New Results for $^{48}Ca + ^{243}Am$

TASCA Workshop at GSI, October 14, 2011

Roger Henderson for the
JINR, LLNL, ORNL, VU collaboration

LLNL-PRES-504612

Science and Technology Principal Directorate

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.
Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94551

Science and Technology

Heavy element experiments require an international team effort

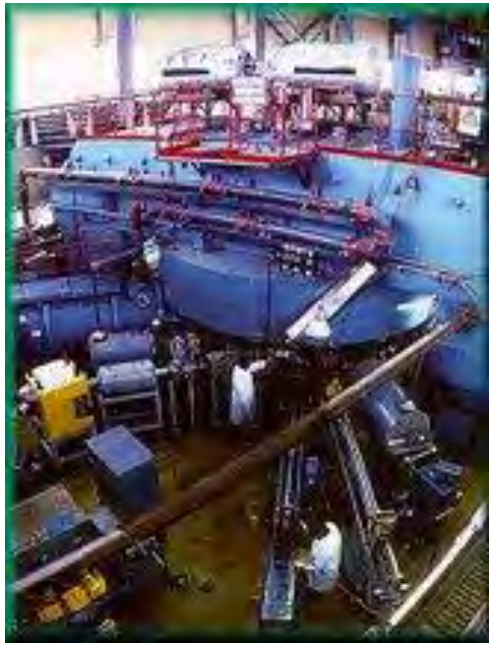
Joint Institute for Nuclear Research, Dubna, Russia
Yu. Ts. Oganessian, F. Sh. Abdullin, S. N. Dmitriev, M. G. Itkis, A. N. Mezentsev, A. N. Polyakov, R. N. Sagaidak, I. V. Shirokovsky, V. G. Subbotin, A. M. Sukhov, Yu. S. Tsyganov, V. K. Utyonkov, A. A. Voinov, and G. K. Vostokin

Lawrence Livermore National Laboratory, Livermore, California
J. M. Gostic, R. A. Henderson, K. J. Moody, D. A. Shaughnessy, M. A. Stoyer, and E. E. Tereshatov

Oak Ridge National Laboratory, Oak Ridge, Tennessee
K. P. Rykaczewski, J. B. Roberto

Vanderbilt University
J. H. Hamilton, A. V. Ramayya

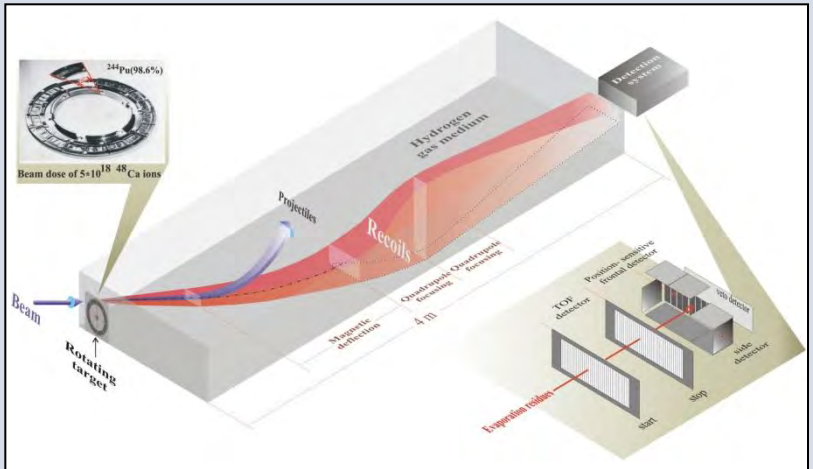
LLNL active collaboration with the Flerov Lab for Nuclear Reactions (JINR, Dubna, Russia)



- U400 cyclotron supplies high intensity $^{48}Ca^{5+}$ beams
- Typical experimental beam dose ~ 10^{19} particles
- Thin (0.35 mg/cm^2) rotating actinide oxide targets electroplated or painted onto 1.5-μm Ti backing
- Rapid separation allows for detection of half-lives from μs to days

