A PLASMA ION SOURCE FOR ISOLTRAP

Thomas Guldager Skov

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Aarhus University

RELEVANCE OF NUCLEAR MASSES

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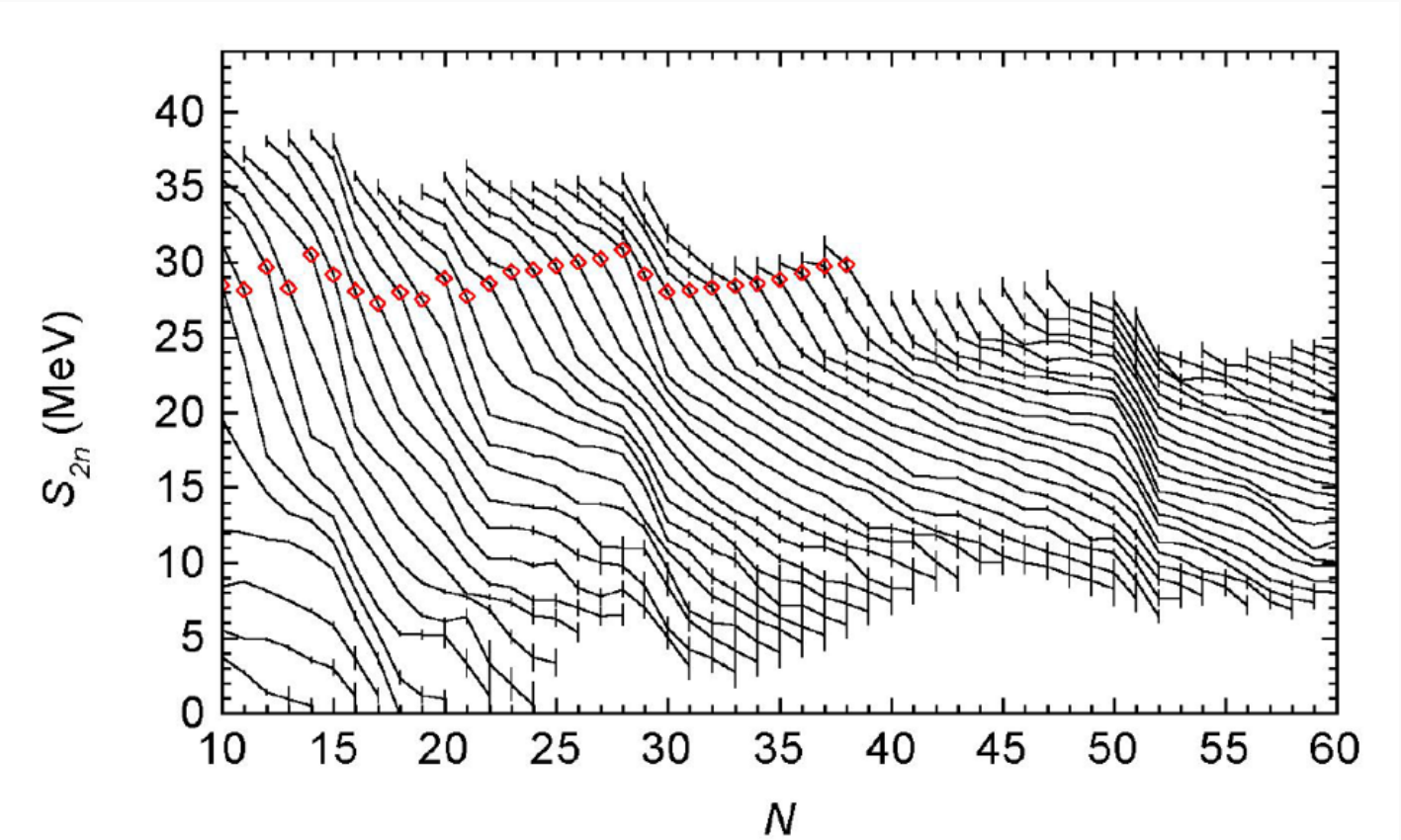
Nuclear Structure, nuclear magic numbers.



