PMT-Spectrometer

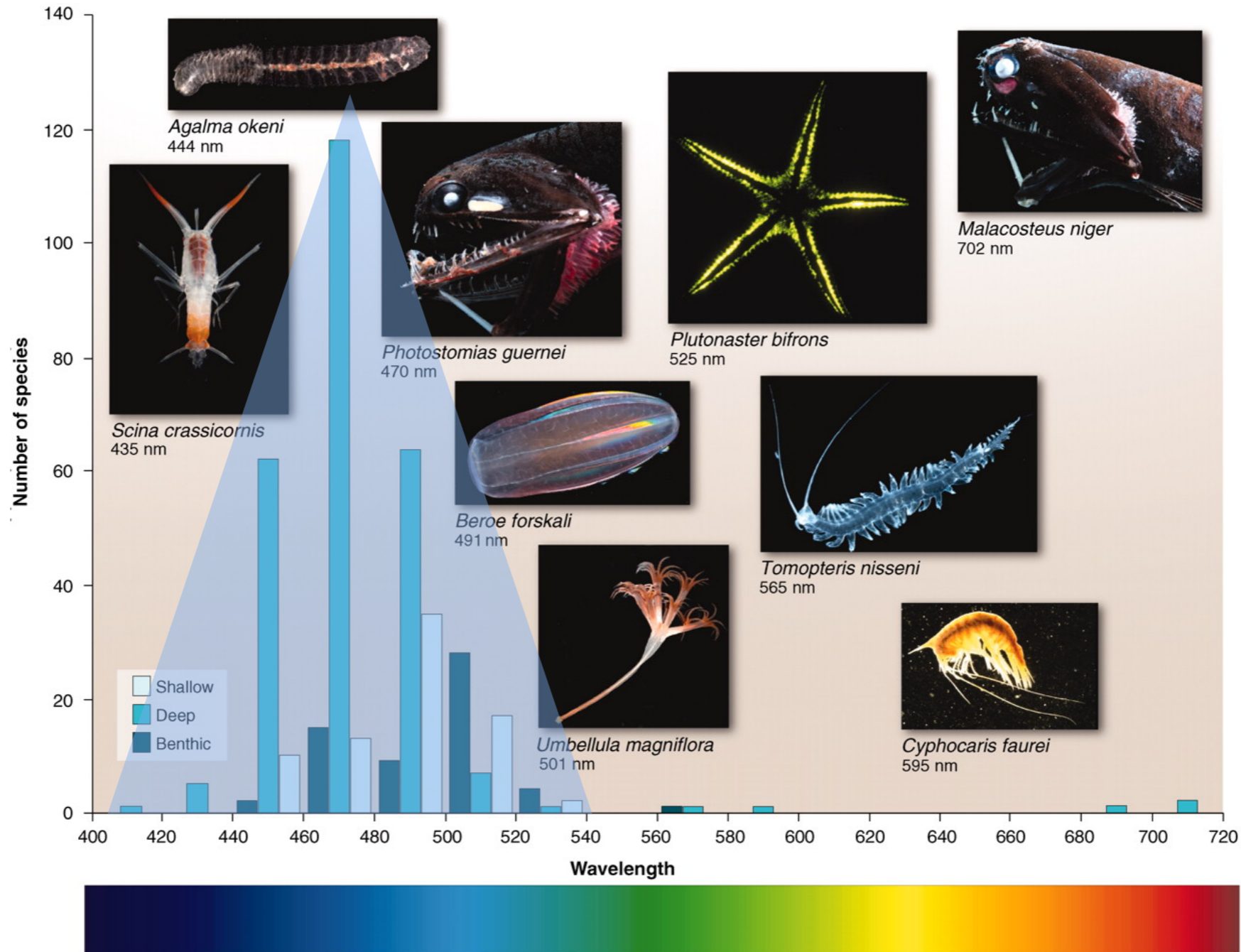## Introduction and Current State

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P-ONE Collaboration Meeting

14.12.2020

Motivation of the PMT-Spectrometer

- Measure the bio spectra of the background for P-ONE
- Light absorption length in dependence of wavelength (Complimentary to STRAW)
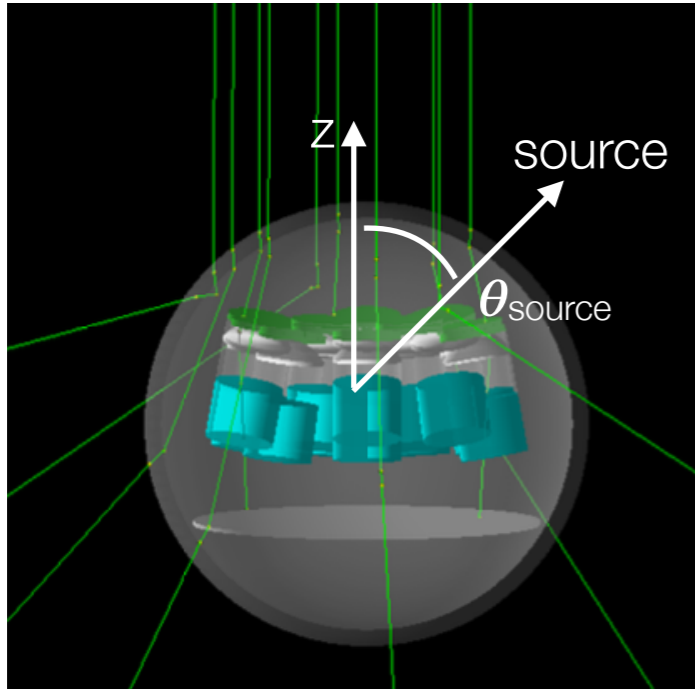
Design and Geometry

