

TRT Online Monitoring Overview

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INSTITUT

November 8, 2010

TRT Dataquality

- 1 Detector Introduction
- 2 Monitoring Infrastructure
- 3 Monitoring Tools
- 4 Shifter's Duties
- 5 On-call shifts



ATLAS Transition Radiation Tracker

Readout channels

- Basic unit: 4 mm diameter drift tubes ("Straws")
- 52544 Straws in 73 layers in the barrel region ($\eta < 1$)
Split in two readout regions
- 122880 Straws in 160 layers in each Endcap ($\eta < 2$)
- 350848 readout channels in total
- ~ 35 hits on tracks in average
- Electron ID using transition radiation
- ~ 7 TR hits on electron tracks in average



ATLAS Transition Radiation Tracker

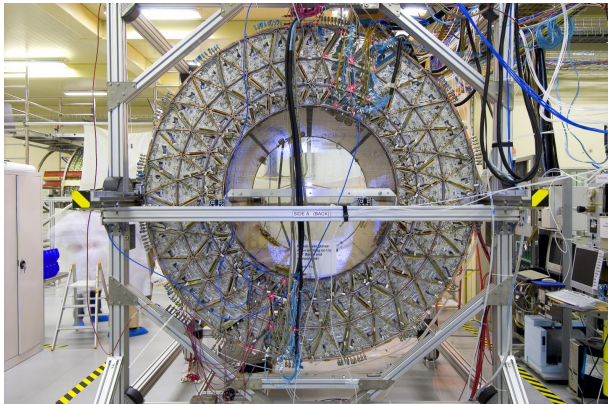
Detector

Infrastructure

Tools

Shifting

On-call





ATLAS Transition Radiation Tracker

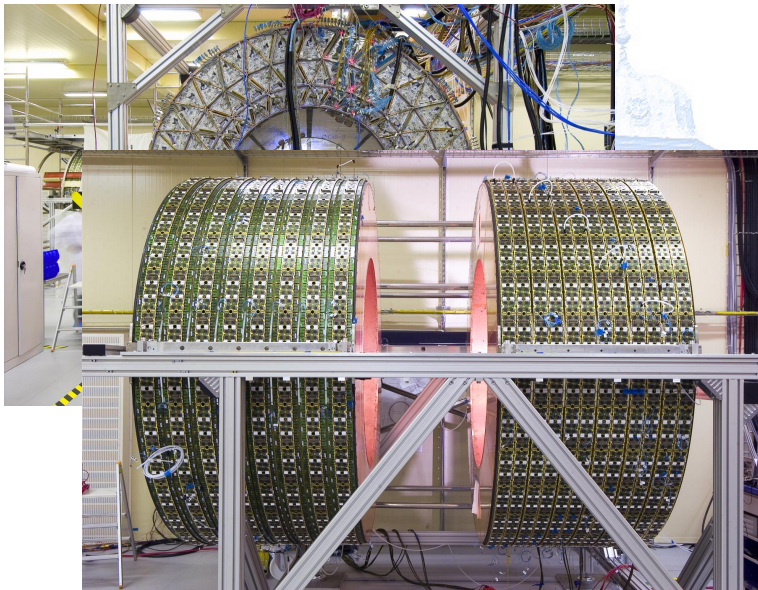
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ATLAS Transition Radiation Tracker

Readout data

- Binary digitization using 2-level discriminators:
Low Level (~ 250 eV) hits for tracking and
High Level (~ 6 keV) hits for particle ID
- Readout window: 75 ns per trigger
- Readout of LL and HL information:
3 HL bits (25 ns windows) and
24 LL bits (3.125 ns window) per straw
- Position of LL leading and trailing edges relative to trigger time are used for drift time measurement and pulse height correction

ATLAS Transition Radiation Tracker

Segmentation

- Lots of different segmentations for different services: LVBoard, HVCell, HVFuse, DTMROC, Module ...
- Here are the ones relevant for monitoring:
 - ASDBLR: Analog frontend chip. Reads 8 Straws
 - DTMROC: Digital frontend chip. Reads 16 Straws
 - Stack/Slice: Barrel and Endcap segmented in 32 phi segments
 - RODs: Each ROD reads half of a Barrel segment (side A or C), in each Endcap 2 RODs read one phi segment
192 RODs in total
 - No modules in the sense the silicons are using
- Readout problems usually at chip or board level, straw level problems cannot be addressed

