Lifetime measurements in neutron-rich Cr isotopes

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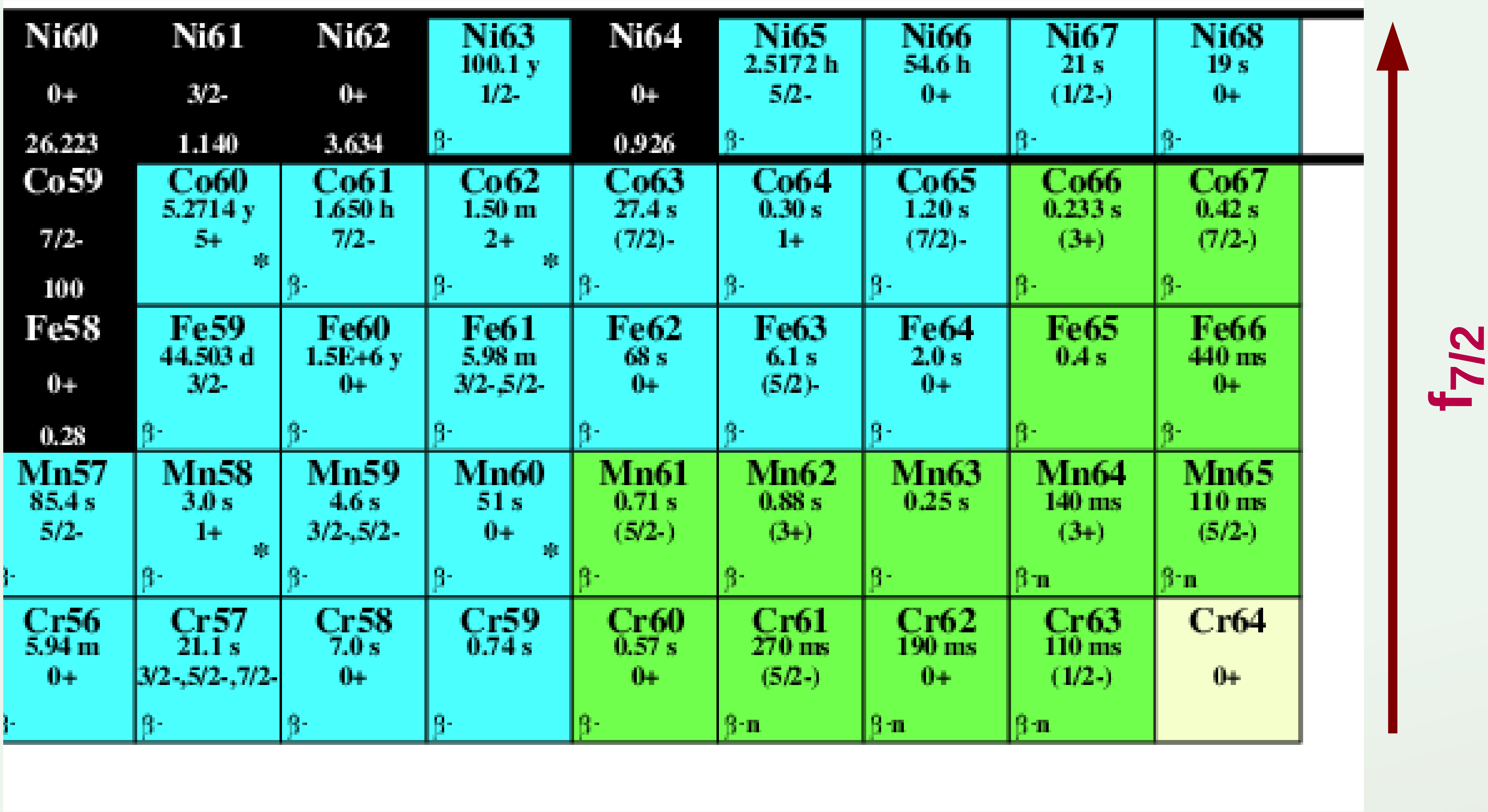
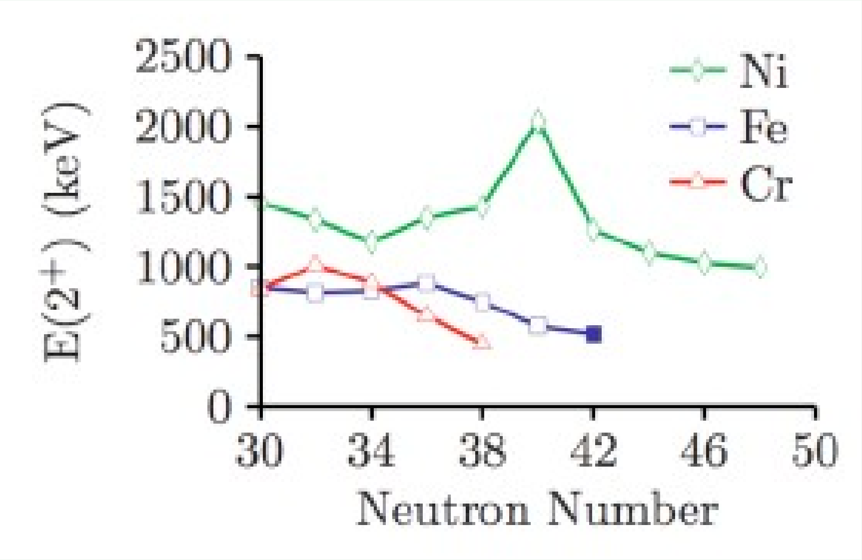
Approaching the N=40 subshell gap

