



HRPPD Quantum Efficiency Measurements

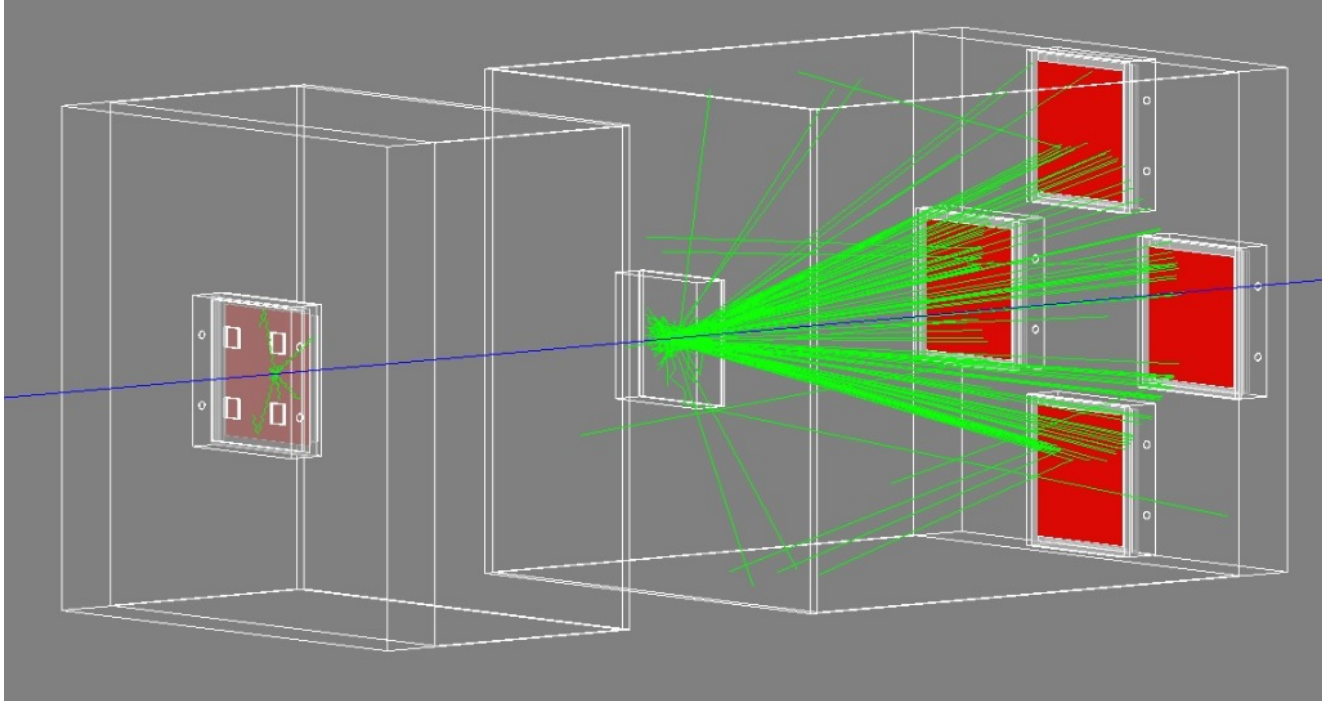
Cheuk-Ping Wong

04-08-2026

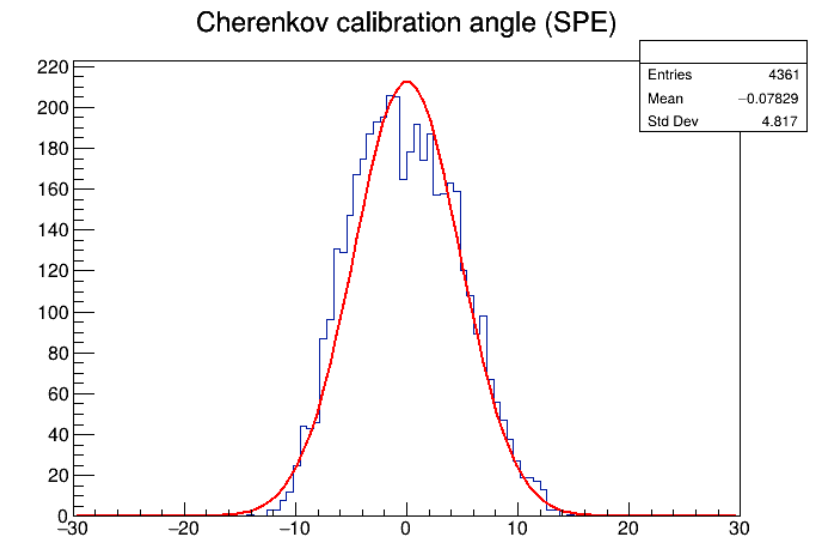
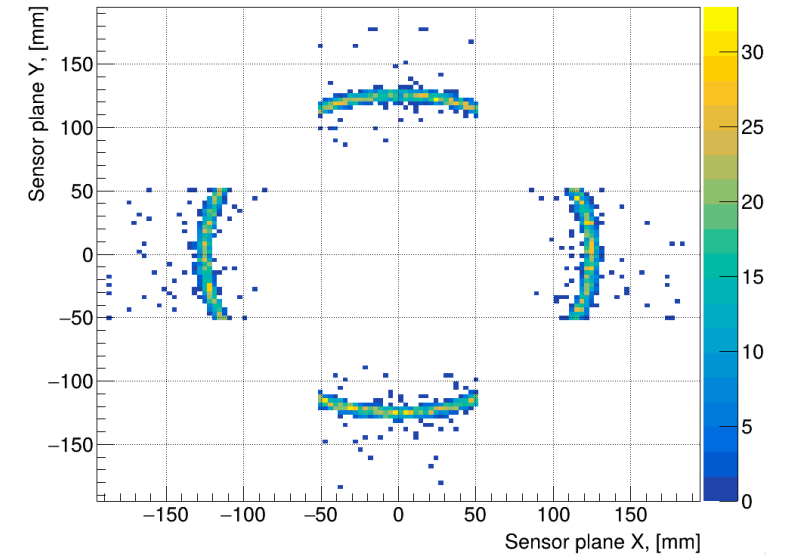


