TT(BIPM)
and Primary frequency standards

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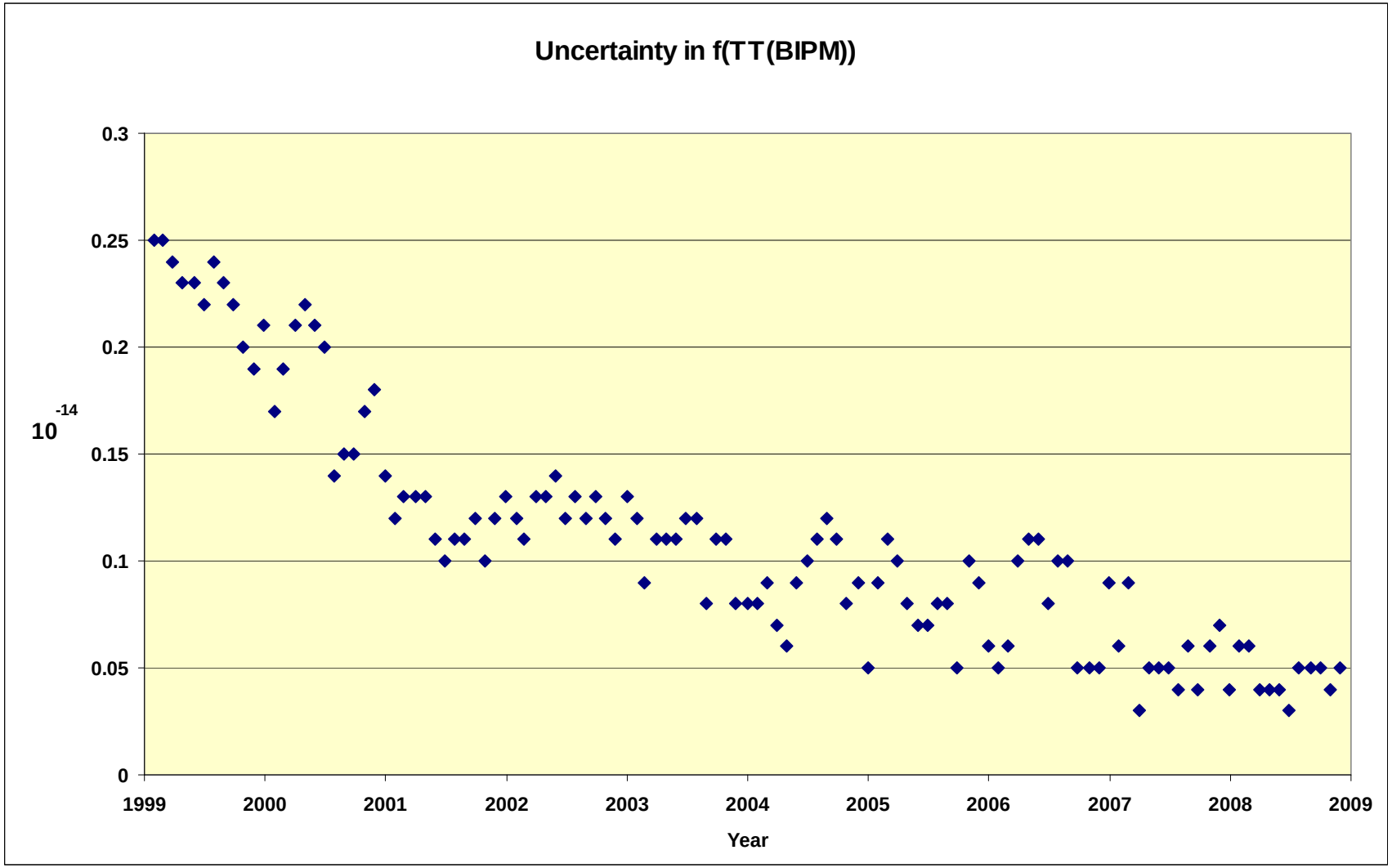
TAI and TT(BIPMxx)

- Terrestrial Time TT is a coordinate time (in the relativistic sense), defined by IAU'2000 Resolution B9 as a linear function of TCG (Geocentric Coordinate Time).

