

In-trap spectroscopy with MLL trap

A. Lopez-Martens

Charting Terra Incognita



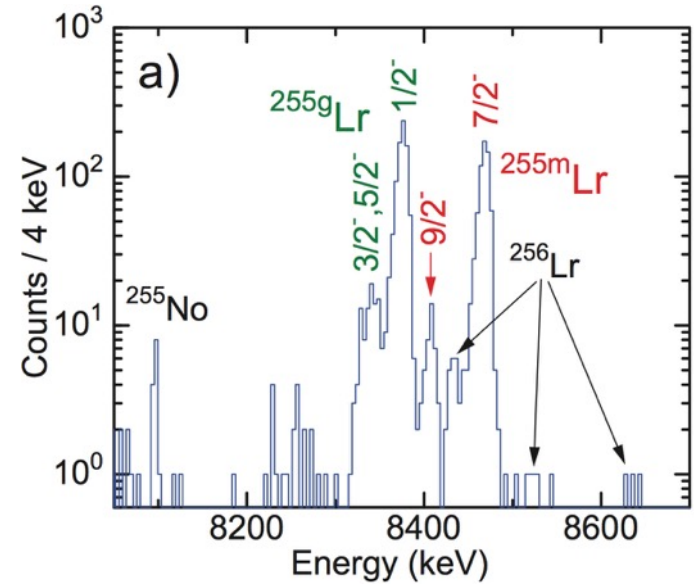
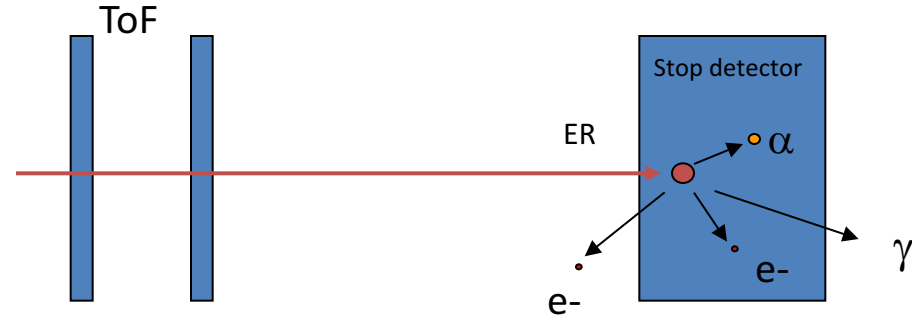
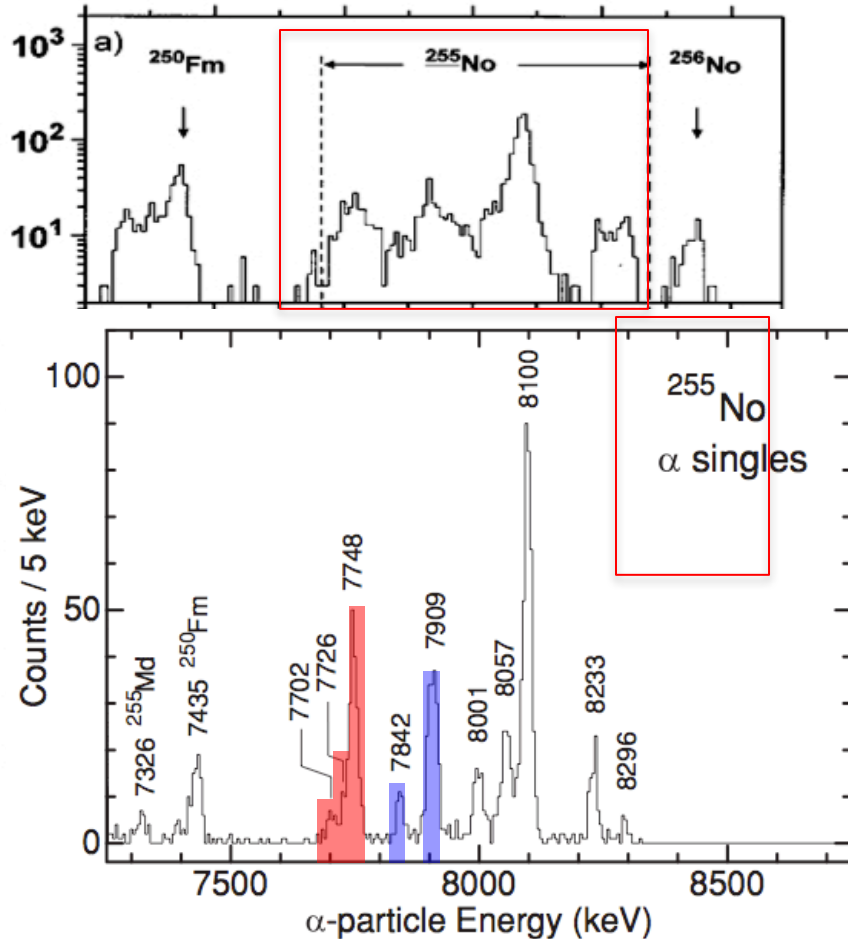
Outline

