Possible Monash involvement in TORCH

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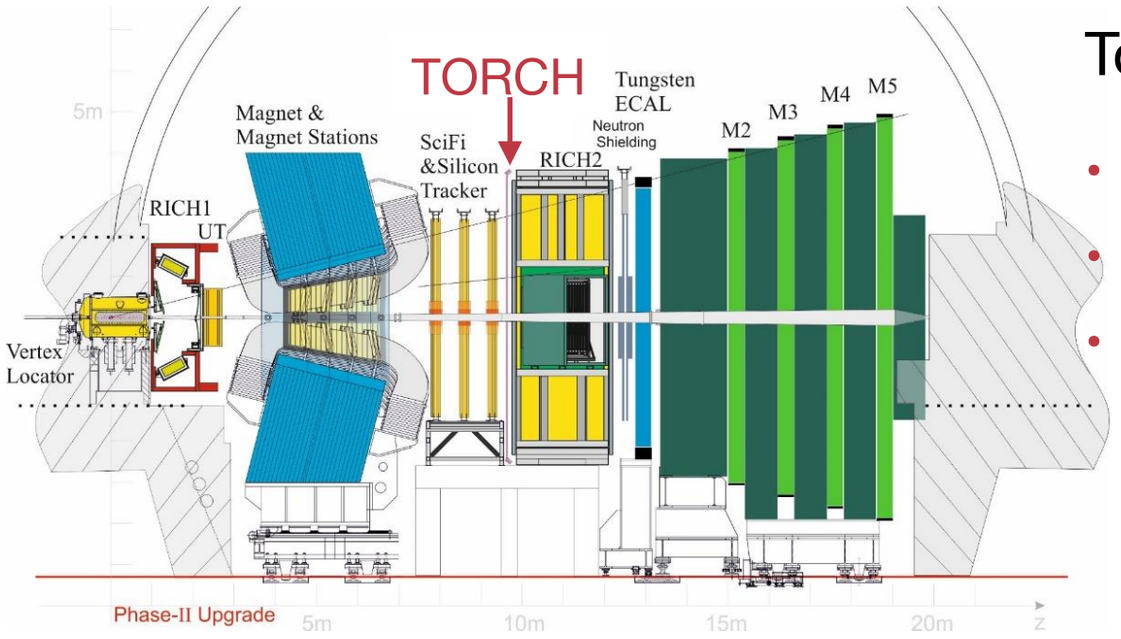
Motivation

- The Monash group are looking to build a long term involvement in an upgrade project
  - Particularly interested in a ***hardware focus*** to make the most of facilities we have available
- We've been in discussions with the TORCH collaboration to identify areas in which we could contribute



Today I'll briefly summarise areas we've discussed

- Measuring Quartz properties
- Investigating the use of Silicon Photomultipliers
- Contributing to Simulation and Reconstruction efforts

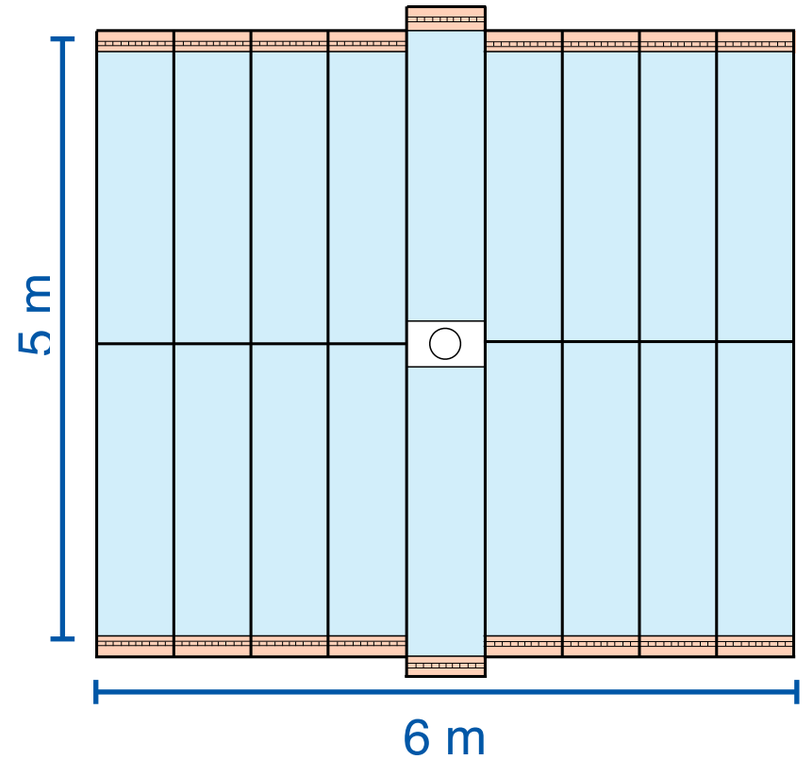
For a comprehensive overview of the TORCH detector, see the talk from last MWA meeting [here]

