GAE Instrumentation and Engineering capabilities

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cta
cherenkov telescope array

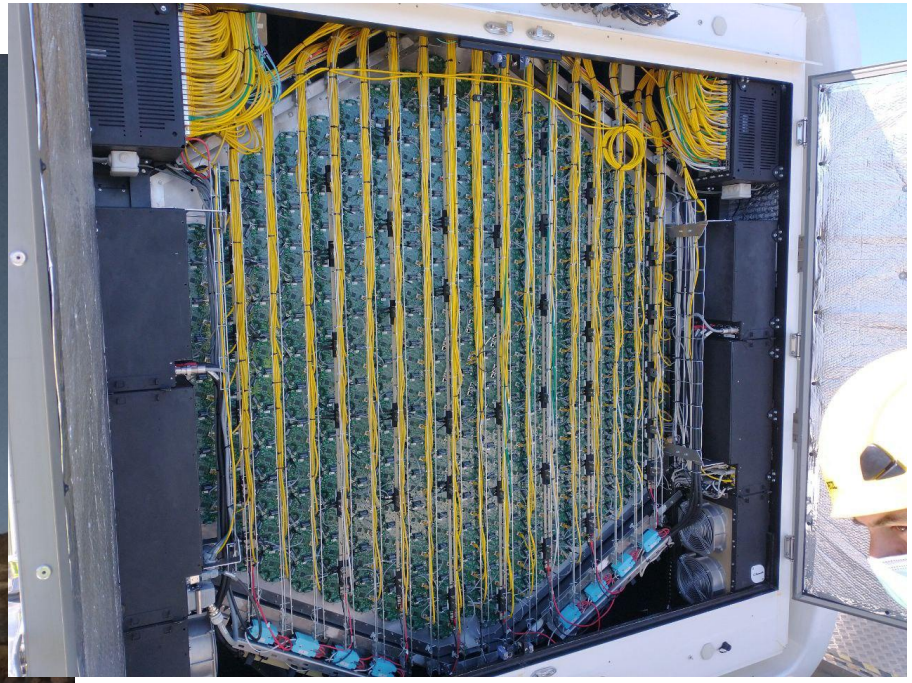
MAGIC
Major Atmospheric
Gamma Imaging
Cerenkov Telescope

Summary

- CTA
  - Trigger Interface Board
  - White Rabbit
- MAGIC
  - Maintenance of receivers and timing
  - Central Píxel
  - Stereo MAGIC - LST
- Other hardware projects
  - European project
  - National project
  - TFGs
- Summary of capabilities

CTA - TIB

The trigger interface board is placed inside the cameras of every LST and NectarCAM MST. It is a complex system.



