MICRO-429: Metrology Practicals

Introduction

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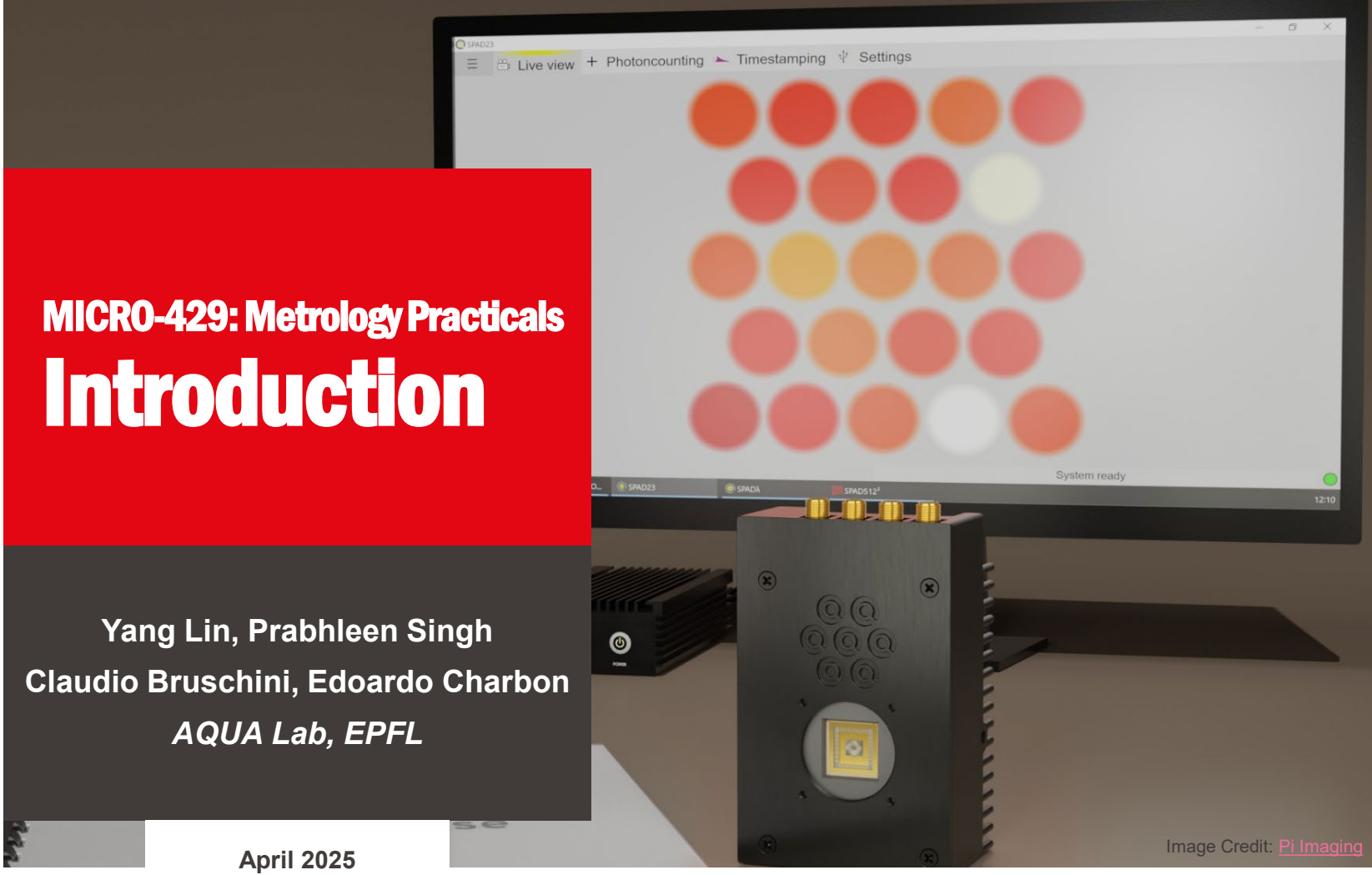