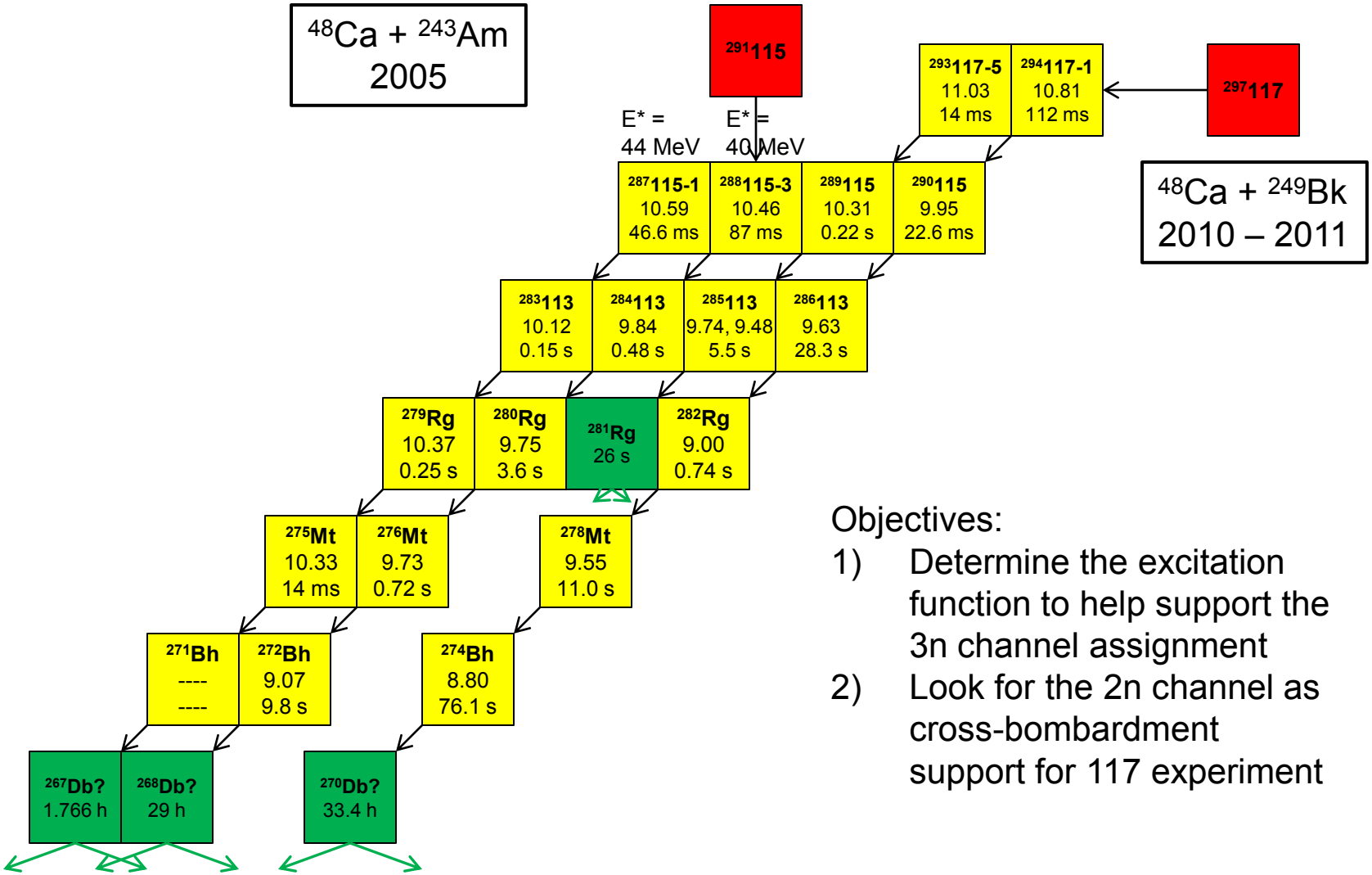
- DGFRS suppression factors are $\geq 10^{15}$ and $\geq 10^4$ for beam- and target-like particles respectively
- α-detection efficiency ~ 87%, fission 100%

Dubna Gas-Filled Recoil Separator (DGFRS)



Transmission Efficiency = 35–40 % for Z = 114–116 nuclei

Previous Results – Why this again?

