

Simulation tool for lifetime measurements

D. Mengoni

Università e Sezione INFN di Padova, Italia.

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Outline

1 Experiment

- Apparatus
- Working principle

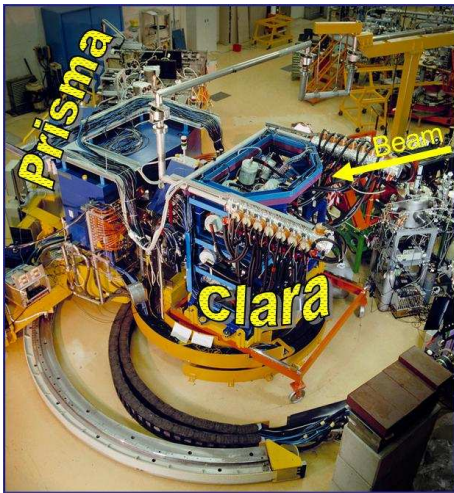
2 Simulation

- Framework
- Event generator
- Results

3 Conclusion



CLARA-PRISMA set-up



CLARA: 25 Euroball clovers

- Efficiency $\sim 3\%$ (E_γ 1.3 MeV) $\rightarrow 1\%$
- P/T $\sim 45\%$
- FWHM ~ 10 keV ($v/c=10\%$) $\rightarrow 6$ keV

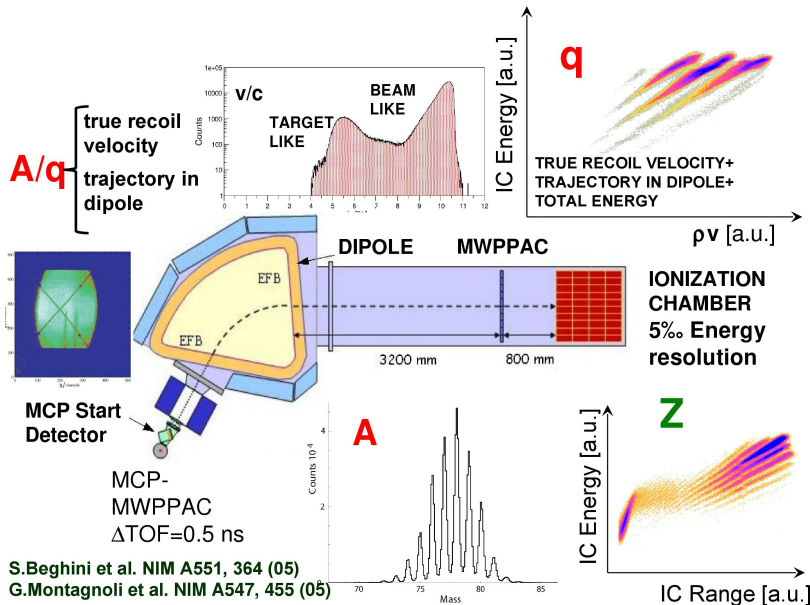
A. Gadea *et al.*, Eur. Phys. J. **A20** (2004) 193.

PRISMA: magnetic spectrometer

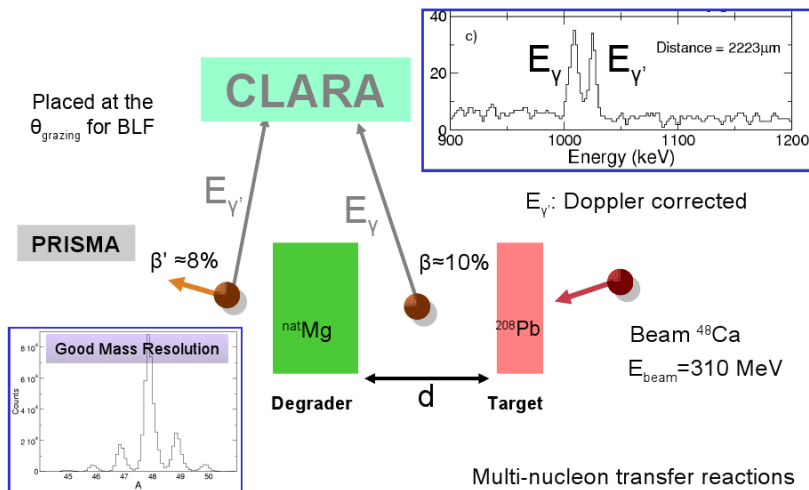
- Solid angle ~ 80 msr
- Mom. acceptance $\pm 10\%$
- Maximum rigidity 1.2 Tm
- Energy resolution 1/1000
- Mass resolution 1/300 FWHM

