New monitors for flux measurement and n-beam profile in EAR2

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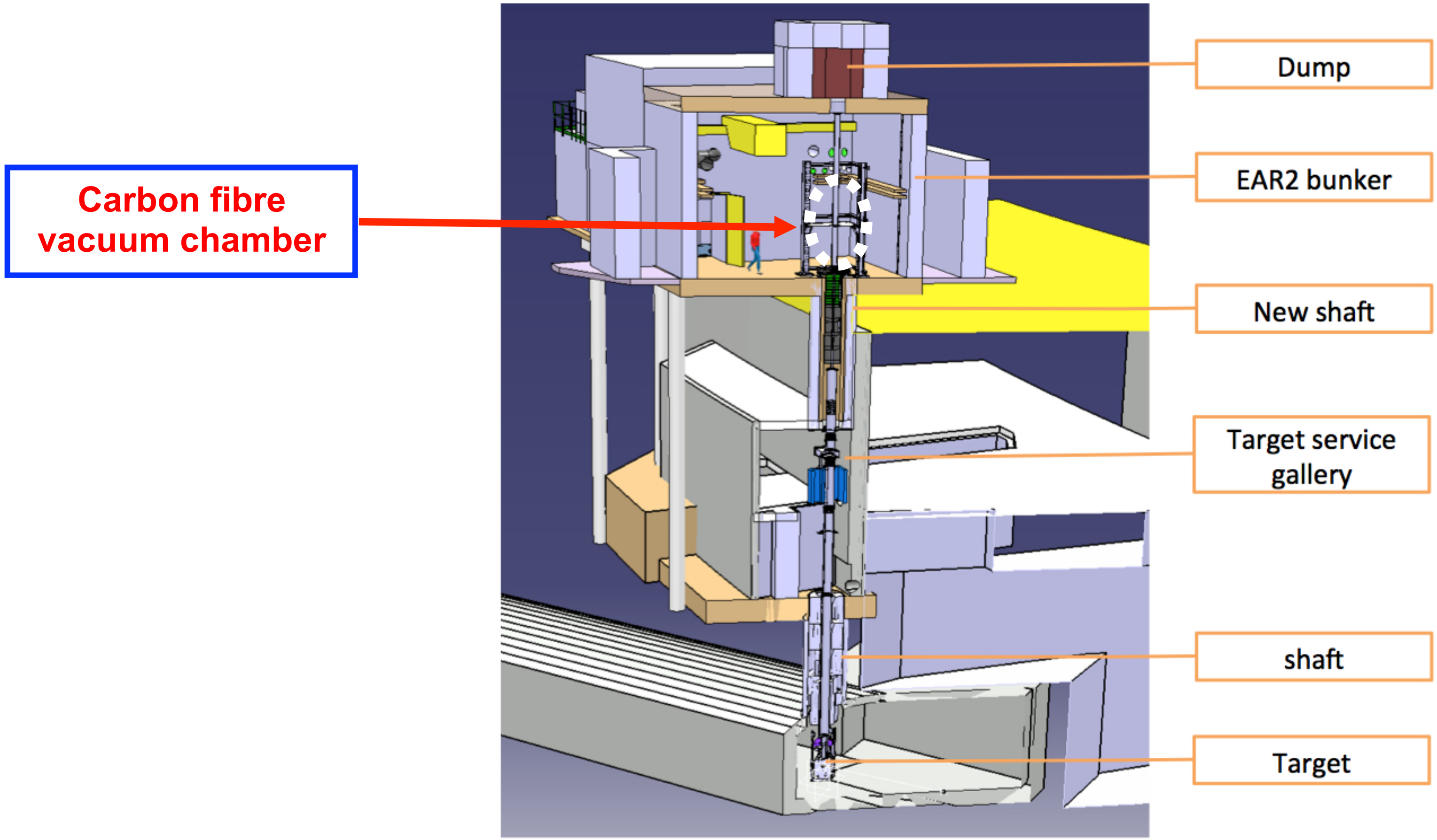
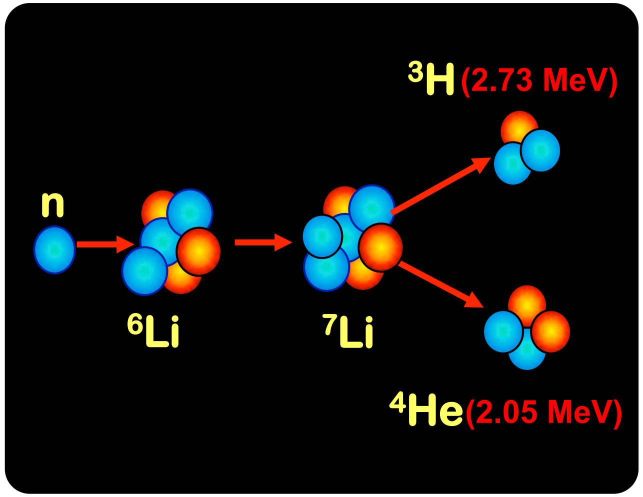
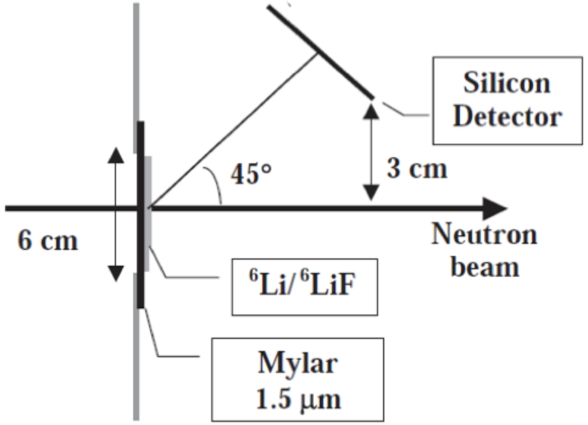
LNS is contributing to the development of the neutron beam monitors for flux and beam size measurements in EAR2