- TT is 'ideal' and should be distinguished from its realizations (really available time scales). There are two practical realizations of TT:
  - TAI +32.184 s
    - see future reports on TAI
  - TT(BIPMxx) every year
    - Post-processed using all available PFS data, as of year 20xx.
    - f(EAL) is estimated each month using available PFS. Monthly estimates are smoothed and integrated to obtain TT(BIPMxx).
    - Last realization: TT(BIPM08), released in January 2009.
    - see ftp://tai.bipm.org/TFG/TT(BIPM)/

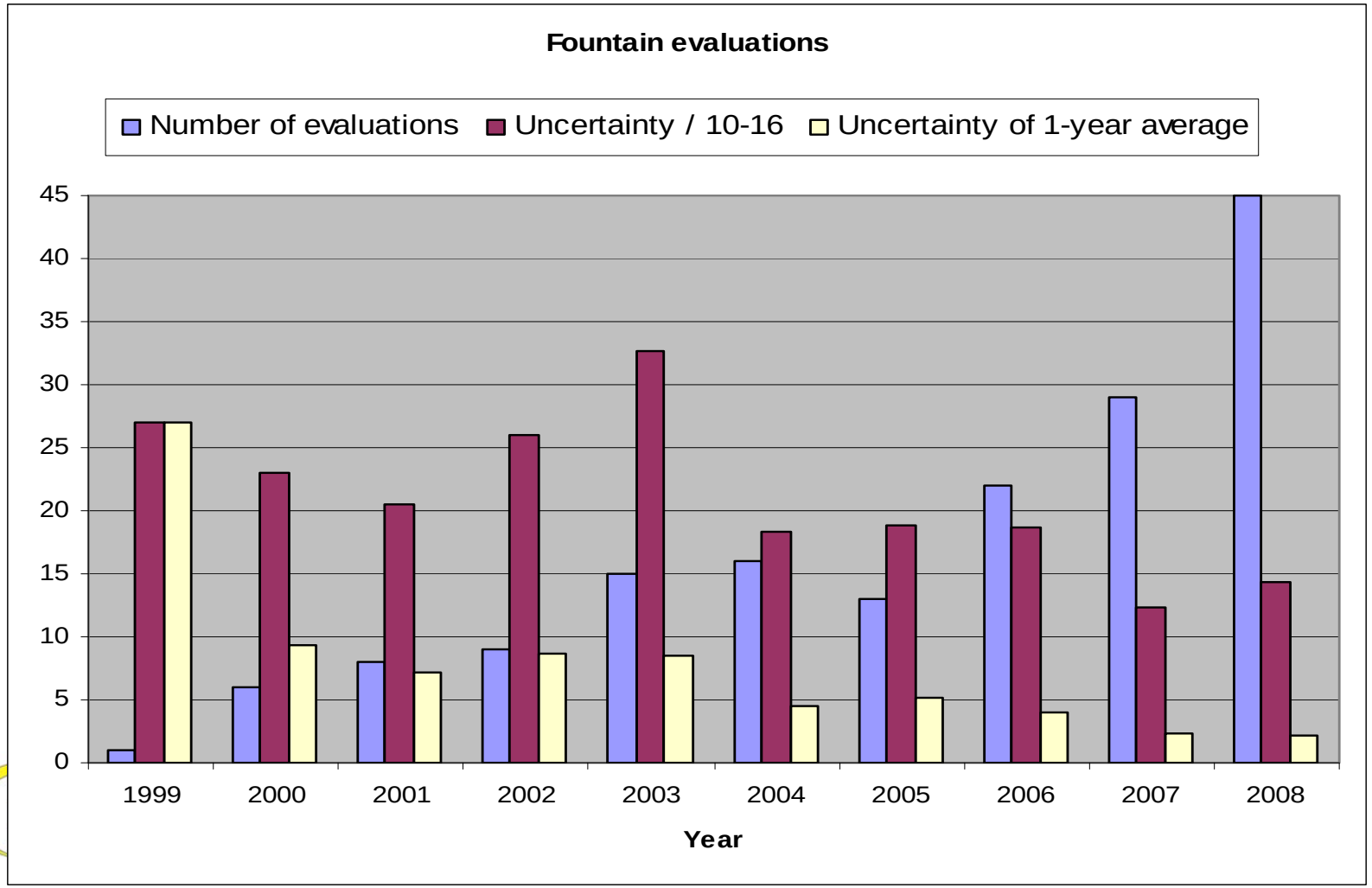
The latest realization TT(BIPM08)

- Frequency accuracy decreases from >2×10^{-15} before 2000 to about 0.5×10^{-15} since 2007.

