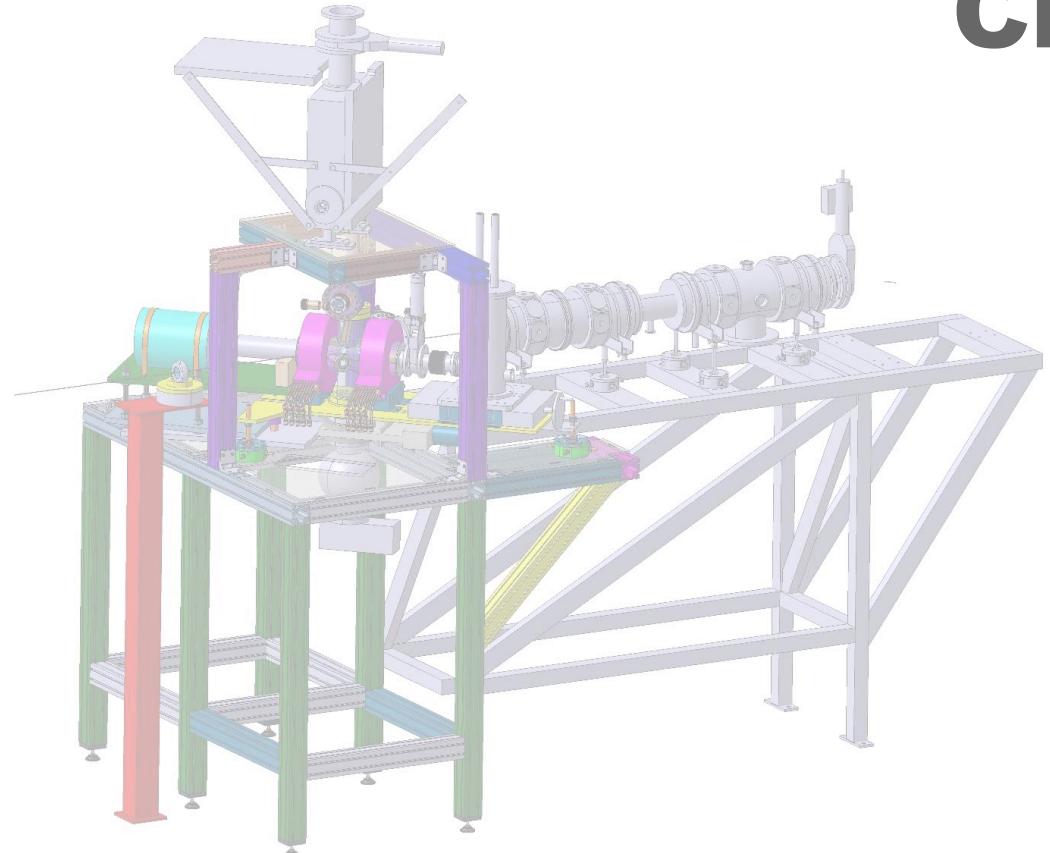




irfu



COversion electrons Chasing at Orsay

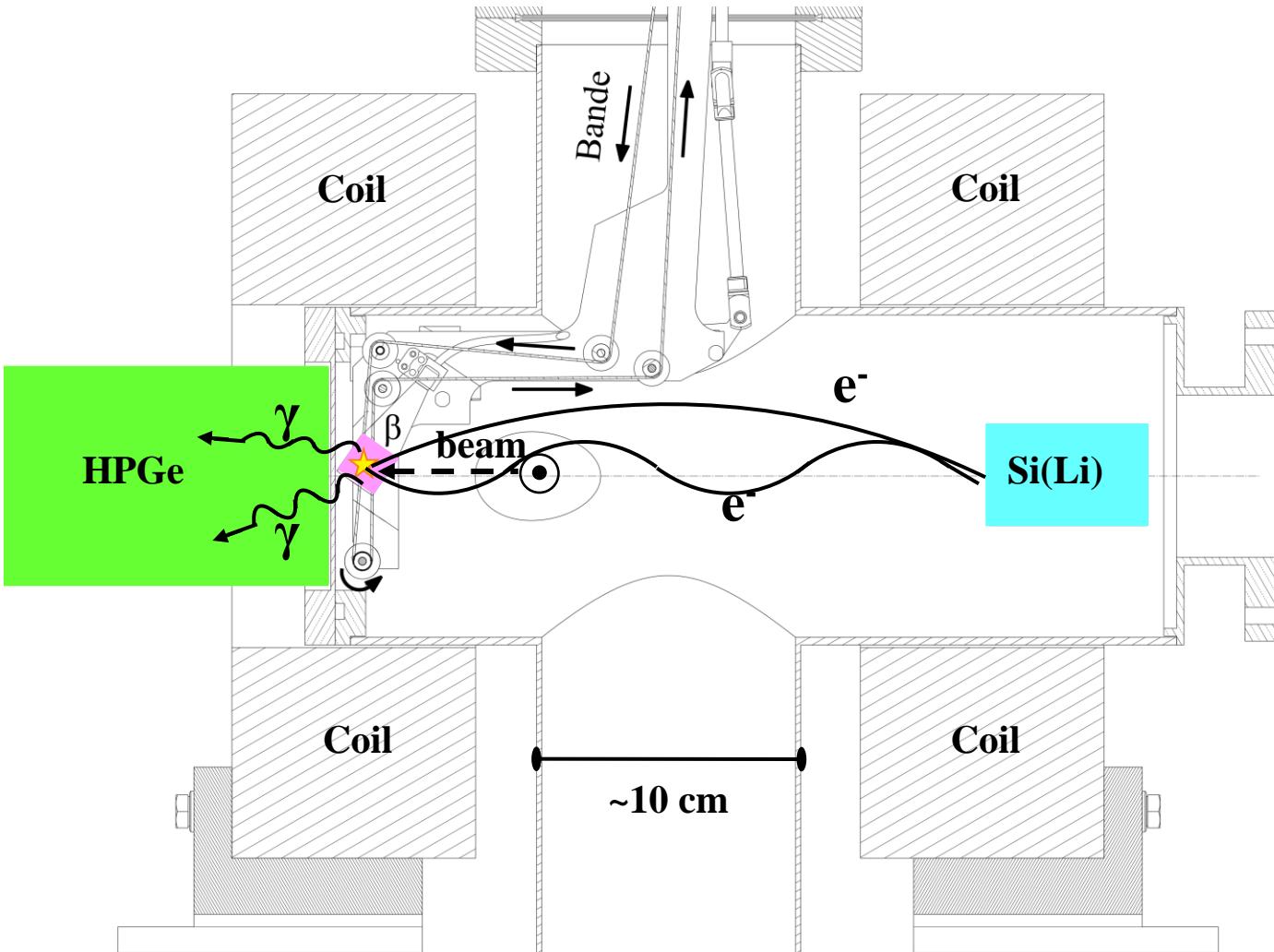
- 1. The decay setup COeCO**
- 2. Last year's timeline and plans**
- 3. On-line commissioning of COeCO**
- 4. New half-life measurement of first excited 0^+ in ^{98}Zr**



