Test Run SVT Performance

Omar Moreno

Santa Cruz Institute for Particle Physics
University of California, Santa Cruz
omoreno1@ucsc.edu

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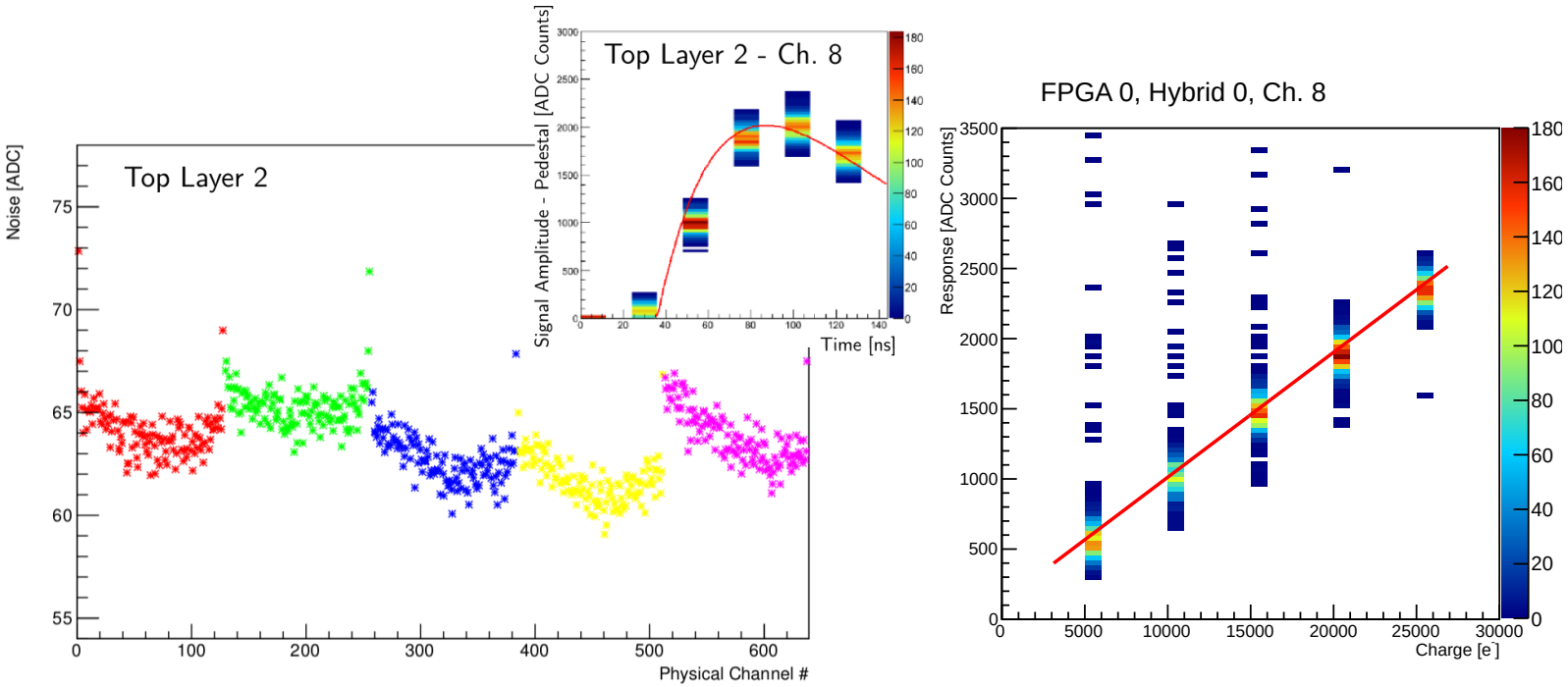
Overview

