Calibration Structures Status

AGIPD meeting Sept. 2012

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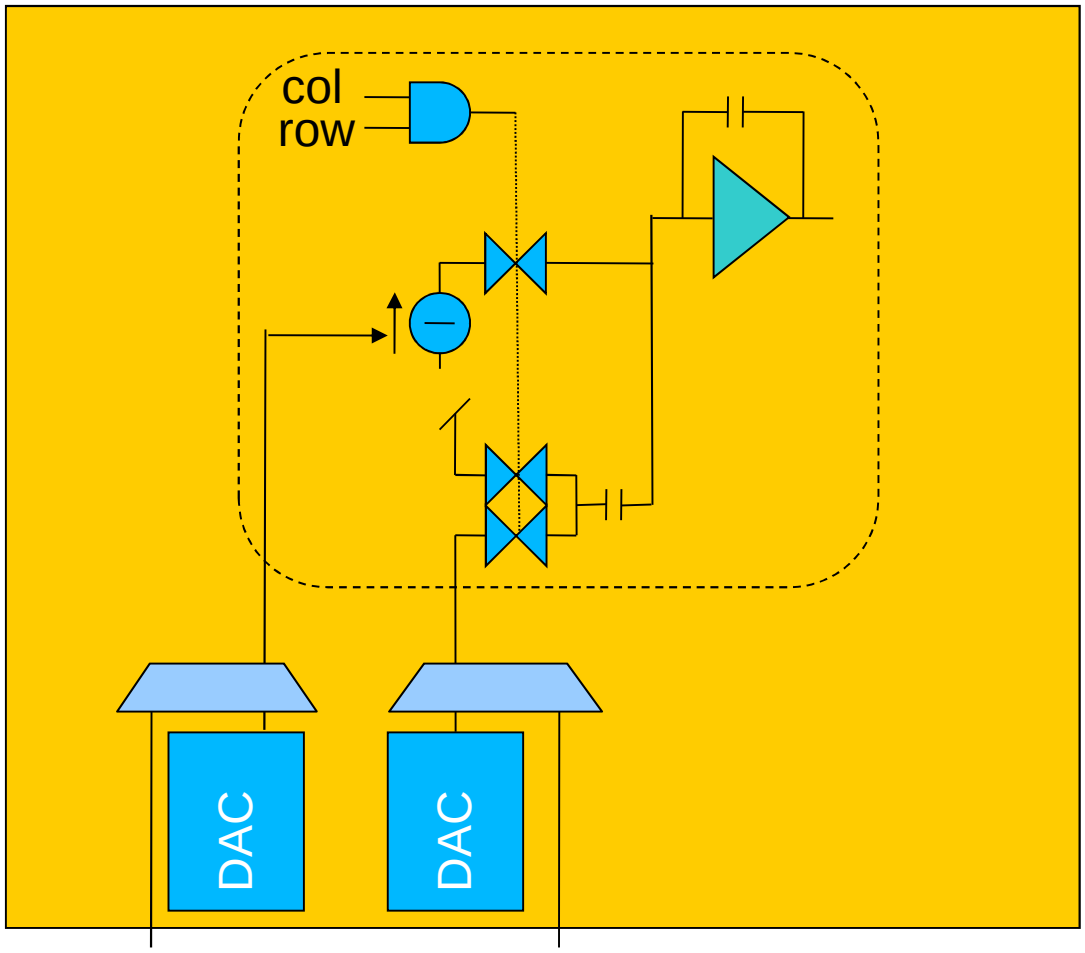
Calibration structures

AGIPD ASIC Review 18/19.1.2012 – Reviewer Comments

“Add several injection schemes in the pixel, with enable signals: [...] injection capacitor, local current source, global bus to access all pixels externally. [...] The injection voltage step could be external, to start with,
or chopped inside of the pixel with a static external voltage. This will allow studying performance and performing cross calibration.”

