

Performances of UTC(OP) based on LNE-SYRTE atomic fountains

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We present the current realization of UTC(OP) generated at LNE-SYRTE, Observatoire de Paris (OP), Paris, France, which is also the source of French legal time. UTC(OP) is based on a H-Maser standard steered by the atomic fountains developed at LNE-SYRTE. The steering algorithm and the prediction of UTC(OP) departure from UTC are described, together with the results of the first year of operation.

The current OP atomic fountain ensemble¹ comprises a Cs fountain called FO1, a fountain operating simultaneously with Cs and Rb atoms called FO2, and a mobile Cs fountain called FOM. All fountains share the same cryogenic oscillator which is phase locked to a H-maser. Thus all fountains measure the frequency of the same H-maser. An automatic fountain data processing has been developed to provide hourly data preliminary corrected of all systematic frequency shifts. These data are further scrutinized to provide data to participate to the steering of TAI monthly calculated by the BIPM. However, the quasi real time data are largely sufficient, as they are, to guarantee a stability of a few 10^{-16} for the time scale generation. The steering software predicts once a day the H-maser frequency for the next day, by extrapolating a linear fit of the last 20 days available data. The correction to be applied to the phase micro stepper² for the next day is the sum of the predicted H-maser frequency, and of an additional term updated monthly, that finely adjust the frequency and the phase of UTC(OP) to UTC, based on the data published by the BIPM in the Circular T.

The choice of this algorithm has been oriented to obtain robustness of the system instead of the ultimate optimization of performances. We will present the results obtained during the first year of operation which demonstrates that the performances of the current UTC(OP) are competitive with the best UTC(k) realizations available today. Since October 2012, the departure of UTC(OP) from UTC remained well below 10 ns.

¹ J. Guéna, M. Abgrall, D. Rovera, P. Laurent, B. Chupin, M. Lours, G. Santarelli, P. Rosenbusch, M. Tobar, R. Li, K. Gibble, A. Clairon, and S. Bize, “Progress in atomic fountains at LNE-SYRTE,” *Ultrasonics, Ferroelectrics and Frequency Control*, IEEE Transactions on, vol. 59, pp. 391–409, march 2012.

² D. Rovera, M. Abgrall, and M. Siccaldi, “Characterization of an auxiliary offset generator for steering of H masers,” in *Proc. of the 26th European Frequency and Time Forum*, 2012.