

Numerical study of the effect of secondary electron emission on the dynamics of electron clouds in gyrotron guns

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- Recall: electronic yield $\gamma(E) = \Lambda_{exp} * \frac{dE_{ions}}{dx}$
- Ion Induced Electrons have been modeled using a Poisson Law

- $P(x = k) = e^{-\lambda} \frac{\lambda^k}{k!} = e^{-\gamma(E_i)} \frac{\gamma(E_i)^k}{k!}$

- Vertical slice of He ions impinging on stainless steel electrode
 - Potential bias: $\Delta\phi = 20kV$
 - Electrode radial positions: $r_a = 10^{-3}m$,
 $r_b = 10^{-2}m$
 - Acquired energy: $E \propto \Delta\phi \log(r/r_a) / \log(r_b/r_a)$

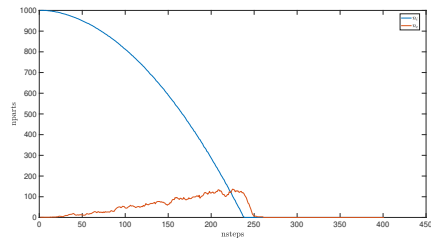


Figure: Particles number as function of time

- Horizontal slice of He ions impinging on stainless steel electrode
 - Potential bias: $\Delta\phi = 20kV$
 - Electrode radial positions: $r_a = 10^{-3}m$, $r_b = 10^{-2}m$
 - Acquired energy: $E \propto \Delta\phi \log(r/r_a) / \log(r_b/r_a)$
 - Yield prediction: Slice 1: $\gamma = 0.96$, Slice 2: $\gamma = 1.33$
 - Obtained yield: Slice 1: 967 e^- for 1000 lost ions
 - Slice 2: 1325 for 1000 ions : Relative error $\propto 1e-3$

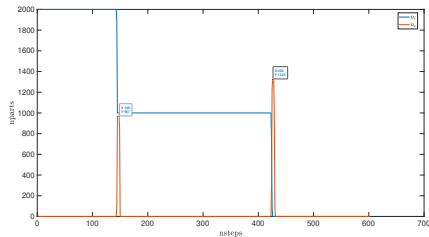


Figure: Particles number as function of time

- Rectangle of incident ions at peak of cloud density
 - 5000 incident ions
 - Zero initial energy
 - End of simulation: +570 electrons remaining
 - $\sim 10\%$ of incident ions number

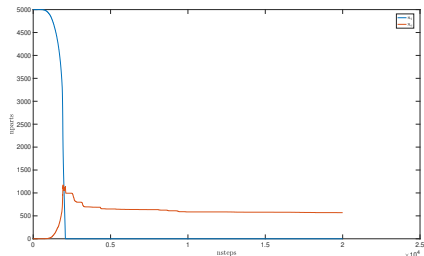


Figure: Particles number as function of time

- Rectangle of incident ions around whole cloud
 - 5000 incident ions
 - Zero initial energy
 - End of simulation: ~ 700 electrons remaining
 - $\sim 14\%$ of incident ions number

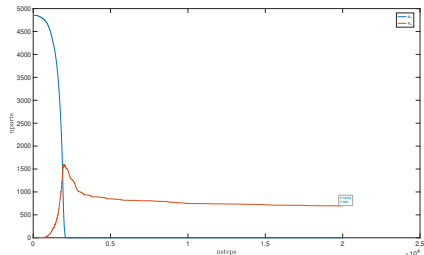


Figure: Particles number as function of time