



Characterization of AGIPD01 / AGIPD02

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Overview



- AGIPD01:

- Parasitic Capacitance: Current source measurements
- Linearity of the gain
- Stresstest of the input capacitance using the pulser
- Direct measurements of the Preamp / CDS

- AGIPD02:

- Energy calibration / Noise
- Seeing particles: β -particles
- Imaging with AGIPD02: the „A“

AGIPD01- Parasitic Capacitance

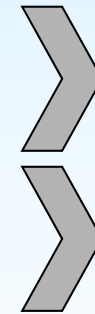


- Determination of the parasitic feedback capacitance of the Preamp using the internal current source
- The design values are:

$$C_{fb,high} = 100 \text{ fF}$$

$$C_{fb,med} = 3 \text{ pF} + 0.1 \text{ pF} = 3.1 \text{ pF}$$

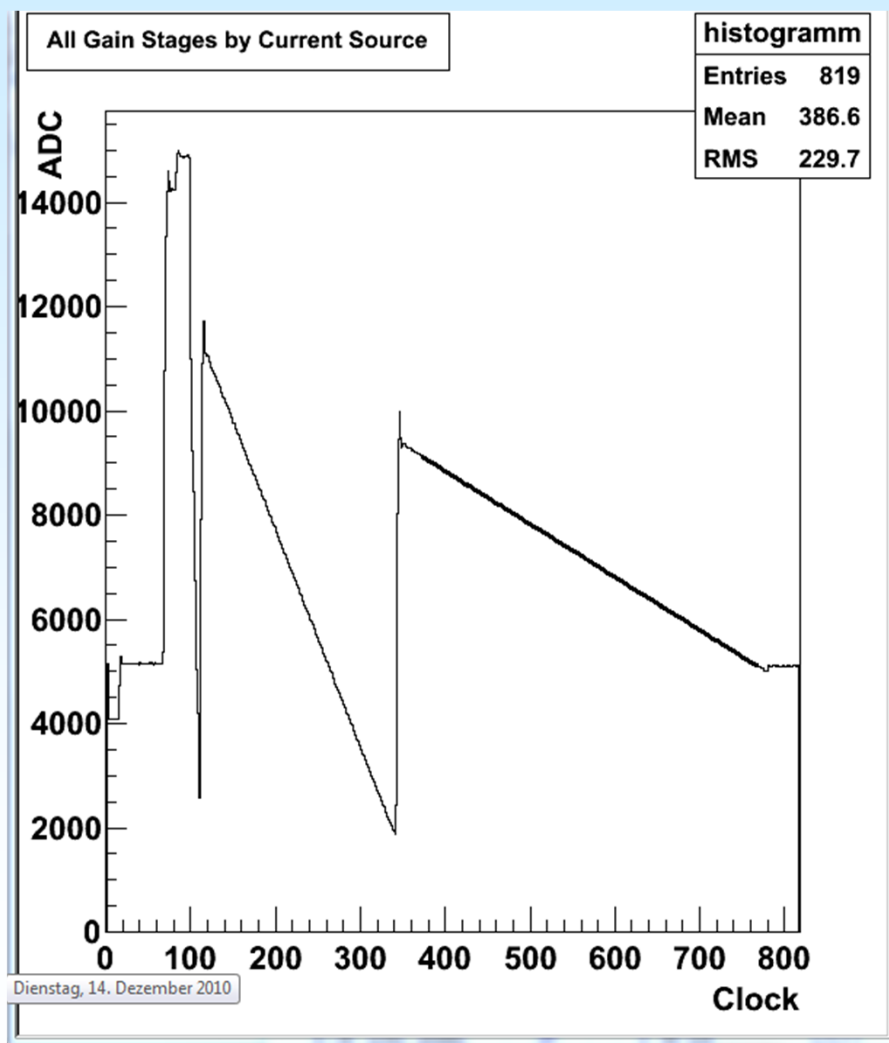
$$C_{fb,low} = 10 \text{ pF} + 3 \text{ pF} + 0.1 \text{ pF} = 13.1 \text{ pF}$$



Gainratio: 31

Gainratio: 4.2

AGIPD01- Parasitic Capacitance



Fitting of each gain stage using a linear function:

Gainratio High/Med: 21.6 (31)

Gainratio Med/Low: 4.1 (4.2)

