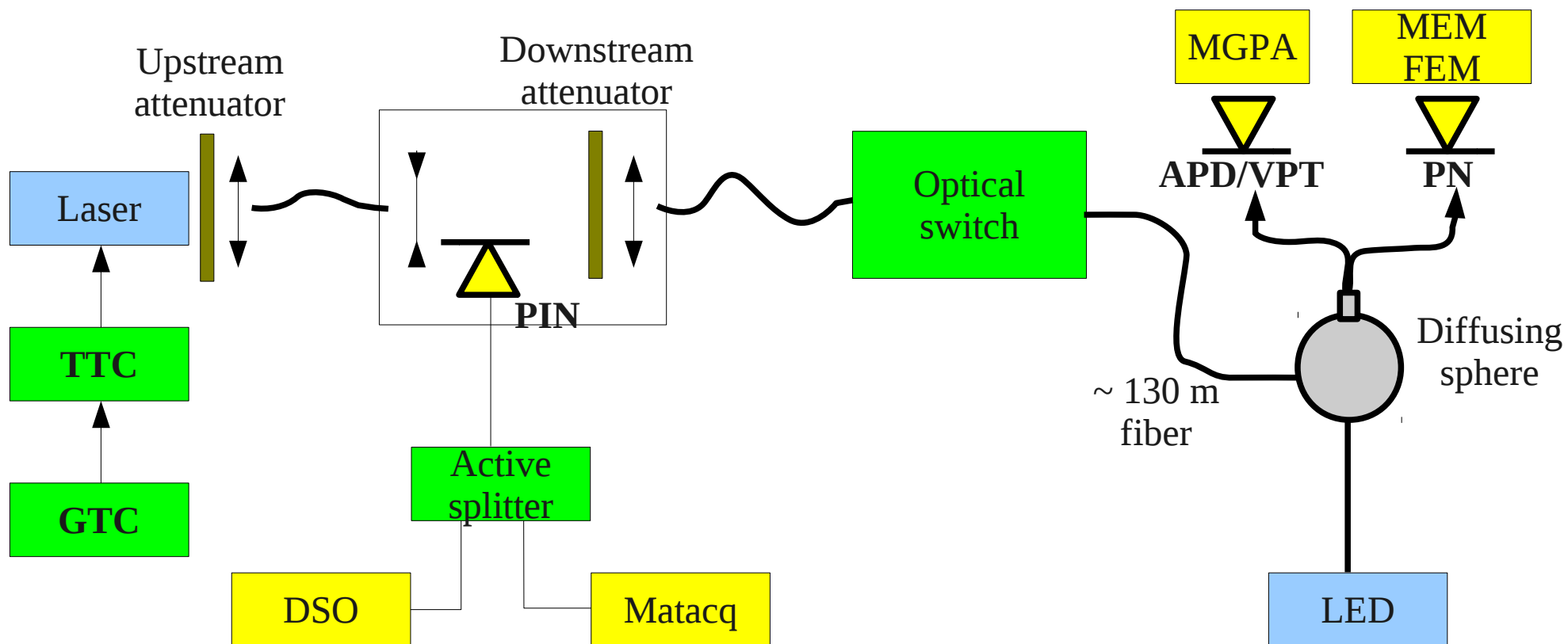


# ECAL monitoring system

## Lessons form 2011 – Plans for 2012

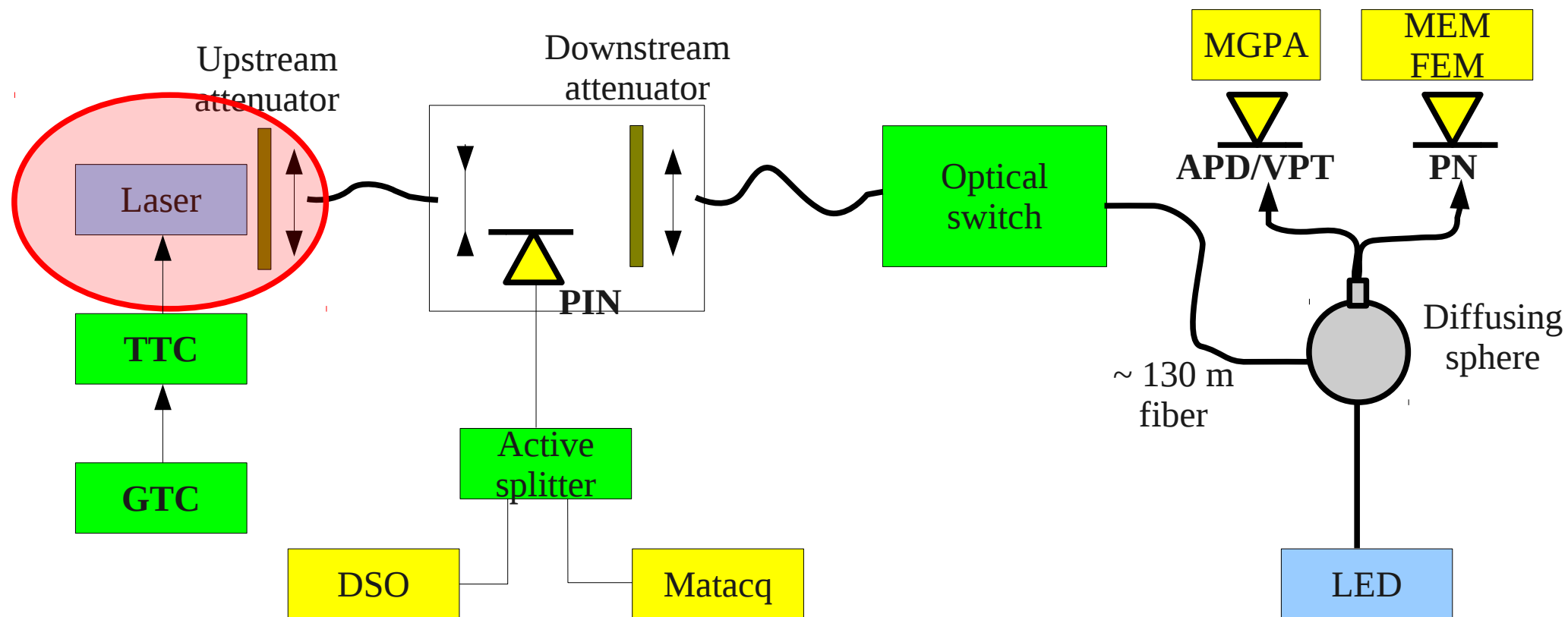
- Hardware :



