AGIPD1.0:

Characterization & Calibration

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Outline

Calibration

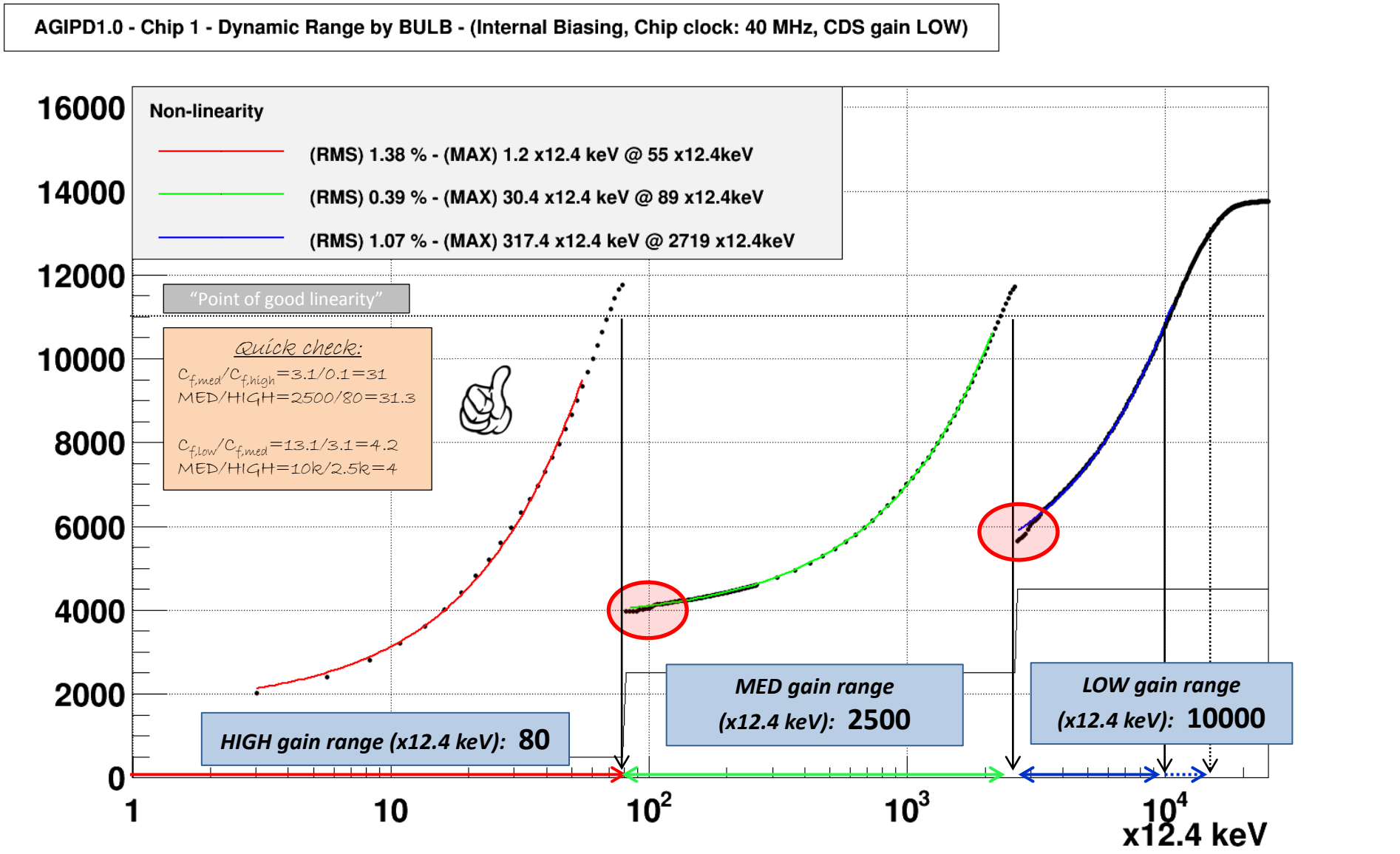
- External: Photons (Bulb, Laser)
- Internal: Test current source

