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Low mass aluminium microstrips for data transmission in the Micro Vertex Detector of the Panda experiment.

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The Micro Vertex Detector is the innermost part of the Panda experiment and is constituted of pixels and strips. The design foresees a triggerless data acquisition, and Topix is the current Asic solution for the pixel readout featuring more than 10k cells with a serial data output exploiting the GigaBit Transceiver project, at present under development at CERN, that will manage the data transmission and the clock distribution.
The connections on the sensor module are made in aluminium to keep low the impact on the material budget; the first prototypes were produced with a 1m length and folded layout, while the width was in the range 100÷200μm. At present there are samples with the same extent but a straight layout to evaluate the aluminium uniformity, and electrical tests are ongoing to verify the behaviour with transceivers complying with the Scalable Low Voltage Signaling standard.

Summary 500 words

The experiment for antiProton ANnihilations at DArmstadt (Panda) will be installed at the new Fair facility in 2017, where the beam will collide on a fixed target.
The Micro Vertex Detector (MVD) is the innermost part of the whole apparatus and is constituted of 4 coaxial barrels and 6 forward disks. The pixel sensors are foreseen for the two internal layers, while double sided strip sensors will form the two external layers; all the disks will be made of pixel with the last two surrounded by a ring of double sided strips.
The main requirements for the pixel detector are a cell size of 100·100μm2, a master clock of 155.5MHz, an amplitude resolution of 12b and a data acquisition system that is able to run triggerless, thus producing a huge amount of data.
The Asic called Topix is the current solution for the readout of the pixel detector, and it will consist of an array including 116·110 cells. Due to the low material budget, limited at 1% of the total radiation length per pixel detector layer, to save on cabling the Topix architecture features a serial output for a data transfer at high speed with a line rate at about 320Mb/s; the system is based on the GigaBit Transceiver (GBT) project under development at CERN for the upgrade of the LHC experiments.
The GBT chipset foresees also an optical transceiver that, besides the data acquisition, will manage the clock distribution and the detector control system; the connections with Topix will be performed by low mass cables made of aluminium microstrips on a kapton support.
The cable are designed in aluminium instead of standard copper to have a low impact on the material budget, and they are constituted by an array of microstrip pairs related to a common shield layer. Different prototypes were produced to test alternative technologies as laminated aluminium on kapton, or deposited aluminium on the same support. The first kind of samples were designed to test cables with the length of 1m produced with a snake like layout to accommodate the whole microstrip on a flexible support with a squared form factor, to avoid the problems related to the uniformity of the aluminium lamination or deposition on a very long structures. Searching for the better trade off between the track density and the signal quality, microstrip with different width and spacing were produced using the value of 100, 150 and 200μm, always holding steady the differential impedance of 100Ω. Currently the prototypes have the same length with a straight layout to test the capability to manufacture microstrip with an unusual dimension, besides a covering sheet has been added as top and/or bottom layer to make the cables stronger and opening the possibility for stacking them. The electrical tests have been performed both at high frequency to evaluate the data transmission quality, and at the operating data rate using the actual drivers and receivers that are conforming to the Scalable Low Voltage Signaling (SLVS) standard; the results will be presented.

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