Laboratoire d'Annecy-le-Vieux de Physique des Particules

Calorimeter for ILC

MICROMEGAS and DAQ STATUS at LAPP

Guillaume Vouters for ILC group at LAPP

DESY - 06 july 2010

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

IN2P3 Institut National de Physique Nucléaire et de Physique des Particules

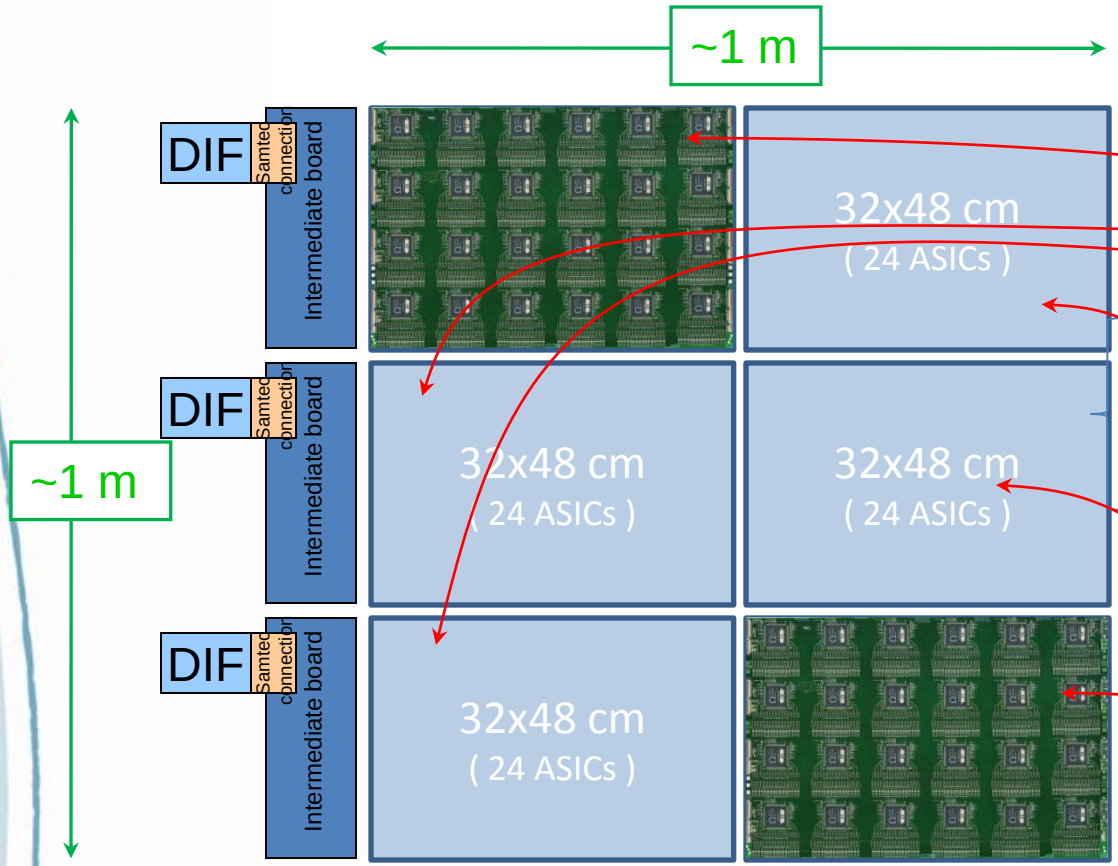
UNIVERSITE CHAMBERY SAVOIE

Outline

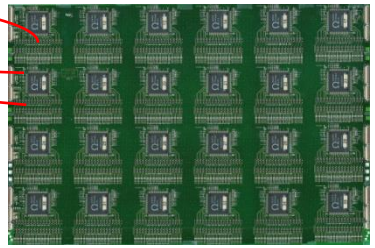
I. **MICROMEGAS Square Meter**
II. Square Meter assembly
III. Beam Test
IV. DAQ
V. MICROROC
VI. DIF

I. MICROMEGAS Square Meter

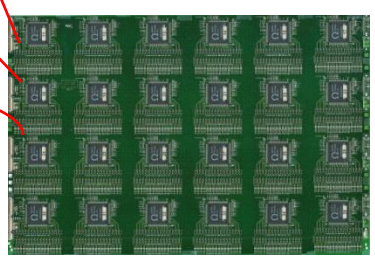
6 ASU 32x48



2 type of ASU PCB



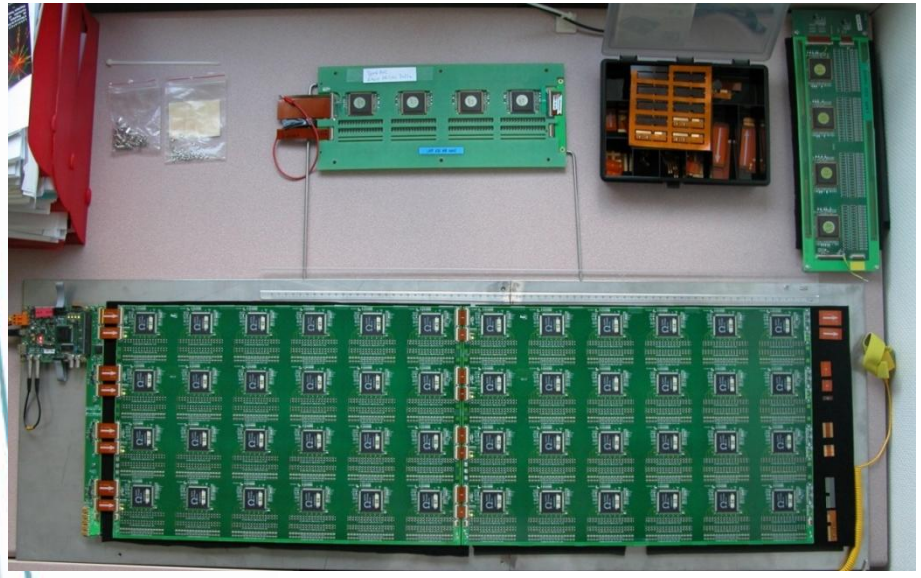
Type 1

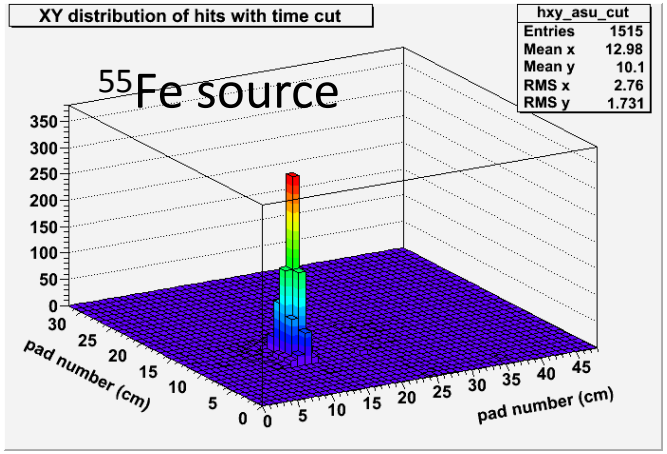


Type 2
(with terminasion)

I. MICROMEGAS Square Meter

ASU 32x48 with HARDROC v.2





An ASU in test box

→ tests with source and beam

A SLAB : 2 chained ASU

→ We managed to control 48 HARDROCs v.2 with 1 DIF

HR2b calibration with test charge

→ 24 HR2b successfully debugged (LAL+LAPP) need PCB modification (also for GRPC production PCBs!)

