Tests of PCB flex (GPF1, Graphic PCB Flex n°1) equipped with 3 sensors

PLUME Phone meeting

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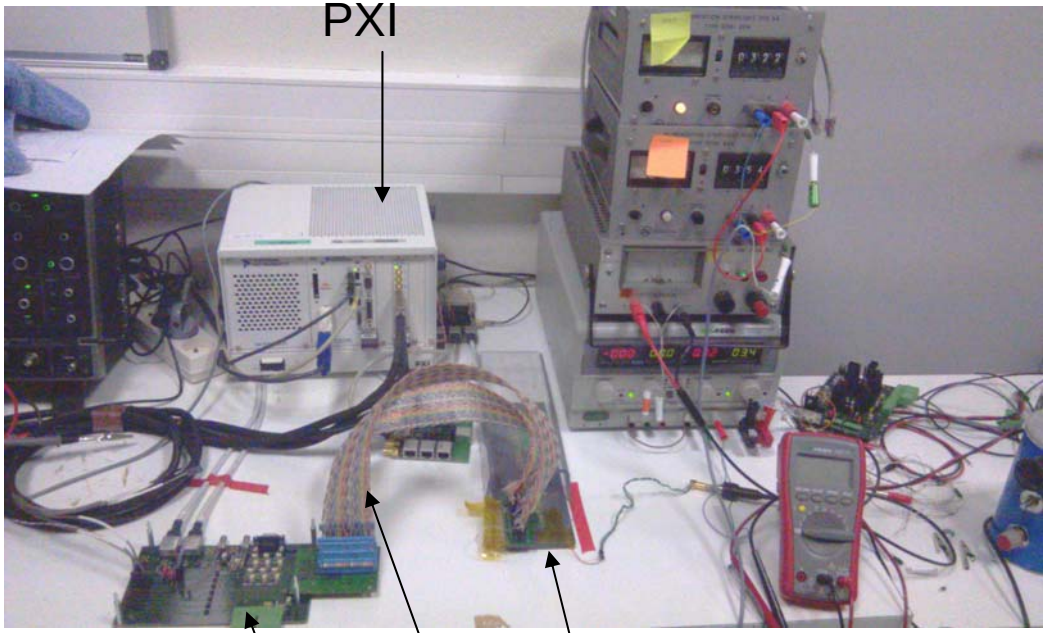
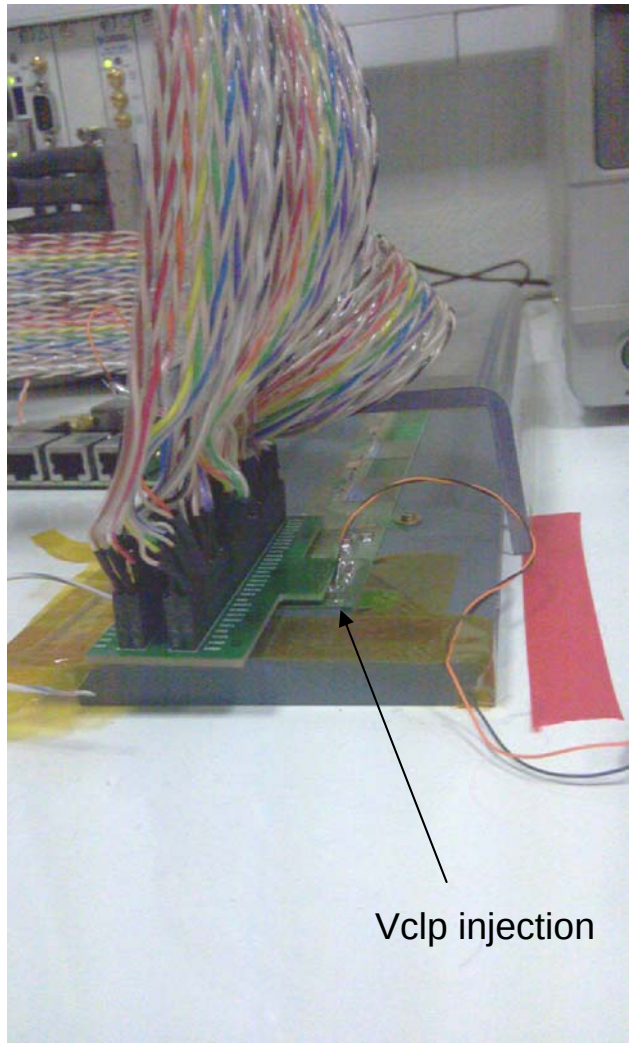
Outline

