



ATLAS-ITk Pixel Module Loading Techniques

Joshua Stewart, Advisor Dr. Joseph Haley
Oklahoma State University, Department of Physics
SLAC DOE Laboratory, ATLAS Division



ABSTRACT

The new ATLAS pixel detector that will operate in the HL-LHC will consist of 5 barrel layers and several end-cap disks, equipped with pixel modules. New strategies are under development to safely and accurately load these pixel modules on carbon-based local-support structures. The local supports provide both, support and cooling to the modules. An efficient thermal path between the module and the local support must be guaranteed to ensure the optimal performance of the modules. Therefore, the interface (adhesive) between the module and the local support must be optimized to mechanically fix the modules and to function as an efficient thermal path. In this contribution the strategies used to load modules in prototypes and their evaluation will be discussed and results presented.

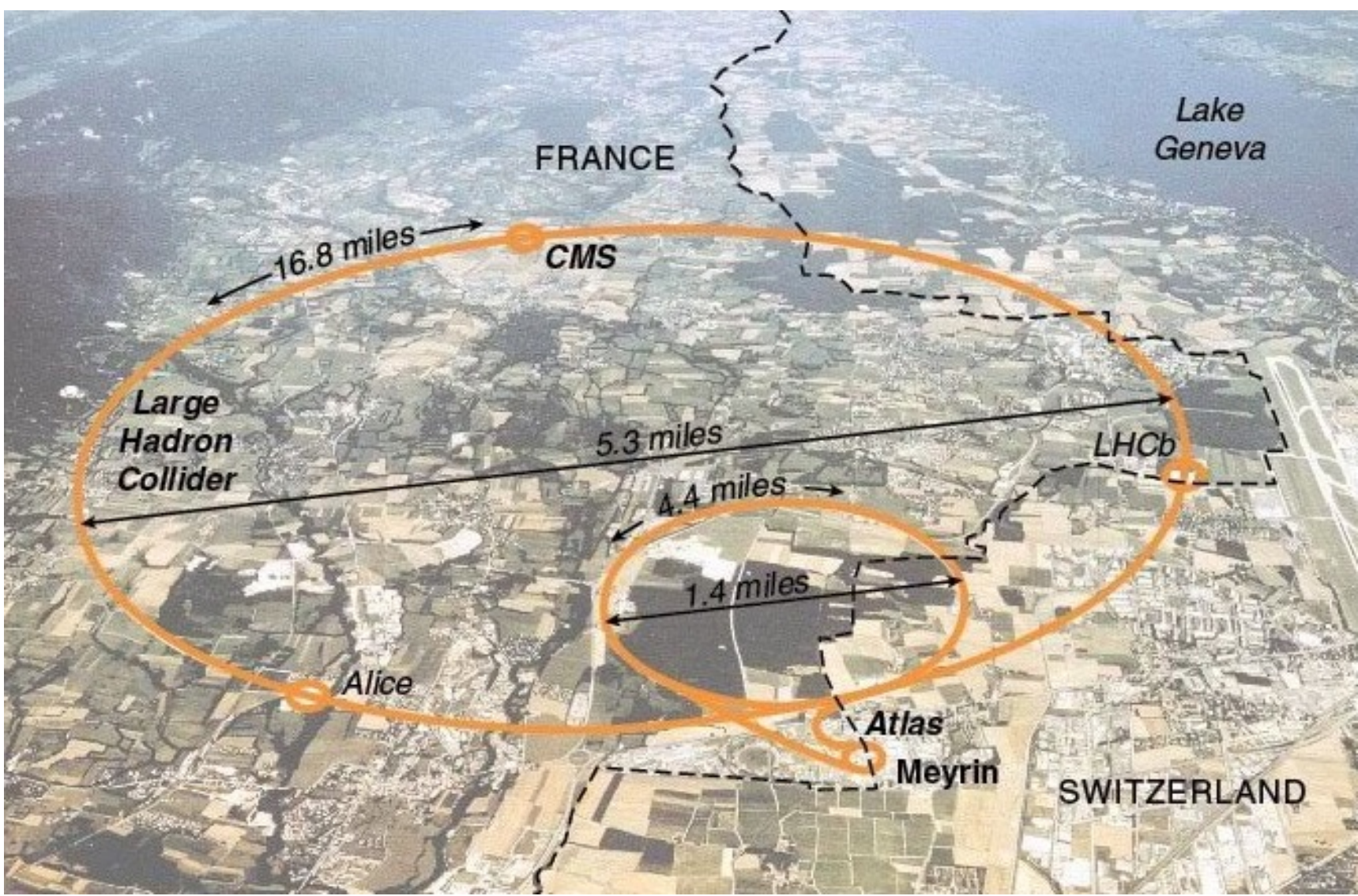
“The entire tracking system of the ATLAS experiment will be replaced during the LHC Phase II shutdown (foreseen to take place around 2025) by an all-silicon detector called the **ITk (Inner Tracker)**. The pixel detector will comprise the five innermost layers, and will be instrumented with new sensor and readout electronics technologies to improve the tracking performance and cope with the HL-LHC environment, which will be severe in terms of occupancy and radiation.” -T. Michael Flick, Phase II ATLAS Pixel Upgrade