- Why in-trap spectroscopy ?
- MLL trap
- Perspectives @ S3

High-quality spectroscopic data

$^{238}\text{U}(^{22}\text{Ne},5n)^{255}\text{No}$

F. Hessberger et al., Eur. Phys. J. A29 (2006) 165



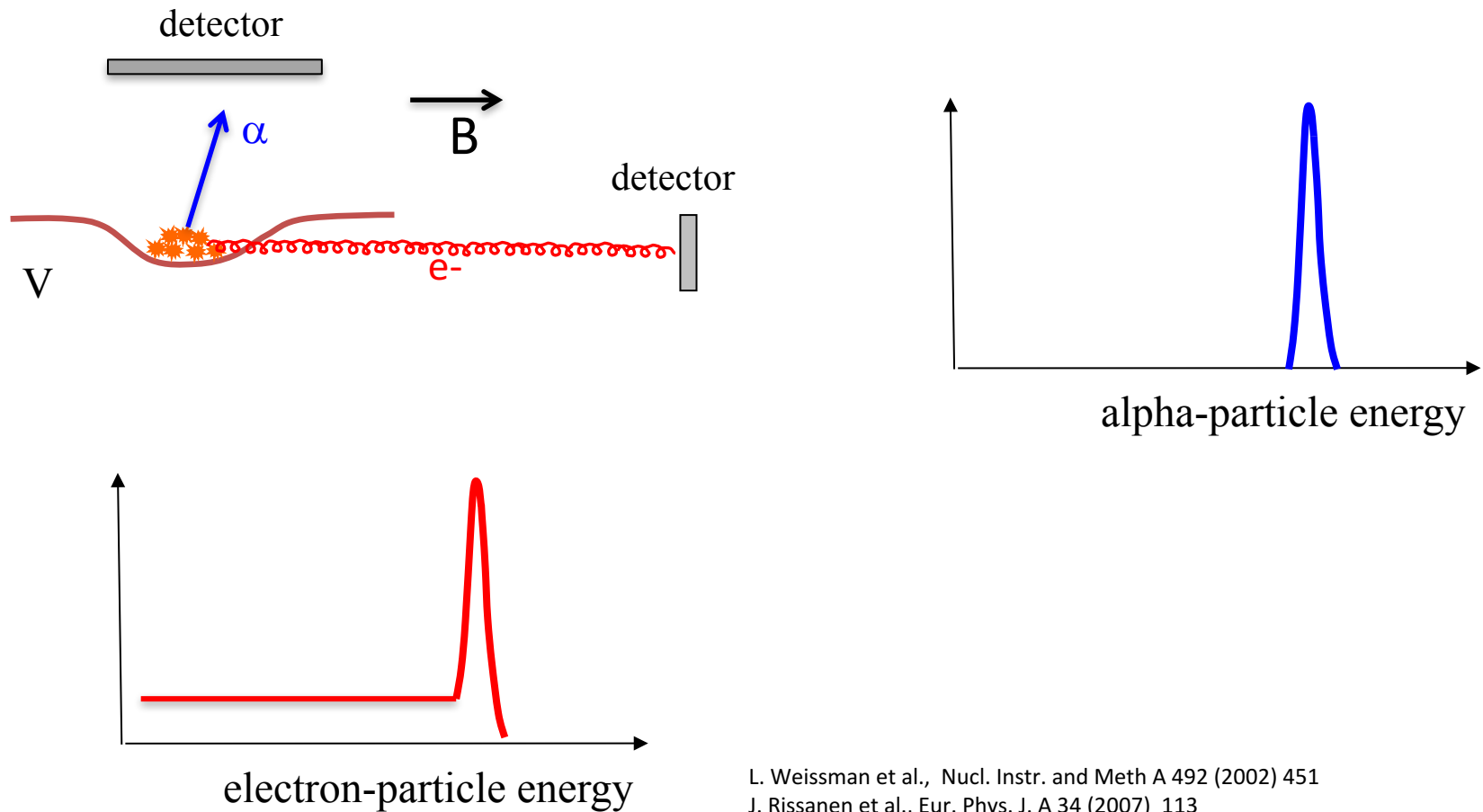
Si PIN photodiodes

M. Asai, F.P. Hessberger and A. Lopez-Martens
Nucl. Phys. A 944 (2015) 308

$^{248}\text{Cm}(^{12}\text{C},5n)^{255}\text{No}$