- Previously on PLUME : last meeting status reminder (18th June 2010 @CERN)
- PLUME in July 2010
- PLUME in August-September 2010
- PLUME in October 2010
- PLUME in the future

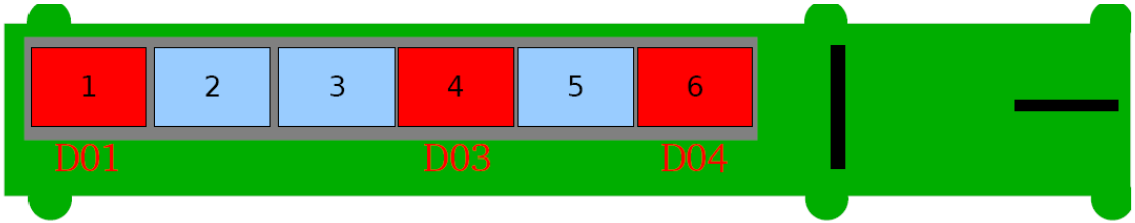
PLUME test bench

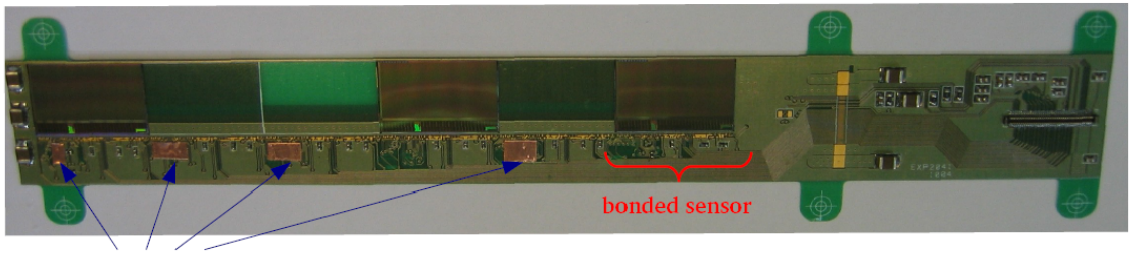




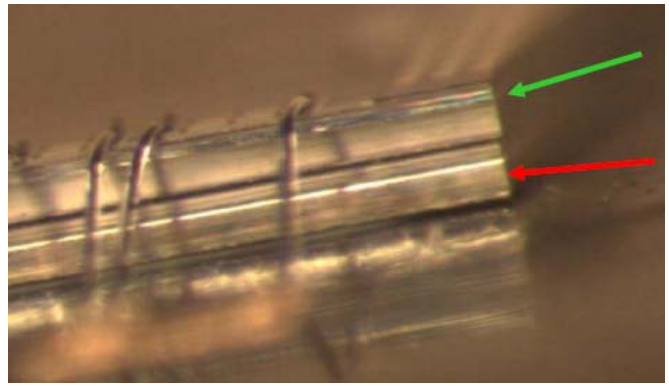
Previously on PLUME GPF1 (1/2)

- Last news from CERN meeting on 18th June 2010





copper scotch to make the bridge between TDO & TDI



- Connection/assembly/ preliminary tests of the different parts composing the PLUME test bench (auxiliary board, Jumper cable, DAQ)

- Electronic tests mainly focused on the GPF1 sensors main output signals/data displayed on the oscilloscope

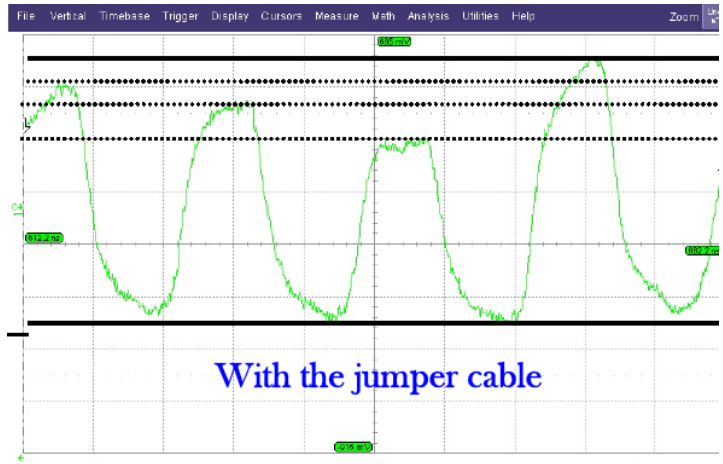
- DAC calibration procedure for the 6th bonded sensor
  Reminder : 8 bondings lines (reference lines) that we bond/unbond to one sensor after another characterize the DAC.

