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Perturbed Angular Correlations with Short-Lived Isotopes, the PAC-SLI setup

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Time Differential Perturbed Angular Correlation of γ -rays (TDPAC) experiments were performed in late 2014 for the first time using the decay cascade from ^{68}mCu (6-, 721 keV, 3.75 min) at the VITO beam line at ISOLDE-CERN. Due to the relatively short half-life the TDPAC measurements were performed online at an improvised provisional experimental setup, where selected samples were chosen such that implanted Cu was expected to occupy regular sites, defects free, at room temperature. The successful work allowed the characterization of the nuclear moments of 2^+ , 84.1 keV, 7.84 ns state and $^{68}\text{mCu}/\text{Cu}$ can now be considered a new and unique Cu probe nucleus for TDPAC for future applications in the fields of materials physics, chemistry and biophysics [1].

Ideal experimental conditions to perform TDPAC measurement with short lived isotopes require a complex technical solution. In this work, we present one possible solution where we describe the main features of a “PAC Short Lived Isotope” set-up, PAC-SLI, set-up under development, motivated and dedicated to the use of the new $^{68}\text{mCu}/^{68}\text{Cu}$ TDPAC isotope.

Main features:

- All blocks (collecting chamber, furnace, 4 detector PAC, variable diaphragm, HV block) are mounted on a movable cradle, with full 3D regulation.
- The sample holder allows for very rapid heating and cooling cycles of the implanted sample. This block is easily extracted for sample changing. It includes measuring sockets for the beam current and sample temperature.
- Drive - actuated from the outside supports, the movable furnace that can be inserted/removed around the sample with an up-down movement. Includes: sockets for furnace power leads and temperature control and furnace up-down interlocks.
- Targeted parameters: impinging beam diameter from 18 to 5 mm (5 steps); furnace temperature over 700 °C, sample cool down from maximum sample temperature in about 30 s, minimal full cycle around 5min. (collecting, measuring, heating, cooling).

References

[1] –A. S. Fenta et al., “The $^{68}\text{mCu}/^{68}\text{Cu}$ isotope as a new probe for hyperfine studies: the nuclear moments” , Accepted by EPL –10/2016.

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