$$\rightarrow \text{Gainratio} = \frac{3.1 + C_p}{0.1 + C_p}$$

$$\rightarrow C_p = 45.4 \text{ fF}$$

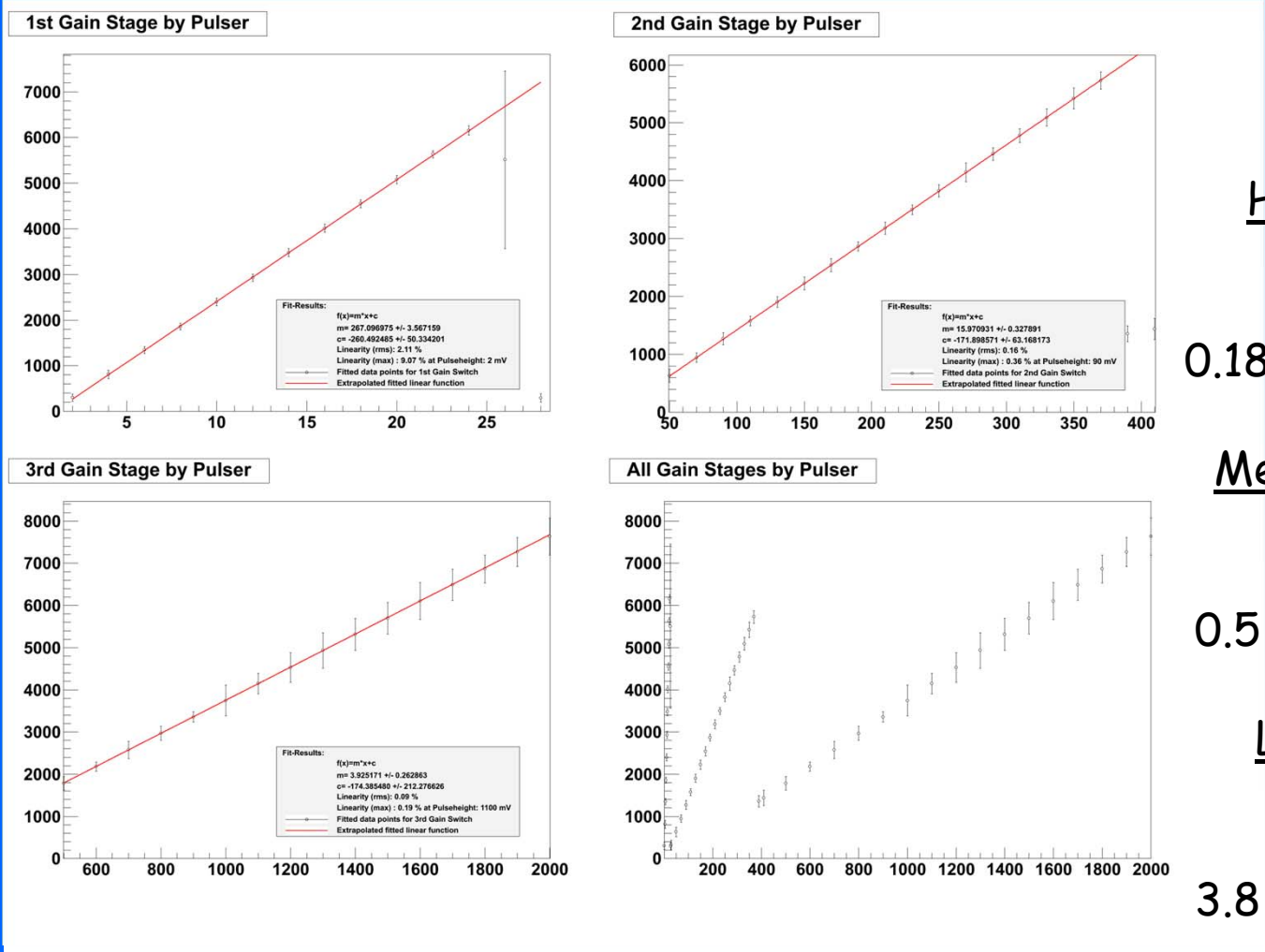
(Simulated values: 30-40 fF)

AGIPD01- Linearity of the gain (before stresstest)



- Linearity test using a pulser applying voltage pulses on a 11 pF input capacitance:
 - A voltage pulse of 1 V corresponds to an equivalent charge of $\sim 20000 \times 12$ keV photons
- For the stresstest:
Pulsing with 1 kHz for 1 hour: $3.6 \cdot 10^6 \times 20k$ 12 keV photons (in case of 1 V pulse height)
- Rise time of the pulse: 5 ns

AGIPD01- Linearity of the gain (before stresstest)



*Excellent
linearity !!*

High gainstage:

2.11 % (rms)
0.18 x 12 keV γ (max)

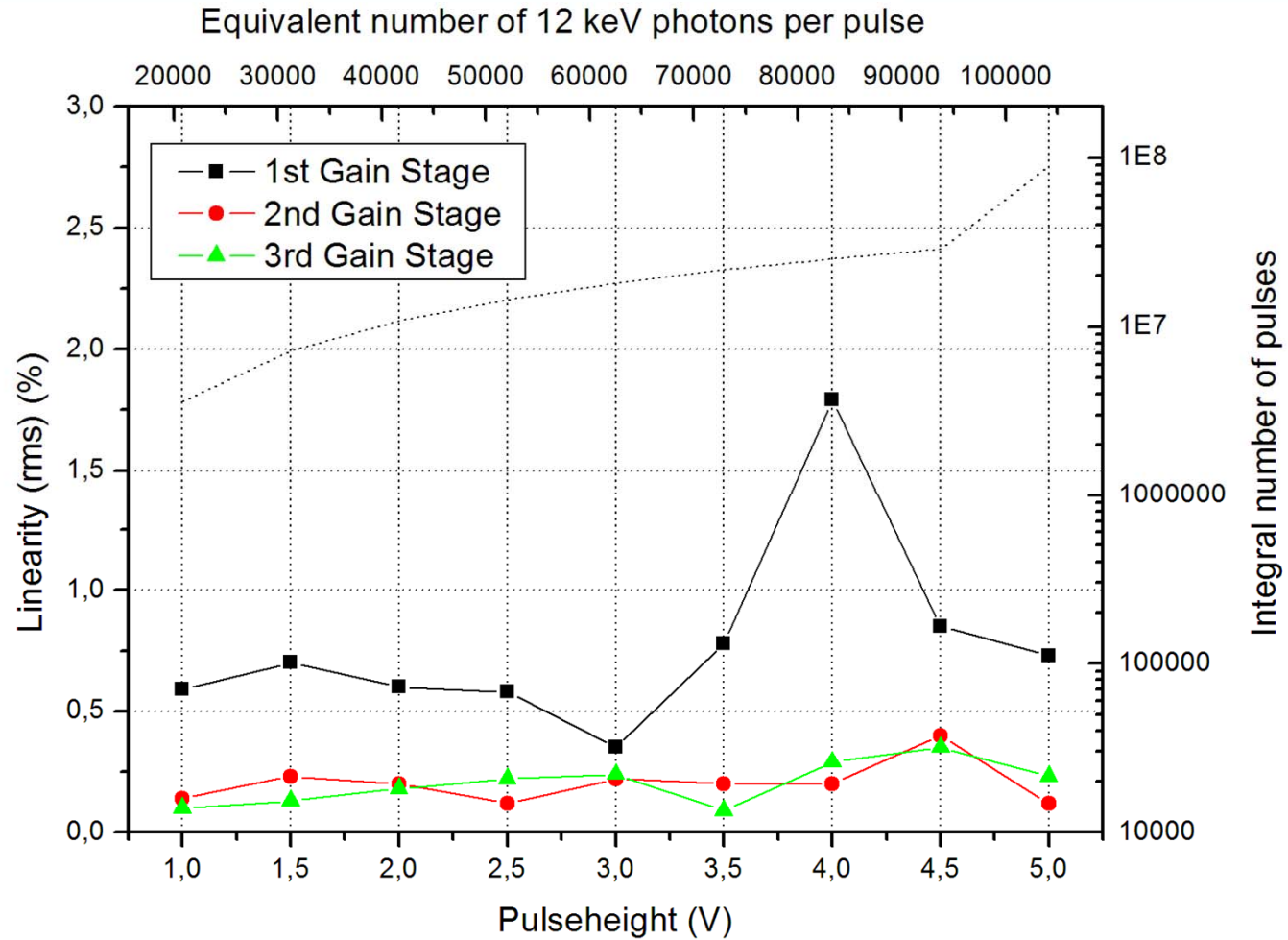
Medium gainstage:

0.16 % (rms)
0.5 x 12 keV γ (max)

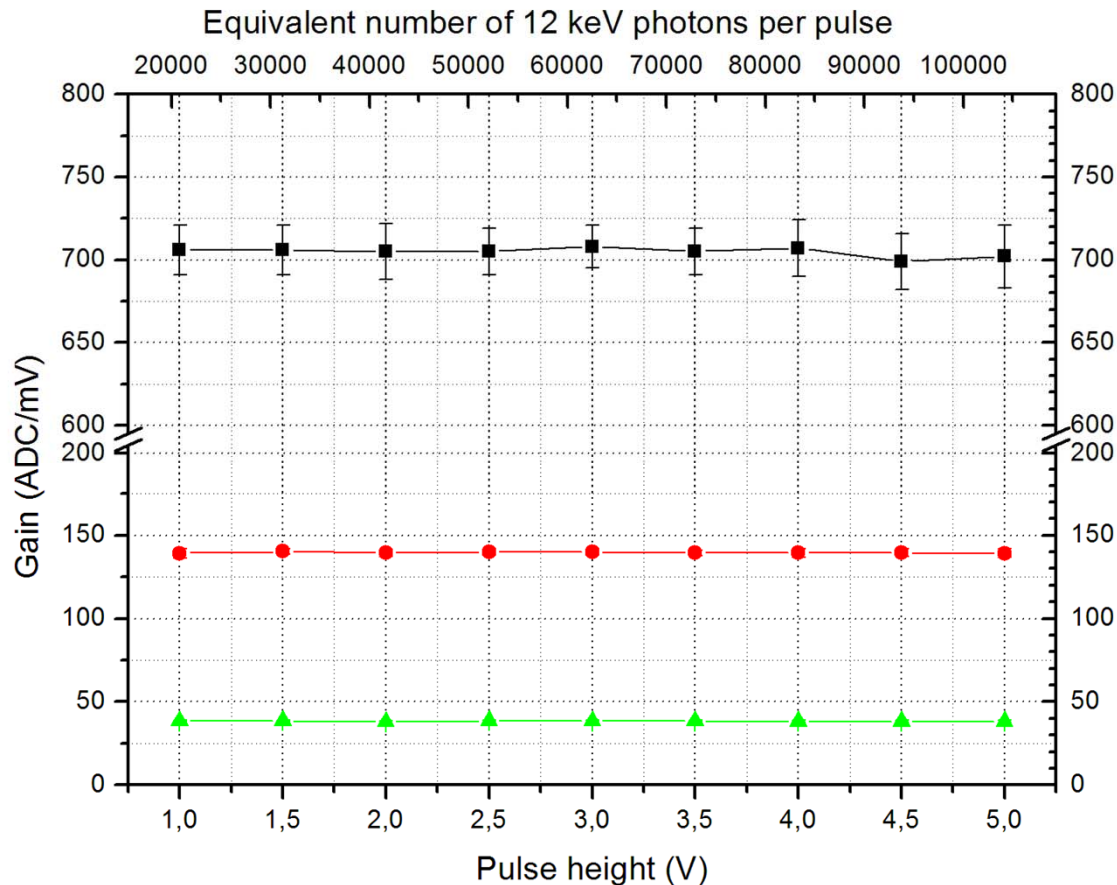
Low gainstage:

0.09 % (rms)
3.8 x 12 keV γ (max)

AGIPD01- Linearity of the gain (after stresstest)



AGIPD01- Linearity of the gain (after stresstest)

