

RICH OnlineMonitor and DataQuality

Software Week Oct 2009



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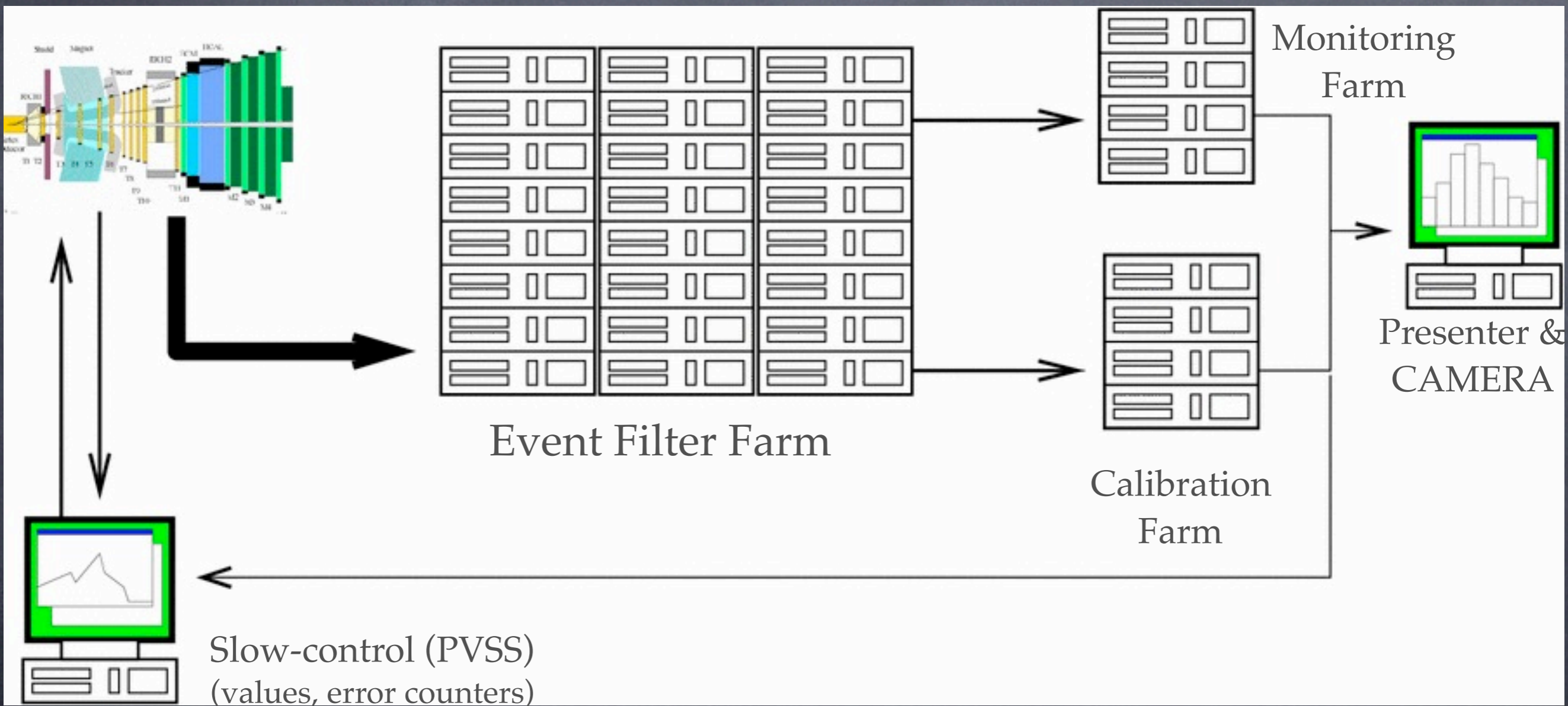


Overview



- Online Monitoring & Data Quality
 - Detect operational issues
 - First look at PID as data is taken
- Calibration Farm
 - Receives events with special calibration trigger
- Express Stream
 - Low-rate of events representing whole run, fast reconstruction
- Offline Monitoring & Data Quality
 - High statistics tests,
 - PID performance

Online Data Flow





- PID monitoring
 - D^* , Λ , K_s , $J/\psi \rightarrow \mu\mu$, K (from D_s)
 - Determine particle type by kinematic constraints, compare to RICH prediction
- Ganga-based mirror alignment
- Alignment monitoring
- Test-pattern monitoring
 - Inject a test-pattern into HPD cathode and monitor efficiency
- Ion feedback
 - Dedicated measurements on machine development days
- Hitmaps, hot / cold pixels
- Refractive index (aerogel, gas)
 - RICH at atmospheric pressures
 - Need to change calibration as atmospheric pressure changes