ATLAS Transition Radiation Tracker

Operation scheme

- Detector is always ON!
- Each straw is under ~ 1500 V HV
- HV trips occur regularly and affect larger areas (192 straws). Most of the time recovered automatically or manually
- HV is subdivided with fuses serving 8 straws each. Fuses containing “bad” straws can be selectively burned
- No recurring permanent hardware issues (we don't have TXs ;))

- 8 Monitoring jobs on **pc-tdq-mon-24/25**
- Infrastructure (MDA, IS, Gatherer) on **pc-tdq-mon-14**
- 6 Provider run on physics streams (2× Egamma, 2× Muons, JetTauEtmis, MinBias for pp, 6× bulk for HI). Those are gathered
- 1 Provider runs on L1_RD(0|1)_EMPTY trigger items (exploiting SCT/Pixel noise streams): Noise monitoring
- 1 Provider runs on L1_RD(0|1)_FILLED trigger items: Beam monitoring
- Sources in /det/trt/TRTMonitoring/athena
- Different sources for beam and regular monitoring
- Configured by RecExOnline_Partition_Online_TRT.py script in /Reconstruction/RecExample/RecExOnline

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File Commands Access Control Settings Logging Level Help

Commit & Reload Load Panels

MRS TS DVS ED QMS LHM OH

RUN CONTROL STATE RUNNING

-Run Control Commands-

SHUTDOWN BOOT
 TERMINATE INITIALIZE
 UNCONFIG CONFIG
 STOP START
 HOLD TRG RESUME TRG

Beam Stable ● Warm Start Warm Stop

-Run Information & Settings-

Run type Physics
 Run number 168603
 Super Master Key 956
 LHC Clock Type BC1
 Recording Enabled
 Start time 07-Nov-2010 12:17:55
 Stop time
 Total time 6 h, 33 m, 39 s

Information Counters Settings

Run Control Segments & Resources Dataset Tags

RUNNING TRT-MDA
RUNNING TRTBarrelA
RUNNING TRTBarrelC
RUNNING TRTEndcapA
RUNNING TRTEndcapC
RUNNING TRTMonitoring
UP NodeCoralProxy:TRT-Monitorin
UP NodeCoralProxy:TRT-Monitorin
RUNNING TRTGatherer
RUNNING TRTGatherer-Expert
UP TRT-Monitoring-1
UP TRT-Monitoring-2
UP TRT-Monitoring-3
UP TRT-Monitoring-4
UP TRT-Monitoring-5
UP TRT-Monitoring-6
UP TRT-Monitoring-7

RootController
 HW
 PMG
 Infrastructure

Infrastructure Advanced

Show Online Segment Find: Match Case Repeats

Subscription criteria WARNING ERROR FATAL INFORMATION Expression Subscribe

TIME	SEVERITY	APPLICATION	NAME	MESSAGE
18:47:48	INFORMATION	IGUI	INTERNAL	All done! IGUI is going to appear...
18:47:46	INFORMATION	IGUI	INTERNAL	Waiting for the "Dataset Tags" panel to initialize...
18:47:46	INFORMATION	IGUI	INTERNAL	Waiting for the "Segments & Resources" panel to initialize...
18:47:45	INFORMATION	IGUI	INTERNAL	Waiting for the "Run Control" panel to initialize...
18:47:44	INFORMATION	IGUI	INTERNAL	Creating panel "Igui.DSPanel"...
18:47:44	INFORMATION	IGUI	INTERNAL	Creating panel "Igui.SegmentsResourcesPanel"...
18:47:44	INFORMATION	IGUI	INTERNAL	Creating panel "Igui.RunControlMainPanel"...
18:47:44	INFORMATION	IGUI	INTERNAL	Waiting for the "Elog-Dialog" panel to initialize...

