Track-Finder Trigger at the Beam Test
Results and Features

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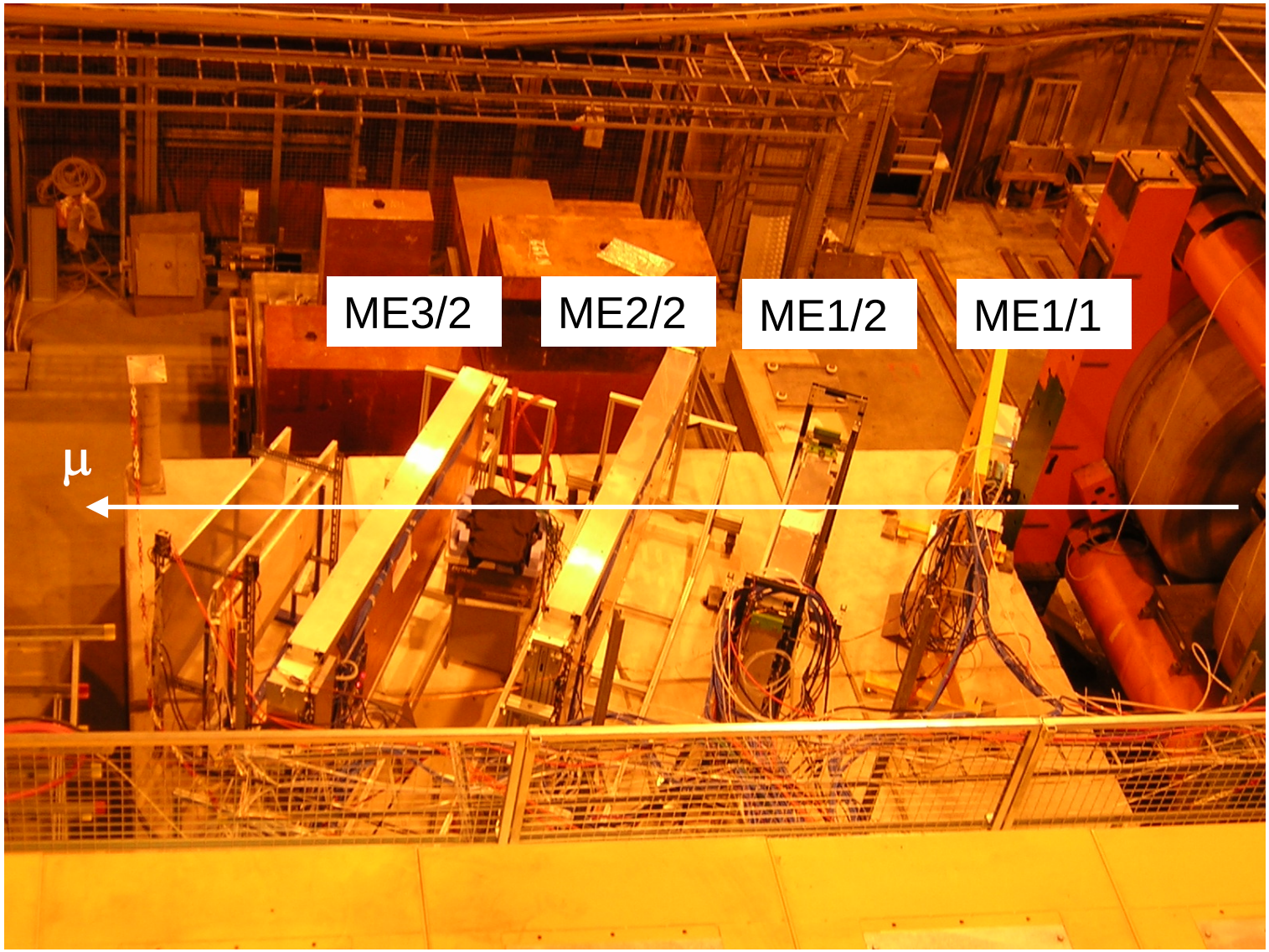
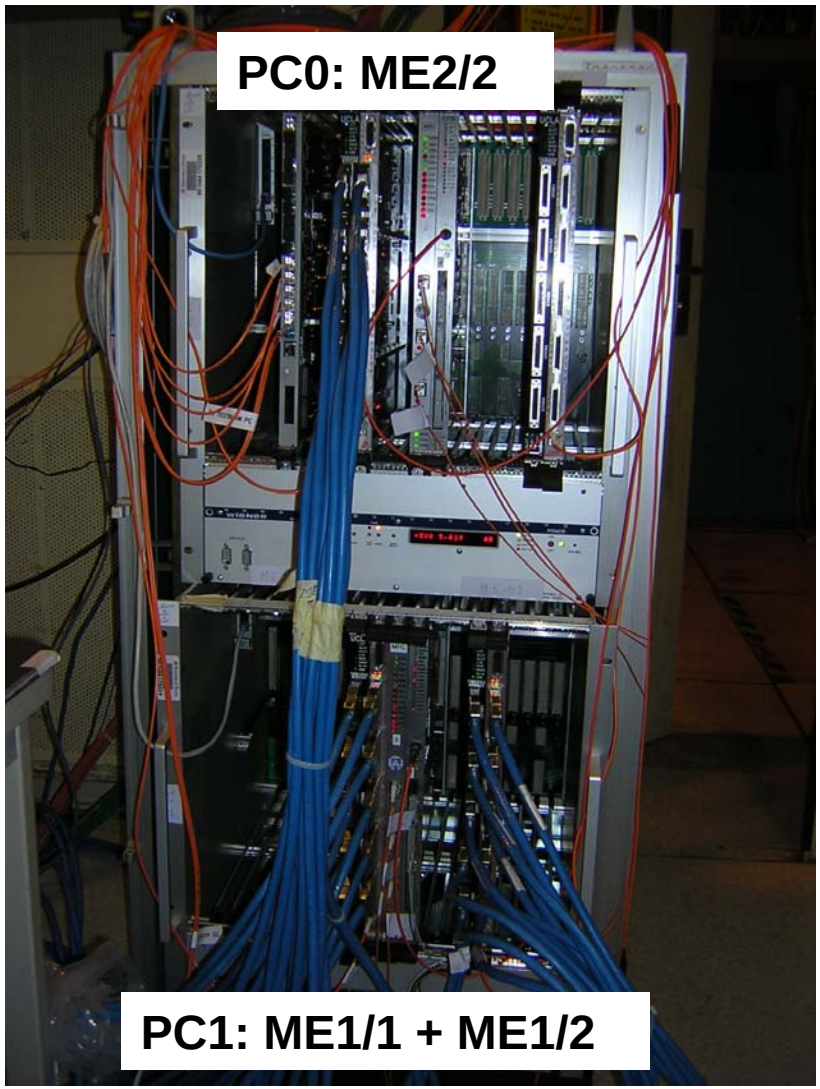
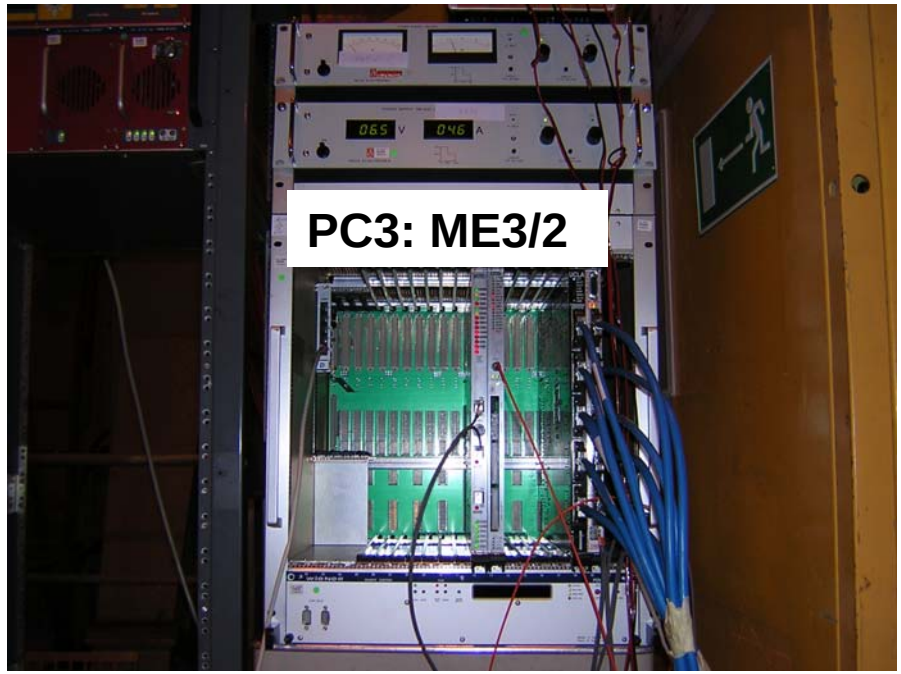
Chamber Arrangedment @ H2



