Plugging in your Offhand

Part II

By Konrad Powers

In the first part of this article I explained how electronic trainers, like the NOPTEL, are used and some of the obvious ways to get information from them. This time I will go beyond the raw scores of my 360 offhand shots and look at the numbers behind the shots.

Breaking Down the Data

It is certainly easy to be overwhelmed with the amount of data that the NOPTEL can output for even just one shot. Some of these are listed below.

- **Date, Shot number and Series number**
- **Hit Value & Location**
- **Total Time spent on target**
- **Time interval between shots**
- **X and Y standard deviations of hold**
- **Location of center of aim**
- **Time location of triggering decision**
- **Rifle movement during triggering relative to pre-triggering movement**
- **Percentage of time the hold spent within an X-ring sized circle**
- **Percentage of time the hold spent within a 9-ring sized circle**

The majority of these numbers are captured during what the NOPTEL calls Statistical Time. The Statistical Time is the time period before the shot when data is captured and stored. This is easily adjusted when setting up the NOPTEL session. For all of my sessions the Statistical Time is 3.0 sec.

To analyze this data I wanted to find out what makes one shot a 9 and another shot a 10. What is the difference between these two shots? To do this I decided to separate all the shots in my population into two groups, good and bad. The shots that I regarded as “good” were the Xs and the 10s. The “bad” shots were the 9s and 8s. When I output the statistical data from the NOPTEL there were two shots (a 9 and a 10) out of the 360 with garbled data. I discounted these shots so that brought my total shot population down to 358 shots, 275 good and 83 bad.