Characterization

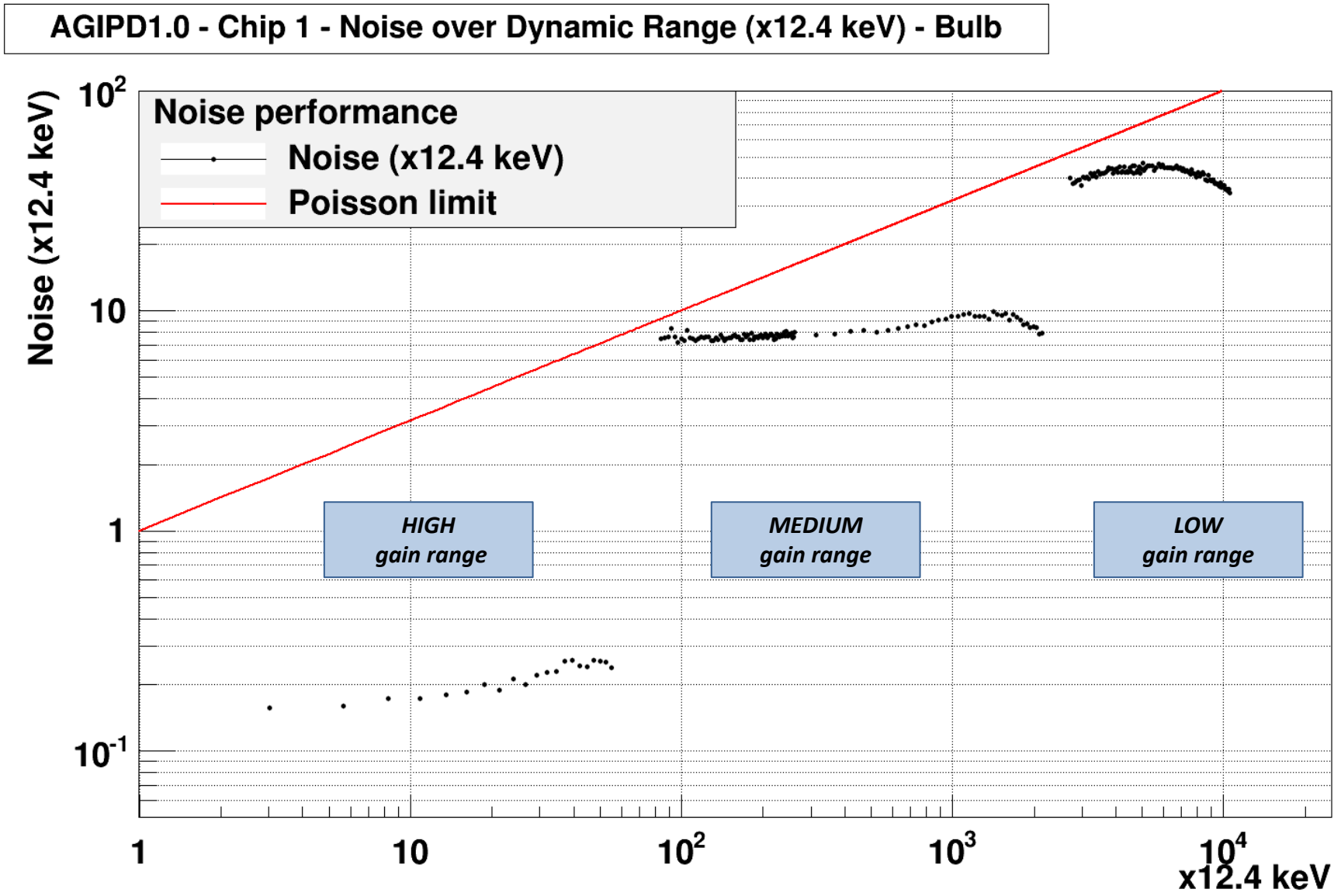
- Chip systematics
- Memory cell sweep

Summary

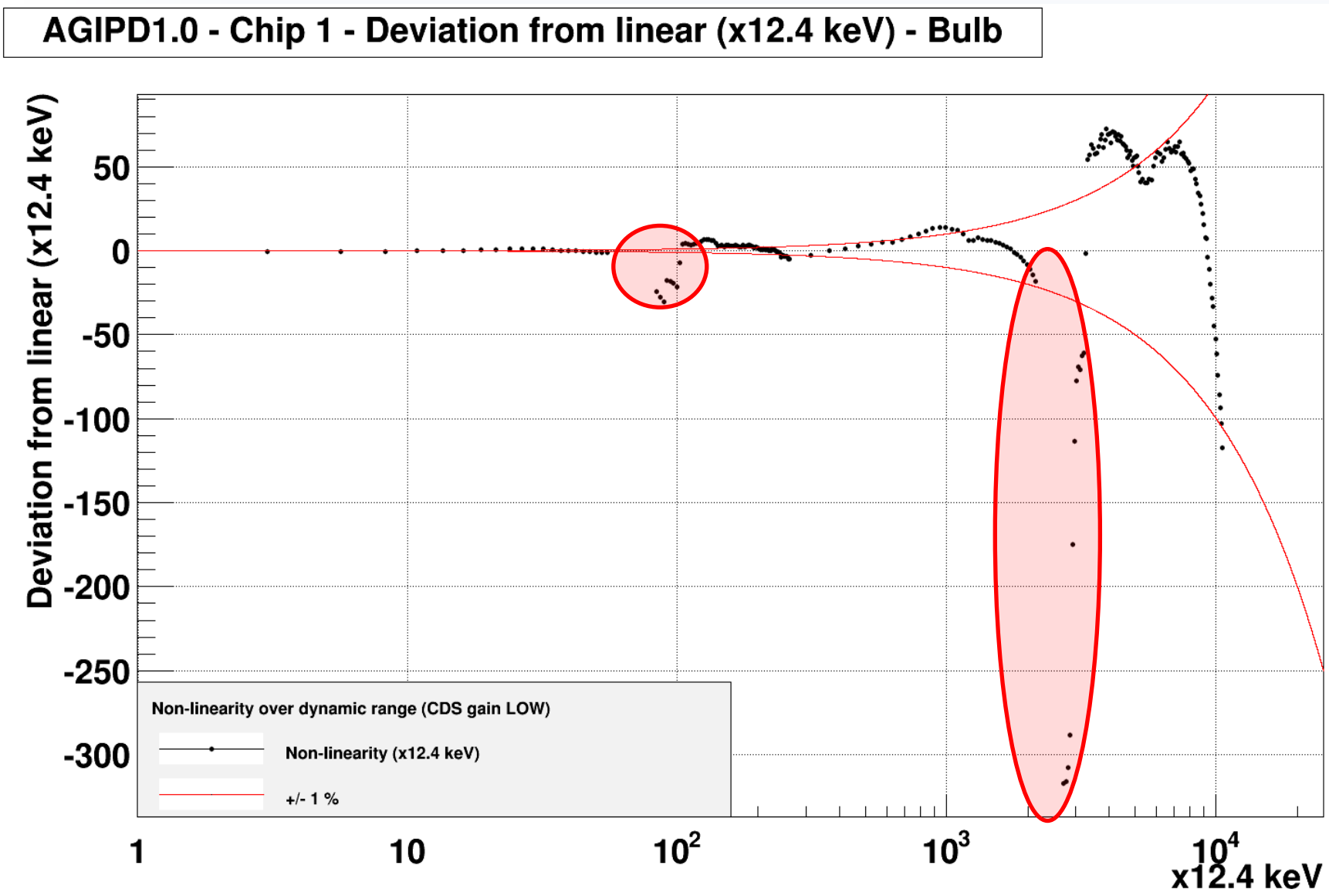
BULB: Dynamic Range



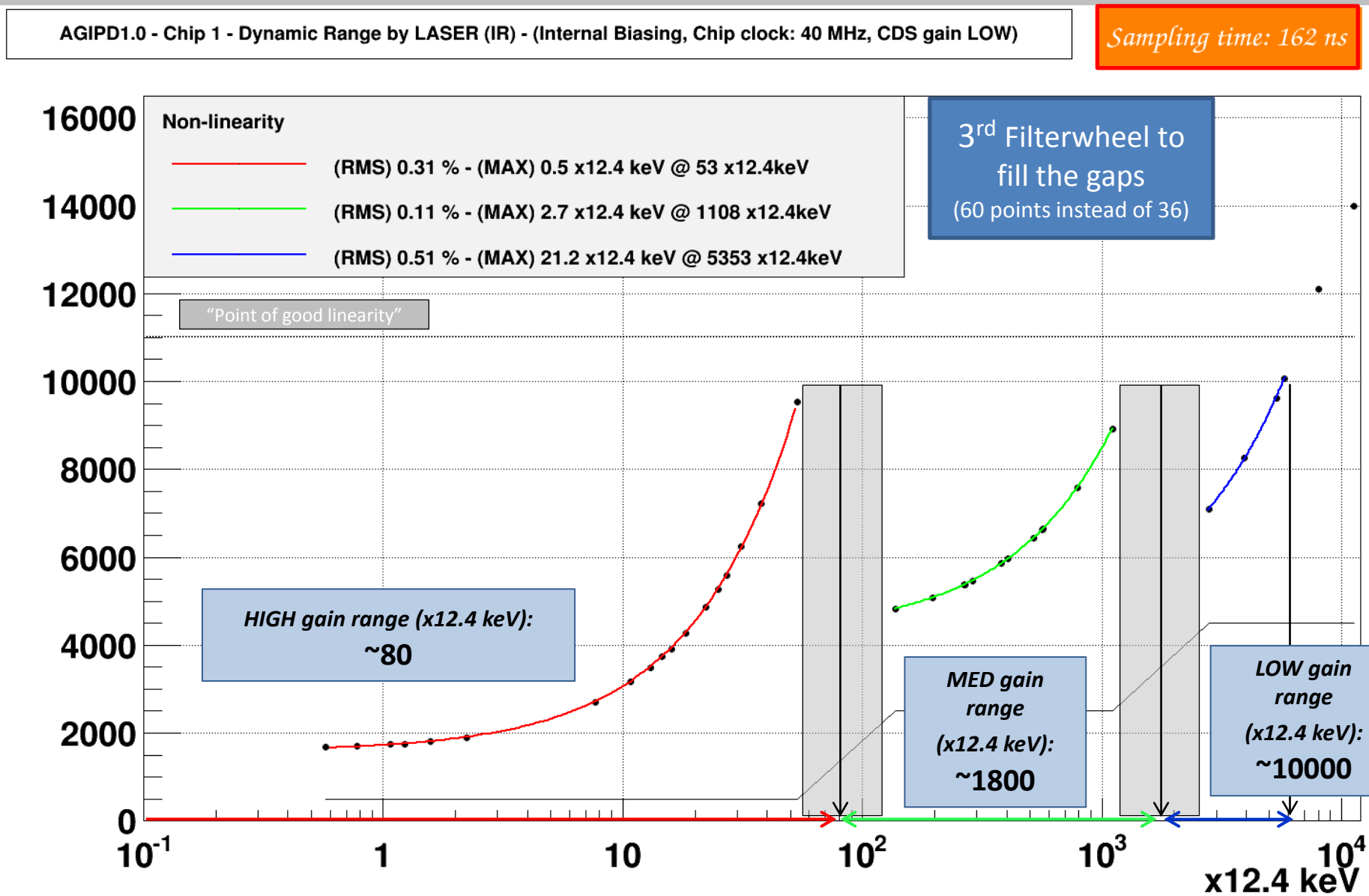
BULB: Noise


AGIPD1.0 - Chip 1 - Noise over Dynamic Range (x12.4 keV) - Bulb
Noise performance
Noise (x12.4 keV)
Poisson limit
HIGH gain range
MEDIUM gain range
LOW gain range
Noise (x12.4 keV)
10^2
10
1
10^{-1}
1
10
10^2
10^3
10^4
x12.4 keV

