Umbilical flasher design – updated specifications document

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Introduction:

The Umbilical Flasher Object (UFO) sits on the top of the laserball source stem. The objective of the UFO is to produce fast light flashes of LEDs oriented in different positions to determine the position and orientation of the source when deployed. A wavelength of (655 ± 5) nm is chosen so that the underwater camera system in SNO+ can observe it, whilst being at an acceptable quantum efficiency level (<1%) of the PMTs.

The UFO source position is to be observed in two complementary ways:  
 1. The angular reconstruction from the SNO+ camera system.

2. Reconstruction from the PMT array.

Specifications:

LED x 8 (BL-LUDR5N30C from BriteLED): 660 nm

Assuming 105 photons per shot and running at 1 kHz for 100 seconds: 1010 photons Cameras will see small fraction of this, say 107 photons.

**Question: will the camera's see this?**

Operation:

Control via two-wire system:

AWG26 wire and RG174 ground, length of 25 m.

Synced trigger out required for PMT system (single-ended ECL). Jitter less than 0.1 ns. Control via raspberry pi2 – python socket.

Limited options – currently we plan only to trigger to pulse. LEDs are selected sequentially – either on number of pulses or time (tbc). The switch condition (# pulses or time) will be fixed.

Sequencing – Each sequence must start at the same preset LED and follow a pattern moving to a neighboring LED in a (counter)clockwise direction. *(Direction tbc).* Need to be able to determine orientation of source. It would be nice, but not necessary, to have full external control of the sequencing.

Time offset between LED trigger and flash must be consistent. Aim to keep below 0.1 ns – this is an arbitrary value but must be consistent over all LEDs and sequences.

*“Trigger out for TUBii to be consistent with ELLIE systems (ECL, Jitter < 0.1 ns). Any input triggers from TUBii can be expected as TTL”.*

To be run in asynchronous trigger mode. Trigger out needs to be in phase with LED light.

Need to make 3 (+1) devices:

* 2 for source holders.
* 1 spare (on-site).
* +1 spare to keep at Sussex for testing (this may not need to have acrylic housing).