Center for Isotopic Research on Cultural and Environmental heritage

INNOVA
CENTRO REGIONALE DI COMPETENZA PER LO SVILUPPO ED IL TRASFERIMENTO DELL'INNOVAZIONE APPLICATA AI BENI CULTURALI E AMBIENTALI

SECONDA UNIVERSITÀ DEGLI STUDI DI NAPOLI
SCUOLA POLITECNICA E DELLE SCIENZE DI BASE
DIPARTIMENTO DI MATEMATICA E FISICA

INFN
Istituto Nazionale di Fisica Nucleare

Absolute measurement of the $^{7}Be(p,\gamma)^{8}B$ cross section with the recoil separator ERNA

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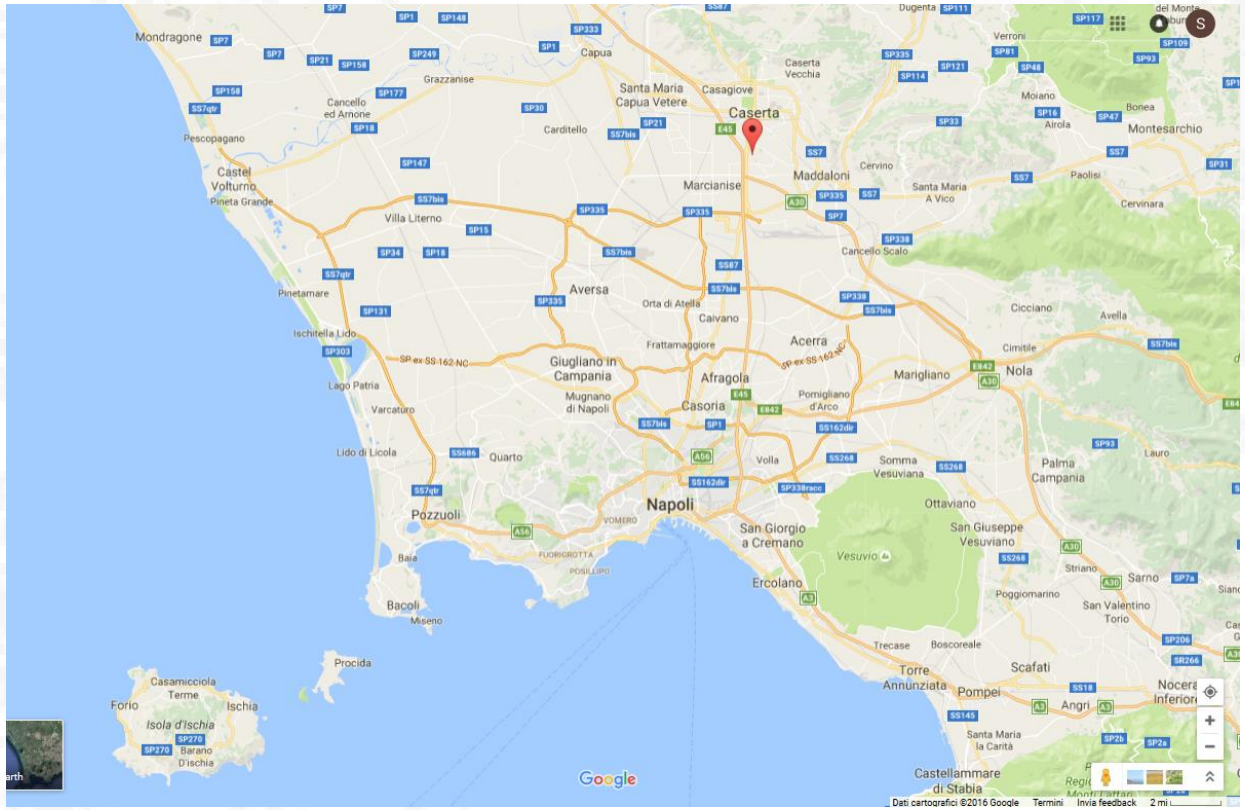
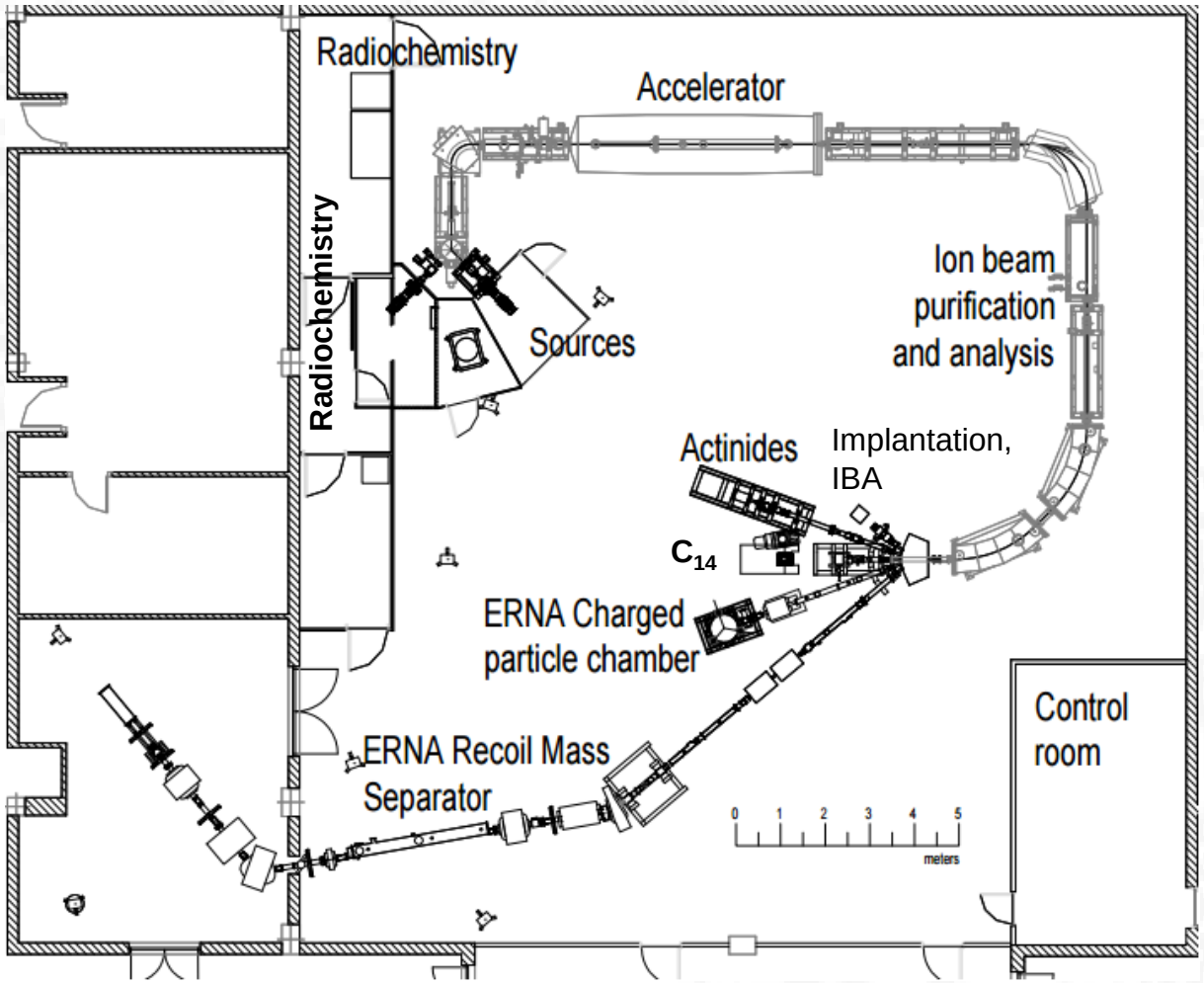
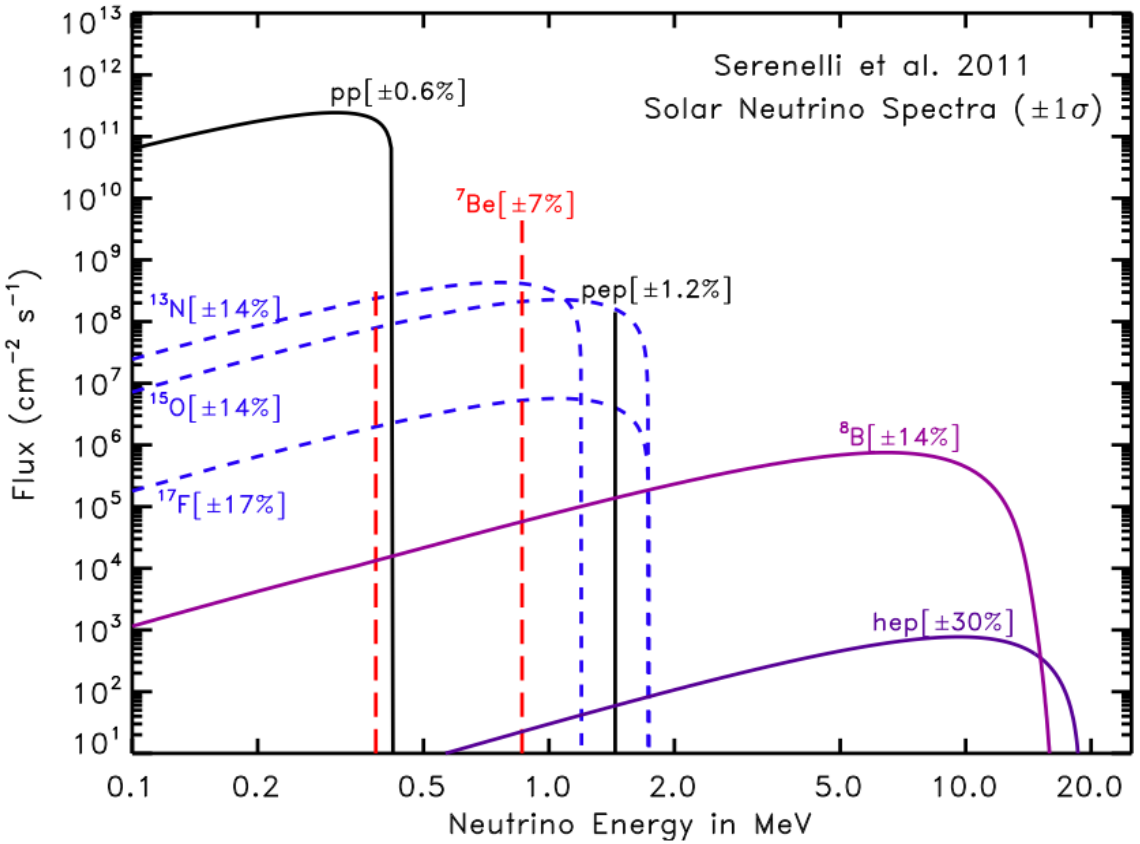
Center for Isotopic Research on Cultural and Environmental heritage (CIRCE)