→ Gain distribution spread of 1 % RMS

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II. Square Meter Assembly

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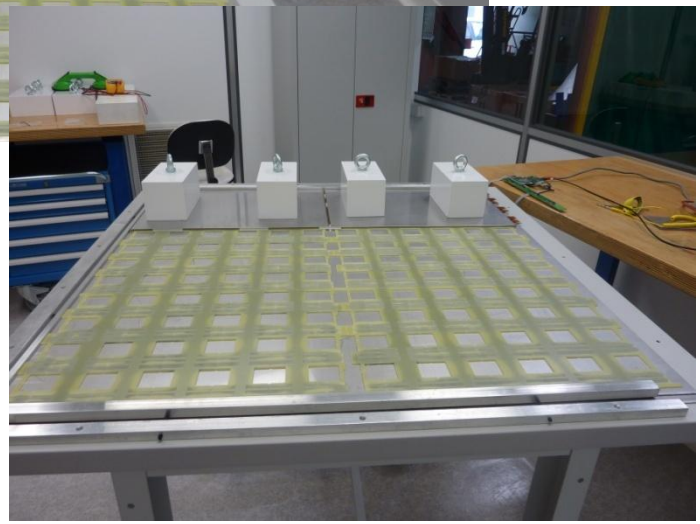


1st SLAB

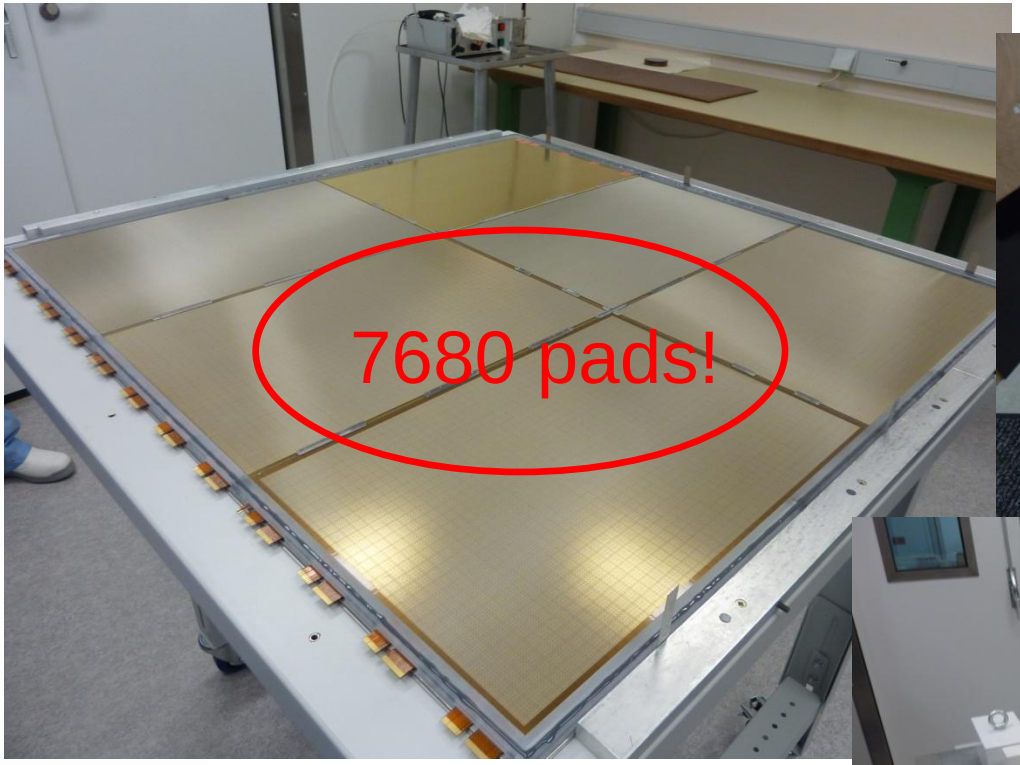
II. Square Meter Assembly

LAPP MAY 2010

2nd SLAB

II. Square Meter Assembly

LAPP MAY 2010



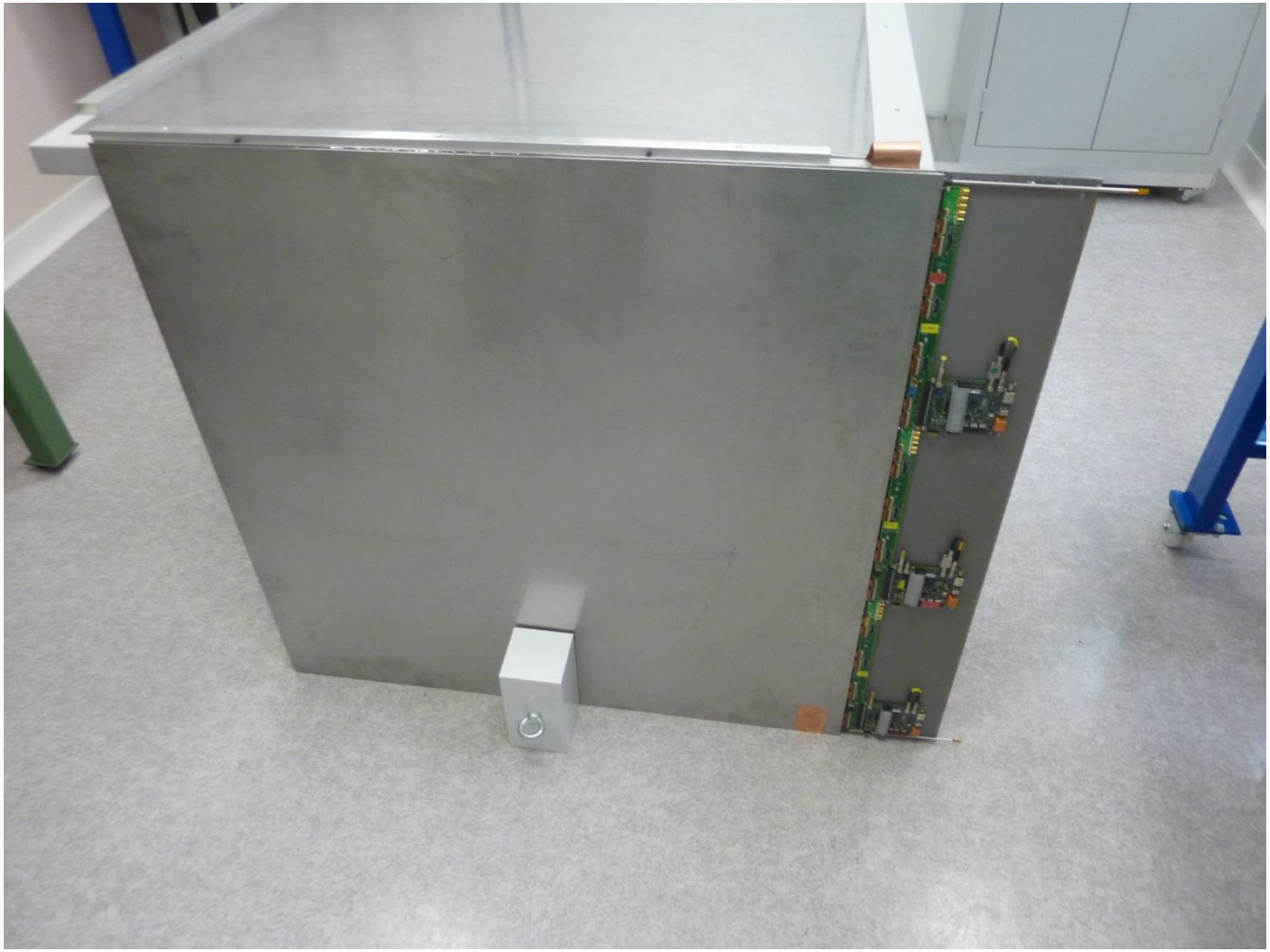
We had unfortunately only 5 ASUs :

