

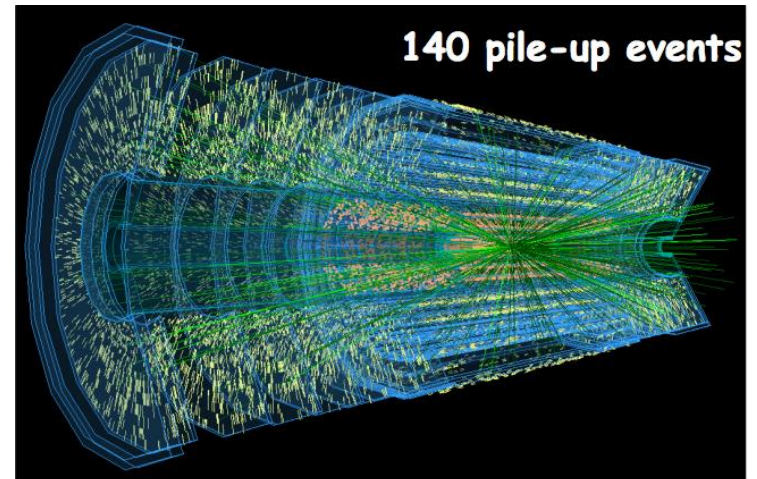
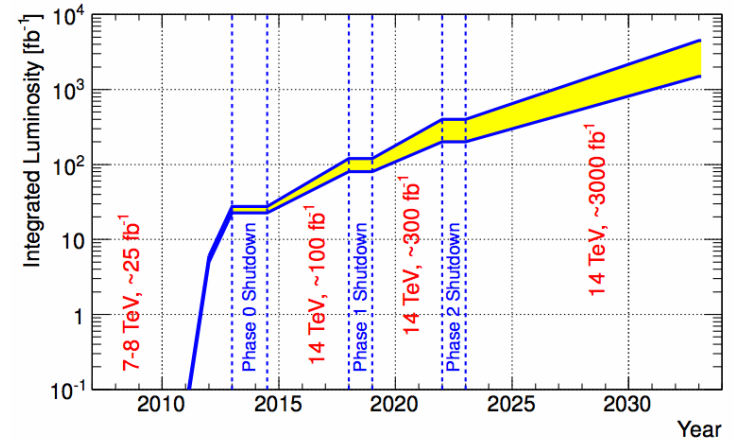
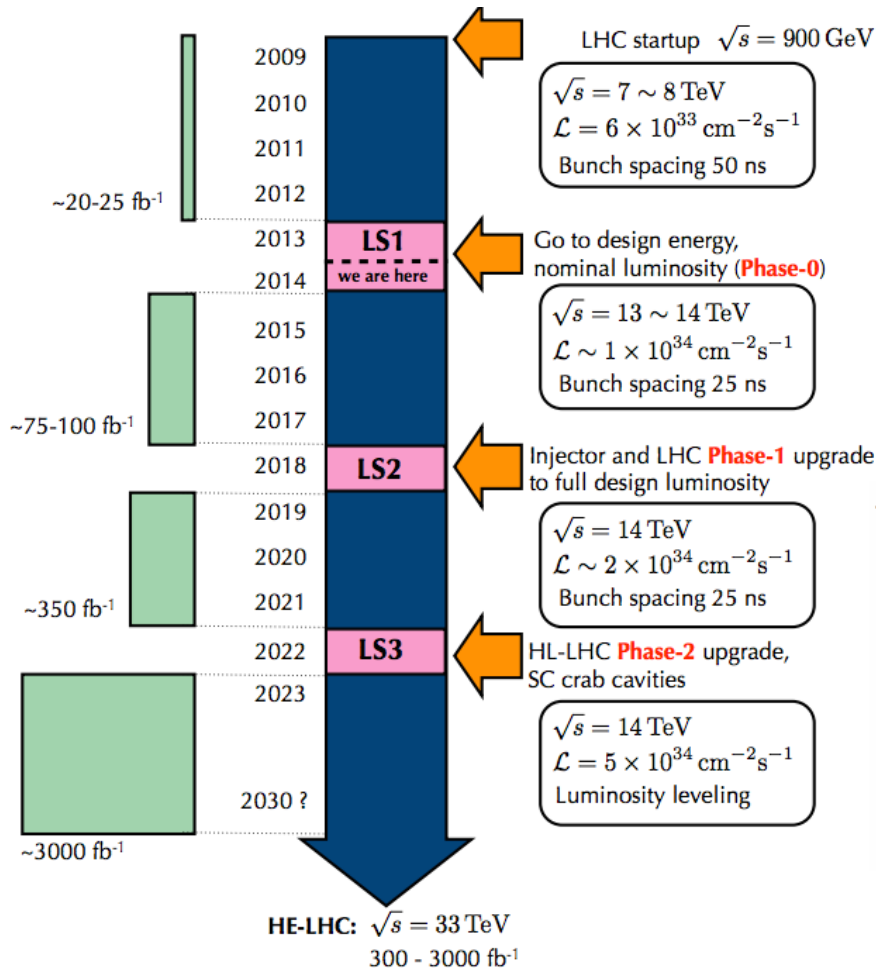
# Characterization of HV-CMOS Sensors for HL-LHC Upgrades

