Multipacting Simulation for the PITZ RF Photo Gun

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PPS 01.11.12

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DESY

Simulations

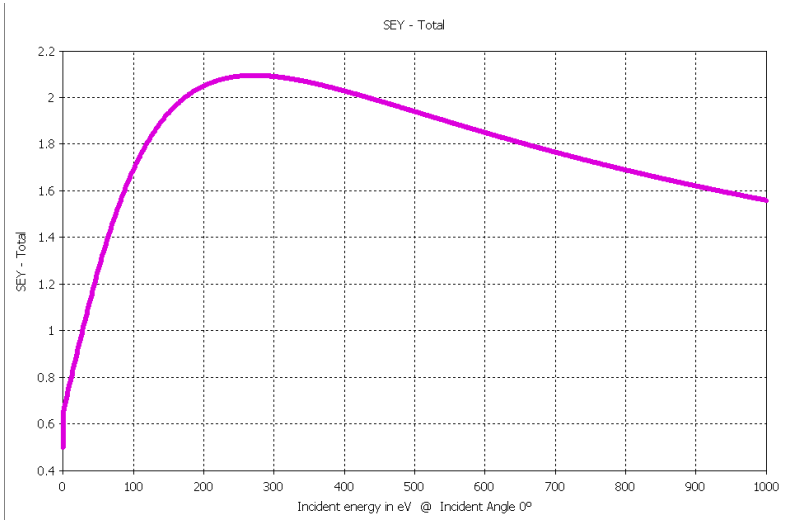
1. RF fields simulation by CST MW Studio
2. External constant magnetic field simulation by CST EM Studio
3. Particle trajectories simulation by CST Particle Studio

Task

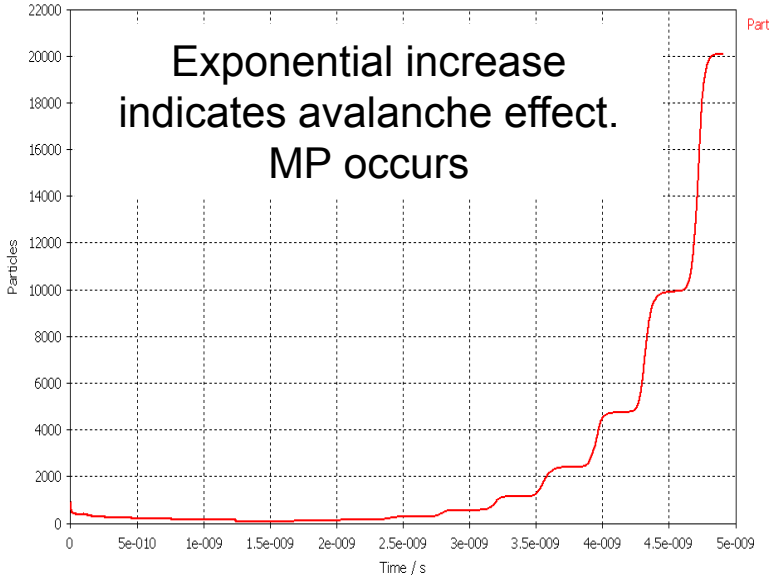
- Multipactor discharge (MP)

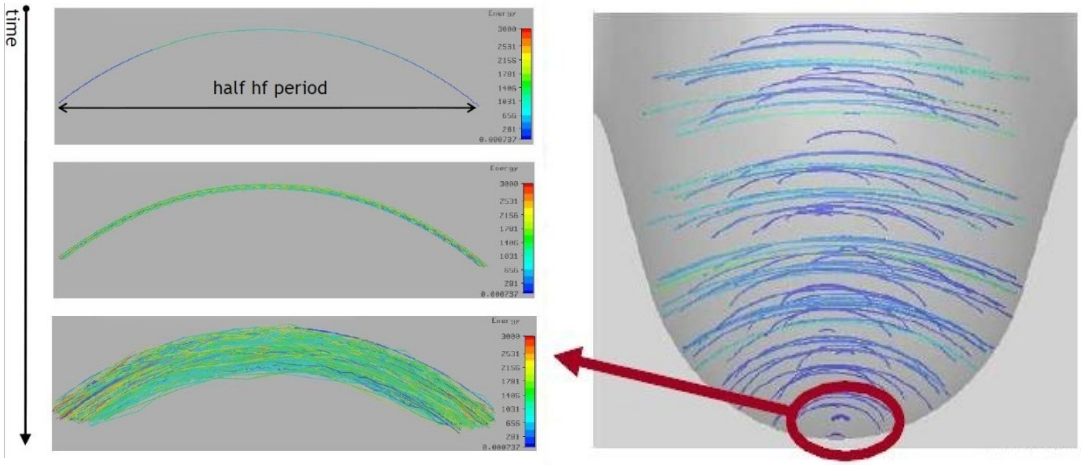
MP depends on:

