In pixel test beam studies

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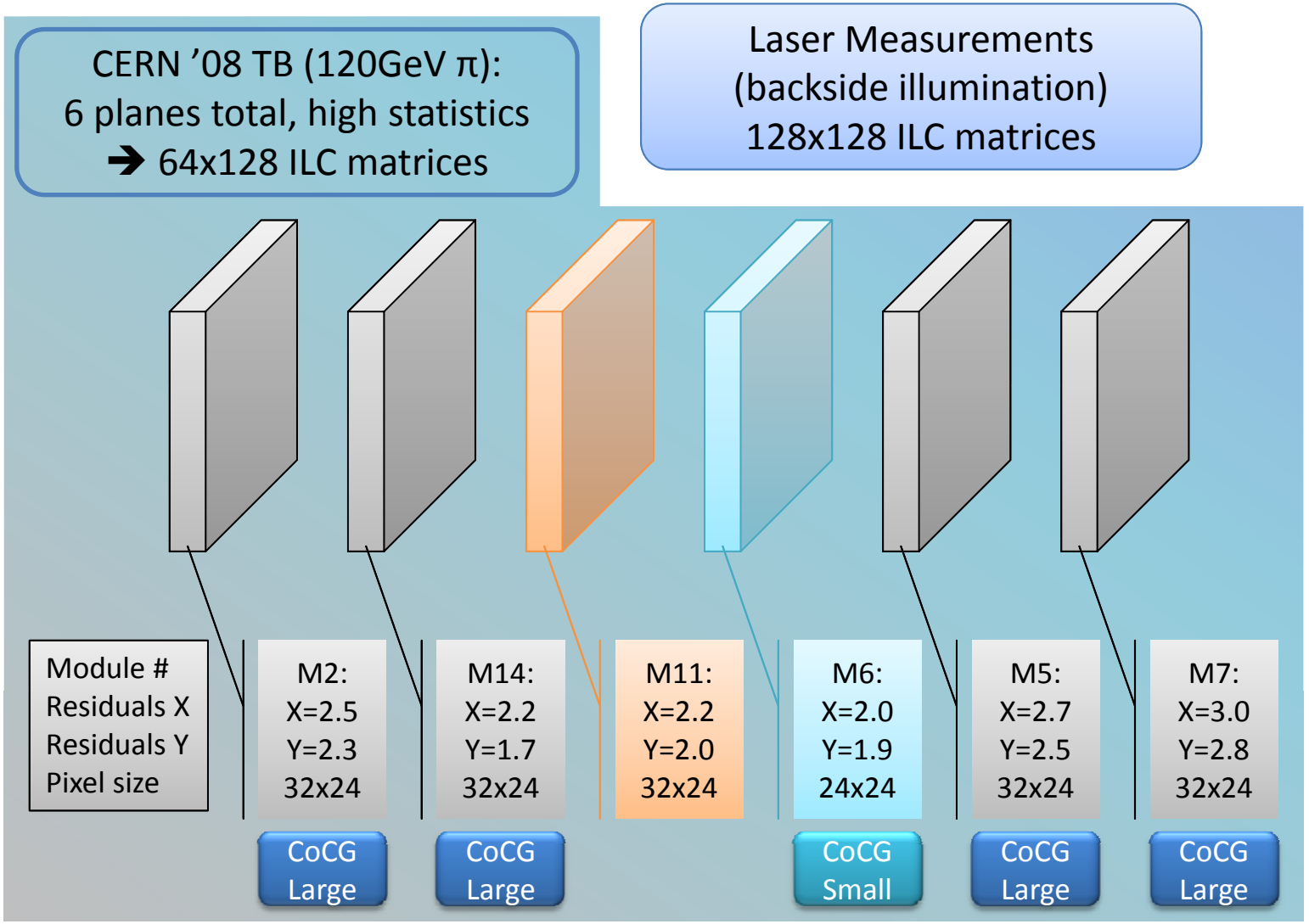
What data are we looking at?