Peripheral Crate Arrangement

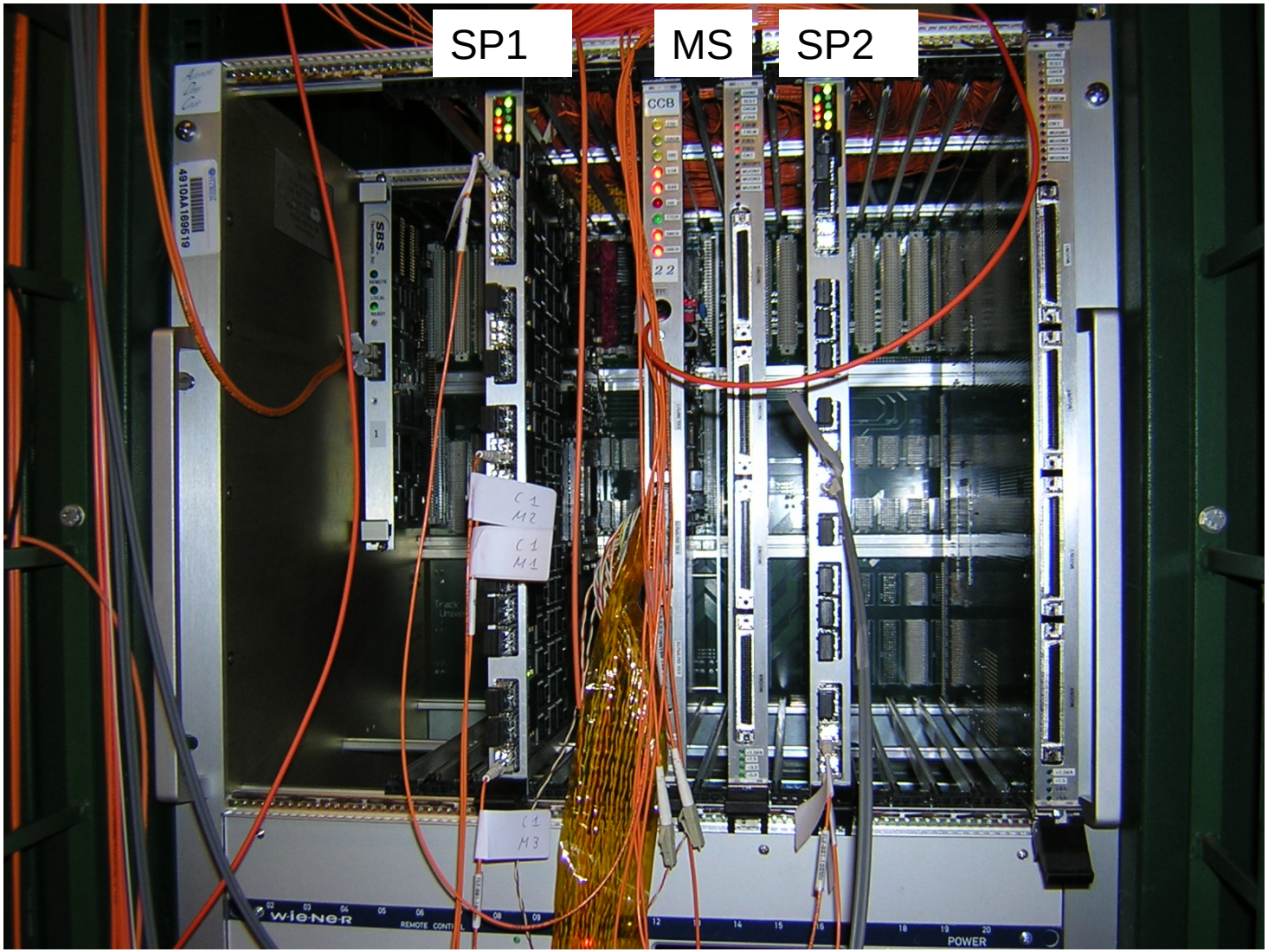




First time 3 MPC → SP test

First time production peripheral backplane tested

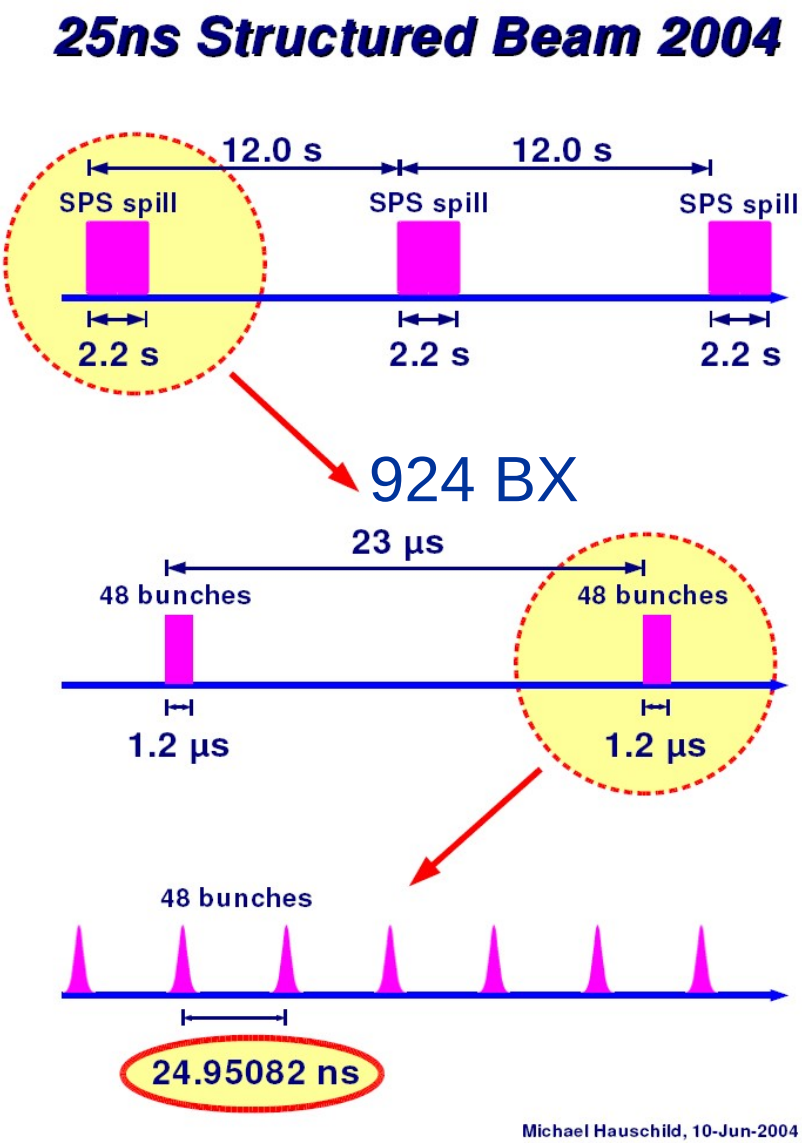
Track-Finder Crate



Track-Finder Trigger Configuration

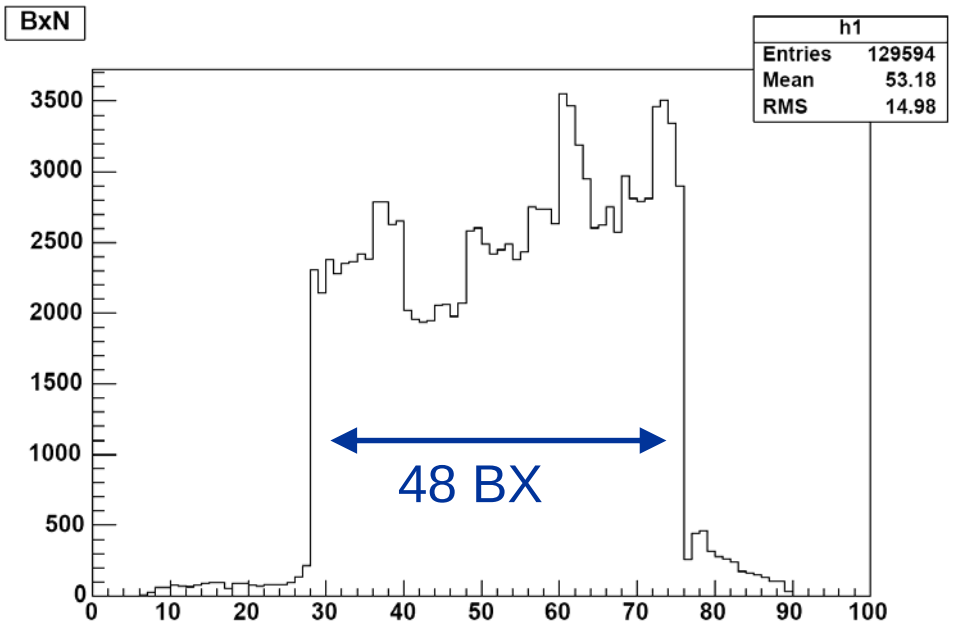
- **MPC configured in "transparent" mode (non-sorting)**
  - Routed specific TMB LCT's to specific optical links
  - Links directed to specific "stations" in Sector Processor
  - Avoids triggering on LCT ghosts
- **Mapping of links changed frequently**
  - See http://www.phys.ufl.edu/~acosta/tb/TrackFinderRuns2004.xls
- **Successful distribution of L1A from Track-Finder through CCB2001**
  - For runs $\geq$ 499
- **Ability to run (and trigger) with two SP's**
  - SP1: ME1/1 + ME1/2
  - SP2: ME2/2 + ME3/2
  - 515 < run < 558
- **Special LUTs used to create ghosts tracks for Muon Sorter tests**
  - Runs $\geq$ 558

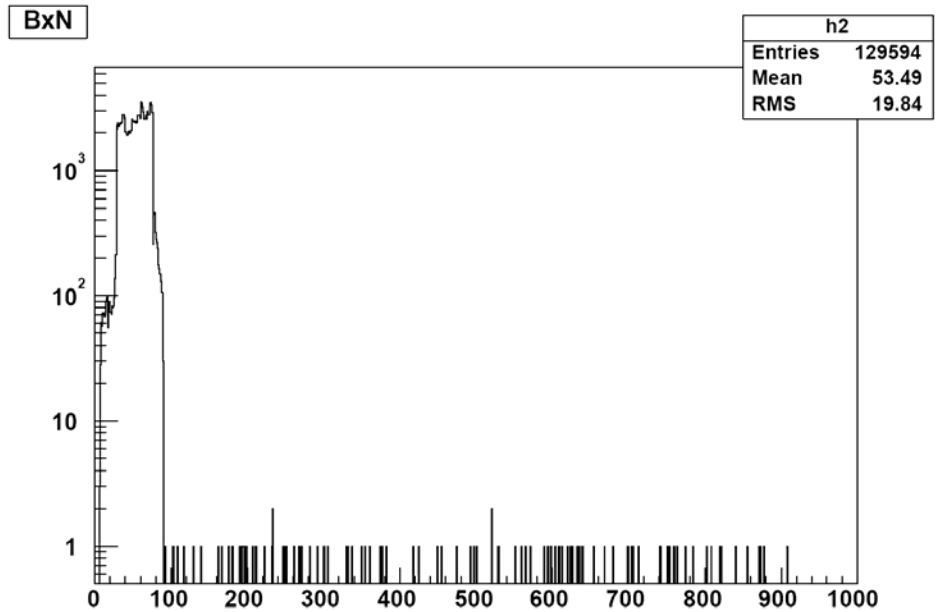
25 ns Structured Beam



- **LHC-like bunch structure during synchronous running**
- **Trigger rates at H2 during spill**
  - **Muons: few Hz – 15 kHz**