A.M. Stefanini *et al.*, Nucl. Phys. **A701** (2002) 109c.

Tracking of PRISMA

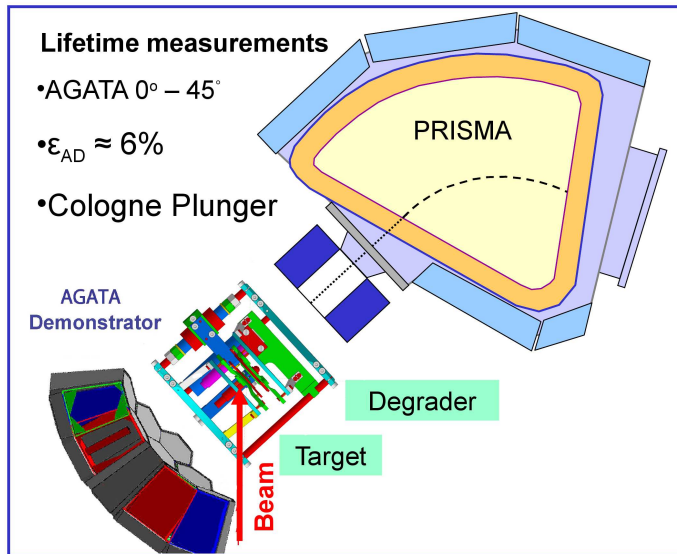


Working principle



J.J. Valiente, D. Mengoni et al., LNL An.Rep. 2007.

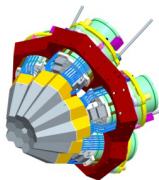
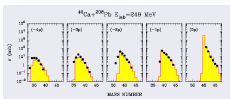
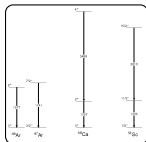
AD-PRISMA set-up



Framework

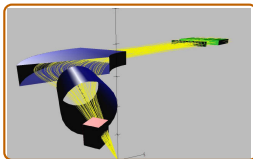
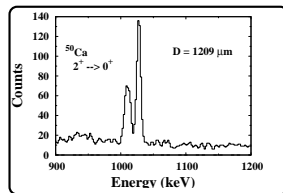
Realistic physics

C code
generator



PSA

Tracking



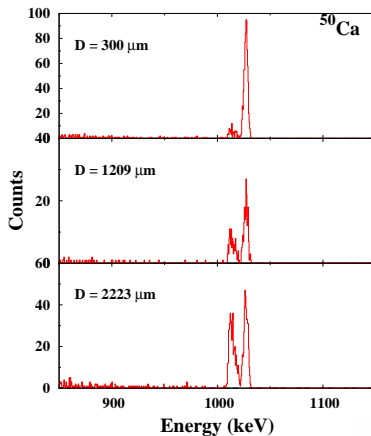
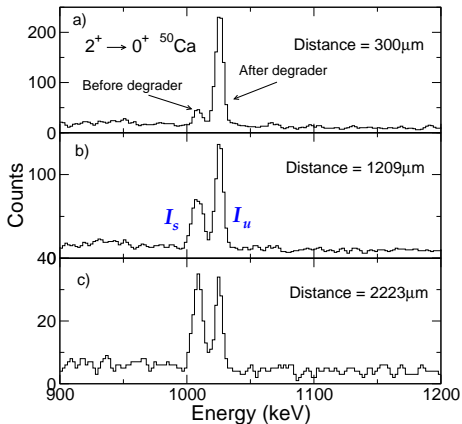
Event generator

