



The LHC Beam Loss Monitoring System

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Beam Loss Monitoring - OVERVIEW

What does the system do?

It measures beam losses in the LHC ring and decides if the beams can continue circulating or they need to be extracted.

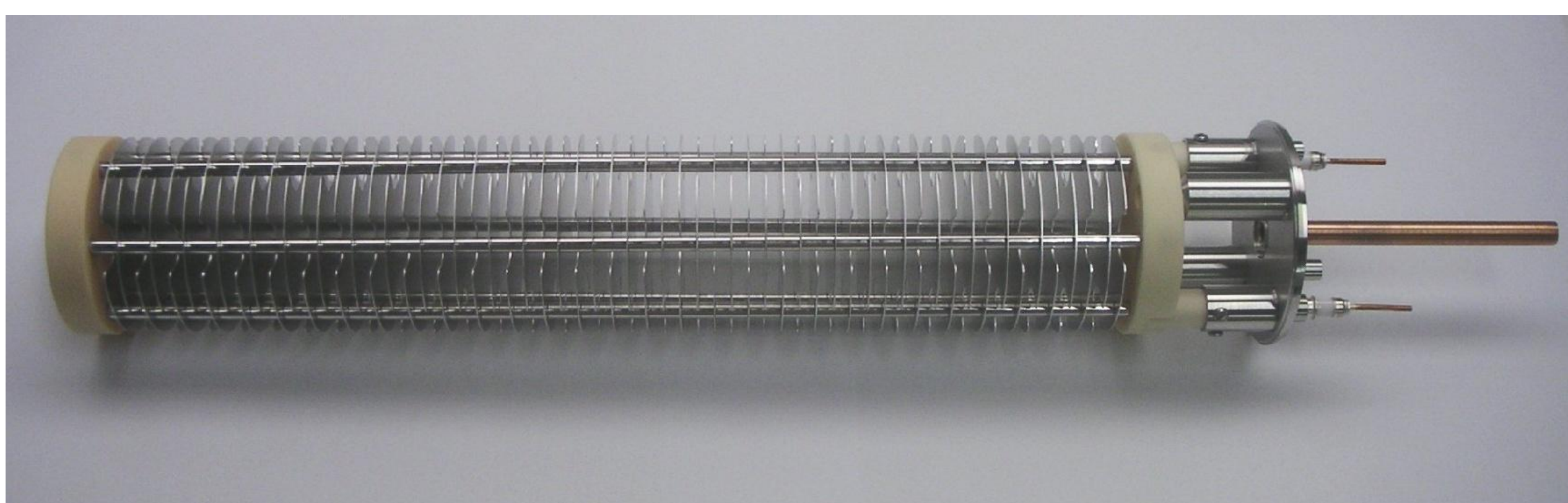
Why?

- To prevent quenches in the superconducting magnets
- To protect machine components against damage
- To identify the loss mechanisms and provide localized measurements of beam losses
- To assist in the tuning of the machine, e.g. by performing aperture scans