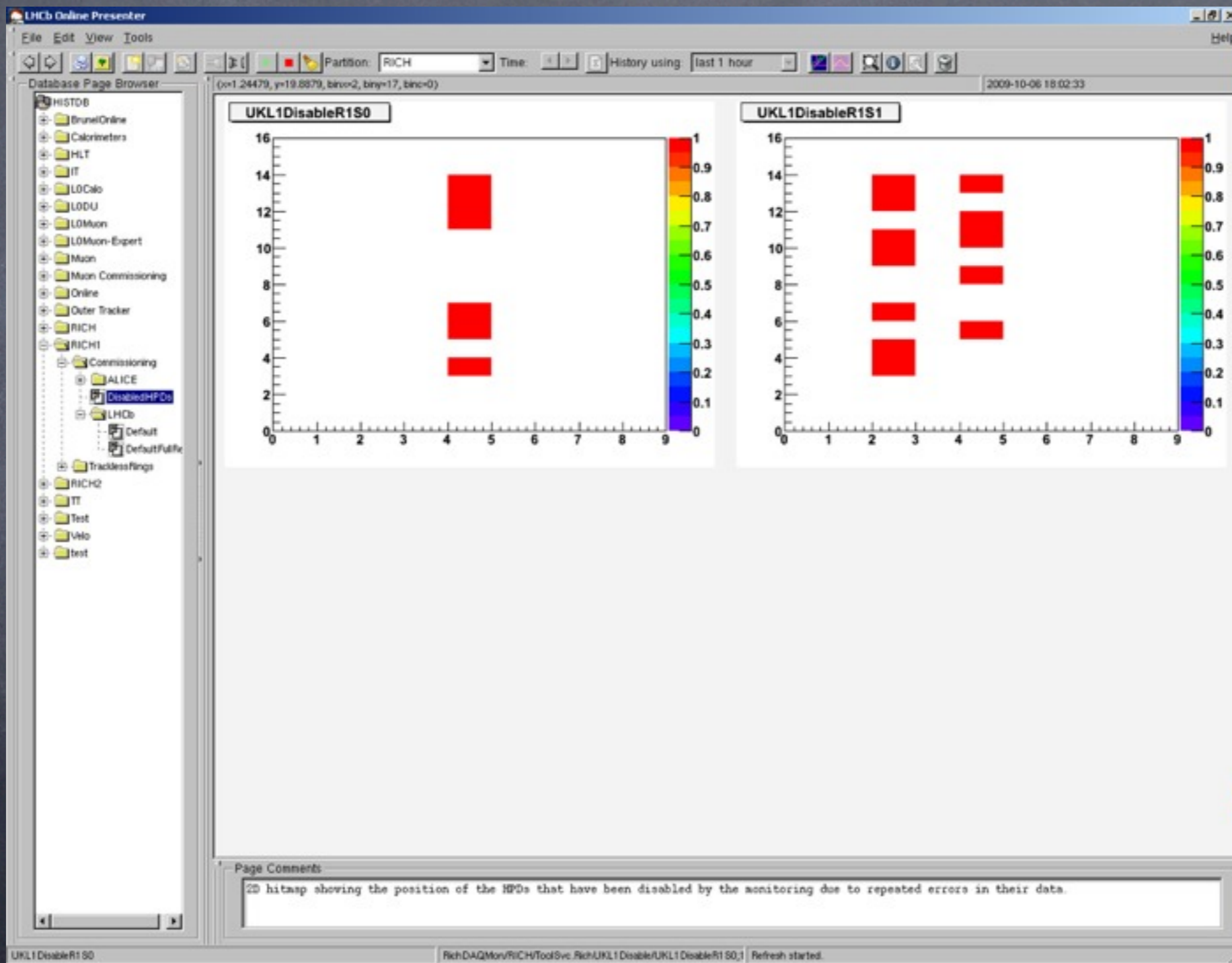


- Trackless rings using Elastic Neural Network
 - Independent handle on Cherenkov angle w/o tracking
 - Change in distribution of radii → change of refractive index
- Data integrity
 - Data banks, transmission errors, etc.
- Automatic HPD disabling during running
 - If an HPD gets faulty, remove from data-stream until problem can be investigated
 - HPDs in “funny state” often send large events
 - ↳ global trigger throttle,
 - ↳ avoid interruption in data-taking by masking HPD in UKL1 data stream.
- CAMERA
 - Error reporting tool

HPD Disabling



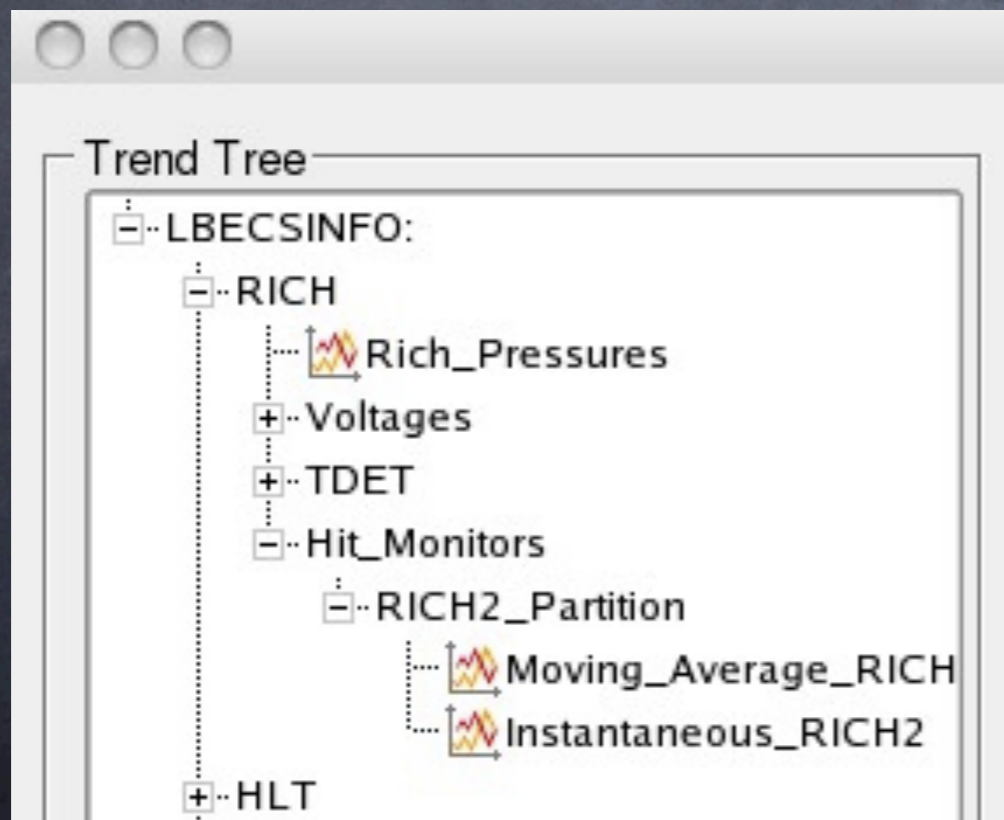
- Disabled HPDs shown in histogram for shifter