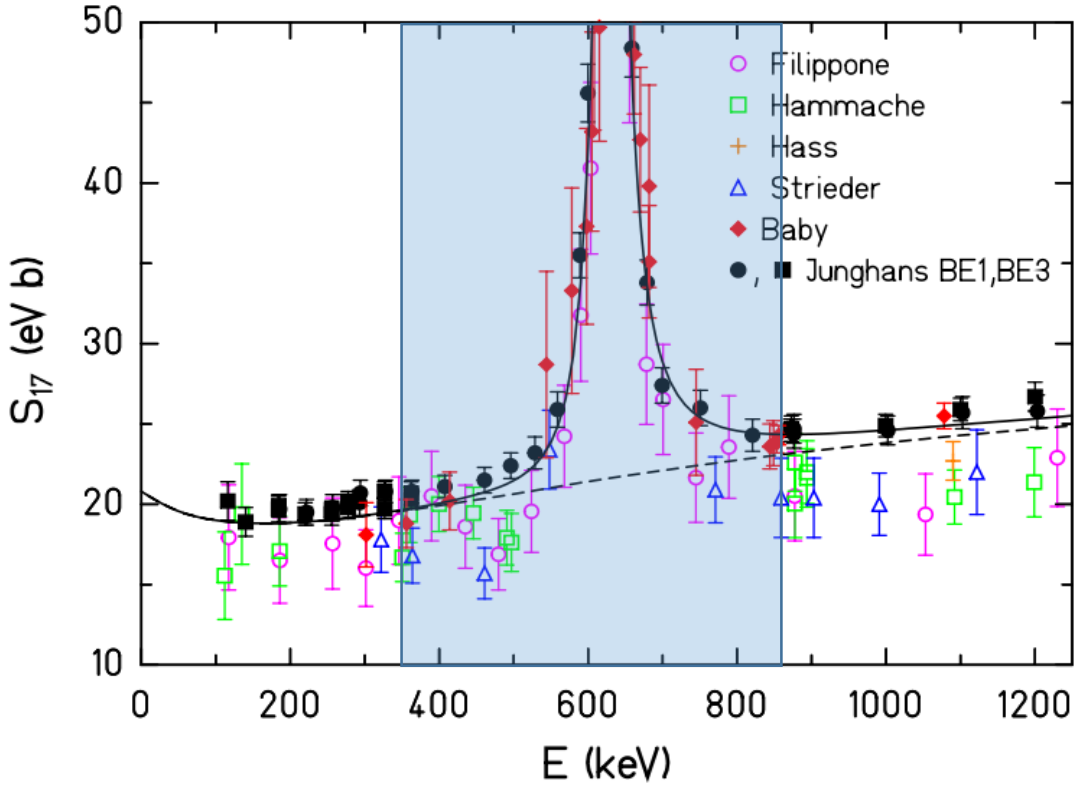




Why $^{7}Be(p,\gamma)^{8}B$?



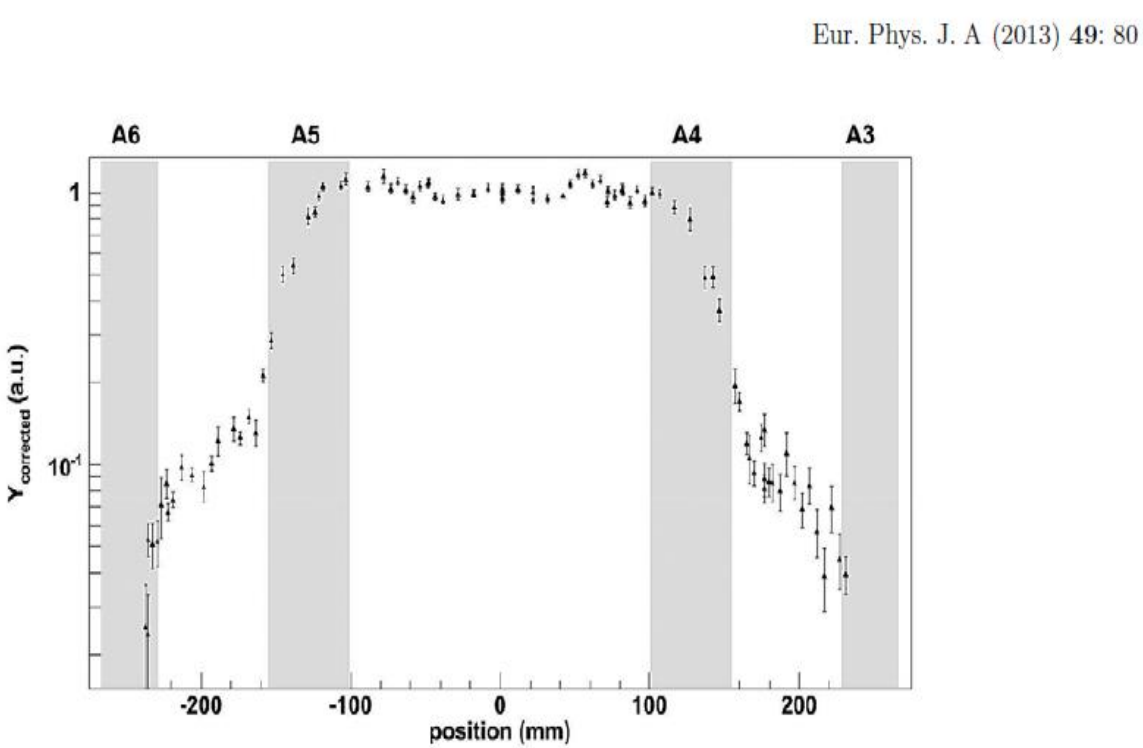
Large uncertainty on the predicted solar neutrino flux.



