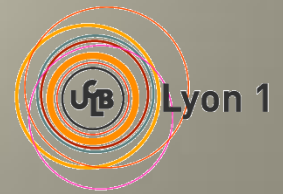


Neutron rich Ruthenium isotope study in the cold-neutron-induced ^{241}Pu fission: analysis status

Clément MANCUSO

PhD supervised by Pr. D. GUINET
&
group “Matière Nucléaire”, IPNLyon

Ecole Doctorale
PHysique et ASTrophysique de Lyon



^{241}Pu (n,f γ) experiment

Detector calibrations and stabilities

Ruthenium analysis status

^{241}Pu (n,f γ) experimental set-up

\approx 4000 runs
for 16 days
(March-April 2013)

Target of ^{241}Pu
thickness $300 \mu\text{m.cm}^{-2}$
78,6 % enriched
with a $25 \mu\text{m}$ Be backing

8 clovers **EXOGRAM**
(EXO_00_a to EXO_07_d) } 90°

2 clovers **LOHENGRIN**
(ILL_08_a to ILL_09_d)
5 singles **GASP**
(GASP_10 to GAPS_14) } 45°
 135°

1 clover **EXOGRAM**
(EXO_15_a to EXO_15_d)

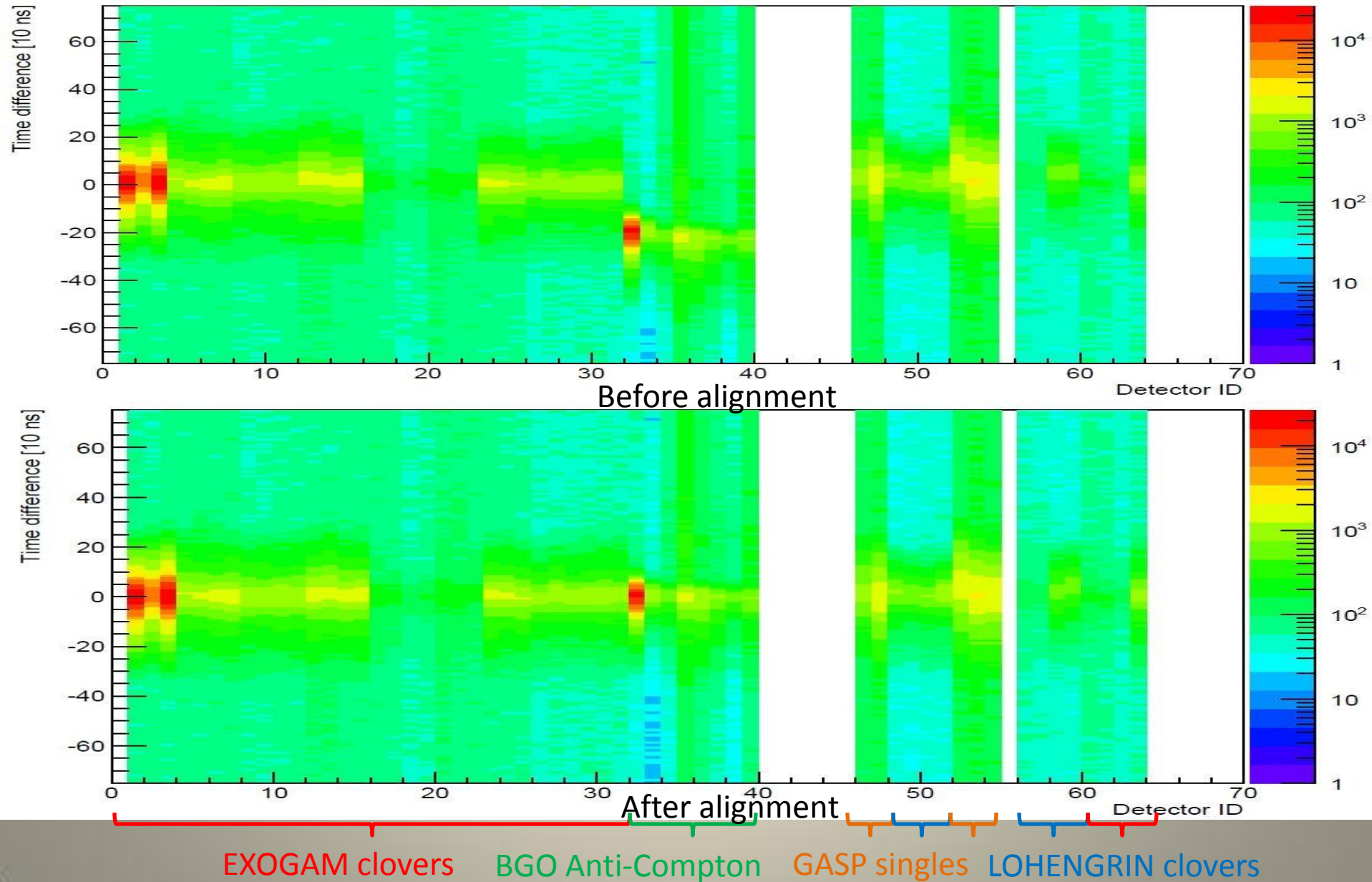
Total of 49 crystals

anti-Compton **BGO**
(AC_01 to AC_15)