COncersion electrons Chasing at Orsay

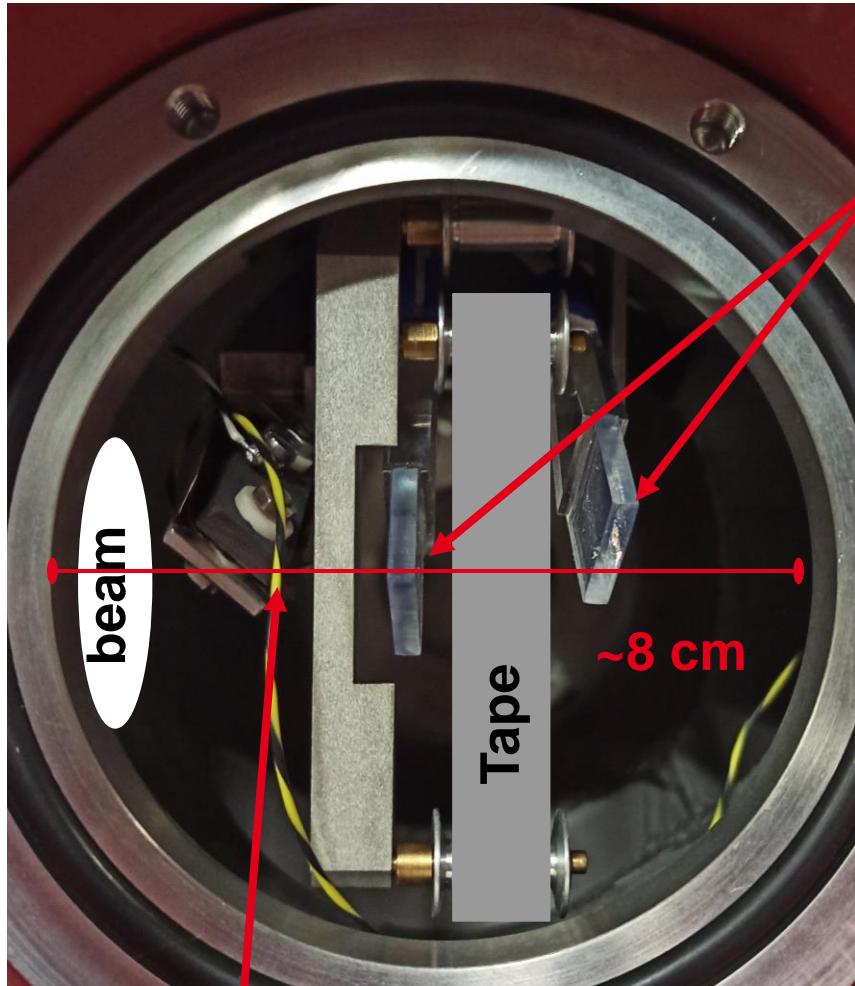
Magnetic transporter (Helmholtz configuration)

- Beam collected on tape
- Plastic scintillator for β -tagging
- Conversion electrons guided inside the chamber to compensate the loss of solid angle
- Tape unwinded to remove the source

