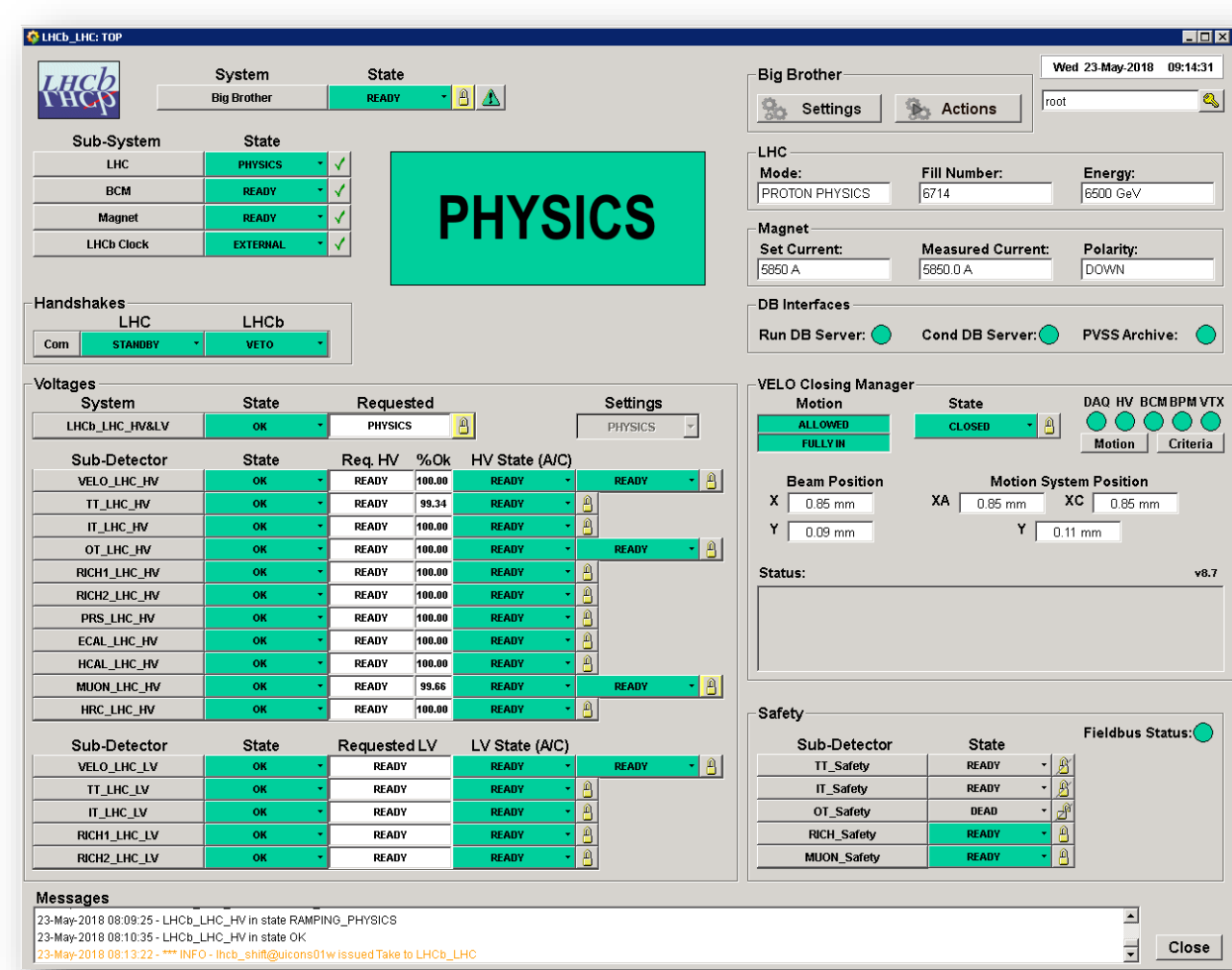
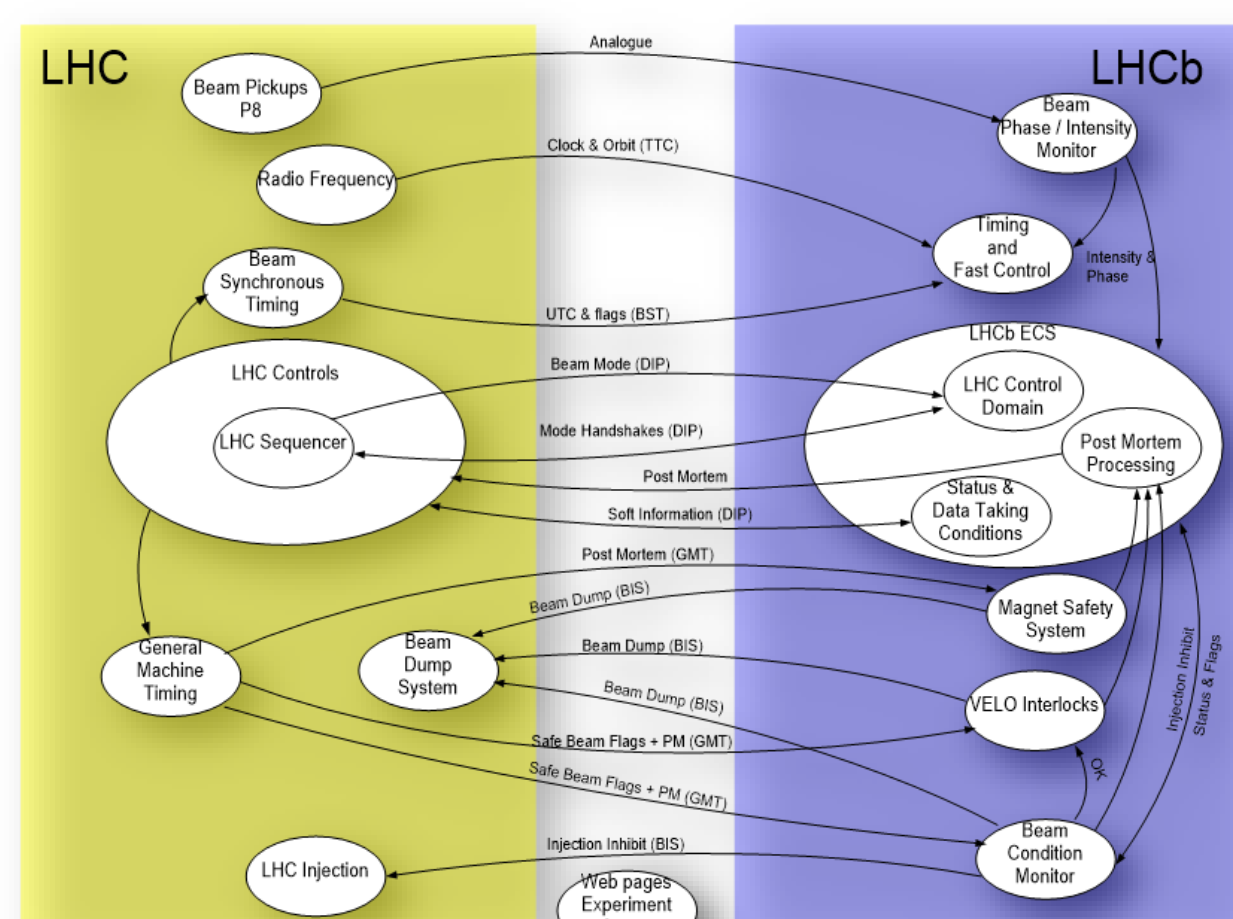