# ECAL monitoring system

## Lessons form 2011 – Plans for 2012

- **Hardware :**





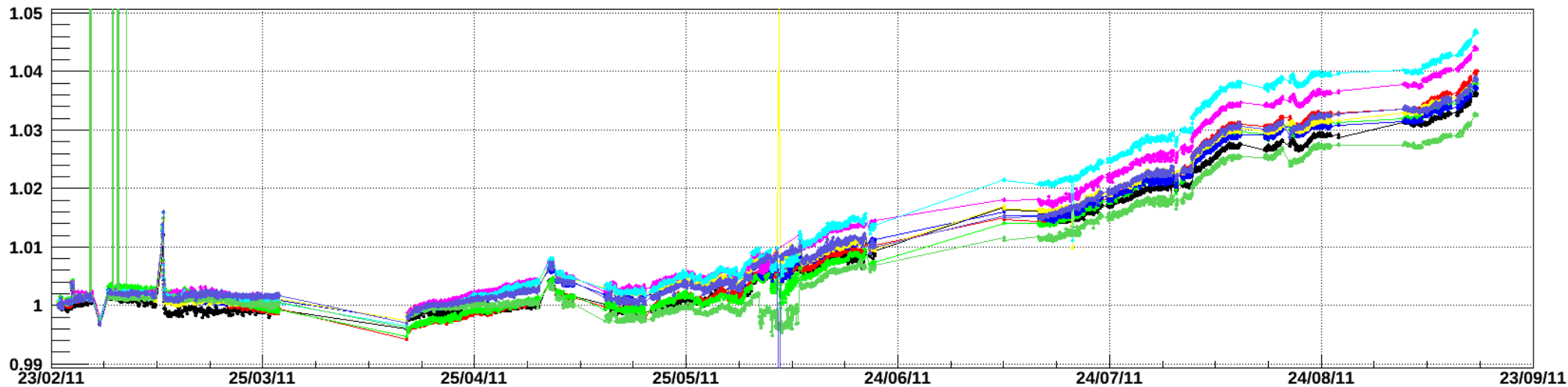
# Lasers

- 2011
  - 2 blue lasers : Quantronix
    - ▶ Different transparency measurement between lasers (few  $10^{-3}$ )
    - ▶ Could be stable but could have also problems with small notice time
      - Problematic period in June
    - ▶ Manpower consuming
      - Maintenance
      - Analysis code development to follow “features”
  - 1 red laser
    - ▶ Used in calibration sequence
    - ▶ Data not used in analysis
      - Crystal behavior not understood