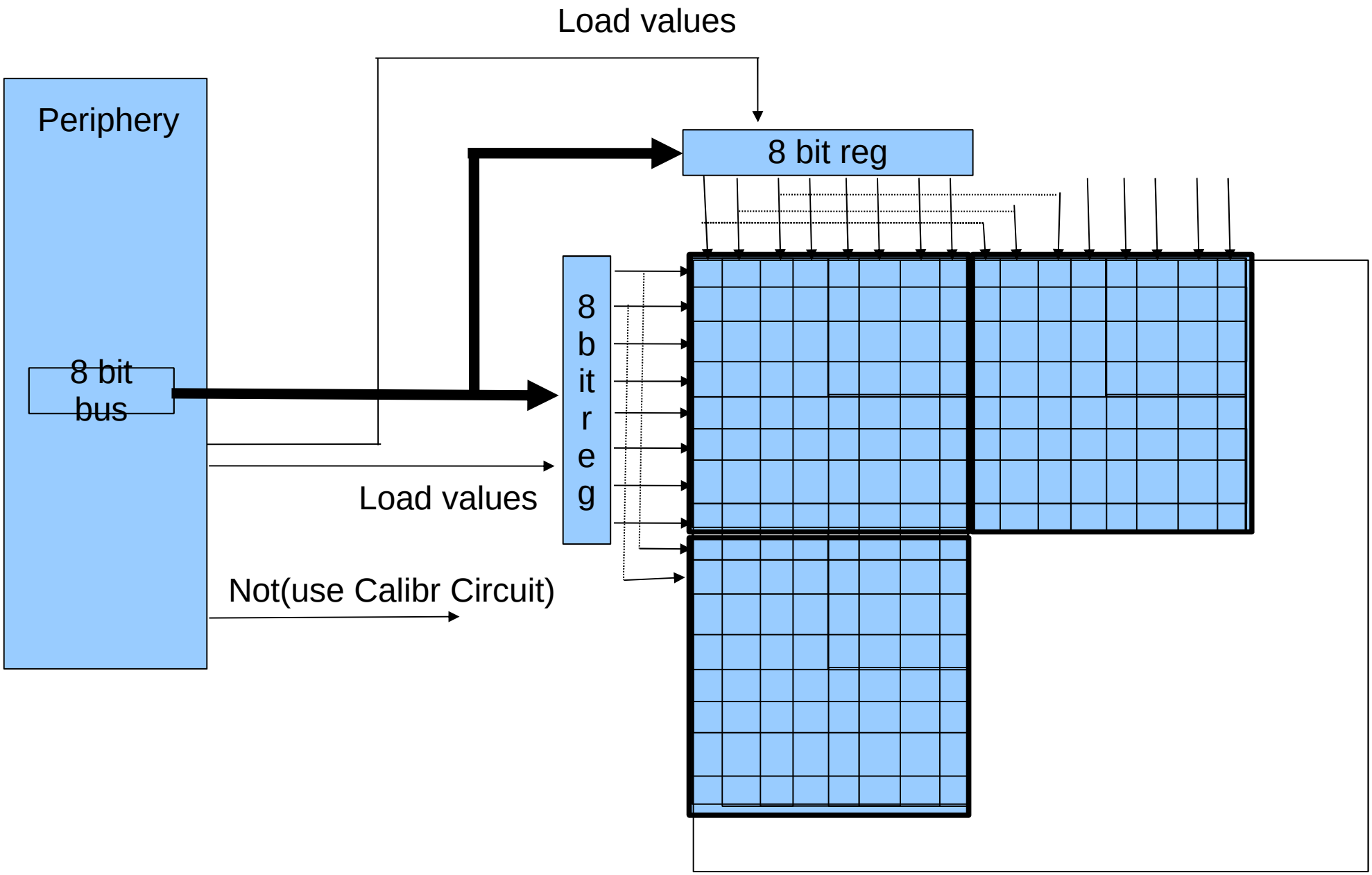


Pulsed Capacitor
target: 1-200 photons
High-Med Gain ranges

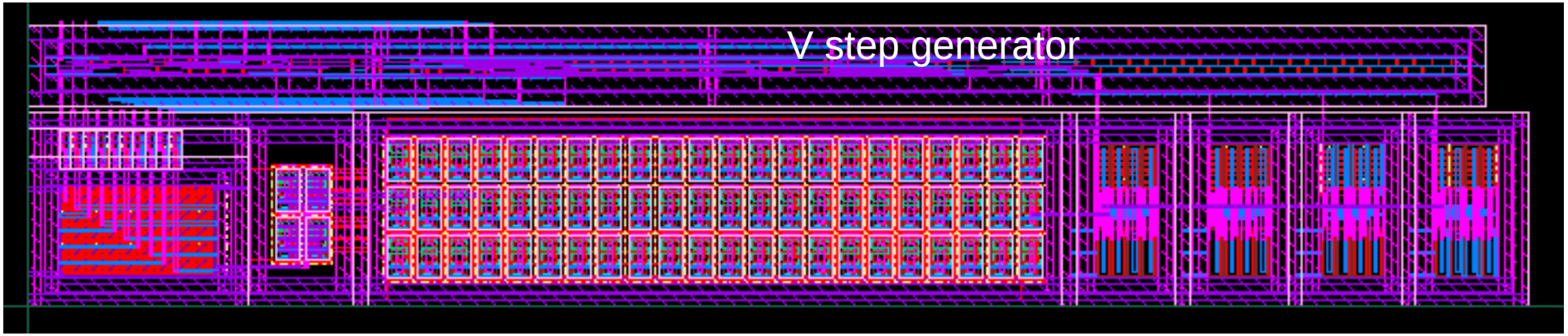
Internal Current Source
target: 180-10000 photons
Med-Low Gain ranges