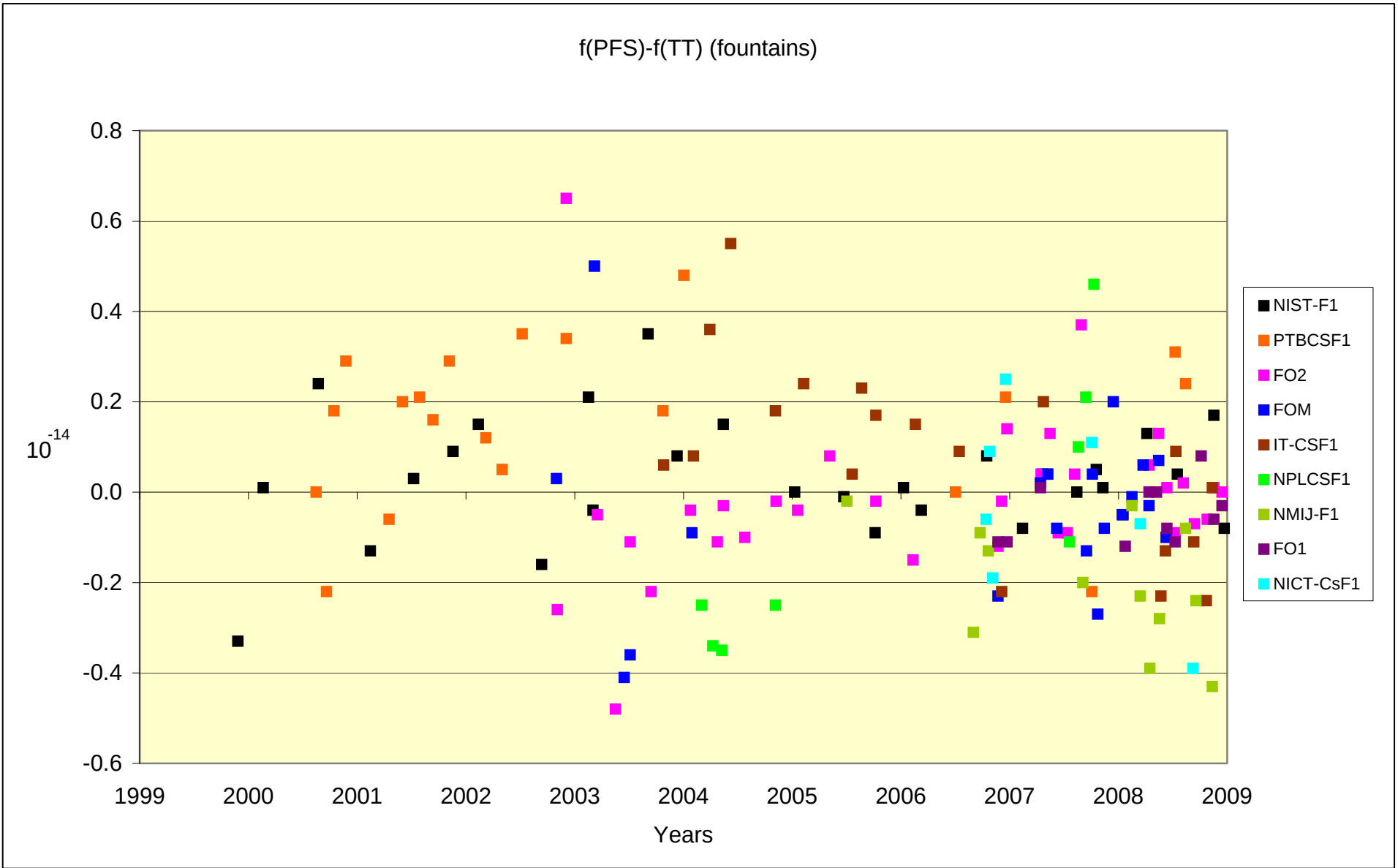


Contributions to TT(BIPM)

