Automated Voltage Control in LHCb

L. Granado Cardoso, C. Gaspar, R. Jacobsson, CERN, Geneva, Switzerland

LHCb is an LHC experiment and needs proper LHCb – LHC coordination to record useful data. In order to acquire the data from the experiment, LHCb has an infrastructure composed of several sub-detectors to record different parameters of the events.

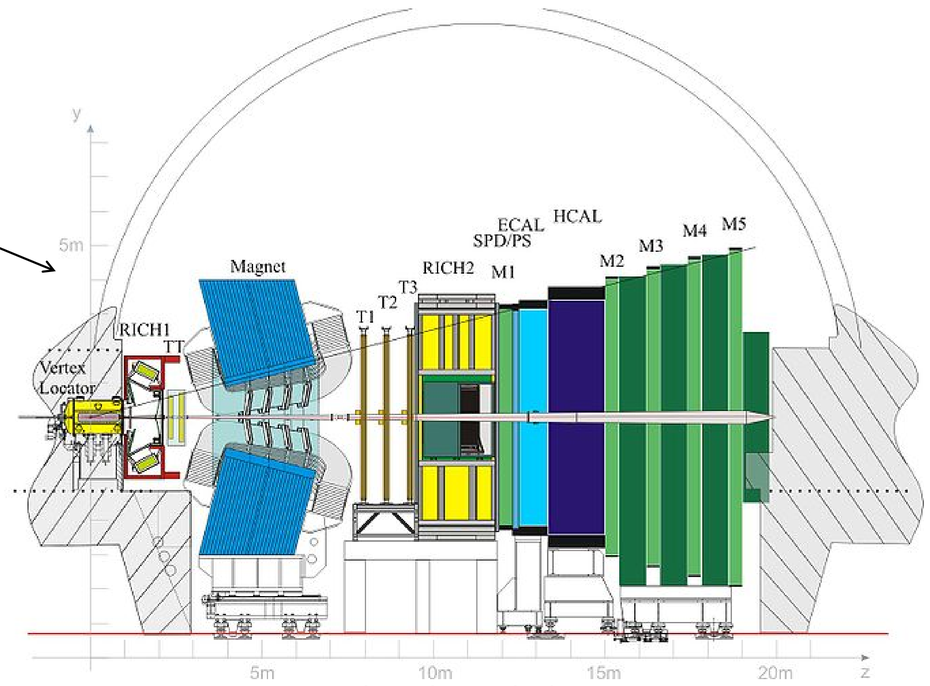

Fig 1. LHCb and its sub-detectors

In order to ensure the safety of the detector and to maximize efficiency, LHCb needs to coordinate the voltage configuration of the different sub-detectors, according to the accelerator status.

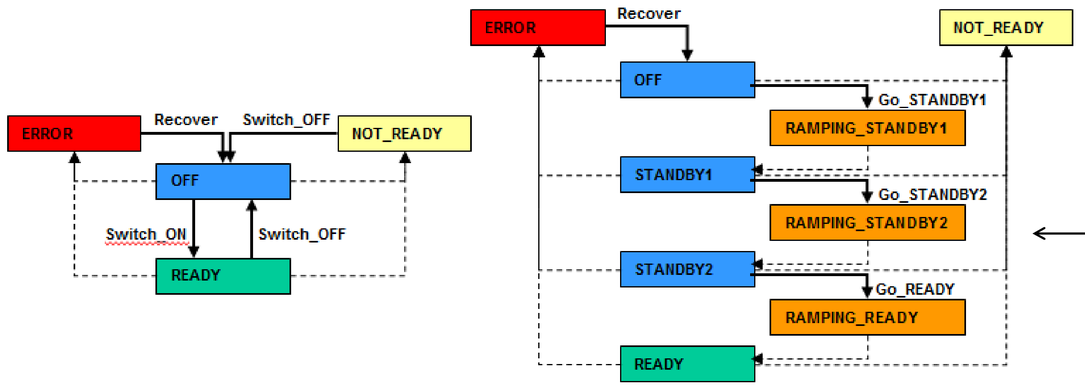

Fig 2. Simplified FSM Object Templates for Low and High Voltage

LHCb subscribes to the LHC data and computes the state of the LHC accelerator., using this data; The LHC state is modelled into discrete states which can be used to drive the voltage system.

The voltage control of the LHC experiments is based on the PVSS SCADA system, which interfaces the drivers of the equipment to the Finite State Machine toolkit.

