



## Square Events

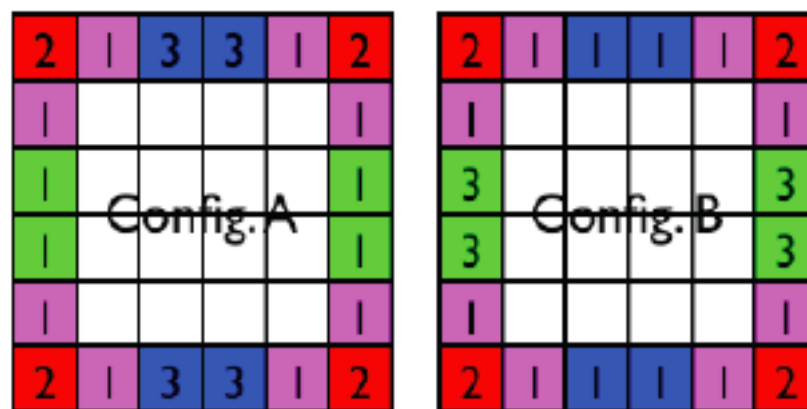
Origin of the energy deposits on the edge of the wafer

François Morisseau(LPC),

Mustapha Benyamna(LPC), Rémi Cornat (LLR).



# the conclusion of CIN-005 note...



What influences the choice between these two configurations is not found yet. What is known is where to find each of them in the ECAL. For instance, wafer 7 of layer 13 shows always configuration B, whatever the circumstances. This leads to the following assumption: what is responsible for the choice between A and B is an hardware property of the wafers. Results of hardware simulations of wafers will be available in a forthcoming note.

Wafers are supposed to be symmetric. Consequently, the way they were glued to the PCB shouldn't have any influence on anything. But wafers could be actually asymmetric. For instance, if the dead zone was slightly bigger in one direction (two opposite borders) than in the other direction, each wafer would have an orientation after being glued. This orientation would not necessarily be the same as other wafers'. But it would be the same whatever the period of data taking. And thus the origin of configurations A and B would be linked with this hardware orientation. This possibility is currently studied.

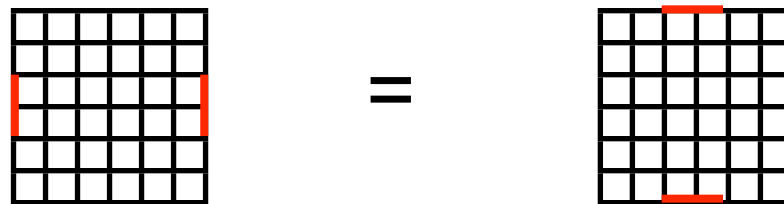


# ...has led to new findings !!!

Rémi Cornat took a look on the very wafers glued on the prototype and he discovered some metallic zones next to the middle pads of their borders.

Those zones seem to have been added by the providers for tests.

Those zones are added to two opposite sides only.



Those zones are between the pixels and the guard-rings.



# What is simulated

With the program used, to simulate the entire wafer is highly CPU time consuming with no guarrantly on the results.

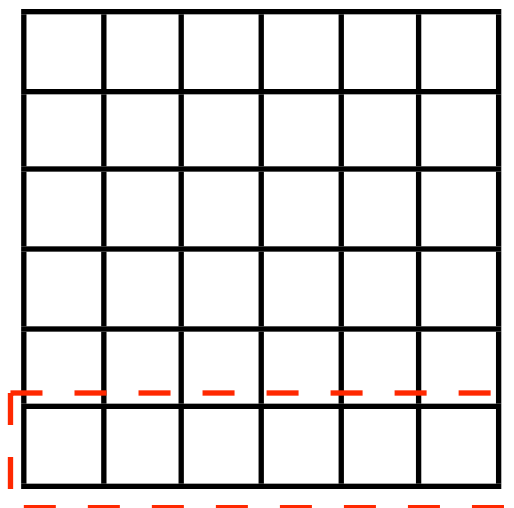
⇒ Simulation of one edge of a wafer

For the same reason,

⇒ Dimensions are scaled ( 1/20 )