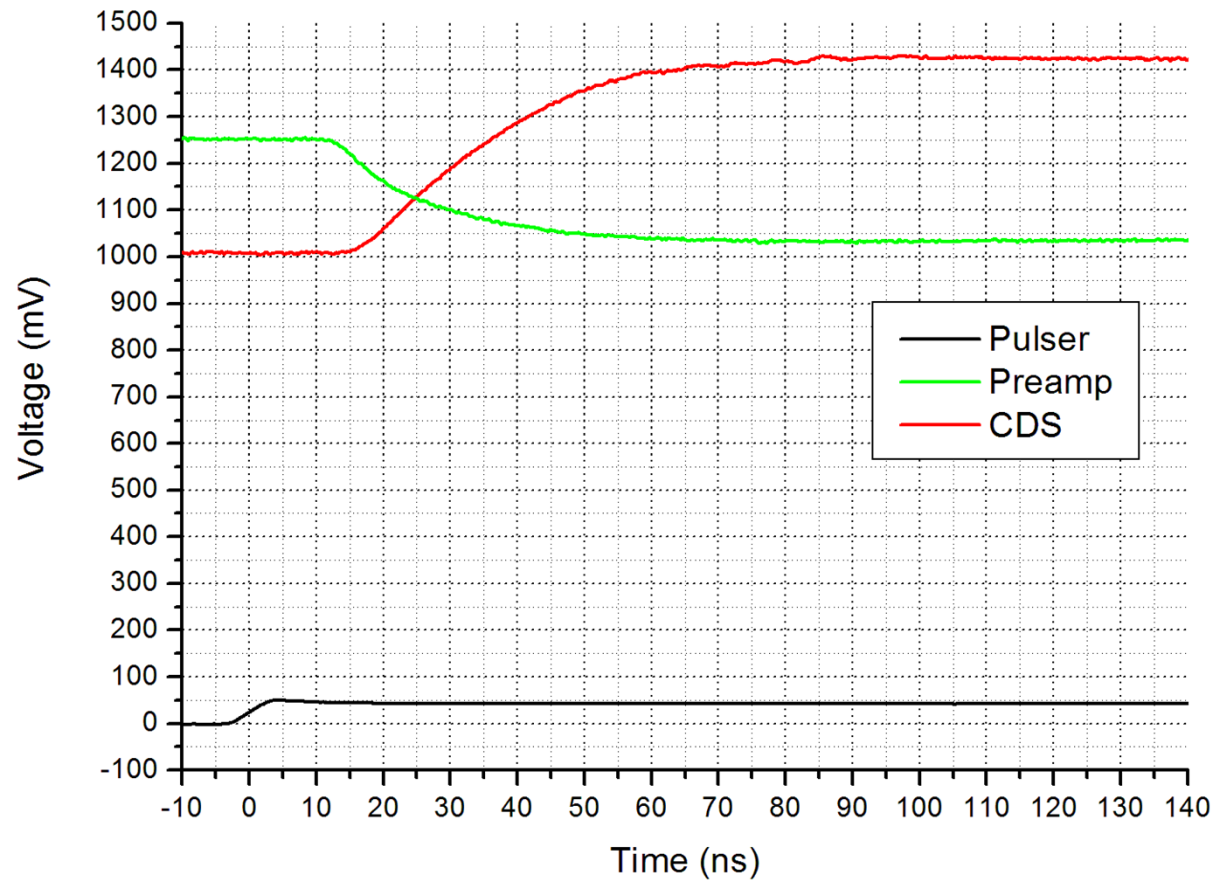


Are the pulses arriving fast enough?
How does the switching look like?

AGIPD01- Direct measurements (Preamp/CDS) High gainstage



Preamp/CDS direct - Pulseheight: 45 mV



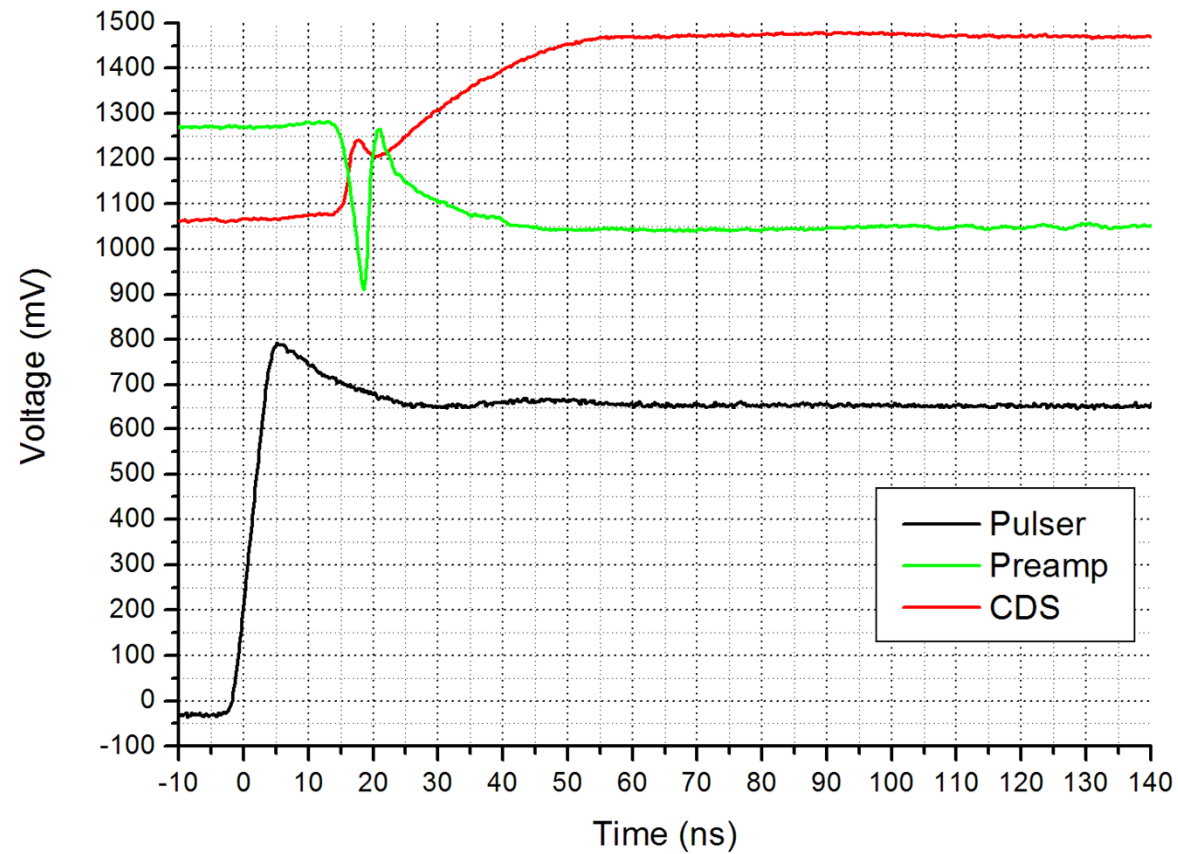
Resumee:

- Risetime of pulser is 5 ns
- Preamp and CDS are properly working within ~50 ns

AGIPD01- Direct measurements (Preamp/CDS) Medium gain stage



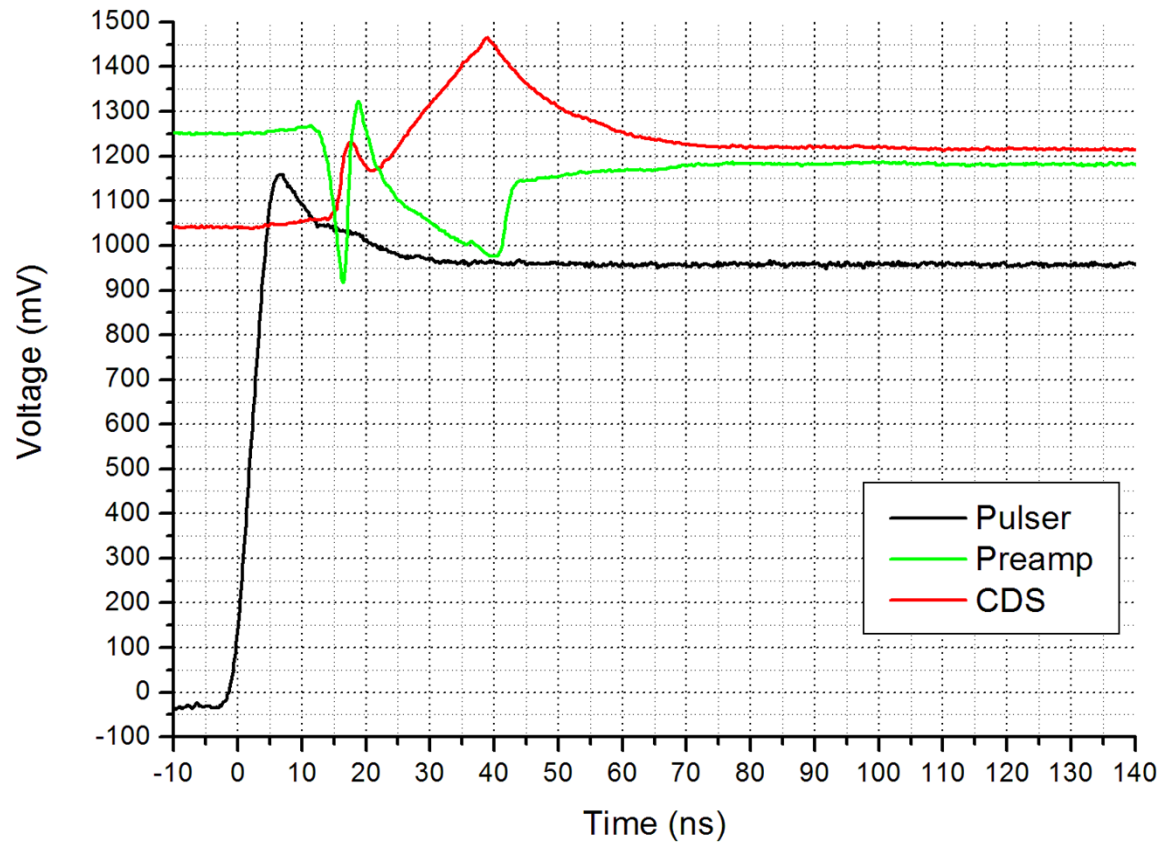
Preamp/CDS direct - Pulseheight: 700 mV



AGIPD01- Direct measurements (Preamp/CDS) Low gainstage



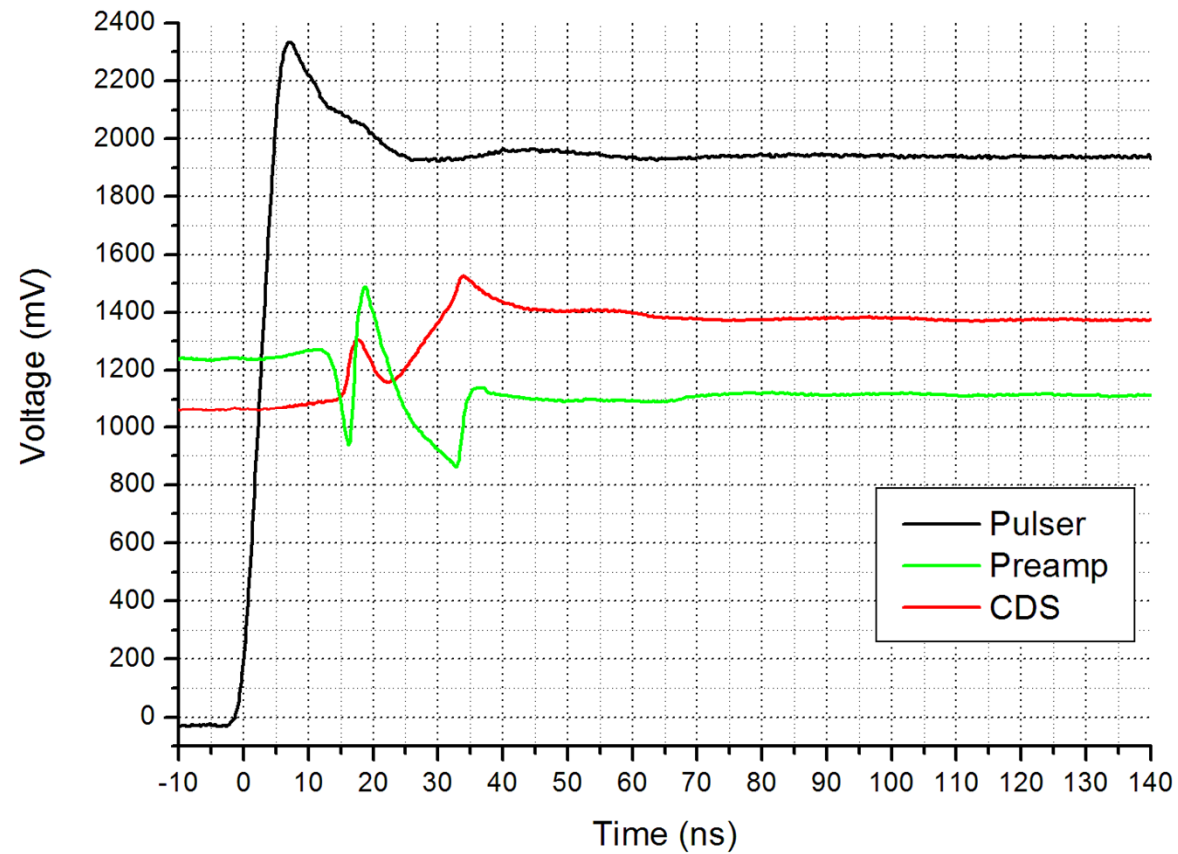
Preamp/CDS direct - Pulseheight: 1000 mV



