Coulomb excitation of n-rich N=40 and N=50 nuclei with

REX-ISOLDE and Miniball

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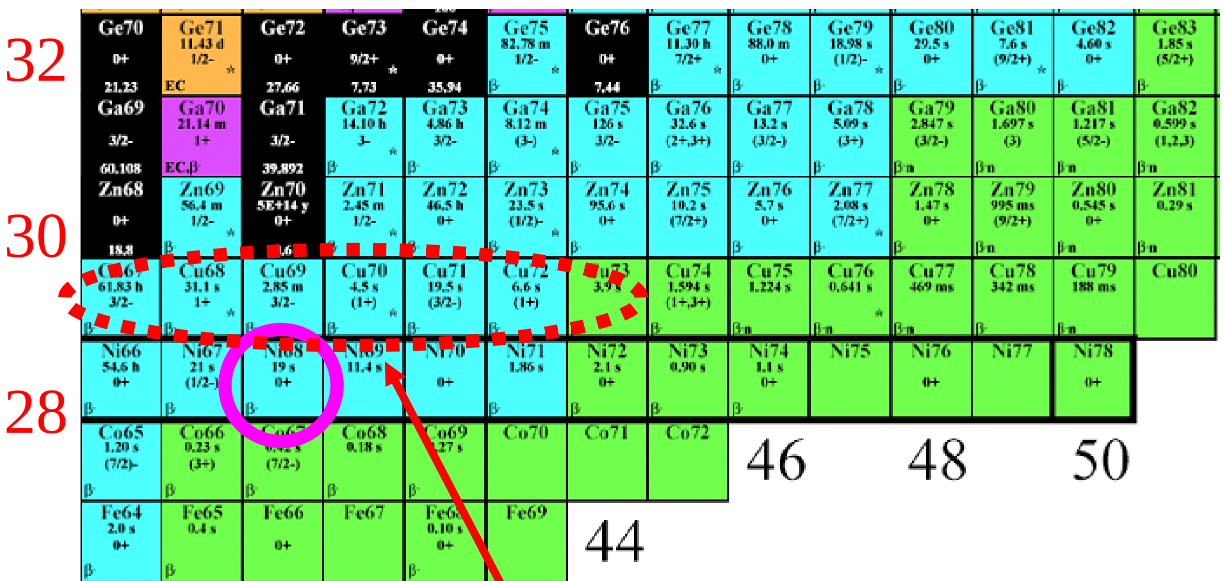
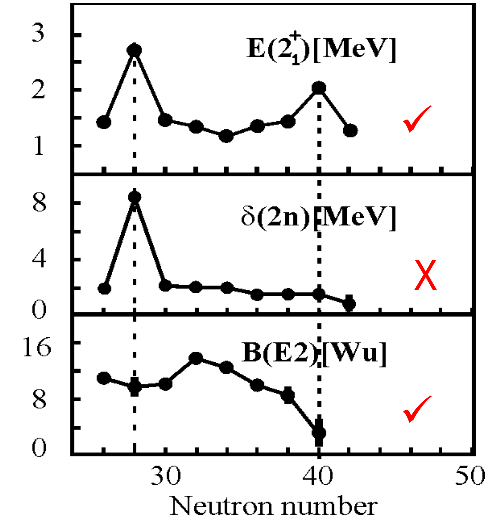
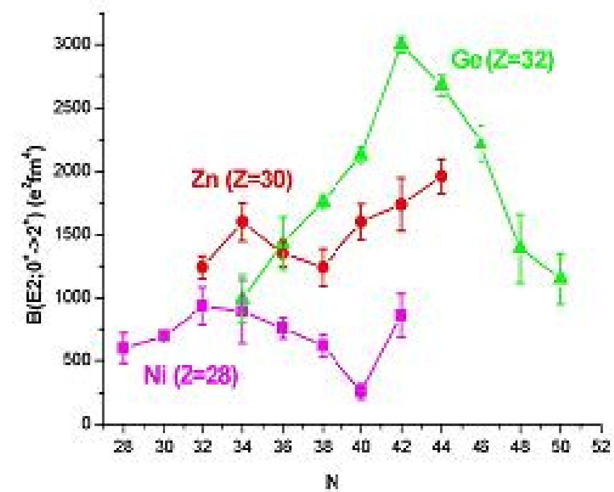
Miniball and **REX-ISOLDE** collaboration

