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FREQUENCY COMPARISON (H_MASER 40 3818) - (SU-CsFO2)
For the period MJD 56504 to MJD 56534.

The primary frequency standard SU-CsFO2 [1] has been compared to the hydrogen Maser 40 3818 of the laboratory, during a measurement campaign between MJD 56504 and 56534 (31st July 2013 - 30th August 2013). The fountain operation covers ~ 78 % of the total measurement duration for the period MJD 56504-56534**.** The mean frequency difference at the middle date of the each period is given in the following table:

Period (MJD)	**Date of the estimation**	**y(HMaser40 3818 – CsFO2)**	**y(HMaser40 3810 – CsFO2)***	u_B	u_A	u_{Link_Maser}
56504-56534	**56519**	**302.9**	**-172.5**	**5.0**	**3.0**	**1.1**

Table 1: Results of the comparison in 1 × 10-16.

*The mean frequency difference y(HMaser40 3810 – CsFO2) was calculated through the measurement of fractional frequency difference between CsFO2 and the hydrogen maser HMaser40 3818, which is not included in the composition of reference group.

The relative frequency instability of CsFO2 was :
2.99×10^{-13} $(\tau/s)^{-1/2}$ during the 30 days (MJD 56504-56534)

For the uncertainty due to the clock link $\mathbf{u}_{Link\_Lab} = 0.1\times10^{-15}$ is obtained by taking into account the actual measurement time.

The CsFO2 standard uncertainty $\boldsymbol{u_B}$ is estimated as 0.5×10^{-16} (1σ) for the relevant periods.

Figure 1 shows the shot by shot data measurements during the period MJD 56504 to MJD 56534.

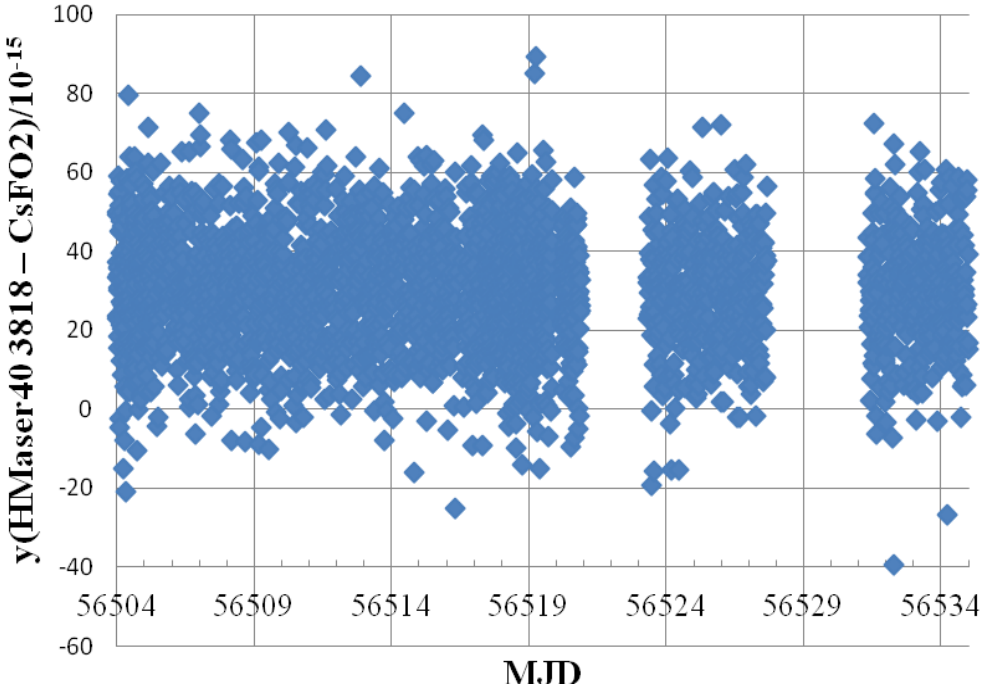

Figure 1: shot by shot data measurements during the period MJD 56504 to MJD 56534

Uncertainty due to the dead times

During the evaluation period there were gaps in the data collection (dead time) due to both intentional and unintentional breaks. Most of the unintentional breaks were caused by failures of the laser locking systems(due to rapid change barometric pressure).

Start of date of measurements (MJD)	End of date of measurements (MJD)	Duration of dead Times H:m:s	second	σ_{x_i}
56504.00089	56505.37388	0:00:00	0	
56505.4436	56516.3959	1:40:24	6024	6.047E-12
56516.5725	56517.3721	4:14:18	15258	8.697E-12
56517.3967	56519.8428	0:35:25	2125	3.965E-12
56520.2133	56520.8709	8:53:31	32011	1.049E-11
56523.3211	56527.6559	58:48:17	211697	4.364E-11
56531.3173	56534.9996	87:52:25	316345	4.364E-11

Table 3: Distribution of Dead Times for the MJD 56504 – 56534 period

The standard deviation of the fluctuations of frequency due to the dead times in measurements is estimated by the ratio

$$\frac{\sqrt{\sum_i \sigma_{x_i}^2}}{T} = \sigma_{Dead\_Time}$$

Period	σ_{Dead_Time}
56504 - 56534	2.38E-17

The uncertainty on the link Maser is obtained by the quadratic sum of the link lab uncertainty and the uncertainty due to the dead times calculated above:

$\mathbf{u}_{Link\_Lab}=1.1\times10^{-16}$,

$\boldsymbol{u}_{Link\_Maser}=\sqrt{\left(\sigma_{Dead\_Time}\right)^2+\left(\sigma_{Link\_Lab}\right)^2}$

Period	$\mathbf{u}_{Link\_Lab}$
56504-56534	1.1×10^{-16}

References

[1] Domnin, Yu.; Baryshev, V.; Boyko, A.; Elkin, G.; Novoselov, A.; Kopylov, L.; Kupalov, D., "The MTsR-F2 fountain-type cesium frequency standard", Measurement Techniques, Volume 55, Number 10, January 2013 , pp. 1155-1162(8)

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