Multipacting Simulations for Spoke Resonators

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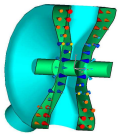
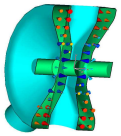


Introduction

- Motivation
- Simulations Approach
- Method Overview
- Existing simulation result
- Outlook

Motivation

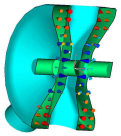
- Spoke resonators show multipacting
- The effect is no show stopper but annoying for operation/start-up
- Established multipacting simulation software exists mostly in 2D
- 3D simulators or coming up (XING, Cornell for wave-guides, MULTP for general geometries)
- We need simulations to understand locations of multipacting (flat part of spoke/outside wall 90° from spoke base/ other ??)
- Can we get rid of multipacting by reshaping the problem spots?



Simulations Approach to Multipacting

Common approach by all simulation software:

- Geometry description
- EM-field description (quality of surface field)
- Surface property description (SEY)(accurate knowledge)
- Particle description: location, energy, (re-)emission
- Scanning of parameter space (field levels, particle energies, rf -phases, emission angles)
- Statistics to identify recurrence patterns



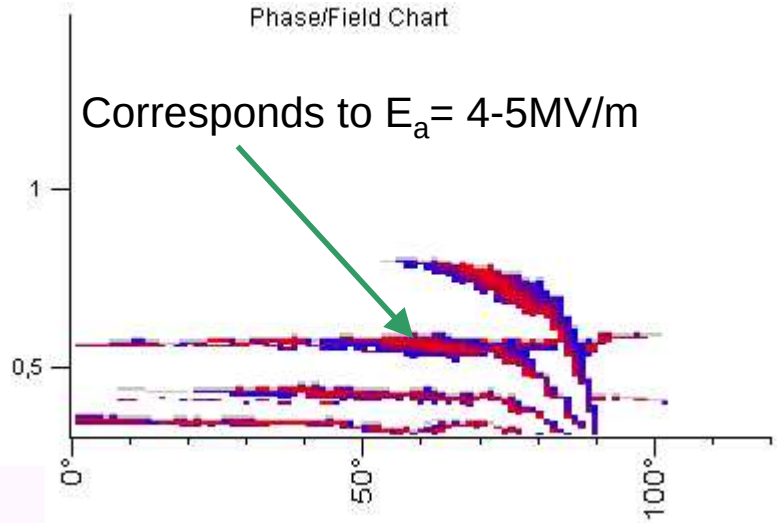
Method Overview

Geometry + EM Field Description

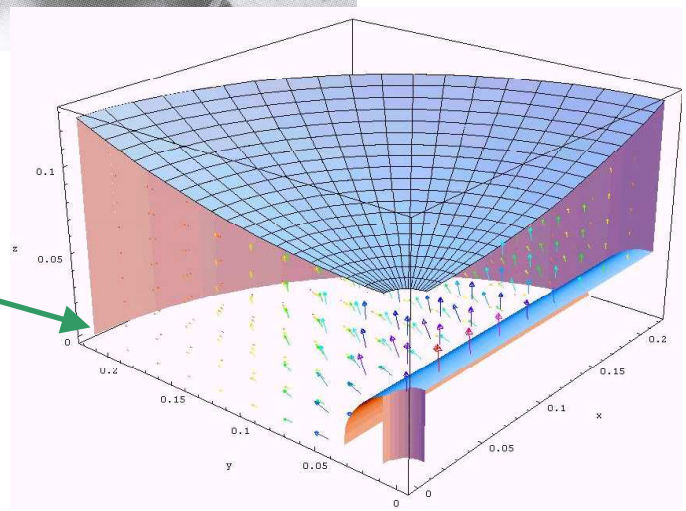
Introduction of particles and material properties into original or processed fields: Scan parameter space (particle and field related) for many particles

