First Range Telescope Tests 9th February 2018

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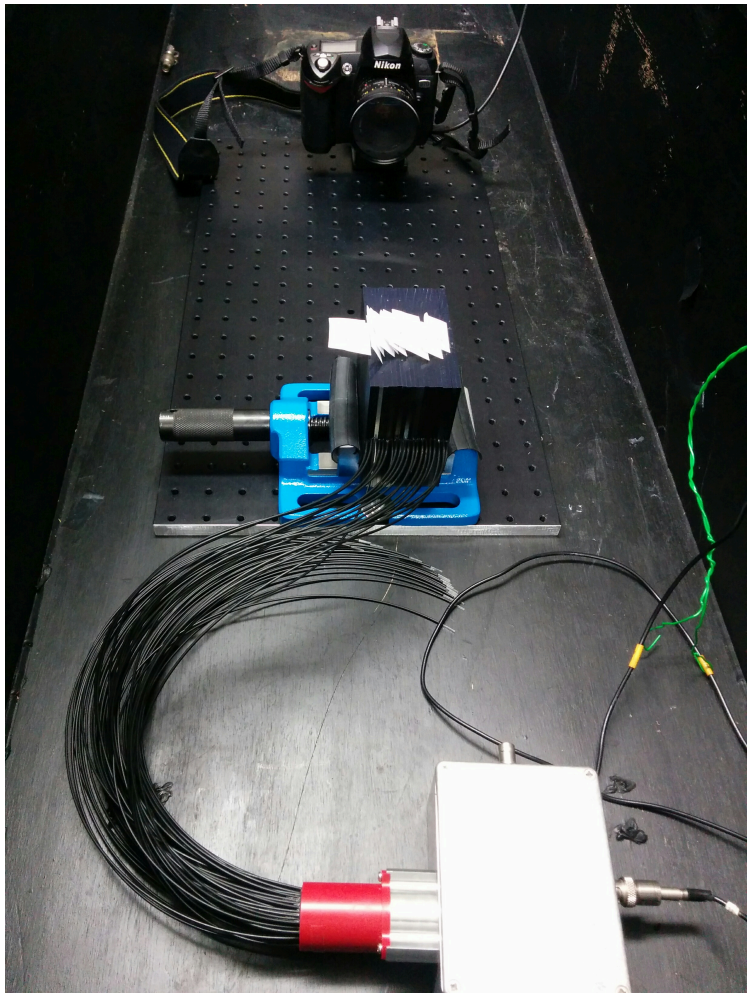
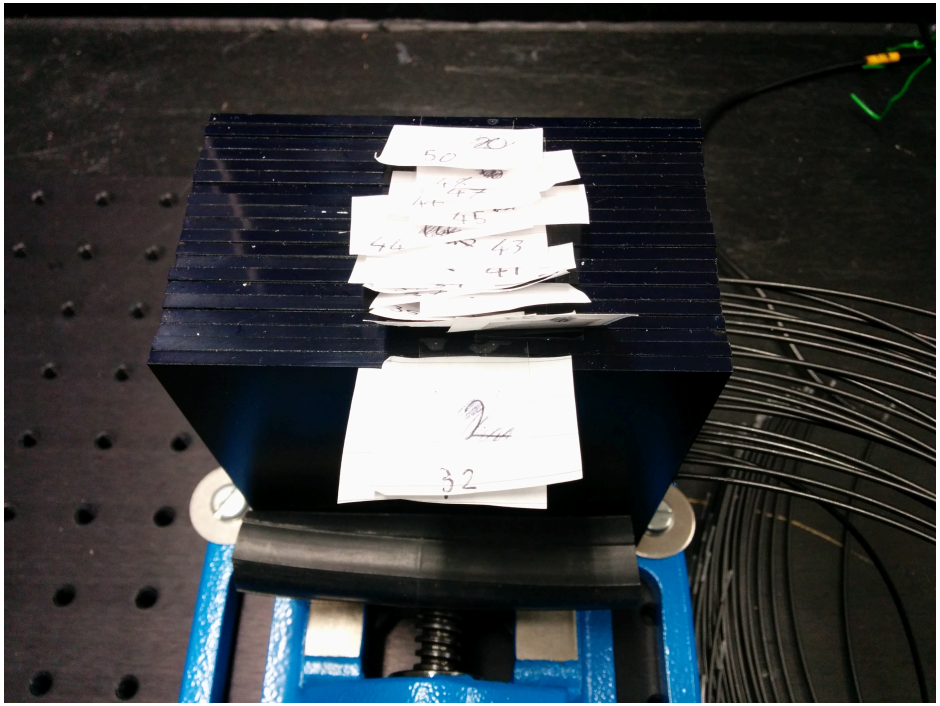
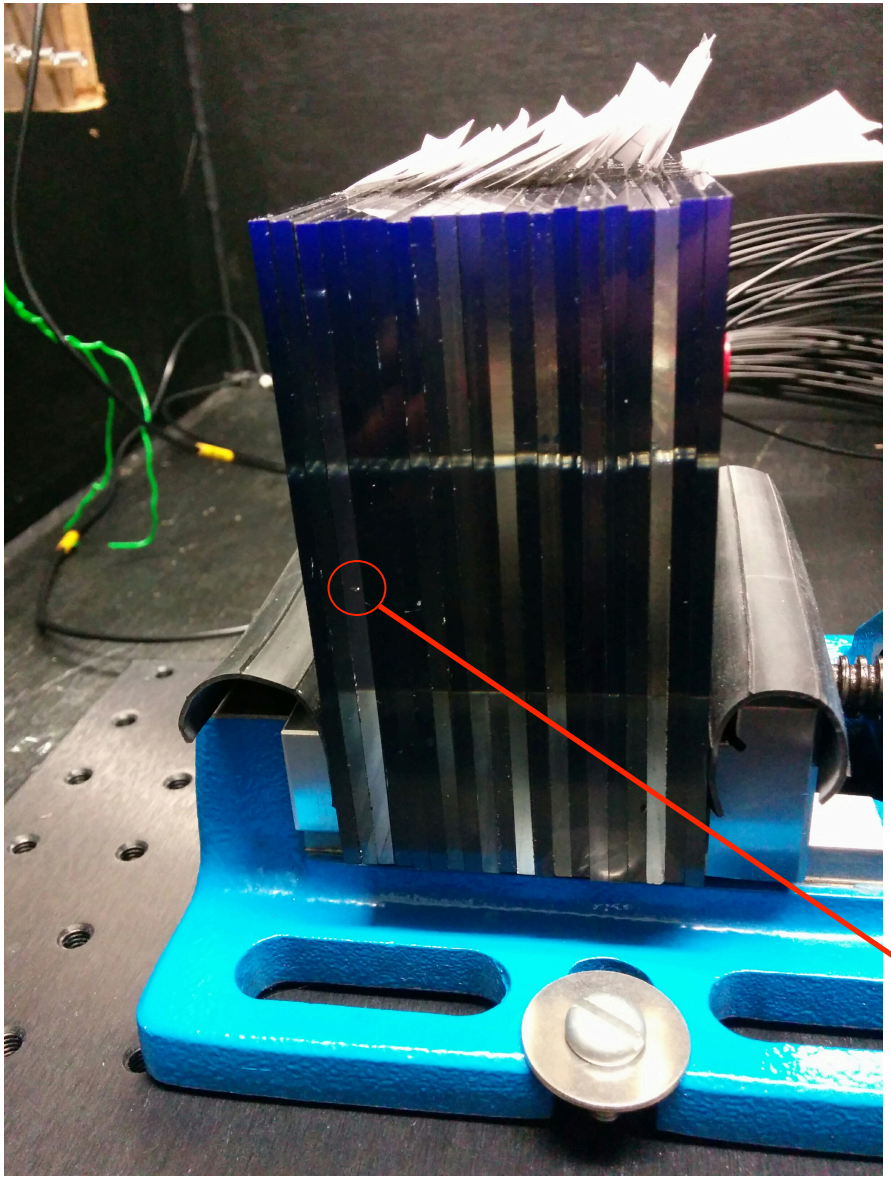
Setup





