

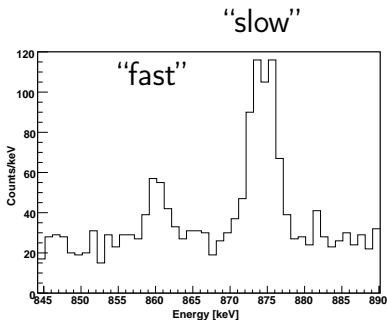
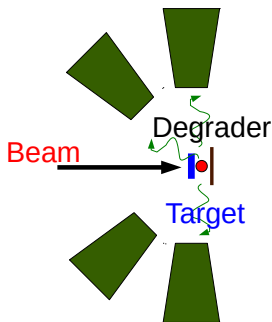
Lifetime measurements with the Oups and Nu-ball hybrid spectrometer

Joa Ljungvall

May 19, 2016

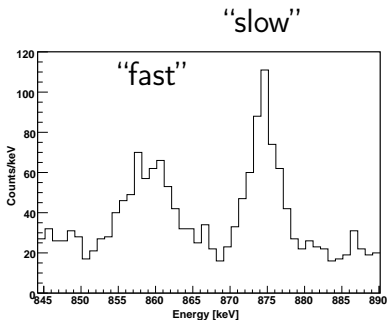
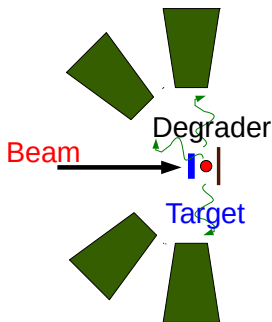
What is a Plunger and Why (the ABC of plumbing)

- A device to perform Recoil Distance Doppler Shift (RDDS) measurements to get the lifetime of an excited state



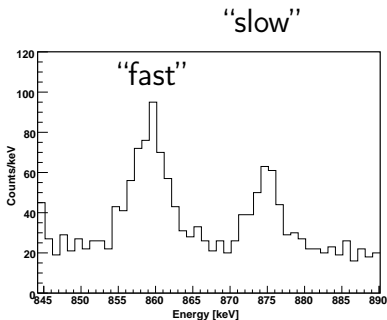
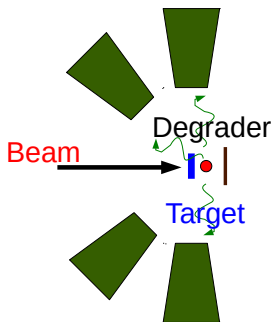
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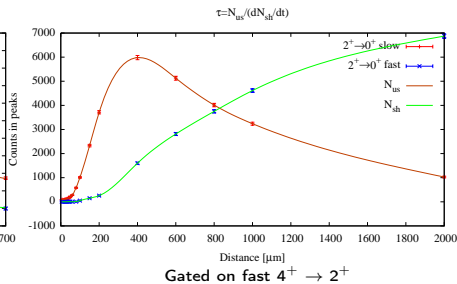
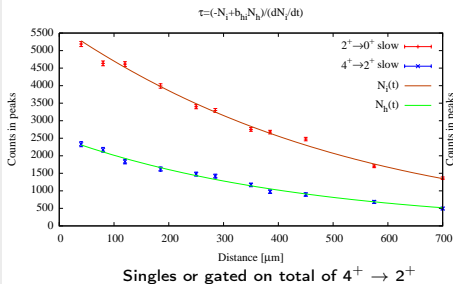
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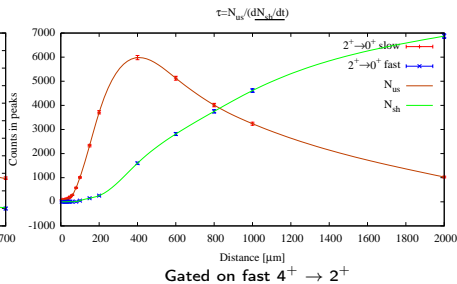
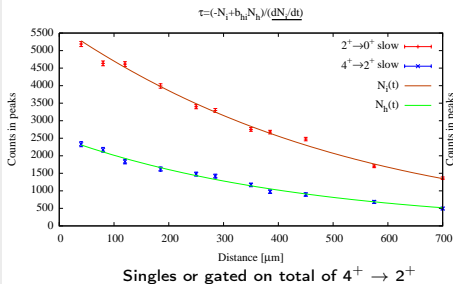
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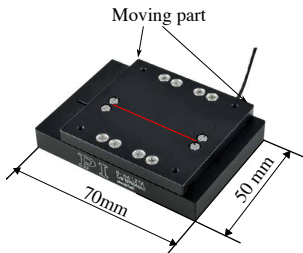


