Light calibration system IFAE

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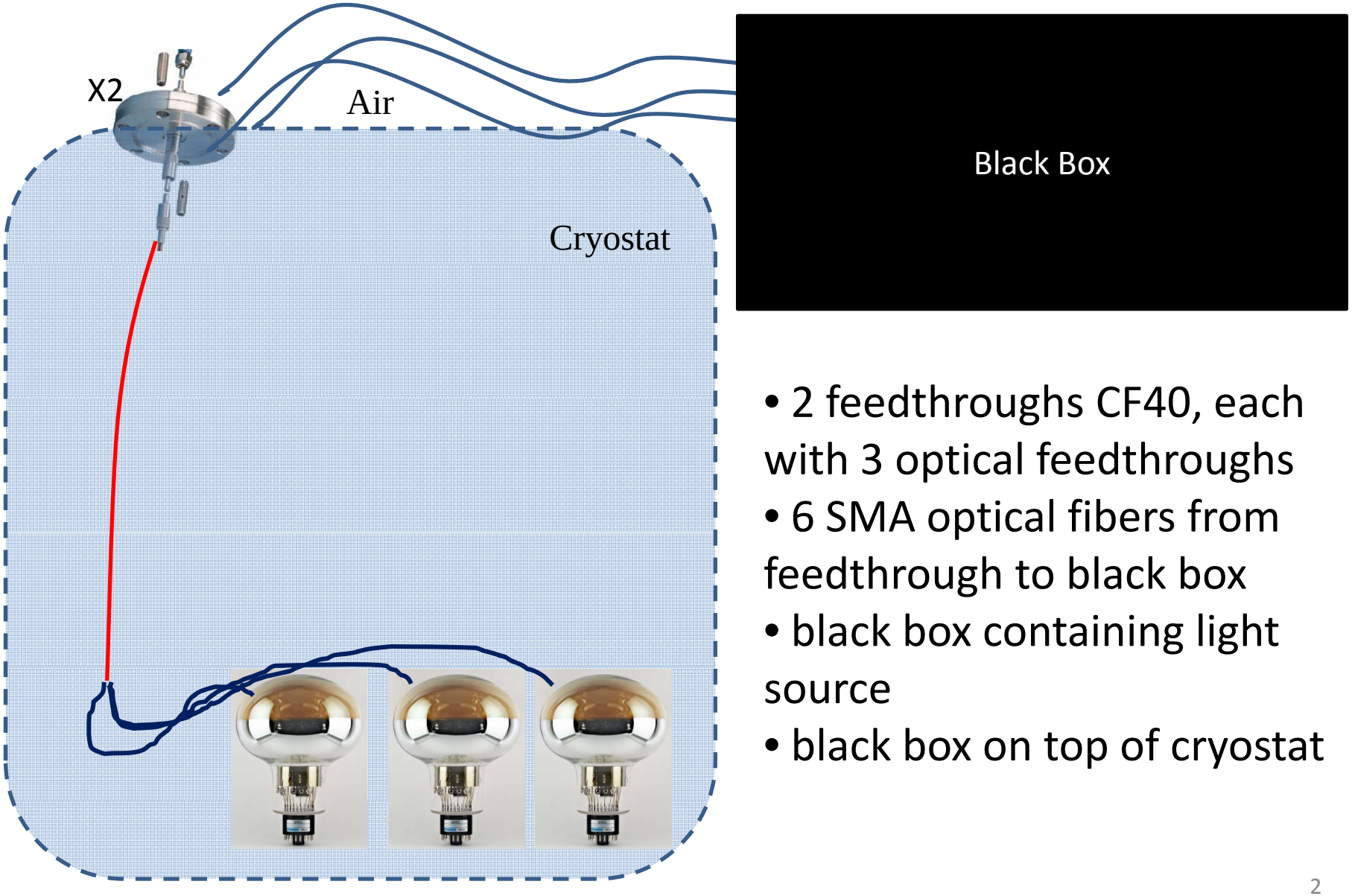
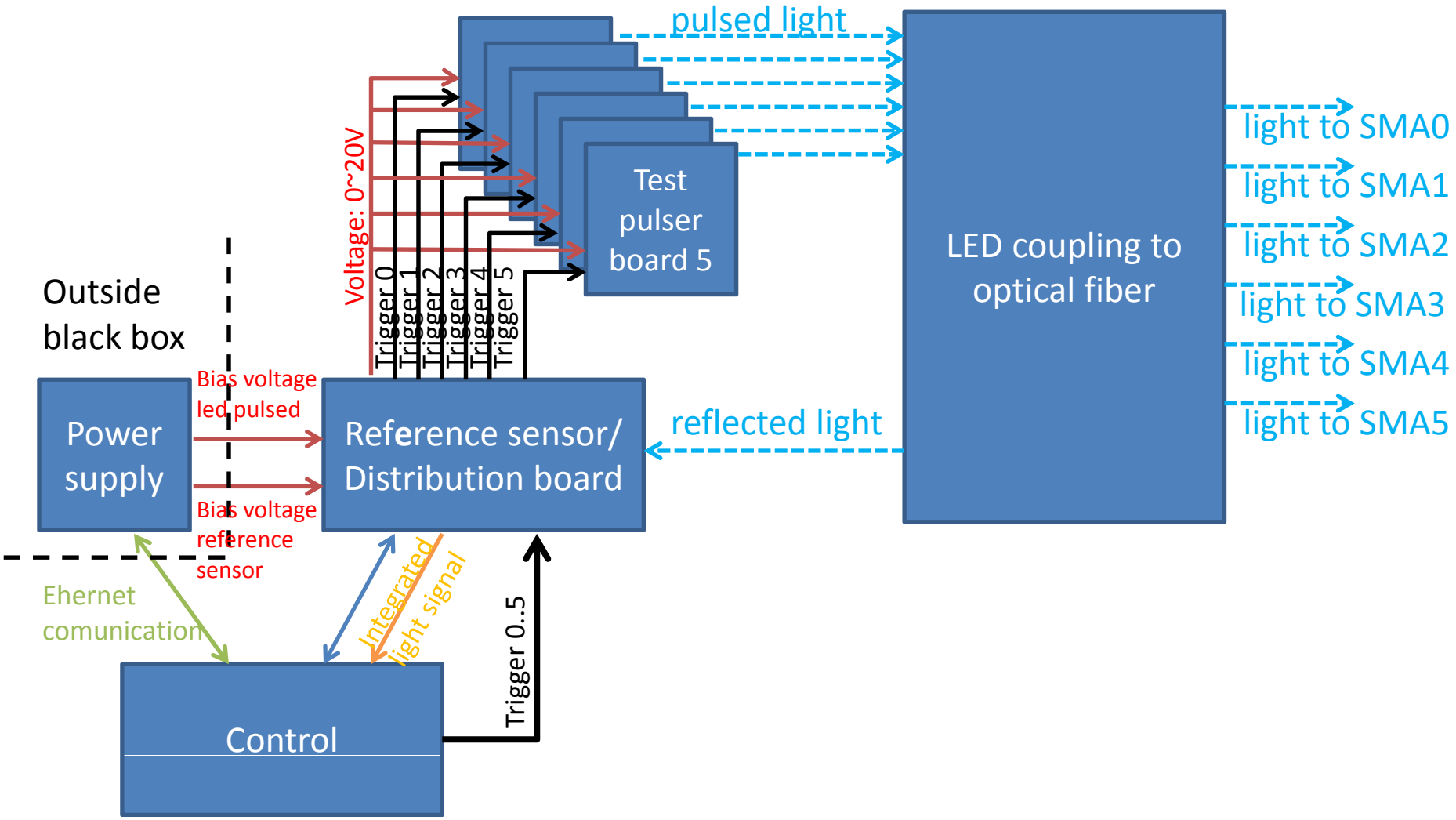
Overall Conceptual Design

