Introduction to Sentaurus

ECE 335F, 2015

University of Toronto

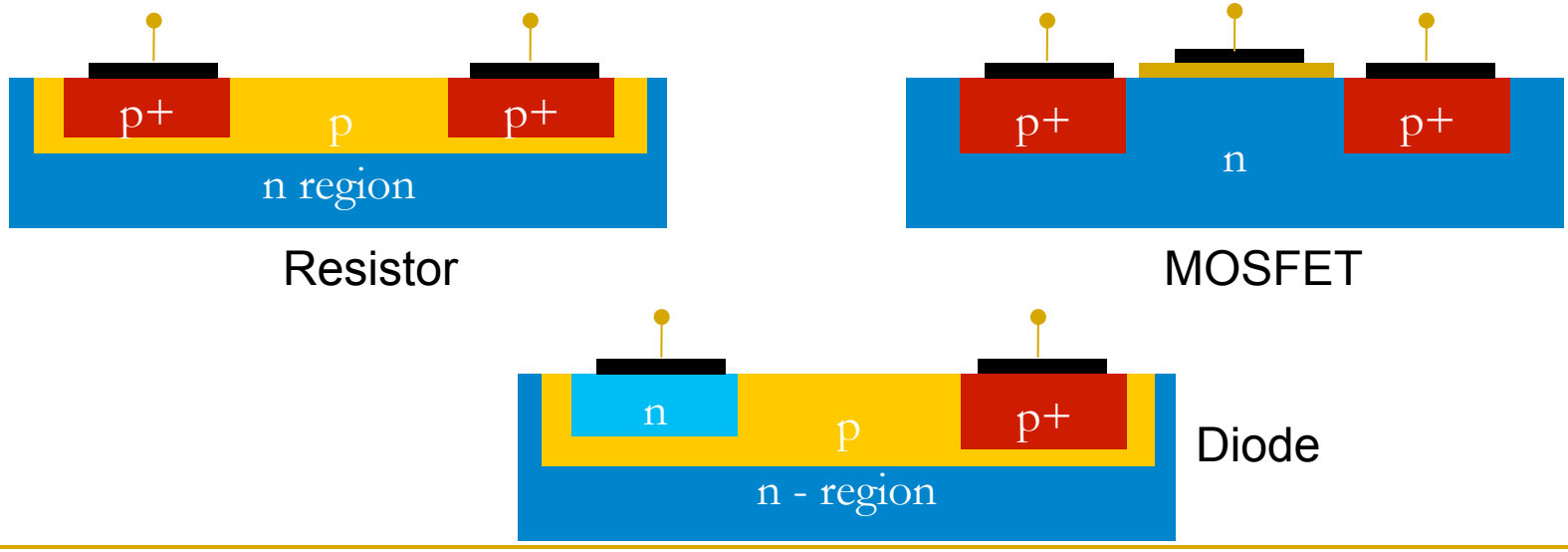
Modified from a version created by Z. R. Chowdhury

Outline

- What to simulate?
- How to simulate?
  - Main interface
  - Tools to use
  - Observe the results

What to Simulate?

- Electronic devices like
  - Resistors
  - Diodes (Project 1)
  - MOSFETs (Project 2)
- Photonic devices can also be simulated