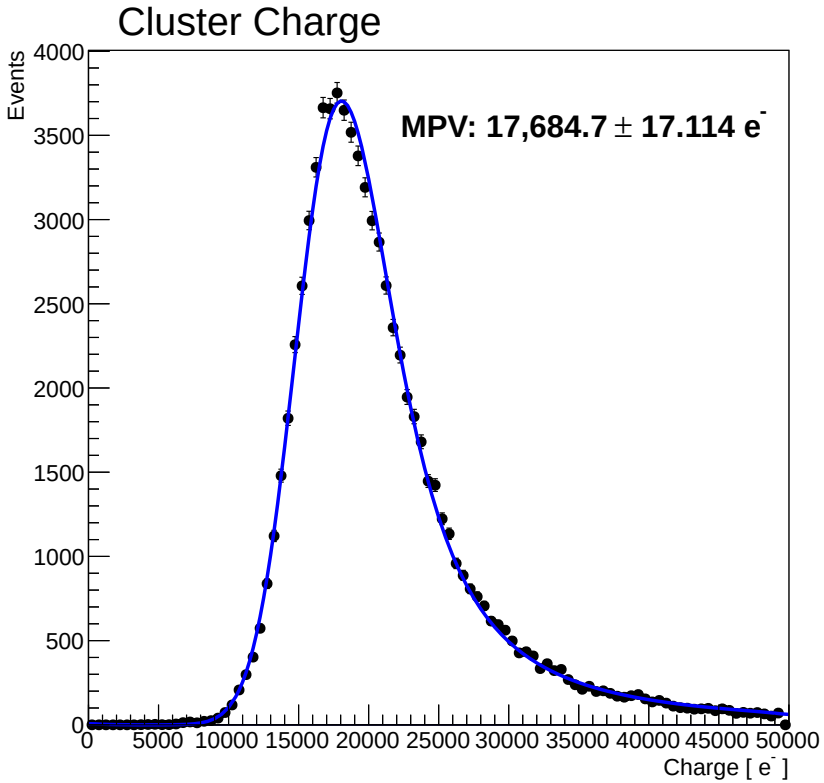
SVT Calibrations

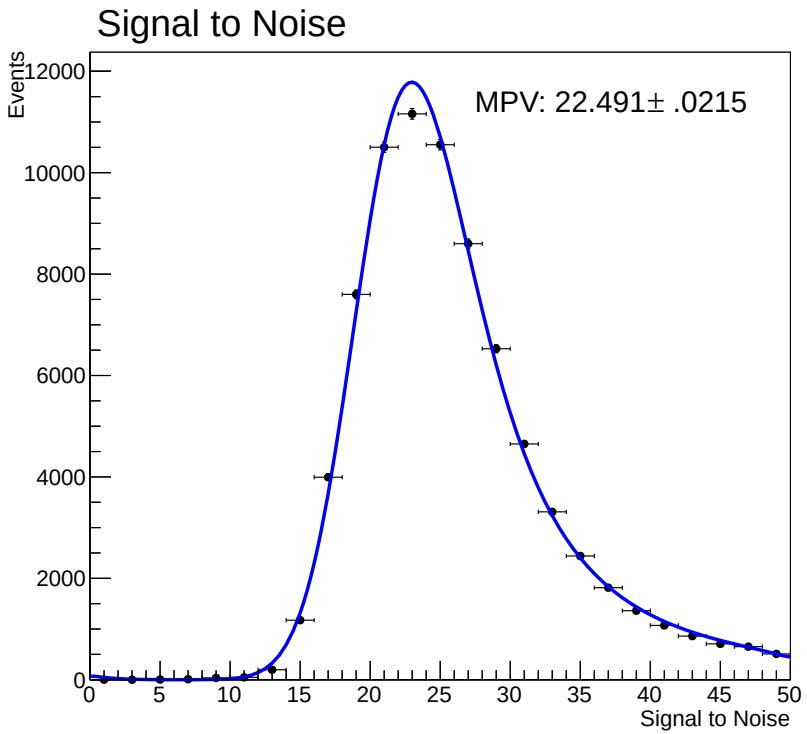
- All calibration runs were taken with the SVT hybrids and readout chips configured to their nominal operating points and sensors reversed-biased to 180 V
- A noise level in the range of 60-69 ADC counts was established
- The internal calibration circuitry of the APV25 was used to determine the signal response along with its scaling with input charge
  - Charge scaling was found to be linear up to 3 MIPs



