

SVT Status Report

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Trigger Hardware meeting 9/20/2002

- 6th SVT Workshop highlights
- Recent development and performance
- Outstanding issues
- Plans



SVT Workshop

- 6th workshop Sept 10-11
 - Follow-up of previous SVT workshop (July)
 - Review work done since
 - Plan for next months
- Highlights
 - Efficiency/acceptance
 - Review of recent improvement
 - Near and medium term plans
 - Firmware development/bug fixes
 - Breakdown of SVT timing and plans
 - Operation and monitoring plans
 - Diagnostics (teststand)

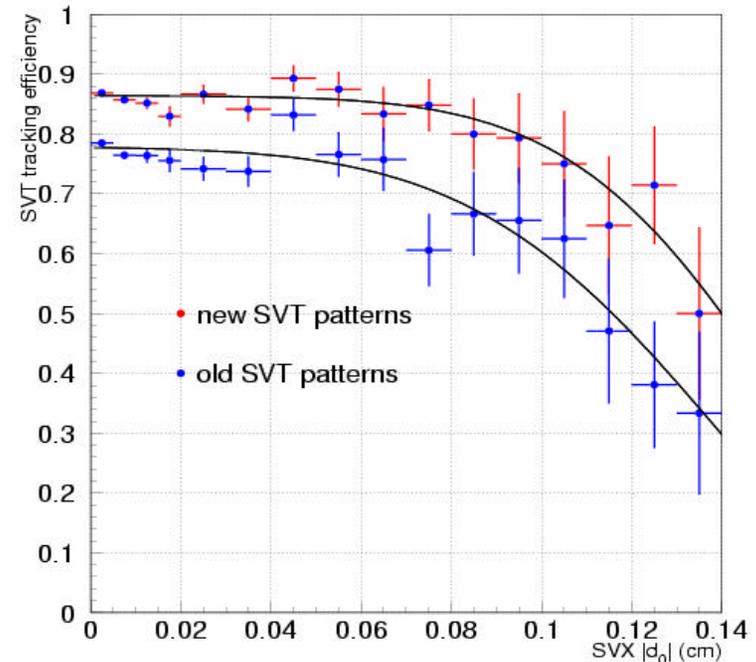
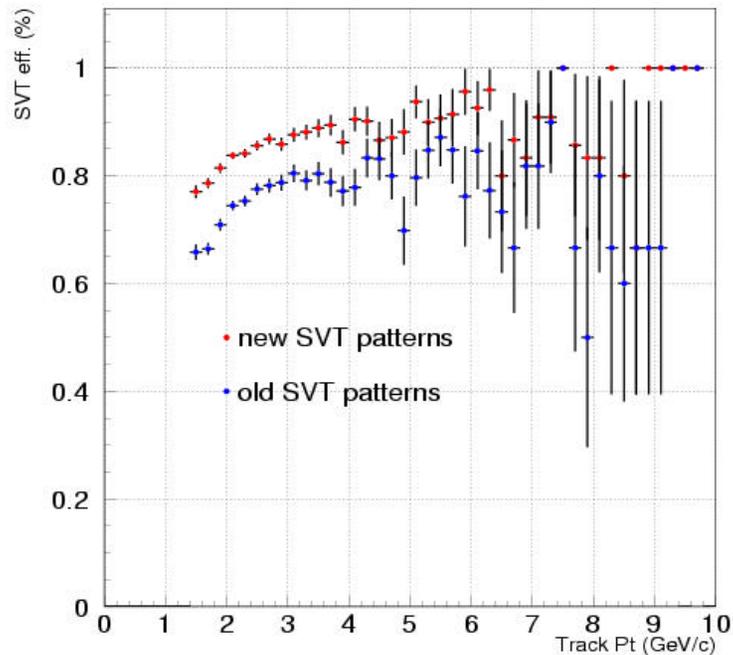


SVT Efficiency and Acceptance

- New patterns were generated tested and declared default since early August
 - Optimized (wider) superstrip size in each layer
 - Improved acceptance shape vs Pt and impact parameter
 - Independent choice of superstrip size and layer map in each wedge
 - Required some fix to download/simulation code
 - We finally took advantage of the effort by Silicon group in June Shutdown
 - Roberto Carosi learnt the whole procedure
 - Hope in further turnaround and feedback in the future



