

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Gravity and Fundamental Physics (1)

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NOVEL CPT ON-BOARD ATOMIC CLOCK TECHNOLOGY FOR GALILEO SECOND
GENERATION**Abstract**

This paper describes the results of the study funded by the CNES to investigate the feasibility of on-board CPT atomic clock for Galileo Second Generation. The aim of this study, realized end of 2020, was to explore the general concept and technology maturity of a compact high-stability CPT atomic clock based on LNE-SYRTE and FEMTO-ST knowledge and research. CPT-based atomic clocks offer inherently good stability performances with reduced size, weight and power. CPT-based vapor cell clocks operate without consumable in disperser or oven, gas or atomic beam, nor microwaves cavity, ultra-high vacuum tube, ionic pump getter, dissociator. CPT-atomic clock show competitive and promising short-term stability results; at FEMTO-ST with push-pull optical pumping combined with auto-balanced Ramsey protocol reaching the level of $2.5 \cdot 10^{-15}$ at 10 000 seconds. The trade-offs are performed to select the proposed concept taking into consideration the background of laboratory-based experiment results with compromise between performance and complexity. Finally the team consolidates the technology aspects with the identification of subsystem solutions.