Note d/dt , removes need to know t_0 !!!

What is a Plunger and Why (the ABC of plumbing)

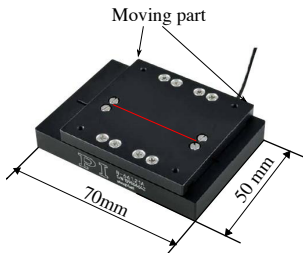
- A device to perform Recoil Distance Doppler Shift (RDDS) measurements to get the lifetime of an excited state
- Normally data is analysed using so-called Differential Decay Curve Method (DDCM)
- Very reliable method for the measurement of lifetimes > 1 picosecond

The Orsay Universal Plunger System (Oups)



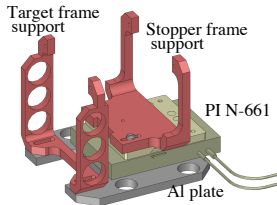
- Single linear piezo motor, 20 mm range, 40 pm precision

The Orsay Universal Plunger System (Oups)

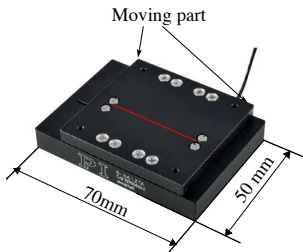


- Build Plunger around motor

- Single linear piezo motor, 20 mm range, 40 pm precision

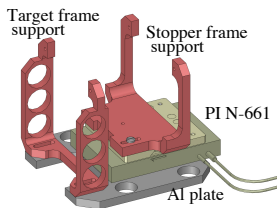
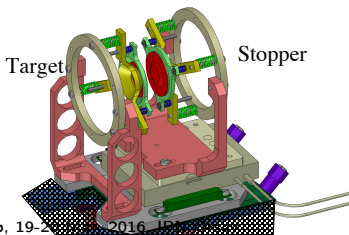


The Orsay Universal Plunger System (Oups)



- Single linear piezo motor, 20 mm range, 40 pm precision

- Build Plunger around motor



- Add minimal amount of structure to adapt to other experimental sites

The Orsay Universal Plunger System (Oups)

Orgam

- Probing the boundary of shape coexistence south of $Z=82$: Lifetime measurements of excited states in ^{170}Os using the RDDS method.
- Search for $X(5)$ symmetry in the ^{168}W nucleus
- Development of the Time Dependent Recoil In Vacuum technique for "radioactive-beam geometry"
- Lifetime measurements using RDDS method after incomplete fusion.
- Octupole collectivity in ^{156}Gd : lifetime measurements of the first 4^- and 6^- states in ^{156}Gd

The Orsay Universal Plunger System (Oups)

MINORCA

- Lifetime measurement of ^{100}Ru : A possible candidate for the E(5) Critical Point symmetry
- Lifetime measurements in ^{113}Te : Determining Optimal effective charges approaching the N=Z=50 doubly-magic shell closure.
- Time dependent recoil in vacuum for Na-like ^{56}Fe ions