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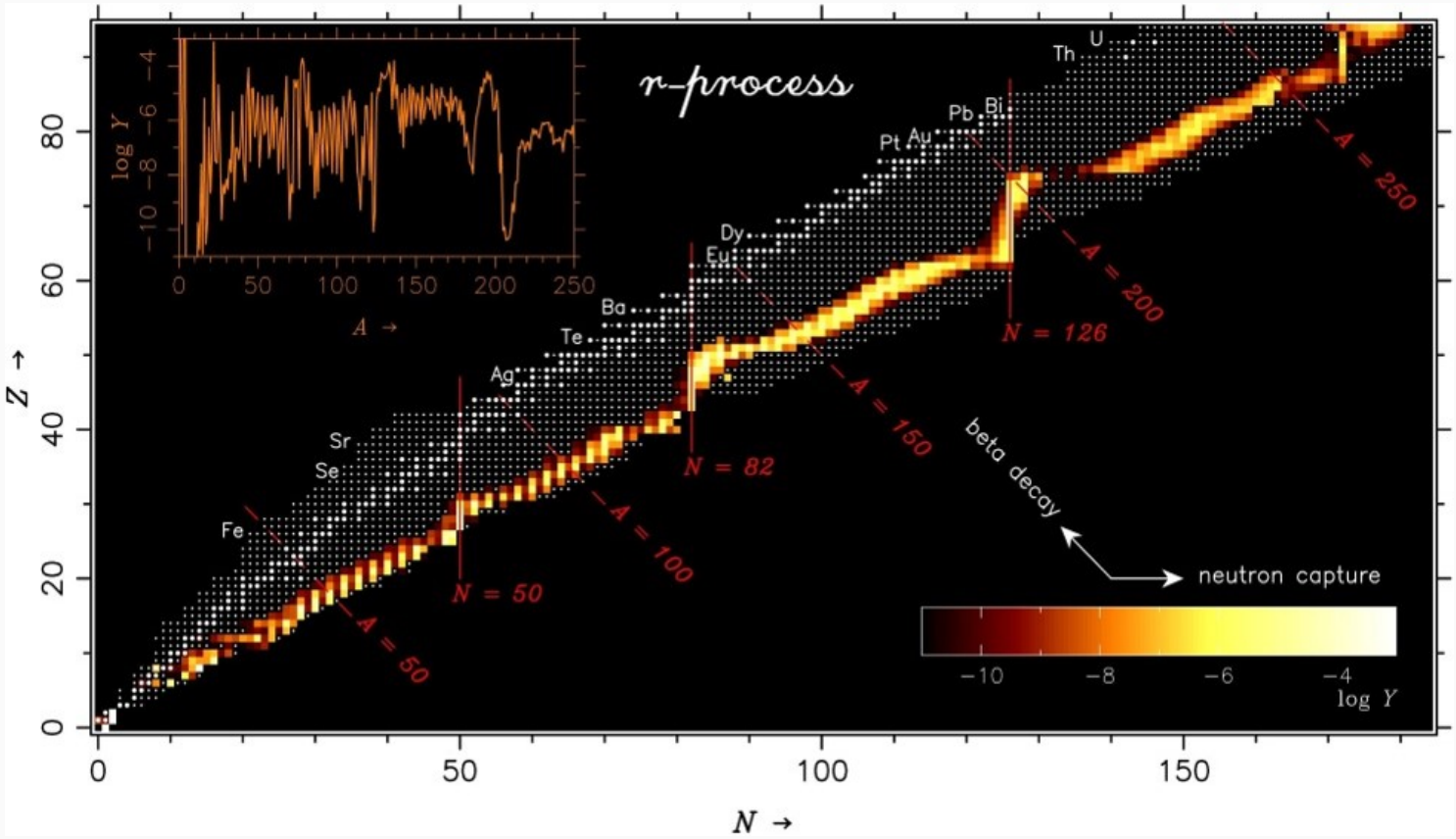
Astrophysical processes, e.g. the r-process.



S. Wanajo et al., ApJ, 606, 1057-1069, 2004.

