Characterizing UV Light Sources for SiPM Testing

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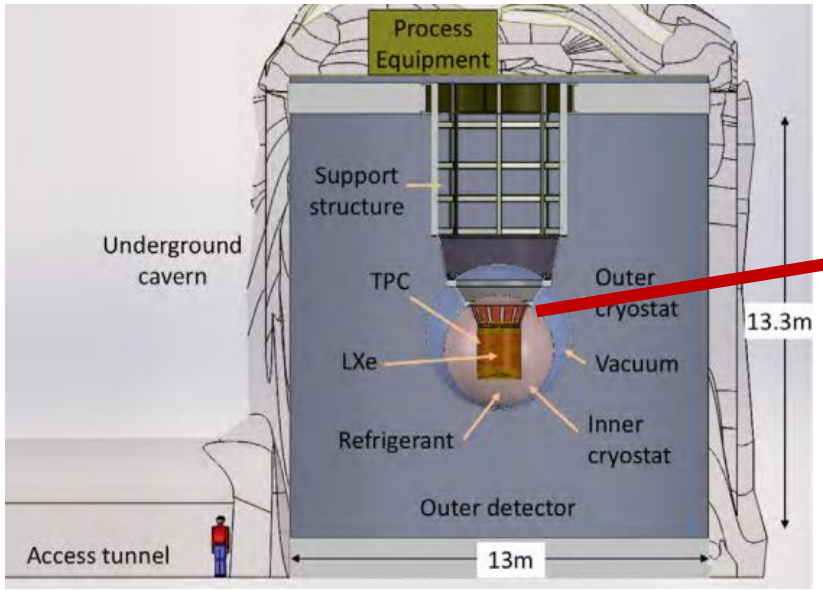
nEXO Detector and Scintillation Light

- nEXO is a proposed tonne-scale liquid Xe detector that will search for neutrinoless double beta decay (0νββ) in ^{136}Xe
- The experiment will use silicon photomultipliers (**SiPMs**) to detect scintillation light in Xe[1]