Brett Larsen

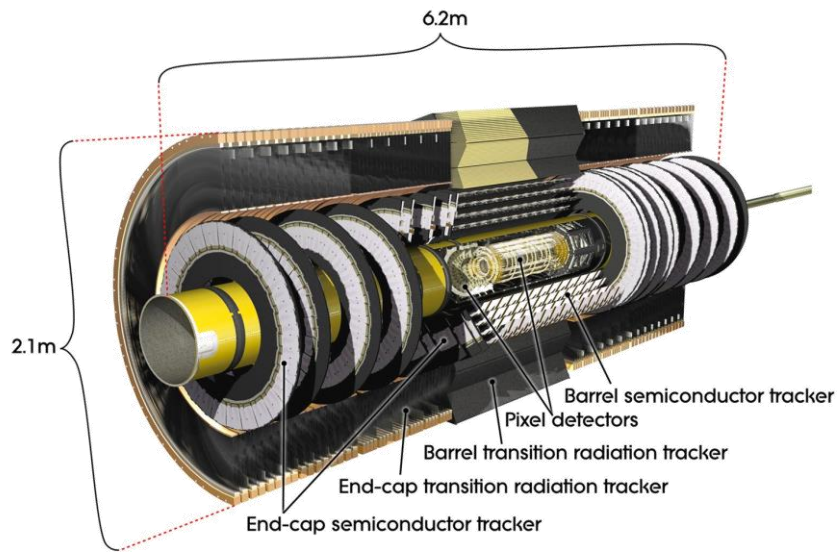
UM CERN REU 2014



# The High Luminosity LHC



# ATLAS Inner Detector

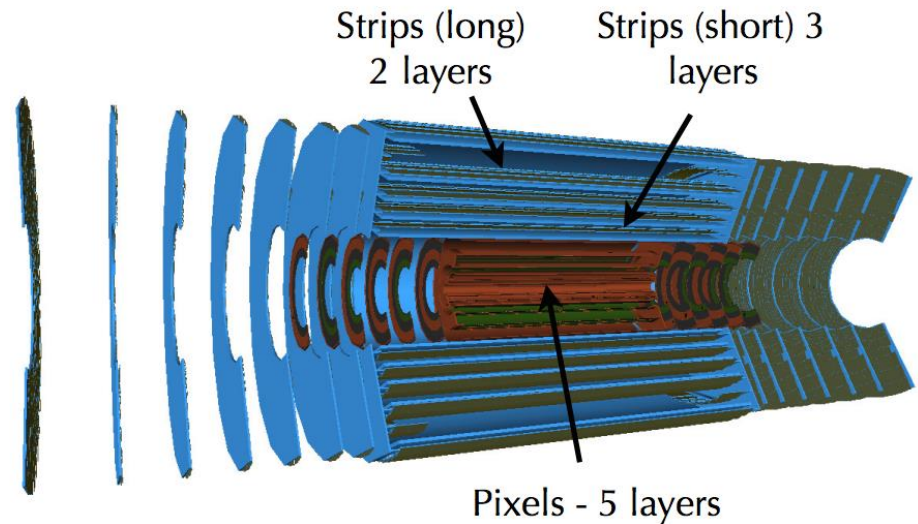


## Current Detector

- Pixel Detector – 4 Layers with IBL
- Semiconductor Tracking Layer (SCT)
- Transition Radiation Tracker (TRT)

