



Follow up Meeting FCT

# ATLAS TILE CALORIMETER DETECTOR CONTROL SYSTEM

GONÇALO RITTO

---

SUPERVISOR: HENRIC WILKENS

# ABOUT ME

---

- ▶ Name: Gonalo Ritto
- ▶ University: Faculdade de Ci4ncias e Tecnologia da Universidade Nova de Lisboa
- ▶ Course: Engineering of Micro and Nanotechnology
- ▶ Starting month: May/2019
- ▶ Experience: ATLAS
- ▶ Departament/Group/Section: EP-ADE-CA
- ▶ Project: TILE CAL - DCS



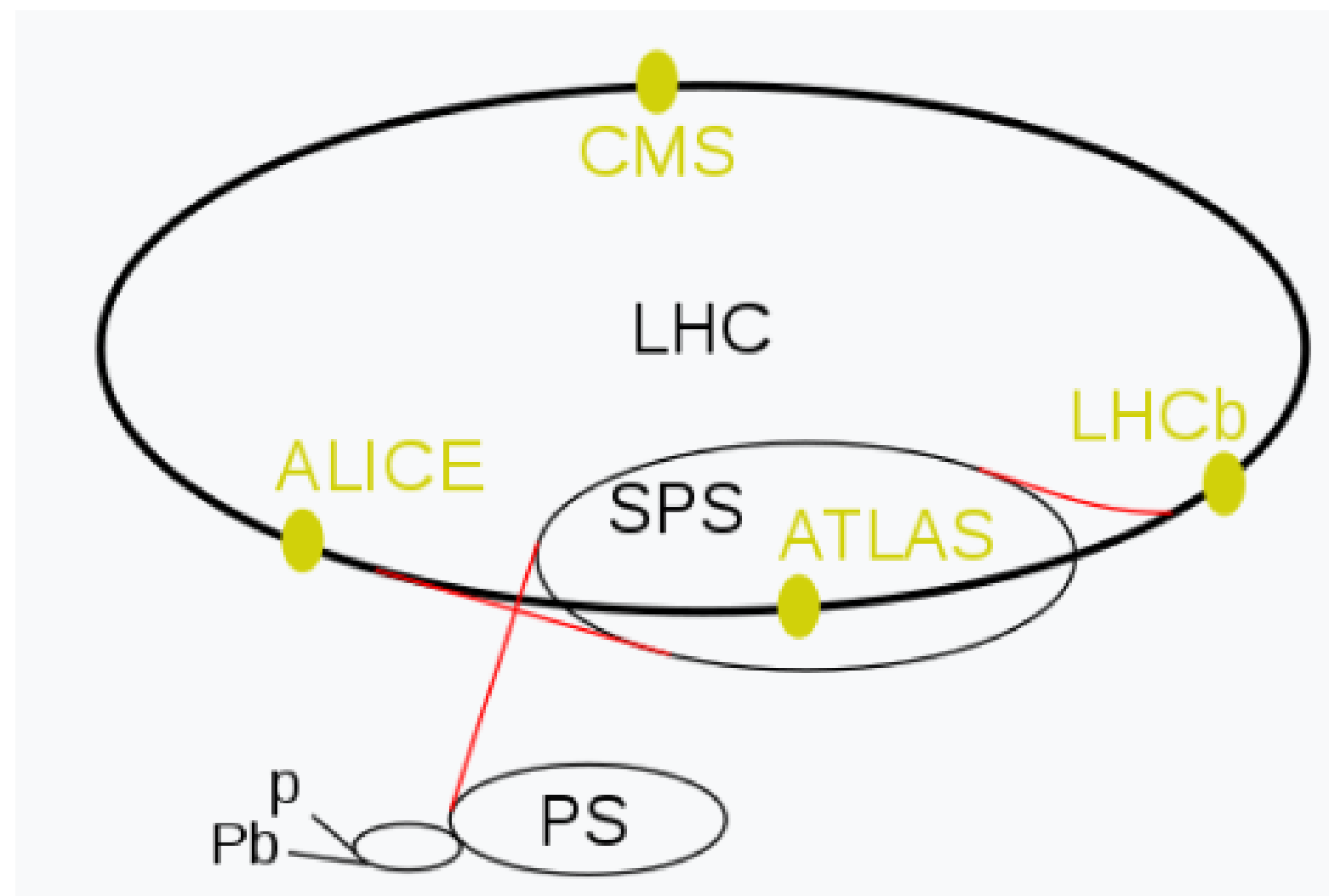
# OBJECTIVE

---