Image Credit: Pi Imaging

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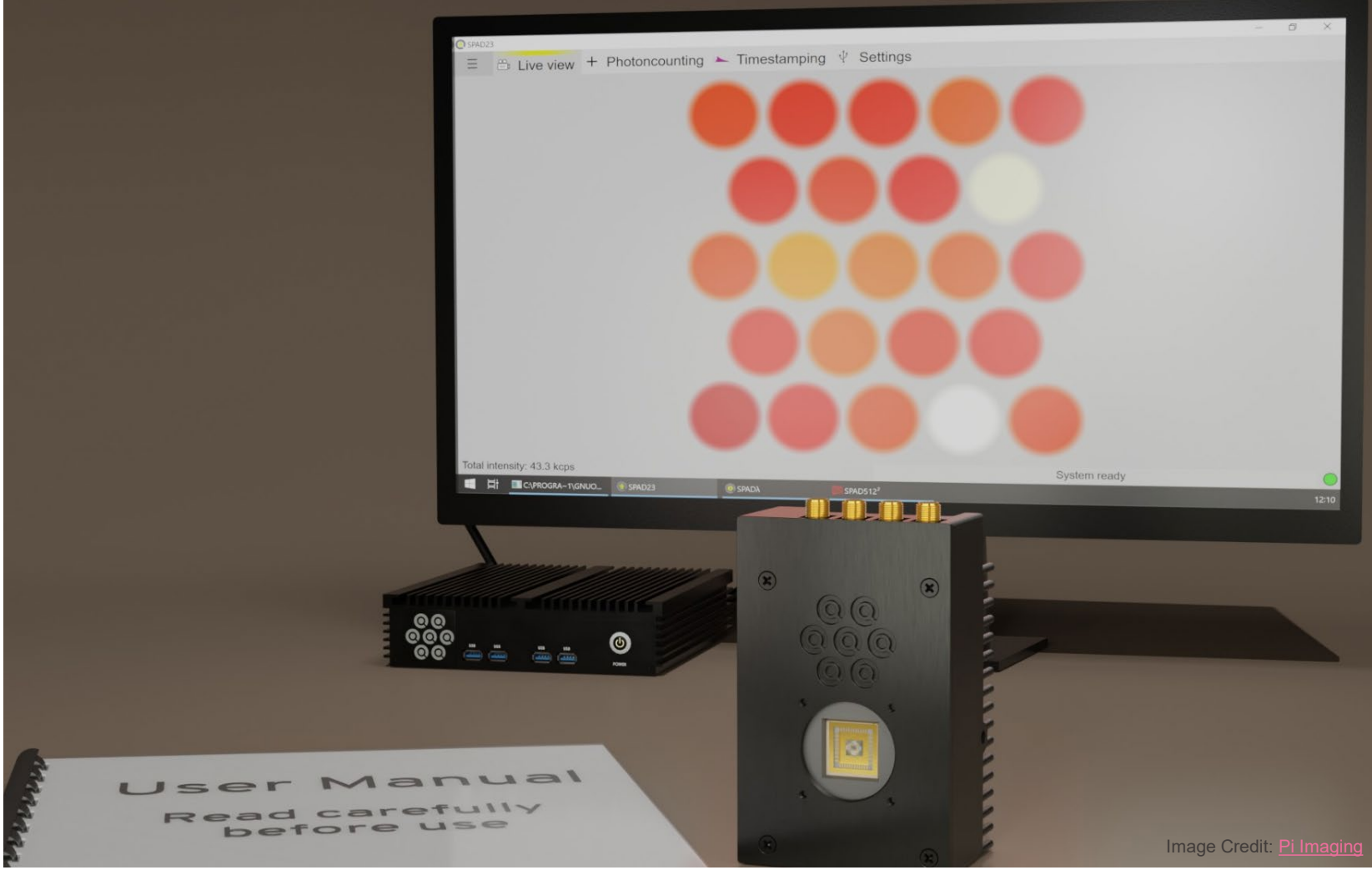