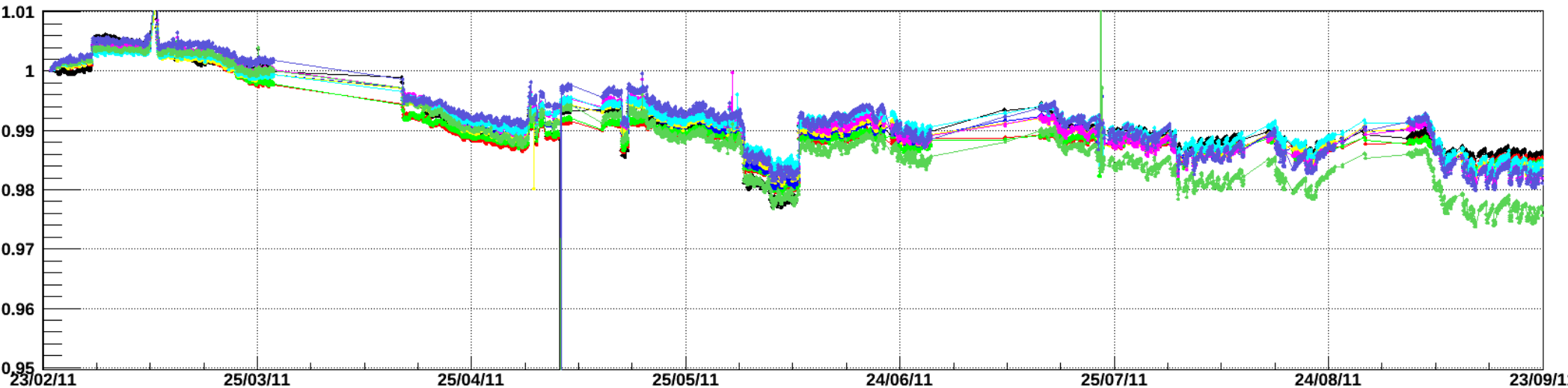


# Red vs Blue

FED 631 : APD/PN by harness @ 800 nm



FED 631 : APD/PN by harness @ 440 nm





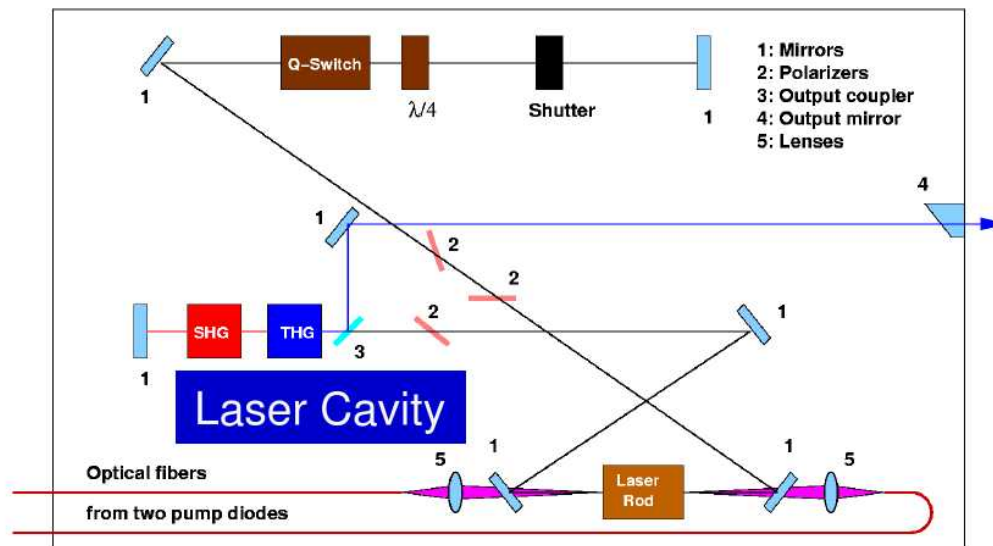
# Lasers

- 2012

- 1 blue Quantronix laser
- 1 new blue laser : Photonics DP2-447 (447 nm – LED pumped)
  - ▶ Expected to be more stable and much less maintenance consuming
  - ▶ To be commissioned at P5
    - Measure basic parameters and stability
    - 2-laser data taking has proven its efficiency in 2011
    - Should be present as soon as possible to take advantage of period w/o transparency loss to check stability
  - ▶ Could request pulse reconstruction algorithm tuning
- 1 new green laser : DTL419 (527 nm - solid state)
  - ▶ Very short pulse (5 ns) for electronics calibration
  - ▶ Second wavelength visible by EB and EE
  - ▶ Redundancy
- 1 red laser

