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SLAC ATLAS Forum

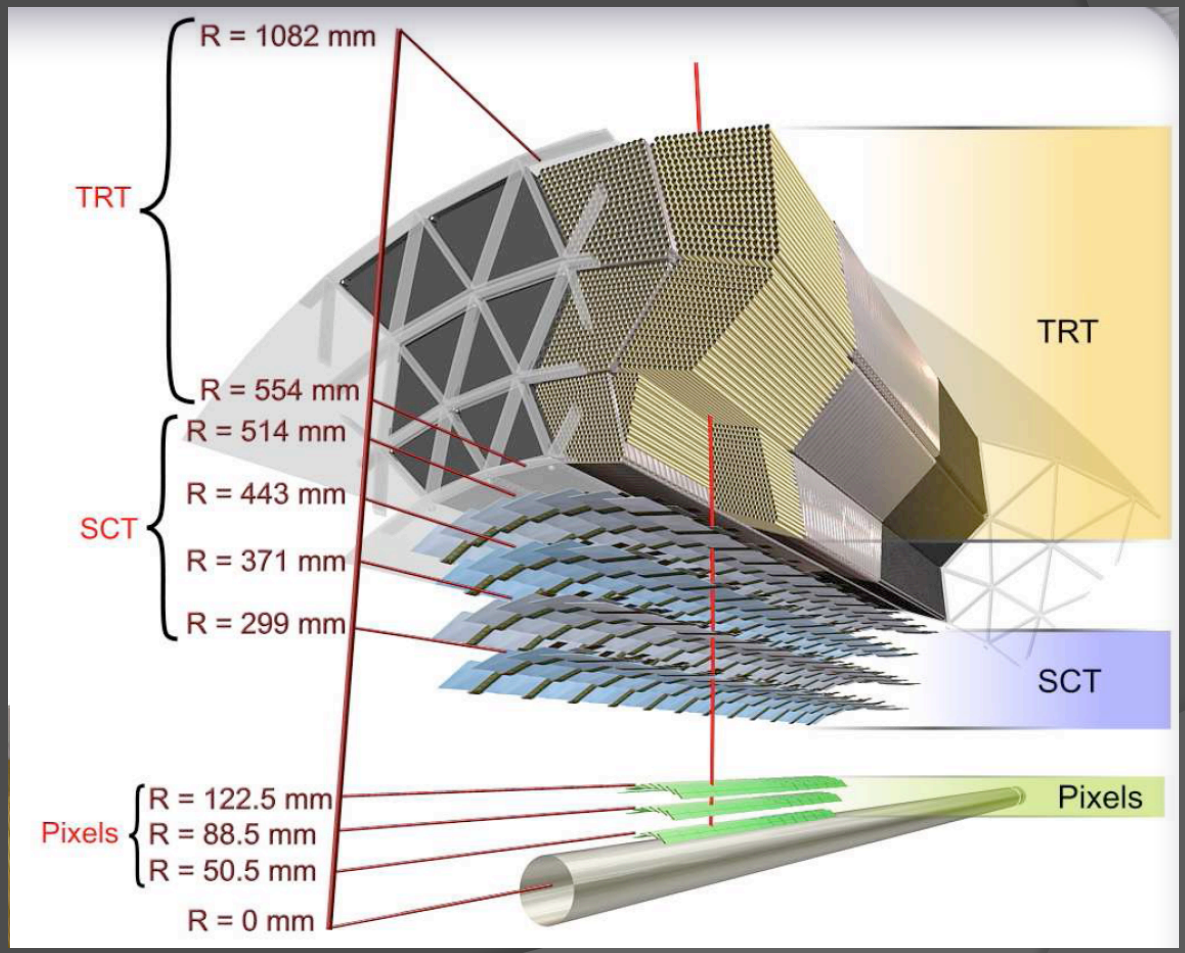
8 October 2008

FIRST LIGHT

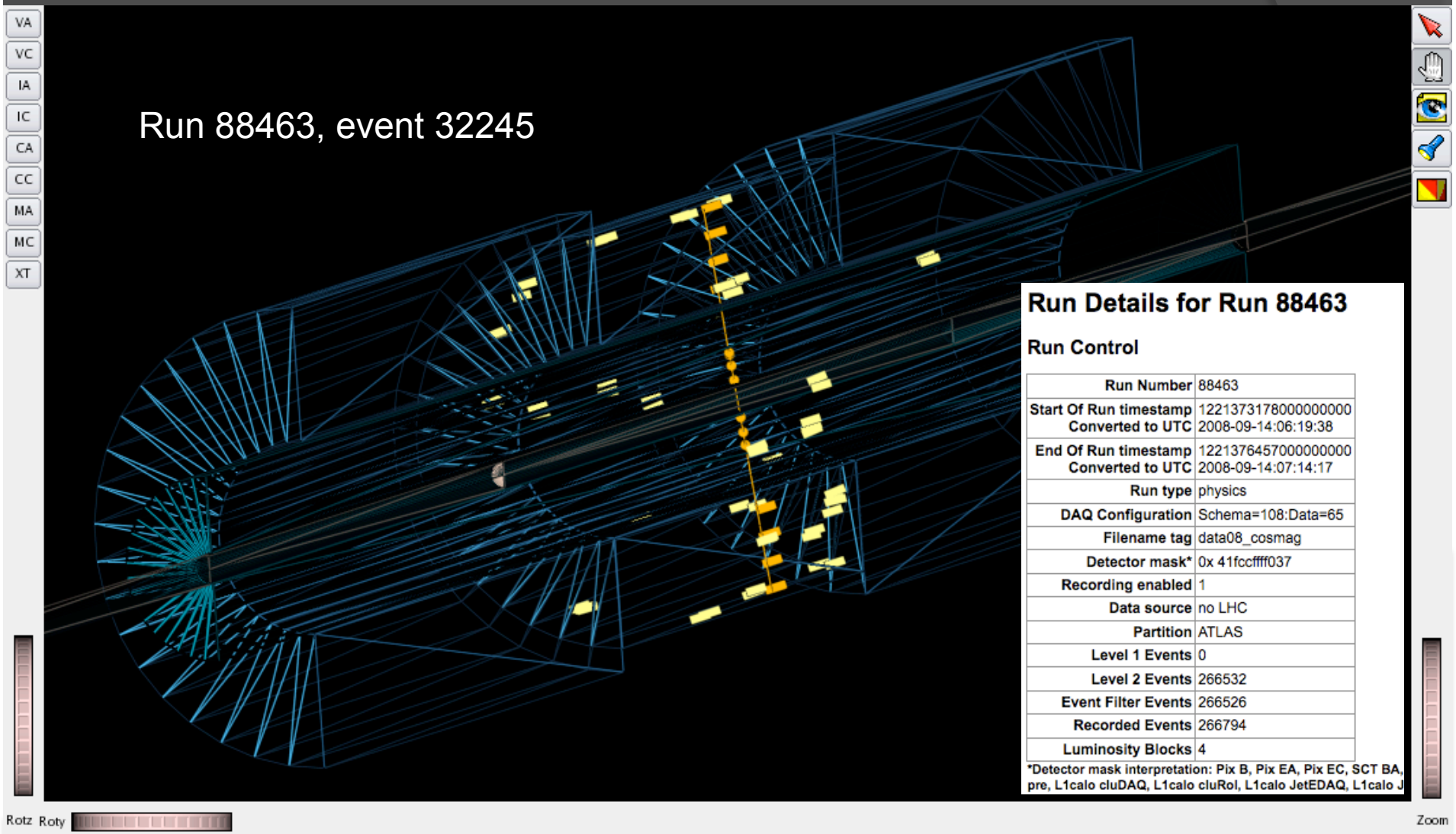
A LOOK AT TIMING IN THE PIXEL DETECTOR WITH THE FIRST COSMICS

The Inner Detector and Timing

- Very different detector types
- Different timing qualities and precisions
- Must ensure intra-detector and inter-detector timing!



First light (I)