possible to enable 1/64 upto all pixels

Calibration Circuit: pixel selection



Pulsed Capacitor



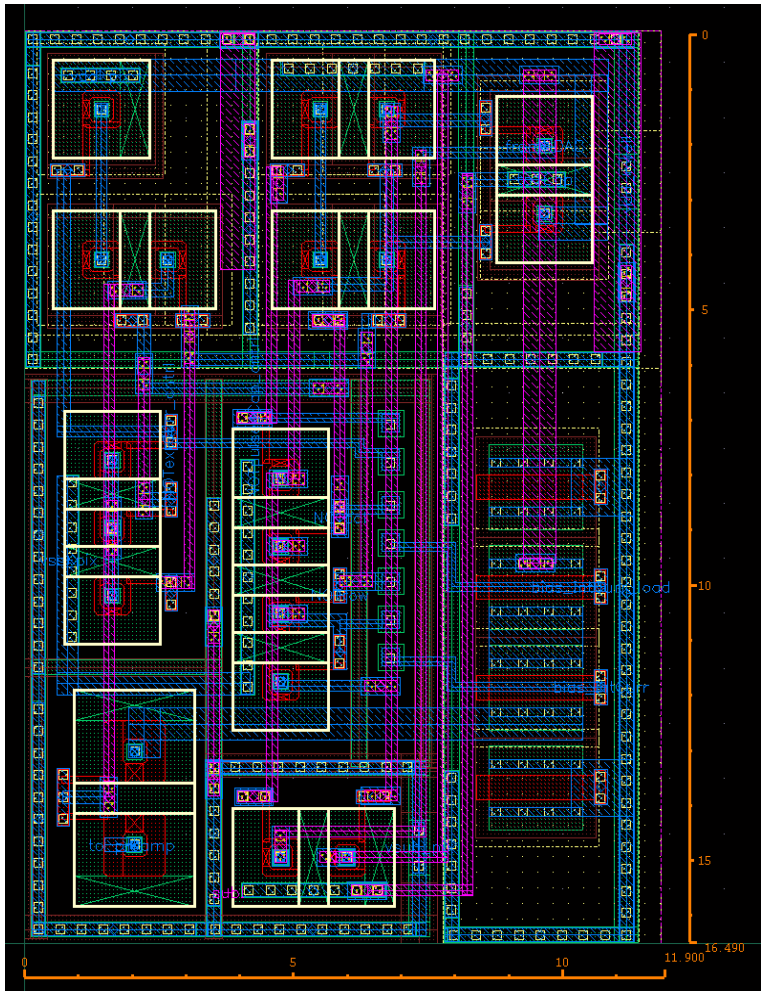
10 bits (1024 levels)
simulated minimum step 0.3 photons

simulated able to charge in ~ 150ns
¼ of pixels + metal parasitic capacitance
=> 4 per chip

