

Testing neutron irradiated HV-CHESS1 chip

Vitaliy Fadeyev, Zach Galloway , Herve Grabas
Alexander Grillo , Zhijun Liang , Abe Seiden
Jennifer Volk, Forest Martinez-Mckinney

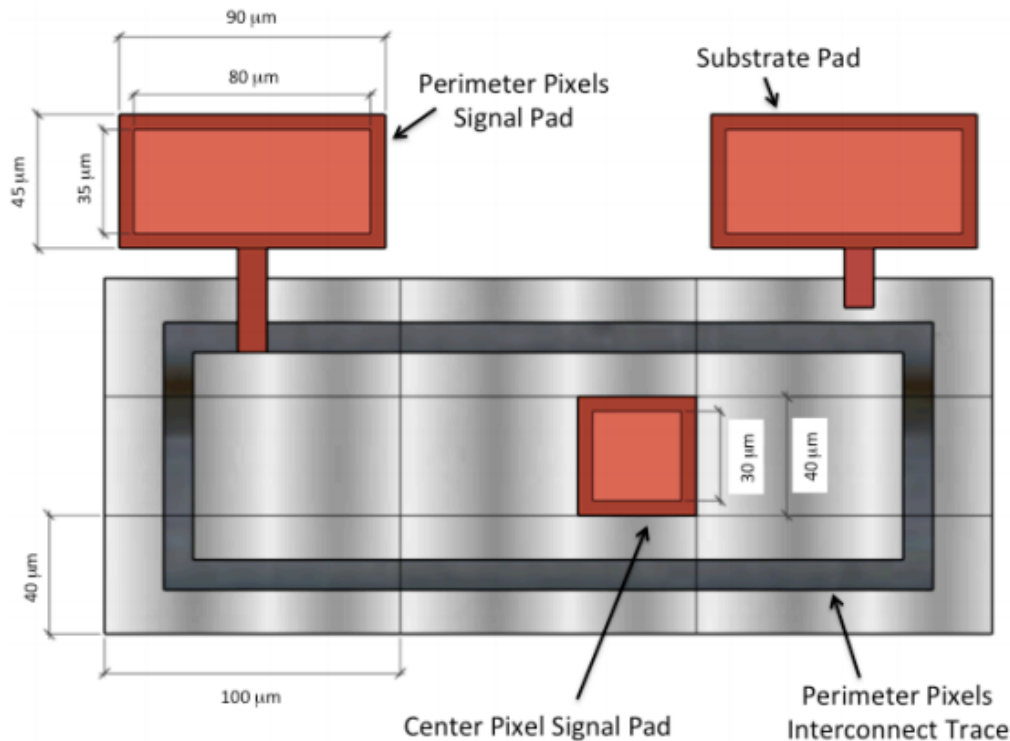
University of California, Santa Cruz

Introduction

- Irradiation
 - HV CHESS1 chips irradiated in $2E14$, $2E15$ Neq/cm² neutron beam in Ljubljana
 - Thanks Igor, Todd and Jaya John for irradiating the chip and shipping them.