SVT Efficiency and Acceptance



- efficiency on triggerable tracks rise from 75% to 85% @ 2 GeV
- Overall efficiency including new wedges (only 6 missing now) from 35% to 45%
- Flatter as a function of impact parameter

Plans for further improvements

- **Short Term plans**

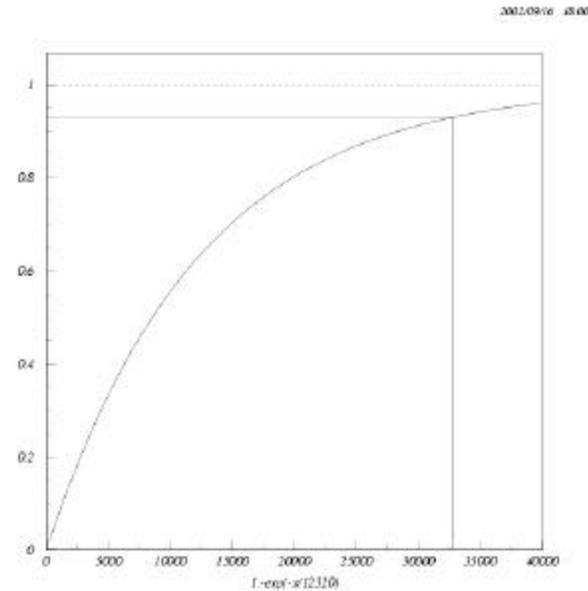
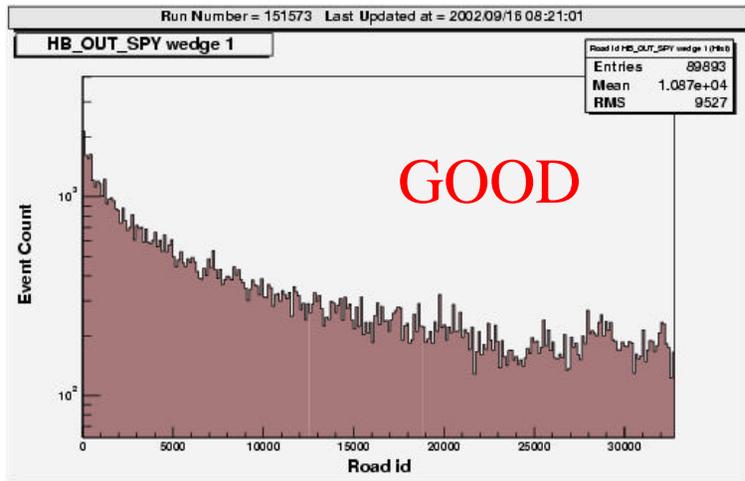
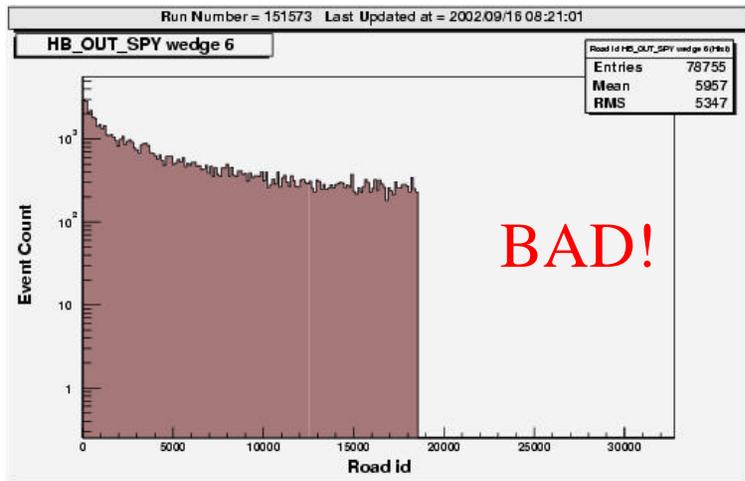
- Fix bug discovered in random number generation...
- Include combination without L0
 - recover 2 more wedges with affordable increase in background
- Improve fitting constants by using either a new procedure based on CDF alignment tables or old, completely independent, procedure

- **Medium Term Plans**

- Can recover 2 more wedges allowing for 3 layer combination
 - Expected resolution from offline tracking results in modest(10 %) increase in rate
 - Need further investigation using svtsim and some fixes to fitting constants
- Continued...