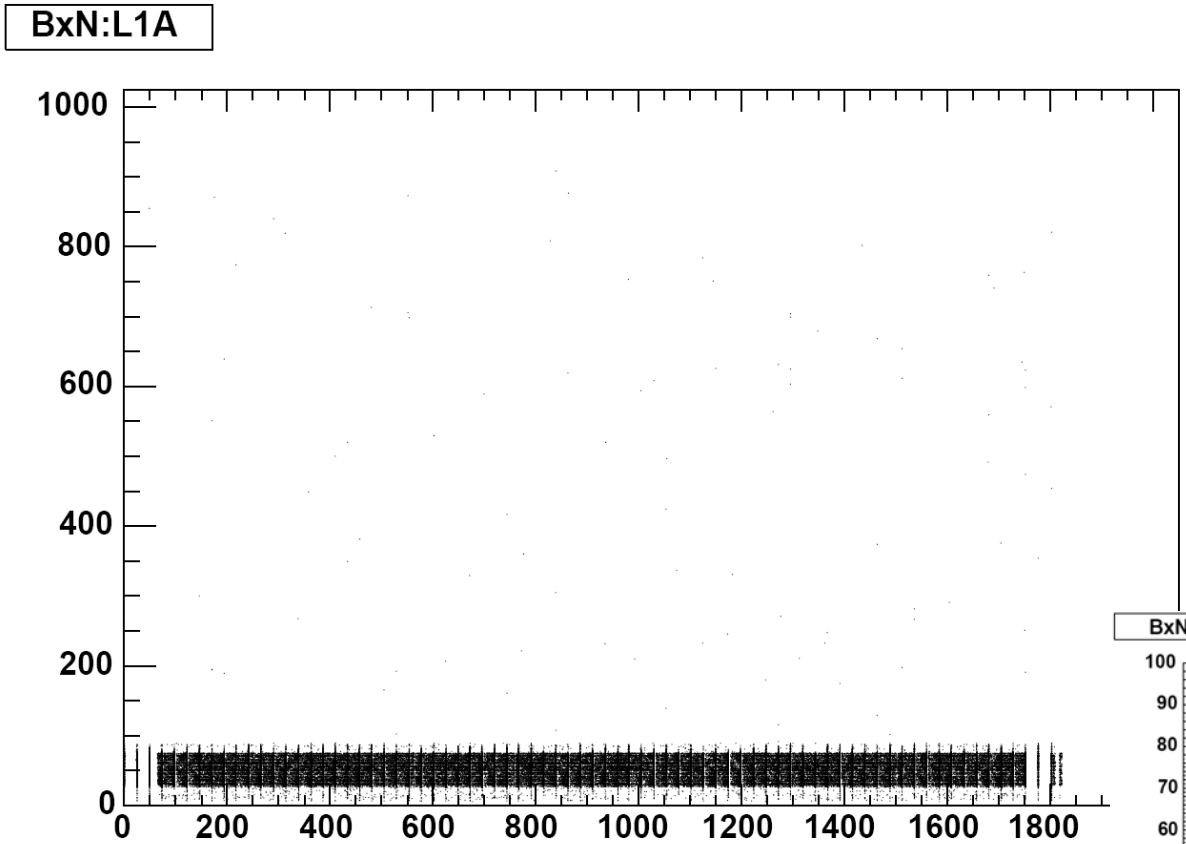
SP BxN Distribution



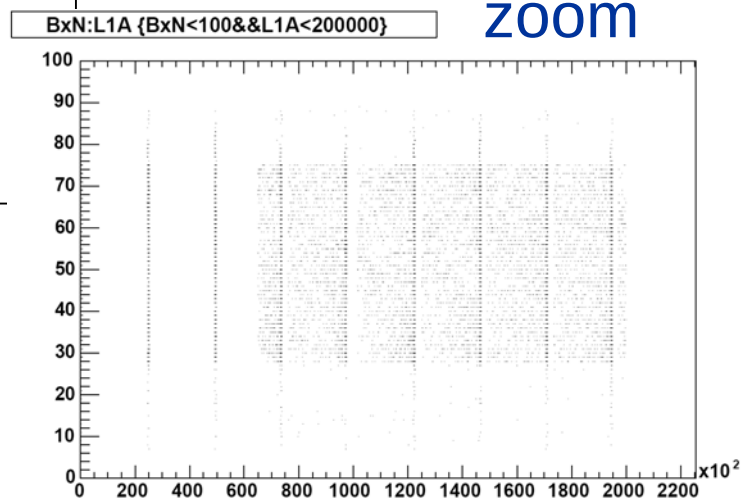


Run 515

BX vs. L1A



zoom

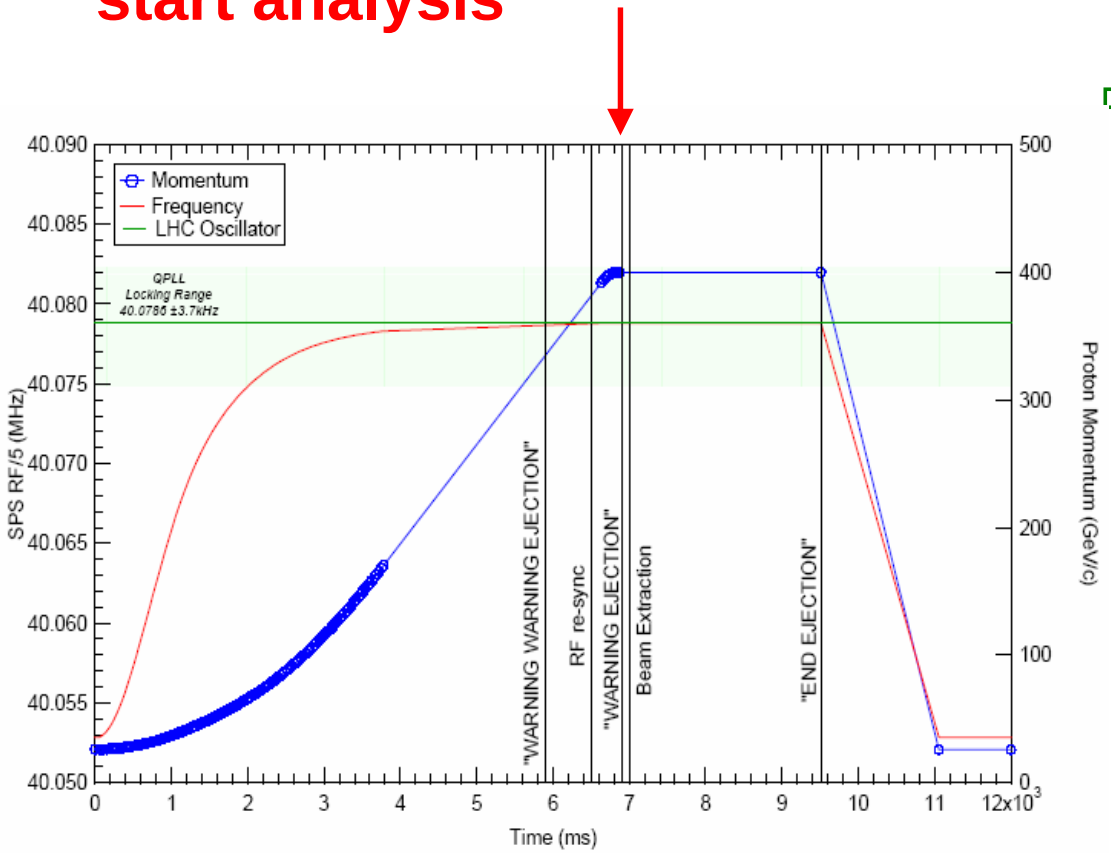


Run 515: 80 spills

BX counter reset every BC0

October's structured beam – report

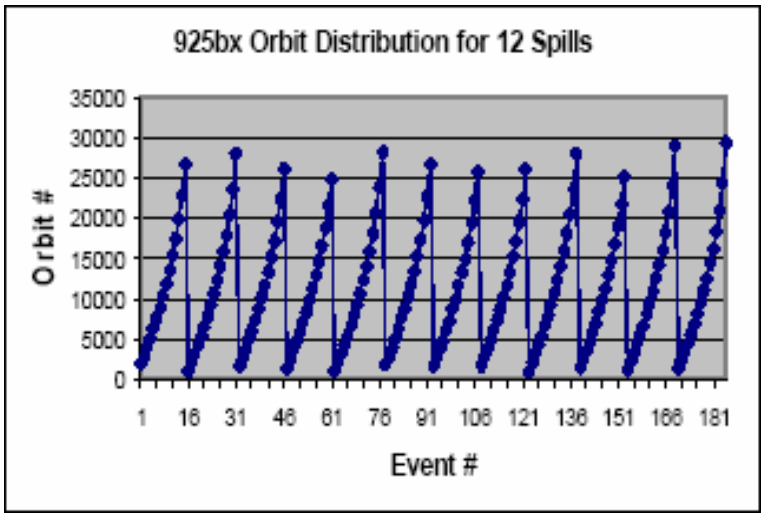
- **Orbit period analysis using CSC Track-Finder at H2**
- **Special firmware in SP to detect non-924bx periods**
- **"Warning Ejection" (400ms after "RF re-sync") used to start analysis**



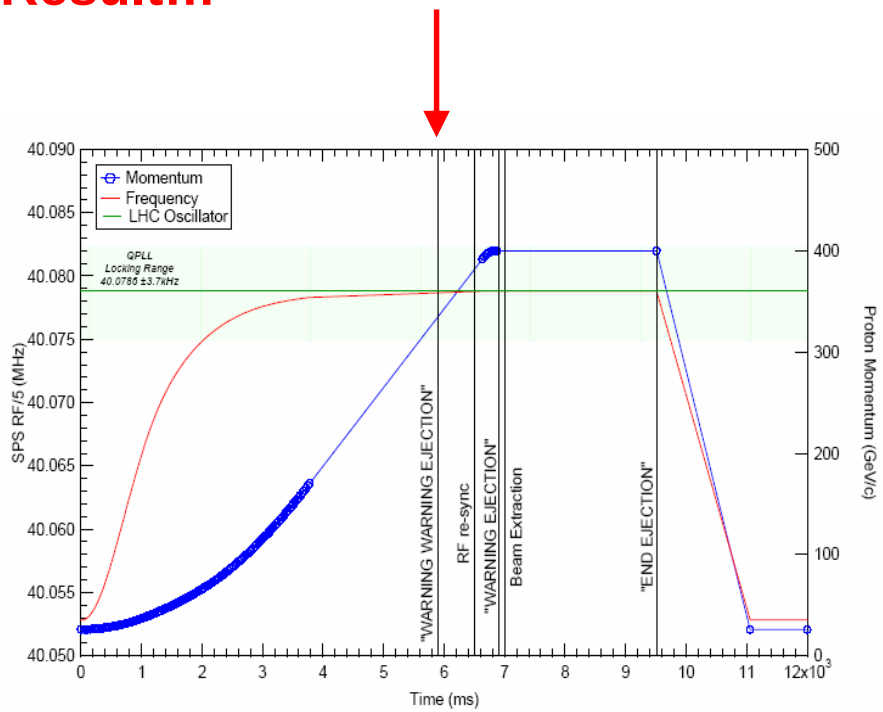
