Status of the SciWire

CCAP Plenary Meeting 4

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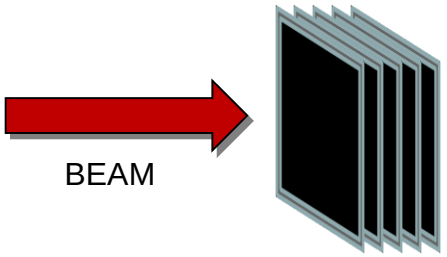
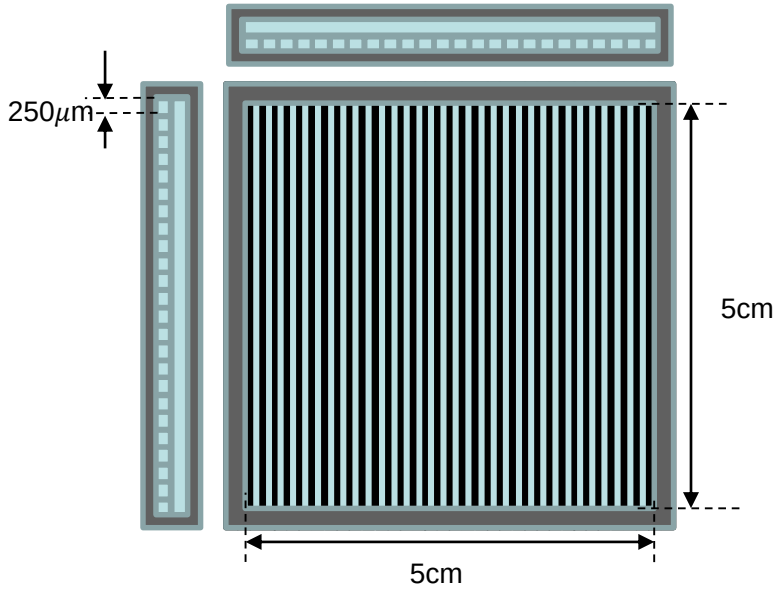
CCAP
Centre for the Clinical Application of Particles

Imperial College London

SciWire - Scintillating Fibre Detector

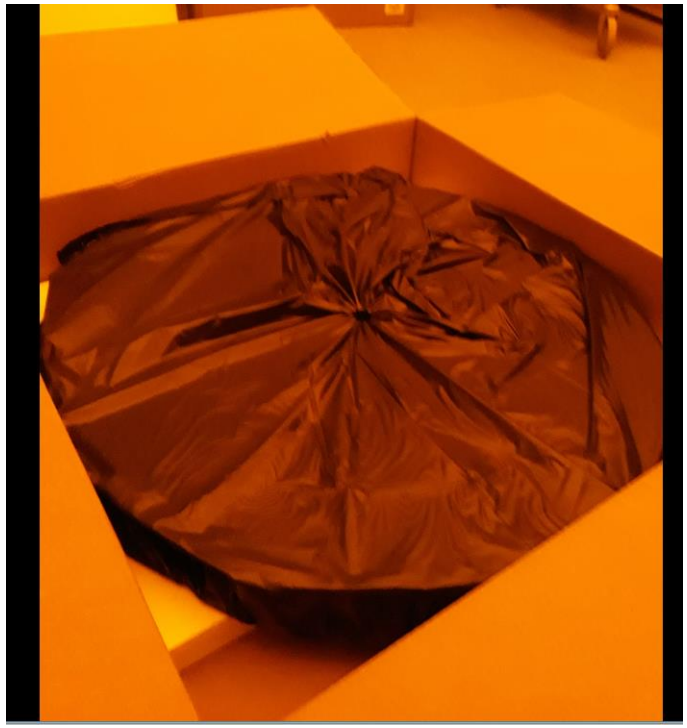
- STFC Impact Acceleration Account grant to develop scintillating fibre detector for low-energy ion beams.
  - Operation of the laser at 10Hz - films not suitable.
  - Online measurements of energy and Intensity profile.
- Plane made of fibres arranged of two layers of fibres perpendicular to each other.
- Detector consists of multiple planes.
- Scintillation light from all planes is read out from one side for each orientation.



