### ATLAS inner detector upgrade

- I'Tk strip detector is build from 2 multi-module assemblies
  - staves in the barrel
  - petals in the end-caps
- provide power, cooling and data to the individual modules
- modules glued to structure
- double-sided with incorporated 40 – 52mm thick silicon
  - rφ resolution: 20 – 25µm
  - z resolution: 850µm

#### Stave and Petal

- evaporative CO₂ cooling down to approximately −35°C
- data transmission up to 2 × 640 MBit/s per module
- conversion to 2 × 10.24 GBit/s fiber at end of structure
- up to 2 × 9.3 A @ 11 V

#### Sensor

- 320µm thick silicon, n⁺-in-p doped
- 8 different sensor types (2 barrel, 6 end-cap)
- made from 150mm wafers
- bias voltage 100 – 700V depending on radiation damage
- required to be radiation tolerant up to
  - 1.2 × 10¹⁲ η/cm²
  - 50.4 MRad

#### Module

- uses sensor as base
- all components glued on:
  - hybrid with front-end ASICs (ABC130*) and HCC
  - powerboard for power conversion on module
- main thermal path through sensor
- all electric connections done with soldering (SMD passive) and wirebonding (ASICS)
- 0(6000) wirebonds

#### Powerboard

- generates 3A@1.5V from 11V
- contains analog monitoring
  - LV voltage and current
  - HV current
  - temperature
- radiation hard DCDC ASIC (upFEAST)
- ASIC for slow control and autonomous safety (AMAC)
- HV filter and switch
- can disconnect single modules from HV

### ATLAS Binary Chip (ABC)

- converts analog signal from strip sensor to binary hit data
- wirebonded directly to 256 strips
- processes signals from 256 strips
- buffers for 12.8 µs + 128 events
  - matches ATLAS trigger scheme and timing
  - compresses data (zero suppression) and builds packets

### Hybrid Control Chip (HCC)

- interface between stave/petal and hybrid
- creates common bus of control signals for ABC (2 × 160 MBit/s)
- collects hit data from up to 11 ABC (160 MBit/s each)
- packetizes and multiplexes data from all ABC per event
- outgoing data to stave/petal up to 640 MBit/s
- generates data clocks from bunch crossing clock

### References