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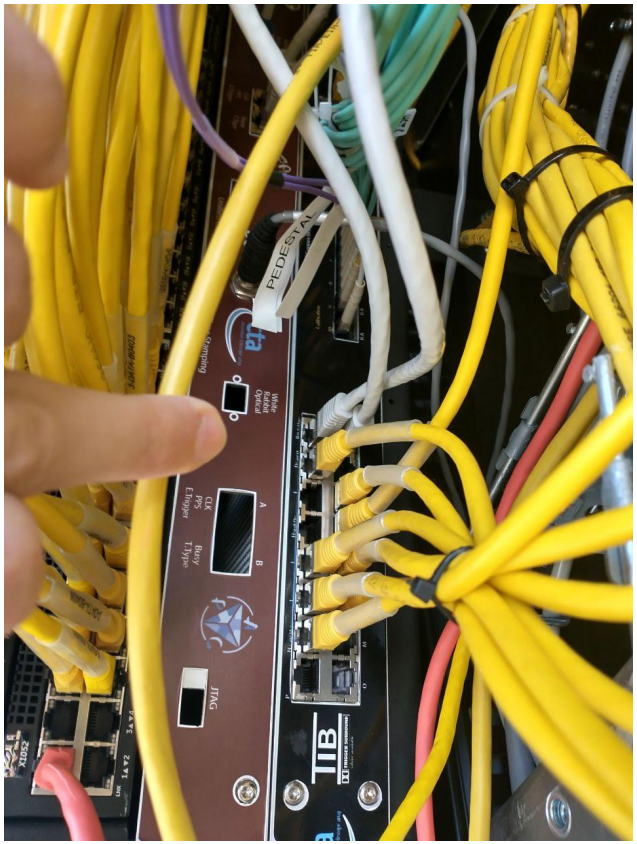
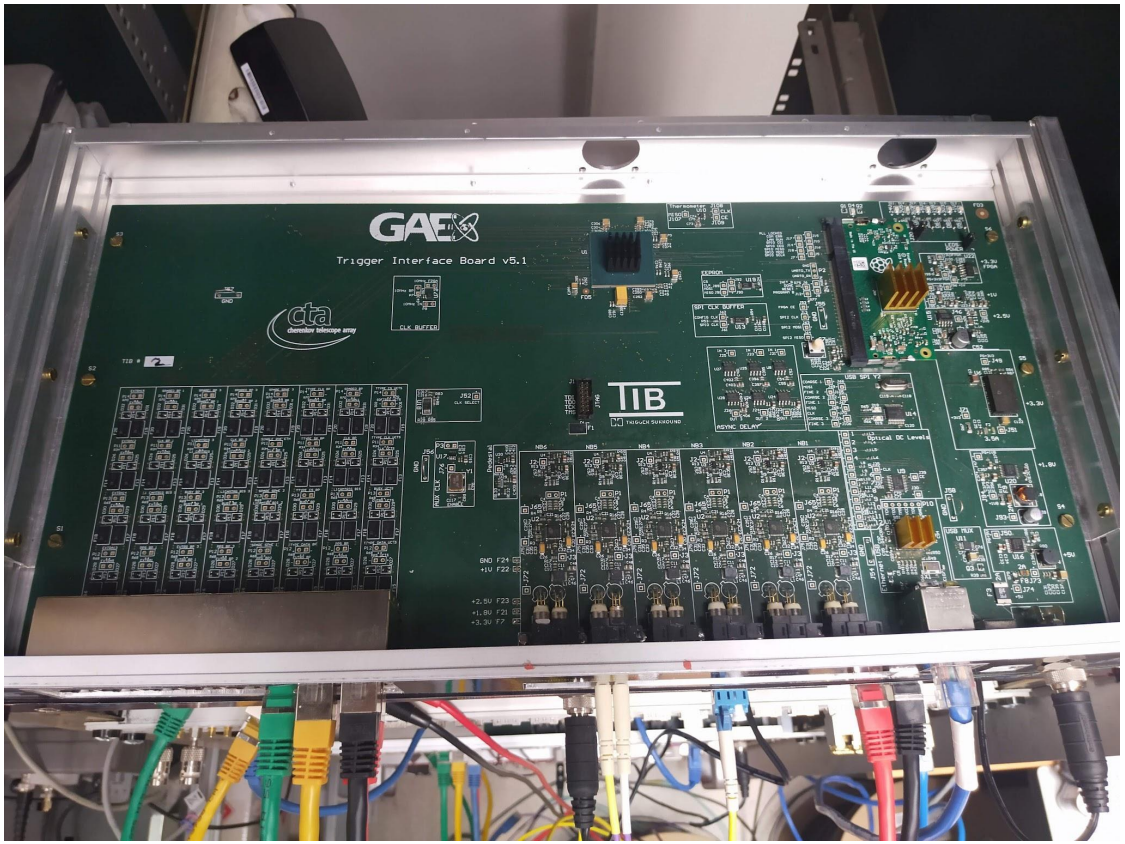
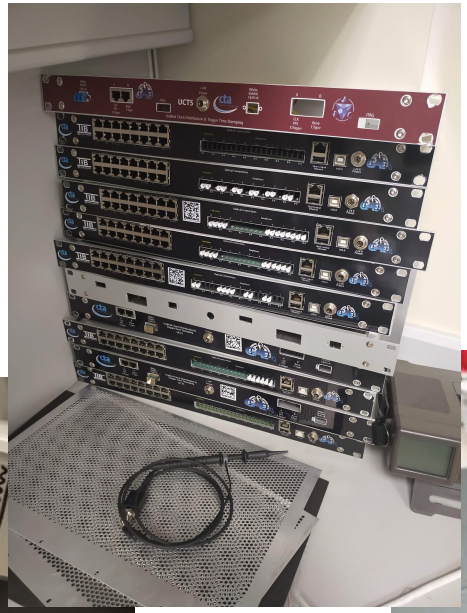


