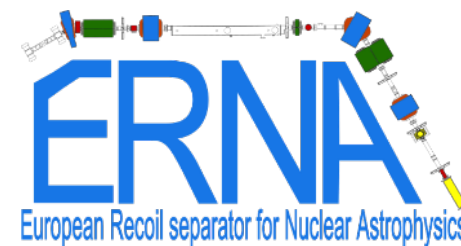


Half-life of ^7Be in different environments and different charge states

- *Raffaele Buompane*
- *Università degli Studi della Campania “Luigi Vanvitelli” and INFN Naples*
- *ERNA and AsBeST collaborations*

AS Be ST

A 7-Beryllium electron capture STudy for nuclear and solid state physics



Istituto Nazionale di Fisica Nucleare



Università
degli Studi
della Campania
Luigi Vanvitelli

Dipartimento di Matematica e Fisica

^7Be Electron Capture decay to ^7Li

The study of the ^7Be decay rate in ionized state would provide information on beta-decay matrix element.

The triple ionized state of the ^7Be is an hydrogenoid atom with a well know electronic wavefunction.

$$t_{1/2} = \kappa / f_0 \xi$$

$$\xi = B_F + B_{GT}$$

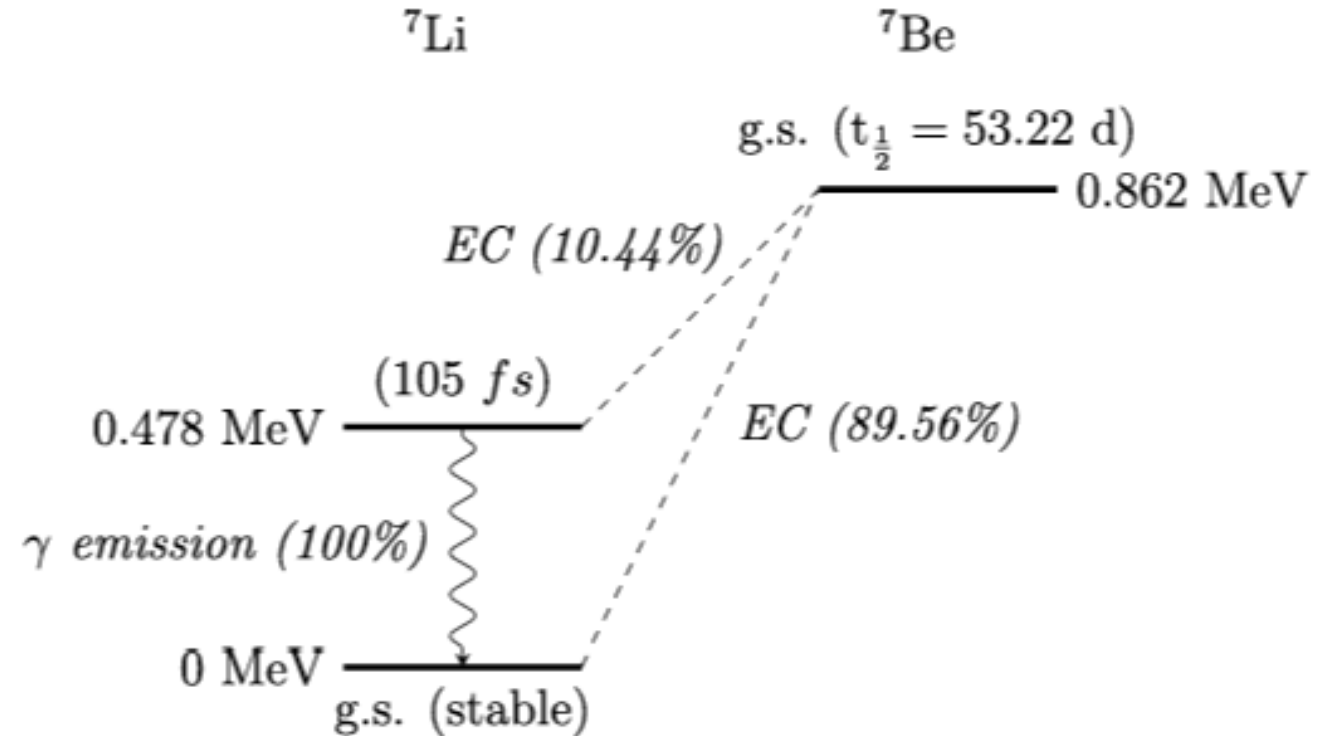


Figure 1. Decay scheme for the ^7Be nucleus from ground state.

