Status and Future Prospects of the SVT (and SSD)

SVT

Speed/Upgradeability (with regards to DAQ1000)

Percentage of detector that is working and will be working

Reparability

Resolution/Performance

SSD

Speed/Upgradeability (with regards to DAQ1000)

Resolution

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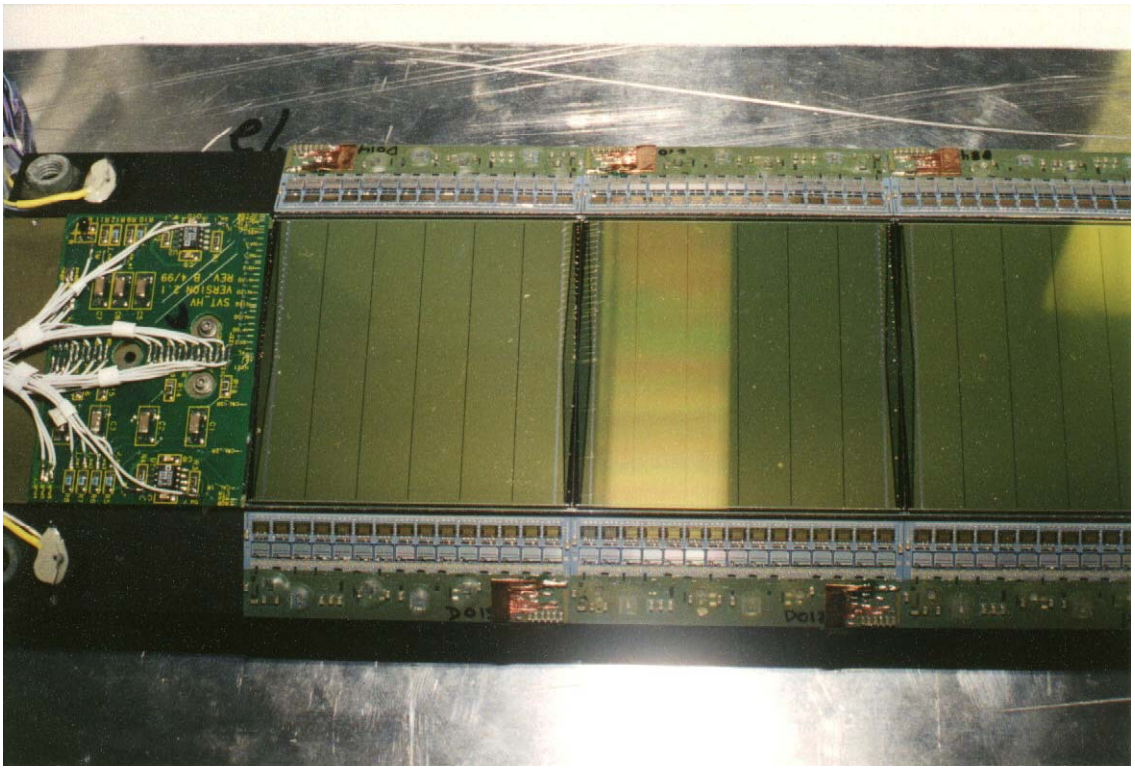
SVT Readout Speed

- Readout Speed limited by Design Speed of SCAs =2MHz *
- Multiplexing is 80 channels to one ADC.
  -There are 128 capacitors per channel.
  -Readout speed max = 80 x 128 /2MHz= 5ms. (200 Hz).
  -Current readout about 120 Hz.
- Multiplexing is built into hybrid.
- Hybrids form integral unit with detector

Conclusion: SVT will never be able to match ~1 kHz readout of DAQ1000.

*Hybrid has been tested at 2.5MHz ; noise and crosstalk were acceptable. Tests would be necessary to get upper limit. But > 4MHz highly unlikely.



Hybrid FEE wire-bonded to Detector ; Forms integrated unit.

SVT History of Percentage of "Bad Channels"*

* "Bad" = dead or noisy.

1. **36 ladders built**	Ended ~ January 2001	**< 1%**
2. Ladders mounted on end-rings and installed on cone	Ended ~ March 2001	
3. RunII AuAu	Aug 2001-Nov 2001	
4. **RunII-pp**	Dec 2002-Jan-2002	**~3.7%**
5. Shutdown 2002 (leak repair)	Feb 2002-Sept 2002	
6. **RunIII Commissioning**	Oct 2002-Dec 2002	**~10.5%**
7. **RunIII(dAu and pp)**	Jan 2003- May 2003	**~12.7%**
8. **Commisioning for RunIV**	Fall 2004	**TBD**

Comments:

- Percentage of bad channels shown do not indicate percentage that was active for the various runs but rather the percentage that is intrinsically damaged. e.g. during some runs failed Readout Boxes (which can be repaired) resulted in a lower operational active detector.