12 detection units
- unit of: 2" filter, 2" lense, 1" PMT
- maximum what fits inside a module
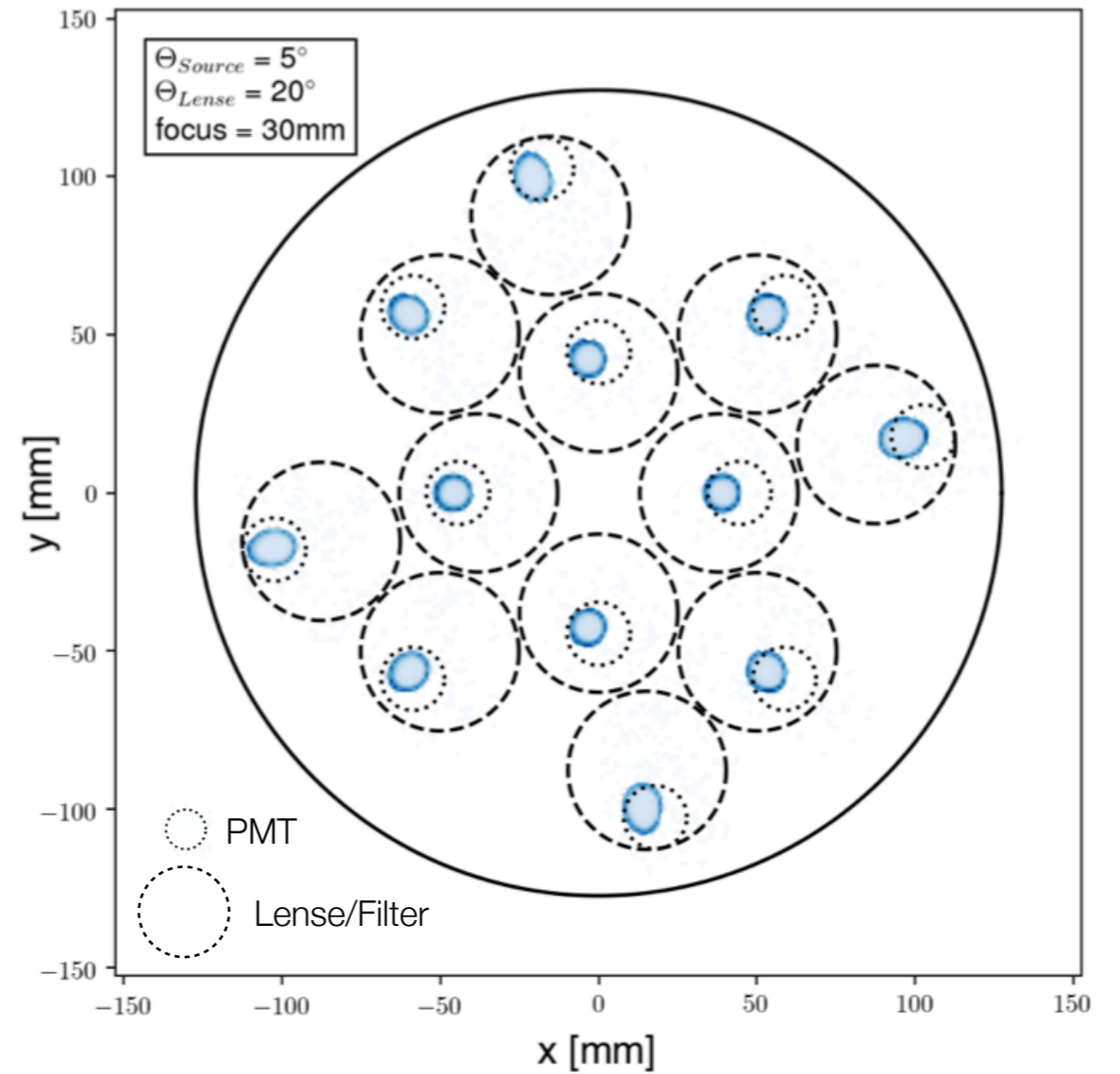
Optimised that all PMTs have the same field of view
- correct distortion of the sphere
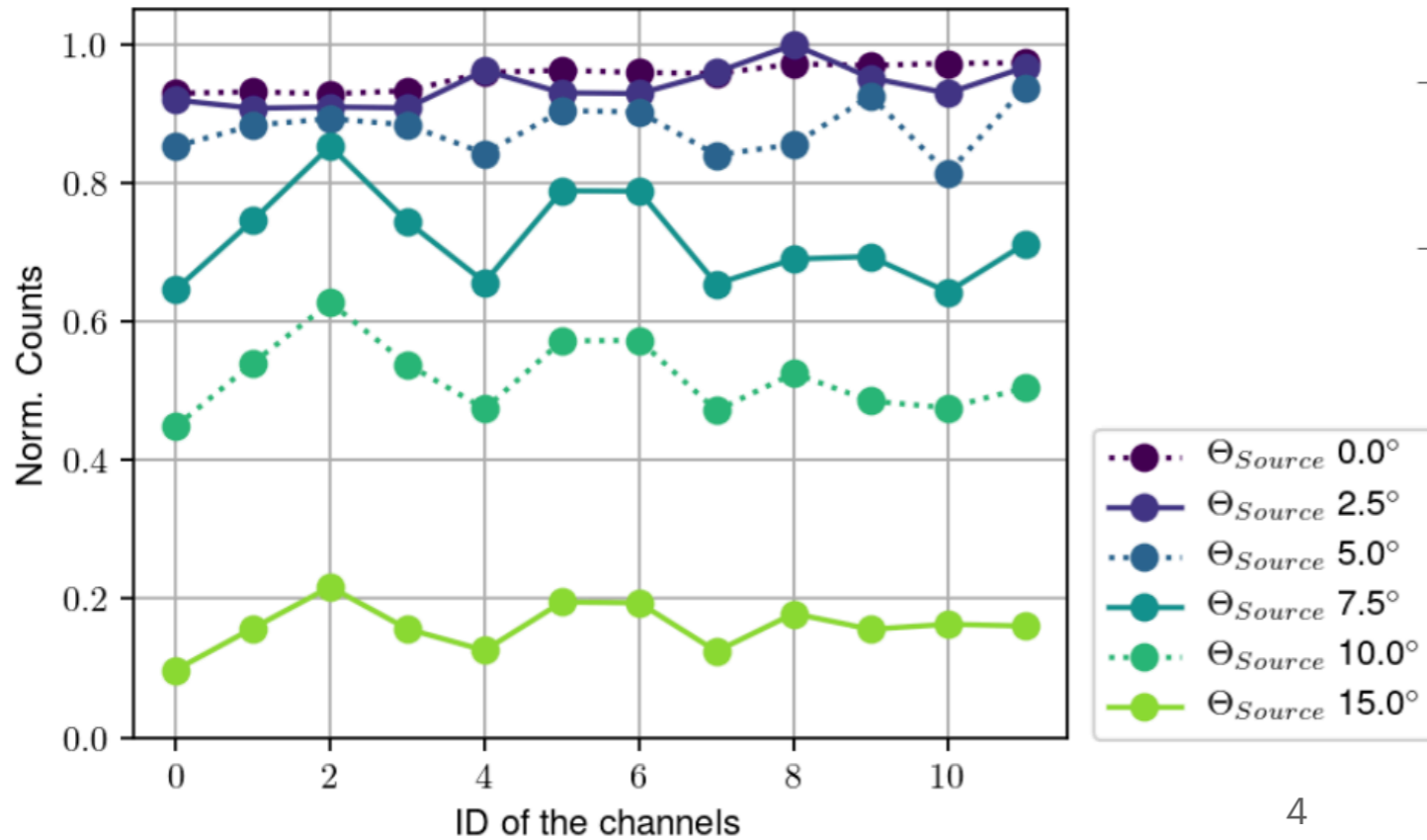- detection units are tilted in θ

