RPC trigger performance

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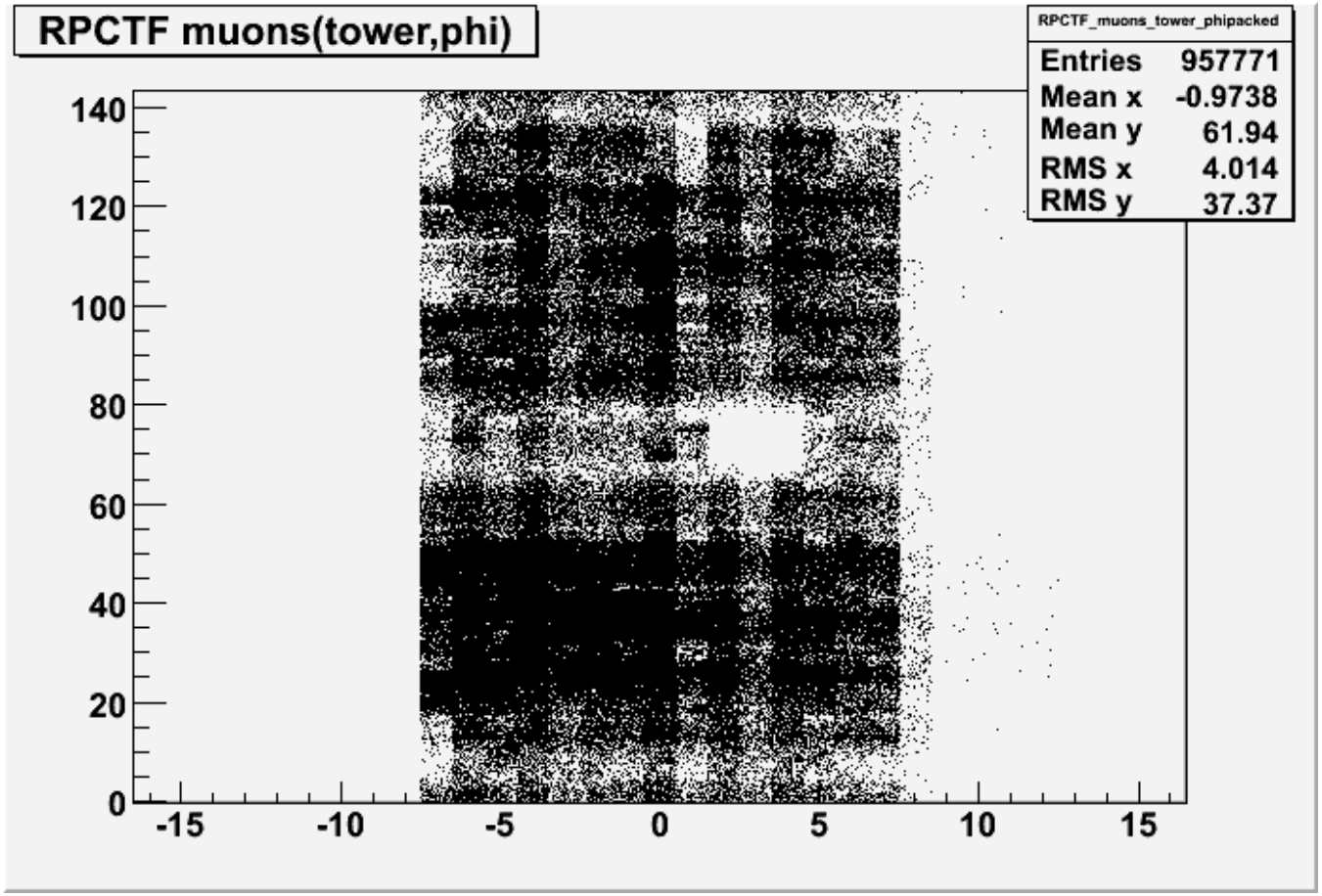
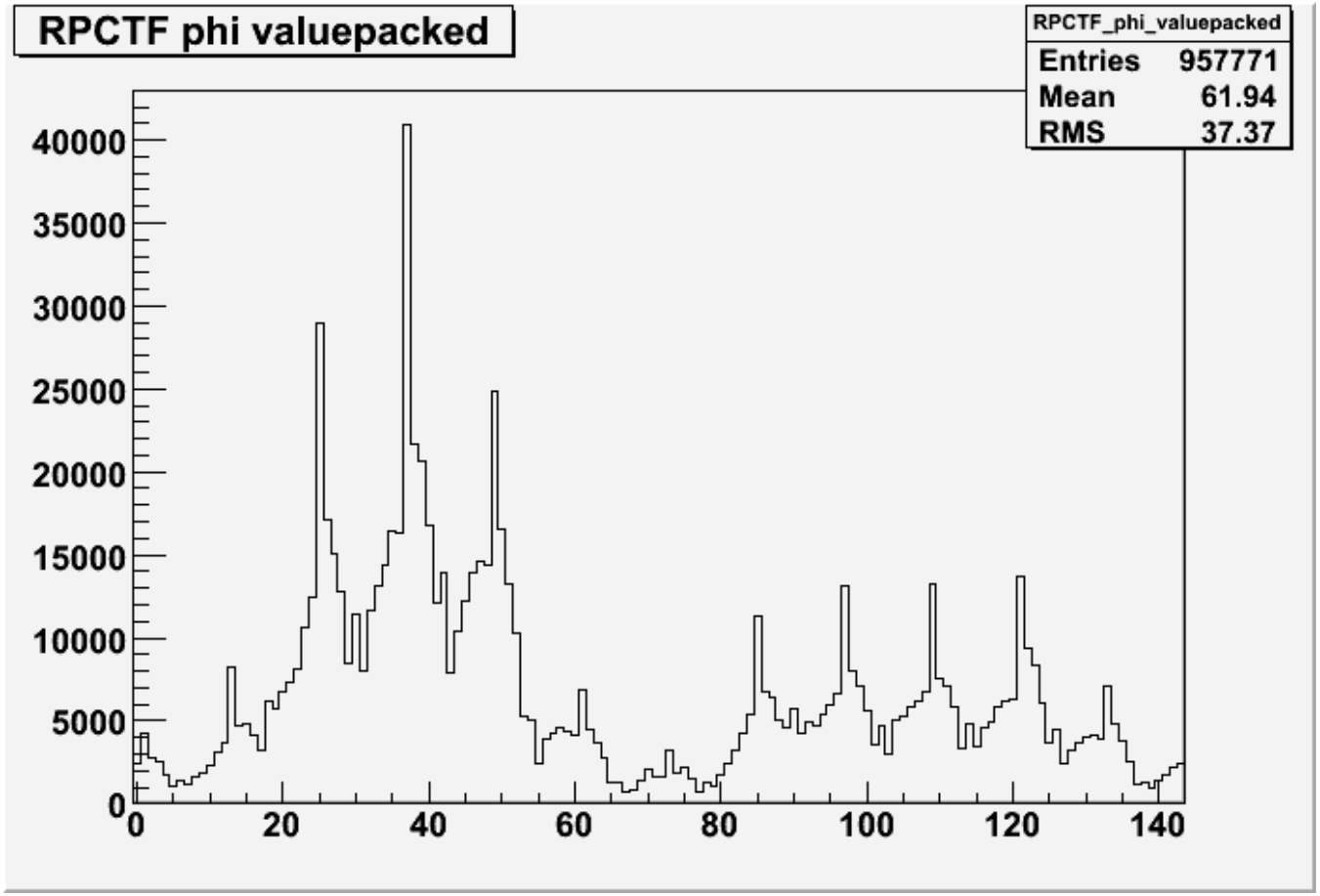
System Performance