Clear Message format Number of visible rows 100 Current MRS subscription WARNING|ERROR|FATAL

- Monitoring jobs in TRT segment

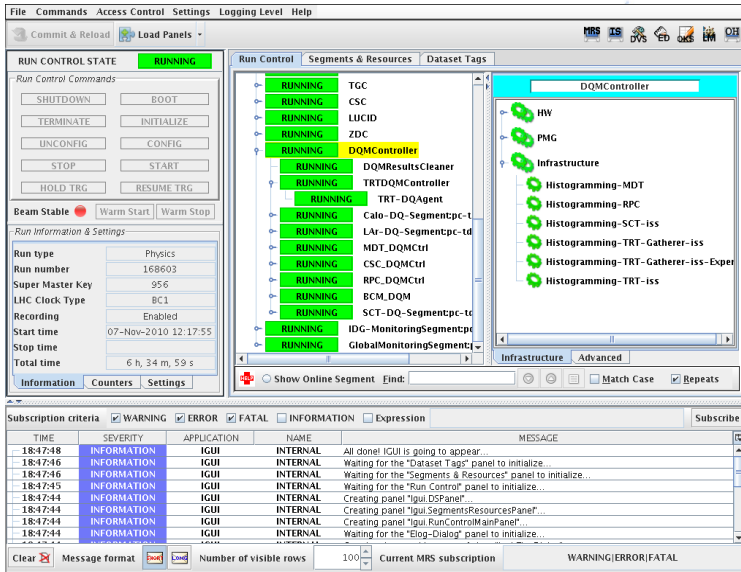
Detector

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The screenshot shows the Runcontrol interface with the following components:

- Top Bar:** File, Commands, Access Control, Settings, Logging Level, Help. Icons for MRS, ITS, DVS, ED, QMS, LHM, OH.
- Left Panel:**
 - RUN CONTROL STATE:** RUNNING
 - Run Control Commands:** SHUTDOWN, BOOT, TERMINATE, INITIALIZE, UNCONFIG, CONFIG, STOP, START, HOLD TRG, RESUME TRG.
 - Beam Stable:** Warm Start, Warm Stop.
 - Run Information & Settings:** Run type (Physics), Run number (168603), Super Master Key (956), LHC Clock Type (BC1), Recording (Enabled), Start time (07-Nov-2010 12:17:55), Stop time, Total time (6 h, 34 m, 59 s).
- Main Panel:**
 - Run Control:** Tree view of segments and resources. 'DQMController' is highlighted.
 - Segments & Resources:** List of running components under DQMController: HW, PMG, Infrastructure, Histogramming-MDT, Histogramming-RPC, Histogramming-SCT-iss, Histogramming-TRT-Gatherer-iss, Histogramming-TRT-Gatherer-iss-Exp, Histogramming-TRT-iss.
- Bottom Panel:**
 - Subscription criteria:** WARNING, ERROR, FATAL, INFORMATION, Expression.
 - Log Table:**

TIME	SEVERITY	APPLICATION	NAME	MESSAGE
18:47:48	INFORMATION	IGUI	INTERNAL	All done! IGUI is going to appear...
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 - Bottom Bar:** Clear, Message format, Number of visible rows (100), Current MRS subscription (WARNING|ERROR|FATAL).

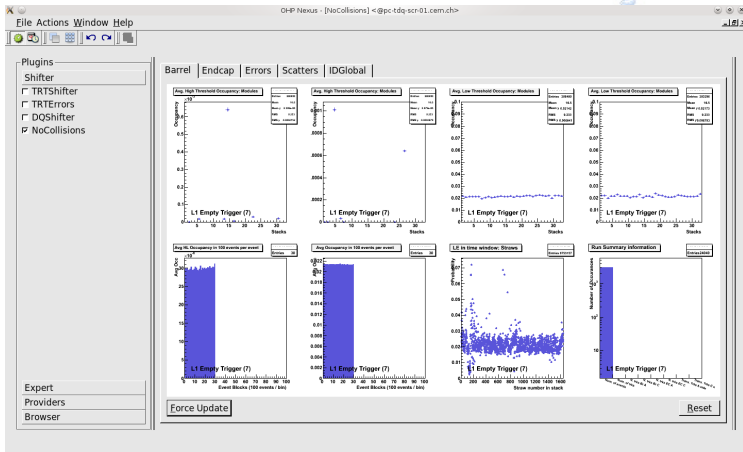
- Infrastructure in DQMController segment

