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Wirebond Encapsulation for HL-LHC Tracking Detectors

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Silicon-based tracking detectors are made possible by semiconductor industry advances, including high-density wirebonding for interconnects. Wirebond connections are made by ultrasonically bonding aluminium wire between sensors, front-end amplifiers and hybrid circuits. A large number of low mass, compact hybrid circuit 'modules', with millions of wirebonds, are needed and must withstand the harsh operational and environmental conditions of the HL-LHC experiments. Exposure to moisture, ionic (halogen) contaminants, and mechanical/thermal stresses can be highly detrimental and have led to unexpected wirebond failures in past and recent large-scale silicon detectors. For improved reliability, I will talk about ongoing evaluations of materials and methods for protection of wirebonds from the HL-LHC environment, as well as providing for handling, assembly, electrical and thermal considerations.

Author: Mr ARNDT, Kirk (University of Oxford Department of Particle Physics)

Presenter: Mr ARNDT, Kirk (University of Oxford Department of Particle Physics)