Beams-doc-1775-v1
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Hand Triggered TBT Data With the Upgraded Tevatron BPMS

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Abstract

In Beams-doc-1757 a problem is shown with injection turn by turn measurements. This note shows that a similar problem occurs in hand triggered turn by turn measurements done in the middle of an HEP store. Since we can now reproduce the problem at times other than injection, we now have more handles with which to trouble-shoot it.

1 Introduction

Pages 17-32 of the March 27 data in Beams-doc-1757 show the data from the B3 house. For all BPMs in this house, the beam arrives around index 6200 in the injection turn by turn (ITBT) array. For the BPMs in all other houses, and for the B3 BPMs on other shots, the beam arrives at index 9. The source of this problem is not yet understood.

Another feature of the problem is that, if the beam arrives at index n for the two BPMs on the first card in the crate, then the beam will arrive on turn n-2 for the two BPMs on the second card, at turn n-4 for the two BPMs on the third card, and so on. This is also not understood.

These data are consistent with the interpretation that the signal to start digitizing arrived at the Echotek card early. That is, the 2000 or so turns after index 6200 look like the first turns of a shot; they do not look like turns 6200 to 8192 of a shot. Other interpretations, such as confusion in readout or DMA are also consistent with the observations.

2 What We Did

The goal of this exercise was to see if we could reproduce the problem in another environment so that we don't have to wait for injections to perform further tests. The basic idea is to watch for abrupt changes in the "15 Hz" noise oscillations that occur in the horizontal plane.

On the afternoon of April 6, 2005, Jim Steimel took 14 sets of hand triggered TBT data during the middle of an HEP store. Jim arranged to trigger a "simultaneous" TBT measurement at both the A3 and B3 houses and to record the data from these measurements. "Simultaneous" is in quotes because there is a small, fixed but unknown relative delay between the start of the TBT measurements in the two houses. Jim recorded the data for HA32 and HB32 for 14 simultaneous measurements. The ITBT problem occurs on average at about 1 of 11 houses each shot. So, if the problem recurs here, it should happen about 3 times in the 28 examples.

Figure 1 shows an example of data from HA32 and HB32 when everything works correctly. The "15 Hz" noise is visible and close to having the same phase. Most plots aren't quite this nice since the "15 Hz" noise does have a frequency spread and the detailed shape changes with time and position around the ring.

Figure 2 shows the cleanest example of the problem. In the HA32 data, near 6200 turns, there is clear break in the data. The break occurs at index 6172. Unlike the injection TBT data, it is not completely clear if the final 2020 points of HA32 correspond to the first 2020 points of HB32. This interpretation is consistent with the data but not 100% convincing.

Figure 3 shows another example of a problem, this time a break in HB32 near turn number 6240. This time, there is on way to interpret the last 2000 or so points of HB32 as matching the first 2000 or so points of HA32 — the slopes are opposite.

Figure 4 shows another example of what might be a problem in HB32, near turn 6200.

Figure 5 shows an interesting feature in the HA32 data near turn 6200 — there is a cusp in the oscillation. It's possible that the cusp is real and not another example of this problem. However I don't see any other instances of it in the 28 examples I have looked at (14 on each of HA32 and HB32).

There are no other candidates for the problem in the recorded data.

3 Conclusions

We have demonstrated a problem with the hand triggered TBT data taken during the middle of an HEP store. It is likely that this problem is the same problem that occurs from time to time in the injection TBT data. Now that it is known that the problem can be reproduced in a more controlled situation, Jim will work to reproduce it on the test stand.

