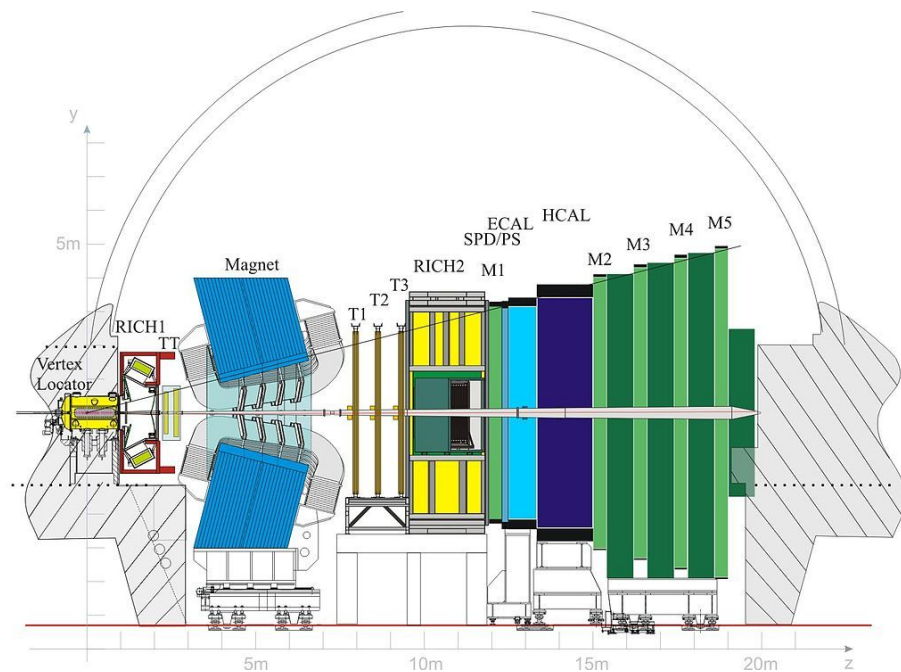# Characterization of MaPMTs for LHCb RICH Upgrade

Maria del Valle Coello

LHCb and RICH

- CP violation in b-hadrons
  - Matter-antimatter asymmetry
  - New physics
- Forward detection of B mesons
- RICH: Ring Imaging CHerenkov
  - PID
- Upgrade: Readout rate
  - Aim for theoretical uncertainty

RICH detectors basics

- Particle identification
  - Light cone
  - Reflection
  - Shape → velocity →
    speed → (reconstructed trajectory) → mass/charge → ID
- RICH2
  - Elementary cell → programming chip → readout board
  - Elementary cells → PMT groups
  - 384 H-Type, 768 R-Type
  - 15-120 mrad coverage; high p
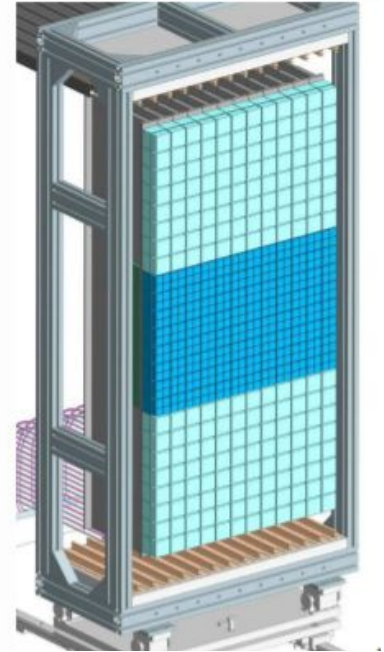
Multi-anode Photo-Multiplier Tubes (MaPMTs)

- 64 channels
- R-Type: smaller, four per EC
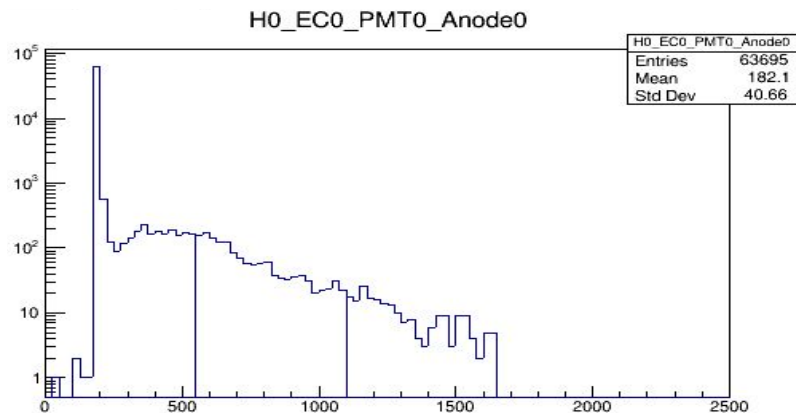- H-Type: larger, one per EC
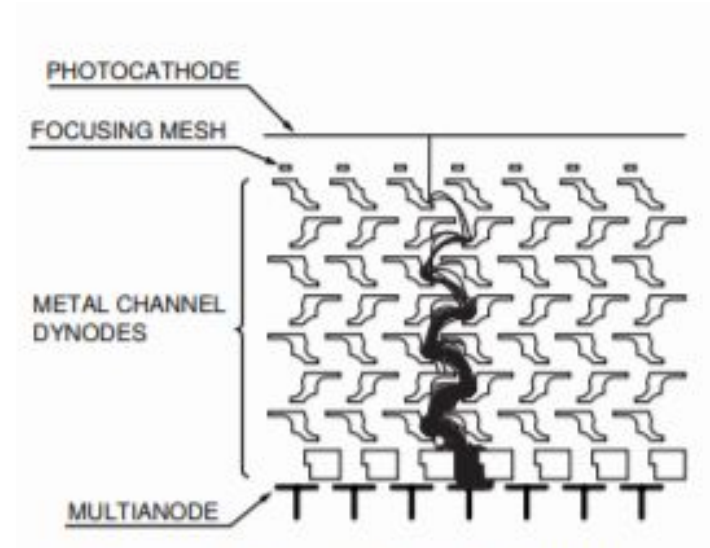
Characterization studies

- Understand the following parameters:
  - Gain
  - Threshold
  - Optimum voltage
  - Occupancy
  - Aging
  - Uniformity
  - Cross-talk
  - Optimum S/N
  - SIN
  - Dark rate
- Every single pixel counts (!)

Ongoing work

- Fixing the FSM for data acquisition
  - Necessary for all PMTs in assembled column
  - In progress
- Developing models for SIN in PMTs
  - Cut down acquisition time by 60%
- Perform tests on full column
  - PMT grouping and layout
- Quantum efficiency measurements

H0_EC0_PMT0_Anode0

H0_EC0_PMT0_Anode0	
Entries	63695
Mean	182.1
Std Dev	40.66

Aside: Swiss-b