We present 3D thermal simulations (excluding hydrodynamics) of a wheel shaped beam stripper made of solid C that has been designed for use in the FISIC (Fast Ion-Slow Ion Collision) experiments at the SPIRAL2 facility. The inner radius, $R_1$, of the target is 32 cm, the outer radius, $R_2$ is 35 cm while the beam is perpendicular to the target surface at a radius, $R_0 = 33$ cm (see Fig. 1). The target is rotated at a rate of 2000 rpm. Several ion species including Ne, Ar and Ni, with the following beam parameters, have been considered. The transverse ion beam intensity distribution in the focal spot is assumed to be Gaussian with $\sigma = 0.5$ mm corresponding to the most extreme case. At the exit of the LINAC, the beam comprises of particle bunches, each bunch having a duration of 1 ns while the bunch frequency is 88 MHz that leads to a separation of 10.36 ns between two neighboring bunches.

Detailed simulations have been done for the following sets of beam and target parameters.

**Case 1:** Ne$^{7+}$ with $E = 5$ MeV/u, $I = 10$ p$\mu$A and $N = 6.25 \times 10^{13}$/s. Two different target thicknesses, namely, 13 and 100 $\mu$g/cm$^2$, respectively, have been considered.

**Case 2:** Ar$^{13+}$ (a) with $E = 4$ MeV/u, $I = 10$ p$\mu$A and $N = 6.25 \times 10^{13}$/s. Three different target thicknesses including, 4.4, 20 and 320 $\mu$g/cm$^2$, respectively, have been used.

(b) with $E = 14$ MeV/u, while using four different target thicknesses, namely, 9.5, 32, 105 and 750 $\mu$g/cm$^2$.

**Case 3:** Ni$^{18+}$ (a) with $E = 10$ MeV/u, $I = 1$ p$\mu$A and $N = 6.25 \times 10^{12}$/s. Five different target thicknesses including, 34, 60, 80 190 and 1300 $\mu$g/cm$^2$, respectively, have been considered.

(b) with $E = 14$ MeV/u, again using five different target thicknesses, namely, 42, 60, 95, 200 and 1450 $\mu$g/cm$^2$, respectively.

These simulations have been performed using a 3D computer code PIC3D [1] which includes ion energy deposition, heat conduction and thermal radiation losses. Two different values of the emissivity, $\epsilon$, namely, 0.2 and 0.8, have been used to check the influence of emissivity on target cooling.

![Figure 1: Stripper geometry.](image1)

![Figure 2: Temperature vs time at $R_0$ (top curve), $R_1$ (middle) and $R_2$ (lowest); red curves ($\epsilon = 0.2$), blue curves ($\epsilon = 0.8$); Ar$^{13+}$, $E = 4$ MeV/u, $I = 10$ p$\mu$A and target thickness = 320 $\mu$g/cm$^2$.](image2)

![Figure 3: Same parameters as in Fig. 2, but using Ni$^{18+}$, $E = 10$ MeV/u, $I = 1$ p$\mu$A and target thickness = 1300 $\mu$g/cm$^2$.](image3)

It is seen in Figs. 2 and 3 that the temperature at the center of the focal spot remains safely below the sublimation temperature of C. However, the possibility of material damage due to thermal stresses needs to be addressed. This work is in progress.

**References**