

**Report to the 20<sup>th</sup> Session of the CCTF****Activities of the Working Group on Primary and Secondary Frequency Standards  
from 1 Oct 2012 to 1 Sept 2015.****Steve Jefferts, Chair**

This has been a comparatively busy time for the working group with several new Primary Frequency Standards (PFS) being evaluated and accepted by the working group. The role of correction of newly proposed biases has also been debated and discussed within the working group and an informal meeting on the topic was held in April of 2015 with robust participation.

In particular, 5 new PFS from 5 different National Metrological Institutes (NMI) have been accepted in the past 2 years. Three of the new PFS are from laboratories which had not previously reported a Cesium Fountain PFS while 2 of the new standards are from groups with a history of reporting Cs fountain PFS results. The new laboratories are: National Physical Institute of India (NPLI), National Institute of Metrology, China (NIM), and VNIIFTRI (Russia). The existing laboratories reporting new PFS are National Institute of Standards and Technology (USA) and Istituto Nazionale di Ricerca Metrologica (Italy). These 5 new PFS bring the total number of PFS reporting to TAI up to 15 with the result that generally a number of PFS results are available in any given month and are reported via circular-T.

All information on the activities above is recorded in the web page of the working group, accessible to working group members at <http://www.bipm.org/wg/CCTF/WGPSFS/Restricted/welcome.jsp>).

At the present time the reported (fractional) systematic uncertainties in PFS range from  $1.5 \times 10^{-16}$  to  $3.9 \times 10^{-15}$ , and a statistical analysis (see FIG 1) seems to indicate that the PFSs are within reasonable statistical agreement. Currently 11 PFS and one secondary standard report to TAI reasonably regularly.

One development that has occurred over the past several years is that several laboratories have implemented quasi-continuous operation of their fountain PFS. This allows those laboratories to realize exceptionally good UTC representations and results in frequency evaluations essentially monthly from these laboratories. Several other laboratories are pursuing this at the present time.

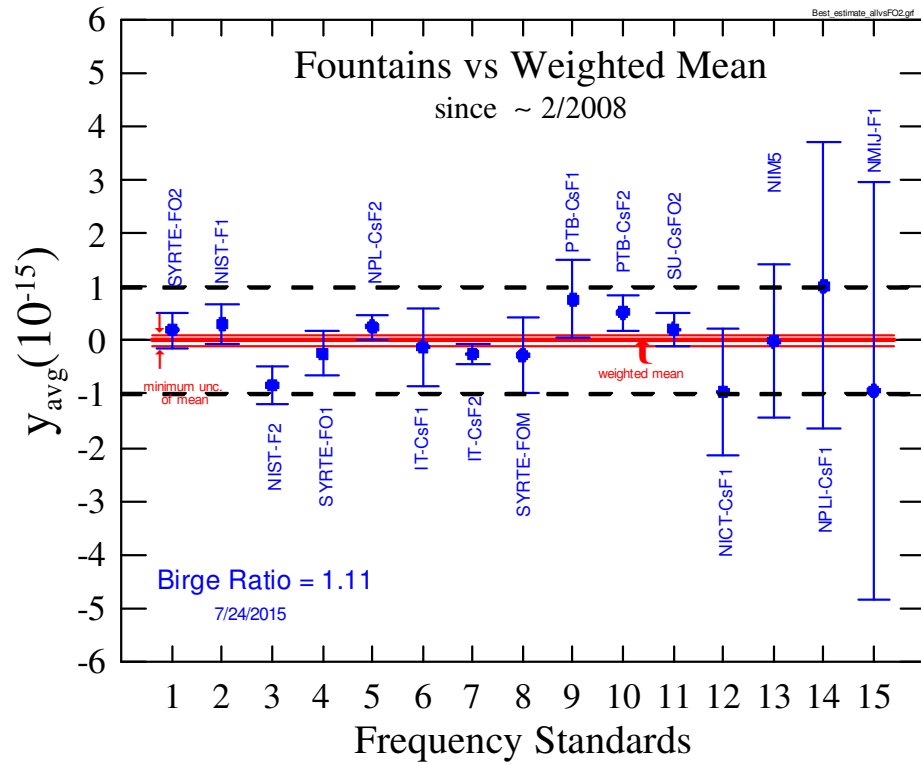


Figure 1 –Primary frequency standards compared to the weighted mean of all of those standards since early 2008. The Birge ratio is 1.1, indicating good agreement.