GRAIN WG meeting

Xx/xx/2024

Francesco Chiapponi
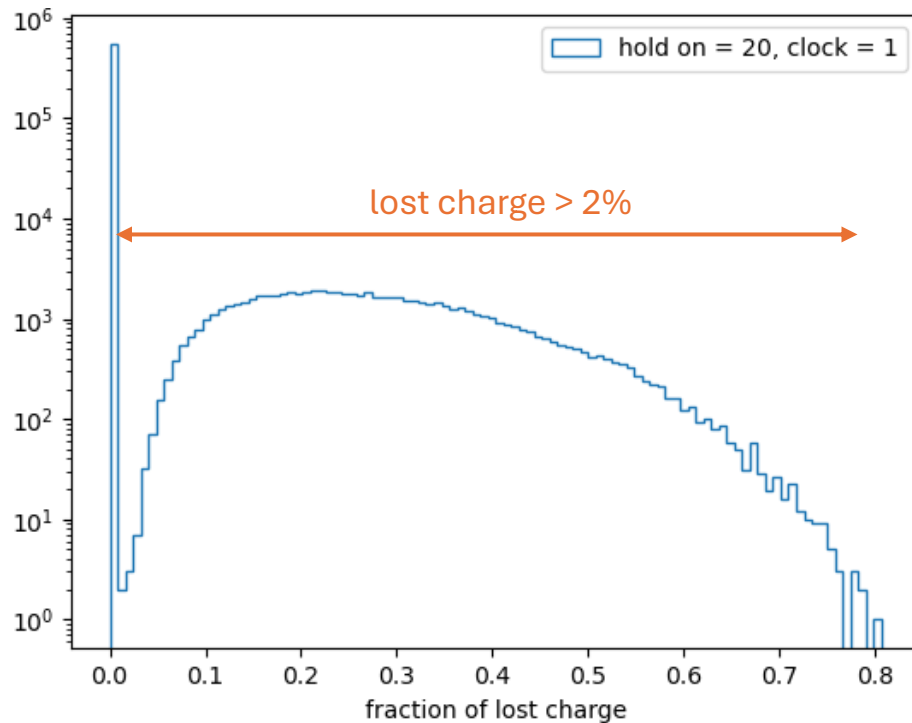
Overview

- 120 spill

- SiPM 3x3

- Simulations for
  - clock frequencies x1, x2, x4, x8 (varying also I_{src})
  - Rq 500, 1000 (1500, 2000)
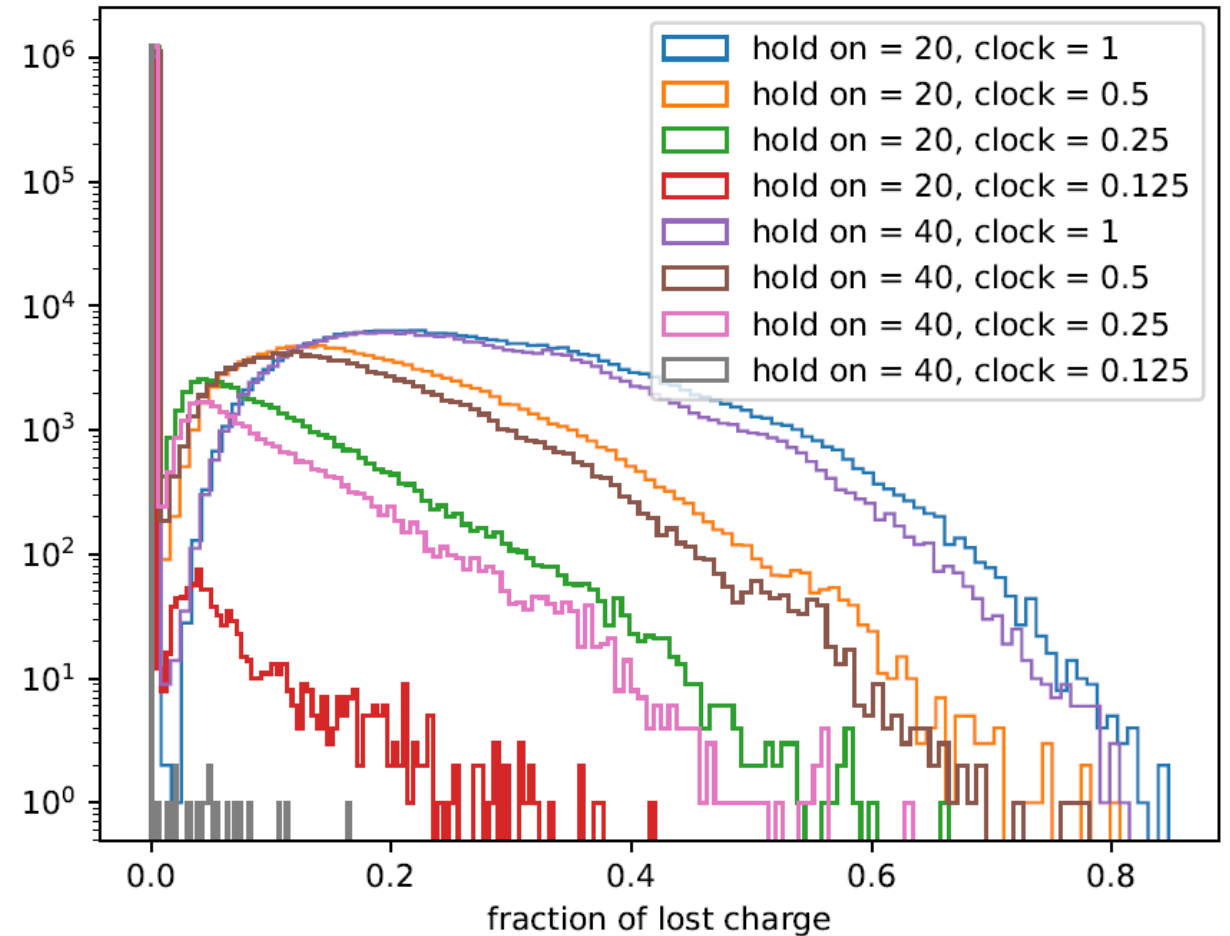 - Hold on 20 , 40 (100)
  - Gain 0, 1, 2

Lost fraction

Fraction of events in which the lost charge was > 2%

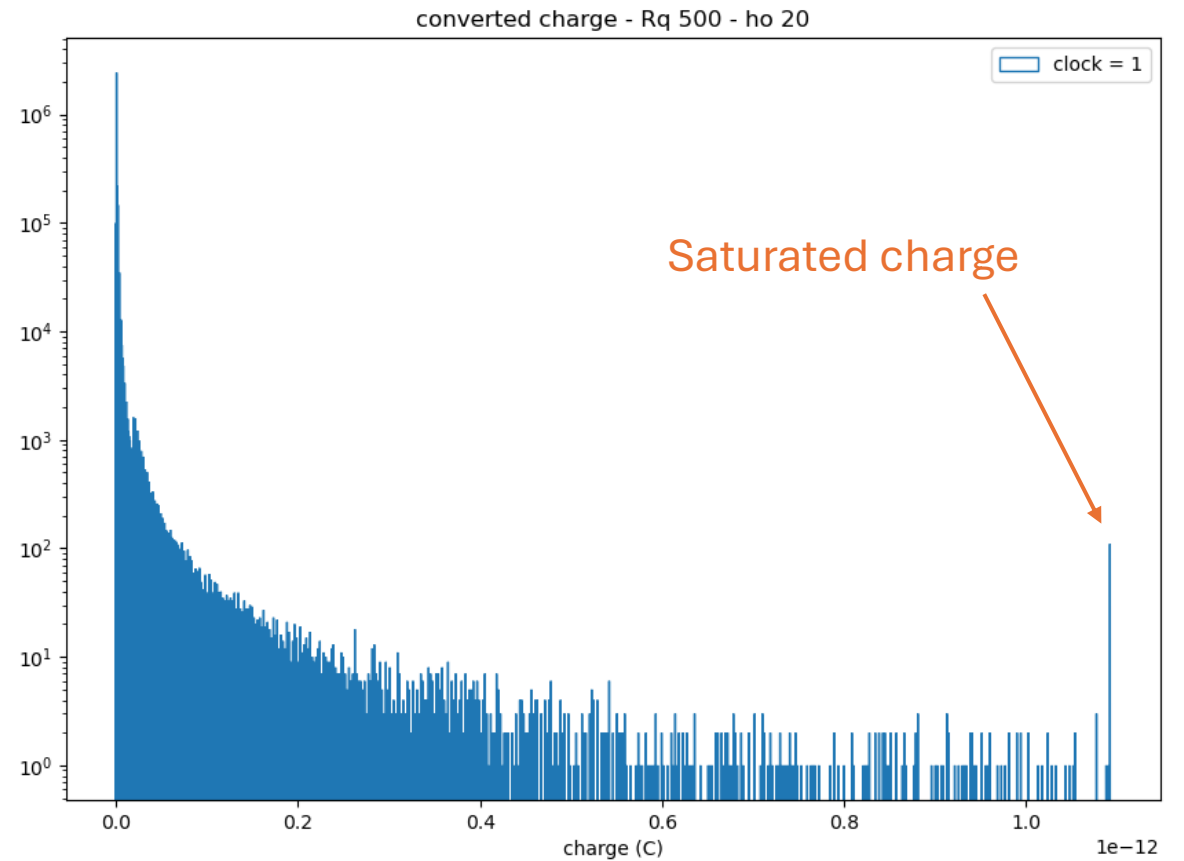$$\text{Lost fraction} = \frac{\text{events with lost charge} > 2\%}{\text{total number of events}}$$

Saturated fraction

Fraction of events in which the ADC saturated

$$\frac{\text{Number of saturated events (ch==2\^9)}}{\text{total number of events}}$$

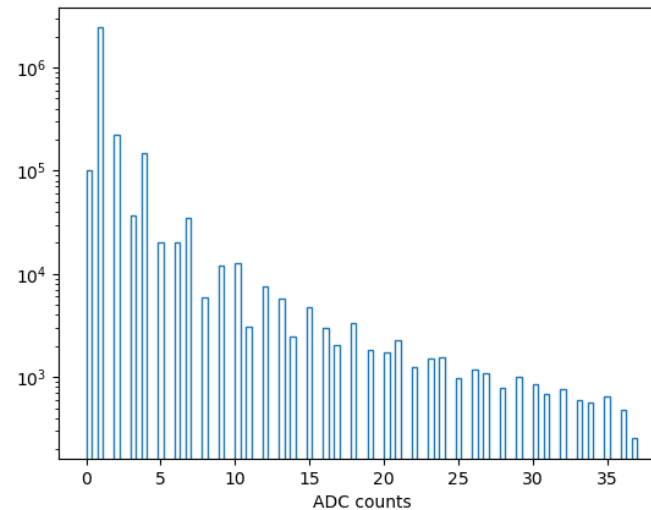converted charge - Rq 500 - ho 20

Saturated charge

ADC resolution

- ADC counts distributions are shown for different values of the FE gain.
- Rq 500, integrator gain = 0.
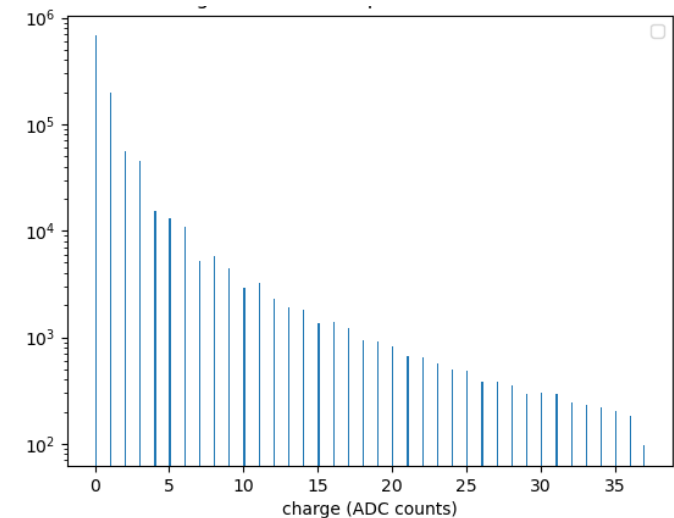- For FE gain = 1 is still possible to fit the pe peaks, but not for g = 2
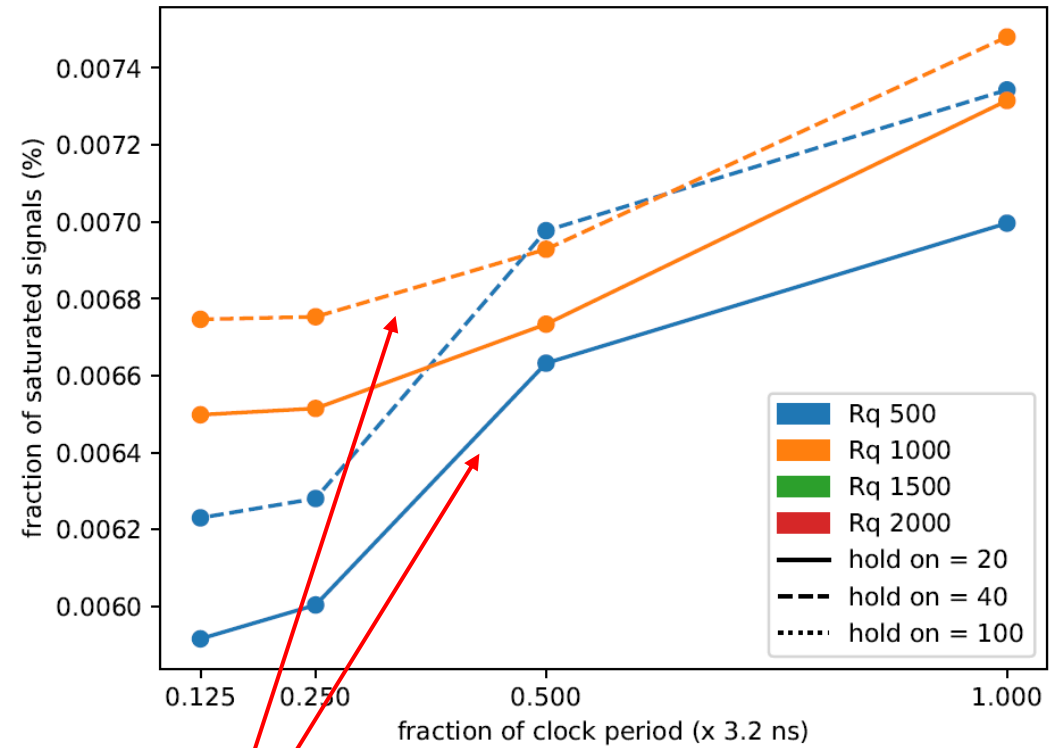