## New Photonics DP2-447 Blue Laser

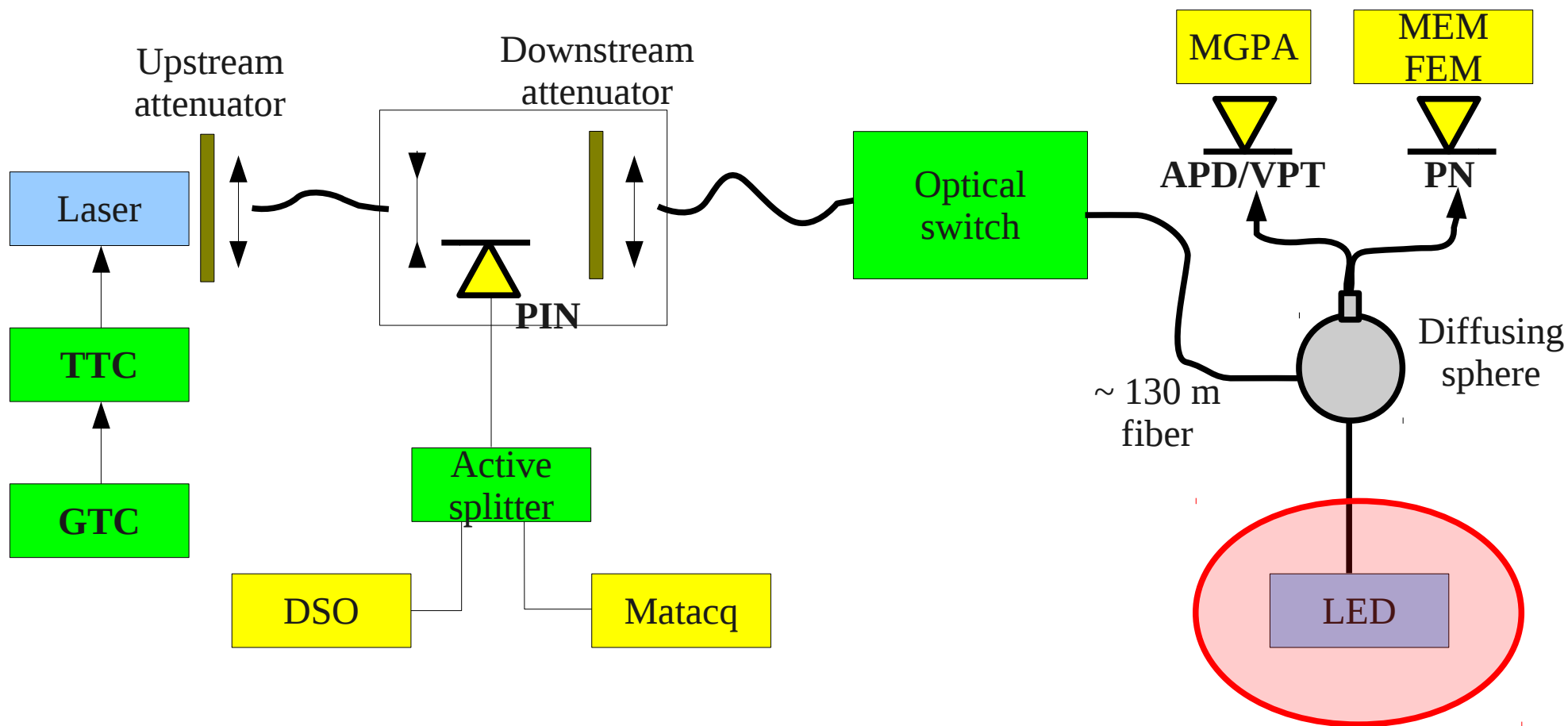
- A Simple Laser:
  - 1 laser system (c.f. 2)
  - Compact laser head: 7.5" x 22" x 3.75"
  - Low power: no external chilled water needed.
- Designed to be rigid and reliable: no user alignment needed.
- Good Width stability: 18.4, 18.4 and 18.6 ns measured with trigger rates at 1, 10 & 100 Hz during M&O training on 1/24/2012.
- Laser is being shipped to Caltech on 2/1/2012.
- The new laser system will be delivered to CERN in March.



# ECAL monitoring system

## Lessons form 2011 – Plans for 2012

- Hardware :





# LED (EE only)

- **2011**

- **2 wavelengths**

- ▶ **455 nm : good amplitude for monitoring measurement**

- **Some instabilities**
- **Dead regions**

- ▶ **617 nm : Edge of VPT QE.**

- **Monitoring measurement impossible on a crystal by crystal basis**
- **Results not understood**