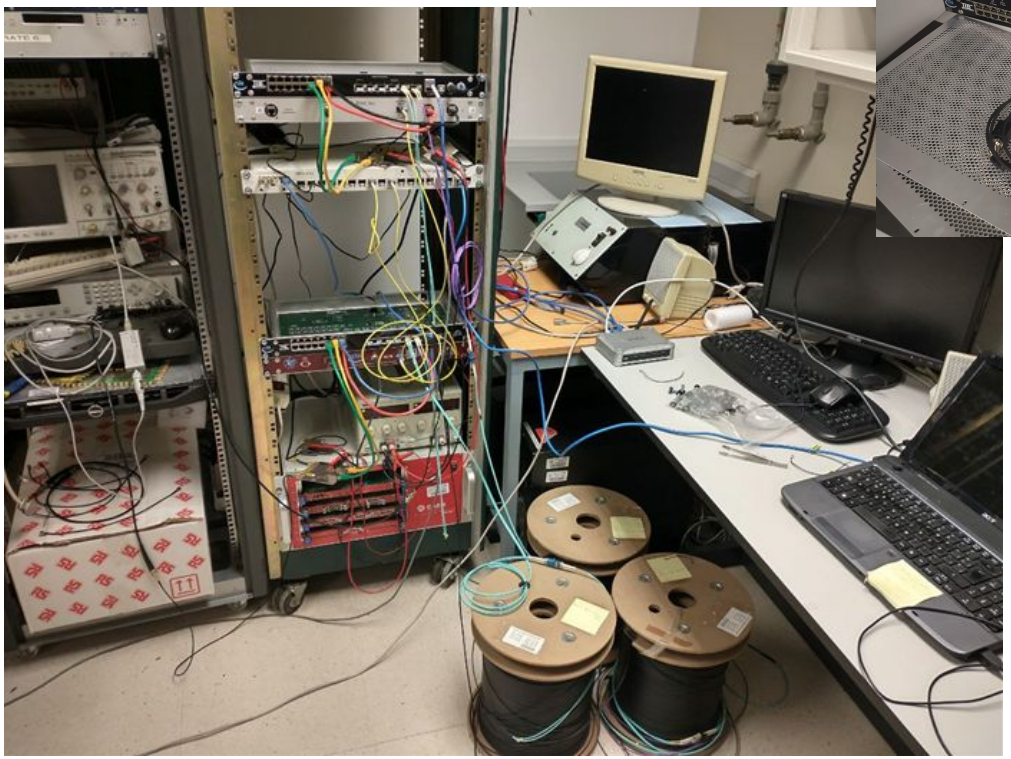


CTA - TIB: Functionalities

- Stereo trigger system between LSTs
  - Optical communications, analog circuits, delay compensation and pulse management
- Control of trigger origins and trigger type labeling
  - Trigger management in FPGA, real time software in microcomputer, networking.
- State machine control and busy handling
  - Time and trigger signal management in FPGA, slow control software
- Slow control capabilities, instructions and monitoring
  - Development of a plugin in C++ for OPC-UA standard.