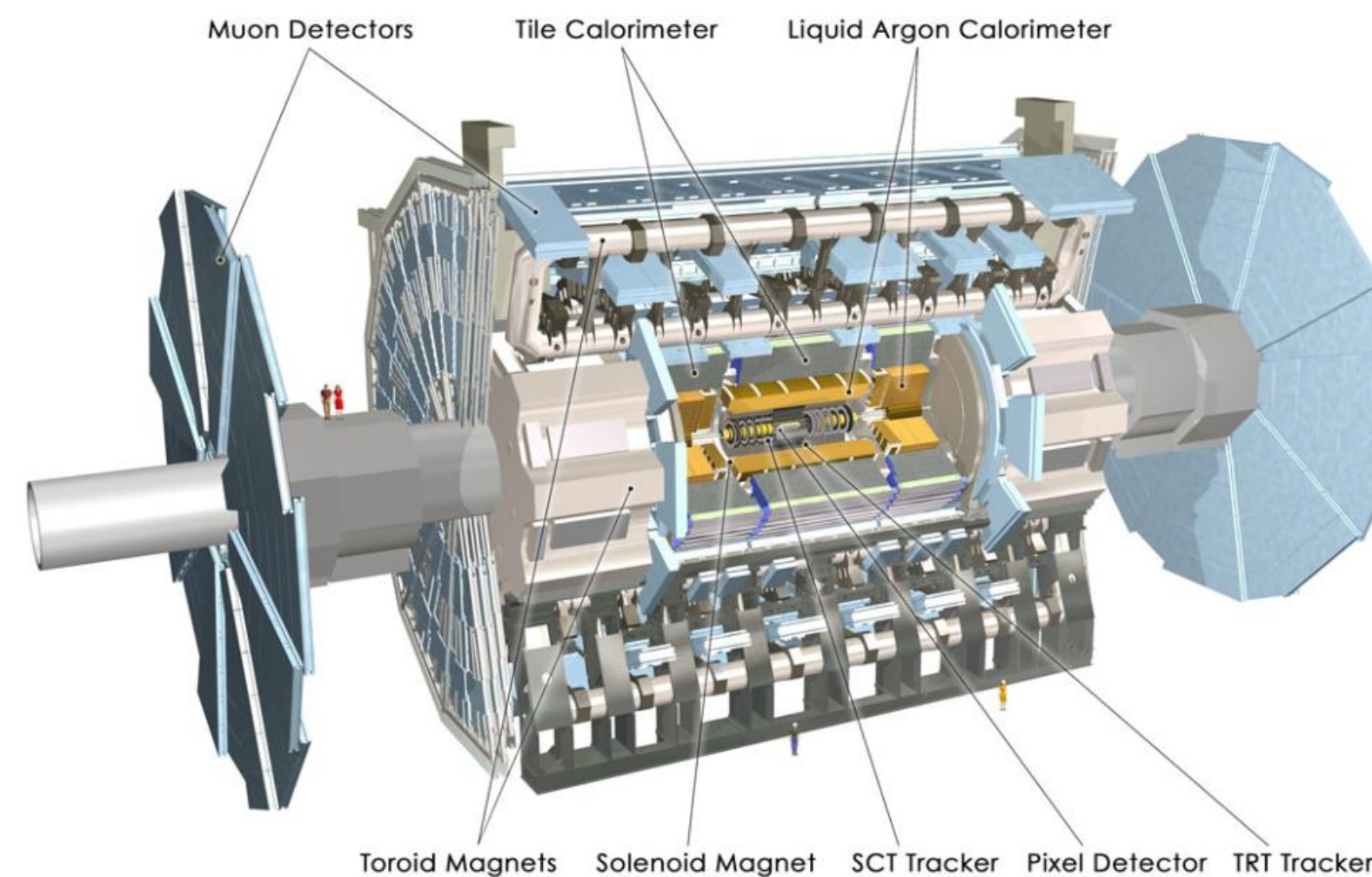
- ▶ Upgrade and maintenance of the System of Control of the Tile Calorimeter used for monitor voltages, currents and temperatures for the Phase - 2 Upgrade of the Large Hadron Collider

# LHC - LARGE HADRON COLLIDER/ ATLAS

- ▶ Length of 27 Km in circumference
- ▶ Proton-Proton Collision  $\rightarrow \sqrt{s}=13 \text{ TeV}$
- ▶ Peak Luminosity  $\rightarrow 1,37 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
- ▶ Four collision points : ATLAS, CMS, ALICE, LHCb



