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Interconnects and Assembly Technologies for Hybrid Pixel Detectors

Hybrid pixel detector modules are state of the art in vertex detectors of the high-energy physics as well as the x-ray cameras in synchrotron radiation experiments. Each module of such a detector consists of a sensor chip and one or more electronic readout chips. In order to connect every pixel on the sensor with an electronic readout cell both parts are bump bonded together.
Solder bump bonding is one of the standard technologies for bonding of hybrid pixel detector modules. Using this technology readout chips with Indium, tin-silver or lead-tin solder bumps are connected to the under bump metallization on sensor pixel pad side. In addition to the well-known solder bump bonding technology the presentation will give an overview of alternative bonding technologies like transient liquid phase bonding (TLPB), thermo-compression bonding or metal-oxide-hybrid bonding. But these technologies require alternative interconnect structures and bonding process parameters. On the other hand these bonding technologies will show advantages either in terms of operating conditions of the hybrid modules or can be used for instance for the bonding of very thin chips.
Based on the description of the alternative bonding technologies examples of use will be given in this presentation. The use cases will describe hybrid module bonding for pixel detector applications as well as other applications like silicon interposers or 3D electronic packages with through silicon via (TSV).

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