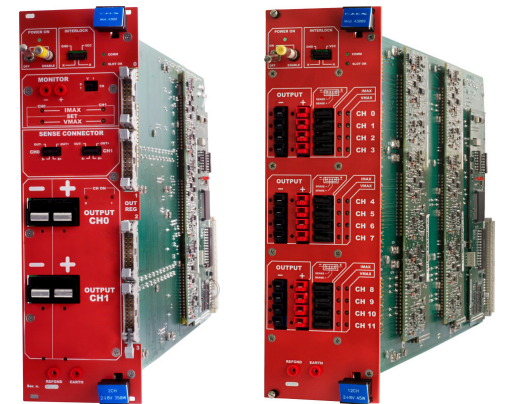


# **Phase 2 DT power system requirements: Actual status**

**Gruppo di lavoro sulle alimentazioni LHC fase 2  
23 Novembre 2017**

# The DT Actual Low Voltage System

- About **1100 LV** channels which powers the **chambers Front Ends (FE)**, the on detector electronics (**MiniCrates**) and rack boards which transfers readout and trigger data outside of UXC.
- Standard **CAEN EASY System**:
  - USC (S4)**:
    - 1 SY4527 with 10 Branch Controller (1 for half wheel)
  - UXC (in the tower racks)**
    - 40 MAO (A3486s)
    - 70 A3009, for MC ( **$\sim 9$  W**) and FE ( **$\sim 30$  W**)
    - 160 A3050 for MC ( **$\sim 120$  W**) and CuOF ( **$\sim 60$  W**)
- It powers also the CMS Alignment LV (22 A3006 boards)



# Phase 2 LV requirements status

In Phase 2 on detector trigger and readout electronics will be changed.

- Starting point is to **to keep the actual powering scheme:**
  - FE electronics will remain the same** and will require same powering (given by A3009)
  - expected power consumption for new MiniCrate will be lower
  - we would keep the same cabling between USC and UXC and on the detector.

- Main open issues:**

- Ageing of the actual Easy System:
  - Expected dose on DT racks at the limit of EASY specifications
- Actual power conversion in the new minicrate still to be decided
  - Lower power, but also lower voltages
    - Linear Regulators (like now) or on detector DC/DC converters (FEAST)

Radiation Tolerances

	10 LHC years with factor 3.15	10 HL-LHC years (with factor 3.15 included, assuming 5000 fb <sup>-1</sup> )	Actual Easy Declared Tolerances
Neutrons Fluence E>100 eV (cm <sup>-2</sup> )	8.96E+09	2.83E+11	
Neutrons Fluence 1 MeV equiv (cm <sup>-2</sup> )	9.91E+09	3.12E+11	2E+12
Neutrons Fluence E >20 MeV (cm <sup>-2</sup> )	9.04E+08	2.85E+11	2E+11
Charged Hadrons Fluence (cm <sup>-2</sup> )	1.17E+07	3.69E+08	
Total for SEE (cm <sup>-2</sup> )	9.16E+08	2.89E+10	
Dose (Gy)	0.4	12.61	150

# DT Actual HV System

USC

8(3) SY4527  
Mainframes



60 (6) A876  
1 Board/Sector



- Power Supply system **designed by CAEN specifically for the CMS DT** in early 2000 with the collaboration of INFN

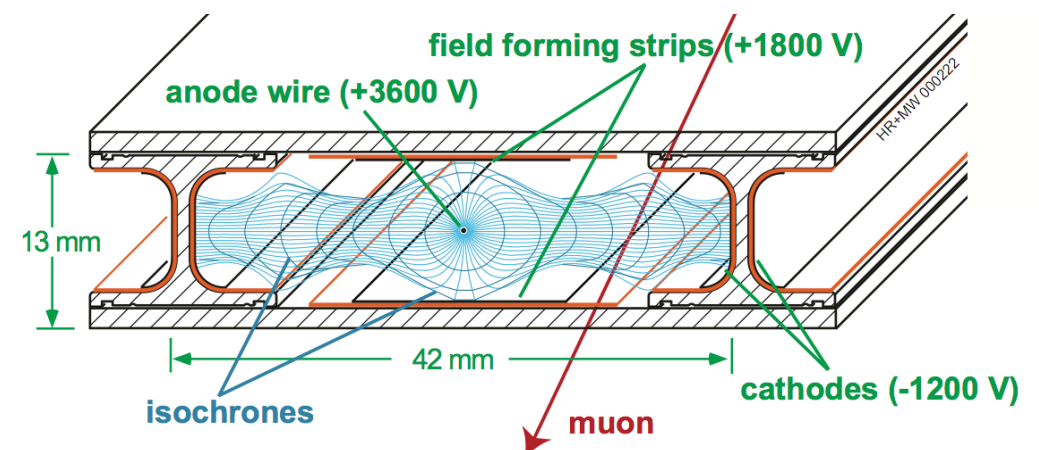
- It was a prototype for the development of the EASY system