AGIPD01- Direct measurements (Preamp/CDS) Low gain stage



Preamp/CDS direct - Pulseheight: 2000 mV

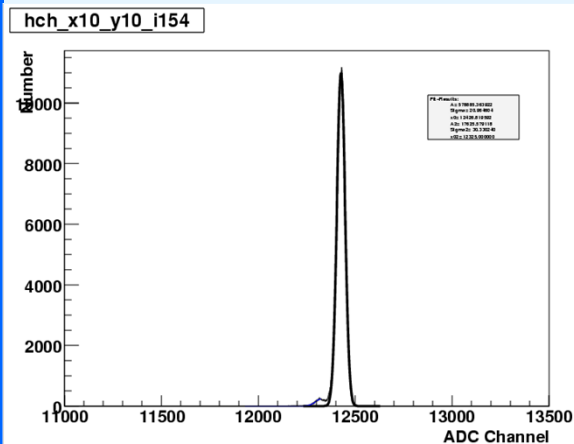


AGIPD02 - Energy calibration

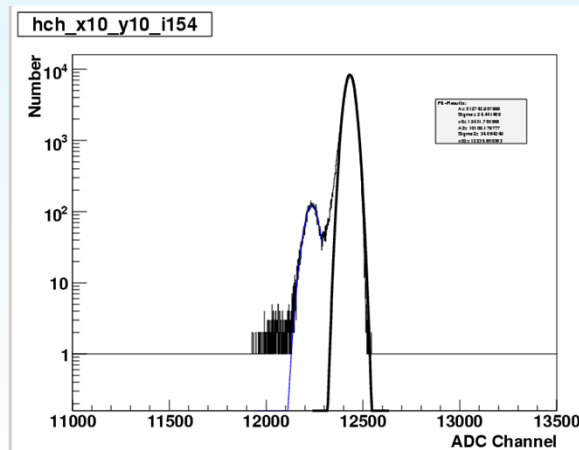


- Energy calibration done using X-ray fluorescence from Ge (10 keV), Mo (17.5 keV) and Sn (25 keV)
- Integration time: 1 μ s
- Sensor voltage: 120 V
- 600000 frames investigated per photon energy

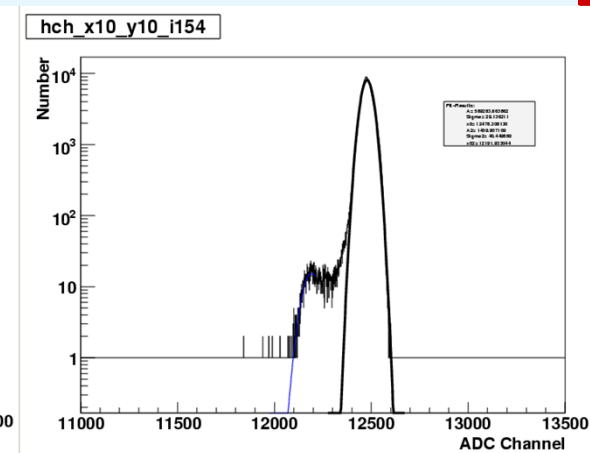
Ge (10 keV)



Mo (17.5 keV)

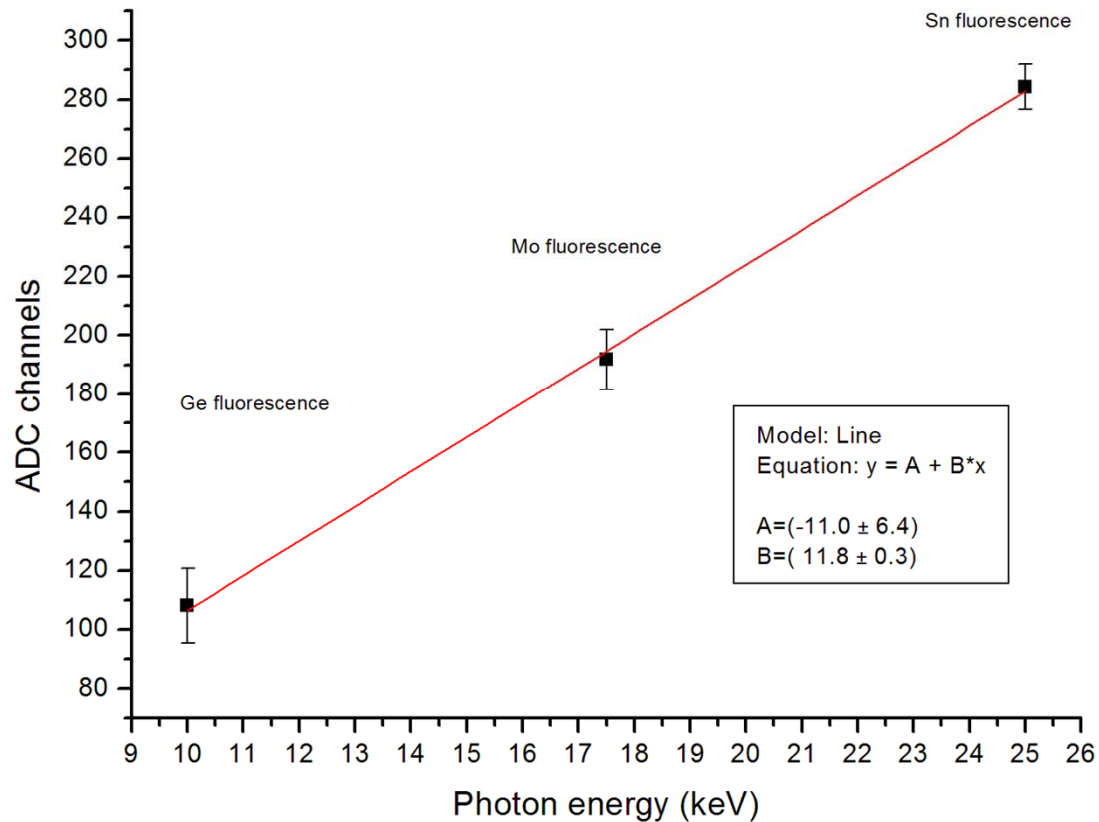


Sn (25 keV)