CERN ’08 TB (120GeV π):
6 planes total, high statistics
➔ 64x128 ILC matrices

Laser Measurements
(backside illumination)
128x128 ILC matrices

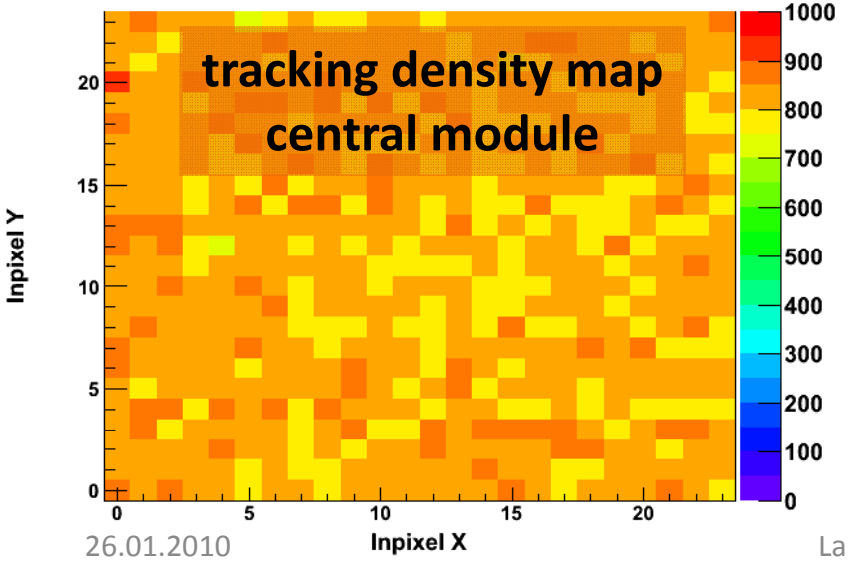


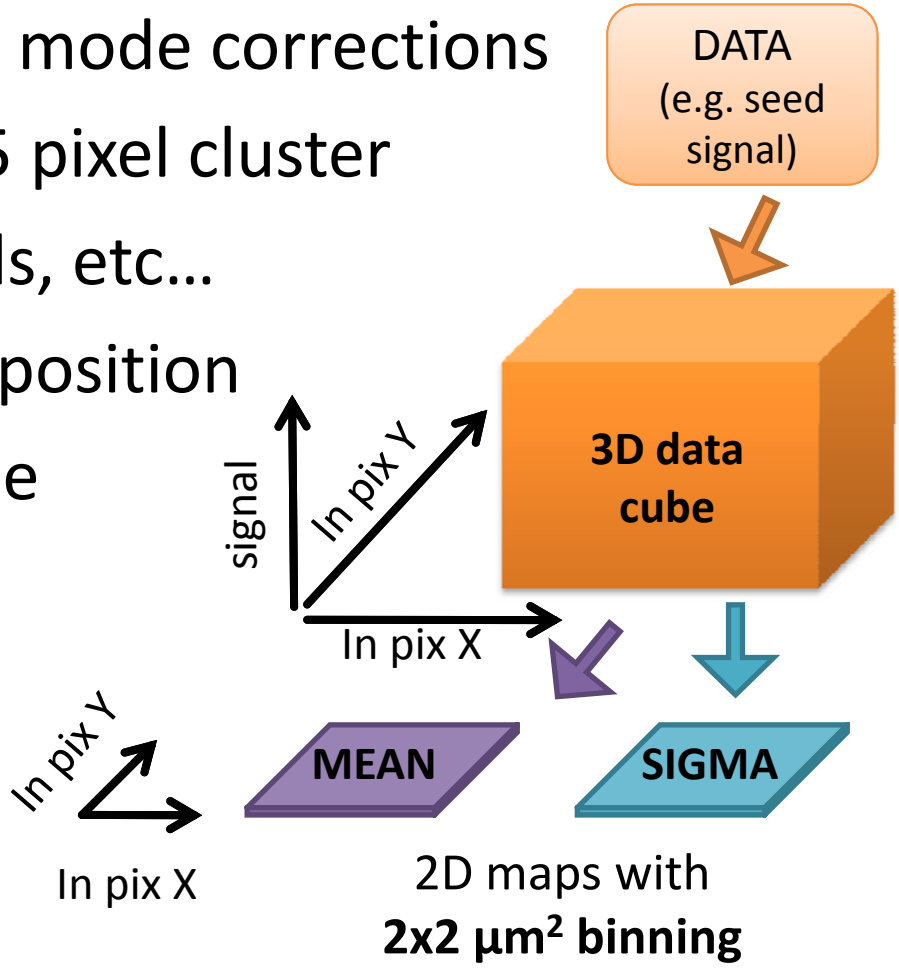
What was studied…

- In pixel studies
  - ➔ high resolution (1-2 µm)
  - ➔ high statistics (first time, total 4 TB data)
- Various properties:
  - ➔ Seed Signal
  - ➔ Cluster Signal
- Two layout type: Common Clear Gate (CoCG)
  - ➔ CoCG Large 32 x 24 μm^2
  - ➔ CoCG Small 24 x 24 μm^2

How was the data analyzed

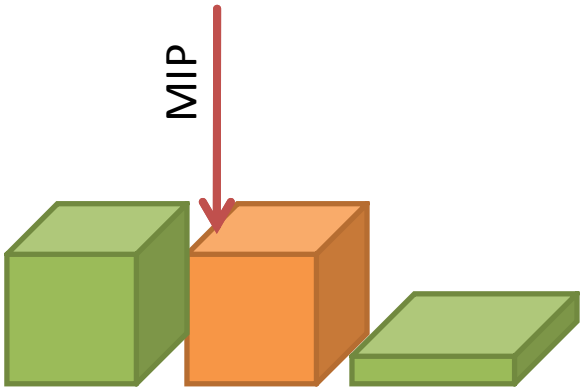
- Pedestal, noise, common mode corrections
- Iterative seed search, 5x5 pixel cluster
- Cuts on hot or noisy pixels, etc…
- Alignment & tracking ➔ position
- All pixels combined to one