for EXOGRAM clovers and GASP singles

Total of 72 channels

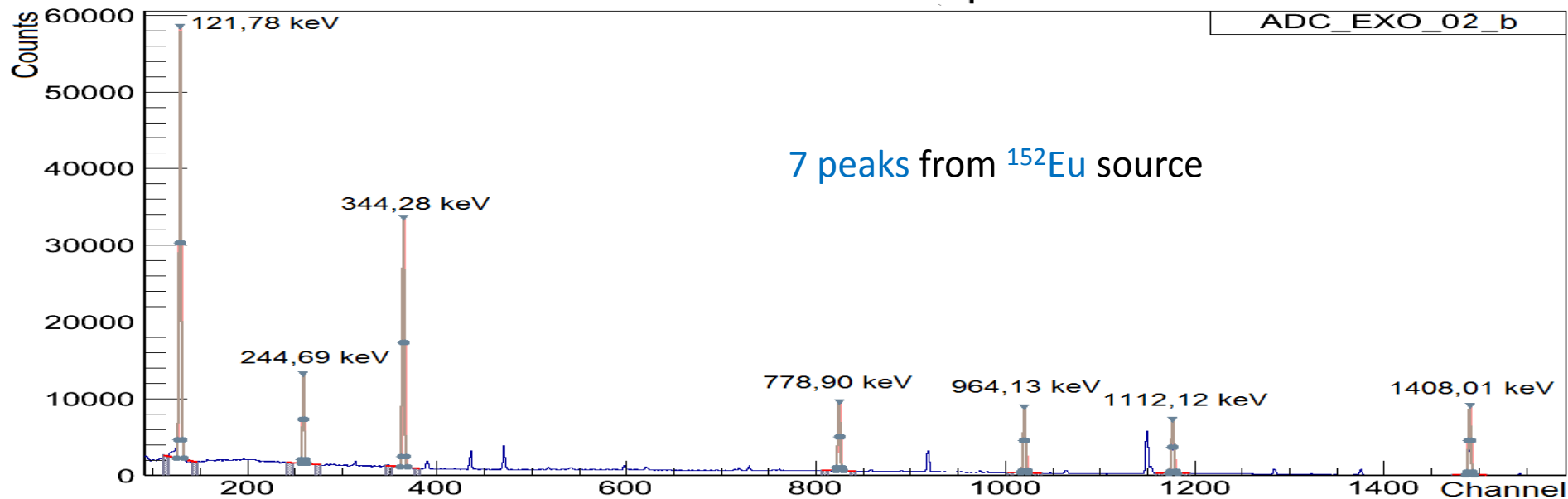
Time stamp alignment



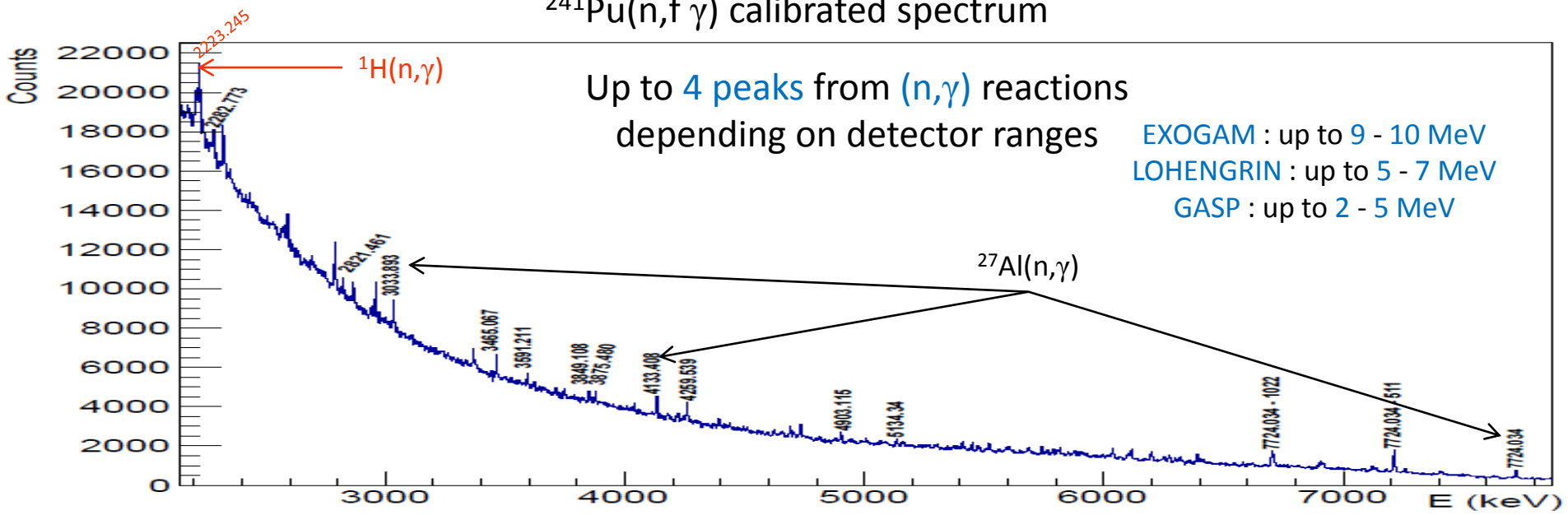
Full energy range calibrations : ^{152}Eu & (n,γ)

