# A Monolithic Pixel Sensor Prototype for the ATLAS Experiment in AMS 180 nm HV-CMOS Technology

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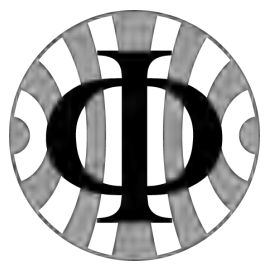
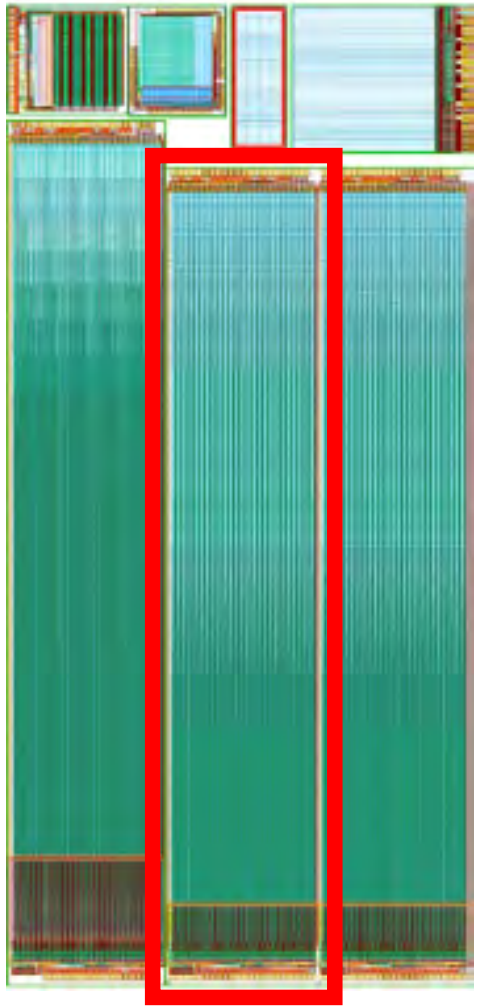


# Focus of this talk:
# Characterization of ATLASPix simple

- Monolithic
- Column drain readout
- On-chip clock generation
- Serial output of up to 1.6 Gbits/s
- 80 Ωcm & 200 Ωcm substrate



Pixel matrix:

- 25 x 400 pixel
- 130 x 40 $\mu m^2$

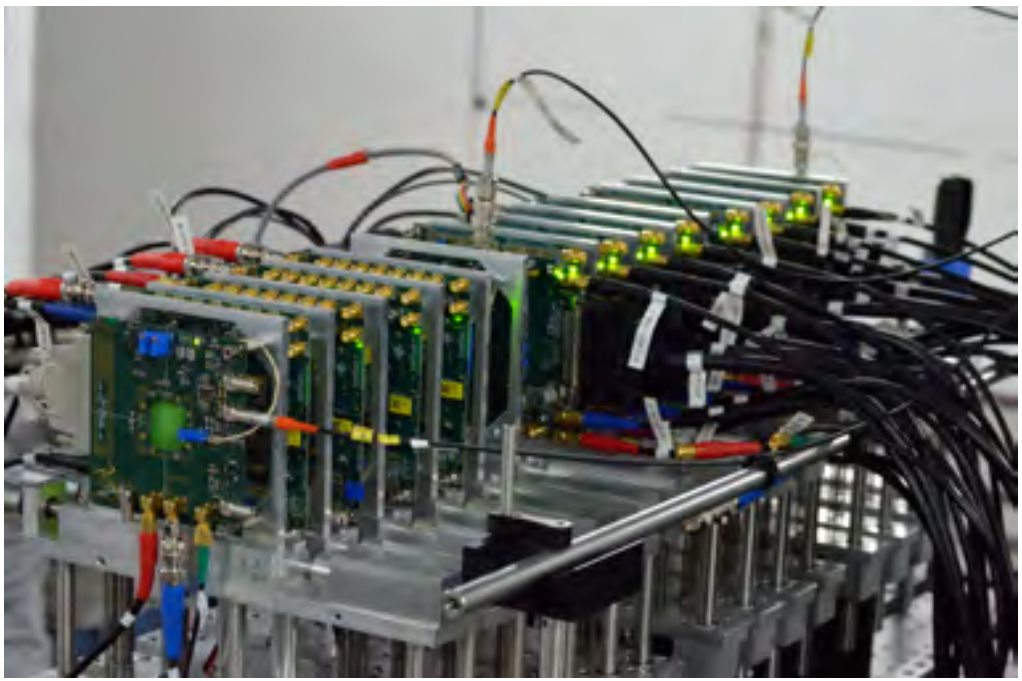
$\rightarrow$ 3.25 x 16 $mm^2$ active area