Monitoring code

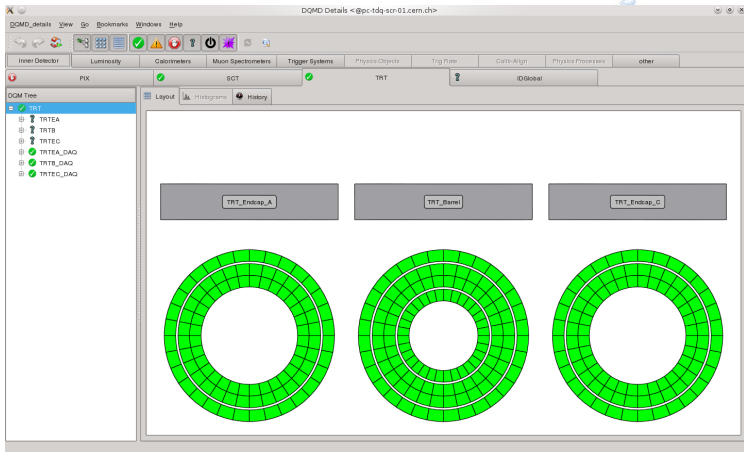
- Monitoring code controlled by `InDetMonitoringTRT.py` in `/InnerDetector/InDetExample/InDetRecExample` package
- For noise monitoring we take every event
- For physics monitoring we take tracks from the `CombinedTracks` collection with at least 10 TRT hits
- Separation in Shift and Expert histograms. Shifter usually only has to worry about Shift histos



OHP



- Two different tabs for standby mode and physics running
- Basically only noise occupancy monitoring for standby
- Mainly track related histograms for physics running
- Key distributions: Residuals and number of tracks / hits on tracks
- Configured by `/atlas/moncfg/tdaq-02-00-03/trt/ohp/TRTMonitoring.ohp.xml`



- Two regions for Shifter (73 histograms) and Expert (320 histograms) monitoring
- Expert histograms = chip and straw level noise occupancies
- Global state only from Shifter histograms
- Shifter histograms only active in physics running (fed by gatherer)
- Histograms, checks, references and thresholds configured in oks

