Neutrino-day
Roma3

Liquid Argon optical readout test facility at Roma3

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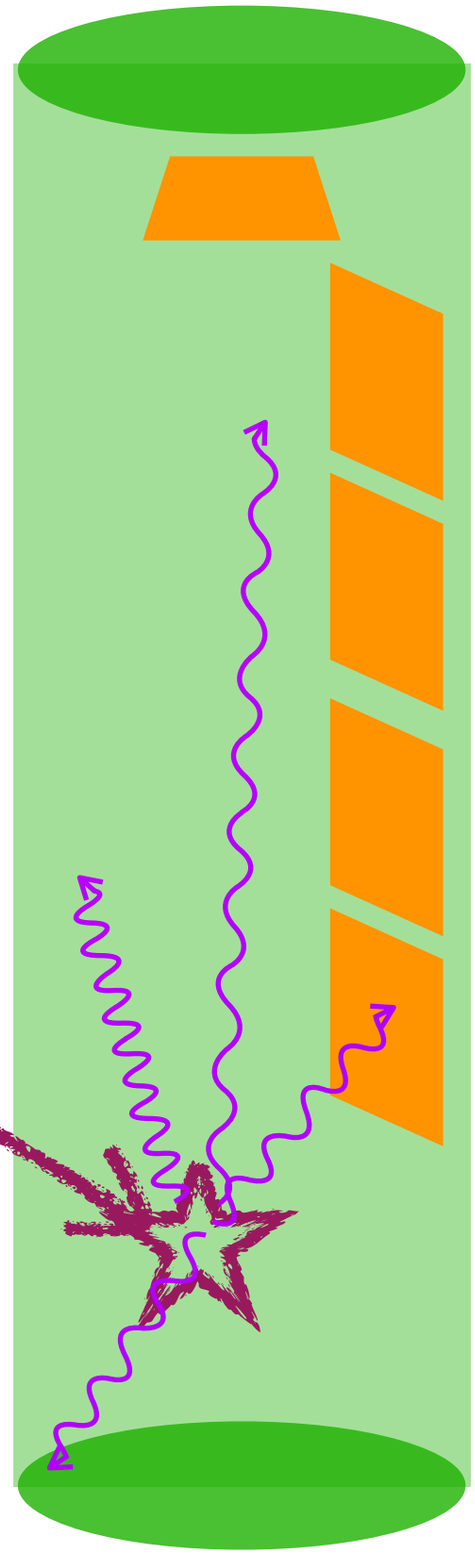
2. *Università degli Studi Roma Tre*