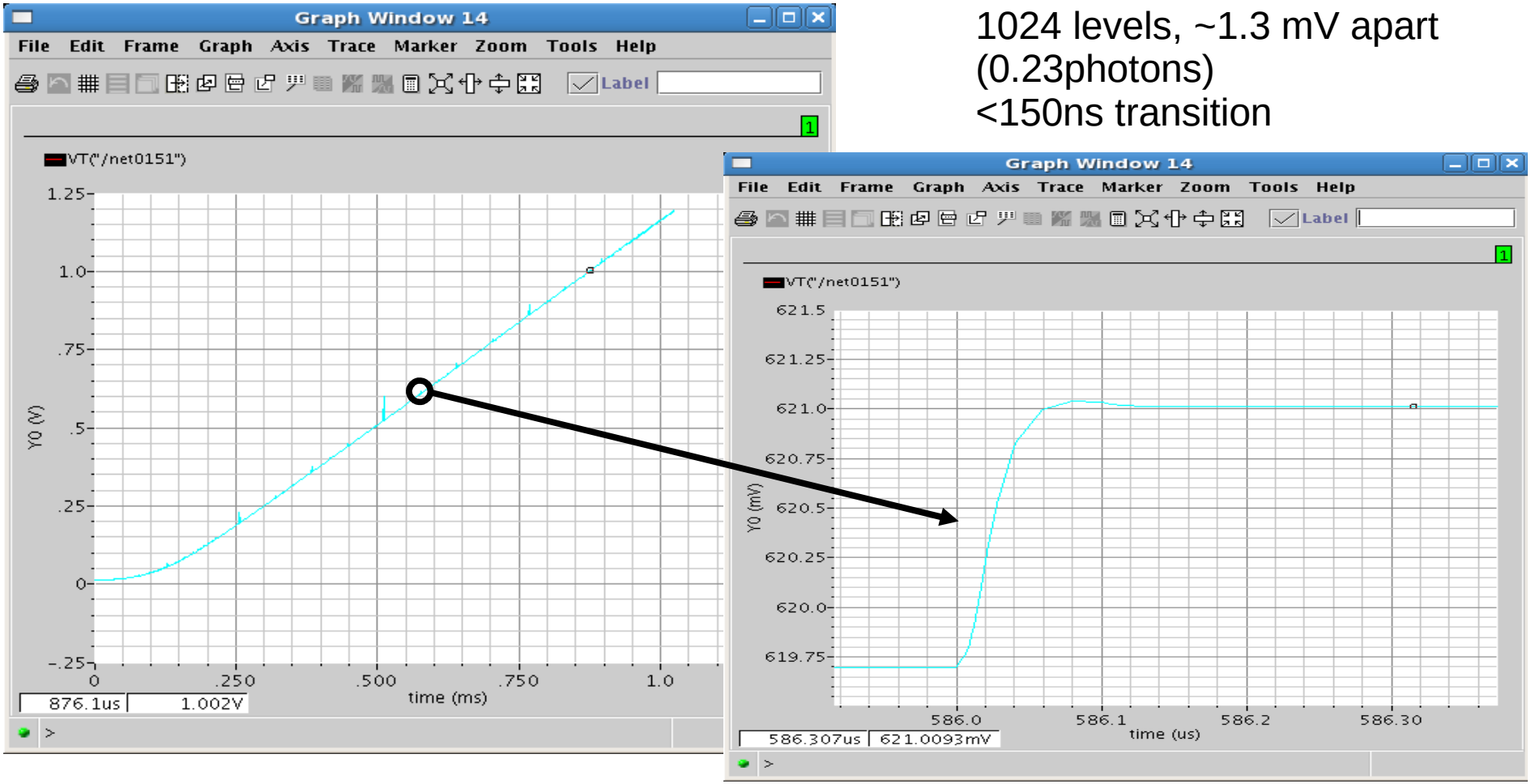
Analog

Digital

check



Pulsed Capacitor

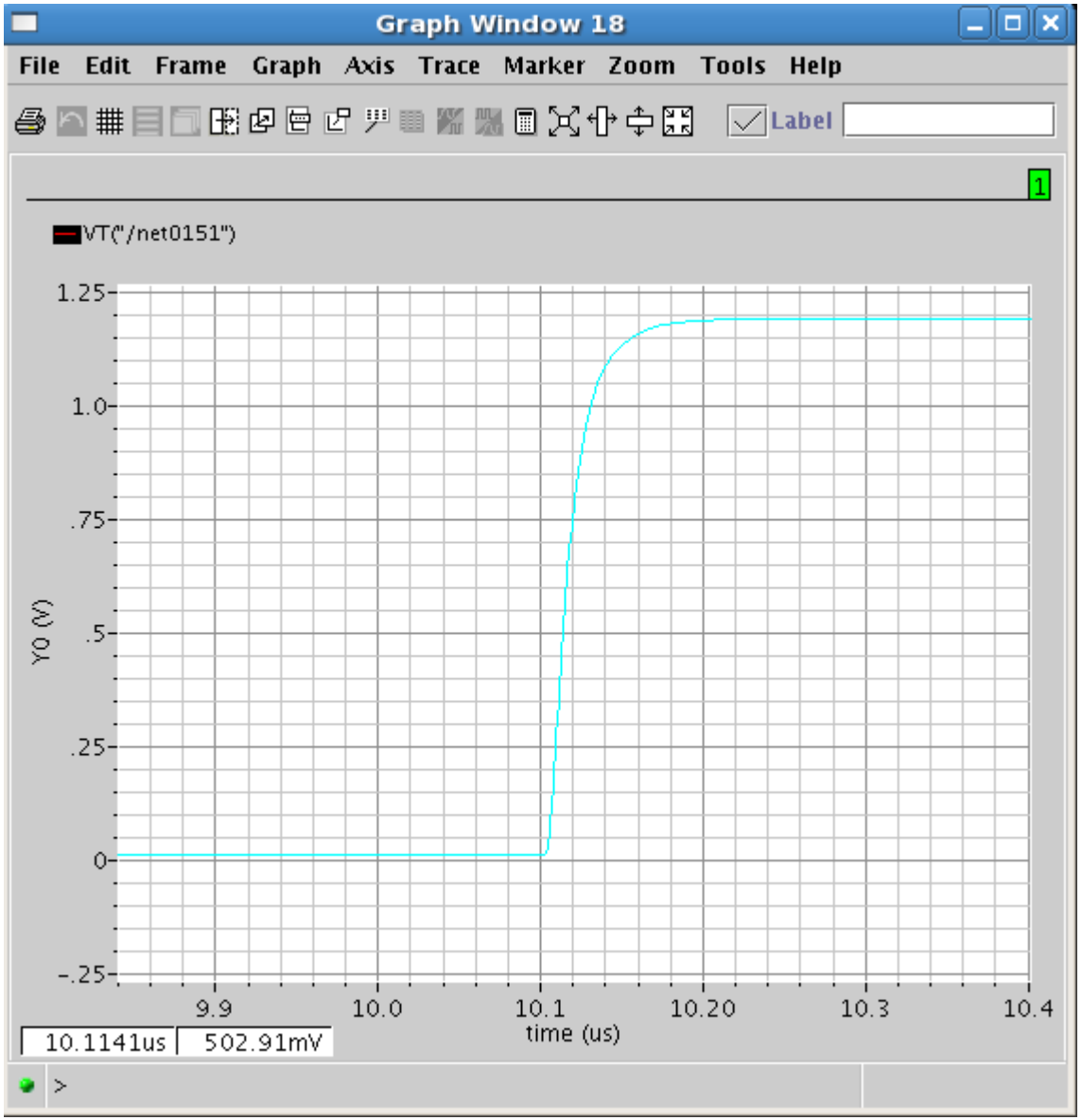


1024 levels, ~1.3 mV apart
(0.23photons)
<150ns transition

est. parasitic C metal design manual IBM pg 424: Cmetal ~ 0.26fF/um
