JRP: NEAT-FT
DELIVERABLE No: CNR D9
Titel / Subject: A fiber link with DRA

Author: G. Bolognini | Type: Diagram | delivered by: 14-07-31
Participants: **CNR** | . | latest update: 14-08-25

Scope: distributed fiber Raman amplification

Current amplification techniques, successfully employed in transfer of optical frequencies over long distances, can exhibit a significant degree of complexity and impose specific constraints on the optical fibre link.

The work of this grant is mainly to study, characterize and experimentally demonstrate the benefits of distributed fiber Raman amplification in long-distance transfer of optical frequencies for time-frequency metrology, finally aiming at frequency comparisons at a level better than 10^{-18}, and to exploit synergies with other amplification methods (i.e. Erbium-doped Fiber or Brillouin amplification) for a boosted performance.

A comprehensive theoretical and experimental study will be performed, aimed at evaluating distributed Raman amplification for frequency-time metrology and specifically for transfer of optical frequency standards over long distances.

Laboratory experiments, as well as in-field trials on deployed links will be carried out, in order to confirm the possibility of effectively using Raman amplification without inducing significant impairments on link performance. In particular, laboratory experiments performed within this project with the set-up summarized in Fig. 1 already pointed out the possibility of achieving Raman amplification of metrological signal over 305 km without relevant distortions in the carrier frequency phase noise (sew Fig. 2).

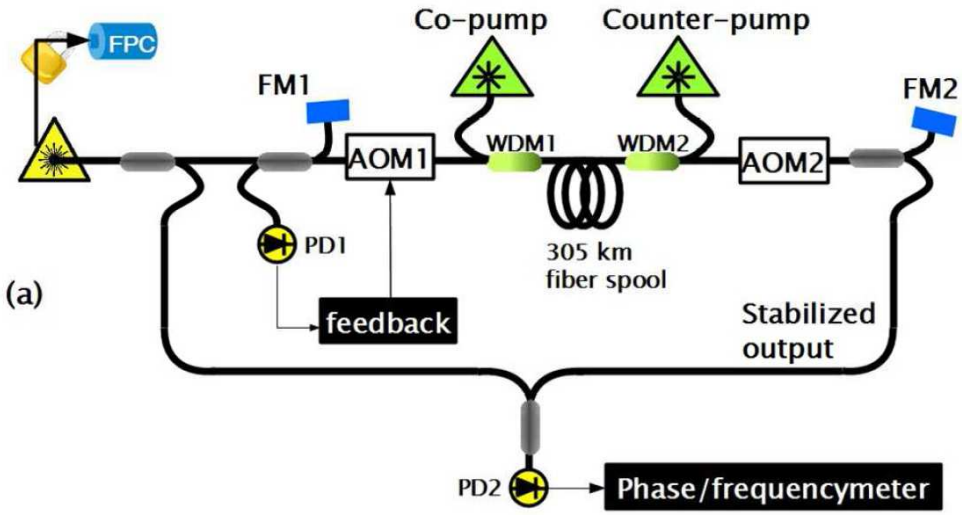

Fig. 1. Set up for DRA in a fiber link based on fiber spools. FPC Fabry Pérot cavity, PD Photodiodes, FM Faraday Mirrors, WDM Wavelength Division Multiplexers, AOM Acousto-Optic Modulators.

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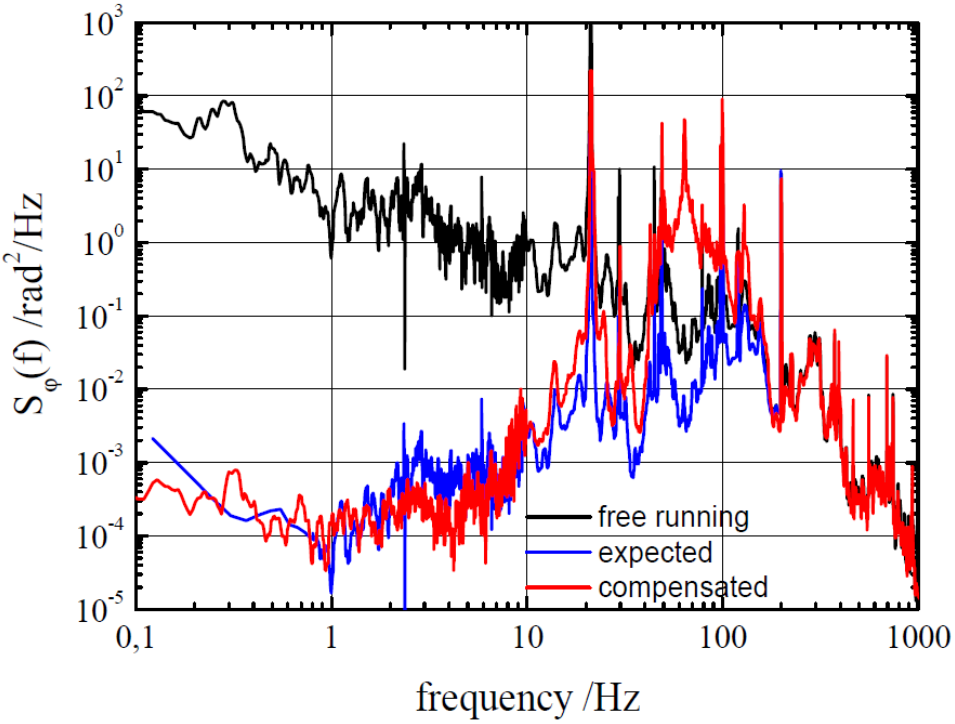

Fig. 2: Phase noise power spectrum of free-running (black line) and stabilized (red line) 305 km link. No degradation in the spectral purity is observed, compared to the expected residual noise for this link (blue line).