F. Alessio¹ on behalf of the LHCb Collaboration
¹CERN, Geneva, Switzerland

Automatic operations

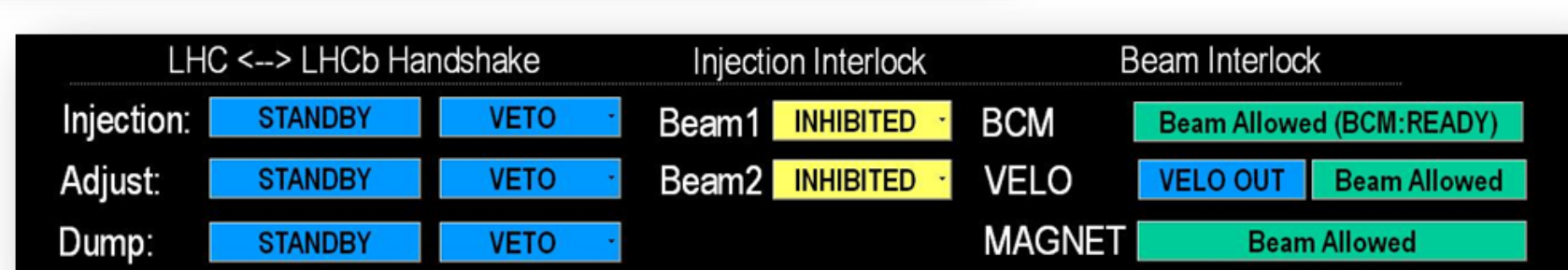
Extensive data exchange with LHC:

- **receive and archive** most important data regarding accelerator (states, modes, beam currents ...)
- **transmit feedback** information regarding operation in LHCb (movable detector position, background and timing measurements ...)