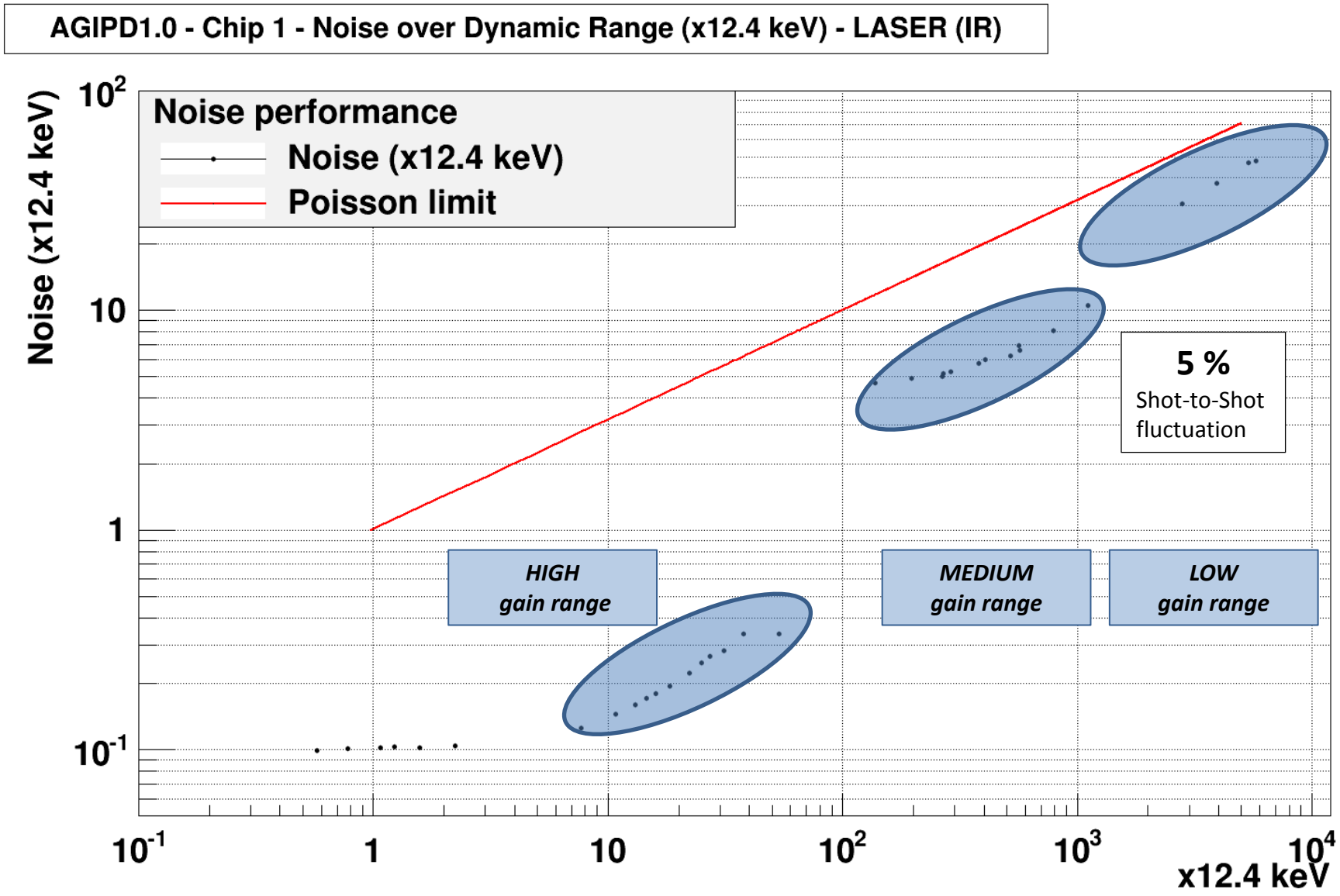
BULB: Non-linearity



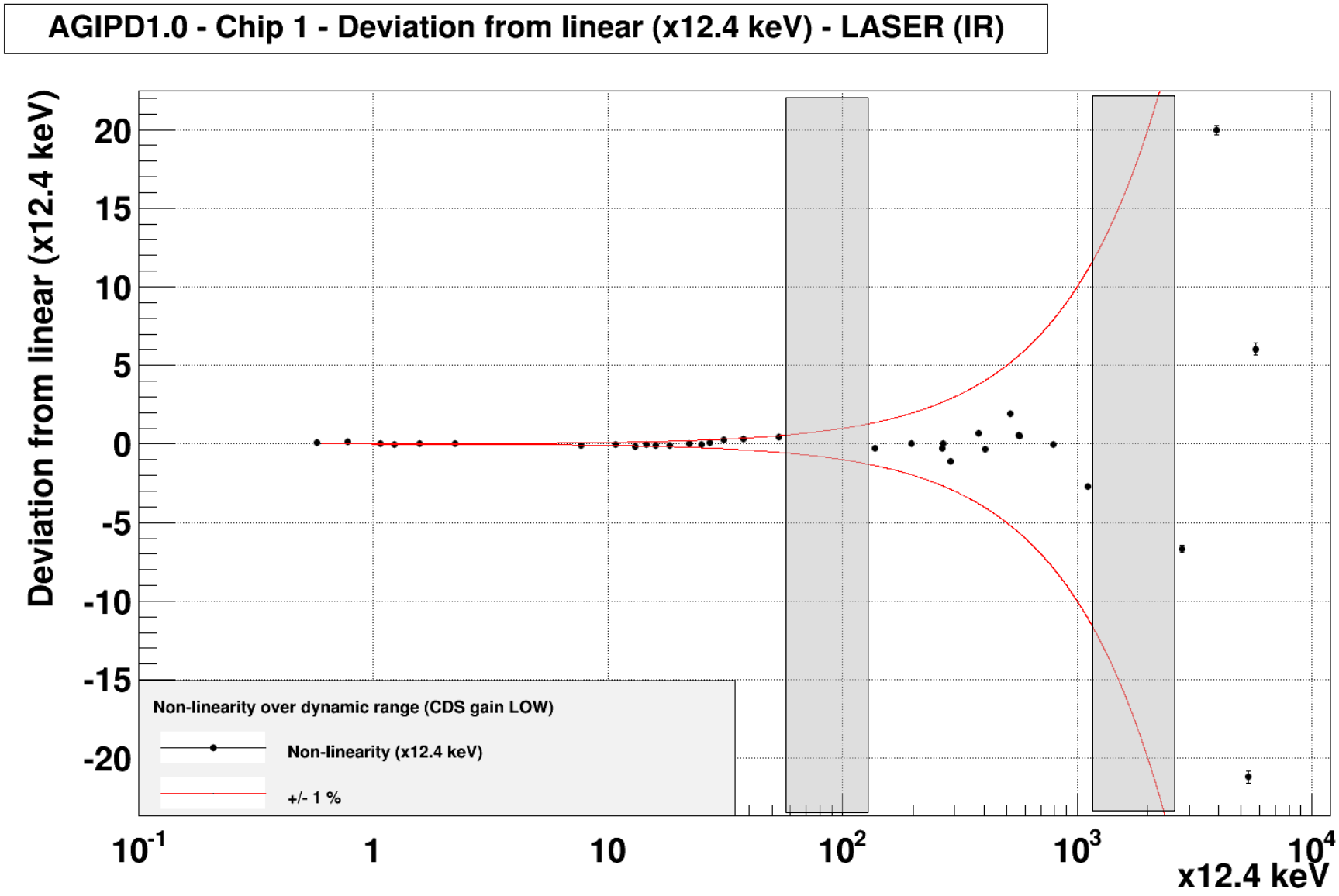
LASER: Dynamic Range



LASER: Noise

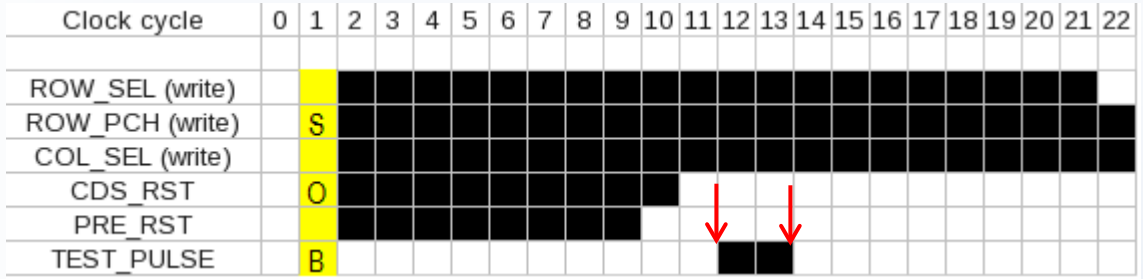

AGIPD1.0 - Chip 1 - Noise over Dynamic Range (x12.4 keV) - LASER (IR)
Noise performance
Noise (x12.4 keV)
Poisson limit
Noise (x12.4 keV)
10^2
10
1
10^{-1}
10^{-1}
1
10
10^2
10^3
10^4
x12.4 keV
5 %
Shot-to-Shot fluctuation
HIGH gain range
MEDIUM gain range
LOW gain range

LASER: Non-linearity



TEST CURRENT: Operation modes

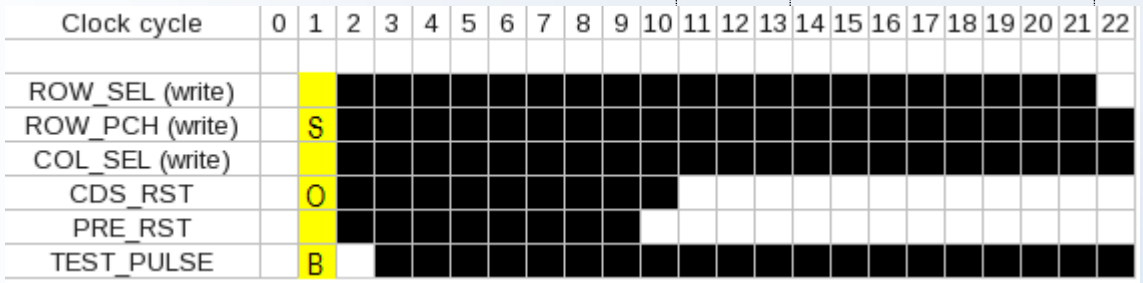
ON during INT



Good:
- *Defined settling time*

Bad:
- *2x charge injection from switching*
- *Charge injection from floating test current node*

