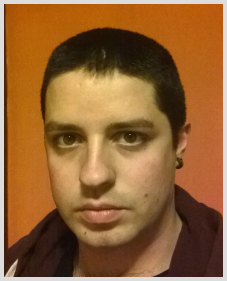

Real time tracking with a silicon telescope prototype using the “artificial retina” algorithm

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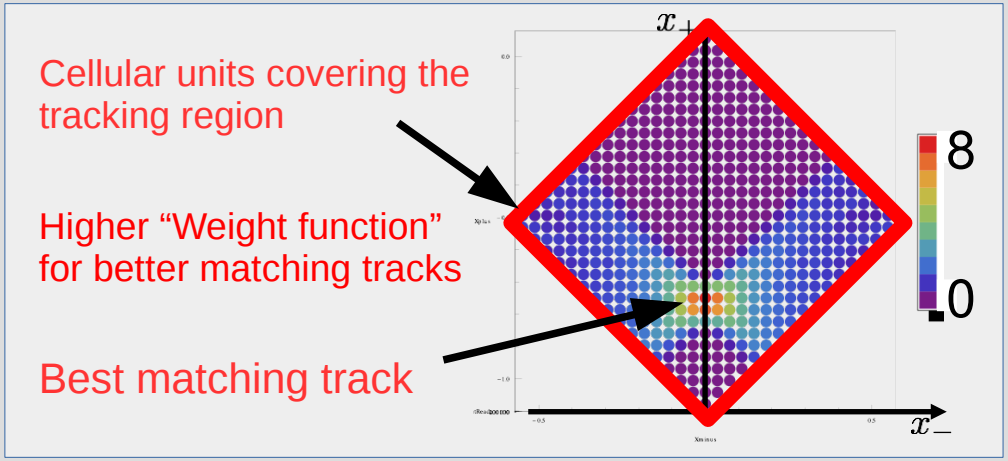
Overview :

- The first prototype of a tracking system with “artificial retina” is presented
- Highly parallelized and pipelined architecture, implemented on commercial FPGAs (Xilinx Kintex 7)
- Real time track reconstruction with offline-like quality and sub-μs latencies
- Modular system:
  can be designed to work at 40MHz LHC rate

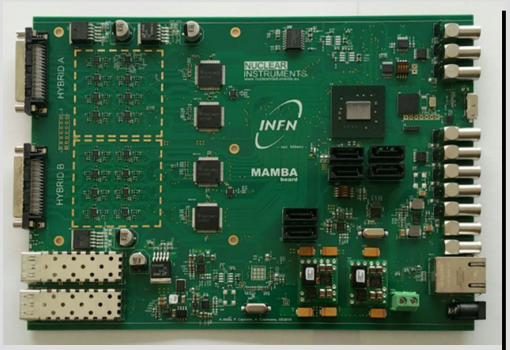
Retina Algorithm :

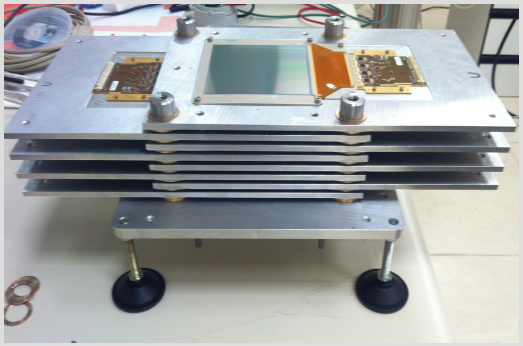
- Inspired from neurobiological mechanism of edge recognition in visual cortex
- A pool of “cellular units” compares the hits from telescope different track hypoteses in parallel



- Tracks are identified by local maxima of the “Weight function”

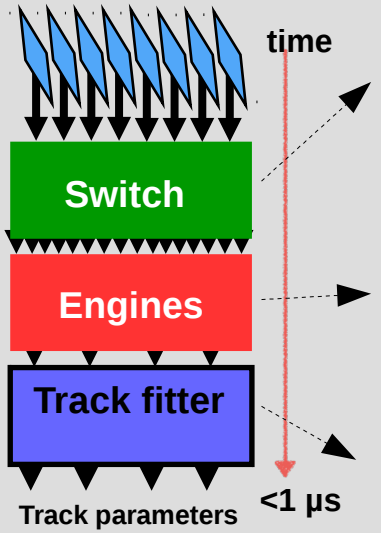
- Custom DAQ board based on Xilinx Kintex 7 FPGA → MAMBA ("Most Advanced Multi Beetle Acquisition") board
- ADC, Zero suppression and hits clustering
- **On-board Retina Algorithm**
- MAMBA board and telescope designed and produced in Milano





- 2D tracking telescope
- 8 single-sided silicon strip sensors:
  → ~10x10cm² active area
  → 183μm pitch,
  → 500μm thickness

Retina Architecture



delivers clusters to cellular units with expected non-negligible response

a pool of cellular units sums the responses for each incoming cluster

provides the track parameters via interpolation of adjacent cell Weight values near the found local maxima

Results and future plans

- **Artificial retina algorithm implemented on custom DAQ+Retina boards, equipped with commercial FPGAs (Xilinx Kintex 7)**
- **Retina architecture succesfully tested up to 40 MHz track rate with FPGA simulation**
- **Real time track reconstruction with offline-like quality and sub-μs latencies**
- **Full prototype functionalities to be tested on beam this summer**

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