



Calibration system with optical fibers

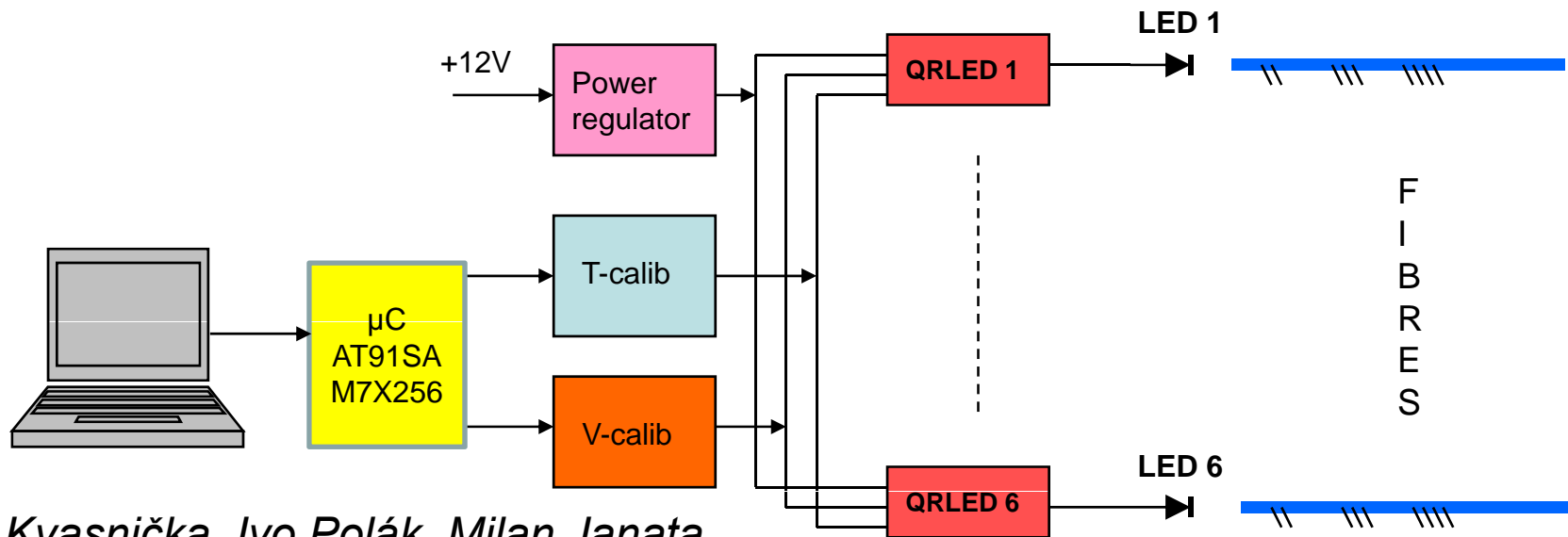
HCAL main meeting, DESY

Objective

- 6CH LED prototype
- Electronic part includes microcontroller on ARM architecture, easily integrated with HEB calib module.
- Optical distribution system with notched fiber seems to be functional

