

Bandgap Reference and DAC in IHP SG13G2 Deep N-well Process

Alexander Elsenhans, Alexander Maatz, Ivan Peric



Outline

- Test Setup
- Bandgap Reference
- Current DAC

Test Setup

Climate Chamber

Power Supply (hidden)

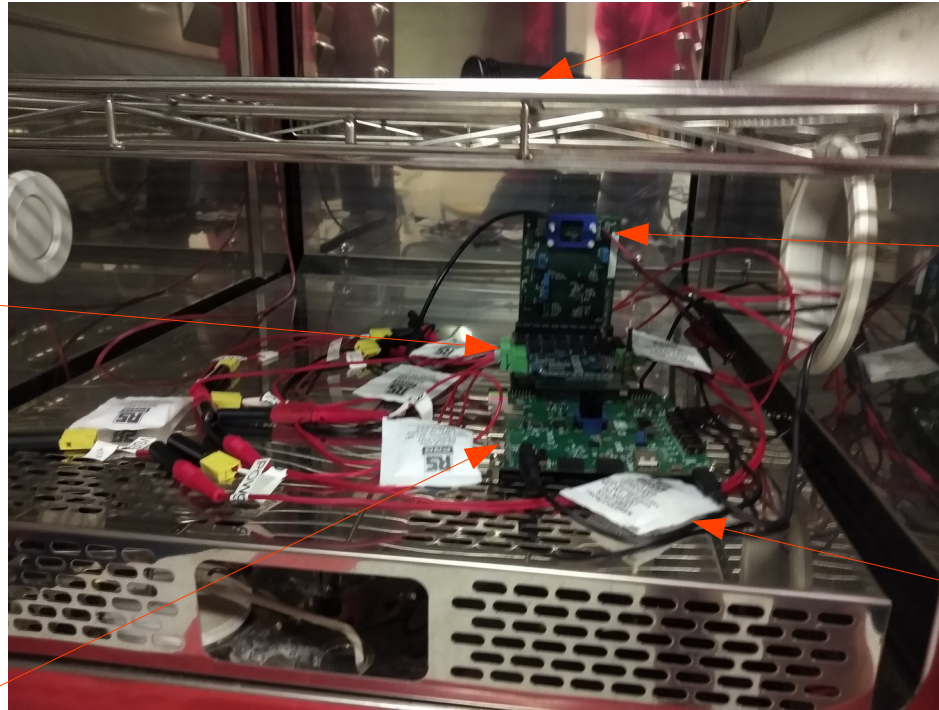