Nuclear structure around N=40

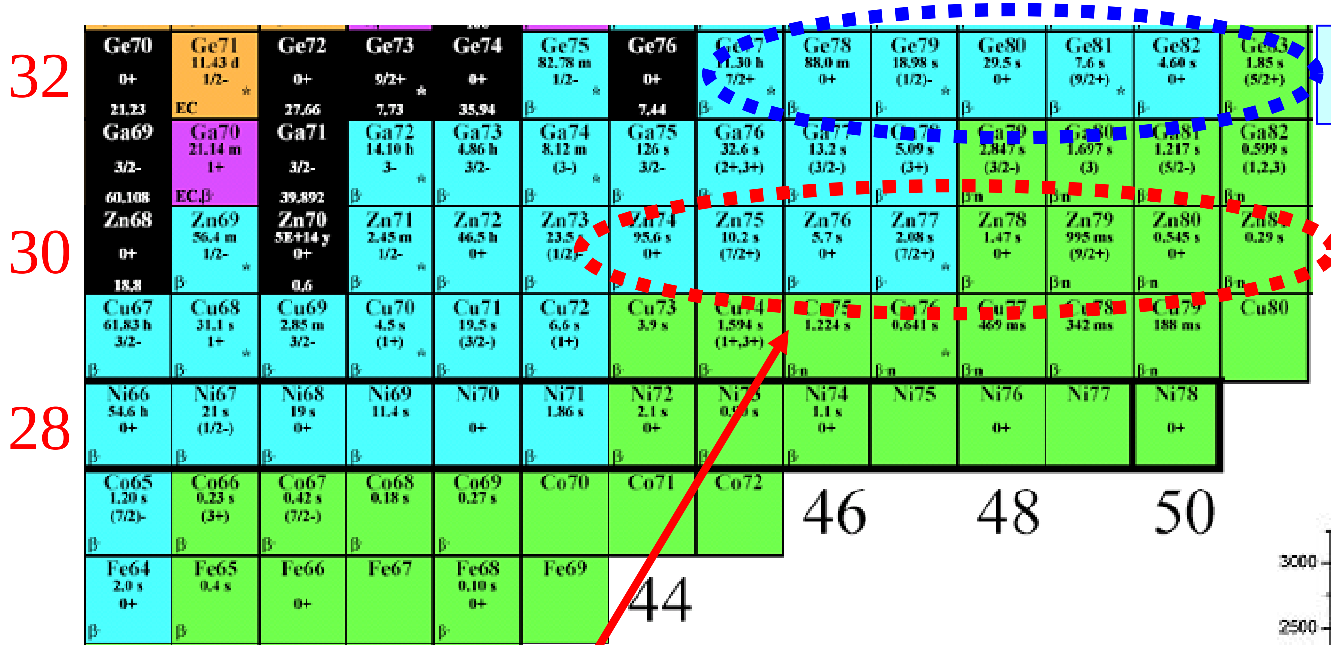


Coulomb excitation with RIB@REX-ISOLDE

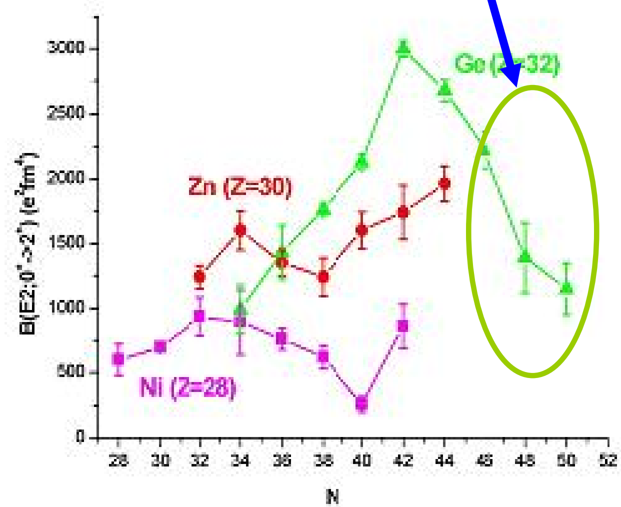




Nuclear structure towards N=50



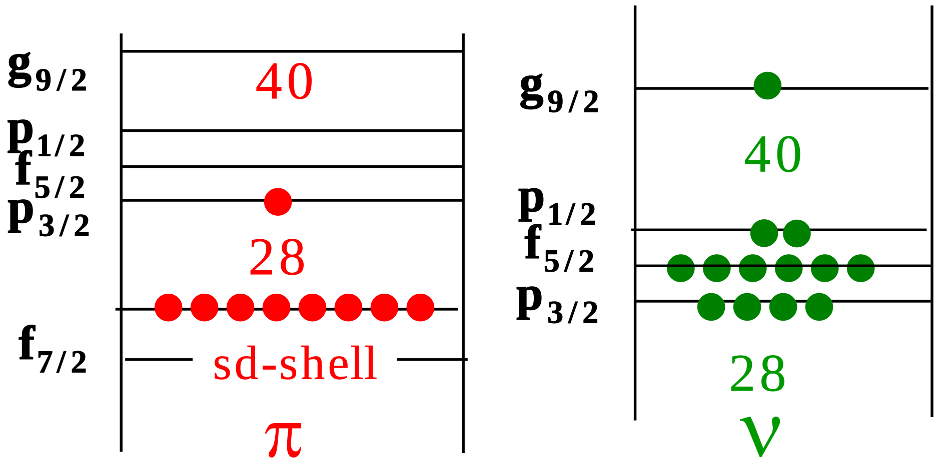
E. Padilla-Rodal et al., PRL94, 122501(2005)



Coulomb excitation of ^{74,76,78}Zn @REX-ISOLDE

N=40: neutron-rich Cu isotopes

➢ **odd-A and odd-odd nuclei around ^{68}Ni ➔ nuclear wave function dominated by single-particle configurations**

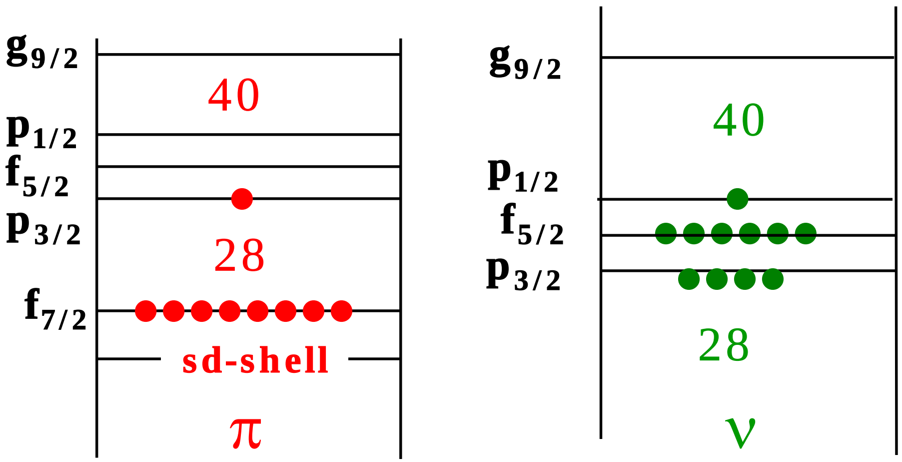


$^{70}_{29}Cu_{41}$

➢ **Coulex of $^{67,68,69,70,71}Cu$: strength of the N=40 subshell closure, evolution of collectivity around ^{68}Ni, testing ground for shell model calculations**

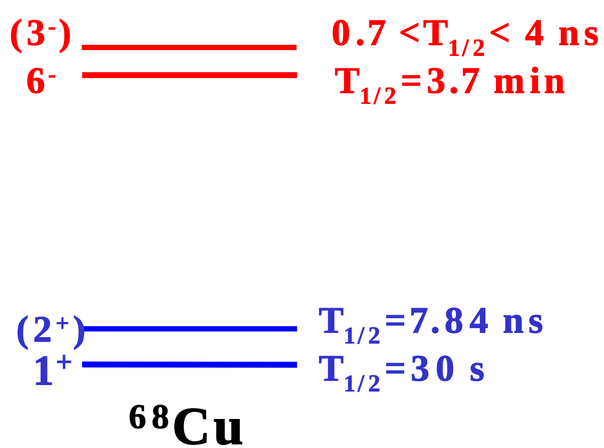
✓ **July 2005: Coulex of $^{68,70}Cu$**

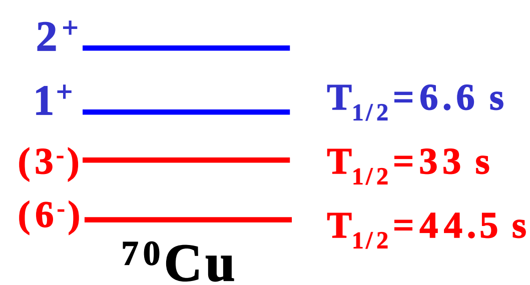
N=40: coulex of ^{68,70}Cu isotopes



$\pi p_{3/2} \otimes \nu p_{1/2}$ ($J^{\pi}=1^{+}, 2^{+}$)

$\pi p_{3/2} \otimes \nu g_{9/2}$ ($J^{\pi}=3^{-}, 4^{-}, 5^{-}, 6^{-}$)



