TWEPP 2012 Topical Workshop on Electronics for Particle Physics

Contribution ID: **124** Type: **Poster**

Hybrid circuits for the CMS Tracker upgrade front-end electronics

Thursday, 20 September 2012 17:14 (1 minute)

The upgrade of the CMS tracker at the HL-LHC requires the design of new front-end modules to cope with the increased luminosity and to implement L1 trigger functionnality. The new modules under development are based on high density hybrid circuits with new flip-chip front-end ASIC, and are wire bonded to strip sensors and connected to a service board for the data transmission. The suitability of different substrate technologies considered for the design of the hybrids is discussed, aiming for a cost effective and reliable manufacturability of the CMS tracker modules.

Summary

The increase of luminosity planned at the HL-LHC is setting new constraints for the CMS Tracker that imposes its upgrade. The higher luminosity will result in a significant increase of the rate of events in the tracker that is addressed with the implementation of a binary readout tracker with higher density of channels. To cope with the increased amount of events a new Level 1 Track Triggering functionnality will be provided by means of specific tracker modules.

New tracker modules are now under development. Firstly, a double sided strip module suitable for the outer areas of the tracker is presented. Its hybrid circuits are based on eight bump bonded CBC2 front-end ASICs that collect 1016 strips signals wire bonded from the sensors at each side, with a pitch of 90 microns. The interconnection on both sides but also between neighboring ASICs enables the stub identification that is necessary for the rejection of low momentum tracks. This densely interconnected hybrid circuit requires the use of high density substrates that are typically used for packaging applications. Rigid, organic multilayer build-up substrates that can provide the required layout densities will be presented. The constraints and features of these rigid build-up substrates, available through several well established manufacturers will be presented. A second option, based on very high density flexible foils made of spinned liquid polyimide build-up structures can also be used for the interconnecting function. This technology is strongly emerging now and is becoming available through several manufacturers too for microelectronics packaging solutions. However, these foils need to be glued on the module structure and despite this added integration complexity their extremely reduced mass is a very valuable feature for the construction tracker modules. Prototype designs to evaluate the suitability of these rigid and flexible substrates will be shown.

For the inner tracking areas, a hybrid module made of a strip sensor on the top side and of a pixelated strip sensor on the other side is being developed. The pixel and strips correlation will allow creating stubs with Z information. Here also, hybrid circuits are proposed to connect the top side sensor strips and the bottom side pixel ASICS to the bump bonded front-end ASICs. To enable the correlation between the strips and the pixels, an increased density of wirebonds is required on the pixilated strips side. Rigid build up substrates allow for a standard wire bonded implementation. A solution based on flexible polyimide foils is also presented, that enables a bump bonded assembly of the pixel ASICs. However in this case the pixel ASICs need to be bump bonded on both sides to provide the interconnection with the sensor and with the polyimide foil: this requires the use of low density through silicon vias, a technology that is also being explored and that will be presented too.

Primary author: BLANCHOT, Georges (CERN)

Presenter: BLANCHOT, Georges (CERN)

Session Classification: POSTERS