PVSS Trending Tool



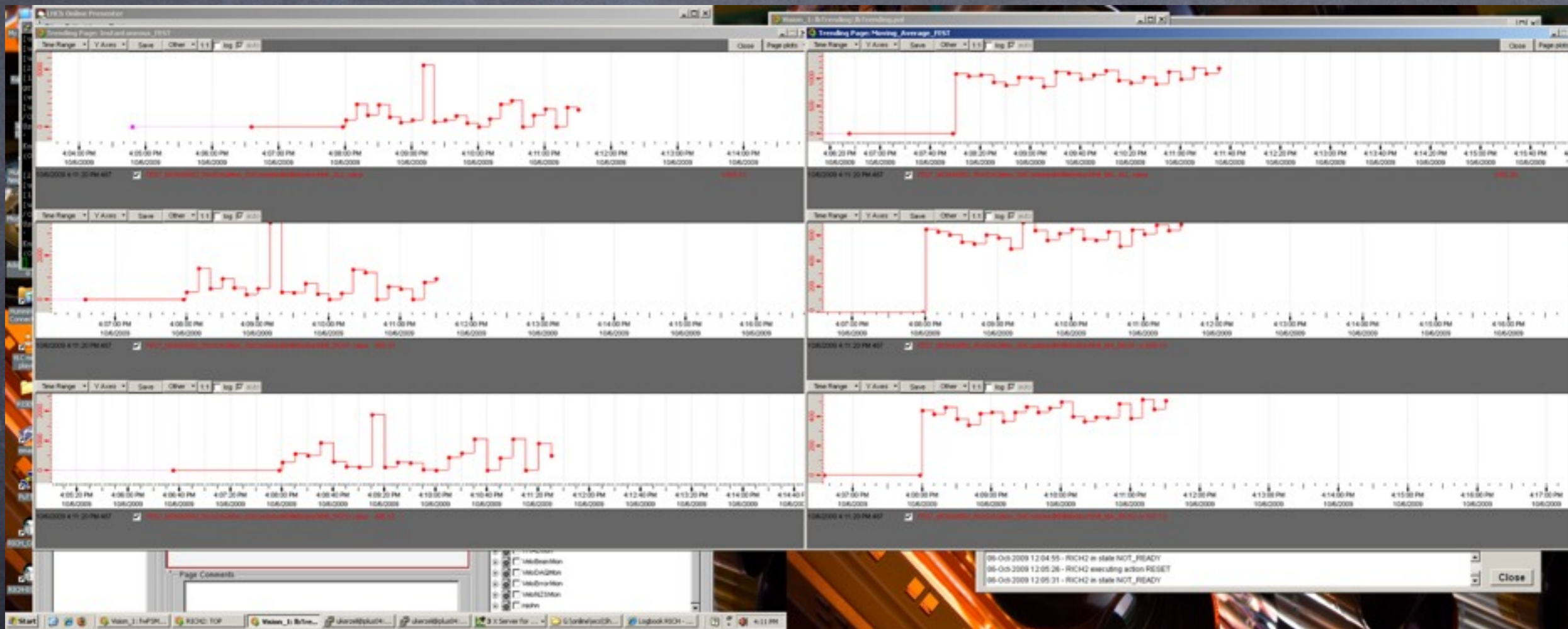
- Shows how a number varies with time
- Automatically archives values in data-base (soon)
- For online monitoring and DQ: #hits
- Log into PC with PVSS installed
 - `./group/online/ecs/Shortcuts38/OTHER/LBECSINFO/LBECSINFO_UI_lbTrending.sh`
- Or click on link on Windows in IP8



- "Right-click" to open trend page
- 2 pages per partition
- Moving Average
- Instantaneous (current value at sampling time)



PVSS Trending Tool



Online DQ



- RICH monitoring project: Panoptes
- Online: two separate monitoring tasks for RICH
 - Task 1: low-level monitoring
 - Integrity of data banks, hit-maps, #hits, hot/cold pixels, ...
 - Task 2:
 - Stand-alone (trackless) ring finding
 - OnlineBrunel: alignment monitoring, ...
 - OnlineDaVinci: PID monitoring (when available)