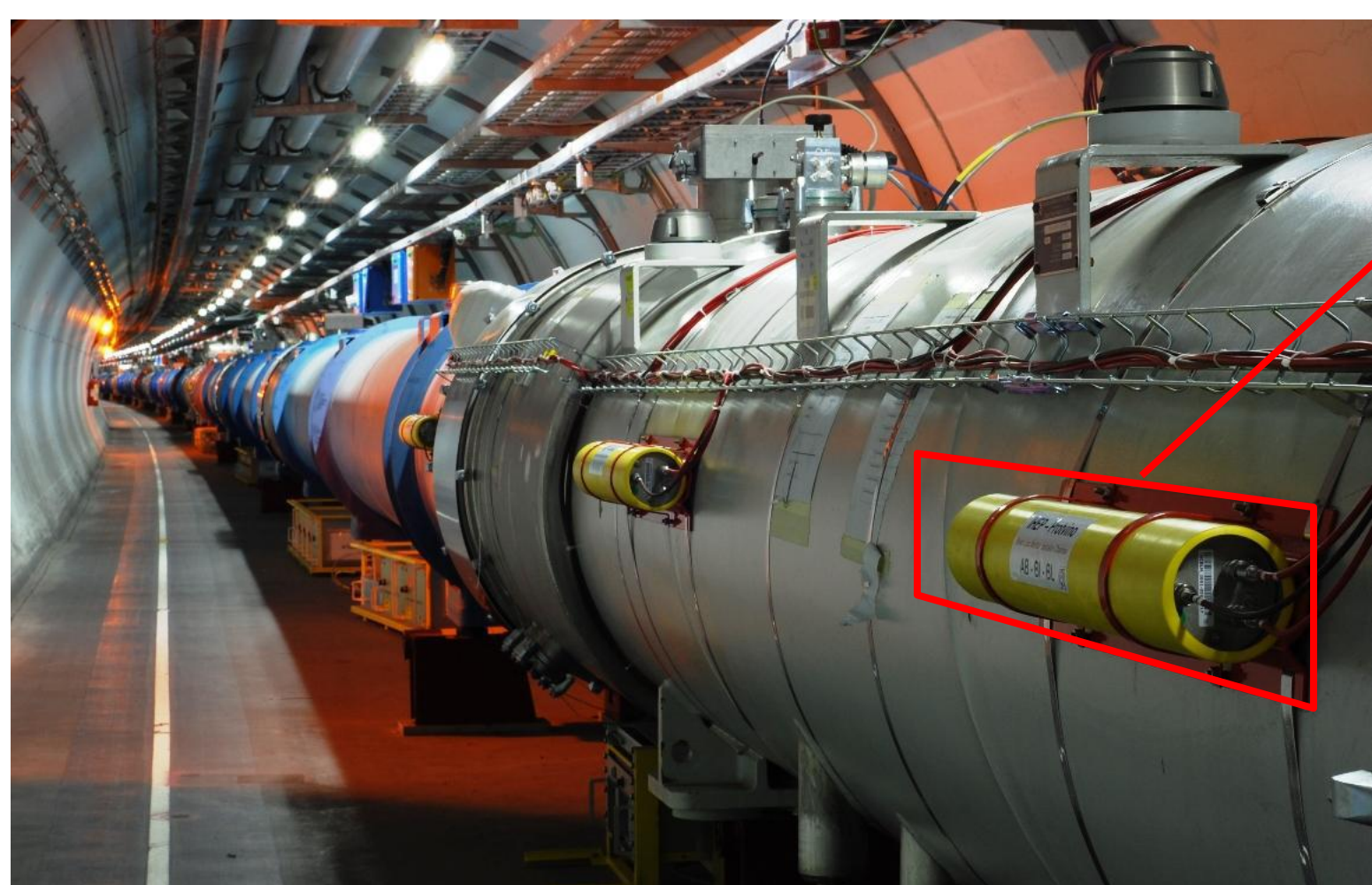
How?

- The *Detector* provides a current proportional to the beam loss
- The *CFC* acquires and digitizes the signal and transmits the data to the surface electronics via gigabit optical links
- The *TC* receives the digitized data, processes it and decides if the beams can continue circulating