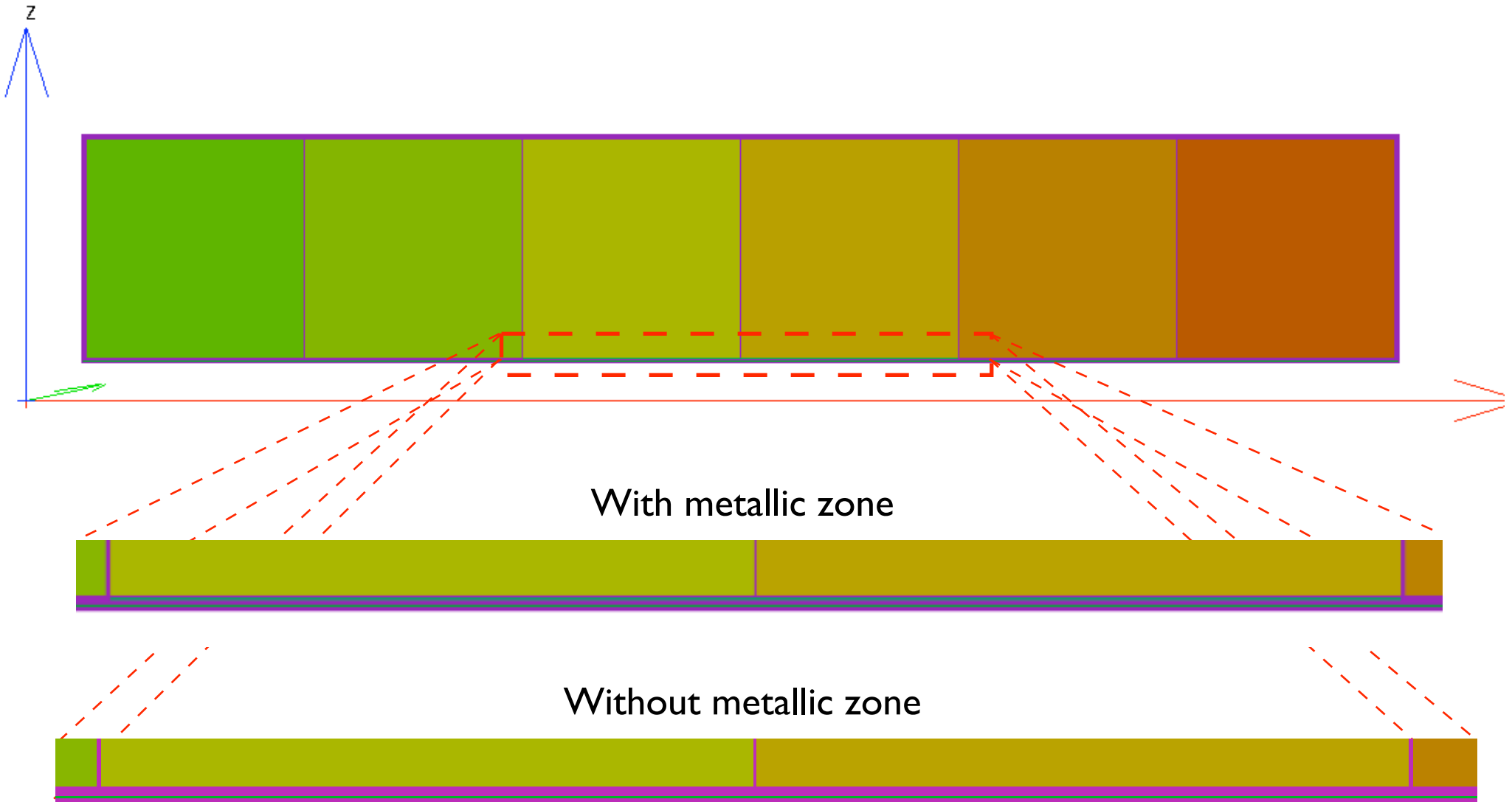
⇒ Only one guardring is simulated.