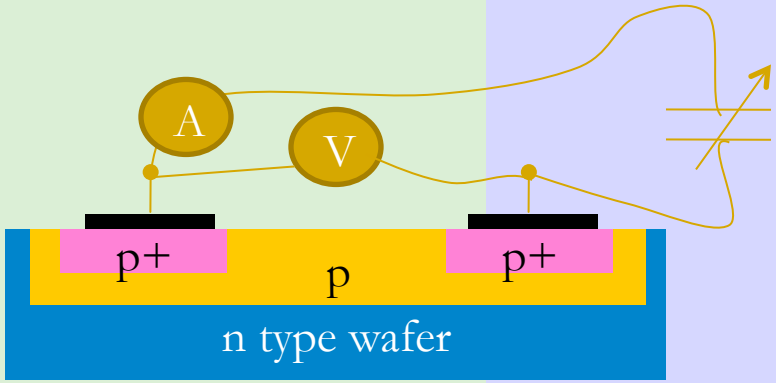


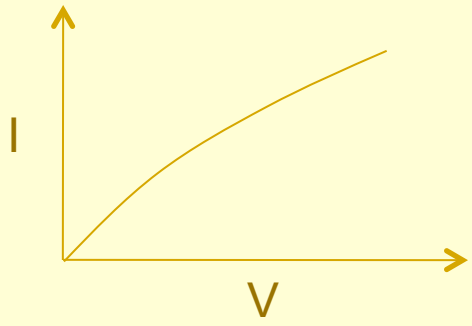
How to test a real device

Fabricate the device
- Start with a wafer
- Implant dopants
- Place electrodes

Test the device

Plot the performance





Sentaurus WorkBench

In terms of Sentaurus

Sentuarus Structure Editor

Sentuarus Device

Inspect
- To plot Curve

Sentaurus Visual
- To plot profile (2D/1D)

How to Simulate

- Many software available for electronic device simulation