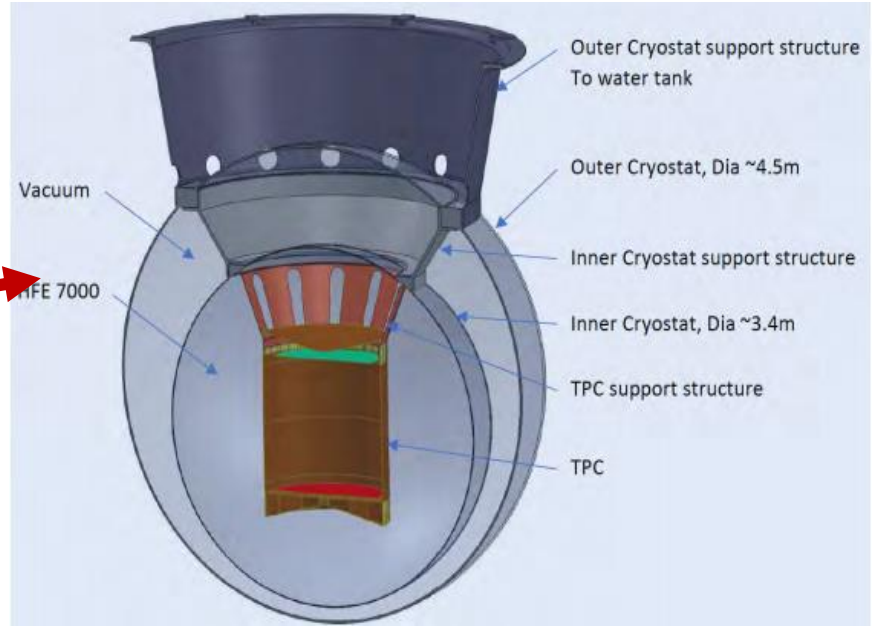
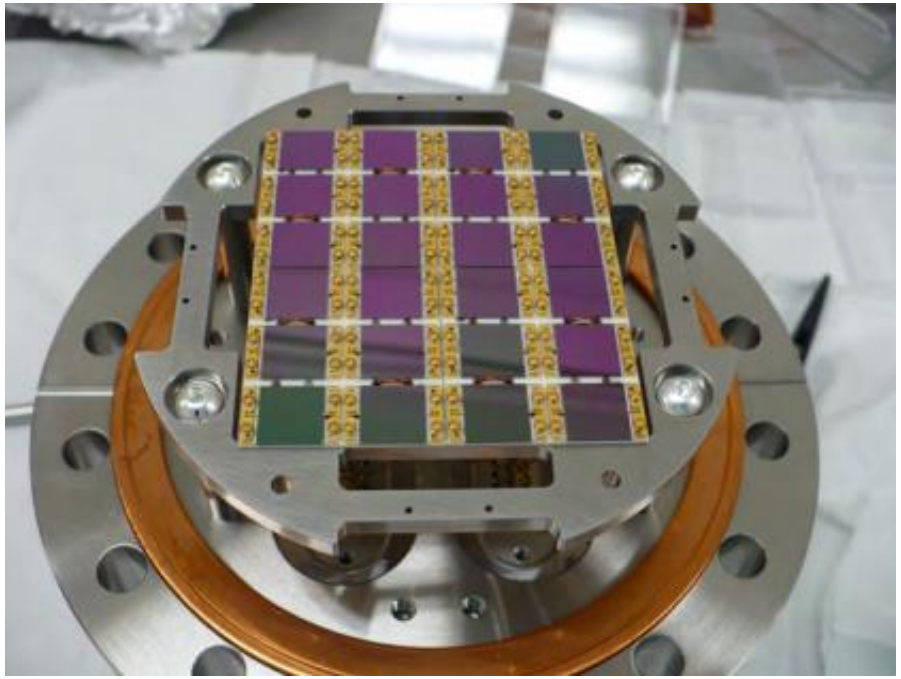


Illustration of the nEXO detector, demonstrating the placement of the LXe TPC and cryostat.

1. arXiv:1805.11142v2

Why SiPMs?

- SiPMs produce a current pulse proportional to the amount of incoming light
- Sensitive to the 175 nm wavelength of Xe scintillation in vacuum ultraviolet (**VUV**) band
- Low radioactivity compared to photomultiplier tubes



Test array of 24 SiPMs used in together with a charge collection tile in LXe[1].

Optical Rail System and Project Objectives

- Purpose is to test SiPMs for nEXO
- Image VUV sources prior to focusing light into the setup
- Example of VUV source is the ^{252}Cf

