

A fast LED driver prototype for HCAL calibration

EUDET extended steering
committee, DESY

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

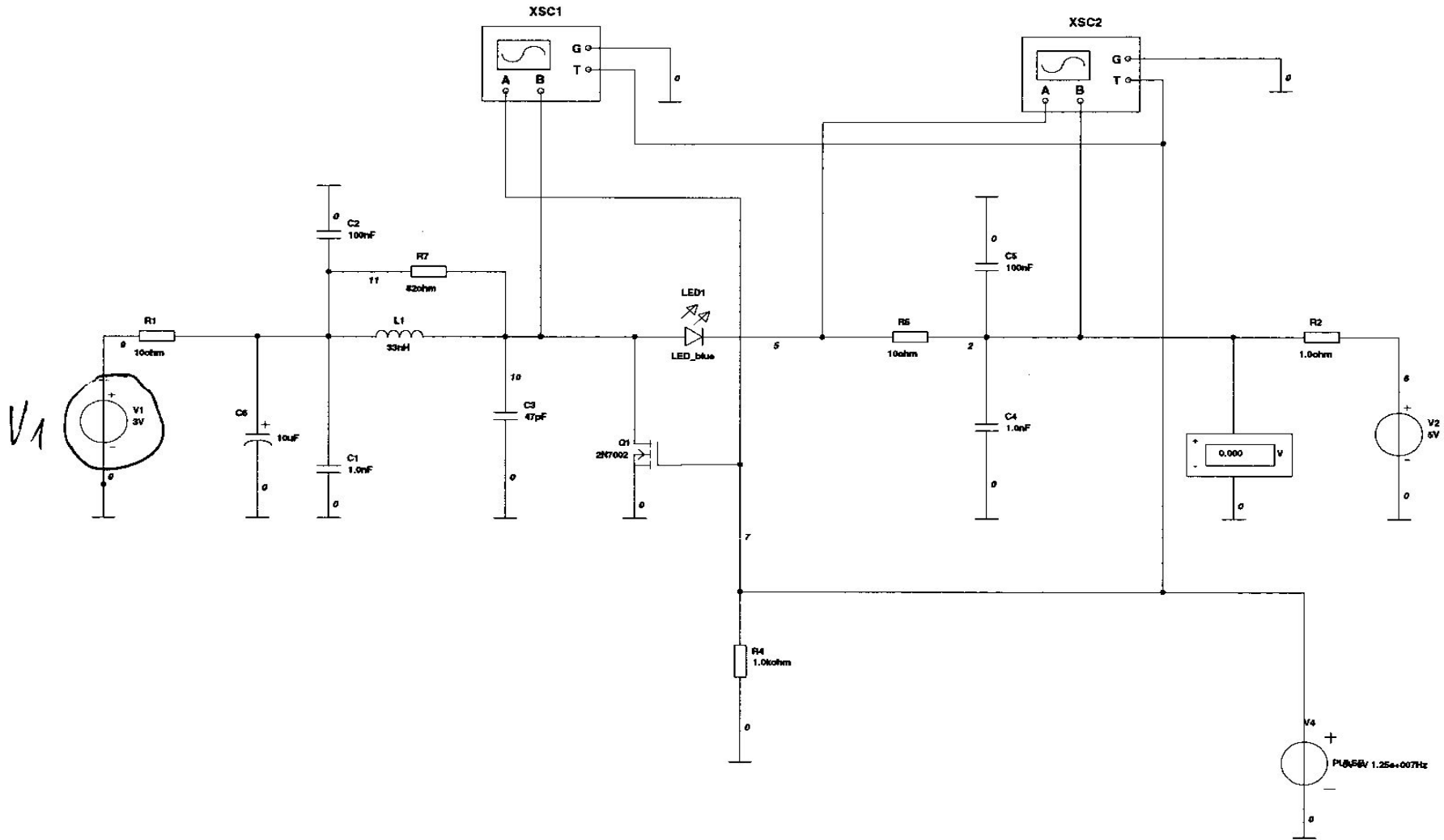
- At AHCAL prototype (uses SiPM), we used CMB, calibration system with UV-LED 400nm driven by very fast rectangular pulses (1ns rise/fall time).
- Steep Rectangular waveform satisfied the needs to vary pulse-width, BUT creates a lots of harmonics and then it converts to electromagnetic **crosstalk!**
- We have found **fixed** pulse-width to about 6ns, we can go to use narrow band ->smooth waveform \approx **less RF interference = Quasi Resonant LED driver (single pulse)**

