Multipacting Simulation of MICE 201 MHz RF Cavity

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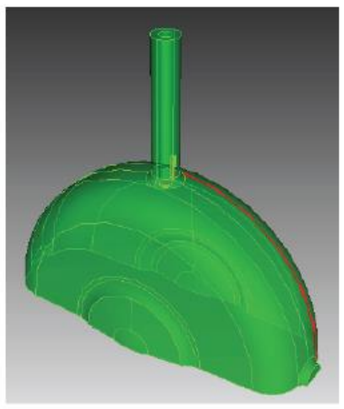
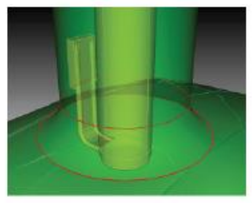
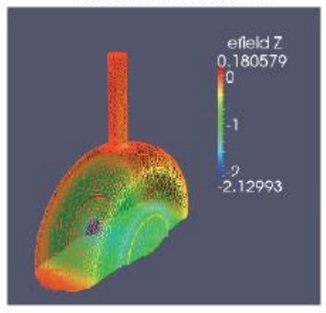
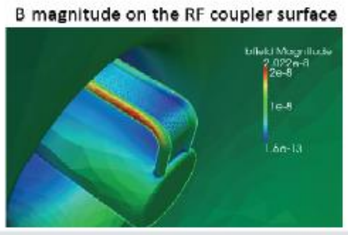
• Omega3p Simulation of Cavity RF field







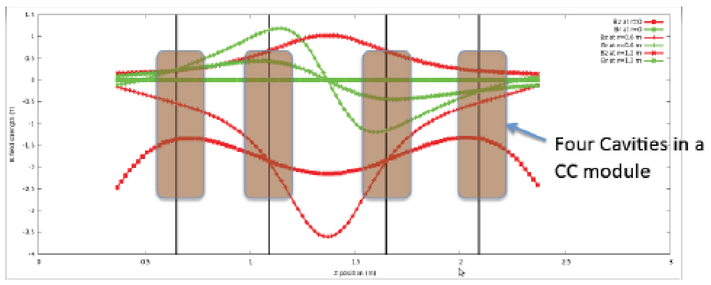


f0=201.901 MHz, Q0=51656
Critical coupling is achieved with 15 degree coupling angle (90 degree corresponds to maximum coupling).

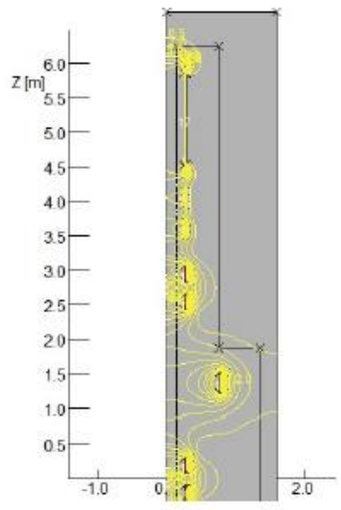
A RF simulation model is built using CUBIT from the 3D CAD drawings used for the MICE cavity fabrication. The model includes curved beryllium windows, RF loop coupler and coaxial waveguide. With the symmetry of the geometry, we only need to calculate half of the cavity.

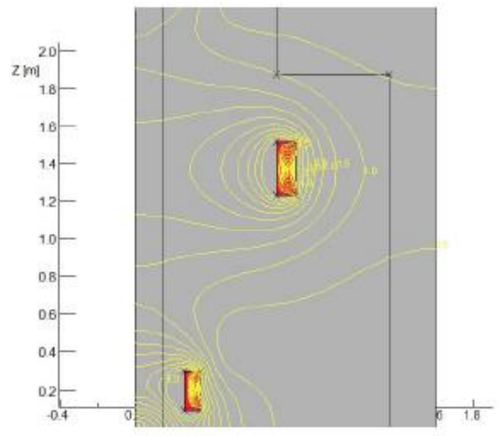
• Magnetic field mapping of MICE cooling channel

The solenoid field in the MICE cooling channel is calculated by OPERA, including all the magnets in Spectrometer Solenoid (SS) modules, Absorber Focusing Coil (AFC) modules and Coupling Coil (CC) modules.



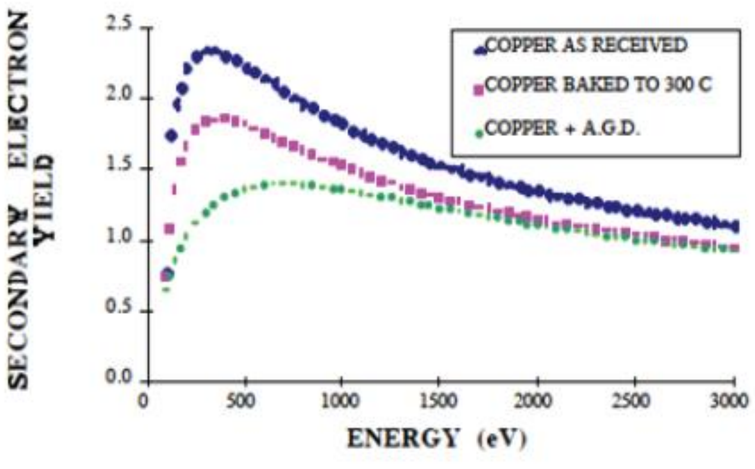
B field plot at r=0 (center), r=0.6 m (RF coupler) and r=1.2 m (RF window).





