# TCAD Simulation of Stitching for Passive CMOS Strip Detectors

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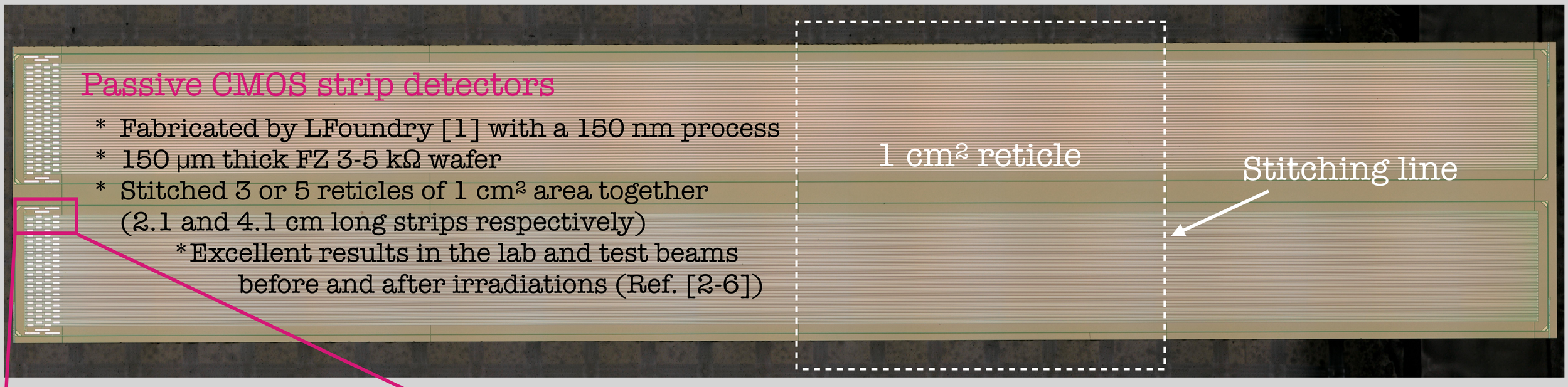
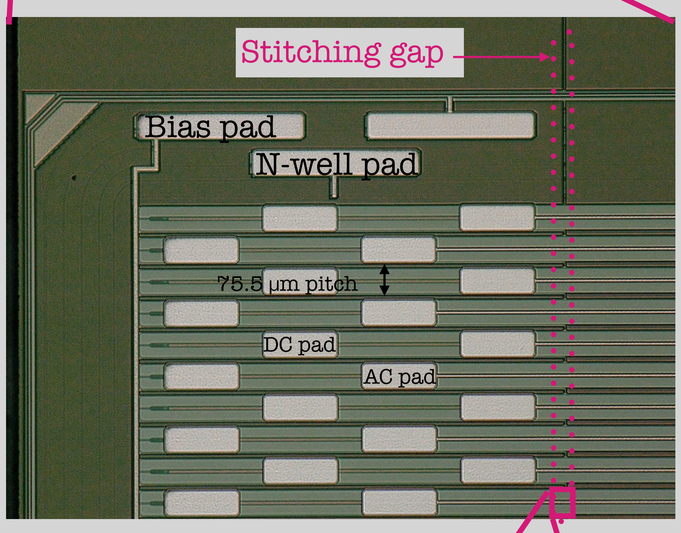
## Passive CMOS strip detectors