Asai et al., Phys. Rev. C 83 (2011) 014315

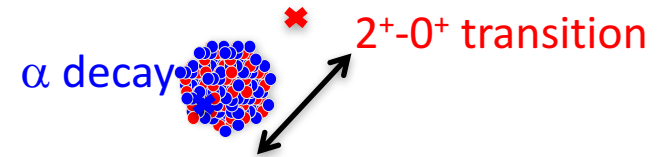
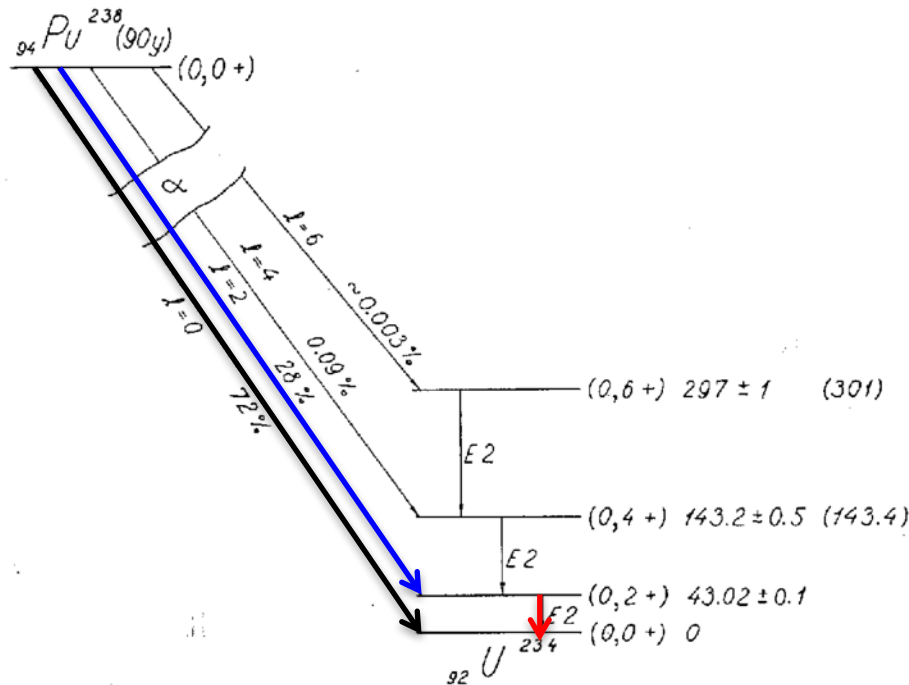
Matterless spectroscopy of purified species



L. Weissman et al., Nucl. Instr. and Meth A 492 (2002) 451
J. Rissanen et al., Eur. Phys. J. A 34 (2007) 113

Possibility of measuring lifetimes of states following α decay ?

