A fast LED driver prototype for HCAL calibration

CALICE meeting Prague

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 a lots of harmonics and then it converts to 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

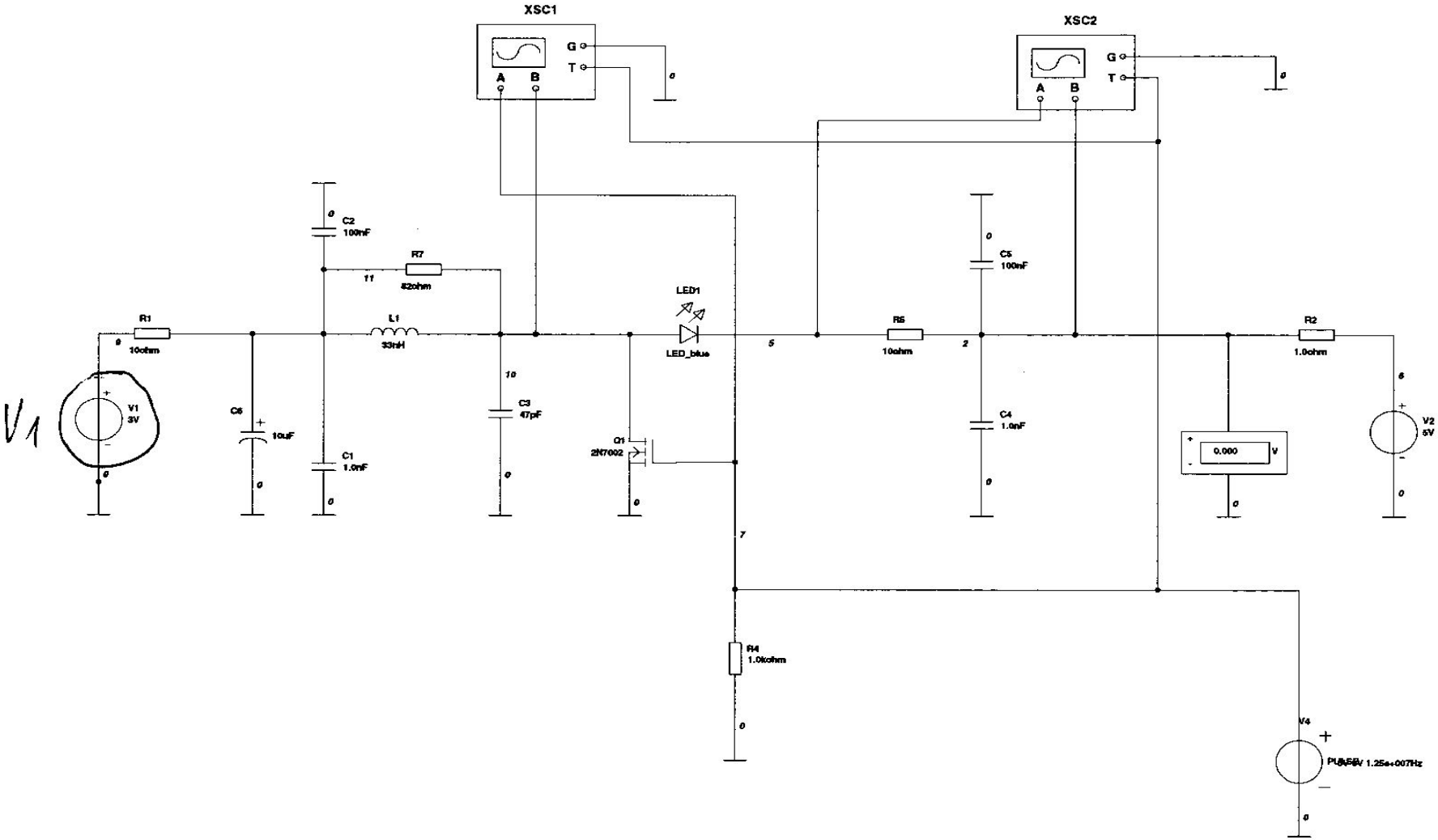
LC circuit, heavily dumped

- **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 needs more work to components**