⇨ ALWAYS 924BX

Communicated to SPS team (Sophie Baron,…)

Last June's problem explanation

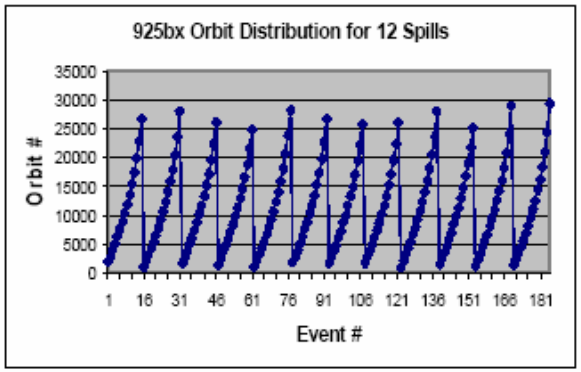


- Tried to reproduce the problem
- Suspicion: wrong Warning signal used as a start ("WWE")
- Same tests as before with the WWE as a start (before RF re-sync)
- Result…



Last June ‘s problem explanation

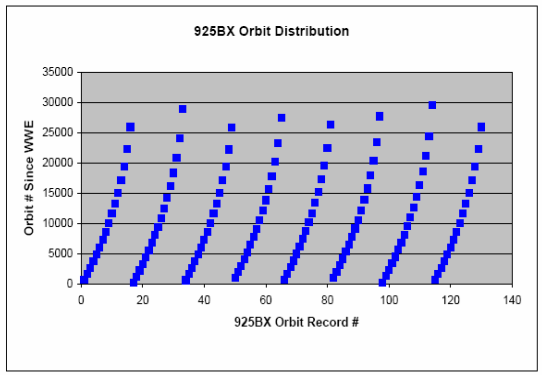
JUNE



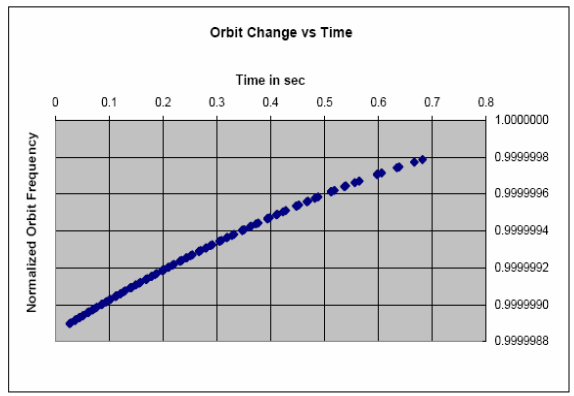
“Conclusion:
Orbit disturbances occur 15-16 times during first 0.7 sec (23 us * 30000) of spill.”