FE gain 0
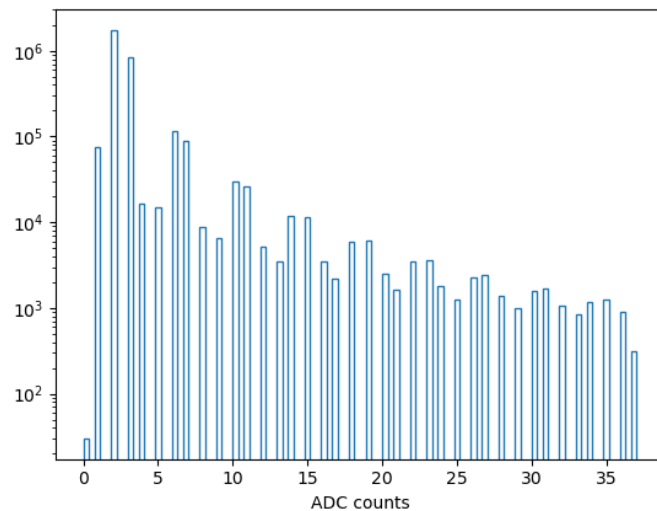
FE gain 1

FE gain 2

Max n°ph: 9

Max n°ph: 14
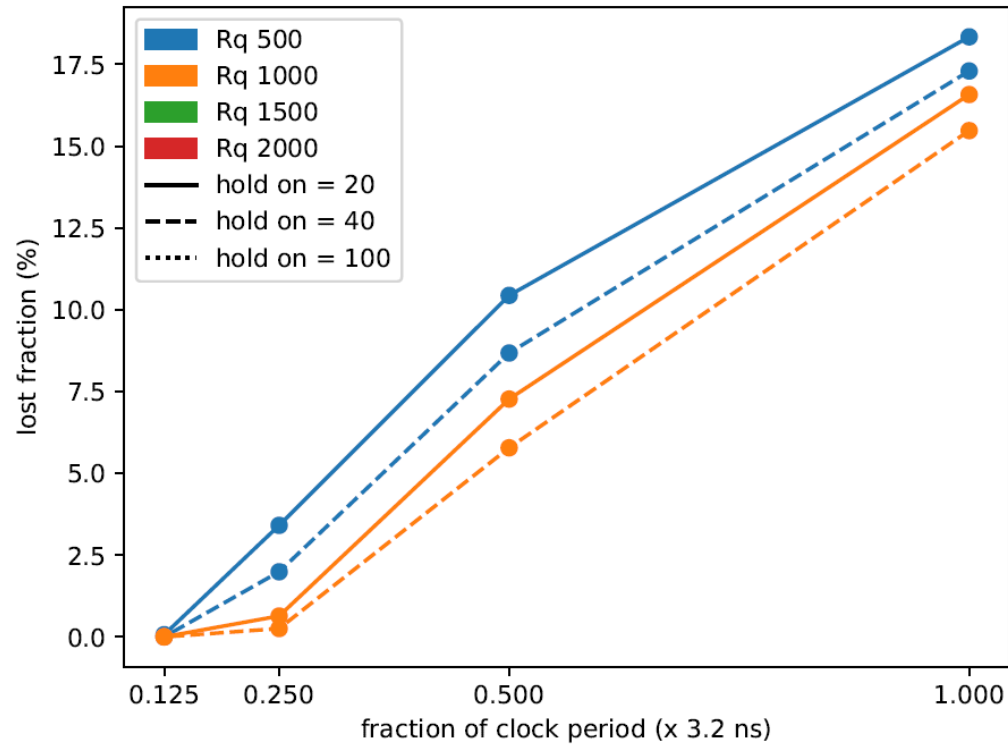
Max n°ph: 25

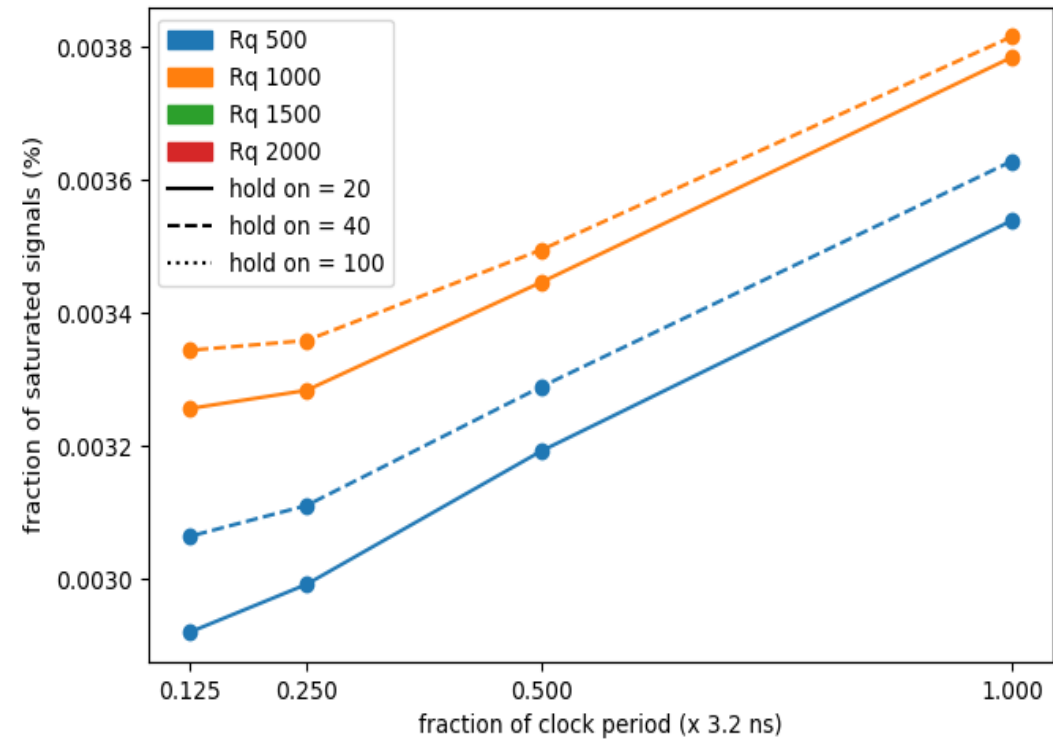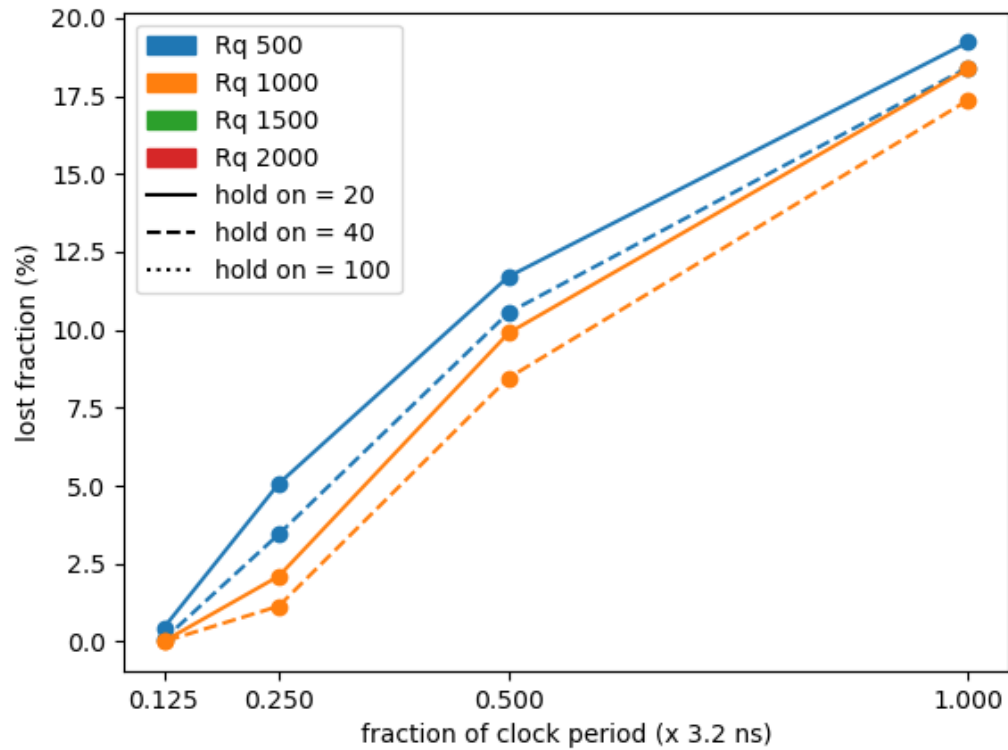# Lost & Saturated fractions - overview

FE GAIN 0

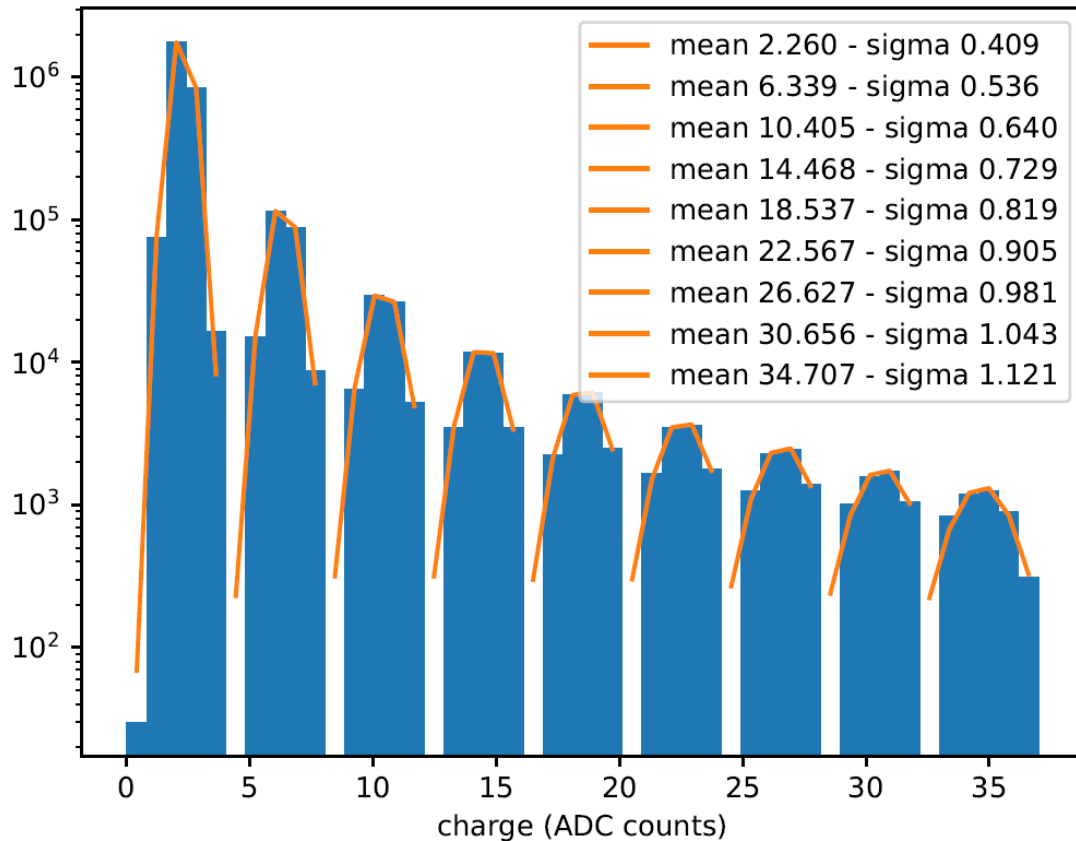Why these different behaviours?