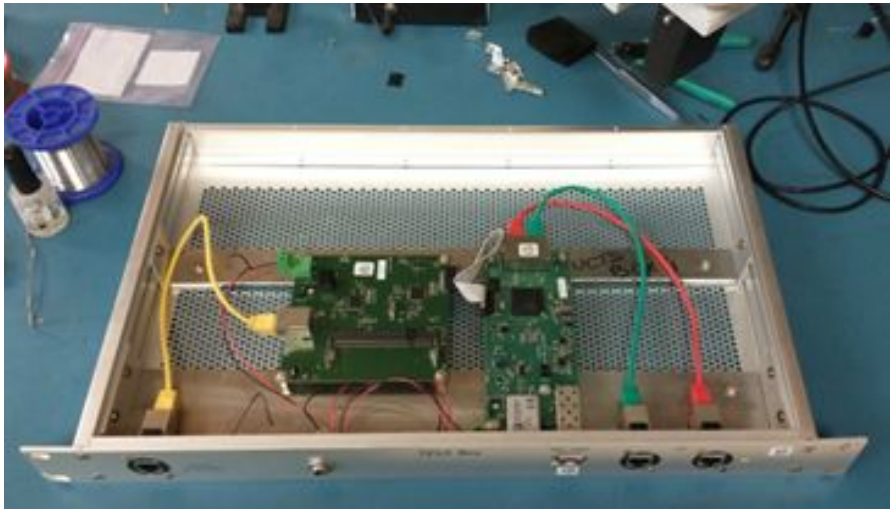
CTA - TIB: Industrialization and test





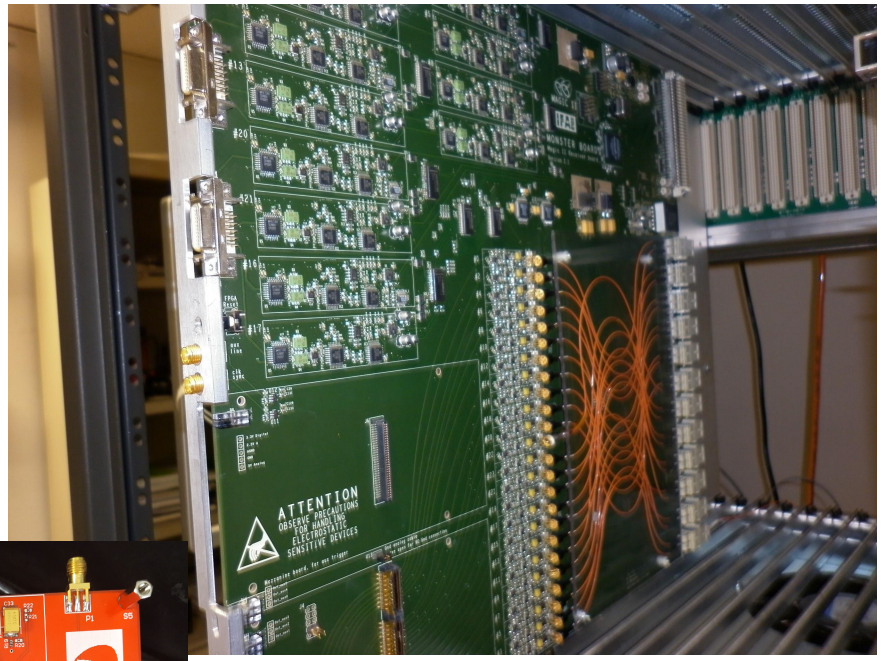
CTA: Timing

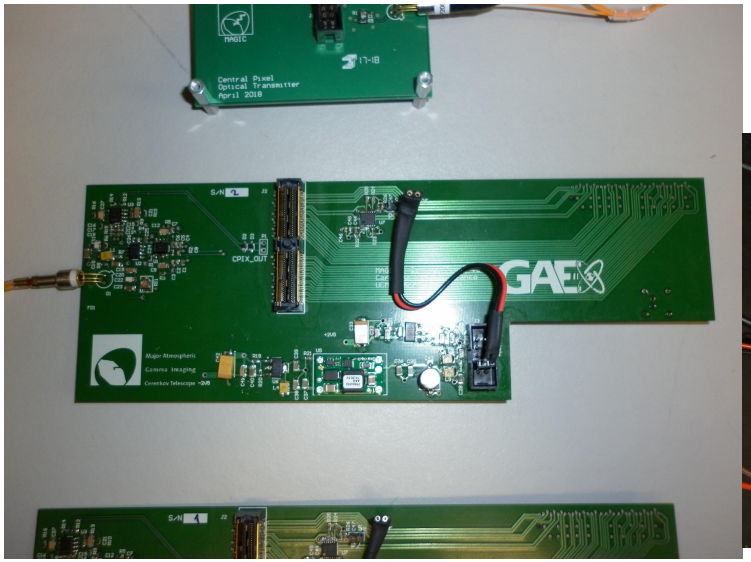
- CTA time distribution relies on a White Rabbit network. GPS + White Rabbit switch + UCTS
- APC team designs the UCTS
- GAE team test UCTS and manages installation at LST including networking and slow control software.