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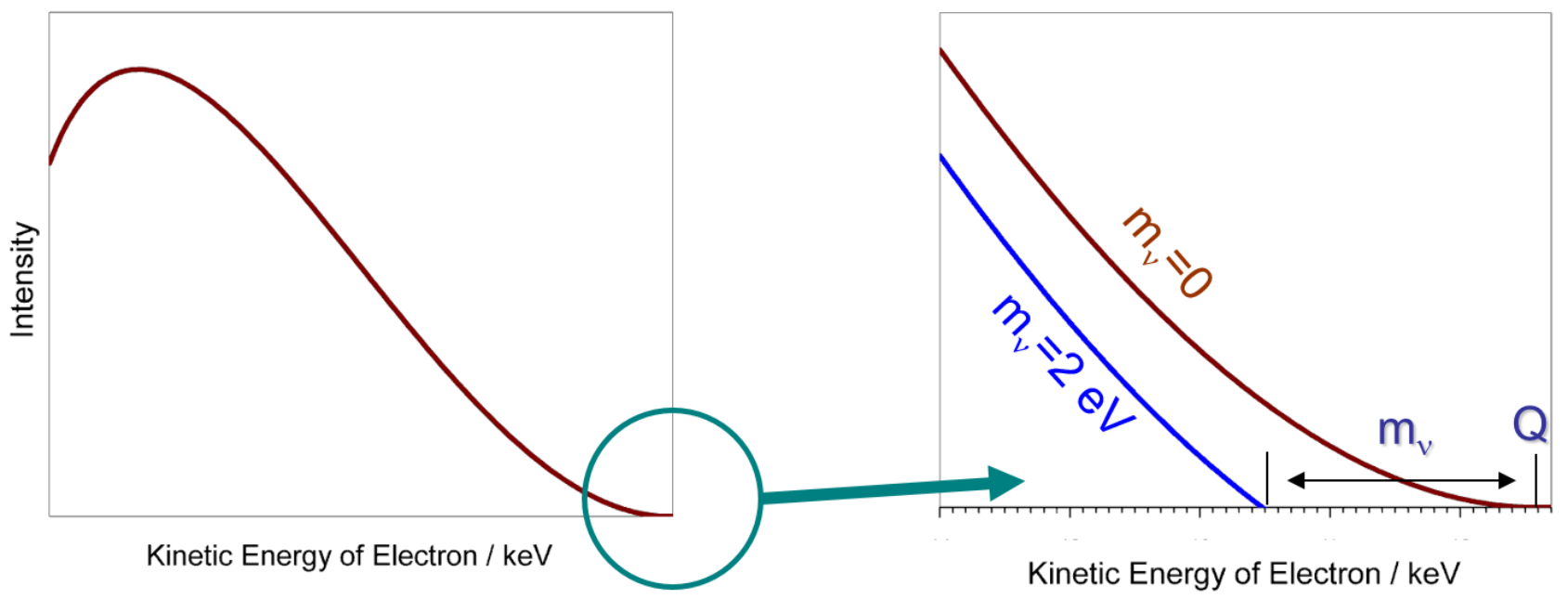
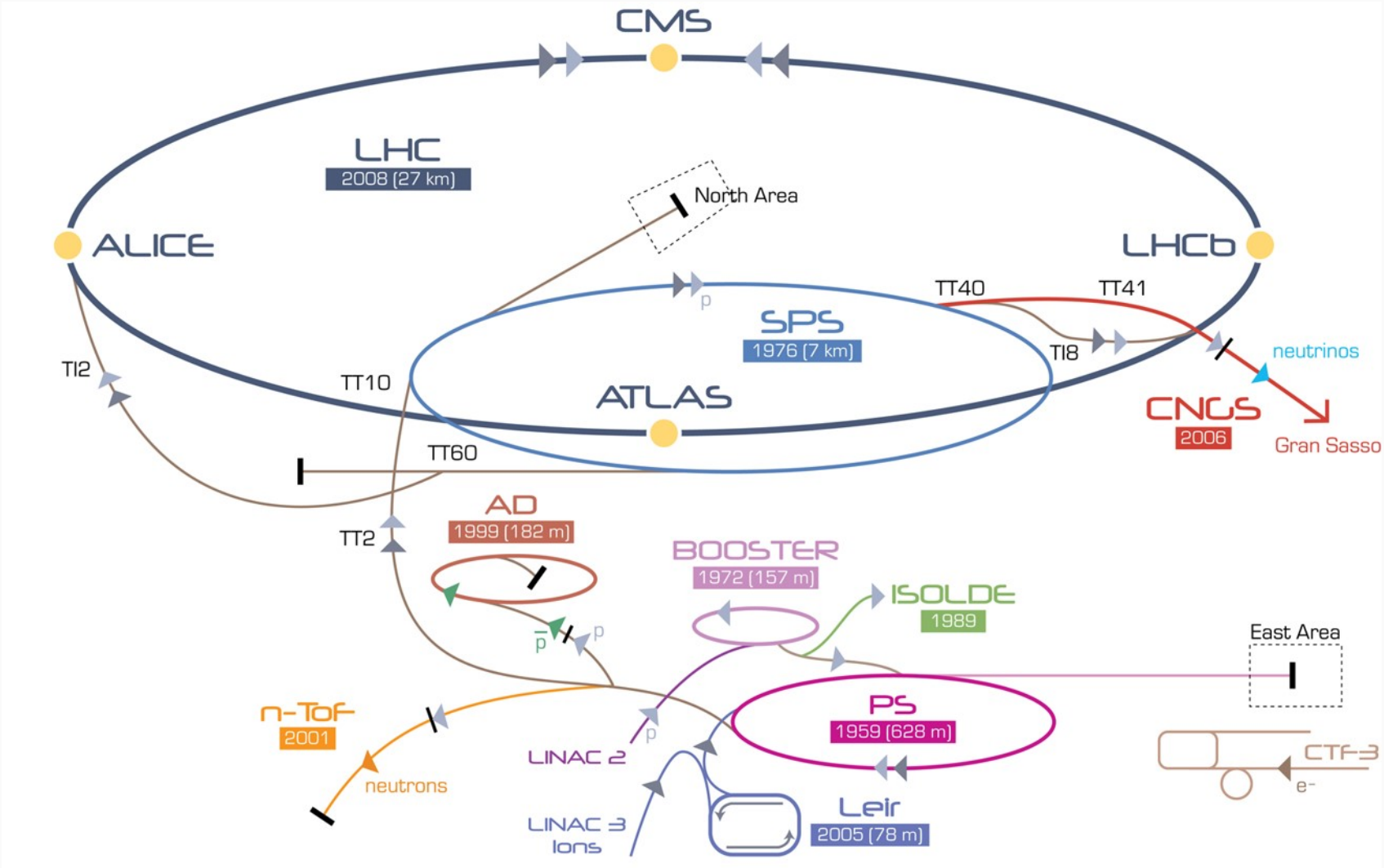
Fundamental Tests, e.g. neutrino mass from β-decay.



