A framework for hardware integration in the LHCb Experiment Control System

L. Granado Cardoso, C. Gaspar, R. Schwemmer, J. Barbosa, F. Alessio, CERN, Geneva, Switzerland
P-Y. Duval, CCPM, Marseille, France

LHCb is an LHC experiment and collects data from the collisions. In order to acquire the data, LHCb has an infrastructure composed of several sub-detectors to record different parameters of the events.

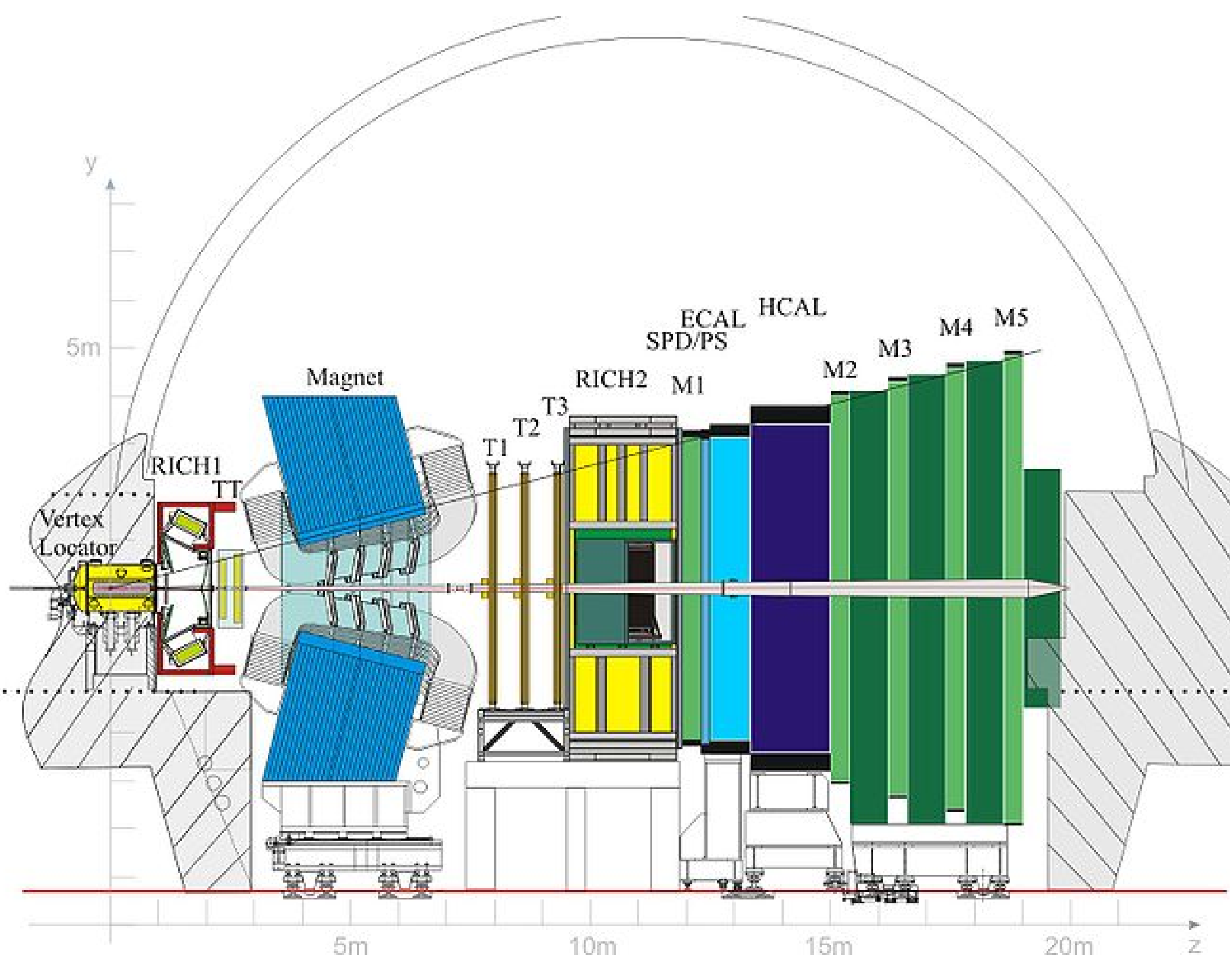

Fig 1. LHCb and its sub-detectors

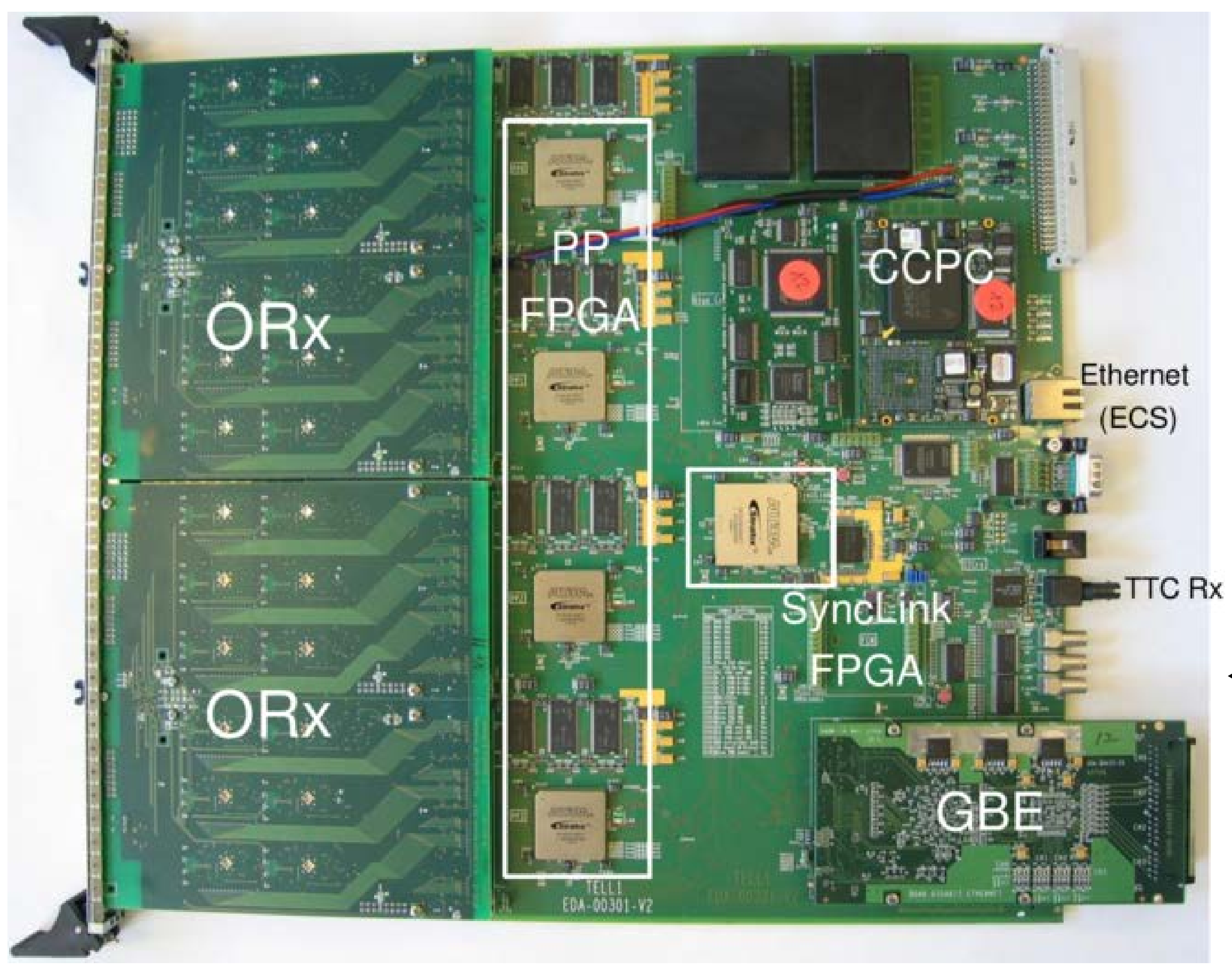

Fig 2. Custom electronic board for data acquisition (TELL1)

Each sub-detector has specialized custom electronic boards and devices to acquire the data from the events produced in the detector. These devices need to be integrated in the LHCb Experiment Control System (ECS) in order to be easily controlled and monitored.