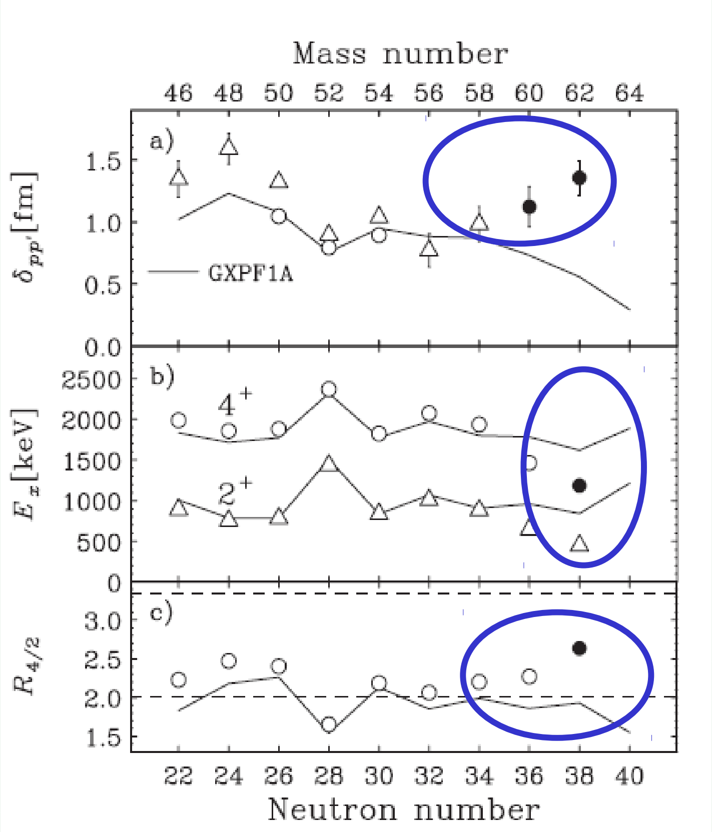


N=40 subshell gap in ^{68}Ni

N=40 subshell gap in ^{68}Ni disappears when protons are removed from the $f_{7/2}$ → Monopole part of the tensor interaction

Calculations in the full fp shell



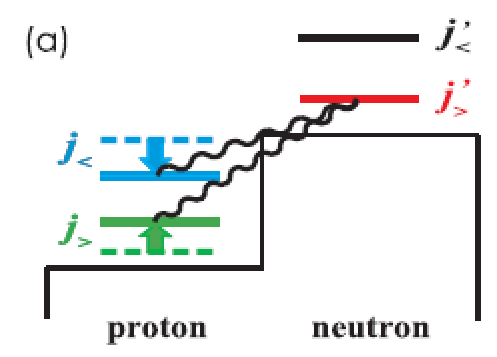


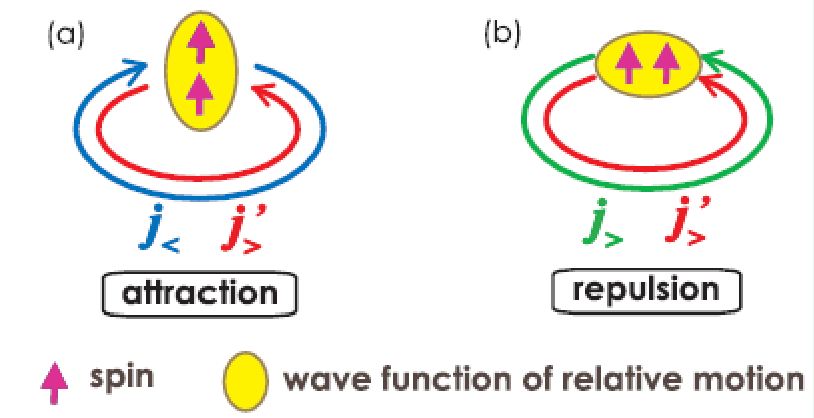
S. Lunardi et al., Phys. Rev. C **76**, 034303 (2007). S. Lenzi et al., LNL Annual Report (2008). P. Adrich et al. Phys. Rev. C **77**, 054306 (2008). O. Sorlin et al., Eur. Phys. J A **16** 55 (2003).

N. Aoi, et al., PRL 102, 012502 (2009)
(p,p') reaction with radioactive beams

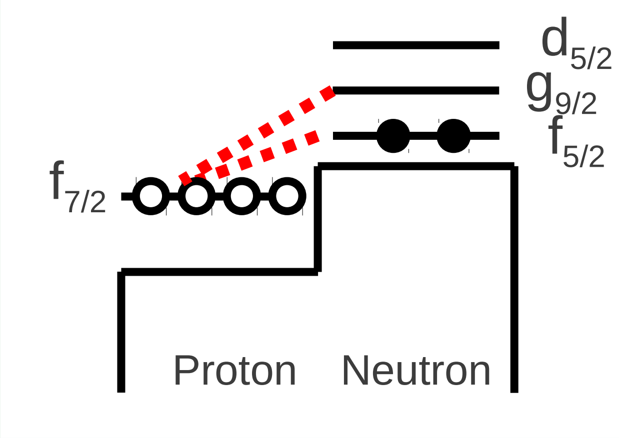
Monopole effect of the tensor interaction