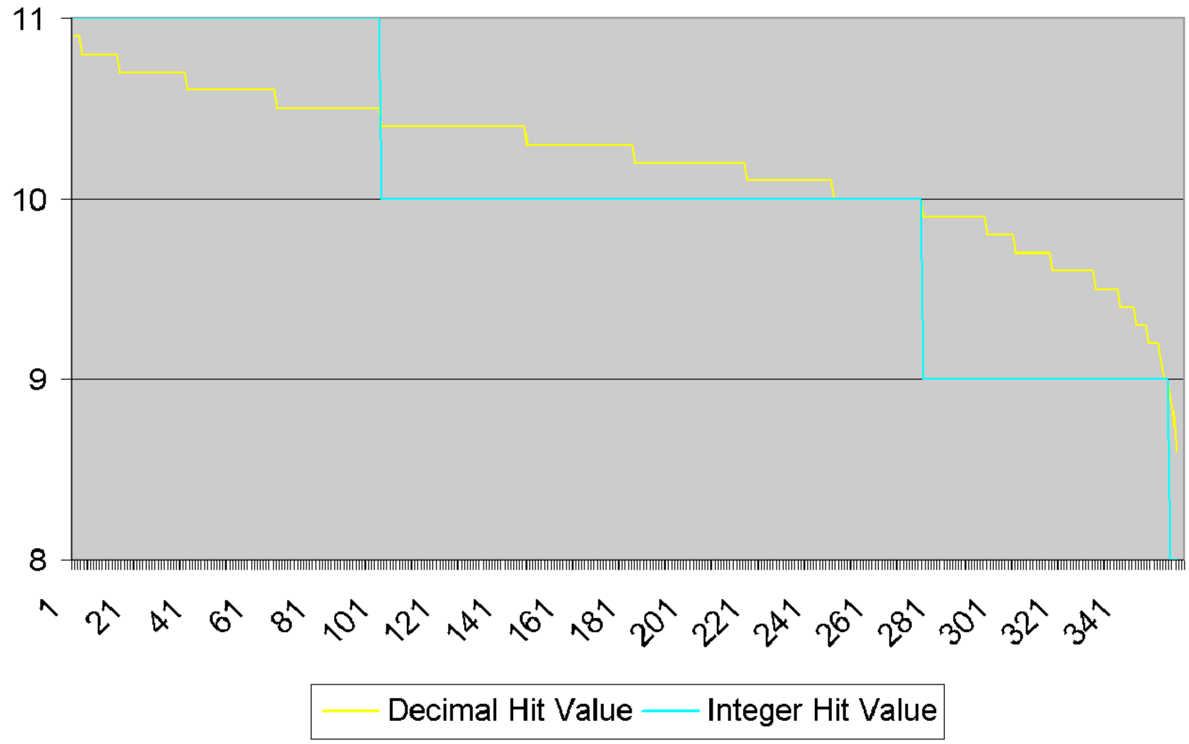

Chart 1

Chart 1 shows all 358 shot hits plotted simply according to score. The decimal values and their integer equivalents are plotted. To call out the Xs I plotted them as 11s. The highest scoring shots are on the left and the shot values decrease as we move to the right. Out of the entire population, I had three shots that were a perfect 10.9. The most numerous shot values were 10.4 and the worst shot value was an 8.6.

As you can see, the break off from good shots to bad shots comes at shot #276. This means that in my examination of “good” vs. “bad” shots, I wanted to see what the difference was between the shots to the left of this point and to the right of this point.

Spending the time to analyze all of the data from each shot would take far too long. So, in the interest of efficiency I needed to decide what part of my shooting technique to examine. Then, I could focus on the data for that particular part. My decision was to examine the two fundamentals of shooting standing, Hold and Trigger Control.

Hold

Remember that hold is the overall size of our wobble area. During the shot sequence, we approach the target from a given point. From that start point the sights are brought to another point that gives us a sight picture acceptable enough to fire. Some shooters bring the rifle from their start point to the shot break point all in one motion but I have never been comfortable shooting on the move and consequently, my shot sequence looks like the hold in Figure 3.