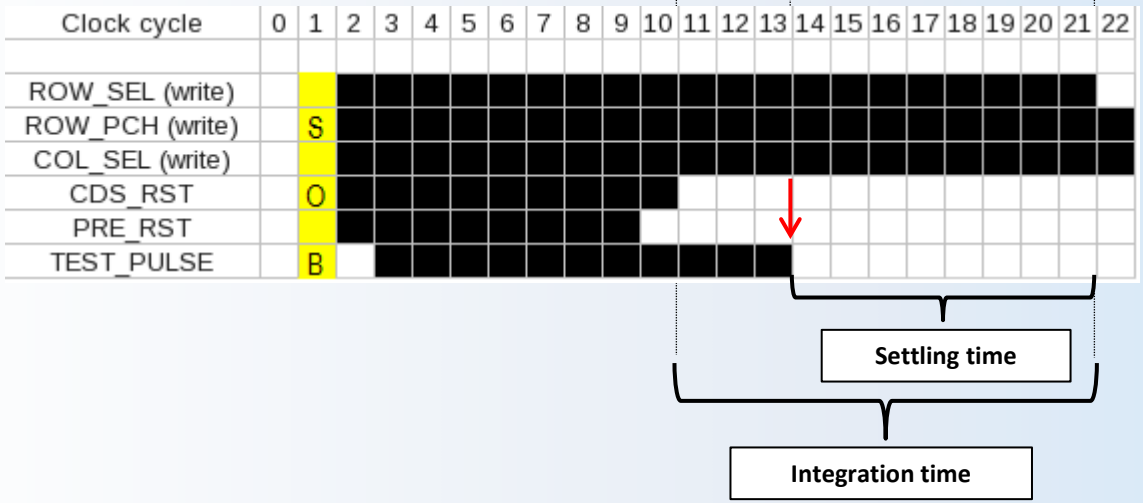
Always ON



Good:
- *No charge injection*

Bad:
- *No defined settling time*

ON during RST

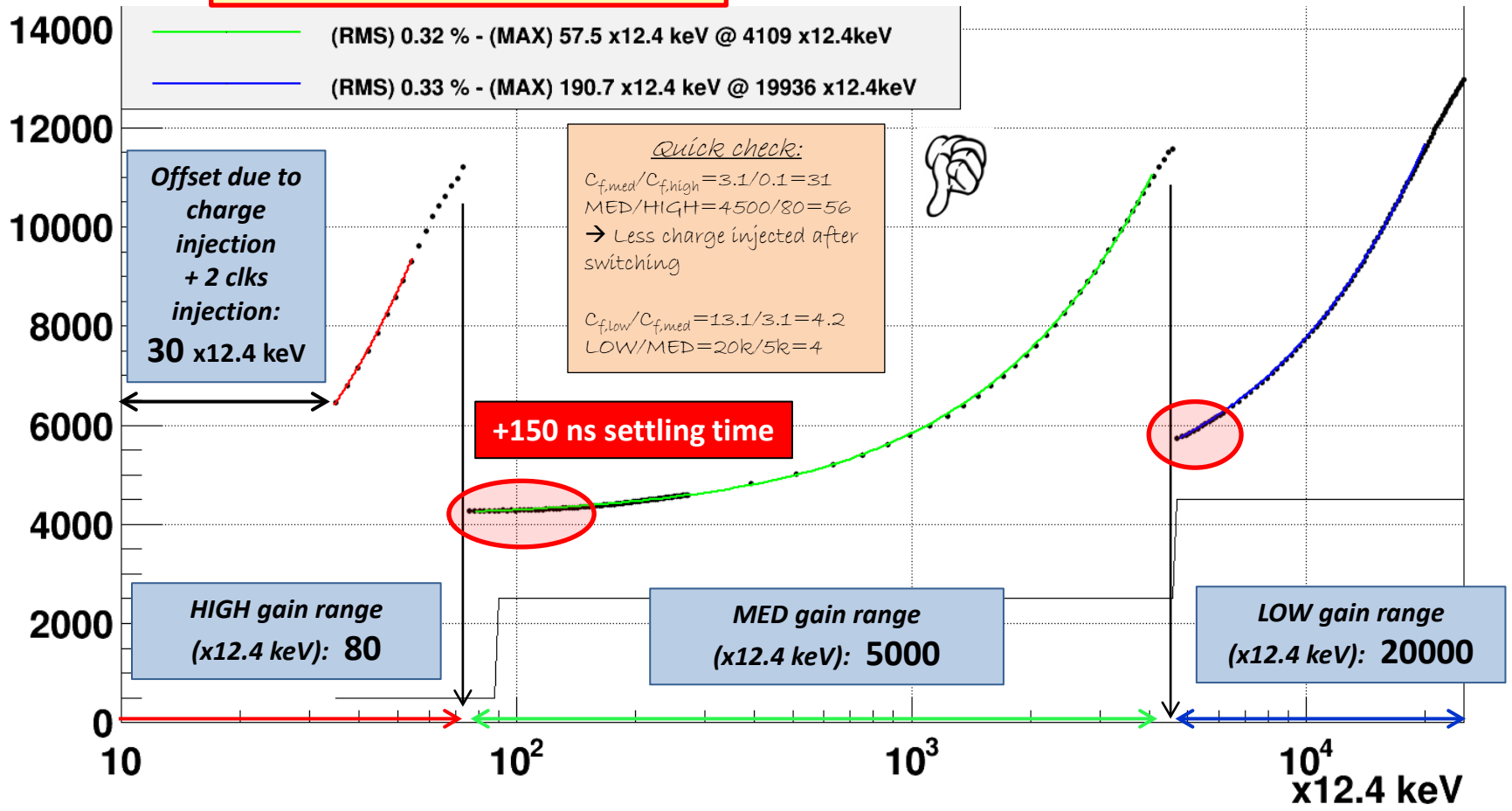


Good:
- *Defined settling time*
- *Charge injection from floating test current node removed by PRE RST*

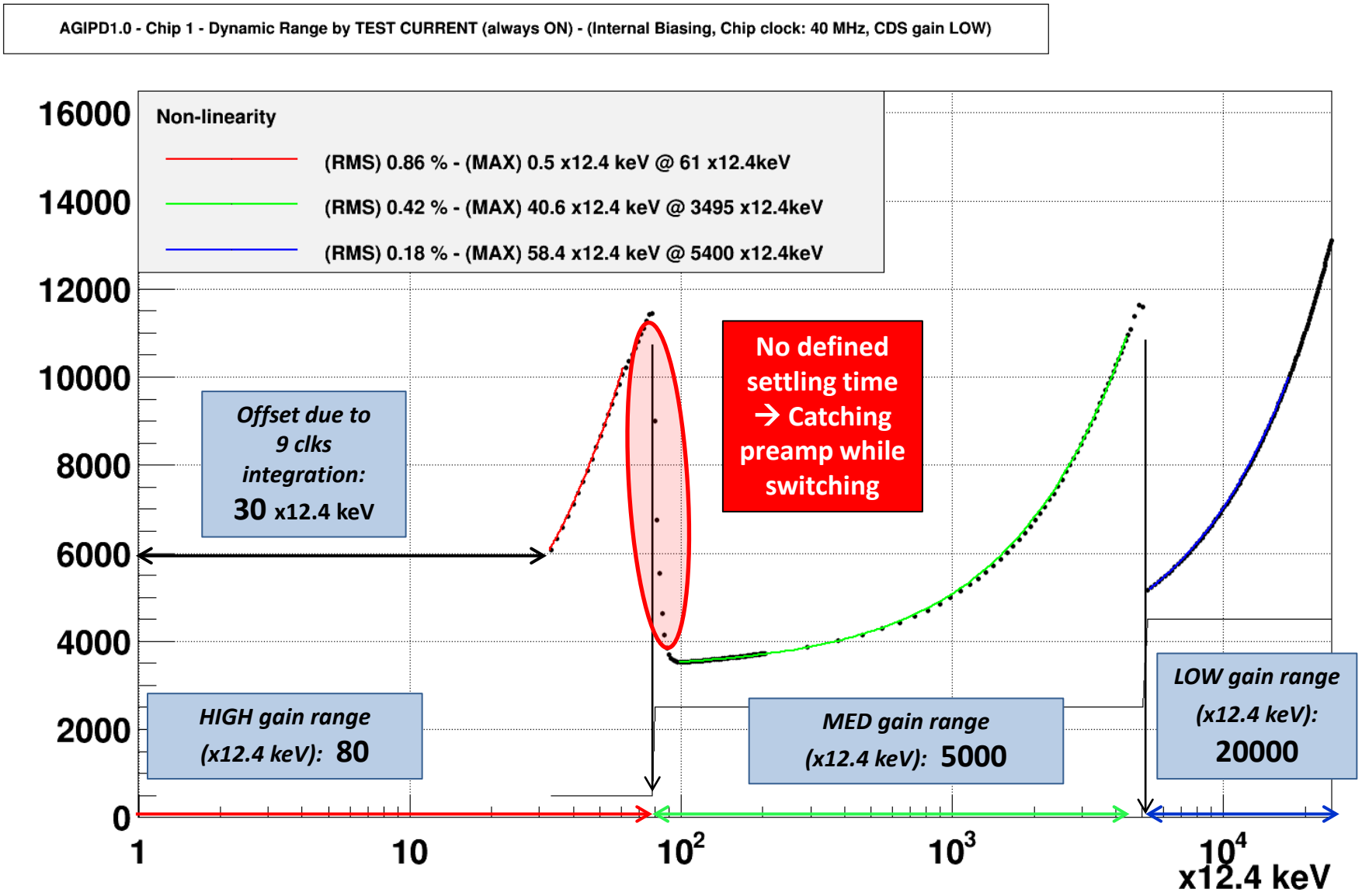
Bad:
- *1x charge injection from switching (2nd)*