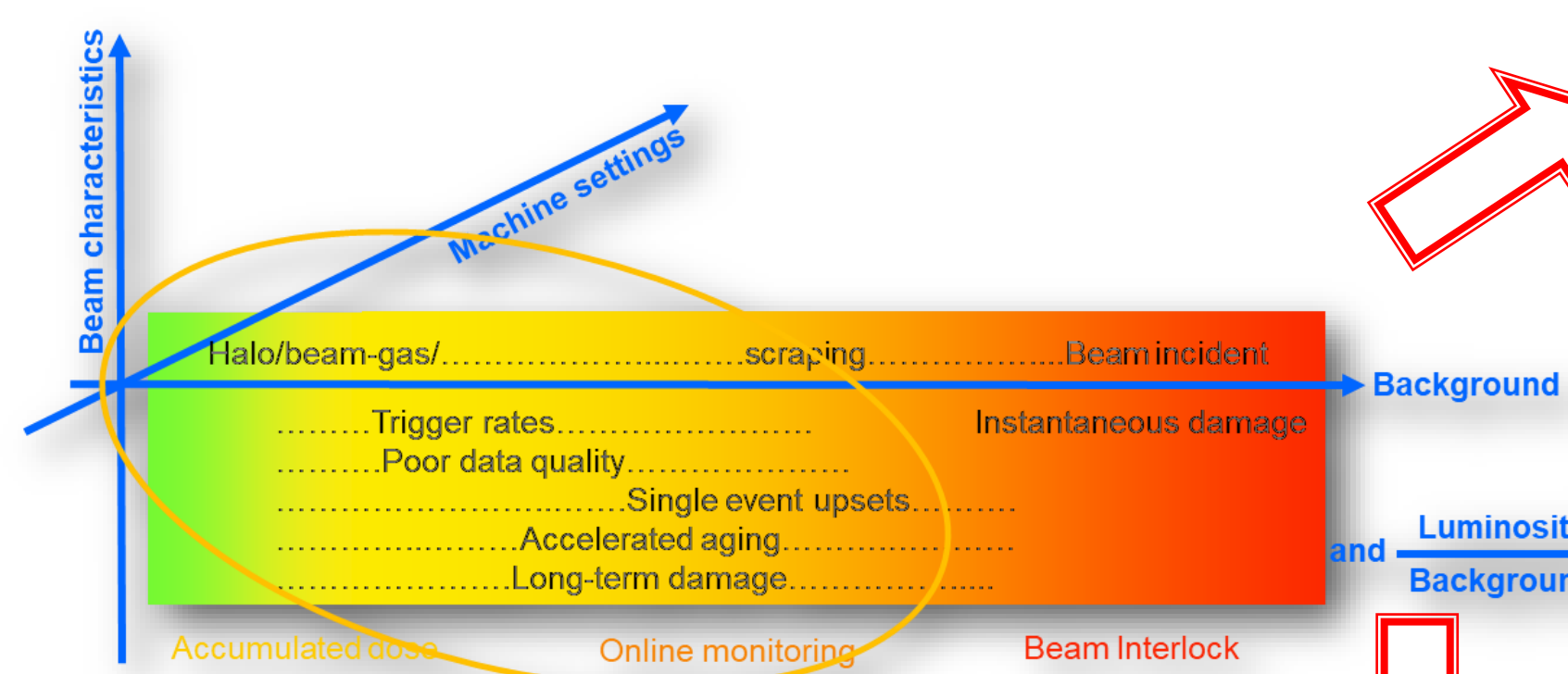


Operate the detector consistently with LHC states and modes

- automatic requests of actions to shifter
- automatic application of recipes wrt to current mode of operation
- automatic checks of correct state for each individual element in the system
- alarms and possibility of direct corrective actions
- HW and SW interlock of beam and global operation in case of mismatch



