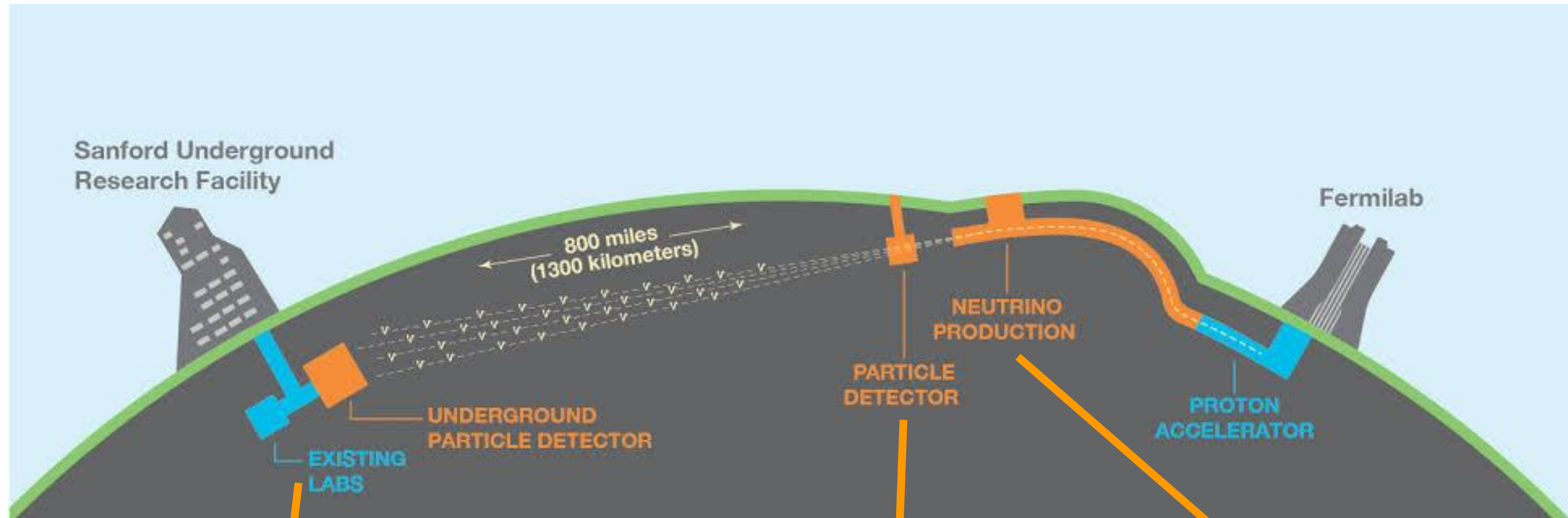


Photon Detection System for DUNE: X-ARAPUCA

Xabier Arrue, Anselmo Cervera

IFIC Summer School 2026

DUNE Overview



Far Detector

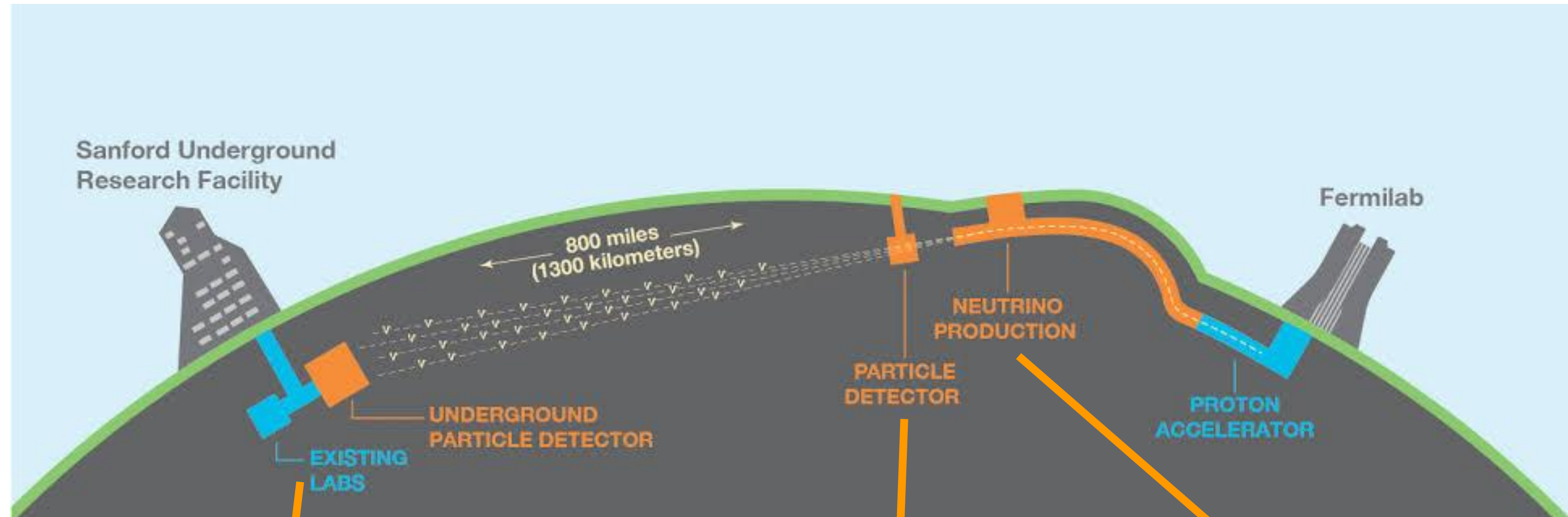
- Oscillations measurement
- LArTPC technology

