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Small rf plasma generator for air

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Complex plasma devices as thrusters or ion sources for fusion and their physical models at reduced size, as the negative ion source NIO1 developed by Consorzio RFX and INFN-LNL, rely on several accessories, like coil shielding, cesium vaporizers, probes and bias electrodes, which needs to be separately tested , both to avoid delays in the major source schedule and to better understand features of those accessories. A simple plasma generator developed at INFN-LNL can be installed on standard pumped vacuum chambers. Air is used as feeding gas for economy; moreover spectroscopy of nitrogen allows for a determination of electron temperature Te in much simpler and direct way than in the other gas cases. Simple and direct diagnostics are described. Even in the present limitation of rf power level, reasonable dense (10^16 m^-3) and bright plasma can be produced, with a large degree of inductive coupling and Te about 4 eV (+/-1 eV) according to the still compelling scaling laws from global ionization balance models. On the other hand, oscillation of the plasma potential (possibly much larger then Te) can be studied as a function of the coil and bias configuration, and may indicate some residual capacitative coupling. Effect of these fluctuation on electron and ion flows inside plasma is worth investigation.

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