Deep Space Atomic Clock (DSAC) for a Technology Demonstration Mission

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There are many different atomic clock technologies but few meet the demanding performance, reliability, size, mass, and power constraints required for space based navigation applications. JPL is currently developing a mercury trapped ion clock [1,2] for a NASA Technology Demonstration Mission (TDM) referred to as DSAC (Deep Space Atomic Clock) [3]. A one year flight demonstration as a hosted payload is planned following a 2016 launch. Ion clock development, status, and a brief mission overview will be presented.

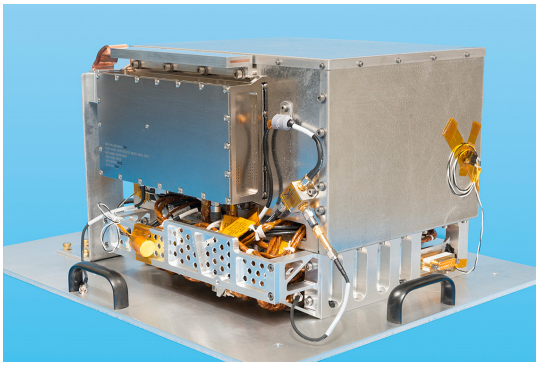

Fig. 1: Mercury ion clock Demonstration Unit (DU) for the DSAC Technology Demonstration Mission.

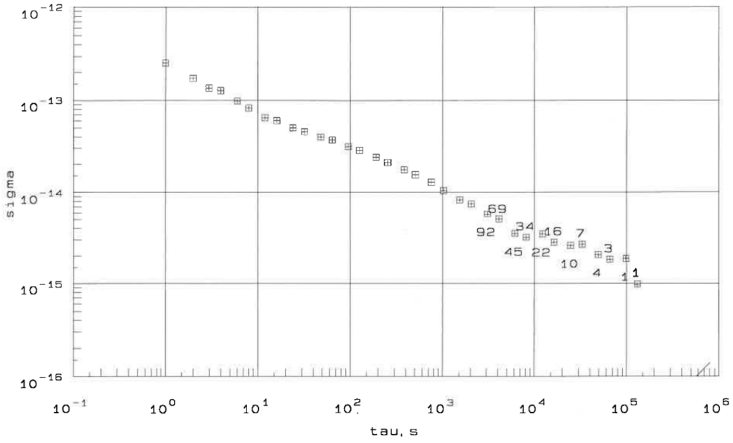

Fig. 2: Seven day Allan Deviation of the DSAC mercury ion clock compared to a hydrogen maser. The performance at one second is limited by the user synthesizer used to generate a 20.456 MHz reference signal.

[1] R.L. Tjoelker et al, "Mercury Atomic Frequency Standards for Space Based Navigation and Timekeeping," Proc. of the 43rd annual PTTI, 2011.

[2] J. D. Prestage et al, "Atomic Clocks and Oscillators for Deep-Space Navigation and Radio Science," Proc. of the IEEE, vol. 95, Nov. 2007, pp. 2235–2247.

[3] Todd A. Ely et al, "The Deep Space Atomic Clock Mission" ; Proc. of the 23rd International Symposium on Space Flight Dynamics, At Pasadena, CA, 2012.