The phase space factor f_0 is determined by the environmental conditions

- ionization state
- chemical bounds

How can we change f_0 in a laboratory?

In solid state environments

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della Campania
Luigi Vanvitelli

Dipartimento di Matematica e Fisica

di Università di Salerno
in Dipartimento di
Ingegneria Industriale

INFN
LNGS

In ions

INFN
ROMA

IMM Institute for
Microelectronics and
Microsystems

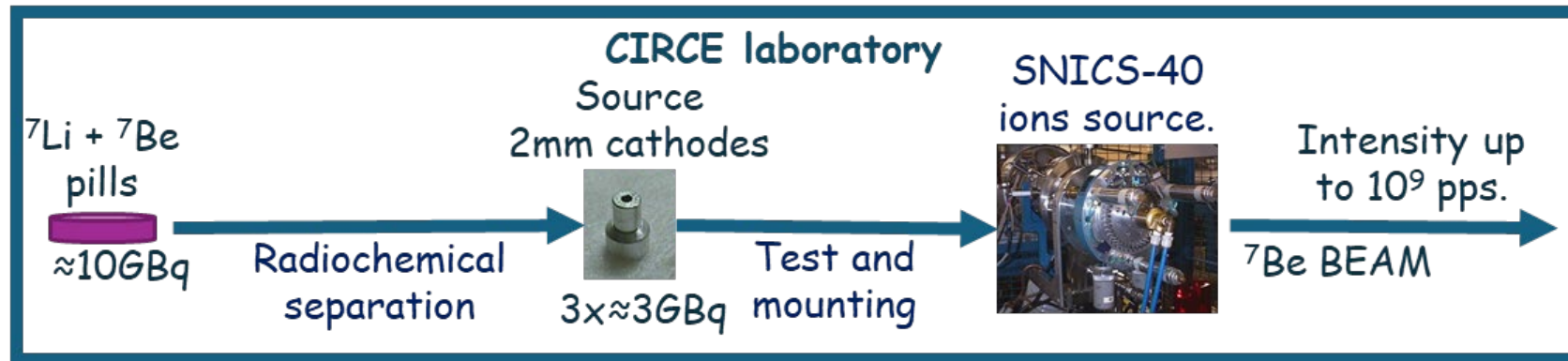
Radiochemistry Lab.

Tandem – Pelletron 3MV

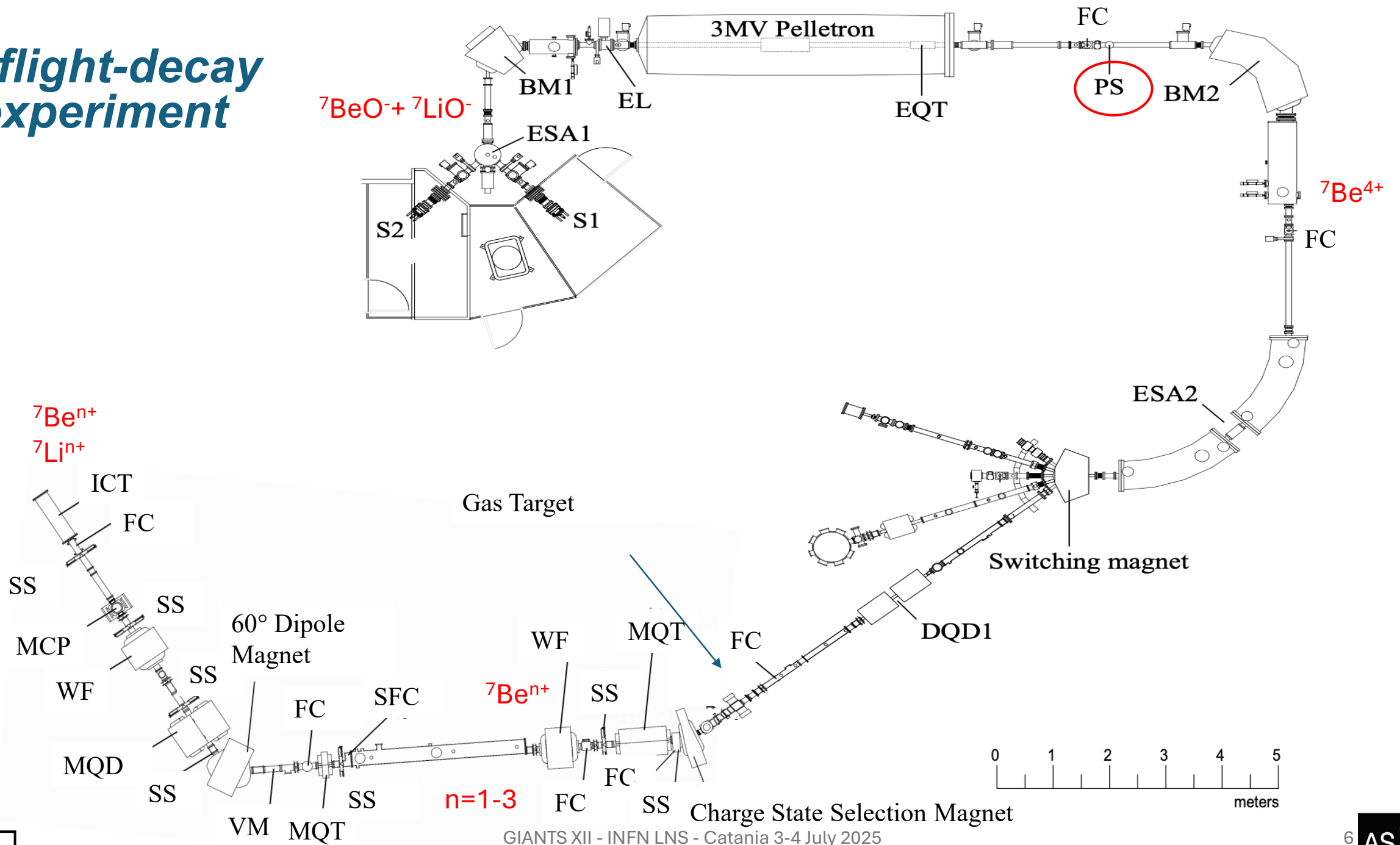
ERNA – European Recoil separator for Nuclear Astrophysics



