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Glue, Cracking, and Interposers: The ATLAS Inner Tracker Upgrade

The ATLAS Inner Tracker upgrade (ITk) is a silicon detector that will replace the existing Inner Detector in preparation for the HL-LHC. The subsystem of the ITk that I will be discussing is the ITk strips (more specifically ITk strips barrel) and the difficulties that have appeared in the past year of attempted production, such as module cracking. The ITk strips barrel subsystem is comprised of a concentric multilayered barrel structure. This is then further comprised of 392 mounted staves (long carbon fiber mounting boards that supply power, readout, and cooling to each sensor). Each stave houses 28, 97x97mm, 75.5 um pitch strip silicon detectors, or modules, which are mounted via conductive adhesive, SE4445. Over the past year, module cracking had been noticed to appear in some modules, noted initially as High Voltage Breakdown, but later discovered to be a result of physical strain on the module during thermal cycling due to the differing Thermal Expansion Coefficients (CTE values) between the silicon and the power board/hybrid data readout chips. In this lightning talk, I will discuss the R&D that has gone into resolving module cracking and the interposer solution that provides a transition between the CTE mismatch of the sensor and mounted circuit boards.

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