ALICE Forward Multiplicity Detector

Purpose

- Extend the measurement of charged particle multiplicity into the forward regions.
- Provide additional centrality determination.
- Measure the event planes inclination.

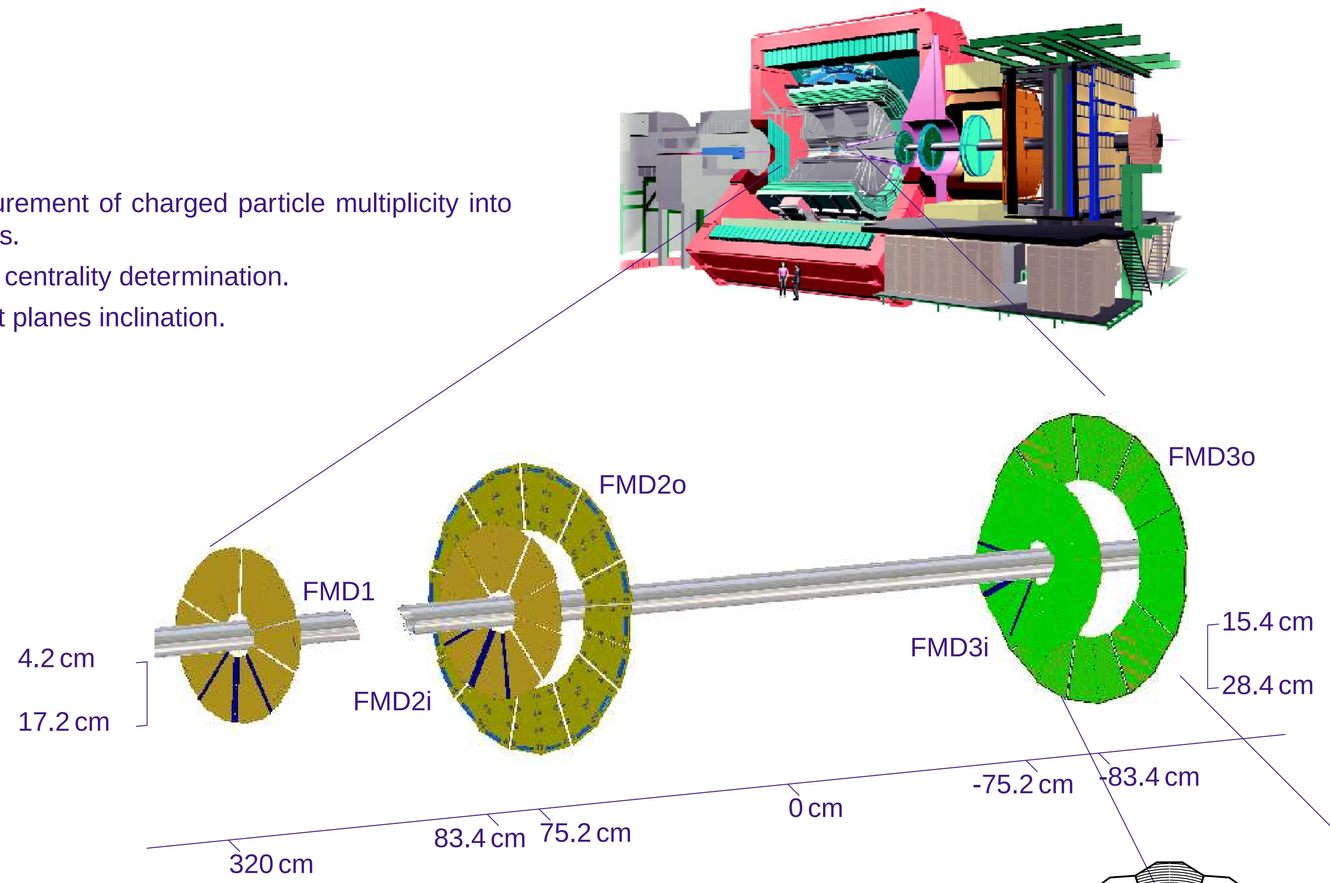

Figure 1: Pseudo-rapidity acceptance of the FMD and ITS

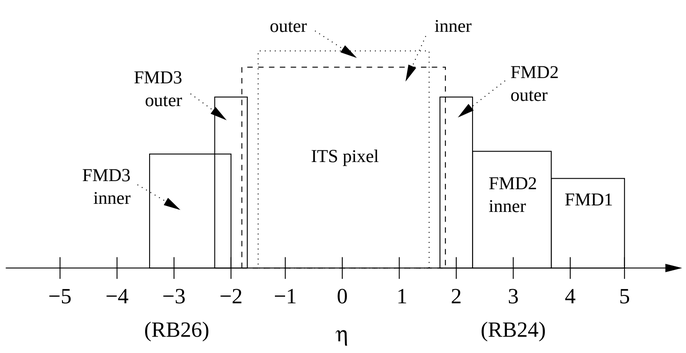

Table 1: Physical dimensions of Si segments and strips.

Ring	Azimuthal sectors	Radial strips
FMD1	20	512
FMD2i	20	512
FMD2o	40	256
FMD3i	20	512
FMD3o	40	256

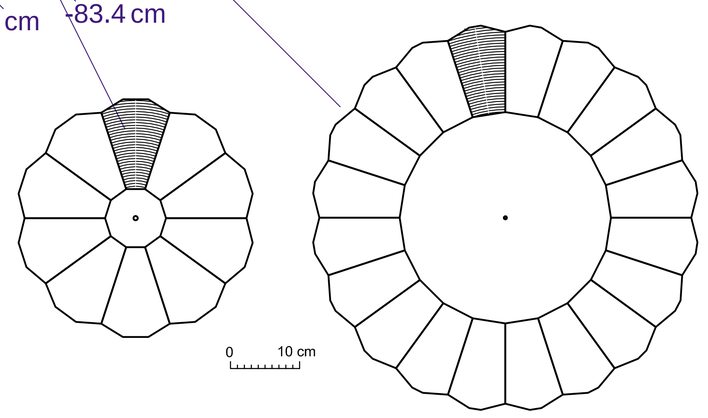

Figure 2: Assembly of an inner ring from 10 modules (left) and an outer ring from 20 modules (right). The size and shape of each module is determined by limitations imposed by the fabrication of sensors from 6 inch silicon wafers.

