1. Why use VLBI for Time Transfer?

Time transfer between different time and frequency laboratories is essential for various scientific and technical applications. Traditionally, this has been achieved using techniques like TWSTFT (Two-Way Satellite Time and Frequency Transfer). However, VLBI (Very Long Baseline Interferometry) offers a more precise and stable method for time transfer.

Modern VLBI techniques have achieved accuracies of 10^-15 for singlebaseline, with typical r.m.s performances of 2 x 10^-15 for single baseline and 1 x 10^-15 for multi-baseline configurations.

2. VLBI Experiments for Time Transfer

VLBI measures the arrival time delays between multiple stations utilizing radio signals from distant celestial radio sources like quasars and pulsars. This precision is nearly one order better than other techniques like GPS and TWSTFT.

3. Time Transfer using IVS and IGS data

Comparison of VLBI and GPS data can provide insights into the stability and accuracy of different time transfer methods. For example, in a study using IGS and IVS data, the difference between VLBI and GPS was found to be around 164.6 microsec, indicating that VLBI time transfer is more stable than GPS time transfer.

4. Conclusions

VLBI offers a unique capability for time transfer, particularly at the highest levels of accuracy. Its stability and precision make it ideal for applications requiring extremely accurate time synchronization.

To compare with GPS using IGS and IVS data, we can use the following formula:

\[ \tau = \frac{1}{2} \left( \sigma_G + \sigma_V \right) \]

where \( \tau \) is the time difference, and \( \sigma_G \) and \( \sigma_V \) are the standard deviations of GPS and VLBI, respectively.

In this study, the stability of the difference between VLBI and GPS was found to be around 164.6 microsec, indicating that VLBI is more stable than GPS.