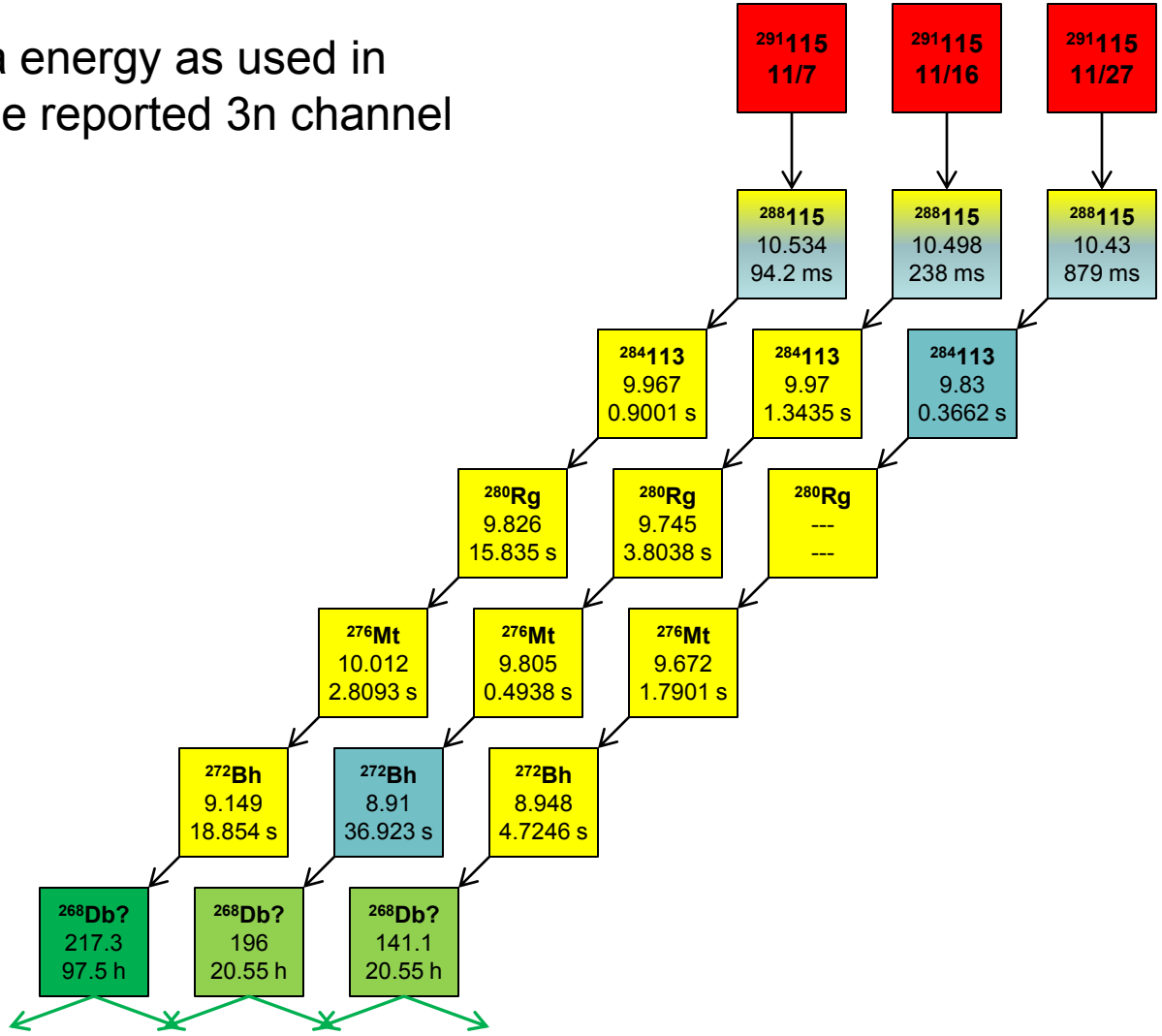


Objectives:

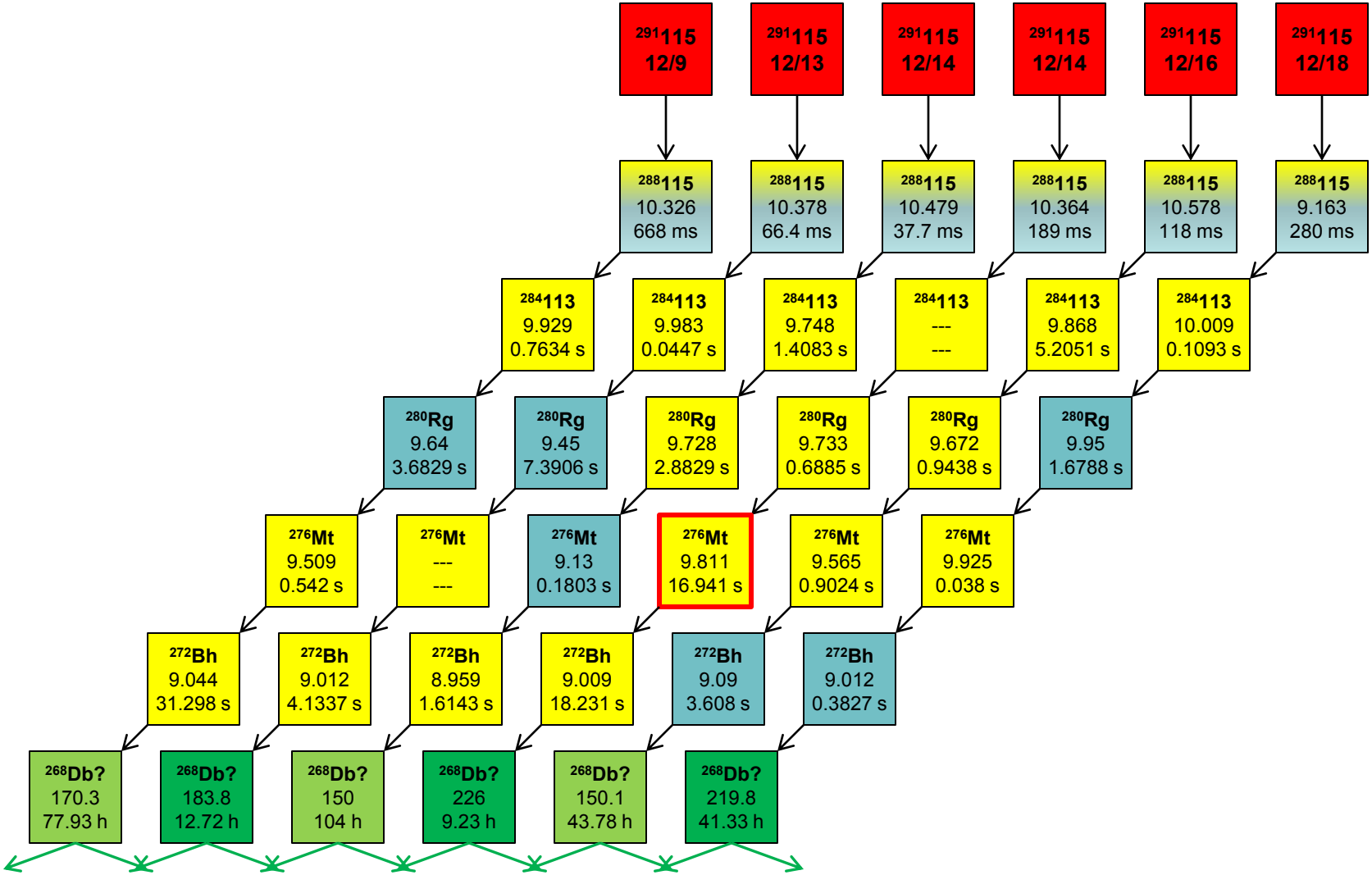
1) Determine the excitation function to help support the 3n channel assignment
2) Look for the 2n channel as cross-bombardment support for 117 experiment