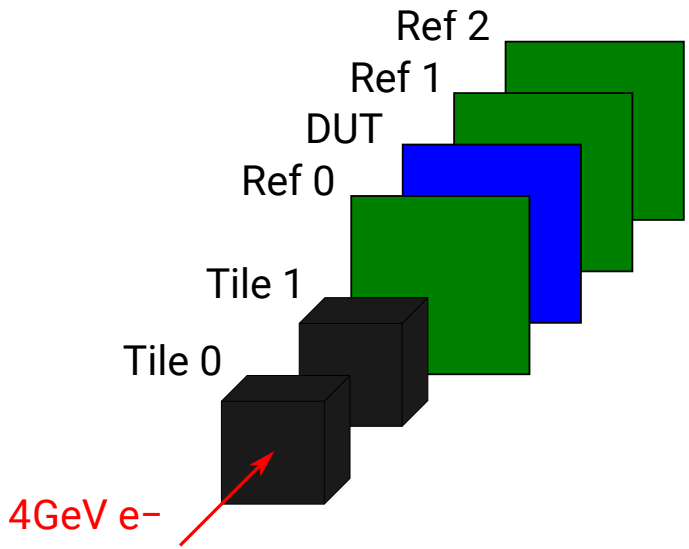
- Amplifier and comparator in pixel
- 3 tune bits

