A fast LED driver prototype for HCAL calibration

EUDET annual meeting at Ecole Polytechnique, Palaisau

Proposal for calibration system

- New LED driver with reduced crosstalk
- A tunable calibration light in the range 0 to 100MIP
- Simplification of the optical system: one LED -> one side emitting fibre, one row of scintillator tiles
- PIN photo diode, do we need them?

LED driver strategy for SiPM calibration

- At AHCAL prototype (uses SiPM), we used CMB, calibration system with UV-LED 400nm driven by very fast rectangular pulses (1ns rise/fall time).

- Steep Rectangular waveform satisfied the needs to vary pulse-width, BUT creates lots of harmonics → electromagnetic **crosstalk**!

- We have found **fixed** pulse-width to about 6ns, we can go to use narrow band ->smooth waveform ≈ **less RF interference = Quasi Resonant LED driver (single pulse)**

Quasi-Resonant LED driver
LC circuit, heavily dumped
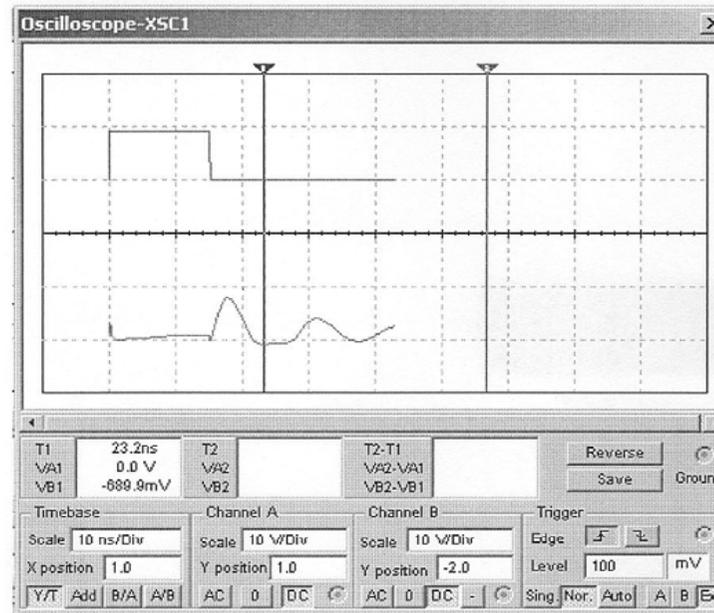
- **Simulation**

- **~ 5ns puls width (slightly depends on the amplitude)**

- 33nH PCB inductance, no ferromagnetic core

- **Prototyping**

- **Used my lovely single side copper foil PCB**

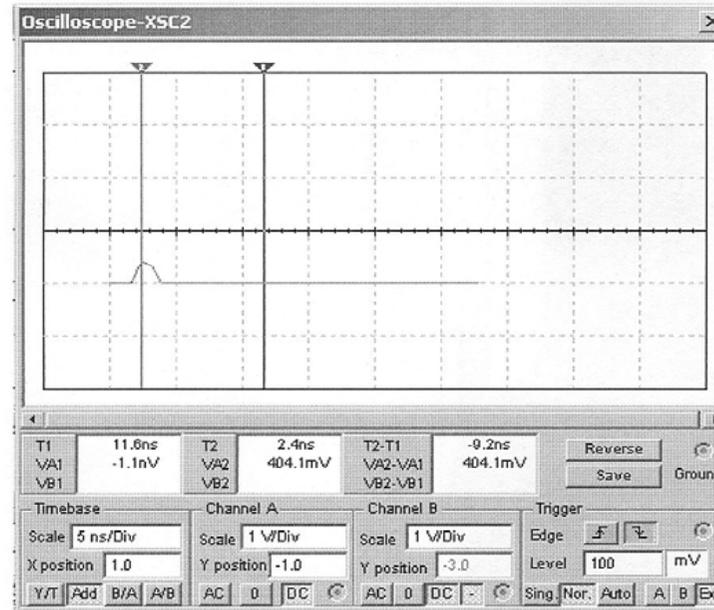- **We need more work on components optimization**

QR LED driver **Simulation**

Simulation at 1.5V amplitude

$V_1 = 1,5V$

- ## XSC1:

  - Upper trace - sync pulse
  - Lower trace – voltage at LED hot end

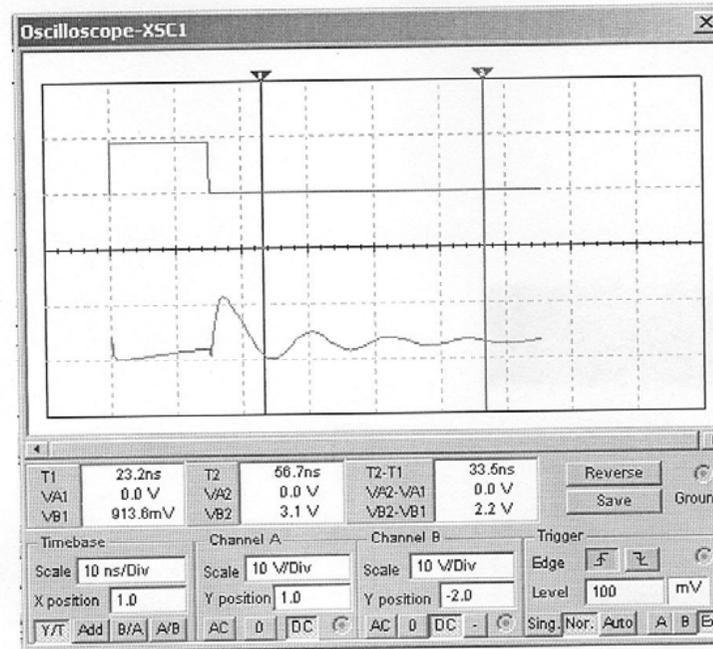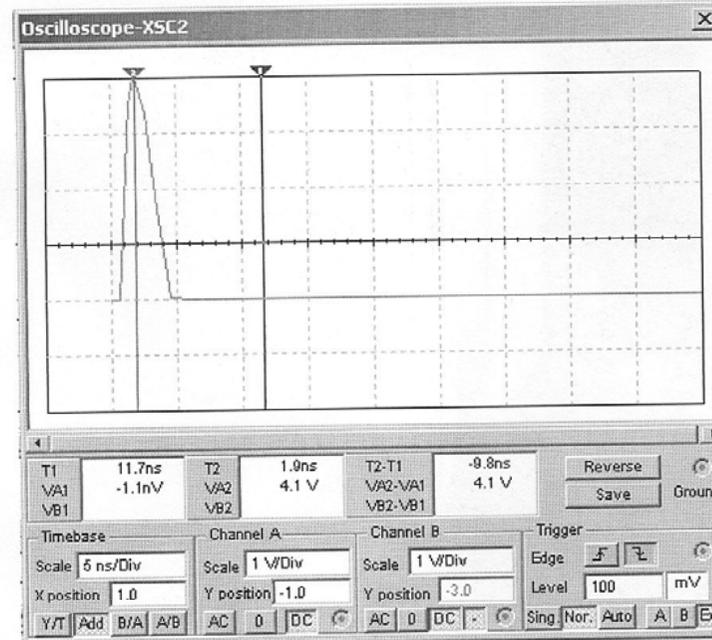- ## XSC2: Lower trace LED current

Simulation at 3V

- ## XSC1:

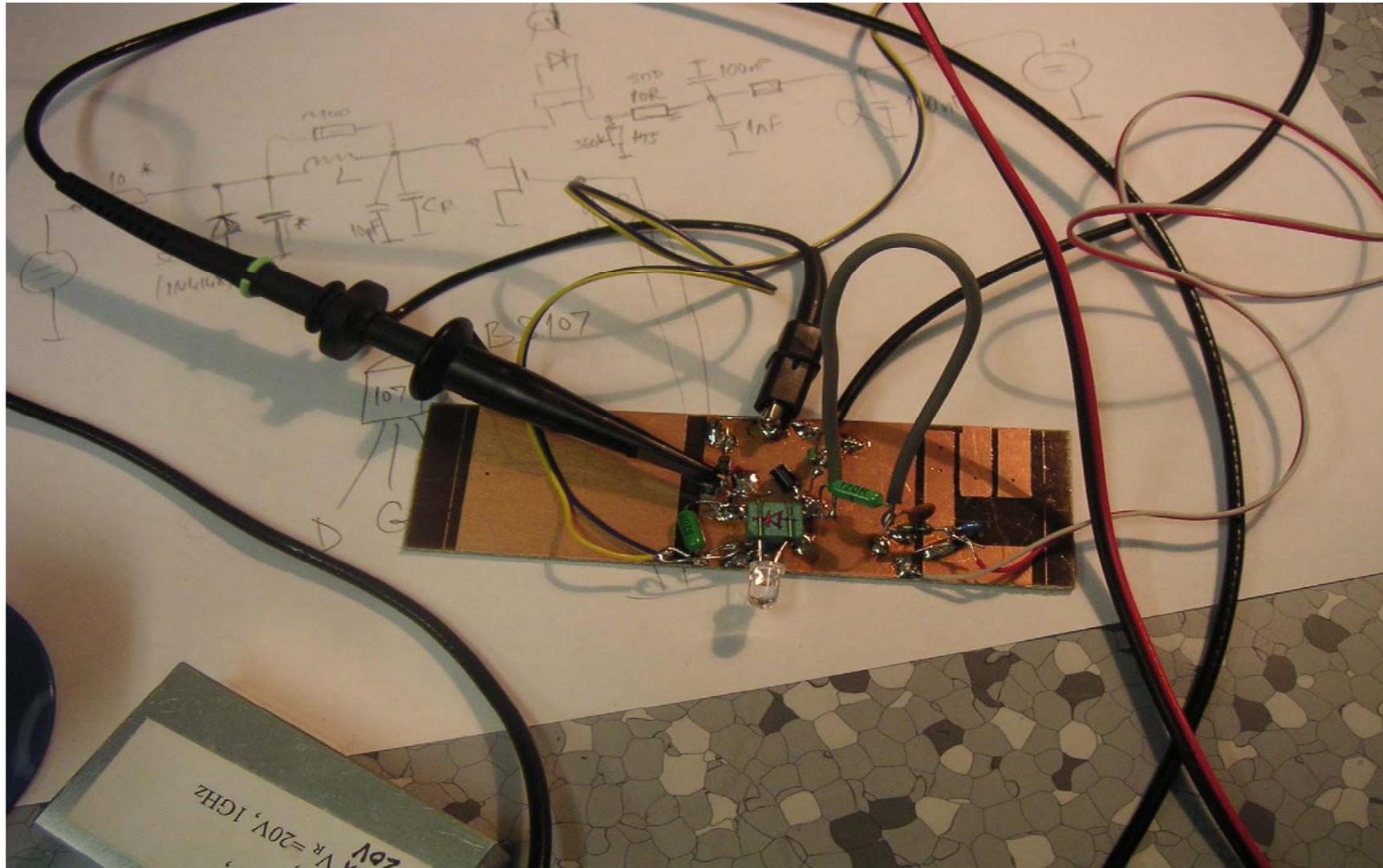- Upper trace - sync pulse
- Lower trace – voltage at LED hot end