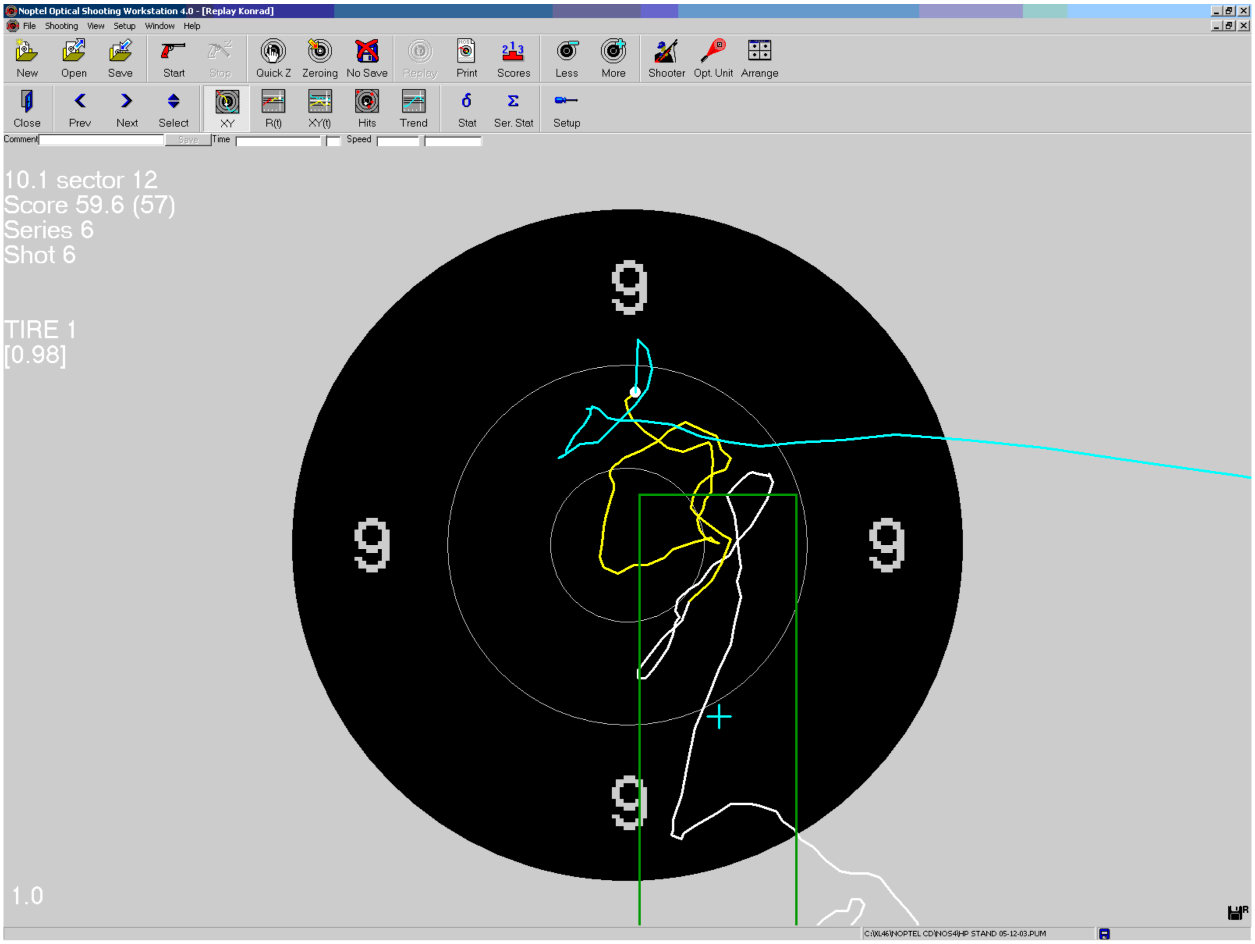

Figure 3

You'll notice that, initially, the rifle approaches the target from the bottom and then slows down. At this time I'm trying to find that satisfactory sight picture and shot position. Since I use a center of mass hold, I'm trying to get the top of the front sight post to cut the sighting black in half. To get to this point I attempt to get the rifle to hold still long enough so that I can break the 4-½ pound trigger.

We can also look at this same shot using one of the NOPTEL replay modes called the R(t) mode. In R(t) mode the rifle movement is shown as an absolute distance from the center of the target with respect to time before the shot breaks. In the Figure 4 example the horizontal dashed line just above the undulating curve represents the center of the x-ring. Any part of the trace that touches that line means that the rifle was pointed at the exact center of the target at that point in time.