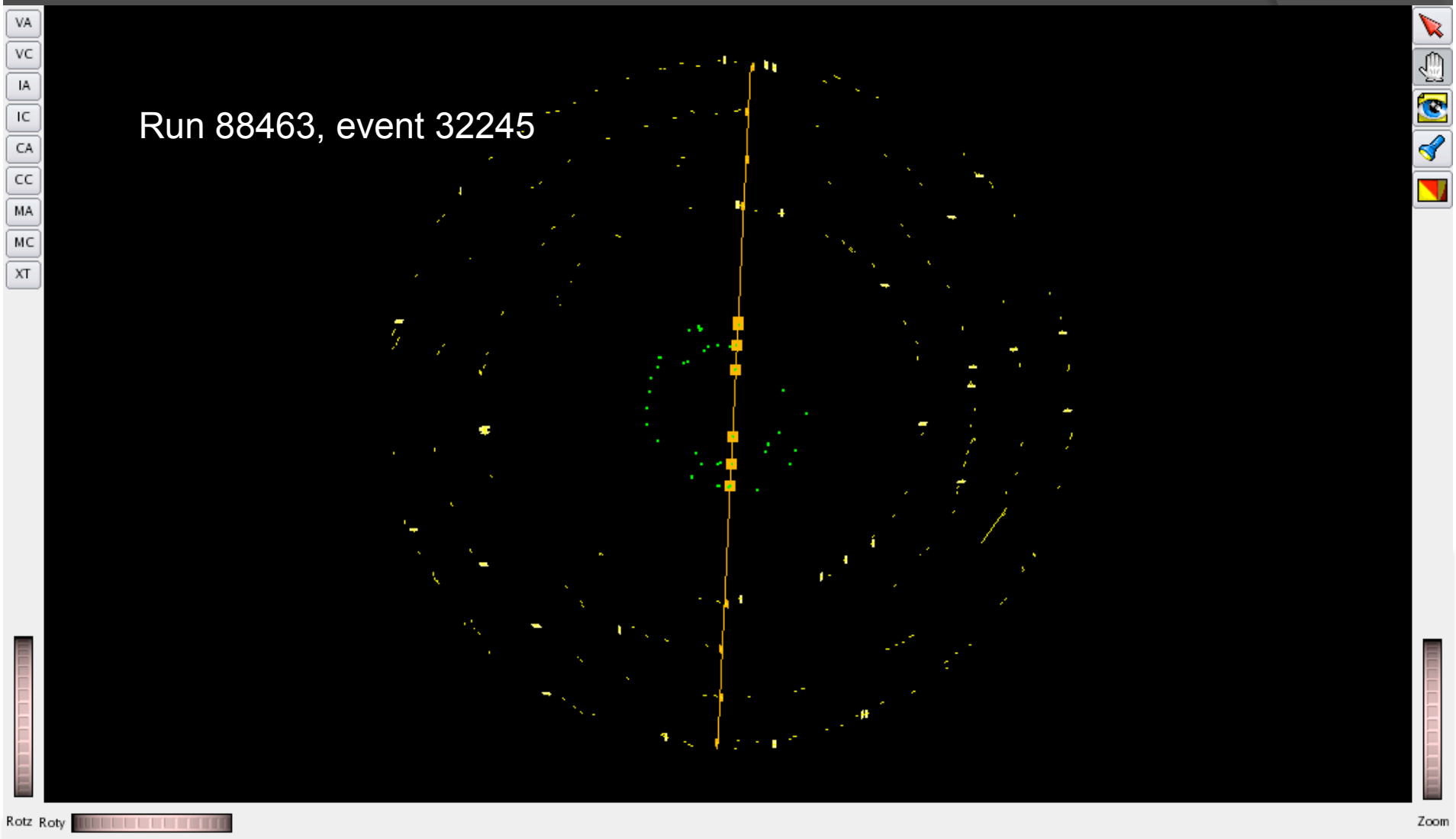
Run Details for Run 88463

Run Control

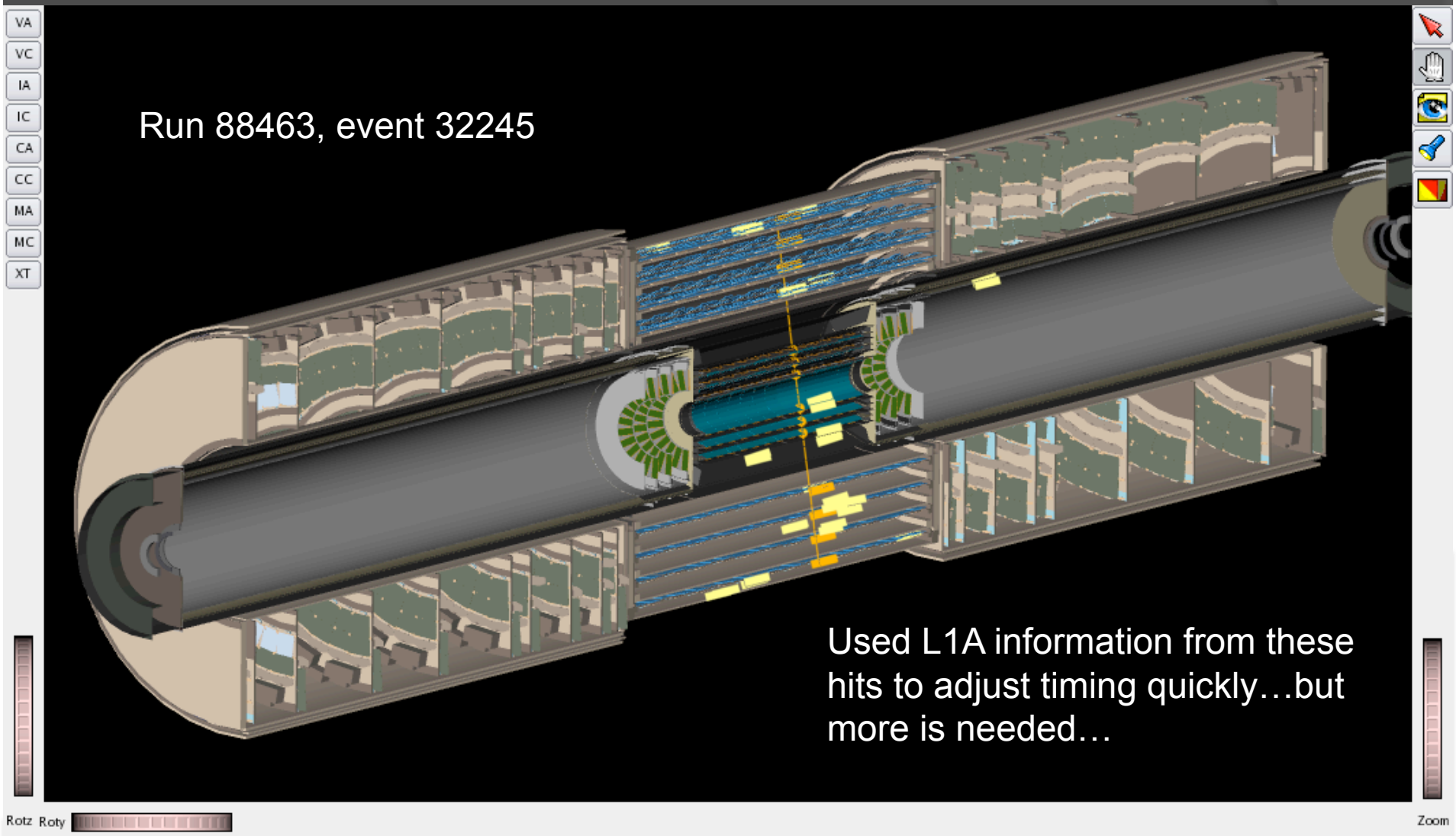
Run Number	88463
Start Of Run timestamp Converted to UTC	1221373178000000000 2008-09-14:06:19:38
End Of Run timestamp Converted to UTC	1221376457000000000 2008-09-14:07:14:17
Run type	physics
DAQ Configuration	Schema=108:Data=65
Filename tag	data08_cosmag
Detector mask*	0x 41fccffff037
Recording enabled	1
Data source	no LHC
Partition	ATLAS
Level 1 Events	0
Level 2 Events	266532
Event Filter Events	266526
Recorded Events	266794
Luminosity Blocks	4

