Experimental Proposal: *E073*

- Title "Electron Screening and Alpha-Decay"
- Spokesperson:

  A. Musumarra, INFN-LNS & University of Catania
- GSI Contact Person:

  C. Nociforo, GSI
- Year of Approval: June 2006
- Shifts: 41 approved (main)

  10 used (main, only FRS-S4)

  31 left (main)

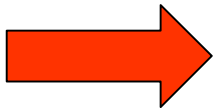
Physical motivation

- Search for evidence of electron screening effects in alpha-decay by modifications in lifetimes and Q_α-values of fully stripped, H-like, He-like α-emitters → faced only theoretically !

Z. Patyk, H. Geissel, Yu. A. Litvinov, A. Musumarra, C. Nociforo
Phys. Rev. C 78, 054317 (2008)

First step: test the technique for (re)measuring neutrals at FRS

selected

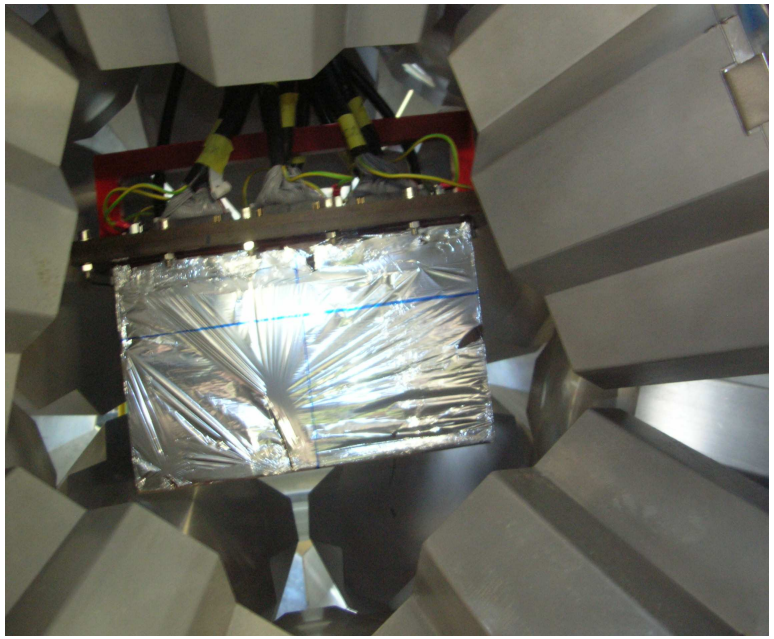


	$T_{1/2}$	α-branch	Q_α(MeV)
^{213}Fr	34.6 s (3)	99.45%	6.905

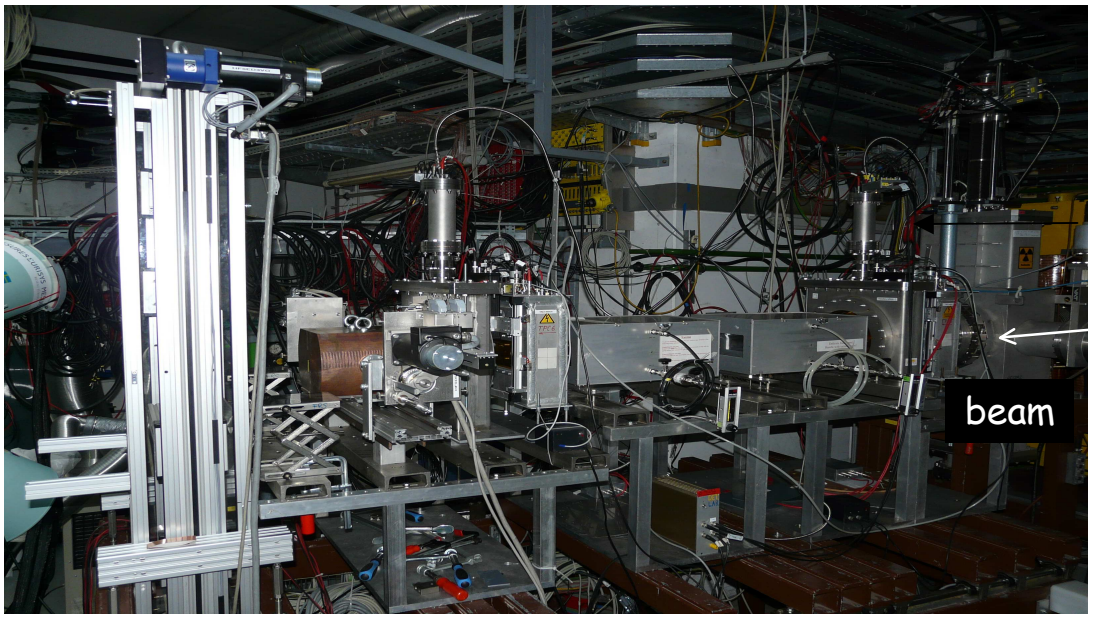
E073 Test beam (April 2008)

10 shifts @FRS-S4 ^{238}U@1GeV·A slow extraction

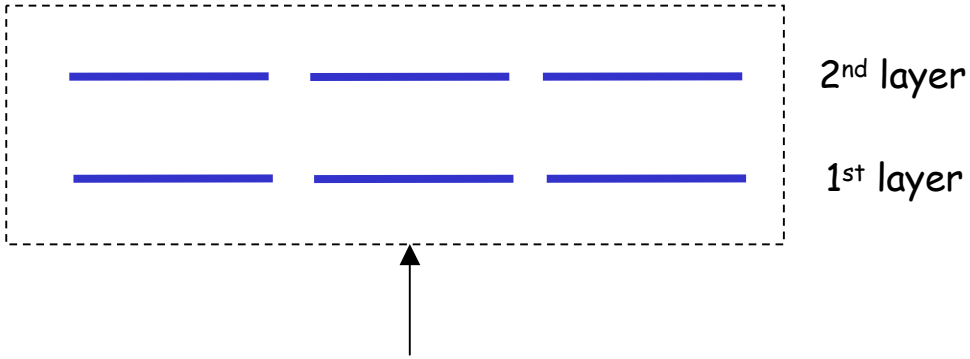
DSSSD RISING
implantation set-up



S4-FRS focal plane



KUMAR et al. NIM A 598(2009)754



E073 test: main achievements in April 2008

* Test of the implantation/decay technique on Silicon (^{213}Fr , ^{214}Ra)

