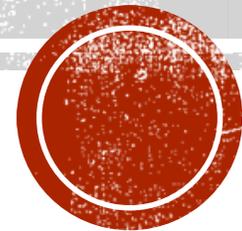


N-IN-N SENSOR GEOMETRY

R. Bradford

3 February, 2016



OVERVIEW

- BNL offered to share 4" wafer. We purchased $\frac{1}{4}$ of the wafer with the remainder being used for silicon drift detectors for Maia. 4 wafers will be fabricated with 2 different resistivities:
 - n<100> n-type silicon
 - 5 k Ω and 10 k Ω (2 wafers of each type)
 - 500 μm -thick
- Fabrication began last spring
- Completion date has slipped twice due to equipment failures at BNL
 - Expecting devices in May
 - We'll go to BNL to do initial testing/characterization.

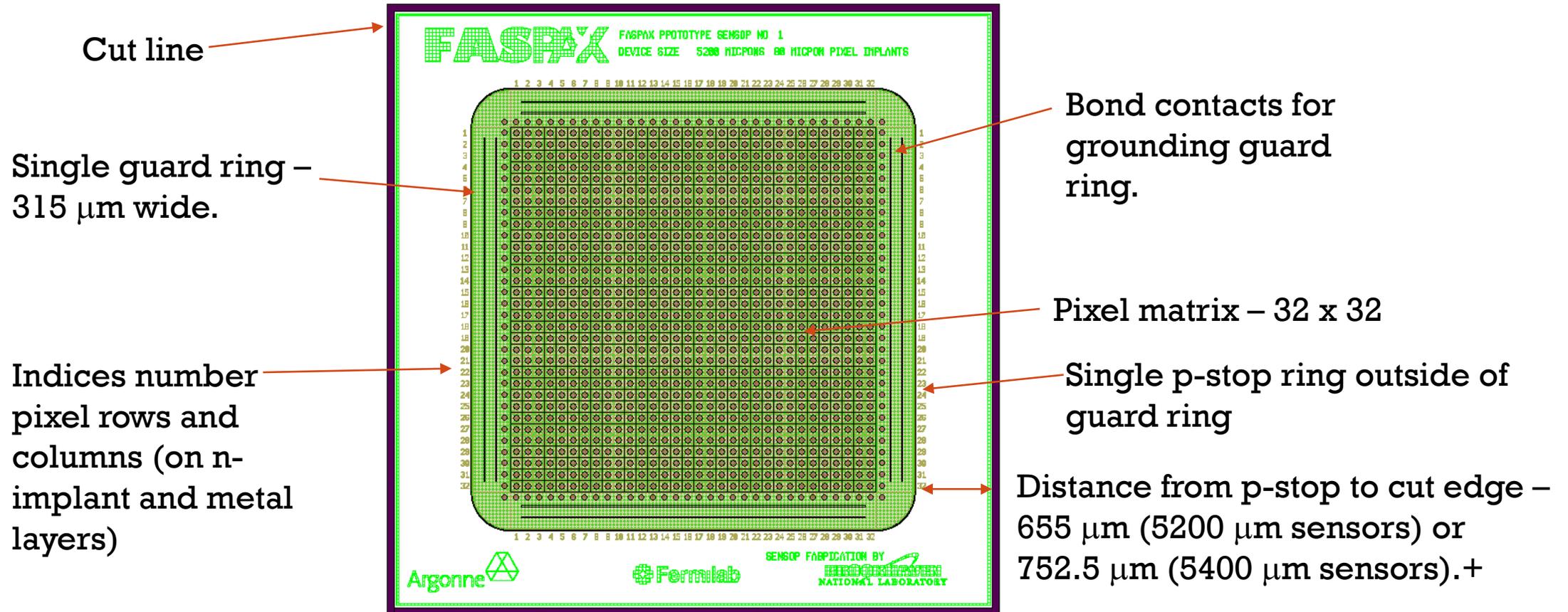