0.26fF/um * 64[pixel] * 200[um] * (64[hor lines]+64[vert lines]) ~ 0.5nF
+ in-chip switches
+ 100fF (per pixel)

¼ of them

Pulsed Capacitor



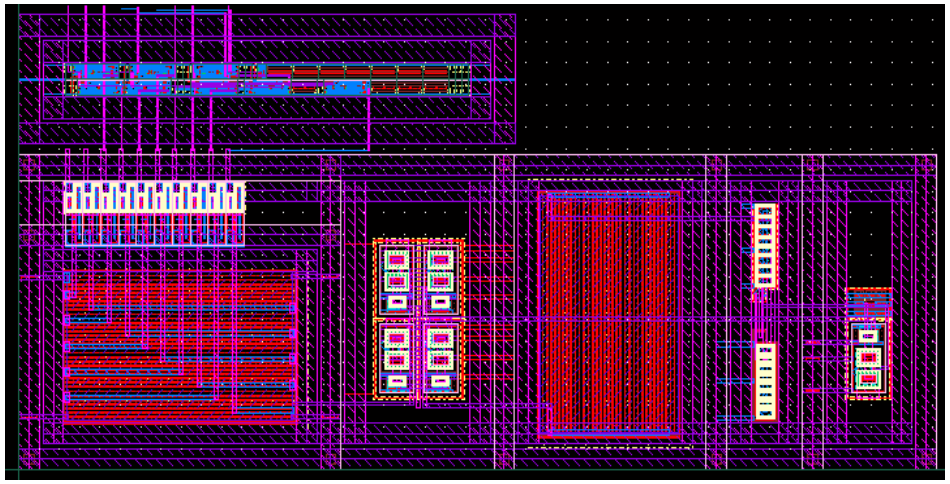
min-max step: 1.18V (215 photons)

