Use of primary frequency standards
for estimating the duration
of the scale unit of TAI

Contribution by the BIPM

Following the 14th meeting of the CCTF and its recommendations S2 and S3 (1999), the time section has re-considered the way in which the data from primary frequency standards (PFS) are used for evaluating the duration of the scale unit of TAI and how they are reported in Circular T and other BIPM publications [1]. The move also intends to respond to the recommendations of the CCTF working group on the expression of uncertainty in primary frequency standards. The changes have been implemented in Circular T in May 2000 and applied for the whole year 2000 in the Annual report. The main points are the following:

- All comparisons of primary frequency standards with TAI which are communicated to the BIPM for report are required to provide a list of information that is published in order to make the comparison more traceable and to provide more details to the user. That list includes

u_B, the combined uncertainty from systematic effects,

Ref(u_B), a reference giving information on the stated value of u_B,

u_A, the uncertainty originating in the instability of the PFS,

$u_{link/lab}$, the uncertainty in the link between the PFS and the clock participating to TAI,

$u_{link/TAI}$, the uncertainty in the link to TAI,

u, the quadratic sum of all four uncertainty values.

- The CCTF Recommendation S3 (1999) encouraged laboratories providing PFS data to publish the results of bilateral comparison with TAI. At the initiative of PTB, joint PTB/BIPM reports have been submitted for publication [2, 3].

- The global treatment of individual PFS measurements provides the relative departure of the duration of the TAI scale unit from the SI second on the geoid. The algorithm itself has not been changed but the uncertainties associated with PFS comparisons have been computed from the procedure above back to 1998. Also, since the stability of EAL is not constant, the stability model has been updated starting 1998. The global treatment of individual measurements led to a relative departure of the duration of the TAI scale unit from the SI second on the geoid ranging, since May 2000, from $+5 \times 10^{-15}$ to $+7 \times 10^{-15}$, with a standard uncertainty of 2×10^{-15} to 3×10^{-15}. Steps are being taken to reduce this offset without impeding the stability of TAI.

References:

1. Petit G., Use of primary frequency standards for estimating the duration of the scale unit of TAI, *Proc. 31st PTTI,* 297, 2000.
2. Bauch A., Fisher B., Heindorff T., Hetzel P., Petit G., Schröder R., Wolf P., "Comparisons of PTB's primary clocks to TAI in 1999", *Metrologia*, **37** (6), 683, 2000.
3. Heindorff T., Bauch A., Hetzel P., Petit G., Weyers S., "PTB primary clocks: Performance and comparison with TAI in 2000", *Metrologia*, submitted.