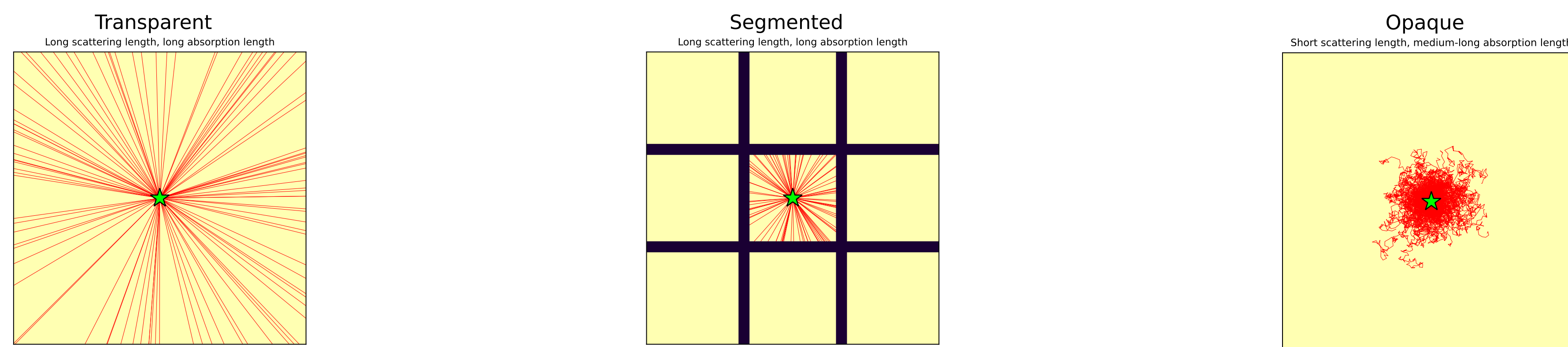


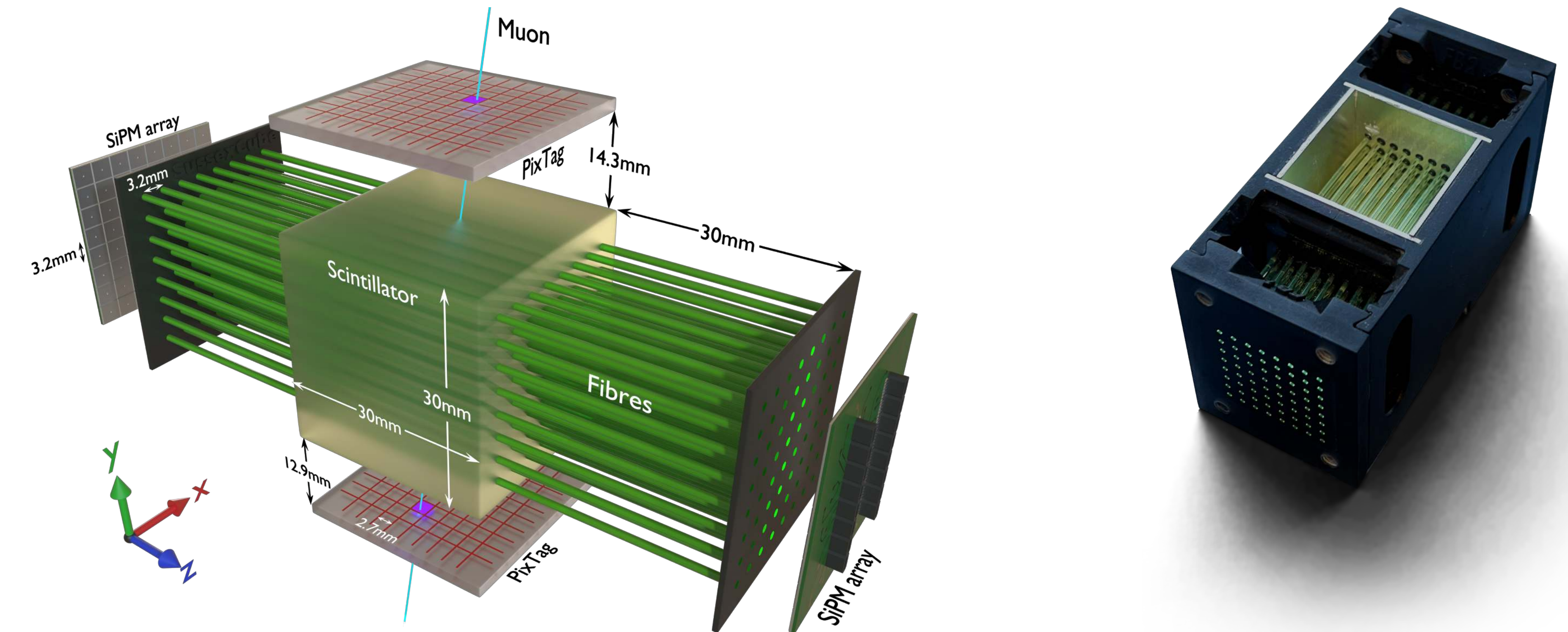
## The LiquidO concept

- **Opaque scintillator** forces scintillation photons to undergo a random walk about their origin: stochastic confinement of light.
- Arrays of **wavelength-shifting (WLS)** fibres pick up and transmit the light to silicon photomultipliers (SiPMs).
- **Excellent position resolution** due to light being confined close to source.
- Confinement of light leads to **preservation of event topology**, which allows strong particle identification.