- **No pulse monitoring**

- ▶ **Direct injection on diffusing spheres**

- **2012**

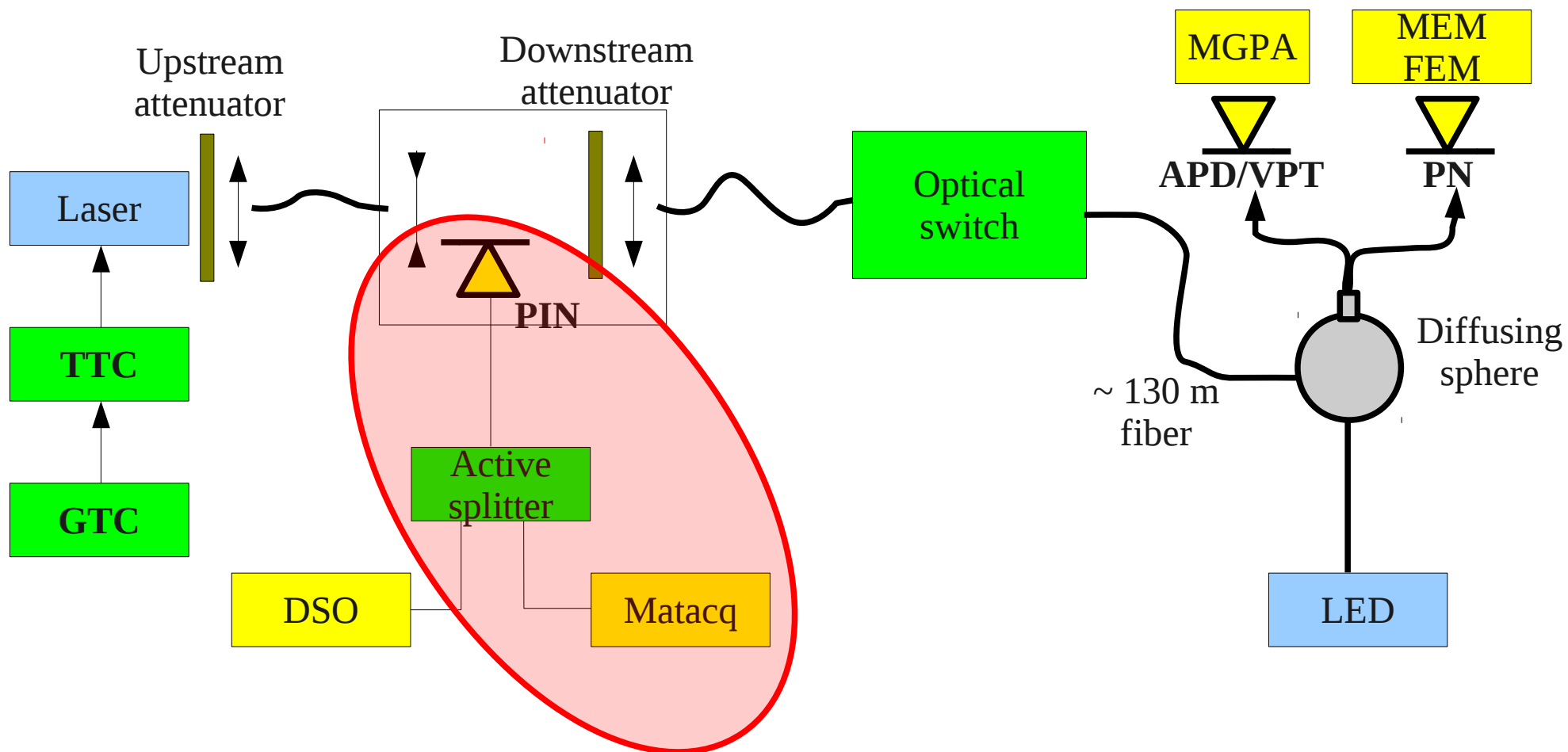
- **Same setup as 2011**



# ECAL monitoring system

## Lessons form 2011 – Plans for 2012

- **Hardware :**





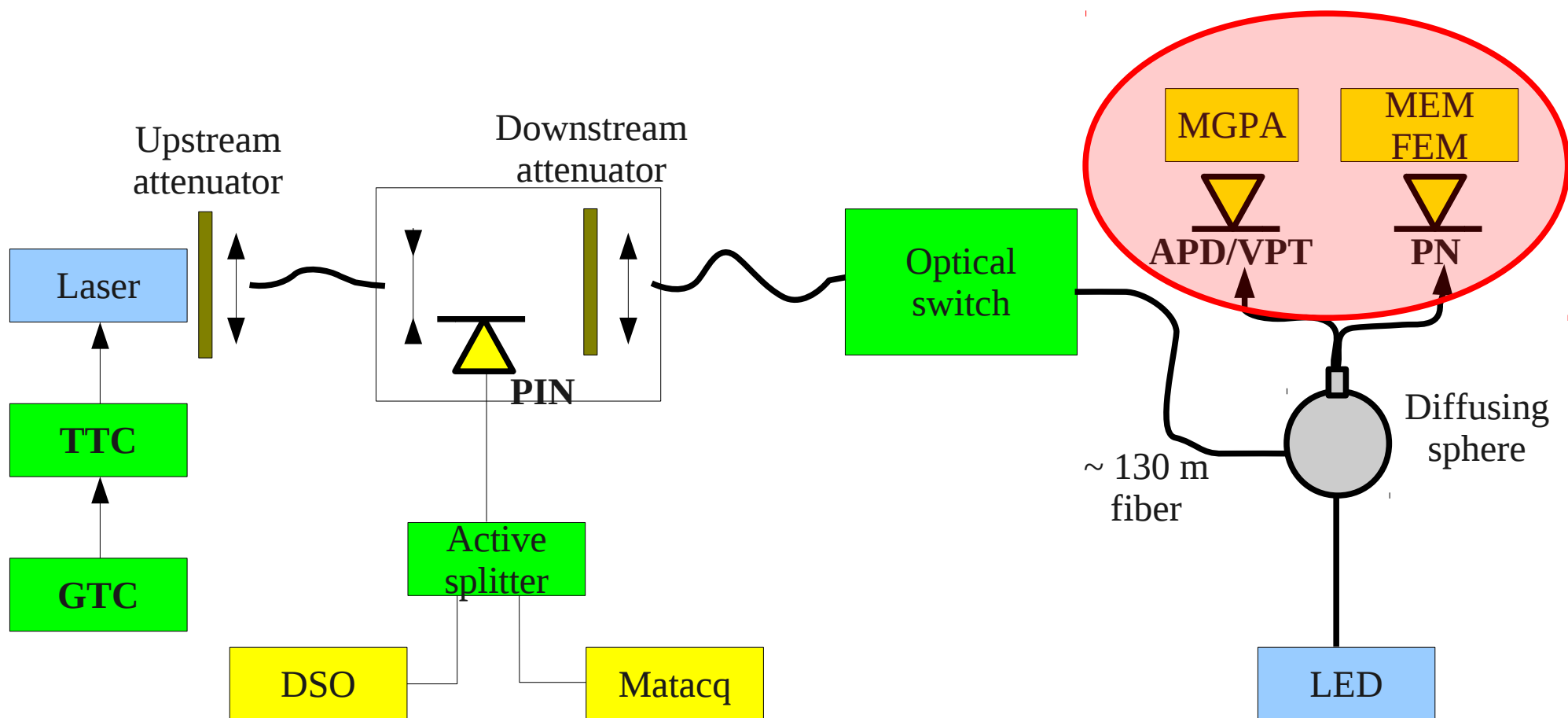
## **PIN diode + matacq**

- **Mandatory to follow laser pulse fluctuations**
- **2011**
  - **S/N ratio not very good**
  - **Discovery of splitter non linearity**
  - **Doubts on “PIN response = laser pulse image” (long tail)**
- **2012**
  - **Remove splitter**
    - ▶ **Install second diode and connect directly on matacq**
  - **Improve S/N ratio**
    - ▶ **Reduce noise level**
    - ▶ **Increase signal level**