- Sentaurus from Synopsys® is a very powerful and industry-standard software

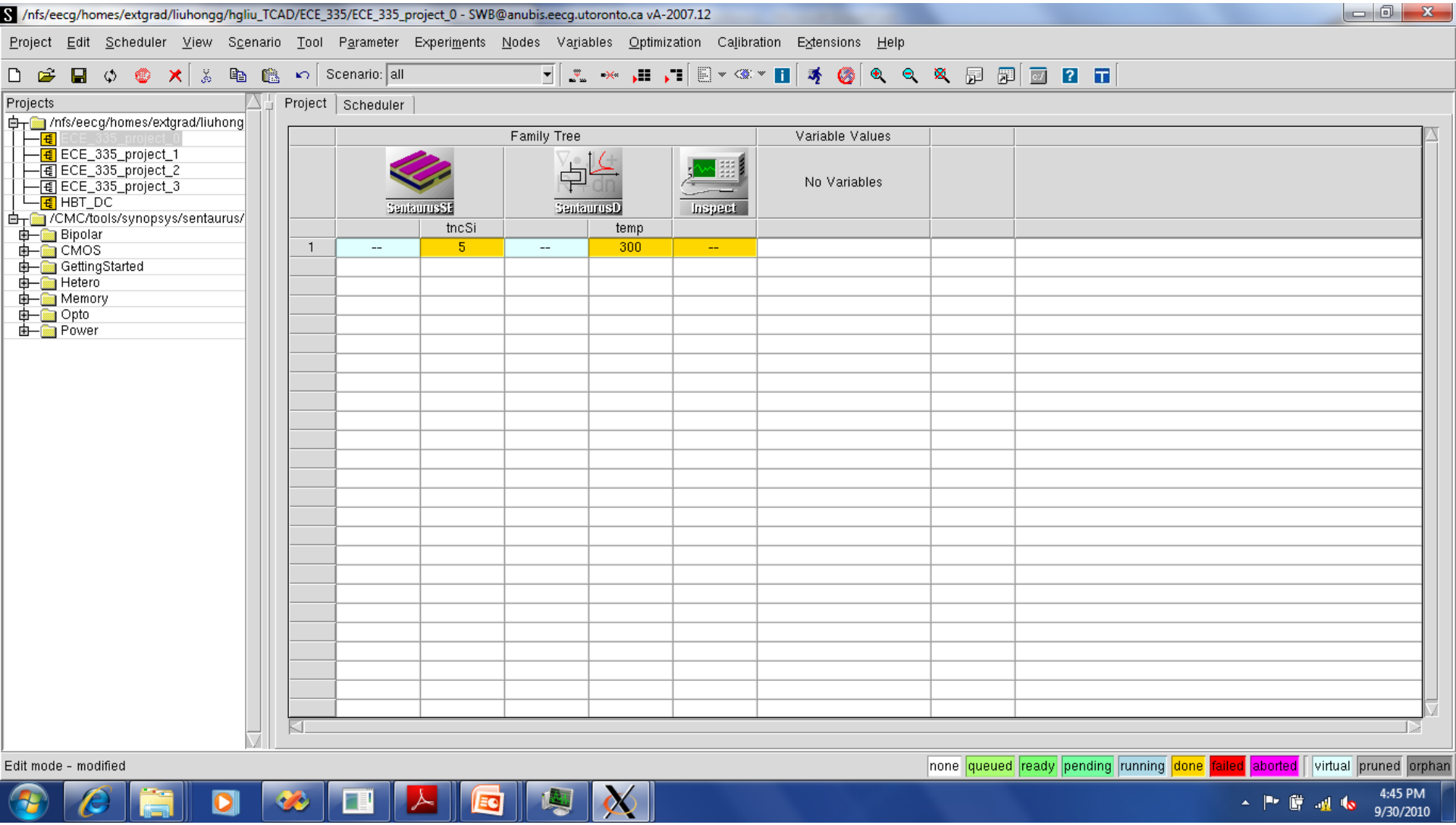
Purpose	Name of the tool	File to edit
Device structure definition	Sentaurus Structure Editor	*sde_dvs.cmd*
Material properties definition		*sdevice.par*
Physics and input definition	Sentaurus Device	*sdevice_des.cmd*
View voltage-current	Inspect	*inspect_ins.cmd*
View 2D/3D distribution	Sentaurus Visual	**.tdr*