Off line ^7Be production via $^7\text{Li}(p,n)^7\text{Be}$



In flight-decay experiment



GIANTS XII - INFN LNS - Catania 3-4 July 2025

In flight-decay experiment

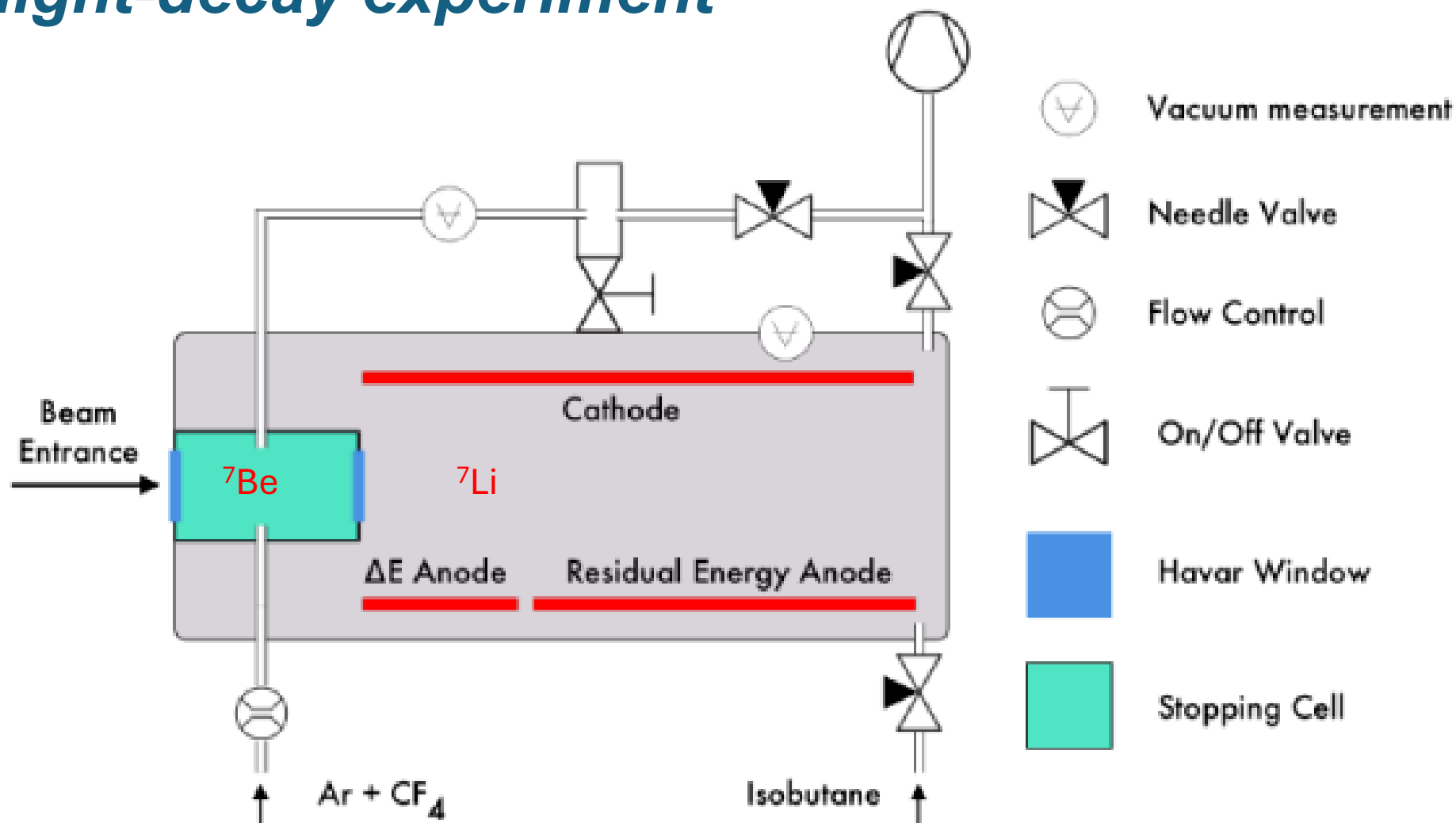
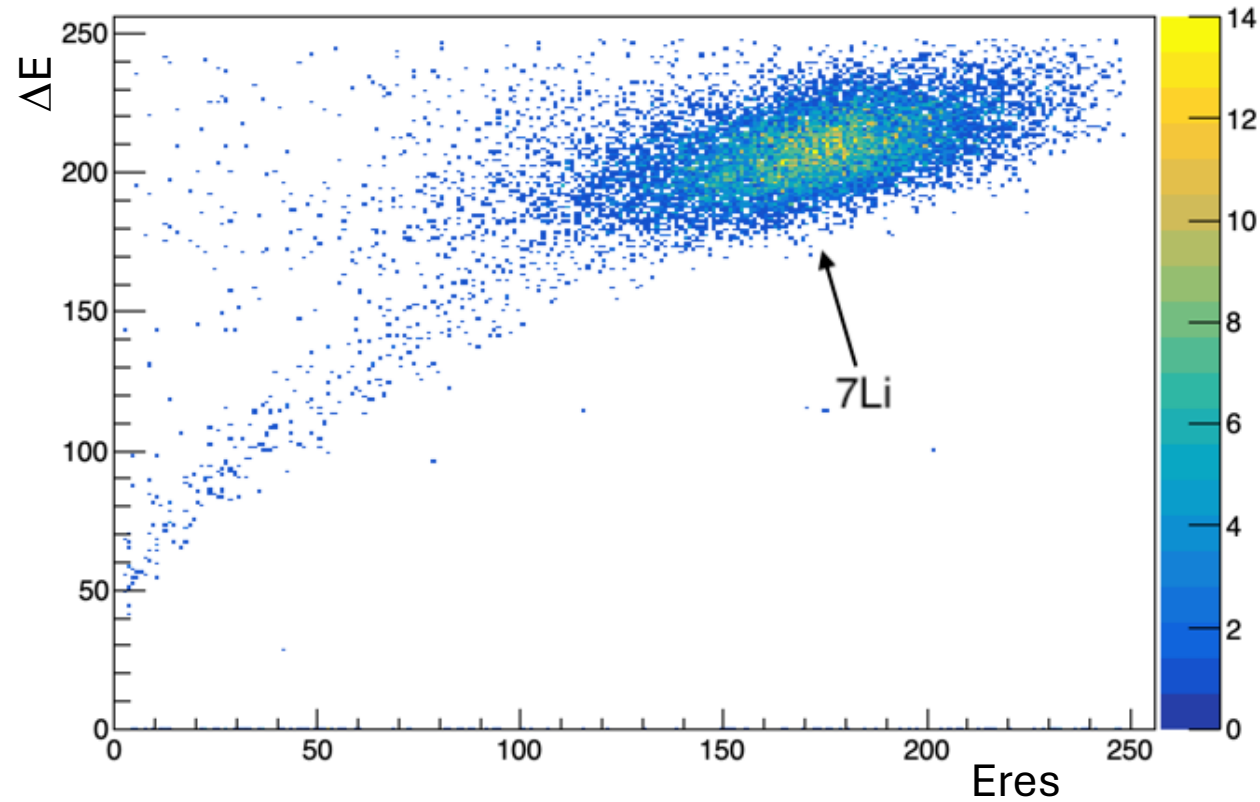


