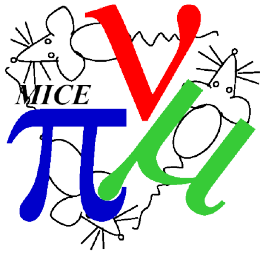


The University Of Sheffield.

Tracker Hardware Update

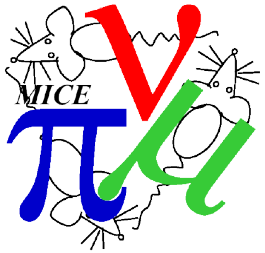
Edward Overton on behalf of the tracker group.

MICE CM36

Outline

- Preparation for Step IV:
  - Tracker Lab
  - Refurbishment
  - LED System

- What to expect running Step IV (Rate Limitations).



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Preparations for Step IV

Tracker Lab

- Used Lab7 for recent cosmic runs, however were required to move elsewhere last year.

- We have ‘moved out’ of lab 7, only the trackers remain there (waiting for Geoff to oversee their move).

- All 4 cryostats and a tracker rack has been relocated to the new tracker room.

- New room is almost ready for use:
  - Services connected.
  - Geoff's dark room area is ready to go.
  - Ready for further development (LVDS testing for example).

- Refurbishment / QA of trackers to begin soon

Tracker Refurbishment

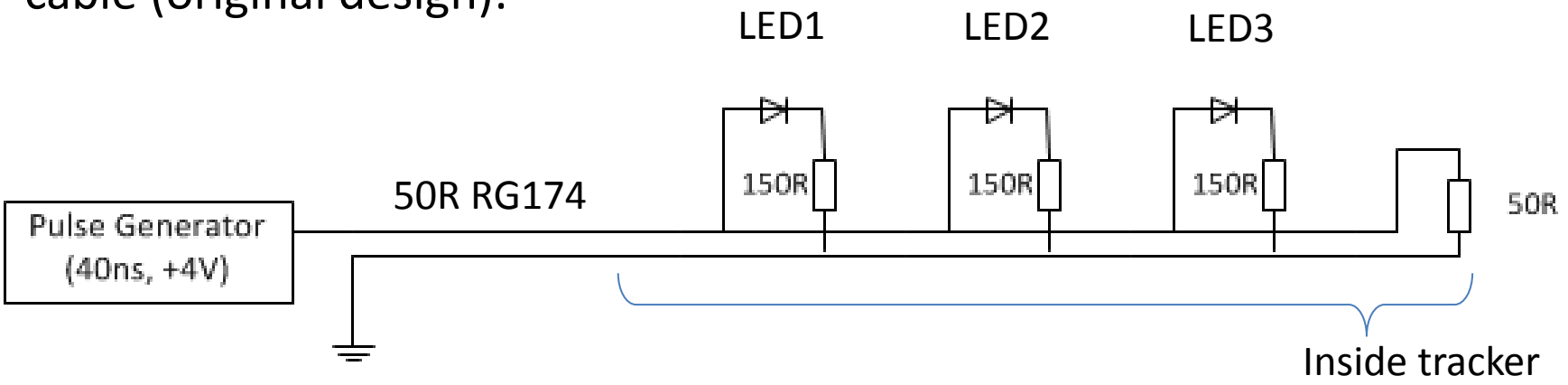
- Check light guides for damage and replace as necessary.
- Check for dead fibres.

- Will be complete by end of July.

LED System

There are two possible routes:

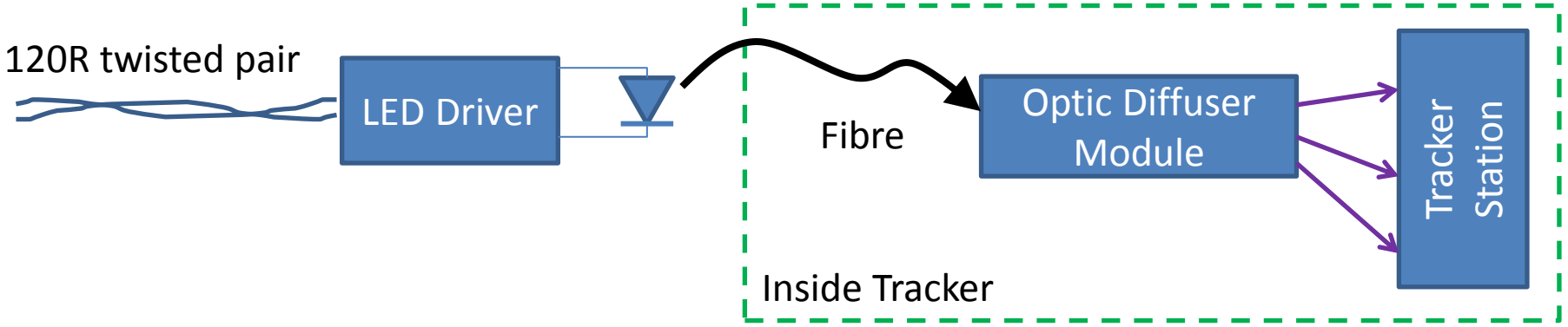
1. Install LED's into tracker modules, drive several LEDs passively off of 50R cable (original design):



