Progress on optical TF metrology at ROA

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Encouraged by the imminent redefinition of the SI second, ROA recently started to construct and implement a stationary Sr optical lattice clock. This project also includes the design and deployment of optical fiber links for future comparisons and time and frequency dissemination.

On the one hand, we will report on the characterization of the atomic flux released by the oven and, after the deceleration of the atoms, before reaching the trapping region. For this purpose, we have designed and built up a compact and light permanent-magnets Zeeman slower performing a transversal magnetic field[1]. We will present the simulated and experimental B field and the velocity-space diagram of the atoms to be loaded into the magneto-optical trap. Moreover, we will described the method employed to find an optimal position of the magnets, and a GUI that allows to customize their final configuration according to the different parameters involved such as the optical power of the cooling laser, length of the apparatus and capture's velocity of the atoms.

On the other hand, we will describe the first steps carried out for ultrastable time and frequency distribution over long fiber links, which have been tested locally. We have implemented separately a time transfer system with White Rabbit technology over a 250-km fiber link[2] and a purely photonic frequency transfer one over a 100-km link[3], being the later actively phase noise compensated. Additionally, we will report on preliminary results in a real time transfer implementation from ROA to Sevilla using ADVA Optical Networking's FSP3000 devices over the national research and education network for Spain (RedIRIS), and over a 22-km dark fiber between ROA and UCA (Universidad de Cádiz) for frequency dissemination.

[1] I. R. Hill et al., "Zeeman slowers for strontium based on permanent magnets", J. Phys. B: At. Mol. Opt. Phys., vol. 47, 075006 (13 pp), 2014.
[2] E. F. Dierikx, at al., "White Rabbit Precision Time Protocol on Long-Distance Fiber Links", IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency, vol. 63, pp. 945–52, 2016.
[3] O. Lopez et al., "Cascaded multiplexed optical link on a telecommunication network for frequency dissemination", Optics Express., vol. 18, pp. 16849-16857, 2010.