$V_1 = 3V$

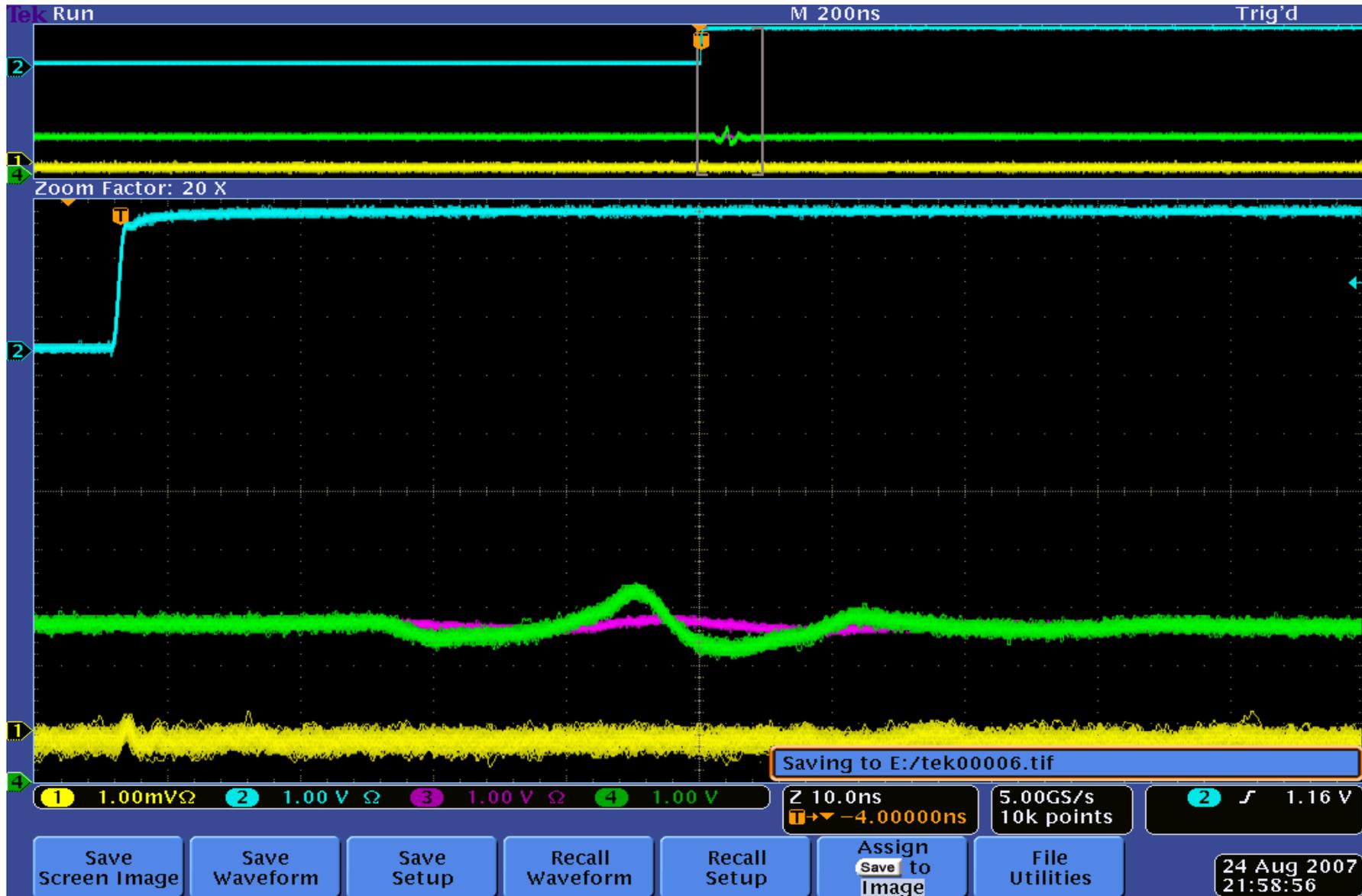- ## XSC2: Lower trace LED current
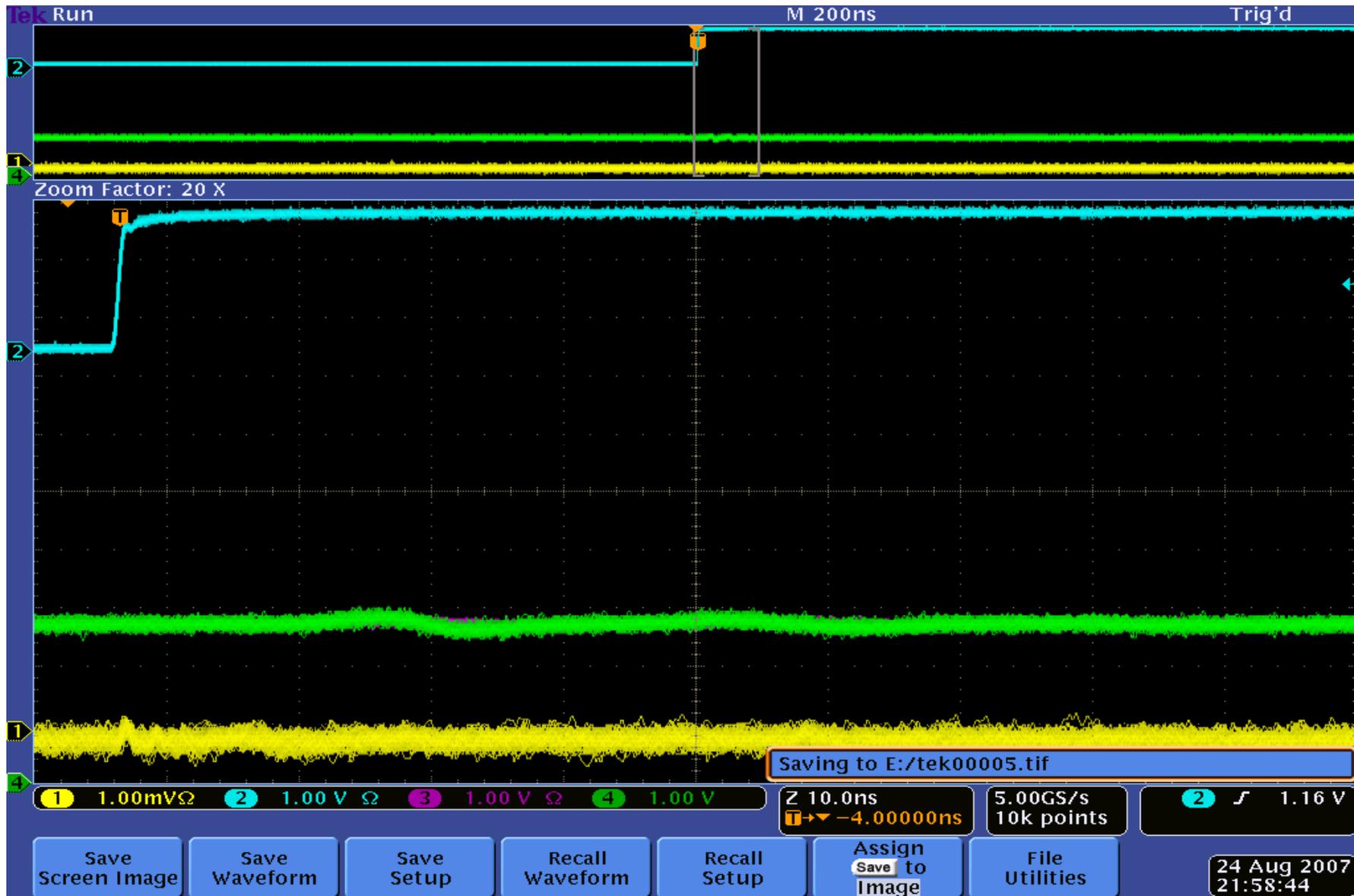
Prototype of QR LED driver

