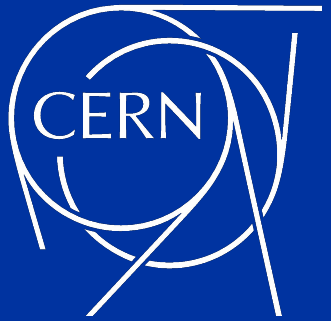
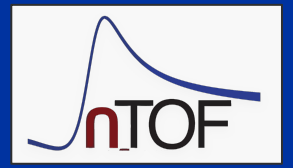


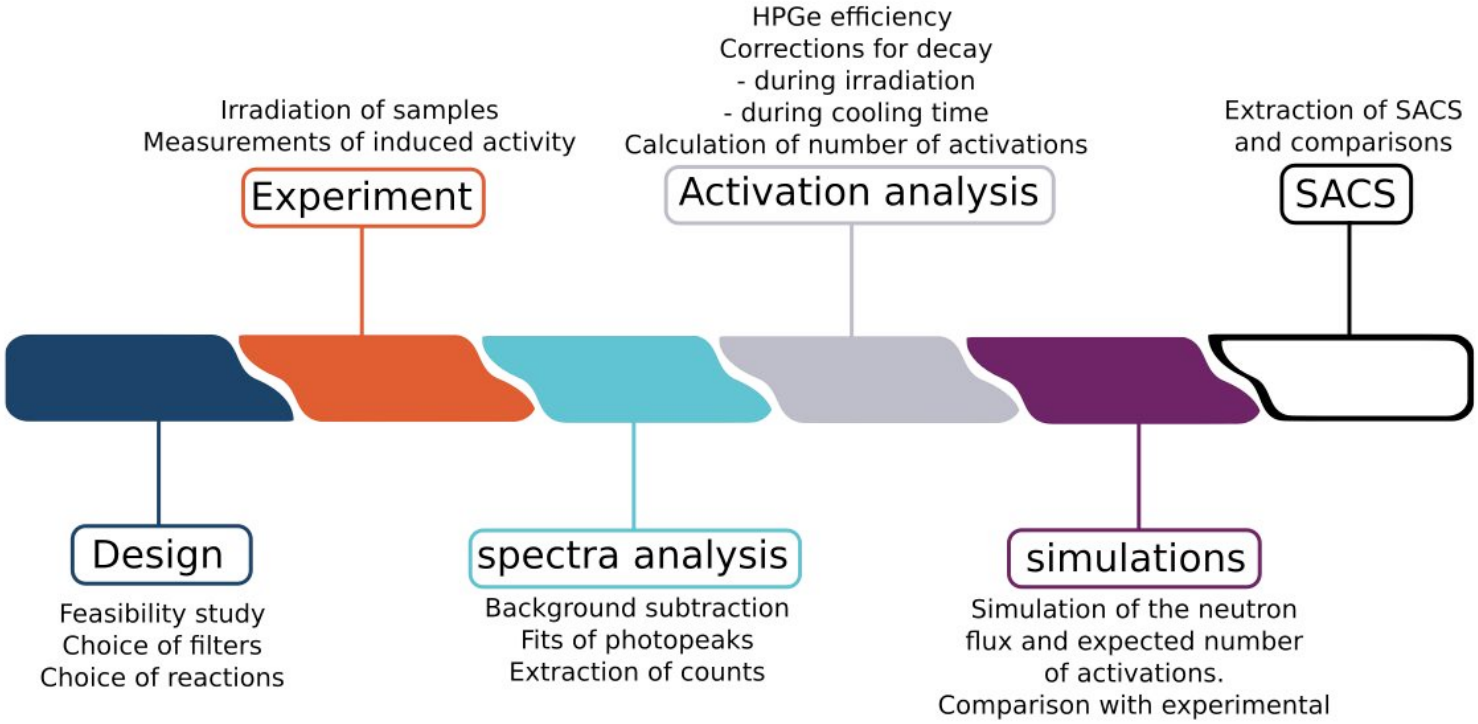


Status of the neutron capture cross section measurements using B4C filters at NEAR

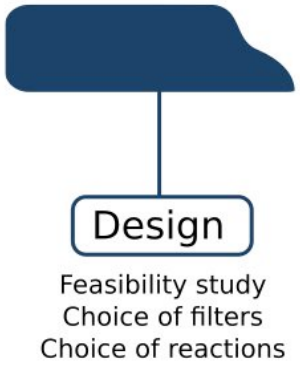
M.E. Stamati, N. Patronis, A. Manna, A. Mengoni, et al.