4 ASUs with HR2 (with SC bug)

1 ASUs with HR2b (without SC bug)

II. Square Meter Assembly

MICROMEGAS Square Meter



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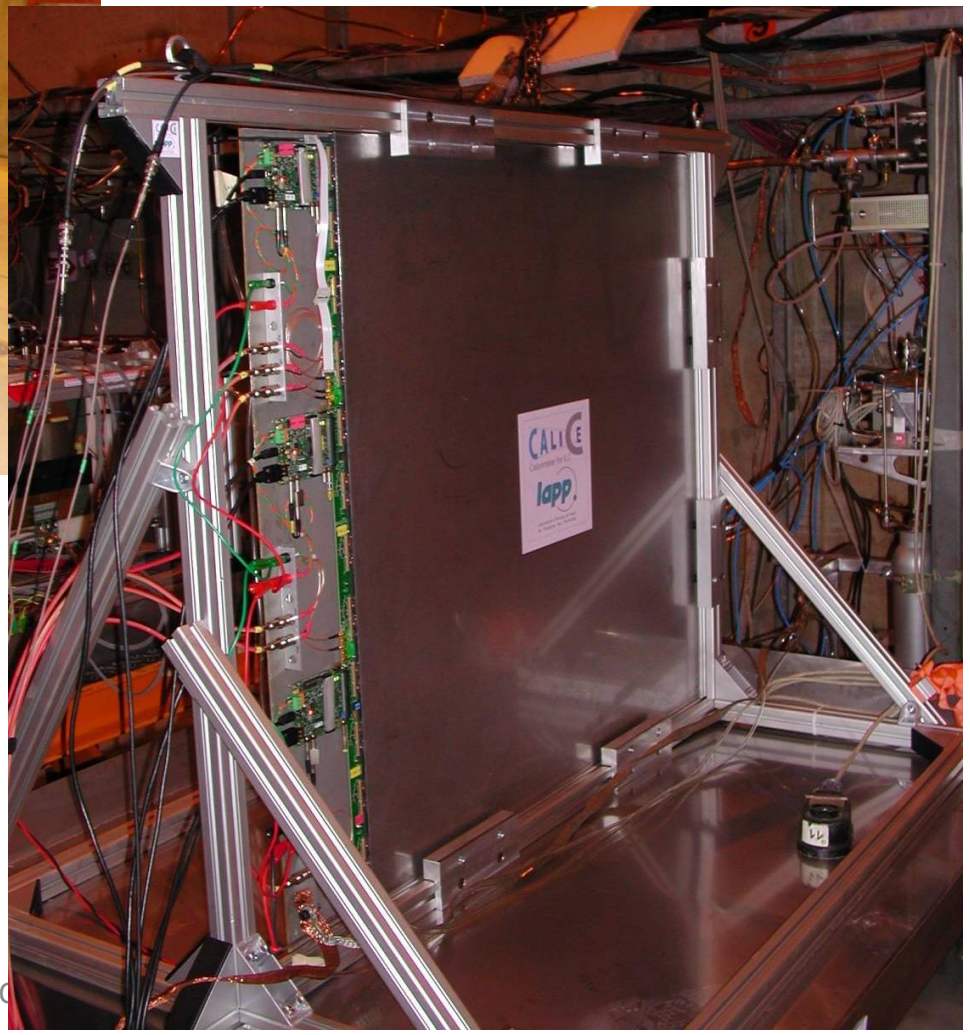
III. Beam Test June/July 2010

SPS H4 CERN – 09june / 07july
(2 weeks with RD51 users)

