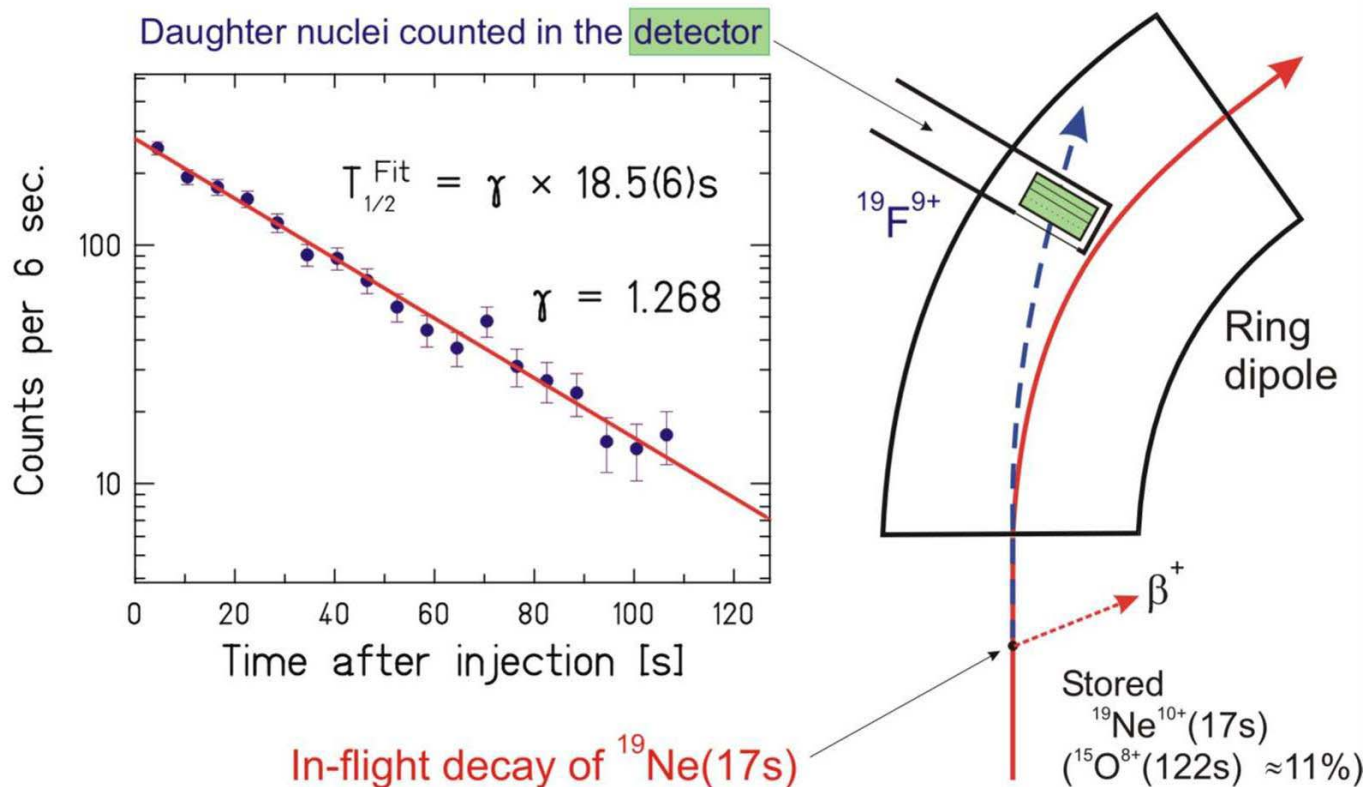


# Experiments with Stored Exotic Nuclei at Relativistic Energies