Cluster Charge and Signal to Noise

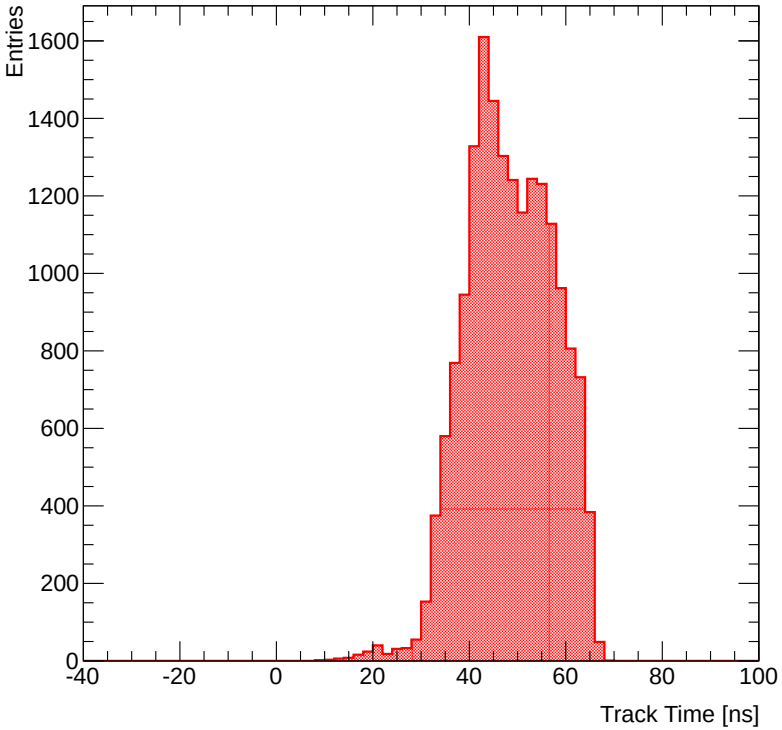
- The APV25's were operated in "multi-peak" mode which allowed for six signal samples to be read out per channel per trigger
  - The signal amplitude and t_0 or a hit are extracted by fitting the samples with an ideal CR-RC function
- The resulting cluster charge distribution has a peak at 17,684 e^- (expected $\sim$ 24,000 e^-) $\Rightarrow$ charge scale is likely wrong and will be investigated soon
- The signal to noise ratio is 22.491