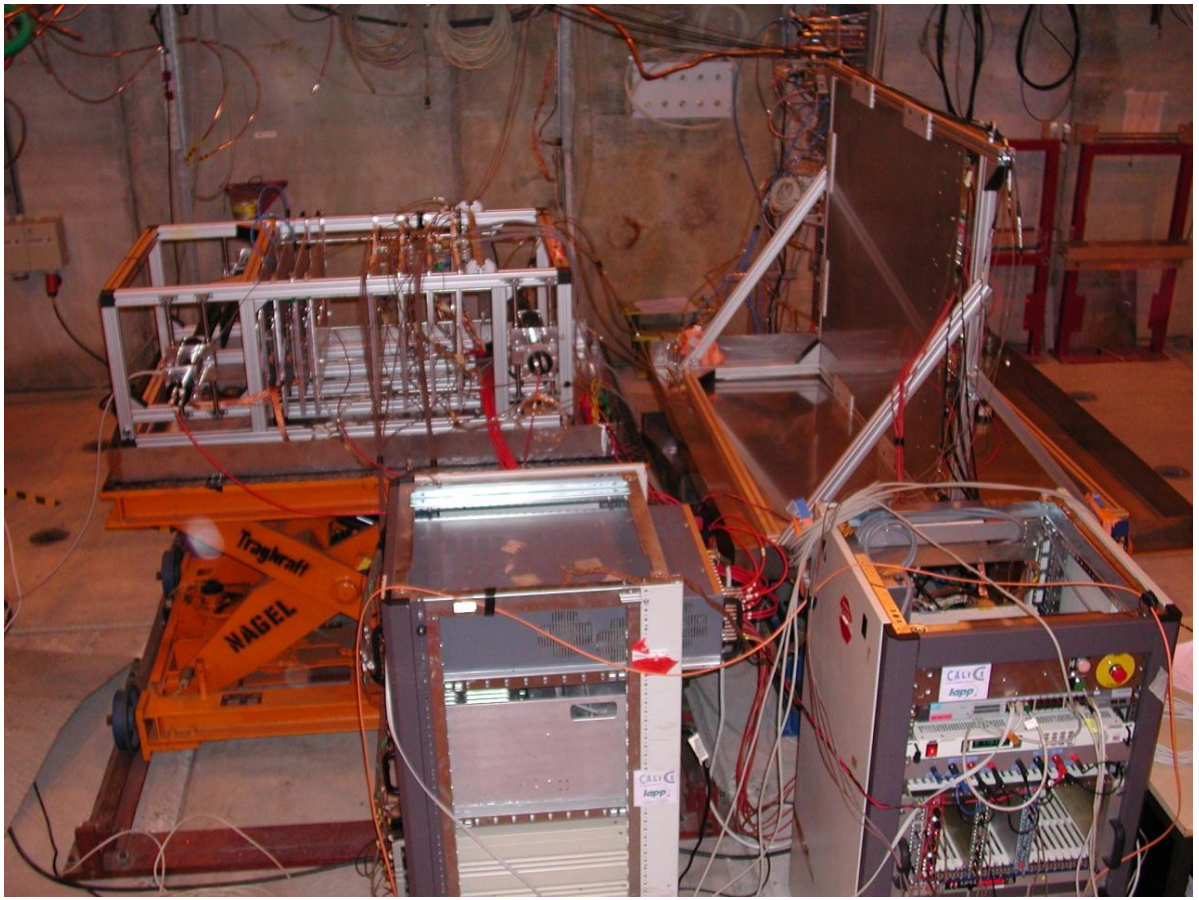


Aim:

- Validate large area design
- Estimate rate effects, sparks effects…
- Measure efficiency and multiplicity disparity over the 1 m^2 area
- Test power pulsing

III. Beam Test June/July 2010

SPS H4 CERN – 09june / 07july



Synchronization between Gassiplex and HR DAQs allow us to use Gassiplex detectors as a telescope for the Square Meter.

III. Beam Test June/July 2010

Outcome

Mechanics : the Square Meter is gas tight and robust.

Electronics :

- Careful grounding : good noise condition
- Electronic gain equalized (only for HR2b)
- Successful synchronization between Gassiplex and HR DAQs
- The HR DAQ is stable and reliable
- **Power Pulsing** was performed and studied **for a Square Meter**

Detector :

- MESH are stable (very few HV supply trips)
- High gain possible (MESH tested up to 420V = Gas gain up to 15000)

Software :

- Reconstruction of simultaneous events from both DAQs
- File book keeping

Lot of data are already taken with the whole MICROMEGAS Square Meter (5 ASUs)
Multiplicity and efficiency scan of each HR2b is on going.

III. Beam Test June/July 2010

Power Pulsing

Preliminary study :

m^2 Power consumption = 6.8 A (3 DIFs + interDIF = 3A)
SLAB 1 = 3.0 A (2 ASU, 12 HRs with defect Preamp)
SLAB 2 = 2.2 A (2 ASU)
SLAB 3 = 1.6 A (1 ASU)

There are 5 different powers:

- Power Analog
- Power DAC
- Power Digital (already tested)
- Power SS (not used)
- Power ADC (not used)

m^2 Power consumption with Power_Analog = 0 (3 SLAB) = 3.92 A

m^2 Power consumption with only 1 SLAB with Power_Analog = 1 :
When SLAB1 : m^2 consumption = 5.68 A (+1.76A)
When SLAB 2 : m^2 consumption = 4.78 A (+0.86A)
When SLAB 3 : m^2 consumption = 4.32 A (+0.40A)

Power_DAC = 0 or Power_Digital = 0 : 20mA less by SLAB

III. Beam Test June/July 2010

Power Pulsing

Power Pulsing was performed and studied :

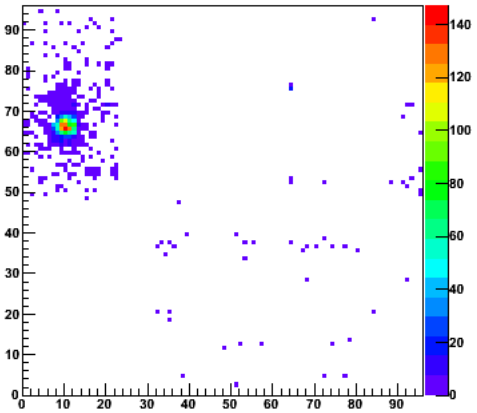
Different tests have been done :

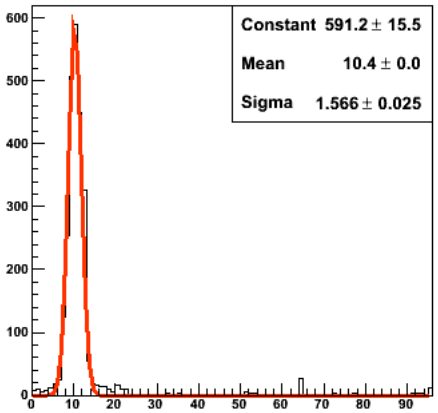
1) Power_Analog and Power_DAC power pulsing together
2) Power_Analog power pulsing
3) Power_DAC power pulsing (less interesting because few current change)
4) Enabling Power_DAC and Power_Analog with delay
5) Power_Analog power pulsing at different rates :