S. Eliseev, Addendum to Proposal P-242 to the INTC.

ISOLDE AND ISOLTRAP



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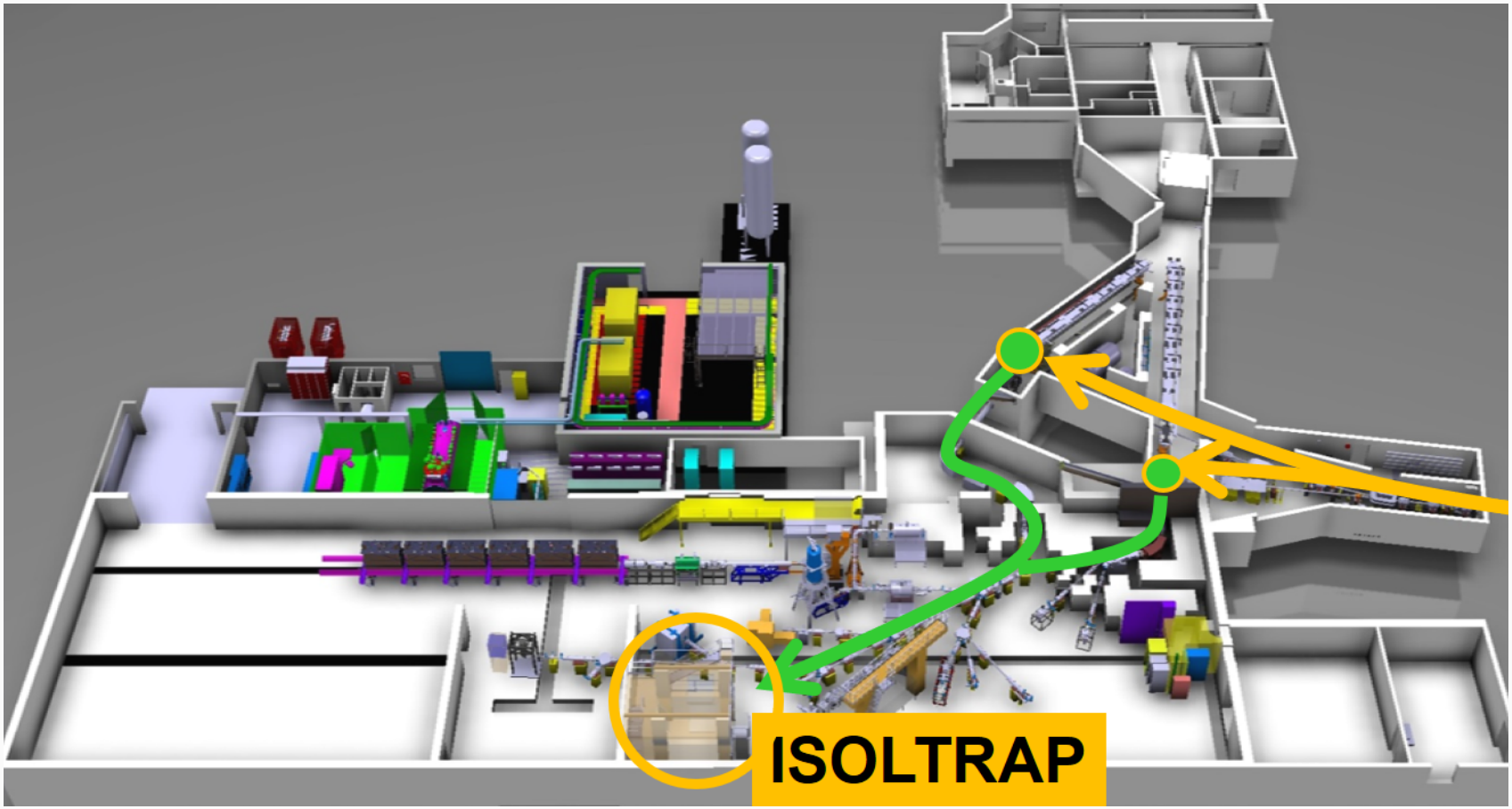

