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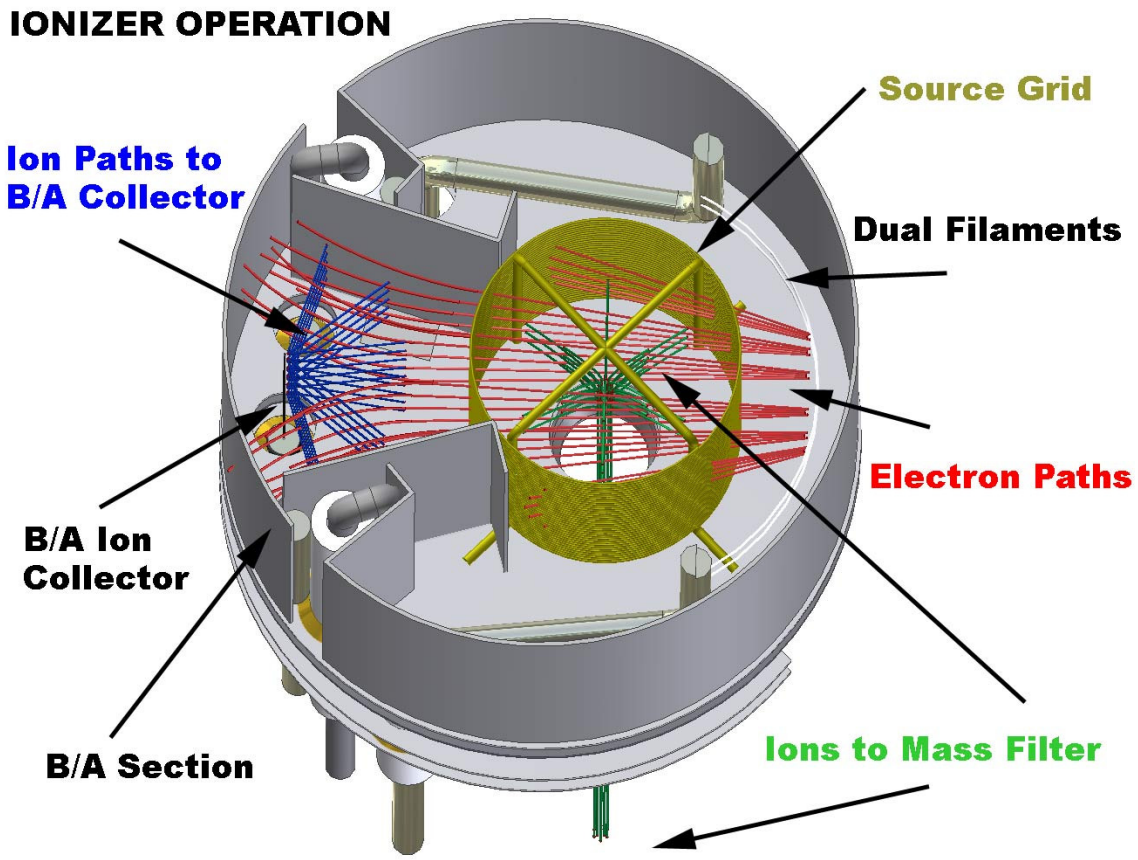
Application Note Number 14: The Built-in Ion Gauge

Abstract: The Extorr ionizer has a Bayard – Alpert type ion gauge integrated into its design. It operates between 10^{-2} and $2x10^{-9}$ torr. This note describes its operation.

The figure below represents the Extorr ionizer and built-in ion gauge. The thoria-coated, dual, iridium filaments to the right of the figure, produce an electron current that passes through the source grid with an energy of 70 eV. Since the probability that the electrons actually hit a molecule within the source grid is typically less that one in a thousand, most of the electrons are available to cause



further ionization in the ion gauge in a high potential section of the ionizer. The ions produced by these "ion gauge ions" travel to a very thin wire which acts as the B-A ion collector. This ion current is proportional to the electron current I_e and the pressure p. The ion gauge sensitivity k is given by

$$k=\frac{I_{ion}}{I_e p} .$$

The pressure measured will then be given by

$$p = \frac{1}{kI_e} I_{ion} = sI_{ion}$$

Typically s is set to one torr per amp. The user can recalibrate this gauge on the Calibration Parameters page of the VacuumPlus software by changing the "Total Sensitivity".

The B-A gauge's lower pressure limit ($2x10^{-9}$ Torr) is due to emission of the soft X-ray radiation generated by primary electrons hitting the anode. These X-ray photons hit the ion collector electrode and release photoelectrons. The electron current due to photoemission is indistinguishable from the ion current of the positive ions collected by the collector electrode. Below 10^{-9} Torr the photoemission current becomes a large enough fraction of the ion current to distort the pressure reading.