22.11.2023

Status bar


Irradiation of samples
Measurements of induced activity
Experiment
HPGe efficiency
Corrections for decay
- during irradiation
- during cooling time
Calculation of number of activations
Activation analysis
Extraction of SACS
and comparisons
SACS
Design
Feasibility study
Choice of filters
Choice of reactions
spectra analysis
Background subtraction
Fits of photopeaks
Extraction of counts
simulations
Simulation of the neutron
flux and expected number
of activations.
Comparison with experimental

Status bar


Design
Feasibility study
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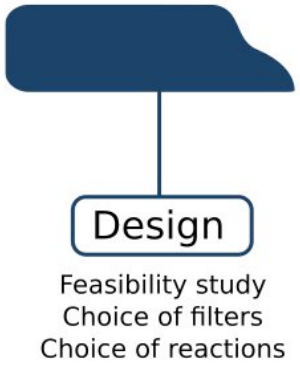
Choice of reactions

Status bar



- Proposal (05.01.2022) :
  http://cds.cern.ch/record/2798978/files/INTC-P-623.pdf

Elisso Stamati[1,2] , Alice Manna[3,4], Gianpiero Gervino[5,6],
Ana-Paula Bernardes[1], Nicola Colonna[7], Maria Diakaki[8], Cristian Massimi[3,4],
Alberto Mengoni[9,4] , Riccardo Mucciola[10,11], Nikolas Patronis[2,1], Pedro Vaz[12], Rosa Vlastou[8],
and the n_TOF Collaboration[13]

- INTC presentation (09.02.2022) :
  https://indico.cern.ch/event/1112243/contributions/4676277/attachments/2370299/4081433/INTCAE.pdf

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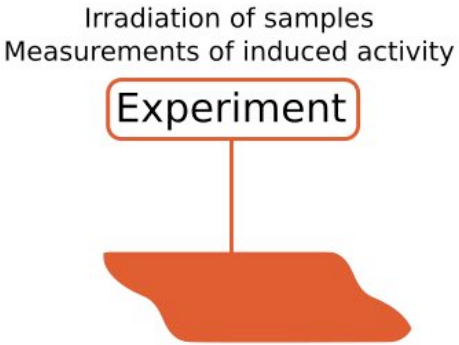
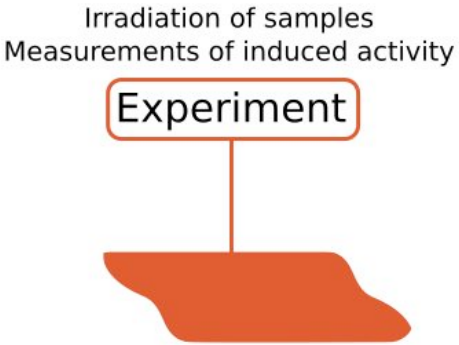