Quasi-Resonant LED driver

LC circuit, heavily damped

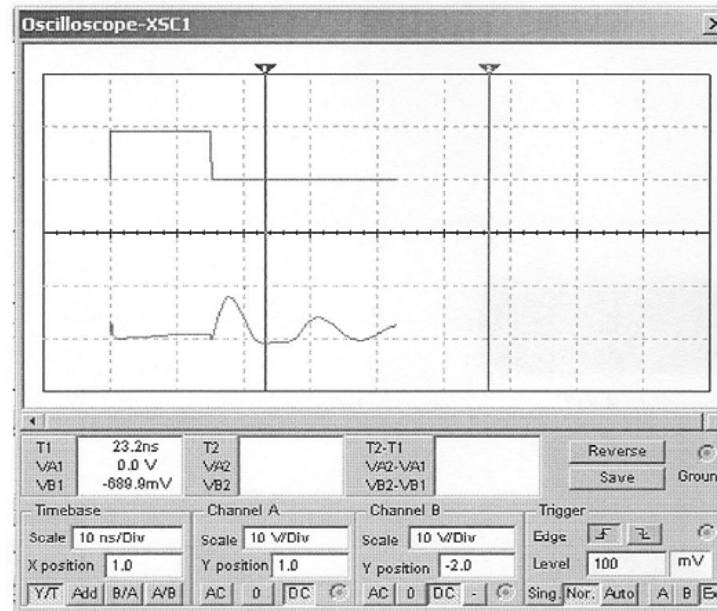
- **Simulation**
- ~ 5ns puls width (slightly depends on the amplitude)
- 33nH PCB inductance, no ferromagnetic core
- **Prototyping**
- Used my lovely single side copper foil PCB
- We needs more work to components optimisation