<150ns transient

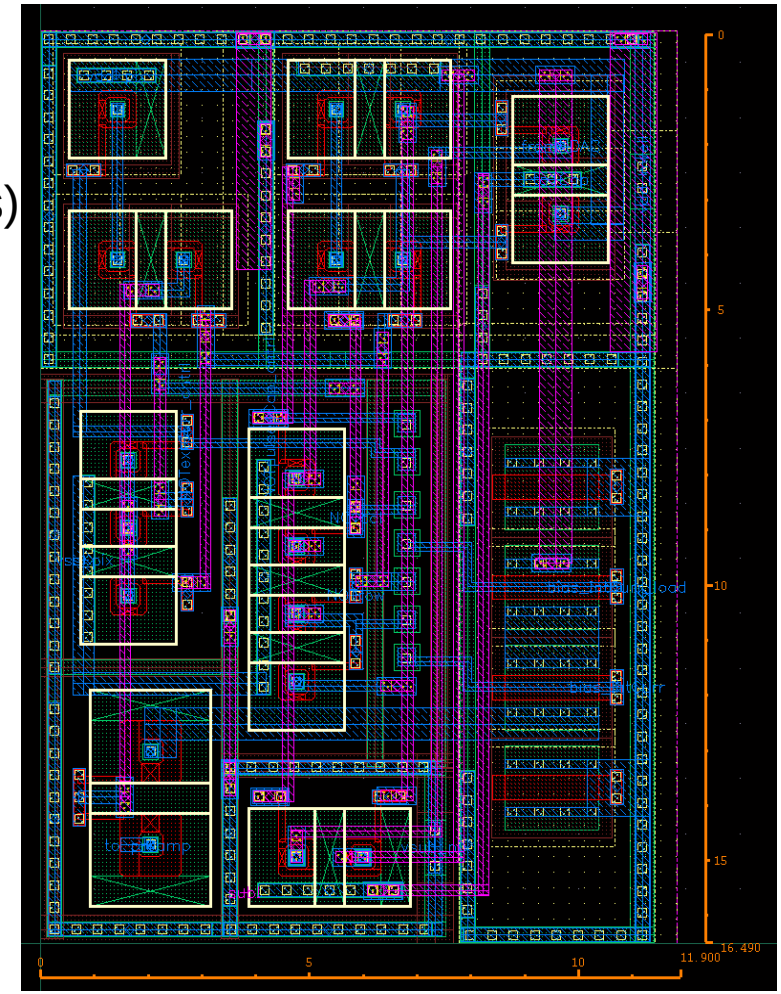
also possible:

- Vss=>Vdd step (272 photons)
- Voltage step from external pad

Internal Current Source



target current ~1uA
1uA was chosen to be able to explore the range 10^2-10^4 photons:
integrated for 100ns => 182 photons
integrated for 10us => 18200 photons)



- 8 bits (256 levels)
  simulated minimum step 18.5nA (3.4 photons in 100ns)

- simulated able to charge
  equivalent of ~180 ph in 100ns
  equivalent of ~18000 ph in 10us

