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A Novel vacuum gauge: Applications for Pressure Measurement, He-Leak detection and Residual Gas Analysis

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A pressure gauge with an integrated He-leak detector based on a novel ion source was presented to the vacuum community at the EVC-14 in 2016. The recent progress in the development of a vacuum gauge based on this ion source will be presented.

The fundamental idea of the vacuum gauge is the novel measuring principle: Instead of directly measuring the ion current, ions are accumulated inside an electron space charge region. The total pressure in the chamber is determined by the accumulation time that is necessary to collect a certain amount of ions. Thereby the capacity of the ion trap is independent from the prevailing pressure and is exclusively determined by the space charge density.

Regarding the pressure measurement, this measuring principle has some advantages compared to the conventional hot cathode: At high pressures the accumulation times are very short. This allows high repetition rates in the range of only a few milliseconds. In the low pressure range (XHV, UHV), the accumulation time is long, however it is possible to measure these pressures reliably since the ions signal remains constant.

Furthermore, a short time-of-flight (TOF) path is connected to the ion source. On this route, the collected ions are separated according to their masses and measured at the Faraday Cup detector in a time separated manner. This enables the gauge to measure the residual gas composition simultaneously to the total pressure. In particular a Helium leakage test can be carried out without the usage of a cost-intensive electron multiplier.

In the talk the underlying physical principles of the novel ion source are presented along with numerous experimental results. Next to total pressure and low mass spectrum measurements, the capability of analyzing the gas composition up to 50 m/z at high repetition rates is evaluated. Use cases for different final applications will be discussed.

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