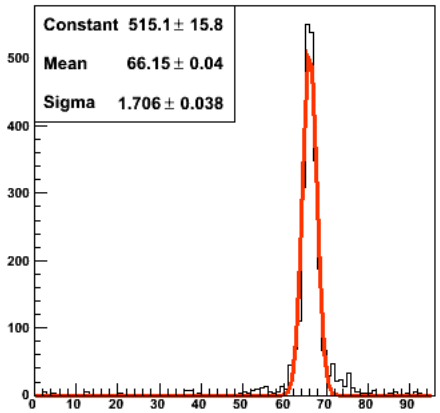
III. Beam Test June/July 2010

Power Pulsing

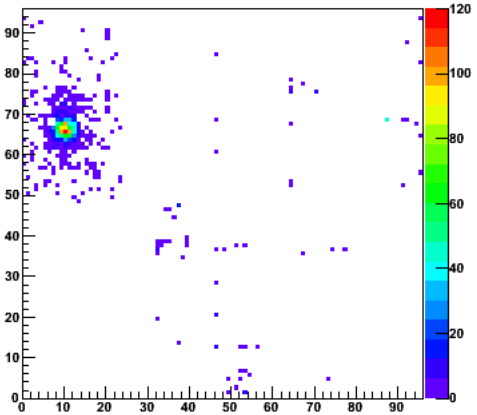
Without PP

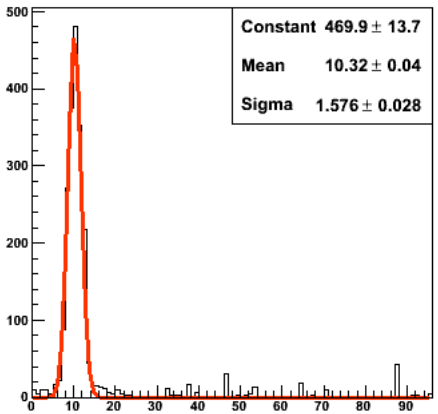


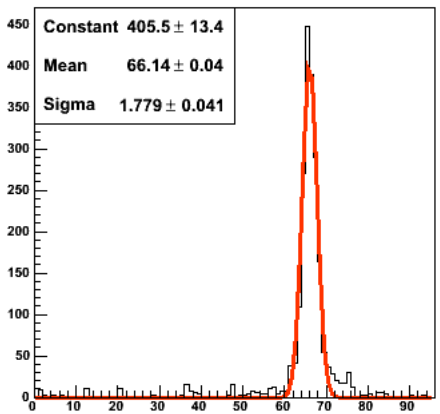




With PP







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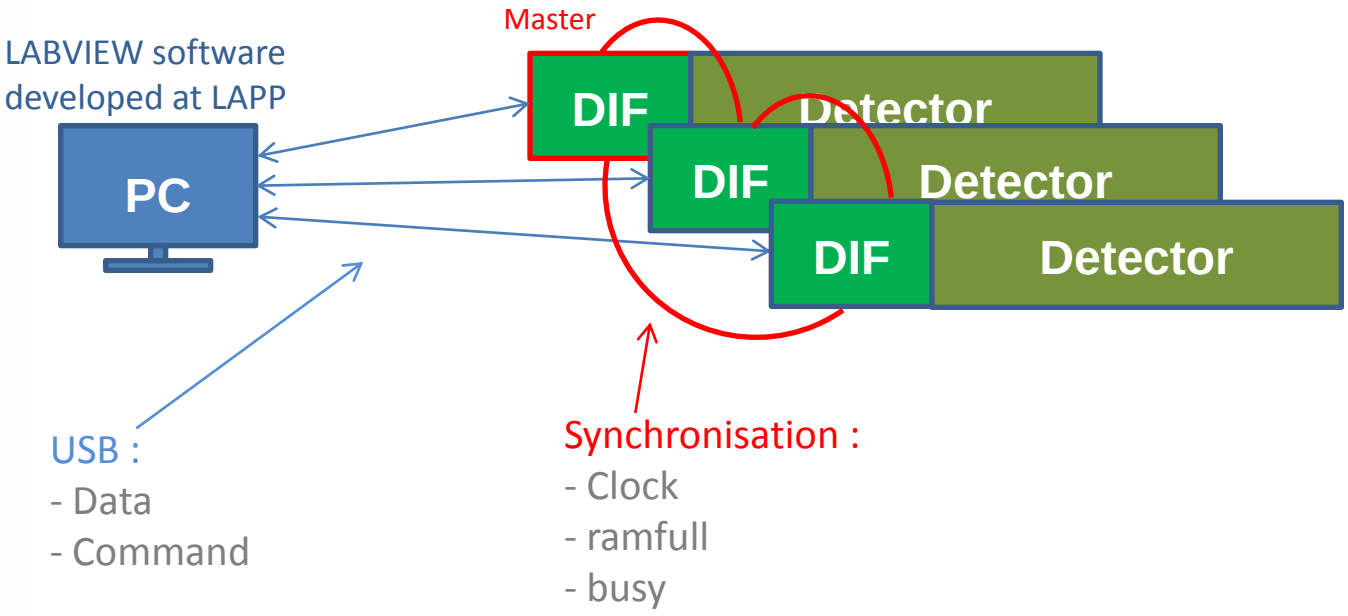
IV. DAQ

