



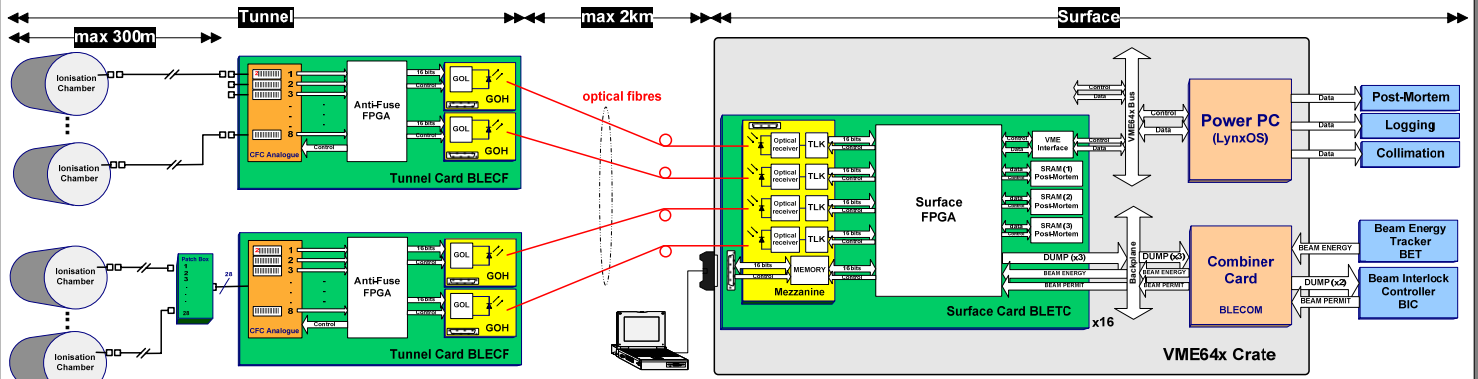
The LHC Beam Loss Monitoring System's Surface Building Installation.

C. Zamantzas, B. Dehning, E. Effinger, J. Emery, G. Ferioli

CERN, 1211 Geneva 23, Switzerland

Abstract: The strategy for machine protection and quench prevention of the *Large Hadron Collider* (LHC) at the European Organisation for Nuclear Research (CERN) is mainly based on the *Beam Loss Monitoring* (BLM) system. At each turn, there will be several thousands of data to record and process in order to decide if the beams should be permitted to continue circulating or their safe extraction is necessary. The BLM system can be sub-divided geographically to the *tunnel* and the *surface* building installations. In this paper the surface installation is explored, focusing not only to the parts used for the processing of the BLM data and the generation of the beam abort triggers, but also to the interconnections made with various other systems in order to provide the needed functionality.

BLM System Overview

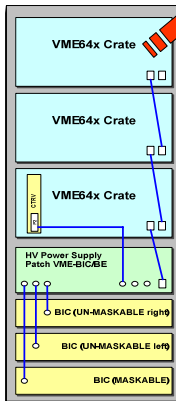


Around 4000 *Ionization Chambers* are the detectors of the system. Tunnel cards, called *BLECFs*, acquire and digitise the data from the detectors and transmit those at the surface using *Gigabit Optical Links*. There, the data processing cards, named *BLETCs*, receive those data and decides whether or not the beam should be permitted to be injected or continue circulating. Each surface card receives data from 2 tunnel cards, which means that it can treat up to 16 channels simultaneously, and provides data for on-line display and post-mortem analysis.

Rack

The **Rack** is accommodating three VME64x crates, three Beam Interlock User Interfaces (BIC), and the High voltage power supply for the detectors.

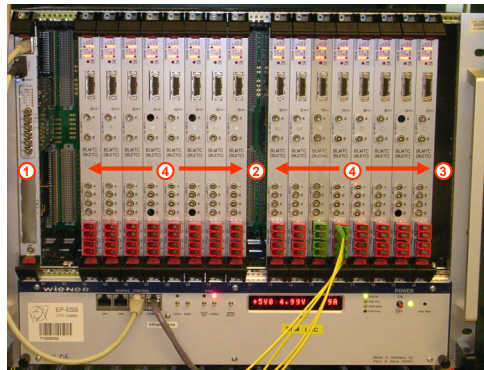
For the BLM system, 25 crates will be used in total, three at each point (except point 7 that will have an extra crate).



VME64x Crate

① The **Crate CPU** is a PowerPC with LynxOS. Its main purpose is to access periodically the processed data and provide them to the *Logging system*, as well as collect and time-stamp the *Post-Mortem* and the *Collimation* data whenever requested.

② The **Timing** card (slot 12) is the Timing Trigger and Control (TTC) card developed by the Beam Instrumentation group. In this application it will provide the Time-Stamp and the Post Mortem triggers.



③ The **Combiner** card (slot 21) is the final receiver of the two beam permit lines that are passing through each of the processing modules. It is re-distributing the Beam Energy data and can initiate various tests for the whole BLM system.

④ A VME card, named DAB64x that provides the processing power, and a mezzanine card, that links the tunnel with this surface installation, comprise each of the 16 BLETC Processing Modules.

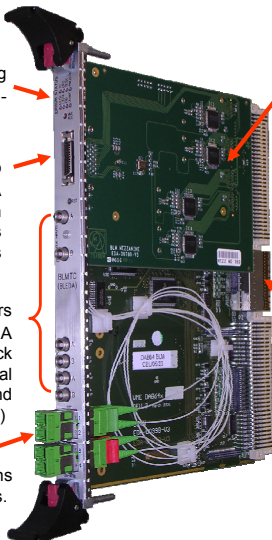
Processing Module (BLETC)

LEDs showing system and communication status

Connector to program the FPGA & Configuration devices, and gives additional access to 9 FPGA's I/Os.

LEMO connectors for accessing FPGA I/Os. (Two clock inputs, two general purpose inputs and two similar outputs.)

E2000-APC input connections to four optical fibres.



The **BLM Mezzanine** is hosting the receiver parts for four optical links. It handles the de-serialization and decoding of the four optical gigabit data transmission lines in parallel and provides the received data to the DAB64x card's FPGA device for processing.

The **P0** connector is using a custom-made backplane on the VME64x crate to daisy-chain, through each of the processing modules, the two beam permit lines and provide the beam energy data input.

BLM's FPGA Processes