Image Credit: Pi Imaging

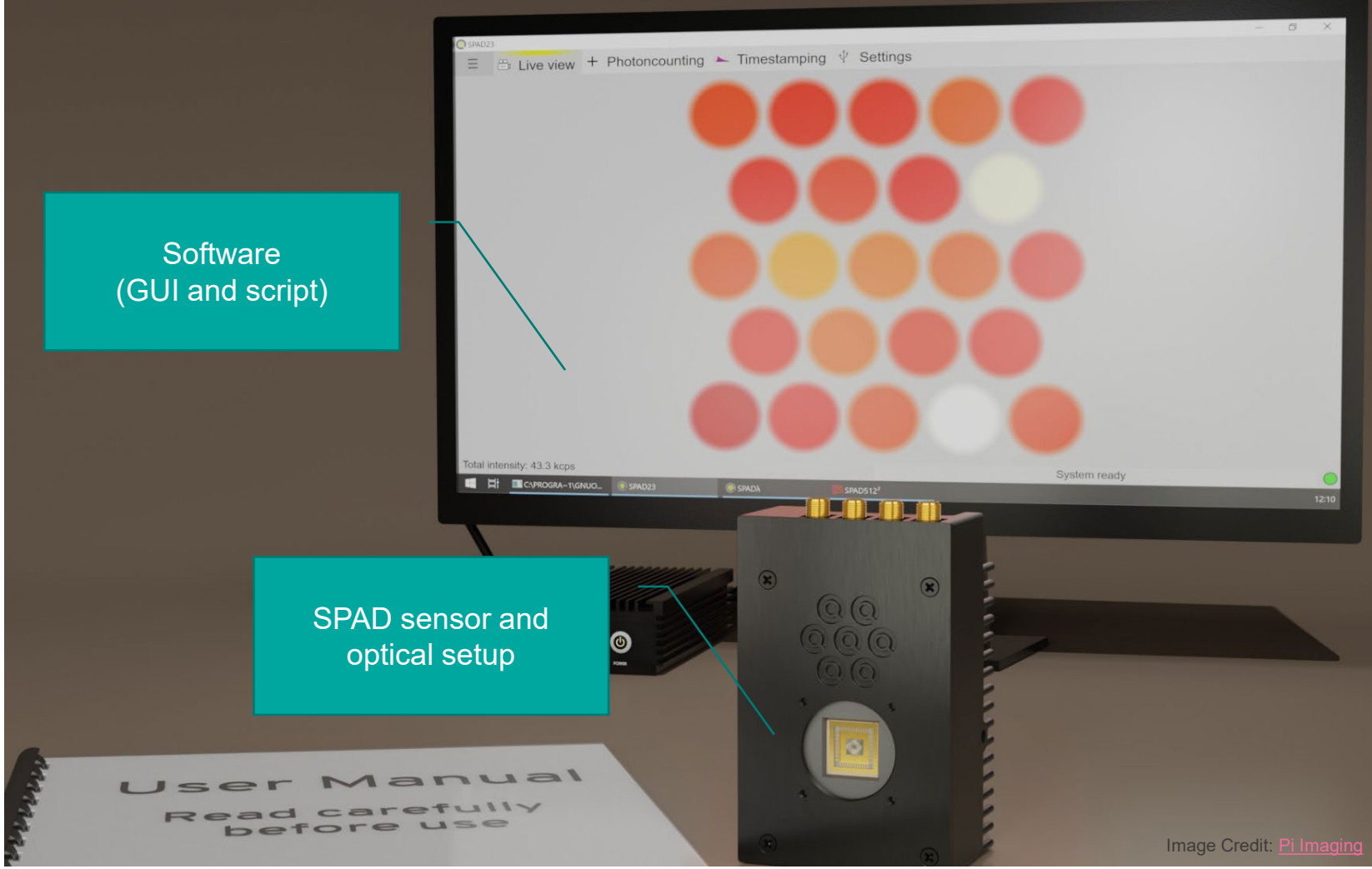


Image Credit: Pi Imaging

Dark count rate
Afterpulsing
Dead time
Photon detection probability
Time jitter
...