QR LED driver Simulation



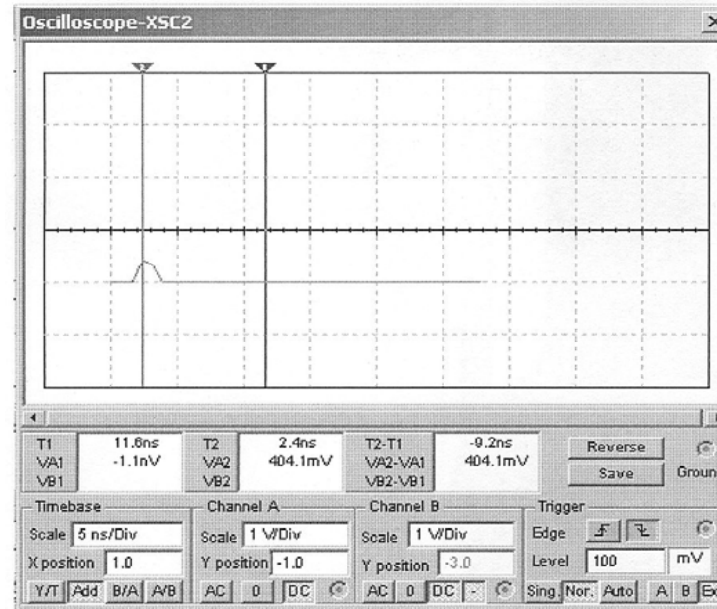
Simulation at 1.5V amplitude

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



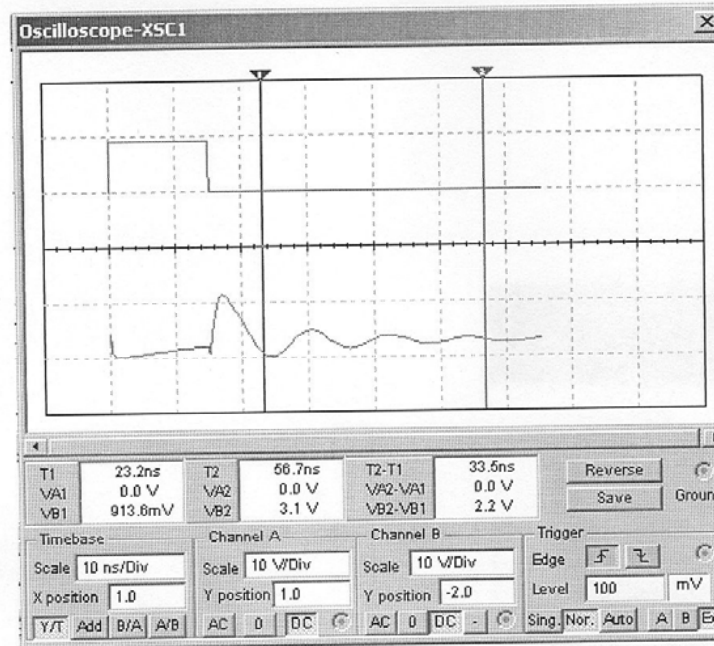
$$V_A = 1,5V$$