Near Detector

- Unoscillated flux monitoring

Neutrino beam

DUNE Overview



Far Detector

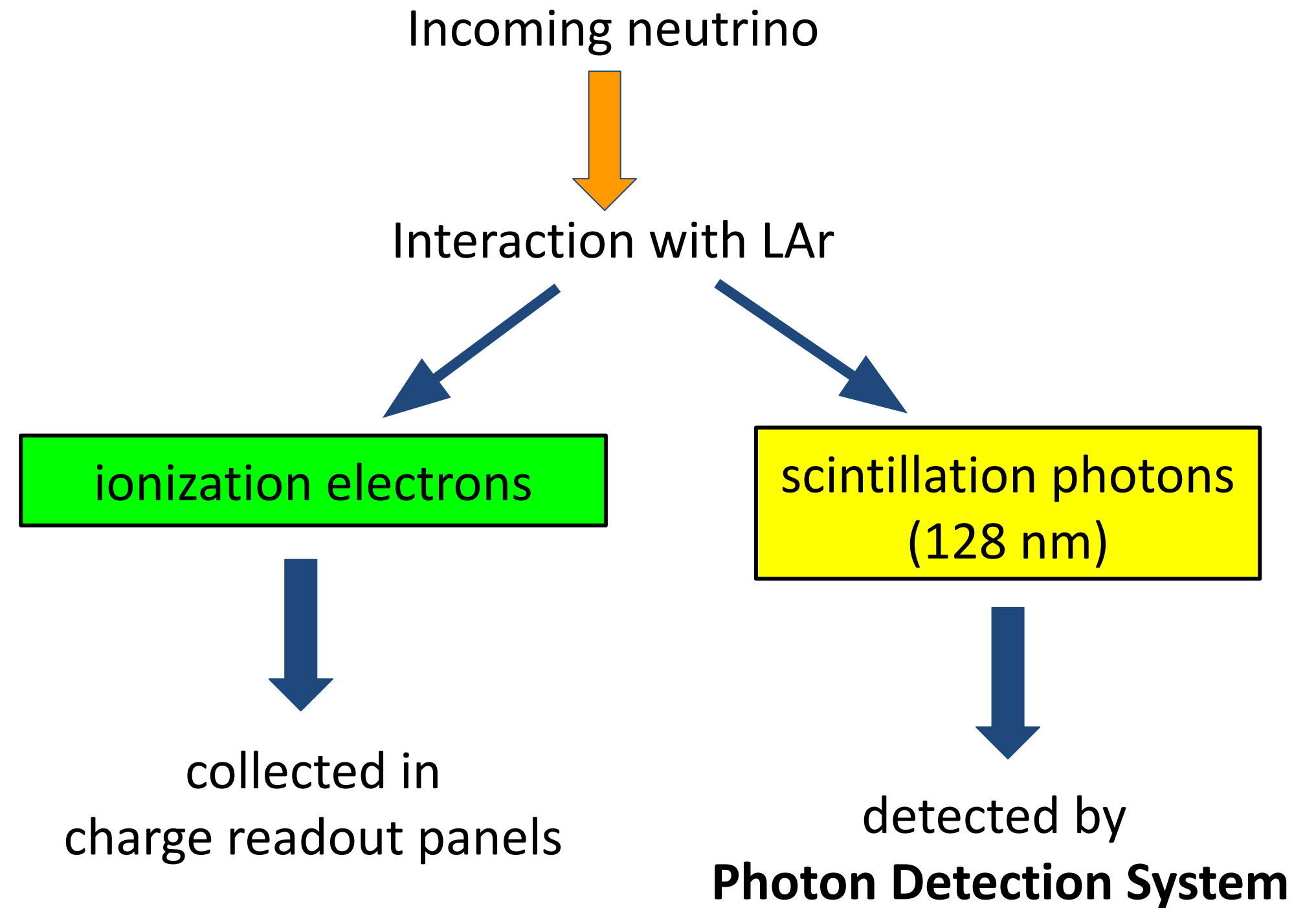
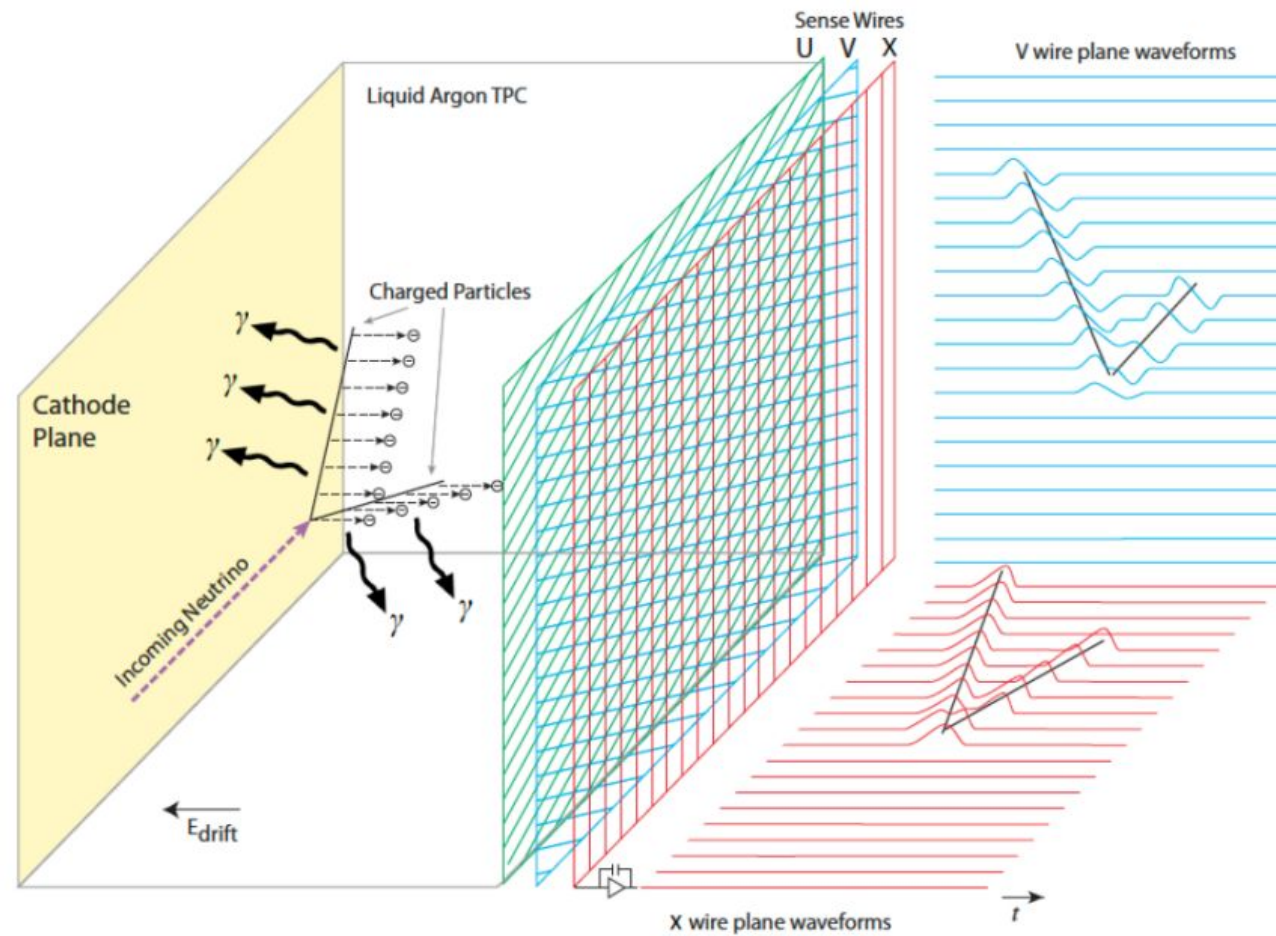
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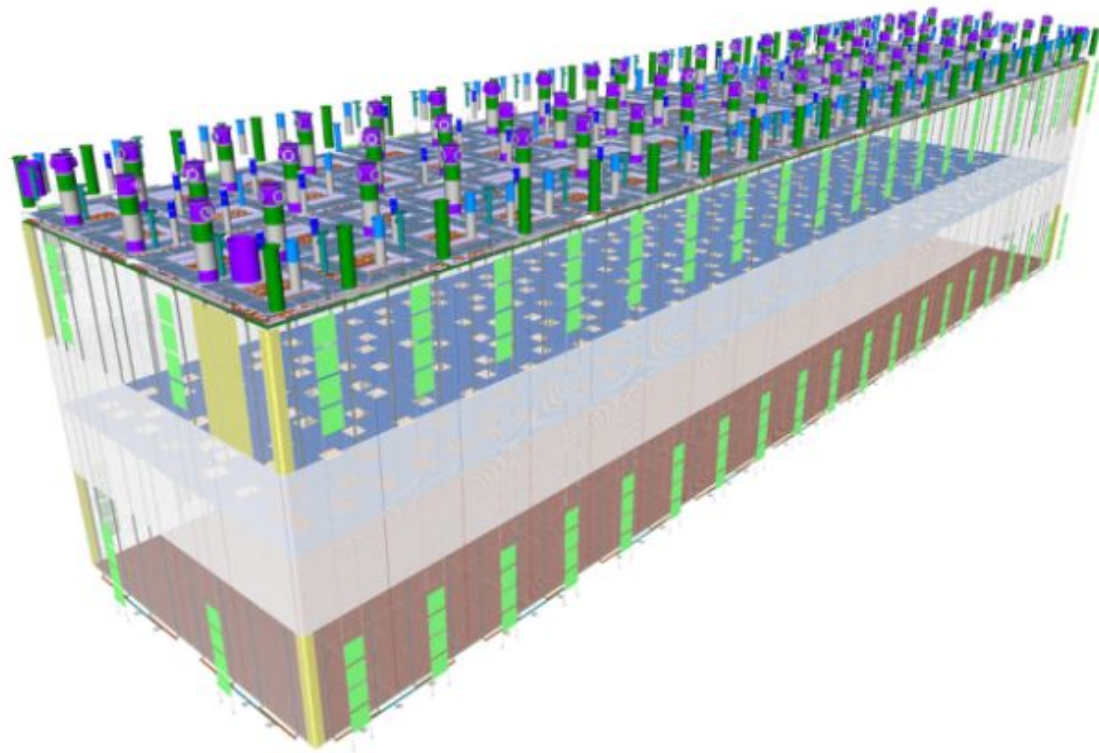
Neutrino beam

FD: Liquid Argon Time Projection Chamber (LArTPC)