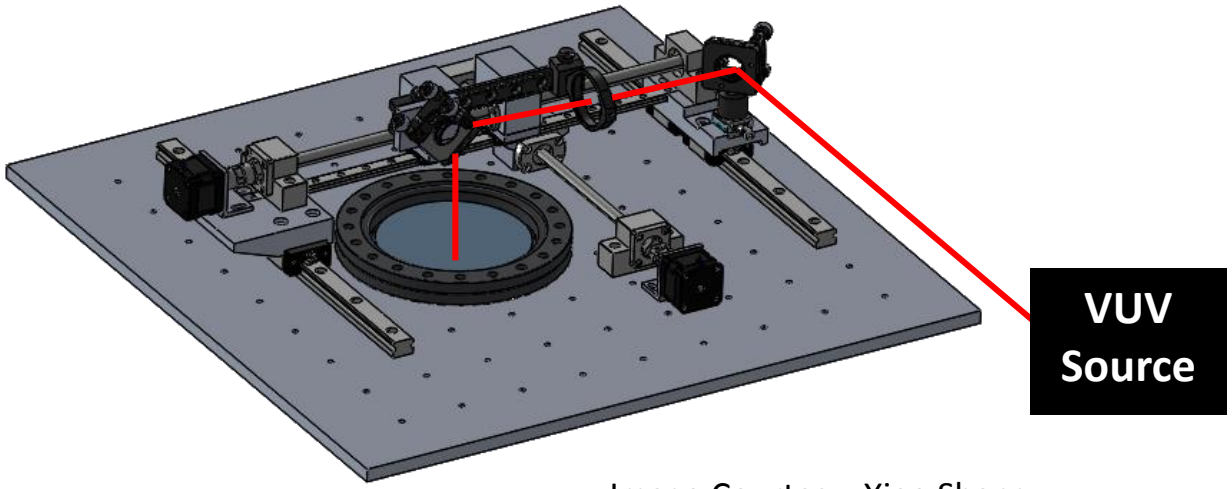
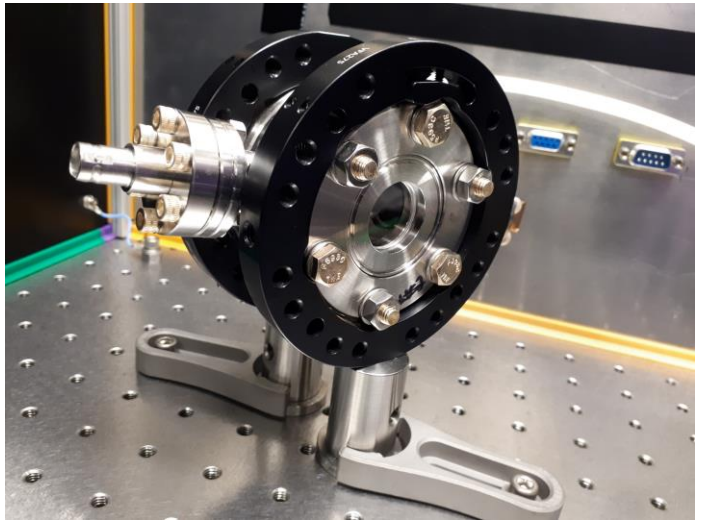


