



Sample Project: Development of ATLAS ITK Pixel Detector module concept based on new 3D integration technologies

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Title
Development of ATLAS ITK Pixel Detector module concept based on new 3D integration technologies

Description
<p>The ATLAS collaboration is currently developing new pixel detectors to cope with the requirements of a tracker upgrade for HL-LH Phase II operation. The ATLAS ITK tracker will need to cope with up to ten-fold increase in radiation damage, hit occupancy and data rates which will require new or improved sensor technologies as well as new module integration technologies.</p> <p>The large size of future pixel detector system, up to 20 m² in active area, requires the development of novel module integration concepts to provide a cost effective assembly and construction of tens of thousands detector modules. Novel industrial-based 3D interconnection technologies using through-silicon-bias (TSV-last) and direct laser soldering of ASICs to flex circuits offer those possibilities. They will allow to achieve final pixel detector modules which are thin, low mass, and reliably integrated objects of sensor, fronted readout ASICs and low mass readout services.</p> <p>Our group strongly pursues the development of ATLAS ITK Pixel Detector modules, in particular the development and qualification TSVs on existing pixel readout chips, their integration to flex circuits with direct laser soldering and connection to low-mass carbon fibre-based readout services.</p> <p>The candidate will work in a team of engineers and physicists to develop the novel pixel detector module concept based on TSV and laser soldering. The project includes the collaboration with specialised CMOS industrial experts on 3D integration, the design and qualification of TSVs, redistribution layers and flex circuits for laser soldering. As part of the qualification of first module prototypes the candidate will work in a team of engineers and physicists during electrical qualification and radiation tests of prototype pixel modules. In a second phase of the project the candidate will test ITK pixel detector modules with novel carbon-fibre based readout services. Data-transmission through carbon-fibre based ζcablesζ has recently been demonstrated as promising alternative to metal-based cables. They allow for significantly reduction of on-detector mass and structural integration to the carbon-fibre mechanical support structures. Signal transmission on carbon fibres cables will allow the candidate to assess its future potential for large detector systems.</p>

Skills

Education in electronics engineering or applied physics, experience in or keen interest to acquire knowledge in design and system integration of VLSI electronics.

Disciplines

Applied Physics, Electronic Engineering

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