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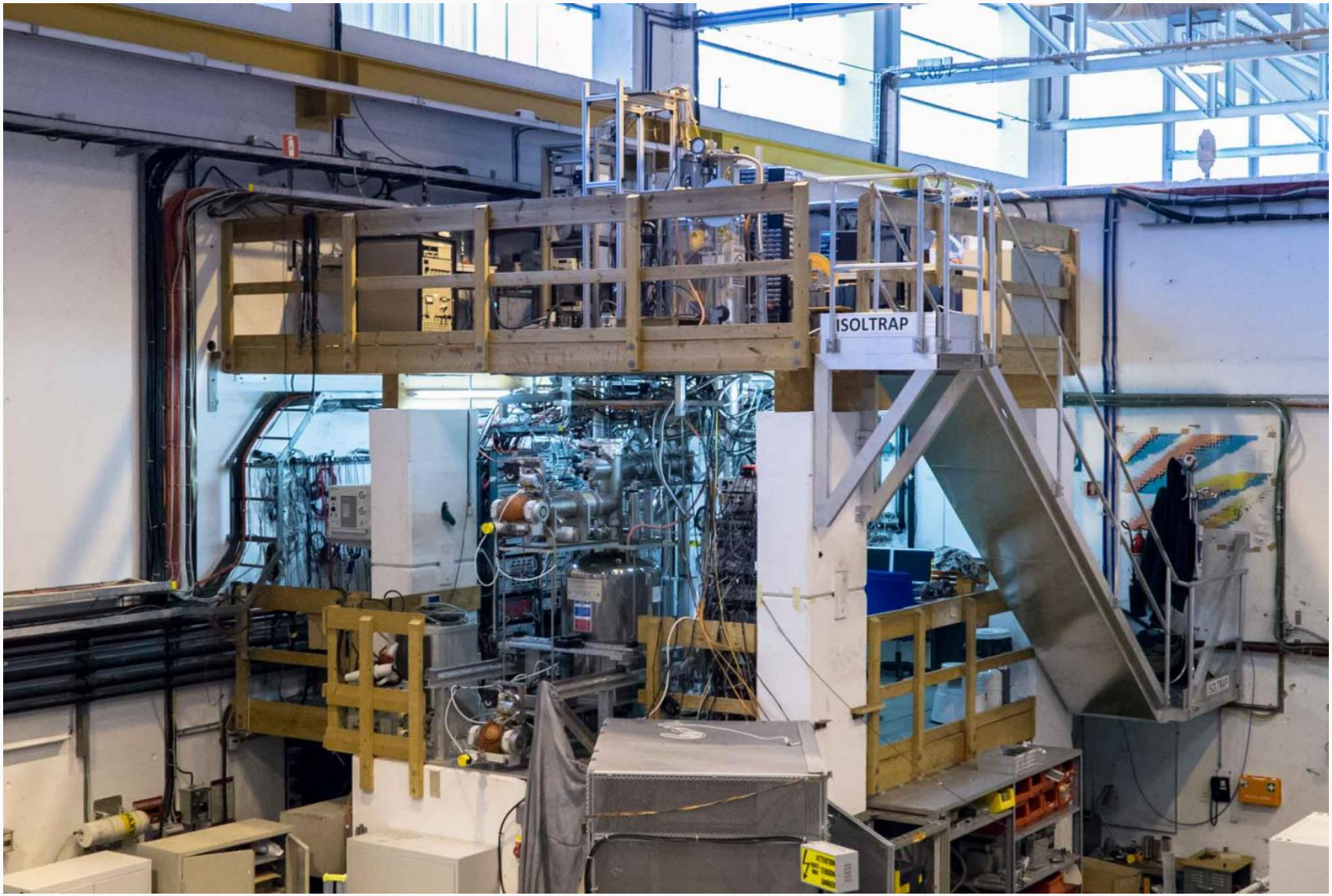


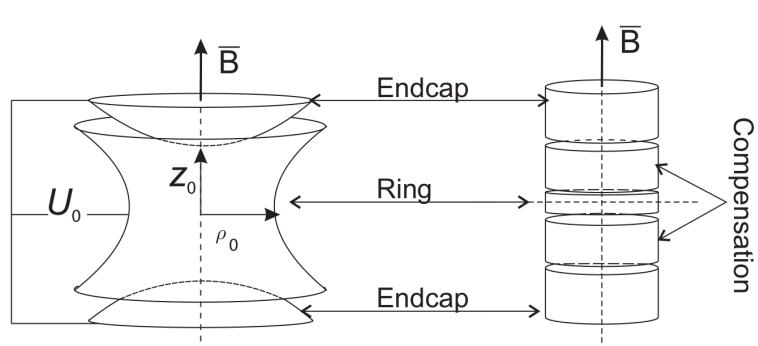
HOW?

