

# 6<sup>th</sup> SVT WORKSHOP

## Fermilab - September 10-11, 2002

### GEOMETRY/ALIGNMENT

A new set of patterns was generated and installed into SVT. This led to a significant improvement in the efficiency of SVT.

A bug was discovered in the pattern generation procedure caused by the use of a bad pseudo-random number generator. This is being fixed and it's expected to lead to a further efficiency improvement.

Action list:

1. Generate new patterns with a better random generator
2. Include 2-3-4-5 combinations in the patterns
3. Make a new .rgeo file using geometrical constants from the offline alignment and generate a new set of fitting constants from there
4. Test the new patterns and fitting constants with SVTSIM and improve the alignment with the standard SVT tools if necessary (wedge to wedge alignment, principal component analysis of the constraints...)
5. Assess the performance of the new geometry with respect to the current one (efficiency, impact parameter distribution etc.) using SVTSIM before testing it with beam.

Roberto will perform these tasks. Items 1-4 are expected to take 2 weeks to complete. Item 5 is expected to require one additional week.

### MAJORITY LOGIC

Giovanni will generate a set of 5 layer patterns. This set will be used by Bill to test the TF operating in the 4/5 mode.

The rest of the work needed to implement 4/5 will start after the new 4/4 implementation will be complete and operational.

### 3 LAYER WEDGES

Jahred showed simulation studies that look very promising. Work still needs to be done to refine the simulation, but the hints are that we probably can recover all the wedges where only three layers are available with a modest increase in trigger rate (~ 10%). We will wait for confirmation of these results before formulating a detailed plan.

### OPERATIONS

It was recognized that one of the main issues is the lack of documentation.

So here is a list of documents that we agreed we need to write very soon. All the authors have agreed to do the job.

1. SVT Cold start by Bill
2. SVTSIM by Alex
3. The SVT Test Stand by Franco
4. SVT Beam Finding by Luciano
5. How to generate SVT constants by Roberto

A number of miscellaneous issues that need to be addressed were also mentioned. For the record, here is a non-prioritized list.

- Improve behavior of beam finding at start of run or start of store
- Messenger task dies occasionally
- AMB, TF download failures
- Beam finder task dies occasionally (needs to be monitored by PROCMON?)
- Generate a spy dump on Halt
- Database documentation & validation needs to be improved (present tool is too naïve)
- Need to run SVTSIM regularly
- Implement basic automatic diagnostics on Halt (look at Merger status)
- Understand low level SVTSIM mismatch

## **TRACK FITTER STATUS**

The bug at  $\phi=0$  has been understood and a new version of the firmware exists that has been successfully tested in the test stand. The plan is to first swap the TF at  $\phi=0$ , then to upgrade all the remaining TF's (we want all the TF's to be identical)

## **MONITORING**

We agreed that we need to:

1. Identify a small set of significant numbers
2. Log them at ~fixed time intervals
3. Group them in one place
4. Check them regularly
  - Hourly by shift crew  
→ Need very clear instructions for CO
  - Daily by SVT pager carrier  
→ Write daily report

This is a proposed list of numbers:

1. SVTSIM failure rate

- Overall and breakdown by wedge
- 2. Efficiency
  - Overall and breakdown by wedge
- 3. Error bit rate in EE word
  - Overall and breakdown by board
- 4. 3D beam position
  - x, y, dx/dz, dy/dz
- 5. Impact parameter tails
  - Overall and breakdown by wedge

We need a script that collects all the above information from different sources (SPYMON, TRIGMON, SVTMON ...) and posts it on a single web page. Bill has volunteered to provide it.

Roberto will make sure that SVTMON is run automatically every day on all the data available in the look area. It will measure SVTSIM failure rates and SVT efficiency and will make this information available to Bill's script.

## **SVTSIM**

An effort will be made, lead by Marco, to run SVTSIM online on the crate CPU's and feed it directly from the spy buffer. We expect this to allow many events/second to be checked with SVTSIM and a much faster response in case of problems than what we can get by running SVTSIM offline. This is expected to be completed in a time frame of 2-3 months.

## **TIMING MEASUREMENTS**

Alex showed the results of his measurements of internal SVT timing. Some of these measurements can be done in the test stand by replaying data from the HF's spy buffers. Unfortunately, in this way, it is not possible to get a complete and consistent picture of the time sequence starting from L1A to the output of the HF's. For this, one needs to do measurements with beam in the real system. In order to minimize disruption to data taking, we want to permanently insert one extra Merger in one SVT wedge at the output of the Hit Finders so that we can take a HF timing measurement at any time, parasitically, without interfering with data taking.

This is the action plan:

1. Request 1 hr with beam for SVT timing studies
2. Install the extra Merger and start a run
3. If some problem occurs take spy buffer dump and investigate
4. Retry as necessary

We agreed to proceed with this plan after the silicon is integrated again and we achieve stable running with SVX+SVT.

## **TIMING IMPROVEMENTS**

The following possible improvements to the SVT execution time were considered:

1. 7 bit digitize (2.4 us)
2. Non-deterministic merging (~2.5 us)
3. Improve GB latency (~1 us)
4. Optimize SVX thresholds (~2us)

The number in parentheses is our best estimate of the expected saving. So a combined total of ~ 8 us could be saved taking the SVT average completion time (measured from L1 accept) from the current ~ 25 us to ~ 17 us. Though we agreed that all these improvements look feasible no detailed plan for their implementation was formulated.

## **TEST STAND**

Franco implemented a test program that generates random events, replays them from the HF spy buffers and checks the results against SVTSIM. It is documented in the “test stand” section of the SVT web site.

In this way we can keep a full SVT wedge plus XFT fanout boards running continuously in the test stand and continuously checked.

It was agreed that it would be preferable to have the data played back from the HF input spy buffers (as opposed to the output spy buffers). This requires Bill's intervention.

## **GHOSTBUSTER FIRMWARE**

The following modifications to the GB firmware were done by Taka and tested in the test stand:

1. Phi non-linearity correction ( $\tan(\phi) \rightarrow \phi$ )
2. SVTSIM reproducible beam subtraction (integer math)
3. Merging of all functions in one chip

Next modification to do is the double buffering of the beam position in order to make sure that the beam position stored in the SVDD for each event is always the same as the one actually used in the beam subtraction for that event. It will be done by Taka and the time estimate is about one week.

## **STANDALONE DIAGNOSTICS**

Franco has provided and documented a nice GUI that serves as a framework for standalone SVT board test. The various board designers just need to provide an

appropriate “plug-in” following the specs documented in the “SVTTEST” section of the SVT web site. The following people have accepted to provide test programs:

1. Bill will do the Hit Finder
2. Luciano will do the Associative Memory

Other boards will be added later.

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