Background

The Large Hadron Collider Geneva, Switzerland

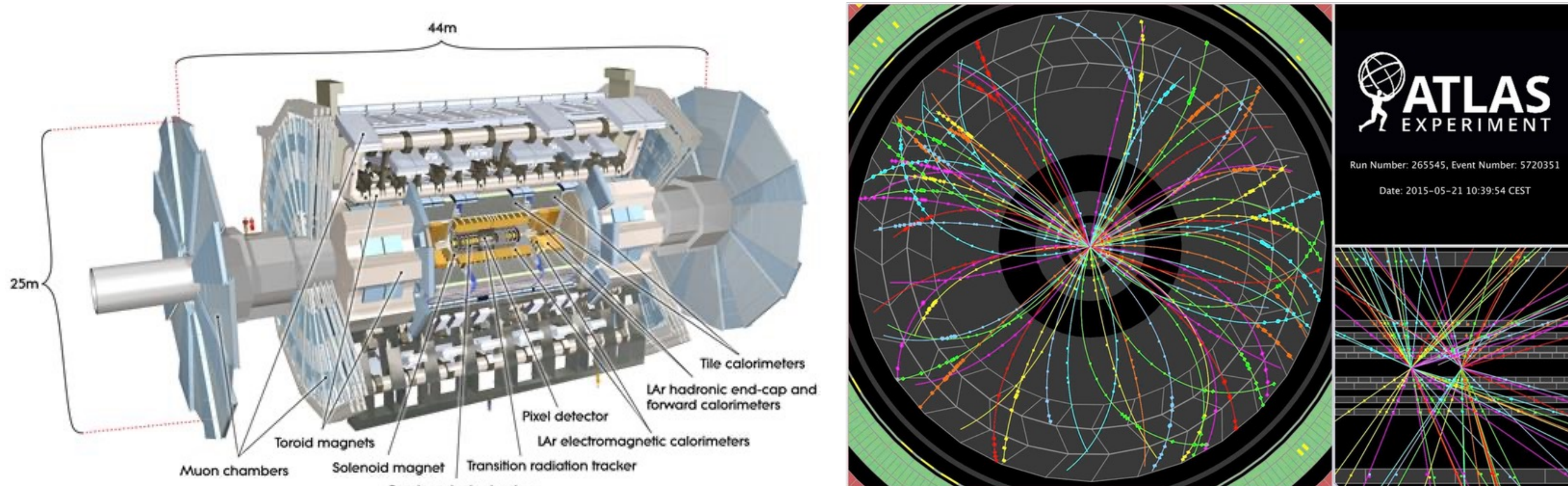
Protons, being a type of Hadron, gives the largest man-made device its name as it collides them at 0.999997828 times the speed of light.