OCTOBER (with WWE)

Sector Processor (SP02) BC0 Analyzer Data
Beam Gate is Triggered by the WWE signal

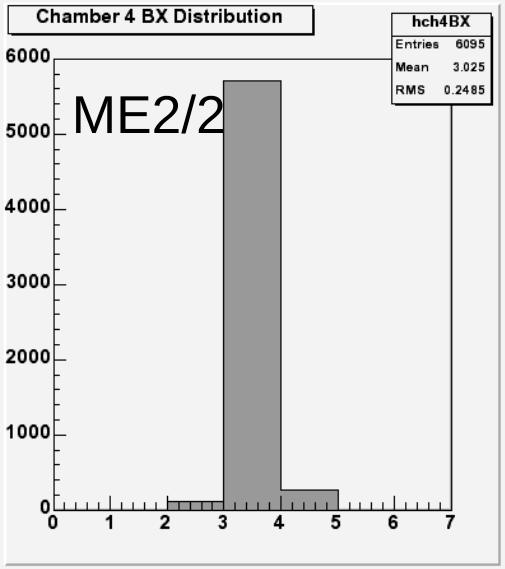


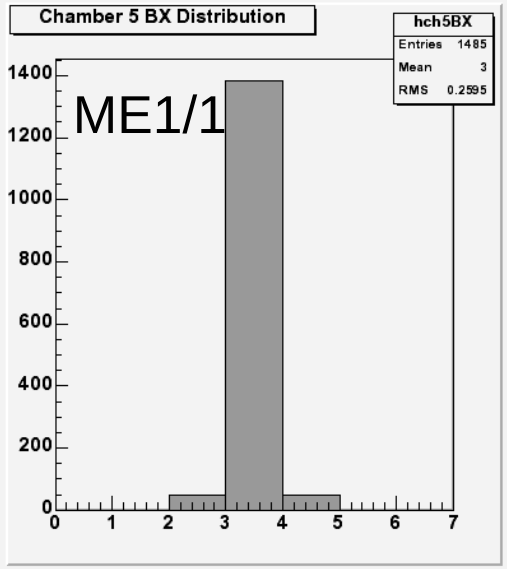
Same Data as Above but Recalculated into Orbit Frequency Change

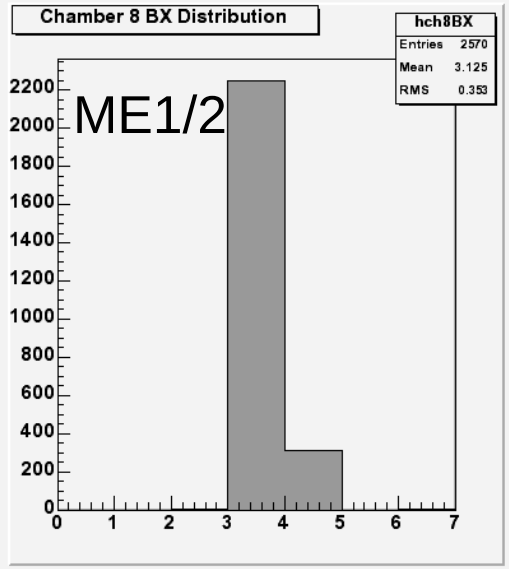


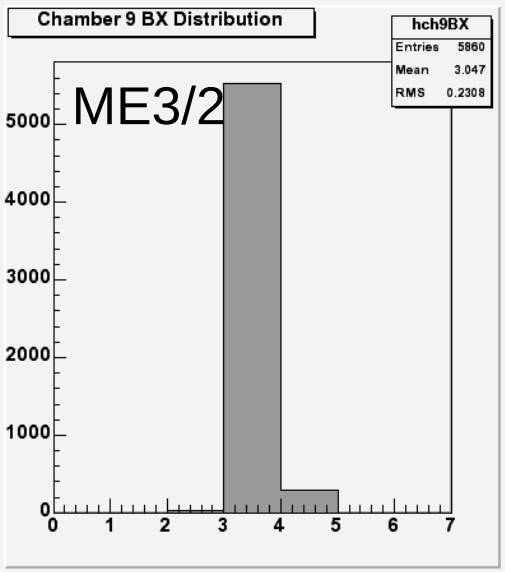
⇨Probably wrong signal used during June’s 25ns run
⇨Confirmed with visit to X5A (if cables left untouched)

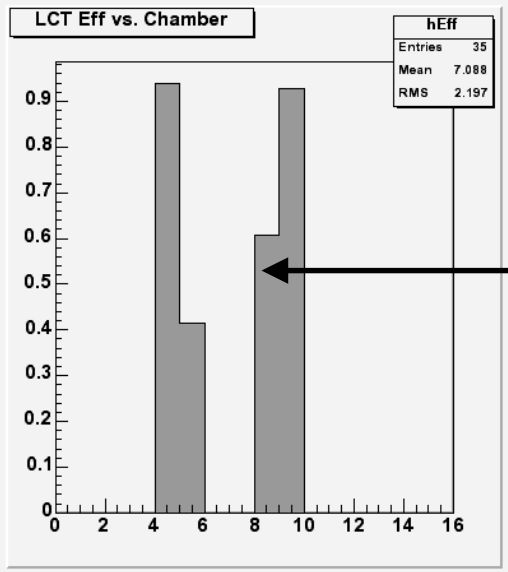
Timing Distribution











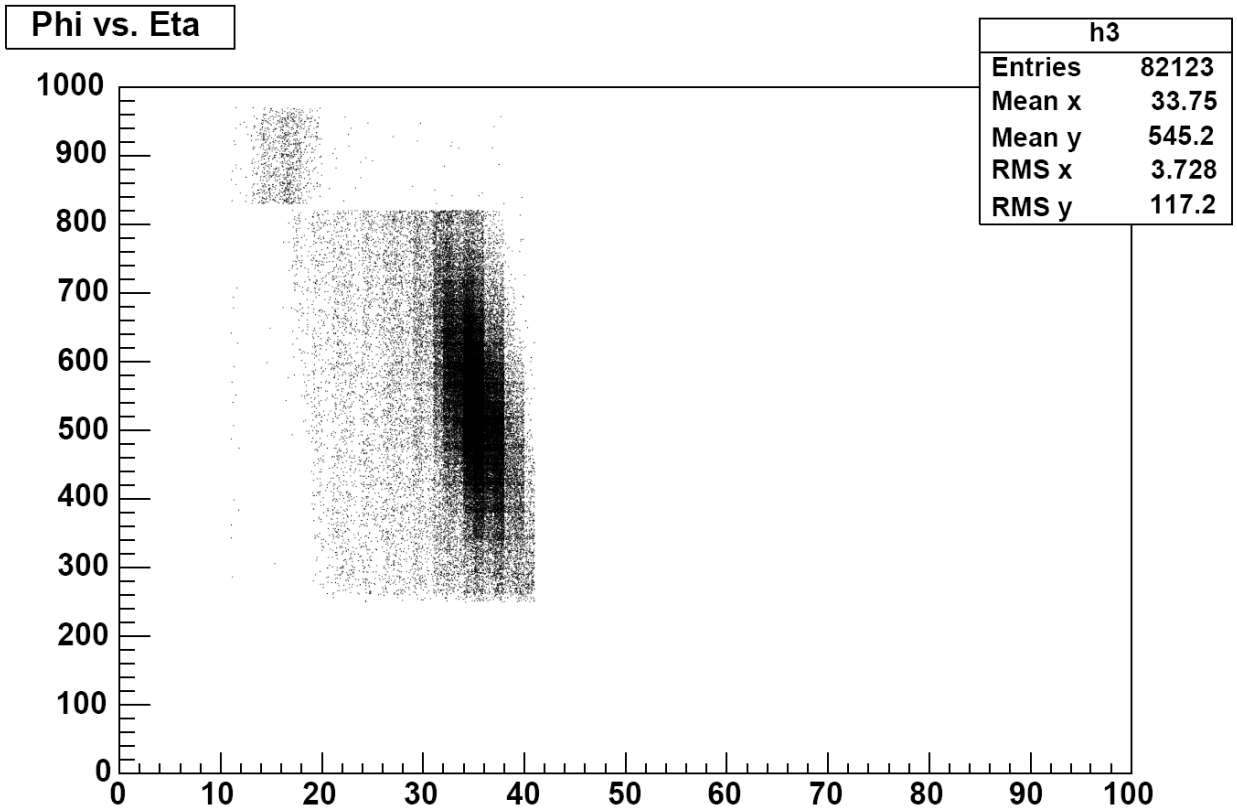
All LCT data nicely centered on same BX as seen by SP

