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"A Proposed VLBI2010 Observing Scenario"

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Introduction

In the IVS WG3 final report, the requirements for the next-generation VLBI systems were boiled down to the following three goals:

- 1 mm position and 1 mm/year velocity for position (TRF)
- Continuous measurements for EOP.
- Rapid Generation and Distribution of IVS Products.

These goals lead to the following recommendations for new VLBI2010 systems:

- Antennas need to be robust and automated.
- Receivers need to be upgraded for broadband performance.
- Sustained high data rates (~8 Gbps) need to be used.
- High antenna slew rates (6 deg/s az and 2 deg/s el?) need to be used.
- High performance eVLBI networks (8 Gbps sustained rates) need to be available at a sub-set of stations.
- Network size needs to be increased, e.g. to 20-40 stations.

At the same time, it is recognized that existing IVS stations will play important roles into the future, e.g.:

- Long careful uninterrupted data records are known to be invaluable for revealing scientific insights.
- More collocated VLBI sites improves the ability to perform inter-technique comparisons.
- More collocated VLBI sites improves the ability to transfer the long-term stability of VLBI scale determinations to other techniques.
- More VLBI sites improves the TRF.
- Larger more sensitive legacy stations play an important role in maintaining the radio CRF, especially for weaker sources.

In order for legacy stations to contribute to VLBI2010, it is only required that they be made compatible in terms of broadband high date rate performance.

As is true today, the following major elements need to be supported for a healthy geodetic/astrometric observing program:

- TRF
- CRF
- Precise EOP
- Rapid EOP
- R&D

A Proposed VLBI2010 Observing Program

Once VLBI2010 is operational, there are three factors that will determine how antennas will be included in the observing program:

- Can the site operate on a nearly continuous basis, e.g. 80-90% of the time? If so, these antennas will form the core of the program. They will observe on a daily basis only stopping for scheduled maintenance and repair.
- Is the site connected to an affordable high performance eVLBI network? If so, these antennas will be used to produce the rapid EOP products.
- Is the site capable of the high slew rates specified for VLBI2010? If so, these sites will form the basis for generating optimized schedules intended for achieving maximum accuracy. Other antennas will be added on a tag-along basis.

A. The core of the observing program will be built around the group of antennas that are capable of nearly continuous operation. On any given day, 80-90% of these antennas will be operational, with the rest being off-line for scheduled maintenance and repair. The majority of these sites will have new antennas and hence will be designed to have VLBI2010 slew rates. Daily schedules will be optimized for this group of antennas with some recognition given to special programs for the day. However, the large number of observations enabled by the high slew rate antennas will allow some excess capacity for these special programs. A select group of the best available sources (~230 of them) will be used routinely. With time, the positions (and motions) of these antennas and sources will become exceedingly well defined. They will form the framework for both the VTRF and ICRF.

B. Some fraction of the group A antennas will also have access to an affordable high performance eVLBI network. If so, these antennas can contribute to the IVS rapid EOP products. Schedules will not be optimized for this particular antenna group since it is recognized that ultimate EOP accuracy is not required for the operational needs of the rapid data. This will ensure that the final products, which use the full network of the day, are as good as possible and can thus make the maximum contribution to scientific studies.

C. The key to making this aspect of the observing program work in practice is to have a correlator significantly larger than required to handle the group A antennas. This will allow several extra antennas to be scheduled on any given day for special TRF and CRF programs. Many of these antennas will be either from the legacy group or from a non-compliant group of antennas that have special attibutes such as large collecting area. Examples of special programs might include:

- Using the largest antennas available to monitor fainter sources.
- Using a large global network to improve the measurement of scale
- Using a regional network for smaller scale studies, e.g. Europe, Asia or the Pacific.
- Extending the VTRF to more stations

The added group C antennas will not typically observe as a separate sub-net, but will observe in concert with the group A antennas so that their products will be well integrated into the group A framework. In this way, the observing program will be coherent meaning that each observation simultaneous enhancing the ICRF, ITRF and EOP. The only difference is that certain days will emphasize some aspects more than others.