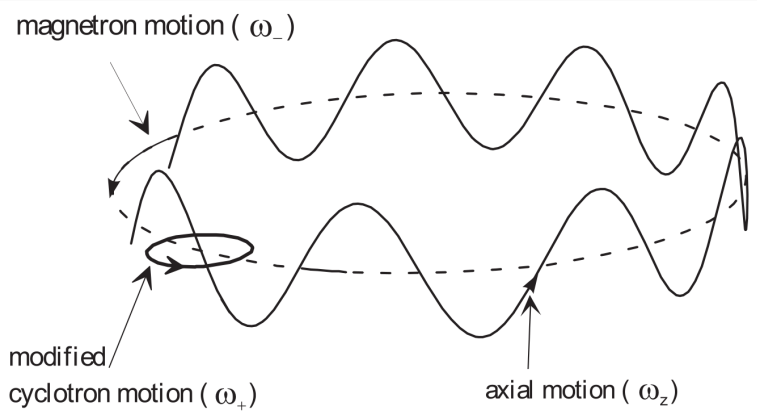
Trap the nuclides of interest in a Penning trap.

$$\omega_{\pm} = \frac{\omega_c}{2} \pm \sqrt{\frac{\omega_c^2}{4} - \frac{\omega_z^2}{2}},$$

$$\omega_c = \frac{q}{m} B.$$

Excite the fast cyclotron motion. Time-of-flight measurements of released ions.





M. Mukherjee et al., Eur. Phys. J. A 35, 1–29 (2008).

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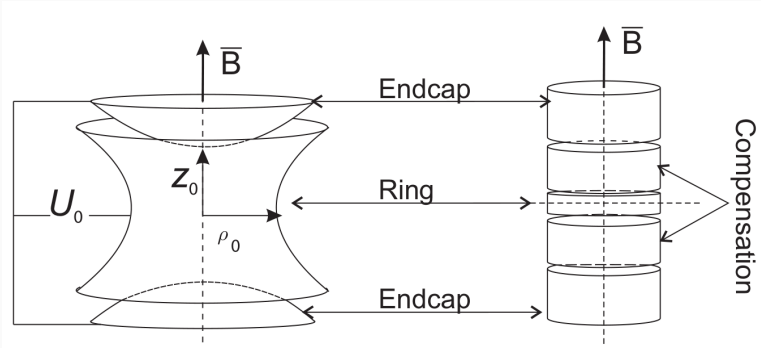
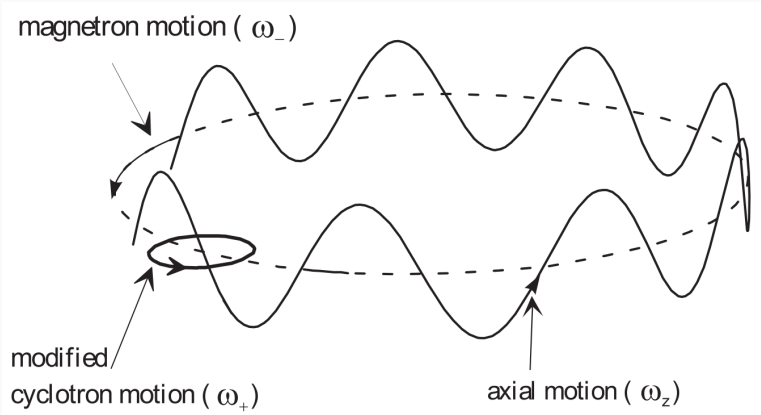
- ToF is a function of excitation frequency $\Rightarrow$ spectrum.





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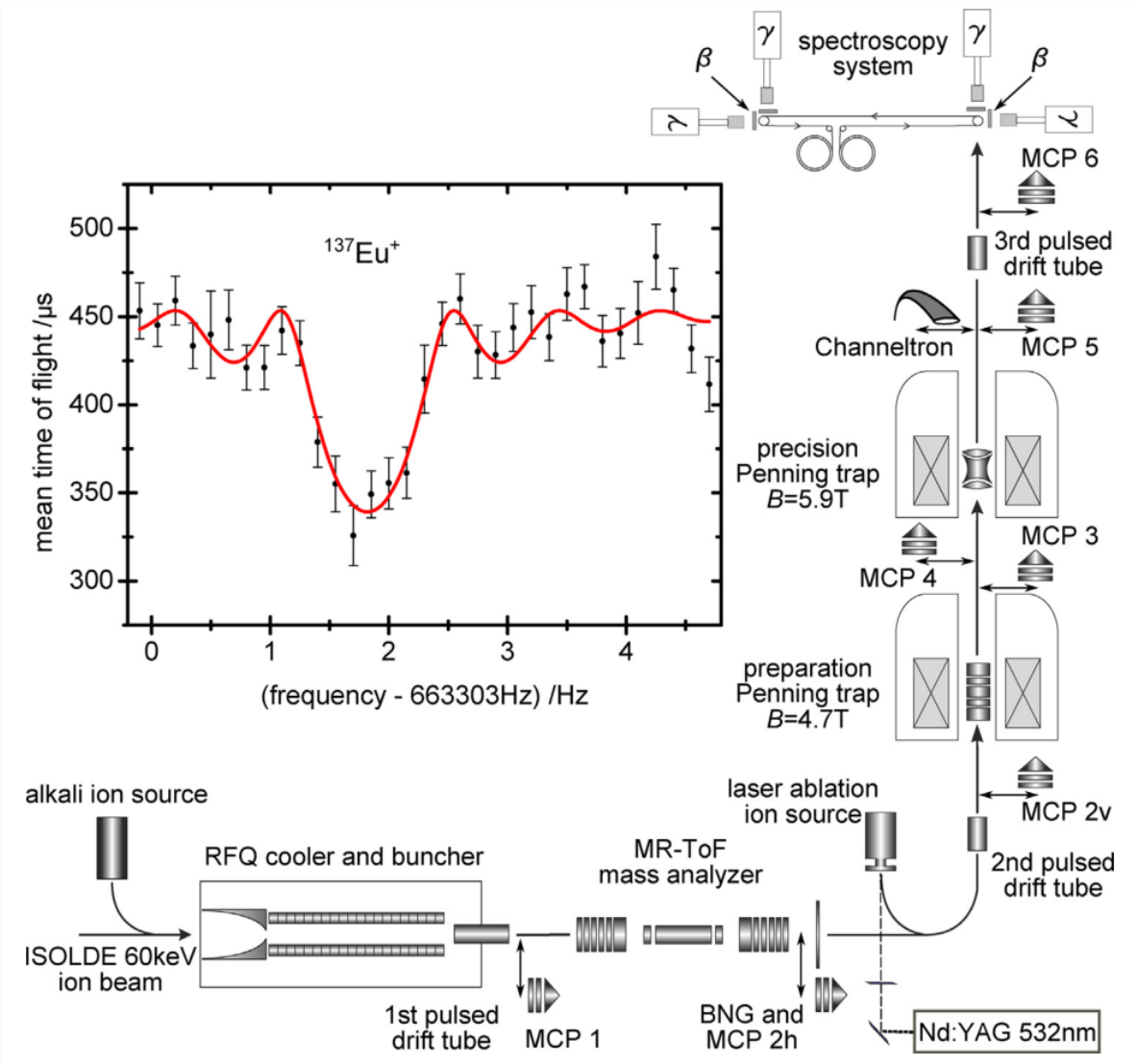
SETUP AND RESULTING SPECTRUM



