NOTO STATION ACTIVITY: CURRENT STATUS AND PERSPECTIVES

Gino Tuccari

Radioastronomy Institute of the Italian National Research Council, Noto Radiotelescope,
Contr.da Renna Bassa, p.o.box 161, 96017 Noto (Sr) Italy
tuccari @ ira.noto.cnr.it

ABSTRACT

Numerous improvements have been introduced at the Noto Radiotelescope, going ahead in the continuous upgrade program. Such program covers items as frequency agility, efficiency optimisation, new acquisition terminals. The paper shows the main guidelines followed in improving the station performance.

FREQUENCY AGILITY

The multiband receiver developed in Noto is in the final stages of mounting and testing before to be installed in the primary focus of the 32 m Noto parabola. It will replace the old not cooled S/X and L band receivers, the former being placed in the primary, the latter in secondary focus.
The system presents several improvements with respect to the old one and adds new functionality. Moreover a full range between 250 and 1000 MHz is added, that includes the 92 and 49 cm VLBI bands. An holographic set of receivers is mounted allowing to check with the phase reference method the surface accuracy.
Receivers for secondary focus are integrated in the new system, allowing to see the entire set of receiver as a unique multifunctional block. Indeed three blocks are present, defined as 'primary', 'vertex' and 'VLBA' box. The first is included in the receiver box placed in the primary focus and contains all the electronics. Moreover the receiver box contains the great dewar, and the noise-cal module. The S/X coaxial feed as the L band one are cooled at 80 K to reduce the noise contribution (Fig.1), while the six LNAs are cooled at 15 K. Appropriate thermal gaps are placed between the orthomode transducer and the waveguide-coaxial conversion to properly take into account the temperature difference.

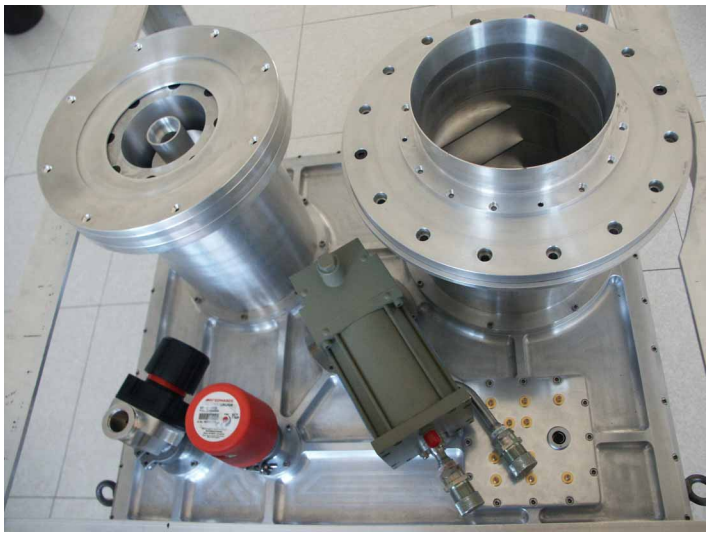

Fig. 1. SXL receiver: on the left L band, on the right
the coaxial S/X feeds protrude from the dewar chamber.

The 'vertex' box is placed in the secondary focus room and is fed by the signals at sky frequency transferred through appropriate cables, as selected by the primary box switch matrix, remotely controlled. IFs produced by the other receivers placed even in the vertex room are selected along with the new receiver bands to be sent to the control room through two channels analog fibre optic connection, with 1GHz bandwidth.

Finally the 'VLBA' box is responsible to reconstruct from the fibres two IFs, to adjust the power levels with 0.5 dB of accuracy and to send to a double channel up-converter, from where is sent back again to this box and selected to feed the four IFD channels of the VLBA terminal.
The three sections are remotely controlled by a dedicated addressable serial/optical interface, and a Windows based program is used to set and control the entire functionality.

EFFICIENCY OPTIMISATION

The active surface developed by the Medicina team for the Noto antenna, has been installed starting with August 2001. The antenna has been unusable until the end of January 2002. Surface errors are now about 150 microns at 45 degrees and such a value or better is expected in the entire elevation range. Surface measurements have been done for elevation greater than 45 degrees using a theodolite, while for lower elevation photogrammetry and holographic method with phase reference, developed in Noto, are going to be adopted.
Efficiency of the surface at 22 GHz is now about 50 %, and a great improvement is possible with a better secondary focus mirror. The subreflector surface rms is now indeed about 400 microns and this affects the full performance at high frequency. A new mirror will be placed with 100 microns accuracy, and this should bring the efficiency for 1.3 cm at about 65-70 % A new receiver operating at 43 GHz is in construction and very good performance are expected. The antenna will be able to operate up to 100 GHz.

Fig.2 A night view of the antenna structure without panels, during the re-surface work period.

Fig.3 The photo shows the new parabola surface.

DATA ACQUISITION

A two heads VLBA4 recorder is now operative and tested and the MK4 decoder inserted in the acquisition environment. This allow to record at a maximum rate of 512 Mbit/s.
The disk based MK5A recorder has been acquired and great importance is given to this VLBI recording method that will replace the tape based systems. Great improvements are indeed expected from the point of view of reliability in the operations and data quality. Noto is included in the IVS evaluation network for the use of such recorder.
The acquisition set available at present includes:

- VLBA4 terminal and recorder (with both VLBA and MKIV formatters)
- MKV recorder
- S2 formatter and recording system
- autocorrelator spectrometer
- holographic correlator.

A great deal is given to the possibility to observe in absentia of personnel. To achieve this goal is necessary to increase as much as possible the reliability in all the components of the observing process. This includes the antenna driving system and the acquisition terminal. For such purpose and to get better performance in the antenna tracking a new Vertex driving system has been ordered and it will be installed in August 2002. Such system includes the entire chain of Antenna Control Unit, driving electronics, brush-less motors, encoders. It's based on digital technology, with respect to the present one, almost entirely analog.
Further development in the acquisition terminal area has to be considered because a development was undertaken to realise a fully digital baseband converter to be inserted in the MKIV data processing rack, taking advantage from the study of a similar hardware, oriented to the ALMA future correlator.

RADAR VLBI ACTIVITY

Noto station participated to radar VLBI observations for the detection and accurate determination of asteroids and spatial debris crossing the earth orbit. In 2001 1999KW4 and numerous debris have been observed, and in 2002 the activity will continue. A three years collaboration is active and the observation of dedicated targets and the development of a software and a real-time correlation system, for a quick analysis of the observed detection, are planned. Noto will be the place where such correlator will operate.