- ✓ Field configuration
- ✓ Cavity geometry
- ✓ Secondary emission yield (SEY) of the cavity material



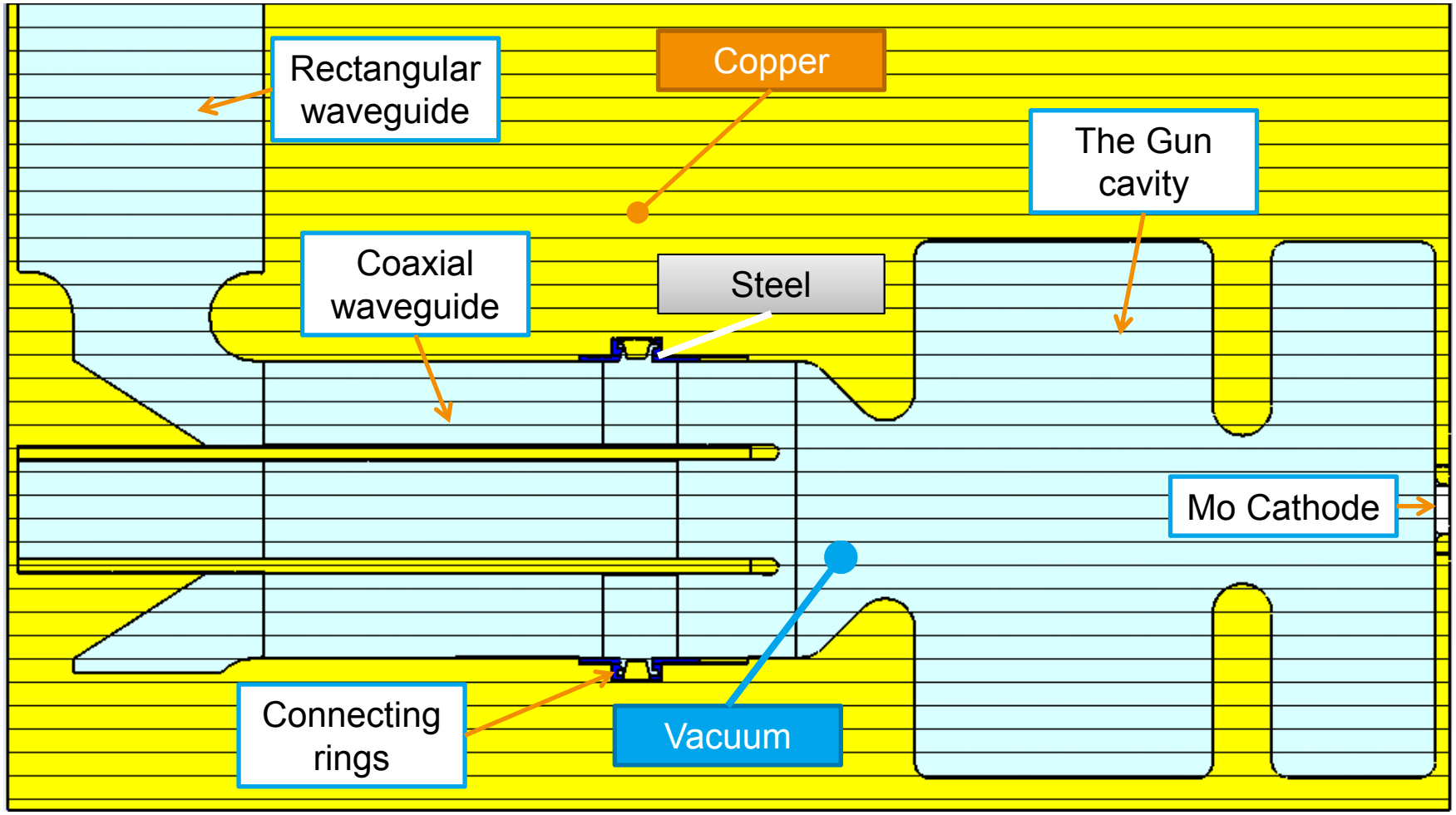
SEY for copper





Example of multipactor trajectories

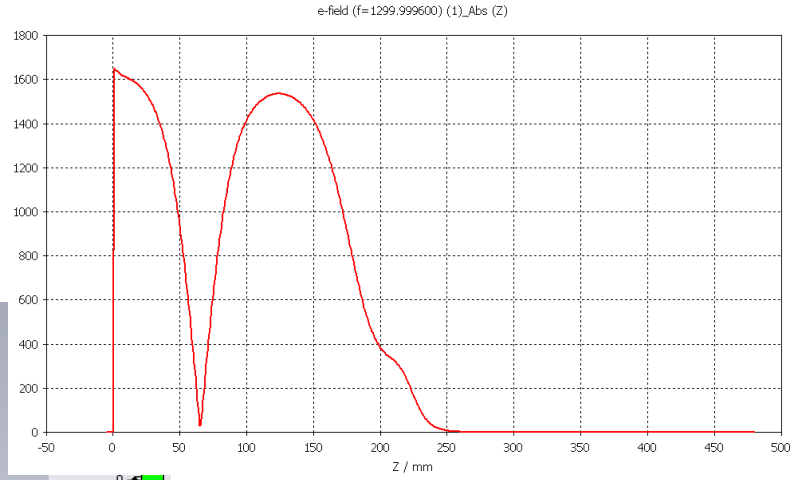
