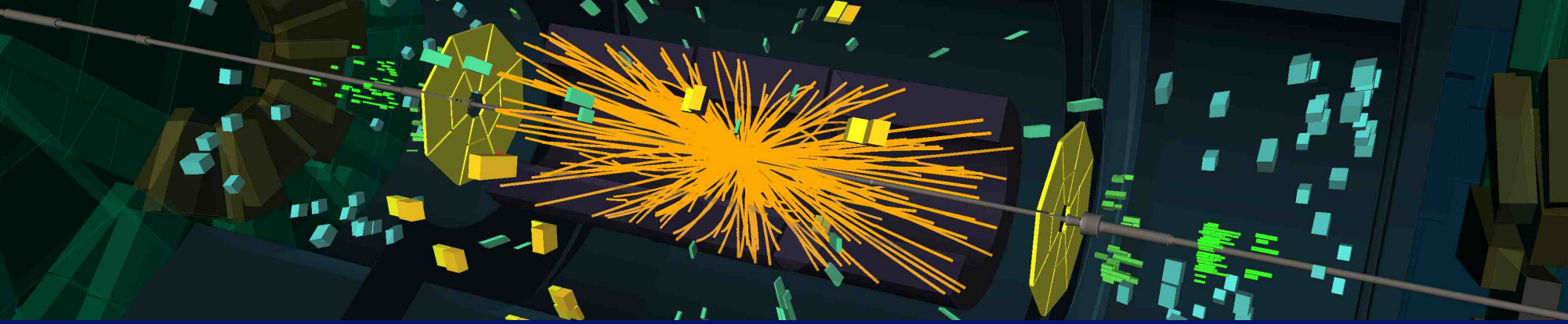

Study of h$\rightarrow b\bar{b}$ and importance of ATLAS inner tracker upgrade

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LPNHE

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October 7, 2016

Thesis overview

Thesis subject: **Study of decay properties of $h \to b\bar{b}$ and importance of ATLAS inner tracker upgrade for this analysis**

Ongoing:

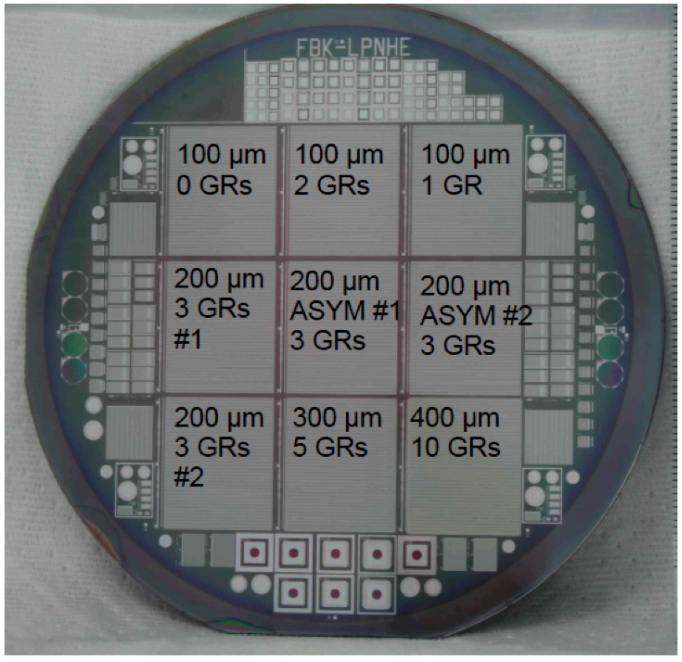
- Development of planar silicon sensors for ATLAS upgrade Tracker (ITK)
  - $\Rightarrow$ Active edge
  - $\Rightarrow$ Thinner sensors
- Testbeams (CERN and DESY) and Lab tests on unirradiated and irradiated sensors
- Qualification task on actual pixel layers configuration

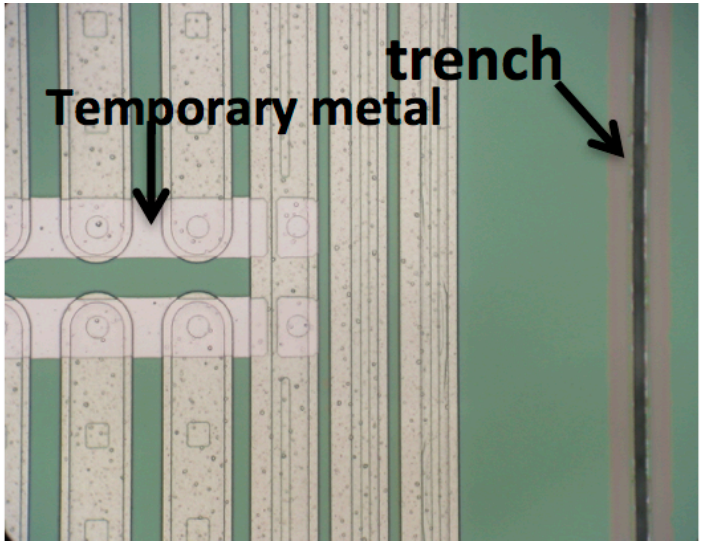
Soon:

- Study of radiation effects on silicon sensors
- Study of $h \to b\bar{b}$
  $\Rightarrow$ Modification of the b-tagging algorithms for the ITK layout and at a larger pile-up

Testbeam results

Sensors Description





FBK production:

- Atlas tracker upgrade
- n on p device
- thickness: 200 μm
- pixel pitch 250 μm x 50 μm
- Biased during test thanks to temporary metal

Active edge production:

- **D**eep **R**eactive **I**on **E**tching technic
- Most aggressive design: 100 μm from last pixel, 0 GR

High Luminosity requirement

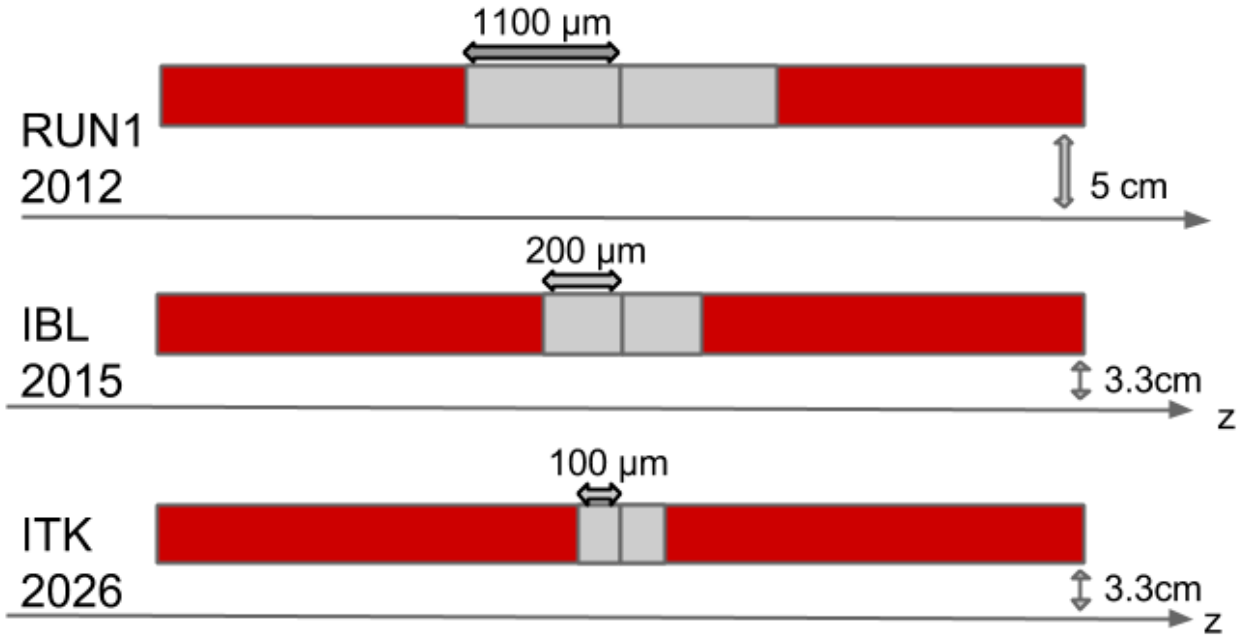
Charge collection efficiency $\Rightarrow$ ToT study
Efficiency above 99 % $\Rightarrow$ Global Efficiency
Homogeneous efficiency $\Rightarrow$ Pixel efficiency
Good spatial resolution $\Rightarrow$ Residuals, Charge sharing