Problem with random generator

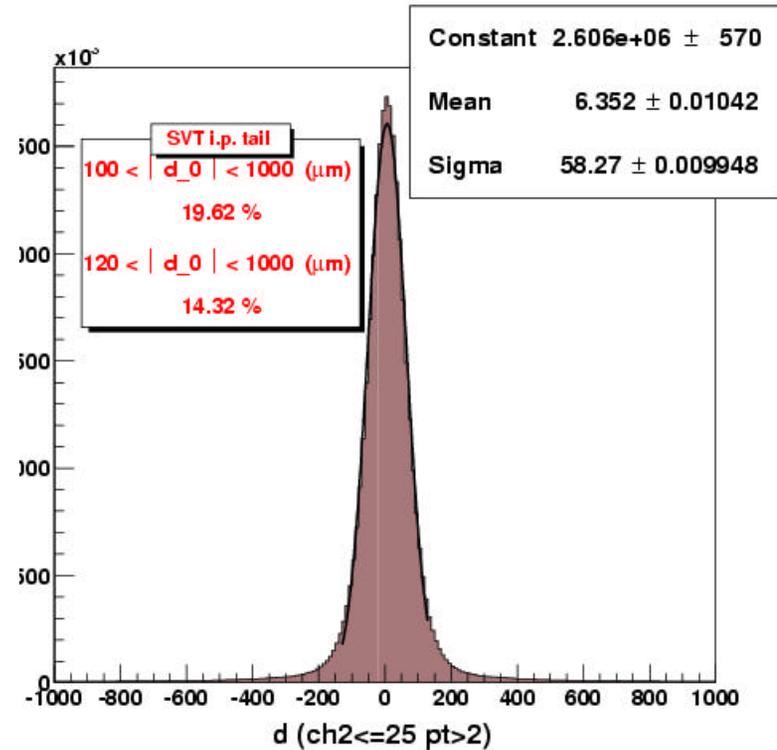
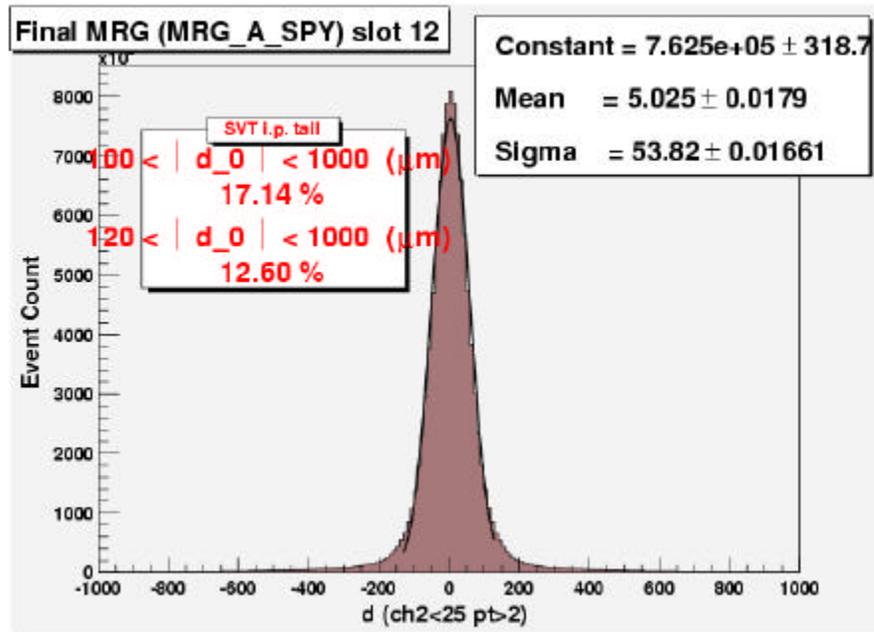


Pattern coverage as a function of
number of patterns



Efficiency loss (1-2 %)

I.P. tails old/new



$N (\text{ch2} \leq 25; 120 \leq d \leq 1000) / N(\text{ch2} \leq 25)$ up to 14.3% from 12.6%

(but design goals were few %)