uncalibrated ^{152}Eu spectrum

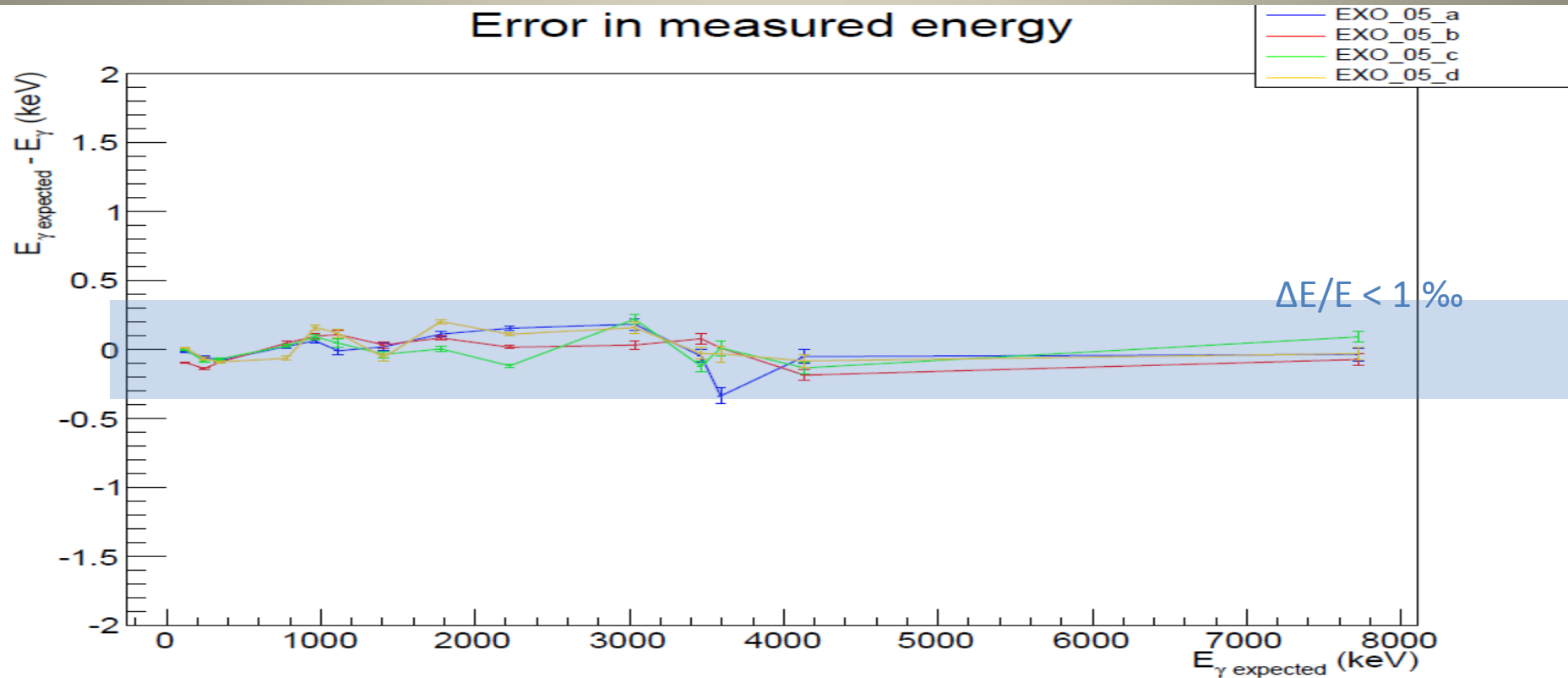
ADC_EXO_02_b



$^{241}\text{Pu}(n,f\gamma)$ calibrated spectrum



Calibration validation

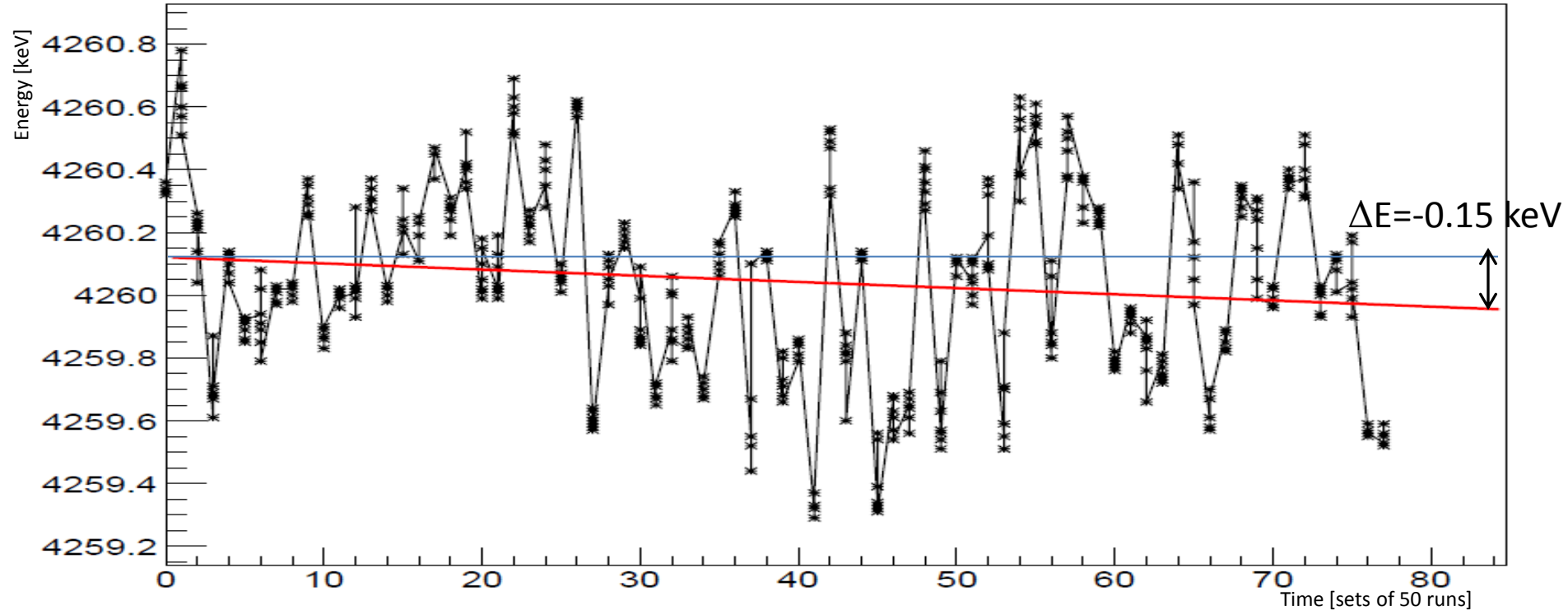


EXO_04, EXO_15_d, ILL_08_d and GASP detectors exhibit discontinuities between ^{152}Eu and Pu data peaks.

Discontinuity amplitudes : same order of magnitude as spectrum bin size.

Energy and resolution stabilities

Time evolution of detected energy



Energy

Most significant shift :