- Module construction simple, easy to diffuse.
- Tested system in lab, to maintain reasonable light uniformity (~10%) required minimum pulse length ~40ns.
- System requires ~20 (slow-ish 10ns rise time) pulse generators (which need design, manufacture, testing).

LED System

2. Use ‘active’ LED driver circuit outside the tracker and use optic fibers/internal diffuser modules to inject light inside:

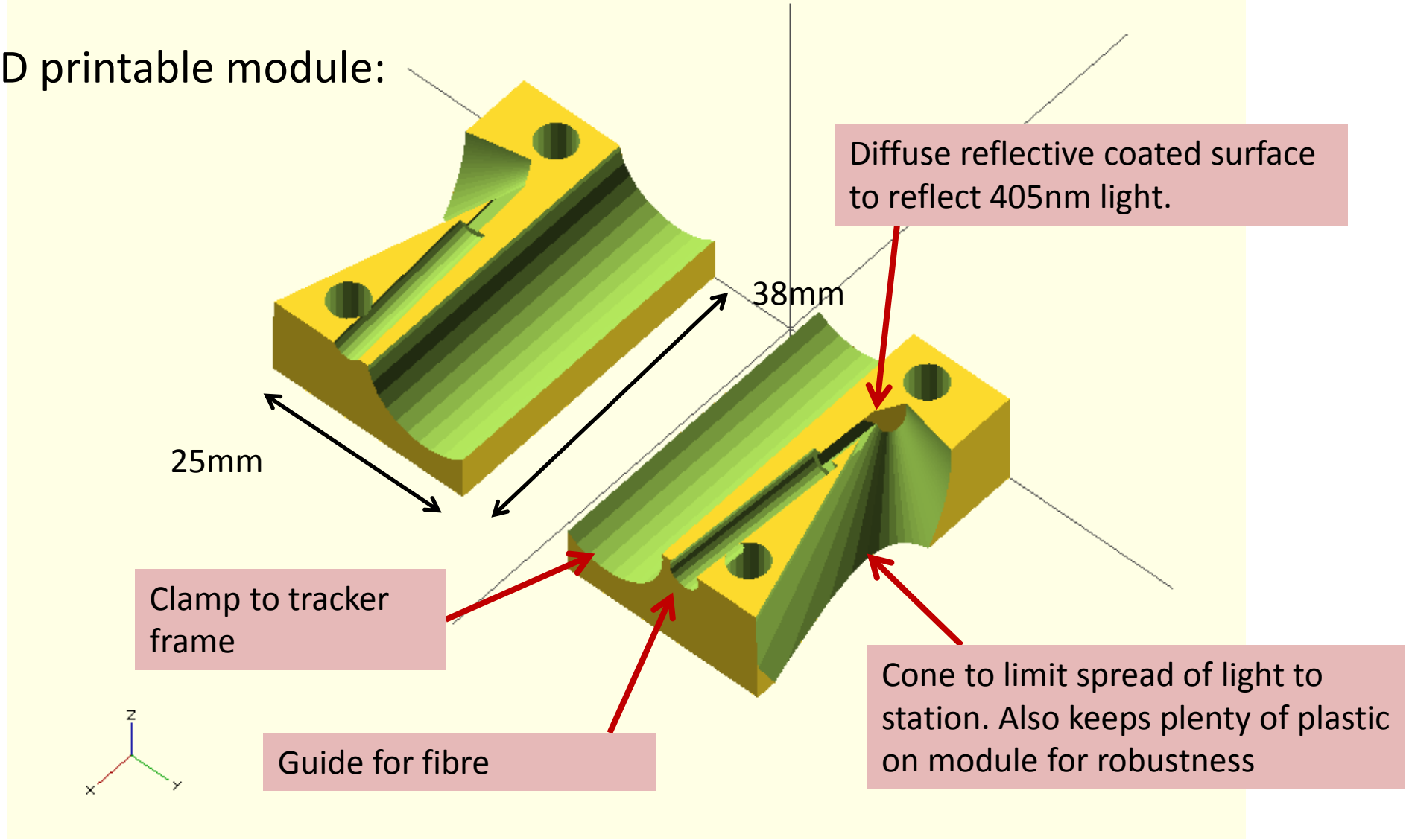