PITZ Gun model

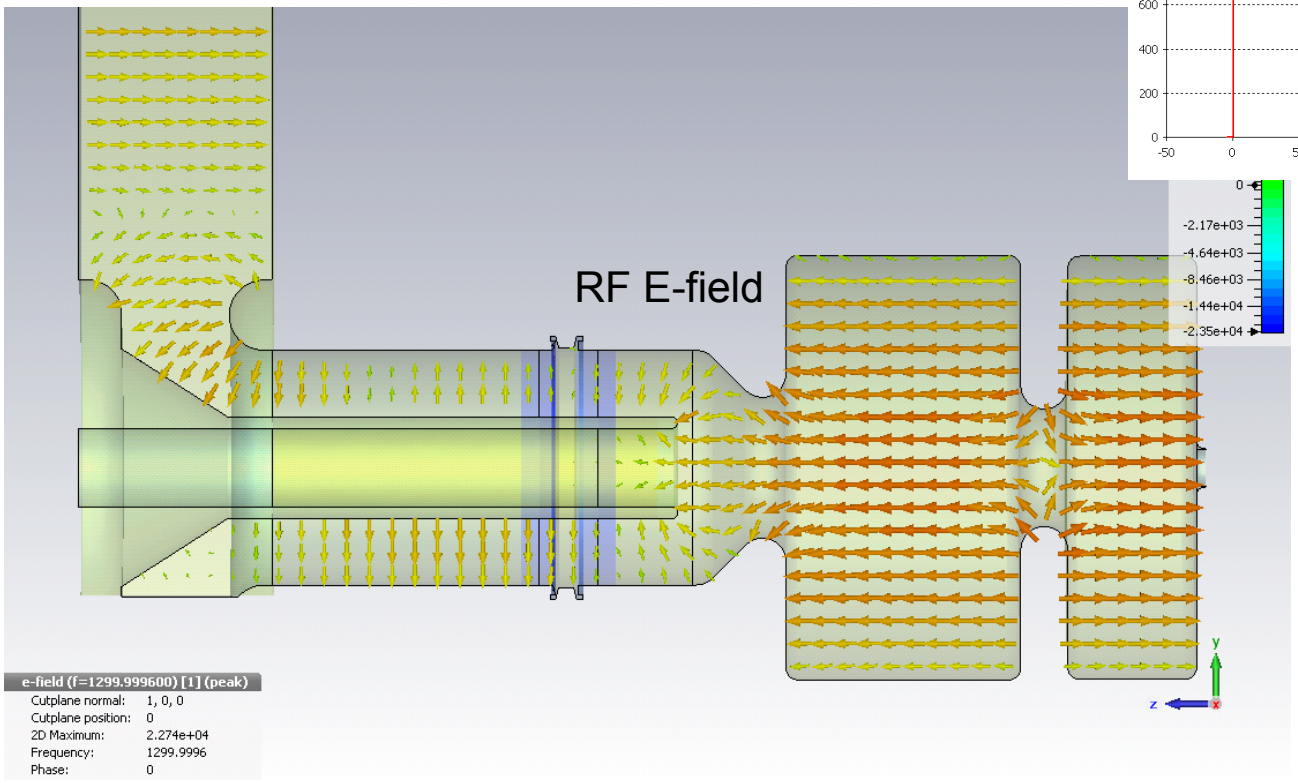


RF fields simulations

RF fields simulation setup:

- Copper model
- Tetrahedral mesh: 918 666 tetrahedrons for half model
- Frequency domain solver
- 1 source port in the rectangular waveguide