- XSC2: Lower trace LED current



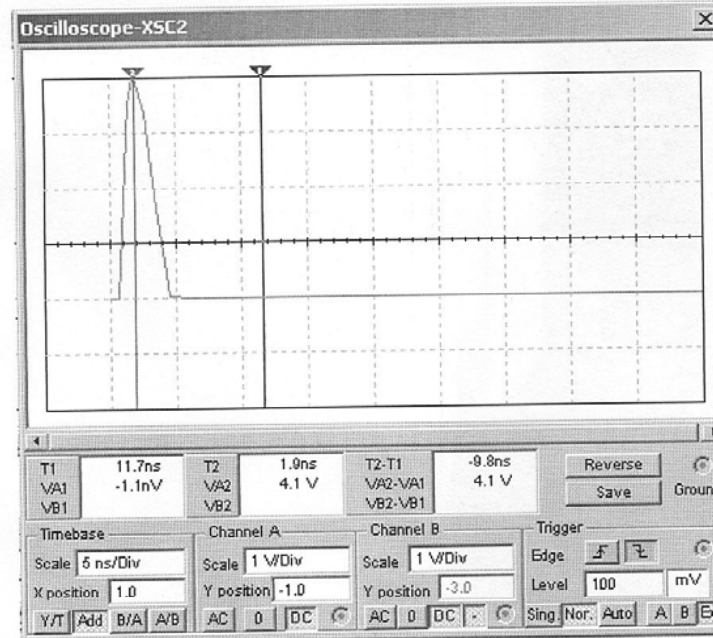
Simulation at 3V

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

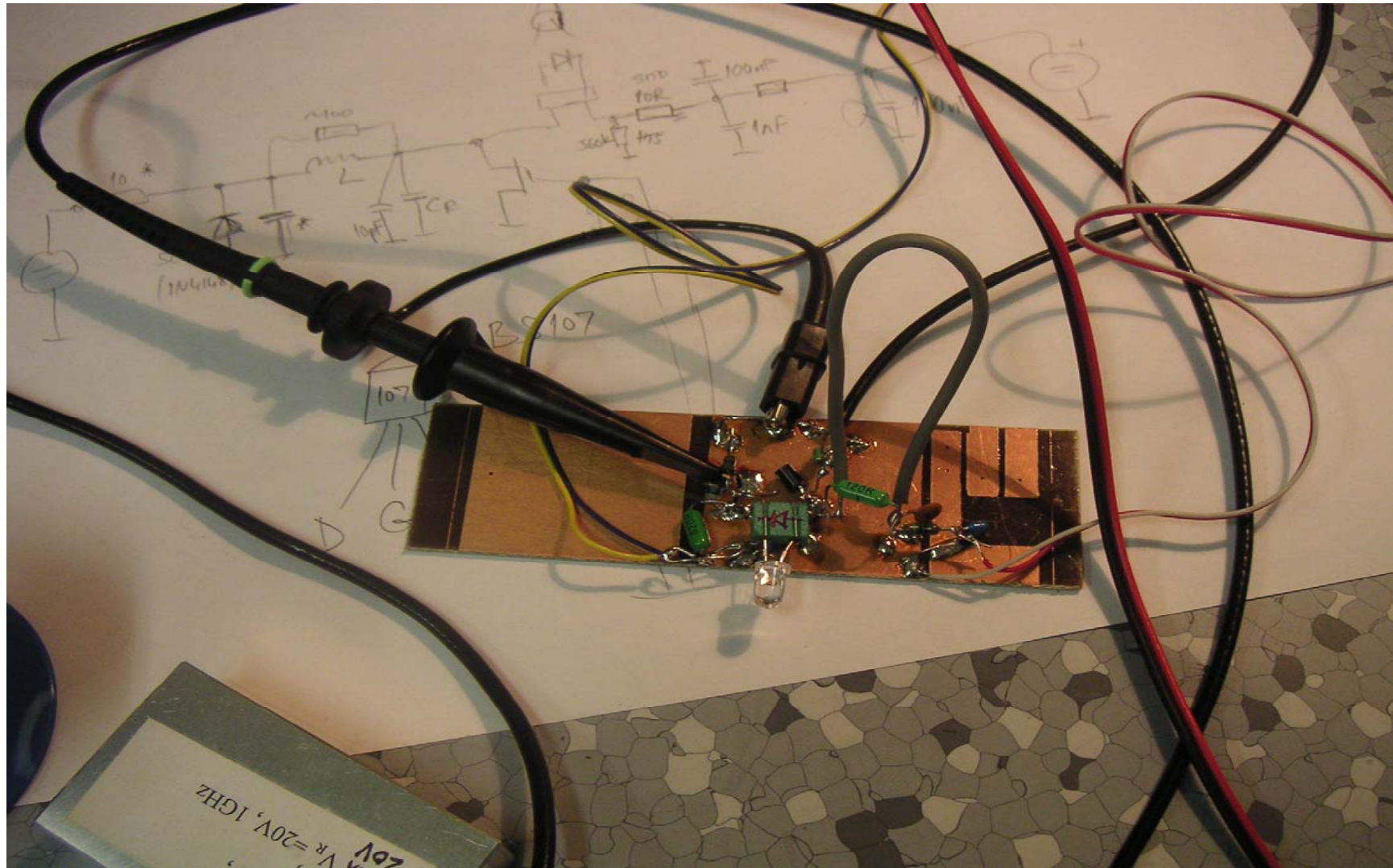


$$V_1 = 3V$$