Irradiation of samples
Measurements of induced activity
Experiment

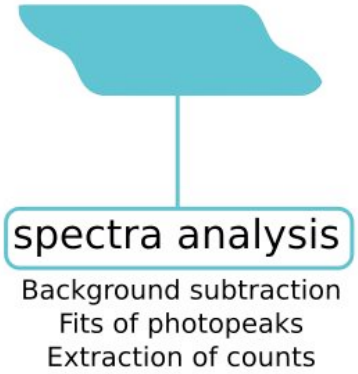
Status bar



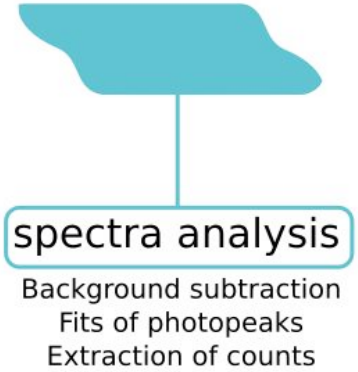
Irradiation @ 2022	Sample	B4C thickness [mm]
08.06 - 20.06	Ce	5
20.06 - 04.07	Ce	10
04.07 - 13.07	Ce	15
13.07 - 20.07	Au	5
20.07 - 27.07	Au	10
27.07 - 03.08	Ge	5
03.08 - 10.08	Au	15
10.08 - 24.08	Zr	5
24.08 - 31.08	Ge	10
31.08 - 13.09	Zr	20
13.09 - 21.09	Ge	15
21.09 - 05.10	Au	20
05.10 - 07.10	Ge	20
26.10 - 02.11	Y	5
02.11 - 09.11	Y	10
09.11 - 16.11	Y	15
16.11 - 23.11	Y	20
Irradiation @ 2023	**Sample**	**B4C thickness [mm]**
12.04 - 19.04	Au	5
19.04 - 26.04	Ce	20
26.04 - 03.05	Zr	10
03.05 - 10.05	Zr	15
17.05 - 31.05	Y	5

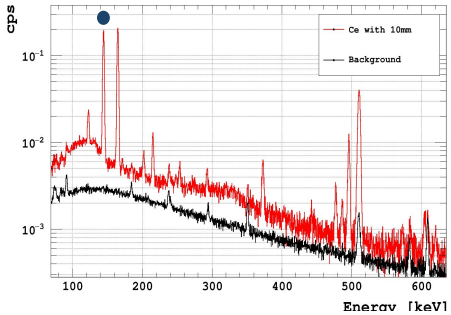
- **2022 run:**
  08.06 - 23.11
- **2023 run:**
  12.04 - 31.05
- **Total irr time:**
  ~ 7.5 months
  Almost continuously, with one YETS break