- Operates at 1.9 Kelvin
- Under 10^{-6} m-bar vacuum (1 atmosphere = 1000 m-bar)
- Run 3 just began April 2022
- Produces tens of petabytes (10^{15} bytes) of information per year



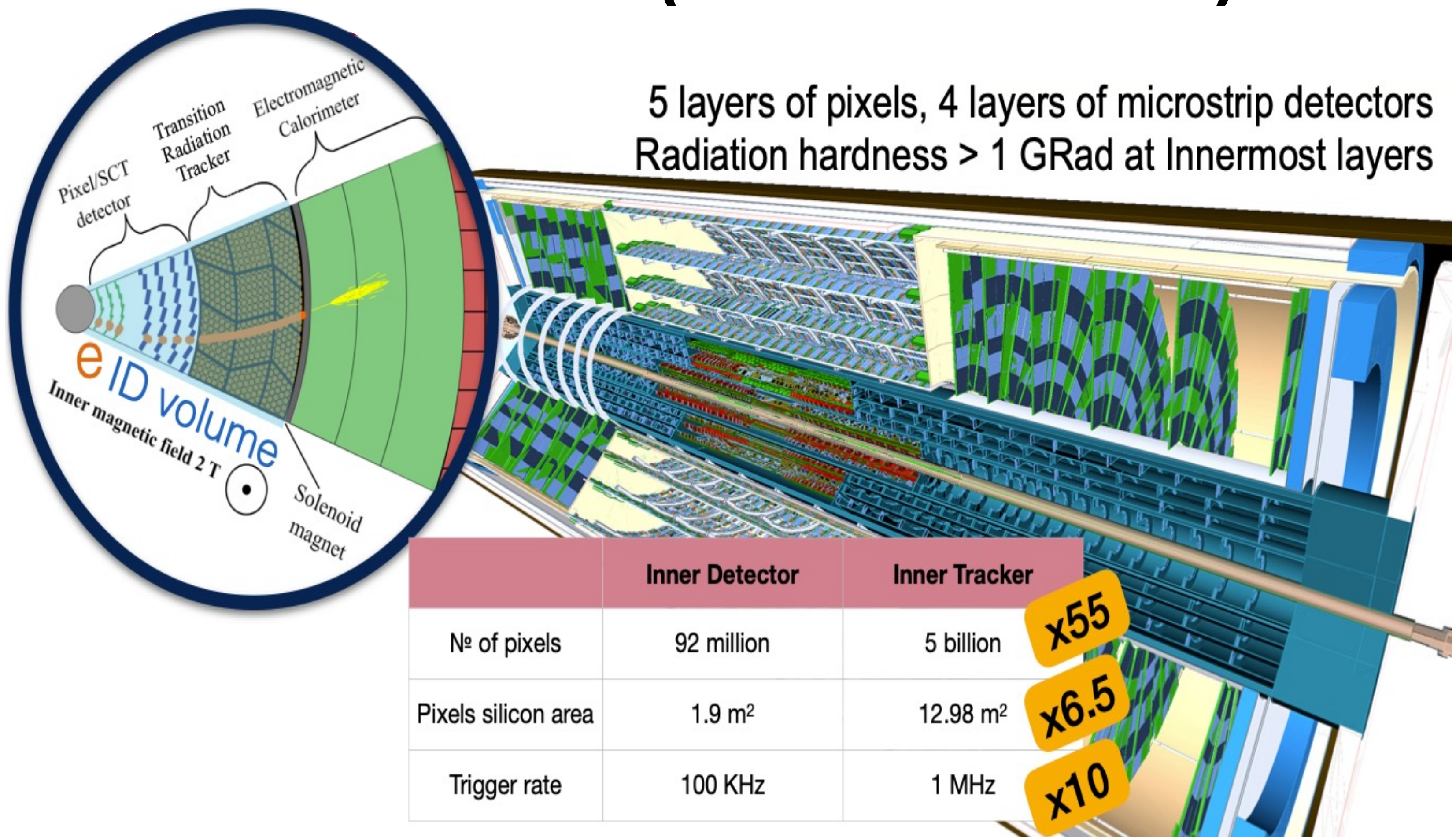
ATLAS Detector Tracking Charged Particles

Curved tracks (due to strong magnetic fields), allow for measurement of charged particle momenta.