Multichannel LED driver

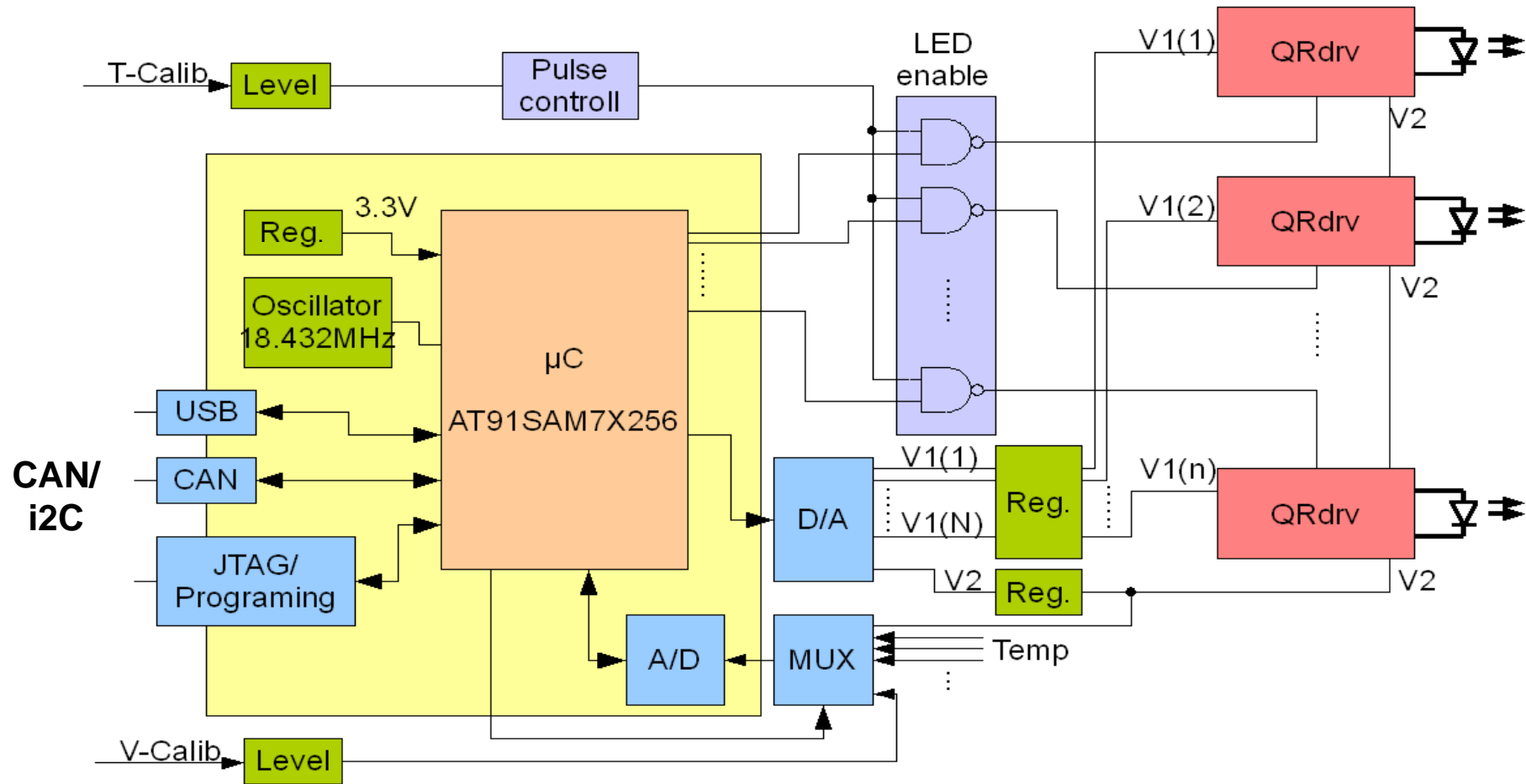
- 1 PCB with the communication module μ C, power regulator, 4-6 channels of QRLED driver
- The communication module communicate with the PC via USB and CAN bus or I2C
- The communication module controls the amplitude, LED Enables, and monitore temperature, voltages
- LED pulse width is ~ 5 ns is fixed, the tunable amplitude in range up to 50-100 MIPs is controlled by the V-calib signal



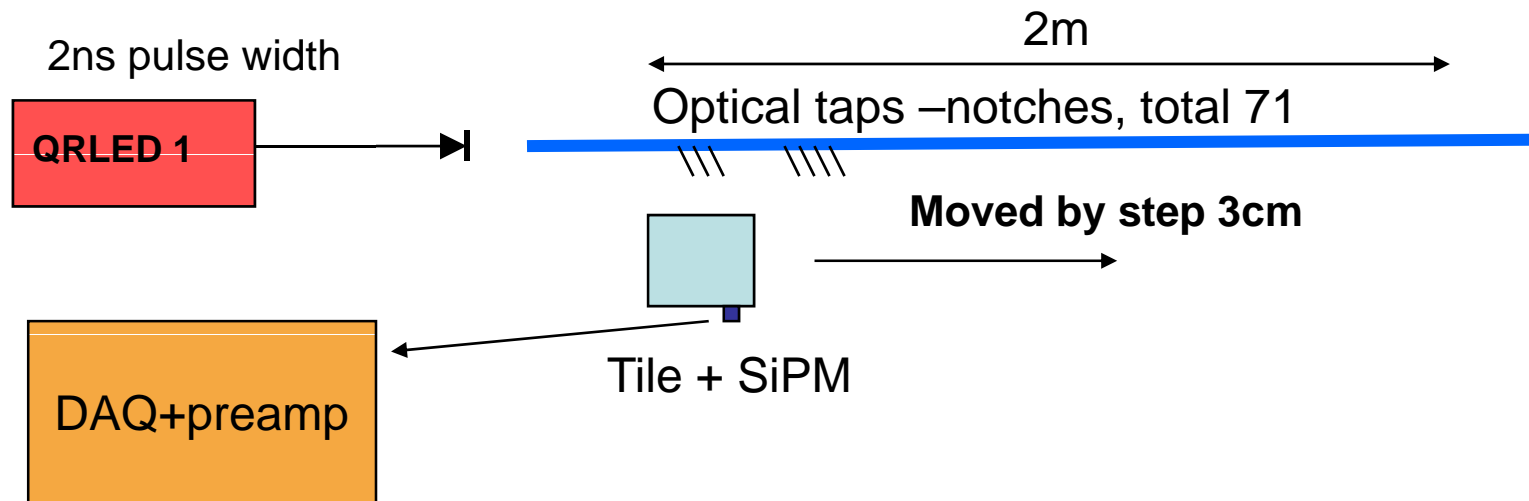
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main HCAL, JUL1,2008