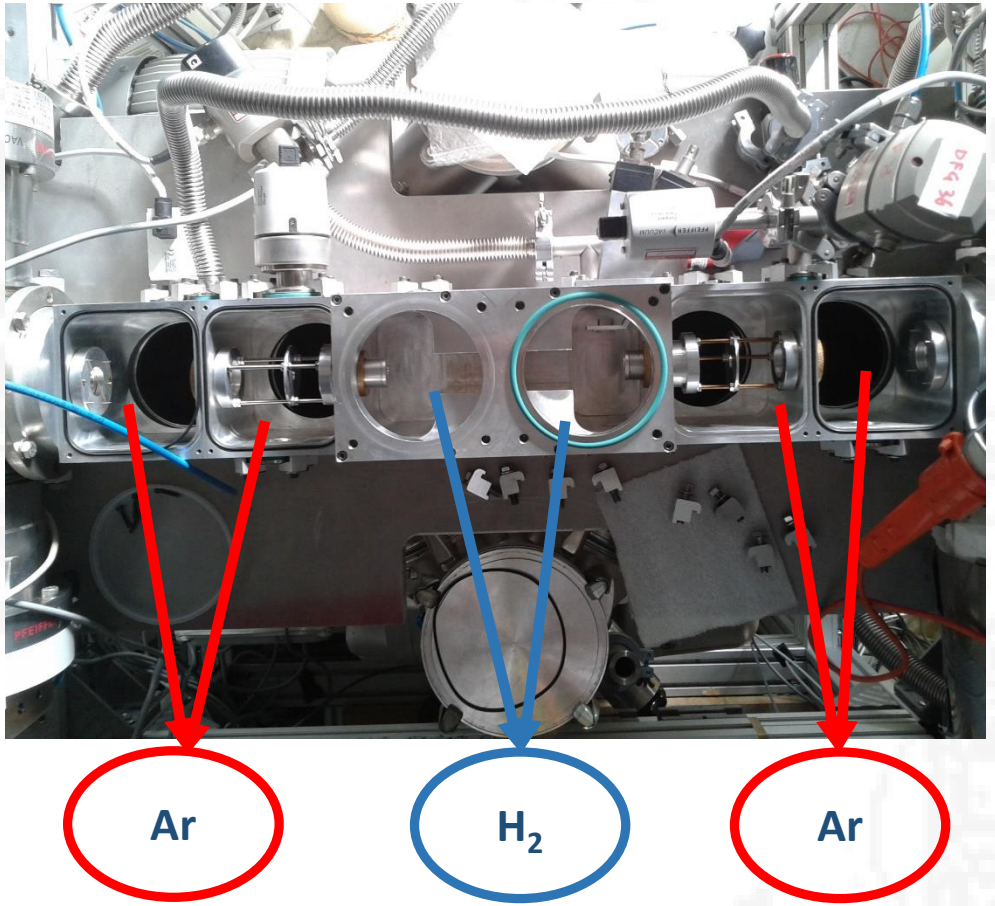
Adelberger et al. 2011

Discrepancy between existing data limits the precision of their extrapolation at astrophysical energy.

Windowless gas target



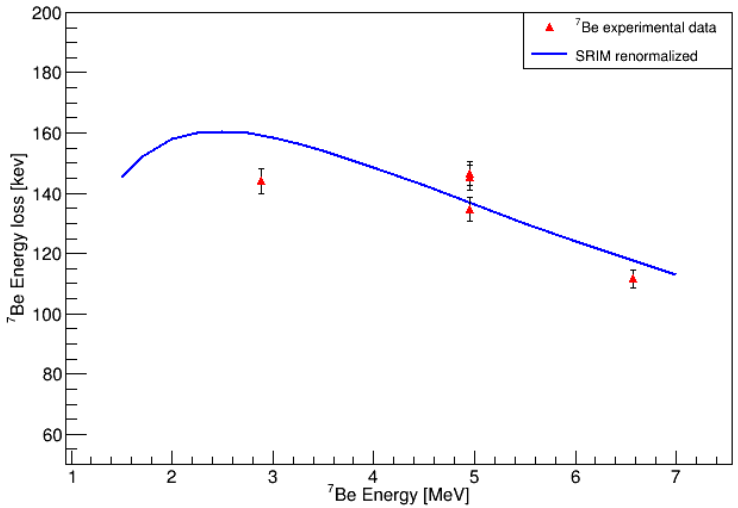
Density profile of the gas target as seen in the yield of the 478 keV γ-ray line from the 7Li(p, p)7Li



Target density $n = 7.22 \pm 0.15 \cdot 10^{18}$ at/cm^2

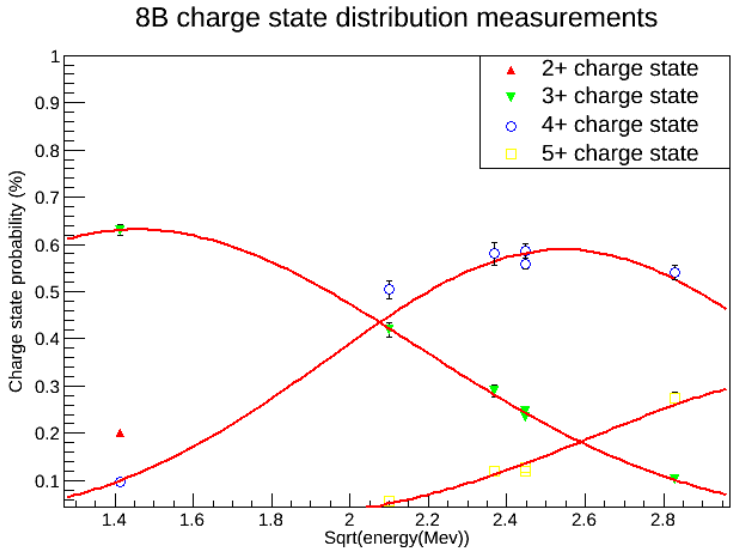
D. Schürmann et al., Eur. Phys. J. A (2013) **49**: 80

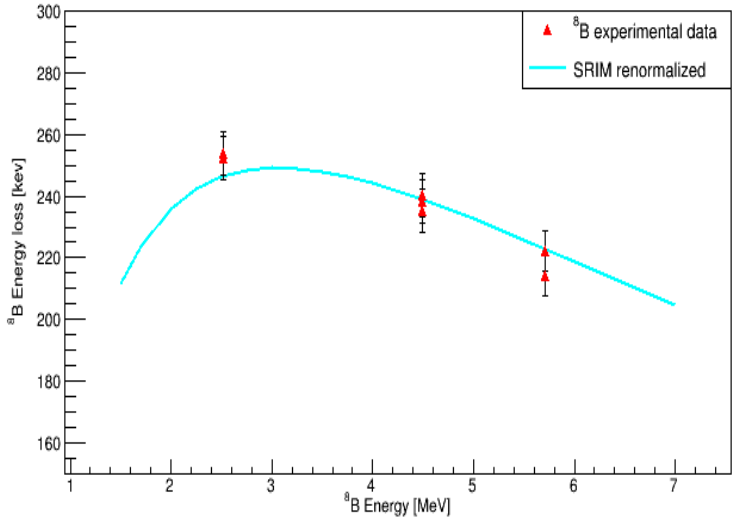
Energy loss measurements



Energy loss of the projectile ^{8}B in the target.
The curve is a renormalized SRIM table.