- Mounted to fit within baseboard without overlapping any of the edges
- Distance between camera lens and beginning of scintillator stack: 25.5 cm

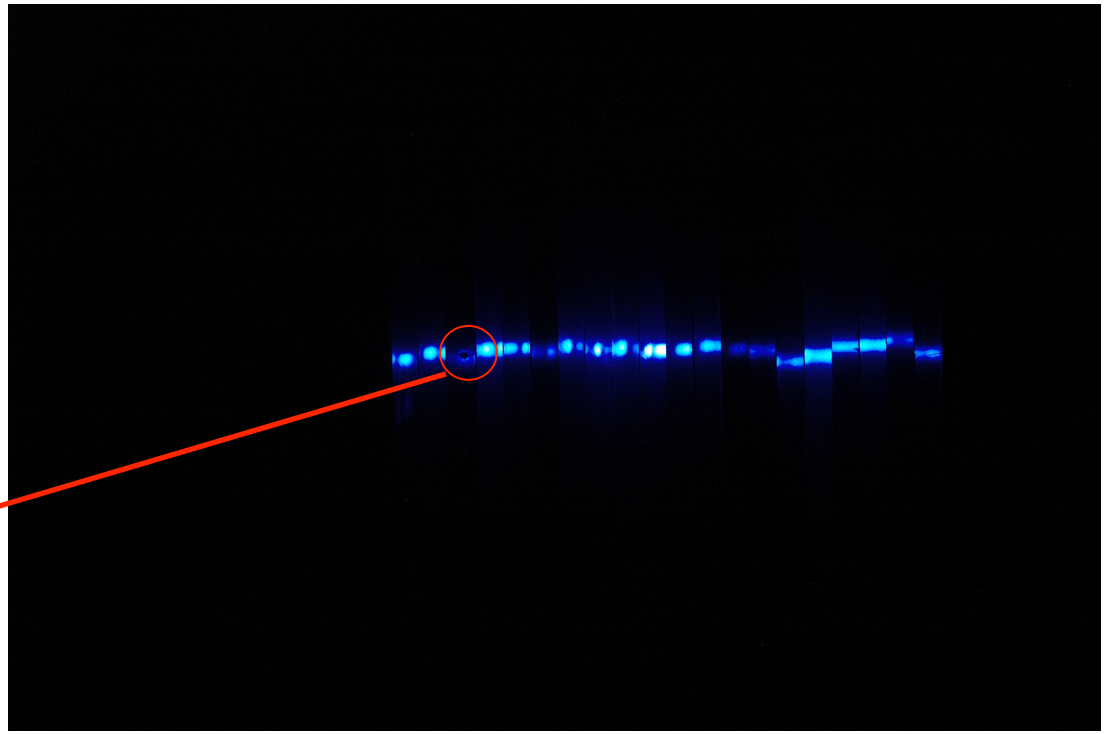
Setup



- 20 x 3 mm scintillator sheet stack
- Scintillator sheet numbering, from left to right, from camera perspective:
  - 50 - 31
- Original LED fibre numbering, from left to right, from camera perspective:
  - 1 – 20
- Further notes:
  - Some of the scintillator sides with the drilled hole need a paint top up
  - Front faces of scintillator (and top face if any sensor is going on top) need polishing to get rid of small scratches

Fibre non-uniformity tests

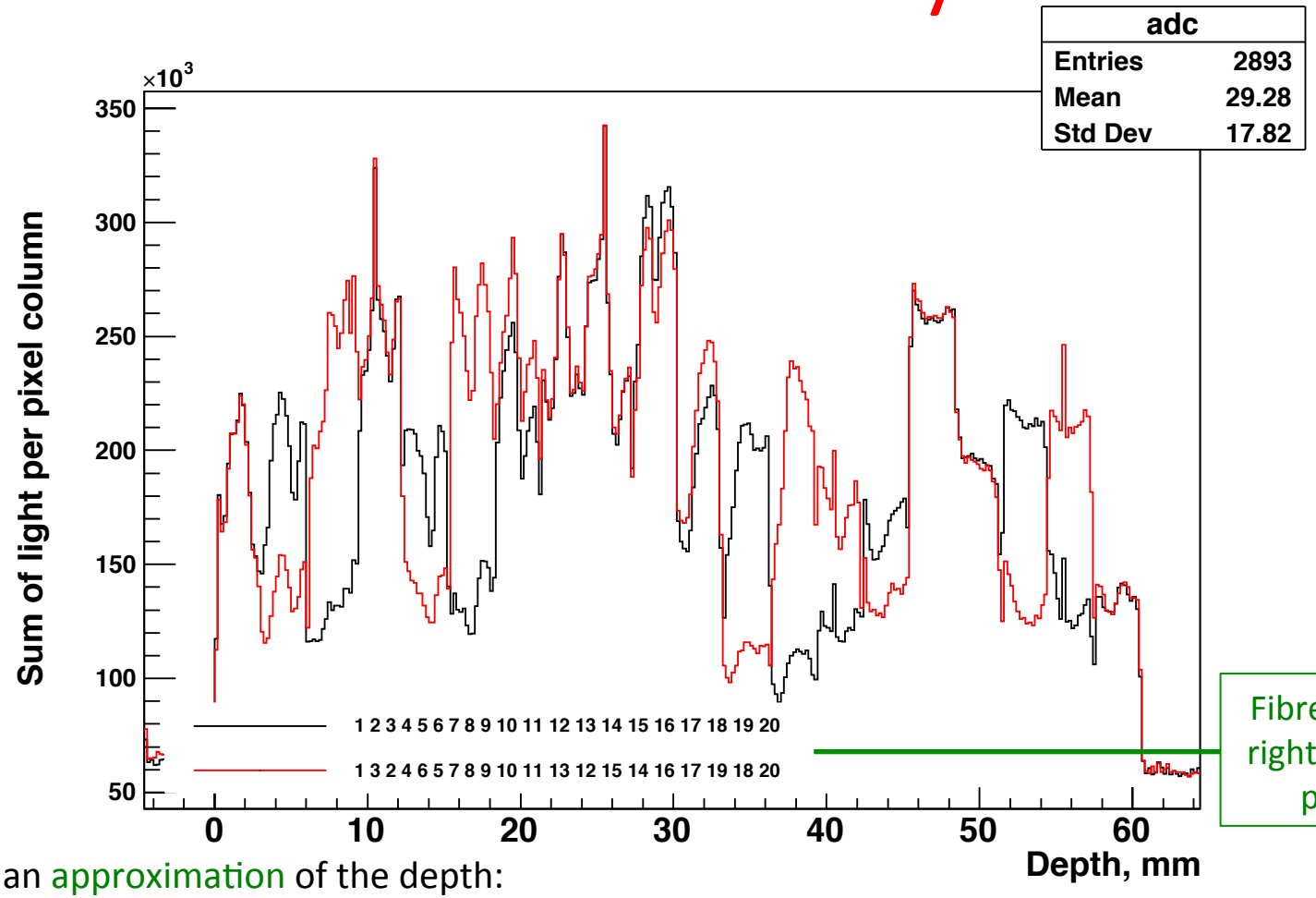
- Images and their analysis show non-uniformity of “illumination” of the scintillator plates:
  - Investigate whether this effect goes with the scintillator or with the fibre