Monopole effect of the tensor interaction in shell evolution





T. Otsuka et al., PRL95 232502 (2005)

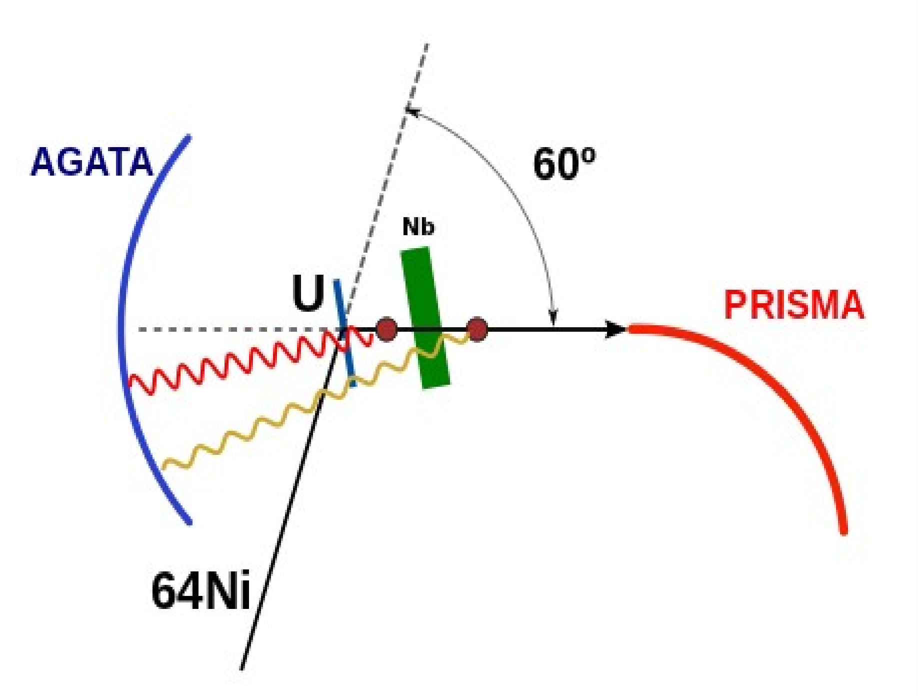


- Cr isotopes 4 holes in the $\pi f_{7/2}$
- Atraction between the $f_{7/2}$ and $f_{5/2}$
- Repulsion between the $f_{7/2}$ and $g_{9/2}$
- Disappearance N=40 subshell gap
- Role of the $d_{5/2}$?

The experiment

SETUP **(June 2010)**

AGATA D. (4-cluster)
PRISMA 60º
Köln Plunger



Multi-nucleon transfer reaction

^{64}Ni + U (Grazing angle 60º)

Beam: 460 MeV (Intensity ~2.5 pnA)

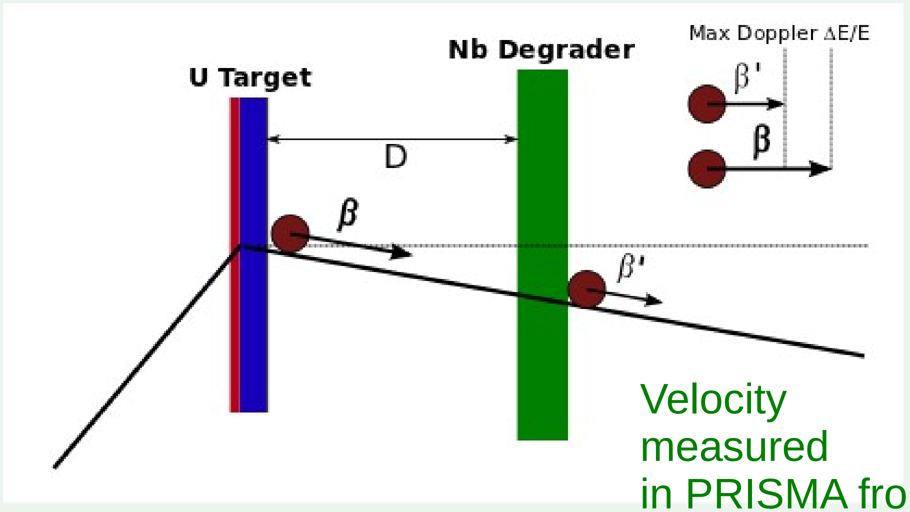
Target: U 1.35 mg/cm^2

70-90 kHz per AGATA crystal!!

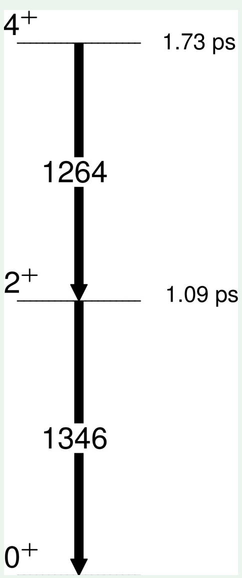
Plunger schedule 6 days experiment

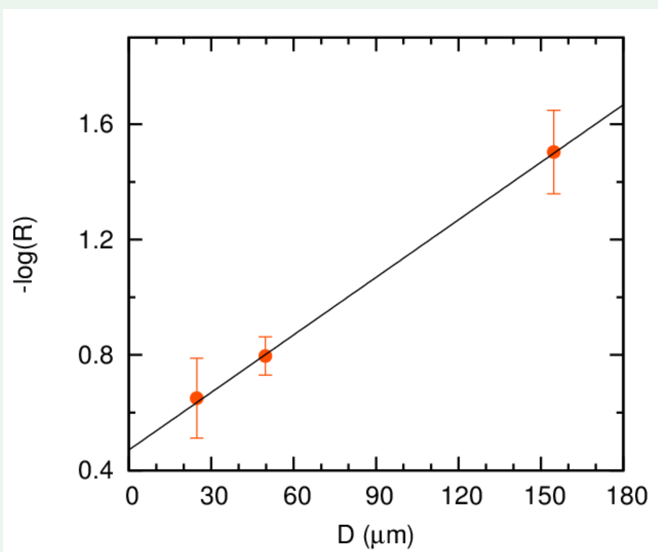
D=45um (3 days) D=20um (1.5 days) D=145um (1.5 days)

