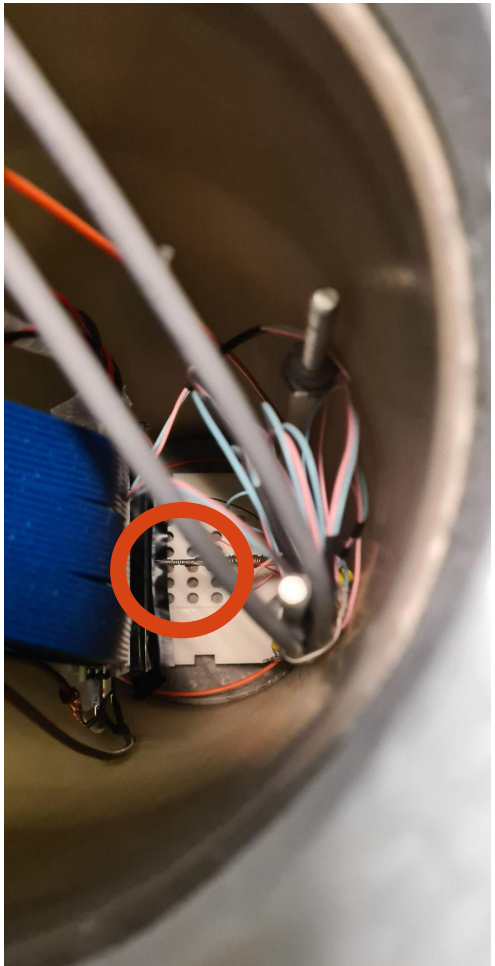
Last tests performed with 16x16 matrix of 1 mm SiPM and 8 Alcors

Silvia Repetto

DUNE - Genova
DUNE - Bologna

12th April 2024

Setup

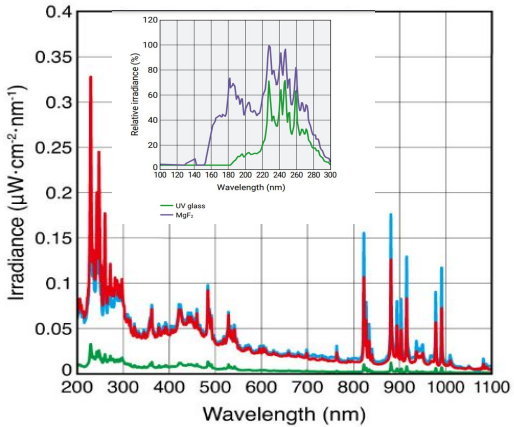


Light source

The source light system is made up of a Xe pulsed lamp at 5 W made by HAMAMATSU, to which is connected a monochromator that gives us the possibility to select a specific wavelength.

In the tests that we present today, we didn’t select a specific wavelength.

As input to the lamp we give a pulse signal with a period of 2 ms.



Measurement conditions

- Tests at room temperature
- We set a threshold of 35 for all pixels in order to avoid dark signal during the tests using the Xenon light source
- Acquisitions were made by testing all chips, activating them one at a time