LED current waveform (GRN) a=3

LED current waveform (GRN) a=2
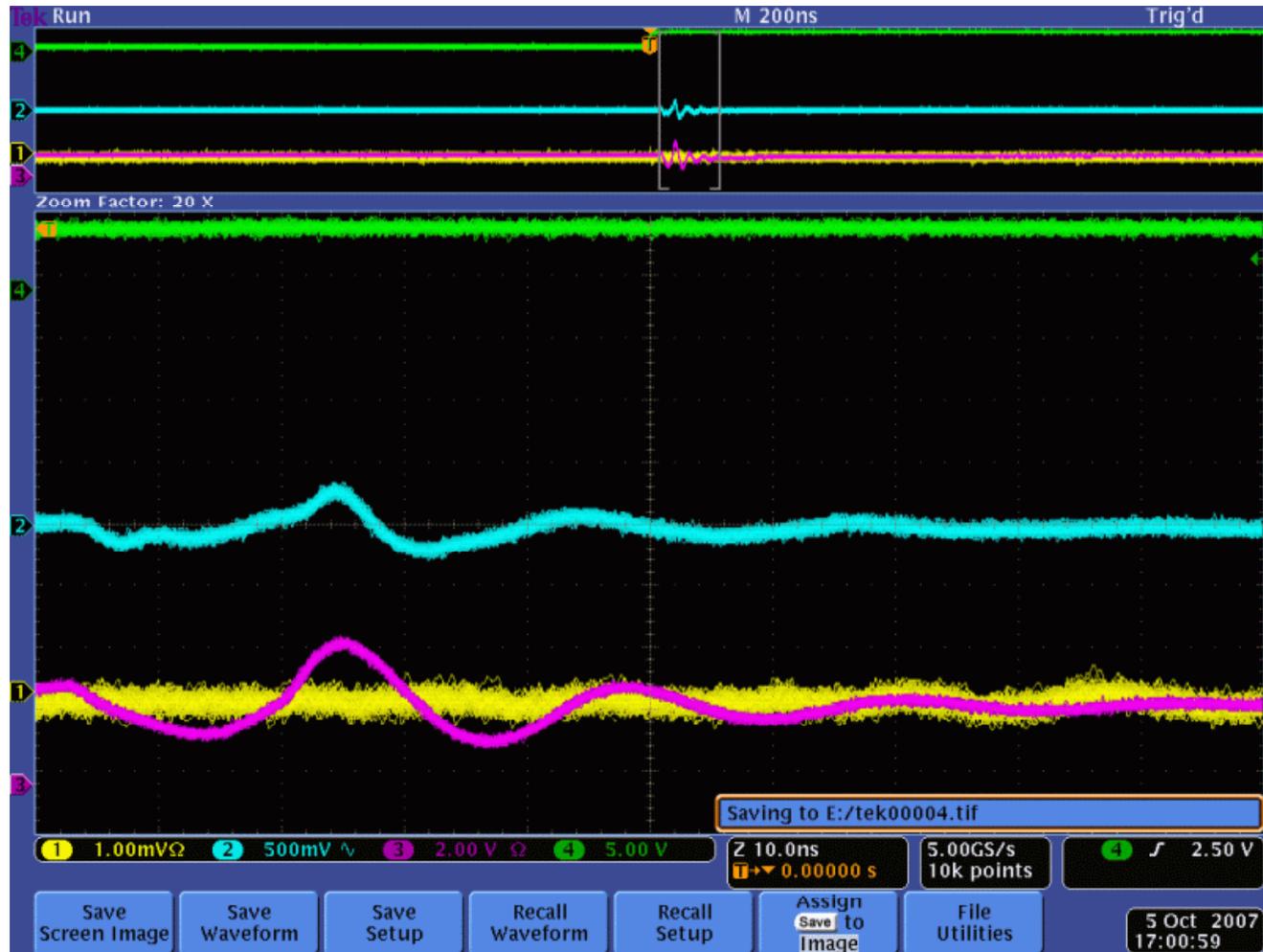