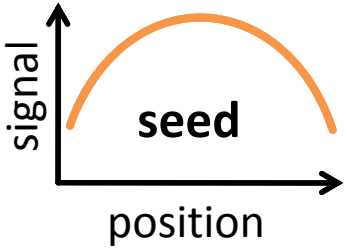
seed & cluster signals: what to expect

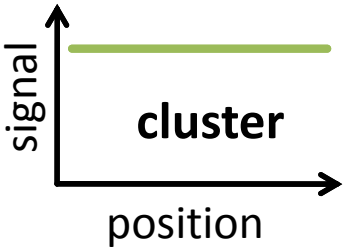
In pixel position:
At pixel **border**



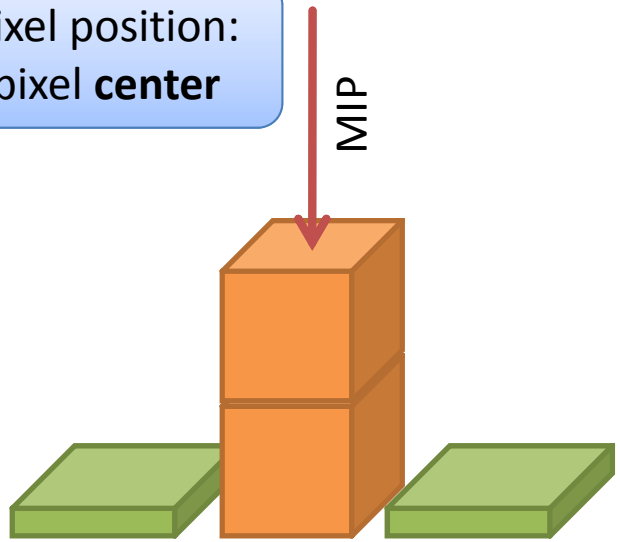
Seed: lowest signal

Cluster: unaffected





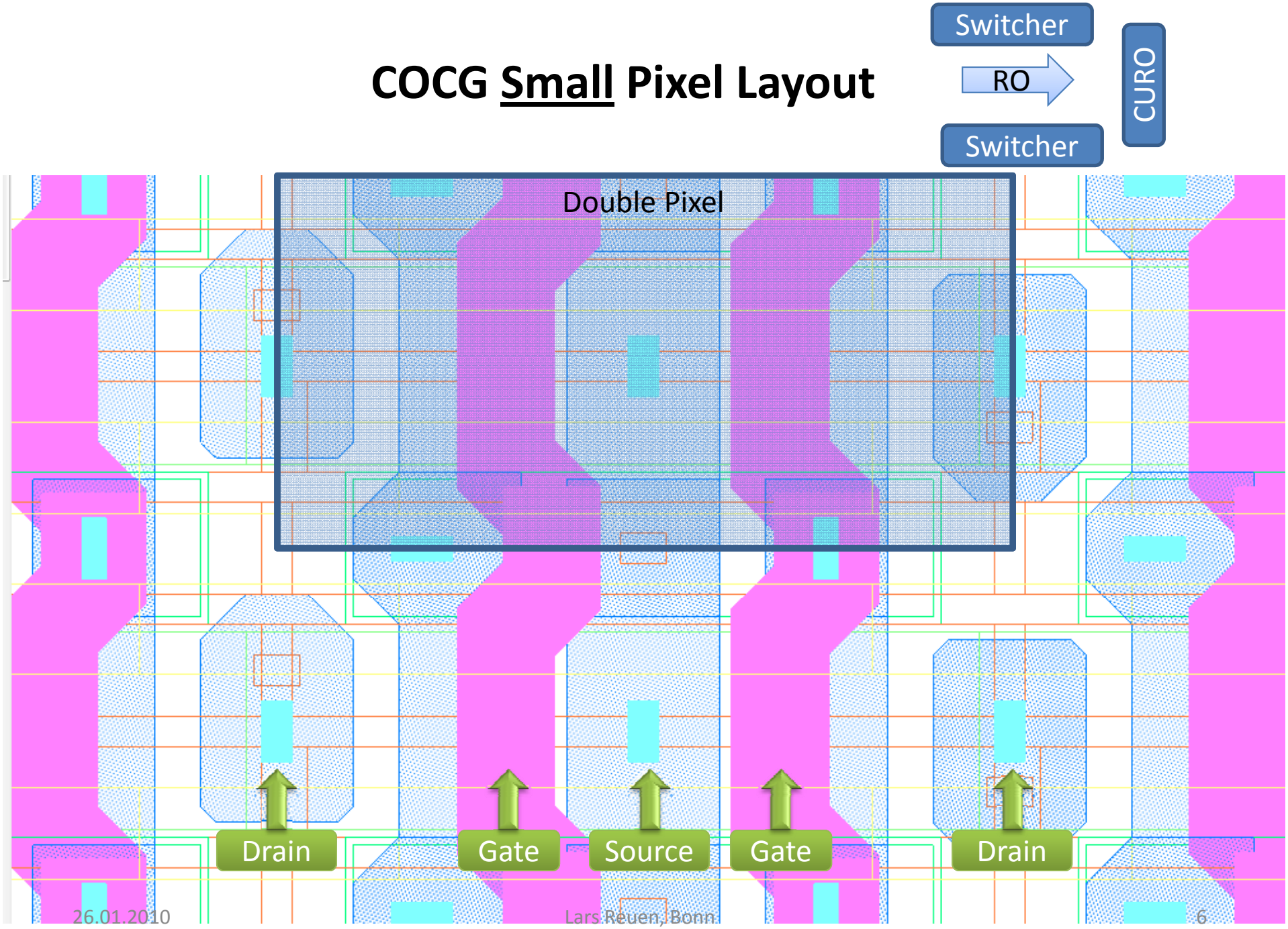
In pixel position:
At pixel **center**



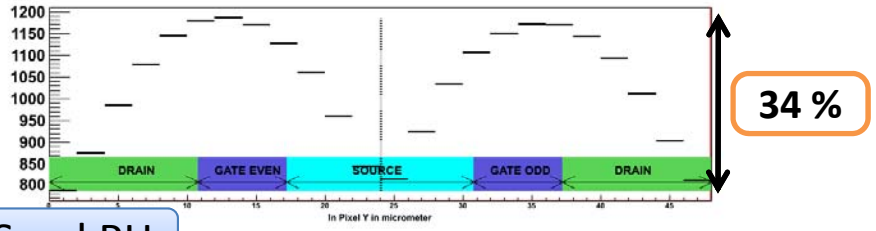
Seed: highest signal

Cluster: unaffected

COCG Small Pixel Layout

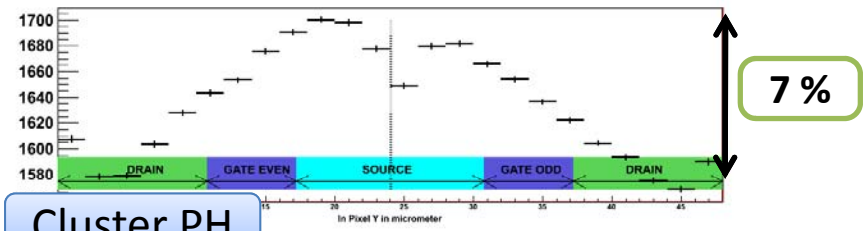


Module 6 (CoCG SMALL): Test Beam Data



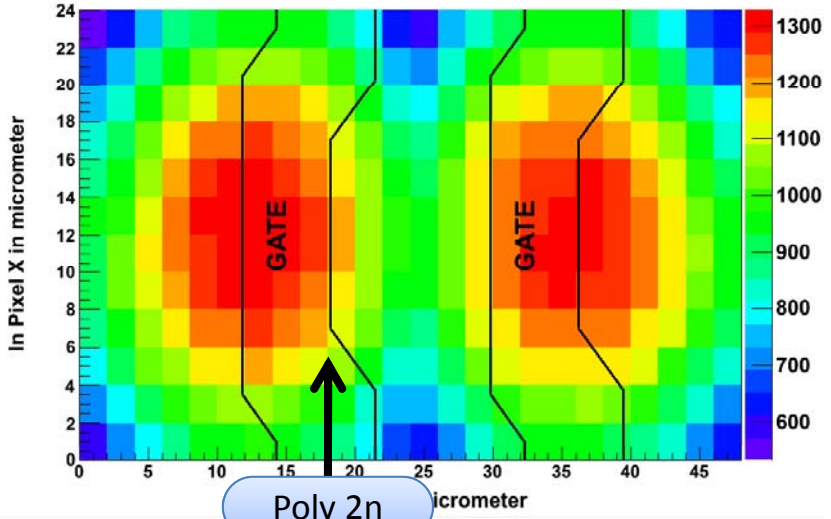
34 %

Seed PH

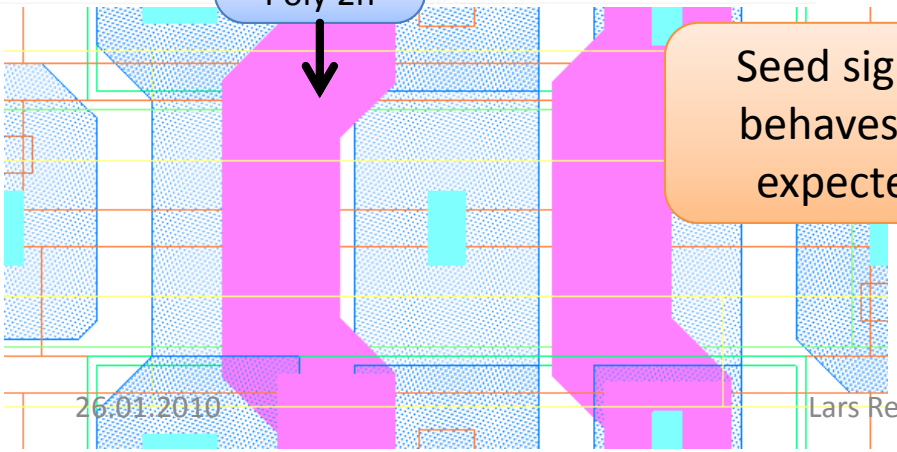


7 %

