To whom it may concern,

my name is David Edward Bruschi and I am a Postdoctoral research Fellow at the York centre for Quantum Technologies, University of York, UK.
I have been awarded 540€ in the last call for STSMs under the COST Action MP1304 to visit Prof. Tsvi Piran at the Racah Institute of Physics (the Hebrew University of Jerusalem, Israel) from the 17th of October till the 23rd of October 2015.

I have successfully completed the visit and I am providing a report of the activities as required by the Action's guidelines for STSM funding.

During this preliminary visit we have discussed the opportunity of employing micrometer quantum systems, known as Bose-Einstein Condensates (BECs), to efficiently detect gravitational waves (GWs), in particular those emitted in the 100Hz-1kHz window of frequencies. This scheme promises to offer an alternative approach to current ones based on laser interferometry, such as LIGO and aLIGO, and those based on resonances in bar-detectors.

I have explained in more detail to Prof. Piran and Dr. Kenta Hotokezaka of his group how the scheme works. We have focused our discussion on three basic elements of the final theoretical formula of the sensitivity obtained in my work New J. Phys 16 (2014) 085003:
i) The available number of "cycles", or the product of the frequency of the impinging wave and the duration of the train of waves, that can be realistically expected;
ii) The squeezing that can be present in the initial state and its role in the final measurement;
iii) The number of measurements that can be performed. This last point is the one that leaves most open questions to be addressed.

Prof. Piran has suggested that studying the following points is essential in order to understand if the scheme is realisable:
i) Find the Q-factor of the cavity and quantify the bandwidth that can be tolerated;
ii) Move beyond the current theoretical formula that considers a monochromatic continuous and periodic signal and find the sensitivity for a realistic wave, i.e., chirping or burst;
iii) Find how many phonons can be produced by an incident gravitational wave and understand if this number can be distinguished from the noise;
iv) Compute the sensitivity of the proposed detection method including all relevant external and internal sources of phononic excitations.
v) Obtain a final realistic figure for the number of measurements that can be performed. This number needs to be very large to compensate for the low amount of cycles that can be realistically expected from sources of gravitational waves.

After this preliminary visit we will continue to investigate the physics of this system according to the issues raised above. We aim at providing a realistic formula in the next six months and, if enough progress is made by then, I aim to visit again Prof. Tsvi Piran's group in Israel during summer 2016 where the next steps of the project will be discussed and tackled.