LED current waveform (GRN) a=1
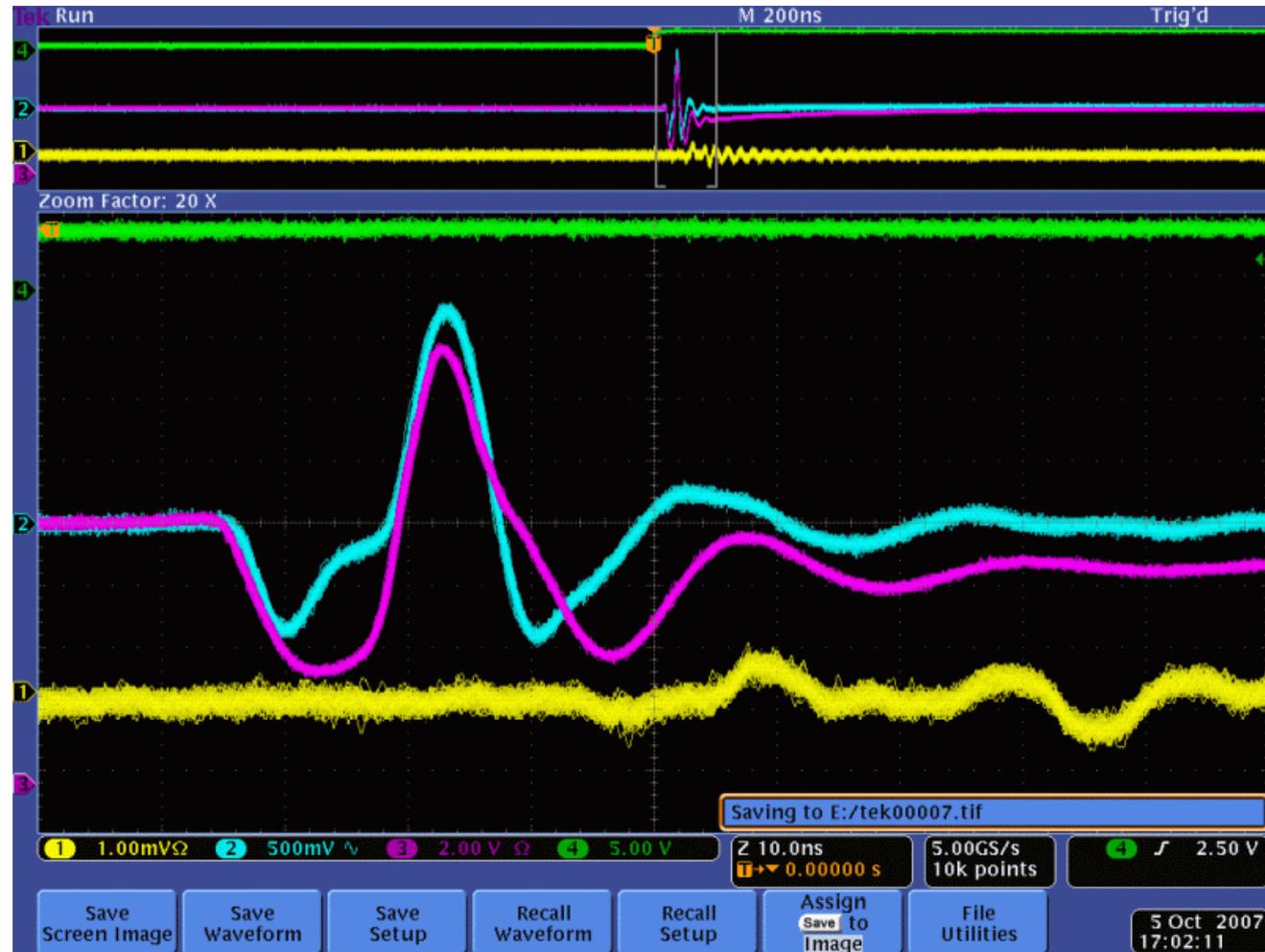
Last tests, more power on LED