  optimisation

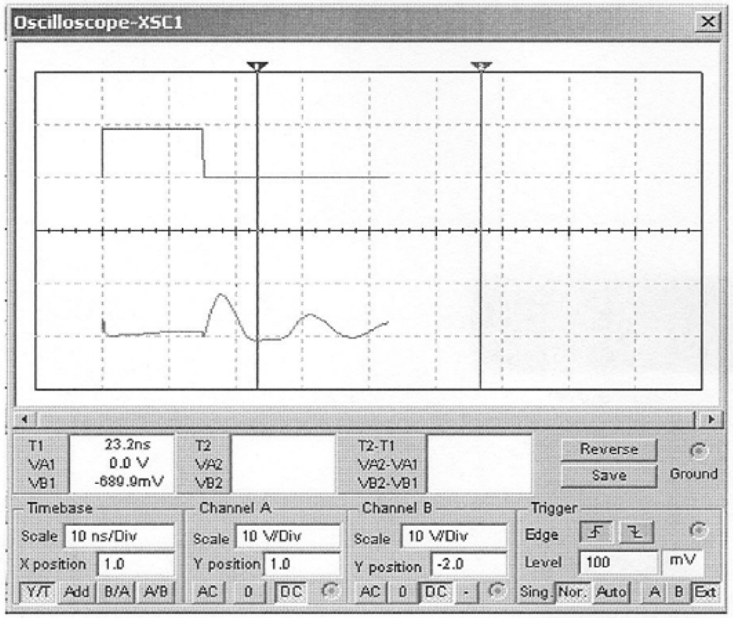
QR LED driver **Simulation**

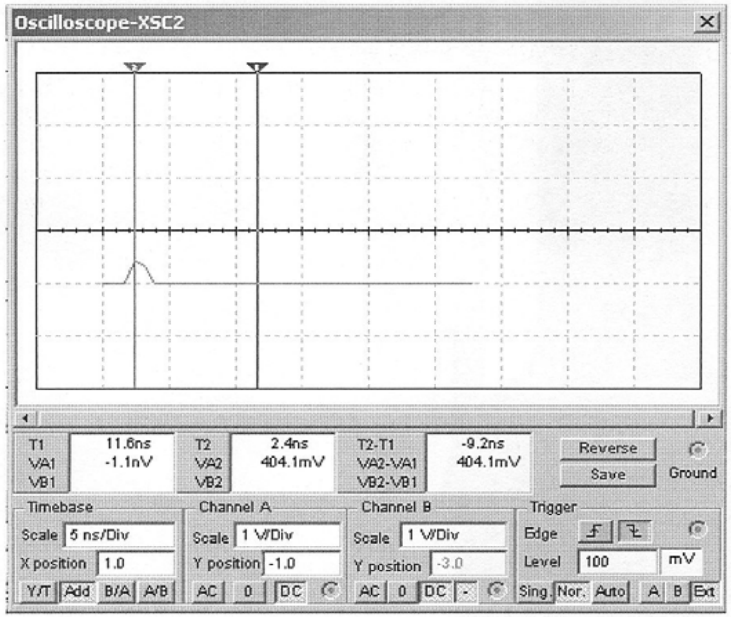


Simulation at 1.5V amplitude

- XSC1:
- Upper trace - sync pulse