Simulations for CERN Beam Test

Standalone pFRICH simulation with the CERN beam test setup



- Installed on the beam test computer and SDCC
- Goal: bring the simulation into sync with the beam test
 - ❑ QE of HRPPD (in progress)
 - ❑ Acceptance / active area
 - ❑ Unify the reconstruction of the beam test data and the simulation



Measurement Setup

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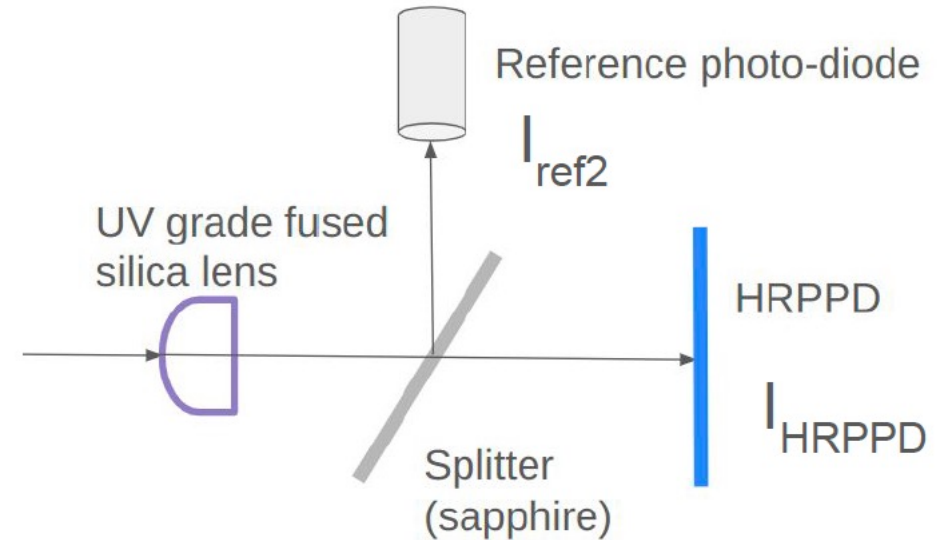
$$= \frac{I_{HRPPD}}{I_{ref}} \cdot \frac{I_{Newport}}{I_{Newport}} \cdot QE_{Newport}$$

where

$$QE_{Newport}(\lambda) = \frac{hc}{e} \cdot \frac{\text{Responsivity}(\lambda)}{\lambda}$$

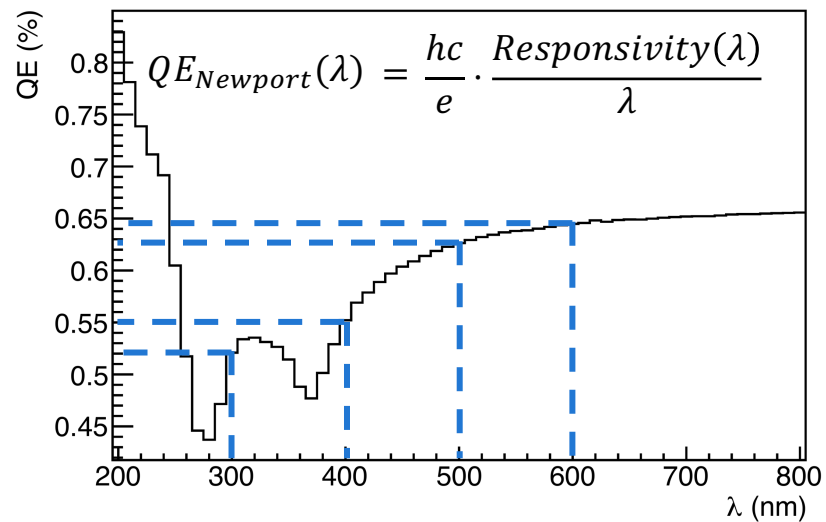
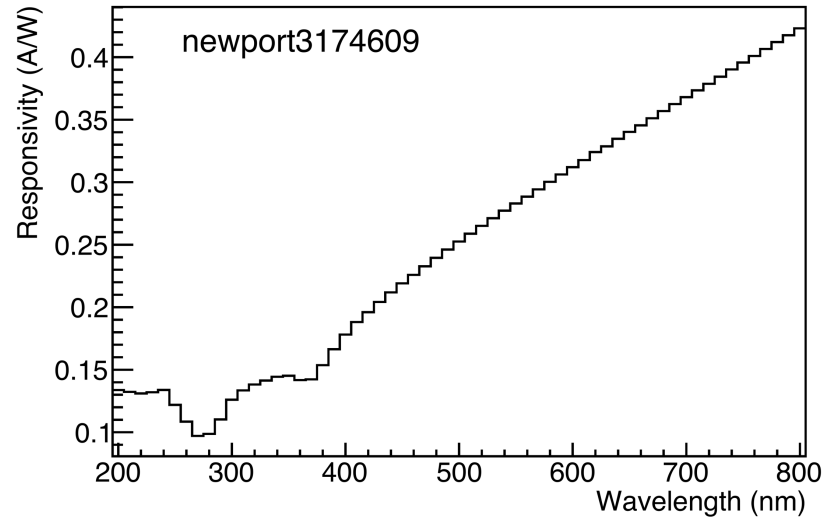
From past photodiode calibration measurements

