Contribution ID: **31** Type: **not specified**

Eco-friendly gas mixtures for gaseous detectors at CERN and beyond

Monday 10 June 2024 17:21 (15 minutes)

Gaseous detectors are indispensable as they serve a multitude of diverse applications in particle and nuclear physics, but also in industry, e.g., in the national security domain. To stay at the forefront of rapidly changing particle detector technologies for future detector applications, gaseous detectors must face a critical global challenge: sustainability. Today's RPC detectors utilise highly potent greenhouse gas mixtures including CF4, SF6, and C2H2F4 with Global Warming Potentials (GWP) of 6630, 23500, and 1300 that of CO2. Current gases used for particle detectors, detector cooling, etc., are the highest source of emissions from CERN (https://hse.cern/environment-report-2021-2022). The key to enabling the continued operation of current detectors and installation of future detectors, especially large-scale ones like ANUBIS, is identifying a viable strategy to replace the current detector gas mixture by an alternative eco-friendly gas mixture while not compromising the detector performance, which is a prominent part of the DRD1 research agenda. The talk will review the challenges to identify a suitable eco-gas mixture and provide an overview of previous work in the context of RPC detectors. The talk will close by outlining possible future avenues.

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Session Classification: Parallel Session A