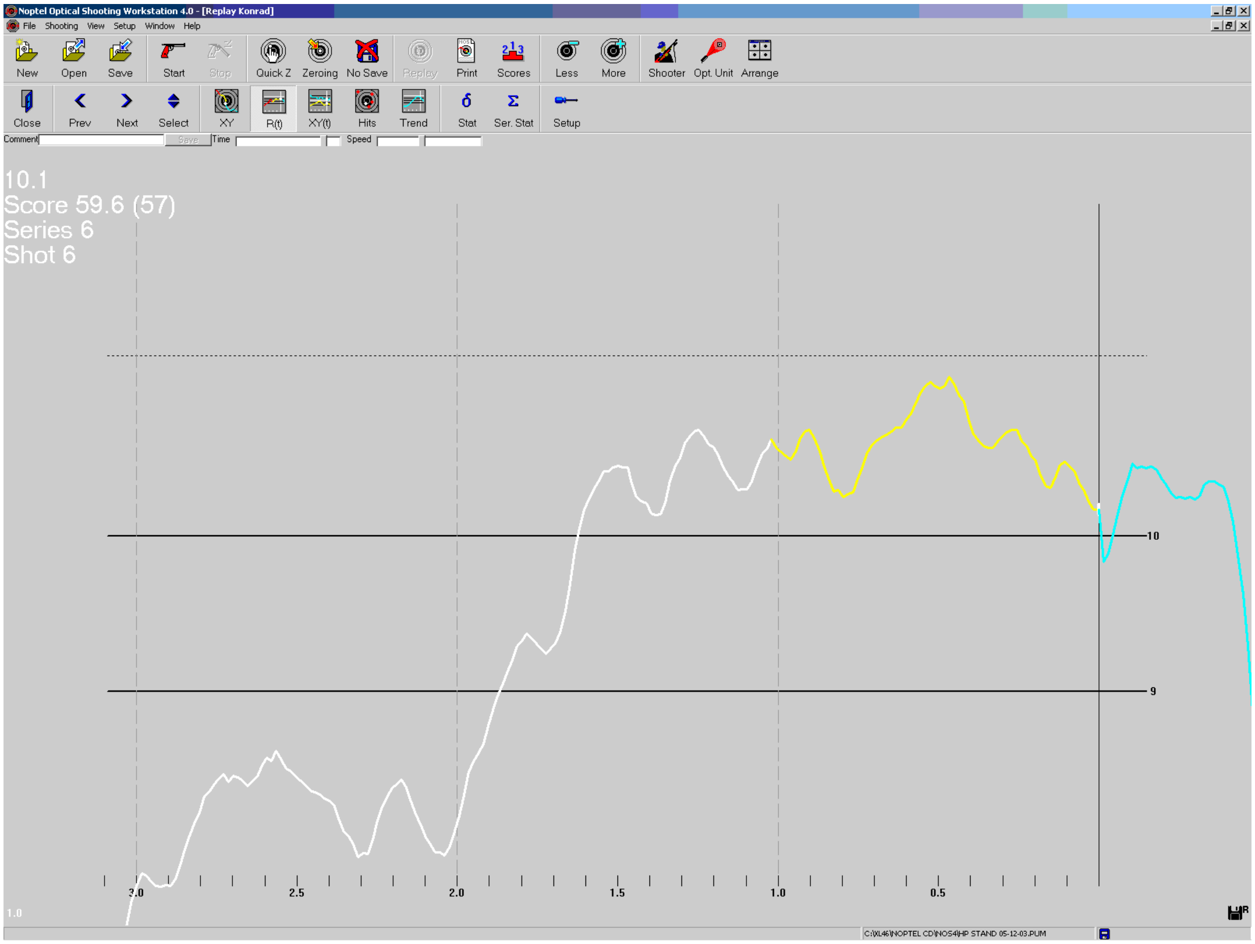

Figure 4

In R(t) replay mode, consistency of hold is represented by the flatness of the curve and aim is represented by the closeness of the curve to the dashed line. In our example shot, the approach to the target can be seen as a drastic movement towards the center (from –2.0 to –1.5 sec. of statistical time). Once the rifle is relatively close to the target center, the hold flattens out. Note that if the shot were fired any time the trace was above the 10-ring line the hit would be a 10. As you can see in Figure 4, I spent a fair amount of time within the 10-ring (about 1.6 sec.) before I fired the shot. Usually when this happens I see the good sight picture but for some reason I can't seem to make the shot go. This may be because I don't have confidence in breaking a clean shot with good trigger control at that particular time.

An important piece of information to be gleaned from this graph is at which point did the shot reach its highest position before the shot break. Put another way, how long before the trigger break did the rifle aim get closest to the center of the target? In the Figure 4 example this point was reached about 0.45 sec. before the trigger break. Ideally, the highest point will be reached at the same time the shot is let go. This may happen on a few shots but if we average the traces for multiple shots that goal is impossible to achieve.

Statistically, the NOPTEL measures hold by taking samples of where the rifle was pointing during the Statistical Time. These samples are converted to X and Y coordinates. From these numerical coordinates the software gives a standard deviation (SD) along both axes. In this case, the actual SD number is a percentage of the width of the ring on the target. But for our purposes all we have to know is that the SD is related to the hold, the larger the SD, the larger the hold along that axis.

For my entire shot population of 358 shots my average SD in the horizontal was 0.61 and in the vertical the average was 0.90. This tells me that my vertical hold movement was 48% greater than in the horizontal direction. This discrepancy between horizontal and vertical movement is called an asymmetric hold. I attribute this to the way I approach the target. I start high and come down below the target. Then, slowly bring the sights up to the middle. In analyzing this movement I find that I'm comfortable approaching the target from a direction that I can see the full size of the sighting black. Therefore, even if I start above the target, my sights come down past the sighting black, below the target and then ascend to the middle. All of this extra vertical movement is reflected in the higher Y-direction SD.