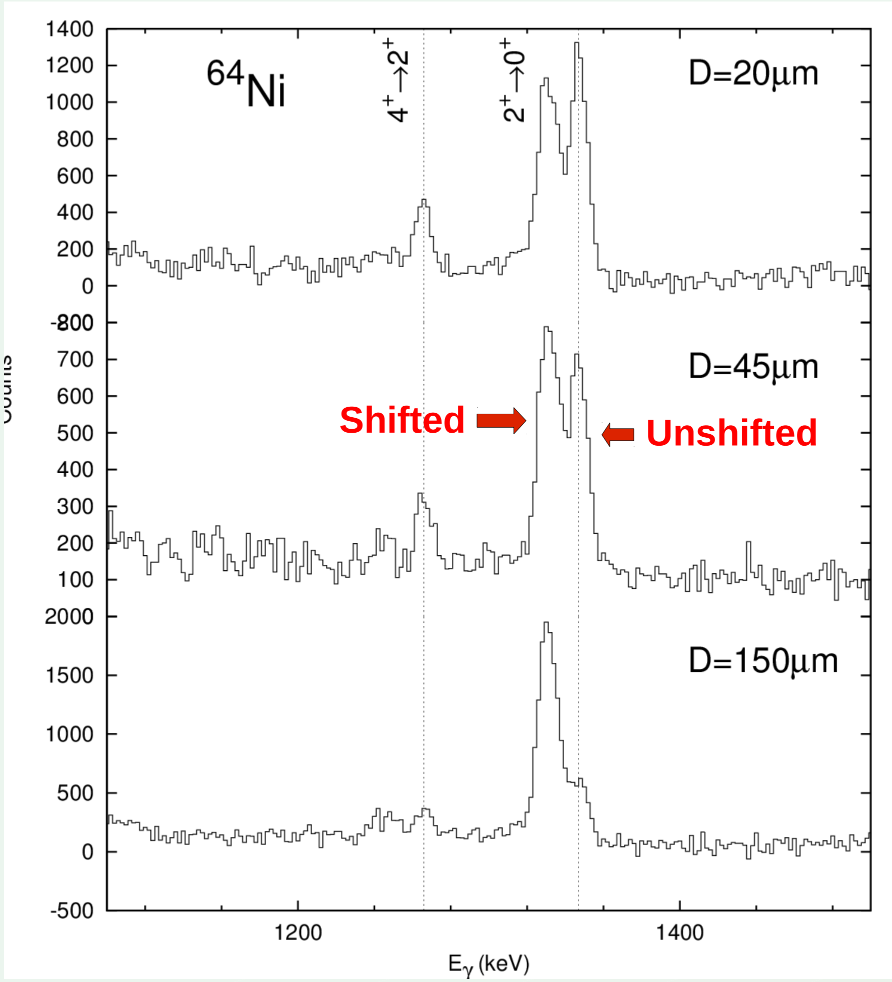
The RDDS method



Velocity measured
in PRISMA from
TOF and path
reconstructed

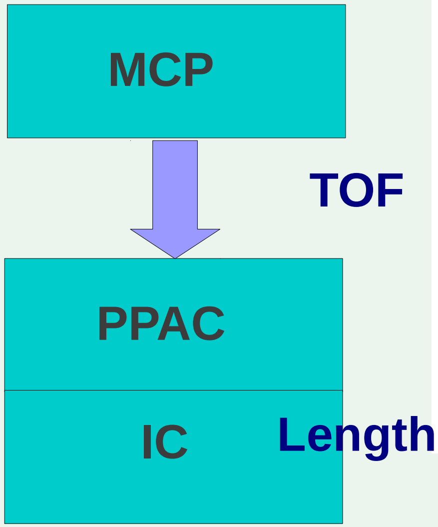


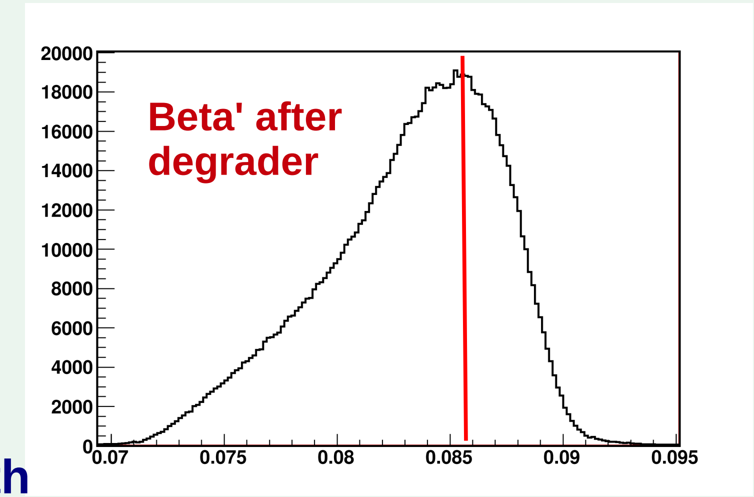


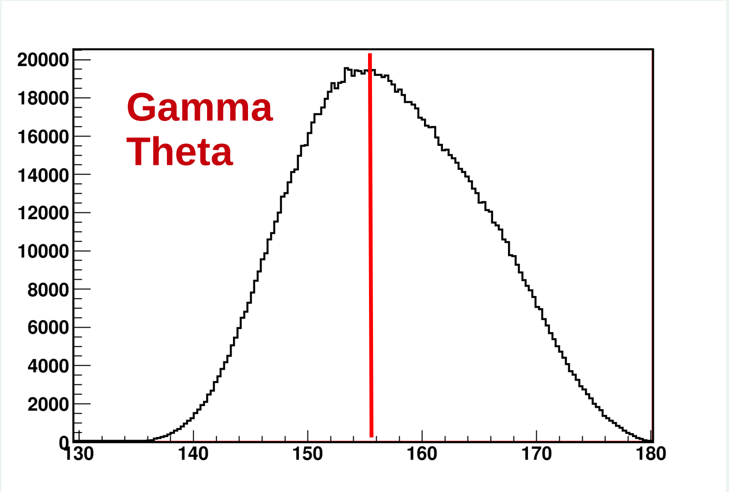


$$R = \frac{I_{after}}{I_{before} + I_{after}} = exp\left(-\frac{1}{\beta\, c\, \tau} D\right)$$

The RDDS method







$$\beta = \beta' + \frac{E_0^{shifted} - E_0}{cos(\theta) E_0}$$

Velocity before degrader is deduced from the energy shift and the averaged gamma-ray detection angle.

