FRAGMENT SEPARATOR DESIGN FOR LOW ENERGY NUCLEAR PHYSICS APPLICATIONS WITH INTENSE BEAMS

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INTRODUCTION

SPIRAL2 is a project to expand the capabilities of the GANIL, France facility in nuclear physics research with exotic beams. One of the new instruments envisioned is the Super Separator Spectrometer (S^3) for high intensity stable heavy ion beams. The physics that is proposed to be studied with the instrument includes super heavy elements synthesis and spectroscopy, fusion and evaporation reactions, nucleon transfers, deep inelastic reactions, some nuclei from secondary reactions, astrophysics at very low energy, and plasma studies. All of the experiments have the common feature of requiring the separation of very rare events from intense backgrounds. Large beam acceptance and high selectivity for weak reaction channels are required. No existing instruments can presently achieve all the design requirements specified. The design of S^3 is unique and challenging in this respect.

S^3 DESIGN

In this talk we will present the S^3 basic design composed of a two-stage separator. This device, proposed by Argonne, is based on a **M**omentum **A**chromat followed by a **M**ass **S**eparator: **MAMS**. The layout of the device in the S^3 vault is shown in Figure 1. This device is a next-generation separator built on the principles of the Oak Ridge RMS and the Texas A&M MARS separators. The basic principle of this device is to first suppress primary beam by at least 1:1000 by a pre-separator (momentum achromat) and then do further beam suppression and physical mass channel selection by a mass separator. The design presented here achieves a combination of beam suppression, evaporation residue transmission and mass channel selection unique in the world. This device is well optimized for fusion evaporation reactions in direct and symmetric kinematics and the delayed study of rare channels. It will allow for unique experiments like in-flight mass identification of superheavy elements, and studies of very weak evaporation channels (like ^{100}Sn).

REFERENCES

1. "The SPIRAL2 Project", www.ganil.fr/research/developments/spiral2/index.html.
2. A. Drouart, B. Erdelyi, B Jacquot, S. Manikonda, J. Nolen, A Villari, "Design study of a pre-separator for the LINAG super separator spectrometer", NIM B (Submitted, 2007).

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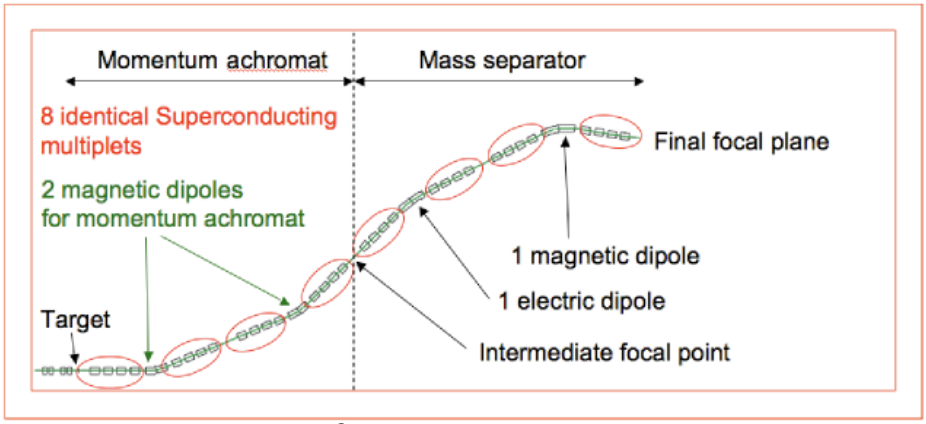

Figure 1: MAMS layout in the proposed S^3 experimental vault. (The overall optical length of S^3 is 29 m.)