Current samples had production issues

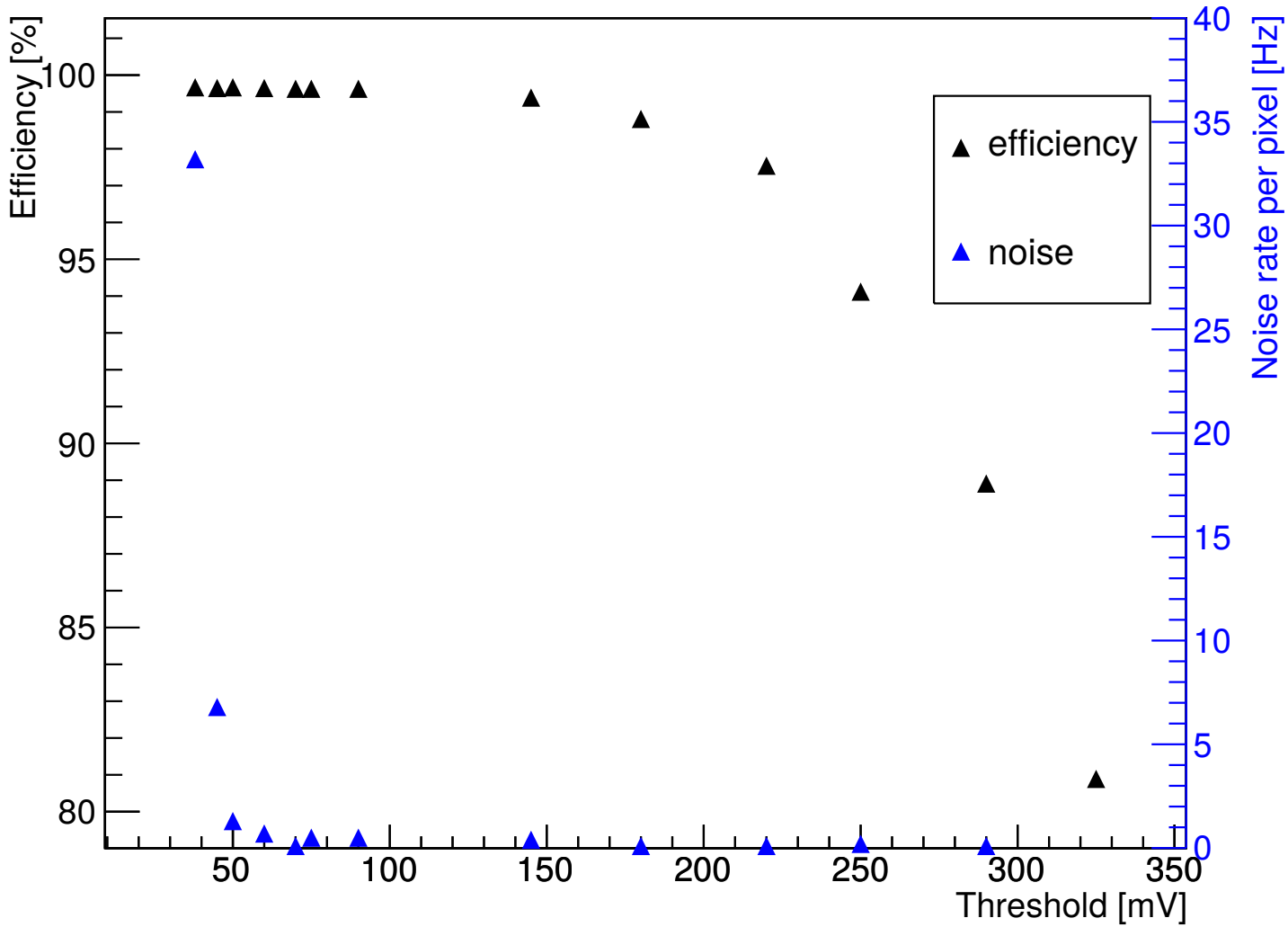
# Setup at DESY

- 3 MuPix8 reference layers for tracking
- Coincidence of 2 scintillating tiles for timing measurement