Wafer





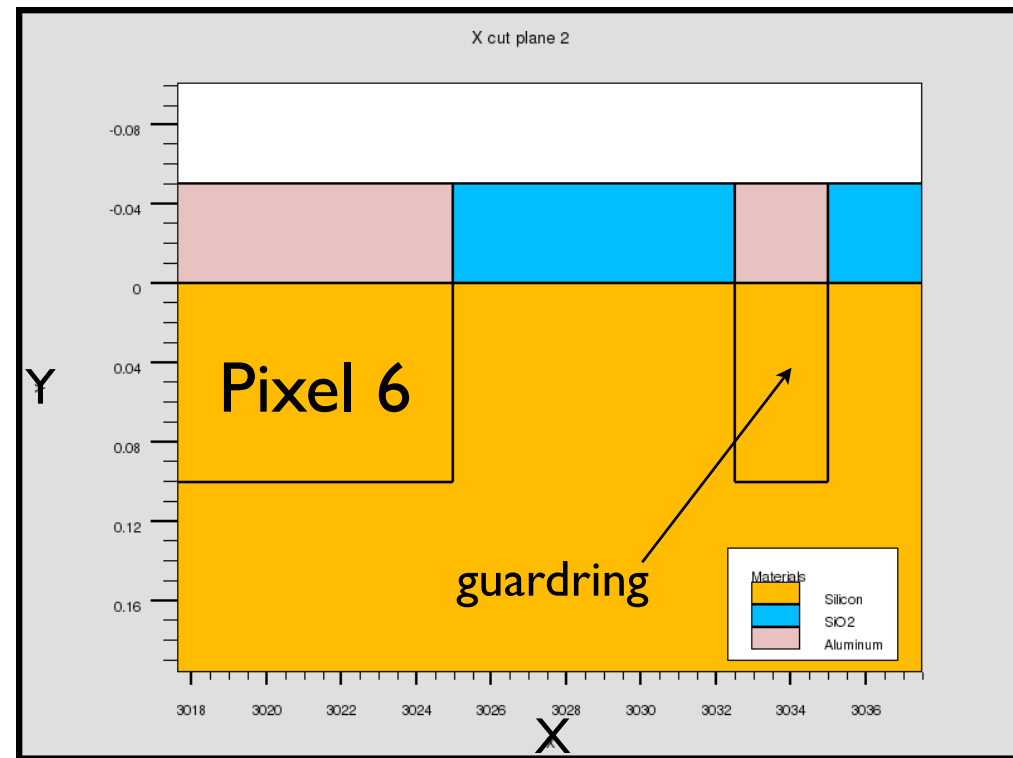
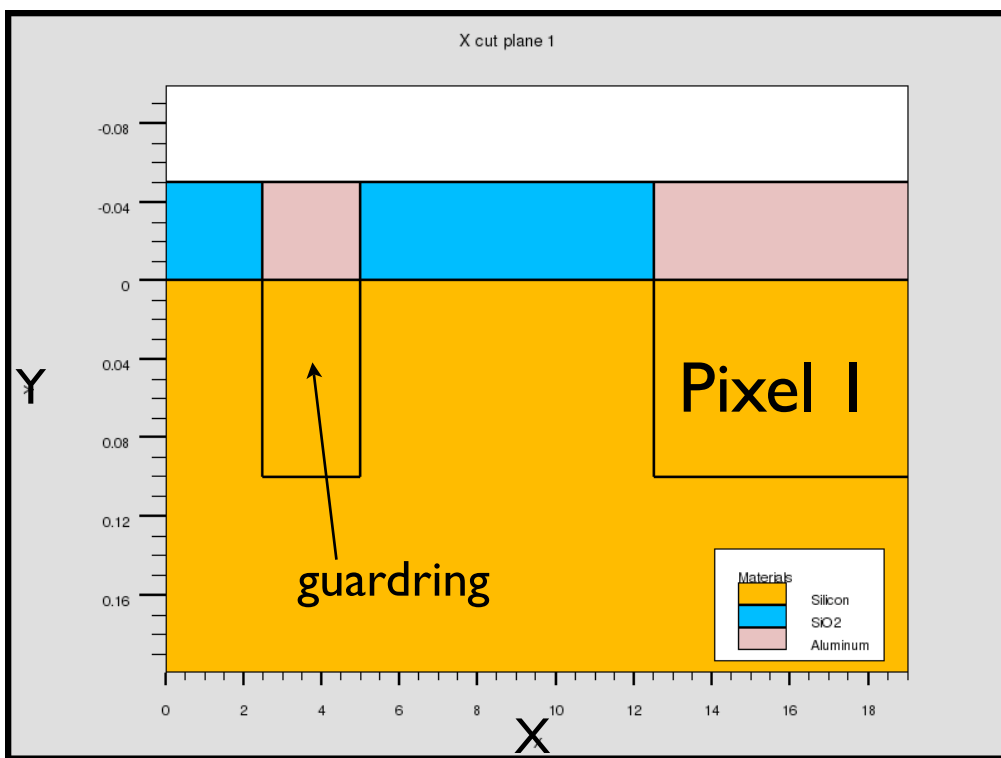