SMU

Laptop to
configure
ASIC

Test Setup

Temperature Logger



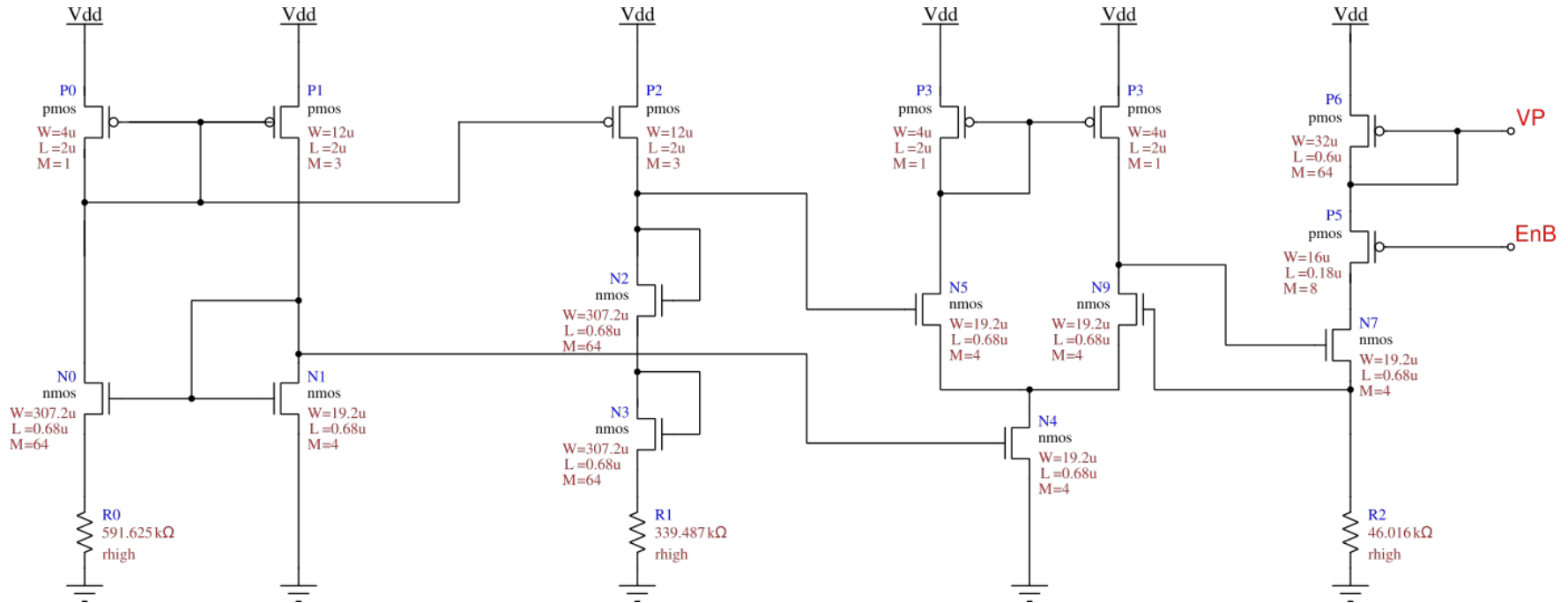
Gecco
Board

PicoPix1

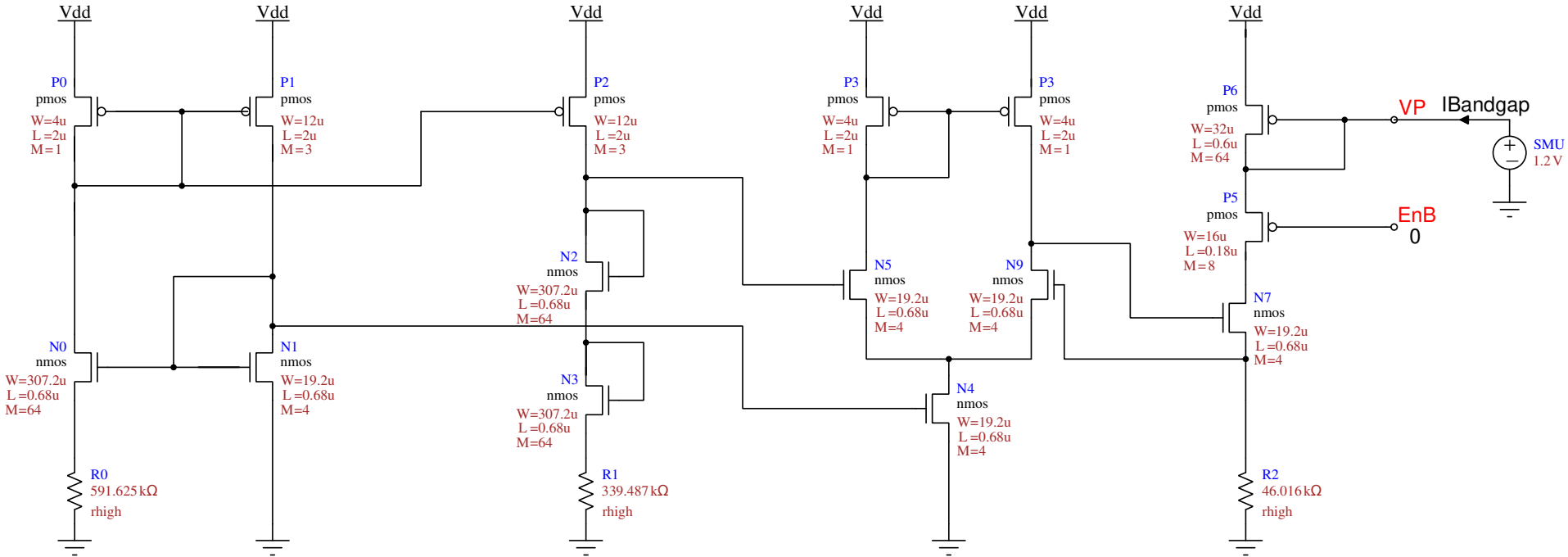
Silica Gel

Nexxy Video
Board

Bandgap Reference (BGR)