1,2 keV at 3 MeV

$\Delta E/E < 0.5 \%$

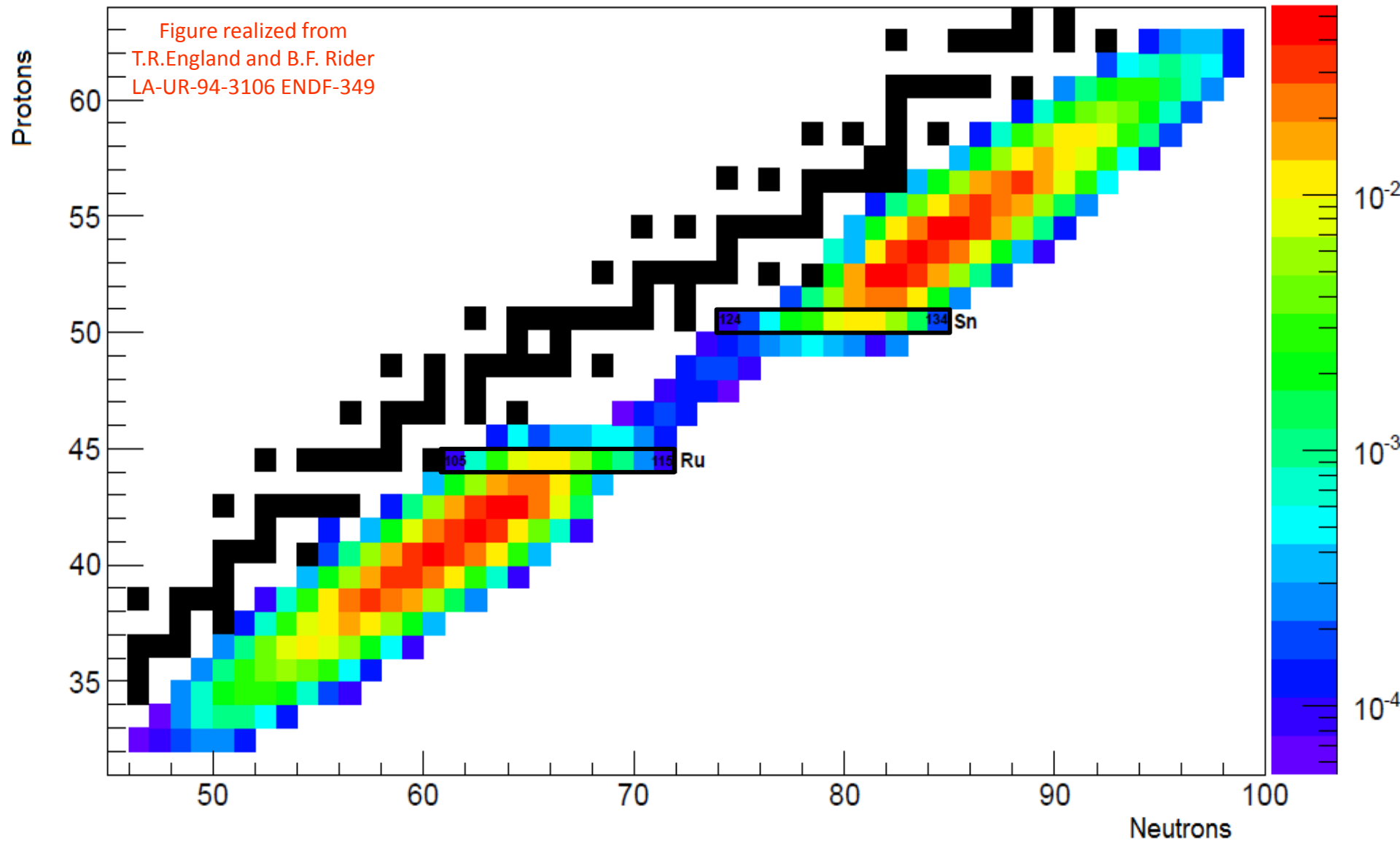
Resolution

Shifts of less than

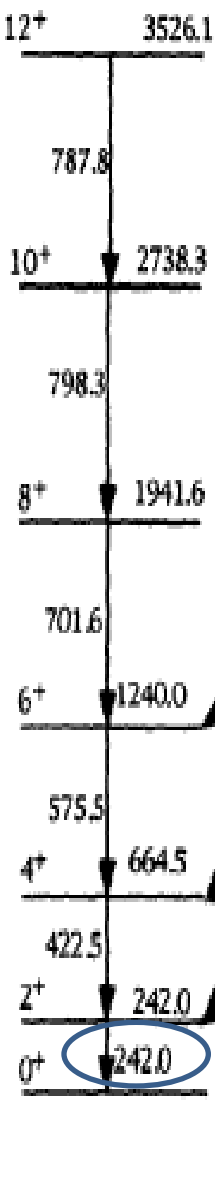
0.5 keV under 3 MeV

Ru in EXILL