Offline DQ

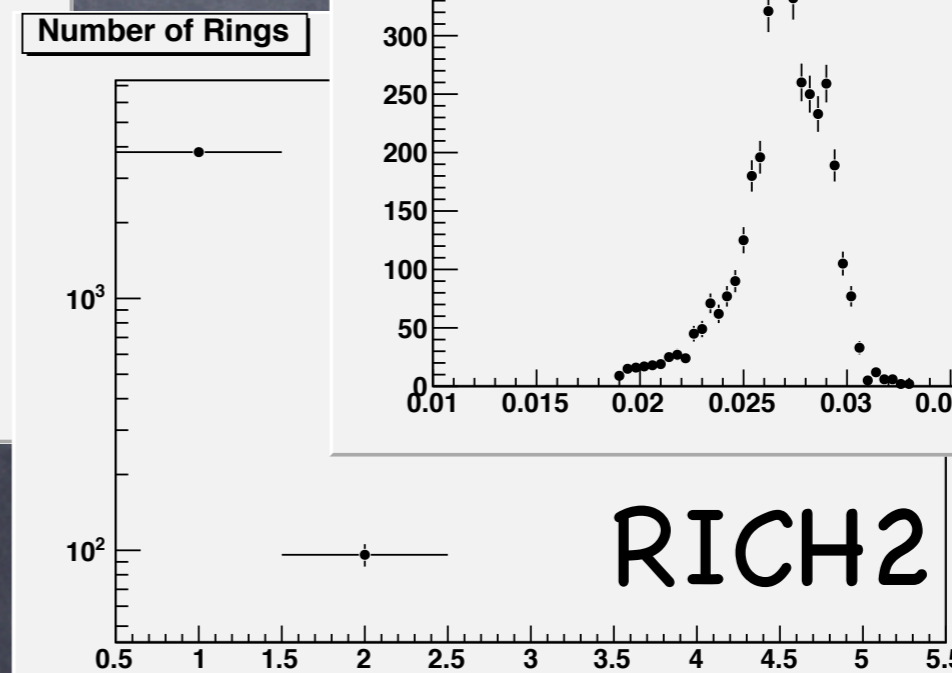
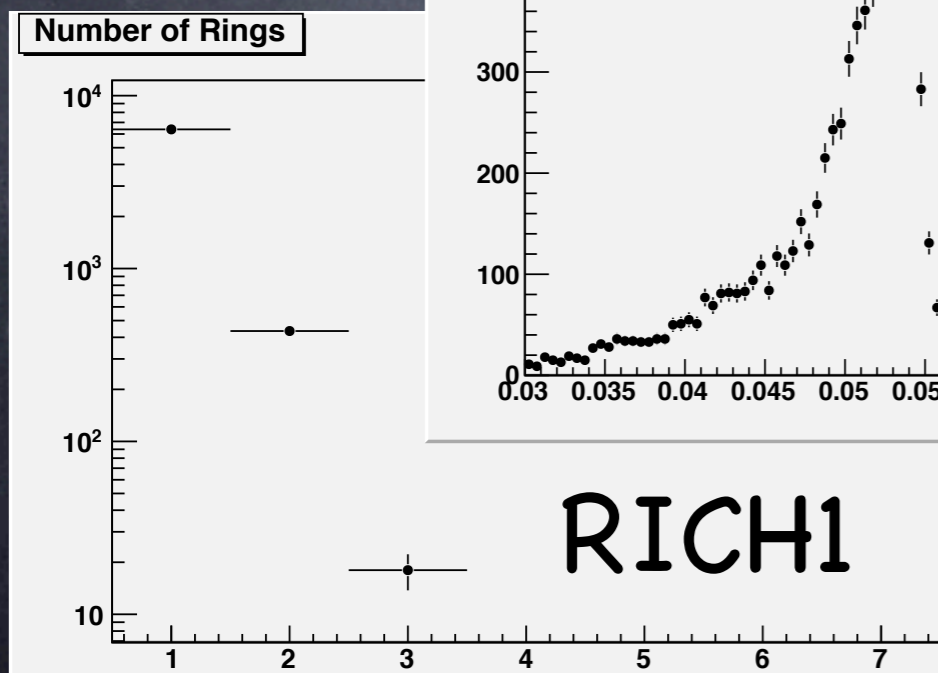
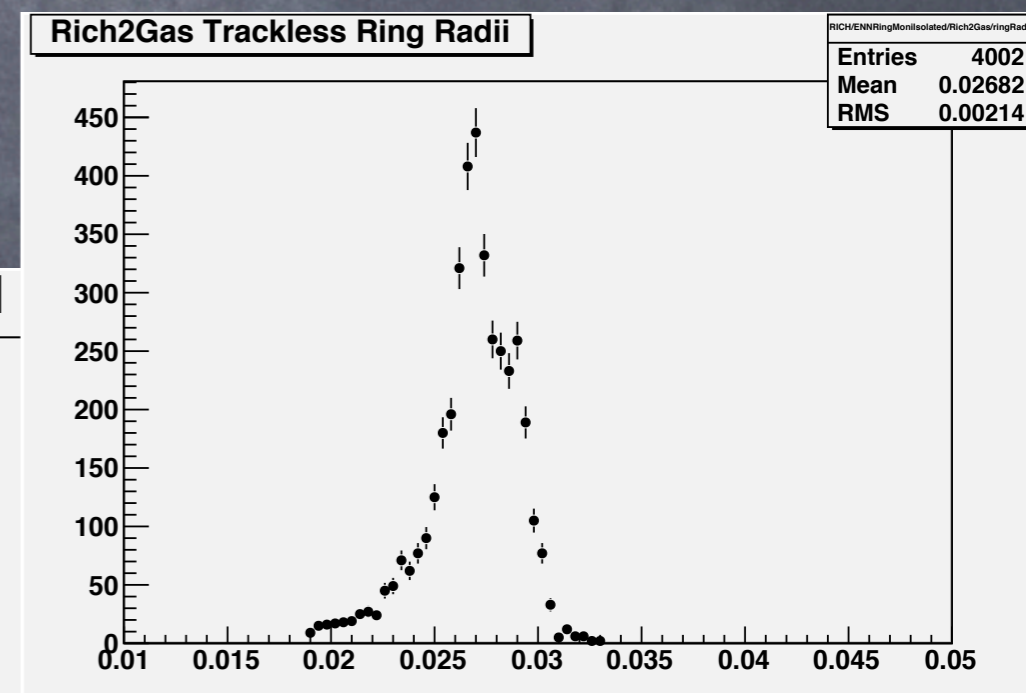
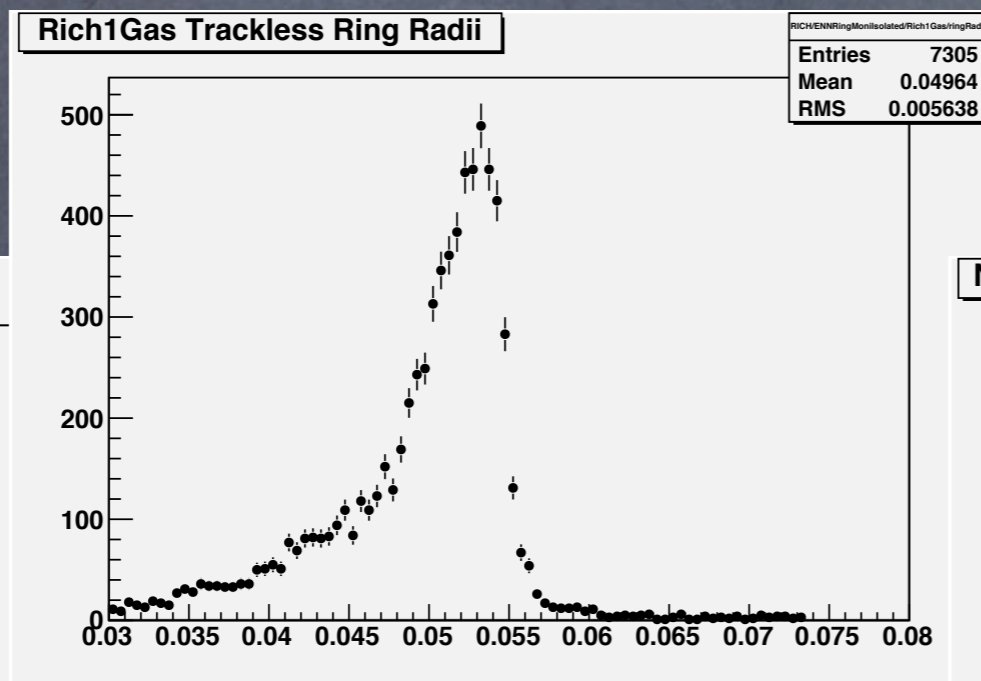


- DQ workflow on Express stream
 - Alignment monitoring (Brunel)
 - PID performance (DaVinci)
- Ganga-based mirror alignment
 - Iterative approach from raw data,
 - Converge on accurate mirror alignment
