The LHCb RICH detectors

The LHCb experiment at the Large Hadron Collider (CERN) will study differences between matter and anti-matter by precise measurements of the decays of B particles.

The RICH system (two RICH detectors and three radiators) provides particle identification by measuring the angle of Cherenkov light as charged particles pass through different radiators. This information can be used to differentiate between the various decay modes of the B hadrons.

The basic light sensitive detector unit is a Hybrid Photon Detector (HPD) column that accommodates 14 or 16 HPDs with all the required electronics for power, high voltage (18 kV) and Level0 trigger operation.

The Detector Control System

The RICH DCS has been built using:

- SCADA System - PVSSII for:
  - Device Description (Run-time Database)
  - Device Access (OPC, Profibus, drivers)
  - Alarm Handling (Generation, Filtering, Masking, etc)
  - Archiving, Logging, Scripting, Trending
  - User Interface Builder
  - Alarm Display, Access Control, etc.
- SMI++ providing:
  - Abstract behavior modeling (Finite State Machines)
  - Automation & Error Recovery (Rule based system)

Hardware interacting with the RICH DCS:

- Wiener Maraton power supplies.
- CAEN power supplies.
- Embedded Local Monitoring Boards (ELMB).
- Temperature, humidity and pressure sensors.
- Laser.
- Networked cameras.
- Video cameras.
- SPECS devices (Serial Protocol for the Experiment Control System)
- A variety of custom devices.
  - Speed of sound measurement (opposite).

DCS responsibilities

- Switch the detector ON or OFF safely.
- Ensure the safety of the detector by:
  - Providing alerts to the operator
  - Taking automatic actions
- Monitor the condition of the electronics:
  - Voltage/Current/Temperature
- Monitor the conditions inside the photon detector enclosure:
  - Temperature/Cooling/Humidity
- Provide feedback to the High Voltage system.
- Collect information about the Cherenkov radiators:
  - Pressure/Temperature/Gas quality
- Collect and analyse images to monitor mirror stability
- Monitor the communication with the hardware via the SPECS protocol.

The LHCb RICH Detector Control System

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