- Improvements in **detector simplicity, cost** and **active material** proportion.



## 64-fibre Cube: detector

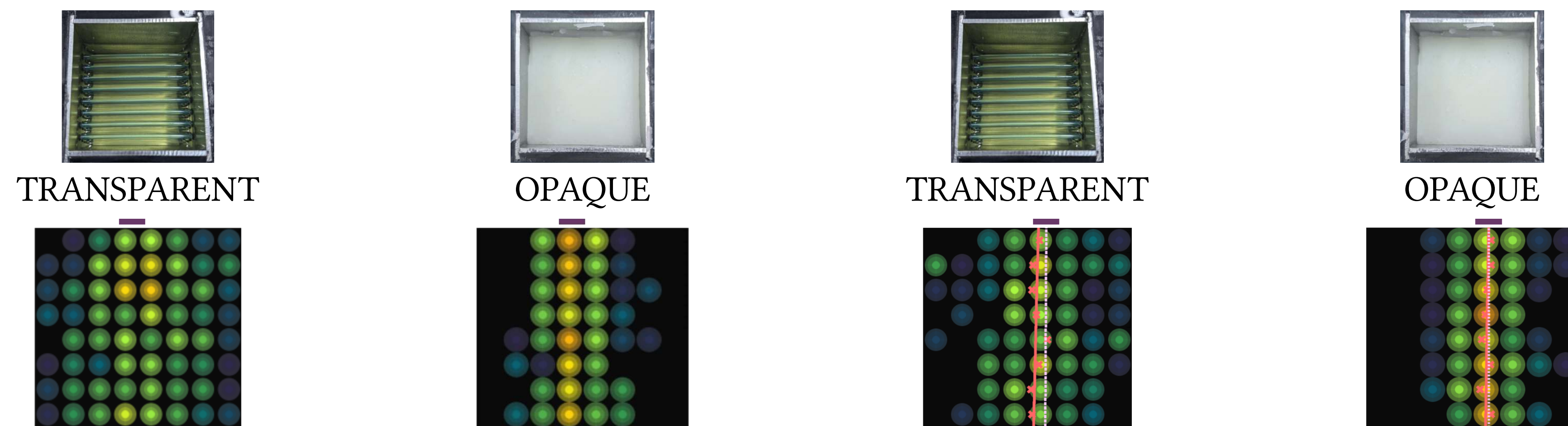
The 64-fibre Cube is formed of a grid of  $8 \times 8$  1 mm diameter WLS fibres, reading out the light from LAB transparent scintillator or NoWaSH opaque scintillator.



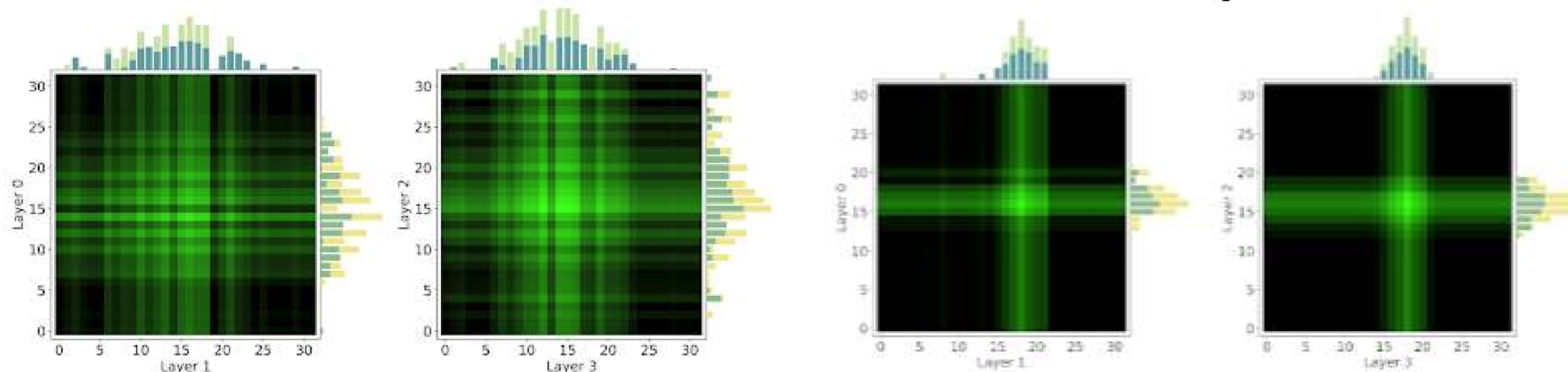
Segmented scintillator “PixTags” are placed above and below for muon selection.