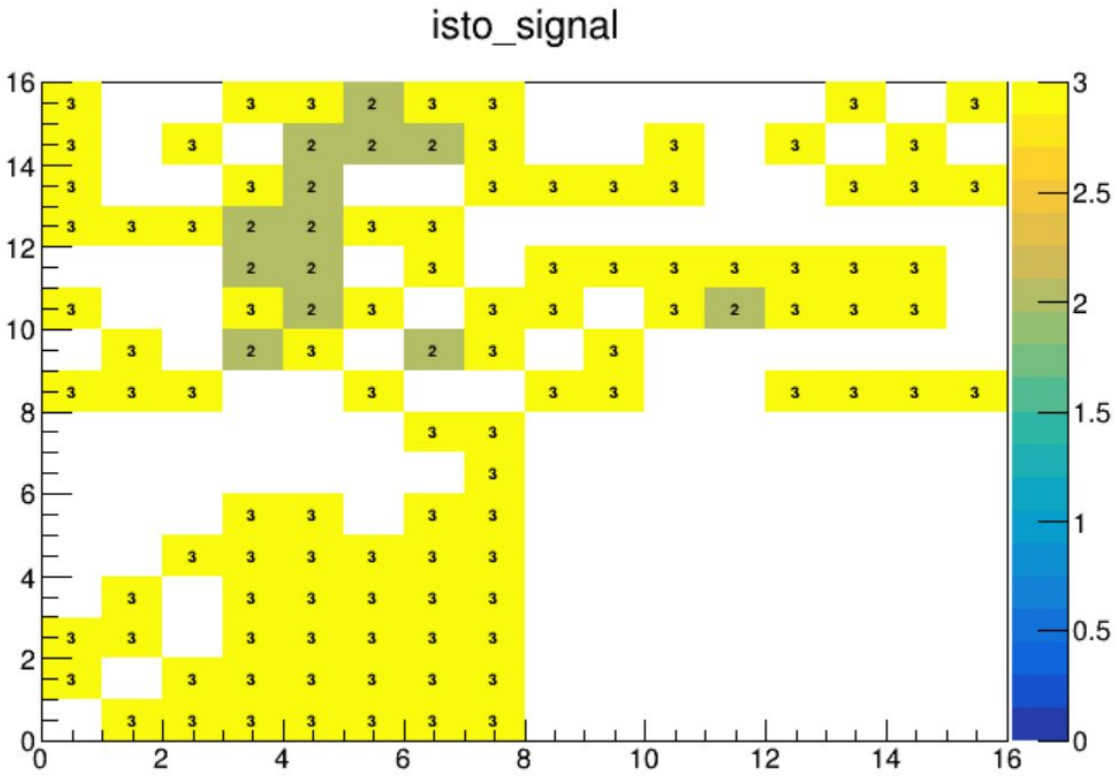
Last tests performed - summary

- Light on all pixels with fiber at 3 cm from the matrix
- Light focused on a side pixel with fiber at 2 mm from pixel 0
- Setup with black screen with a 0.7 mm hole in the center
    1. Measurements with light on and patched hole
    2. Measurements with light on and open hole

Light on all pixels

- The acquisition time set is 50 frames, where each frame lasts for 102.4 us
- To calculate the light signals detected by SiPMs, we look for signals that have a ToT between 400 and 1000 ns and are at an interval of 2 ms (i.e. the period of the Xenon source)
- Since the acquisition time lasts for 5.12 ms, we expect 3 light signals for each SiPM
- In this type of test we have a low reproducibility