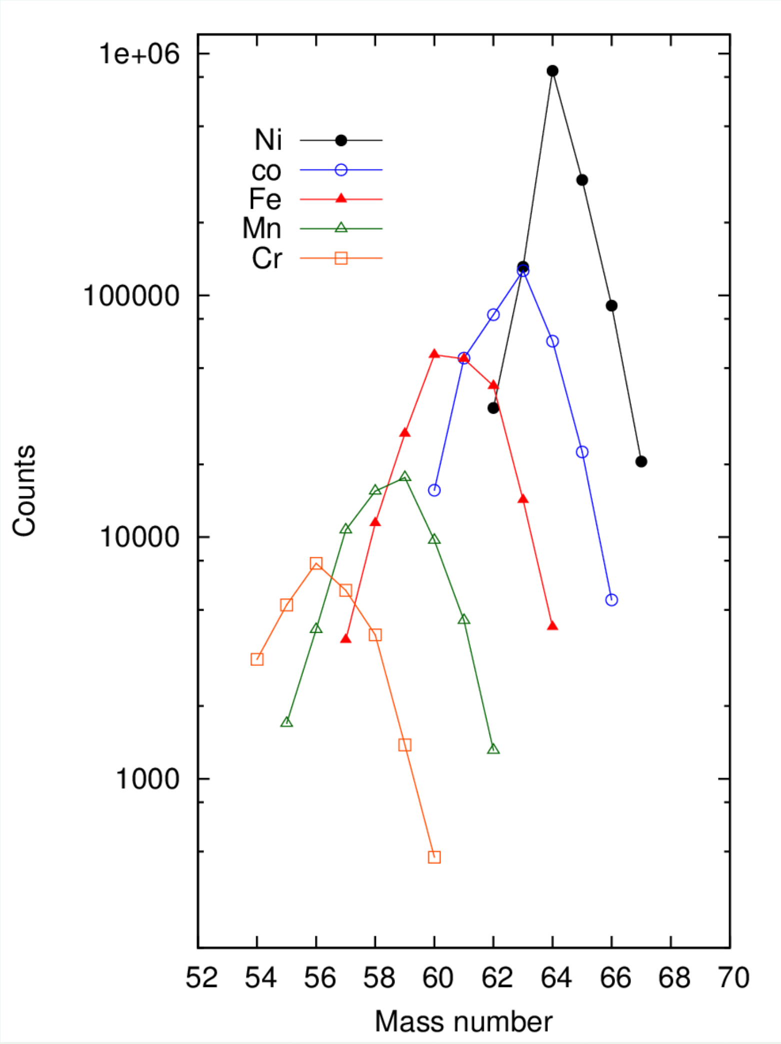
^{64}Ni $2^+ \rightarrow 0^+$ $T_{1/2} = 3.5(7)$ ps