L1 RPC trigger occupancy - (η, ϕ)



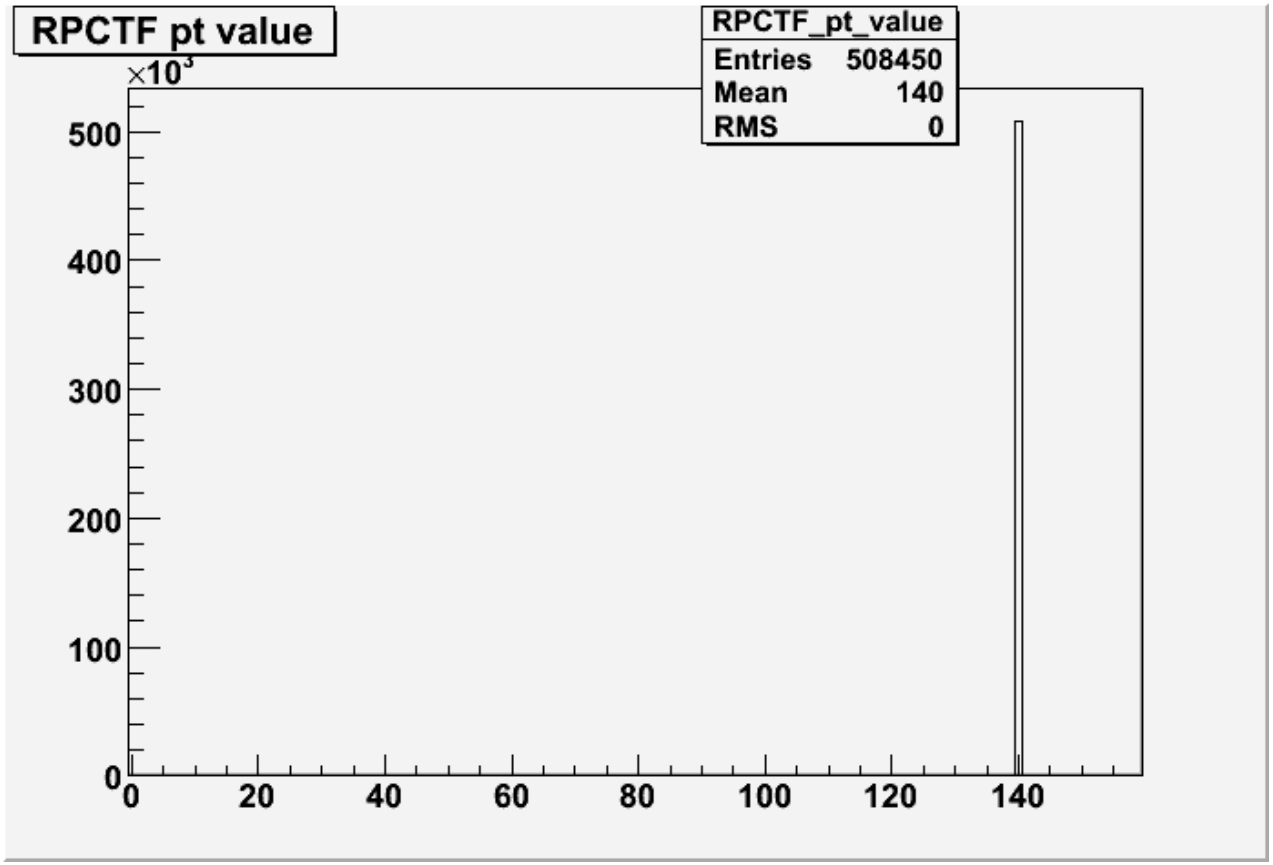
- All Trigger Crates (12) operational, giving triggers
- Dead region due to RPC chambers from W+1 Sector7 off
- Small number of trigger coming from positive endcap

ϕ distribution of RPC muon candidates



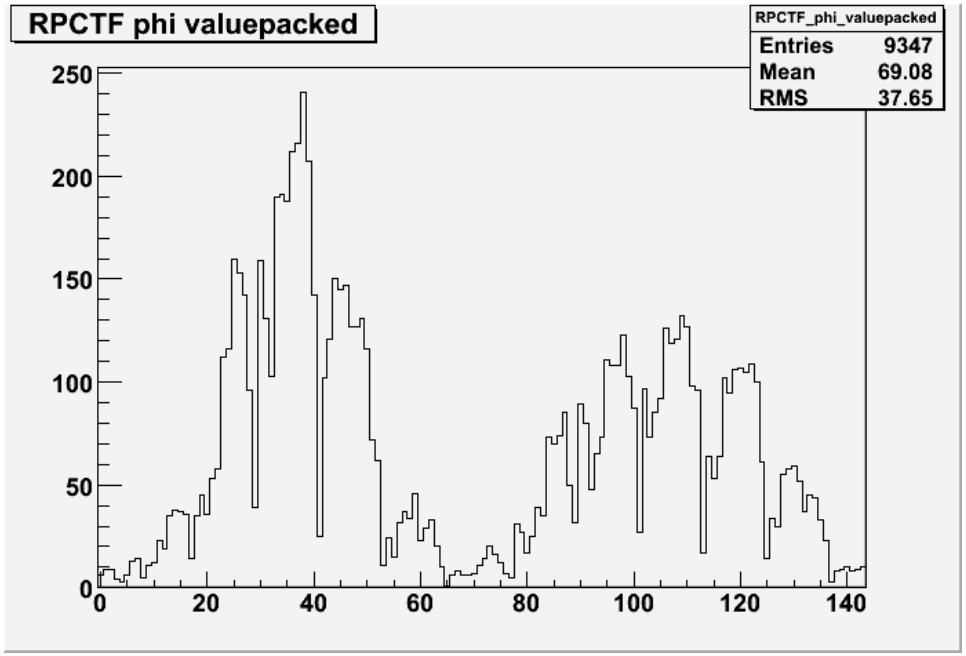
- Structure due to geometrical segmentation of RPC chambers and logic of RPC Ghost Buster (when using cosmic patterns, see next slides)