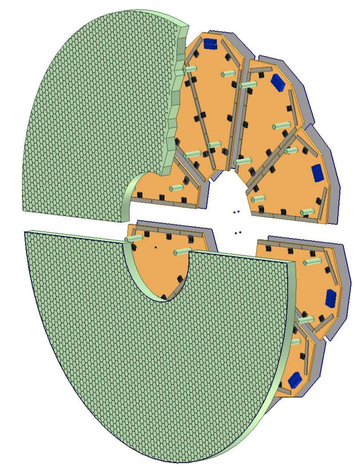

Figure 3: Exploded view of the assembly of an inner FMD ring, showing the two honeycomb support plates, the hybrid cards, and the Si sensors. Adjacent hybrids and sensors are staggered slightly to allow for overlaps in azimuth of the inactive part of the sensors.

Test Beam Results

Tests of VA1 pre-amplifiers

The VA1 chip is a custom version of the popular Viking chip. It has high radiation tolerance and low noise.

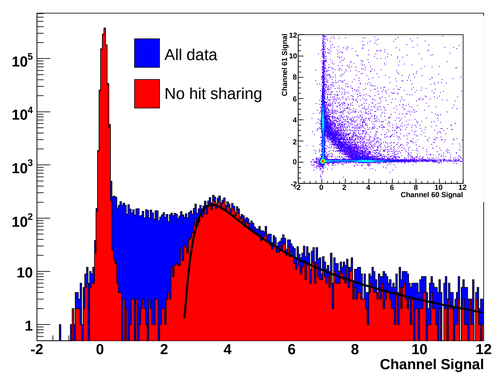

Figure 4: Laboratory test system data. After data is corrected for sharing (signal from one MIP shared of 2 or 3 channels), a signal–to–noise ratio of $\approx 60 : 1$ was obtained. Insert shows anti–correlation of neighbouring strips.