Beam, background and online luminosity monitor/control

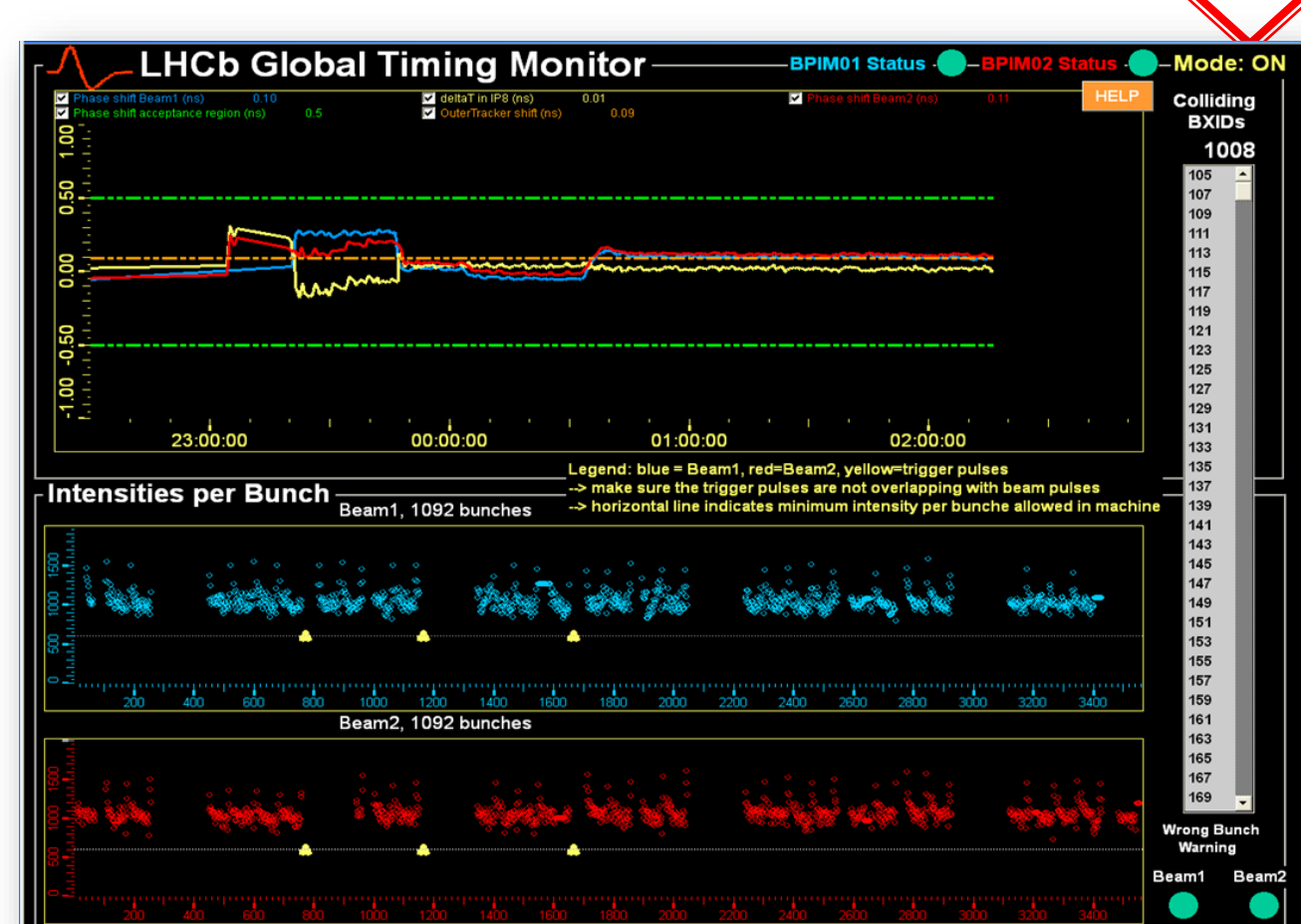
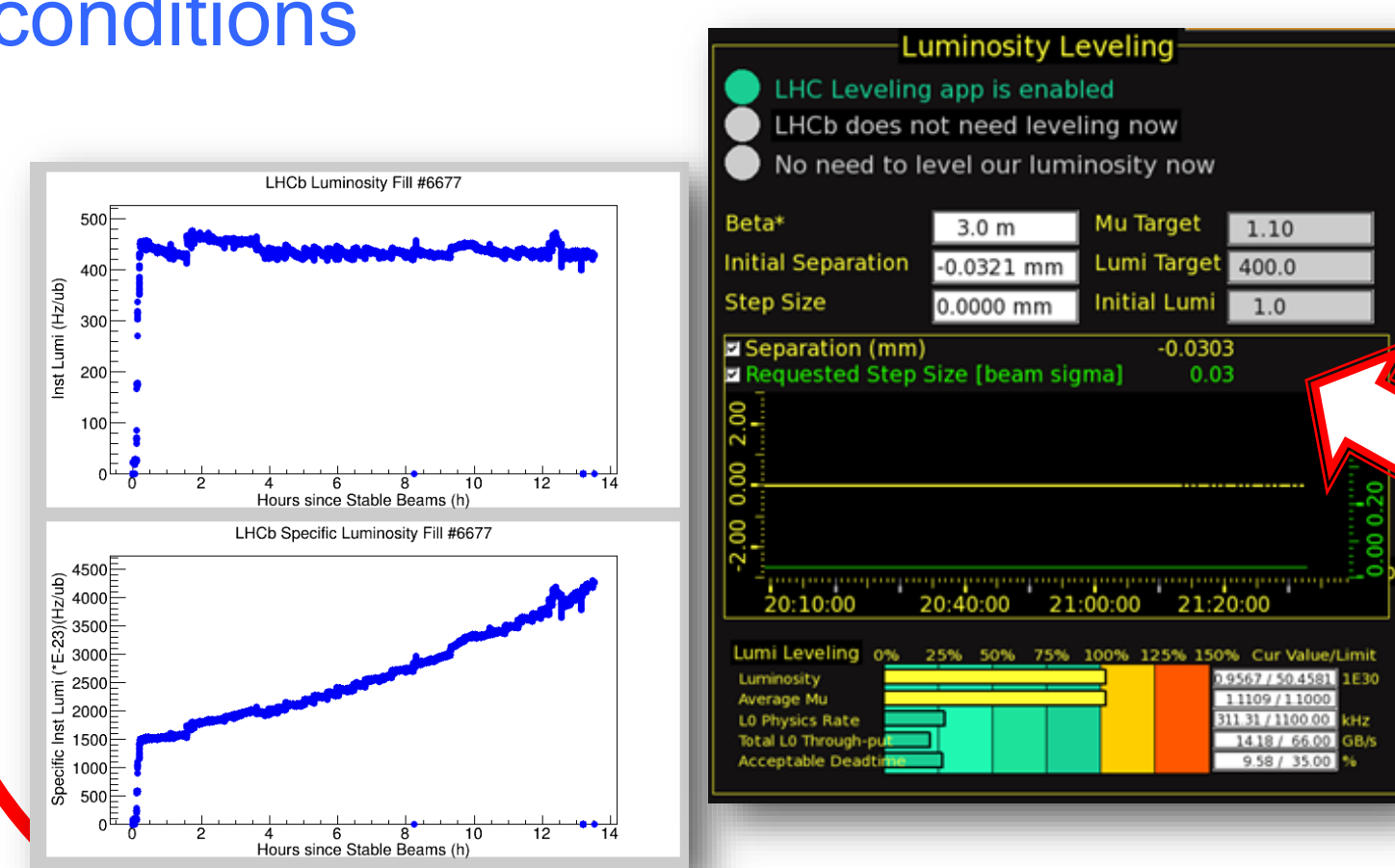


Complete system to monitor
beam and background conditions

- information used in real-time for detector operation in the control room (ex. clock shift)
- information sent back to the LHC for feedback
- protection against failures

