ITk Detector Overview
Arturo Rodriguez Rodriguez
on behalf of the ATLAS ITk Collaboration

ATLAS Inner Tracker for HL-LHC (ITk)

At the HL-LHC the ITk detector will face:
- Radiation Damage
  - HL-LHC should deliver ~ 4000 fb⁻¹ (current inner detector for IBL ~ 850 fb⁻¹)
  - New sensor design requires increased radiation hardness
- Pileup ~ 200
- Keep current inner detector occupancy granularity increased by ~10x

ITk Pixel Detector:
- 5 barrel layers: short barrel + inclined modules (|η| < 1.4) + endcap rings (|η| < 4)
- 4 barrel layers + 2x6 endcap wheels (|η| < 2.7)

ITk Strip Detector:
- Pixel Module development:
  - Si n-in-p technology, small pixel size
  - FE chip: Gbps readout capability
  - Flip-chip using bump bonding
  - Serial powering scheme
- Sequence development on going:
  - Attachment, wire bonding, encapsulation
- All silicon design
- Higher granularity
- Minimum material
- η coverage increased to 4 (currently ~ 2.5)
- CO₂ cooling

Local Support:
- Mechanical stability requirement:
  - Barrel and endcap z, R (20 μm), φ (2μm)
  - Titanium cooling pipes
  - Electrical services

ITk Strip Detector

Barrel Module:
- Rectangular geometry
  - Strip length 2.4 ~ 4.8 cm
  - Pitch 75.5 μm
  - Stereo angle 52 mrad
  - 2 different modules

Endcap Module:
- Radial geometry
  - Strip length 1.9 ~ 6 cm
  - Pitch 63.9 ~ 80.7 μm
  - Stereo angle 40 mrad
  - 6 different modules

Double-Sided R0 strip module

- Single-sided modules on both sides of a core
- Unirradiated sensors
- PetaF0 core including coolant tubes
- Readout independently from both sides, using a Nexys board
- Successfully tested in:
  - Freiburg clean room
  - Beam Test at DESY

ASIC rad hard 65nm CMOS: Joint ATLAS & CMS project within RD53 collaboration

References:

Technical Design Report for the ATLAS Inner Tracker Strip Detector (CERN-LHCC-2017-005)

* A double-sided, shield-less stave prototype for the ATLAS Upgrade strip tracker for the High Luminosity LHC (https://cds.cern.ch/record/2003050)