LHC experiments

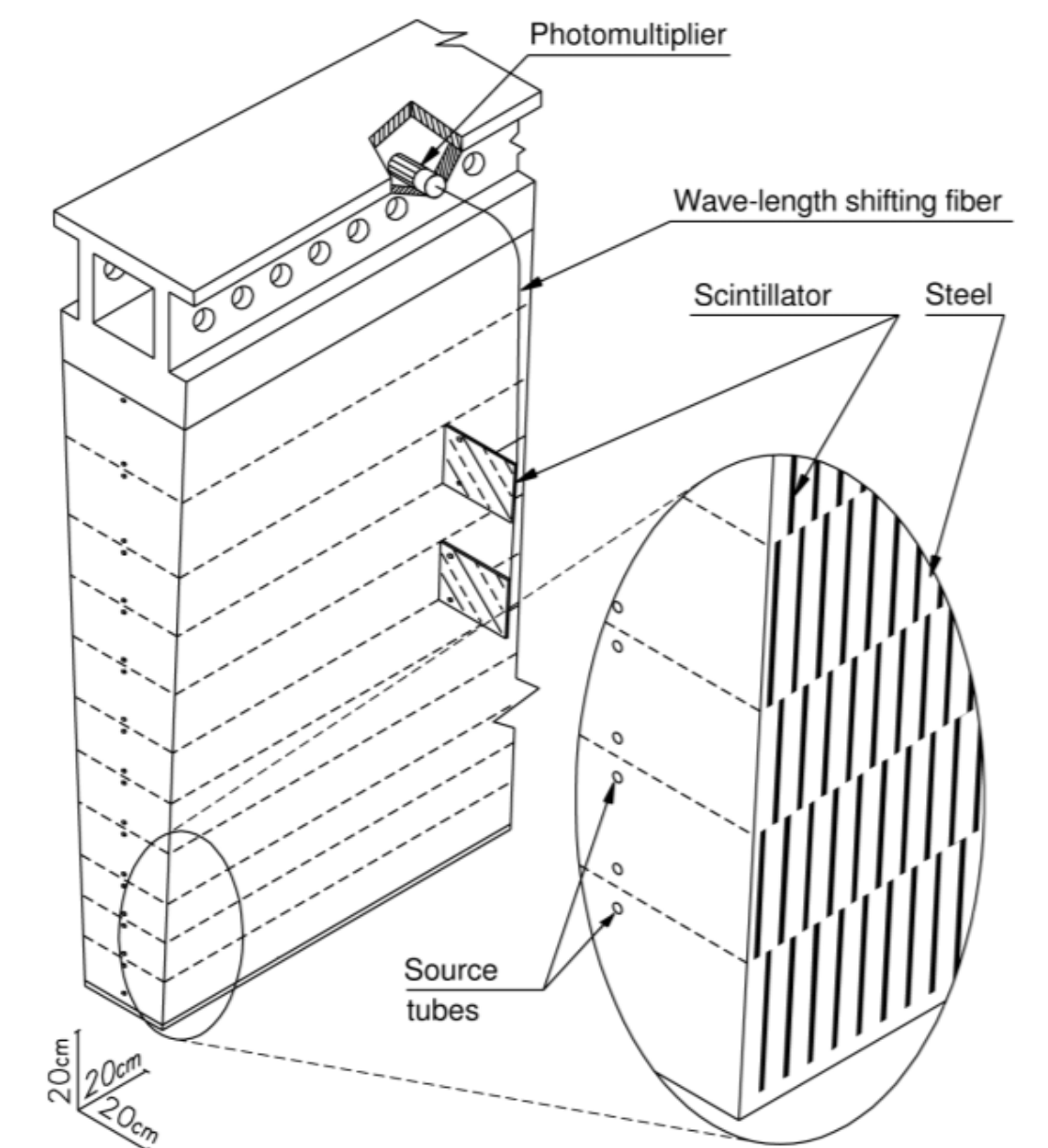
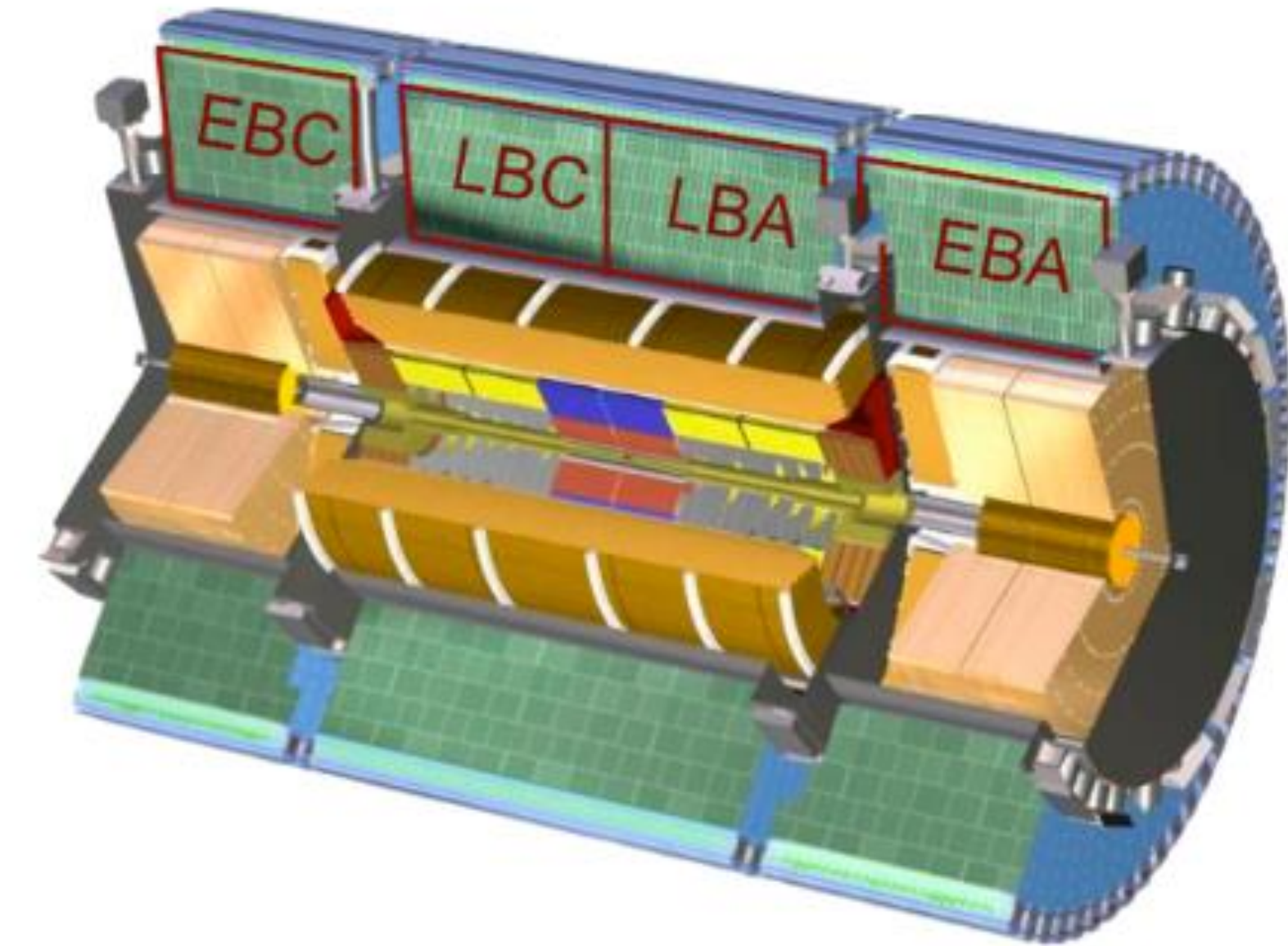


