Department of Physics

Preliminary Results:

UniS University of Surrey Guildford

Rare Isotope Identification-Stopped beam GSI Feb 2006

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RISING

The technique : Fragmentation Isomer Spectroscopy@GSI

- **Production of exotic nuclei relativistic fragmentation of ^{208}Pb, ^{107}Ag and ^{58}Ni on a beryllium target**
- **Identification of the products with the FRS spectrometer**
- **Measurement of the isomeric γ-decay with the RISING Ge Array**

Give access to isomeric states from few hundreds of ns to several hundreds of μs

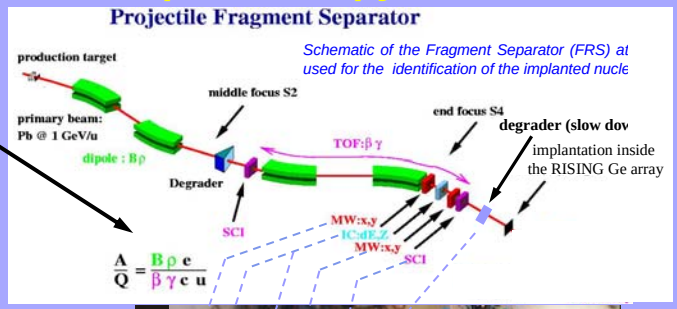
Can be used for both :

- **nuclear reaction mechanism studies (through isomeric ratio)**

One can study how much spin is put in the fragmentation reaction leading to the produced nuclei. Indeed you can see how often the isomeric state is populated. With selection in momentum (trough position selection in the middle focal plane) one can look at this spin population dependence of the transferred momentum.

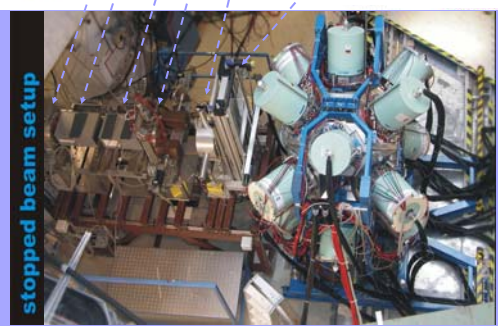
- **nuclear structure (through gamma spectroscopy of isomeric decay)**

The gamma decay scheme of the isomeric state will give structural information, thought classical gamma spectroscopy, of the different levels (spin, parity…).

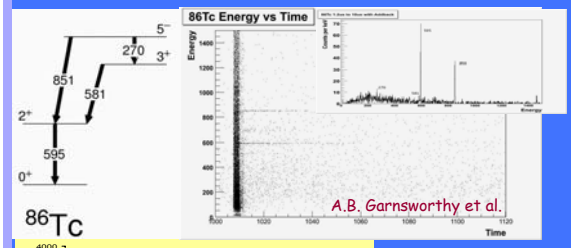


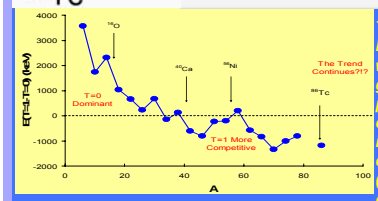
Schematic of the Fragment Separator (FRS) at used for the identification of the implanted nucle

The RISING germanium array is made of 15 Euroball clusters of seven crystals in a packed configurations. The total efficiency is estimated between 11-15%. The energy output was sent to a digital electronic and the timing was given by a analogue electronics.



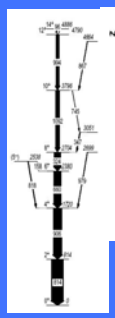
^{86}Tc setting, mapping of the T=0 interaction in N=Z



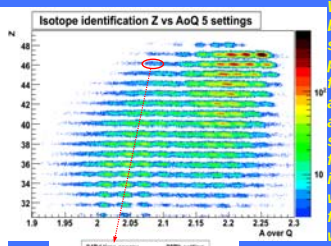


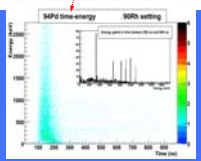
The use of an ^{107}Ag high intensity beam allowed us to produce ^{86}Tc with enough statistics to get gamma-gamma coincidence. We present a preliminary decay scheme of the isomer, which gives information on the T=0 and T=1 coupling in this N=Z nucleus (heaviest N=Z nuclei with known gamma transitions).