240 (20) A877 Boards  
1 Board/Chamber  
1 Channel/Half Layer



UXC

- Very large system:  $\sim 14\text{K}$  channels
  - +3600 V** for the anodic wires (with half layer granularity)
  - +1800 V** for the strips
  - 1200 V** for the cathodes



# Phase 2 HV requirements

## DT requirements will not change in Phase 2

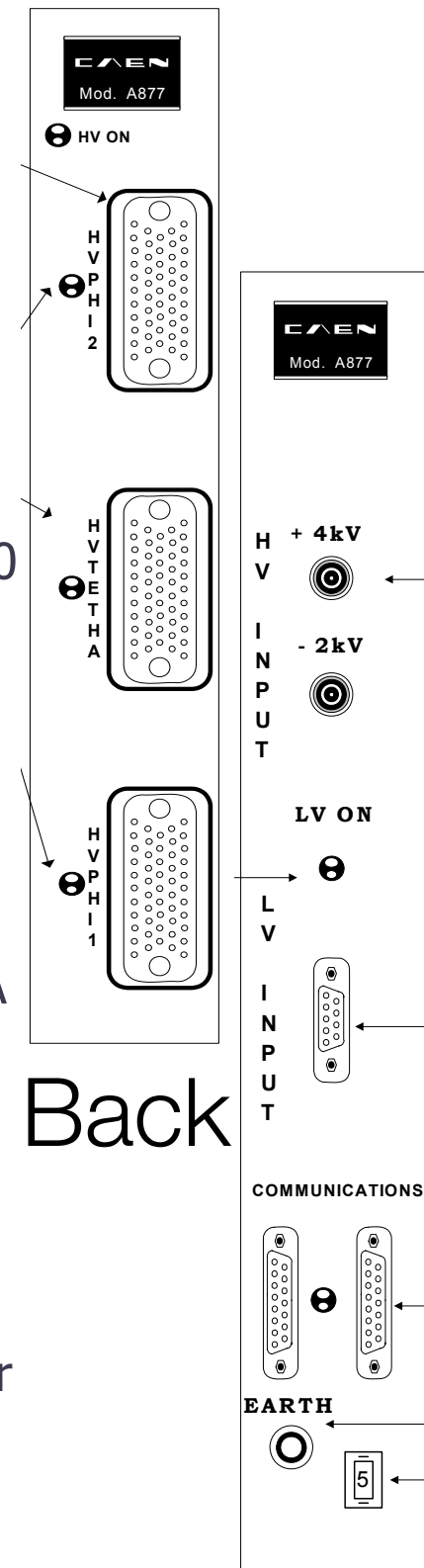
- Cabling/granularity/infrastructure are planned to remain the same

## Weak point are the A877 boards which operates in UXC:

- No equivalent catalogue item
- We asked CAEN to develop a **new version of the A877** with updated technology
  - An offer has been given for a development cost of 150k CHF and 1 year in time
  - Money has been already allocated in the DT budget
- Development could start next year**
  - Weak point is the manpower in the DT community for testing and radiation tolerance evaluation
  - We would gladly share knowledge and testing for common components.

## A877 Board Specifications

- Output:** 3 Radial Connectors
- 36 independent HV channels** (24 Anodes, 12 Strips, 12 Cathodes)
  - Anodes** + 4K V, i0 20  $\mu$ A
  - Strips** +2K V, i0 10  $\mu$ A
  - Cathodes** - 2K V, i0 50  $\mu$ A
  - Resolution**  $\sim$ 100 nA
- Inputs:**
  - 2 SHV channels from A876 (4K and -2K V)
  - 9 PIN LV (15 V)
  - 15 Pin Link Connector
- Same location of LV modules for radiation and magnetic field tolerance



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