Photon Detection System: ARAPUCA

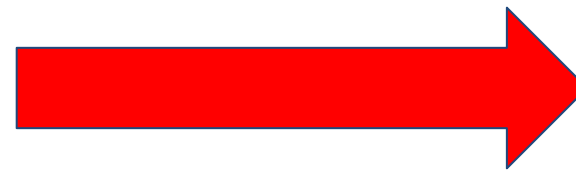
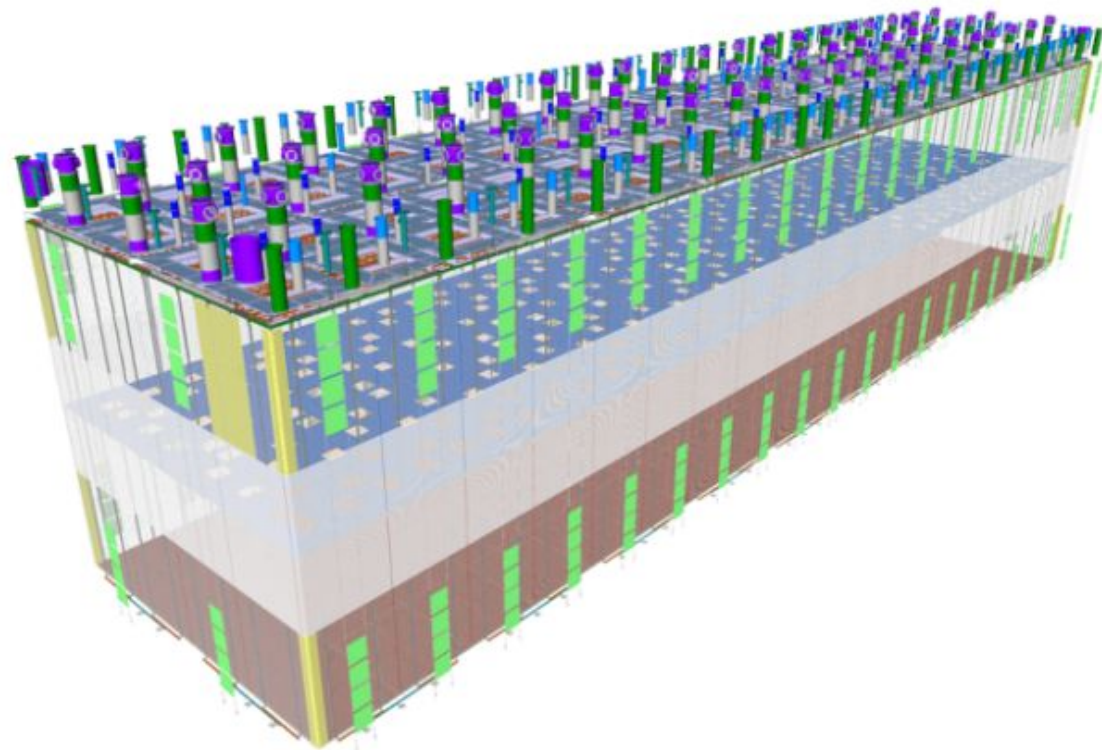
FD-VD LArTPC



- 672 X-ARAPUCA MegaCells
- Optical coverage: 15% of cathode and 7.4% of lateral walls
- Detection efficiency $\sim 3\%$

Photon Detection System: ARAPUCA

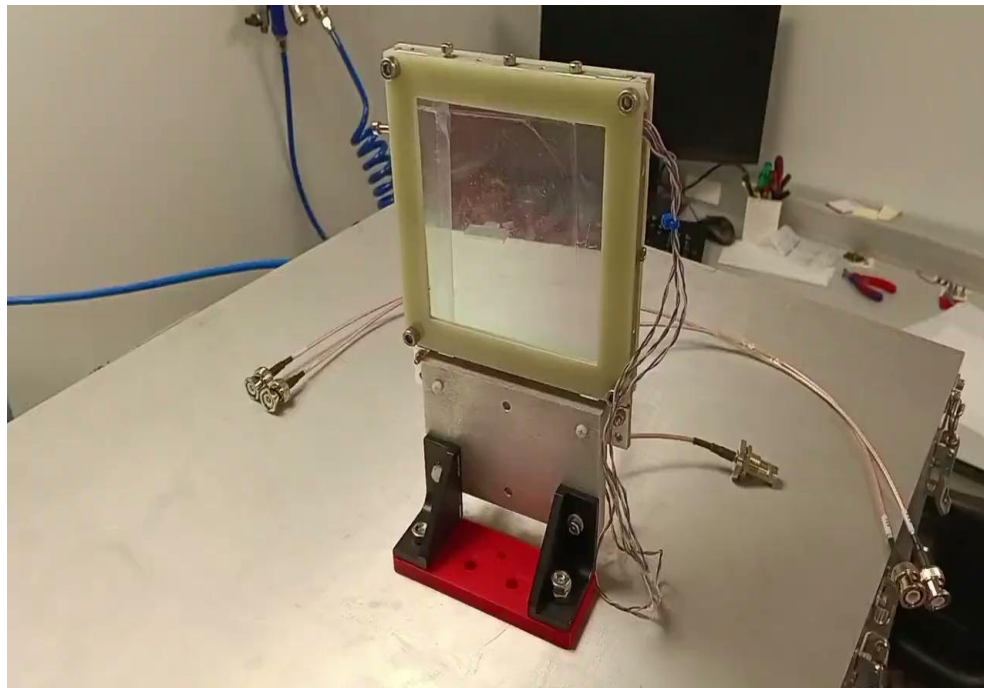
FD-VD LArTPC



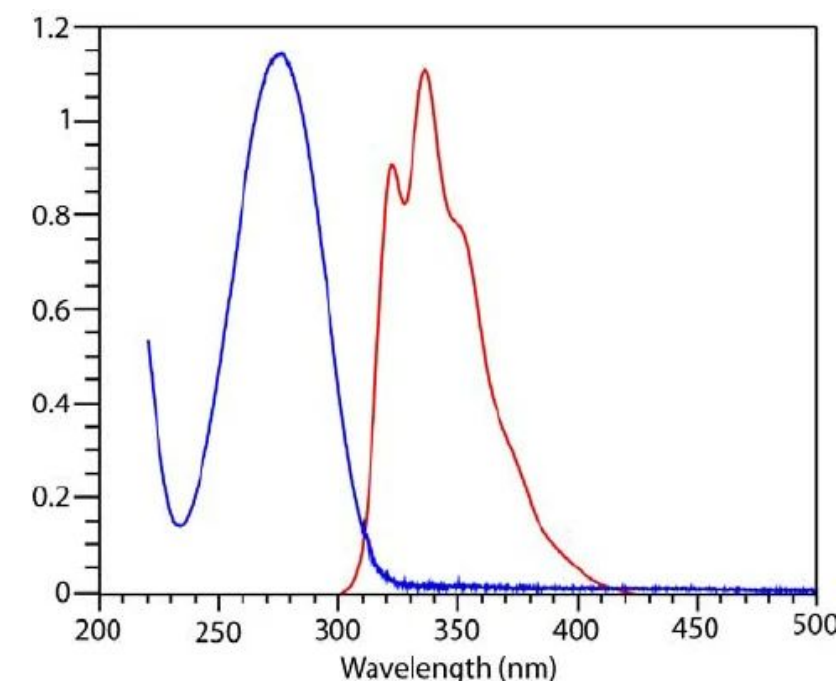
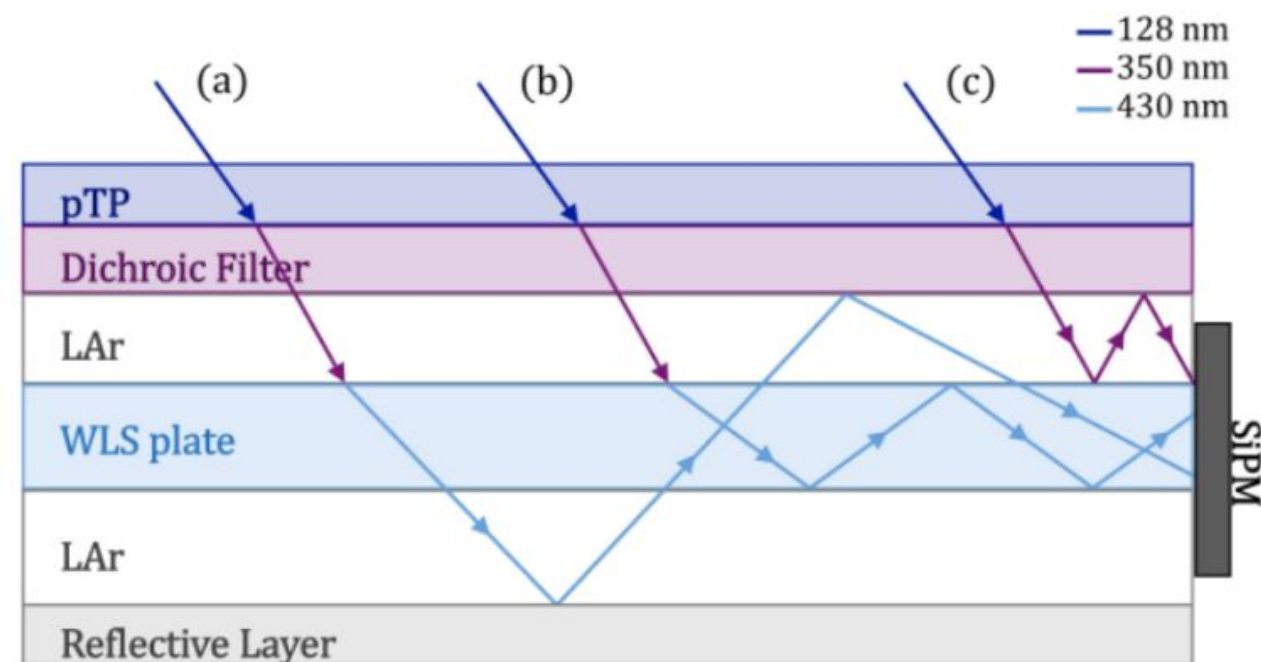
- 672 X-ARAPUCA MegaCells
- Optical coverage: 15% of cathode and 7.4% of lateral walls
- Detection efficiency $\sim 3\%$

