

# Experimental Proposal E073: Electron Screening and alpha-decay

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- Year of Approval: 2006
- Shifts: 41 approved (main) , 0 used

# Physics Motivation

- Search for evidence of electron screening effects in alpha-decay by **modifications** in lifetimes and  $Q_\alpha$ -values of fully stripped, H-like, He-like  $\alpha$ -emitters  $\rightarrow$  **faced only theoretically !**

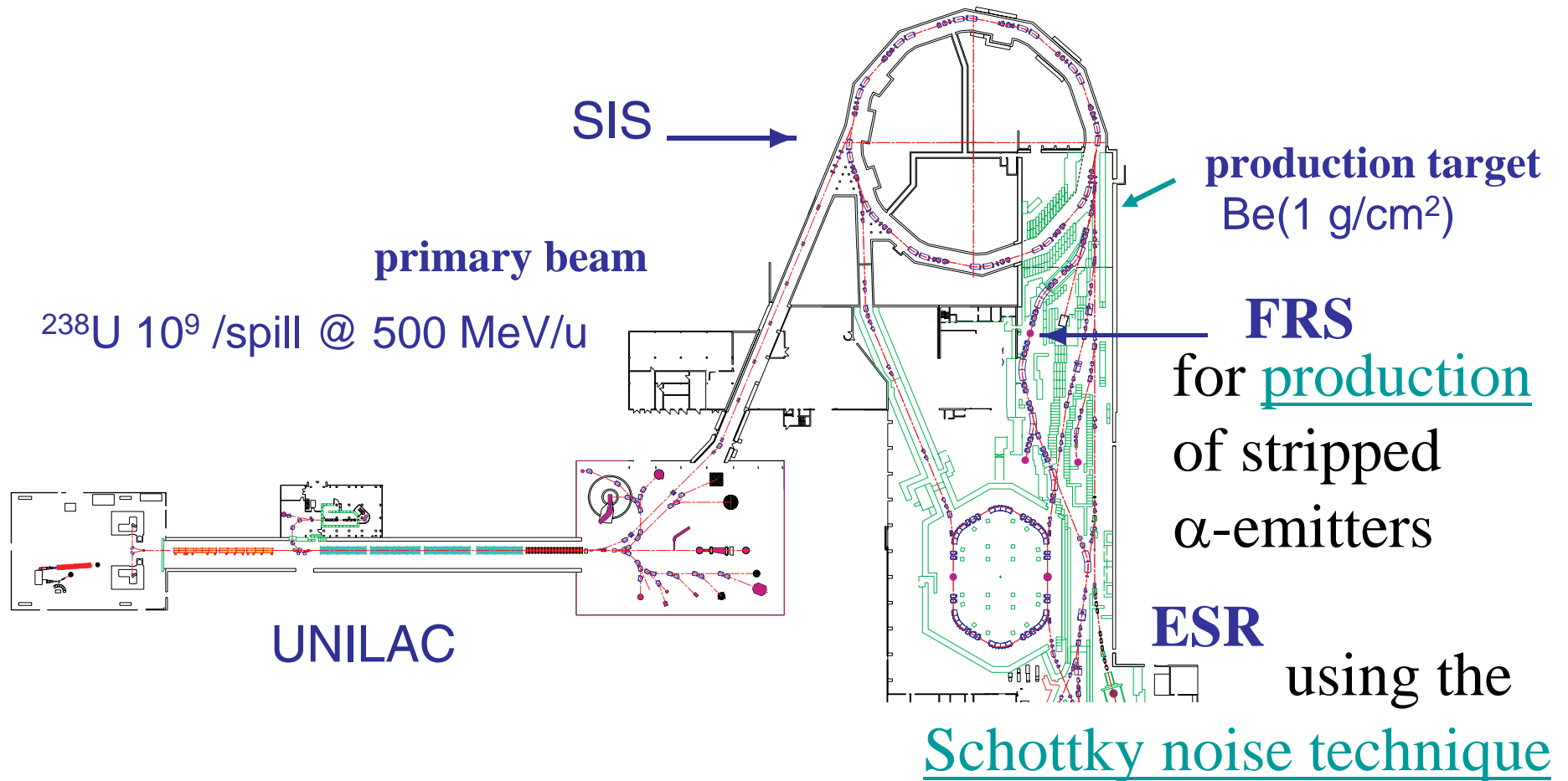
- **Selected cases :**

Nucleus	$T_{1/2}$	$\alpha$ -Branch (%)	$Q_\alpha$ (MeV)	$U^{\text{al}}$ (keV)
$^{213}\text{Fr}^{87+}$	34.6 s (3)	99.45	6.905	38.0
$^{220}\text{Fr}^{87+}$	27.4 s (3)	99.65	6.801	38.0
$^{212}\text{Rn}^{86+}$	23.9 m (12)	100	6.385	37.3