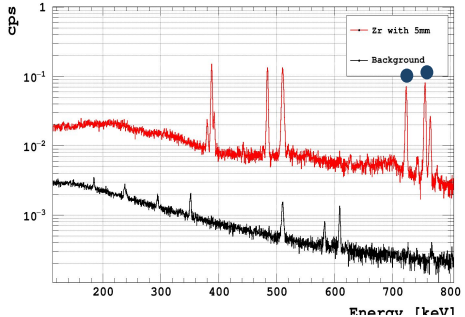
Status bar

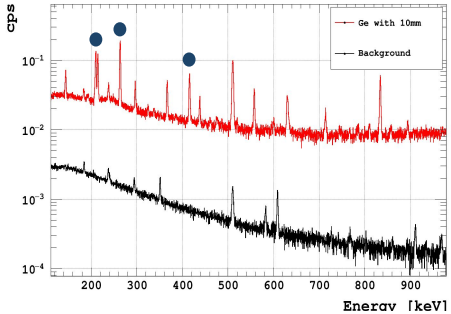

spectra analysis
Background subtraction
Fits of photopeaks
Extraction of counts

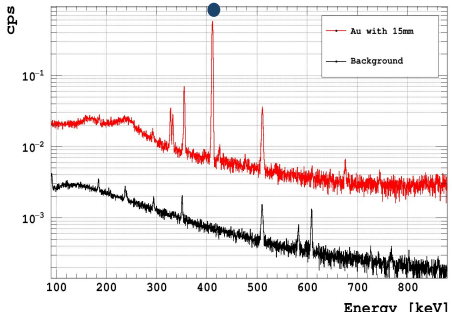
Status bar





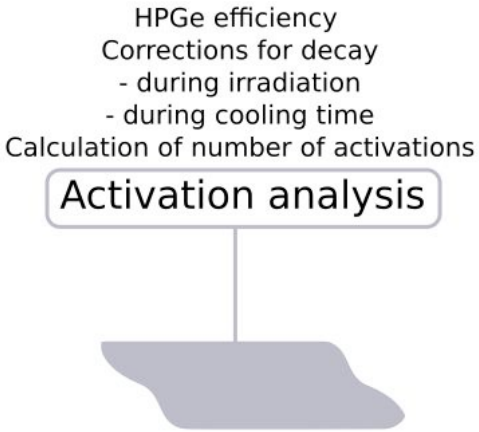






n_TOF collaboration meeting Dec. 2022 @ Edinburgh

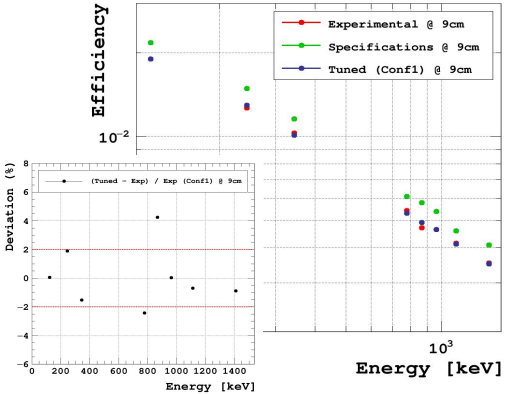
Status bar

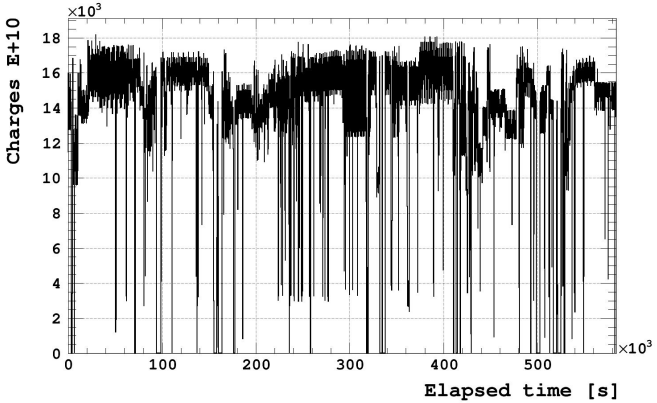

HPGe efficiency
Corrections for decay
- during irradiation
- during cooling time
Calculation of number of activations
Activation analysis

Status bar

HPGe efficiency
Corrections for decay
- during irradiation
- during cooling time
Calculation of number of activations

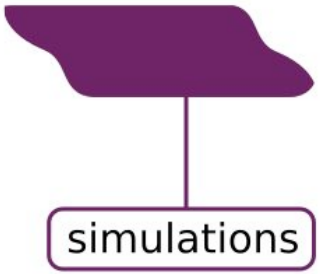
Activation analysis





n_TOF collaboration meeting Dec. 2022 @ Edinburgh

Status bar

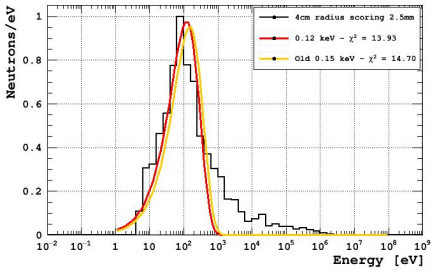


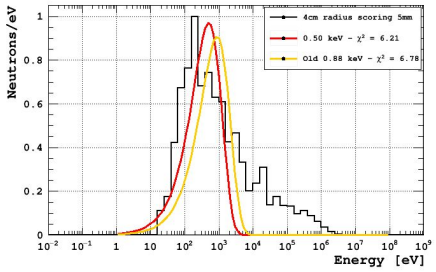
Simulation of the neutron flux and expected number of activations.
Comparison with experimental

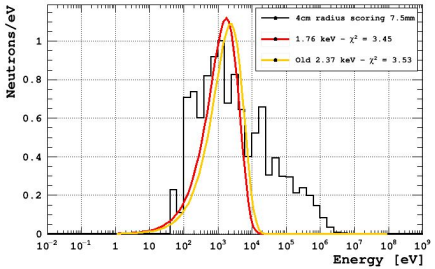
Status bar

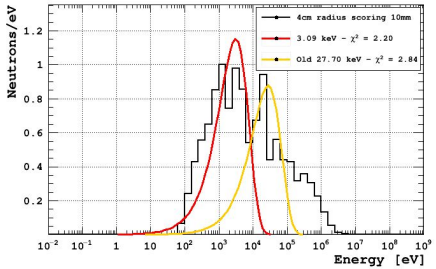
simulations

Simulation of the neutron flux and expected number of activations.
Comparison with experimental









n_TOF collaboration meeting May 2023 @ CERN

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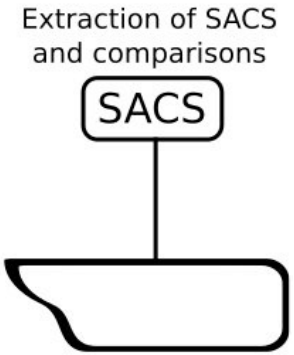

