



# ADC chip layout framework

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# Chip design infrastructure

- ❖ Technologies supported by Cern
  - 130 and 65 nm from GF(former IBM) and TSMC
- ❖ Radiation issues
  - Component types used
- ❖ Chip assembly software and simulation
  - Script based assembly at Nevis
  - Mixed (analog and digital) simulation
- ❖ Common blocks needed for sub-designs
  - Radiation hard/qualified blocks



# Supported technologies at Cern



## Supported Technologies





# Radiation issues

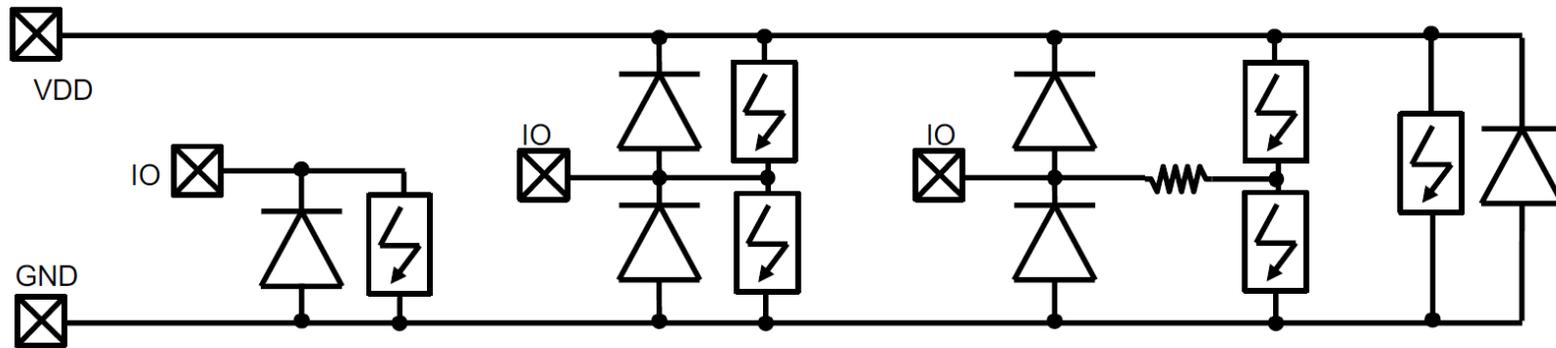
- ❖ Standard 1.2V (65nm) transistors are radiation hard
  - Thick oxide transistors (2.5V and 3.3V) are to be used with extreme carefulness
- ❖ MiM capacitors are radiation hard and show excellent matching
- ❖ MoM capacitors are radiation hard and show also very good matching
  - Should be studied by MonteCarlo as there is no good info about the matching in the PDK documentation
- ❖ Due to the radiation issues, standard IO pad library is not usable. Cern hired external company to develop 1.2V IO pads.



# Radiation issues



## ESD structures and I/O pads



- Rated for 1.2V
- Only core devices, thin gate oxide
- Outsourced the development work for Rad-Tol ESD circuitry
  - Power clamps
  - Low-capacitance analog I/O (160 fF, 1 kV ESD)
  - HBM+CDM ESD-protected I/O for digital (2 kV ESD)
  - Delivered May 2014



# Chip assembly software and simulation

- ❖ We expect whole chip assembly to be done at Nevis by using automatic scripting and/or minimal manual layout labor
- ❖ Encounter or its successor software to be used
- ❖ Script development specifics for 8 channel ADC chip is under way at Nevis
- ❖ Problem with chip seal ring library from standard TSMC library discovered at Nevis setup – will be solved with the help of TSMC/Cern
- ❖ Cern supported mixed signal simulation setup to be used for whole chip simulation



## Common blocks for sub-designs

- ❖ We plan to use radiation hard IO pads developed by Cern subcontractor
- ❖ We test-simulate radiation hard differential SLVS, 1.2GHz, 1.2V receiver and transmitter
- ❖ We also are looking into possibilities to use radiation hard band-gap design
- ❖ Rx/Tx and Bangap are IP blocks developed by Bergamo collaborator of Cern
- ❖ PLL is missing



# Conclusion

- ❖ TSMC 65n technology, supported by Cern, selected to be used for ADC design, is radiation hard and few issues with its PDK to be solved soon
- ❖ ADC chip assembly scripts development is underway
- ❖ Few (Rx/Tx, Band-gap) common blocks needed for sub-designs are under the evaluation/modification.