Begin 10/29/2010
^{48}Ca E = 248 MeV; E* ~ 40 MeV

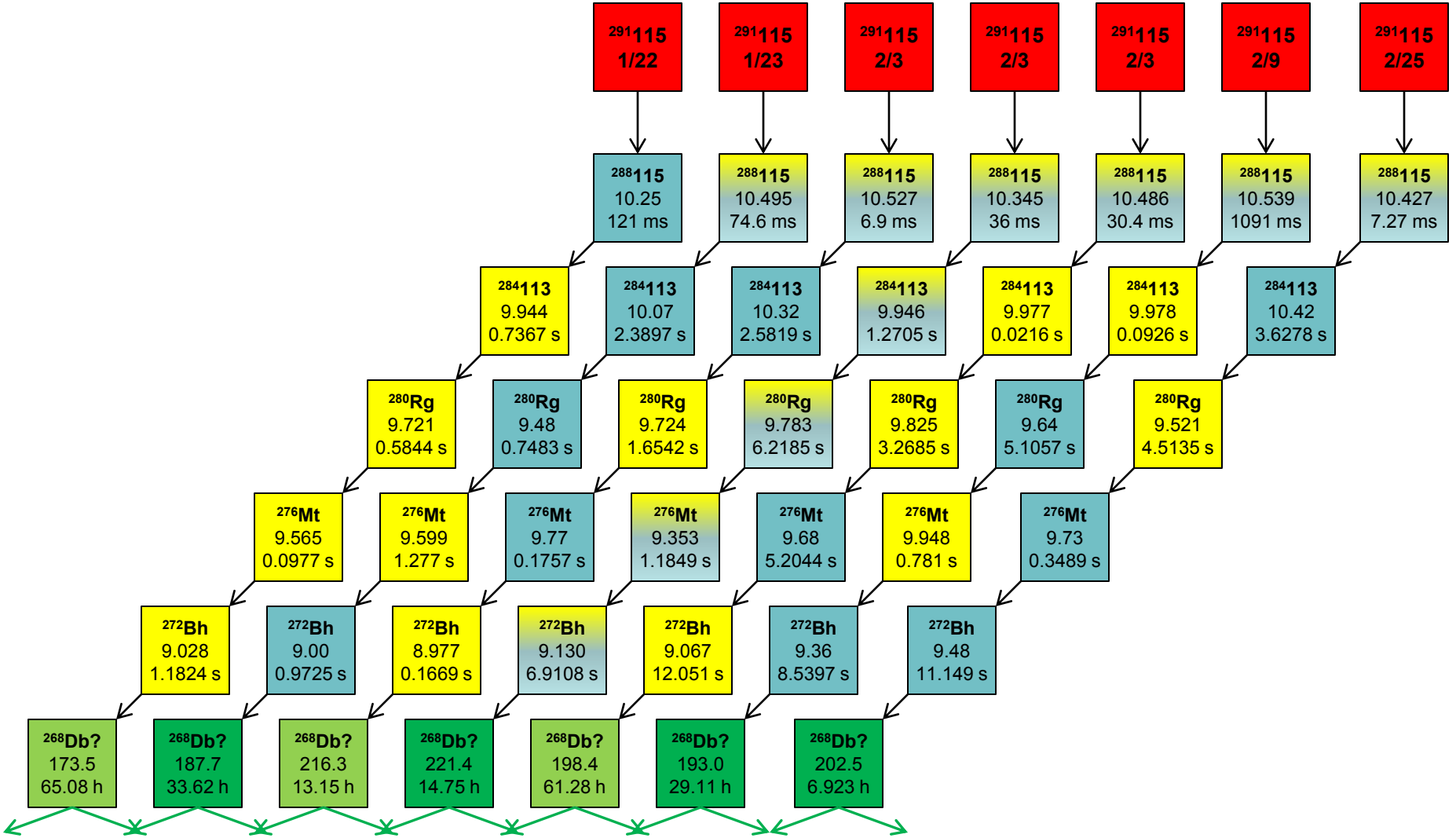
Same ^{48}Ca energy as used in 2005 for the reported 3n channel