*Detector mask interpretation: Pix B, Pix EA, Pix EC, SCT BA, pre, L1calo cluDAQ, L1calo cluRoI, L1calo JetEDAQ, L1calo J

First light (II)

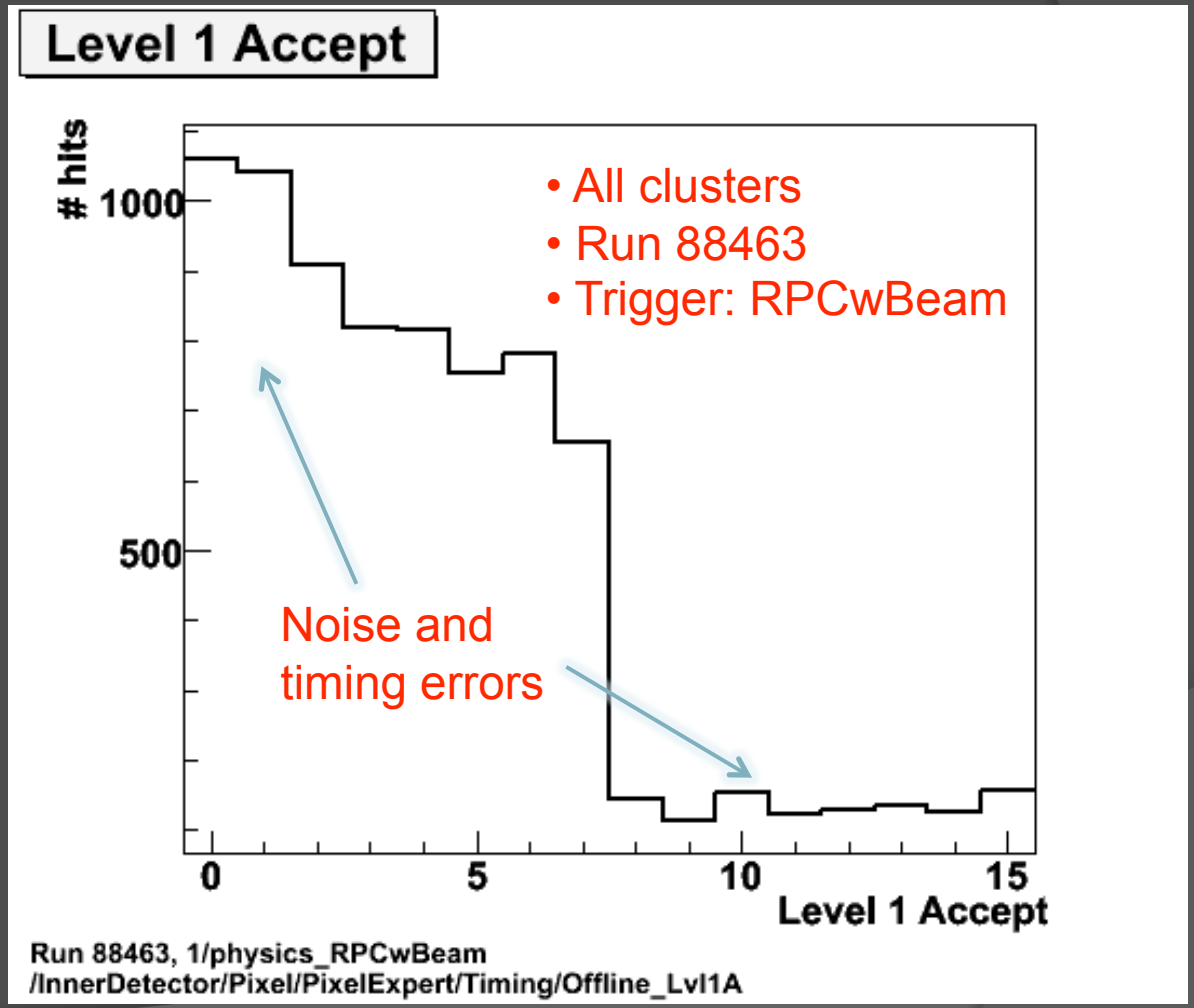