- Lower trace – voltage at LED hot end

- XSC2: Lower trace LED current



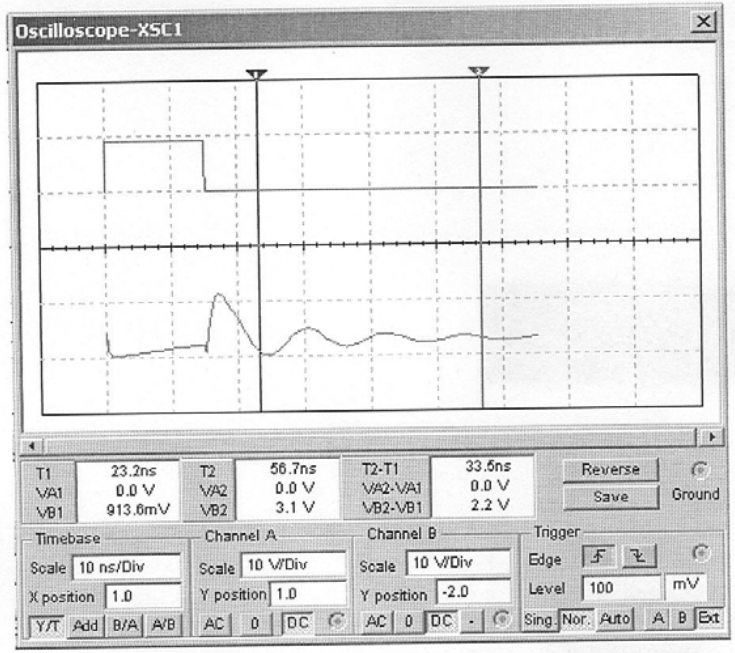


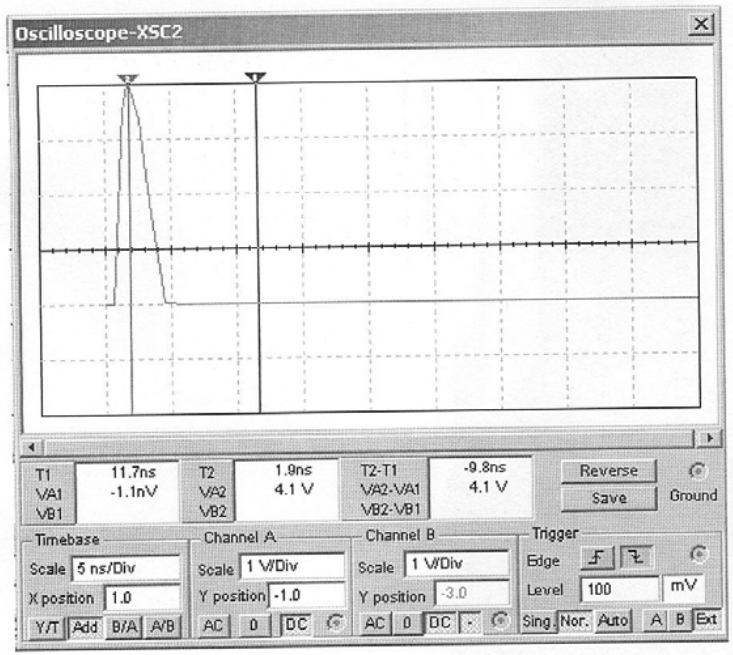
$V_1 = 1{,}5\,V$