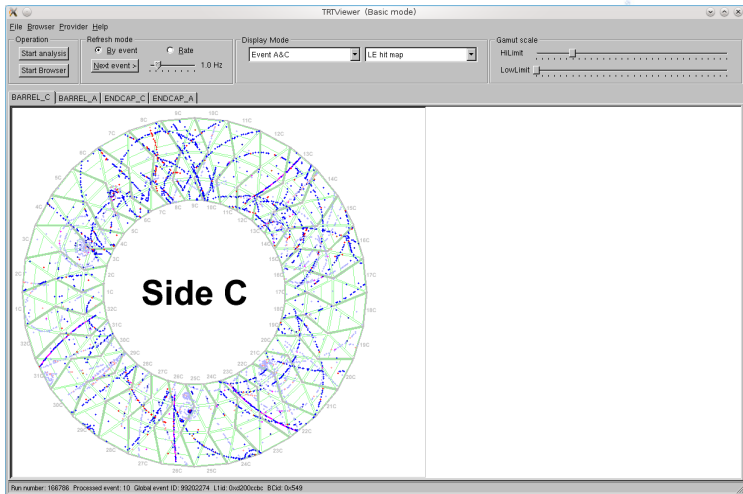
Detector

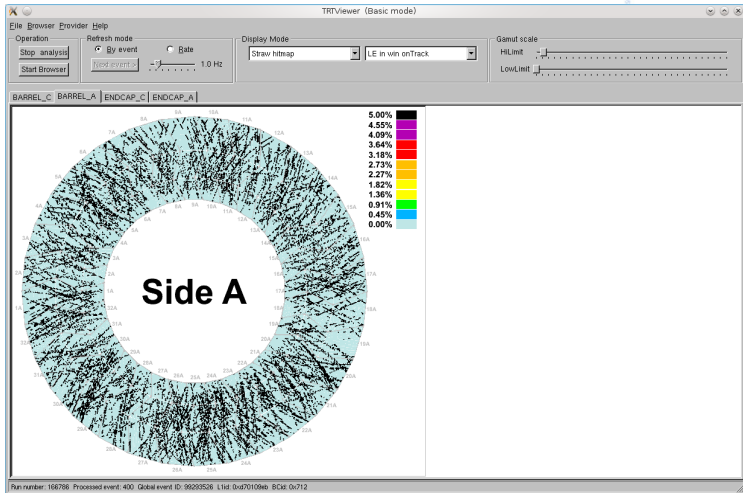
Infrastructure

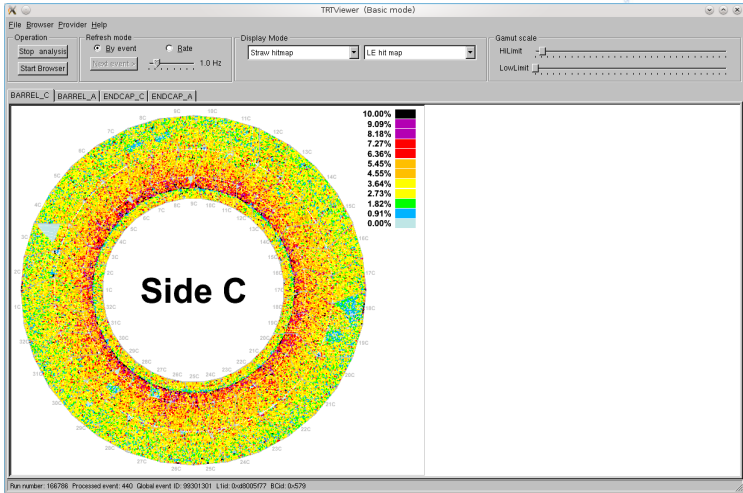
Tools

Shifting

On-call

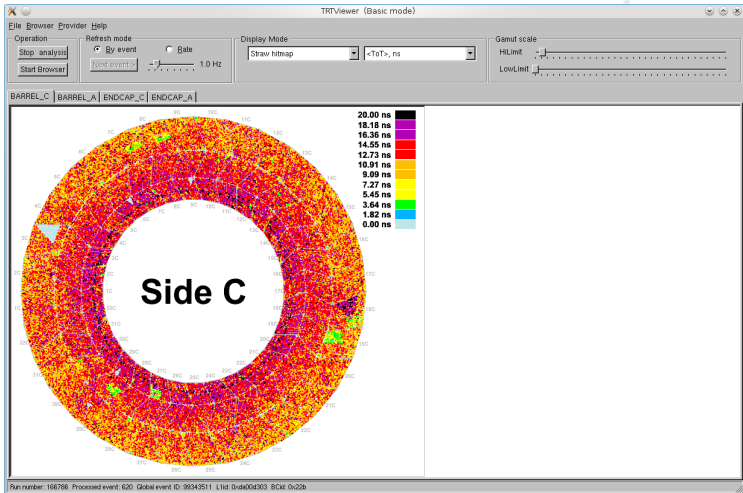








TRTViewer



- TRT low-level monitoring tool
- Comes in different flavors (RAW data, ATHENA, online)
- “Topological” representation of single events and monitoring histograms
- Selection of displayed quantity allows for selection of detector property to be monitored
- Should be used by shifters regularly to spot detector problems (I usually found one per shift block)

Regular duties on shift

Detector

Infrastructure

Tools

Shifting

On-call

- On start of shift do a handover and a logon checklist (~15 min)
- Do a DCS checklist at the beginning of the shift and if you feel like again after 4 hours ((20 min-1 h depending on experience of shifter and how carefully it is done)
- Do a DQ checklist at the beginning of the shift and then every hour ((2 min-10 min depending on collisions and experience)
- Watch FSM and MRS for alarms and take appropriate actions (mostly logging or calling experts)
- Take and analyze calibration scans during calibration periods (6 different calibrations, require some shifter intervention but extremely well documented)
- Write sensible shift logs

Frequently required actions on shift

Detector

Infrastructure

Tools

Shifting

On-call

- Identify and recover synchronization problems
 - Deal with HV trips (not much the shifter can actually do besides logging and calling)
 - Deal with busy RODs. Rare event nowadays
 - Fulfill special appointments (“keep an eye on ...”, “try to take a screenshot of ...”, mainly during morning shifts)
 - Drink coffee
 - Comment on facebook status of your friends
 - Watch current episode of your favorite TV show
- ⇒ Shifts range from 8 hours of hard work to 7 hours of not trying to fall asleep

TRT On-calls

- Several On-call shifts:
 - DAQ On-call (Shared between 3 DAQ experts. If they get called often immediate action is required)
 - DCS On-call (You don't call DCS unless it is really urgent)
 - Monitoring On-call (Shared between 3 DQ experts. Usually expert on call takes offline DQ expert shift at the same time)
 - Gas On-call
 - Cooling On-call
 - +Run coordinator
 - +Anatoli
- TWIKI page for logging of calls going to any of the first three On-call phones
- In principle there are instructions for nearly everything but esp. less experienced shifters tend to call experts as soon as there is something suspicious