Lost & Saturated fractions - overview

FE GAIN 1

Charge calibration – INT. GAIN 0

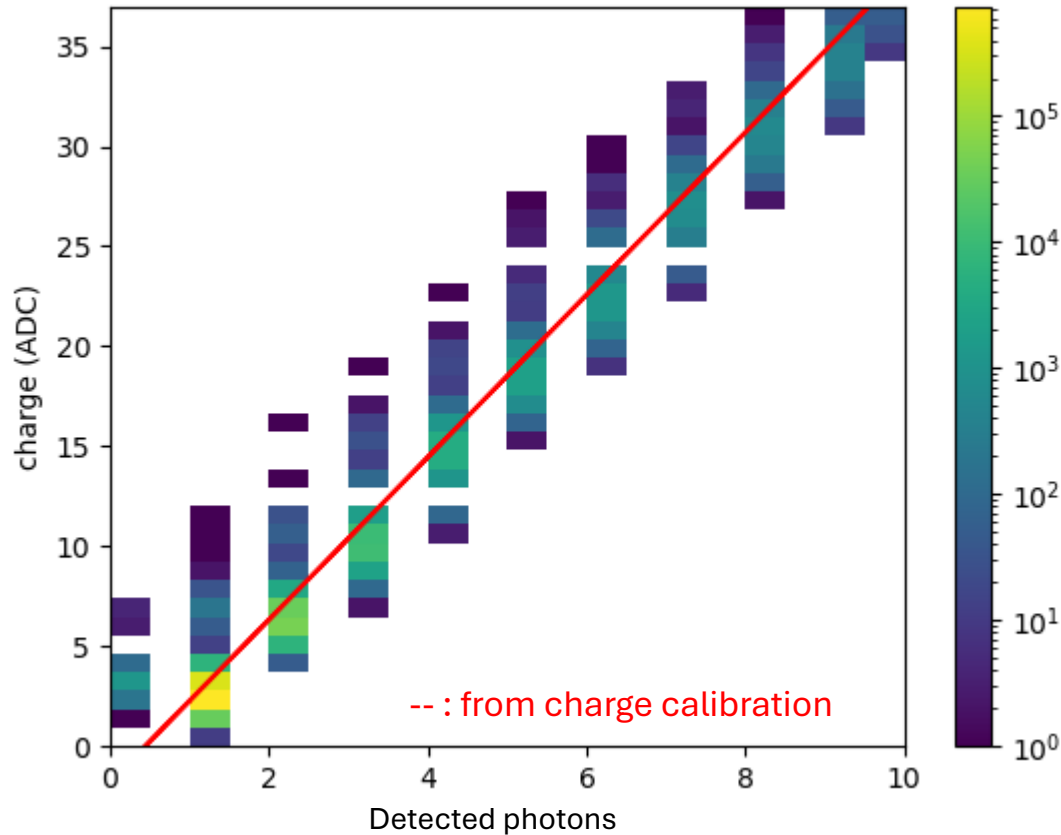charge fit GAIN 0 - Rq 500 - ho 20 - clock 1

mean 2.260 - sigma 0.409
mean 6.339 - sigma 0.536
mean 10.405 - sigma 0.640
mean 14.468 - sigma 0.729
mean 18.537 - sigma 0.819
mean 22.567 - sigma 0.905
mean 26.627 - sigma 0.981
mean 30.656 - sigma 1.043
mean 34.707 - sigma 1.121

charge (ADC counts)

charge calibration - Rq 500 - ho 20 - clock 1

0.246 ph/ADC

ADC charge

n° of photons

m = 4,06 ADC/ph
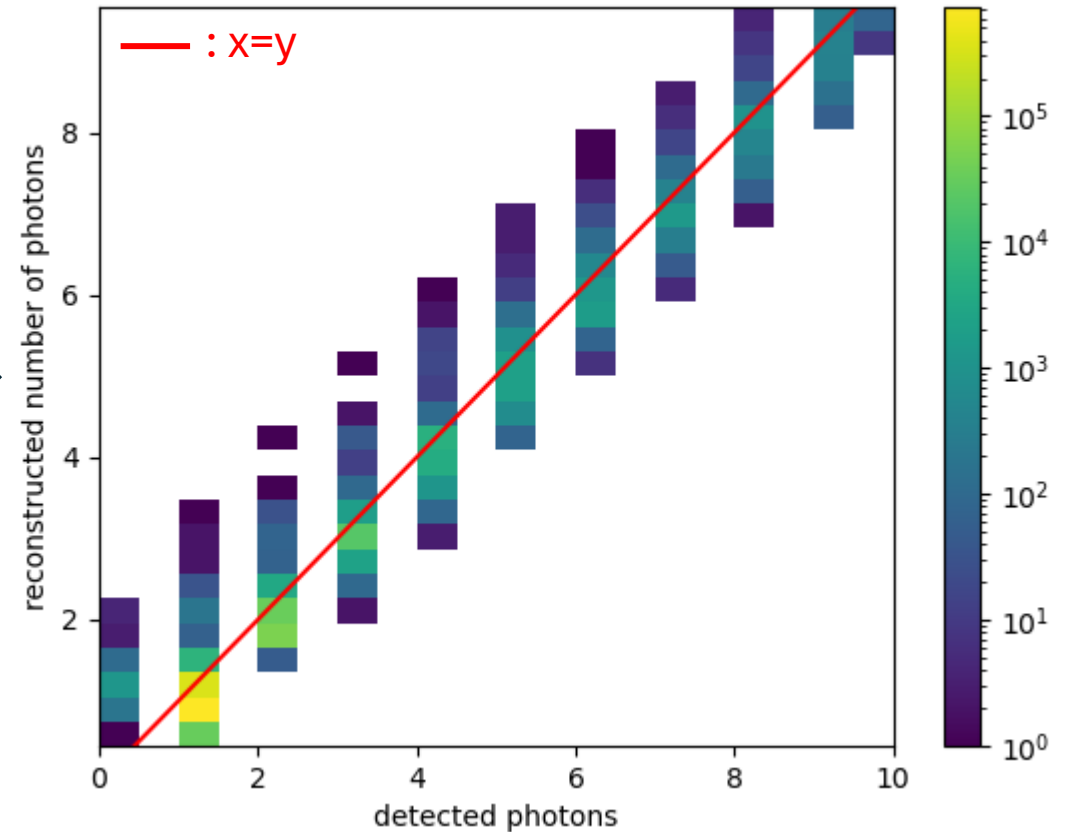q = -2,09
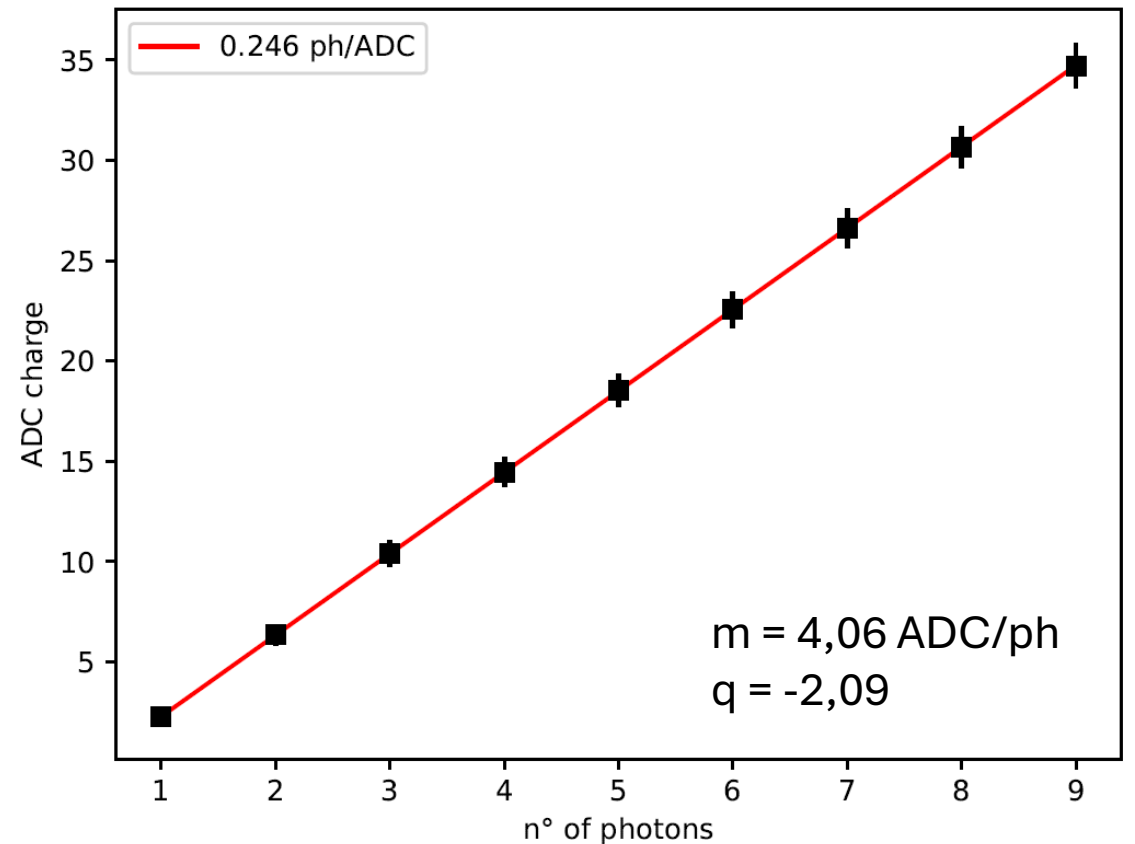
Reconstructed charge – INT. GAIN 0