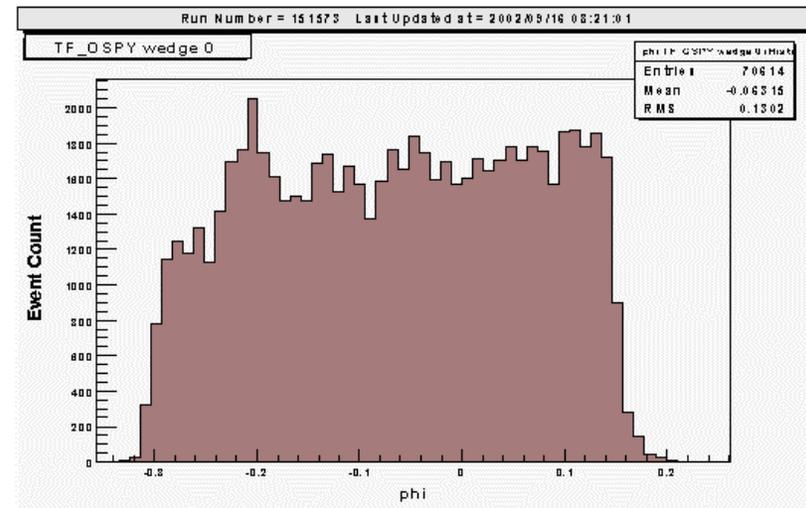
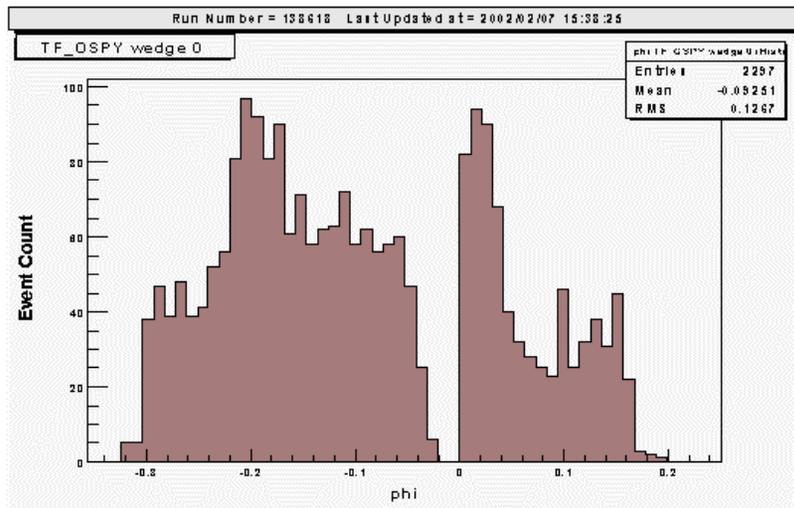
Resolutions up to 58 micron from 54 (including beam)

Plan for 4/5 (majority logic)

- increase efficiency on the 60% of the wedges that have 5 layers (depends on the assumed ladder efficiency)
 - Have the pattern to start playing with
 - Need to test on simulation first
 - TF downloading
 - Improvements in Ghostbusting algorithm
 - Need to test new features of the TF board
 - Hopefully no firmware fixes needed!
 - Won't work at first try
 - Will ask for special runs in the next months
 - Hopefully ready to go by early next year



Firmware fixes – TF $\phi=0$ bug

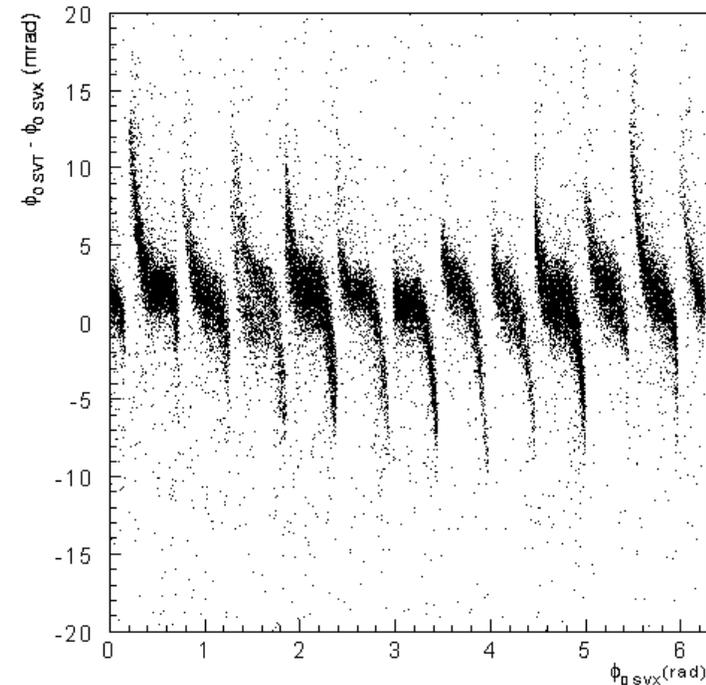


FIXED !