Note visibility of scratch on camera image

  - Change around order of fibres and observe changes

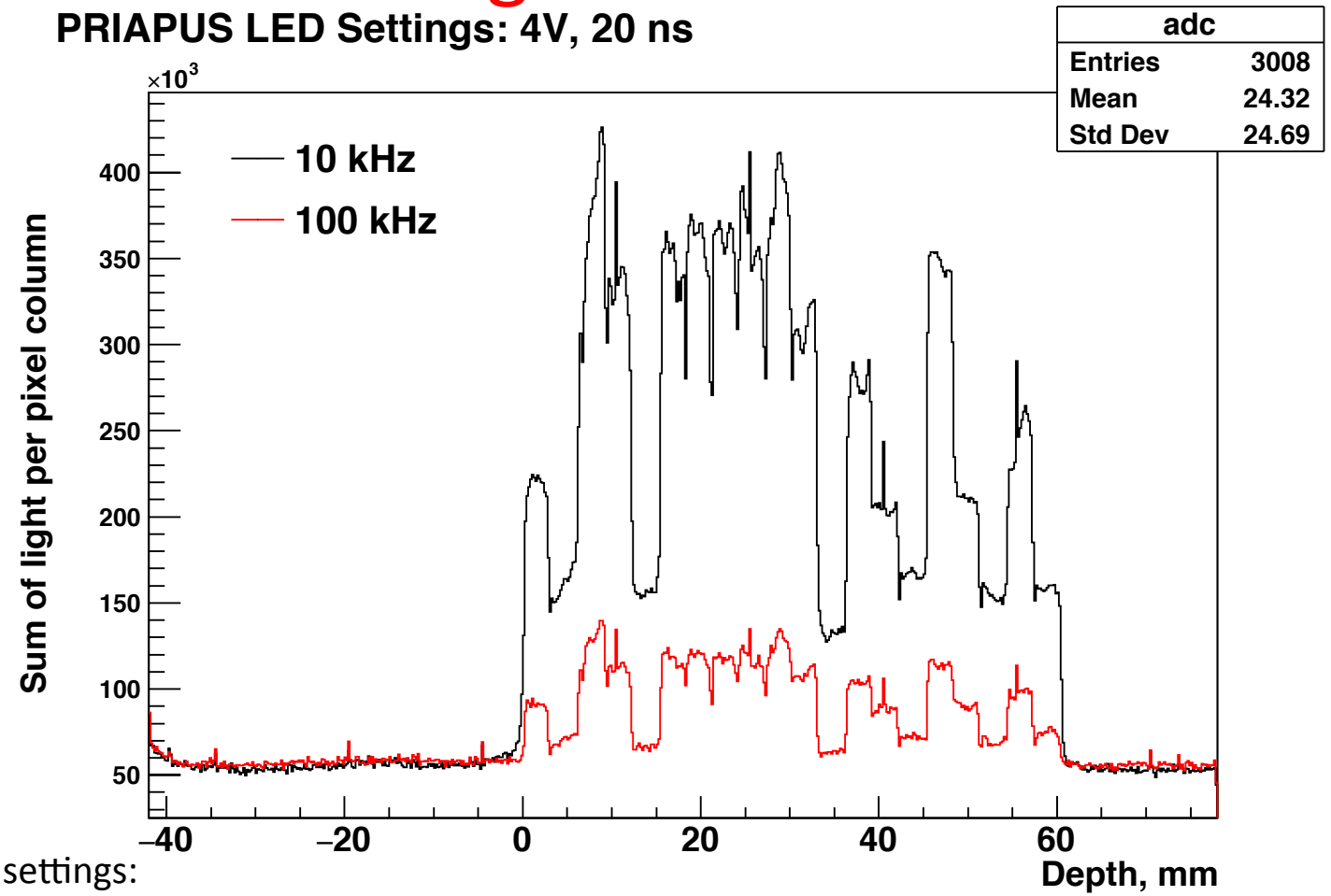
Fibre non-uniformity tests



Fibre order, left to right, from camera perspective

- X-axis is an approximation of the depth:
  - From expectation of scintillator stack being 60 mm long, not from pixel size calculation
- Conclusion: the effect goes with the fibre
  - Non-uniformity caused by the light cone not distributing light equally across the fibres, it was designed to be used with different fibres