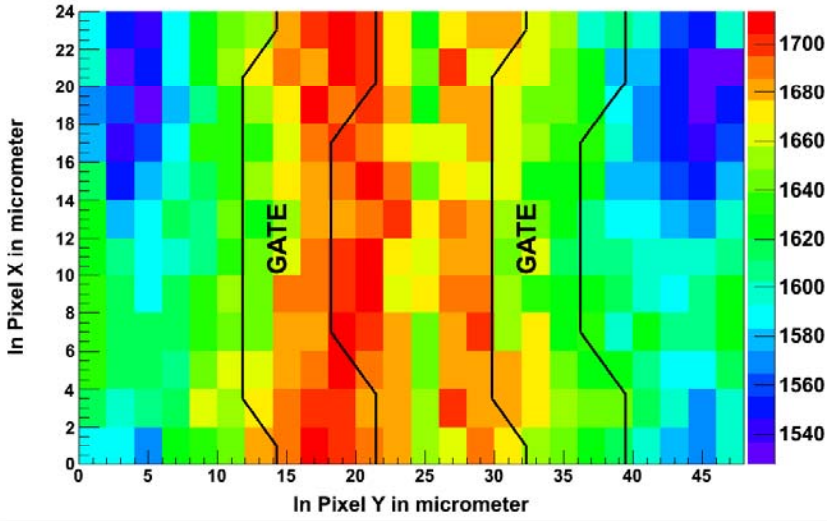
Cluster PH



Poly 2n



Seed signal behaves as expected

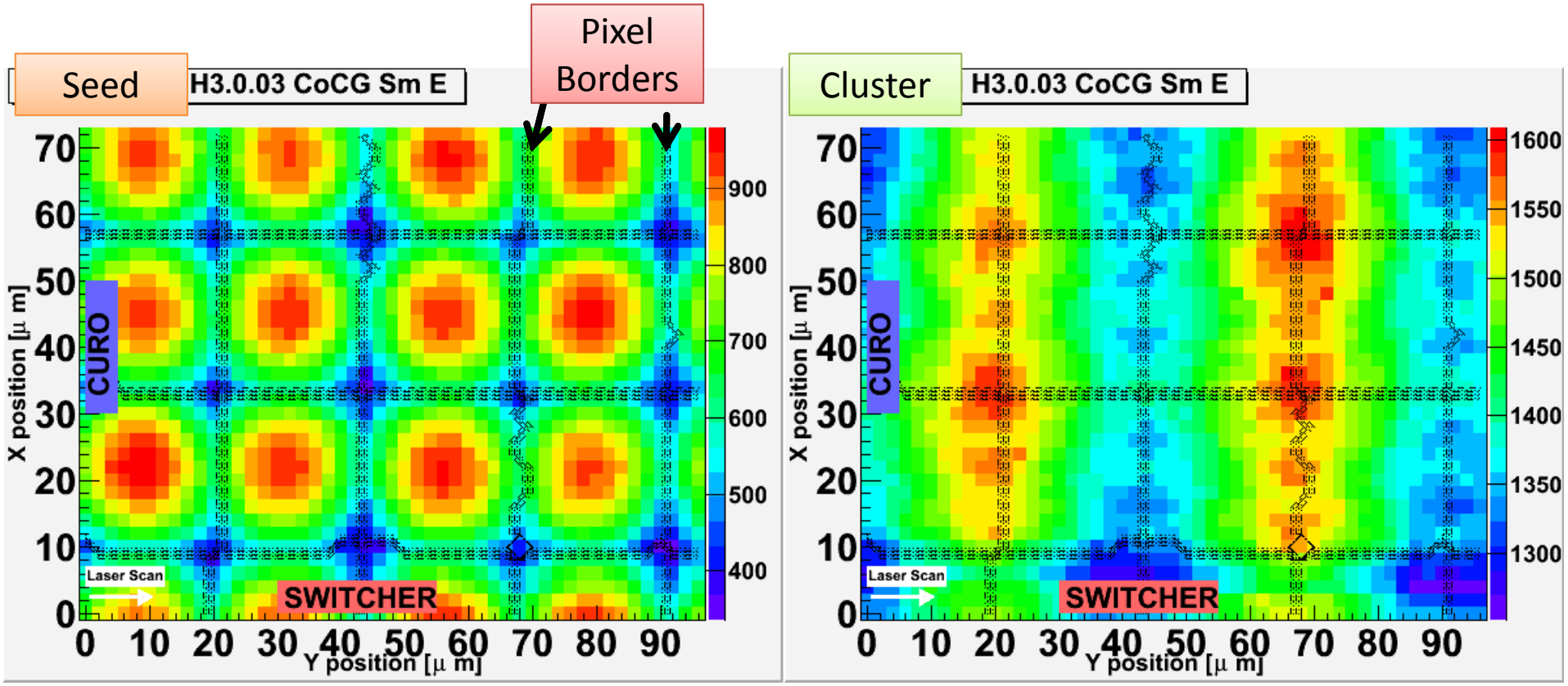


Double pixel like dependence of cluster signal

Laser measurement COCG Small

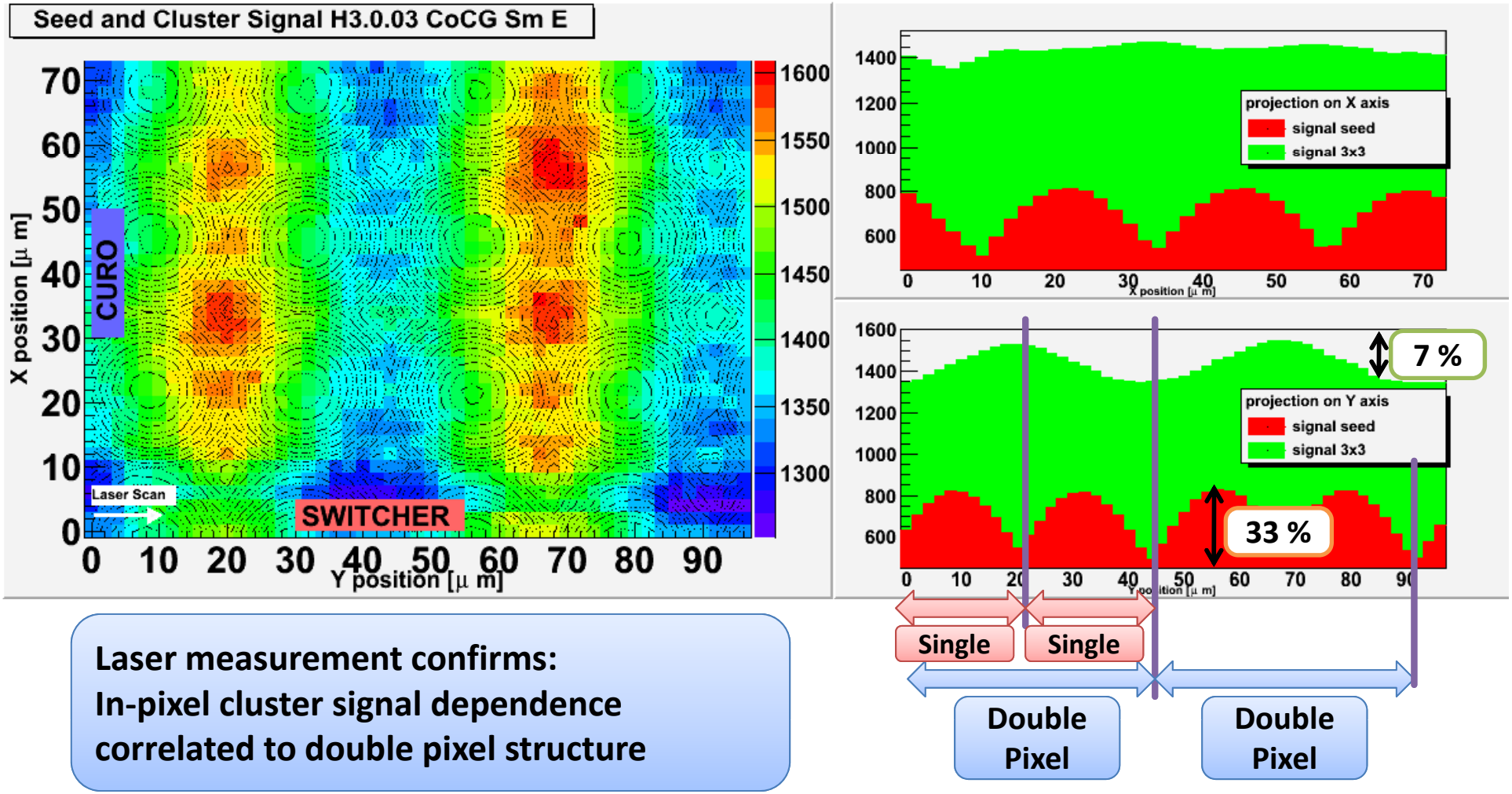
Can we confirm the effect with an independent measurement?

