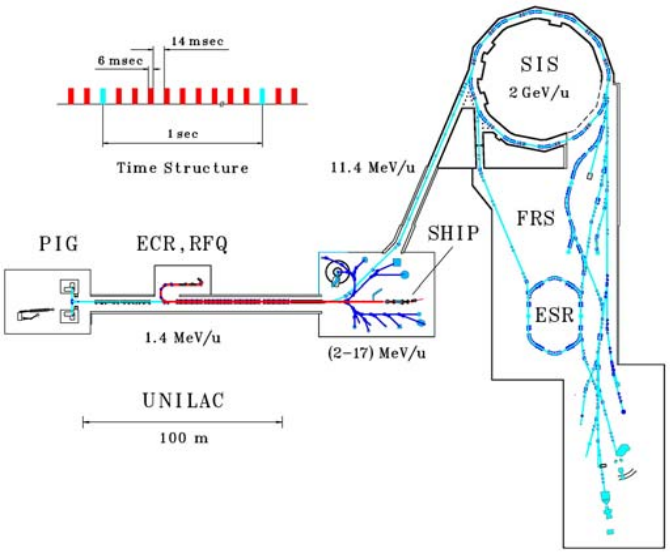
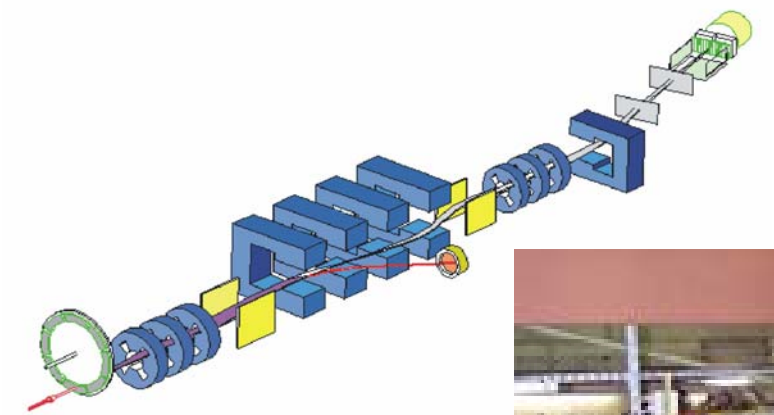
SHIPTRAP: the Penning trap spectrometer at GSI

