

Determination of Right HRS Vernier Sign

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There was some confusion this week when attempting to set the Right HRS angle for four-pass production. The difficulty arises from a lack of clarity of the sign of the vernier. On the Left HRS, the sign can be easily determined.

The set angle (in degrees) of the spectrometer is determined from the floor marks and corresponding vernier value as follows:

$$\theta_0 = \theta_{floor} + \frac{ver.}{173.7} - 0.179 \quad (LHRS)$$

$$\theta_0 = \theta_{floor} + \frac{ver.}{173.7} + 0.197 \quad (RHRS).$$

From these equations, we can see that moving the spectrometer to a larger angle will increase the vernier value of the given floor mark. Figure 1 shows a picture of the Right HRS floor mark/vernier at a specific angle during the Fall 2016 run period. The floor mark of 48.50° can be seen near the middle of the figure, and the floor mark of 48.75° can be seen near the left edge of figure. If the spectrometer is moved to a larger angle, the floor marks will be shifted towards the right. Comparing to the above equation, this means that more positive vernier values are on the right when looking through the angle camera. We have further confirmed that this is the correct sign convention by examining pointing survey results for the Right HRS.

When setting the spectrometer angle, the Hall A technical staff knows what angle the experiment wants. Then a program will use the above equation to tell them what floor mark and vernier position to set. The problem is that the scratch (or smudge) near the number 20 on the right side of the vernier in figure 1 is interpreted as a negative sign; but this is actually the positive side of the vernier. A photo taken of the Right HRS floor

mark/vernier system can be seen in figure 2. From this photo, there do not seem to be any obvious markings for the vernier sign.

This sign uncertainty caused some difficulty when setting the angle for four-pass production this week. We requested the spectrometer to be set to the angle 53.473° . The program used the above equation and determined the following floor mark/vernier values: floor mark = 53.25 and vernier = +4.5, or floor mark = 53.50 and vernier = -38.9. Because of the sign confusion, the spectrometer was initially set to floor mark = 53.50 and vernier = +38.9 (wrong by almost half a degree).

In conclusion, we believe the vernier needs to be cleaned and the sign accurately marked on all the numbers. For the Right HRS, the positive vernier values are on the right side of the zero mark when looking through the angle camera. For comparison, a picture of the vernier on the Left HRS is shown in figure 3. The negative signs can be more clearly seen here, but even they are beginning to fade.



Figure 1: Screen shot of Right HRS angle camera. Two floor mark angles can be seen, with the larger angle at the left of the plot.

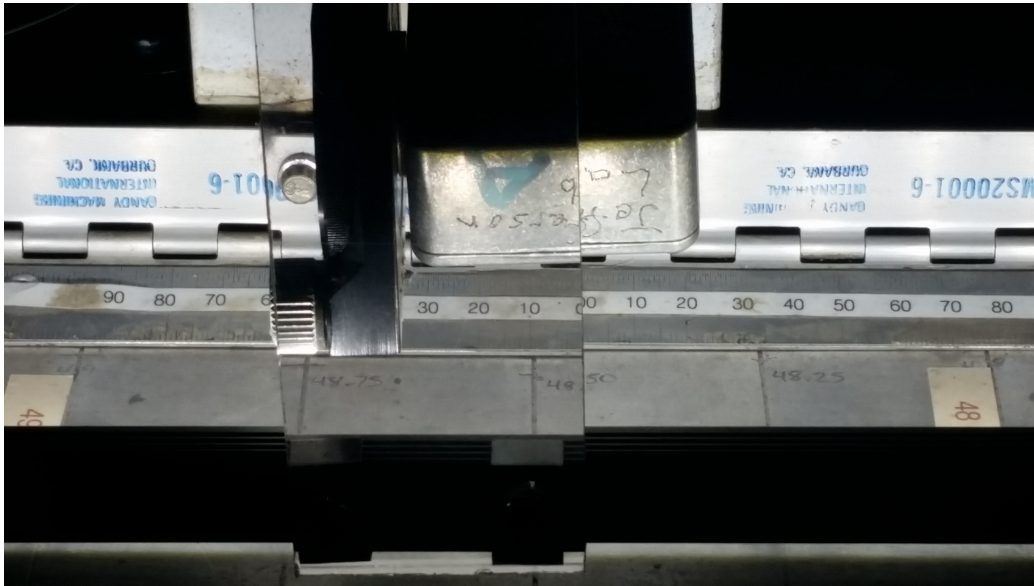


Figure 2: Photo of Right HRS angle system. The distortion in the middle comes from the camera holder.



Figure 3: Photo of Left HRS angle system. The more negative vernier values correspond to larger floor mark angles, in agreement with the equation in the text.