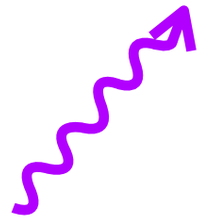
12.05.2025
Roma3

Liquid Argon as scintillation detector

LAr @ ~87 K

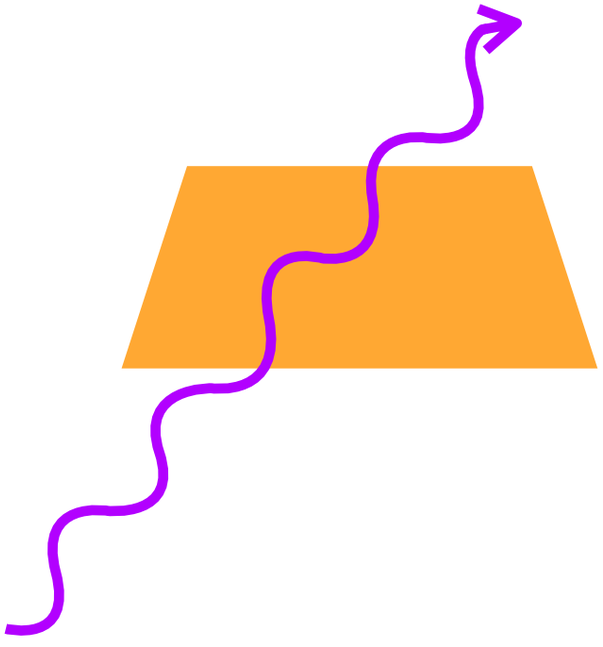


in-coming radiation



Scintillation photon VUV: ~ 120 nm

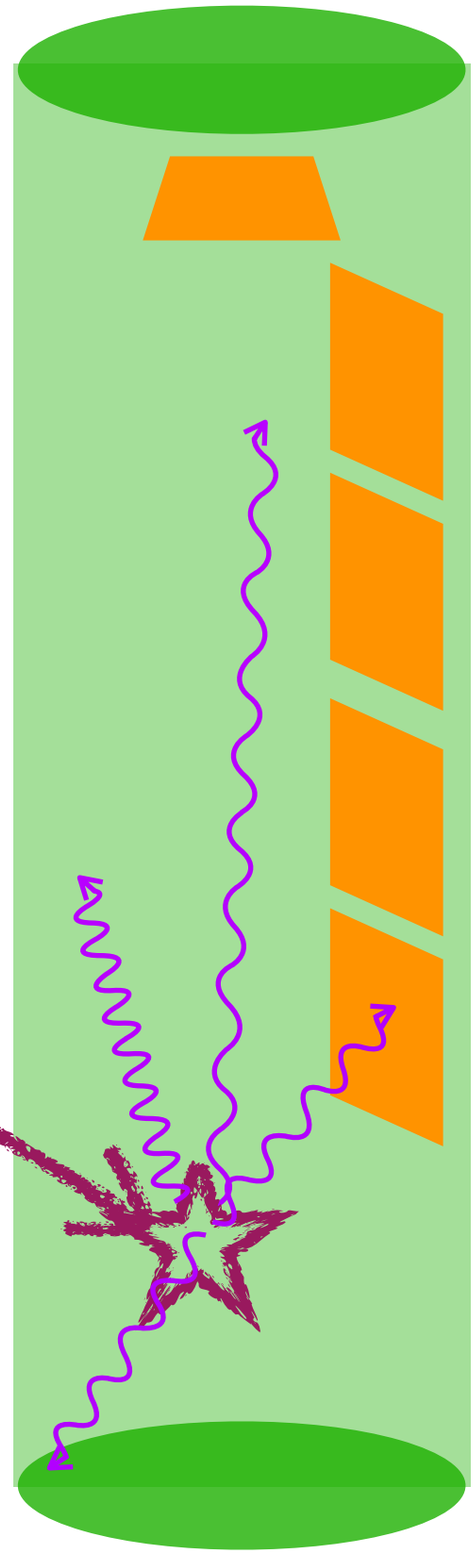
photo-sensor for visible light



insensitive to VUV photon

Liquid Argon as scintillation detector

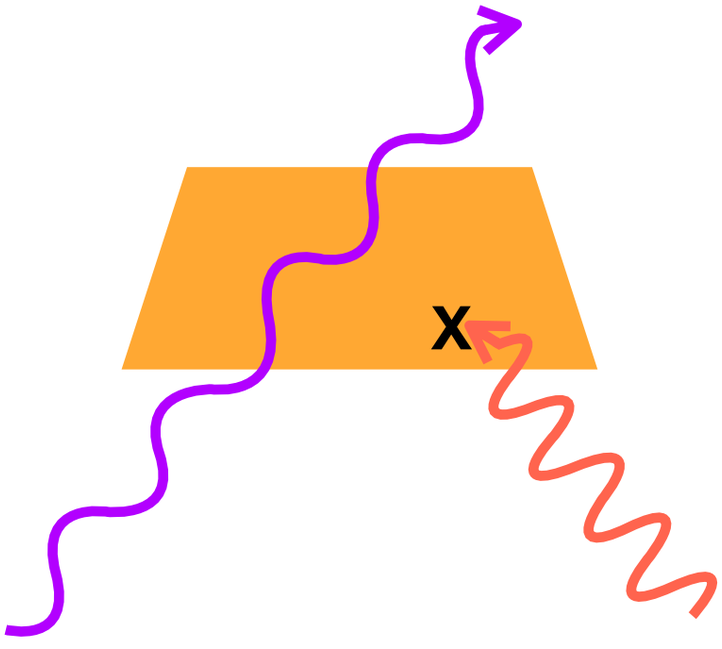
LAr @ ~87 K