Pu Fission simulated Yields in function of N and Z

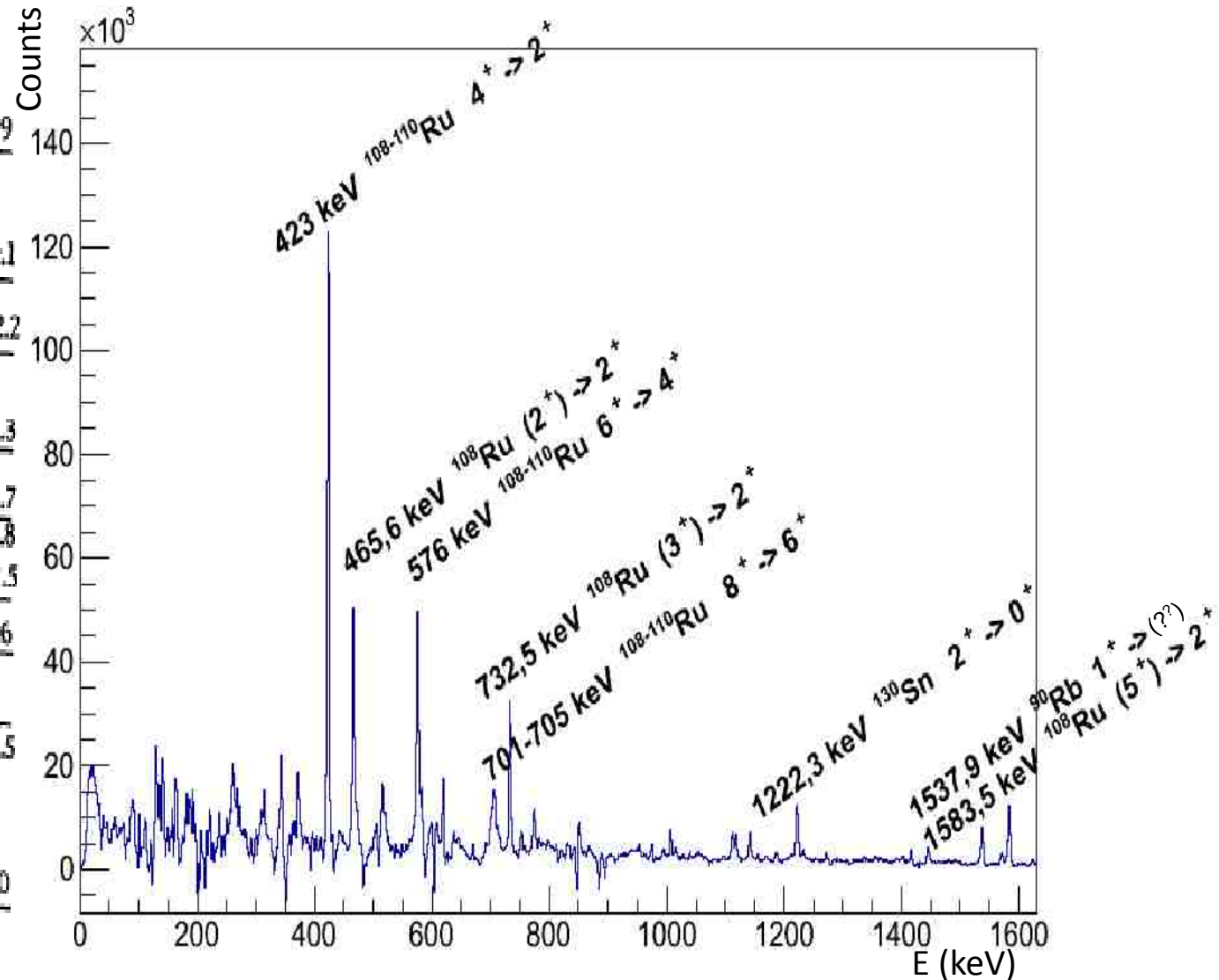


Fold effects : tools

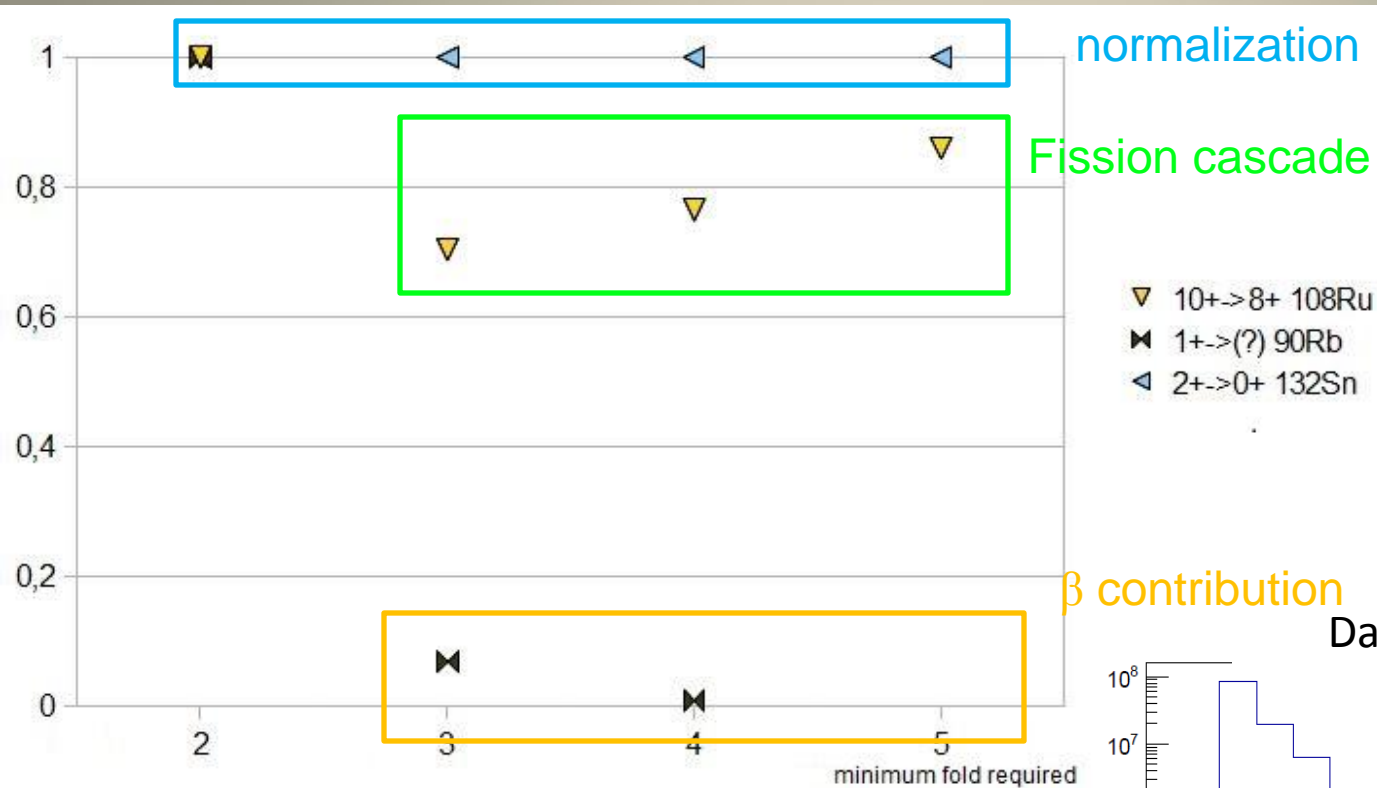


G.H.Lu
PRC 52-3 (1995)