To look at the overall hold size we can take the root mean squared of the X and Y SD components,

$$S = \sqrt{SD_x^{\ 2} + SD_y^{\ 2}}$$

This "S" value is an indication of the overall hold size without specific regard for direction. By plotting this S value with the hit values we can see if there is any correlation between the hold and final shot placement.

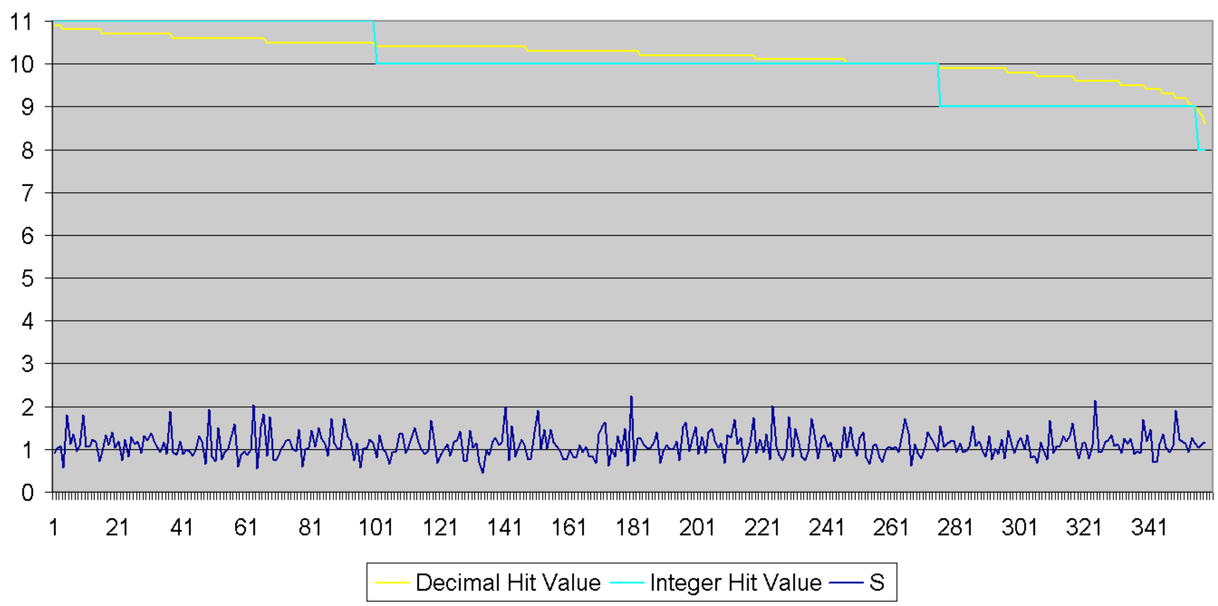

Chart 2

A glance at Chart 2 shows that there doesn't seem to be a trend in S that would explain the change from "good" shots to "bad" ones. The overall size of my hold seems to be pretty consistent whether the shot is within the 10-ring or outside of it.

Trigger Control

The NOPTEL measures trigger control with two indices, TIRE and RTV, both of which require a little explanation. Recall the R(t) replay of a shot from Figure 4. You can see that the plot starts off in the 8-ring and then approaches the center. It settles in the 10-ring and reaches a high point. But about 0.45 sec. before the shot break, the plot drops, which means that the rifle moved away from center and then the shot broke.

The NOPTEL takes the last 0.6 seconds before the shot and divides this time into three equal length segments. It then looks at which of these 0.2-second segments contains the high point of the shot. This high point is the closest the rifle got to the center of the target during this 0.6-second phase. If the high point is contained in the segment from 0.6-0.4 sec. before the shot, the TIRE value is 1. If it's the second segment (0.4-0.2 sec. before the shot) the TIRE value is 2 and the third and last 0.2-second segment makes the TIRE value 3. In the example shot in Figure 4 the TIRE value is 1 because the high point is at 0.45 seconds before the shot break and therefore in the 1st segment. Having a TIRE value of 3 is advantageous because there is less time for the shot to go astray.