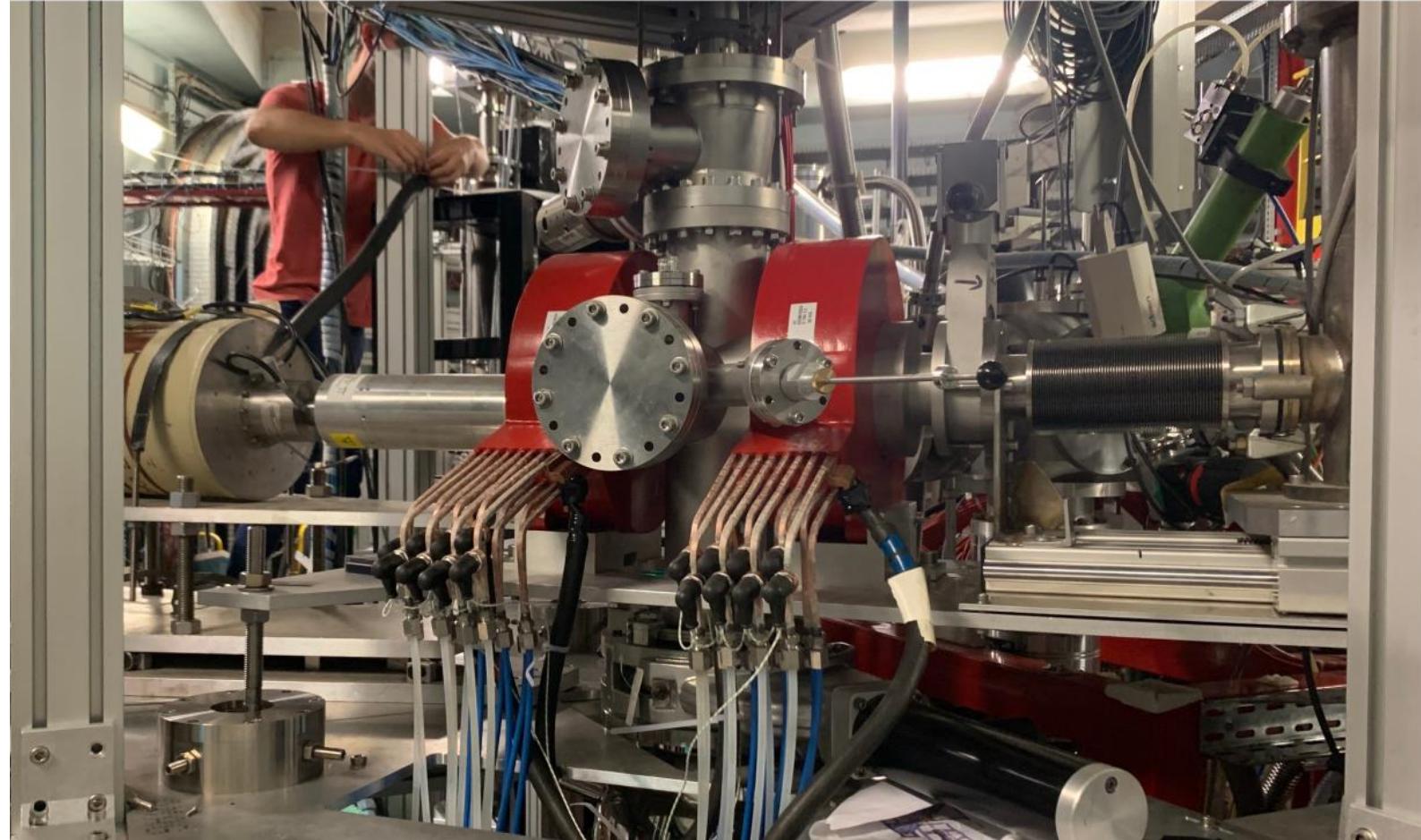




COnversion electrons Chasing at Orsay

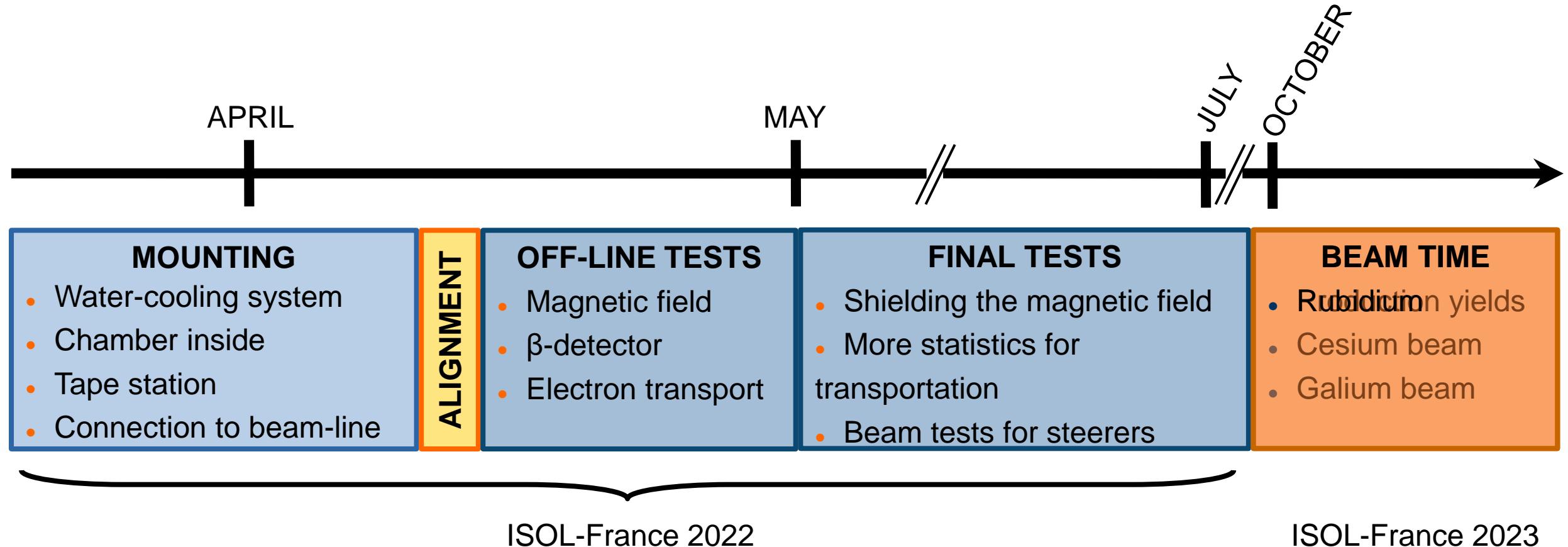


Plastic
scintillator

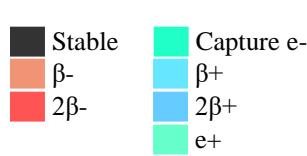




COeCO year 0 (2022)