Light signals recorded by the SiPMs

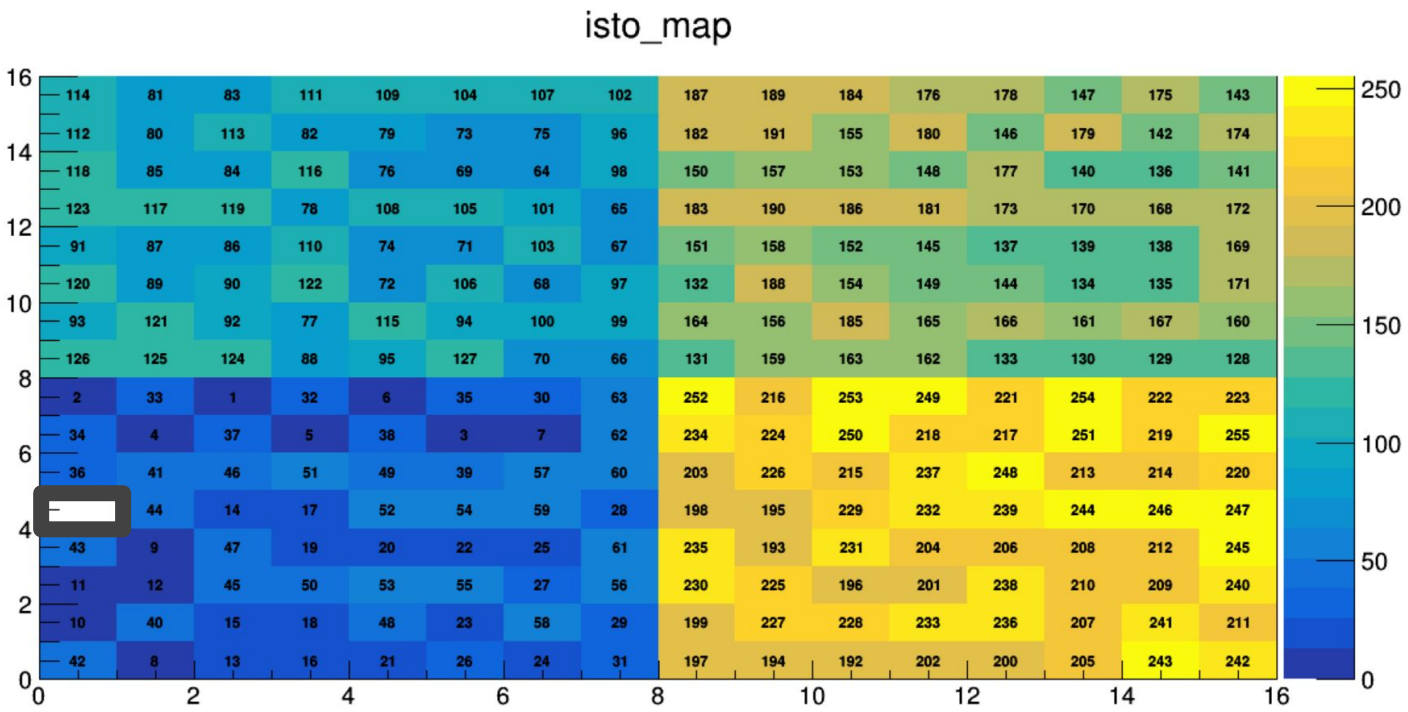


Chip U6, U7 and U8 not acquired - acquisition not completed

111/160 pixels detected light

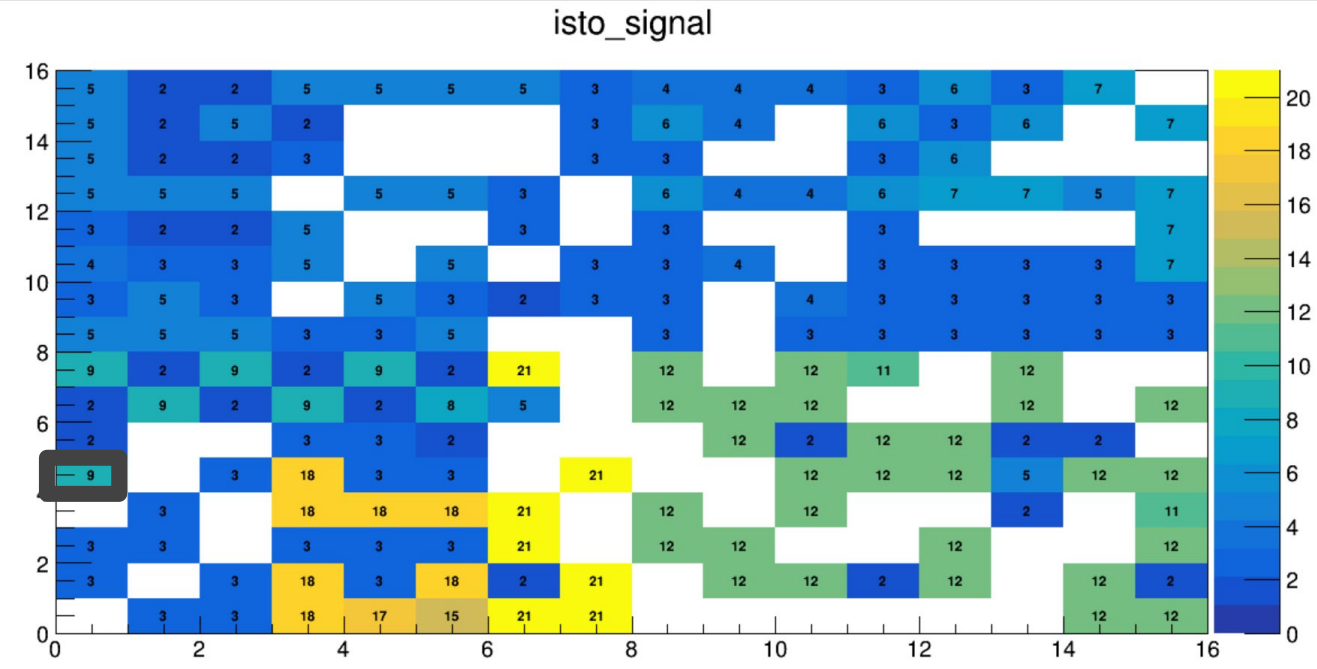
Improving the number of acquisitions we could have more reproducibility

Xenon light centered with respect to pixel 0



The fiber was centered with respect to the pixel of coordinates (0,4) and all the pixel was set to a threshold of 35

