CST STUDIO SUITE

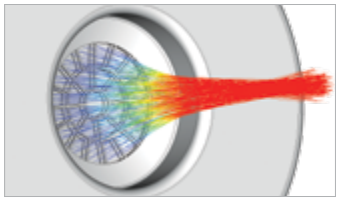
Charged Particle Simulation

CST PARTICLE STUDIO® (CST PS) is a specialist tool for the fast and accurate 3D analysis of charged particle dynamics in 3D electromagnetic fields. As a member of CST STUDIO SUITE®, CST PS is fully integrated in the CST design environment, taking advantage of the standard-raising user interface as well as the solver technology of our multi-purpose electromagnetic modules CST MICROWAVE STUDIO® (CST MWS) and CST EM STUDIO® (CST EMS). CST PS is based on the knowledge, research and development that went into the algorithms used in the MAFIA-4 simulation package.

CST PARTICLE STUDIO® features 3 modules:

- TRK (particle tracking and DC gun simulation including space charge)
- PIC (self-consistent transient particle-in-cell simulation)
- WAK (wakefield simulation)

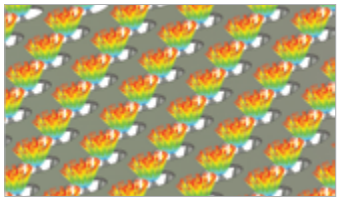
TRK – Particle TRACKING and Electron Gun Design



Gridded gun analysis

EMISSION MODELS

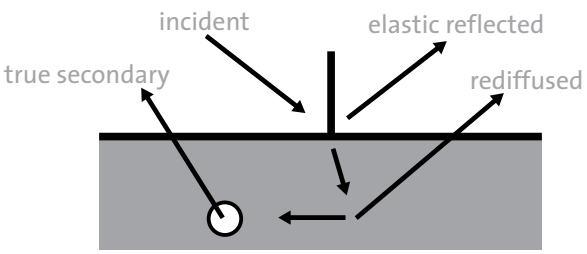
- Fixed
- Space charge limited
- Thermionic
- Field emission
- Secondary emission

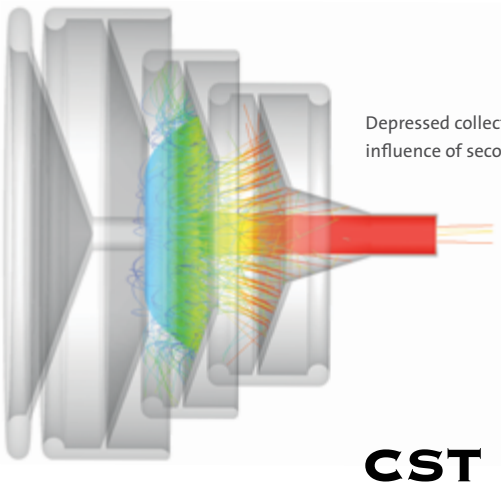


Particle trajectory on top of a Spindt type field emitter array

SECONDARY EMISSION MODEL

- Furman model (incl. elastic reflected, rediffused and true secondary particles)
- Vaughan's model for the secondary emission yield
- Import of secondary electron emission yield vs. particle energy from measurement data
- Analysis of absorbed power and current
- Multipaction (observation of increase in particles versus time)



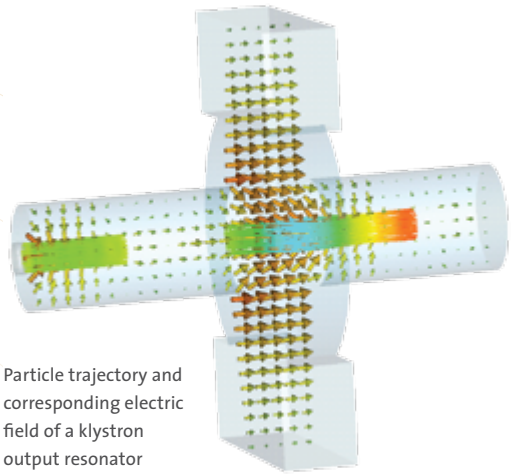


Depressed collector simulation under the influence of secondary electron emission