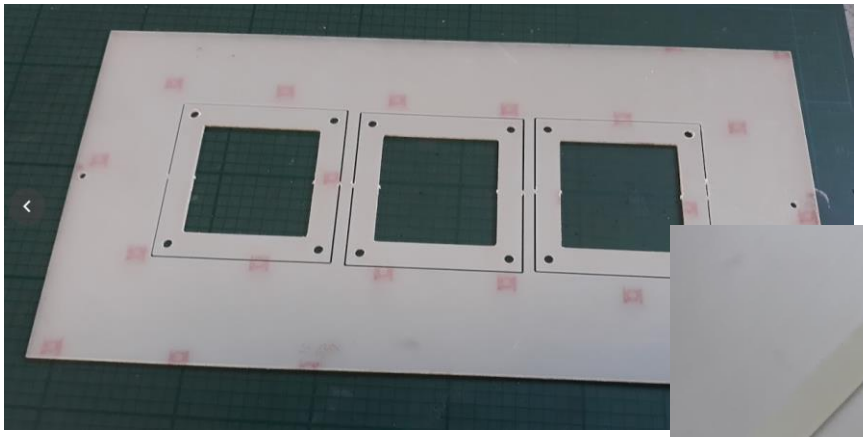


Fibres

- BCF-20 250μm square cross-section fibres manufactured by Saint Gobain.
  - Polystyrene core with PMMA cladding.
  - 492 nm emission (green), 2.7 ns decay time.



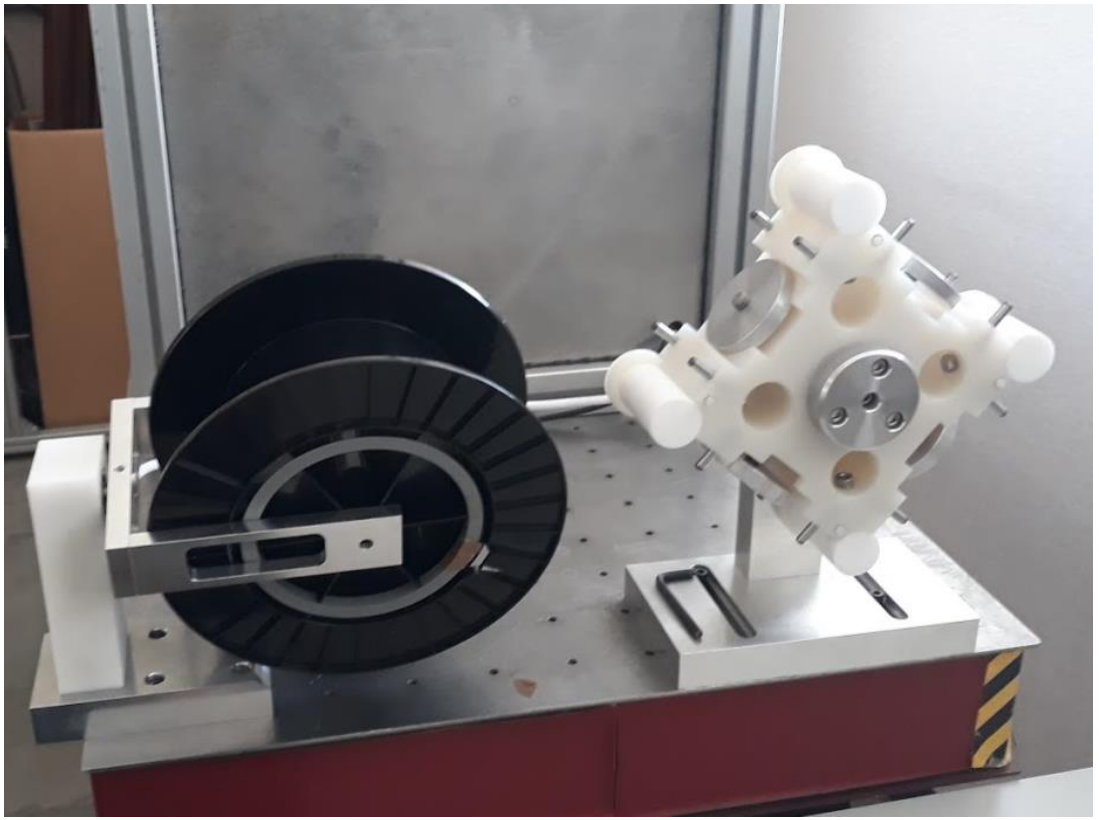
840m on a cardboard spool 76cm diameter.



Frames made of FR4 fibreglass (PCB substrate). 300μm recess milled out for the fibres to sit in.