Analog 

Digital 

check 

Internal Current Source: how it behaves

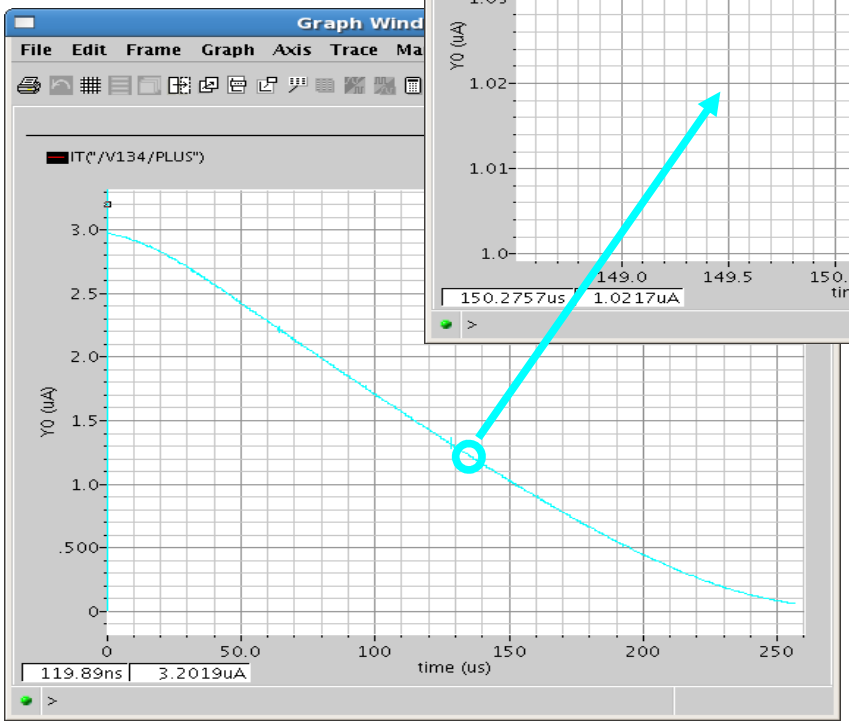
range ~40nA - ~2.5uA

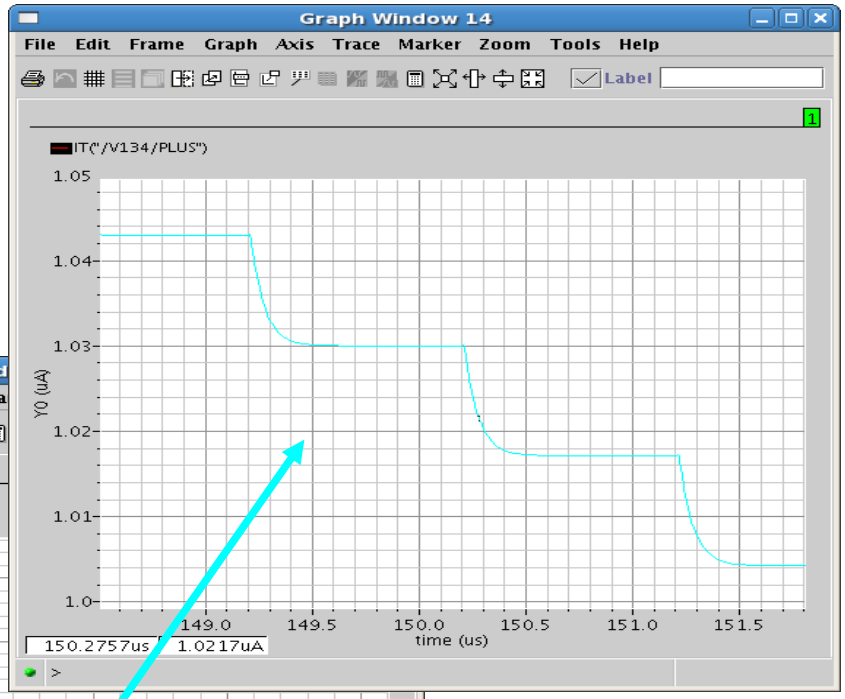
minimum step ~17nA (~3 photons in 100ns)

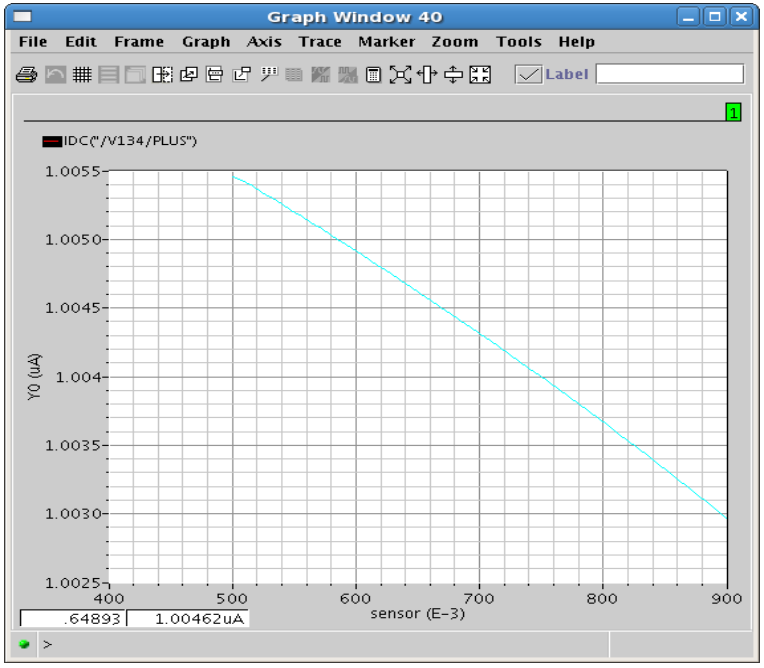
> 68 Mohm Zout
(ΔI <0.3% with sensor V varying 0.5-0.7-0.9V)

Leakage current ~1pA

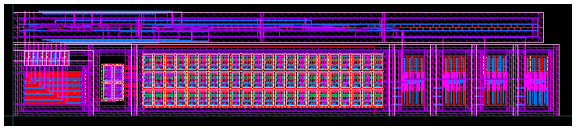
(< 1e in 100ns)