A diagram showing the main elements of the ATLAS detector. (Image: ATLAS Experiment)



# TILE CALORIMETER

- ▶ Measurement of jet- and missing- energy
- ▶ 12m length and outer radius of 4.25m
- ▶ Weights 2900 tons
- ▶ Organic Scintillating tiles as active material and steel plates as absorber
- ▶ Around 10 000 photomultipliers
- ▶ Composed of 3 cylindrical sections
- ▶ Divided in 4 partitions: EBA LBA LBC EBC
- ▶ Each partition is divided in 64 modules
- ▶ Each module has its own Front-end electronics



Tile Calorimeter wedge module.

# HIERARCHY OF ATLAS DCS –DETECTOR CONTROL SYSTEM

DCS Back-End

ATLAS

Other ATLAS Sub-detector DCS

TILE CAL

EBA

LBA

LBC

EBC

Infrastructure

- Cooling
- Calibration
- VME Crates

DCS Front-End

Low Voltage Power Supply

High Voltage Distribution



# DCS –DETECTOR CONTROL SYSTEM

## Low Voltage Power Supply

### Off-detector

#### 200V DC Power Supply

- 1<sup>st</sup> stage of LV system
- Single Channel Power Supply
- 16 power supplies per partition

#### Auxiliary board

- For on/off of fLVPS

### On-detector

#### fLVPS Power Supplies

- 2<sup>nd</sup> stage
- 8 bricks where each one converts 200V DC input to voltages ranging from -15 to +15V
- ELMB for monitoring/control