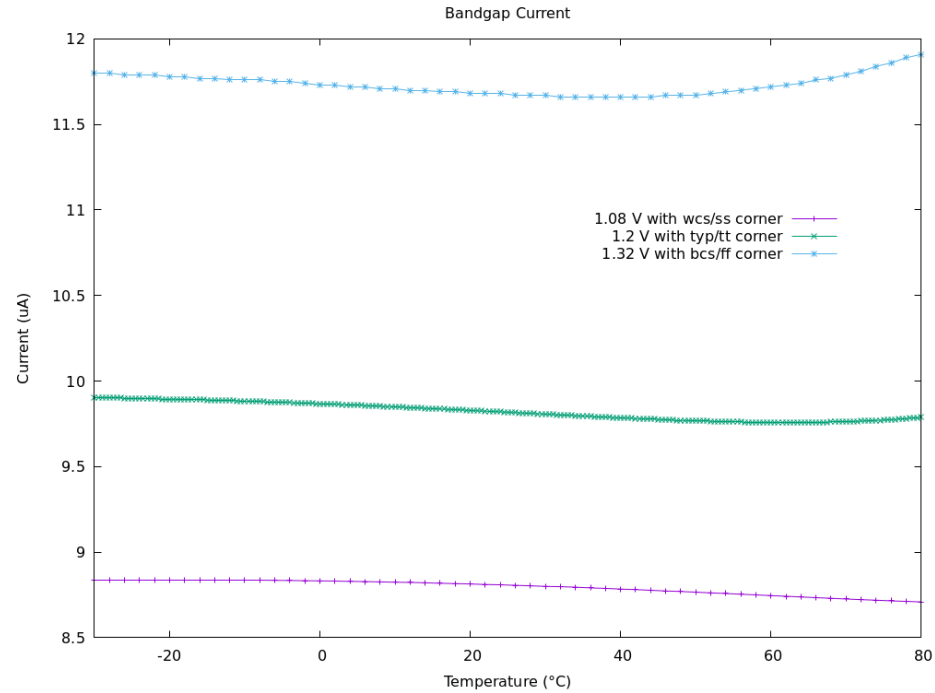
BGR – Test Setup



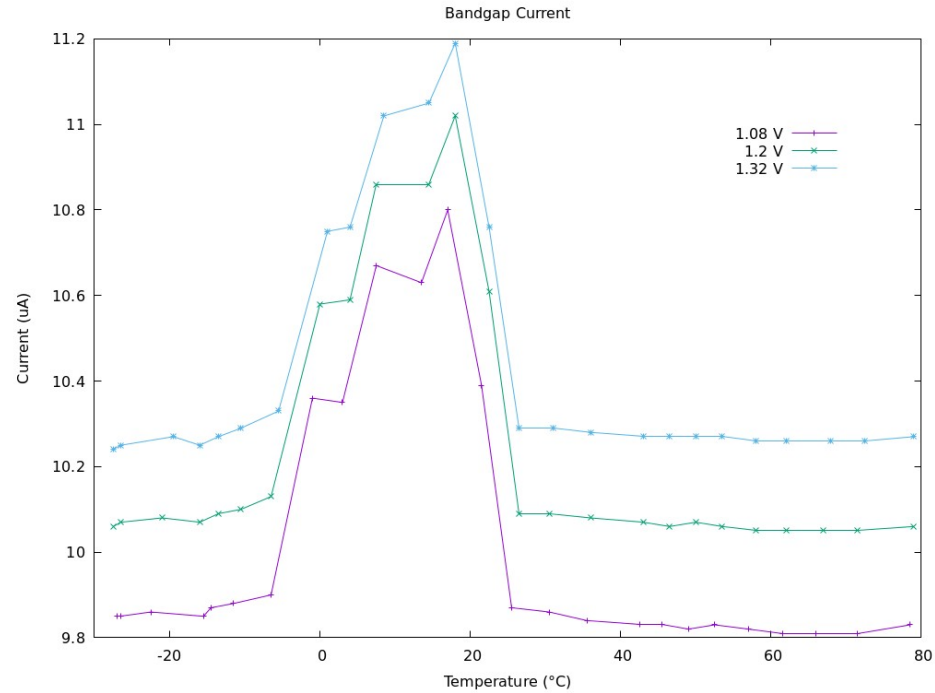
BGR - Tests

- Temperature Sweep for different supply voltages, $v_{dd} = 1.2 \text{ V}$ (+- 10%)
- Compare to simulations (schematic only) with different corners
- Test with PicoPix1 on substrate 2 (normal)
- Nexxys Video Board is used to configure the PicoPix1 but then switched off for its protection
 - No start-up tests

