GGNMOS Mesh and Sdevice TCAD Sim.

Lab4

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ABSTRACT:

In this lab, we applied the same meshing strategies used in lab 2, except with the GGNMOS device from lab 3. Files “nmos_bnd.tdr” and “nmos_fps.tdr” from lab 3 must be copied to the new lab folder along with GGNMOS in order to get the correct build mesh. Sentaurus Structure Editor provides the 2D GGNMOS device structure, then build mesh is applied to the same structure and, yet again, shown in a separate Sentaurus window where all mesh boxes must be checked. We also implemented the streamlines again, this time for GGNMOS, which represent the diode current flow. The electrical and thermal characteristics of GGNMOS are simulated under the condition of HBM(human body model) standard 2KV pulse, where the streamlines and same 2D graphs, from lab 2, are utilized. Implemented ‘svisual’ and ‘inspect’ to provide the 2D images (current density and temperature distribution) or the graphs (I vs. V and Tmax vs. time).

Commands:

1. bender /home/cemaj/zhill $ mkdir Lab4

2. bender /home/cemaj/zhill $ cd Lab4

3, bender /home/cemaj/zhill/Lab3 $ cp nmos_bnd.tdr ../Lab4

4. bender /home/cemaj/zhill/Lab3 $ cp nmos_fps.tdr ../Lab4

5. bender /home/cemaj/zhill $ sde -l m3d.jrl -noopenGL

6. bender /home/cemaj/zhill/Lab4 $ sdevice hbm_for_ggnmos18.cmd &

7. bender /home/cemaj/zhill/Lab4 $ sdevice &

8. bender /home/cemaj/zhill/Lab4 $ inspect &

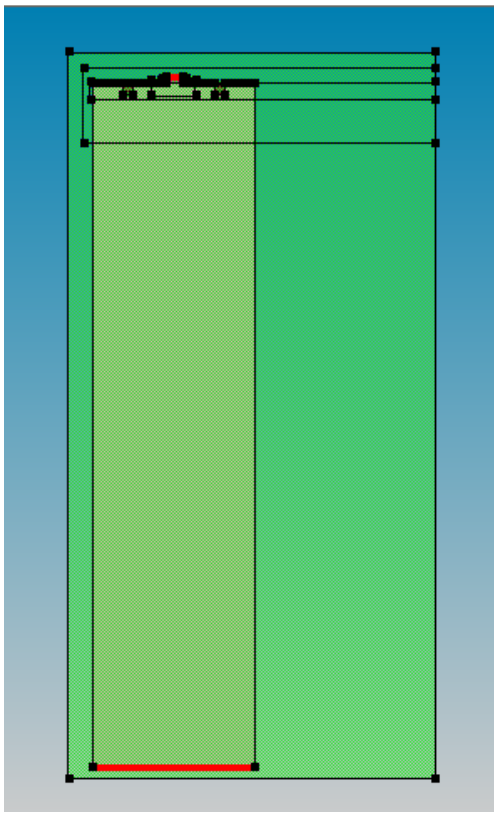
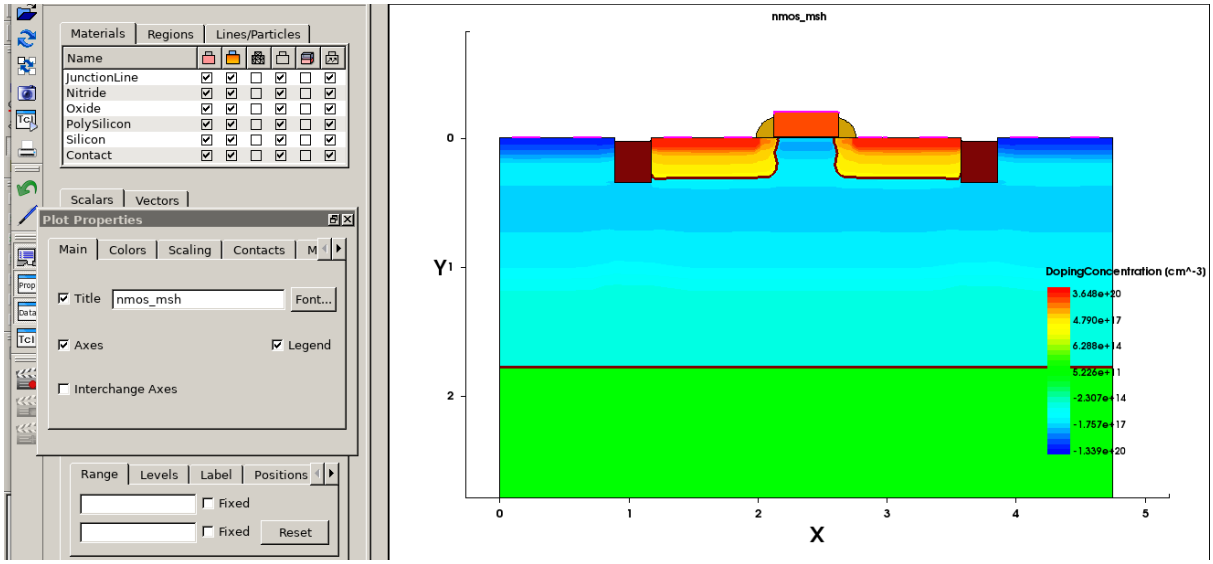
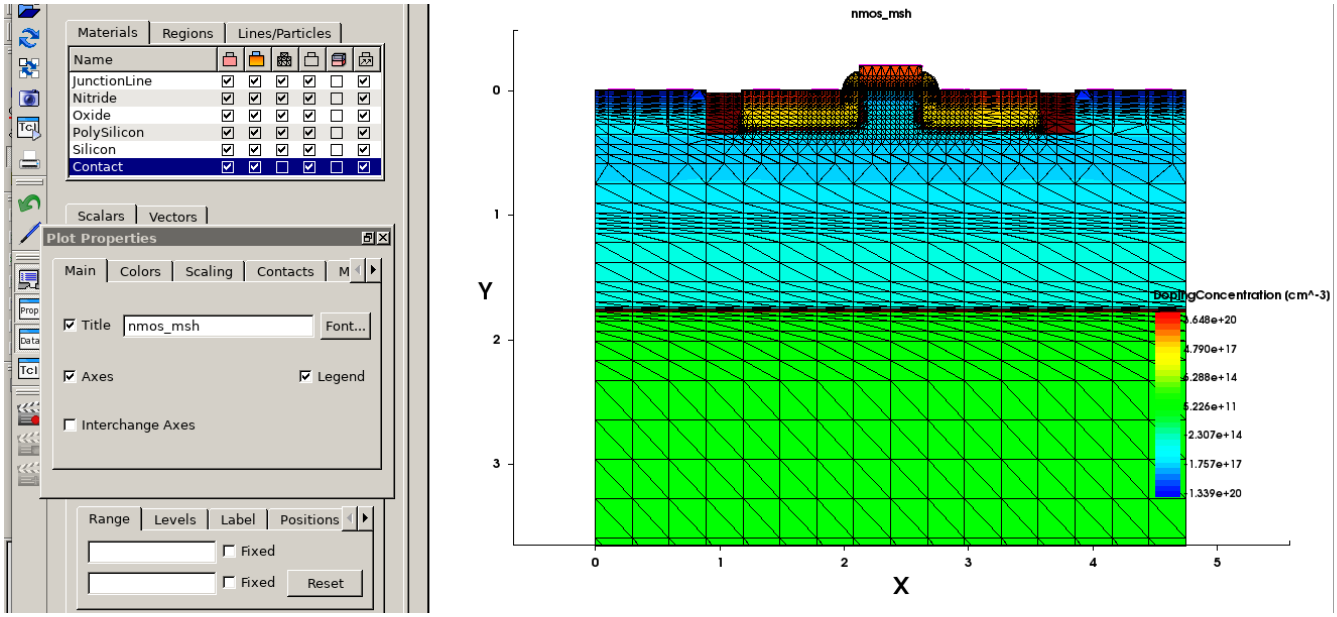


Figure 1: GGNMOS Device Structure

There are still two green layers on top of one another but, unlike in lab 2, the lighter green area is shifted to the left. Plus, some black dots and lines are connected differently such as the large rectangle in the middle rather than at both ends, where there are smaller boxes.