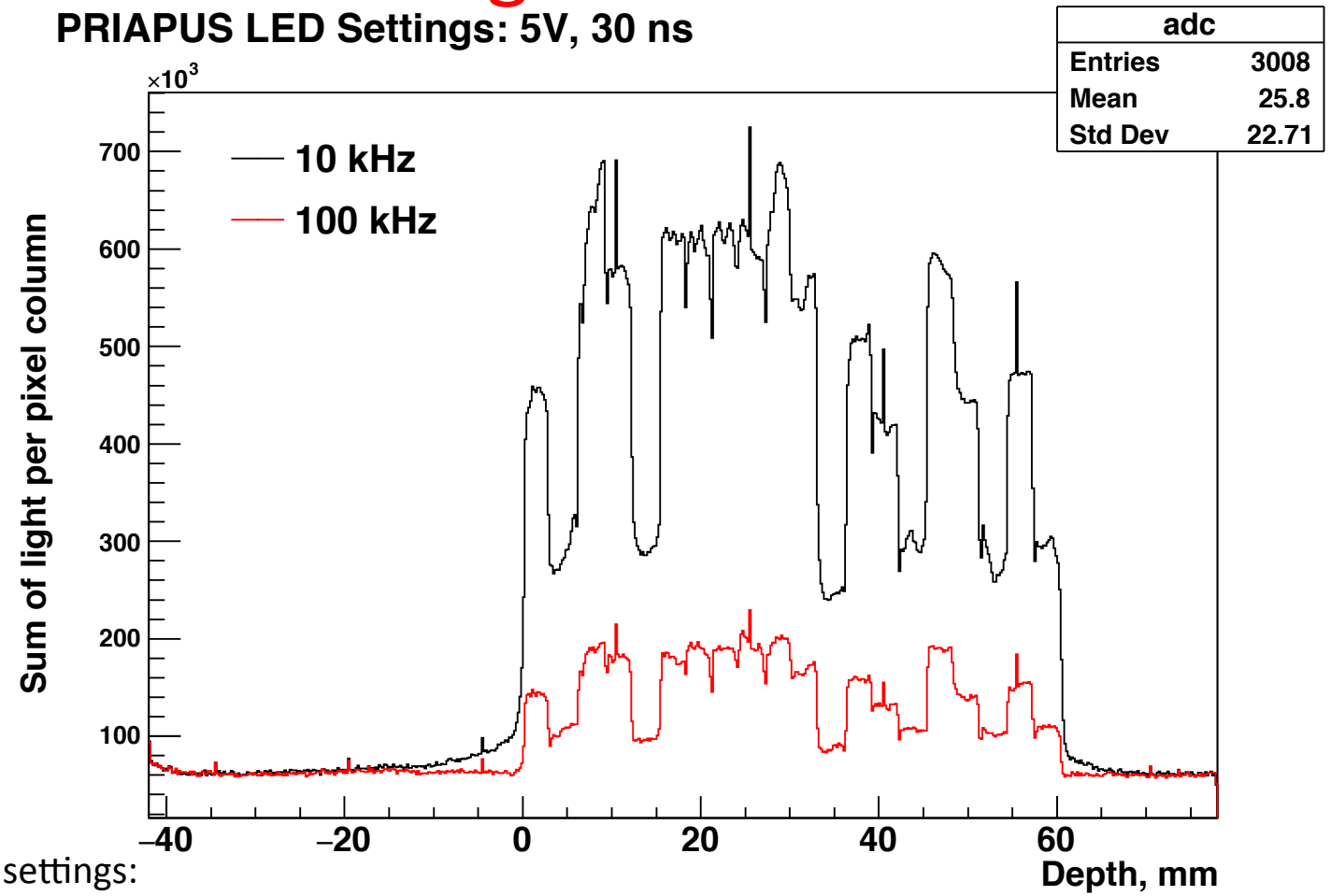
Tests of LED settings matched to PRIAPUS tests



- Camera settings:
  - Exposure: 1 second (to match 1 second PRIAPUS frame)
  - ISO: 800
  - Aperture: f/1.8 (largest possible)