$$\text{Measure } \frac{I_{HRPPD}}{I_{ref}}$$

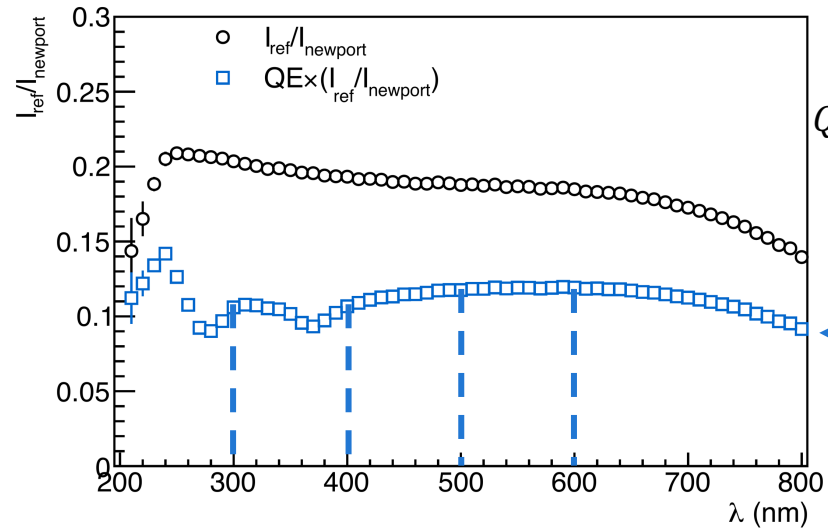
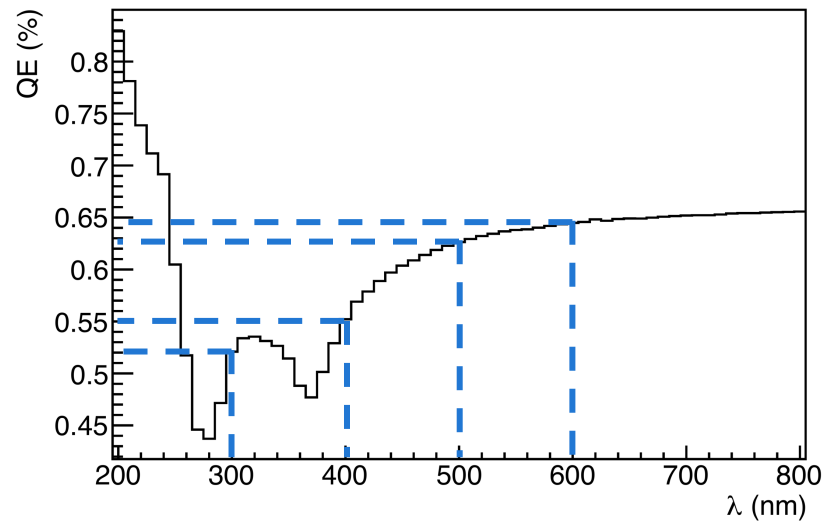
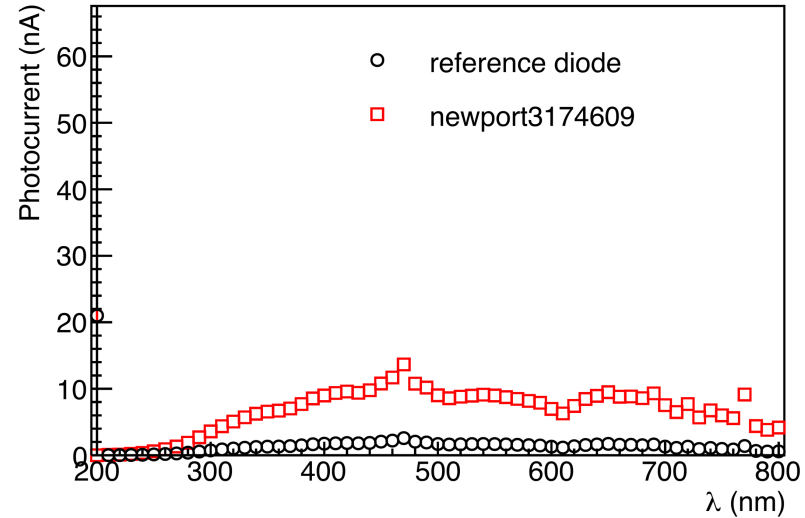
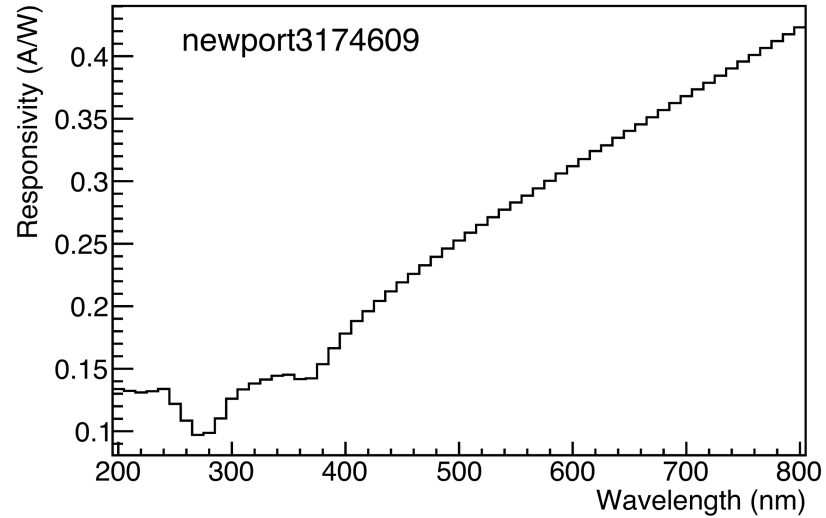