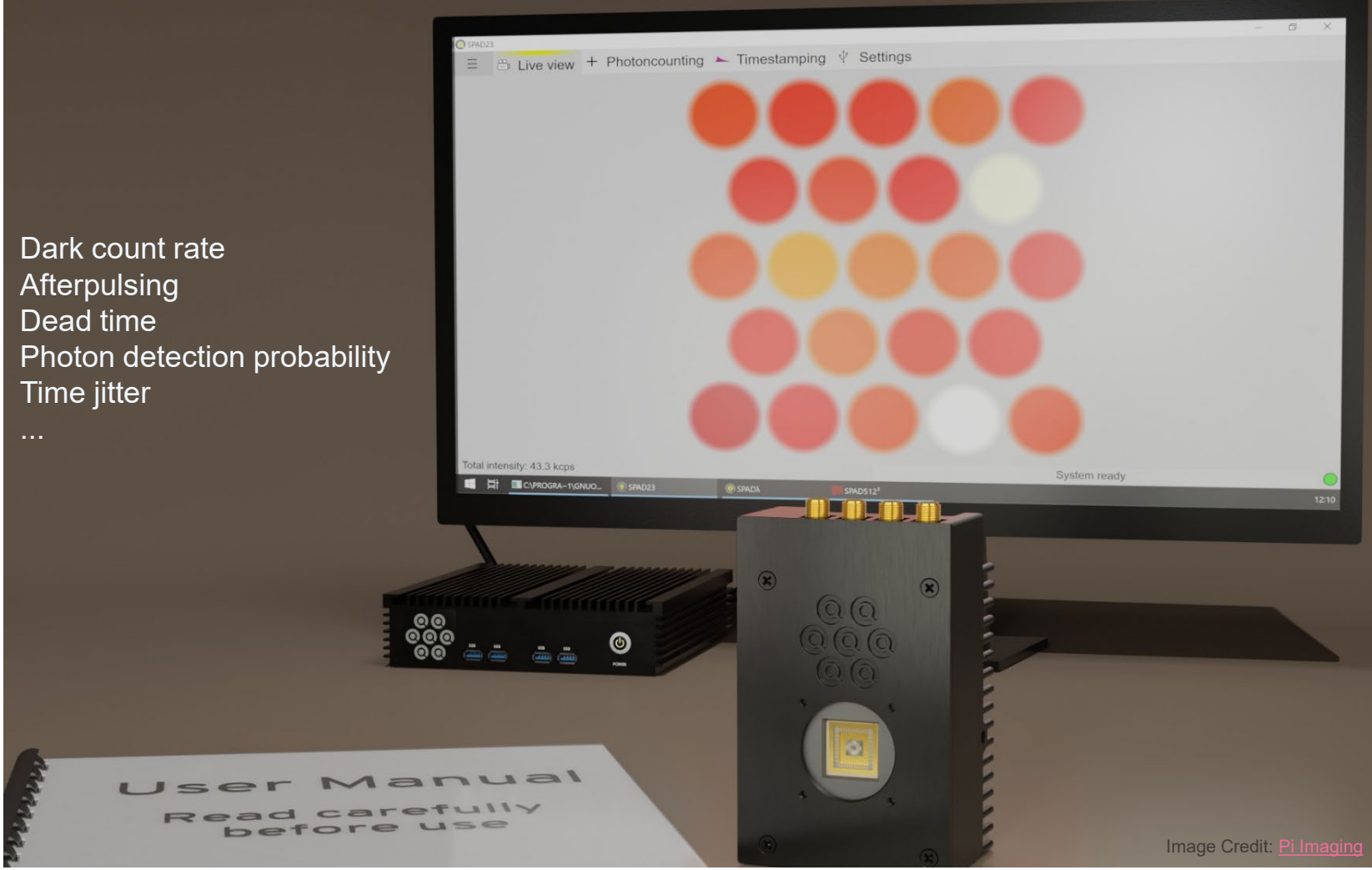