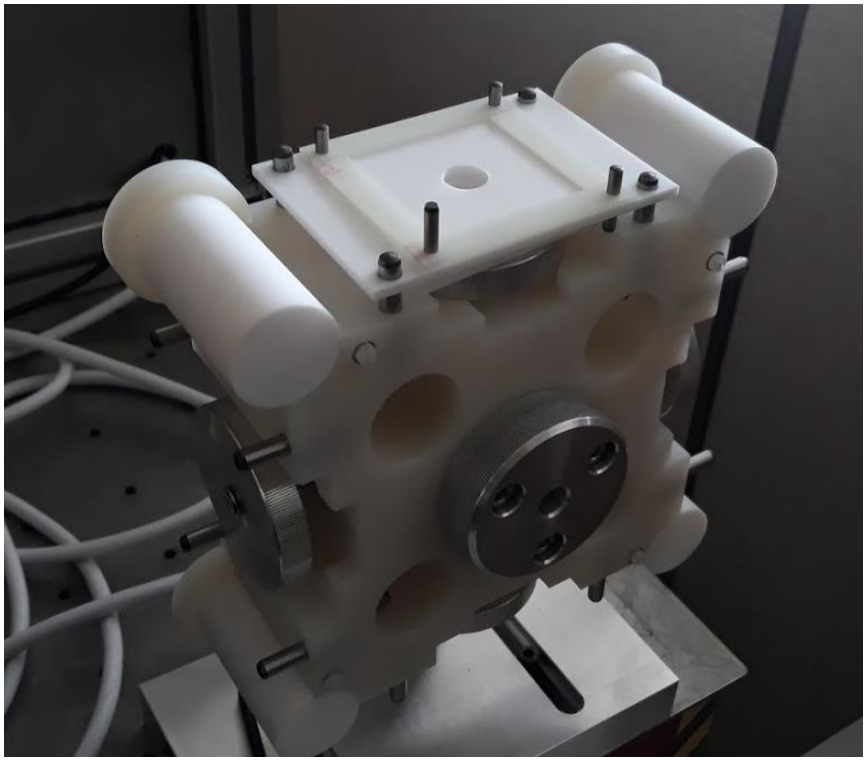
Fibre Winding

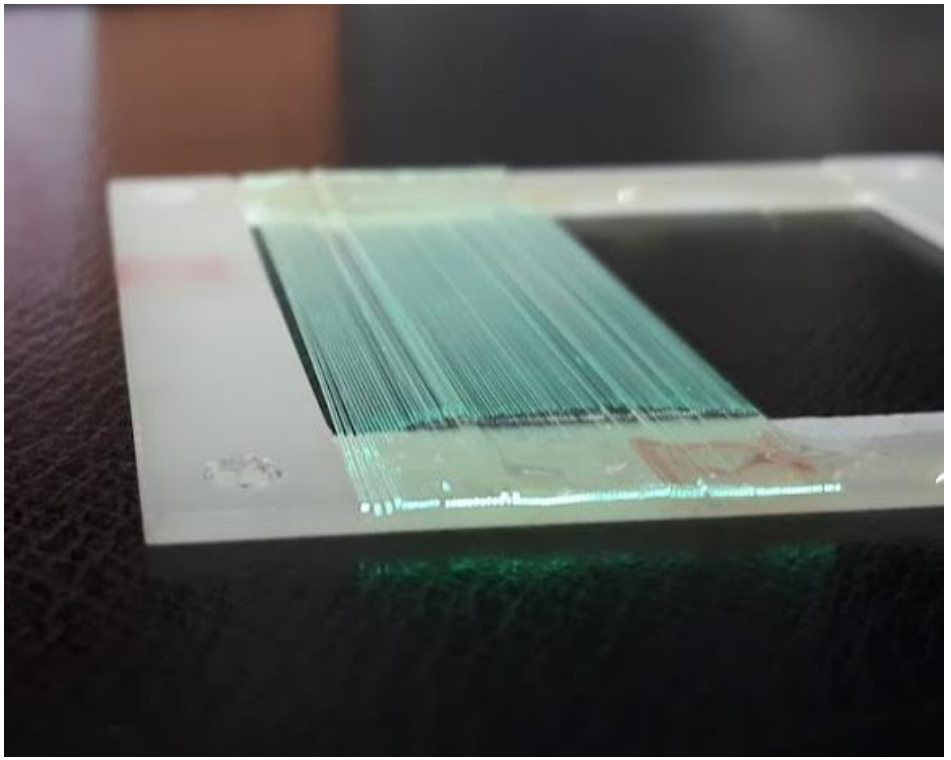
- Rotating spool to take out any twists.
- Jig designed to wind 4 frames at a time.
- Tensioning done manually.