Setup

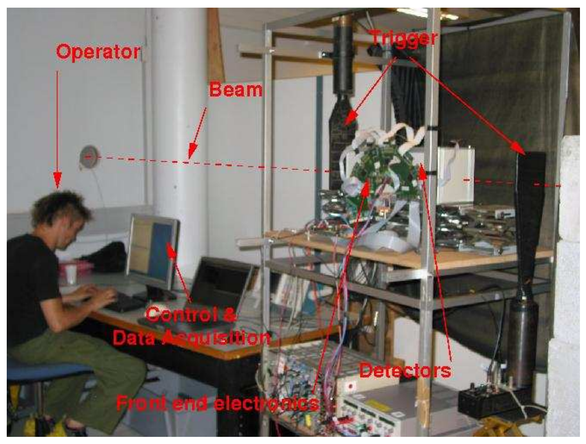

Figure 5: Test beam setup at ASTRID in Århus, Denmark. The beam is a $\approx 680\,\mathrm{MeV}\ e^-$ scrape–off.

Control and DAQ

Every aspect of the Front–End–Electronics (ALTROs, VA1s, and digitiser boards controller) is controllable via the RCU and the ALTRO bus.

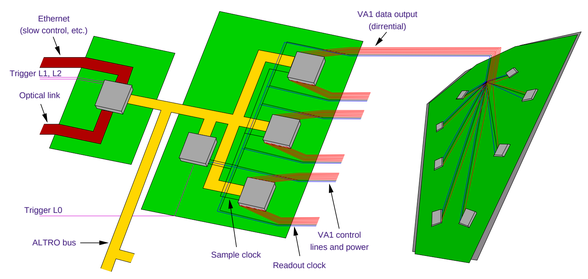

Figure 6: Front end electronics. Data is pushed to the DAQ over the optical link.

A custom control interface and monitor was used.

Data is read–out to a stand–alone standard Local Data Concentrator (commodity PC running Linux) via optical fibres.

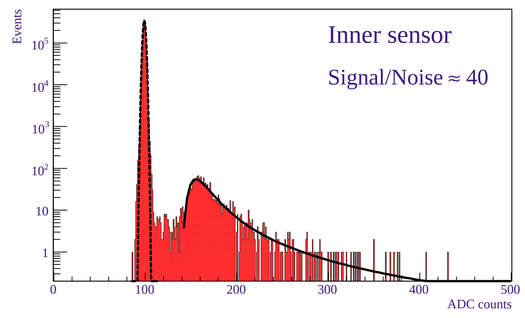

Figure 7: ADC spectrum for an inner sensor. Disregarding the sharing, a signal–to–noise ratio of $\approx 40 : 1$ is seen.

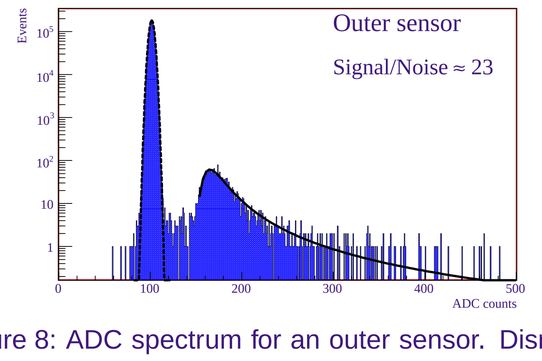

Figure 8: ADC spectrum for an outer sensor. Disregarding the sharing, a signal–to–noise ratio of $\approx 23 : 1$ is seen.

Results

Data was collected and analysed off–line.

The noise (and therefor also the signal–to–noise ratio) is best at the inner most strips of the two types and sensors, and gets worse with increasing strip length. The inner sensors have a smaller pitch than the outer sensors, and is therefor also expected to show a better signal–to–noise ratio.

Results yields a signal–to–noise ratio of $\approx 40 : 1$ for the inner sensors, and $\approx 23 : 1$ for the outer modules.

This is well within the design requirements [1] of the FMD.

References

[1] ALICE Collaboration, J. J. Gaardhoje *et al.*, . CERN-LHCC-2004-025.

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