These devices have a big number of registers and also interface other devices which can be accessed by several different protocols (I2C, Parallel Bus, etc.) each with different types of settings.

fwHw is a tool that allows the abstraction of these electronic devices and create models of the hardware. This hides the complexity of accessing the hardware and allows for an easy integration into the ECS.

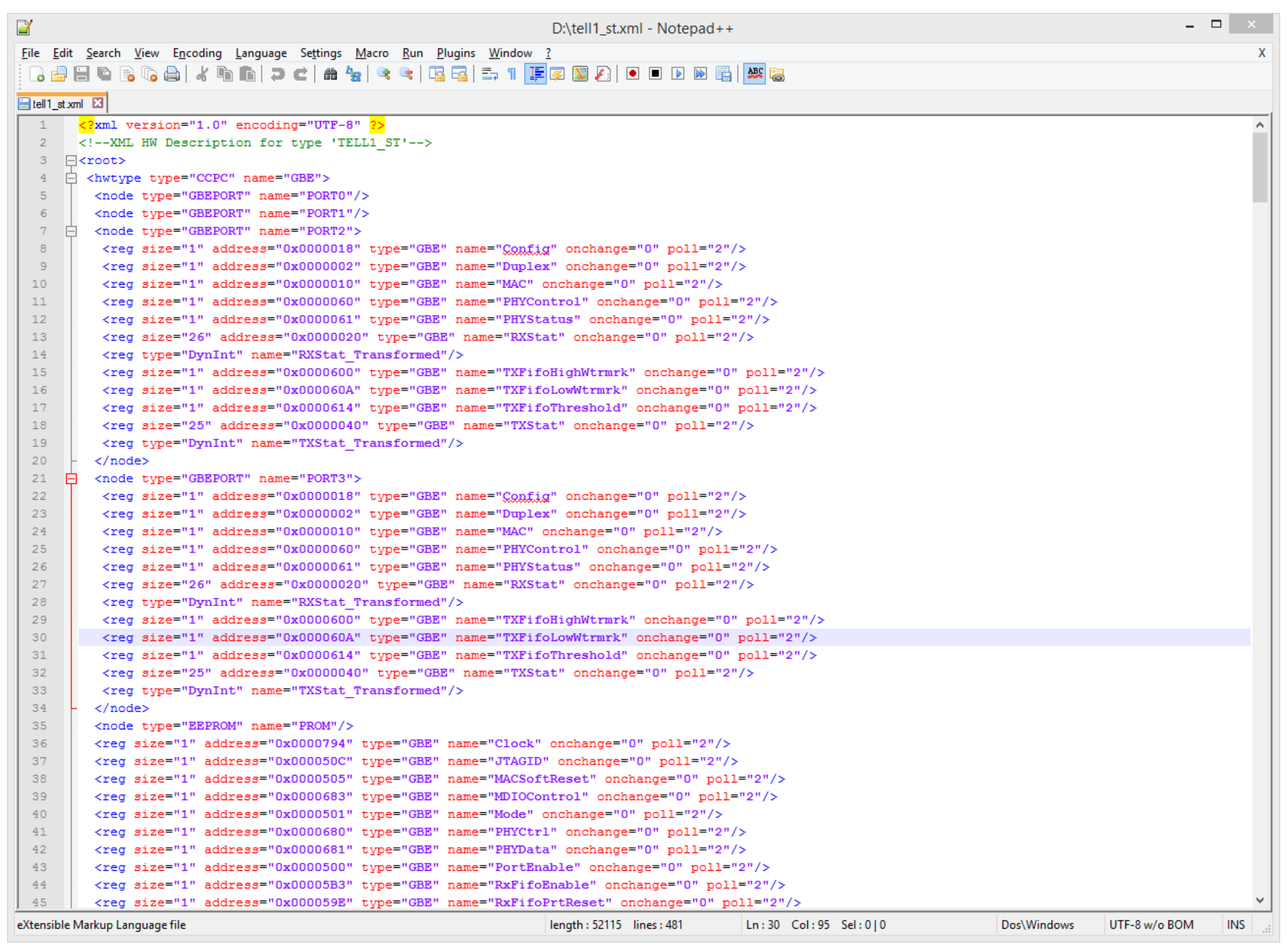

Fig 3. XML File with the hardware description (TELL!)

