



TALENT & The ATLAS Pixel Project @IdeaSquare

Heinz Pernegger / CERN



TALENT & ATLAS Pixel



- The TALENT Project is the Marie Curie Initial Training Network in the context of the ATLAS Pixel Tracker Upgrade program
- It provides research and training to the 17 TALENT fellows in detector instrumentation, specifically Pixel detectors
- TALENT is a network of 7 universities, 3 research labs and 8 industrial partners



TALENT

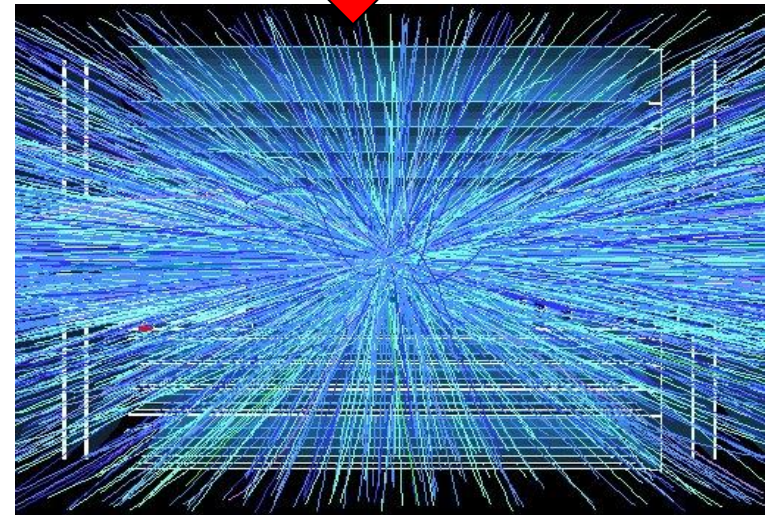
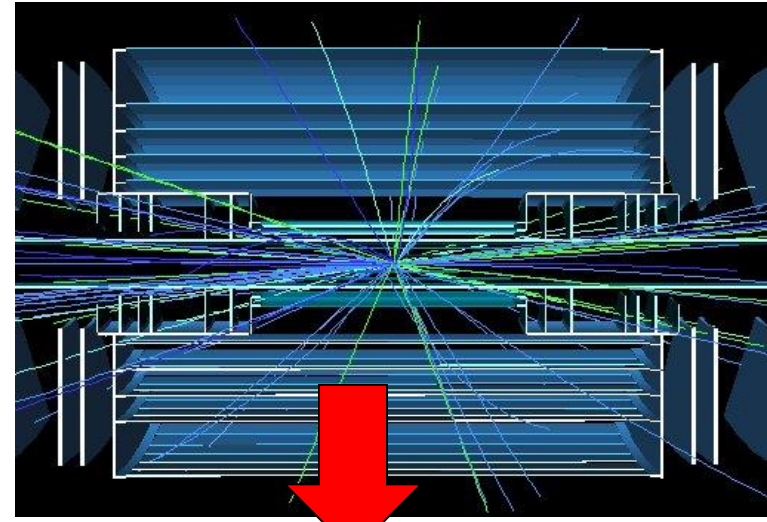


- TALENT fellows are embedded in ATLAS Pixel research activities

IdeaSquare Opening Dec 9th 2014

Challenges for the future

- Future detectors at LHC require
 - Higher hit-rate capability
 - Higher segmentation
 - Higher radiation hardness
 - Lighter detectors
- ATLAS Pixel & TALENT research on
 - New sensors
 - New electronics
 - Light mechanics
 - System integration