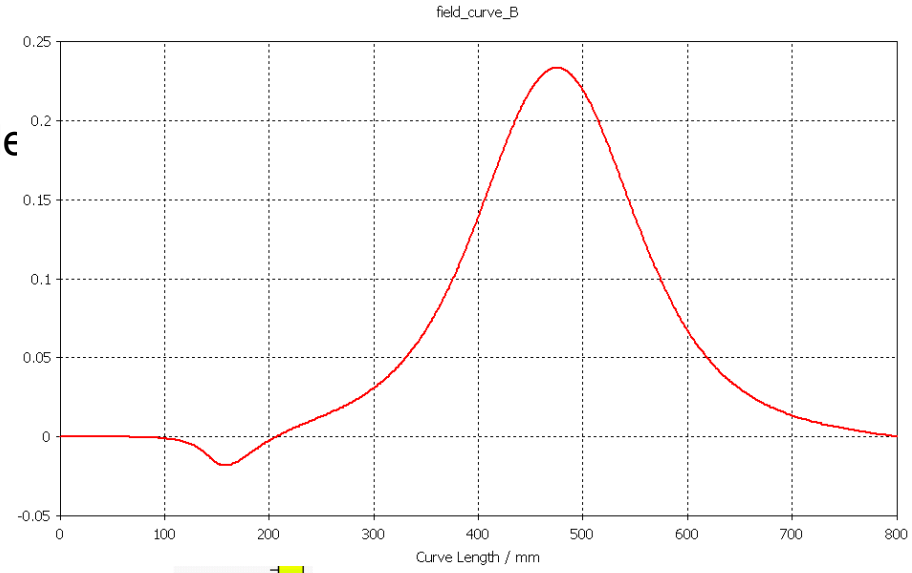
RF fields simulation result:

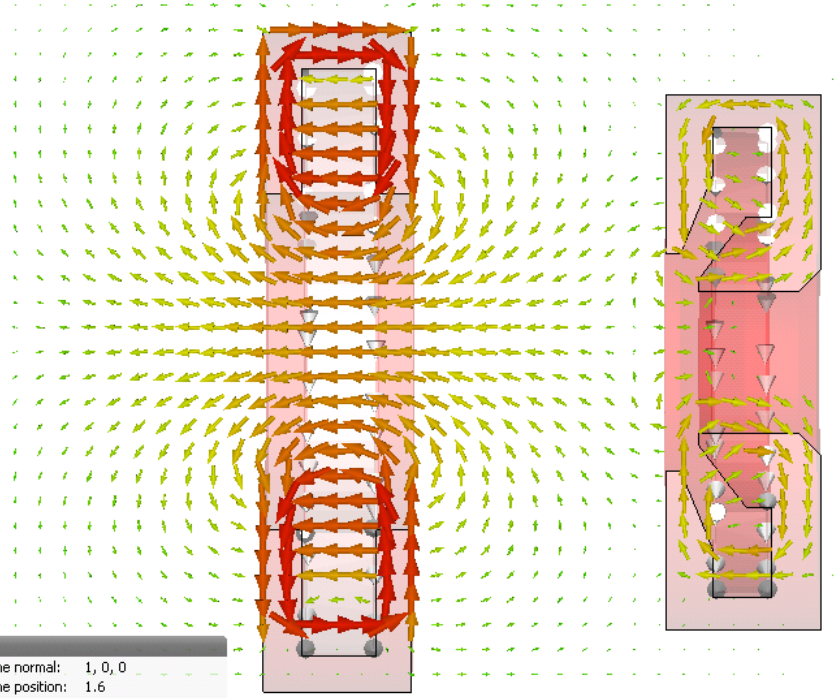
Field balance = 1.0739
S11 = -49.54 dB

External magnetic field simulations

Magnetic field simulation setup:

- Copper model
- Hexahedral mesh: 2 120 899 cells for 1/4 mode
- Magnetostatic solver
- I_bucking=-0.06725-0.082696*I_main

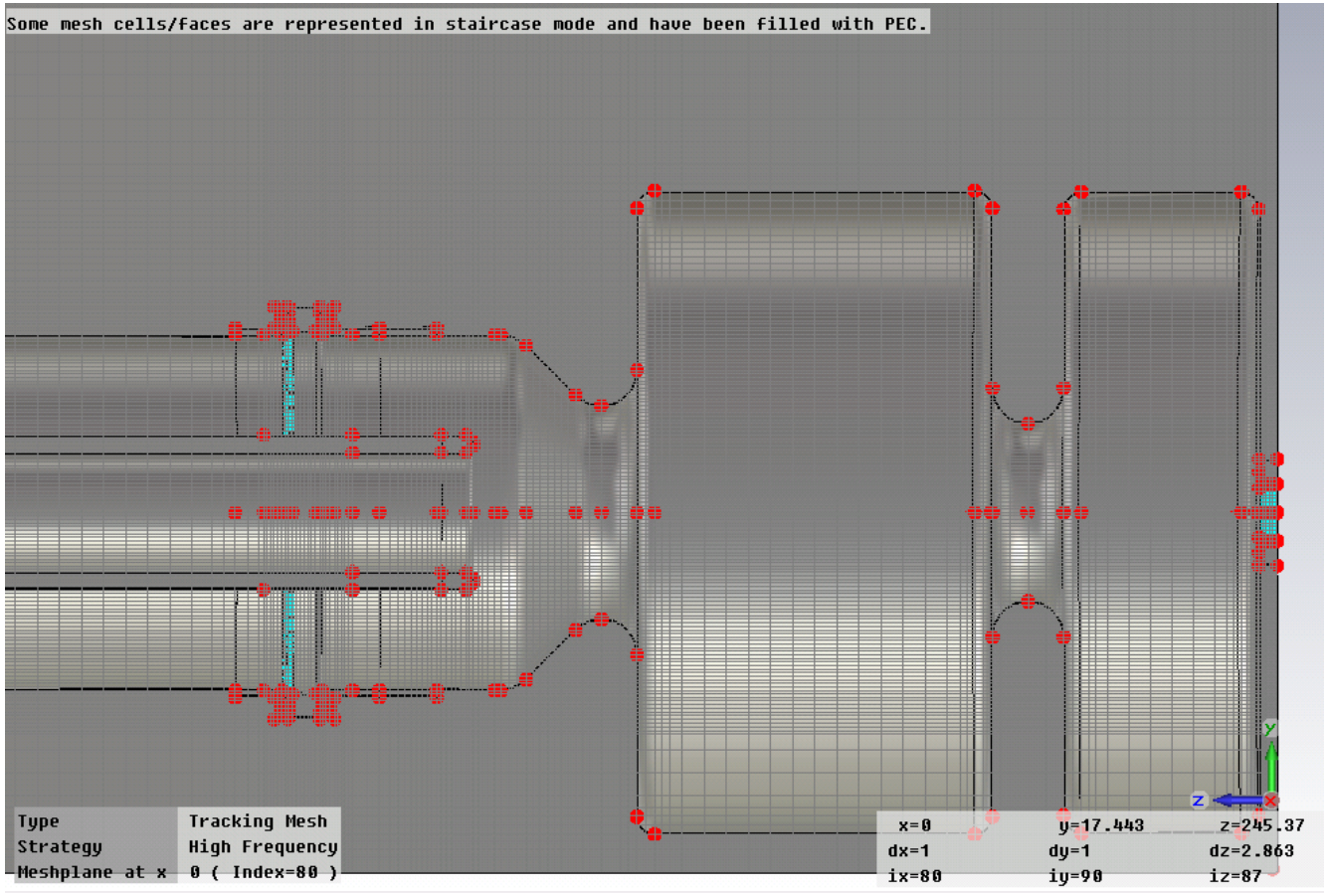




Tracking simulations

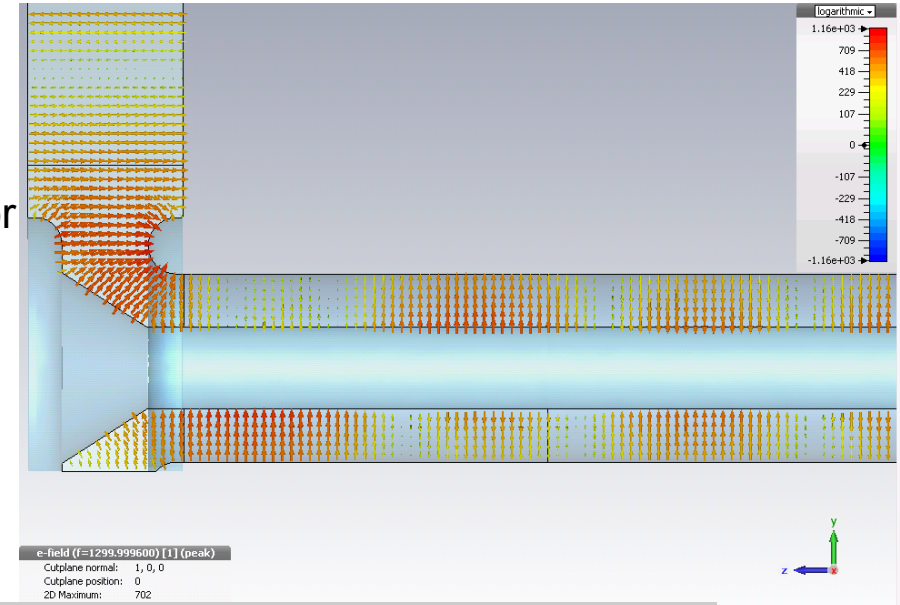
Tracking simulation setup:

- Copper, steel, Mo model
- Hexahedral mesh: 5 218 720 cells for full model
- Tracking solver
- Imported fields



Problems

- RF field simulations:
  - Non-symmetry wave in the coaxial waveguide
  - Model adjustments: geometry is not optimal for RF fields. S11 parameter is not smallest.