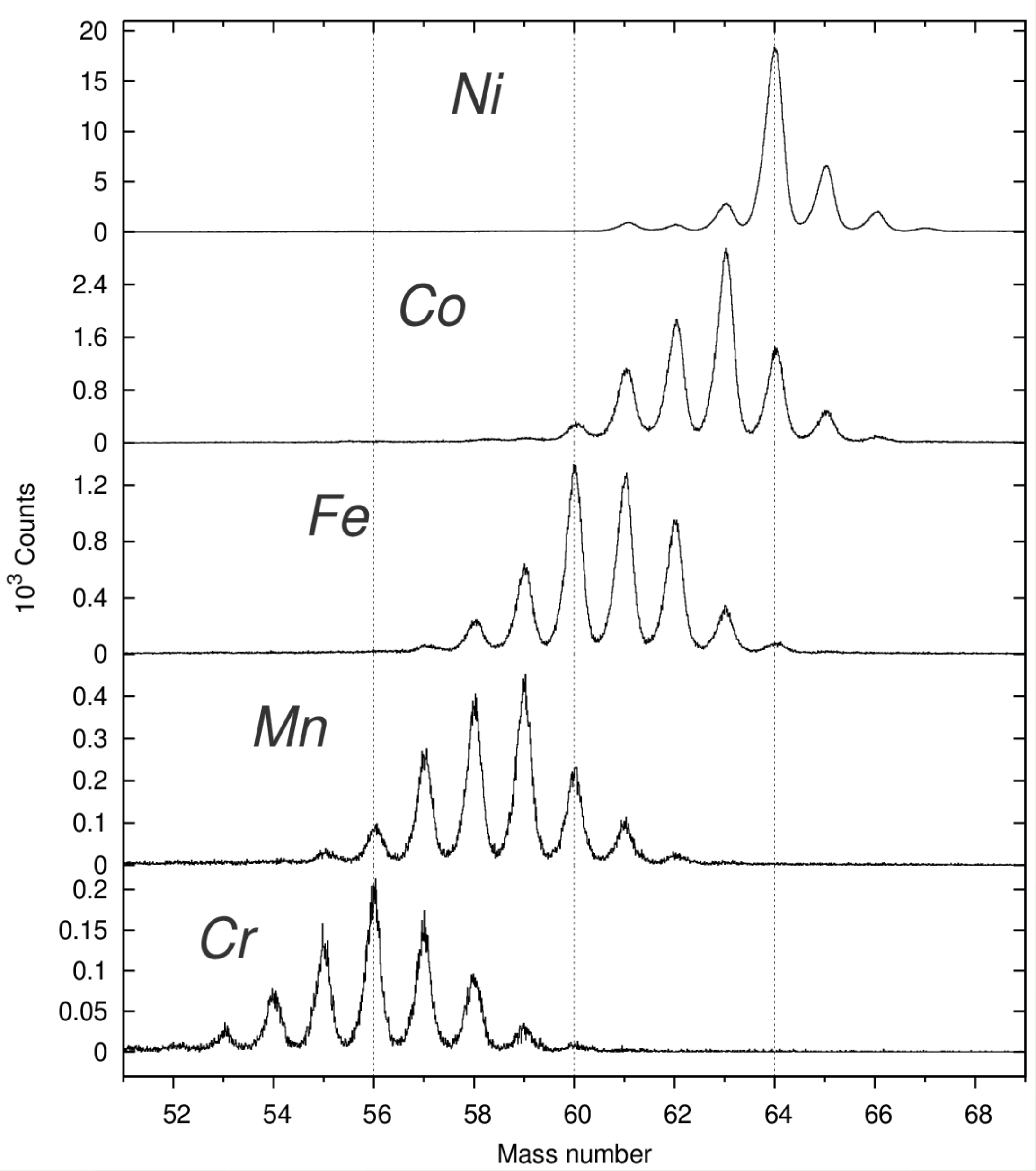
Previous $T_{1/2} = 1.088(35)$ ps

Need to take into acount the feeding from the 4+ state.

Yield in different masses

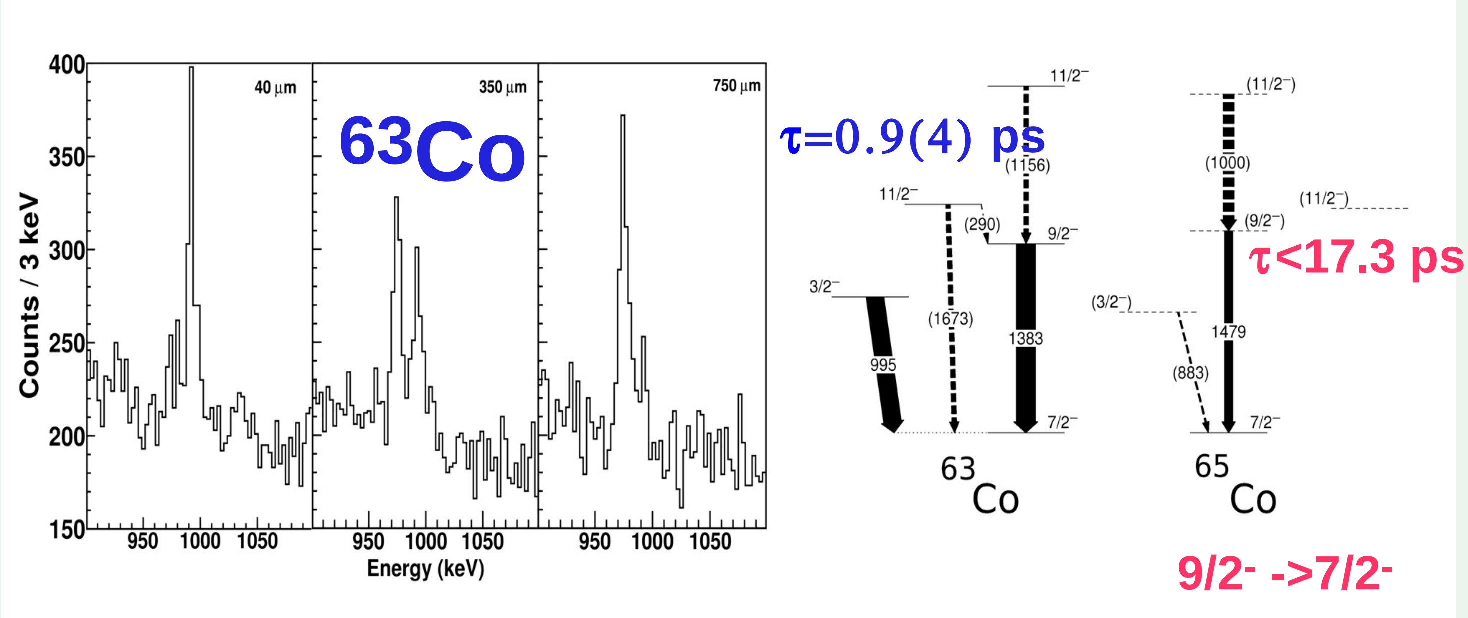
Statistics for one distance:



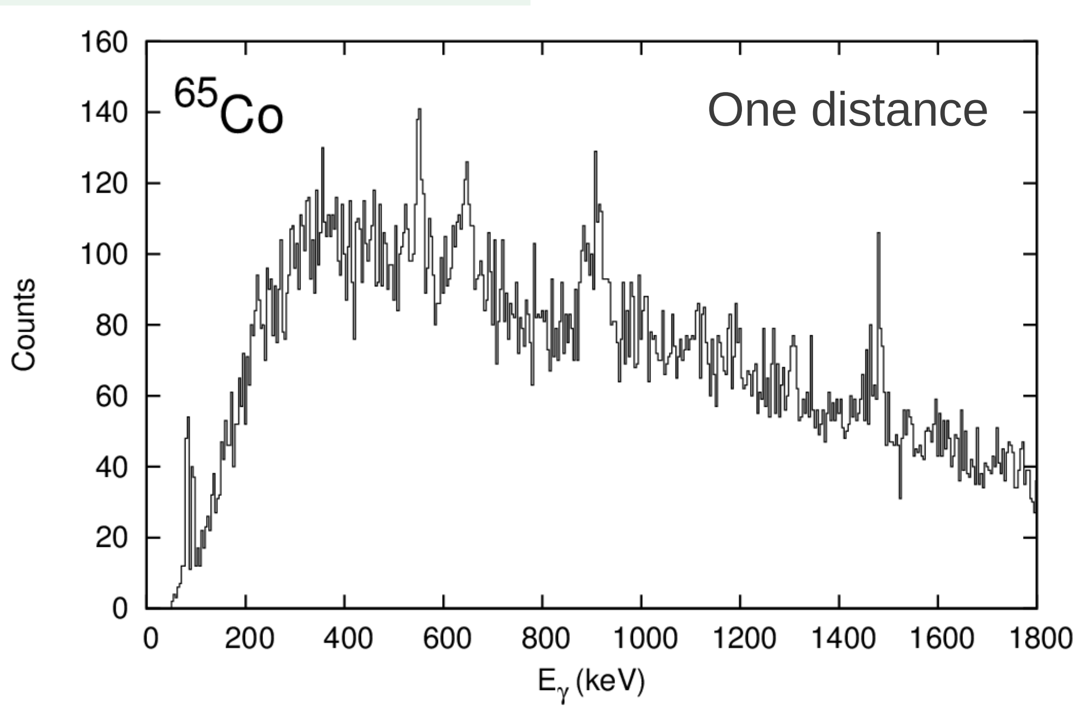


Cobalt isotopes

Known lifetimes in neutron-rich Co isotopes



Dijon et al. PRC 83, 64321 (2011)