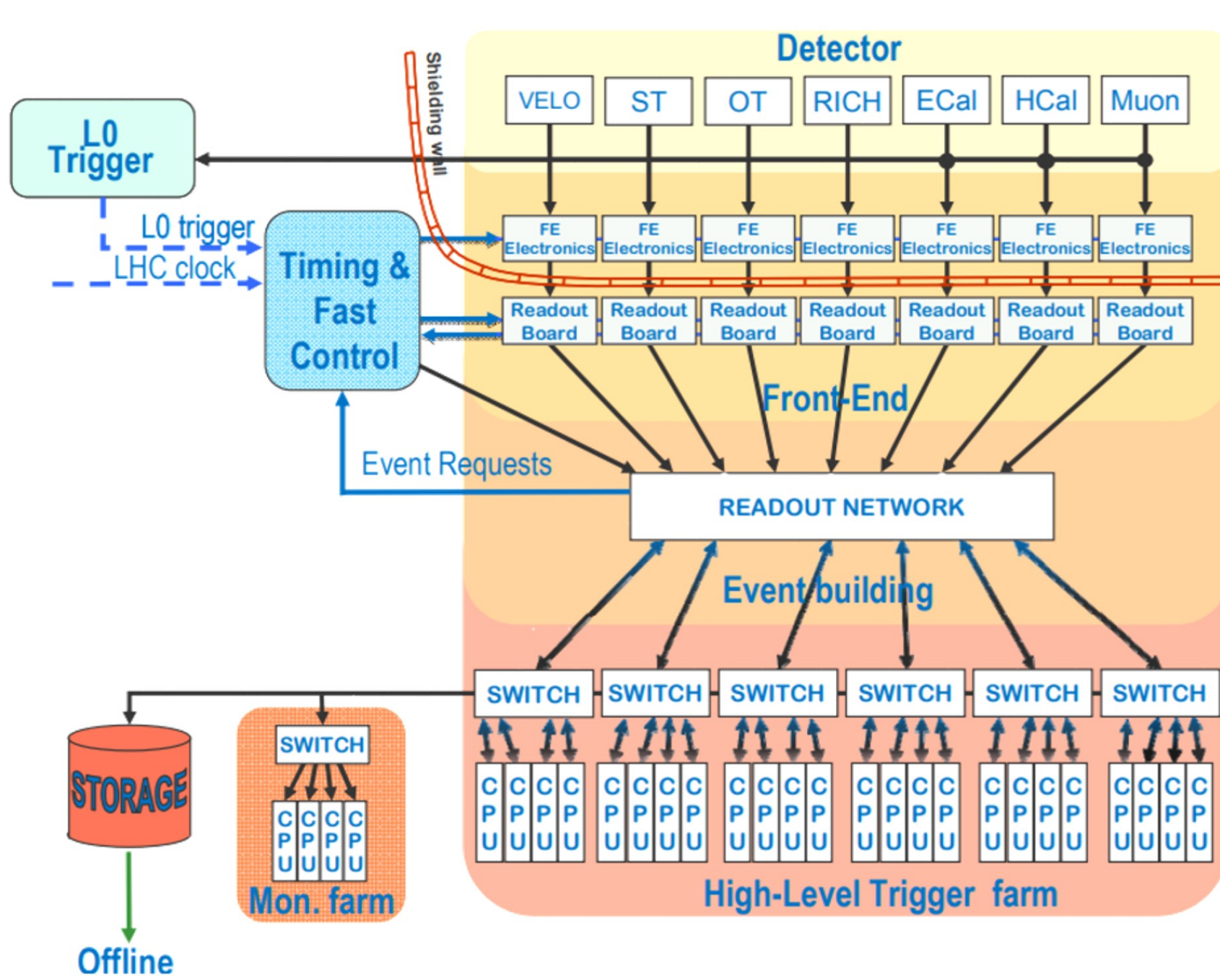
Monitor and control of the online luminosity through a dedicated “*leveling application*”:

- Define and fix the value of luminosity for consistent dataset and stable operational conditions



- select which target luminosity
- automatic calculation of beam separation
- real-time transmission of leveling request to the LHC