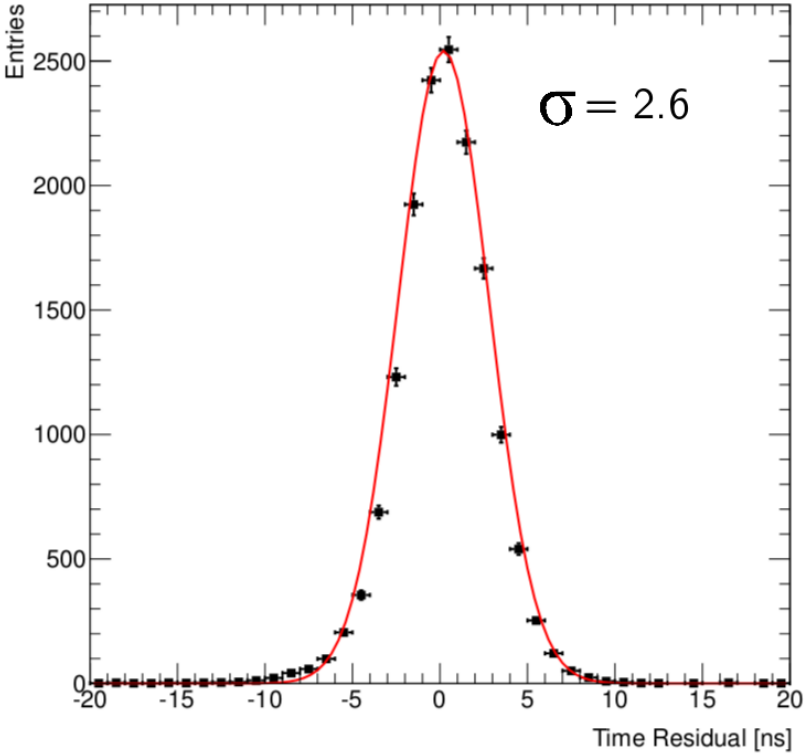




t_0 Resolution

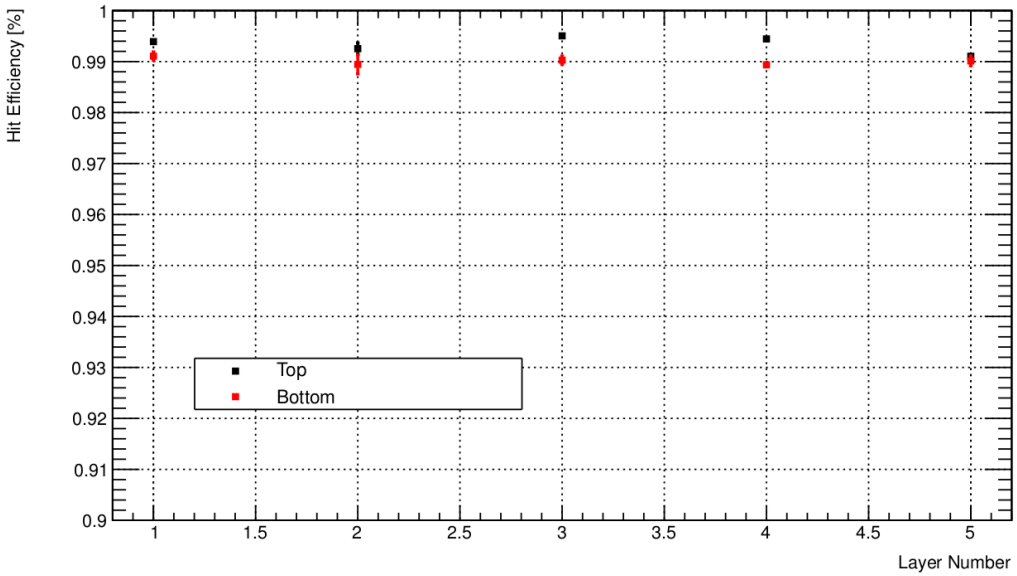
- The hit time of each of the clusters is obtained by computing the amplitude-weighted average of the fitted t_0 times
- The t_0 resolution was studied by comparing the cluster hit time to the average hit time of all cluster hits composing a track (Track Time)
- After correcting for offsets for each sensor, the t_0 resolution was determined to be 2.6 ns





Single Hit Efficiency

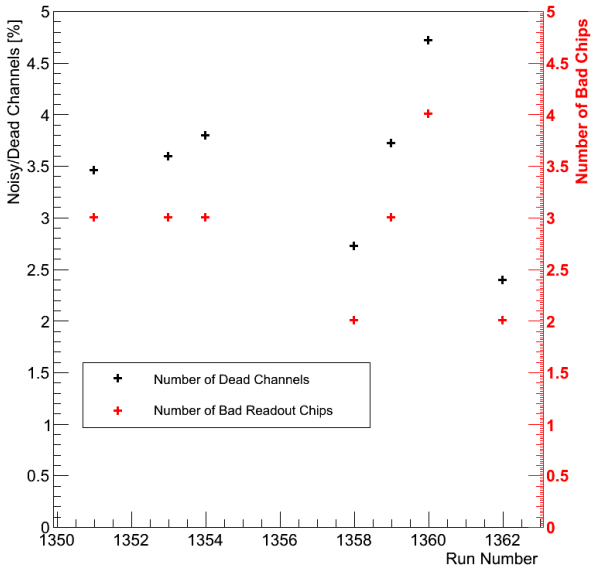
- Tracks are fit using only four SVT layers and then extrapolated to each of the sensors absent from the fit
- If the track is found to lie within the detector acceptance, a search for a hit within that layer was conducted
  - Tracks which intersect known bad channels or its neighbour were dropped
  - All tracks which intersected the edge of one of the sensors were dropped
  - All known bad regions of a sensor were excluded