n-flux measurement: SiMon in EAR1

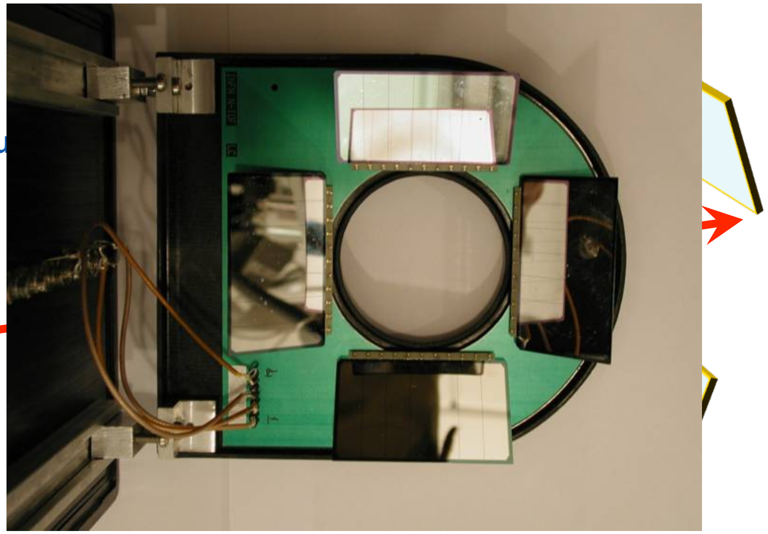
(M. Barbagallo, PHD thesis)