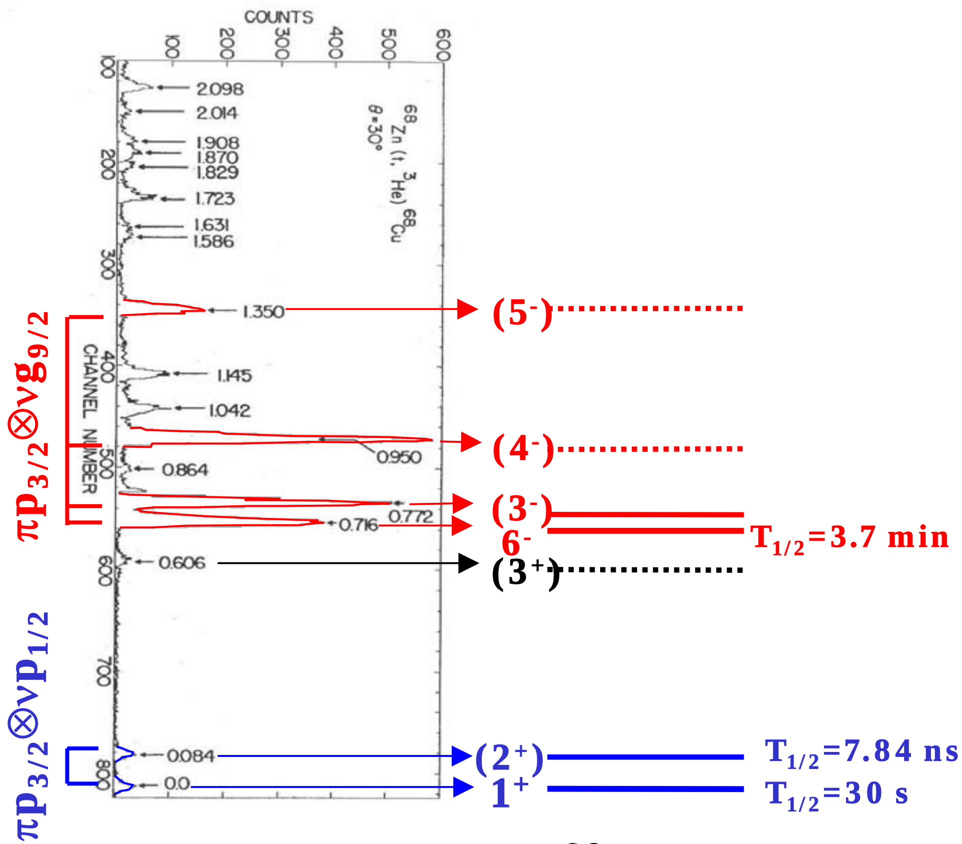


T. E. Ward et al., PR88, 1802(1969)
L. Hou et al., PRC68, 054306(2003)

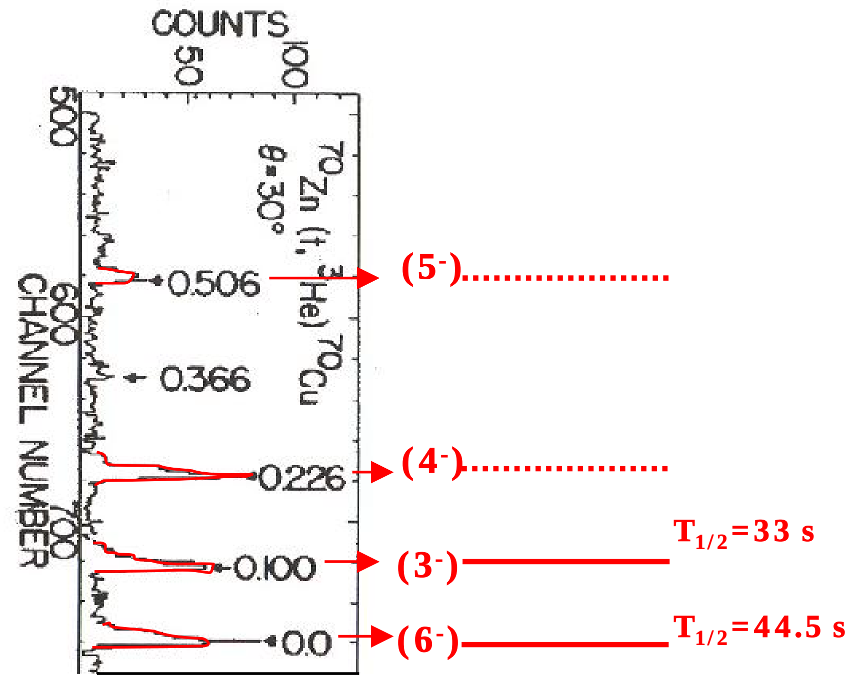
J. Van Roosbroeck et al., PRL92(2004)112501
J. Van Roosbroeck et al., PRC69(034313).

Neutron-rich even-A Cu isotopes

- ^{68,70}Cu-



^{68}Cu

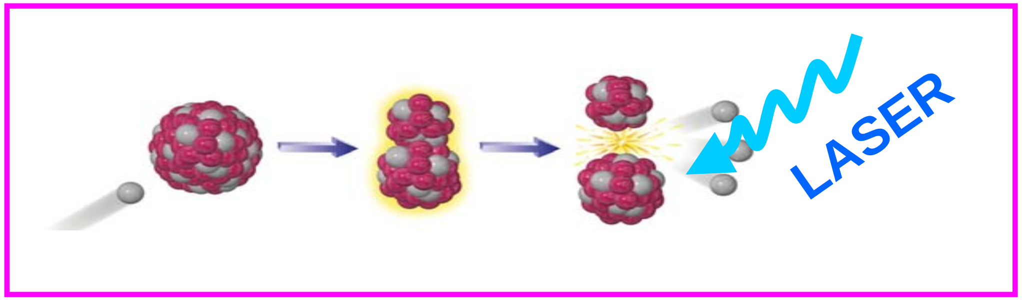


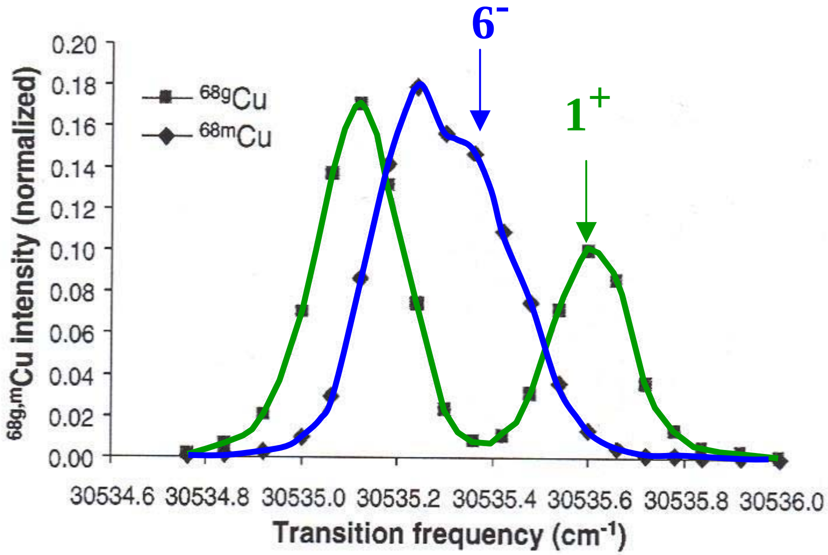
^{70}Cu

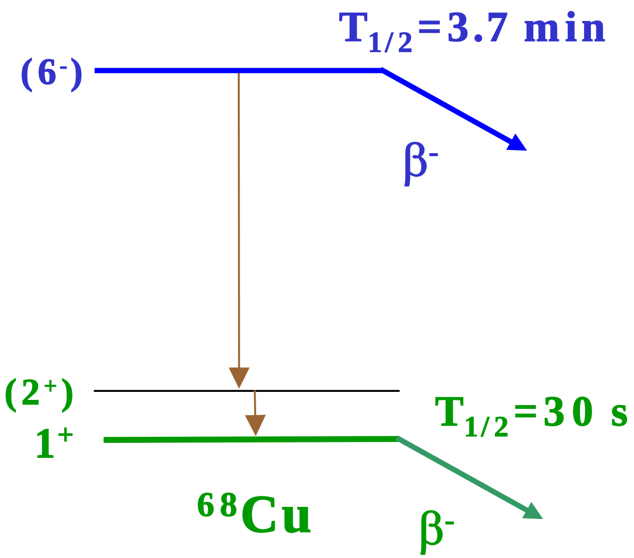
J.D. Sherman *et al*. PLB67 (77) 257
T. Ishii et al., Jaeri-Review, 2002-029, 25