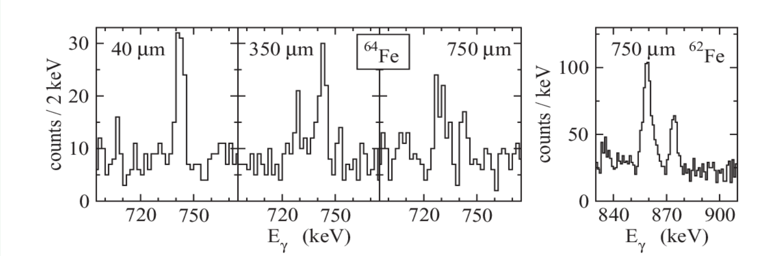
Possible lifetimes measurements...

Iron isotopes

Known lifetimes in neutron-rich Co isotopes

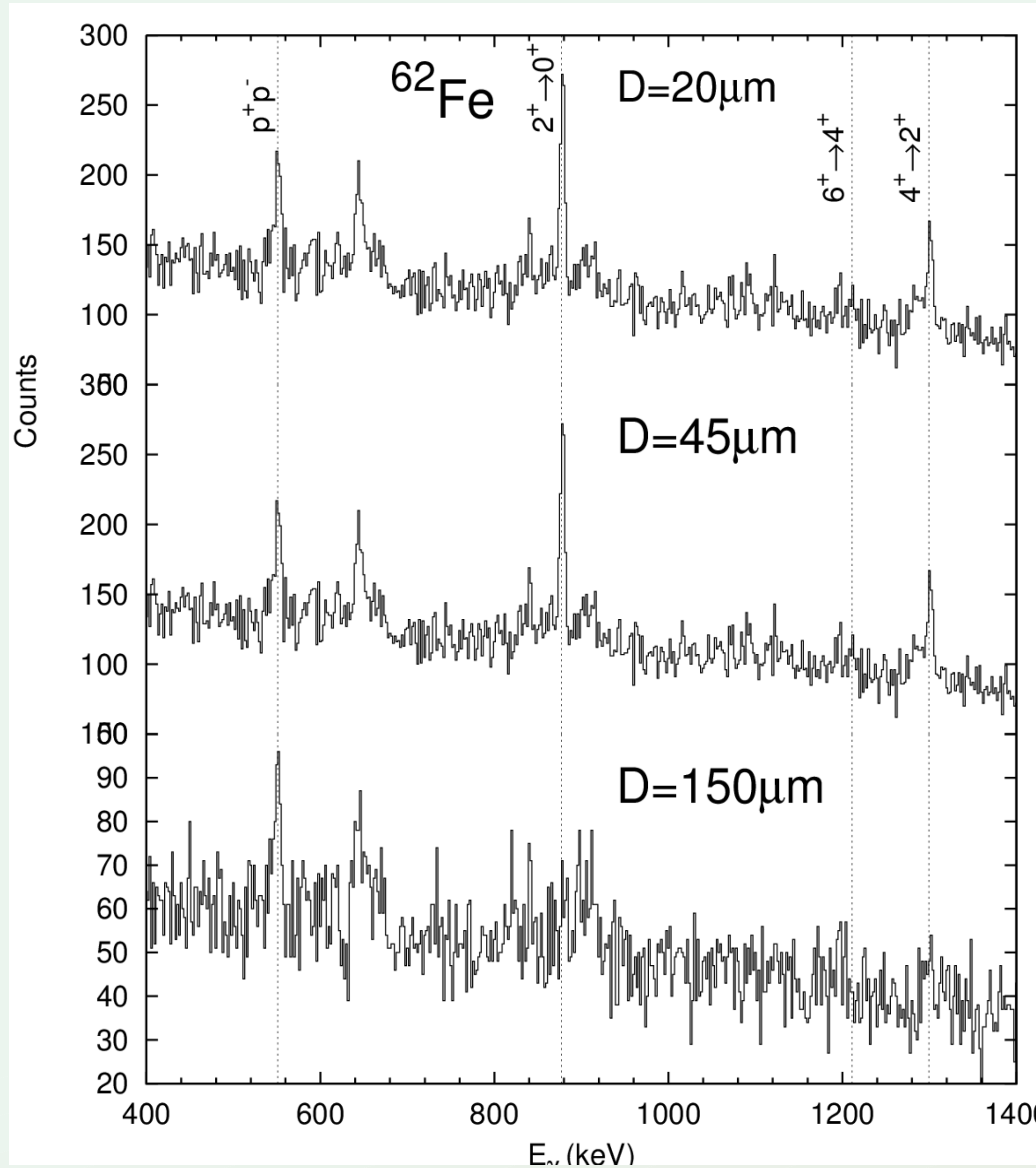
First lifetime measuremets for the 2^+ state in ^{64}Fe and ^{62}Fe