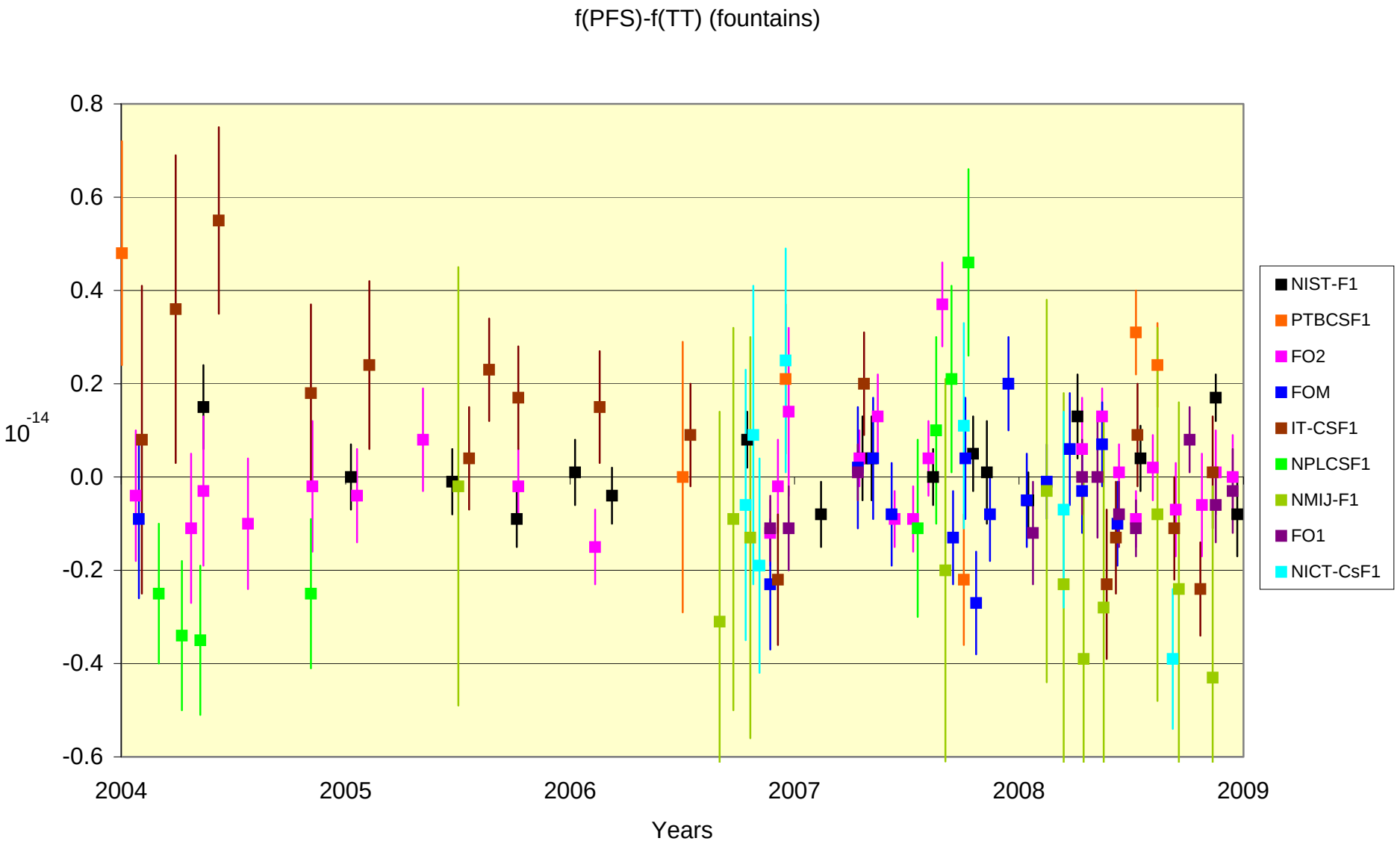
- TT(BIPM) performances due to increasing number of Cs fountains
- A rough statistical estimate would put TT(BIPM) accuracy in the low 10^{-16}, but time transfer and instability of EAL limit this.