detection unit

Filter

Lens

PMT

config1

config1

config2

config1b

tilt θ_1

tilt θ_2

tilt θ_3
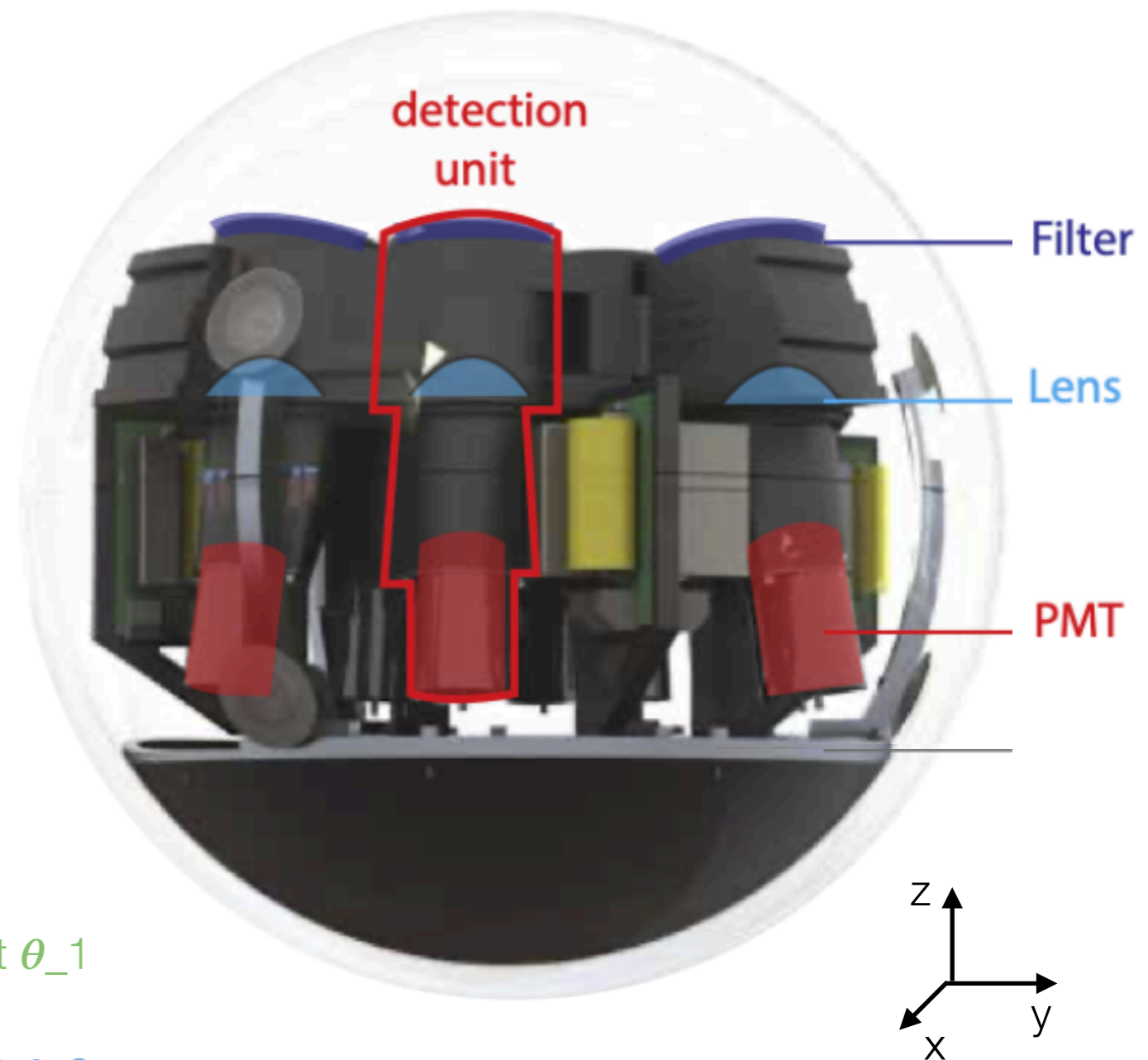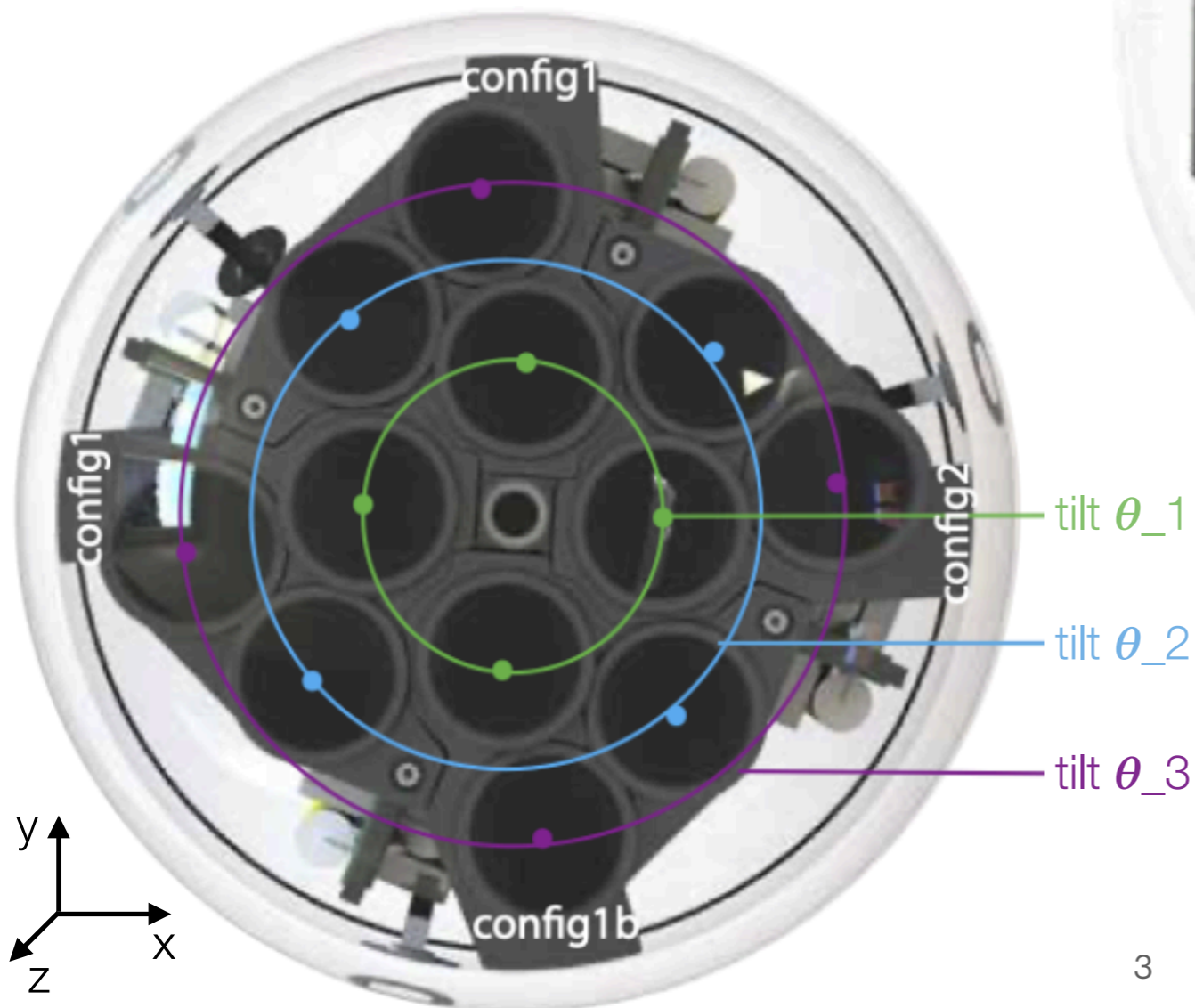
Geant4 Simulation

Light intensity at the PMTs for $\theta_{source} = 5$

$\Theta_{Source} = 5°$
$\Theta_{Lense} = 20°$
focus = 30mm

PMT

Lense/Filter

Angular acceptance per PMT (=channel) vs. θ_{source}

Legend:
- Θ_{Source} 0.0°
- Θ_{Source} 2.5°
- Θ_{Source} 5.0°
- Θ_{Source} 7.5°
- Θ_{Source} 10.0°
- Θ_{Source} 15.0°