➔ Laser instead of MIP,
➔ 128x128 pixel matrix
(same layout: COCG small)



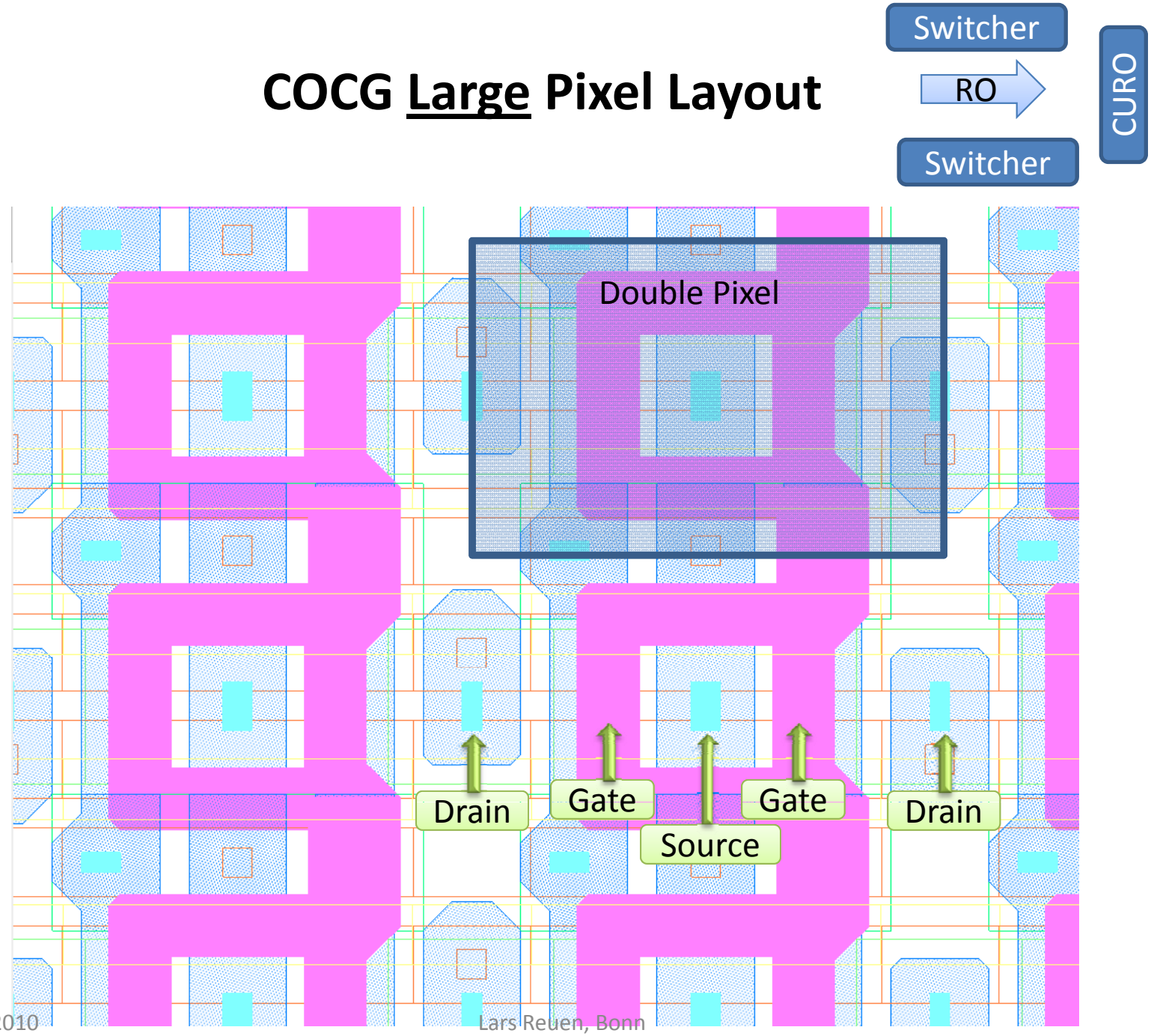
Laser measurement COCG Small

Contour = Seed, Color = Cluster

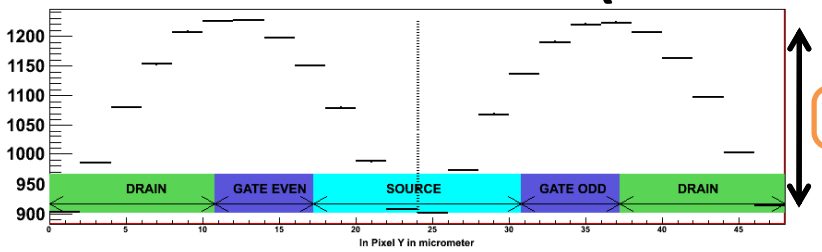


Laser measurement confirms:
In-pixel cluster signal dependence correlated to double pixel structure

