Monitoring Beacons with FAROS

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The December 2013 column discussed getting more involved in radio than just making QSOs. It demonstrated a relatively easy way (with caveats, of course) to make elevation angle measurements of arriving signals. This month's column discusses another example of an experiment that can be undertaken by most Amateurs.

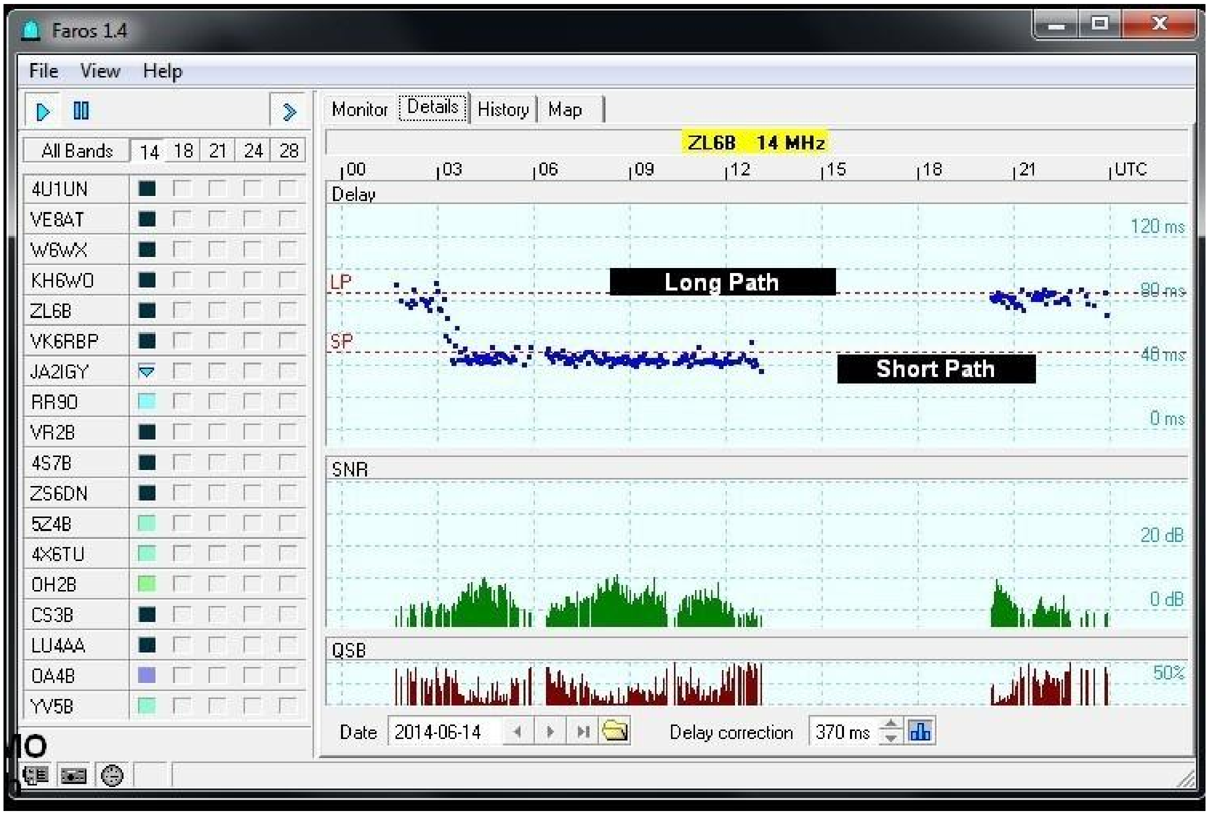
It uses the NCDXF/IARU beacons and associated software to see what's happening with respect to propagation over a designated path, including the opportunity to compare actual propagation to predicted propagation. For the record, NCDXF is the Northern California DX Foundation and IARU is the International Amateur Radio Union.

Information about the NCDXF/IARU beacons is at **http://www.ncdxf.org/pages/beacons.html**. There are 18 beacons around the world, and they transmit on 20m, 17m, 15m, 12m and 10m. Each beacon on each band transmits for 10 seconds. Thus in a three minute period, one can assess worldwide propagation on a given band.