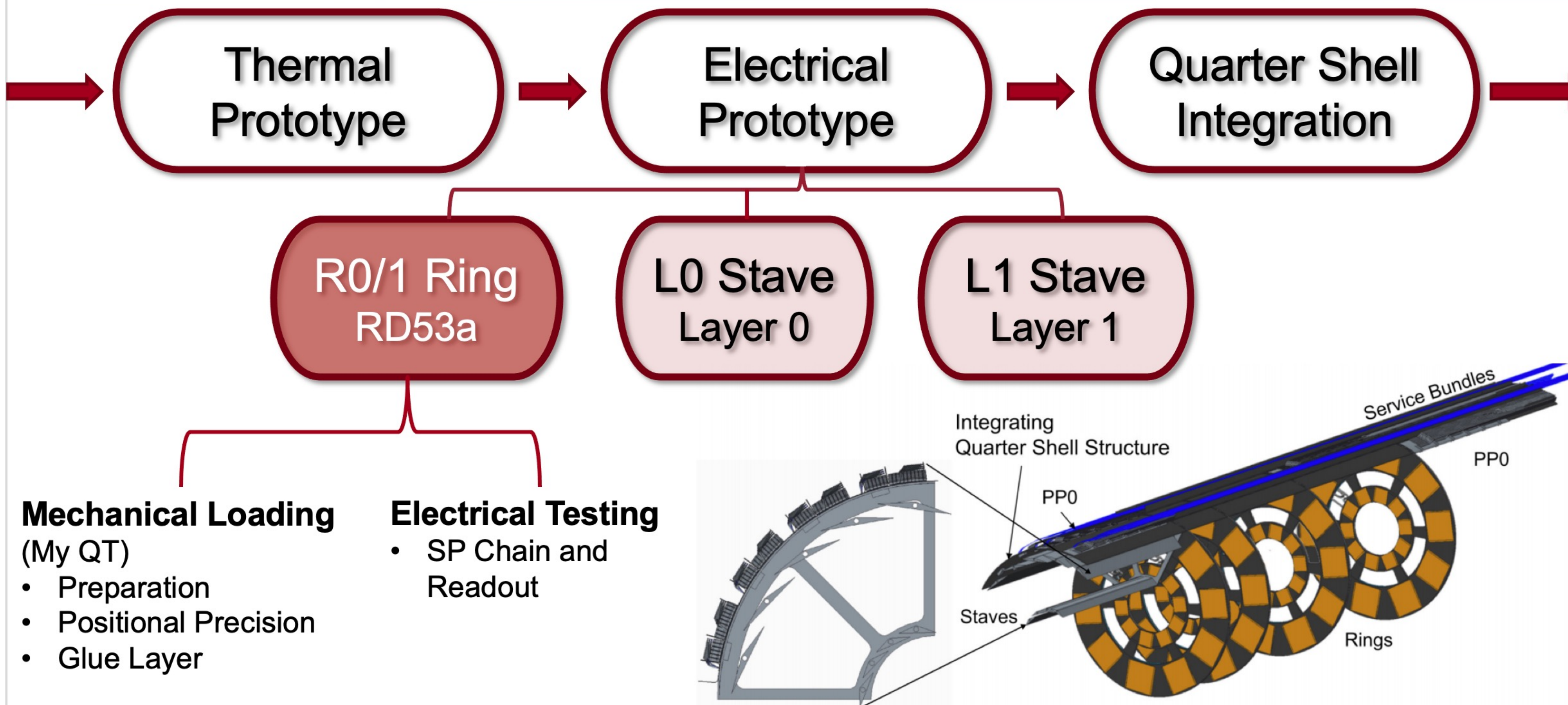


The ITk (Inner Tracker)

