

The Einstein Telescope beam pipe vacuum system: challenges and perspective

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The Einstein Telescope (ET) aims to realize a 3rd generation Gravitational Waves detector, which promises to revolutionize the way we observe and understand the Universe. ET will observe the coalescence of stellar and intermediate mass black hole binary systems (BBH) back to the dark ages of the Universe, shedding light on the first phases of the Universe formation and contributing solving the dark matter enigma. Also, the expected rate detection of gravitational waves will boost our knowledge also in fundamental physics, nuclear physics, astrophysics and cosmology.

To achieve the required sensitivity, ET will operate in UHV condition with arms vacuum system consisting of a one-meter diameter tube with an overall length of 120 km operating at 10^{-10} mbar and a preliminary cost estimation of the order of 560 million euros. It is clear that the realization of a vacuum system of such size requires a process of optimization in the choice of materials, manufacturing processes, treatments on the tubes and pumping systems in order to find a cost-effective solution.

After a short review on the vacuum systems of the 2nd generation of gravitational waves detectors, we will address some of the critical aspects in realizing the ET beam pipe vacuum system, one of the largest UHV system ever made.