TEST CURRENT (250): ON during INT

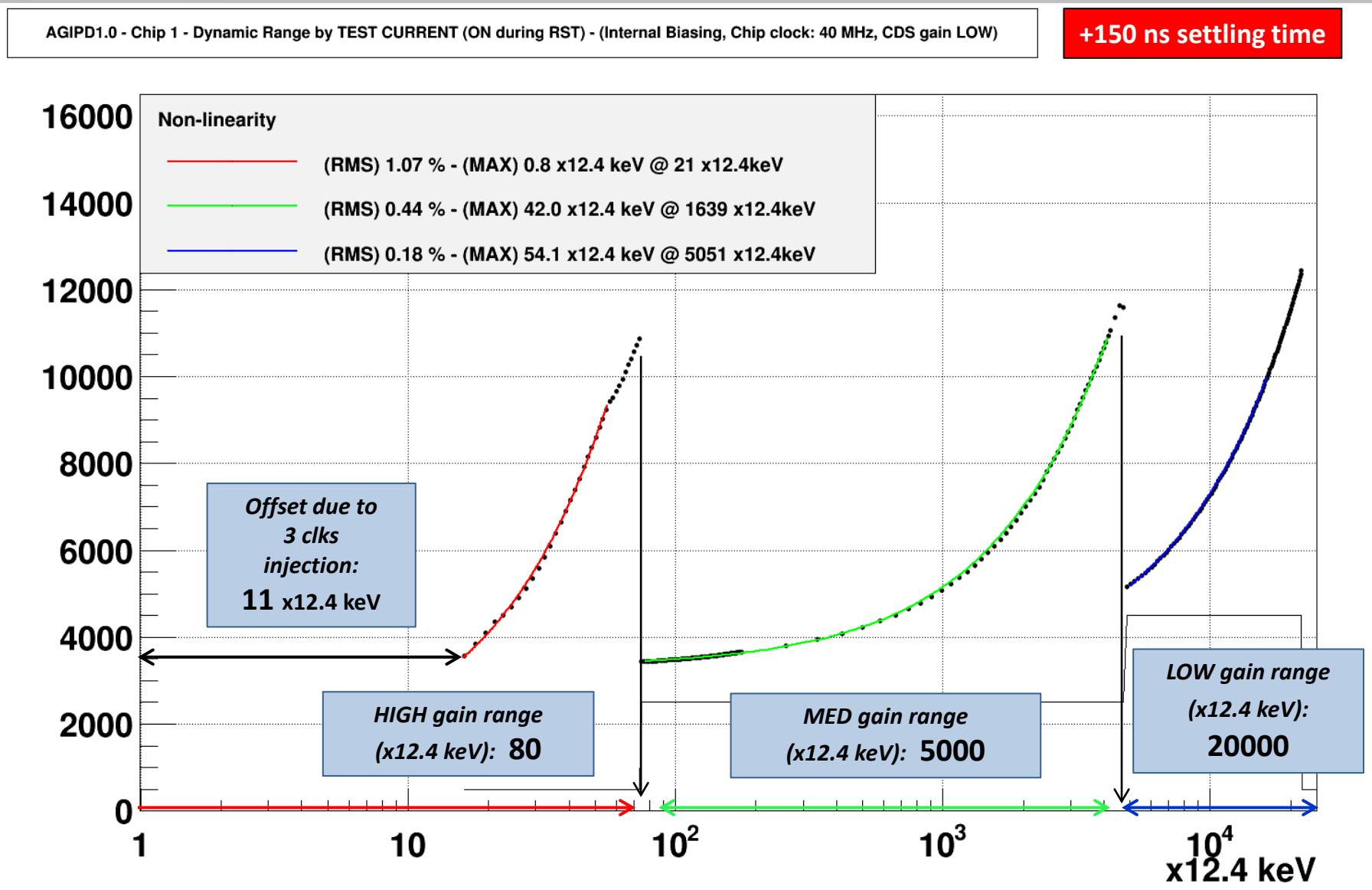
```
root [0] .x /afs/psi.ch/user/g/greiffenberg_d/root/AGIPD10_Calibration_testI_Analysis_CDSgainLOW_03Feb2014.c
File 'A10_Chip1_Calibration_testI250_CDSgainLOW.root' opened successfully
Pixel #100 - Fit summary:
HIGH gain stage: m(H)= (353.857 +/- 0.081) ADC/clk | c(H)= 6096.6 +/- 0.5
MEDIUM gain stage: m(M)= (4.095 +/- 0.000) ADC/clk | c(M)= 4171.0 +/- 0.1
LOW gain stage: m(L)= (0.937 +/- 0.000) ADC/clk | c(L)= 3867.9 +/- 0.3
```



