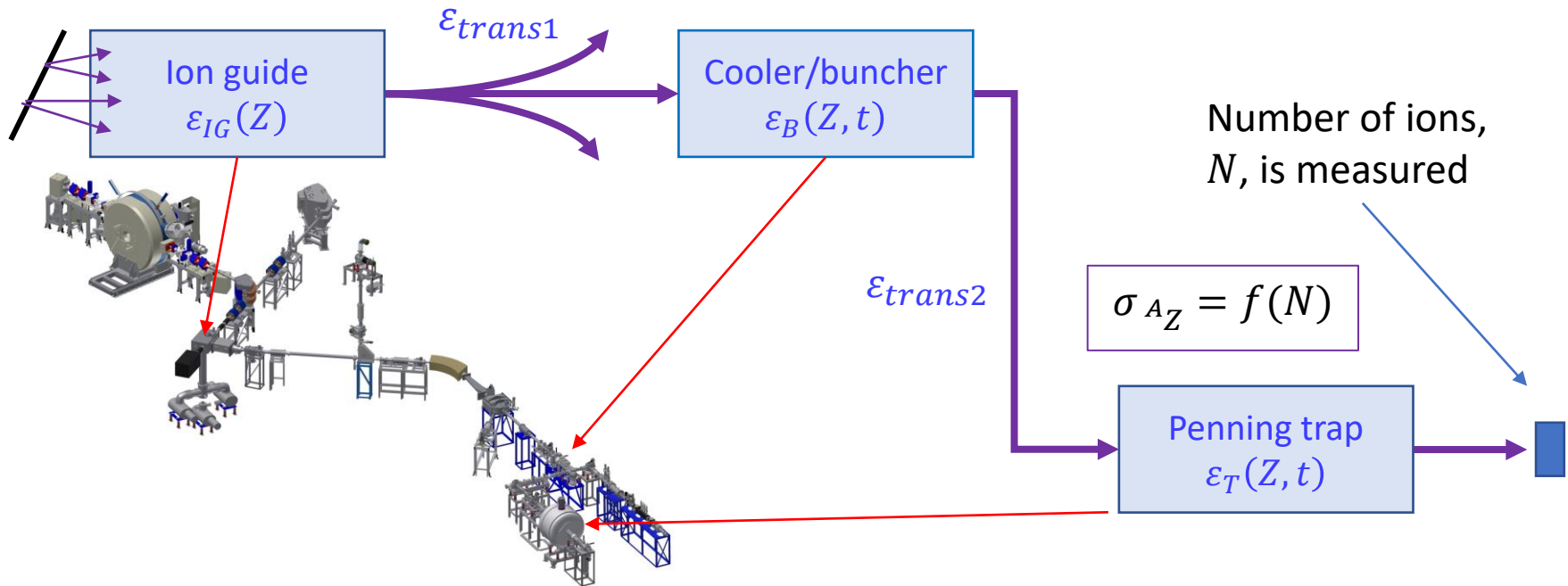


Refining the fission yield study techniques at the IGISOL

Heikki Penttilä

Accelerator Laboratory, Department of Physics,
University of Jyväskylä, FIN-40014 Jyväskylä, Finland

