Italy INAF Analysis Center

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Abstract This report summarizes the activity of the Italian INAF VLBI Analysis Center. Our Analysis Center is located in Bologna, Italy and belongs to the Institute of Radio Astronomy (IRA), which is part of the National Institute of Astrophysics (INAF). IRA runs the observatories of Medicina and Noto, where two 32-m twin VLBI AZ-EL telescopes are located. This report contains the AC's VLBI data analysis activities and illustrates the latest experiments, involving the Italian antennas and correlator, carried out in the last two years.

1 Current Status and Activity

Following the installation of the software correlator DiFX in 2012 in Bologna, there have been a number of experiments to test the correlation pipeline for geodesy. These VLBI experiments were performed mainly on a single baseline Medicina — Noto and subsequently extended to Matera after seeking a collaboration with ASI, who manages the antenna facility. The VITA (ITAlian Vlbi network) project has been launched as a national pilot project, obtaining observing time at the stations. We obtained first successful fringes on the three baselines in April 2015 after some gaps in the availability of the antennas due to major maintenance and refurbishing during 2014.

Meanwhile there was also a major switch of the Medicina and Noto antennas to the DBBC2 systems,

which have progressively become the standard back-end for geodetic observations also on the IVS network. Medicina was changing from a Mark IV back-end, while Noto was changing from a VLBA one. This required some hardware and software procedure adjustments at the antennas, the geodetic set up already being embedded in the DBBC, although the transition to the newer formatter Fila10G, designed to complement the DBBC, proved to be more difficult, particularly on the correlation side. In fact some time was required before SKED was updated to reflect the changes at the antennas and manual editing of vex files was no longer needed. Further adjustments were also implemented when the decision was taken to change to the VDIF format, which on one hand brings the advantage of more streamlined data transmission on the networks, but on the other still is not fully implemented in SKED.

After overcoming these initial challenges we were able to perform four successful experiments across 2015 and 2016 with the aim of setting up a calendar of regular experiments similar to EUROPE ones, but on a smaller scale. Additional work is needed to find the optimal scheduling set-up.

At present we are also involved in the LIFT project in collaboration with INRIM (National Institute of Metrology) where a distributed time and frequency optical link was set up in Medicina to perform multiple VLBI tests in a geodetic setup to verify the accuracy and reliability of their solution compared to standard maser clock timing in use at the antenna. During the EUR137 experiment in 2015, Medicina participated with both clock synchronizations, and afterwards a few more experiments on the Medicina — Noto baseline were performed to try to solve the issues raised. There were updates to the INRIM system in Medicina, so more experiments are expected in the near future.

In 2017 it is also planned to connect the Matera antenna to the distributed time and frequency link, thanks to the newly founded MeTGeSp project. Additional VITA experiments with the common clock, delivered by INRIM, will be performed as soon as the optical link will be available.

2 Data Analysis and Results

The IRA started to analyze VLBI geodetic databases in 1989, using a CALC/SOLVE package on the HP1000 at the Medicina station. In subsequent years, the same software was installed first on an HP360 workstation and later on an HP715/50 workstation. In more recent years, two HP785/B2600 workstations and an HP282 workstation were used. In 2007, a new Linux workstation was set up for the migration of all the VLBI data analysis, and Mark 5 Calc/Solve was installed. During the last years, our Analysis Center had some inner problems, and we did not participate regularly in IVS activities. But we continued to update the catalog, and we installed and tested the latest releases of CALC/SOLVE and νSolve.

3 Outlook

We expect that another researcher will join the group in the next few months, allowing us to contribute again to IVS activities and to submit INAF tropospheric parameters to the IVS Data Centers regularly. We will also produce an updated long term geodetic solution.