1) Decay of 2^+ states in deformed nuclei

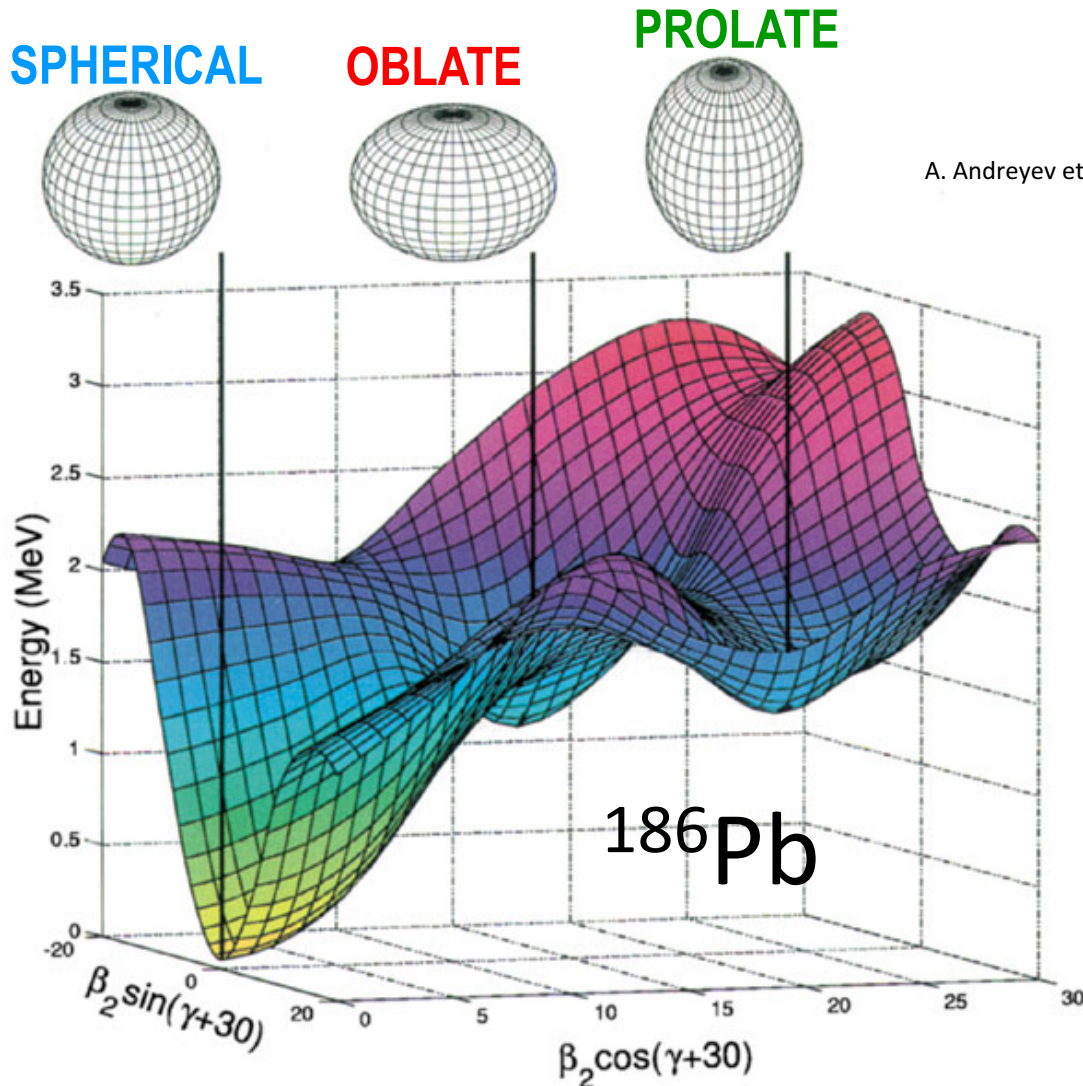


Distance travelled between 2 events depends on the lifetime of the 2^+ state

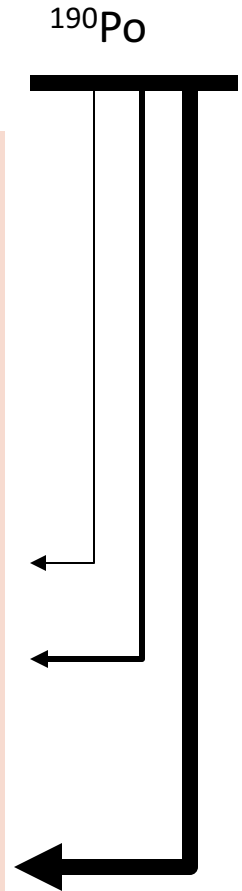
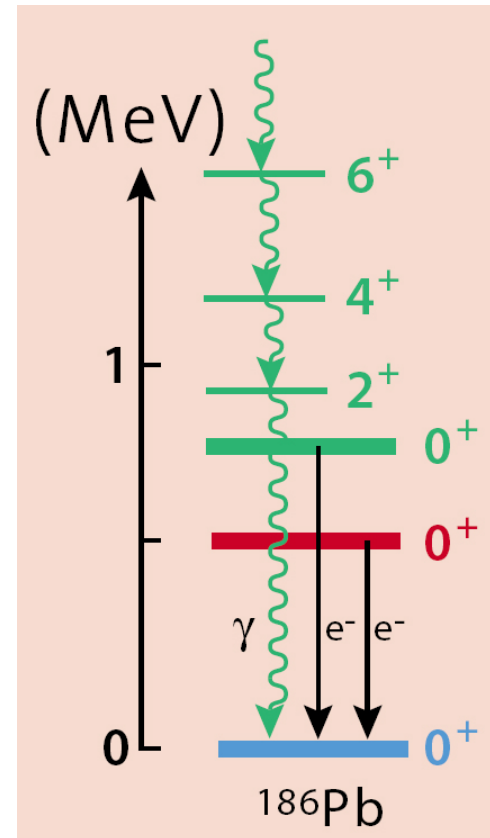
On the Fine Structure of Alpha Decay, Bohr, Fröman and Mottelson (1955)

$\tau(2^+)$ gives access to the intrinsic quadrupole moment Q_0

2) Decay of 0^+ states



A. Andreyev et al. Nature 405 (2000) 430



$\tau(0^+)$ gives access to the monopole strength $\rho^2(E_0)$

Challenge

Can we measure such small distances ($\sim 50 \mu\text{m}$ for 100 ps) ?