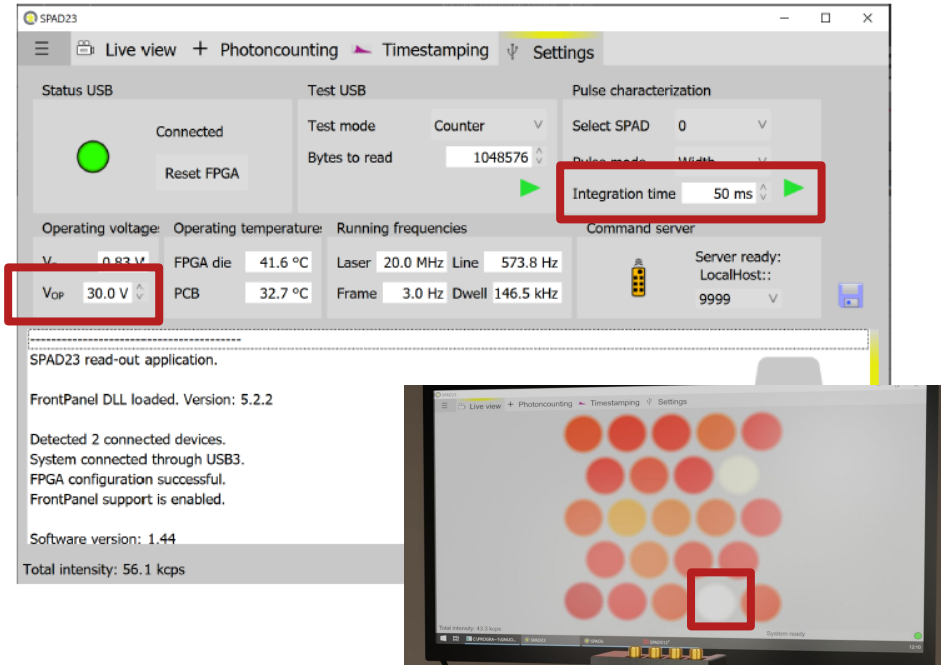