Coincidences with 242 keV



Fold effects : results

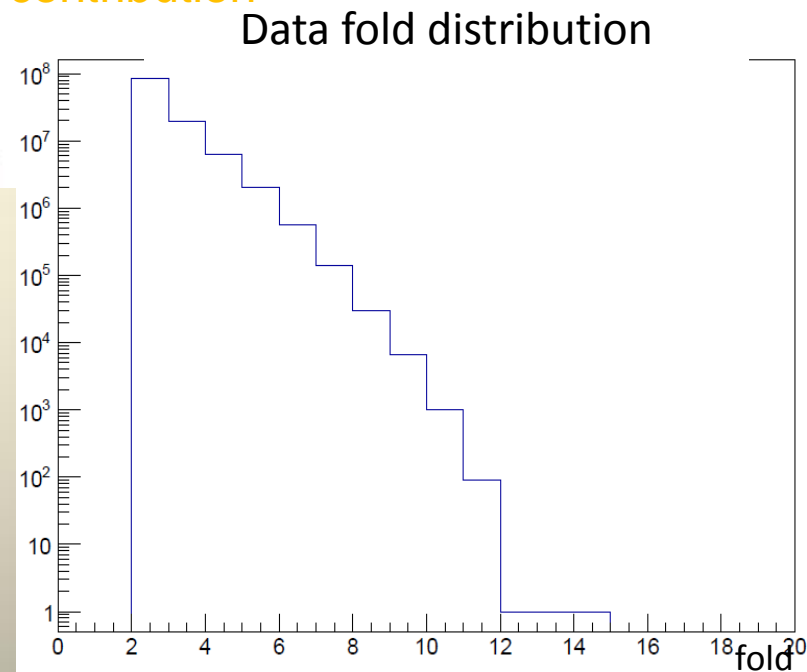


Long fission cascade favored

Rapid decrease of statistic

BUT drastic decrease of
beta contributions

=> Optimum for fold ≥ 4

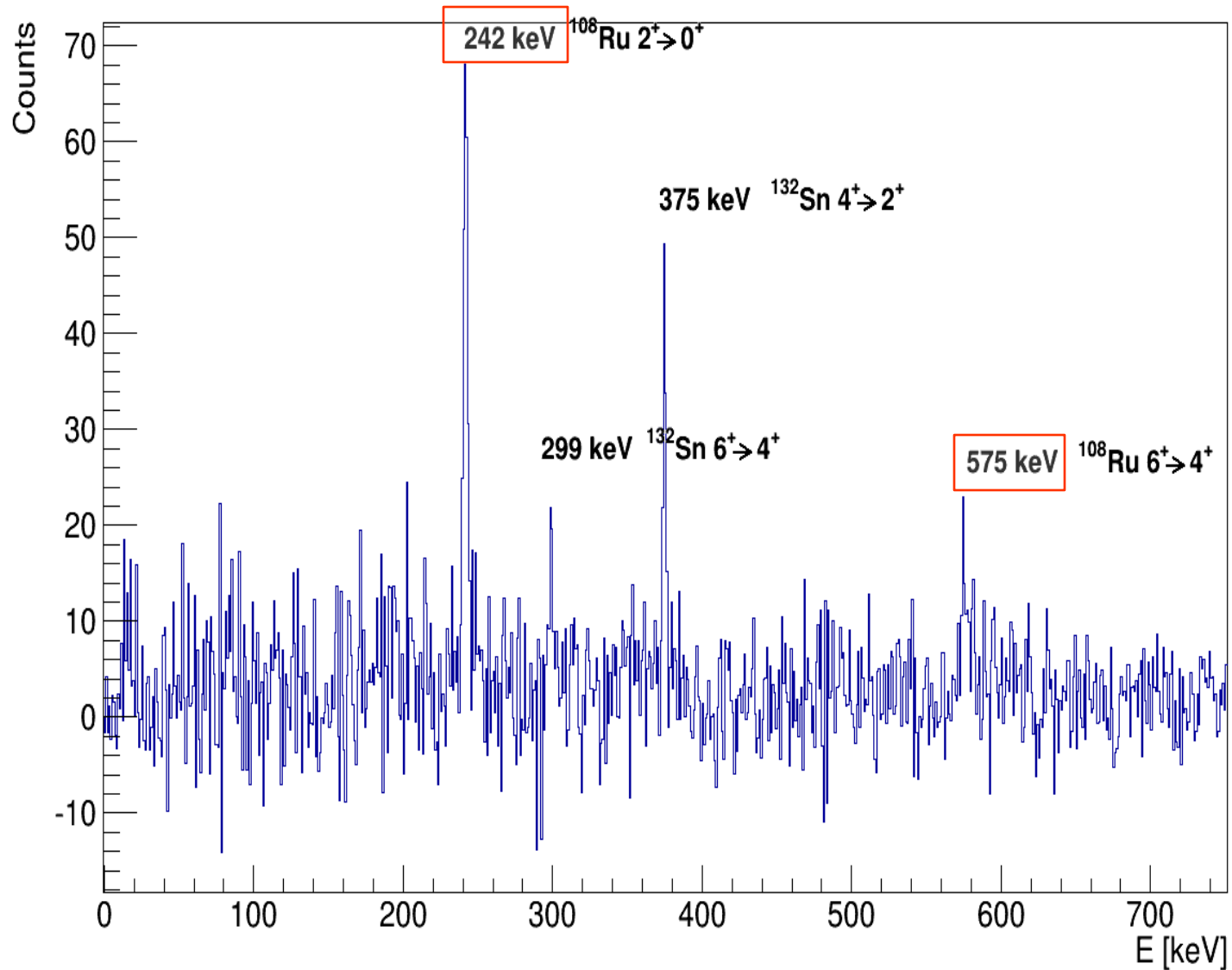
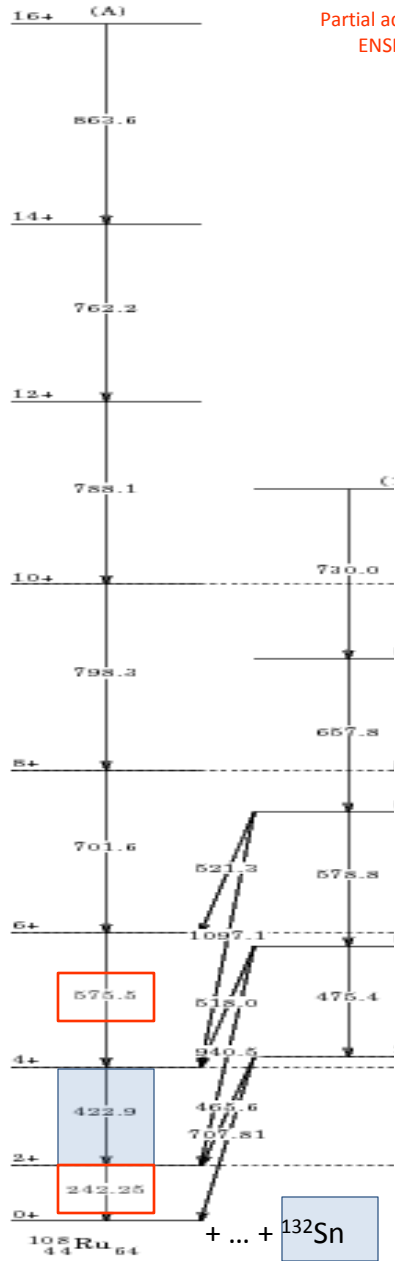