Physics motivation : shape transition around N=60



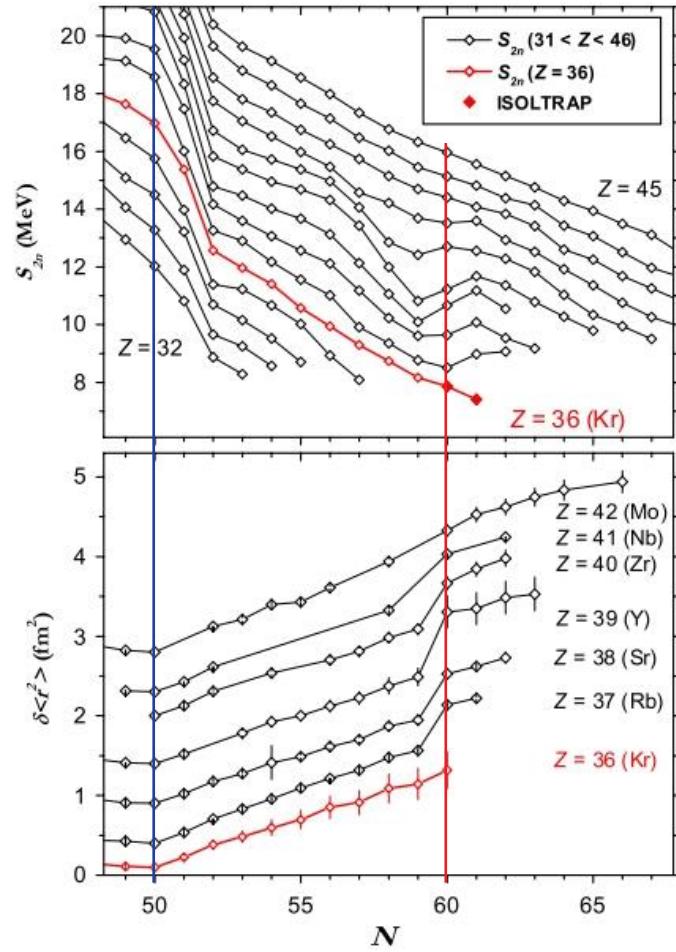
Z = 40

N = 50	N = 56	N = 60
⁹¹ Ru β+	⁹² Ru β+	⁹³ Ru β+
⁹⁴ Ru β+	⁹⁵ Ru β+	⁹⁶ Ru 2β+
⁹⁷ Ru β+	⁹⁸ Ru Stable	⁹⁹ Ru Stable
¹⁰⁰ Ru Stable	¹⁰¹ Ru Stable	¹⁰² Ru Stable
¹⁰³ Ru β-	¹⁰⁴ Ru 2β-	¹⁰⁵ Ru β-
¹⁰⁶ Ru β-	¹⁰⁷ Ru β-	
⁹⁰ Tc β+	⁹¹ Tc β+	⁹² Tc β+
⁹³ Tc β+	⁹⁴ Tc β+	⁹⁵ Tc β+
⁹⁶ Tc β+	⁹⁷ Tc e-capture	⁹⁸ Tc β-
⁹⁹ Tc β-	¹⁰⁰ Tc β-	¹⁰¹ Tc β-
¹⁰² Tc β-	¹⁰³ Tc β-	¹⁰⁴ Tc β-
¹⁰⁵ Tc β-	¹⁰⁶ Tc β-	
⁸⁹ Mo β+	⁹⁰ Mo β+	⁹¹ Mo β+
⁹² Mo 2β+	⁹³ Mo e-capture	⁹⁴ Mo Stable
⁹⁵ Mo Stable	⁹⁶ Mo Stable	⁹⁷ Mo Stable
⁹⁸ Mo 2β-	⁹⁹ Mo β-	¹⁰⁰ Mo 2β-
¹⁰¹ Mo β-	¹⁰² Mo β-	¹⁰³ Mo β-
¹⁰⁴ Mo β-	¹⁰⁵ Mo β-	
⁸⁸ Nb β+	⁸⁹ Nb β+	⁹⁰ Nb β+
⁹¹ Nb e-capture	⁹² Nb β+	⁹³ Nb Stable
⁹⁴ Nb β-	⁹⁵ Nb β-	⁹⁶ Nb β-
⁹⁷ Nb β-	⁹⁸ Nb β-	⁹⁹ Nb β-
¹⁰⁰ Nb β-	¹⁰¹ Nb β-	¹⁰² Nb β-
¹⁰³ Nb β-	¹⁰⁴ Nb β-	
⁸⁷ Zr β+	⁸⁸ Zr e-capture	⁸⁹ Zr β+
⁹⁰ Zr Stable	⁹¹ Zr Stable	⁹² Zr Stable
⁹³ Zr β-	⁹⁴ Zr 2β-	⁹⁵ Zr β-
⁹⁶ Zr 2β-	⁹⁷ Zr β-	⁹⁸ Zr β-
⁹⁹ Zr β-	¹⁰⁰ Zr β-	¹⁰¹ Zr β-
¹⁰² Zr β-	¹⁰³ Zr β-	
⁸⁶ Y β+	⁸⁷ Y β+	⁸⁸ Y β+
⁸⁹ Y Stable	⁹⁰ Y β-	⁹¹ Y β-
⁹² Y β-	⁹³ Y β-	⁹⁴ Y β-
⁹⁵ Y β-	⁹⁶ Y β-	⁹⁷ Y β-
⁹⁸ Y β-	⁹⁹ Y β-	¹⁰⁰ Y β-
¹⁰¹ Y β-	¹⁰² Y β-	
⁸⁵ Sr e-capture	⁸⁶ Sr Stable	⁸⁷ Sr Stable
⁸⁸ Sr Stable	⁸⁹ Sr β-	⁹⁰ Sr β-
⁹¹ Sr β-	⁹² Sr β-	⁹³ Sr β-
⁹⁴ Sr β-	⁹⁵ Sr β-	⁹⁶ Sr β-
⁹⁷ Sr β-	⁹⁸ Sr β-	⁹⁹ Sr β-
¹⁰⁰ Sr β-	¹⁰¹ Sr β-	
⁸⁴ Rb β+	⁸⁵ Rb Stable	⁸⁶ Rb β-
⁸⁷ Rb β-	⁸⁸ Rb β-	⁸⁹ Rb β-
⁹⁰ Rb β-	⁹¹ Rb β-	⁹² Rb β-
⁹³ Rb β-	⁹⁴ Rb β-	⁹⁵ Rb β-
⁹⁶ Rb β-	⁹⁷ Rb β-	⁹⁸ Rb β-
⁹⁹ Rb β-	¹⁰⁰ Rb β-	
⁸³ Kr Stable	⁸⁴ Kr Stable	⁸⁵ Kr β-
⁸⁶ Kr β-	⁸⁷ Kr β-	⁸⁸ Kr β-
⁸⁹ Kr β-	⁹⁰ Kr β-	⁹¹ Kr β-
⁹² Kr β-	⁹³ Kr β-	⁹⁴ Kr β-
⁹⁵ Kr β-	⁹⁶ Kr β-	⁹⁷ Kr β-
⁹⁸ Kr β-	⁹⁹ Kr β-	
⁸² Br β-	⁸³ Br β-	⁸⁴ Br β-
⁸⁶ Br β-	⁸⁷ Br β-	⁸⁸ Br β-
⁸⁹ Br β-	⁹⁰ Br β-	⁹¹ Br β-
⁹² Br β-	⁹³ Br β-	⁹⁴ Br β-
⁹⁵ Br β-	⁹⁶ Br β-	⁹⁷ Br β-
⁹⁸ Br β-	⁹⁹ Br β-	
⁸¹ Se β-	⁸² Se 2β-	⁸³ Se β-
⁸⁴ Se β-	⁸⁵ Se β-	⁸⁶ Se β-
⁸⁷ Se β-	⁸⁸ Se β-	⁸⁹ Se β-
⁹⁰ Se β-	⁹¹ Se β-	⁹² Se β-
⁹³ Se β-	⁹⁴ Se β-	⁹⁵ Se β-

- Some data on conversion electrons to calibrate the setup (conversion coefficients)
- Region of known shape coexistence, with E0 to measure



