A fast LED driver prototype for HCAL calibration

EUDET annual meeting at Ecole Polytechnique, Palaisau

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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

- 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



• XSC2: Lower trace LED current

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 $V_1 = 3V$

Prototype of QR LED driver



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LED current waveform (GRN) a=3



LED current waveform (GRN) a=2

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LED current waveform (GRN) a=1

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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)



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Response to middle amplitude



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Response to high amplitude

 200mA current at LED



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Response to high amplitude

 The Light from LED was optically blocked to PIN.



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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