TRT On-calls

Typical DQ calls

- “OMG, TRT is Grey/Red!” (during periods w/o collisions)
→ RTFM! (often triggered by no-so-well-trained Global DQ shifters or SL)
- “OMG, TRT turned Green!” (We actually had this once, I still don’t understand this one)
- Noise monitoring not working
→ Problems with trigger menu
- Monitoring not working at all
→ Communication errors during runstart. RC has to restart by hand

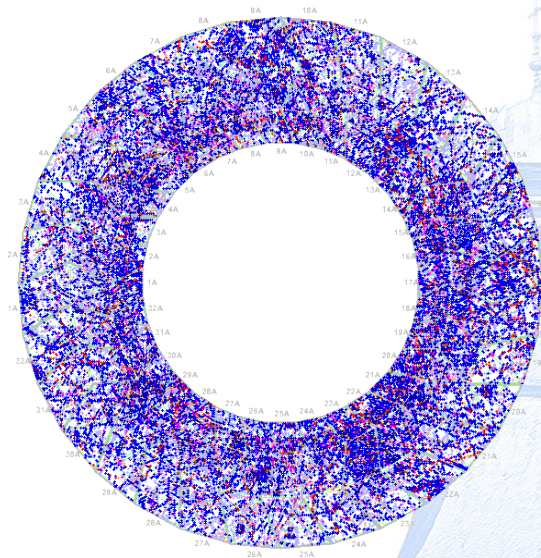
TRT On-calls

Some real action calls

- Major concerns throughout ACR because of different seemingly TRT problems (“triggers are not working because of TRT”). In the end it turned out to be a RC shifter which did not know about the TRT resync.
- IS magnetic field reading incident
- Screwed up histograms all over the place. This was a tough one. In the end it turned out ATLAS was running in Cosmics mode although having collisions so the reconstruction tried to monitor cosmics from collision tracks.



Thanks for your attention



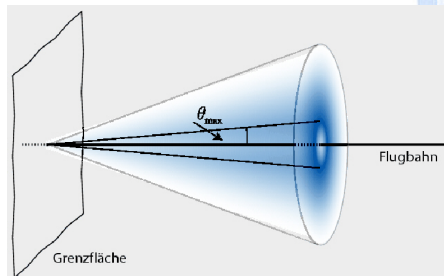
Questions?



ATLAS Transition Radiation Tracker

Transition radiation

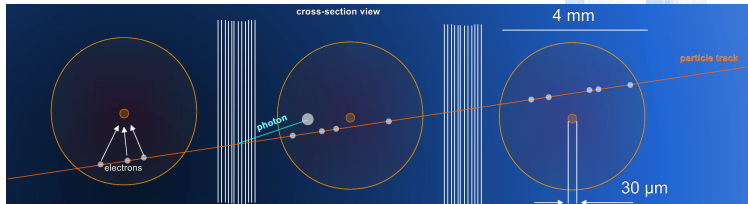
- Charged particles radiate X-ray photons when crossing boundaries between media of differing refractive indices
- Radiated energy $\propto \gamma$
- Detection of X-ray photons using noble gases (mainly Xenon)



ATLAS Transition Radiation Tracker

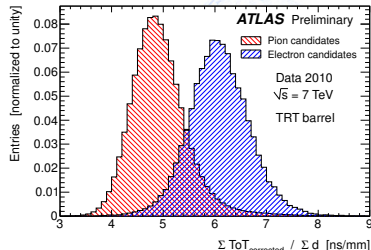
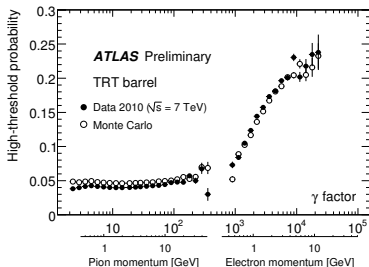
Transition radiation

- Fiber matrix (barrel region) and foil stacks (endcaps) as radiators → Lots of boundaries between media
- Detection by special drift gas in the straws (70% Xe)
- Electronically readout by two level discriminators