Arapuca: Brazilian bird trap

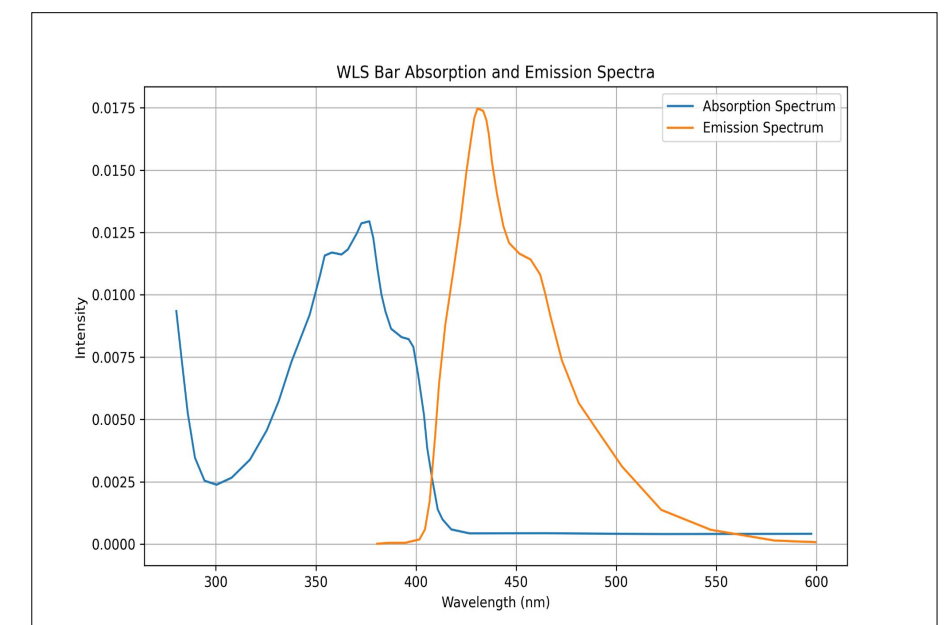
Photon Detection System: ARAPUCA



1. pTP absorbs VUV light and re-emits in 300-400 nm
2. Dichroic filter only lets light above 300 nm pass
3. WLS plate emits light in 400-50 nm into SiPM

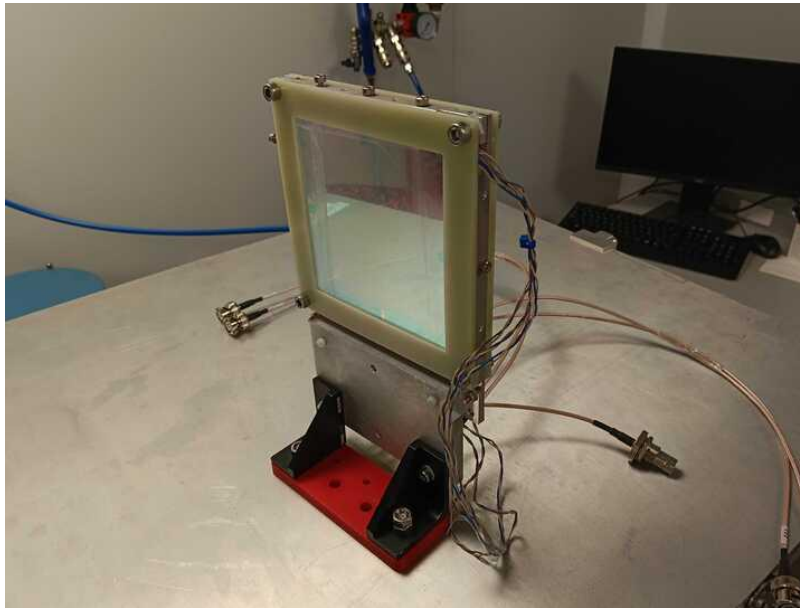


pTP spectrum

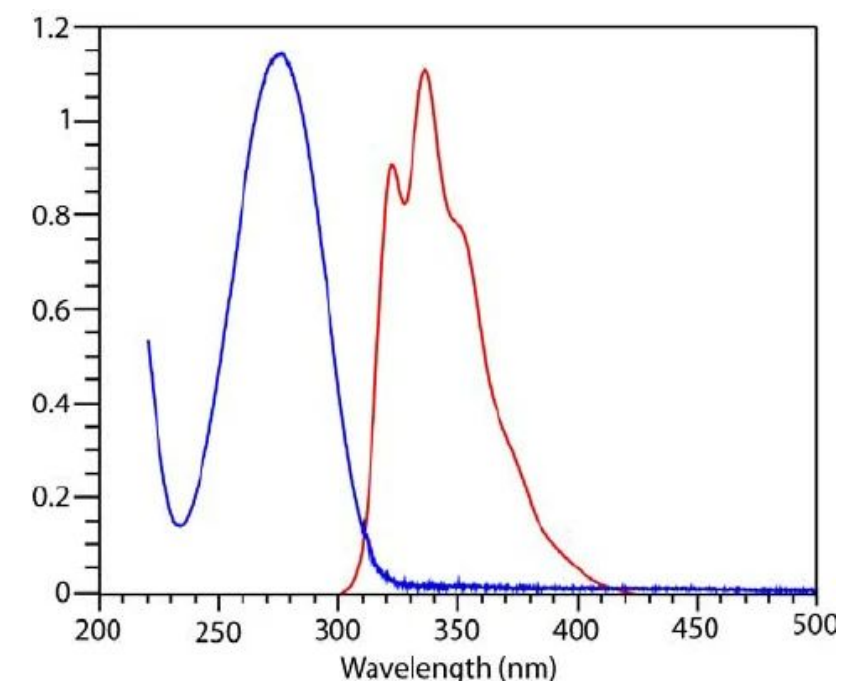
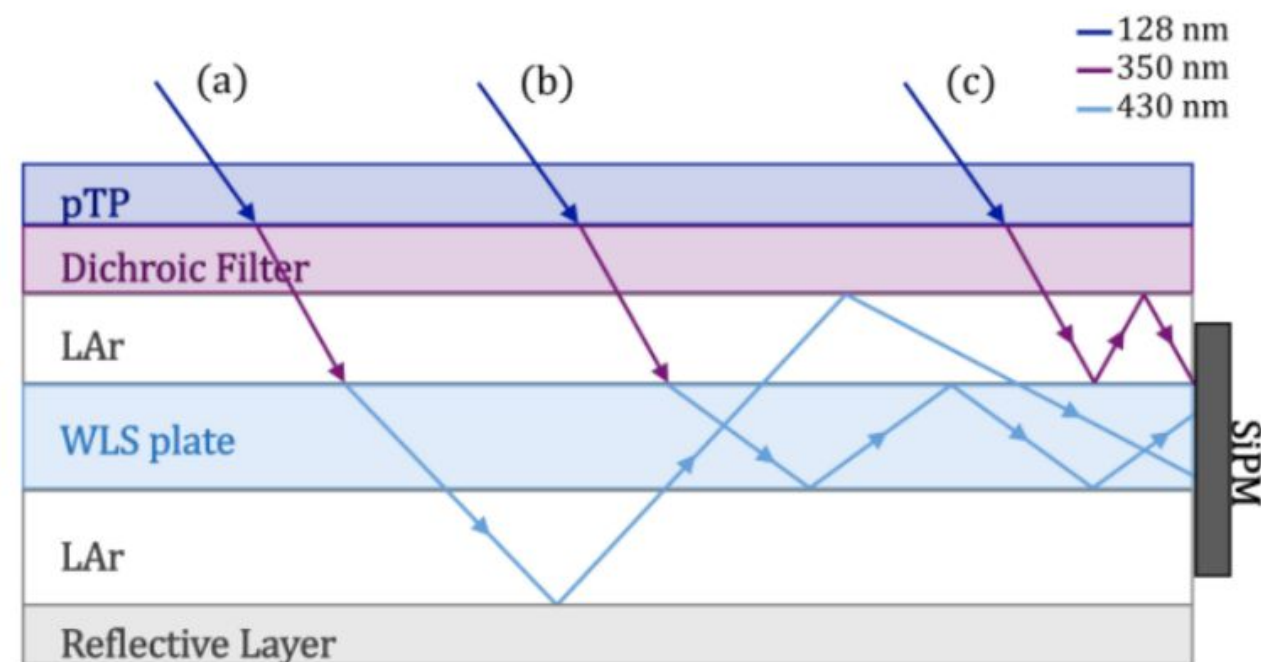