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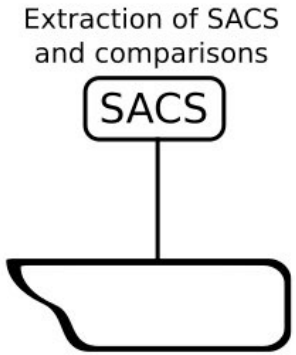
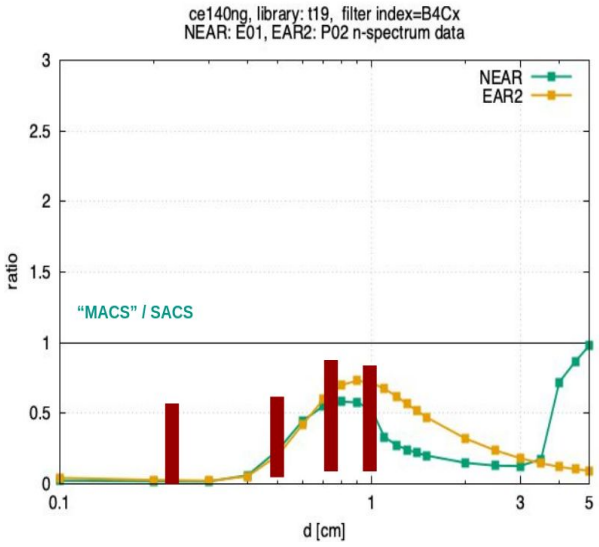
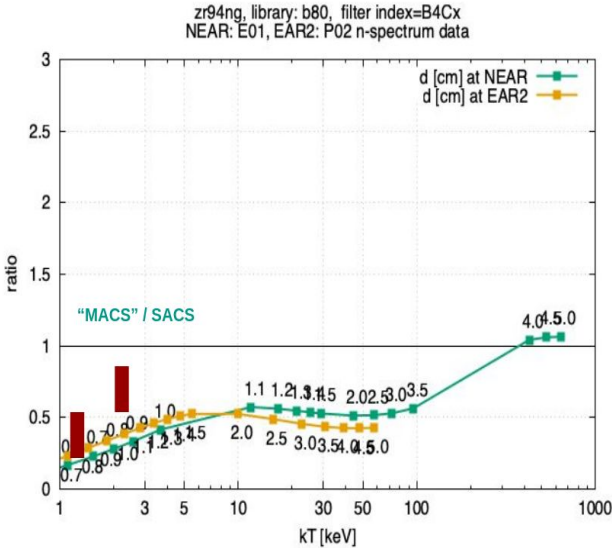
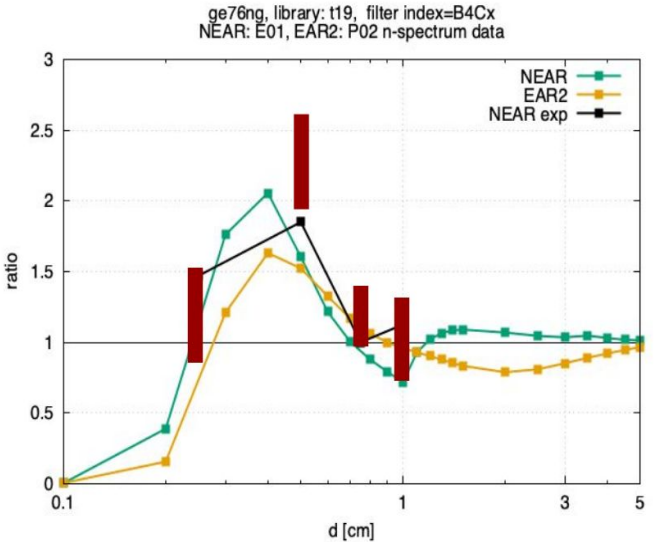