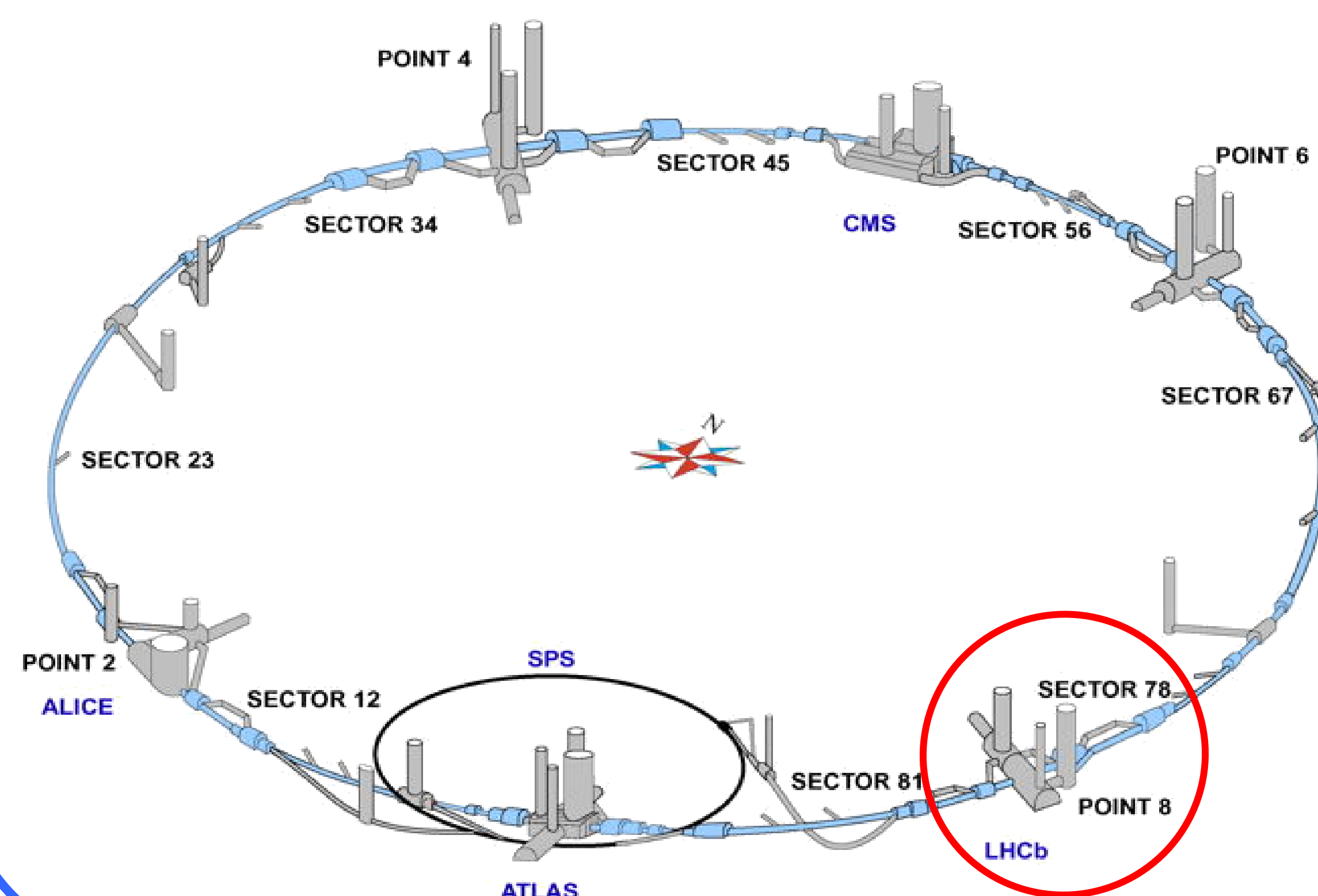
Centralized Readout Supervision



The LHCb readout system is centrally controlled by a single Readout Supervisor:

- reception and distribution of global timing
- reception and distribution of HW trigger
- generation and distribution of synchronous and asynchronous commands
- interface to central control system for run management and activity configurations
- timestamping and description of events
- backpressure handling
- events distribution over the network

The LHCb detector



Real-time calibration and alignment

Automatic tasks are launched on a dedicated data sample selected by HLT1:

- Alignment tasks for tracking and RICH mirrors
- Calibration tasks for RICH, OT global time and calorimeter pi0

The output of the tasks is available at real-time for the selection and reconstruction of events, such that the online and offline performance are identical.

For more details, see poster in this conference:

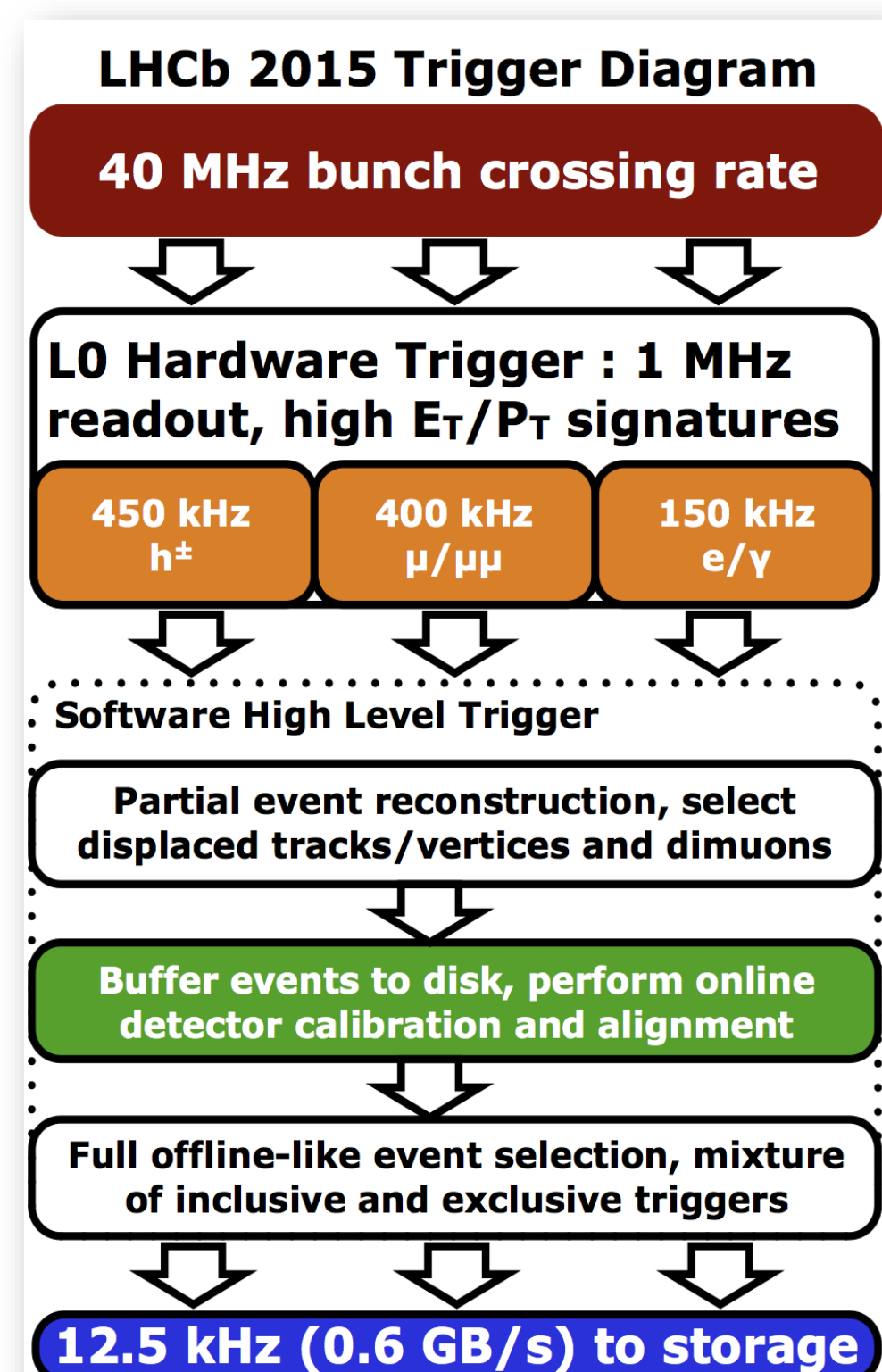
- “*LHCb full-detector real-time alignment and calibration: latest developments and perspectives*”, S. Maddrell-Mander, D. Vom Bruch

Powerful trigger system

Two-level trigger system

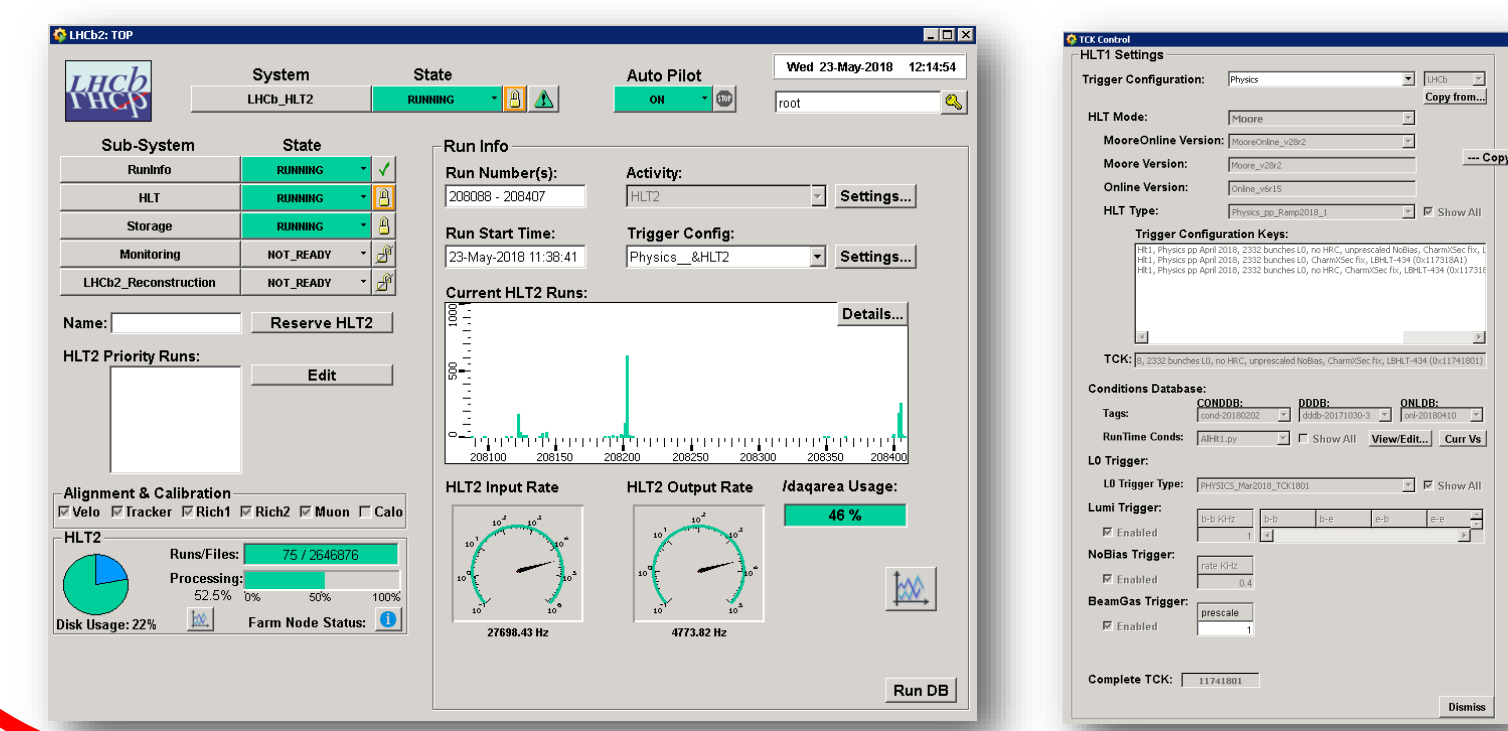
- HW (L0) for rate reduction
- SW (HLT1 and HLT2) for event selection