# ECAL monitoring system

## Lessons form 2011 – Plans for 2012

- **Hardware :**





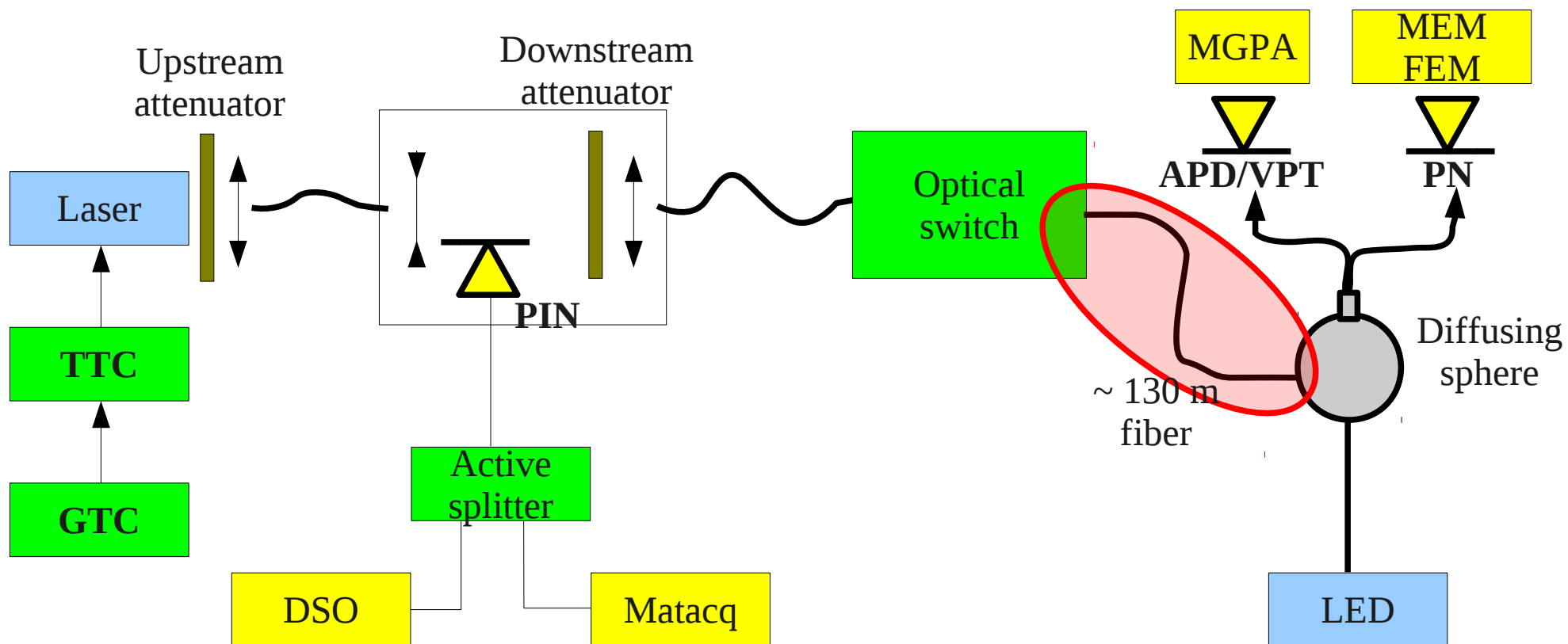
# APD/VPT+PN

- **2011**
  - **No big problems**
  - **Measure residual non-linearities**
- **2012**
  - **Use linearity corrections as default**
  - **Rebuild SPR library with new PIN setup**
    - ▶ **Compare measurements with Blue, Green and Red laser**
    - ▶ **Conclude on PIN performances**
    - ▶ **Conclude on pulse reconstruction algorithm**

