Contribution ID: **257** Type: **Mini Oral and Poster**

Iterative Retina for barrel-shape tracker and high magnetic field and high track multiplicity

Tuesday 13 October 2020 16:42 (1 minute)

Real-time track reconstruction in high energy physics experiments at colliders running at high luminosity is very challenging for trigger systems. When it is run on FPGAs, the Retina algorithm has been used in High Energy Physics experiments mainly in the case of parallel plane detection layers without magnetic field such as the LHCb VELO detector. However another interesting geometry is a tracking detector with a barrel shape made of multiple concentric cylindrical layers surrounded by a strong magnetic field. Our research aims to adapt Retina algorithm to a tracker detector with cylindrical geometry and complex physical environment and implement it on FPGA devices. We have first studied the Retina algorithm performance in terms of Pt and initial angle resolution with a simple simulation then with a full GEANT4 simulations. For such detector geometry and in presence of high track multiplicity, we have recently developed a process where the Retina algorithm is run in an iterative way, identifying region of interests in the track parameter space in the first pass and then reconstructing the track parameters with high accuracy in the second pass. From the simulation, both the efficiency and the purity of our procedure is above 90%. Getting promising results we are now implementing it in an FPGA. A Xilinx Kintex-7 evaluation board is chosen as the firmware platform. In this contribution we will report on the expectations from the simulations and the preliminary performance (efficiency, resolution, resource and latency) results on the hardware platform.

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Author: Mr DENG, Wendi (ULB & CCNU)

Co-authors: Mrs SONG, Zixuan (ULB & CCNU); DE LENTDECKER, Gilles (Universite Libre de Bruxelles (BE)); Prof. WANG, Dong (CCNU); Prof. HUANG, Guangming (CCNU); Prof. ROBERT, Frédéric (ULB)

Presenter: Mr DENG, Wendi (ULB & CCNU)

Session Classification: Poster session B-01