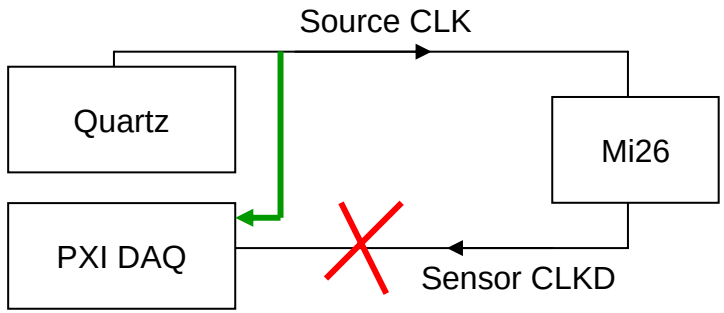
Previously on PLUME GPF1 (2/2)

What was underlined :

- ***Jumper cable/GPF1 connector :***
  GPF1 is equipped with the wrong connector, hence we had to adjust with some difficulties for the connection to the auxiliary card (flat cable)

- ***Capacitive coupling on the jumper cable*** :
  the arrangement of the LVDS pairs traces at the GPF1 connector (+/- pairs consecutively) leads to a capacitive coupling between CLKD and sensor data line through the jumper cable and results in an oscillation in an amplitude oscillation of the CLKD signal
  => separate +/- pairs on the flex
  at the connector level
  AND redesign the jumper cable
  => temporary solution was to use CLK
  instead of CLKD to synchronize the data



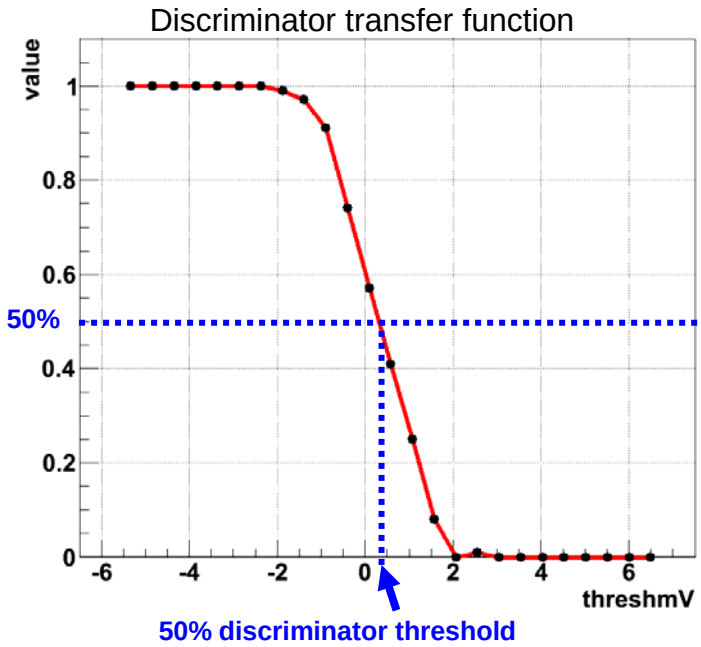


PLUME in July 2010

- ***Investigation on CLKD :*** to check that even though there was an amplitude oscillation of CLKD no clock pulse was missed (eye diagram, systematic comparison measurements by using CLK and CLKD).
  => No problem was observed, nevertheless we can now choose in DAQ interface to use the source CLK instead of CLKD and that's what was used for the measurements.
- ***Sensor n°4 & n°1 :*** 2 other sensors were bonded at the beginning of July 2010
- ***JTAG daisy chain*** implemented for 3 sensors
- ***PXI DAQ preliminary tests with 3 sensors (hours) :***
  ** in normal mode data :*
  To identify the sensors data, to read the header/trailer/data length, to count the frames in order to see if some frames were lost, for one and more sensors.
  To test if the data of the 3 sensors are well synchronized :
  START termination resistor on the flex had to be changed from 50Ω to 4.7kΩ
  START signal and CLK synchronization
  ** in pattern only mode :*
  To generate a pattern at a certain line and check it has been well read by the DAQ
- ***DAC calibration procedure :*** bonding/measuring/unbonding the 8 DAC lines of each sensor one after another.
  Typical DAC parameters as expected for Mi26 sensors