# ECAL monitoring system

## Lessons form 2011 – Plans for 2012

- **Hardware :**

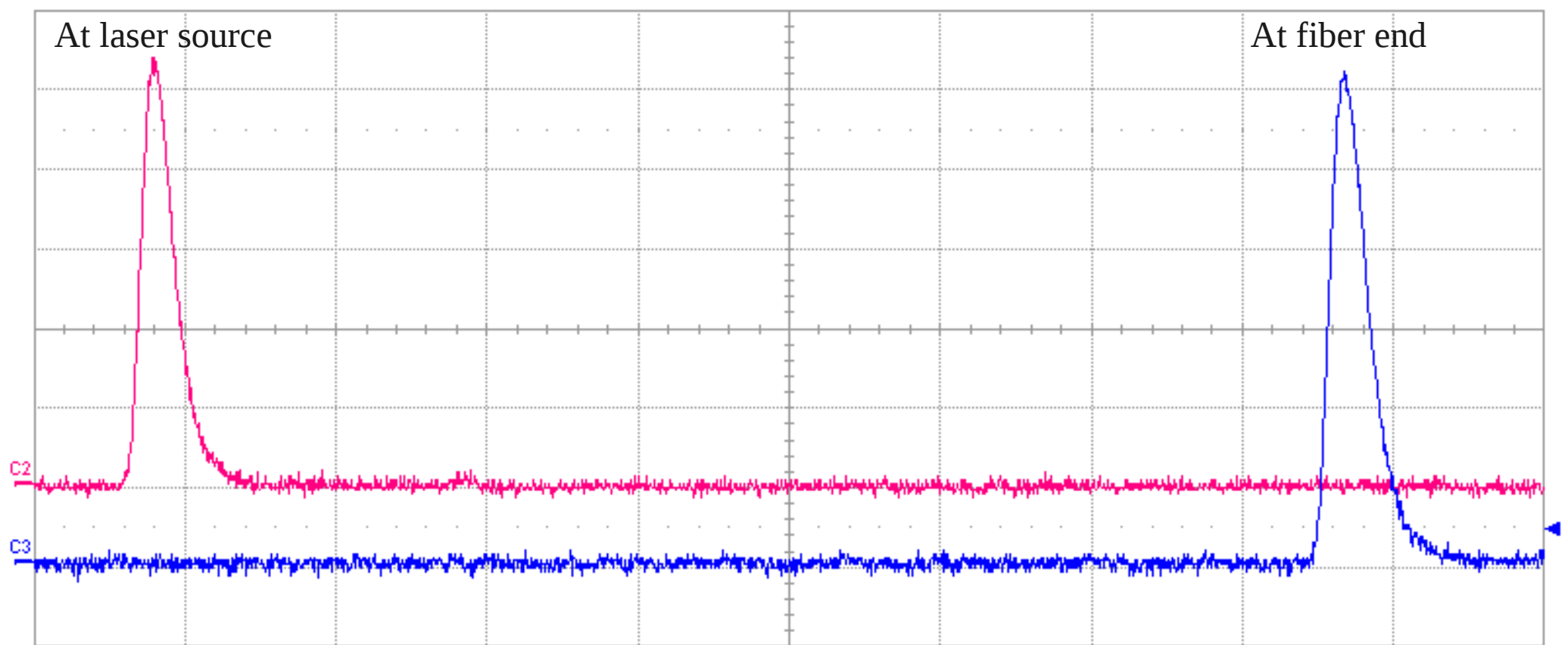




# Fibers

- **2011**
  - **Suspicious on fiber modal dispersion**
  - **Very weird effect :**
    - ▶ **Depends on WL, fiber length, light source, etc**
- **2012**
  - **To be measured with all sources**
    - ▶ **With spare bundle (110 m)**
  - **Example : Green laser**
    - ▶ **Compare pulses at source and at fiber end (30 m)**
    - ▶ **Still need to validate the measurement method**

- 30 meters of fiber :