^{68,70,m,g}Cu: production of isomeric beams

Example: ^{68}Cu

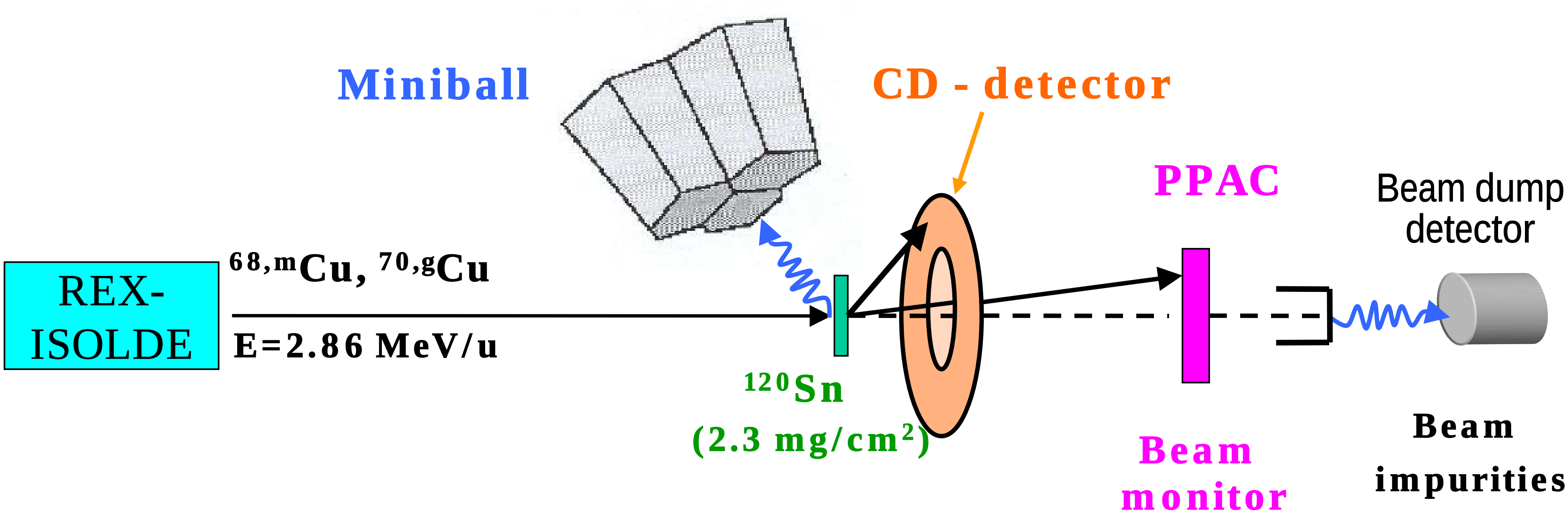






U. Koester et al., NIMB167(2000)528
^{70}Cu: J. Van Roosbroeck et al., PRL92(2004)112501

Experimental setup for coulex @Isolde

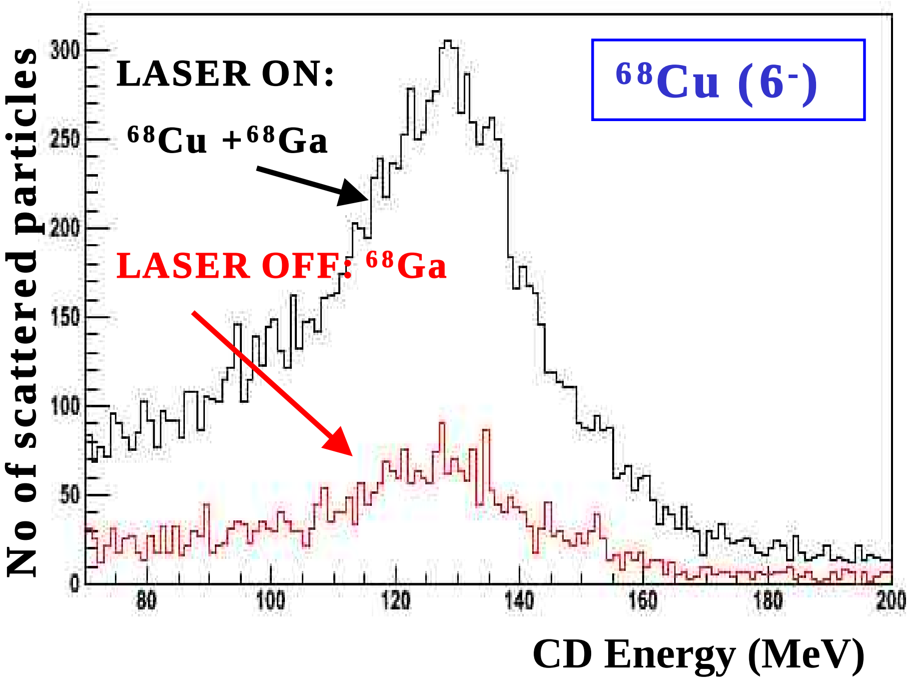


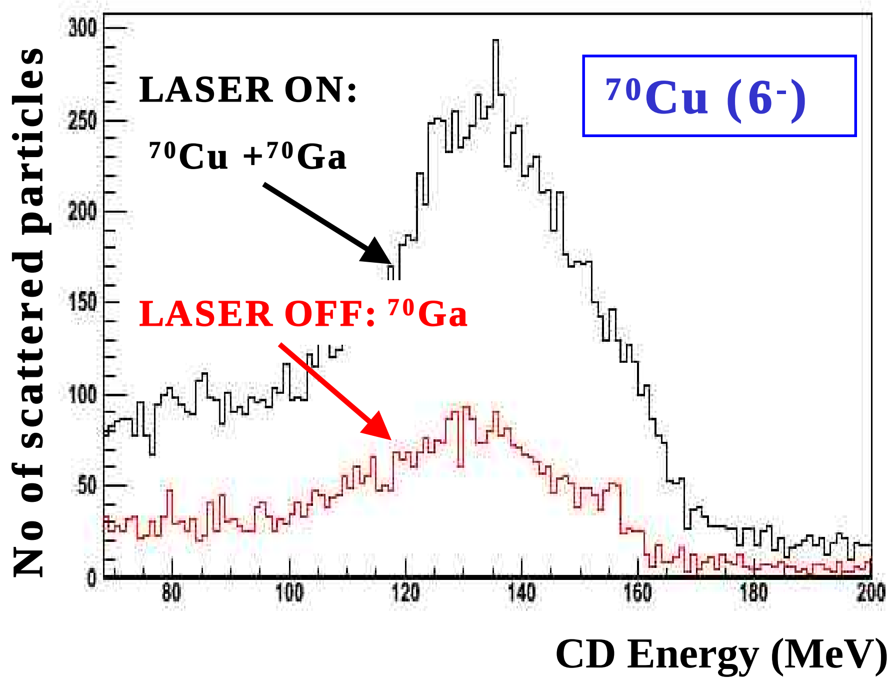
$Y_{MB}(^{68,m}Cu) \sim 3 \cdot 10^{5}$ pps