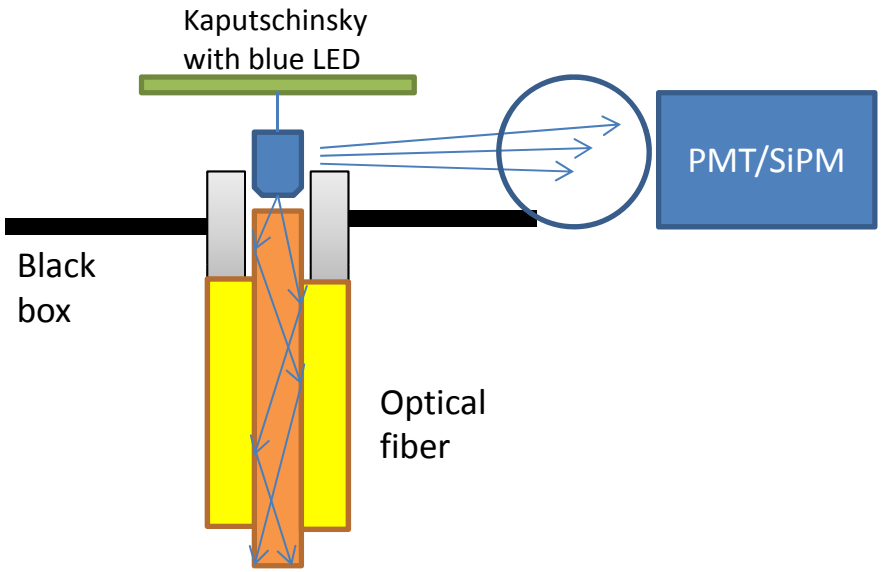


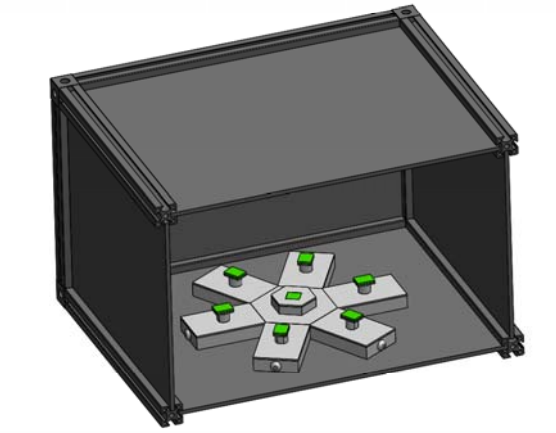
- 2 feedthroughs CF40, each with 3 optical feedthroughs
- 6 SMA optical fibers from feedthrough to black box
- black box containing light source
- black box on top of cryostat

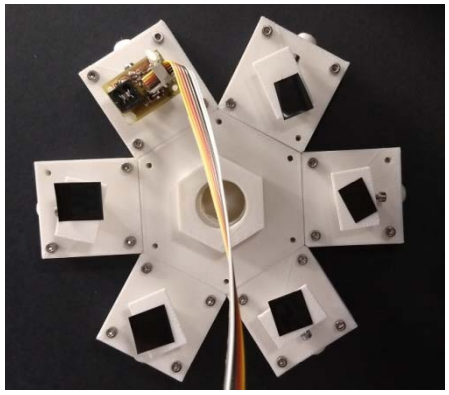
Black box concept



LED coupling cavity







- Based on Thorsten idea
- 3D printed
- Tested in all 6 positions and measured power entering fiber with powermeter
- Large variations from position to position: ~2 factor
- Tested same position several times: roughly the same variation

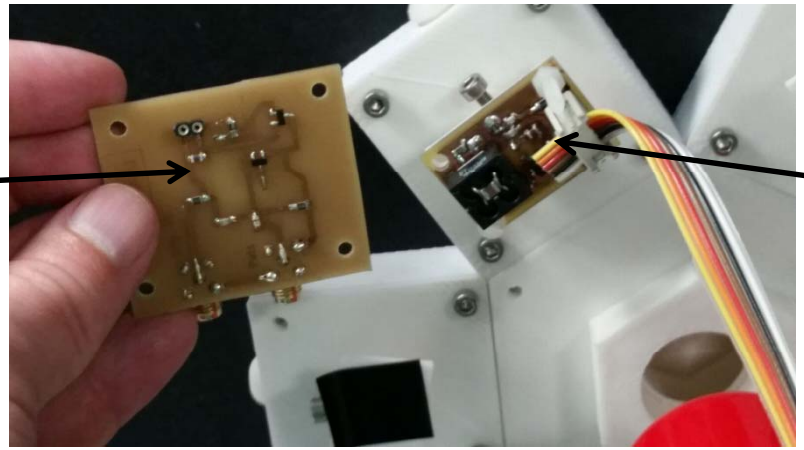
=> Sensitive to placing of Kaputschinsky PCB but might be better with final PCBs and long LEDs (by mistake legs of these was cut)

Power supply

- CPX200DP
- Two ouputs
  - Reference sensor voltage (0 ~ 30V)
  - Bias LED pulsed light (7 ~ 20V)
- Developed a Python library to comunicate with it.
  - Tested and used in the LED light pulsed board test

LED pulsed light board

Kaputchinsky circuit from Thorsten.