Need to update all the other 11 TF +
spares for consistency

Firmware upgrade - GB

- Several function will be in one single chip:
 - Phi non linearity correction
 - Beam subtraction
 - Ghost removal
- The above tested in the simulation
- Next step : double buffering scheme to read beam position in to SVDD from the GB itself (exact recording of the used beam line for every event)

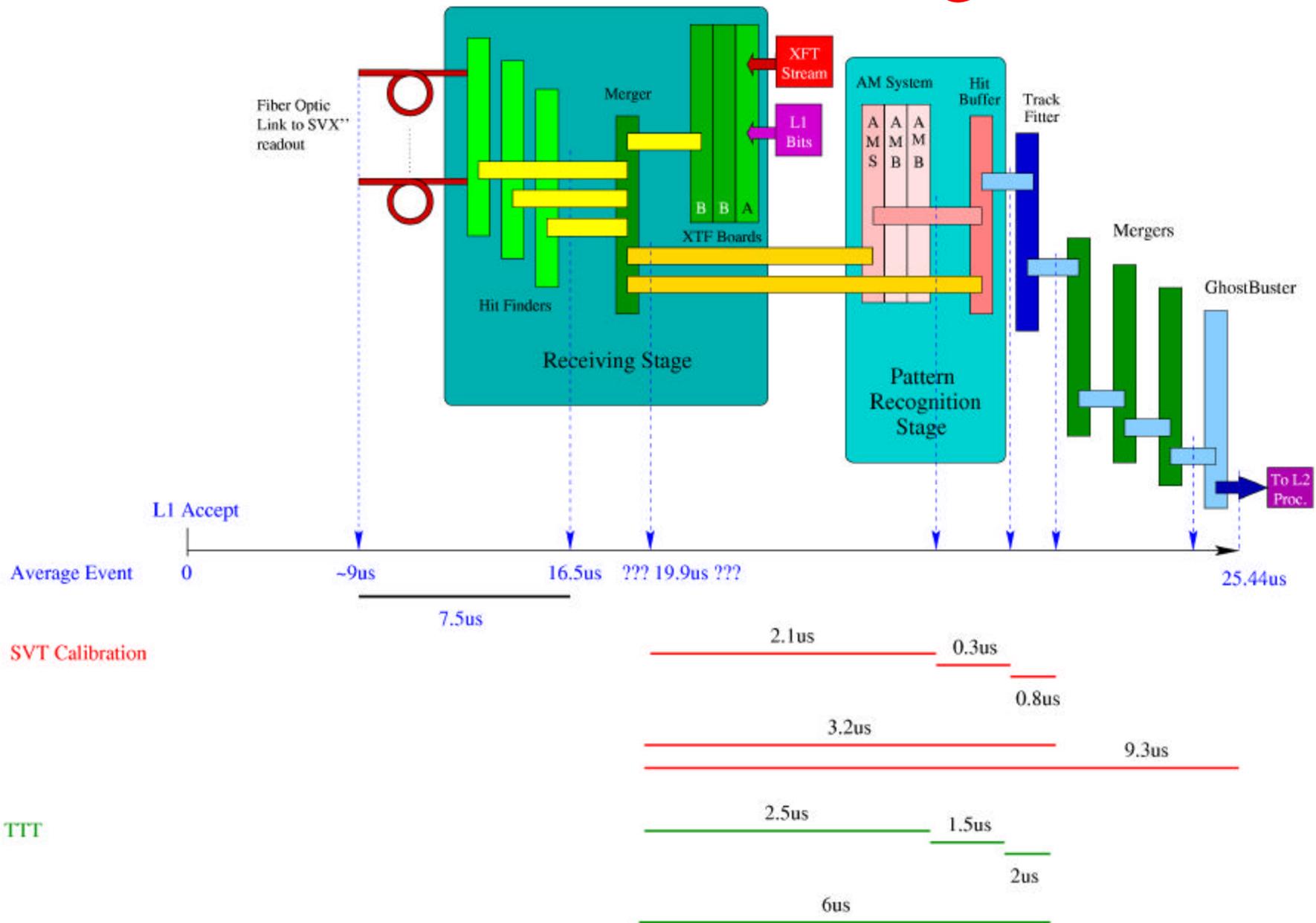


SVT Timing studies

- Current SVT processing time average (including SVX data digitization and transmission) is 25.5 us
- Need to gain something for:
 - Higher luminosity
 - Accommodate 4/5
- Studies to understand breakdown of various stages (later feed this into the simulation)
 - Timing versus SVX thresholds
- Recently inserted test points into several boards to be able to use logic state analyzer
- Need to repeat this in several condition



Measured timing



SVX II Thresholds

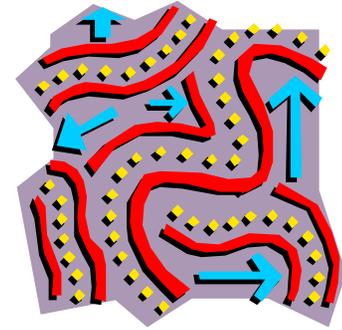
Two SVX special runs with thresholds set to higher values:

Run #	Threshold	Occupancy	SVT time From L1A
Regular	-	~15%	25.44 μ s
150119	9	~3%	24.78 μ s
150118	11	~3%	23.48 μ s

O(2 μ s) improvement



Mergers



- 4 input-2 output device
- Merges data streams
- 2 possible ways of doing that
 - **Non deterministic:** “first come first serve” until end of event
 - **Deterministic:** Sequential processing of inputs (first all A data, then all B data & so on...)
- So far we’ve been using deterministic
 - Easier to implement and understand
 - Limited FPGA size makes it somewhat hard to implement
- Typical processing: $(2/3) \times (\text{nwords}) \times (0.033) \text{us}$

Conclusions

- Places we can gain something:
 - Si Thresholds $2 \mu\text{s}$
 - Non deterministic Merger(s) $\sim 2.5 \mu\text{s}$ (firmware exists)
 - GB latency $1-1.5 \mu\text{s}$
 - Split SVX readout, 7 bit digitization $2.4 \mu\text{s}$
- Need a more systematic timing measurement



Operations and Monitoring

- Recognize the need for smoother running and increased support:
 - More people to carry pager and become expert
 - Improve documentation
 - Need a tool to summarize trigger performance in one single place
 - Need to run simulation against data in a regular way and report failure rate (plan to run simulation in the crate itself -> infinite statistics)
 - Fix occasional crate crashes and board downloading failures
 - Need to minimize disruption to data taking from occasional beam finding problem (next slides)



