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

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In this document, behavior of ions inducing electrons in presence of magnetic and strong electric fields is reviewed. Ion-induced electron-emissions (IIEE) are implemented in the FENNECS code [**?**]. Results are planned to be compared with the Trapped Electrons Experiment (TREX).

Keywords: Gyrotron, electron cloud, trapped electron cloud, ionisation, IIEE, FENNECS

I. INTRODUCTION

II. THEORY

A. Gyrotron guns

- A few words on gyrotrons
- What they are used for
- GT-170: image
- Possible disruptions in the use of gyrotrons
- Has this been quantified ? Time scale ? Densities ? Clouds

B. The FENNECS code

- Particle In Cell code
- Brief description of implementation
- Vlasov Poisson system of equations

C. Ion-Induced Electron-Emissions

- Schou's model
- Kinetic emissions
- Low energies: potential emissions
- Possible cascade phenomena

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D. Trapped Electrons EXperiment TREX

- Description of the experiment
- What we hope to see
- Comparisons with our module ?

E. Numerical implementation

- Find tabulated values of energy loss (material dependant)
- Find tabulated values for electronic yield
- Fit these values with energy polynomials of various degrees
- Poisson distribution - random numbers with $\lambda = \gamma(E)$
- Invert Buneman algorithm
- Generate electrons at last position of lost ion with # of electrons following Poisson

In order to implement numerically Schou's model from Eq.(**??**), it was necessary to obtain reference values for the electronic yield, as a function of incident ions' energies. Tabulated values for the energy loss dE/dx of protons in various materials were extracted from [**?** **?**]. To be consistent with the TREX experiment plans (See **??**), attention was drawn on 304 stainless steel ^{304}SS, copper Cu and aluminum Al.

III. RESULTS

IV. CONCLUSION