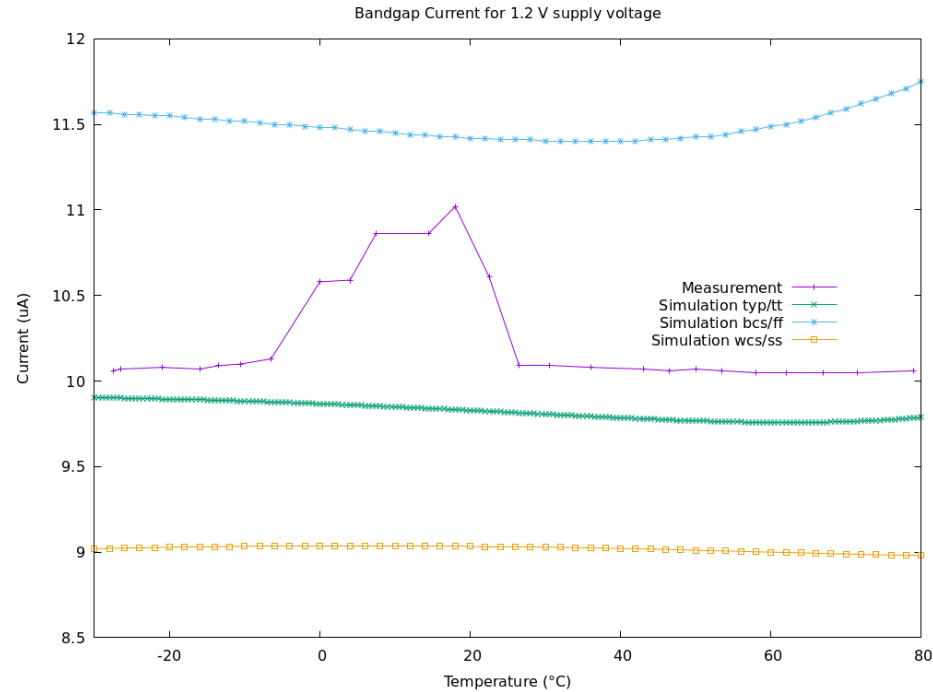
BGR - Simulation



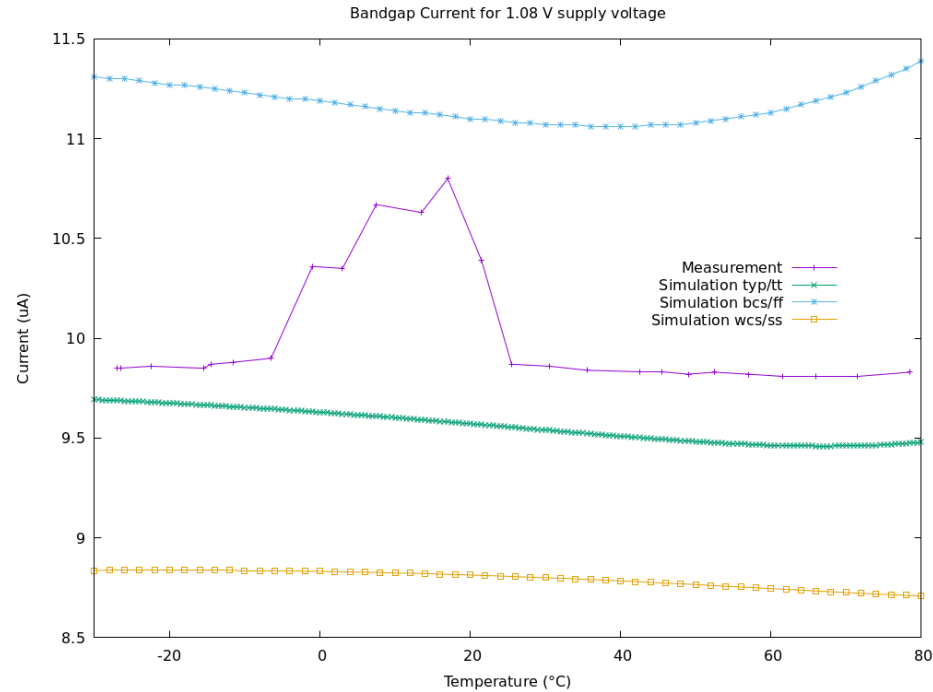
BGR - Measurement



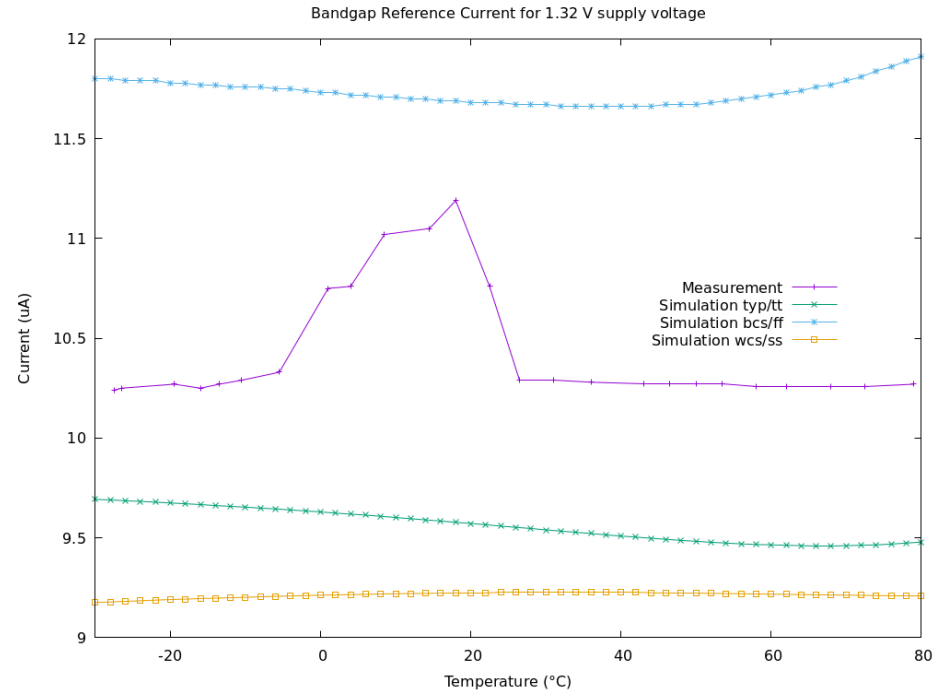
BGR – Measurement vs Simulation



BGR – Measurement vs Simulation



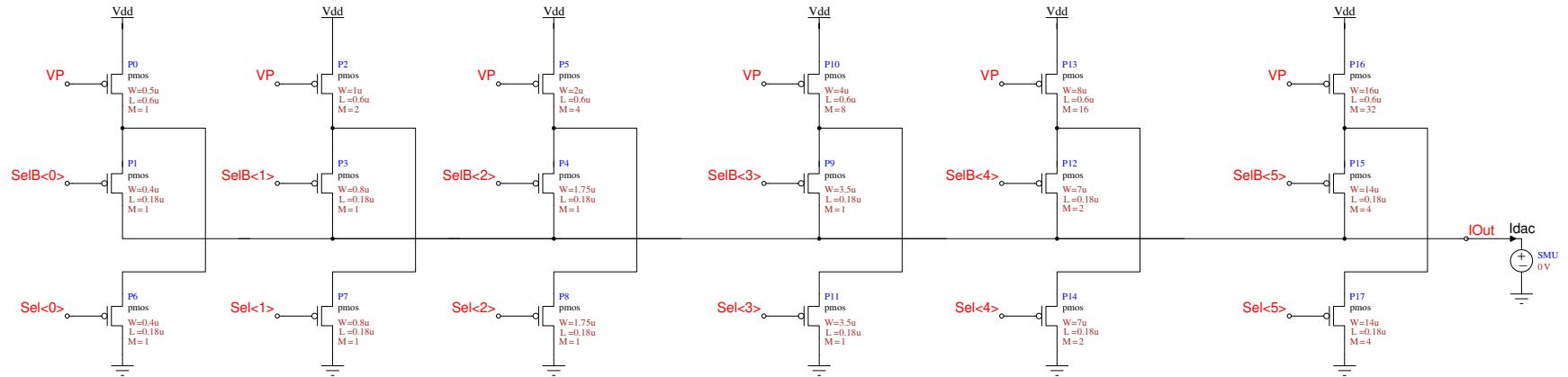
BGR – Measurement vs Simulation



BGR - Conclusion

- Very strange peak around room temperature with does not correspond to simulations
- --> Transistor Models are not perfect, especially for Deep N-well process (triple well process)
- Chip died due to strong increase in current at VDDA during transition 85 °C --> 25 °C
 - Probably latch-up
- Question are these curves good enough for our applications?