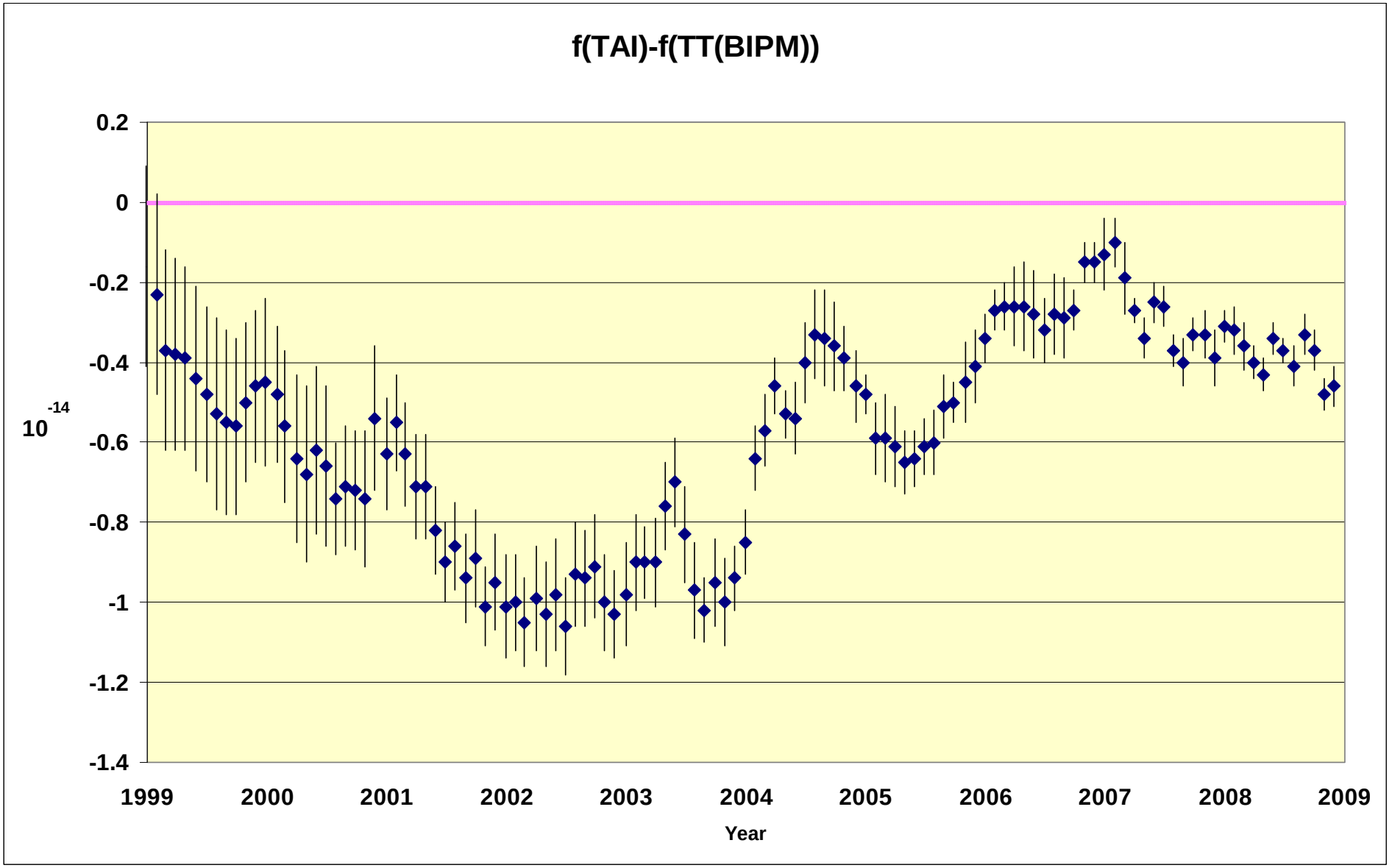
- 164 fountain evaluations contribute to TT(BIPM2008)
- Global χ^2 = 1.29 (1.18 after removing 4 "outliers")