Ivo Polak, IP_ASCR, Prague

A block diagram of the calibrator



Test setup for **notched** and **side-emitting** fibers



The fiber lay over the tile.

Simplified optical system for calibration

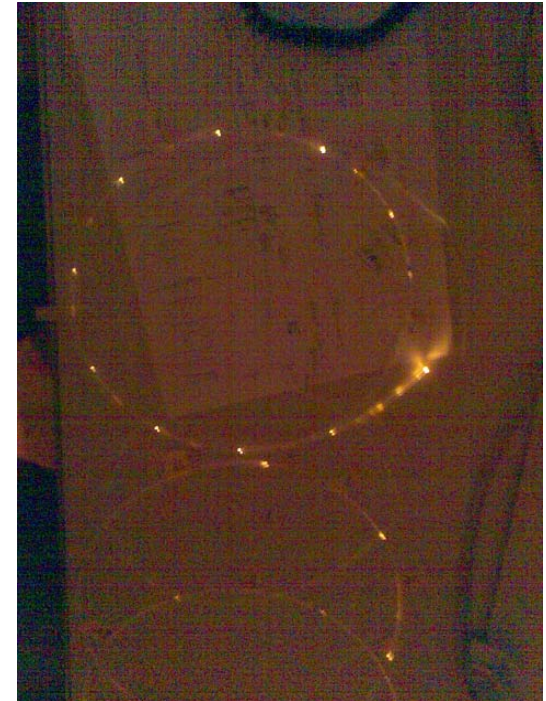
Idea: use one fibre for one row of tiles

Problems:

- uniformity of distributed light
- enough intensity of distributed light
- concentration of LED light into one fibre

Two fibres:

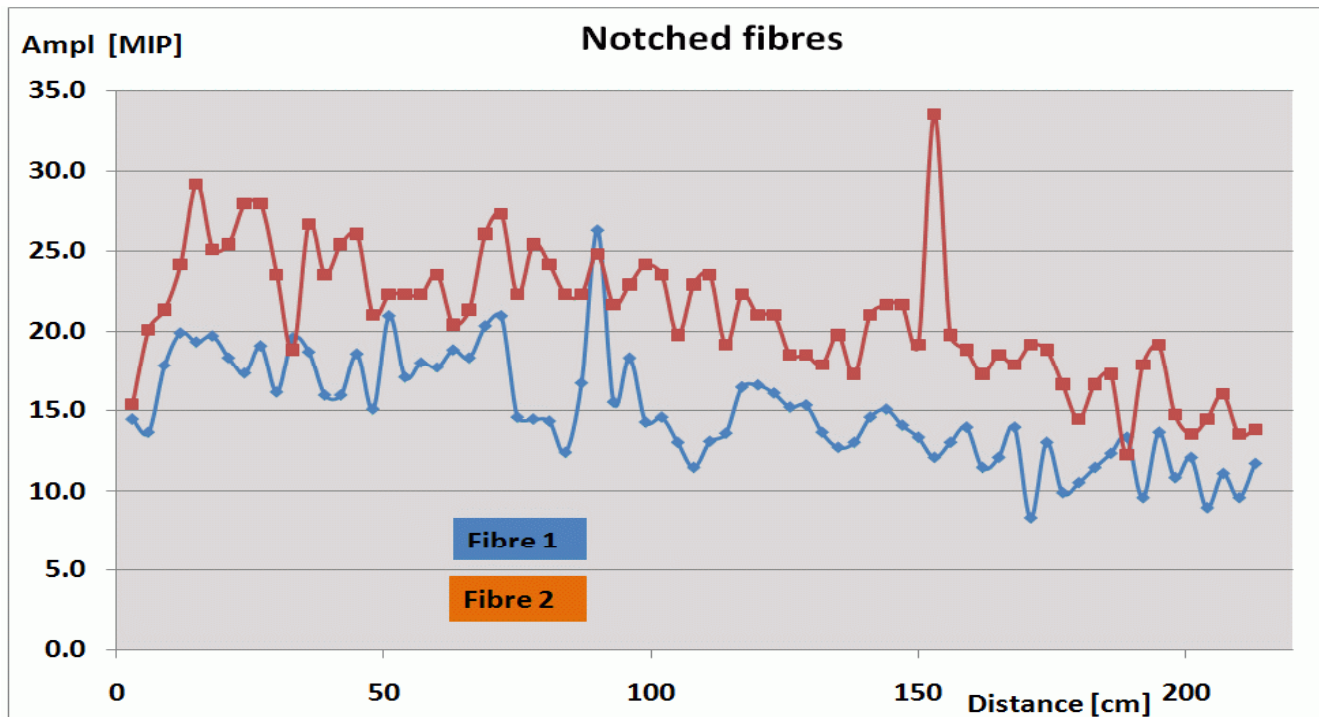
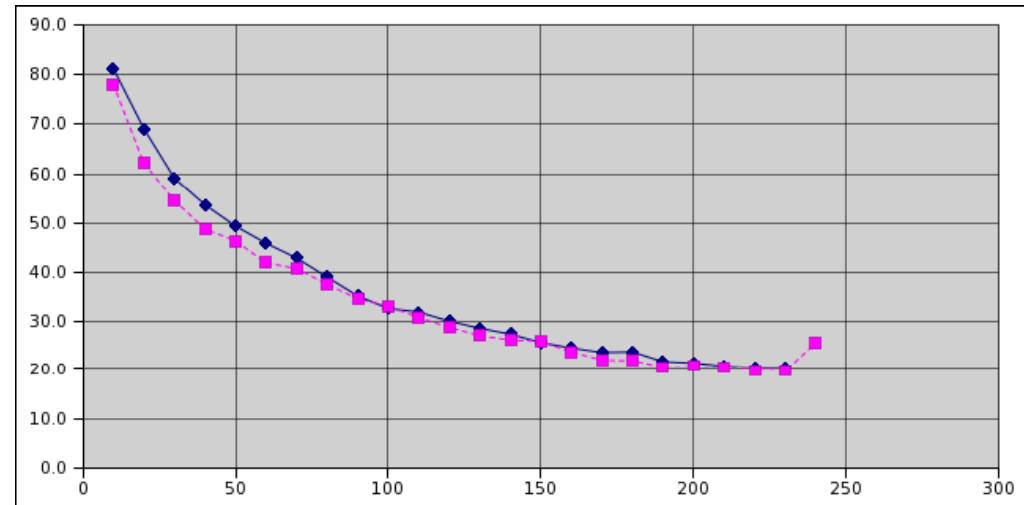
- **Side-emitting** (FiberTech SLS600 series)
 - exponential fall of intensity
 - possibilities to buy at market
- **Notched fibre** (manually produced by Safibra comp.)
 - better uniformity of distributed light
 - need to mechanize production - R&D