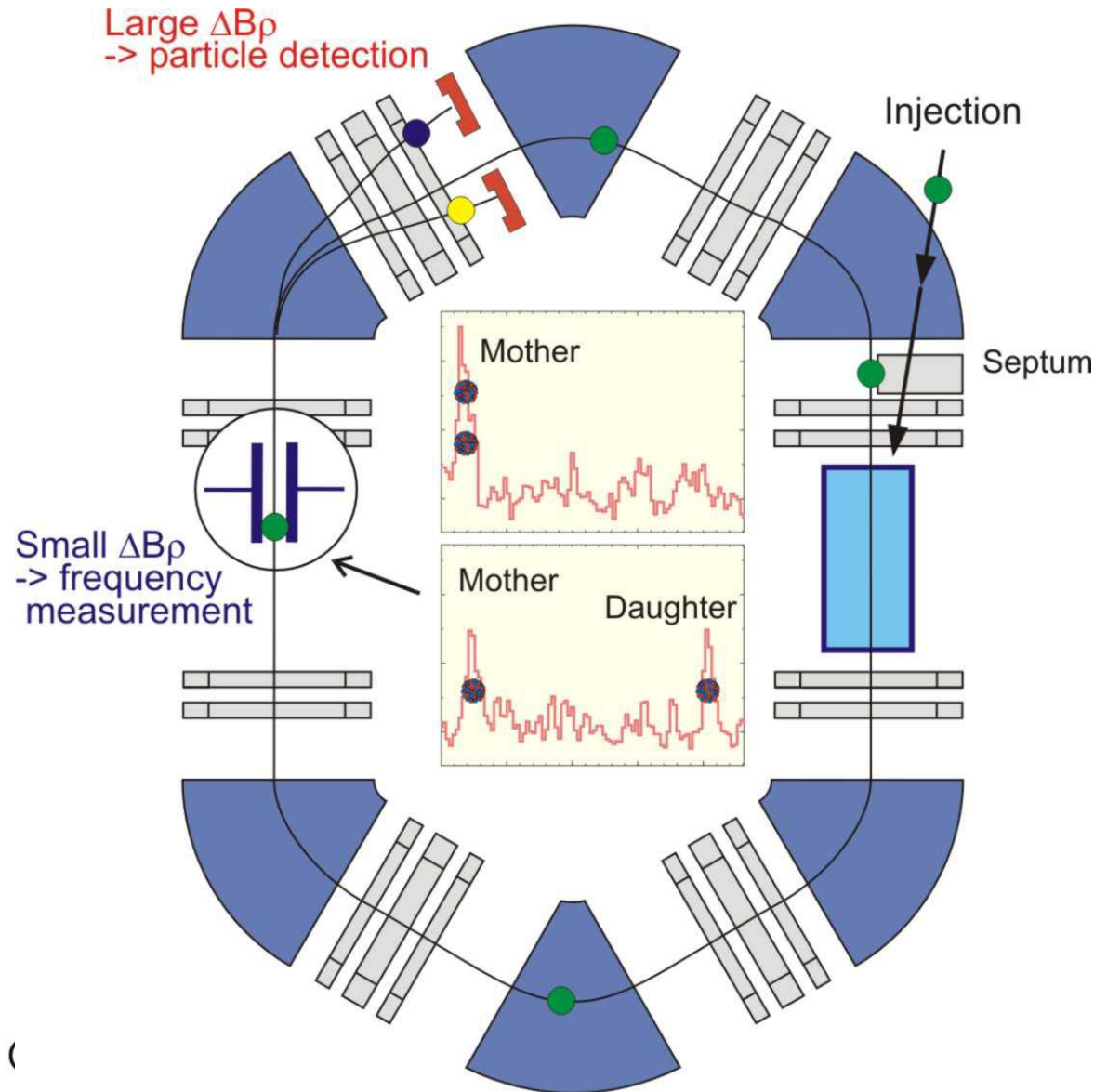
## \* Lifetime Measurements with Bare and Few-Electron Atoms