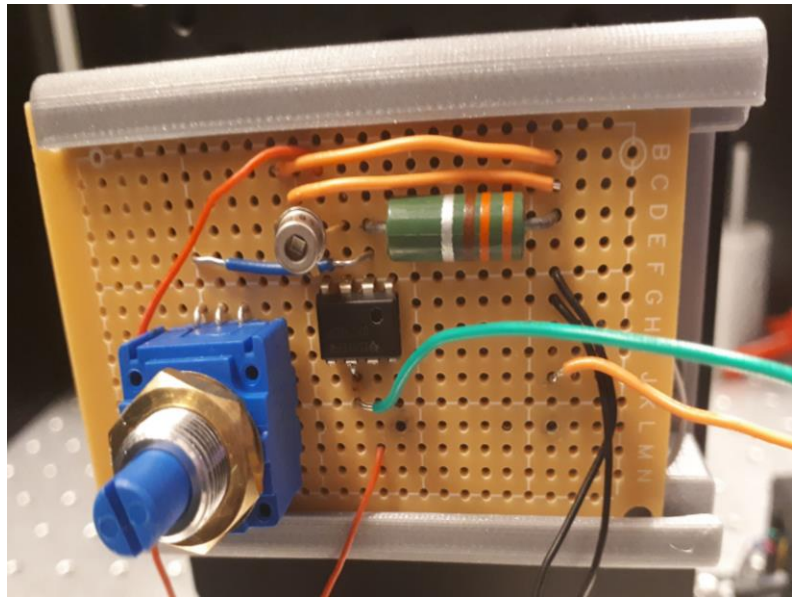
Image Courtesy: Xiao Shang

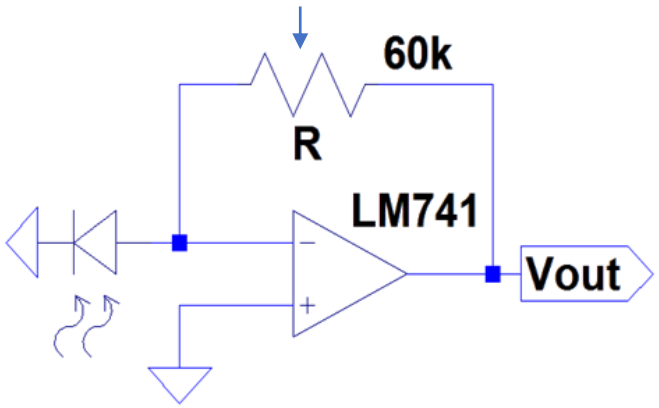


A ^{252}Cf source developed in the Brunner Neutrino Laboratory by previous students.

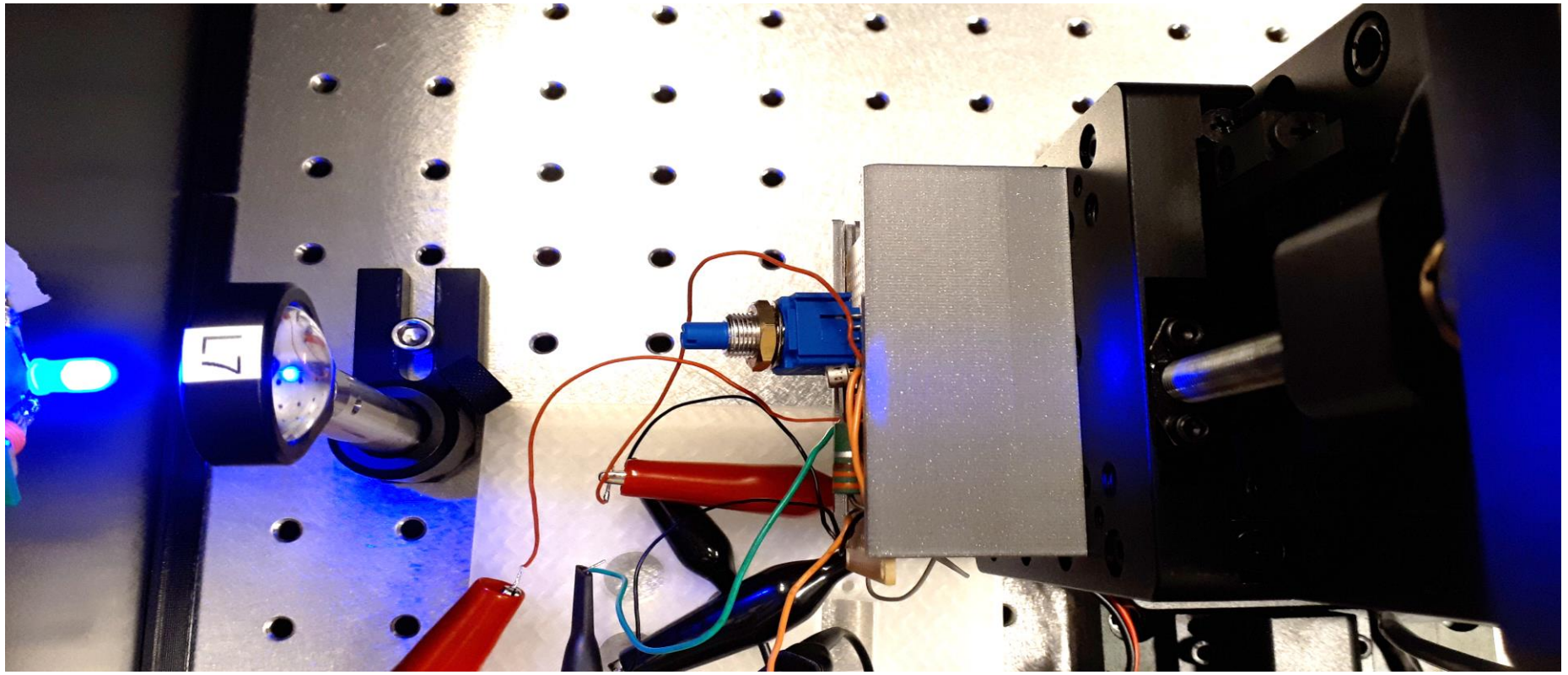
Electronics and Photodiode Circuit

- A transimpedance amplifier circuit was built and tested to optimize the performance of the photodiode
- Adjusting various parameters yield a suitable gain

