

*[1000 words max]*

## **Impacts of the external environment on the Virgo detector during the third Observing Run (O3: April 2019 – March 2020)**

Sources of geophysical noise (such as wind, sea waves and earthquakes) or of anthropogenic noise (nearby activities, road traffic, etc.) impact ground-based gravitational-wave (GW) interferometric detectors, causing transient sensitivity worsening and gaps in data taking.

During the one year-long third Observing Run (O3: from April 01, 2019 to March 27, 2020), the Virgo Collaboration collected a large dataset, which has been used to study the response of the Advanced Virgo detector to a variety of environmental conditions. We correlated environmental parameters to global detector performance, such as observation range (the live distance up to which a given GW source could be detected), duty cycle and control losses (losses of the global working point, the instrument configuration needed to observe the cosmos). Where possible, we identified weaknesses in the detector that will be used to elaborate strategies in order to improve Virgo robustness against external disturbances for the next data taking period, O4, currently planned to start at the end of 2022. The lessons learned could also provide useful insights for the design of the next generation of ground-based interferometers.

The associated article has been posted to arXiv recently (<https://arxiv.org/abs/2203.04014>) and submitted to a journal.