# Lifetime Measurements of Stored Ions applying $B\rho$ -Change

Nuclear  $T_{1/2}$  in the microseconds-to-hours range

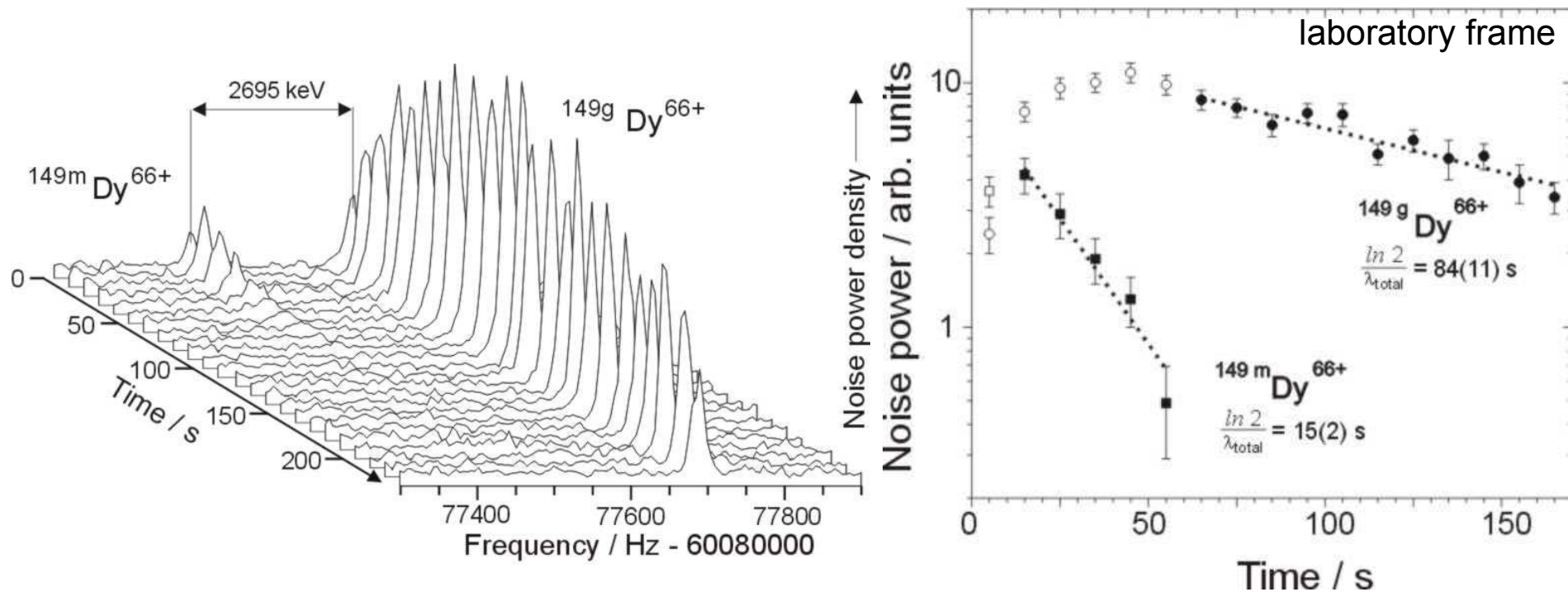


# Principle of Lifetime Measurements with Schottky Analysis



# Changes of halflives of nuclear isomers in fully ionized atoms

Half-life of the isomeric state of  $^{149}\text{Dy}$  in neutral atom is 0.49(2) s