Scintillation photon VUV: ~ 120 nm

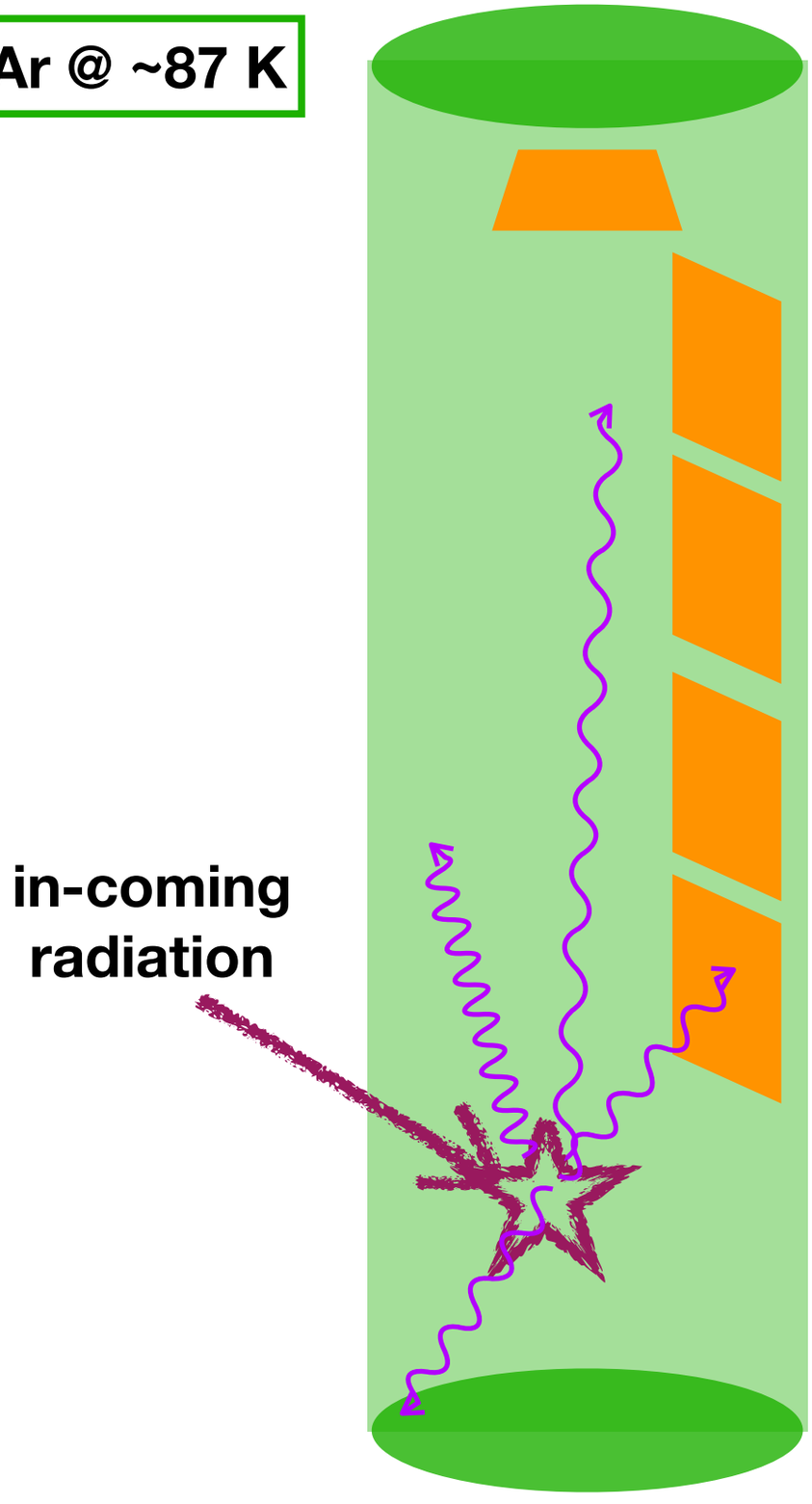
photo-sensor for visible light

visible light photons



Liquid Argon as scintillation detector

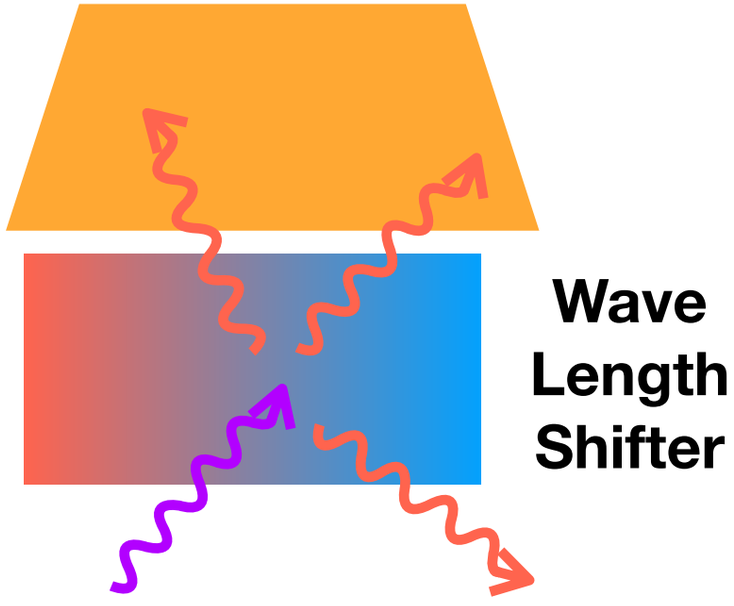
LAr @ ~87 K



Scintillation photon VUV: ~ 120 nm

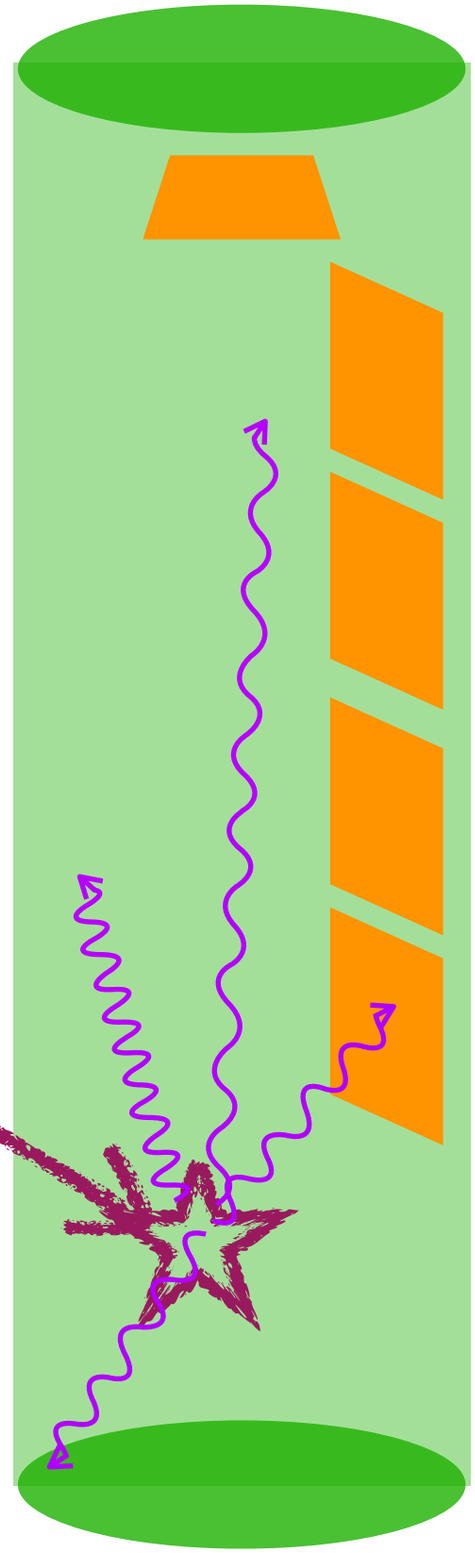
photo-sensor for visible light

visible light photons



Liquid Argon as scintillation detector

LAr @ ~87 K