- +/- 30mm in x and y direction
- Beam spot diameter = 2 mm
- Step size = 1 mm
- Photocathode voltage = -100 V
- Wavelength = 300, 400, 500, 600 nm
- ~4.5 hours per HRPPD scan

Quantum Efficiency of Photodiode 3174609

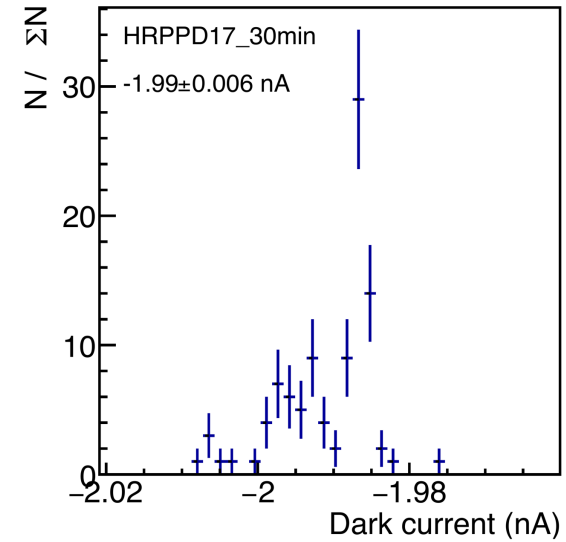
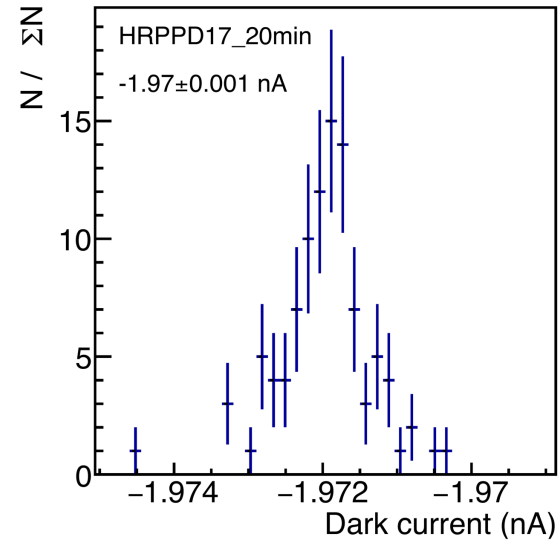
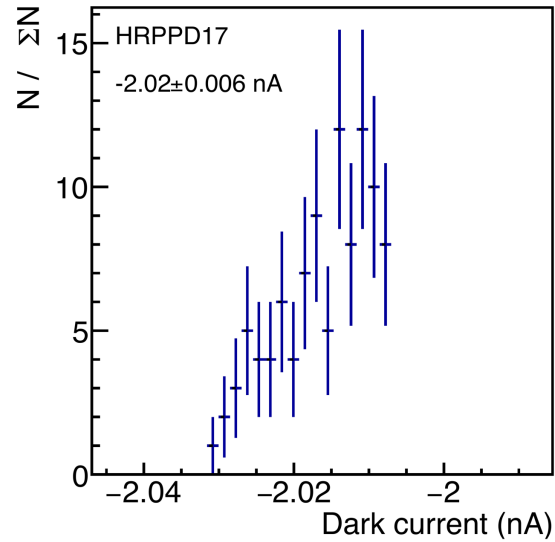


