Contribution ID: **38** Type: **not specified**

Low material budget aluminium-polyimide adhesiveless interconnection elements for detectors for LHC and future colliders

Tuesday, May 28, 2024 5:30 PM (15 minutes)

One of the key achievements within last decade in creating vertex detectors for upgrade existing and creating new detectors for physics experiments is developing and using novel thin silicon novel thin Monolithic Active Pixel Sensors (MAPS) e.g. ALPIDE MAPS developed by ALICE collaboration for Upgraded Inner Tracking System (ALICE ITS2). Using such thin (˜50um thick) silicon sensors allows to obtain unprecedented low material budget of 0.05-0.1%X0 per layer.
Meanwhile, for successful realization of low material budget detector modules also need to be chosen and used reliable and robust interconnection technique and low budget materials for realization of interconnection elements. Taking into account features of existing technologies, materials and approaches one of optimal option is using single- and multilayered printed circuit flexible microcables and boards based on adhesiveless aluminium-polyimide foiled dielectrics. As an interconnection techniques ultrasonic welding of aluminium ribbon leads can be used (Single-point TAB technique, SpTAB).
Using special ultralight microcables (so-called „chipcables„) allows to perform functional testing MAPS that results to ensure using only fully tested and high-quality sensors for further assembling detector modules (approach is implementing in pixel layers for ALICE FoCal).
Abovementioned materials and approaches also might be used for novel extremely low budget detector layers based on thin curved/bent stitched MAPS. Using such materials and approaches allow to perform connecting flexible interconnection elements to the sensor and then perform their bending to required radius (prototypes of ALICE ITS3 single chip assemblies created and successfully tested).
As further development for realization interconnection elements for detector layers new adhesiveless aluminium-polyimide materials with thin (10um) and thick (200um) conductive aluminium layers for low budget modules and for modules with requirements concerning low voltage drop respectively are developed.

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Session Classification: Session III

Track Classification: Detectors for LHC and future colliders