fLVPS Power Supply

# DCS – DETECTOR CONTROL SYSTEM

---

## High Voltage Distribution system

### Off detector

High Voltage  
power supply

- 1<sup>st</sup> Stage of HV system

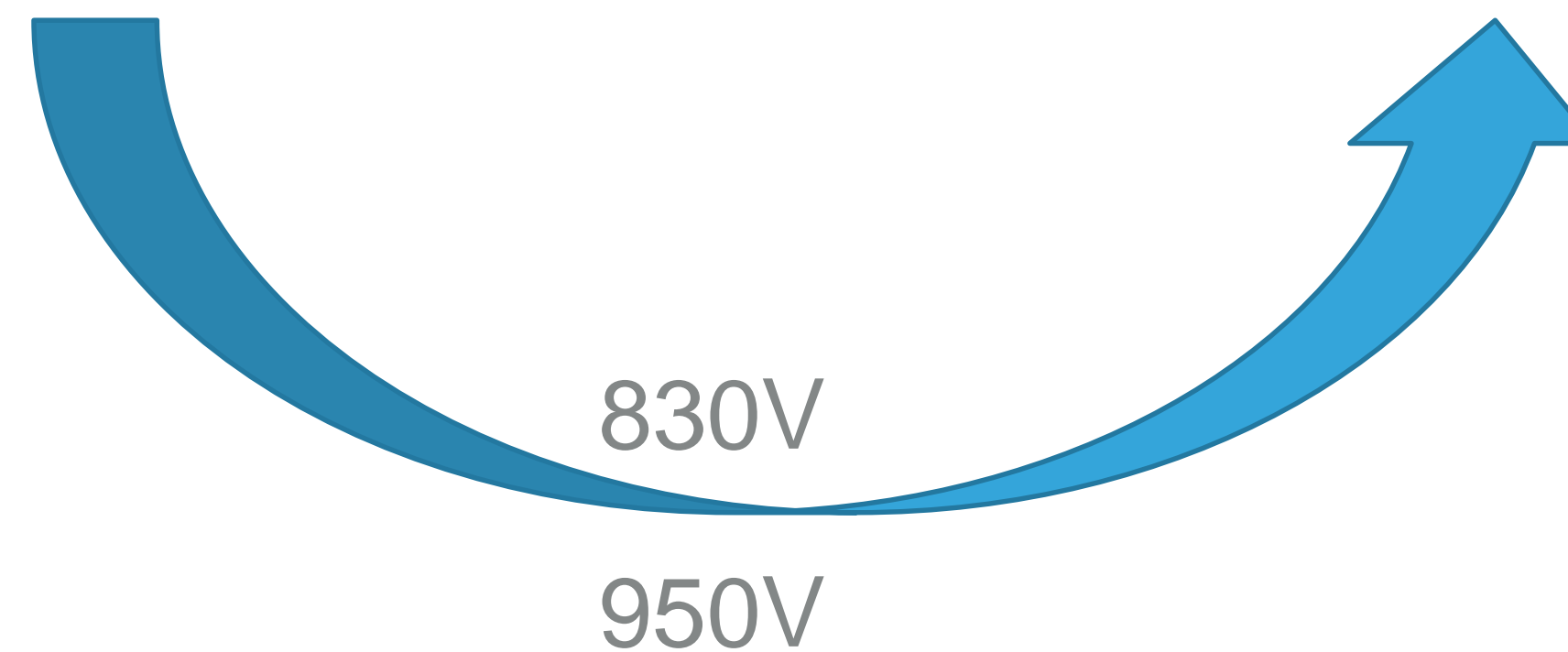
### On detector

HV-micro

- 2<sup>nd</sup> Stage

- Regulation and monitoring HV to  
the PMT (48 in total)

- Temperature measurement





# DCS –DETECTOR CONTROL SYSTEM

- ▶ Continuously monitors parameters of the detector such as: temperatures, voltages, currents, etc...
- ▶ Provides alert in case of hardware malfunction and takes preventive actions in some defined situations.
- ▶ Must provide sufficient data resources to the experts when debugging the system



Analog Operation

Device Name: test1:AnalogDigital/fcTemperature01Sensor1

Description: Barrel Temperatures

Input value

Current value: 15 (unit undefined) Details Last modified: 2019.08.22 09:44:57.780

Debug

Alarms

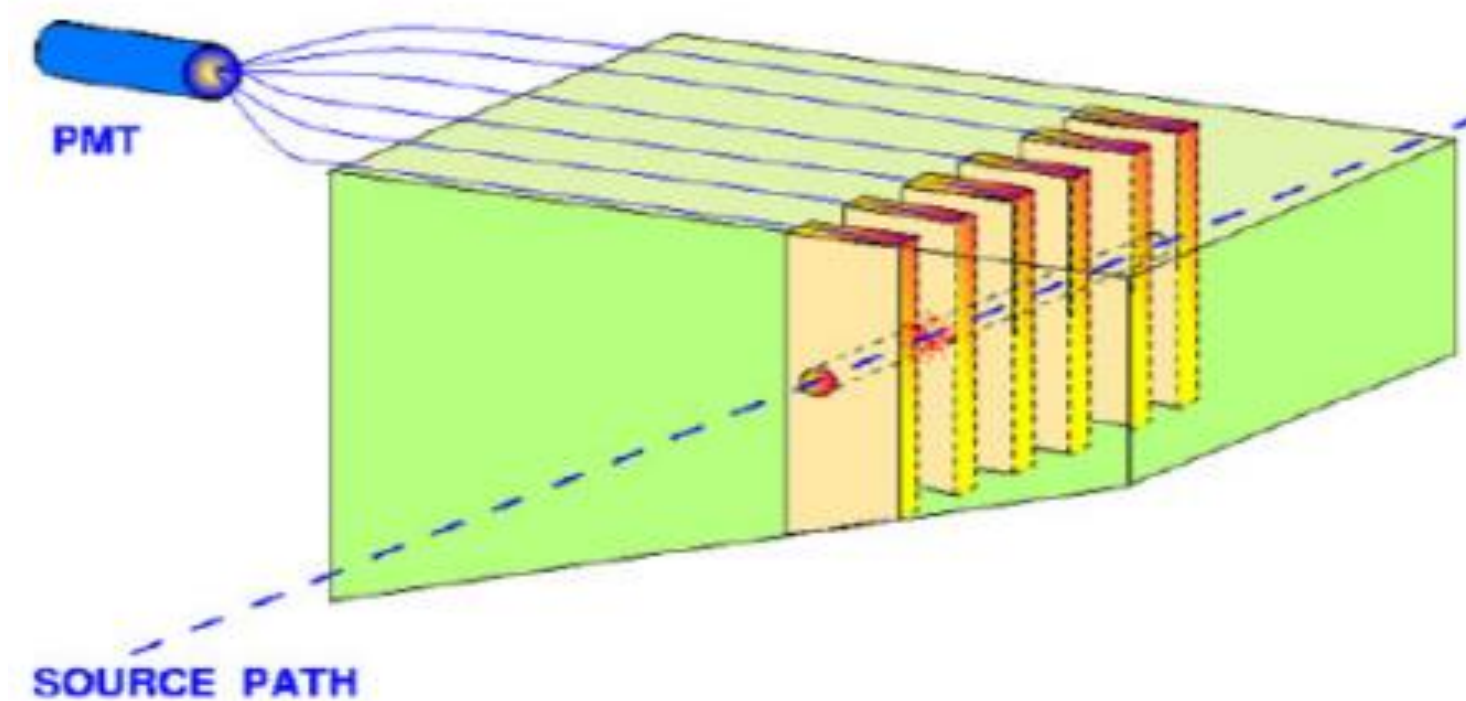
Text	Limit Values	Alarm Class
TOO HOT	< 18	_fwErrorAck
WARM	< 16	_fwWarningAck
OK	< 14	_fwWarningAck
COOL	< 12	_fwWarningAck
TOO COLD	< 12	_fwErrorAck