- Simple (already manufactured) driver circuit can provide ~1ns rise time light pulse, duration ~7ns.
- System inside tracker is purely to guide light, so the light pulse generation circuitry can be modified at a later date.
- Possible to fit smaller modules in tracker
- Module to diffuse light at end of fibre needs constructing.

Light Diffuser Module Design

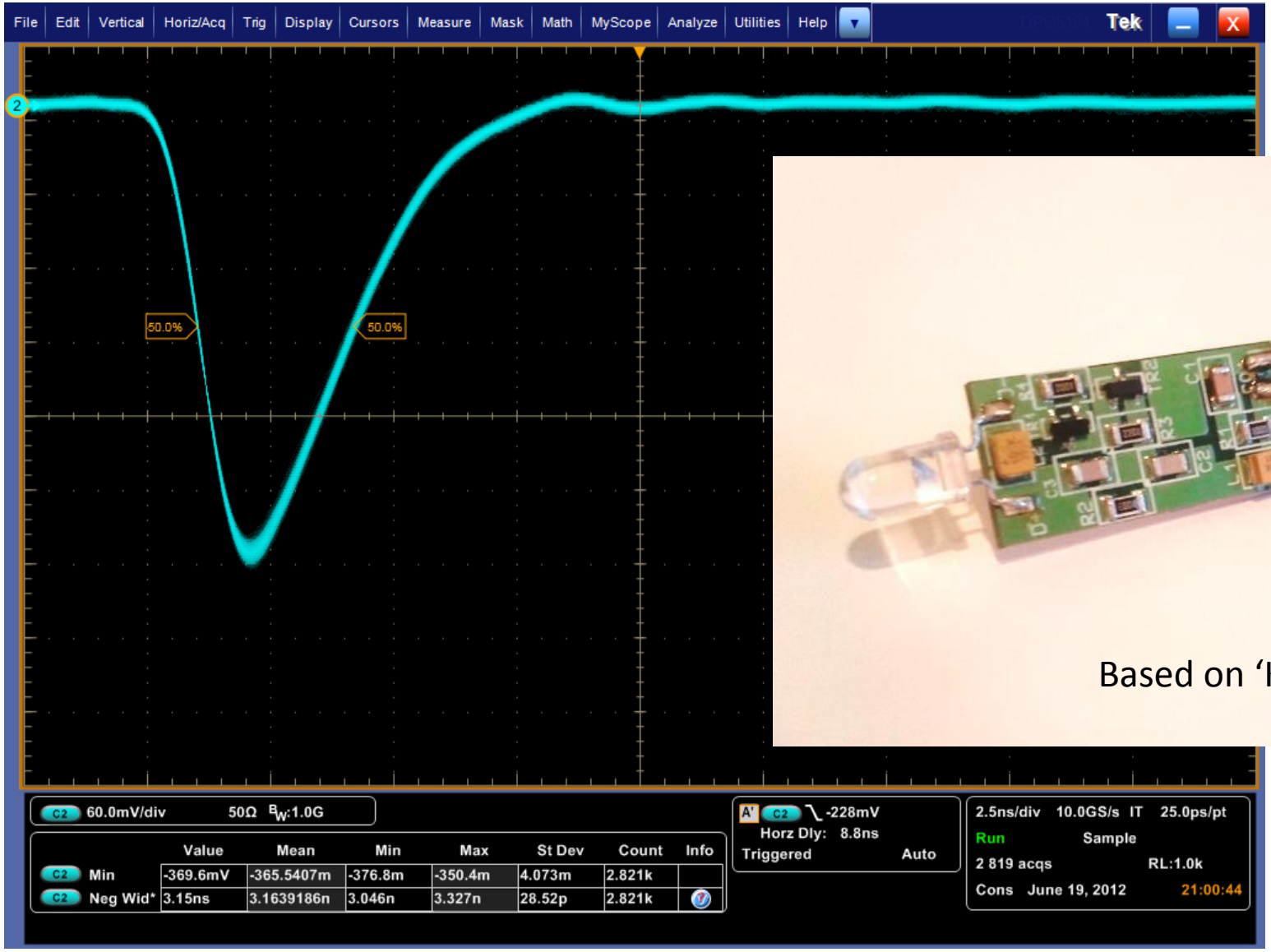
(System 2)