- Reconstruction: high statistics tests
 - PID performance
 - Refractive index
 - Alignment monitoring (after potential re-alignment)

Trackless Rings



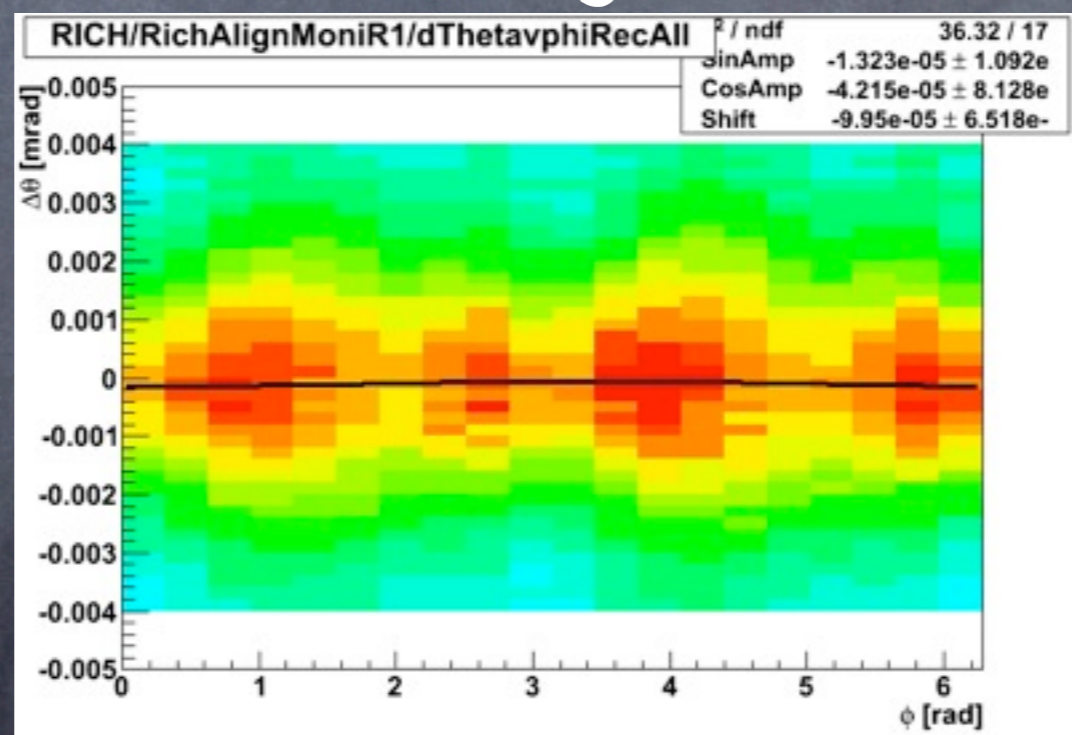
- ENN quite fast, process sizeable fraction of events in MF
- Both for Rich1 (gas) and Rich2
- Used to find isolated rings
- Plots taken from one SaveSet at June FEST week (i.e. 10 min at nominal data taking rate)