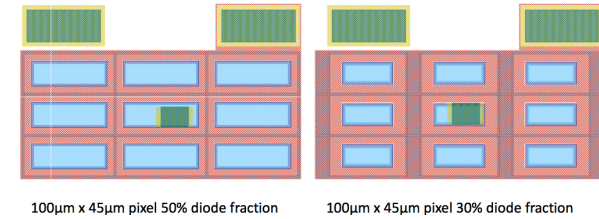
Setup for I-V measurement

- Measure I-V for central pixel



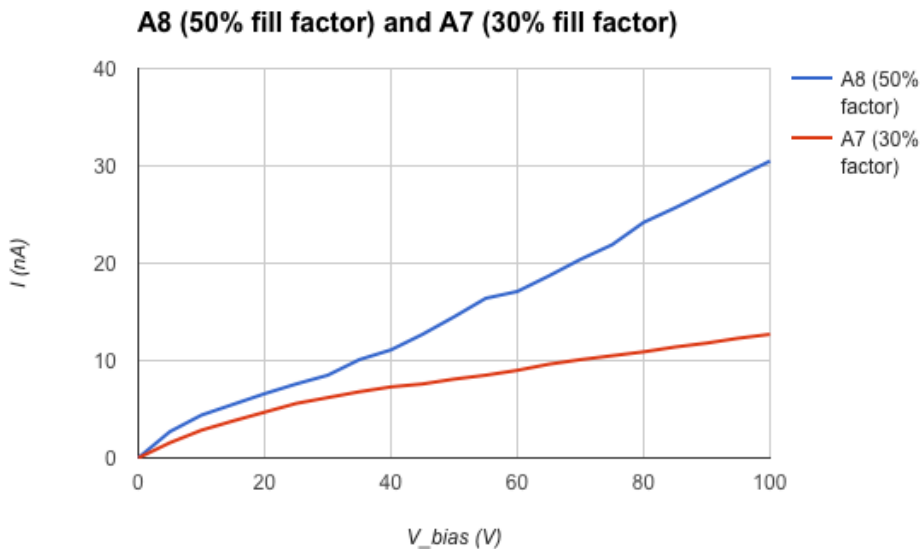
Substrate: grounded
Perimeter pixels: +HV
Central pixel: +HV