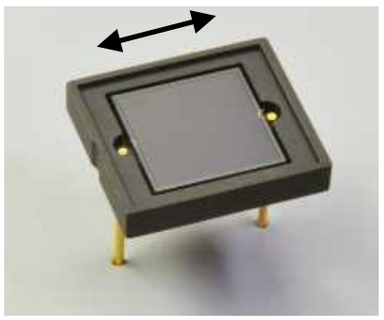


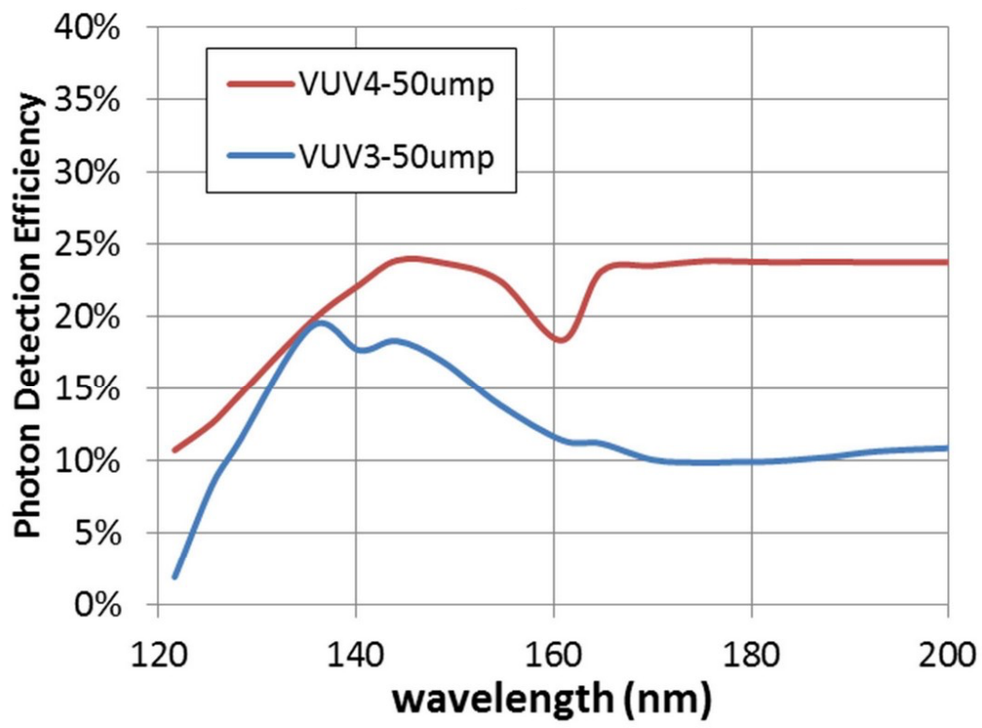
Scintillation photon VUV: ~ 120 nm

photo-sensor sensitive to VUV

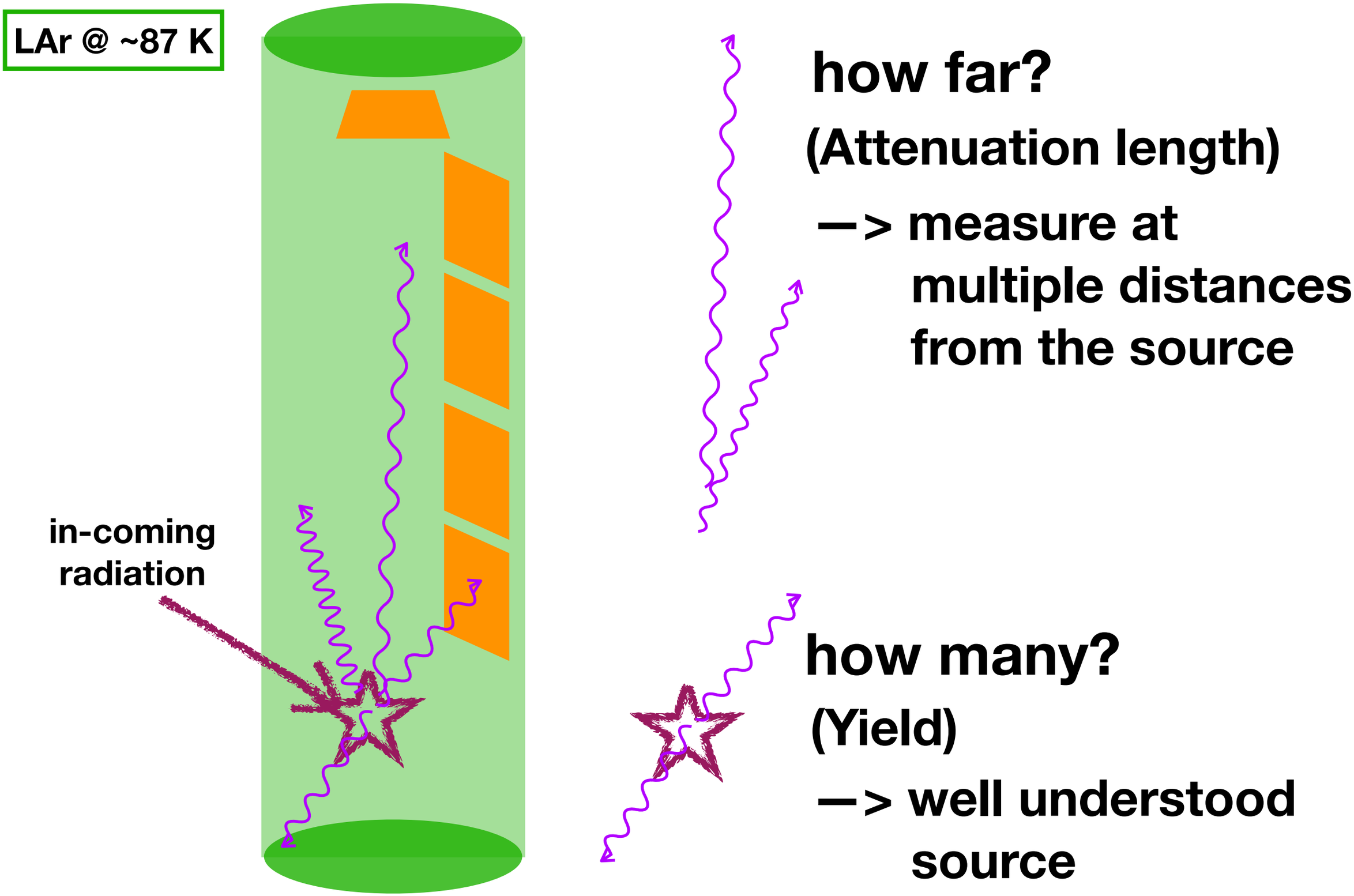
Hamamatsu VUV4 type MPPC SiPM

6 mm





Liquid Argon as scintillation detector



Liquid Argon as scintillation detector

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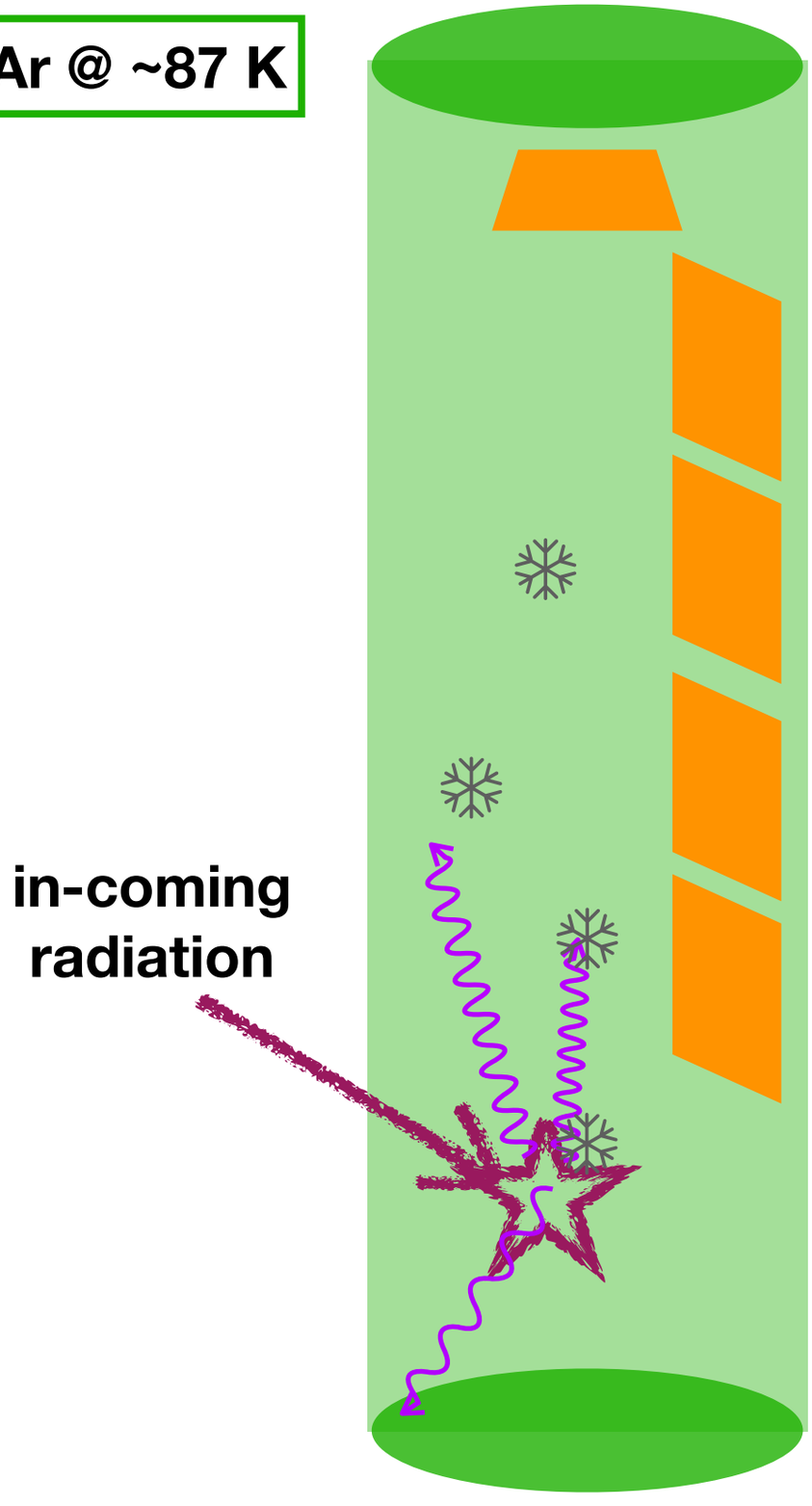