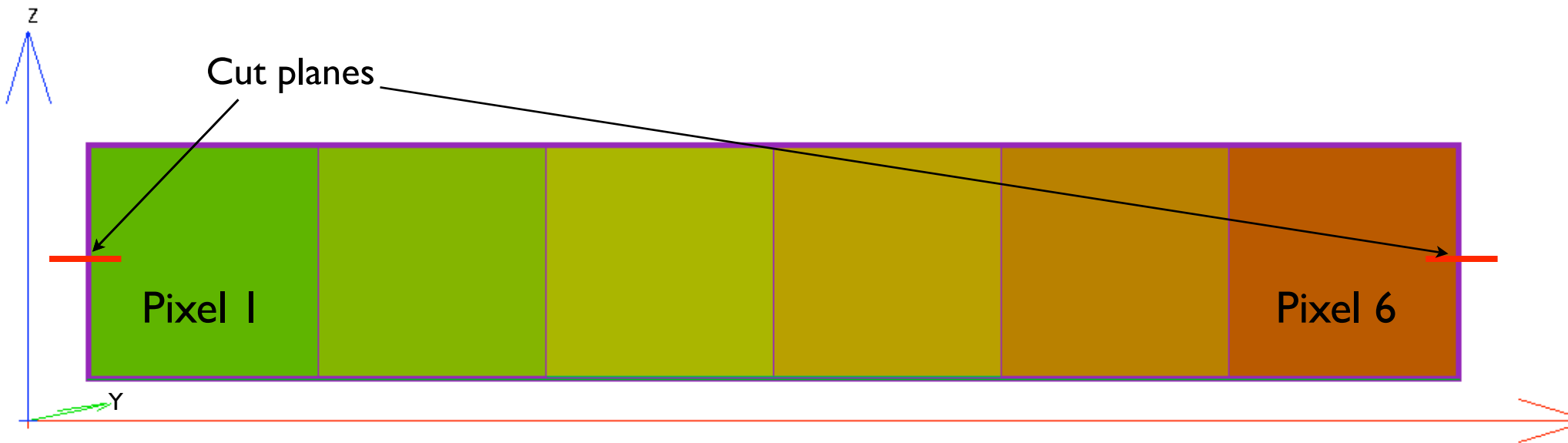
# 2 configurations