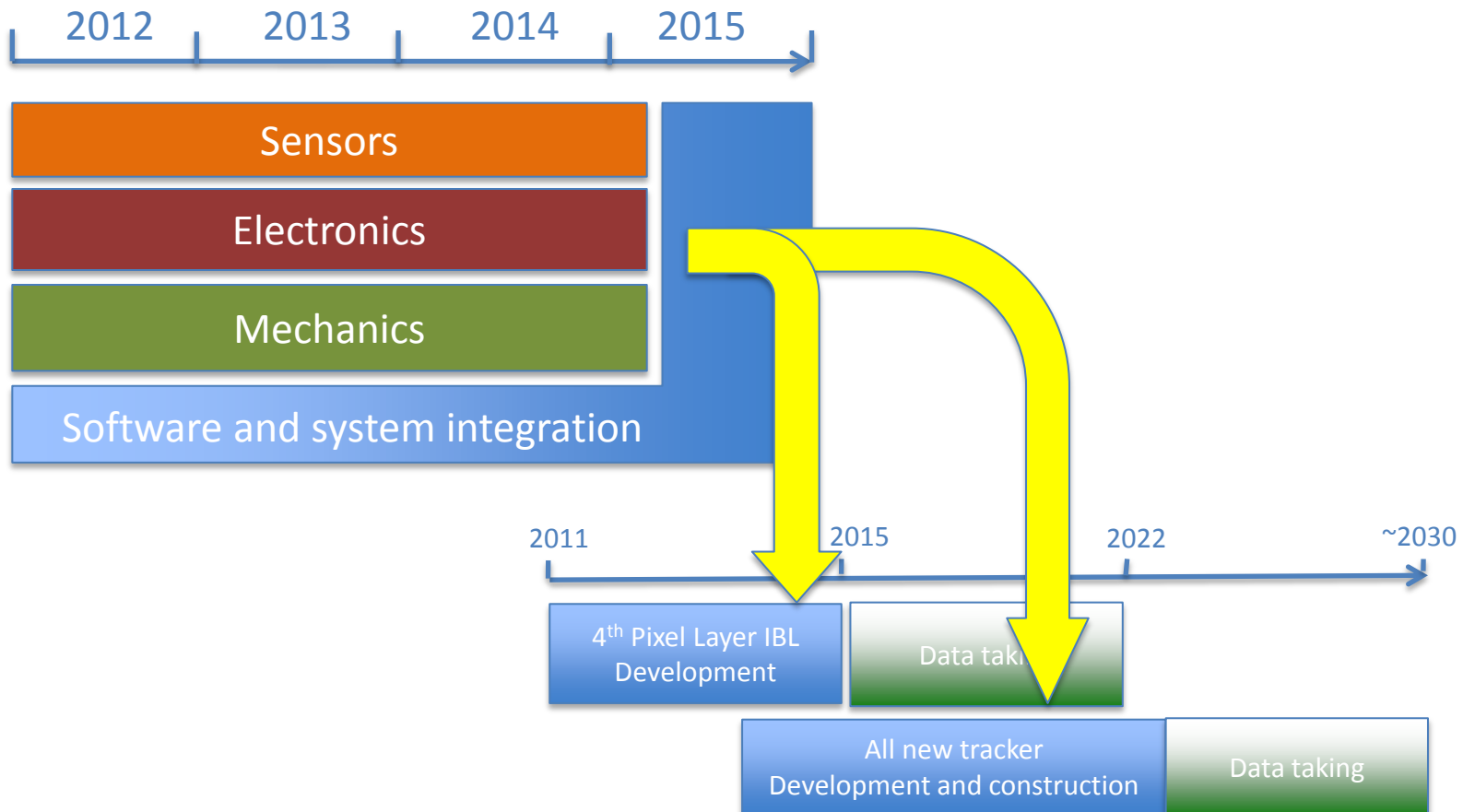




TALENT = Pixel RD



- Motivation = develop next generation pixel detectors
- TALENT Timeline 2012-2015 is a perfect match:



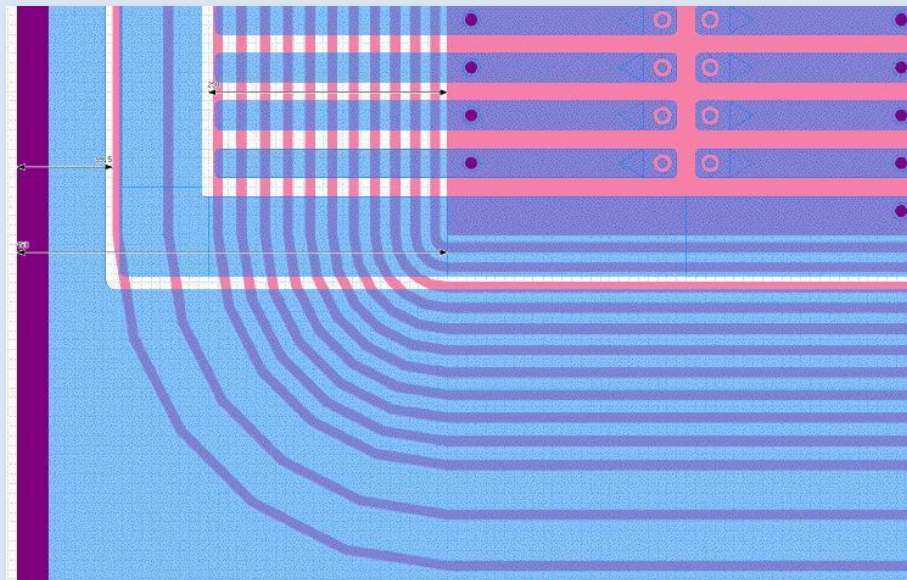
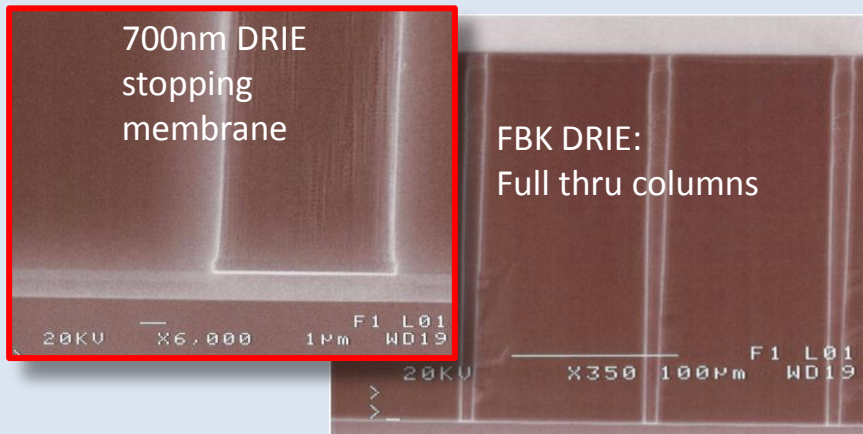
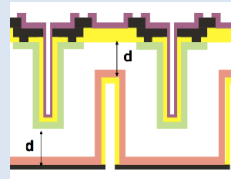
New Sensor: 3D and Planar

3D slim edge (CNM, FBK)

- column through ~full bulk 2 electrodes per pixel
- depletion horizontally (short depletion width leads to low bias voltage)
- Radiation hardness through fast signal collection and low depletion voltage

Planar n-n Slim Edge Design (CiS)

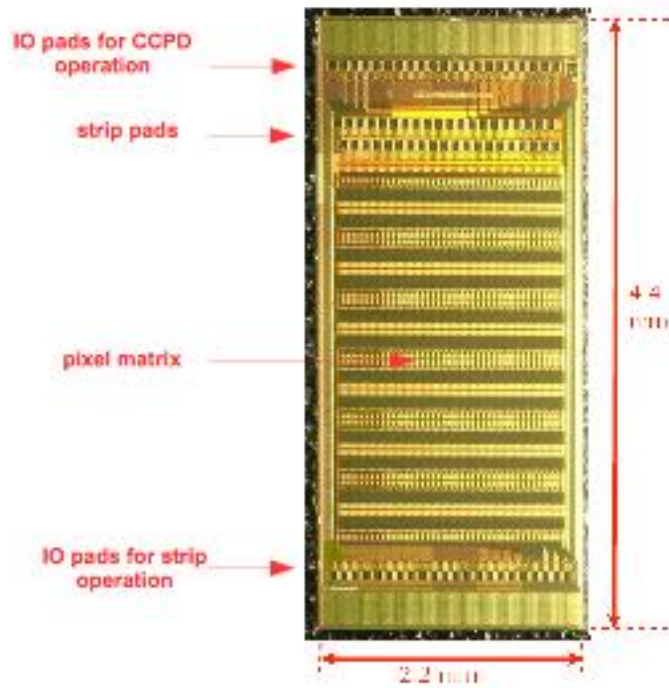
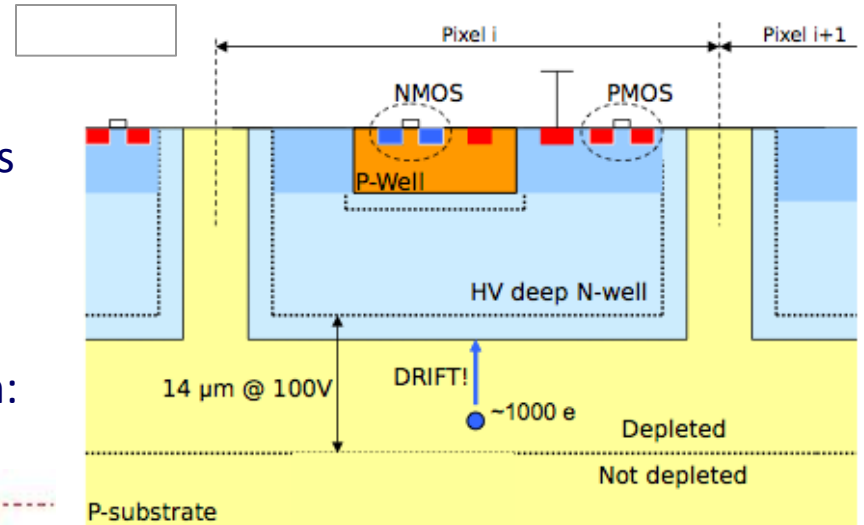
- minimize inactive edge by shifting guard rings underneath active pixel region
 - → 200 – 250 μm inactive edge achievable
- manufactured by CiS similar present Pixel