-- : from charge calibration

reconstructed photons GAIN 0 - Rq 500 - ho 20 - clock 1

—— : x=y
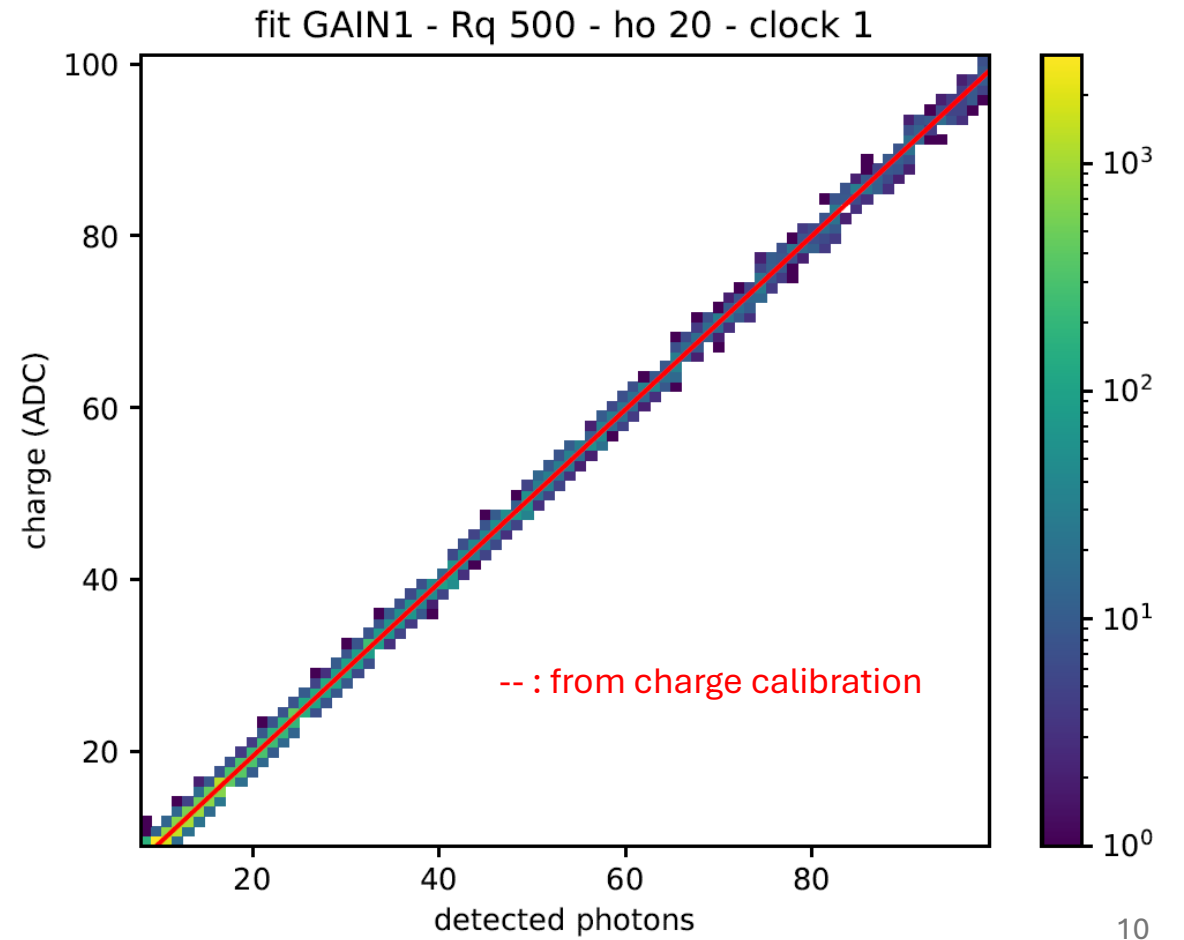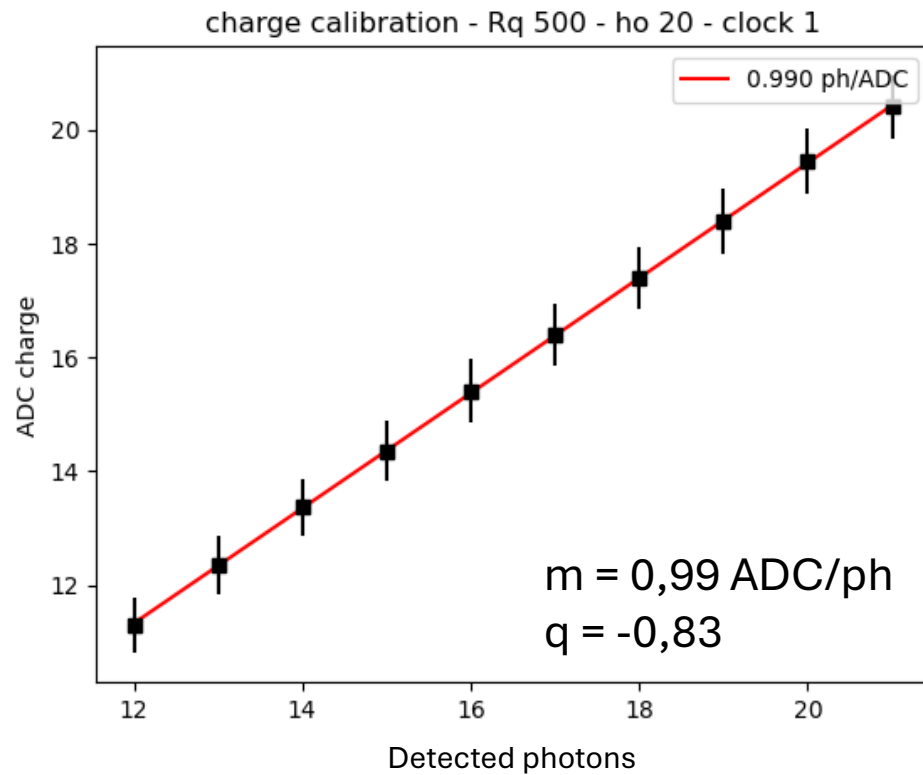
Good linearity for GAIN 0
Good reconstruction capability
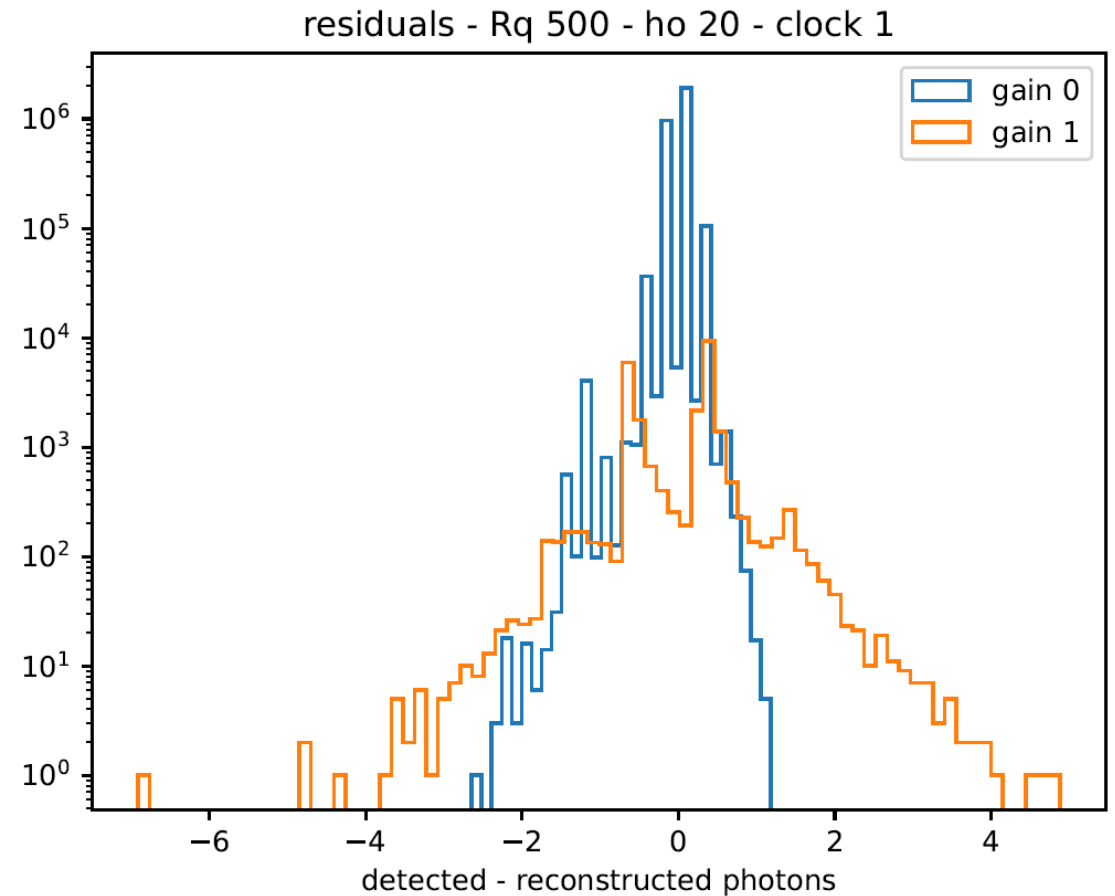
FE GAIN 0

Calibration for INT. GAIN 1

Only the beginning of the distribution was fitted (n° ph <22)

charge calibration - Rq 500 - ho 20 - clock 1

0.990 ph/ADC

m = 0,99 ADC/ph
q = -0,83

fit GAIN1 - Rq 500 - ho 20 - clock 1

-- : from charge calibration

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Reconstructed charge

Using calibration for gain 0 and 1, the number of photons is reconstructed from ADC charge

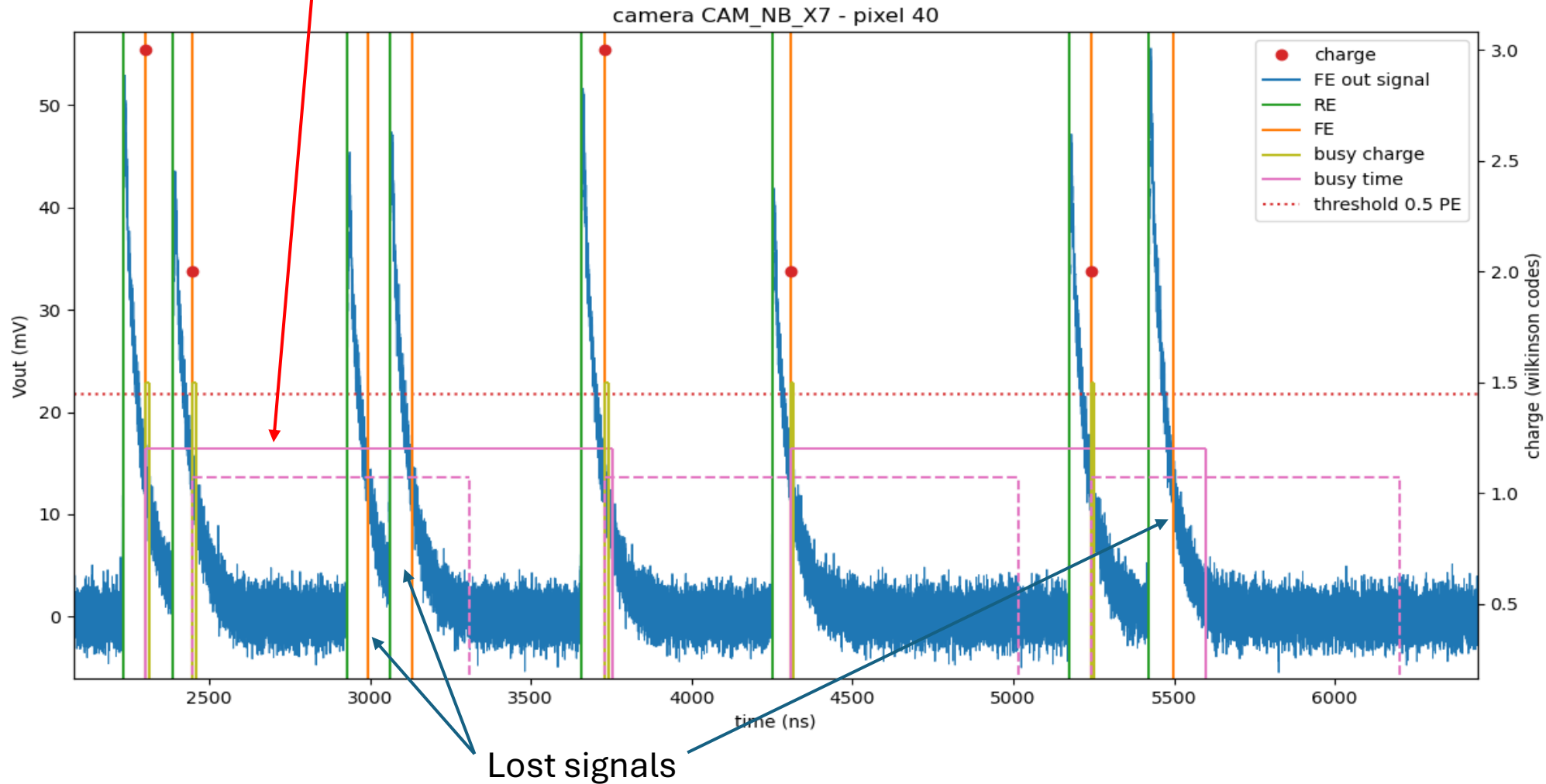all reconstructed photons - Rq 500 - ho 20 - clock 1

residuals - Rq 500 - ho 20 - clock 1
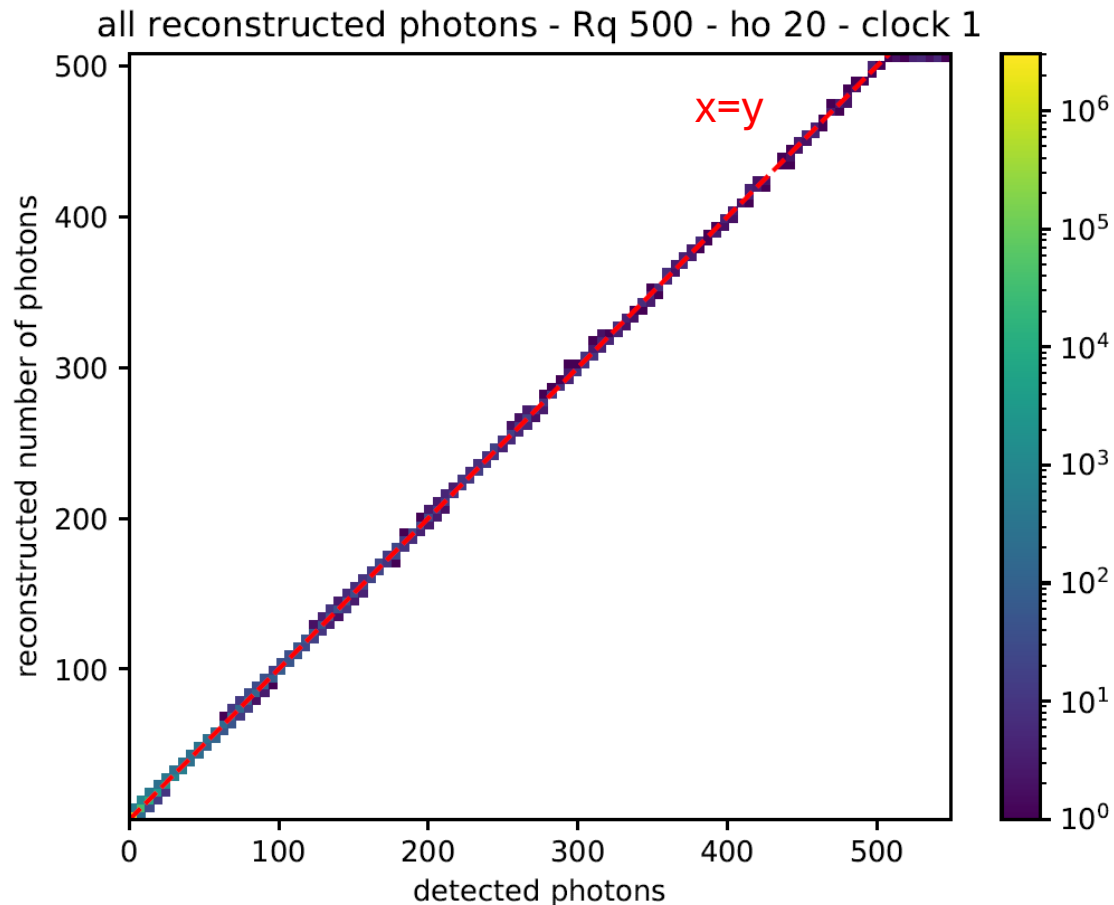
Lost photons