Norm. Counts

ID of the channels

Filter Selection

- 11 PMTs equipped filters
- 1 PMT without filter to measure integrated light
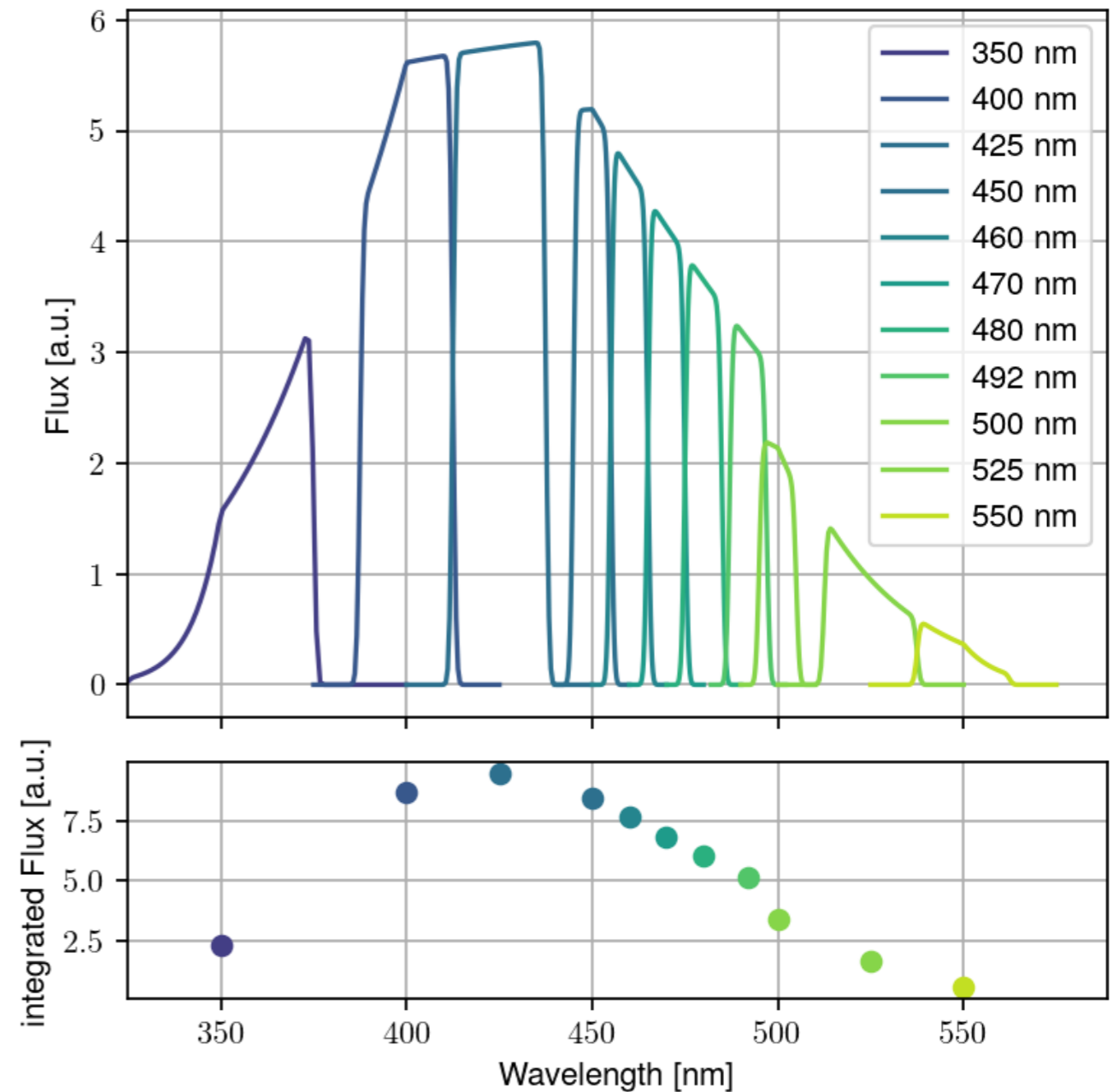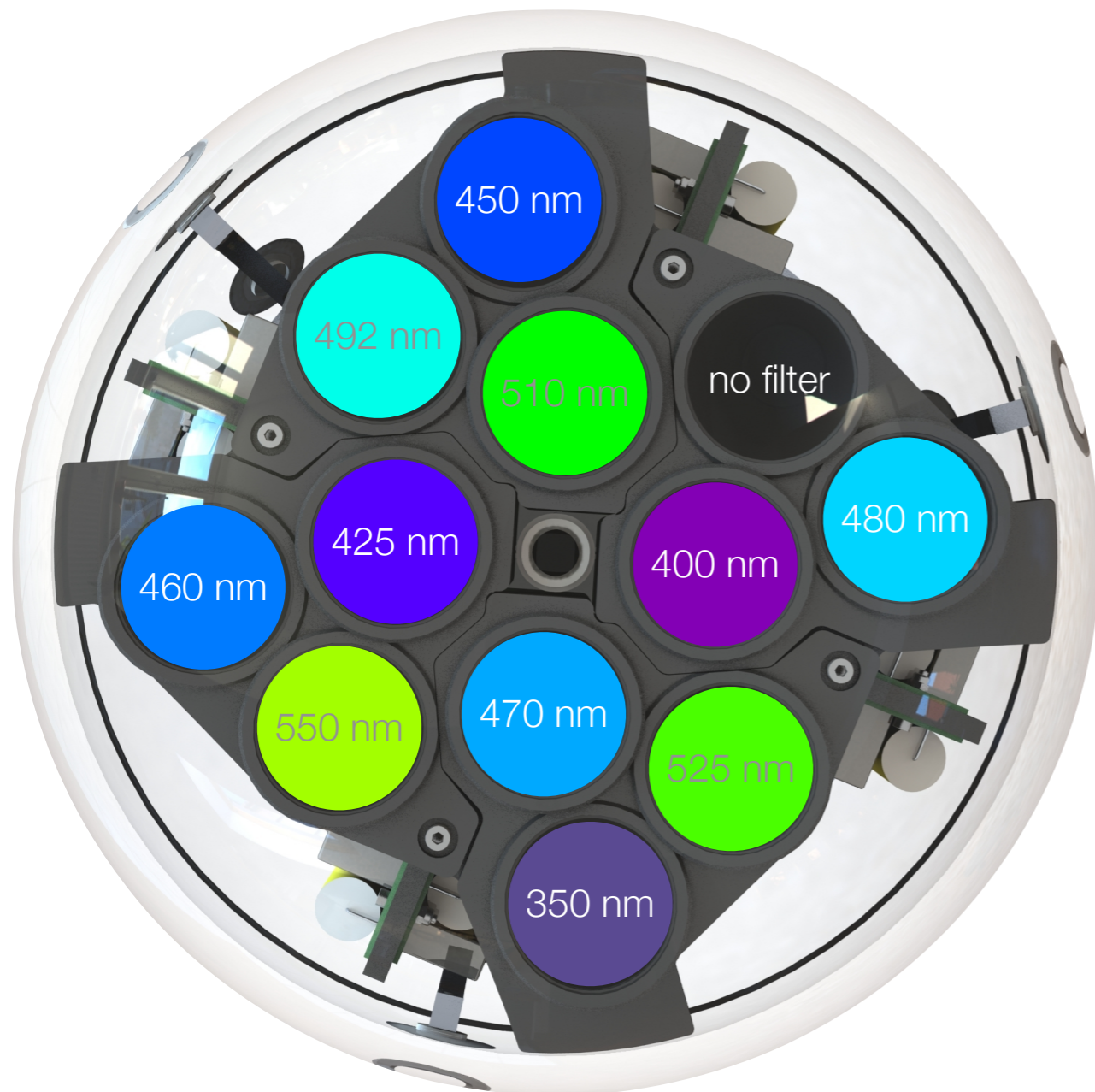
The first plot is a convolution for each PMT+Filter which covers:
- Absorption of water (distance = 1 m)
- Absorption of glass (glass thickness)
- QE of PMT (measured)

Deployment and Measurements

Both PMT-Spectrometer survived the deployment.