Depleted CMOS sensors

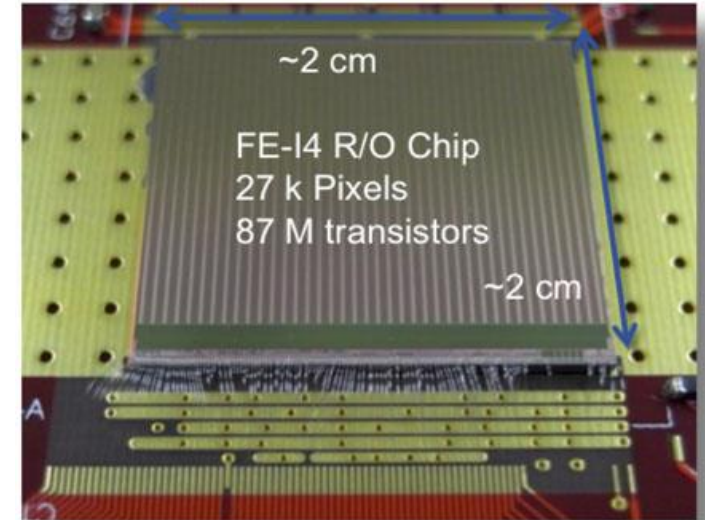
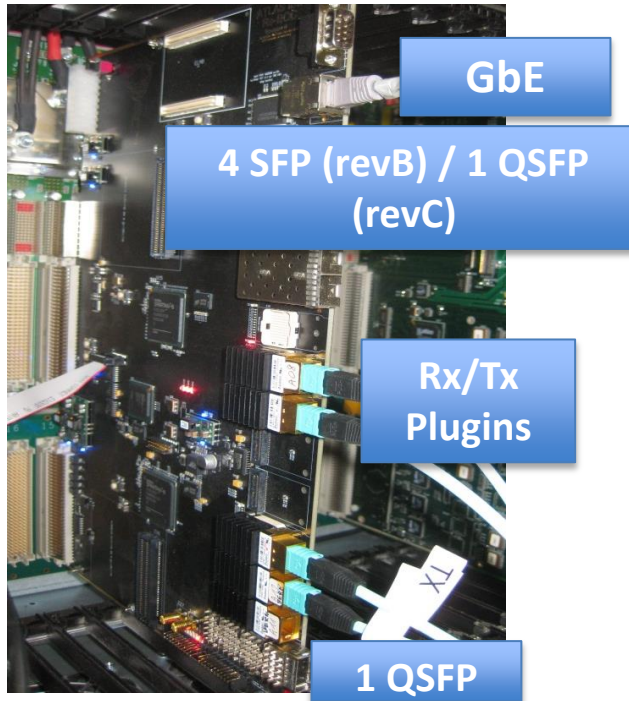
- CMOS sensors are used for imagers in cameras, i.e. for photon detection at low energies
-> large volume at lower price

- Combine HV/HR processes to allow charged particle detection:
Depleted HV-CMOS sensors



- Electronics is include in sensor pixel -> “Smart Pixel” allows first processing of information on sensor
- **Depleted Monolithic Active Pixel Sensor (DMPAS)**

New generation Pixel FE chip and readout electronics



- New architecture for higher efficiency at high hit rates
- Smaller pad side to improve pattern recognition and impact parameter resolution
- Higher radiation hardness ($\sim 300\text{Mrad}$)