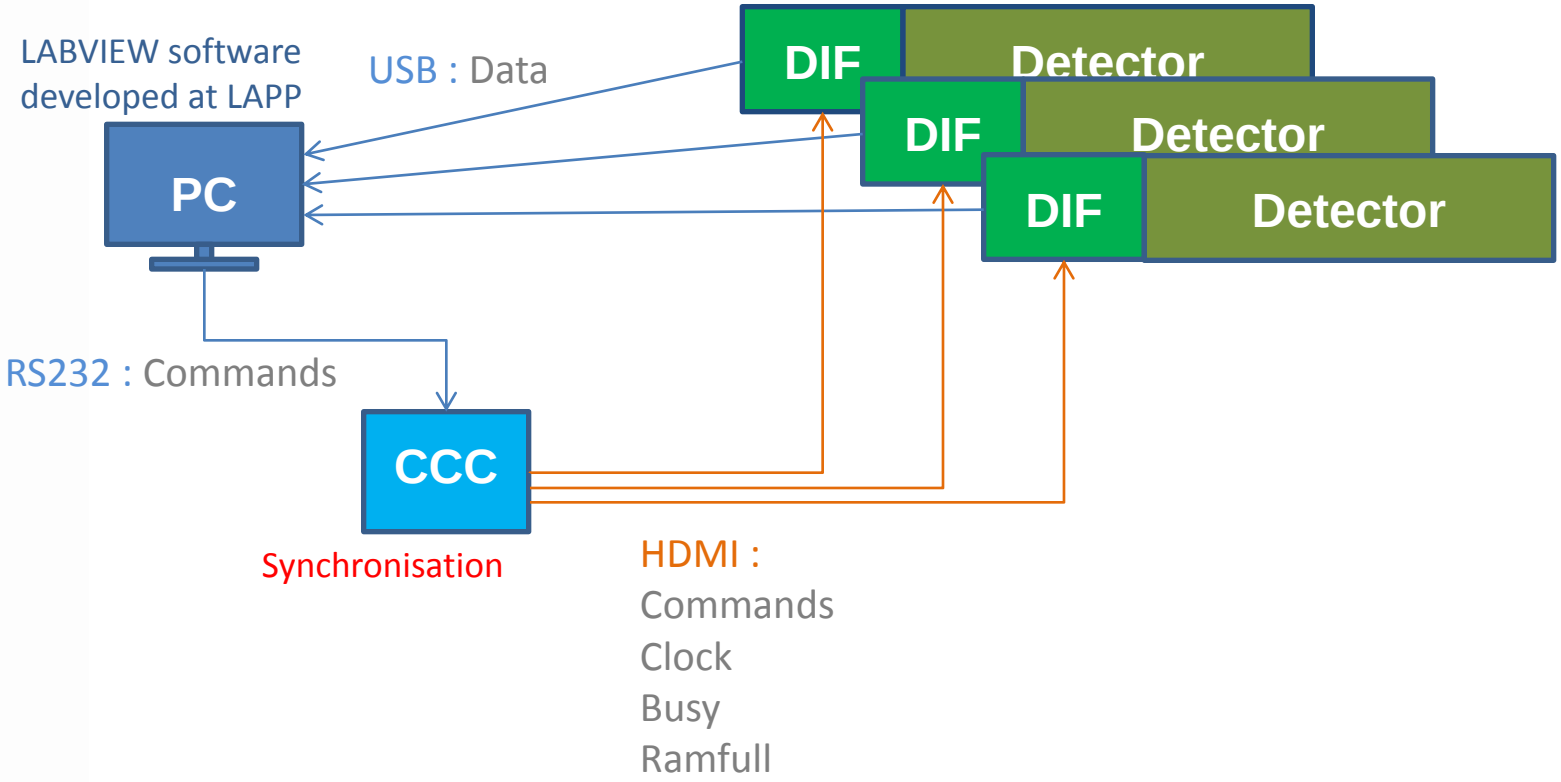
Past Architecture



Not perfectly synchronized !!
And very hard to setup with lot of DIFs…

IV. DAQ

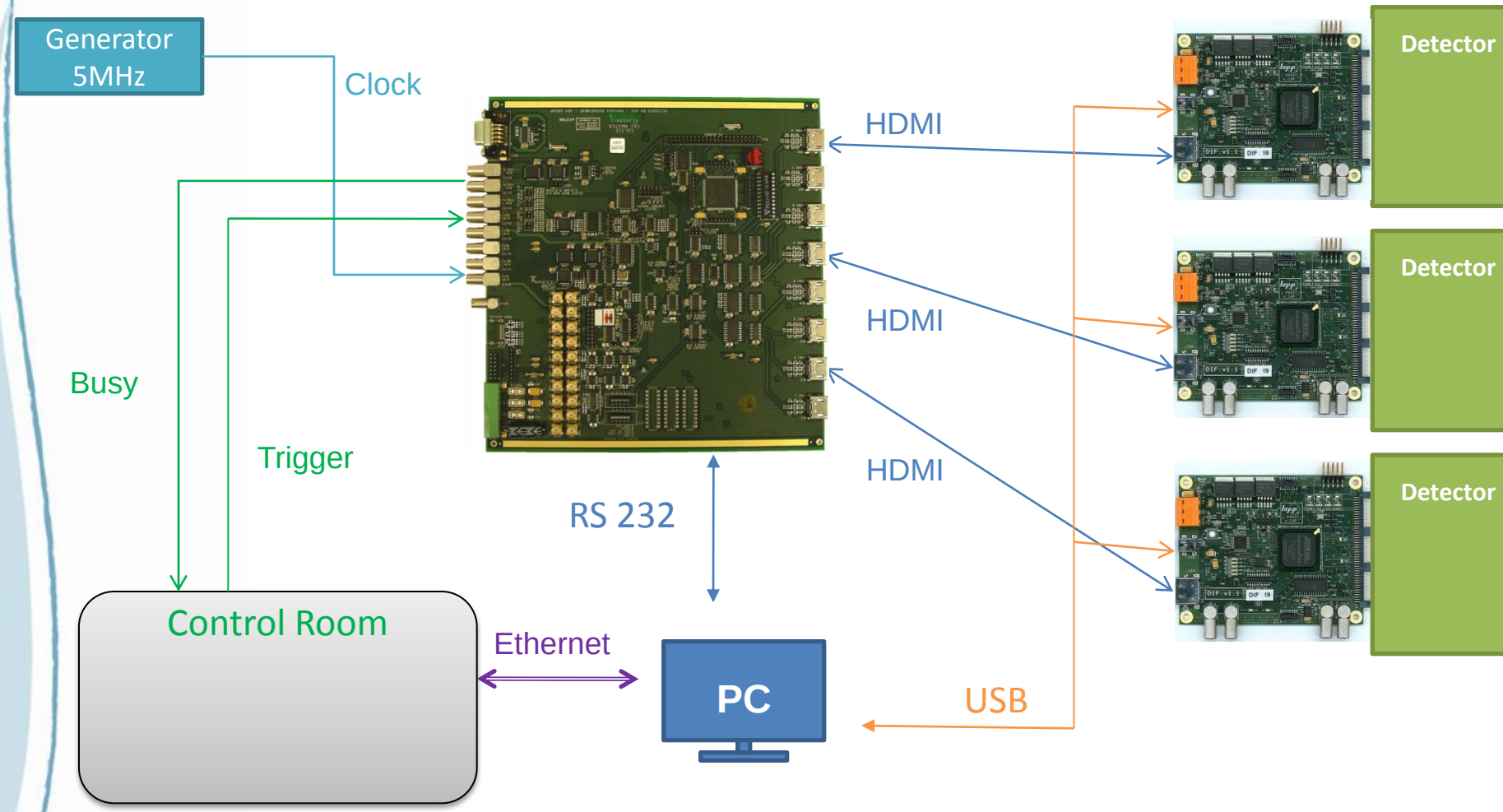
Intermediate Architecture



Before the DAQ CALICE is ready, we need something synchronized.
That's why we developed an intermediate DAQ.
This setup is perfectly synchronized and easy to use up to 8 DIFs (or more using CCC in cascade) the limit is the USB communication.