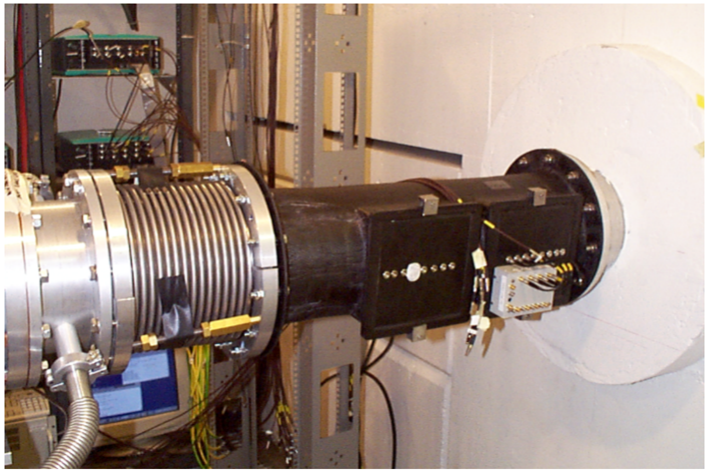




a ^{6}Li
captu

n

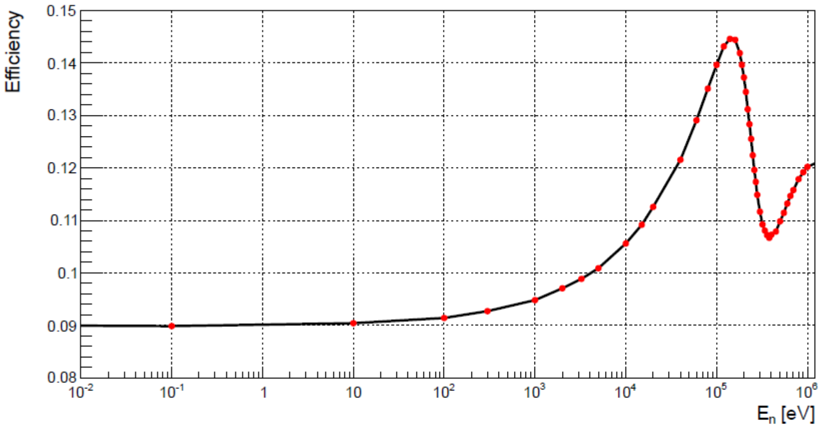




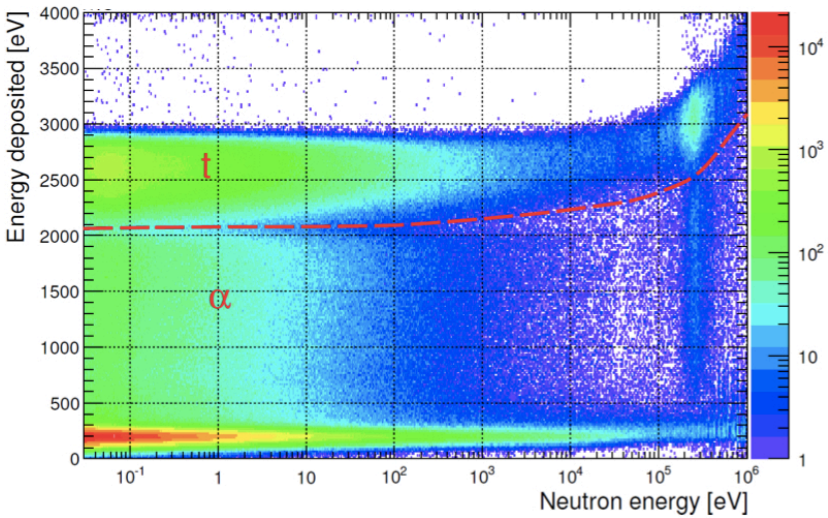
Detection of tritons to measure the n-flux

(M. Barbagallo, PHD thesis)

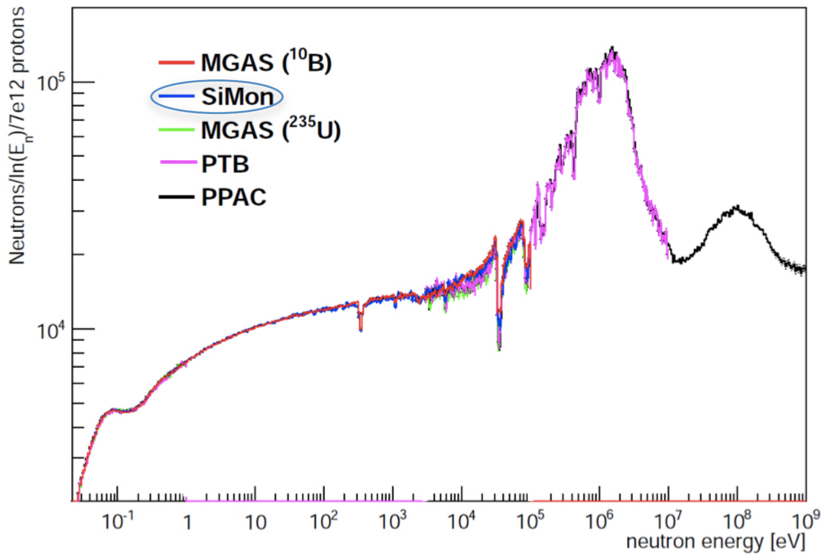
Calculated detection efficiency for tritons. The increase is related to the forward-peaked angular distribution



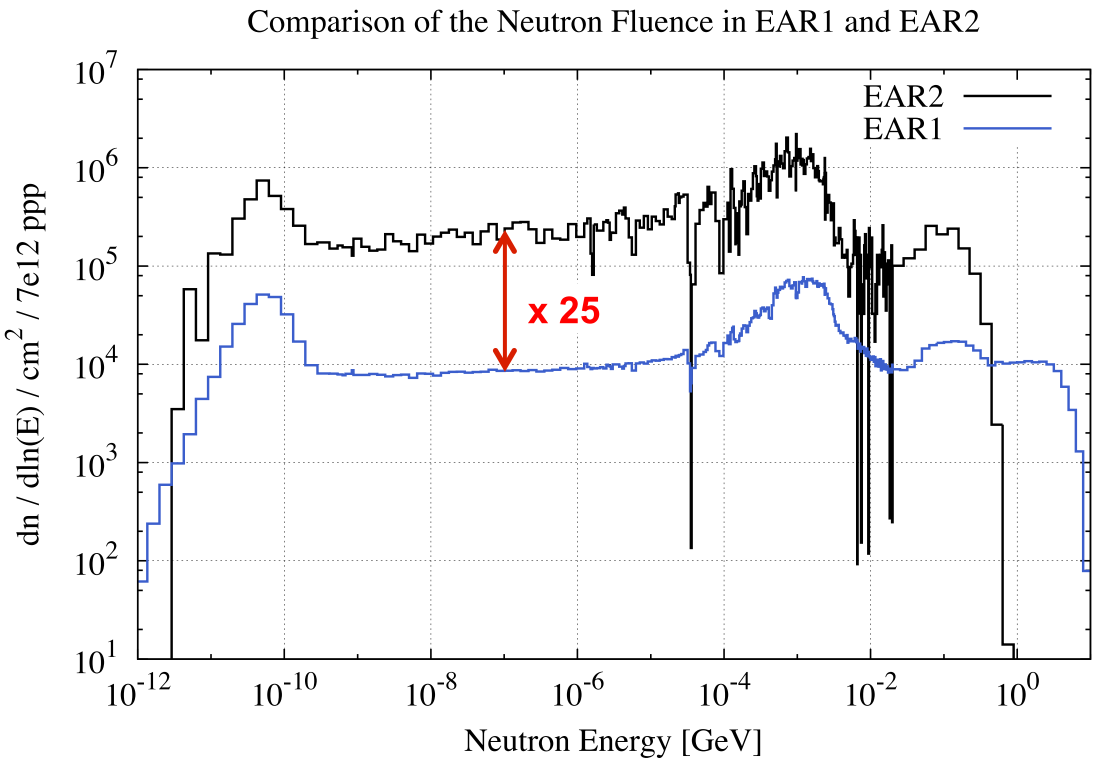
Energy deposition in each silicon detector vs. neutron energy