$Y_{MB}(^{70,g}Cu) \sim 5 \cdot 10^{4}$ pps

Coulex of $^{68,70,m,g}Cu$

➢ **Laser ON/OFF runs for determining isobaric contaminants (Ga)**



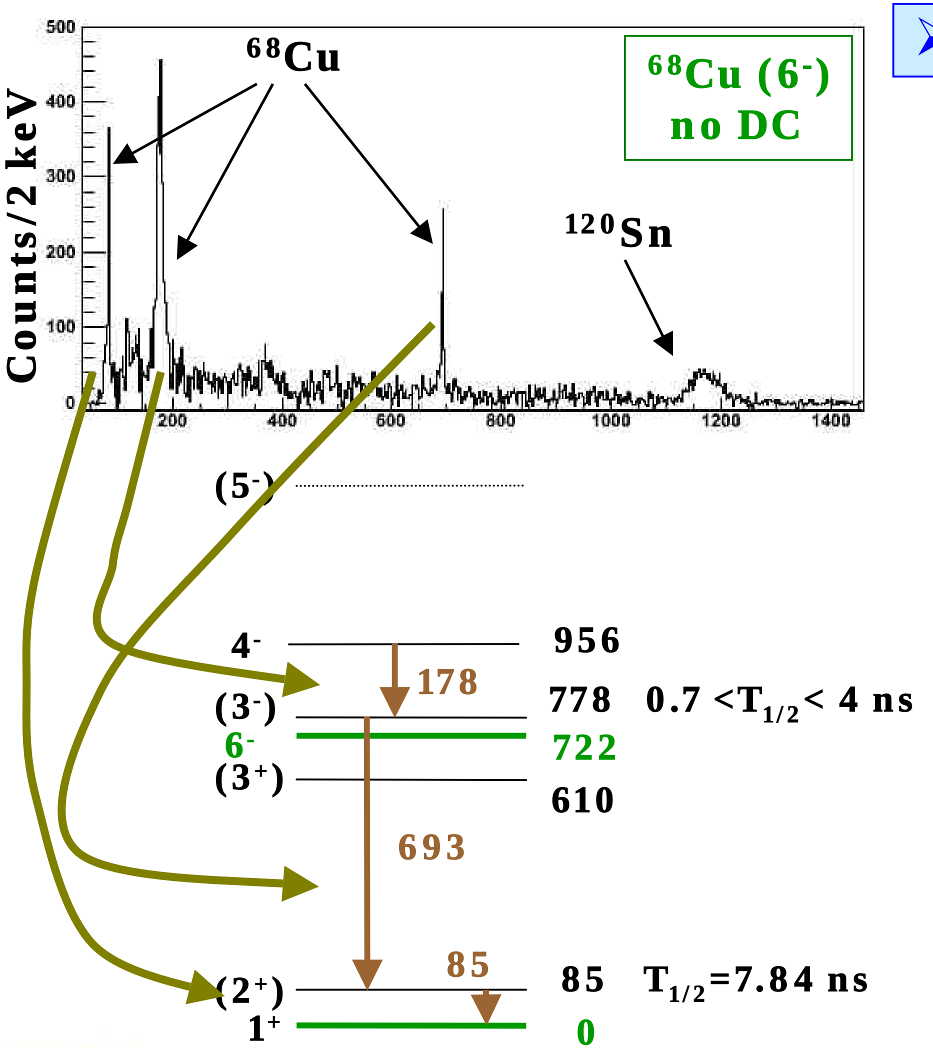


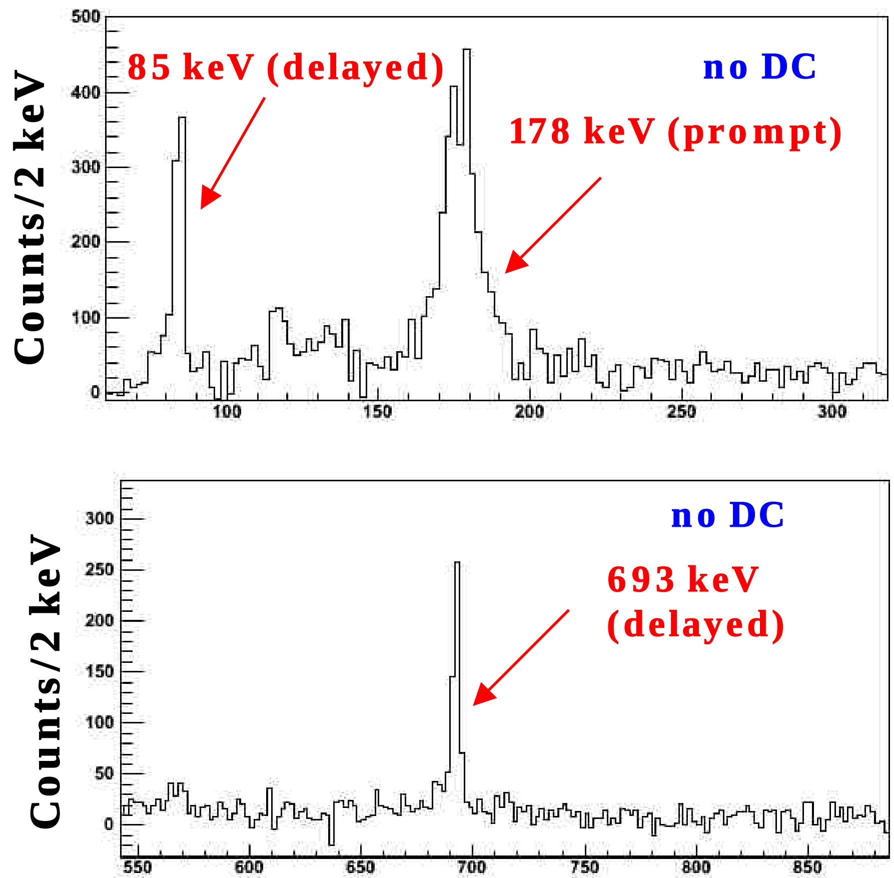
^{68}Cu/total = 74 ± 2 %

^{70}Cu/total = 70 ± 3 %

Coulex of $^{68,m}Cu$

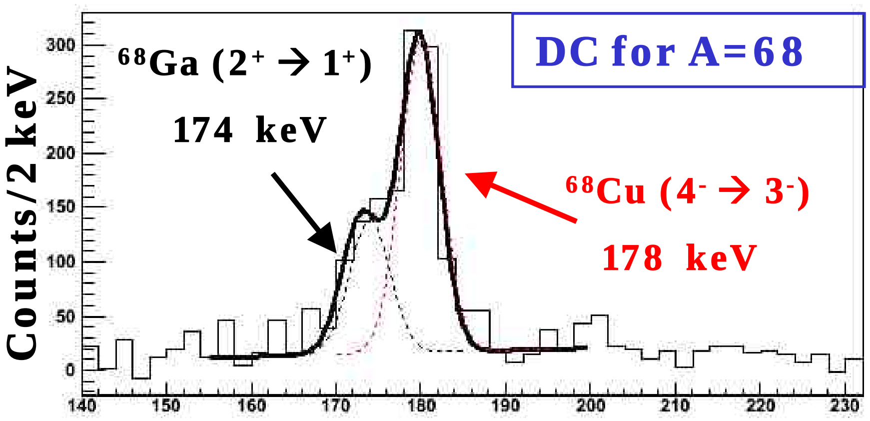
➤ $^{68,m}Cu$ (2.86 MeV/u) @ ^{120}Sn (2.3 mg/cm^2)