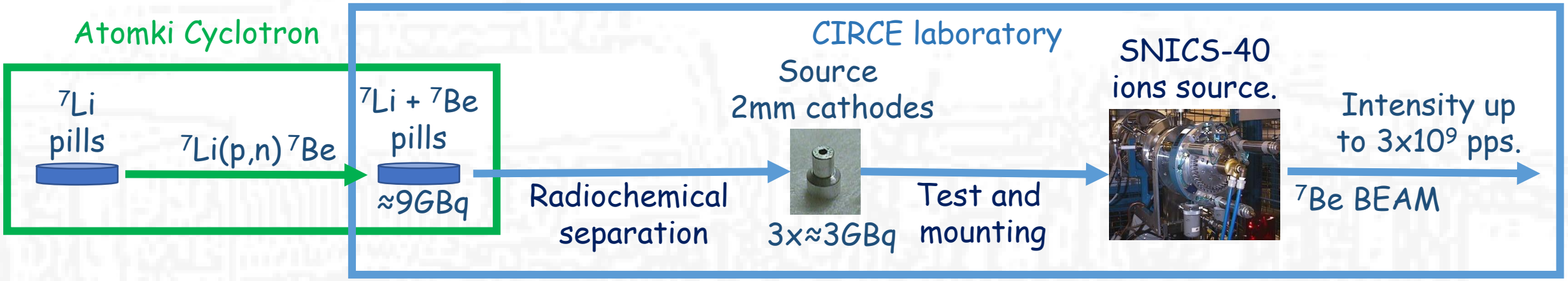
The measurements are performed selecting the 3^{+} recoils.

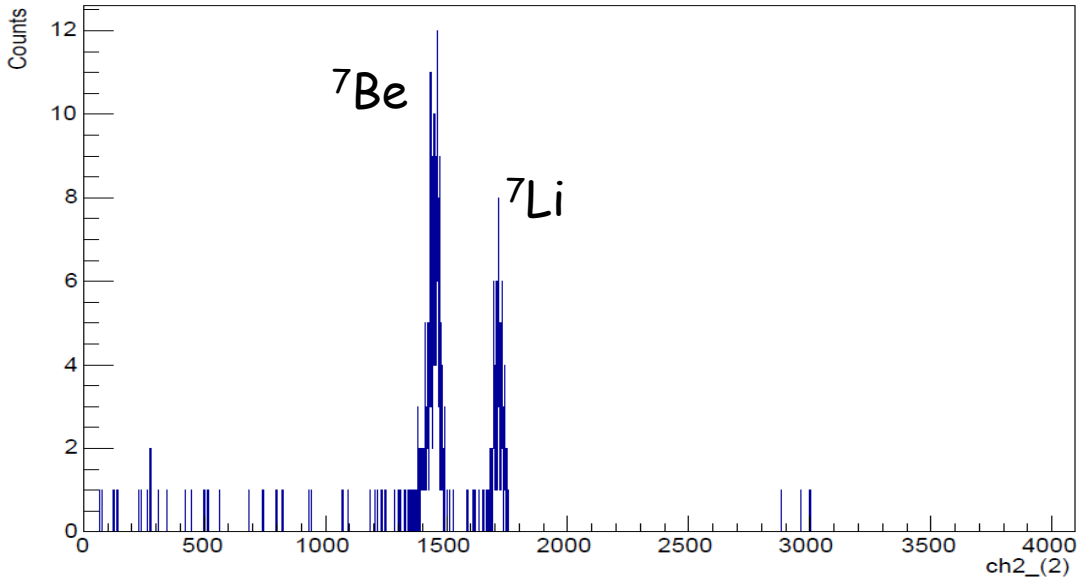


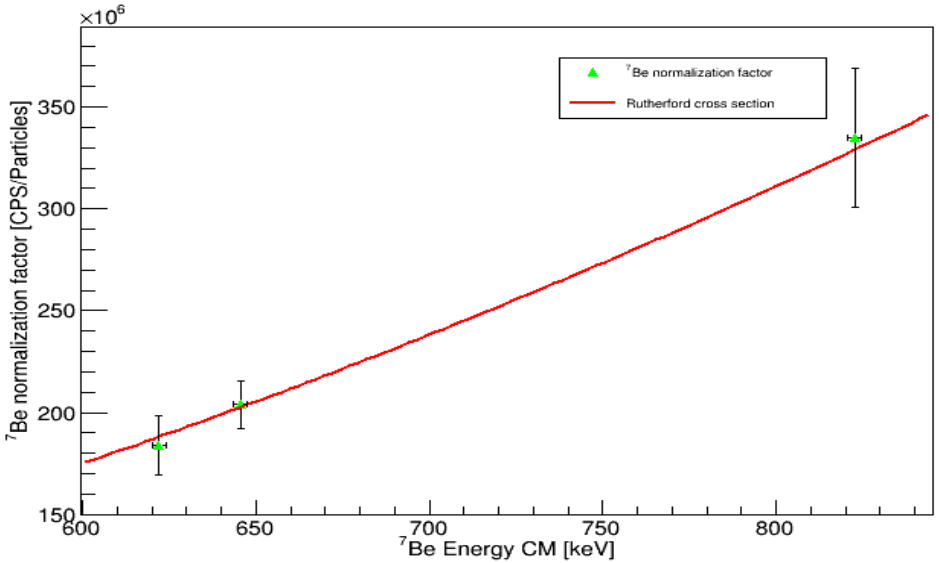


Energy loss of the projectile ^{7}Be in the target.
The curve is a renormalized SRIM table.