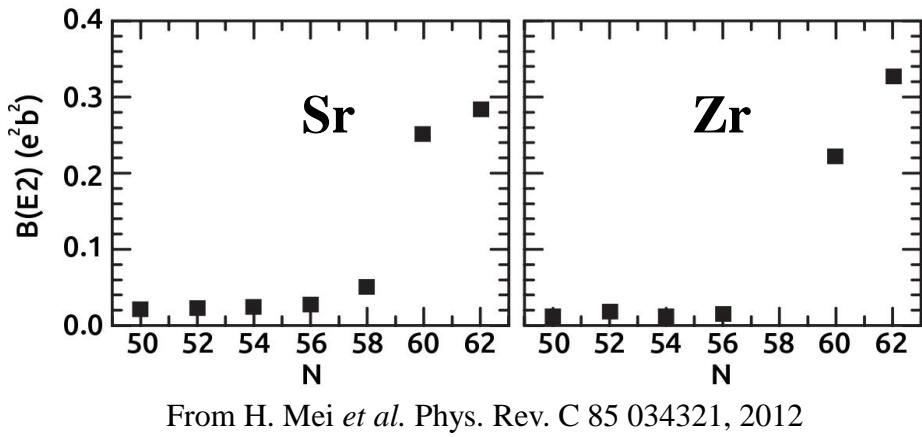
Physics motivation : shape transition around N=60