5 layers of pixels, 4 layers of microstrip detectors
Radiation hardness > 1 GRad at Innermost layers

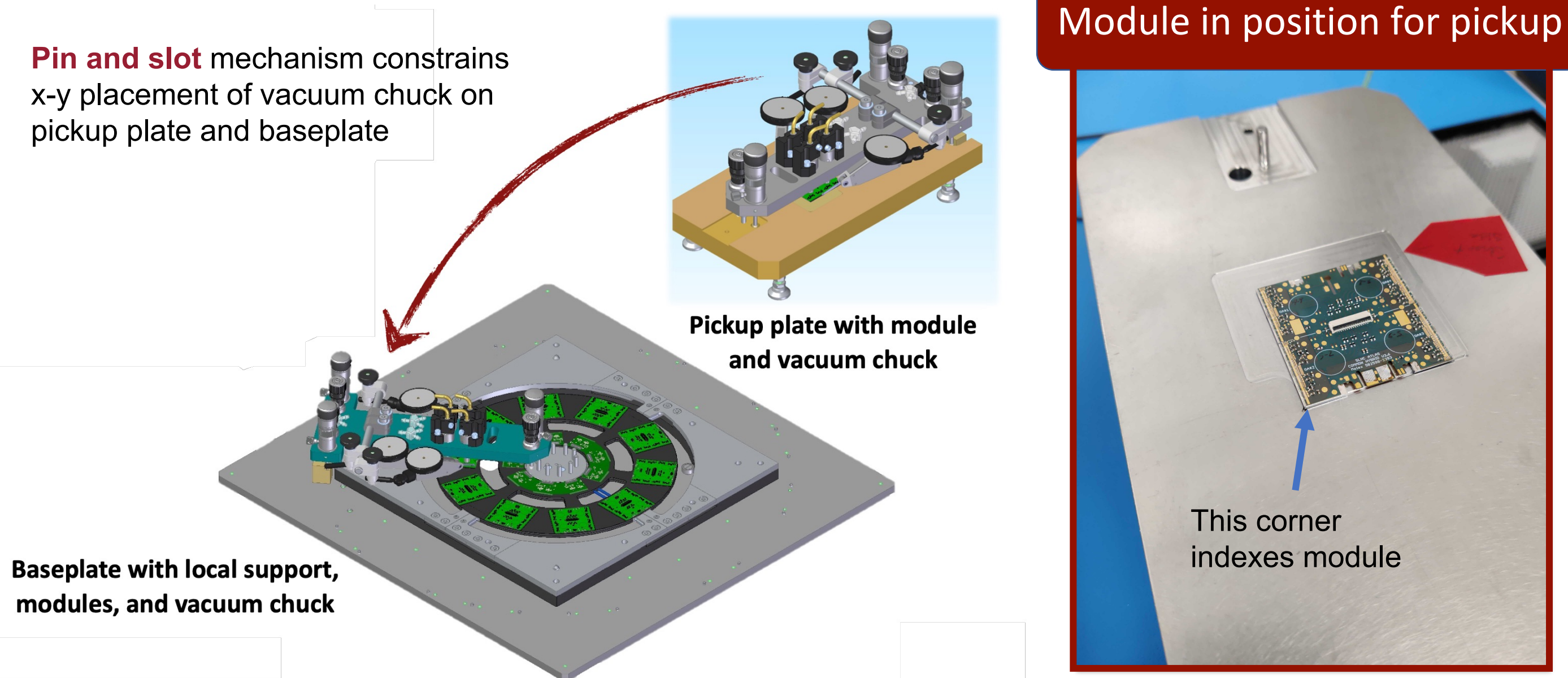


19-X Prototyping