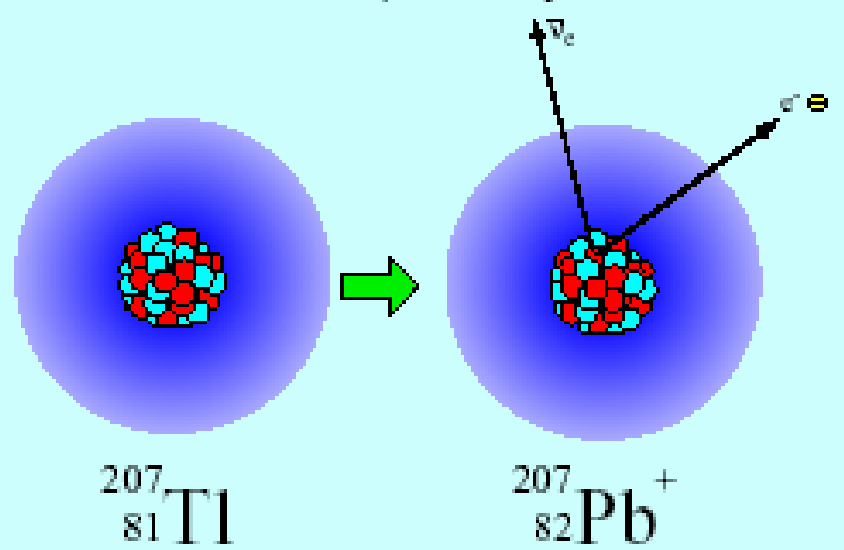


Measured half-life in the fully ionized atom is 11(1) s

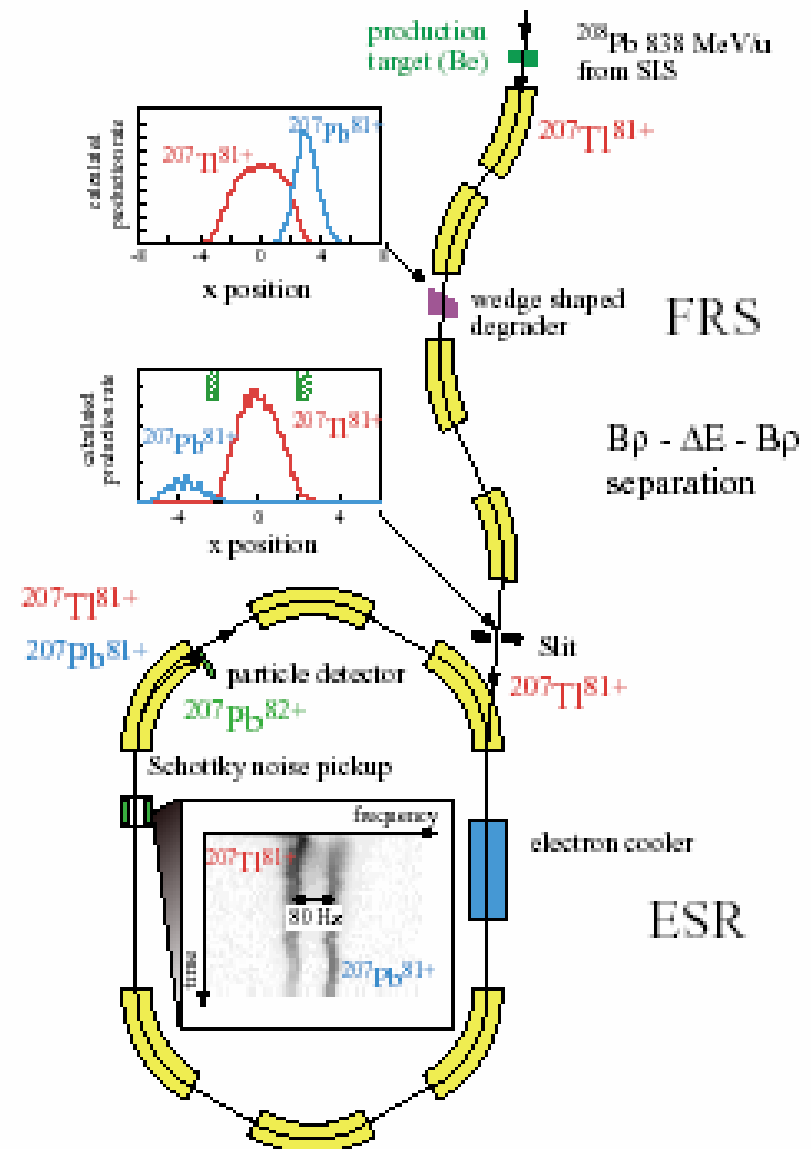
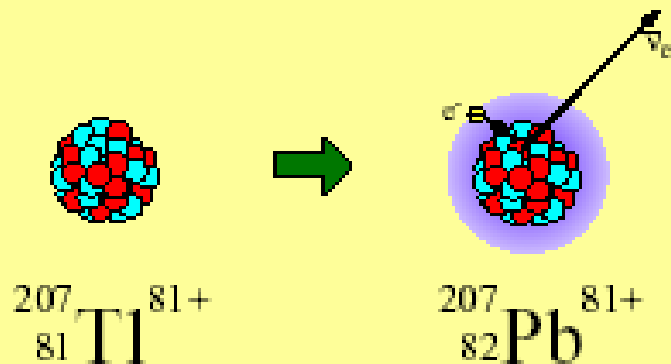
Hindrance factor  $\frac{T_{1/2} \text{ (fully ionized)}}{T_{1/2} \text{ (neutral)}} = 22(2)$