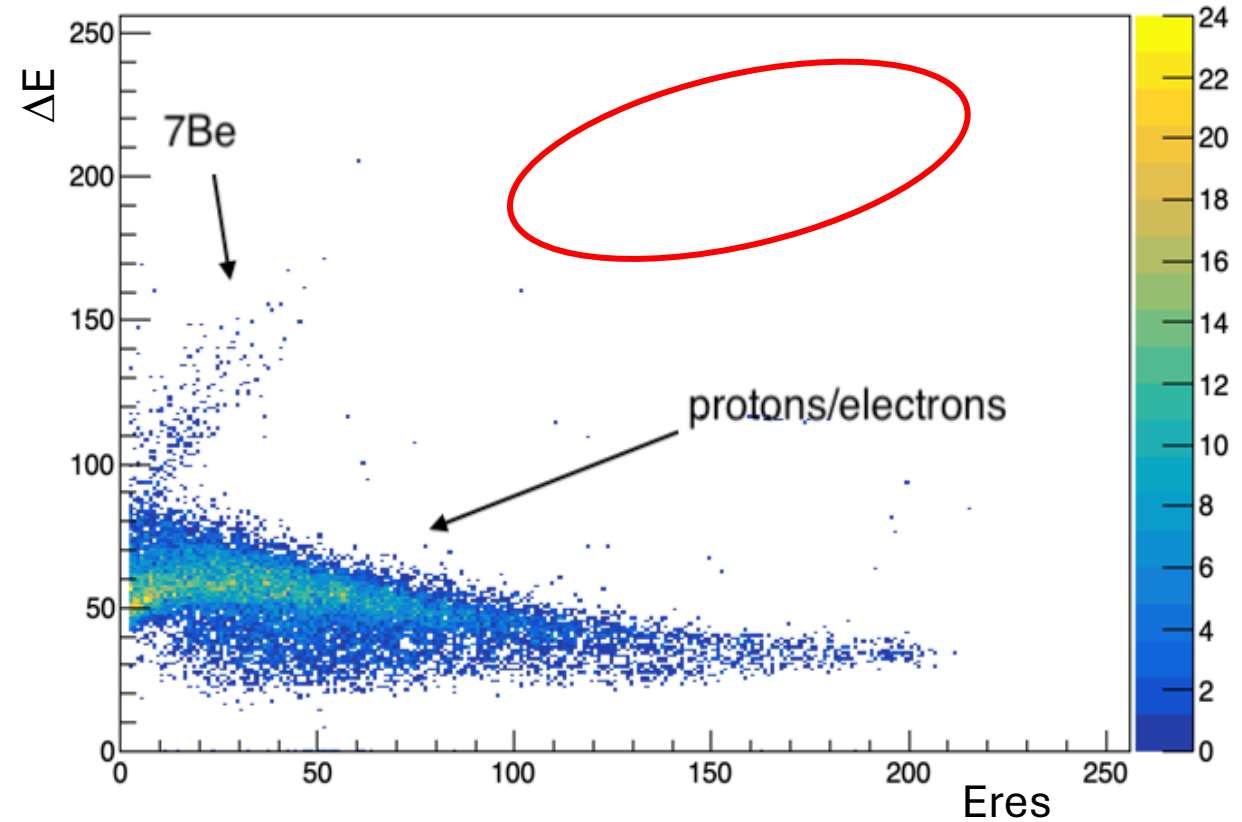
Fig WP1.2.1 Scheme of the setup of the Ionization Chamber with the additional cell.