FSM object templates were created and distributed to the sub-detectors who implement them on their systems.
These objects are then integrated in the global Experiment Control System

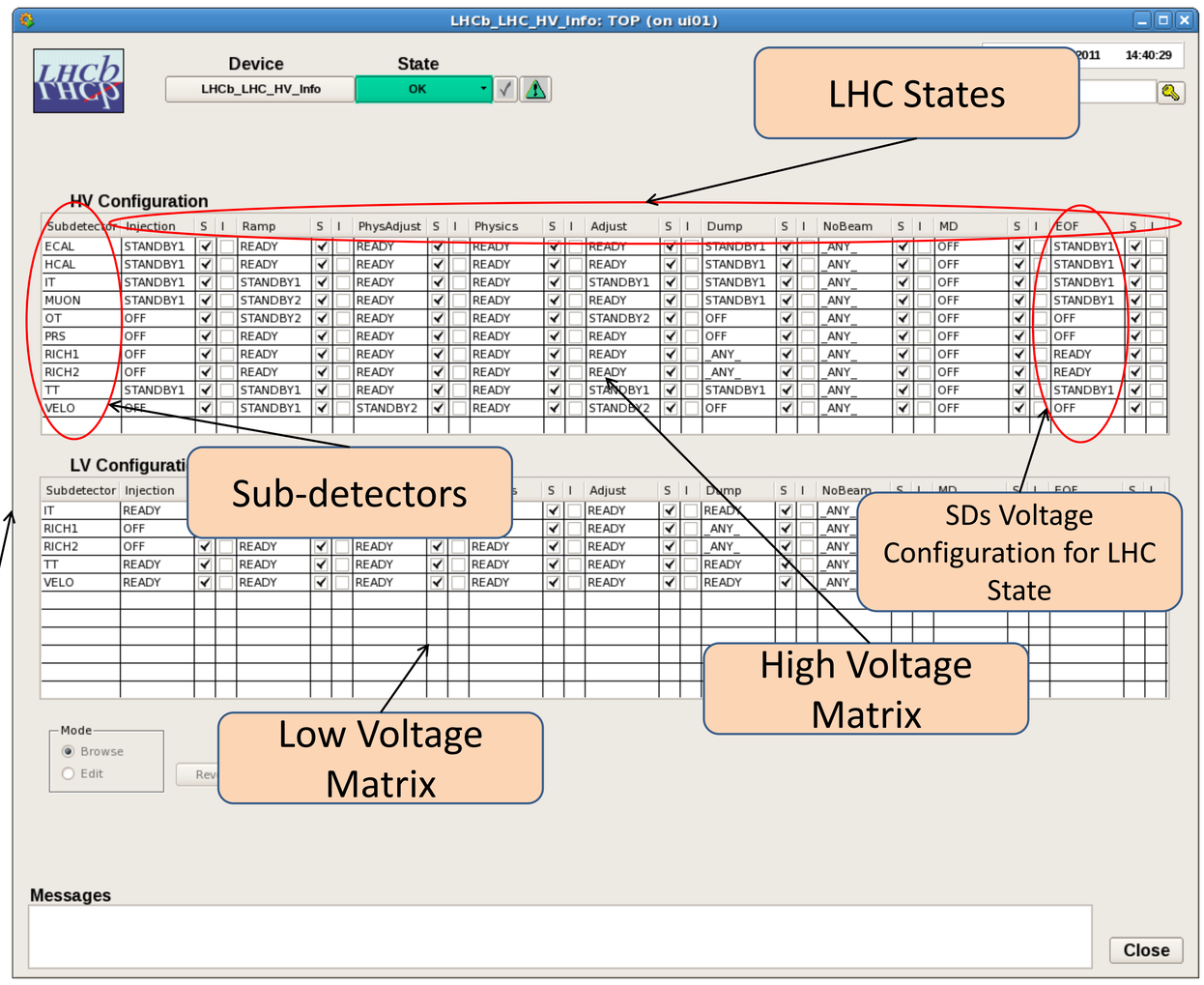

Fig 3. LHC State – LHCb Sub-detector voltage configuration matrix

The Automated Voltage Control System acts as a proxy between the LHC state and the sub-detectors voltage FSM objects.
It sets automatically the sub-detectors voltage settings according to a matrix LHC State <-> LHCb SD Voltage, sending the required action to the sub-detectors.