- We see response of PIN photodiode at oscilloscope
- Amplitude up to 2mVpeak @ 50 Ω

Response to low amplitude

- **LED current (cyan)**

  (voltage @ 10Ohm)

- **PIN response (yellow)**
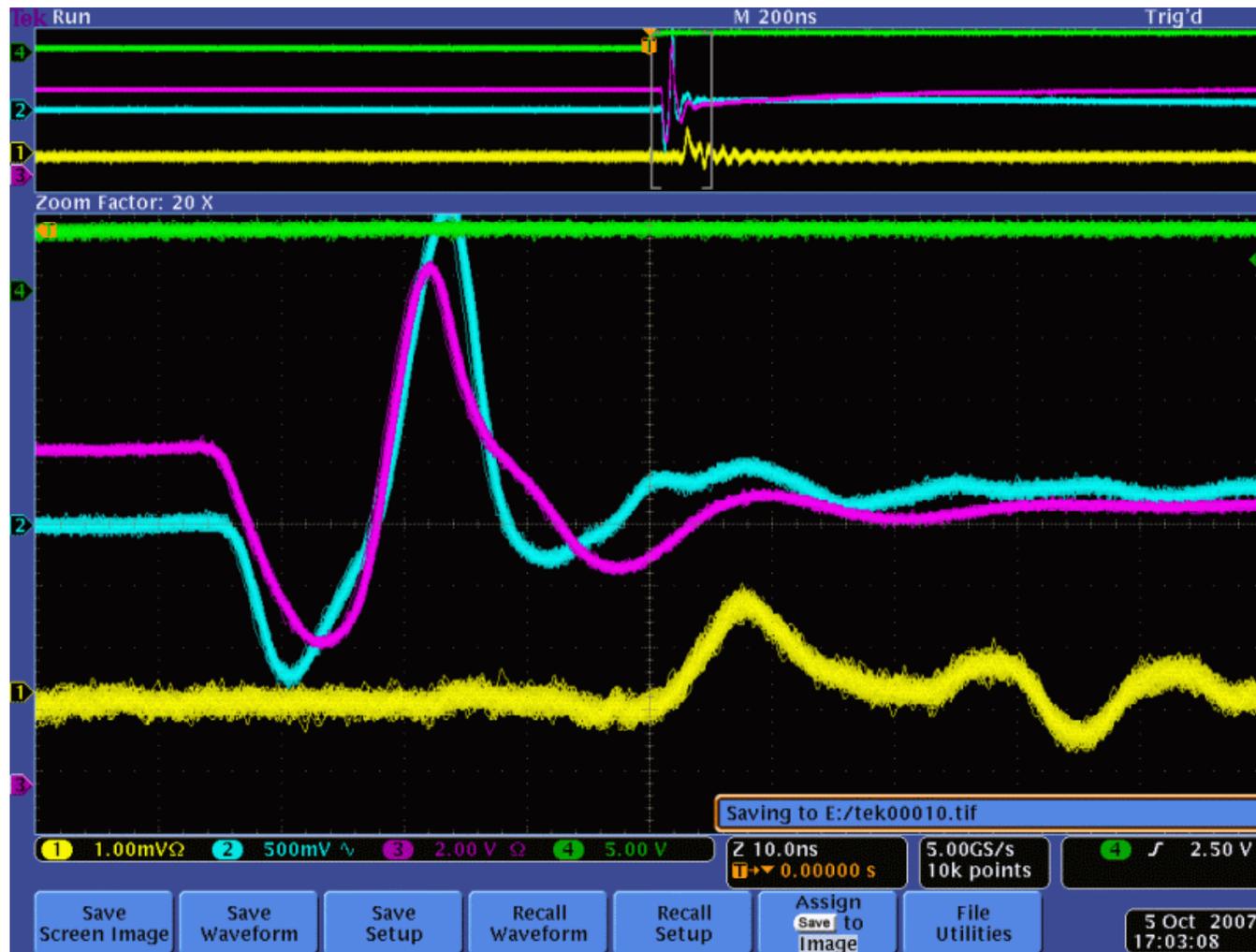
- **LED anode (violet)**
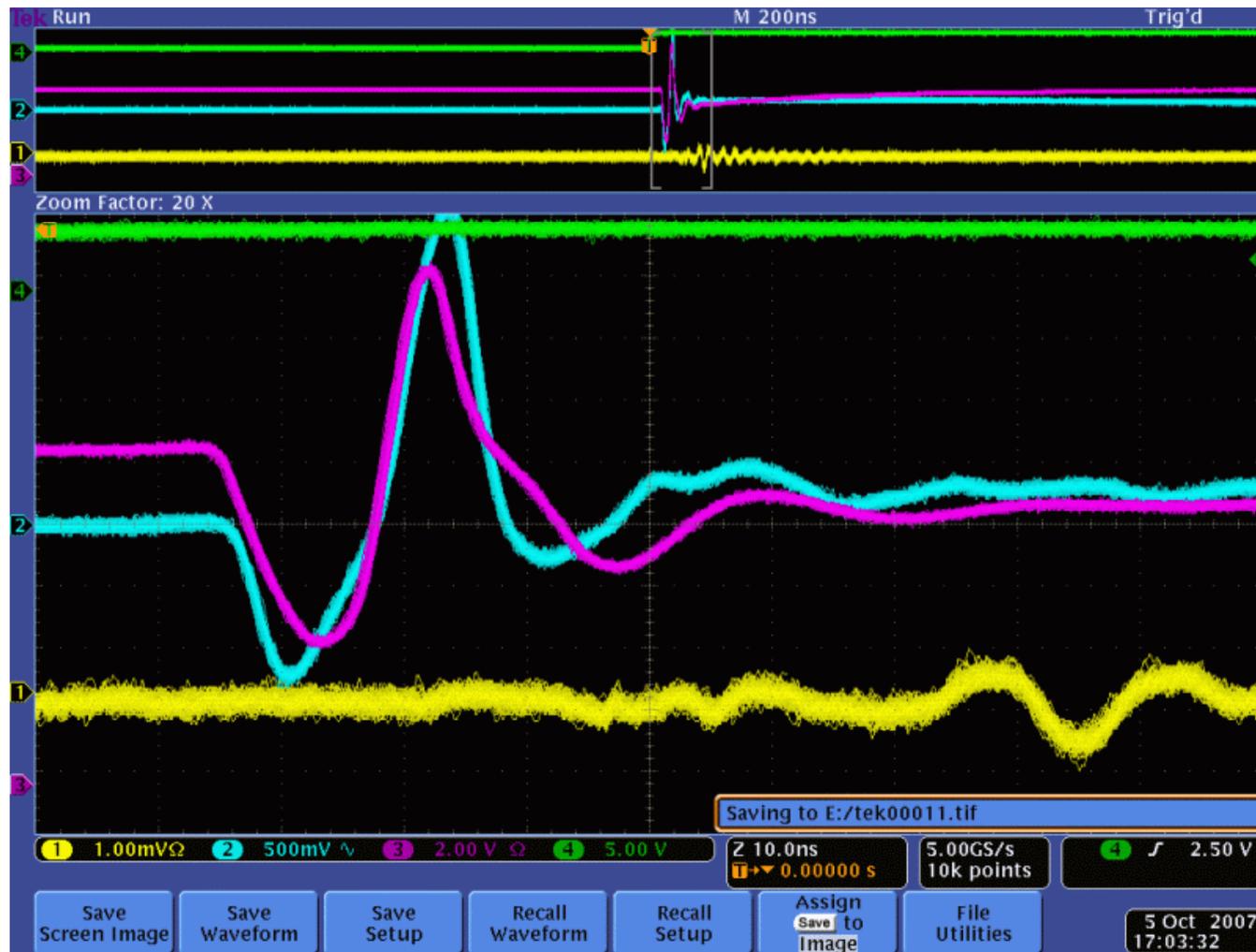
Response to middle amplitude

Response to high amplitude

- **200mA** current at LED

Response to high amplitude

- The Light from LED was optically blocked to PIN.

Conclusion

- QR LED driver is very promising technique to reduce Electro-Magnetic-Interferences
- PCB of the two-channel QR LED driver is being designed now
- End of October - PCB will be assembled – ready for tests
- November – summary report to EUDET
- November – measurements of light transfer in side-emitting fibres