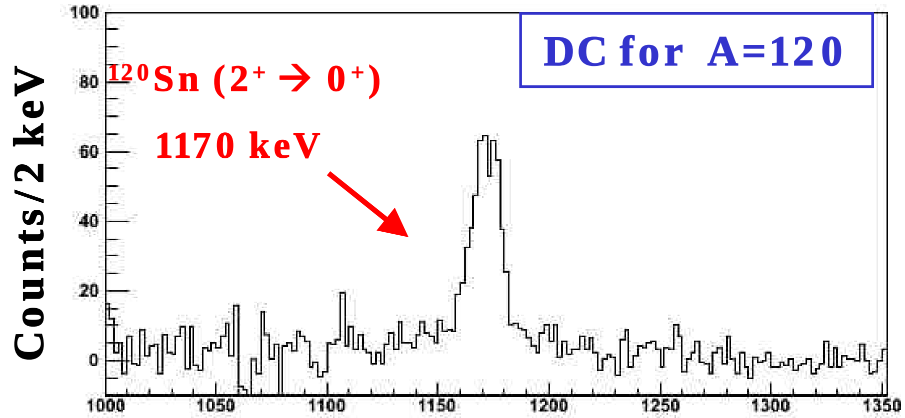




Coulex of ^{68,m}Cu

➤ ^{68,m}Cu (2.86 MeV/u) @ ^{120}Sn (2.3 mg/cm^2)

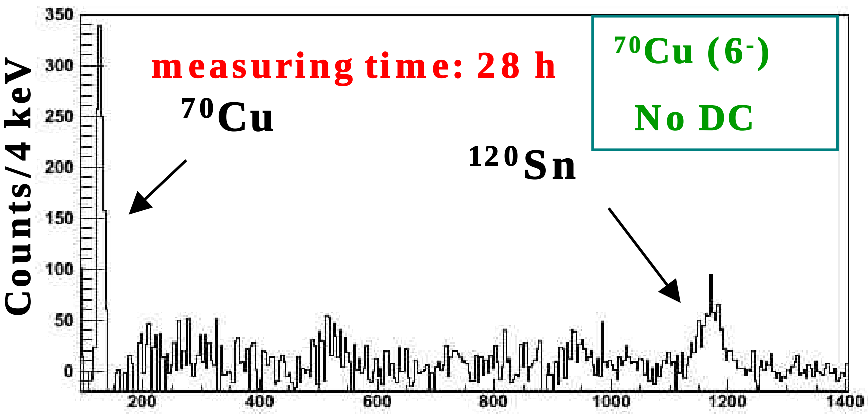


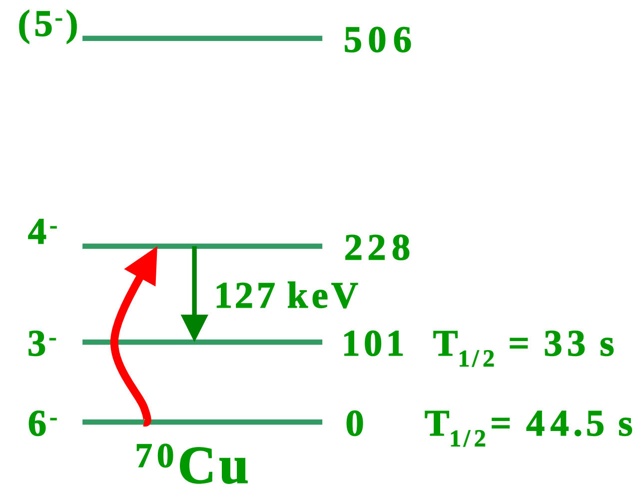


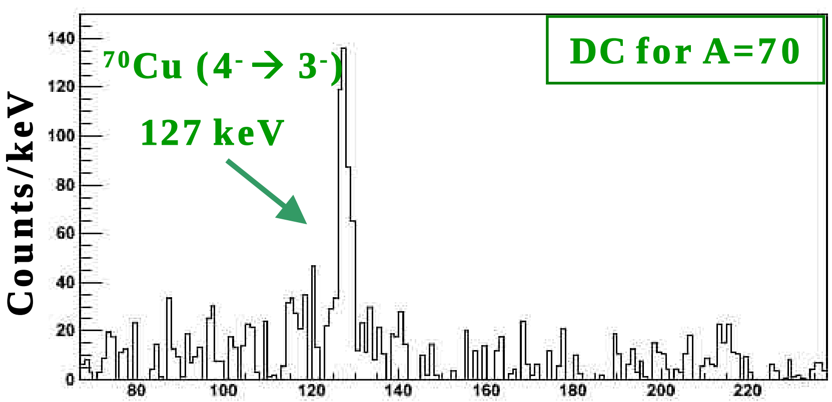
^{68}Cu (preliminary): B(E2; $4^- \rightarrow 6^-$) = 6.7 ± 0.6 W.u.

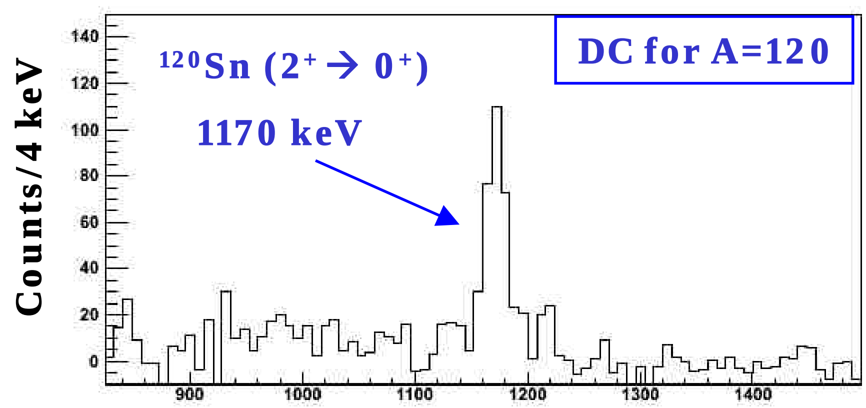
Coulex of ^{70,g}Cu

- ^{70,g}Cu (2.86 MeV/u) @ ^{120}Sn (2.3 mg/cm^2)