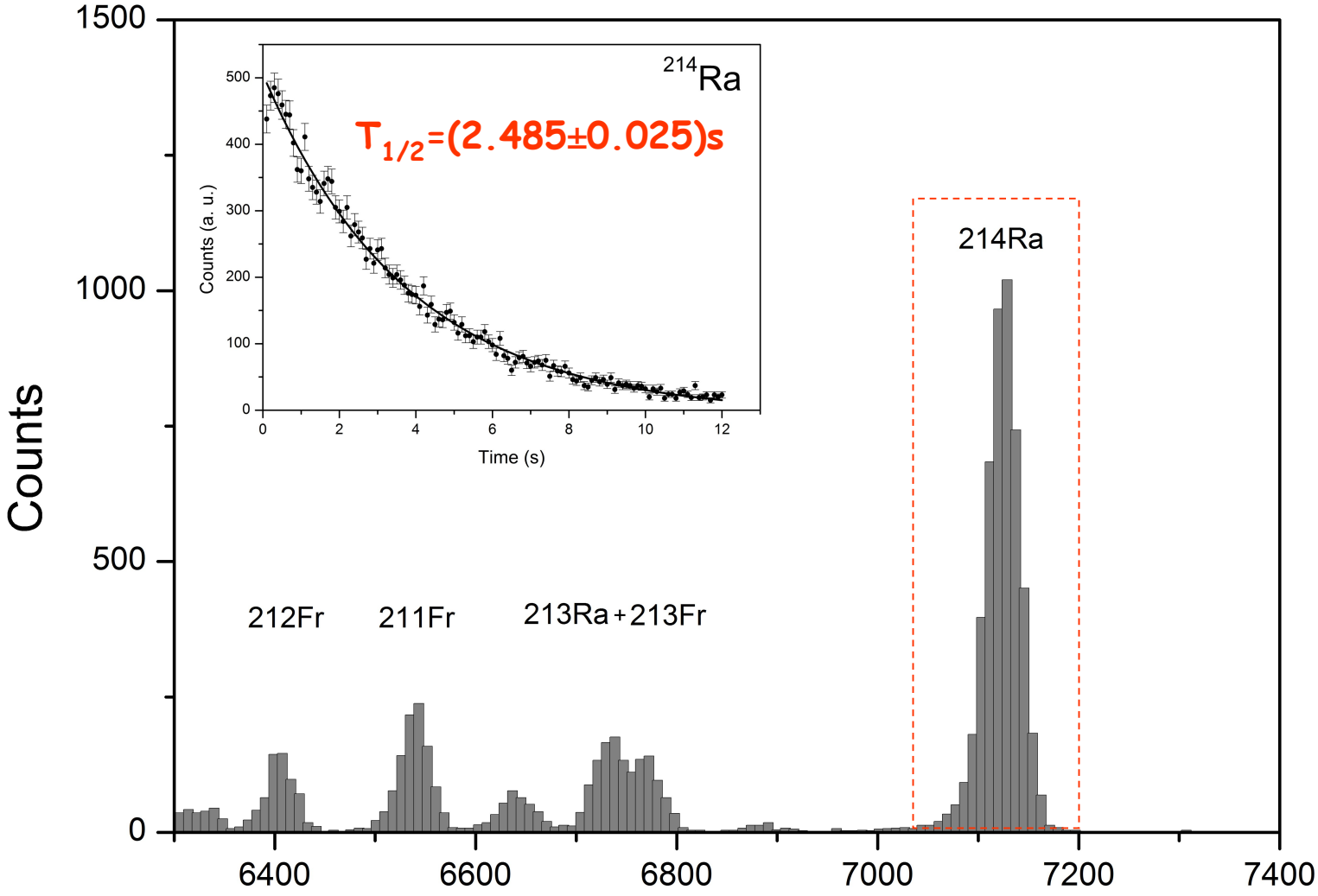
* High precision α–decay lifetime measurement achieved

* Reliability and effectiveness of γ-decay tagging for nuclide identification

* By product: contemporary gamma measurement during the run (RISING Ge-Array)

Presented to NSD 09 Croatia

^{214}Ra
Improved $T_{1/2}$ determination



Accepted value

^{214}Ra: $T_{1/2}$=2.460 ± 0.030 s

To be published...

Next: Bare nuclide measurement in the ESR

31 shifts remain

Will ^{238}**U** be available on 2010 ?

We ask *18 shifts* for FRS settings and **Schottky** measurements.

ESR Electron and Stochastic cooling required.

1) FRS setting (^{213}**Fr**$^{87+}$**@400 MeV/u**) : high purity required

2) ESR setting : count how many α–daughter (^{209}**At**) remain after decay in ESR

Many particles decay measurement

Single particle decay measurement by daughter decay tagging

Summary E073

- *Beam time required in 2010:*

18 shifts of U^{238} @600-400 MeV/u

intensity 10^9 pps

  - *4 shift:* FRS tuning for ^{213}Fr.
  - *14 shifts:* for **Schottky** measurements in the ESR.

Electron Screening effects on α-decay

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