and 4, show the energy distribution and the total power of the back-bombardment electrons at the desired scanning area as a function of the cavity voltage and current density on the cathode surface by using PARMEAL. The typical parameters of the RF gun and the cathode are shown in table 1.

Table 1: Parameters of the RF gun used the numerical simulation code.

Resonant frequency [MHz]	2856
Coupling coefficient β	2.79
Q value	12500
R/Q [Ω]	980
Number of cells	4.5
Accelerating mode	π
Cathode radius [mm]	1
Cathode material	LaB_6
Initial cathode temperature [°C]	1545

The stopping range of the back-bombardment electrons in the cathode was calculated by using Eq. 1, and the results are used to calculate the stopping power and depicted at Fig. 5. Then Eq. 2 was used to calculate the change of the cathode temperature. Finally, the change of the current density was determined by using the cathode performance test depicted in Fig. 6.

The expected change of the cathode temperature due to the heat deposited in the cathode by the back-bombardment electrons was 14 °C, finally, the expected change in the cathode current density 3.4 A/cm^2. This result of the cathode temperature change is reasonably with the experimental measurements in KU-FEL. The change in the cathode temperature and the current density are displayed in Fig. 6. As a future work, modification of the simulation code to consider the change of the cathode temperature and beam current during the macropulse.

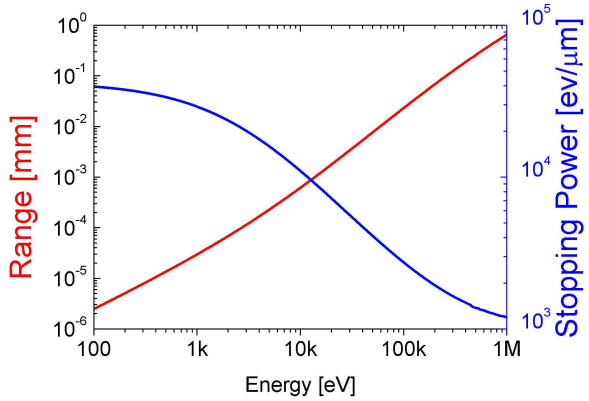

Fig. 5. The range and stopping power in LaB_6 cathode were calculated by using semi empirical TIO Equation.

Moreover demonstration with experimental data is needed to confirm the numerical simulation code.

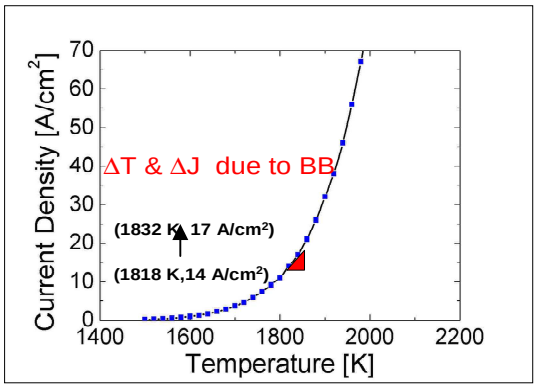

Fig.6. Ideal emission characteristic of single crystal of LaB_6 cathode.

4. Conclusions

We have developed a numerical simulation code for deep understanding of the back-bombardment electrons. The code start with calculated the energy distribution and the total power of the back-bombardment electrons by using PARMELA and KUBALI cods respectively. Then the range and the stopping power were determined by using the semi empirical equation. Then, the change in the cathode temperature is determined by using thermal diffusion equation. Finally, the change in the current density is calculated from the cathode performance test. Modifications with demonstration are required to realize the simulation code.

5. References

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