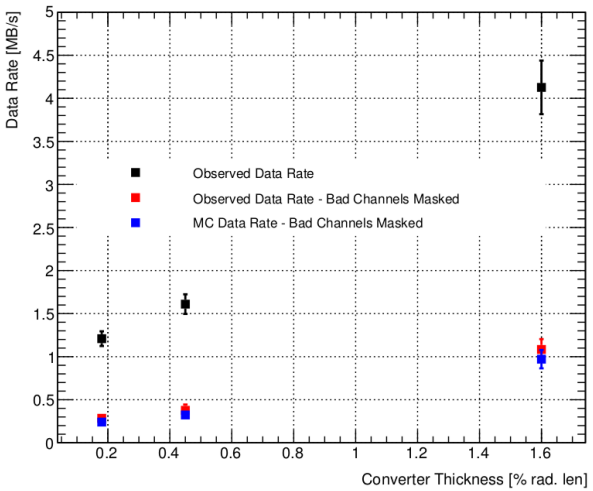


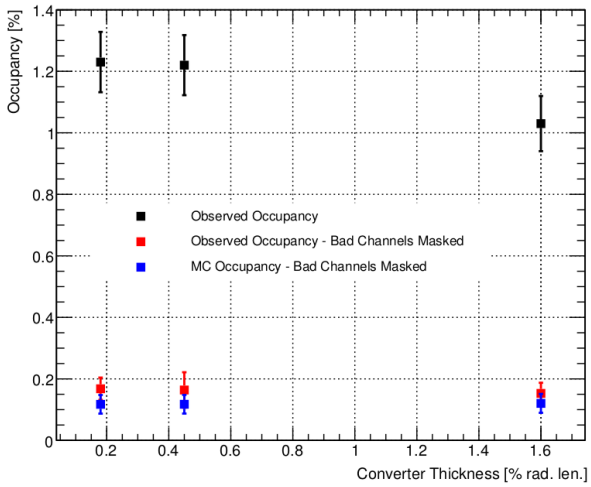
- Hit efficiencies, excluding known bad regions of a sensor, were measured to be above 98%