WLS spectrum

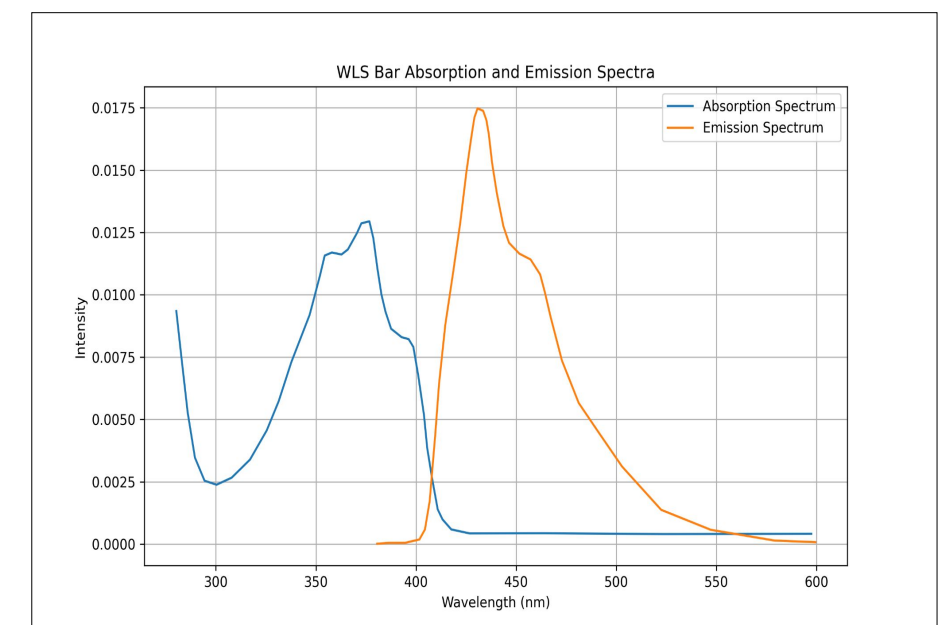
Photon Detection System: ARAPUCA



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pTP spectrum

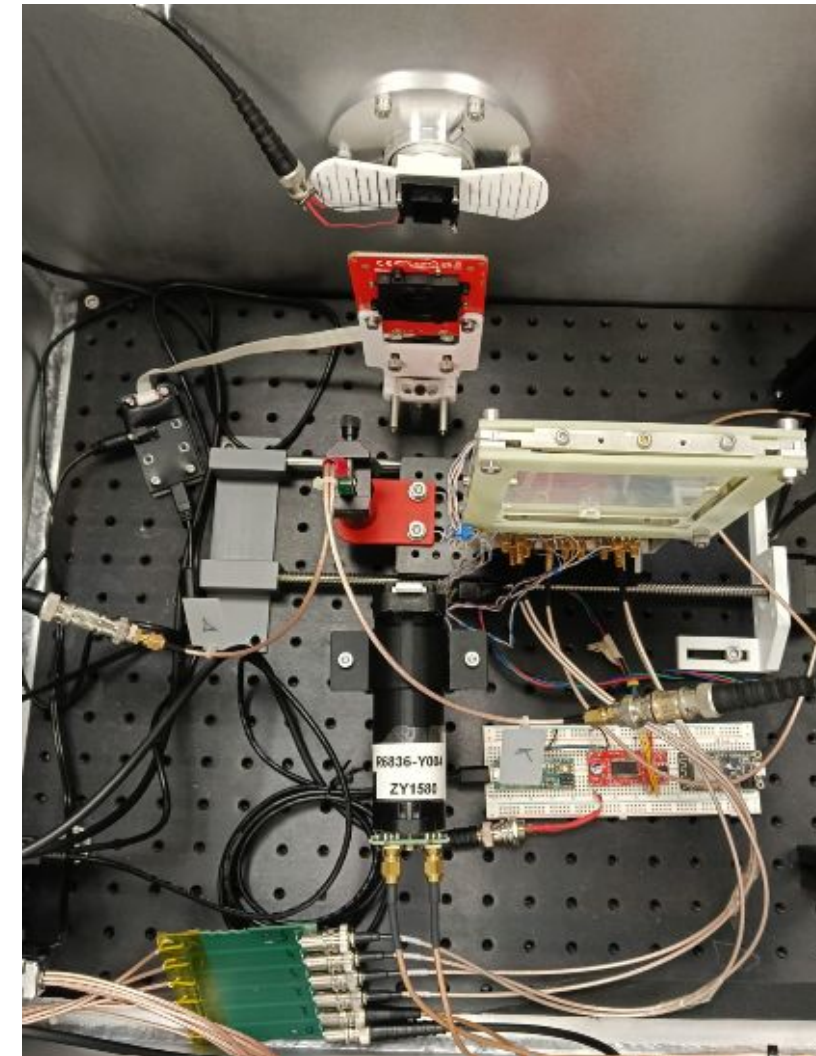
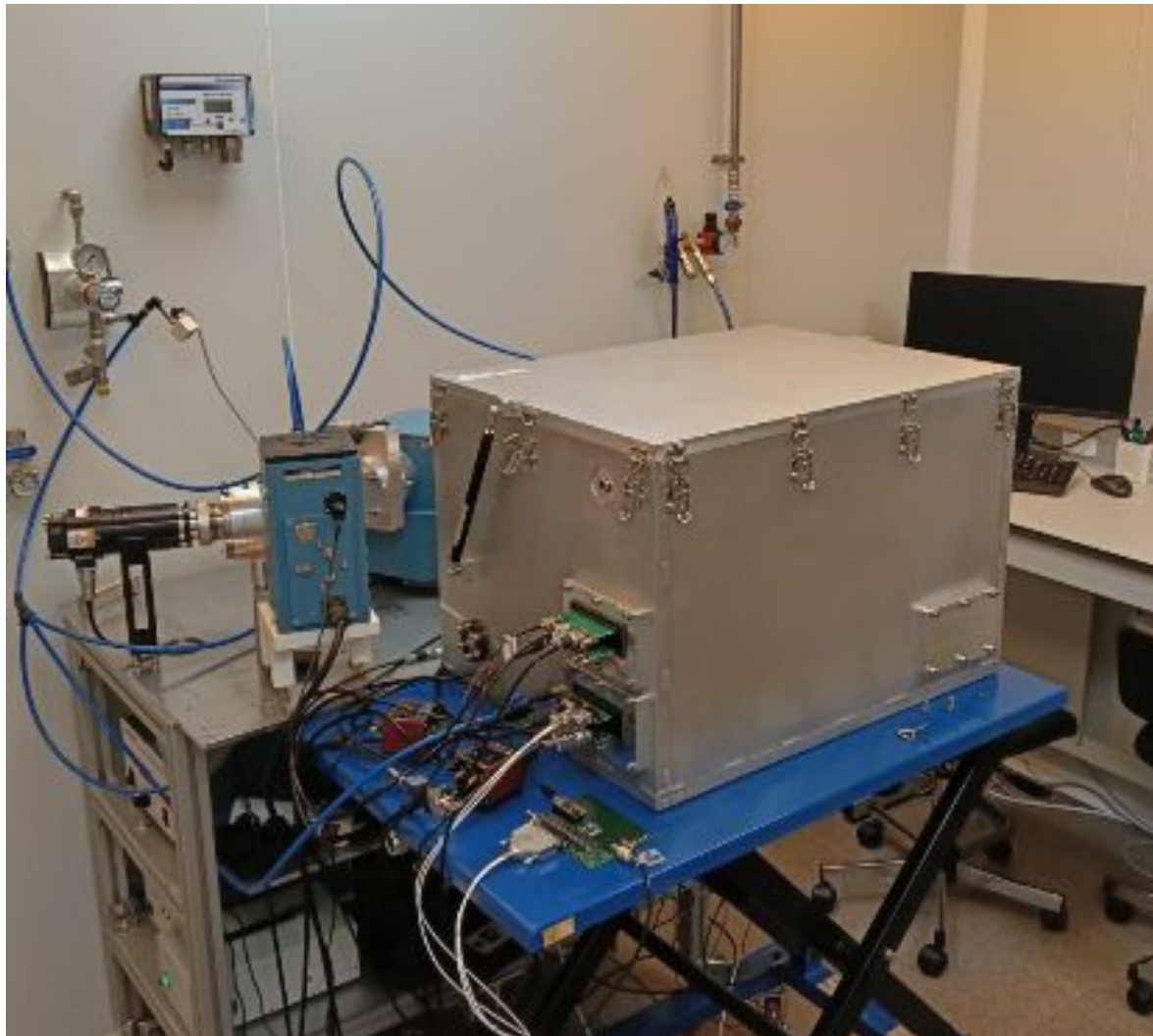


