Detector description and performance

Momentum and mass measurements

The LHCb tracking system is composed by the two TT stations (Muon system side) and by the inner TT stations (Tracker), which are the outer pair (Tracker) two-barrel detector system explored.

Between the TT and the inner TT tracking stations there is a conventional dipole magnet that produces an integrated magnetic field of order 0.1 T. A momentum resolution of $\sigma_p/p \approx 0.05 - 0.08 \%$ is obtained from the full tracking system, achieving a 5% mass resolution of $15 \text{ MeV}/c^2$.

LHCb Trigger

Two levels of trigger are set up in LHCb: the Level 0 trigger (hardware based) selects events mainly requiring high $p_T$ particles, reducing the rate from 40 MHz to 1 MHz.

This is further reduced by the High Level Trigger (software based) imposing high IP and high $p_T$ track requirements; a first full event reconstruction is also performed in order to select interesting physics events, such that 2 $\Lambda$'s are the rate at which data will be stored.

Particle identification

Two Ring Imaging Cherenkov detectors (RECH and RICH) are present in LHCb, in order to identify particles in a wide momentum range: $\Delta E/E$ separation is achieved by measuring Cherenkov light emission angles, with resolutions of $0.5 \text{ mrad}$.

This particle identification leads to a flavour tagging performance of $c(\mu - \pi) > 0.999$ for $b$-mesons, very important for CP violation studies.

Energy measurement and electronics and hadrons identification is performed using the electromagnetic calorimeter ECAL (resolution $\sigma_E/E = 0.16 - 0.18$) and the hadronic calorimeter HCAL (resolution $\sigma_E/E = 0.18 - 0.20$). A preshower detector is placed just before them.

Maus are tracked through the muon system where they are detected by Multi Wire Proportional Chambers for ME-8 stations, and Triple GEM detectors for the MI inner station.

Conclusions

The LHCb experiment, searching for New Physics in CP violation and rare decays, will study a large number of decay channels of $b$ hadrons produced at CERN’s LHC. The experiment has been commissioned and tested through cosmic-ray and beam data, and is now ready for data taking with first collisions.

First data will be exploited to validate the expected detector performance and for some first measurements at energies never accessed before. With the first months of data LHCb will be able to perform crucial flavour physics measurements, hopefully probing physics beyond the Standard Model.