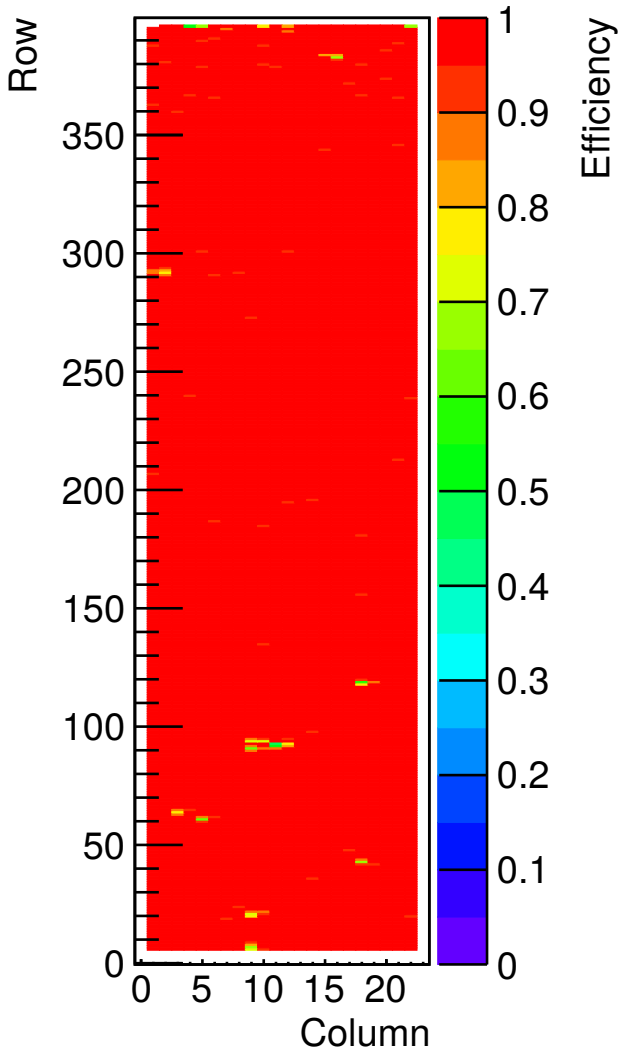


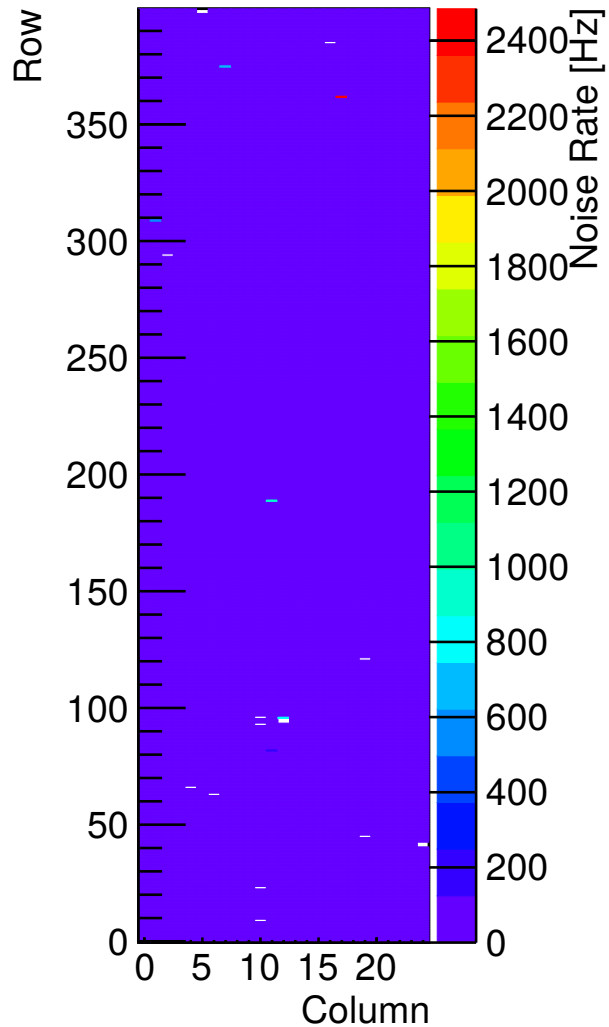
# Efficiency vs threshold



# Efficiency and noise maps

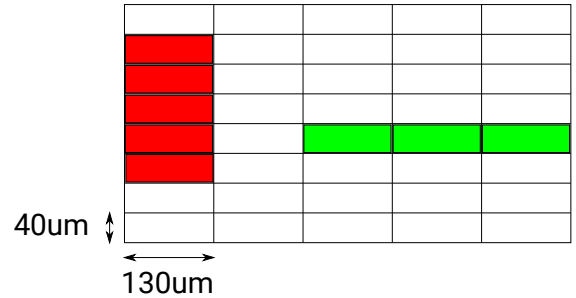
- Threshold = 60 mV, HV = -60 V
- Efficiencv = 99.6 %