Matching ESR storage time

# Experimental method



## Standard techniques

*H. Geissel et al., NIM B70, 286 (1992)*

*F. Bosh, J. Phys. B 36, 585 (2003)*

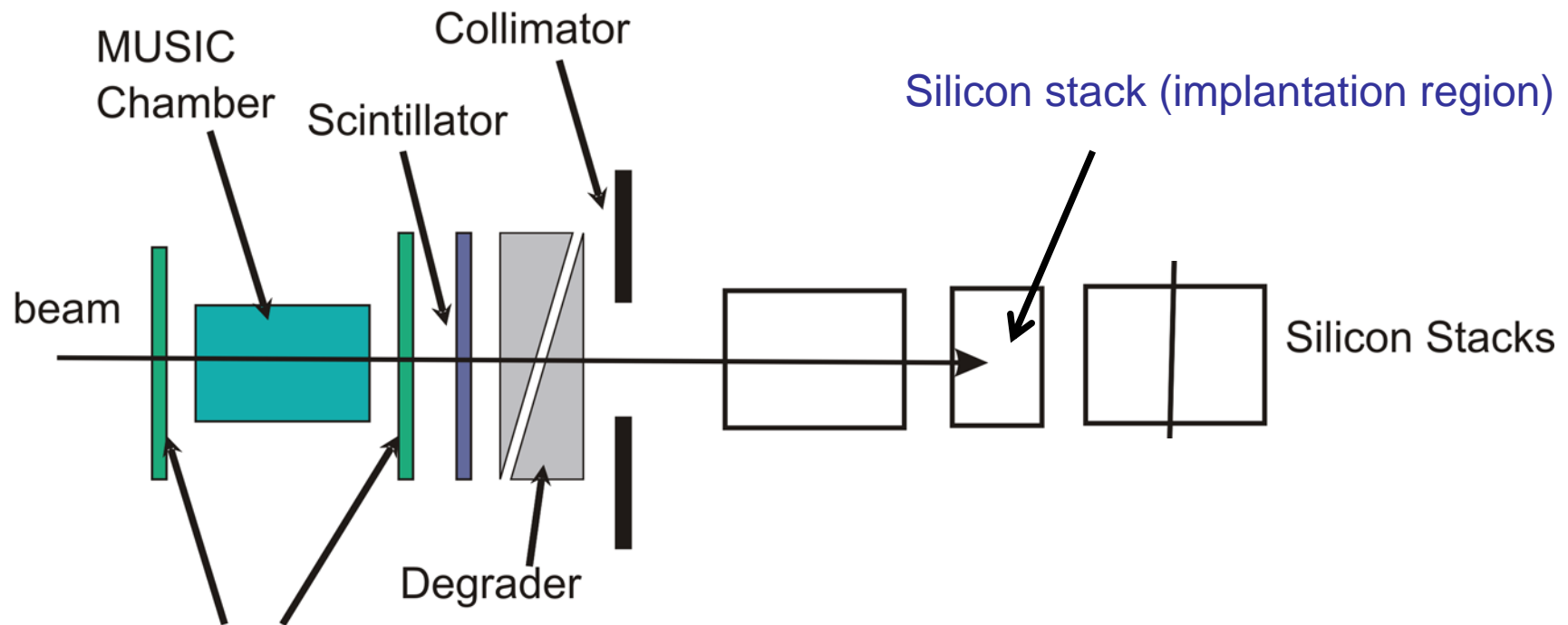
# Beam planning

1. FRS (S4) : (re)measuring neutral halflives of  $^{213}\text{Fr}$  at the implantation setup at the final focal plane (rate kept  $<10^2/\text{s}$ )

The equipment at the second half of the separator is partially available → same like S323 exp (save setup mounting time)

→ 9 Shifts slow-extracted  $^{238}\text{U}$  beam after July 2008

# Implant-decay setup at S4



Multiwire  
Proportional  
Counter (MWPC)  
or Time Projection  
Chamber (TPC) detectors

Presence at mid-focal plane of  
**Al** ( $730 \text{ mg/cm}^2$ ) **wedge**  
instead of the reaction target

# Beam planning

... without changing anything in the first half of the separator

2. FRS (ESR) : lifetime measurements of injected  $^{213}\text{Fr}^{86,87+}$  ( $\sim 600/\text{spill}$ ) by observation of the disappearance of the mother and the appearance of the daughter nuclei  $\rightarrow$  9 Shifts of  $^{238}\text{U}$  fast-extracted beam anytime in 2008

In total we request 18 Shifts  $^{328}\text{U}$  beamtime for 2008