

# Stripping of a molecular beam to a higher charge state by means of two successive stripper foil

P. Kumar, G. Korschinek, T. Faestermann, P. Ludwig, G. Rugel, D. Seiler, A. Wallner, *TU Munich*  
S. Ojha, S. Gargari, S. Chopra, R. Joshi, D. Kanjilal, *IUAC New Delhi, India*

## INTRODUCTION

High energy beams of high ion currents from a Tandem Accelerator are a common requirement in Nuclear Physics, Materials Science and Accelerator Mass Spectrometry (AMS) research. In AMS sometimes, molecular beams are chosen from the ion source to achieve a high ion yield for the negative ions (e.g.  $\text{BeO}^-$ ,  $\text{MnO}^-$ ,  $\text{MnF}_3^-$ ,  $\text{FeO}^-$ ) or to suppress isobaric background (e.g.  $\text{CaH}_3^-$  vs  $\text{KH}_3^-$ ). In these cases the final energy of the ion of interest is reduced as the energy up to the stripper is shared by the molecular constituents. Attempts are made to increase the ion yield in conjunction with an increased energy of the ion of interest by using two consecutive stripper foils at the terminal of the Tandem Accelerator.

The stripping process for molecular beams is somewhat different than for atomic beams. There the ion of interest is accompanied during the passage through the stripper by all other ions of the initial molecule. If they are close enough to the ion of interest, interference during stripping can happen. For this project, the tandem accelerators at the MLL and at the Inter-University Accelerator Centre (IUAC) New Delhi were used.

## RESULTS

We have studied the charge state distribution of Sr, Mn and Ca injected as  $\text{SrF}_3^-$ ,  $\text{MnF}_3^-$  and  $\text{CaF}_3^-$  respectively using two strippers of  $4 \mu\text{g}/\text{cm}^2$  each with a gap of  $\approx 9$  cm in between (Fig. 1,2). The similar effect as shown in Fig. 1,2 has also been achieved by double foils system with a distance of less than 1 mm by spot welding two frames with foils.

It is found that a double stripper system with a marginal gap between the stripper-foils produces higher charge states and higher ion yields for the constituents of multiple molecules. Elements bound in a molecule do not attain the same high charge state as the single ion at the same velocity. This is because of the interference with the other constituents from the molecule, which can be overcome by employing a second stripper foil. Thus the capability of Tandem accelerators for molecular beams can be improved in terms of higher energy with higher yield by the use of a double stripper foil system made of two foils having some separation between them. The full publication can be found at Ref. [1].

## REFERENCES

- [1] P. Kumar et al., Nucl. Instrum. Meth. B, 269(2011) 1986-1991

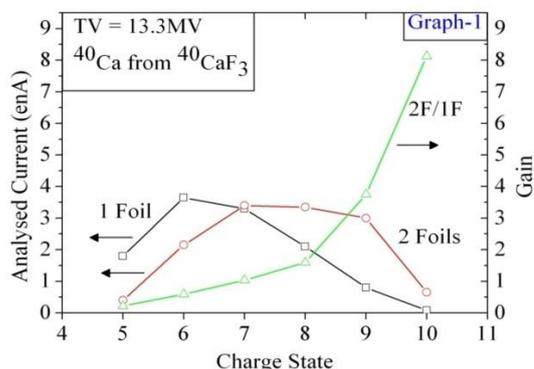


Figure 1: Charge state distribution of molecular anions using single and double stripper foils at the terminal for injection of  $^{40}\text{CaF}_3^-$  molecules. 2F/1F represents the gain in the analyzed current, if two strippers are used at the terminal.

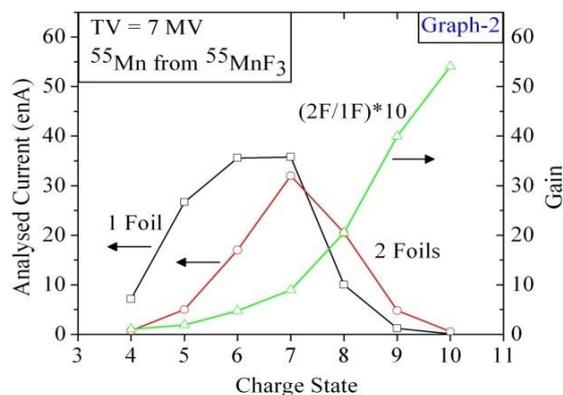


Figure 2: Same as Fig. 1, only with injection of  $^{55}\text{MnF}_3^-$  at lower terminal voltage.