*With the SILVACO package.*

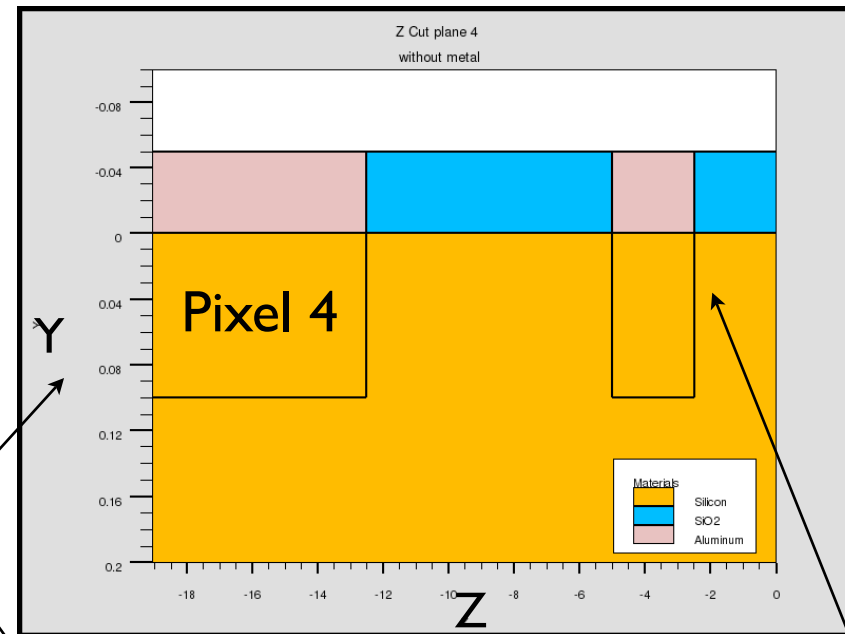
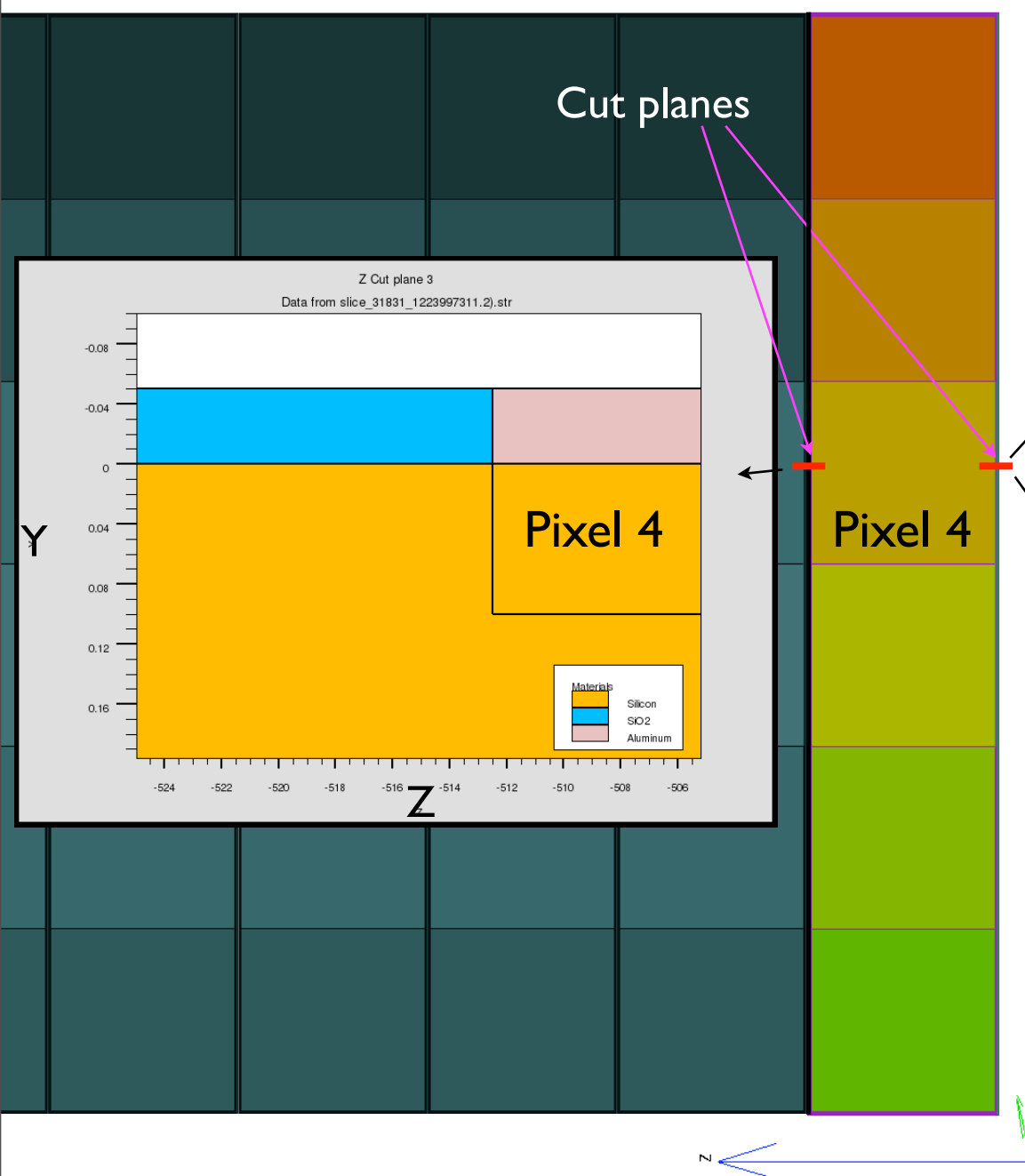