WLS spectrum

DUNE laboratory at IFIC: ARAPUCA efficiency measurement

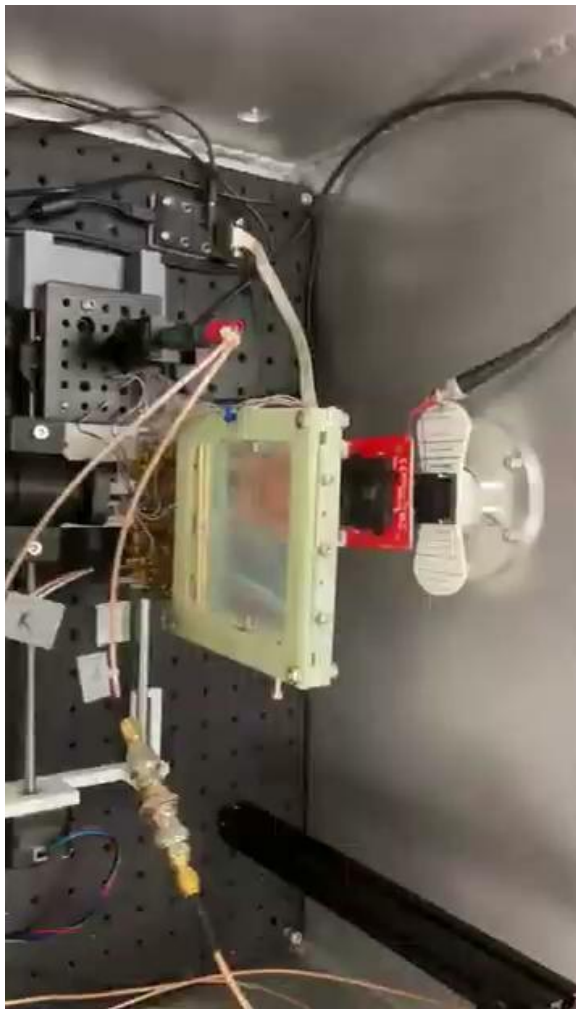
Optical room

→ Clean room for measurements in the dark and avoiding dust particles in sensors

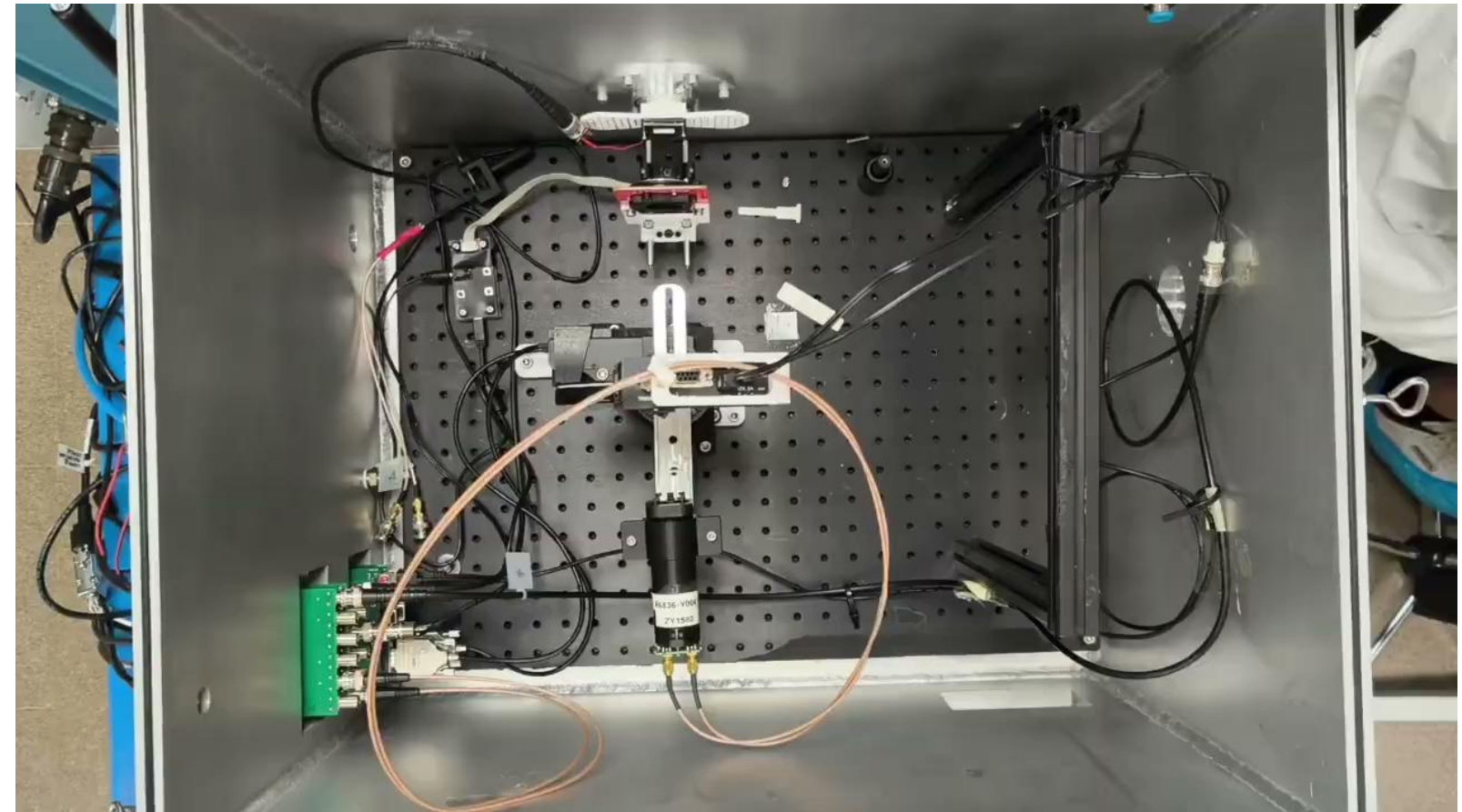


Optical room

- ① Linear-stage measurements:
- Efficiency
 - Sensor calibration

