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

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IIEE - implementation

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

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

Module tests

- 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: $E \propto \Delta\phi \log(r/r_a)/\log(r_b/r_a)$

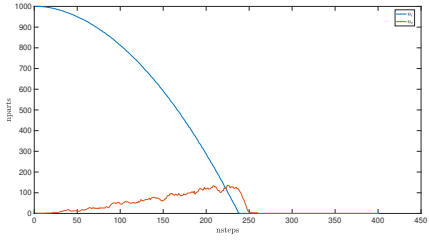


Figure: Particles number as function of time

Module tests

- 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 $\propto 1e-3$

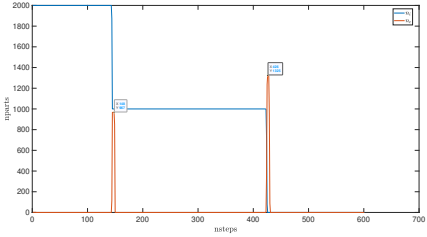


Figure: Particles number as function of time

Module tests - TREX extrude geometry

- 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

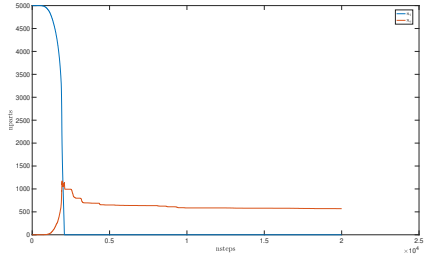
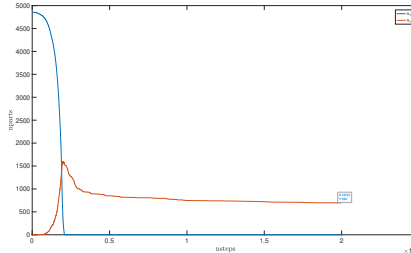


Figure: Particles number as function of time

Module tests - TREX extrude geometry

- 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



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