Fibre Winding

- Frames then placed on the winding jig in a lowered position.
- Fibre snapped at random points
  - Possibly due to small defects in the fibre.
- Prototype frames only cover half the width.

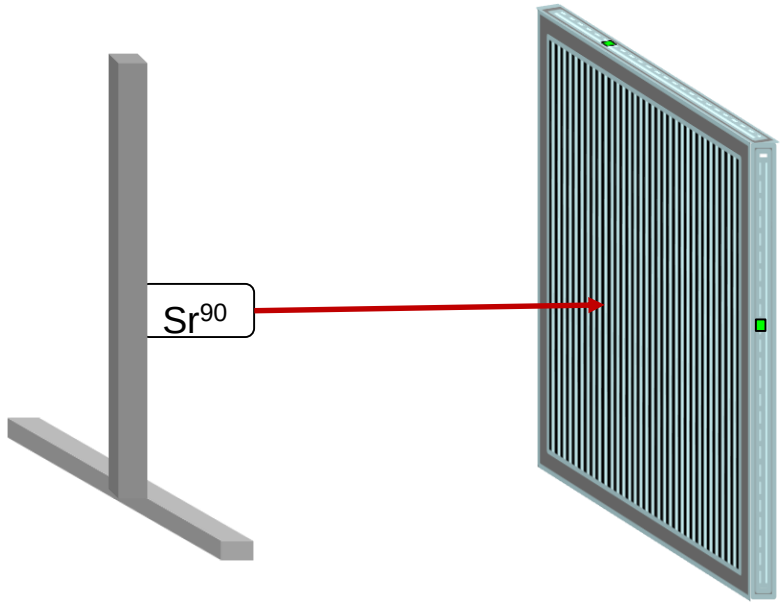




Detector performance characterisation

- Step a Sr^{90} source across face of the detector, positioning the source at the centre of a pair of x and y fibres.

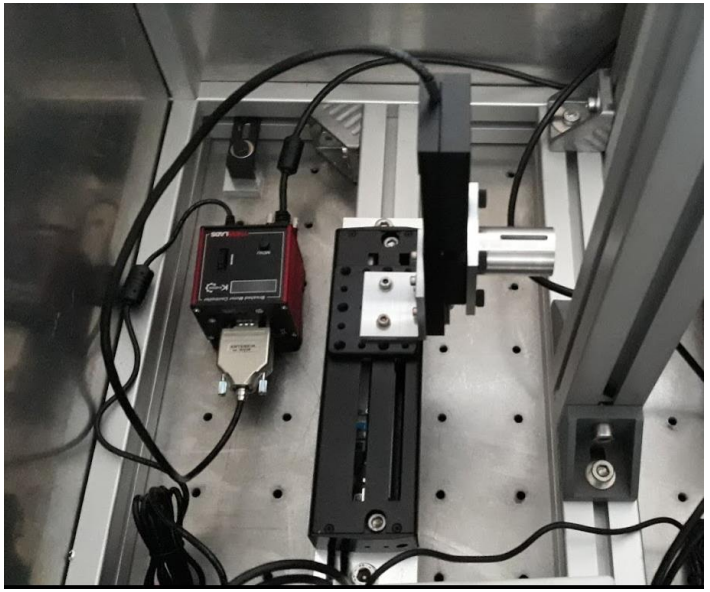
- Measure.
  - Position resolution.
  - Cross-talk.



- Possibility of dose profile measurements.