PMT-Spectrometer 001 is taking data constantly

Lost readout electronic of PMTs on PMT-Spectrometer 002:
- FPGA of PADIWA has lost its memory and can't be reprogrammed - unknown issue
- The readout electronic was working only for 2 days after the deployment
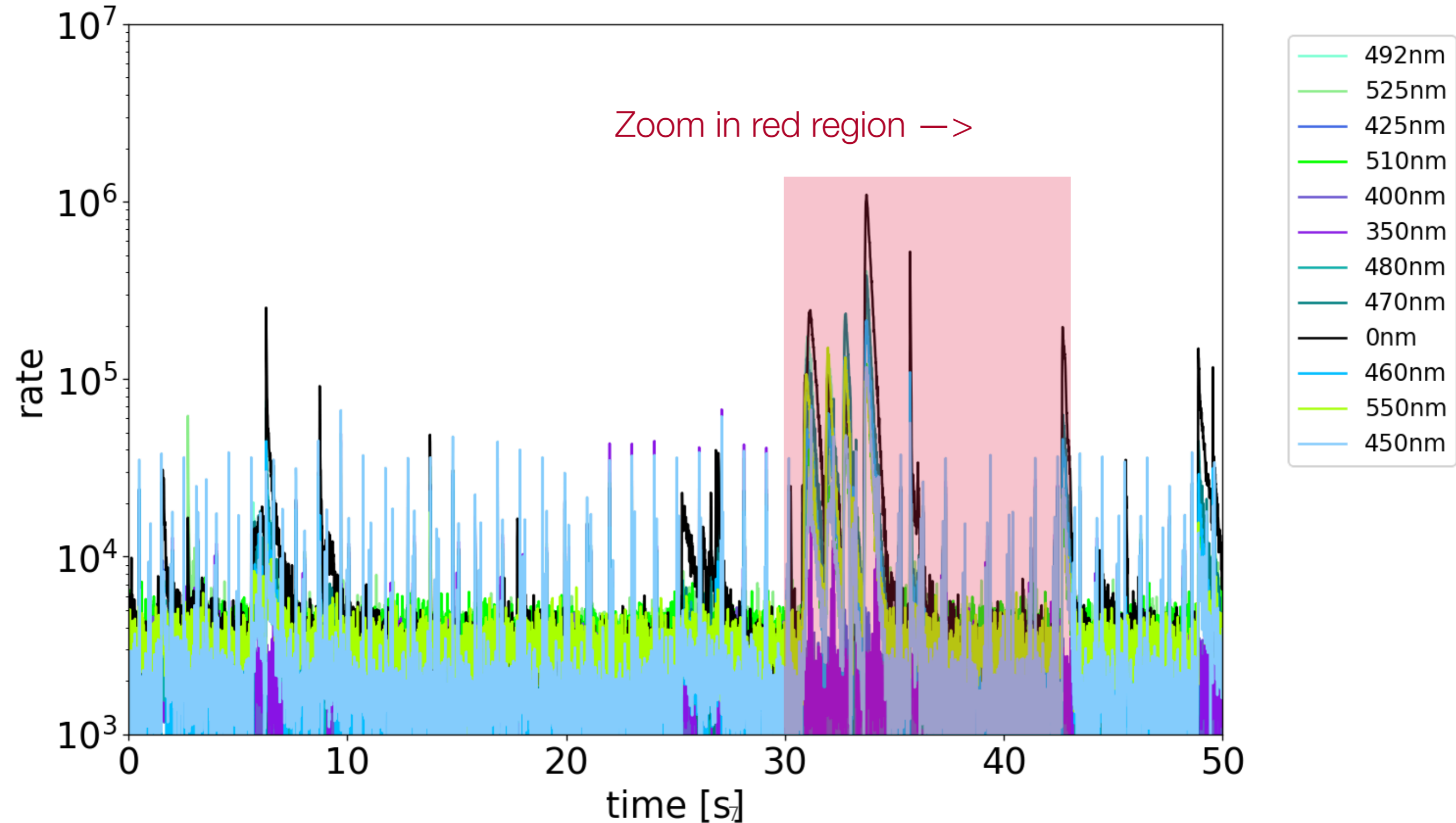- Other sensors like camera and Mini-spectrometer are still working.
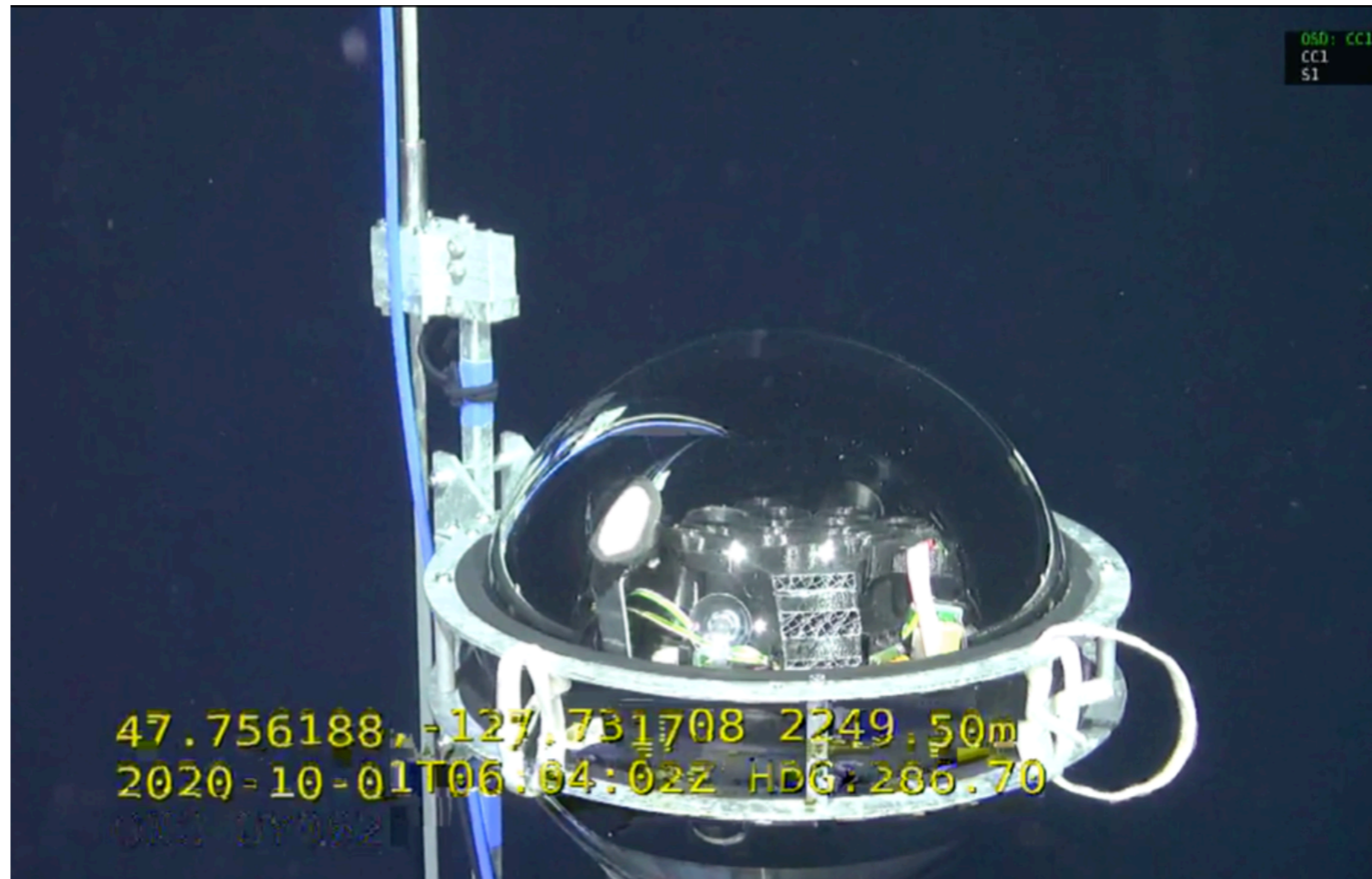
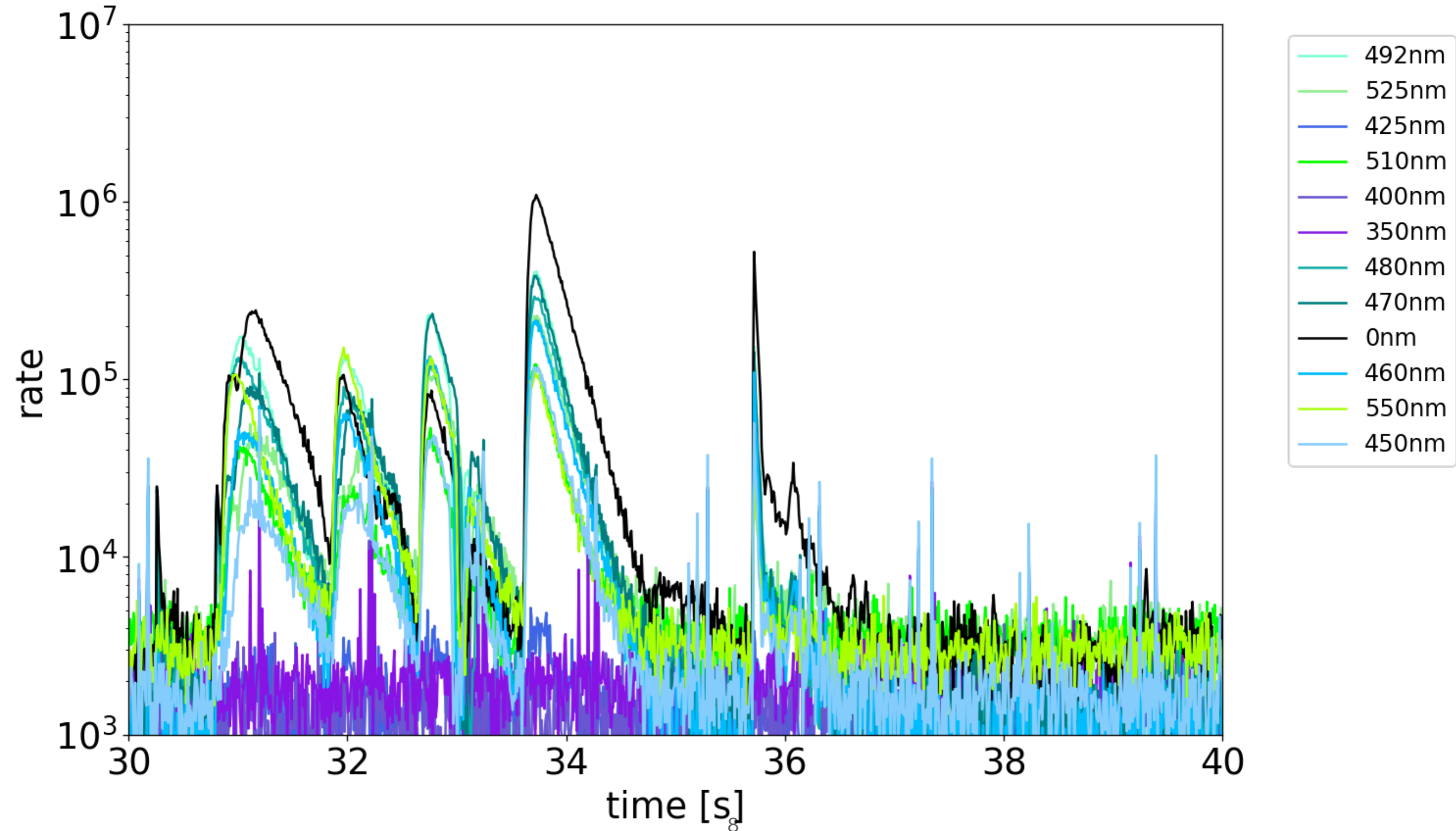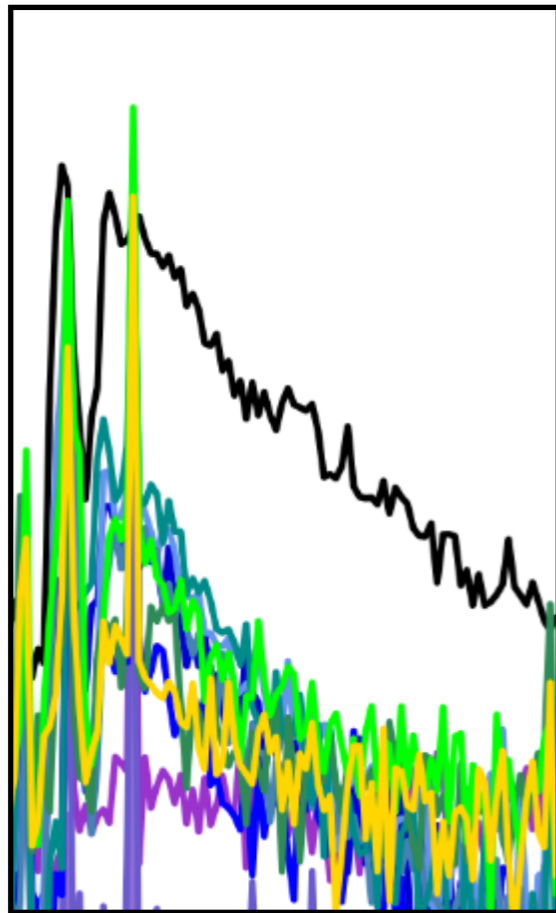# Rates of the PMTs