- XSC2: Lower trace LED current



Prototype of QR LED driver

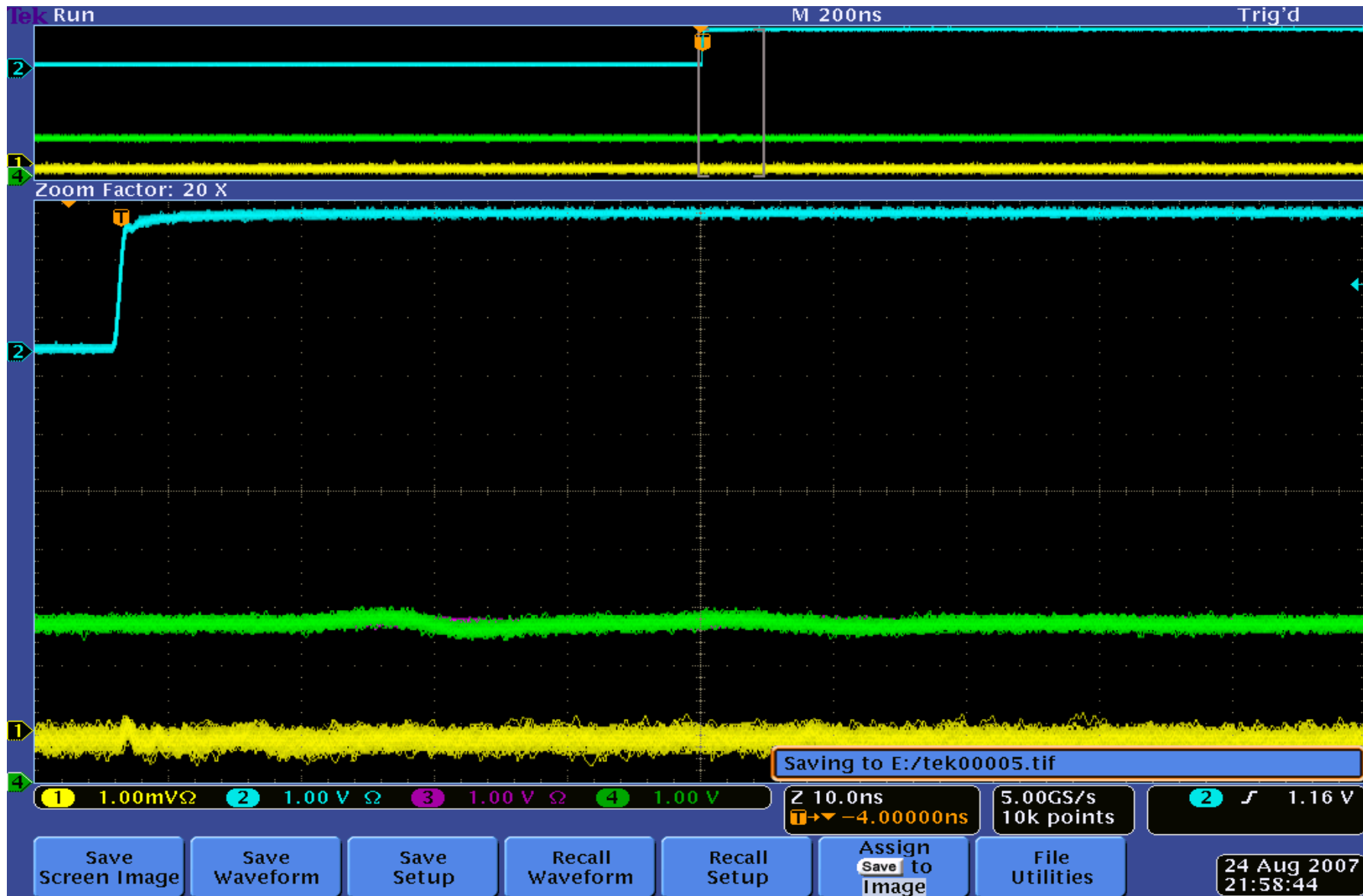


EUDET, AUG 27, 2007

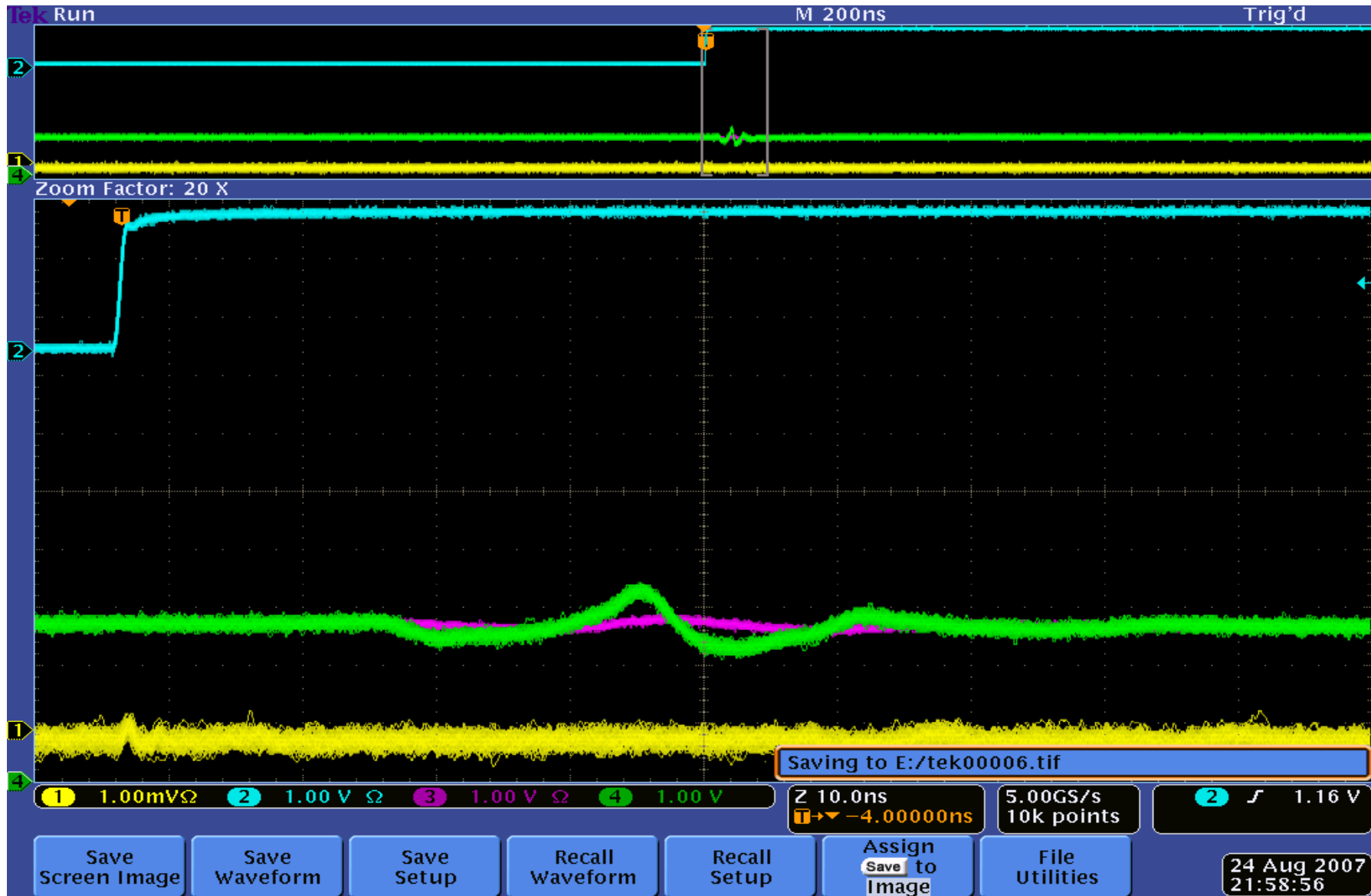
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