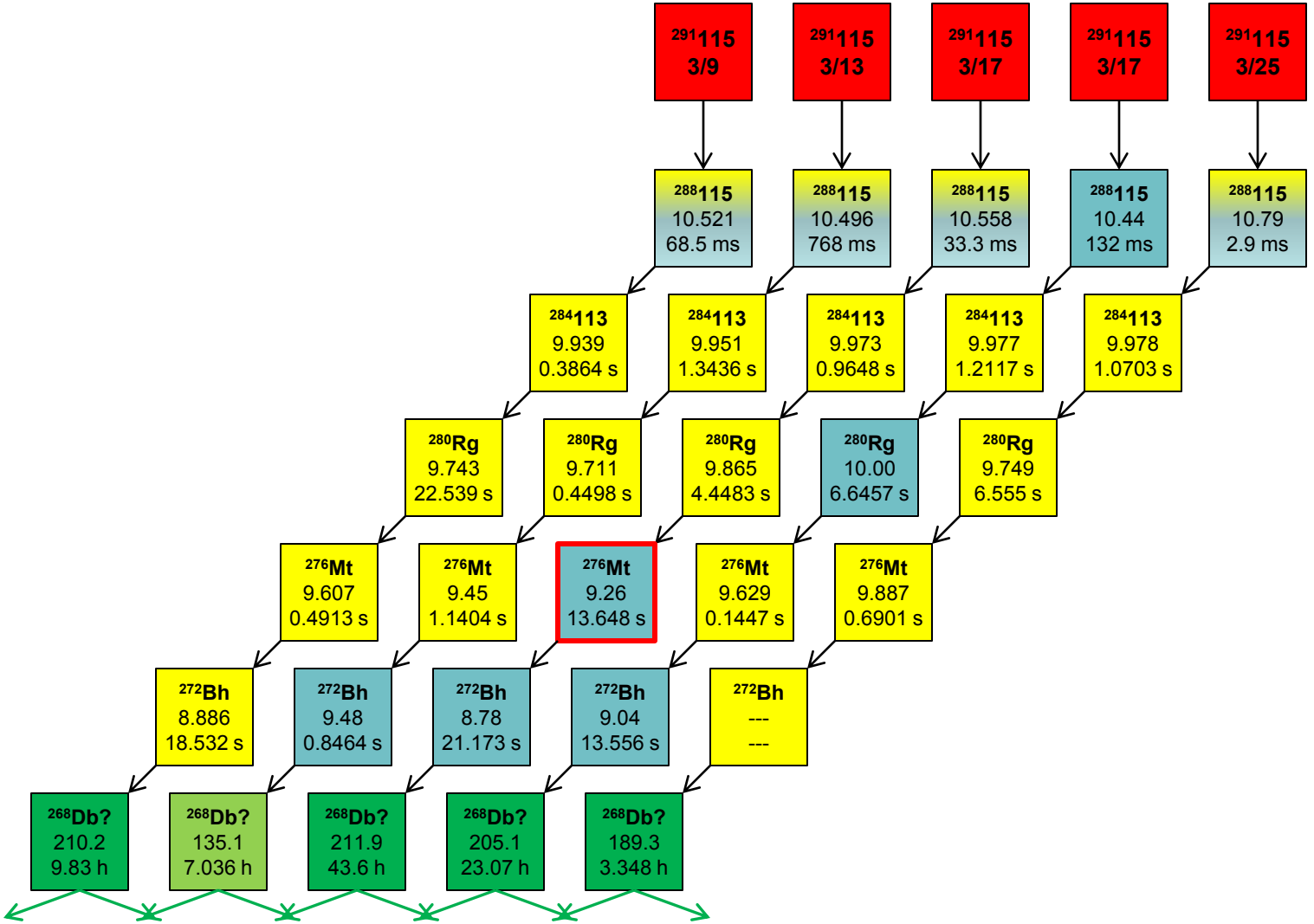
Continue 12/1/2010
^{48}Ca E = 243.3 MeV; E* ~ 36 MeV