DEVICE OVERVIEW

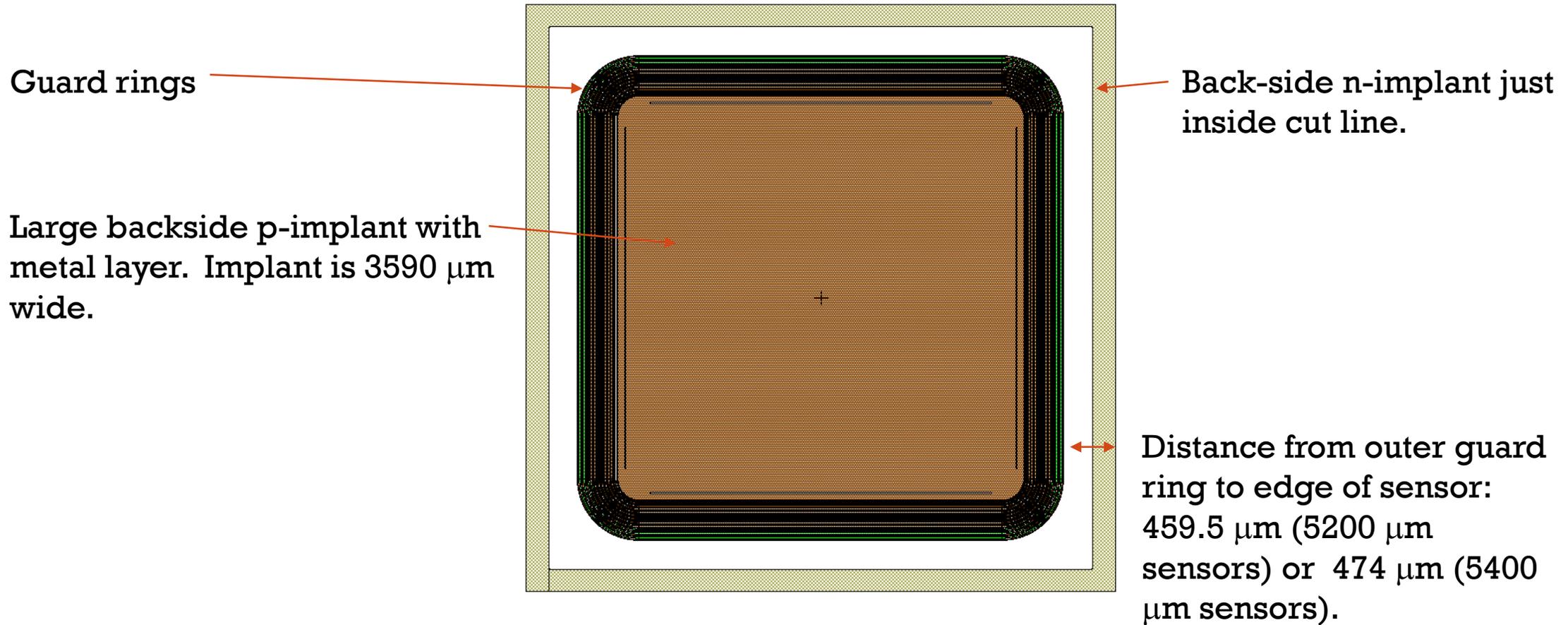
Device #	Overall Size (μm)	Implant Size (μm)	Notes
1	5200	80	11 standard guard rings
2	5200	54	11 standard guard rings
3	5200	Varied	Test sensor with varied pixel structure and 11 standard guard rings.
4	5200	Varied	Test sensor with varied pixel structure and 7 wider guard rings.
5	5400	80	13 standard guard rings
6	5400	54	13 standard guard rings



DEVICE OVERVIEW - FRONT



DEVICE OVERVIEW - BACK



DETAIL: STANDARD GUARD RINGS



Gap between guard rings = $(n * 1.5 + 11.5) \mu\text{m}$

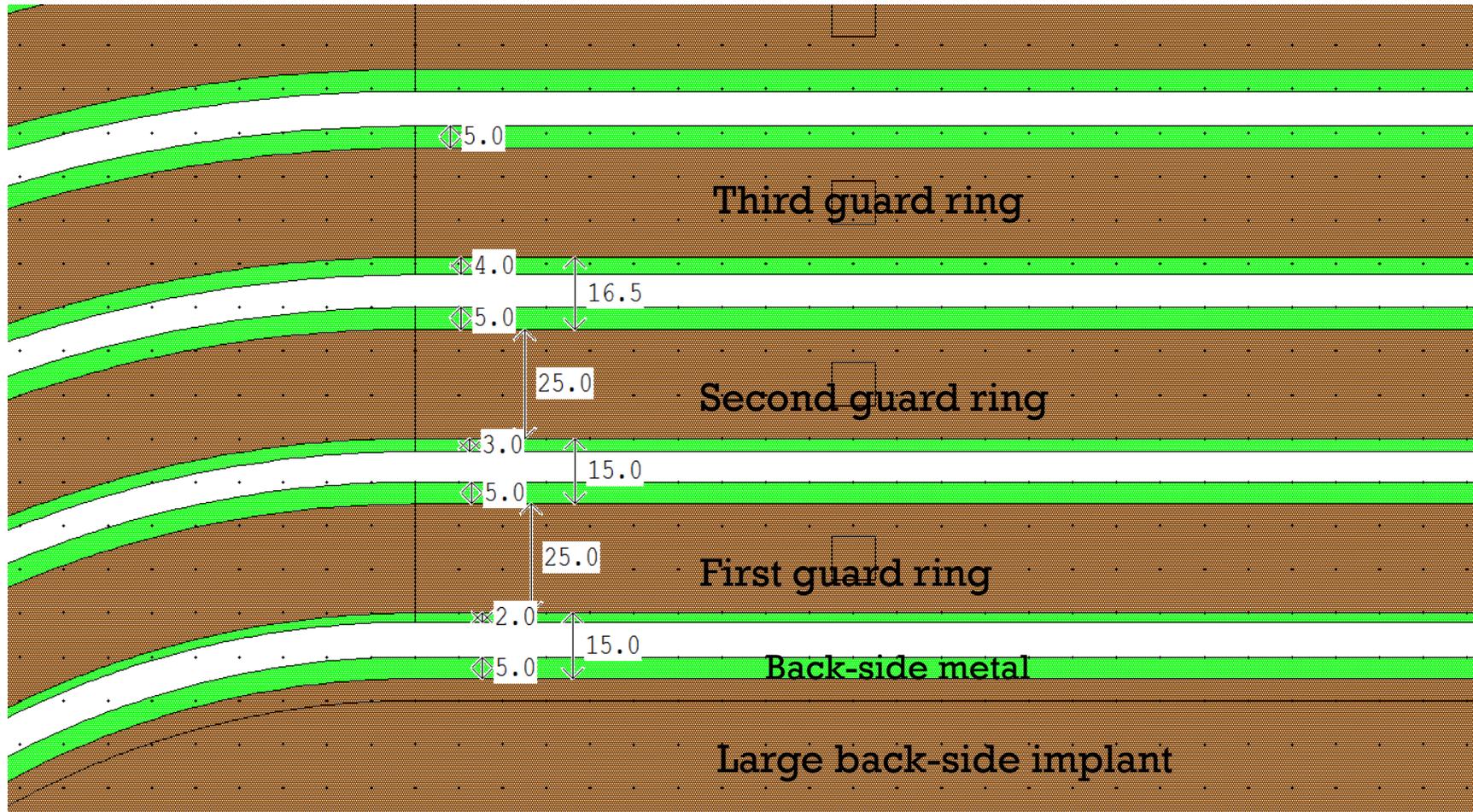
Metal away from pixels: 5 μm (constant)