# Observation of Bound-State Beta Decay

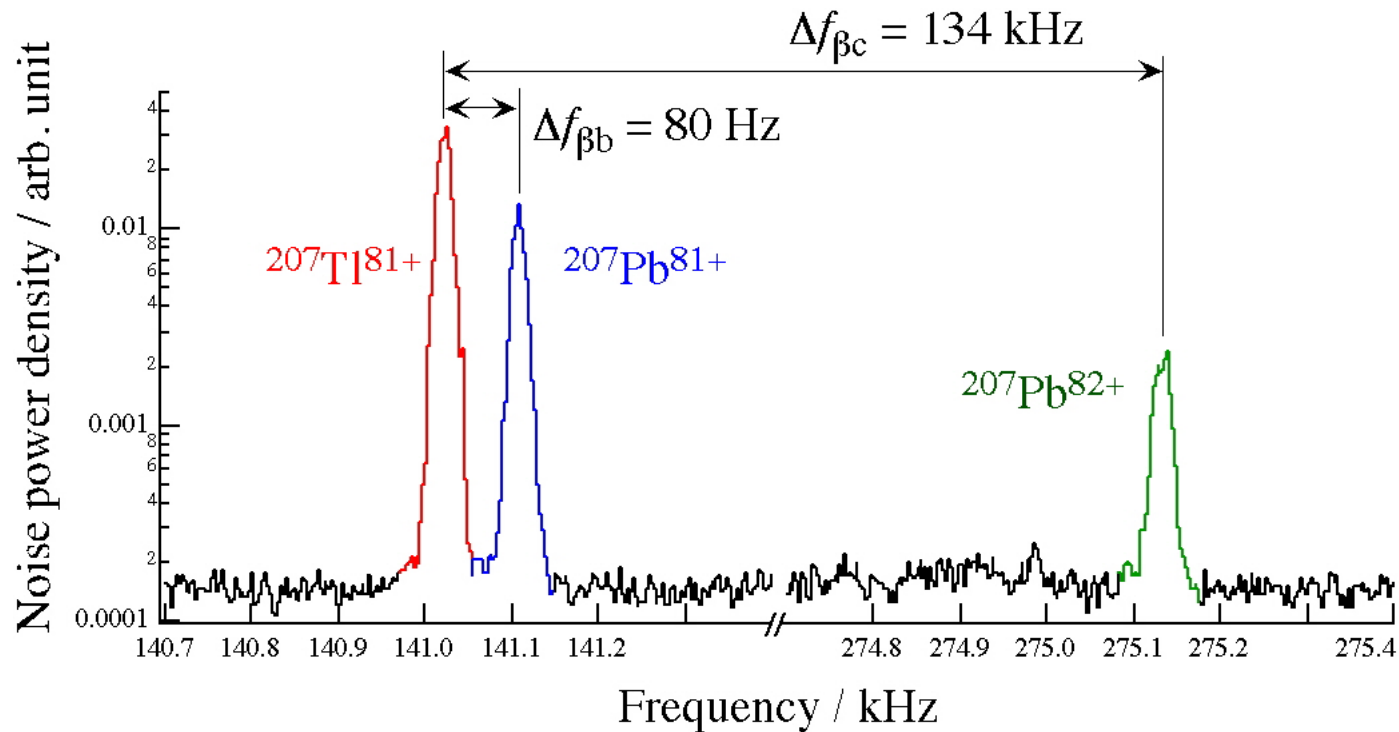
continuous state  $\beta$ -decay



bound state  $\beta$ -decay



# Direct Observation of Bound-state and Continuum Beta Decay

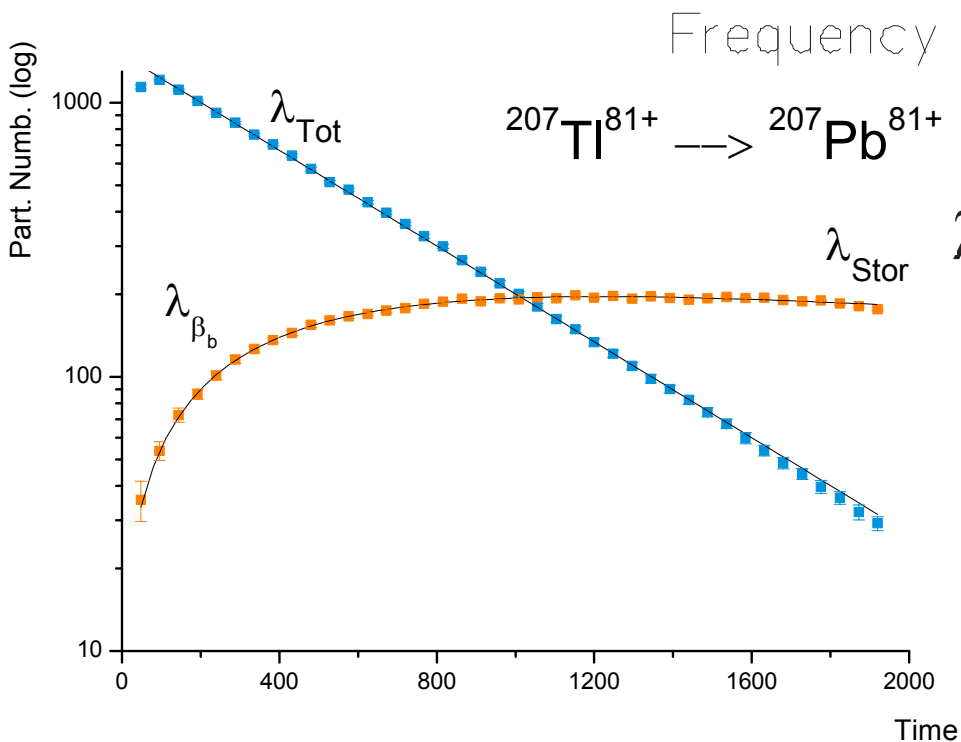
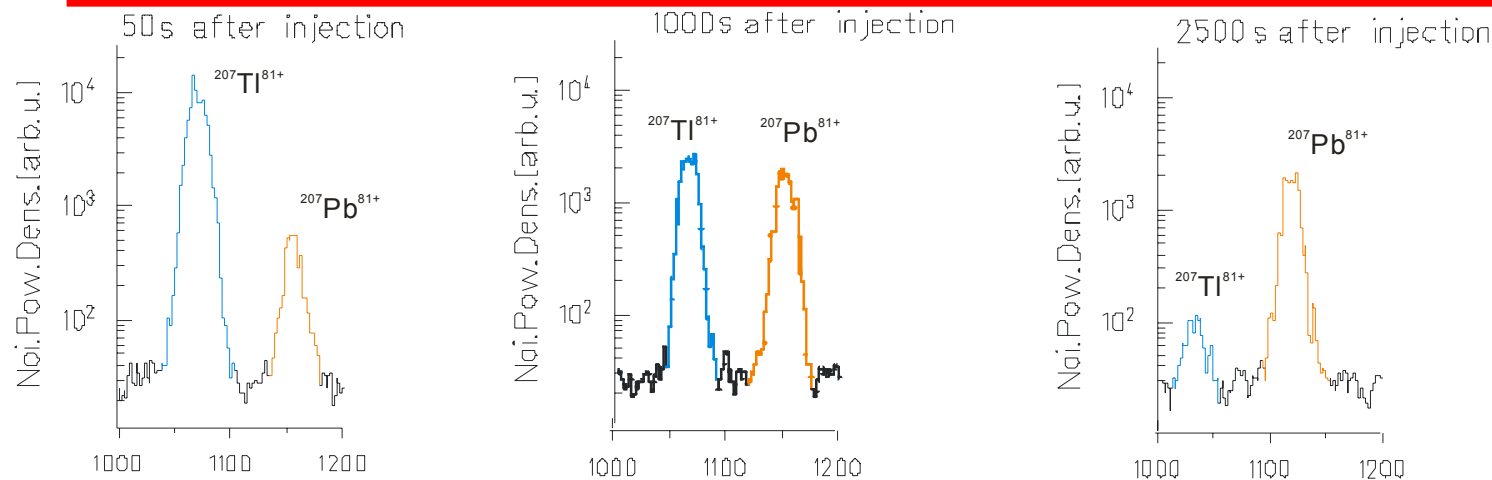


$$Q_{\beta c} = m(^{207}\text{Tl}^{81+}) - m(^{207}\text{Pb}^{82+}) - m(e^-) = 1406 \text{ keV}$$

$$Q_{\beta b} = Q_{\beta c} + B_{e^-} = 1507 \text{ keV}; \quad B_{e^-} = 101 \text{ keV}$$

$$\frac{\Delta f}{f} = \alpha_p \frac{\frac{m}{q} (^{207}\text{Tl}^{81+}) - \frac{m}{q} (^{207}\text{Pb}^{81+/82+})}{\frac{m}{q} (^{207}\text{Tl}^{81+})}$$

# Measured Bound-State Beta Decay of $^{207}\text{Tl}$



$$\lambda_{\text{Tot}} = \lambda_{\beta_b} + \lambda_{\beta_c} + \lambda_{\text{Stor}}$$

$$\lambda_{\text{Tot}} = 2.012 \cdot 10^{-3} \text{ s}^{-1}$$

$$\lambda_{\beta_b} = 3.291 \cdot 10^{-4} \text{ s}^{-1}$$

$$\lambda_{\text{Stor}} = 2.138 \cdot 10^{-4} \text{ s}^{-1}$$

$$\lambda_{\beta_c} = 1.469 \cdot 10^{-3} \text{ s}^{-1}$$

$$\frac{\lambda_{\beta_b}}{\lambda_{\beta_b} + \lambda_{\beta_c}} = 0.183 \pm 0.004$$



# Measured Bound-State Beta Decay of $^{207}\text{Tl}$

