Status of the SmartPhantom and Future Plans

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SmartPhantom Concept

SmartPhantom consists of several scintillating fibre stations in series.

- Idea is to measure the energy deposition at several locations to estimate Bragg Peak to then estimate the energy deposition at the location of cell samples.
- Utilises 250 μm cylindrical fibres.
- A station consists of two planes oriented 90° with respect to each other.

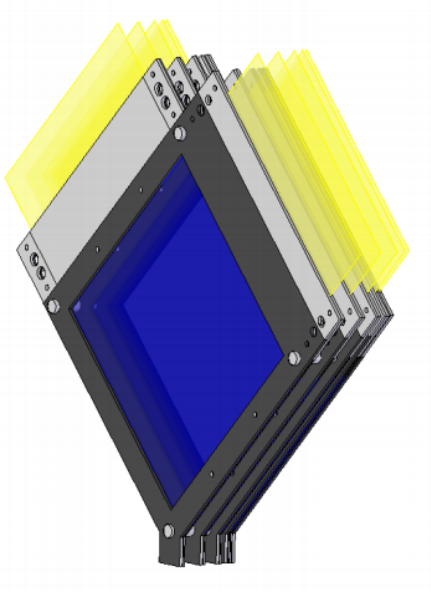
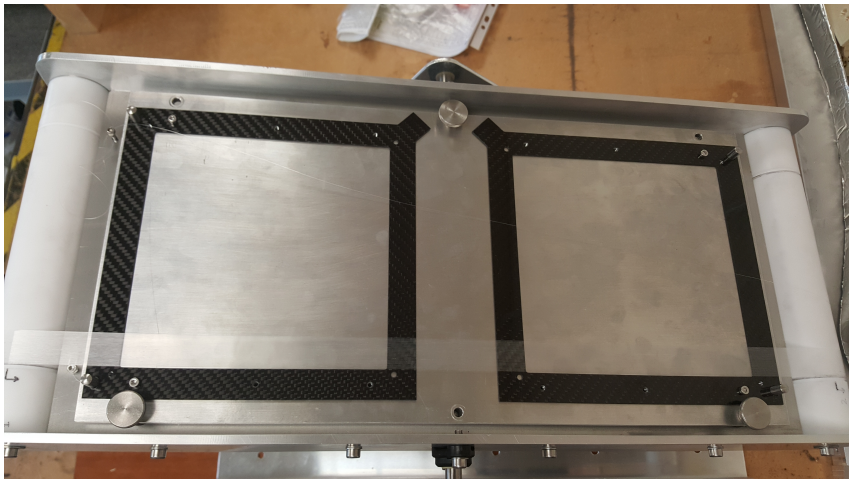


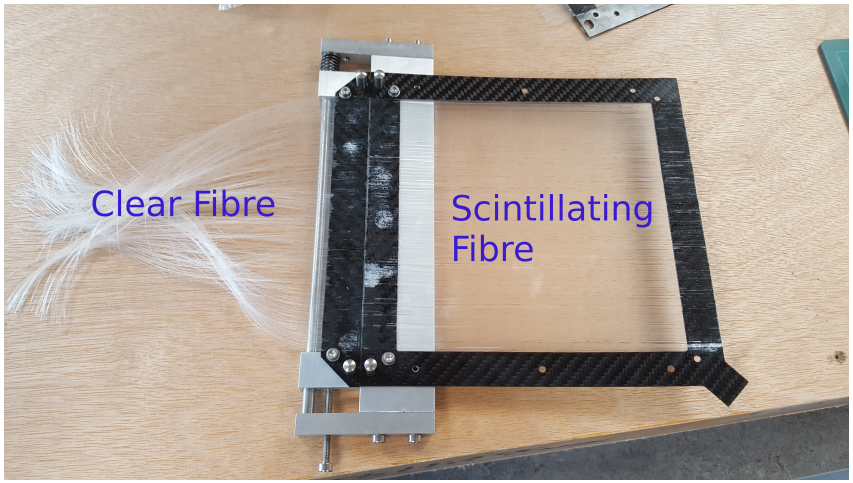
Figure: Initial concept of SmartPhantom planes.

SmartPhantom Concept

Liam designed a winding jig for winding fibres:



Liam also designed an alignment jig to connect clear fibre to scintillating fibre:



The clear fibre will be bundled and imaged by a camera.

Issues

- Tests with a Sr-90 source with SciWire (scintillating fibre detector but different application to SmartPhantom) failed to obtain a signal.
- Prototypes of SmartPhantom frames with fishing wire revealed problems with tension and alignment.