Pt distribution of RPC muon candidates

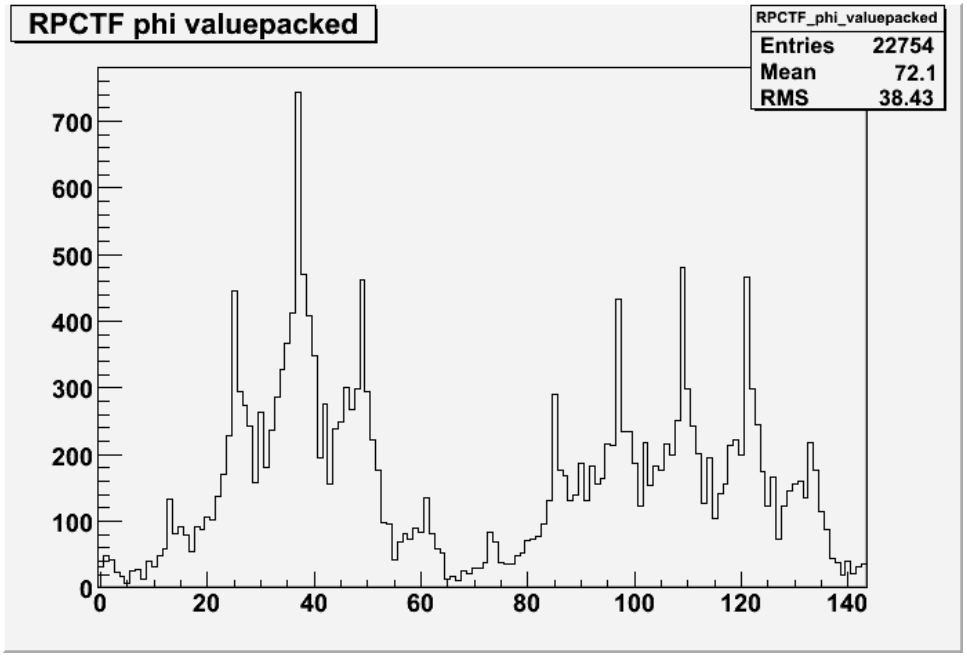


- During cosmic runs wide patterns used, pt not measured
- RPC ghost buster logic relies on pt measurement. If neighboring candidates have equal pt, one with higher ϕ survives ghostbusting. Note that peaks are located on sectors edges

ϕ distribution of RPC muon candidates - comparison of MC on Cosmic and LHC patterns



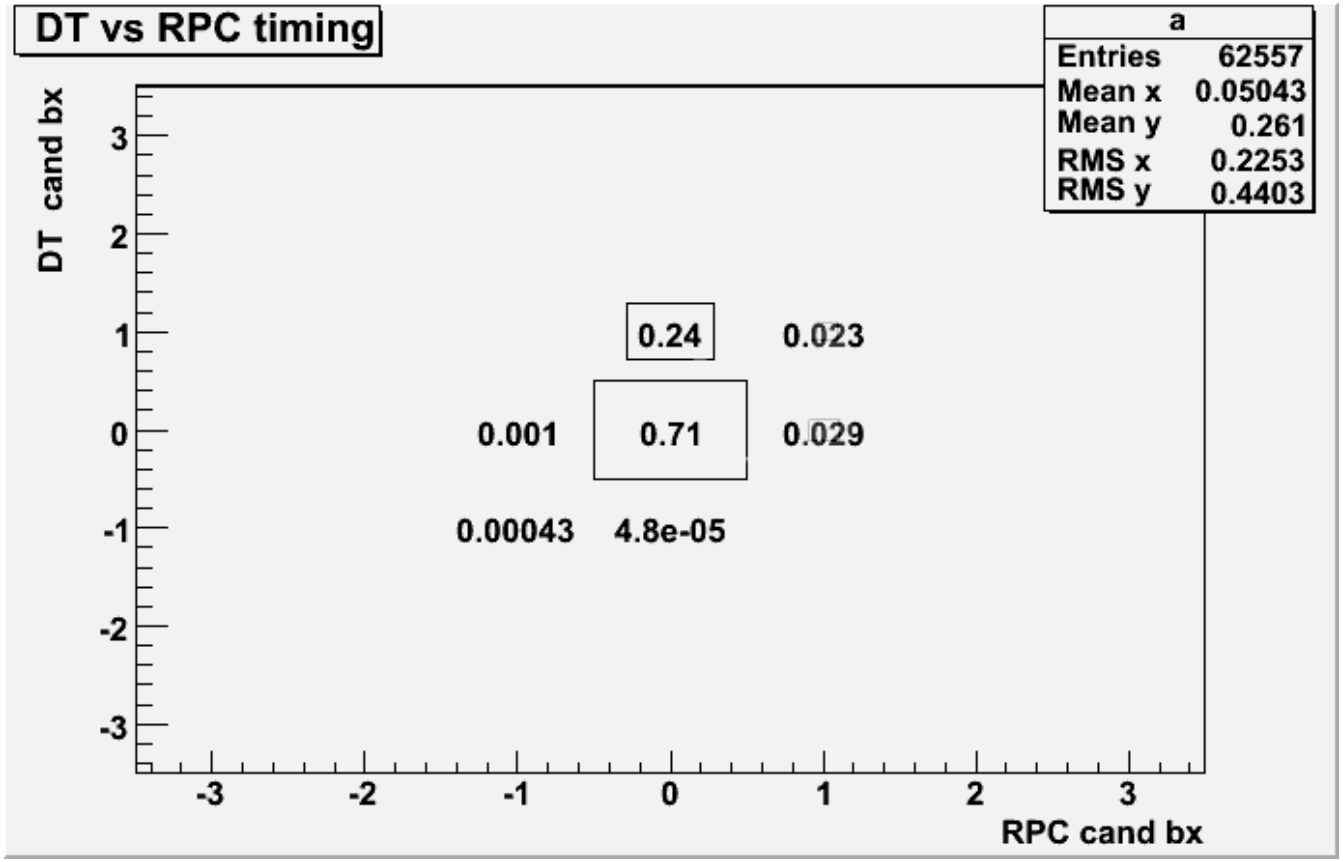
LHC patterns with pt measurement
(MC, mag field on)



