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# CMS RPC Longevity Studies

## Content

The Compact Muon Solenoid (CMS), is one of the four experiments on the biggest and most powerful accelerator in the world, the Large Hadron Collider (LHC). The Resistive Plate Chambers (RPC) are fast, gas-filled muon detectors, mainly used to provide muon triggers to the entire CMS experiment, but also to complement the other muon detectors - the drift tubes in the central "Barrel" part of the CMS detector and the cathode strip chambers in the closing "Endcap" stations.
The RPC detectors same as any other detector present aging. This aging should be monitored closely because these effects can cause the detector to send false signals, loose efficiency and/or report bad values. Knowing how the detector is aging is crucial in order to maintain stable operations.
In order to study these detectors it's necessary to analyze all the operation metrics (condition data). The vast amount of information recorded for each of the 1064 RPC Detectors mounted in CMS requires a large amount of computation. To overcome this, a data processing system was developed. This system is designed to analyze current, rate, temperature, gas-flow, relative humidity and HF concentration. In doing so, we have real-time metrics of how the RPC system is performing, therefore allowing us to know when maintenance is required.
In this talk we will present a couple of studies that have lead to a better understanding of where the RPC's aging comes from, and even show a proof of concept for a method that can be used to predict future problems.
We start by understanding the currents inside the detector and finding relations between current and luminosity. Afterwards, we will analyze and breakdown the current into its different parts such as ohmic, cosmic, and to what I call; physics current. Here we will see that the physics current is not affected at all by the RPC's aging and that in-fact, it has maitained a stable behavior through-out the years.
A separate study has been done, along side GIF++ to show the correlation between the ohmic current and HF concentration in the detectors. This seems to indicate that the increase could be due to the HF production, but moreover that it is harmless to the physics of the detector.
In order to prove that our physics isn't affected we have to look into the rate's correlation with luminosity. This relation, is the same as that of the current vs luminosity, this indicates that there is a factor which relates current and rate. This factor is know as the Average Charge per Cluster and should be constant in time; if the detector is healthy. This proves that the physics hasn't changed since the beginning of the detector's operation.

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