First light (III)

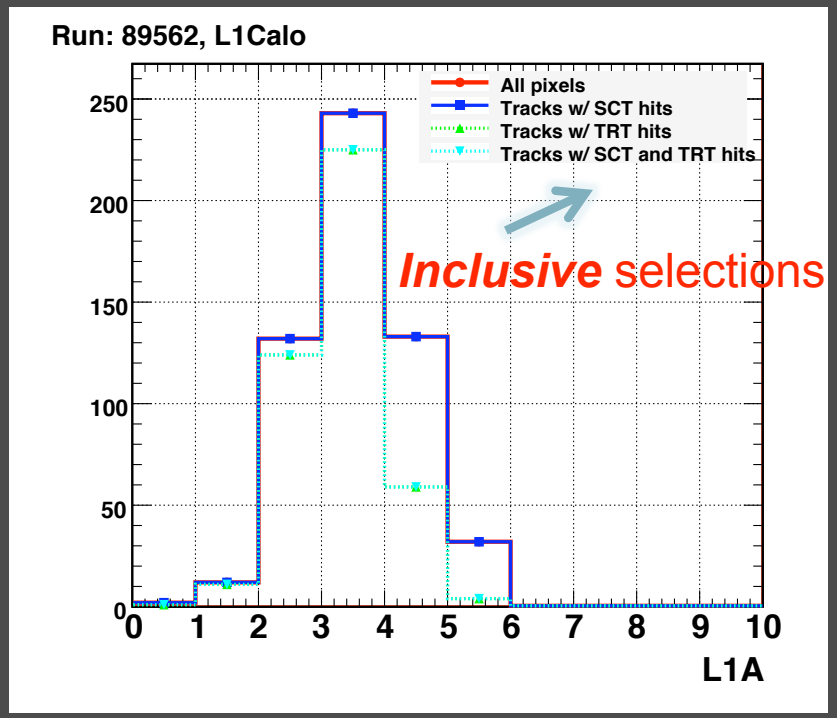


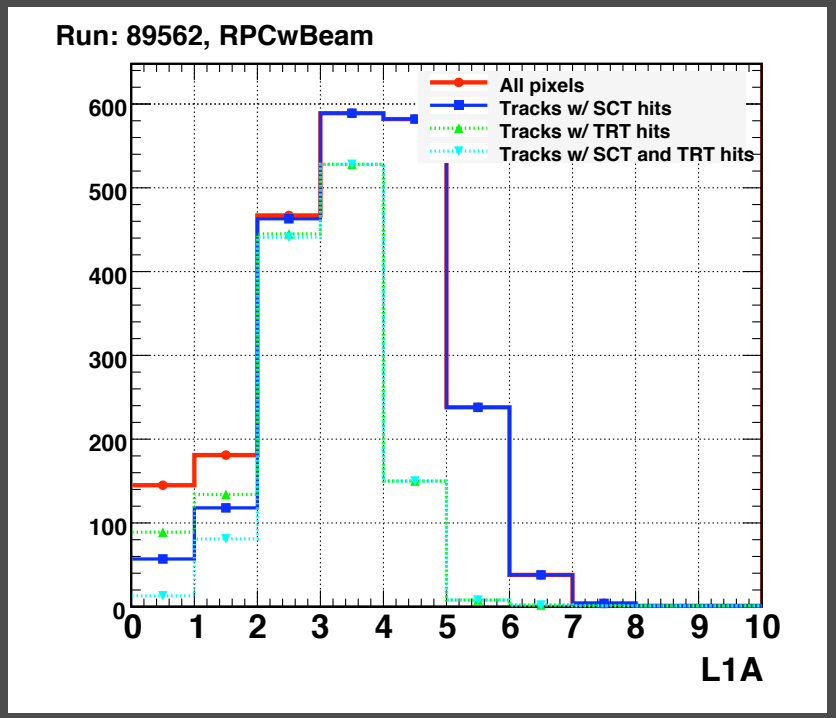
We need more than just pretty pictures!