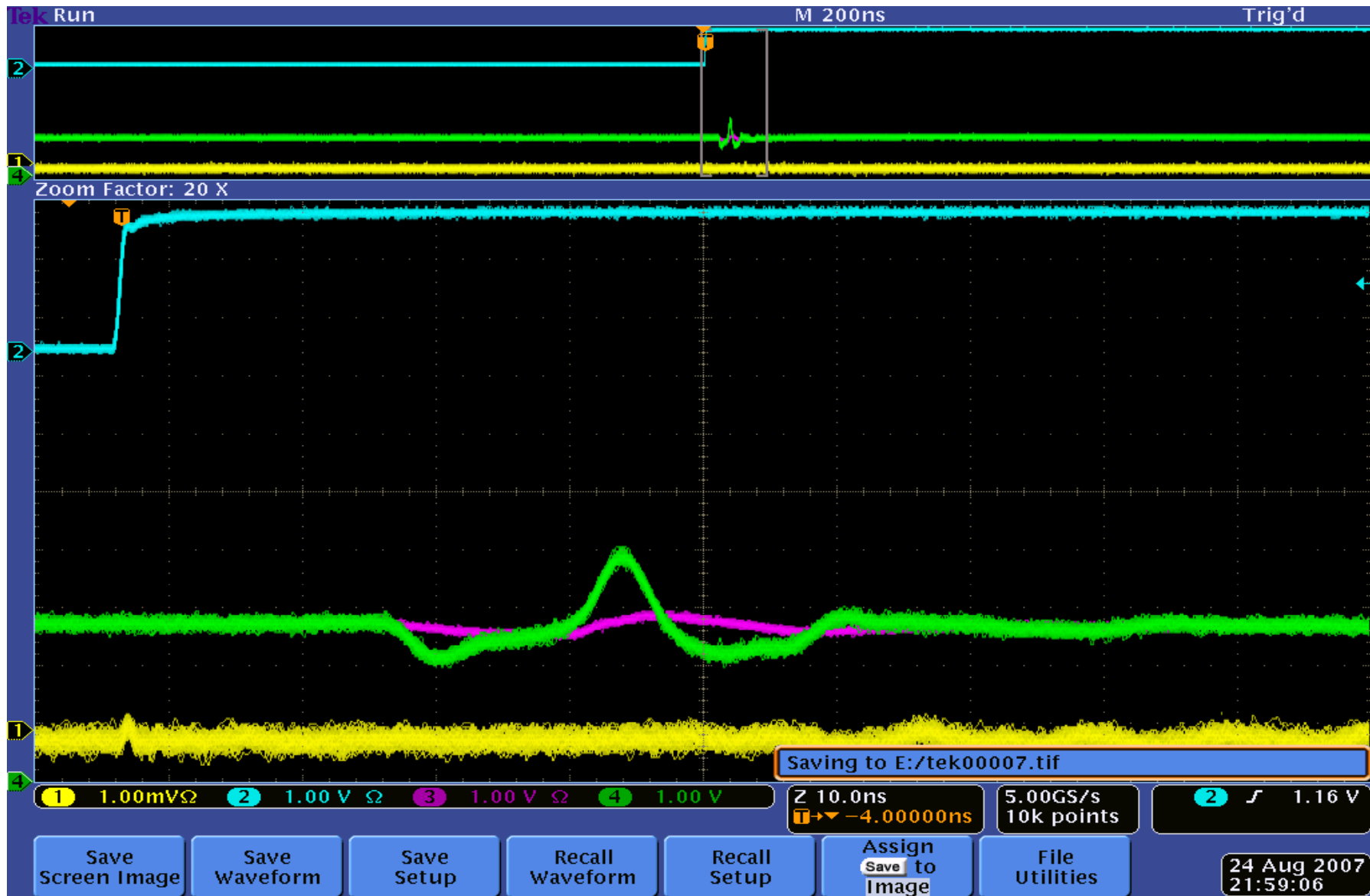
LED current waveform (GRN) a=1



LED current waveform (GRN) a=2



LED current waveform (GRN) $a=3$



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