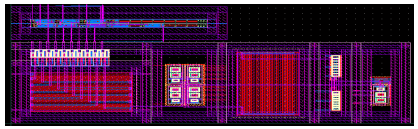




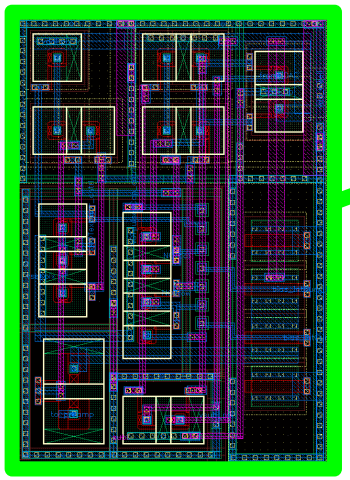


Where to put them

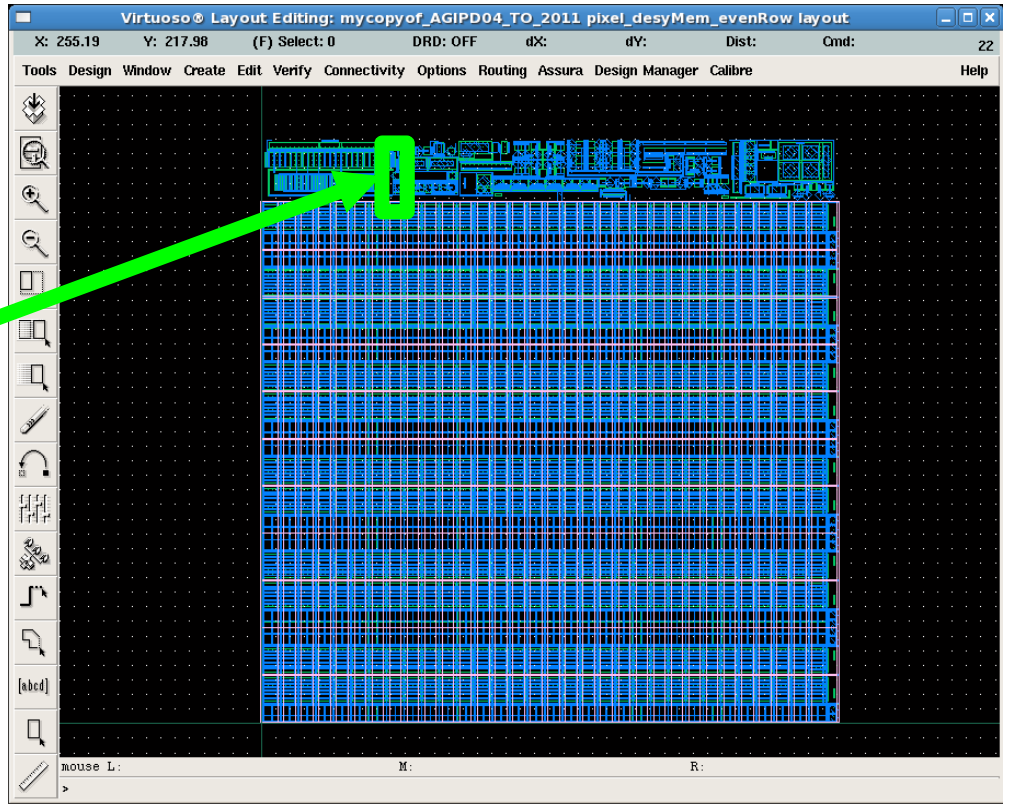


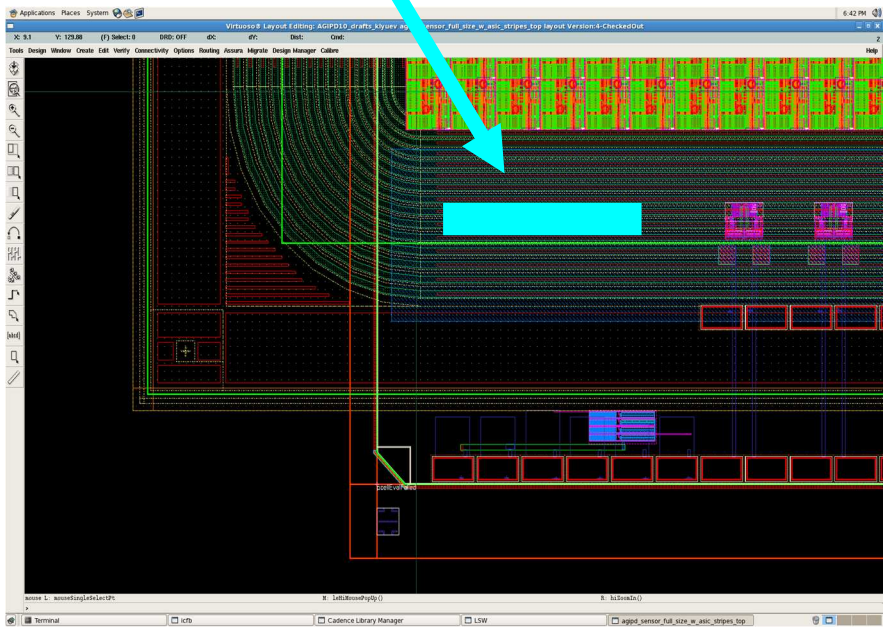


Biasing circuits



In-pixel switches





Pulsed C