

SmartPhantom Meeting

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SmartPhantom is proposed to be an instrumented phantom:

- Several scintillating fibre stations in series will measure the energy deposited.
- Consists of 250 μm fibres
- A single plane consists of 982 of such fibres, with a station consisting of two planes oriented 90° with each other.
- Infer information both on-line as well as through more detailed off-line analysis.

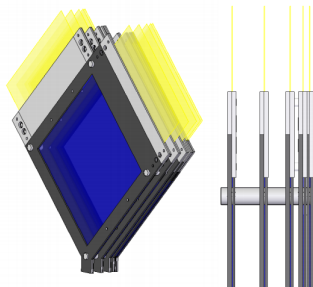
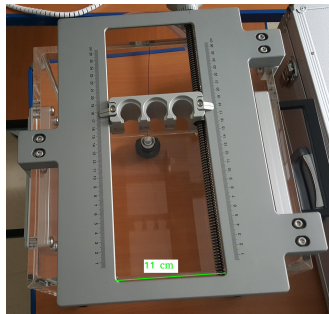
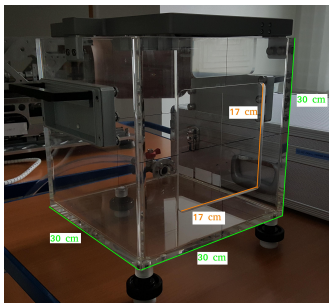


Figure: Not the latest design for the frames.

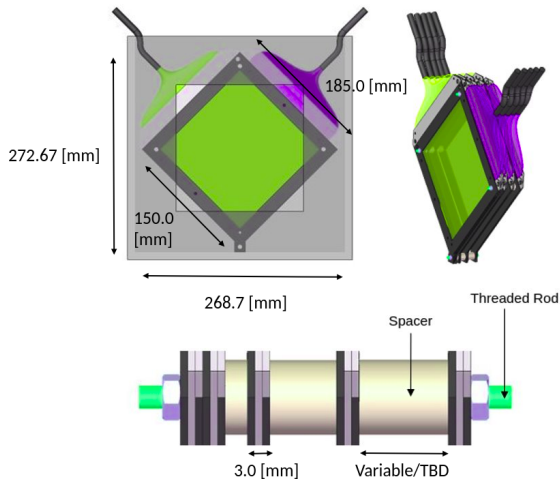
Water Phantom Dimensions

The dimensions of the water phantom as we understand are:
(PTW Water Phantom T41023)



SmartPhantom Dimensions

Current dimensions for the SmartPhantom planes for the prototype:



Can be adjusted as necessary.

Impact of Scintillating Fibres

Effect of the presence of the planes based on Geant4 simulations for protons (similar for carbon-ions):

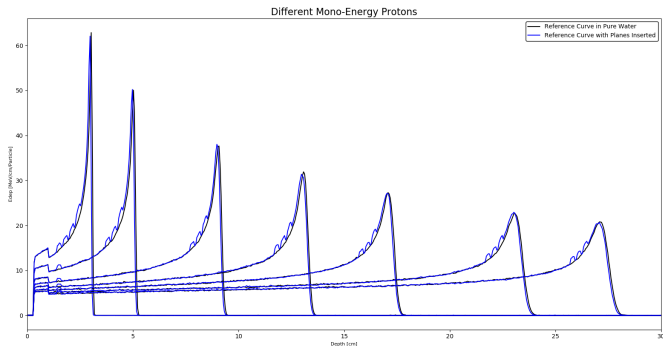


Figure: (Simulation) Comparison of the energy deposition of multiple energies of proton in a pure water phantom (black curve) against the energy deposition with four layers of 250 micron scintillating fibres present (blue curve). The initial bump at the start is due to the walls of the water phantom.

- To readout the scintillating fibres, each fibre is connected with a clear fibre.
- The bundle of clear fibres will then be imaged by a camera.
- The controls/triggering for the camera will be controlled with LabVIEW code which is being developed.
 - LabVIEW can provide a GUI for the user.
- Images will be analysed with code to determine the light yield which can then be converted into energy deposition.
- Hoped that on-line analysis can provide user average energy deposited for each beam spill for monitoring purposes.

Possible Analysis Results

- May be possible to reconstruct the energy deposition curve based on the measurements:

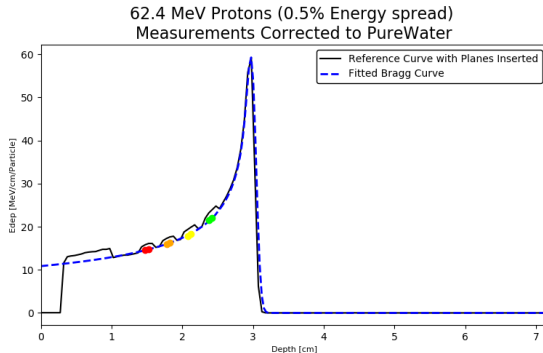


Figure: (Simulation) The black curve is the energy deposition from a simulation (i.e. what one would measure). The coloured points are what is measured. The curve in blue is fitted Bragg peak to the 8 measured points.

Possible Analysis Results

In principle, this should work for all energies: (as well as carbon-ions)

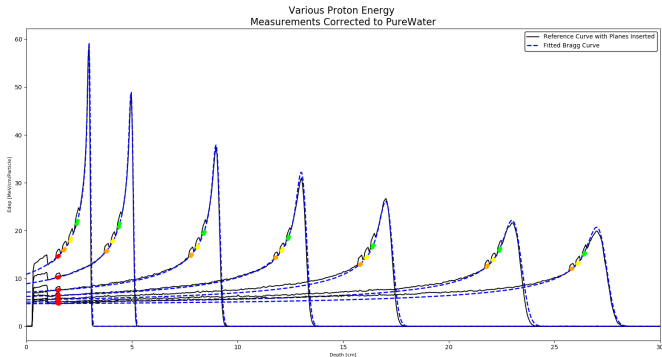


Figure: (Simulation) The black curve is the energy deposition from a simulation (i.e. what one would measure). The coloured points are what is measured. The curves in blue are fitted Bragg peak to the 8 measured points.

Possible Analysis Results

Would also be able to measure the beam profile:

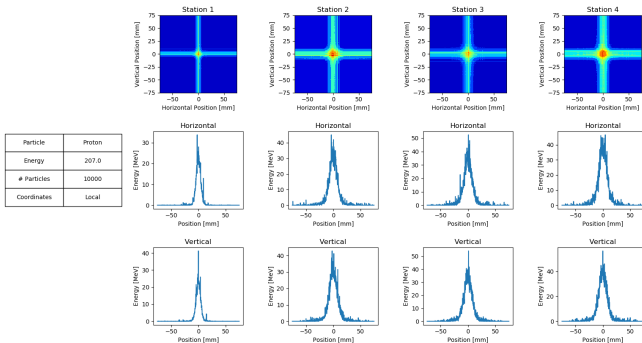


Figure: (Simulation)

Could try to match profiles to simulations to get location of dose deposits in cell samples.

- It is expected that the assembly of the jig will be finished near the end of August.
- In parallel, code for the readout of the clear fibres from cameras will be developed combined with various analysis codes.
- Manufacture and prototyping of the detector planes using a collimated Sr-90 source will take place from the end of August to early October.
- These detector planes will then be brought to MedAustron to be used in shifts taking place from October onwards.