3D printable module:



LED Driver

(System 2)



Based on ‘Kapustinsky’ circuit

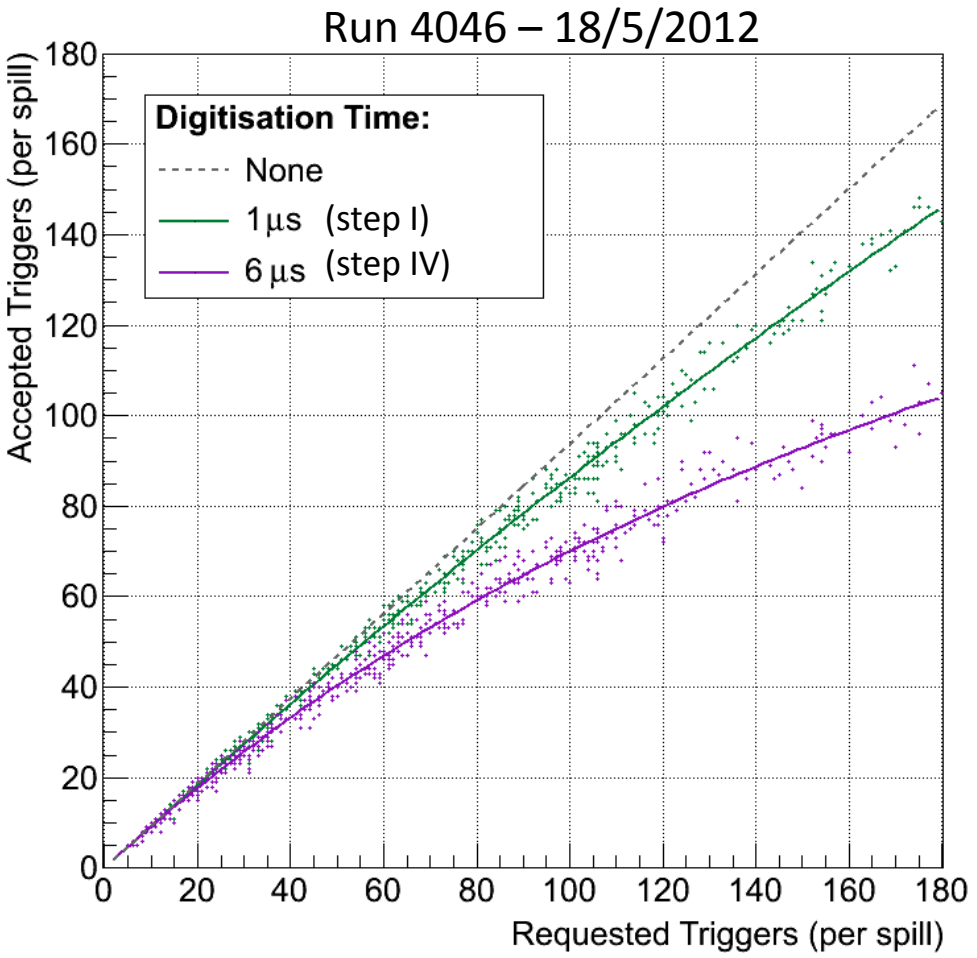
Rate Limitations at Step IV

'Dude where's my muon?'

Digitisation time in Step IV

(From single station test)

- Results from specific run taken with varying rate.
- Run taken with 1us digitisation time.
- 6us digitisation applied later using the 'trigger_time_tag'
- Using a 120ns alive window.
- Dotted line is $y = \alpha x$. If the digitisation time is 0ns then this is what you get (because of the 'Alive window').



$$y = \frac{\alpha x}{1 + \beta x}$$

$\alpha = 0.95 \pm 0.1$
$\beta = (3.5 \pm 0.1)\text{x}10^{-3}$

$\alpha = 0.94 \pm 0.1$
$\beta = (8.6 \pm 0.5)\text{x}10^{-5}$

From real data…

(From single station test)

- Plot on right was for high rate pion beam… so for muon beams effect is not as bad.

- Depending on expected rates at step IV it could be possible to reduce this effect:
  - Re-commission beam bump to make maximum use of 3ms spill.
  - Dip target more frequently at lower beamloss, but we wear out the target quicker.