Image Credit: Pi Imaging

T3 - Dark count rate (DCR) and afterpulsing statistics in photon-counting devices

Dark count rate (DCR)

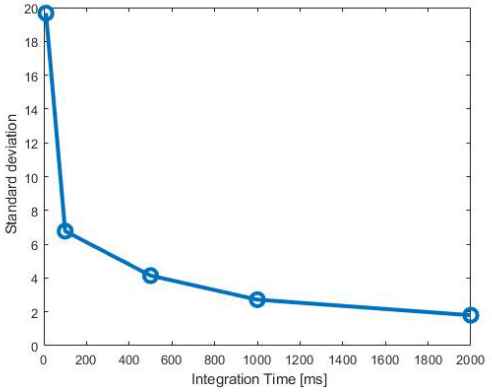
- Controlling SPAD sensor w/ GUI (Part I, 1-14)
  - Integration time
  - Excess bias voltage
  - Hot pixel

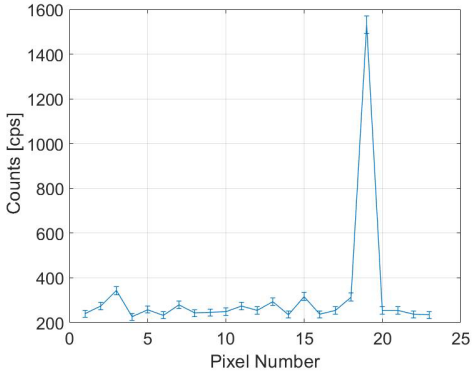


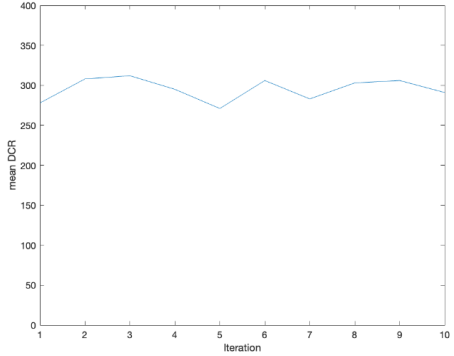
T3 - Dark count rate (DCR) and afterpulsing statistics in photon-counting devices

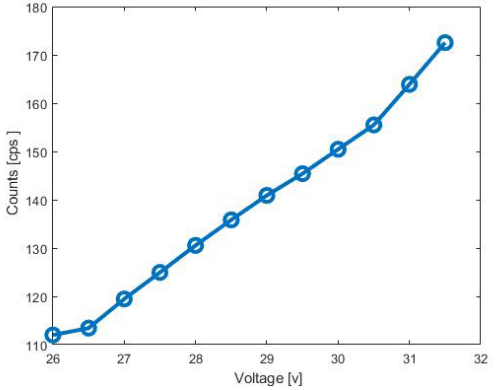
Dark count rate (DCR)

- DCR statistics
  - Mean DCR vs Iterations (Part II, 15-18)
  - Std vs Integration time (Part II, 19-21)
  - DCR vs excess bias voltage (Part II, 22-25)





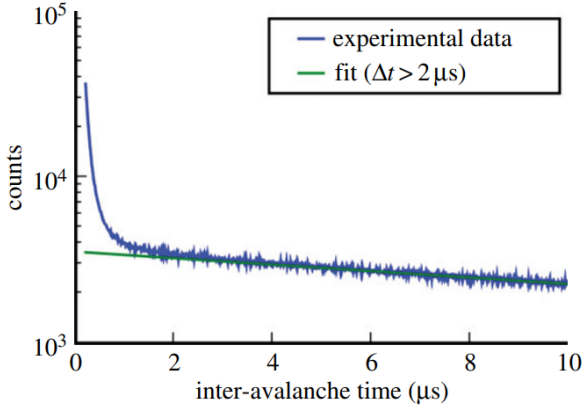




T3 - Dark count rate (DCR) and afterpulsing statistics in photon-counting devices

Afterpulsing Probability Measurement

- Adjusting illumination w/ GUI
- Inter-arrival time measurement (Part III, 26-28)
- Data analysis (Part III, 29-34)
  - Dead time
  - Afterpulsing probability
- Hot pixel vs regular pixel (Part III, 35)



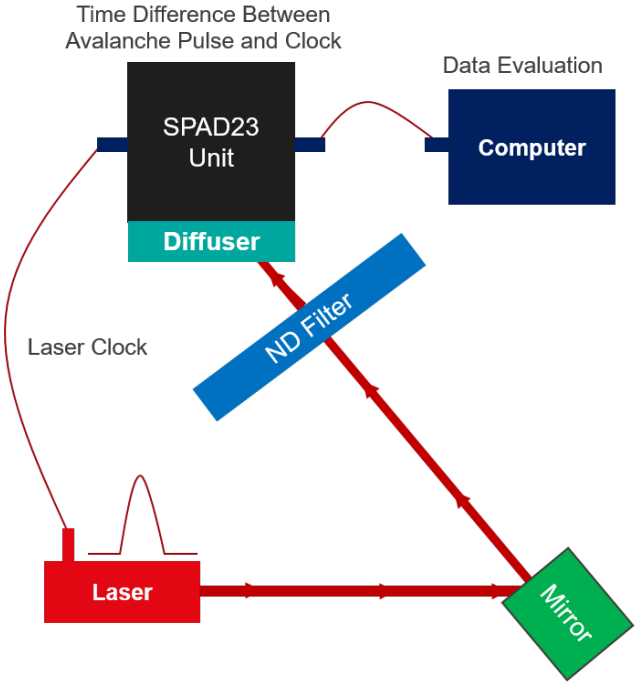
T3 - Dark count rate (DCR) and afterpulsing statistics in photon-counting devices

