Isotope separation method on Rare-Earths atomic jets produced by laser ablation through magnetic fields

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The process investigated in this work belongs to the IEAv isotope separation program, and consists in focusing a high power Nd:YAG laser beam on a metallic Rare-Earth target, immersed in a low pressure environment, creating a high energy atomic vapor (plasma plume) [1], Figure 1. One of the objectives is to characterize the plasma plume, and for that a circular electrostatic probe is used [2]. Collecting the current and voltage data, it is possible to obtain the ion velocity and to estimate the ion density and electrons temperature temporal evolution as a function of laser fluency. By knowing these parameters one can project a convenient magnetic field geometry that allow to split spatially the isotopes (ions only), generated by laser ablation.

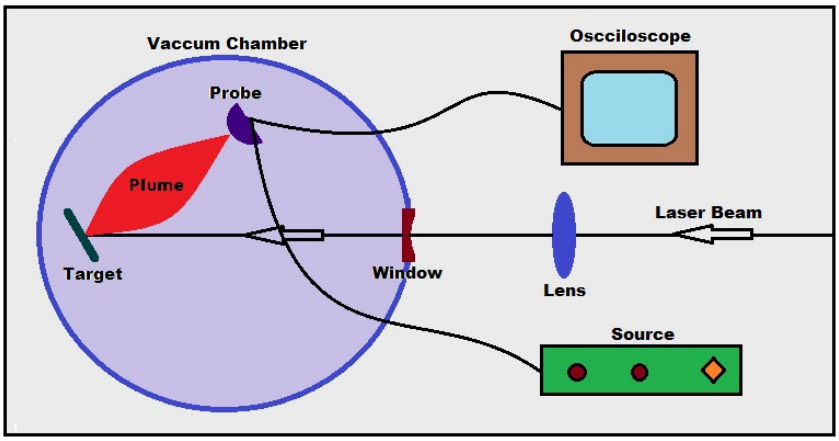

Figure 1: Experimental Setup.

Generally, magnetic mass separation techniques require ions with high velocities, which is obtained accelerating them by electric field stages. Data from Molybdenum plasma plumes were already extracted by an electrostatic probe and demonstrated that the ion velocity can reach about 60 km/s. Such velocity is high enough to introduce the ions in a magnetic field system without have to pass them by an electric field stage previously for acceleration, simplifying the experimental setup.

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[1] J. Dieleman and E. van de Riet and J. C. S. Kools, Japanese Journal of Applied Physics, v.31, p 1964 (1992).
[2] C. E. Sosolik, A. C. Lavery, E. B. Dahl, and B. H. Cooper, Review of Cientific Instruments, Vol. 71, 9, p.332 (2000).