## Event displays

By using muons passing through the fiducial volume as selected by the PixTags, a clear difference can be seen between the transparent and opaque scintillator cases.

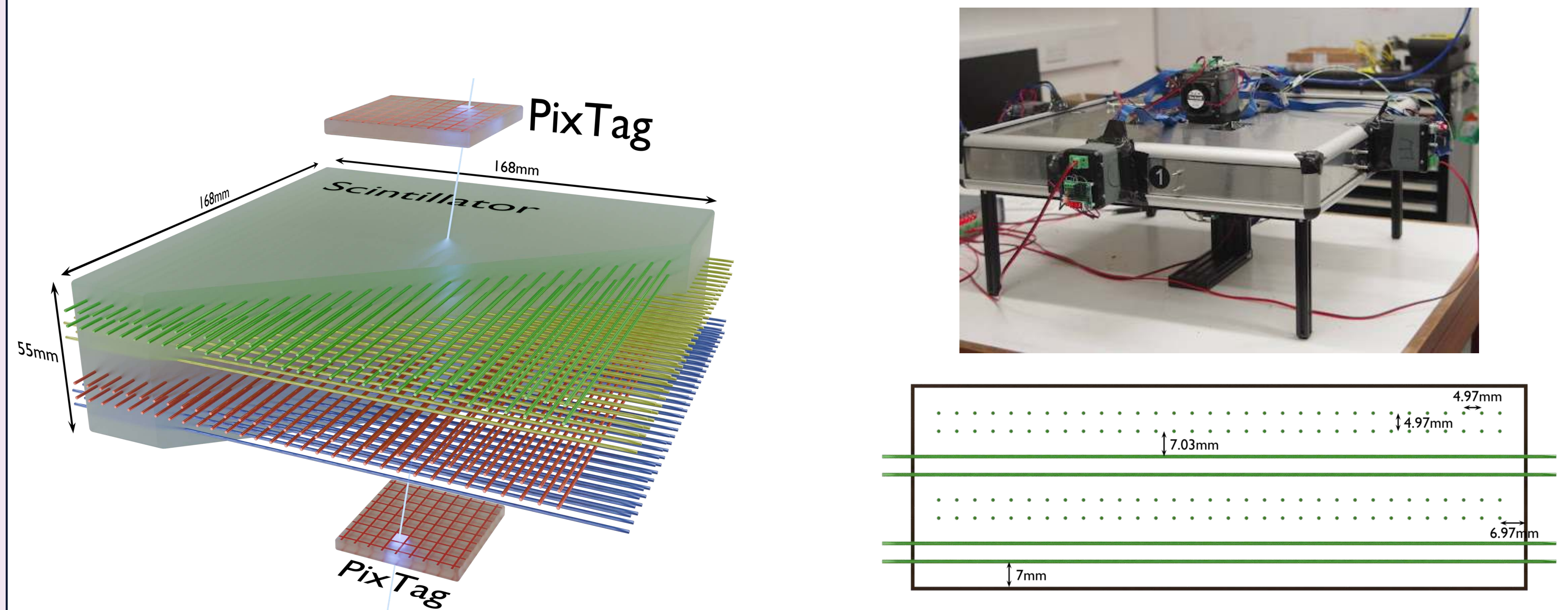


Once again, through-going muons are again used to highlight the stark contrast between the transparent and opaque operation modes of the detector.



## 256-fibre Tile: detector

The 256-fibre Tile is comprised of 8 layers of 32 fibres, alternating direction every two rows. All components are identical to the Cube.



## Conclusions

- LiquidO particle tracking has been demonstrated experimentally, with two separate opaque scintillator detectors.
- The muon position is determined to a resolution of 0.45 mm, which is twice as good as a simple segmented detector. Simulation studies show that this can be further improved (up to 5–10 $\times$ ) by tweaking the fibre pitch and scattering length of the scintillator.
- High purity Michel electron sample selected using characteristic timing and energy signature.
- Event topology of stopping muons and subsequent Michel electrons can clearly be seen in the event displays.