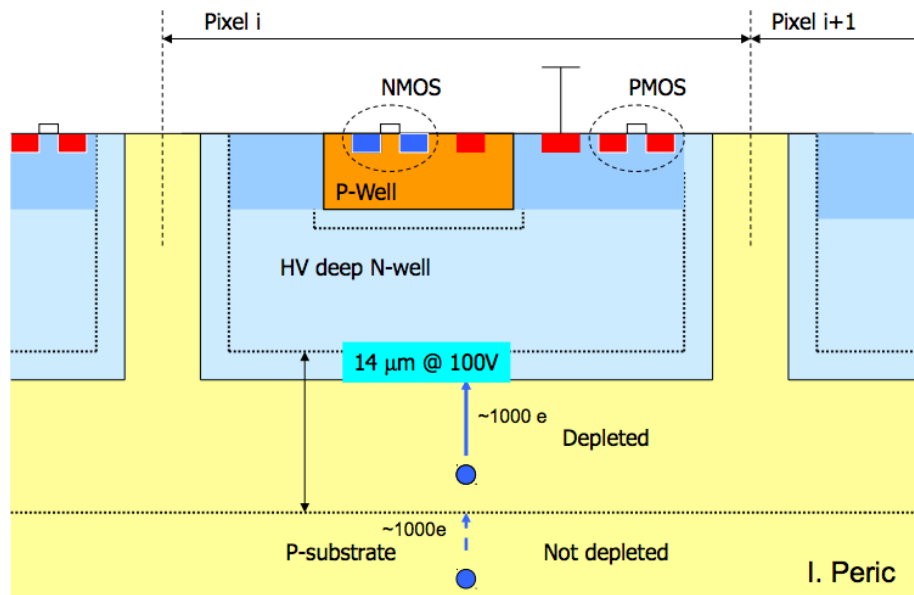
## Planned Upgrade

- New Detector Technology
- 5 Pixel Layers
- TRT replaced by strip detectors

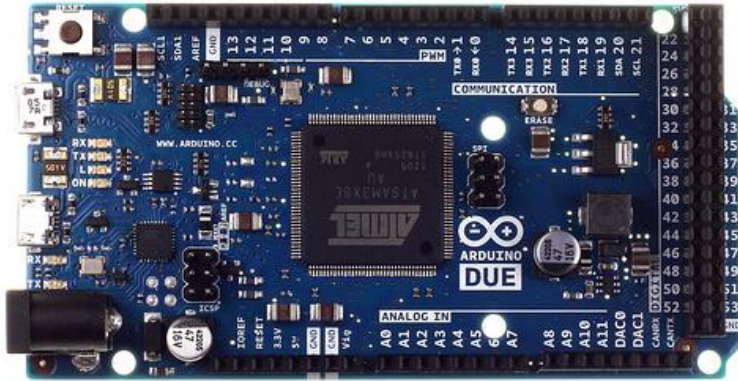


# High Voltage CMOS Technology

- Commercially available technology, significantly cheaper than custom process
- Able to design active circuits within the sensor
- Deep sub-micron technology is intrinsically radiation-hard

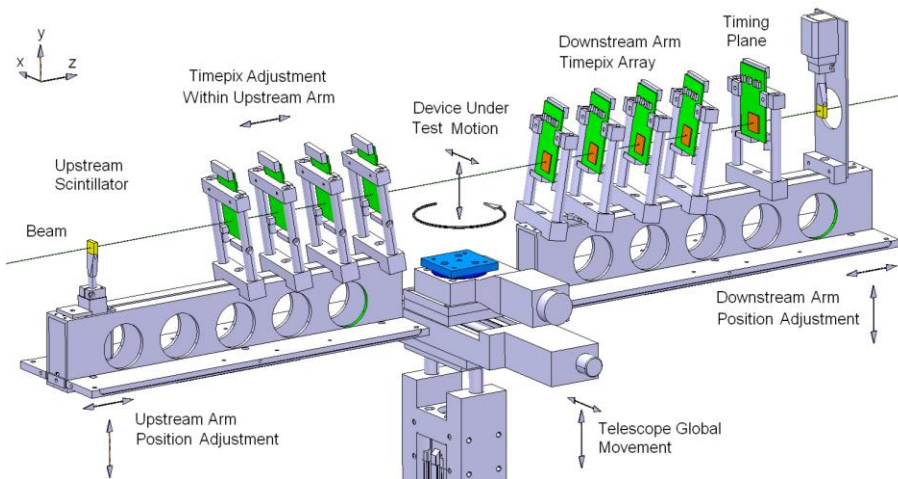


# Chip Characterization for Test Beam



## 1. Software for Tuning Pixel Arrays

- Replace outdated hardware and software
- Tune each pixel or strip individually
- Challenges: Timing on the chip, readout speed



## 2. Test Beam Measurements

- Four weeks of beam time during July and August
- Make efficiency measurements to compare to other detector technologies



# Gruyères and Lavaux



# References

1. Akiba, Kazuyoshi et al. “The Timepix Telescope for High Performance Particle Tracking.” April 2013.
2. Gonzalez-Sevilla, Sergio. “Radiation-hard Active Pixel Detectors based on HV-CMOS Technology for HL-LHC Detector Upgrades.” July 2013.
3. Muenstermann, Daniel. “Pixel Detectors at Future Colliders: Recent Achievements and Future Perspectives.” May 2012.
4. The ATLAS Experiment ([atlas.ch](http://atlas.ch)).

