## The Micromegas construction project for the ATLAS New Small Wheel

The Micromegas is one of the technologies selected by the ATLAS experiment for the upgrade of the Innermost station of the forward Muon Spectrometer, in order to maintain the precision tracking properties in the upcoming luminosity upgrade of the Large Hadron Collider. The New Small Wheel will have to operate in a high background radiation region, while reconstructing muon tracks as well as furnishing information for the Level-1 trigger. An overview of the design, construction and QA/QC procedures for the Micromegas panels is presented.

### The New Small Wheel

- High rate of tracks (increasing with n)
- Fake triggering
- Higher background rates

### Configuration

- L1 trigger relies on Big Wheel (fake triggers). Cannot distinguish cases:
  - A (real high-p_t track)
  - B (low-p_t particle created in toroid)
  - C (multiple scattering)

**Micromegas primary precision tracker**
- Good Spatial resolution < 100 µm
- Good track separation (0.4 mm readout granularity)
- Resistive anode strips → suppress discharge influence on efficiency
- Provide online segments for trigger

**sTGC primary trigger detector**
- Good timing resolution for bunch ID
- Online track vector with angle resolution < 1 mrad
- pads: region of interest
- strips: track info (strip pitch 3.2 mm)
- wire groups: coarse azimuthal coordinate

- 16 Sectors: 8 Small + 8 Large

### Micromegas Operation

- Charged particles ionize the detector gas (100 pairs/cm in Ar:CO2 93:7 for muons)
- Ionization electrons produced in the conversion/drift gap drift towards the micro-mesh and pass through it due to the high field ratio. Then they are amplified in avalanches in the high field region between micro-mesh and the resistive anode strips, producing a large signal which is then collected on the anode strips
- Fast evacuation of the avalanche ions by the micromesh, thus allowing good operation in a high rate environment

### Panel Construction

- Panel is a sandwich of two skins glued on a stiff plane without mechanical constraints
- It consists of two PCBs (500µm) with aluminum made honeycomb and frame in between

### Structure of panel

- Super – flat surfaces are required as reference planes
- Double Vacuum tables or Granite + Stiff – back
- Single or dual step processes

### Structure of module

A Micromegas chamber is a quadruplet: 4 gaps provide 4 track measurement points. The 4 gaps are defined by 5 panels
- 3 Drift panels
- 2 Resistive Read out panels

### QA / QC

- Gas tightness
- Mesh Tension
- RO – PCB positioning

### Components

- FEB pin gluing

### Assembly / Integration

- Strict cleaning protocol before chamber assembly
- Integration@BB5: Cabling / electronics support / Cosmic data

### Conclusions

- Complex construction and required mechanical precision of detectors is achieved
- Unprecedented use of large size Micromegas detectors
- Challenging issues and problems treated and solved applying engineering solutions

### Bibliography