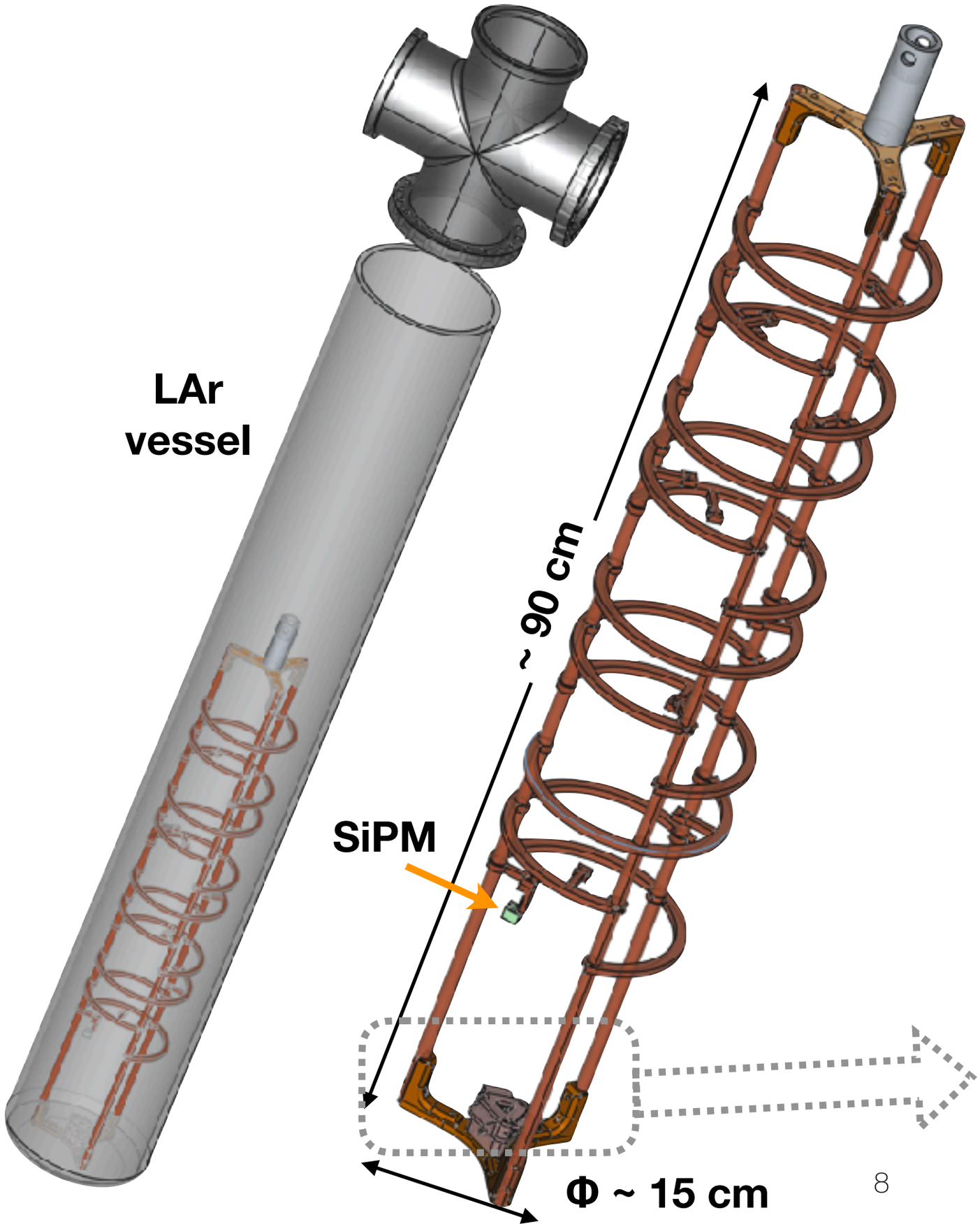
❄ **Impurities:**

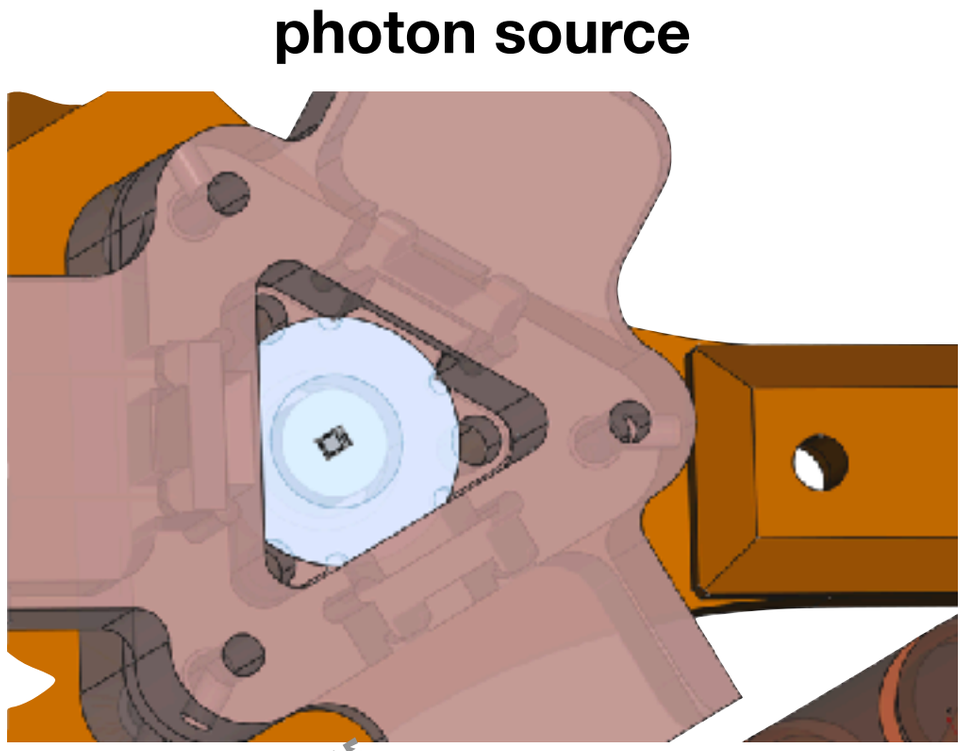
O_2, N_2, CO_2

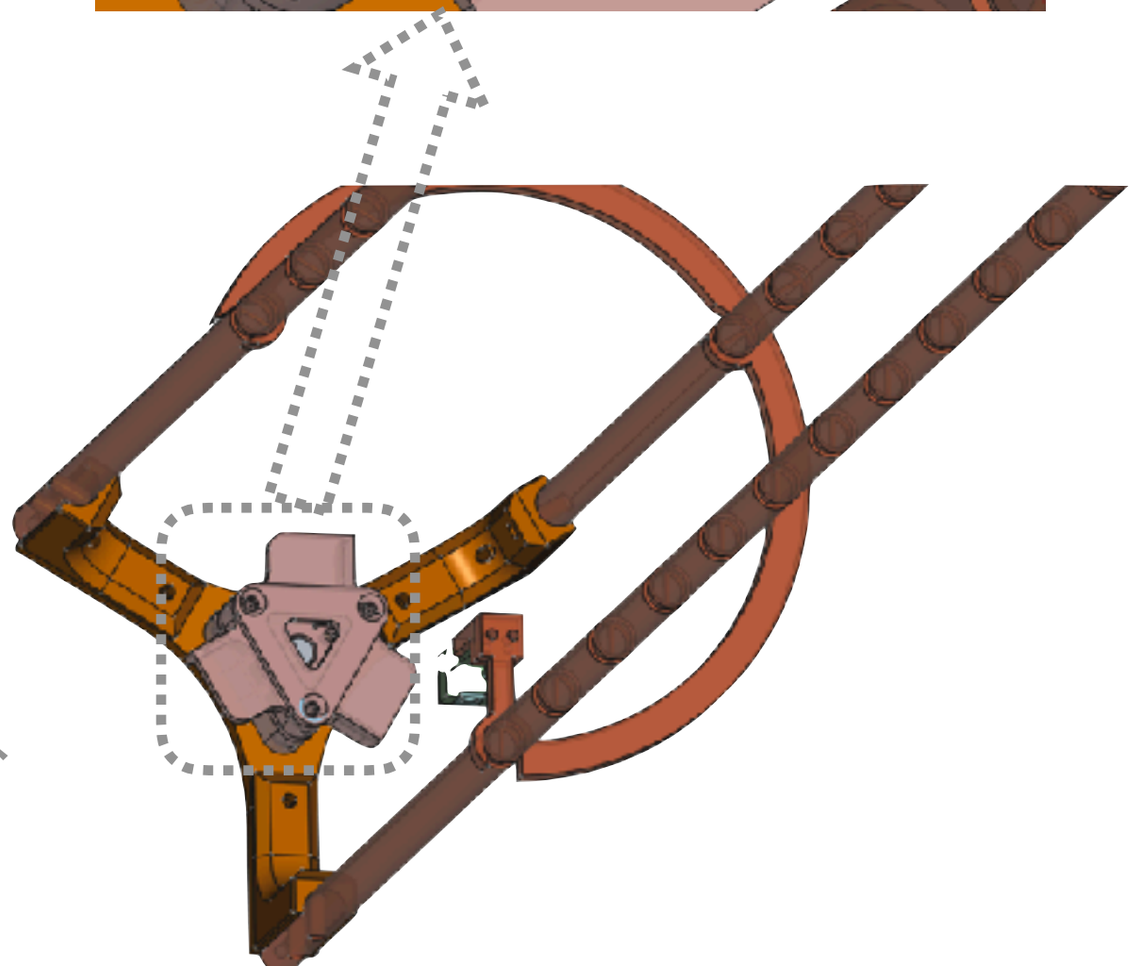
- **reduce yield**
- **more attenuation**

