

Cosmic and Final ATLAS Inner Detector - SCT tests

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Detector setup and motivations

A combined cosmic run with the Inner Detector Semiconductor Tracker (SCT) and Transition Radiation Tracker (TRT) has been performed in May 2007 at CERN in the SR1 building of the ATLAS experimental area.

Goals of the combined test:

Operational aspects:

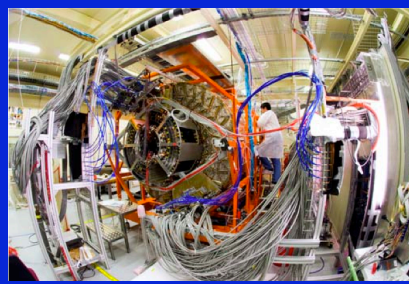
- Gain experience with detector operation.
- Test combined detector supply systems.
- Commission and test combined readout and trigger.
- Develop standalone and combined monitoring tools.
- Commission offline software chain with real data.

Detector performance aspects:

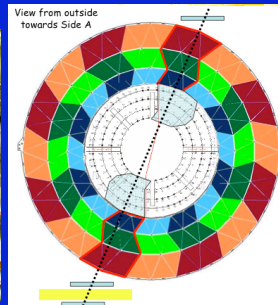
- Test SCT 4 barrels together and operation with the TRT.
- Checks of grounding.
- Test synchronous operation and check cross talk and noise.
- Collect cosmics for efficiency, alignment and tracking studies.



Insertion of SCT into TRT in February 2007



Cabling of 1/4 of the SCT and 1/8 of the TRT during 5 weeks



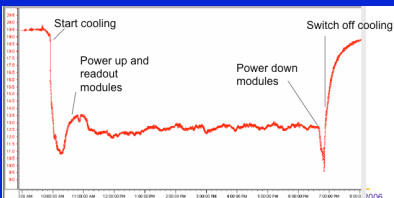
Final setup with the SCT and TRT readout modules and scintillators

Procedure to setup the system:

- Cabling: procedure proven to be very important for installation in the pit.
- Verification of connectivity: Pipe work pressure and leak, power supplies and fibres.
- Calibration: Adjust readout settings and test communication.
- Test digital function and analog performance.

Detector Control System DCS:

- Provides monitoring of the cooling system, environmental and control and monitoring of the power supplies.
- Interlock safety system hardware based.
- The data is archived in the conditions database to be used by the offline software.



Monitoring of the environmental temperature

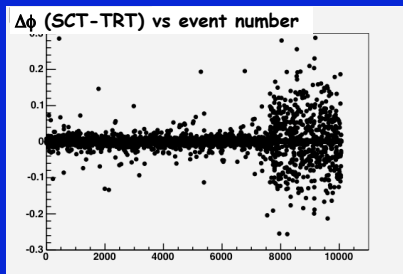
Detector operation

Data Acquisition DAQ:

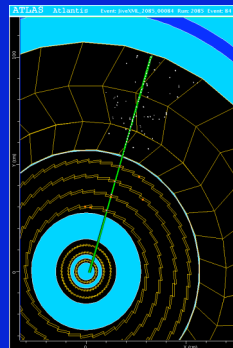
- Gain experience with calibration and physics mode operation.
- Develop tools for detector time-in and understand synchronization problems.

Monitoring:

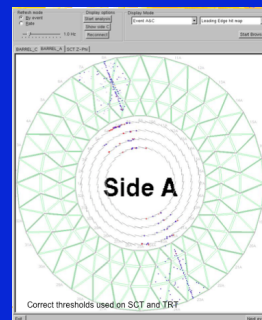
- Two different event displays were used.
- Histograms to check detector performance and synchronization.



An example of a run in which synchronization was lost



Cosmic event displayed with Atlantis event display



Cosmic event displayed with Viewer event display

Data analysis

The ATLAS inner detector reconstruction software was used to analyse both noise and cosmic runs providing prompt feedback to the detector performance

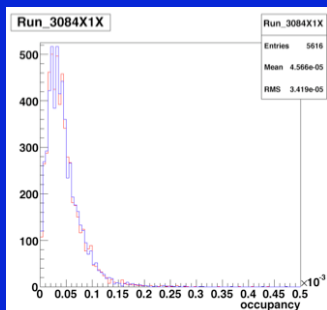
Noise studies:

The noise was measured in the following conditions:

- Different calibrations
- Trigger rate scan (5Hz-50KHz).
- Threshold scans with TRT on and off.
- With heaters on/off/switching.
- Different grounding schemes.
- While TRT being readout.

Conclusion:

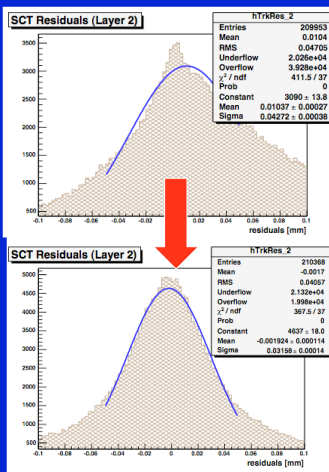
- The calibration with capacitance corrections provided less spread in the module noise occupancies.
- No increase of noise was observed in any configuration.



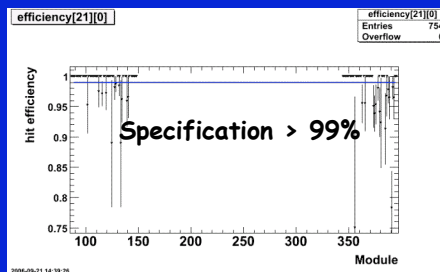
Module noise occupancy for different groundings

Studies with cosmic runs:

- The offline reconstruction software was tested with real cosmic events.
- The different alignment methods were tested with real data and with the as built geometry.
- The detector performance in terms of efficiency, mechanical tolerances and resolution was verified.



Residuals before and after alignment



Efficiency as a function of module number

A big step towards the commissioning of the inner detector has been accomplished by the combined tests with SCT and TRT barrels. Full DAQ, DCS, monitoring and offline chains have been successfully tested. The good performance of the detector has been verified.