Lost photons wrt MC photons
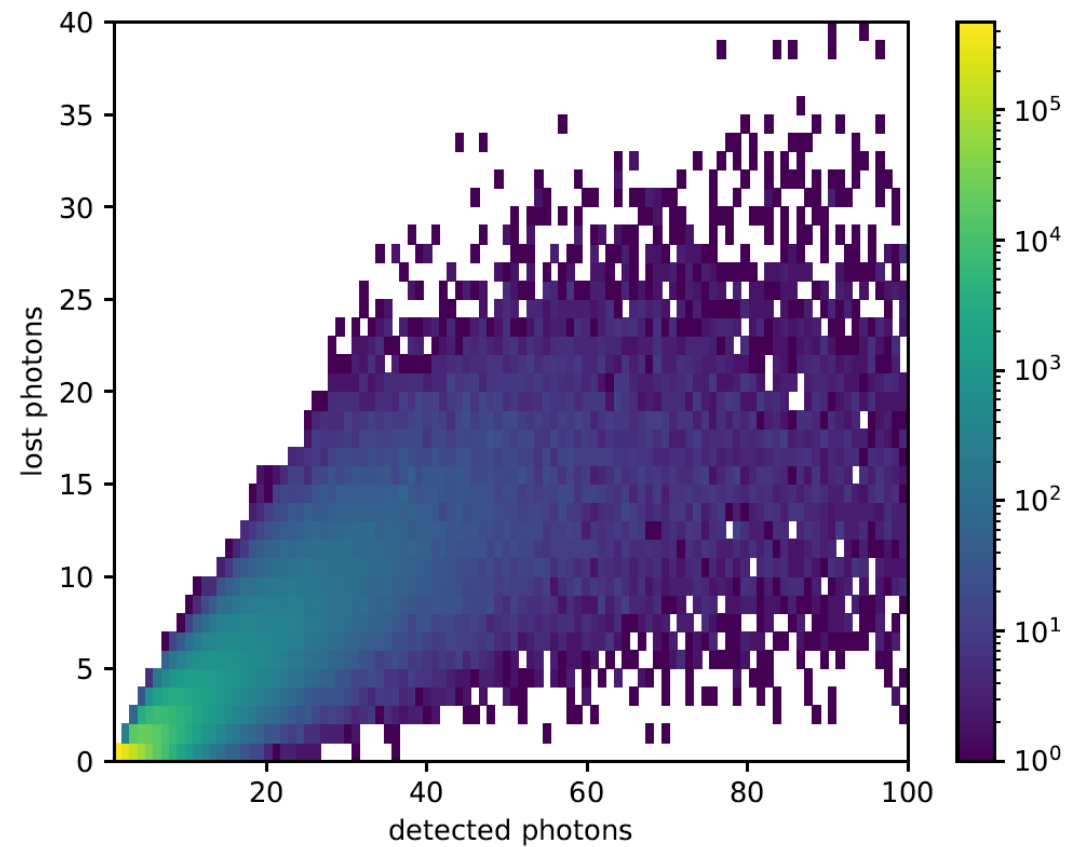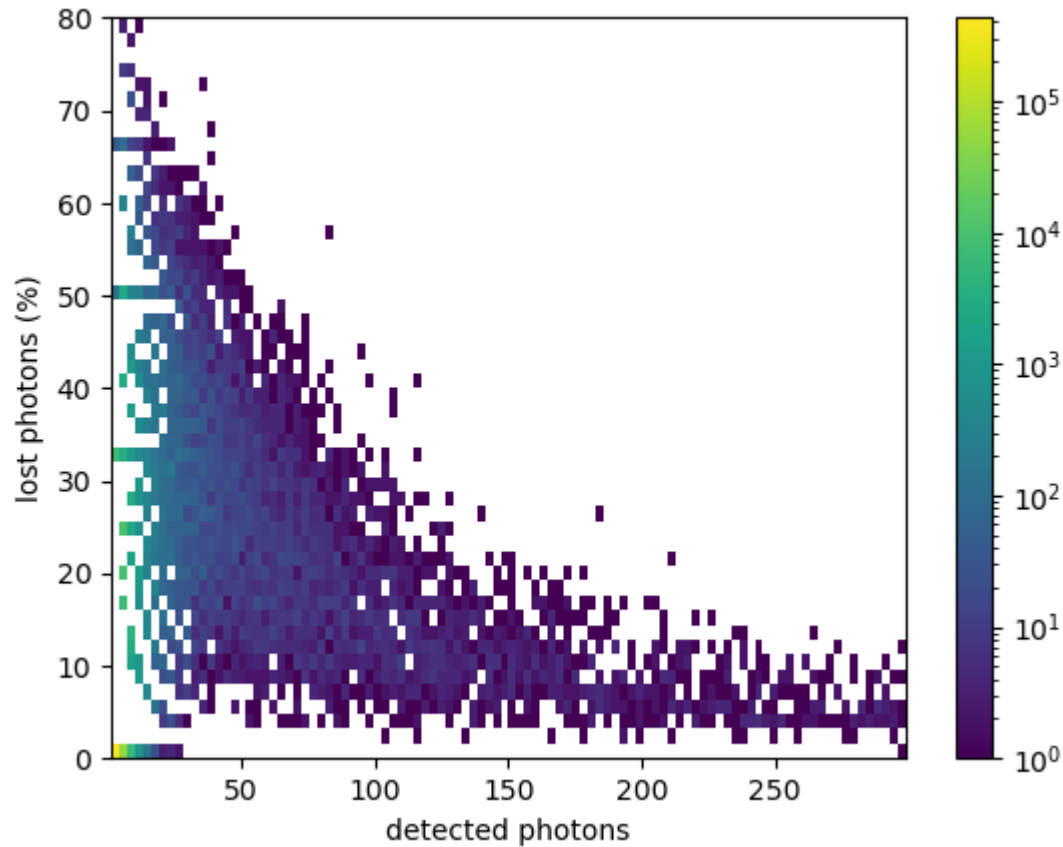
Waveform displayer

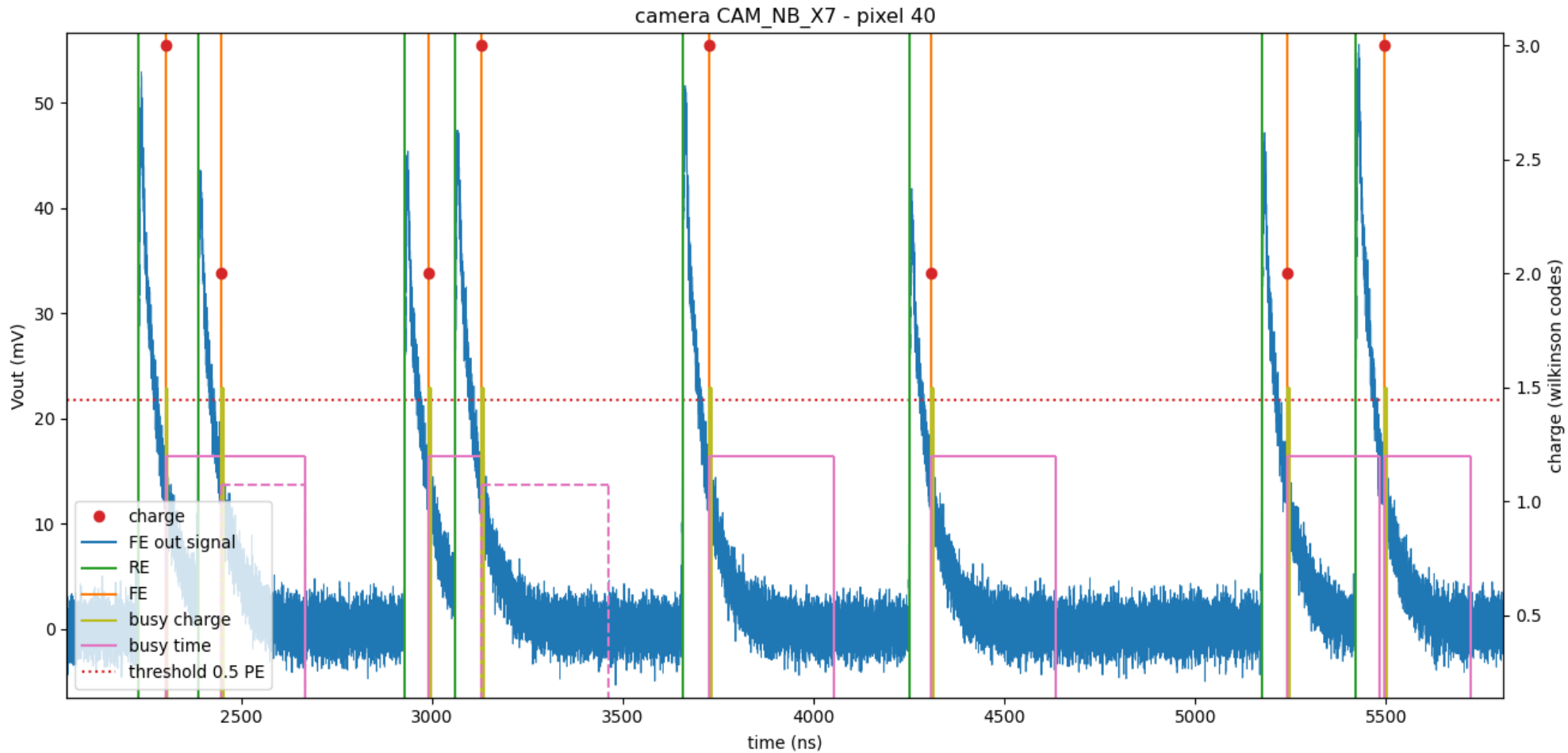Timestamp digitization gives the largest contribution to lost signals

camera CAM_NB_X7 - pixel 40

- Clock 1
- Rq 500
- FE gain 0
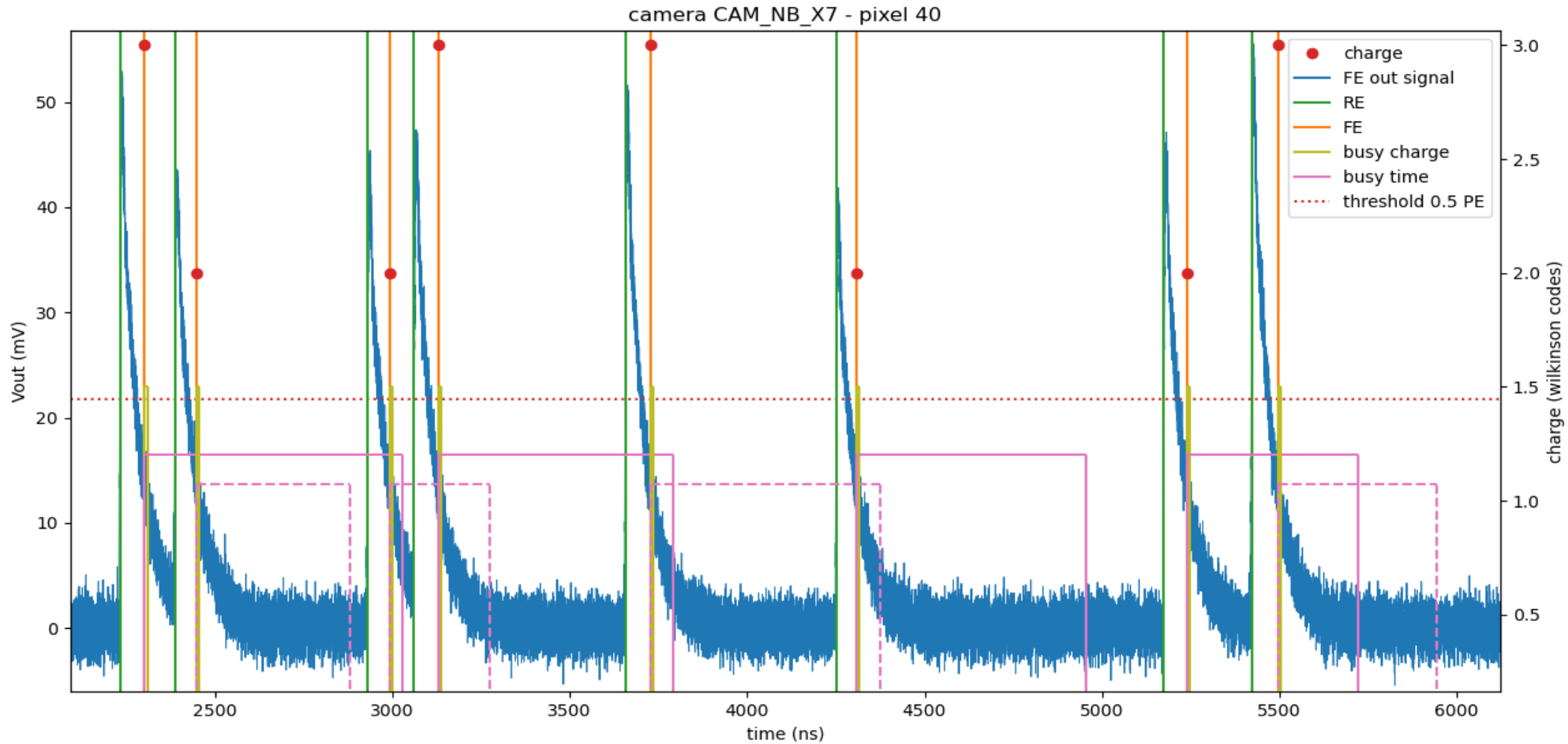
Lost signals