Fluence in EAR1

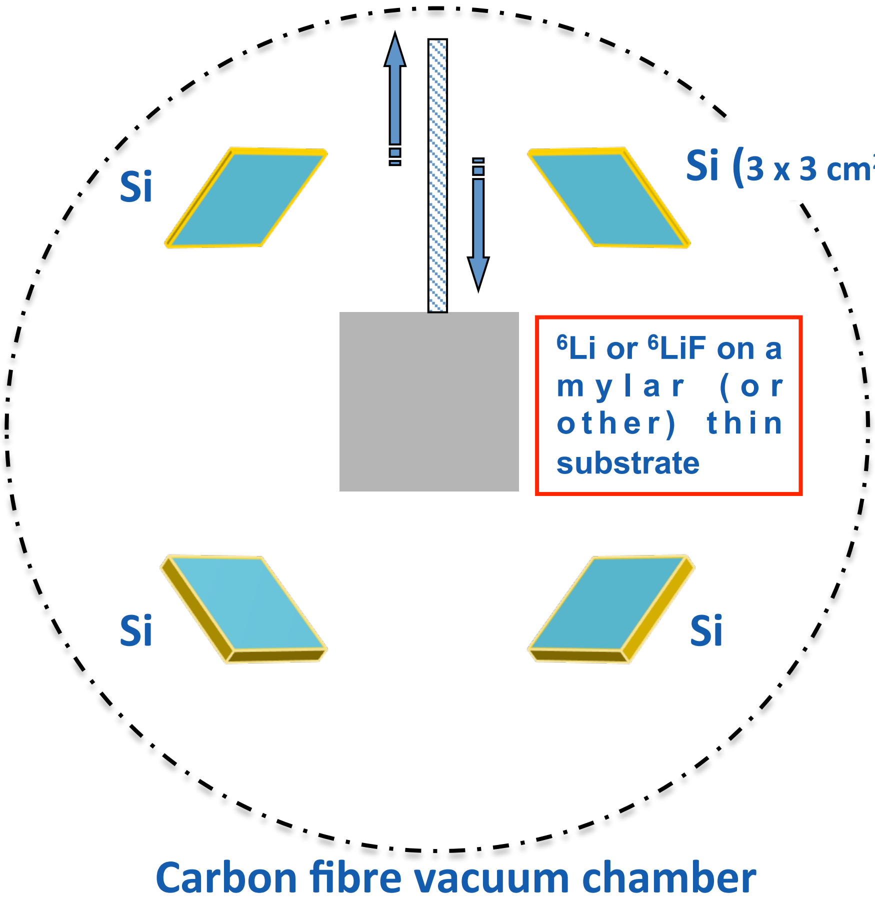


SiMon2
Beam monitor for neutron flux measurement in EAR2



- **SiMon2** will be similar to the version1.
- Silicon detectors are 3 x 3 cm^2, 300μm thick.
- ***^{6}Li and ^{6}LiF deposited onto a thin foil 5 x 5 cm^2 made of mylar (or aluminum, carbon fibre or other). ^{6}LiF is easier to produce.***