Bρ scan with ^{107}Ag beam : study of fragmentation



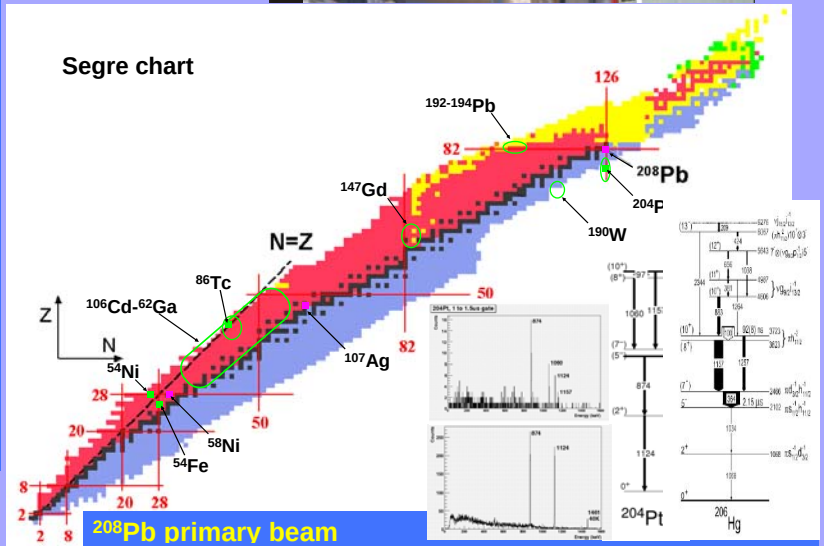
I^{π}=12^{+} isomer N. Marginean et al., PRC67 (2003) 061301





We used one day of beam time to make Bρ scan of the fragments produced by the fragmentation of ^{107}Ag on a Be target, we will be able to get the cross section for all the fragments and the isomeric ratio of the ones with isomers. This is the first systematic study where both the cross section and the isomeric ratio will be determined from the same experimental conditions. They both together should allow us to better understand the way spin is distributed during a relativistic fragmentation reaction.

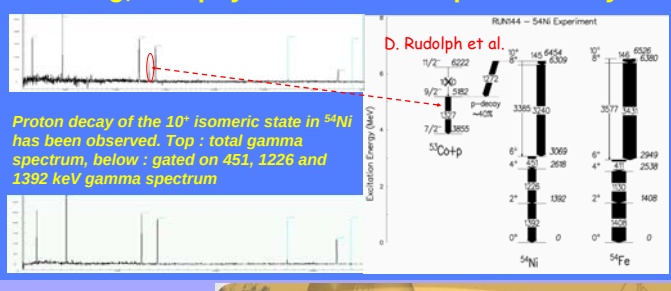
Segre chart



^{208}Pb primary beam

With this beam we made several settings, to study the N=126 shell closure south of ^{208}Pb (first gamma rays from the ^{204}Pt!!) or to study the spin in different fragmentation reaction "cold fragmentation" (204Pt, 206Hg..) or "hot fragmentation" ^{190}Pb and ^{147}Gd (27^{+} isomer in ^{148}Tb populated, highest spin observed in a fragmentation reaction!!!)

^{54}Ni setting, N=Z physics and isomer proton decay



Proton decay of the 10^{+} isomeric state in ^{54}Ni has been observed. Top : total gamma spectrum, below : gated on 451, 1226 and 1392 keV gamma spectrum

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EPSRC Engineering and Physical Sciences Research Council

GSI Gesellschaft für Schwerionenforschung mbH, Darmstadt in der Helmholtz-Gemeinschaft