Continue 12/18/2010
^{48}Ca E = 239.5 MeV; E* ~ 33 MeV

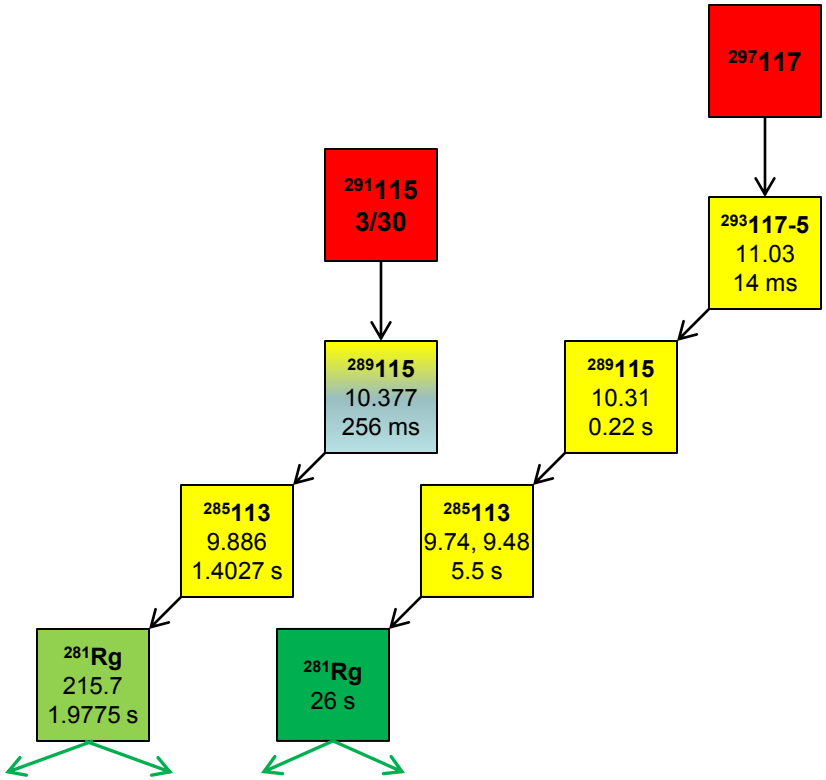


Continue 2/25/2011 with New Target
^{48}Ca E = 239.5 MeV; E* ~ 33 MeV

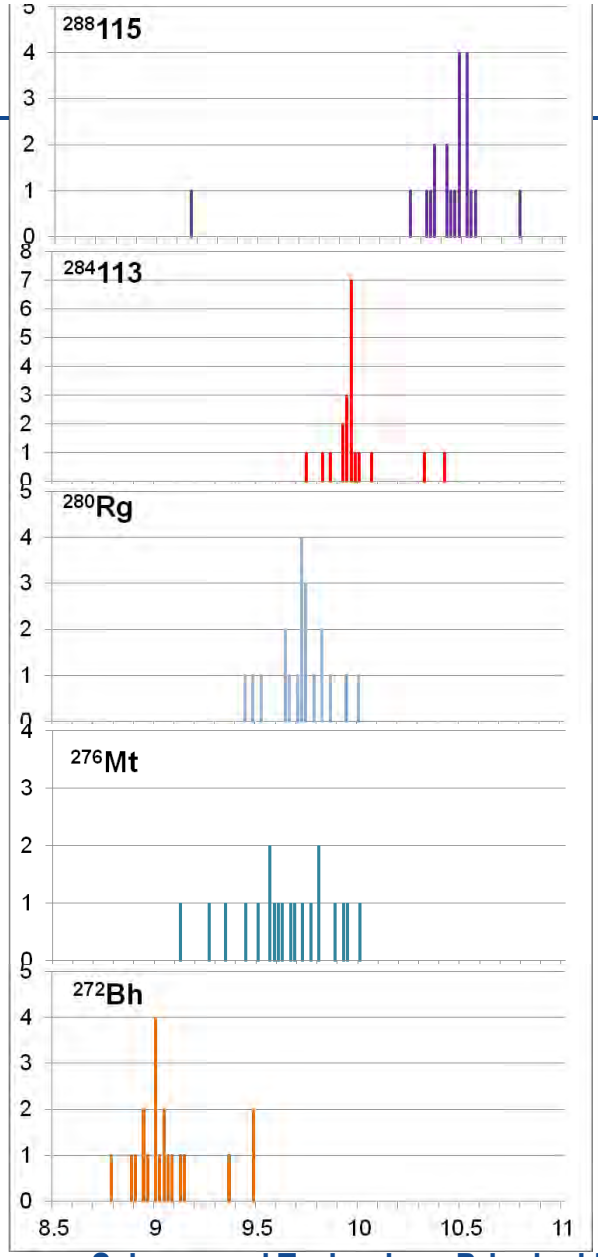


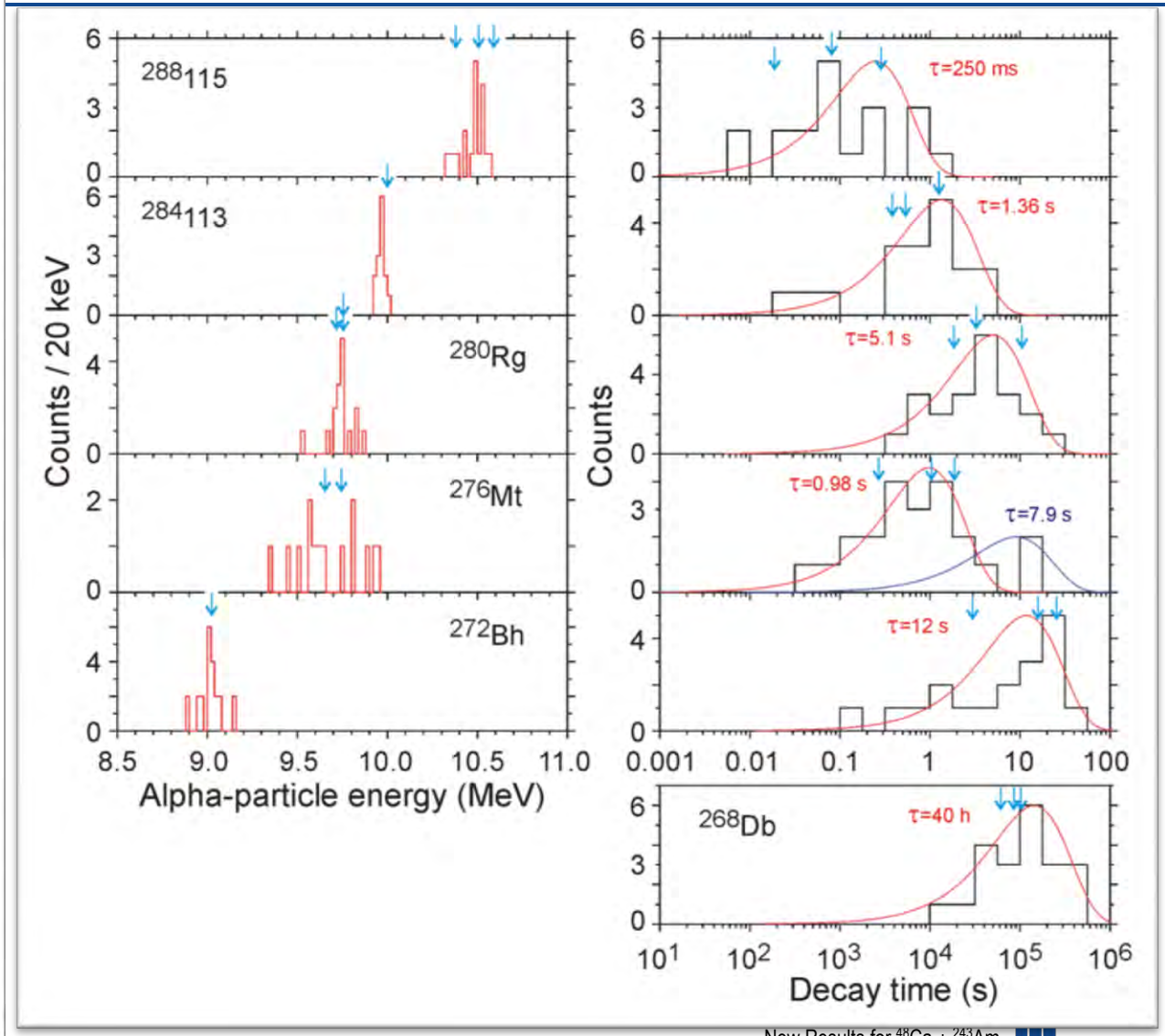
Continue 2/25/2011 with New Target ^{48}Ca E = 239.5 MeV; E* ~ 33 MeV