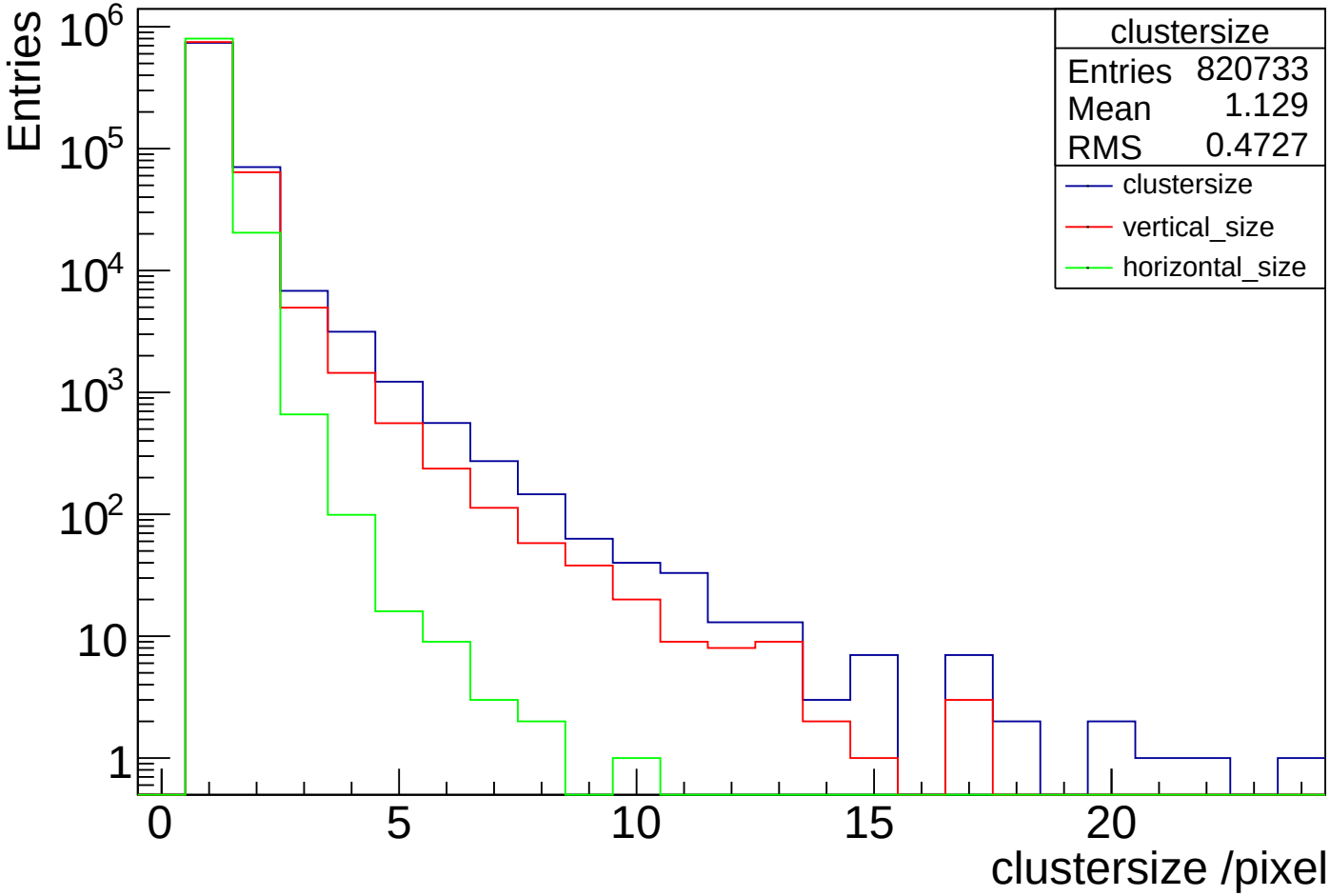


# Hit multiplicities

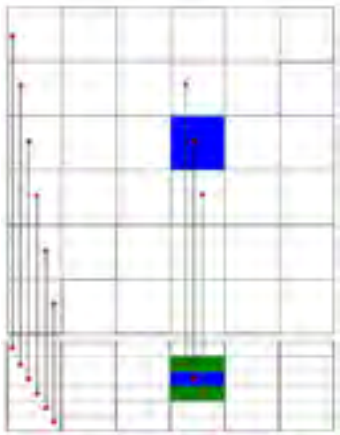
- $\frac{\#\text{double}}{\#\text{single}} \approx 0.1$
- $\frac{\#\text{double\_vertical}}{\#\text{double\_horizontal}} \approx \frac{\text{pix\_height}}{\text{pix\_length}}$