# Transverse X Shape

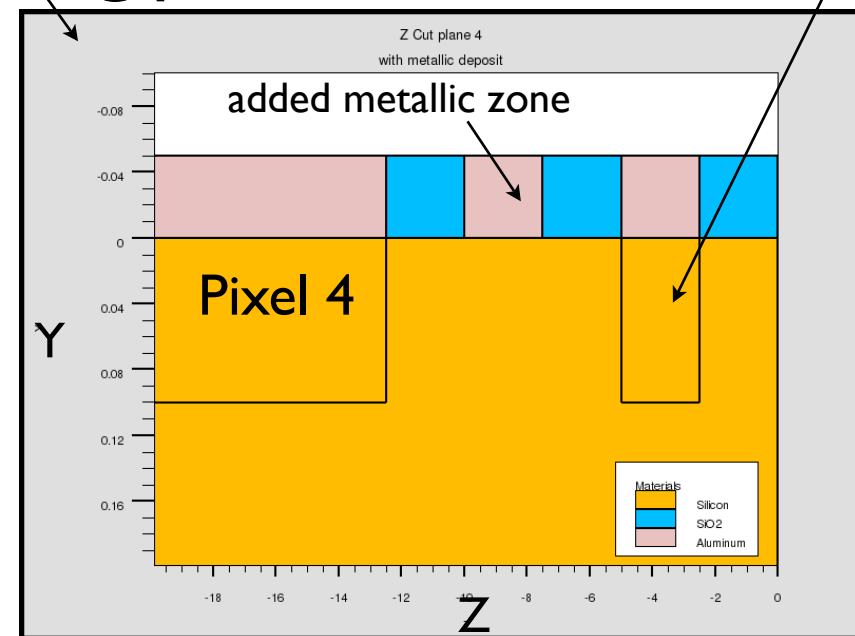




# Transverse Z Shape

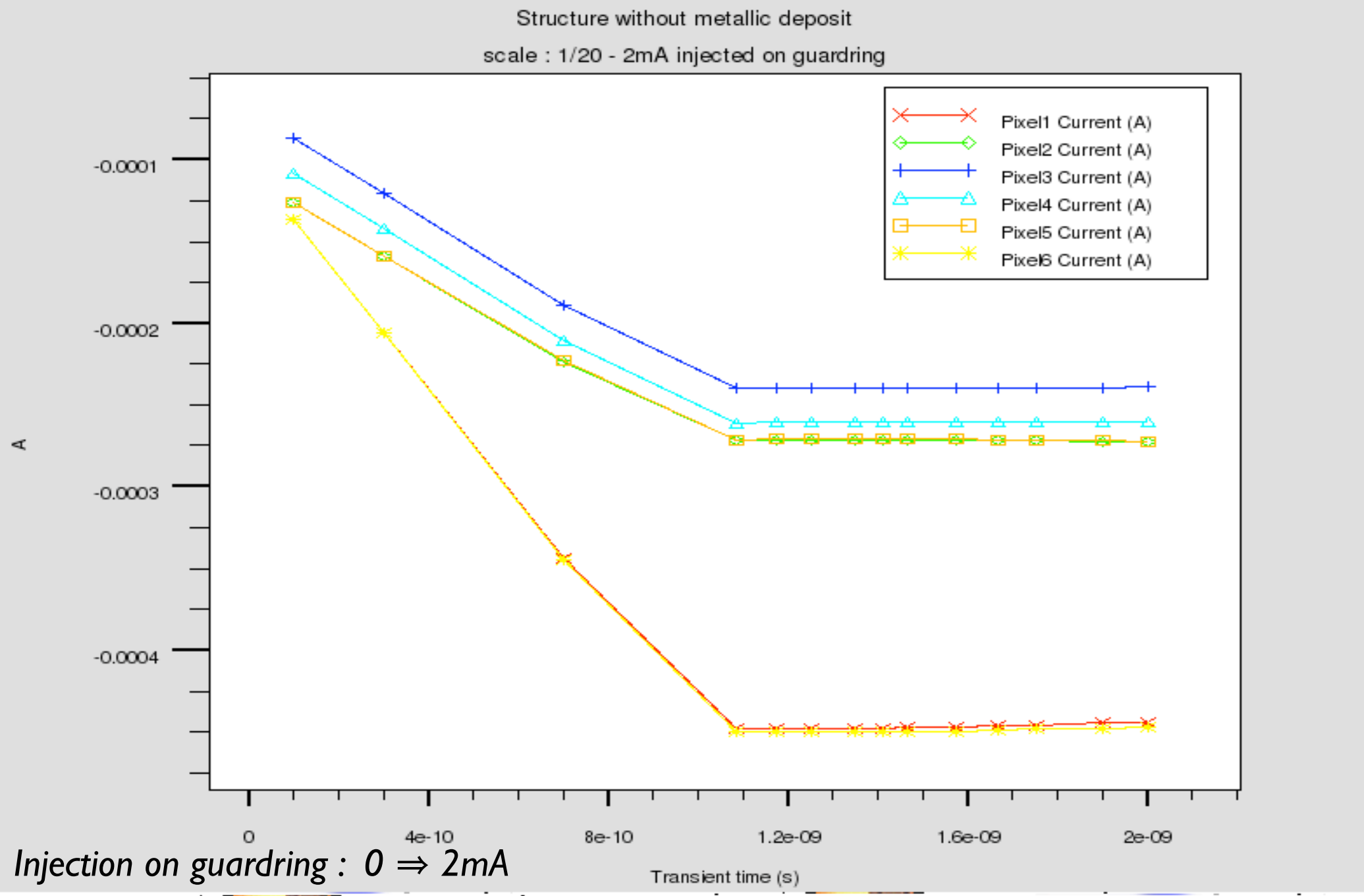


Or





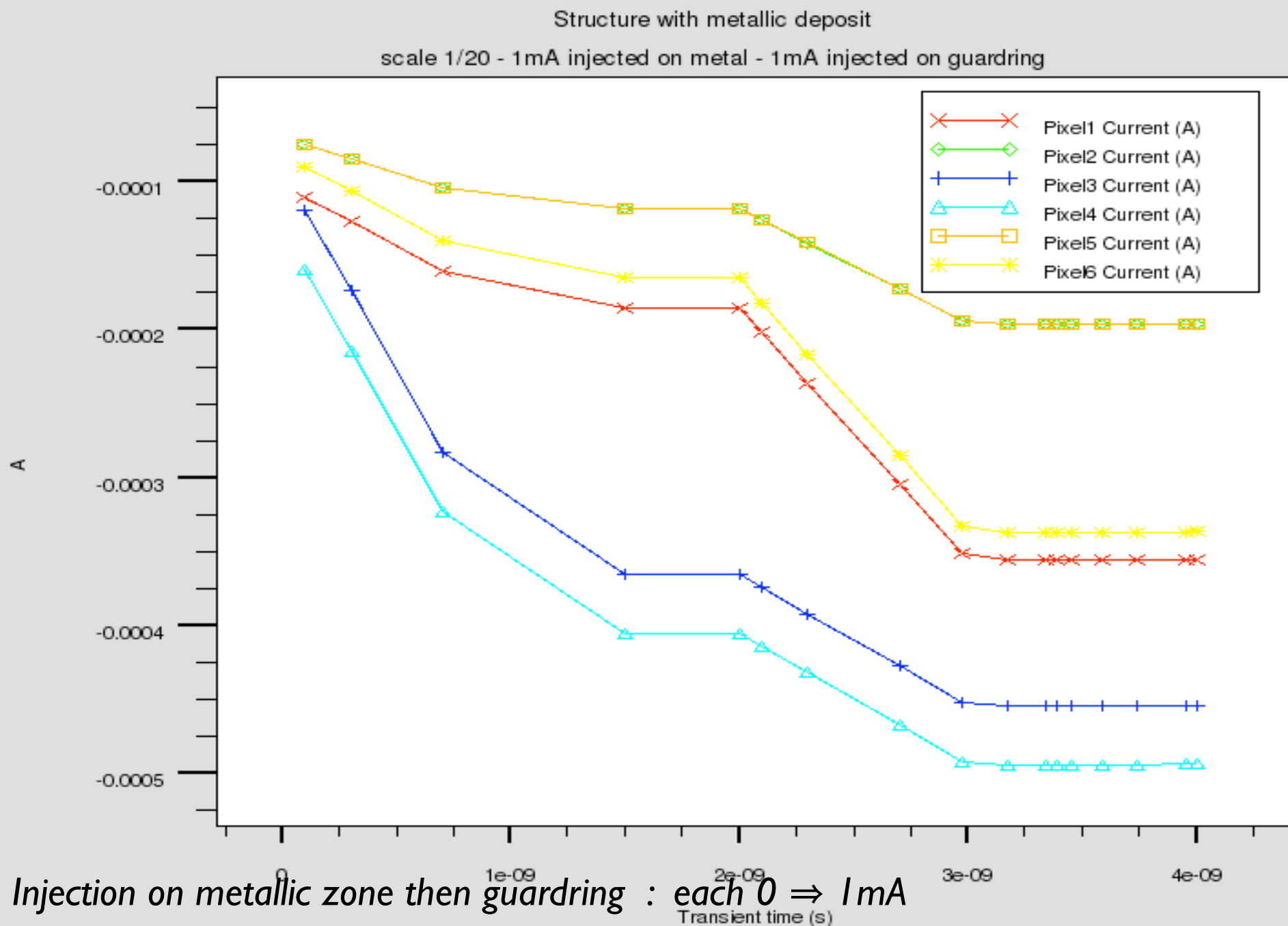