SiMon2
Beam monitor for neutron flux measurement in EAR2

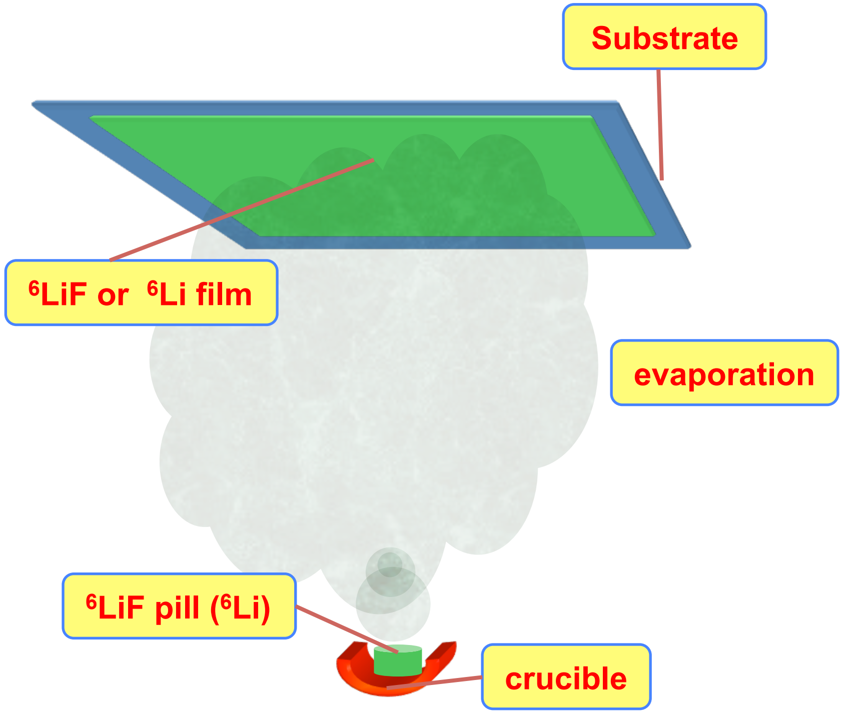


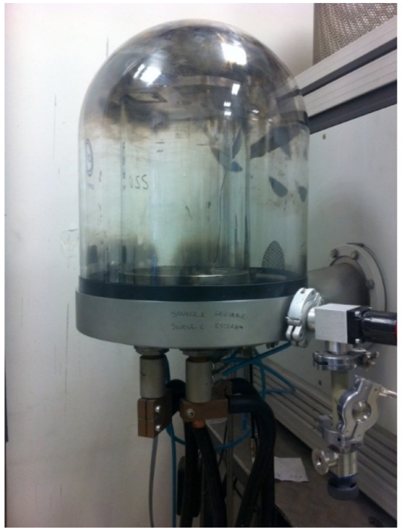
Deposition thickness below:

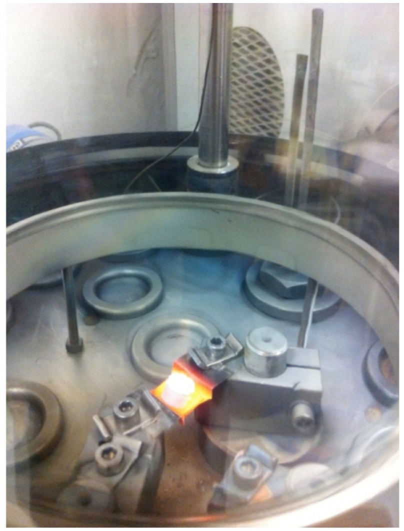
- ***300 μg/cm^2 for ^{6}Li (6.5 μm) [used in SIMON1]***
- ***500 μg/cm^2 for ^{6}LiF (2 μm)***

Usually the optimal thickness is a compromise between efficiency and energy loss of ^{3}H

At LNS we can produce the ^{6}Li / ^{6}LiF foils.