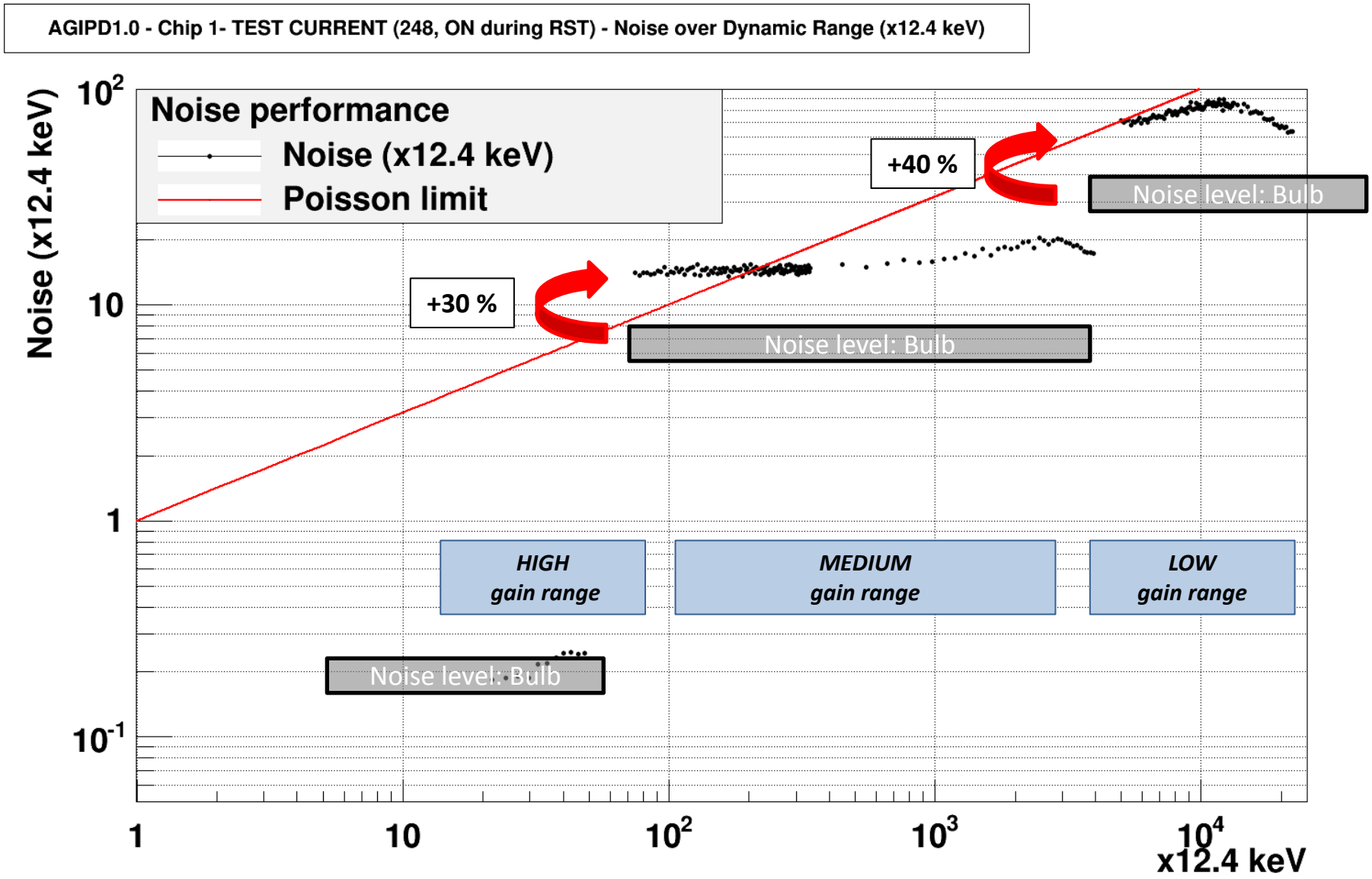
TEST CURRENT (250): always ON



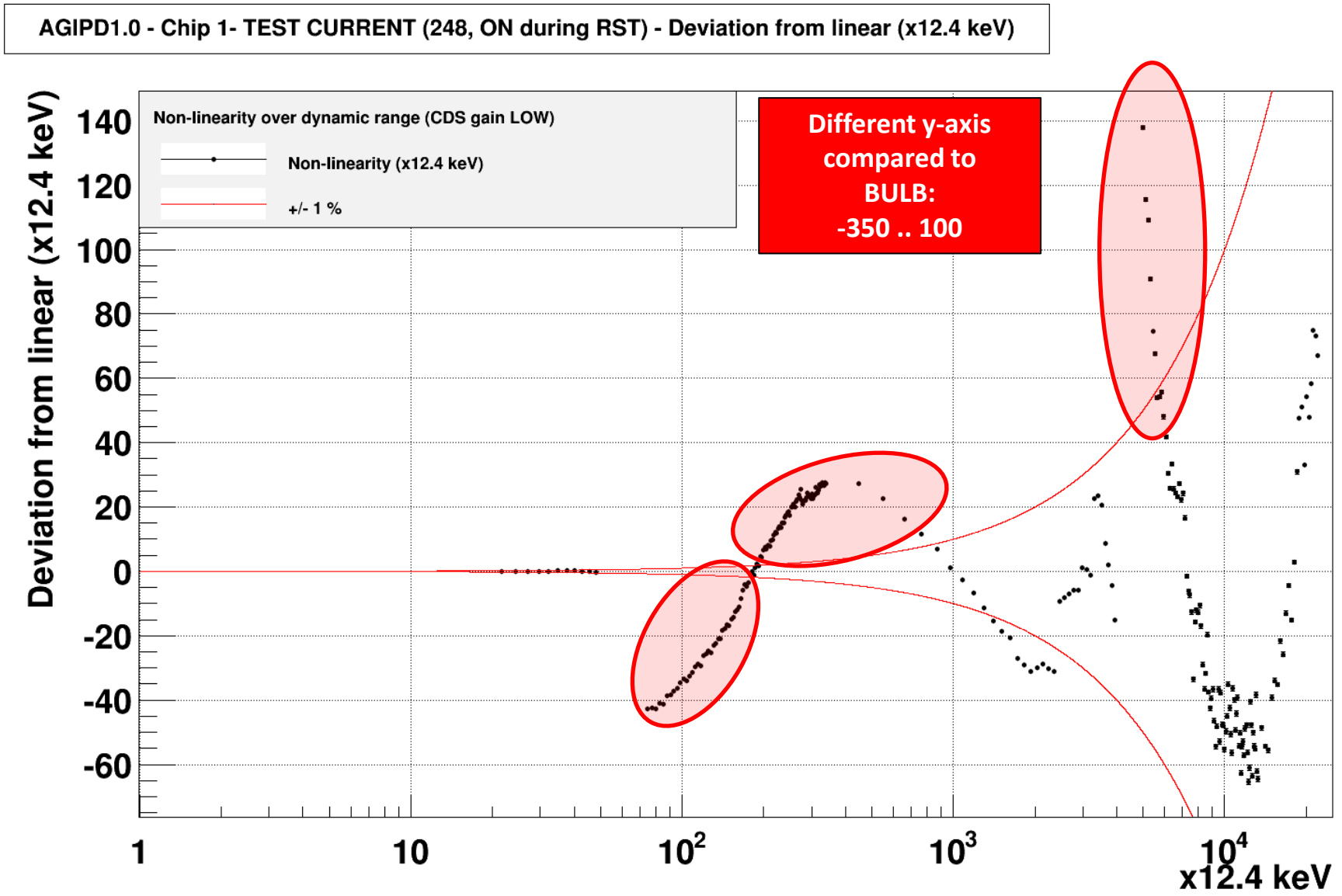
TEST CURRENT (250): ON during RST



TEST CURRENT (250): ON during RST

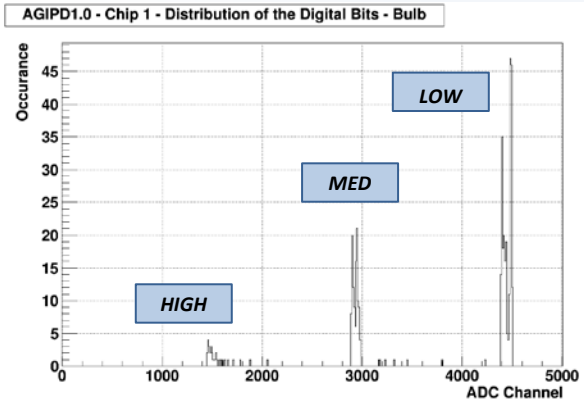


TEST CURRENT (250): ON during RST

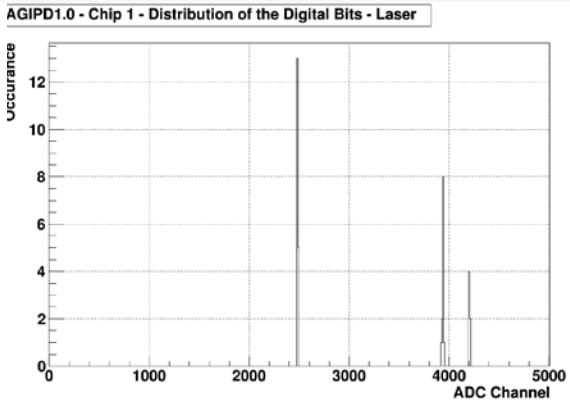


Digital bit information

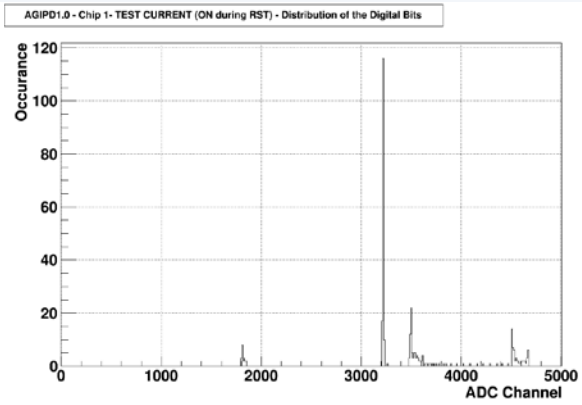
Bulb



Laser



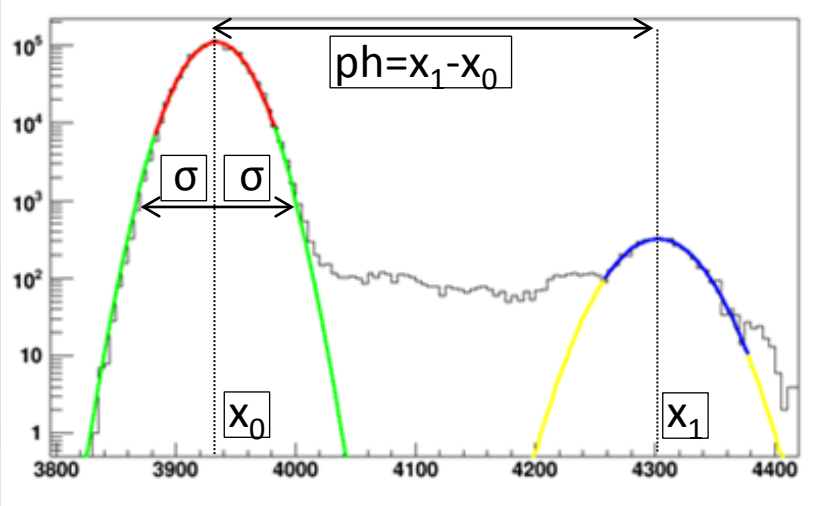
Test current

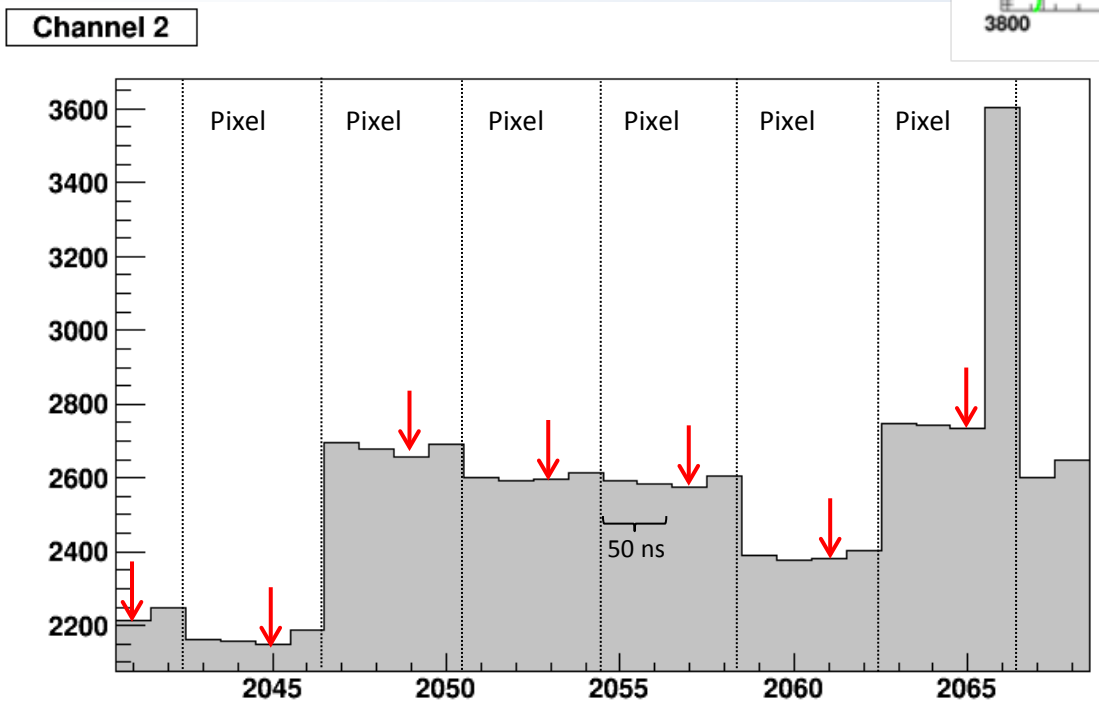


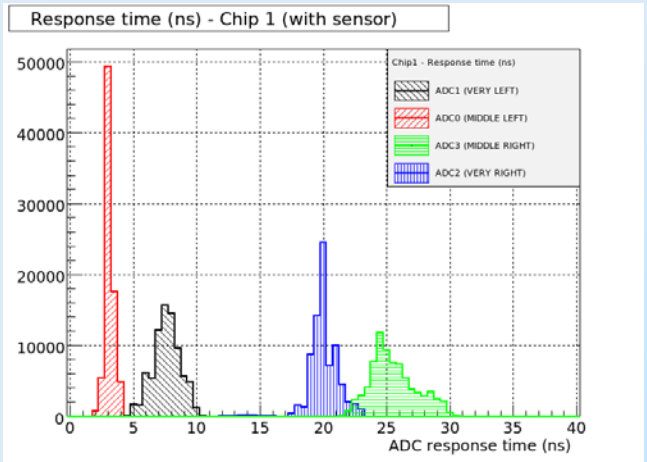
???