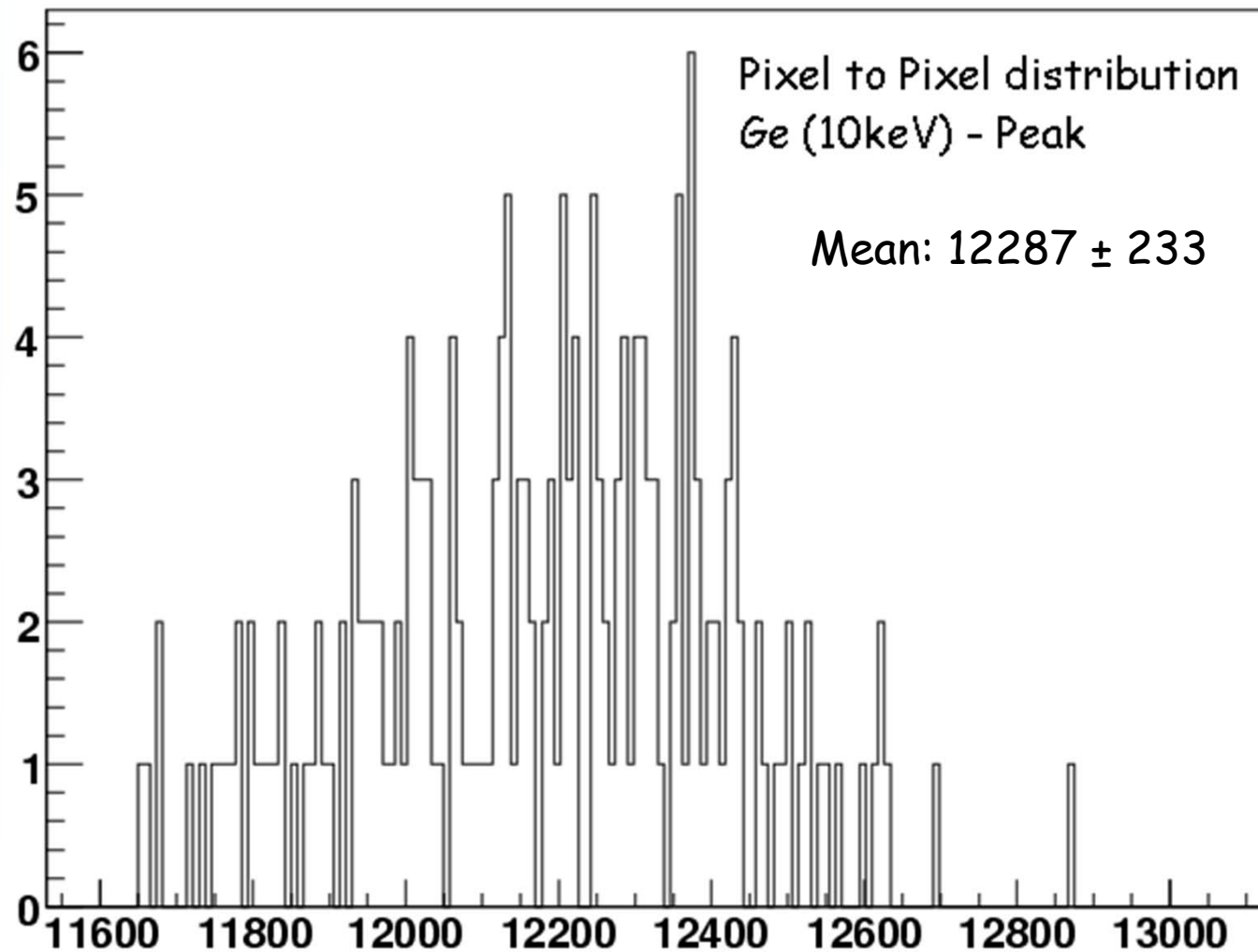
Nonlog scale to demonstrate
low number of fluorescence
photons!