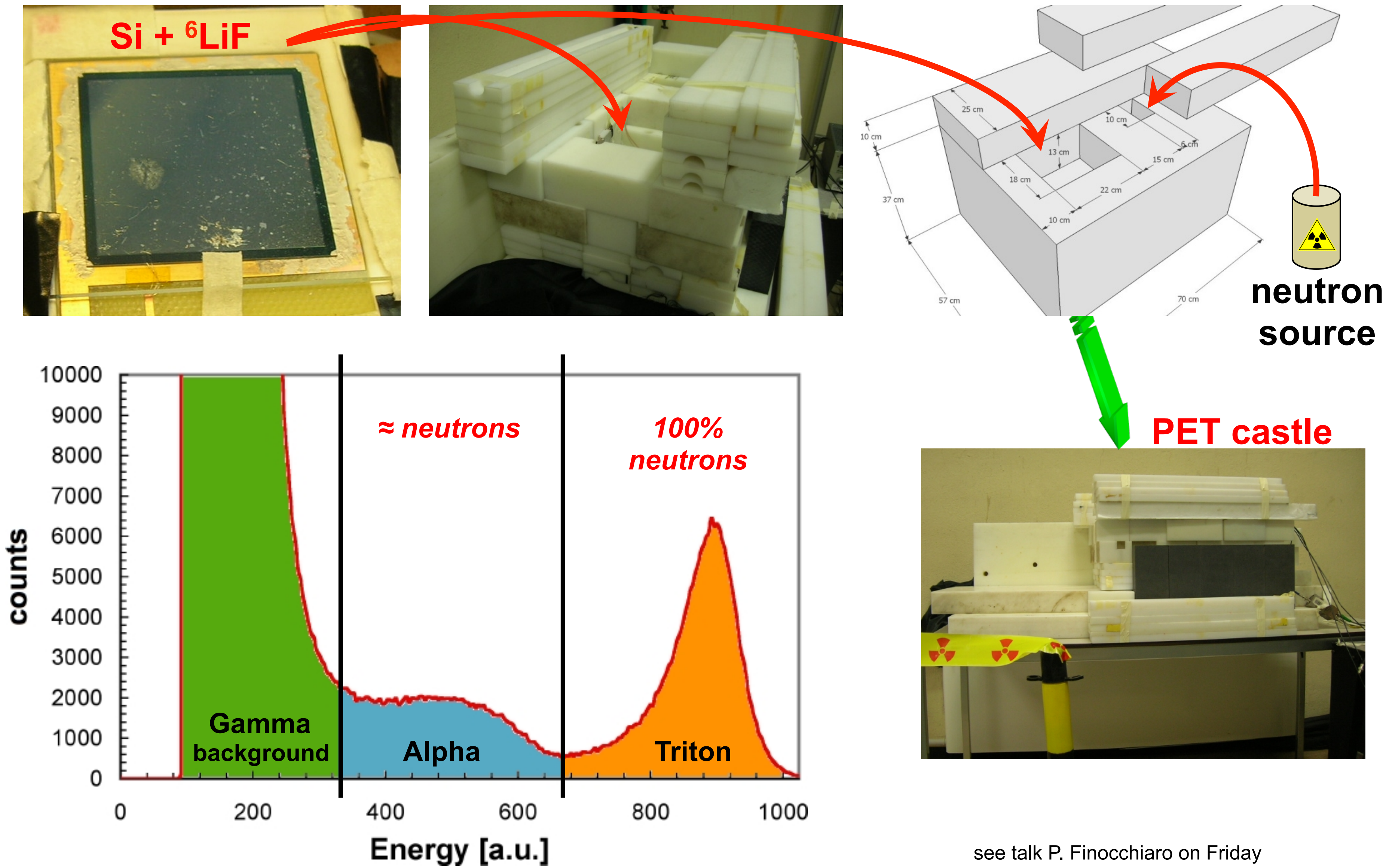




For pure ^{6}Li the deposition must be passivated by means of two ultra-thin carbon sheets (in a sandwich configuration).

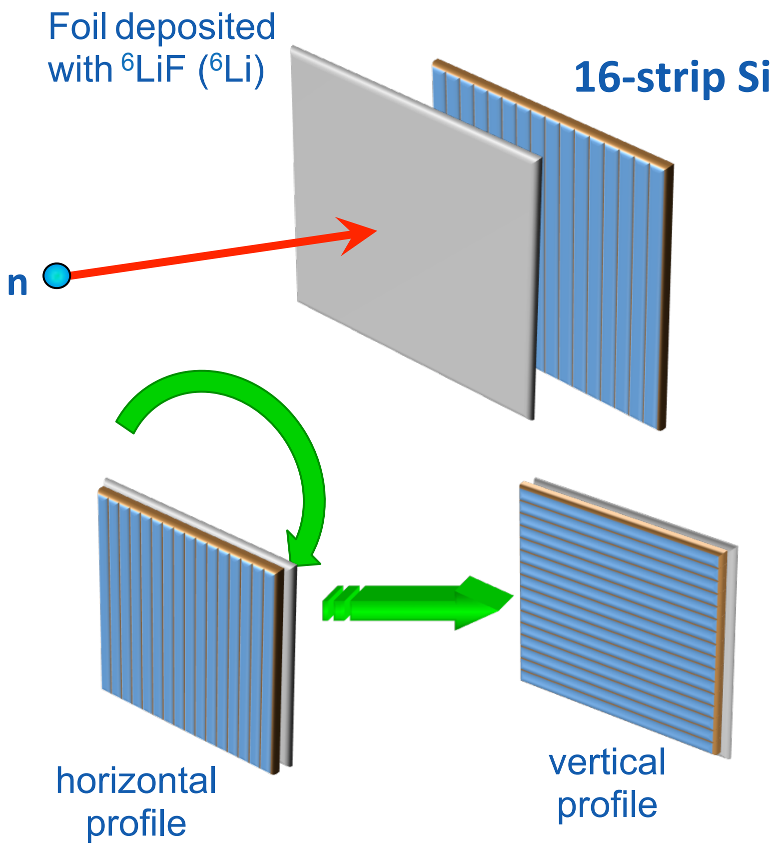
The evaporation process takes few hours for 500μg/cm^{2} of ^{6}LiF. No passivation is required.

Test at JRC: 3x3 cm^2 Si detector + LNS ^{6}LiF layer



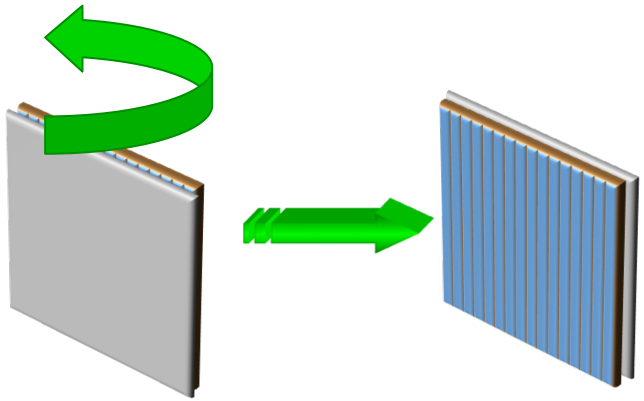
Transversal profiles of the neutron beam

A position sensitive silicon detector could allow to measure the X and Y neutron beam profiles



16 ADC channels required only during the profiles measurements.

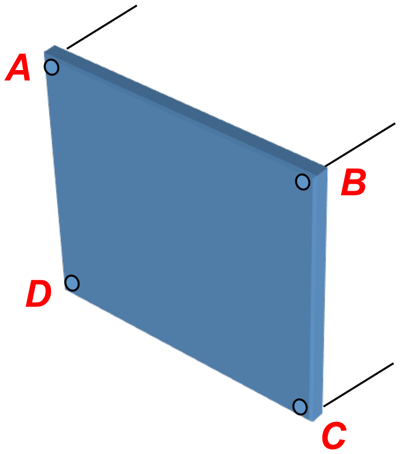
The flux in the forward and backward emission could be measured by rotating the device