- Factor of ~2.5 increase from changing rate from 10 to 100 kHz
- No saturation

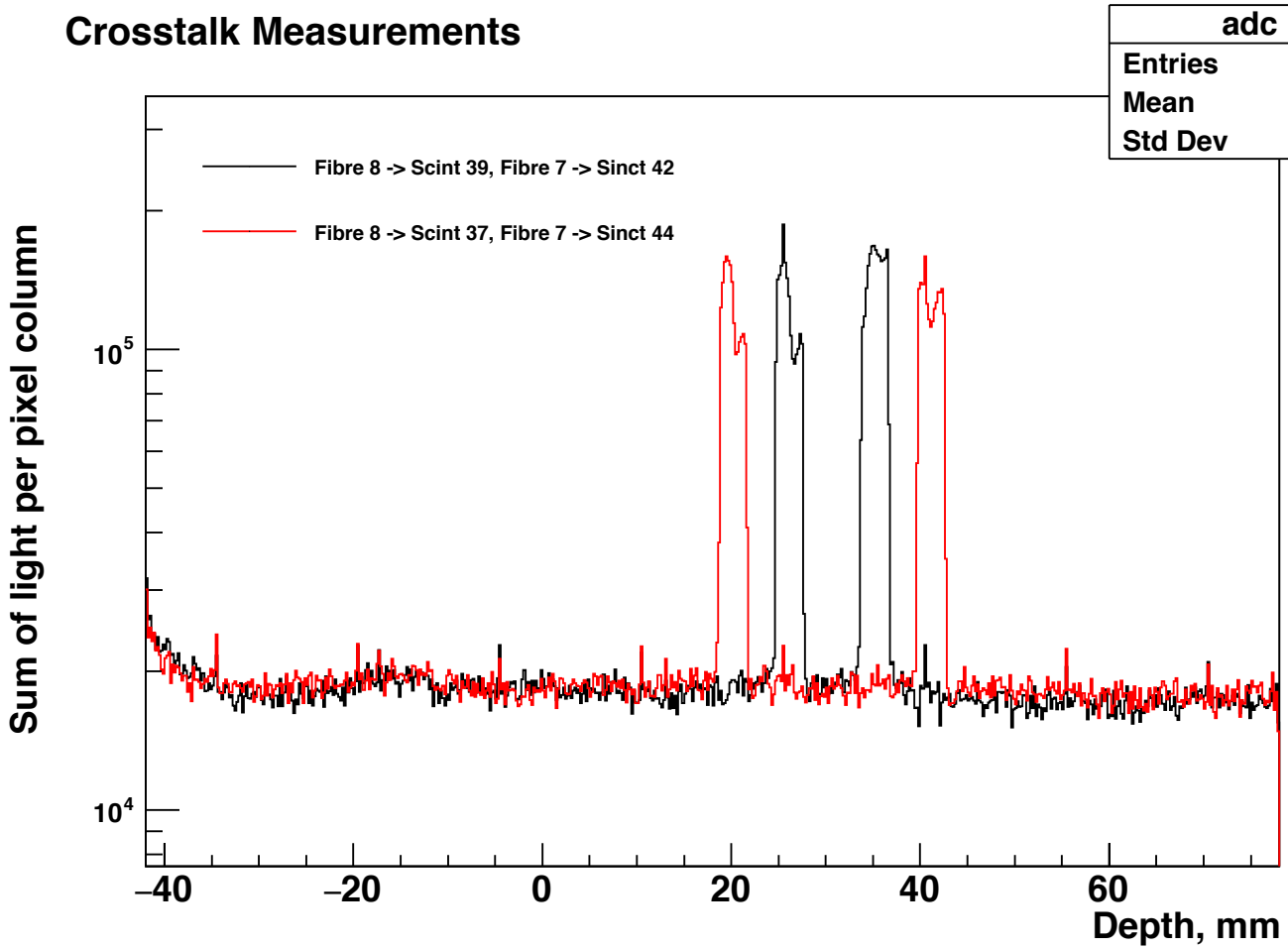
Tests of LED settings matched to PRIAPUS tests



- Camera settings:
  - Exposure: 1 second (to match 1 second PRIAPUS frame)
  - ISO: 800
  - Aperture: f/1.8 (largest possible)

- Factor of ~3.1 increase from changing rate from 10 to 100 kHz (compared to 2.5 for lower LED settings)
- No saturation, but very near (maximum pixel sum = 757, saturation = 765)

Crosstalk tests with 2 fibres



LED settings:

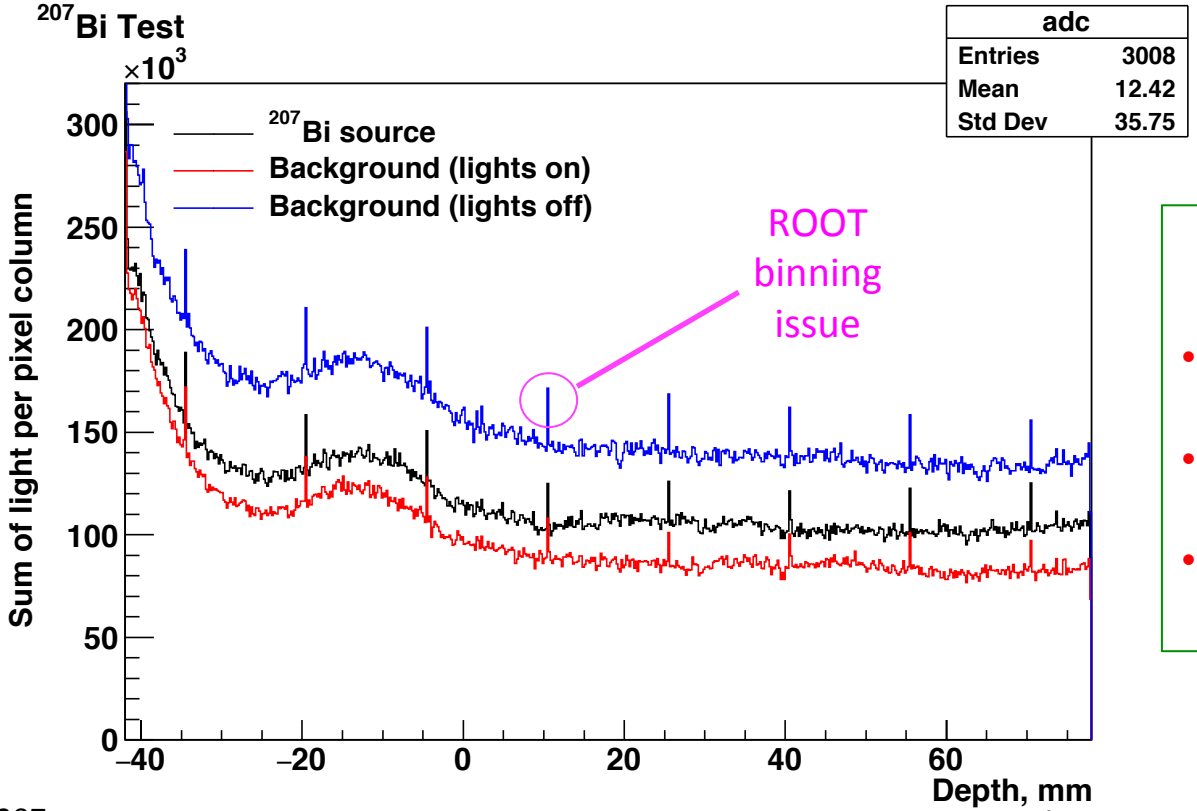
- Same as settings used for PRIAPUS measurements at UCL
- 5 V, 30 ns, 100 kHz

