European VLBI meeting for Geodesy and Astrometry

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Geodetic VLBI Using the MkII-BWS-Technique

1. Geodetic VLBI-Experiments

a) Observed experiments:
- MEO 1 (Madrid - Effelsberg - Onsala) 27/28 July '80 at X-Band 8.4 GHz, 40 MHz BWS (failed due to technical problems).
- MEO 2 (Madrid - Effelsberg - Onsala) 26/27 Sept. '80 at X-Band 8.4 GHz, 40 MHz BWS (partial success on Madrid-Onsala-baseline. To be recorrelated at MPI processor).
- WEJO 1 (Effelsberg - Metsähovi) 5/6 Oct. '80 at 5 GHz, 20 MHz BWS (data reduction completed).
- WEJO 2 (Westerbork - Effelsberg - Jodrell Bank - Onsala - Chilbolton) 12/13 April '81 at 5 GHz (Chilbolton and Onsala lost ~ 50 % of time due to equipment mal-function. Correlation at MPI and JPL completed. Final reduction in progress). 40 MHz BWS.

b) Planned experiments:
- WEJO 3 (Westerbork - Effelsberg - Jodrell Bank - Onsala) 12/13 Dec. '81 at 5 GHz, 40 MHz BWS.
- MEO 3 (Madrid - Weilheim - Johannesburg - Onsala) 1982 at S-Band.
- WEJO 4 (Westerbork - Effelsberg - Jodrell Bank - Onsala) Dec. '82 at 5 GHz, 40 MHz BWS.

2. Processing

The video tapes have been processed both at the MPIfR-correlator in Bonn and at the JPL-Caltech correlator in Pasadena. The comparison of the output is being carried out at the different stages of the postprocessing in order to cross-check the software packages. First results indicate that apart from the trouble of having to run the data twice through the Bonn correlator (one time at each frequency channel), there is no major problem to obtain the BWS delays with the Bonn data.

3. Shortcomings of present setup

a) Lack of ionospheric delay calibration
For real time elimination of the ionospheric delays, two widely separated frequency bands have to be used. Possible technical approaches have to be studied, e. g. a four-channel-sequence.

b) Lack of instrumental delay calibration
The presence of instrumental delay (and phase) errors limits the achievable geodetic precision to ~ ± 0.5 ns. The two available approaches to measure and/or eliminate these errors (the MIT- and the JPL-methods) have to be studied in detail and considered for implementation.

c) Lack of highly stable frequency standards at Westerbork and Jodrell Bank. Preliminary results indicate that the clock performance is inadequate for BWS delays at both stations. However other possible instrumental delay sources have to be checked.

4. Doppler Campaigns

Doppler satellite observations at two frequencies (150 and 400 MHz) hold the promise to provide measurements of the ionospheric refraction. The WEJO 2 VLBI-experiment was accompanied by a Doppler Campaign (ERIDOC-Project) and the observations are now being processed. For extraction of the ionospheric delay only the Magnavox and Marconi Doppler instruments could be used. The JMR-type data, helas, do not yield any ionospheric information.

5. Baseline results from WEJO 1

The 20 MHz BWS delays on the Effelsberg-Metsähovi-baseline show a tenfold improvement over the 2 MHz-delays (1.9 ns versus 13.9 ns fitting rms), which is consistent with the low available SNR. At Metsähovi a HP rubidium standard was used. The post fit errors in the baseline components are ± 0.23 m in X, ± 0.21 in Y and ± 0.52 in Z. With a more refined reduction programme these values should improve.

6. References on instrumental phase and delay calibration systems

THOMAS, J.B. : The Tone Generator and Phase Calibration in VLBI Measurements. DSN Progress Report 42-44, NASA-JPL, 1978.

ROGERS, A.E.E. : Phase and Group delay Calibration of a Very Long Baseline Interferometer by East Coast VLBI Group. Proc. Conf. on Radio Interferometry Techniques for Geodesy. NASA Conference Publ. 2115, 1980.