ATLAS Transition Radiation Tracker

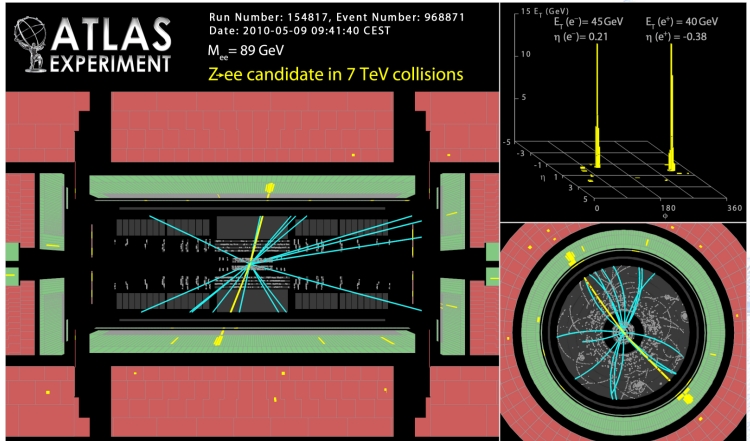
Electron ID



- Only electrons radiate significant amounts of TR
- Number of HL hits indicates intensity of TR and therefor particle ID

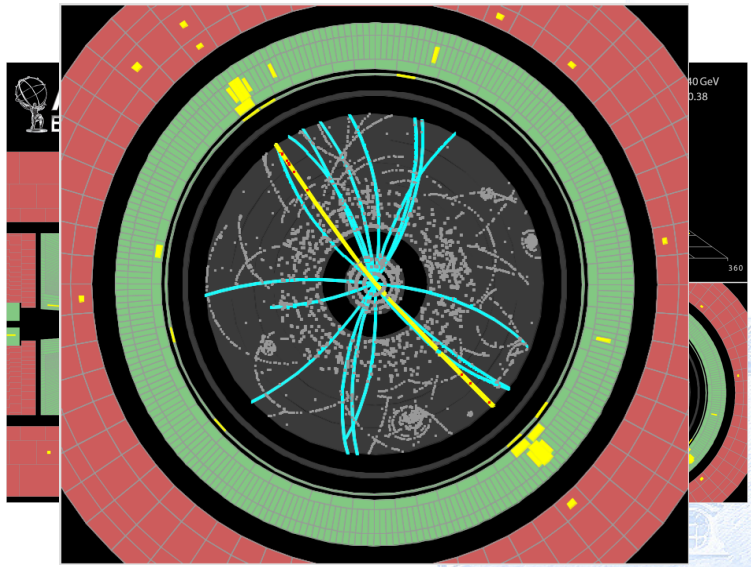
ATLAS Transition Radiation Tracker

What you can use it for...



ATLAS Transition Radiation Tracker

What you can use it for...



COBRA panel

File View Help

Partition: **ATLAS** Refresh Interval: (5 sec) Refresh Reconnect Disconnect

Component	ROD Busy	S-Link Busy	ROL Buffer Status	ID #	ROD L1 ID	ROS L1 ID
[-] Barrel A	OK	OK		31		
[+] VME Crate 1	OK	OK		sbc-trt-r...		
[+] VME Crate 2	OK	OK		sbc-trt-r...		
[-] Barrel C	OK	OK		32		
[+] VME Crate 3	OK	OK		sbc-trt-r...		
[+] VME Crate 4	OK	OK		sbc-trt-r...		
[-] Endcap A	OK	OK		33		
[+] VME Crate 1	OK	OK		sbc-trt-r...		
[+] VME Crate 2	OK	OK		sbc-trt-r...		
[+] VME Crate 3	OK	OK		sbc-trt-r...		
[-] Endcap C	OK	OK		34		
[+] VME Crate 4	OK	OK		sbc-trt-r...		
[+] VME Crate 5	OK	OK		sbc-trt-r...		
[+] VME Crate 6	OK	OK		sbc-trt-r...		

Active RODs: 192 # Active ROLs: 192 # Masked RODs: 0 Connected

COBRA panel

- Generally speaking this is a DAQ tool
- Allows for the monitoring of a lot of different DAQ properties on ROD level
- Important to spot and recover busy RODs
- Mainly mentioned here because it's probably gonna stay also for future ID shifts