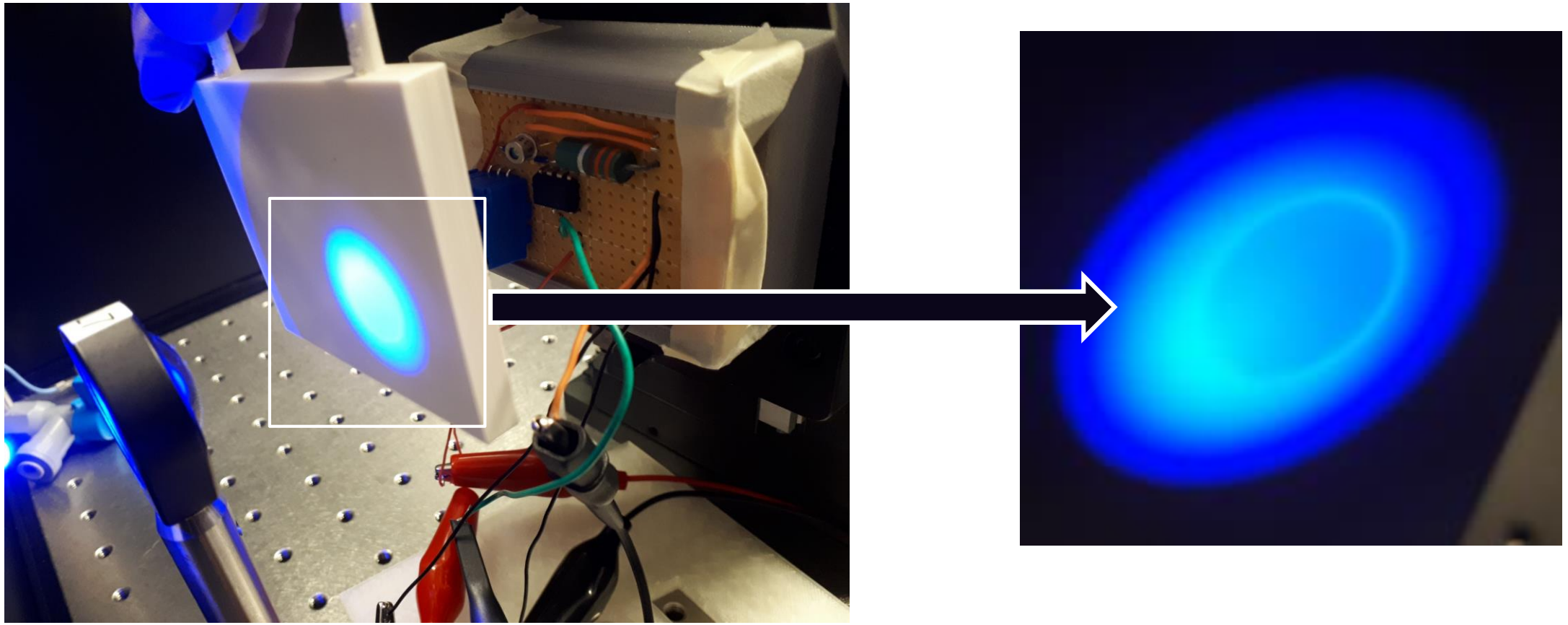




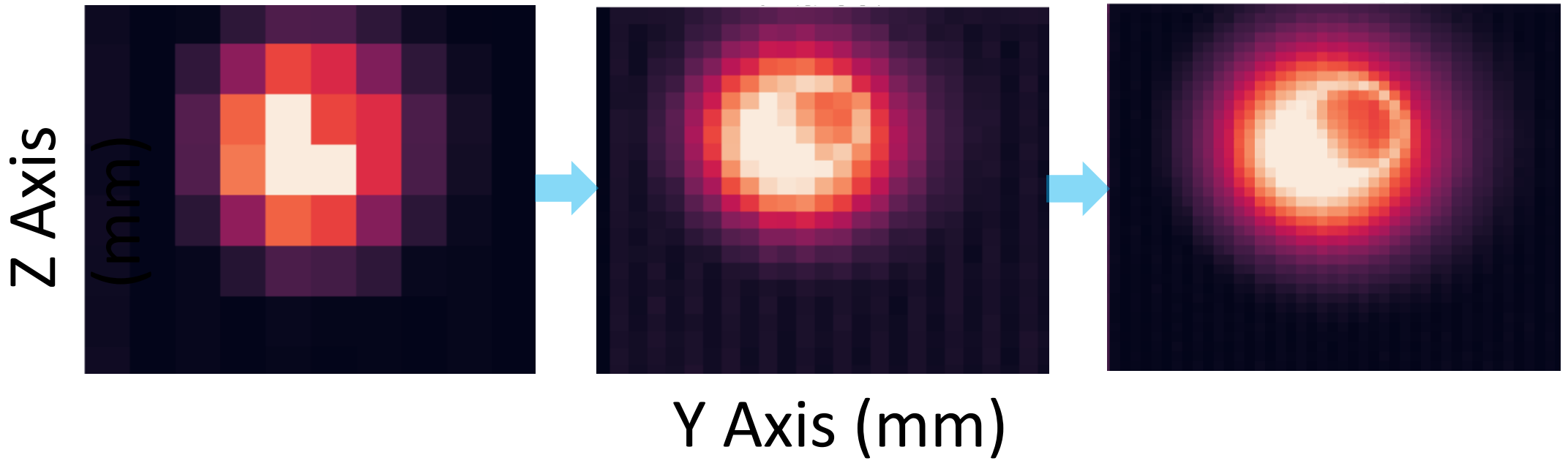
Preliminary Tests of Light Response



Mapping LED Test Image



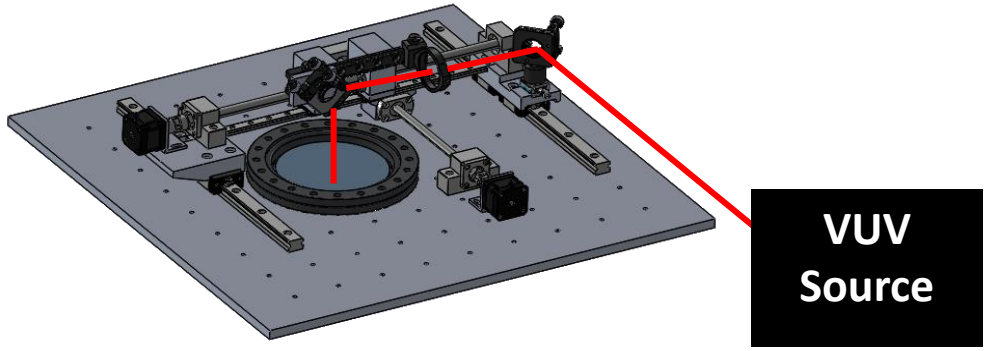
Early Results



50x50 mm grid scan at various increments. (left) 5 mm increments with no aperture, (middle) 2 mm interval with aperture, and (right) 1 mm interval with aperture.

Current Work and Future Directions

- Currently performing tests with a 405 nm laser
- Simulating the emission with a pulsed, expanding beam to practice characterizing the unknown ^{252}Cf source



- Aspire to use the ^{252}Cf source as the VUV source in the optical rail system setup once the emissions are quantified

Acknowledgements

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nEXO

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