Mask Unmask Acknowledge

Close

# CESIUM CALIBRATION

- ▶ To calibrate and monitor the full optical path of the Tile Calorimeter, a system of powerful  $^{137}\text{Cs}$  gamma sources, driven by a liquid flow through all the scintillating tiles is used.
- ▶ Monitor sensors of temperature, pressure and the position of the capsule



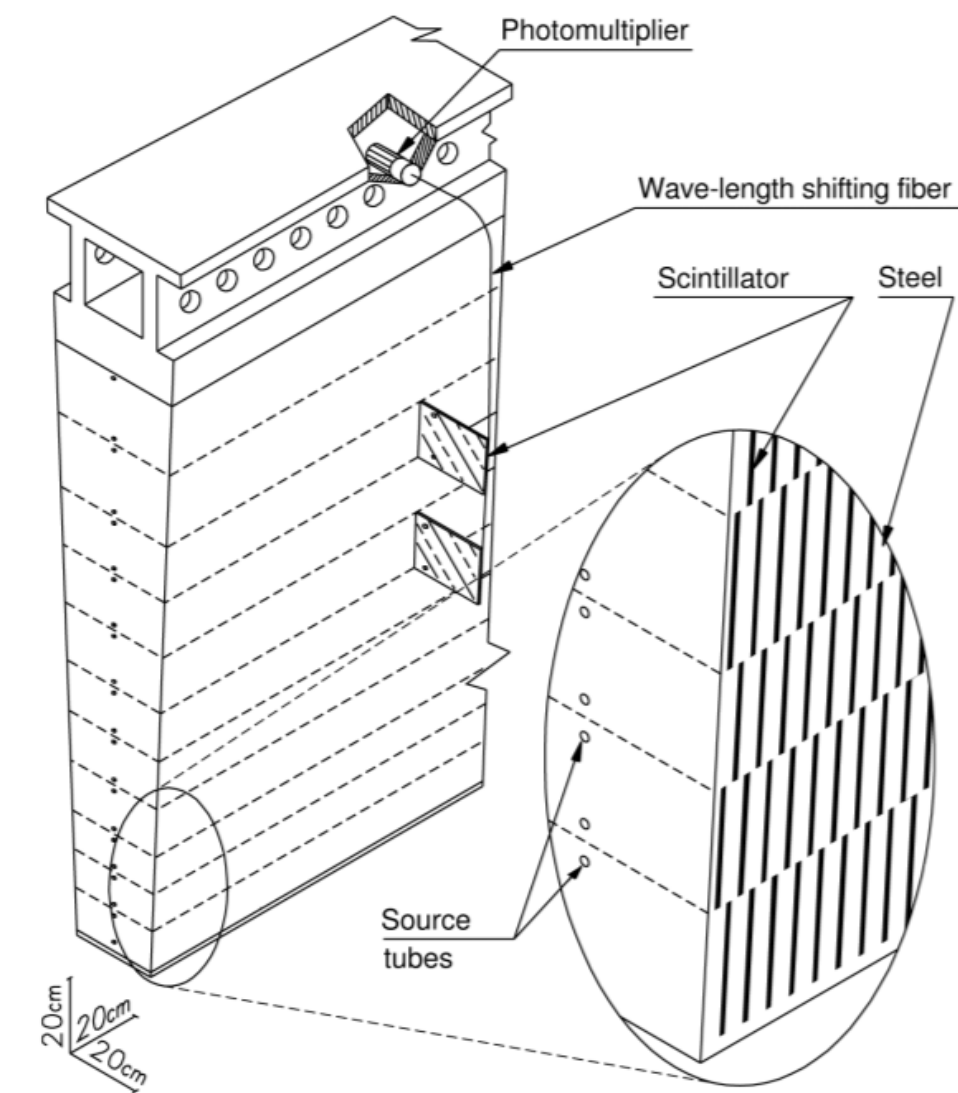
The concept of the  $^{137}\text{Cs}$  source calibration system.