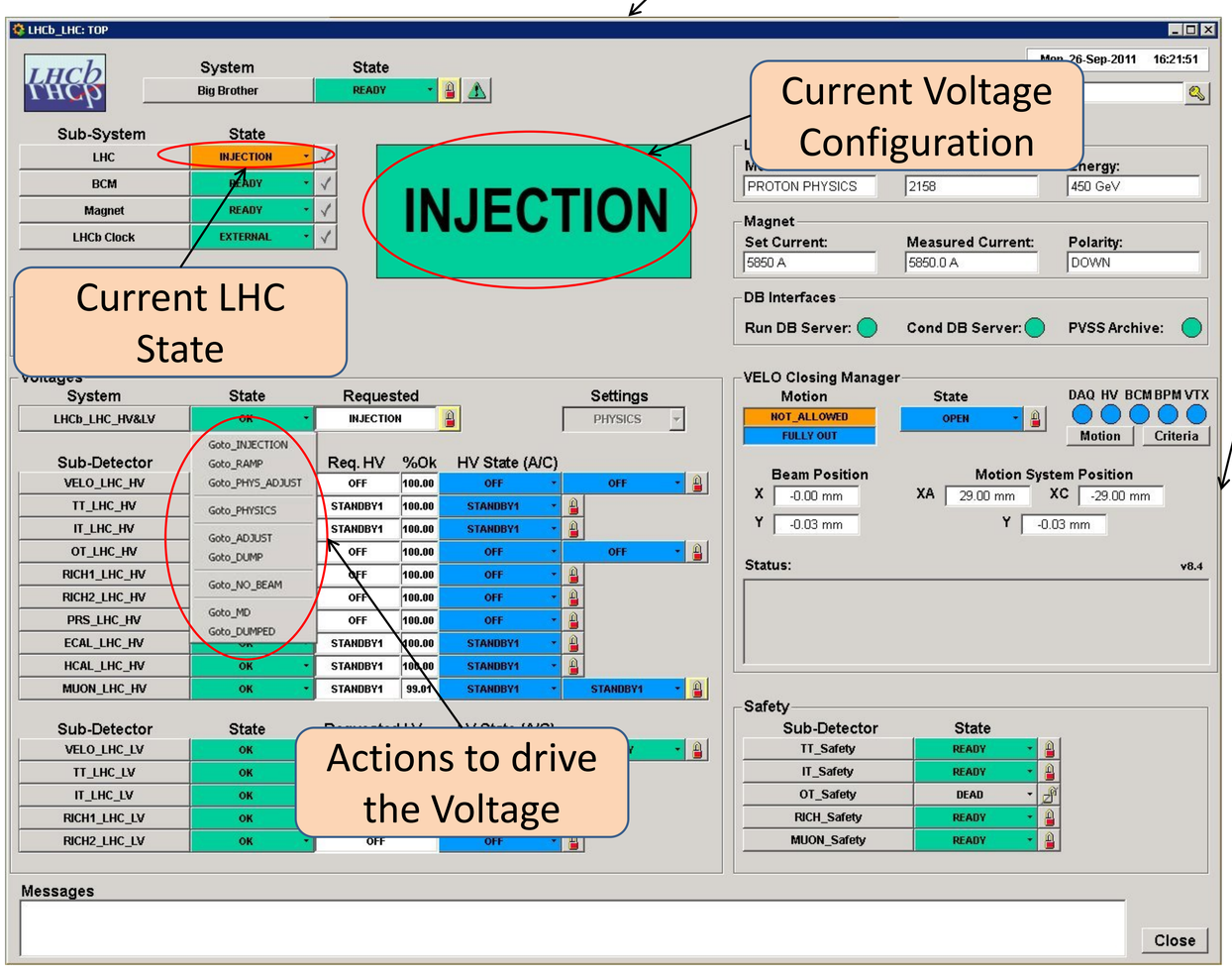

Fig 4. “Big Brother” – Main Voltage Control Panel

Using the Automated Voltage Control it’s no longer needed to send the GOTO_<Req_V_State> to each sub-detector voltage system, but a single GOTO_<LHC_State> which can be sent to all the sub-detectors in parallel and correctly configure them.

The Automated Voltage Control removes complexity from the system and improves the operation of the Experiment. There is no need to track the different voltage settings for each of the sub-detectors at the different LHC states.
The safety of the detector is also assured as incorrect and unsafe voltage configurations can now easily be viewed and adjusted according to the current LHC state requirements.