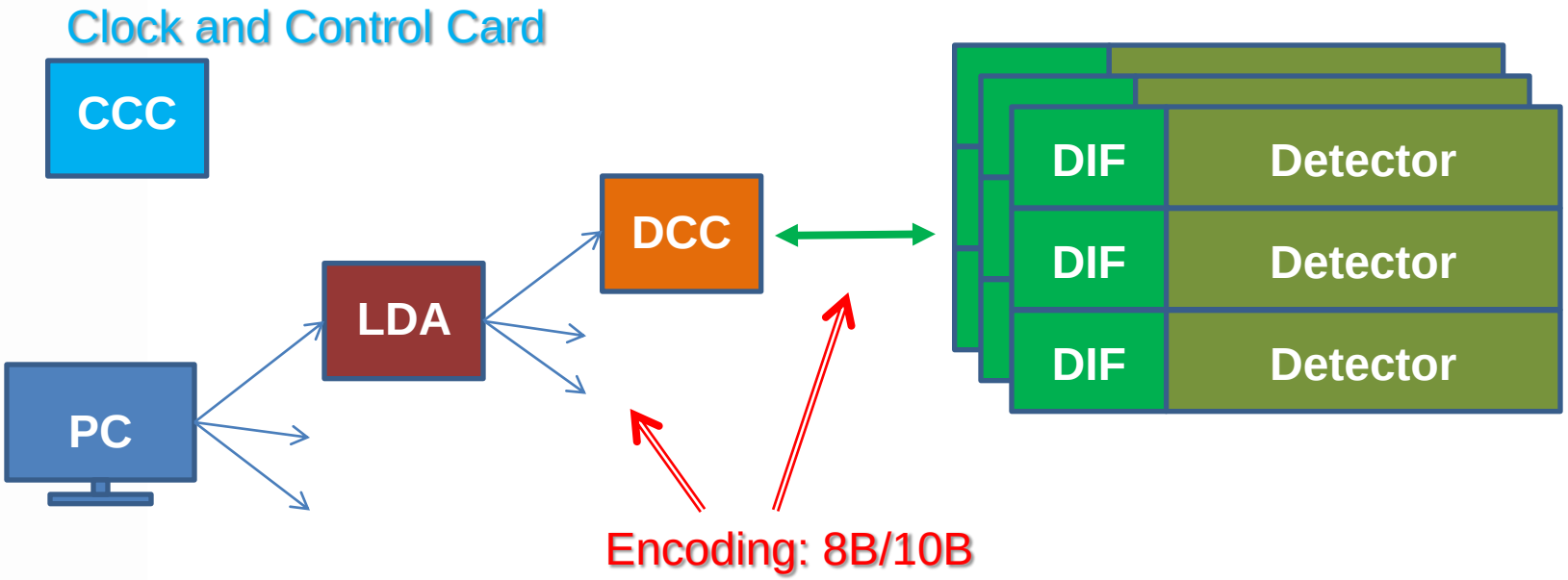
IV. DAQ

Use of the CCC for the current DAQ



IV. DAQ

Future CALICE DAQ Architecture



The 8b/10B encoding/decoding has been tested with the DHCAL DIF. This board has been developed with an Altera FPGA whereas the 8B/10b has been coded with a Xilinx FPGA as target. But the conversion was a success and data was sent and received between the DCC and the DIF.

Next step is to perform the Slow Control of a detector.

Progresses are limited because of final LDA availability

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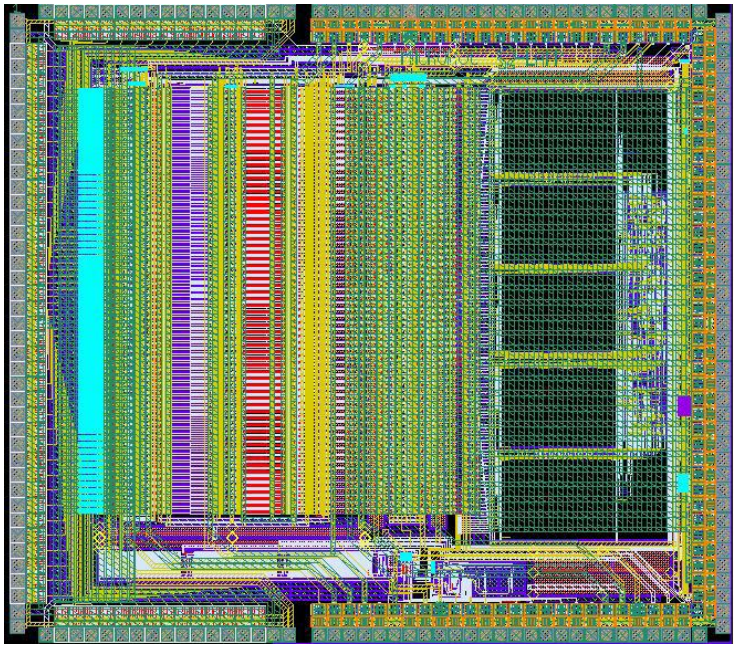
V. MICROROC

MICRO MEsh GAseous Structure (MICROMEGAS) and Gas Electron Multipliers (GEM)



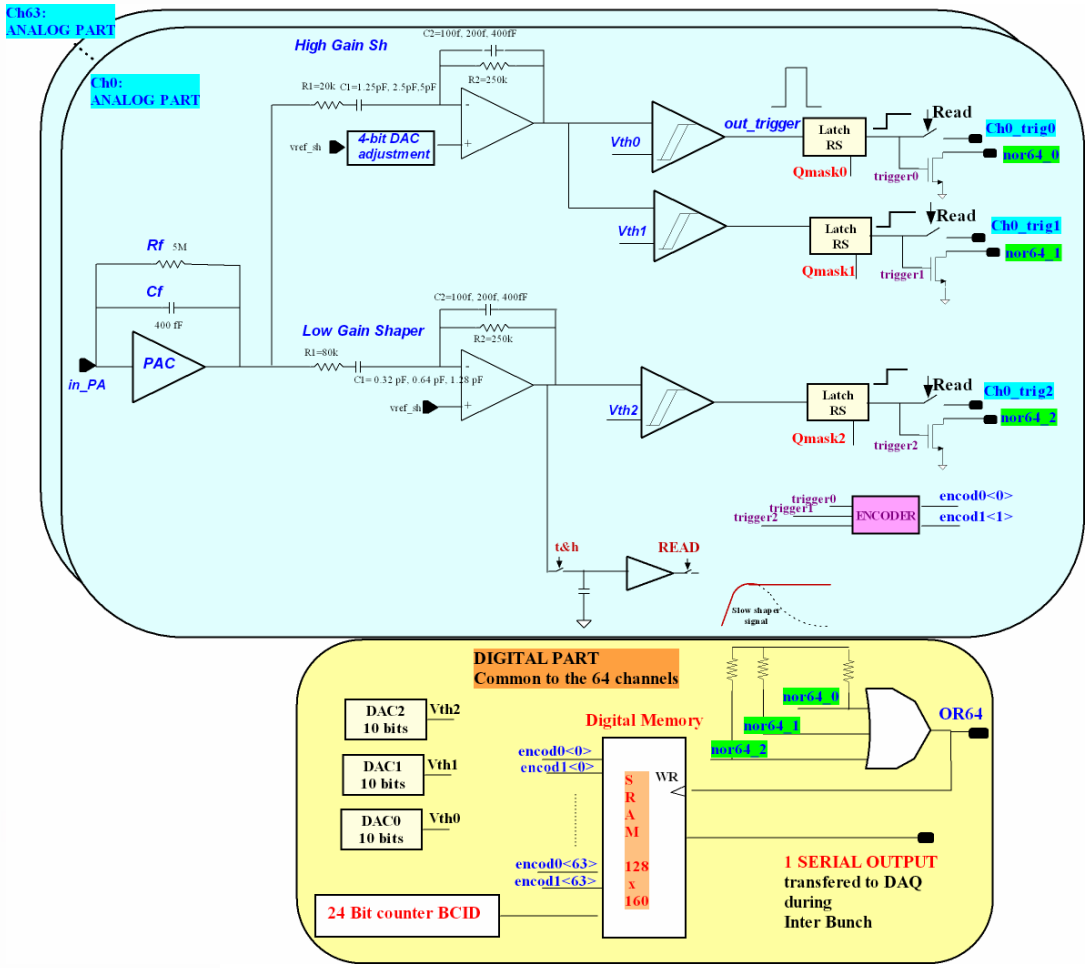
MICROROC is a fruit of the collaboration between LAPP and LAL/OMEGA based on the experience of previous ASICs (DIRAC and HARDROC) and on multiple test beam results

MICROROC :

- 64 channel mixed-signal integrated circuit
- numeric part from HARDROC
- very front end part (preamp and shapers) especially re-designed for 1m^2 MICROMEGAS
- HV sparks robustness for the electronics
- low noise performance to detect signals down to 2fC
- pin to pin compatible with Hardroc

V. MICROROC

Caracteristics



Dynamic range for low and medium threshold : 350fC (Individual channel Pedestal adjustement (4 bits))