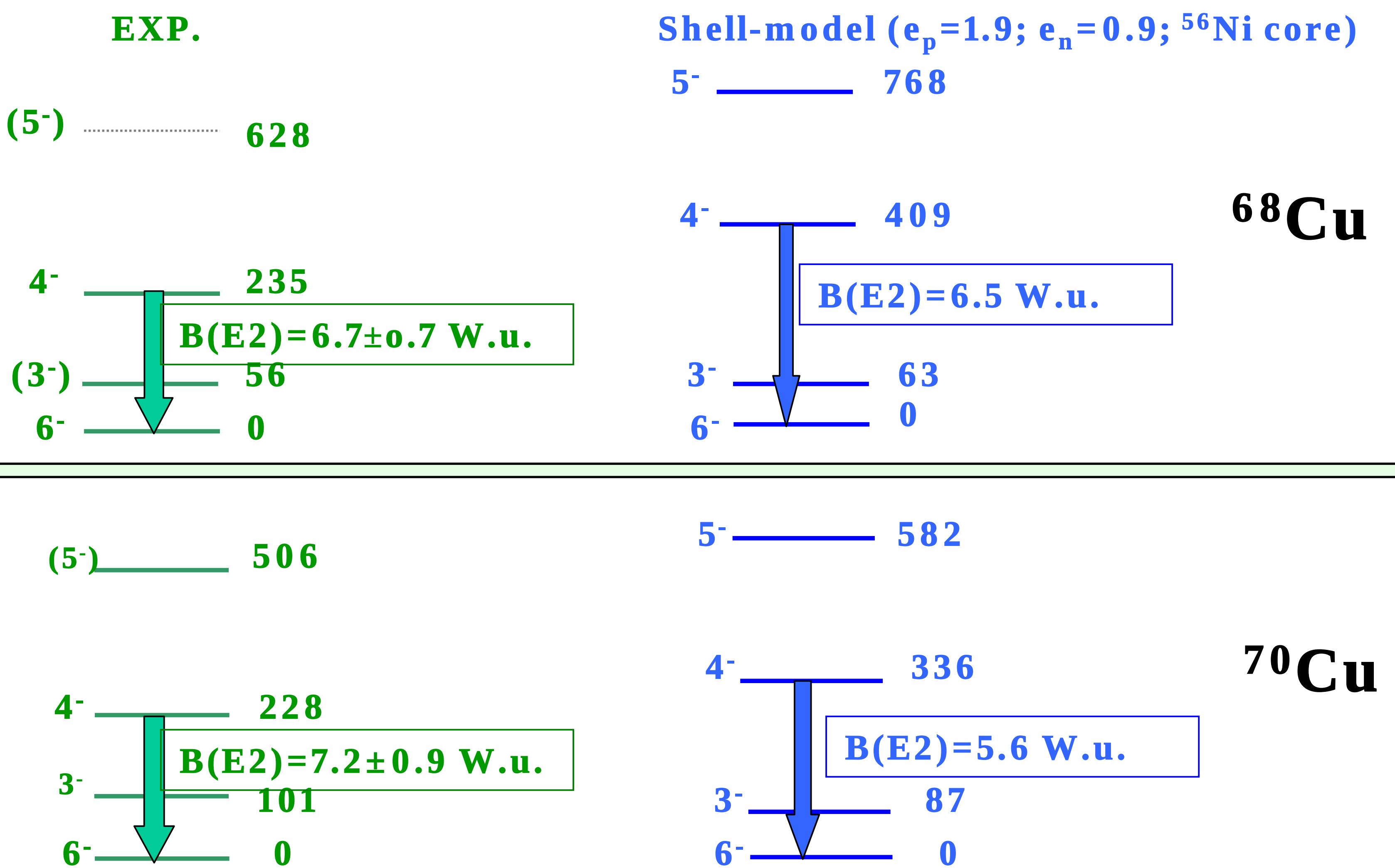






^{70}Cu (preliminary): B(E2; 4$^-$ → 6$^-$) = 7.2 ± 0.9 W.u.

Coulex of $^{68,m}Cu$, $^{70,g}Cu$



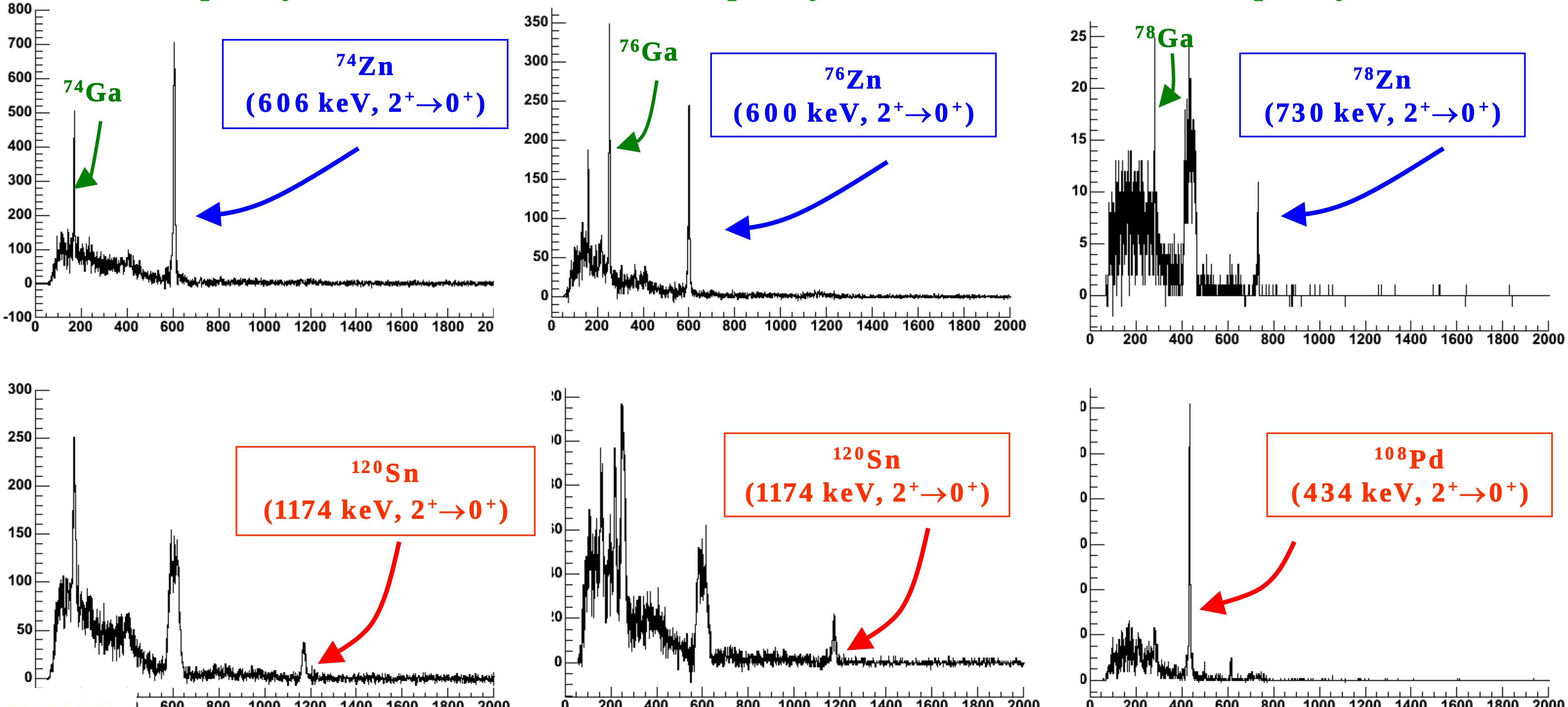
**N. Smirnova, Private Communication

Towards the doubly magic ^{78}Ni
- evolution of collectivity in ^{74,76,78}Zn -

- ~12.5 h beam
- ~7 10^5 ^{74}Zn/s
- ^{120}Sn target (2.3 mg/cm^2)
- ~80% purity

- ~14.5 h beam
- ~3 10^5 ^{76}Zn/s
- ^{120}Sn target (2.3 mg/cm^2)
- ~68% purity

- ~23.5 h beam
- ~8 10^3 ^{78}Zn/s
- ^{108}Pd target (2 mg/cm^2)
- ~59% purity

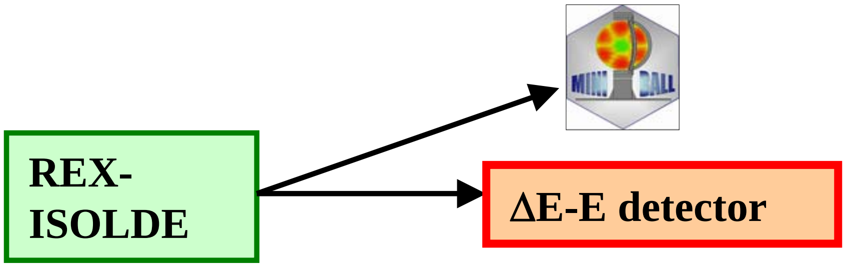


Towards the doubly magic ^{78}Ni

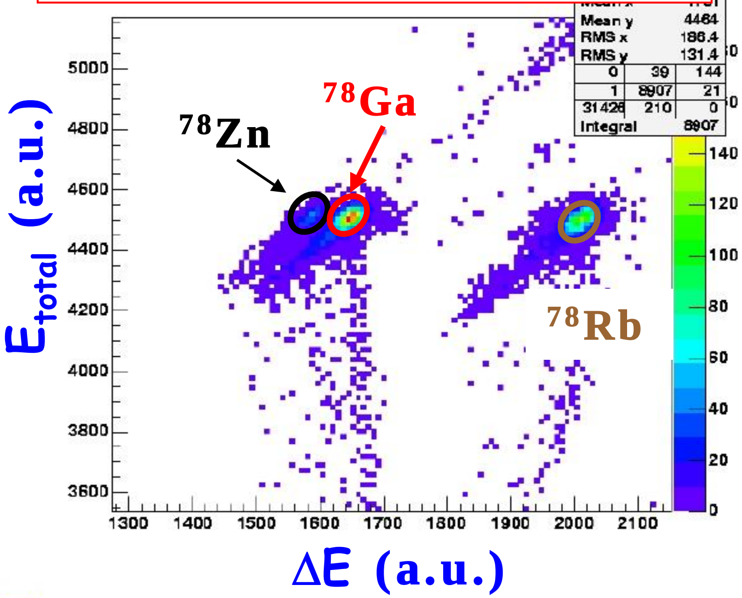
- evolution of collectivity in ^{74,76,78}Zn -