The idea: novel recoil-distance method

C. Weber et al., International Journal of Mass Spectrometry 349–350 (2013) 270–276

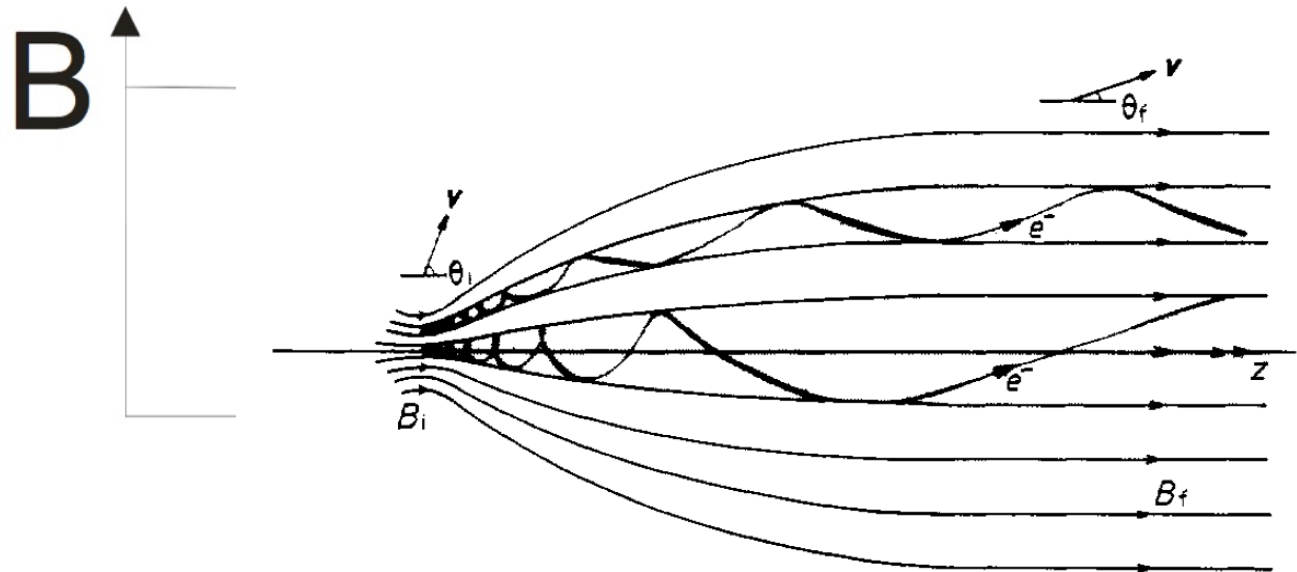
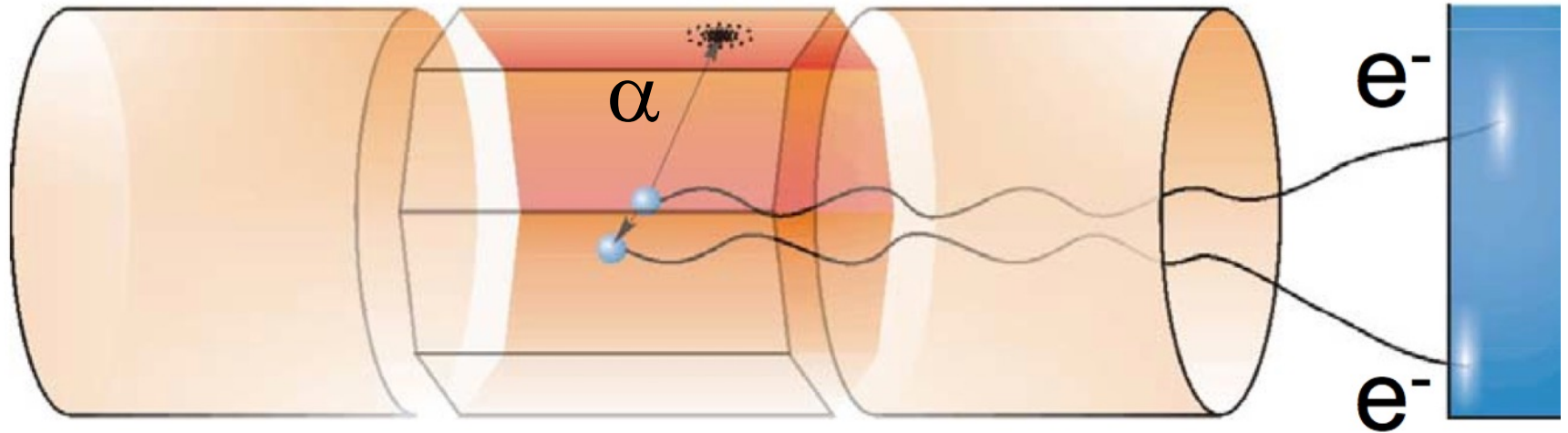
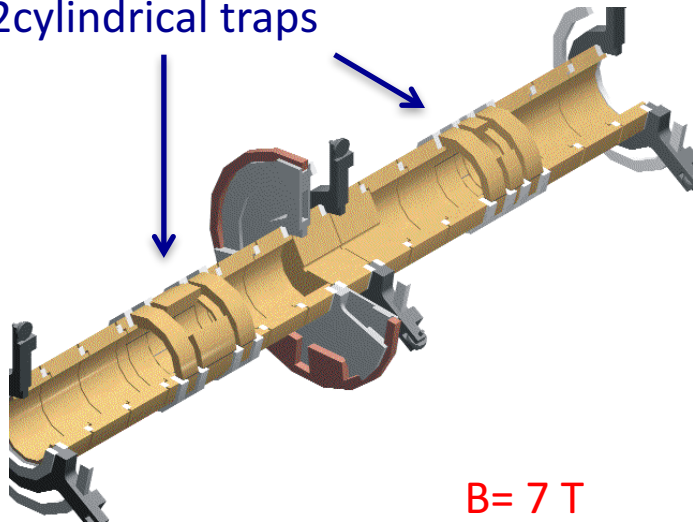


Image by F. Herfurth

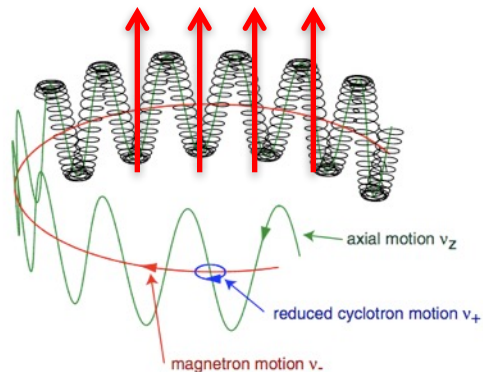
P. Kruit and F.H. Read, J. Phys. E: Sci. Instrum. 16 (1983) 313