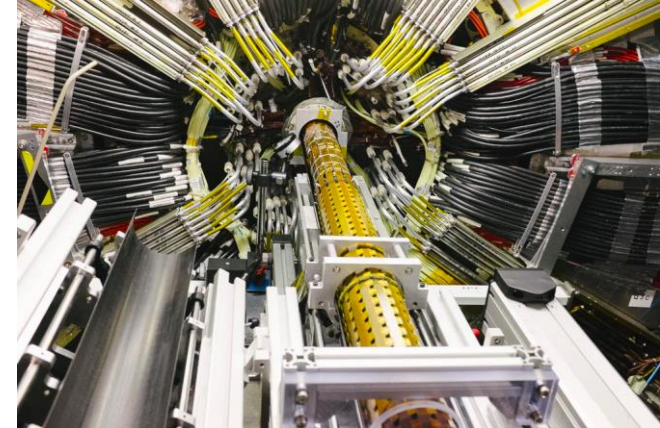
Supports and integration



March 26th

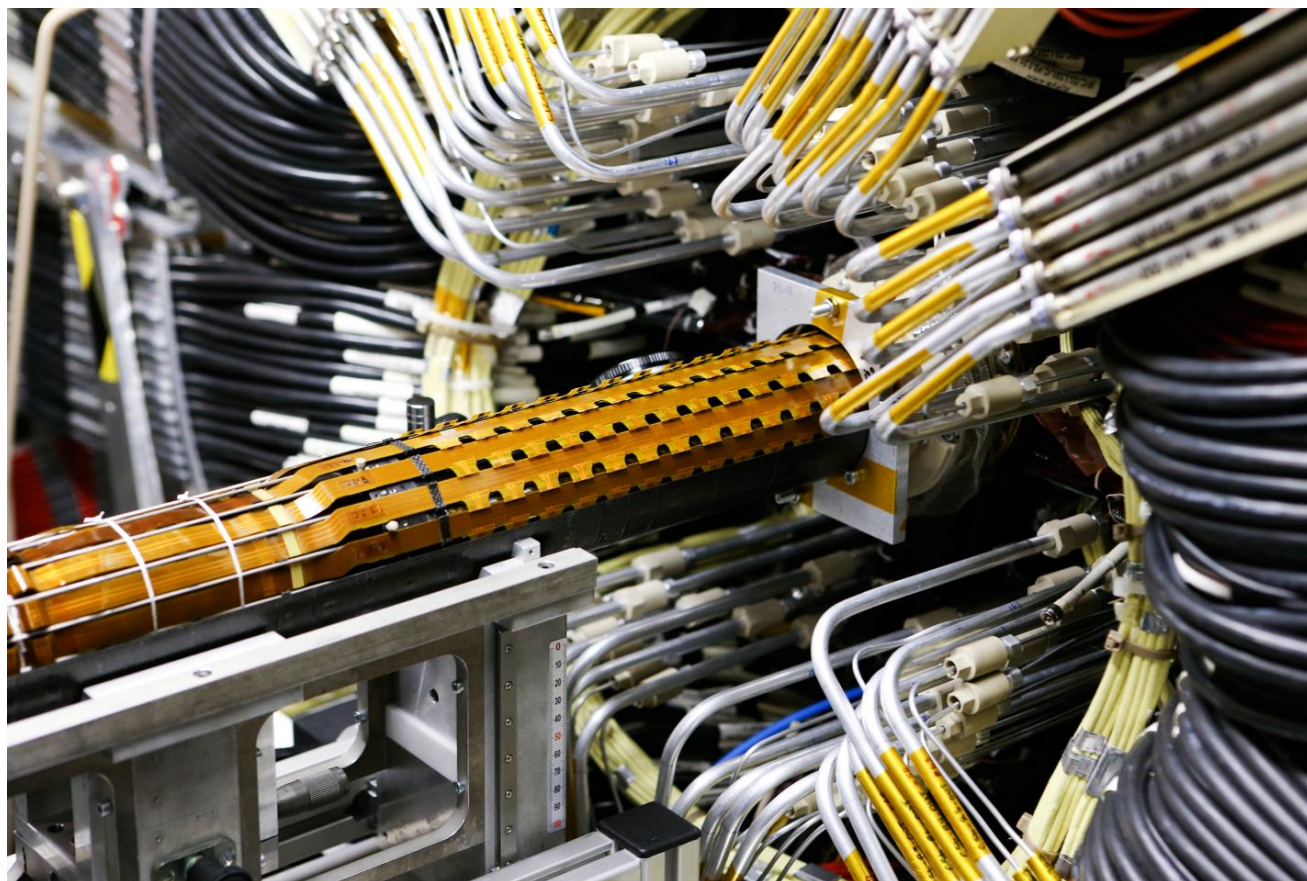


May 7th



Pixel and IBL ready to run!