Camera settings:

- Chosen to avoid saturation
- Exposure: 1 second
- Aperture: f/5

- Conclusion: just as with single fibre tests we do not see any crosstalk!

^{207}Bi Tests



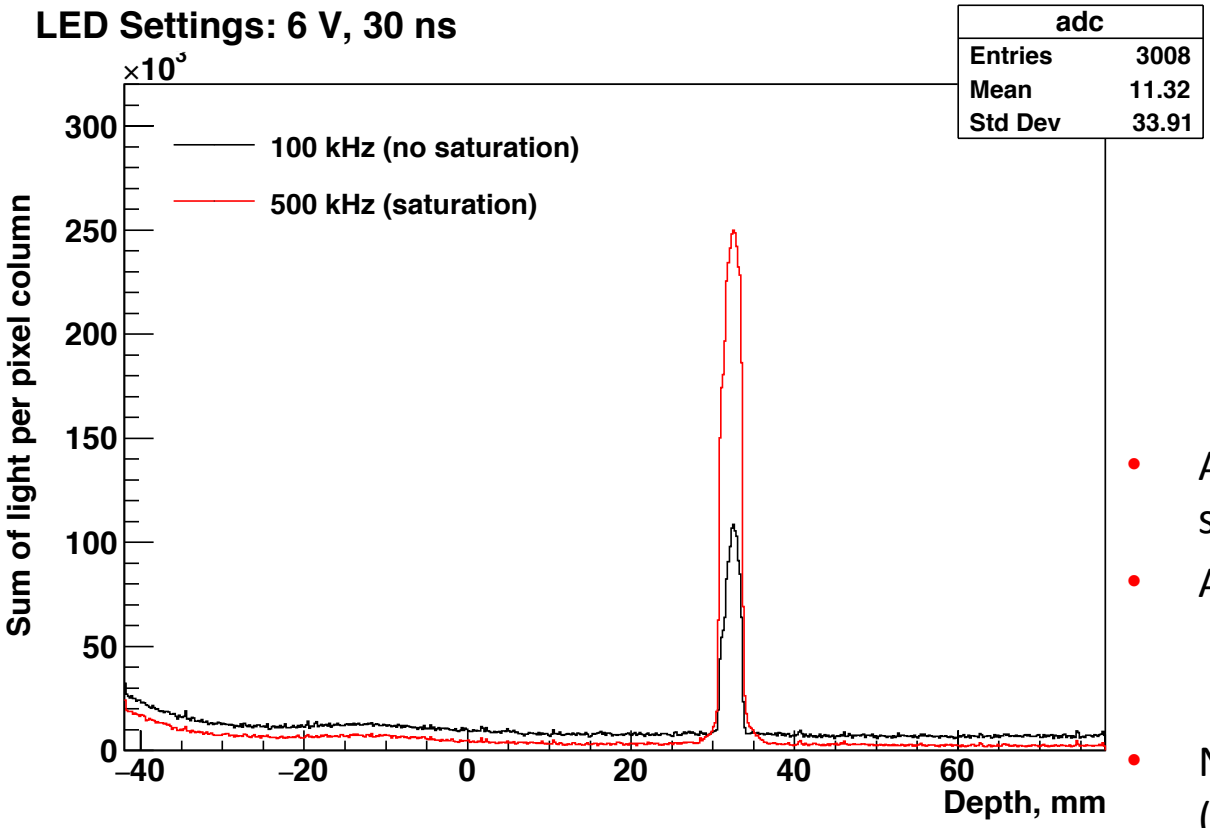
Camera settings:

- Exposure: 30 seconds (maximum)
- Aperture: f/1.8 (largest possible)
- ISO: 1800 (most sensitive to light)

- ^{207}Bi source placed against right side of stack edge (from camera's perspective)
- All camera settings set to extremes to allow in as much light as possible
- Background measurement taken on a different day to ^{207}Bi, with slightly different lens focus settings and without the scintillator stack
- Conclusions:
  - We do not see any signal from ^{207}Bi
  - What gives us the background shape we see?
  - Why is there more background with lights off?!