PLUME in August-September 2010

- **How to calibrate a sensor on PLUME (how to turn off the other sensors) ?**
  What is the influence of the non studied sensors ?
  How to validate the flex design ?
- Start to calibrate sensors discriminators (scan over thresholds)
- **The 50% threshold depends on the other sensors activity**
- **Extensive study on a chip alone on PCB with the PLUME test bench**
  => to have a better knowledge of the sensor behavior in PLUME environment
  in order to make the comparison easier
  => to push to the limit the environmental conditions to identify the critical parameters
  => what is the 50% discriminator threshold sensitive to for a single chip ?



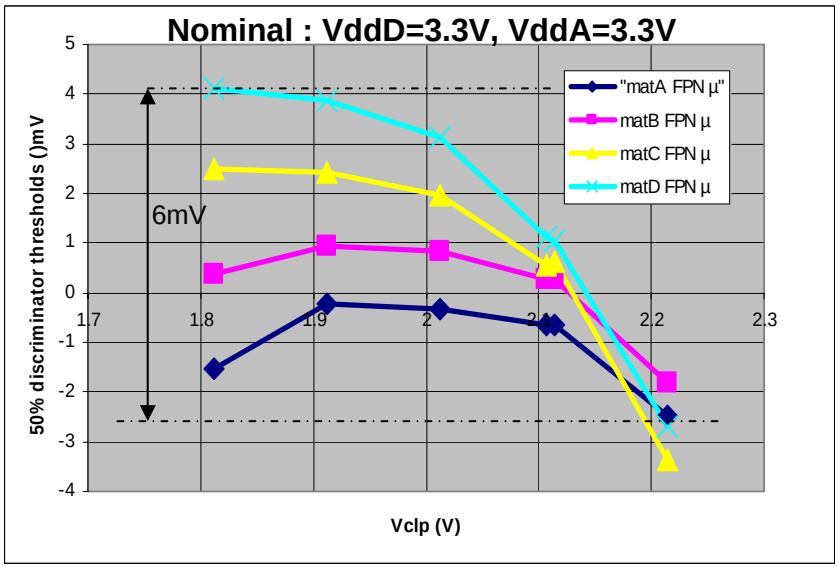
PLUME in August-September 2010

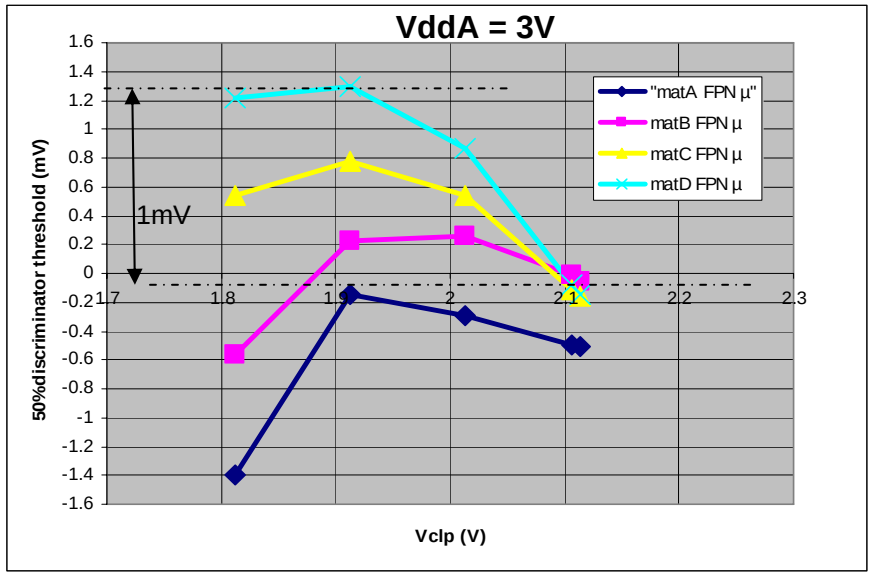
What did we learn from this ?