Waveform displayer

camera CAM_NB_X7 - pixel 40

Waveform displayer

camera CAM_NB_X7 - pixel 40

Waveform displayer

camera CAM_NB_X7 - pixel 40
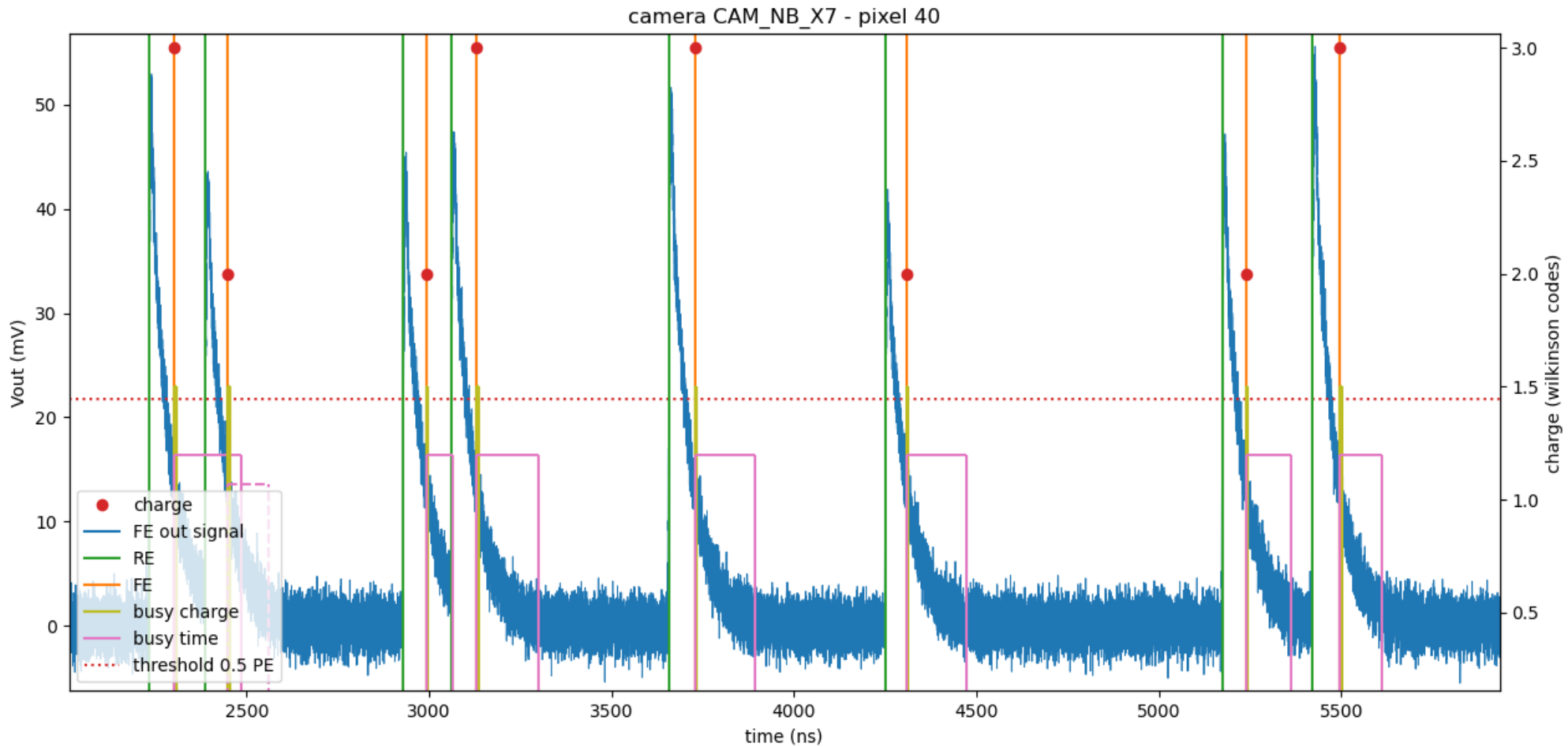
- Clock 1-8
- Rq 500
- FE gain 0

Waveform displayer

camera CAM_NB_X7 - pixel 40
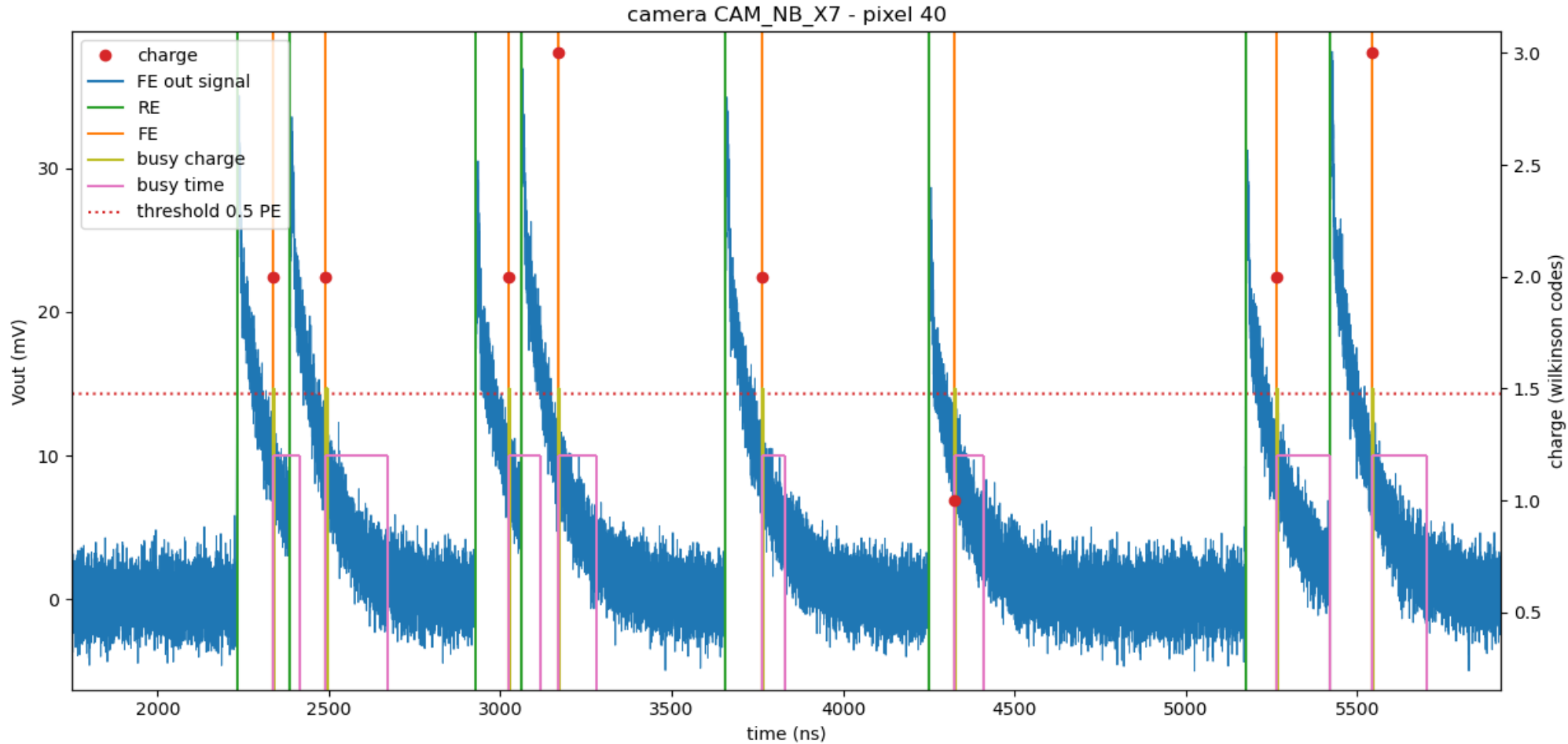
Waveform displayer – FE gain scan

Pixel 40 – CAM NB_X7

- Clock 1-2
- Rq 500
- FE gain 0

Lost signals
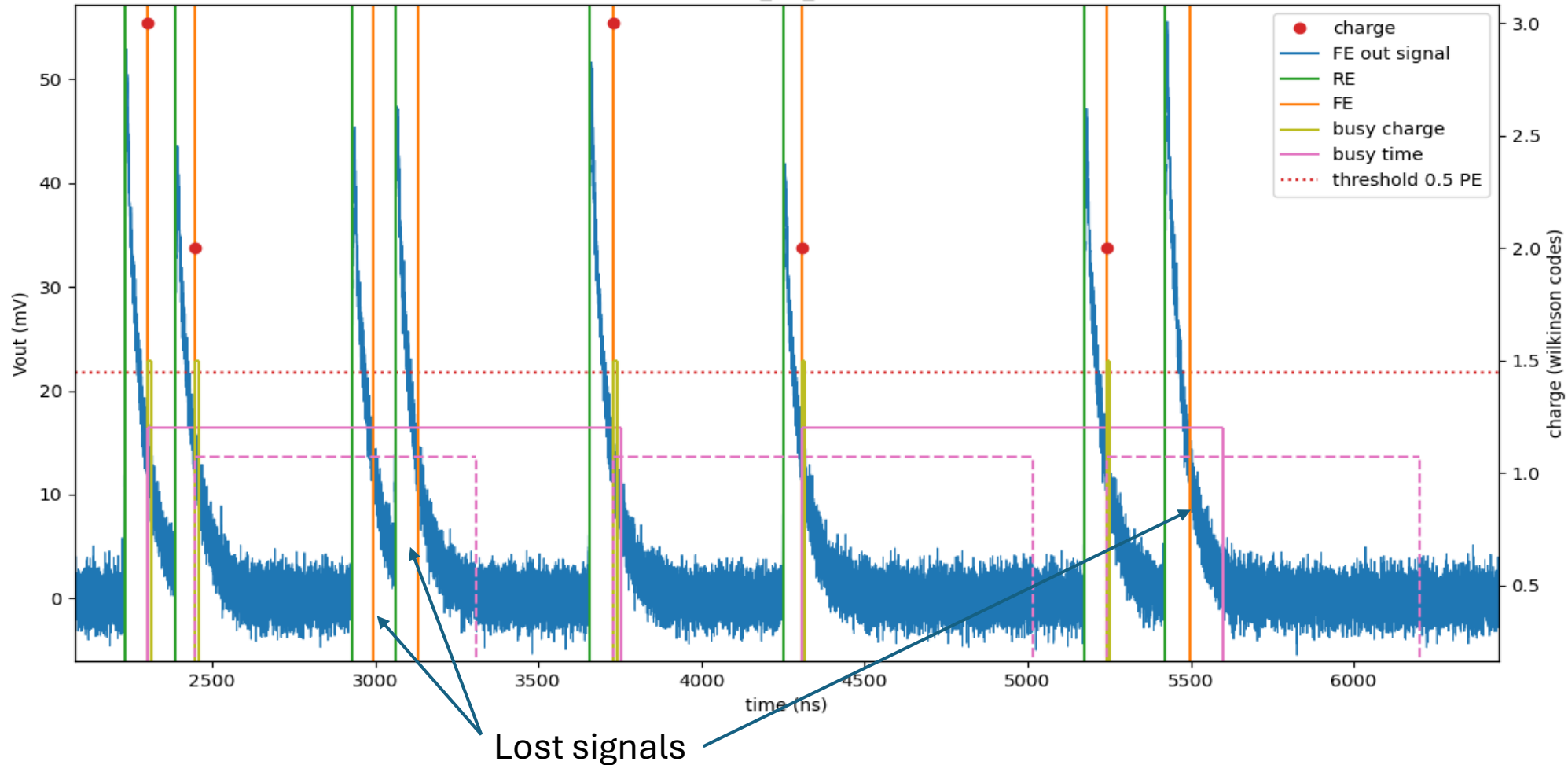
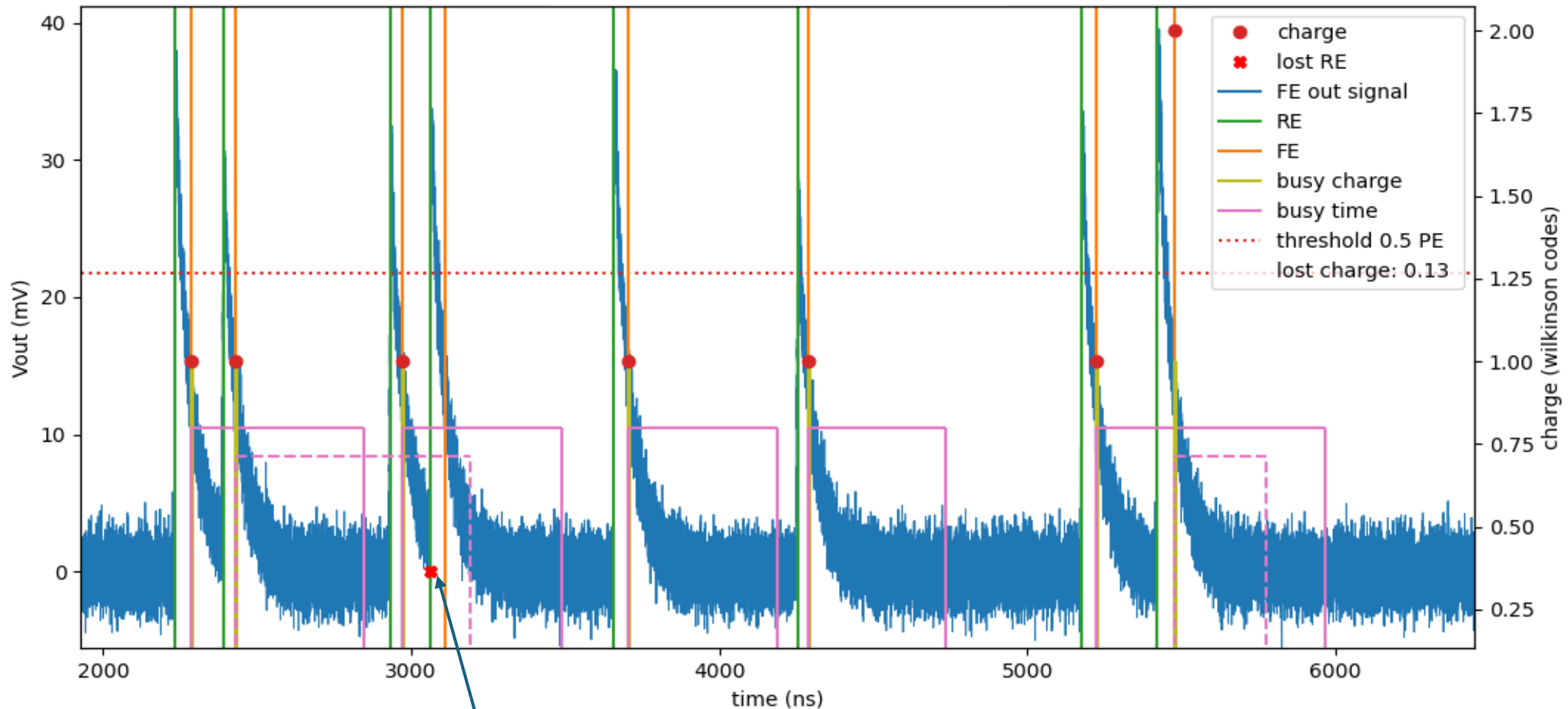# Waveform displayer – FE gain scan