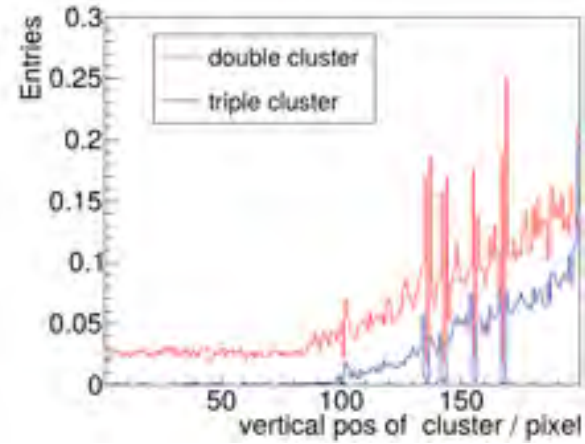
# Corsstalk

- Line from each pixel to periphery
- Potential line crosstalk

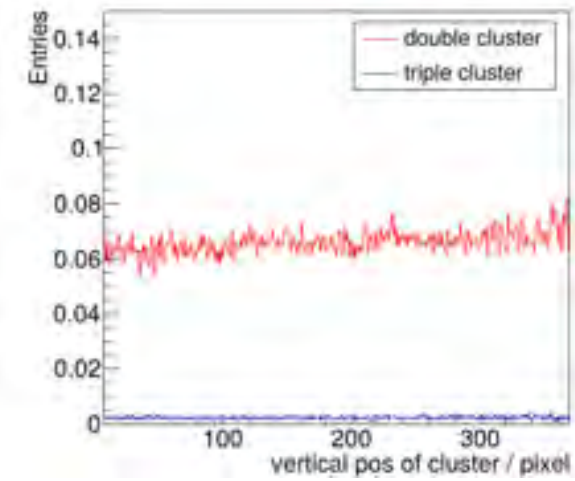


- No indication of crosstalk of in-pixel electronics yet

MuPix8 -
Comperator in periphery

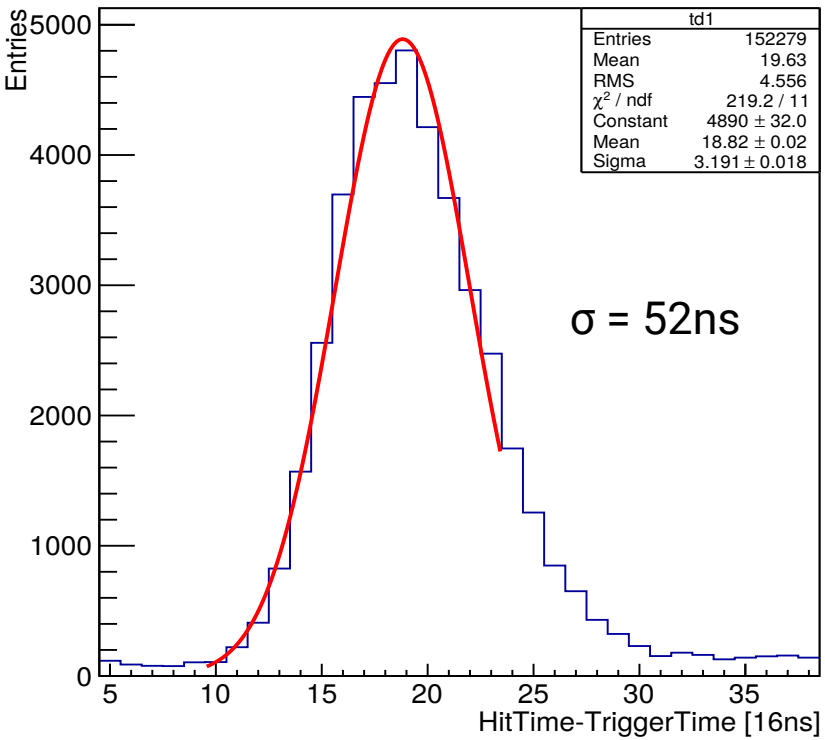