In flight-decay experiment

Li beam - Cell 26 mbar - Chamber 10 mbar



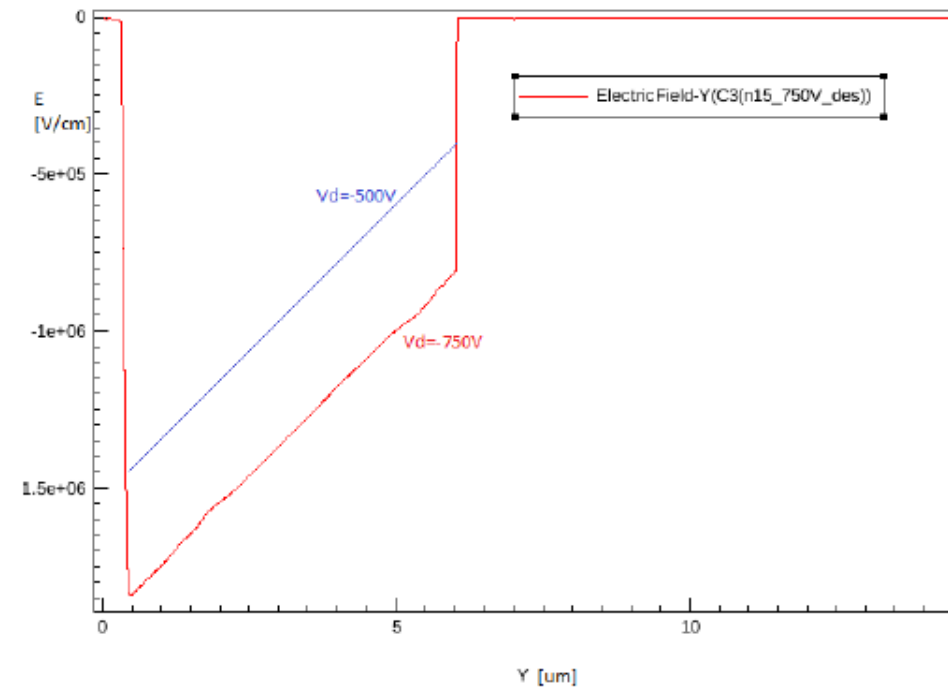
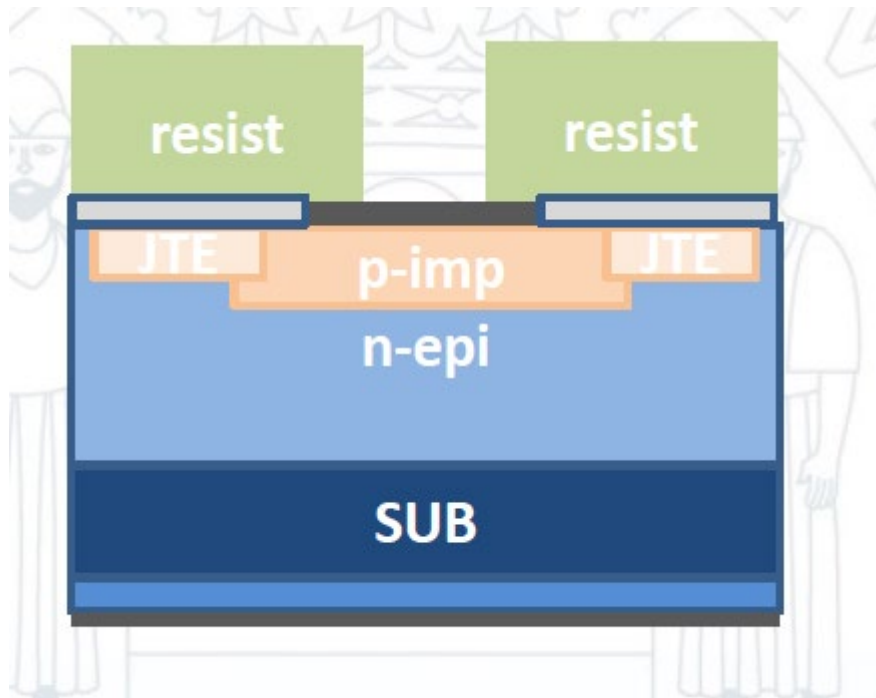
Be beam - Cell 26 mbar - Chamber 10 mbar



