Contribution ID: **80** Type: **Oral**

Multi-Gigabit Wireless Data Transmission

Thursday 14 April 2016 11:30 (20 minutes)

Wireless techniques have developed extremely fast the last decade, and using them in particle physics detectors for data transfer is not science fiction any more.
Tremendous advances in silicon technologies have made possible to build high performance transceivers operating in the mm band, where the 57-66 GHz band is situated. The use in the HEP environment has been triggered by the high data transfer rate that can be achieved in this license free 9 GHz band and its unique energy propagation charateristic.
It has a free space loss of 68 dB over 1m, a high penetration loss, measured to be about -50dB for a fully equipped SCT (ATLAS) detector module, and an oxygen absorption of about 15 dB/Km. The last effect is of less importance in this case, since a typical data transmission distance in HEP detectors is from a few cm to about a few meters where attenuation of about 0.1 dB are expected.Operating at 60 GHz frequency results in a more focused antenna with a narrower beam width for a fixed antenna size, that minimizes the possibility of interference and the risk that the transmission can be intercepted. Also the use of high carrier frequency provides low form factor, which will reduce the material budget. These features, the high path loss, high material penetration loss, narrow beamwidth, Line-Of-Sight (LOS), and operation in a controlled environment, makes the 60 GHz band optimal for short range operation. This provides an extremely desirable frequency-reuse that can handle a large number of transceivers in a small area as in the HEP detectors and other detector facilities. Also, the fact that we can provide higher data transfer by using higher frequencies to transmit the data, makes this spectrum feasible as replacement or supplement to fiber optics.
In this talk I will present the latest developments of the 60 GHz transceiver at University of Heidelberg as well as the development at CEA Leti, and antenna development at University of Uppsala.

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Session Classification: Common Detector Technologies

Track Classification: Experiments and Detectors