- Influence of external parameters : VddD, VddA, Vclp, current consumption, temperature
- Influence of internal parameters : memory activity, running frequency

Influence on the important sensor parameters : noise, 50% discriminator thresholds, dispersion

Example :



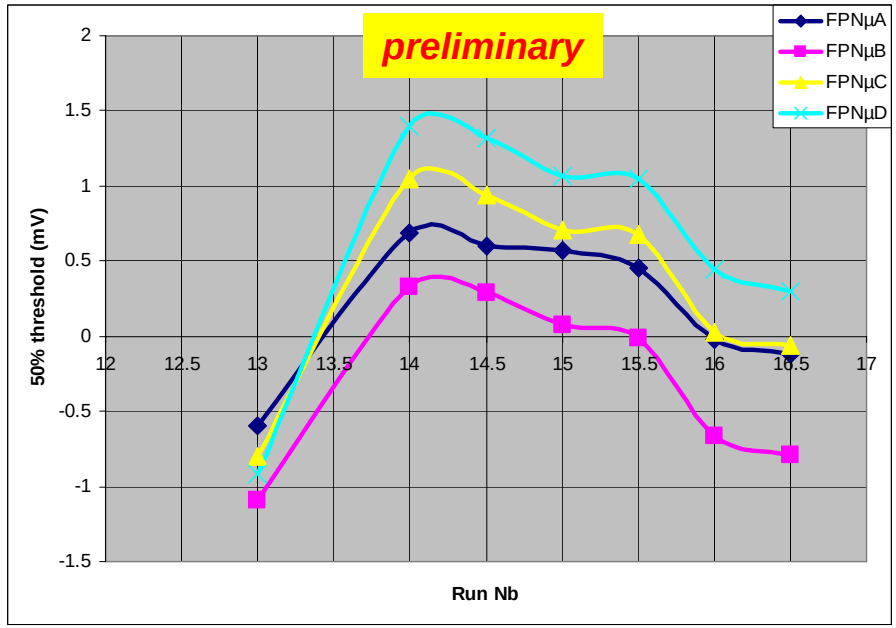


PLUME in October 2010

- Back to the sensors discriminators characterization, focused on the 6th sensor
- Improved conditions from our experience on the chip alone on PCB *(Example : Vclp)*

- Do we find back what we had for only one sensor on PCB ?
- On what criteria can the flex design be validated ?
- Influence on the calibration results of the other sensors activities
- Find a “satisfying”, stable operating point (VddD=3V, power decrease)

Hundreds of measurements !
*
Plenty of influencing parameters
*
Working conditions limits



13	ref D+P SUZE, C1(ILVDS=32,ILVDSTx=0), C4(ILVDS=32,ILVDSTx=0)
14	D+P SUZE, C1(ILVDS=**0**,ILVDSTx=0), C4(ILVDS=**0**,ILVDSTx=0)
14.5	D+P NOSUZE, C1(ILVDS=**0**,ILVDSTx=0), C4(ILVDS=**0**,ILVDSTx=0)
15	D+P SUZE, C1(ILVDS=**0**,ILVDSTx=0), C4(ILVDS=**32**,ILVDSTx=0)
15.5	D+P NOSUZE, C1(ILVDS=**0**,ILVDSTx=0), C4(ILVDS=**32**,ILVDSTx=0)
16	D+P SUZE, C1(ILVDS=**32**,ILVDSTx=0), C4(ILVDS=**0**,ILVDSTx=0)
16.5	D+P NOSUZE, C1(ILVDS=**32**,ILVDSTx=0), C4(ILVDS=**0**,ILVDSTx=0)

PLUME in the next months

- To “end” the GPF1 sensors calibration :
- To make extensive test with the DAQ (days) in normal read-out mode
- Sensor working tests
  * To determine the fake hit rate
  * To check the pixel behavior and working
  * To calculate the pixel multiplicity
- To use GPF1 back for the thermal study
  * to set up the thermal test bench
  * to compare with Franziska’s simulation results
- IR laser test bench to calibrate the sensors
- Influence of the metal traces underneath the sensors

No show stopper