Metal toward pixels = $(n + 1.0) \mu\text{m}$

P-implants: 12 μm (constant)



DETAIL: WIDE GUARD RINGS



Implants are a constant 25 μm .

Gaps increase at a rate of 1.5 μm /guard ring.

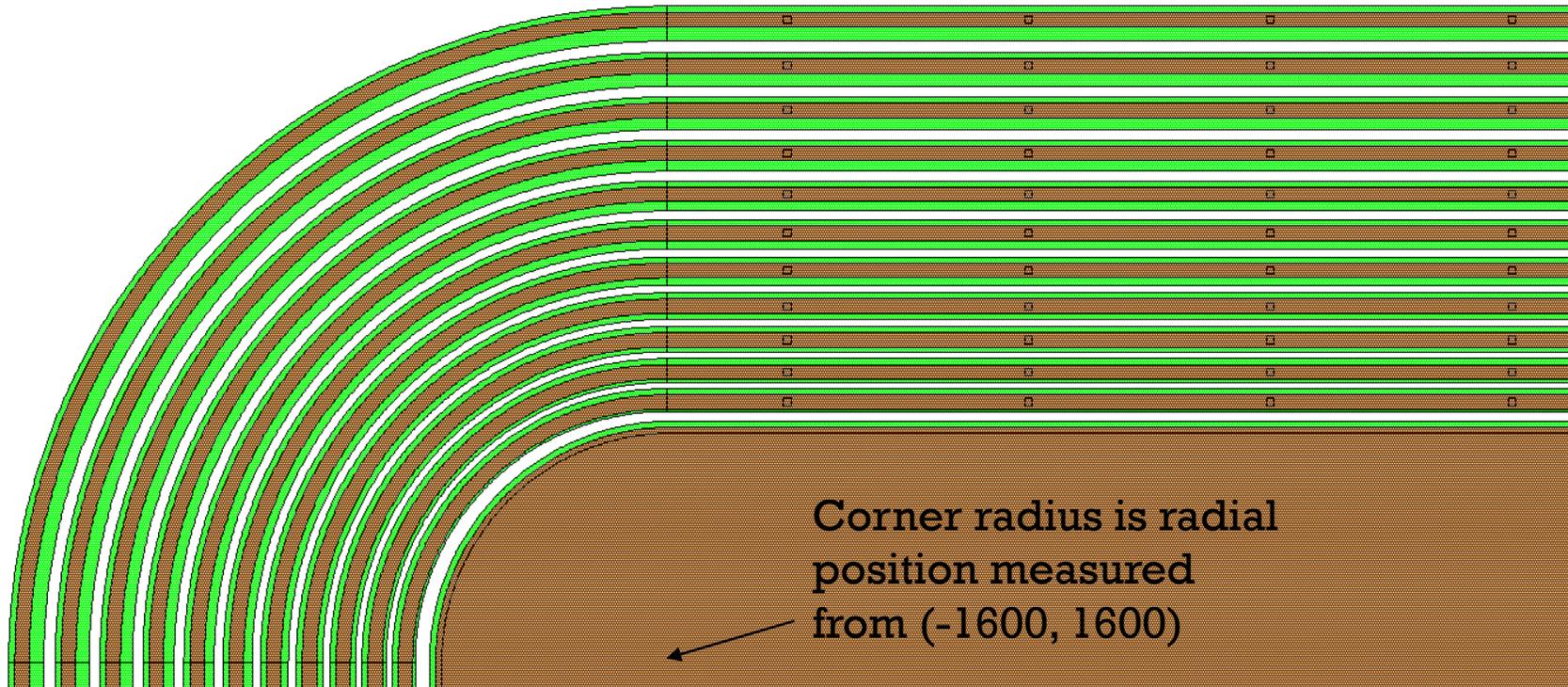
Metal overhang toward pixels grows by 1.0 μm /guard ring.

Metal overhang away from pixels is a constant 5 μm .