CST

CHANGING THE STANDARDS

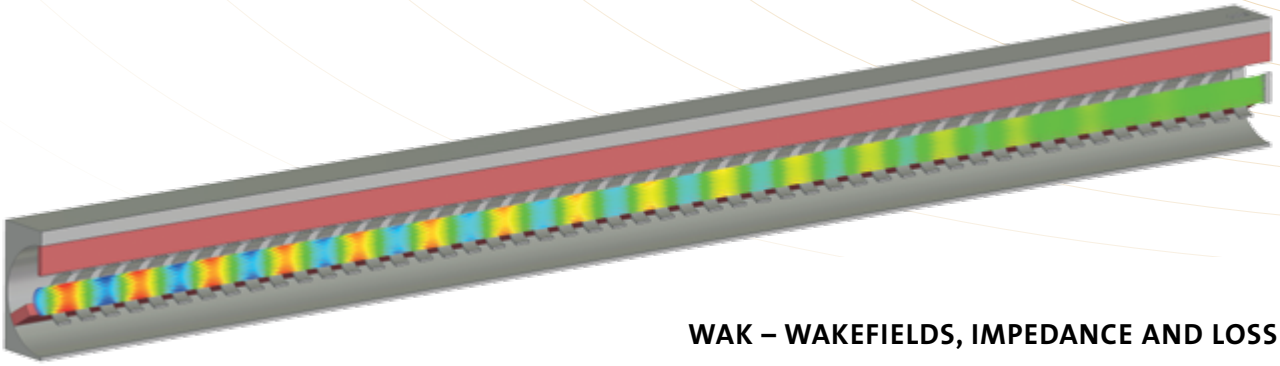
Charged Particle Simulation



Particle trajectory and corresponding electric field of a klystron output resonator

PIC – DESIGN OF MICROWAVE TUBES

- DC emission
- Emission of Gaussian bunch series
- Explosive emission
- GUN/PIC interface for realistic beam input created by an electron gun
- User defined particle source via ASCII interface
- Support of all CST MWS time domain solver features including:
  - dispersive materials
  - lossy metals
  - discrete ports
  - waveguide ports
- Direct output signal monitoring
- Grid and metallic foil models (including energy dependency)
- Multipacting stopping criterion
- GPU computing



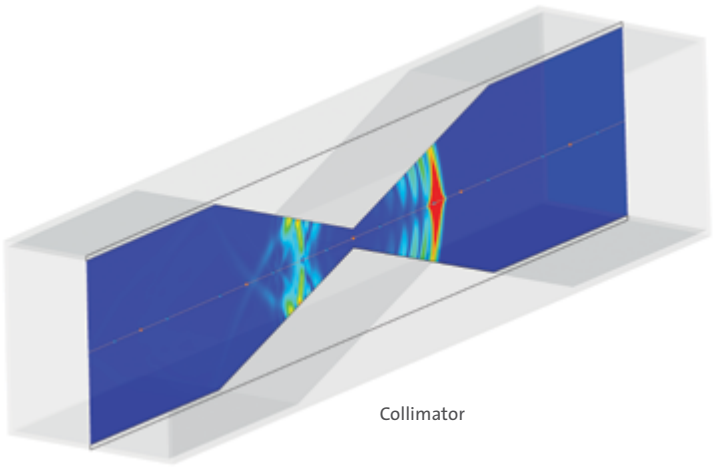
Particle trajectory inside the traveling wave tube (TWT). The velocity modulation of the particles is shown by the different colours

WAK – WAKEFIELDS, IMPEDANCE AND LOSS FACTOR

- Automatic calculation of wakefields and loss factor
- Direct and indirect integration schemes for obtaining the wakefield
- Resistive wake: considers surface losses
- Special beam boundary operator, even for non-relativistic beams ($v < c$)
- Direct output signal monitoring
- Wakefield postprocessor for user-defined sampling
- Cluster computing

GENERAL FEATURES OF CST PARTICLE STUDIO

- Integrated in the CST design environment
  - Intuitive parametric 3D modelling
  - 64 bit support
  - VBA compatible macro language
  - Powerful user-definable postprocessing
- PERFECT BOUNDARY APPROXIMATION (PBA)®
- Intuitive magnet design (solenoid / permanent magnet)
- Particle monitoring and emittance calculation
- Import of external magnetic fields
- Eigenmode solver for accurate cavity analysis
- Shunt impedance, R/Q, and a transit time factor
- Periodic boundaries and mode dispersion diagrams
- Co-simulation with thermal solver



Collimator