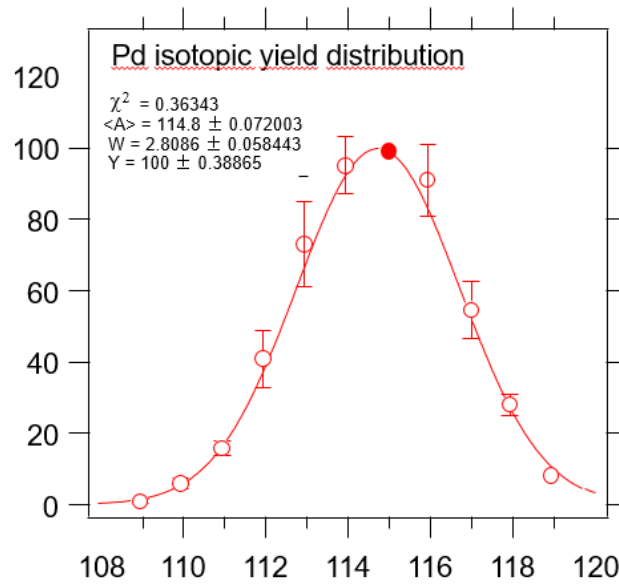
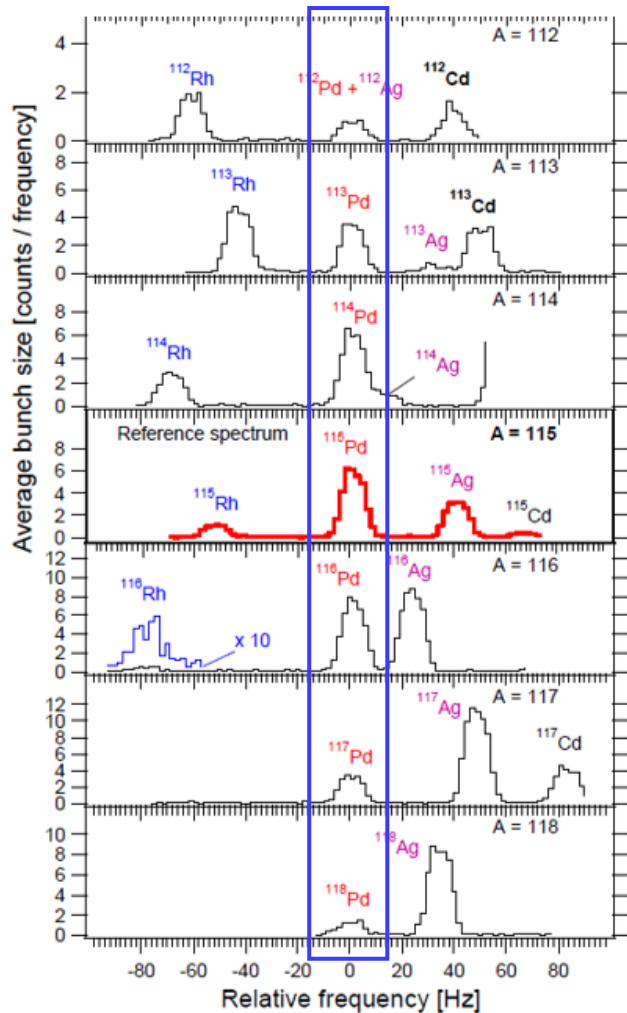
The issue with the fission yield measurements



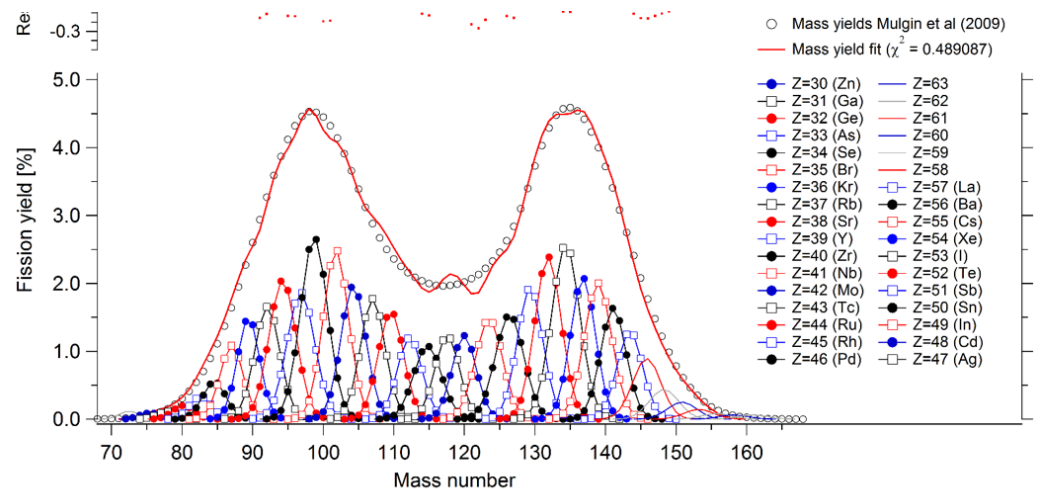
Hopeless to deduce the absolute cross section – relative cross sections can be deduced and be normalised to total σ

Total transportation efficiency $\epsilon_{IG} \epsilon_{trans1} \epsilon_B \epsilon_{trans2} \epsilon_T$ is a function of Z