MICRON Silicon micro strip detector F-140

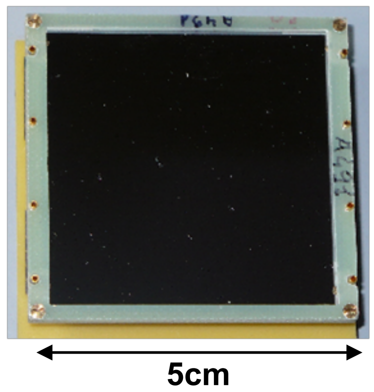
Transversal profiles of the neutron beam

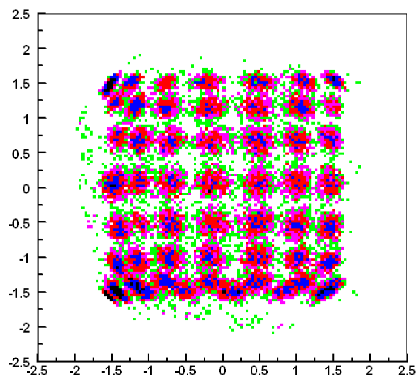
An alternative possibility to be investigated, is to use a position sensitive silicon detector using a **continuous resistive layer**, with the readout at the four corners.



$$X = \frac{(A + D) - (B + C)}{\sum}$$

$$Y = \frac{(A + B) - (C + D)}{\sum}$$



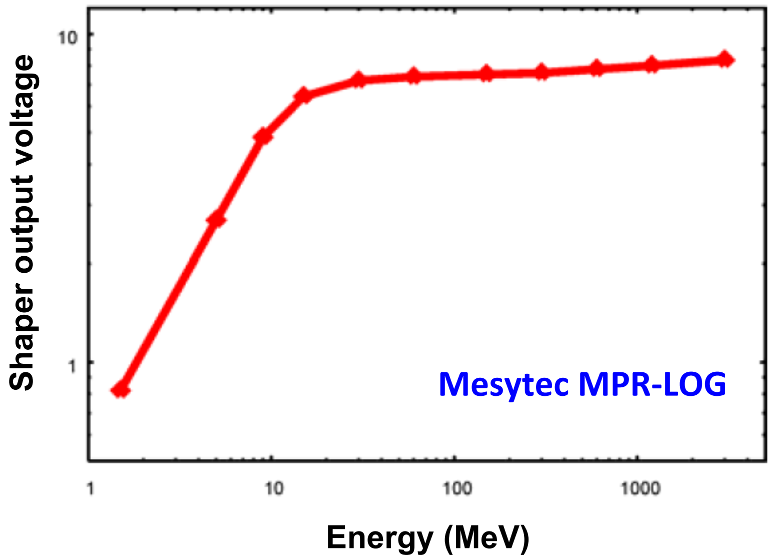


How to reduce the effects of the prompt gamma flash

As readout electronics for the silicon detectors, a Mesytech lin/log preamplifier will be tested.

It guarantees a very fast recovery from large signals and precise spectroscopy of small signals.