Date: 2020-12-10 14:00
Readout frequency: ~11Hz
Module: PMT-Spectrometer 01

Rates of the PMTs

Date: 2020-12-10 14:00
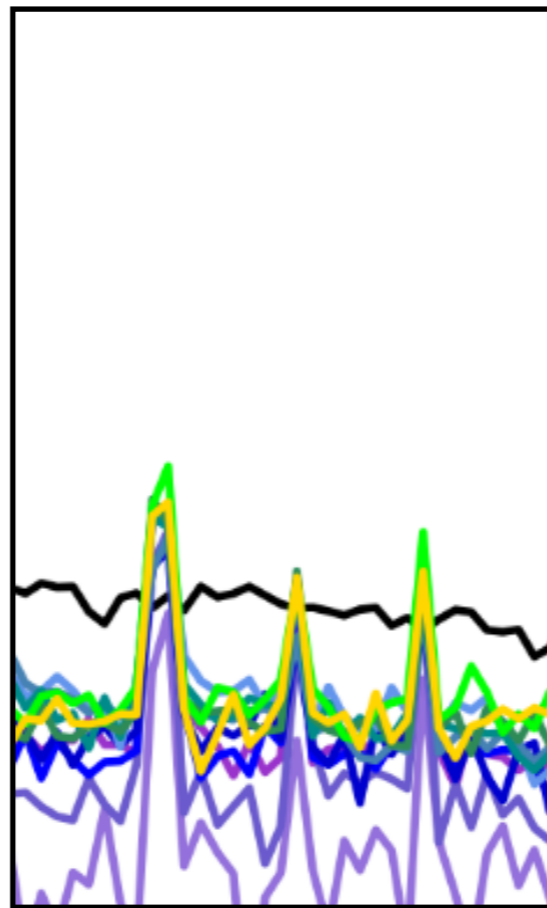Readout frequency: ~11Hz
Module: PMT-Spectrometer 01
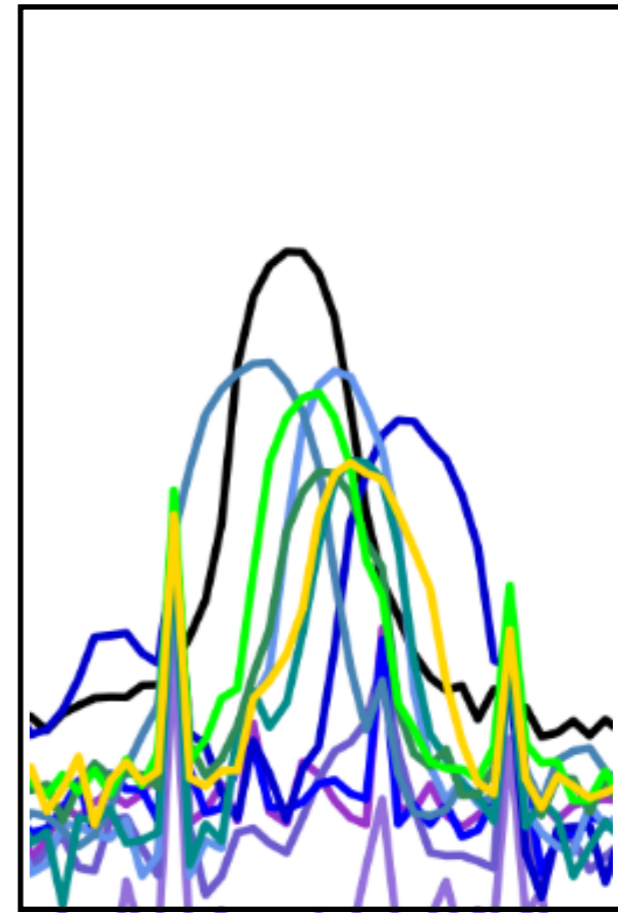
Preliminary spectrum results