- The ATLAS IBL is completed and installed!

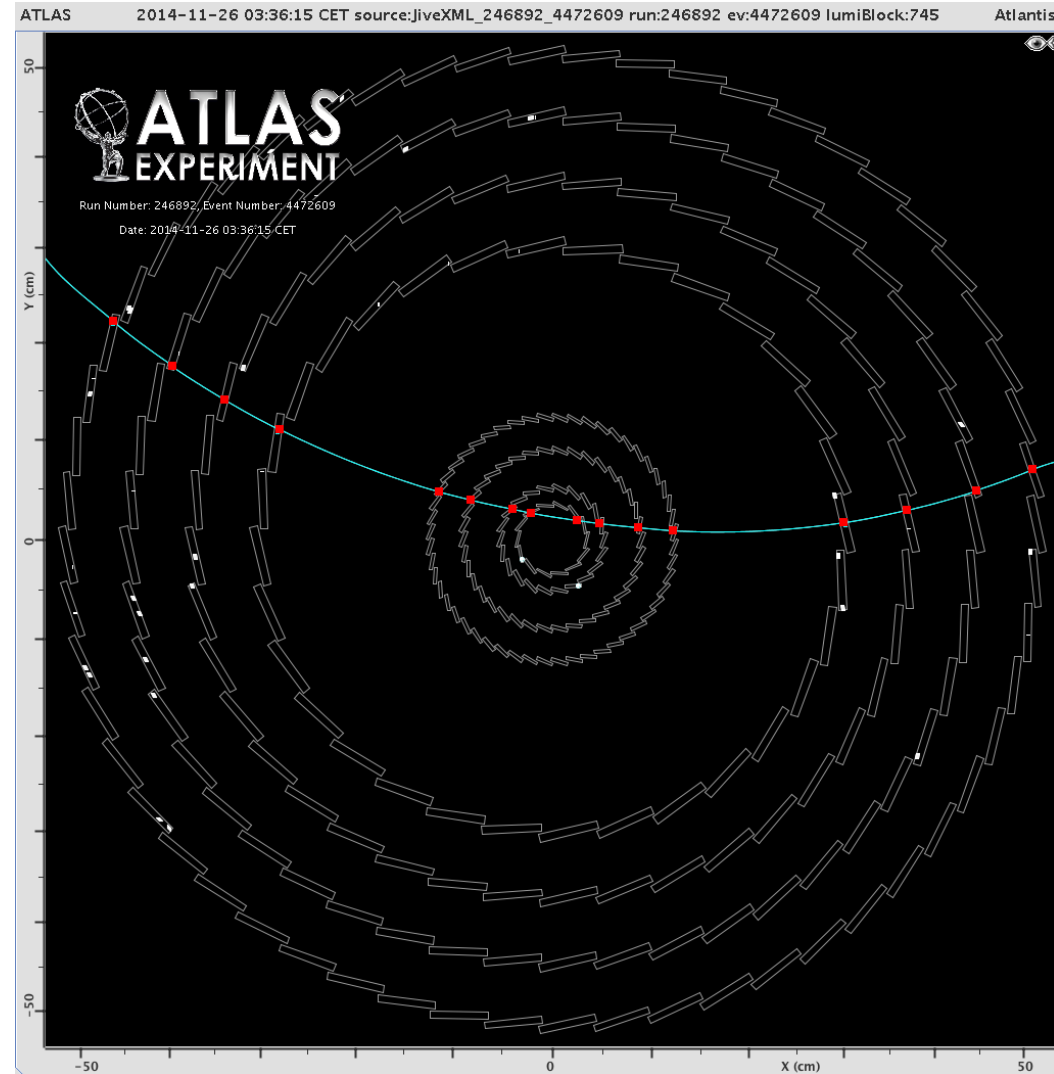




Pixel and IBL in ATLAS now



- Cosmic ray reconstructed in Atlas tracker with Pixel and IBL in the center





TALENT @ IdeaSquare



- IdeaSquare is the ideal place for young creative minds to mix and exchange ideas
- TALENT fellows come from physics, electronics, mechanics and work together with other students on several very successful projects :
 - Diamonds and silicon pixel detectors
 - Novel CMOS sensors
 - Integrated to telescopes for testbeams
 - Staves and module of the IBL at different construction phases