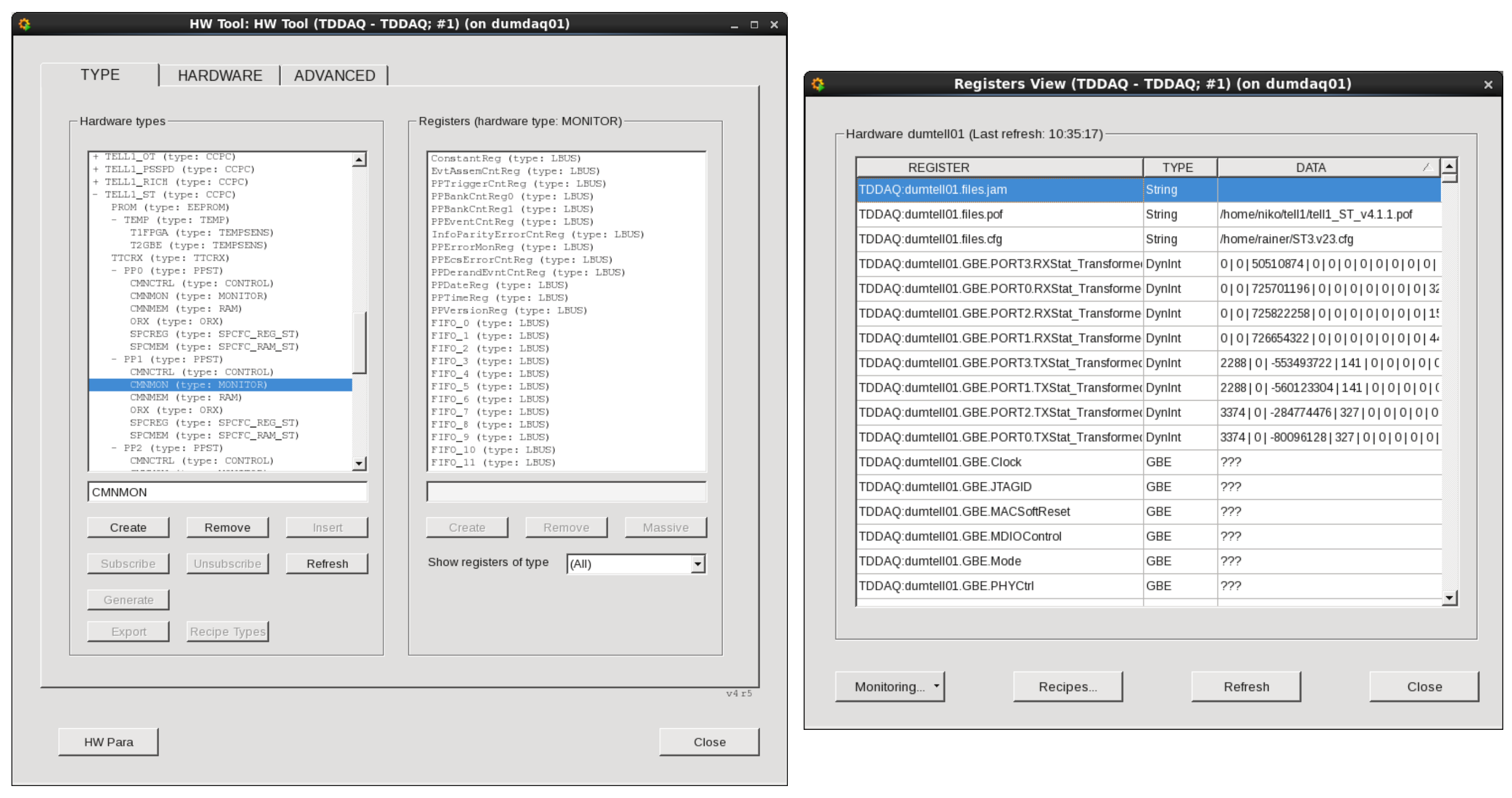

Fig 4. HW Tool with the imported model from the XML File and some of the defined named registers

From an XML file containing the description of the hardware and all the settings necessary to access the hardware registers, a model can be created in the control system. Registers are then able to be accessed via their defined names. These settings are transmitted to a server that interfaces the hardware and is aware of all the different protocols to communicate with the hardware.