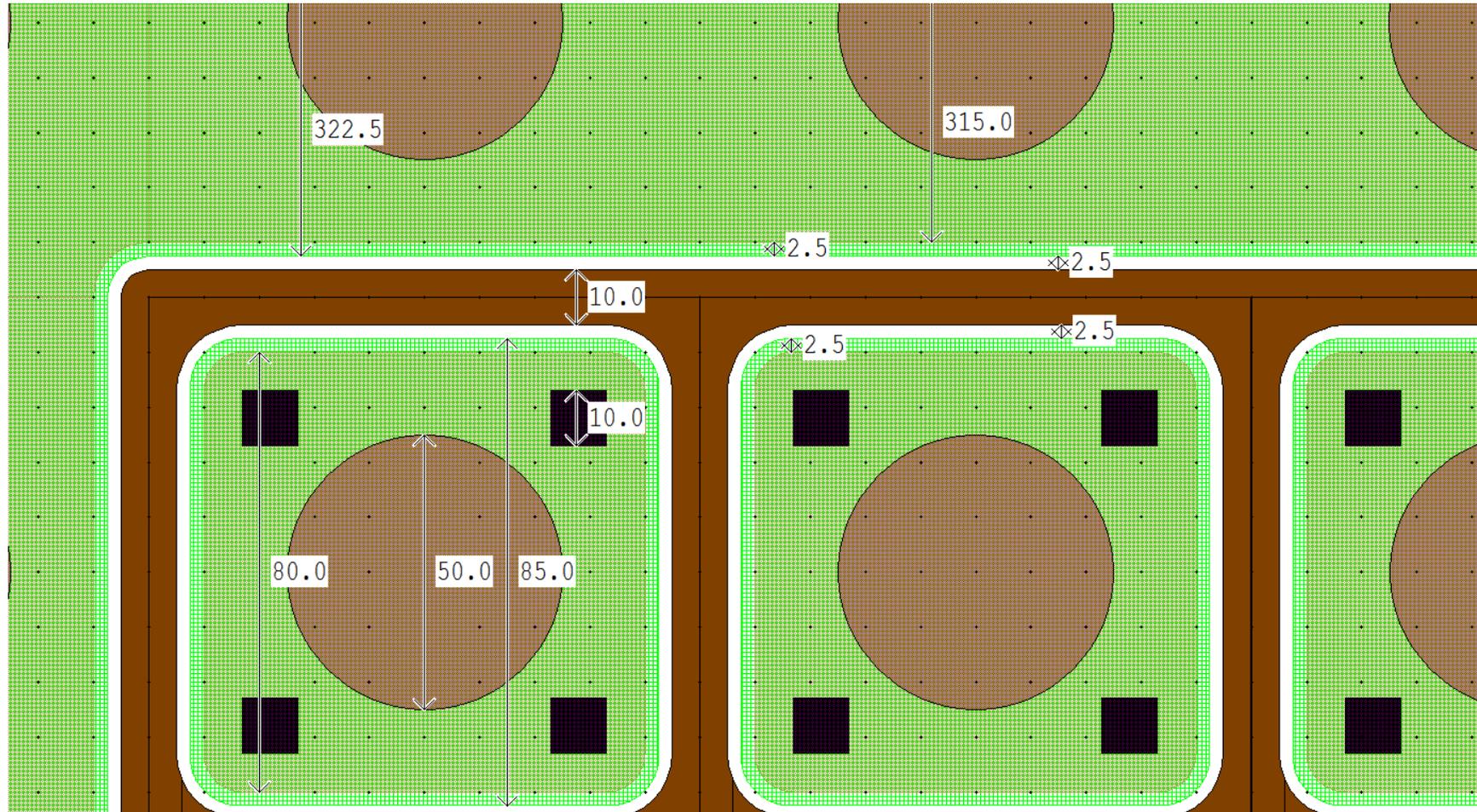


CORNER DETAIL

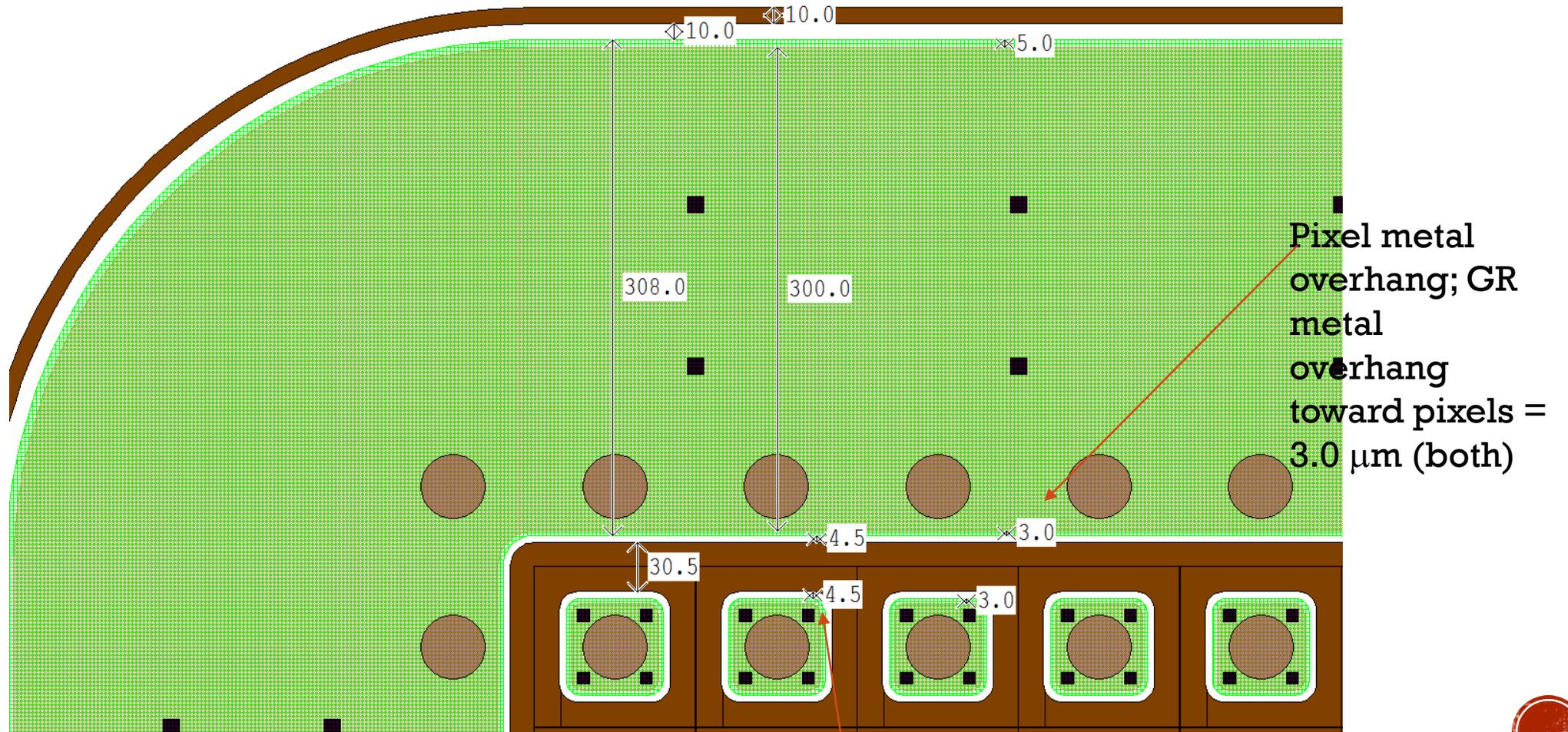
Note: 11 guard rings for 5200 μm sensors;
13 guard rings for 5400 μm sensors.



