



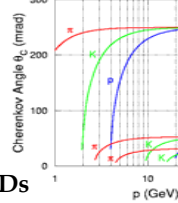
RICH High Voltages & PDF Analysis @ LHCb

Erica Fanchini

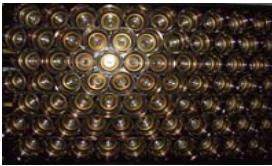


RICH and pixel Hybrid Photon Detectors (HPDs)

- Two Ring Imaging Cherenkov (RICH) detectors
- Particle ID in the particle momentum range 1 - 100 GeV/c
- p/K/n separation to enhance S/N ratio and provide efficient tagging of hadrons
- 3 radiators: silica aerogel (solid), C₄F₁₀ and CF₄ (gaseous)

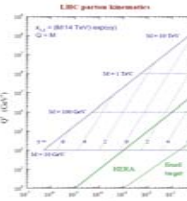


- Cherenkov photons detected by HPDs
- Silicon pixel chip encapsulated in the vacuum tube
- HPD granularity: 2.5 x 2.5 mm² and binary readout
- Quartz window and S20 photocathode
- 484 HPDs and wavelength range 200–600 nm

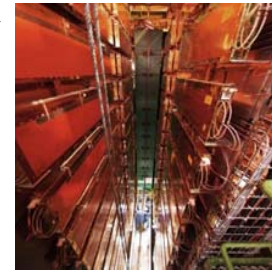


LHCb & Muon Detector

- Single arm spectrometer in the forward region
- Bunch crossing rate 40MHz
- Energy in the center of mass $\sqrt{s} = 14\text{TeV}$
- Nominal luminosity $2 \cdot 10^{32} \text{cm}^{-2} \text{s}^{-1}$

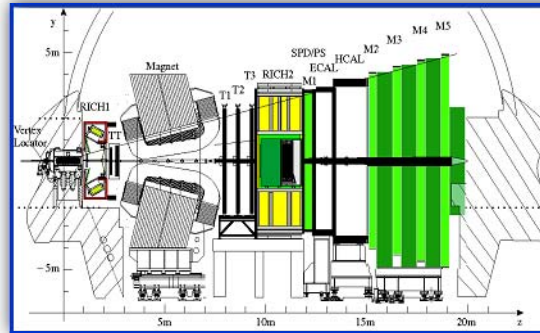
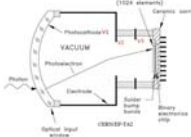


- Kinematic region available $1.8 < \eta < 4.9$
- 5 muon stations with 1368 MWPC & 24 triple GEM
- Inner acceptance 16mrad and outer acceptance 258mrad (bending plane)
- Online muon pt measurement with a resolution $< 20\%$

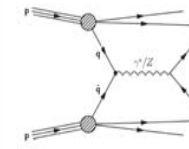


High Voltages

- Cross focusing electric field inside HPD to accelerate and focus photoelectrons
- 3 negative voltages: $V_1 = -20\text{kV}$, $V_2 = -19.7\text{kV}$, $V_3 = -16.4\text{kV}$
- Demagnification factor of 5 at 20kV
- 32 ISEG[®] power supplies generate -20kV
- 242 HV boards manage the input voltage and create the 2 lower voltages



Drell-Yan Process



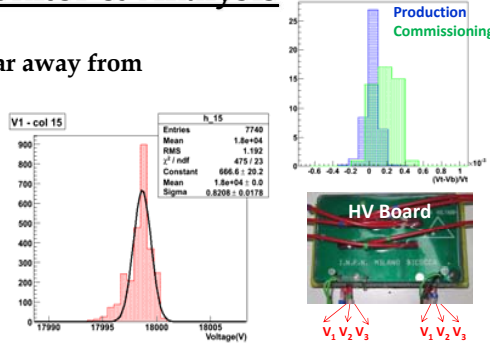
- Leptons with opposite charge in the final state (i.e. 2μ)
- Radiation correction at NLO & NNLO
- Well known W and Z physics
- High production rate since the first day of collisions

$$h(p) + h'(p') \rightarrow \gamma^*(q) + X(p + p' - q)$$

$$\rightarrow l(k) + l'(k') + X(p + p' - q) \quad q = k + k'; q' = Q' > 0$$

High Voltages Monitor & Analysis

- High voltage distribution system 100m far away from the power supply
- High stability needed
- PVSS[®] control software monitors power supplies and HV boards
- Good agreement in the comparison between production and commissioning data



PDF Analysis

$$\sigma_{hh}(p, p') \cong \sum_{parton, i, j} \int dx dx' \sigma_{ij}(xp, x'p') \phi_{i/h}(x) \phi_{j/h}(x')$$

PDFs

- Description of the internal structure of the proton
- Only theoretical prediction in the LHC kinematic region available
- Low theoretical uncertainties, PDFs well known
- All kinematic range considered