Cosmic (wide) patterns
(MC, mag field on)

- Cosmic (wide) patterns used for better efficiency during cosmic runs
- Peaks due to use of wide patterns and ghost buster logic - shape is understood

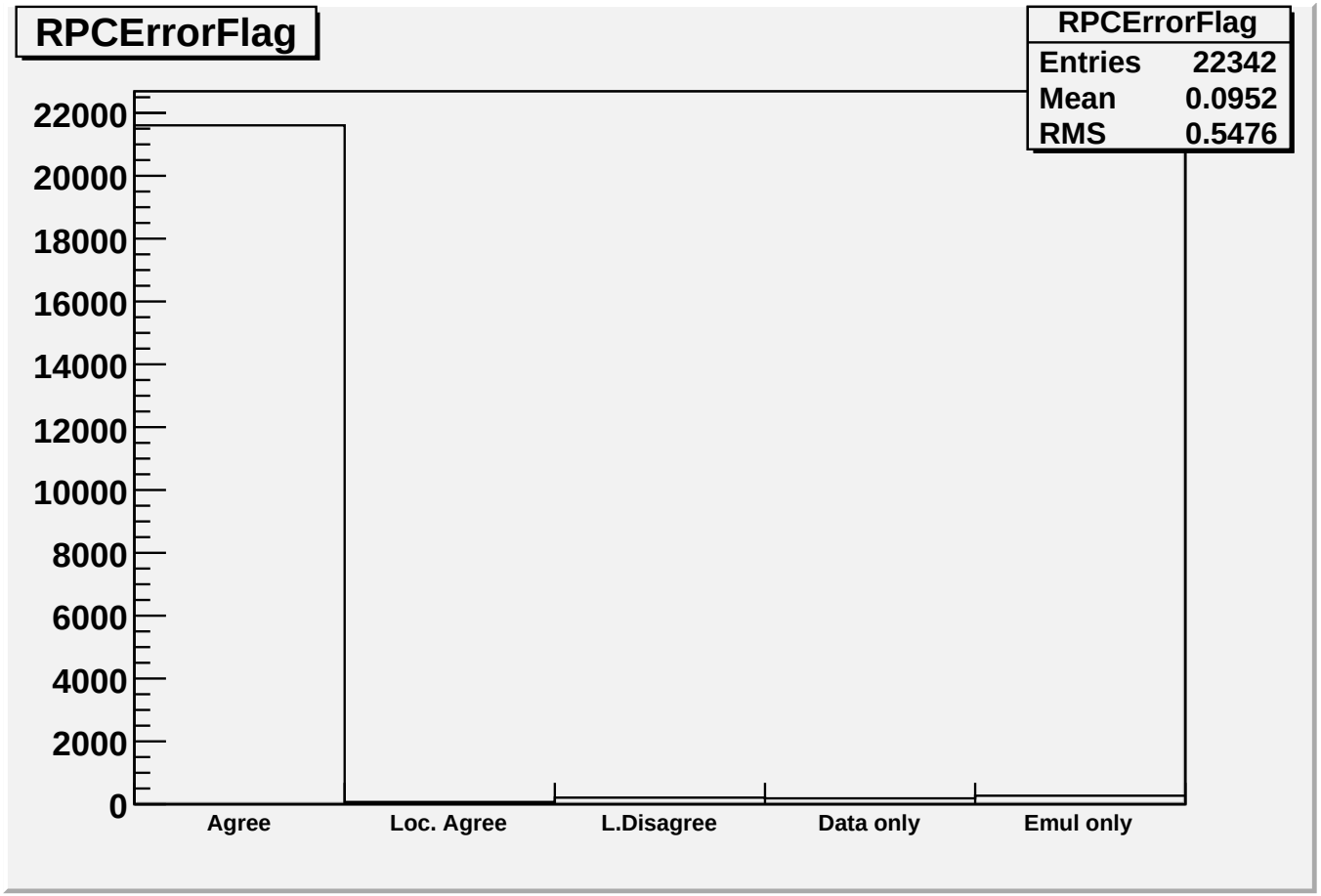
DT-RPC timing comparison



- Good DT-RPC synchronization.
- In 25% of events DT triggered 1BX later. Some fine tuning possible