Data are buffered between HLT1 and HLT2 in order to apply real-time calibration and alignment



Simultaneous configuration of ~5000 nodes through a Trigger Configuration Key (TCK)

- easy change of activity even in the middle of data taking
- different trigger menu for different activities



Control room operations

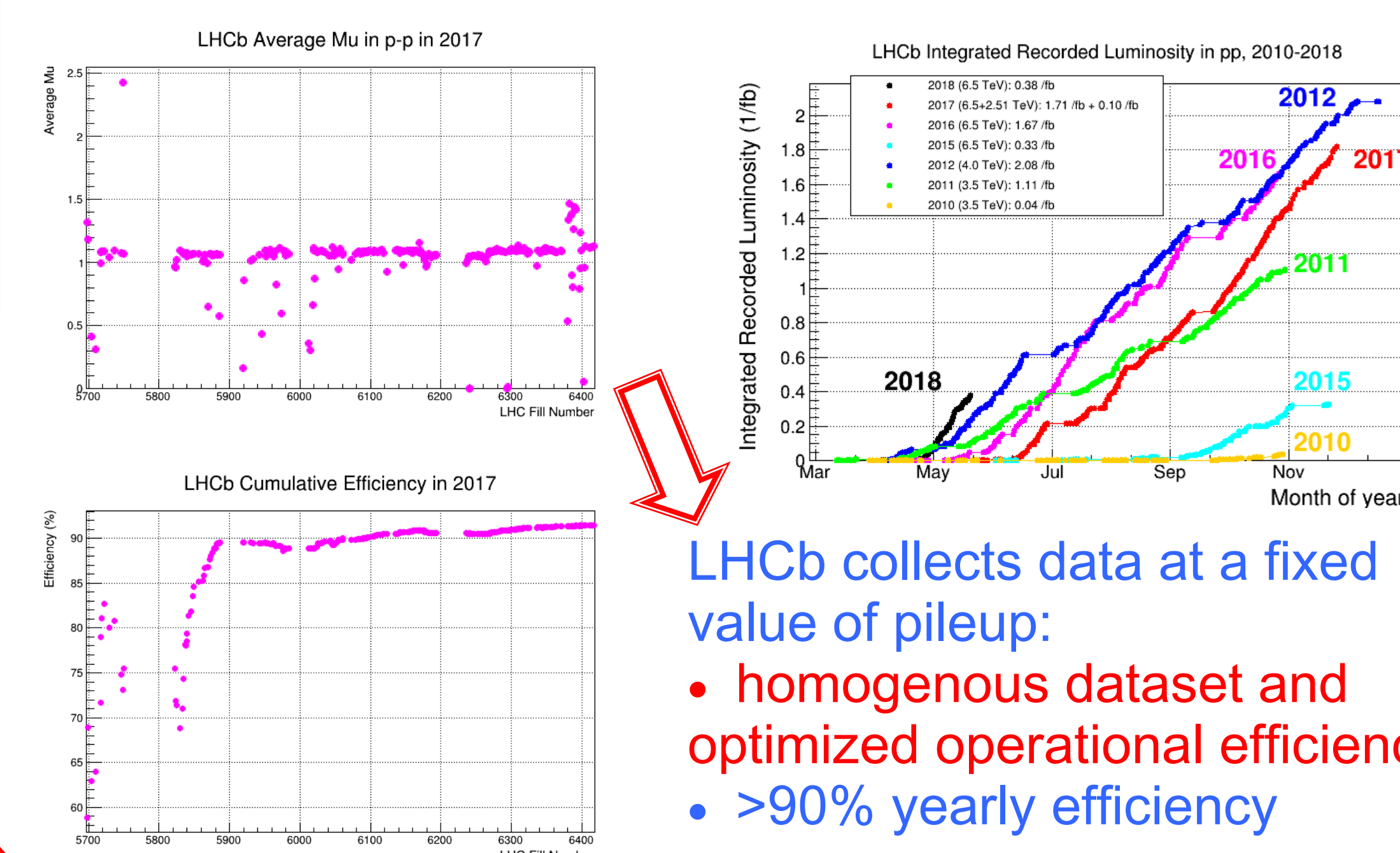
Two shifters 24/7:

- **Shift Leader**, in charge of safety and detector operations
- **Data Manager**, in charge of online data quality and assistance to Shift Leader

- + on-call sub-systems piquet and experts



Data collection



LHCb collects data at a fixed value of pileup:

- homogenous dataset and optimized operational efficiency
- >90% yearly efficiency

Highest level of flexibility in setting up and performing procedures:

- calibration and event type selection
- resets and asynchronous commands for real-time reconfiguration
- interface to LHCb control system and LHC data exchange