S. Naimi *et al.* Phys. Rev. Lett. 105 032502, 2010

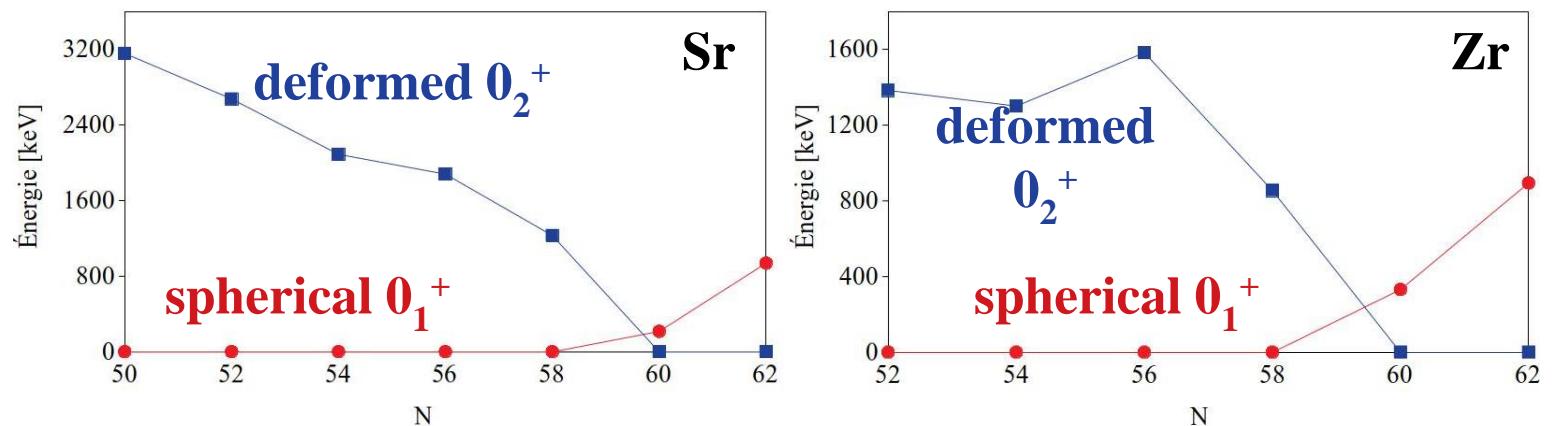
Masses

Radius

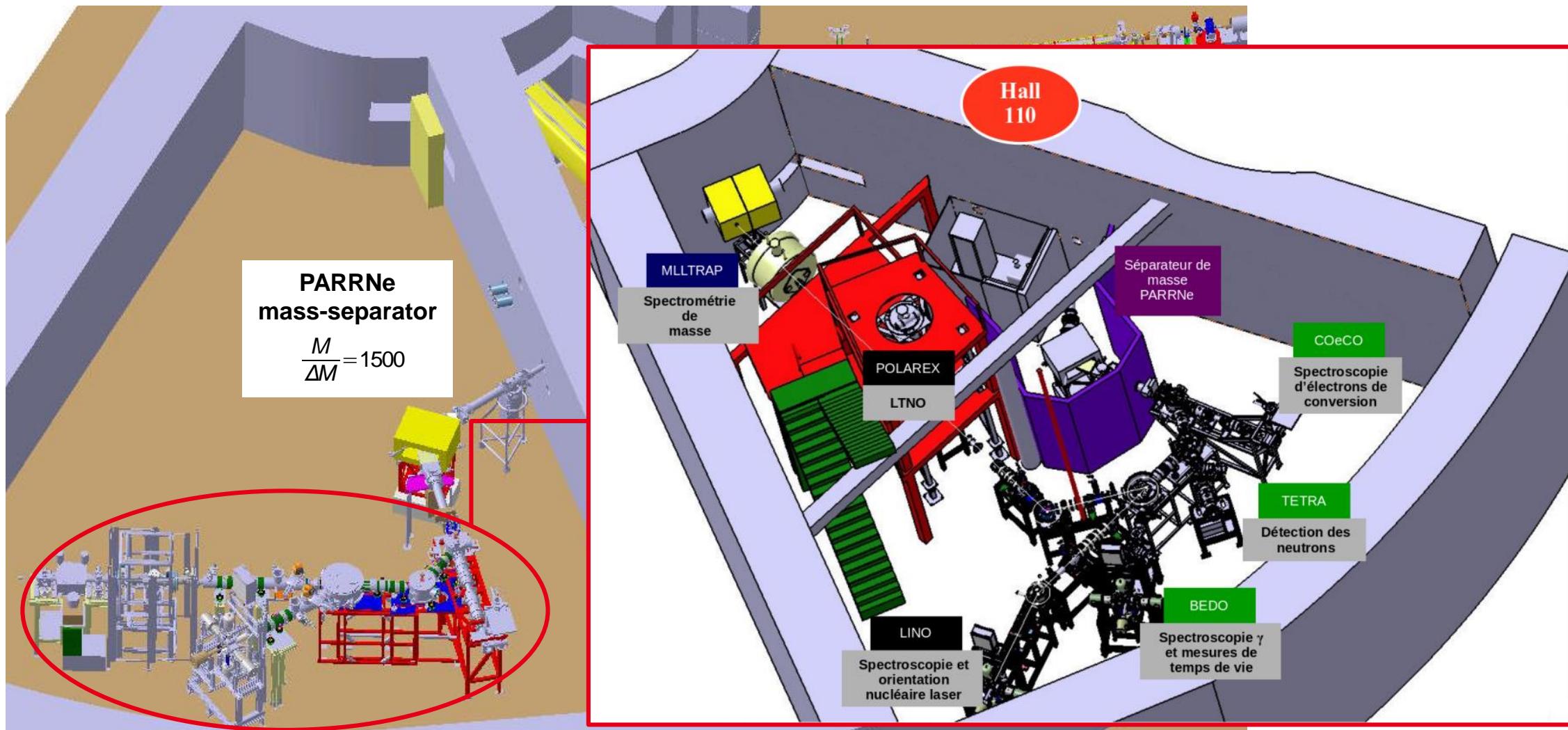


Reduced
transition
probabilities

E0 transitions

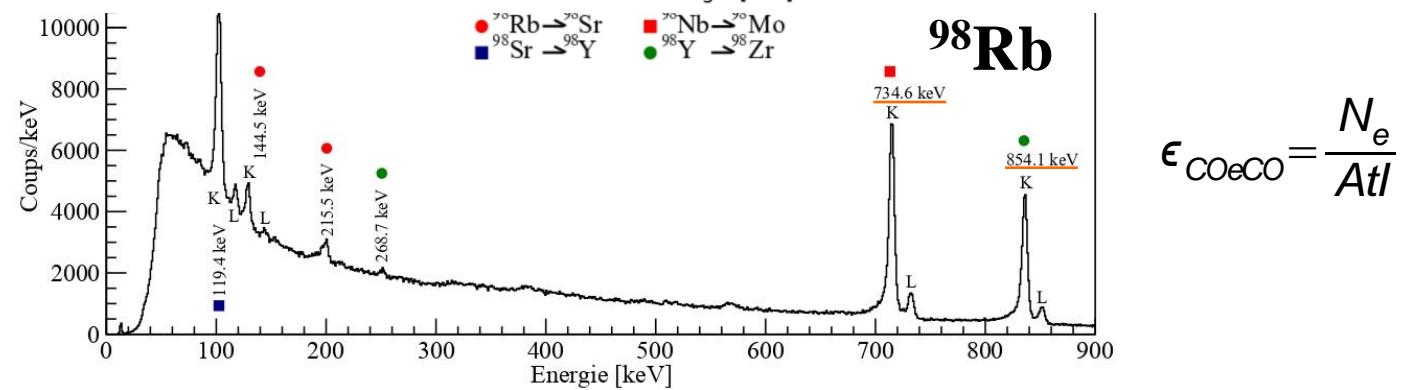
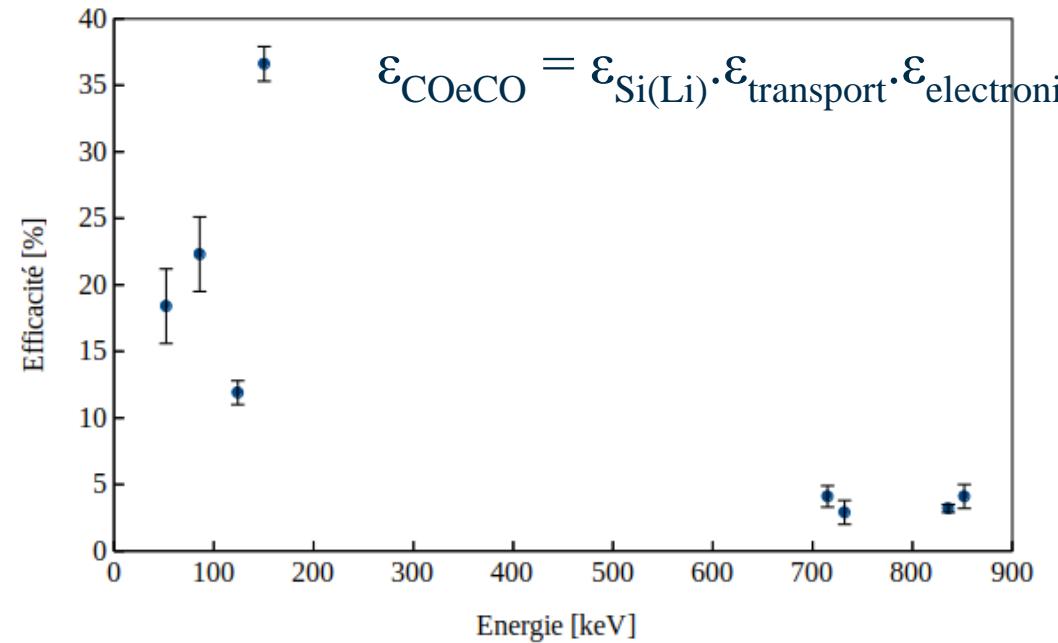
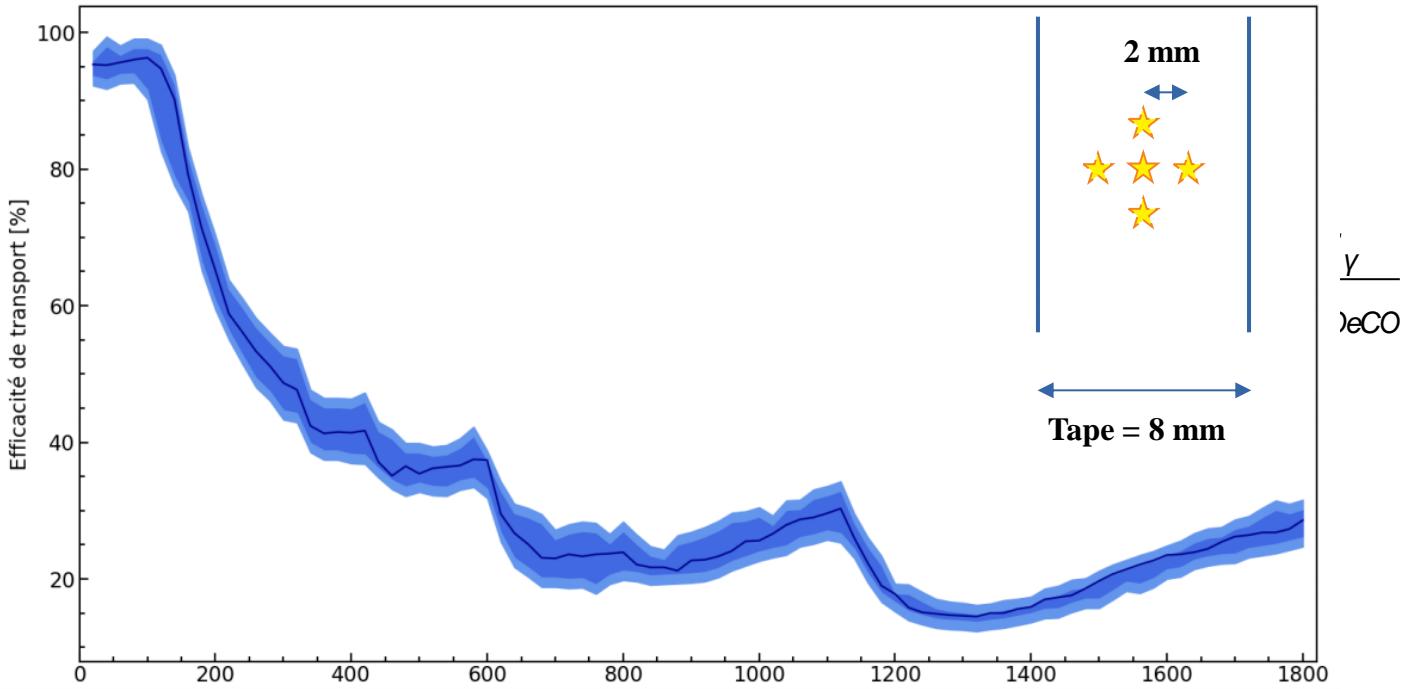