Tests with LED settings to match PRIAPUS saturation

- LED settings for tests carried out at UCL with PRIAPUS were set to NOT saturate the sensor
  - Data was not taken above LED 5 V, 30 ns and 100 kHz, at which there was no saturation
  - Increase LED settings to those which would presumably saturate PRIAPUS: 6 V, 30 ns



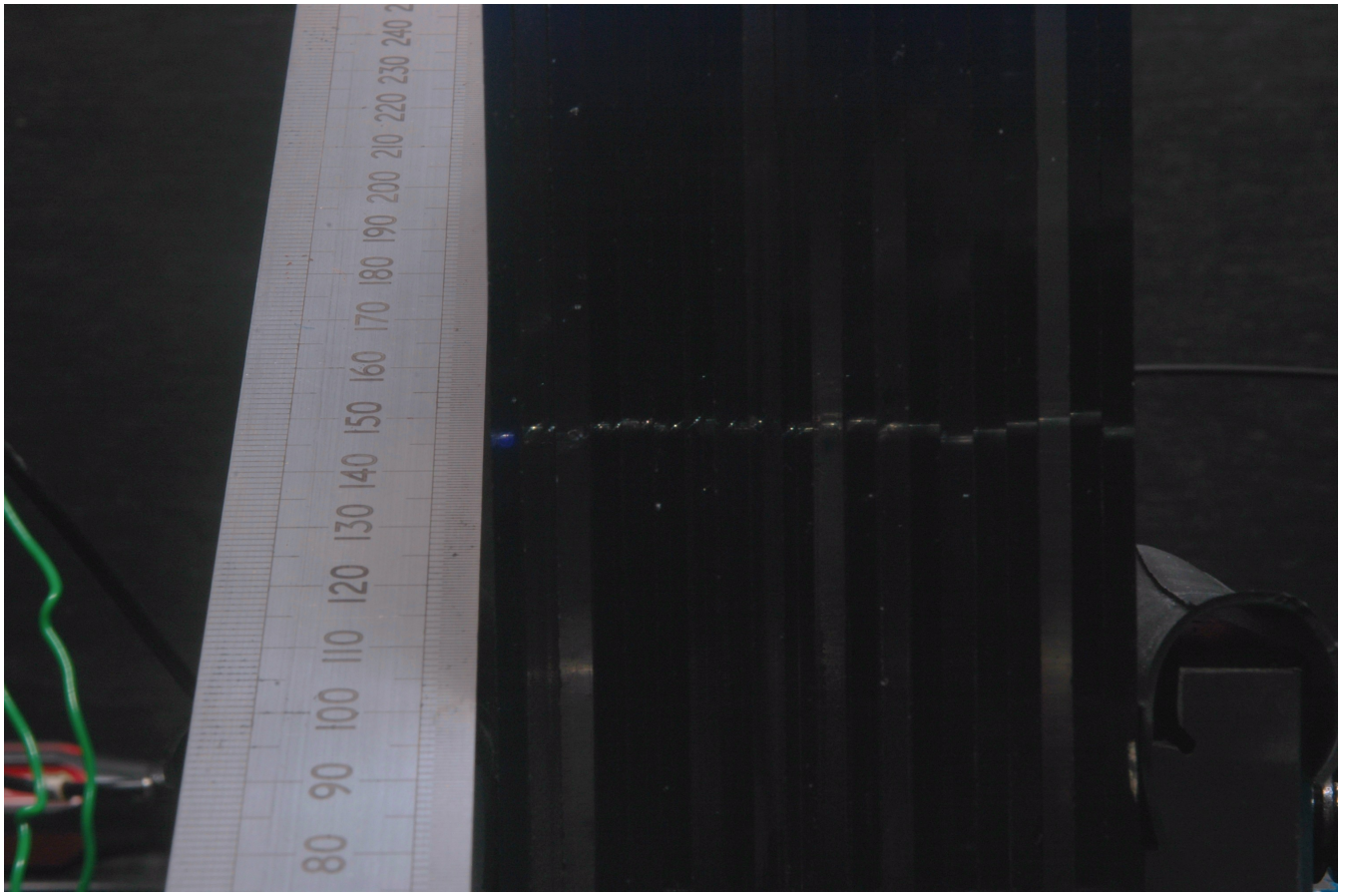
Camera settings:

- Exposure: 30 seconds
- Aperture: f/22 (smallest possible aperture, best for focusing)
- ISO: 200 (least noise)

- At 6 V, 30 ns, 100 kHz – no saturation
- At 6 V, 30 ns, 500 kHz – saturation
  - Can reduce exposure to avoid saturation
- No saturation seen with maximum (and above) PRIAPUS LED settings

Focusing on the middle of the scintillator plane

- Carry out tests to determine the focus setting on the lens in order to get the focus in the middle of the scintillator stack



- Use a ruler angled at 45° to the scintillator and focus on the value corresponding to the middle of the stack (160 cm)
- Set aperture to smallest setting (f/22) in order to have the largest possible depth of field
- Set ISO to smallest noise setting (200)
- We were able to focus on the middle of the scintillator plane with a focus of 3 (yellow numbers along the rim of the lens) using a close up macro lens + 2
- The distance between the lens edge and the scintillator stack is 30.5 cm