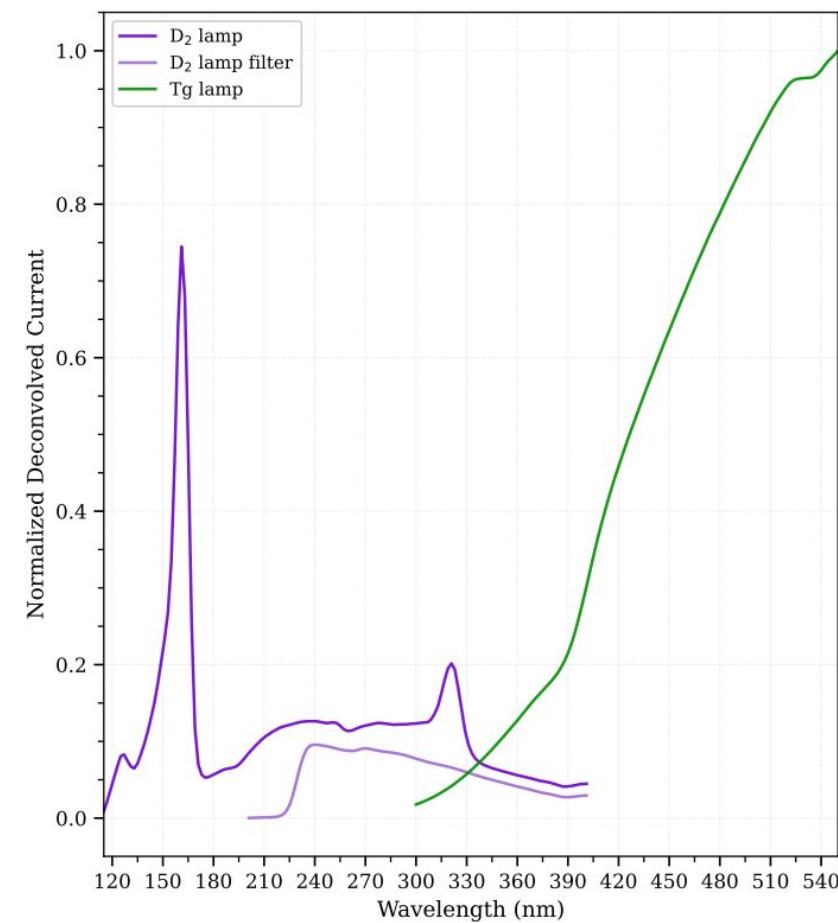
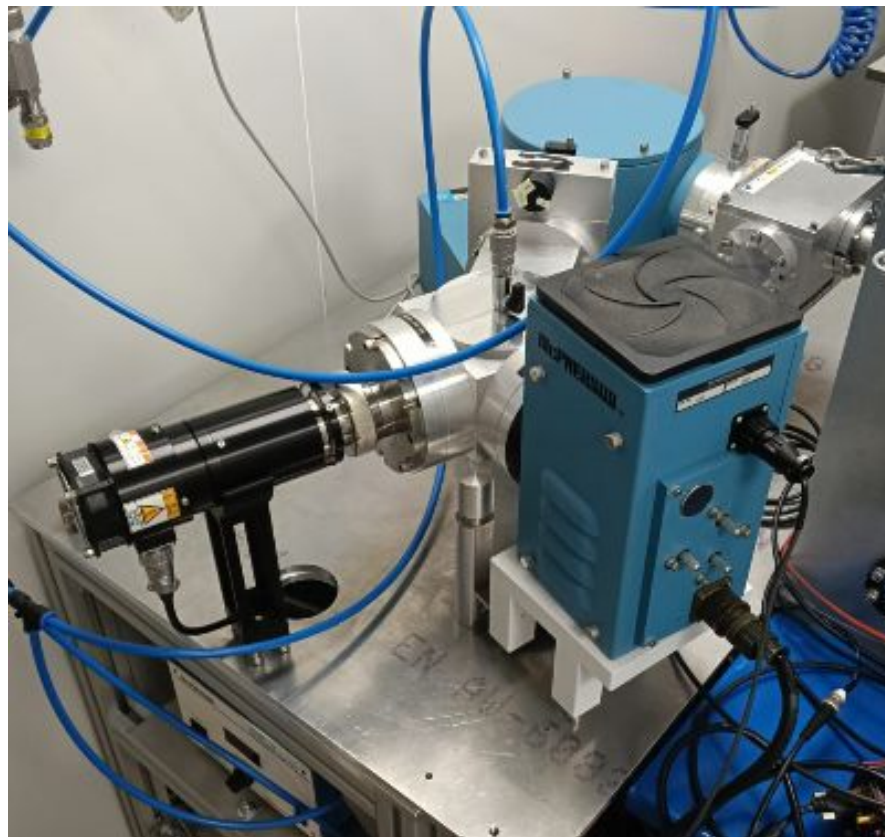


- ② Rotatory setup measurements:
- Reflectivity
 - Transmittance



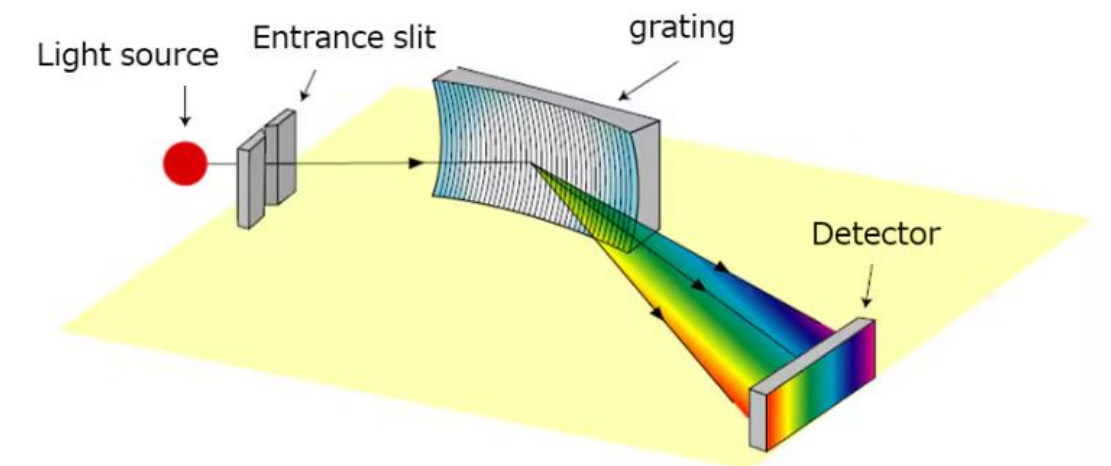
Experimental equipment

Light sources: D2 and Tg lamps

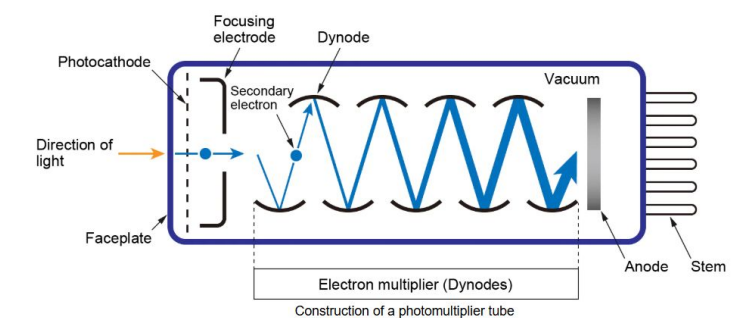
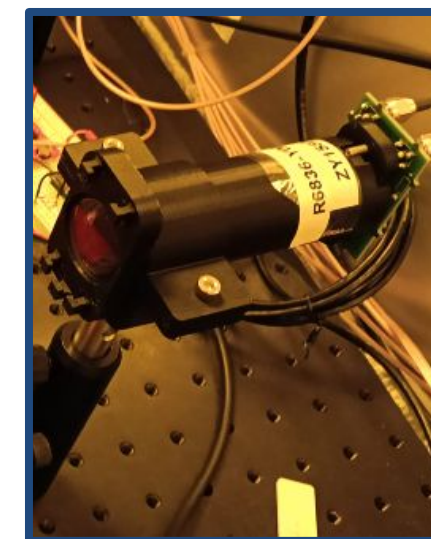