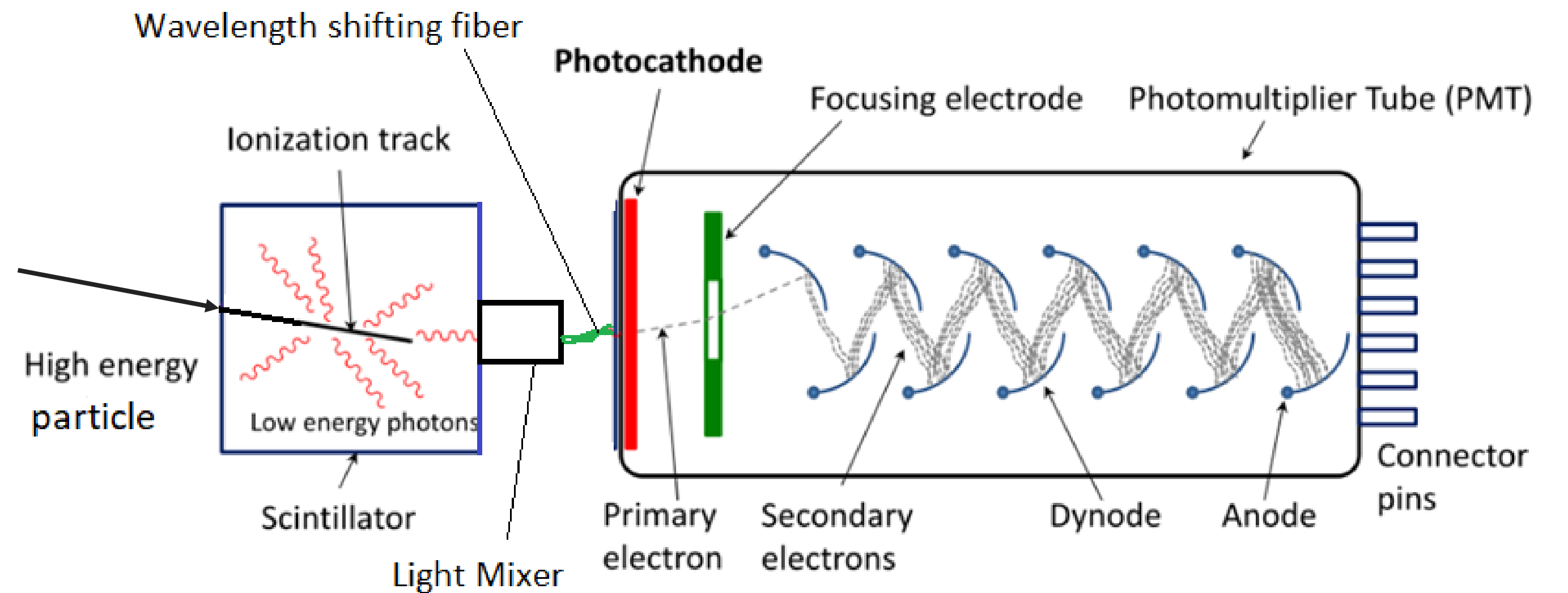
Dumb-bell-shaped capsule in a bent segment of the calibration tubes.

# PMT TEST BENCH

- ▶ Photocathode sensitivity
- ▶ PMT amplification gain
- ▶ Dark Current
- ▶ Drift
- ▶ Quantum Efficiency

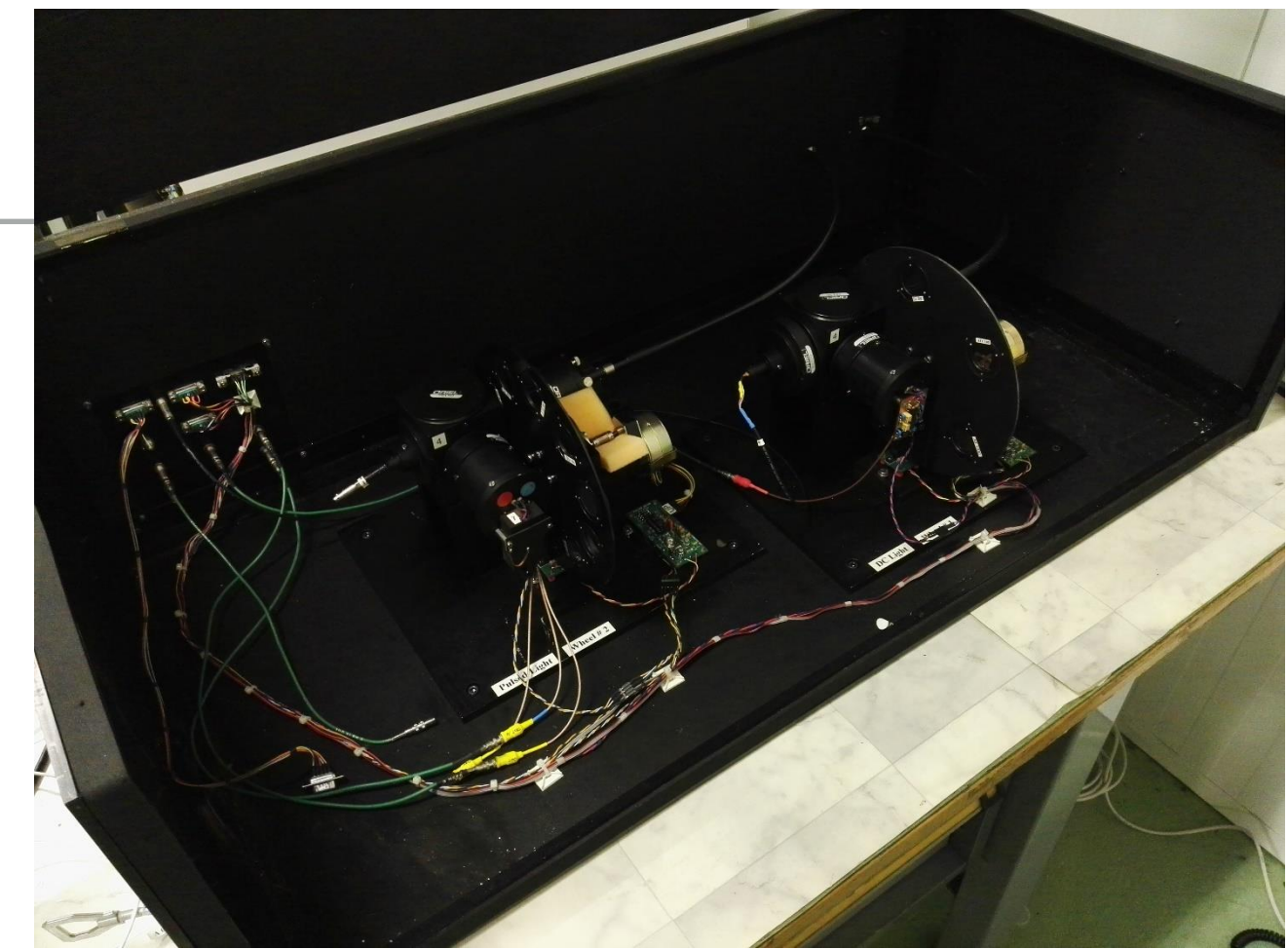


Tile Calorimeter wedge module.