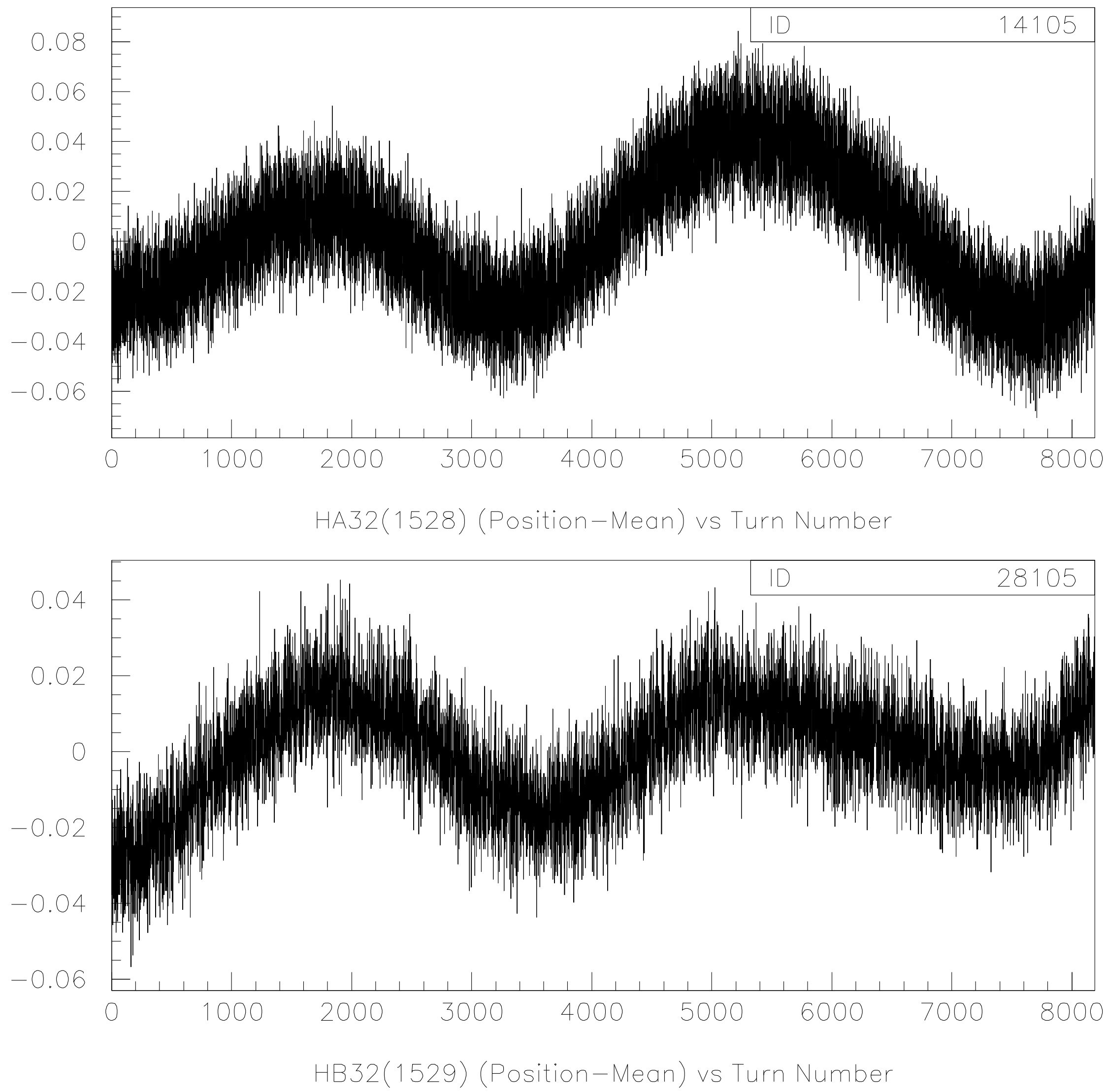

Figure 1: "Simultaneous" turn by turn measurements at HA32 and HB32 for 36 on 36 HEP running. The dominant feature is the "15 Hz" noise. Note that the two curves track each other well. The number in brackets is the time of the measurement in the format (hhmm).