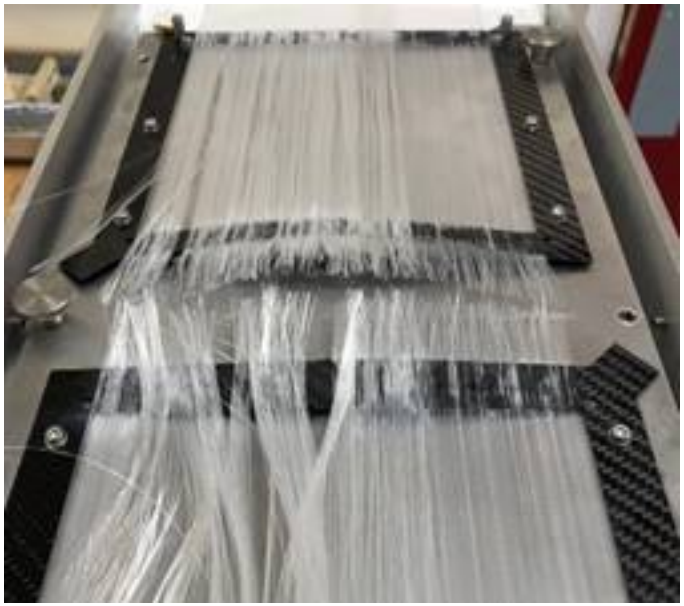


Figure: Tension issues in first prototype.

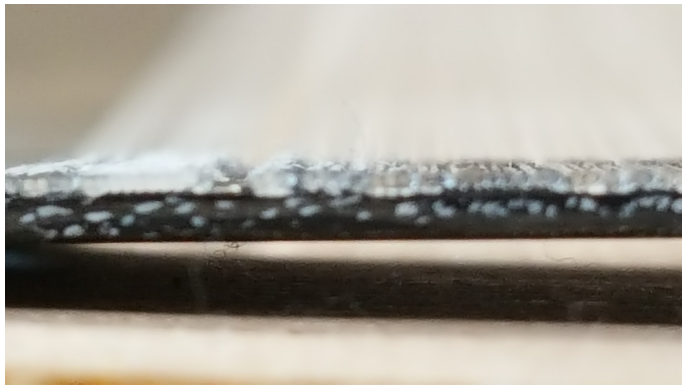


Figure: Blurry picture showcasing some clumping of wires in second prototype.

Issues cont.

Third prototype was made making edits to resolve tension and alignment issues:

- Winding jig was modified to prevent movement when gluing fibres to frame.
- Gluing method was refined to further prevent fibre movement.
- No tensioner used to keep tension low.
- Frame aperture was changed to be smaller and circular.

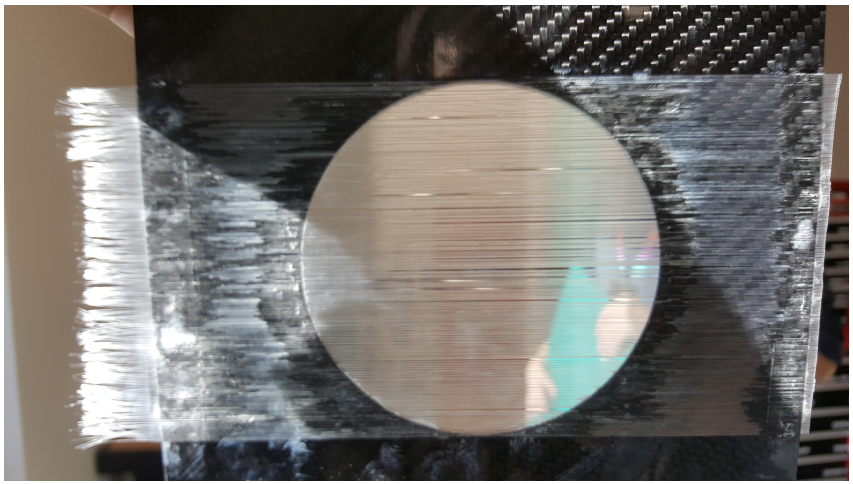


Figure: Third prototype with smaller aperture.

Issues cont.

The third prototype worked but several issues afterwards were noted:

- We had used superglue for gluing fishing wire to frame for the prototype but this has potential issues with the scintillating fibres and was brittle $\Rightarrow$ Use Araldite (Epoxy Resin)
- Frame aperture reduction limits its usage $\Rightarrow$ Increase circular aperture while also increasing frame thickness
- Polishing of the ends was poor $\Rightarrow$ Introduce a recess to pot in resin
- Just prototyping with fishing wire may be introducing issues which may not be present with real fibres $\Rightarrow$ Make prototype with actual fibres

Going Forwards

Will make a fourth prototype as specified in previous slide:

- However, even if this prototype has no issues, we need to purchase more fibre for actual SmartPhantom frames.
- Order was placed 28/10/2019, but there is a 6-8 week lead time.

In parallel, we want to to check the scintillating fibres work with charged particles:

- Will test the Sr-90 source on a single fibre to make sure we can get a signal.
- Also gives us the opportunity to verify several aspects of the camera readout.