Alignment Monitoring



- Monitoring histograms integrated in Brunel
 - ↳ both online and offline
- Fit to be used in online monitoring implemented in OMA Lib
 - Any deviation from straight line indicates mis-alignment



- Need to change onlineBrunel to pre-book all relevant histograms

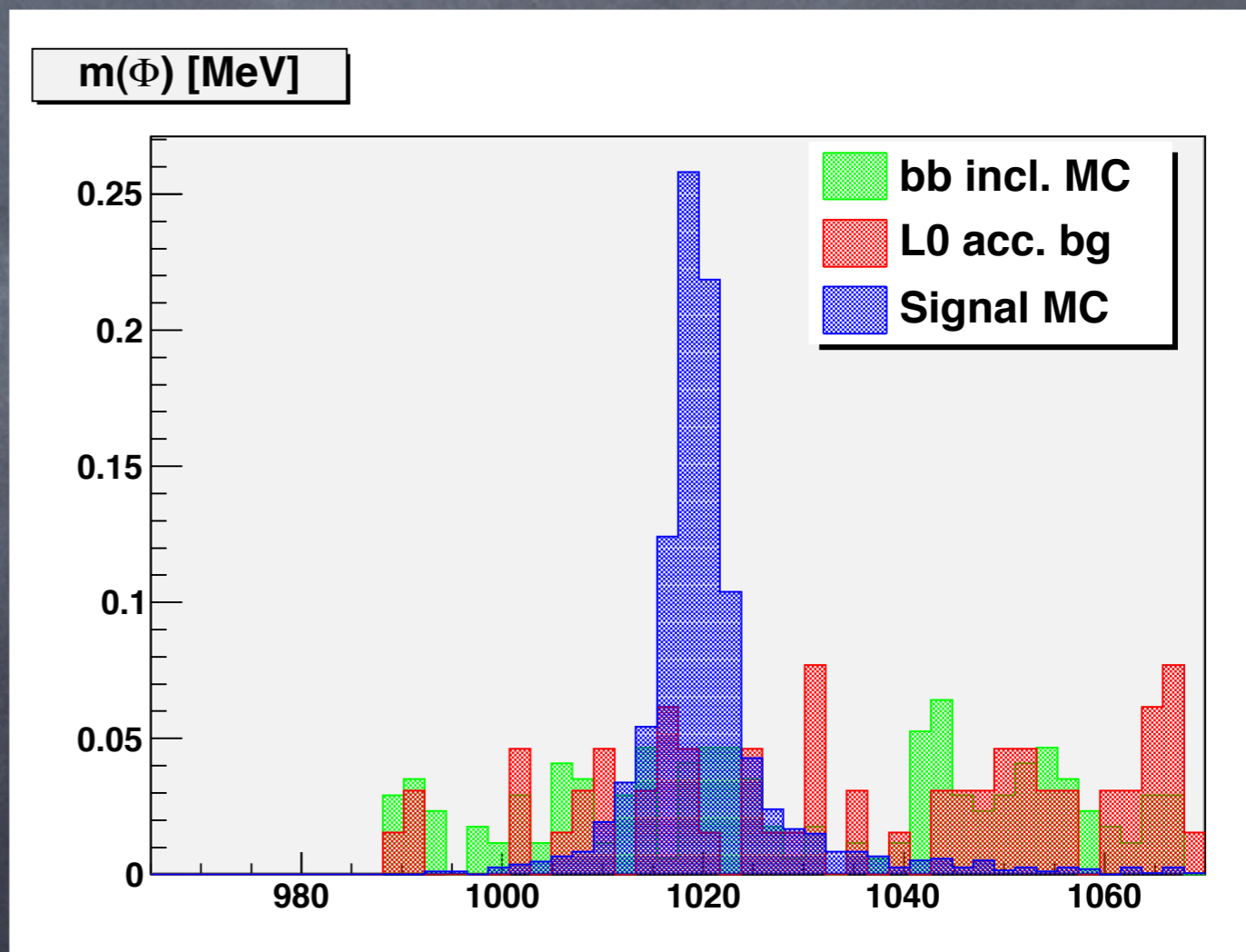
Calibration Farm



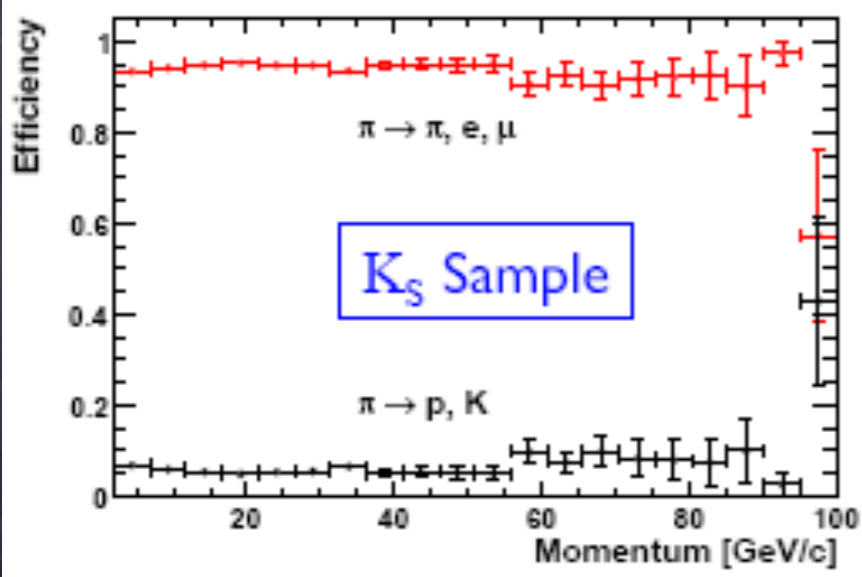
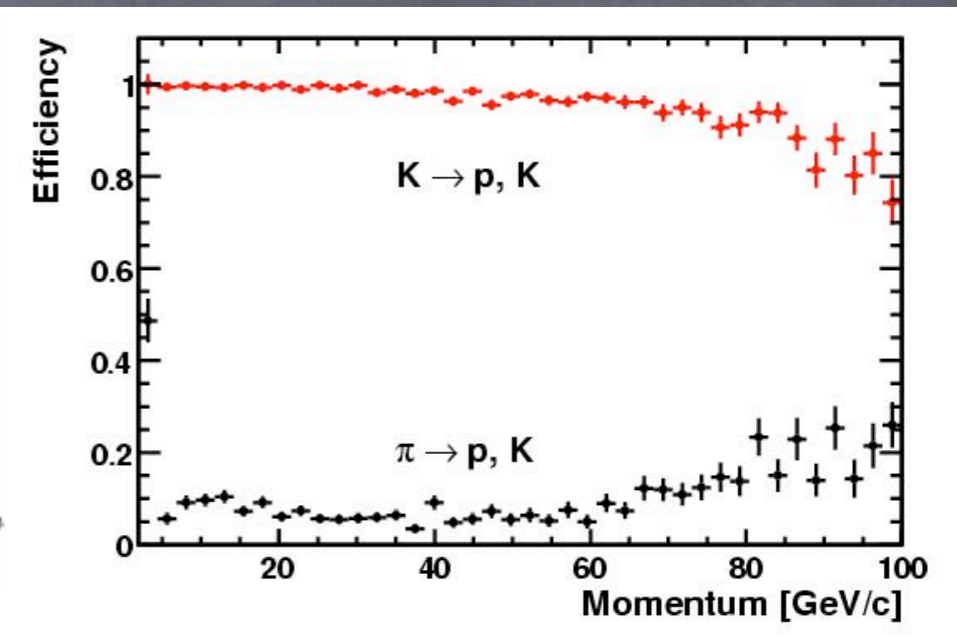
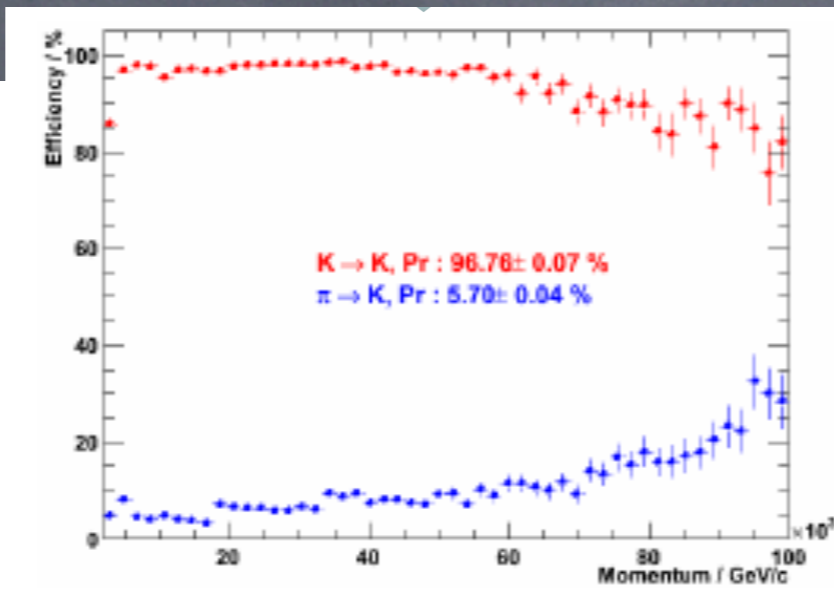
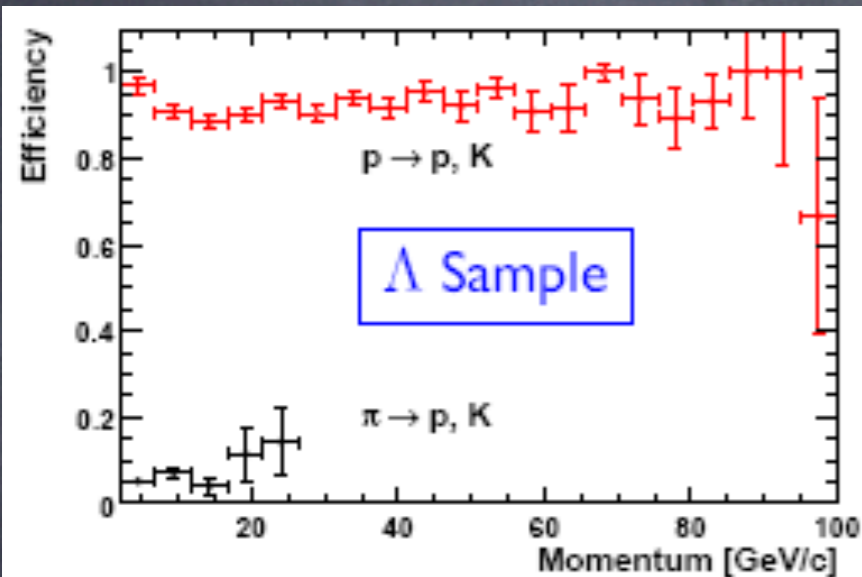
- Dedicated PC (one PC, 8 cores, will not be expanded)
- Data taken with dedicated triggers is sent there
 - 3 calibration triggers possible, sent in abort gap
 - Trigger A: 100Hz (? from Calorimeter)
 - Trigger C not yet used
- No data written out – just histograms
 - Histo. saved every 10min, then automated analysis
- For the RICH:
 - A: Corner-pixel test-pattern + dark-count
 - B: PINT test pattern → **must not be used by anyone**
 - C: Laser
 - Which rate do we want for C ?
 - ↳ will need to be negotiated with other sub-det.



