Analysis of TowerA Am$^{241}$ Data

SVAC Friday Meeting
Face-to-Face
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Do the layer occuppancies, trigger rate, and deadtime make sense in this very high rate data?

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## Tower A $^{241}$Am Runs

<table>
<thead>
<tr>
<th>Config</th>
<th>Source</th>
<th>Alum Absorber [Inches]</th>
<th>Tkr Trigger</th>
<th>Random Pulser Trig [Hz]</th>
<th>Trig Rate Before deadtime [KHz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No</td>
<td>0</td>
<td>No</td>
<td>1000</td>
<td>1.</td>
</tr>
<tr>
<td>2</td>
<td>Yes</td>
<td>0</td>
<td>No</td>
<td>1000</td>
<td>1.</td>
</tr>
<tr>
<td>3</td>
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<td>0</td>
<td>Yes</td>
<td>0</td>
<td>54.</td>
</tr>
<tr>
<td>4</td>
<td>Yes</td>
<td>.125</td>
<td>Yes</td>
<td>0</td>
<td>44.</td>
</tr>
<tr>
<td>5</td>
<td>Yes</td>
<td>.25</td>
<td>Yes</td>
<td>0</td>
<td>23.</td>
</tr>
<tr>
<td>6</td>
<td>Yes</td>
<td>.125</td>
<td>Yes</td>
<td>0</td>
<td>6.5</td>
</tr>
</tbody>
</table>
1) A 60 KeV x-rays makes a 58 KeV electron in Si via the photoelectric effect.
2) Elec dE/dx to rest in <30um (erratic path).
4) Most of the time, blob goes to one Si strip.
5) All pulses are the same height if preamps have same gain.
6) All have same time above threshold if Hiro sets disc at a constant frac of MinI.

\[
\begin{align*}
\text{MinI} &= 115 \quad \text{[Kev]} \\
\text{Exray} &= 59.5 \quad \text{[Kev]} \\
\text{DiscLevel} &= 31.6 \quad \text{[Kev]}
\end{align*}
\]

![Diagram showing Tracker Preamp (GTFE-G) Output with V_{si(t_i)}/V_{si(t_{si\_peak})} vs. pulse height in [Kev] and t_1 vs. flux over time.](image)
TOT Plots

135000990: Source 0”, No Tkr Trig, 1 KHz Pulser

TOT says pulses are only over for 20 ticks = 1.0 usec (not 5.2 usec ???)
Layer Average Cluster Occupancies

1) No tracker trigger, only 1 KHz random pulser.
2) Blue points: Am source with 0” alum absorber - Black points
3) Red curve is a calculation based on source strength, material transmissions, distance from source, and 60 Kev pulse time over threshold.
4) Black points are for No Source.
Am Source 0”
No tracker trigger
1 KHz random pulser.

Blue= Ratio of sequential layer occupancies

Red= Calculated ratios

Layer 10 data corrected for having only .75 the time over threshold as the other layers - as seen in TOT.

The other layers also look like they are not exactly 5.2 usec and need TOT corrections.
The Tkr Trig rate (before dead times) depends on the Layer Multiplicites and the time over threshold of a pulse.

**Red** = Tkr Trig Rate based on calculated Layer Multiplicites.

**Black** = Measured rate from slope of “GEM Delta Event Time” distribution

**Blue** = Event rate to tape

Aluminum absorber thickness [inches]
Source, Tkr Trig, No Pulser

0” (54 KHz)  .25” (23 KHz)  .5” (6.5 KHz)

1) Should be a nice straight line for a Poisson process (rate=1/slope)
2) For >6.5 KHz, back pressure from EGSE tape writing causes weird deadtimes.
3) As expected, at the far left of each plot is 26.5 usec deadtime with no events.
4) The initial slopes at the far left are straight lines and agree with the trigger request rate calculated from the occuppancies.
Some Conclusions

1) Tower A endured 54 KHz of trigger requests (~4 min of data taking) and wrote tape at 6 KHz without crashing DAQ.

2) Layer occuppancies predict the same 54 KHz seen in the GEM dt slope.

3) Layer occuppancies agree with the material present, expected pulse time over threshold, ~source strength.

4) Don’t understand why TOT only shows 1 usec pulse time over threshold.

5) The EGSE DAQ saturates tape writing at 6 KHz.