R. N. Wolf et al., IJMS 349-350 (2013) 123-133.

PROJECT

Upcoming ISOLTRAP experiment will measure the masses of ^{131}Cs and ^{131}Xe.

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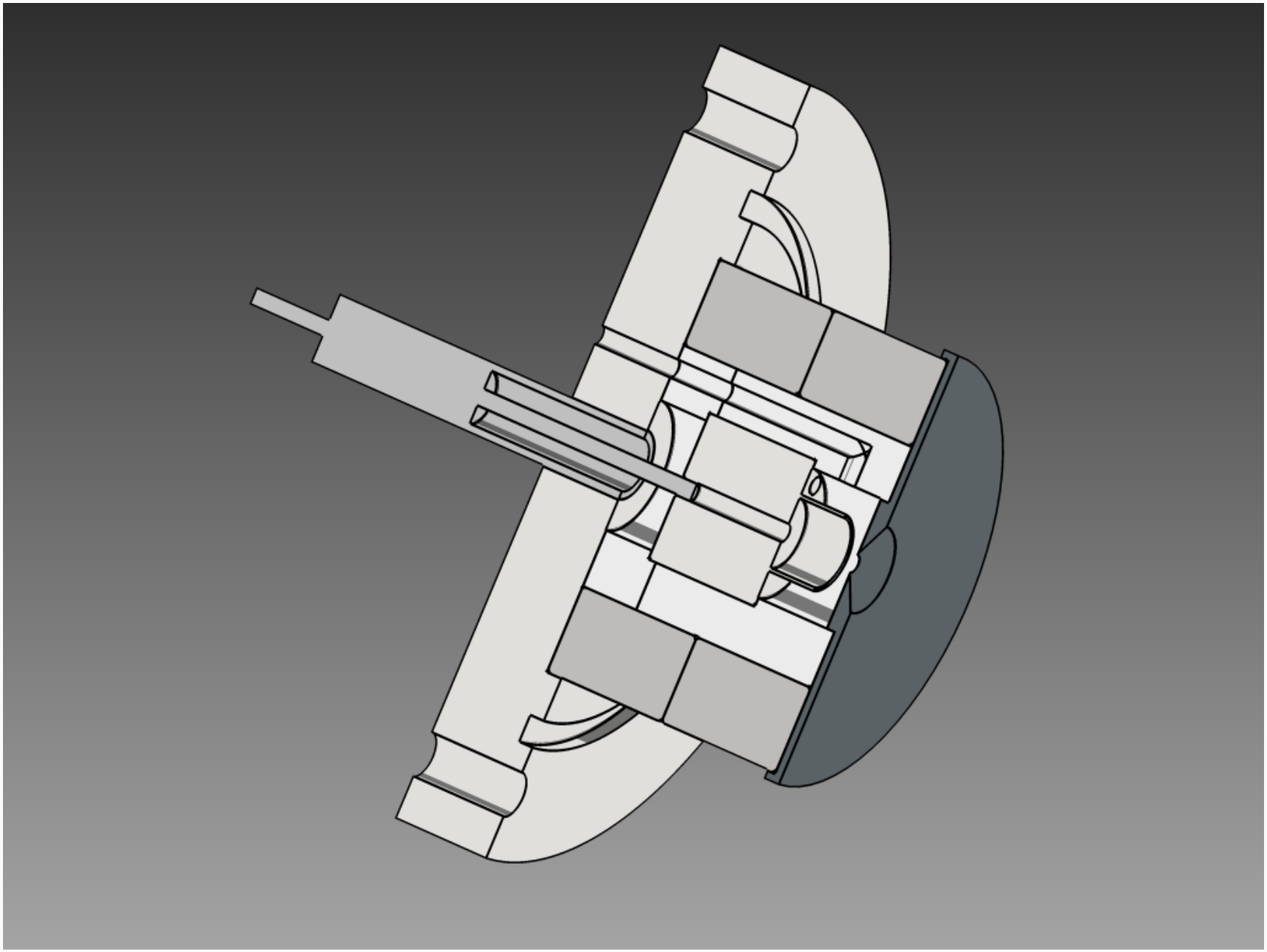
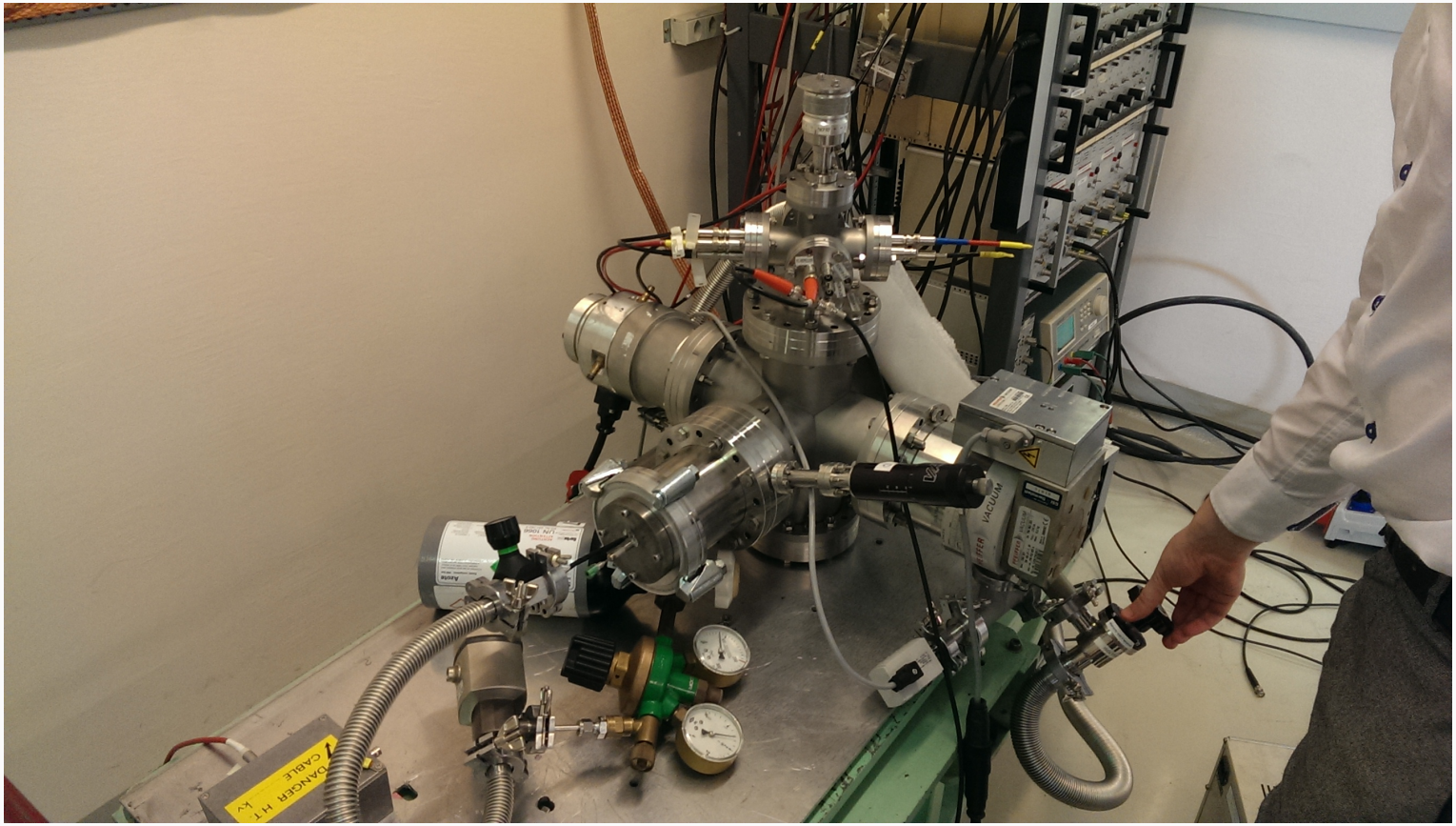
Project stages

