VERY LONG BASELINE INTERFEROMETRY (VLBI)

by

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ABSTRACT

This is a tutorial paper which emphasizes the basic concepts of VLBI: simple block diagrams, coherence, and synchronization requirements. Typical large VLBI experiments have simultaneous objectives in positional astronomy, in astrophysics, in geodesy, in time and frequency synchronization, and even in geophysics! A brief review of the major experimental programs going on around the world will be given.

Paper was not received.

QUESTION AND ANSWER PERIOD

DR. REDER:

I have a question on the transfer of the local oscillators by satellite. Do you mean time ticks or do you mean actual oscillations?

DR. COHEN:

My understanding of it is that the data transmit a local oscillator signal, not the time ticks but something similar to a time wave.

DR. REDER:

What do you gain over a hydrogen maser? It will not work because of atmospheric effects.

DR. COHEN:

I presume they'll go both ways. It's equivalent of having a microwave link and you can make round trips and compare, essentially the echo. This procedure is already used.

MR. GROVE:

It would be sent up and back and compared at the source. This is the way I understand it.

DR. REDER:

How could it be better than a hydrogen maser?

MR. GROVE:

It would be hard. It would be the high frequency, I guess that would be the thing that picks it out. It would be left subject to the atmospheric.

DR. WINKLER:

There is a third party who would like to make a comment. Dr. Johnston?

DR. JOHNSON:

I may be mistaken but I thought the purpose of the experiment of connecting the two antennas via satellite was just to give immediate data reduction. There isn't, in my mind, any attempt going to be made to maintain local oscillator coherence for the original experiment. I think the reason for that is the satellite motion is very bouncy. The position of the satellite can't be known to, say, centimeter accuracy that you may need for coherence, so they're not going to try to do anything like that.

DR. WINKLER:

Of course, one could again use the satellite only to provide long-term stability and for short-term rely on local standards. I would like to insert two comments here myself. One is, many of you will ask those who are not radio astronomers what has this got to do with what we are discussing in applications of time/frequency. So I encourage you to listen to these talks and to translate everything that you hear in the following way.

You have essentially an electronic navigation system where you determine your position by measuring the times of arrivals of an incoming electromagnetic wave. You get in fact your position so you get a baseline accuracy. You observe a not pseudorandom but a truly random modulated phase and for that reason you need to have your clocks initially within a certain acquisition window which we have heard from Dr. Cohen to be usually 5 microseconds or something like that.

These are all features which we also see in practically every electronic navigation system. The only advantage is that here we have relatively extremely fixed sources, despite your comments. I look at it from exactly the other side and you have a tremendous amount of data because you integrate over a considerable period of time.

Transit is being observed for quite a while with very wide band widths, 2 megacycles or something more. You have possibly the ability to utilize the very best clocks, and apparently you require frequency stability in an area where the hydrogen maser is at its best. It may even be that another oscillator, the super conductive cavity oscillator for that was mentioned by Dr. Hellwig two days ago, may also become useful for the application.

So all of these are thoughts which may be useful to keep in mind because we can learn from the experience here in a very sophisticated way to utilize frequency standards.