Lamp spectrum

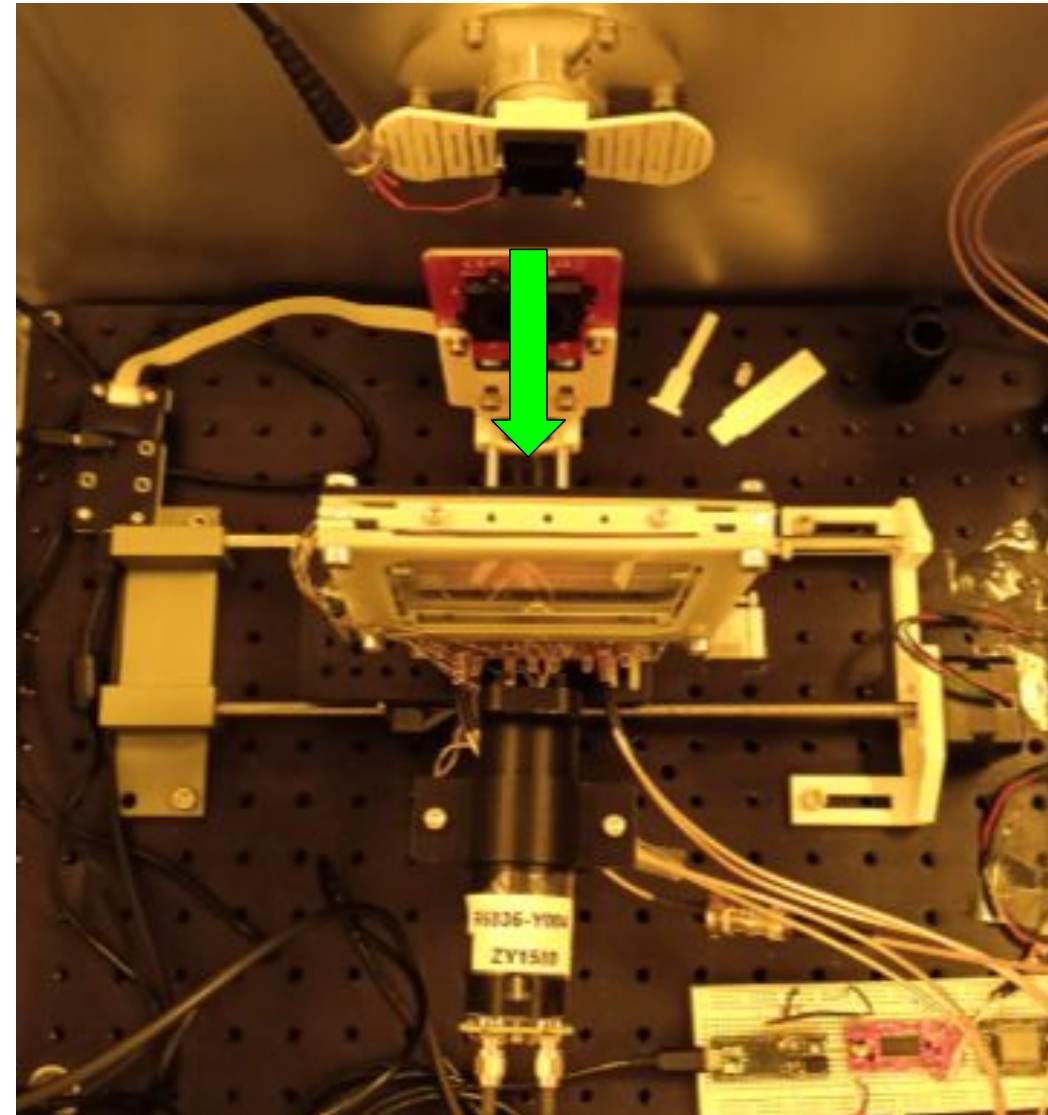
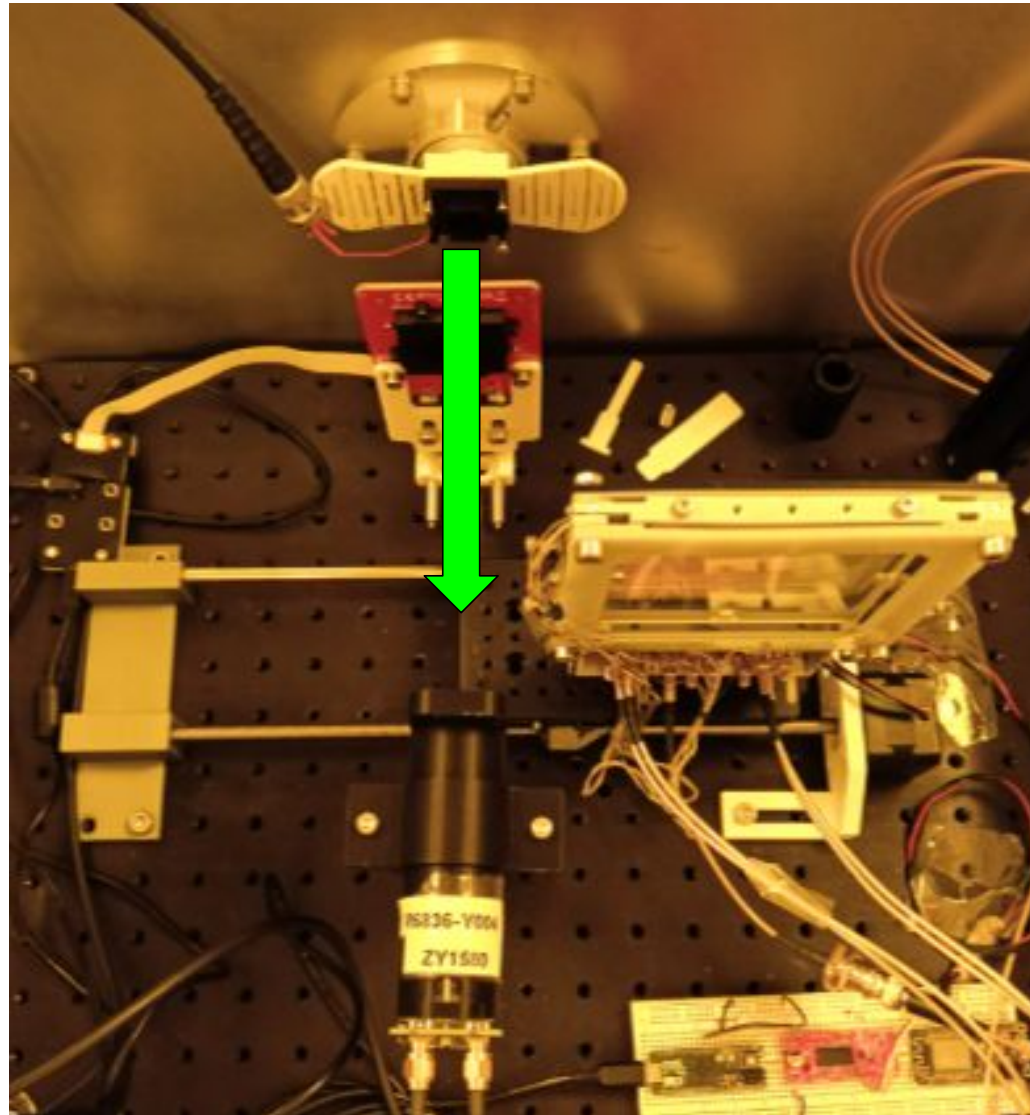
Monochromator



PhotoMultiplier Tube (PMT)



Efficiency measurement: Photocurrent method



We will work in a Gaseous Argon atmosphere to avoid VUV absorption of oxygen

OBJECTIVE: Make comparison measurements between light hitting mini-ARAPUCA and PMT. Compute the collection efficiency of mini-ARAPUCA

THANK YOU FOR LISTENING!