Maier Leibnitz Laboratory trap

2 cylindrical traps



$B = 7 \text{ T}$



Mass measurement tower

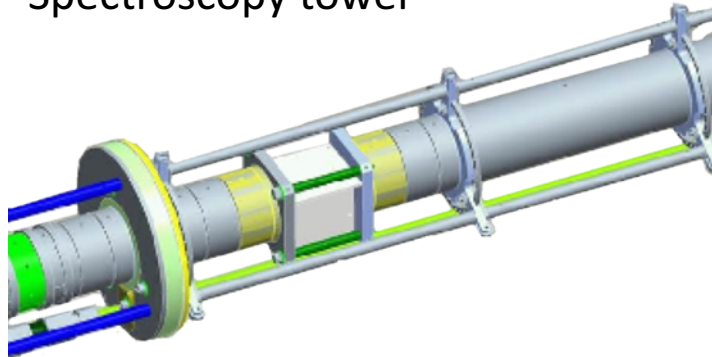
MLL trap @ Munich



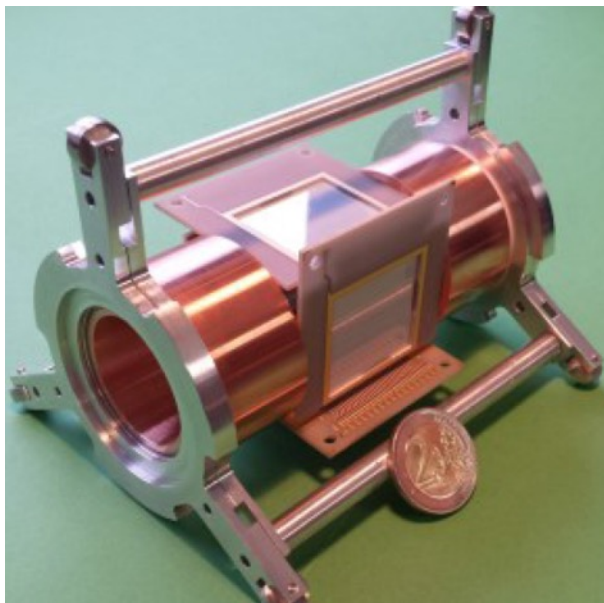
V.S. Kolhinen et al., Nucl. Instr. Meth. A 600 (2009) 391

MLL trap

Spectroscopy tower



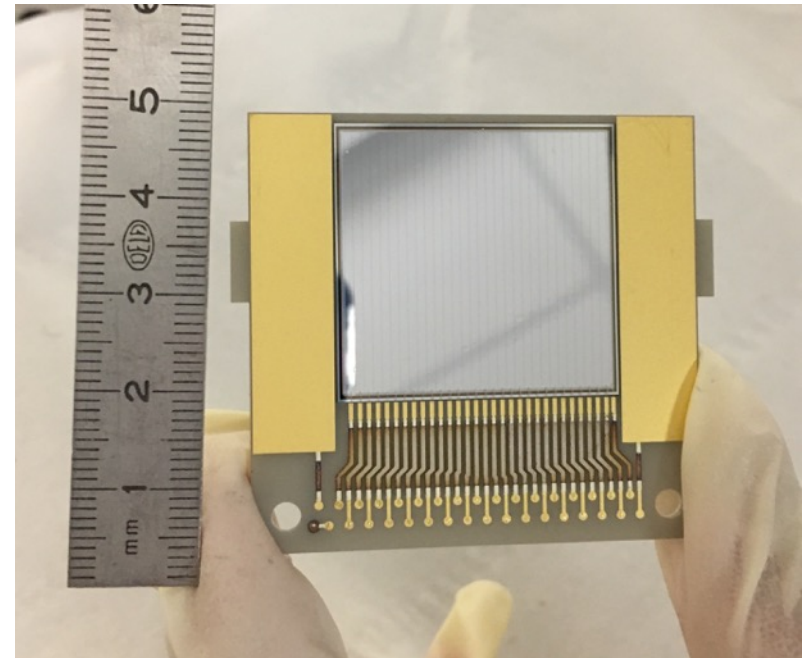
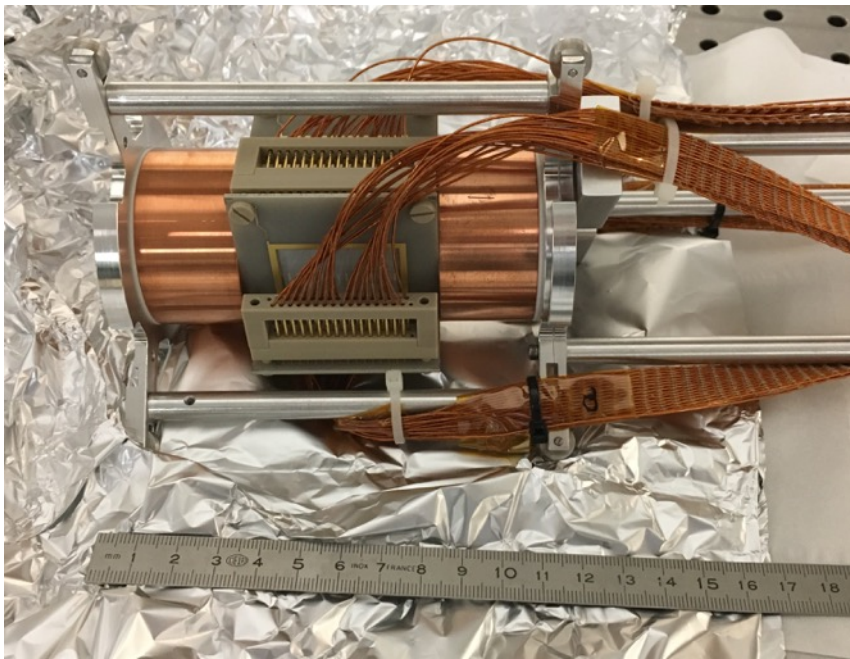
C. Weber et al., International Journal of Mass Spectrometry 349–350 (2013) 270–276