ALTO radioactive beams



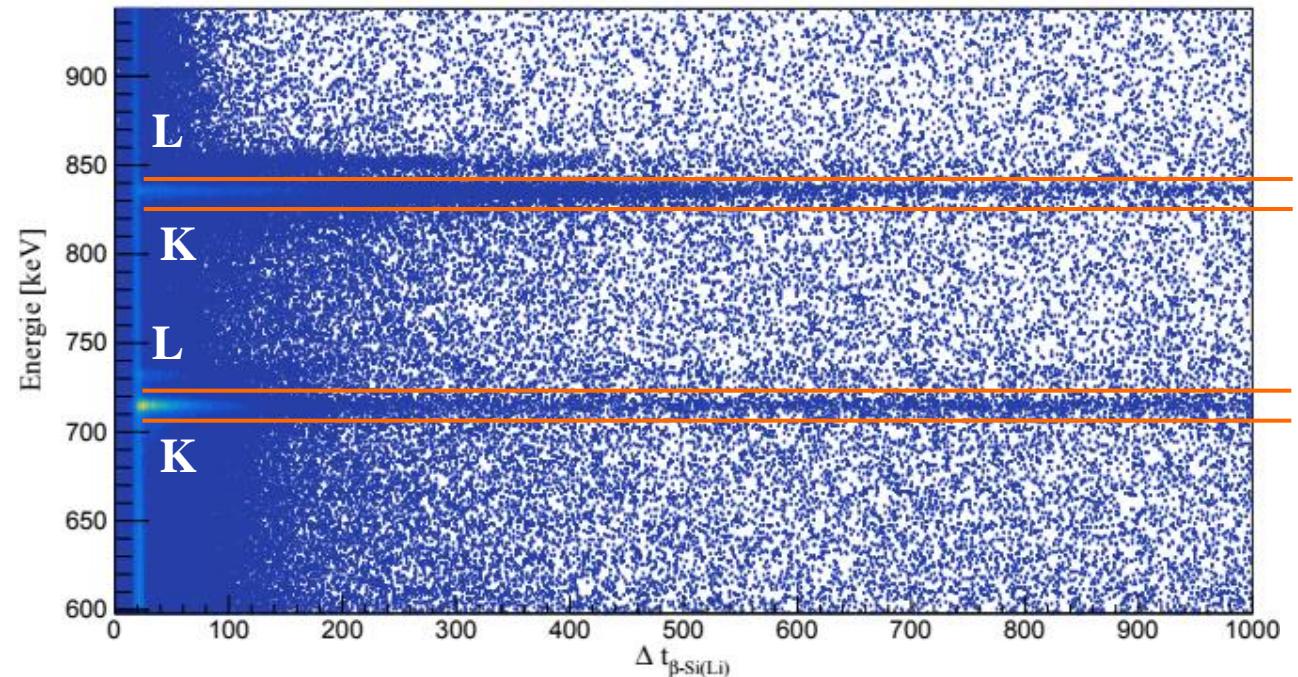


On-line commissioning of COeCO

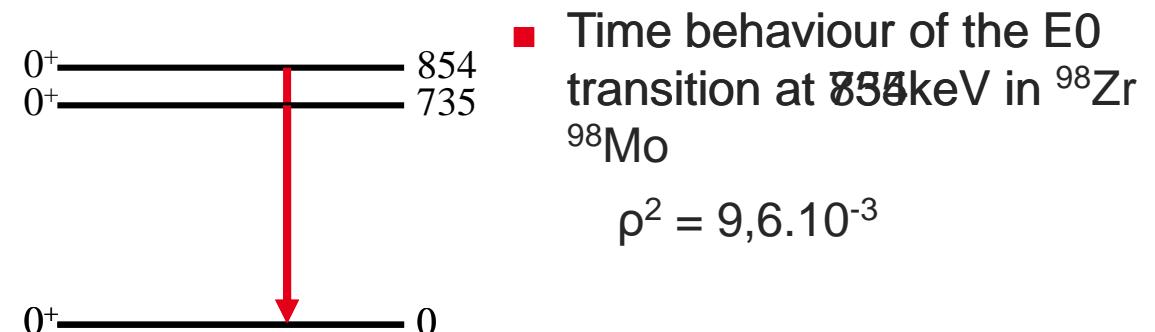
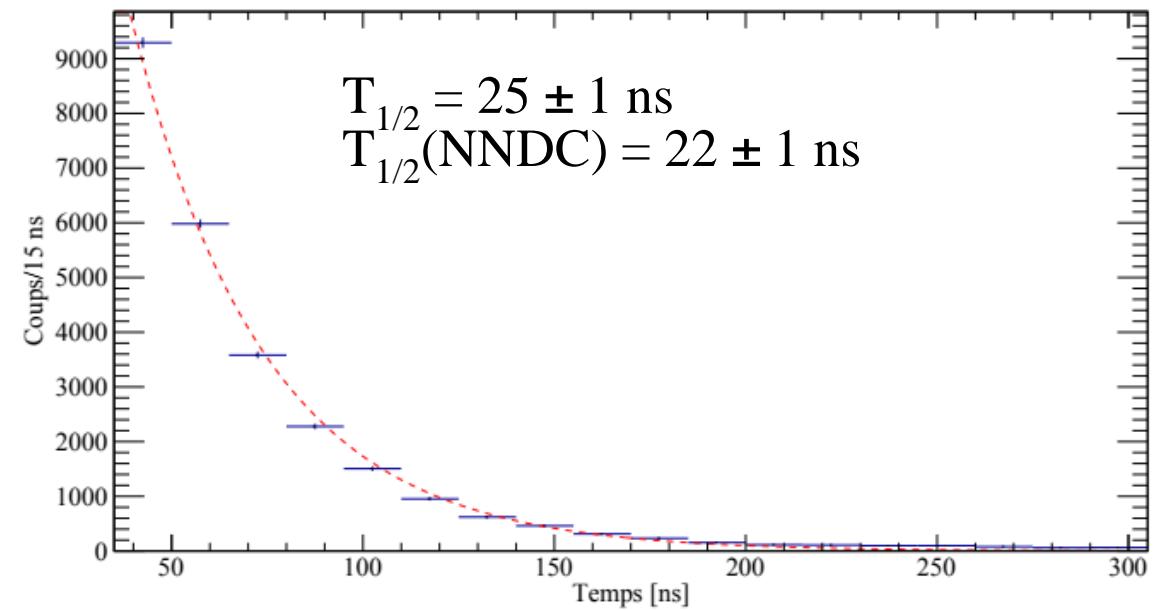