Pixel 40 – CAM NB_X7

Lost signal

- Clock 1-2
- Rq 500
- FE gain 1

Waveform displayer – FE gain scan

Pixel 44 – CAM NB_X7

- Clock 1-2
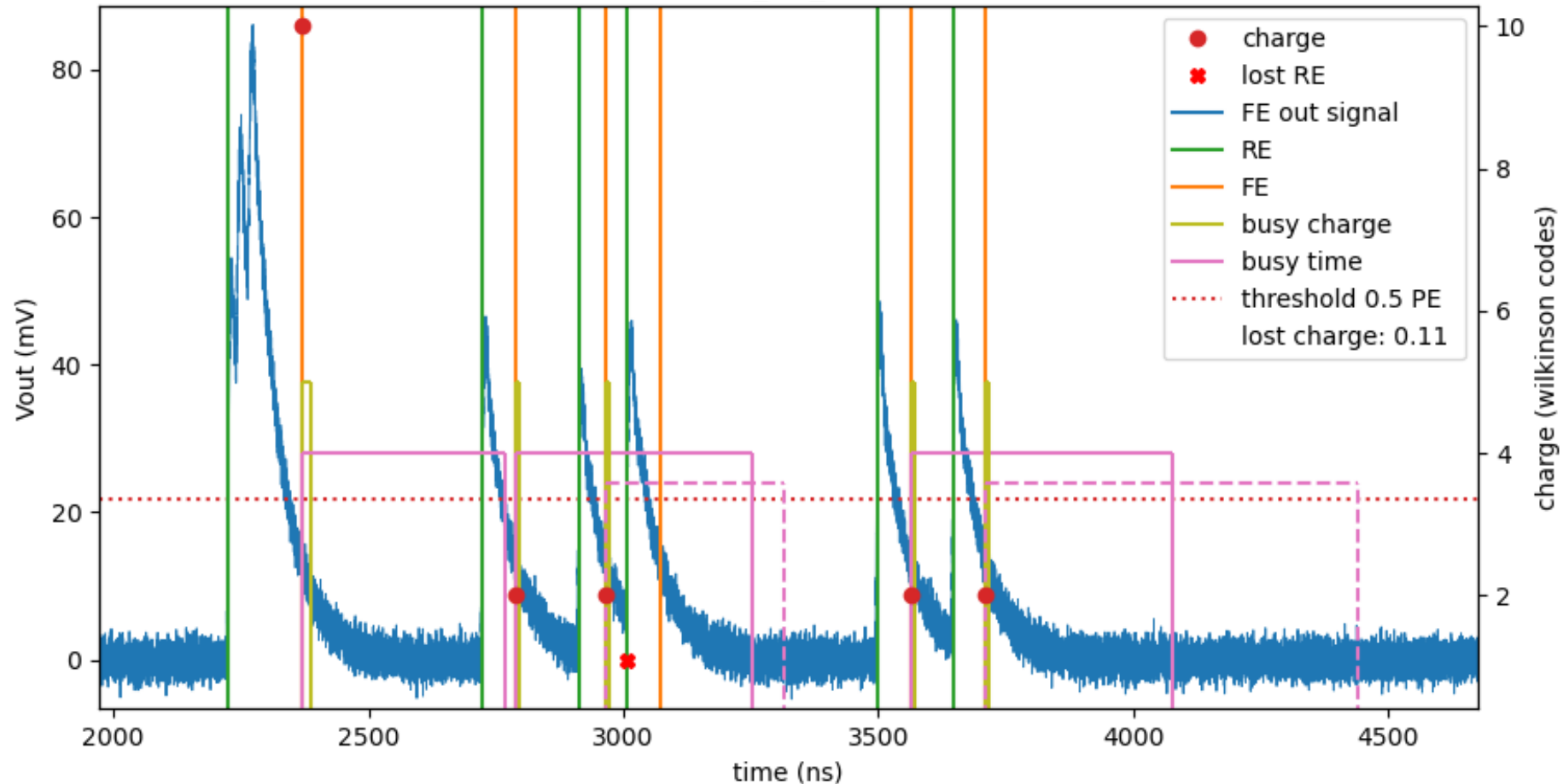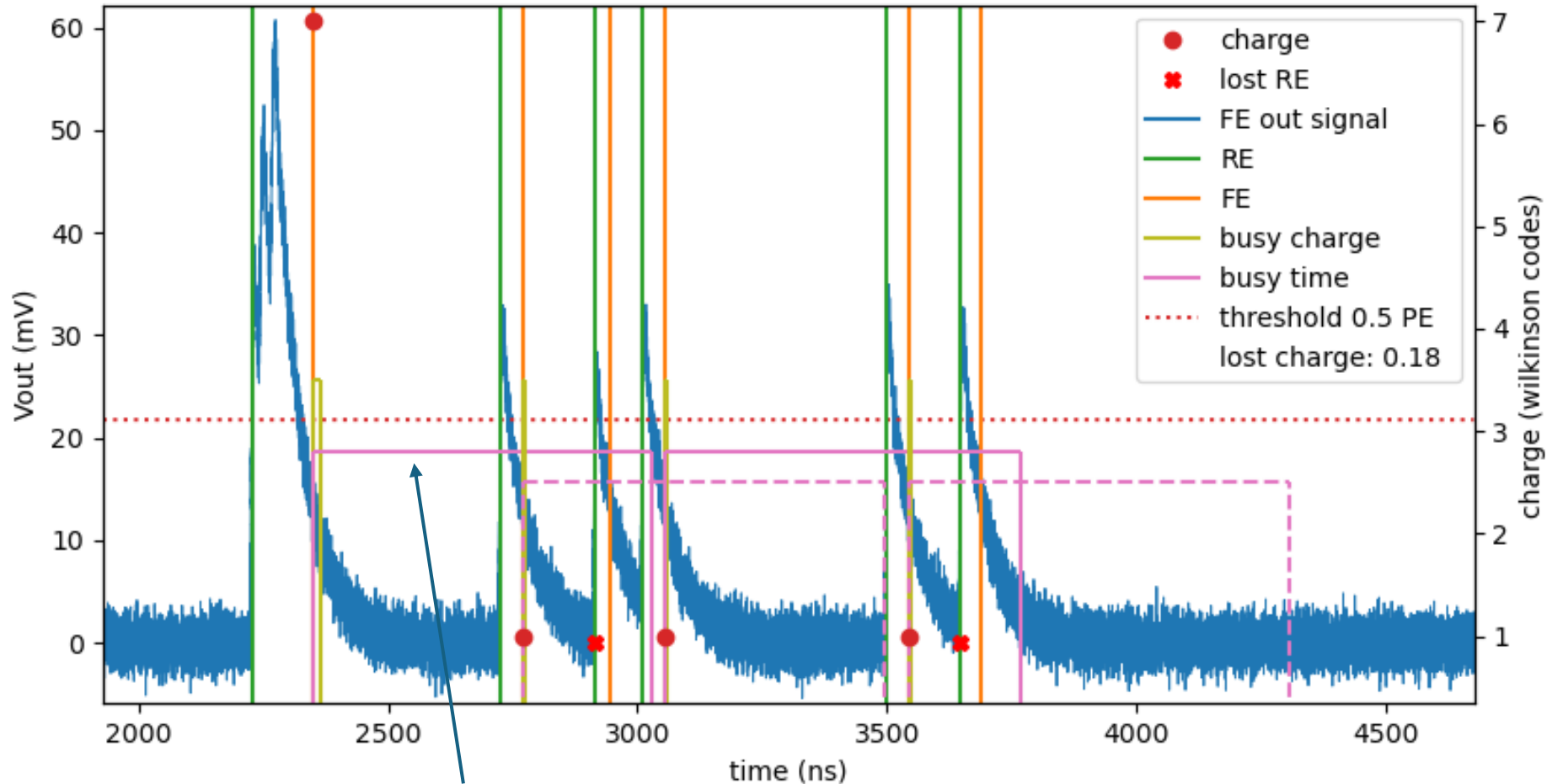- Rq 500
- FE gain 0

Waveform displayer – FE gain scan

Pixel 44 – CAM NB_X7

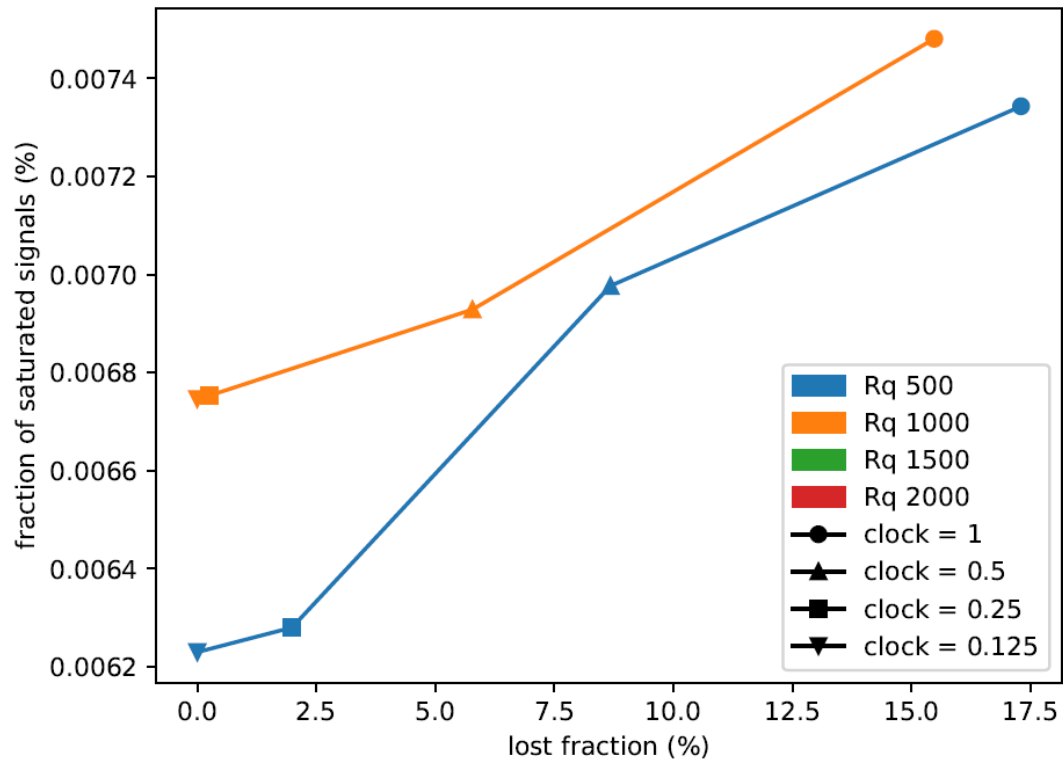Why timestamp digitization is longer than for FE gain 0 ?