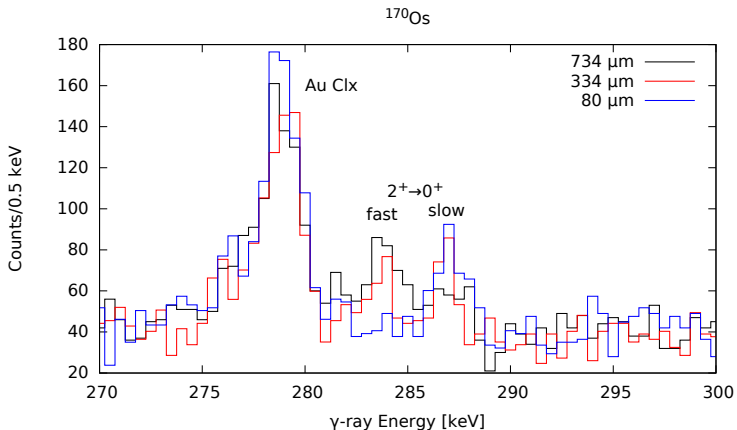
The Orsay Universal Plunger System (Oups)

AGATA@Ganil

- Lifetime and g-factor measurements in the vicinity of ^{68}Ni using the AGATA, Oups and VAMOS
- Neutron monopole drifts near the N=50 closed shell towards ^{78}Ni

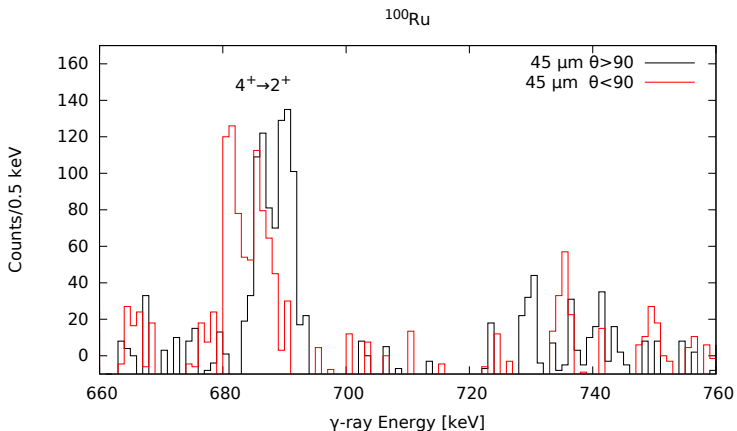
The Orsay Universal Plunger System (Oups)

An Orgam spectrum (A. Goasduff)



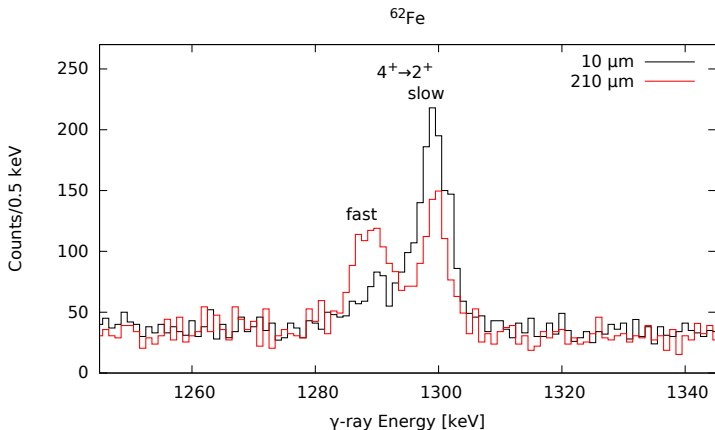
The Orsay Universal Plunger System (Oups)

A Minorca spectrum (T. Konstantinopoulos)



The Orsay Universal Plunger System (Oups)

An AGATA spectrum (Y. Truly)



Nu-ball and Recoil Distance Doppler Shift measurements

An image (M. Lebois)



Nu-ball and Recoil Distance Doppler Shift measurements

Basic data (for Nu-ball+Oups)