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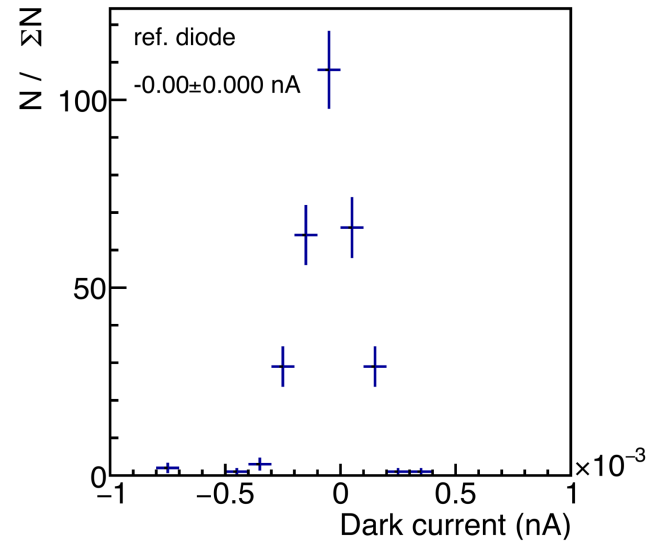
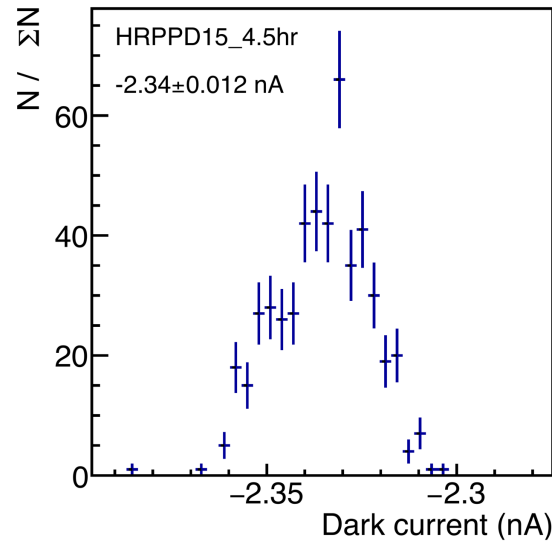
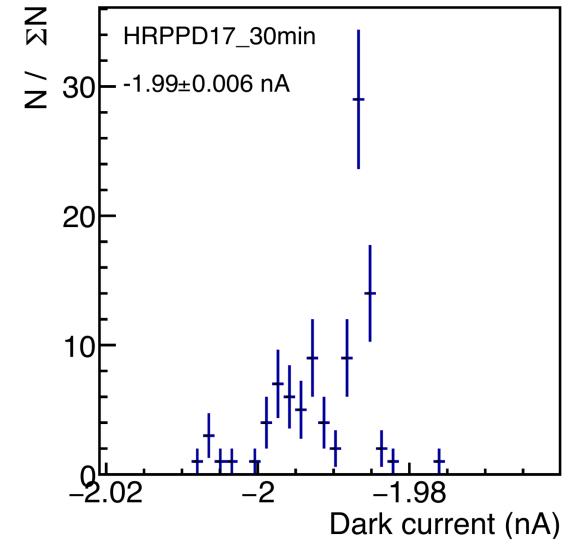
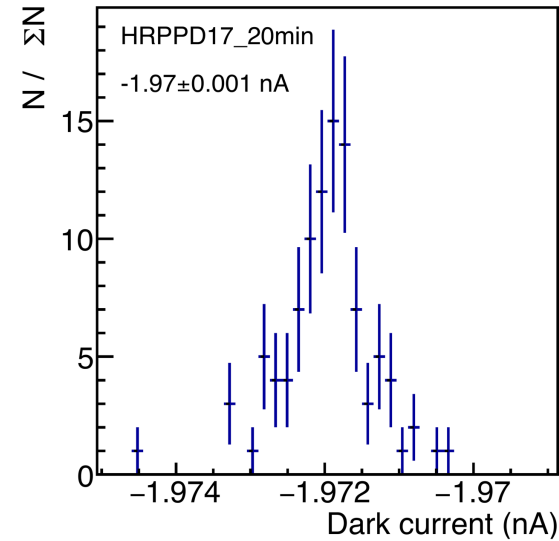
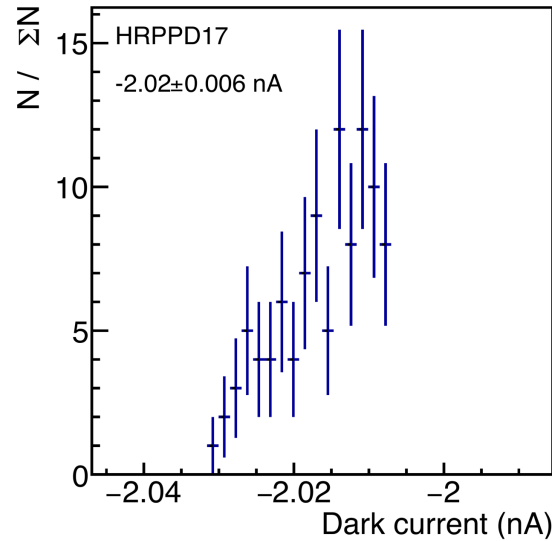