AGIPD02 - Energy calibration / Noise

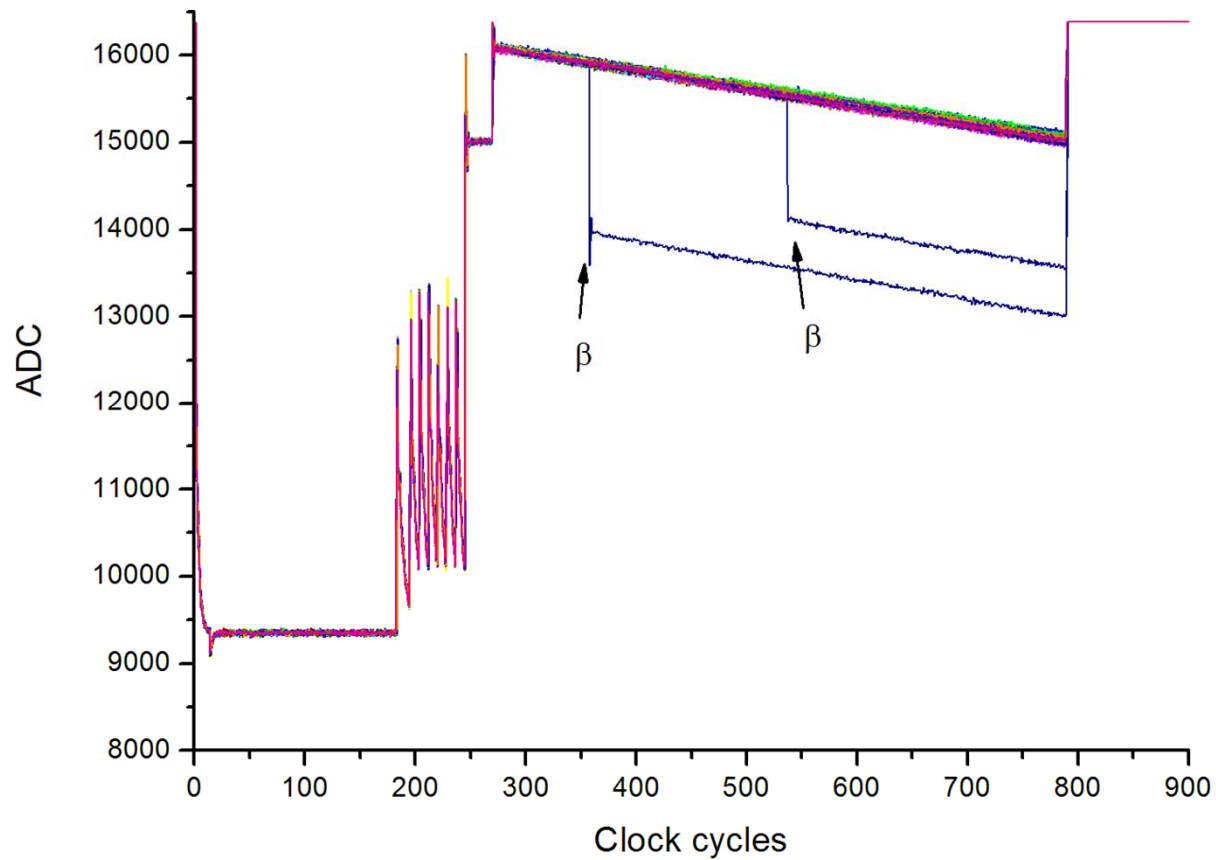


→ Noise measurements with an integration time of 100 ns reveal a value of (1.33 ± 0.03) keV, corresponding to an ENC of $(367 \pm 8) e^-$

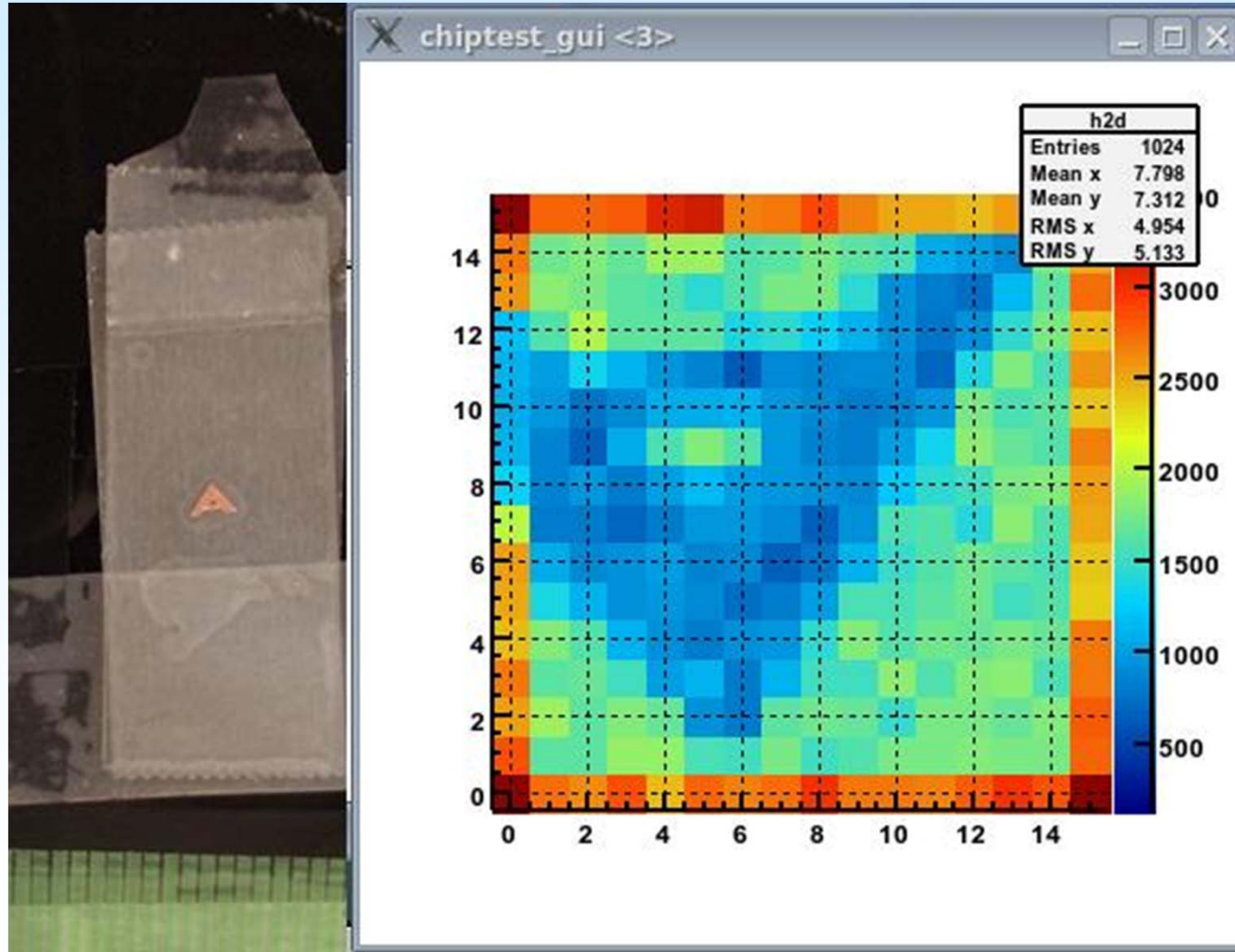
AGIPD02 - Energy calibration / Noise



AGIPD02 - Detection of β s from ^{90}Sr



AGIPD02 - Imaging: the „A“



Conclusions



- AGIPD01:

- Parasitic Capacitance of Preamplifier as predicted
- Excellent linearity of the gain
- No change in neither gain nor linearity after extensive pulsing of the input capacitance with the equivalent pulse heights of up to $7 \cdot 10^8 \times 1.1 \cdot 10^5$ 12 keV photons

- AGIPD02:

- ENC of $(367 \pm 8) e^-$ → Dedicated investigation of noise sources
- Possibility of single photon resolution demonstrated
- Imaging!



Thank you!