Low apparent efficiency is a geometric effect

BX Window for Track-Finder Trigger

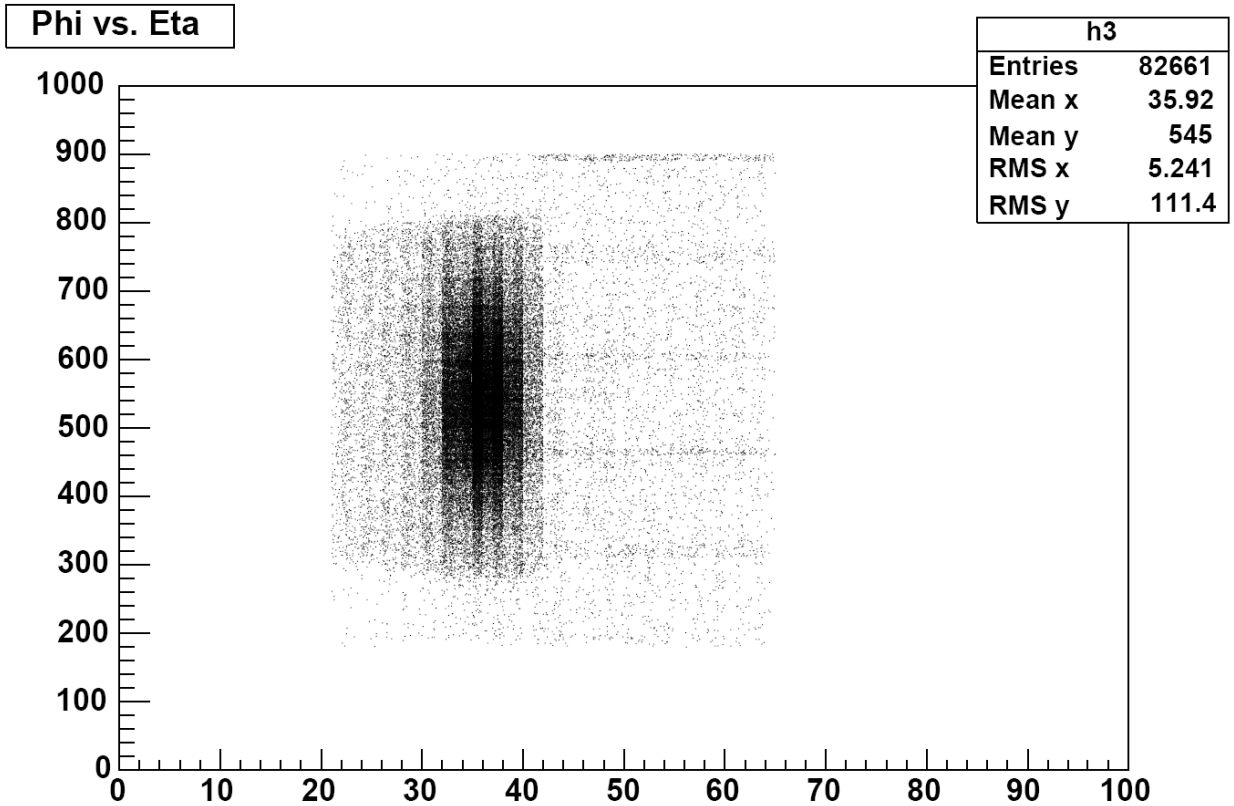
- **SP can accept LCT's over a 2 BX window. Earliest arriving LCT defines BX of track**
  - **Improves tolerance for segments out-of-time**
  - **Increases probability for L1A delivered on wrong BX, though**
- **Last June: many runs with LCT data shared across 2 BX as seen by SP**
  - **RPC Link Board group (Warsaw) sees 10% of SP triggers arriving too early**
- **This October: disable multi-BX window for some runs taken in conjunction with Link Board**
  - **RPC groups sees only 0.4% of triggers out-of-time!**

ME1/1 Profile



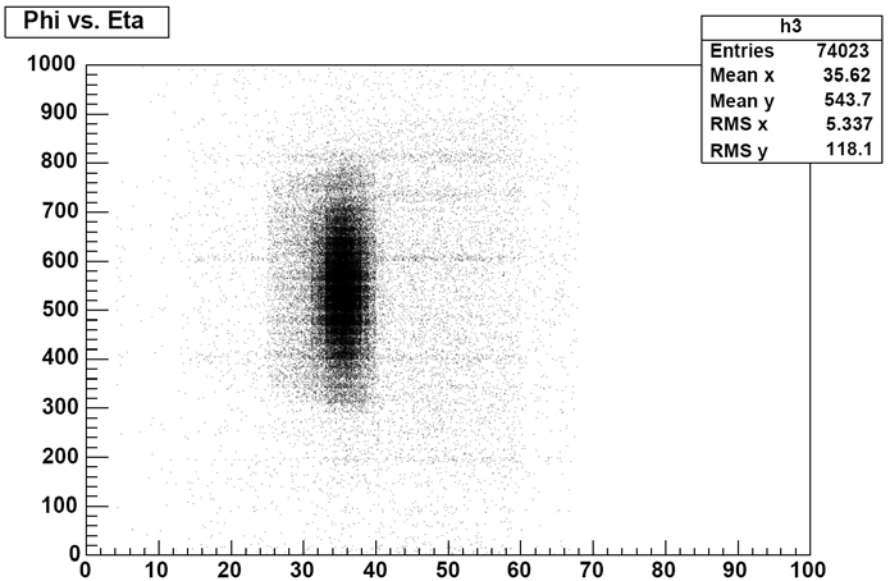
- Wire tilt visible
- Fifth CFEB with 3:1 ganging visible
  - TMB should not send this data to trigger path?

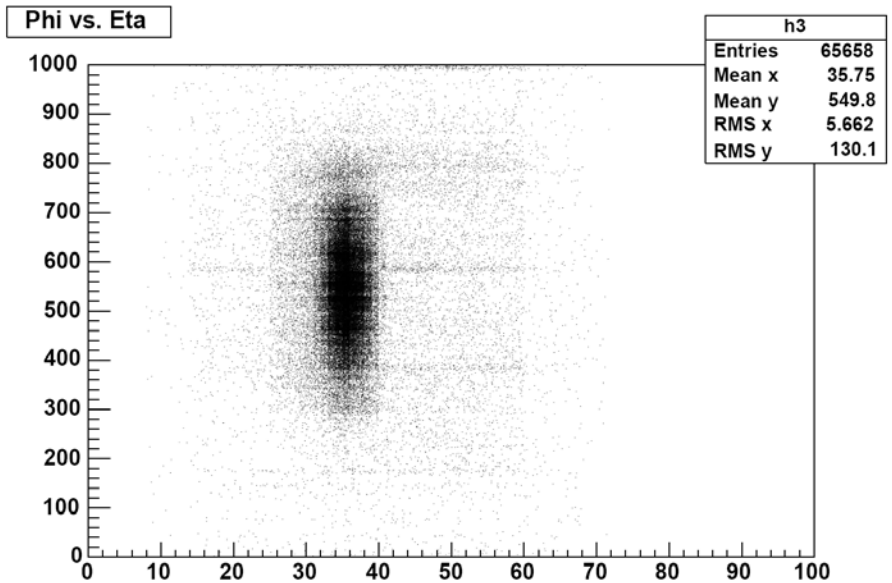
ME1/2 Profile



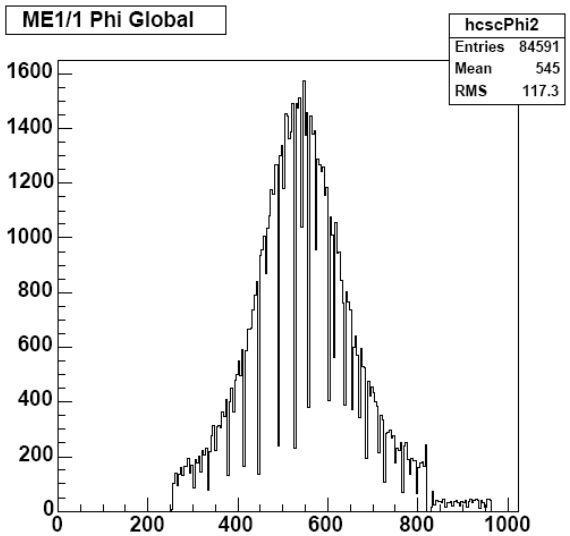
- Shadow of ME1/1 seen (ME1/1 + ME “n” triggers)
- ME2/2 + ME3/2 triggers are sometimes outside geometric acceptance of ME1/1 and ME1/2