DETAIL: 80 μM PIXELS



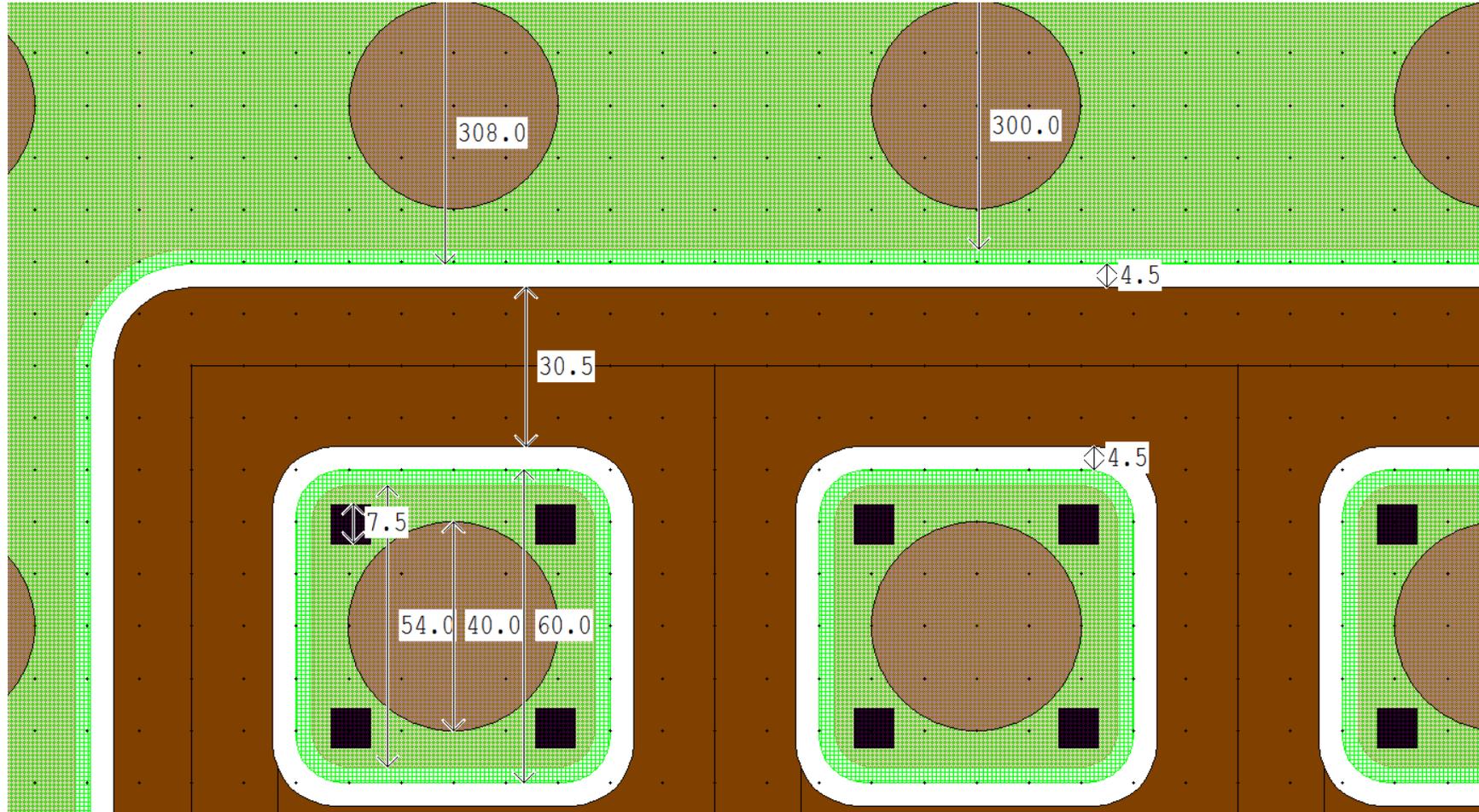
DETAIL: FRONT GUARD RING, 54 μM PIXELS



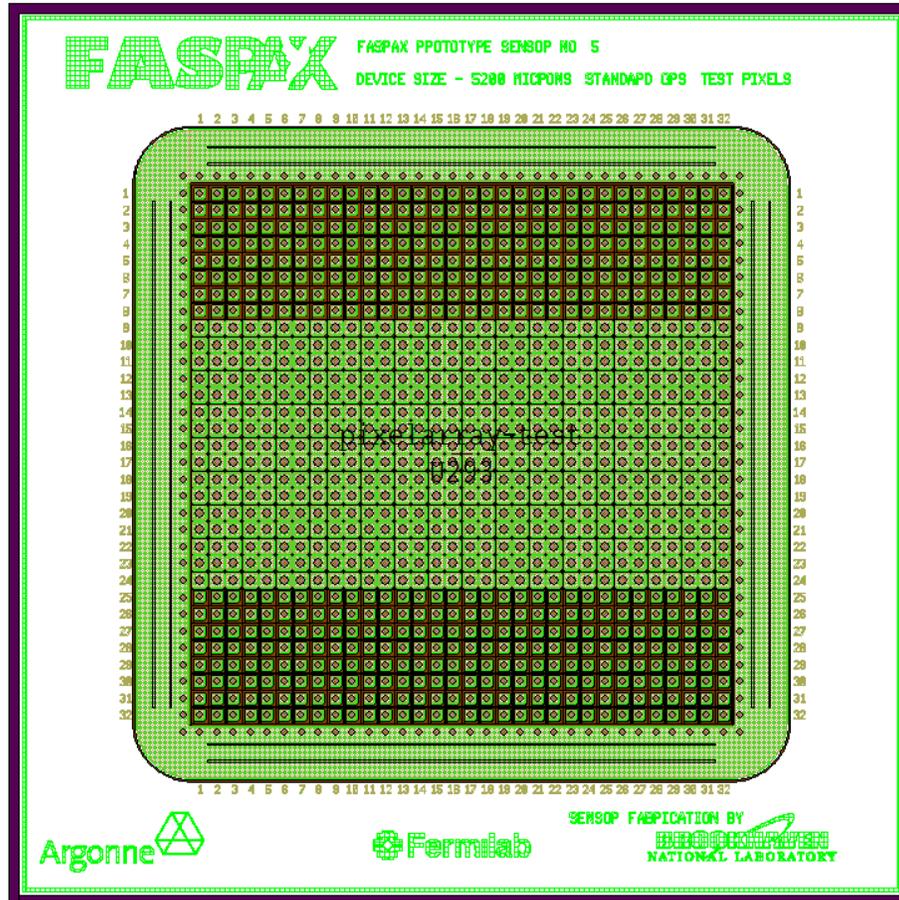
Gap between pixel metal and p-stop = 4.5 μm