- My guess is that much of the failures are due to the rather harsh assembly procedures of step2 and harsh disassembly and repair procedure of step 5 (But no way to know for sure).

- Hopefully the next two runs where minimal handling of the SVT should occur will give us a better idea of its natural degradation. (E.g. this past shutdown the SVT was not accessed although the cone was removed).

Possibility of Repairs to SVT

- ~13% bad channels are currently known to be bad.
- About 7% are (what I call) grouped failures, i.e. 1/4 ladder or more.
- 6% are what I call random (i.e. less than ¼ ladder)

What is the main difference?

Grouped failures are potentially reparable. Random failures are not (or highly unlikely) reparable. I consider a grouped failure as potentially reparable because it implies a common source which implies it is off-hybrid and thus possible to re-work.

Unfortunately…

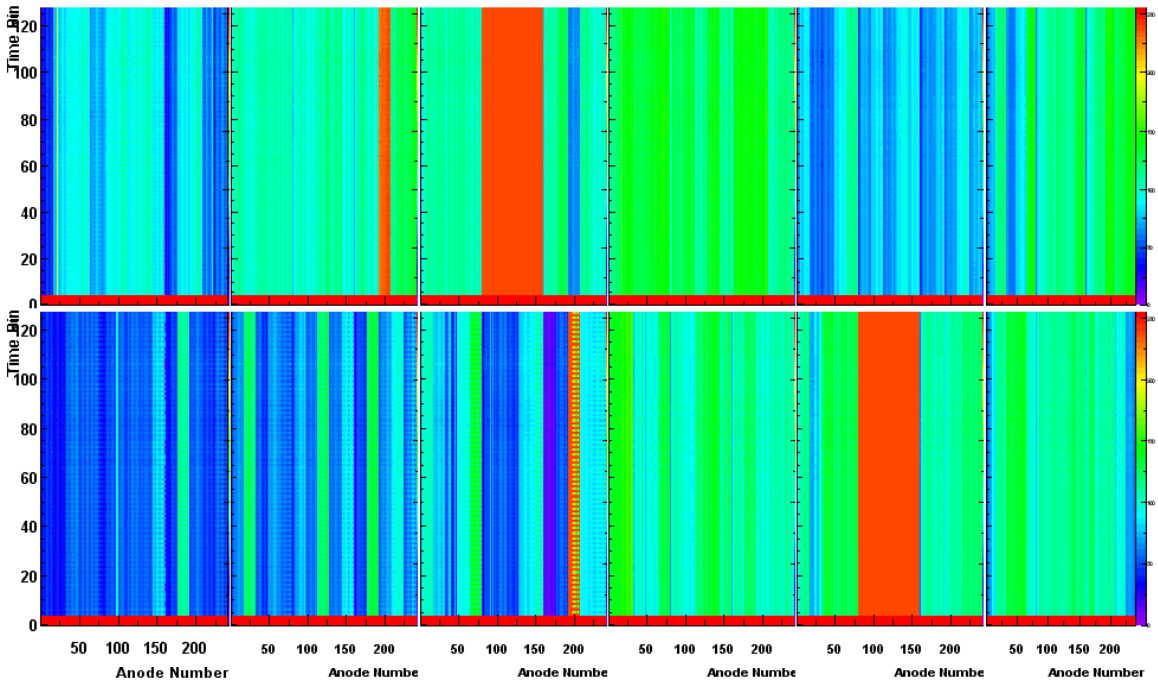
What is required to repair any bad channels?

1. Complete disassembly of SVT into individual ladders.
2. Replacement (by sawing off) of water fittings. New design would be needed for new water fittings.
3. Debug and repairs of grouped failures
4. Estimate would take on the order of a year---would have to miss a running period.
5. My guestimate from experience is that one could anticipate an additional 10% new damage…SVT wasn't really designed to come apart easily.