The effects can be quantified from different measurement conditions

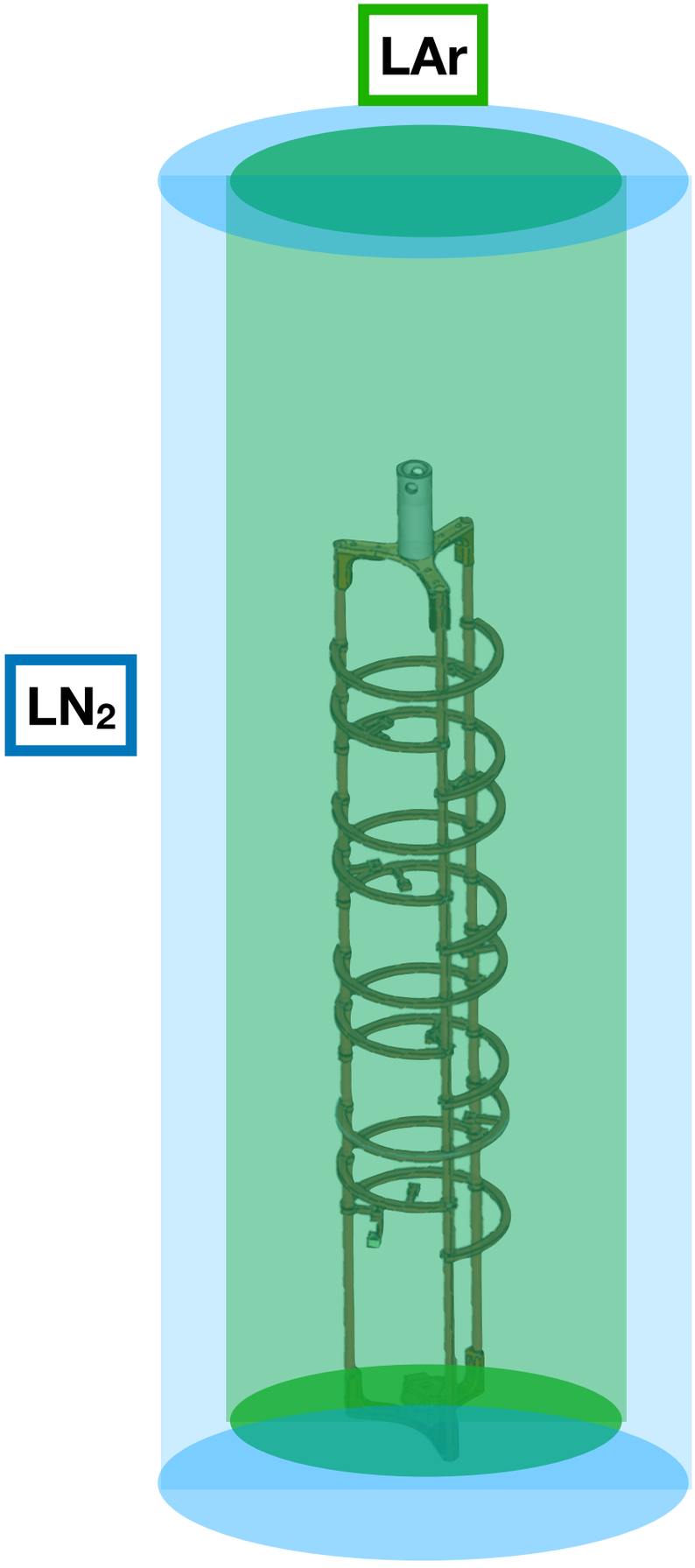
SiPM detector and light source mounting structures







To produce and operate liquid Argon



LAr

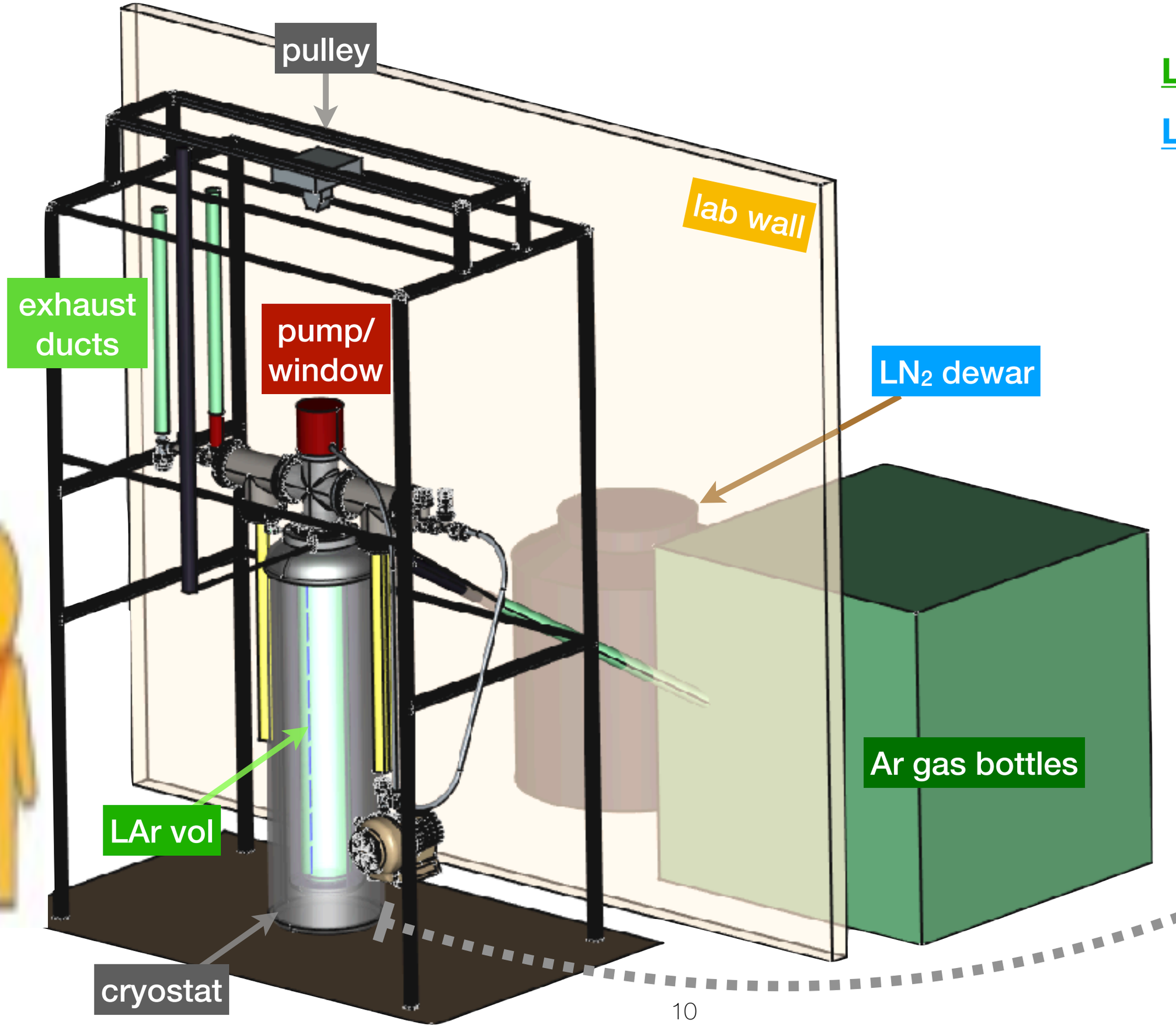
Melting point	83.8 K	-189.3 °C
Boiling point	87.3 K	-185.8 °C