Conclusions

- Good nph reconstruction for both FE gain 0 and 1
- Lost fraction and saturated fraction decrease as clock frequency increases
- Higher hold on values give smaller lost fraction but higher saturation
- ADC resolution (for Int. gain 0) get worse as FE gain decreases
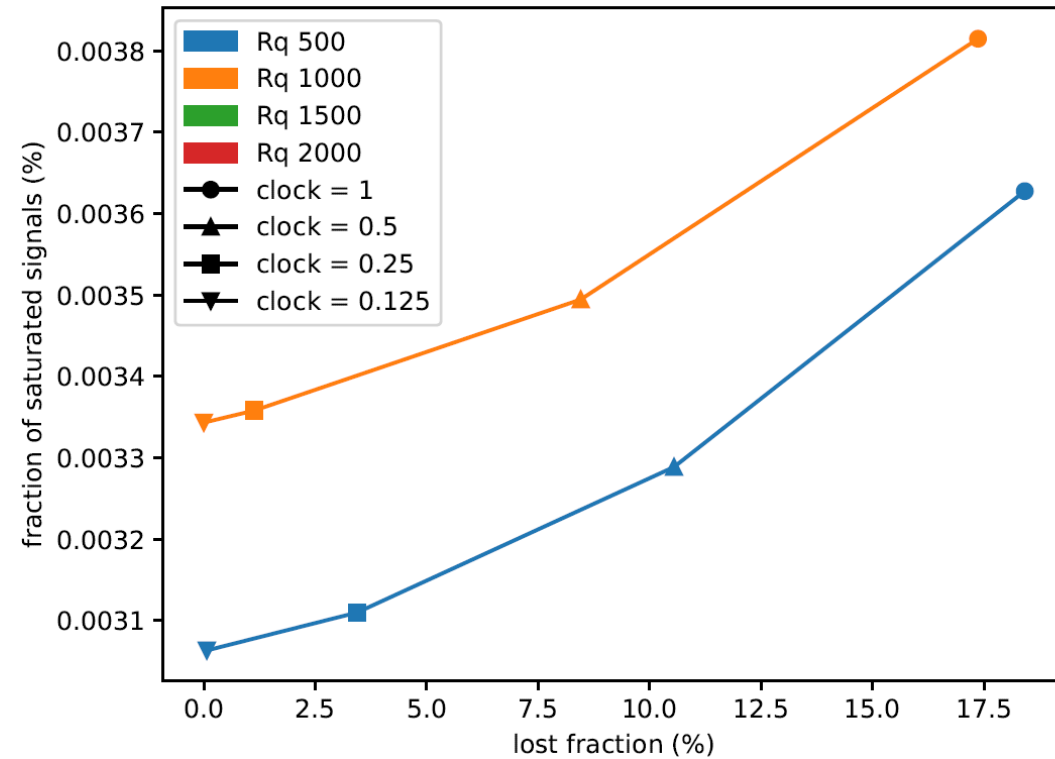- Timestamp digitization strongly affects the amount of lost photons
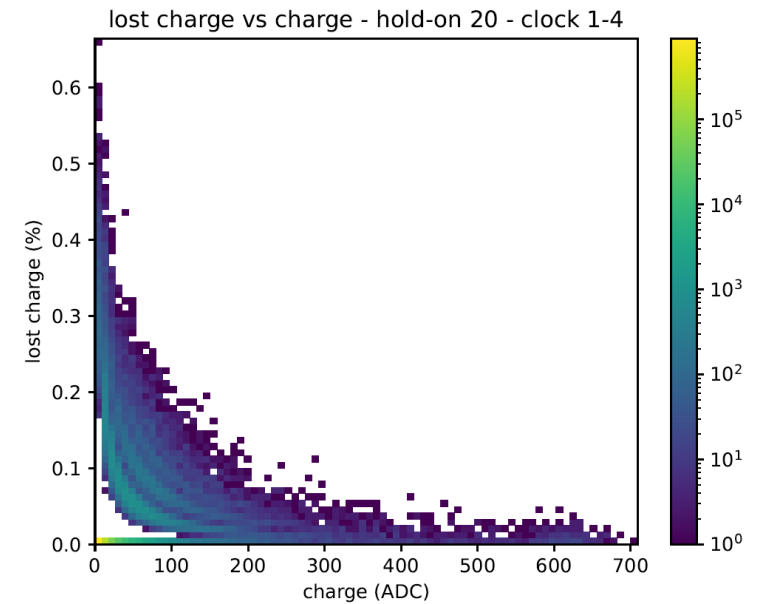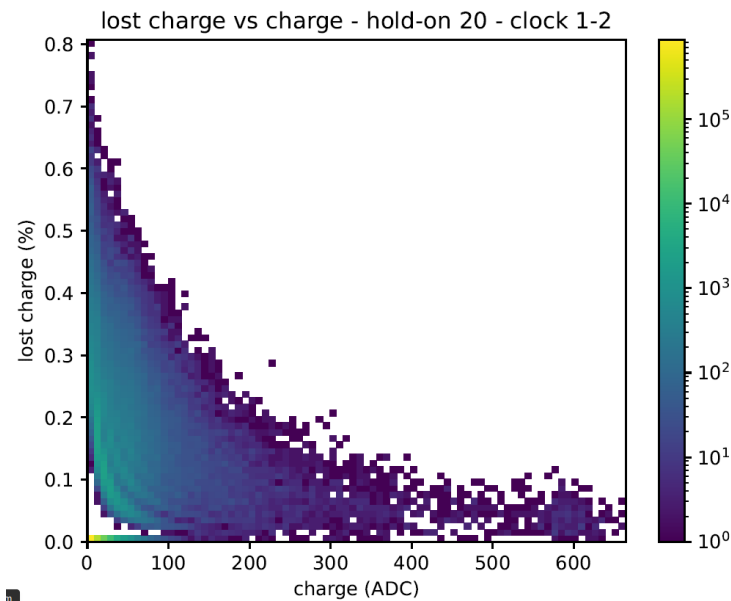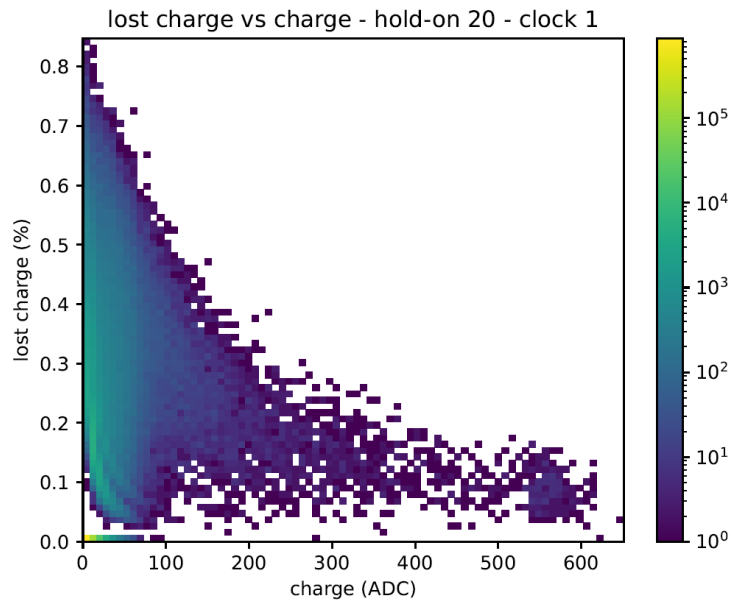
Backup

Saturated vs Lost fractions

FE GAIN 0

FE GAIN 1
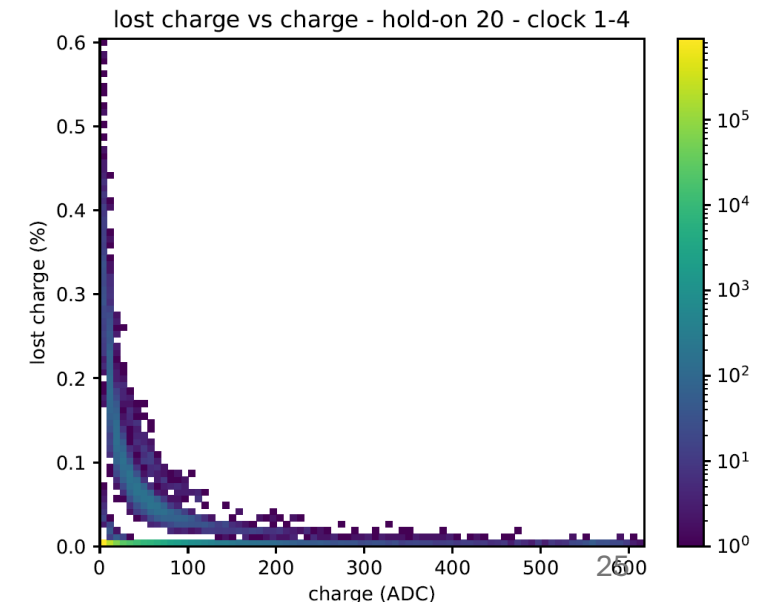
Lost charge

Rq 500

lost charge vs charge - hold-on 20 - clock 1

lost charge vs charge - hold-on 20 - clock 1-2

lost charge vs charge - hold-on 20 - clock 1-4

Rq 1000

lost charge vs charge - hold-on 20 - clock 1

lost charge vs charge - hold-on 20 - clock 1-2

lost charge vs charge - hold-on 20 - clock 1-4
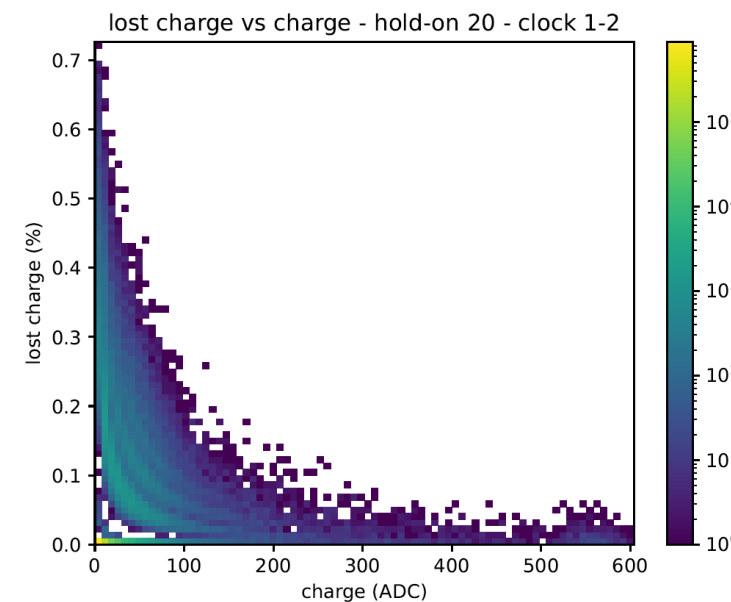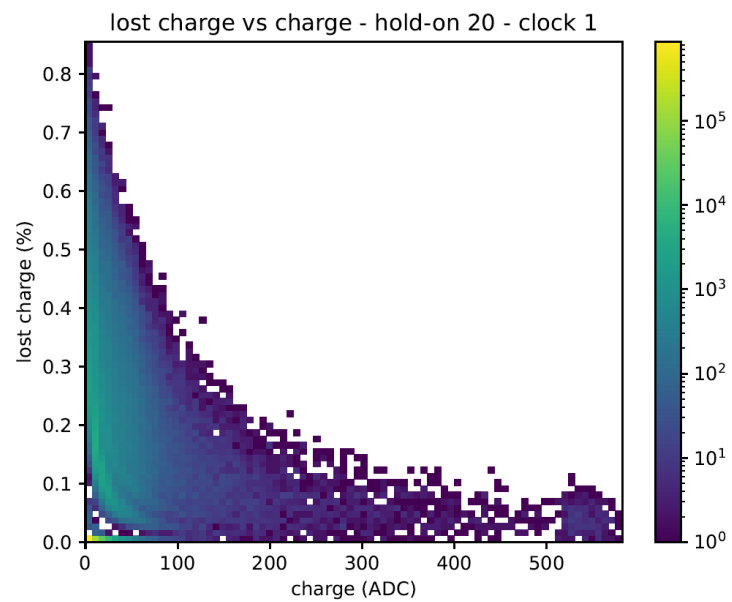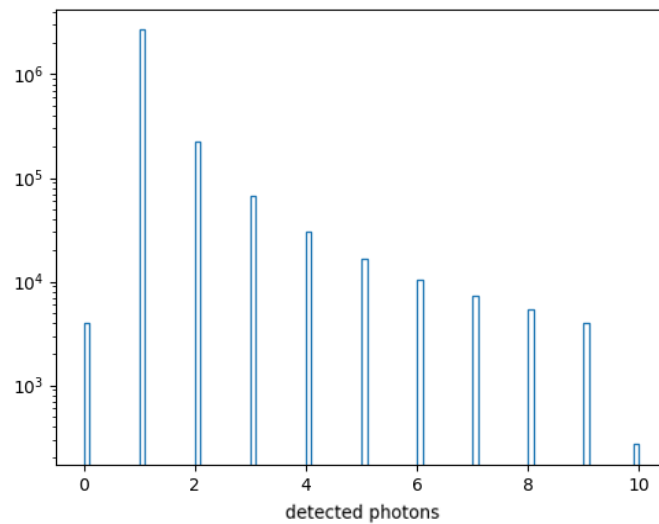
ADC resolution

Photon distribution for Rq 500 and capacitor gain 0

Waveform displayer

camera CAM_NB_X7 - pixel 70

- Clock 1-8
- Rq 500
- FE gain 0