# Results - Without Metallic zones







# Results - With Metallic zones

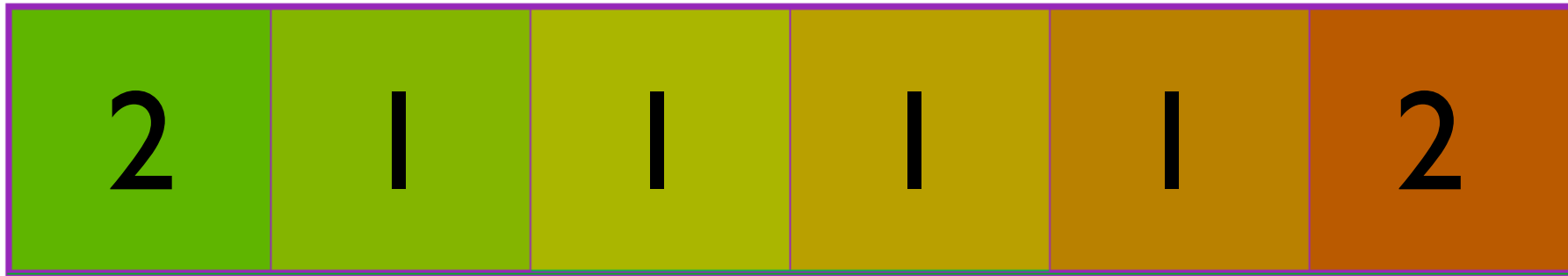


Injection on metallic zone then guarding : each 0  $\Rightarrow$  1mA  
Transient time (s)