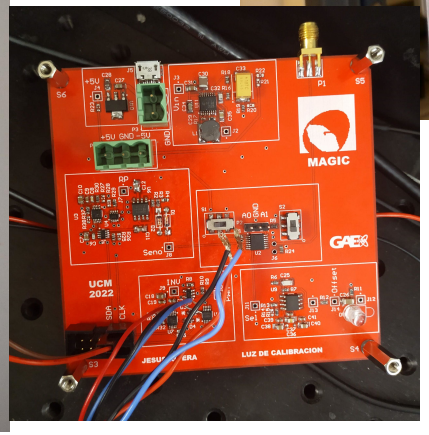


MAGIC

- Maintenance of MAGIC systems:
  - Timing system, based on a GPS+Rb clock + ad-hoc electronics.
  - Receiver boards.
  - Central Píxel.
  - Calibration light for CPIX







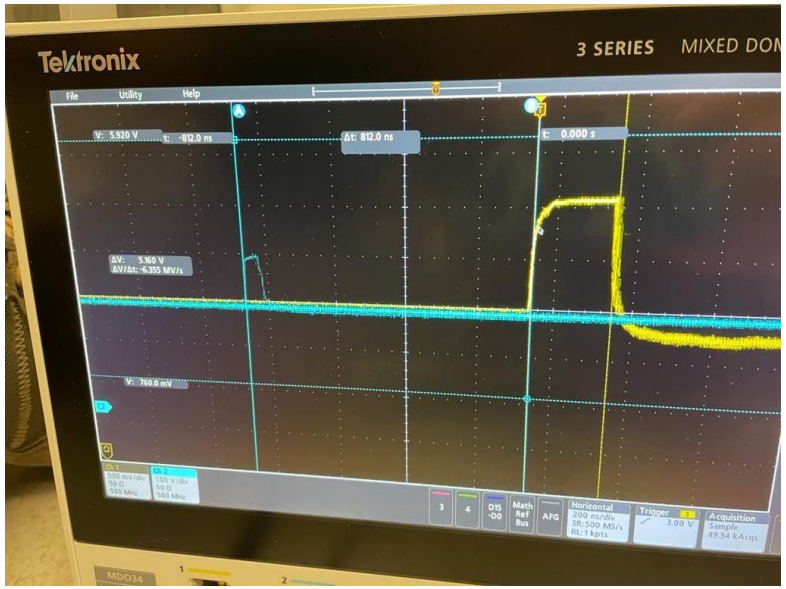
Stereo MAGIC - LST

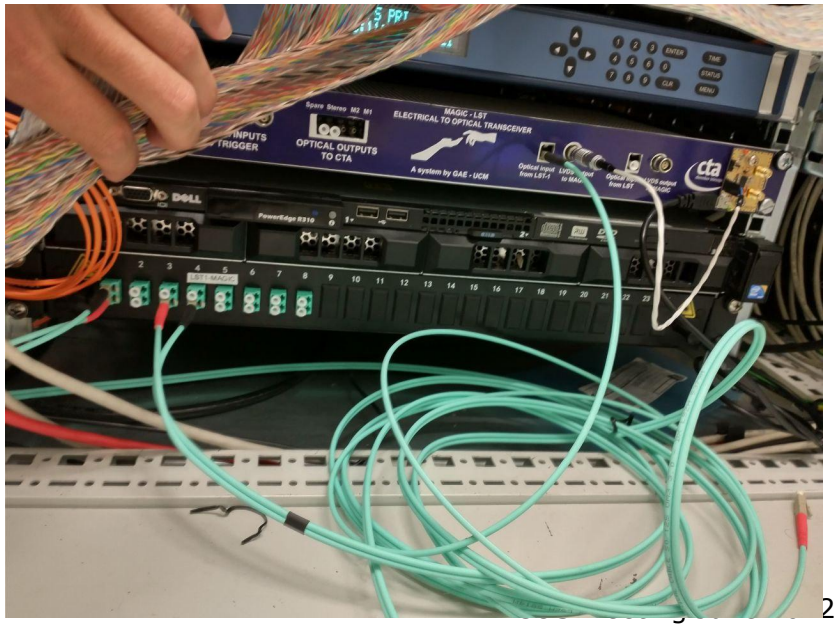
- MAGIC triggers at ~300 Hz.
- LST triggers at ~15 kHz.

A real stereo is not very useful. But we can label the LST triggers confirmed by MAGIC telescopes.

We build the MAGIC electrical to optical transceiver, so MAGIC and LST can exchange trigger signals.