Detector: Ionization Chamber

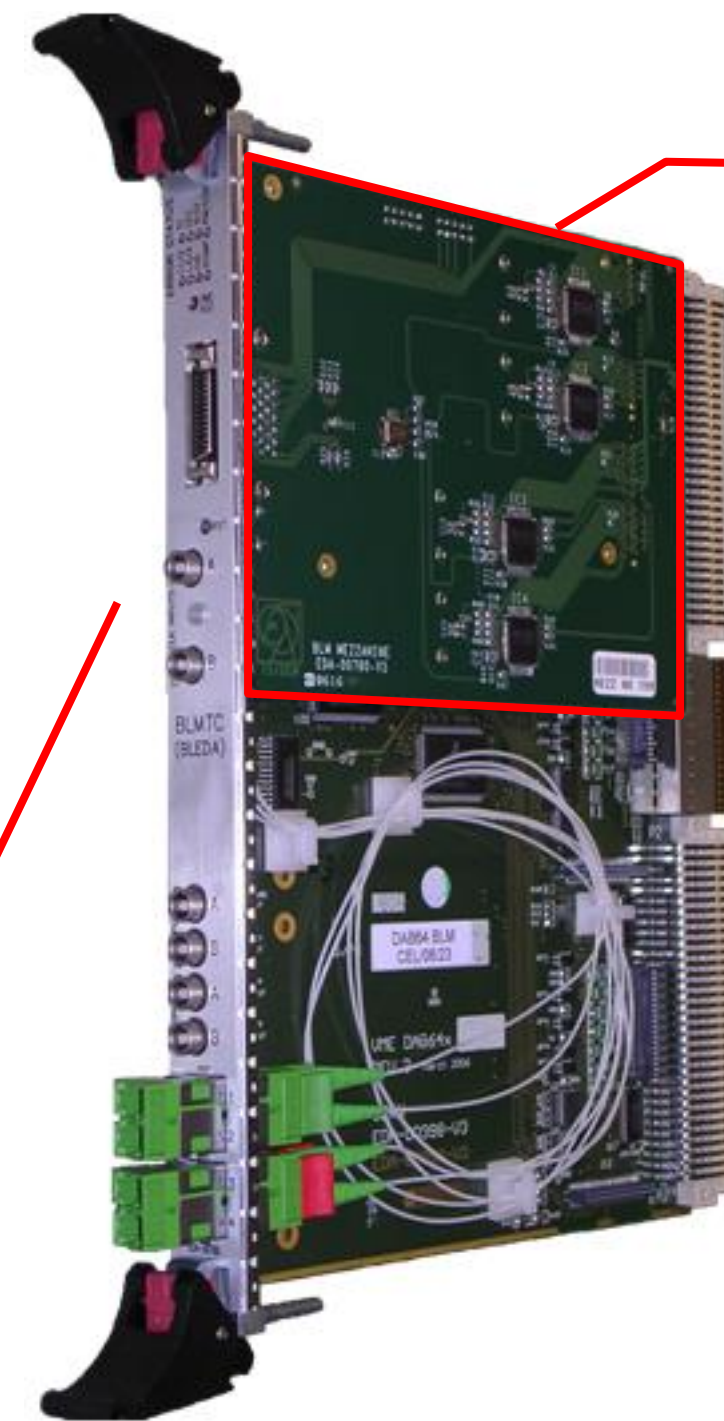


- About 4000 detectors around the ring, outside the cryostat
- Passing charged particles induce a current in the chamber