ATLASPix-
Comperator in pixel

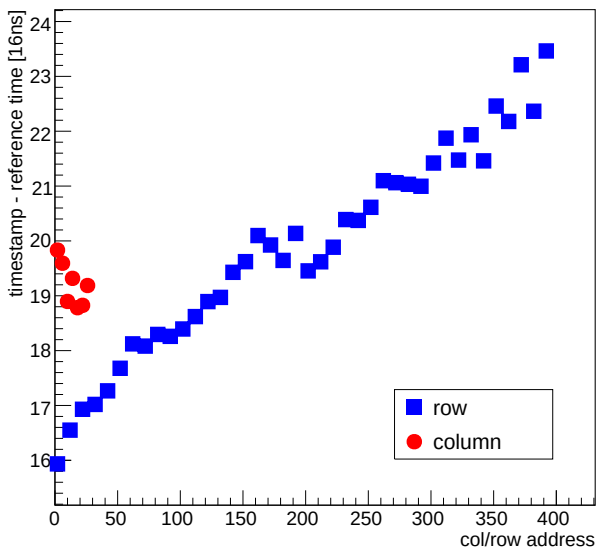


# Time resolution

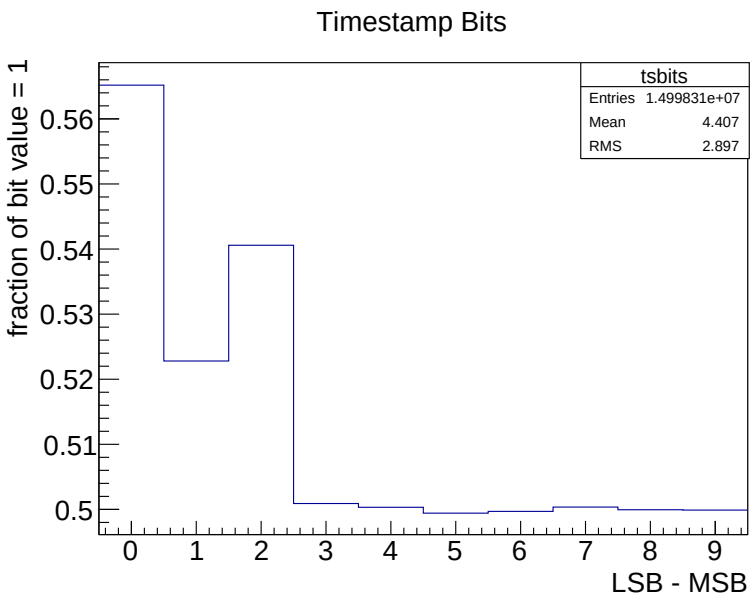
## First shot

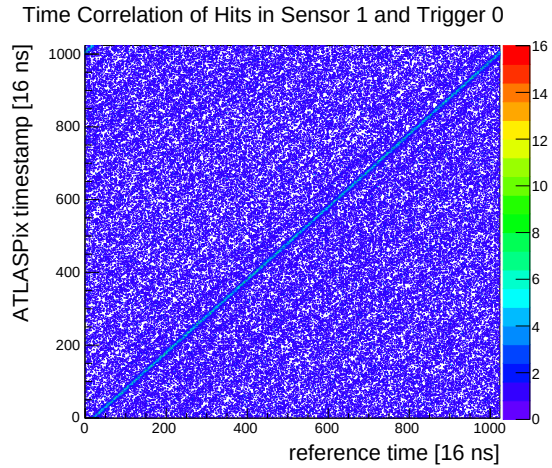



- Worse than expected from simulation and previous sensors
- Increasing delays over row and column