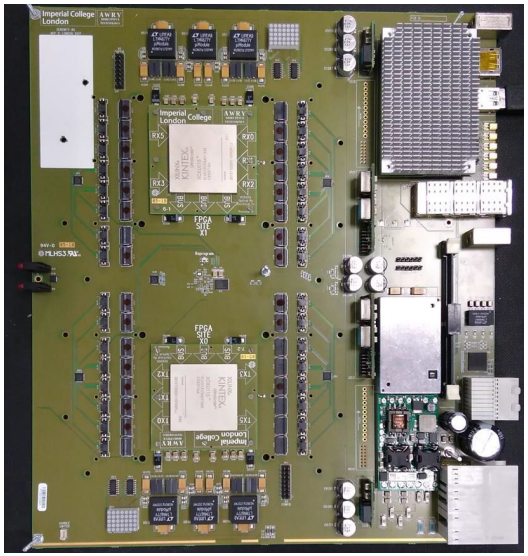
First stereo data taking the 8th of June of 2022

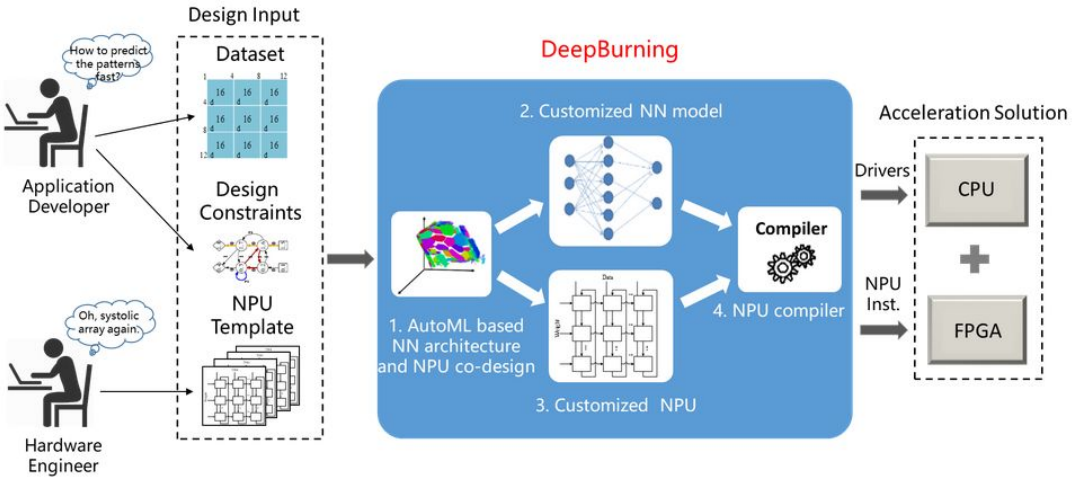




New hardware projects

- Application for the european call HORIZON-INFRA-2022-TECH-01 and national call “España verde y digital”
- Target: To develop neural networks for trigger systems, and implement them in FPGAs to speed up their performance.
- Several tools already available:
  - Software: fpgaConvNet, DeepBurning, DNNWeaver, Snowflake, Caffeine
  - Hardware: Serenity





Other funny projects

- GIEC students are involved in electronics developments for MAGIC and CTA. They have developed part of the central pixel, optical emitters and receivers to test optical fibers, programmable pulse generators and other ancillary devices and software.

Beyond CTA and MAGIC we have other habilities:

- RF design. We can develop, simulate and test microwave circuits:
  - TFG GIEC: Analysis, design, simulation, manufacture and measurement of a substrate integrated circuit
  - TFG GIEC: Design of a signal distribution network for a reconfigurable antenna array
- EEG
  - TFG GIEC: Design, construction and test of a low cost electroencephalography sensor

Capabilities

- Analog electronic design, optimized for high speed and low noise
- Complex PCB Design
- Experience with PCB manufacturing in industries, in Spain and China.
- PCB reworking in our soldering station
- Electronic tests
- Complex firmware development for FPGAs, for platforms Intel (Altera) and AMD (Xilinx)
- Slow control software development, based on OPC-UA or direct use of Raspberry Pi microcomputers or Arduino.
- Software development in C++ and Python.
- RF Design
- New laboratory 219.B

Questions?