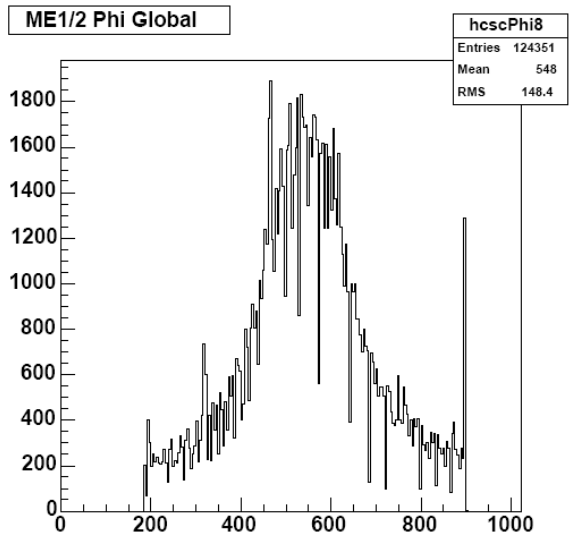
ME2/2 and ME3/2 Profiles

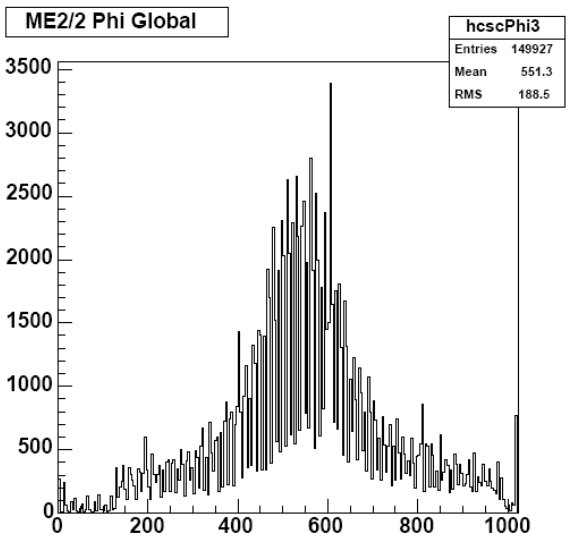


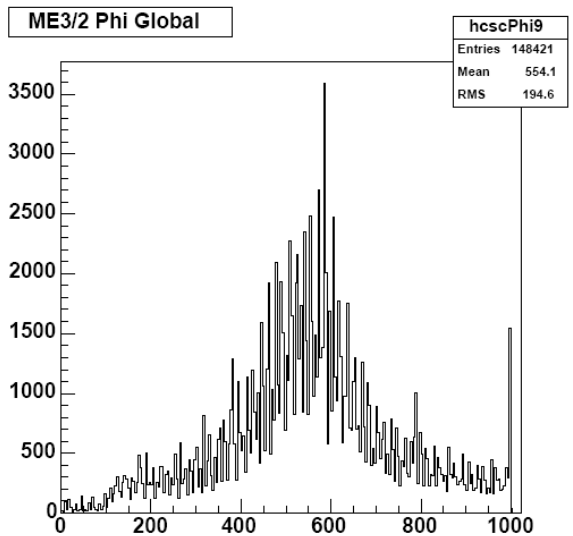


Global Phi Distribution







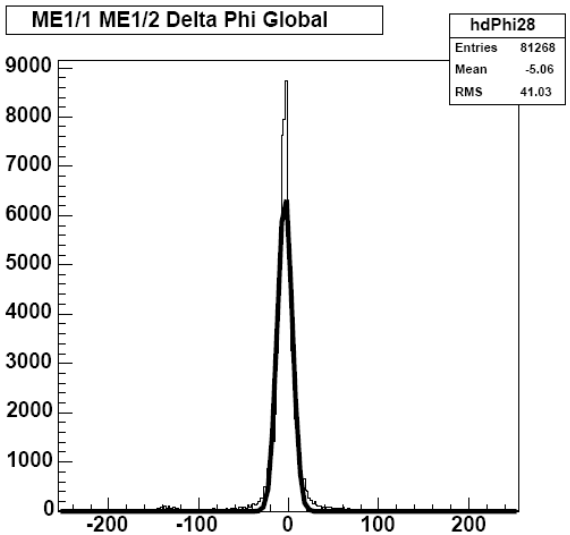


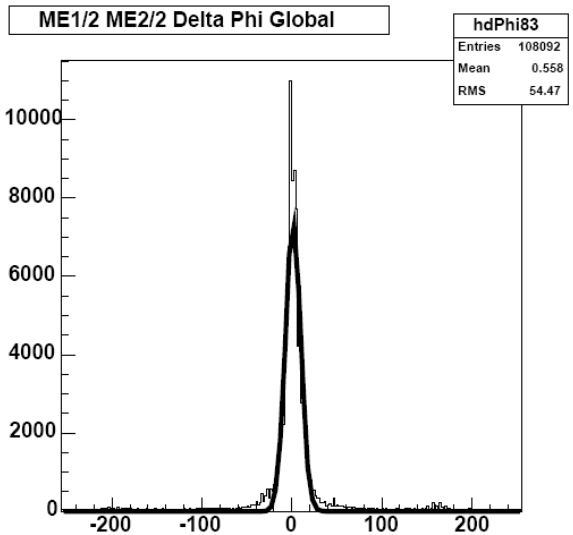
Full chamber coverage with SP trigger (may be useful for analyses)

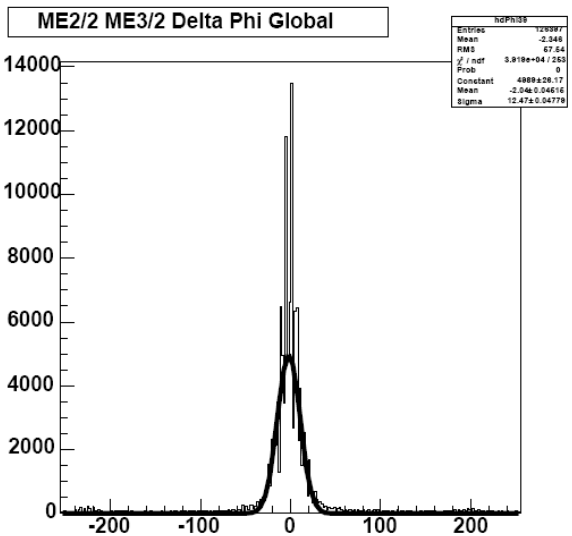
Uses ORCA LUT for Local Phi (related to strip id) and alignment corrections

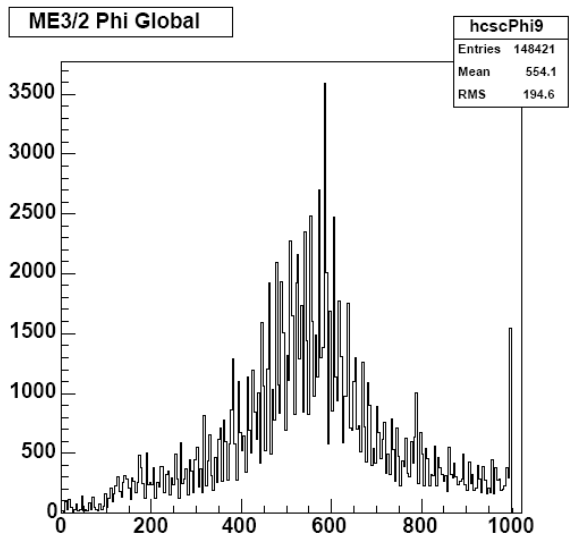
Thanks to Valuev for updates to TMB/SR simulation