• Track3P simulation of MICE 201 MHz RF Cavity

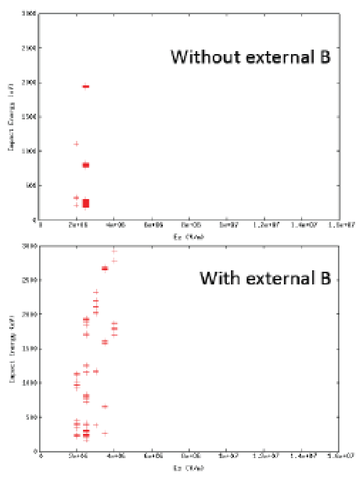
Baglin, V., et al. "The secondary electron yield of technical materials and its variation with surface treatments."

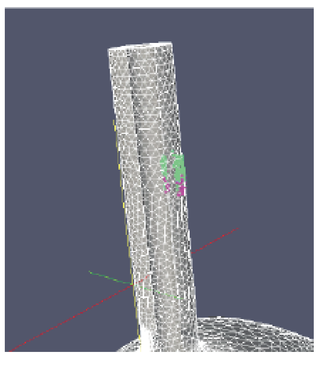


Second Emission Yield (SEY) coefficient is defined as the number of secondary electrons emitted per incident particle and strongly depends on the surface material and treatment. Multipacting occurs at impact energy level where SEY is larger than 1. In this cavity, there are two kinds of surface: electropolished copper and TiN coated Beryllium. The SEY coefficient of copper that we used in the MP simulations is shown on the left. For simplicity, the TiN coated Be surface is treated as an absorber surface.

In Track3P, at each accelerating field gradient level, primary electrons are released from the cavity surface at different RF phases in the first RF cycle and tracked through several RF cycles. The impact energies and locations, as well as the electron trajectories are recorded. They are used to identify the MP electrons later in the post-processing. In this report, the field gradient is scanned from 0.5 MV/m to 16 MV/m and the impact energy at which the secondary electron can emit is from 10 to 3000 eV.

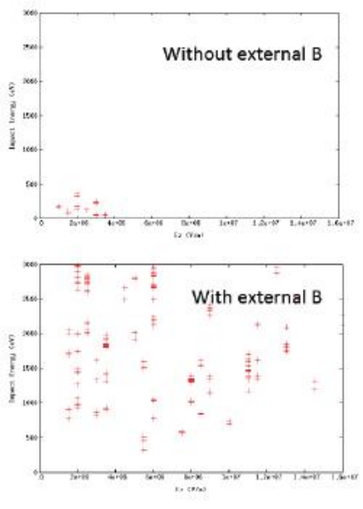
• MP in the coaxial waveguide

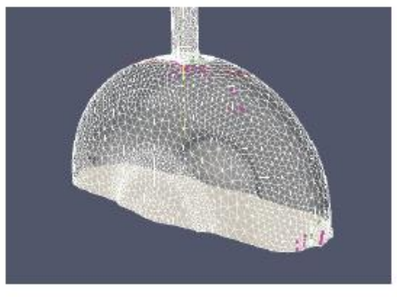




Impact Position: green without B field, magenta with B field.

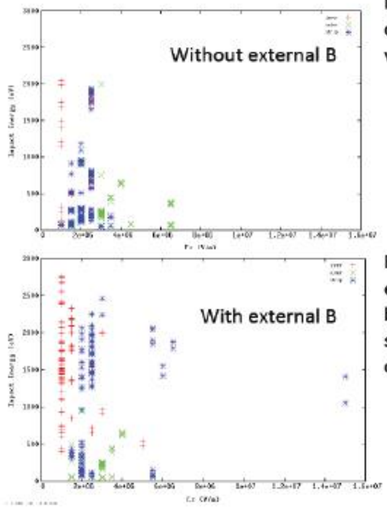
• MP in the cavity body





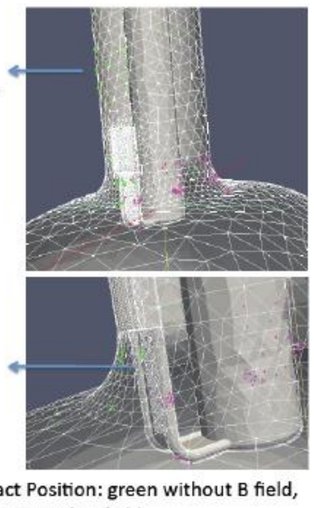
Impact Position: green without B field, magenta with B field.

• MP at the coupler region



Electron drift into waveguide

Resonant electrons between strip and cavity wall



Impact Position: green without B field, magenta with B field.

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