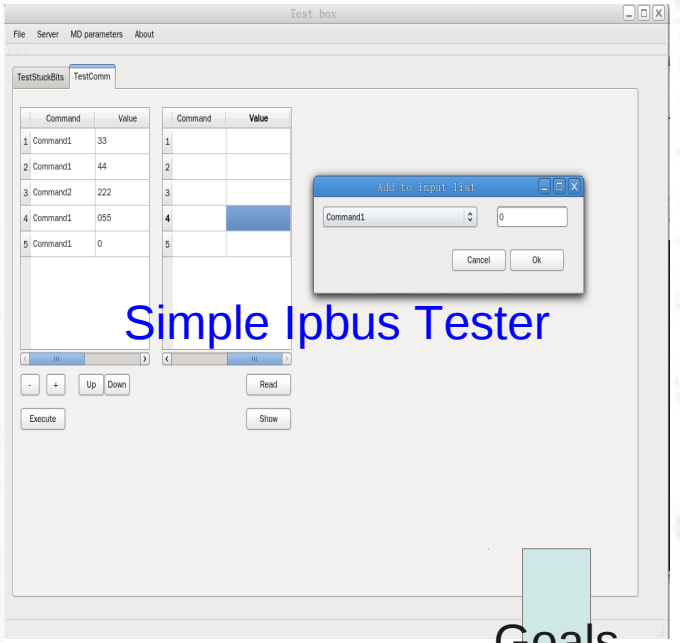




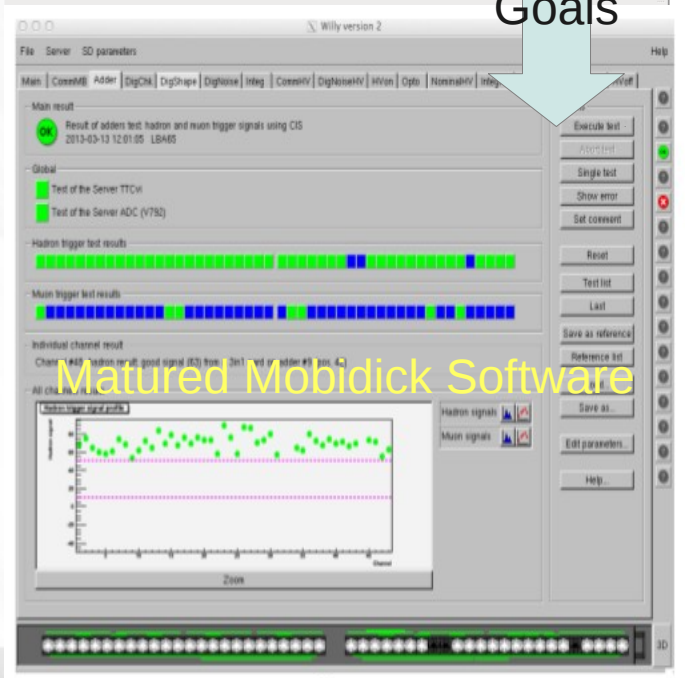


Software design

- Like the Willy in Mobidick4, the Gui Software is needed to perform the tests.
- Features:
  - Software runs on all kinds of OS
  - Run the test, display the status/results and histograms.
  - Easy to add new test into the software.
  - Core algorithm doesn't depend on GUI—easy to transplant.
  - Including a software emulator which act as the hardware for software developing.
  - Using Ipbus core and UDP to manipulating hardware through Ethernet/wifi. (Server-Client => Client Only)



Goals



Willy GUI

Summary

- Upgrades of TileCal Electronics:
    - Superdrawers->Minidrawers
    - Rod(100kHz)->sRod(40MHz)
- Upgrades of the test bench (Mobidick4->Prometeo)
    - Main board to match the Rod -> sROD
    - Remove canbus dongles
- Upgrades of the software (Mobidick4 -> Prometeo)
    - PPC(server, processing)+Willy(client, displaying)
      ->Ipbus(firmware)+GUI client(processing+displaying)

Prospect

- After this workshop finish the mechanical production
- By the end of Feb finish the main skeleton of software and do simple tests.
- In 2 months waiting for firmware installed
- After that finish final test/tuning on the box.
- In the future, replace the commercial main board to the sROD designed by ATLAS.