Tips and Tricks

- Always disable V_OP from the GUI before exposing SPAD to strong light to avoid saturation
- When adjusting the illumination for SPAD, start with low intensity to high intensity

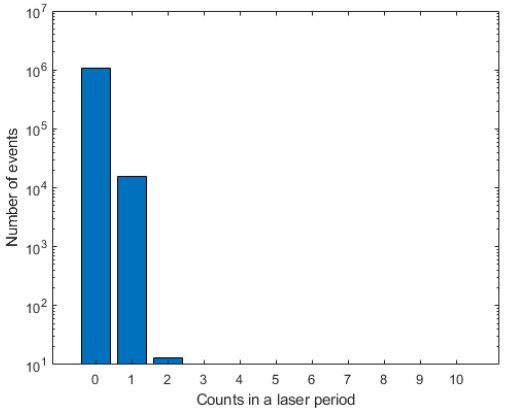
T4 - Sensitivity in photon-counting devices

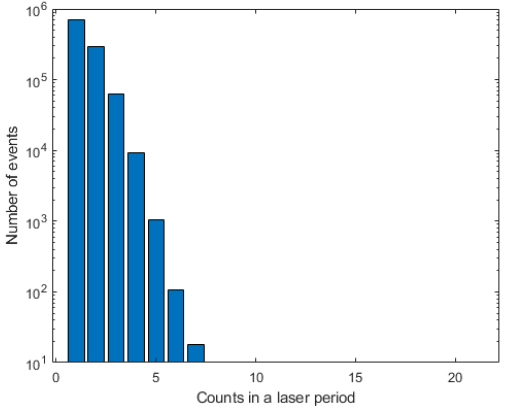
- Preparation
  - Plotting and analysis of practical data (Part 0)
  - Laser safety training
- Setup
  - SPAD23 setup (Part I, 2-8)
  - Optical setup (Part I, 9-14)
  - Wearing goggles



T4 - Sensitivity in photon-counting devices

- Photon counts of single pixels
  - Measurement (Part II, 15-16)
  - Data analysis (Part II, 17-22)
- Photon counts of the SiPM
  - Measurement (Part II, 23)
  - Data analysis (Part II, 24-29)
- Photo-Response Uniformity
  - Measurement (Part III, 30-35)
  - Data analysis (Part III, 36-38)





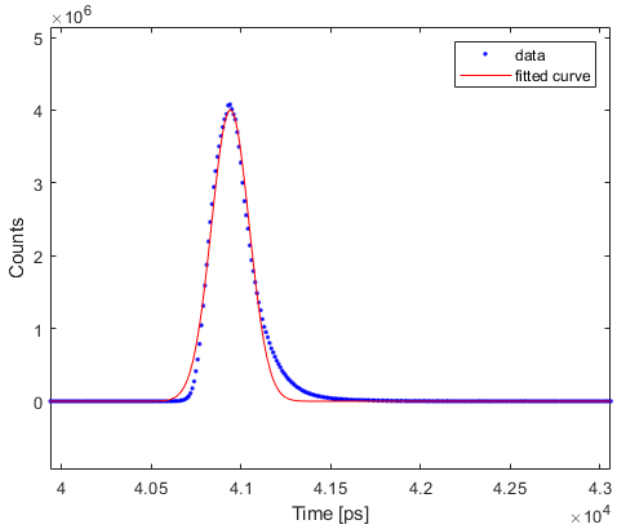
T4 - Sensitivity in photon-counting devices