Ana Martin

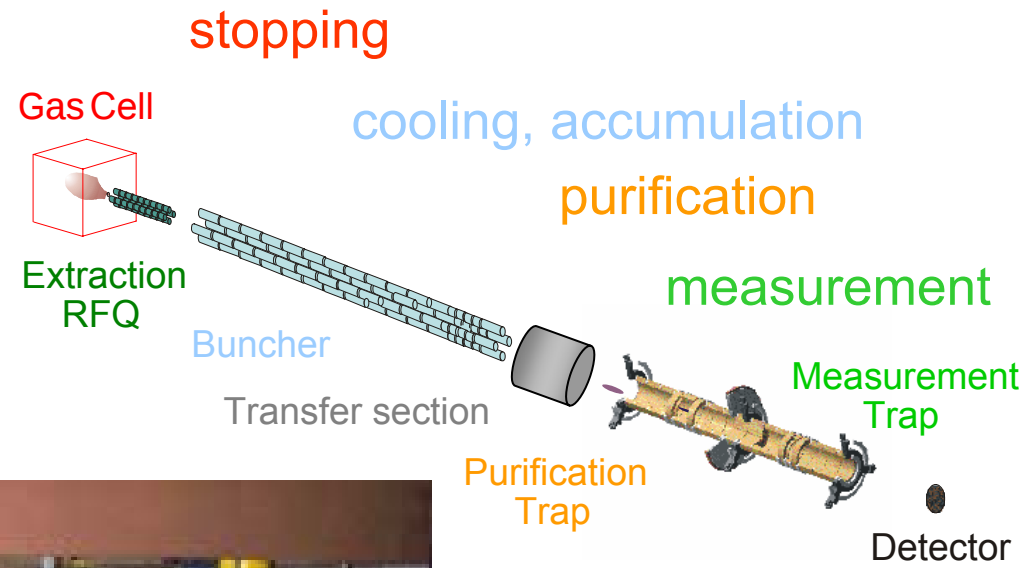


SHIPTRAP = SHIP + TRAP + …

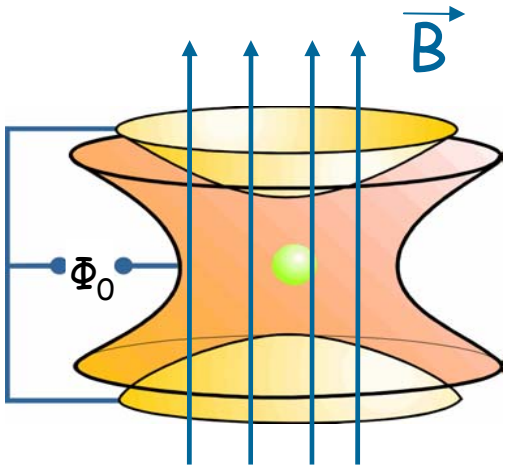
SHIPTRAP = Precision experiments with fusion-evaporation reaction products at low energy behind SHIP using ion traps

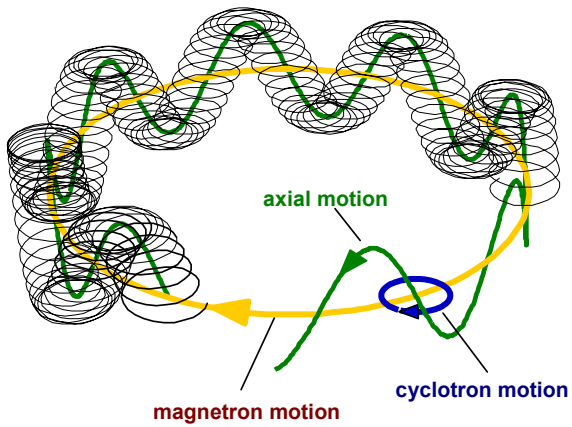


primary beam, 3-4 Mev/u



Ion Motion in a Penning Trap





Axial motion: oscillation in E-field

$$\omega_z = \sqrt{\frac{qV_0}{md^2}}$$

Magnetron motion: E x B drift

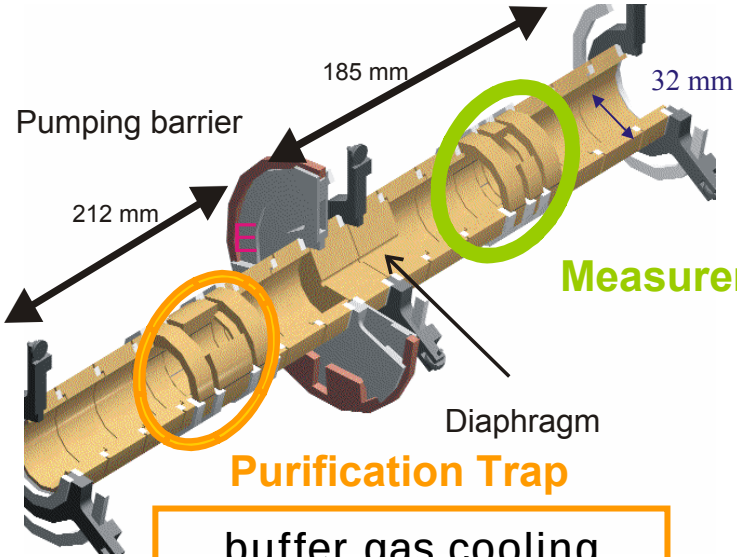
$$\omega_- = \frac{\omega_c}{2} - \sqrt{\frac{\omega_c^2}{4} - \frac{\omega_z^2}{2}}$$

Reduced cyclotron motion:

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

$$\omega_c = \omega_+ + \omega_- = \frac{q}{m}B$$

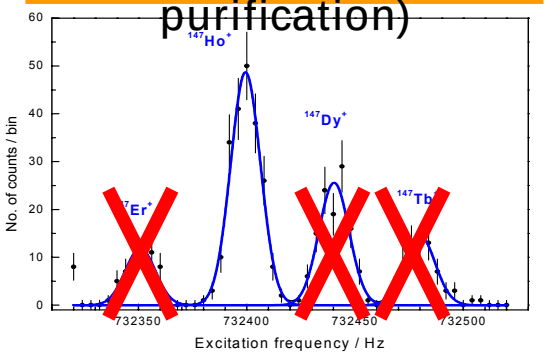
Double system Penning trap



Measurement Trap

Purification Trap

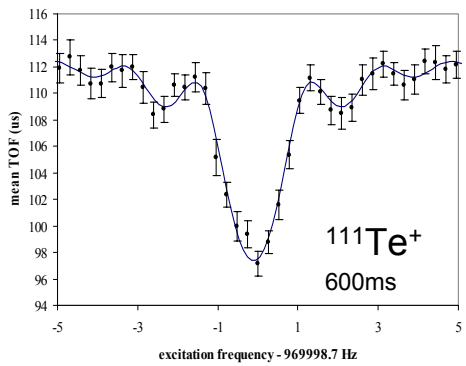
buffer gas cooling
mass selective
(isobaric
purification)



precision mass measurement
via the determination of the ion
cyclotron frequency

TOF-ICR = Time-of-flight Ion Cyclotron Resonance

$$m_{ion} = \frac{eB}{2\pi \nu_c}$$

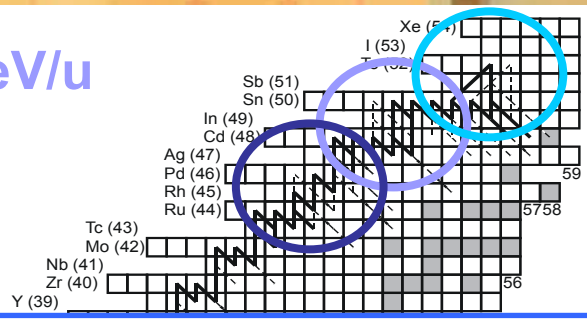


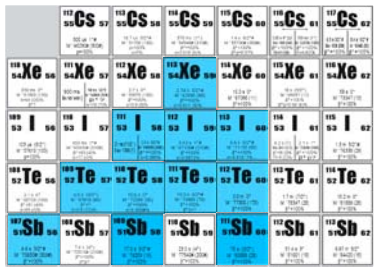
Mass measurements in the rp-process end point region

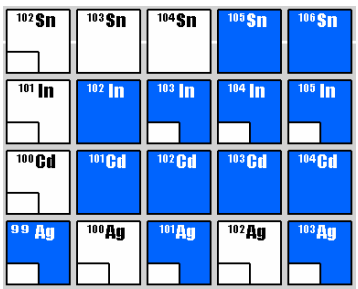
$^{50}Cr+^{58}Ni \rightarrow ^{108}Te^*$ @ 3.6 MeV/u - 4.0 MeV/u

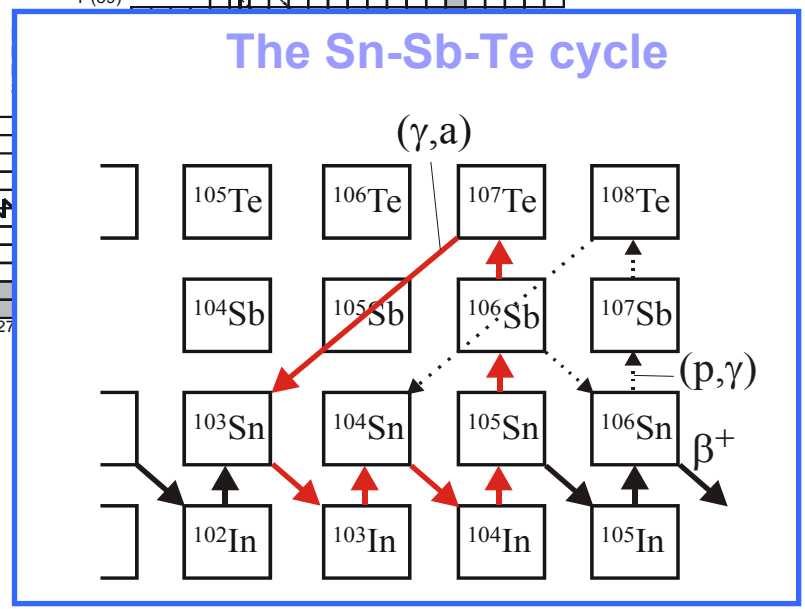
$^{58}Ni+^{58}Ni \rightarrow ^{116}Ba^*$ @ 4.0 MeV/u

$^{40}Ca+^{58}Ni \rightarrow ^{98}Cd^*$ @ 5.0 MeV/u









Precision mass measurements are important for rp-process calculations

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