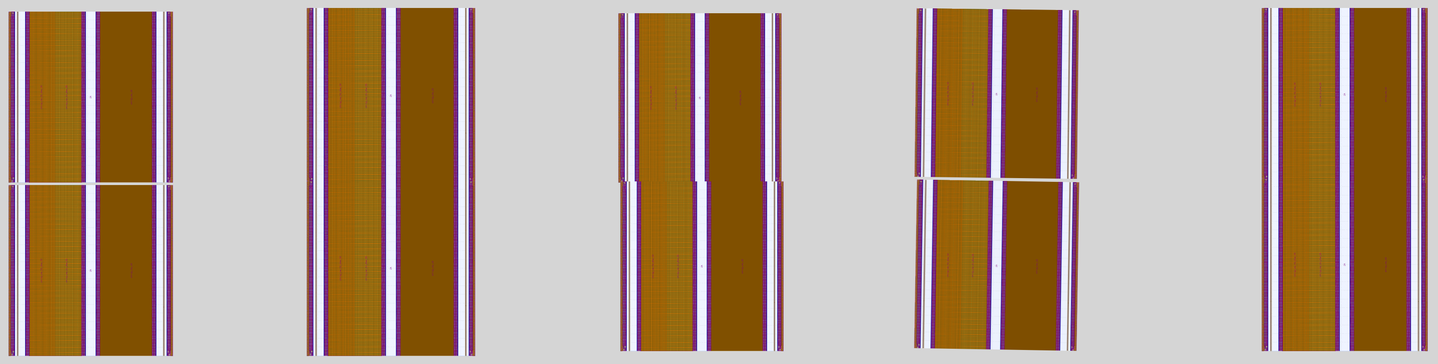
* Fabricated by LFoundry [1] with a 150 nm process
* 150 µm thick FZ 3-5 kΩ wafer
* Stitched 3 or 5 reticles of 1 cm² area together (2.1 and 4.1 cm long strips respectively)
  * Excellent results in the lab and test beams before and after irradiations (Ref. [2-6])



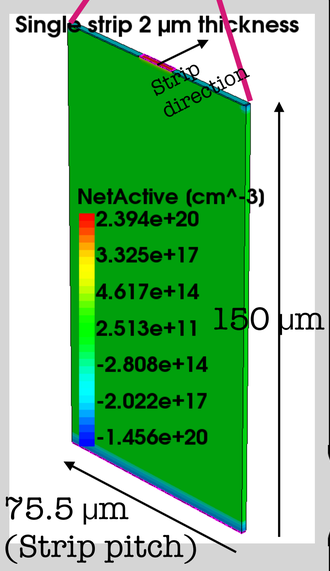

## What is stitching?

It is the connection of two reticles together. It is needed to fabricate large area detectors with CMOS technology.
-> Simulation study of stitching mismatch:




## TCAD simulations

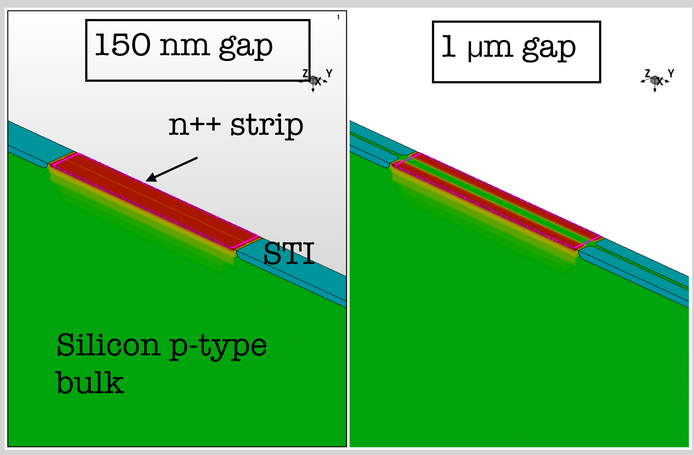
* Only separated stitching
* 2 µm long strip, 75.5 µm pitch, 150 µm thick
* Using same parameters as in Ref. [2, 4]




Synopsys TCAD [7] simulation of two possible stitching mismatched cases:

### - 150 nm stitching gap:

* Same as the fabrication process
* Gives some realistic simulation

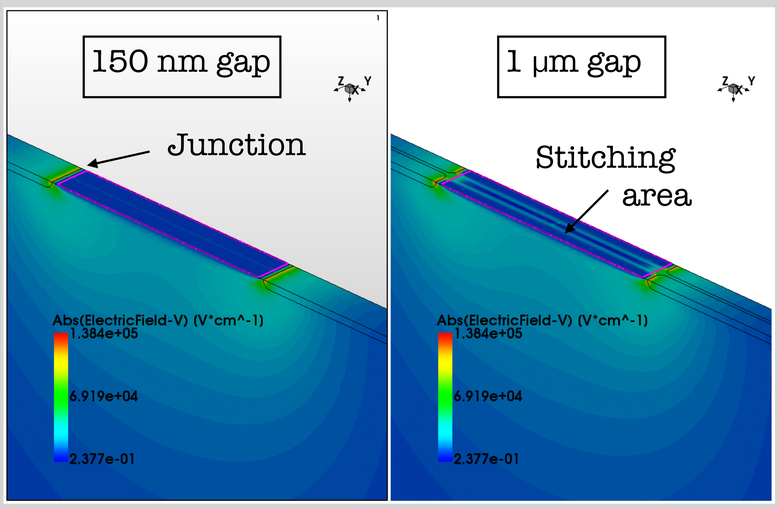



### - 1 µm stitching gap:

* NON realistic
* Gives clear details of what the stitching effects could be

## Simulation results @ 100 V

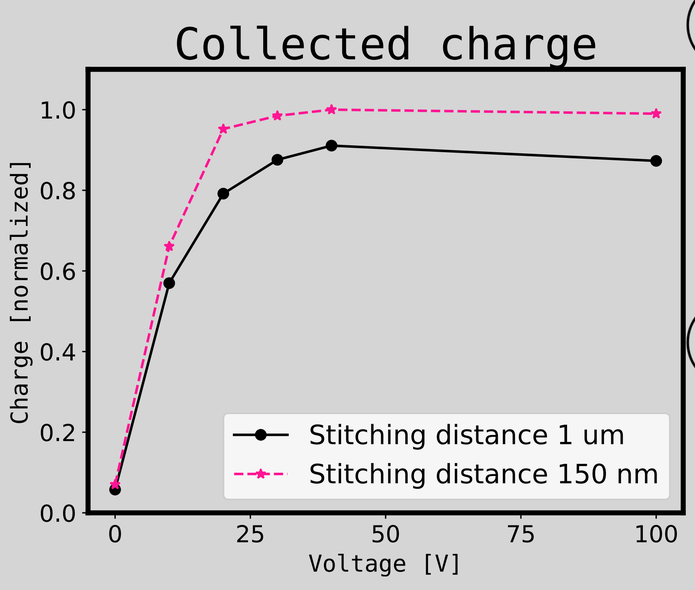
**TCAD simulation of the electric field (E)**




* Increment of E at the stitching area, but still lower than E in the junction

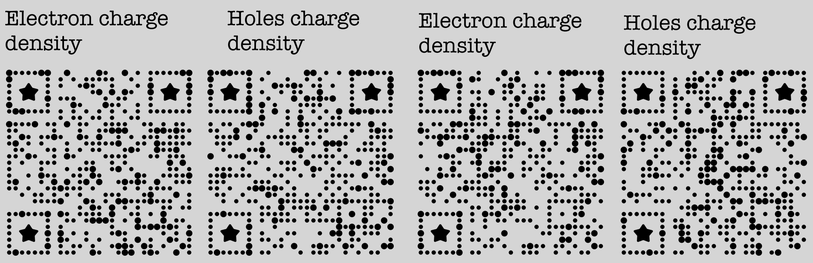
**Charge collection comparison:**

* Transient MIP
* Integration of the charge during 25 ns
* Larger stitching mismatch decreases the collected charge of the strip
* This is a 2 µm long strip simulation:
  - When scaled with longer strips the decrease of charge due to stitching is negligible




**Transient charge simulation:**

150 nm stitching gap — 1 µm stitching gap




## Conclusions

* Passive CMOS is proven to be a valid technology for fabricating large area strip detectors with stitching
* TCAD simulations show no critical impact of potential stitching mismatch
* Future projects:
  - Fabrication of active CMOS strips
  - Fabrication of passive CMOS full wafer

## Acknowledgements

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## References

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[2] NIMA 1033 (2022) 166671
[3] NIMA 1039 (2022) 167031
[4] NIMA 1061 (2024) 169132
[5] VERTEX2023, 067 (2024)
[6] NIMA 1064 (2024) 169407
[7] Synopsys Sentaurus TCAD, 675 Almanor Ave Sunnyvale, CA 94085, US, 2024


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