- Need more points, especially in the medium energy range
- De-focused beam could explain the lack of consistency with simulations

Half-life measurements of E0 transitions



- Time difference between an event in the plastic scintillator (β) and an event in the Si(Li) (CE)
- Compute strength of the transition, $\rho^2 = \frac{\ln(2)}{T_{1/2} \Omega_K}$



- Time behaviour of the E0 transition at 854 keV in ^{98}Zr

$$\rho^2 = 9.6 \cdot 10^{-3}$$

Two-states mixing mode

States resulting from the mixing of two deformed states 1 and 2 with mixing angle θ :

$$\begin{cases} |0_i^+\rangle = \cos\theta |0_1^+\rangle + \sin\theta |0_2^+\rangle \\ |0_f^+\rangle = -\sin\theta |0_1^+\rangle + \cos\theta |0_2^+\rangle \end{cases}$$

Transition strength given by :

$$\rho^2(E0) = \left| \frac{\langle \Phi_f | \hat{T}(E0) | \Phi_i \rangle}{eR^2} \right|^2$$

If the surface of both states shape can be described by a sum of spherical harmonics :

$$\rho^2(E0) = \frac{Z^2}{R_0^2} \cos^2\theta \sin^2\theta [\Delta \langle r^2 \rangle]^2$$

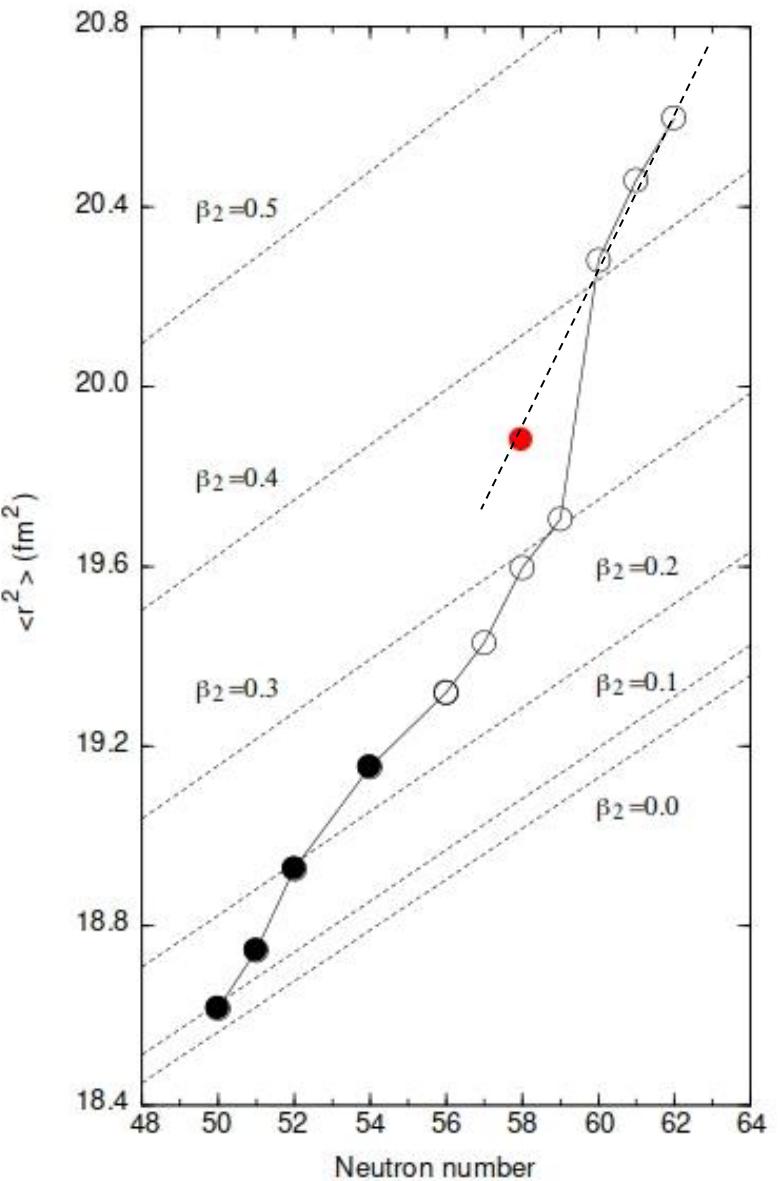


Figure from Campbell et al., PRL 89(8), 2002,
10.1103/PhysRevLett.89.082501
space in



Conclusion

- On-line commissioning of the COeCO setup with neutron-rich Rb beam
- All subsections were characterized (β , coils, Si(Li), etc.) as well as the setup as a whole
- Half-life of first excited 0^+ state in ^{98}Zr measured to be $T_{1/2} = 82 \pm 2$ ns
- New value of p^2 and δr^2 adds to our understanding of shape transition in the region
- Campaign to study neutron-rich silver in april