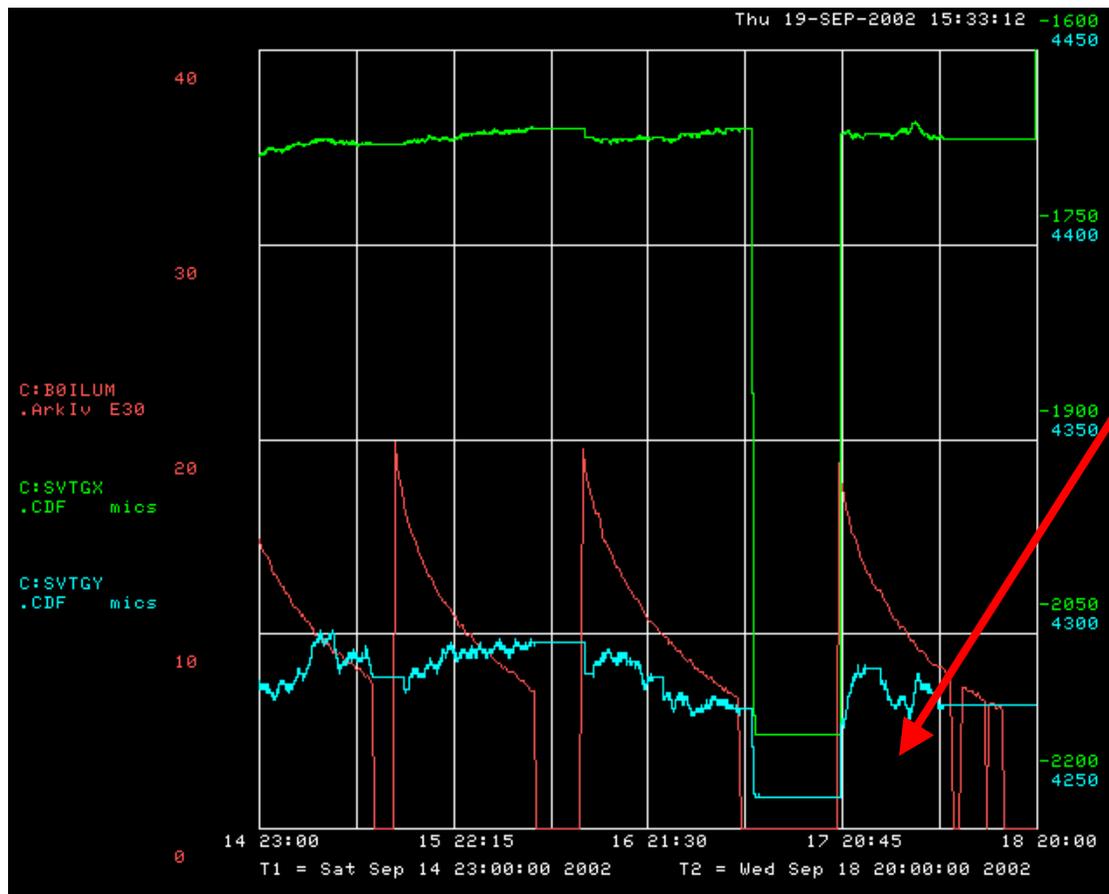
Beam Movements

- In the last ~ 2 months:
- 2 jumps in x (0.5 mm) and y (0.25 mm) probably correlated with deliberate orbit changes
- Slope constant within $200 \mu\text{rad}$

	X	Y
MAX store to store beam center variation	500 μm	300 μm
MAX store to store slope variation	200 μr	100 μr
Typical end store beginning of next store beam center variation	30 μm	30 μm
Typical variation within a store	50 μm	30 μm



Beam Fitter problem n. 1



Fitter fooled by
replayed fake hits
(and tracks)