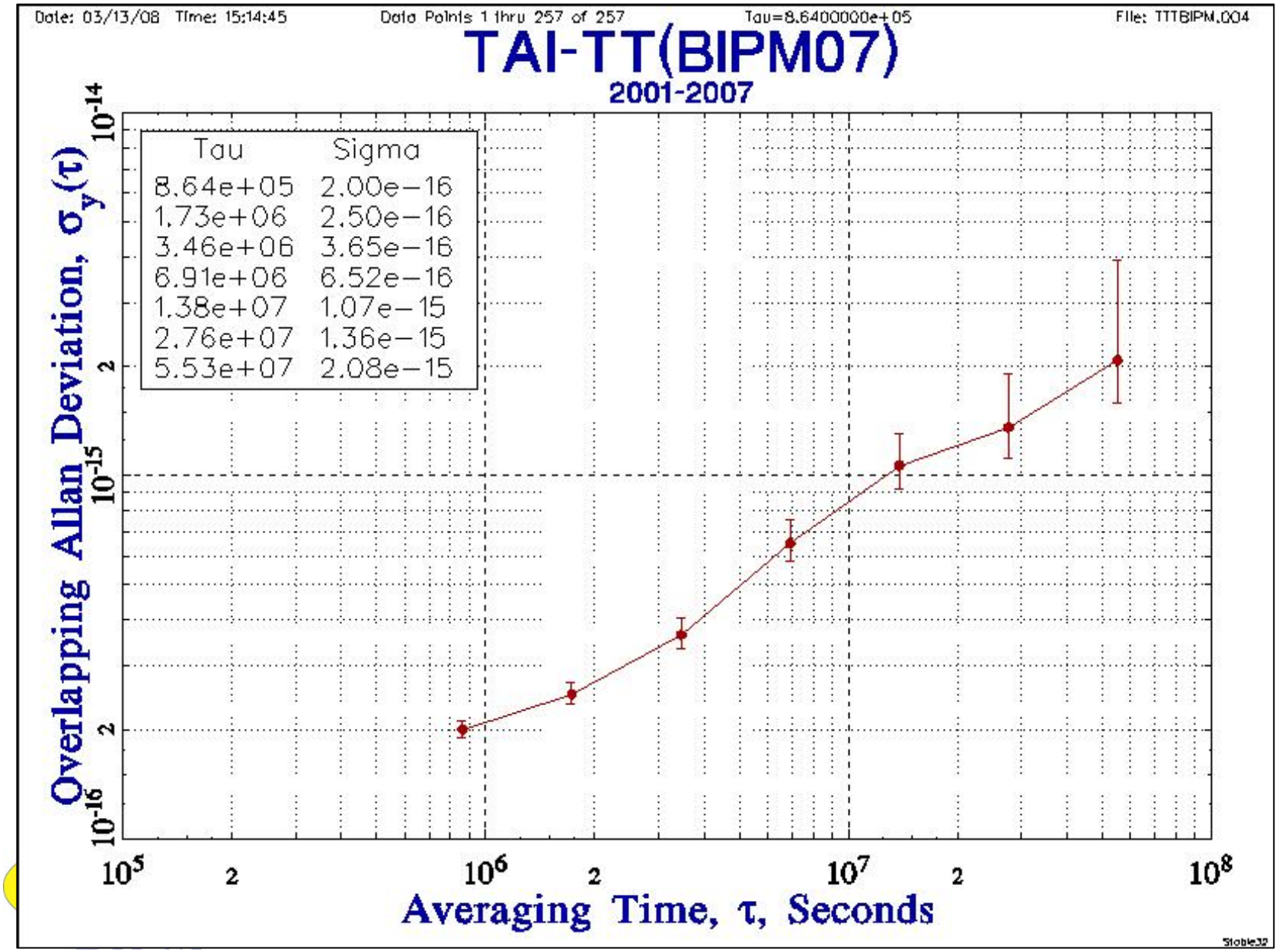
- 125 fountain evaluations in last 5 years
- Global $\chi^2 = 1.30$ (1.19 after removing 3 "outliers")
- Situation similar (even slightly worse) in the most recent period



TT(BIPM) allows to estimate accuracy of TAI



TT allows to estimate stability of TAI
Instabilities of up to 2×10^{-15} over a few years are possible



Conclusions

- Primary frequency standards have gained about one order of magnitude in accuracy every 10 years, and this expected to continue. We are at $3\text{-}4 \times 10^{-16}$.
- The full accuracy of PFS is presently not completely passed to TT(BIPM) because of
  - the noise of frequency transfer
  - slightly inconsistent PFS evaluations

- We might use (at least analyze) secondary representations of the second
  - if laboratories provide them