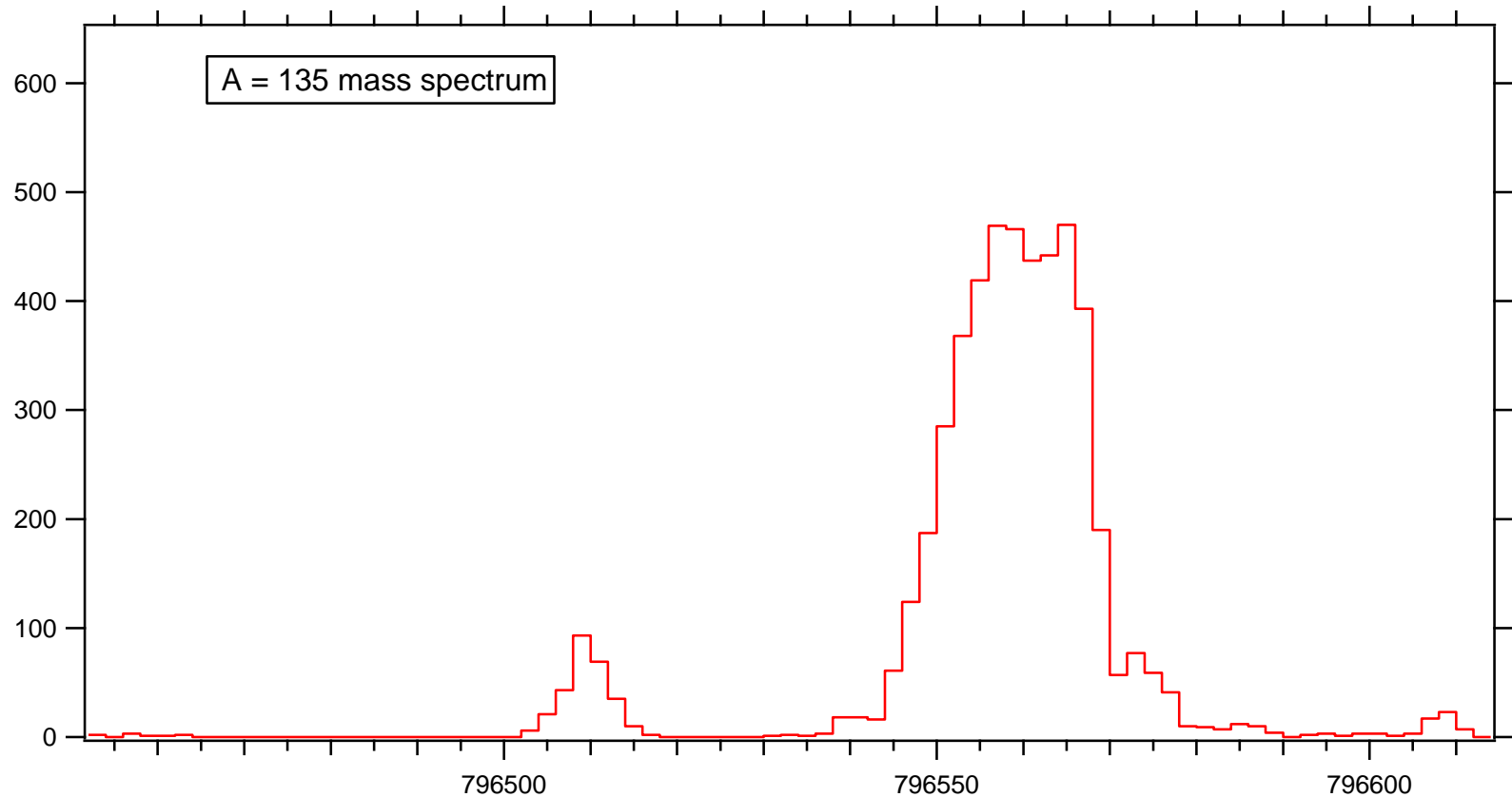
A way to go around the chemical efficiency