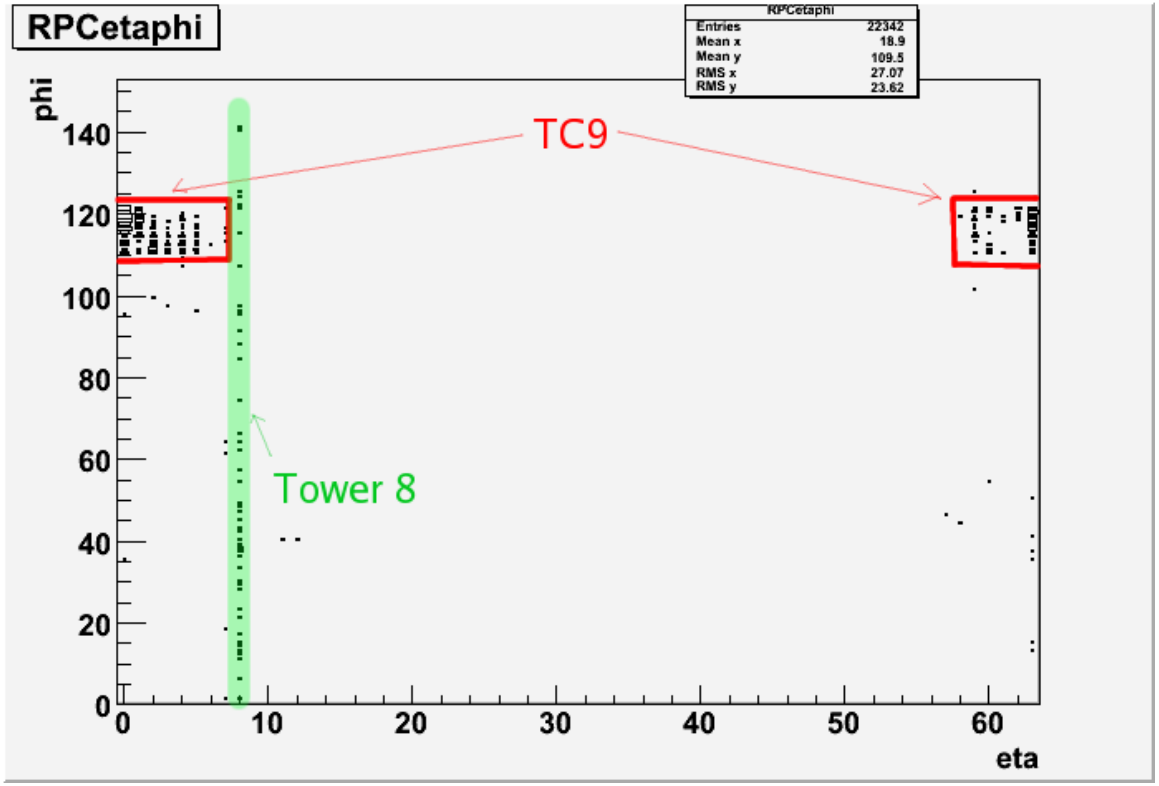
Comparison with emulator

Data-emulator comparison - 98% agreement (run 70036)



Note: some changes in RPC geometry were done during CMSSW_2_0_0 cycle, need special handling when comparing data with emulator (see trigger electronics review on Jan 22, 2009)