- Two information streams: gammas towards the AD and projectile-like heavy nuclei towards PRISMA.
- Inclusion of target-degrader effect: effective thickness of the degrader.
- Velocity of the ion derived from the exp. one measured in PRISMA.
- Output format: fully compatible with AGATA.
- Stand-alone PRISMA tool: trajectory reconstruction, stopping power, AGATA input format, output suitable for tracked gammas merging.
- <http://agata.pd.infn.it>, <http://www.lnl.infn.it/~docserv/>



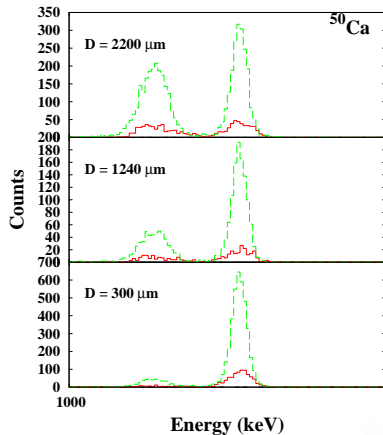
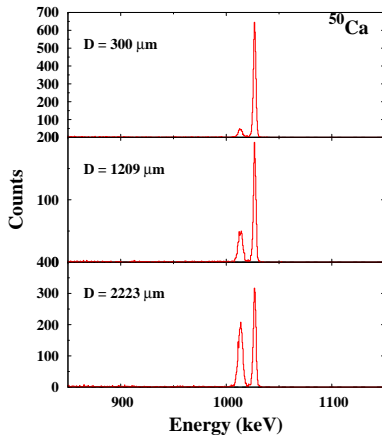
The ^{50}Ca case: CLARA-PRISMA

Comparison between simulated and experimental data ($\tau \sim 100$ ps)



The ^{50}Ca case: AD-PRISMA

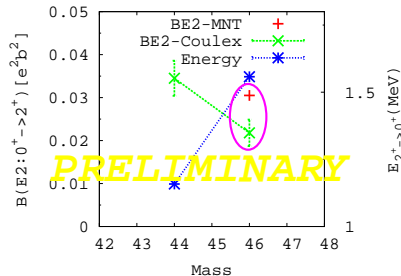
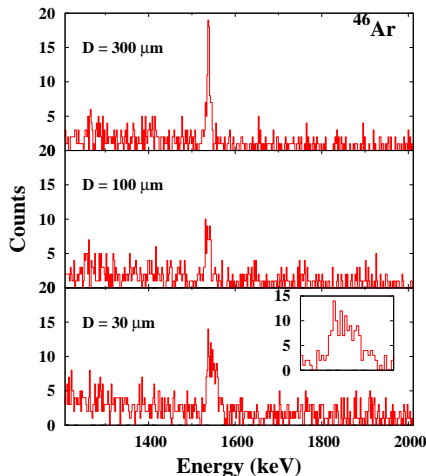
Comparison between simulated and experimental data



^{46}Ar lifetime derivation

Weakening of $N=28$?

fully shifted peak for $D=30\mu\text{m}$ (short lifetime) \Rightarrow simulation!



H. Scheit *et al.*, Phys. Rev. Lett **77** (1996) 3967.

Outlook and Conclusions

- The novel method for lifetime measurement in neutron-rich nuclei can be successfully simulated.
- Possibility to fully simulate experiment: ^{52}Ca with the AD + PRISMA + Köln Plunger (LoI already submitted.)
- Derivation of lifetime otherwise impossible to extract from exp. data.

... near future

Two body MNT generator: selected nucleus and angle using a given input file (grazing code) including cross section for a selected channel.