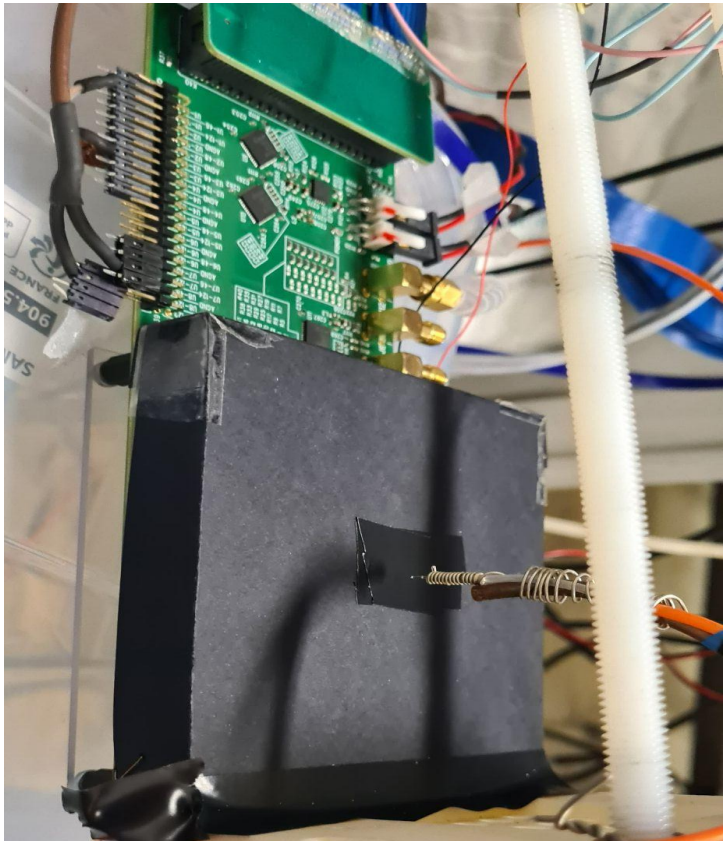
Xenon light focused on pixel 0



Even pixels far away from the fiber register 3 light signals

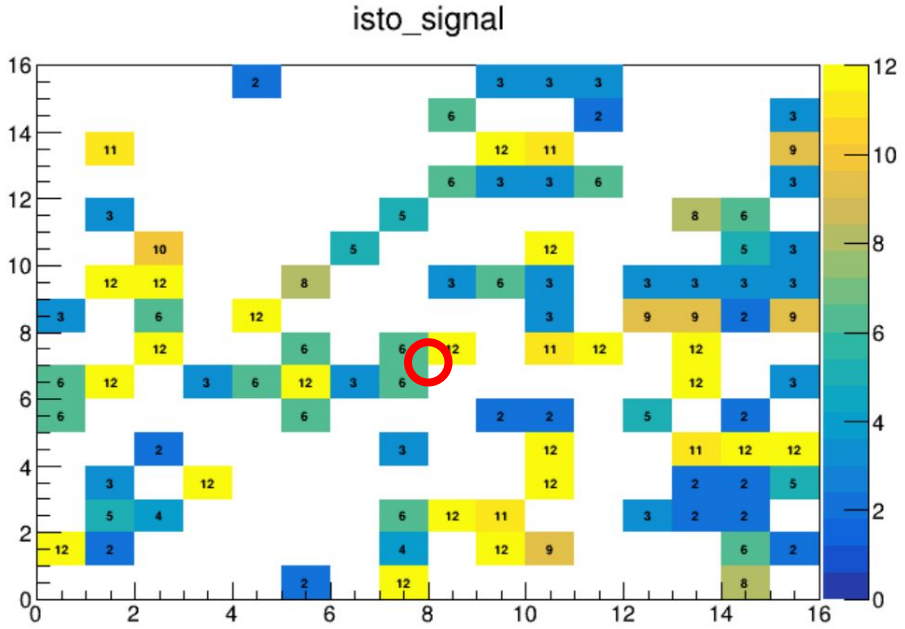
For each chip we took 7 acquisition files, although not all of them finished the acquisition

Setup with black screen with a 0.7 mm patched hole in the center



In this case, no pixel registers any light signal. Therefore, we can conclude that the black card does not let light through, even if the lamp is on.

Black screen with a 0.7 mm open hole in the center



The light is detected everywhere

For each chip we took 4 acquisition files, although not all of them finished the acquisition (chip U2 and U6 - 3 files)

Hole of the black screen

Conclusions and next steps

- The TPB could act as a light guide
- See papers:
  - ➢ “R&D of wavelength-shifting reflectors and characterization of the quantum efficiency of tetraphenyl butadiene and polyethylene naphthalate in liquid argon” (G. R. Araujo)
  - ➢ “Wavelength Shifters for Applications in Liquid Argon Detectors” (Marcin Ku´zniak)
  - ➢ “VUV-Vis optical characterization of Tetraphenyl-butadiene films on glass and specular reflector substrates from room to liquid Argon temperature” (R. Francini)
- More tests with the 3 mm SiPM matrix, again with TPB to see if there is the same effect
- Tests with the matrix without TPB