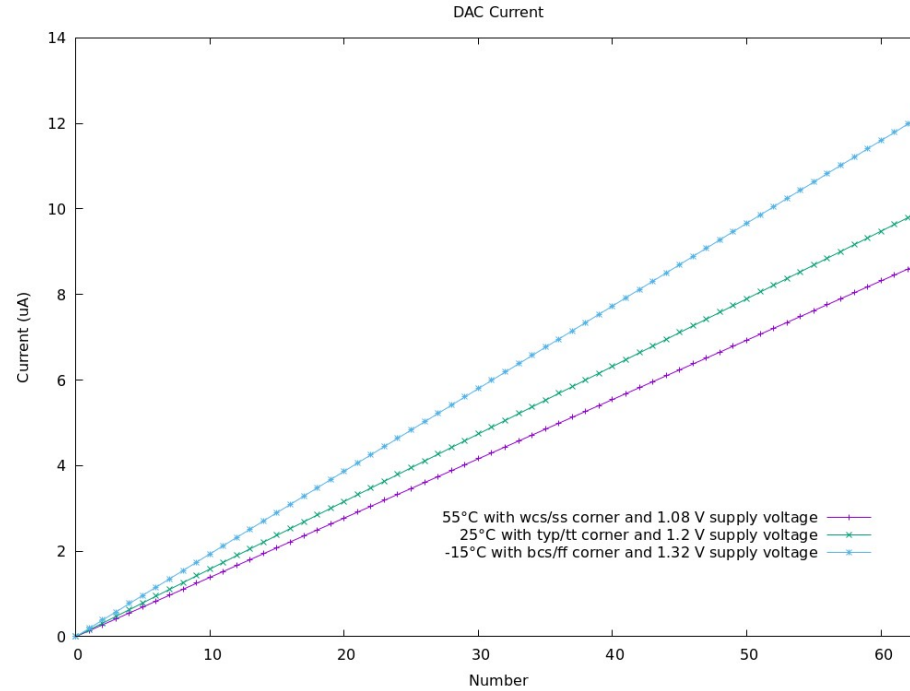
DAC - Test



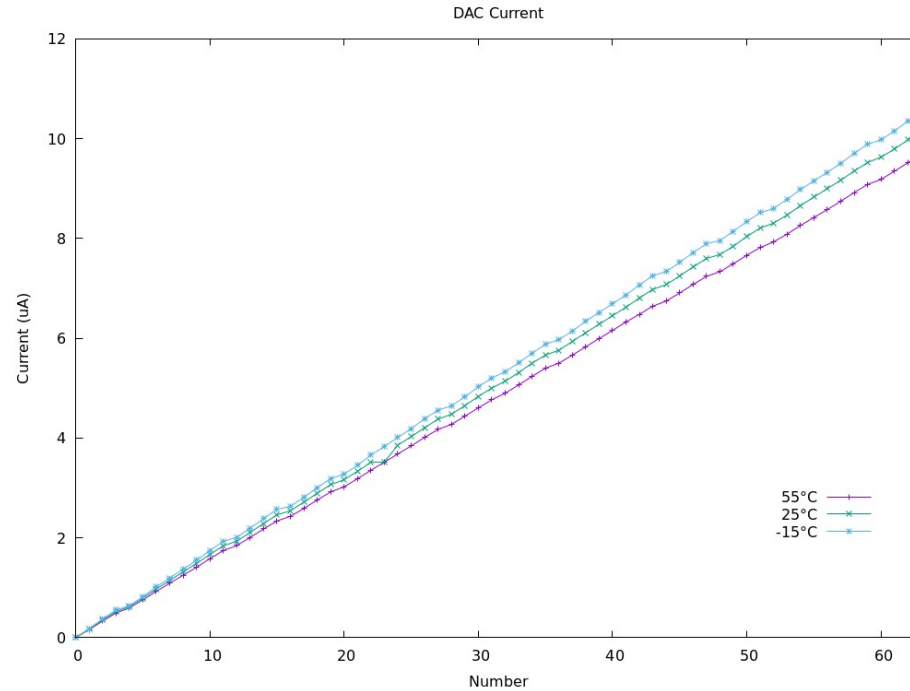
DAC - Test

- Test of DAC on PicoPix1 in Substrate 7 (epi)
- Test of all possible output currents at three different temperature and supply voltage points
 - 1.32 V, -15 °C (best case bcs)
 - 1.2 V, 25 °C (typical case typ)
 - 1.08 V, 55 °C (worst case wcs)
- Nexxys Video Board this time on because we have to constantly reconfigure PicoPix1