- Set up test lab.
- Characterization of the ion source.
- Implementation in ISOLTRAP and test of extraction.

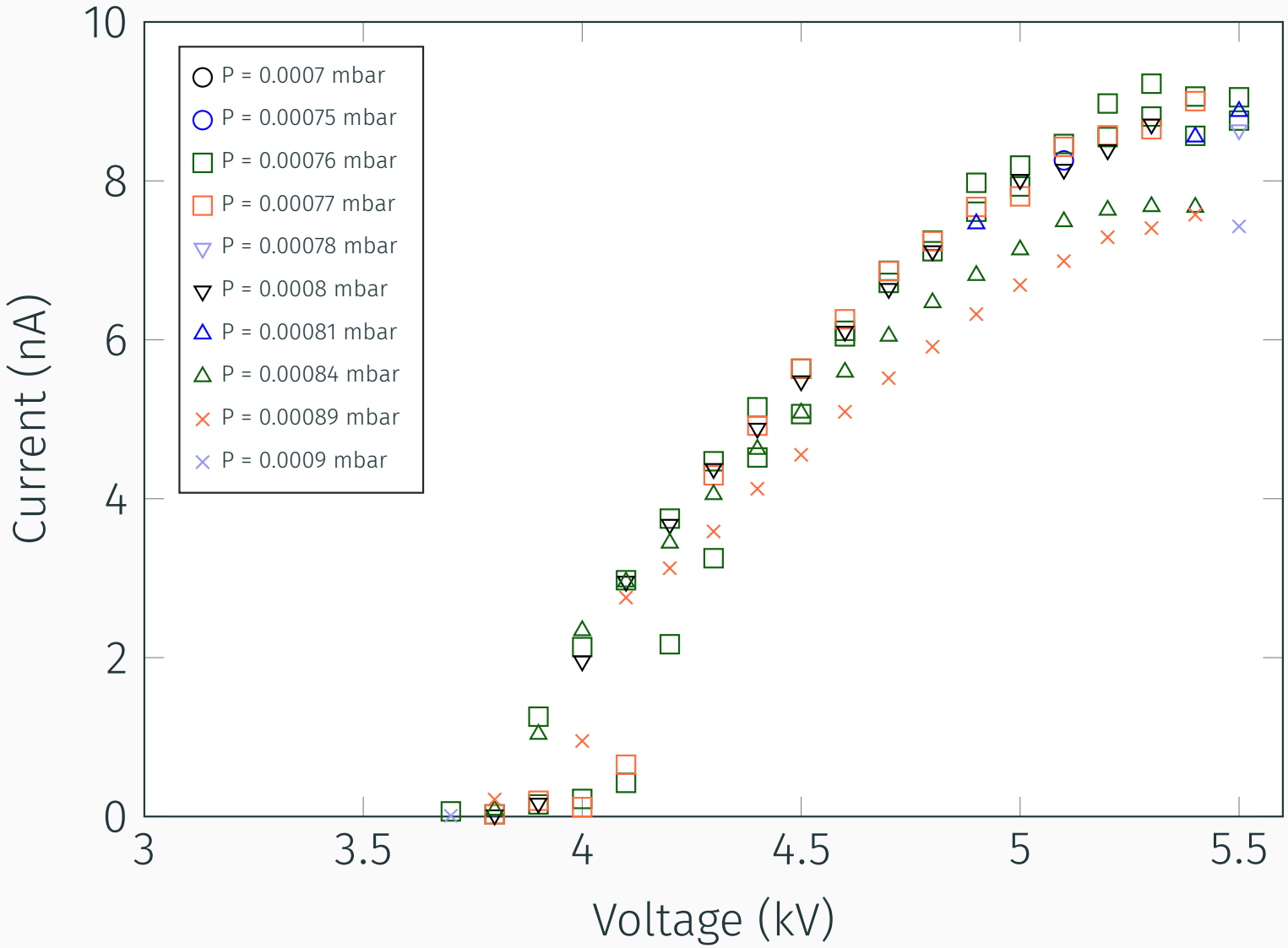
THE PLASMA SOURCE



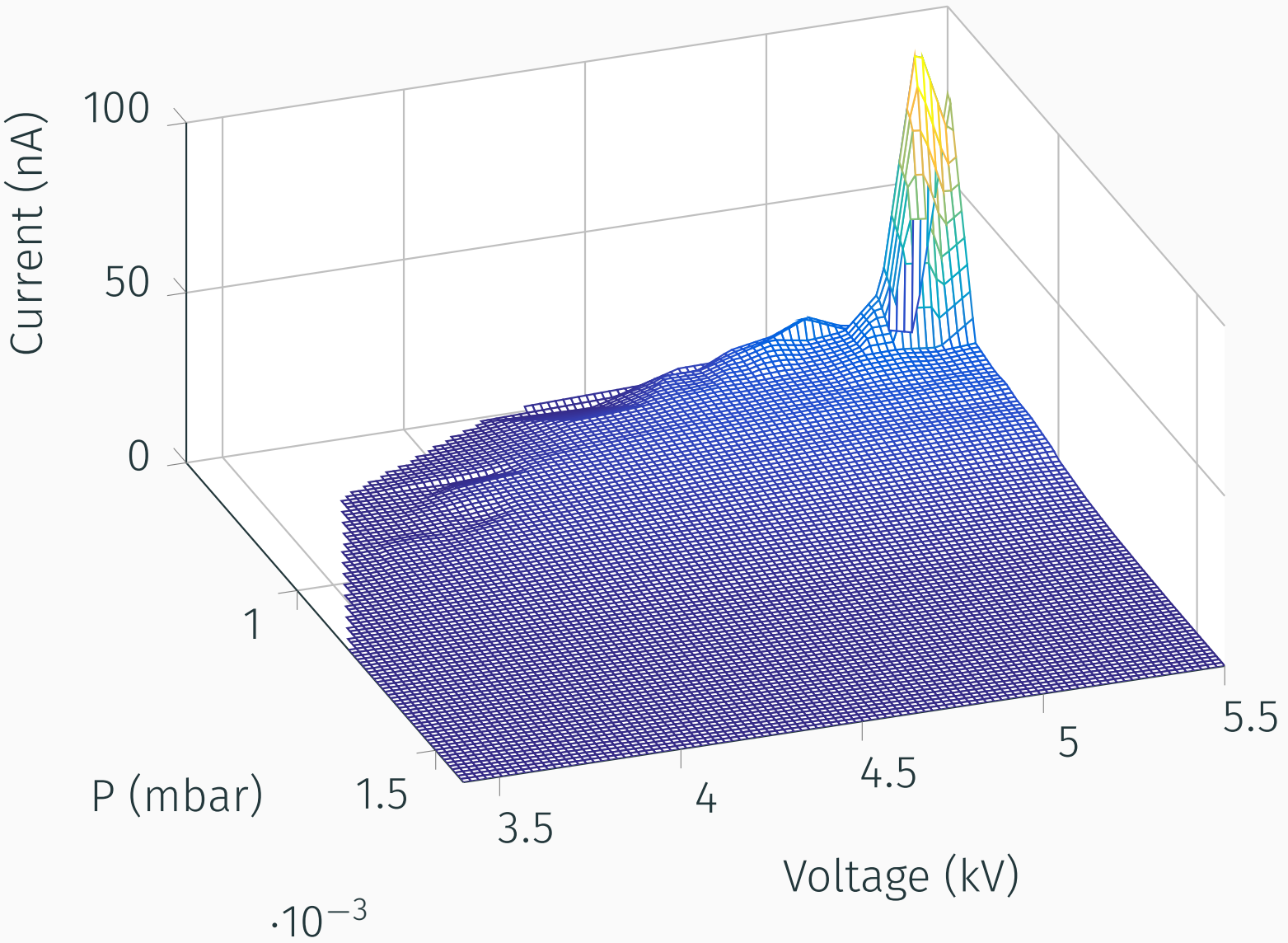
TEST SETUP



RESULTS


P = 0.0007 mbar
P = 0.00075 mbar
P = 0.00076 mbar
P = 0.00077 mbar
P = 0.00078 mbar
P = 0.0008 mbar
P = 0.00081 mbar
P = 0.00084 mbar
P = 0.00089 mbar
P = 0.0009 mbar
Current (nA)
Voltage (kV)
0
2
4
6
8
10
3
3.5
4
4.5
5
5.5

RESULTS



CONCLUSION

- Nuclear mass measurements are relevant to several fields of research.
- Nuclear masses are determined from TOF-measurements after release from a Penning trap.
- The new plasma ion source will allow for ionisation of gasses inside the ISOLTRAP setup.

Questions?