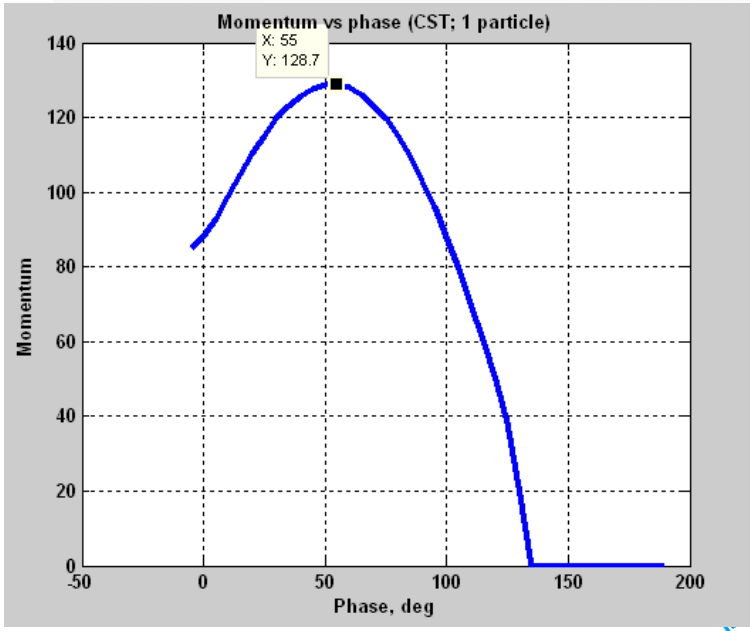


- Tracking simulations:
  - Mesh is not the best for simulations
  - RF field multiplication coefficient:

Was wrong due to mistake in interpretation of RF fields (wrong phase)

  - Long time of simulations and

(even for single particle)



Current work and next steps

- Tracking simulations for:
  - RF fields at the cathode: 60 MV/m; 45MV/m; 10MV/m; 2MV/m; 1MV/m
  - Magnetic fields I_main / I_bucking: 350A / ~ -30A; 350A / -200A
  - RF phase: -20 deg; 0 deg; 30 deg (MMMG); 150 deg

Thank you for your attention.