The software is the automatic Faros beacon monitor software offered by Alex Shovkopylas VE3NEA. Visit **http://www.dxatlas.com/faros** for details. This software continuously monitors the beacons, measures the SNR (signal-to-noise ratio), measures the delay (after proper calibration of your system), derives a QSB index of the signal strength and then presents the data in graphical format. Refer to the Faros documentation for proper set-up of your system and discussion of the various measured parameters.

What results can you expect to see after everything is running and you've monitored a beacon and collected data? I'll use data from Tony Bombardiere K2MO to show some of the expected (and unexpected) results.

Figure 1 is the result of K2MO monitoring the ZL6B beacon on 20m for the entire day on June 14, 2014. This image also shows some of the Faros software options. For this entire 24-hour period, K2MO's 5-element monoband 20m Yagi was pointed along the long path to ZL6B (a heading of 65 degrees).



Date 2014-06-14

Delay correction 370 ms

Figure 1 – ZL6B to K2MO on June 14, 2014

The delay measurements (dark blue dots) are the top plot, with the delay axis in milliseconds (ms) on the right. The short path from K2MO to ZL6B is around 14,452 km, and the short path delay calculates to 48 milliseconds. The long path from K2MO to ZL6B is around 25,580 km, and the long path delay calculates to 85 milliseconds. Note that the correction factor for the delay in K2MO's system is 370 milliseconds, which is mostly a delay through the internet to receive the beacon transmit timing pulse.

The SNR data is the green vertical-line data in the middle plot, with its scale on the right (in dB). The QSB index data is the reddish vertical line data in the bottom plot, with its scale on the right in percent.

Note that long path propagation begins around 2000 UTC and goes to about 0300 UTC on this day in June. Also note that short path propagation starts around 0300 UTC and goes to about 1300 UTC. The short path SNR is actually higher than measured as it is off the back of K2MO's 5-element Yagi – K2MO says the front-to-back is something like 24 dB.

Also note the delay times when propagation changes from long path to short path around 0300 UTC. The intermediate values of delay suggest a non-great circle path – commonly referred to as a skewed path. From last month's column, it would be interesting to understand why long path failed after 0300 UTC, why short began after 0300 UTC, and what possible skewed path filled in between long path and short path.

A caveat is in order here. Before charging off on the tasks in the previous paragraph, it would be good to understand what the Faros software does when both long path and short path are simultaneously present. Both paths could be arriving into K2MO, and the question to ask is “does the Faros software get confused under this condition?” If you’ve ever heard a station coming in on both short path and long path at the same time, you’ll understand that it could be extremely tough to copy.

Figure 2 is another set of data from K2MO. It shows the results of monitoring the ZS6DN beacon on June 15, 2014. The short path delay for this path calculates to 42 milliseconds.

Date 2014-06-15

Delay correction 370 ms

Figure 2 – ZL6B to K2MO on June 15, 2014

There were two periods (0500-0700 UTC and 2300-0000 UTC) of decent short path propagation. But there were also two extremely brief openings around 1700 UTC and around 1930 UTC. These are a great example of the dynamic short-term nature of the ionosphere, and would cause wonder if you were “in the right place at the right time”.

Another interesting result (but not shown) was a 3-day monitoring of the RR9O beacon in Novosibirsk, Russia. This is an over-the-pole path for K2MO, and as such we would expect geomagnetic field activity and polar cap absorption events to cause problems. Indeed, on two of the three days there is a short path opening between about 0900 UTC and 1500 UTC. But on the other day, there was no short path opening. A quick look at space weather (for example, at http://www.swpc.noaa.gov/today.html#satenv and http://www.swpc.noaa.gov/today.html#xray) showed an elevated K index on that day that was the likely culprit.

Lastly, I mentioned earlier that the Faros software allowed comparing measured results to predicted results. K2MO had several of these comparison (again, not shown), and they were compared to W6ELProp predictions. This all comes out of the Faros software, so there’s no need to do any extra work.

There you have it – a relatively easy way to study real-time ionospheric propagation. You certainly could generate a lot of data, but I suggest starting out simple with just monitoring one beacon on one band. As you gain experience, you could add more beacons or more bands – or both. As always with real-world experiments, pay attention to the details of your set-up to keep your observations and resulting conclusions valid.