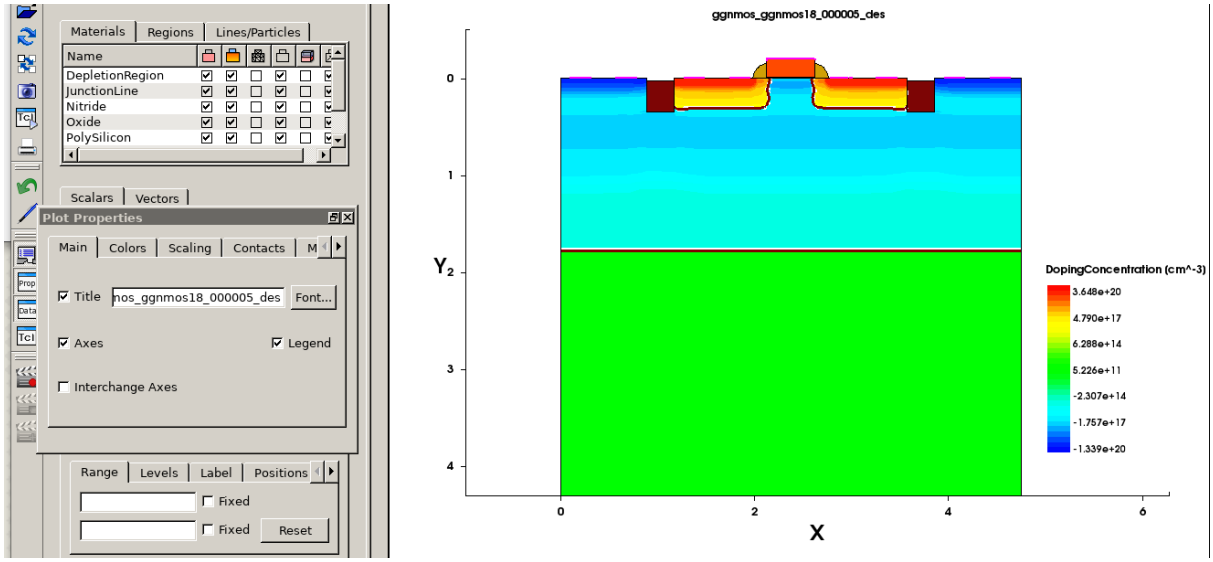
(a) all mesh boxes not checked



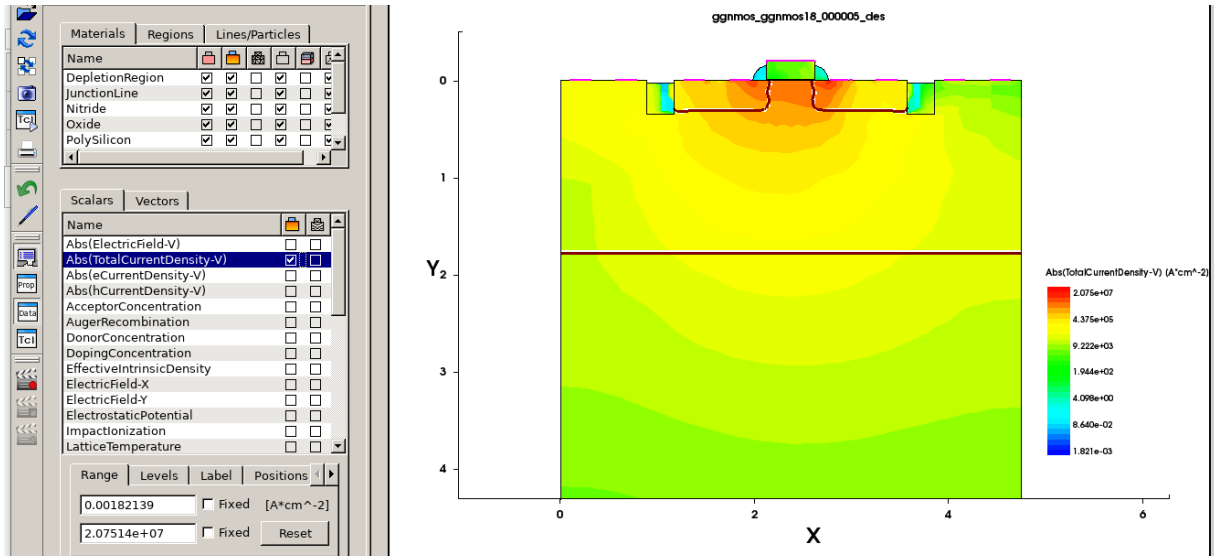
(b) all mesh boxes checked

Figure 2: GGNMOS Build Mesh

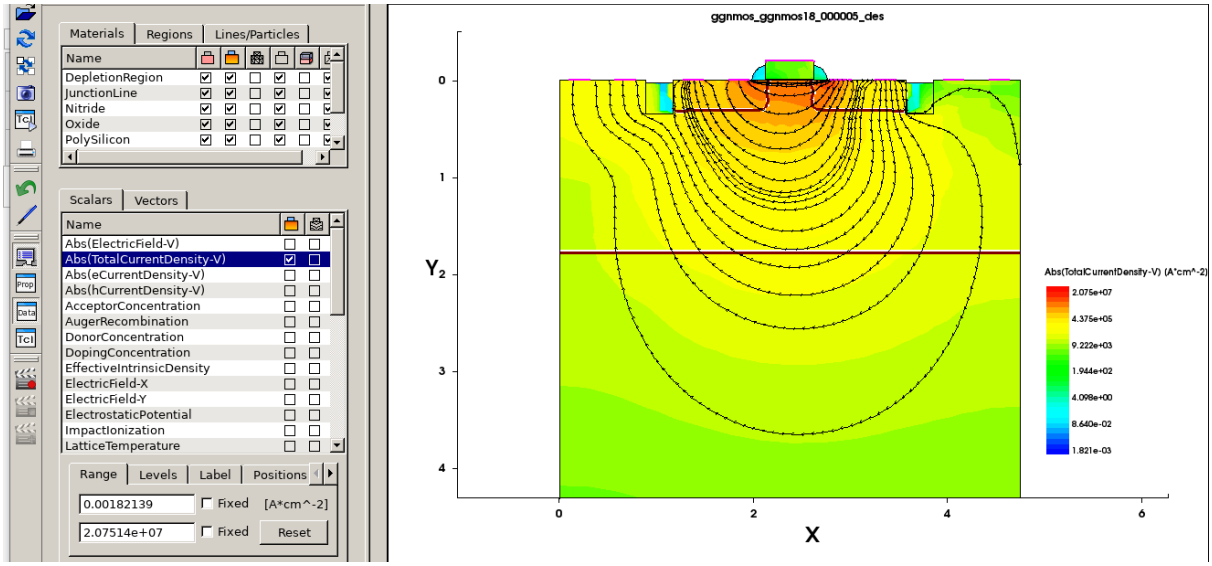
The upper region has less concentration than the lower but the contact points still remain the highest. Smaller mesh boxes are shown in each contact spot while those in the other regions appear bigger.