# PMT TEST BENCH

- ▶ Update of VI (Virtual Instrument) from LabView from older version
- ▶ Calibration of the temperature of PMT box
- ▶ Calibration of the wheels of LightBox



LightBox

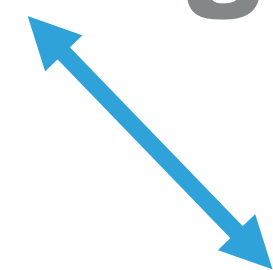


PMT box

**Computer (Labview)**



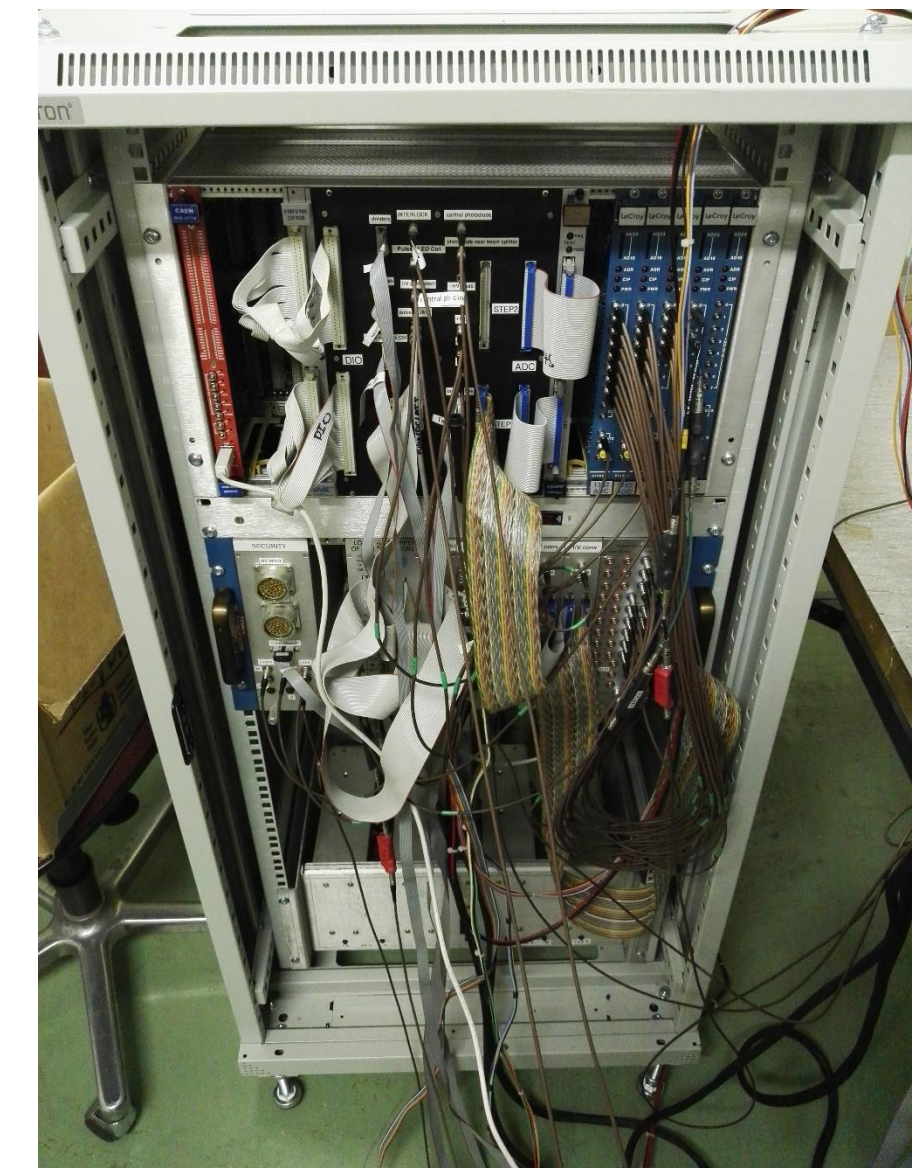
**Data Aquisation / Power Supply  
/ Analog to Digital Converter**



**PMT box**



**LightBox**



# TRAINING

- ▶ **WinCC OA (Open Architecture)**
  - Based on a commercial Supervision Control and Data Acquisition tool (SCADA)
- ▶ **JCOP** – Provides software packages to WinCC OA
- ▶ **FSM (Finite State Machine)** – November 2019

Channel Name

Actual

vMon  V

iMon  mA

Settings

v0  V

i0  mA

Operation

Configuration

Ramp Up  V/s

Ramp Down  V/s

Trip Time  s

---

THANK YOU!