- Angle of Phase I's: 46°
- Angle of Clovers: 90°
- Efficiency for Phase I's detector
@ 1 MeV (Useful for RDDS): 2.4%
- Efficiency for Clovers
@ 1 MeV (Useful for gating): 3.7%
- Efficiency for LaBr_3 's : 0.4%

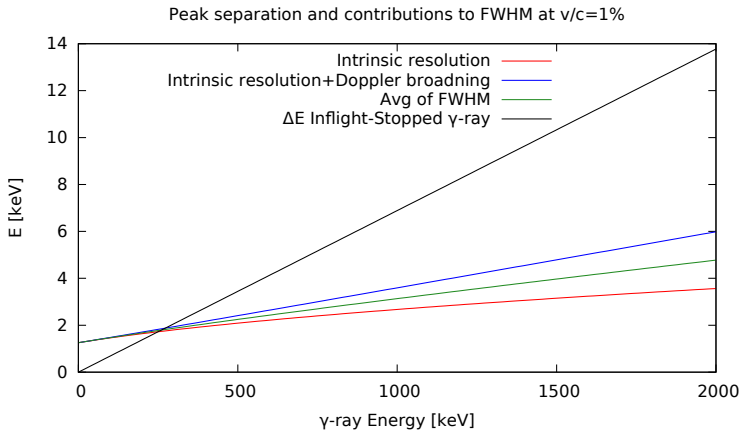
Nu-ball and Recoil Distance Doppler Shift measurements

Some reflections

- 15 MeV Tandem
- $\gamma\gamma$ for channel selection
- Experiments will be on the limit of feasible, pre-experimental preparation important
- Target preparation. . .

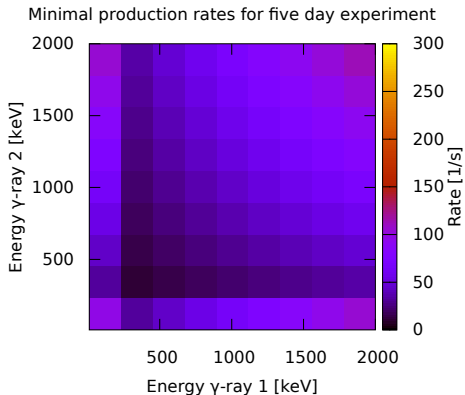
Nu-ball and Recoil Distance Doppler Shift measurements

Some rules of thumb (for Nu-ball+Oups)



Nu-ball and Recoil Distance Doppler Shift measurements

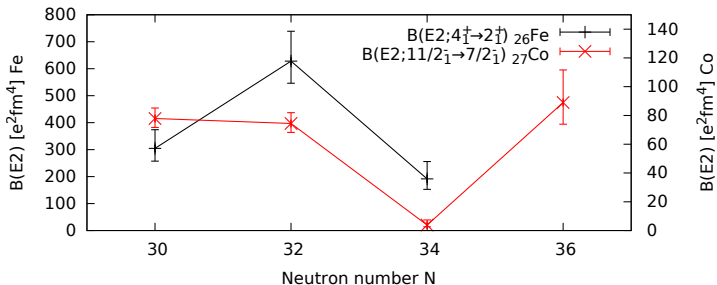
Some rules of thumb (for Nu-ball+Oups)



Some ideas



- ^{61}Co 50 mb \rightarrow 6000/s
- $11/2_1^-$ state, Litt. value $\tau = 10_{-3}^{+10}$ ps, new value $\tau < 2$ ps
- Redo in $\gamma\gamma$
- Bonus, 4_1^+ in ^{58}Fe



Some ideas



- ${}^{66}\text{Ge}$ 100 mb \rightarrow 10000/s
- $B(E2; 2_1^+ \rightarrow 0_1^+)$ anomaly resolved but...
- Higher yrast and non-yrast lifetimes not well known
- Redo in $\gamma\gamma$