^{7}Be beam

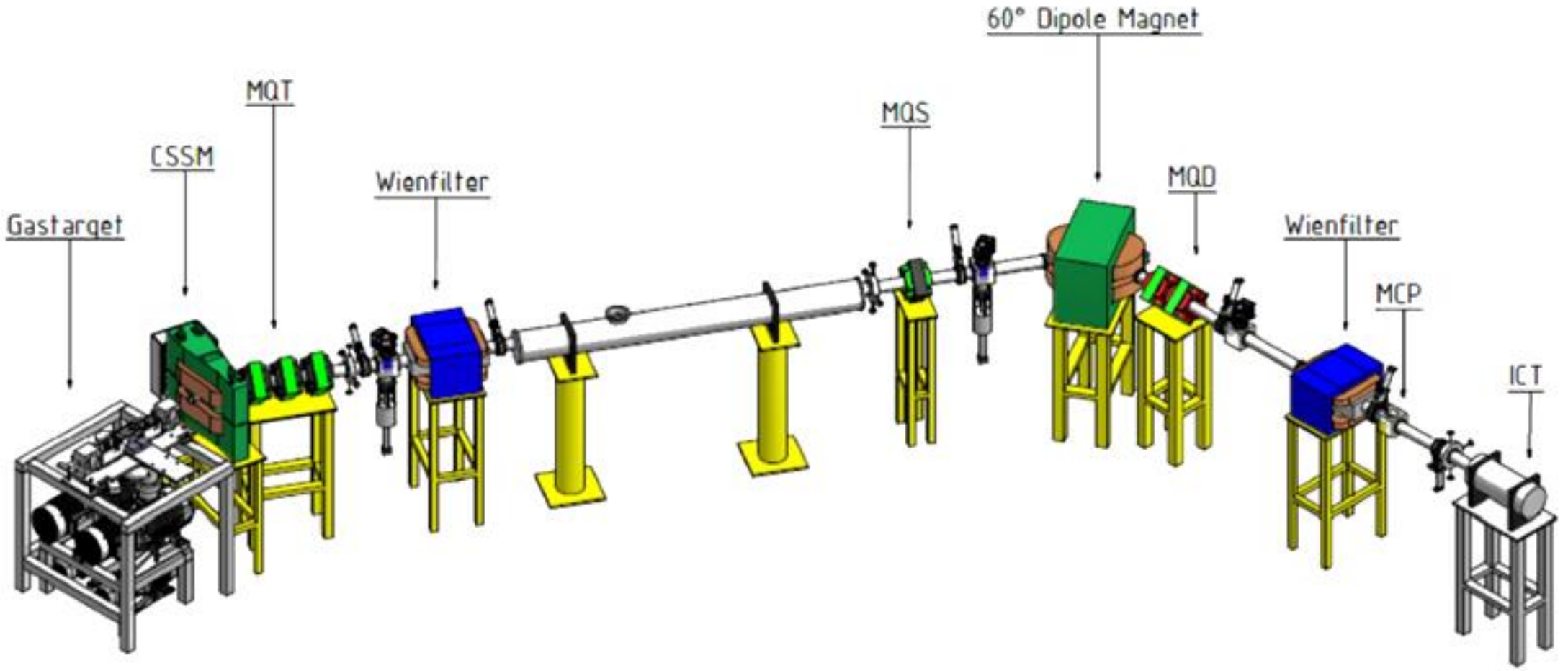




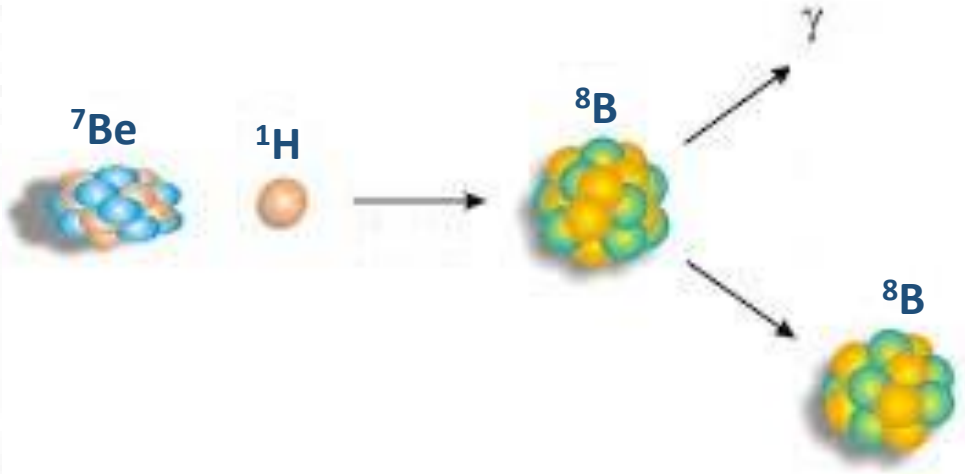


The number of incident projectiles, including lithium contamination, is monitored on line through elastic scattering.