Simulation at 3V

- XSC1:
- Upper trace - sync pulse
- Lower trace – voltage at LED hot end

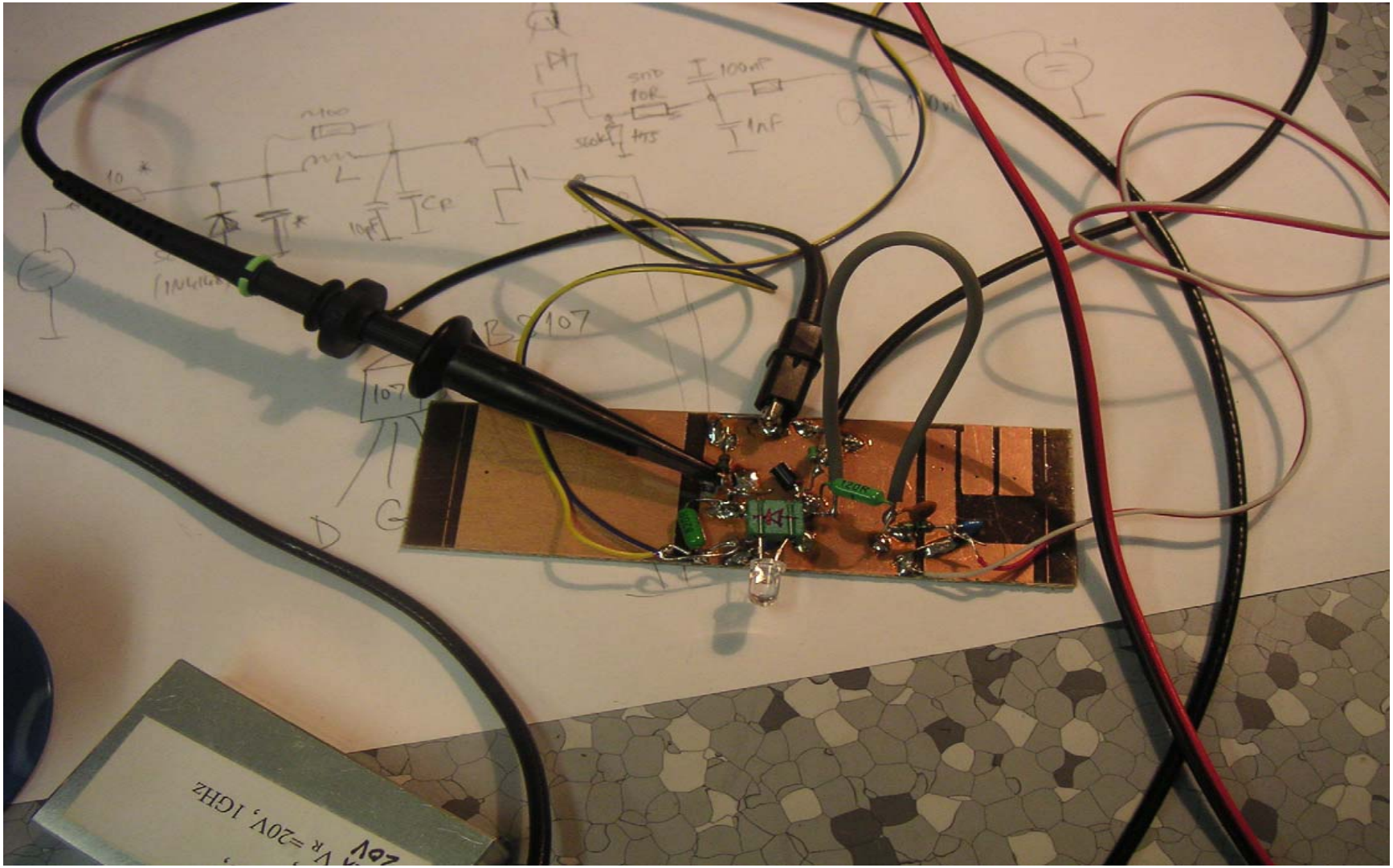
- XSC2: Lower trace LED current