Statistics to identify recurrence, multiplication

MULTP Results for ANL Spoke



Suspicious Location



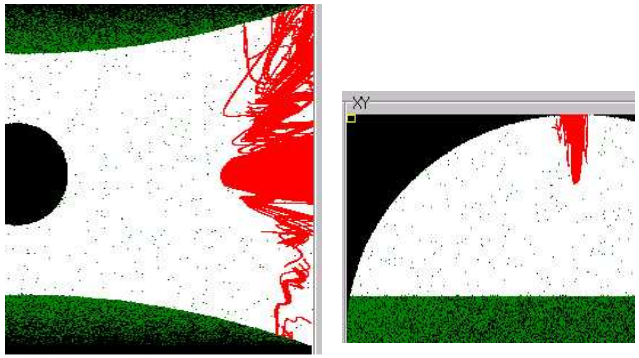
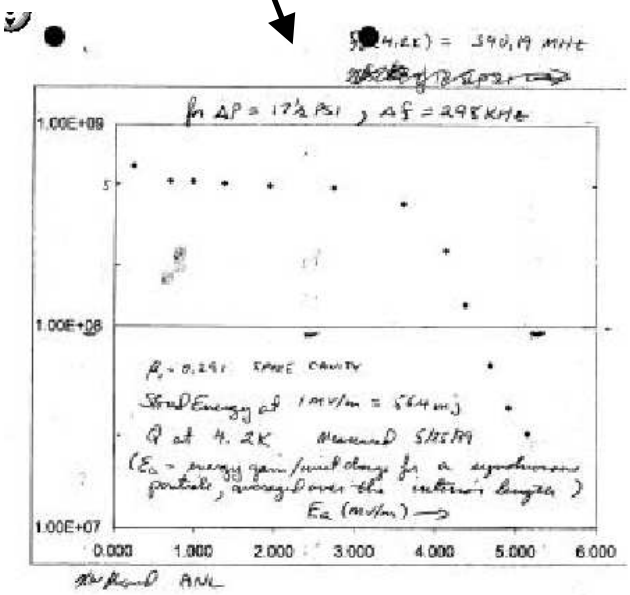
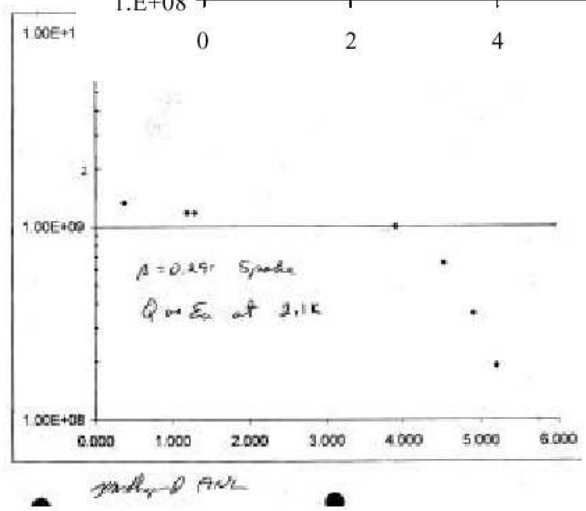


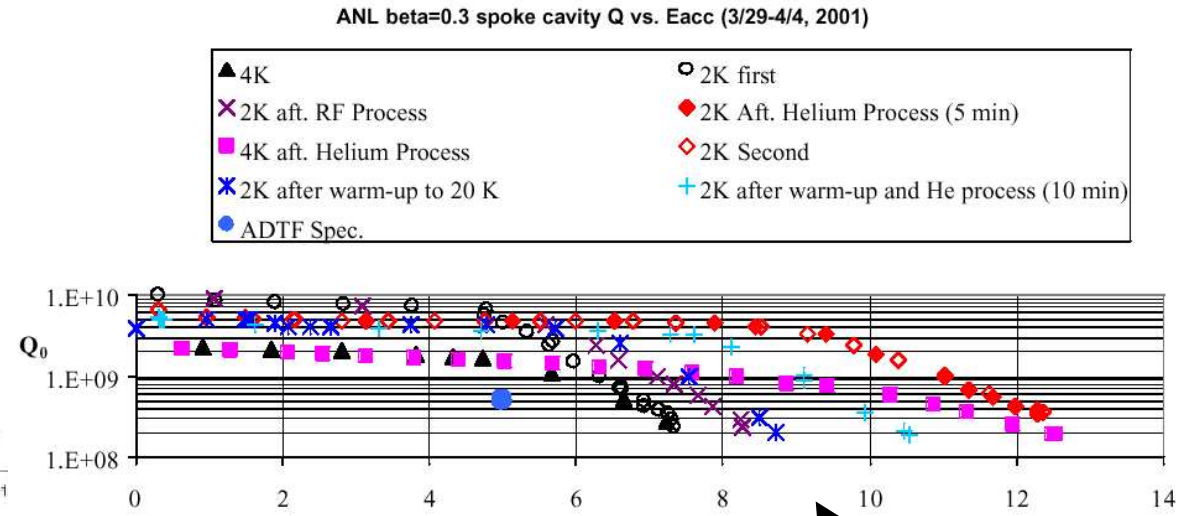
Fig.12a. The electron trajectories of the resonant multipaction.

MULTP Results for ANL Spoke

Original Measurement

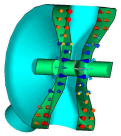






Measurement with improved surface

Outlook

Things needed to improve the understanding:

- Evaluate existing 3D software and compare with measurements
- Identify multipacting locations
- Evaluate geometry modifications