

Characterizing the SOFIA/ANDES TwinMUSIC *

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Preliminary values for the resolutions of various figures of merit have been deduced by the SOFIA TwinMUSIC [1] for the spectra of isotopes obtained from the fission of ^{238}U . The energy-loss resolution was measured to be $\sigma_{\frac{\Delta E}{E}} = 0.34\%$ with P25 gas (Fig. 1). This leads to a charge resolution of $\sigma_{Z_{1,2}} = 0.23 \pm 0.01$ for the measurements in $\frac{1}{2}$ of the TwinMUSIC and $\sigma_{Z_{1+2}} = 0.31 \pm 0.02$ for the sum of both. The steep falloff of $\Delta_{t,10-90\%} \approx 150\text{ps}$ of the drift times close to the cathode measured for single anodes yields a corresponding resolution of the straight-line fit to a track through the active volume of $\sigma_{dt,fit} = (268 \pm 40)\text{ps}$ (Fig. 2). For the electrical field settings applied the measured drift velocity is well reproduced by Magboltz simulations. After fine adjustment of the drift-times with the help of an adjacent MWPC, a position resolution for the single anode of $\sigma_{x,PB} = (28 \pm 11)\mu\text{m}$ and $\sigma_{x,FF} = (47 \pm 13)\mu\text{m}$ for the primary beam and fission fragments, respectively, can be deduced (Fig. 3). Consequently, the angular distribution of the fragments of $\approx 40\text{mrad}$ could be measured with a precision of $\sigma_{\Theta,FF} = (0.13 \pm 0.10)\text{mrad}$ by event-wise tracking.

The analysis of the data is still ongoing, further refinements on the achieved resolutions are to be expected. Isotopic mass yields have been deduced and published elsewhere [2]. Changes in the design of the TwinMUSIC detector system are ongoing and will allow for an even better charge, position and angular resolution. We are aiming for a full 3D tracking operation with rates of $1 - 2\text{MHz}$ with a non-triggered DAQ. The potential of a low-pressure operation ($0.2 - 0.3\text{atm}$) and the application of other, 'faster' gas mixtures will be tested too.

The next physics run is already scheduled 2014 at CaveC looking into more details of the isotopic mass distributions. In the far future, a more complete set of measurements will be performed in the context of R^3B (Reaction studies with Relativistic Radioactive Beams) at the FAIR (Facility for Antiproton and Ion Research) project at GSI/Darmstadt. Dedicated detector developments will be performed for those endeavors which foster similar developments e.g. for the instrumentation of the SuperFRS.

References

- [1] B.Voss et al., "Results from the SOFIA/ANDES TwinMUSIC", GSI Report 2013-1, p.204 (2013)
- [2] E. Pellereau et al., EPJ Web of Conferences 62, 06005 (2013)

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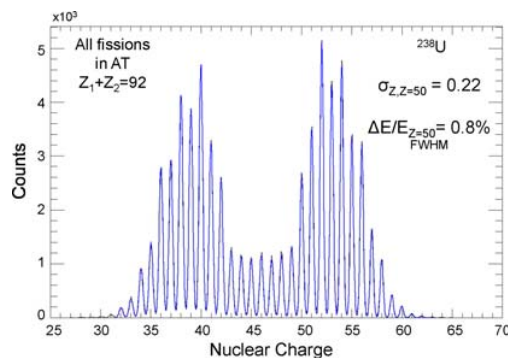


Figure 1: Nuclear charge distribution for electromagnetically excited fission inside the active target.

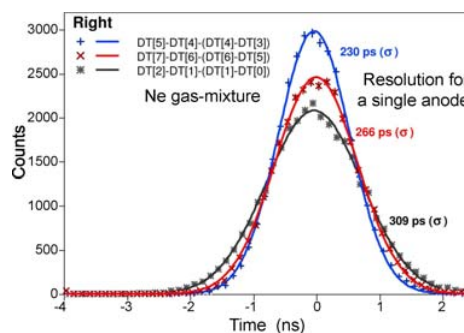


Figure 2: Distribution of the residuals for tracking of fragments inside the right compartment of the TwinMUSIC. The resolutions given are deduced for single anodes.

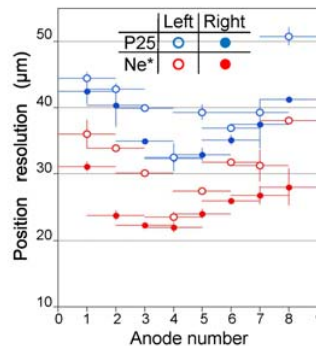


Figure 3: Position resolution obtained for the tracking of fragments inside the TwinMUSIC.