Sentaurus Workbench anchors all these tools, variables and used to run simulations

Where to Start

- To Open Sentaurus Workbench
  - Type swb in terminal window
- To open other tools if necessary
  - Go to Extensions in the top menu and select other tools

Sentaurus WorkBench Interface



Demonstration of SWB

- Editing the command
- Running a tool
- Adding Parameters
- Adding parameter Values
- Output
- Debug

Explanation of SDE

- Things to define in SDE
  - shapes and dimensions of different regions
  - Electrode placements
  - doping profile or distribution (NOTE: for Gaussian Profile)
  - grid points or mesh to solve the structure
- Running SDE
  - Right Click on the node, visualize, choose tecplot
- Viewing the structure
  - Right Click on the node, visualize, choose tecplot
- Debugging the command
  - Common mistakes

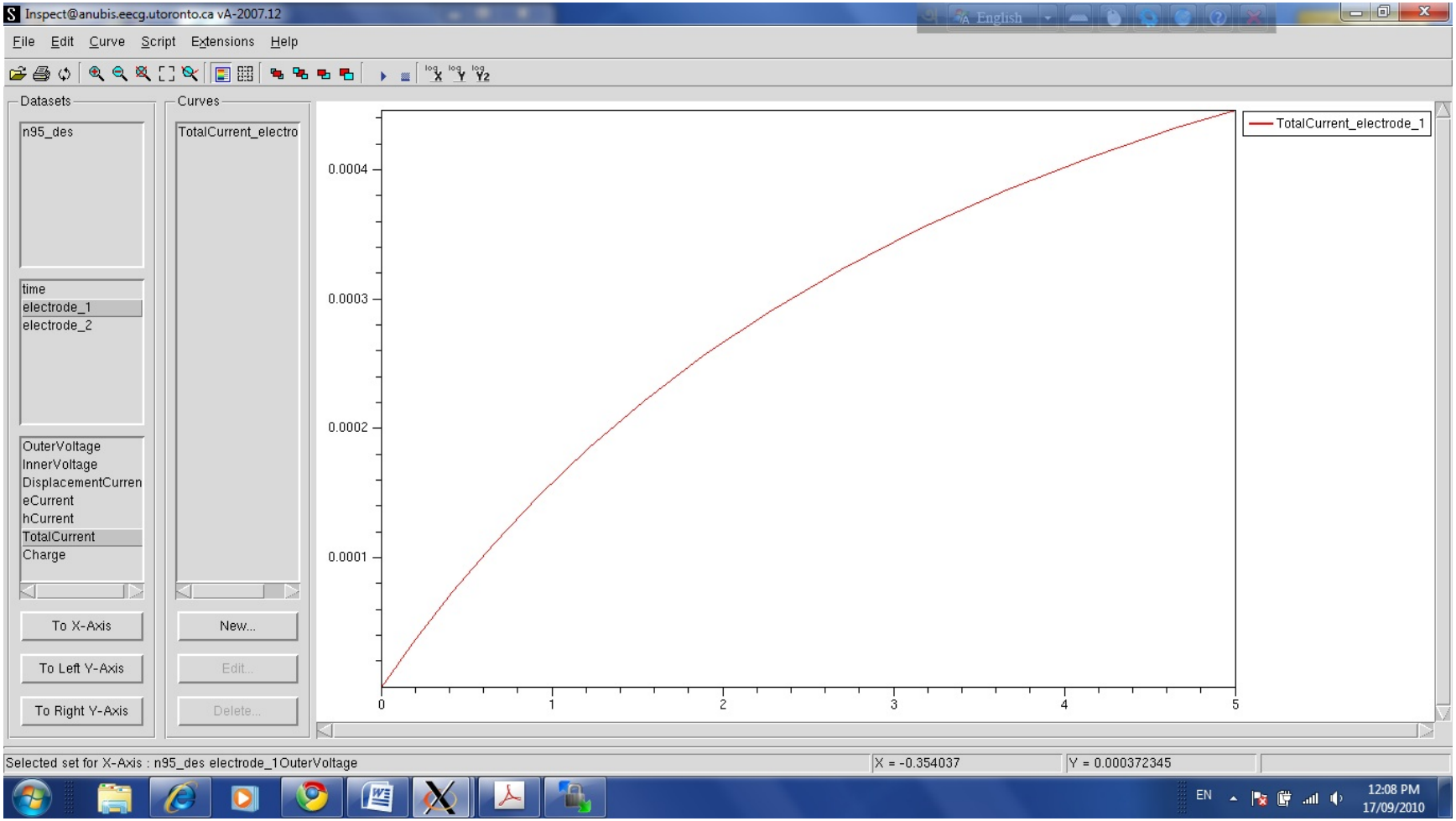
Material Properties

- Available in sdevice.par

SDevice

- Things to define in Sentaurus Device
  - Input output files
  - Electrode properties
  - Physics to consider
  - Math and Plot section
  - Solve section
- Log/output files
  - n95_des.log and n95_des.out

Inspect


Inspect@anubis.eecg.utoronto.ca vA-2007.12
File Edit Curve Script Extensions Help
Datasets
n95_des
time
electrode_1
electrode_2
OuterVoltage
InnerVoltage
DisplacementCurren
eCurrent
hCurrent
TotalCurrent
Charge
Curves
TotalCurrent_electro
To X-Axis
To Left Y-Axis
To Right Y-Axis
New...
Edit...
Delete...
TotalCurrent_electrode_1
0.0004
0.0003
0.0002
0.0001
0
1
2
3
4
5
Selected set for X-Axis : n95_des electrode_1 OuterVoltage
X = -0.354037
Y = 0.000372345
EN
12:08 PM
17/09/2010

Conclusion

- Project 0 is available in /CMC/kits/VRGlocal/ECE_335.2016/
- Simulation Using Sentaurus – Guide
  - Guides you step by step through the process and
  - also covers description of the commands
- Further questions? Email zheng.yong@mail.utoronto.ca