

TD-07-024

ANALYST Simulations of Multipactor in Cornell Superconducting B-Factory Cavity

I.Gonin, N.Solyak

September, 6, 2007

Motivation

The multipactor (MP) is a well-known phenomenon when the resonant trajectories can lead to electron avalanche growing exponentially and may lead to operational problems of the RF devices.

Design&Simulations group of Technical Division have got a request from H. Padamsee (Cornell University) to investigate the possible MP in superconducting B-Factory cavity developed in Cornell University.

Simulations

Recently developed software ANALYST [1] has been used for MP simulations. ANALYST MP analysis consists of two stages.

1. Running ANALYST module OM3P for calculation of E and H fields distribution.
2. Running ANALYST module PT3P for particle tracking using the fields from OM3P

Slides 3 and 4 presents the results of OM3P and PT3P.

1. RESULTS of OM3P

OM3P employs high-order adaptive finite-element methods to accurately compute RF fields. About 600K second order elements has been used. From previous experience it's provide acceptable accuracy for farther particle tracking. Pictures below shows the mesh, E and H fields as results of OM3P.

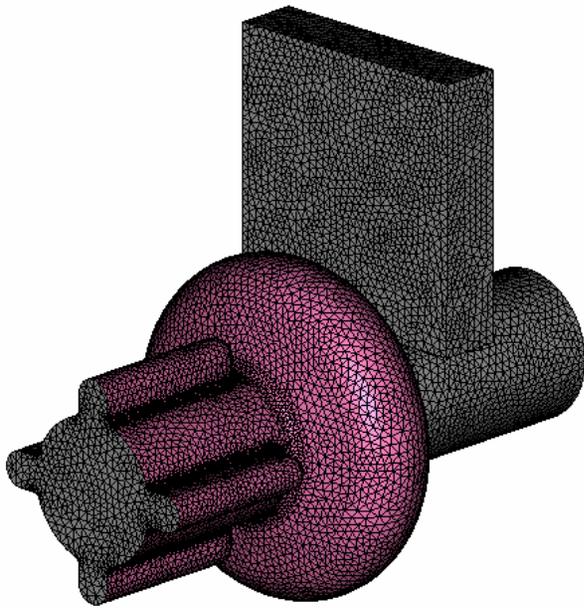


Fig.1 Finite element mesh used in OM3P for fields simulation , mesh consists from about 600K second order elements

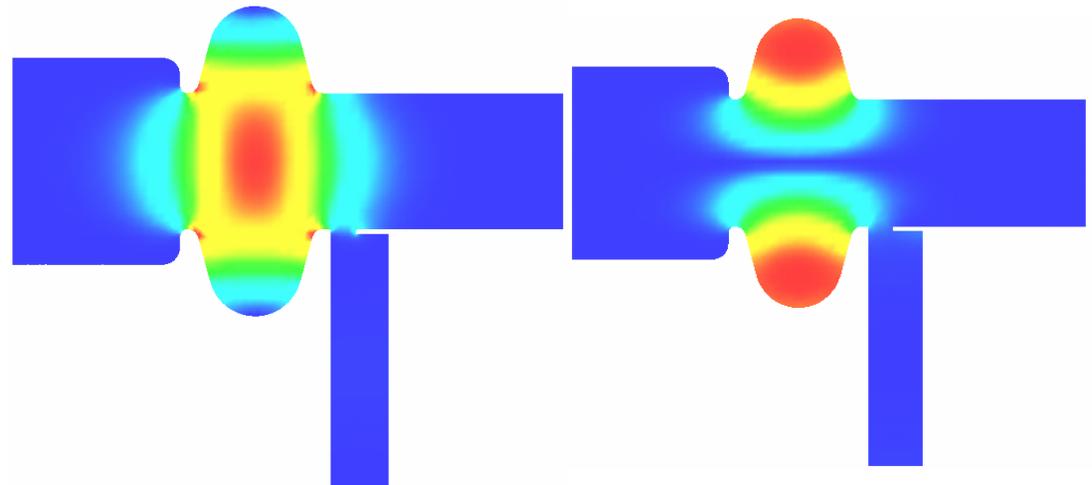


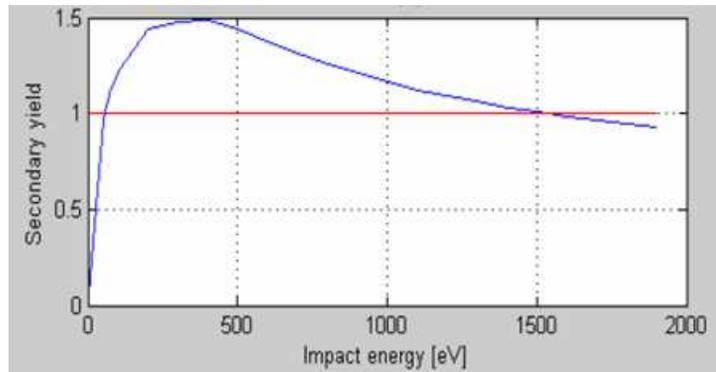
Fig.2 Distribution of electric (left) and magnetic (right) fields in B-factory cavity

2. RESULTS of PT3P

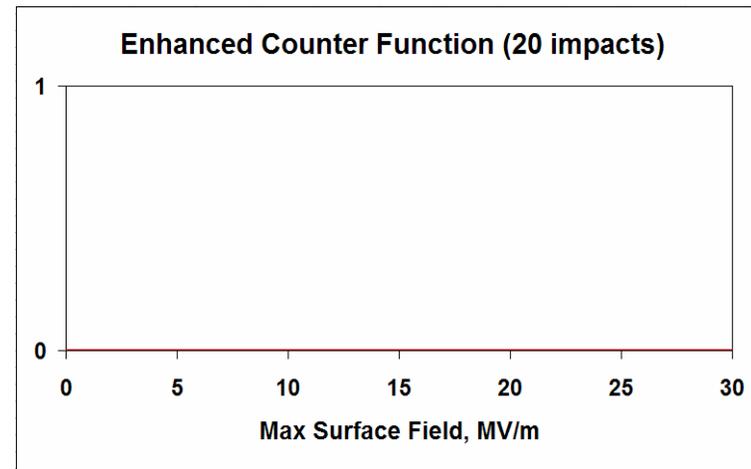
The main PT3P output parameter is Enhanced Counter Function (ECF), defined as the number of particles that survive at least N impacts at a particular field level. ECF includes the effect of secondary yield (see plot) at each impact.

Starting points for MP simulations cover all surfaces, including cell itself, waveguide and fluted beam pipe.

For B-cell cavity, PT3P doesn't indicate any survived particles after 10 impacts. ECF after 20 impacts is shown below and equal zero for all values of max surface field up to 30 MV/m.



Secondary Electron yield function used in MP simulations



CONCLUSION: no MP in B-Factory cavity

[1] J.DeFord et al., Proc. of PAC 2003, Portland, OR, pp. 3554-3556.