And finally…

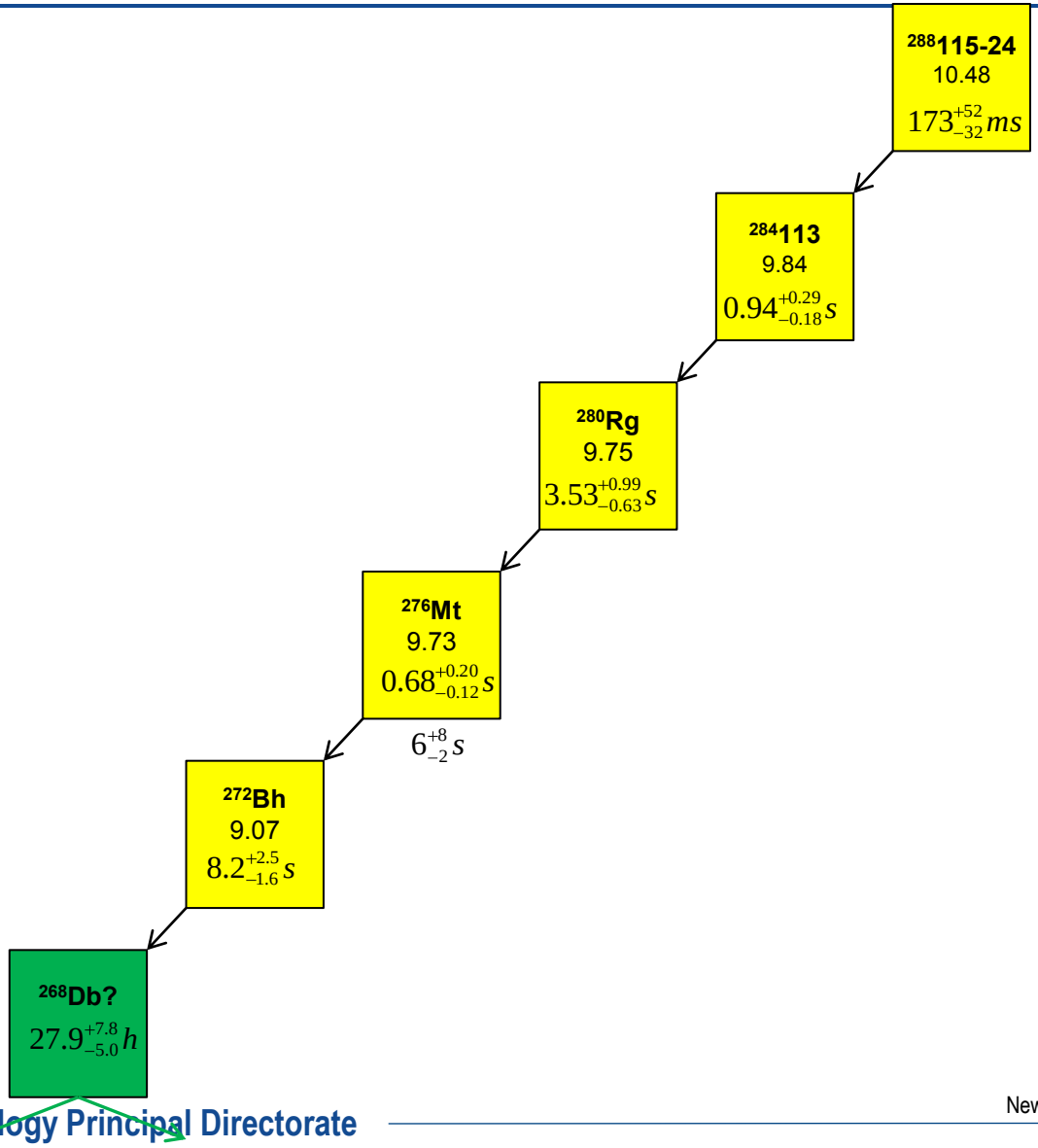


Decay Properties

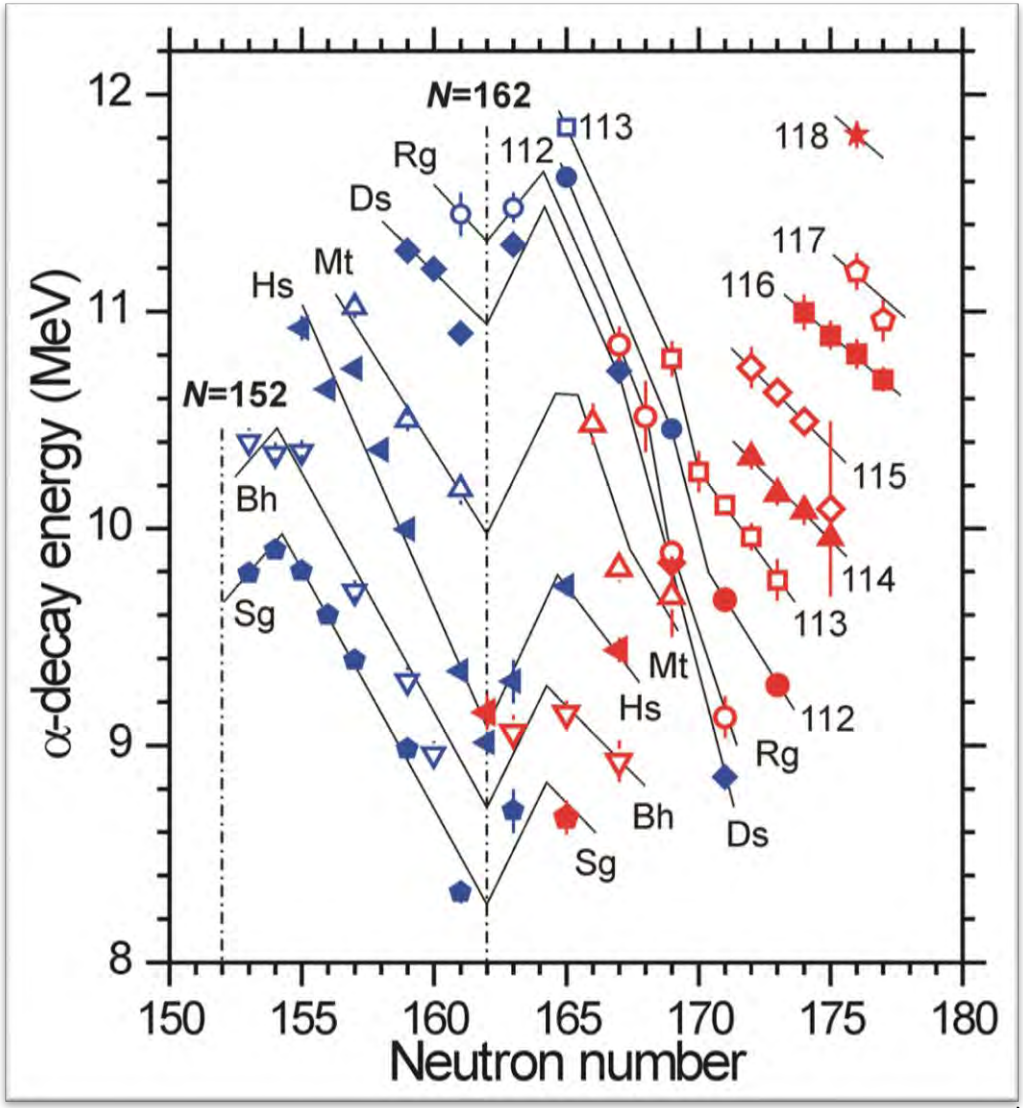




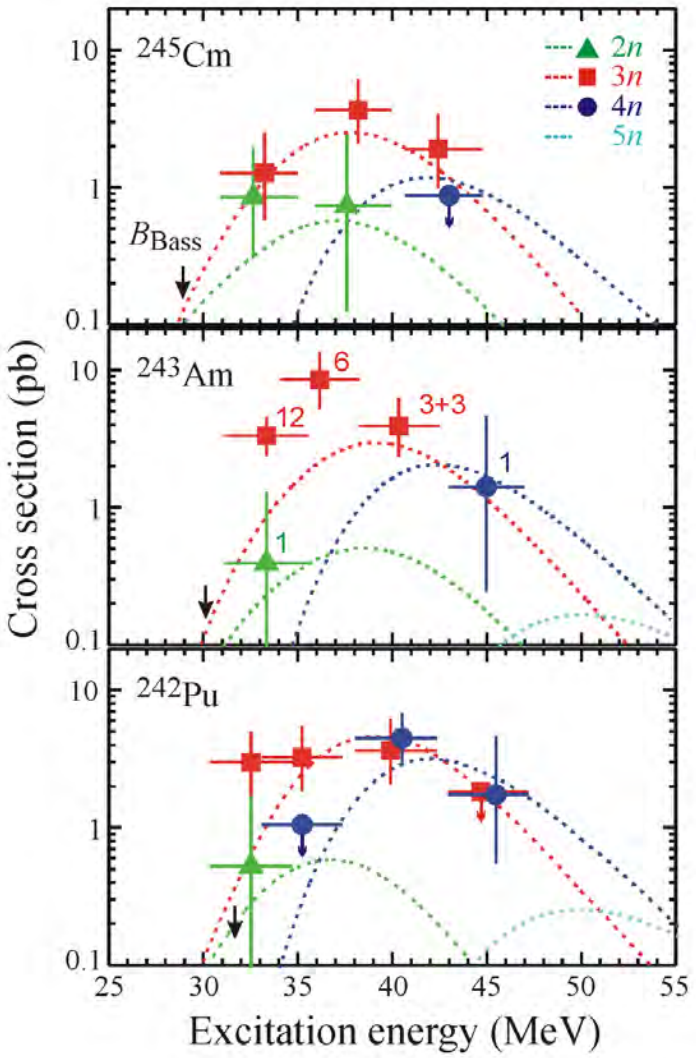
Decay Properties Summary



Decay Properties Summary



Cross sections



Theoretical data from
V. Zagrebaev

Continuation

- Started again on 9/29 – Objectives
  - At least one more 2n event
  - More 4n channel data
  - 5n channel??
- Continue until December shutdown

Acknowledgements

- Russian Foundation for Basic Research Grants # 11-02-12050 & 11-02-12066

- U.S. DOE under Contract DE-AC05-00OR22725 (ORNL); and the Laboratory Directed Research and Development Program at LLNL project tracking code 08-ERD-030 under DOE Contract DE-AC52-07NA27344 (LLNL); Grant # DE-FG-05-88ER40407 (VU)

- ^{243}Am provided by U.S. DOE through ORNL

- Work performed in the framework of the Russian Federation/U.S. Joint Coordinating Committee for Research on the Fundamental Properties of Matter