The IVS Technical Development Center at the Onsala Space Observatory

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Abstract

Two microwave radiometers are available at the Onsala Space Observatory. At least one is regularly used during the geodetic VLBI experiments. The purpose of using these Water Vapor Radiometers (WVRs) is to obtain independent measurements of the atmospheric wet delay. In this report we summarize the main activities during 2002.

1. Background — The Two Water Vapor Radiometers (WVRs)

The two microwave radiometers developed at the Onsala Space Observatory (OSO) are here referred to as ASTRID and KONRAD. ASTRID was first used in a geodetic VLBI experiment in July 1980. It was upgraded in 1991–1992 from being controlled directly by the Field System to a stand alone PC-based data acquisition system. Figure 1 shows ASTRID at the Onsala site. It has been running more or less continuously since then but it has become more and more difficult to find the necessary hardware to maintain the PC system. After the CONT02 campaign at the end of October we turned off the power and started to replace the WVR control and data acquisition system. In the next section we give a brief description of this upgrade.

Figure 1. The ASTRID WVR at the Onsala Space Observatory.

Figure 2. The KONRAD WVR performing test measurements at the Onsala site.

KONRAD was developed and built over several years and it was first used in scientific applications during 2000 and 2001 in the EC supported CLIWA-NET project. Results from these measurement campaigns were presented in last year's report [1]. Figure 2 shows the WVR.

2. Upgrade of the Old WVR ASTRID

During the last years it has become more and more obvious that the 1991 design of the WVR interface was becoming obsolete and difficult to maintain when spare parts were needed. For example, our colleague Christer Andersson at the observatory offered his private old computer monitor with Hercules graphics in order to be able to acquire data from the summer of 2002 and up to the end of the CONT02 campaign.

A masters thesis project was initiated and has been carried out during 2002 [2]. Here we will summarize the main ideas and the result of this work. The microwave unit was kept in its original design. The main reason for this is to acquire a long time series of the measured wet delay (or water vapor content) and to a large extent maintaining the stability in terms of the calibration of the observed sky emissions. Also the original step motors, with their driver electronics, are used in the upgraded system since this design has proven to be extremely reliable over the last 22 years of operation.

The previous interface design was based on very special components and the software was written in the language C by a number of different programmers none of whom is working at the observatory today. The new design is based on commercially available standard products assuming that it will be a flexible system where modifications are easy to implement. The software package LabView is used to control the step motors, to activate the calibration switches in the microwave front-end, and to read back status signals and detector outputs from the radiometer.

The hardware in the microwave unit are Field Point modules (see Figure 3) also from National

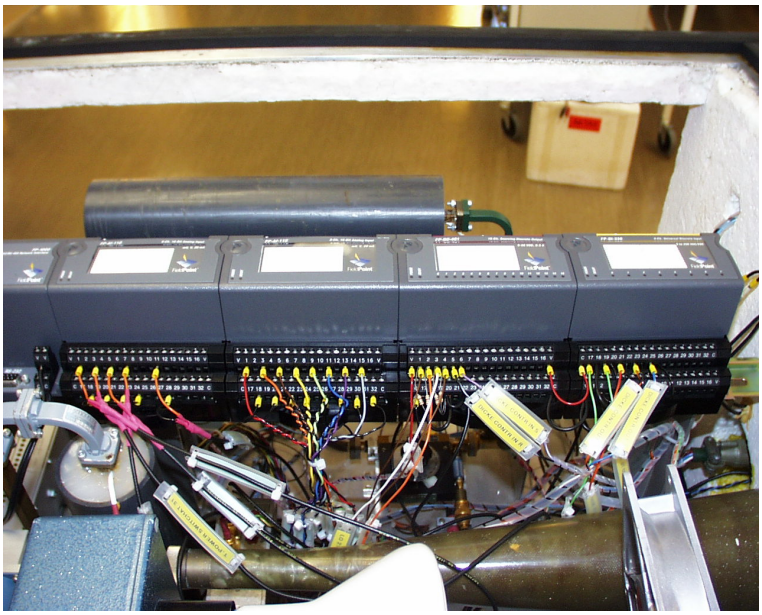

Figure 3. The Field Point hardware in the microwave unit in the ASTRID WVR [2].

Instruments. These have been designed to work with the LabView software. However, National Instruments does not offer any hardware suitable for an interface to control the existing step motors. Therefore, control electronics for the step motors was acquired from Galil and only a few logical circuits had to be added to obtain the necessary control signals to the step motor drivers.

Presently the system is controlled by a Pentium 4 PC from Dell and the graphical user interface (designed in LabView) is almost identical to that used for the KONRAD WVR.

3. Outlook

The IVS Technical Development Center at the Onsala Space Observatory now has two WVRs that are user-friendly in terms of operations. During the next few years we will focus on the analysis of the data acquired with these instruments. An immediate task is to assess the data quality of the WVR from the CONT02 campaign when the two WVRs were operating side-by-side using different observing schemes. KONRAD was slaved to the VLBI schedule and ASTRID was mapping the entire sky (above elevation angles of approximately 20 degrees).

References

[1] Elgered, G., and B. Stoew, The IVS Technical Development Center at the Onsala Space Observatory, in *IVS 2001 Annual Report, NASA/TP-2002-210001*, Eds. N.R. Vandenberg and K.D. Baver, GSFC, Greenbelt, MD, pp. 277–280, 2002.

[2] Strömbäck, M., and D. Backman, Construction of a data acquisition and pointing control interface for a microwave radiometer, *Master of Science Thesis*, Dept. Radio and Space Science, Chalmers University of Technology, Göteborg, Sweden, 2003.