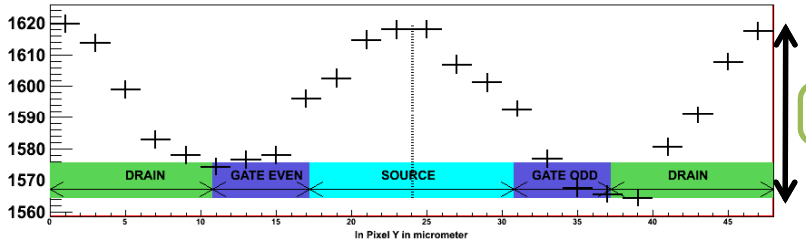
COCG Large Pixel Layout



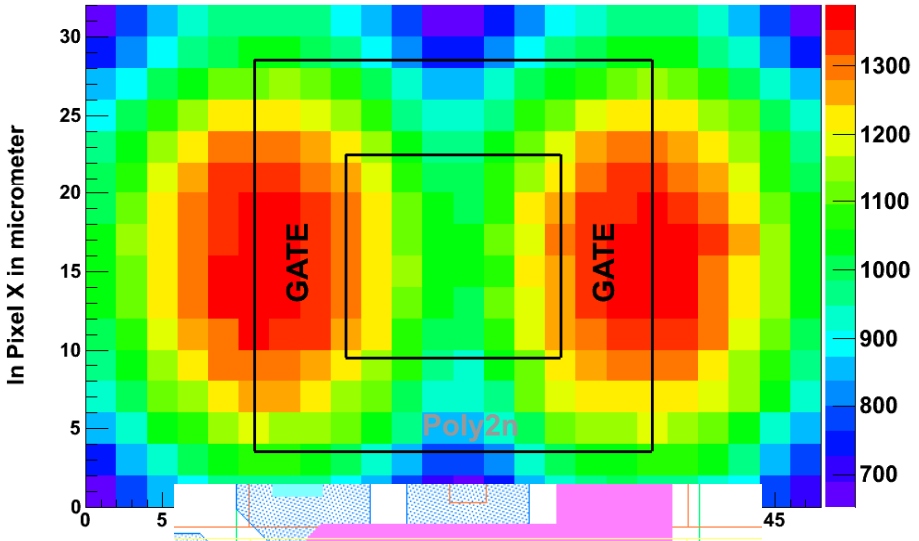
Module 2 (CoCG LARGE): Test Beam

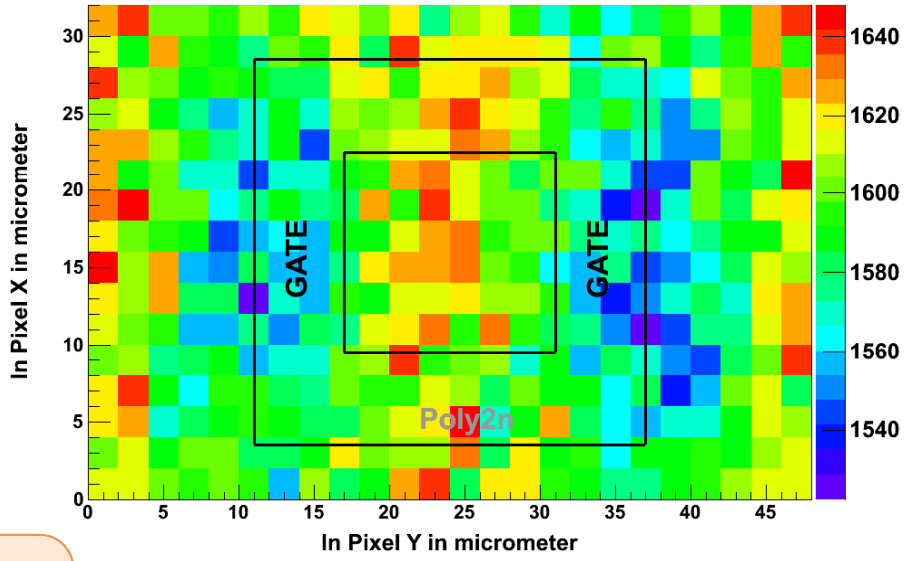


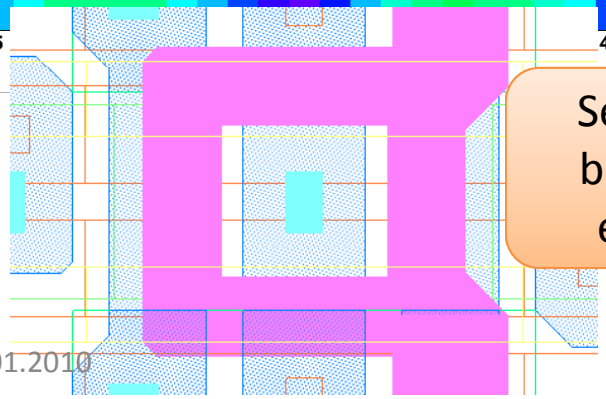
26 %



3%



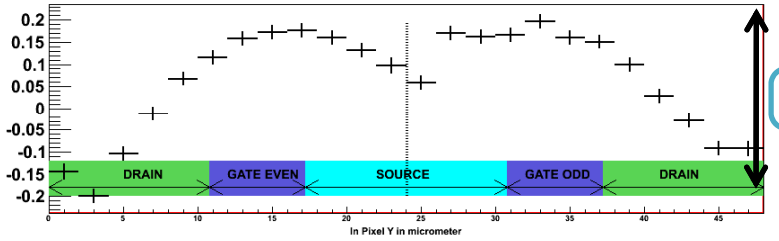




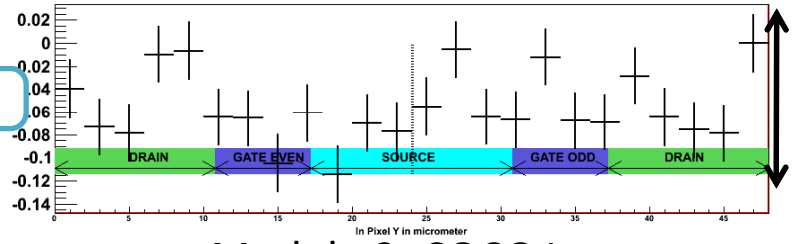
Seed signal behaves as expected

single pixel like dependence of cluster signal, small effect
➔ analysis artifact

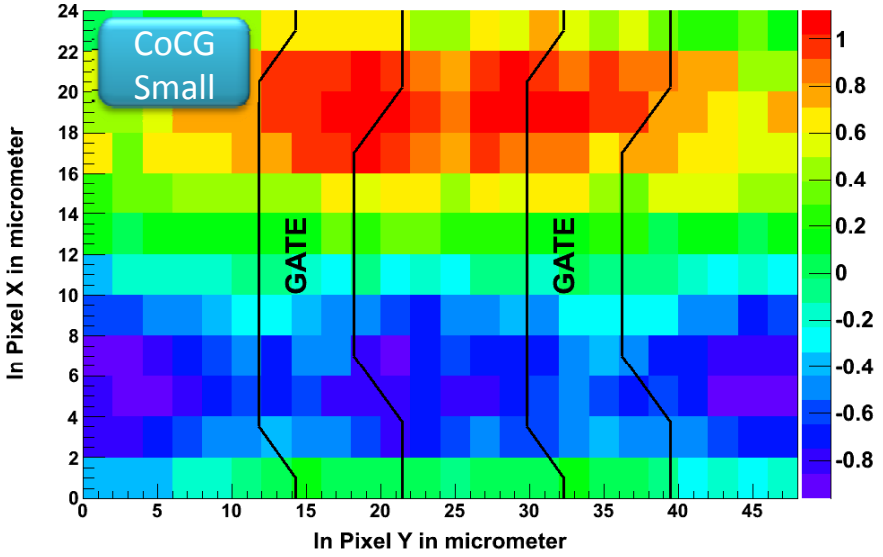
Do we have to worry? No!



0.4 µm

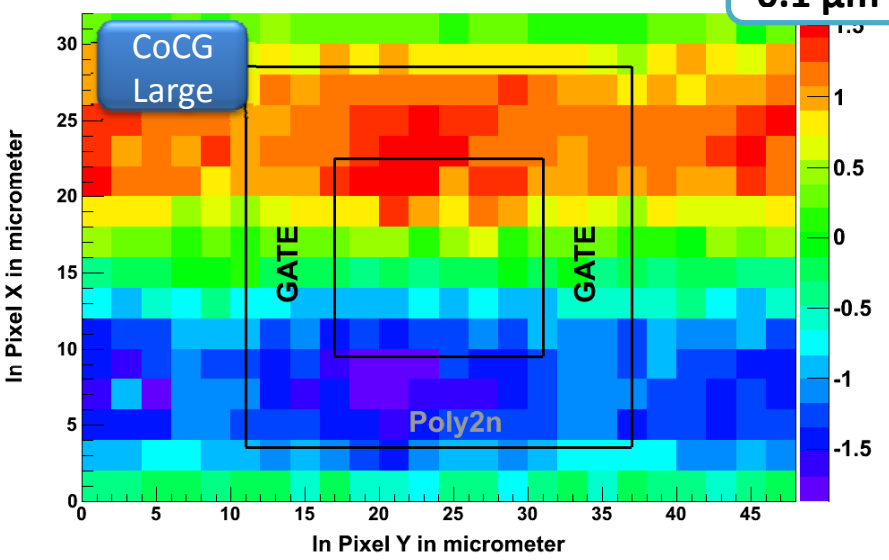


Module 6: COCG Small



Module 2: COCG Large

0.1 µm



Check effect on residuals: plot X vs. Y

→ no effects from position reconstruction

Minimal effect on X residuals
➔ neglectible

Possible explanation

- Ballistic deficit under source
- Potential difference between gate & source less than between gate & drain
- Possible test:
  - ➔ Laser scan with slower/faster read out
  - ➔ effect should become more/less prominent

Summary

- In pixel studies with TB “08 basically finished
- Most properties vs. in pixel position as expected
- Interesting but very small effect of cluster signal dependence on in pixel (Y) position with one layout type
  ➔ effect on position reconstruction is insignificant
  ➔ more of academic than practical concern