Data-emulator comparison - disagreements

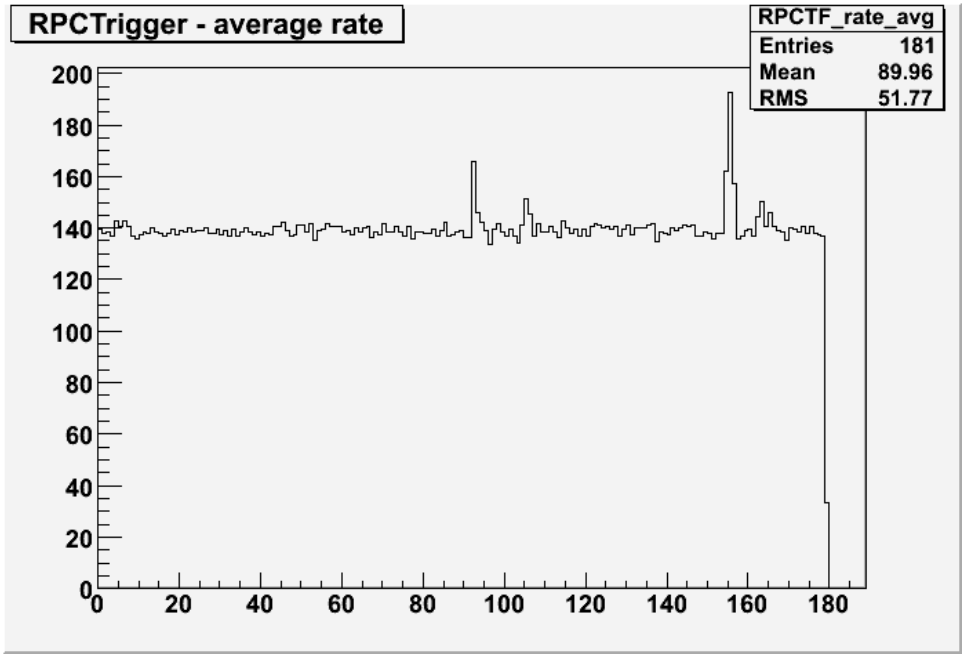


Eta-phi distributions of disagreeing candidates (eta 63 is tower -1, eta 60 is tower -3)

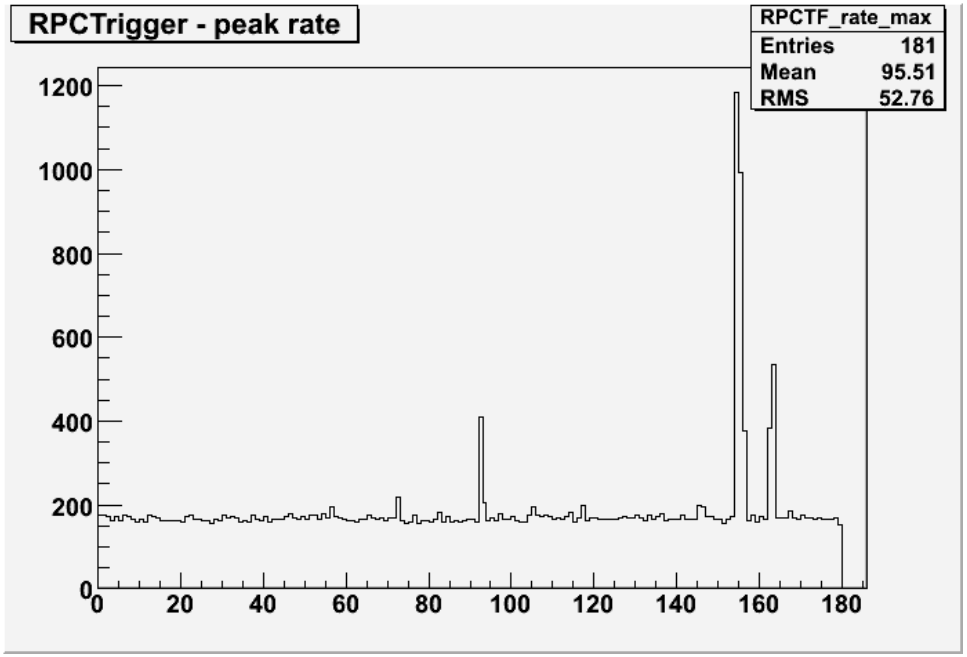
- Disagreement mostly visible for trigger crate 9, probably due to transmission errors (new firmware with improved transmissions since CRAFT).
- Some candidates with eta=8 also disagree

