CLOCK TIME ERRORS AND TIME PREDICTION

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ABSTRACT

Based on a reasonable mathematical model which describes the time dispersion on most state-of-the-art clocks, the errors in time prediction are quantified. This model contains both random as well as non-random terms. These terms are prioritized as to the significance of their contribution to a clock's time dispersion, and this prioritization is shown to be a function of the prediction time.

Some simple methods of prediction are compared with optimum prediction and it is shown that by a judiacious choice of data processing, one can come extremely close to optimum prediction using these simple methods.

(Paper not Received)

QUESTION AND ANSWER PERIOD

SGT. OSTROWSKI:

Ostrowski, Newark Air Force Station.

In the use of the chambers for these cesiums to improve their performance, has there been any definite improvements in short term stability by just putting them in a chamber?

MR. ALLAN:

I think the effects are only in the long term stability, at least as we documented it. We have not seen any material effect in the short term stability.

SGT. OSTROWSKI:

And the long term, approximately what, do you think?

MR. ALLAN:

After we were into this second environmental chamber we saw flicker levels drop at least a half an order of magnitude, maybe even an order of magnitude in some cases.

SGT. OSTROWSKI:

And the biggest effect, do you think, was temperature or vibration?

MR. ALLAN:

I think probably temperature. We also were able to measure temperature coefficients and see that it was a real effect, just due to room temperature variations.

MR. RUEGER:

For the last chart shown, could you give us a little more data on how you determined it was that good or what your reference was to make that number?

MR. ALLAN:

Okay. To go on with that, that is another hour, but let me

just see if I can give you a quick snapshot. We have seven other cesium standards, commercial standards, in our ensemble. During this period of time, for the most part, NBS was not a significant member of that ensemble. So, it is not totally true, but it is approximately true that NBS 4 and UTC NBS were almost independent.

So, what is happening here is you are seeing the time fluctuation of a weighted ensemble of 7 commercial cesiums versus NBS 4, almost. To go into more detail would take quite a bit more time. In the bottom case, we are using a recursive filter to give a best estimate or near-best estimate of the NBS source frequency for time prediction purposes. So, this is in its raw frequency. This is the filtered estimate of the frequency, filtering out the higher frequency components. I don't know whether that helps.

But, without going into quite a bit more detail, that is basically what is shown.