

Towards an international optical clock comparison between NPL and SYRTE using an optical fibre network

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For the last ten years several research groups explored optical frequency transfer on long-haul fibre links. The longest link achieved so far is 1840 km long between PTB and MPQ in Germany [1]. The transfer techniques developed under the NEAT-FT project [2] are now mature enough to enable the remote optical clock comparison via optical fibre. Using these techniques, we aim at



Fig. 1: Map of the London-Paris link that will be employed to compare the optical clocks in NPL and SYRTE.

performing an international comparison of the clocks developed at SYRTE and NPL, by measurement of the frequency ratio of their atomic transitions. The two laboratories are separated by a geographical distance of 340 km and linked by the pan-European Research and Education network GÉANT, operated by DANTE. The total length of the link connecting the 2 laboratories exceeds 760 km.

The high accuracy comparison requires bi-directional operation in order to actively compensate the propagation phase noise on both fibres. The link will be equipped with low noise bi-directional optical amplifiers along the link, and a Fiber Brillouin amplifier at one end of the link. A large fraction of the optical fibre link is installed in metropolitan areas and other noisy environment (such as the Eurotunnel between the UK and France). Results on the fibre noise cancellation over portions of the London-Paris link will be presented with discussions on the experiment outlook and next steps.

[1] S. Droste, F. Ozimek, Th. Udem, K. Predehl, T. W. Hänsch, H. Schnatz, G. Grosche, R. Holzwarth: Optical Frequency Transfer over a single-span 1840-km Fiber Link. *Phys. Rev. Lett.* 111, 110801 (2013)

[2] http://www.ptb.de/emrp/neatft_home.html

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