An optical network for accelerating real-time tracking with FPGAs

The **"Artificial Retina"** architecture is a **tracking** system that can operate at the very **first level of processing**.
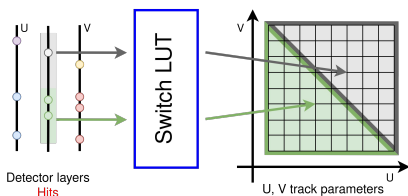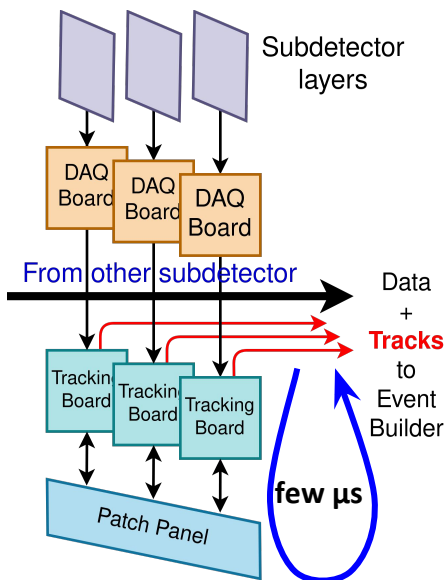
The **distribution network** allows to **collect data from several DAQ** nodes and **overcome FPGA size limits**.

Tracking cells spreaded on separate chips.

The network is implemented with **optical serial links**.

The system can be integrated in **LHCb** data flow.
VELO tracking is a interesting case to study.

The full-simulation shows **very close efficiency performance.**

Track type	ε CPU pat-reco (%)	ε FPGA pat-reco (%) all z	fiducial z-region
Long tracks with $p > 5$ GeV/c and hits in VELO> 5	99.84 ± 0.02	99.27 ± 0.06	99.45 ± 0.05
Long tracks from b with $p > 5$ GeV/c and hits in VELO> 5	99.61 ± 0.13	99.24 ± 0.21	99.41 ± 0.18
Long tracks from c with $p > 5$ GeV/c and hits in VELO> 5	99.89 ± 0.12	98.50 ± 0.53	98.62 ± 0.53
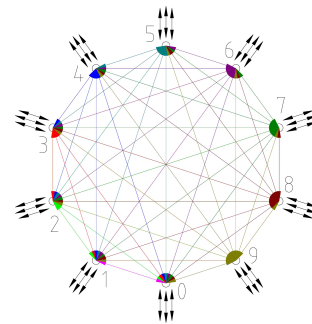
Life-size prototype with 10 Boards in **advanced state of realization**, passing all preliminary tests.

Long run test at max speed on a smaller system: **no transmission error** detected on all but one link.

Planned to perform **parasitic operation** on real VELO data during **Run-3 data taking**.