Rate studies

Run 70036 - rate history



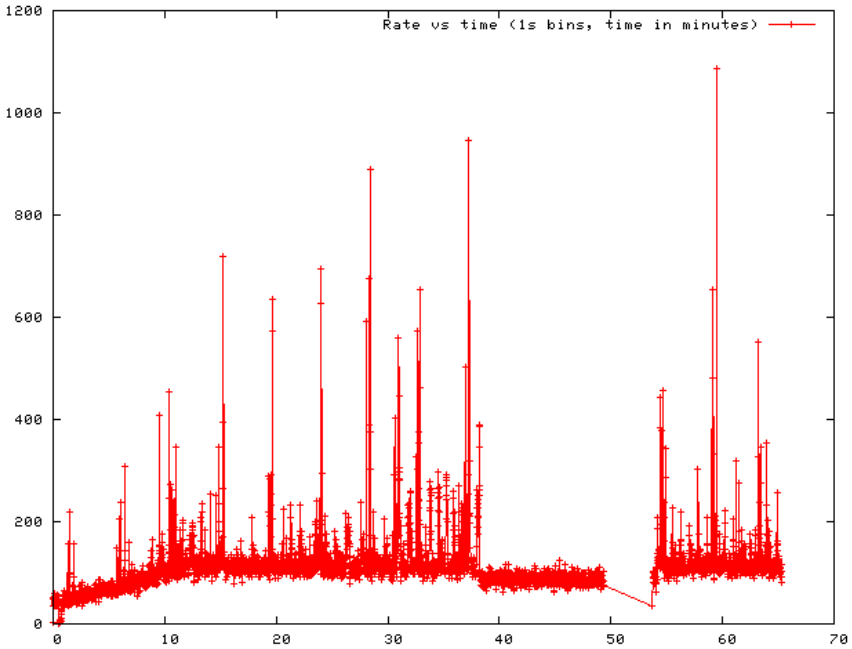
Average rate in 1 minute bins (run 70036)



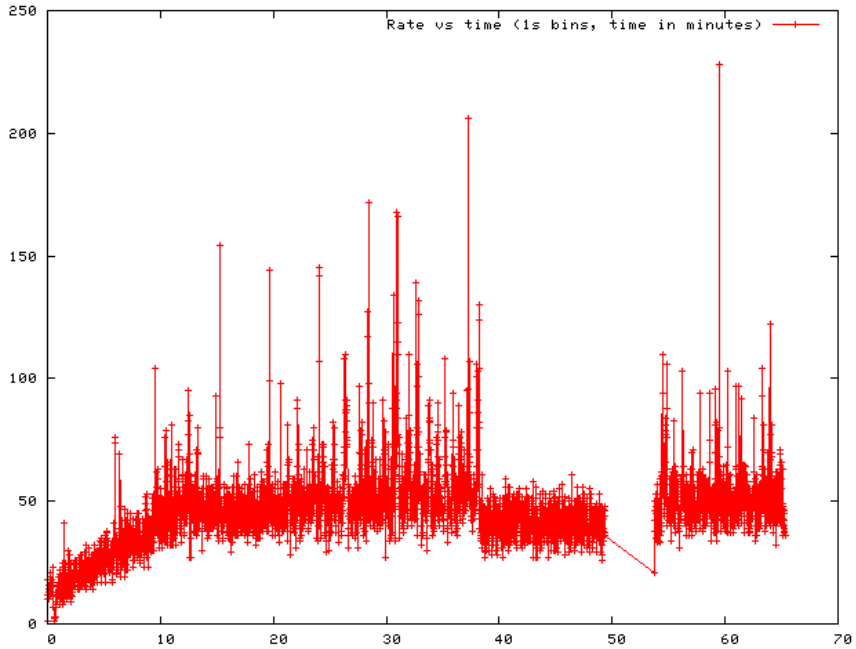
Max rate during 1 minute bins (same run)

- Average rate of trigger from RPC on level of $\sim$ 140 Hz. Unfortunately peaks visible
- Rate monitoring added to L1TRPC DQM

Coherent chamber noise - can we fix it in trigger RPC logic?



Recorded 3/6 trigger logic rates for run 67977
avg trigger rate ~ 110Hz (including peaks)
Max peak ~ 1100Hz



Simulated 4/6 trigger logic rates for run 67977
avg trigger rate ~ 45Hz (including peaks)
Max peak ~ 220Hz

- Run 67977, dedicated to RPC noise studies (e.g. RPC masked in GMT for some time)
- Requiring coincidence of higher number of planes doesn't fix the problem - peaks still present

Summary

- RPC trigger had stable operation during CRAFT. All 12 Trigger Crates (full system) fully operational
- Trigger rate peaks visible due to coherent chambers noise. Problem cannot be compensated by changing the RPC trigger logic