$$QE_{HRPPD} = \frac{I_{HRPPD}}{I_{ref}} \cdot \frac{I_{ref}^{Newport}}{I_{Newport}} \cdot QE_{Newport}$$

Dark Current Of HRPPD 15 & 17

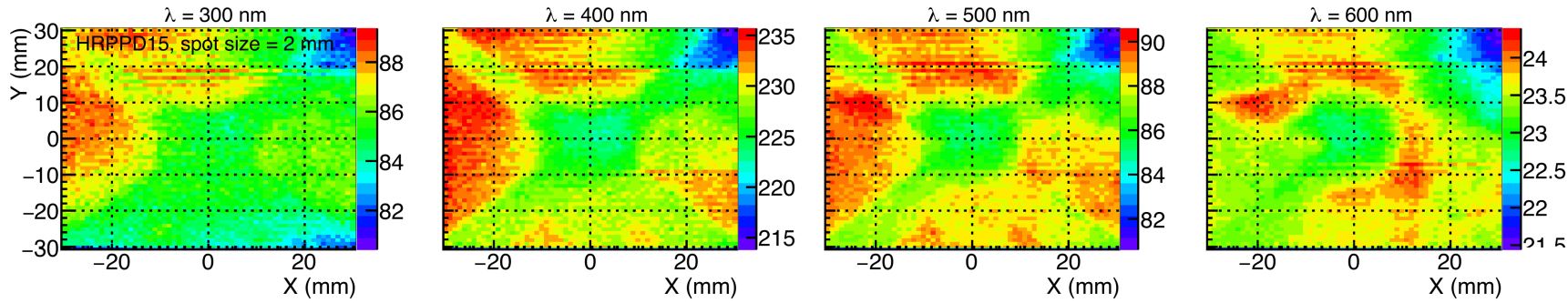


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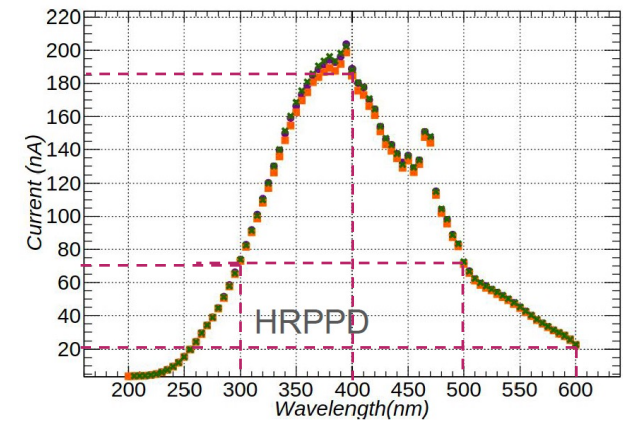
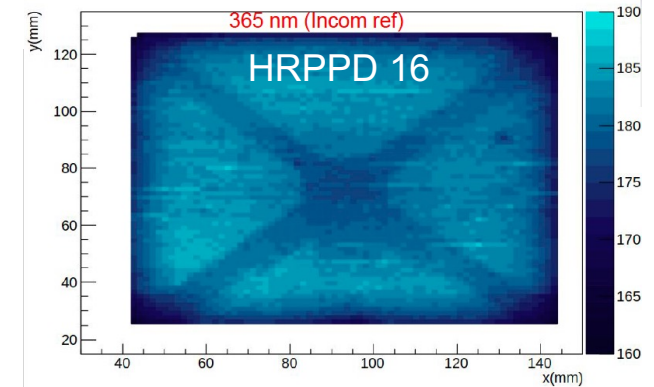
Quantum Efficiency of HRPPD 15