I-V

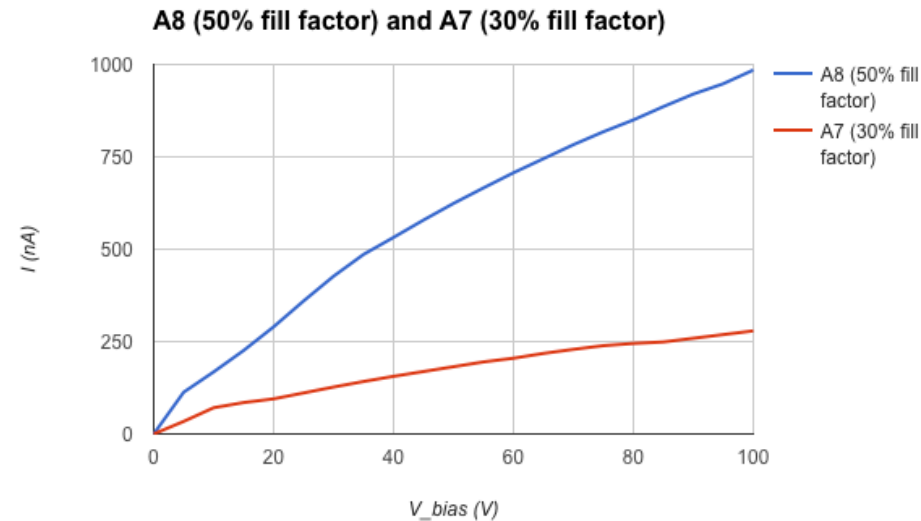


- A8: 45X800 μm 50% N-Well fill factor
- A7: 45X800 μm 30% N-Well fill factor

2E 14 irradiated



2E 15 irradiated

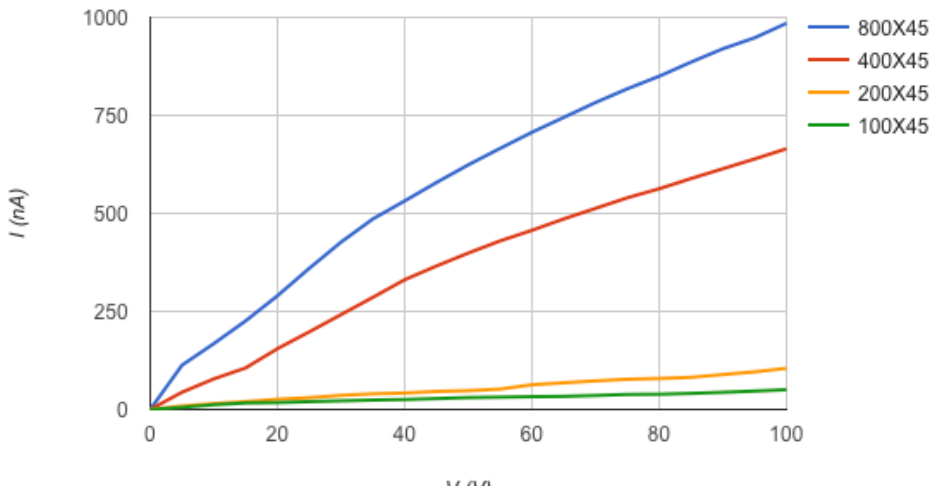


Pixel Size dependence

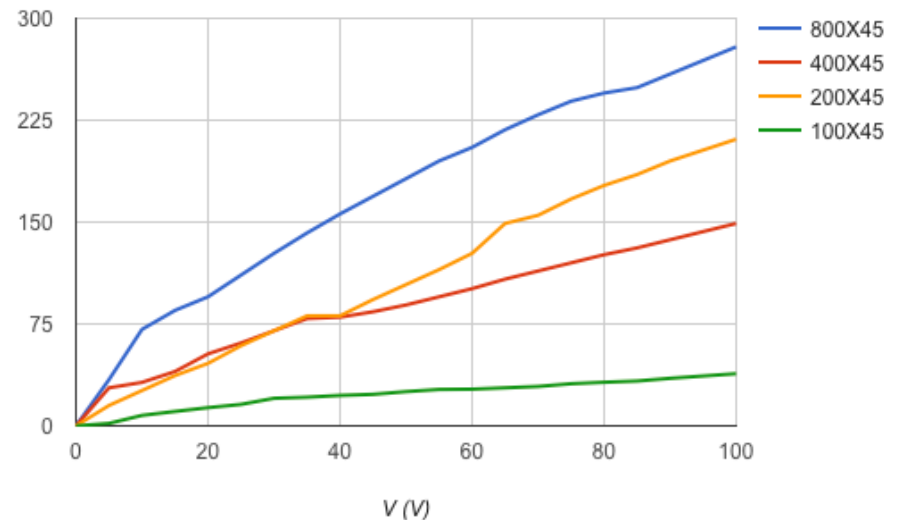
- 50% fill factor pixels show larger size dependence on leakage current.