Beam composition for ^{74,76,78}Zn:

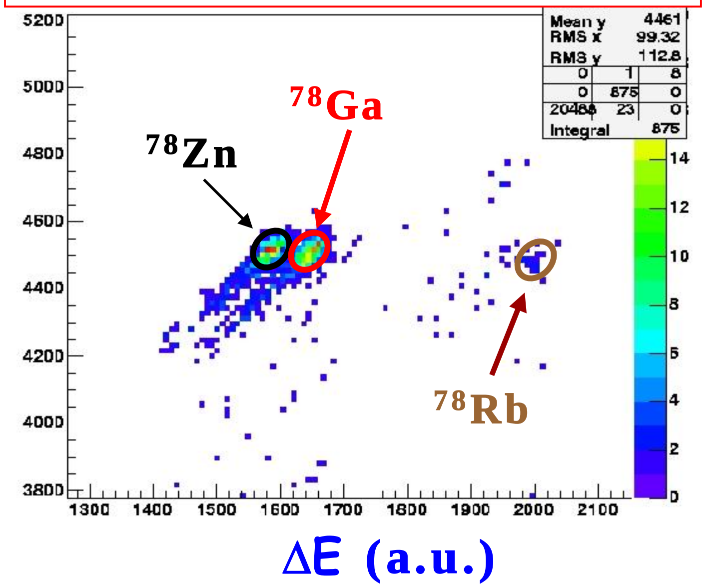
- ✓ laser ON/OFF measurements;
- ✓ Ionization chamber – Si detector;
- ✓ proton-to-neutron detector;



Proton beam on target: p+^{238}U

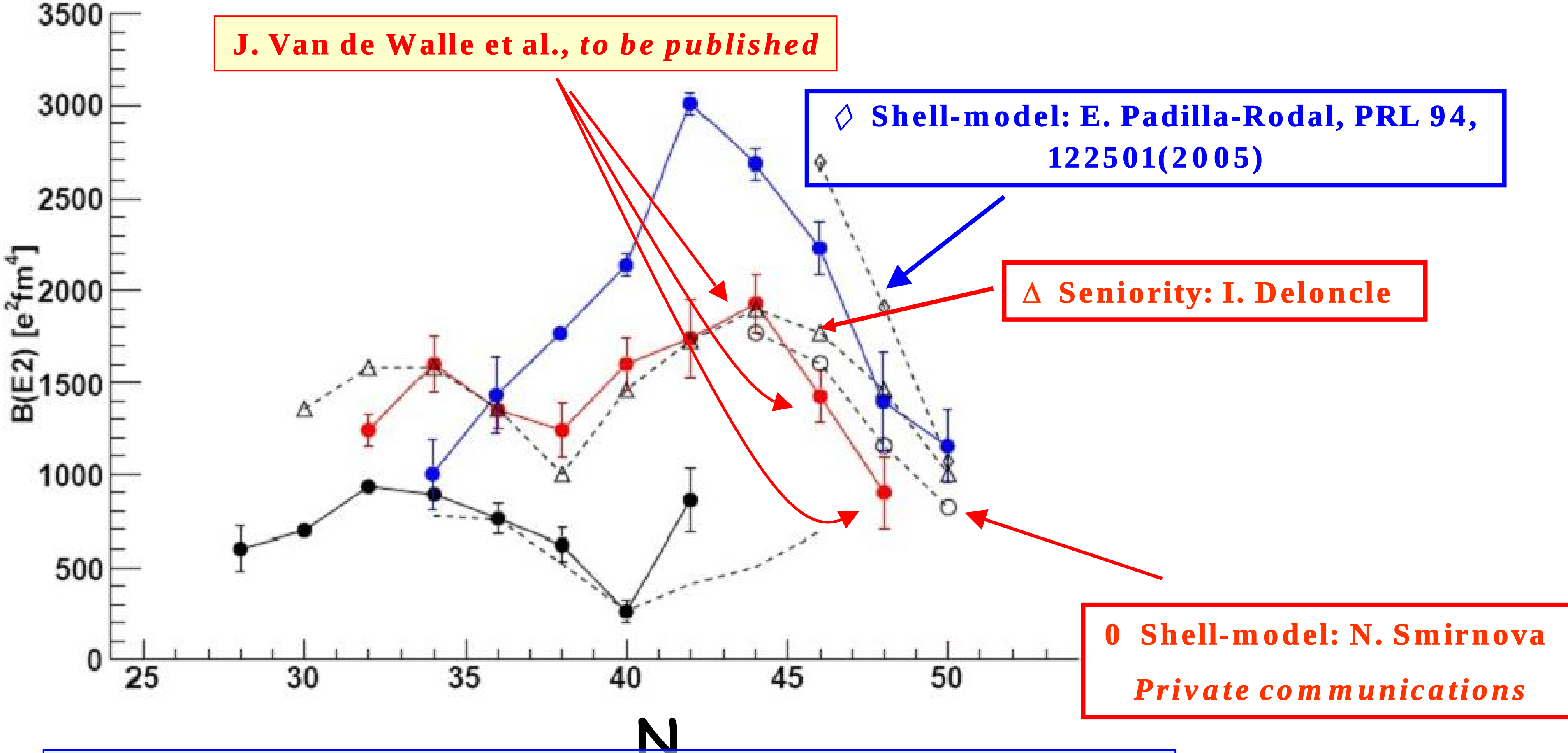


Proton beam on converter: n+^{238}U



Towards the doubly magic ^{78}Ni

- evolution of collectivity in ^{74,76,78}Zn -



- ➢ ^{74}Zn: agreement with intermediate energy Coulex (Ganil)
- ➢ Steep drop in B(E2) towards N=50

Conclusions and outlook

✓**July 2004: coulex of $^{74,76,78}Zn$; $B(E2;2^+ \rightarrow 0^+)$ measured;**

✓**July 2005: first isomeric beams post-accelerated by REX-ISOLDE;**

✓ **Coulex of $^{68,70}Cu$, $\pi p_{3/2} \otimes \nu g_{9/2}$ multiplet : $B(E2; 4^- \rightarrow 6^-)$ measured, energy and spin of the 4^- state fixed; experimental results in good agreement with the preliminary shell model-calculations.**

Upcoming runs:

- **July 2006: coulex of ^{80}Zn;**
- **August 2006: coulex of $^{67,69,71}Cu$.**

The Collaboration

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MINIBALL and REX-ISOLDE collaboration

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