Characterization

- Filling each memory cell with fluorescence photons (Mo 17.5 keV)
- Extracting:
  - Pulseheight: ph
  - Baseline: x_0
  - Noise: σ
- Chip operated @ 80 MHz → 40 MHz on-chip (25 ns)
- Sampling after 50 ns

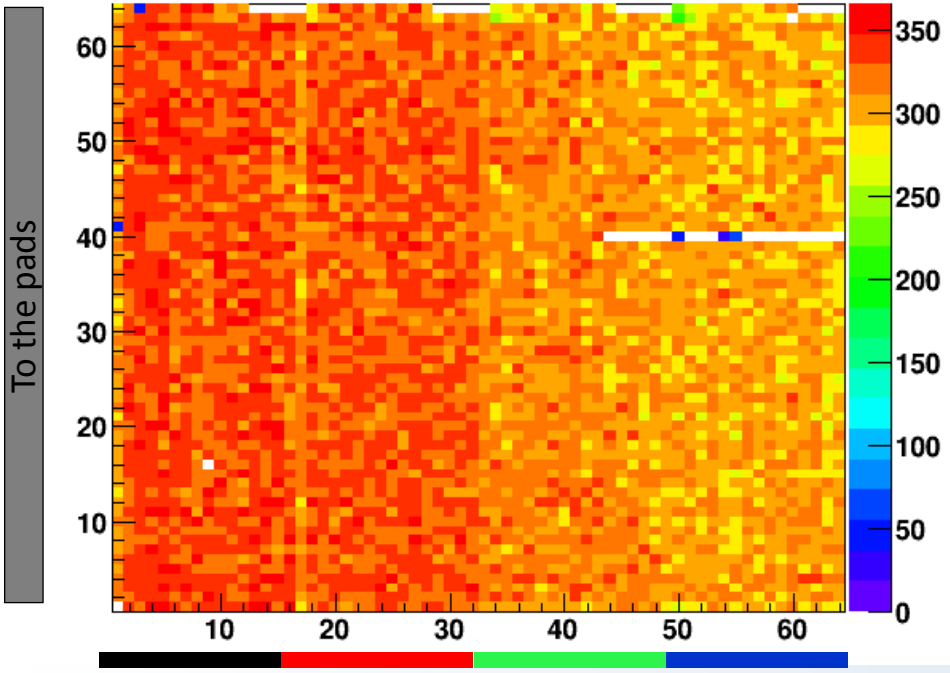




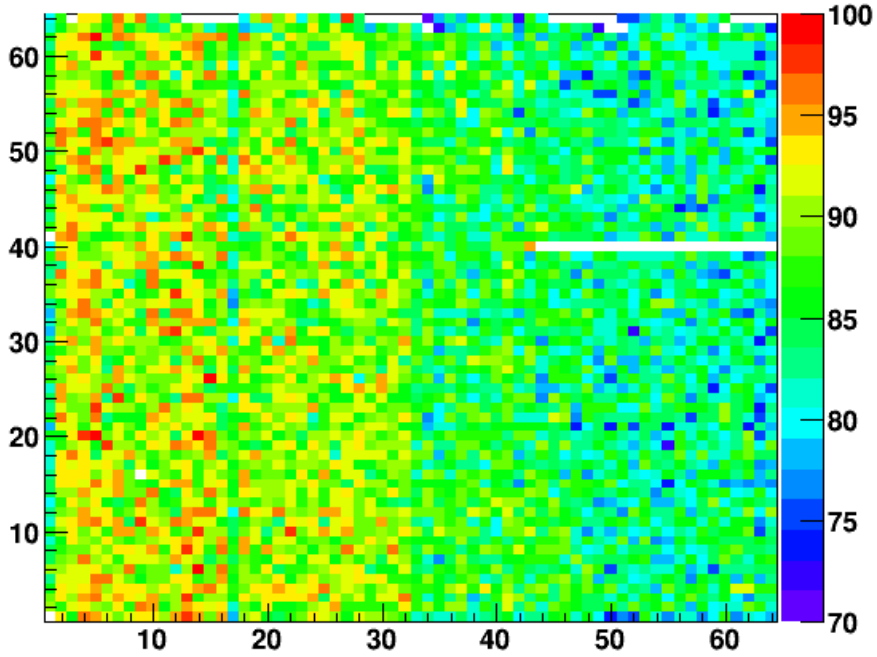


Chip systematics: Pulseheight

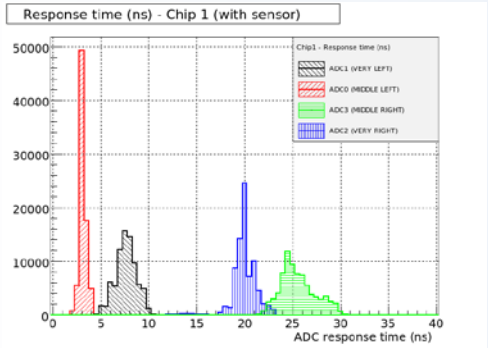
Pulseheight (ADC)

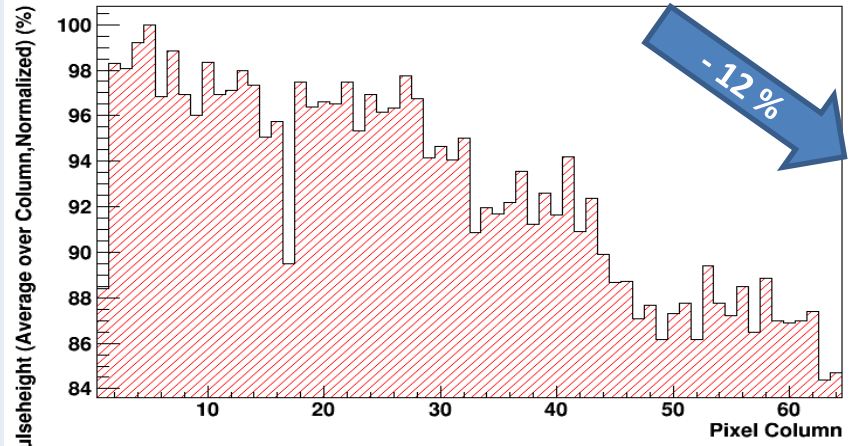


Relative Pulseheight (%)