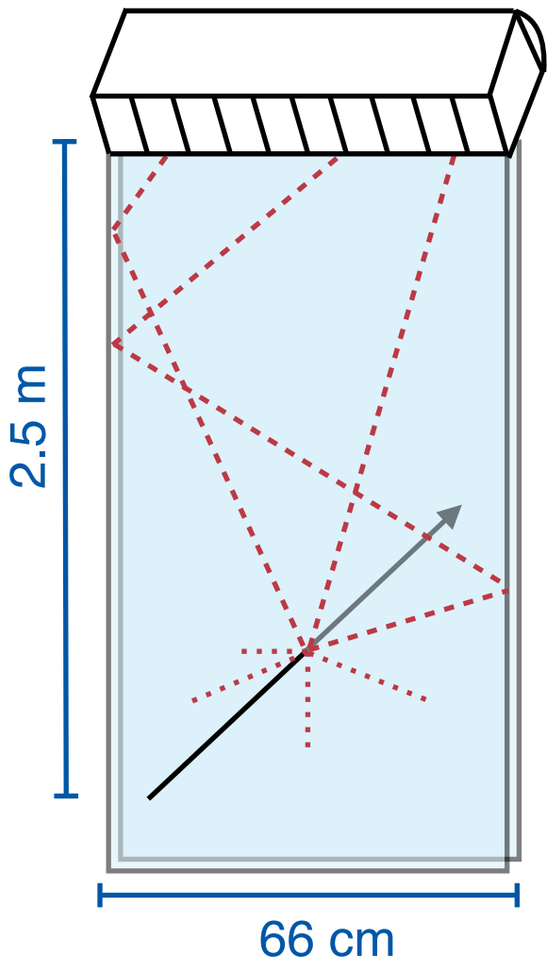
Quartz properties

- The TORCH modules are constructed from large plates of fused silica (quartz)

- Accurate measurements of the quartz properties are required

  - Surface roughness
  - Smoothness
  - Refractive index variations





- We've been investigating whether some of these measurements could be performed here at Monash

  - e.g. using Atomic Force Microscopes

- The logistics of performing measurements (e.g. getting quartz here etc.) still been understood

Silicon photomultipliers

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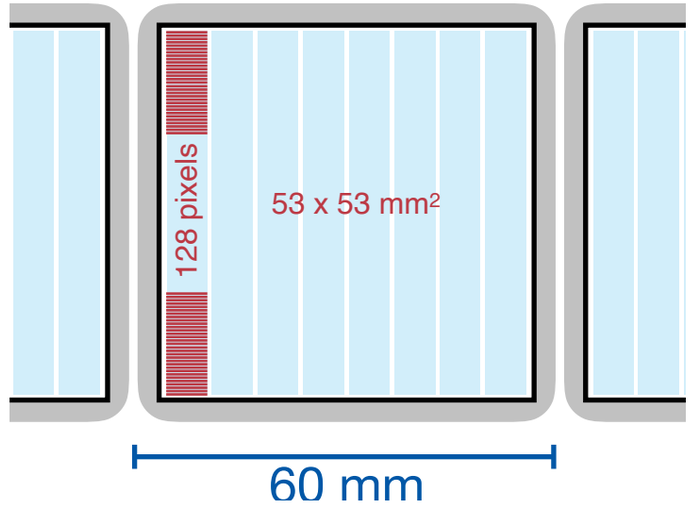
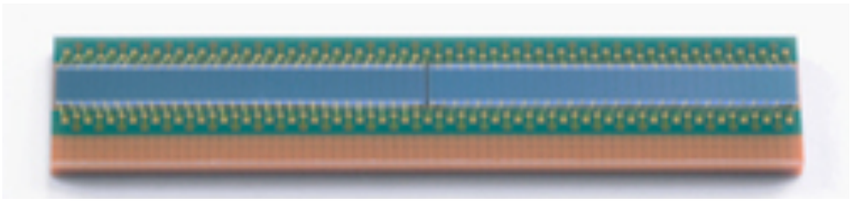
- The current TORCH design used Multi-channel plate Photomultiplier tubes to detect the Cherenkov photons
  - Aim for a single photon resolution of 70ps



- There is interest in looking at ***Silicon Photomultipliers*** as an alternative technology
- It would be useful to quantify the **timing resolution** of SiPMs to understand if they are competitive



Hamamatsu SiPM used in the SciFi Tracker

- Requires performing tests of a prototype using a pulsed single-photon source
- Longer term project
- Would require setting up our own lab space

Simulation and reconstruction

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- In the shorter term we are interested in contributing to **software tasks** in which we might be able to get started more quickly

Simulation

- The current simulation models of TORCH don't include the ***mechanics and infrastructure***

- Potential contribution could be helping implement the support structures in DD4Hep model

Reconstruction

- Current reconstruction algorithms are slow and various optimisation techniques are being investigated

- Potential to investigate alternative algorithms or if GPUs can speed up the reconstruction

Outlook

- The Monash group is interested in joining the TORCH collaboration as a longer term project
- Potential to use MWA CoFund opportunities to provide resources for joint projects
- It would be an opportunity to develop hardware projects here at Monash