^{108}Ru

Partial adopted
ENSDF

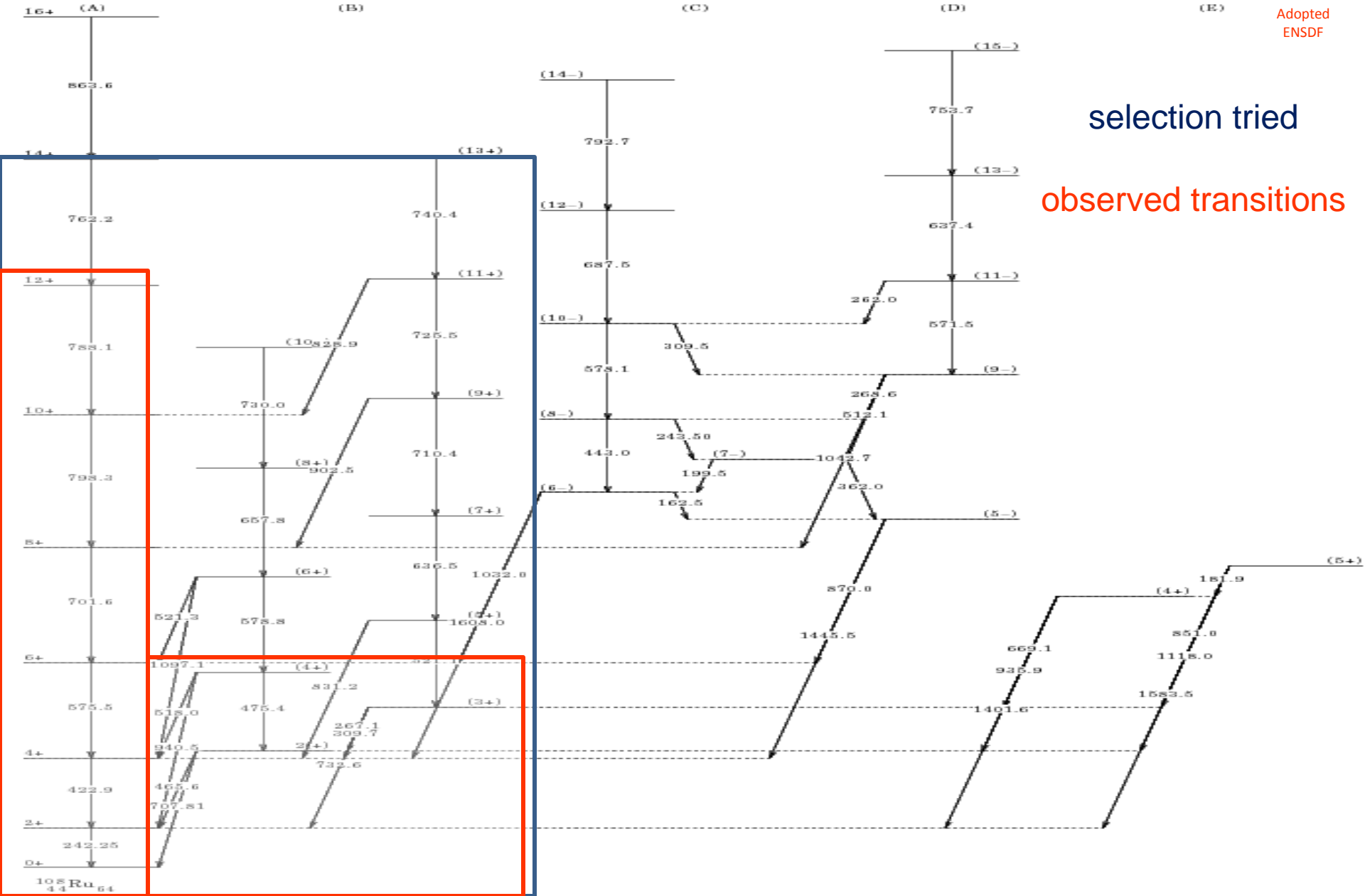
Adopted
ENSDF

Double gated spectrum 4041 keV - 423 keV



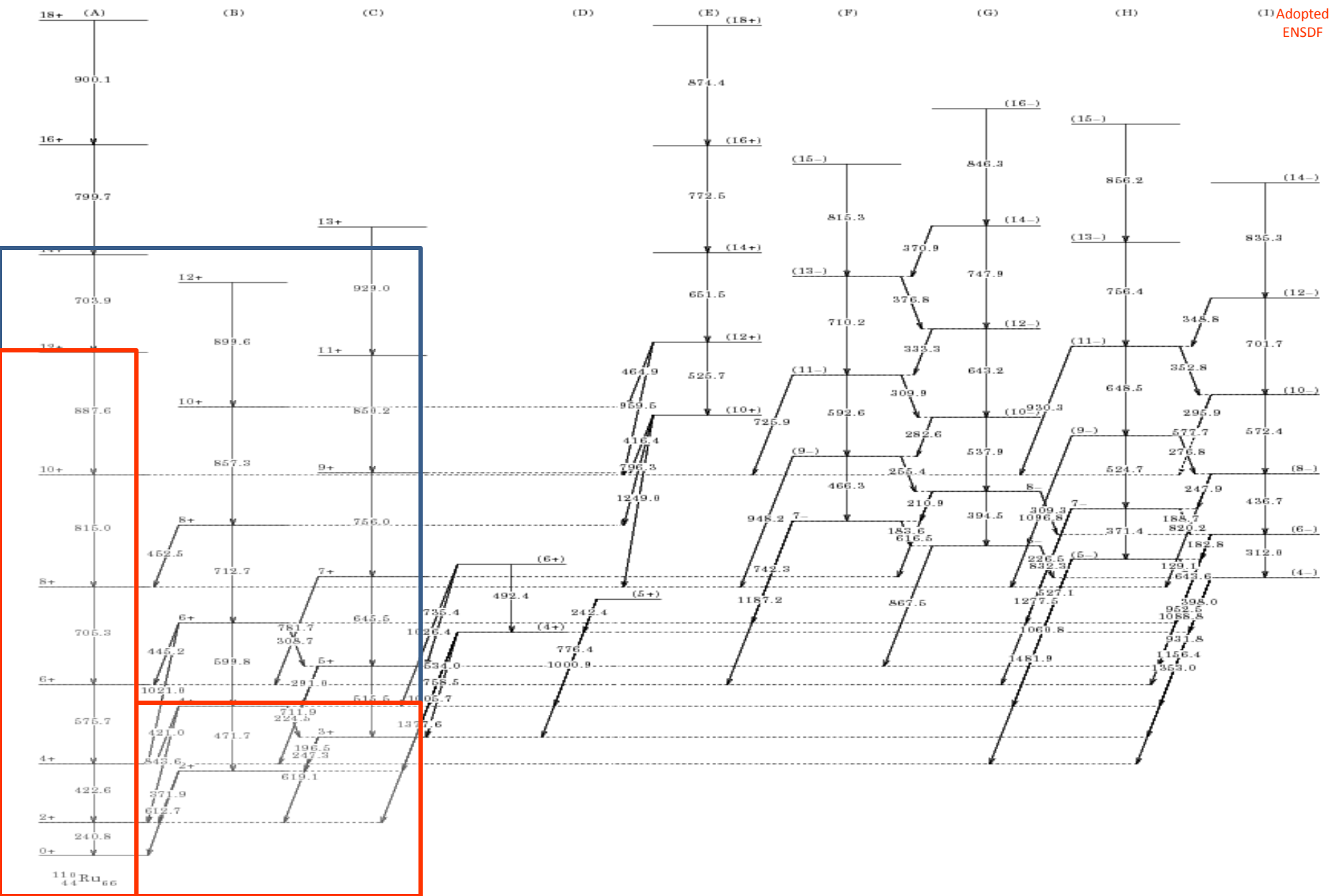
^{108}Ru

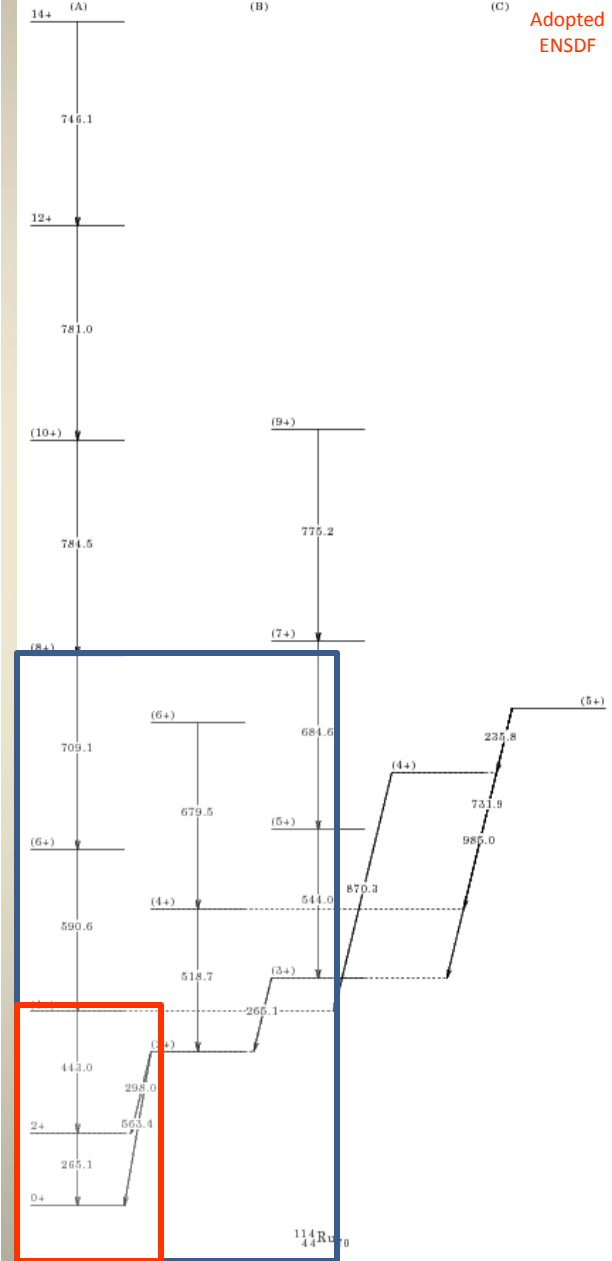
11



^{110}Ru

12





Statements on ruthenium isotopes

Bands are named as
ENSDF ones

^{108}Ru : ground state band up to level 12^+
possible g-vibrational band up to level 4^+
two-phonon γ -vibrational band level (5^+)

^{109}Ru : All bands up to $E^* \approx 1300$ keV

^{110}Ru : ground state band up to level 12^+
one phonon quasi- γ band up to level 4^+

^{111}Ru : $7/2^-$ ($\alpha=-1/2$) band up to level $23/2^-$

^{112}Ru : ground state band up to level 8^+

^{113}Ru : $7/2$ ($\alpha=-1/2$) band up to level $19/2^-$

^{114}Ru : yrast band up to level 4^+

^{115}Ru : not observed

Conclusion

Time and energy calibrations have been performed.

Detector energy and resolution time stabilities have been checked.

The whole information is available in a report (soon available for the collaboration).

Fold effect on fission event analysis has been studied.

Ruthenium isotopes have been studied.

No new transitions have been found.

^{115}Ru isotope has not been observed.

Original physics program is out of reach.

I would like to thank all the people having participated in this work as well as the whole EXILL collaboration.

Thank for your attention!

Feel free to ask questions.