

A plunger for high energy beams to be used at HISPEC/ PRESPEC

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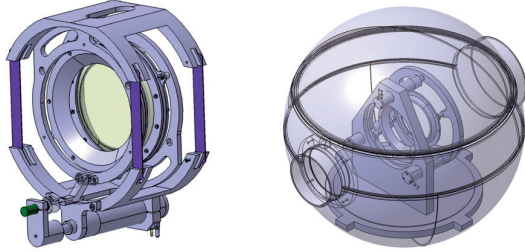


Figure 1: Left: Plunger device with flat springs. Right: Plunger device with three motors.

Development of a plunger for high energy beams to be used at HISPEC/ PRESPEC

A plunger for high energy beams to be used at the HISPEC/ PRESPEC set-up at GSI Helmholtzzentrum für Schwerionenforschung is under construction in Cologne.

There are special challenges for plunger measurements with relativistic beams.

- The distances between the target and the degrader foils have to be variable in a range from mechanical contact up to a few centimeters because of the high recoil velocities of the order of $v/c = 50\%$.
- The target and degrader foils need to be large enough for a typical beam diameter up to 8 cm and the structure has to be sufficiently stable to allow an accurate and parallel mounting of target and degrader foils with thicknesses in the range of a few μm for foils up to more than 1 mm.

These are different dimensions compared to a standard plunger device for fusion evaporation reactions, where the foils have thicknesses in the order of micrometers and the beam diameter is typically around one millimeter.

Two different types of devices have been constructed and tested in Cologne, as described in the following passages.

A plunger with flat springs

For the exact movement of such extremely large and heavy target foils another plunger concept than usual is necessary. A plunger device with flat springs allow for a parallel movement of target and degrader with respect to each other. A prototype for testing was built (see Figure 1). It has a maximum driving range of 30 mm, limited by the piezo motor, and a precision of 0.1 mm. Thus this is a construction for experiments where a rather low precision is needed.

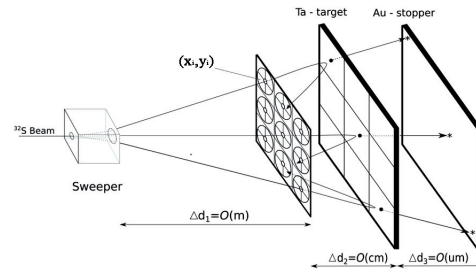


Figure 2: Experimental setup for measurements for RDDS experiments with extremely large beam diameters.

A plunger with three motors

A precision of 0.1 mm is not sufficient for all plunger measurements with low energetic beams. Therefore, the construction of a second plunger device with three piezo motors is in progress. A prototype for testing was built (see Figure 1 right-hand side). We proved that by using a new software developed at IKP, Cologne three Piezo motors can be operated parallel in a way to achieve a highly precise parallelism of target and degrader foil. It has been found, that this plunger fulfills all requirements of a future experiment to be performed at the HISPEC/ DESPEC/ AGATA experimental set-up. It is also possible to construct this plunger in a three foil version.

Experimental setup to test RDDS experiments with extremely large target and stopper/ degrader foils

A setup to test RDDS experiments with extremely large target and degrader/stopper foils is shown in Fig. 2. It is intended to excite levels in Ta via Coulomb excitation where lifetimes are very well known [1]. By this method it will be possible to measure absolute target to stopper separations at different locations on the target. Separate sets of photodiodes will be used to measure backscattered projectiles at the specific target locations (x_i, y_i) to fix the kinematics of the coulomb excitations. This experiment will be performed at the Cologne FN tandem accelerator.

References

- [1] T. Klug, A. Dewald, V. Werner, P. von Brentano, R.F. Casten, Phys. Lett. B 495 (2000) 55.