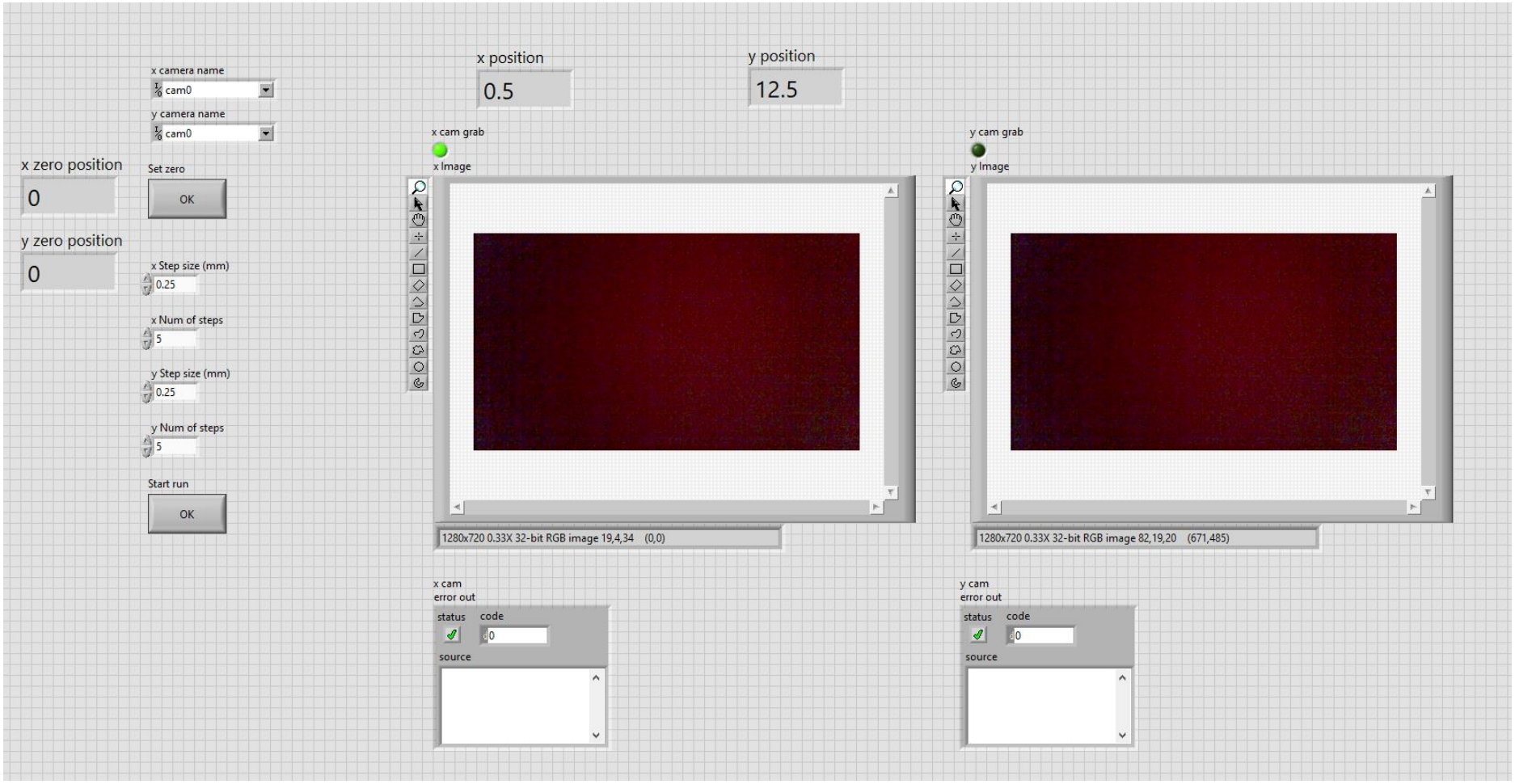
Detector performance characterisation

- 2 linear drive stages from Thorlabs mounted perpendicular to each other.
- 2 FLIR Chameleon-3 USB cameras.
- 1.7MBq Sr-90 source



Controls and Monitoring

- Labview used with the .NET interface to Thorlab's software for the stages and the NI-IMAQdx interface for the cameras.



Diagnostics workshop

- 19th of March held a half-day workshop on low-energy ion beam diagnostics.
  - http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/naturalsciences/physics/clinicalapplicationofparticles/eventssummary/event_14-2-2019-18-5-47
- The workshop had an interdisciplinary mix of 20 participants from UK and German universities, national labs, and industry.
- Talks on specific projects and discussions that explored the common needs of existing and future facilities; issues with current technologies; and new areas of detector development that are under investigation or being planned.
  - New collaborations to be developed.
- Tour of the laser lab, Gabor lens and SciWire.

Summary

- Parts manufactured and winding of prototype frames complete.
  - Learnt important details about the winding procedure.
- Controls and monitoring software being written in Labview and will be installed on the DAQ laptop.
- Radiation tests.
  - Paperwork updated due to lab move.
- Acknowledgements.
  - Big thank you to the Dan and Ian in the workshop.
  - Thanks to Vera, et. al and Johan.
  - Thanks to everyone who helped with the workshop.