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POTOMAC: towards a realistic secondary and backscattered emission model for the multipactor

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Vacuum Radio-Frequency (RF) devices can be subject to the multipactor effect, characterized by the very fast growth of the electron density in the vacuum. The created electrons have many undesirable effects, ranging from the perturbation of the RF signal to the initiation of a corona discharge that can lead to the complete destruction of the device. Hence, it is critical to be able to estimate precisely the RF power threshold P_{max} above which the multipactor appears. As P_{max} measurements require a specific test bed and are onerous, simulation tools are widely used. Even if they are powerful in some simple situations (*e.g.* rectangular waveguides with metallic walls), their reliability is still questionable in many other practical cases: sophisticated geometries, presence of a magnetic field or components including dielectric materials.
P_{max} is highly dependent on the electron emission (EE) properties of the RF compound surfaces. It is thus crucial to improve the modeling of these processes in order to make simulations more reliable. Numerous works use simple electron emission models, based on empirical laws that are not fully representative of the EE processes complexity. Most of the time, no distinction is made between secondary and backscattered electrons. As these two types of electrons are created by very different physical phenomena, their angular and energy distribution are also different.
Therefore, we recently developed a model simulating the multipactor within an infinite parallel-plate waveguide composed of materials representative of the spatial field (silver, aluminium, PTFE$\cdots$). POTOMAC (Physical simulatiOn TOol for Multipactor in Advanced Configurations), a physical EE model that makes a distinction between secondary and backscattered electrons was then implemented. We will show throughout some examples the importance of realistic modelling of the EE on the multipactor dynamics and in particular the importance of the inelastically backscattered electrons.

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