Let’s talk about this today

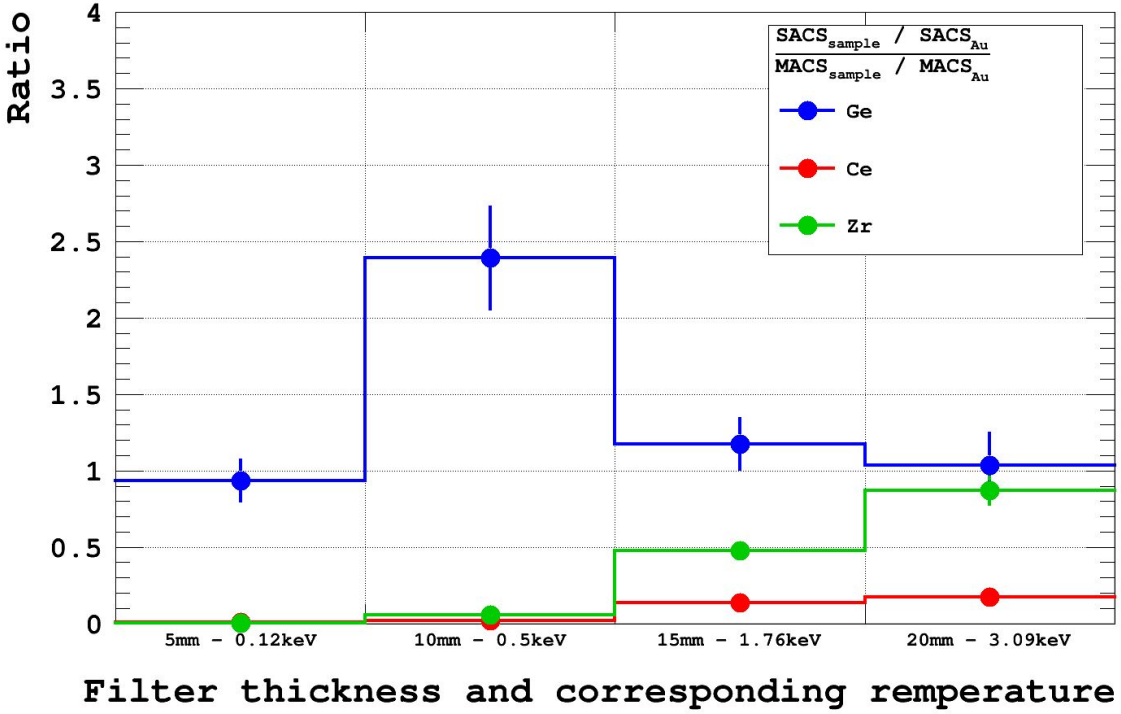
SACS vs MACS ratios

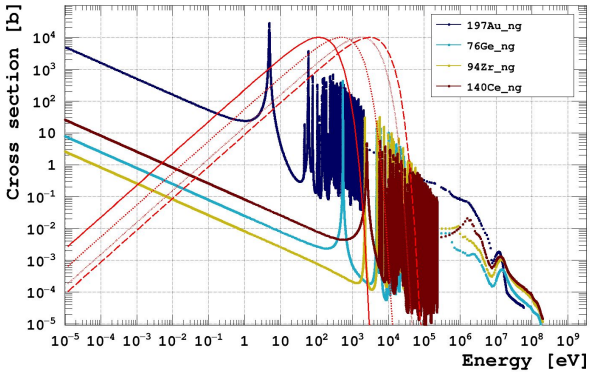




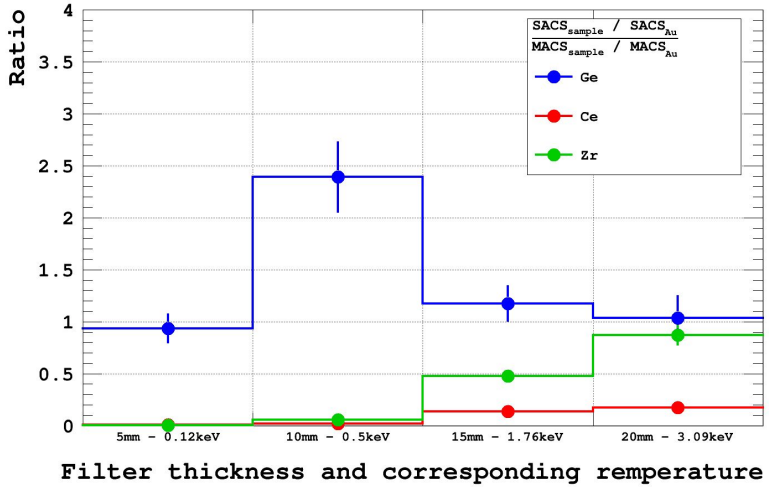


SACS vs MACS ratios



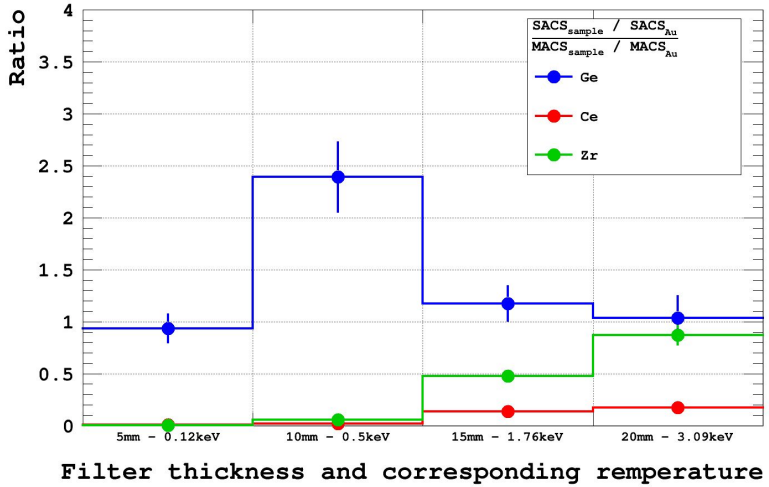


What conclusions can we make?



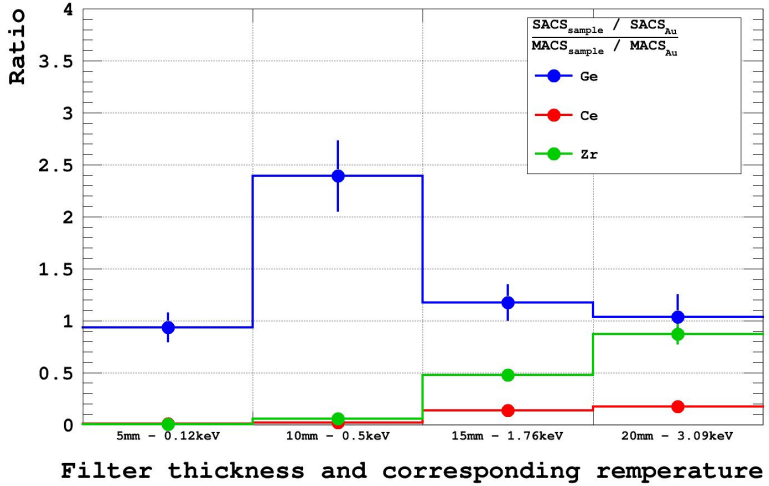
1. By **increasing** the thickness of B4C, the situation can be **improved** as we are filtering out more and more resonances, however there is a **limit** to how much we can increase this thickness

What conclusions can we make?



2. Only based on SACS ratios like the ones before, we can get the MACS within a **factor 2 or 3**, which is still important for exotic physics cases, cases in which only theoretical calculations exist.
   This accuracy could be further improved through a **combination** of such **experimental SACS ratios** and **theoretical cross section calculations**

What conclusions can we make?



3. The present situation could be further **improved** by shaping the initial spectrum even more with the **use of a moderator**.

Summary

As is, a SACS measurement can lead to a MACS estimation within a factor of **2 or 3**.
Improvements:
i) **Thicker** filters (up to a **limit**)
ii) Use of **moderator**

Thank you for your attention!

Credits…

Thank you for your attention!

Credits…

Proposal and design:
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Beta spectrometer preparation:
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Interventions organisation:
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Radiation Protection:
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