2E 15 irradiated
50% fill factor

800X45, 400X45, 200X45 and 100X45

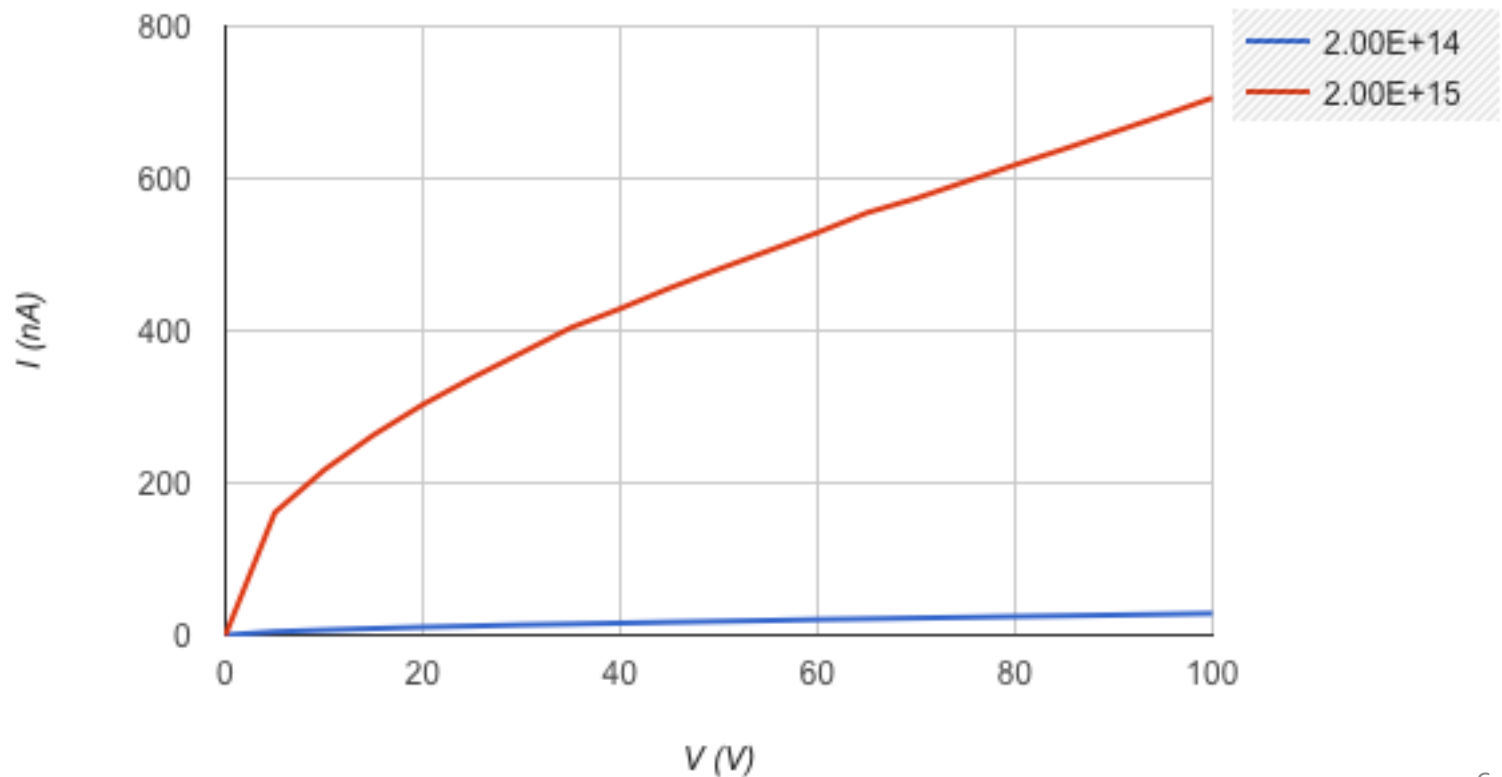


2E 15 irradiated
30% fill factor



I-V curve for Big array

- Big Array with 30% fill factor (2X2 mm²)



Power consumption for a HV-CMOS full size sensor

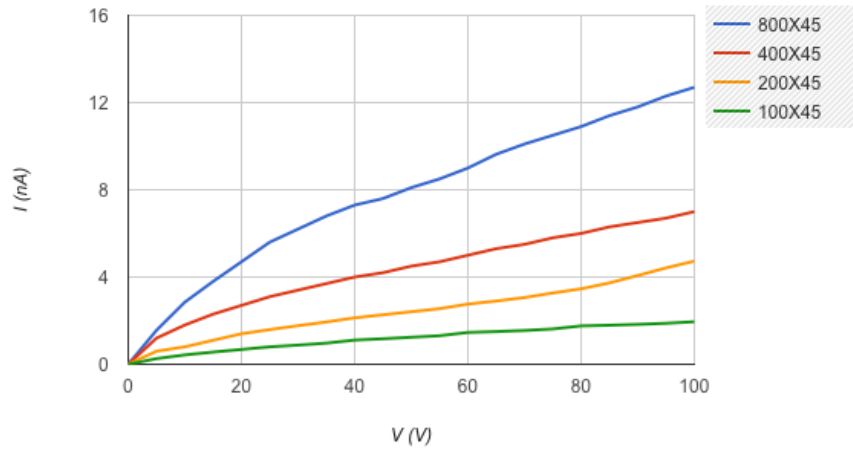
- 50% N-Well fill factor
 - Leakage current after $2E15 \text{ Neq/cm}^2$ for full size sensor: $1\mu\text{A} * 128 * 4 * 32 = 16\text{mA}$
 - Power consumption : $16\text{mA} * 120\text{V} = 1.9 \text{ Watt}$
- 30% N-Well fill factor
 - Leakage current after $2E15 \text{ Neq/cm}^2$
 $0.27\mu\text{A} * 128 * 4 * 32 = 4.4\text{mA}$
 - Power consumption : $4.4\text{mA} * 120\text{V} = 0.53 \text{ Watt}$

Summary

- I-V Performance in neutron irradiated HV-CHESS1
- Leakage current in passive pixel with 50% N-Well fill factor is higher than 30% one.
- Estimated Power consumption for full size sensor:
 - 0.5 Watt for 30% fill factor pixel
 - About 2Watt for 50% fill factor pixel
 - The requirement from cooling should less than 2 Watt

Pixel Size dependence

2E 14 irradiated
50% fill factor



2E 14 irradiated
30% fill factor

