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Volatile Residue of hydrocarbons in ET: a UHV chamber for CRDS at the CIRCE laboratories

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A significant challenging aspect of the ET vacuum system is the requirement on the hydrocarbon partial pressure (p_{hy}) for molecules heavier than 100 atomic mass unit (amu), as reported in the ET design report:
\begin{equation}
p_{hy}\le1\cdot10^{-14}\,mbar
\end{equation}
In order to reach this partial pressure, both the non volatile and volatile residue of hydrocarbons should be considered.
The former is strictly related to the cleanliness level of the internal surfaces of the system, the latter might give a non negligible contribution to the partial pressure in the final vacuum system.
However, accurately measuring hydrocarbon partial pressure under vacuum conditions is complex. The typical approach in Ultra High Vacuum (UHV) conditions involves using a Residual Gas Analyzer (RGA).
Generally, is not simple to distinguish the contribution of different molecules in the spectrum of the instrument. Indeed, the RGA analysis requires a deep knowledge of the typical cracking pattern of the molecule that complicates the identification of many partial pressures in a vacuum system.
In the present work we want to introduce a new facility in UHV, which will be able to perform really accurate measurements of p_{hy} using an extremely high sensitive technique like Cavity Ring-Down Spectroscopy (CRDS). This technique is based on the measurement of the cavity ring-down time, which gives information about the intracavity absorber concentration and hence gas pressure.
This system marks the first application of CRDS in UHV conditions, aiming to measure only lighter hydrocarbons ($<$ 100 amu).
However, CRDS it is rather promising in measuring p_{hy} at the stringent levels required for ET, especially in the perspective to use it in the chain of processes for the UHV cleaning test, complementing the established Fourier-Transform Infrared spectroscopy (FTIR) and X-ray Photoelectron Spectroscopy (XPS) techniques.

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