Dynamic range for high threshold : 600fC

Noise rms = 0.3fC

Peaking time : 25ns to 175ns with 25ns step

Improved spark protection

Submitted in June 2010

Expected in September

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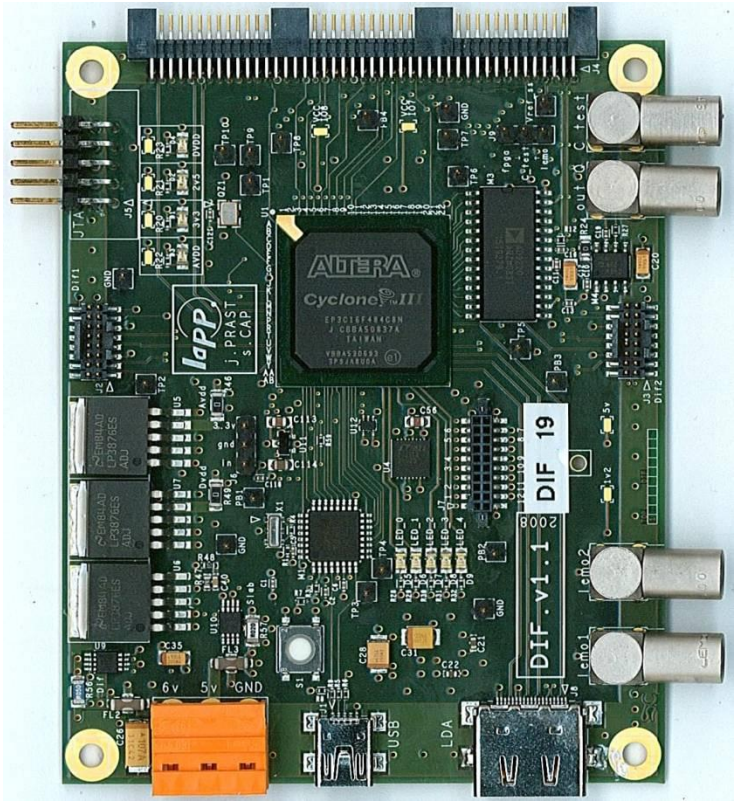
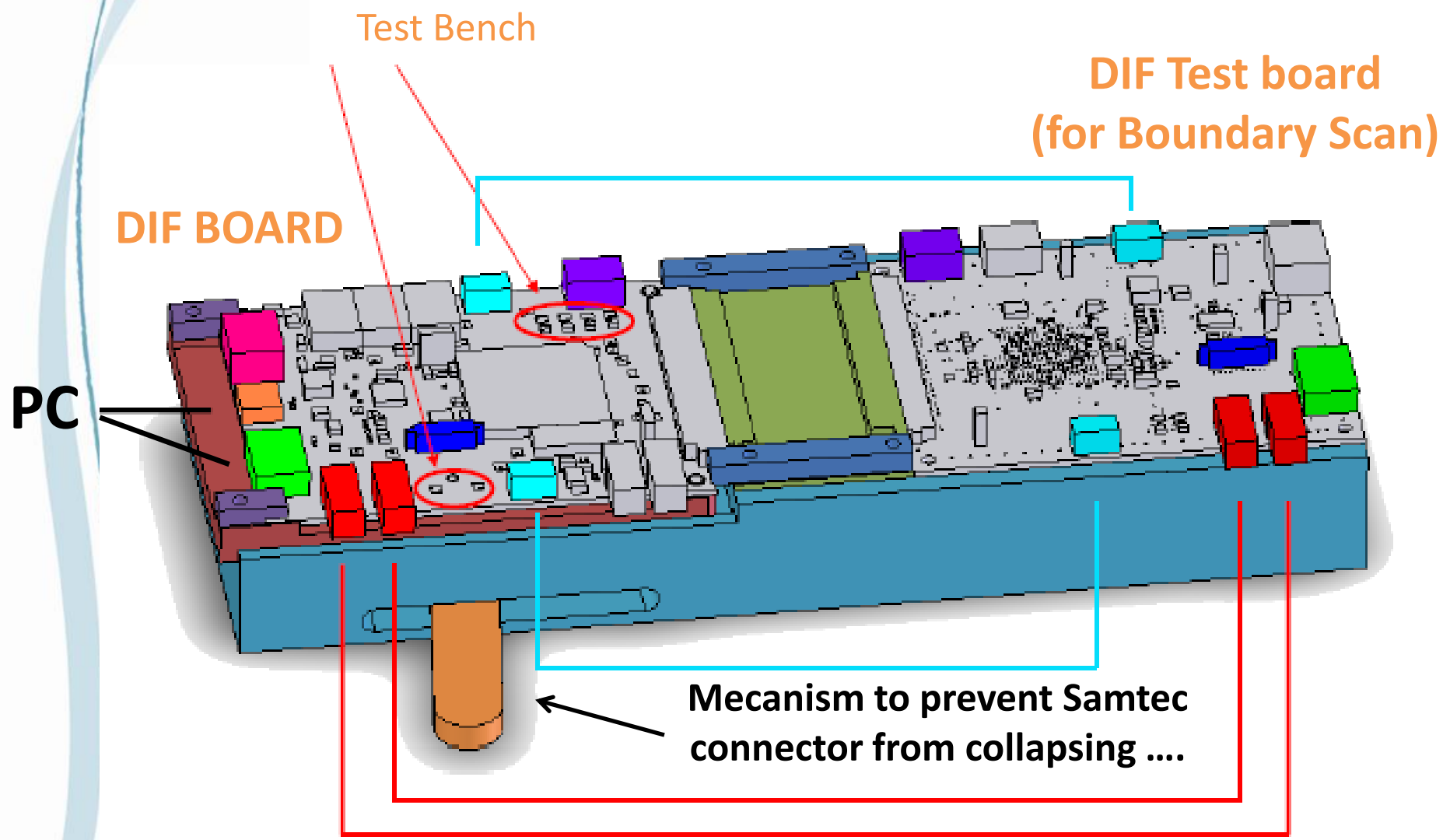
VI. DIF

DHCAL DIF production for the Cubic Meter

- **150 DIF are being produced** (as they are currently).
- Last week, all the PCB and all components have been received by the manufacturer.
- 150 boards should be cabled end of July.
- Boards will be tested at LAPP.
- Test bench is ready (Boundary scan + functional tests).
- **=> Boards will be ready for September**



VI. DIF


Test Bench
DIF Test board
(for Boundary Scan)
DIF BOARD
PC
Mecanism to prevent Samtec
connector from collapsing ….

IV. Conclusion

MICROMEGAS Square Meter realization and Beam Tests is a success.
Almost one month of operation of the m2 detector in CERN/SPS high energy beams
This prototype has provided precious information for future mass production.

DAQ intermediate architecture is fully operational

DIF VHDL for the future CALICE DAQ is on going but fully operational LDA is required.

The MICROROC ASIC, dedicated for large area MICROMEGAS readout, has been developed and submitted.