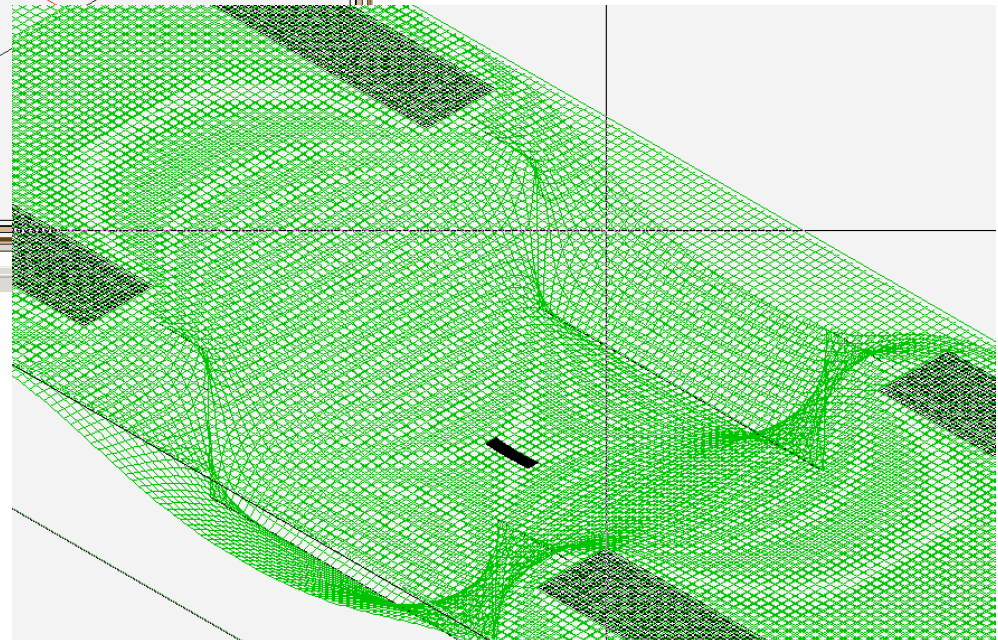
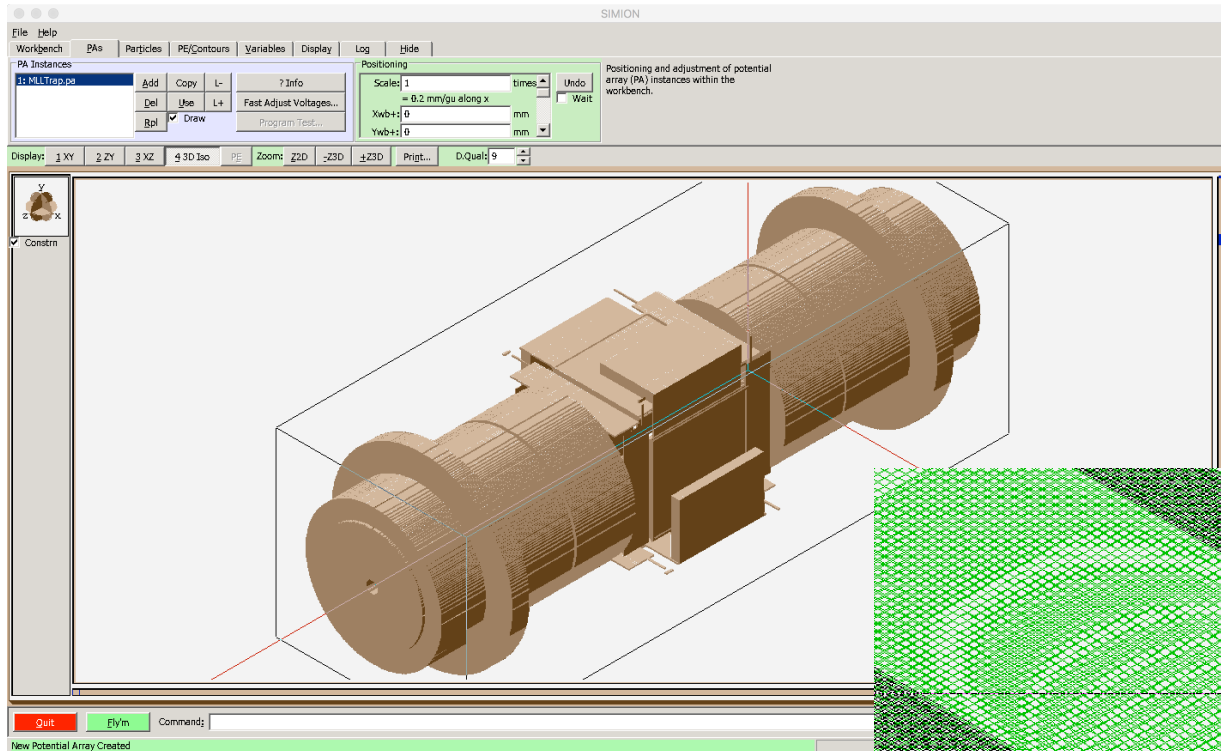
Status

