

# **Onset of Deformation in Neutron-Rich Yttrium Isotopes Studied by the Coulomb Excitation Tagged by the $\beta$ -decay**

*SPES Lol*

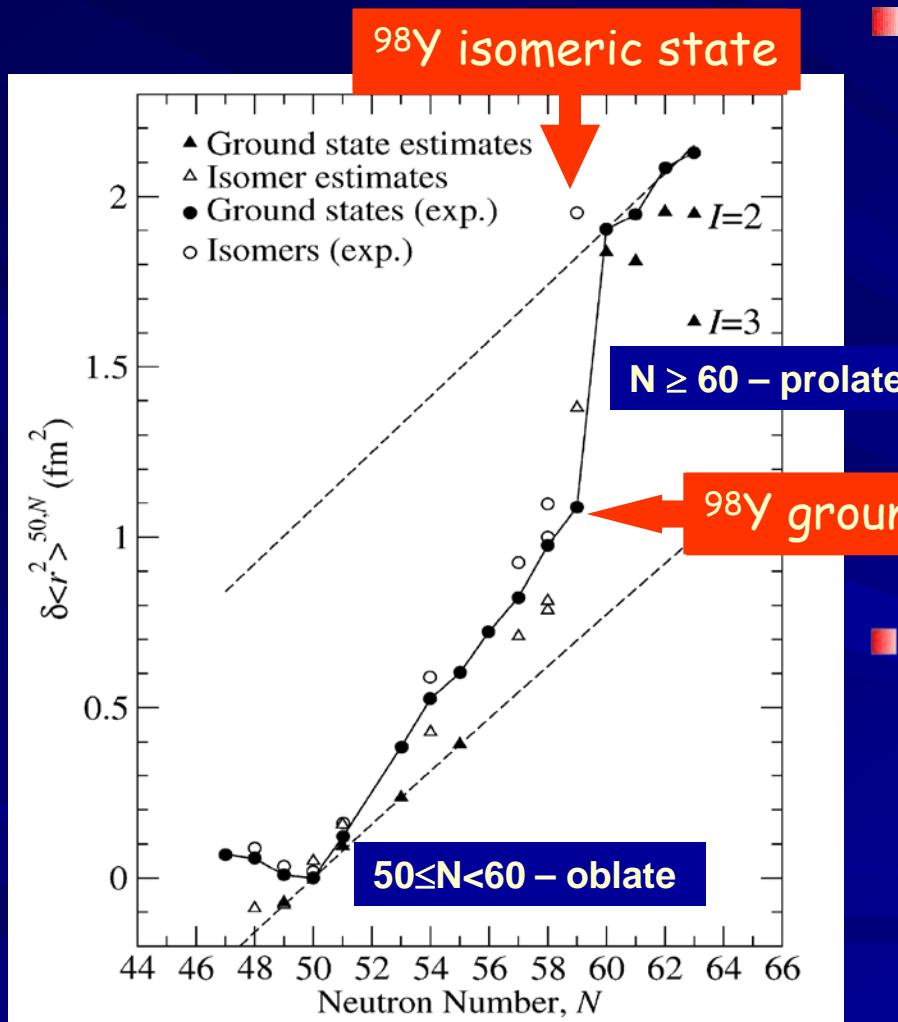
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*SPES2010 workshop  
Legnaro, Italy  
15-17 November 2010*



- **IFJ PAN Kraków:** M. Kmiecik, P. Bednarczyk, M. Ciemała, A. Czermak, B. Fornal, J. Grębosz, A. Maj, M. Ziębliński et al.
- **HIL, Warsaw University:** K. Hadyńska-Kleć, G. Jaworski, P.J. Napiorkowski, M. Palacz, D.A. Piętak, J. Srebrny, K. Wrzosek-Lipska, M. Zielińska et al.
- **Milano University:** G. Benzoni, A. Bracco, F. Camera, S. Leoni, B. Million, O. Wieland et al.
- **IPN Orsay:** M. Niikura, F. Azaiez, D. Beaumel, S. Franchoo, I. Matea, I. Stefan et al.
- **CSNSM Orsay:** G. Georgiev et al.
- **LNL Legnaro:** G. de Angelis, J.J. Valiente-Dobon, E. Sahin, A. Gottardo, D. Napoli et al.
- **GANIL:** O. Sorlin, G. de France, E. Clement, Ch. Schmitt, J.P. Wieleczko, K. Mazurek et al.
- **GSI:** M. Górska, J. Gerl et al.
- **IFIC Valencia:** A. Gadea et al.