LN_2

Boiling point	77.3 K	-195.9 °C

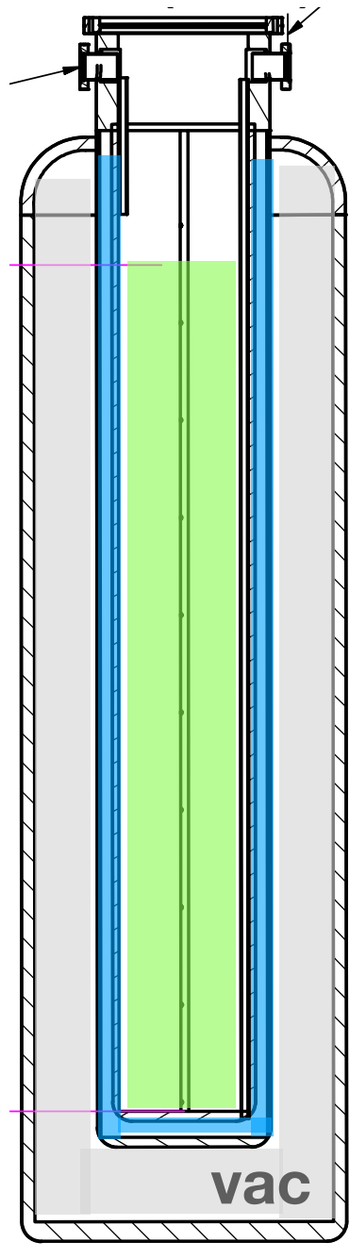
surround the Ar vessel with LN_2 to liquify Ar gas, and to keep the LAr cold

Layout of the instruments



LAr vol: ~ 40 L

LN_2 vol: ~ 17 L



OLAF

Optical Liquid Argon Facility

to benchmark/commission the
LAr - SiPM
readout for *LEGEND-1000*

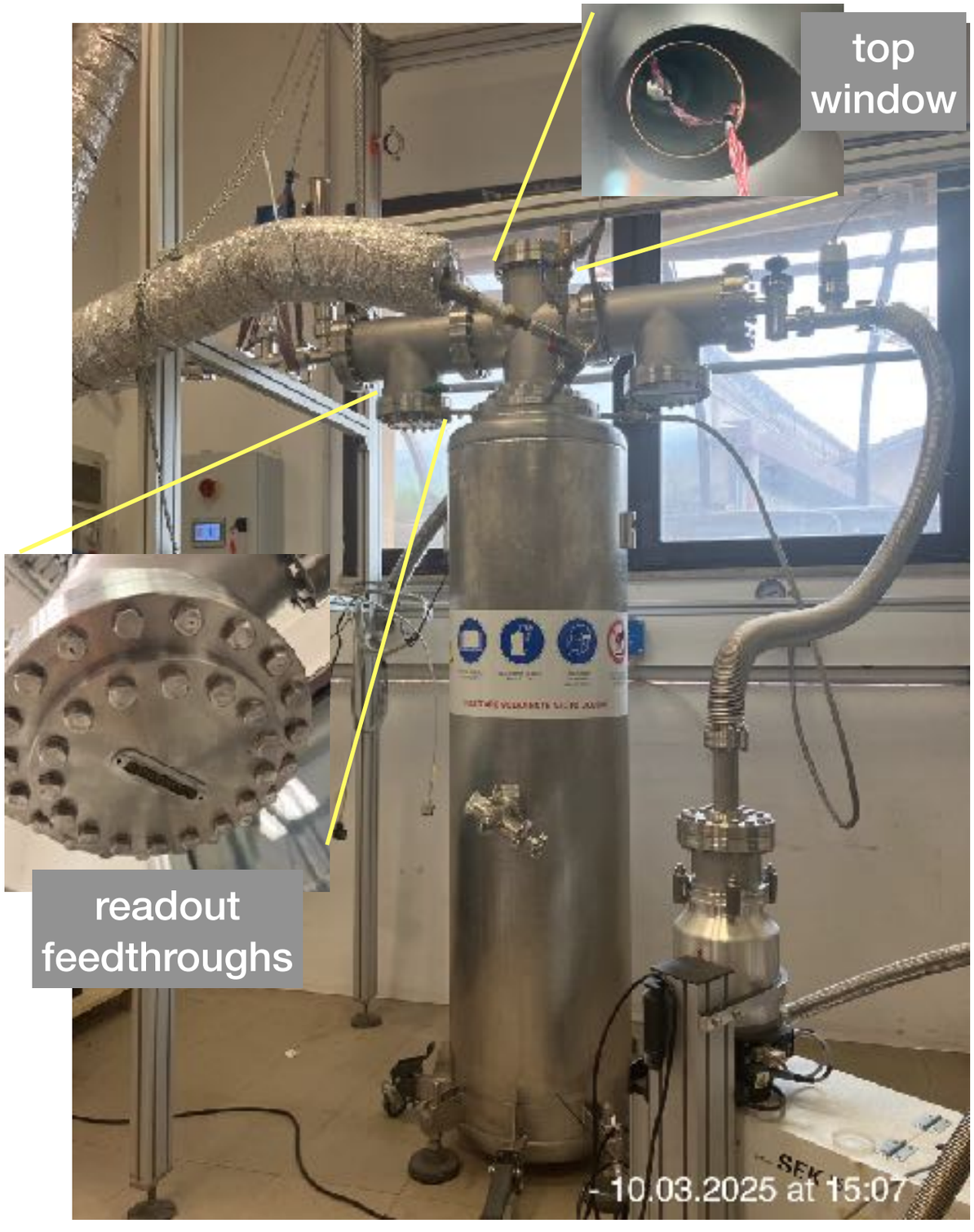
setup at Roma3
Ar 6.0 gas liquefied by LN_2
direct SiPM(VUV) readout