Trap moved from Munich to Orsay (see Enrique Minaya's talk)

Simulations of the spectroscopy trap underway (Pierre Chauveau)

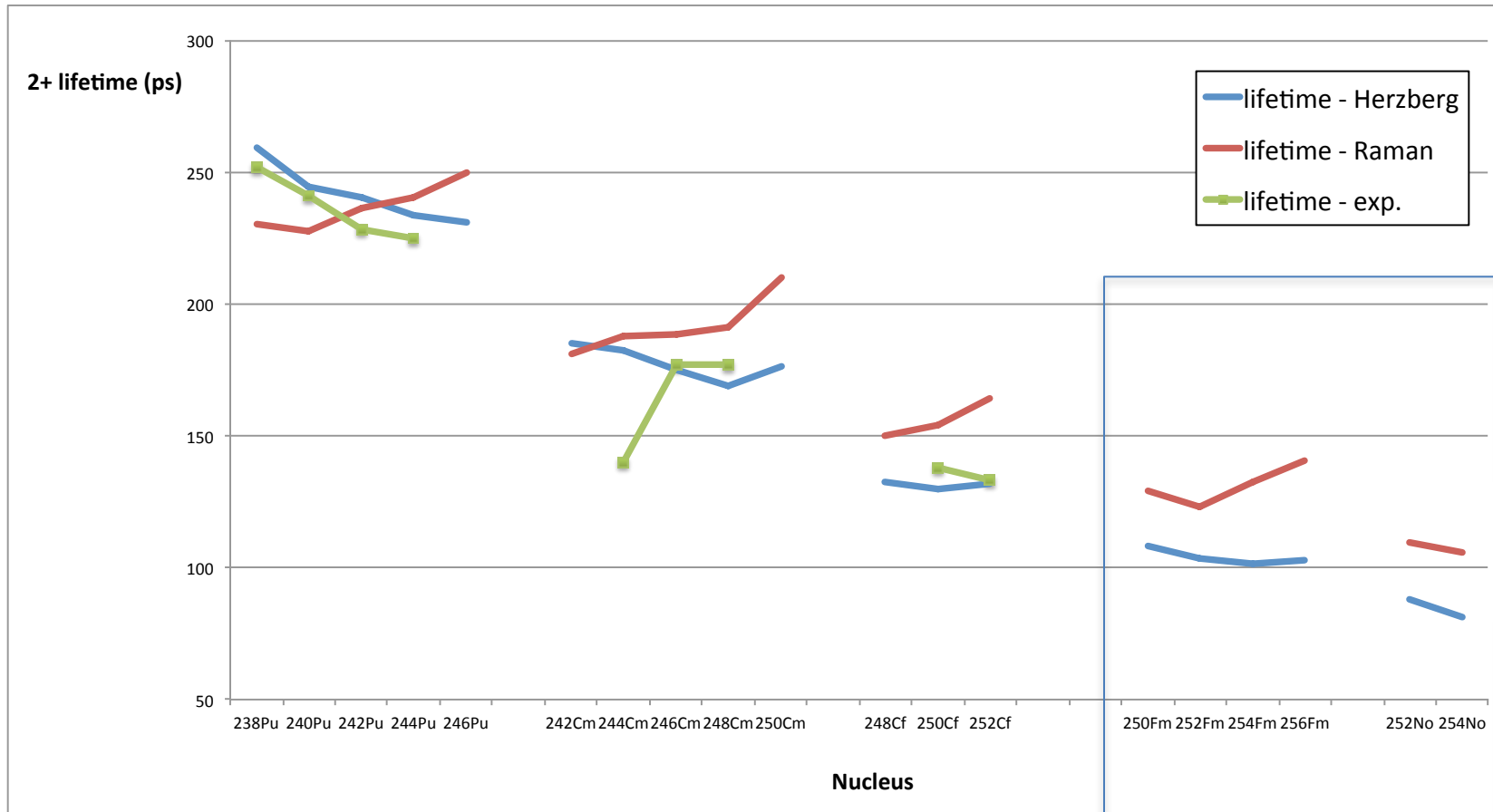


Status



Goal: detailed simulations of ions and decay in the trap to validate the concept

Perspectives @ S3



Perspectives @ S3

Ch. Theisen, P.T. Greenlees, T.-L. Khoo, P. Chowdhury and T. Ishii, Nucl. Phys. A 944 (2015) 333