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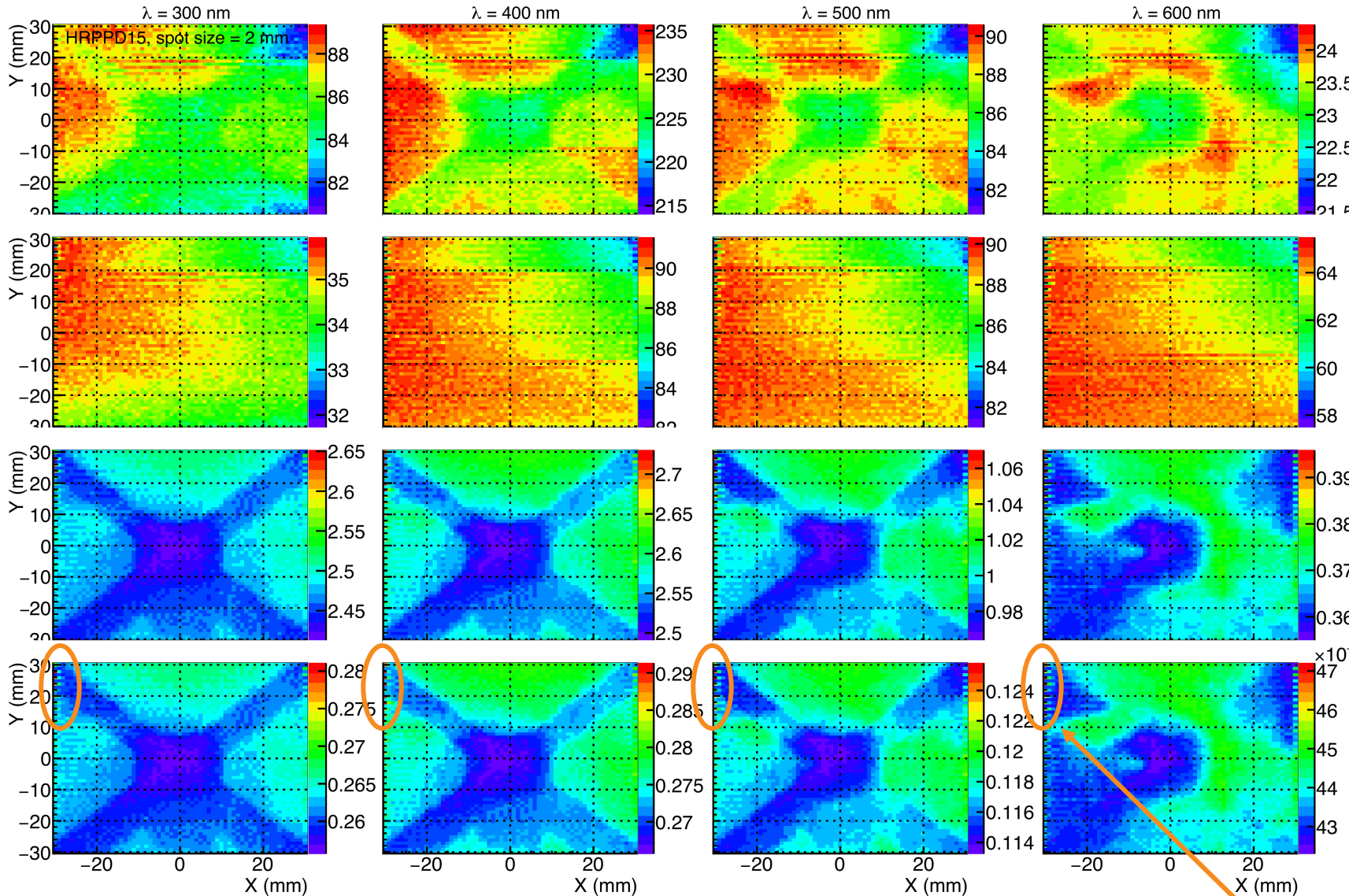
- Max. brightness
- Dark current subtracted
- No Photodiode calibration correction yet!

https://indico.bnl.gov/event/24127/contributions/94288/attachments/56073/95937/chatterjee_hrppd_qe_25Jul.pdf



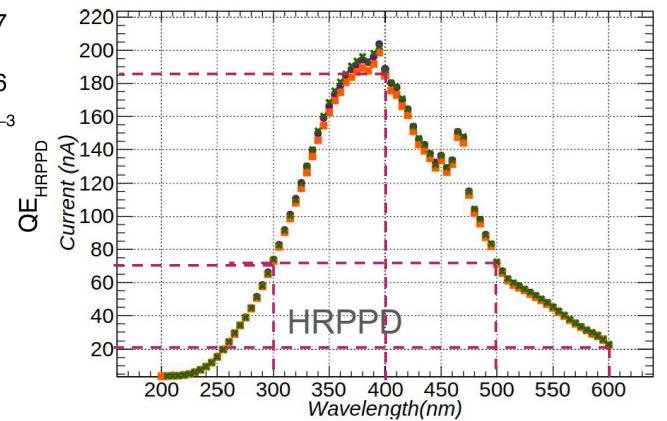
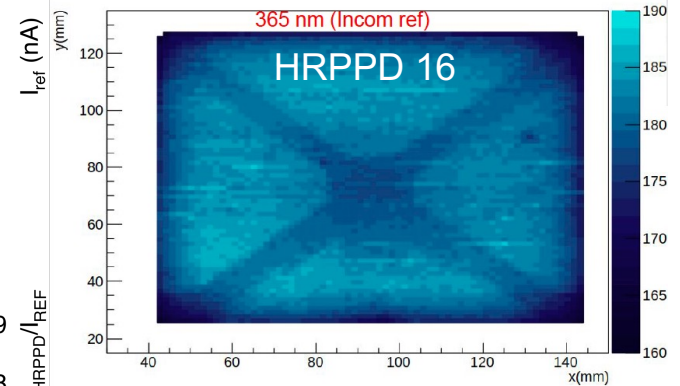
Quantum Efficiency of HRPPD 15