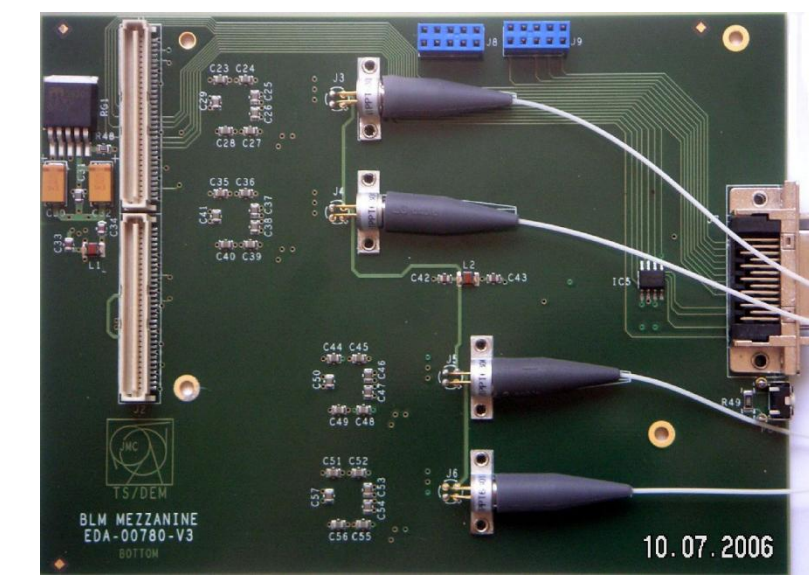


ANALOG LINK
max. 700 m

TC: Threshold Comparator



GOH Receiver Mezzanine

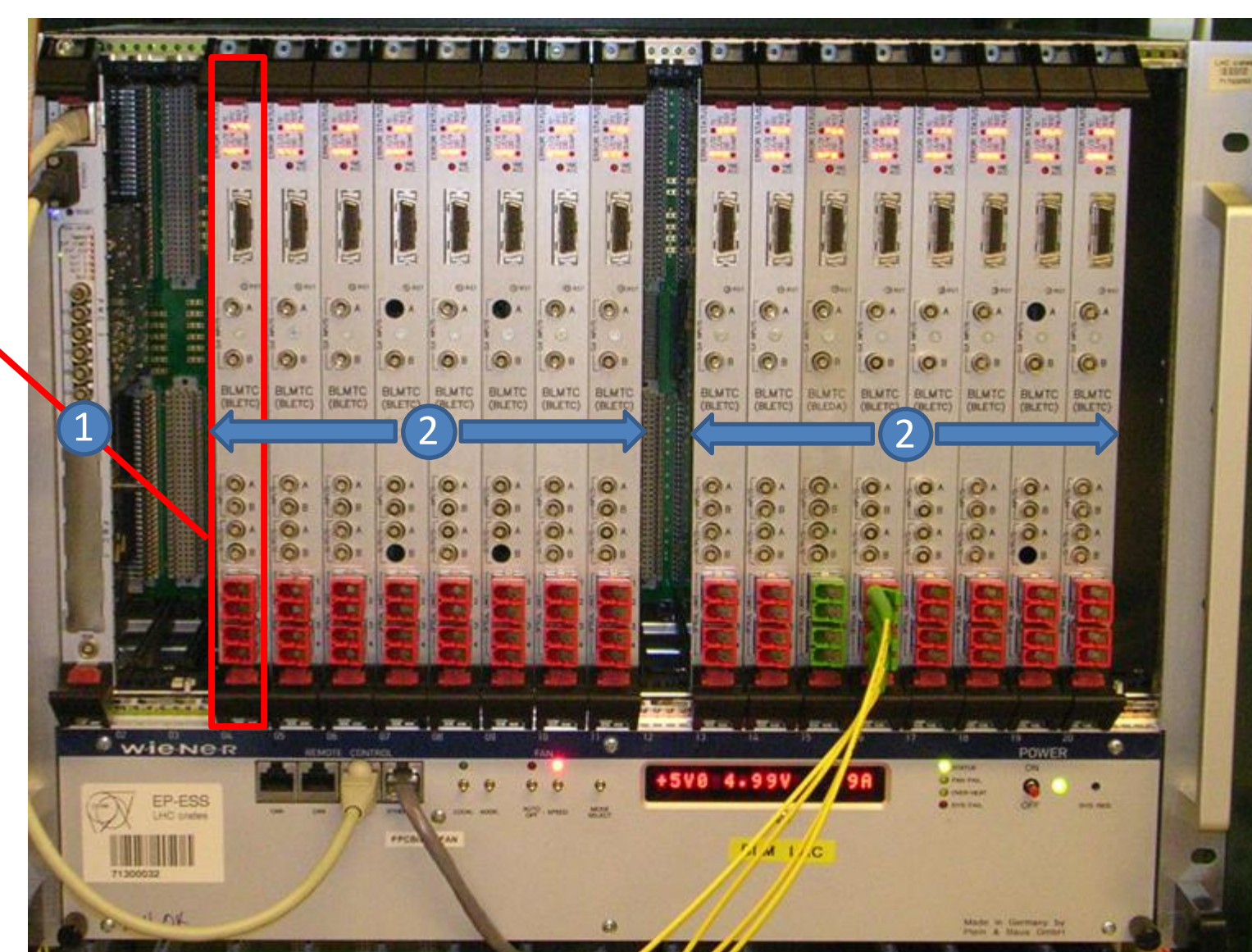


- Contains the receiver parts for two CFC outputs, handles deserialization and decoding of data
- Doubled optical links: *four* optical input diodes

FPGA-based processing:

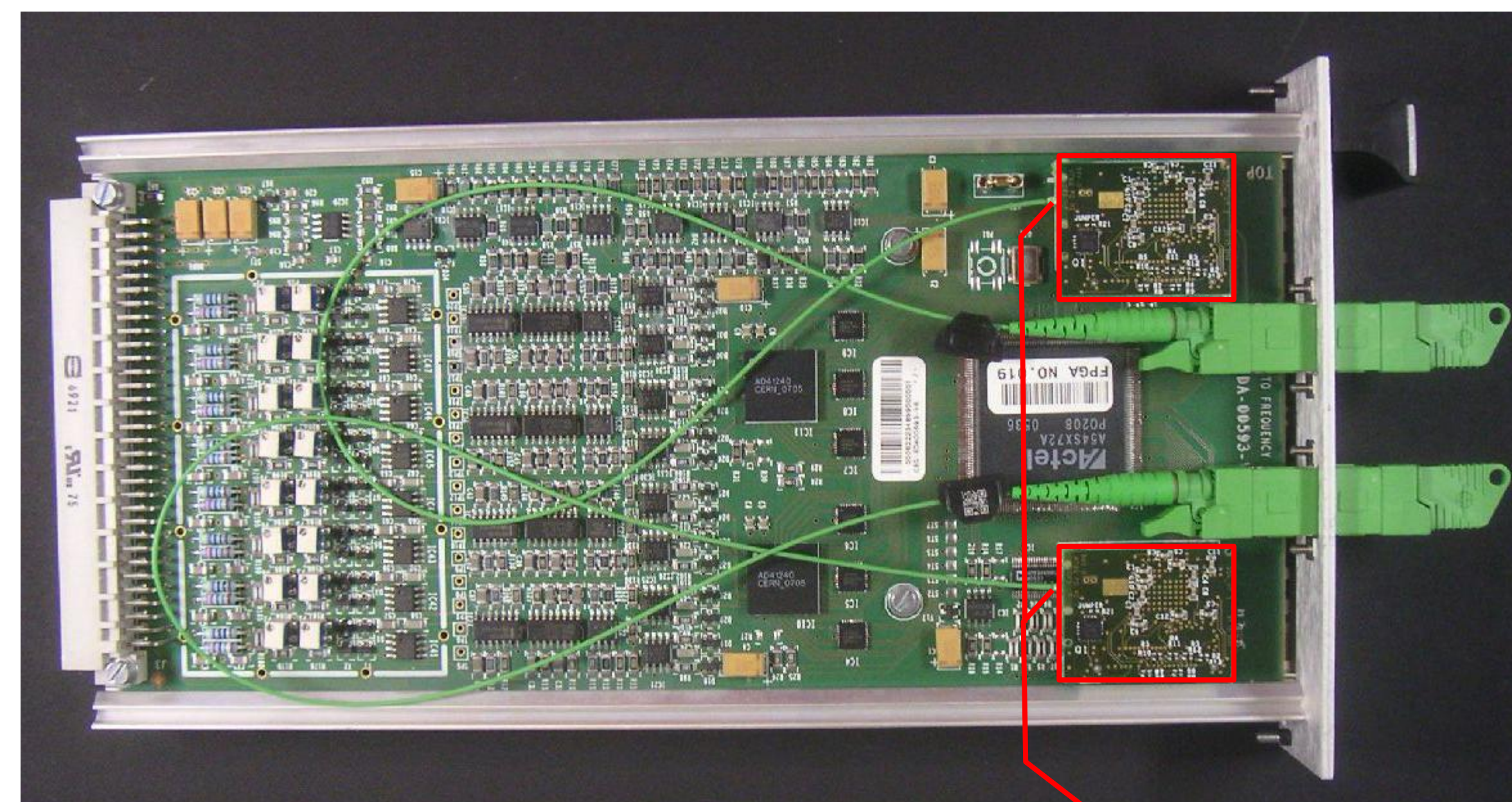
- Produces and maintains a history of the received data in the form of Moving Sum Windows
- Compares the sums to appropriate thresholds

VME Crate



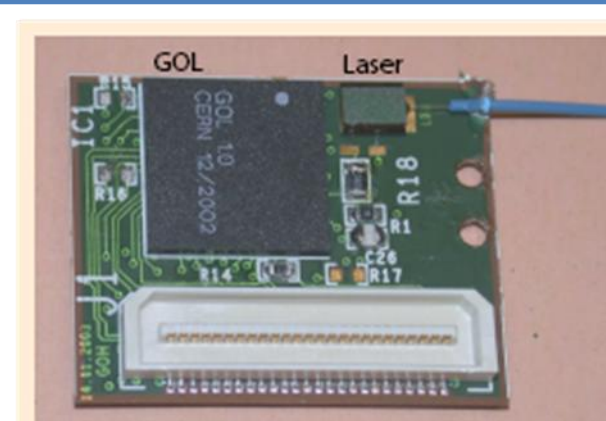
- ① Slot 1: Front End Computer (FEC)
- ② Slots 4-11, 13-20: Threshold Comparator (TC)

CFC: Current to Frequency Converter



- In the tunnel, therefore radiation-tolerant design!
- Digitizes and encodes current signal coming from 8 detectors
- Transmits the data to the surface electronics
- Doubled GOH interface to increase reliability

GOH Transmitter



- Gigabit *Optical Hybrid*: long-distance optical link
- Radiation-tolerant ASIC designed at CERN
- 800Mbps transmission rate

DIGITAL LINK
max. 3 km

TUNNEL

SURFACE