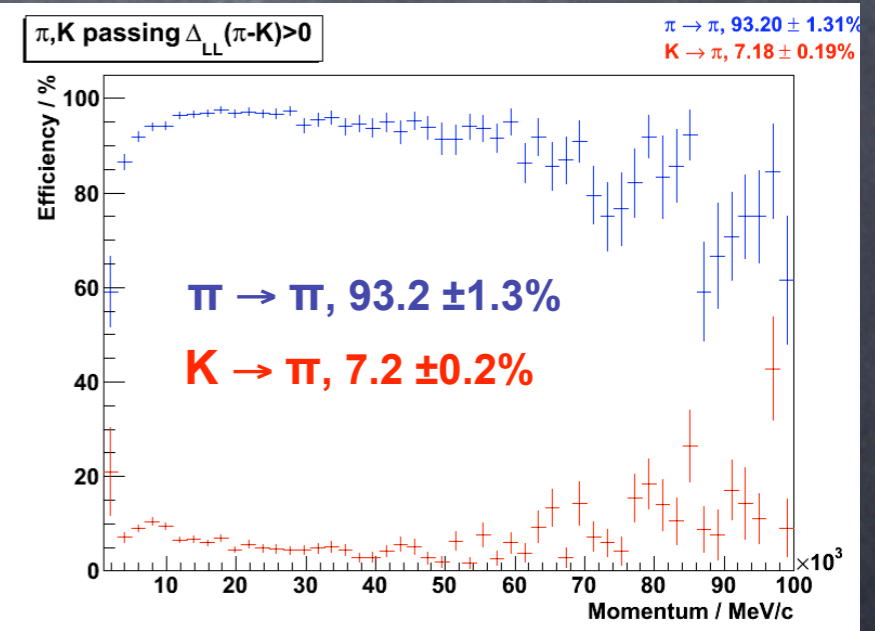
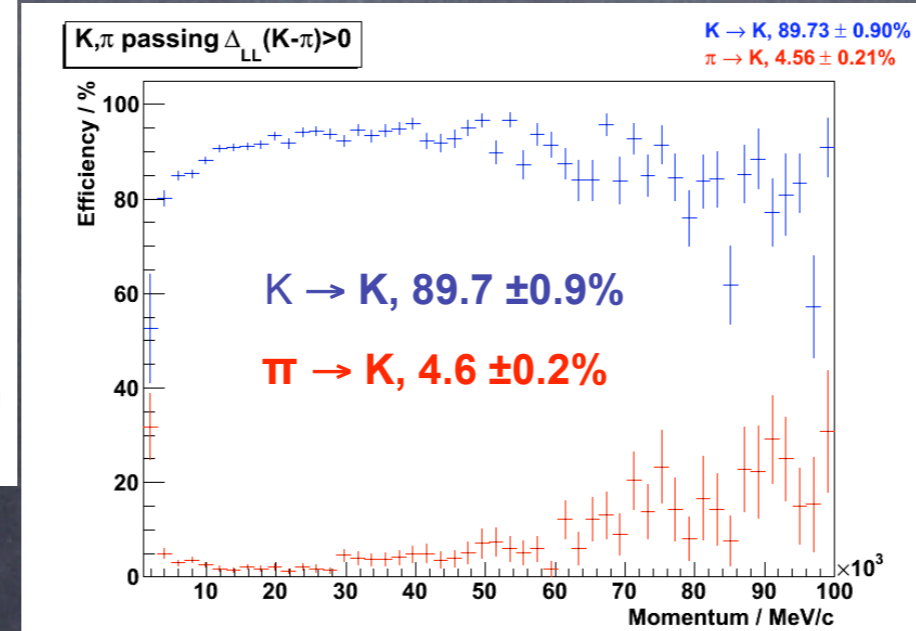
- Use dedicated exclusive decays to monitor PID performance
 - ↳ Particle type can be inferred from kinematics
 - $J/\psi \rightarrow \mu\mu$
 - $\Lambda \rightarrow p\pi$
 - $D^* \rightarrow D\pi$
 - $\phi \rightarrow KK$
(ϕ from D_s)
 - $K_s \rightarrow \pi\pi$
- Identified particles as “true” particles in performance plots



PID Monitoring



$D^* \rightarrow D\pi$



$\phi \rightarrow KK$

PID Monitoring



- Selections integrated into monitoring code
 - for Online: Need something like “onlineDavinci” or onlineBrunel + PHYS
 - for Offline: Should be part of current DQ monitoring using Express Stream / Grid reconstruction, etc.

- Automated alerts being investigated
 - Fit PID performance vs $p_{(t)}$

Reporting Errors



- ErrorLogger
 - Output of MsgSvc sent to central logger
 - Writing of log-files switched off by default...
- CAMERA: Client / server based error reporting tool
 - Report single incidents, e.g. DAQ error in a given event, ...
 - Attach further details to messages
 - More text describing more details
 - Histograms, e.g. single event histograms triggering the error
 - Error messages and additional info saved
 - GUI for easy access to messages
 - Supports multiple servers for load balancing
 - Available as part of the ONLINE project
 - Just adapt the config files and run :-)
 - TWiki <http://lbtwiki.cern.ch/bin/view/RICH/RichCamera>

CAMERA



The screenshot displays a computer desktop with several windows. The primary window is a 2D histogram titled "2D Histogram" with "Entries 40904". The histogram shows a distribution of points in a 2D space, with axes ranging from -600 to 600. A color scale on the right indicates density, ranging from 0 (blue) to 2 (red). Below the histogram, a terminal window shows the following text:

```
Single event hit map : Run 30917 Event 104953  
Time of report:  
Wed Aug 27 16:39:11 2008
```

Another terminal window at the bottom shows a Python script snippet:

```
Rich1 : DASH injection tests w/o 23/06/2008  
EventSelector().Input = [  
  "DATA='file:///var/network/pchh/jonesc/data/RICH1/PHYSICS/30917/030917_0000077583.raw' SVC='LHCb::MDPSelector'",  
  "DATA='file:///var/network/pchh/jonesc/data/RICH1/PHYSICS/30917/030917_0000077654.raw' SVC='LHCb::MDPSelector'",  
]
```

The top right window, titled "CAMERA", is a log viewer showing a list of messages. The messages include:

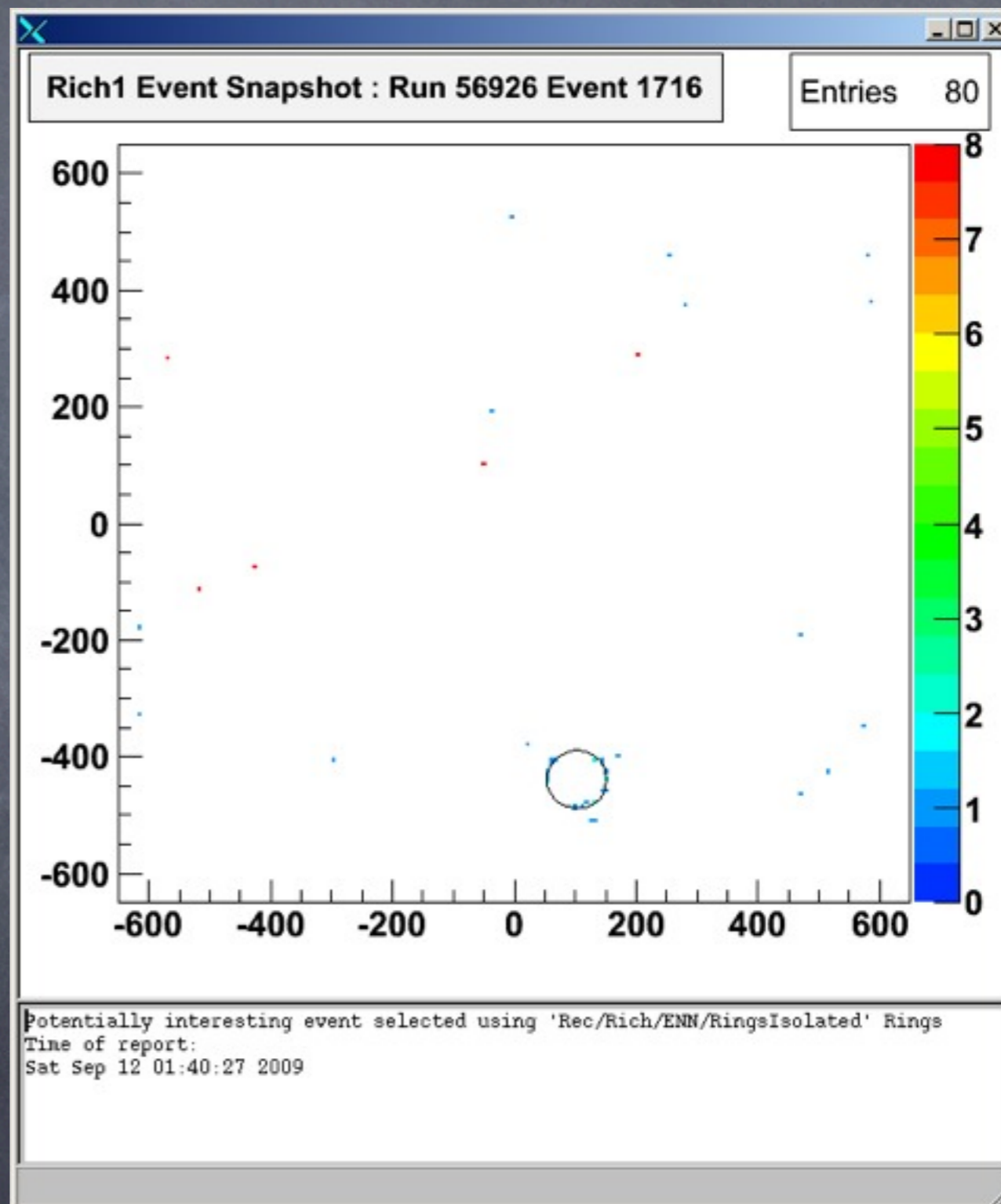
- All
- HBMapMon - 23
- RichDAQMon - 162
- RichNHMapMon - 9
- RingEventSnapshot - 206
- SoftPixelMask - 9
- ToolSvc RichOnlineStatus - 27
- ToolSvc RichUKL1Disable - 25

The log messages are mostly "RingEventSnapshot: Event Snapshot ->" and "HBMapMon: Seen [number] Events (0 empty) in the last [number]".

CAMERA



- Can also overlay (simple) ROOT objects
 - E.g. online track-less ring finding during RICH1 cosmic challenge
 - Overlay circle where the ring is found



Summary & Status



- RICH Online Monitoring and DataQuality far advanced
- CAMERA proved very useful tool in commissioning and cosmics
- Strategies for low → high level monitoring in place
 - Most tools implemented
 - Low-level monitoring, ring-finding tested at nominal data-taking rate during FEST weeks since January.
 - First round of speed optimisations done, could gain considerably by optimising code
(Monitoring Farm has a given size and works on “best effort”)
- In progress:
 - Calibration Farm operational and we can detect dedicated calibration triggers
 - Need to test automatic activation of test-pattern in the real detector and subsequent analysis
 - Can only be done in LHCb partition, i.e. global data-taking

Summary & Status



- In Progress:
 - We can see the alignment monitoring plots using the online mode of the Presenter
 - ↳ Sort out technical details: SaveSets, OMA Lib to activate the automated analysis, alerts to central LHCb shifter.
- PID Monitoring
 - Physics selections ready, infrastructure in place to create PID performance plots using data rather than MC truth
 - Online: Need OnlineDavinci to create PID plots
 - Offline: Workflow with Brunel and DaVinci
 - Then: automated analysis using OMA Lib, alert shifter (online/offline), create default pages for presenter
- To discuss: when to declare data "bad"
 - Trigger new alignment if detect 1mrad mis-alignment
 - What about PID performance ?



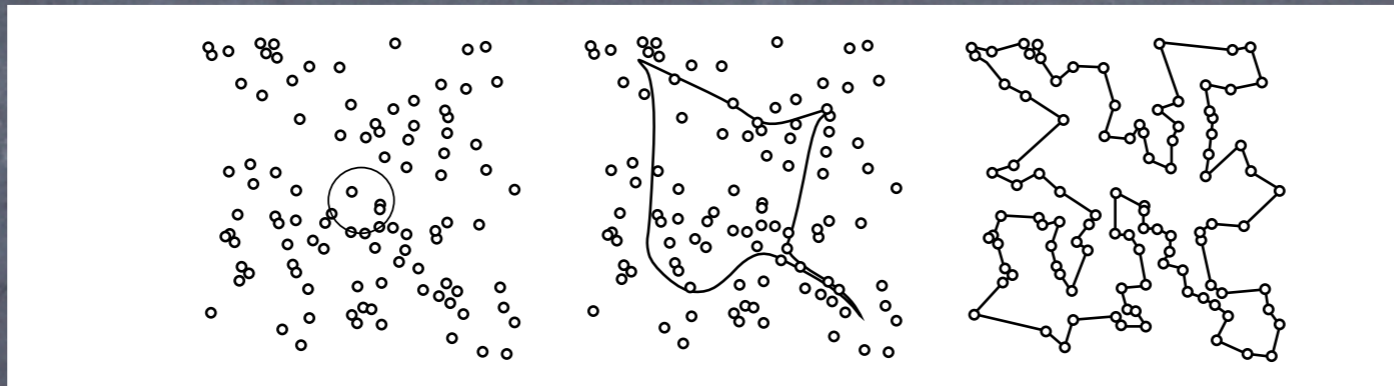
BACKUP



Elastic NN



- Solution to Travelling Salesman problem
 - Imagine rubber-band with knots:
 - knots are the cities, the rubber band automatically gives the shortest route.



- For ring-finding:
 - Restrict minimised energy function to rings
 - Used successfully at CBM Experiment (GSI, Germany)
 - Take code from technical note
 - CBM-SOFT-note-2005-002
 - More details in future RICH s/w meeting



- dd
- dd