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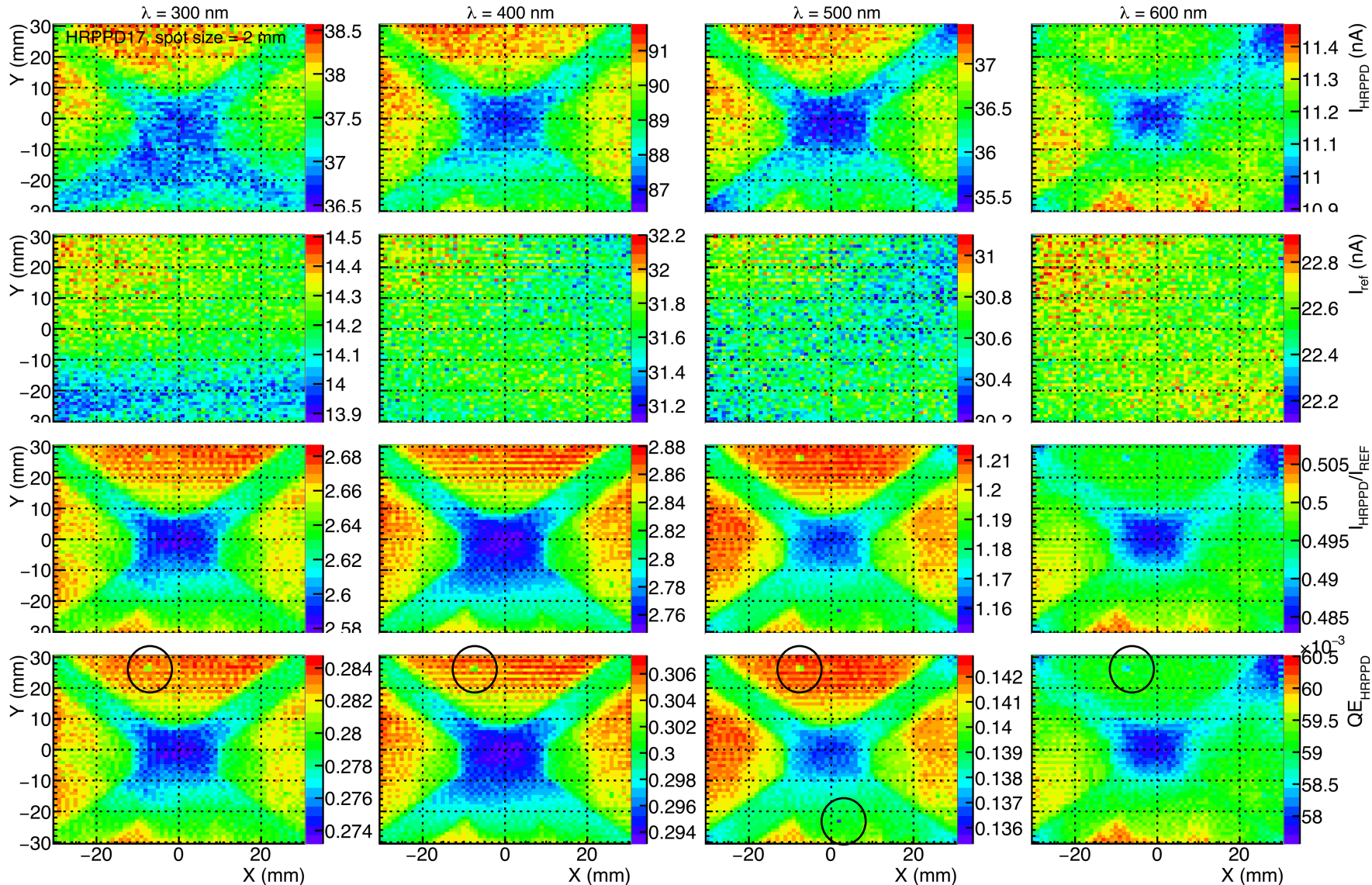
- Max. brightness
- Dark current subtracted
- No Photodiode calibration correction yet!

https://indico.bnl.gov/event/24127/contributions/94288/attachments/56073/95937/chatterjee_hrppd_qe_25Jul.pdf



Quantum Efficiency of HRPPD 17

$$QE_{HRPPD} = \frac{I_{HRPPD}}{I_{HRPPD,ref}} \cdot \frac{I_{ref}^{Newport}}{I_{Newport}} \cdot QE_{Newport}$$



- Lower brightness
- Dark current subtracted
- No Photodiode calibration correction yet!
- Incom spec sheet:
 - Mean QE (365nm) = 35.2%, spatial uniformity=88%
 - Mean QE (420nm) = 28.7%

Summary and To-do

- Updating standalone pfRICH simulation for the beam test
- Measured quantum efficiency of HRPPD 15 & 17
 - Need correction of from the photodiode calibration
- 3 more HRPPD tiles to go