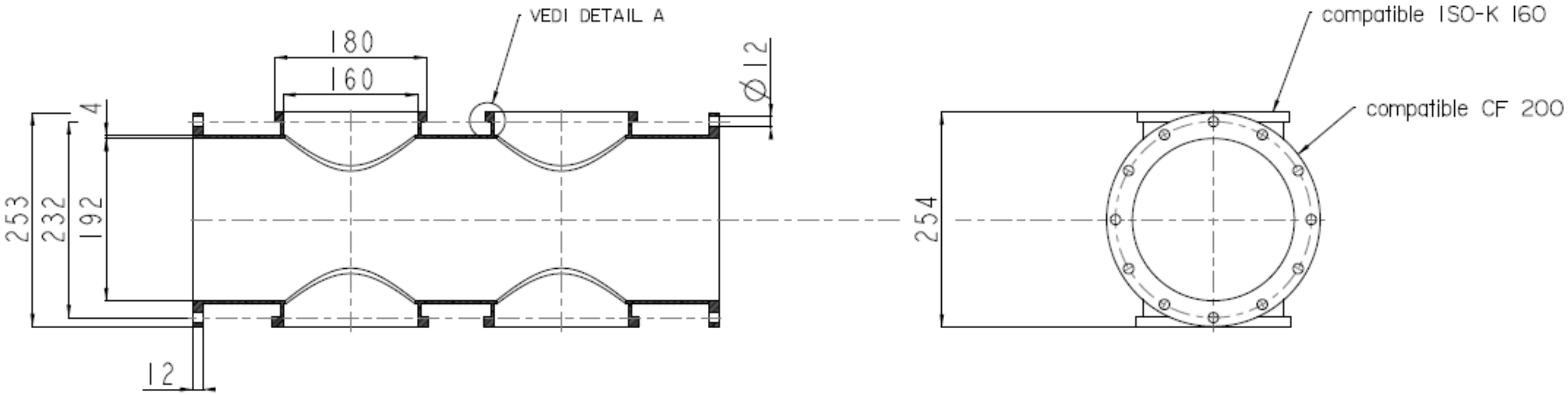
lin/log preamplifier

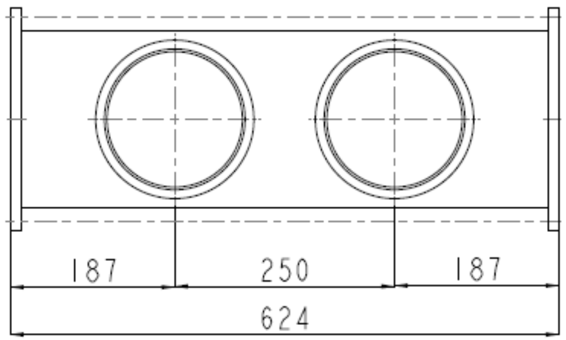


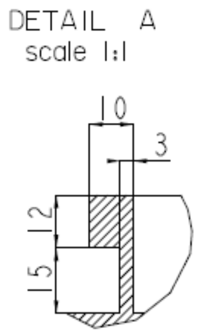
It provides a linear range which covers 70% of the total range. The last 30% cover the range of up to 3 GeV

Carbon fibre vacuum chamber for n_monitor devices

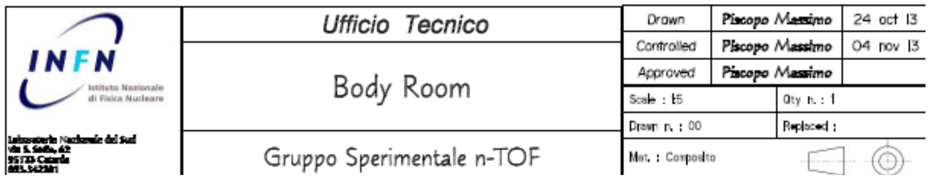
(designed by LNS)







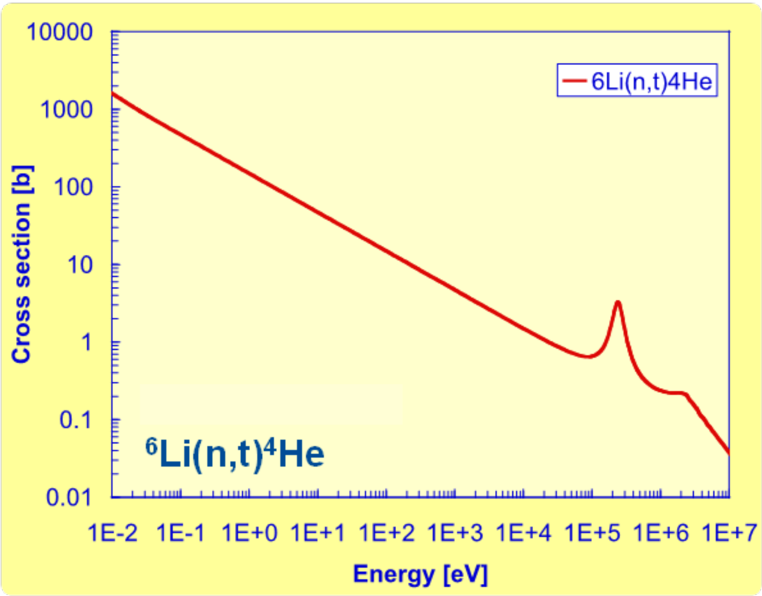
pedding offer by
Quick Batten
Trieste (ITALY)



The chamber design should comply with the cern safety rules (not yet delivered to us)

The thickness of the chamber (3.5mm) is chosen in order to withstand 7 bar

Thanks for your attention


10000
1000
100
10
1
0.1
0.01
Cross section [b]
6Li(n,t)4He
^{6}Li(n,t)^{4}He
1E-2 1E-1 1E+0 1E+1 1E+2 1E+3 1E+4 1E+5 1E+6 1E+7
Energy [eV]

Room body n-TOF

Material: *COMPOSITE*

✓ Master	*Epoxy*
✓ Inclusion	*Carbon Fiber - PAN*
✓ Master name	*EPR 320*
✓ Inclusion name	*CQX 400 (406 g/m^2 - 12k)*
✓ Production	*Rolling [0, -45, 90, +45]*

Characteristics and properties:

➢ ρ - density	*1,80 g/cm^3*
➢ E - elastic	*210·10^3 N/mm^2 (MPa)*
➢ σ_{am} tensile	*430 N/mm^2 (Mpa)*
➢ σ_{am} compression	*350 N/mm^2 (MPa)*
➢ σ_{am} flexure	*140 N/mm^2 (MPa)*
➢ operating temperature	*max 200 °C*

Comparative table:

	ρ - density (g/cm^3)	σ_{am} flexure (N/mm^2)	E – elastic (N/mm^2)	S_{room} - (7 bar) mm.
Carbon Steel	7,85	160	206000	3,6
Stainless Steel (aisi 304)	7,88	235	200000	3,0
Aluminum alloy (anticorodal)	2,65	85	70000	6,0
Composite	1,80	140	210000	3,5