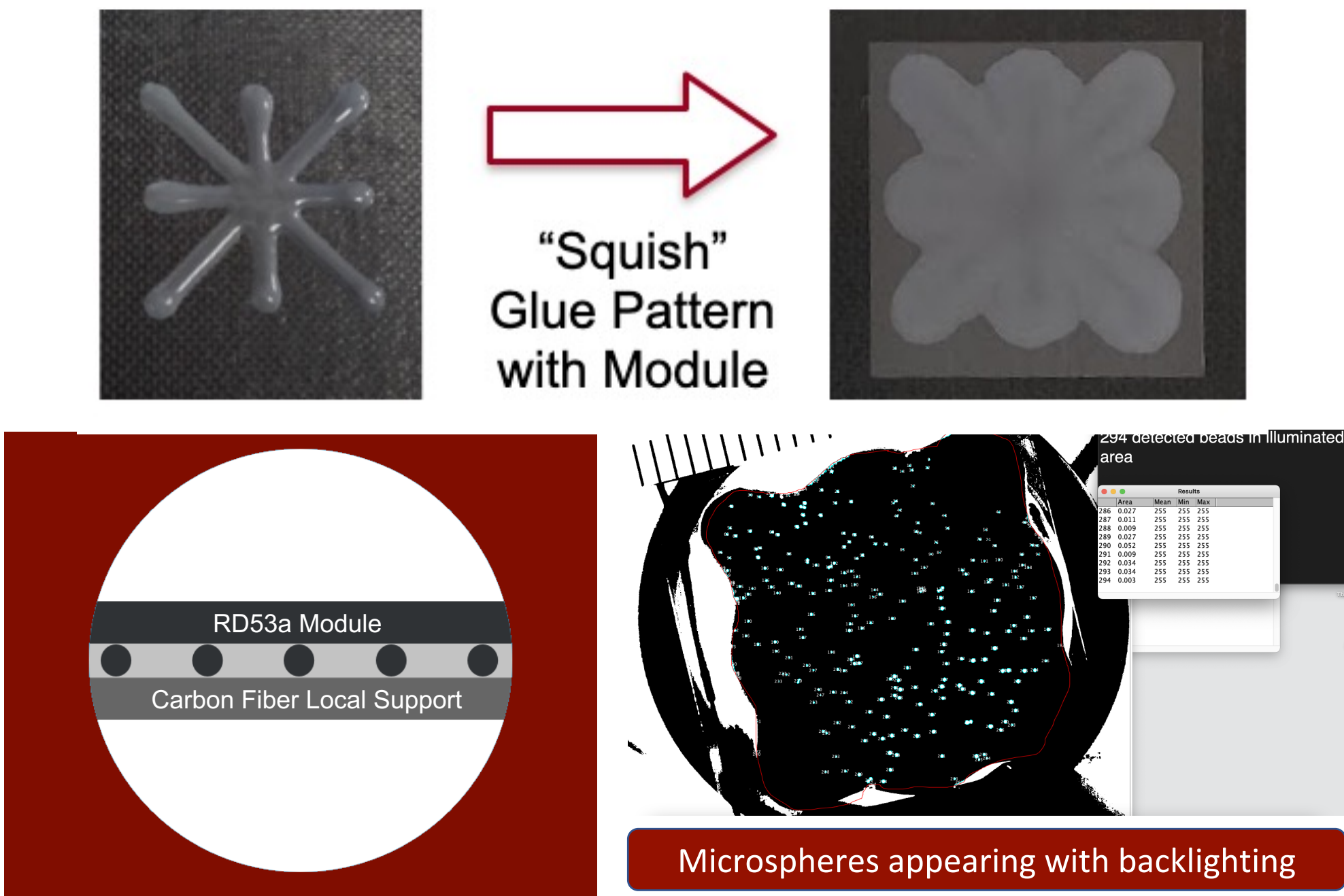


Module Loading

Indexing the RD53a Module X-Y Placement

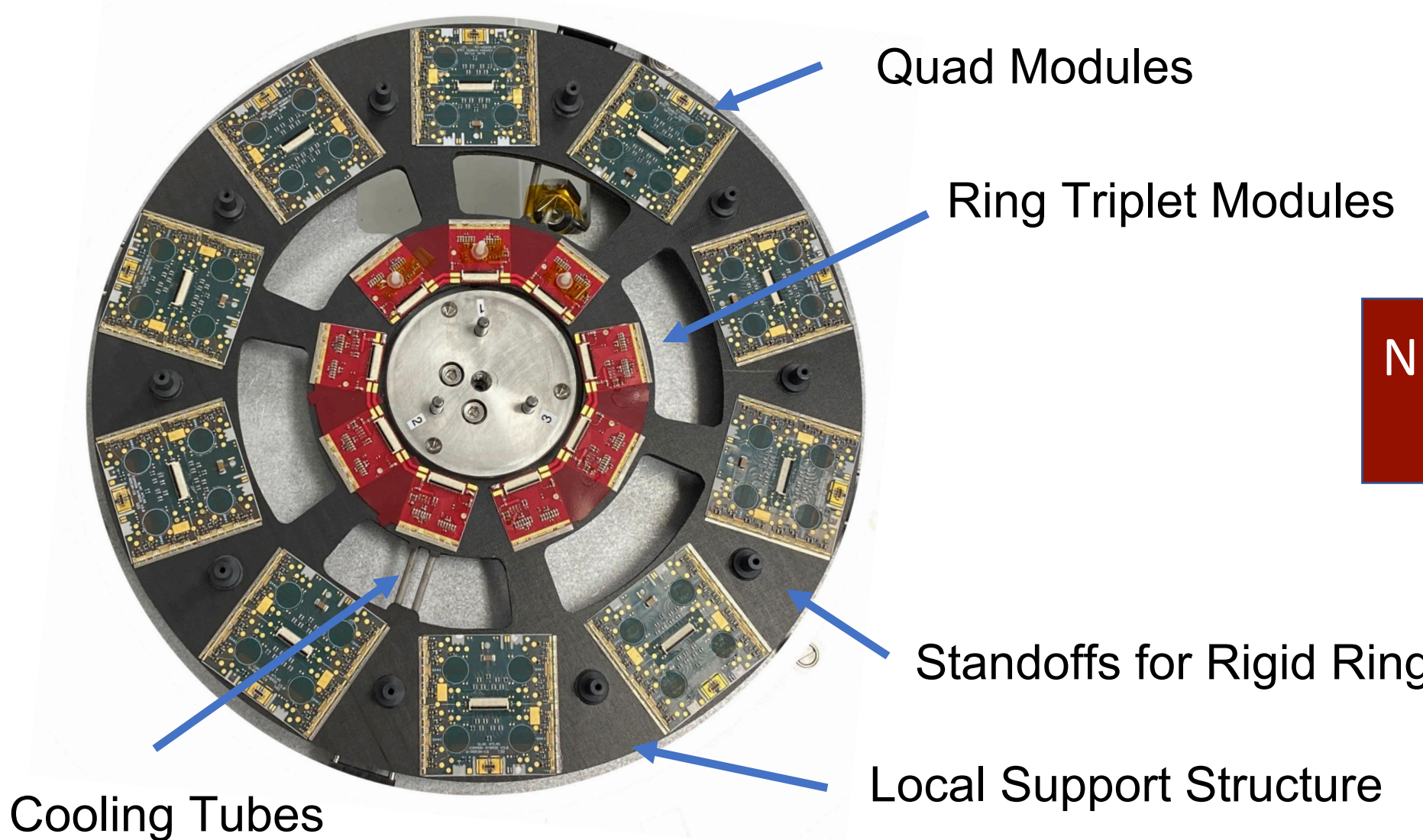


Thermal Transference: Modulated by Glue Thickness and Coverage



RD53a Ring Prototype Loaded SLAC April 26th, 2022

Featured in ATLAS Weekly, May 3rd



NEXT: Final Design Reviews and Pre-Production!