Plotting the TIRE values along with the results for all the shots gives us chart 3,

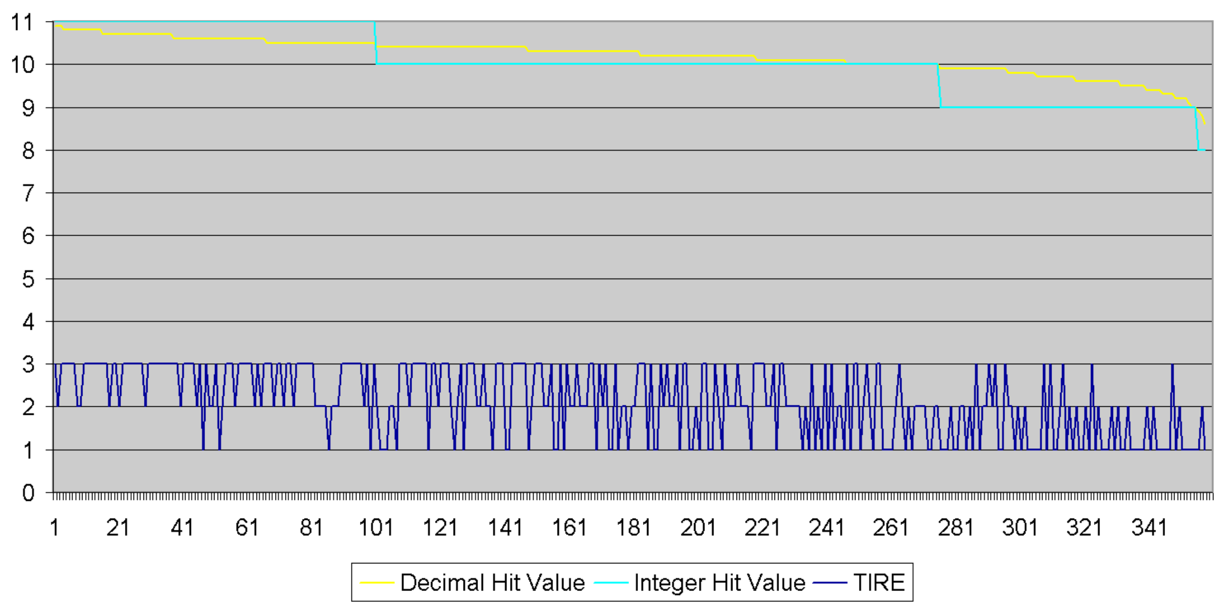

Chart 3

We can see from chart 3 that the TIRE values are predominantly 3 for the shots that resulted in an X. Once we move into the area that were the 10s, we can see an increase in the number of shots with TIRE 2. Shots outside of the 10-ring (#277 and greater) have relatively few TIRE 3 values.

Relative Triggering Value (RTV) is the second trigger control index. It is a measurement of the rifle movement in the last 0.2 seconds before the shot breaks relative to the movement of the rifle in the 0.8 seconds previous to this. Mathematically, this is expressed as,

$$RTV = \frac{\text{movement in last } 0.2 \text{ sec.}}{\text{movement in previous } 0.8 \text{ sec.}}$$

If this RTV value is 1.0, the movement during triggering was the same as the pre-triggering movement. An RTV value of greater than 1.0 means that the movement during triggering was greater than it was before triggering.

What all this means to us highpower shooters is that an RTV of greater than 1.0 is indicative of added rifle movement during triggering. A lot of times this is caused by pulling on the trigger in such a way that the trigger pull itself moves the rifle. Other causes of this excess movement is flinching or anticipating the shot.

Chart 4 shows the RTV values of all the shots relative to their results. The shots with the better hit values are to the left.