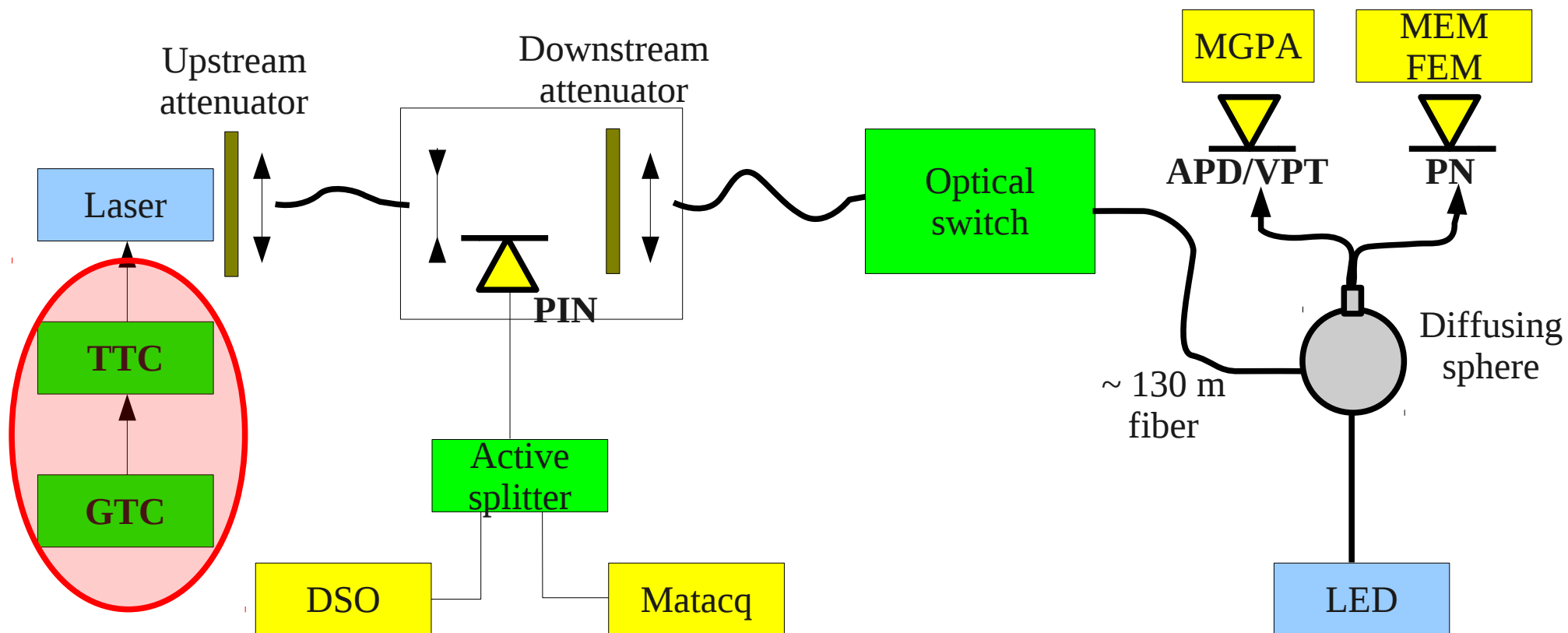


Measure	P1:dt@lv(C2,C3)	P2:width(C3)	P3:rise(C3)	P4:fall(C3)	P5:ampl(C3)	P6:width(C2)
value	157.243 ns	5.707 ns	2.613 ns	7.662 ns	320.4 mV	4.850 ns
mean	157.22589 ns	5.65302 ns	2.70710 ns	7.24073 ns	307.766 mV	4.72561 ns
min	157.016 ns	5.377 ns	2.158 ns	5.674 ns	259.8 mV	4.419 ns
max	157.498 ns	6.224 ns	3.107 ns	8.640 ns	335.9 mV	5.208 ns
sdev	68.91 ps	102.55 ps	127.93 ps	462.71 ps	9.314 mV	97.18 ps
num	1.006e+3	1.006e+3	1.006e+3	1.006e+3	1.006e+3	1.006e+3
status	✓	⌘	⌘	⌘	⌘	⌘

# ECAL monitoring system

## Lessons form 2011 – Plans for 2012

- **Hardware :**







# Sequence driving

- **2011**
  - **Lasers triggered with WTE**
    - ▶ **Generated by GTC**
    - ▶ **Translated by TTC-ci**
    - ▶ **WTE in same orbit as laser pulse**
- **2012**
  - **Photonics laser requests  $> 90 \mu\text{s}$  for pumping**
    - ▶ **WTE should be in previous orbit**
    - ▶ **Need GTC firmware modifications**
    - ▶ **Firmware ready to be tested**
    - ▶ **Backup solution with new EMTC firmware with 10 ms shift on WTE**



# Sequence definition

- **2011**
  - **Blue EB + Blue EE + Red EB + B-LED EE + O-LED EE**
    - ▶ ~ 45 minutes
  - **September onwards :**
    - ▶ **Blue1 + Blue2 + B-LED + O-LED**
- **2012**
  - **4 laser sources : Quantronics, Photonics, Green, Red**
  - **Need to stick with sequence < 45 minutes to follow fast transparency loss component**
    - ▶ **Max = 3 colors in steady state**
    - ▶ **2-blue sequence mandatory for :**
      - **New laser commissioning : ~ 1 month**
      - **Before laser swap : ½ day**



# Conclusions

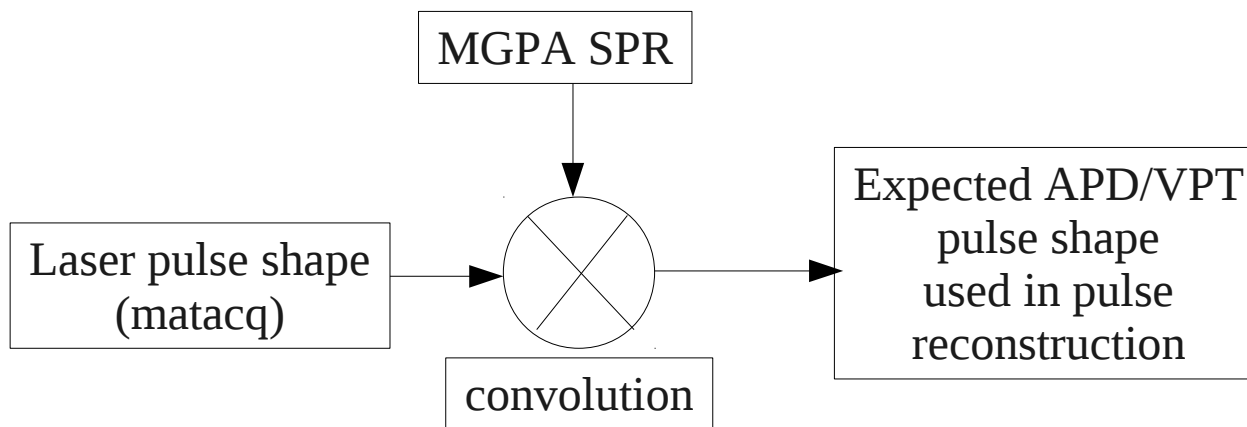
- **Laser monitoring system works 24/7 in 2011**
  - **Able to get useful data even in worse conditions (June)**
    - ▶ **Requested lot of work to accommodate variable performances**
  - **From “sub-optimal” to “almost-optimal” at end of 2011**
- **Our goal : “optimal” performances in 2012**
  - **New blue laser**
  - **New PIN line + calibration**
  - **New SPR library**
  - **Fiber dispersion measurement**
    - ▶ **Possible show-stopper for ultimate performances**
    - ▶ **Work-around with stable light sources**



# Backup

- **Pulse reconstruction with shapes template**

(See also CMS DN-2008/001)



- **Use SPR library and MATAcq information on sequence by sequence basis**