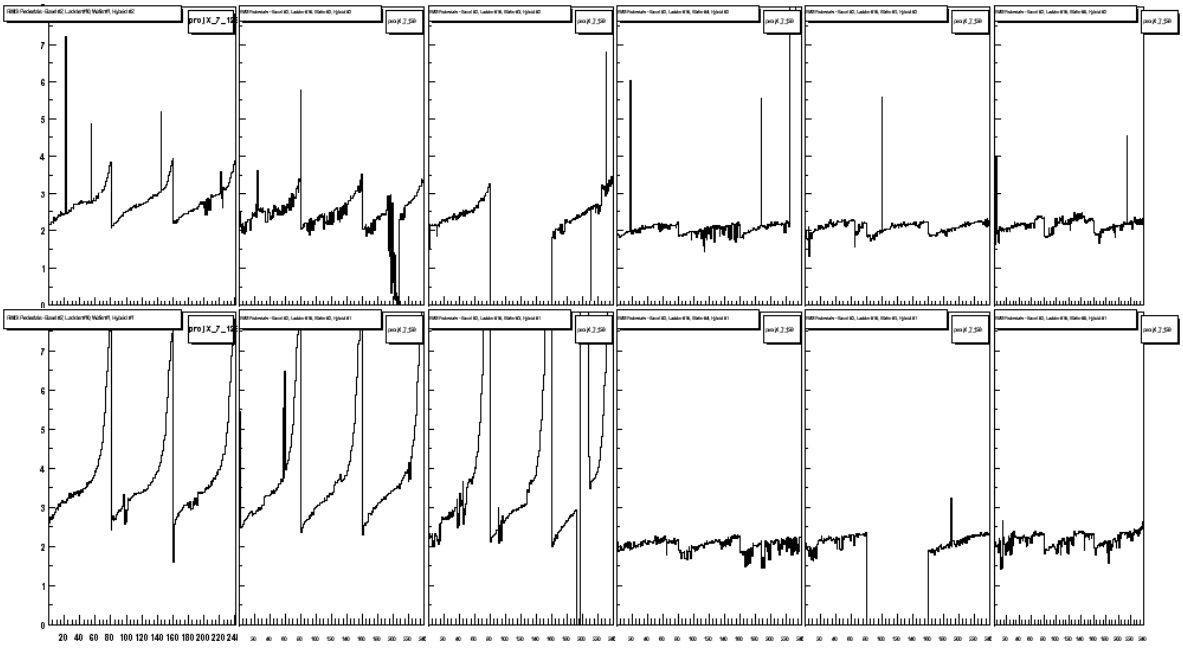
Conclusion: Will probably not want to attempt to repair SVT unless failures are too large for physics and the dominated by "grouped" failures.

Example of a Grouped Failure, East Ladder L10B02

Pedestals Ladder 10 Barrel 2



Projected Noise Ladder 10 Barrel 2



Possibility of Building New Ladders

Original SVT construction plan called for fabricating enough spare parts to build three spare ladders. (Six distinct types of ladders exist so could not build during original construction)

- **Spares of irreproducible parts**

  Exists enough **detectors** (though quality is uncertain)

  Will exist in a couple of years enough **hybrids** (spare production continuing slowly)

- **Spares of expensive but reproducible parts**

  Beryllium detector carriers

Long 7 detector	1 spare
Short 7 detector	2 spares
Long 6 detector	1 spare
Short 6 detector	none
Long 4 detector	1
Short 4 detector	none

- **Replaceable parts**

  Many other parts are missing but can be reproduced with effort.

Conclusion: It is possible to build three more ladders if necessary

Possibility of Building New Ladders(Continued)