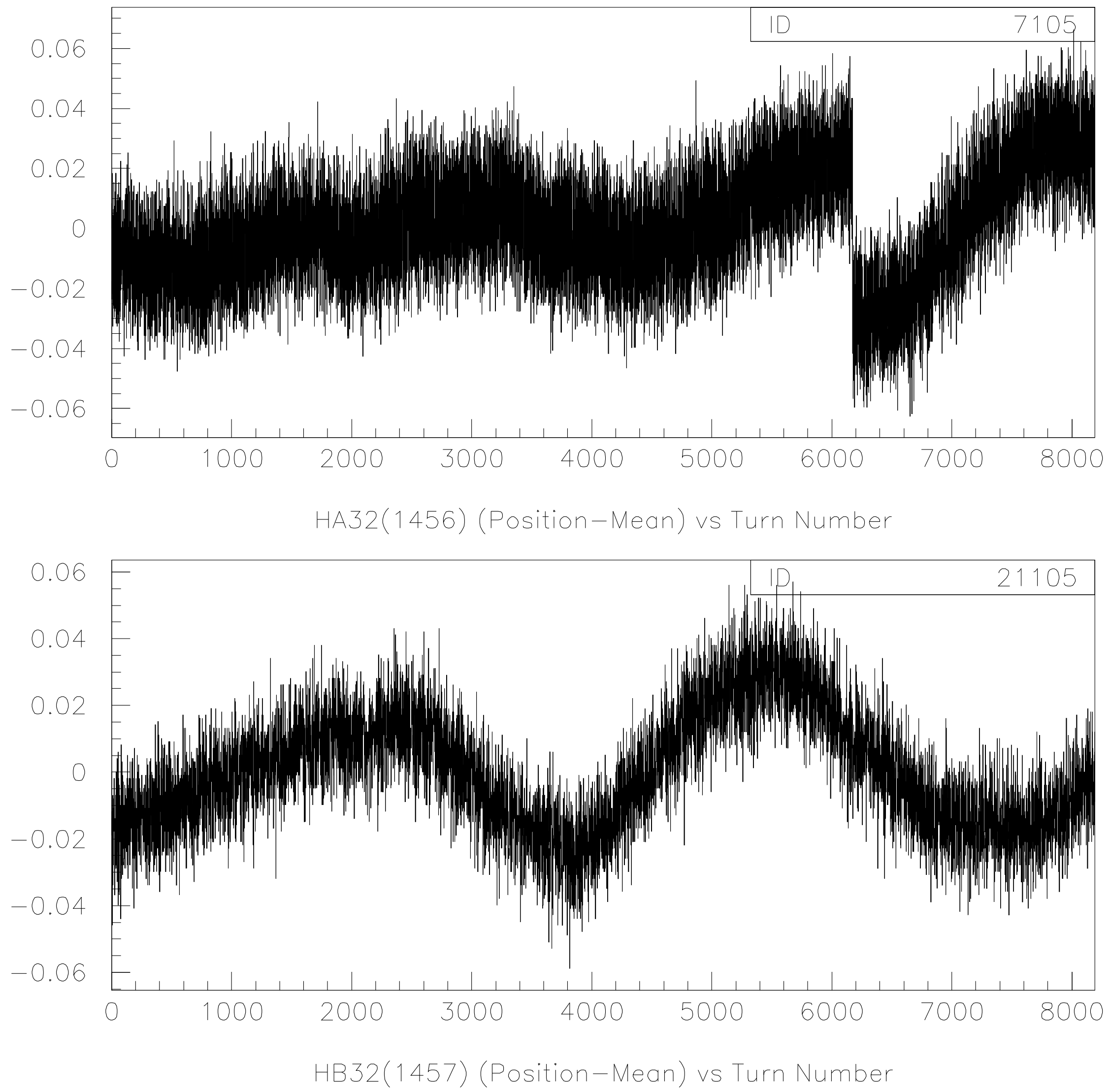

Figure 2: "Simultaneous" turn by turn measurements at HA32 and HB32 for 36 on 36 HEP running. A clear break can be seen in the HA32 data near turn 6200.