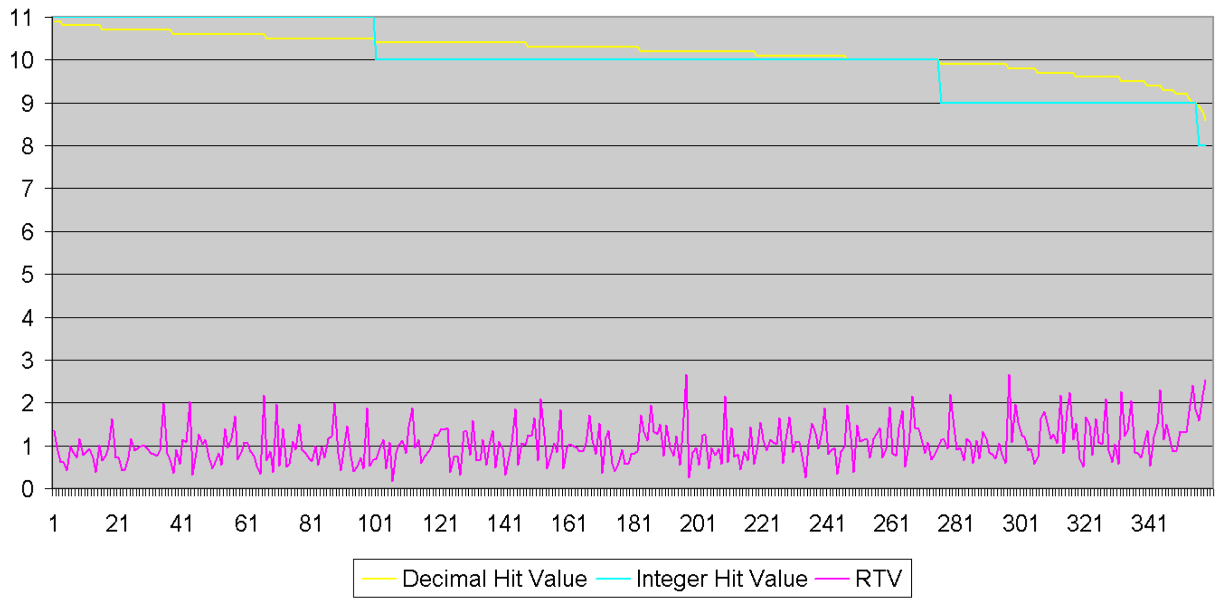

Chart 4

Although very subtle, there is a definite upward trend to the RTV plot as it moves to the right, especially when we reach the good/bad threshold. The average RTV for the "good" shots is 0.98.

The average for the “bad” is 1.27. These numbers show that shots within the 10-ring had a wobble during triggering just as good as before triggering, while the shots that were out had an increase in movement just before the shot break. This was most likely caused by a less than clean trigger break.

Conclusion

By understanding the data that we can extract from an electronic trainer like the NOPTEL, an analysis of shooting technique can be done. This analysis can be done on several parameters depending on which technique is of interest. In my case, I was most interested in the Hold and Trigger Control of my standing position. By using the NOPTEL for several sessions of many shots each I had, I felt, a large enough population of shots to see if there were any trends in my shooting.

I compared my hold for shots that wound up in the 10-ring to the shots that were out of the 10-ring. There did not appear to be any pattern that would indicate one quality of hold with “good” shots and another quality of hold with “bad” shots. Even so, I did notice that I have an asymmetrical hold with greater movement in the vertical direction.

There WAS a discrepancy between “good” and “bad” shots when it came to trigger control. During a “bad” shot my aiming point degenerated during triggering. These shots were characterized by satisfactory aim during the hold, but a quick degradation of hold while triggering took place.

In my particular case it seems that trigger control cost me more points than hold did. To improve my standing scores further I need to develop a way to break shots cleaner with less disturbance of the rifle. This may also have a side benefit in that I would have the confidence in breaking shots faster. If I can do this, then I have more time to concentrate on my hold and improve it further.