# Onset of deformation in $\gamma$ isotopes



- nuclear charge radii differences and electric quadrupole moments in ground states of  $^{86-90},^{92-102}\gamma$  and isomeric states of  $^{87-90},^{93,96,97,98}\gamma$  studied using laser spectroscopy
- The experimental charge radii for  $\gamma$  isotopes compared to estimates that were obtained by assuming static  $\beta_2$  deformation alone. The two dashed lines correspond to calculations made assuming deformation parameters  $\beta_{\text{rms}} = 0$  and  $0.43$

B. Cheal et al., Physics Letters B 645, 133 (2007)

# We propose to look at this problem of deformation change and shape coexistence from $\gamma$ -spectroscopy point of view

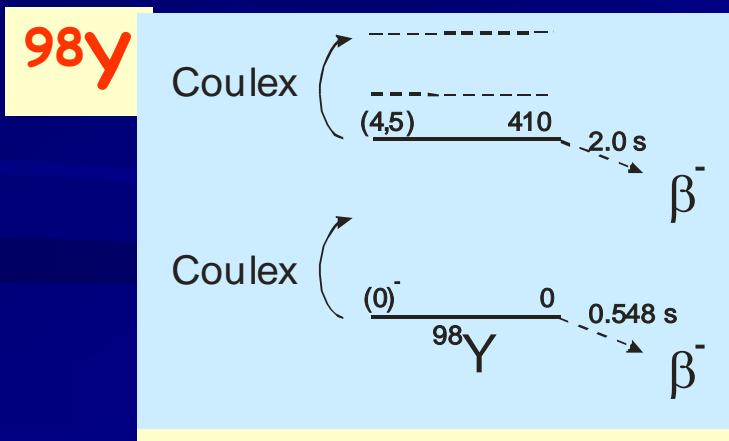
## ■ Method:

Coulomb excitation of  $^{88-102}\text{Y}$  isotopes ( $N=50-63$ ) in g.s. and isomeric state (produced in SPES), tagged by  $\beta$ -decay ( $T_{1/2} \approx 1$  s)  
 $B(E2)$  measurement

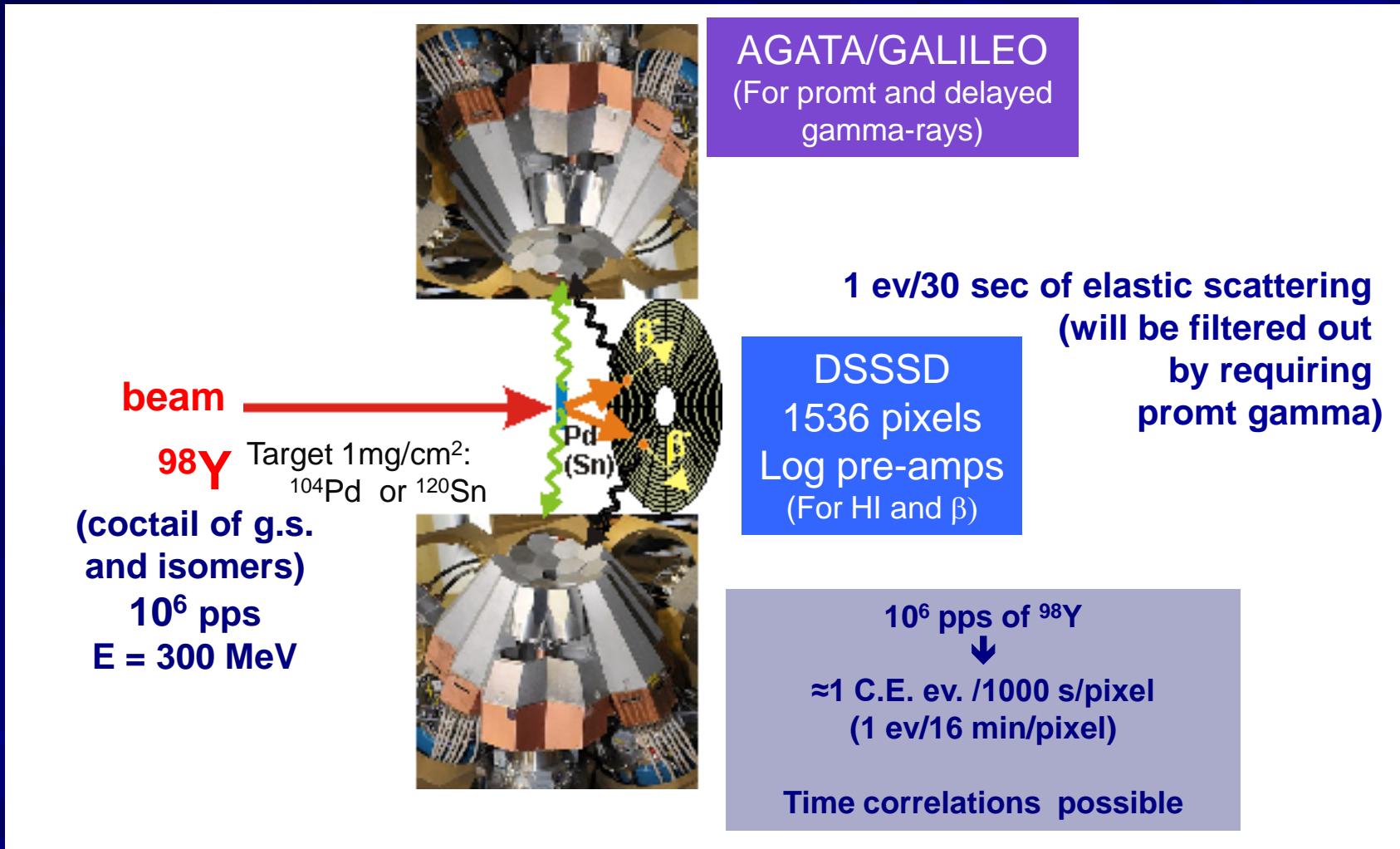
## ■ Beams:

$10^4 - 10^8$  particles/s,  $\approx 3$  MeV/u

## ■ The $^{98}\text{Y}$ case:

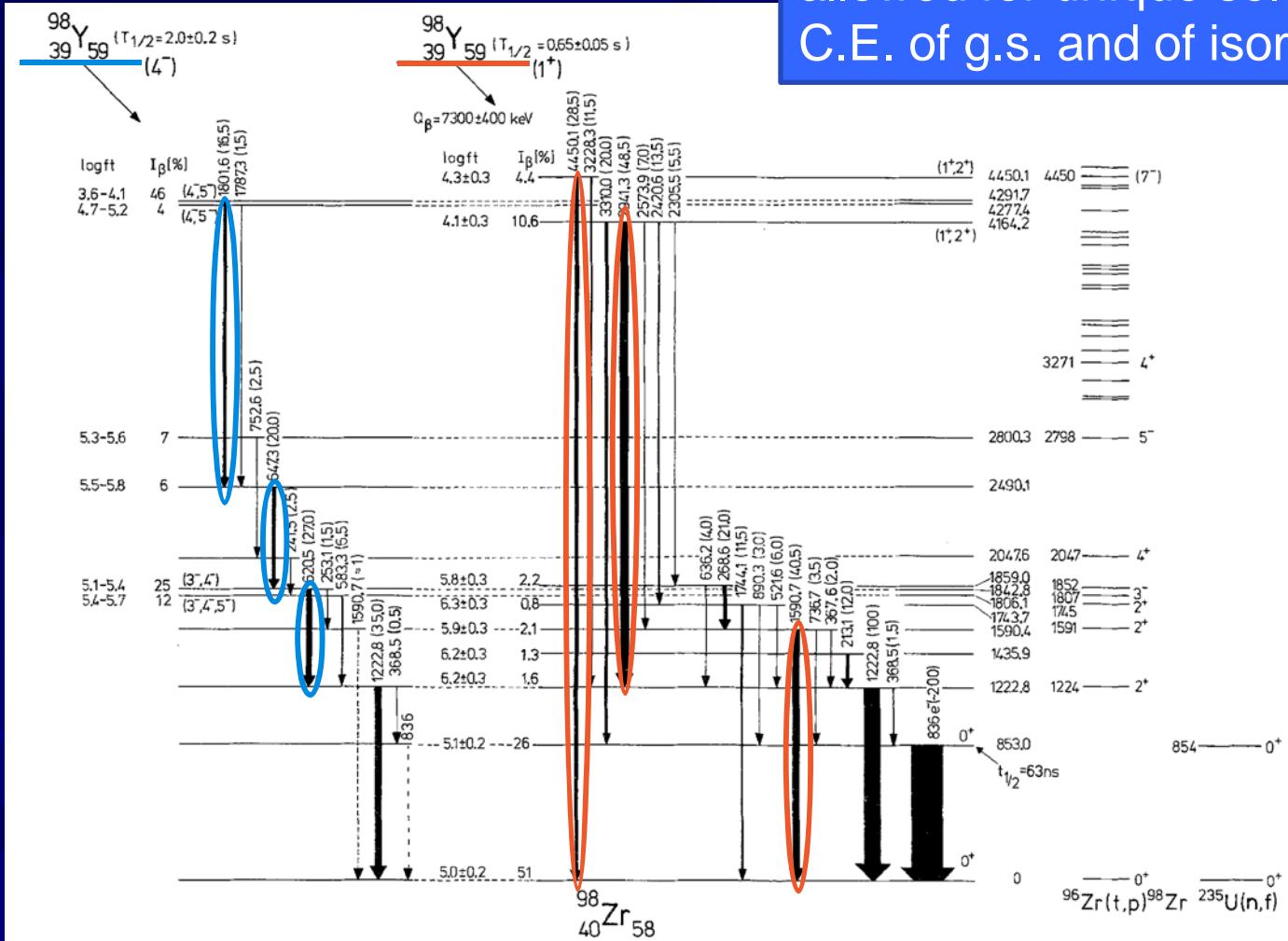


# Experimental setup



# $^{98}\text{Y}$ decay

K. Sistemich et al., Z. Physik A 281, 169 (1977).



Different  $\gamma$ -cascades after  $\beta$ -decays allowed for unique selection of C.E. of g.s. and of isomeric state

- $B(E2)$ -values from Coulomb excitation of  $^{88-102}\text{Y}$  isotopes, tagged by the  $\beta$ -decay, can give information on the onset of deformation in  $N \geq 60$  nuclei (both in g.s. and isomeric states) and on the nature of shape coexistence in  $^{98}\text{Y}$
- Beams available for SPES will be good for such studies
- Similar studies in more neutron-rich Y isotopes will be possible with SPIRAL2
- Highly efficient and segmented  $\gamma$ -ray arrays needed → AGATA (or GALILEO)