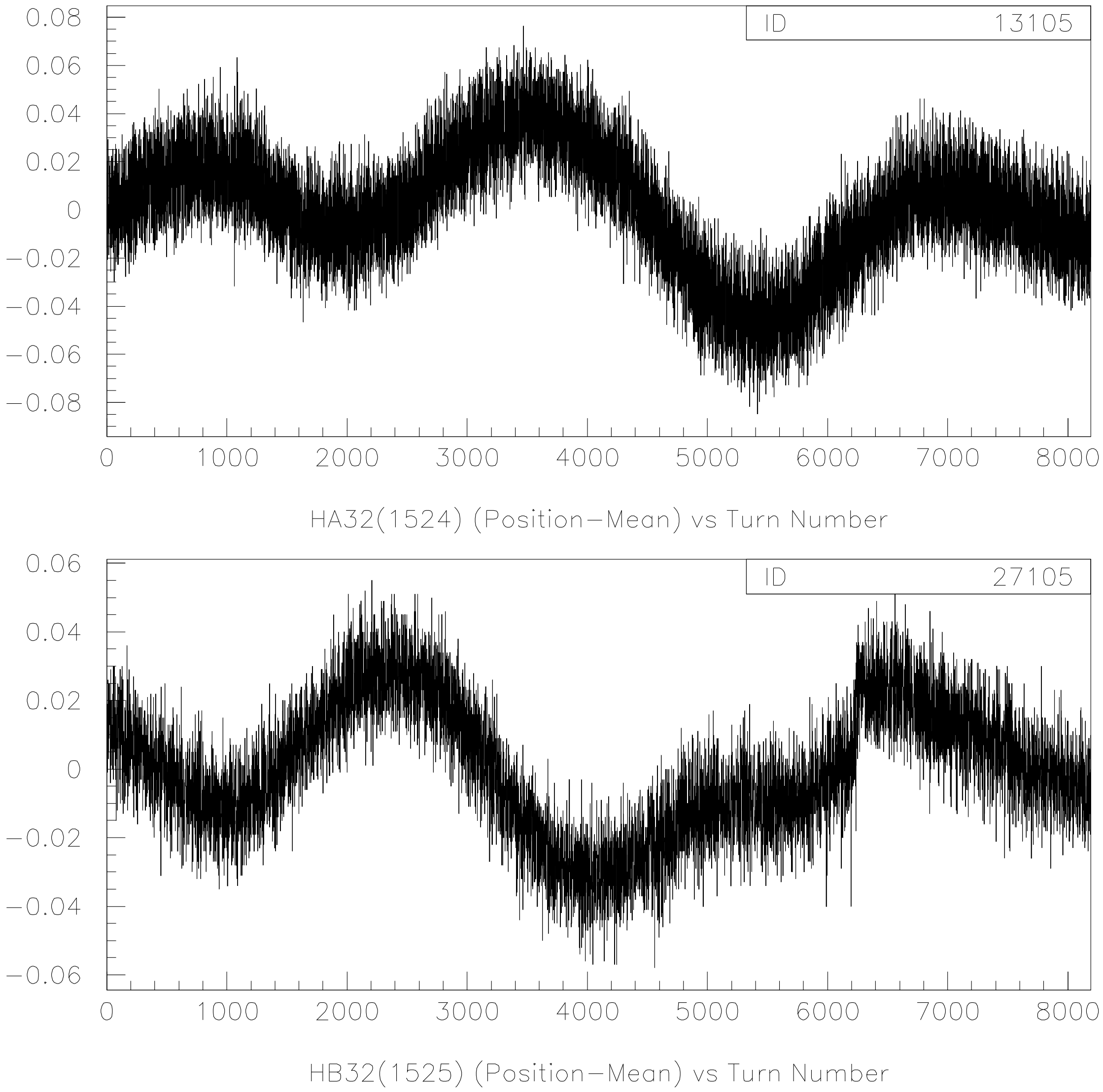

Figure 3: "Simultaneous" turn by turn measurements at HA32 and HB32 for 36 on 36 HEP running. A break can be seen in the HB32 data near turn 6200.