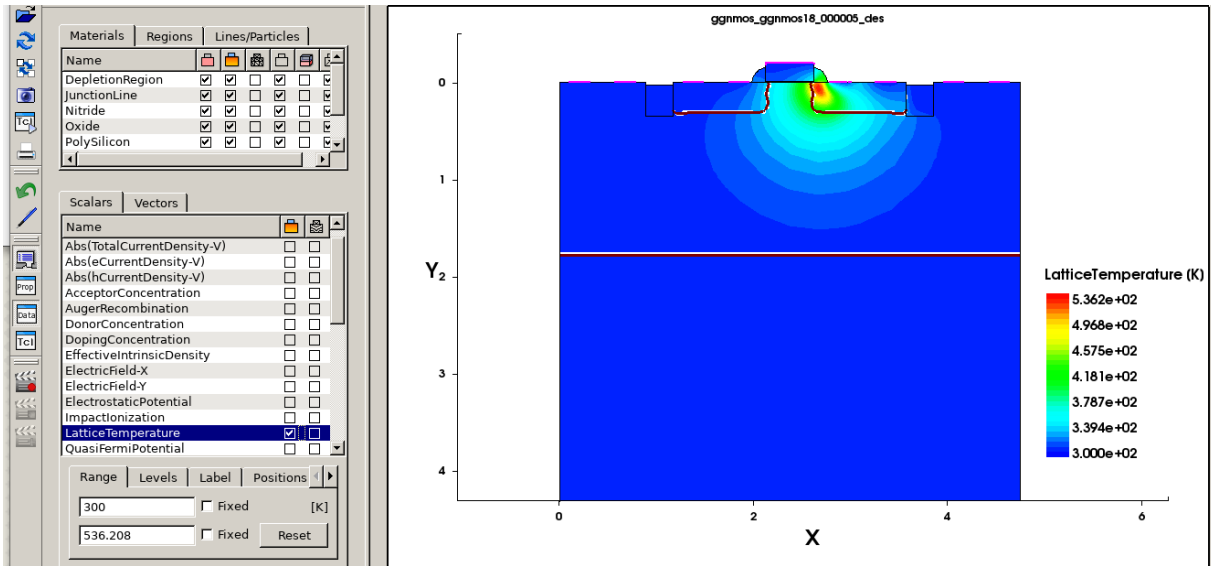
(a) Basis GGNMOS simulation



(b) I-V 2D simulation



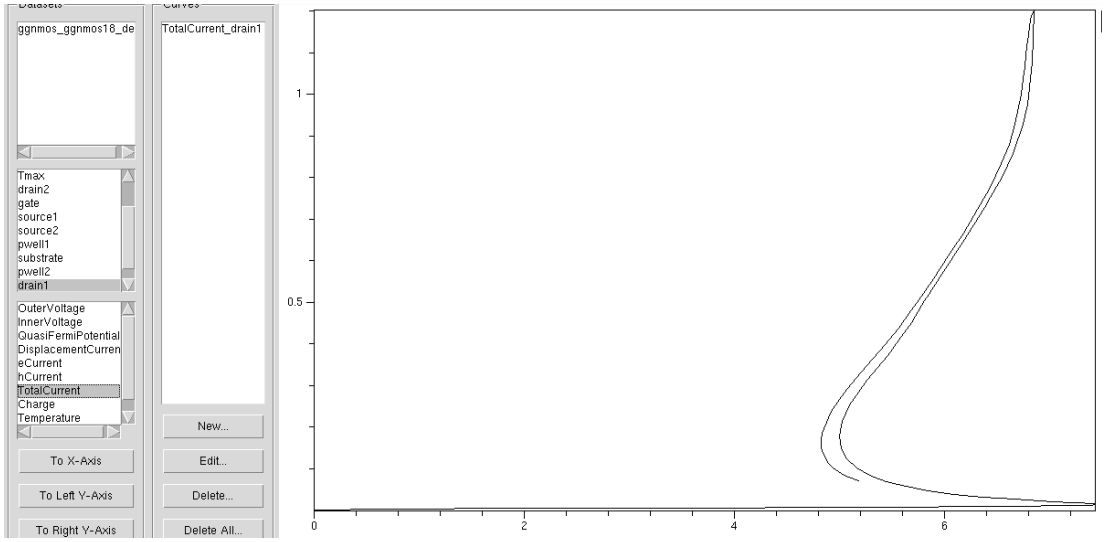
(c) Streamlining in I-V 2D simulation



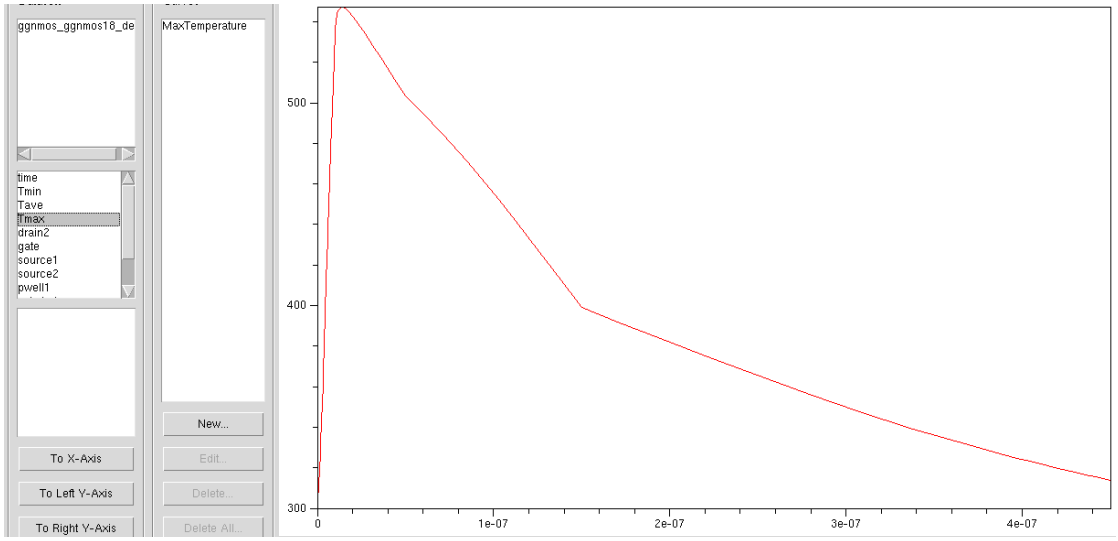
(d) Lattice Temperature 2D simulation

Figure 3: HBM GGNMOS simulation results on 10ns

After implementing the I-V simulation, Figure 3(b), each region becomes more concentrated, especially as we get closer to the middle of the source and drain but there are a few darker spots within these contacts, blue within the STLs, and less concentration is shown in the upper right corner. The streamlines move a bit more fluently than in lab 2, they curve to the left in the warmer sections but begin to curve right in the lower regions. With the contacts rearranged, the sides of each streamline that concave out now concave in. Almost the entire structure is dark blue when the lattice temperature is shown, Figure 3(d), except when we approach the drainage point where the hot spot is right under the spacer connected to the drain.



(a) TotalCurrent vs. OuterVoltage (drain1)



(b) Temperature (Tmax) vs. time

Figure 4: HBM GGNMOS simulation curve results

In Figure 4(a), the line constantly proceeds diagonally until X ~ 6.8 where it begins to move in the opposite direction then eventually curves, as expected, in the opposite direction and reaches the peak (Y = 1.2). Once the max peak is reached, we begin to see a similar curve as the line continues downward until X ~ 4.6 just below Y = 0.2. Now looking at Figure 4(b), the line constantly moves vertically until Y ~ 550 where the second portion of the graph shows straighter lines. There are four different lines in the second portion revealing the temperatures in which the rate of change begins to increase, since less steeper slopes mean the temperatures are obtained at shorter time intervals.