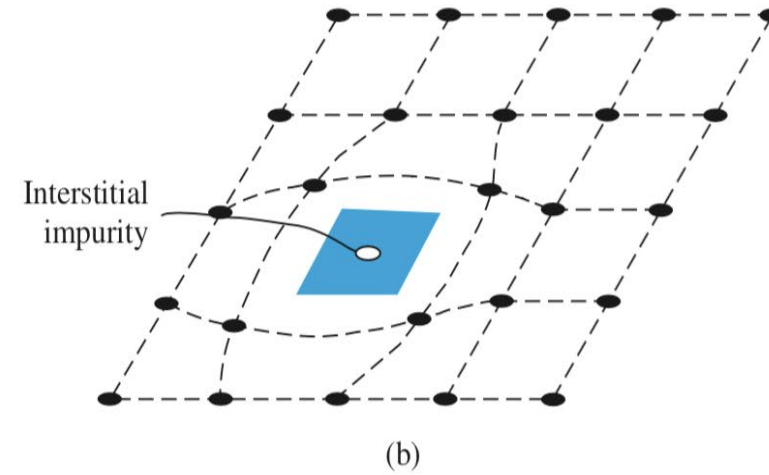
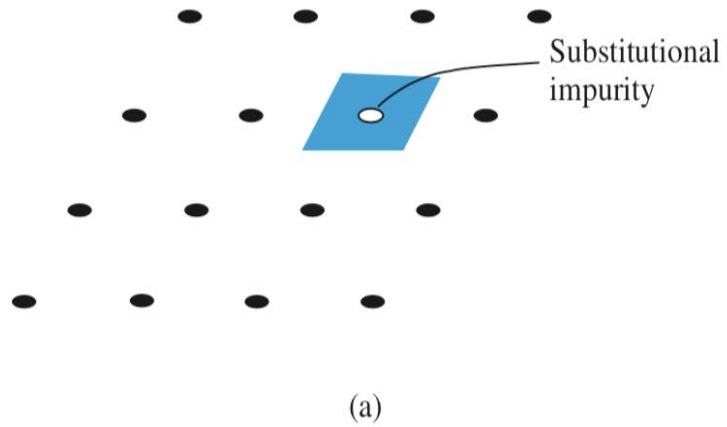
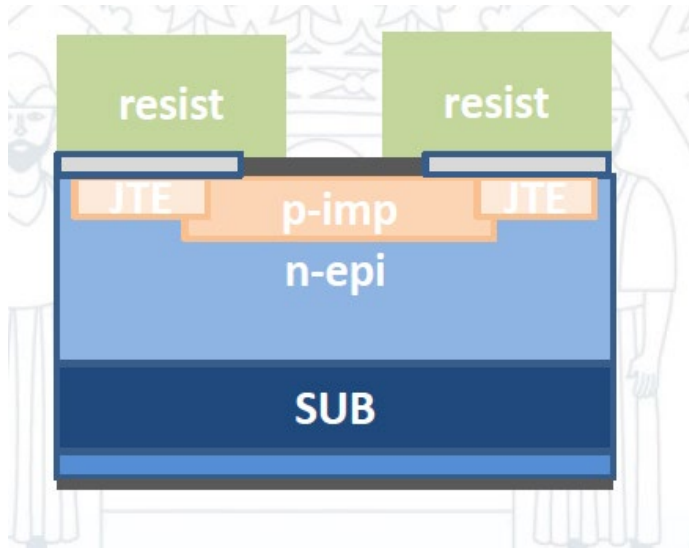
- A long run with high intensity ${}^7\text{Li}$ beam injected shows that ${}^7\text{Li}$ is sufficiently suppressed.

SiC Implantation experiment

- The electronic wavefunction and the density of electrons in the nucleus can be perturbate by the application of an electric field (Stark effect).
- Implantation of ^7Be atoms inside the depletion region of a SiC diode with inverse polarization in order to produce intense electric field.