Mass yields need to be imported from other measurements



The issue with the fission yield measurements vol. 2

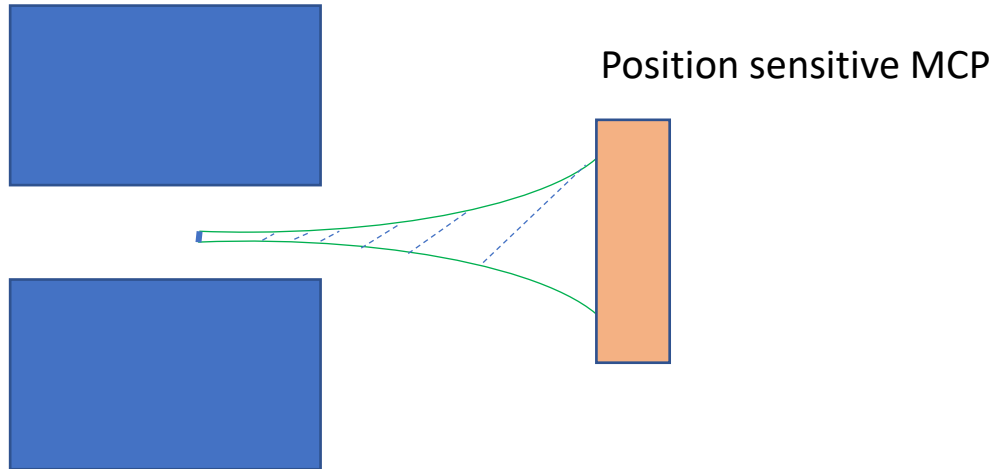


Purification Penning trap mass resolution is not sufficient to properly resolve all isotopes

Improved resolution from Position Image Ion Cyclotron Resonance

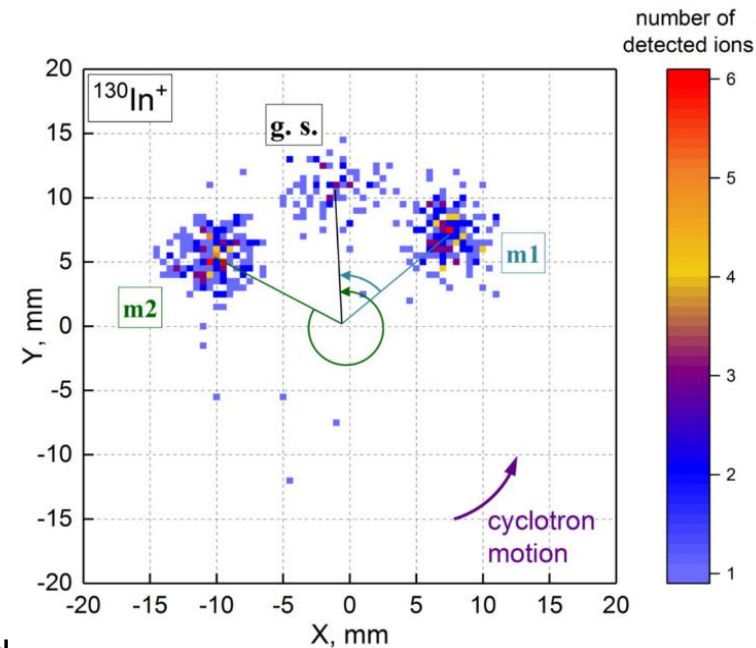


Circulation speed in the trap depends on the ion mass

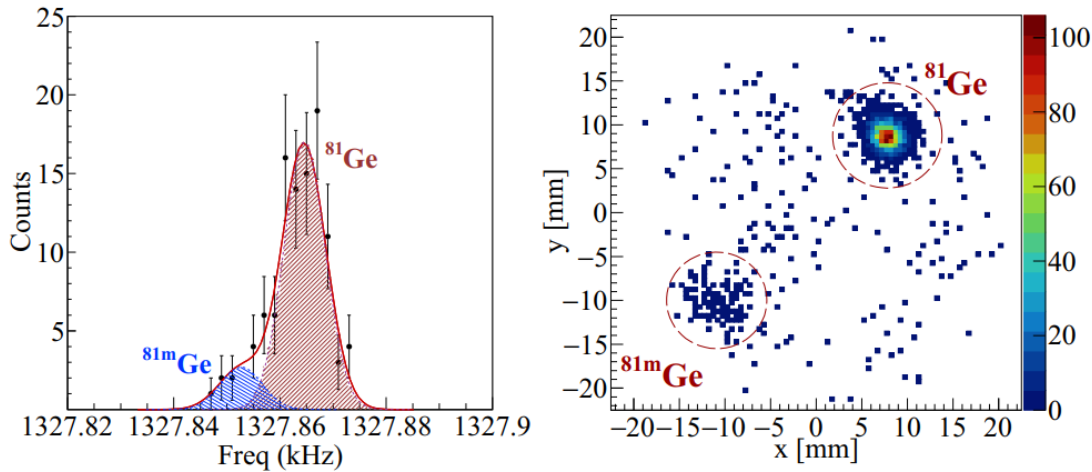


Ion circulation radius increases as the magnetic field lowers outside the trap magnet