DETAIL: 54 μM PIXELS



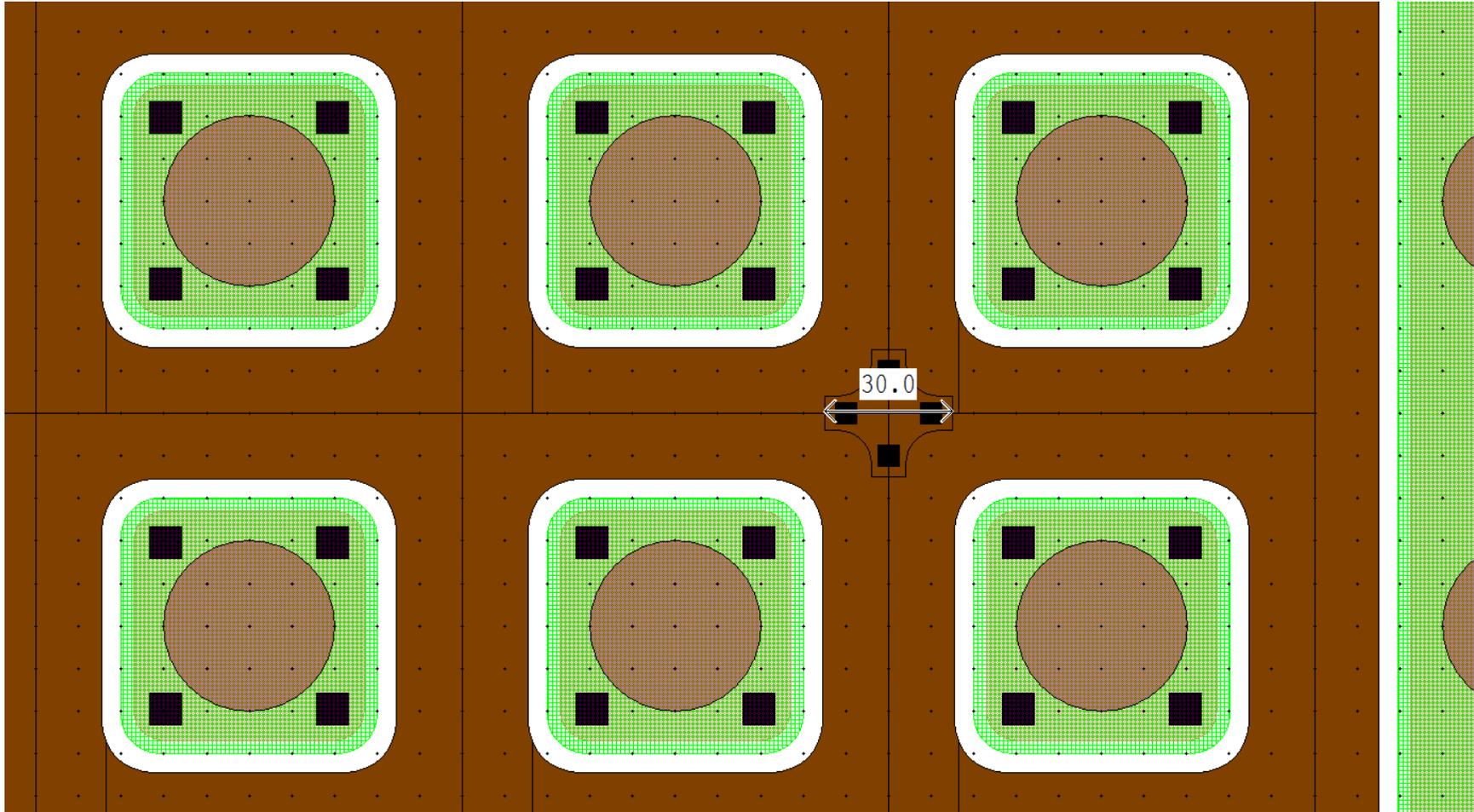
FYI: TEST PIXEL ARRAYS



Two designs incorporate “test pixels” where the inner pixel array has been divided into ~8 sub-groups with varied parameters. Varied implant size, p-stop width, gap between p-stop and pixel implant, etc.



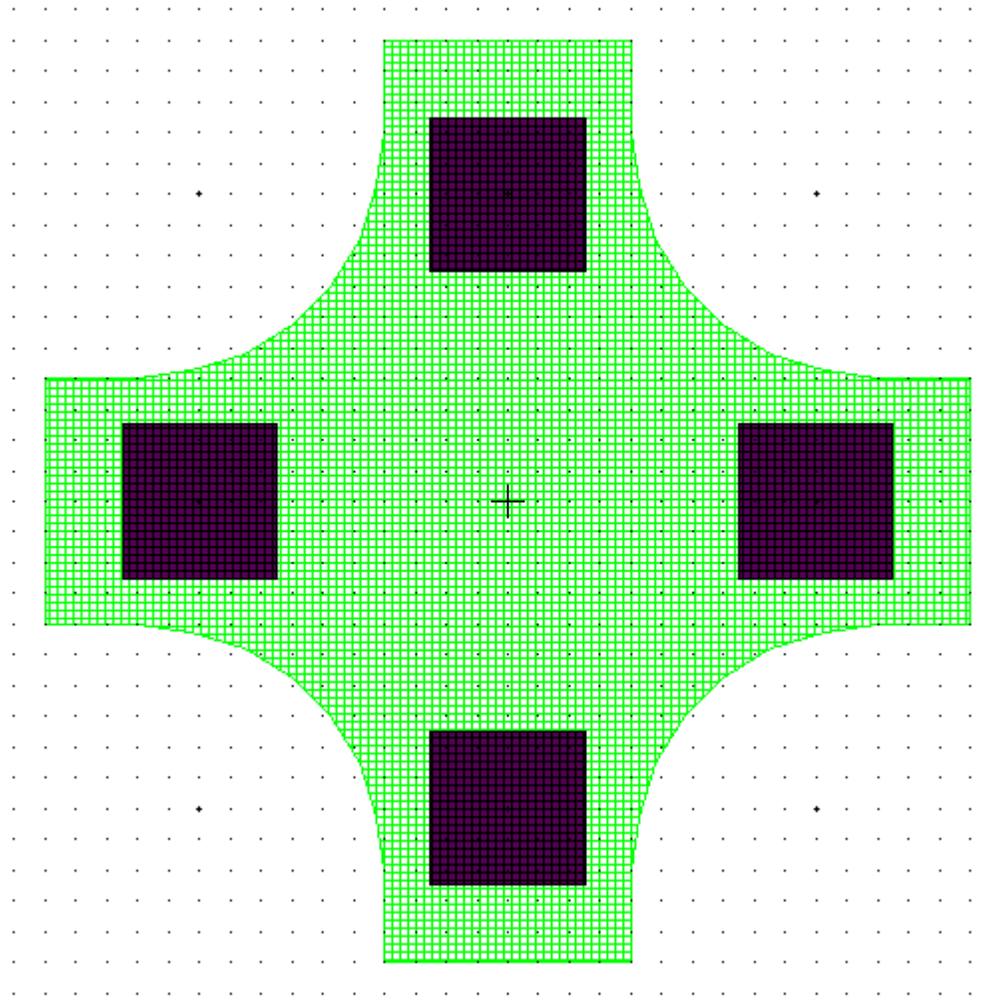
FYI: P-STOP CONTACTS



Subset of sensors have probe contacts on p-stop. Idea was suggested by BNL as a possible means of testing the sensors from one side by biasing the p-stop. Nobody was sure it would work, but we put these on a few of the sensors.