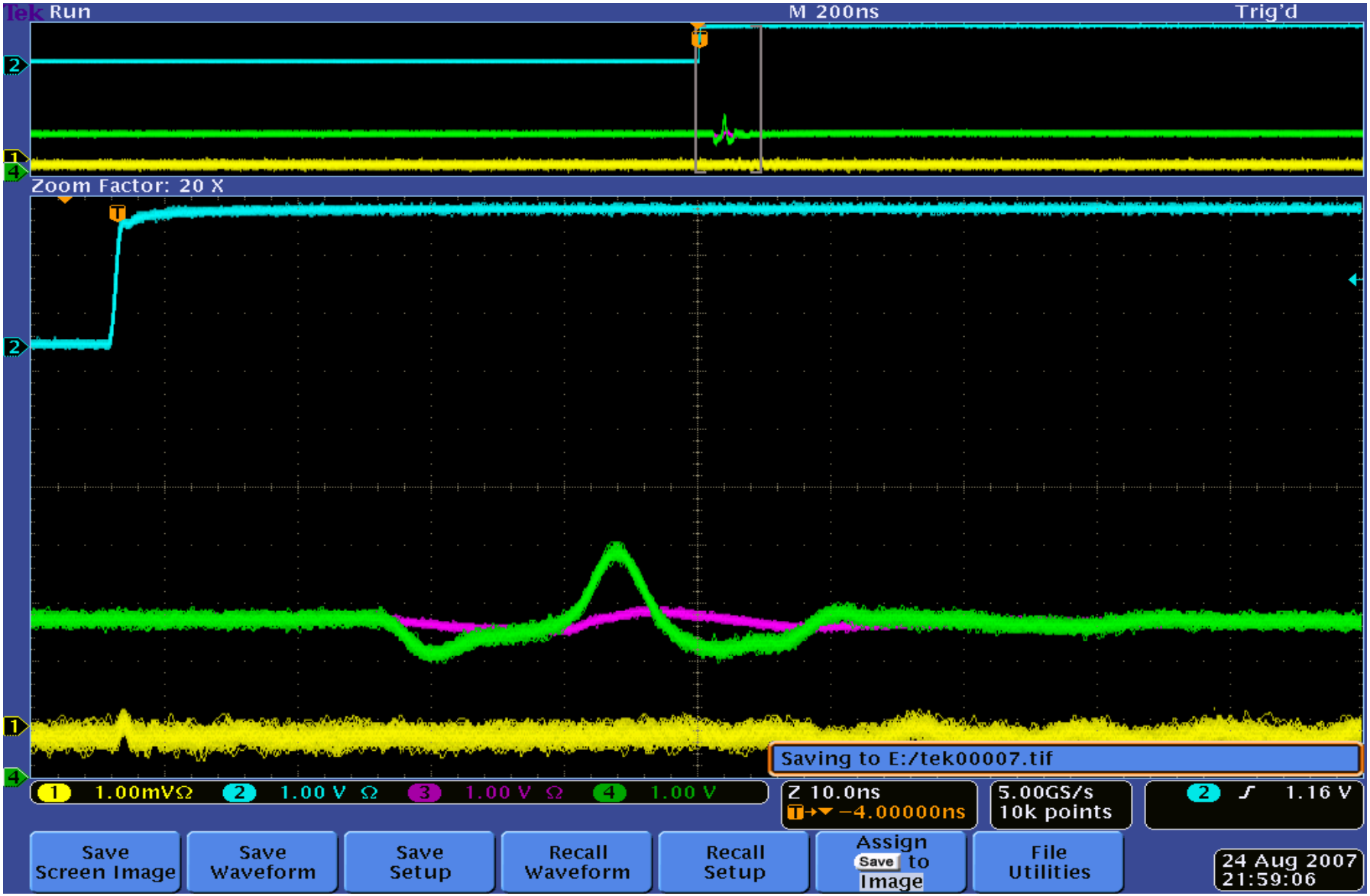


$V_1 = 3V$

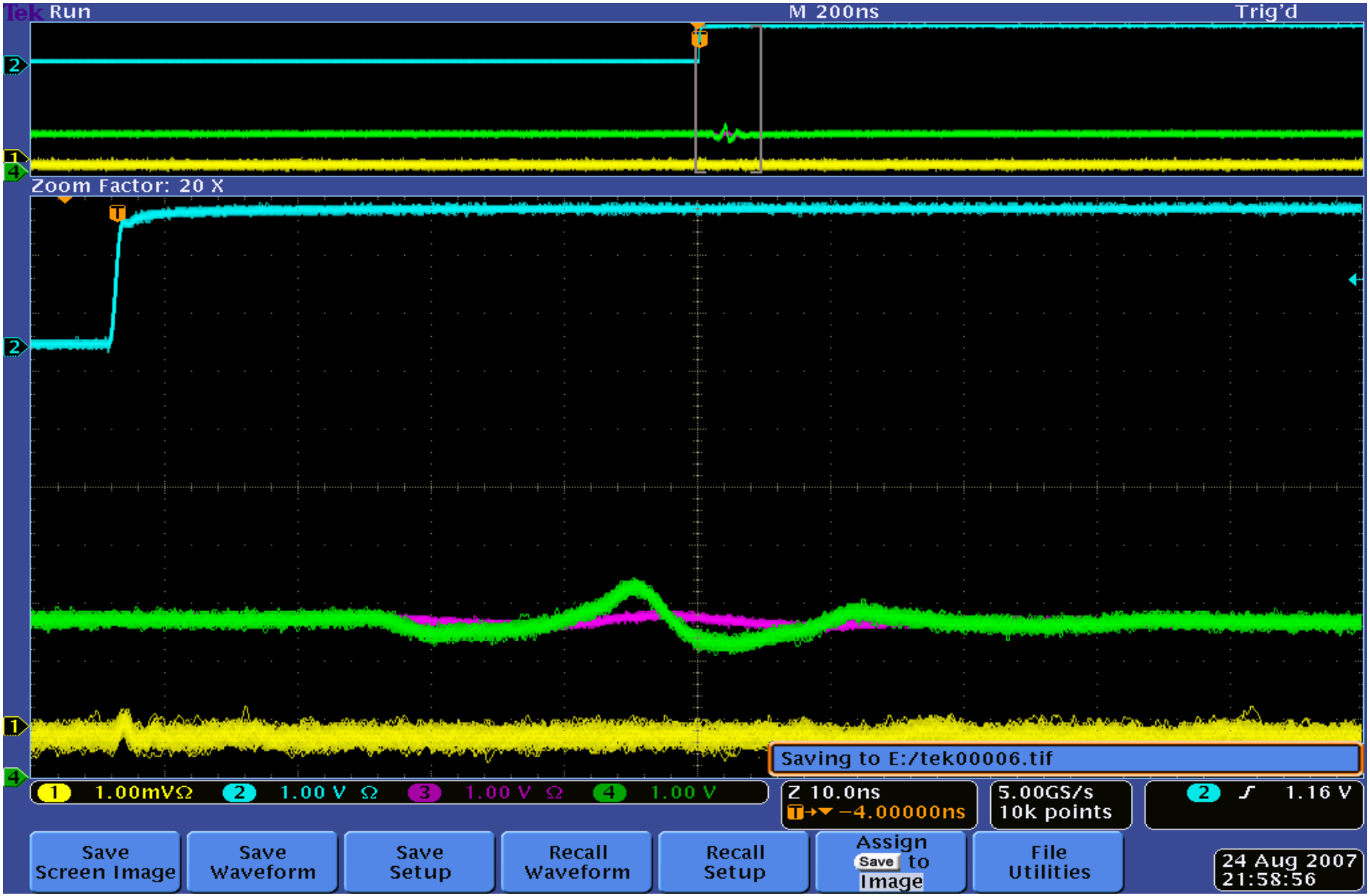
Prototype of QR LED driver



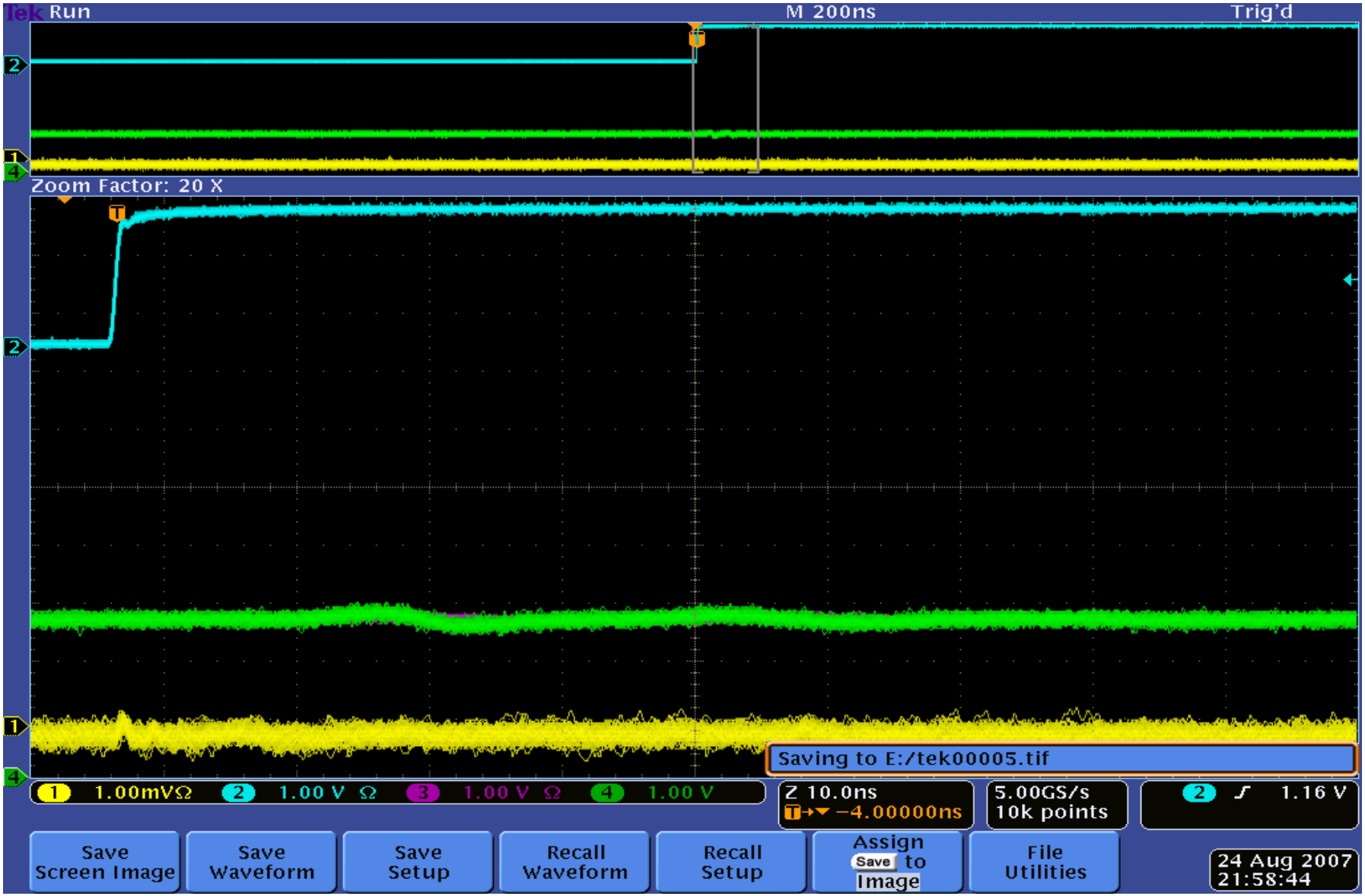
LED current waveform (GRN) a=3



LED current waveform (GRN) a=2



LED current waveform (GRN) a=1



Conclusion

- QR LED driver is very promising technique to reduce Electro-Magnetic-Interferences
- During September we plan to have a single channel protoboard for lab tests with PIN-photodiodes
- In October two-channel QR LED driver on PCB ready to measure light transfer in side-emitting fibres