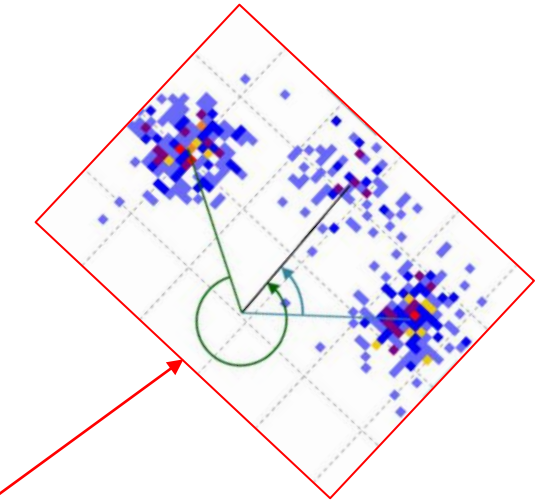
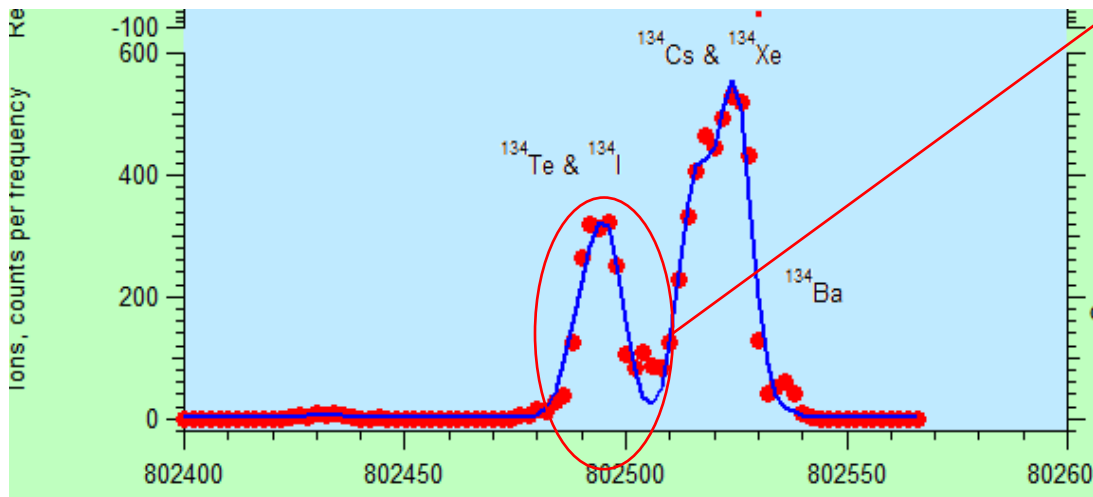
Ions with different mass are clearly separated in the position sensitive ion detector