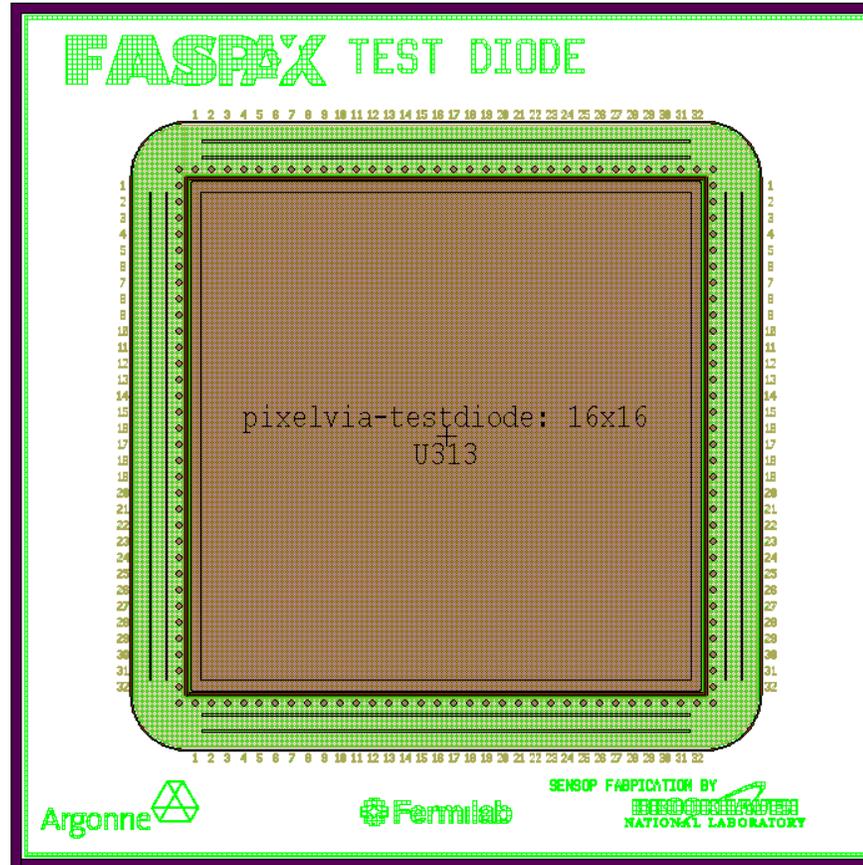
DETAIL: P-STOP CONTACTS



Same layer structure as bump bonding contacts – metal (green) with vias (purple) to contact the p-stop implant. There are also openings in passivation and vias layers, which are not shown at left. This structure was specified by BNL for bond openings.



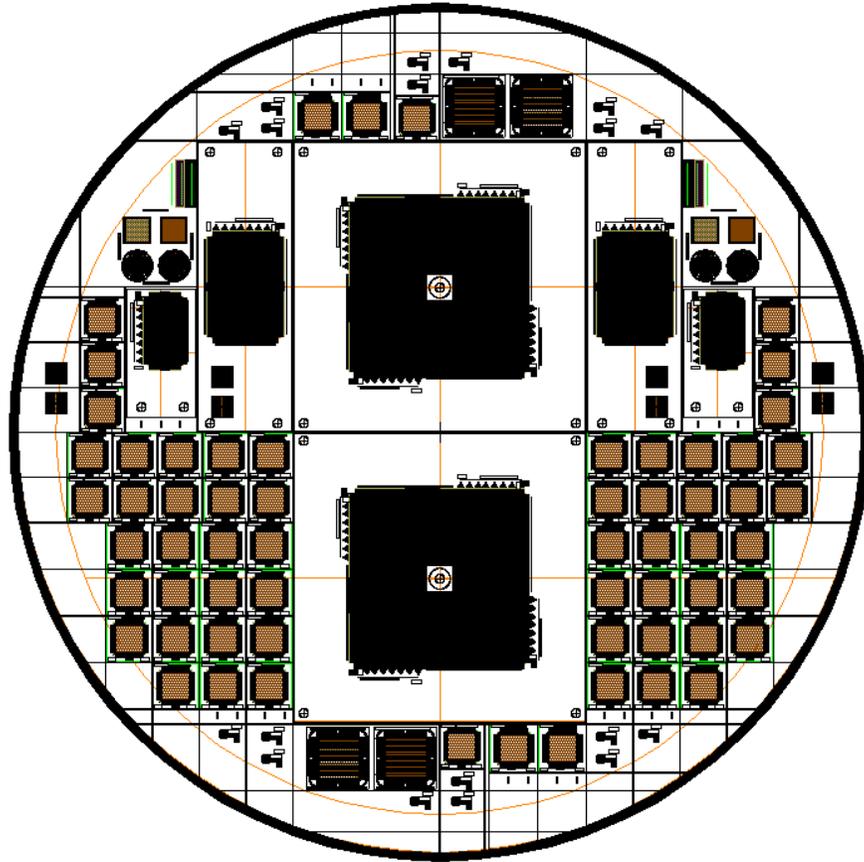
FYI: TEST DIODE



Single diode with same dimensions as typical sensor. Periphery is also similar.



FYI. WAFER LAYOUT



62 devices on each wafer.



FYI: DEVICE BREAKDOWN OF WAFER LAYOUT

Sensor Number	Notes	Number of Devices
1	5200 μm , 80 μm pixels, 11 guard rings	14
2	5200 μm , 54 μm pixels, 11 guard rings	14
3	5200 μm , varied pixels, 11 guard rings	3
4	5200 μm , varied pixels, 7 wide guard rings	3
5	5400 μm , 80 μm pixels, 13 guard rings	14
6	5400 μm , 54 μm pixels, 13 guard rings	13
Test Diode	5200 μm , single diode	1