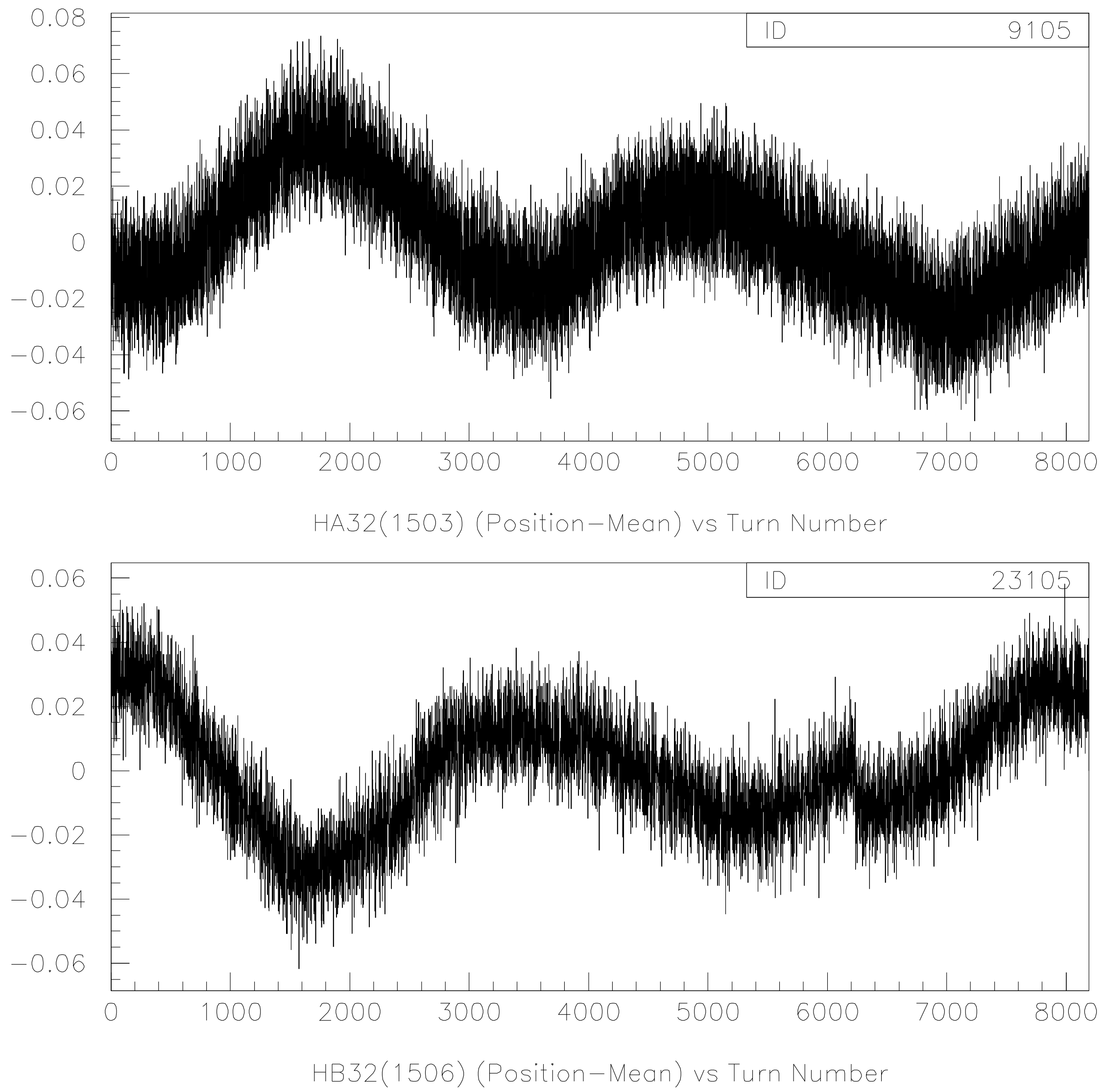

Figure 4: "Simultaneous" turn by turn measurements at HA32 and HB32 for 36 on 36 HEP running. There are some irregularities in the HB32 data near turn 6200. These may be another occurrence of the same problem shown in the previous two figures.

