

Lightpulsar Studies

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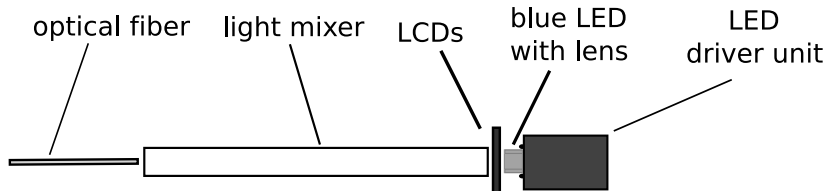
September 9th, 2009



Overview

- ▶ Light pulser foreseen to check the proper operation of all EMC channels
- ▶ Radiation damages reduce the light transmittance of PWO
- ▶ With a light pulser the detection of radiation damages of the crystals and photodetectors is also possible
- ▶ Requirements for the light pulser
 - ▶ Puls form like PWO signal
 - ▶ Different colors (blue, green, red)
 - ▶ High light output
 - ▶ Intensity variation in a wide range (1:1000)
 - ▶ Small dimensions

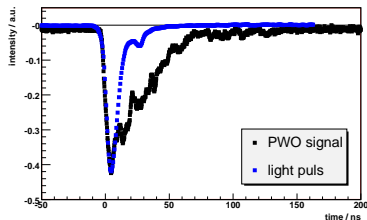
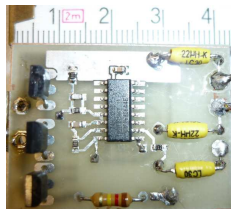
Planned setup



- ▶ Blue LED with lens to focus the light at the light mixer
- ▶ Red and green LED mounted close to the lens
- ▶ LCD attenuator between lens and light mixer

Blue LED-Pulser

- ▶ Blue light pulser for the detection of the radiation damages of the crystals
- ▶ Different light pulsers were tested
- ▶ Small driver unit
- ▶ Rise time of the light puls is similar to the PWO signal
- ▶ Needs high voltage ($U = 700\text{ V}$)

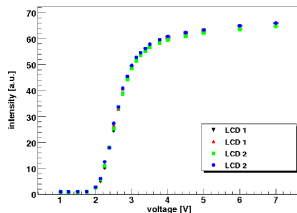


LEDs

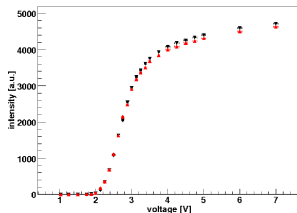
	intensity / a.u.	
	FRAEN	CARCLO
Luxeon Rebel	0.72	1
Luxeon K2	0.36	0.33
Luxeon V	0.57	0.38
Luxeon III	0.43	0.41
Luxeon I	0.33	

- ▶ Different LEDs with lenses from 2 manufacturer were tested
- ▶ The Luxeon Rebel with the Carclo lens have the highest light intensity

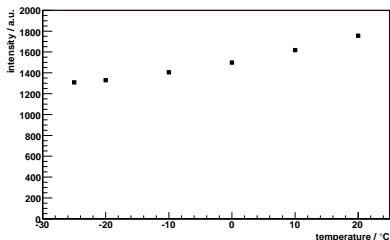
Transmittance of LCD



- ▶ Advantages of LCDs:
 - ▶ No moving elements, control of transmittance by voltage
 - ▶ No maintenance
- ▶ 2 LCDs are required for dynamic range of 1:4600
- ▶ Minimal attenuation by LCDs
 - ▶ 1 LCD: 69 %
 - ▶ 2 LCDs: 82 %

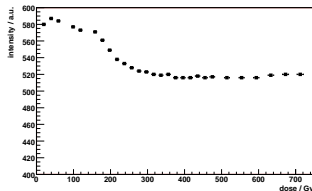


Light Intensity



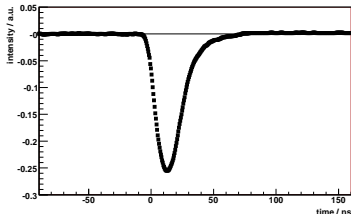
- ▶ The light intensity of the pulser depends on the temperature
- ▶ Light intensity decreases about 25 % between 20 °C and -25 °C
- ▶ The maximum light intensity for the planned setup (at 20 °C) is equivalent to about 14 GeV

Radiation hardness



- ▶ Test of radiation hardness with a dose of 720 Gy (dose rate: 200 Gy/h)
- ▶ During the radiation:
 - ▶ Light intensity decreases about 10 %
 - ▶ Current of the voltage supply for the ICs rise from 3 mA to 16 mA
- ▶ After the radiation the light intensity rised about 6 % and the current decreases to 3 mA after some days

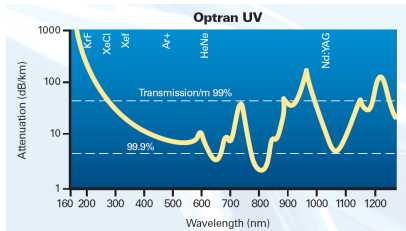
Red and green LED-Pulser



- ▶ Red and green LEDs to detect the radiation damages of the photodetectors
- ▶ Use of Kapustinskys pulser
 - ▶ No high voltage supply
 - ▶ Small driver unit
 - ▶ Low light intensity
 - ▶ Light puls not similar to PWO signal

Optical fibers

- ▶ Optical fibers are mounted with optical grease to the light mixer to increase the light intensity about 33 %
- ▶ Optical grease between optical fiber and crystal increase the light intensity about 50 %
- ▶ For a high light intensity and a small bending radius 4 fibers of $200\ \mu\text{m}$ will be used ($R_{bend} = 6\ \text{cm}$)
- ▶ With this combination 400 crystals can be monitored by one pulser



Summary and Outlook

- ▶ The presented LED-Pulser creates light pulses with short rise time which is similar to PWO signals
- ▶ The control of the light intensity by LCDs is possible, but they require a light source with a higher light intensity
- ▶ The light pulser is small and can be mounted close to the crystals

- ▶ Outstanding R&D
 - ▶ Increase the light intensity
 - ▶ Coupling of red and green LED