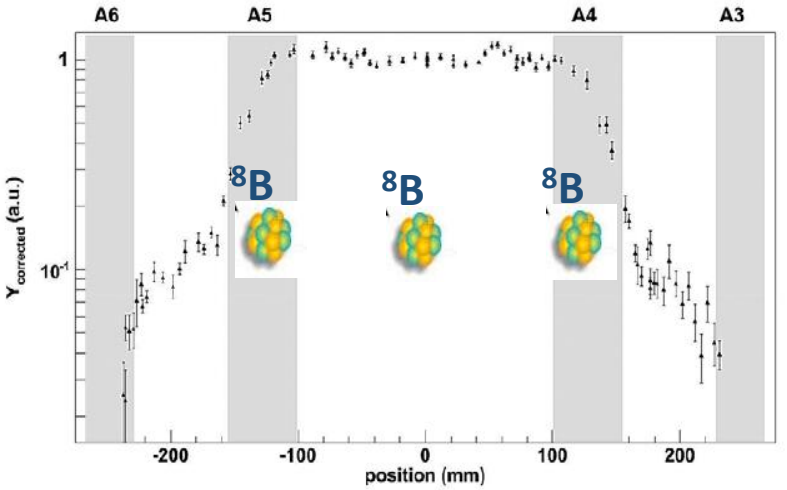
European Recoil mass separator for Nuclear Astrophysics (ERNA)



800 keV emittance



Eur. Phys. J. A (2013) 49: 80

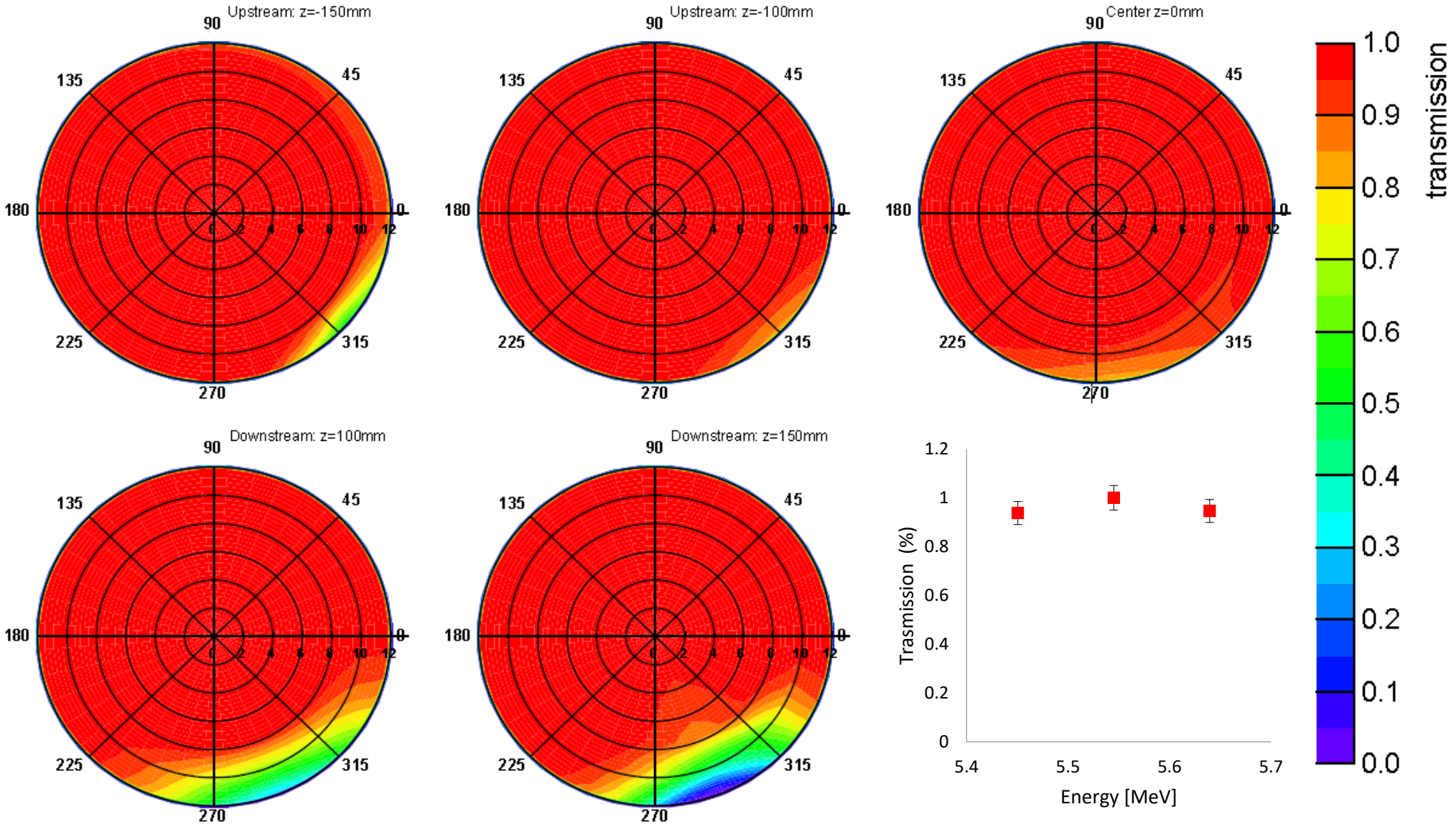


Kinematics and straggling produce 8 mrad recoils emittance and $\Delta E \approx 80$ keV.