- Timing and BCID errors in run 88463
- Need to understand more directly the timing dependence of trigger streams and other effects



Looking at timing information for tracks with different triggers

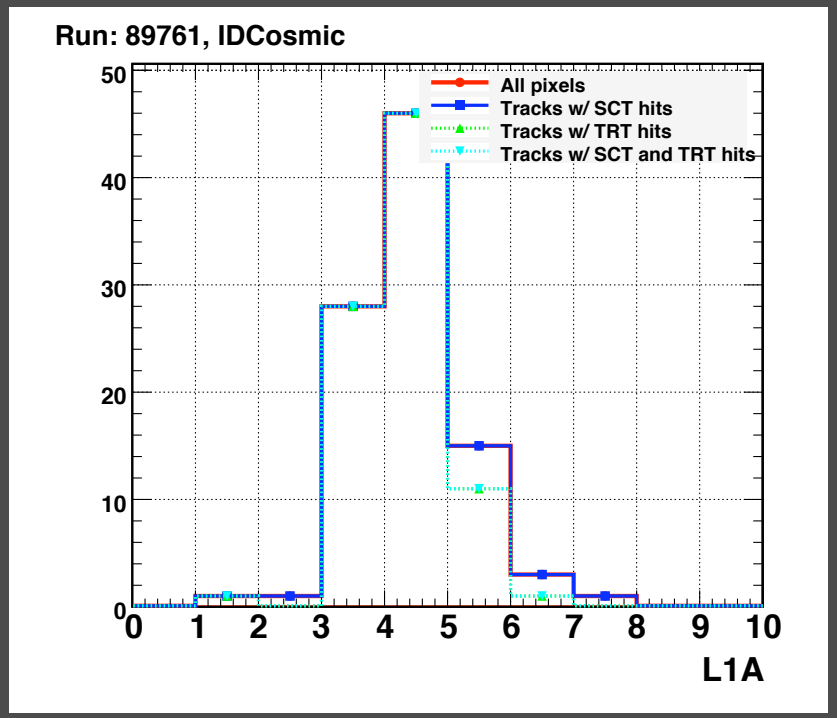


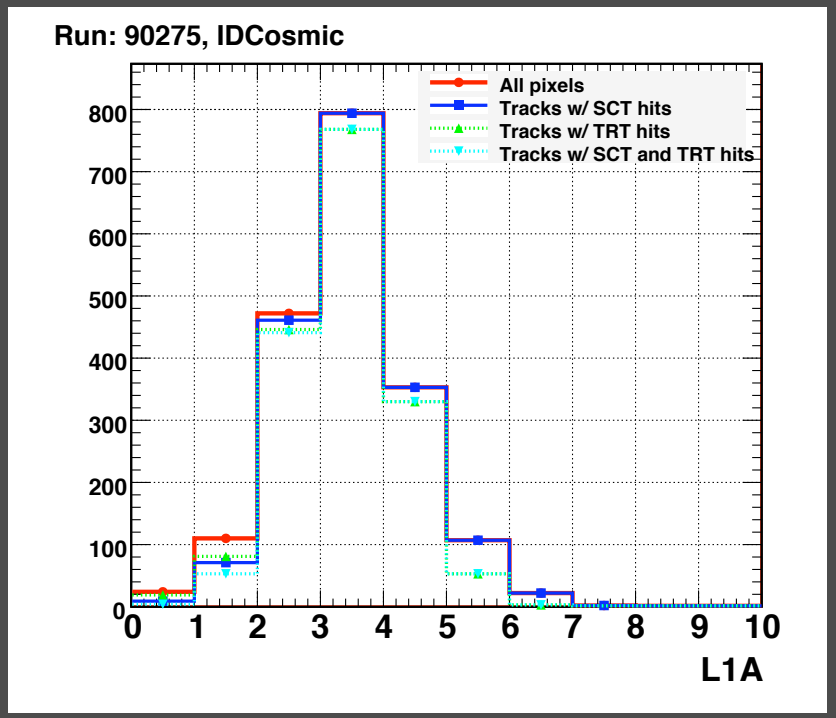


Saw much better time alignment with L1Calo

RPC had some work to do… but TRT fine timing helps a lot

Comparing different running conditions after timing feedback

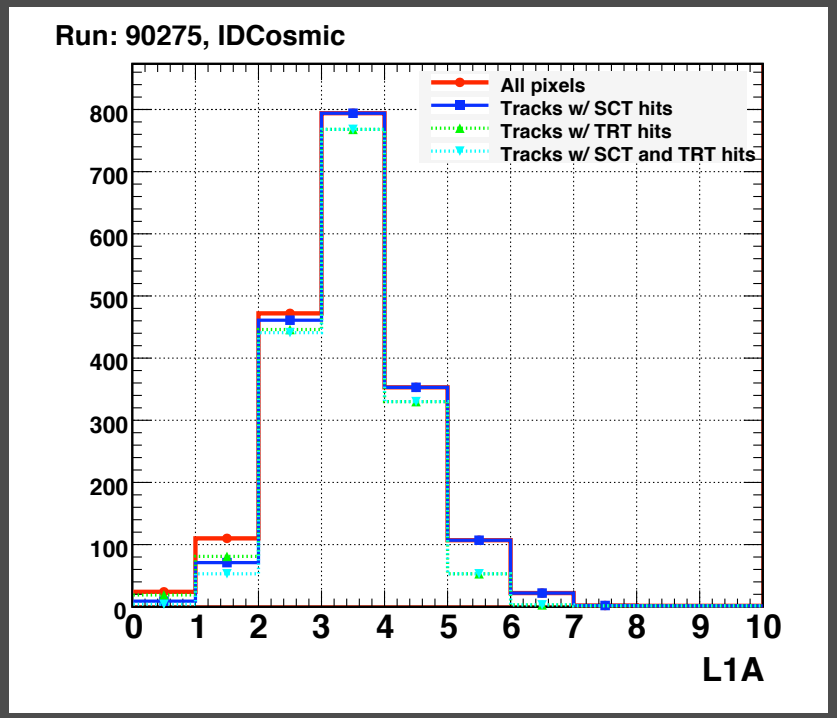