Reduction of dead area

$\Downarrow$

Edge Efficiency analysis

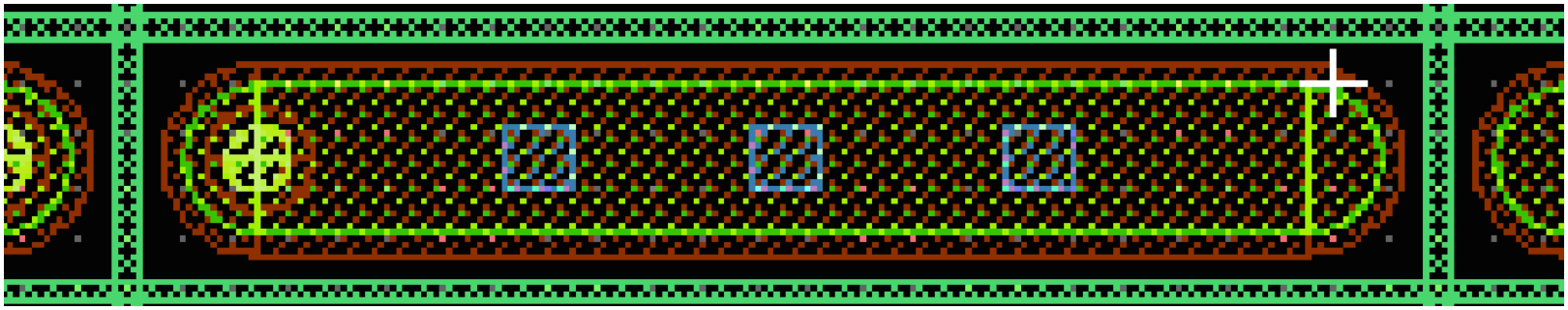
ACTIVE EDGE
100 μm



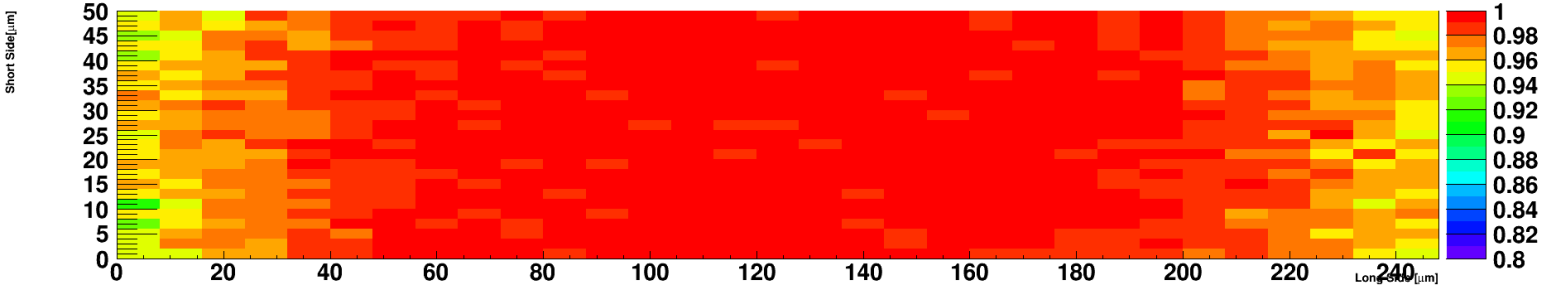
4 Testbeams: $*$ March 2015 at DESY with 4 GeV electrons
$*$ July 2015, May & August 2016 at CERN with 120 GeV pions