Light distribution, measured by moving scintillator with SiPM along the fiber

UV-LED 400nm, 2.5ns pulsewidth

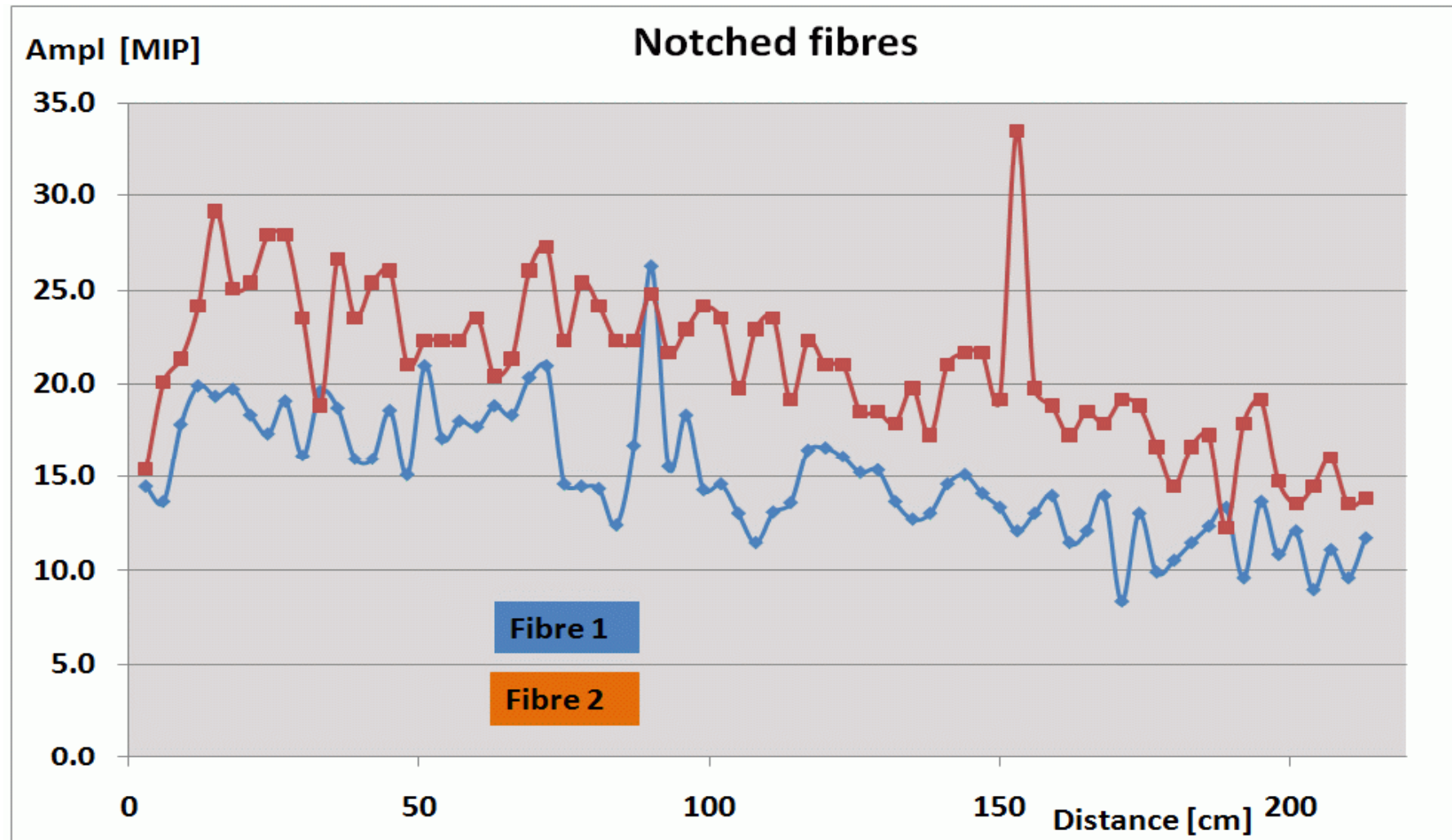
Side-emitting fibre,
light declines 4-times along 2m



Notched fibre,
a light on taps
declines by **1.5** along 2m

Notched fiber

Hand-cut prototypes tested with QRLED driver at maximum amplitude
Fibers have 71 notches at 3cm pitch - length 2.5m, diameter 1mm



Notched fiber

- spread of the light at taps can be improved by process of automation – needs to be developed
- decreasing of systematic fall of the light intensity along fiber will be discussed with the manufacturer
- the light output seems to be at maximum level, the input light must be increased (pulse-width 2 → 5ns) to reach 100MIPs

Conclusion on optical part

- We suggest to use notched fibre
- Mechanisation needs to be developed
- Decrease of attenuation tap factor should be discussed
- Will the fibre be positioned in tails or in absorber?

Conclusion

- Communication module is ready, the final design of PCB for the digital part starts in July
- Optimization of the QRLED driver (tests of the linearity, adjustment for another LED type) – July
- Design of PCB for the complete calibration 6CH prototype will be done in August
- PCB production – September, tests – October
- In parallel – an innovation of the optical system
- System integration to “detector prototype” starts and will continue
- Time schedule is tough but no principal problems encountered