SVT Data Rates

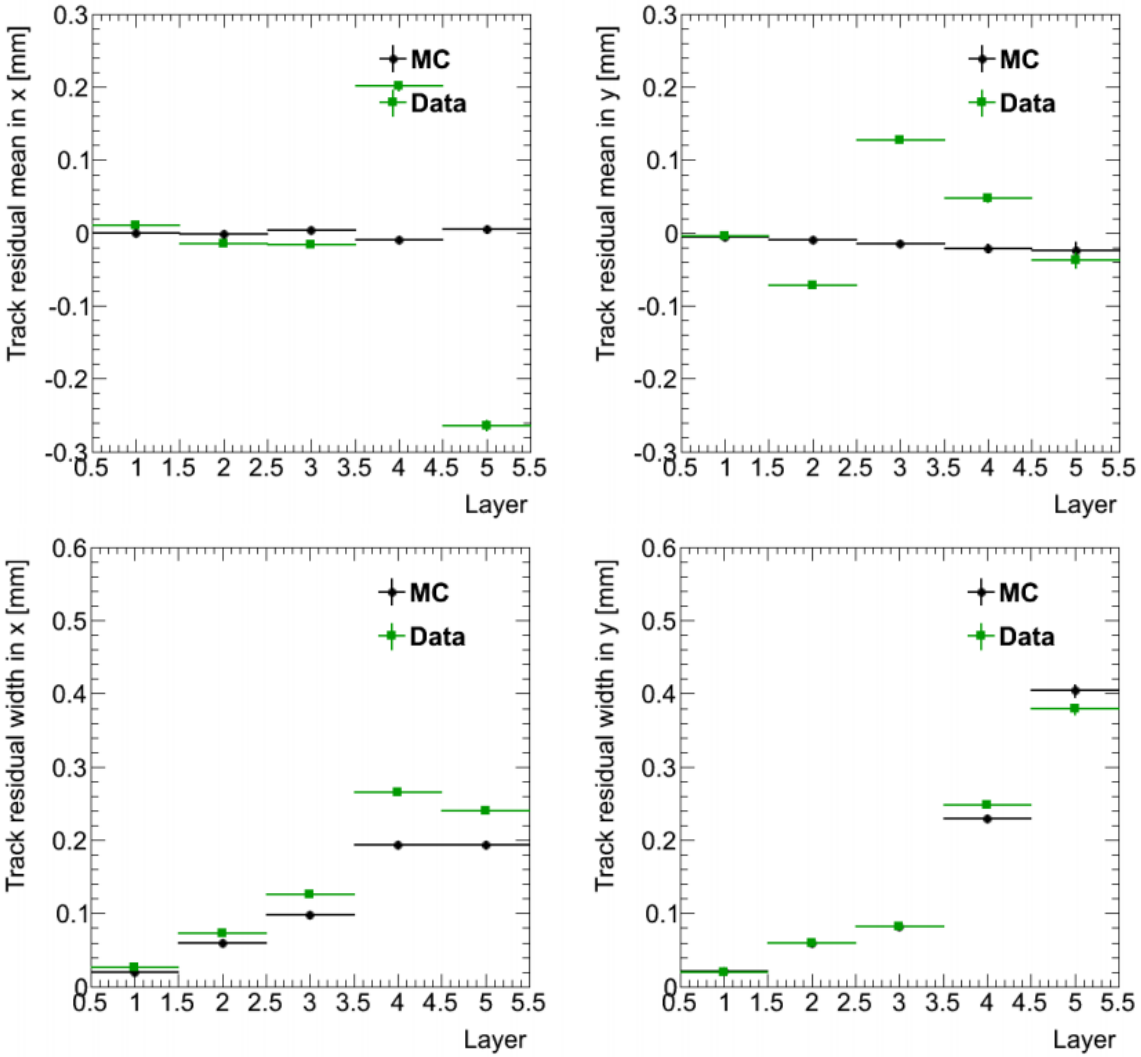
- During the Test Run, the number of noisy/bad channels varied from 2% to 4.5% from run to run
  - A majority of the bad channels were caused by misconfigured chips, a chip whose pedestals shifted and a noisy sensor (bottom layer 3)
- The number of noisy channels resulted in a readout rate that was higher than expected $\Rightarrow$ max $\sim$ 4.1 Mb/s
- The occupancies in the SVT ranged from 1% to 1.3%
- Once most bad channels were masked out, the data rate and occupancies were comparable to that expected from Monte Carlo







Track Residuals



- The Test Run SVT was aligned using a combination of optical, laser and touch probe surveys conducted at SLAC and JLab
- The Track residuals (Hit position - track position) indicate that the position of the sensors is correct to within a few hundred microns
- The large contribution from multiple scattering can be seen by the increase in the width with layer

Summary

- The peak of the cluster charge distribution is lower than expected and is likely being caused by an incorrect gain
- After all corrections are applied, the t_0 resolution is found to be 2.6 ns
- The single hit efficiencies for all sensors, excluding bad regions, were measured to be above 98 %
- The occupancies and data rates are as expected once noisy/bad bad channels have been masked out
- The current alignment of the SVT is correct to within a few hundred microns