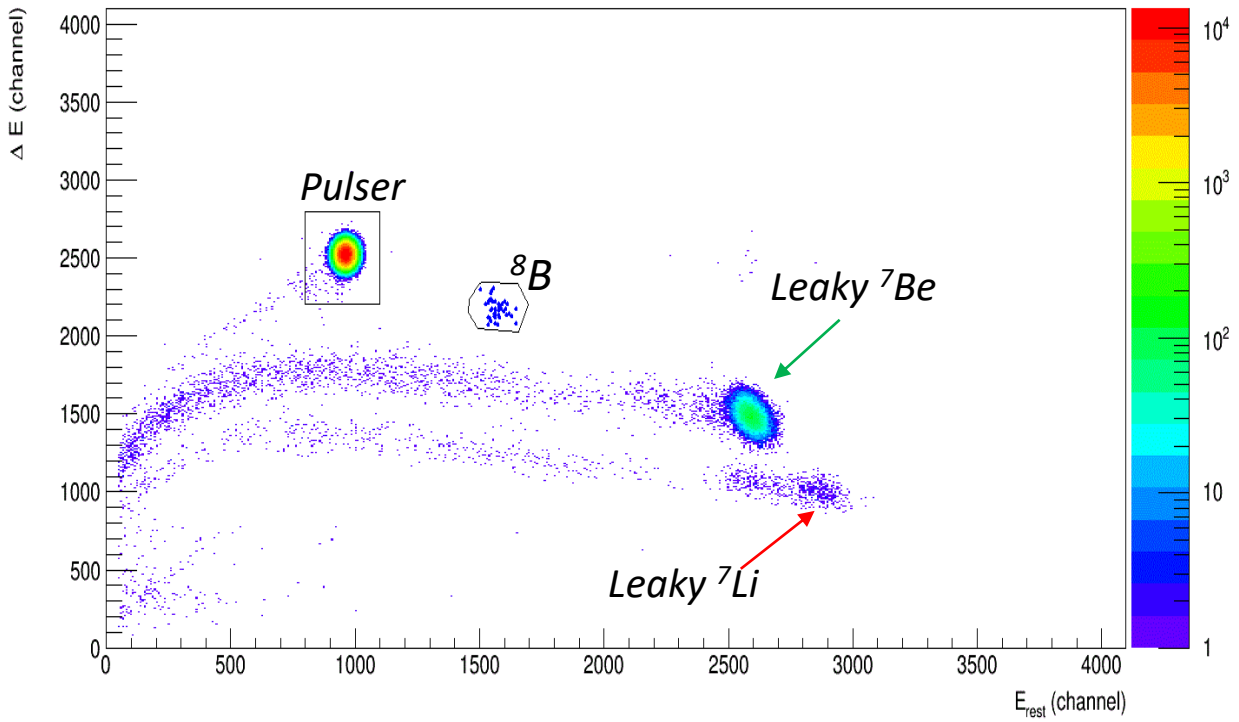
The ^{8}B can be product in different part along the gas target.

A tuning with full acceptance in all condition is mandatory.

800 keV acceptance

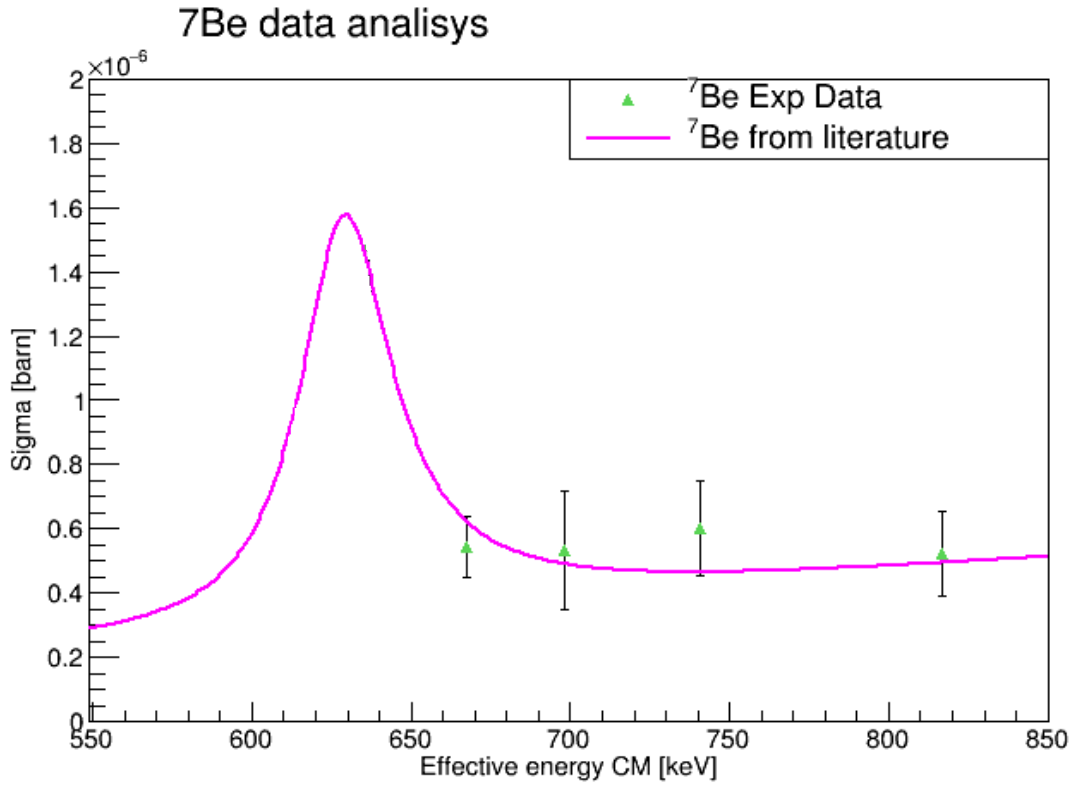


First results



E-ΔE spectrum with ionization chamber telescope.
The ^{8}B recoil are well separated from the leaky.

Measurements points performed at E> 650keV center of mass effective energy.
The continues curve is from literature.



Conclusion

- A very intense ^{7}Be beam, up to $3x10^{9}$ pps, is produced and characterized at CIRCE laboratory.
- The characterization of the extended gas target and the tunings of the separator has been completed at 800 keV and 600 keV and the analysis at 350 keV are in progress ;
- The preliminary measurements of absolute cross section, of the $^{7}Be(p,\gamma)^{8}B$ reaction above the 629 keV resonance are performed;
- Other measurements have been performed covering the resonance and the data analysis is ongoing;
- More measurements are planned in the next year at low energy (350 - 400 keV), according the availability of ^{7}Be;

Thanks