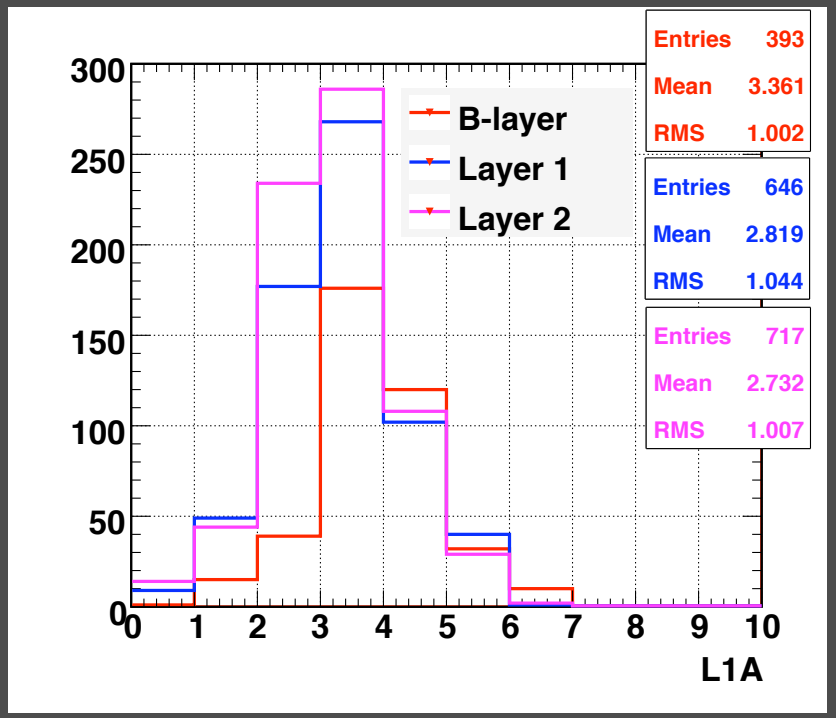


Later run with various improvements also from other subdetectors

Slightly wider, but rack→detector cable lengths accounted for

Taking a closer look at the intra-pixel timing

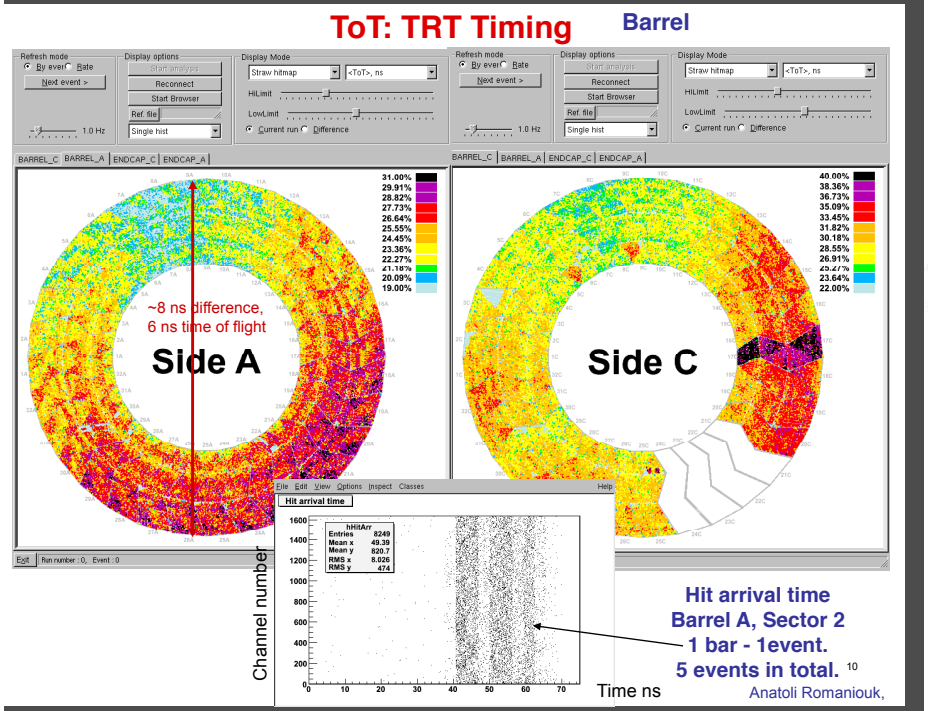


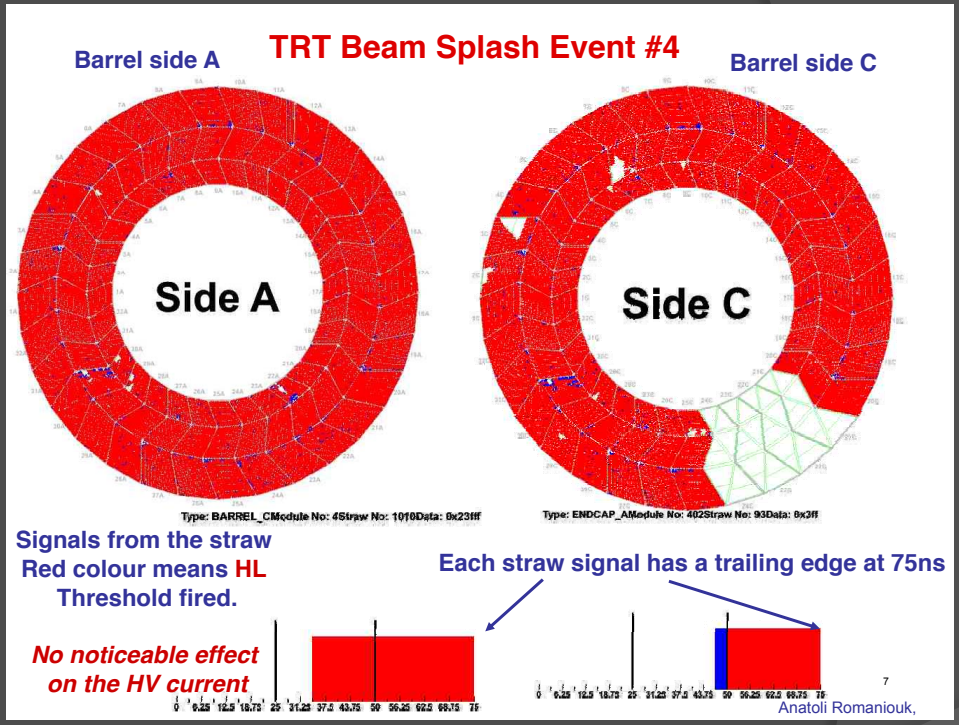


Same as previous page: run 90275 (IDCosmic stream)

L1A for all clusters on tracks, but now by layer

Using the TRT as a reference





TRT is now very well timed in and the fine grained t_0 will allow pixel to adjust to a well-known reference point

Beam splash events:

Rough estimate: 10-100 per straw
Unique opportunity to time whole the detector at once in one event!

This saves may be months of work.

Summary

- The multitude of cosmic tracks seen by the pixel detector has allowed a plethora of studies on performance and timing to begin in earnest
- The use of detailed sub-detector and trigger-level timing information will allow for a de-convolution of trigger timing jitter and real intra-pixel timing differences