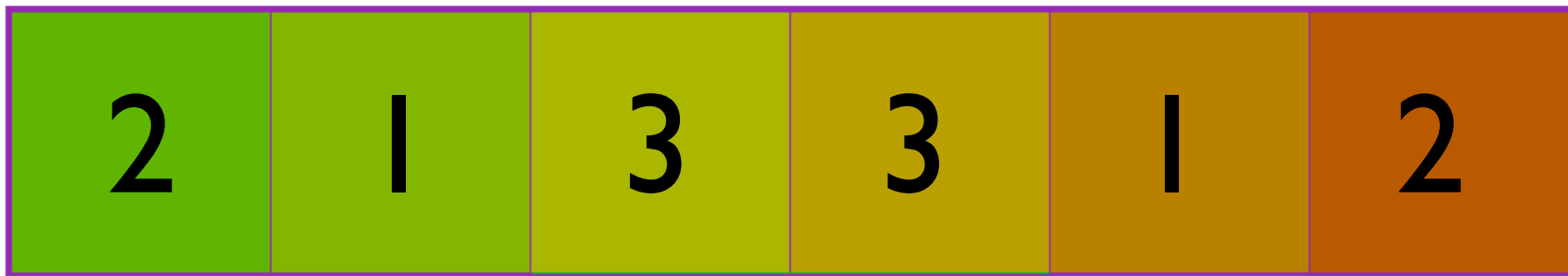


# Relative Energy deposits

$z$   
Without metallic deposits

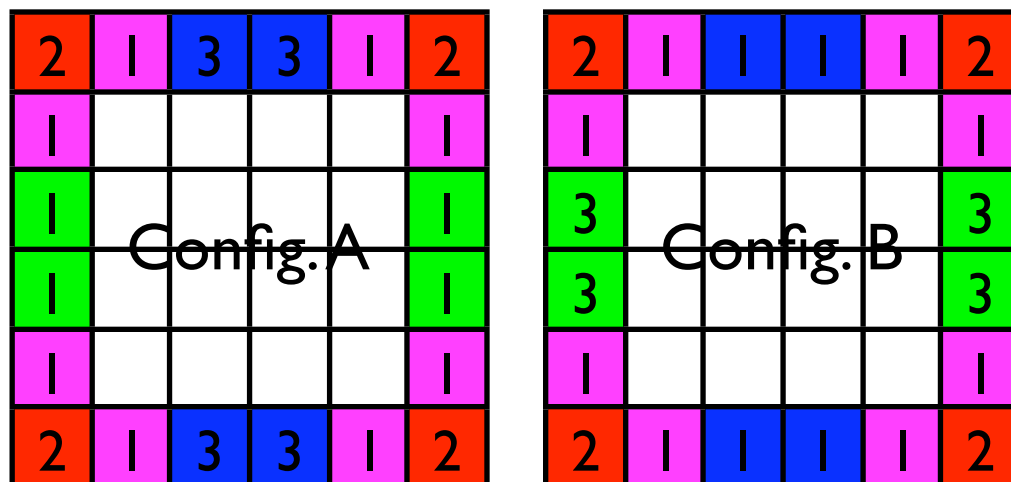


With metallic deposits





# Conclusion



The metallic deposits on the wafers explain the two configurations A & B discovered in the test beam data.

Configuration A & B are actually the same configuration.

The illusion of difference is induced by the way the wafers were glued (rotation of  $90^\circ$ ).

***see CIN-009 for details***



# Futur

CIN-9 has been released as my last involvement on this subject.

There are still a lot to do about the Square Event phenomenon:

A Test Bench with 3x3 wafers is under way at the LPC Clermont-Ferrand. We are waiting for the wafers for the time being. If everything is on time, we should be able to do the measurements at the beginning of November.

The CIN-006 and CIN-007 notes describe the work done so far.

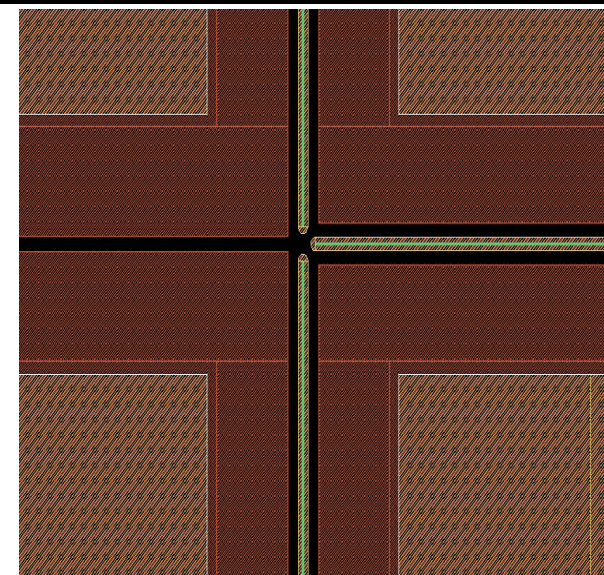
Mustapha Benyamna and Rémi Cornat will show the results to the collaboration after.

This study explains the relative weight found in test beam data but it is a simulation. Might I suggest to set up a test bench for this particular study ?

David Ward found new shapes ( T shapes and line shapes inside wafers - see David Ward's talk at Manchester 09/08).

We know that some metallic deposits have been put between pixels (as shown on the right).

So we could check, with Silvaco simulations, if those metallic deposits between pixels are responsible for the shapes found by David.





# As for me...

My contract is finishing soon.

So I just wanted to say:

Farewell everybody;  
and good luck for the futur !!!