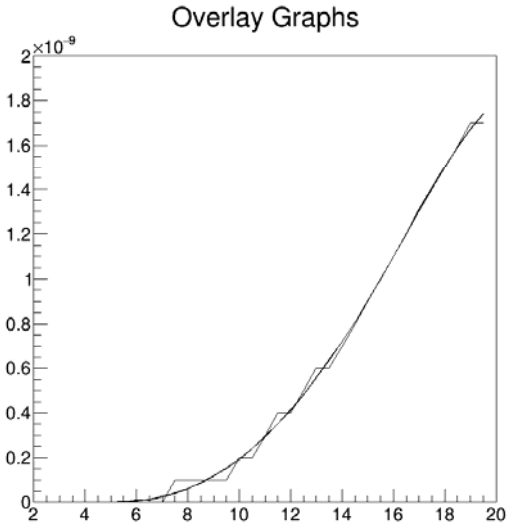


Adapted version to LED coupling setup

- Based on Kapuscinsky scheme
- A filter has been added
- Prototype tested (next slide)
- Less powerfull than left one.
- Waiting final version from manufacturer to be assembled and tested.

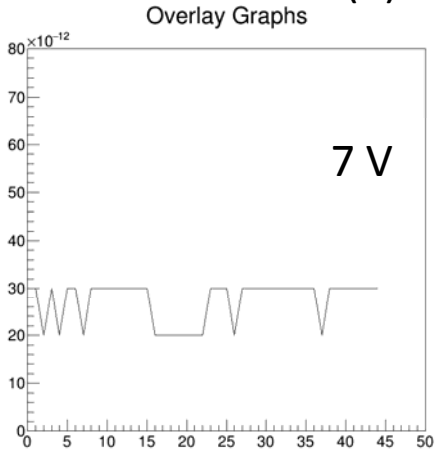
LED pulsed light board result

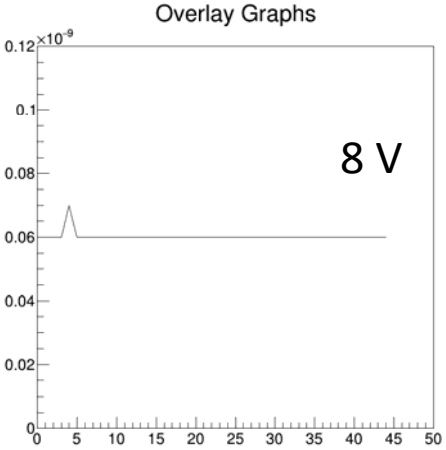
Power vs voltage

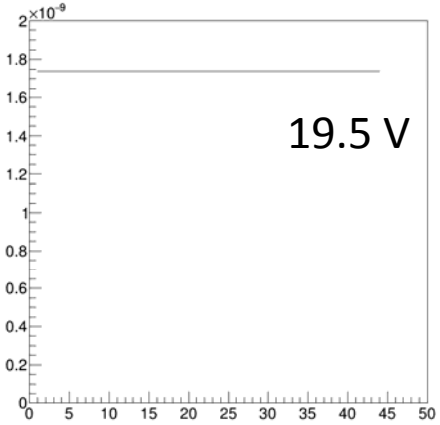


- All measurements has been done with a powermeter bought for the test
- Overlayed measurements for diferent frequencies (100 .. 10kHz)
- Power normalized to 1kHz
- It doesn't depend of pulse frequency
- There are not time dependency

Power vs time (h)