Isotopic yield ratio measurements



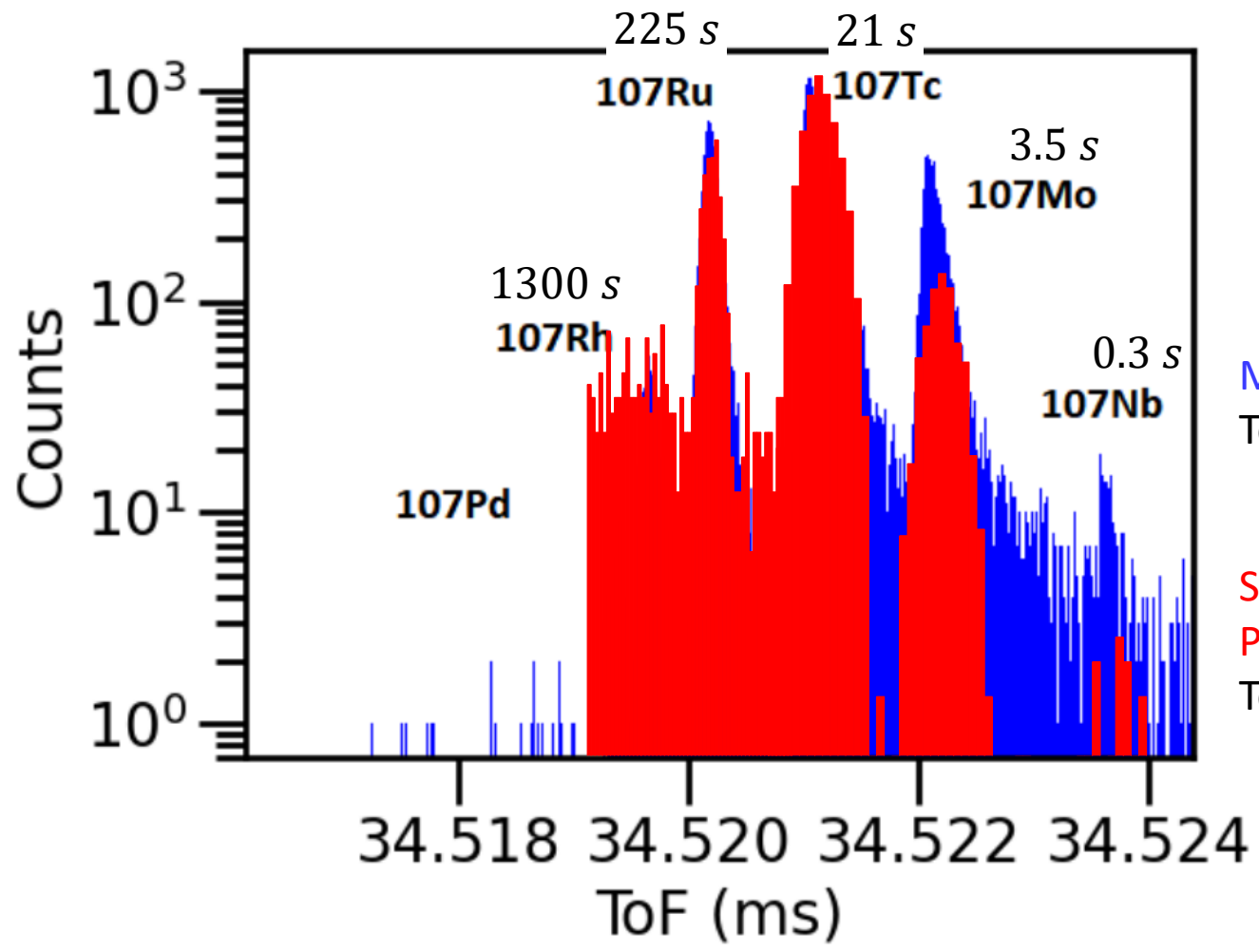
V. Rakopoulos et al., PRC99 (2019) 014617



Disturbing question:

Is the ratio of the transmission efficiencies of different elements **same** for PI-ICR and sideband cooling techniques?

MR-TOF mass separation



MR-TOF mass spectrum
Total time < 50 ms

Sideband cooling
Penning trap spectrum
Total time > 1000 ms

JYFL Accelerator News 1/2022

<https://www.jyu.fi/science/en/physics/current/jyfl-accelerator-news>

Joint Ariel-SANDA meeting, March 7-11, 2022

Test case: 25 MeV proton fission of ^{232}Th

- To test: How reliable PI-ICR can be used to resolve mass peaks that cannot be resolved with sideband cooling technique or MR-TOF ? Are there "chemical" effects and how severe they are? If there are, what are the ways to go around ?
- A reasonable amount of data of this reaction using sideband cooling technique exists
- ^{232}Th data however needs to be completed and some of the data remeasured before publication
- 6 days of beamtime at JYFL-ACLAB approved for testing different scenarios for the utilisation of PI-ICR technique
- Delays of the IGISOL experimental program harmful, but allowed to install and work on the MR-TOF spectrometer – maybe to be utilised in the tests and the yield measurements ?

Thank you for your attention.