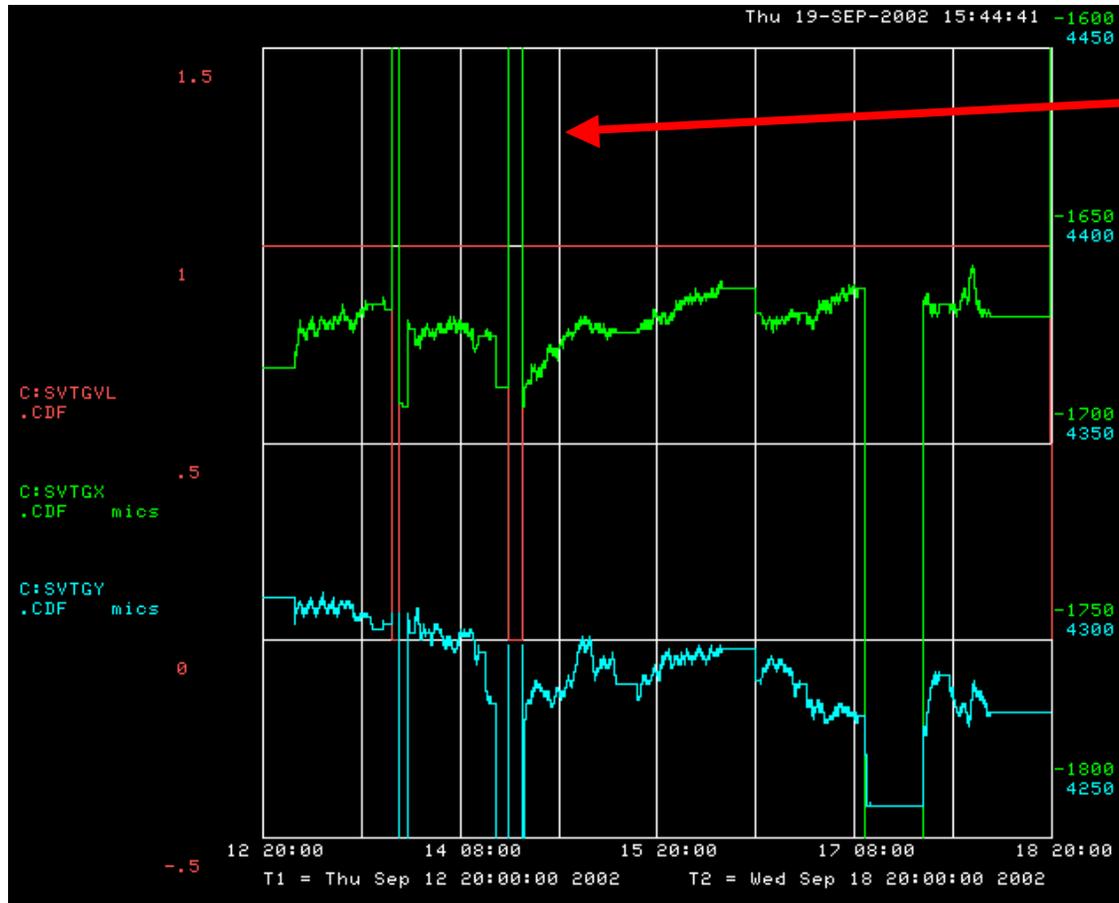
Added a flag to
avoid this

BOILUM

Xbeam

Ybeam

Beam fitter problem n. 2



Beam fitter started
from scratch (0,0)
when crate reboots

(SVTGVL=0)

GB memory
cleared when crate
power cycled

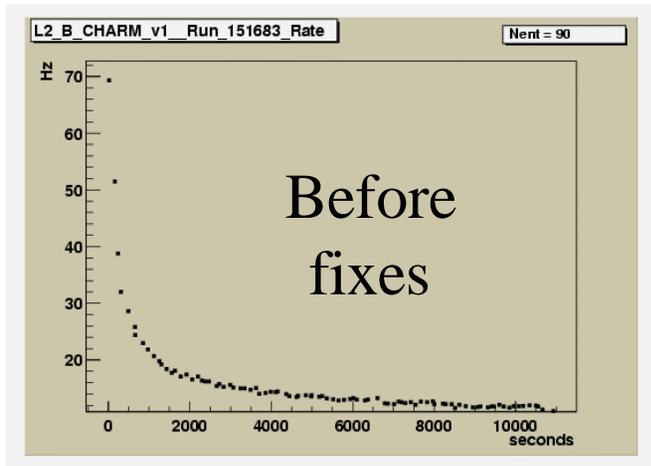
SVTGVL

Xbeam

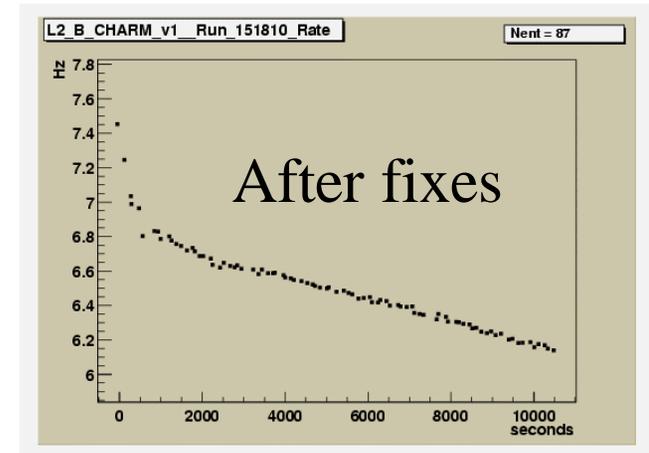
Ybeam



Beam instability versus SVT fitter problems



Start of stores
B_CHARM
rate



- Problem 1 and 2 fixed by reloading GhostBuster at each run with whatever last good fit and by avoiding running the fitter on fake data.
- Outstanding problem is to avoid large beam shift at start of store (Tevatron problem)
- Need a way to veto trigger when beam fit is not yet available
- A flag in to an SVT word? (but, how do we account for lost luminosity?)