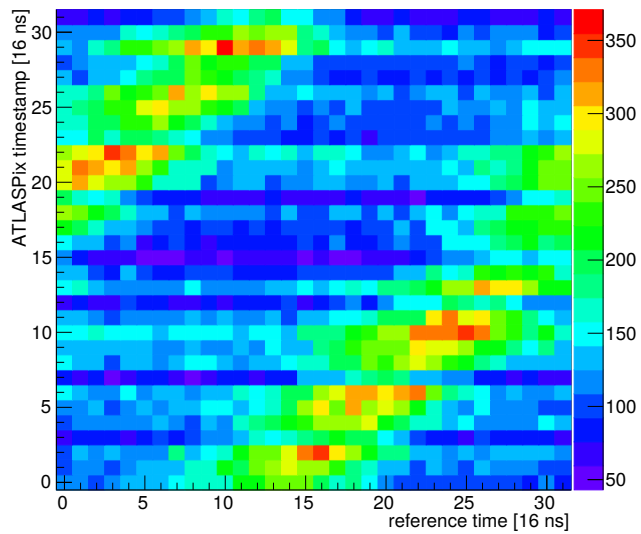


# 'Sticky' timestamp bits



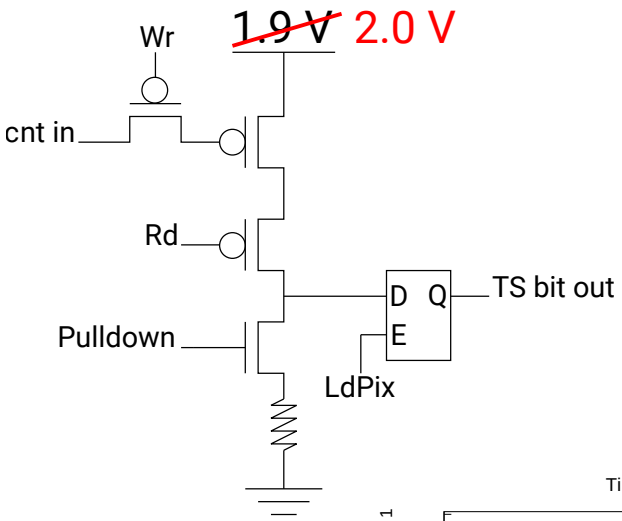



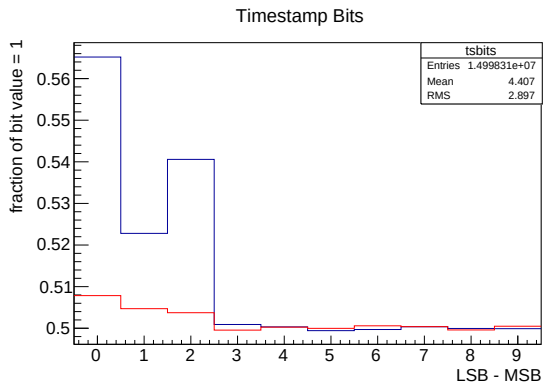

Projected to 5 LSBs

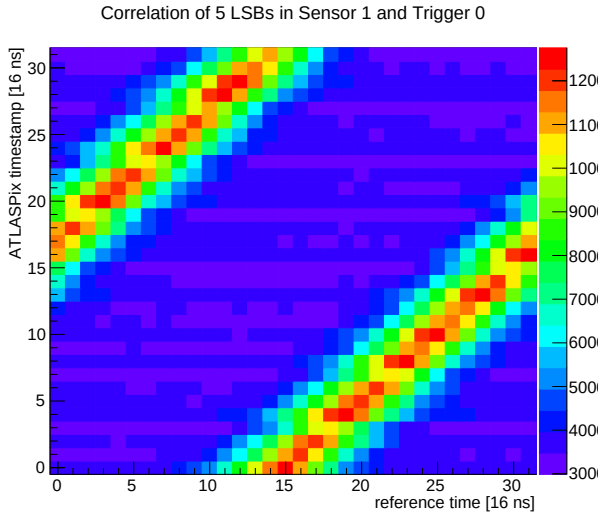



- 3 LSBs on too often
- Timestamp distribution not flat

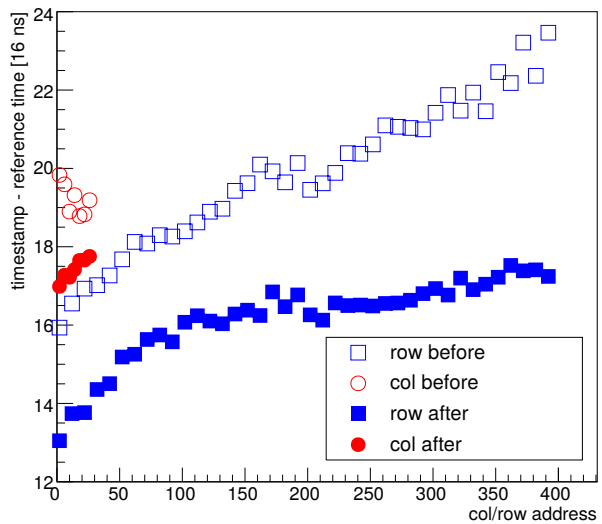
# Improved time resolution



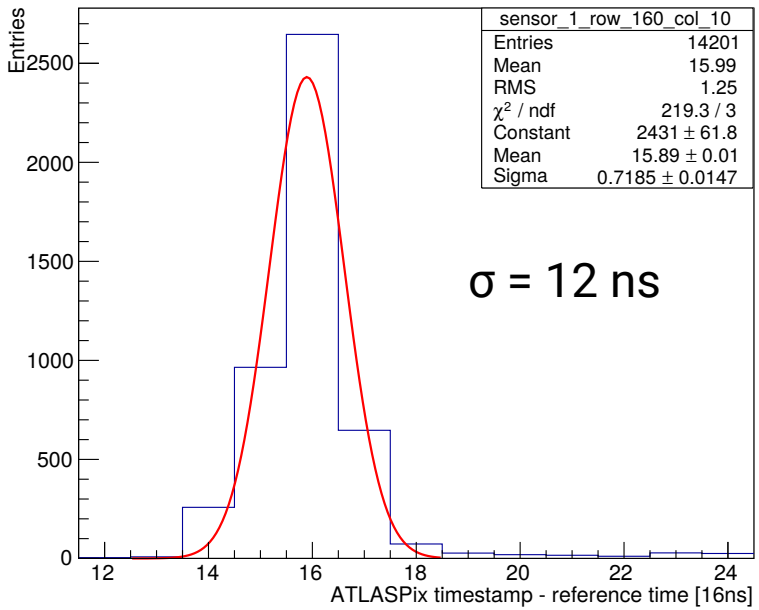




## Delay over col/row




- $\sigma$ impoved from 52 to 40 ns
- Still increasing delay over row

# Single pixel time resolution




- Roughly the same for all pixels
- Different DAC settings give $\sigma = 10\,\text{ns}$

Summary:

- Pixel-by-pixel corrections would increase time resolution significantly
- Potentially still room for DAC optimization
- Sticky bit problem not fully solved
- New production might also bring improvement




Thank you for
your attention!