The abstraction of the hardware into models, also allows for the usage of recipes (named sets of configurations) which can be applied to the registers of the devices. This allows to easily configure the devices for various running modes of the LHC.

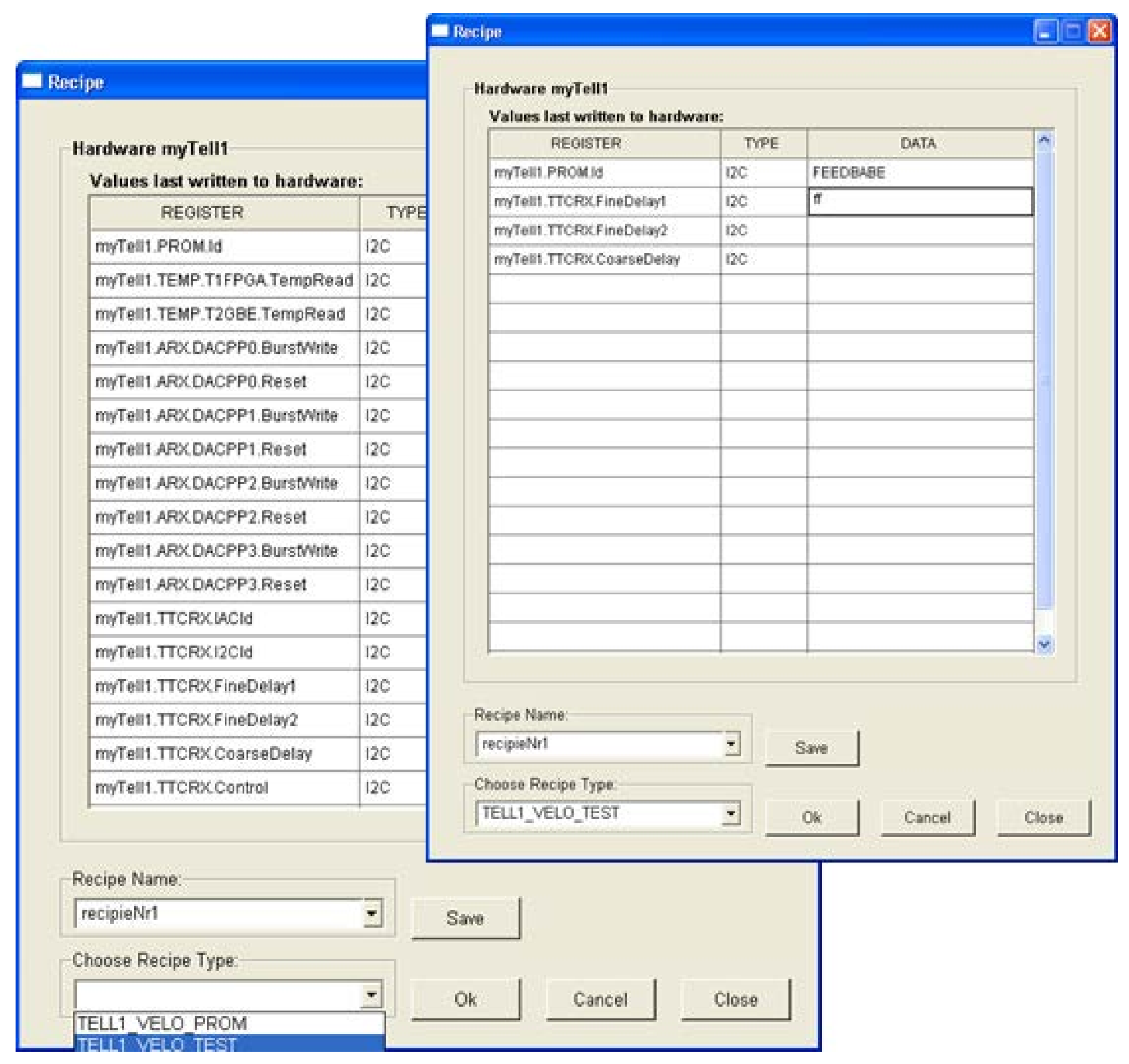

Fig 5. HW tool recipes for some registers of a device

Subdetectors can now create their own User Interfaces and control trees. They will use libraries provided by the fwHw tool to access their hardware via the defined registers in the models.