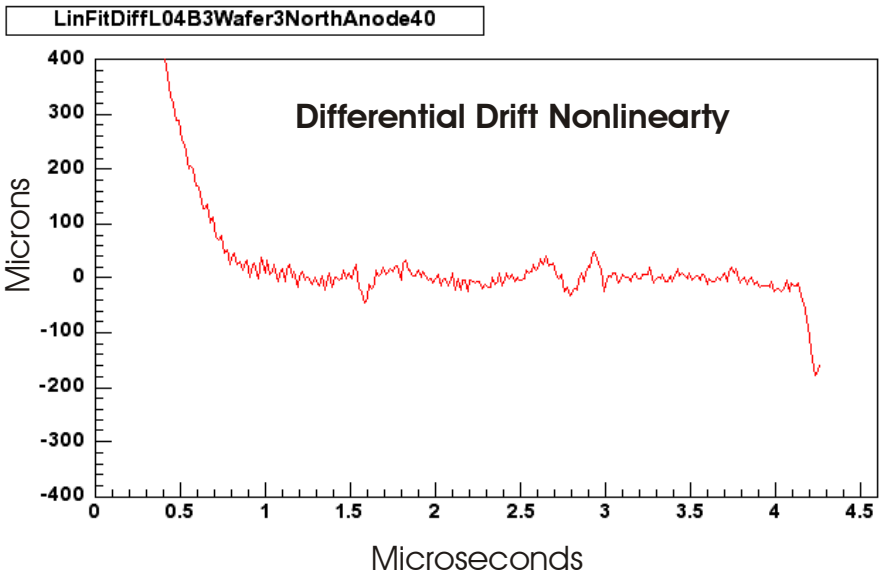
But…

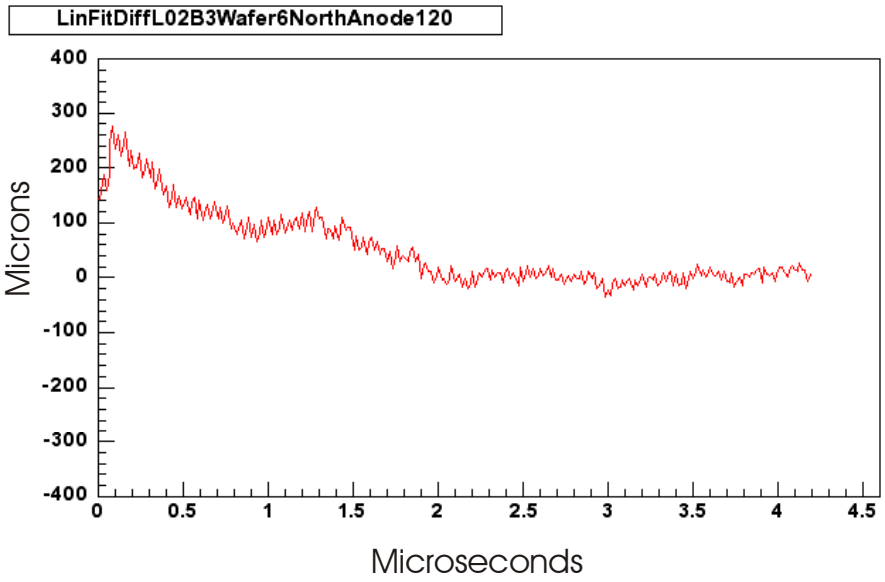
- Effort to fabricate enough parts is non-negligible
- There are six distinct variants of the ladders and we likely would not know which ones to build until after SVT was disassembled for repairs.
- Note that 3 ladders is on the average 3/36= 8% of the SVT. Currently no ladder is more than half bad, so replacement would at most be 50% effective in increasing number of good channels, i.e. we may only gain an increase of 4% good channels.

Conclusion: Building the spare ladders is likely to cost a lot of time, effort, and maybe $ for not much gain in working channels.

SVT Performance.

- Best current estimate is that the residuals in both z (anode direction) and r-phi (drift direction) are on the order of **100-150 um**.
- I expect that ~**50 um** should be possible in z. (**70um = anode pitch/√12**)
- Resolution in drift direction should improve (currently a linear drift is assumed.) There exist laser calibrations of drift distance vs. time for all ladders that soon will be used.
- Two laser calibration examples demonstrating non-linearity is shown below.





SVT Performance (continued)

- Alignment should improve with AuAu data from upcoming run.
- But residuals will only likely to improve if there is a good physics motivation to drive the hard work necessary for improvement (high pt AuAu physics? Improve minimum distance from primary that one can look for V0s in AuAu?)
- Currently SVT seems to provide a slight increase in strangeness than is found than with just TPC alone (~ 30% increase) in pp.
- Presumably SVT should help more with strangeness reconstruction in AuAu.

Conclusion: SVT is working as well as it ever will and improvements (in residuals) will only come in software and analysis if there is good physics motivation.

SSD Expected Performance

Installation

- 2002 Test Ladder Installed (Will be modified in future to serve as single spare ladder)
- 2003 10 Ladders (out of total of 20) Installed——1/2 SSD installed
- 2004 10 more Ladders to be installed ————————Full SSD installed

Resolution

Double sided strip detectors with 95 um pitch and 35 mRad stereo angle implies resolutions of:

20 um in r-ϕ 800 um in z

Readout Rate

- Expected to be 130 Hz---limited by parallelism, i.e. number of cone cables and readout boards.
- Potential Future readout rate=2.6 kHz

  —Requires one Readout board/ladder and re-cabling the cone. (Gains factor of 10)

  —Requires that it not necessary to send zeros to fill receiver board ASICs. (gains factor of 2)

Conclusion:

SSD may be a viable candidate to remain after DAQ upgrade. It depends on whether it is still sufficiently alive and whether it satisfies new physics requirements.

Summary

- SVT working reasonably well
- Hope that the percentage of working channels remains high enough until DAQ1000 ends the SVT's useful life.
- If not, decision to repair depends on nature of failures and anticipated benefits.
- SSD has potential future after DAQ1000 depending on performance and new physics goals.