Tips and Tricks

- Always disable V_OP from the GUI before exposing SPAD to strong light to avoid saturation
- When adjusting the illumination for SPAD, start with low intensity to high intensity
- Delete the text file named “pix23.txt” as mentioned

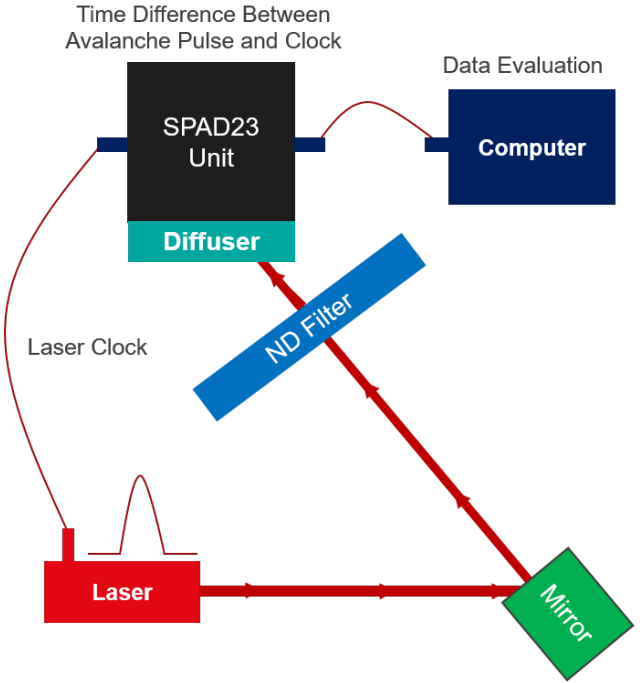
T5 - Timing jitter measurements in single-photon detectors

- Preparation
  - Plotting and analysis of practical data (Part 0)
  - Laser safety training
- Setup
  - SPAD23 setup (Part I, 5-11)
  - Optical setup (Part I, 12-20)
  - Wearing goggles



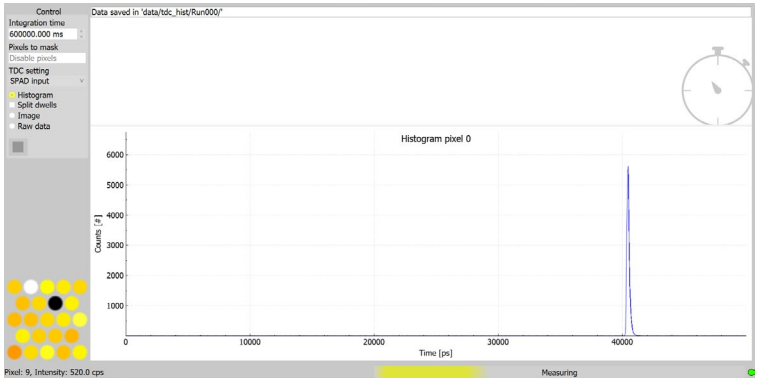
T5 - Timing jitter measurements in single-photon detectors

- Preparation
  - Plotting and analysis of practical data (Part 0)
  - Laser safety training
- Setup
  - SPAD23 setup (Part I, 5-11)
  - Optical setup (Part I, 12-20)
  - Wearing goggles



T5 - Timing jitter measurements in single-photon detectors

- TCSPC Measurement I (Part II, 21-24)
- Data Analysis I (Part II, 25-27)
- TCSPC Measurement II (Part II, 28-29)
- Data Analysis II (Part II, 30-34)



- Same illumination level with different ND filter and laser output power combinations

T5 - Timing jitter measurements in single-photon detectors

Tips and Tricks

- Always disable V_OP from the GUI before exposing SPAD to strong light to avoid saturation
- When adjusting the illumination for SPAD, start with low intensity to high intensity
- Double-check the parameter and setup before the measurement
  - Each measurement takes 10 min
- Read the laser datasheet and test report

Thank you

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