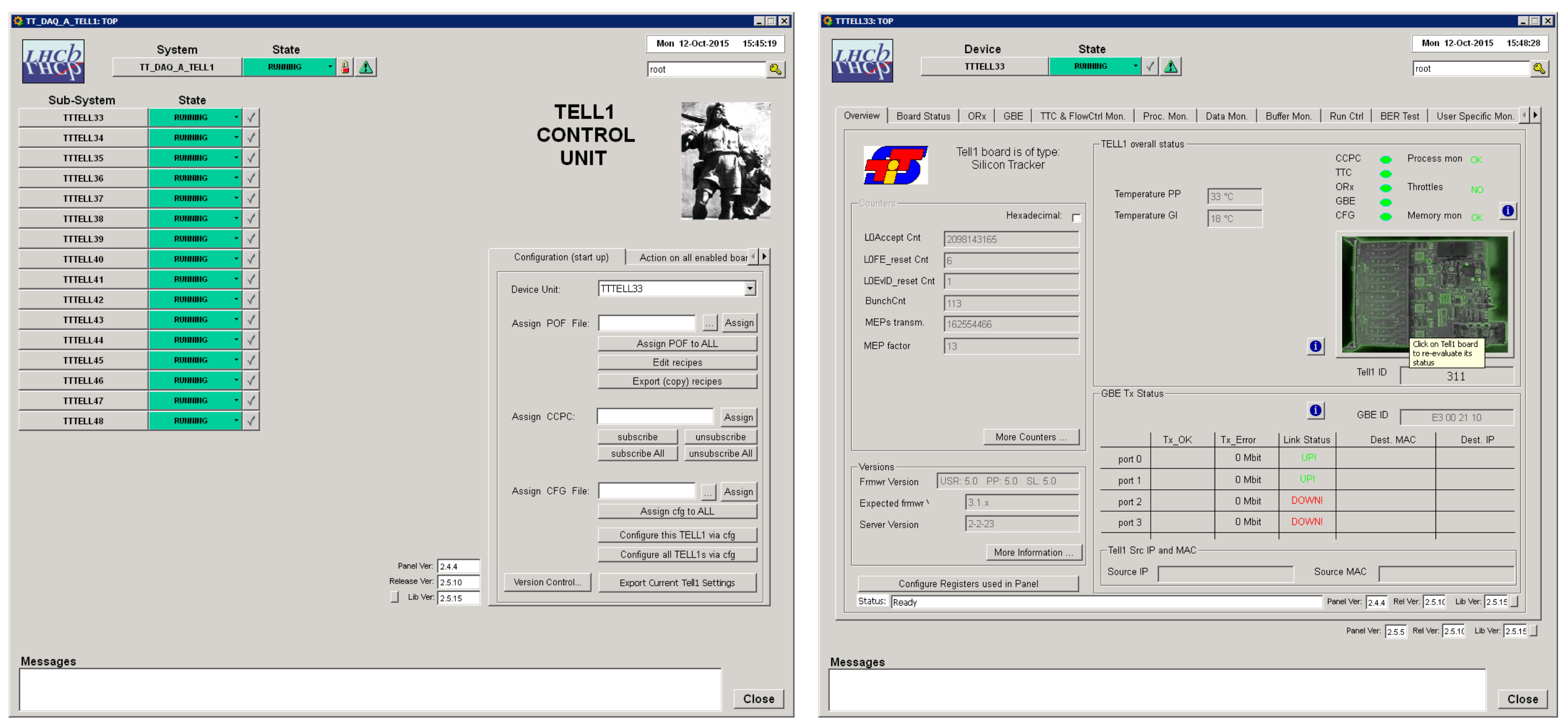

Fig 6. Control Tree and TELL1 panel for one of the LHC sub-detectors. Communication with the hardware is implemented via fwHw libraries

The fwHw tool removes complexity from the system, by abstracting the models of the devices into the Control System. This hides the complexity of the hardware access, allowing the communication with the hardware registers to be done just using the names defined in the models. It provides libraries that sub-detectors can use to easily create the specific panels and control trees for their specific devices. It also allows for the usage of recipes for easier configuration of the devices and as a base for automatic actions on the ECS.