Δϕ Distributions







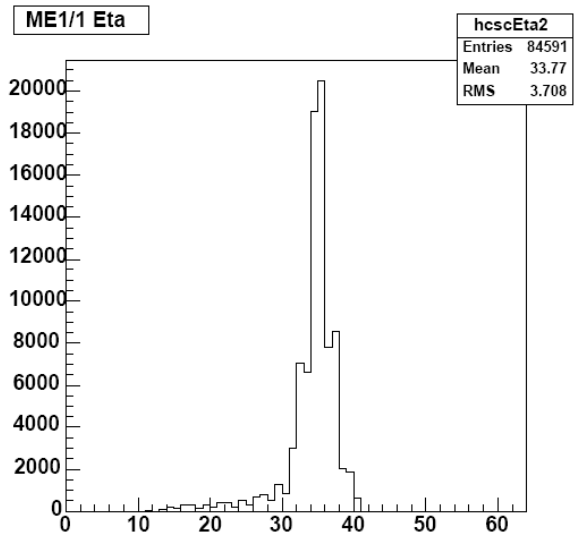


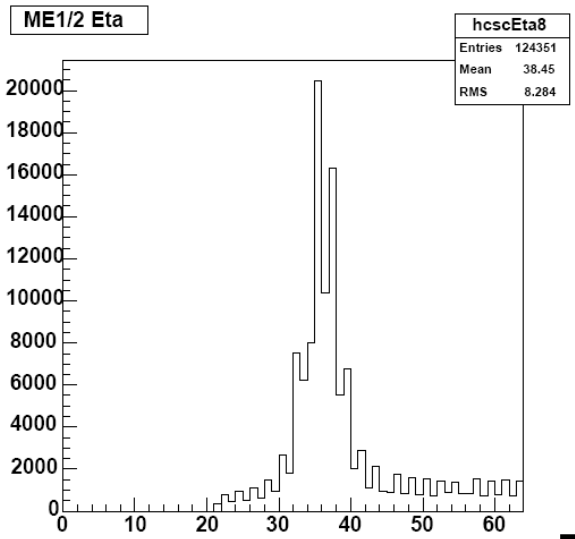
Difference in Phi between pairs of chambers.

Indeed aligned.

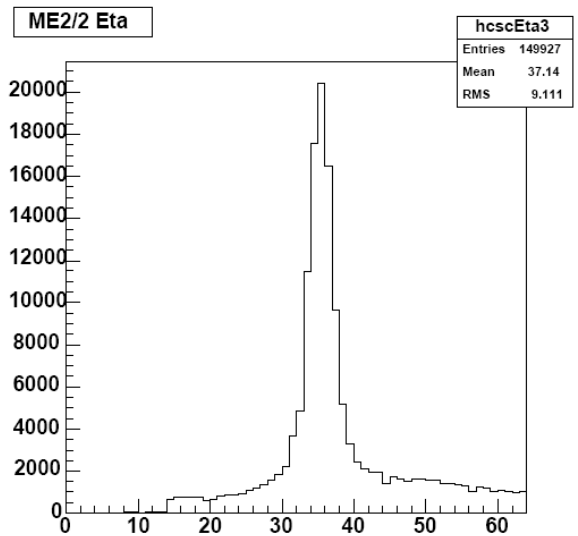
Warning: scaling of strip pitch vs. WG is not taken into account

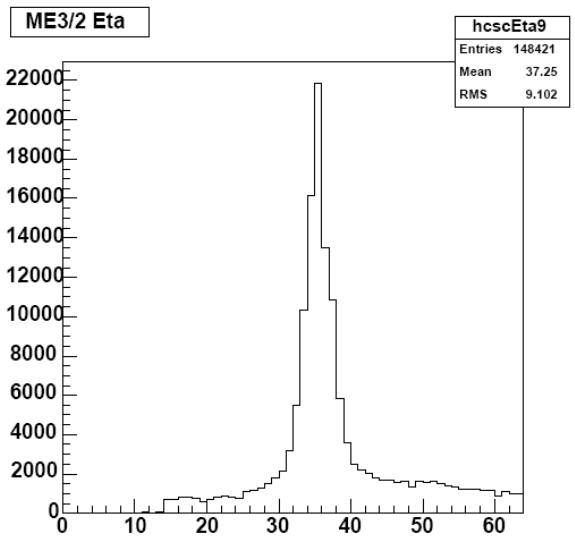
Global Eta Distributions



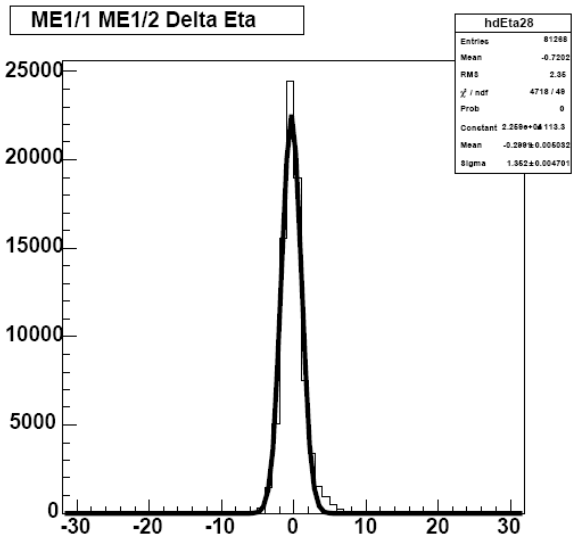


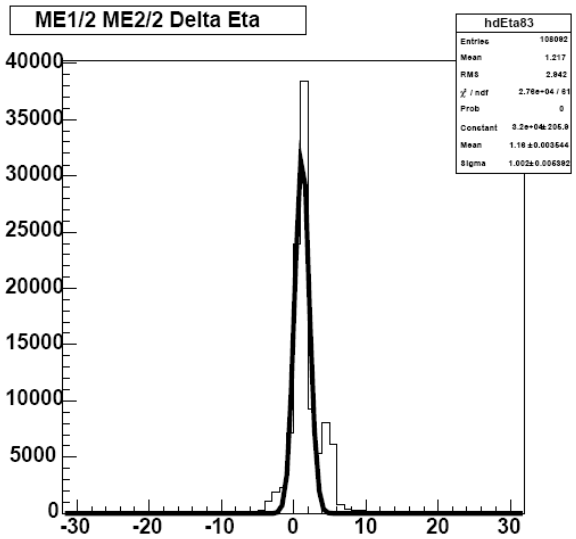
Eta≡WG+offset

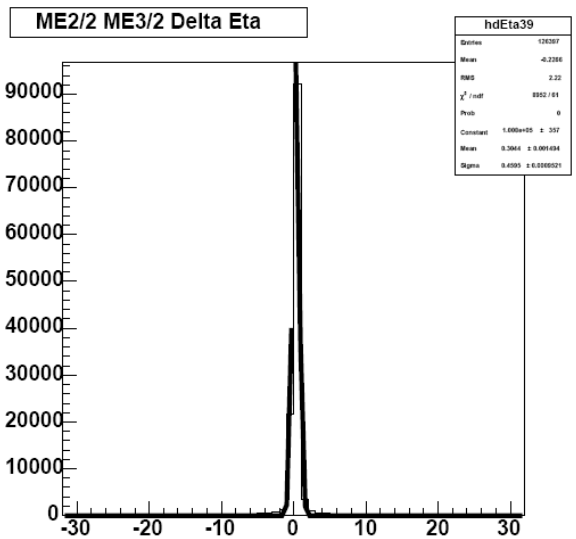


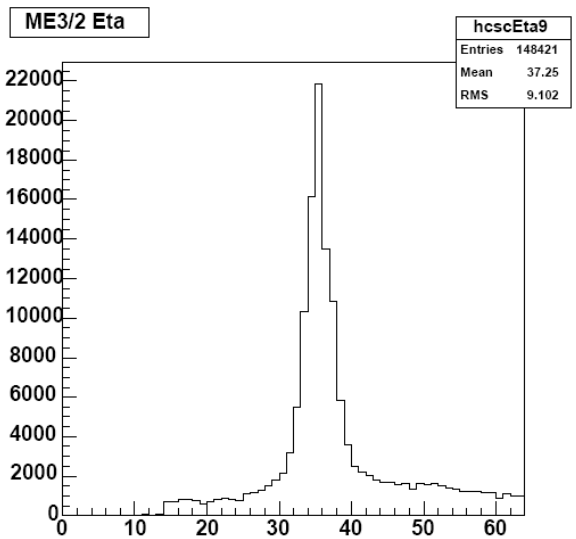


Δη Distributions









Wire tilt in ME1/1 not taken into account

LCT Efficiency for ME3/2

- **ME3/2 was added to Track-Finder inputs once new production peripheral crate backplane was installed**
- **ALCT routed through RAT module**
- **Efficiency ~95% efficiency for finding correlated ALCT+CLCT (was 0% in June)**
  - **Compared to ~99.5% for ME2/2**

SP and MS Logic Validation

- **Muon Sorter reports back to SP "winner bits" for those SP tracks selected**
  - **Analysis of 270K events shows perfect agreement between reported winner bits and expected winner bits based on SP output**
  - **Additional 43K events analyzed with SP re-programmed to create extra ghost tracks for same muon: same conclusion**
  - **Checked winner bits sent to two SPs running simultaneously, again agreement**
- **SP Track-Finding logic was also tested. Logged outputs agree perfectly with emulation based on logged inputs (as in previous tests)**