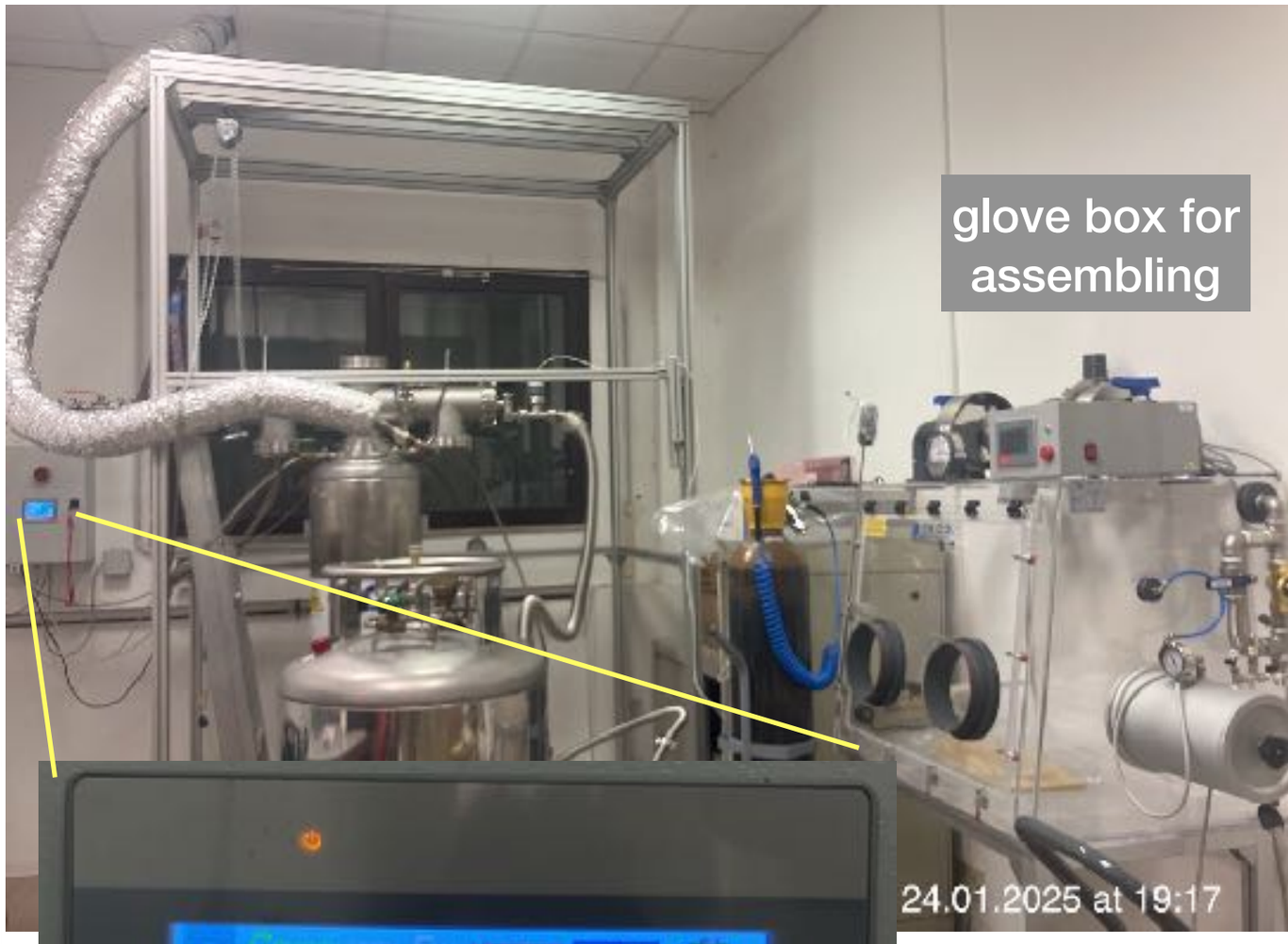
LAr optical properties that can be studied

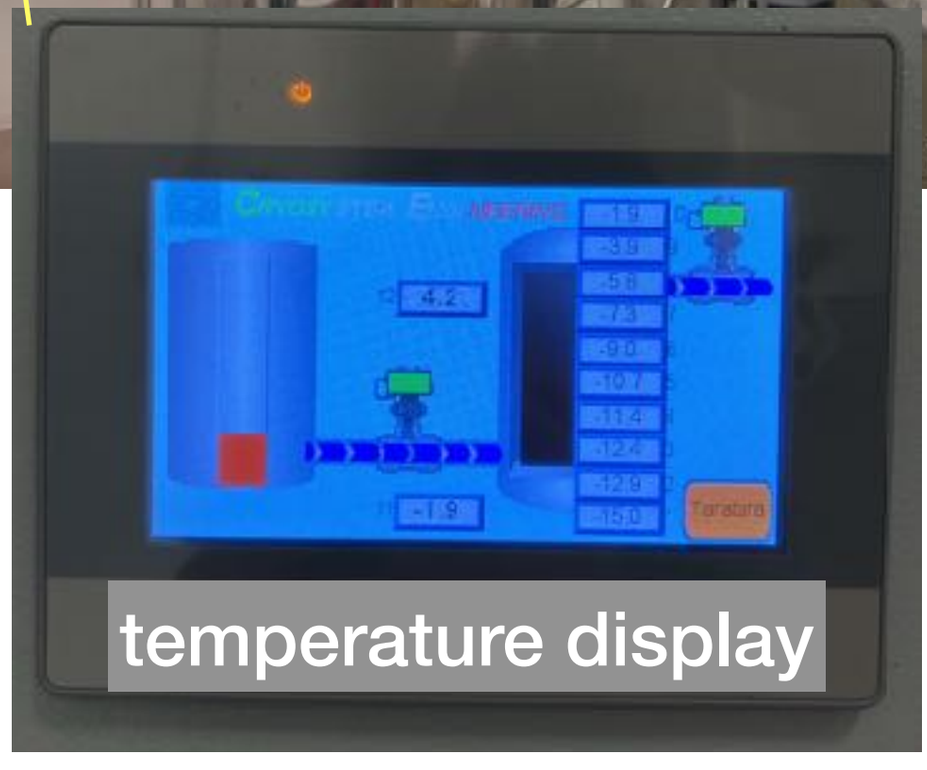
- scintillation photon yield
- (effective) attenuation length
- impurity effect (wo purification or doping)
- *time constants*
- …

OLAF cryogenic setup at INFN-Roma3

configuration for Ar liquefaction test







vacuum and cryogenic vessels, LN_2 dewar by company CryoSystemEngineering

Experimental skill box

Liquid Argon optical property measurement in OLAF

- high vacuum
- cryogenic
- detector readout
- signal processing
- trigger logic
- data acquisition, packaging, analysis

Plenty of chance to get your hands dirty on all of these