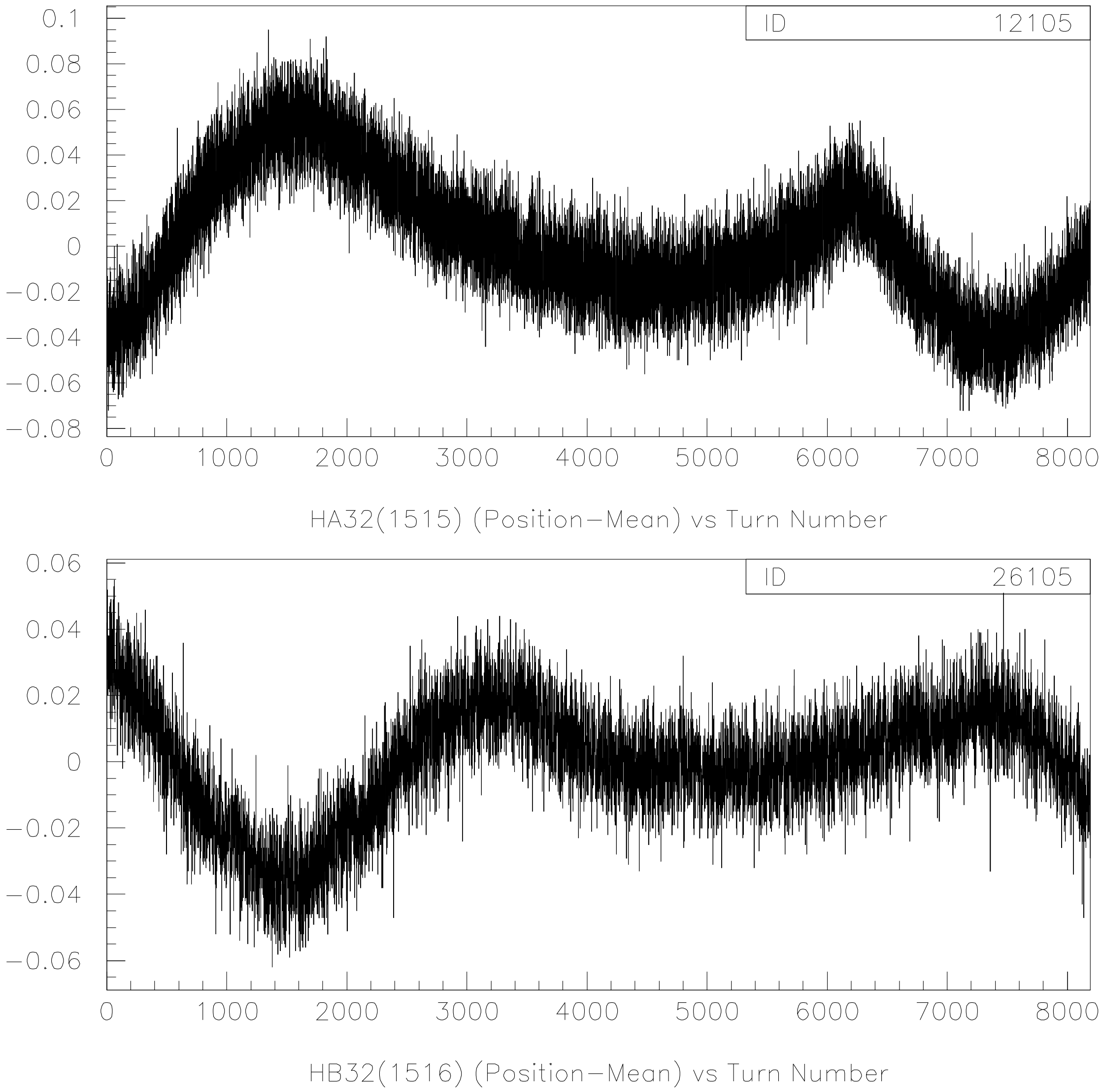

Figure 5: "Simultaneous" turn by turn measurements at HA32 and HB32 for 36 on 36 HEP running. There is a cusp in the HA32 data near turn 6200.