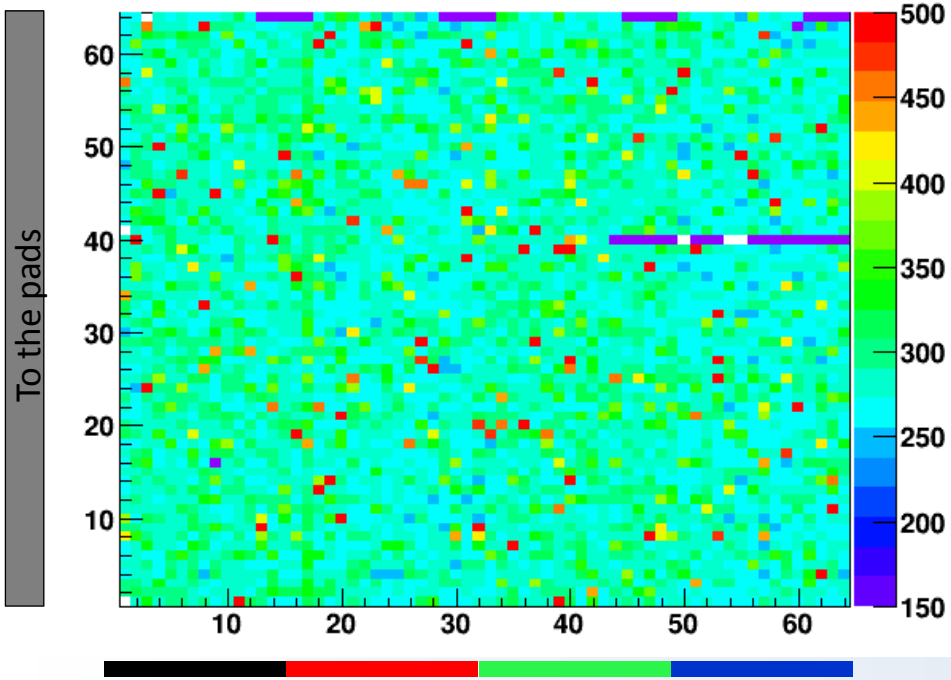
Decrease of pulseheight



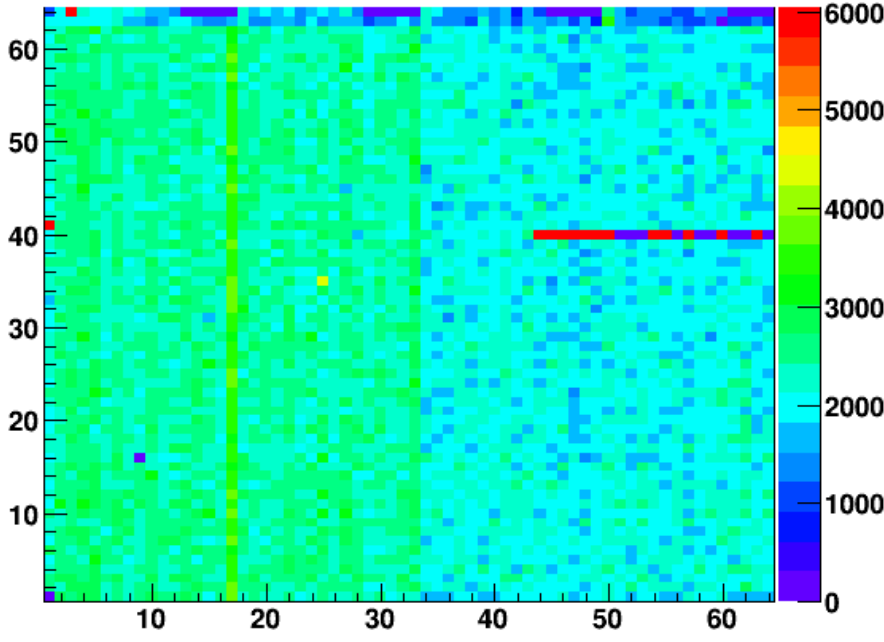


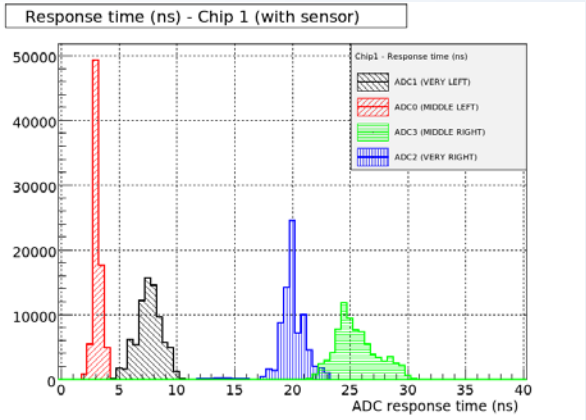
Chip systematics: Noise & Baseline

Noise (ENC)



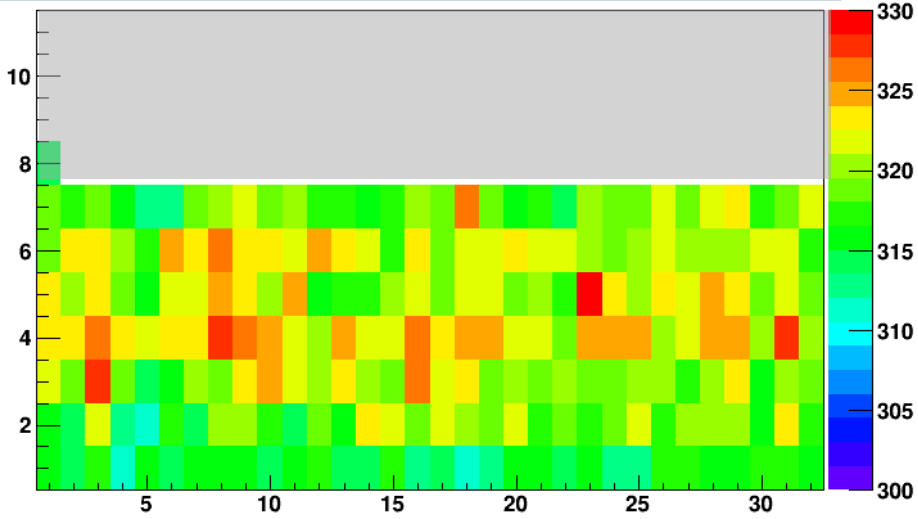
Baseline (ADC)



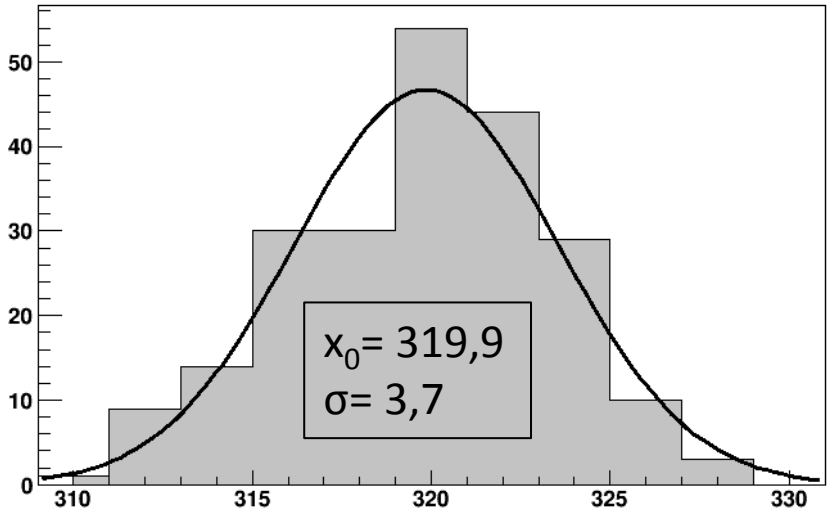


Memory cell systematics: Pulseheight

Pulseheight (ADC)



Distribution of Pulseheight



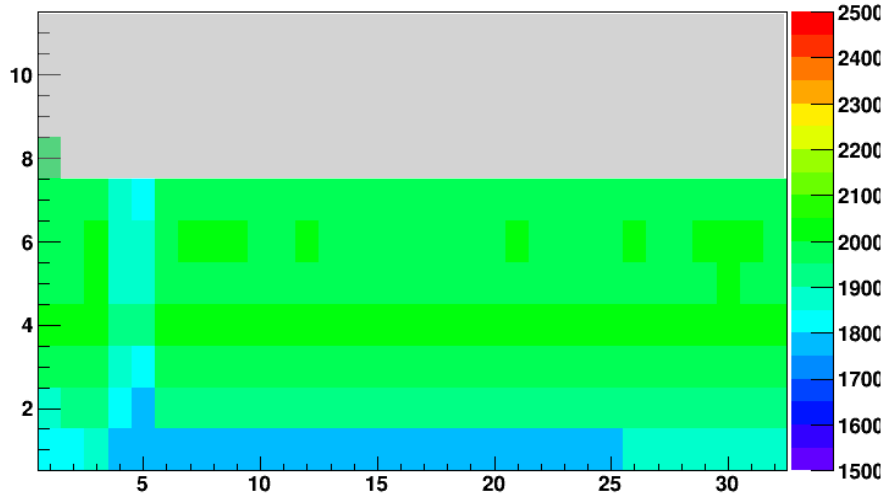
- Memcell: 0 .. 224 with mchip012 (dead)
- Memcell: 224 .. 352 with mchipDG

→Only showing results from one Chiptestbox
(Rest is measured at this moment)

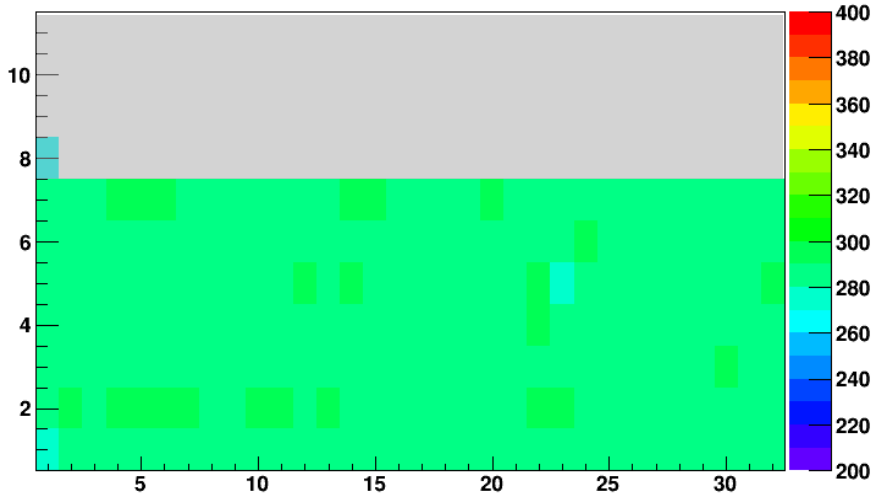
- Fluorescence: Mo 17.5 keV
- Memory cell variation: ± 1.16 % (rms)

Memory cell systematics: Others

Baseline (ADC)



Noise (ENC)



- Baseline shows systematic variations:

→ Row 1 (significantly lower)
→ Row 4 (slightly higher)
→ Column 4, 5 (significantly lower)
→ … more tiny baselines variations, depending on display quality

- Noise as pulse height rather homogeneous