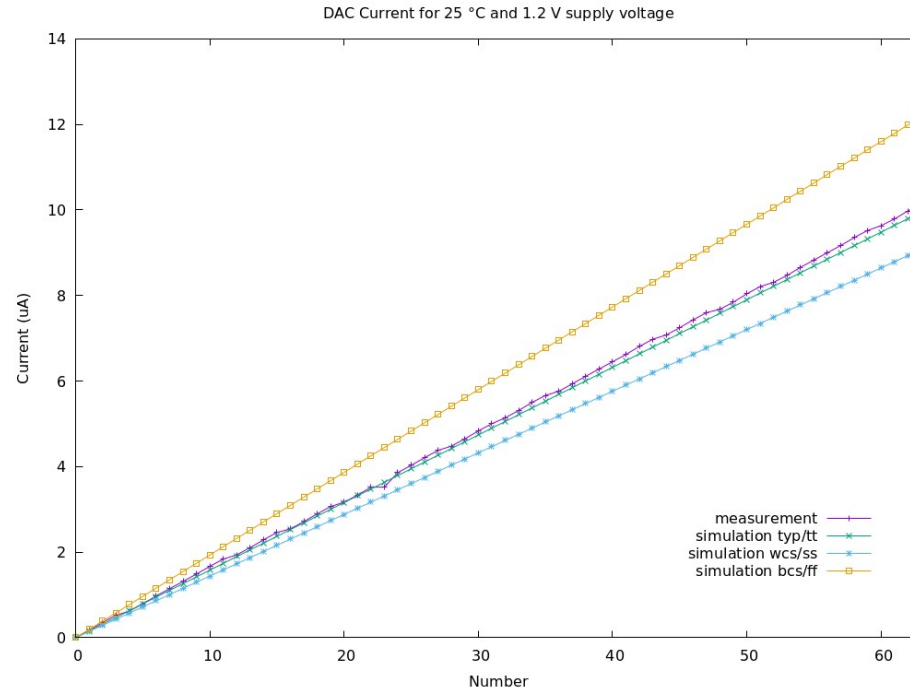
DAC - Simulation



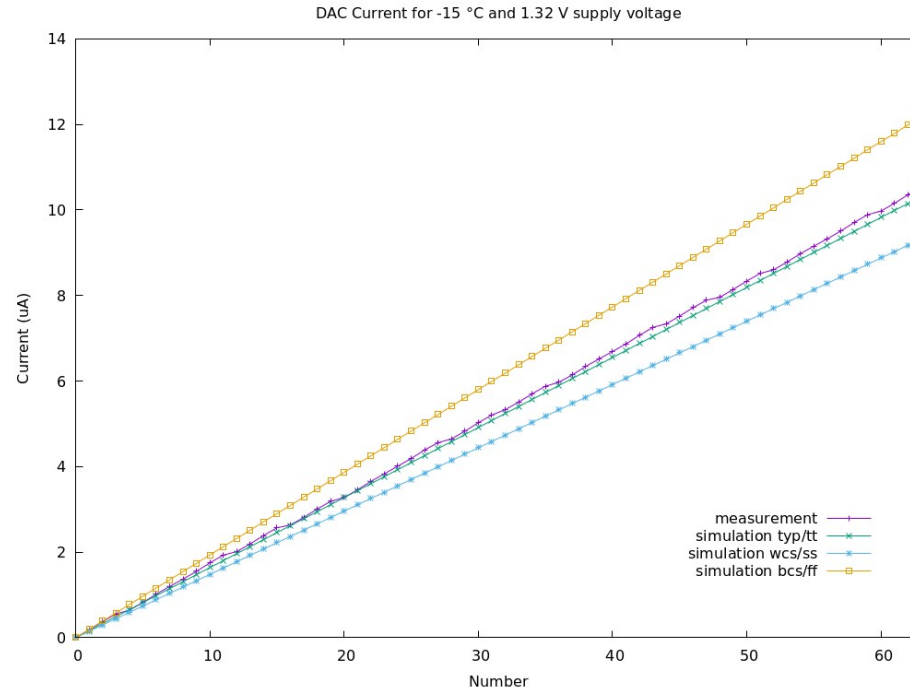
DAC - Measurement



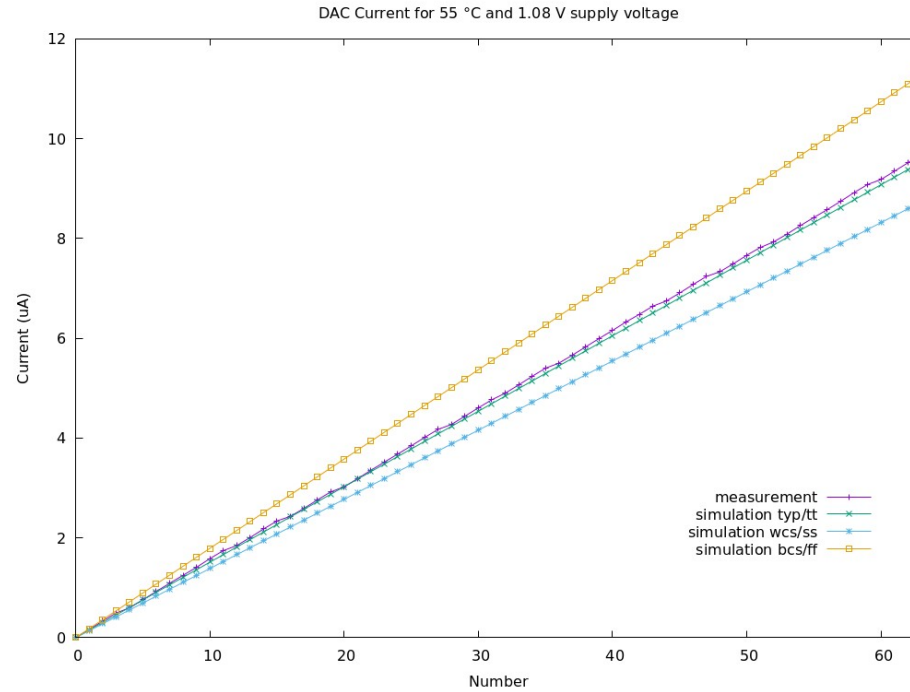
DAC - Measurement



DAC - Measurement



DAC - Measurement



DAC - Conclusion

- DAC is monotonous, except one step which can be related to a measurement error
- In this case here we are very close to typical case
- Unfortunately we are not able to compare it with BGR measurement because of different substrate