Pixel Efficiency

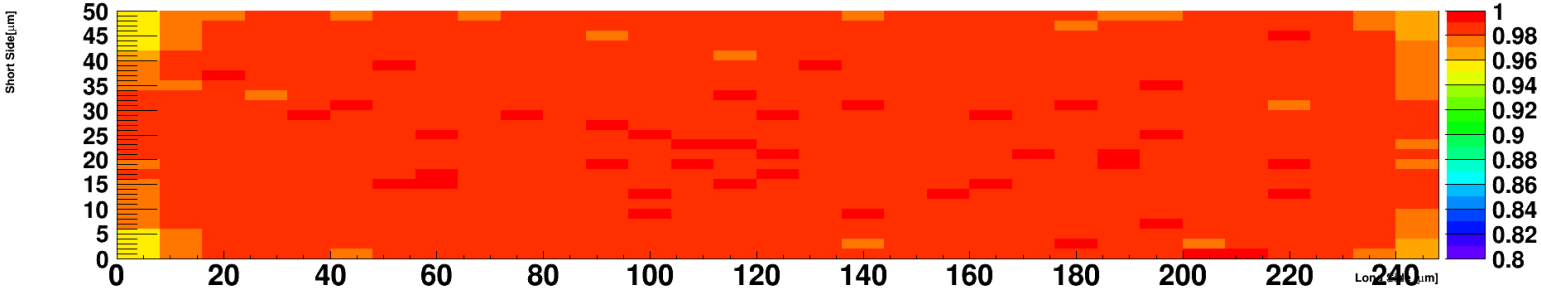
PIXEL



DESY



CERN

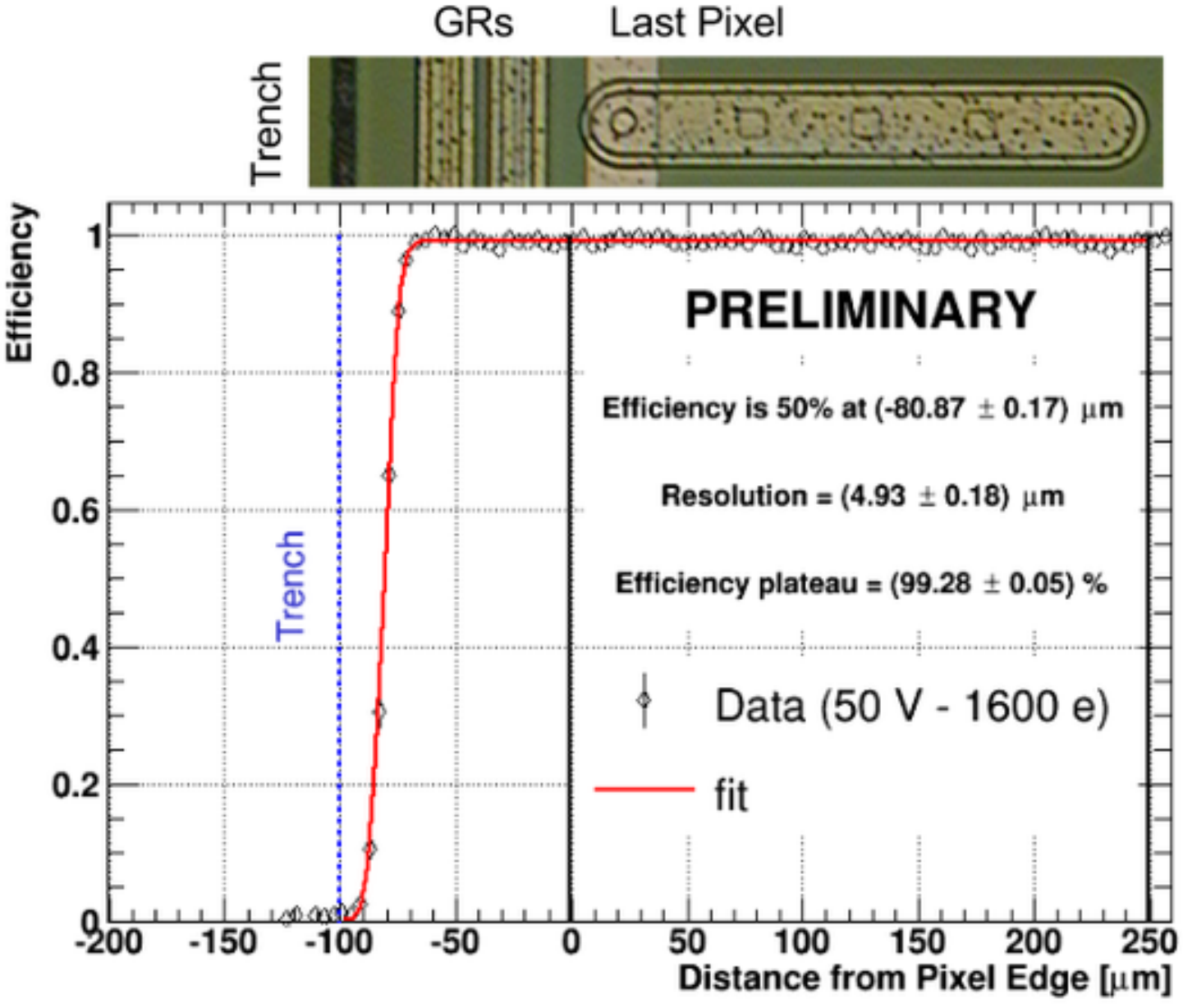


∗ more homogeneous at CERN. Related to reduced MS

∗ no permanent bias structures ⇒ no permanent hit inefficiencies

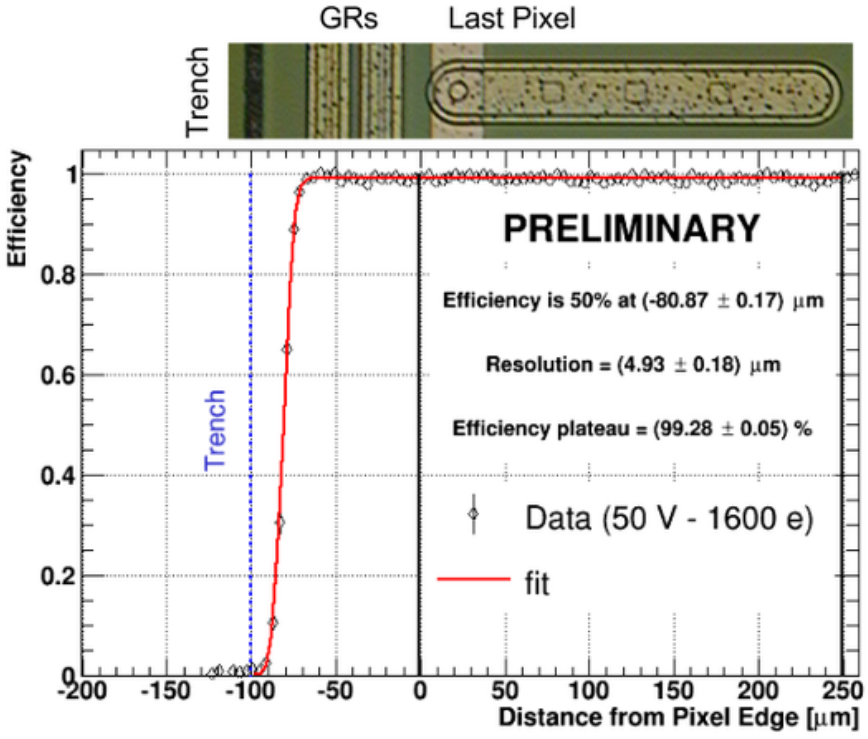
⇒ uniform charge efficiency

Edge Efficiency

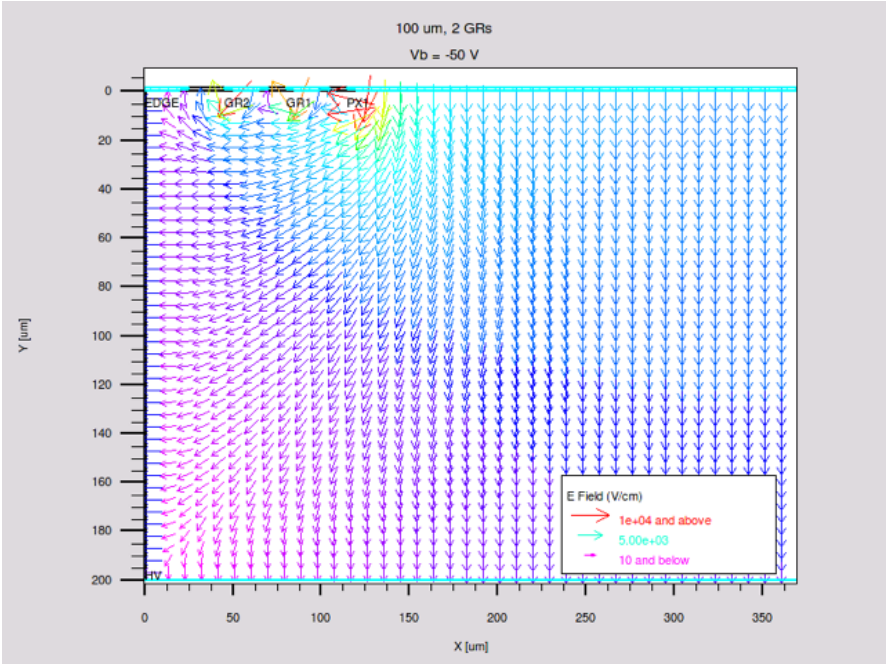


Edge Efficiency

Edge efficiency profile



Simulation of the Electrical field at the edge (Marco)



Velocity is related to E: $v = \mu E$ with μ the mobility
Loss of efficiency close to the edge related to the low velocity
$\Rightarrow$ Simulation and data are in good agreement

Future Plans

Good results in terms of efficiency especially at the edge.

Next steps:

- End of qualification task (Autumn 2016)
- Caracterisation of irradiated sensors $\Rightarrow$ Testbeam End of October 2016
- Study of radiation effects on silicon sensors
- Study of $h \rightarrow b\bar{b}$
  $\Rightarrow$ Modification of the b-tagging algorithms for the ITK layout and at a larger pile-up