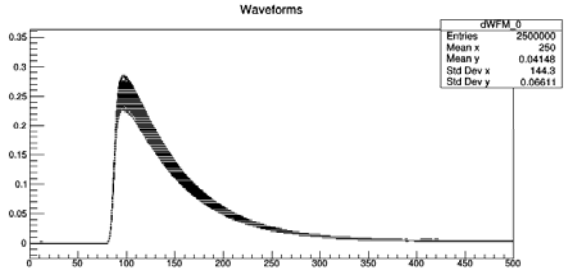


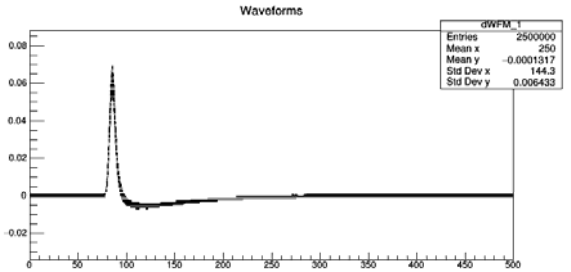




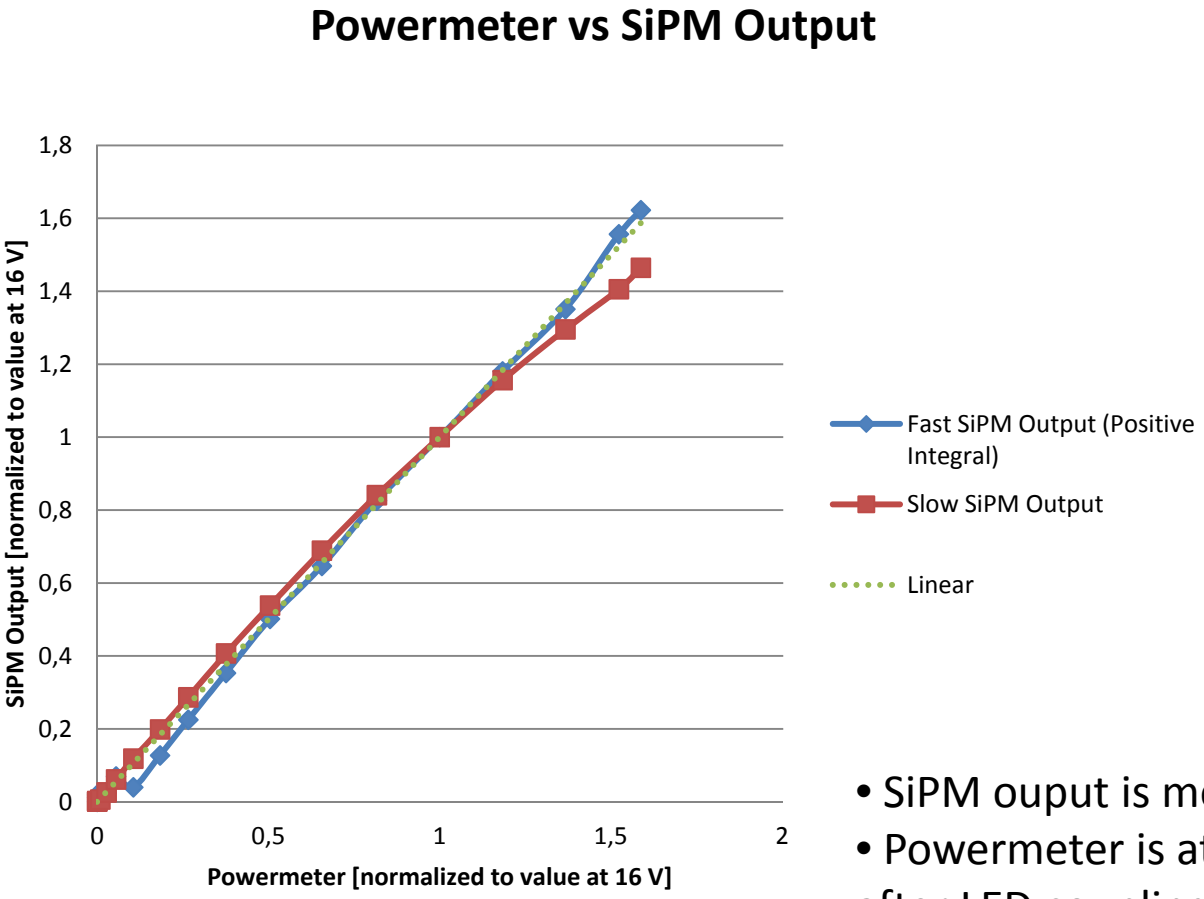
Reference sensor/ distribution board

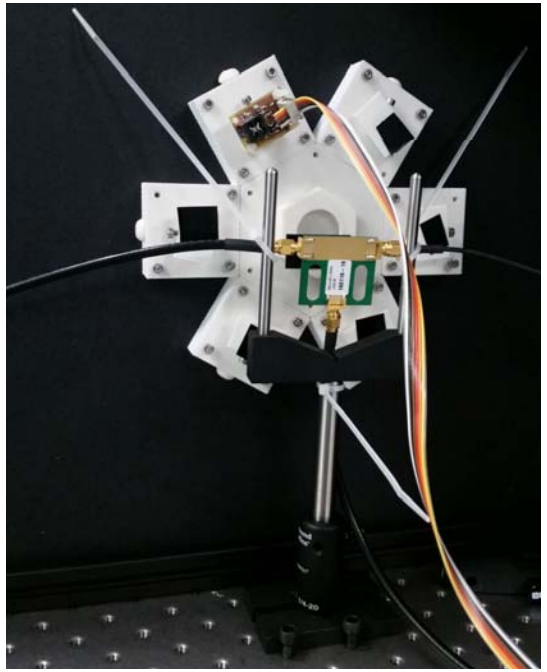
- Reference sensor
  - SensL SiPM (up left)
    - Fast output (down)
    - Slow output (to be used)
  - Integrator (up right)
    - Limited sampling rate in control board (200kS)
    - Developing control for integrator window.
    - Analog output to control board
  - Developing test to adquire the full channel (sensor + integrator + ADC)
- Distribution board
  - Distribute Bias voltage
    - Common to all LED pulser boards
  - Distribute trigger
    - From the control board to each connector to LED pulsed board.
  - TTL trigger for the charge readout
  - Control comunication through TTL signals
    - 6 trigger, 2 for integrator, 2 analog signals
- Both functionlities will be implemented in one board
- To be designed as soon as finished the test with the full chanel





Powermeter vs SiPM Output

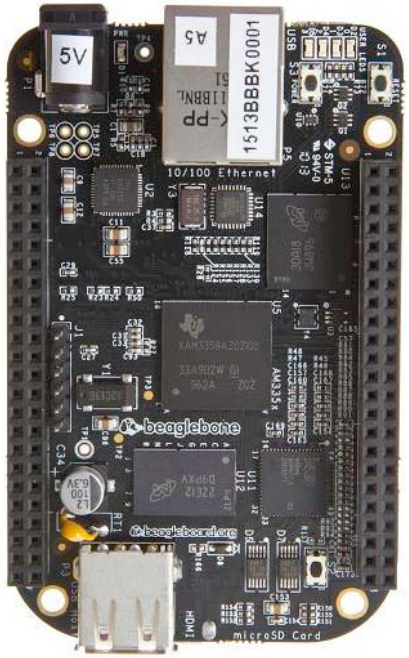




- SiPM ouput is measured with an oscilloscope
- Powermeter is at the end of optical fiber after LED coupling
- Positive integral by computing
- Slow output is no lineal at high power

Control board

- Beagle bone black
  - Embedded linux inside
  - 7 Channels ADC
    - Reference ouput sensor
    - Temperature
  - Comunication with Power supply
    - Python library
  - PWM to trigger pulsed LED boards
  - Control integration window.
    - Timing has to be improved
    - Developing code for real time units inside beaglebone
  - To be develop the user control software.
    - Web server interface through wireless (general network)
    - OPC-UA server though tehcnical network (evaluating)



Summary and next steps

- LED coupling cavity finished
  - Enough light for the refernce sensor
- LED pulser board design finished
  - To be assembled and tested
- Comunication with power supply developed
- To be done in priority order:
  - Finish the full channel adquisition test: Sensor + integrator + ADC.
    - Critical to decide if the adquisition chain is ok or it has to be changed.
    - One time finished a full system test could be done (before Christmas)
  - Design the reference/distribution board to fit in the LED coupling cavity
  - Develop software for control user