$T_{1/2}$=7.4(26) ps **$T_{1/2}$=7.4(9) ps**



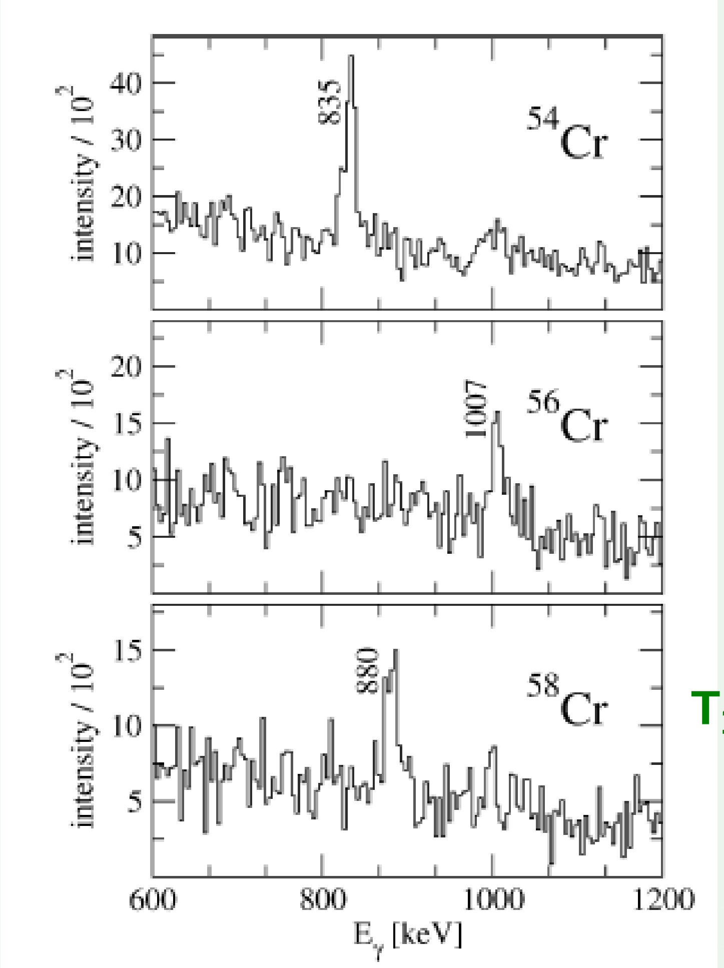
J. Ljungvall et al. PRC 81, 61301R (2010)

We will measure the 4+ state lifetime for first time.

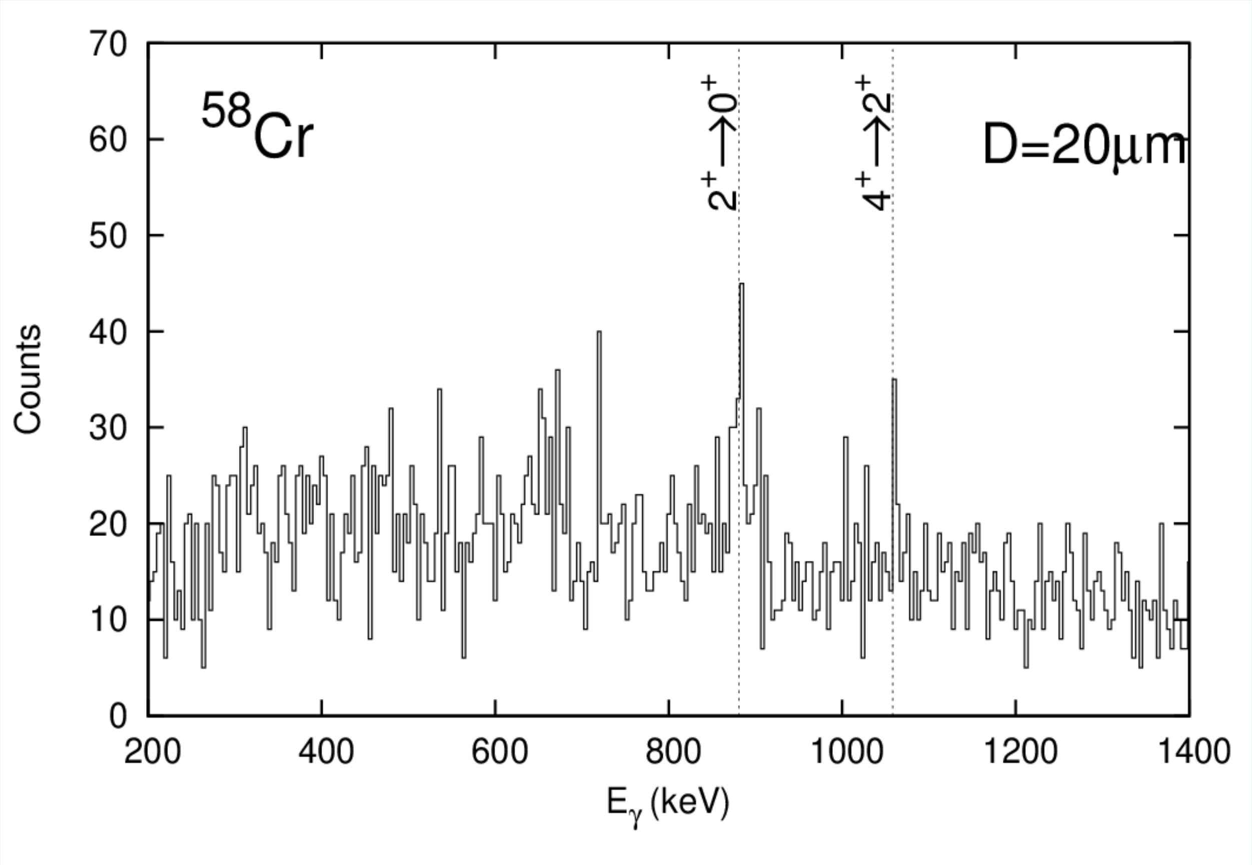


Cromium isotopes

GSI - FRS + RISING
Coulomb excitation at relativistic energies



$T_{1/2}$=7.8 ps



Analysis ongoing...

A. Bürger et al. / Physics Letters B 622 (2005) 29.