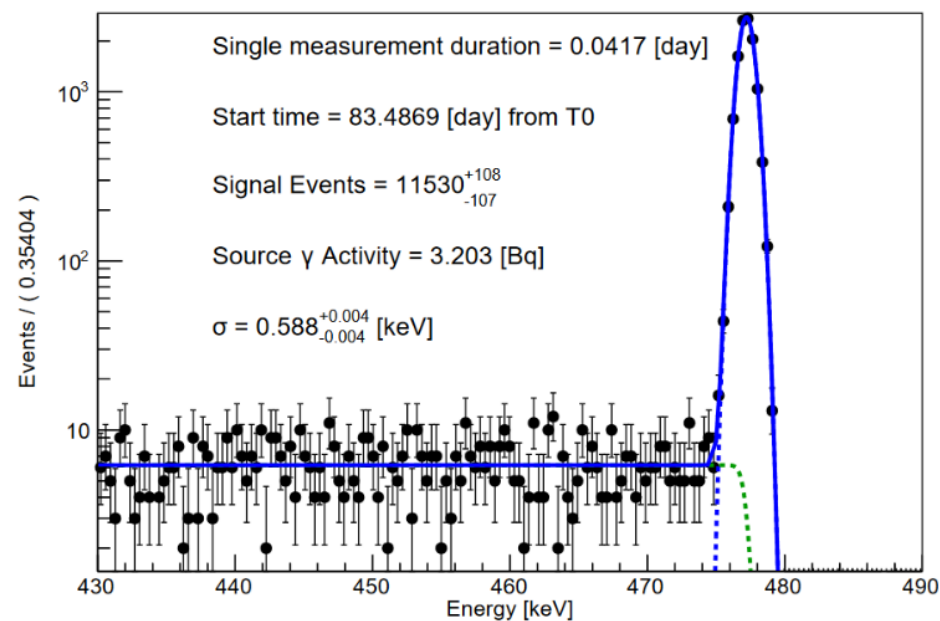


SiC Implantation experiment



SiC Implantation

A high precision and accuracy measurement of the ^7Be half-life at LNGS



$$T_{1/2} = 53.284 \pm 0.016 \text{ d}$$

Santonastaso et al Journal of Physics

G 52, Issue 3



STELLA = SubTErrestrial Low Level Assay

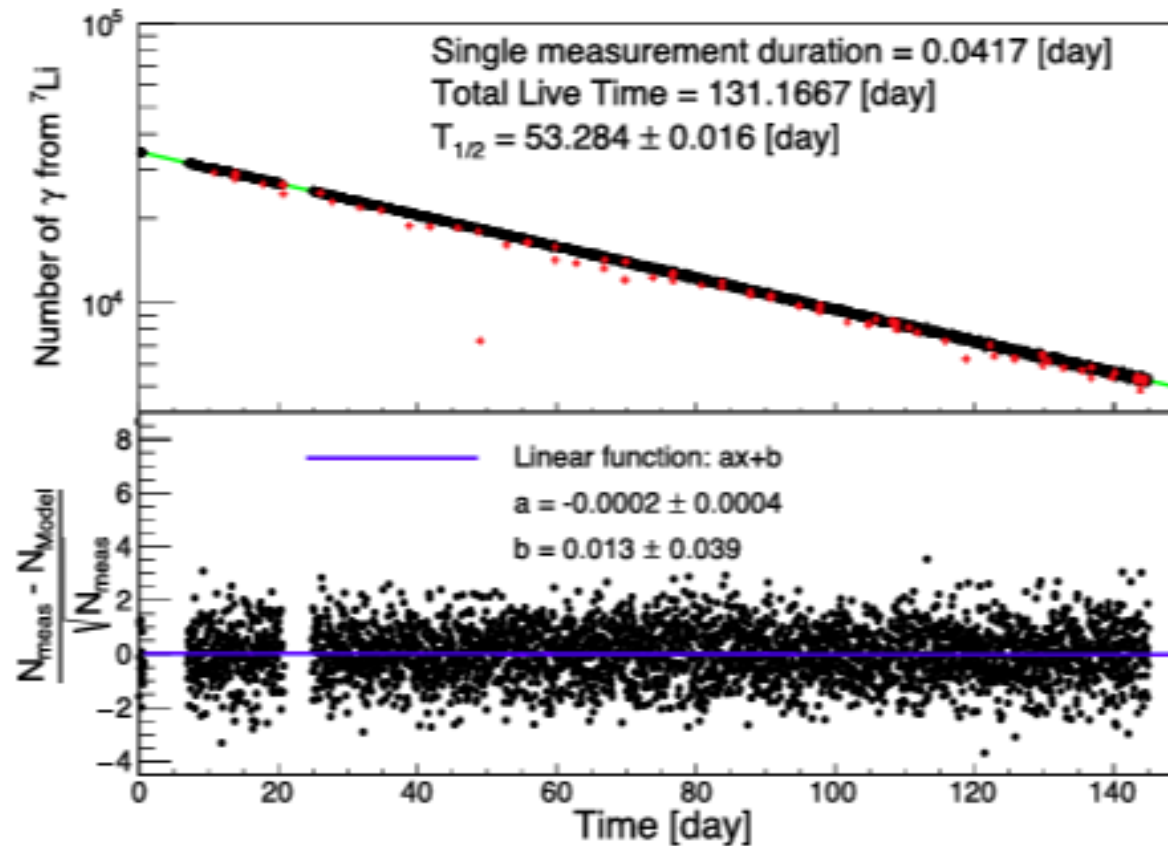
Summary and outlook:

1. Commissioning for ${}^7\text{Be}^{n+}$ inflight half-life measurement completed.
 2. Precise measurement of ${}^7\text{Be}$ half-life of ${}^7\text{Be}$ hosted in SiC performed.
 3. Complete ${}^7\text{Be}$ EC measurements when enough ${}^7\text{Be}$ will be available.
 4. Long run at LNGS – STELLA laboratory with implanted SiC diode, planned from September 2025.
-

SiC Implantation

A high precision and accuracy measurement of the ^7Be halflife at LNGS

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In flight-decay experiment