| ← ~ 10 s → | ← ~ 10 s → | ← ~ 10 s → |

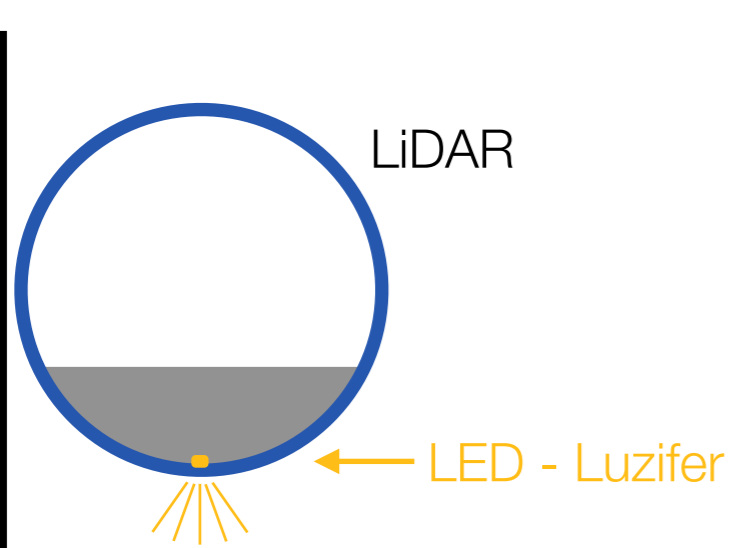Typical gamma
pulse shape

Very short
pulse duration

"exotic" shape
due to detector geometry ?

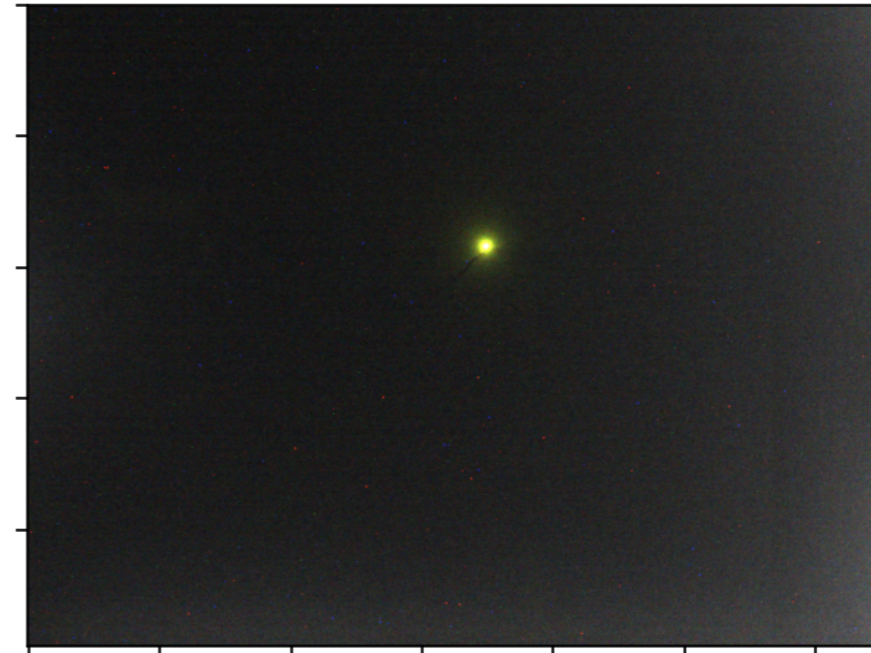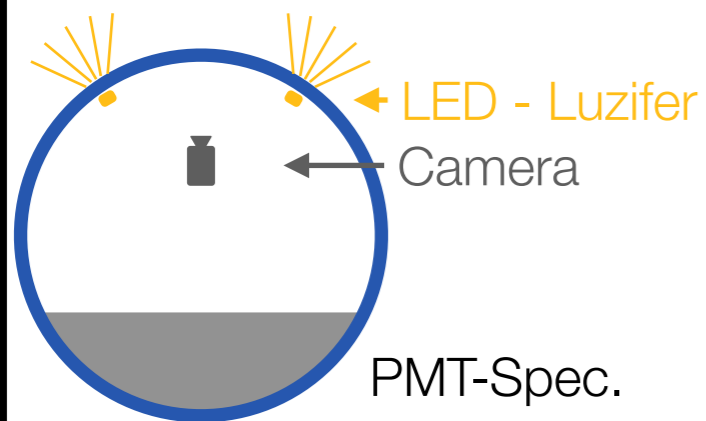More in bioluminescence report by Stephan Meighen-Berger…

