Preliminary test of a cold-atom based clock prototype on a microgravity platform: Rubiclock on the A-300 0g

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In our presentation we will show the preliminary results of the Rubiclock cold-atoms based atomic clock operating in microgravity. These results were obtained during the latest flight campaign of the Airbus A300-0g (3-14 march 2014). Performing parabolic flights this aircraft allows us to collect data for about 1800s of total microgravity operation with typically 20s of continuous microgravity environment. Even though there is no room for measuring the clock stability within such a short timeframe, the campaign had three crucial objectives instrumental in establishing the interest of the Rubiclock concept for microgravity operation:

1. Test the robustness of the design that allows for operation in microgravity with only minor modifications
2. Demonstrate the ability to interrogate the atomic reference for a duration longer than the theoretical limit on the ground
3. Demonstrate that microgravity reduces dead times in the clock operation as a significant fraction of the atoms can be recycled from one cycle to the next one.

In order to achieve these results a significant effort was put in realizing a more compact and rugged setup including a fully re-designed atomic resonator and laser system (see fig. 1).

We will begin our presentation by briefly describing the key technical aspects of the different subsystems and then report on the results of the microgravity flight campaign. We will then conclude presenting the perspectives of our collaboration with the French space agency for making a demonstration of clock operation on the same platform.

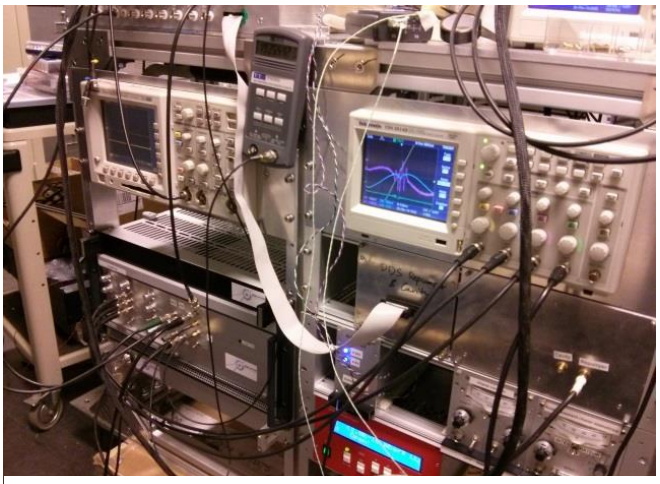

Figure 1. Rubiclock laser system is visible on the bottom left of the picture. Its telecom-based design allows it to fit in a 6U 19in rack. Signal from integrated reference cell is visible in the top right