Camera
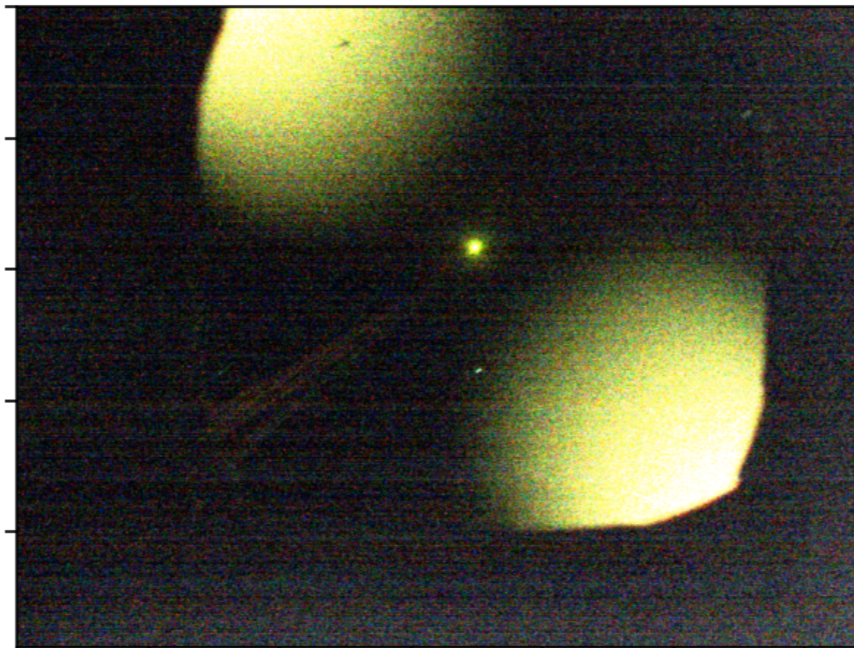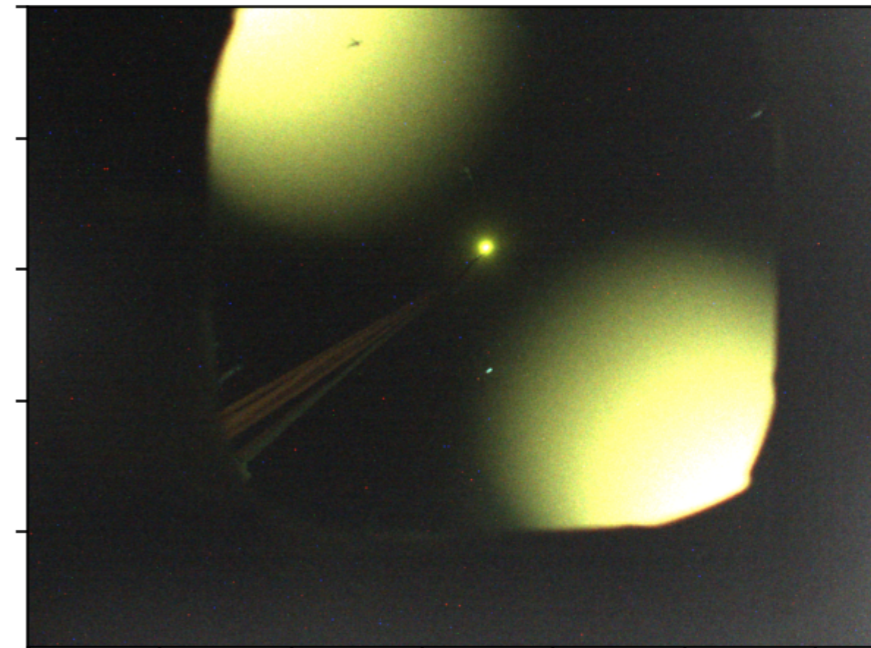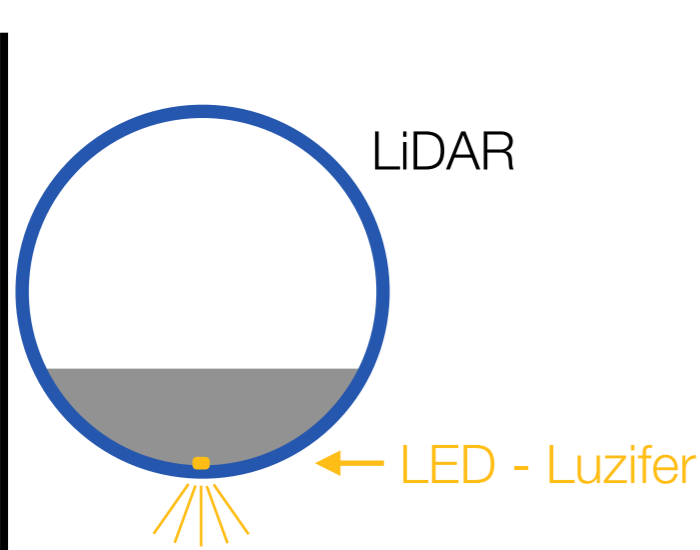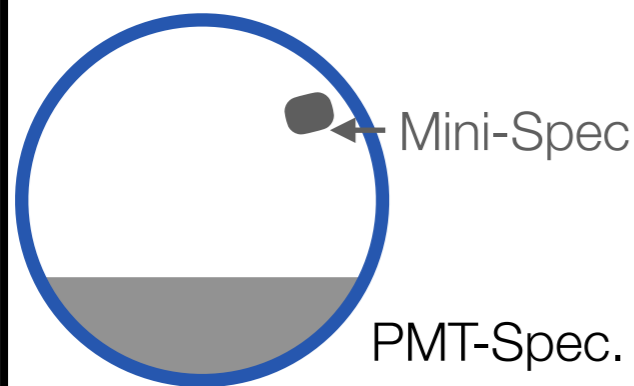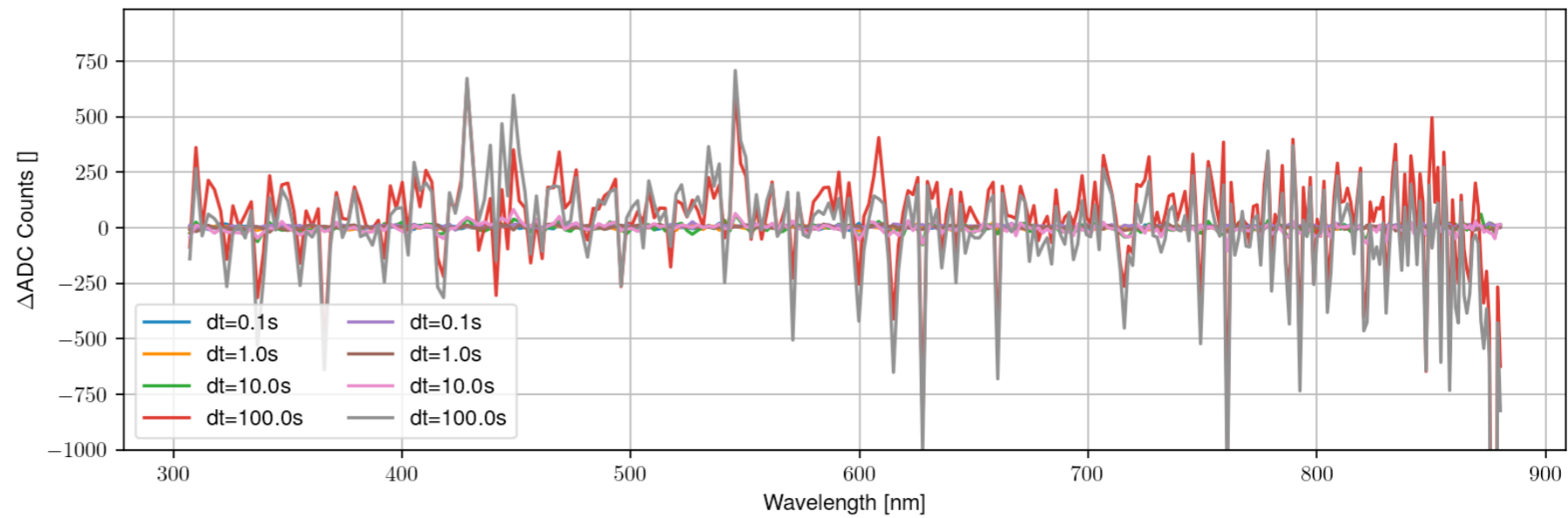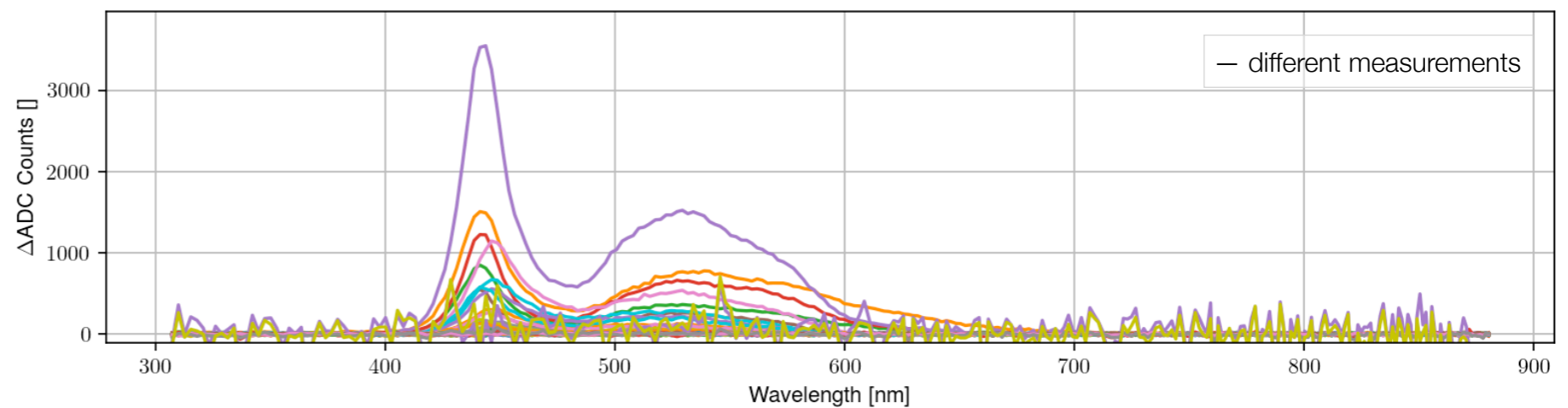
Mini-Spectrometer

Summary and Outlook

- Design of PMT-spectrometer works fine.
- PMTSPECTROMETER001 are running successfully and will continuously take spectra, provide reference for bioluminescence simulation
- Need more study on PMTSPECTROMETER002's padiwa lost
- Analysis software is under constructing

Thank you for your attention !
Any question?